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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

**Glossary:**

|       |                                 |
|-------|---------------------------------|
| TSL   | tissue simulating liquid        |
| ConvF | sensitivity in TSL / NORM x,y,z |
| N/A   | not applicable or not measured  |

**Calibration is Performed According to the Following Standards:**

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "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)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

## Measurement Conditions

DASY system configuration, as far as not given on page 1.

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.10.2    |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 1900 MHz $\pm$ 1 MHz   |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 40.0           | 1.40 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 40.9 $\pm$ 6 % | 1.38 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

|                                                             |                    |                                                |
|-------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                                |
| SAR measured                                                | 250 mW input power | 9.65 W/kg                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>39.1 W/kg <math>\pm</math> 17.0 % (k=2)</b> |

|                                                               |                    |                                                |
|---------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                                |
| SAR measured                                                  | 250 mW input power | 5.05 W/kg                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>20.4 W/kg <math>\pm</math> 16.5 % (k=2)</b> |

## Body TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 53.3           | 1.52 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 53.6 $\pm$ 6 % | 1.47 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

|                                                             |                    |                                                |
|-------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                                |
| SAR measured                                                | 250 mW input power | 9.56 W/kg                                      |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>39.1 W/kg <math>\pm</math> 17.0 % (k=2)</b> |

|                                                               |                    |                                                |
|---------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                                |
| SAR measured                                                  | 250 mW input power | 5.05 W/kg                                      |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>20.5 W/kg <math>\pm</math> 16.5 % (k=2)</b> |

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $51.8 \Omega + 6.8 j\Omega$ |
| Return Loss                          | - 23.2 dB                   |

### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $48.4 \Omega + 7.8 j\Omega$ |
| Return Loss                          | - 21.9 dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.170 ns |
|----------------------------------|----------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |       |
|-----------------|-------|
| Manufactured by | SPEAG |
|-----------------|-------|

## DASY5 Validation Report for Head TSL

Date: 21.02.2019

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d148**

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.38$  S/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.26, 8.26, 8.26) @ 1900 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

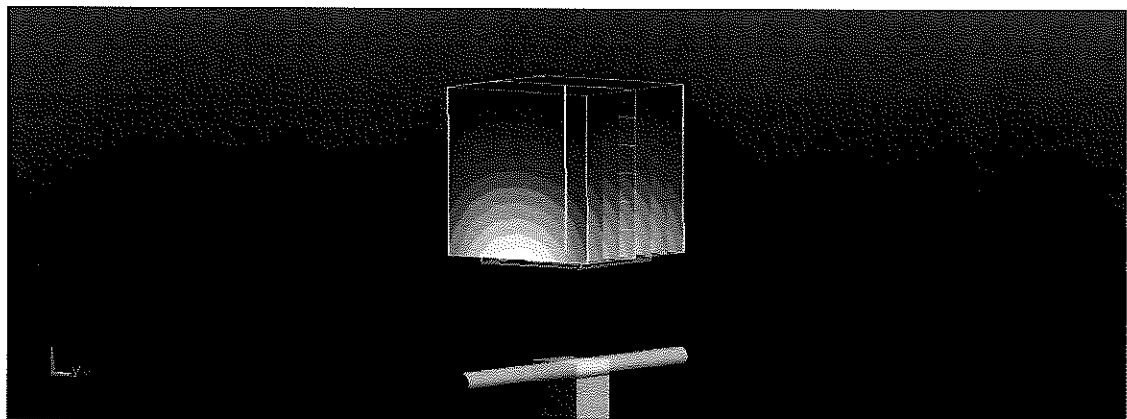
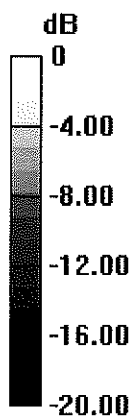
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 109.4 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 17.8 W/kg

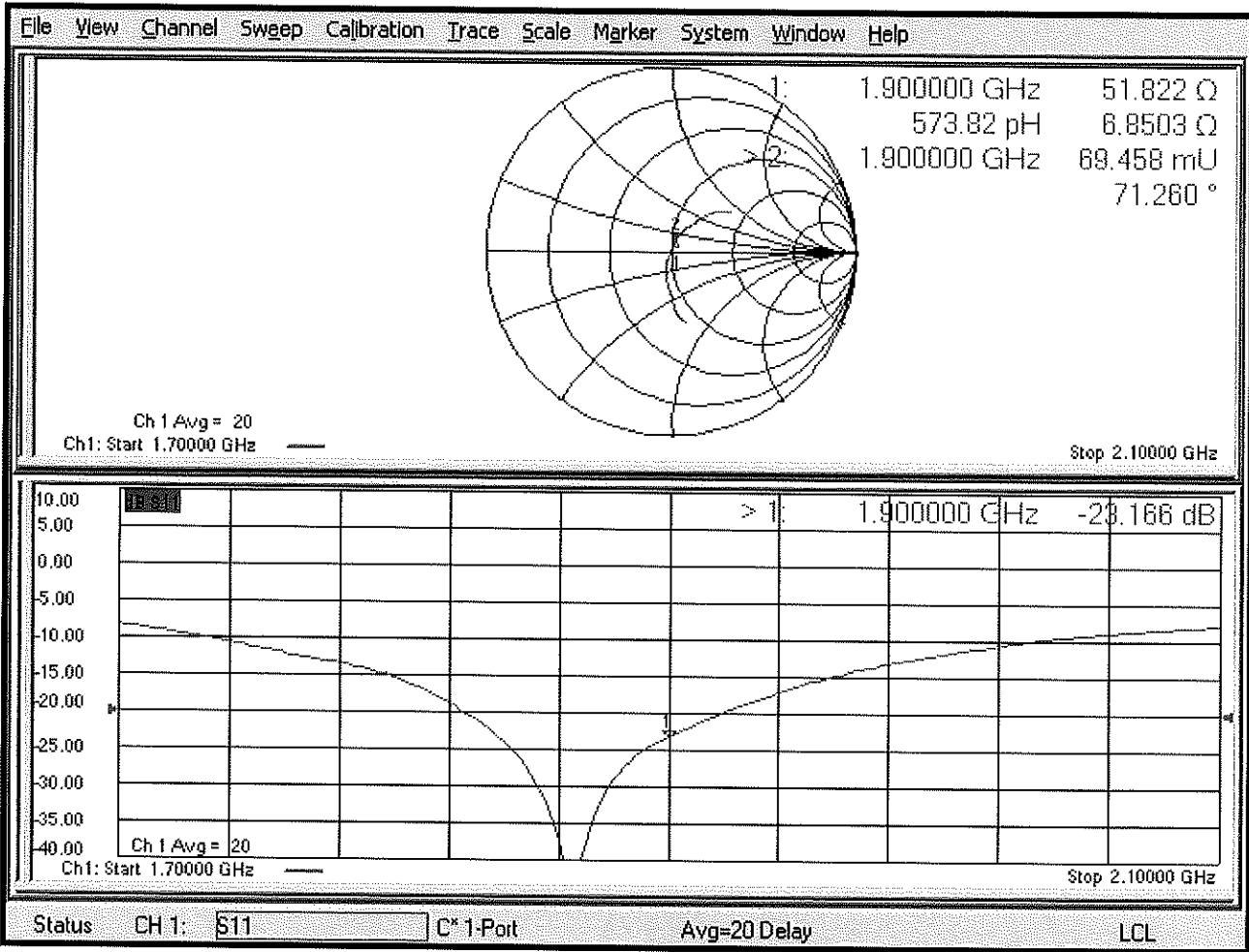
**SAR(1 g) = 9.65 W/kg; SAR(10 g) = 5.05 W/kg**

Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.76 dBW/kg

Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 21.02.2019

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d148**

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.47$  S/m;  $\epsilon_r = 53.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.23, 8.23, 8.23) @ 1900 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

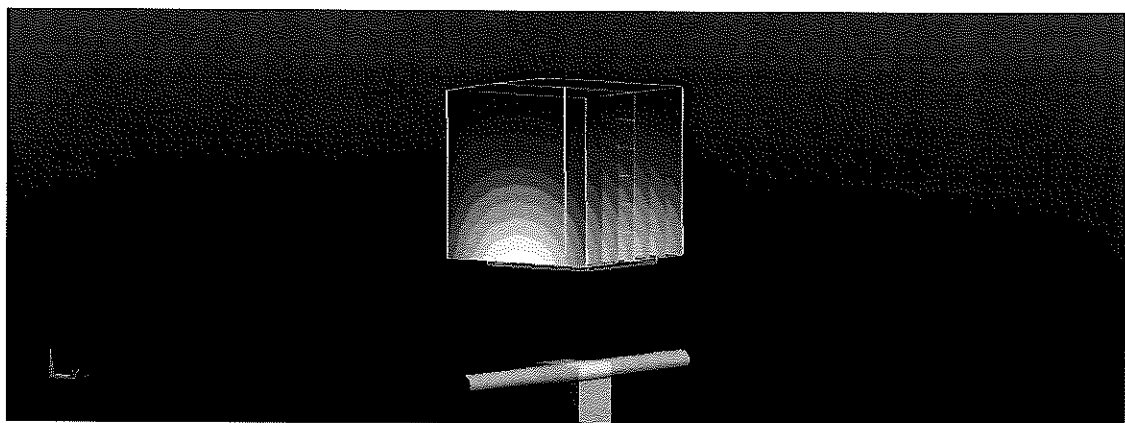
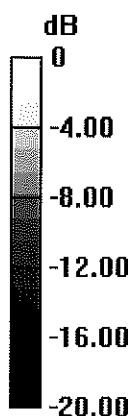
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.7 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 17.0 W/kg

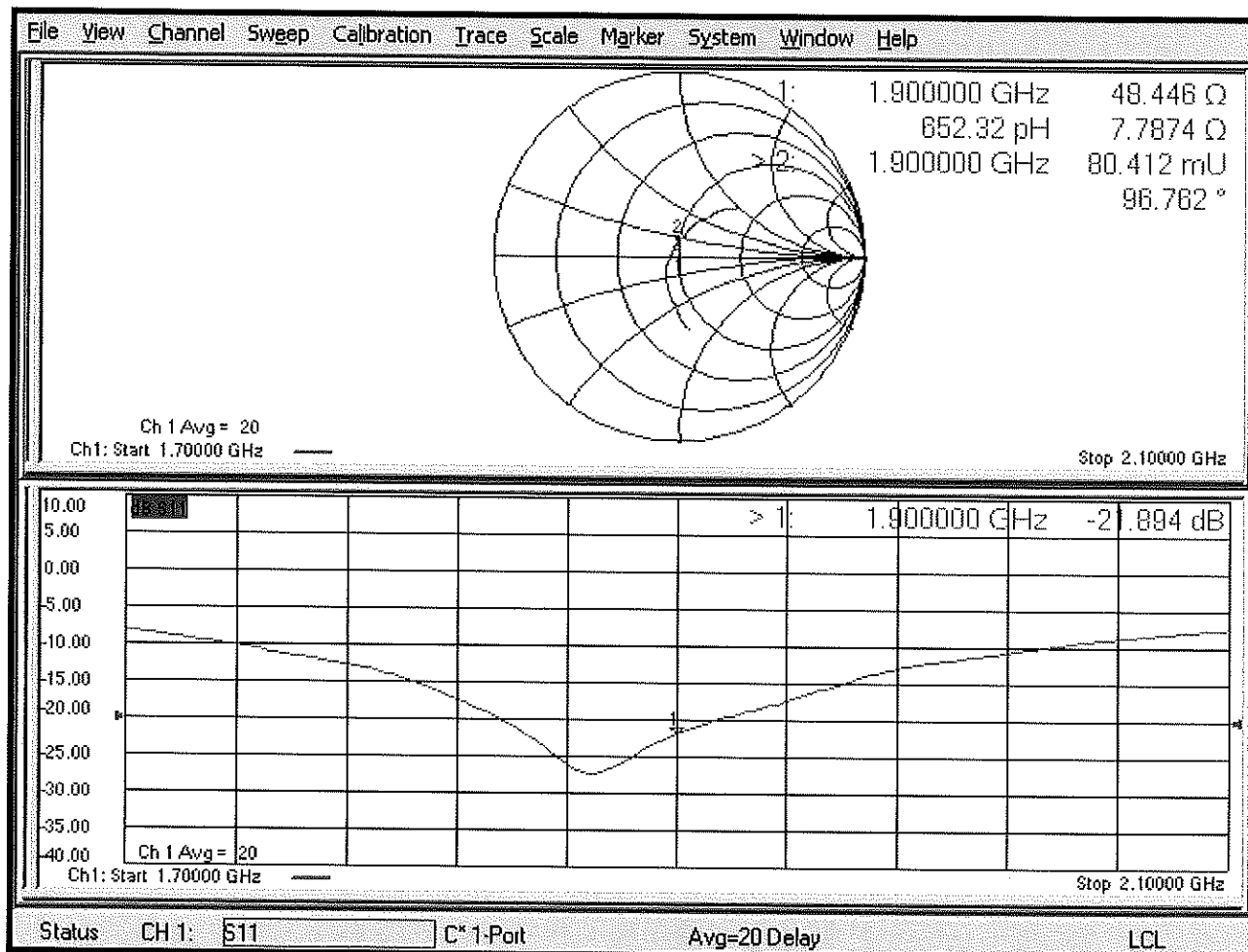
**SAR(1 g) = 9.56 W/kg; SAR(10 g) = 5.05 W/kg**

