



## **FCC TAS validation – Part 2: Tests under dynamic transmit power scenarios**

**FCC ID** : A4RGK2MP  
**Equipment** : Phone  
**Model Name** : GK2MP, GL066  
**Applicant** : Google LLC  
1600 Amphitheatre Parkway,  
Mountain View, CA, 94043 USA  
**Standard** : FCC 47 CFR Part 2 (2.1093)

The product was received on Dec. 06, 2024 and testing was started from Apr. 01, 2025 and completed on Apr. 15, 2025. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample provide by manufacturer and the test data has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been pass the FCC requirement.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

A handwritten signature in blue ink, reading 'Cona Huang', positioned above a horizontal line.

Approved by: Cona Huang / Deputy Manager

### ***Sporton International Inc. Wensan Laboratory***

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan



## **Table of Contents**

|                                                                               |           |
|-------------------------------------------------------------------------------|-----------|
| <b>1. Introduction .....</b>                                                  | <b>4</b>  |
| <b>2. Tx Varying Transmission Test Cases and Test Proposal .....</b>          | <b>4</b>  |
| <b>3. SAR Time Averaging Validation Test Procedures.....</b>                  | <b>5</b>  |
| 3.1 Test sequence determination for validation .....                          | 5         |
| 3.2 Test configuration selection criteria for validating TAS .....            | 5         |
| 3.3 Test procedures for conducted power measurements.....                     | 5         |
| <b>4. NTN SAR Time Averaging Validation Test Procedures .....</b>             | <b>8</b>  |
| <b>5. Spatial TAS .....</b>                                                   | <b>9</b>  |
| <b>6. Test Configurations .....</b>                                           | <b>10</b> |
| 6.1 WWAN (sub-6) transmission .....                                           | 10        |
| 6.2 Test case list for sub-6GHz transmissions.....                            | 13        |
| <b>7. Conducted Power Test Results for Sub-6 and NTN TAS validation .....</b> | <b>14</b> |
| 7.1 Measurement set-up .....                                                  | 14        |
| 7.2 NTN Measurement set-up.....                                               | 15        |
| 7.3 Measured Plimit and Pmax .....                                            | 16        |
| 7.4 Sub-6 summary test results .....                                          | 17        |
| 7.5 Time-varying Tx power measurement results.....                            | 18        |
| 7.6 Change in Power Index.....                                                | 42        |
| 7.7 Change in call test results.....                                          | 44        |
| 7.8 Switch in SAR exposure test results .....                                 | 46        |
| 7.9 Re-selection in call test results.....                                    | 48        |
| 7.10 LTE Uplink CA.....                                                       | 50        |
| 7.11 NTN with time-varying startup test sequence.....                         | 52        |
| <b>8. Conclusions.....</b>                                                    | <b>54</b> |
| <b>9. Annex .....</b>                                                         | <b>54</b> |
| 9.1 Test sequence is generated based on below parameters of the DUT: .....    | 54        |
| 9.2 Test Sequence A waveform: .....                                           | 54        |
| 9.3 Test Sequence B waveform:.....                                            | 55        |
| <b>10. Test Equipment List.....</b>                                           | <b>56</b> |

### **Appendix A. Test Setup Photos**



## History of this test report

| Report No.   | Version | Description             | Issued Date   |
|--------------|---------|-------------------------|---------------|
| FA4N0919-01C | 01      | Initial issue of report | Apr. 21, 2025 |
| FA4N0919-01C | 02      | Update section 6.1      | Jun. 06, 2025 |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |

## **1. Introduction**

This purpose of this Part 2 report is to demonstrate that the DUT complies with FCC RF exposure compliance requirement under varying Tx power transmission scenarios, thus validating the Samsung S.LSI proprietary Spatial Time Average SAR (S-TAS) with Non-Terrestrial Networks\_ForOEM\_v.2.8 for FCC equipment authorization of the handset. The values of Plimit used in this report per scenario are determined in Part 0 report.

## **2. Tx Varying Transmission Test Cases and Test Proposal**

The following scenarios are covered in this report to demonstrate compliance with FCC RF exposure in Tx varying transmission conditions.

1. During a time-varying Tx power transmission – to prove that TAS feature accounts for Tx power variations in time accurately.
2. During a call disconnect and re-establish scenario – to prove that the TAS feature accounts for history of Tx power from past accurately
3. During a technology/band handover – to prove that TAS feature accounts for history across transitions in band/technology
4. During operating state change – to prove that TAS feature functions correctly to meet compliance limits across operate state changes
5. During time averaging window change – to prove that TAS feature properly handles the change from one time averaging window to another as specified by FCC, and meets the normalized FCC limit of 1.0 at all time

As described in Part 0, the RF exposure is proportional to the Tx power for sub-6. Thus, we rely on conducted power measurements (sub-6) in each dynamic case to demonstrate that overall RF exposure is within the FCC limit.

The overall procedure for validating the test is summarized below:

1. Measure conducted power over time, denoted as  $TxPower(t)$ , with time index  $t$  for each radio
2. Convert measured powers to RF exposure values using linear relationship shown below. In below expression,  $P_{limit,sub-6}$  would be the measured power at which FR1 technology meets measured SAR level of  $SAR_{design\_target}$  as described in Part 0.

$$SAR(t) = \frac{TxPower(t)}{P_{limit,sub-6}} * SAR_{design\_target} \quad (2.1.1)$$

3. Compute the average RF exposure over the most recent measurement duration which are denoted as  $TSAR$  for sub6. These durations are as specified by FCC. This measurement duration interval is then given by  $[t - TSAR, t]$  for sub-6.
4. Divide the RF exposure by corresponding FCC limit and ensure the sum denoted as TER (total exposure ratio) is less than 1 for all. The following equation describes the calculation of TER and its target constraint.  $LSAR$  is the number of fixed, mobile or portable RF sources using SAR-based formula, the expressions below is general considering a number radios in general denoted by  $LSAR$ .

$$\sum_{LSAR=0}^{LSAR-1} \frac{SAR_{avr,LSAR}}{FCC\ SAR} \leq 1 \quad (2.1.3)$$

### **3. SAR Time Averaging Validation Test Procedures**

Test plan and test procedure for validating Samsung SLSI TAS feature for sub-6 scenarios

#### **3.1 Test sequence determination for validation**

Two sequences for time varying Tx power are pre-defined as given below for sub-6 case.

1. Test Sequence A is generated with two power levels. One is maximum power level Pmax and the other is lower power level. The lower power level is defined as 3dB lower value than maximum power level. At first, maximum power level is applied for 80 seconds. After this, lower power level is used until this test is finished.
2. Test Sequence B is generated at multiple power levels that are specified in the Appendix as a function of Pmax and Plimit.

#### **3.2 Test configuration selection criteria for validating TAS**

This section provides general guidance for selecting test cases in TAS feature validation.

##### **3.2.1 Test configuration selection for time-varying Tx power transmission**

The Samsung S.LSI TAS algorithm is independent of band, modes or channel of any technology. Hence, we can validate using one or two combinations of band/mode/channel per technology. The criteria for selecting these would be based on the relative value of Plimit and Pmax as determined in Part 0. Essentially, we need to pick this combination such that Plimit is less than Pmax so that the TAS algorithm will enforce power restriction. Two bands can be selected from Part 0 with different values of Plimit -select one corresponding to lowest Plimit and another being highest but still less than Pmax.

##### **3.2.2 Test configuration selection for change in call**

The criteria to select the technology/band for transition between call setup and call drop is to choose the one with least Plimit among all bands in Part 0. The test is performed with DUT requested power at Pmax so that the Samsung S.LSI TAS feature enforces power restriction for longest duration. The call change is performed when the DUT is operating with restricted power. One such test is sufficient since behavior is not dependent on band/technology.

##### **3.2.3 Test configuration for change in technology/band/window**

FCC specifies different measurement durations for time averaging based on operating frequency. The change of operating frequency can result in change of time window for averaging, for e.g. change from 100s averaging for frequency below 3GHz to 60s averaging for frequency above 3-6 GHz, The criteria for selecting test case to demonstrate compliance across time window change is to pick a technology/band corresponding to each time window from Part 0 such that Plimit is less than Pmax.

### **3.3 Test procedures for conducted power measurements**

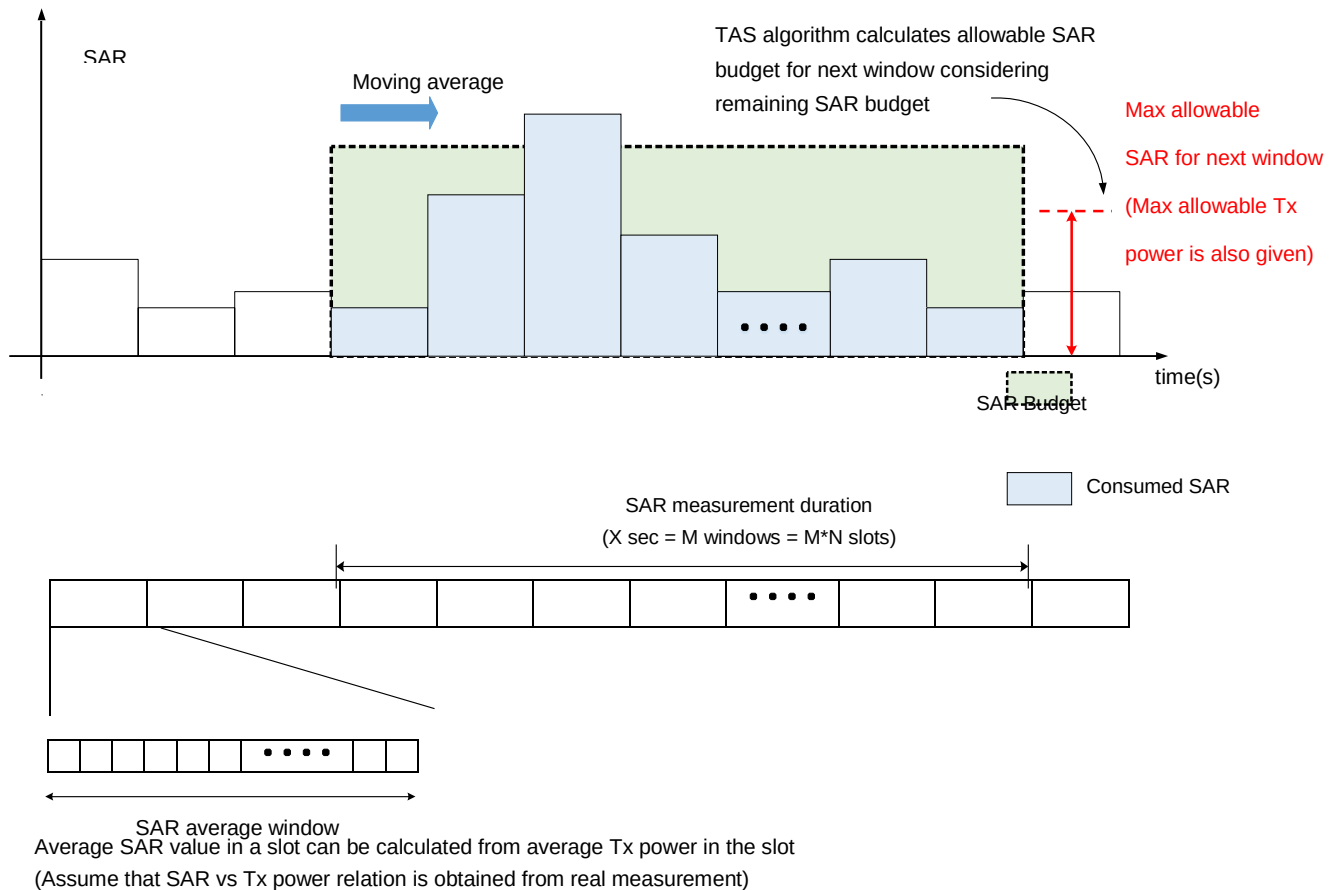
This section provides general conducted power measurement procedures to perform compliance test under dynamic scenarios described in Section 2.

#### **3.3.1 Time-varying Tx power transmission scenario**

This test is performed with two pre-defined test sequences as described in Section 3.1 for all technologies operating on sub-6GHz applying to both UMTS, LTE and NR as selected in Section 3.2.1. The purpose of the test is to demonstrate the maximum power limiting enforcement and that the time-averaged SAR does not exceed the FCC limit at all times.

### 3.3.1.1 Test procedure

1. Using the Pmax and Plimit obtained in Part 0/1, generate the test sequence of power levels for each selected technology/band. Both test sequences A and B are generated. Maximum power can be changed according to DUT test results.
2. Establish the connection of the DUT to the call box in the selected RAT, with the call box requesting the DUT Tx power to be according to the sequence determined in Step 1. An initial value of Tx power will be set to 0dBm for 100s before the desired test sequence starts to help with post-processing of the time-average value with the very first value in the sequence. This is illustrated in the figure below



**Figure 3.3-1 SAR measurement from Tx power using block-wise processing**

3. Release connection.
4. After the completion of the test, prepare one plot with the following information:
  - a. Instantaneous Tx power versus time measured in Step 2
  - b. Requested Tx power versus time used in Step 2
  - c. Time-averaged power over 100s using instantaneous values from Step 2
  - d. Power level Plimit which is determined as meeting SAR target in Part 0/1
5. Make a second plot containing the following information:
  - a. Computed time-averaged 1gSAR versus time determined in Step 2
  - b. FCC 1gSAR limit of 1.6W/kg

The pass condition is to demonstrate time-averaged 1gSAR versus time shown in Step 5 value versus time does not exceed the FCC limit of 1.6 W/kg throughout the test duration. We would also demonstrate that time-averaged power does not exceed the Plimit at any time in the plot in Step 4.

### 3.3.2 Change in call scenario

This test is to demonstrate that Samsung S.LSI TAS feature correctly accounts for past Tx powers during time- averaging when a new call is established. The call change has to be carried out when the power limit enforcement is ongoing.

#### 3.3.2.1 Test procedure

1. Establish radio connection of DUT with call box e.g. using LTE technology
2. Configure call box to set DUT Tx power to a low value of -10dBm for 100s.
3. Configure call box to send "ALL UP" power control commands and continue LTE transmission from DUT so that maximum power of Pmax is achieved.
4. After 60s of transmission at Pmax power level, release the call from call box.
5. After 10s, re-establish the LTE connection from call box to DUT and repeat sending "ALL UP" power control command to bring the Tx power to Pmax level again.
6. Continue LTE transmission at Pmax level for another 110s.
7. Release LTE connection.
8. After the completion of the test, prepare one plot with the following information (a) Instantaneous Tx power versus time (b) Requested Tx power versus time (c) Time-averaged power over 100s using instantaneous values and (d) Power level Plimit which is determined as meeting SAR target
9. Make a second plot containing the following information (a) Computed time-averaged 1gSAR versus time and (b) FCC 1gSAR limit of 1.6W/kg

Pass condition is to demonstrate time-averaged 1gSAR value versus time does not exceed the FCC limit of 1.6 W/kg throughout the test duration. It is required to check if SAR calculation is accounting for call drop and connection. Current TAS algorithm software makes the UE estimate the exact amount of Tx power and average SAR even during call drop and call re-establishment event. The UE stores time information when it goes into a sleep mode and wake-up to calculate Tx power on / off duration.

### 3.3.3 Change in technology/band/window

This test is to demonstrate that Samsung S.SLSI TAS feature can properly handle change of technology/band and consequently time window as necessary during handover scenarios. Since both Plimit and window duration can change across bands, we have to use separate equations below for converting Tx power to SAR as well as apply a combined SAR exposure criterion as shown below.

$$SAR\ 1\ (t) = \frac{TxPower(t)}{Plimit,sub6} * SAR\_design\_target \quad (3.3.1)$$

$$SAR\ 2\ (t) = \frac{TxPower(t)}{Plimit,sub6} * SAR\_design\_target \quad (3.3.2)$$

where  $Plimit,1,FR1$  would correspond to measured power at which first technology/band meets measured SAR level of  $SAR\_design\_target1$  as described in Part 0 and Part 1 with time-averaging duration of  $T1,SAR$ . Similarly,  $Plimit,FR2$  would be the measured EIRP at which FR2 technology meets measured PD level of  $PD\_design\_target$  as described in Part 0. Similarly, the quantities  $Plimit,2,FR1$ ,  $SAR\_design\_target2$ ,  $T2,SAR$  are defined for the second technology/band.

### 3.3.4 Change in Power Index

This test is to demonstrate that Samsung S.LSI TAS feature can properly handle change of RSI resulting from different SAR index state detected by host platform software. It involves changing the Plimit value during the test for the same technology to emulate power index change.

### 3.3.5 Test configuration for SAR exposure switching

The criteria for selecting test case is to pick an LTE band and a NR band with Plimit lower than Pmax in each case. The test is performed with both RATs connected in an EN-DC scenario. In the first portion of the test, DUT is requested to transmit at maximum power for NR and minimum power for LTE. In the second portion of the test, DUT is requested to transmit at maximum power for both NR and LTE. In the final portion of the test, DUT is requested to transmit at minimum power for NR and maximum power for LTE.

**3.3.6 Test procedure for handover between two TAS RATs**

1. Establish radio connection of DUT with call box e.g. using NR band
2. Configure call box to set DUT Tx power to a low value of 0dBm for 110s.
3. Configure call box to send "ALL UP" power control commands and continue NR transmission from DUT so that maximum power of Pmax is achieved. Continue transmission at the maximum power for 120s.
4. Change RAT from NR to LTE and configure call box to send "ALL UP" power control commands in LTE
5. Continue call in LTE at maximum power for 400s

**3.3.7 Test configuration for Uplink CA**

The criteria for selecting this test case is to demonstrate the compliance of the TAS algorithm when an LTE or FR1 transmission is done over multiple CC. This test shows that the TAS algorithm compliance is independent on the Transmission scenarios (single CC or CA), select any one technology that the EUT supports to demonstrate compliance.

**4. NTN SAR Time Averaging Validation Test Procedures**

In this Section, we cover the test plan and test procedure for validating Samsung S.LSI TAS feature for NTN scenario.

This sequence is generated with two power levels. One is a very low power and the other is maximum power level of Pmax. At first, the low power level is applied for 540 s seconds (by placing the transmission in the idle mode). After this, maximum power level is used for 540 s or more.

**NTN with time-varying startup test sequence**

1. Establish NTN connection of DUT with call box on NTN band
2. Send an RRC release to the UE so that it goes into the idle mode with no transmission and keep that state for 540 s.
3. Configure MAC padding in DL & UL in connected mode so that maximum power (Pmax) is achieved and continue transmission for 540 s
4. Release NTN connection

## 5. Spatial TAS

In legacy TAS algorithm (V2.3), it was assumed that all antennas are correlated regardless of their direction of transmission in space. Thus, the main concept was to split the SAR/TER on the transmitting RATs even they are transmitting on different antennas. Such approach is considered as a worst case scenario in terms of transmitting power. Thus, to enhance the performance of the transmission power of RATs, we should consider the spatial properties of each antenna and the correlations between the antennas transmissions. The TAS algorithm from the latest Samsung submission document revision v2.7 is implemented.

