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TAS VALIDATION REPORT

Applicant Name:
Apple, Inc.
One Apple Park Way
Cupertino, CA 95014 USA (Excluding State of Alaska)

Date of Testing:
07/15/2025 – 08/08/2025
Test Site/Location:
Element, Morgan Hill, CA, USA
Document Serial No.:
1C2503270029-29.BCG-R2

FCC ID:	**BCG-A3281**
APPLICANT:	**APPLE INC.**

DUT Type:	Watch
Application Type:	Certification
FCC Rule Part(s):	CFR §2.1093
Model(s):	A3281
Additional Model(s):	A3282
Device Serial Numbers:	Pre-Production Samples [WPC9X, 2XCF6, 2WT0H, PFVWG]

Note: This revised Test Report supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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. Test results reported herein relate only to the item(s) tested.

RJ Ortanez
Executive Vice President

ACCREDITED
CERT #2041.02

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
LTE Band 71	Voice/Data	665.5 - 695.5 MHz
LTE Band 12	Voice/Data	699.7 - 715.3 MHz
LTE Band 17	Voice/Data	706.5 - 713.5 MHz
LTE Band 13	Voice/Data	779.5 - 784.5 MHz
LTE Band 14	Voice/Data	790.5 - 795.5 MHz
LTE Band 26 (Cell)	Voice/Data	814.7 - 848.3 MHz
LTE Band 5 (Cell)	Voice/Data	824.7 - 848.3 MHz
LTE Band 66 (AWS)	Voice/Data	1710.7 - 1779.3 MHz
LTE Band 4 (AWS)	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 25 (PCS)	Voice/Data	1850.7 - 1914.3 MHz
LTE Band 2 (PCS)	Voice/Data	1850.7 - 1909.3 MHz
LTE Band 7	Voice/Data	2502.5 - 2567.5 MHz
LTE Band 41	Voice/Data	2498.5 - 2687.5 MHz
LTE Band 53	Voice/Data	2488.5 - 2490 MHz
NR Band n71	Voice/Data	665.5 - 695.5 MHz
NR Band n12	Voice/Data	701.5 - 713.5 MHz
NR Band n14	Voice/Data	790.5 - 795.5 MHz
NR Band n26 (Cell)	Voice/Data	816.5 - 846.5 MHz
NR Band n5 (Cell)	Voice/Data	826.5 - 846.5 MHz
NR Band n66 (AWS)	Voice/Data	1712.5 - 1777.5 MHz
NR Band n25 (PCS)	Voice/Data	1852.5 - 1912.5 MHz
NR Band n2 (PCS)	Voice/Data	1852.5 - 1907.5 MHz
NR Band n7	Voice/Data	2502.5 - 2567.5 MHz
NR Band n41	Voice/Data	2501.01 - 2685.0 MHz
NR Band n53	Voice/Data	2488.5 - 2490MHz
NTN Band 254	Data	1610.2 - 1626 MHz
2.4 GHz WLAN	Voice/Data	2412 - 2472 MHz
5 GHz WIFI	Voice/Data	U-NII-1: 5180 - 5240 MHz U-NII-2A: 5260 - 5320 MHz U-NII-2C: 5500 - 5720 MHz U-NII-3: 5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz
802.15.4 ab-NB	Data	5728.75 - 5846.25 MHz
NFC	Data	13.56 MHz
UWB	Data	6489.6 - 7987.2 MHz

1.2 Time-Averaging Algorithm for RF Exposure Compliance

Per FCC regulations, compliance with RF exposure safety limits may be demonstrated using time-averaged RF transmission power. Since RF exposure levels are directly associated with the transmitted (TX) power—i.e., lower TX power generally results in lower RF exposure—transmission power can be dynamically controlled to satisfy regulatory thresholds. Specifically, for transmission frequencies below 6 GHz, compliance is evaluated based on the Specific Absorption Rate (SAR).

To address these requirements, the Time-Averaged Specific Absorption Rate (TA-SAR) algorithm has been developed to regulate TX power such that the time-averaged RF exposure remains within the SAR limits defined by the FCC.

This document outlines the validation of the TA-SAR algorithms through comprehensive test planning, measurement procedures, measurement setup, and measurement results. TA-SAR algorithm validation was conducted for 2G, 3G, LTE, and NR FR1 technologies, based on various test scenarios incorporating different combinations of operating parameters as detailed in Table 1-1.

Table 1-1 TA-SAR Operating Parameters

Operating Parameters	Description
P_{sub6_limit} (dBm)	The time-averaged maximum power level limit for different band in sub6.
$P_{LowThresh\_offset}$ (dBm)	To calculate $P_{LowThresh}$. • $P_{LowThresh} = P_{sub6\_limit} - P_{LowThresh\_offset}$
$P_{UE\_backoff\_offset}$ (dBm)	To calculate $P_{UE\_backoff}$. • $P_{UE\_backoff} = P_{sub6\_limit} - P_{UE\_backoff\_offset}$
$P_{UE\_\max\ \_cust\_offset}$ (dBm)	To calculate $P_{UE\_\max\ \_cust}$. $P_{UE\_\max}$ is maximum TX power at which a UE can possibly transmit in sub6. • $P_{UE\_\max\ \_cust} = \min(P_{EU\_max}, P_{sub6\_limit} + P_{UE\_\max\ \_cust\_offset})$

The table below shows Final Plimit settings and maximum tune up output power Pmax configured for this EUT for various transmit conditions (Exposure Condition Index ECI for MediaTek). Note that the device uncertainty for sub-6GHz WWAN is shown below:

Table 1-2

SAR_design_target Calculations						
Mode/Band	1g SAR [W/kg]			10g SAR [W/kg]		
	Smart Tx Uncertainty	SAR_design_target	SAR_regulatory_limit	Smart Tx Uncertainty	SAR_design_target	SAR_regulatory_limit
LTE FDD Band 7	2.00	0.75	1.6 W/kg	1.20	2.27	4 W/kg
LTE TDD Band 41	2.00	0.75		1.20	2.27	
NR FDD Band n7	2.00	0.75		1.20	2.27	
NR FDD Band n41	2.00	0.75		1.20	2.27	
All other modes/bands	1.20	0.91		1.20	2.27	

The maximum time-averaged output power (dBm) for any WWAN sub-6 technology, band, and ECI is the minimum of ("Plimit " and "Maximum tune up output power Pmax") + corresponding device uncertainty on the table above. SAR values in this report were scaled to this maximum time-averaged output power to determine compliance per KDB Publication 447498 D04v01.

1.3 Bibliography

Report Type	Report Serial Number
RF Exposure Part 1 Test Report	1C2503270029-28.BCG
RF Exposure Part 0 Test Report	1C2503270029-27.BCG
RF Exposure Compliance Summary	1C2503270029-30.BCG

2 RF EXPOSURE LIMITS

2.1 Uncontrolled Environment

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 made 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.

2.2 Controlled Environment

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.

2.3 RF Exposure Limits for Frequencies Below 6 GHz

Table 2-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

2.4 Time Averaging Windows for FCC Compliance

Per October 2018 TCB Workshop Notes, the time-averaging windows below 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

3 TA-SAR VALIDATION TEST CASES

To validate the time-averaging feature and demonstrate compliance under varying transmission conditions, the following transmission scenarios were evaluated as part of the TA-SAR testing:

- **Scenario 1**: Test under different TA-SAR parameters to verify that the TA-SAR algorithm meets compliance requirements with different combinations of operating parameters.
- **Scenario 2**: Test under time-varying TX power to verify that the TA-SAR algorithm ensures SAR compliance through dynamic TX power.
- **Scenario 3**: Test under call drop and re-establishment conditions to ensure the TA-SAR algorithm control continuity and SAR compliance.
- **Scenario 4**: Test under RAT/band handover to ensure the TA-SAR algorithm control continuity and correctness.
- **Scenario 5**: Test under different ECIs (Exposure Condition Index) to ensure the TA-SAR algorithm control behaves as expected during ECI switching from one ECI to another. (e.g. extremity to head)
- **Scenario 6**: Test under different transmission antennas to ensure the TA-SAR algorithm control works correctly during antenna switching from one antenna to another.

To add confidence in the feature validation, the SAR measurements are also performed but only performed for transmission scenario 2 to avoid the complexity in SAR measurement (such as, for scenario 4 requiring change in SAR probe calibration file to accommodate different bands and/or tissue simulating liquid).

4 TA-SAR TEST SCENARIOS AND TEST PROCEDURES

To demonstrate that the TA-SAR algorithm performs as intended under a range of operating scenarios, Table 4-1 outlines the corresponding test scenarios along with the expected test sequences used for validation. Test sequences 0, 1, and 2 are defined in Section 4.1.

Table 4-1
Test Scenario List of TA-SAR Validation

Test Scenario		Test Sequences #	Description
1	Range of TA-SAR Parameters	0	Adjust parameters
2	Time-Varying TX Power	1 and 2	Test under time-varying TX power
3	Call Disconnection and Re-Establishment	0	Test call drop and re-establishment
4	Band Handover	0	Test band change
5	ECI (Exposure Condition Index) Change	0	Test under ECI transition (e.g. extremity to head)
6	Antenna Switching	0	Change antenna

4.1 Test Sequence Determination for Validation

Three predefined test sequences involving potentially time-varying TX power are used for TA-SAR validation:

- Test sequence 0: EUT's TX power is requested to be maximum.
- Test sequence 1: EUT's TX power is requested to be at power less than $P_{LowThresh}$ for 300s, then at maximum power for 200s, and finally at $P_{LowThresh}$ -2dB for the remaining time.
- Test sequence 2: EUT's TX power to vary with time. This sequence is generated relative to 12 measured P_{UE_max}, measured P_{sub6_limit} and calculated $P_{UE\_backoff}$ (= measured P_{sub6_limit} in dBm - $P_{UE\_backoff\_offset}$ in dB) of EUT based on measured P_{sub6_limit}.

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

A. Measured maximum power (P_{UE_max})

B. Measured Tx_power_at_*SAR_design_limit* (P_{sub6_limit})

C. Threshold of dynamic power reduction status determination: reserve hysteresis margin for instantaneous power ($P_{LowThresh}$)

D. *SAR_time_window* (FCC: 100s for $f < 3GHz$, 60s for $3GHz < f < 6GHz$)

The details for generating these two test sequences are described and listed in Appendix E

4.2 Test Configuration Selection Criteria for TA-SAR

4.2.1 Scenario 1: Range of TA-SAR Parameters via Conducted Power Measurements

This test is performed by changing the parameters ($P_{LowThresh\_offset}$, $P_{UE\_backoff\_offset}$, $PU_{E\_max\_cust\_offset}$) for the selected RAT (Radio Access Technologies) and band. Since Mediatek's TA algorithm operation is independent of RATs/bands/channels, any one RAT can be selected for this test and the selected band of the RAT has the least P_{sub6_limit}. In principle, two sets of the parameters are determined for this test (if applicable). If the parameters of the EUT are fixed (without a support of dynamic change), only the set of the default parameters needs to be tested.

4.2.2 Scenario 2: Time-Varying TX Power via Conducted Power Measurements

Since Mediatek's TA-SAR feature operation is independent of bands and channels for a given RAT, selecting one band per RAT is sufficient to validate this feature. Two bands per RAT are proposed for this test. The criteria for band selection for each RAT is based on the P_{sub6_limit} values (corresponding to *SAR_design_limit*) and is described as below:

Select two bands, among the ones whose P_{sub6_limit} values are below P_{UE_max}, which correspond to least and highest P_{sub6_limit} values respectively.

- Only one band needs to be tested if all the bands have the same $P_{sub6\_limit.}$
- Only one band needs to be tested if only the band has Psub6_limit below P_{UE_max}.
- If the same least P_{sub6_limit} applies to multiple bands, select the band with the highest measured 1gSAR at P_{sub6_limit}.
- If P_{sub6_limit} values of all bands are all over P_{UE_max} (i.e., TA-SAR feature is not enabled), there is no need to test this RAT.

4.2.3 Scenario 3: Call Disconnection and Re-establishment via Conducted Power Measurements

For call disconnection measurement, the criteria for selecting the test configuration are:

- Select the RAT/band with least P_{sub6_limit} among all supported RATs/bands.
- Select the RAT/band having the highest measured 1gSAR at P_{sub6_limit} if multiple RATs/bands having same least P_{sub6_limit}.
- Select the radio configuration in this RAT/band that corresponds to the highest measured 1gSAR at P_{sub6_limit}.

4.2.4 Scenario 4: Band Handover via Conducted Power Measurements

For a given TX antenna, select a RAT/band with the lowest P_{sub6_limit} and the other RAT/band with the highest P_{sub6_limit} . Both of them have P_{sub6_limit} values less than P_{UE_max} if possible.

- Select the RAT/band having the highest measured 1gSAR at P_{sub6_limit} if multiple RATs/bands have the same lowest P_{sub6_limit} .
- Select the RAT/band having the lowest measured 1gSAR at P_{sub6_limit} if multiple RATs/bands have the same highest P_{sub6_limit}.

4.2.5 Scenario 5: Exposure Condition Index (ECI) Change via Conducted Power

Select any one RAT/band, which has at least two ECIs whose P_{sub6_limit} values are below P_{UE_max}.

4.2.6 Scenario 6: Antenna Switching via Conducted Power Measurements

Among RATs/bands supporting TX antenna switches, select the RAT/band with the highest P_{sub6_limit} difference between a pair of supported TX antennas.

- Select the RAT/band having the highest measured 1gSAR at P_{sub6_limit} if multiple RATs/bands having the same P_{sub6_limit} difference between the supported TX antennas.
- Antenna selection order
    - Select the configuration with two antennas having P_{sub6_limit} values less than P_{UE_max}.
    - If the previous configuration does not exist, select the configuration with one antenna having P_{sub6_limit} value less than P_{UE_max}.
    - If the above two cannot be found, select one configuration with the two antennas having the least difference between their P_{sub6_limit} and P_{UE_max} (i.e., P_{sub6_limit} can be greater than P_{UE_max}).

4.2.7 Scenario 7: Time Window Switching via Conducted Power Measurements

Select one RAT/band with 60s-time averaging window, and the other RAT/band with 100s-time averaging window. Both have P_{sub6_limit} values less than P_{UE_max} if possible.

- Select at least one of the selected RAT/bands has its P_{sub6_limit} less than P_{UE_max}.

4.2.8 Scenario 8: SAR Exposure Switching via Conducted Power Measurements

If supported, SAR exposure switch with two active radios having the *same and different time averaging windows* should be covered in this test. Mediatek's TA algorithm operation is independent of the source of SAR exposure (e.g., LTE vs. NR FR1) and ensures total time-averaged RF exposure compliance for SAR exposure among the scenarios of radio 1 only, radio 1 + radio 2, and radio 2 only.

- Select any two $< 6GHz$ RATs/bands that the EUT supports for simultaneous transmission (e.g., LTE+NR FR1).
- The selection order among all supported simultaneous transmission configurations is
    - Select one configuration with P_{sub6_limit} values of radio1 and radio2 less than their corresponding P_{UE_max}, and their P_{sub6_limit} values are different if possible.
    - If the previous configuration does not exist, at least one radio has its P_{sub6_limit} less than P_{UE_max}.
    - If the above two cannot be found, select one configuration that has P_{sub6_limit} of radio1 and radio2 with the least difference between P_{sub6_limit} and P_{UE_max} (i.e., P_{sub6_limit} can be greater than P_{UE_max}).
- One test with two active radios in any two different time windows is sufficient to cover this scenario.
- One SAR switching is sufficient because the TA algorithm operation is the same.

4.2.9 Scenario 2: Time-Varying TX Power via SAR Measurements

Sections 4.2.1 to 4.2.8 focus on Mediatek's TA feature compliance validation via conducted TX power measurements. This section further provides a SAR measurement procedure for time-varying TX power scenario described in section 4.2.2 Hence, this section follows the test configuration of section 4.2.2 and uses test sequences 1 and 2 defined in section 4.1.

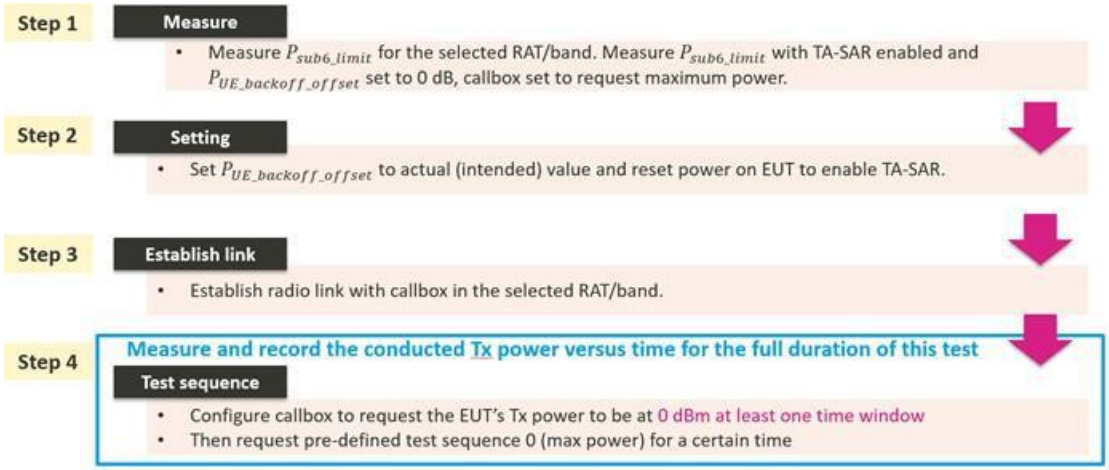
4.3 Test Procedures for TA-SAR

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

4.3.1 Scenario 1: Range of TA-SAR Parameters via Conducted Power Measurements

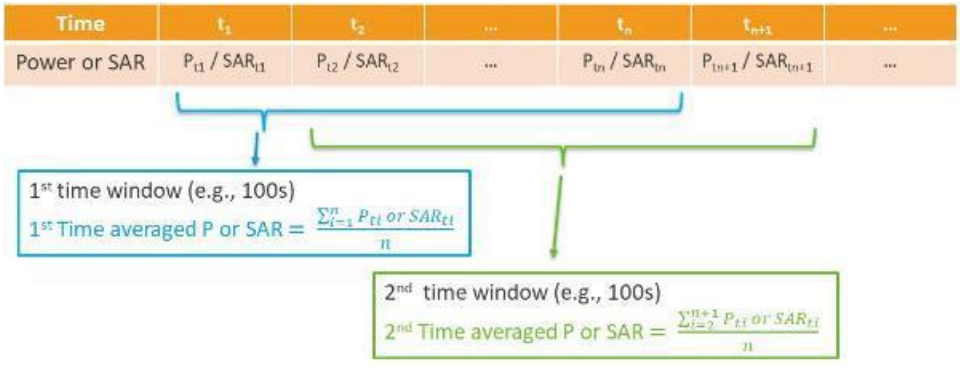
TX power is measured, recorded, and processed by the following steps:

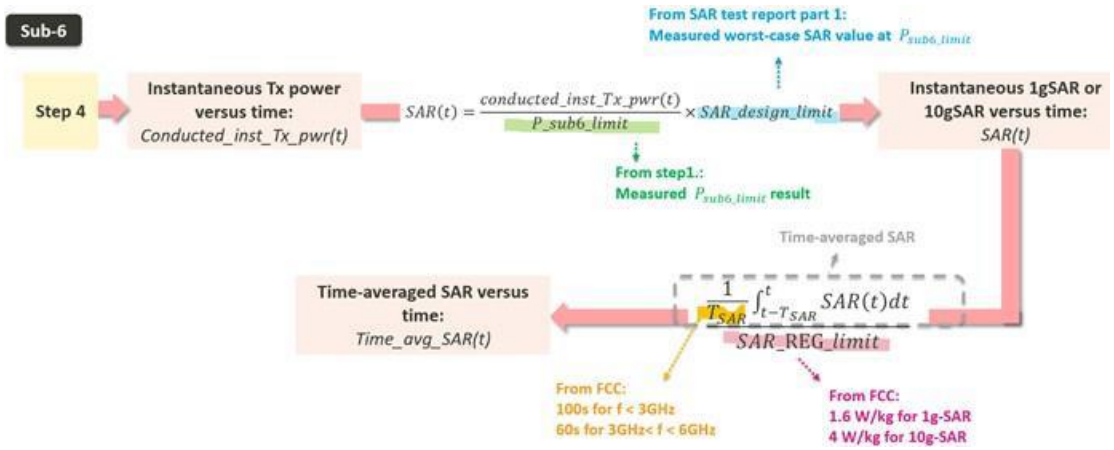
- Step 1~4: measure and record TX power versus time for test scenario 1



- Step 5: convert the measured conducted TX power into SAR

Convert the measured conducted TX power from step 4 into 1gSAR or 10gSAR value using the following equation. Perform the running time average to power and 1gSAR or 10g SAR to determine time-averaged value versus time as follows,



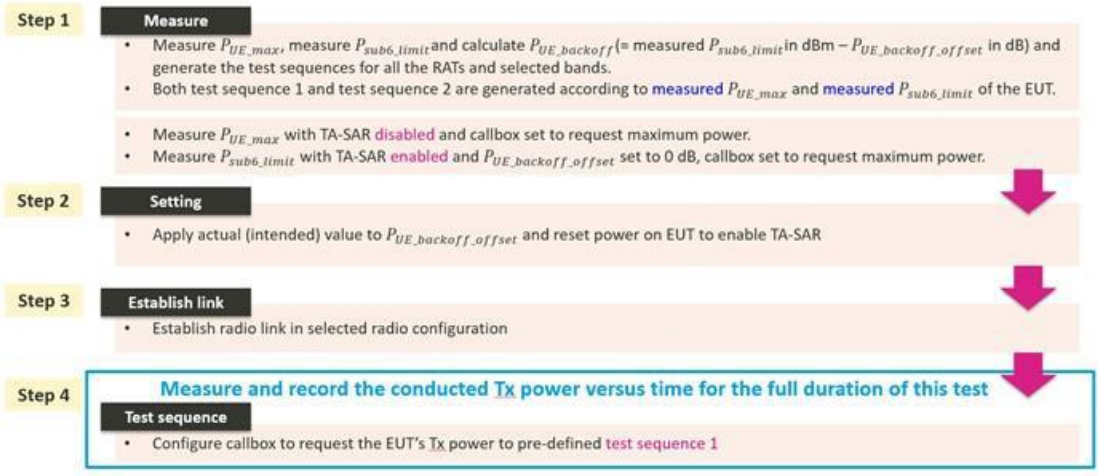


- Step 6: Plot results
    - Make one power perspective plot containing:
        - Instantaneous TX power.
        - Requested power.
        - Calculated time-averaged power.
        - Calculated time-averaged power limits.
    - Make one SAR perspective plot containing
        - Calculated time-averaged 1gSAR or 10gSAR.
        - FCC limit of 1.6 W/kg (1gSAR) or 4.0 W/kg (10gSAR).

