



Test report No.: 25B0338R-SAUSV05S-D

Part 2: RF Exposure Compliance Test Report

Product Name	5G WWAN Module
Trademark	Foxconn
Model and /or type reference	T99W696
Applicant's name / address	Hon Lin Technology Co., Ltd 11F, No.32, Jihu Rd., Neihu Dist., Taipei City 114, Taiwan R.O.C.
Manufacturer's name	Hon Lin Technology Co., Ltd
FCC ID	2AQ68W696T6
Verdict Summary	IN COMPLIANCE
Documented By (Senior Project Specialist / Genie Chang)	Genie Chang
Tested By (Senior Engineer / Luke Cheng)	Luke Cheng
Approved By (Assistant Manager / San Lin)	San Lin
Date of Receipt	2025/11/12
Date of Issue	2026/03/16
Report Version	V1.0

INDEX

Page

1. Introduction	6
1.1 Time-Averaging Algorithm for RF Exposure Compliance	6
1.2 Bibliography.....	6
2. RF Exposure Limits.....	7
2.1 Time Averaging Windows for FCC Compliance.....	7
3. Tx Varying Transmission Test Case and Test Proposal	8
4. SAR Time Averageing Validation Test Procedures.....	11
4.1 Test sequence determination for validation	11
4.2 Test configuration selection criteria for validating Smart Transmit feature	12
4.2.1 Test configuration selection for time-varying Tx power transmission	12
4.2.2 Test configuration selection for change in call	13
4.2.3 Test configuration selection for change in technology/band	13
4.2.4 Test configuration selection for change in antenna.....	13
4.2.5 Test configuration selection for change in DSI.....	14
4.2.6 Test configuration selection for change in time window	14
4.2.7 Test configuration selection for SAR exposure switching	15
4.3 Test procedures for conducted power measurements.....	16
4.3.1 Test procedures for Time-varying Tx power scenario	16
4.3.2 Test procedures for Change in call scenario.....	17
4.3.3 Test procedures for Change in technology and band	18
4.3.4 Test procedures for Change in antenna	19
4.3.5 Test procedures for Change in DSI	19
4.3.6 Test procedures for Change in time window.....	19
4.3.7 Test procedures for SAR exposure switching.....	22
4.4 Test procedure for SAR measurements	23
5. Test Configurations.....	25
5.1 WWAN transmission.....	25
6. Conducted Power Results for Sub-6 Smart Transmit Feature Validation.....	28
6.1 Conoducted power measurement setup.....	28
6.2 Plimit and Pmax measurement result.....	31
6.3 Time-varying Tx power test results (Test case 1 ~ 7 in Table 5-2)	32
6.3.1 WCDMA Band 2 Antenna 0 (Test case 1 in Table 5-2)	33
6.3.2 LTE Band 25 Antenna 0 (Test case 2 in Table 5-2).....	35
6.3.3 LTE Band 48 Antenna 0 (Test case 3 in Table 5-2).....	37
6.3.4 5GNR n30 Antenna 0 (Test case 4 in Table 5-2)	39
6.3.5 5GNR n77 Antenna 0 (Test case 5 in Table 5-2)	41
6.4 Change in Call Test Results (Test case 6 in Table 5-2).....	43
6.5 Change in Technology/Band Test Results (Test case 7 in Table 5-2)	44
6.6 Change in Antenna Test Results (Test case 8 in Table 5-2).....	45
6.7 Change in Time Window Test Results (Test case 6 in Table 5-2)	46
6.7.1 Test case 9: transition from band 25 to band 48 (i.e., 100s to 60s), then back to	

band 25	46
6.7.2 Test case 10: transition from band 48 to band 25 (i.e., 60s to 100s), then back to band 48	48
6.8 SAR Exposure Switching Test Results (Test case 11 in Table 5-2).....	49
7. SAR Results for Sub-6 Smart Transmit Feature Validation	50
7.1 SAR Measurement Setup.....	50
7.2 SAR Measurement Results for Time-varying Tx Power Case	51
7.2.1 WCDMA Band 2 Antenna 0 SAR test result	52
7.2.2 LTE Band 25 Antenna 0 SAR test result.....	54
7.2.3 LTE Band 48 Antenna 0 SAR test result.....	56
7.2.4 5GNR Band n30 Antenna 0 SAR test result	58
7.2.5 5GNR Band n77 Antenna 0 SAR test result	60
8. Test Equipment List	62
9. Measurement Uncertainty.....	63
10. System verification.....	65
10.1 SAR System Check.....	65
10.1.1 Dipoles	65
10.1.2 SAR System Check Result.....	65
10.2 Tissue Calibration Result.....	66
11. Conclusions	67
Appendix A. Test Sequences	
Appendix B. Test Sequences Test Procedures for Sub-6 GHz NR + Sub-6 GHz Radio	
Appendix C. System Verification	
Appendix D. Test Setup Photographs	
Appendix E. Probe Calibration Data	
Appendix F. Dipole & Source Calibration	

Competences and Guarantees

DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA.

General conditions

1. The test results relate only to the samples tested.
2. The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.
3. This report must not be used to claim product endorsement by TAF or any agency of the government.
4. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.
5. Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Revision History

Report No.	Version	Description	Issued Date
25B0338R-SAUSV05S-D	V1.0	Initial issue of report.	2026/03/16

1. Introduction

1.1 Time-Averaging Algorithm for RF Exposure Compliance

The equipment under test (EUT) contains a Qualcomm modem supporting 2G/3G/4G technologies bands. The modem implements the Qualcomm® Smart Transmit feature with algorithms designed to control and manage transmitting power in real time, ensuring that the time-averaged RF exposure remains compliant with applicable regulatory requirements.

The purpose of this Part 2 report is to demonstrate the validity of the Smart Transmit feature implementation in the EUT and to evaluate RF exposure compliance under dynamic transmission scenarios.

In this report, the maximum time-averaged transmit power limits for all supported technologies and bands are derived from the corresponding SAR and/or power density characterization results established during static transmission evaluation.

1.2 Bibliography

Document	Report Number
FCC SAR_Test_Part 0	25B0338R-SAUSV05S-C
FCC SAR_Test_Part 1	25B0338R-SAUSV01S-A
Part 2: RF Exposure Compliance Test Report	25B0338R-SAUSV05S-D

2. RF Exposure Limits

2.1 Time Averaging Windows for FCC Compliance

According to Oct. 2018 TCB workshop guidance, the below time-averaging windows is used for assessing timeaveraged exposures for devices that are capable of actively monitoring and adjusting power output over time to comply with exposure limits.

Interim Guidance	Frequency (GHz)	Maximum Averaging Time (sec)
SAR	< 3	100
	3 – 6	60
MPE	6 – 10	30
	10 – 16	14
	16 – 24	8
	24 – 42	4
	42 – 95	2

3. Tx Varying Transmission Test Case and Test Proposal

To validate time averaging feature and demonstrate the compliance in Tx varying transmission conditions, the following transmission scenarios are covered in Part 2 test:

1. During a time-varying Tx power transmission: To prove that the Smart Transmit feature accounts for Tx power variations in time accurately.
2. During a call disconnect and re-establish scenario: To prove that the Smart Transmit feature accounts for history of past Tx power transmissions accurately.
3. During technology/band handover: To prove that the Smart Transmit feature functions correctly during transitions in technology/band.
4. During antenna (or beam) switch: To prove that the Smart Transmit feature functions correctly during transitions in antenna (AsDiv scenario) or beams (different antenna array excitation configurations).
5. During change in device state: To prove that the Smart Transmit feature functions correctly during transitions in device state, say, from body-worn state to hotspot mode (i.e., when hotspot mode is turned ON), or say, from extremity mode to body-worn state (grip sensor triggered OFF), etc. Device state here refers to all the device configurations required to be tested by FCC, for example, head position, body-worn position, hotspot mode, and extremity.
6. During time window switch: To prove that the Smart Transmit feature correctly handles the transition from one time window to another specified by FCC, and maintains the normalized time-averaged RF exposure to be less than FCC limit of 1.0 at all times.
7. SAR vs. PD exposure switching during sub6+mmW transmission: To prove that the Smart Transmit feature functions correctly and ensures total RF exposure compliance during transitions in SAR only exposure, SAR+PD exposure, and PD only exposure scenarios.
8. SAR exposure switching between two active radios (radio1 and radio2): To prove that the Smart Transmit feature functions correctly and ensures total RF exposure compliance when exposure varies among SAR_radio1 only, SAR_radio1 + SAR_radio2, and SAR_radio2 only scenarios.

As described in Part 0 report, the RF exposure is proportional to the Tx power for a SAR- and/or PD-characterized wireless device. Thus, time-averaging algorithm validation in this Part 2 report can be effectively performed through conducted/radiated power measurement. Therefore, the compliance demonstration under dynamic transmission conditions and feature validation are performed in measurement setup for above transmission scenarios.

The strategy for the validation in Tx varying transmission conditions and RF exposure measurement is outlined as follows:

<Conducted power / Radiated power measurement>

Demonstrate the total RF exposure averaged over FCC defined time windows does not exceed FCC's SAR and PD limits, through time-averaged power measurements.

- Measure conducted Tx power for $f < 6\text{GHz}$ and radiated Tx power (EIRP) for $f > 10\text{GHz}$
- Convert it into RF exposure and divide by respective FCC limits to get normalized exposure
- Perform time-averaging over predefined time windows
- Demonstrate that the total normalized time-averaged RF exposure is less than 1 for all transmission scenarios (i.e., previous scenarios 1 to 8);

- For sub6 transmission only:

$$1g_or_10gSAR(t) = \frac{conducted_Tx_power(t)}{conducted_Tx_power_P_{limit}} \times 1g_or_10gSAR_P_{limit} \quad (1a)$$

$$\frac{\frac{1}{T_{SAR}} \int_{t-T_{SAR}}^t 1g_or_10gSAR(t) dt}{FCC\ SAR_{limit}} \leq 1 \quad (1b)$$

- For sub6 + mmW transmission:

$$1g_or_10gSAR(t) = \frac{conducted_Tx_power(t)}{conducted_Tx_power_P_{limit}} \times 1g_or_10gSAR_P_{limit} \quad (2a)$$

$$4cm^2PD(t) = \frac{radiated_Tx_power(t)}{radiated_Tx_power_input.power.limit} \times 4cm^2PD@input.power.limit \quad (2b)$$

$$\frac{\frac{1}{T_{SAR}} \int_{t-T_{SAR}}^t 1g_or_10gSAR(t) dt}{FCC\ SAR_{limit}} + \frac{\frac{1}{T_{PD}} \int_{t-T_{PD}}^t 4cm^2PD(t) dt}{FCC\ 4cm^2PD_{limit}} \leq 1 \quad (2c)$$

where, $conducted_Tx_power(t)$, $conducted_Tx_power_P_{limit}$, and $1g_or_10gSAR_P_{limit}$ correspond to the measured instantaneous conducted Tx power, measured conducted Tx power at P_{limit} , and measured $1g_or_10gSAR$ values at P_{limit} for sub-6 transmission. Similarly, $radiated_Tx_power(t)$, $radiated_Tx_power_input.power.limit$, and $4cm^2PD@input.power.limit$ correspond to the measured instantaneous radiated Tx power, radiated Tx power at $input.power.limit$, and $4cm^2PD$ value at $input.power.limit$ for mmW transmission. Both P_{limit} and $input.power.limit$ are the parameters pre-defined in Part 0 and loaded via Embedded File System (EFS) on to the DUT. T_{SAR} is the time window for $f < 6\text{ GHz}$ radio defined by FCC; T_{PD} is the time window for $f \geq 6\text{ GHz}$ radio defined by FCC.

<RF Exposure measurement>

- Demonstrate the total RF exposure averaged over predefined time windows does not exceed FCC's SAR and PD limits, through time-averaged SAR and PD measurements. To add confidence in feature validation, RF exposure measurements are performed, but performed for scenario 1 only while avoiding the complexity in SAR/PD measurement (in particular, for scenario 3 requiring change in SAR probe calibration file to accommodatedifferent bands and/or tissue simulating liquid).

- For $f < 6$ transmission only:

Measure instantaneous SAR versus time

Demonstrate total time-averaged RF exposure is less than 1.0 at all times.

$$1g_or_10gSAR(t) = \frac{pointSAR(t)}{pointSAR_P_{limit}} \times 1g_or_10gSAR_P_{limit} \quad (3a)$$

$$\frac{\frac{1}{T_{SAR}} \int_{t-T_{SAR}}^t 1g_or_10gSAR(t) dt}{FCC\ SAR_{limit}} \leq 1 \quad (3b)$$

- For $f < 6$ GHz + $f \geq 6$ GHz transmission:

Measure instantaneous E-field versus time for $f \geq 6$ radio and instantaneous conducted power versus time for $f < 6$ radio

Demonstrate the total normalized time-averaged RF exposure versus time is less than 1.0 at all times.

$$1g_or_10gSAR(t) = \frac{conducted_Tx_power(t)}{conducted_Tx_power_P_{limit}} \times 1g_or_10gSAR_P_{limit} \quad (4a)$$

$$4cm^2PD(t) = \frac{[point\ E(t)]^2}{[pointE_input.power.limit]^2} \times 4cm^2PD@input.power.limit \quad (4b)$$

$$\frac{\frac{1}{T_{SAR}} \int_{t-T_{SAR}}^t 1g_or_10gSAR(t) dt}{FCC\ SAR_{limit}} + \frac{\frac{1}{T_{PD}} \int_{t-T_{PD}}^t 4cm^2PD(t) dt}{FCC\ 4cm^2PD_{limit}} \leq 1 \quad (4c)$$

where, $pointSAR(t)$, $pointSAR_P_{limit}$, and $1g_or_10g_SAR_P_{limit}$ correspond to the measured instantaneous point SAR, measured point SAR at P_{limit} , and measured $1g_or_10gSAR$ value at P_{limit} corresponding to $f < 6$ GHz transmission for sub-6 transmission. Similarly, $pointE(t)$, $pointE_input.power.limit$, and $4cm^2PD_input.power.limit$ correspond to the measured instantaneous E-field, E-field at $input.power.limit$, and $4cm^2PD$ value at $input.power.limit$ for mmW transmission.

Note: cDASY6 measurement system by Schmid & Partner Engineering AG (SPEAG) measures relative

E-field, and provides ratio (in dB) given by $10 \times \log_{10} \left\{ \frac{[pointE(t)]^2}{[pointE_input.power.limit]^2} \right\}$ versus time

4. SAR Time Averaging Validation Test Procedures

This chapter provides the test plan for validating the Smart Transmit feature for sub6 transmission. The 100 seconds time-window for operating $f < 3\text{GHz}$ is used as an example to detail the test procedures. The same test plan and test procedures described in this chapter apply to 60 seconds time window for $3\text{GHz} \leq f < 6\text{GHz}$.

4.1 Test sequence determination for validation

Following the FCC recommendation, two test sequences having time-variation in Tx power are predefined for sub6 ($f < 6\text{GHz}$) validation:

- Test sequence 1: Requesting EUT to transmit at maximum power, measured P_{max} , for 80s, then requesting for half of the maximum power, i.e., measured $P_{max}/2$, for the rest of the time.
- Test sequence 2: requesting EUT to transmit at time-varying Tx power levels. This sequence is generated relative to measured P_{max} , measured P_{limit} and calculated Preserve (= measured P_{limit} - Reserve_power_margin) of EUT based on measured P_{limit} .

The details for generating these two test sequences is described and listed in Appendix A.

Note:

For test sequence generation, “measured P_{limit} ” and “measured P_{max} ” are used instead of the “ P_{limit} ” specified in EFS entry and “ P_{max} ” specified for the device, because Smart Transmit feature operates against the actual power level of the “ P_{limit} ” that was calibrated for the EUT. The “measured P_{limit} ” accurately reflects what the feature is referencing to, therefore, it should be used during feature validation testing. The RF tune up and device-to-device variation are already considered in Part 0 report prior to determining P_{limit} .

4.2 Test configuration selection criteria for validating Smart Transmit feature

For validating Smart Transmit feature, this section provides a general guidance to select test cases. In practice, an adjustment can be made in test case selection. The justification/clarification may be provided

4.2.1 Test configuration selection for time-varying Tx power transmission

The Smart Transmit time averaging operation is independent of bands, modes, and channels for a given technology. Hence, validation of Smart Transmit in one band/mode/channel per technology is sufficient. Two bands per technology are proposed and selected for this testing to provide high confidence in this validation. Note this test is designed for single radio transmission scenario. If UE supports sub6 NR in both non-standalone (NSA) and standalone (SA) modes, then validation in time-varying Tx power transmission scenario described in this section needs to be performed in SA mode. Otherwise, it needs to be performed in NSA mode with LTE anchor set to low power. The choice between SA and NSA mode needs to also take into account the selection criteria described below. In general, one mode out of the two modes (NSA or SA) is sufficient for this test. The criteria for the selection is based on the Part 0 report, select two bands* in each supported technology (i.e., LTE for QRD) that correspond to least** and highest*** P_{limit} values for validating Smart Transmit, where $P_{limit} < P_{max}$.

Note:

1. P_{max} refers to maximum Tx power configured for this device in this technology/band (not rated Pmax). This Pmax definition applies throughout this Part 2 report.
2. If $P_{limit} > P_{max}$, the validation test with time-varying test sequences is not needed as no power enforcement will be required in this condition.

- * If one P_{limit} level applies to all the bands within a technology or if only one band within a technology has $P_{limit} < P_{max}$, then only one band needs to be tested. In this case, select one band/radio configuration for this test. The highest measured $1g_or_10gSAR$ shown in Part 1 report is selected.
- * * In case of multiple bands having the same least P_{limit} within the technology, then select any one band out of these bands. The “least P_{limit} ” term also implies that the technology/band with the largest difference between P_{max} and P_{limit} ($P_{limit} < P_{max}$) should be considered in the selection.
- * * * The band having a higher P_{limit} (meaning lower SAR at P_{max}) needs to be properly selected so that the power limiting enforced by Smart Transmit can be validated using the pre-defined test sequences. If the highest P_{limit} in a technology is too high (i.e., $> P_{max}$) where the power limiting enforcement is not needed when testing with the pre-defined test sequences, then the next highest level should be checked. This process should be continued within the technology until the second band for validation testing is determined.

4.2.2 Test configuration selection for change in call

The criteria to select a test configuration for call-drop measurement is:

- Select technology/band with least P_{limit} among all supported technologies/bands and $P_{limit} < P_{max}$, then select one radio configuration within the selected band for this test. Use the highest measured $1g_or_10gSAR$ listed in Part 1 report.
- In case of multiple bands having same least P_{limit} , then select one band/radio configuration for this test.
- Test for change in call is not required if all $P_{limit} > P_{max}$

This test is performed with the EUT being requested to transmit at maximum power, the above band selection will result in Tx power enforcement (i.e., EUT forced to transmit at a sustainable level) for longest duration, at that time, call change (call drop/reestablish) is performed. One test is sufficient as the feature operation is independent of technology and band.

4.2.3 Test configuration selection for change in technology/band

The selection criteria for this measurement is to have EUT switch from a technology/band with lowest (or highest) P_{limit} within the technology group to a technology/band with highest (or lowest) P_{limit} within the technology group, or vice versa. The selection order is:

- First select both technology/band configurations having $P_{limit} < P_{max}$. In case of multiple bands having the same P_{limit} , select one band/radio configuration for this test. If this can not be found, then,
- Select at least one technology/band configuration having $P_{limit} < P_{max}$. If all $P_{limit} > P_{max}$, then, test for change in technology/band is not required.

This test is performed with the EUT being requested to transmit at maximum power, the technology/band switch is performed during Tx power enforcement (i.e., EUT forced to transmit at $P_{reserve}$). One test is sufficient as the feature operation is independent of technology and band.

4.2.4 Test configuration selection for change in antenna

The criteria to select a test configuration for antenna switch (between primary and diversity antennas) measurement is:

- Whenever possible and supported by the EUT, first select antenna switch configuration within the same technology/band/DSI (i.e., same technology, band and DSI combination), and having different P_{limit} , and having both $P_{limit} < P_{max}$ where possible. Otherwise, select at least one antenna having $P_{limit} < P_{max}$.
- If the EUT does not support antenna switch within the same technology/band, but has multiple transmitting antennas to support different frequency bands, then antenna switch test should be performed in combination with technology and/or band switch. Note in this case, if possible, antenna switch test may be included as part of either change in technology and band (Section 4.2.3) or change in time window (Section 4.2.6).

- Test for change in antenna is not required if all $P_{limit} > P_{max}$

This test is performed with the EUT being requested to transmit in selected technology/band at maximum power out of antenna, the antenna switch is performed during Tx power enforcement (i.e., EUT forced to transmit at a sustainable level). One test is sufficient as the feature operation is independent of technology and band.

