Part 1: Test Under Static Transmission Scenario

For
SMARTPHONE

FCC ID: BCG-E8138A
Model Name: A2649

Report Number: 14040867-S4V2
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Revision History

Rev.	Date	Revisions	Revised By
V1	8/1/2022	Original Issue	--
V2	8/4/2022	Updated n66 ANT 4 power in §4.1	Nathan Sousa

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1. Introduction

The equipment under test (EUT) contains the Qualcomm modem supporting 2G/3G/4G/5G technologies and mmW 5G NR bands. Both WWAN modems are enabled with Qualcomm's Smart Transmit feature with algorithms to control and manage transmitting power in real time and to ensure the time-averaged RF exposure from the WWAN modems are always in compliance with FCC requirements.

In addition to these WWAN modems, the EUT contains a different modem to support WLAN.

The purpose of this Part 1 report is to demonstrate that this EUT complies with FCC RF exposure limits at maximum time-averaged transmit power limits for WWAN technologies, and at maximum transmit power limits for WLAN technologies. The specifics of this report are as listed:

- SAR and power density (PD) compliance for all WWAN radios (Sub-6 GHz + 5G mmW NR) is assessed based on maximum time-averaged transmit power (static transmission condition). Relevant FCC KDBs and exclusion criteria are applied on a time-average power basis for WWAN technologies. The maximum time-averaged transmit power limits for supported WWAN technologies, bands, and antennas in this report are derived in the Part 0 report. The validation of the Qualcomm's Smart Transmit time-averaging algorithm and compliance under the Tx varying transmission scenario for WWAN technologies are reported in the Part 2 report.
- SAR compliance for WLAN radios are assessed based on maximum transmit power as per relevant FCC KDBs.
- Demonstrated compliance in simultaneous transmission scenarios involving both WWAN and WLAN transmissions, where WWAN exposure is assessed based on time-averaged transmit power limits, and WLAN exposure is assessed based on maximum transmit power limits.

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

The P_{limit} and *input.power.limit* used in this report are determined and listed in the Part 0 report.

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

2. Measurement Setup and General Information

The SAR measurement are recorded in UL *FCC SAR Test Report* (Report No. 14040867-S1).

This section provides the details of the test setup used for PD measurement.

2.1. Test Environment

Test Location	UL Verification Services
Ambient Temperature	22 ± 2˚C

2.2. Power Density Measurement System

The power density measurement system is constructed based on the DASY6 platform by SPEAG. The DASY6 with EUmmWv2 and 5G software module can measure the electromagnetic exposure (electromagnetic and power density) up to 110GHz as close as 2mm from any transmitter.

2.2.1. Power Density Probe

The novel EUmmWV3 & EUmmWV4 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)
- ISO17025 accredited calibration

2.2.2. 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: 30 GHz at 5.55 mm from the case surface
- Frequency accuracy: ± 100 MHz
- 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 × 100 × 100 mm
- Weight: 1 kg

Tables 2-1 and 2-2 show the verification test results. The measured power density (PD) value is within ±10% of target level; for the 5G verification source's uncertainty, please refer to Appendix B.

Table 2-1: System Validation Results for SAR 5

SAR Lab	Date	Frequency (GHz)	5G Verification Probe SN	Probe Cal. Due Data	5G Verification Source SN	Source Cal. Due Data	Result Incident power (mW/cm2) over 4cm²	$Target_n$ (Ref. Value)	Deviation (dB)	Result Total power (mW/cm2) over 4cm²	$Target_{Tot}$ (Ref. Value)	Deviation (dB)
SAR 5	5/18/2022	30	9496	2/25/2023	1003	11/13/2021	33.1	33.5	-0.05	33.6	33.5	0.01
SAR 5	5/18/2022	30	9496	2/25/2023	1003	11/13/2021	33.1	33.5	-0.05	33.5	33.5	0.00
SAR 5	5/18/2022	30	9496	2/25/2023	1003	11/13/2021	33	33.5	-0.07	33.5	33.5	0.00
SAR 5	5/18/2022	30	9496	2/25/2023	1003	11/13/2021	33.1	33.5	-0.05	33.6	33.5	0.01
SAR 5	5/18/2022	30	9496	2/25/2023	1003	11/13/2021	32.9	33.5	-0.08	33.4	33.5	-0.01
SAR 5	5/18/2022	30	9496	2/25/2023	1003	11/13/2021	33.2	33.5	-0.04	33.6	33.5	0.01
SAR 5	5/18/2022	30	9496	2/25/2023	1003	11/13/2021	32.9	33.5	-0.08	33.4	33.5	-0.01
SAR 5	5/18/2022	30	9496	2/25/2023	1003	11/13/2021	33.2	33.5	-0.04	33.6	33.5	0.01
SAR 5	5/18/2022	30	9496	2/25/2023	1003	11/13/2021	33.1	33.5	-0.05	33.5	33.5	0.00
SAR 5	5/18/2022	30	9496	2/25/2023	1003	11/13/2021	33.2	33.5	-0.04	33.6	33.5	0.01
						Average	33.08			Average	33.53	

Table 2-2: System Validation Results for SAR 7

SAR Lab	Date	Frequency (GHz)	5G Verification Probe SN	Probe Cal. Due Data	5G Verification Source SN	Source Cal. Due Data	Result Incident power (mW/cm2) over 4cm2	Targetn (Ref. Value)	Deviation (dB)	Result Total power (mW/cm2) over 4cm2	TargetTot (Ref. Value)	Deviation (dB)
SAR 7	6/1/2022	30	9589	8/16/2022	1003	9/16/2022	30.4	33.5	-0.42	31.1	33.5	-0.32
SAR 7	6/1/2022	30	9589	8/16/2022	1003	9/16/2022	31	33.5	-0.34	31.8	33.5	-0.23
SAR 7	6/1/2022	30	9589	8/16/2022	1003	9/16/2022	30.9	33.5	-0.35	31.7	33.5	-0.24
SAR 7	6/1/2022	30	9589	8/16/2022	1003	9/16/2022	30.9	33.5	-0.35	31.7	33.5	-0.24
SAR 7	6/1/2022	30	9589	8/16/2022	1003	9/16/2022	31.1	33.5	-0.32	31.9	33.5	-0.21
SAR 7	6/1/2022	30	9589	8/16/2022	1003	9/16/2022	31.1	33.5	-0.32	31.9	33.5	-0.21
SAR 7	6/1/2022	30	9589	8/16/2022	1003	9/16/2022	31.2	33.5	-0.31	32	33.5	-0.20
SAR 7	6/1/2022	30	9589	8/16/2022	1003	9/16/2022	30.9	33.5	-0.35	31.7	33.5	-0.24
SAR 7	6/1/2022	30	9589	8/16/2022	1003	9/16/2022	30.8	33.5	-0.36	31.6	33.5	-0.25
SAR 7	6/1/2022	30	9589	8/16/2022	1003	9/16/2022	30.7	33.5	-0.38	31.4	33.5	-0.28
						Average	30.9			Average	31.68	

Table 2-3: System Check Results

SAR Lab	Date	Frequency (GHz)	5G Verification Source SN	Source Cal. Due	Result Incident power (mW/cm2) over 4cm²	$Target_n$ (Ref. Value)	Deviation (dB)	Delta ±10 %	Result Total power (mW/cm2) over 4cm²	$Target_{Tot}$ (Ref. Value)	Deviation (dB)	Delta ±10 %
SAR 5	5/31/2022	30	1003	9/16/2022	35.1	33.08	0.26	6%	35.7	33.53	0.27	6%
SAR 5	6/4/2022	30	1003	9/16/2022	34.3	33.08	0.16	4%	35.0	33.53	0.19	4%
SAR 5	6/8/2022	30	1003	9/16/2022	33.8	33.08	0.09	2%	34.3	33.53	0.10	2%
SAR 5	6/24/2022	30	1003	9/16/2022	35.1	33.08	0.26	6%	35.7	33.53	0.27	6%
SAR Lab	**Date**	**Frequency (GHz)**	**5G Verification Source SN**	**Source Cal. Due**	**Result Incident power (mW/cm2) over 4cm²**	**$Target_n$ (Ref. Value)**	**Deviation (dB)**	**Delta ±10 %**	**Result Total power (mW/cm2) over 4cm²**	**$Target_{Tot}$ (Ref. Value)**	**Deviation (dB)**	**Delta ±10 %**
SAR7	6/1/2022	30	1003	9/16/2022	30.5	30.9	-0.06	-1%	31.3	31.7	-0.06	-1%
SAR7	6/6/2022	30	1003	9/16/2022	30.4	30.9	-0.07	-2%	31.1	31.7	-0.08	-2%
SAR7	6/13/2022	30	1003	9/16/2022	30.9	30.9	0.00	0%	31.6	31.7	-0.01	0%
SAR7	6/24/2022	30	1003	9/16/2022	30.8	30.9	-0.01	0%	31.4	31.7	-0.04	-1%

SAR 5:

Measurement Report for 30GHz Source SN: 1003, FRONT, Validation band, UID 0 -, Channel 30000 (30000.0MHz)

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
, 30GHz Source SN: 1003	100.0 x 100.0 x 100.0		Phone

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G Air	FRONT, 5.55	Validation band	CW, 0--	30000.0, 30000	1.0

Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave- xxxx	---Air	EUmmWV4 - SN9496_F1-55GHz, 2022-02-24	DAE4ip Sn1619, 2022-04-21