For example, consider a DUT with two antennas one at the top and one at the bottom and each are transmitting in two different direction with no common area affected by both. For such DUT architecture, if each antenna utilize the full SAR compliance while transmitting simultaneously, then the power transmission is still under compliance since no area is affected by both transmissions and thus no area will have SAR above SAR compliance.

For a DUT with N antennas, a spatial correlation matrix (R) can be constructed to map the correlation between each two antennas when they transmit simultaneously. Thus this correlation matrix is given as

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1N} \\ r_{21} & r_{22} & \dots & r_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ r_{N1} & r_{N2} & \dots & r_{NN} \end{bmatrix}$$

And it has the following characteristics

- $r_{ij}$  is the correlation between antenna i and antenna j
- The value of  $r_{ij}$  is either 0 or 1, where 1 means fully correlated and 0 means fully uncorrelated.
- $r_{ii}$  is the self-correlation of each antenna and it is always 1

For ENDC operation, the value of the correlation coefficients ( $r_{ij}$ ) between the two transmitting antennas ( $i,j$ ) will determine the splitting ratios between the two operating RATs as follow

- If  $r_{ij} = 0$  then each antenna will transmit with full SAR compliance
- If  $r_{ij} = 1$  then the full SAR compliance will be split among both antennas with ration a:b, where  $a + b = 1$

Since the R matrix entries depends on the antenna distribution of each DUT, then our spatial TAS algorithm is implemented to operate with any R matrix (antenna distribution agnostic).

The values of the R matrix entries should be determined by the OEM based on the DUT used. One way to determine the values of the R matrix entries is to use the SPLSR test mentioned in FCC KDB 447498 D01, section 4.3.2.

The SPLSR test is done between each pair of antennas as follow

- Measure the SAR peak location for each antenna  $(x_i, y_i, z_i)$  and  $(x_j, y_j, z_j)$
- Calculate  $\Gamma_{ij} = \frac{(SAR_{i,max} + SAR_{j,max})^{1.5}}{D}$ , where  $SAR_{i,max} = SAR_{j,max} = SAR_{comp}$  and  $D = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (z_i - z_j)^2}$
- Check if the value of  $\Gamma_{ij} \leq 0.04$  for 1g and 0.1 for 10g then these two antennas are considered fully uncorrelated and we can set  $r_{ij} = 0$ . Otherwise, a Volumetric SAR evaluation can be done to check the non-correlation of both antennas and if not set  $r_{ij} = 1$
- If volumetric SAR cannot meet FCC SAR compliance requirements, set  $r_{ij} = 1$ .

NOTE: The antennas corresponding to the selected RSIs or change in technology/band/window should be in the  $r_{ij}=1$  if EUT is configured Spatial TAS algorithm.

## 6. Test Configurations

### 6.1 WWAN (sub-6) transmission

- 1 The Plimit values correspond to SAR\_design\_target.
- 2 GSM doesn't support time average feature of dynamic power varying, the power will be fixed at the static reduce power level at different exposure conditions for RF exposure compliance. For the GSM Plimit power levels in the table correspond to the burst average power levels which don't account for TX duty cycle.
- 3 UMTS, LTE, FR1 and NTN: Plimit power levels in the table correspond to the time-averaged power levels which accounts for TX duty cycle.
- 4 Maximum target power, Pmax, is configured in NV settings in EUT to limit maximum transmitting power. This power is converted into peak power in NV settings for TDD schemes.

**Table 6.1.1:  $P_{limit}$  for supported technologies and bands ( $P_{limit}$  corresponding to SAR design target)**

| Wireless technology<br>(No Accounting duty cycle) | Mode         | Duty cycle | Antenna | Maximum Power Condition   | Head       |              | Hotspot      | Body-worn/Extremity |              | P Max Burst average power (dBm) |
|---------------------------------------------------|--------------|------------|---------|---------------------------|------------|--------------|--------------|---------------------|--------------|---------------------------------|
|                                                   |              |            |         |                           | Standalone | Simultaneous | Simultaneous | Standalone          | Simultaneous |                                 |
|                                                   |              |            |         | Index 1                   | Index 2    | Index 3      | Index 4      | Index 5             | Index 6      |                                 |
|                                                   |              |            |         | P limit                   |            |              |              |                     |              |                                 |
|                                                   |              |            |         | Burst average power (dBm) |            |              |              |                     |              |                                 |
| GSM850                                            | GSM/GPRS 1TX | 12.50%     | Ant0    | 32.50                     | 35.60      | 34.40        | 34.10        | 35.00               | 34.30        | 32.50                           |
|                                                   | GPRS 2TX     | 25.00%     |         | 31.50                     | 32.60      | 31.40        | 31.10        | 32.00               | 31.30        | 31.50                           |
|                                                   | GPRS 3TX     | 37.50%     |         | 30.50                     | 30.80      | 29.60        | 29.30        | 30.20               | 29.50        | 30.50                           |
|                                                   | GPRS 4TX     | 50.00%     |         | 29.50                     | 29.60      | 28.40        | 28.10        | 29.00               | 28.30        | 29.50                           |
|                                                   | EDGE 1TX     | 12.50%     |         | 26.50                     | 35.60      | 34.40        | 34.10        | 35.00               | 34.30        | 26.50                           |
|                                                   | EDGE 2TX     | 25.00%     |         | 25.50                     | 32.60      | 31.40        | 31.10        | 32.00               | 31.30        | 25.50                           |
|                                                   | EDGE 3TX     | 37.50%     |         | 24.50                     | 30.80      | 29.60        | 29.30        | 30.20               | 29.50        | 24.50                           |
|                                                   | EDGE 4TX     | 50.00%     |         | 23.50                     | 29.60      | 28.40        | 28.10        | 29.00               | 28.30        | 23.50                           |
| GSM850                                            | GSM/GPRS 1TX | 12.50%     | Ant1    | 32.20                     | 30.30      | 29.60        | 33.10        | 33.80               | 33.10        | 32.20                           |
|                                                   | GPRS 2TX     | 25.00%     |         | 31.30                     | 27.30      | 26.60        | 30.10        | 30.80               | 30.10        | 31.30                           |
|                                                   | GPRS 3TX     | 37.50%     |         | 30.30                     | 25.50      | 24.80        | 28.30        | 29.00               | 28.30        | 30.30                           |
|                                                   | GPRS 4TX     | 50.00%     |         | 29.30                     | 24.30      | 23.60        | 27.10        | 27.80               | 27.10        | 29.30                           |
|                                                   | EDGE 1TX     | 12.50%     |         | 26.20                     | 30.30      | 29.60        | 33.10        | 33.80               | 33.10        | 26.20                           |
|                                                   | EDGE 2TX     | 25.00%     |         | 25.30                     | 27.30      | 26.60        | 30.10        | 30.80               | 30.10        | 25.30                           |
|                                                   | EDGE 3TX     | 37.50%     |         | 24.30                     | 25.50      | 24.80        | 28.30        | 29.00               | 28.30        | 24.30                           |
|                                                   | EDGE 4TX     | 50.00%     |         | 23.30                     | 24.30      | 23.60        | 27.10        | 27.80               | 27.10        | 23.30                           |
| GSM1900                                           | GSM/GPRS 1TX | 12.50%     | Ant2    | 29.50                     | 34.70      | 34.00        | 31.80        | 32.80               | 32.10        | 29.50                           |
|                                                   | GPRS 2TX     | 25.00%     |         | 28.00                     | 31.70      | 31.00        | 28.80        | 29.80               | 29.10        | 28.00                           |
|                                                   | GPRS 3TX     | 37.50%     |         | 27.50                     | 29.90      | 29.20        | 27.00        | 28.00               | 27.30        | 27.50                           |
|                                                   | GPRS 4TX     | 50.00%     |         | 26.50                     | 28.70      | 28.00        | 25.80        | 26.80               | 26.10        | 26.50                           |
|                                                   | EDGE 1TX     | 12.50%     |         | 25.50                     | 34.70      | 34.00        | 31.80        | 32.80               | 32.10        | 25.50                           |
|                                                   | EDGE 2TX     | 25.00%     |         | 24.50                     | 31.70      | 31.00        | 28.80        | 29.80               | 29.10        | 24.50                           |
|                                                   | EDGE 3TX     | 37.50%     |         | 23.50                     | 29.90      | 29.20        | 27.00        | 28.00               | 27.30        | 23.50                           |
|                                                   | EDGE 4TX     | 50.00%     |         | 22.50                     | 28.70      | 28.00        | 25.80        | 26.80               | 26.10        | 22.50                           |
| GSM1900                                           | GSM/GPRS 1TX | 12.50%     | Ant0    | 28.70                     | 43.80      | 43.10        | 26.40        | 28.40               | 27.70        | 28.70                           |
|                                                   | GPRS 2TX     | 25.00%     |         | 27.20                     | 40.80      | 40.10        | 23.40        | 25.40               | 24.70        | 27.20                           |
|                                                   | GPRS 3TX     | 37.50%     |         | 26.70                     | 39.00      | 38.30        | 21.60        | 23.60               | 22.90        | 26.70                           |
|                                                   | GPRS 4TX     | 50.00%     |         | 25.70                     | 37.80      | 37.10        | 20.40        | 22.40               | 21.70        | 25.70                           |
|                                                   | EDGE 1TX     | 12.50%     |         | 24.70                     | 43.80      | 43.10        | 26.40        | 28.40               | 27.70        | 24.70                           |
|                                                   | EDGE 2TX     | 25.00%     |         | 23.70                     | 40.80      | 40.10        | 23.40        | 25.40               | 24.70        | 23.70                           |
|                                                   | EDGE 3TX     | 37.50%     |         | 22.70                     | 39.00      | 38.30        | 21.60        | 23.60               | 22.90        | 22.70                           |
|                                                   | EDGE 4TX     | 50.00%     |         | 21.70                     | 37.80      | 37.10        | 20.40        | 22.40               | 21.70        | 21.70                           |



| Wireless technology<br>(Accounting duty cycle) | Mode     | Duty cycle | Antenna | Maximum Power Condition | Head       |              | Hotspot      | Body-worn/Extremity |              | P Max Time-average power (dBm) |
|------------------------------------------------|----------|------------|---------|-------------------------|------------|--------------|--------------|---------------------|--------------|--------------------------------|
|                                                |          |            |         |                         | Standalone | Simultaneous | Simultaneous | Standalone          | Simultaneous |                                |
|                                                |          |            |         | Index 1                 | Index 2    | Index 3      | Index 4      | Index 5             | Index 6      |                                |
|                                                |          |            |         | P limit                 |            |              |              |                     |              |                                |
| Time-average power (dBm)                       |          |            |         |                         |            |              |              |                     |              |                                |
| WCDMA B2                                       | R99/HSPA | 100.00%    | Ant2    | 24.00                   | 25.80      | 25.10        | 21.60        | 22.30               | 21.60        | 24.00                          |
| WCDMA B2                                       | R99/HSPA | 100.00%    | Ant0    | 23.80                   | 35.20      | 34.50        | 16.30        | 18.90               | 18.20        | 23.80                          |
| WCDMA B4                                       | R99/HSPA | 100.00%    | Ant2    | 24.00                   | 26.20      | 25.50        | 21.00        | 21.70               | 21.00        | 24.00                          |
| WCDMA B4                                       | R99/HSPA | 100.00%    | Ant0    | 23.80                   | 33.50      | 32.80        | 18.00        | 19.50               | 18.80        | 23.80                          |
| WCDMA B5                                       | R99/HSPA | 100.00%    | Ant0    | 24.30                   | 28.20      | 27.50        | 24.70        | 25.40               | 24.70        | 24.30                          |
| WCDMA B5                                       | R99/HSPA | 100.00%    | Ant1    | 24.10                   | 22.00      | 21.30        | 24.10        | 24.80               | 24.10        | 24.10                          |
| LTE B7                                         | PC3      | 100.00%    | Ant2    | 24.10                   | 24.50      | 23.30        | 20.00        | 20.70               | 20.00        | 24.10                          |
| LTE B7                                         | PC3      | 100.00%    | Ant0    | 23.90                   | 31.60      | 30.90        | 18.70        | 20.90               | 20.20        | 23.90                          |
| LTE B12/B17                                    | PC3      | 100.00%    | Ant0    | 24.30                   | 30.60      | 29.90        | 26.30        | 27.00               | 26.30        | 24.30                          |
| LTE B12/B17                                    | PC3      | 100.00%    | Ant1    | 24.10                   | 22.90      | 22.20        | 26.50        | 27.20               | 26.50        | 24.10                          |
| LTE B13                                        | PC3      | 100.00%    | Ant0    | 24.30                   | 29.30      | 28.60        | 22.90        | 28.40               | 27.70        | 24.30                          |
| LTE B13                                        | PC3      | 100.00%    | Ant1    | 24.10                   | 23.00      | 22.30        | 22.80        | 27.20               | 26.50        | 24.10                          |
| LTE B14                                        | PC3      | 100.00%    | Ant0    | 24.30                   | 29.10      | 28.40        | 22.80        | 27.80               | 27.10        | 24.30                          |
| LTE B14                                        | PC3      | 100.00%    | Ant1    | 24.10                   | 23.10      | 22.30        | 23.00        | 27.20               | 26.50        | 24.10                          |
| LTE B25/B2                                     | PC3      | 100.00%    | Ant2    | 24.00                   | 25.90      | 25.20        | 20.10        | 20.80               | 20.10        | 24.00                          |
| LTE B25/B2                                     | PC3      | 100.00%    | Ant0    | 23.90                   | 35.90      | 35.20        | 16.50        | 19.10               | 18.40        | 23.90                          |
| LTE B25/B2                                     | PC3      | 100.00%    | Ant1    | 24.00                   | 17.40      | 16.70        | 20.30        | 21.50               | 20.80        | 24.00                          |
| LTE B25/B2                                     | PC3      | 100.00%    | Ant5    | 23.80                   | 19.20      | 18.20        | 21.70        | 22.40               | 21.70        | 23.80                          |
| LTE B26/B5                                     | PC3      | 100.00%    | Ant0    | 24.30                   | 28.40      | 27.70        | 23.80        | 26.20               | 25.50        | 24.30                          |
| LTE B26/B5                                     | PC3      | 100.00%    | Ant1    | 24.10                   | 22.60      | 21.50        | 24.20        | 24.90               | 24.20        | 24.10                          |
| LTE B30                                        | PC3      | 100.00%    | Ant2    | 22.90                   | 24.10      | 23.40        | 19.60        | 20.30               | 19.60        | 22.90                          |
| LTE B30                                        | PC3      | 100.00%    | Ant0    | 20.50                   | 32.50      | 31.80        | 18.60        | 20.20               | 19.50        | 20.50                          |
| LTE B41/B38                                    | PC3      | 63.30%     | Ant2    | 22.10                   | 22.90      | 21.70        | 19.00        | 19.70               | 19.00        | 22.10                          |
| LTE B41/B38                                    | PC2      | 43.30%     | Ant2    | 22.40                   | 22.90      | 21.70        | 19.00        | 19.70               | 19.00        | 22.40                          |
| LTE B41/B38                                    | PC3      | 63.30%     | Ant0    | 21.90                   | 31.50      | 30.80        | 18.60        | 20.90               | 20.20        | 21.90                          |
| LTE B41/B38                                    | PC2      | 43.30%     | Ant0    | 22.20                   | 31.50      | 30.80        | 18.60        | 20.90               | 20.20        | 22.20                          |
| LTE B48                                        | PC3      | 63.30%     | Ant6    | 18.00                   | 25.70      | 25.00        | 18.80        | 20.10               | 19.40        | 18.00                          |
| LTE B48                                        | PC3      | 63.30%     | Ant7    | 20.10                   | 25.50      | 24.80        | 18.10        | 18.80               | 18.10        | 20.10                          |
| LTE B66/B4                                     | PC3      | 100.00%    | Ant2    | 24.00                   | 25.50      | 24.80        | 21.30        | 22.00               | 21.30        | 24.00                          |
| LTE B66/B4                                     | PC3      | 100.00%    | Ant0    | 23.90                   | 34.70      | 34.00        | 18.20        | 19.60               | 18.90        | 23.90                          |
| LTE B66/B4                                     | PC3      | 100.00%    | Ant1    | 24.00                   | 15.70      | 14.50        | 20.50        | 21.20               | 20.50        | 24.00                          |
| LTE B66/B4                                     | PC3      | 100.00%    | Ant5    | 23.80                   | 19.80      | 18.60        | 22.50        | 23.20               | 22.50        | 23.80                          |
| LTE B71                                        | PC3      | 100.00%    | Ant0    | 24.30                   | 29.50      | 28.80        | 27.30        | 28.40               | 27.70        | 24.30                          |
| LTE B71                                        | PC3      | 100.00%    | Ant1    | 24.10                   | 23.40      | 22.50        | 26.70        | 27.40               | 26.70        | 24.10                          |
| FR1 n7                                         | PC3      | 100.00%    | Ant2    | 24.10                   | 23.40      | 22.20        | 20.60        | 21.90               | 21.20        | 24.10                          |
| FR1 n7                                         | PC3      | 100.00%    | Ant0    | 23.90                   | 31.80      | 31.10        | 18.40        | 20.50               | 19.80        | 23.90                          |
| FR1 n12                                        | PC3      | 100.00%    | Ant0    | 24.30                   | 29.40      | 28.70        | 23.80        | 26.10               | 25.40        | 24.30                          |
| FR1 n12                                        | PC3      | 100.00%    | Ant1    | 24.10                   | 22.40      | 21.50        | 25.20        | 25.90               | 25.20        | 24.10                          |
| FR1 n14                                        | PC3      | 100.00%    | Ant0    | 24.30                   | 28.90      | 28.20        | 23.00        | 28.20               | 27.50        | 24.30                          |
| FR1 n14                                        | PC3      | 100.00%    | Ant1    | 24.10                   | 22.40      | 21.50        | 23.10        | 26.10               | 25.40        | 24.10                          |
| FR1 n25/n2                                     | PC3      | 100.00%    | Ant2    | 24.00                   | 27.10      | 26.40        | 20.60        | 21.30               | 20.60        | 24.00                          |
| FR1 n25/n2                                     | PC3      | 100.00%    | Ant0    | 23.90                   | 36.70      | 36.00        | 17.00        | 19.10               | 18.40        | 23.90                          |
| FR1 n25/n2                                     | PC3      | 100.00%    | Ant1    | 24.00                   | 14.60      | 13.70        | 19.50        | 20.20               | 19.50        | 24.00                          |
| FR1 n25/n2                                     | PC3      | 100.00%    | Ant5    | 23.80                   | 18.60      | 17.40        | 20.50        | 21.30               | 20.60        | 23.80                          |
| FR1 n26/n5                                     | PC3      | 100.00%    | Ant0    | 24.30                   | 28.40      | 27.70        | 25.20        | 26.00               | 25.30        | 24.30                          |
| FR1 n26/n5                                     | PC3      | 100.00%    | Ant1    | 24.10                   | 22.00      | 21.10        | 24.20        | 24.90               | 24.20        | 24.10                          |
| FR1 n30                                        | PC3      | 100.00%    | Ant2    | 22.90                   | 24.90      | 24.20        | 19.60        | 20.30               | 19.60        | 22.90                          |
| FR1 n30                                        | PC3      | 100.00%    | Ant0    | 20.50                   | 33.70      | 33.00        | 18.80        | 21.10               | 20.40        | 20.50                          |
| FR1 n41/n38                                    | PC3      | 100.00%    | Ant2    | 24.10                   | 23.10      | 21.90        | 20.90        | 21.60               | 20.90        | 24.10                          |



