

## RF Exposure report



The following samples were submitted and identified on behalf of the client as:

**Product Name** Qualcomm WiFi 7/BT Combo module  
**Brand Name** Qualcomm  
**Model No.** QCNCM825  
**Product Type:** Notebook PC  
**Brand Name:** ASUS  
**Host Information** **Model Name:** S5507Q, S5507QA, S5507QAD, K5507Q, V5507Q, P5507CQ, Q5507Q  
All models are electrically identical, different model names are for marketing purpose.  
**Applicant** ASUSTeK COMPUTER INC.  
1F., No. 15, Lide Rd., Beitou Dist., Taipei City 112, Taiwan  
**FCC ID** MSQ-QCNCM825  
**Date of EUT Receipt** Mar. 26, 2024  
**Date of Test(s)** Apr. 15, 2024 ~ Apr. 21, 2024  
**Date of Issue** Jul. 03, 2024

In the configuration tested, the EUT complied with the standards specified above.

**Remarks:**

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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**Signed on behalf of SGS**

| Clerk / Kimmy Chiou | PM / Kiki Lin | Approved By / John Yeh |
|---------------------|---------------|------------------------|
|                     |               |                        |

**Date: Jul. 03, 2024**

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## Revision History

| Report Number    | Revision | Description                  | Issue Date    | Revised By  | Remark |
|------------------|----------|------------------------------|---------------|-------------|--------|
| TESA2403000152ES | 00       | Initial creation of document | Jul. 03, 2024 | Kimmy Chiou |        |
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**Note:**

1. The mark " \* " is the revised version of the report due to comments submitted by the certification.
2. Variant information of model numbers is provided by the applicant, test results of this report are applicable to the sample EUT(s) received.  
And are assessed as electrically identical in RF characteristics, therefore, no further assessment required for the variant(s).

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# 1 GENERAL INFORMATION

## 1.1 Test Facility

| Laboratory                                            | Test Site Address                                                                                           | Test Site Name | FCC Designation number | IC CAB identifier |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|----------------|------------------------|-------------------|
| SGS Taiwan Ltd.<br>Central RF Lab.<br>(TAF code 3702) | 1F, No. 8, Alley 15, Lane 120,<br>Sec. 1, NeiHu Road, NeiHu<br>District, Taipei City, 11493,<br>Taiwan.     | SAR 2          | TW0029                 | TW3702            |
|                                                       |                                                                                                             | SAR 6          |                        |                   |
|                                                       |                                                                                                             | SAR 8          |                        |                   |
|                                                       | No. 2, Keji 1st Rd., Guishan<br>Township, Taoyuan County,<br>33383, Taiwan                                  | SAR 1          | TW0028                 |                   |
|                                                       |                                                                                                             | SAR 4          |                        |                   |
|                                                       | <b>No.134, Wu Kung Road,<br/>New Taipei Industrial Park,<br/>Wuku District, New Taipei<br/>City, Taiwan</b> | <b>SAR 3</b>   | TW0027                 |                   |
|                                                       |                                                                                                             | SAR 7          |                        |                   |

**Note:** Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

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## 2 INTRODUCTION

Qualcomm® FastConnect™ Time Averaged SAR (TAS) for Qualcomm WLAN technologies controls and manages transmit power in real time to always ensure the time averaged RF exposure is in compliance with regulatory requirements.

The purpose of this report is to demonstrate the Qualcomm® FastConnect™ time averaged SAR (TAS) feature RF exposure compliance under dynamic transmission scenarios.

This test report provides reference to test results and plots using parameters is determined from for static SAR test and configurate in Qualcomm® FastConnect™ Time Averaged SAR (TAS) BDF for validating the Qualcomm® FastConnect™ Time Averaged SAR (TAS) feature.

### 2.1 Reference

Table 2-1 References

| Document      | Report number    |
|---------------|------------------|
| Part 1 report | TESA2403000152ES |

### 2.2 Acronyms

Table 2-2 lists the acronyms used in this document.

Table 2-2 Acronyms

| Term | Description                     |
|------|---------------------------------|
| AG   | Antenna group                   |
| PD   | Power density                   |
| APD  | Absorbed power density          |
| IPD  | Incident power density          |
| BDF  | Board data file                 |
| CDD  | Cyclic delay diversity          |
| DBS  | Dual band simultaneous          |
| DSI  | Device state index              |
| EUT  | Equipment under test            |
| HBS  | High band simultaneous          |
| MIMO | Multiple-input multiple-output  |
| OEM  | Original equipment manufacturer |
| SAR  | Specific absorption rate        |
| SISO | Single-input single-output      |
| TAS  | Time averaged SAR               |

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### 3 QUALCOMM® FASTCONNECT™ TIME AVERAGED SAR (TAS) OPERATION

#### 3.1 Background

Regulatory RF exposure limits are defined with respect to time-averaged RF exposure. Qualcomm Qualcomm® FastConnect™ Time Averaged SAR (TAS) algorithm performs transmit power control to ensure at all times the wireless device is in compliance with the configured limit of RF exposure averaged over a defined time window denoted as TSAR for SAR and PD

NOTE: For FCC, WLAN 6GH operates in the 6GHz ~ 7GHz band. The Interim RF Exposure Test Procedures for U-NII 6-7GHz Portable Devices requires RF exposure assessment with SAR and incident PD (total) using mmW near-field probe and total-field/power-density reconstruction method.

The Qualcomm® FastConnect™ Time Averaged SAR (TAS) supports maximum time-averaging windows (denoted as TSAR) as defined by the FCC:

- For FCC, a 30 second time-averaging window is used by Qualcomm® FastConnect™ Time Averaged SAR (TAS) for WLAN operation in 2.4GHz, 5GHz, and 6GHz WLAN bands.

**Table 3-1 Frequencies of operation and time-averaging windows used by Qualcomm® FastConnect™ Time Averaged SAR (TAS)**

| FCC <sup>1</sup>   |                              |
|--------------------|------------------------------|
| WLAN band          | Time-averaging window length |
| 2.4GHz, 5GHz, 6GHz | 30s                          |

<sup>1</sup>The FCC time-averaging window table is based on FCC interim guidance.

#### 3.2 Basic concept of the feature

Qualcomm® FastConnect™ Time Averaged SAR (TAS) manages the instantaneous transmit power to maintain the time-averaged power and associated RF exposure is below the regulatory compliance limit.

- If the time-averaged transmit power approaches the SAR compliance power, then the instantaneous transmit power is limited to ensure the time-averaged transmit power does not exceed the SAR compliance power in any TSAR time window (i.e., the time-averaged RF exposure complies with the FCC RF exposure limit in any time window).
- The wireless device can instantaneously transmit at high transmit powers for a short time durations before limiting the power to maintain time-averaged SAR compliance.

#### 3.3 Configurable parameters

This section defines the key parameters required for Qualcomm® FastConnect™ Time Averaged SAR (TAS) Validation.

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The following inputs are key parameters required for functionality of the Qualcomm® FastConnect™ Time Averaged SAR (TAS) feature.

NOTE: The OEM must configure these parameters in the board data file (BDF).

- Time-Averaged Exposure Mode (FCC or ICNIRP) or Peak exposure mode, configurable for a given region/country: When enabled in Peak Exposure mode, Qualcomm® FastConnect™ Time Averaged SAR (TAS) limits instantaneous Tx power not to exceed  $P_{lim}$  in both simultaneous and single antenna case.
- $P_{lim}$  per WLAN band/ant/DSI/regulatory limit (FCC or ICNIRP limit). Either FCC or ICNIRP limits can be chosen for a given region/country.
- Antenna group (AG) table: Optional feature to group transmit antennas such that the antennas in each group have RF exposure that is mutually exclusive (either have sum of SAR less than regulatory limit or meet SPLSR criteria) with antennas belonging to a different group.
- Reserve margin (in dB).

Dynamic inputs:

- Country of operation (location-based awareness).
- Device state index (DSI).

Non-configurable parameters (fixed entries):

- $P_{max}$  values per each WLAN operating state.

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### 3.3.1 $P_{lim}$

$P_{lim}$  (in dBm) is the power corresponding to the  $SAR_{target}$  for FastConnect WLAN. In other words,  $P_{lim}$  is the maximum time-average transmit power setting for Qualcomm® FastConnect™ Time Averaged SAR (TAS), at which this radio configuration (i.e., antenna, band and DSI state) reaches the  $SAR_{target}$ . The Fast Connect TAS algorithm uses  $P_{lim}$  to and the real time transmit power to ensure the real time-averaged SAR is below the  $SAR_{target}$  in real time and thus ensure device RF Exposure compliance.

### 3.3.2 $P_{max}$

$P_{max}$  for FastConnect WLAN represents the maximum WLAN transmit power from other power setting in board data file. The  $P_{max}$  value could be identified by compare the target power (Rate-to-Power) and compliance transmit (CTL) and other power limit.

$$P_{max} = \min \{CTL, \text{Regdomain}, TPE/TPC, \text{Rate-to-Power}\}$$

### 3.3.3 Reserve margin

Qualcomm® FastConnect™ Time Averaged SAR (TAS) allows minimum reserve power  $P_{reserve}$  ( $= P_{lim} - \text{reserve margin}$ ) for WLAN radio to transmit, which can be used to maintain the link. The reserve margin is a global parameter, meaning it applies to all the radio configurations. When the reserve margin is set to zero dB, the Qualcomm® FastConnect™ Time Averaged SAR (TAS) effectively allows minimum transmit power  $P_{reserve} = P_{lim}$  at all times, in other words, the EUT transmits continuously at  $P_{lim}$ .