4.3.2 Scenario 2: Time-Varying TX Power via Conducted Power Measurements

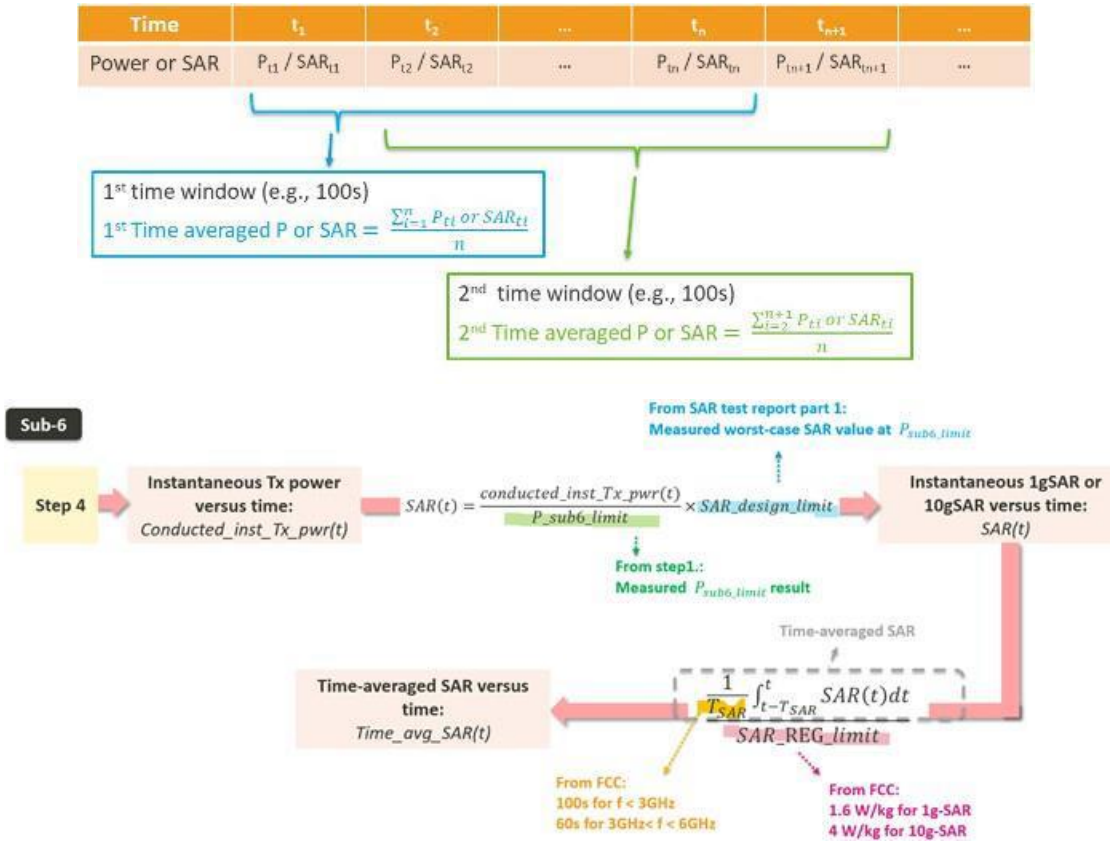
TX power is measured, recorded, and processed by the following steps:

- Step 1~4: measure and record TX power versus time for test scenario 2



- Step 5: convert the measured conducted TX power into SAR

Convert the measured conducted TX power from step 4 into 1gSAR or 10gSAR value using the following equation. Perform the running time average to power and 1gSAR or 10g SAR to determine time-averaged value versus time as follows,



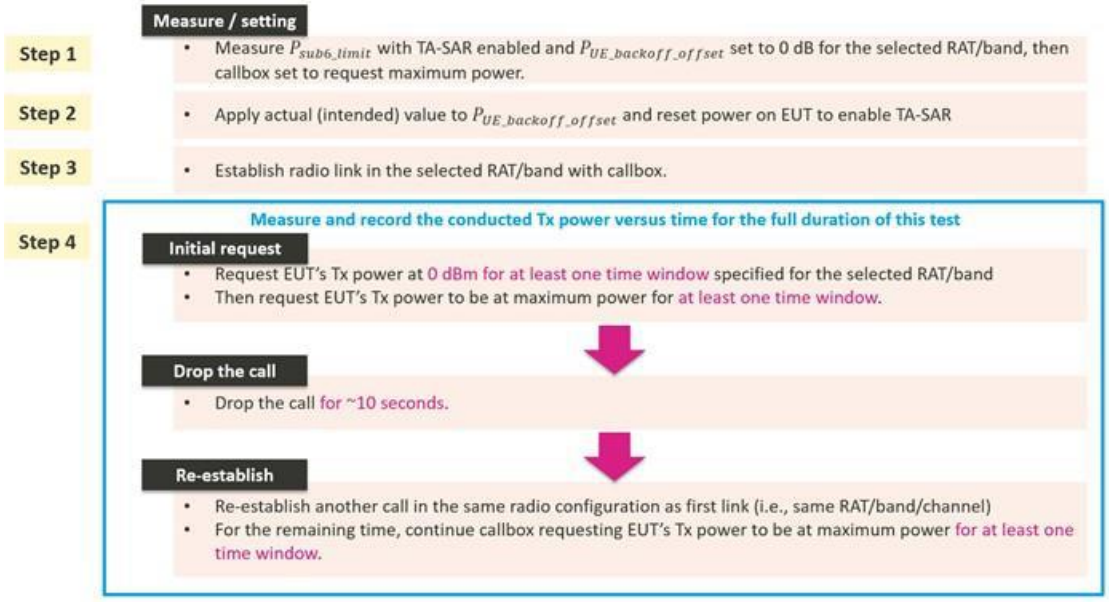
- Step 6: Plot results
  - Make one power perspective plot containing:
    - Instantaneous TX power.
    - Requested power (test sequence 1).
    - Calculated time-averaged power.
    - Calculated time-averaged power limits.
  - Make one SAR perspective plot containing
    - Calculated time-averaged 1gSAR or 10gSAR.
    - FCC limit of 1.6 W/kg (1gSAR) or 4.0 W/kg (10gSAR).
- Step 7: repeat steps 2~6 for test sequence 2.

  Repeat steps 2 ~ 6 for pre-defined test sequence 2 and replace test sequence 1 in step 4 with test sequence 2.
- Step 8: repeat steps 2~7 for different bands.

4.3.3 Scenario 3: Call Disconnection and Re-establishment via Conducted Power Measurements

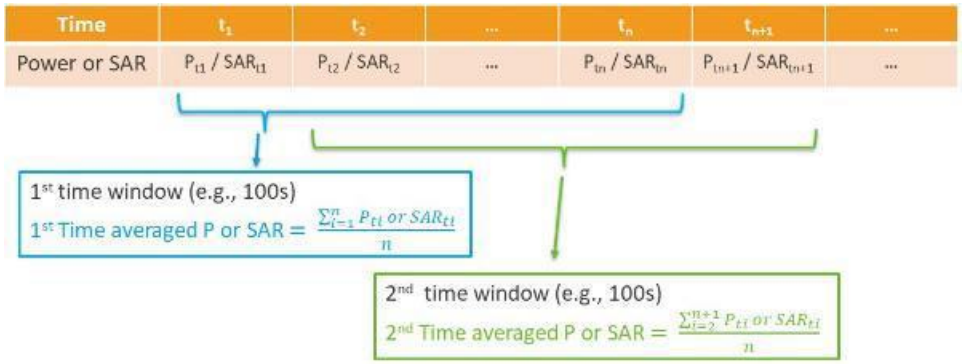
TX power is measured, recorded, and processed by the following steps:

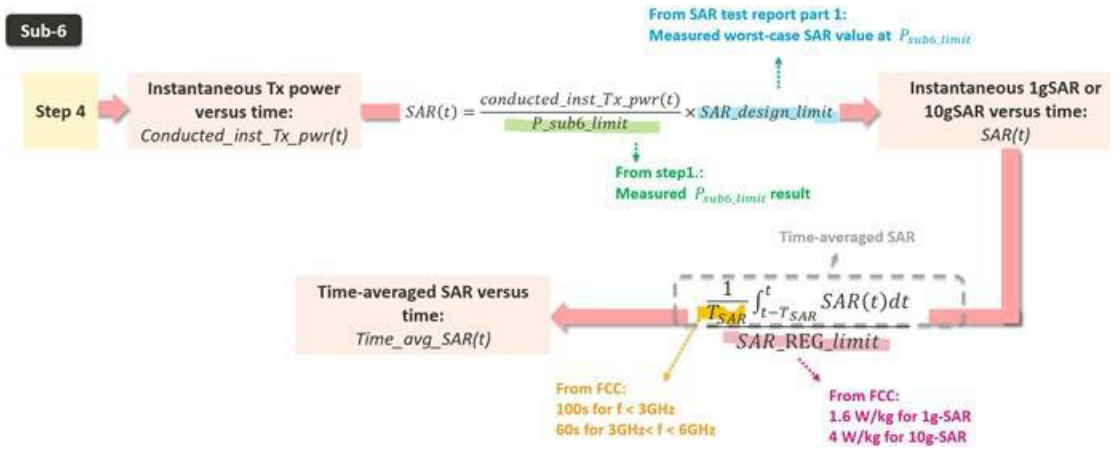
- Step 1~4: measure and record TX power versus time for test scenario 3



- Step 5: convert the measured conducted TX power into SAR

Convert the measured conducted TX power from step 4 into 1gSAR or 10gSAR value using the following equation. Perform the running time average to power and 1gSAR or 10g SAR to determine time-averaged value versus time as follows,



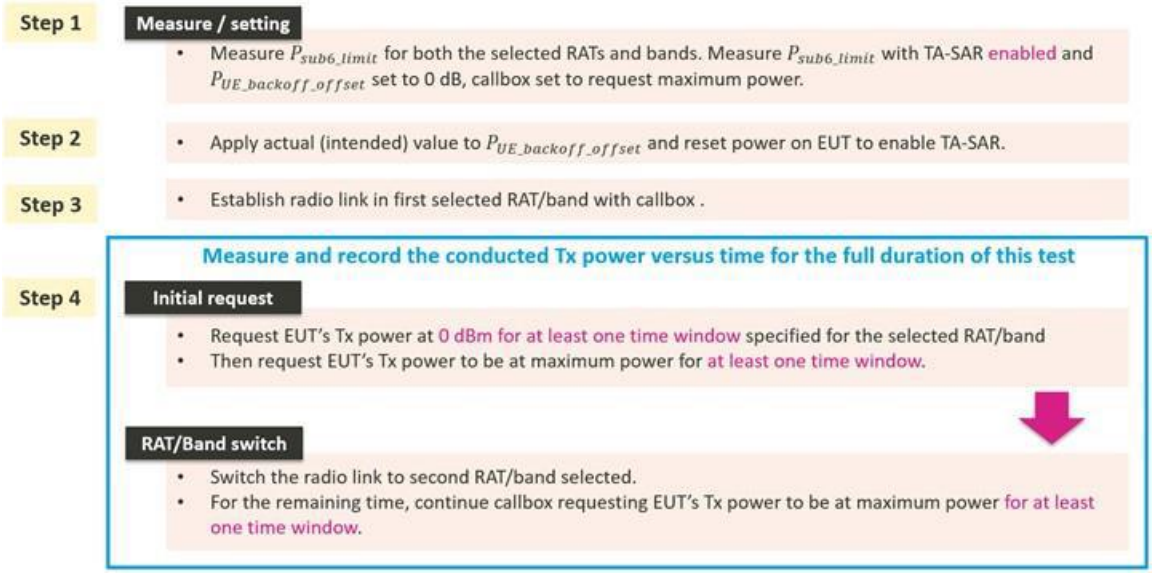


- Step 6: Plot results
    - Make one power perspective plot containing:
        - Instantaneous TX power.
        - Requested power.
        - Calculated time-averaged power.
        - Calculated time-averaged power limits.
    - Make one SAR perspective plot containing
        - Calculated time-averaged 1gSAR or 10gSAR.
        - FCC limit of 1.6 W/kg (1gSAR) or 4.0 W/kg (10gSAR).

4.3.4 Scenario 4: Band Handover via Conducted Power Measurements

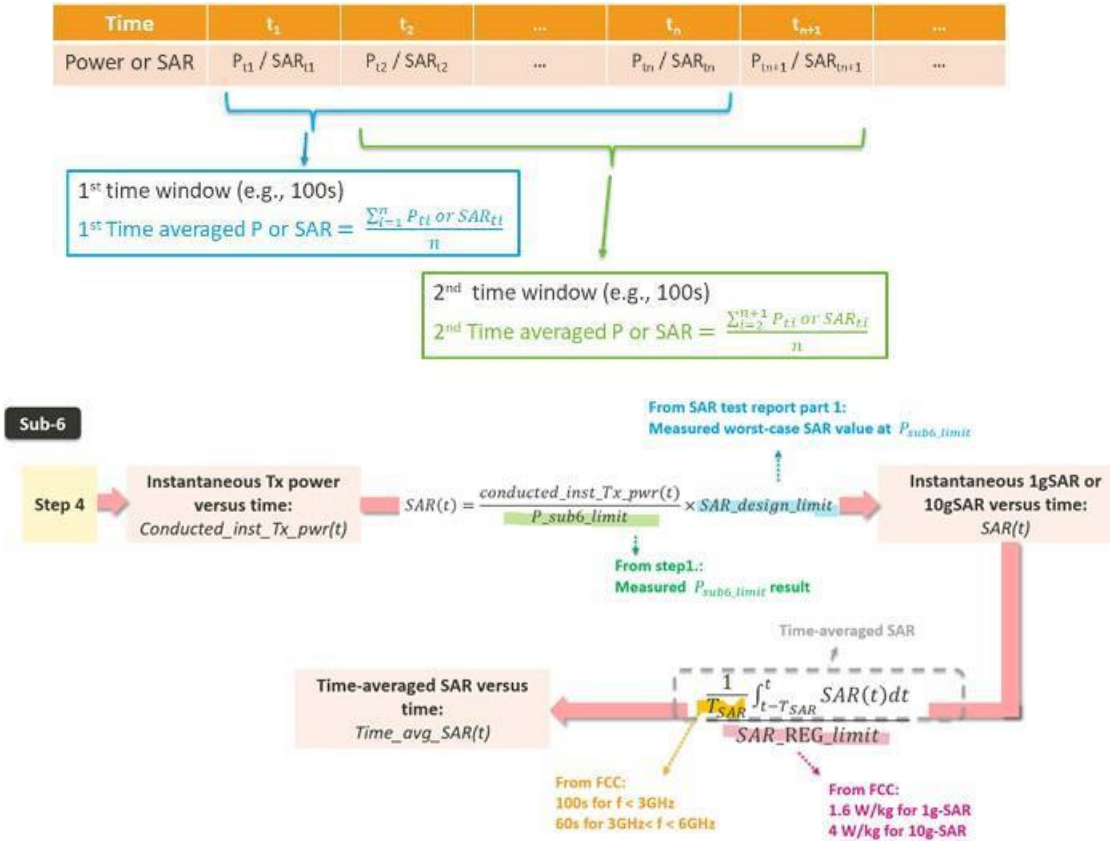
TX power is measured, recorded, and processed by the following steps:

- Step 1~4: measure and record TX power versus time for test scenario 3



- Step 5: convert the measured conducted TX power into SAR

Convert the measured conducted TX power from step 4 into 1gSAR or 10gSAR value using the following equation. Perform the running time average to power and 1gSAR or 10g SAR to determine time-averaged value versus time as follows,



- Step 6: Plot results
  - Make one power perspective plot containing:
    - Instantaneous TX power.
    - Requested power.
    - Calculated time-averaged power.
    - Calculated time-averaged power limits.
  - Make one SAR perspective plot containing
    - Calculated time-averaged 1gSAR or 10gSAR.
    - FCC limit of 1.6 W/kg (1gSAR) or 4.0 W/kg (10gSAR).

4.3.5 Scenario 5: Exposure Condition Index (ECI) Change via Conducted Power

The test procedure is identical to section 4.3.4 except for the following 2 changes:

- Replace band switch operation with ECI switch.
- In Step 4, the second ECI switching is arranged after the first one lasts for at least one time window, i.e., switch the second ECI back to the first ECI, and then continue with callbox requesting EUT's Tx power to be at maximum power for at least one time window.

It is noted that the following operations are done as well for this scenario:

- The correct power control is controlled by TA_SAR during ECI switches from one ECI to another.
- The validation criteria are, at all times, the time-averaged 1gSAR or 10gSAR versus time shall not exceed FCC limit of 1.6 W/kg for 1gSAR or 4.0 W/kg for 10gSAR.

4.3.6 Scenario 6: Antenna Switching via Conducted Power Measurements

The test procedure is identical to section 4.3.4 except for the following 2 changes:

- Replace band switch operation with antenna switch.
- In Step 4, the second antenna switching is arranged after the first one lasts for at least one time window, i.e., switch the second antenna back to the first antenna, and then continue with callbox requesting EUT's Tx power to be at maximum power for at least one time window.