## FCC RF Exposure Report

Report No. : FA4N0919-01C

|             |       |         |      |       |       |       |       |       |       |       |
|-------------|-------|---------|------|-------|-------|-------|-------|-------|-------|-------|
| FR1 n41     | PC2   | 50.00%  | Ant2 | 23.00 | 23.10 | 21.90 | 20.90 | 21.60 | 20.90 | 23.00 |
| FR1 n41     | PC1.5 | 25.00%  | Ant2 | 19.50 | 23.10 | 21.90 | 20.90 | 21.60 | 20.90 | 19.50 |
| FR1 n41/n38 | PC3   | 100.00% | Ant0 | 24.00 | 31.70 | 31.00 | 19.10 | 21.30 | 20.60 | 24.00 |
| FR1 n41     | PC2   | 50.00%  | Ant0 | 22.80 | 31.70 | 31.00 | 19.10 | 21.30 | 20.60 | 22.80 |
| FR1 n41     | PC1.5 | 25.00%  | Ant0 | 18.50 | 31.70 | 31.00 | 19.10 | 21.30 | 20.60 | 18.50 |
| FR1 n41/n38 | PC3   | 100.00% | Ant1 | 24.10 | 17.00 | 15.80 | 21.30 | 22.00 | 21.30 | 24.10 |
| FR1 n41     | PC2   | 50.00%  | Ant1 | 23.00 | 17.00 | 15.80 | 21.30 | 22.00 | 21.30 | 23.00 |
| FR1 n41     | PC1.5 | 25.00%  | Ant1 | 18.70 | 17.00 | 15.80 | 21.30 | 22.00 | 21.30 | 18.70 |
| FR1 n41/n38 | PC3   | 100.00% | Ant5 | 23.70 | 15.80 | 14.60 | 21.90 | 22.60 | 21.90 | 23.70 |
| FR1 n41     | PC2   | 50.00%  | Ant5 | 22.60 | 15.80 | 14.60 | 21.90 | 22.60 | 21.90 | 22.60 |
| FR1 n41     | PC1.5 | 25.00%  | Ant5 | 18.30 | 15.80 | 14.60 | 21.90 | 22.60 | 21.90 | 18.30 |
| FR1 n66     | PC3   | 100.00% | Ant2 | 24.00 | 26.70 | 26.00 | 21.30 | 22.00 | 21.30 | 24.00 |
| FR1 n66     | PC3   | 100.00% | Ant0 | 23.90 | 35.00 | 34.30 | 18.60 | 20.10 | 19.40 | 23.90 |
| FR1 n66     | PC3   | 100.00% | Ant1 | 24.00 | 15.50 | 14.60 | 20.90 | 21.60 | 20.90 | 24.00 |
| FR1 n66     | PC3   | 100.00% | Ant5 | 23.80 | 19.80 | 18.60 | 21.30 | 22.00 | 21.30 | 23.80 |
| FR1 n71     | PC3   | 100.00% | Ant0 | 24.30 | 30.10 | 29.40 | 26.40 | 28.40 | 27.70 | 24.30 |
| FR1 n71     | PC3   | 100.00% | Ant1 | 24.10 | 23.50 | 22.80 | 26.20 | 26.90 | 26.20 | 24.10 |
| FR1 n77/n78 | PC3   | 100.00% | Ant6 | 24.00 | 24.10 | 23.40 | 18.50 | 19.40 | 18.70 | 24.00 |
| FR1 n77/n78 | PC2   | 50.00%  | Ant6 | 23.00 | 24.10 | 23.40 | 18.50 | 19.40 | 18.70 | 23.00 |
| FR1 n77/n78 | PC1.5 | 25.00%  | Ant6 | 19.50 | 24.10 | 23.40 | 18.50 | 19.40 | 18.70 | 19.50 |
| FR1 n77/n78 | PC3   | 100.00% | Ant7 | 23.50 | 23.90 | 22.70 | 18.10 | 18.80 | 18.10 | 23.50 |
| FR1 n77/n78 | PC2   | 50.00%  | Ant7 | 22.50 | 23.90 | 22.70 | 18.10 | 18.80 | 18.10 | 22.50 |
| FR1 n77/n78 | PC1.5 | 25.00%  | Ant7 | 19.00 | 23.90 | 22.70 | 18.10 | 18.80 | 18.10 | 19.00 |
| FR1 n77/n78 | PC3   | 100.00% | Ant1 | 24.00 | 13.70 | 12.50 | 16.10 | 19.00 | 18.30 | 24.00 |
| FR1 n77/n78 | PC2   | 50.00%  | Ant1 | 23.00 | 13.70 | 12.50 | 16.10 | 19.00 | 18.30 | 23.00 |
| FR1 n77/n78 | PC1.5 | 25.00%  | Ant1 | 19.50 | 13.70 | 12.50 | 16.10 | 19.00 | 18.30 | 19.50 |
| FR1 n77/n78 | PC3   | 100.00% | Ant5 | 23.50 | 16.60 | 15.90 | 23.00 | 23.70 | 23.00 | 23.50 |
| FR1 n77/n78 | PC2   | 50.00%  | Ant5 | 22.50 | 16.60 | 15.90 | 23.00 | 23.70 | 23.00 | 22.50 |
| FR1 n77/n78 | PC1.5 | 25.00%  | Ant5 | 19.00 | 16.60 | 15.90 | 23.00 | 23.70 | 23.00 | 19.00 |
| NTN B23     | PC3   | 83.00%  | Ant1 | 21.70 |       |       |       | 20.50 |       | 21.70 |
| NTN B255    | PC3   | 83.00%  | Ant4 | 22.70 |       |       |       | 20.00 |       | 22.70 |

## 6.2 Test case list for sub-6GHz transmissions

To validate TAS algorithm in various sub-6GHz conditions, the chosen TC (Test Case) list is defined as in Table 6.2.1.

**Table 6.2.1 Sub-6GHz TAS validation test case list**

| No. | Test Scenario                      | Test case                           | Test configuration                       |
|-----|------------------------------------|-------------------------------------|------------------------------------------|
| 1   | Time-varying Tx power transmission | LTE_Time_Varying_Tx_Power_Case_1    | WCDMA B2                                 |
| 2   |                                    | LTE_Time_Varying_Tx_Power_Case_1    | WCDMA B5                                 |
| 3   |                                    | LTE_Time_Varying_Tx_Power_Case_1    | LTE B14                                  |
| 4   |                                    | LTE_Time_Varying_Tx_Power_Case_1    | LTE B66/4                                |
| 5   |                                    | SA_FR1_Time_Varying_Tx_Power_Case_1 | n14 (SA Mode)                            |
| 6   |                                    | SA_FR1_Time_Varying_Tx_Power_Case_1 | n77/n78 pc3 (SA Mode)                    |
| 7   | Time-varying Tx power transmission | LTE_Time_Varying_Tx_Power_Case_2    | WCDMA B2                                 |
| 8   |                                    | LTE_Time_Varying_Tx_Power_Case_2    | WCDMA B5                                 |
| 9   |                                    | LTE_Time_Varying_Tx_Power_Case_2    | LTE B14                                  |
| 10  |                                    | LTE_Time_Varying_Tx_Power_Case_2    | LTE B66/4                                |
| 11  |                                    | SA_FR1_Time_Varying_Tx_Power_Case_2 | n14 (SA Mode)                            |
| 12  |                                    | SA_FR1_Time_Varying_Tx_Power_Case_2 | n77/n78 pc3 (SA Mode)                    |
| 13  | Change operate states              | SA_FR1_RF_SAR_Index_Change          | n77/n78 pc3 (SA Mode) Index 5 to Index 3 |
| 14  | Drop call                          | Call_Disconnect_Reestablishment     | LTE B66/4                                |
| 15  | SAR exposure switch                | NSA_FR1_Dominant_Power_Switching    | LTE B48, n25/n2 (NSA Mode)               |
| 16  | Re-selection in call               | NR_TO_LTE_IRAT_HO                   | nn25/n2 (SA Mode) to LTE B48             |
| 17  | UL CA                              | -                                   | LTE B66                                  |
| 18  | Time varying Tx power              | NTN_Time varying Tx power           | NTN Band 255                             |

Remark:

- (\*)The same  $P_{limit}$  value is applied for all modulation schemes associated with a specific communication technology.
- Correlation matrix for Spatial TAS implementation for WWAN antenna pairs, UL MIMO antenna operating on different antenna groups, therefore TAS validation is not required.

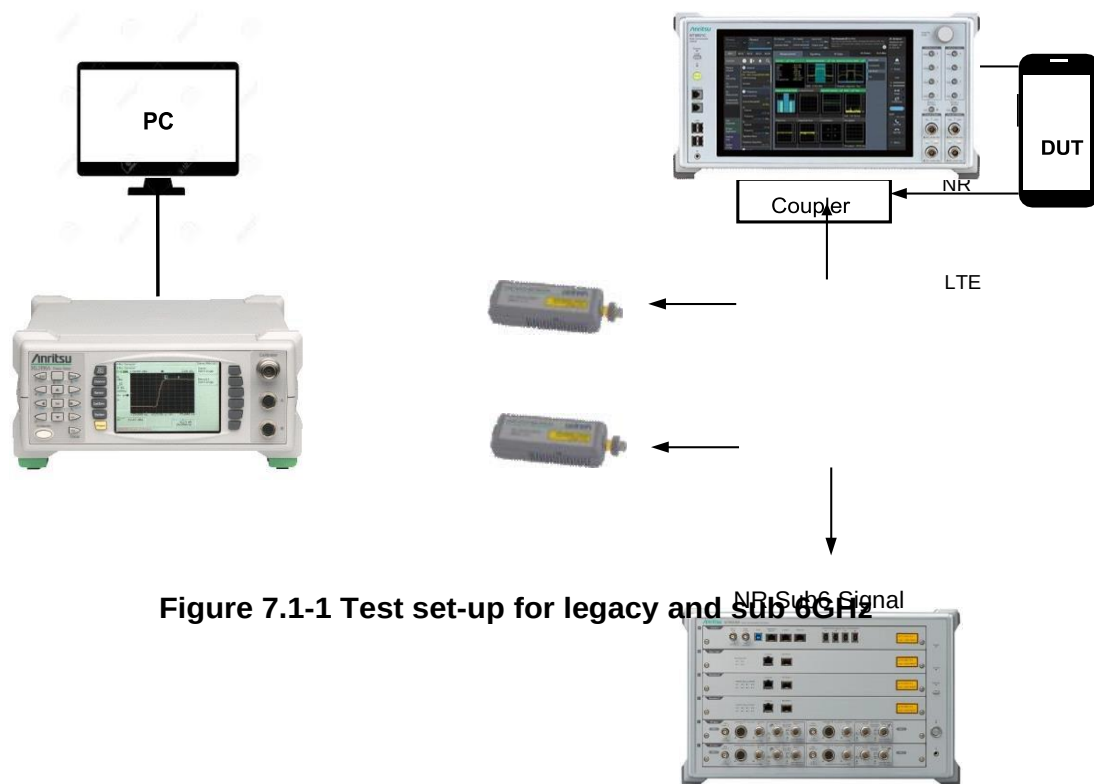
| Antenna Group | AG0          | AG1          | AG2          |
|---------------|--------------|--------------|--------------|
|               | Ant 0, Ant 6 | Ant 1, Ant 5 | Ant 2, Ant 7 |

Uplink MIMO antenna combination

|        |         |         |         |         |
|--------|---------|---------|---------|---------|
| N77/78 | Ant 6+1 | Ant 6+5 | Ant 7+1 | Ant 7+5 |
| N41    | Ant 2+1 | Ant 2+5 | Ant 0+1 | Ant 0+5 |

## **7. Conducted Power Test Results for Sub-6 and NTN TAS validation**

### **7.1 Measurement set-up**



**Figure 7.1-1 Test set-up for legacy and sub 6GHz**

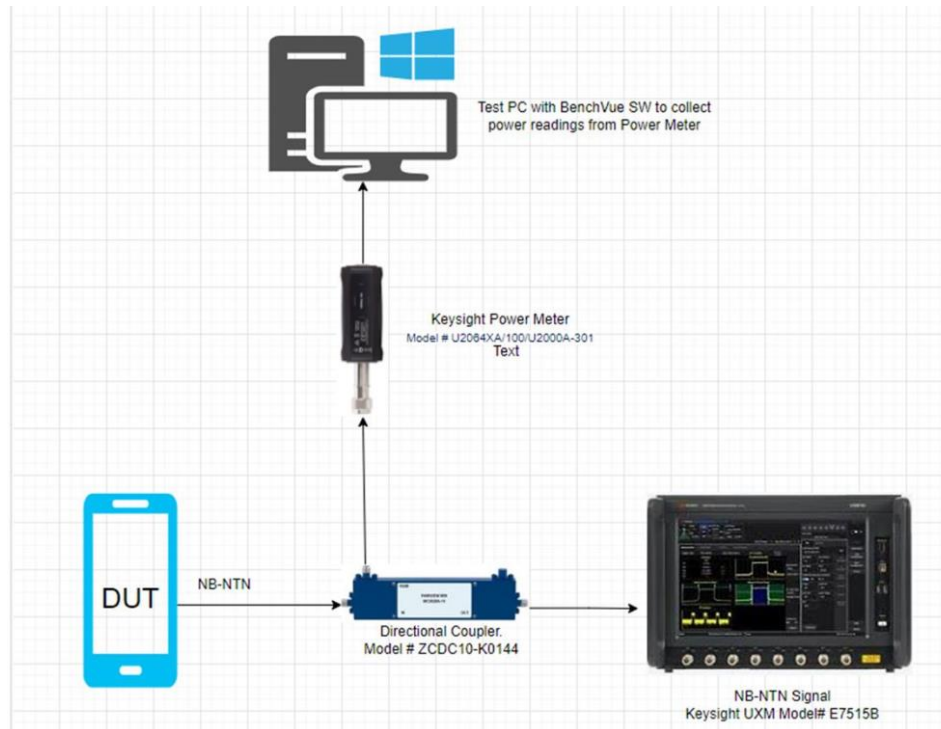
The test setup for TAS validation with sub-6GHz RATs only is shown in Figure 7.1-1.

Power readings for each active technology are recorded every 100ms and dumped in an excel file. A post- processing tool is used to extract data from the excel file and plot the required metrics such as time-averaged power, SAR and TER values versus time as described in Section 3.3.

In summary, the tests have to be executed as following procedure.

1. Measure conduction sub 6GHz Tx power corresponds to SAR regulation.
2. Execute time-varying test scenarios. And record sub 6GHz power using sub 6GHz power meter equipment.
3. The time interval between subsequent conducted power measurements is 0.1s (typically much less than 1 second)
4. Plot the recorded results over measurement time. And evaluate the results for validation.
5. The required Power level is burst average power level controlled by call box, the power varying measurement correspond to time-average power levels after accounting for duty cycle in the case TDD modulation schemes (e.g. LTE, 5G FR1 TDD bands).

## **7.2 NTN Measurement set-up**



**Figure 7.2-1 Test set-up for NTN transmission**

The test setup for TAS validation for NTN is shown in Figure 7.2-1. Normally, a power meter sensor would measure total power in the entire frequency of its specification e.g. 10MHz to 40GHz for the U2064XA unit. A common power meter is able to display and record the readings for each sensor at the same time for postprocessing at a PC. The signaling call box Keysight E7515B is used to establish the call and data connection to the DUT for NB-NTN. The couplers are able to provide the transmit signal from DUT to power sensors while uplink and downlink signaling messages exchanged with the call box on the same path. A script is designed using a Keysight software called "Test App" that enables the DUT to establish an NBNTN connection with maximum power configured in the system information message. All the path losses from RF port of DUT to the callbox and the power meters are calibrated and automatically entered as offsets in the callbox and power meter, which are also connected to the control PC used in the test setup. The Keysight software (Test App) is used to save the required configuration in the form of a script (.scpi file) which can be utilized for multiple test runs if required. Another Keysight software called "BenchVue" is used to collect readings from the power meter every 100ms and save them in an excel or MATLAB format.

1. Measure conduction NTN Tx power corresponding to SAR regulation.
2. Set NTN power level with some margin. Then, start the test.
3. Execute time-varying test scenarios. Record NTN power using sub-6GHz power meter equipment.
4. Plot the recorded results over measurement time. Evaluate the results for validation.

Note that P<sub>limit</sub> is different according to the OEM, so it is necessary to set the P<sub>limit</sub> suitable for each terminal.

### 7.3 Measured *Plimit* and *Pmax*

The measured *Plimit* for all the selected radio configurations are listed in Table 7.2.1. *Pmax* was also measured for radio configurations selected for testing time-varying Tx power transmission scenario in order to generate test sequences following the test procedures.

The instantaneous maximum power for WWAN antennas is min {*Pmax*, *Plimit*+6 dB} during TAS power transmission behavior.