The value is chosen by the OEM and stored in the board data file (BDF). It is in 0.1 dB increments. A single value is applied to all bands and modes.

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## 4 COMPLIANCE ASSESSMENT METHODOLOGY

This chapter outlines the overall strategy to demonstrate FCC compliance.

### 4.1 Overall strategy

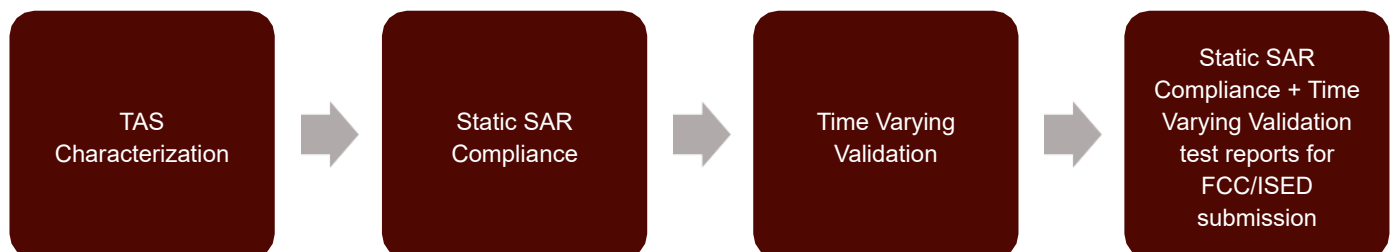
To demonstrate the compliance of Qualcomm® FastConnect™ Time Averaged SAR (TAS). Three parts of assessment should be completed, and Static SAR compliance test report and Time Varying Validation test report should be created for certification approval:

**Qualcomm\_FastConnect\_TAS\_Characterization** – OEM must perform SAR/PD characterization at the device level to determine Plim for RF exposure test.

**Qualcomm\_FastConnect\_TAS\_Static\_SAR\_Compliance** – OEM must perform Static SAR testing for all supported WLAN band/antenna/DSI. The maximum time average Tx power levels are determined from the SAR characterization and test in static transmission (e.g., FTM mode) to validate and demonstrate RF exposure meets the design target.

**Qualcomm\_FastConnect\_TAS\_Time\_Varying\_Validation** – Test with pre-defined test sequence for each validation scenario to demonstrate RF Exposure compliance is achieved by Qualcomm® FastConnect™ Time Averaged SAR (TAS). Qualcomm releases a test tool that can be used for the validation scenarios and also provides installation and test guides to OEMs manufactures. OEM manufactures should determine the appropriate test mode/channel and complete the TAS Time Varying Validation Report and submit in FCC certification submissions.

High-level procedure for Qualcomm® FastConnect™ Time Averaged SAR (TAS) product approval process is shown in Figure 4-1.



**Figure 4-1 High-level process for Qualcomm® FastConnect™ Time Averaged SAR (TAS) approval process**

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## 4.2 Validation strategy

The following scenarios cover validation tests to prove Qualcomm® FastConnect™ Time Averaged SAR (TAS) accounts for the history of transmission power accuracy at all times including before, during, and after transition in each scenario.

Since RF exposure is proportional to the Tx power for a SAR wireless device, time-averaging algorithm validation can be effectively performed through conducted power measurements is outlined as specified in Section 5.5 to all validation scenarios.

Also, to have high confidence in validation, but also be practical, the strategy for the **Time-Varying Test Sequence** including both conducted power measurement and RF exposure measurement is outlined as specified in Section 5.5 Section 5.6.

### 4.2.1 Time-Varying Test Sequence

This test proves the Qualcomm® FastConnect™ Time Averaged SAR (TAS) accounts for Tx power variations in time accurately.

- Two bands to be selected for this test as possible and one antenna/DSI from each band should be selected and tested to prove the Qualcomm® FastConnect™ Time Averaged SAR (TAS) feature accounts for Tx power variations in time accurately using the conducted power measurement approach. This test sequence is also used for pointSAR measurement to demonstrate Qualcomm® FastConnect™ Time Averaged SAR (TAS) feature in radiated test setup.

In addition, this test is performed to capture the maximum time-averaged results in at least two time-averaging windows duration.

### 4.2.2 Change in antenna (applicable when the software supports SISO diversity operation)

This test is to prove that FastConnect functions correctly during transitions in  $P_{lim}$  (at different antennas) within the same WLAN band and same Antenna Group. If device supports SISO and transmission diversity between an Antenna to another antenna, then this test is applicable. If WLAN MIMO CDD is implemented, then device is always under MIMO transmission, in this case, this test is NOT applicable.

- One band/DSI and two antenna ports should be selected for conducted power measurement.

### 4.2.3 Change in device state (DSI) (applicable when the device supports multiple DSI)

This is to prove that Qualcomm® FastConnect™ Time Averaged SAR (TAS) performs power enforcements to maintain compliance during transitions in the device state.

- One antenna/band and two DSIs should be selected for conducted measurement.

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#### 4.2.4 Change in WLAN band

This is to prove that the Qualcomm® FastConnect™ Time Averaged SAR (TAS) functions correctly during transitions in radios and bands.

- One antenna/DSI and two bands should be selected for conducted power measurement.

#### 4.2.5 Simultaneous Transmission

This is to prove that the Qualcomm® FastConnect™ Time Averaged SAR (TAS) functions in transition from 1<sup>st</sup> standalone WLAN radio to simultaneous WLAN radios and back to 2<sup>nd</sup> standalone WLAN radio.

- Select two bands per simultaneous transmissions feature implemented to Qualcomm® FastConnect™ Time Averaged SAR (TAS) device for this test. One antenna/DSI and two bands should be selected for conducted power measurement.

### 4.3 Conducted power measurement

This section provides general procedures to perform conducted power measurement under dynamic transmission scenarios and apply to all test scenarios described in section 4.2.

1. Measure conducted power.
2. Convert it into RF exposure and divide by respective limits to get normalized exposure use equation as described in this section.
3. Perform time-averaging over predefined time windows.
4. Demonstrate that the total normalized time-averaged RF exposure is <1 for all transmission scenarios.

- For frequency below 6GHz or if regulator requires SAR for WLAN 6GHz band.

$$1g\_or\_10gSAR(t) = \frac{\text{Conducted\_Tx\_power}(t)}{\text{Conducted\_Tx\_power\_Plim}} * 1g\_or\_10gSAR\_Plim \quad (1a)$$

$$\frac{\frac{1}{TSAR} \int_{t-TSAR}^t 1g\_or\_10gSAR(t) dt}{FCC \text{ or ICNIRP SAR limit}} \leq 1 \quad (1b)$$

- For frequency greater than 6GHz if regulator requires APD. (Applicable for ISED)

$$4cm^2 PD(t) = \frac{\text{Conducted\_Tx\_power}(t)}{\text{Conducted\_Tx\_power\_Plim}} * 4cm^2 PD\_Plim \quad (1c)$$

$$\frac{\frac{1}{TSAR} \int_{t-TSAR}^t 4cm^2 PD(t) dt}{APD 4cm^2 PD limit} \leq 1 \quad (1d)$$

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Where,  $conducted\_Tx\_power(t)$ ,  $conducted\_Tx\_power\_Plim$  and  $1g\_or\_10gSAR\_Plim$  correspond to the measured instantaneous conducted Tx power and conducted Tx power at  $P_{lim}$  of DUT, and  $1g\_or\_10gSAR$  values at  $P_{lim}$  for the worst-case radio configuration within the tested band/Antenna/DSI. Similarly,  $4cm^2 PD\_Plim$  correspond to the APD values at  $P_{lim}$  for the worst-case radio configuration within the tested band (greater than 6GHz)/Antenna/DSI.

The equations (1a) & (1b) are applicable if SAR is required by regulator to address RF exposure for the band greater than 6GHz.

NOTE: The ratio circled in red square is obtained from the measurement on the radio configuration is selected for validation test while the  $1g\_or\_10gSAR\_Plim$  and  $4cm^2 PD\_Plim$  must be from the SAR value in the worst-case radio configuration within the tested band/Antenna/DSI in static SAR report and scale to the  $conducted\_Tx\_power\_Plim$  level is measured from DUT used in validation test.

#### 4.4 RF exposure measurement

This section provides the general procedure to demonstrate the Qualcomm® FastConnect™ Time Averaged SAR (TAS) comply SAR limit in radiated test setup. Through pointSAR measurement for only test scenario **Time-Varying Test Sequence** (section 4.2.1) to add confidence in the Qualcomm® FastConnect™ Time Averaged SAR (TAS) feature validation, while avoiding the complexity in SAR measurement.

1. Choose worst case EUT orientation of SAR measurement per according to Static SAR test report and perform pointSAR measurement use cDASY6
2. Measure instantaneous SAR versus time and demonstrate total normalized time-averaged RF exposure is <1.0 at all times.

- ☐ For frequency below 6GHz or if regulator requires SAR for WLAN 6GHz band.

$$1g\_or\_10gSAR(t) = \frac{pointSAR(t)}{pointSAR\_Plim} * 1g\_or\_10gSAR\_Plim \quad (2a)$$

$$\frac{\frac{1}{TSAR} \int_{t-TSAR}^t 1g\_or\_10gSAR(t) dt}{FCC or ICNIRP SAR limit} \leq 1 \quad (2b)$$

- ☐ For frequency greater than 6GHz if regulator requires APD. (Applicable for ISED)

$$4cm^2 PD(t) = \frac{pointSAR(t)}{pointSAR\_Plim} * 4cm^2 PD\_Plim \quad (2c)$$

$$\frac{\frac{1}{TSAR} \int_{t-TSAR}^t 4cm^2 PD(t) dt}{APD 4cm^2 PD limit} \leq 1 \quad (2d)$$

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where,  $pointSAR(t)$ ,  $pointSAR_{Plim}$ , and  $1g\_or\_10gSAR_{Plim}$  correspond to the measured instantaneous point SAR and point SAR at  $P_{lim}$  of DUT, and  $1g\_or\_10gSAR$  values at  $P_{lim}$  for the worst-case radio configuration within the tested band/Antenna/DSI. Similarly,  $4cm^2 PD_{Plim}$  is the APD values at  $P_{lim}$  for the worst-case radio configuration within the tested band (greater than 6GHz)/Antenna/DSI.

