HCT Co., Ltd.
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# PART 2 : RF Exposure Compliance Test Report

| | |
|---|---|
| **Applicant Name:**<br>**SAMSUNG Electronics Co., Ltd.**<br>129, Samsung-ro, Yeongtong-gu, Suwon-Si,<br>Gyeonggi-do, 16677 Rep. of Korea | **Date of Issue:** Jan.27, 2022<br>**Test Report No.:** HCT-SR-2201-FC017<br>**Test Site: HCT CO., LTD.** |

**FCC ID:** **A3LSMX808U**

| | |
|---|---|
| **Equipment Type:** | **Portable Tablet** |
| **Application Type:** | **Class II permissive change** |
| **FCC Rule Part(s):** | **CFR §2.1093** |
| **Model name:** | **SM-X808U** |
| **Date of Test:** | **Jan. 24, 2022 ~ Jan.25, 2022** |
| **Results:** | **Pass** |

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested By

Jee-ILL, Lee
Test Engineer
SAR Team
Certification Division

Reviewed By

Yun-jeang, Heo
Technical Manager
SAR Team
Certification Division

**REVISION HISTORY**

The revision history for this test report is shown in table.

| Revision No. | Date of Issue | Description |
|---|---|---|
| 0 | Jan.27, 2022 | Initial Release |

This test results were applied only to the test methods required by the standard.

The above Test Report is not related to the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA.

# Table of Contents

# 1. RF Exposure Limits

## 1.1RF Exposure Limits for Frequencies < 6 GHz

| HUMAN EXPOSURE | UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g) | CONTROLLED ENVIRONMENT Occupational (W/kg) or (mW/g) |
|---|---|---|
| SPATIAL PEAK SAR * (Partial Body) | 1.6 | 8.0 |
| SPATIAL AVERAGE SAR ** (Whole Body) | 0.08 | 0.4 |
| SPATIAL PEAK SAR *** (Hands / Feet / Ankle / Wrist) | 4.0 | 20.0 |

**NOTES:**

* The Spatial Peak value of the SAR averaged over any 1 g of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

** The Spatial Average value of the SAR averaged over the whole-body.

*** The Spatial Peak value of the SAR averaged over any 10 g of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

**Uncontrolled Environments** are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be mad fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

**Controlled Environments** are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e.as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

## 1.2 RF Exposure Limits for Frequencies > 6 GHz

Per §1.1310 (d)(3), the MPE limits are applied for frequencies above 6 GHz. Power Density is expressed in unitsof W/m² or mW/cm².
Peak Spatially Averaged Power Density was evaluated over a circular area of 4 cm2 per interim FCC Guidance fornear-field power density evaluations per October 2018 TCB Workshop notes

| Frequency range (MHz) | Power density (mW/cm ²) | Averaging time (minutes) |
|---|---|---|
| (A) Limits for Occupational/Controlled Exposure | | |
| 1,500-100,000 | 5 | 6 |
| (B) Limits for General Population/Uncontrolled Exposure | | |
| 1,500-100,000 | 1 | 30 |

Note: 1.0 mW/cm$^2$ is 10 W/m$^2$

## 1.3 TInterim Guidance for Time Averaging

Per October 2018 TCB Workshop Notes, the below time-averaging windows can be used for assessing time-averaged exposures for devices that are capable of actively monitoring and adjusting power output over time to comply with exposure limits.

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

# 2. Test Location

## 2.1 Test Laboratory

| | |
|---|---|
| **Company Name** | HCT Co., Ltd. |
| **Address** | 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si,Gyeonggi-do, 17383 KOREA |
| **Telephone** | 031-645-6300 |
| **Fax.** | 031-645-6401 |

## 2.2 Test Facilities

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

| | |
|---|---|
| **Korea** | National Radio Research Agency (Designation No. KR0032) |
| | KOLAS (Testing No. KT197) |

# 3. Information of the DUT

## 3.1 DUT Specification overview

| | |
|---|---|
| **Model Name** | SM-X808U |
| **Equipment Type** | Tablet |
| **FCC ID** | A3LSMX808U |
| **Application Type** | Class II Permissive Change |
| **Applicant** | SAMSUNG Electronics Co., Ltd. |

| Band & Mode | Operating Mode | Tx Frequency |
|---|---|---|
| UMTS Band 5 | Data | 826.4 MHz~ 846.6 MHz |
| UMTS Band 4 | Data | 1 712.4 MHz~ 1 752.6 MHz |
| UMTS Band 2 | Data | 1 852.4 MHz~ 1 907.6 MHz |
| LTE Band 2 | Data | 1 850.7 MHz~ 1 909.3 MHz |
| LTE Band 4 | Data | 1 710.7 MHz~ 1 754.3 MHz |
| LTE Band 5 (Cell) | Data | 824.7 MHz~ 848.3 MHz |
| LTE Band 7 | Data | 2 502.5 MHz~ 2 567.5 MHz |
| LTE Band 12 | Data | 699.7 MHz~ 715.3 MHz |
| LTE Band 13 | Data | 779.5 MHz~ 784.5 MHz |
| LTE Band 14 | Data | 790.5 MHz ~ 795.5 MHz |
| LTE Band 25 | Data | 1 850.7 MHz~ 1 914.3 MHz |
| LTE Band 26 | Data | 814.7 MHz~ 848.3 MHz |
| LTE TDD Band 41 | Data | 2 498.5 MHz ~ 2 687.5 MHz |
| LTE Band 30 | Data | 2 307.5 MHz ~ 2 312.5 MHz |
| LTE Band 66 (AWS) | Data | 1 710.7 MHz ~ 1 779.3 MHz |
| LTE Band 71 | Data | 665.5 MHz~ 695.5 MHz |
| NR Band 2 | Data | 1 852.5 MHz~ 1 907.5 MHz |
| NR Band 5 | Data | 826.5 MHz~ 846.5 MHz |
| NR Band 25 | Data | 1 852.5 MHz ~ 1912.5 MHz |
| NR Band 30 | Data | 2 307.5 MHz ~ 2 312.5 MHz |
| NR Band 41 | Data | 2 506.02 MHz~ 2 679.99 MHz |
| NR Band 66 | Data | 1 712.5 MHz~ 1 777.5 MHz |
| NR Band 71 | Data | 665.5 MHz - 695.5 MHz |
| NR Band 77 DoD | Data | 3 460.02 MHz~ 3 540 MHz |
| NR Band 77 | Data | 3 710.10 MHz~ 3 969.99 MHz |
| NR Band n260 | Data | 37000 MHz~ 40000 MHz |
| NR Band n261 | Data | 27500 MHz~ 28350 MHz |
| 2.4 GHz WLAN | Data | 2 412 MHz~ 2 462 MHz |
| U-NII-1 | Data | 5 180 MHz~ 5 240 MHz |
| U-NII-2A | Data | 5 260 MHz~ 5 320 MHz |
| U-NII-2C | Data | 5 500 MHz~ 5 720 MHz |
| U-NII-3 | Data | 5 745 MHz~ 5 825 MHz |
| U-NII-4 | Data | 5 845 MHz~ 5 885 MHz |
| U-NII-5 | Data | 5 935 MHz~ 6 415 MHz |
| U-NII-6 | Data | 6 435 MHz~ 6 525 MHz |
| U-NII-7 | Data | 6 535 MHz~ 6 875 MHz |
| U-NII-8 | Data | 6 895 MHz~ 7 115 MHz |
| Bluetooth | Data | 2 402 MHz ~ 2 480 MHz |
| S-PEN | Data | 530 kHz |

| | Mode | Serial Number |
|---|---|---|
| Device Serial Numbers | 4G/5G Sub 6 NR | R52RC04WDMJ |
| | The manufacturer has confirmed that the devices tested have the same physical, mechanical and thermal characteristics are within operational tolerances expected for production units. | |

Only operations relevant to this permissive change LTE B14/LTE B30 and n30 for Main 1 Ant and LTE B30 for Sub 1 Ant with EN-DC configuration were evaluated for compliance. Please See original compliance evaluation in Part2: RF Exposure Report NO: HCT-SR-2111-FC006.for complete evaluation of these operation modes.