4.2.5 Test configuration selection for change in DSI

The criteria to select a test configuration for device state switch measurement is:

- Select a technology/band/antenna having the $P_{limit} < P_{max}$ within any technology and device state index (DSI) group, and for the same technology/band/antenna having a different P_{limit} ($P_{limit} < P_{max}$) in any other DSI group. Both the selected DSIs should have $P_{limit} < P_{max}$ where possible. Otherwise, select at least one DSI having $P_{limit} < P_{max}$. Note that the selected DSI transition need to be supported by the device.
- Test for change in device state is not required if all $P_{limit} > P_{max}$

This test is performed with the EUT being requested to transmit in selected technology/band at maximum power out of antenna, the antenna switch is performed during Tx power enforcement (i.e., EUT forced to transmit at a sustainable level). One test is sufficient as the feature operation is independent of technology, band, antenna and device state.

4.2.6 Test configuration selection for change in time window

FCC specifies different time window for time averaging based on operation frequency. The criteria to select a test configuration for validating Smart Transmit feature and demonstrating the compliance during the change in time window is

- Select any technology/band that has operation frequency classified in one time window defined by FCC (such as 100s time window), and its corresponding P_{limit} is less than P_{max} if possible.
- Select the 2nd technology/band that has operation frequency classified in a different time window defined by FCC (such as 60s time window), and its corresponding P_{limit} is less than P_{max} if possible.
- It is preferred both P_{limit} values of two selected technology/bands are less than corresponding P_{max} , but if not possible or due to limitation of test setup, then at least one of technologies/bands has its P_{limit} less than P_{max} .
- Else, if all $P_{limit} > P_{max}$, then,
 - ✓ First select both technologies/bands (one is in 100s time window, another is in 60s time window) having $(P_{limit} - P_{max}) < 2.2\text{dB}$; if it is not available, then
 - ✓ Select at least one technology/band in 60s time window having $(P_{limit} - P_{max}) < 2.2\text{dB}$; if it is not available, then
 - ✓ Test for change in time window is not required.

This test is performed with the EUT being requested to transmit at maximum power in selected technology/band. Test for one pair of time windows selected is sufficient as the feature operation is the same.

4.2.7 Test configuration selection for SAR exposure switching

If supported, the test configuration for SAR exposure switching should cover

1. SAR exposure switch when two active radios are in the same time window.
2. SAR exposure switch when two active radios are in different time windows. One test with two active radios in any two different time windows is sufficient as Smart Transmit operation is the same for RF exposure switch in any combination of two different time windows. For device supporting LTE + mmW NR, this test (i.e., Scenario 2) is covered in SAR vs PD exposure switch validation.

The Smart Transmit time averaging operation ensures total time-averaged RF exposure compliance independent of the source of SAR exposure (for example, LTE vs. Sub6 NR). Hence, validation of Smart Transmit in any one band combination for each simultaneous SAR transmission scenario (i.e., one band combination for LTE + Sub6 NR transmission, and one band combination for interband ULCA) is sufficient, where the SAR exposure varies among SARradio1 only, SARradio1 + SARradio2, and SARradio2 only scenarios.

The criteria to select a test configuration for validating Smart Transmit feature during SAR exposure switching scenarios is

- Following the above two test requirements, select the required configuration(s) for the EUT supported simultaneous transmission scenario(s).

Among all supported simultaneous transmission configurations, the selection order is

1. Select one configuration where both P_{limit} of radio1 and radio2 is less than their corresponding P_{max} , preferably, with different P_{limits} . If this configuration is not available, then,
2. Select one configuration that has P_{limit} less than its P_{max} for at least one radio. If this cannot be found, then,
3. The test for SAR exposure switch when two active radios are in the same time window is not required.

For SAR exposure switch when two active radios are in the different time windows, the selection order is:

- ✓ Select both configurations that has P_{limit} of radio1 and radio2 greater than P_{max} but having $(P_{limit} - P_{max}) < 2.2\text{dB}$. If this cannot be found, then,
- ✓ Select at least one configuration in 60s window that has $(P_{limit} - P_{max}) < 2.2\text{dB}$. If all $(P_{limit} - P_{max}) > 2.2\text{dB}$, then,
- ✓ Test for SAR exposure switch when two active radios are in the different time windows is not required.

Test for one band combination per each simultaneous transmission technology is sufficient as the feature operation is the same.

4.3 Test procedures for conducted power measurements

This section provides general conducted power measurement procedures to perform compliance test under dynamic transmission scenarios described in Section 3. In practice, an adjustment can be made in these procedures. The justification/clarification may be provided.

4.3.1 Test procedures for Time-varying Tx power scenario

This test is performed with the two pre-defined test sequences described in Section 4.1 for all the technologies and bands selected in Section 4.2.1. The purpose of the test is to demonstrate the effectiveness of power limiting enforcement and that the time averaged transmit power when converted into 1g_ or 10g_SAR values does not exceed the regulatory limit at all times (see Eq. (1a) and (1b)).

Test procedure:

1. Measure P_{max} , measure P_{limit} and calculate $P_{reserve}$. Follow Section 4.1 to generate the test sequences for all the technologies and bands selected in Section 4.2.1. Test condition to measure P_{max} , P_{limit} and $P_{reserve}$ is:
 - Measure P_{max} with Smart Transmit disabled and callbox set to request maximum power.
 - Measure P_{limit} with Smart Transmit Peak exposure mode enabled, and callbox set to request maximum power.
 - Measure P_{max} via test sequence 1 measurement
2. Set the EUT to the intended Smart Transmit exposure mode, then set callbox to request the EUT to transmit at pre-defined test sequence 1 (generated in Step 1), measure and record Tx power versus time. 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. (3a)) using Step 1.b result, and then perform 100s running average to determine time-averaged 1g_or_10gSAR versus time as illustrated in below Figure 4-1.
3. Make one plot containing:
 - a. Computed time-averaged 1g_or_10gSAR versus time determined in Step 2
 - b. Corresponding regulatory 1g_or_10gSAR_{limit} limit.
4. Repeat Steps 2~3 for pre-defined test sequence 2.
5. Repeat Steps 2~4 for all the selected technologies and bands.

The validation criteria is, at all times, the time-averaged 1g_or_10g SAR versus time determined in Step 2 (and plotted in Step 4) shall not exceed the regulatory 1g_or_10gSAR_{limit} limit.

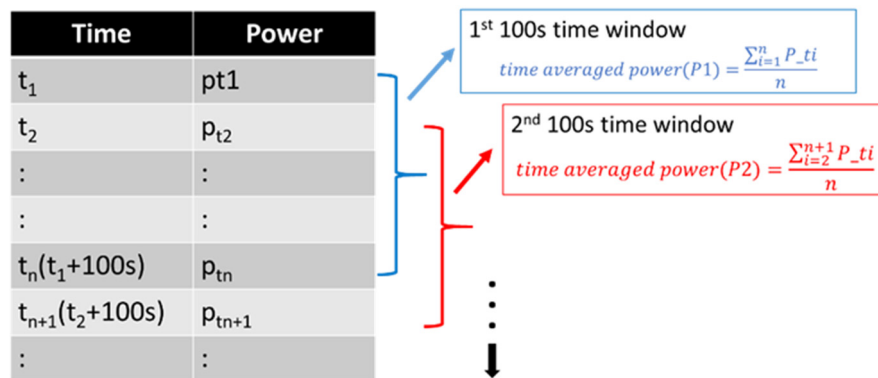


Figure 4-1 100s running average illustration

4.3.2 Test procedures for Change in call scenario

This test is to demonstrate that Smart Transmit feature accurately accounts for the past Tx powers during time-averaging when a new call is established.

The call drop and re-establishment needs to be performed during power limit enforcement to demonstrate the continuity of RF exposure management and limiting in call change scenario. In other words, the RF exposure averaged over any 100s-time window (including the time windows containing the call change) doesn't exceed the corresponding regulatory $1g_or_10gSAR_{limit}$ limit.

Test procedure:

1. Measure P_{limit} for the technology/band selected in Section 4.2.2. Measure P_{limit} with Smart Transmit Peak exposure mode enabled, and callbox set to request maximum power.
2. Set EUT to the intended Smart Transmit exposure mode.
3. Establish radio link with callbox in technology/band selected in Section 4.2.2.
4. Request EUT to transmit at 0 dBm for at least 100 seconds, followed by requesting EUT to transmit at maximum Tx power for about ~60 seconds, and drop the call then reestablish another call in the same radio configuration (i.e., same technology/band/channel) and continue callbox requesting EUT to transmit at maximum Tx power for the remaining time for a total test time of ~360 seconds. Measure and record Tx power versus time.
5. Once the measurement is done, extract instantaneous Tx power versus time, and convert the conducted Tx power into $1g_or_10gSAR$ value (see Eq. (1a)) using Step 1 result, and then perform 100s running average to determine time-averaged $1g_or_10gSAR$ versus time as illustrated in **Figure 4-1**.

6. Make one plot containing:

- (a) computed time-averaged 1g_or_10gSAR versus time determined in Step 4 for the 1st call, (b) computed time-averaged 1g_or_10gSAR versus time determined in Step 4 for the 2nd call, (c) combined time-averaged 1g_or_10gSAR of the 1st call and 2nd call versus time and (d) corresponding regulatory 1g_or_10gSAR_{limit} limit.

The validation criteria is, at all times, the combined time-averaged 1g_or_10gSAR versus time determined in Step 6c shall not exceed the regulatory 1g_or_10gSAR_{limit} limit

4.3.3 Test procedures for Change in technology and band

This test is to demonstrate the correct power control by Smart Transmit during technology switches and/or band handovers.

Similar to the change in call test in Section 4.3.2, the technology and band handover needs to be performed to validate the continuity of RF exposure limiting during the transition. Since the P_{limit} could vary with technology and band, the equations (1a) and (1b) can be written as follows for transmission scenario having change in technology/band,

$$1g_or_10gSAR_1(t) = \frac{conducted_Tx_power_1(t)}{conducted_Tx_power_P_{limit_1}} \times 1g_or_10gSAR_P_{limit_1} \quad (5a)$$

$$1g_or_10gSAR_2(t) = \frac{conducted_Tx_power_2(t)}{conducted_Tx_power_P_{limit_2}} \times 1g_or_10gSAR_P_{limit_2} \quad (5b)$$

$$\frac{\frac{1}{T_{SAR}} \left[\int_{t-T_{SAR}}^t 1g_or_10gSAR_1(t) dt + \int_{t-T_{SAR}}^t 1g_or_10gSAR_2(t) dt \right]}{1g_or_10gSAR_{limit}} \leq 1 \quad (5c)$$

where, $conducted_Tx_power_1(t)$, $conducted_Tx_power_P_{limit_1}$, and $1g_or_10gSAR_P_{limit_1}$ correspond to the instantaneous Tx power, conducted Tx power at P_{limit} , and compliance 1g_or_10gSAR values of technology1/band1 at P_{limit_1} ; $conducted_Tx_power_2(t)$, $conducted_Tx_power_P_{limit_2}$, and $1g_or_10gSAR_P_{limit_2}$ correspond to the instantaneous Tx power, conducted Tx power at P_{limit} , and compliance 1g_or_10gSAR values of technology2/band2 at P_{limit_2} . Transition from the technology1/band1 to the technology2/band2 happens at time-instant 't1'.

Test procedure:

1. Measure P_{limit} for both the technologies and bands selected in Section 4.2.3. Measure P_{limit} with Smart Transmit Peak exposure mode enabled and callbox set to request maximum power.
2. Set EUT to intended Smart Transmit exposure mode.
3. Establish radio link with callbox in first technology/band selected in Section 4.2.3.
4. Request EUT to transmit at 0 dBm for at least 100 seconds, followed by requesting EUT to transmit at maximum Tx power for about ~60 seconds, and then switch to second technology/band selected in Section 4.2.3. Continue with callbox requesting EUT to transmit at maximum Tx power for the remaining time for a total test time of ~360 seconds. Measure and record Tx power versus time for the entire duration of the test.
5. Once the measurement is done, extract instantaneous Tx power versus time, and convert the conducted Tx

power into 1g_or_10gSAR value (see Eq. (5a) and (5b)) using corresponding technology/band Step 1 result, and then perform 100s running average to determine timeaveraged 1gSAR versus time as illustrated in Figure 4-1. Note that in Eq.(5a) & (5b), instantaneous Tx power is converted into instantaneous 1g_or_10gSAR value by applying the worst-case 1gSAR value for the selected technologies/bands at P_{limit} as reported in Part 1 report.

6. Make one plot containing:

- (a) computed time-averaged 1g_or_10gSAR of the 1st technology/band versus time determined in Step 5, (b) computed time-averaged 1g_or_10gSAR of the 2nd technology/band versus time determined in Step 5, (c) combined time-averaged 1g_or_10gSAR of the 1st technology/band and 2nd technology/band versus time determined in Step 5 and (d) corresponding regulatory 1g_or_10gSAR_{limit} limit.

The validation criteria is, at all times, the combined time-averaged 1g_or_10gSAR versus time shall not exceed the regulatory 1g_or_10gSAR_{limit} limit.

4.3.4 Test procedures for Change in antenna

This test is to demonstrate the correct power control by Smart Transmit during antenna switches from primary to diversity. The test procedure is identical to Section 4.3.3, with switching antenna instead of technology/band.

The validation criteria is, at all times, the time-averaged 1g_or_10gSAR versus time shall not exceed the regulatory 1g_or_10gSAR_{limit} limit.

4.3.5 Test procedures for Change in DSI

This test is to demonstrate the correct power control by Smart Transmit during device state transitions from one device state (say, body-worn or hotspot or extremity) to another. The test procedure is identical to Section 4.3.3, with changing device state instead of technology/band. The validation criteria is, at all times, the time-averaged 1g_or_10gSAR versus time shall not exceed the regulatory 1g_or_10gSAR_{limit} limit.

4.3.6 Test procedures for Change in time window

This test is to demonstrate the correct power control by Smart Transmit during the change in averaging time window when a specific band handover occurs. FCC specifies time-averaging windows of 100s for Tx frequency < 3GHz, and 60s for Tx frequency between 3GHz and 6GHz.

Similar to the change in technology and band test in Section 4.3.3, to validate the continuity of RF exposure limiting during the transition, the band handover test needs to be performed when EUT handovers from operation band less than 3GHz to greater than 3GHz or vice versa. The equations (1a) and (1b) can be written as follows for transmission scenario having change in time window,

$$1g_or_10gSAR_1(t) = \frac{conducted_Tx_power_1(t)}{conducted_Tx_power_P_{limit_1}} \times 1g_or_10gSAR_P_{limit_1} \quad (6a)$$

$$1g_or_10gSAR_2(t) = \frac{conducted_Tx_power_2(t)}{conducted_Tx_power_P_{limit_2}} \times 1g_or_10gSAR_P_{limit_2} \quad (6b)$$

$$\frac{\frac{1}{T1SAR} \left[\int_{t-T1SAR}^t 1g_or_10gSAR_1(t) dt \right] + \frac{1}{T2SAR} \left[\int_{t-T2SAR}^t 1g_or_10gSAR_2(t) dt \right]}{1g_or_10gSAR_{limit}} \leq 1 \quad (6c)$$

where, $conducted_Tx_power_1(t)$, $conducted_Tx_power_P_{limit_1}$, and $1g_or_10gSAR_P_{limit_1}$ correspond to the instantaneous Tx power, conducted Tx power at P_{limit} , and compliance $1g_or_10gSAR$ values of band1 at P_{limit_1} ; $conducted_Tx_power_2(t)$, $conducted_Tx_power_P_{limit_2}$, and $1g_or_10gSAR_P_{limit_2}$ correspond to the instantaneous Tx power, conducted Tx power at P_{limit} , and compliance $1g_or_10gSAR$ values of band2 at P_{limit_2} . One of the two bands is less than 3GHz, another is greater than 3GHz. Transition from first band with time-averaging window ' $T1SAR$ ' to the second band with time-averaging window ' $T2SAR$ ' happens at time-instant ' $t1$ '.

Test procedure:

1. Measure P_{limit} for both the technologies and bands selected in Section 4.2.6. Measure P_{limit} with Smart Transmit Peak exposure mode enabled, and callbox set to request maximum power.
2. Set EUT to intended Smart Transmit exposure mode.

Transition from 100s time window to 60s time window, and vice versa

3. Establish radio link with callbox in the technology/band having 100s time window selected in Section 4.2.6.
4. Request EUT to transmit at 0 dBm for at least 100 seconds, followed by requesting EUT to transmit at maximum Tx power for about ~140 seconds, and then switch to second technology/band (having 60s time window) selected in Section 4.2.6. Continue with callbox requesting EUT to transmit at maximum Tx power for about ~60s in this second technology/band, and then switch back to the first technology/band. Continue with callbox requesting EUT to transmit at maximum Tx power for at least another 100s. Measure and record Tx power versus time for the entire duration of the test.
5. Once the measurement is done, extract instantaneous Tx power versus time, and convert the conducted Tx power into 1g_or_10gSAR value (see Eq. (6a) and (6b)) using corresponding technology/band Step 1 result, and then perform 100s running average to determine timeaveraged 1g_or_10gSAR versus time as illustrated in Figure 4-1. Note that in Eq.(6a) & (6b), instantaneous Tx power is converted into instantaneous 1g_or_10gSAR value by applying the worst-case 1g_or_10gSAR value for the selected technologies/bands at P_{limit} .
6. Make one plot containing: (a) computed time-averaged 1g_or_10gSAR of the 1st technology/band (having 100s time window) versus time determined in Step 5, (b) computed time-averaged 1g_or_10gSAR of the 2nd technology/band (having 60s time window) versus time determined in Step 5, (c) combined time-averaged 1g_or_10gSAR of (a) and (b), and (d) corresponding regulatory 1g_or_10gSAR_{limit} limit.

Transition from 60s time window to 100s time window, and vice versa

7. Establish radio link with callbox in the technology/band having 60s time window selected in Section 4.2.6.
8. Request EUT to transmit at 0 dBm for at least 60 seconds, followed by requesting EUT to transmit at maximum Tx power for about ~80 seconds, and then switch to second technology/band (having 100s time window) selected in Section 4.2.6. Continue with callbox requesting EUT to transmit at maximum Tx power for about ~100s in this second technology/band, and then switch back to the first technology/band. Continue with callbox requesting EUT to transmit at maximum Tx power for at least another 140s. Measure and record Tx power versus time for the entire duration of the test.
9. Repeat above Step 5~6 procedures to generate the corresponding plots

The validation criteria is, at all times, the combined time-averaged 1g_or_10gSAR versus time shall not exceed the regulatory 1g_or_10gSAR_{limit} limit.

4.3.7 Test procedures for SAR exposure switching

This test is to demonstrate that Smart Transmit feature accurately accounts for switching in exposures among SAR from radio1 only, SAR from both radio1 and radio2, and SAR from radio2 only scenarios, and ensures total time-averaged RF exposure complies with the FCC limit. The detailed test procedure for SAR exposure switching in the case of LTE+Sub6 NR nonstandalone mode transmission scenario is provided in Appendix B.

Test procedure:

1. Measure conducted Tx power corresponding to P_{limit} for radio1 and radio2 in selected band. Test condition to measure conducted P_{limit} is:
 - Establish device in call with the callbox for radio1 technology/band. Measure conducted Tx power corresponding to radio1 P_{limit} with Smart Transmit Peak exposure mode enabled and callbox set to request maximum power.
 - Repeat above step to measure conducted Tx power corresponding to radio2 P_{limit} . If radio2 is dependent on radio1 (for example, non-standalone mode of Sub6 NR requiring radio1 LTE as anchor), then establish radio1 + radio2 call with callbox, and request all down bits for radio1 LTE. In this scenario, with callbox requesting maximum power from radio2 Sub6 NR, measured conducted Tx power corresponds to radio2 P_{limit} (as radio1 LTE is at all-down bits)
2. Set EUT to intended Smart Transmit exposure mode for radio1 + radio2. In this description, it is assumed that radio2 has lower priority than radio1. Established device in radio1+radio2 call, and request all-down bits or low power on radio1, with callbox requesting UE to transmit at maximum power in radio2 for at least one time window. After one time window, set callbox to request UE to transmit at maximum power on radio1, i.e., all-up bits. Continue radio1+radio2 call with both radios at maximum power for at least one time window, and drop (or request all-down bits) radio2. Continue radio1 at maximum power for at least one time window. Record the conducted Tx power for both radio1 and radio2 for the entire duration of this test.
3. Once the measurement is done, extract instantaneous Tx power versus time for both radio1 and radio2 links. Similar to technology/band switch test in Section 4.3.3, convert the conducted Tx power for both these radios into 1g_or_10gSAR value (see Eq. (5a) and (5b)) using corresponding technology/band P_{limit} measured in Step 1, and then perform 100s running average to determine time-averaged 1g_or_10gSAR versus time as illustrated in Figure 4-1. Note that here it is assumed both radios have Tx frequencies < 3GHz, otherwise, 60s running average should be performed for radios having Tx frequency between 3GHz and 6GHz.
4. Make one plot containing: (a) computed time-averaged 1g_or_10gSAR versus time determined in Step 3 and combined time-averaged 1g_or_10gSAR versus time, and (b) corresponding regulatory 1g_or_10gSAR_{limit} limit.