The equations (2a) & (2b) are applicable if SAR is required by regulator to address RF exposure for the band greater than 6GHz.

NOTE: The ratio circled in red square is obtained from the measurement on the radio configuration is selected for validation test while the  $1g\_or\_10gSAR_{Plim}$  and  $4cm^2 PD_{Plim}$  must be from the SAR value in the worst-case radio configuration within the tested band/Antenna/DSI in static SAR report and scale to the  $conducted\_Tx\_power_{Plim}$  level is measured from DUT used in validation test.

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## 5 EUT AND TEST SETUP INFORMATION

### 5.1 DUT information

- DUT: Brand Name: ASUS Model: S5507Q with Qualcomm WLAN 6GHz module installed (Regulatory Model: QCNCM825, FCC ID: MSQ-QCNCM825)
- Qualcomm QCNCM825 module supports WLAN 6GHz and Bluetooth applications, includes 2.4/5/6 GHz, 2 streams 802.11a/b/g/n/ac/ax/be + Bluetooth 5.3.

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUT Name             | ASUS laptop S5507Q with Qualcomm WLAN 6GHz module installed                                                                                                                                                                                                                                                                                                                                                                          |
| EUT FCC ID           | Module FCC ID: MSQ-QCNCM825                                                                                                                                                                                                                                                                                                                                                                                                          |
| EUT Description      | Notebook Computer                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Radio Technologies   | WLAN 6GHz + Bluetooth                                                                                                                                                                                                                                                                                                                                                                                                                |
| Equipment Categories | Portable                                                                                                                                                                                                                                                                                                                                                                                                                             |
| TX Frequencies       | WLAN 2.4GHz Band: 2400 MHz ~ 2483.5 MHz<br>WLAN U-NII 1: 5150 MHz ~ 5250 MHz<br>WLAN U-NII 2a: 5250 MHz ~ 5350 MHz<br>WLAN U-NII 2c: 5470 MHz ~ 5725 MHz<br>WLAN U-NII 3: 5725 MHz ~ 5850 MHz<br>WLAN U-NII 4: 5850 MHz ~ 5925 MHz (US only)<br>WLAN U-NII 5: 5925 MHz ~ 6425 MHz<br>WLAN U-NII 6: 6425 MHz ~ 6525 MHz<br>WLAN U-NII 7: 6525 MHz ~ 6875 MHz<br>WLAN U-NII 8: 6875 MHz ~ 7125 MHz<br>Bluetooth: 2400 MHz ~ 2483.5 MHz |

QCNCM825 supports 2x2 WLAN with two physical antenna ports:

|                    |              |
|--------------------|--------------|
| Radio Tx chain     | Antenna port |
| 2GHz (Chain0)      | Aux Ant      |
| 2GHz (Chain1)      | Main Ant     |
| 5GHz/6GHz (Chain0) | Aux Ant      |
| 5GHz/6GHz (Chain1) | Main Ant     |

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## 5.2 DUT Qualcomm® FastConnect™ Time Averaged SAR (TAS) Configured Parameters

The DUT has Qualcomm® FastConnect™ Time Averaged SAR (TAS) parameters configured in Board Data File for test in this test report.

## 5.3 Test equipment list

The test equipment used in this Qualcomm® FastConnect™ Time Averaged SAR (TAS) Time varying test report is listed in Table 5-1.

**Table 5-1 Test equipment list**

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| Equipment List |                              |                       |               |                          |                          |
|----------------|------------------------------|-----------------------|---------------|--------------------------|--------------------------|
| Manufacturer   | Device                       | Type                  | Serial number | Date of last calibration | Date of next calibration |
| SPEAG          | Data acquisition Electronics | DAE4                  | 1719          | Jan/17/2024              | Jan/16/2025              |
| SPEAG          | Dosimetric E-Field Probe     | EX3DV4                | 7642          | Feb/21/2024              | Feb/20/2025              |
| SPEAG          | System Validation Dipole     | D2450V2               | 728           | Aug/28/2023              | Aug/27/2024              |
| SPEAG          | System Validation Dipole     | D5GHzV2               | 1023          | Jan/24/2024              | Jan/23/2025              |
| R&S            | MXG Analog Signal Generator  | SMB100A03             | 182012        | May/21/2024              | May/20/2025              |
| Agilent        | Dual-directional coupler     | 772D                  | MY46151258    | Sep/26/2023              | Sep/25/2024              |
| Agilent        | Dual-directional coupler     | 778D                  | MY46151242    | Sep/26/2023              | Sep/25/2024              |
| EMCI           | Amplifier                    | ZHL-42                | 980189        | Calibration not required | Calibration not required |
| EMCI           | Amplifier                    | ZVE-8G                | 980190        | Calibration not required | Calibration not required |
| R&S            | Power Meter                  | NRX                   | 102034        | Dec/13/2023              | Dec/12/2024              |
| R&S            | Power Sensor                 | NRP18S                | 101974        | Nov/21/2023              | Nov/20/2024              |
| R&S            | Power Sensor                 | NRP18S                | 109066        | Oct/23/2023              | Oct/22/2024              |
| SPEAG          | Dielectric Assessment Kit    | DAK-3.5               | 1342          | May/21/2024              | May/20/2025              |
| Agilent        | Network Analyzer             | E5071C                | MY46107530    | May/03/2024              | May/02/2025              |
| Keysight       | Economy calibration kit      | 85032E                | MY61410221    | May/29/2024              | May/28/2025              |
| SPEAG          | Software                     | DASY 6<br>V16.0.0.116 | N/A           | Calibration not required | Calibration not required |
| SPEAG          | Phantom                      | ELI                   | N/A           | Calibration not required | Calibration not required |
| R&S            | Up/Down-Converter            | CMW Z800A             | 100227        | May/30/2024              | May/29/2025              |
| R&S            | Radio Communication Test     | CMW 500               | 170274        | May/30/2024              | May/29/2025              |
| TECPEL         | Digital thermometer          | DTM-303A              | TP190085      | Dec/19/2023              | Dec/18/2024              |

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## 5.4 Conducted Power Measurement

### 5.4.1 Test selection criteria

The conducted power measurement method is used for all validation test scenarios. These tests demonstrate the power enforcement by Qualcomm® FastConnect™ Time Averaged SAR (TAS) where  $P_{lim}$  could vary before and after transition.

#### 5.4.1.1 Test selection for Time-Varying Test Sequence

Select one representative test channel from all the available radio configurations (band/ant(s)/DSI) that has  $P_{max} > P_{lim} + \text{device uncertainty}$ .

- If  $P_{max} < P_{lim} + \text{device uncertainty}$  for all radio configurations, then select radio configuration with largest ( $P_{max}$  dBm –  $P_{lim}$  dBm) value.
- If  $P_{max} > P_{lim} + \text{device uncertainty}$  for more than one radio configuration. Then, order of preference is given by:
  - If multiple radio configurations (band/ant(s)/DSI) meet this criteria, then SISO is preferred over MIMO due to simplified test setup.
  - After determining SISO vs. MIMO configuration, then select the configuration that has largest ( $P_{max}$  dBm –  $P_{lim}$  dBm) dB delta.
- Test to be performed at two bands for Time-Varying Test sequence test. If only one band within a configuration has  $P_{max} > P_{lim}$  and  $P_{lim} > P_{max}$  in all other configurations, then only one band needs to be tested.
- Test is not required if  $P_{lim} > P_{max}$  for all radio configurations.

NOTE: The same selection criteria are applicable for both conducted & radiated tests.

#### 5.4.1.2 Test selection for Change in Antenna

This test scenario does not apply if SISO mode diversity is not supported. (e.g., CDD is enabled and always use MIMO). The criteria to select test configuration for Change in Antenna measurement is:

- The antennas selected for this test should be in the same antenna group.
- Whenever possible and supported by the EUT, first select antenna switch configuration within the same band/DSI (i.e., same band and DSI combination), and having different  $P_{lim}$ , and having both  $P_{max} > P_{lim} + \text{device uncertainty}$  where possible. Otherwise, select at least one antenna having  $P_{max} > P_{lim} + \text{device uncertainty}$ .
  - If multiple radio configurations (band/DSI) meet  $P_{max} > P_{lim} + \text{device uncertainty}$ , then select the configuration that has largest ( $P_{max}$  dBm –  $P_{lim}$  dBm) dB delta.
  - If  $P_{max} < P_{lim} + \text{device uncertainty}$  for all radio configurations, then select radio configuration with largest ( $P_{max}$  dBm –  $P_{lim}$  dBm) value.

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- If the EUT does not support antenna switch within the same band, but has multiple transmitting antennas to support different frequency bands, then antenna switch test should be performed in combination with Change in WLAN band test scenario.
- Test for Change in Antenna is not required if all  $P_{lim} > P_{max}$  for all radio configurations.