## 3.2Time-Averaging Algorithm for RF Exposure Compliance

The device is enabled with Qualcomm® Smart Transmit feature.

This featureperforms time averaging algorithm in real time to control and manage transmitting power and ensure the time-averaged RF exposure is in compliance with FCC requirements all the time.DUT contains embedded file system(EFS) version 16 configured for the second generation (GEN 2) for sub 6 and for the first generation(GEN 1) for mmWave.

The Smart Transmit algorithm maintains the time-averaged transmit power, in turn, time-averaged RF exposure of SAR_design_target for sub 6 radio or PD_design_target for 5G mmW NR, below the predefined time averaged power limit for each characterized technology and band.
Smart Transmit allows the device to transmit at higher power instantaneously, as high as Pmax, when needed, butenforces power limiting to maintain time-averaged transmit power to Plimit for frequencies < 6 GHz and input.power.limit for frequencies > 6 GHz.

Note that the device uncertainty for sub6GHz WWAN is 1.0dB for this DUT, the device uncertainty for mmW is2.1 dB, and the reserve power margin is 3 dB.

This purpose of the Part 2 report is to demonstrate the DUT complies with FCC RF exposure requirement und er Tx varying transmission scenarios, thereby validity of Qualcomm® Smart Transmit feature implementation i n thisdevice.
It serves to compliment the Part 0 and Part 1 Test Reports to justify compliance per FCC.

**■ Regulatory body configuration:**

Based on regulatory requirement for each countries/regions, FCC time window/limits and/or ICNIRP 1998 time window/limits can be selected and/or combined. Additionally, Time-Averaged Exposure mode or Peak Exposure mode can be selected based on MCC for Smart Transmit to operate. In Time-Averaged Exposure mode, the wireless device can instantaneously transmit at high transmit powers and exceed the Plimit for a short duration before limiting the power to maintain the time-averaged transmit power under the Plimit; while in Peak Exposure mode, the maximum instantaneous transmit power is limited to Plimit. Depending on EFS version, regulatory body configuration is different.

**■ *force peak* for Tx transmitting frequency**

The Smart Transmit feature applies time-averaging windows when the device detects an MCC that matches Time-Averaged Exposure MCCs list. For each of the MCCs under Time-Averaged Exposure MCCs list, the Smart Transmit feature can limit either maximum peak power or maximum time-average power to Plimit per tech/band/antenna/DSI. If force peak is set to ‘1’ for a given tech/band/antenna/DSI in the EFS, then the Smart Transmit feature limits the maximum Tx power to Plimit for the selected tech/band/antenna/DSI. In other words, with force peak set to ‘1’, under static condition (i.e., fixed tech/band/antenna/DSI) and in single active Tx scenario, Smart Transmit can guarantee Tx power level of Plimit at all times.

The EFS Version of DUT is EFS ver.16
This device was tested in part 2 of Tx Varying transmission(Time-Averaged Exposure mode) testing using US MCC (310).and MCC ,‘1’ was used to test the peak exposure mode.

All Part 2 tests of this device were conducted according to the guidelines of the Qualcomm document 80-W2112-5 Rev. R

## ■Test case reduction for multiple filings

Per the Guidance of the FCC and Qualcomm (Document No: 80-W2112-5 Rev. R, Sec.4.2.2, Appendix K)
For multiple filings with same chipset, the test case reduction proposal for Part 2 testing is:

1. Full set of tests in the first filing, i.e., both power measurement and RF exposure measurement, are required.

2. For all subsequent filings with the same chipset, only power measurement (scenarios (a) – (h)) is required. In the case of scenario (a) time-varying Tx transmission test, only one band (instead of two bands) per technology is sufficient

## Measurement Plot Summary Table

| Test Case# | Test Scenario | Tech | Band | Antenna | DSI | Channel | Frequency | Conducted Plot No. |
|---|---|---|---|---|---|---|---|---|
| 1 | Time-varying Tx. power transmission (Conducted Power, SAR) | LTE | B30 | Main1 | 1 | 27710 | 2310 | 1 |
| 2 | | Sub6 NR | n30 | Main1 | 1 | 462000 | 2310 | 2 |
| 3 | SAR1 vs SAR2 | LTE | B12 | Main1 | 1 | 23095 | 707.5 | 3 |
| | | Sub6 NR | n30 | Main1 | 1 | 462000 | 2310 | |

Only operations relevant to this permissive change LTE B14/LTE B30 and n30 for Main 1 Ant and LTE B30 for Sub 1 Ant with EN-DC configuration were evaluated for compliance. Please See original compliance evaluation in Part2:RF Exposure Report NO: HCT-SR-2111-FC006.for complete evaluation of these operation modes.

# 4. WWAN (sub-6)transmission

The *Plimit* values, corresponding to 1.0 W/kg (1gSAR) and 2.5 W/kg (10gSAR) of *SAR_design_target*, for technologies and bands supported by EUT are derived in Part 0 report and summarized in Table 4-1. Note all *Plimit* power levels entered in Table 4-1 correspond to average power levels after accounting for duty cycle in the case of TDD modulation schemes (for e.g., GSM, LTE TDD & Sub6 NR TDD).

Table 4-1: *Plimit* for supported technologies and bands (*Plimit* in EFS file)