The validation criteria is, at all times, the combined time-averaged 1g_or_10gSAR versus time shall not exceed the regulatory 1g_or_10gSAR_{limit} limit.

4.4 Test procedure for SAR measurements

This section provides general conducted power measurement procedures to perform compliance test under dynamic transmission scenarios described in Section 3. In practice, an adjustment can be made in these procedures. The justification/clarification may be provided.

To validate time averaging algorithm through SAR measurement, the “path loss” between callbox antenna and EUT needs to be calibrated to ensure that the EUT Tx power reacts to the requested power from callbox in a radiated call. It should be noted that when signaling in closed loop mode, protocol-level power control is in play, resulting in EUT not solely following callbox TPC (transmit power control) commands. In other words, EUT response has many dependencies (RSSI, quality of signal, path loss variation, fading, etc.,) other than just TPC commands. These dependencies have less impact in conducted setup (as it is a controlled environment and the path loss can be very well calibrated) but have significant impact on radiated testing in an uncontrolled environment, such as SAR test setup. Therefore, the deviation in EUT Tx power from callbox requested power is expected.

The following steps are for time averaging algorithm validation through SAR measurement:

1. “Path Loss” calibration: Place the EUT against the flat section of the SAM Twin phantom in the worst-case position determined based on Section 4.2.1. For each band selected, prior to SAR measurement, perform “path loss” calibration between callbox antenna and EUT. Since the SAR test environment is not controlled, extreme care needs to be taken to avoid the influence from reflections. The test setup is described in Section 8.1.
2. Time averaging algorithm validation:
 - a. For a given radio configuration (technology/band) selected in Section 4.2.1, enable Smart Transmit Peak exposure mode, with callbox to request maximum power, perform area scan, conduct pointSAR measurement at peak location of the area scan. This pointSAR value, *pointSAR_{P_{limit}}* corresponds to pointSAR at the measured *P_{limit}* obtained in Step 1 of Section 4.3.1.

- b. Set EUT to intended Smart Transmit exposure mode, with callbox requesting the EUT to transmit at power levels described by test sequence 1 in Step 1 of Section 4.3.1, conduct pointSAR measurement versus time at peak location of the area scan determined in this section Step 2(a). Once the measurement is done, extract instantaneous pointSAR vs time data, $pointSAR(t)$, and convert it into instantaneous 1gSAR vs. time by using equation (3a):

$$1g_or_10gSAR(t) = \frac{pointSAR(t)}{pointSAR_P_{limit}} \times 1g_or_10gSAR_P_{limit} \quad (3a)$$

where, $pointSAR_P_{limit}$ corresponds to the value determined in Step 2.a, and $pointSAR(t)$ corresponds to instantaneous pointSAR determined in Step 2.b.

- c. Perform 100s running average to determine time-averaged 1gSAR versus time.
d. Make one plot containing (a) computed time-averaged 1g_or_10gSAR versus time determined in this section Step 2.c, (b) regulatory $1g_or_10gSAR_{limit}$ limit.
e. Repeat Step 2.b ~ 2.d for test sequence 2 generated in Step 1 of Section 4.3.1.
f. Repeat Step 2.a ~ 2.e for all the technologies and bands selected in Section 4.2.1.

The time-averaging validation criteria for SAR measurement is that, at all times, the timeaveraged 1g_or_10gSAR versus time shall not exceed the regulatory $1g_or_10gSAR_{limit}$ limit.

5. Test Configurations

5.1 WWAN transmission

The P_{limit} values for technologies and bands supported by the EUT are derived in the Part 0 report and summarized in Table 5-1.

Based on equations (1a), (2a), (3a) and (4a), it is clear that Part 2 testing outcome is normalized quantity, which implies that it can be applied to any radio configuration within a selected technology/band/DSI. Thus, as long as applying the worst-case SAR obtained from the worst radio configuration in Part 1 testing to calculate time-varying SAR exposure in equations (1a), (2a), (3a) and (4a), the accuracy in compliance demonstration remains the same. Therefore, there may be some differences between the radio configuration selected for Part 2 testing and the radio configuration associated with worst-case SAR obtained in the Part 1 evaluation.

Table 5-1 Plimit Summary by Technogy, Band and Antenna

Band	Mode	P_{limit}			
		Body DSI 1			
		Ant 0	Ant 1	Ant 2	Ant 3
WCDMA B2	RMC	18	-	-	-
WCDMA B4	RMC	18.5	-	-	-
WCDMA B5	RMC	22	-	-	-
LTE Band 2	QPSK	18	-	16.5	-
LTE Band 4	QPSK	18.5	-	18	-
LTE Band 5	QPSK	21.5	-	-	-
LTE Band 7	QPSK	19	-	17	-
LTE Band 12	QPSK	21.5	-	-	-
LTE Band 13	QPSK	21.5	-	-	-
LTE Band 14	QPSK	21.5	-	-	-
LTE Band 17	QPSK	21.5	-	-	-
LTE Band 25	QPSK	18	-	16.5	-
LTE Band 26	QPSK	21.5	-	-	-
LTE Band 30	QPSK	17.5	-	15.5	-
LTE Band 38	QPSK	18.5	-	15.5	-
LTE Band 41_PC3	QPSK	18.5	-	15.5	-
LTE Band 41_PC2	QPSK	18.5	-	15.5	-
LTE Band 42	QPSK	12.5	-	16.5	-
LTE Band 43	QPSK	12.5	-	16.5	-
LTE Band 48	QPSK	12.5	-	16.5	-
LTE Band 66	QPSK	18.5	-	18	-
LTE Band 71	QPSK	24	-	-	-
5G NR n2	QPSK	18	-	16.5	-
5G NR n5	QPSK	21.5	-	-	-
5G NR n7	QPSK	18.5	-	16.5	-
5G NR n12	QPSK	21.5	-	-	-
5G NR n13	QPSK	21.5	-	-	-
5G NR n14	QPSK	21.5	-	-	-
5G NR n25	QPSK	18	-	16.5	-
5G NR n26	QPSK	21.5	-	-	-
5G NR n30	QPSK	17.5	-	15.5	-
5G NR n38	QPSK	24	-	14.5	-

5G NR n41_PC3	QPSK	24	17.5	14.5	18.5
5G NR n41_PC2	QPSK	24	17.5	14.5	18.5
5G NR n41_PC1.5	QPSK	24	17.5	14.5	18.5
5G NR n48	QPSK	17	-	15.5	-
5G NR n66	QPSK	18.5	-	17	-
5G NR n71	QPSK	24	-	-	-
5G NR n77_PC3	QPSK	17	17	15.5	14.5
5G NR n77_PC2	QPSK	17	17	15.5	14.5
5G NR n77_PC1.5	QPSK	17	17	15.5	14.5
5G NR n78_PC3	QPSK	17	17	15.5	14.5
5G NR n78_PC2	QPSK	17	17	15.5	14.5
5G NR n78_PC1.5	QPSK	17	17	15.5	14.5

Note

All Plimit power levels entered in Table 5-1 correspond to average power levels after accounting for duty cycle in the case of TDD modulation schemes.

Maximum tune up target power, Pmax, is configured in NV settings in EUT to limit maximum transmitting power..

The EUT maximum allowed output power is equal to Pmax + device uncertainty.

Table 5-2 Selections for Sub6 configurations validation measurements

Tase Case	Test scenario	Tech	Band	Antenna	DSI	Channel	Freq. (MHz)	BW (MHz)	RB Size	RB offset	mode	position	Dist. (mm)	Part 1 Worst-case radio config 1g SAR measured at Plimit (W/kg)
1	Time-varying Tx power transmission	WCDMA	2	0	1	9400	1880	-	-	-	RMC	Bottom	0	0.839
2		LTE	25	0	1	26365	1882.5	20	1	0	QPSK	Bottom	0	0.939
3		LTE	48	0	1	56207	3646.7	20	1	0	QPSK	Front edge	0	1.000
4		NR	n30	0	1	462000	2310	10	1	0	QPSK	Bottom	0	0.854
5		NR	n77	0	1	656000	3750	100	1	0	QPSK	Front edge	0	0.903
6	Change in call	LTE	25	0	1	26365	1882.5	20	1	0	QPSK	Bottom	0	1.005
7	Tech/band switch	LTE	25	0	1	26365	1882.5	20	1	0	QPSK	Bottom	0	1.005
		WCDMA	2	0	1	9400	1880	-	-	-	RMC	Bottom	0	1.003
8	Antenna Switch	NR	n77	0	1	656000	3750	100	1	0	QPSK	Front edge	0	0.903
		NR	n77	2	1	656000	3750	100	1	0	QPSK	Bottom	0	0.931
9	Time-window Change (100s_60s_100s)	LTE	25	0	1	26365	1882.5	20	1	0	QPSK	Bottom	0	0.939

10	Time-window Change (60s_10s_60s)	LTE	48	0	1	56207	3646.7	20	1	0	QPSK	Front edge	0	1.000
11	SAR VS SAR (EN-DC)	LTE	12	0	1	23095	707.5	10	1	0	QPSK	Bottom	0	0.663
		NR	n77	0	1	656000	3750	100	1	0	QPSK	Front edge	0	0.903

Base on the selection criteria described in section 4.2, the test configurations for the Tx varying transmission test listed in section 3 are:

1. Technologies and bands for time-varying Tx power transmission: The test case 1~5 listed in Table 5-2 are selected to test sequences described in Section 4.1 in both timevarying conducted power measurement and time-varying SAR measurement.
2. Technology and band for change in call test: Select technology/band having the lowest P_{limit} among all supported technologies/band (test case 6 in Table 5-2) for performing the call drop test in conducted power setup.
3. Technologies and bands for change in technology/band test: Following the guidelines in Section 4.2.3, test case 7 in Table 5-2 is selected for handover test from a technology/band within one technology group (LTE Band 25, DSI=1, antenna 0), to a technology/band in the same DSI within another technology group (WCDMA Band 2, DSI=1, antenna 0) in conducted power setup.
4. Technologies and bands for change in Antenna Switch test: Following the guidelines in Section 4.2.4, test case 8 in Table 5-2 is selected for handover test from a technology/band within one technology group (5G NR n77, DSI=1, antenna 0), to a technology/band in the same DSI within another technology group (5G NR n77, DSI=1, antenna 1) in conducted power setup.
5. Technologies and bands for change in time-window: Based on selection criteria in Section 4.2.6, for a given DSI=1, test case 9~10 in Table 5-2 is selected for time window switch between 60s window (LTE Band 48, Antenna 0) and 100s window (LTE Band 5, Antenna 0) in conducted power setup.
6. Technologies and bands for switch in SAR exposure: Based on selection criteria in Section 4.2.7 Scenario 1, test case 11 in Table 5-2 is selected for SAR exposure switching test in one of the supported simultaneous WWAN transmission scenario, i.e., LTE + Sub6 NR active in the same 100s time window, in conducted power setup.

6. Conducted Power Results for Sub-6 Smart Transmit Feature Validation

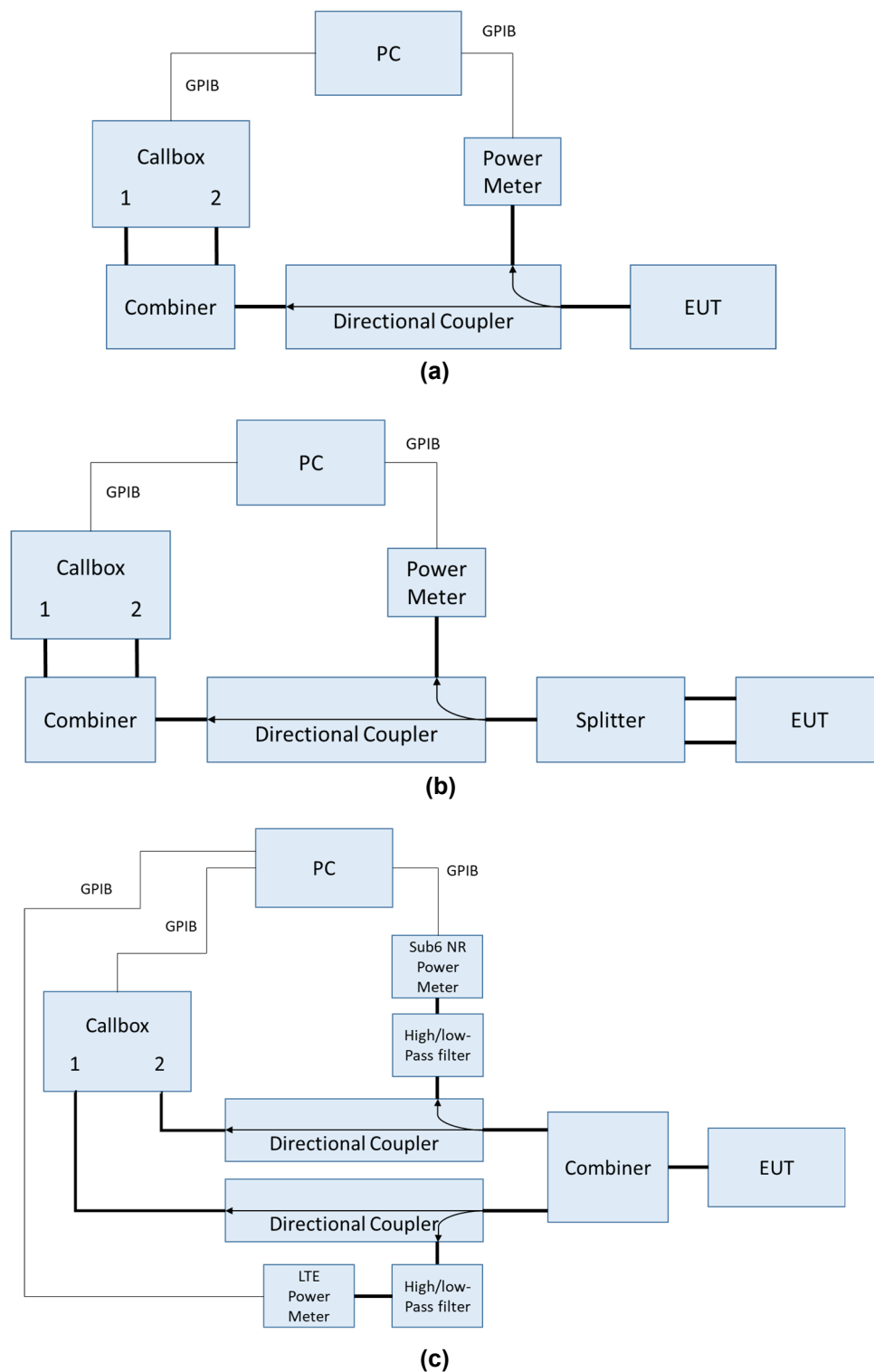
6.1 Cononducted power measurement setup

The Rohde & Schwarz CMW500 callbox is used in this test. The schematic of the setup used to measure conducted powers is shown in Figure 6-1 and test setup pictures are shown in Appendix E. For single antenna measurement, one port (RF1 COM) of the callbox is connected to the RF port of the EUT using a directional coupler. For antenna & technology switch measurement, two ports (RF1 COM and RF3 COM) of the callbox are connected to a combiner, which is connected to the RF port of the EUT using a directional coupler. The other end of the directional coupler is connected to a splitter to connect to two RF ports of the EUT corresponding to the two antennas of interest. In both the setups, power meter is used to tap the directional coupler for measuring the conducted output power of the EUT. For time averaging validation test (Section 4.3.1) and call drop test (Section 4.3.2), only one port (RF1 COM) of the callbox is used to communicate with the EUT, for technology/band switch measurement (Section 4.3.3), both ports (RF1 COM and RF3 COM) of callbox are used to switch from one technology communicating on RF1 COM port to another technology communicating on RF3 COM port.

All the path losses from RF port of EUT to the callbox RF COM port and to the power meter are calibrated and entered as offsets in the callbox and the power meter via test scripts on PC used to control callbox and power meter.

LTE + Sub-6 GHz NR Test Setup:

If the LTE conducted port and Sub-6 GHz NR conducted port are same on this EUT (i.e., they share the same antenna), then low-/high-pass filters are used to separate the LTE and Sub-6 GHz NR signals for power meter measurement via directional couplers, as shown in below Figures 6-1b and 6-1c.

**Figure 6-1 Conducted power measurement setup**

Both the callbox and power meter are connected to the PC using GPIB cables. Two test scripts are custom made for automation: one is for time-varying transmit power measurement, another is for call drop and technology/band switch tests. The test duration set in the test scripts is 500 seconds.

For time-varying transmit power measurement, the PC runs the 1st test script to send GPIB commands to control the callbox's requested power versus time, while at the same time to record the conducted power measured at EUT RF port using the power meter. The commands sent to the callbox to request power are:

- 0 dBm for 100 seconds
- Test sequence 1 or test sequence 2 (defined in Section 4.1 and generated in Section 4.3.1), for 360 seconds
- Stay at the last power level of test sequence 1 or test sequence 2 for the remaining time.

Power meter readings are periodically recorded every 0.1s for sub6 technologies. A running average of this measured Tx power over 100 seconds (i.e., 1000 data points collected at 0.1s sampling rate) is performed in the post-data processing to determine the 100s-time averaged power.

For call drop and technology/band switch tests, the callbox is set to request maximum power all the time. When the call is established, the 2nd test script runs at the same time to start recording the Tx power measured at EUT RF port using the power meter, the call drop/re-establish, or technology/band switch is performed when the Tx power of EUT is at sustainable power level. See Section 4.3.2 for detailed test procedure of call drop test, and Section 4.3.3 for detailed test procedure of technology/band switch test.

To demonstrate compliance, all the conducted Tx power measurement results were converted into $1g_or_10gSAR$ values by using equation (1a) listed below:

$$1g_or_10gSAR(t) = \frac{conducted_Tx_power(t)}{conducted_Tx_power_P_{limit}} \times 1g_or_10gSAR_P_{limit} \quad (1a)$$

and by applying the worst-case $1g_or_10gSAR$ value for each technology/band at P_{limit} as reported in Part 1 report.

6.2 Plimit and Pmax measurement result

The measured P_{max} and measured P_{limit} of each selected radio configuration given in Table 5-2 are listed in Table 6-1. P_{max} was measured for radio configurations selected for testing time-varying power transmission scenarios to generate test sequences following the test procedures in section 4.1

Table 6-1 Measured Plimit and Pmax of selected radio configurations

Tase Case	Test scenario	Tech	Band	Antenna	DSI	Channel	Freq. (MHz)	BW (MHz)	RB Size	RB offset	mode	position	Dist. (mm)	EFS Plimit Setting (dBm)	Tune-up Pmax (dBm)	Measured Plimit (dBm)	Measured Pmax (dBm)
1	Time-varying Tx power transmission	WCDMA	2	0	1	9400	1880	-	-	-	RMC	Bottom	0	17.5	18	17.7	23.8
2		LTE	25	0	1	26365	1882.5	20	1	0	QPSK	Bottom	0	18	18	17.6	23
3		LTE	48	0	1	56207	3646.7	20	1	0	QPSK	Front edge	0	10.5	12.5	11.7	20.2
4		NR	n30	0	1	462000	2310	10	1	0	QPSK	Bottom	0	17.5	17.5	17.1	21.7
5		NR	n77	0	1	656000	3750	100	1	0	QPSK	Front edge	0	12	17	16.5	22.2
6	Change in call	LTE	25	0	1	26365	1882.5	20	1	0	QPSK	Bottom	0	18	18	17.6	23
7	Tech/band switch	LTE	25	0	1	26365	1882.5	20	1	0	QPSK	Bottom	0	18	18	17.6	23
		WCDMA	2	0	1	9400	1880	-	-	-	RMC	Bottom	0	17.5	18	17.7	23.8
8	Antenna Switch	NR	n77	0	1	656000	3750	100	1	0	QPSK	Front edge	0	12	17	16.5	22.2
		NR	n77	2	1	656000	3750	100	1	0	QPSK	Bottom	0	10.5	15.5	15.1	22.3
9	Time-window Change (100s_60s_100s)	LTE	25	0	1	26365	1882.5	20	1	0	QPSK	Bottom	0	18	18	17.6	23
10	Time-window Change (60s_10s_60s)	LTE	48	0	1	56207	3646.7	20	1	0	QPSK	Front edge	0	10.5	12.5	11.7	20.2
11	SAR VS SAR (EN-DC)	LTE	12	0	1	23095	707.5	10	1	0	QPSK	Bottom	0	21.5	21.5	21.4	23.4
		NR	n77	0	1	656000	3750	100	1	0	QPSK	Front edge	0	12	17	16.5	22.2

Note:

The device uncertainty of Pmax is +/-1 dB as provided by manufacturer.