Scan Setup

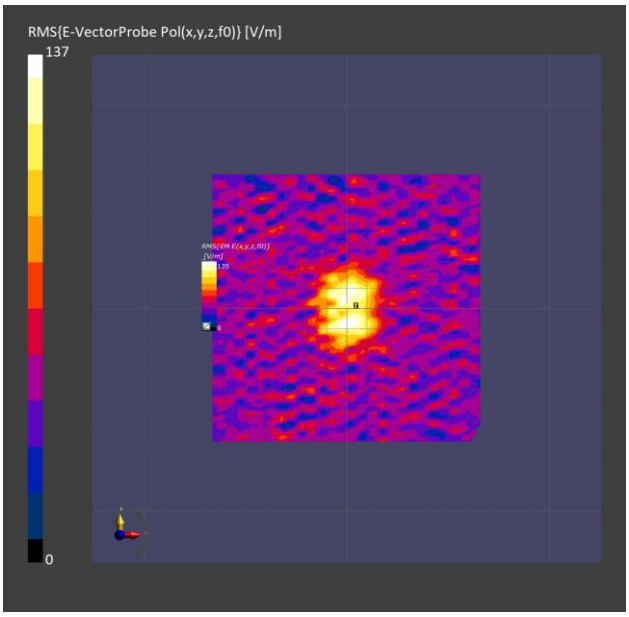
	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	5.55
MAIA	N/A

Measurement Results

	5G Scan
Date	2022-05-31, 20:12
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	35.1
psPDtot+ [W/m^2]	35.7
psPDmod+ [W/m^2]	36.1
E_{max} [V/m]	135
Power Drift [dB]	-0.08

Warning(s) / Error(s)

Details	5G Scan
Warning(s)	
Error(s)	



SAR 7:

Measurement Report for 30GHz Source SN: 1003, FRONT, Validation band, UID 0 -, Channel 30000 (30000.0MHz)

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
, 30GHz Source SN: 1003	100.0 x 100.0 x 100.0		Phone

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G Air	FRONT, 5.55	Validation band	CW, 0--	30000.0, 30000	1.0

Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave- xxxx	---Air	EUmmWV4 - SN9589_F1-55GHz, 2021-08-16	DAE4 Sn1462, 2021-10-11

Scan Setup

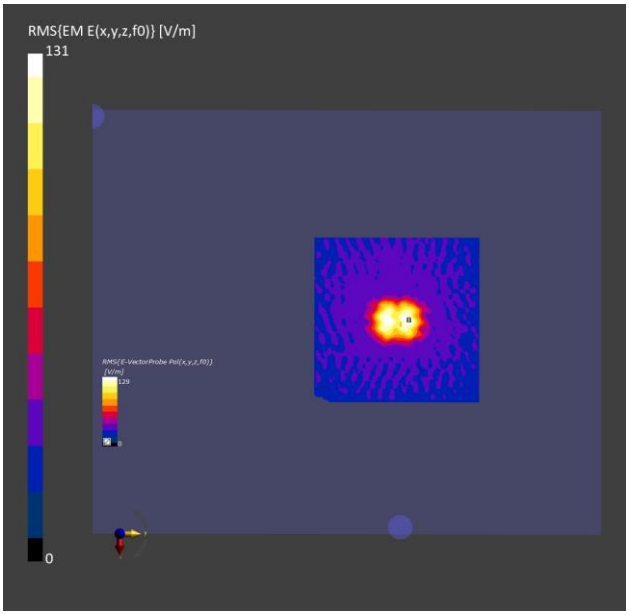
	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	5.55
MAIA	N/A

Measurement Results

	5G Scan
Date	2022-06-06, 20:39
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	30.4
psPDtot+ [W/m^2]	31.1
psPDmod+ [W/m^2]	33.1
E_{max} [V/m]	132
Power Drift [dB]	-0.04

Warning(s) / Error(s)

Details	5G Scan
Warning(s)	
Error(s)	



3. Test Condition, Configuration, and Assessment

3.1. Qualcomm Smart Transmit Parameters

The input parameters described in §2.3 of the Compliance Summary report are required for functionality of Qualcomm's Smart Transmit algorithm.

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

The Part 0 report documents the determination of P_{limit} for Sub-6 GHz WWAN bands (Part 0, §2.4) and the *input.power.limit* for 5G mmW NR bands using the design targets (Part 0, §3.7), and device related uncertainty listed below:

Total Uncertainty	$SAR_{Design\ Target}$ (1-g W/kg)	$SAR_{Design\ Target}$ (10-g W/kg)	$SAR_{Design\ Limit}$ (1-g W/kg)	$SAR_{Design\ Limit}$ (10-g W/kg)
1.00	0.8	2.0	1.0	2.5

Total Uncertainty	$PD_{Design\ Target}$ (W/m^2)	$PD_{Design\ Limit}$ (W/m^2)
2.00	5.0	8.0

- Tx_power_at_SAR_design_target (P_{limit} in dBm) for Tx transmitting frequency < 6 GHz
  - The maximum time-average transmit power, in dBm, at which this radio configuration (i.e., band and technology) reaches the *SAR_design_target*. This *SAR_design_target* is pre-determined for the specific device, and it shall be less than regulatory SAR limit after accounting for all design related tolerances. The time-averaged SAR is assessed against this *SAR_design_target* in real time to determine the compliance. The P_{limit} could vary with technology, band and DSI (device state index), therefore it has the unique value for each technology, band and DSI.
- Reserve_power_margin (dB)
  - With Smart Transmit EFS version 17 or lower:
    - The margin, in dB, below the P_{limit} to reserve for future transmission with a minimum transmit power ($P_{reserve}$):

$$P_{reserve\ (dBm)} = P_{limit\ (dBm)} - Reserve_{power\ margin\ (dB)}$$

    - The *Reserve_power_margin* is a global parameter, meaning it applies to all the technologies and bands. When the *Reserve_power_margin* is set to zero dB, Smart Transmit effectively limits the upper bound of EUT transmit power to P_{limit}, in other words, the EUT transmits continuously at P_{limit}.
  - With Smart Transmit EFS version 18 or higher:
    - For 2G and 3G WWAN technologies, the parameter of *Reserve_power_margin* has been re-named to *Reserve_power_margin_db_2g_3g_wwan*.
    - For 4G/5G WWAN technologies, the equivalent reserve of *Reserve_power_margin* is denoted as *total_min_exp_budget_linear_4g_5g_wwan*. Furthermore, the parameter of *secondary_split_ratio* is introduced in EFS version 18 and higher so the OEM can determine the minimum reserve margin out of total minimum reserve (i.e., *secondary_split_ratio* * *total_min_exp_budget_linear_4g_5g_wwan*) that is used for the secondary WWAN radio in a two-WWAN-radio transmission scenario. Here, primary WWAN radio in a two-WWAN-radio transmission scenario can get minimum reserve margin of (1 – *secondary_split_ratio*) * *total_min_exp_budget_linear_4g_5g_wwan*.
- *input.power.limit* (dBm) for Tx transmitting frequency ≥ 6 GHz
  - The maximum time-average power at the input of antenna element port, in dBm, at which each beam meets the *PD_design_target* that is less than the regulatory power density limit after accounting for all design related tolerances.

- *Smart Tx Gen*: **ONLY** applicable for Smart Transmit EFS version 16 or higher
  - The EFS version 16 (or higher) supports 2nd generation of Smart Transmit (GEN2). The EUT with Smart Transmit EFS version 16 (or higher) has an option to select GEN1 or GEN2. The procedure to determine PD char (i.e., *input.power.limit*) is different. Therefore, in the case of EUT with Smart Transmit EFS version 16 (or higher), additional mmW module switch test is needed to confirm if Smart Transmit EFS used in EUT is configured for GEN1 or GEN2. The EFS configuration (GEN1 or GEN2) should correspond to the PD char performed in Part 0 report, otherwise, EFS configuration should be changed to match GEN1/GEN2 PD char of Part 0 report.
  - Qualcomm 2nd generation of Smart Transmit (GEN2) supports Sub-6 GHz and mmW favor modes. The Smart Transmit EFS provides below options to configure for a given MCC (country/region):
    - GEN1
    - GEN2_MMW
    - GEN2_SUB-6 GHZ
    - GEN2_SUB-6 GHZ_MMW
- *force peak* for Tx transmitting frequency < 6 GHz
  - The Smart Transmit feature applies time-averaging windows when the device detects an MCC that matches Time-Averaged Exposure MCCs list. For each of the MCCs under Time-Averaged Exposure MCCs list, the Smart Transmit feature can limit either maximum instantaneous Tx power or maximum time-average power to P_{limit} per tech/band/antenna/DSI. If force peak is set to '1' for a given tech/band/antenna/DSI in the EFS, then the Smart Transmit feature limits the maximum instantaneous Tx power to P_{limit} for the selected tech/band/antenna/DSI. In other words, with force peak set to '1', under static condition (i.e., fixed tech/band/antenna/DSI) and in single active Tx scenario, Smart Transmit can guarantee Tx power level of P_{limit} at all times.
- *WWAN Backoff (dB) for WiFi/BT*: **ONLY** applicable for Smart Transmit EFS version 16 (or higher) in GEN1 or GEN2_MMW configurations[1]
  - The EFS version 16 (or higher) provides the entry to backoff WWAN radio when WLAN is transmitting. This backoff when WiFi/BT is transmitting can be configured per tech/band/DSI/antenna (Sub-6 GHz antenna and mmW module) in GEN1 or GEN2_MMW configuration only. Therefore, in the case of EUT with Smart Transmit EFS version 16 (or higher), perform additional tests (one for Sub-6 GHz WWAN radio, and one for mmW WWAN radio) to verify whether backoff configured in EFS is properly applied by Smart Transmit for GEN1 or GEN2_MMW configurations when WiFi/BT is transmitting.

3.1.1. Qualcomm Smart Transmit Parameters for the Sub-6 Modem

For this EUT, the input parameters listed in §2.3 of the Part 0 report are populated via the EFS entry.

3.1.2. Qualcomm Smart Transmit parameters for the 5G modem

For this EUT, the *input.power.limit* parameters for the 5G mmW NR radio(s) are listed in §4.7.3 of the Part 0 report and are populated via EFS entry into the EUT.