#### 5.4.1.3 Test selection for Change in device state index (DSI)

This test scenario does not apply if multiple DSIs is not supported in the device. The criteria to select test configuration for Change in DSI measurement is:

- Select a band/antenna having the  $P_{max} > P_{lim} + \text{device uncertainty}$  within any DSI, and for the same band/antenna(s) having a different  $P_{lim}$  in any other DSI. Both the selected DSIs should have  $P_{max} > P_{lim} + \text{device uncertainty}$  where possible. Otherwise, select at least one DSI having  $P_{max} > P_{lim} + \text{device uncertainty}$ .
- If  $P_{max} < P_{lim} + \text{device uncertainty}$  for all band/antenna(s), then select radio configuration with largest ( $P_{max} \text{ dBm} - P_{lim} \text{ dBm}$ ) value.
- If  $P_{max} > P_{lim} + \text{device uncertainty}$  for more than one radio configuration, then order of preference is given by:
  - If multiple radio configurations (band/ant(s)/DSI) meet this criteria and if device support SISO. Then SISO is preferred over MIMO due to simplified test setup.
  - After determining SISO vs. MIMO configuration, then select the configuration that has largest ( $P_{max} \text{ dBm} - P_{lim} \text{ dBm}$ ) dB delta.
- Test for Change in DSI is not required if all  $P_{lim} > P_{max}$  for all radio configurations.

#### 5.4.1.4 Test selection for Change in WLAN band

The criteria to select test configuration for Change in WLAN band measurement is:

- First select both bands in a DSI having  $P_{max} > P_{lim} + \text{device uncertainty}$  where possible. Otherwise, select at least one band having  $P_{max} > P_{lim} + \text{device uncertainty}$ .
- If  $P_{max} < P_{lim} + \text{device uncertainty}$  for all radio configurations, then select radio configuration with largest ( $P_{max} \text{ dBm} - P_{lim} \text{ dBm}$ ) value.
- If  $P_{max} > P_{lim} + \text{device uncertainty}$  for more than one radio configuration. Then, order of preference is given by:
  - If multiple radio configurations (band/ant(s)/DSI) meet this criteria and if device support SISO. Then SISO is preferred over MIMO due to simplified test setup.
  - After determining SISO vs. MIMO configuration, then select the configuration that has largest ( $P_{max} \text{ dBm} - P_{lim} \text{ dBm}$ ) dB delta.
- The antennas corresponding to the selected bands should be in the same antenna group.

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- Test for Change in WLAN band is not required if all  $P_{lim} > P_{max}$  for all radio configurations.

#### 5.4.1.5 Test selection for Simultaneous Transmission

This test scenario does not apply if simultaneous transmission within WLAN bands is not supported in the device. The criteria to select test configuration for Simultaneous Transmission measurement is:

- The bands must be selected from supported Simultaneous Transmission configuration. (e.g., WLAN DBS and/or HBS)
- First select both bands in a DSI having  $P_{max} > P_{lim} + \text{device uncertainty}$  where possible. Otherwise, select at least one band having  $P_{max} > P_{lim} + \text{device uncertainty}$ .
- If  $P_{max} < P_{lim} + \text{device uncertainty}$  for all radio configurations, then select radio configuration with largest  $(P_{max} \text{ dBm} - P_{lim} \text{ dBm})$  value.
- If  $P_{max} > P_{lim} + \text{device uncertainty}$  for more than one radio configuration. Then, order of preference is given by:
  - If multiple radio configurations (band/ant(s)/DSI) meet this criteria and if device support SISO. Then SISO is preferred over MIMO due to simplified test setup.
  - After determining SISO vs. MIMO configuration, then select the configuration that has largest  $(P_{max} \text{ dBm} - P_{lim} \text{ dBm})$  dB delta.
- The antennas corresponding to the selected bands should be in the same antenna group.
- Even if a device has  $P_{lim} > P_{max}$  for all radio configurations, then “Simultaneous Transmission” test scenario should still be performed for validation of Qualcomm® FastConnect™ Time Averaged SAR (TAS) device.

NOTE: For all above test selection.  $P_{max} = \min(\text{CTL, Regdomain, TPE/TPC, Rate-to- Power})$  of the selected channel//rate/band. Since Qualcomm® FastConnect™ Time Averaged SAR (TAS) supports the same  $P_{lim}$  for all modulations in same antenna/band/DSI, the selection of test modulation/channel chooses the highest  $P_{max}$  modulation.

#### 5.4.2 Test procedure

1. Measure  $P_{lim}$  for modes at validation antenna ports, bands and/or DSIs with **Qualcomm® FastConnect™ Time Averaged SAR (TAS) Peak Exposure Mode** enabled with callbox to establish the chosen mode for test. Denote this measured power value as  $Conducted\_Tx\_power\_P_{lim}$ .

NOTE: The measurement of Peak Exposure Mode should be performed with 70% or higher WLAN duty cycle (for example, using iPerf to generate UL traffic).

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2. Set EUT to the intended **Qualcomm® FastConnect™ Time Averaged SAR (TAS) mode**.
3. Establish radio link with the callbox in the selected band.

NOTE: For the purpose of collecting repeatable time averaged power data, it is recommended to include a section of 30s at the beginning of every test with the device WLAN connection disconnected or turned off or transmitting at a very low duty cycle.

4. Request EUT to transmit in following **Transition sequence**:
  - a. **Time-Varying Test Sequence** – Request EUT to transmit maximum power for at least 30s with 100% duty cycle and 50% duty cycle for 60s to determine time- averaged 1gSAR versus time.

| Time duration (seconds) | Duty Cycle (%) |
|-------------------------|----------------|
| 30                      | 100%           |
| 60                      | 50%            |

- b. **Change in antenna** – EUT operates at Antenna 1 (e.g., Main antenna port) and requests to transmit at maximum power for at least 60s. Then switch to operation on Antenna 2 (e.g., Aux antenna port), followed by at least 120s of observation.
- c. **Change in device state (DSI)** – EUT operates at DSI 1 and requests to transmit at maximum power for at least 60s. Then switch to operation on DSI 2, followed by at least 120s of observation (observation period includes transition time).
- d. **Change in WLAN band** – EUT operates at Band 1 and requests to transmit at maximum power for at least 60s. Then it switches to Band 2 using the same antenna port and observes another 120s (observation period includes transition time).
- e. **Simultaneous Transmissions**: First establish WLAN connection with the callbox in radio2 configuration and request radio2 configuration to transmit at maximum duty cycle for at least 120s to test predominantly radio2 SAR exposure scenario. Then add radio1 configuration to the existing radio2 configuration call, and request both radio1 and radio2 to transmit at maximum duty cycle to test radio1 and radio2 SAR exposure scenario for at least 120s. Then drop (or request low duty cycle) for radio2 configuration to test predominantly radio1 SAR exposure scenario for another at least 120s. Record the conducted Tx powers for both radio1 and radio2 configurations for the entire duration of this test.

Note: radio1 and radio2 should operate at different band.

5. Measure and record Tx power versus time.
  - a. Once the measurement is done, extract instantaneous Tx power versus time, and convert the conducted Tx power into 1g\_or\_10g SAR value, see Eq. (1a), using Step 1 result.
  - b. Then perform 30s moving average to determine time-averaged 1g\_or\_10gSAR versus time as illustrated in Figure 5-6.

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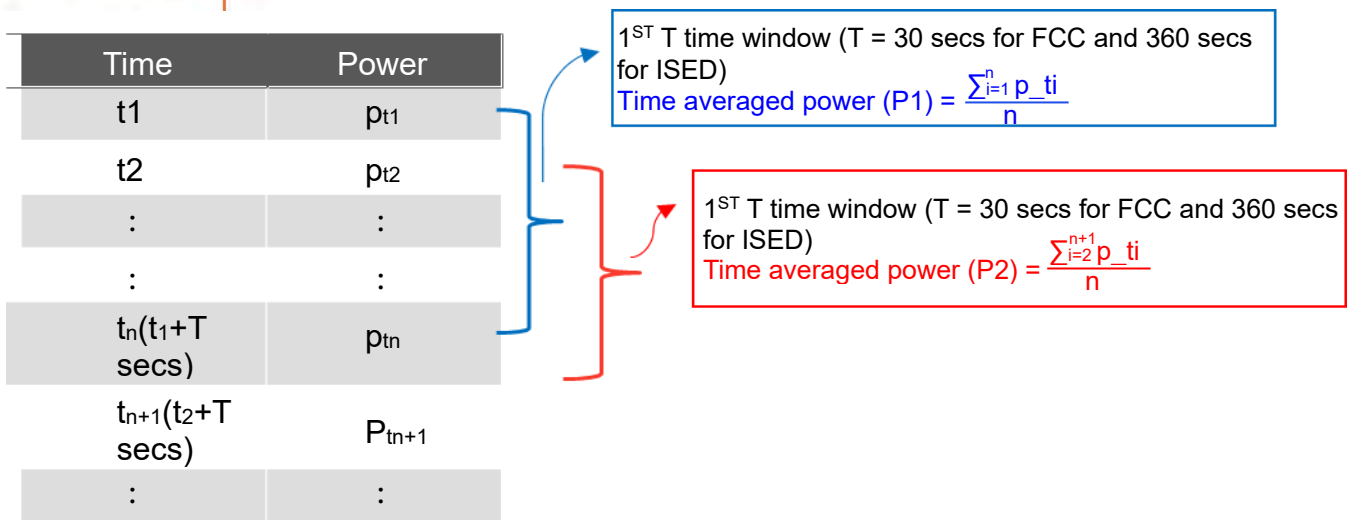


Figure 5-6 Time running/moving average illustration

The following normalization is used to convert 1g\_or\_10gSAR exposure using Equation (1a) and (1c) in section 4.3 to validate the continuity of RF exposure limits during the transition. The procedures from step1 and step 2 in this section should be completed for each configuration under test and use below equations to validate the RF exposure during the transition.