**Table 7.2.1 Measured *Plimit* and *Pmax* of selected radio configurations**

| item | Test Scenario                     | Antenna | Power Index | Test band             | Mode             | Pmax Setting (dBm) | measured Pmax (dBm) | Plimit Setting (dBm) | Measured Plimit (dBm) | Total Uncertainty (dB) |
|------|-----------------------------------|---------|-------------|-----------------------|------------------|--------------------|---------------------|----------------------|-----------------------|------------------------|
| 1    | Time varying Tx power case 1      | Ant 0   | 4           | WCDMA B2              | RMC 12.2Kbps     | 23.8               | 21.91               | 16.3                 | 15.89                 | 1.7                    |
| 2    |                                   | Ant 1   | 2           | WCDMA B5              | RMC 12.2Kbps     | 24.1               | 24.08               | 22                   | 21.64                 | 1.4                    |
| 3    |                                   | Ant 1   | 2           | LTE B14               | QPSK/10M/25/0    | 24.1               | 24.2                | 23.1                 | 23.04                 | 0.9                    |
| 4    |                                   | Ant 1   | 3           | LTE B66/4             | QPSK/20M/50/0    | 24                 | 20.01               | 14.5                 | 14.03                 | 1                      |
| 5    |                                   | Ant 1   | 4           | n14 (SA Mode)         | BPSK/10M/1/1     | 24.1               | 23.75               | 23.1                 | 22.84                 | 0.9                    |
| 6    |                                   | Ant 1   | 3           | n77/n78 pc3 (SA Mode) | BPSK/100M/135/69 | 24                 | 18.33               | 12.5                 | 12.25                 | 1                      |
| 7    | Time varying Tx power case 2      | Ant 0   | 4           | WCDMA B2              | RMC 12.2Kbps     | 23.8               | 21.91               | 16.3                 | 15.89                 | 1.7                    |
| 8    |                                   | Ant 1   | 2           | WCDMA B5              | RMC 12.2Kbps     | 24.1               | 24.08               | 22                   | 21.64                 | 1.4                    |
| 9    |                                   | Ant 1   | 2           | LTE B14               | QPSK/10M/25/0    | 24.1               | 24.2                | 23.1                 | 23.04                 | 0.9                    |
| 10   |                                   | Ant 1   | 3           | LTE B66/4             | QPSK/20M/50/0    | 24                 | 20.01               | 14.5                 | 14.03                 | 1                      |
| 11   |                                   | Ant 1   | 4           | n14 (SA Mode)         | BPSK/10M/1/1     | 24.1               | 23.75               | 23.1                 | 22.84                 | 0.9                    |
| 12   |                                   | Ant 1   | 3           | n77/n78 pc3 (SA Mode) | BPSK/100M/135/69 | 24                 | 18.33               | 12.5                 | 12.25                 | 1                      |
| 13   | Change in operating state         | Ant 1   | 5           | n77/n78 pc3 (SA Mode) | BPSK/100M/1/1    | 24                 | 23.99               | 19                   | 18.86                 | 1                      |
|      |                                   | Ant 1   | 3           | n77/n78 pc3 (SA Mode) | BPSK/100M/135/69 | 24                 | 18.33               | 12.5                 | 12.25                 | 1                      |
| 14   | Call_Disconnect_Reestablishment   | Ant 1   | 3           | LTE B66/4             | QPSK/20M/50/0    | 24                 | 20.01               | 14.5                 | 14.03                 | 1                      |
| 15   | NSA_FR1_Dominant_Power_Switching  | Ant 6   | 4           | LTE B48               | QPSK/20M/50/0    | 18                 | 17.76               | 18.8                 | 17.76                 | 1                      |
|      |                                   | Ant 0   | 4           | n25/n2 (NSA Mode)     | BPSK/40M/108/54  | 23.9               | 22.92               | 17                   | 16.84                 | 1.1                    |
| 16   | NR_TO_LTE_IRAT_HO                 | Ant 0   | 4           | n25/n2 (SA Mode)      | BPSK/40M/108/54  | 23.9               | 22.92               | 17                   | 16.84                 | 1.1                    |
|      |                                   | Ant 6   | 4           | LTE B48               | QPSK/20M/50/0    | 18                 | 17.76               | 18.8                 | 17.76                 | 1                      |
| 17   | UL CA                             | Ant 0   | 4           | LTE B66_PCC           | QPSK/20M/1/0     | 23.9               | 23.87               | 18.2                 | 17.93                 | 1.1                    |
|      |                                   |         |             | LTE B66_PCC+SCC       | QPSK/20M/1/0     | 23.9               | 22.82               |                      | 16.95                 |                        |
| 18   | NTN_Time_Varying_Startup_sequence | Ant 4   | 5           | NTN B255              | BPSK/15k/10      | 22.7               | 23.6                | 20                   | 19.9                  | 1                      |

Note that the EUT has multiple power indexes to manage the output power for different conditions corresponding to RF exposure conditions in above table, detailed power index trigger conditions are illustrated in the operational description, and 1g and 10g SAR design target are shown in the part 0 report.

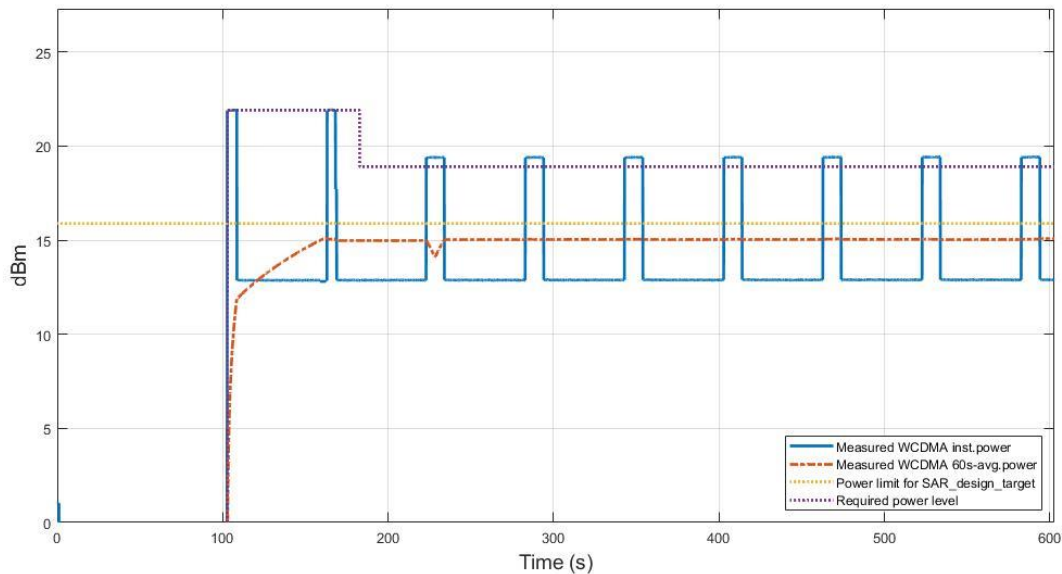
### 7.4 Sub-6 summary test results

| Item | Test Scenario                     | Antenna | Power Index | Test band             | Mode             | Total Uncertainty (dB) | 1g SAR design target (W/kg) | 1g Time average SAR (W/kg) | Deviation (dB) |
|------|-----------------------------------|---------|-------------|-----------------------|------------------|------------------------|-----------------------------|----------------------------|----------------|
| 1    | Time varying Tx power case 1      | Ant 0   | 4           | WCDMA B2              | RMC 12.2Kbps     | 1.7                    | 0.489                       | 0.413                      | -0.73          |
| 2    |                                   | Ant 1   | 2           | WCDMA B5              | RMC 12.2Kbps     | 1.4                    | 0.609                       | 0.552                      | -0.43          |
| 3    |                                   | Ant 1   | 2           | LTE B14               | QPSK/10M/25/0    | 0.9                    | 0.627                       | 0.562                      | -0.48          |
| 4    |                                   | Ant 1   | 3           | LTE B66/4             | QPSK/20M/50/0    | 1                      | 0.713                       | 0.649                      | -0.41          |
| 5    |                                   | Ant 1   | 4           | n14 (SA Mode)         | BPSK/10M/1/1     | 0.9                    | 0.445                       | 0.395                      | -0.52          |
| 6    |                                   | Ant 1   | 3           | n77/n78 pc3 (SA Mode) | BPSK/100M/135/69 | 1                      | 0.622                       | 0.629                      | 0.05           |
| 7    | Time varying Tx power case 2      | Ant 0   | 4           | WCDMA B2              | RMC 12.2Kbps     | 1.7                    | 0.489                       | 0.402                      | -0.85          |
| 8    |                                   | Ant 1   | 2           | WCDMA B5              | RMC 12.2Kbps     | 1.4                    | 0.609                       | 0.531                      | -0.60          |
| 9    |                                   | Ant 1   | 2           | LTE B14               | QPSK/10M/25/0    | 0.9                    | 0.627                       | 0.54                       | -0.65          |
| 10   |                                   | Ant 1   | 3           | LTE B66/4             | QPSK/20M/50/0    | 1                      | 0.713                       | 0.632                      | -0.52          |
| 11   |                                   | Ant 1   | 4           | n14 (SA Mode)         | BPSK/10M/1/1     | 0.9                    | 0.445                       | 0.379                      | -0.70          |
| 12   |                                   | Ant 1   | 3           | n77/n78 pc3 (SA Mode) | BPSK/100M/135/69 | 1                      | 0.622                       | 0.619                      | -0.02          |
| 13   | Change in operating state         | Ant 1   | 5           | n77/n78 pc3 (SA Mode) | BPSK/100M/1/1    | 1                      | 0.426                       | 0.606                      | -0.11          |
|      |                                   | Ant 1   | 3           | n77/n78 pc3 (SA Mode) | BPSK/100M/135/69 | 1                      | 0.622                       |                            |                |
| 14   | Call_Disconnect_Reestablishment   | Ant 1   | 3           | LTE B66/4             | QPSK/20M/50/0    | 1                      | 0.713                       | 0.639                      | -0.48          |
| 15   | NSA_FR1_Dominant_Power_Switching  | Ant 6   | 4           | LTE B48               | QPSK/20M/50/0    | 1                      | 0.421                       | 0.632                      | -0.20          |
|      |                                   | Ant 0   | 4           | n25/n2 (NSA Mode)     | BPSK/40M/108/54  | 1.1                    | 0.662                       |                            |                |
| 16   | NR_TO_LTE_IRAT_HO                 | Ant 0   | 4           | n25/n2 (SA Mode)      | BPSK/40M/108/54  | 1.1                    | 0.662                       | 0.622                      | -0.27          |
|      |                                   | Ant 6   | 4           | LTE B48               | QPSK/20M/50/0    | 1                      | 0.421                       |                            |                |
| 17   | UL CA                             | Ant 0   | 4           | LTE B66_PCC           | QPSK/20M/1/0     | 1.1                    | 0.753                       | 0.702                      | -0.30          |
|      |                                   |         |             | LTE B66_PCC+SCC       | QPSK/20M/1/0     |                        |                             |                            |                |
| 18   | NTN_Time_Varying_Startup_sequence | Ant 4   | 5           | NTN B255              | BPSK/15k/10      | 1                      | 0.414                       | 0.425                      | 0.11           |

## 7.5 Time-varying Tx power measurement results

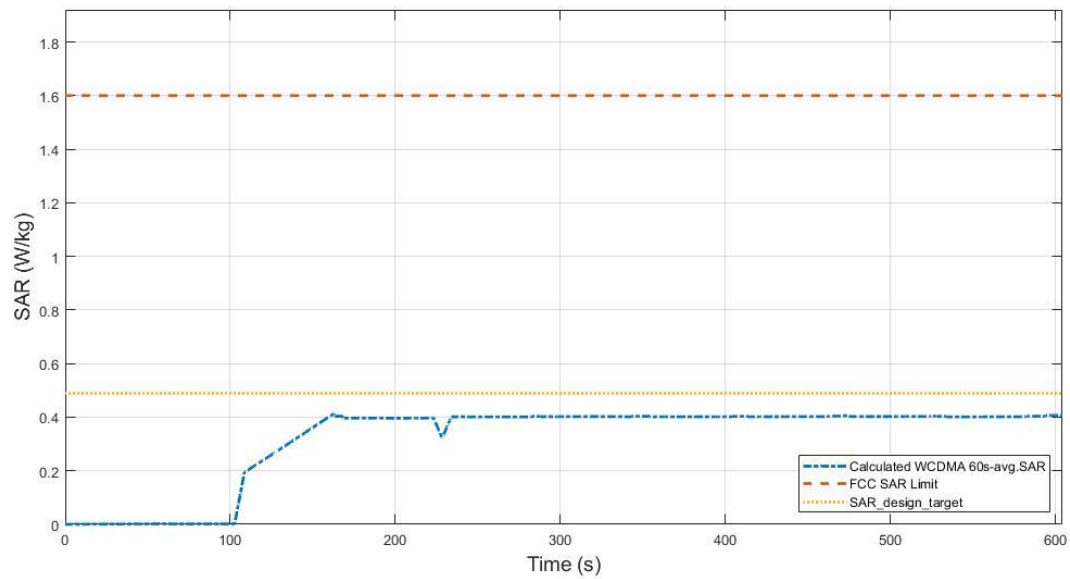
Following the test procedure in Section 3, the conducted Tx power measurement results for all selected test cases are listed in this section. In all conducted Tx power plots, the blue line shows the measured instantaneous power using the power meter, the red line shows the time-averaged Tx power and yellow line shows the Plimit value corresponding to design target. In all SAR plots, the dotted blue line shows the time-averaged 1gSAR while the red line shows the corresponding FCC limit of 1.6W/Kg. Time-varying Tx power measurements were conducted for TC#1 - 12 in Table 7.2.1 by generating the test sequence A or B given in Appendix.

### 7.3.1 TC01: WCDMA B2\_Time\_Varying\_Tx\_Power\_Case\_1



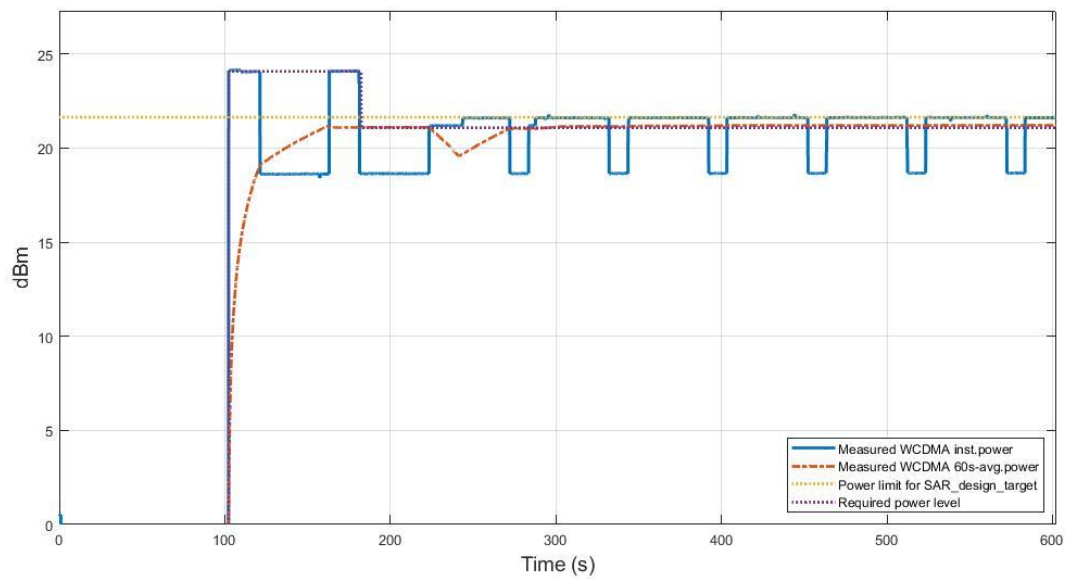
**Figure 7.3-1 Time average conducted power**

Figure 7.3-1 shows the conducted Tx power plot with calculated time-averaged power based on the measured instantaneous Tx power with 1gSAR FCC Limit value. As shown in Figure 7.3-1, it is confirmed for time- average Tx power that the FCC limit was not exceeded, and that the averaged Tx power is smaller than the target power, and it will saturate to target power with little margin. Figure 7.3-2 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



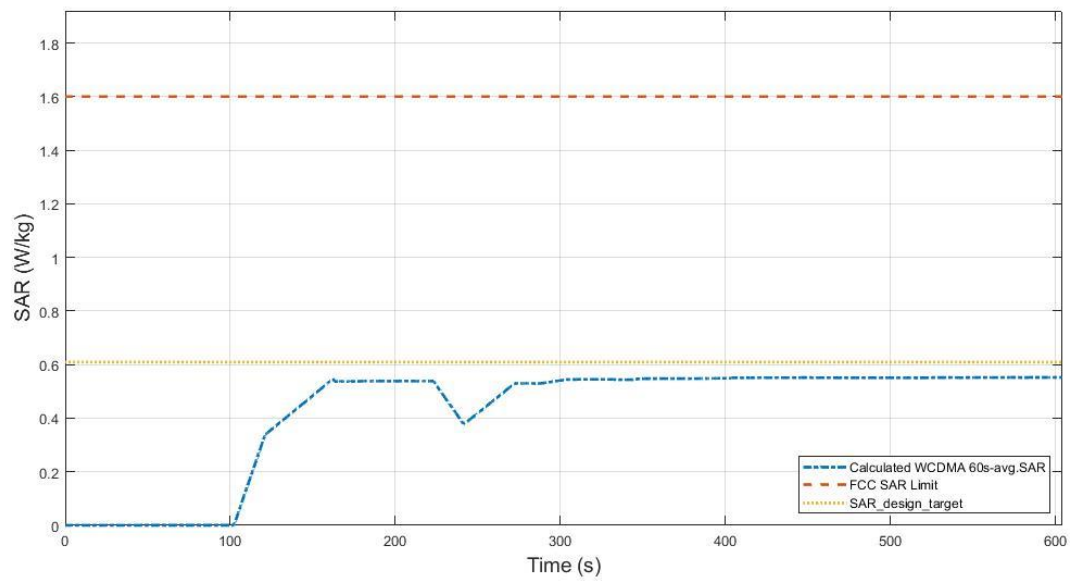
**Figure 7.3-2 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.413 W/kg |
| Device uncertainty                  | 1.7 dB     |

**7.3.2 TC02: WCDMA B5\_Time\_Varying\_Tx\_Power\_Case\_1**


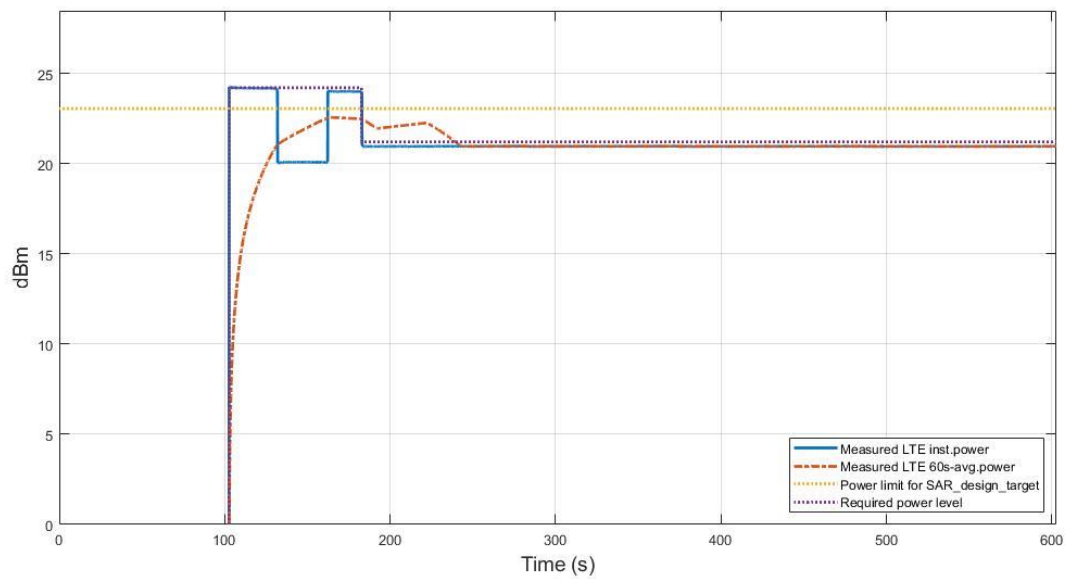
**Figure 7.3-3 Time-average conducted power**

Figure 7.3-3 shows the instantaneous and time-averaged Tx power for this test. As shown in Figure 7.3-3, it is confirmed for time-average Tx power that the FCC limit was not exceeded, and that the averaged Tx power is lower than the value of Plimit. Figure 7.3-4 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