3.2. Device Test Configuration for SAR Measurements

In summary, SAR is evaluated on this EUT in test configurations and test conditions listed below:

- Test configurations: Hotspot SAR exposure (1-g SAR) from all device surfaces/edges (front, back, left, right, top, bottom) having a transmitting antenna located ≤ 25mm from that device surface/edge when in direct contact with flat section of SAM phantom. Hotspot SAR is evaluated at 5mm separation distance for all selected device surfaces as per FCC KDB publication 648474 D04.
- Test condition: The SAR measurements on all supported Sub-6 WWAN technologies and bands are conducted with the EUT transmitting at maximum time-average transmit power (P_{limit}) or maximum RF tune-up power (P_{max}) if $P_{max} \leq P_{limit}$.

See UL *FCC SAR Test Report* (Report No. 14040867-S1) for details

[1] This is not a compliance test, the compliance in WWAN + WLAN/BT scenario should be demonstrated in Part 1 simultaneous transmission analysis section; *WWAN Backoff (dB) for WiFi/BT* is applicable **ONLY** when EUT is configured as GEN1 and/or GEN2_MMW.

3.3. Device Test Configuration for PD Measurements

As can be seen in §3 of the Part 0 report, the PD exposure for this EUT has been assessed against the $PD_{Design\ Target}$ listed in §4.2of this report using a validated simulation approach for the worst cases for all its beams. To further confirm the compliance, a subset of beams and test cases were selected for PD verification, see §4.2.

The following beam selection criteria for the PD verification test were used:

- Select one single beam (antenna array config) per polarization (vertical or horizontal) and per mmW antenna module
  - The single beam containing highest number of active antenna ports. For example, the single beam with 4 active patch ports should be selected over the beam with a single active patch port
- Select one beam per mmW antenna module
  - The beam pair containing the highest number of active antenna ports.

Additionally, since the worst-case surface dictates the compliance, the PD measurement is made on the worst channel and worst surface determined through the validated simulation approach, see Appendix B of the Part 0 report.

Based on the aforementioned criteria and the EUT codebook in §3.3 of the Part 0 report, Tables 3-1, 3-2, and 3-3 list the selected beams and test cases for PD verification measurement(s). The definition of the EUT surface is illustrated in Figure 3-1.

Table 3-1: PD verification test cases for n258

Module/Antenna	Ch.	Beam ID1	Beam ID2	BW	RB	DUT
		V	H	MHz	#	Surface
ANT M2	2032499	44		100	1	Back
	2018333		164	100	1	Back
	2032499	36	164	50	1	Back
	2032499	36	164	50	1	Left
Module/Antenna	Ch.	Beam ID1	Beam ID2	BW	RB	DUT
		V	H	MHz	#	Surface
ANT M1	2025833	16		100	1	Back
	2032499	16	144	100	1	Back
	2025833		146	100	33	Back
	2025833		146	100	33	Left
	2025833		146	100	33	Top
Module/Antenna	Ch.	Beam ID1	Beam ID2	BW	RB	DUT
		V	H	MHz	#	Surface
ANT M3	2025833	42		100	1	Right
	2032499	42	170	100	1	Right
	2032499		175	100	33	Right
	2032499		175	100	33	Back
	2032499		175	100	33	Front

Table 3-2: PD verification test cases for n260

Module/Antenna	Ch.	Beam ID1	Beam ID2	BW	RB	DUT
		V	H	MHz	#	Surface
ANT M2	2253330		174	100	1	Back
	2277500	46	174	100	1	Back
	2253330	46		50	66	Back
	2253330	46		50	66	Left
Module/Antenna	**Ch.**	**Beam ID1**	**Beam ID2**	**BW**	**RB**	**DUT**
		V	**H**	**MHz**	**#**	**Surface**
ANT M1	2229167		147	100	1	Back
	2229167	19	147	100	1	Back
	2229167	18		50	66	Back
	2229167	18		50	66	Left
	2229167	18		50	66	Top
Module/Antenna	**Ch.**	**Beam ID1**	**Beam ID2**	**BW**	**RB**	**DUT**
		V	**H**	**MHz**	**#**	**Surface**
ANT M3	2229167	50		100	1	Right
	2229167		177	100	1	Right
	2229167	50	178	100	1	Right
	2229167	50		100	1	Back
	2229167	50		100	1	Front

Table 3-3:PD verification test cases for n261

Module/Antenna	Ch.	Beam ID1	Beam ID2	BW	RB	DUT
		V	H	MHz	#	Surface
ANT M2	2083330	34		100	1	Back
	2077084		174	100	1	Back
	2070833	46	174	100	33	Back
	2070833	46	174	100	33	Left
Module/Antenna	**Ch.**	**Beam ID1**	**Beam ID2**	**BW**	**RB**	**DUT**
		V	**H**	**MHz**	**#**	**Surface**
ANT M1	2070833		155	100	1	Back
	2083330	17	145	100	1	Back
	2070833	28		50	33	Back
	2070833	28		50	33	Left
	2070833	28		50	33	Top
Module/Antenna	**Ch.**	**Beam ID1**	**Beam ID2**	**BW**	**RB**	**DUT**
		V	**H**	**MHz**	**#**	**Surface**
ANT M3	2077084	42		100	1	Right
	2077084	42	170	100	1	Right
	2083330		170	100	1	Right
	2083330		170	100	1	Back
	2083330		170	100	1	Front

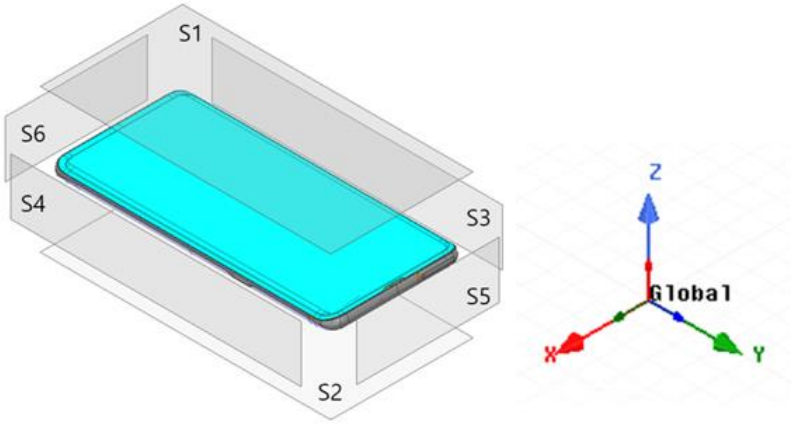


Figure 3-1: EUT surface definition (S1=Front, S2=Rear, S3=Edge 4, S4=Edge 2, S5=Edge 1, S6=Edge 3)

4. Summary of Results

4.1. SAR Measurement and Conducted Power Results at P_{limit}

The transmit power limit, P_{limit}, that corresponds to the $SAR_{Design\ Target}$, stated in §3.1 for all technologies and bands, was determined through the Part 0 report and are listed in EFS entries in §2.4 of the Part 0 report. For this EUT, the P_{max} (maximum RF tune-up power) for select Sub-6 GHz technologies is less than, or equal to, the corresponding P_{limit} + tolerance, as summarized and shown in Table 4-1.