Maximum value of SAR (measured) = 14.4 W/kg



0 dB = 14.4 W/kg = 11.58 dBW/kg

# Impedance Measurement Plot for Body TSL



## APPENDIX D: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue verification:

- 1) The network analyzer and probe system was configured and calibrated.
- 2) The probe was immersed in the tissue. The tissue was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
- 3) The complex admittance with respect to the probe aperture was measured
- 4) The complex relative permittivity  $\epsilon'$  can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\epsilon_r\epsilon_0}{[\ln(b/a)]^2} \int_a^b \int_a^b \int_0^\pi \cos\phi' \frac{\exp[-j\omega r(\mu_0\epsilon_r'\epsilon_0)^{1/2}]}{r} d\phi' d\rho' d\rho$$

where Y is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively,  $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$ ,  $\omega$  is the angular frequency, and  $j = \sqrt{-1}$ .

**Table D-I**  
**Composition of the Tissue Equivalent Matter**

| Frequency (MHz)           | 750          | 750        | 835   | 835   | 1750 | 1750 | 1900  | 1900  | 2450       | 2450 |
|---------------------------|--------------|------------|-------|-------|------|------|-------|-------|------------|------|
| Tissue                    | Head         | Body       | Head  | Body  | Head | Body | Head  | Body  | Head       | Body |
| Ingredients (% by weight) |              |            |       |       |      |      |       |       |            |      |
| Bactericide               | See page 2-3 | See page 2 | 0.1   | 0.1   |      |      |       |       | See page 4 |      |
| DGBE                      |              |            |       |       | 47   | 31   | 44.92 | 29.44 |            | 26.7 |
| HEC                       |              |            | 1     | 1     |      |      |       |       |            |      |
| NaCl                      |              |            | 1.45  | 0.94  | 0.4  | 0.2  | 0.18  | 0.39  |            | 0.1  |
| Sucrose                   |              |            | 57    | 44.9  |      |      |       |       |            |      |
| Water                     |              |            | 40.45 | 53.06 | 52.6 | 68.8 | 54.9  | 70.17 |            | 73.2 |

FCC ID: ZNFX320AA



SAR EVALUATION REPORT



Approved by:  
Quality Manager

Test Dates:  
05/21/19 - 06/10/19

DUT Type:  
Portable Handset

APPENDIX D:  
Page 1 of 4

## 2 Composition / Information on ingredients

The item is composed of the following ingredients:

|                                                                  |                                                                                                                                                     |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| H <sub>2</sub> O                                                 | Water, 35 – 58%                                                                                                                                     |
| Sucrose                                                          | Sugar, white, refined, 40 – 60%                                                                                                                     |
| NaCl                                                             | Sodium Chloride, 0 – 6%                                                                                                                             |
| Hydroxyethyl-cellulose                                           | Medium Viscosity (CAS# 9004-62-0), <0.3%                                                                                                            |
| Preventol-D7                                                     | Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyl-3(2H)-isothiazolone, 0.1 – 0.7% |
| Relevant for safety; Refer to the respective Safety Data Sheet*. |                                                                                                                                                     |

**Figure D-1**  
**Composition of 750 MHz Head and Body Tissue Equivalent Matter**

**Note:** 750MHz liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

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### Measurement Certificate / Material Test

|              |                                          |
|--------------|------------------------------------------|
| Item Name    | Body Tissue Simulating Liquid (MSL750V2) |
| Product No.  | SL AAM 075 AA (Batch: 170608-1)          |
| Manufacturer | SPEAG                                    |

### Measurement Method

TSL dielectric parameters measured using calibrated DAK probe.

### Setup Validation

Validation results were within  $\pm 2.5\%$  towards the target values of Methanol.

### Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

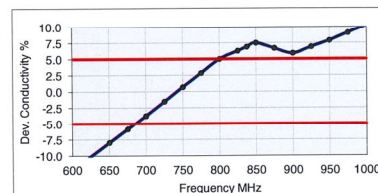
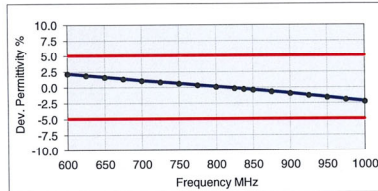
### Test Condition

|                 |                                                             |
|-----------------|-------------------------------------------------------------|
| Ambient         | Environment temperatur ( $22 \pm 3$ )°C and humidity < 70%. |
| TSL Temperature | 22°C                                                        |
| Test Date       | 20-Jun-17                                                   |
| Operator        | CL                                                          |

### Additional Information

|                   |                         |
|-------------------|-------------------------|
| TSL Density       | 1.212 g/cm <sup>3</sup> |
| TSL Heat-capacity | 3.006 kJ/(kg*K)         |

| f [MHz] | Measured |       |       | Target |       | Diff. to Target [%] |         |
|---------|----------|-------|-------|--------|-------|---------------------|---------|
|         | e'       | e''   | sigma | eps    | sigma | Δ-eps               | Δ-sigma |
| 600     | 57.3     | 26.02 | 0.84  | 56.1   | 0.95  | 2.2                 | -12.2   |
| 625     | 57.1     | 24.67 | 0.86  | 56.0   | 0.95  | 1.9                 | -10.1   |
| 650     | 56.8     | 24.32 | 0.88  | 55.9   | 0.96  | 1.6                 | -8.0    |
| 675     | 56.6     | 24.02 | 0.90  | 55.8   | 0.96  | 1.3                 | -5.8    |
| 700     | 56.3     | 23.71 | 0.92  | 55.7   | 0.96  | 1.1                 | -3.8    |
| 725     | 56.1     | 23.48 | 0.95  | 55.6   | 0.96  | 0.8                 | -1.5    |
| 750     | 55.9     | 23.25 | 0.97  | 55.5   | 0.96  | 0.6                 | 0.7     |
| 775     | 55.6     | 23.04 | 0.99  | 55.4   | 0.97  | 0.3                 | 2.9     |
| 800     | 55.4     | 22.82 | 1.02  | 55.3   | 0.97  | 0.1                 | 5.0     |
| 825     | 55.2     | 22.65 | 1.04  | 55.2   | 0.98  | -0.1                | 6.3     |
| 838     | 55.1     | 22.56 | 1.05  | 55.2   | 0.98  | -0.3                | 6.9     |
| 850     | 54.9     | 22.47 | 1.06  | 55.2   | 0.99  | -0.4                | 7.5     |
| 875     | 54.7     | 22.34 | 1.09  | 55.1   | 1.02  | -0.7                | 6.7     |
| 900     | 54.5     | 22.21 | 1.11  | 55.0   | 1.05  | -0.9                | 5.9     |
| 925     | 54.3     | 22.08 | 1.14  | 55.0   | 1.06  | -1.3                | 6.9     |
| 950     | 54.1     | 21.95 | 1.16  | 54.9   | 1.08  | -1.6                | 7.9     |
| 975     | 53.8     | 21.86 | 1.19  | 54.9   | 1.09  | -1.9                | 9.1     |
| 1000    | 53.6     | 21.76 | 1.21  | 54.8   | 1.10  | -2.2                | 10.2    |



**Figure D-2**  
**750MHz Body Tissue Equivalent Matter**

|                                    |                                                                                     |                            |                                                                                       |                                 |
|------------------------------------|-------------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFX320AA                  |  | SAR EVALUATION REPORT      |  | Approved by:<br>Quality Manager |
| Test Dates:<br>05/21/19 - 06/10/19 | DUT Type:<br>Portable Handset                                                       | APPENDIX D:<br>Page 2 of 4 |                                                                                       |                                 |

**Measurement Certificate / Material Test**

Item Name **Head Tissue Simulating Liquid (HSL750V2)**  
 Product No. SL AAH 075 AA (Batch: 170612-4)  
 Manufacturer SPEAG

**Measurement Method**

TSL dielectric parameters measured using calibrated DAK probe.

**Setup Validation**

Validation results were within  $\pm 2.5\%$  towards the target values of Methanol.

**Target Parameters**

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

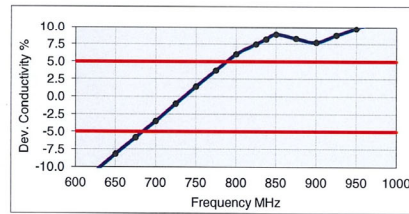
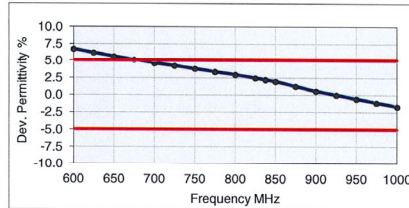
**Test Condition**

Ambient Environment temperatur ( $22 \pm 3^\circ\text{C}$  and humidity  $< 70\%$ ).  
 TSL Temperature  $22^\circ\text{C}$   
 Test Date 20-Jun-17  
 Operator CL

**Additional Information**

TSL Density  $1.284 \text{ g/cm}^3$   
 TSL Heat-capacity  $2.701 \text{ kJ/(kg}^\circ\text{K)}$

|         | Measured |       |       | Target |       | Diff.to Target [%]  |                       |
|---------|----------|-------|-------|--------|-------|---------------------|-----------------------|
| f [MHz] | e'       | e''   | sigma | eps    | sigma | $\Delta\text{-eps}$ | $\Delta\text{-sigma}$ |
| 600     | 45.6     | 22.97 | 0.77  | 42.7   | 0.88  | 6.7                 | -13.1                 |
| 625     | 45.2     | 22.73 | 0.79  | 42.6   | 0.88  | 6.2                 | -10.6                 |
| 650     | 44.9     | 22.49 | 0.81  | 42.5   | 0.89  | 5.6                 | -8.2                  |
| 675     | 44.5     | 22.27 | 0.84  | 42.3   | 0.89  | 5.1                 | -5.8                  |
| 700     | 44.2     | 22.05 | 0.86  | 42.2   | 0.89  | 4.6                 | -3.5                  |
| 725     | 43.8     | 21.88 | 0.88  | 42.1   | 0.89  | 4.2                 | -1.0                  |
| 750     | 43.5     | 21.72 | 0.91  | 41.9   | 0.89  | 3.8                 | 1.4                   |
| 775     | 43.2     | 21.55 | 0.93  | 41.8   | 0.90  | 3.4                 | 3.7                   |
| 800     | 42.9     | 21.38 | 0.95  | 41.7   | 0.90  | 2.9                 | 6.0                   |
| 825     | 42.6     | 21.24 | 0.97  | 41.6   | 0.91  | 2.4                 | 7.5                   |
| 838     | 42.5     | 21.17 | 0.99  | 41.5   | 0.91  | 2.2                 | 8.2                   |
| 850     | 42.3     | 21.09 | 1.00  | 41.5   | 0.92  | 2.0                 | 8.0                   |
| 875     | 42.0     | 20.98 | 1.02  | 41.5   | 0.94  | 1.2                 | 8.3                   |
| 900     | 41.7     | 20.87 | 1.05  | 41.5   | 0.97  | 0.5                 | 7.7                   |
| 925     | 41.5     | 20.76 | 1.07  | 41.5   | 0.98  | 0.0                 | 8.7                   |
| 950     | 41.2     | 20.64 | 1.09  | 41.4   | 0.99  | -0.6                | 9.7                   |
| 975     | 40.9     | 20.55 | 1.11  | 41.4   | 1.00  | -1.1                | 10.9                  |
| 1000    | 40.6     | 20.46 | 1.14  | 41.3   | 1.01  | -1.7                | 12.1                  |