6.3 Time-varying Tx power test results (Test case 1 ~ 7 in Table 5-2)

The measurement setup is shown in Figure 5-1. The purpose of the time-varying Tx power measurement is to demonstrate the effectiveness of power limiting enforcement and that the time-averaged Tx power when represented in time-averaged 1gSAR or 10gSAR values does not exceed FCC limit as shown in Eq. (1a) and (1b), rewritten below:

$$1g_or_10gSAR(t) = \frac{conducted_Tx_power(t)}{conducted_Tx_power_P_{limit}} \times 1g_or_10gSAR_P_{limit} \quad (1a)$$

$$\frac{\frac{1}{T_{SAR}} \int_{t-T_{SAR}}^t 1g_or_10gSAR(t) dt}{FCC_SAR_{limit}} \leq 1 \quad (1b)$$

where, $conducted_Tx_power(t)$, $conducted_Tx_power_P_{limit}$, and $1g_or_10gSAR_P_{limit}$ correspond to the measured instantaneous conducted Tx power, measured conducted Tx power at P_{limit} , and measured $1g_or_10gSAR$ values at P_{limit} , and measured $1g_or_10gSAR$ values at P_{limit} reported in Part 1 test (listed in Table 5-2 of this report as well).

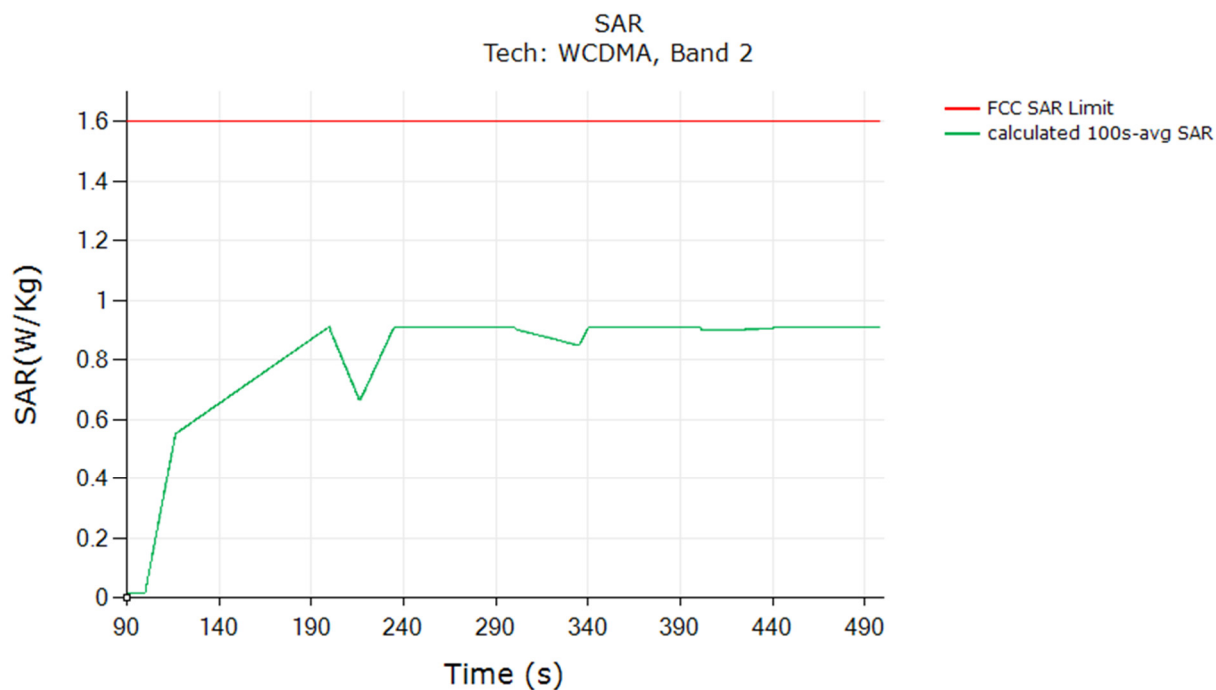
Following the test procedure in Section 4.3, the conducted Tx power measurement for all selected configurations are reported in this section. In all the conducted Tx power plots, the green curve represents time-averaged power and red line represents the conducted power limit that corresponds to FCC limit of 1.6 W/kg for 1gSAR or 4.0 W/kg for 10gSAR.

Similarly, in all the $1g_or_10gSAR$ plots (when converted using Eq. (1a)), the green curve represents the 100s/60s-time averaged $1gSAR_or_10gSAR$ value calculated based on instantaneous 1gSAR or 10gSAR; and the red line limit represents the FCC limit of 1.6 W/kg for 1gSAR or 4.0 W/kg for 10gSAR.

Time-varying Tx power measurements were conducted on test cases 1 ~ 7 in Table 5-2, by generating test sequence 1 and test sequence 2 given in APPENDIX A: using measured P_{limit} and measured P_{max} for each of these test cases.

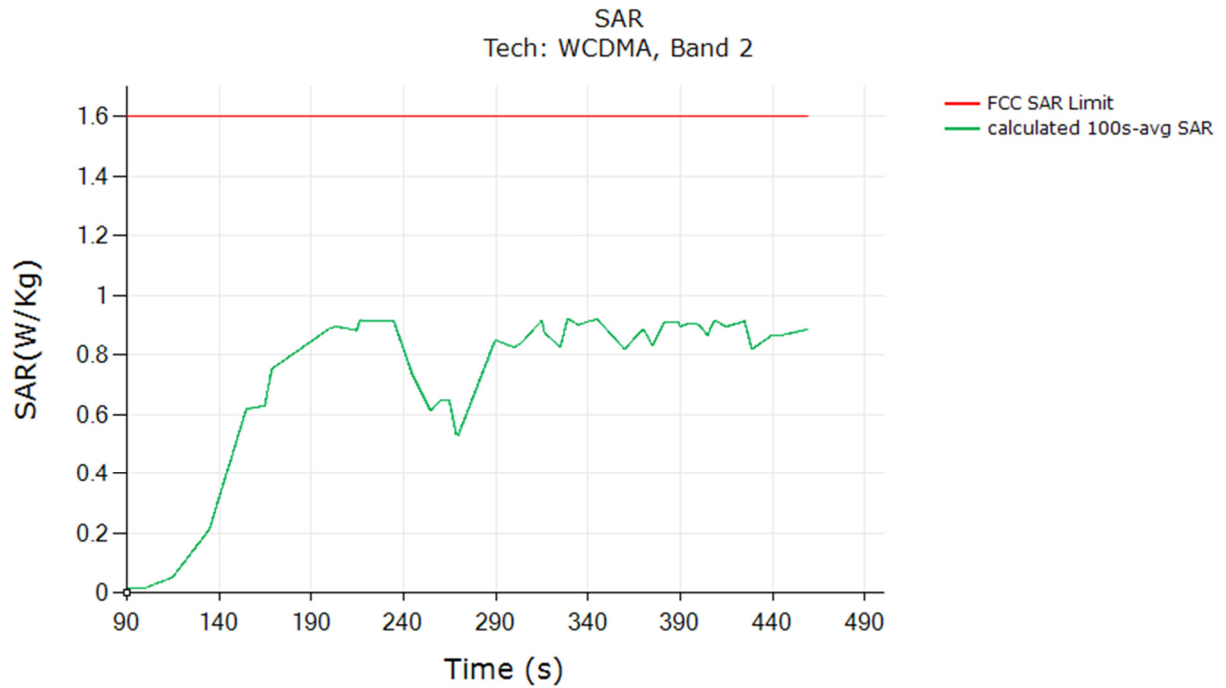
6.3.1 WCDMA Band 2 Antenna 0 (Test case 1 in Table 5-2)

Test result for Test Sequence 1:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.911	(W/kg)
Validated: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

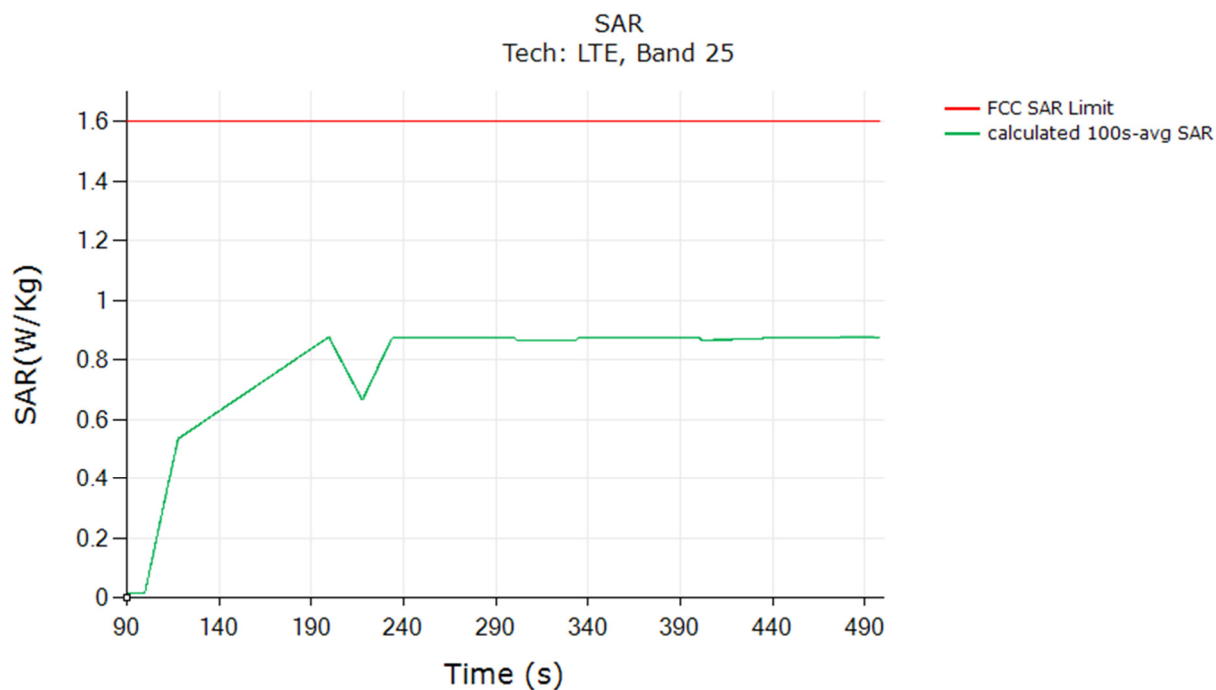
Test result for Test Sequence 2:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.920	(W/kg)
Validated: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

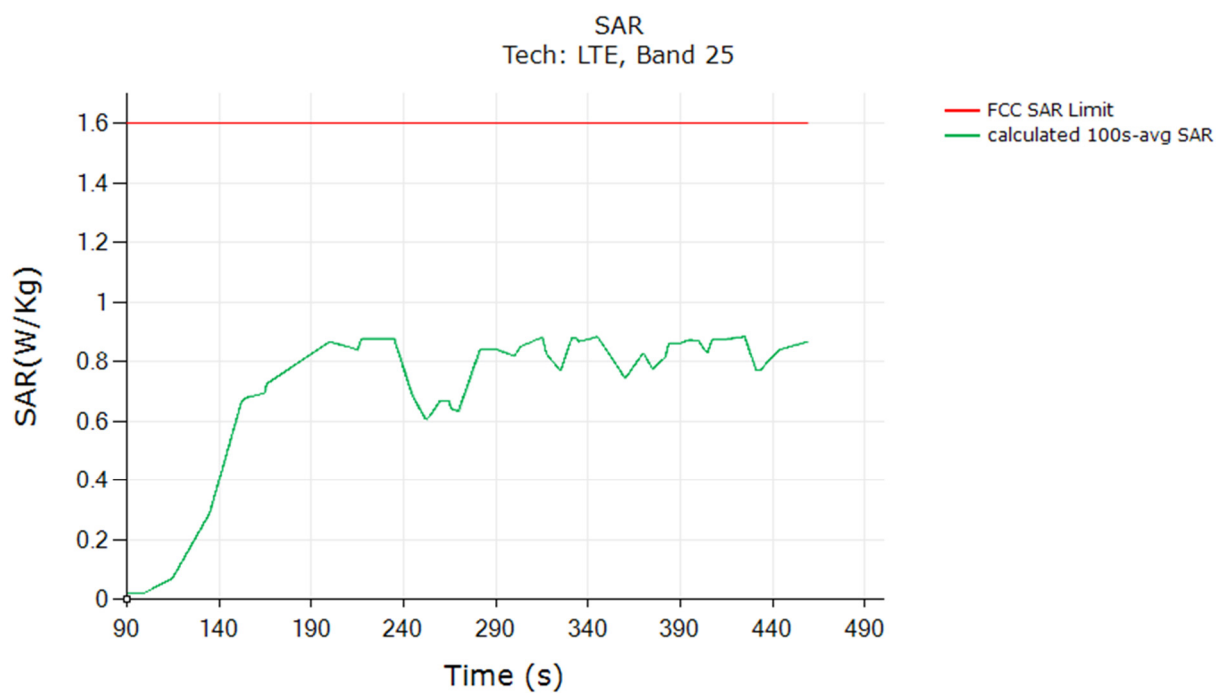
6.3.2 LTE Band 25 Antenna 0 (Test case 2 in Table 5-2)

Test result for Test Sequence 1:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.877	(W/kg)
Validated: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

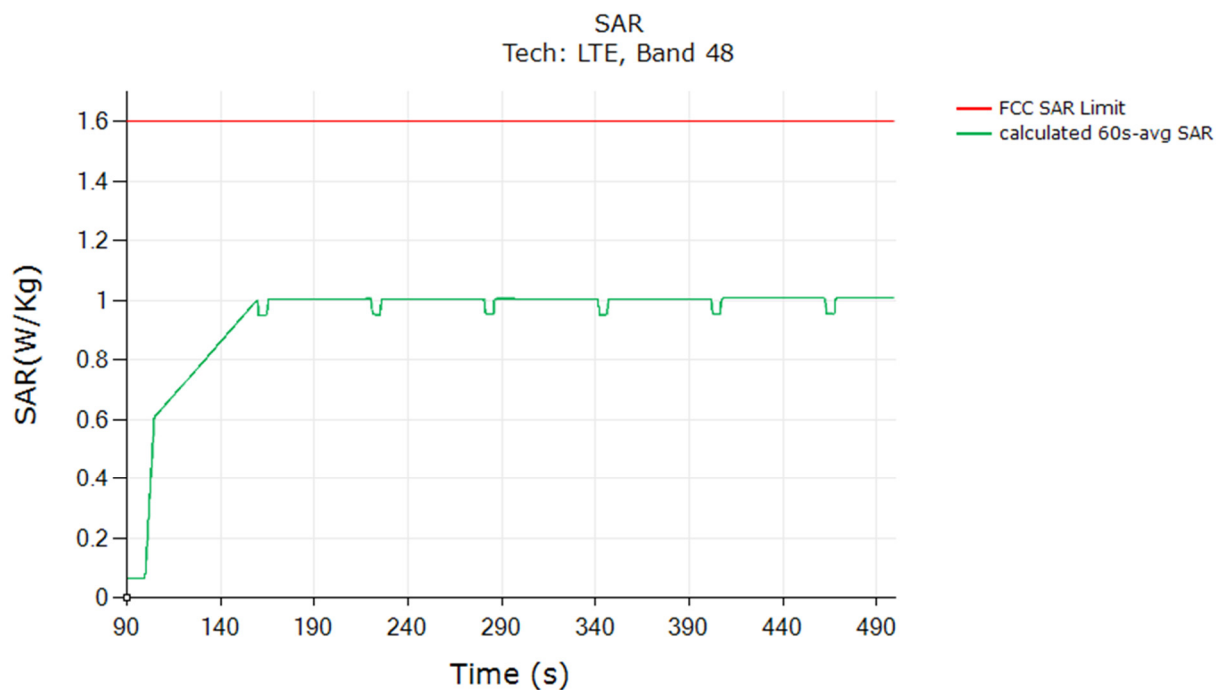
Test result for Test Sequence 2:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.884	(W/kg)
Validated: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

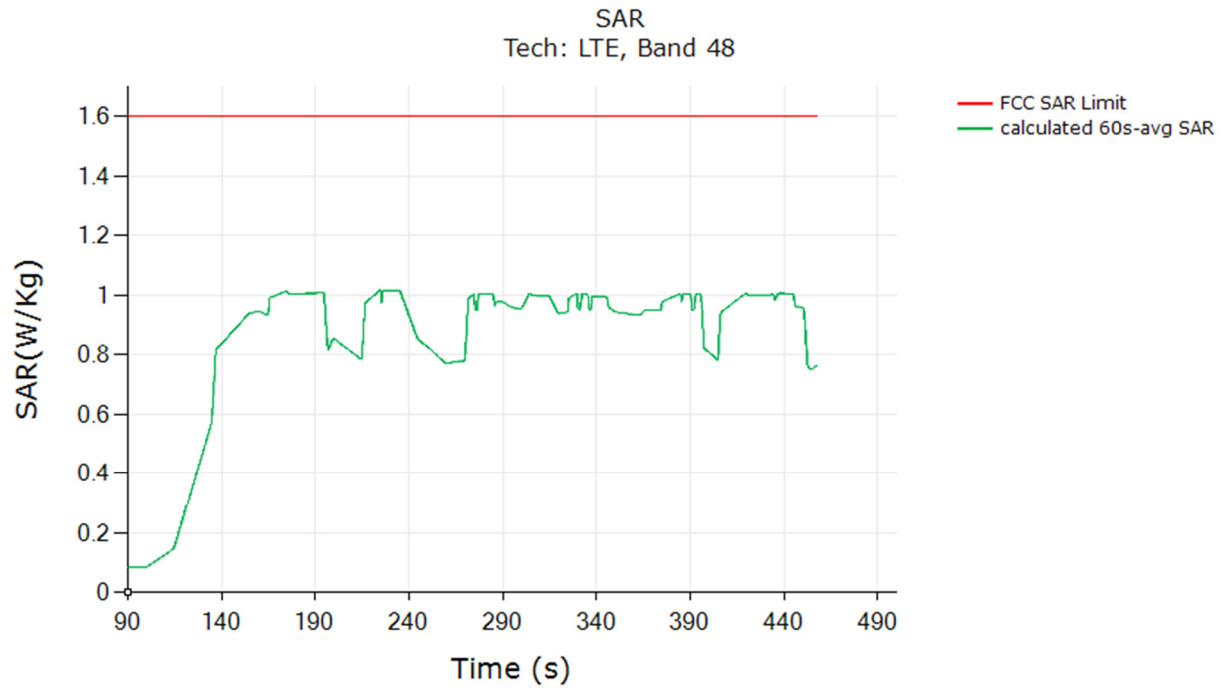
6.3.3 LTE Band 48 Antenna 0 (Test case 3 in Table 5-2)

Test result for Test Sequence 1:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	1.007	(W/kg)
Validated: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