| SAR Exposure Configurations | | | Plimt (all values are time averaged) | | Pmax | | |
|---|---|---|---|---|---|---|---|
| | | | Body SAR Grip Off | Body SAR Grip ON | Burst Average Power [dBm] | Frame Averaged Power [dBm] | UL:DL Ratio |
| Test Configuration | | | Max Power | Reduced Power | | | |
| Averaging volume | | | 1g | 1g | | | |
| DSI | | | 0 | 1 | | | |
| Mode | Band | Antenna | Plimt | | Pmax | | |
| UMTS | 5 | Main 1 | 23.5 | 16.0 | 23.5 | FDD | 100% |
| UMTS | 4 | Main 1 | 23.5 | 13.0 | 23.5 | FDD | 100% |
| UMTS | 2 | Main 1 | 23.5 | 13.0 | 23.5 | FDD | 100% |
| LTE FDD | 2 | Main 1 | 24.0 | 13.0 | 24.0 | FDD | 100% |
| LTE FDD | 4 | Main 1 | 24.0 | 13.0 | 24.0 | FDD | 100% |
| LTE FDD | 5 | Main 1 | 24.0 | 16.0 | 24.0 | FDD | 100% |
| LTE FDD | 7 | Main 1 | 21.5 | 10.5 | 21.5 | FDD | 100% |
| LTE FDD | 12 | Main 1 | 24.0 | 14.0 | 24.0 | FDD | 100% |
| LTE FDD | 13 | Main 1 | 24.0 | 14.0 | 24.0 | FDD | 100% |
| LTE FDD | 14 | Main 1 | 24.0 | 14.0 | 24.0 | FDD | 100% |
| LTE FDD | 25 | Main 1 | 24.0 | 13.0 | 24.0 | FDD | 100% |
| LTE FDD | 26 | Main 1 | 24.0 | 14.0 | 24.0 | FDD | 100% |
| LTE FDD | 30 | Main 1 | 22.0 | 10.5 | 22.0 | FDD | 100% |
| LTE FDD | 66 | Main 1 | 24.0 | 13.0 | 24.0 | FDD | 100% |
| LTE FDD | 71 | Main 1 | 24.0 | 14.0 | 24.0 | FDD | 100% |
| LTE TDD PC3 | 41 | Main 1 | 22.0 | 11.0 | 24.0 | 22.0 | 63.3% |
| LTE TDD PC2 | 41 | Main 1 | 22.9 | 11.0 | 26.5 | 22.9 | 43.3% |
| LTE FDD With FR1 ENDC | 2 | Sub 1 | 24.0 | 13.5 | 24.0 | FDD | 100% |
| LTE FDD With FR1 ENDC | 30 | Sub 1 | 22.0 | 10.5 | 22.0 | FDD | 100% |
| LTE FDD With FR1 ENDC | 66 | Sub 1 | 24.0 | 13.5 | 24.0 | FDD | 100% |
| LTE FDD With FR1 ENDC | 7 | Sub 1 | 21.5 | 13.0 | 21.5 | FDD | 100% |
| NR FDD | 2 | Main 1 | 24.0 | 13.5 | 24.0 | FDD | 100% |
| NR FDD | 5 | Main 1 | 24.0 | 16.0 | 24.0 | FDD | 100% |
| NR FDD | 25 | Main 1 | 24.0 | 13.5 | 24.0 | FDD | 100% |
| NR FDD | 30 | Main 1 | 22.0 | 12.0 | 22.0 | FDD | 100% |
| NR FDD | 66 | Main 1 | 24.0 | 13.5 | 24.0 | FDD | 100% |
| NR TDD | 71 | Main 1 | 24.0 | 14.0 | 24.0 | FDD | 100% |
| NR TDD (PC3) | 77 | Main 3 | 18.5 | 8.0 | 24.5 | 18.5 | 25% |
| NR TDD (PC2) | 77 | Main 3 | 20.5 | 8.0 | 26.5 | 20.5 | 25% |
| NR TDD (PC3) | 41 | Main 1 | 18.0 | 8.0 | 24.0 | 18.0 | 25% |
| NR TDD (PC2) | 41 | Main 1 | 20.5 | 8.0 | 26.5 | 20.5 | 25% |

* Maximum tune up 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. The EUT maximum allowed output power is equal to *Pmax* + 1dB device uncertainty.

Table 4-2: Radio configurations selected for Part 2 test

| Test Case # | Test Scenario | Tech | Band | Antenna | DSI | Channel | Frequency [MHz] | RB/RB Offset/Bandwidth (MHz) | Mode | SAR Exposure Scenario | Part 1 Worst Case Measured SAR at Plimit (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Time-varying Tx power transmission | LTE | B30 | Main1 | 1 | 27710 | 2310 | 1/24/10 MHz BW | QPSK | Grip On, Top, 0mm | 0.711 |
| 2 | | Sub6 NR | n30 | Main1 | 1 | 462000 | 2310 | 1/1/10 MHz BW | QPSK | Grip On, Top, 0mm | 0.964 |
| 3 | SAR1 vs SAR2 | LTE | B12 | Main1 | 1 | 23095 | 707.5 | 25/24/10 MHz BW | QPSK | Grip On, Top, 0mm | 0.468 |
| | | Sub6 NR | n30 | Main1 | 1 | 462000 | 2310 | 1/1/10 MHz BW | QPSK | Grip On, Top, 0mm | 0.964 |

Note
1. the EUT has a proximity sensor to manage Body SAR exposure at 0 mm, which is represented using DSI = 1. the maximum 1g SAR among all remaining exposure scenarios or the minimum *Plimit* among all remaining exposure scenarios is used in Smart Transmit feature for time averaging operation

1. Antenna switch test case was not included in the test plan selection since the DUT dose not support any SA transmission on any additional antennas.

Based on the selection criteria described in Section 4.2, the radio configurations for the Tx varying transmission test cases listed in Section 6 are:

1. Technologies and bands for time-varying Tx power transmission: The test case 1~2 listed in Table 4-2 are selected to test with the test sequences defined in Section 4.1 in both time- varying conducted power measurement and time-varying SAR measurement.

2. Technologies and bands for switch in SAR exposure: Based on selection criteria in Section
test case in Table 7-2 is selected for SAR exposure switching test in one of the supported simultaneous WWAN transmission scenario, i.e., LTE + Sub6 NR active in the same 100s time window, in conducted power setup.

# 5. Time-varying Tx power measurement for below 6GHz frequency

## 5.1 P*limit* and P*max* measurement Results

The measured *Plimit* for all the selected radio configurations given in Table 4-2 are listed in below Table 5-1. *Pmax* was also measured for radio configurations selected for testing time-varying Txpower transmission scenarios in order to generate test sequences following the test procedures in Section 5.1.

| Test Case # | Test Scenario | Tech | Band | Antenna | DSI | Channel | Frequency [MHz] | RB/RB Offset/Bandwidth (MHz) | Mode | SAR Exposure Scenario | Plimit EFS Setting[dBm] | Tune Up Target Power Pmax[dBm] | Measured *Plimit* [dBm] | Measured *Pmax* [dBm] | Part 1 Worst Case Measured SAR at Plimit (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Time-varying Tx power transmission | LTE | B30 | Main1 | 1 | 27710 | 2310 | 1/24/10 MHz BW | QPSK | Grip on, Top, 0mm | 10.5 | 22 | 10.71 | 21.7 | 0.711 |
| 2 | | Sub6 NR | n30 | Main1 | 1 | 462000 | 2310 | 1/1/10 MHz BW | QPSK | Grip on, Top, 0mm | 12 | 22 | 12.14 | 22.54 | 0.964 |
| 3 | SAR1 vs SAR2 | LTE | B12 | Main1 | 1 | 23095 | 707.5 | 25/24/10 MHz BW | QPSK | Grip on, Top, 0mm | 14 | 24 | 14.2 | 24.51 | 0.468 |
| | | Sub6 NR | n30 | Main1 | 1 | 462000 | 2310 | 1/1/10 MHz BW | QPSK | Grip on, Top, 0mm | 12 | 22 | 12.14 | 22.54 | 0.964 |

Table 5-1: Measured Plimit and Pmax of selected radio configuration

Note:

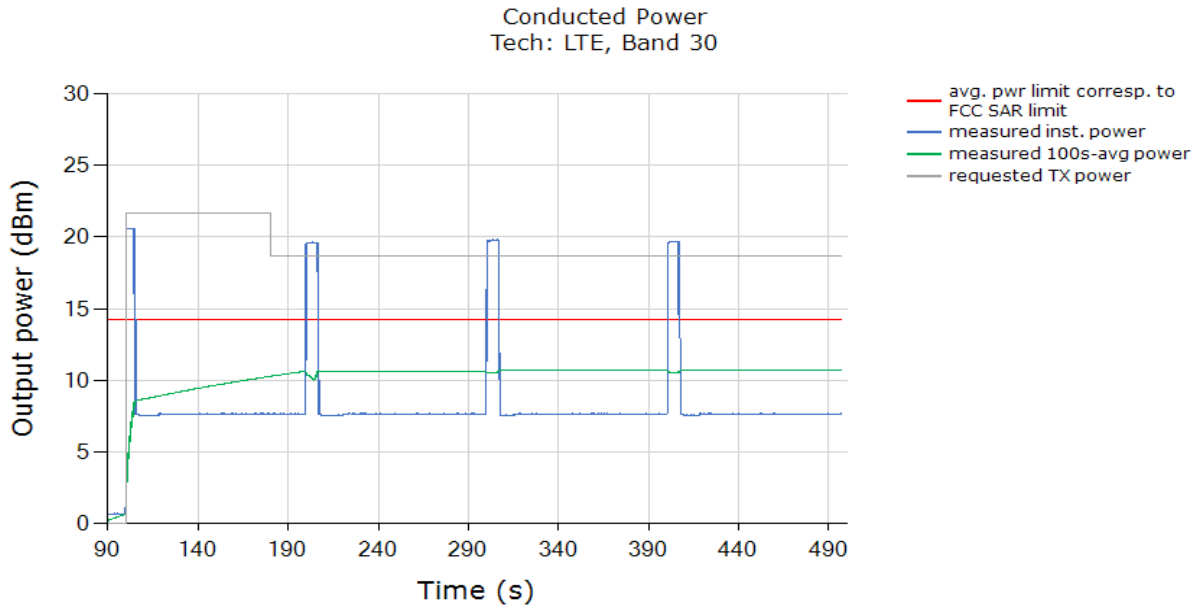
1. The device uncertainty of *Pmax* is +1dB/-1.5dB as provided by manufacturer.

## 5.2Time-varying Tx power measurement results

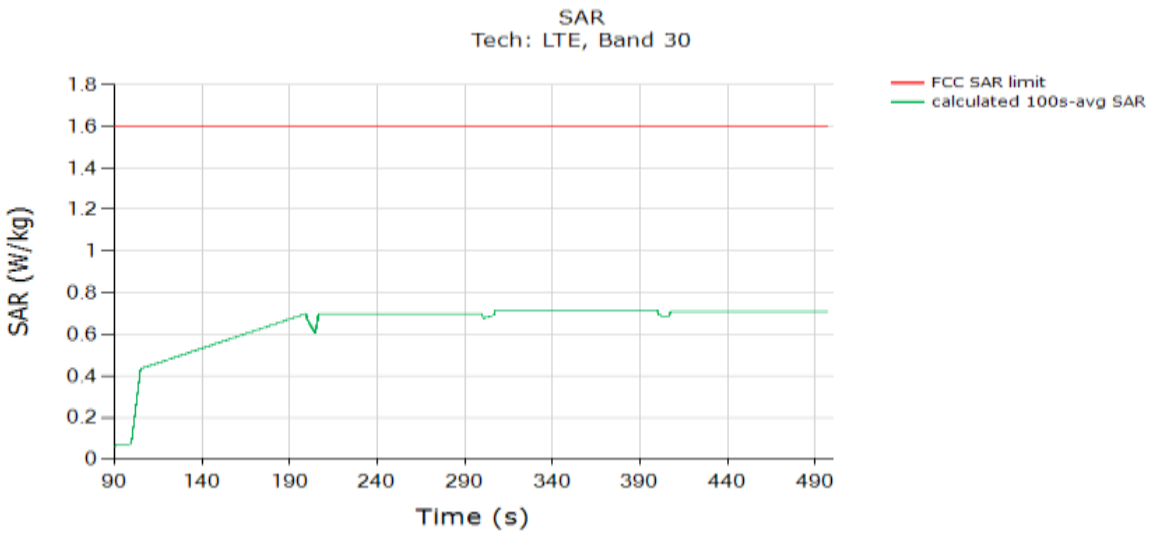
### 5.2.1 LTE Band 30 (test case 1 in Table 4-2)

**Conducted Plot No. 1**

Test result for test sequence 1:

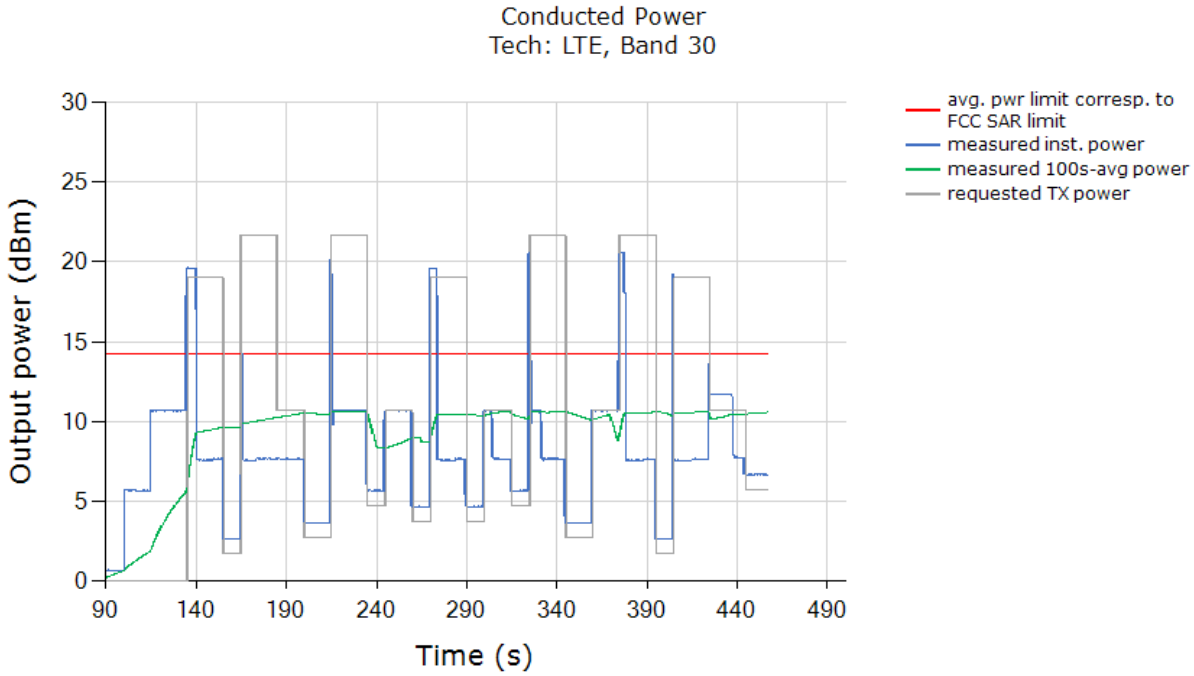



Above time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using Equation (1a) and plotted below to demonstrate that the time-averaged 1gSAR versus time does not exceed the FCC limit of 1.6 W/kg for 1gSAR:

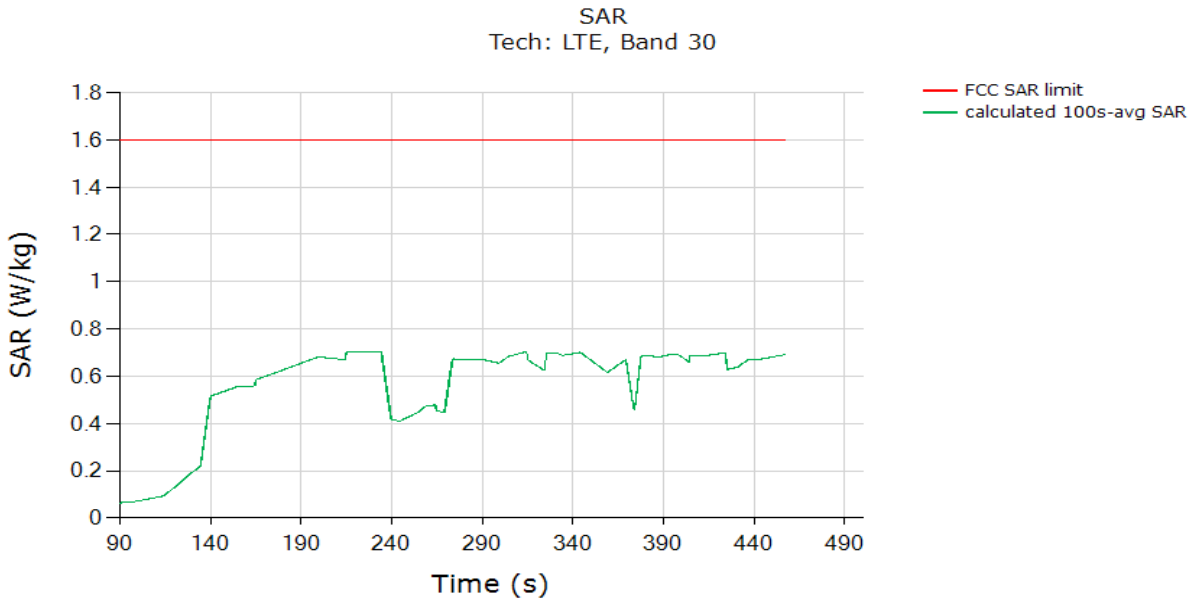



| | |
|---|---|
| FCC 1g SAR Limit [W/kg] | 1.6 W/kg |
| Max 100s-time averaged 1gSAR (green curve) | 0.714 W/kg |
| Validated: Max time averaged SAR (green curve) is within 1dB device uncertainty of measured SAR at *Plimit* (last column in Table 4-2). | |

Test result for test sequence 2:




Above time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using Equation  and plotted below to demonstrate that the time-averaged 1gSAR versus time does not exceed the FCC limit of 1.6 W/kg for 1gSAR:

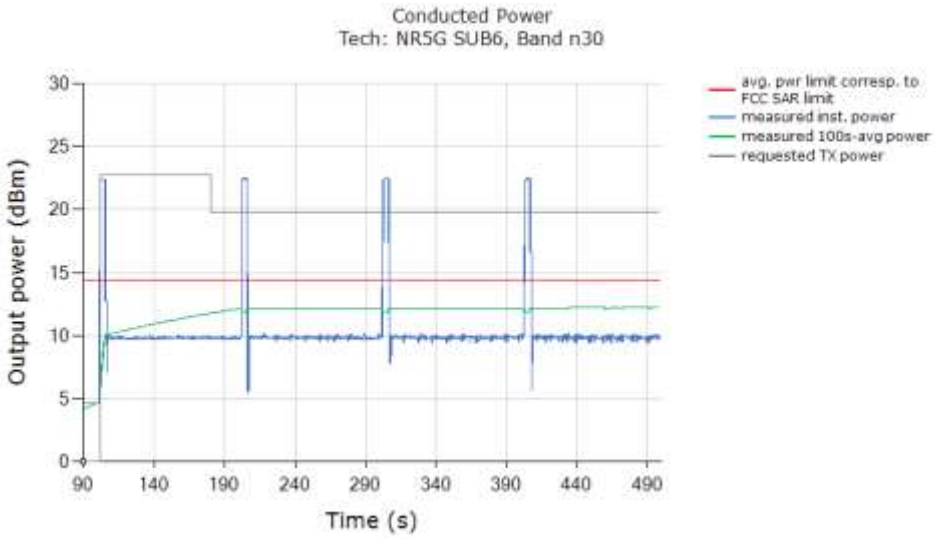



| | |
|---|---|
| FCC 1g SAR Limit [W/kg] | 1.6 W/kg |
| Max 100s-time averaged 1gSAR (green curve) | 0.703W/kg |
| Validated: Max time averaged SAR (green curve) is within 1dB device uncertainty of measured SAR at *Plimit* (last column in Table 7-2). | |

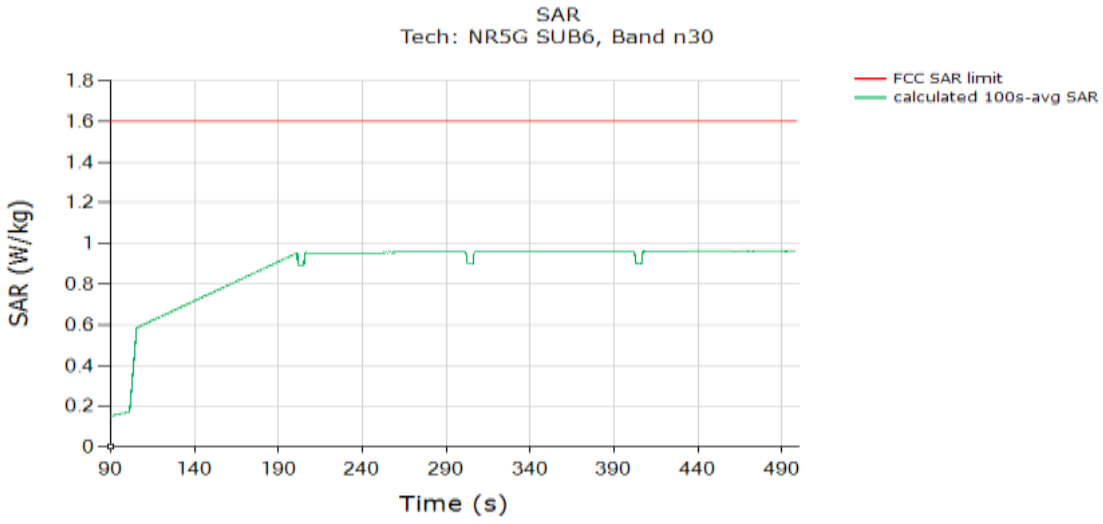
### 5.2.2.Sub6 NR n30 (test case 2 in Table 4-2)