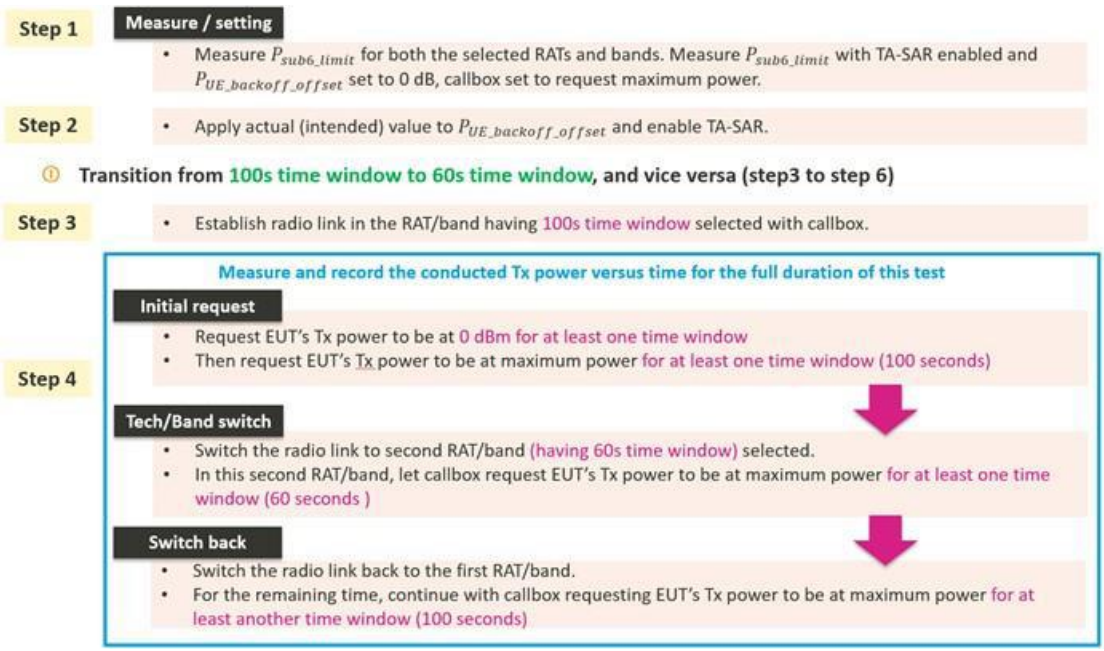
It is noted that the following operations are done as well for this scenario:

- The correct power control is controlled by TA_SAR during antenna switches from one antenna to another.
- The validation criteria are, at all times, the time-averaged 1gSAR or 10gSAR versus time shall not exceed FCC limit of 1.6 W/kg for 1gSAR or 4.0 W/kg for 10gSAR.

4.3.7 Scenario 7: Time Window Switching via Conducted Power Measurements

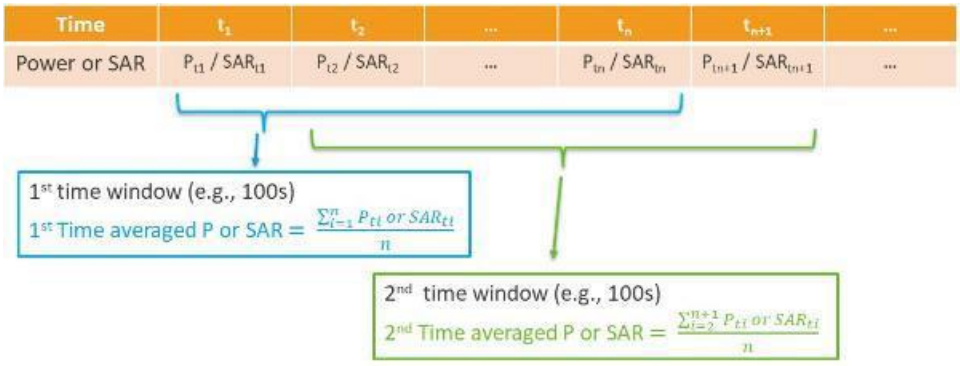
TX power is measured, recorded, and processed by the following steps:

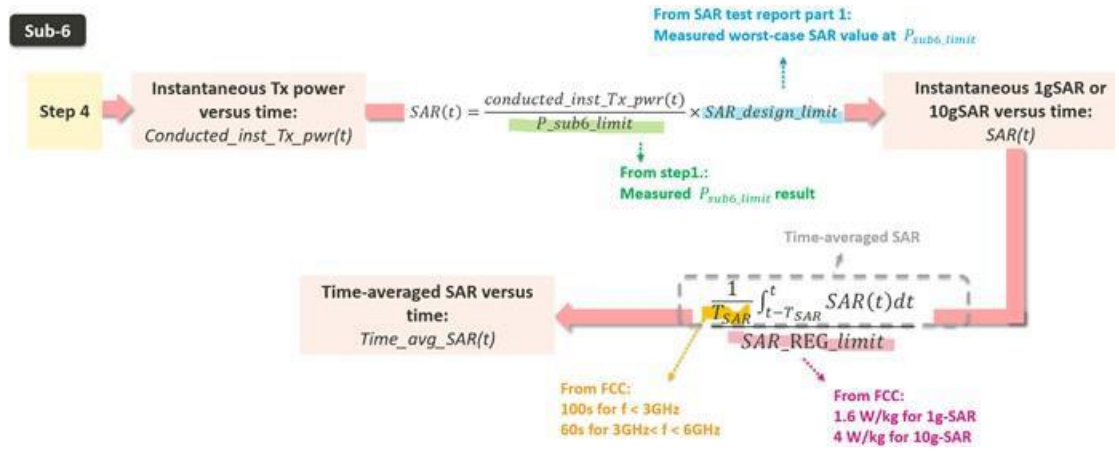
- Step 1~4: measure and record TX power versus time for test scenario 3



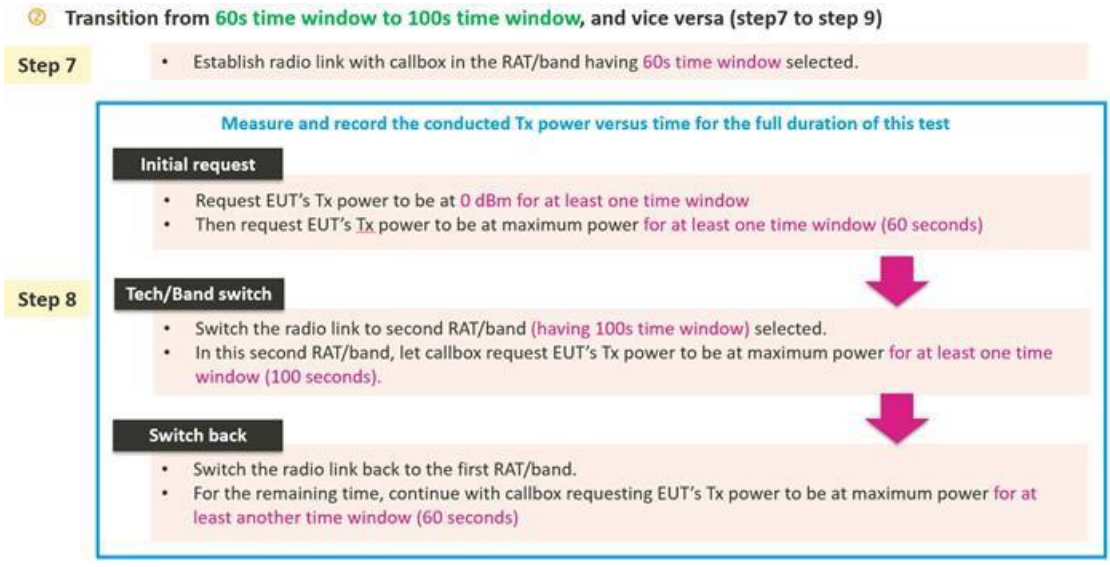
- Step 5: convert the measured conducted TX power into SAR

Convert the measured conducted TX power from step 4 into 1gSAR or 10gSAR value using the following equation. Perform the running time average to power and 1gSAR or 10g SAR to determine time-averaged value versus time as follows,





- Step 6: Plot results
  - Make one power perspective plot containing:
    - Instantaneous TX power.
    - Requested power.
    - Calculated time-averaged power.
    - Calculated time-averaged power limits.
  - Make one SAR perspective plot containing
    - Calculated time-averaged 1gSAR or 10gSAR.
    - FCC limit of 1.6 W/kg (1gSAR) or 4.0 W/kg (10gSAR).
    - Normalized time-averaged 1gSAR/1.6 or 10gSAR/4.0.
- Step 7~8: measure and record TX power versus time in another time window change

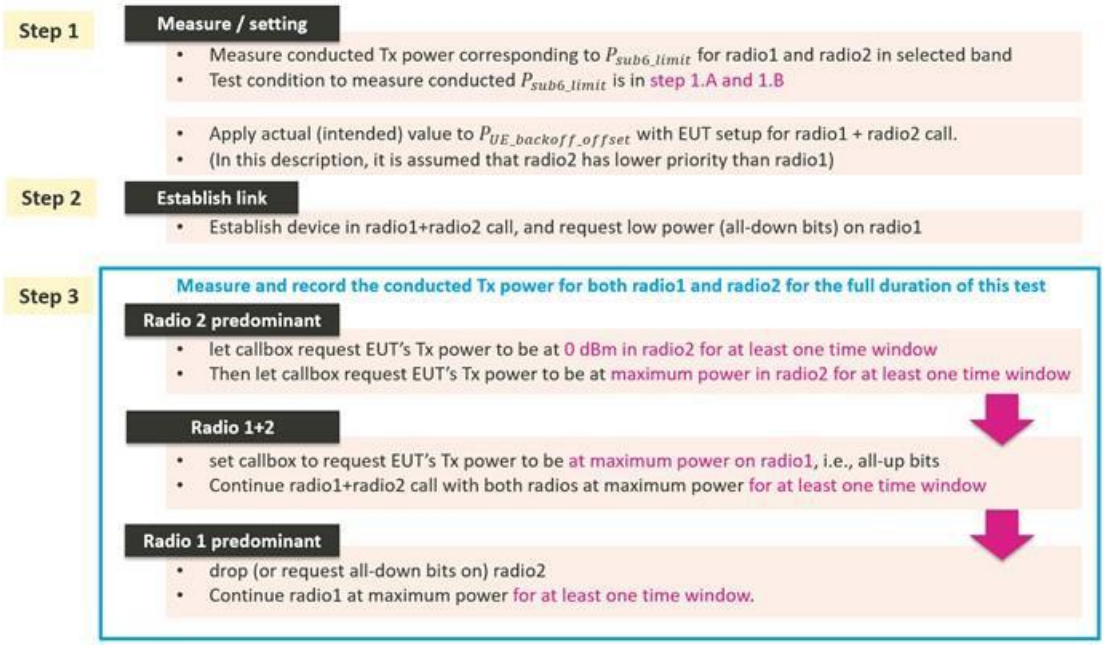


- Step 9: convert the measurement and plot results

- Convert the measured conducted TX power from step 8 into 1gSAR or 10gSAR value using the equation in step 5.
- Repeat step 6 to generate the plots.

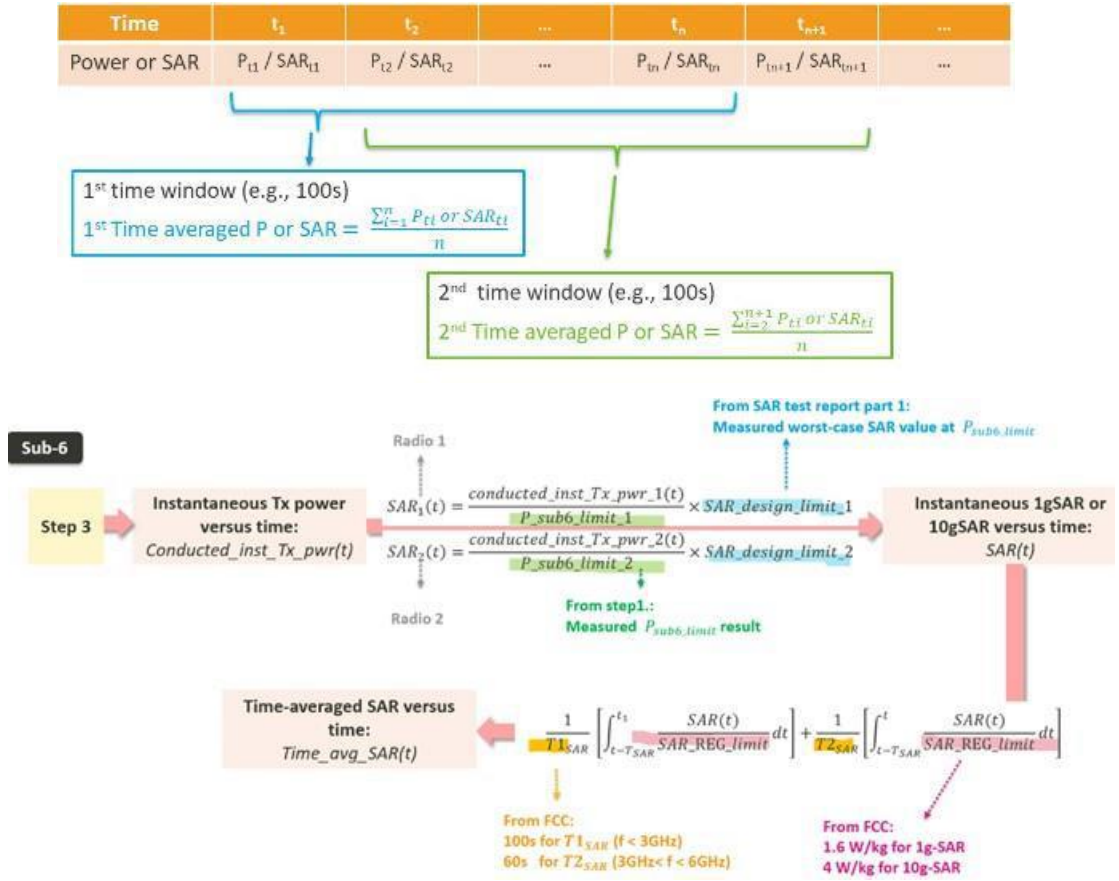
4.3.8 Scenario 8: SAR Exposure Switching via Conducted Power Measurements

- Step 1~3: measure and record TX power versus time for test scenario 8 A.
  - Measure conducted TX power corresponding to radio1 P_{sub6_limit}
    - Establish device in call with the callbox for radio1 band.
    - Measure conducted TX power corresponding to radio1 P_{sub6_limit} with TA_SAR enabled and $P_{EU\_backoff\_offset}$ set to 0 dB, callbox set to request maximum power.
  - Measure conducted TX power corresponding to radio2 P_{sub6_limit}
    - Repeat above step to measure conducted TX power corresponding to radio2 P_{sub6_limit}.
    - If radio2 is dependent on radio1 (for example, non-standalone mode of NR FR1 requiring radio1 LTE as anchor), then establish radio1 + radio2 call with callbox, and request all down bits for radio1 LTE.
    - In this scenario, with callbox requesting maximum power from radio2 NR FR1, measured conducted TX power corresponds to radio2 P_{sub6_limit} (as radio1 LTE is at all-down bits).



- Step 4: convert the measured conducted TX power into SAR

Convert the measured conducted TX power from step 3 into 1gSAR or 10gSAR value using the following equation. Perform the running time average to power and 1gSAR or 10g SAR to determine time-averaged value versus time as follows,

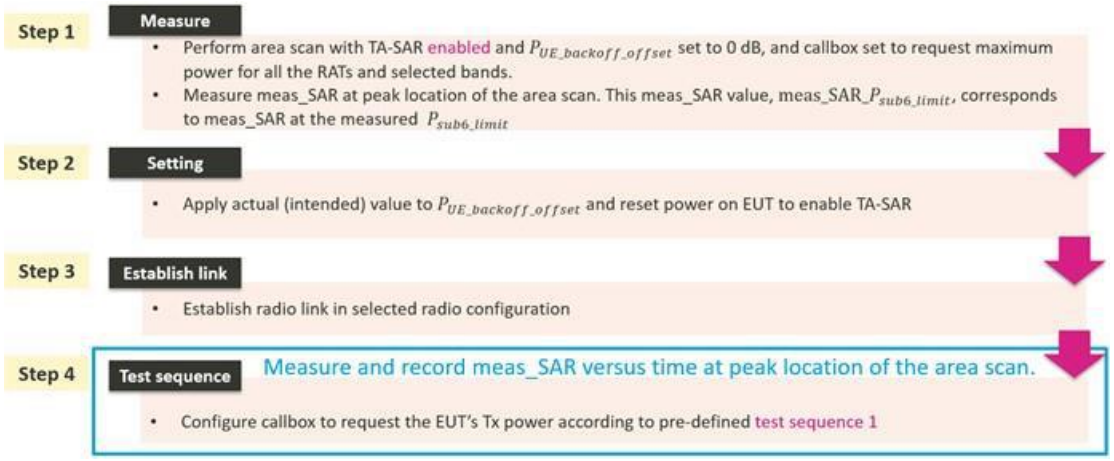


- Step 5: Plot results
  - Make one power perspective plot containing:
    - Instantaneous TX power.
    - Requested power.
    - Calculated time-averaged power.
    - Calculated time-averaged power limits.
  - Make one SAR perspective plot containing
    - Calculated time-averaged 1gSAR or 10gSAR.
    - FCC limit of 1.6 W/kg (1gSAR) or 4.0 W/kg (10gSAR).
    - Normalized time-averaged 1gSAR/1.6 or 10gSAR/4.0.

4.3.9 Scenario 2: Time-Varying TX Power via SAR Measurements

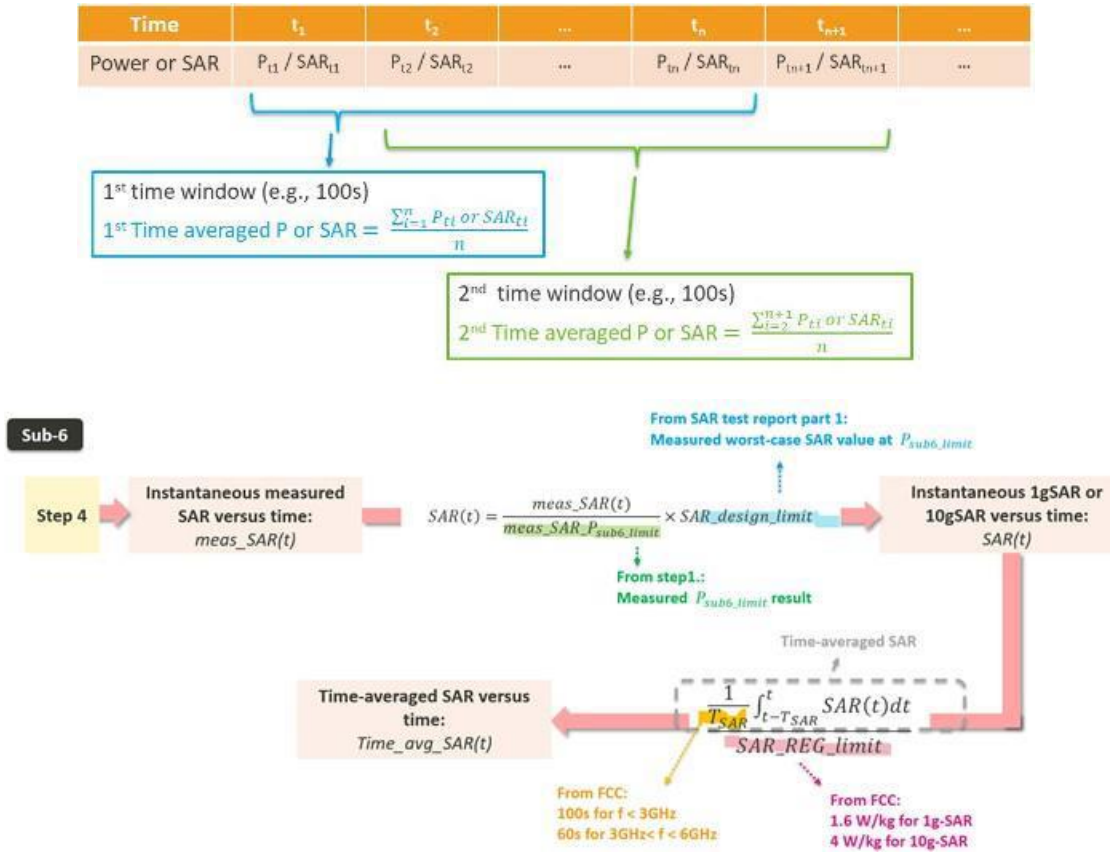
SAR is measured, recorded, and processed by the following steps:

- Step 1~4: measure and record TX power versus time for test scenario 3



- Step 5: convert the measured SAR into time-averaged SAR

Convert the instantaneous measured SAR from step 4 into 1gSAR or 10gSAR value. Perform the running time average to 1gSAR or 10g SAR to determine time-averaged value versus time as follows,



where, *meas_SAR_P*$_{sub6\_limit}$ is the value determined in step 1, and *meas_SAR(t)* is the instantaneous measured SAR measured in step 4.