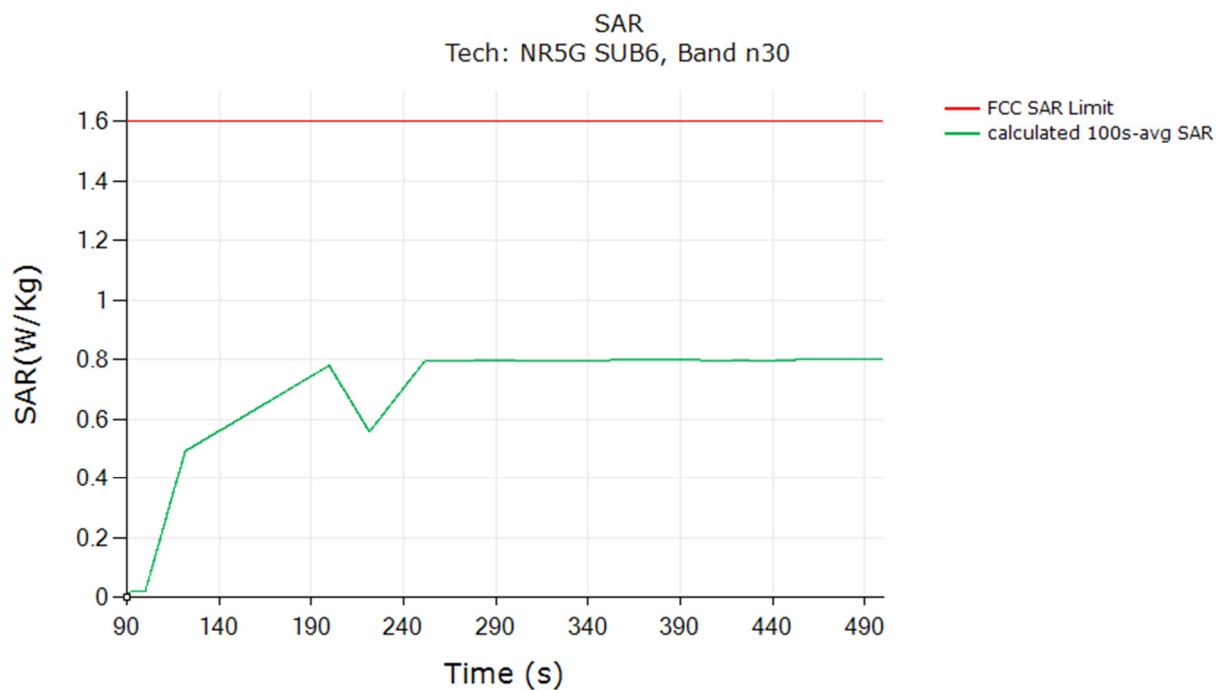
Test result for Test Sequence 2:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	1.009	(W/kg)
Validated: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

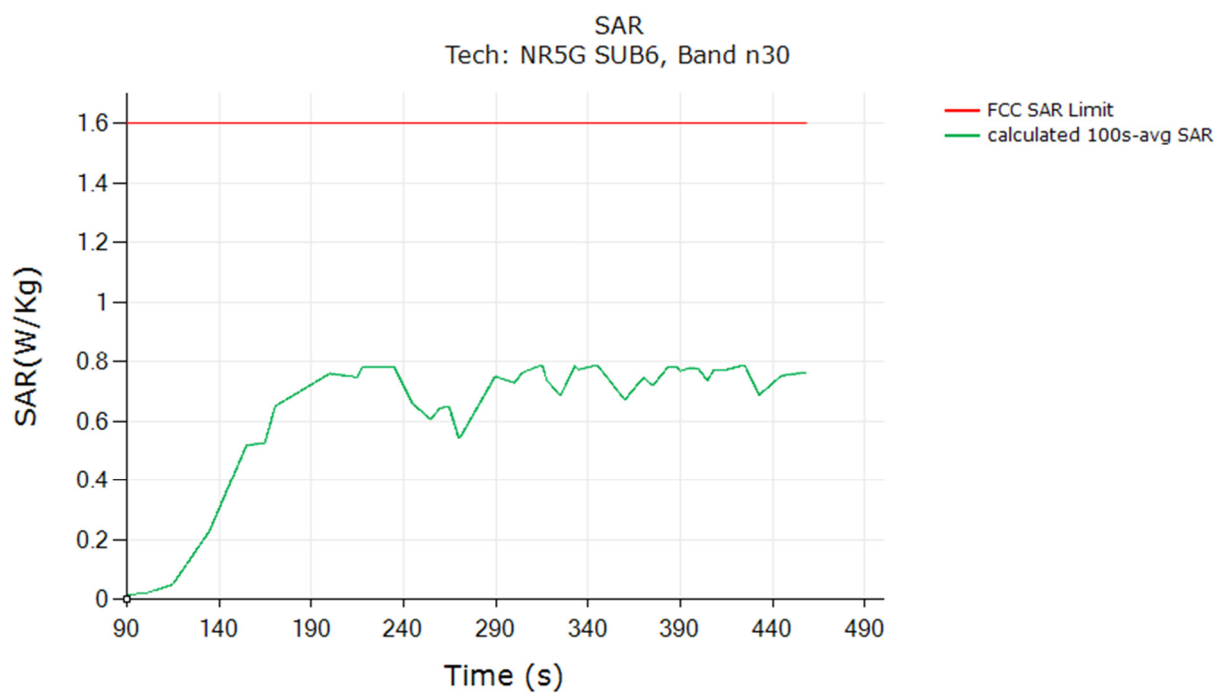
6.3.4 5GNR n30 Antenna 0 (Test case 4 in Table 5-2)

Test result for Test Sequence 1:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.802	(W/kg)
Validated: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

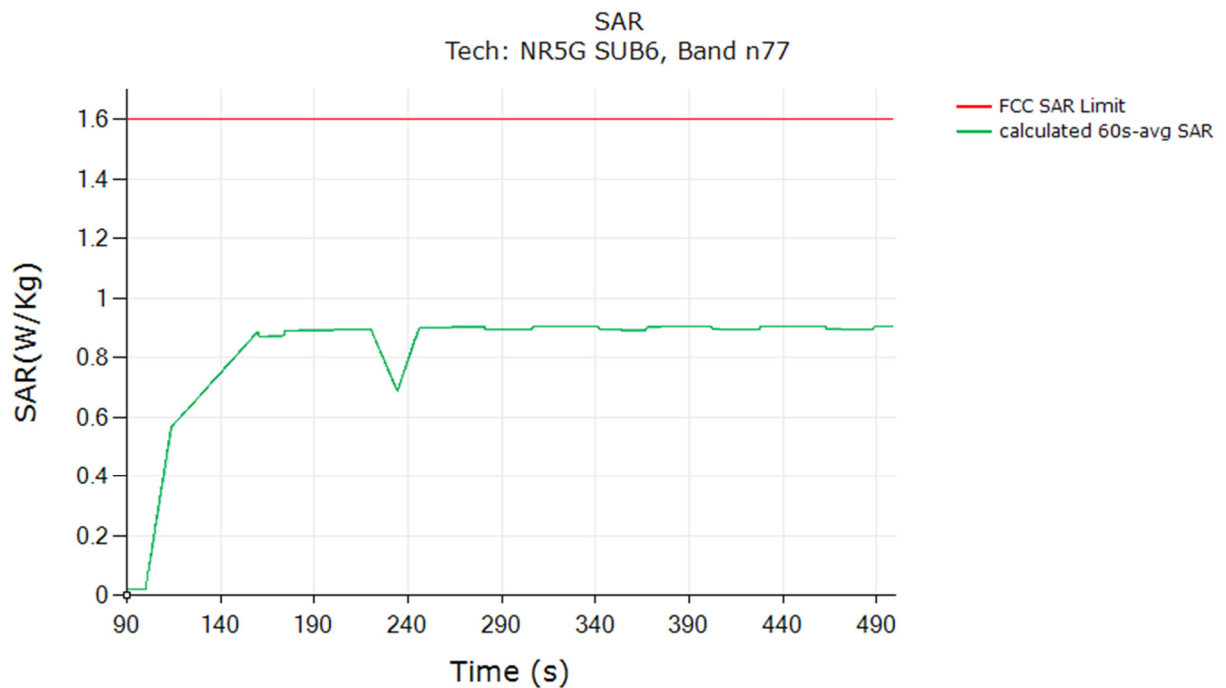
Test result for Test Sequence 2:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.789	(W/kg)
Validated: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

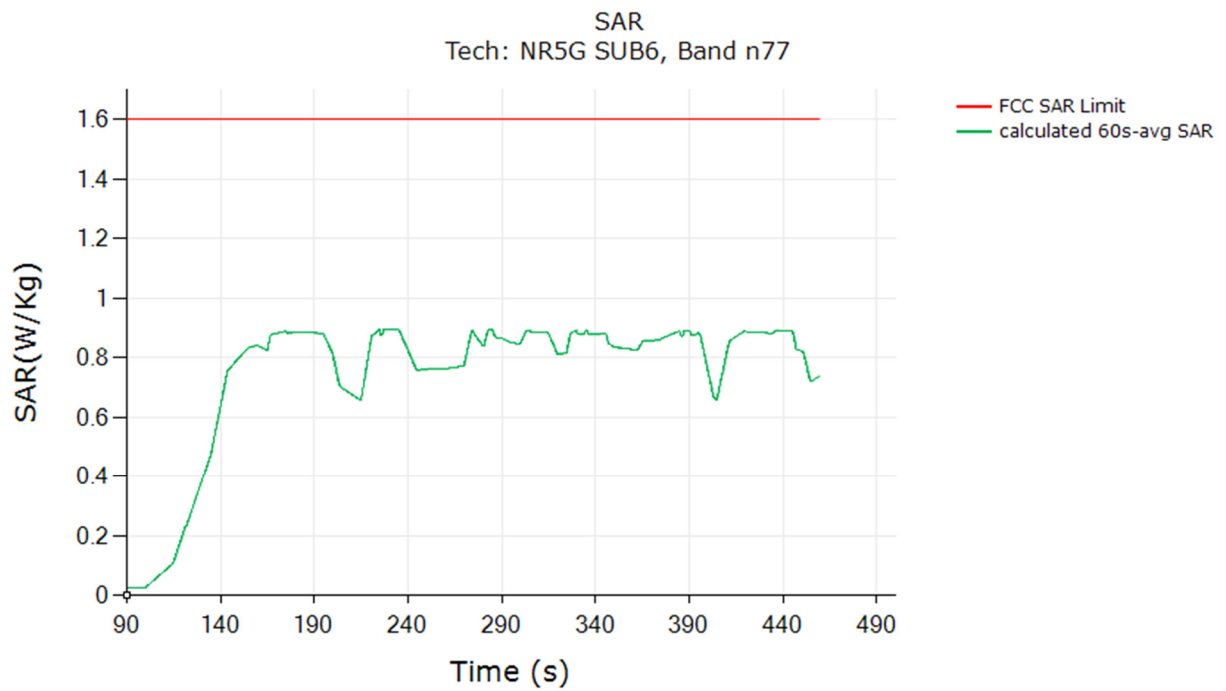
6.3.5 5GNR n77 Antenna 0 (Test case 5 in Table 5-2)

Test result for Test Sequence 1:



FCC 1gSAR limit	1.6	(W/kg)
Max 60s-time averaged 1gSAR (green curve)	0.901	(W/kg)
Validated: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

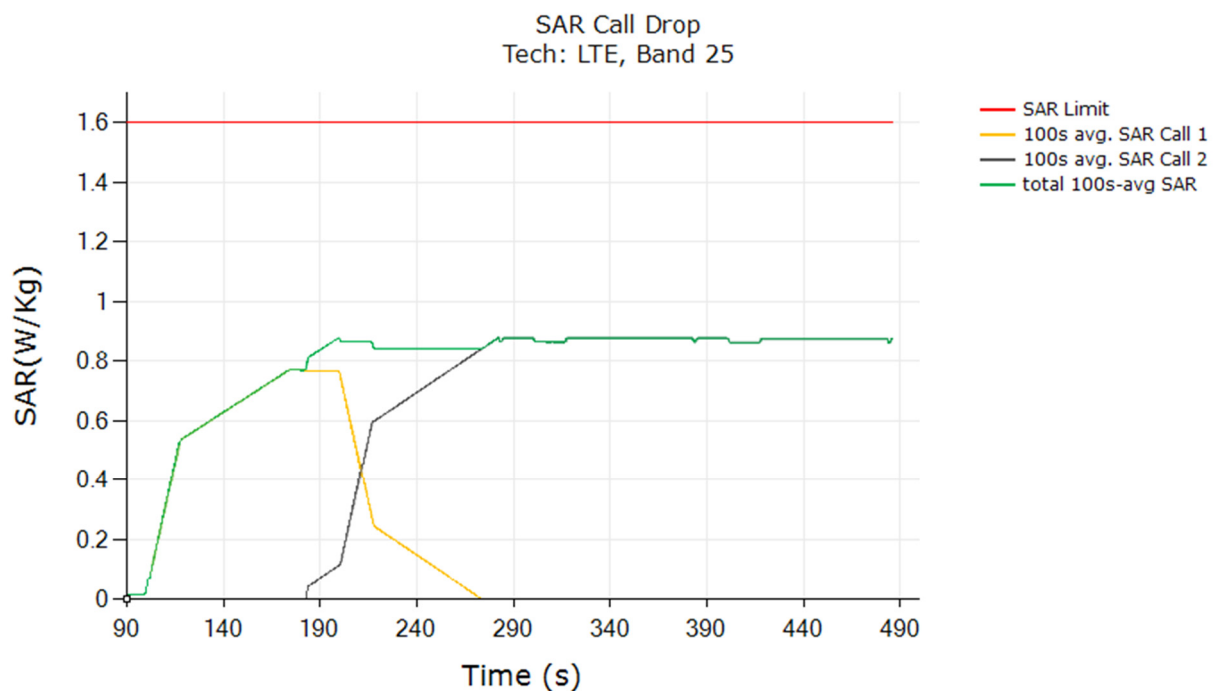
Test result for Test Sequence 2:



FCC 1gSAR limit	1.6	(W/kg)
Max 60s-time averaged 1gSAR (green curve)	0.894	(W/kg)
Validated: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

6.4 Change in Call Test Results (Test case 6 in Table 5-2)

This test was measured with LTE Band 25, Antenna 0, DSI = 1, and with callbox requesting maximum power. The call drop was manually performed when the DUT is transmitting at $P_{reserve}$ level as shown in the plot below. The measurement setup is shown in **Figure 6-1**, and the detailed test procedure is described in Section 4.3.2. Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using Equation (1a) and plotted below to demonstrate that the time-averaged 1gSAR versus time does not exceed the FCC limit of 1.6 W/kg for 1gSAR:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.878	(W/kg)
Validated		

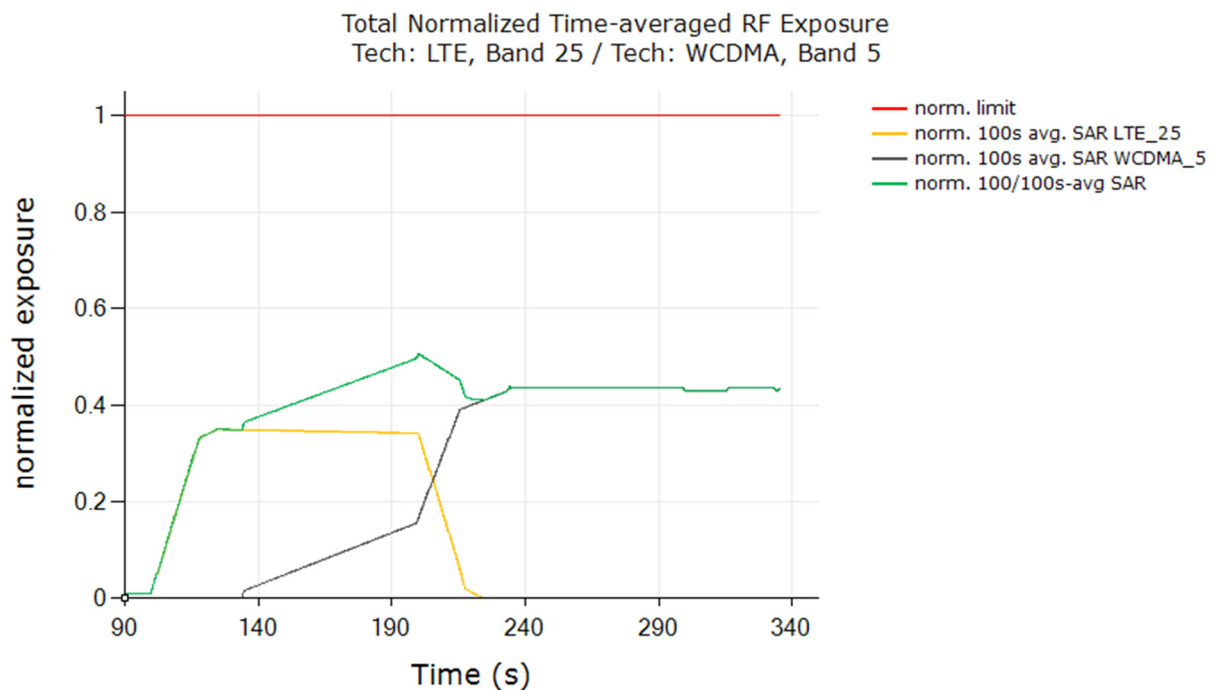
The test result validated the continuity of power limiting in call change scenario.

6.5 Change in Technology/Band Test Results (Test case 7 in Table 5-2)

This test was conducted with callbox requesting maximum power, and with technology switch from LTE Band 5, Antenna 0, DSI = 1, to LTE Band 5 WCDMA Band 5, Antenna 0, DSI = 1,. Following procedure detailed in Section 4.3.3 using the measurement setup shown in Figure 6-1, the technology/band switch was performed when the DUT

is transmitting at Preserve level as shown in the plot below.

Time-averaged conducted Tx power measurement results were converted into time-averaged normalized SAR values using Equation (5a), (5b) and (5c), and plotted below to demonstrate that the time-averaged normalized SAR versus time does not exceed the normalized FCC limit of 1.0:



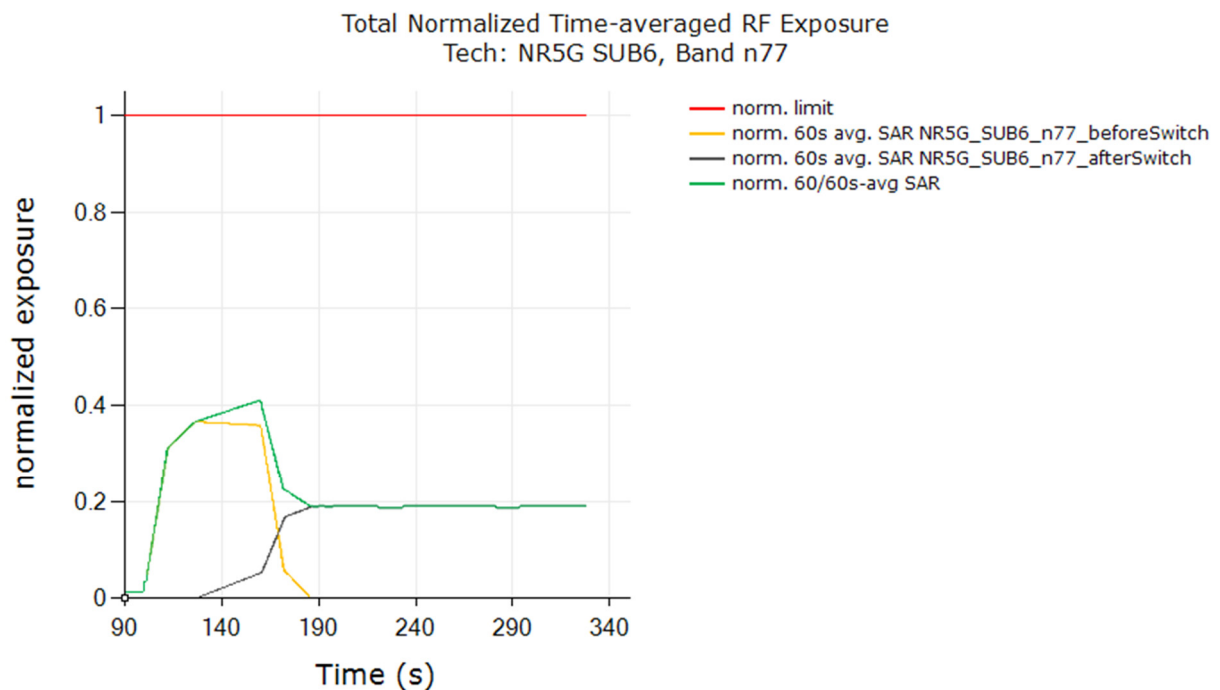
FCC normalized Exposure Ratio	Exposure Ratio	1
Max time averaged normalized Exposure Ratio (green curve)	Exposure Ratio	0.507
Validated		

The above test result validated the continuity of power limiting in technology/band switch scenario.

6.6 Change in Antenna Test Results (Test case 8 in Table 5-2)

This test was conducted with callbox requesting maximum power, and with an antenna switch from 5GNR n77, Antenna 0, DSI = 1 to 5GNR n77, Antenna 2, DSI = 1. Following procedure detailed in Section 4.3.4, and using the measurement setup shown in Figure 6-1, the technology/band switch was performed when the DUT is transmitting at $P_{reserve}$ level as shown in the plot below

All the time-averaged conducted Tx power measurement results were converted into time-averaged normalized SAR values using Equation (5a), (5b) and (5c), and plotted below to demonstrate that the time-averaged normalized SAR versus time does not exceed the normalized FCC limit of 1:



FCC normalized Exposure Ratio	Exposure Ratio	1
Max time averaged normalized Exposure Ratio (green curve)	Exposure Ratio	0.411
Validated		

The above test result validated the continuity of power limiting in technology/band switch scenario.