**Figure D-3**  
**750MHz Head Tissue Equivalent Matter**

|                                    |                                                                                     |                       |                                                                                       |                                 |
|------------------------------------|-------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFX320AA                  |  | SAR EVALUATION REPORT |  | Approved by:<br>Quality Manager |
| Test Dates:<br>05/21/19 - 06/10/19 | DUT Type:<br>Portable Handset                                                       |                       |                                                                                       | APPENDIX D:<br>Page 3 of 4      |

### 3 Composition / Information on ingredients

The Item is composed of the following ingredients:

|                      |              |                                     |
|----------------------|--------------|-------------------------------------|
| Water                | 50 – 73 %    |                                     |
| Non-ionic detergents | 25 – 50 %    | polyoxyethylenesorbitan monolaurate |
| NaCl                 | 0 – 2 %      |                                     |
| Preservative         | 0.05 – 0.1 % | Preventol-D7                        |

Safety relevant ingredients:

|                    |         |                                                                                                        |
|--------------------|---------|--------------------------------------------------------------------------------------------------------|
| CAS-No. 55965-84-9 | < 0.1 % | aqueous preparation, containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyl-3(2H)-isothiazolone |
| CAS-No. 9005-64-5  | < 50 %  | polyoxyethylenesorbitan monolaurate                                                                    |

According to international guidelines, the product is not a dangerous mixture and therefore not required to be marked by symbols.

## Figure D-4 Composition of 2.4 GHz Head Tissue Equivalent Matter

**Note:** 2.4 GHz head liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

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### Measurement Certificate / Material Test

|              |                                                 |
|--------------|-------------------------------------------------|
| Item Name    | Head Tissue Simulating Liquid (HBBL1900-3800V3) |
| Product No.  | SL AAH 196 AB (Batch: 170619-1)                 |
| Manufacturer | SPEAG                                           |

### Measurement Method

TSL dielectric parameters measured using calibrated DAK probe.

### Setup Validation

Validation results were within  $\pm 2.5\%$  towards the target values of Methanol.

### Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

### Test Condition

|                 |                                                              |
|-----------------|--------------------------------------------------------------|
| Ambient         | Environment temperature ( $22 \pm 3$ )°C and humidity < 70%. |
| TSL Temperature | 22°C                                                         |
| Test Date       | 20-Jun-17                                                    |
| Operator        | CL                                                           |

### Additional Information

TSL Density 1.054 g/cm<sup>3</sup>

TSL Heat-capacity 3.089 kJ/(kg·K)