**Conducted Plot No. 2**

Test result for test sequence 1

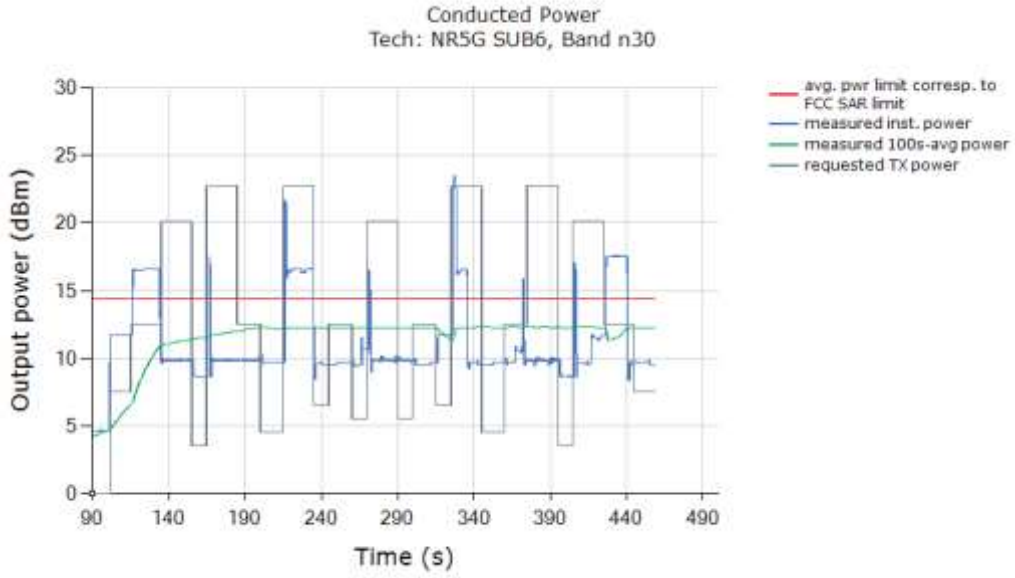



Above time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using Equation  and plotted below to demonstrate that the time-averaged 1gSAR versus time does not exceed the FCC limit of 1.6 W/kg for 1gSAR:

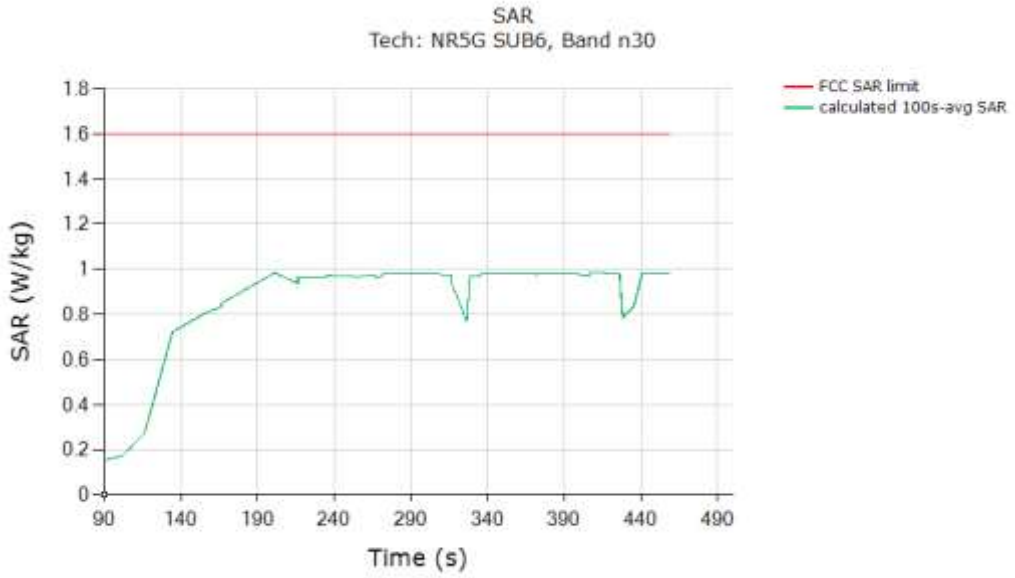



| | |
|---|---|
| FCC 1g SAR Limit [W/kg] | 1.6 W/kg |
| Max 100s-time averaged 1g SAR (green curve) | 0.962W/kg |
| Validated: Max time averaged SAR (green curve) is within 1dB device uncertainty of measured SAR at *Plimit* (last column in Table 4-2). | |

Test result for test sequence 2:




Above time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using Equation  and plotted below to demonstrate that the time-averaged 1gSAR versus time does not exceed the FCC limit of 1.6 W/kg for 1gSAR:

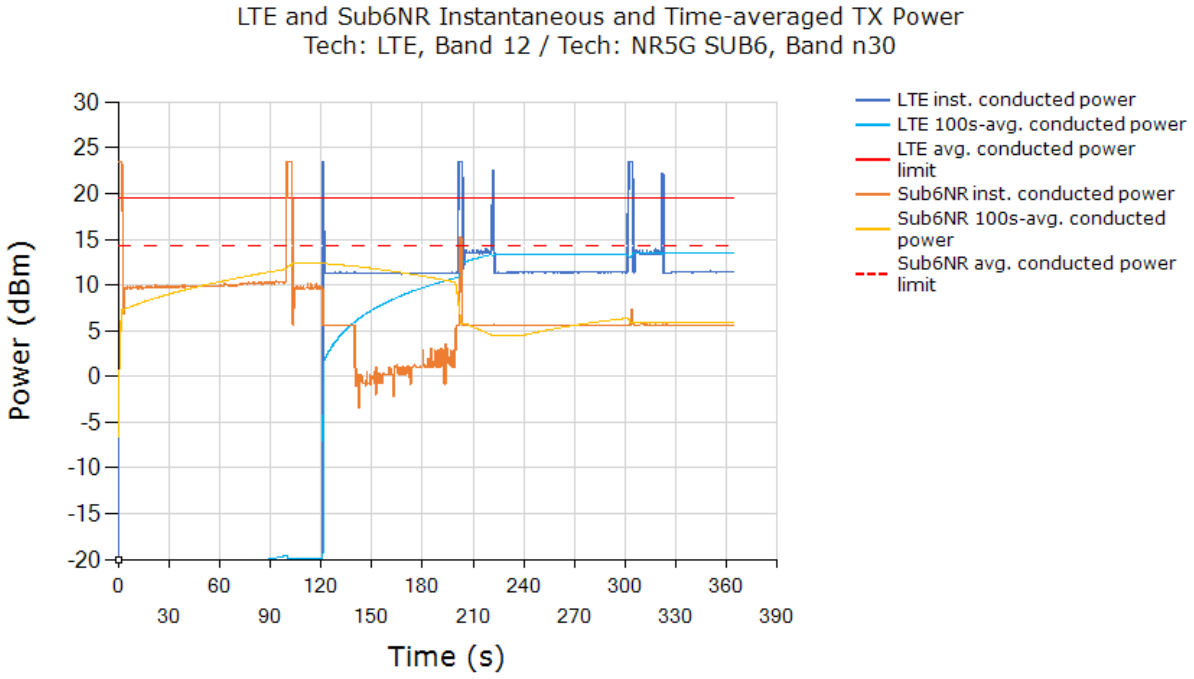



| | |
|---|---|
| FCC 1g SAR Limit [W/kg] | 1.6 W/kg |
| Max 100s-time averaged 1gSAR (green curve) | 0.984W/kg |
| Validated: Max time averaged SAR (green curve) is within 1dB device uncertainty of measured SAR at *Plimit* (last column in Table 4-2). | |