- if tested with both radio configurations below 6GHz:

$$1g\_or\_10gSAR_1(t) = \frac{Conducted\_Tx\_Power\_1(t)}{Conducted\_Tx\_Power\_Plim\_1} * 1g\_or\_10gSAR\_Plim\_1 \quad (4a)$$

$$1g\_or\_10gSAR_2(t) = \frac{Conducted\_Tx\_Power\_2(t)}{Conducted\_Tx\_Power\_Plim\_2} * 1g\_or\_10gSAR\_Plim\_2 \quad (4b)$$

$$\frac{\frac{1}{TSAR} \left[ \int_{t-TASR}^{t_1} 1g\_or\_10gSAR_1(t) dt + \int_{t-TASR}^t 1g\_or\_10gSAR_2(t) dt \right]}{FCC \text{ or ICNIRP SAR limit}} \leq 1 \quad (4c)$$

where, *conducted\_Tx\_power\_1(t)*, *conducted\_Tx\_power\_Plim\_1*, and *1g\_or\_10gSAR\_Plim\_1* correspond to the instantaneous Tx power, conducted Tx power at *P<sub>lim\_1</sub>* of DUT, and compliance 1g\_or\_10gSAR values of Antenna 1 (or Band 1 or DSI1) at *P<sub>lim\_1</sub>*;

*conducted\_Tx\_power\_2(t)*, *conducted\_Tx\_power\_Plim\_2*, and *1g\_or\_10gSAR\_Plim\_2* correspond to the instantaneous Tx power, conducted Tx power at *P<sub>lim\_2</sub>* of DUT, and compliance 1g\_or\_10gSAR values of Antenna 2 (or Band 2 or DSI2) at *P<sub>lim\_2</sub>*.

Transition from the Antenna 1 (or Band 1 or DSI1) to the Antenna 2 (or Band 2 or DSI2) happens at time-instant '*t<sub>1</sub>*'.

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- if tested with radio configuration: 2.4/5GHz WLAN assessed using SAR + 6GHz WLAN band assessed using APD (e.g., applicable for ISED):

$$1g\_or\_10gSAR_1(t) = \frac{Conducted\_Tx\_Power\_1(t)}{Conducted\_Tx\_Power\_Plim\_1} * 1g\_or\_10gSAR\_Plim\_1 \quad (5a)$$

$$4cm^2 PD_2(t) = \frac{Conducted\_Tx\_Power\_2(t)}{Conducted\_Tx\_Power\_Plim\_2} * 4cm^2 PD\_Plim\_2 \quad (5b)$$

$$\frac{\frac{1}{TSAR} \int_{t-TASR}^{t_1} 1g\_or\_10gSAR(t) dt}{ICNIRP SAR limit} + \frac{\frac{1}{TSAR} \int_{t-TASR}^t 4cm^2 PD(t)}{APD 4cm^2 PD limit} \leq 1 \quad (5c)$$

where, *conducted\_Tx\_power\_1(t)*, *conducted\_Tx\_power\_Plim\_1*, and *1g\_or\_10gSAR\_Plim\_1* correspond to the measured instantaneous conducted Tx power and conducted Tx power at *P<sub>lim\_1</sub>* of DUT, and *1g\_or\_10gSAR* values at *P<sub>lim\_1</sub>* for the worst-case radio configuration within the tested 2.4/5GHz WLAN band;

*conducted\_Tx\_power\_2(t)*, *conducted\_Tx\_power\_Plim\_2*, and *4cm<sup>2</sup> PD\_Plim\_2* correspond to the instantaneous Tx power, conducted Tx power at *P<sub>lim\_2</sub>* of DUT, and *4cm<sup>2</sup> PD* values (APD) of at *P<sub>lim\_2</sub>* for the worst-case radio configuration within the tested 6GHz WLAN band.

Transition from the Band1 to the Band2 happens at time-instant '*t<sub>1</sub>*'.

- if tested with both radio configurations greater than 6GHz bands that are assessed using APD (e.g., applicable for ISED):

$$4cm^2 PD_1(t) = \frac{Conducted\_Tx\_Power\_1(t)}{Conducted\_Tx\_Power\_Plim\_1} * 4cm^2 PD\_Plim\_1 \quad (6b)$$

$$4cm^2 PD_2(t) = \frac{Conducted\_Tx\_Power\_2(t)}{Conducted\_Tx\_Power\_Plim\_2} * 4cm^2 PD\_Plim\_2 \quad (6b)$$

$$\frac{\frac{1}{TSAR} \left[ \int_{t-TASR}^{t_1} 4cm^2 PD_1(t) dt + \int_{t-TASR}^t 4cm^2 PD_2(t) dt \right]}{APD 4cm^2 PD limit} \leq 1 \quad (6c)$$

where, *conducted\_Tx\_power\_1(t)*, *conducted\_Tx\_power\_Plim\_1*, and *4cm<sup>2</sup> PD\_Plim\_1* correspond to the instantaneous Tx power, conducted Tx power at *P<sub>lim\_1</sub>* of DUT, and compliance *4cm<sup>2</sup> PD* values (APD) of Band 1 (or Antenna 1) at *P<sub>lim\_1</sub>*;

*conducted\_Tx\_power\_2(t)*, *conducted\_Tx\_power\_Plim\_2*, and *4cm<sup>2</sup> PD\_Plim\_2* correspond to the instantaneous Tx power, conducted Tx power at *P<sub>lim\_2</sub>* of DUT, and compliance *4cm<sup>2</sup> PD* values (APD) of Antenna Band 2 (or Antenna 2) at *P<sub>lim\_2</sub>*.

Transition from the Band 1 (or Antenna 1) to the Band 2 (or Antenna 2) happens at time- instant '*t<sub>1</sub>*'.

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6. Make one plot containing:

- a. Computed time-averaged  $1g\_or\_10gSAR$  (and/or  $4cm^2$  PD) versus time from above procedure.
- b. Corresponding regulatory  $1g\_or\_10gSAR$  (and/or  $4cm^2$  PD) limit.

The validation criteria is, at all times, the combined time-averaged  $1g\_or\_10gSAR$  (and/or  $4cm^2$  PD) versus time shall not exceed the regulatory  $1g\_or\_10gSAR$  (and/or  $4cm^2$  PD) limit.

## 5.5 pointSAR measurement test sequence

### 5.5.1 Test selection criteria

The pointSAR test is performed only with **Time-Varying Test Sequence** to provide high confidence in the algorithm validation. The radio configuration for this test is selected by following the selection criteria described in Section 5.5.1.1.

### 5.5.2 Test procedure

1. For a given radio configuration:

- a. Enable WLAN connection with callbox in **Qualcomm® FastConnect™ Time Averaged SAR (TAS) Peak Exposure Mode** and enable high duty cycle Tx while performing the following steps.
- b. Perform the area scan.
- c. Conduct pointSAR measurement at peak location of the area scan for 120s.

This pointSAR value,  $pointSAR\_Plim$  corresponds to pointSAR at the measured  $P_{lim}$ .

NOTE: The measurement of Peak Exposure Mode should be performed with 70% or higher WLAN duty cycle (for example, using iPerf to generate UL traffic).

2. Set EUT to intended FastConnect Time-Averaged Exposure Mode with callbox to establish the same chosen radio configuration (mode/channel) for test.

- a. Perform Time-averaged point SAR measurements at the same peak location as Peak Exposure Point SAR measurement for 120s. Note this includes initial 30s with WLAN with very low duty cycle (or WLAN is disconnected) and 90s of high duty cycle (WLAN has to be connected with high uplink traffic).
- b. Once the measurement is done, extract instantaneous pointSAR versus time data,  $pointSAR(t)$
- c. Convert it into instantaneous  $1gSAR$  versus time by using Equation (2a) and (2c) in Section 4.4:

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$$1g\_or\_10gSAR(t) = \frac{pointSAR(t)}{pointSAR\_Plim} * 1g\_or\_10gSAR\_Plim \quad (2a)$$

$$4cm^2 PD(t) = \frac{pointSAR(t)}{pointSAR\_Plim} * 4cm^2 PD\_Plim \quad (2c)$$

where, *pointSAR\_Plim* corresponds to the value determined in Step 1, and *pointSAR(t)* corresponds to instantaneous pointSAR determined in Step 2 in this section.

- d. Then perform 30s moving average to determine time-averaged 1gSAR versus time.

### 3. Make one plot containing:

- a. Computed time-averaged 1g\_or\_10gSAR (or 4cm<sup>2</sup> PD) versus time determined from Step 2.
- b. Regulatory 1g\_or\_10gSAR (or 4cm<sup>2</sup> PD) limit.

The validation criteria for pointSAR measurement is, at all times, the time averaged 1g\_or\_10gSAR (or 4cm<sup>2</sup> PD) versus time shall not exceed the regulatory 1g\_or\_10gSAR (or 4cm<sup>2</sup> PD) limit.

## 5.6 DUT worst case 1gSAR and test mode selection

The Plim is configured in Qualcomm® FastConnect™ Time Averaged SAR (TAS) BDF per according to the Static SAR test and used for validation in this test report.

Base on the Static SAR Compliance Test Report. The worst case 1gSAR of each radio configuration are extracted from Static SAR report and listed in Table 5-2.