- Step 6: Plot results
    - Calculated time-averaged 1gSAR or 10gSAR.
    - FCC limit of 1.6 W/kg (1gSAR) or 4.0 W/kg (10gSAR).
- Step 7: repeat steps 2 ~ 6 for pre-defined test sequence 2

Repeat steps 2 ~ 6 for pre-defined test sequence 2 and replace test sequence 1 in step 4 with test sequence 2.

- Step 8: repeat steps 2 ~ 7 for all the selected bands

The validation criteria are, at all times, the time-averaged 1gSAR or 10gSAR versus time shall not exceed FCC limit of 1.6 W/kg for 1gSAR or 4.0 W/kg for 10gSAR.

5 POWER LIMIT AND TEST CONFIGURATIONS

5.1 Sub-6 Power Limit Table

The P_{sub6_limit} values, corresponding to 0.75 W/kg (1gSAR) and 2.27 W/kg (10gSAR) of *SAR_design_limit*, for technologies and bands supported by EUT are summarized in Table 5-1.The *SAR_design_limit* is determined by factoring in device uncertainty margin. It is important to note that for TDD bands with transmit duty cycles less than or equal to 100%, the measured power limit reflects the burst-average power level and does not account for the TX duty cycle.

Table 5-1
P_{sub6_limit} for supported RAT

Exposure Scenario:	Maximum Tune-up Output Power*	Head	Extremity
Averaging Volume:		1g	10g
Spacing:		10 mm	0 mm
ECI:		1	0
Technology/Band	Pmax		
LTE Band 71	24.50	50.10	31.50
LTE Band 12	24.50	46.20	30.30
LTE Band 17	24.50	N/A	N/A
LTE Band 13	24.50	48.90	30.90
LTE Band 14	24.50	50.10	30.50
LTE Band 26	24.50	54.20	32.60
LTE Band 5	24.50	52.10	32.80
LTE Band 4	24.00	N/A	N/A
LTE Band 66	24.00	28.90	37.00
LTE Band 2	24.00	N/A	N/A
LTE Band 25	24.00	27.90	35.30
LTE Band 7	24.00	18.40	36.50
LTE Band 41	22.00	19.20	36.40
LTE Band 53	20.00	41.90	29.00
NR Band n71	24.50	47.90	31.30
NR Band n12	24.50	48.30	30.10
NR Band n14	24.50	46.30	30.20
NR Band n26	24.50	50.70	32.10
NR Band n5	24.50	53.80	32.10
NR Band n66	24.00	29.30	37.70
NR Band n2	24.00	N/A	N/A
NR Band n25	24.00	26.90	38.30
NR Band n7	24.00	18.40	37.40
NR Band n41	24.00	18.60	37.90
NR Band n53	20.00	40.50	26.30

Table 5-2
ECI and Corresponding Exposure Scenarios

Scenario	Description	SAR Test Cases
Extremity – Back Side (ECI = 0)	▪ Device evaluated for wrist exposure ▪ 0 mm distance from a flat phantom ▪ Back Side	*Wristwatch and wrist-worn transmitter SAR per KDB Publication 447498 D04*
Head – Front Side (ECI = 1)	▪ Device evaluated for next-to-mouth use in front of the device ▪ 10 mm distance from a flat phantom to measure head SAR ▪ Front Side	*Wristwatch and wrist-worn transmitter SAR per KDB Publication 447498 D04*

5.2 Test Configuration

Table 5-3 lists the radio configurations used in TA-SAR validation testing, including technologies, bands, ECIs, antennas, and worst-case measured 1g/10g SAR under P_{sub6_limit}.

Table 5-3
Test configurations selected for TAS validation

Test Case #	Test Scenario	Technology	Antenna	ECI	Band	Channel	Frequency (MHz)	Test Configurations	SAR Exposure Scenario	Worst Case Measured SAR at Plim (W/kg)	Tune-up Plimit (dBm)	Tune-up Pmax (dBm)	Measured Plimit (dBm)	Measured Pmax (dBm)
1	Range of TA-SAR Parameter	LTE	FCM	1	7	21100	2535	QPSK 1/0, 20 MHz BW	Front, 10 mm	0.747	18.4	24.0	19.92	25.47
2	Time Varying Tx Power	LTE	FCM	1	41 PC3	40620	2593	QPSK 1/0, 20 MHz BW	Front, 10 mm	0.866	19.2	22.0	19.00	22.11
3			FCM	1	7	21100	2535	QPSK 1/0, 20 MHz BW	Front, 10 mm	0.747	18.4	24.0	18.73	24.32
4		NR SA	FCM	1	n41 PC3	518598	2593	DFT-s-OFDM QPSK 1/1, 20 MHz BW	Front, 10 mm	0.882	18.6	24.0	17.81	22.46
5			FCM	1	n7	507000	2535	DFT-s-OFDM QPSK 1/1, 20 MHz BW	Front, 10 mm	0.879	18.4	24.0	18.77	24.17
6	Call Disconnection and Re-establishment	LTE	FCM	1	7	21100	2535	QPSK 1/0, 20 MHz BW	Front, 10 mm	0.747	18.4	24.0	18.73	24.32
7	Band Handover	NR SA	FCM	1	n7	507000	2535	DFT-s-OFDM QPSK 1/1, 20 MHz BW	Front, 10 mm	0.879	18.4	24.0	18.77	24.17
		LTE	FCM	1	41 PC3	40620	2593	QPSK 1/0, 20 MHz BW	Front, 10 mm	0.866	19.2	22.0	19.00	22.11
8	Exposure Condition Index (ECI) Change	LTE	FCM	0	7	21100	2535	QPSK 1/0, 20 MHz BW	Back, 0 mm	0.145	36.5	24.0	25.23	25.18
				1	7	21100	2535	QPSK 1/0, 20 MHz BW	Front, 10 mm	0.747	18.4	24.0	20.10	25.09
9	Antenna Switch	LTE	FCM	1	7	21100	2535	QPSK 1/0, 20 MHz BW	Front, 10 mm	0.747	18.4	24.0	19.95	24.05
		LTE	BCM	1	71	133297	681	QPSK 1/0, 20 MHz BW	Front, 10 mm	0.003	50.1	24.5	24.86	24.89

Note: The conducted power tolerance of P_{lim} for LTE Band 7, LTE Band 41 PC3, NR n7 SA and NR n41 PC3 SA is +2/-1 dB, as provided by manufacturer.

Note: The conducted power tolerance of P_{lim} for the other supported bands is +1.2/-1 dB, as provided by manufacturer.

Note: The conducted power tolerance of P_{max} is at +1.2 dB as provided by manufacturer.

Based on the selection criteria described in Section 4.2, the radio configurations for the Tx varying transmission test cases listed in Section 3 are:

1. Scenario 1: Based on selection criteria in Section 4.2.1, The test case 1 listed in Table 5-3 is selected to test with the test sequences in range of TA-SAR parameters conducted power measurement.
2. Scenario 2: Based on selection criteria in Section 4.2.2, The test cases 2~5 listed in Table 5-3 is selected to test with the test sequences in both time-varying conducted power measurement and time-varying SAR measurement.
3. Scenario 3: Based on selection criteria in Section 4.2.3, LTE Band 7, Antenna FCM, ECI = 1, having the lowest P_{limit} among all technologies and bands (test case 6 in Table 5-3), is selected for performing the call drop test in conducted power setup.
4. Scenario 4: Based on selection criteria in Section 4.2.4, test case 7 in Table 5-3 is selected for handover test from a technology/band within one technology group (NR n7 SA, ECI = 1, Antenna FCM), to a technology/band in the same ECI within another technology group (LTE Band 41 PC3, ECI = 1, Antenna FCM) in conducted power setup.
5. Scenario 5: Based on selection criteria in Section 4.2.5, test case 8 in Table 5-3 is selected for ECI switch test by establishing a call in LTE Band 7, Antenna FCM in ECI = 0, and then handing over to ECI = 1 exposure scenario in conducted power setup.
6. Scenario 6: Based on selection criteria in Section 4.2.6, for a given ECI=1, test case 9 in Table 5-3 is selected for antenna switch from LTE Band 71, Antenna BCM to LTE Band 7, Antenna FCM in conducted power setup.

6 CONDUCTED POWER MEASUREMENT FOR TA-SAR

6.1 Conducted Power Measurement Setup

LTE test setup

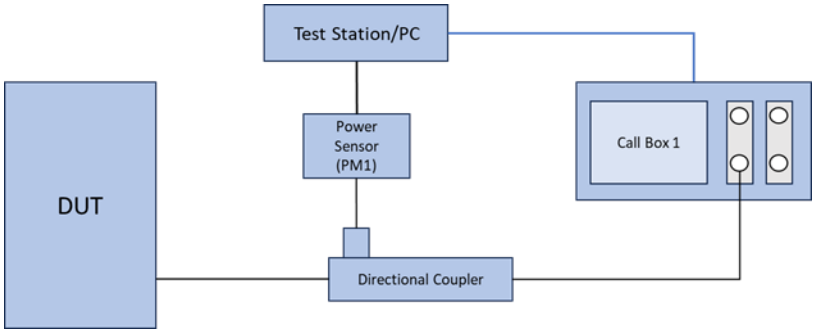
The Rohde & Schwarz CMW500 callbox was used in this test. The test setup schematic is shown in Figure 6-1a (Appendix D – Test Setup Photo 1) for measurements with a single antenna of DUT and in Figure 6-1b (Appendix D – Test Setup Photo 3) for measurements involving antenna switch. For single antenna measurement, one port (RF1 COM) of the callbox is connected to the RF port of the DUT using a directional coupler. In the setups, power meter is used to tap the directional coupler for measuring the conducted output power of the DUT. For all legacy conducted tests, only RF1 COM port of the callbox is used to communicate with the DUT.

Sub6 NR test setup:

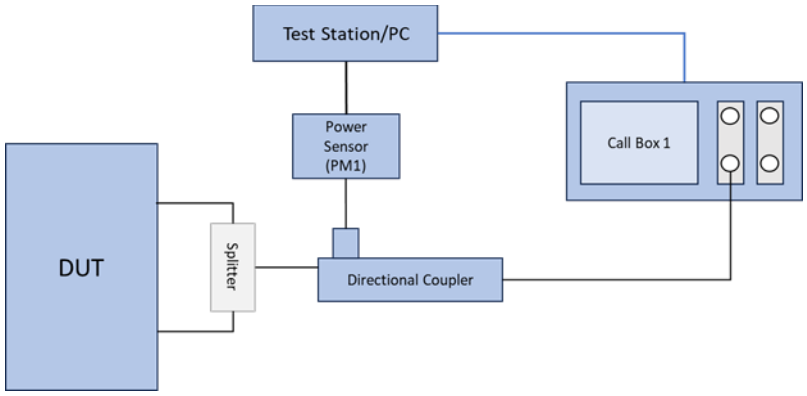
The Keysight UXM 5G callbox was used in this test. The test setup schematic is the same as the Legacy Test Setup shown in Figure 6-1a (Appendix D – Test Setup Photo 2). One port of the callbox is connected to the RF port of the DUT using a directional coupler.

For technology/band switch measurement, the callbox LTE conducted port and Sub6 NR conducted port are separate; therefore, the LTE and Sub6 NR signals for power meter measurement are performed on separate RF ports as shown below in Figure 6-1c (Appendix D – Test Setup Photo 4). One antenna of the DUT used for signaling two different technologies is connected to a directional coupler. The other end of the directional coupler is connected to a splitter to connect to two RF ports of the UXM corresponding to the two technologies of interest. In the setup, the power meter is used to tap the directional coupler for measuring the conducted output power of the DUT.

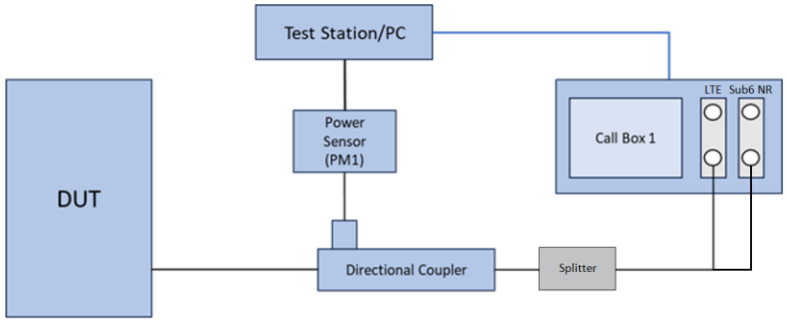
All the path losses from RF port of DUT to the callbox RF COM port and to the power meter are calibrated and automatically entered as offsets in the callbox and the power meter via test scripts on the PC used to control callbox and power meter.



(a) Appendix D – Test Setup Photo 1 and 2



(b) Appendix D – Test Setup Photo 3



(c) Appendix D – Test Setup Photo 4

Figure 6-1
Conducted Power Measurement Setup

Both the callbox and power meter are connected to the PC using GPIB cables. Two test scripts are custom made for automation:

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

- 0dBm for 100 seconds
- test sequence 1 or test sequence 2 (defined in Section 4.1 and generated in Section 4.2.2), for 360 seconds.
- stay at the last power level of test sequence 1 or test sequence 2 for the remaining time.

Power meter readings are periodically recorded every 100ms. A running average of this measured Tx power over 100 seconds is performed in the post-data processing to determine the 100s-time averaged power.

For call drop, technology/band/antenna switch, and ECI switch tests, after the call is established, the callbox is set to request the DUT's Tx power at 0dBm for 100 seconds while simultaneously starting the 2nd test script runs at the same time to start recording the Tx power measured at DUT RF port using the power meter. After the initial 100 seconds since starting the Tx power recording, the callbox is set to request maximum power from the DUT for the rest of the test. Note that the call drop/re-establish, or technology/band/antenna switch or DSI switch is manually performed when the Tx power of DUT is at

$P_{reserve}$ level. See Section 4.3 for detailed test procedure of call drop test, technology/band/antenna switch test and ECI switch test.

6.2 Scenario1: Range of TA-SAR Parameters, Test Case 1

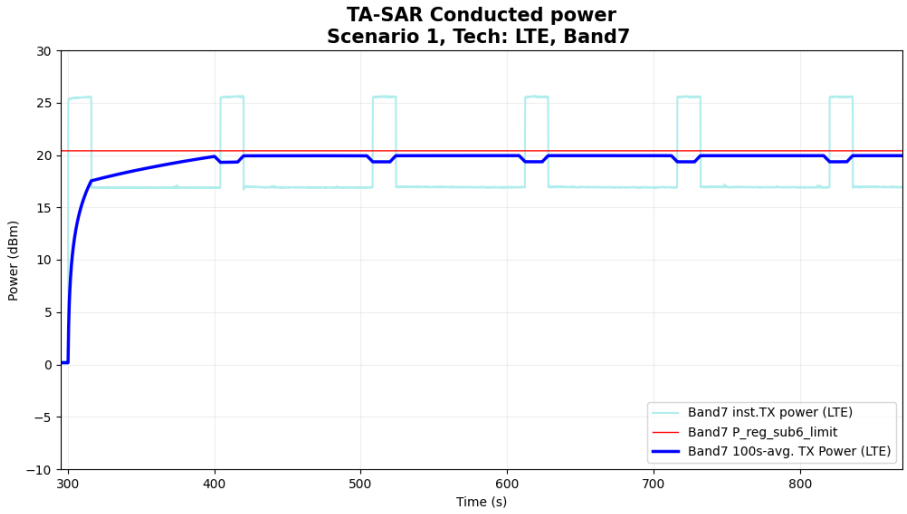
In this scenario, two TA-SAR parameters were varied to validate the performance of MediaTek's TA-SAR algorithm. The corresponding parameter sets are summarized in Table 6-1, and the test procedure is conducted in accordance with Section 4.3.1. The measurement setup is illustrated in Figure 6-1. A high-level summary of the final validation results is presented in the last column of the table, demonstrating that MediaTek's TA-SAR algorithm consistently ensures that the time-averaged SAR remains below the FCC limit across all test conditions. The following section provides a detailed, case-by-case analysis of the algorithm's behavior under different parameter configurations.

Table 6-1 TA-SAR parameters setting for Scenario 1

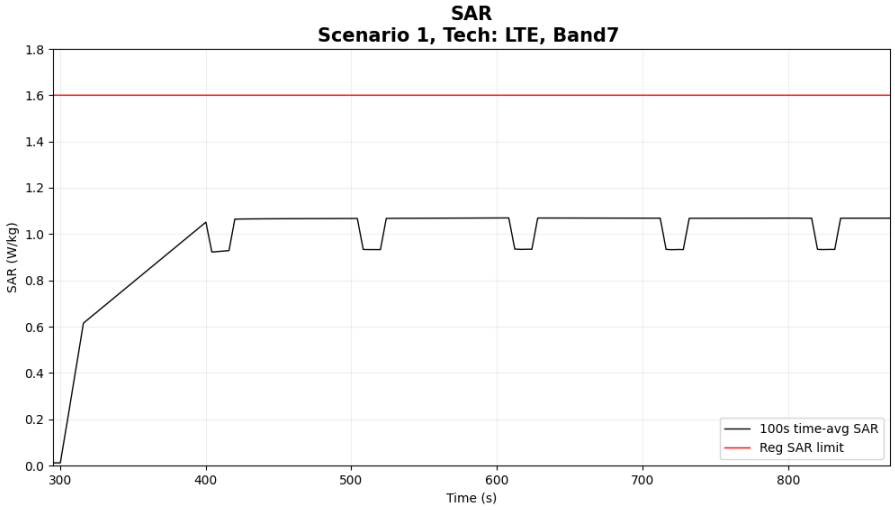
Test Case	RAT	Test Band	Test Seq.	ECI	Max Power (dBm)	P_{sub6_limit} (dBm)	$P_{LowThresh}$ (dBm)	$P_{UE\_backoff}$ (dBm)	$P_{UE\_max\_cust}$ (dBm)	Pass/Fail SAR limit
1	LTE	Band 7	0	1	25.2	18.4	17.4	15.4	18.4	Pass

These test cases are conducted for 4G LTE under Band 7 with ECI = 1. The detailed test procedure is outlined in Section 4.3.1. For each test case, two figures are presented: the first figure illustrates the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit}$ = P_{sub6_limit} + 2 dB device uncertainty). The second figure shows the corresponding time-averaged SAR over time, calculated from the time-averaged TX power using the equation specified in Section 4.3.1. Across all test cases, the time-averaged SAR remains below the FCC regulatory limit.