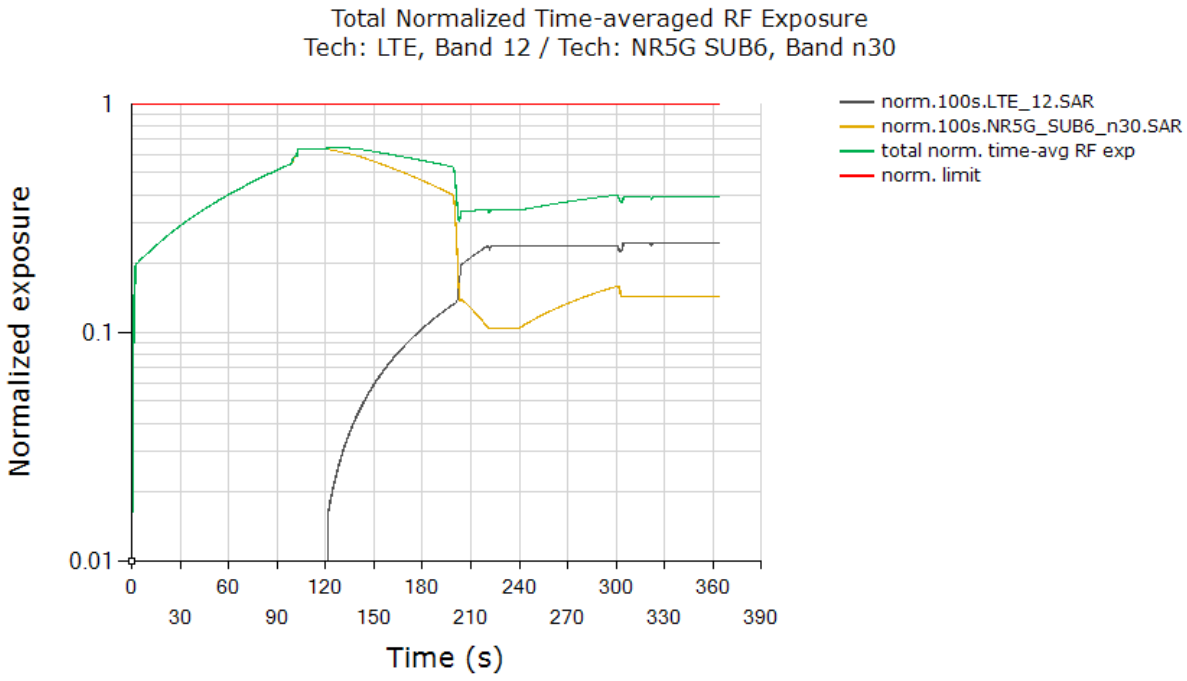
## 5.3 Switch in SAR exposure test results (test case 3 in Table 4-2)

This test was conducted with callbox requesting maximum power, and with the EUT in LTE B12 + Sub6 NR Band n30 call. Here, LTE B12, DSI = 1 (100s window, EFS *Plimit* = 14.0dBm, *Pmax* = 24.0dBm, measured *Plimit* = 14.20dBm), and Sub6 NR Band n30, DSI = 1 (100s window, *Plimit* = 12.0dBm in EFS setting, EUT's average *Pmax* = 22.0dBm, measured *Plimit* = 12.14dBm). The SAR exposure switch measurement is performed with the EUT in various SAR exposure scenarios, i.e., in $SAR_{Sub6NR}$ only scenario (t =10s ~125s), $SAR_{Su6NR}$ + $SAR_{LTE}$ scenario (t =125s ~ 245s) and $SAR_{LTE}$ only scenario (t >245s).

**Conducted Plot No.3**




Plot 2: All the conducted Tx power measurement results were converted into time-averaged normalized SAR and plotted below to demonstrate that the time-averaged normalized SAR versus time does not exceed the FCC limit of 1 unit.




| | |
|---|---|
| FCC normalized total exposure limit | 1.0 |
| Max Norm. Total time-avg. SAR (green curve) (green curve) | 0.649 |
| Validated: | |

Plot Notes:

Device starts predominantly in Sub6 NR SAR exposure scenario between 5s and 125s, and in LTE SAR + Sub6 NR SAR exposure scenario between 125s and 245s, and in predominantly in LTE SAR exposure scenario after t=245s. Here, Smart Transmit allocates a maximum of 100% of exposure margin (based on 3dB reserve margin setting) for Sub6 NR. This corresponds to a normalized 1gSAR exposure value = 100% * 0.964W/kg measured SAR at Sub6 NR *Plimit* / 1.6W/kg limit = 0.603± 1dB device related uncertainty (see orange curve between 5s~125s). For predominantly LTE SAR exposure scenario, maximum normalized 1gSAR exposure should correspond to 100% exposure margin = 0.468W/kg measured SAR at LTE *Plimit* / 1.6W/kg limit = 0.293 ± 1dB device related uncertainty (see black curve after t =245s).
Additionally, in SAR exposure switch test, at all times the total time-averaged normalized RF exposure (green curve) should not exceed normalized SAR_design_target + 1dB device uncertainty. In this test, with a maximum normalized SAR of 0.649 being ≤ 0.794 (= 1/1.6 + 1dB device uncertainty), the above test result validated the continuity of power limiting in SAR exposure switch scenario.

# 6. Equipment List

| Manufacturer | Type / Model | S/N | Calib. Date | Calib.Interval | Calib.Due |
|---|---|---|---|---|---|
| Keysight Technologies | UXM 5G Wireless Test Platform | E7515B | 05/28/2020 | Annual | 05/17/2022 |
| R&S | Power Sensor | 1419.0006K02-109996-wi | 12/16/2021 | Annual | 12/16/2022 |
| R&S | Power Sensor | 1419.0087K02101351-zV | 12/16/2021 | Annual | 12/16/2022 |
| Narda | Directional Coupler | 03096 | 04/05/2021 | Annual | 04/05/2022 |
| Narda | Directional Coupler | 03089 | 04/05/2021 | Annual | 04/05/2022 |
| Mini-circuits | Power Splitter | ZN2PD2-63-S+ | 04/13/2021 | Annual | 04/13/2022 |
| R&S | Wireless Communication Test Set CMW500 | 127521 | 05/04/2021 | Annual | 05/04/2022 |

# 7. Conclusion

Qualcomm Smart Transmit feature employed in Samsung Portable Tablet (FCC A3LSMX808U) has been validated through the conducted/radiated power measurement (asdemonstrated in Chapters 5)

As demonstrated in this report, the power limiting enforcement is effective and the totalnormalized time-averaged RF exposure does not exceed 1.0 for all the transmission scenarios described in Section 4.

Therefore, the EUT complies with FCC RF exposure requirement.