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Table 5-2 Plim and Worst case 1gSAR

|      |                             | Modulation          | Channel | P <sub>max</sub><br>(dBm) | P <sub>lim</sub><br>(dBm) | Tune up<br>Limit<br>(dBm) | Reported<br>1g SAR<br>(W/kg) |
|------|-----------------------------|---------------------|---------|---------------------------|---------------------------|---------------------------|------------------------------|
| DSIO | 2.4GHz SISO<br>Aux antenna  | 11b/1Mbps           | 6       | 18                        | 13.5                      | 15                        | 0.626                        |
|      | 2.4GHz SISO<br>Main antenna | 11b/1Mbps           | 6       | 18                        | 13.5                      | 15                        | 0.546                        |
|      | 2.4GHz MIMO<br>Aux antenna  | 11b/1Mbps           | 6       | 18                        | 13.5                      | 15                        | 0.648                        |
|      | 2.4GHz MIMO<br>Main antenna |                     |         |                           |                           | 15                        |                              |
|      | 5.2GHz MIMO<br>Aux antenna  | 11ac<br>VHT160/MCS0 | 50      | 12.25                     | 9.25                      | 10.75                     | 0.762                        |
|      | 5.2GHz MIMO<br>Main antenna |                     |         |                           |                           | 10.75                     |                              |
|      | 5.3GHz MIMO<br>Aux antenna  | 11ac<br>VHT80/MCS0  | 58      | 14.25                     | 9.25                      | 10.75                     | 0.804                        |
|      | 5.3GHz MIMO<br>Main antenna |                     |         |                           |                           | 10.75                     |                              |
|      | 5.6GHz MIMO<br>Aux antenna  | 11ac<br>VHT160/MCS0 | 114     | 12.75                     | 9.5                       | 11                        | 0.786                        |
|      | 5.6GHz MIMO<br>Main antenna |                     |         |                           |                           | 11                        |                              |
|      | 5.8GHz MIMO<br>Aux antenna  | 11ac<br>VHT80/MCS0  | 155     | 16.5                      | 8.75                      | 10.25                     | 0.776                        |
|      | 5.8GHz MIMO<br>Main antenna |                     |         |                           |                           | 10.25                     |                              |
|      | 5.9GHz MIMO<br>Aux antenna  | 11ac<br>VHT160/MCS0 | 163     | 12                        | 9.5                       | 11                        | 0.734                        |
|      | 5.9GHz MIMO<br>Main antenna |                     |         |                           |                           | 11                        |                              |
|      | 6.2GHz MIMO<br>Aux antenna  | 11be<br>EHT320/MCS0 | 31      | 14.5                      | 11                        | 12.5                      | 0.969                        |
|      | 6.2GHz MIMO<br>Main antenna |                     |         |                           |                           | 12.5                      |                              |
|      | 6.5GHz MIMO<br>Aux antenna  | 11be<br>EHT320/MCS0 | 95      | 14.5                      | 11.75                     | 13.25                     | 0.925                        |
|      | 6.5GHz MIMO<br>Main antenna |                     |         |                           |                           | 13.25                     |                              |
|      | 6.7GHz MIMO<br>Aux antenna  | 11be<br>EHT320/MCS0 | 127     | 14.5                      | 10.75                     | 12.25                     | 0.635                        |
|      | 6.7GHz MIMO<br>Main antenna |                     |         |                           |                           | 12.25                     |                              |
|      | 7GHz MIMO<br>Aux antenna    | 11be<br>EHT320/MCS0 | 191     | 14.5                      | 11.25                     | 12.75                     | 0.818                        |
|      | 7GHz MIMO<br>Main antenna   |                     |         |                           |                           | 12.75                     |                              |

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In this test report. The radio configurations selection for FastConnect Time-Varying Validation measurements as provided in Table 5-3. The conducted power is measured at DUT for this validation test under **Qualcomm® FastConnect™ Time Averaged SAR (TAS) Peak Exposure Mode** enabled as per procedure required in step 1 in Section 5.5.2.

**Table 5-3 Radio configurations selected for FastConnect Time-Varying Validation measurements in this test report.**

|      | Band        | Ant          | Modulation      | P <sub>max</sub> | P <sub>lim</sub> | conducted_Tx_<br>power –<br>P <sub>lim</sub> (dBm) | 1g_or_10gSAR<br>–<br>P <sub>lim</sub> (W/kg) | Time Varying<br>Test<br>Sequence         | Change in<br>WLAN Band   | Simultaneous<br>Transmissions |
|------|-------------|--------------|-----------------|------------------|------------------|----------------------------------------------------|----------------------------------------------|------------------------------------------|--------------------------|-------------------------------|
| DSIO | 2.4GHz SISO | Aux(Chain0)  | 11b / 1Mbps     | 18               | 13.5             | 13.06                                              | 0.604                                        | Conducted<br>and pointSAR<br>measurement |                          |                               |
|      | 2.4GHz MIMO | Aux(Chain0)  | 11b / 1Mbps     | 18               | 13.5             | 13.16                                              | 0.614                                        |                                          |                          | Conducted<br>measurement      |
|      | 2.4GHz MIMO | Aux(Chain0)  | 11ac(20) / MCS0 | 18               | 13.5             | 12.18                                              | 0.363                                        |                                          | Conducted<br>measurement |                               |
|      | 5.8GHz MIMO | Aux(Chain0)  | 11ac(20) / MCS0 | 17.5             | 8.75             | 7.25                                               | 0.310                                        |                                          | Conducted<br>measurement | Conducted<br>measurement      |
|      | 5.8GHz MIMO | Main(Chain1) | 11ac(20) / MCS0 | 17.5             | 8.75             | 9.2                                                | 0.531                                        | Conducted<br>and pointSAR<br>measurement |                          |                               |

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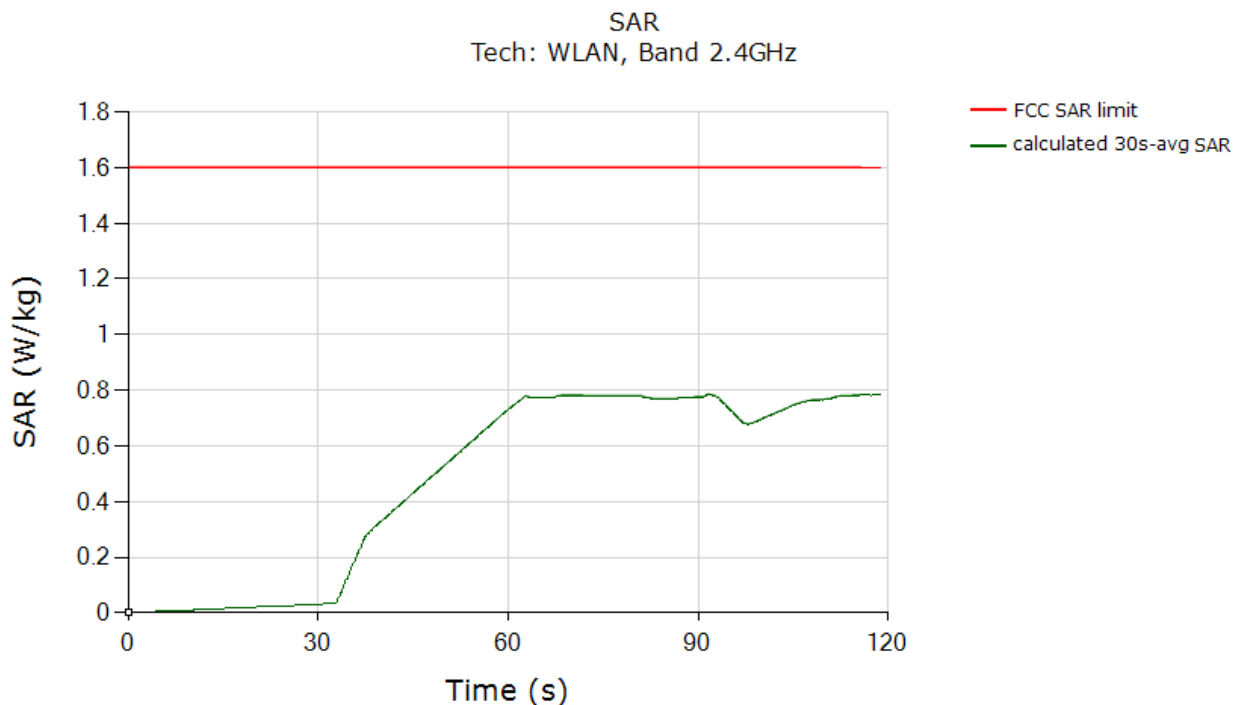
## 6 FCC VALIDATION TEST RESULT

### 6.1 Time-Varying Test Sequence

#### 6.1.1 Test parameters – 1<sup>st</sup> Band

| Tech/Band/Ant/DSI                              | Parameters                    | Values |
|------------------------------------------------|-------------------------------|--------|
| 11b / 1Mbps; 2.4GHz SISO;<br>Aux(Chain0); DSI0 | $P_{\max}$                    | 18     |
|                                                | Reserve margin (dB)           | 1      |
|                                                | Meas. Cond. $P_{\lim}$ (dBm)  | 13.06  |
|                                                | Meas. SAR @ $P_{\lim}$ (W/kg) | 0.604  |

#### 6.1.2 Test plots and result – 1<sup>st</sup> Band



|                                     |       |
|-------------------------------------|-------|
|                                     | W/Kg  |
| FCC exposure limit                  | 1.6   |
| Max time-averaged SAR (green curve) | 0.784 |
| Validated                           |       |