6.2.1 Test Case 1 LTE Band 7, ECI = 1



Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using 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:



	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (black curve)	1.070
Validated: Pass	

6.3 Scenario 2: Time-Varying TX Power, Test Case 2.1~5.2

In this scenario, MediaTek's TA-SAR algorithm is evaluated under more dynamic power test sequences. Test Sequence #1 and Test Sequence #2 are described in Section 4.1. All corresponding test cases are summarized in Table 6-2, and the test procedure follows the methodology outlined in Section 4.3.2. The measurement setup is depicted in Figure 6-1. A high-level summary of the validation results is provided in the last column of Table 6-2, confirming that MediaTek's TA-SAR algorithm consistently maintains the time-averaged SAR below the FCC regulatory limit across all test cases. The following sections present a case-by-case analysis illustrating the algorithm's performance across different radio access technologies (RATs).

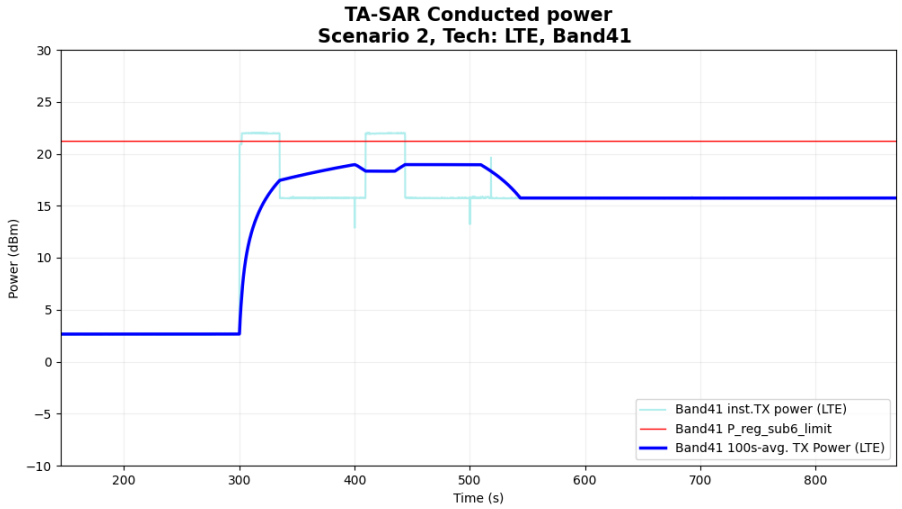
Table 6-2 TA-SAR parameters setting for Scenario 2

Test Case	RAT	Test Band	Test Seq.	ECI	Max Power (dBm)	P_{sub6_limit} (dBm)	$P_{LowThresh}$ (dBm)	$P_{UE\_backoff}$ (dBm)	$P_{UE\_max\_cust}$ (dBm)	Pass/Fail SAR limit
2.1	LTE	Band 41	1	1	25.2	19.2	18.2	16.2	19.2	Pass
2.2	LTE	Band 41	2	1	25.2	19.2	18.2	16.2	19.2	Pass
3.1	LTE	Band 7	1	1	25.2	18.4	17.4	15.4	18.4	Pass
3.2	LTE	Band 7	2	1	25.2	18.4	17.4	15.4	18.4	Pass
4.1	NR SA	n41 PC3	1	1	25.2	18.6	17.6	15.6	18.6	Pass
4.2	NR SA	n41 PC3	2	1	25.2	18.6	17.6	15.6	18.6	Pass
5.1	NR SA	n7	1	1	25.2	18.4	17.4	15.4	18.4	Pass
5.2	NR SA	n7	2	1	25.2	18.4	17.4	15.4	18.4	Pass

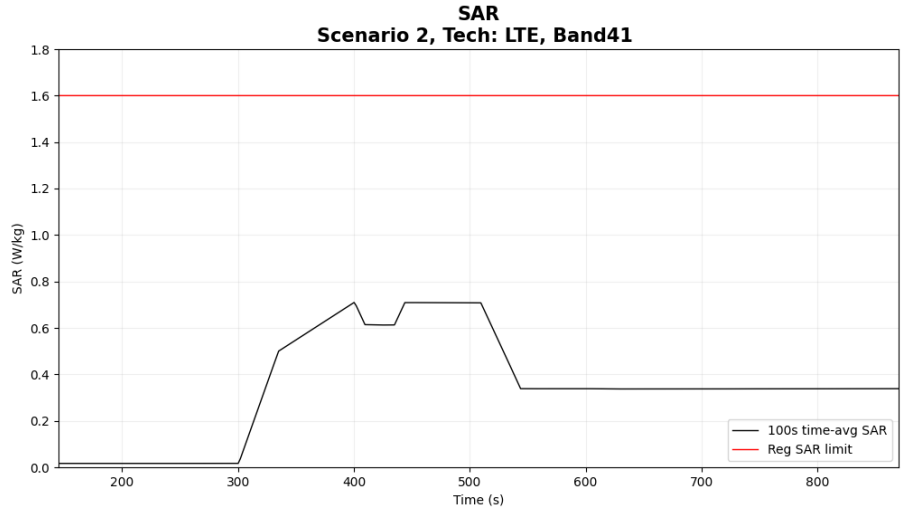
6.3.1 Test Case 2.1~2.2 LTE Band 41, ECI = 1

These test cases are conducted for LTE Band 41 with ECI = 1. The detailed test procedure is outlined in Section 4.3.2. For each test case, two figures are presented: the first figure illustrates the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit} = P_{sub6\_limit}$ + 2 dB device uncertainty). The second figure shows the corresponding time-averaged SAR over time, calculated from the time-averaged TX power using the equation specified in Section 4.3.2. Across all test cases, the time-averaged SAR remains below the FCC regulatory limit.

Test result for test sequence 1:

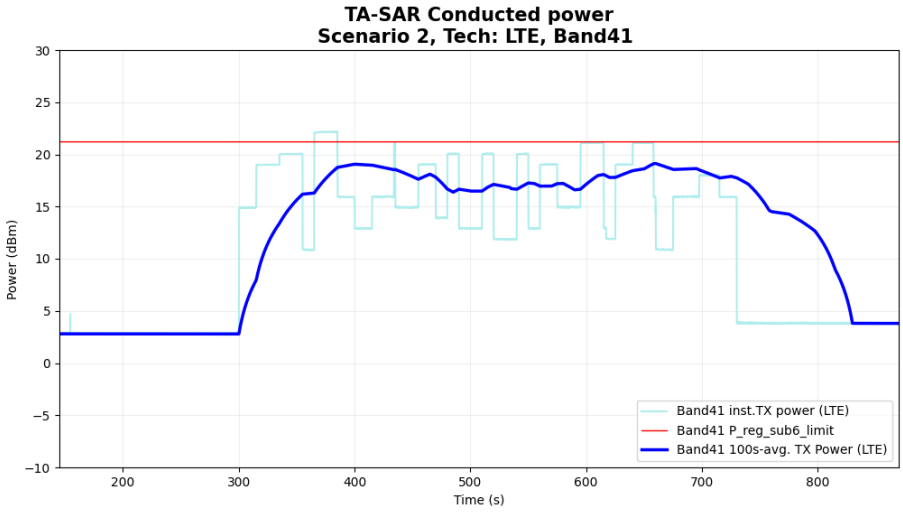


Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using and plotted below to demonstrate that the time-averaged 1gSAR versus time does not exceed the FCC limit of 1.6 W/kg for 1gSAR:

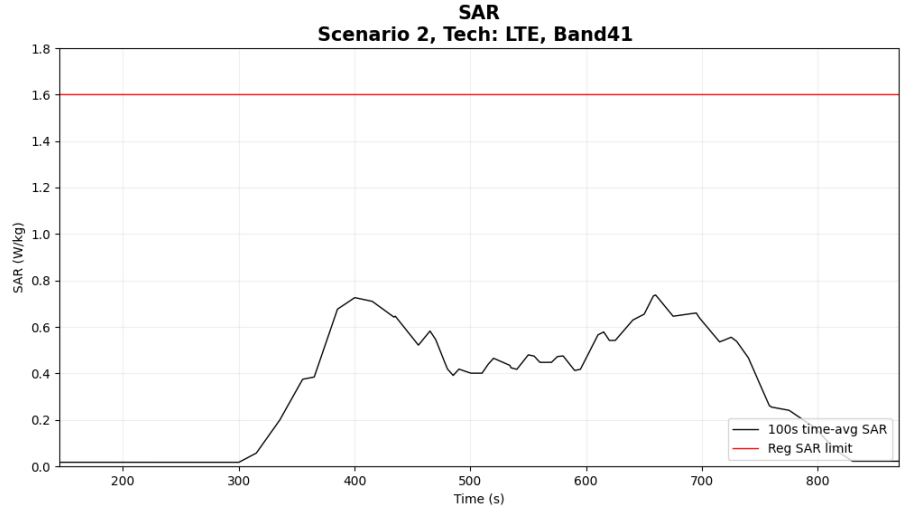


	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (black curve)	0.710
Result: Pass	

Test result for test sequence 2:



Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using 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:

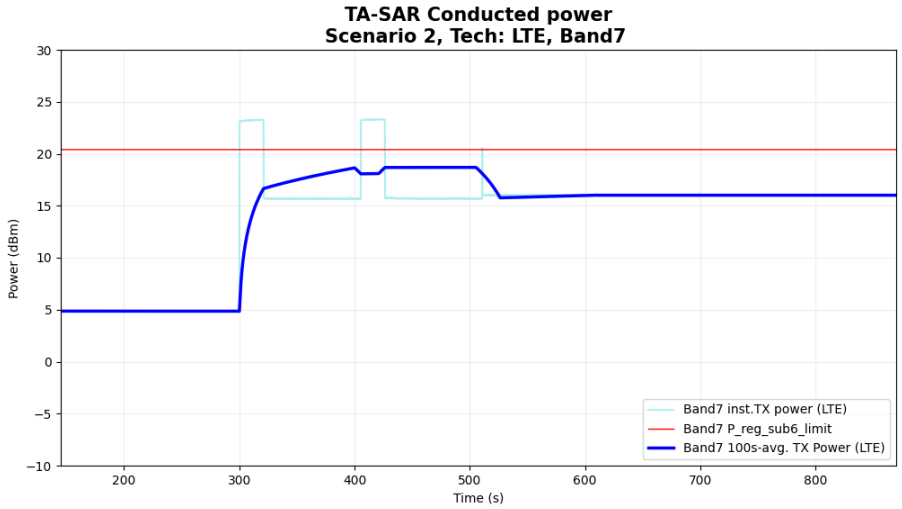


	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (black curve)	0.737
Result: Pass	

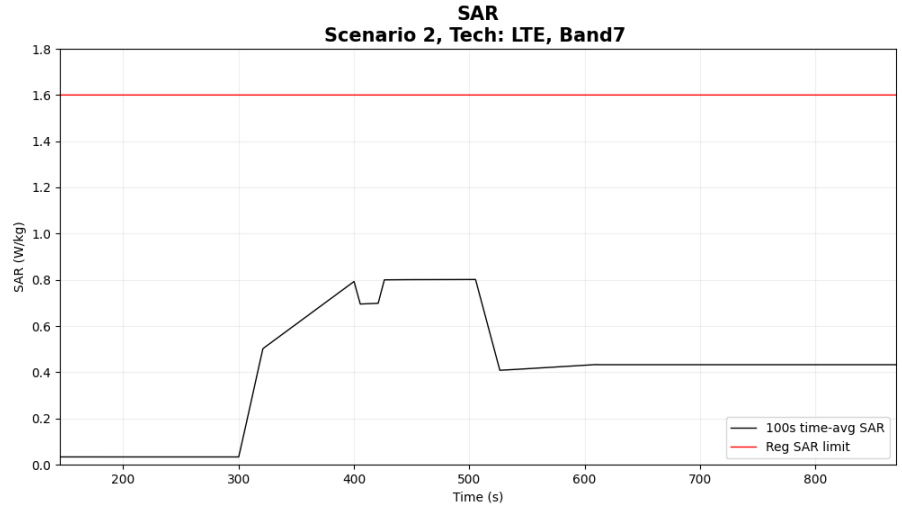
6.3.2 Test Case 3.1~3.2 LTE Band 7, ECI = 1

These test cases are conducted for LTE Band 7 with ECI = 1. The detailed test procedure is outlined in Section 4.3.2. For each test case, two figures are presented: the first figure illustrates the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit} = P_{sub6\_limit}$ + 2 dB device uncertainty). The second figure shows the corresponding time-averaged SAR over time, calculated from the time-averaged TX power using the equation specified in Section 4.3.2. Across all test cases, the time-averaged SAR remains below the FCC regulatory limit.

Test result for test sequence 1:

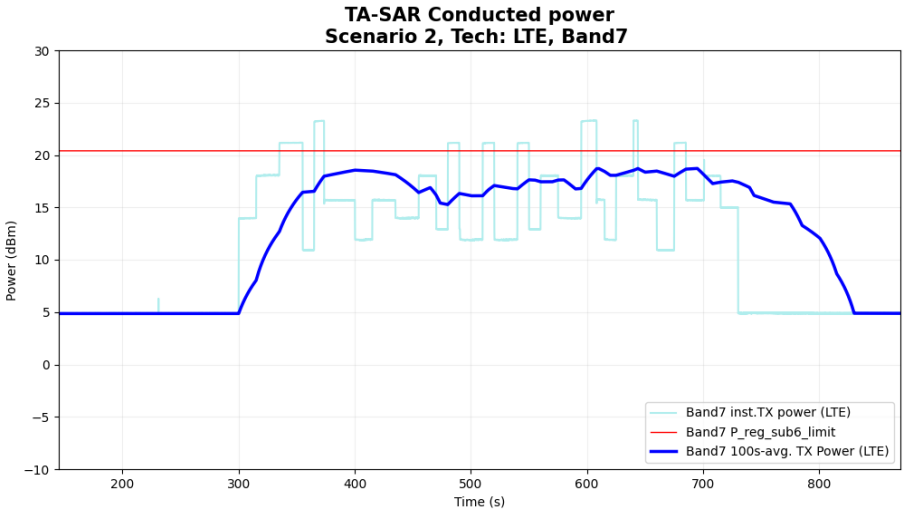


Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using and plotted below to demonstrate that the time-averaged 1gSAR versus time does not exceed the FCC limit of 1.6 W/kg for 1gSAR:

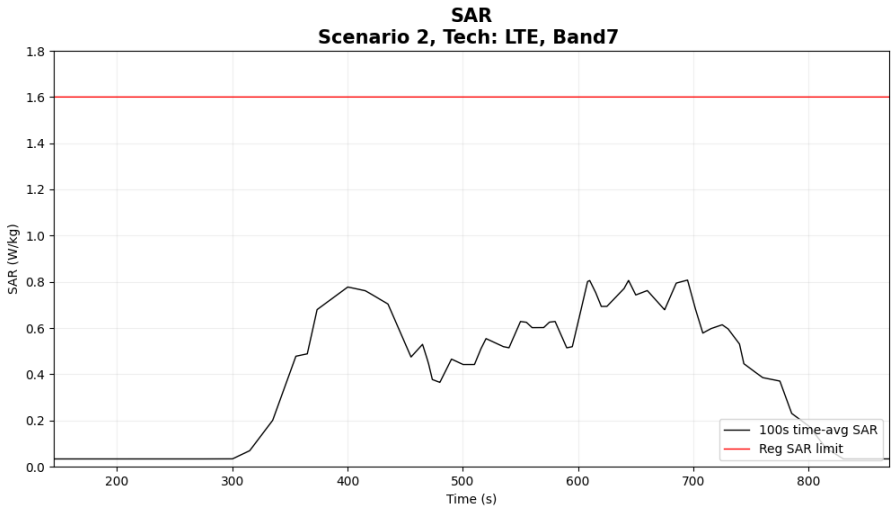


	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (black curve)	0.801
Result: Pass	

Test result for test sequence 2:



Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using 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:

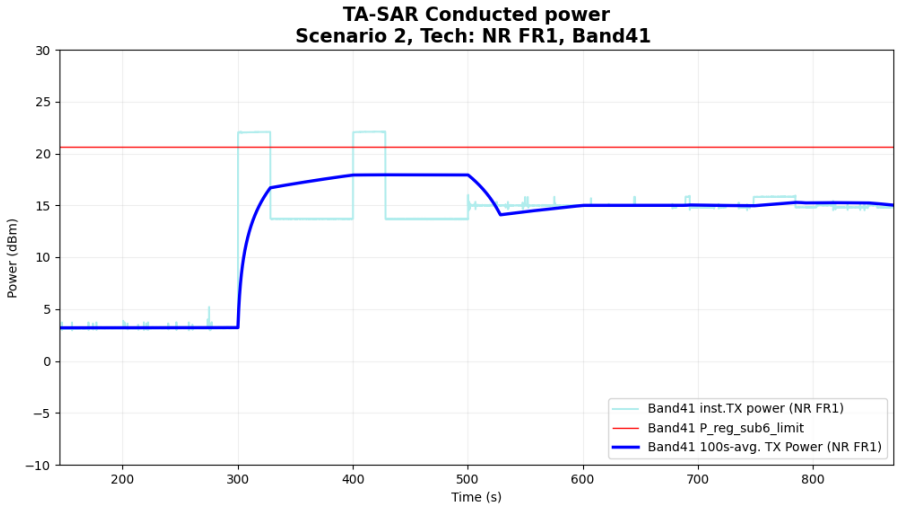


	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (black curve)	0.807
Result: Pass	

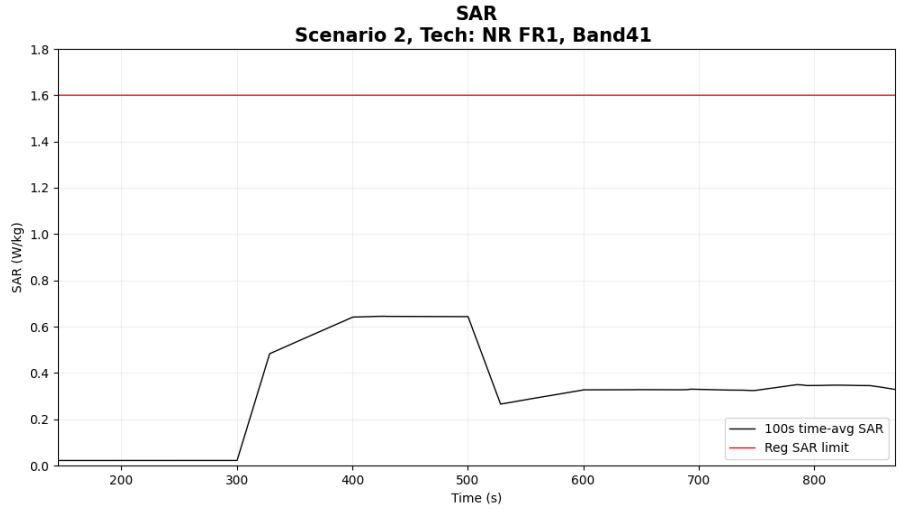
6.3.3 Test Case 4.1~4.2 NR n41 SA, ECI = 1

These test cases are conducted for NR n41 SA with ECI = 1. The detailed test procedure is outlined in Section 4.3.2. For each test case, two figures are presented: the first figure illustrates the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit} = P_{sub6\_limit}$ + 2 dB device uncertainty). The second figure shows the corresponding time-averaged SAR over time, calculated from the time-averaged TX power using the equation specified in Section 4.3.2. Across all test cases, the time-averaged SAR remains below the FCC regulatory limit.