# Appendix A: Test Sequences

1. Test sequence is generated based on below parameters of the EUT:

   a. Measured maximum power ($P_{max}$)

   b. Measured Tx_power_at_SAR_design_target ($P_{limit}$)

   c. Reserve_power_margin (dB)

      $P_{reserve}$ (dBm) = measured $P_{limit}$(dBm) – Reserve_power_margin (dB)

   d. *SAR_time_window* (100s for FCC)

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

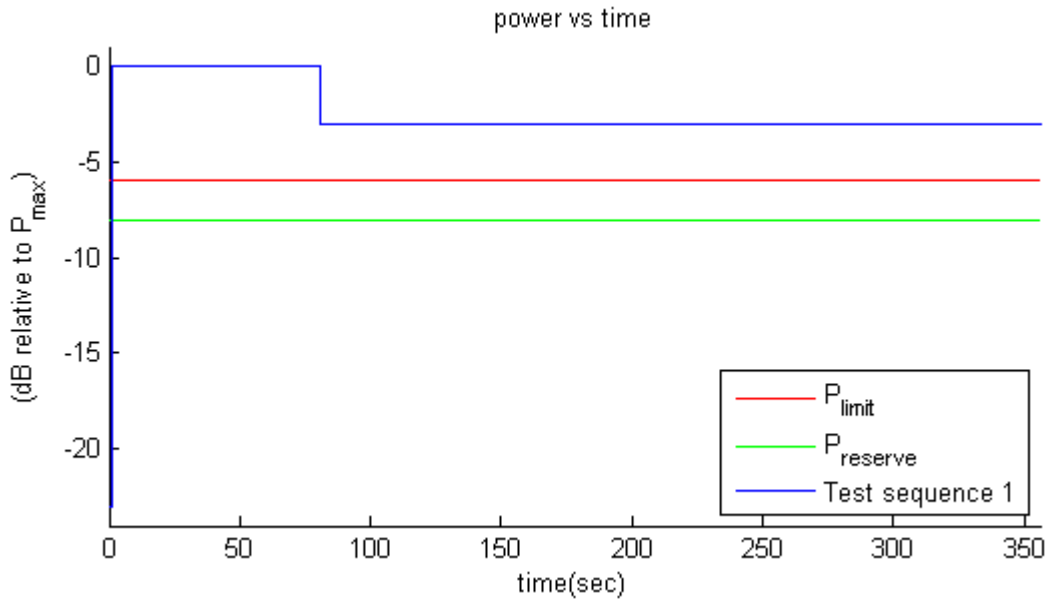



**Figure 1 Test sequence 1 waveform**

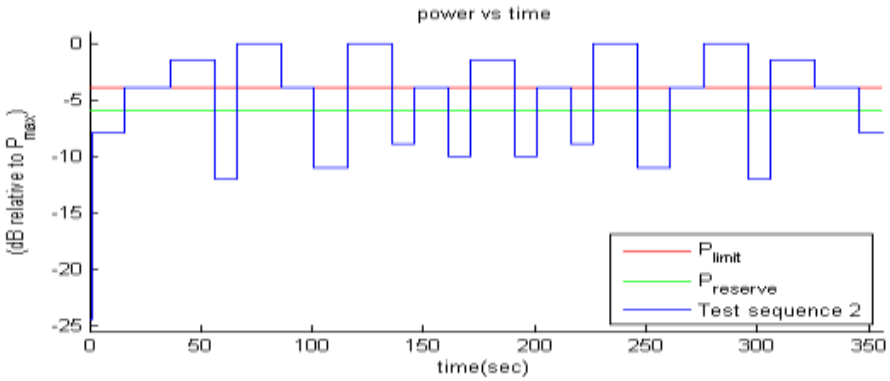
3. Test Sequence 2 Waveform:

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

**Table -1 Test Sequence 2**

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

The Test Sequence 2 waveform is shown in Figure A-2



# Appendix B:Test Procedures for sub6 NR + LTE Radio

Appendix B provides the test procedures for validating Qualcomm Smart Transmit feature for LTE + Sub6 NR non-standalone (NSA) mode transmission scenario, where sub-6GHz LTE link acts as an anchor.

## B.1 Time-varying Tx power test for sub6 NR in NSA mode

Follows Section 5.2.1 to select test configurations for time-varying test. This test is performed with two pre-defined test sequences (described in Section 5.1) applied to Sub6 NR (with LTE on all-down bits or low power for the entire test after establishing the LTE+Sub6 NR call with the callbox). Follow the test procedures described in Section 5.3.1 to demonstrate the effectiveness of power limiting enforcement and that the time averaged Tx power of Sub6 NR when converted into 1gSAR values does not exceed the regulatory limit at all times (see Eq. (1a) and (1b)). Sub6 NR response to test sequence1 and test sequence2 will be similar to other technologies (say, LTE), and are shown in Sections 8.3.7 and 8.3.8.

## B.2 Switch in SAR exposure between LTE vs. Sub6 NR during transmission

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

**Test procedure:**

1. Measure conducted Tx power corresponding to $P_{limit}$ for LTE and sub6 NR in selected band. Test condition to measure conducted $P_{limit}$ is:

   - □ Establish device in call with the callbox for LTE in desired band. Measure conducted Tx power corresponding to LTE $P_{limit}$ with Smart Transmit enabled and *Reserve_power_margin* set to 0 dB, callbox set to request maximum power.
   - □ Repeat above step to measure conducted Tx power corresponding to Sub6 NR $P_{limit}$. If testing LTE+Sub6 NR in non-standalone mode, then establish LTE+Sub6 NR call with callbox and request all down bits for radio1 LTE. In this scenario, with callbox requesting maximum power from Sub6 NR, measured conducted Tx power corresponds to radio2 $P_{limit}$ (as radio1 LTE is at all-down bits)

2. Set *Reserve_power_margin* to actual (intended) value with EUT setup for LTE + Sub6 NR call. First, establish LTE connection in all-up bits with the callbox, and then Sub6 NR connection is added with callbox requesting UE to transmit at maximum power in Sub6 NR. As soon as the Sub6 NR connection is established, request all-down bits on LTE link (otherwise, Sub6 NR will not have sufficient RF exposure margin to sustain the call with LTE in all-up bits). Continue LTE (all-down bits)+Sub6 NR transmission for more than one time-window duration to test predominantly Sub6 NR SAR exposure scenario (as SAR exposure is negligible from all-down bits in LTE). After at least one time-window, request LTE to go all-up bits to test LTE SAR and Sub6 NR SAR exposure scenario. After at least one more time-window, drop (or request all-down bits) Sub6 NR transmission to test predominantly LTE SAR exposure scenario. Continue the test for at least one more time-window. Record the conducted Tx powers for both LTE and Sub6 NR for the entire duration of this test.

3. Once the measurement is done, extract instantaneous Tx power versus time for both LTE and Sub6 NR links. Similar to technology/band switch test in Section 5.3.3, convert the conducted Tx power for both these radios into 1gSAR value (see Eq. (6a) and (6b)) using corresponding technology/band $P_{limit}$ measured in Step 1, and then perform 100s running average to determine time-averaged 1gSAR versus time as illustrated in Figure 3-1. Note that here it is assumed both radios have Tx frequencies < 3GHz, otherwise, 60s running average should be performed for radios having Tx frequency between 3GHz and 6GHz.

4. Make one plot containing: (a) instantaneous Tx power versus time measured in Step 2.

5. Make another plot containing: (a) instantaneous 1gSAR versus time determined in Step 3, (b) computed time-averaged 1gSAR versus time determined in Step 3, and (c) corresponding regulatory $1gSAR_{limit}$of 1.6W/kg.
The validation criteria is, at all times, the time-averaged 1gSAR versus time shall not exceed the regulatory $1gSAR_{limit}$of 1.6W/kg.