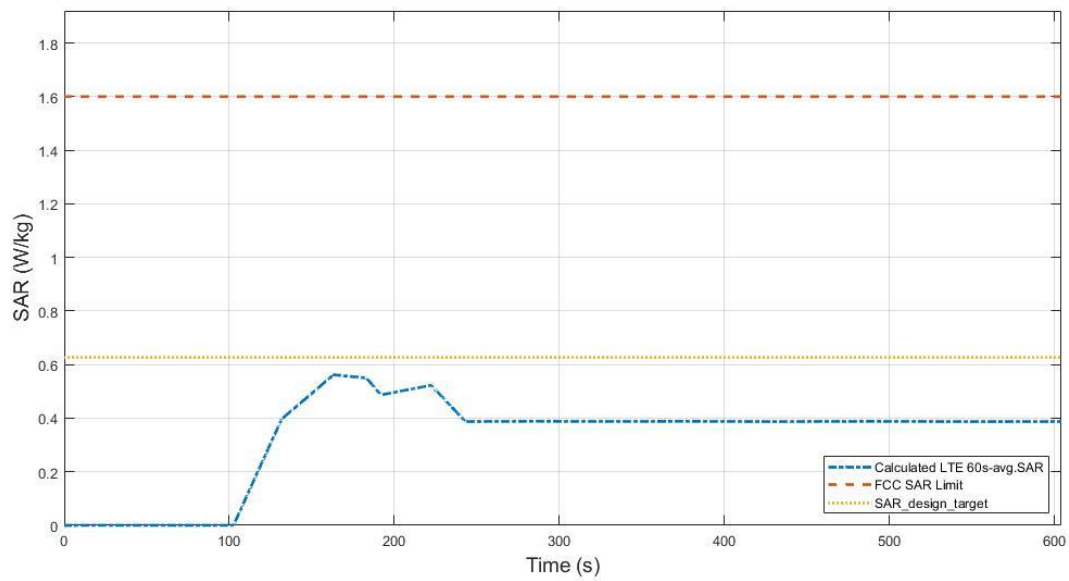
**Figure 7.3-4 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.552 W/kg |
| Device uncertainty                  | 1.4 dB     |

**7.3.3 TC03: LTE Band 14\_Time\_Varying\_Tx\_Power\_Case\_1**


**Figure 7.3-5 Time-average conducted power**

Figure 7.3-5 shows the instantaneous and time-averaged Tx power for this test. As shown in Figure 7.3-5, it is confirmed for time-average Tx power that the FCC limit was not exceeded, and that the averaged Tx power is lower than the value of Plimit. Figure 7.3-6 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



**Figure 7.3-6 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.562 W/kg |
| Device uncertainty                  | 0.9 dB     |

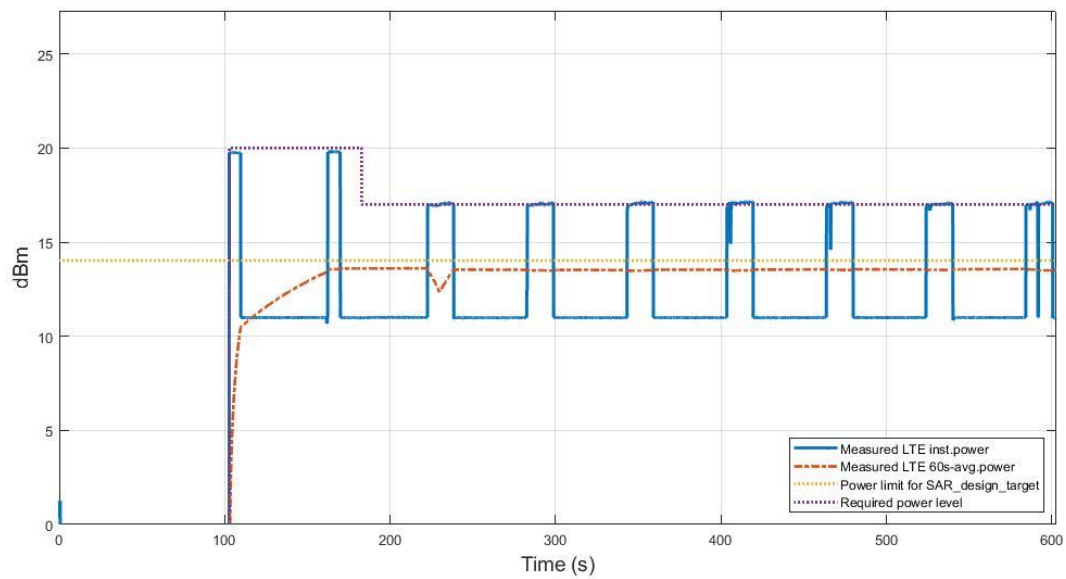
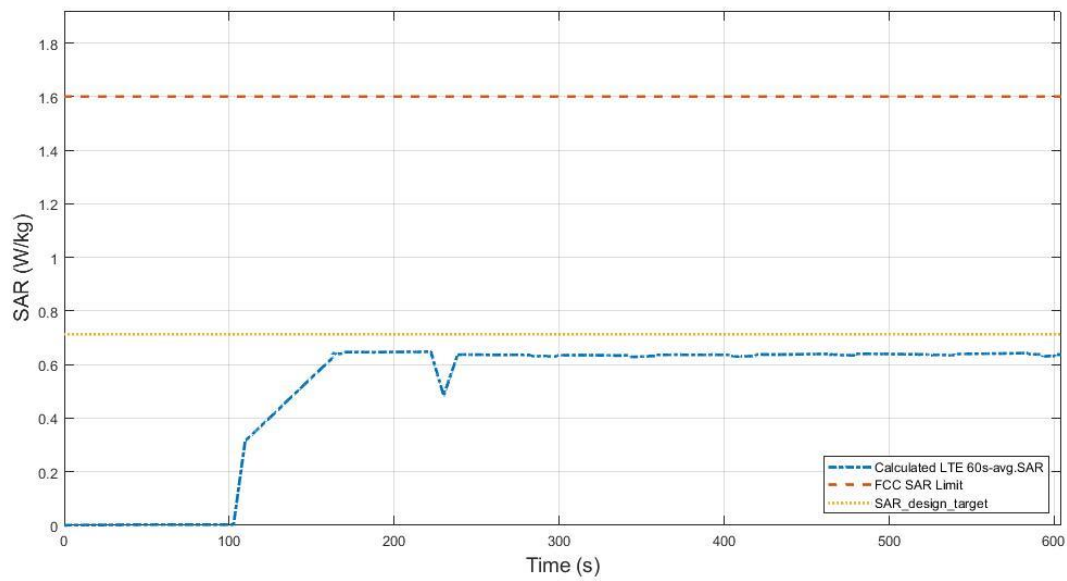
**7.3.4 TC04: LTE Band 66/4\_Time\_Varying\_Tx\_Power\_Case\_1**

**Figure 7.3-7 Time-average conducted power**

Figure 7.3-7 shows the instantaneous and time-averaged Tx power for this test. As shown in Figure 7.3-7, it is confirmed for time-average Tx power that the FCC limit was not exceeded, and that the averaged Tx power is lower than the value of Plimit. Figure 7.3-8 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



**Figure 7.3-8 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.649 W/kg |
| Device uncertainty                  | 1 dB       |

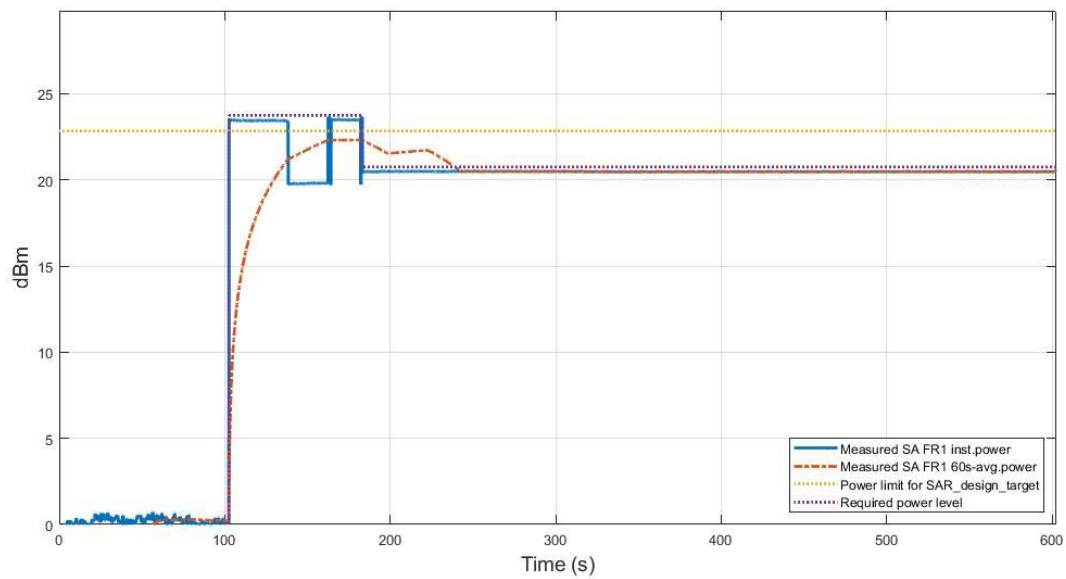
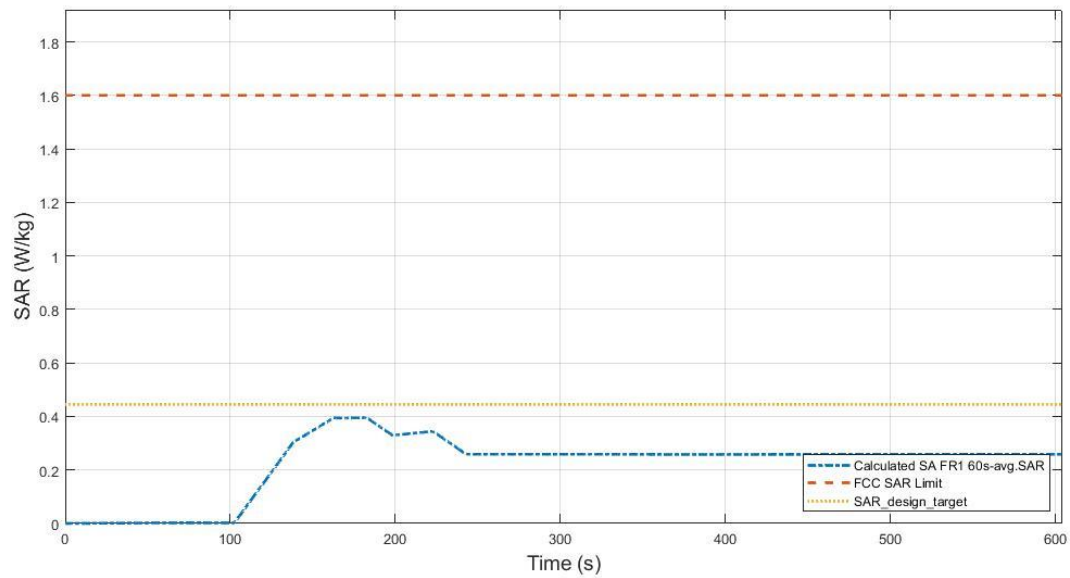
**7.3.5 TC05: FR1 n14\_Time\_Varying\_Tx\_Power\_Case\_1**

**Figure 7.3-9 Conducted Tx power**

Figure 7.3-9 shows the instantaneous and time-averaged Tx power for this test. As shown in Figure 7.3-9, it is confirmed for time-average Tx power that the FCC limit was not exceeded, and that the averaged Tx power is lower than the value of Plimit. Figure 7.3-10 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



**Figure 7.3-10 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.395 W/kg |
| Device uncertainty                  | 0.9 dB     |

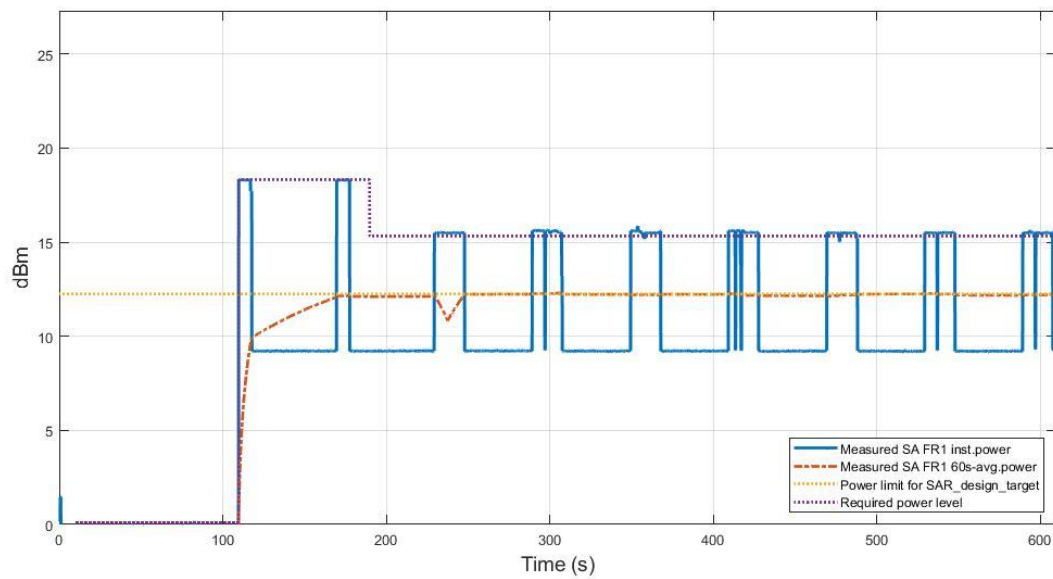
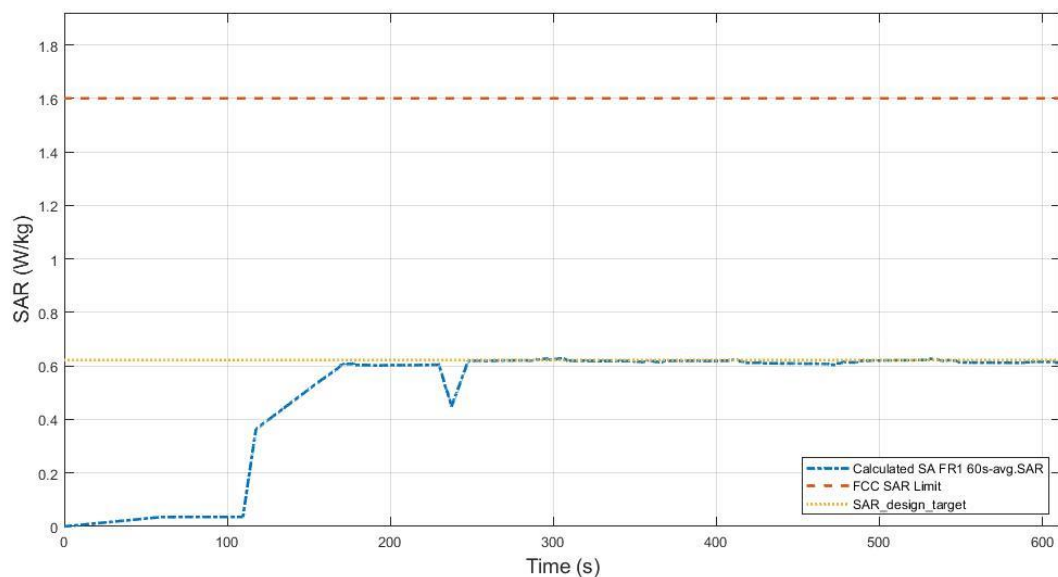
**7.3.6 TC06: FR1 n77/n78\_Time\_Varying\_Tx\_Power\_Case\_1**

**Figure 7.3-11 Conducted Tx power**

Figure 7.3-11 shows the instantaneous and time-averaged Tx power for this test. As shown in Figure 7.3-11, it is confirmed for time-average Tx power that the FCC limit was not exceeded, and that the averaged Tx power is lower than the value of Plimit. Figure 7.3-12 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



**Figure 7.3-12 Total time-averaged SAR in F\_TC04**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.629 W/kg |
| Device uncertainty                  | 1 dB       |

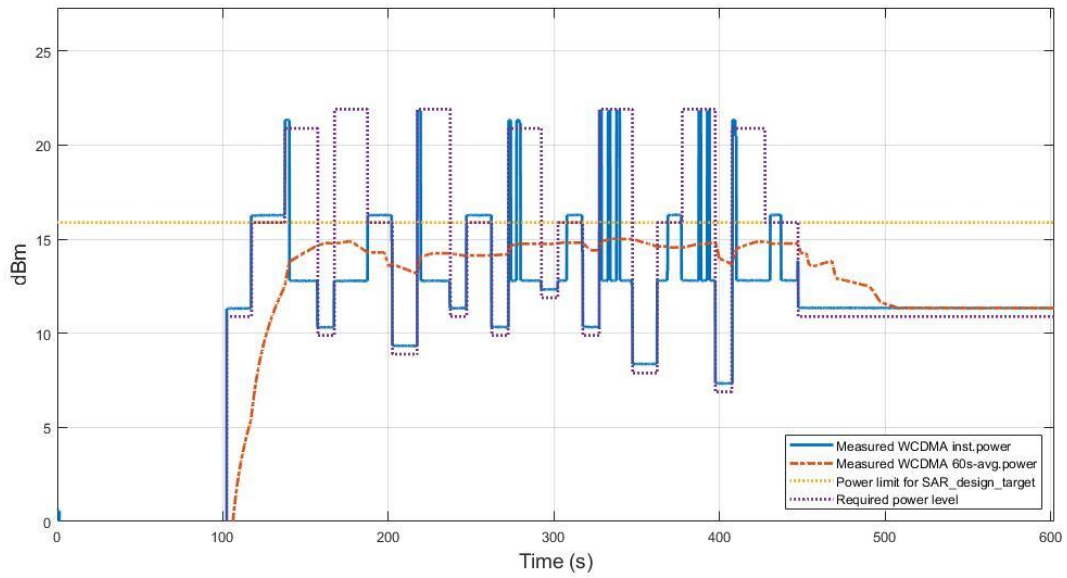
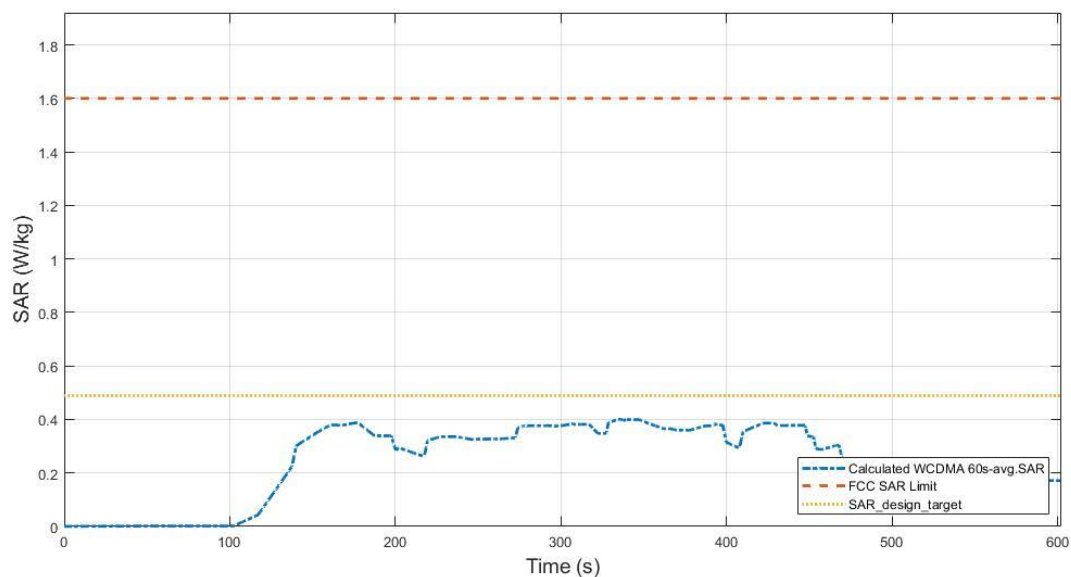
**7.3.7 TC07: WCDMA B2\_Time\_Varying\_Tx\_Power\_Case\_2**