Test result for test sequence 1:

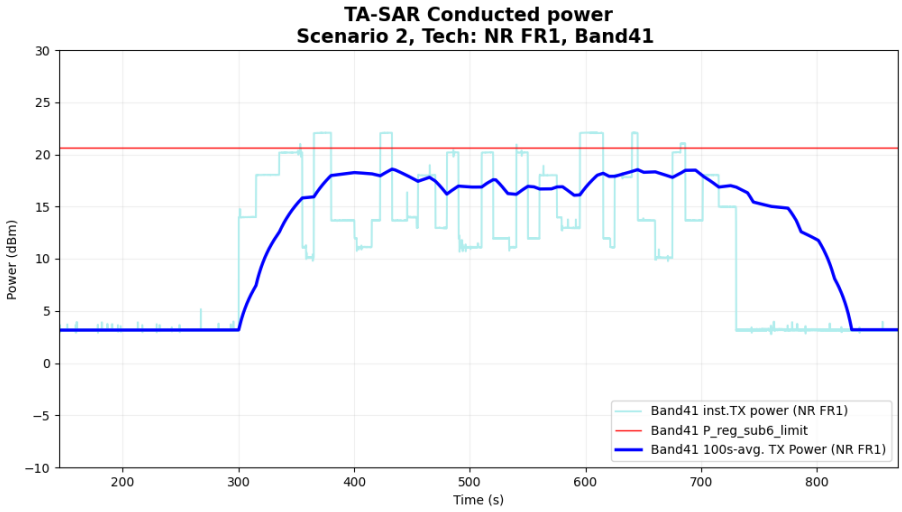


Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using and plotted below to demonstrate that the time-averaged 1gSAR versus time does not exceed the FCC limit of 1.6 W/kg for 1gSAR:

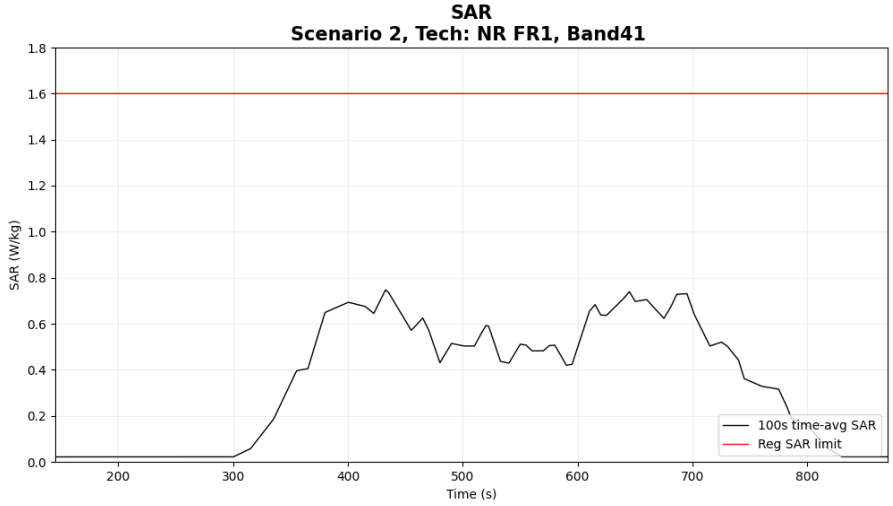


	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (black curve)	0.645
Result: Pass	

Test result for test sequence 2:



Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using 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:

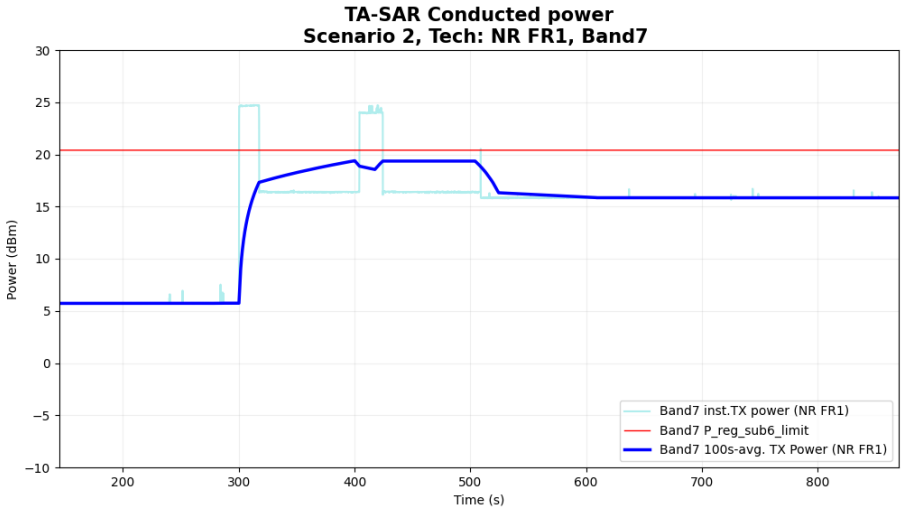


	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (black curve)	0.747
Result: Pass	

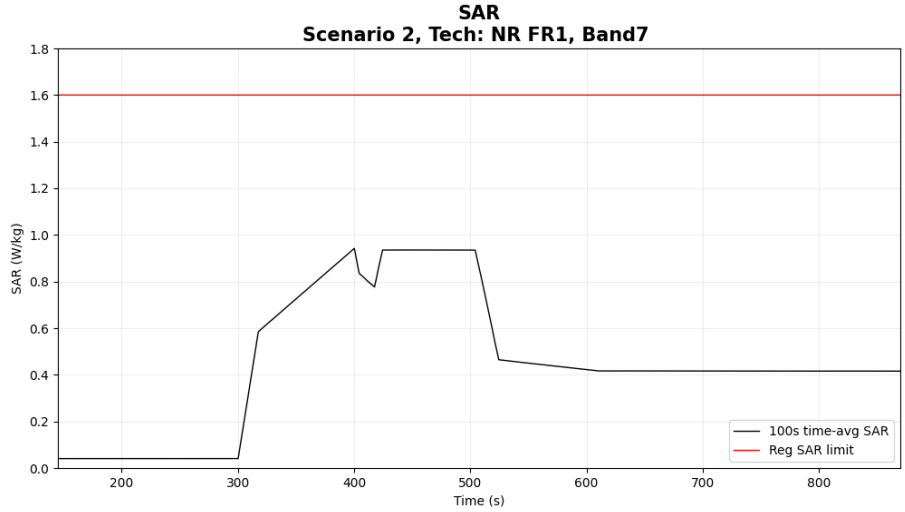
6.3.4 Test Case 5.1~5.2 NR n7 SA, ECI = 1

These test cases are conducted for NR n7 SA with ECI = 1. The detailed test procedure is outlined in Section 4.3.2. For each test case, two figures are presented: the first figure illustrates the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_\mathrm{limit}} = P_{sub6\_limit}$ + 2 dB device uncertainty). The second figure shows the corresponding time-averaged SAR over time, calculated from the time-averaged TX power using the equation specified in Section 4.3.2. Across all test cases, the time-averaged SAR remains below the FCC regulatory limit.

Test result for test sequence 1:

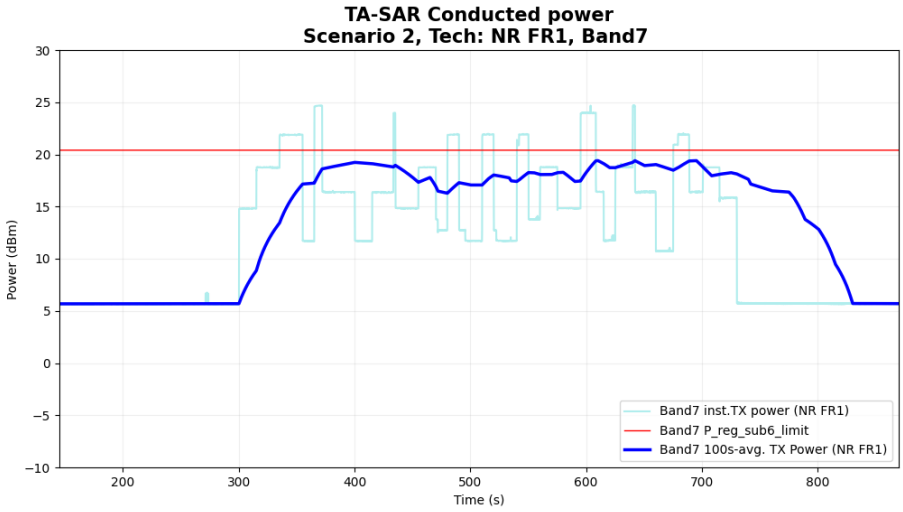


Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using and plotted below to demonstrate that the time-averaged 1gSAR versus time does not exceed the FCC limit of 1.6 W/kg for 1gSAR:

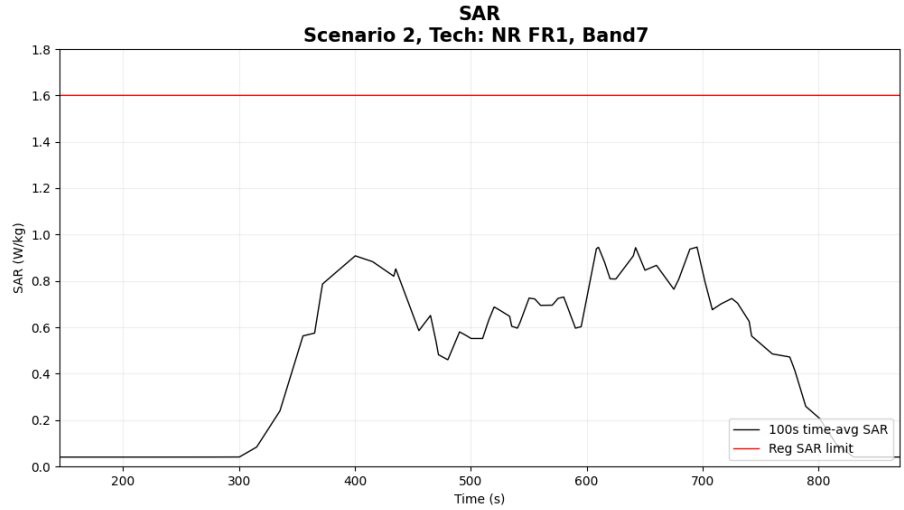


	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (black curve)	0.942
Result: Pass	

Test result for test sequence 2:



Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using 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:



	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (black curve)	0.946
Result: Pass	

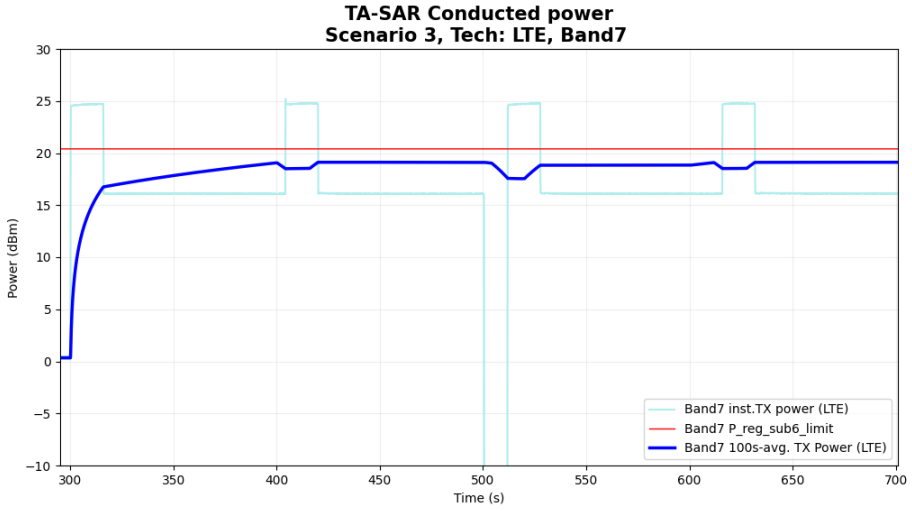
6.4 Scenario 3: Call Disconnection and Re-establishment, Test Case 6

In this scenario, Test Sequence #0 is applied, in which the call box requests maximum transmit (TX) power for each RAT. A call drop is manually introduced for a predefined duration, after which the call is re-established to resume data transmission. The test case for this scenario is summarized in Table 6-3, and the test procedure follows the methodology described in Section 4.3.3. The measurement setup is illustrated in Figure 6-1. A high-level summary of the final validation results is provided in the last column of the table, demonstrating that MediaTek's TA-SAR algorithm consistently ensures the time-averaged SAR remains below the FCC regulatory limit. The following section provides further analysis of the algorithm's behavior under these test conditions.

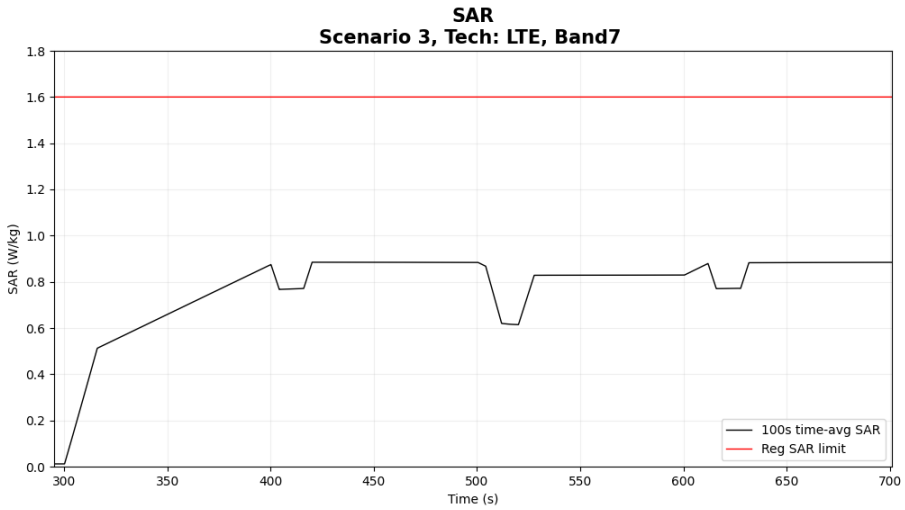
Table 6-3 TA-SAR parameters setting for Scenario 3

Test Case	RAT	Test Band	Test Seq.	ECI	Max Power (dBm)	P_{sub6_limit} (dBm)	$P_{LowThresh}$ (dBm)	$P_{UE\_backoff}$ (dBm)	$P_{UE\_max\_cust}$ (dBm)	Pass/Fail SAR limit
6	LTE	Band 7	0	1	25.2	18.4	17.4	15.4	18.4	Pass

These test cases are conducted for LTE Band 7 with ECI = 1. The detailed test procedure is outlined in Section 4.3.2. For each test case, two figures are presented: the first figure illustrates the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit} = P_{sub6\_limit}$ + 2 dB device uncertainty). The second figure shows the corresponding time-averaged SAR over time, calculated from the time-averaged TX power using the equation specified in Section 4.3.3. Across all test cases, the time-averaged SAR remains below the FCC regulatory limit.



Time-averaged conducted Tx power is converted/calculated into time-averaged 1gSAR using 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:



	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (black curve)	0.885
Result: Pass	

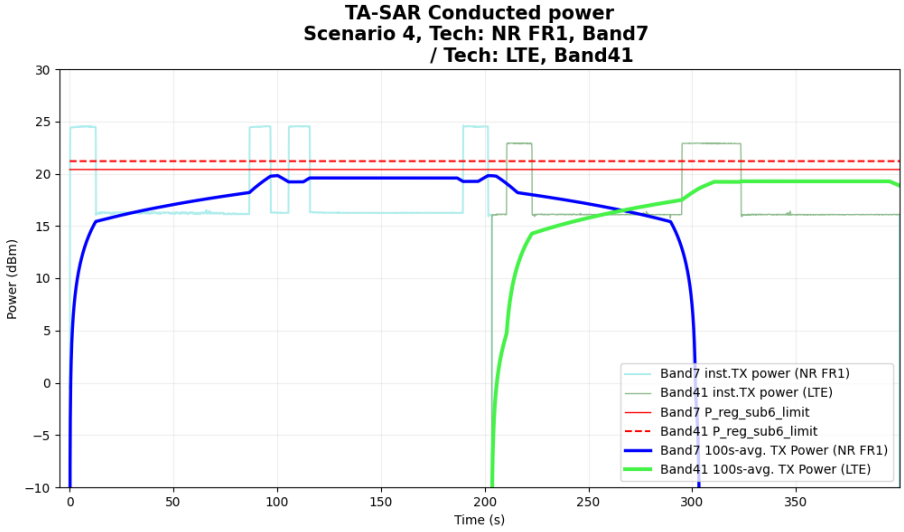
6.5 Scenario 4: Band Handover, Test Case 7

In this scenario, Test Sequence #0 is applied, in which the call box requests maximum transmit (TX) power for each RAT. Band and RAT handovers are manually triggered at predefined time instances to evaluate the algorithm's performance during transitions. The test cases comprehensively cover handover scenarios between different RATs. These cases are summarized in Table 6-4, and the test procedure is described in Section 4.3.4. The measurement setups are illustrated in Figure 6-1. A high-level summary of the final validation results is provided in the last column of the table, confirming that MediaTek's TA-SAR algorithm consistently maintains the time-averaged SAR below the FCC regulatory limit across all handover conditions. The following section provides further analysis of the algorithm's behavior under these test conditions.

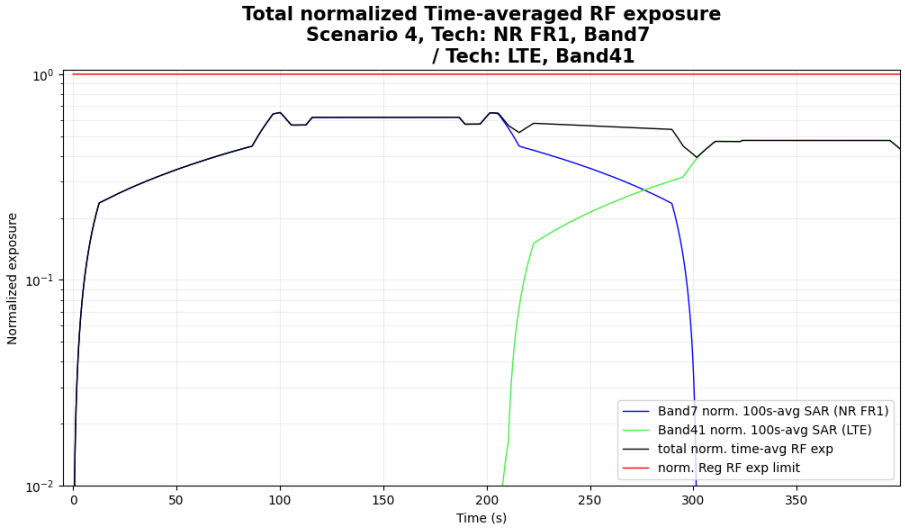
Table 6-4 TA-SAR parameters setting for Scenario 4

Test Case	RAT	Test Band	Test Seq.	ECI	Max Power (dBm)	P_{sub6_limit} (dBm)	$P_{LowThresh}$ (dBm)	$P_{UE\_backoff}$ (dBm)	$P_{UE\_max\_cust}$ (dBm)	Pass/Fail SAR limit
7	NR SA	n7	0	1	25.2	18.4	17.4	15.4	18.4	Pass
	LTE	Band 41 PC3	0	1	25.2	19.2	18.2	16.2	19.2	Pass

This test case evaluates the TA-SAR algorithm during a handover from NR n7 SA to LTE Band 41 PC3, with ECI set to 1. The detailed test procedure is outlined in Section 4.3.4. The first figure presents the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit} = P_{sub6\_limit}$ + 2 dB device uncertainty). The handover is configured to occur at 500 seconds. As shown in the figure, the time-averaged TX power for each individual RAT remains below its respective P_{sub6_limit}. The second figure illustrates the corresponding time-averaged normalized SAR over time, derived from the TX time-averaged power using the equation provided in Section 4.3.4. The results confirm that the time-averaged normalized SAR remains below the FCC normalized limit of 1 throughout the test duration.