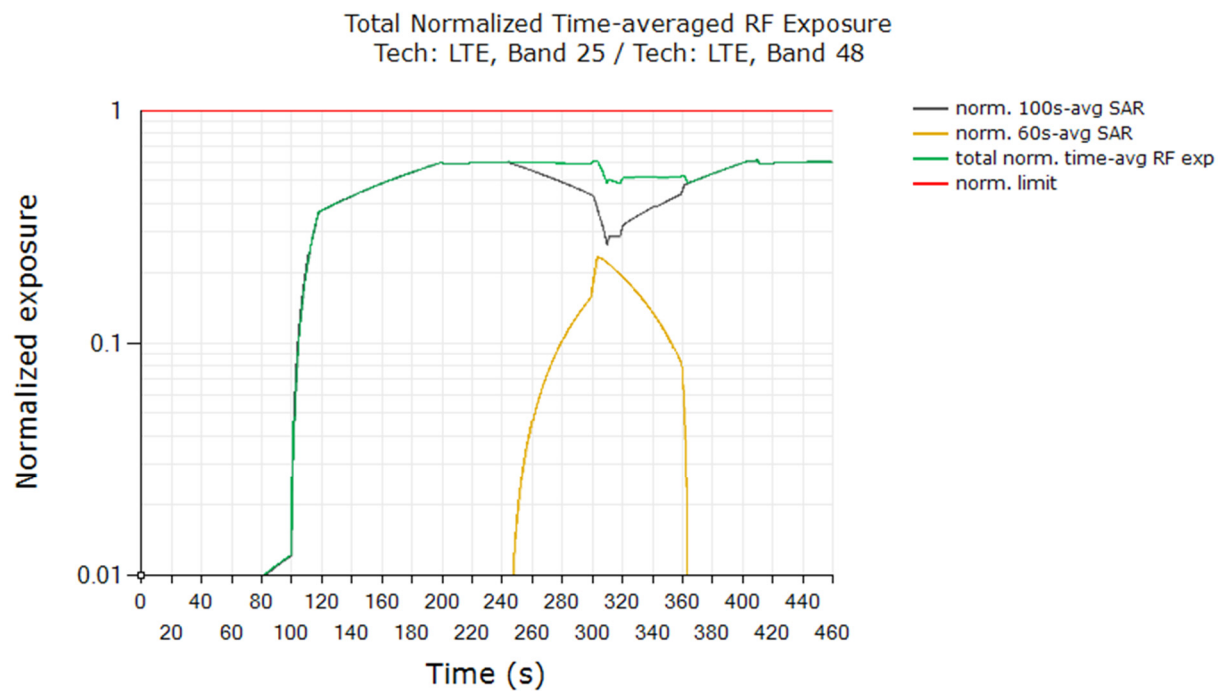
6.7 Change in Time Window Test Results (Test case 6 in Table 5-2)

6.7.1 Test case 9: transition from band 25 to band 48 (i.e., 100s to 60s), then back to band 25

This test was conducted with callbox requesting maximum power, and with timewindow/ antenna switch between LTE Band 25, Antenna 0, DSI = 1 (100s window) and LTE Band 48, Antenna 0, DSI = 1 (60s window). Following procedure detailed in Section 4.3.6, and using the measurement setup shown in Figure 6-1, the time-window switch via tech/band/antenna switch was performed when the EUT is transmitting at $P_{reserve}$ level.

Test result for change in time-window (from 100s to 60s to 100s):

All the conducted Tx power measurement results were converted into time-averaged normalized SAR values using Equation (6a), (6b) and (6c), and plotted below to demonstrate that the time-averaged normalized SAR versus time does not exceed the FCC limit of 1 unit. Equation (6a) is used to convert the Tx power of device to obtain 100s-averaged normalized SAR in LTE B25 as shown in black curve. Similarly, equation (6b) is used to obtain 60s-averaged normalized SAR in LTE B48 as shown in orange curve. Equation (6c) is used to obtain total time-averaged normalized SAR as shown in green curve (i.e., sum of black and orange curves).



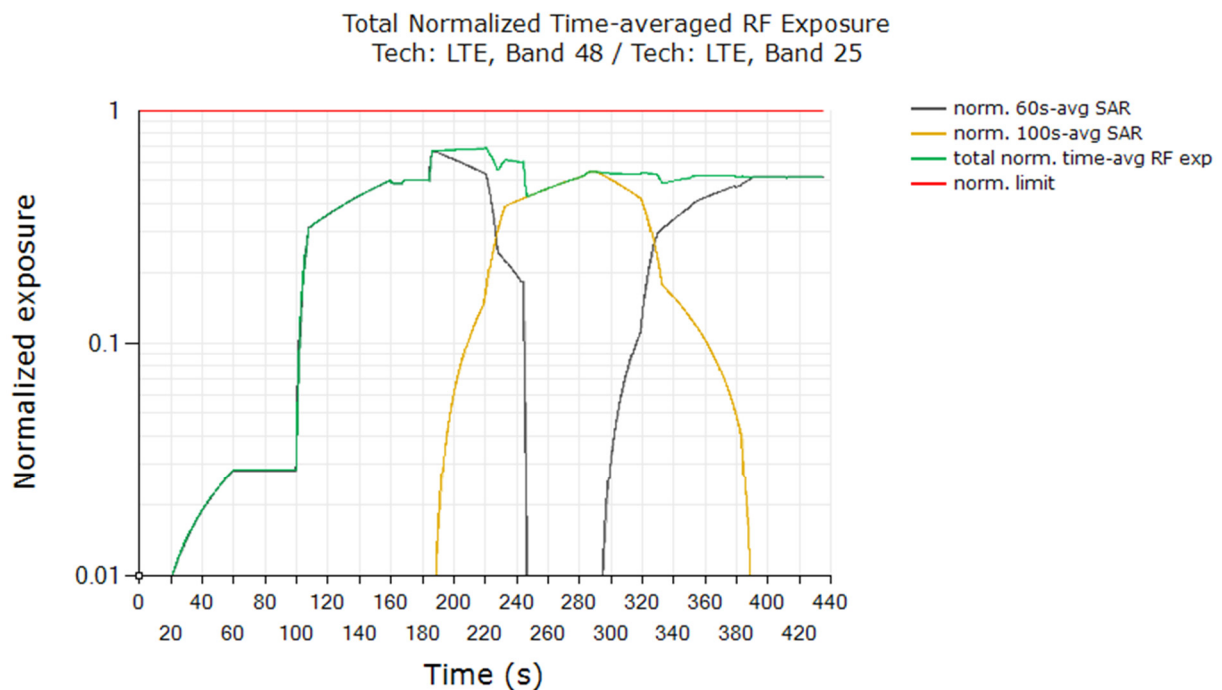
FCC normalized Exposure Ratio limit	Exposure Ratio	1
Max time averaged normalized Exposure Ratio (green curve)	Exposure Ratio	0.615
Validated		

The above test result validated the continuity of power limiting in time window/antenna change scenario.

6.7.2 Test case 10: transition from band 48 to band 25 (i.e., 60s to 100s), then back to band 48

Test result for change in time-window (from 60s to 100s to 60s):

All the conducted Tx power measurement results were converted into time-averaged normalized SAR values using Equation (6a), (6b) and (6c), and plotted below to demonstrate that the time-averaged normalized SAR versus time does not exceed the FCC limit of 1 unit. Equation (6a) is used to convert the Tx power of device to obtain 60s-averaged normalized SAR in LTE B48 as shown in black curve. Similarly, equation (6b) is used to obtain 100s-averaged normalized SAR in LTE B25 as shown in orange curve. Equation (6c) is used to obtain total time-averaged normalized SAR as shown in green curve (i.e., sum of black and orange curves).



FCC normalized Exposure Ratio limit	Exposure Ratio	1
Max time averaged normalized Exposure Ratio (green curve)	Exposure Ratio	0.698
Validated		

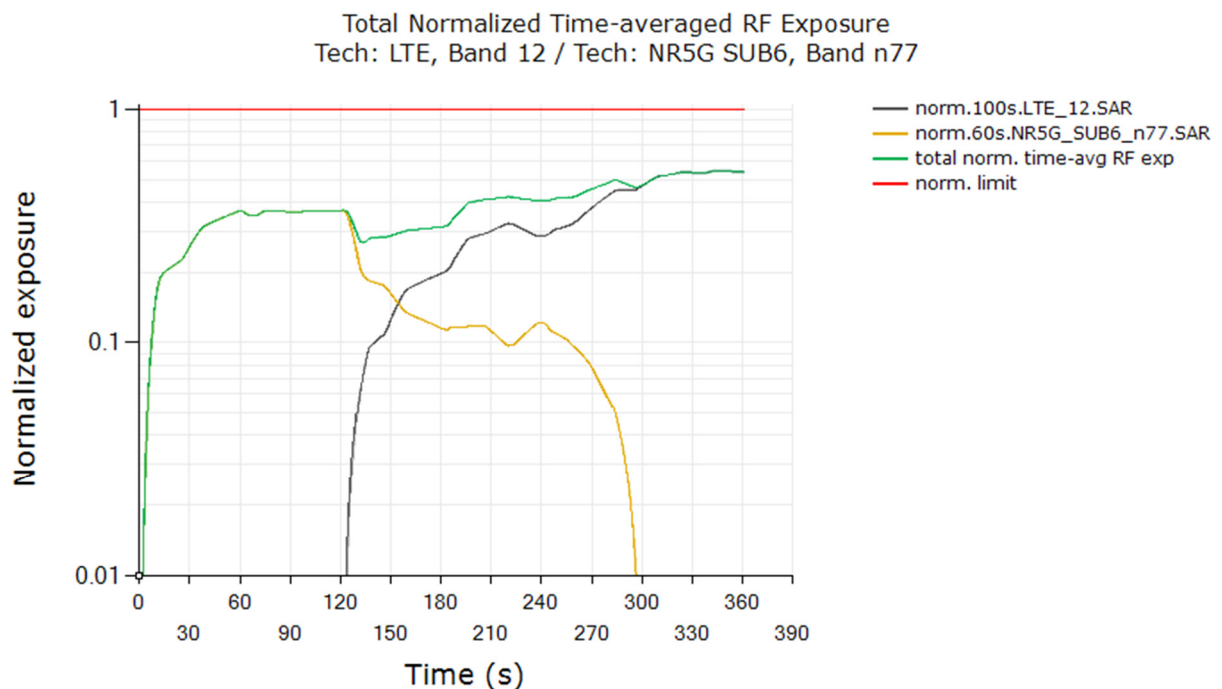
The above test result validated the continuity of power limiting in time window change scenario.

6.8 SAR Exposure Switching Test Results (Test case 11 in Table 5-2)

This test was conducted with callbox requesting maximum power, and with the EUT in LTE Band 12 + Sub6 NR Band n77 call. Following procedure detailed in Section 4.3.7 and Appendix B.2, and using the measurement setup shown in Figure 6-1 since LTE and Sub6 NR are on different antenna ports, the SAR exposure switch measurement is performed with the EUT in various SAR exposure scenarios.

All the conducted transmission power measurement results were converted into time-averaged normalized SAR values using Equation (6a), (6b) and (6c) and plotted below to demonstrate that the time-averaged normalized SAR versus time does not exceed the FCC limit of 1 unit. Equation (6a) is used to convert the LTE transmission power of the device to obtain the 100 seconds-averaged normalized SAR in LTE Band 12 as shown with the black curve. Similarly, equation (6b) is used to obtain the 100 seconds-averaged normalized SAR in Sub-6 GHz NR n77 as shown with the orange curve. Equation (6c) is used to obtain the total time-averaged normalized SAR as shown with the green curve (i.e., sum of both the black and orange curves).

The test result validated the continuity of power limiting in call change scenario.



FCC normalized Exposure Ratio limit	Exposure Ratio	1
Max time averaged normalized Exposure Ratio (green curve)	Exposure Ratio	0.544
Validated		

7. SAR Results for Sub-6 Smart Transmit Feature Validation

7.1 SAR Measurement Setup

The measurement setup is similar to normal SAR measurements, the EUT is positioned against the flat section of the SAM Twin phantom and wirelessly connected with the callbox. The difference in SAR measurement setup for time averaging algorithm validation is that the callbox is signaling in close loop power control mode (instead of requesting maximum power in open loop control mode) and callbox is connected to the PC using GPIB so that the test script executed on PC can send GPIB commands to control the callbox's requested power over time (test sequence). The same test script used in conducted setup for time-varying transmit power measurements is also used here for running the test sequences during SAR measurements, and the recorded values from the disconnected power meter by the test script were discarded.

As mentioned in Section 4.4, for EUT to follow TPC command sent from the callbox wirelessly, the "path loss" between callbox antenna and the EUT needs to be calibrated. Since the SAR chamber is in uncontrolled environment, precautions must be taken to minimize the environmental influences on "path loss". Similarly, in the case of time-varying SAR measurements in Sub-6 GHz NR (with LTE as an anchor), "path loss" between the callbox antenna and the EUT needs to be carefully calibrated for both the LTE link as well as for the Sub-6 GHz NR link.

The EUT is placed in its worst-case position according to Table 5-2.

7.2 SAR Measurement Results for Time-varying Tx Power Case

Following Section 4.4 procedure, time-averaged SAR measurements are conducted using SAR probe at peak location of area scan over 500 seconds. cDASY6 system verification for the SAR measurements are provided in Appendix C and the associated SPEAG certificates are attached in Appendix D.

SAR probe integration times depend on the communication signal being tested as defined in the probe calibration parameters.

Since the sampling rate used by DASY for pointSAR measurements is not in user control, the individual pointSAR data from DASY are extracted into excel spreadsheet and the number of points in 100s interval is determined by $\text{total_points} \times (100\text{s} / \text{pointSAR_total_scan_time_duration})$. Running average is performed over these number of points in excel spreadsheet to obtain 100s averaged pointSAR.

Following Section 4.4, for each of selected technology/band:

1. With EUT set to peak mode, area scan is performed at P_{limit} , and time-averaged pointSAR measurements are conducted to determine the pointSAR at P_{limit} , denoted as $\text{pointSAR}_{P_{limit}}$.
2. With EUT set to intended Smart Transmit exposure mode, two more time-averaged pointSAR measurements are performed at the same peak location for test sequences 1 and 2.

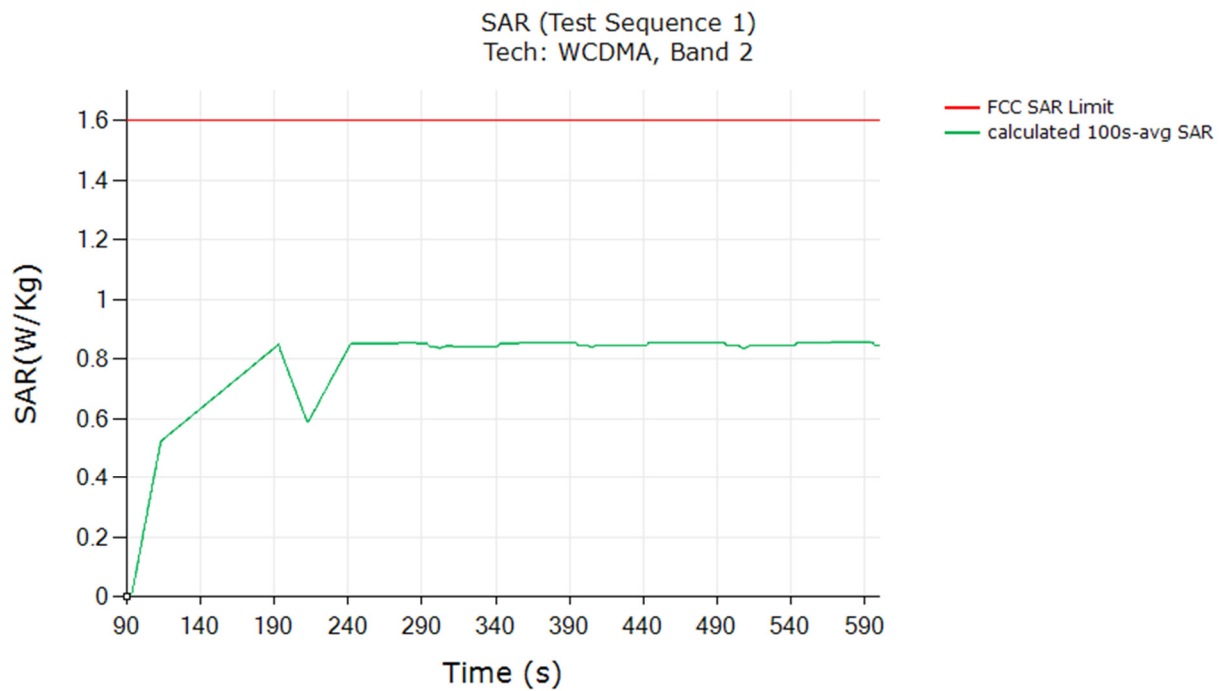
To demonstrate compliance, all the pointSAR measurement results were converted into 1gSAR values by using equation (3a) listed below:

$$1g_or_10gSAR(t) = \frac{\text{pointSAR}(t)}{\text{pointSAR}_{P_{limit}}} \times 1g_or_10gSAR_{P_{limit}} \quad (3a)$$

where, $\text{pointSAR}(t)$, $\text{pointSAR}_{P_{limit}}$, and $1g_or_10g_SAR_{P_{limit}}$ correspond to the measured instantaneous point SAR, measured point SAR at P_{limit} from above step1 and 2, and measured $1g_or_10gSAR$ value at P_{limit} obtained from Part 1 report and listed in Table 5-2.