**Figure 7.3-13 Conducted Tx power**

Figure 7.3-13 shows the instantaneous and time-averaged Tx power with test sequence B. Figure 7.3-14 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



**Figure 7.3-14 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.402 W/kg |
| Device uncertainty                  | 1.7 dB     |

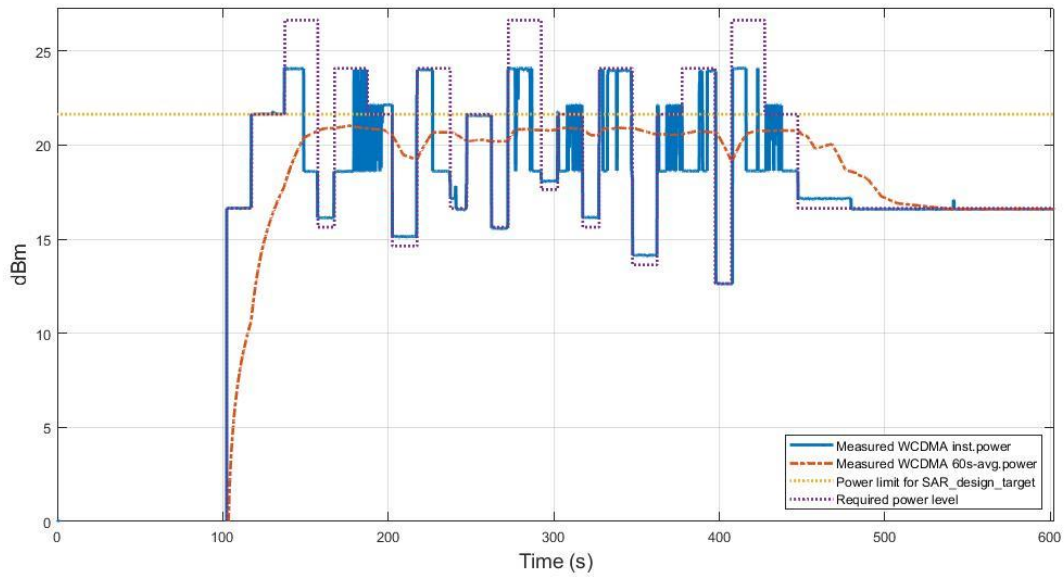
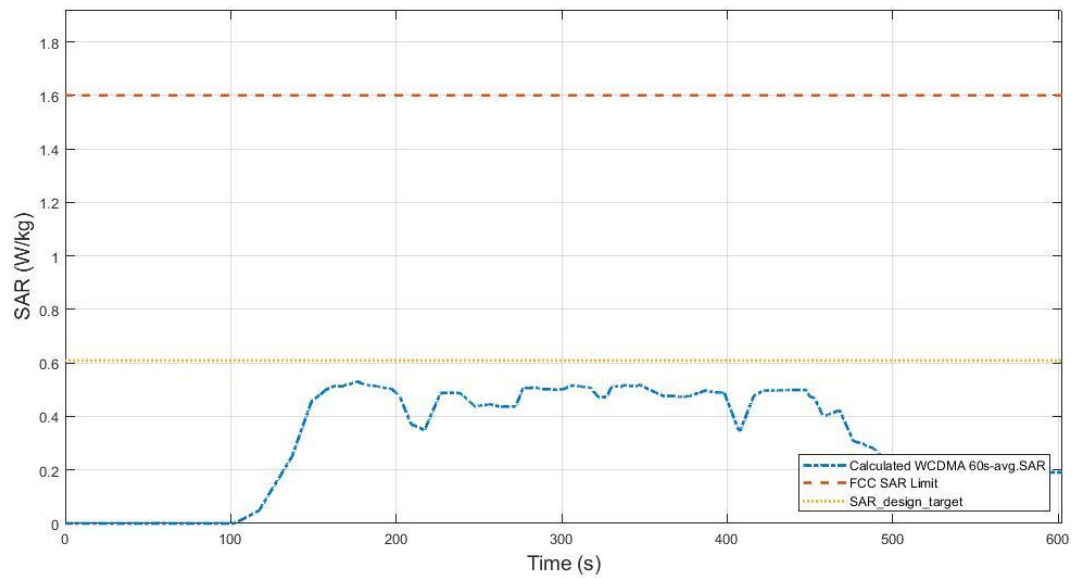
**7.3.8 TC08: WCDMA B5\_Time\_Varying\_Tx\_Power\_Case\_2**

**Figure 7.3-15 Conducted Tx power**

Figure 7.3-15 shows the instantaneous and time-averaged Tx power with test sequence B. Figure 7.3-16 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



**Figure 7.3-16 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.531 W/kg |
| Device uncertainty                  | 1.4 dB     |

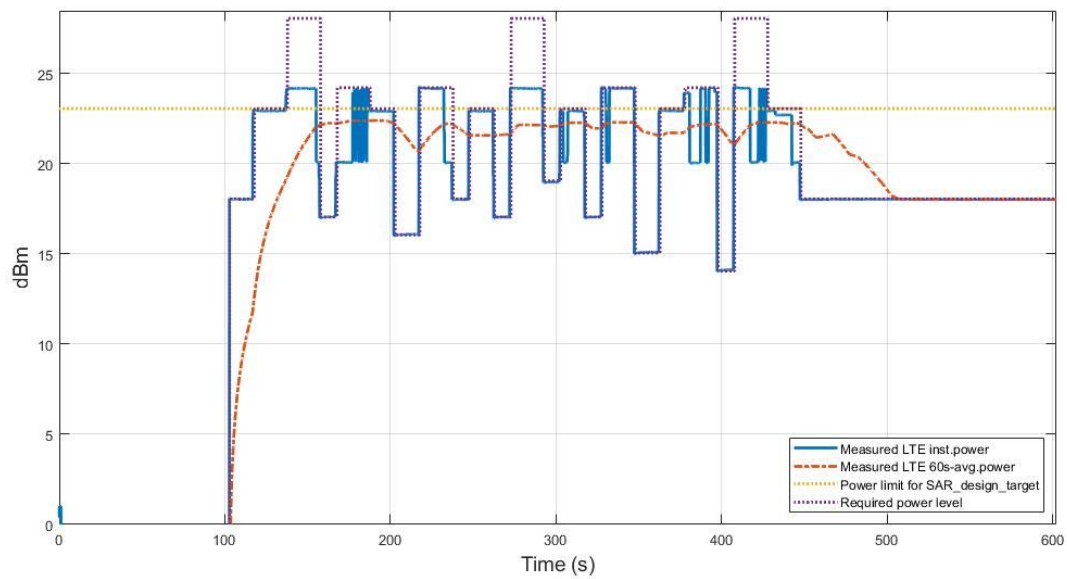
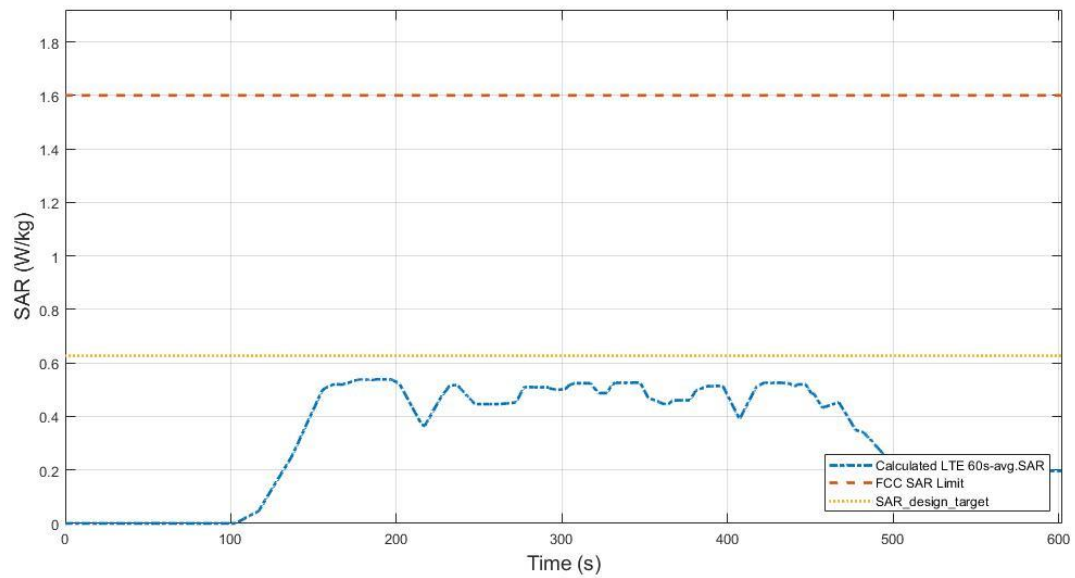
**7.3.9 TC09: LTE Band 14\_Time\_Varying\_Tx\_Power\_Case\_2**

**Figure 7.3-17 Conducted Tx power**

Figure 7.3-17 shows the instantaneous and time-averaged Tx power with test sequence B. Figure 7.3-18 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



**Figure 7.3-18 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.540 W/kg |
| Device uncertainty                  | 0.9 dB     |

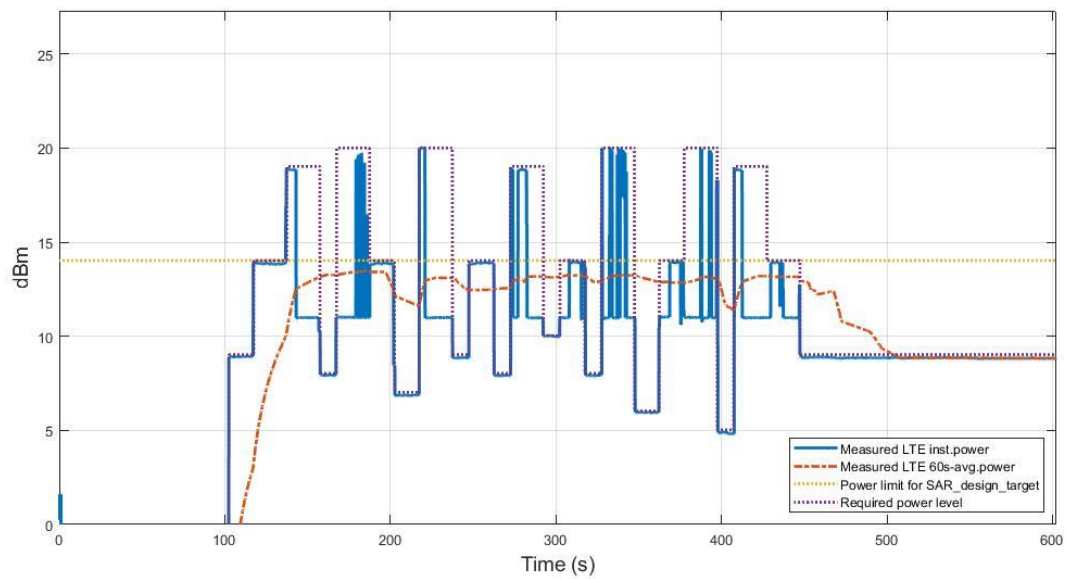
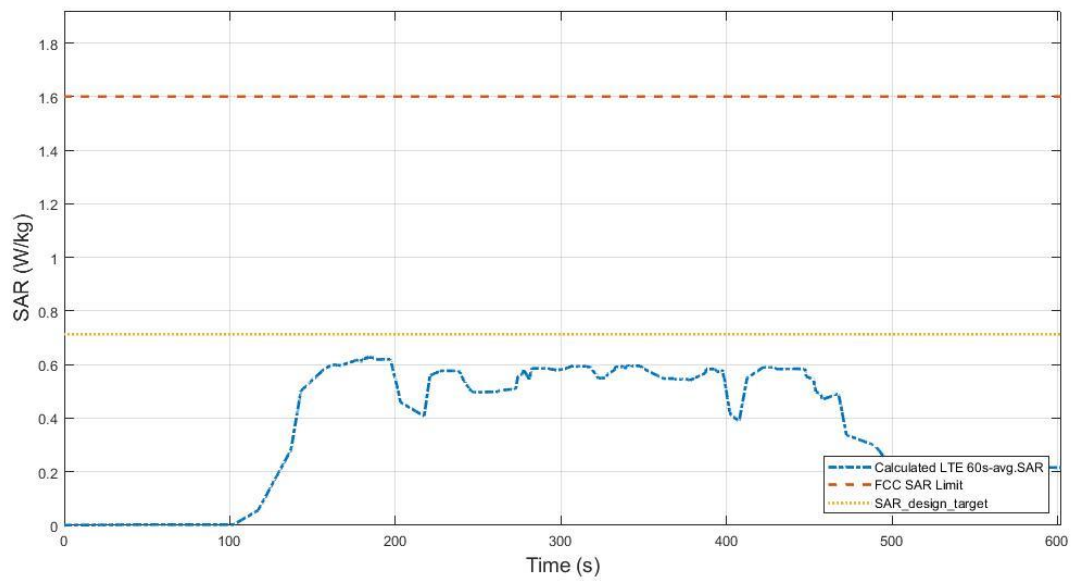
**7.3.10 TC10: LTE Band 66/4\_Time\_Varying\_Tx\_Power\_Case\_2**

**Figure 7.3-19 Conducted Tx power**

Figure 7.3-19 shows the instantaneous and time-averaged Tx power with test sequence B. Figure 7.3-20 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



**Figure 7.3-20 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.632 W/kg |
| Device uncertainty                  | 1 dB       |

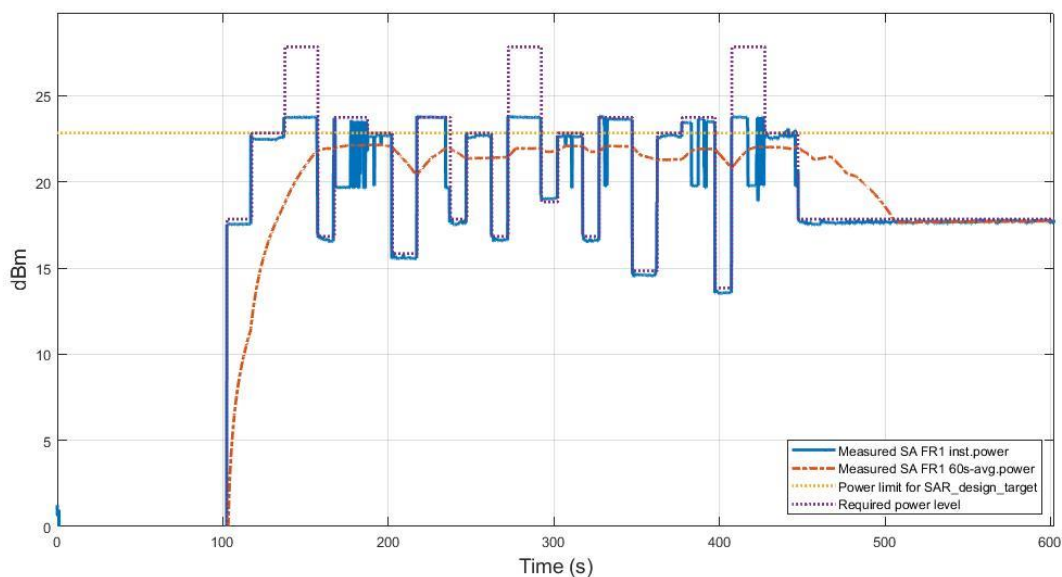
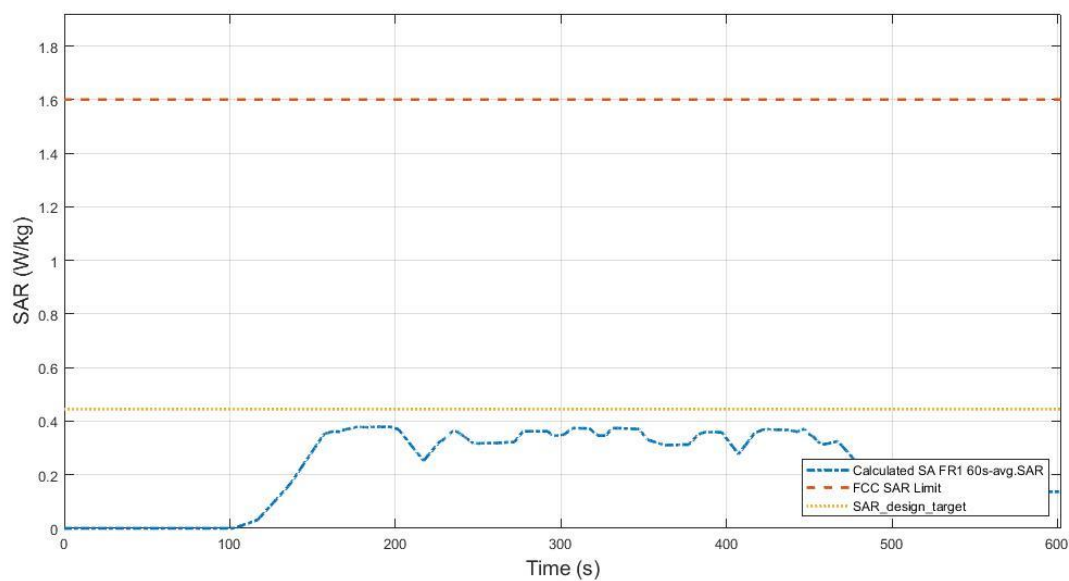
**7.3.11 TC11: FR1 n14\_Time\_Varying\_Tx\_Power\_Case\_2**

**Figure 7.3-21 Conducted Tx power**

Figure 7.3-21 shows the instantaneous and time-averaged Tx power with test sequence B. Figure 7.3-22 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



**Figure 7.3-22 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.379 W/kg |
| Device uncertainty                  | 0.9 dB     |