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



FCC normalized SAR limit	1.0
Max normalized 100s-time averaged SAR (black curve)	0.651
Result: Pass	

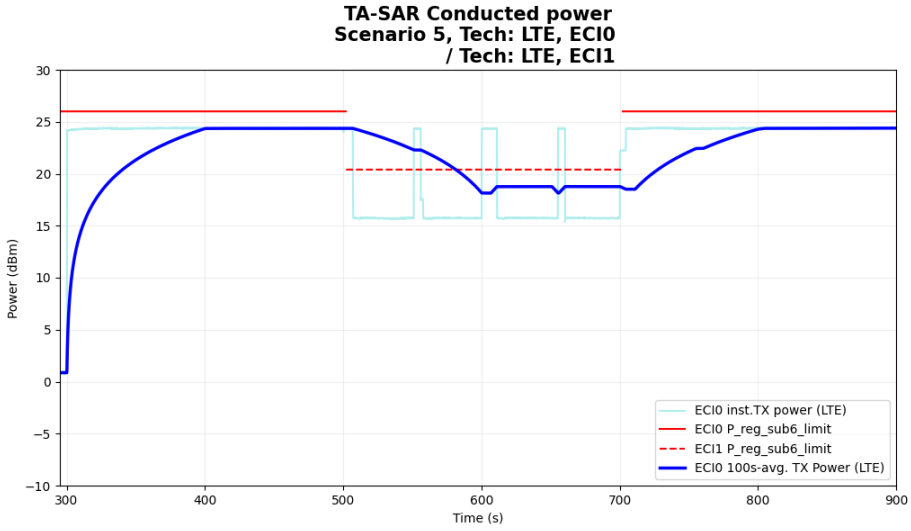
6.6 Scenario 5: ECI Change, Test Case 8

In this scenario, Test Sequence #0 is applied, in which the call box requests maximum transmit (TX) power for each RAT. An ECI change is manually triggered on the EUT side at a predefined time instance to evaluate the TA-SAR algorithm's response. The test case covers ECI switching scenarios between two different ECIs. This test case is summarized in Table 6-5, and the test procedure follows the methodology described in Section 4.3.5. The measurement setup is shown in Figure 6-1. A high-level summary of the final validation results is presented in the last column of the table, confirming that MediaTek's TA-SAR algorithm consistently ensures that the time-averaged SAR remains below the FCC regulatory limit. The following section provides further analysis of the algorithm's behavior under these test conditions.

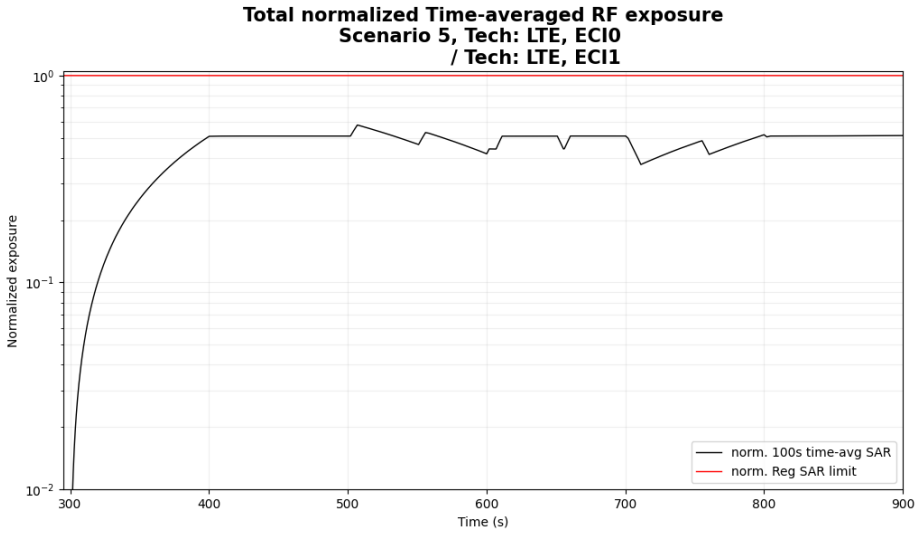
Table 6-5 TA-SAR parameters setting for Scenario 5

Test Case	RAT	Test Band	Test Seq.	ECI	Max Power (dBm)	P_{sub6_limit} (dBm)	$P_{LowThresh}$ (dBm)	$P_{UE\_backoff}$ (dBm)	$P_{UE\_max\_cust}$ (dBm)	Pass/Fail SAR limit
8	LTE	Band 7	0	0	25.2	50.1	49.1	47.1	25.2	Pass
	LTE	Band 7	0	1	25.2	18.4	17.4	15.4	18.4	Pass

This test case is designed to validate the TA-SAR algorithm during ECI transitions within LTE Band 7, specifically from ECI = 0 to ECI = 1. The detailed test procedure is described in Section 4.3.5. The first figure presents the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit}$ = P_{sub6_limit} + device uncertainty). Two ECI change events are manually configured during the test: the first at 500 seconds (from ECI = 0 to ECI = 1) and the second at 700 seconds (from ECI = 1 back to ECI = 0). The figure shows that the time-averaged TX power for each ECI remains below its corresponding $P_{reg\_sub6\_limit}$. The second figure depicts the resulting time-averaged normalized SAR over time, calculated from the TX power using the equation provided in Section 4.3.5. The results confirm that the time-averaged normalized SAR remains below the FCC normalized limit of 1 throughout the test duration.



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



FCC normalized SAR limit	1.0
Max normalized 100s-time averaged SAR (black curve)	0.576
Validated: Pass	

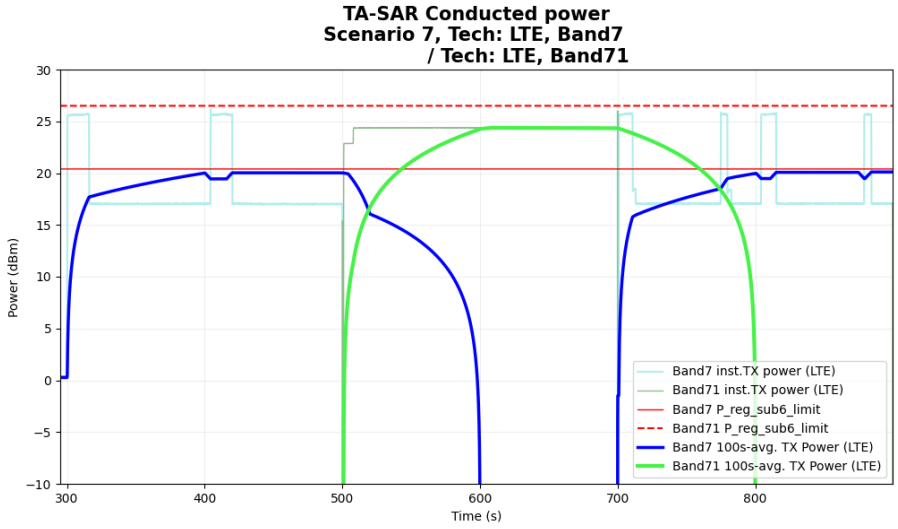
6.7 Scenario 6: Antenna Switching, Test Case 9

In this scenario, Test Sequence #0 is applied, in which the call box requests maximum transmit (TX) power for each RAT. An antenna change is manually triggered on the EUT side at a specific time instance to evaluate the TA-SAR algorithm's response. The test case associated with this scenario is summarized in Table 6-6, and the test procedure is described in Section 4.3.6. The measurement setup is illustrated in Figure 6-1. A high-level summary of the final validation results is provided in the last column of the table, confirming that MediaTek's TA-SAR algorithm consistently ensures the time-averaged SAR remains below the FCC regulatory limit. The following section provides further analysis of the algorithm's behavior under these test conditions.

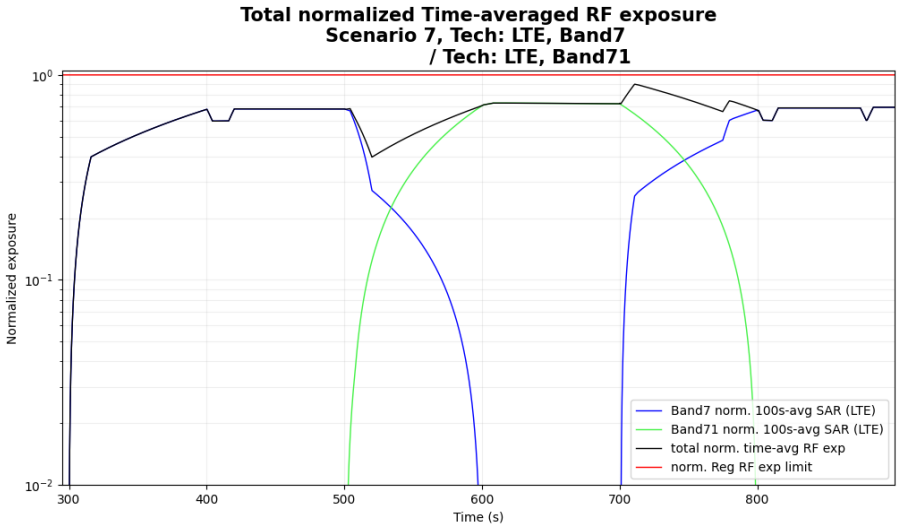
Table 6-6 TA-SAR parameters setting for Scenario 6

Test Case	RAT	Test Band	Test Seq.	ECI	Max Power (dBm)	P_{sub6_limit} (dBm)	$P_{LowThresh}$ (dBm)	$P_{UE\_backoff}$ (dBm)	$P_{UE\_max\_cust}$ (dBm)	Pass/Fail SAR limit
9	LTE	Band 7	0	1	25.2	18.4	17.4	15.4	18.4	Pass
	LTE	Band 71	0	1	25.7	50.1	49.1	47.1	25.7	Pass

This test case is intended to validate the TA-SAR algorithm during antenna switching events between LTE Band 7 Antenna FCM and LTE Band 71 Antenna BCM with ECI = 1. The detailed test procedure is described in Section 4.3.6. The first figure illustrates the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit}$ = P_{sub6_limit} + device uncertainty). Two antenna switching events are manually configured during the test: the first at 500 seconds (from Antenna FCM to Antenna BCM) and the second at 700 seconds (from Antenna BCM to Antenna FCM). As shown in the figure, the time-averaged TX power remains below the defined power limit throughout the transitions. The second figure presents the corresponding time-averaged normalized SAR over time, calculated from the TX power using the equation provided in Section 4.3.6. The results demonstrate that the time-averaged normalized SAR consistently remains below the FCC limit of 1 throughout the test duration.



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



FCC normalized SAR limit	1.0
Max normalized 100s-time averaged SAR (black curve)	0.901
Validated: Pass	

7 SYSTEM VERIFICATION

7.1 Tissue Verification

Table 7-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% Dev σ	% Dev ε
7/28/2025	2450 Head	20.9	2300	1.697	38.178	1.670	39.500	*1.62%*	*-3.35%*
			2310	1.705	38.170	1.679	39.480	*1.55%*	*-3.32%*
			2320	1.712	38.162	1.687	39.460	*1.48%*	*-3.29%*
			2400	1.770	38.032	1.756	39.289	*0.80%*	*-3.20%*
			2450	1.805	37.980	1.800	39.200	*0.28%*	*-3.11%*
			2480	1.827	37.916	1.833	39.162	*-0.33%*	*-3.18%*
			2500	1.844	37.881	1.855	39.136	*-0.59%*	*-3.21%*
			2510	1.853	37.871	1.866	39.123	*-0.70%*	*-3.20%*
			2535	1.872	37.851	1.893	39.092	*-1.11%*	*-3.17%*
			2550	1.883	37.837	1.909	39.073	*-1.36%*	*-3.16%*
			2560	1.889	37.822	1.920	39.060	*-1.61%*	*-3.17%*
			2600	1.922	37.730	1.964	39.009	*-2.14%*	*-3.28%*
			2650	1.965	37.678	2.018	38.945	*-2.63%*	*-3.25%*
			2680	1.985	37.620	2.051	38.907	*-3.22%*	*-3.31%*
			2700	2.002	37.567	2.073	38.882	*-3.42%*	*-3.38%*
8/6/2025	2450 Head	22.2	2300	1.704	38.320	1.670	39.500	*2.04%*	*-2.99%*
			2310	1.711	38.309	1.679	39.480	*1.91%*	*-2.97%*
			2320	1.719	38.299	1.687	39.460	*1.90%*	*-2.94%*
			2400	1.776	38.201	1.756	39.289	*1.14%*	*-2.77%*
			2450	1.814	38.135	1.800	39.200	*0.78%*	*-2.72%*
			2480	1.837	38.085	1.833	39.162	*0.22%*	*-2.75%*
			2500	1.852	38.044	1.855	39.136	*-0.16%*	*-2.79%*
			2510	1.859	38.025	1.866	39.123	*-0.38%*	*-2.81%*
			2535	1.878	37.980	1.893	39.092	*-0.79%*	*-2.84%*
			2550	1.890	37.962	1.909	39.073	*-1.00%*	*-2.84%*
			2560	1.898	37.952	1.920	39.060	*-1.15%*	*-2.84%*
			2600	1.928	37.883	1.964	39.009	*-1.83%*	*-2.89%*
			2650	1.966	37.788	2.018	38.945	*-2.58%*	*-2.97%*
			2680	1.989	37.744	2.051	38.907	*-3.02%*	*-2.99%*
			2700	2.004	37.702	2.073	38.882	*-3.33%*	*-3.03%*

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

7.2 Test System Verification

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in Appendix C.

Table 7-2
System Verification Results – 1g

SAR System	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Source SN	Probe SN	DAE	Measured SAR 1g (W/kg)	1 W Target SAR 1g (W/kg)	1 W Normalized SAR 1g (W/kg)	Deviation 1g (%)
AM4	2450	Head	7/28/2025	23.5	20.9	0.10	750	7360	534	5.75	53.300	57.500	7.88%
AM3	2450	Head	8/6/2025	24.0	22.3	0.10	750	7552	1676	5.03	53.300	50.300	-5.63%
AM4	2600	Head	7/28/2025	23.5	20.9	0.10	1042	7360	534	5.61	54.900	56.100	2.19%
AM3	2600	Head	8/6/2025	24.0	22.3	0.10	1042	7552	1676	5.81	54.900	58.100	5.83%

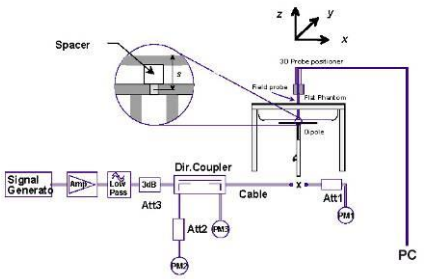


Figure 7-1
System Verification Setup Diagram

Figure 7-2
System Verification Setup Photo

8 SAR MEASUREMENT FOR TA-SAR

8.1 SAR Measurement Setup

The measurement setup is similar to normal SAR measurements as described in the Part 1 Test Report. The difference in SAR measurement setup for time averaging feature validation is that the callbox is signaling in close loop power control mode (instead of requesting maximum power in open loop control mode) and callbox is connected to the PC using GPIB so that the test script executed on PC can send GPIB commands to control the callbox's requested power over time (test sequence). The same test script used in conducted setup for time-varying Tx power measurements is also used in this section for running the test sequences during SAR measurements, and the recorded values from the disconnected power meter by the test script were discarded.

As mentioned in Section 4.3.9, for DUT to follow TPC command sent from the callbox wirelessly, the "path loss" between callbox antenna and the DUT needs to be very well calibrated. Since the SAR chamber is in uncontrolled environment, precautions must be taken to minimize the environmental influences on "path loss". Similarly, in the case of time-varying SAR measurements in Sub6 NR (with LTE as anchor), "path loss" between callbox antenna and the EUT needs to be carefully calibrated for both LTE link as well as for Sub6 NR link.

8.2 Scenario 2: Time-Varying TX Power, Test Case 2.1~5.2

In this scenario, MediaTek's TA-SAR algorithm is evaluated under more dynamic power test sequences. Test Sequence #1 and Test Sequence #2 are described in Section 4.1. All corresponding test cases are summarized in Table 6-2, and the test procedure follows the methodology outlined in Section 4.3.9. All measurements were conducted using the DASY6 system. A high-level summary of the validation results is provided in the last column of Table 8-1, confirming that MediaTek's TA-SAR algorithm consistently maintains the time-averaged SAR below the FCC regulatory limit across all test cases. The following sections present a case-by-case analysis illustrating the algorithm's performance across different radio access technologies (RATs).

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

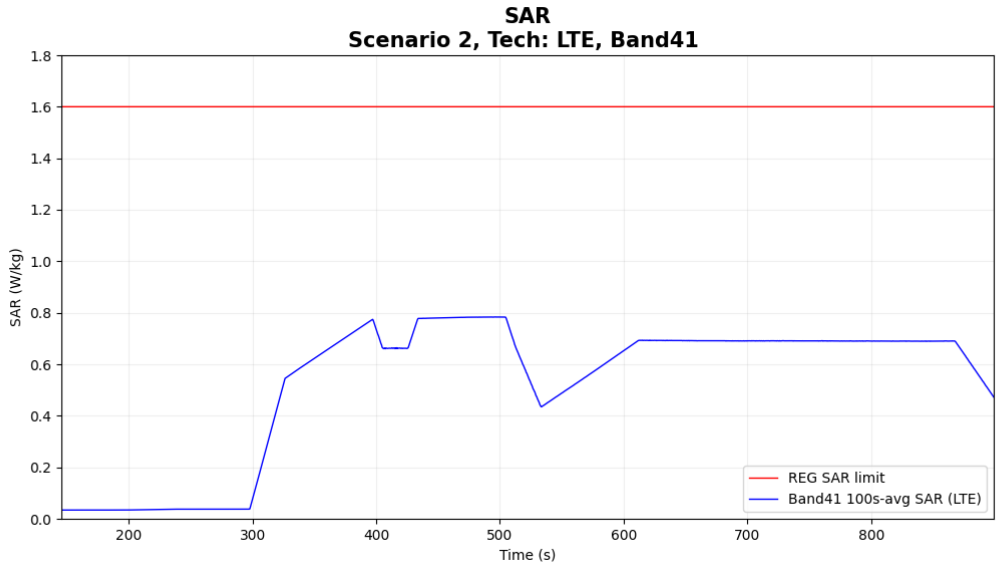
Table 8-1 TA-SAR parameters setting for Scenario 2

Test Case	RAT	Test Band	Test Seq.	ECI	Max Power (dBm)	P_{sub6_limit} (dBm)	$P_{LowThresh}$ (dBm)	$P_{UE\_backoff}$ (dBm)	$P_{UE\_max\_cust}$ (dBm)	Pass/Fail SAR limit
2.1	LTE	Band 41	1	1	25.2	19.2	18.2	16.2	19.2	Pass
2.2	LTE	Band 41	2	1	25.2	19.2	18.2	16.2	19.2	Pass
3.1	LTE	Band 7	1	1	25.2	18.4	17.4	15.4	18.4	Pass
3.2	LTE	Band 7	2	1	25.2	18.4	17.4	15.4	18.4	Pass
4.1	NR SA	n41 PC3	1	1	25.2	18.6	17.6	15.6	18.6	Pass
4.2	NR SA	n41 PC3	2	1	25.2	18.6	17.6	15.6	18.6	Pass
5.1	NR SA	n7	1	1	25.2	18.4	17.4	15.4	18.4	Pass
5.2	NR SA	n7	2	1	25.2	18.4	17.4	15.4	18.4	Pass

8.2.1 Test Case 2.1~2.2 LTE Band 41 PC3, ECI = 1

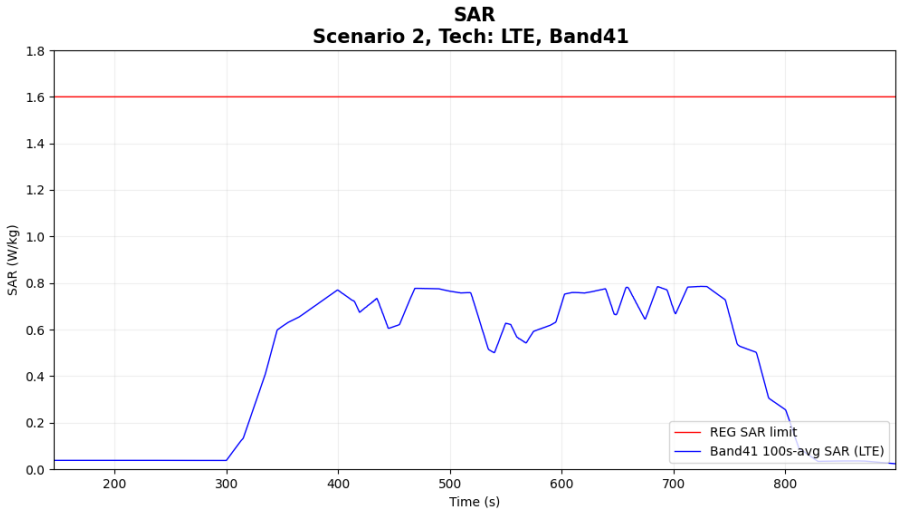
These test cases are conducted for LTE Band 41 PC3 with ECI = 1. The detailed test procedure is outlined in Section 4.3.2. For each test case, the figure shows the corresponding time-averaged SAR over time, calculated from the time-averaged TX power using the equation specified in Section 4.3.2. Across all test cases, the time-averaged SAR remains below the FCC regulatory limit.