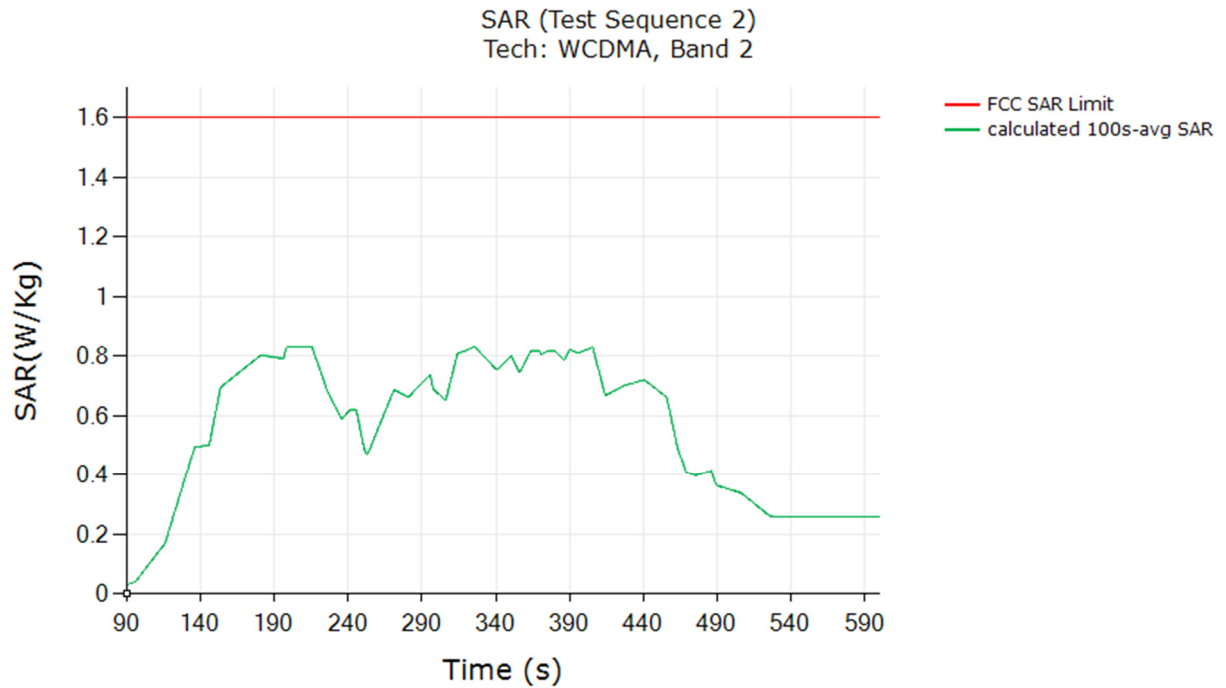
7.2.1 WCDMA Band 2 Antenna 0 SAR test result

SAR Test Results for Test Sequence 1:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.856	(W/kg)
Valid: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

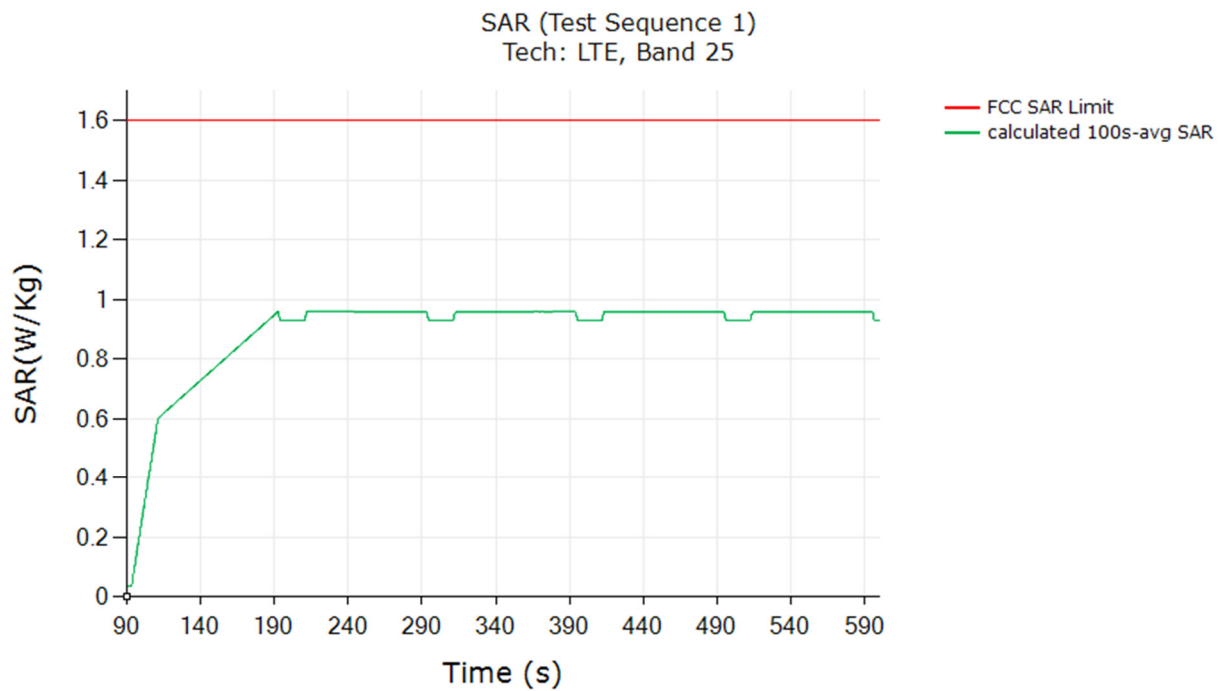
SAR Test Results for Test Sequence 2:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.831	(W/kg)
Valid: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

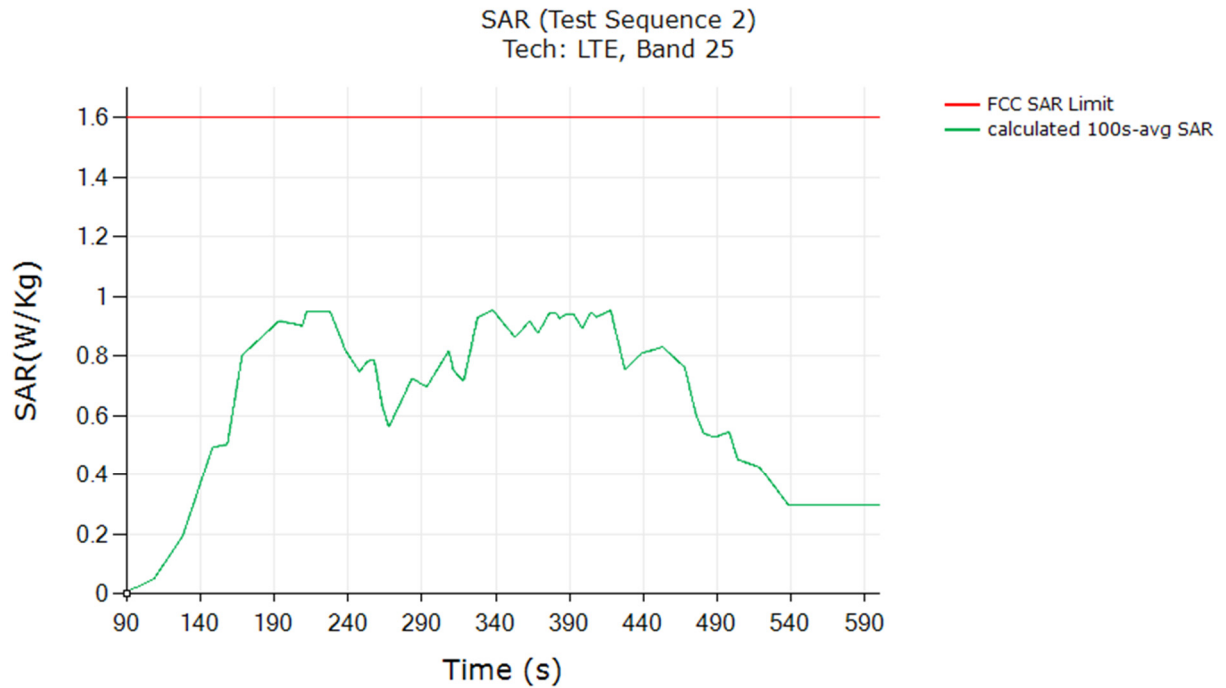
7.2.2 LTE Band 25 Antenna 0 SAR test result

SAR Test Results for Test Sequence 1:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.938	(W/kg)
Valid: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

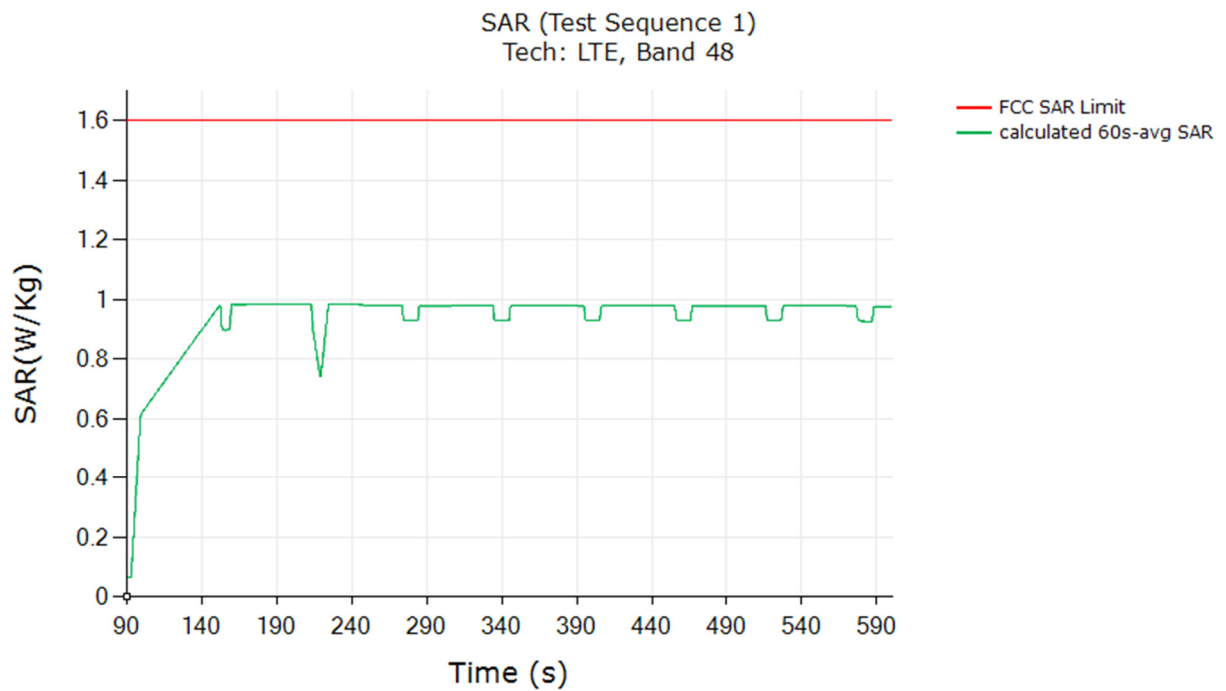
SAR Test Results for Test Sequence 2:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.934	(W/kg)
Valid: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

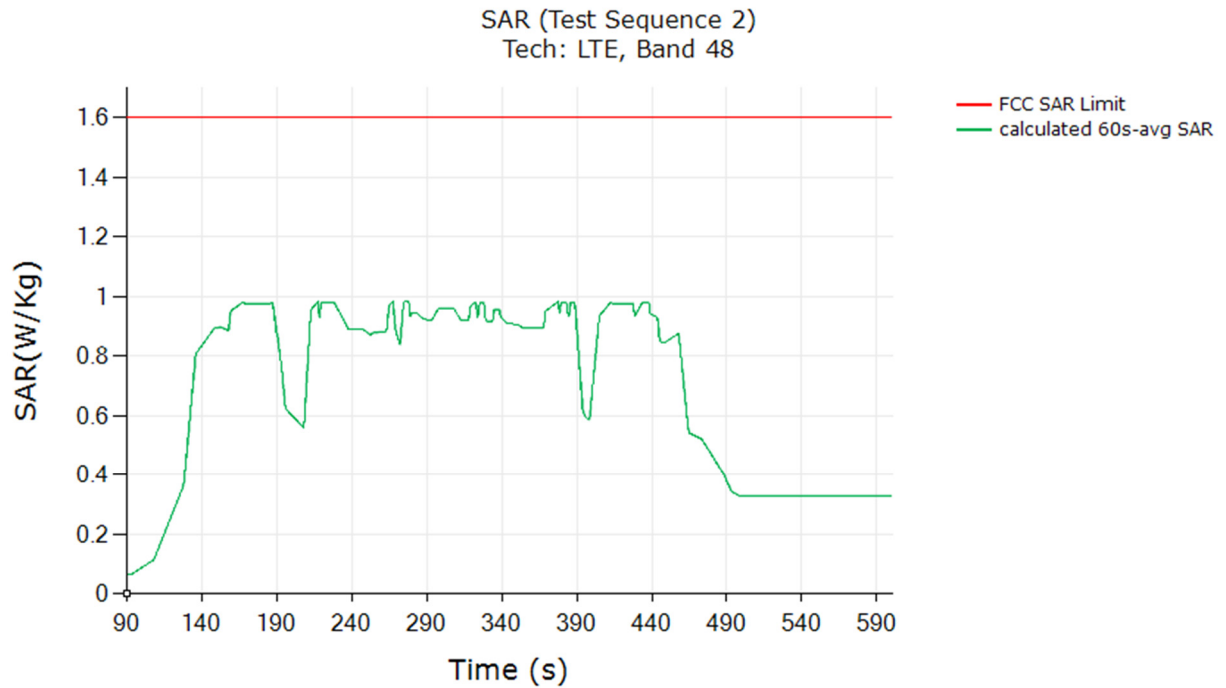
7.2.3 LTE Band 48 Antenna 0 SAR test result

SAR Test Results for Test Sequence 1:



FCC 1gSAR limit	1.6	(W/kg)
Max 60s-time averaged 1gSAR (green curve)	0.984	(W/kg)
Valid: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

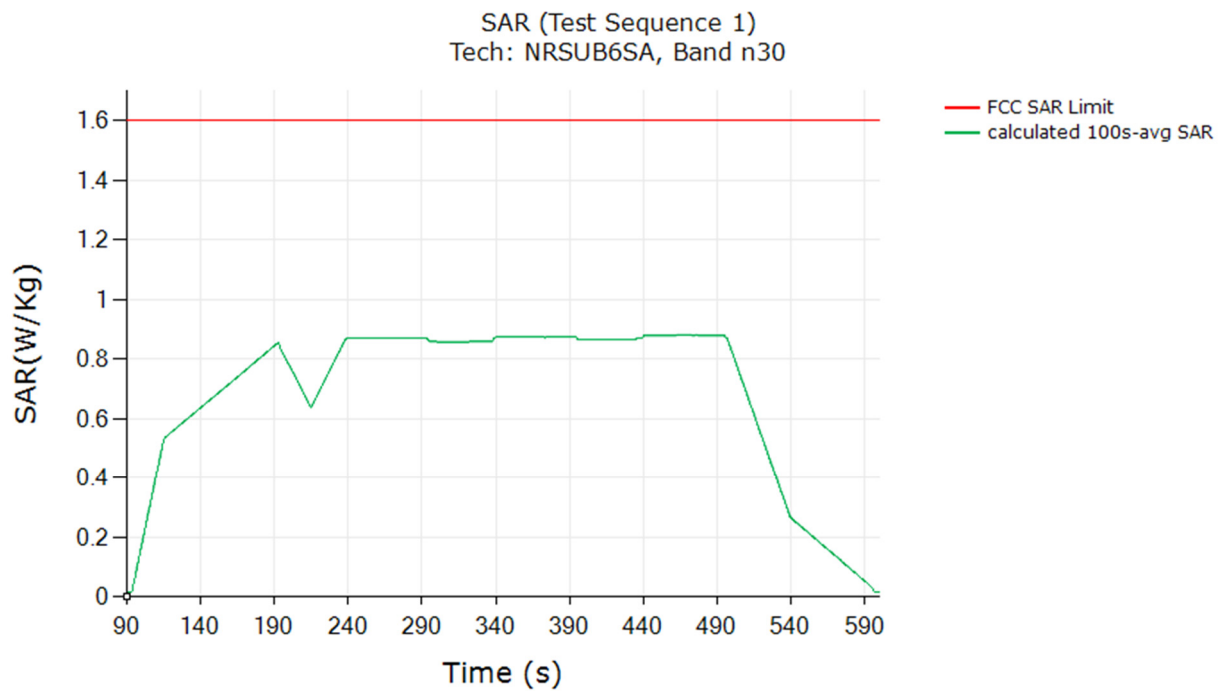
SAR Test Results for Test Sequence 2:



FCC 1gSAR limit	1.6	(W/kg)
Max 60s-time averaged 1gSAR (green curve)	0.983	(W/kg)
Valid: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

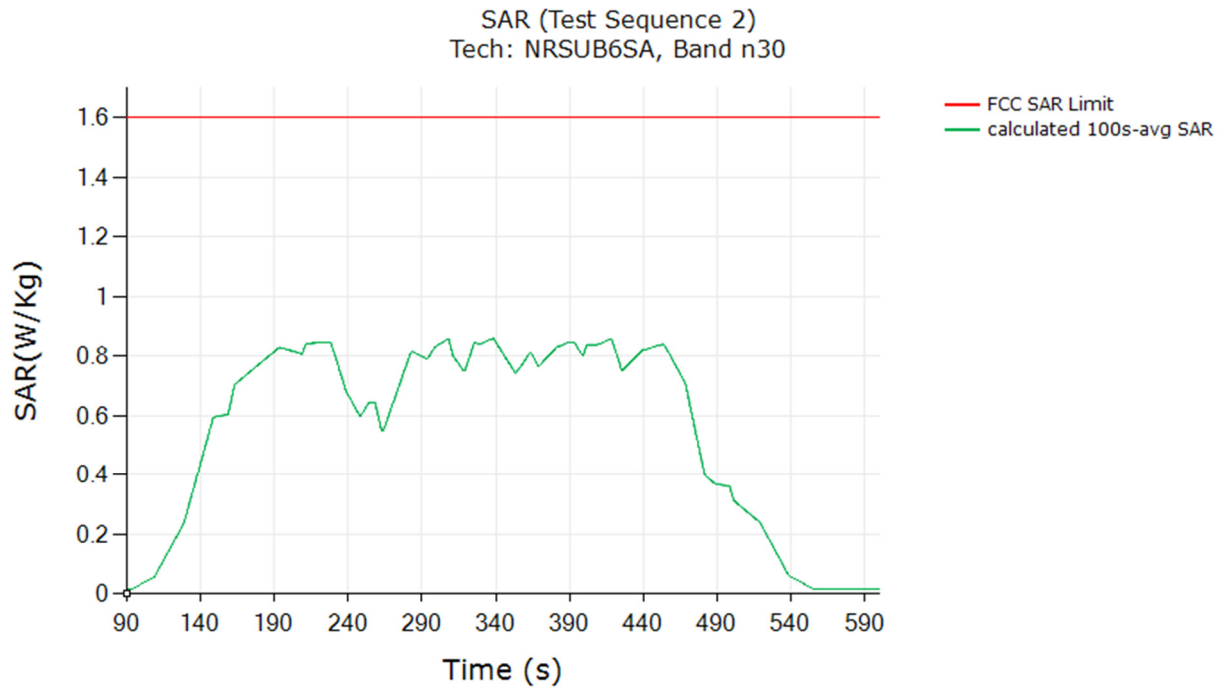
7.2.4 5GNR Band n30 Antenna 0 SAR test result

SAR Test Results for Test Sequence 1:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.879	(W/kg)
Valid: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

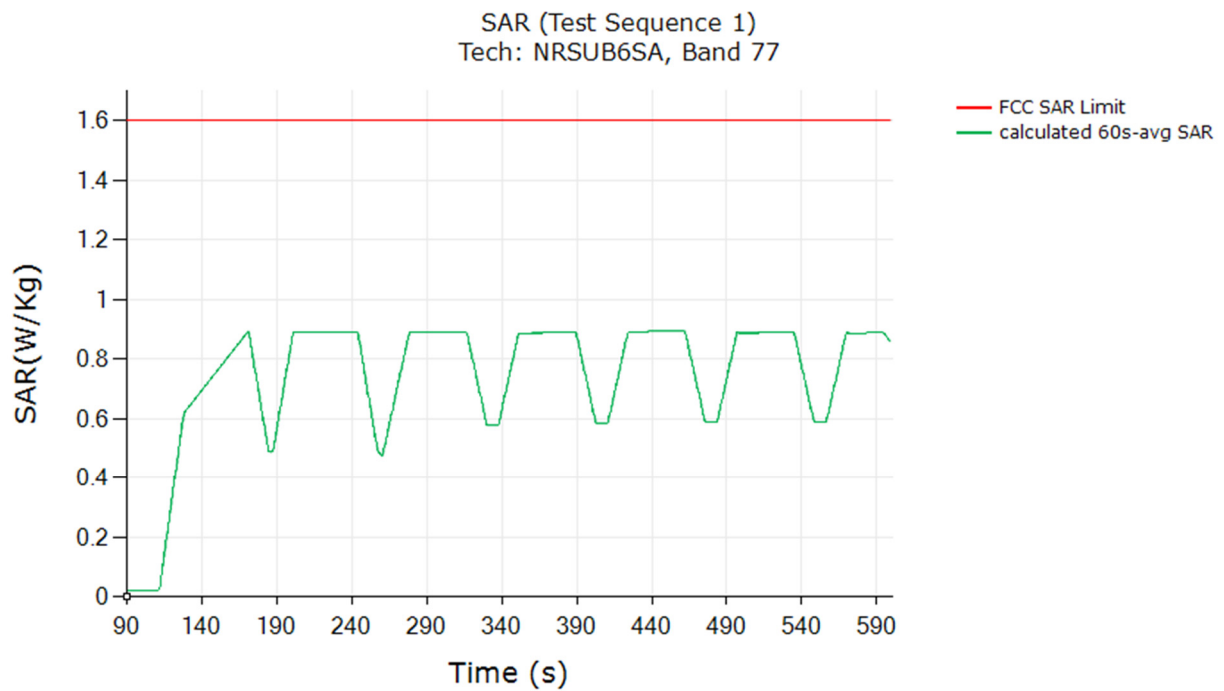
SAR Test Results for Test Sequence 2:



FCC 1gSAR limit	1.6	(W/kg)
Max 100s-time averaged 1gSAR (green curve)	0.859	(W/kg)
Valid: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