Table 4-1: Comparison of P_{limit} and P_{max}

Exposure Scenario			Head				Body & Hotspot				Hotspot				Pmax (dBm)	
Spatial-average			1-g				1-g				1-g					
Test Distance			0 mm				5 mm				5 mm					
Power Mode (DSI)		Duty Cycle	DSI: 0				DSI: 1				DSI: 1					
Antenna	Tech/Band		Pdesign (dBm)	Plimit + Tolerance (dBm)	Pdesign (dBm)	Plimit + Tolerance (dBm)	Pdesign (dBm)	Plimit + Tolerance (dBm)	Pdesign (dBm)	Plimit + Tolerance (dBm)	Pdesign (dBm)	Plimit + Tolerance (dBm)	Pdesign (dBm)	Plimit + Tolerance (dBm)		
			Burst Average		Frame Average		Burst Average		Frame Average		Burst Average		Frame Average		Burst Average	Frame Average
ANT 1	GSM 850 2 slots	25.0%	37.59	32.50	31.57	26.48	32.26	32.00	26.24	25.98	32.26	32.00	26.24	25.98	32.50	26.48
	GSM 1900 2 slots	25.0%	39.06	31.00	33.04	24.98	26.55	23.70	20.52	17.68	24.30	23.70	18.28	17.68	31.00	24.98
	W-CDMA B2	100.0%	32.59	25.30	32.59	25.30	20.11	17.70	20.11	17.70	17.98	17.70	17.98	17.70	25.70	25.70
	W-CDMA B4	100.0%	27.50	23.70	27.50	23.70	20.45	17.40	20.45	17.40	17.78	17.40	17.78	17.40	25.70	25.70
	W-CDMA B5	100.0%	30.96	25.70	30.96	25.70	27.38	25.70	27.38	25.70	26.85	25.70	26.85	25.70	25.70	25.70
	LTE Band 5	100.0%	31.02	25.70	31.02	25.70	26.84	25.70	26.84	25.70	26.84	25.70	26.84	25.70	25.70	25.70
	LTE Band 7	100.0%	27.38	25.70	27.38	25.70	20.64	20.30	20.64	20.30	20.62	20.30	20.62	20.30	25.70	25.70
	LTE Band 12/17	100.0%	33.20	25.70	33.20	25.70	27.74	25.70	27.74	25.70	26.98	25.70	26.98	25.70	25.70	25.70
	LTE Band 13	100.0%	31.47	25.70	31.47	25.70	27.06	25.70	27.06	25.70	26.35	25.70	26.35	25.70	25.70	25.70
	LTE Band 14	100.0%	31.77	25.70	31.77	25.70	27.01	25.70	27.01	25.70	26.63	25.70	26.63	25.70	25.70	25.70
	LTE Band 25/2	100.0%	29.84	25.30	29.84	25.30	19.82	17.70	19.82	17.70	18.34	17.70	18.34	17.70	25.70	25.70
	LTE Band 26	100.0%	31.28	25.70	31.28	25.70	26.82	25.70	26.82	25.70	26.82	25.70	26.82	25.70	25.70	25.70
	LTE Band 30	100.0%	27.21	25.70	27.21	25.70	22.91	21.80	22.91	21.80	22.03	21.80	22.03	21.80	25.70	25.70
	LTE Band 41	63.3%	30.07	25.70	28.08	23.71	23.50	22.30	21.52	20.31	22.78	22.30	20.80	20.31	25.70	23.71
	LTE Band 41 (PC2)	43.3%	32.70	28.70	29.07	25.06	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	28.70	25.06
	LTE Band 53	63.3%	28.79	20.70	26.81	18.71	21.09	20.70	19.10	18.71	21.09	20.70	19.10	18.71	20.70	18.71
	LTE Band 66/4	100.0%	28.29	23.70	28.29	23.70	20.14	17.40	20.14	17.40	17.73	17.40	17.73	17.40	25.70	25.70
	LTE Band 71	100.0%	33.40	25.70	33.40	25.70	27.68	25.70	27.68	25.70	27.47	25.70	27.47	25.70	25.70	25.70
	NR n5	100.0%	32.08	25.70	32.08	25.70	28.58	25.70	28.58	25.70	28.17	25.70	28.17	25.70	25.70	25.70
	NR n7	100.0%	27.29	25.70	27.29	25.70	21.12	20.30	21.12	20.30	20.92	20.30	20.92	20.30	25.70	25.70
	NR n12	100.0%	31.98	25.70	31.98	25.70	28.04	25.70	28.04	25.70	27.13	25.70	27.13	25.70	25.70	25.70
	NR n14	100.0%	31.20	25.70	31.20	25.70	27.00	25.70	27.00	25.70	26.83	25.70	26.83	25.70	25.70	25.70
	NR n25/2	100.0%	31.26	25.30	31.26	25.30	21.25	17.70	21.25	17.70	18.33	17.70	18.33	17.70	25.70	25.70
	NR n26	100.0%	32.10	25.70	32.10	25.70	26.66	25.70	26.66	25.70	26.66	25.70	26.66	25.70	25.70	25.70
	NR n30	100.0%	28.63	25.70	28.63	25.70	22.51	21.80	22.51	21.80	22.12	21.80	22.12	21.80	25.70	25.70
	NR n41	100.0%	31.48	25.70	31.48	25.70	21.10	20.30	21.10	20.30	20.85	20.30	20.85	20.30	25.70	25.70
	NR n53	100.0%	27.40	20.70	27.40	20.70	21.68	18.90	21.68	18.90	21.24	18.90	21.24	18.90	20.70	20.70
	NR n66	100.0%	28.17	23.70	28.17	23.70	20.83	17.40	20.83	17.40	18.92	17.40	18.92	17.40	25.70	25.70
	NR n70	100.0%	30.58	23.70	30.58	23.70	19.77	17.40	19.77	17.40	17.79	17.40	17.79	17.40	25.70	25.70
	NR n71	100.0%	32.75	25.70	32.75	25.70	28.44	25.70	28.44	25.70	27.71	25.70	27.71	25.70	25.70	25.70
ANT 2	GSM 850 2 slots	25.0%	30.31	29.10	24.29	23.08	32.79	31.50	26.77	25.48	32.79	31.50	26.77	25.48	31.50	25.48
	GSM 1900 2 slots	25.0%	27.58	26.70	21.56	20.68	28.49	28.20	22.47	22.18	28.49	28.20	22.47	22.18	28.50	22.48
	W-CDMA B2	100.0%	21.17	20.70	21.17	20.70	22.68	22.20	22.68	22.20	22.68	22.20	22.68	22.20	23.40	23.40
	W-CDMA B4	100.0%	20.98	20.50	20.98	20.50	22.23	20.70	22.23	20.70	21.47	20.70	21.47	20.70	23.40	23.40
	W-CDMA B5	100.0%	23.38	23.10	23.38	23.10	26.51	24.70	26.51	24.70	26.51	24.70	26.51	24.70	24.70	24.70
	LTE Band 5	100.0%	23.42	23.10	23.42	23.10	28.04	24.70	28.04	24.70	28.04	24.70	28.04	24.70	24.70	24.70
	LTE Band 7	100.0%	17.15	16.90	17.15	16.90	20.02	18.30	20.02	18.30	19.83	18.30	19.83	18.30	23.20	23.20
	LTE Band 12/17	100.0%	23.71	23.40	23.71	23.40	26.37	24.70	26.37	24.70	26.37	24.70	26.37	24.70	24.70	24.70
	LTE Band 13	100.0%	24.32	23.80	24.32	23.80	27.43	24.70	27.43	24.70	27.43	24.70	27.43	24.70	24.70	24.70
	LTE Band 14	100.0%	24.08	23.80	24.08	23.80	26.08	24.70	26.08	24.70	26.08	24.70	26.08	24.70	24.70	24.70
	LTE Band 25/2	100.0%	20.95	20.70	20.95	20.70	22.47	22.20	22.47	22.20	22.47	22.20	22.47	22.20	23.40	23.40
	LTE Band 26	100.0%	24.34	23.10	24.34	23.10	26.97	24.70	26.97	24.70	26.97	24.70	26.97	24.70	24.70	24.70
	LTE Band 30	100.0%	19.42	19.00	19.42	19.00	21.37	20.50	21.37	20.50	21.37	20.50	21.37	20.50	23.20	23.20
	LTE Band 41	63.3%	19.77	18.70	17.78	16.71	22.00	19.80	20.01	17.81	21.14	19.80	19.16	17.81	25.70	23.71
	LTE Band 53	63.3%	17.85	17.60	15.86	15.61	20.16	19.50	18.17	17.51	19.89	19.50	17.90	17.51	20.70	18.71
	LTE Band 66/4	100.0%	21.21	20.50	21.21	20.50	22.20	20.70	22.20	20.70	20.95	20.70	20.95	20.70	25.70	25.70
	LTE Band 71	100.0%	25.52	24.70	25.52	24.70	27.78	24.70	27.78	24.70	27.78	24.70	27.78	24.70	24.70	24.70
	NR n5	100.0%	25.80	23.10	25.80	23.10	28.40	24.70	28.40	24.70	28.40	24.70	28.40	24.70	24.70	24.70
	NR n7	100.0%	17.75	16.90	17.75	16.90	20.54	18.30	20.54	18.30	19.94	18.30	19.94	18.30	23.20	23.20
	NR n12	100.0%	23.88	23.40	23.88	23.40	26.56	24.70	26.56	24.70	26.56	24.70	26.56	24.70	24.70	24.70
	NR n14	100.0%	24.43	23.80	24.43	23.80	26.23	24.70	26.23	24.70	26.23	24.70	26.23	24.70	24.70	24.70
	NR n25/2	100.0%	22.12	20.70	22.12	20.70	22.76	22.20	22.76	22.20	22.76	22.20	22.76	22.20	23.40	23.40
	NR n26	100.0%	23.54	23.10	23.54	23.10	28.21	24.70	28.21	24.70	28.21	24.70	28.21	24.70	24.70	24.70
	NR n30	100.0%	19.48	19.00	19.48	19.00	21.94	20.50	21.94	20.50	21.94	20.50	21.94	20.50	23.20	23.20
	NR n41	100.0%	17.78	16.70	17.78	16.70	20.42	17.80	20.42	17.80	19.32	17.80	19.32	17.80	25.70	25.70
	NR n53	100.0%	16.04	15.60	16.04	15.60	18.50	17.50	18.50	17.50	17.78	17.50	17.78	17.50	20.70	20.70
	NR n66	100.0%	21.27	20.50	21.27	20.50	21.69	20.70	21.69	20.70	21.58	20.70	21.58	20.70	25.70	25.70
	NR n70	100.0%	21.26	20.50	21.26	20.50	22.01	20.70	22.01	20.70	21.21	20.70	21.21	20.70	25.70	25.70
	NR n71	100.0%	25.19	24.70	25.19	24.70	27.31	24.70	27.31	24.70	27.31	24.70	27.31	24.70	24.70	24.70