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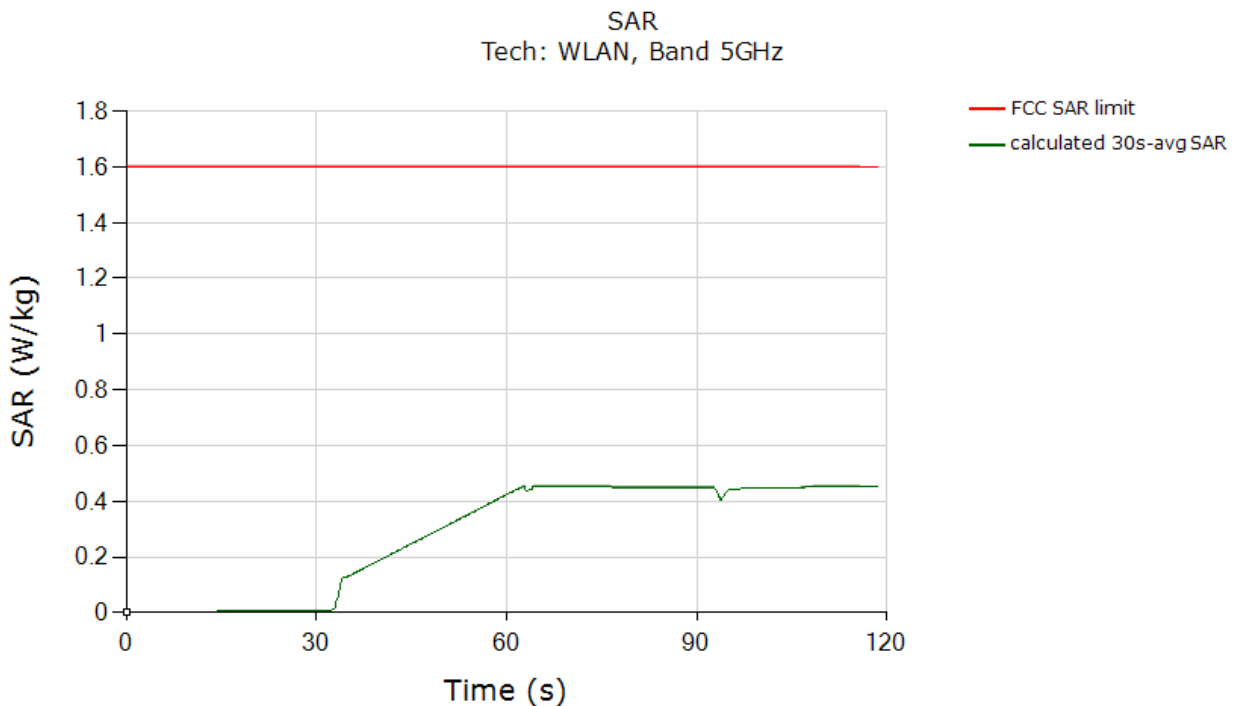
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6.1.3 Test parameters – 2<sup>nd</sup> Band

| Tech/Band/Ant/DSI                                   | Parameters                    | Values |
|-----------------------------------------------------|-------------------------------|--------|
| 11ac(20) / MCS0; 5.8GHz<br>MIMO; Main(Chain1); DSI0 | $P_{\max}$                    | 17.5   |
|                                                     | Reserve margin (dB)           | 1      |
|                                                     | Meas. Cond. $P_{\lim}$ (dBm)  | 9.2    |
|                                                     | Meas. SAR @ $P_{\lim}$ (W/kg) | 0.531  |

6.1.4 Test plots and result – 2<sup>nd</sup> Band

|                                     | W/Kg  |
|-------------------------------------|-------|
| FCC exposure limit                  | 1.6   |
| Max time-averaged SAR (green curve) | 0.454 |
| Validated                           |       |

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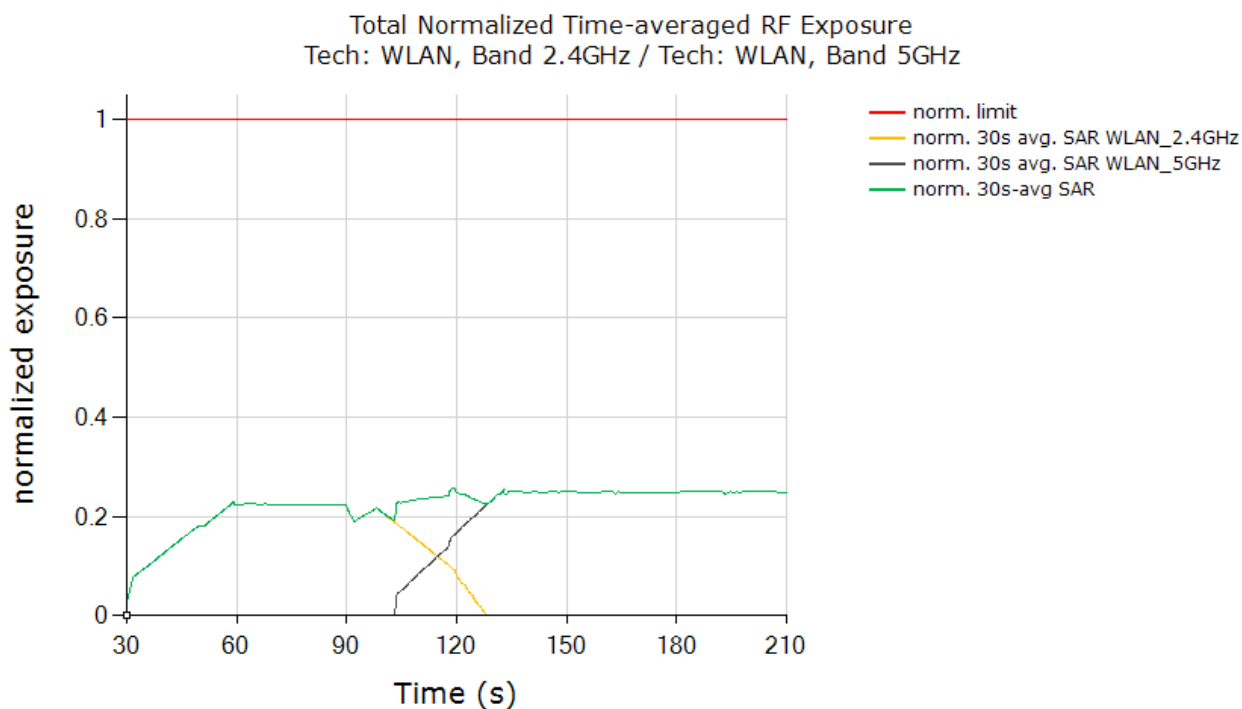
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## 6.2 Change in WLAN band

### 6.2.1 Test parameters

| Tech/Band/Ant/DSI                                  | Parameters                   | Values |
|----------------------------------------------------|------------------------------|--------|
| 11ac(20) / MCS0; 2.4GHz<br>MIMO; Aux(Chain0); DSI0 | $P_{max}$                    | 18     |
|                                                    | Reserve margin (dB)          | 1      |
|                                                    | Meas. Cond. $P_{lim}$ (dBm)  | 12.18  |
|                                                    | Meas. SAR @ $P_{lim}$ (W/kg) | 0.363  |
| Switch time (sec)                                  |                              | 99     |
| 11ac(20) / MCS0; 5.8GHz<br>MIMO; Aux(Chain0); DSI0 | $P_{max}$                    | 17.5   |
|                                                    | Reserve margin (dB)          | 1      |
|                                                    | Meas. Cond. $P_{lim}$ (dBm)  | 7.25   |
|                                                    | Meas. SAR @ $P_{lim}$ (W/kg) | 0.31   |

### 6.2.2 Test plots and result



|                                                      |                      |
|------------------------------------------------------|----------------------|
|                                                      | Norm. exposure value |
| FCC normalized total exposure limit                  | 1.0                  |
| Max total normalized time-averaged SAR (green curve) | 0.256                |
| Validated                                            |                      |

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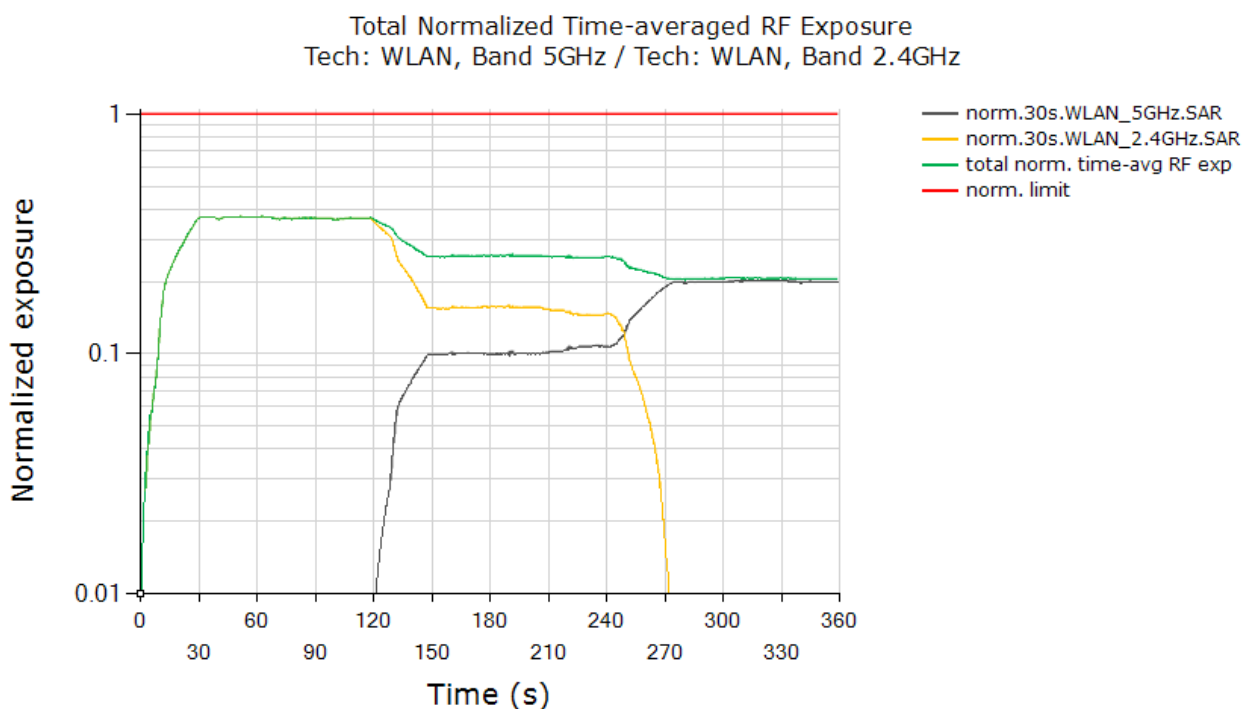
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## 6.3 Simultaneous Transmissions