| f [MHz] | e'   | e''  | sigma | eps  | sigma | Delta-eps | Delta-sigma |
|---------|------|------|-------|------|-------|-----------|-------------|
| 1900    | 41.8 | 12.3 | 1.3   | 40.0 | 1.4   | 4.5       | -8.2        |
| 1950    | 41.6 | 12.3 | 1.3   | 40.0 | 1.4   | 4.0       | -4.6        |
| 2000    | 41.4 | 12.4 | 1.4   | 40.0 | 1.4   | 3.6       | -1.3        |
| 2050    | 41.2 | 12.6 | 1.4   | 39.9 | 1.4   | 3.3       | -0.9        |
| 2100    | 41.1 | 12.7 | 1.5   | 39.8 | 1.5   | 3.1       | -0.6        |
| 2150    | 40.9 | 12.8 | 1.5   | 39.7 | 1.5   | 2.9       | -0.2        |
| 2200    | 40.7 | 12.9 | 1.6   | 39.6 | 1.6   | 2.7       | 0.2         |
| 2250    | 40.6 | 13.0 | 1.6   | 39.6 | 1.6   | 2.5       | 0.5         |
| 2300    | 40.4 | 13.2 | 1.7   | 39.5 | 1.7   | 2.3       | 1.1         |
| 2350    | 40.2 | 13.3 | 1.7   | 39.4 | 1.7   | 2.1       | 1.5         |
| 2400    | 40.0 | 13.4 | 1.8   | 39.3 | 1.8   | 1.8       | 2.1         |
| 2450    | 39.8 | 13.5 | 1.8   | 39.2 | 1.8   | 1.6       | 2.6         |
| 2500    | 39.7 | 13.7 | 1.9   | 39.1 | 1.9   | 1.3       | 2.6         |
| 2550    | 39.5 | 13.7 | 2.0   | 39.1 | 1.9   | 1.1       | 2.2         |
| 2600    | 39.3 | 13.9 | 2.0   | 39.0 | 2.0   | 0.8       | 2.5         |
| 2650    | 39.1 | 14.0 | 2.1   | 38.9 | 2.0   | 0.5       | 2.6         |
| 2700    | 39.0 | 14.2 | 2.1   | 38.9 | 2.1   | 0.2       | 2.7         |
| 2750    | 38.7 | 14.3 | 2.2   | 38.8 | 2.1   | -0.2      | 2.6         |
| 2800    | 38.6 | 14.4 | 2.2   | 38.8 | 2.2   | -0.4      | 2.5         |
| 2850    | 38.4 | 14.5 | 2.3   | 38.7 | 2.2   | -0.8      | 2.6         |
| 2900    | 38.2 | 14.6 | 2.3   | 38.6 | 2.3   | -1.0      | 2.6         |
| 2950    | 38.1 | 14.7 | 2.4   | 38.6 | 2.3   | -1.3      | 2.6         |
| 3000    | 37.9 | 14.8 | 2.5   | 38.5 | 2.4   | -1.7      | 2.6         |
| 3050    | 37.7 | 14.8 | 2.5   | 38.4 | 2.5   | -2.0      | 2.8         |
| 3100    | 37.5 | 14.9 | 2.6   | 38.4 | 2.5   | -2.3      | 2.8         |
| 3150    | 37.3 | 15.0 | 2.6   | 38.3 | 2.6   | -2.6      | 2.9         |
| 3200    | 37.1 | 15.1 | 2.7   | 38.3 | 2.6   | -3.0      | 2.9         |
| 3250    | 37.0 | 15.1 | 2.7   | 38.2 | 2.7   | -3.3      | 3.0         |
| 3300    | 36.8 | 15.2 | 2.8   | 38.2 | 2.7   | -3.6      | 3.1         |
| 3350    | 36.6 | 15.3 | 2.8   | 38.1 | 2.8   | -3.9      | 3.2         |
| 3400    | 36.4 | 15.3 | 2.9   | 38.0 | 2.8   | -4.2      | 3.3         |
| 3450    | 36.3 | 15.4 | 3.0   | 38.0 | 2.9   | -4.5      | 3.4         |
| 3500    | 36.1 | 15.5 | 3.0   | 37.9 | 2.9   | -4.8      | 3.5         |
| 3550    | 36.0 | 15.5 | 3.1   | 37.9 | 3.0   | -5.0      | 3.6         |
| 3600    | 35.8 | 15.6 | 3.1   | 37.8 | 3.0   | -5.3      | 3.6         |
| 3650    | 35.7 | 15.7 | 3.2   | 37.8 | 3.1   | -5.6      | 3.7         |
| 3700    | 35.5 | 15.7 | 3.2   | 37.7 | 3.1   | -5.8      | 3.9         |
| 3750    | 35.4 | 15.8 | 3.3   | 37.6 | 3.2   | -6.1      | 3.9         |
| 3800    | 35.2 | 15.9 | 3.4   | 37.6 | 3.2   | -6.3      | 4.1         |
| 3850    | 35.1 | 15.9 | 3.4   | 37.5 | 3.3   | -6.6      | 4.1         |

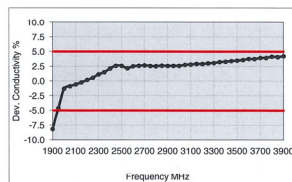
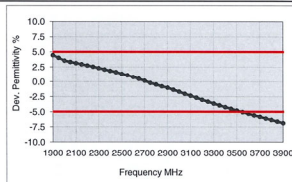


Figure D-5  
2.4 GHz Head Tissue Equivalent Matter

|                                    |                                                                                     |                       |                                                                                       |                                 |
|------------------------------------|-------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFX320AA                  |  | SAR EVALUATION REPORT |  | Approved by:<br>Quality Manager |
| Test Dates:<br>05/21/19 - 06/10/19 | DUT Type:<br>Portable Handset                                                       |                       |                                                                                       | APPENDIX D:<br>Page 4 of 4      |

## APPENDIX E: SAR SYSTEM VALIDATION

Per FCC KDB Publication 865664 D02v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

**Table E-1**  
**SAR System Validation Summary – 1g**

| SAR System | Freq. (MHz) | Date      | Probe SN | Probe Cal Point |      | Cond. ( $\sigma$ ) | Perm. ( $\epsilon_r$ ) | CW VALIDATION |                 |                | MOD. VALIDATION |             |      |
|------------|-------------|-----------|----------|-----------------|------|--------------------|------------------------|---------------|-----------------|----------------|-----------------|-------------|------|
|            |             |           |          |                 |      |                    |                        | SENSITIVITY   | PROBE LINEARITY | PROBE ISOTROPY | MOD. TYPE       | DUTY FACTOR | PAR  |
| D          | 750         | 4/12/2019 | 3914     | 750             | Head | 0.903              | 42.785                 | PASS          | PASS            | PASS           | N/A             | N/A         | N/A  |
| H          | 835         | 7/13/2018 | 7409     | 835             | Head | 0.932              | 43.227                 | PASS          | PASS            | PASS           | GMSK            | PASS        | N/A  |
| E          | 1750        | 2/6/2019  | 3589     | 1750            | Head | 1.363              | 41.670                 | PASS          | PASS            | PASS           | N/A             | N/A         | N/A  |
| L          | 1900        | 5/22/2019 | 7308     | 1900            | Head | 1.450              | 38.200                 | PASS          | PASS            | PASS           | GMSK            | PASS        | N/A  |
| E          | 2450        | 2/5/2019  | 3589     | 2450            | Head | 1.825              | 39.836                 | PASS          | PASS            | PASS           | D               | PASS        | PASS |
| I          | 750         | 5/16/2019 | 7357     | 750             | Body | 0.937              | 56.547                 | PASS          | PASS            | PASS           | N/A             | N/A         | N/A  |
| J          | 835         | 3/10/2019 | 7488     | 835             | Body | 0.988              | 53.868                 | PASS          | PASS            | PASS           | GMSK            | PASS        | N/A  |
| D          | 1750        | 4/29/2019 | 3914     | 1750            | Body | 1.529              | 51.886                 | PASS          | PASS            | PASS           | N/A             | N/A         | N/A  |
| G          | 1900        | 8/10/2018 | 7410     | 1900            | Body | 1.567              | 52.239                 | PASS          | PASS            | PASS           | GMSK            | PASS        | N/A  |
| E          | 1900        | 2/5/2019  | 3589     | 1900            | Body | 1.584              | 54.248                 | PASS          | PASS            | PASS           | GMSK            | PASS        | N/A  |
| K          | 2450        | 3/6/2019  | 7417     | 2450            | Body | 2.039              | 50.670                 | PASS          | PASS            | PASS           | D               | PASS        | PASS |