Exposure Scenario		Duty Cycle	Head				Body & Hotspot				Hotspot				Pmax (dBm)	
Spatial-average			1-g				1-g				1-g					
Test Distance			0 mm				5 mm				5 mm					
Power Mode (DSI)			DSI: 0				DSI: 1				DSI: 1					
Antenna	Tech/Band		Pdesign (dBm)	Plimit + Tolerance (dBm)	Pdesign (dBm)	Plimit + Tolerance (dBm)	Pdesign (dBm)	Plimit + Tolerance (dBm)	Pdesign (dBm)	Plimit + Tolerance (dBm)	Pdesign (dBm)	Plimit + Tolerance (dBm)	Pdesign (dBm)	Plimit + Tolerance (dBm)		
			Burst Average		Frame Average		Burst Average		Frame Average		Burst Average		Frame Average		Burst Average	Frame Average
ANT 4	GSM 1900 2 slots	25.0%	24.70	24.20	18.68	18.18	26.88	25.70	20.86	19.68	26.20	25.70	20.18	19.68	28.00	21.98
	W-CDMA B2	100.0%	19.55	18.20	19.55	18.20	21.54	19.70	21.54	19.70	20.00	19.70	20.00	19.70	22.60	22.60
	W-CDMA B4	100.0%	20.31	20.00	20.31	20.00	23.22	21.10	23.22	21.10	21.43	21.10	21.43	21.10	22.60	22.60
	LTE Band 7	100.0%	17.63	17.40	17.63	17.40	22.84	19.50	22.84	19.50	19.94	19.50	19.94	19.50	23.20	23.20
	LTE Band 25/2	100.0%	18.63	18.20	18.63	18.20	22.28	19.70	22.28	19.70	20.41	19.70	20.41	19.70	22.60	22.60
	LTE Band 30	100.0%	18.49	18.00	18.49	18.00	22.00	18.10	22.00	18.10	18.50	18.10	18.50	18.10	23.20	23.20
	LTE Band 41	63.3%	21.25	19.70	19.26	17.71	23.78	21.00	21.79	19.01	21.28	21.00	19.29	19.01	25.70	23.71
	LTE Band 48	63.3%	20.80	20.50	18.81	18.51	24.66	22.00	22.67	20.01	22.43	22.00	20.44	20.01	25.00	23.01
	LTE Band 66/4	100.0%	20.33	20.00	20.33	20.00	24.46	21.10	24.46	21.10	21.52	21.10	21.52	21.10	24.20	24.20
	NR n7	100.0%	18.74	17.40	18.74	17.40	20.64	19.50	20.64	19.50	19.86	19.50	19.86	19.50	23.20	23.20
	NR n25/2	100.0%	18.47	18.20	18.47	18.20	21.90	19.70	21.90	19.70	20.43	19.70	20.43	19.70	22.60	22.60
	NR n30	100.0%	18.83	18.00	18.83	18.00	21.34	18.10	21.34	18.10	18.71	18.10	18.71	18.10	23.20	23.20
	NR n41	100.0%	19.41	17.70	19.41	17.70	21.99	19.00	21.99	19.00	19.65	19.00	19.65	19.00	25.70	25.70
	NR n66	100.0%	20.76	20.00	20.76	20.00	23.19	21.10	23.19	21.10	21.50	21.10	21.50	21.10	24.20	24.20
	NR n70	100.0%	20.76	20.00	20.76	20.00	24.26	21.10	24.26	21.10	21.42	21.10	21.42	21.10	24.20	24.20
	NR n77	100.0%	20.11	19.70	20.11	19.70	21.79	18.50	21.79	18.50	19.55	18.50	19.55	18.50	25.00	25.00
ANT 7	LTE Band 48	63.3%	31.48	26.00	29.49	24.01	24.48	22.50	22.49	20.51	23.16	22.50	21.18	20.51	26.00	24.01
	NR n77	100.0%	34.41	24.00	34.41	24.00	23.24	19.60	23.24	19.60	22.13	19.60	22.13	19.60	25.70	25.70
ANT 8	LTE Band 48	63.3%	25.23	25.00	23.24	23.01	19.58	19.30	17.60	17.31	19.58	19.30	17.60	17.31	26.00	24.01
	NR n77	100.0%	22.71	21.60	22.71	21.60	17.61	17.10	17.61	17.10	17.61	17.10	17.61	17.10	25.70	25.70
ANT 9	LTE Band 48	63.3%	25.60	21.70	23.61	19.71	21.97	19.70	19.98	17.71	20.04	19.70	18.06	17.71	21.70	19.71
	NR n77	100.0%	28.08	21.90	28.08	21.90	17.92	15.80	17.92	15.80	16.36	15.80	16.36	15.80	25.70	25.70

Therefore, for this EUT, SAR and conducted power measurements at P_{limit} will be the same as those performed at P_{max}. SAR measured at P_{limit} (reported in UL's FCC SAR Test Report, 13571607-S1) can be leveraged in this section to avoid re-testing. The worst-case reported SAR values for Sub-6 GHz are listed in §2.4 of the Part 0 report and the worst-case reported WLAN SAR results are listed in Table 4-2.

Table 4-2: Worst-case reported WLAN SAR

Techonology	Freq (GHz)	ANT			Reported 1-g SAR (W/kg)			P_{max}		
		Head	Body-worn	Hotspot	Head	Body-worn	Hotspot	Head	Body-worn	Hotspot
WLAN	2.4	ANT 4	ANT 4	ANT 3	0.446	0.403	0.536	15.25	17.25	16.75
	5	ANT 6	ANT 6	ANT 6	0.356	0.453	0.453	14.75	15.75	15.75

Note that WLAN SAR for each of the bands in the above table lists the worst-case SAR out of both WLAN antennas and WLAN MIMO.

4.2. PD Measurement Results at input.power.limit

Tables 3-1 to 3-3 list the beams selected for PD verification test for this EUT and Tables 4-3 to 4-5 list the corresponding PD measurement results at 2 mm spacing. Qualcomm's Smart Transmit algorithm operates based on time-averaged transmit power reported on a per symbol basis, which is independent of modulation, channel, and bandwidth (RBs). Therefore, PD measurements in Tables 4-3 to 4-5 were conducted with the EUT in *Factory Test Mode* (FTM), with CW modulation and on the worst-case channel determined through simulations (See Appendix B of the Part 0 report), with the EUT transmitting at *input.power.limit* (listed in Table 3-4 of the Part 0 report) corresponding to the tested beams.

All 4cm^2 PD values for the selected beams are listed in Tables 4-3 to 4-5. In addition to these selected beams, 4cm^2 PD for a few more beams (highlighted in Tables 4-3 to 4-5) were used in the Part 2 report.

Table 4-3: PD Measurement results for n258

Module/Antenna	Frequency		Beam ID1	Beam ID2	input.power.limit	CC	BW	RB	Signal Type	DUT Surface	Normal psPD	Total psPD
	MHz	Ch.	V	H	dBm	#	MHz	#			W/m^2	W/m^2
ANT M2	25200	2032499	44		-0.6	1	100	1	CW	Back	3.270	3.570
	24350	2018333		164	-0.5	1	100	1	CW	Back	2.630	3.200
	25200	2032499	36	164	-4.3	1	50	1	CW	Back	3.550	**4.410**
	25200	2032499	36	164	-4.3	1	50	1	CW	Left	1.220	1.420
Module/Antenna	Frequency		Beam ID1	Beam ID2	input.power.limit	CC	BW	RB	Signal Type	DUT Surface	Normal psPD	Total psPD
	MHz	Ch.	V	H	dBm	#	MHz	#			W/m^2	W/m^2
ANT M1	24800	2025833	16		7.1	1	100	1	CW	Back	2.490	2.950
	25200	2032499	16	144	0.9	1	100	1	CW	Back	1.620	1.980
	24800	2025833		146	5.3	1	100	33	CW	Back	3.930	**4.690**
	24800	2025833		146	5.3	1	100	33	CW	Left	0.855	0.884
	24800	2025833		146	5.3	1	100	33	CW	Top	0.401	0.418
Module/Antenna	Frequency		Beam ID1	Beam ID2	input.power.limit	CC	BW	RB	Signal Type	DUT Surface	Normal psPD	Total psPD
	MHz	Ch.	V	H	dBm	#	MHz	#			W/m^2	W/m^2
ANT M3	24800	2025833	42		-0.6	1	100	1	CW	Right	3.900	4.550
	25200	2032499	42	170	-5	1	100	1	CW	Right	3.930	4.790
	25200	2032499		175	0.5	1	100	33	CW	Right	5.100	**6.890**
	25200	2032499		175	0.5	1	100	33	CW	Back	3.350	3.500
	25200	2032499		175	0.5	1	100	33	CW	Front	2.670	3.030

PD_Design_Target (W/m^2): 5
Total Uncertainty (dB): 2.00
Worst-case: S2 (Rear)

Module	Printed backoff Value bj (linear)	FCC PD Limit (W/m^2)	bj*PD_design_target + total uncertainty (W/m^2)	Beam/Beam-pair ID	Measured PD (W/m^2)	Surface	Contribution Factor c(i,j)
1	0.9772	10	7.744	146	4.690	S2	0.0407
2	0.9772	10	7.744	36/164	4.410	S2	0.0407
Verification: (0.0407 x 4.69) + (0.0407 x 4.41) = 0.37037 < 7.744							

Note: Module 0 contains antennas M1 and M2, module 1 contains antenna M3

Table 4-4: PD Measurement results for n260

Module/Antenna	Frequency		Beam ID1	Beam ID2	input.power.limit	CC	BW	RB	Signal Type	DUT Surface	Normal psPD	Total psPD
	MHz	Ch.	V	H	dBm	#	MHz	#			W/m²	W/m²
ANT M2	38500	2253330		174	2	1	100	1	CW	Back	4.430	4.890
	39950	2277500	46	174	-1.9	1	100	1	CW	Back	3.380	3.800
	38500	2253330	46		2.9	1	50	66	CW	Back	5.050	**5.630**
	38500	2253330	46		2.9	1	50	66	CW	Left	2.440	2.840
Module/Antenna	Frequency		Beam ID1	Beam ID2	input.power.limit	CC	BW	RB	Signal Type	DUT Surface	Normal psPD	Total psPD
	MHz	Ch.	V	H	dBm	#	MHz	#			W/m²	W/m²
ANT M1	37050	2229167		147	7.7	1	100	1	CW	Back	2.620	3.020
	37050	2229167	19	147	4.7	1	100	1	CW	Back	1.900	2.270
	37050	2229167	18		8.3	1	50	66	CW	Back	3.820	**4.330**
	37050	2229167	18		8.3	1	50	66	CW	Left	0.357	0.364
	37050	2229167	18		8.3	1	50	66	CW	Top	0.338	0.392
Module/Antenna	Frequency		Beam ID1	Beam ID2	input.power.limit	CC	BW	RB	Signal Type	DUT Surface	Normal psPD	Total psPD
	MHz	Ch.	V	H	dBm	#	MHz	#			W/m²	W/m²
ANT M3	37050	2229167	50		0.6	1	100	1	CW	Right	4.860	**5.710**
	37050	2229167		177	0.6	1	100	1	CW	Right	3.180	4.020
	37050	2229167	50	178	-2.8	1	100	1	CW	Right	3.190	3.970
	37050	2229167	50		0.6	1	100	1	CW	Back	1.630	1.780
	37050	2229167	50		0.6	1	100	1	CW	Front	3.010	3.100

PD_Design_Target (W/m²): 5
Total Uncertainty (dB): 2.00
Worst-case: S2 (Rear)