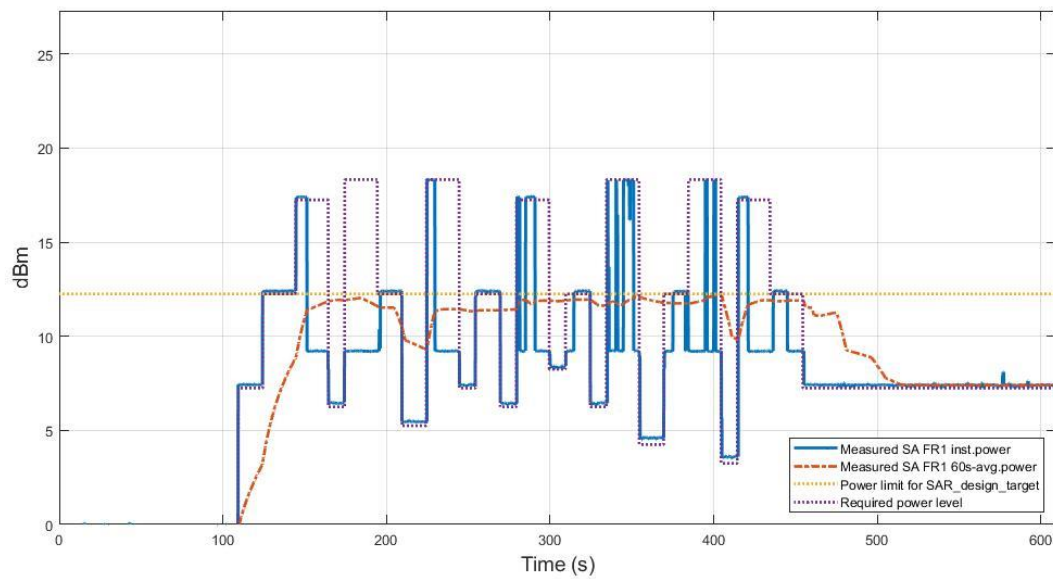
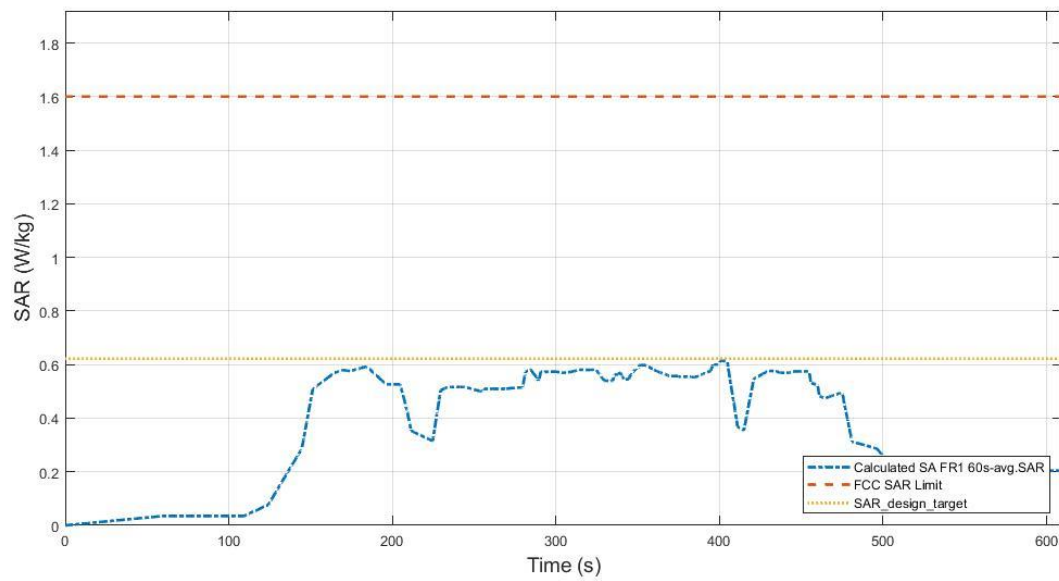
**7.3.12 TC12: FR1 n77/n78\_Time\_Varying\_Tx\_Power\_Case\_2**

**Figure 7.3-23 Conducted Tx power**

Figure 7.3-23 shows the instantaneous and time-averaged Tx power with test sequence B. Figure 7.3-24 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



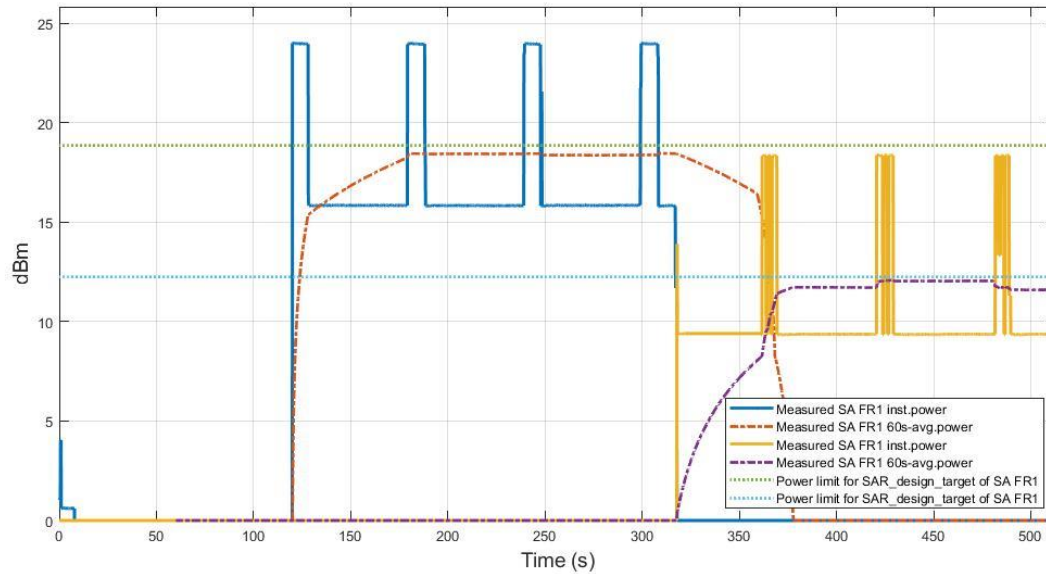
**Figure 7.3-24 Total time-averaged SAR**

|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.619 W/kg |
| Device uncertainty                  | 1 dB       |

## 7.6 Change in Power Index

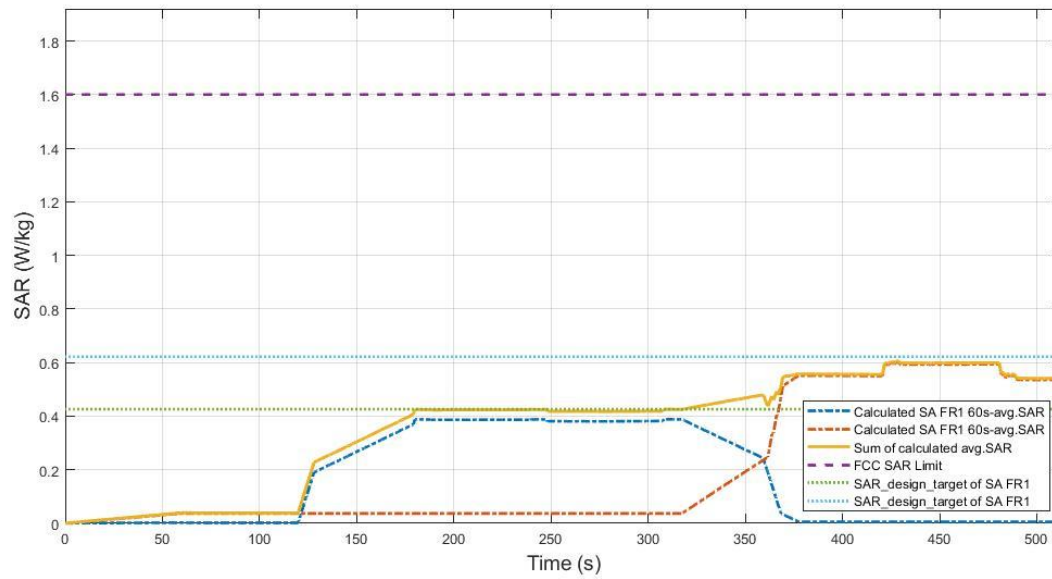
The test results in this section are obtained following the procedure in Section 3. The test cases correspond to TC#13 in Table 7.2.1.

### 7.4.1 TC13: SA\_FR1 n77/n78\_RF\_SAR\_Index\_Change



**Figure 7.4-1 Conducted Tx power for SAR states change**

Figure 7.4-1 shows the instantaneous and time-averaged conducted Tx power for the duration of the test. Figure 7.4-2 shows the time-averaged 1gSAR value for each of power index 5 and power index 3 value, as well as the total SAR value.



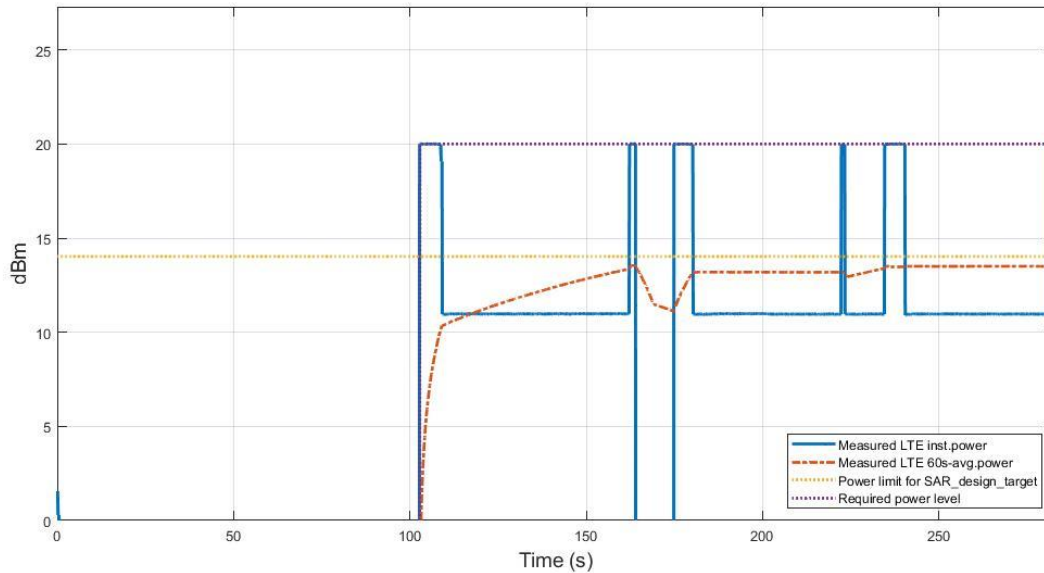
**Figure 7.4-2 Total time-averaged SAR**

|                                                   |            |
|---------------------------------------------------|------------|
| FCC 1gSAR limit                                   | 1.6 W/kg   |
| Max sum of calculated average SARs (yellow curve) | 0.606 W/kg |
| Device uncertainty                                | 1 dB       |

## 7.7 Change in call test results

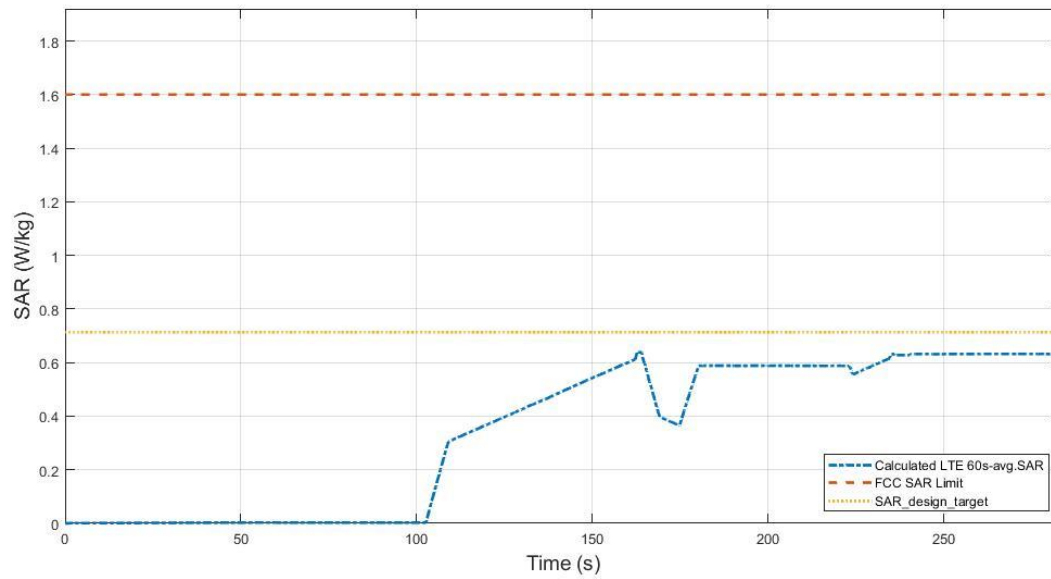
The test results in this section are obtained following the procedure in Section 3. The test case corresponds to TC#14 in Table 7.2.1.

### 7.5.1 TC14: LTE Band 66/4\_Call\_Disconnect\_Reestablishment



**Figure 7.5-1 Conducted Tx power in Call Disconnect Reestablishment**

Figure 7.6-1 shows the instantaneous and time-averaged Tx power for this test. The call disconnected around 160s and resumed after 10s. It is confirmed for time-average Tx power that the FCC limit was not exceeded, and that the averaged Tx power is lower than the value of P<sub>limit</sub>. Figure 7.6-2 shows the plot of calculated time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg. Looking at the results, it can be seen that even if transmission is stopped due to a call drop, the SAR value measured for a period of time window is stored in the window section and is continuously checked.



**Figure 7.5-2 Total time-averaged SAR**

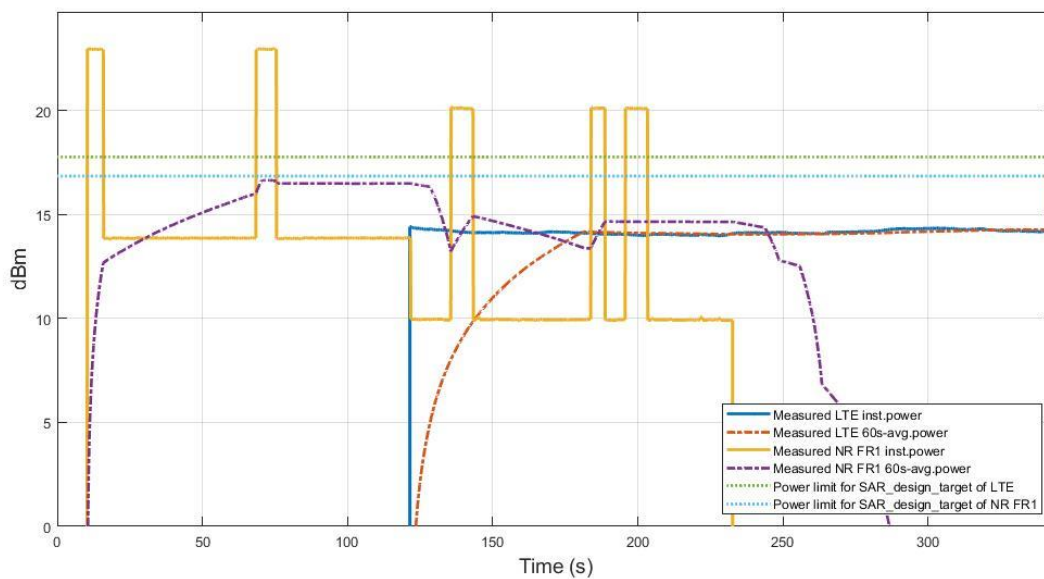
|                                     |            |
|-------------------------------------|------------|
| FCC 1gSAR limit                     | 1.6 W/kg   |
| Max time average 1gSAR (blue curve) | 0.639 W/kg |
| Device uncertainty                  | 1 dB       |

## 7.8 Switch in SAR exposure test results

The test results in this section are obtained following the procedure in Section 3. The test cases correspond to TC#15 in Table 7.2.1.

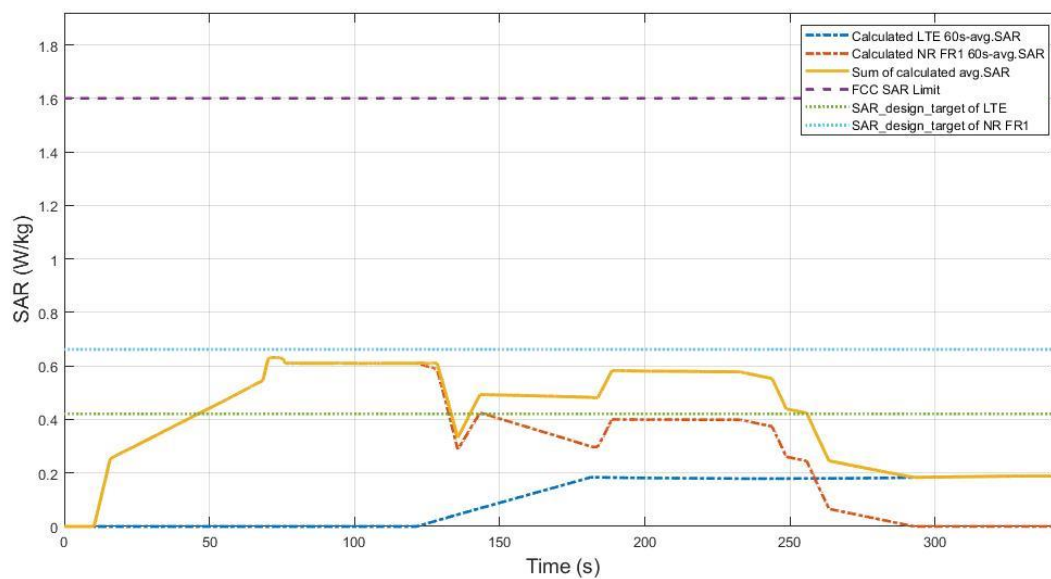
### 7.6.1TC15: NSA\_FR1\_Dominant\_Power\_Switching (ENDC LTE Band 48\_n25/n2)

In this LTE Band 48+FR1 n25/n2 NSA scenario, we first establish LTE and NR call. In the first part of test, LTE is sent to lowest transmit power using “ALL DOWN” power control commands from call box while NR is sent to maximum power using “ALL UP” power control commands from call box. This would correspond to FR1 dominant SAR scenario and lasts about 110s. In the second part of test, LTE is sent “ALL UP” commands and transmissions are continued, resulting in LTE+FR1 SAR scenario lasting another 110s. In the third part of test, NR is sent “ALL DOWN” power control commands so that it becomes an FR1 dominant SAR scenario for 110s. Finally, both LTE and NR connections are released.



**Figure 7.6-1 Time average SAR of LTE B48 and FR1 n25/n2 in EN-DC case**

Figure 7.8-1 shows the instantaneous and time-averaged Tx power for both LTE band B48 and NR FR1 band n25/n2 versus time. When both LTE and FR1 operate, the SAR value was the highest instantaneously, but it can be seen that sum of average power in LTE and FR1 decreases again as soon as it is turned off. Figure 7.7-2 shows the computed time-averaged SAR value for LTE and FR1 as well as the sum. It was confirmed that algorithm operated under the SAR design target + total uncertainty, while also being under the FCC limit of 1.6W/Kg at all times. After the operation of FR1 is turned off, it can also be seen that the average power of LTE increases.