### 6.3.1 Test parameters

| Tech/Band/Ant/DSI                                  | Parameters                    | Values |
|----------------------------------------------------|-------------------------------|--------|
| 11b / 1Mbps; 2.4GHz MIMO;<br>Aux(Chain0); DSI0     | $P_{\max}$                    | 18     |
|                                                    | Reserve margin (dB)           | 1      |
|                                                    | Meas. Cond. $P_{\lim}$ (dBm)  | 13.16  |
|                                                    | Meas. SAR @ $P_{\lim}$ (W/kg) | 0.614  |
| 11ac(20) / MCS0; 5.8GHz<br>MIMO; Aux(Chain0); DSI0 | $P_{\max}$                    | 17.5   |
|                                                    | Reserve margin (dB)           | 1      |
|                                                    | Meas. Cond. $P_{\lim}$ (dBm)  | 7.25   |
|                                                    | Meas. SAR @ $P_{\lim}$ (W/kg) | 0.310  |

### 6.3.2 Test plots and result



|                                                      | Norm. exposure value |
|------------------------------------------------------|----------------------|
| FCC normalized total exposure limit                  | 1.0                  |
| Max total normalized time-averaged SAR (green curve) | 0.373                |
| Validated                                            |                      |

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## 7 POINTSAR TEST

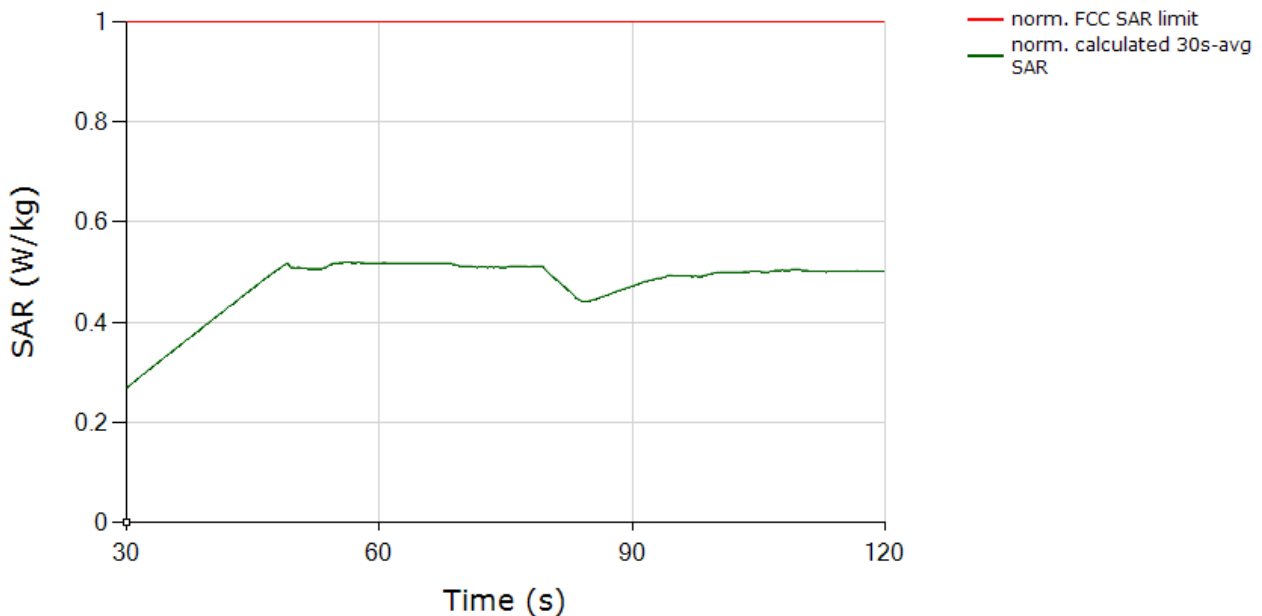
### 7.1 Time-Varying Test Sequence

#### 7.1.1 Test parameters – 1<sup>st</sup> Band

| Tech/Band/Ant/DSI                              | Parameters                          | Values      |
|------------------------------------------------|-------------------------------------|-------------|
| 11b / 1Mbps; 2.4GHz SISO;<br>Aux(Chain0); DSI0 | Test Position                       | Laptop Mode |
|                                                | Meas. SAR @ P <sub>lim</sub> (W/kg) | 0.604       |

#### 7.1.2 Test plots and result – 1<sup>st</sup> Band

SAR Time-Varying Test Sequence  
Tech: WLAN, Band 2.4GHz



|                                                      |                      |
|------------------------------------------------------|----------------------|
|                                                      | Norm. exposure value |
| FCC normalized total exposure limit                  | 1.0                  |
| Max total normalized time-averaged SAR (green curve) | 0.519                |
| Validated                                            |                      |

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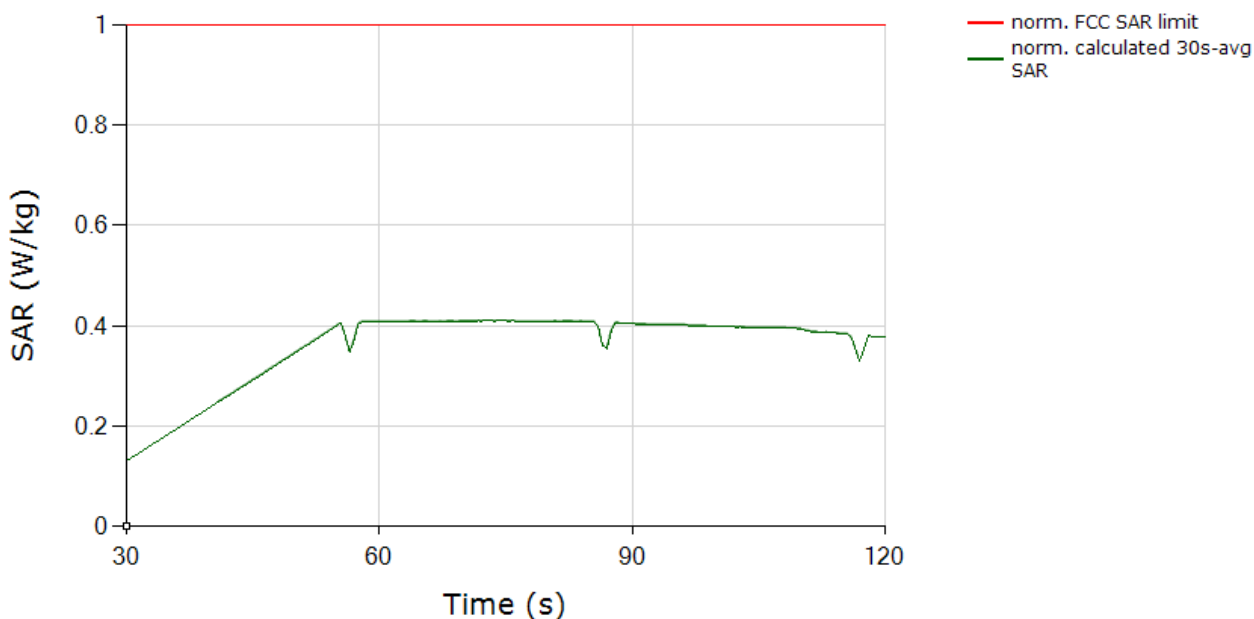
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7.1.3 Test parameters – 2<sup>nd</sup> Band

| Tech/Band/Ant/DSI                                   | Parameters                          | Values      |
|-----------------------------------------------------|-------------------------------------|-------------|
| 11ac(20) / MCS0; 5.8GHz<br>MIMO; Main(Chain1); DSI0 | Test Position                       | Laptop Mode |
|                                                     | Meas. SAR @ P <sub>lim</sub> (W/kg) | 0.531       |

7.1.4 Test plots and result – 2<sup>nd</sup> Band

SAR Time-Varying Test Sequence  
Tech: WLAN, Band 5.8GHz



|                                                      |                      |
|------------------------------------------------------|----------------------|
|                                                      | Norm. exposure value |
| FCC normalized total exposure limit                  | 1.0                  |
| Max total normalized time-averaged SAR (green curve) | 0.41                 |
| Validated                                            |                      |

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**10 APPENDIXES**

**Refer to separated files for the following appendixes.**

**10.1 SAR\_Appendix B DAE & Probe Cal. Certificate**

**10.2 SAR\_Appendix C Phantom Description & Dipole Cal. Certificate**

**- End of report -**

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