Module	Printed backoff Value bj (linear)	FCC PD Limit (W/m²)	bj*PD_design_target + total uncertainty (W/m²)	Beam/Beam-pair ID	Measured PD (W/m²)	Surface	Contribution Factor c(i,j)
1	0.9772	10	7.744	18	4.330	S2	0.0137
2	0.9772	10	7.744	46	5.630	S2	0.0137
Verification: (0.0137 x 4.33) + (0.0137 x 5.63) = 0.136452 < 7.744							

Note: Module 0 contains antennas M1 and M2, module 1 contains antenna M3

Table 4-5: PD Measurement results for n261

Module/Antenna	Frequency		Beam ID1	Beam ID2	input.power.limit	CC	BW	RB	Signal Type	DUT Surface	Normal psPD	Total psPD
	MHz	Ch.	V	H	dBm	#	MHz	#			W/m²	W/m²
ANT M2	28300	2083330	34		-0.4	1	100	1	CW	Back	4.260	4.800
	27925	2077084		174	-0.2	1	100	1	CW	Back	4.270	4.640
	27550	2070833	46	174	-4.2	1	100	33	CW	Back	5.250	**5.580**
	27550	2070833	46	174	-4.2	1	100	33	CW	Left	1.400	1.410
Module/Antenna	Frequency		Beam ID1	Beam ID2	input.power.limit	CC	BW	RB	Signal Type	DUT Surface	Normal psPD	Total psPD
	MHz	Ch.	V	H	dBm	#	MHz	#			W/m²	W/m²
ANT M1	27550	2070833		155	4.5	1	100	1	CW	Back	2.900	3.420
	28300	2083330	17	145	1.1	1	100	1	CW	Back	2.280	2.630
	27550	2070833	28		7.4	1	50	33	CW	Back	4.490	**5.180**
	27550	2070833	28		7.4	1	50	33	CW	Left	0.394	0.432
	27550	2070833	28		7.4	1	50	33	CW	Top	0.956	1.050
Module/Antenna	Frequency		Beam ID1	Beam ID2	input.power.limit	CC	BW	RB	Signal Type	DUT Surface	Normal psPD	Total psPD
	MHz	Ch.	V	H	dBm	#	MHz	#			W/m²	W/m²
ANT M3	27925	2077084	42		-0.5	1	100	1	CW	Right	1.790	2.790
	27925	2077084	42	170	-4.4	1	100	1	CW	Right	1.710	2.390
	28300	2083330		170	-0.6	1	100	1	CW	Right	2.880	**3.910**
	28300	2083330		170	-0.6	1	100	1	CW	Back	0.658	0.752
	28300	2083330		170	-0.6	1	100	1	CW	Front	1.470	1.830

PD_Design_Target (W/m²): 5
Total Uncertainty (dB): 2.00
Worst-case: S2 (Rear)

Module	Printed backoff Value bj (linear)	FCC PD Limit (W/m²)	bj*PD_design_target + total uncertainty (W/m²)	Beam/Beam-pair ID	Measured PD (W/m²)	Surface	Contribution Factor c(i,j)
1	0.955	10	7.568	28	5.180	S2	0.0318
2	0.955	10	7.568	46/174	5.580	S2	0.0318
Verification: (0.0318 x 5.18) + (0.0318 x 5.58) = 0.342168 < 7.568							

Note: Module 0 contains antennas M1 and M2, module 1 contains antenna M3

The PD distribution plots for both point PD and 4cm^2 avg PD for the highest PD configuration in Tables 4-1, 4-2 & 4-3 is given below.

Note: Dasy mmWave module automatically computes grid extents from anchor scan

n258:

Measurement Report for AA2107, EDGE RIGHT, Custom Band, UID 0 -, Channel 25200000 (25200.0MHz)

Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
, AA2107	147.0 x 71.0 x 7.0		Phone

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G Air	EDGE RIGHT, 2.00	Custom Band	CW, 0--	25200.0, 25200000	1.0

Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave- xxxx	---Air	EUmmWV4 - SN9496_F1-55GHz, 2022-02-24	DAE4ip Sn1619, 2022-04-21

Scan Setup

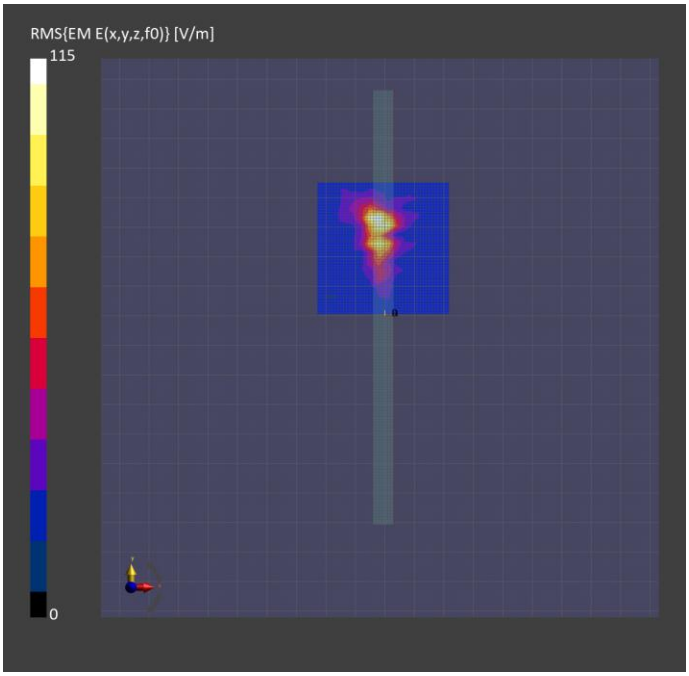
	5G Scan
Grid Extents [mm]	25.0 x 25.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	2.0
MAIA	N/A

Measurement Results

	5G Scan
Date	2022-07-06, 10:57
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	5.10
psPDtot+ [W/m^2]	6.89
psPDmod+ [W/m^2]	7.57
E_{max} [V/m]	115
Power Drift [dB]	0.11

Warning(s) / Error(s)

Details	5G Scan
Warning(s)	Measurement area not sufficient according to IEC 63195.
Error(s)	



n260:
Measurement Report for AA2107, EDGE RIGHT, Custom Band, UID 0 -, Channel 37050000 (37050.0MHz)
Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
, AA2107	147.0 x 71.0 x 7.0		Phone

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G Air	EDGE RIGHT, 2.00	Custom Band	CW, 0--	37050.0, 37050000	1.0

Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave- xxxx	---Air	EUmmWV4 - SN9589_F1-55GHz, 2021-08-16	DAE4 Sn1462, 2021-10-11

Scan Setup

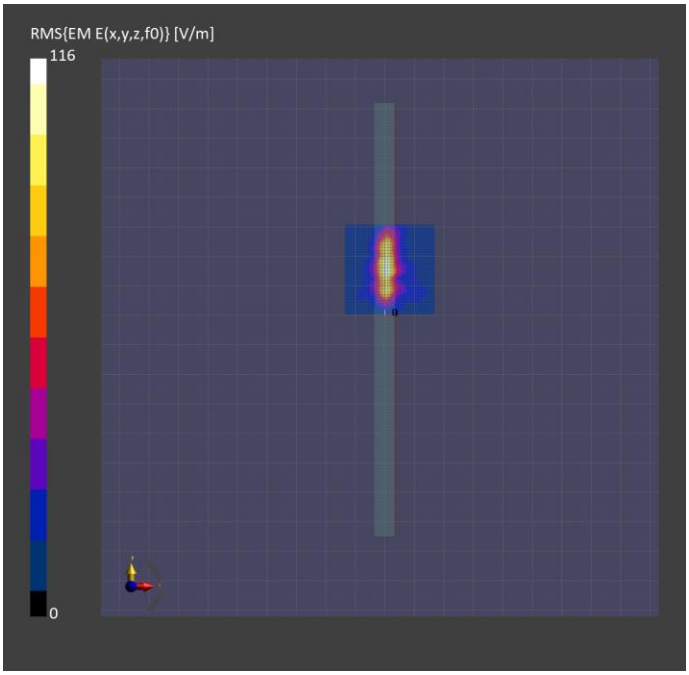
	5G Scan
Grid Extents [mm]	25.0 x 25.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	2.0
MAIA	N/A

Measurement Results

	5G Scan
Date	2022-06-08, 22:15
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	4.86
psPDtot+ [W/m^2]	5.71
psPDmod+ [W/m^2]	6.13
E_{max} [V/m]	116
Power Drift [dB]	-0.04

Warning(s) / Error(s)

Details	5G Scan
Warning(s)	Measurement area not sufficient according to IEC 63195.
Error(s)	



n261:
Measurement Report for AA2107, BACK, Custom Band, UID 0 -, Channel 27550000 (27550.0MHz)
Device under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
, AA2107	147.0 x 71.0 x 7.0		Phone

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G Air	BACK, 2.00	Custom Band	CW, 0--	27550.0, 27550000	1.0

Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave- xxxx	---Air	EUmmWV4 - SN9496_F1-55GHz, 2022-02-24	DAE4ip Sn1619, 2022-04-21

Scan Setup

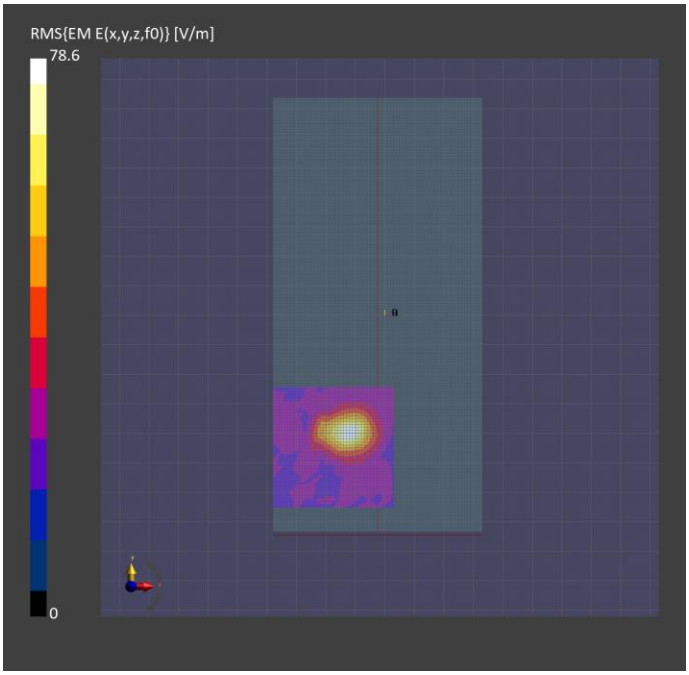
	5G Scan
Grid Extents [mm]	25.0 x 25.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	2.0
MAIA	Y

Measurement Results

	5G Scan
Date	2022-06-10, 08:40
Avg. Area [cm^2]	4.00
psPDn+ [W/m^2]	5.25
psPDtot+ [W/m^2]	5.58
psPDmod+ [W/m^2]	5.73
E_{max} [V/m]	78.6
Power Drift [dB]	-0.34

Warning(s) / Error(s)

Details	5G Scan
Warning(s)	Power drift exceeds warning threshold.
Error(s)	



4.3. Simultaneous Transmission Analysis

The EUT supports simultaneous transmission of multiple radios. RF exposure compliance in simultaneous transmission scenarios is evaluated in this section.