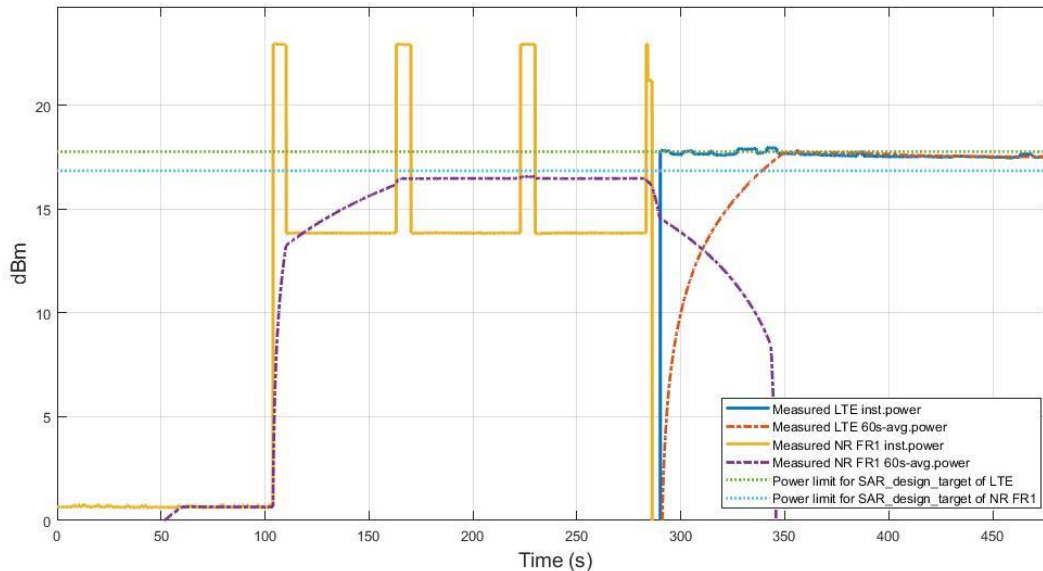

**Figure 7.6-2 Total time-averaged SAR**

|                                                   |            |
|---------------------------------------------------|------------|
| FCC 1gSAR limit                                   | 1.6 W/kg   |
| Max sum of calculated average SARs (yellow curve) | 0.632 W/kg |
| Device uncertainty                                | 1.1 dB     |

## 7.9 Re-selection in call test results

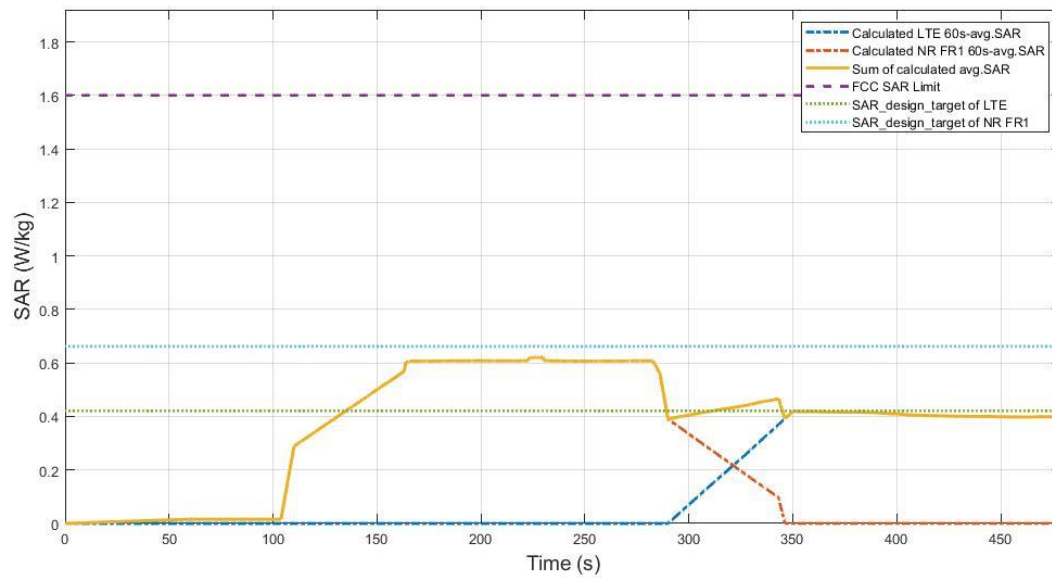
The test results in this section are obtained following the procedure in Section 3. The test cases correspond to TC#16 in Table 7.2.1.

### 7.8.1 TC16: FR1 n25/n2 to LTE Band 48 IRAT Re-selection



**Figure 7.8-1 Conducted Tx power for SAR IRAT re-selection**

Figure 7.8-1 shows the instantaneous and time-averaged conducted Tx power for both LTE Band 48 and NR FR1 n25/n2 for the duration of the test. Around time stamp of ~280s, a RAT re-selection from LTE Band 48 to NR FR1 n25/n2 was executed, resulting in reduction of time-averaged power of Band 48 and simultaneous increase in time-averaged power of n25/n2. Figure 7.8-2 shows the time-averaged 1gSAR value for each of LTE Band 48 and NR FR1 n25/n2, as well as the total SAR value.


**Figure 7.8-2 Total time-averaged SAR**

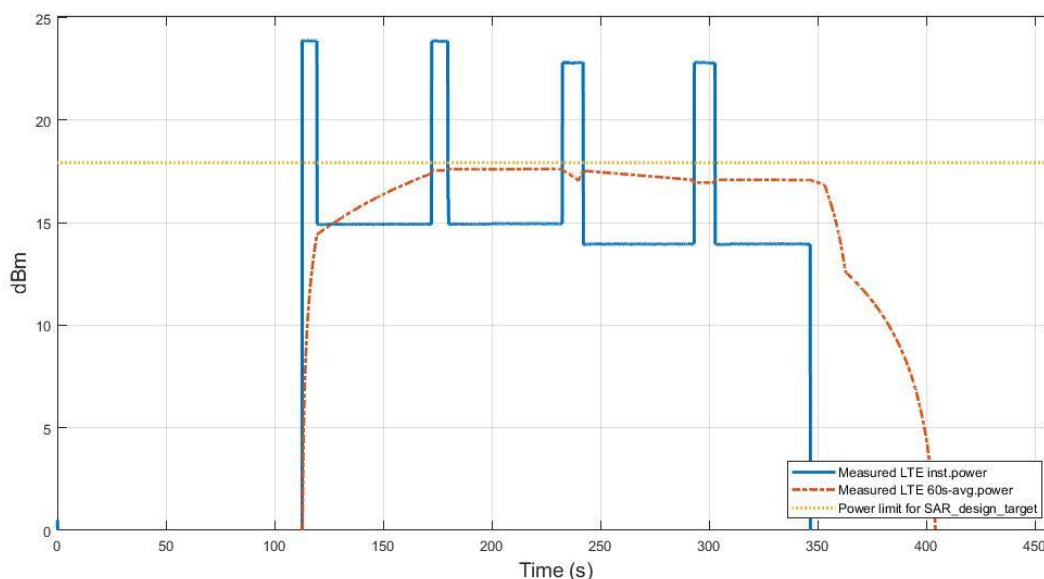
|                                                   |            |
|---------------------------------------------------|------------|
| FCC 1gSAR limit                                   | 1.6 W/kg   |
| Max sum of calculated average SARs (yellow curve) | 0.622 W/kg |
| Device uncertainty                                | 1.1 dB     |

## 7.10 LTE Uplink CA

The test results in this section are obtained following the procedure in Section 3. The test cases correspond to TC#17 in Table 7.2.1.

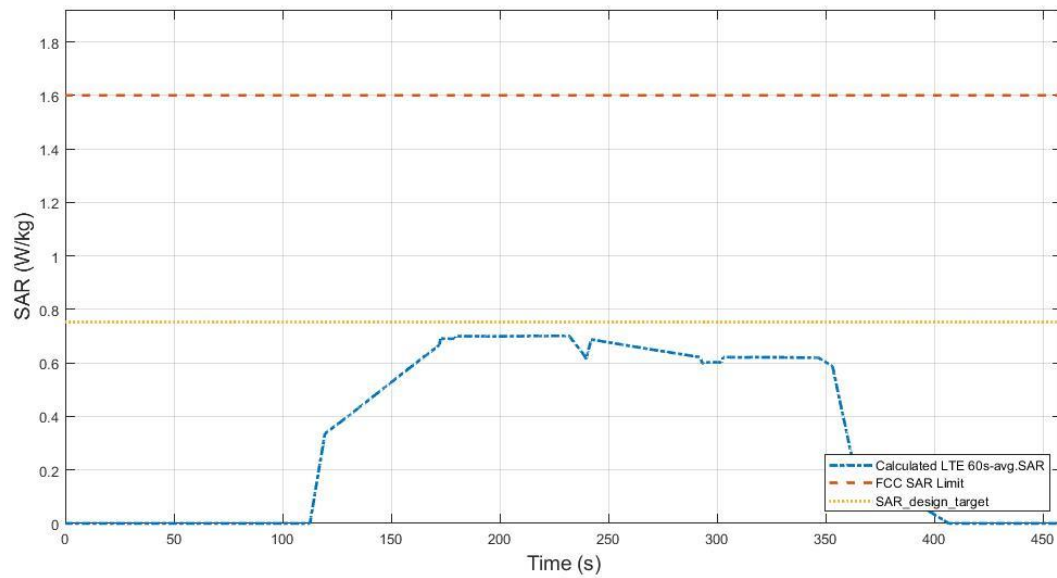
### 7.9.1TC17: LTE\_UL\_CA (LTE Band 66)

Figure 7.10-1 shows the conducted Tx power plot with calculated time-averaged power based on the measured instantaneous Tx power with 1gSAR FCC Limit value. In this test, SAR\_design\_target would be 0.753W/kg at 18.2dBm. The setting value and measured values are described in Table 7.2.1. An MPR of 2dB is configured within this band so with 100% duty cycle the maximum power should be reaching 23.9dBm.



**Figure 7.9-1 Conducted transmitted power of LTE Band 66 in UL CA**

Next after 120s, an intra-band CA is configured (CA\_7C) where a new CC is added and the transmission is continued for another 120s. As shown in Figure 7.9-1, the total power of the two CC is kept almost the same as in the single CC transmission. Average power in Figure 7.9-1 assures the compliance of the average power of the transmitted signal which is below 18.2dBm and consequently the average SAR in Figure 7.9-2 is below 1W/kg which is below the FCC limit of 1.6W/kg



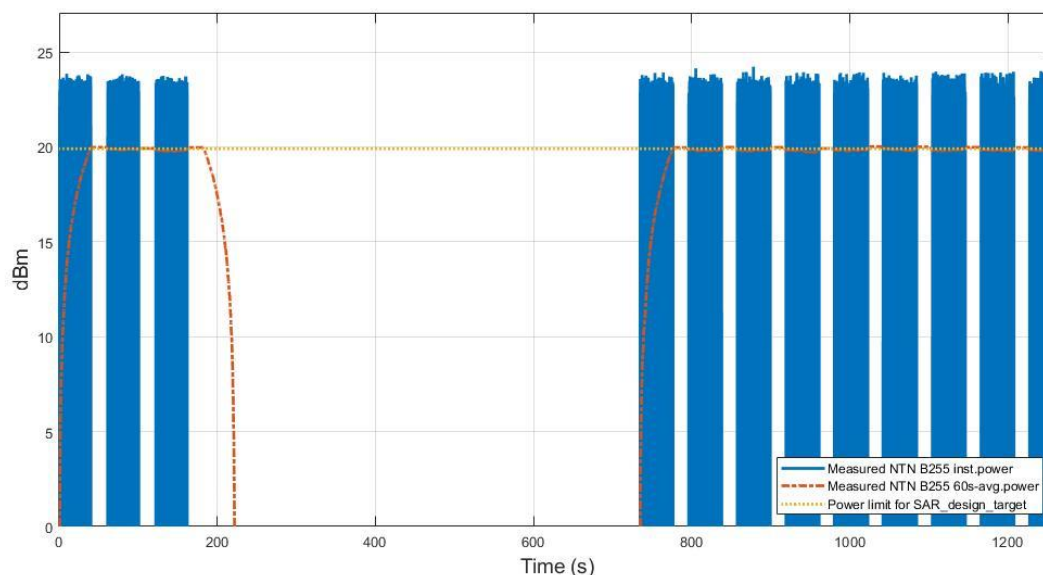
**Figure 7.9-2 Total time-averaged SAR**

|                                                 |            |
|-------------------------------------------------|------------|
| FCC 1gSAR limit                                 | 1.6 W/kg   |
| Max sum of calculated average SARs (blue curve) | 0.702 W/kg |
| Device uncertainty                              | 1.1 dB     |

## 7.11 NTN with time-varying startup test sequence

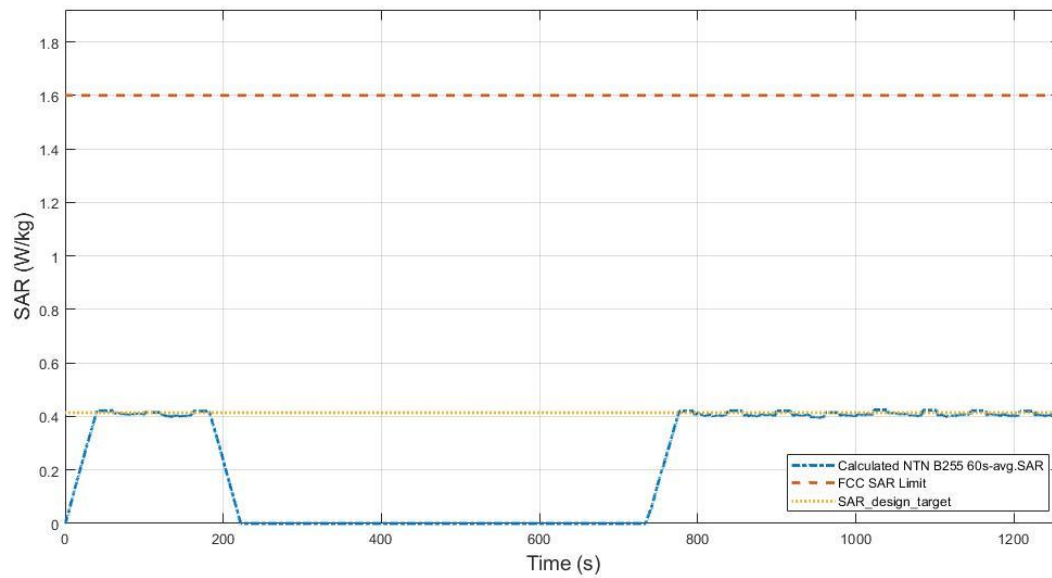
The test results in this section are obtained following the procedure in Section 3. The test cases correspond to TC#18 in Table 7.2.1.

### 7.11.1 TC18: NTN\_B255\_Time\_Varying\_Startup\_sequence



**Figure 7.11-1 Conducted Tx power for NTN\_Time\_Varying\_Startup\_sequence**

Figure 7.11-1 shows the conducted Tx power plot with calculated time-averaged power based on the measured instantaneous Tx power with 1gSAR FCC Limit value. As shown in Figure 7.11-1, it is confirmed for 60s time average Tx power that the FCC limit was not exceeded, and that the averaged Tx power is smaller than the target power, and it will saturate to target power with little margin. Figure 7.11-2 shows the plot of calculated 60s time-averaged 1gSAR for this test demonstrating that exposure is well below the FCC limit of 1.6W/Kg.



**Figure 7.11-2 Total time-averaged SAR**

|                                                   |            |
|---------------------------------------------------|------------|
| FCC 1gSAR limit                                   | 1.6 W/kg   |
| Max sum of calculated average SARs (yellow curve) | 0.425 W/kg |
| Device uncertainty                                | 1 dB       |

## **8. Conclusions**

Samsung S.LSI TAS feature employed in this product has been validated through the conducted power measurement for sub-6, radiated power measurement for FR2 as demonstrated in this report, the power limiting enforcement is effective and the total normalized time-averaged RF exposure does not exceed 1.0 for all the transmission scenarios. Therefore, the EUT complies with FCC RF exposure requirement.

## **9. Annex**

### **9.1 Test sequence is generated based on below parameters of the DUT:**

1. Measured maximum power (Pmax)
2. Measured Tx power (Plimit) to satisfy SAR Compliance
3. Setup time to make SAR Remaining be full
4. Do test according to test sequence

### **9.2 Test Sequence A waveform:**

- Based on the parameters above, the Test Sequence A is generated with two power levels. One is maximum power level and the other is lower power level. The lower power level is defined as 3dB lower value than maximum power level. At first, maximum power level is applied for 80 seconds (SAR\_time\_window x 1.2). After then, lower power level is used until this test is finished.

### **9.3 Test Sequence B waveform:**

- Based on the parameters above, the Test Type B is generated with pre-defined power levels, which is described in Table 10.3.1.

**Table 10.3.1 Table of test sequence B**

| Time duration (second) | Power level (dB) |
|------------------------|------------------|
| 15                     | Plimit - 5       |
| 20                     | Plimit           |
| 20                     | Plimit + 5       |
| 10                     | Plimit – 6       |
| 20                     | Pmax             |
| 15                     | Plimit           |
| 15                     | Plimit -7        |
| 20                     | Pmax             |
| 10                     | Plimit-5         |
| 15                     | Plimit           |
| 10                     | Plimit-6         |
| 20                     | Plimit + 5       |
| 10                     | Plimit – 4       |
| 15                     | Plimit           |
| 10                     | Plimit – 6       |
| 20                     | Pmax             |
| 15                     | Plimit-8         |
| 15                     | Plimit           |
| 20                     | Pmax             |
| 10                     | Plimit – 9       |
| 20                     | Plimit + 5       |
| 20                     | Plimit           |
| 15                     | Plimit – 5       |

**10. Test Equipment List**

| Manufacturer | Name of Equipment                   | Type/Model                   | Serial Number | Calibration         |               |
|--------------|-------------------------------------|------------------------------|---------------|---------------------|---------------|
|              |                                     |                              |               | Last Cal.           | Due Date      |
| Anritsu      | Base Station                        | MT8821                       | 6201074414    | Aug. 20, 2024       | Aug. 19, 2025 |
| Anritsu      | Base Station                        | MT8000                       | 6262186342    | Oct. 29, 2024       | Oct. 28, 2025 |
| Testo        | Hygro meter                         | 608-H1                       | 45196600      | Oct. 28, 2024       | Oct. 27, 2025 |
| Anritsu      | Signal Generator                    | MG3710A                      | 6201502524    | Sep. 24, 2024       | Sep. 23, 2025 |
| Anritsu      | Power Meter                         | ML2496A                      | 2119003       | Jul. 16, 2024       | Jul. 15, 2025 |
| Anritsu      | Power Sensor                        | MA2411B                      | 1911333       | Jul. 15, 2024       | Jul. 14, 2025 |
| Anritsu      | Power Sensor                        | MA2411B                      | 1911334       | Jul. 15, 2024       | Jul. 14, 2025 |
| Keysight     | CATR measurement antenna            | SAF-2434231535-328-S1-280-DP | 16920-01      | Note <sup>(1)</sup> |               |
| Warison      | 10-50 GHz Directional Coupler       | WCOU-10-50S-10               | WR889BMC4B1   | Note <sup>(1)</sup> |               |
| ATM          | 500M-18GHz Dual Directional Coupler | C122H-10                     | P610410z-02   | Note <sup>(1)</sup> |               |
| Woken        | Attenuator 1                        | WK0602-XX                    | N/A           | Note <sup>(1)</sup> |               |
| Woken        | Attenuator 2                        | PE7005-10                    | N/A           | Note <sup>(1)</sup> |               |
| Woken        | Attenuator 3                        | PE7005- 3                    | N/A           | Note <sup>(1)</sup> |               |

Note <sup>(1)</sup>: Prior to conducted or EIRP power measurement, the path loss from the EUT to the power meter, which includes the RF cable, attenuator and directional coupler, was measured and determined.