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01r04 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to FCC KDB Publication 865664 D01v01r04.

|                                    |                                                                                     |                       |                                                                                       |                                 |
|------------------------------------|-------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFX320AA                  |  | SAR EVALUATION REPORT |  | Approved by:<br>Quality Manager |
| Test Dates:<br>05/21/19 - 06/10/19 | DUT Type:<br>Portable Handset                                                       |                       |                                                                                       | APPENDIX E:<br>Page 1 of 1      |

## APPENDIX G: DOWNLINK LTE CA RF CONDUCTED POWERS

## 1.1 LTE Downlink Only Carrier Aggregation Test Reduction Methodology

SAR test exclusion for LTE downlink Carrier Aggregation is determined by power measurements according to the number of component carriers (CCs) supported by the product implementation. Per April 2018 TCBC Workshop Notes, the following test reduction methodology was applied to determine the combinations required for conducted power measurements.

### LTE DLCA Test Reduction Methodology:

- The supported combinations were arranged by the number of component carriers in columns.
- Any limitations on the PCC or SCC for each combination were identified alongside the combination (e.g. CA\_2A-2A-4A-12A, but B12 can only be configured as a SCC).
- Power measurements were performed for "supersets" (LTE CA combinations with multiple components carriers) and any "subsets" (LTE CA combinations with fewer component carriers) that were not completely covered by the supersets.
- Only subsets that have the exact same components as a superset were excluded for measurement.
- When there were certain restrictions on component carriers that existed in the superset that were not applied for the subset, the subset configuration was additionally evaluated.
- Both inter-band and intra-band downlink carrier aggregation scenarios were considered.
- Downlink CA combinations for SISO operations were measured independently, per May 2017 TCBC Workshop notes.

Table 1 – Example of Exclusion Table for SISO Configurations

| Index  |          |              |              |              |              | Approved Contract Document (Title) |              |              |              |              |              | Index  |              |              |              |              |              | Approved Contract Document (Title) |  |  |  |  |  |
|--------|----------|--------------|--------------|--------------|--------------|------------------------------------|--------------|--------------|--------------|--------------|--------------|--------|--------------|--------------|--------------|--------------|--------------|------------------------------------|--|--|--|--|--|
| Index  | DOC      | Doc 1        | Doc 2        | Doc 3        | Doc 4        | Index                              | DOC          | Doc 1        | Doc 2        | Doc 3        | Doc 4        | Index  | DOC          | Doc 1        | Doc 2        | Doc 3        | Doc 4        |                                    |  |  |  |  |  |
| Doc 1  | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 1                              | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 1  | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 2  | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 2                              | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 2  | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 3  | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 3                              | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 3  | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 4  | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 4                              | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 4  | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 5  | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 5                              | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 5  | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 6  | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 6                              | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 6  | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 7  | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 7                              | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 7  | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 8  | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 8                              | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 8  | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 9  | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 9                              | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 9  | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 10 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 10                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 10 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 11 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 11                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 11 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 12 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 12                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 12 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 13 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 13                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 13 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 14 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 14                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 14 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 15 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 15                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 15 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 16 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 16                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 16 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 17 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 17                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 17 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 18 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 18                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 18 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 19 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 19                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 19 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 20 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 20                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 20 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 21 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 21                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 21 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 22 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 22                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 22 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 23 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 23                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 23 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 24 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 24                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 24 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 25 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 25                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 25 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 26 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 26                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 26 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 27 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 27                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 27 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 28 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 28                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 28 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 29 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 29                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 29 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 30 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 30                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 30 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 31 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 31                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 31 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 32 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 32                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 32 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 33 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 33                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 33 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 34 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 34                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 34 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 35 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 35                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 35 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 36 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 36                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 36 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 37 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 37                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 37 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 38 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 38                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 38 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 39 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 39                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 39 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 40 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 40                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 40 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 41 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 41                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 41 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 42 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 42                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 42 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 43 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 43                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 43 | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 |                                    |  |  |  |  |  |
| Doc 44 | CA-24-24 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 44                             | CA-24-24-24A | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | 1.15.15.15.1 | Doc 44 | CA-24-24-24A | 1.15.15.15.1 |              |              |              |                                    |  |  |  |  |  |

|                                           |                                                                                                                                               |                           |                                                                                                 |                                        |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: ZNFX320AA                         |  <b>PCTEST</b><br><small>ANALYSIS LABORATORY, INC.</small> | SAR EVALUATION REPORT     |  <b>LG</b> | <b>Reviewed by:</b><br>Quality Manager |
| <b>Test Dates:</b><br>05/21/19 - 06/10/19 | <b>DUT Type:</b><br>Portable Handset                                                                                                          | APPENDIX G<br>Page 1 of 3 |                                                                                                 |                                        |

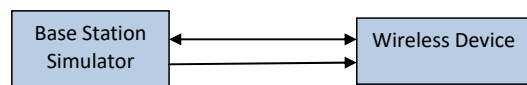
## 1.2 LTE Downlink Only Carrier Aggregation Test Selection and Setup

SAR test exclusion for LTE downlink Carrier Aggregation is determined by power measurements according to the number component carriers (CCs) supported by the product implementation. For those configurations required by April 2018 TCBC Workshop Notes, conducted power measurements with LTE Carrier Aggregation (CA) (downlink only) active are made in accordance to KDB Publication 941225 D05Av01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s) (SCC) on the downlink only. All uplink communications and acknowledgements remain identical to specifications when downlink carrier aggregation is inactive on the PCC. Additional conducted output powers are measured with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band.

Per FCC KDB Publication 941225 D05Av01r02, no SAR measurements are required for carrier aggregation configurations when the maximum average output power with downlink only carrier aggregation active is not more than 0.25 dB higher than the average output power with downlink only carrier aggregation inactive. All bands required for SAR testing per FCC KDB procedures were considered. Based on the measured maximum powers below, no additional SAR tests were required for DLCA SAR configurations.