It must be noted here that Qualcomm's Smart Transmit time-averaging algorithm was applied to only WWAN (Sub-6GHz/5G mmW NR) on this device, where the time-averaged power level is controlled so that the RF exposure is ≤ $SAR_{Design\ Target}$ (corresponding to P_{limit}) for Sub-6 GHz WWAN and ≤ $PD_{Design\ Target}$ (corresponding to input.power.limit) for 5G mmW NR. Since there is total design related uncertainty arising from TxAGC and device-to-device variation, the worst-case RF exposure should be determined by accounting for this uncertainty in the corresponding design target, thus, with 1dB of device uncertainty for sub-6 WWAN and 2dB of device uncertainty for 5G mmW NR. Therefore, the worst-case RF exposure for this EUT is:

Table 4-6: Worst-case time-averaged RF exposure for WWAN

Scenario	WWAN	
	Sub-6 GHz WWAN	5G mmW NR
Maximum time-averaged power level	P_{limit}	input.power.limit
Maximum time-averaged exposure (Design Targets)	0.8 W/kg (1-g SAR)	5 W/m²
Design-related uncertainty (dB)	1.00	2.00
Worst-case time-averaged RF exposure	Reported SAR† = 0.9 W/kg (1-g SAR)	Reported PD* = 6 W/m²

†: For this EUT, (P_{limit} + 1.0dB uncertainty) ≥ P_{max} (maximum RF tune-up output power).
Therefore, time-averaged SAR exposure from Smart Transmit enabled EUT (at P_{limit}) cannot exceed the reported SAR corresponding to Pmax listed in Table 5-2.

*: Smart Transmit allows only 75% of maximum PD exposure for this EUT utilizing EFS entries listed in Table 4-1. See §5.3.1 for details.

WLAN reported 1g SAR at the maximum RF tune-up output power is listed in Table 4-2.

4.3.1. Analysis

RF exposure compliance with WWAN+WLAN simultaneous transmission scenarios is demonstrated for various radio configurations using the equation below:

> Total norm. RF exposure = norm. RF exposure from Smart Transmit enabled WWAN (norm. SAR from Sub-6 GHz + norm. PD from 5G mmW NR) + norm. SAR from WLAN ≤ 1.0 normalized limit (1)

Smart Transmit algorithm in WWAN adds directly the time-averaged RF exposure from Sub-6 GHz WWAN and time-averaged RF exposure from 5G mmW NR, i.e.,

> norm. RF exposure from Smart Transmit enabled WWAN: (normalized SAR exposure from Sub-6 GHz) + (normalized PD exposure from 5G mmW NR) ≤ 1.0 normalized limit (2)

In other words, Smart Transmit algorithm controls the total RF exposure from both Sub-6 GHz radio and 5G mmW NR to not exceed the FCC limit. All WWAN sub6 antennas are assumed to collocate with each mmW module (i.e., ignoring spatial distribution of WWAN Sub-6 hotspots) and directly adds normalized RF exposures from Sub-6 GHz WWAN and from each 5G mmW NR module, i.e.,

> If A = max normalized time-averaged SAR exposure from Sub-6 GHz,
> B = max normalized time-averaged PD exposure from 5G mmW NR,

Then, equation (2) can be re-written as below because All WWAN sub6 antennas are assumed to collocate with each mmW module and 5G mmW NR hotspot:

Smart Transmit enabled WWAN: x(t) * A + (1-x(t)) * B ≤ 1.0 normalized limit (3)

Here, "*x(t)*A*" represents percentage of normalized time-averaged RF exposure from Sub-6 GHz WWAN, and x(t) ranges between [0,1]; "*(1-x(t))*B*" is remaining percentage of RF exposure contribution from 5G mmW NR. Smart Transmit controls '*x*' in real time such that the sum of these exposures never exceeds the 1.0 normalized limit.

Note that mathematically:

$x(t) * A + (1 - x(t)) * B \leq max(A, B) \leq 1.0\ normalized\ limit$ for x(t) ∈ [0,1] (4)

Therefore, if equations (5a) and (5b) are proven:

$A + norm.SAR\ from\ WLAN \leq 1.0\ norm.limit$ (5a),

$B + norm.SAR\ from\ WLAN \leq 1.0\ norm.limit$ (5b),

Then, based on equation (4), the condition below is also proved:

$[x(t) * A + (1 - x(t)) * B] + norm.SAR\ from\ WLAN \leq 1.0\ norm.limit$ (5c)

which is the same as equation (1), as a means to demonstrate compliance for simultaneous transmission.

Additionally, it should be noted that in the absence of 5G mmW NR, Smart Transmit limits the maximum RF exposure contributed from Sub-6 GHz WWAN to 100% normalized exposure (i.e., *x*=1.0 in equation 3). Therefore:

Smart Transmit enabled WWAN: A=max (normalized SAR exposure from Sub-6 GHz) ≤ 1.0 normalized limit (6a)

Smart Transmit enabled WWAN: B=max (normalized PD exposure from 5G mmW NR) ≤ 1.0 normalized limit (6b)

Thus, for compliance demonstration given by equation (1), equation (7) is obtained by combining equations (5a & 5b) and (6a & 6b) and should be proven to guarantee simultaneous transmission compliance:

Total normalized RF exposure = norm. SAR from Sub-6 GHz WWAN + norm. SAR from WLAN < 1.0 normalized FCC limit (7a)

Total normalized RF exposure = norm. PD from 5G mmW NR WWAN + norm. SAR from WLAN < 1.0 normalized FCC limit (7b)

The compliance for simultaneous transmission scenarios of WWAN (Sub-6 GHz/5G mmW NR) radio enabled with Smart Transmit and WLAN without Smart Transmit is re-evaluated for all transmission scenarios supported by this EUT.

As described in equation (7), simultaneous transmission analysis for WWAN + WLAN is performed in two parts:

1. Sub-6 GHz WWAN + WLAN (i.e., Eq. (7a) with compliance demonstration in §4.3.2)
2. 5G mmW NR WWAN + WLAN (i.e., Eq. (7b) with compliance demonstration in §4.3.3)

By combining equations *a* and *b* variants, the FCC requirement expressed in Eq. (1) is re-written below:

Total norm. RF exposure = norm. RF exposure from Smart Transmit enabled WWAN (norm. SAR from Sub-6 GHz WWAN + norm. PD from 5G mmW NR) + norm. SAR from WLAN ≤ 1.0 normalized limit (1)

4.3.2. Simultaneous Transmission Compliance Demonstration for Sub-6 GHz WWAN + WLAN

Simultaneous transmission analysis for Sub-6 WWAN + WLAN is shown in the UL FCC SAR Test Report 14040867-S1.

4.3.3. Simultaneous Transmission Compliance Demonstration for 5G mmW NR WWAN + WLAN

Simultaneous transmission analysis is performed in this section using worst-case PD values listed in Tables 4-3 to 4-5 for compliance demonstration of 5G mmW NR WWAN + WLAN, along with all worst-case reported SAR, extracted from UL FCC SAR Test Report 13571601-S1, values for WLAN listed in Table 4-2.

Simultaneous transmission analysis on all 5G mmW NR WWAN + WLAN scenarios are listed below:

Table 4-7: Simultaneous transmission analysis scenarios for 5G mmW NR WWAN + WLAN

1	2.4GHz WLAN* + 5G mmW NR
2	5GHz WLAN* + 5G mmW NR
3	5GHz WLAN* + BT + 5G mmW NR

*: For each of the WLAN bands, worst-case SAR out of both WLAN antennas and WLAN MIMO scenarios is used during simultaneous transmission analysis. Additionally, note that WLAN 2.4GHz and WLAN 5GHz cannot transmit simultaneously.

The total exposure ratio (TER) is calculated using the equation below, followed by the calculated TER for this EUT:

Table 4-8: 5G mmW NR Simulation PD Surface Ratio n258

n258						
Surface	PD Magnitude Ratio		Head	Body[1]	Meas. Total PD (W/m^2)	Measured Total PD x 0.8 (W/m^2)
	2mm (W/m^2)	5mm (W/m^2)	PD x 0.8 @ 2mm (W/m^2)	PD x 0.8 @ 5mm (W/m^2)		
S1	0.5		**3.65**	**3.2**	3.030	2.424
S2	1.0	0.8	N/A	**6.4**	4.690	3.752
S3	0.4		N/A	**2.6**	1.420	1.136
S4	1.0	0.7	N/A	**6.4**	6.890	5.512
S5	0.1		N/A	**0.6**	0.418	0.334
S6	0.0		N/A	**0.0**		

[1] Results for Body were calculated using the most conservative ratio between the PD Magnitudes for 2mm and 5mm.