Test result for test sequence 1:



	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (blue curve)	0.784
Result: Pass	

Test result for test sequence 2:

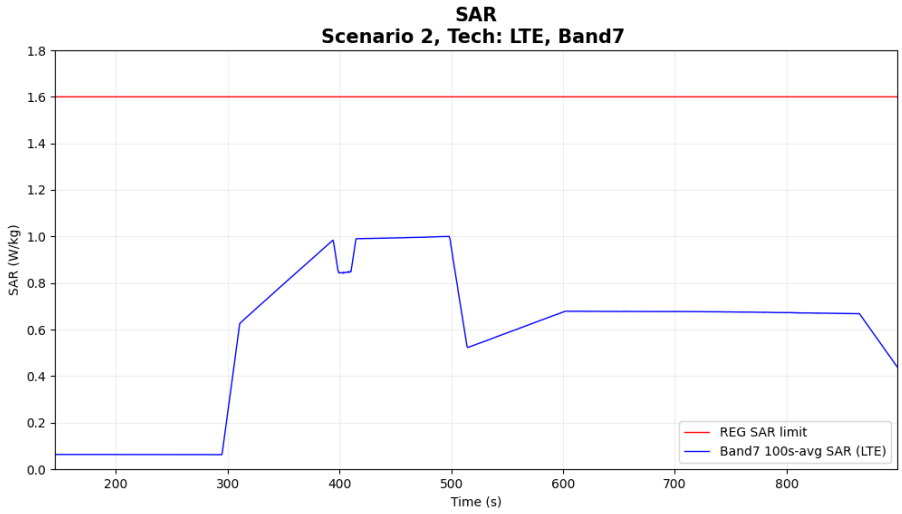


	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (blue curve)	0.786
Result: Pass	

8.2.2 Test Case 2.3~2.4 LTE Band 7, ECI = 1

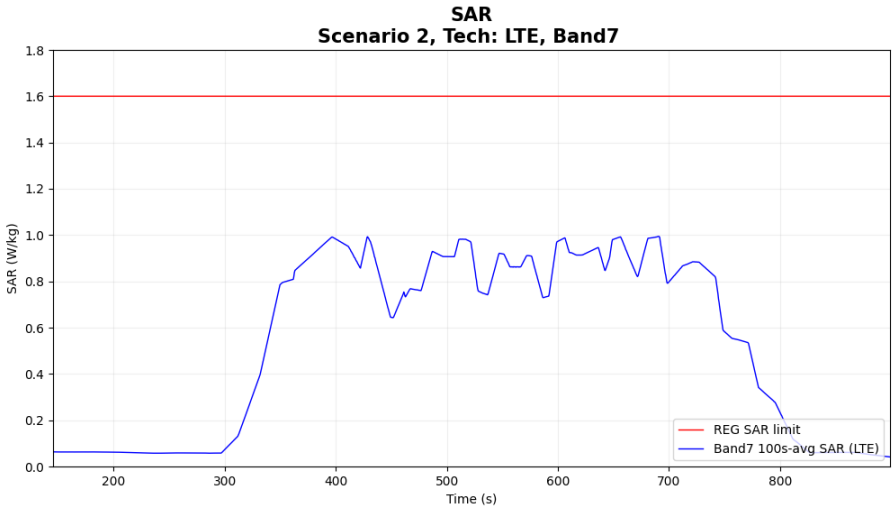
These test cases are conducted for LTE Band 7 with ECI = 1. The detailed test procedure is outlined in Section 4.3.2. For each test case, two figures are presented: the first figure illustrates the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit} = P_{sub6\_limit}$ + 2 dB device uncertainty). The second figure shows the corresponding time-averaged SAR over time, calculated from the time-averaged TX power using the equation specified in Section 4.3.2. Across all test cases, the time-averaged SAR remains below the FCC regulatory limit.

Test result for test sequence 1:



	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (blue curve)	1.0
Result: Pass	

Test result for test sequence 2:

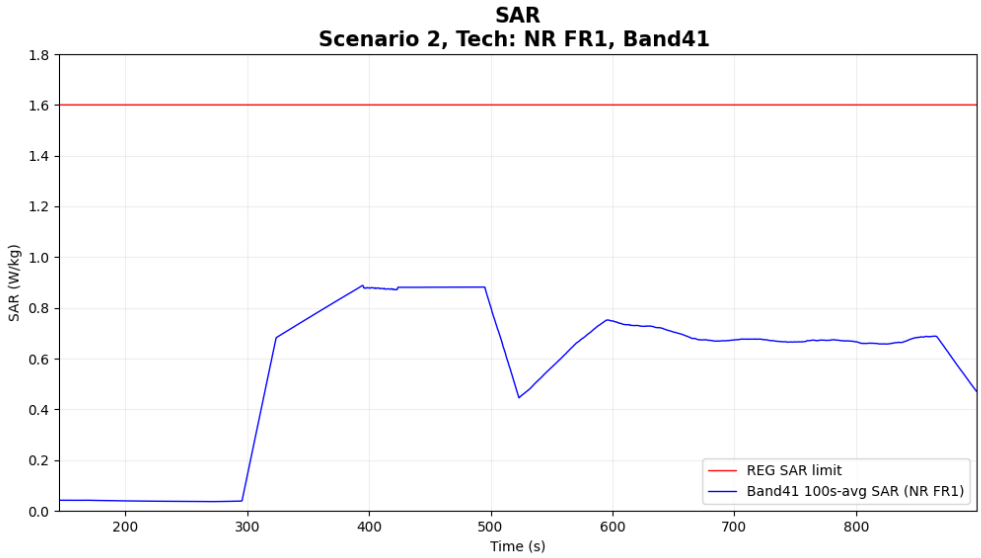


	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (blue curve)	0.994
Result: Pass	

8.2.3 Test Case 2.5~2.6 NR n41 PC3 SA, ECI = 1

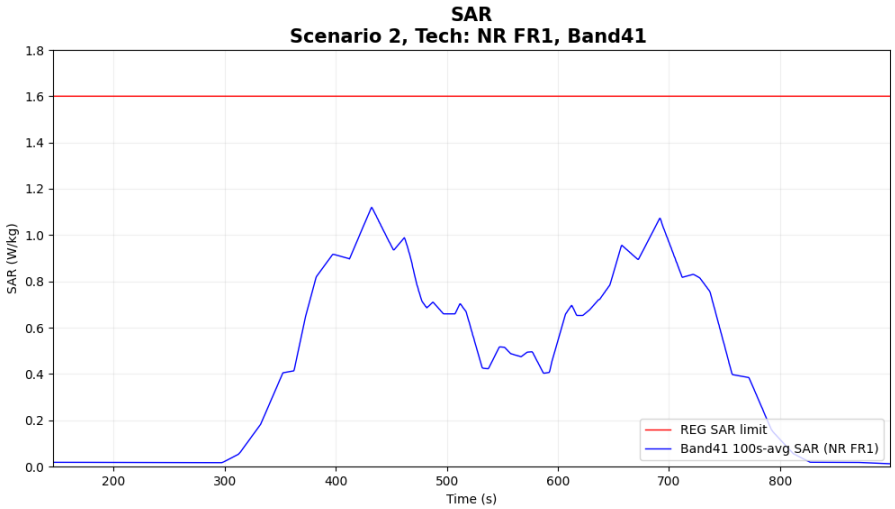
These test cases are conducted for NR n41 PC3 SA with ECI = 1. The detailed test procedure is outlined in Section 4.3.2. For each test case, two figures are presented: the first figure illustrates the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit}$ = P_{sub6_limit} + 2 dB device uncertainty). The second figure shows the corresponding time-averaged SAR over time, calculated from the time-averaged TX power using the equation specified in Section 4.3.2. Across all test cases, the time-averaged SAR remains below the FCC regulatory limit.

Test result for test sequence 1:



	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (blue curve)	0.888
Result: Pass	

Test result for test sequence 2:

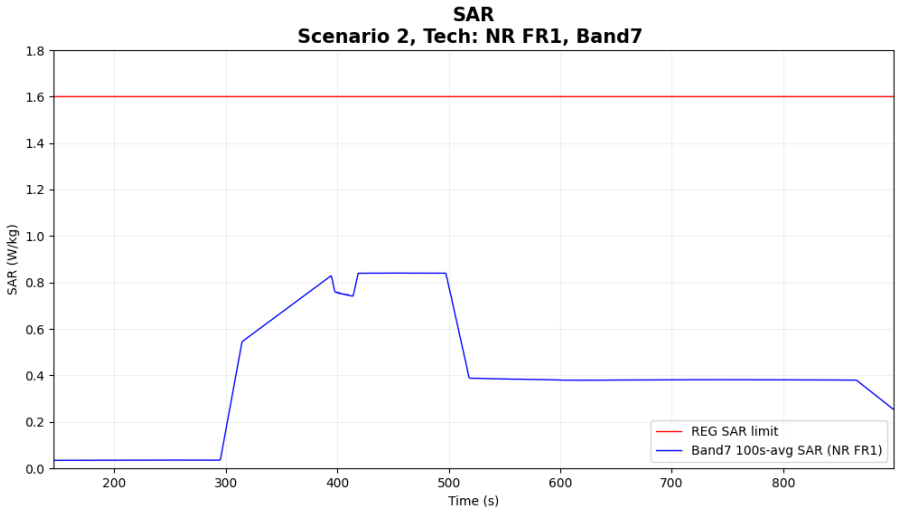


	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (blue curve)	1.120
Result: Pass	

8.2.4 Test Case 2.7~2.8 NR n7 SA, ECI = 1

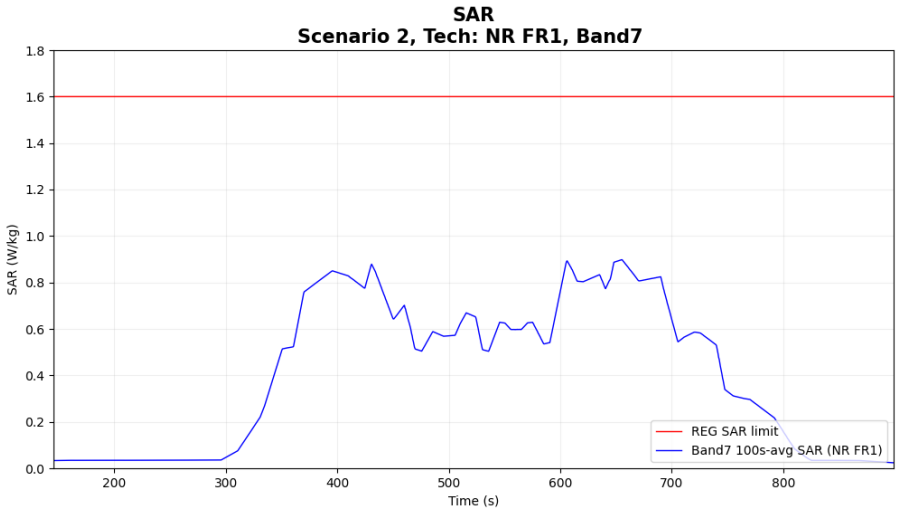
These test cases are conducted for NR n7 SA with ECI = 1. The detailed test procedure is outlined in Section 4.3.2. For each test case, two figures are presented: the first figure illustrates the EUT's instantaneous conducted transmit (TX) power, the time-averaged conducted TX power over time, and the applicable power limit ($P_{reg\_sub6\_limit} = P_{sub6\_limit}$ + 2 dB device uncertainty). The second figure shows the corresponding time-averaged SAR over time, calculated from the time-averaged TX power using the equation specified in Section 4.3.2. Across all test cases, the time-averaged SAR remains below the FCC regulatory limit.

Test result for test sequence 1:



	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (blue curve)	0.84
Result: Pass	

Test result for test sequence 2:



	(W/kg)
FCC 1gSAR limit	1.6
Max 100s-time averaged 1gSAR (blue curve)	0.898
Result: Pass	

9 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	N9020A	MXA Signal Analyzer	10/27/2024	Annual	10/27/2025	MY51240479
Agilent	N5182A	MXG Vector Signal Generator	12/5/2024	Annual	12/5/2025	US46240505
Agilent	8753ES	S-Parameter Network Analyzer	9/25/2024	Annual	9/25/2025	MY40003841
Agilent	E4438C	ESG Vector Signal Generator	11/15/2024	Annual	11/15/2025	MY45092078
Agilent	E4438C	ESG Vector Signal Generator	12/8/2024	Annual	12/8/2025	MY42081752
Agilent	E4438C	ESG Vector Signal Generator	10/23/2024	Annual	10/23/2025	MY45093852
Agilent	8753ES	S-Parameter Vector Network Analyzer	9/25/2024	Annual	9/25/2025	US39170118
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433974
Anritsu	ML2496A	Power Meter	2/10/2025	Annual	2/10/2026	1351001
Anritsu	MA24106A	USB Power Sensor	9/23/2024	Annual	9/23/2025	1827526
Anritsu	MA24106A	USB Power Sensor	9/27/2024	Annual	9/27/2025	2018527
Anritsu	MA2411B	Pulse Power Sensor	2/10/2025	Annual	2/10/2026	1315051
Anritsu	MA2411B	Pulse Power Sensor	10/21/2024	Annual	10/21/2025	1027293
Thermco Products Inc	4052	Long Stem Thermometer	2/27/2024	Biennial	2/27/2026	127064
Thermco Products Inc	4052	Long Stem Thermometer	2/27/2024	Biennial	2/27/2026	240171060
Control Company	S66279	Therm./ Clock/ Humidity Monitor	2/16/2024	Annual	2/16/2025	240140006
Keysight Technologies	E7515B	UXM 5G Wireless Test Platform	6/13/2025	Annual	6/13/2026	MY60192562
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
Pasternack	PE2088	Power Divider	N/A	N/A	N/A	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	VLF-6000+	Low Pass Filter DC to 6000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	N/A	N/A	N/A	2437
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	N/A	N/A	N/A	2408
Narda	BW-S3W2	Attenuator	CBT	N/A	CBT	0120
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Rhode & Schwarz	CMW 500	Wideband Radio Communication Tester	4/30/2025	Biennial	4/30/2027	170387
Rhode & Schwarz	CMW 500	Wideband Radio Communication Tester	4/7/2025	Annual	4/7/2026	167284
Rohde & Schwarz	NRP8S	3 Path Dipole Power Sensor	2/24/2025	Annual	2/24/2026	109961
Rohde & Schwarz	NRP8S	3-Path Dipole Power Sensor	10/28/2024	Annual	10/28/2025	109956
Rohde & Schwarz	NRP8S	3-Path Dipole Power Sensor	10/28/2024	Annual	10/28/2025	109957
Rohde & Schwarz	NRP50S	3-Path Dipole Power Sensor	2/19/2025	Annual	2/19/2026	101339
Rohde & Schwarz	NRX	Power Meter	1/30/2025	Annual	1/30/2026	102583
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2025	Annual	5/12/2026	1070
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/10/2024	Annual	9/10/2025	1045
SPEAG	D2450V2	2450 MHz SAR Dipole	5/13/2025	Annual	5/13/2026	750
SPEAG	D2600V2	2600 MHz SAR Dipole	5/7/2025	Annual	5/7/2026	1042
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/11/2025	Annual	3/11/2026	534
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/13/2025	Annual	5/13/2026	1676
SPEAG	EX3DV4	SAR Probe	5/14/2025	Annual	5/14/2026	7552
SPEAG	EX3DV4	SAR Probe	3/7/2025	Annual	3/7/2026	7360

Notes:

1. CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler, or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.
2. Each equipment item is used solely within its respective calibration period.

10 MEASUREMENT UNCERTAINTIES

Applicable for SAR measurements < 6 GHz:

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	10gms u_i (± %)	v_i
Measurement System									
Probe Calibration	E2.1	7	N	1	1	1	7.0	7.0	∞
Axial Isotropy	E2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E2.2	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	E2.3	2	R	1.732	1	1	1.2	1.2	∞
Linearity	E2.4	0.3	N	1	1	1	0.3	0.3	∞
System Detection Limits	E2.4	0.25	R	1.732	1	1	0.1	0.1	∞
Modulation Response	E2.5	4.8	R	1.732	1	1	2.8	2.8	∞
Readout Electronics	E2.6	0.3	N	1	1	1	0.3	0.3	∞
Response Time	E2.7	0.8	R	1.732	1	1	0.5	0.5	∞
Integration Time	E2.8	2.6	R	1.732	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	E6.1	3	R	1.732	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E6.1	3	R	1.732	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E6.2	0.8	R	1.732	1	1	0.5	0.5	∞
Probe Positioning w/ respect to Phantom	E6.3	6.7	R	1.732	1	1	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E5	4	R	1.732	1	1	2.3	2.3	∞
Test Sample Related									
Test Sample Positioning	E4.2	3.12	N	1	1	1	3.1	3.1	35
Device Holder Uncertainty	E4.1	1.67	N	1	1	1	1.7	1.7	5
Output Power Variation - SAR drift measurement	E2.9	5	R	1.732	1	1	2.9	2.9	∞
SAR Scaling	E6.5	0	R	1.732	1	1	0.0	0.0	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E3.1	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	E3.3	4.3	N	1	0.78	0.71	3.3	3.0	76
Liquid Permittivity - measurement uncertainty	E3.3	4.2	N	1	0.23	0.26	1.0	1.1	75
Liquid Conductivity - Temperature Uncertainty	E3.4	3.4	R	1.732	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	E3.4	0.6	R	1.732	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	E3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	E3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)			RSS				12.2	12.0	191
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.4	24.0	

The above measurement uncertainties are according to IEEE Std. 1528-2013

11 CONCLUSION

11.1 Measurement Conclusion

The SAR evaluation indicates that the DUT complies with the RF radiation exposure limits of the FCC and Innovation, Science, and Economic Development Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

12 REFERENCES

[1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.

[2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, 2006.

[3] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, Sept. 1992.

[4] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.

[5] IEEE Standards Coordinating Committee 39 –Standards Coordinating Committee 34 – IEEE Std. 1528-2013, IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

[6] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.

[7] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.

[8] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. 1 -124.

[9] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.

[10] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.

[11] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.

[12] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[13] G. Hartsgrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.

[14] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.

[15] W. Gander, Computermathematick, Birkhaeuser, Basel, 1992.

[16] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.

[17] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[18] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.

[19] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hoschschule Zürich, Dosimetric Evaluation of the Cellular Phone.

[20] IEC 62209-1, Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1: Devices used next to the ear (Frequency range of 300 MHz to 6 GHz), July 2016.

[21] Innovation, Science, Economic Development Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 5, March 2015.

[22] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2015

[23] FCC SAR Test Procedures for 2G-3G Devices, Mobile Hotspot and UMPC Devices KDB Publications 941225, D01-D07

[24] SAR Measurement Guidance for IEEE 802.11 Transmitters, KDB Publication 248227 D01

[25] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publications 648474 D03-D04

[26] FCC SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers, FCC KDB Publication 616217 D04

[27] FCC SAR Measurement and Reporting Requirements for 100MHz – 6 GHz, KDB Publications 865664 D01-D02

[28] FCC General RF Exposure Guidance and SAR Procedures for Dongles, KDB Publication 447498, D01-D02

[29] Anexo à Resolução No. 533, de 10 de Septembro de 2009.

[30] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), Mar. 2010.