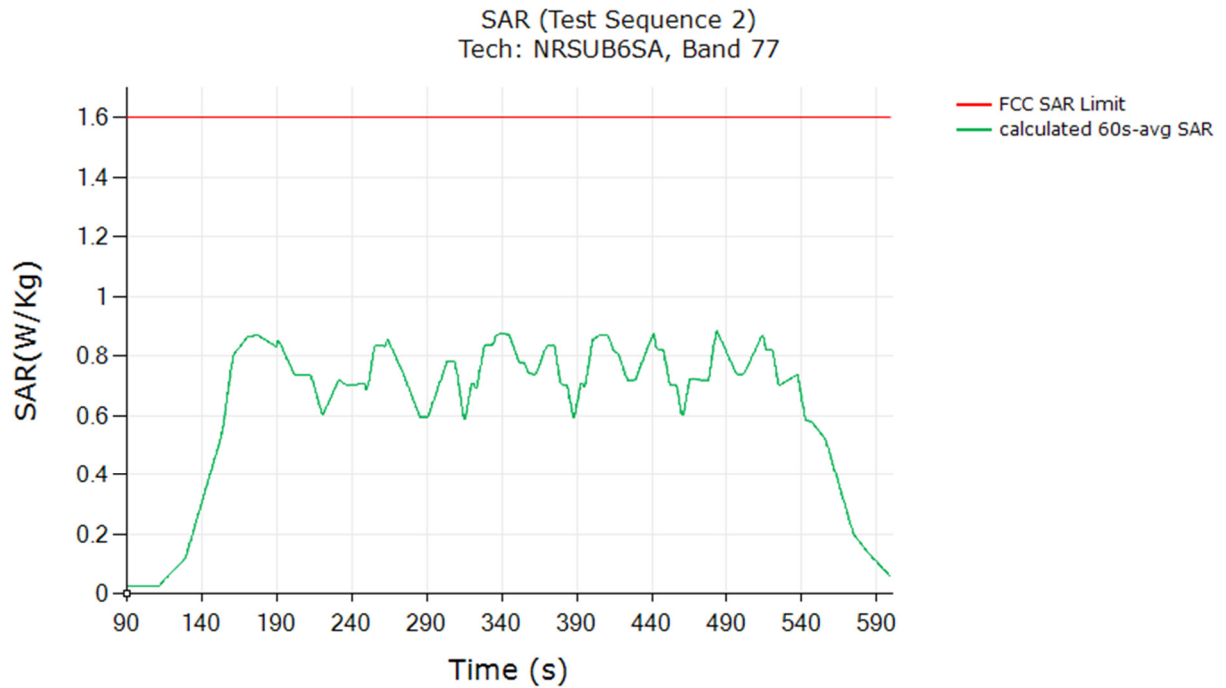
7.2.5 5GNR Band n77 Antenna 0 SAR test result

SAR Test Results for Test Sequence 1:



FCC 1gSAR limit	1.6	(W/kg)
Max 60s-time averaged 1gSAR (green curve)	0.894	(W/kg)
Valid: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

SAR Test Results for Test Sequence 2:



FCC 1gSAR limit	1.6	(W/kg)
Max 60s-time averaged 1gSAR (green curve)	0.885	(W/kg)
Valid: Max time averaged SAR (green curve) does not exceed measure SAR at Plimit + Total uncertainty		

8. Test Equipment List

Instrument	Manufacturer	Model No.	Serial No.	Last Calibration	Next Calibration
Reference Dipole 1950MHz	Speag	D1950V3	1213	2025/11/12	2028/11/11
Reference Dipole 2300MHz	Speag	D2300V2	1045	2025/04/15	2028/04/14
Reference Dipole 2600MHz	Speag	D2600V2	1077	2025/04/15	2028/04/14
Reference Dipole 3700MHz	Speag	D3700V2	1056	2025/11/12	2028/11/11
Device Holder	Speag	N/A	N/A	N/A	N/A
Data Acquisition Electronic	Speag	DAE4	1791	2025/04/23	2026/04/22
E-Field Probe	Speag	EX3DV4	7784	2025/04/23	2026/04/22
SAR Software	Speag	DASY8	V16.4.0.5005	N/A	N/A
Power Amplifier	Mini-Circuit	ZHL-42	D051404-20	N/A	N/A
Power Amplifier	Mini-Circuit	ZVE-8G+	447202211	N/A	N/A
Directional Coupler	Agilent	87300C	MY44300353	N/A	N/A ¹
Attenuator	Woken	WATT-218FS-10	N/A	N/A	N/A ¹
Attenuator	Mini-Circuit	BW-S20W2+	N/A	N/A	N/A ¹
Universal Radio Communication	Anritsu	MT8000A	6262134961	2025/05/14	2026/05/13
Universal Radio Communication	R&S	CMW500	157304	2025/03/13	2026/03/12
Vector Network Analyzer	Agilent	E5071C	MY46108013	2025/03/28	2026/03/27
Signal Generator	Anritsu	MG3694A	041902	2025/08/16	2026/08/15
Power Meter	Anritsu	ML2487A	6K00001447	2025/10/16	2026/10/15
Power Sensor	Anritsu	MA2411B	1339194	2025/10/17	2026/10/16
Power Meter	R&S	NRP8S	115018	2025/12/10	2026/12/09
Power Meter	R&S	NRP8S	115017	2025/12/10	2026/12/09

9. Measurement Uncertainty

Measurement uncertainty for 300 MHz to 3 GHz							
Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)
Measurement System Errors							
Probe Calibration	±13.3%	N	2	1	1	±6.7%	±6.7%
Probe Calibration Drift	±1.7%	R	1.732	1	1	±1.0%	±1.0%
Probe Linearity	±4.7%	R	1.732	1	1	±2.7%	±2.7%
Broadband Signal	±2.8%	R	1.732	1	1	±1.6%	±1.6%
Probe Isotropy	±7.6%	R	1.732	1	1	±4.4%	±4.4%
Other Probe+Electronic	±0.8%	N	1	1	1	±0.8%	±0.8%
RF Ambient	±1.8%	N	1	1	1	±1.8%	±1.8%
Probe Positioning	±0.006 mm	N	1	0.14	0.14	±0.1%	±0.1%
Data Processing	±1.2%	N	1	1	1	±1.2%	±1.2%
Phantom and Device Errors							
Conductivity (meas.)	±2.5%	N	1	0.78	0.71	±2.0%	±1.8%
Conductivity (temp.)	±3.3%	R	1.732	0.78	0.71	±1.5%	±1.4%
Phantom Permittivity	±14.0%	R	1.732	0	0	±0.0%	±0.0%
Distance DUT - TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
Device Positioning	±1.0%	N	1	1	1	±1.0%	±1.0%
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%
DUT Modulation	±2.4%	R	1.732	1	1	±1.4%	±1.4%
Time-average SAR	±1.7%	R	1.732	1	1	±1.0%	±1.0%
DUT drift	±2.5%	N	1	1	1	±2.5%	±2.5%
Val Antenna Unc.	±0.0%	N	1	1	1	±0.0%	±0.0%
Unc. Input Power	±0.0%	N	1	1	1	±0.0%	±0.0%
Correction to the SAR results							
Deviation to Target	±1.9%	N	1	1	0.84	±1.9%	±1.6%
SAR scaling	±0.0%	R	1.732	1	1	±0.0%	±0.0%
Combined Uncertainty						±11.3%	±11.2%
Expanded Uncertainty						±22.7%	±22.5%

Measurement uncertainty for 3 GHz to 6 GHz

Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)
Measurement System Errors							
Probe Calibration	±13.1%	N	2	1	1	±6.6%	±6.6%
Probe Calibration Drift	±1.7%	R	1.732	1	1	±1.0%	±1.0%
Probe Linearity	±4.7%	R	1.732	1	1	±2.7%	±2.7%
Broadband Signal	±2.6%	R	1.732	1	1	±1.5%	±1.5%
Probe Isotropy	±7.6%	R	1.732	1	1	±4.4%	±4.4%
Other Probe+Electronic	±1.2%	N	1	1	1	±1.2%	±1.2%
RF Ambient	±1.8%	N	1	1	1	±1.8%	±1.8%
Probe Positioning	±0.005 mm	N	1	0.29	0.29	±0.2%	±0.2%
Data Processing	±2.3%	N	1	1	1	±2.3%	±2.3%
Phantom and Device Errors							
Conductivity (meas.)	±2.5%	N	1	0.78	0.71	±2.0%	±1.8%
Conductivity (temp.)	±3.4%	R	1.732	0.78	0.71	±1.5%	±1.4%
Phantom Permittivity	±14.0%	R	1.732	0.25	0.25	±2.0%	±2.0%
Distance DUT - TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
Device Positioning	±1.0%	N	1	1	1	±1.0%	±1.0%
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%
DUT Modulation	±2.4%	R	1.732	1	1	±1.4%	±1.4%
Time-average SAR	±1.7%	R	1.732	1	1	±1.0%	±1.0%
DUT drift	±2.5%	N	1	1	1	±2.5%	±2.5%
Val Antenna Unc.	±0.0%	N	1	1	1	±0.0%	±0.0%
Unc. Input Power	±0.0%	N	1	1	1	±0.0%	±0.0%
Correction to the SAR results							
Deviation to Target	±1.9%	N	1	1	0.84	±1.9%	±1.6%
SAR scaling	±0.0%	R	1.732	1	1	±0.0%	±0.0%
Combined Uncertainty						±11.7%	±11.6%
Expanded Uncertainty						±23.3%	±23.1%

10. System verification

10.1 SAR System Check

10.1.1 Dipoles



The SAR dipoles are optimized symmetrical dipole with $\lambda/4$ balun matched to a Flat phantom section filled with tissue simulating liquids. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC signals. They are available for the variety of frequencies between 300MHz and 10 GHz. The provided tripod is used to hold the dipole below the phantom. As the distance between the dipole center and the TSL is critical, a spacer is placed between the dipole and the phantom. The spacing distance is frequency dependent.

10.1.2 SAR System Check Result

1. Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %.
2. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Input Power (mW)	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Delta 1g ± 10 (%)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Delta 10g ± 10 (%)	Tissue Temp. (°C)
2026/3/9	1950	250	9.65	40.20	38.6	-3.98	5.06	21.10	20.24	-4.08	22.1
2026/3/9	2300	250	11.90	48.20	47.6	-1.24	5.71	23.30	22.84	-1.97	22.1
2026/3/9	3700	100	6.89	69.50	68.9	-0.86	2.59	25.50	25.9	1.57	22.1

10.2 Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using Dielectric Probe Kit and Vector Network Analyzer.

Date	Tissue Type	Frequency (MHz)	Relative Permittivity (ϵ_r)			Conductivity (σ)			Tissue Temp. (°C)
			Measured	Target	Delta (%)	Measured	Target	Delta (%)	
2026/3/9	Head	1950	39.60	40.00	-1.00	1.42	1.40	1.43	22.1
2026/3/9	Head	1880	39.80	40.00	-0.50	1.40	1.40	0.00	22.1
2026/3/9	Head	1882.5	39.72	40.00	-0.70	1.40	1.40	0.00	22.1
2026/3/9	Head	2300	39.44	39.50	-0.15	1.63	1.67	-2.40	22.1
2026/3/9	Head	2310	39.41	39.48	-0.18	1.63	1.68	-2.98	22.1
2026/3/9	Head	3700	37.60	37.73	-0.34	3.04	3.12	-2.56	22.1
2026/3/9	Head	3646.7	37.70	37.79	-0.24	2.96	3.07	-3.58	22.1
2026/3/9	Head	3750	37.51	37.68	-0.45	3.06	3.17	-3.47	22.1

11. Conclusions

The Qualcomm® Smart Transmit feature implemented in the EUT has been validated through conducted and radiated power measurements, as well as SAR evaluations.

The results demonstrate that the Smart Transmit power control mechanism effectively enforces the configured transmit power limits and ensures that the total normalized time-averaged RF exposure remains within the applicable regulatory limits under all evaluated transmission scenarios.

Therefore, the EUT is considered to be in compliance with the applicable RF exposure requirements.

Appendix A - Test Sequences

1. Test sequence is generated based on below parameters of the EUT:
 - a. Measured maximum power (P_{max})
 - b. Measured Tx_power_at_SAR_design_target (P_{limit})
 - c. Sustainable power ($P_{reserve}$)
 - Compute Preserve based on Reserve_power_margin (dB), i.e.,
 $P_{reserve} \text{ (dBm)} = \text{measured } P_{limit} \text{ (dBm)} - \text{Reserve_power_margin (dB)}$
 - For EUT enable with Smart Transmit EFS version 17 (or lower),
 Reserve_power_margin (dB) entered in EFS is a global parameter and applies to all WWAN technologies
 - For EUT enabled with Smart Transmit EFS version 18 (or higher),
2G and 3G WWAN technologies: Reserve_power_margin (dB) =
 $\text{reserve_power_margin_db_2g_3g_wwan}$
4G and 5G WWAN technologies: Reserve_power_margin (dB) =
 $-10 * \log_{10}(\text{total_min_exp_budget_linear_4g_5g_wwan})$ for 4G and 5G technologies
 - d. FCC SAR_time_window (100s for $f < 3\text{GHz}$, 60s for $3\text{GHz} < f \leq 6\text{GHz}$ and 30s for $6\text{GHz} < f \leq 10\text{GHz}$)

2. Test Sequence 1 Waveform:

Based on the parameters above, the Test Sequence 1 is generated with one transition between high and low Tx powers. Here, high power = P_{max} ; low power = $P_{max}/2$, and the transition occurs after 80 seconds at high power P_{max} . As long as the power enforcement is taking into effective during one 100s/60s time window, the validation test with this defined test sequence 1 is valid, otherwise, select other radio configuration (band/DSI within the same technology group) having lower P_{limit} for this test. The Test sequence 1 waveform is shown below:

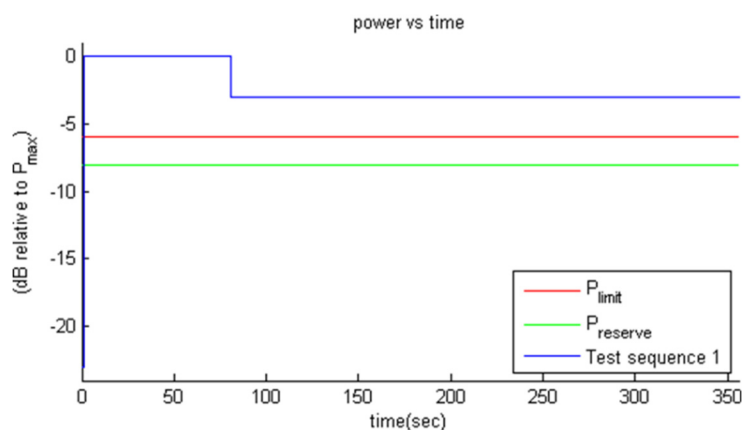


Figure 11-1 Test sequence 1 waveform

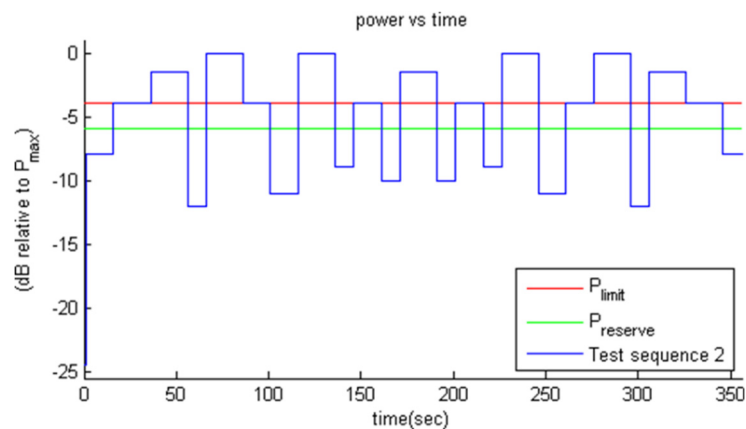
3. Test Sequence 2 Waveform:

Based on the parameters in A.1, the Test Sequence 2 is generated as described in Table 11-1, which contains two 170 second-long sequences (yellow and green highlighted rows) that are mirrored around the center row of 20s, resulting in a total duration of 360 seconds:

Table 11-1 Test Sequence 2

Time duration (seconds)	dB relative to P_{limit} or $P_{reserve}$
15	$P_{reserve} - 2$
20	P_{limit}
20	$(P_{limit} + P_{max})/2$ averaged in mW and rounded to nearest 0.1 dB step
10	$P_{reserve} - 6$
20	P_{max}
15	P_{limit}
15	$P_{reserve} - 5$
20	P_{max}
10	$P_{reserve} - 3$
15	P_{limit}
10	$P_{reserve} - 4$
20	$(P_{limit} + P_{max})/2$ averaged in mW and rounded to nearest 0.1 dB step
10	$P_{reserve} - 4$
15	P_{limit}
10	$P_{reserve} - 3$
20	P_{max}
15	$P_{reserve} - 5$
15	P_{limit}
20	P_{max}
10	$P_{reserve} - 6$
20	$(P_{limit} + P_{max})/2$ averaged in mW and rounded to nearest 0.1 dB step
20	P_{limit}
15	$P_{reserve} - 2$

The Test Sequence 2 waveform is shown below



Appendix B - Test Procedures for Sub-6 GHz NR + Sub-6 GHz Radio

Appendix B provides the test procedures for validating Qualcomm Smart Transmit feature for LTE + Sub6 NR non-standalone (NSA) mode transmission scenario, where sub6GHz LTE link acts as an anchor, and for validating interband ULCA transmission scenario.

SAR exposure switch validation with one simultaneous transmission scenario (i.e., either FR1 NSA or LTE interband ULCA) is sufficient as Smart Transmit operation is the same.

B1. Time-varying Transmission Power Test for Sub-6 GHz NR in NSA Mode

Follow Section 4.2.1 to select test configurations for time-varying test. This test is performed with two pre-defined test sequences (described in Section 4.1) applied to Sub6 NR (with LTE on all-down bits for the entire test after establishing the LTE+Sub6 NR call with the callbox). Follow the test procedures described in Section 4.3.1 to demonstrate the effectiveness of power limiting enforcement and that the time averaged Tx power of Sub6 NR when converted into 1gSAR values does not exceed the regulatory limit at all times (see Eq. (1a) and (1b)). Sub6 NR response to test sequence1 and test sequence2 will be similar to other technologies (say, LTE), and are shown in Section 7.3.

B2. Time-varying Transmission Power Test for Sub-6 GHz NR in NSA Mode

This test is to demonstrate that Smart Transmit feature accurately accounts for switching in exposures among SAR for LTE radio only, SAR from both LTE radio and sub6 NR, and SAR from sub6 NR only scenarios, and ensures total time-averaged RF exposure compliance with FCC limit.

Test procedure:

1. Measure conducted Tx power corresponding to P_{limit} for LTE and sub6 NR in selected band. Test condition to measure conducted P_{limit} is:
 - a. Establish device in call with the callbox for LTE in desired band. Measure conducted Tx power corresponding to LTE P_{limit} with Smart Transmit Peak exposure mode enabled and callbox set to request maximum power.
 - b. Repeat above step to measure conducted Tx power corresponding to Sub6 NR P_{limit} . If testing LTE+Sub6 NR in non-standalone mode, then establish LTE+Sub6 NR call with callbox and request all down bits for radio1 LTE. In this scenario, with callbox requesting maximum power from Sub6 NR, measured conducted Tx power corresponds to radio2 P_{limit} (as radio1 LTE is at all-down bits)
2. Set EUT to the intended Smart Transmit exposure mode for LTE + Sub6 NR call. First, establish LTE connection with the callbox, and then add Sub6 NR connection. As soon as the Sub6 NR connection is established, request all-down bits (or low power) on LTE link and then request UE to transmit at maximum power in Sub6 NR. Continue LTE (all-down bits) + Sub6 NR transmission for more than one time-window duration to test predominantly Sub6 NR SAR exposure scenario (as SAR exposure is negligible from all-down bits in LTE). After at least one time-window, request LTE to go all-up bits to test LTE SAR and Sub6 NR SAR exposure scenario. After at least one more time-window, drop (or request all-down bits) Sub6 NR

transmission to test predominantly LTE SAR exposure scenario. Continue the test for at least one more time-window. Record the conducted Tx powers for both LTE and Sub6 NR for the entire duration of this test.

3. Once the measurement is done, extract instantaneous Tx power versus time for both LTE and Sub6 NR links. Similar to technology/band switch test in Section 4.3.3, convert the conducted Tx power for both these radios into $1g_or_10gSAR$ value (see Eq. (5a) and (5b)) using corresponding technology/band P_{limit} measured in Step 1, and then perform 100s running average to determine time-averaged $1g_or_10gSAR$ versus time as illustrated in Figure 4-1. Divide this by regulatory $1g_or_10gSAR$ limit to obtain normalized time-averaged $1g_or_10gSAR$ versus time. Note that here it is assumed both radios have Tx frequencies < 3GHz, otherwise, 60s running average should be performed for radios having Tx frequency between 3GHz and 6GHz.
4. Make one plot containing: (a) computed normalized time-averaged $1g_or_10gSAR$ for LTE versus time determined in Step 3, (b) computed normalized time-averaged $1g_or_10gSAR$ for Sub6 NR versus time determined in Step 3, (c) computed total normalized time-averaged $1g_or_10gSAR$ versus time (sum of Steps (4.a) and (4.b)) determined in Step 3, and (d) corresponding normalized regulatory $1g_or_10gSAR_{limit}$ limit of 1.0.

The validation criteria is, at all times, the time-averaged $1g_or_10gSAR$ versus time shall not exceed the regulatory $1g_or_10gSAR_{limit}$ limit.