Table 4-9: 5G mmW NR Simulation PD Surface Ratio n260

n260						
Surface	PD Magnitude Ratio		Head	Body[1]	Meas. Total PD (W/m^2)	Measured Total PD x 0.8 (W/m^2)
	2mm (W/m^2)	5mm (W/m^2)	PD x 0.8 @ 2mm (W/m^2)	PD x 0.8 @ 5mm (W/m^2)		
S1	0.5		**4.2**	**3.2**	3.100	2.480
S2	1.0	0.8	N/A	**6.4**	5.630	4.504
S3	0.3		N/A	**1.9**	2.840	2.272
S4	1.0	0.7	N/A	**6.4**	5.710	4.568
S5	0.2		N/A	**1.3**	0.392	0.314
S6	0.1		N/A	**0.6**		

[1] Results for Body were calculated using the most conservative ratio between the PD Magnitudes for 2mm and 5mm.

Table 4-10: 5G mmW NR Simulation PD Surface Ratio n261

n261						
Surface	PD Magnitude Ratio		Head	Body[1]	Meas. Total PD (W/m^2)	Measured Total PD x 0.8 (W/m^2)
	2mm (W/m^2)	5mm (W/m^2)	PD x 0.8 @ 2mm (W/m^2)	PD x 0.8 @ 5mm (W/m^2)		
S1	0.5		**3.9**	**3.2**	1.830	1.464
S2	1.0	0.8	N/A	**6.4**	5.580	4.464
S3	0.3		N/A	**1.9**	1.410	1.128
S4	1.0	0.7	N/A	**6.4**	3.910	3.128
S5	0.2		N/A	**1.3**	1.050	0.840
S6	0.0		N/A	**0.0**		

[1] Results for Body were calculated using the most conservative ratio between the PD Magnitudes for 2mm and 5mm.

Table 4-11: Head TER for Worst-Case WLAN + 5G mmW NR n258

Head TER	psPD	2.4 GHz WiFi	5 GHz WiFi	BT P_{low}	psPD + 2.4 GHz WLAN	psPD + 5 GHz WLAN	psPD + 5 GHz WLAN + BT
	W/m^2	W/kg	W/kg	W/kg			
TER Combinations	1	2	3	4	1+2	1+3	1+3+4
Applicable limit	10	1.6	1.6	1.6	1	1	1
Reported Exposure	3.650	0.446	0.356	0.086	-	-	-
Ratio to Limit	0.365	0.279	0.222	0.054	0.644	0.587	0.641

Table 4-12: Head TER for Worst-Case WLAN + 5G mmW NR n260

Head TER	psPD	2.4 GHz WiFi	5 GHz WiFi	BT P_{low}	psPD + 2.4 GHz WLAN	psPD + 5 GHz WLAN	psPD + 5 GHz WLAN + BT
	W/m^2	W/kg	W/kg	W/kg			
TER Combinations	1	2	3	4	1+2	1+3	1+3+4
Applicable limit	10	1.6	1.6	1.6	1	1	1
Reported Exposure	4.210	0.446	0.356	0.086	-	-	-
Ratio to Limit	0.421	0.279	0.222	0.054	0.700	0.643	0.697

Table 4-13: Head TER for Worst-Case WLAN + 5G mmW NR n261

Head TER	psPD	2.4 GHz WiFi	5 GHz WiFi	BT P_{low}	psPD + 2.4 GHz WLAN	psPD + 5 GHz WLAN	psPD + 5 GHz WLAN + BT
	W/m^2	W/kg	W/kg	W/kg			
TER Combinations	1	2	3	4	1+2	1+3	1+3+4
Applicable limit	10	1.6	1.6	1.6	1	1	1
Reported Exposure	3.910	0.446	0.356	0.086	-	-	-
Ratio to Limit	0.391	0.279	0.222	0.054	0.670	0.613	0.667

Table 4-14: Body/Hotspot TER for Worst-Case WLAN + 5G mmW NR n258

n258								
Body/Hotspot TER		psPD	2.4 GHz WiFi	5 GHz WiFi	BT P_{low}	psPD + 2.4 GHz WLAN	psPD + 5 GHz WLAN	psPD + 5 GHz WLAN + BT
		W/m^2	W/kg	W/kg	W/kg			
Scenario		1	2	3	4	1+2	1+3	1+3+4
Applicable limit		10	1.6	1.6	1.6	1	1	1
S1 @ 5 mm	Reported Exposure	3.200	0.403	0.453	0.018	-	-	-
	Ratio to Limit	0.320	0.252	0.283	0.011	0.572	0.603	0.614
S2 @ 5mm	Reported Exposure	6.400	0.403	0.453	0.085	-	-	-
	Ratio to Limit	0.640	0.252	0.283	0.053	0.892	0.923	0.976
S3 @ 5mm	Reported Exposure	2.600	0.536	0.431	0.089	-	-	-
	Ratio to Limit	0.260	0.335	0.269	0.056	0.595	0.529	0.585
S4 @ 5mm	Reported Exposure	6.400	0.485	0.000	0.087	-	-	-
	Ratio to Limit	0.640	0.303	0.000	0.055	0.943	0.640	0.695
S5 @ 5mm	Reported Exposure	0.600	0.403	0.431	0.004	-	-	-
	Ratio to Limit	0.060	0.252	0.269	0.002	0.312	0.329	0.332
S6 @ 5mm	Reported Exposure	0.000	0.292	0.390	0.007	-	-	-
	Ratio to Limit	0.000	0.183	0.244	0.004	0.183	0.244	0.248

Table 4-15: Body/Hotspot TER for Worst-Case WLAN + 5G mmW NR n260

n260								
Body/Hotspot TER		psPD	2.4 GHz WiFi	5 GHz WiFi	BT P_{low}	psPD + 2.4 GHz WLAN	psPD + 5 GHz WLAN	psPD + 5 GHz WLAN + BT
		W/m^2	W/kg	W/kg	W/kg			
Scenario		1	2	3	4	1+2	1+3	1+3+4
Applicable limit		10	1.6	1.6	1.6	1	1	1
S1 @ 5 mm	Reported Exposure	3.200	0.403	0.453	0.018	-	-	-
	Ratio to Limit	0.320	0.252	0.283	0.011	0.572	0.603	0.614
S2 @ 5mm	Reported Exposure	6.400	0.403	0.453	0.085	-	-	-
	Ratio to Limit	0.640	0.252	0.283	0.053	0.892	0.923	0.976
S3 @ 5mm	Reported Exposure	1.900	0.536	0.431	0.089	-	-	-
	Ratio to Limit	0.190	0.335	0.269	0.056	0.525	0.459	0.515
S4 @ 5mm	Reported Exposure	6.400	0.485	0.000	0.087	-	-	-
	Ratio to Limit	0.640	0.303	0.000	0.055	0.943	0.640	0.695
S5 @ 5mm	Reported Exposure	1.300	0.403	0.431	0.004	-	-	-
	Ratio to Limit	0.130	0.252	0.269	0.002	0.382	0.399	0.402
S6 @ 5mm	Reported Exposure	0.600	0.292	0.390	0.007	-	-	-
	Ratio to Limit	0.060	0.183	0.244	0.004	0.243	0.304	0.308

Table 4-16: Body/Hotspot TER for Worst-Case WLAN + 5G mmW NR n261

n261								
Body/Hotspot TER		psPD	2.4 GHz WiFi	5 GHz WiFi	BT P_{low}	psPD + 2.4 GHz WLAN	psPD + 5 GHz WLAN	psPD + 5 GHz WLAN + BT
		W/m^2	W/kg	W/kg	W/kg			
Scenario		1	2	3	4	1+2	1+3	1+3+4
Applicable limit		10	1.6	1.6	1.6	1	1	1
S1 @ 5 mm	Reported Exposure	3.200	0.403	0.453	0.018	-	-	-
	Ratio to Limit	0.320	0.252	0.283	0.011	0.572	0.603	0.614
S2 @ 5mm	Reported Exposure	6.400	0.403	0.453	0.085	-	-	-
	Ratio to Limit	0.640	0.252	0.283	0.053	0.892	0.923	0.976
S3 @ 5mm	Reported Exposure	1.900	0.536	0.431	0.089	-	-	-
	Ratio to Limit	0.190	0.335	0.269	0.056	0.525	0.459	0.515
S4 @ 5mm	Reported Exposure	6.400	0.485	0.000	0.087	-	-	-
	Ratio to Limit	0.640	0.303	0.000	0.055	0.943	0.640	0.695
S5 @ 5mm	Reported Exposure	1.300	0.403	0.431	0.004	-	-	-
	Ratio to Limit	0.130	0.252	0.269	0.002	0.382	0.399	0.402
S6 @ 5mm	Reported Exposure	0.000	0.292	0.390	0.007	-	-	-
	Ratio to Limit	0.000	0.183	0.244	0.004	0.183	0.244	0.248

5. Conclusions

Table 5-1 shows the worst-case 1-g SAR at P_{limit} and worst-case 4cm^2-avg PD at *input.power.limit.*

Table 5-1: Reported RF Exposure Level

Reported RF Exposure Level		Notes
Highest 1-g SAR at P_{limit} (W/kg)	0.948	Refer to §1 for the reference SAR Report
Highest 4cm^2-avg PD at *input.power.limit* (W/m^2)	6.89	§5.2
Highest 1-g SAR (W/kg) for simultaneous Tx (Sub-6 WWAN + WLAN)	1.507	Refer to §1 for the reference SAR Report
Highest Total Exposure Ratio for simultaneous Tx (5G mmW NR + WLAN)	0.976	§5.3

Qualcomm's Smart Transmit feature employed in the EUT meets the $SAR_{Design\ Target}$ and $PD_{Design\ Target}$ (within the design uncertainties) when operating in the static transmission condition at P_{limit} and *input.power.limit*, respectively, and is compliant with the FCC RF exposure limits.

Appendices

Refer to separated files for the following appendixes.

A. mmW Probe Certificate

B. Verification Source Certificate