General PCC and SCC configuration selection procedure

- PCC uplink channel, channel bandwidth, modulation and RB configurations were selected based on section C)3)b)ii) of KDB 941225 D05 V01r02. The downlink PCC channel was paired with the selected PCC uplink channel according to normal configurations without carrier aggregation.
- To maximize aggregated bandwidth, highest channel bandwidth available for that CA combination was selected for SCC. For inter-band CA, the SCC downlink channels were selected near the middle of their transmission bands. For contiguous intra-band CA, the downlink channel spacing between the component carriers was set to multiple of 300 kHz less than the nominal channel spacing defined in section 5.4.1A of 3GPP TS 36.521. For non-contiguous intra-band CA, the downlink channel spacing between the component carriers was set to be larger than the nominal channel spacing and provided maximum separation between the component carriers.
- All selected PCC and SCC(s) remained fully within the uplink/downlink transmission band of the respective component carrier.



**Figure 1**  
**DL CA Power Measurement Setup**

|                                    |                                                                                                                                   |                       |                                                                                                 |                                 |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFX320AA                  |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR EVALUATION REPORT |  <b>LG</b> | Reviewed by:<br>Quality Manager |
| Test Dates:<br>05/21/19 - 06/10/19 | DUT Type:<br>Portable Handset                                                                                                     |                       |                                                                                                 | APPENDIX G<br>Page 2 of 3       |

## 1.3 Downlink Carrier Aggregation RF Conducted Powers

### 1.3.1 LTE Band 12 as PCC

**Table 1**  
**Maximum Output Powers**

| Combination   | PCC      |              |              |                      |      |            |                  |                  |                      | SCC 1    |              |                  |                      | Power                                 |                                   |
|---------------|----------|--------------|--------------|----------------------|------|------------|------------------|------------------|----------------------|----------|--------------|------------------|----------------------|---------------------------------------|-----------------------------------|
|               | PCC Band | PCC BW [MHz] | PCC (UL) Ch. | PCC (UL) Freq. [MHz] | Mod. | PCC UL# RB | PCC UL RB Offset | PCC (DL) Channel | PCC (DL) Freq. [MHz] | SCC Band | SCC BW [MHz] | SCC (DL) Channel | SCC (DL) Freq. [MHz] | LTE Tx.Power with DL CA Enabled (dBm) | LTE Single Carrier Tx Power (dBm) |
| CA 2A-12A (2) | LTE B12  | 10           | 23095        | 707.5                | QPSK | 1          | 25               | 5095             | 737.5                | LTE B2   | 10           | 900              | 1960                 | 25.30                                 | 25.30                             |
| CA 4A-12A     | LTE B12  | 10           | 23095        | 707.5                | QPSK | 1          | 25               | 5095             | 737.5                | LTE B4   | 10           | 2175             | 2132.5               | 25.05                                 | 25.30                             |

### 1.3.2 LTE Band 5 as PCC

**Table 2**  
**Maximum Output Powers**

| Combination  | PCC      |              |              |                      |      |            |                  |                  |                      | SCC 1    |              |                  |                      | Power                                 |                                   |
|--------------|----------|--------------|--------------|----------------------|------|------------|------------------|------------------|----------------------|----------|--------------|------------------|----------------------|---------------------------------------|-----------------------------------|
|              | PCC Band | PCC BW [MHz] | PCC (UL) Ch. | PCC (UL) Freq. [MHz] | Mod. | PCC UL# RB | PCC UL RB Offset | PCC (DL) Channel | PCC (DL) Freq. [MHz] | SCC Band | SCC BW [MHz] | SCC (DL) Channel | SCC (DL) Freq. [MHz] | LTE Tx.Power with DL CA Enabled (dBm) | LTE Single Carrier Tx Power (dBm) |
| CA 2A-5A (1) | LTE B5   | 10           | 20525        | 836.5                | QPSK | 1          | 25               | 2525             | 881.5                | LTE B2   | 10           | 900              | 1960                 | 24.48                                 | 25.10                             |
| CA 4A-5A     | LTE B5   | 10           | 20525        | 836.5                | QPSK | 1          | 25               | 2525             | 881.5                | LTE B4   | 10           | 2175             | 2132.5               | 25.12                                 | 25.10                             |

### 1.3.3 LTE Band 4 as PCC

**Table 3**  
**Maximum Output Powers**

| Combination | PCC      |              |              |                      |      |            |                  |                  |                      | SCC 1    |              |                  |                      | Power                                 |                                   |
|-------------|----------|--------------|--------------|----------------------|------|------------|------------------|------------------|----------------------|----------|--------------|------------------|----------------------|---------------------------------------|-----------------------------------|
|             | PCC Band | PCC BW [MHz] | PCC (UL) Ch. | PCC (UL) Freq. [MHz] | Mod. | PCC UL# RB | PCC UL RB Offset | PCC (DL) Channel | PCC (DL) Freq. [MHz] | SCC Band | SCC BW [MHz] | SCC (DL) Channel | SCC (DL) Freq. [MHz] | LTE Tx.Power with DL CA Enabled (dBm) | LTE Single Carrier Tx Power (dBm) |
| CA 4A-5A    | LTE B4   | 10           | 20175        | 1732.5               | QPSK | 1          | 0                | 2175             | 2132.5               | LTE B5   | 10           | 2525             | 881.5                | 24.69                                 | 24.80                             |
| CA 4A-12A   | LTE B4   | 10           | 20175        | 1732.5               | QPSK | 1          | 0                | 2175             | 2132.5               | LTE B12  | 10           | 5095             | 737.5                | 24.56                                 | 24.80                             |

### 1.3.4 LTE Band 2 as PCC

**Table 4**  
**Maximum Output Powers**

| Combination   | PCC      |              |              |                      |      |            |                  |                  |                      | SCC 1    |              |                  |                      | Power                                 |                                   |
|---------------|----------|--------------|--------------|----------------------|------|------------|------------------|------------------|----------------------|----------|--------------|------------------|----------------------|---------------------------------------|-----------------------------------|
|               | PCC Band | PCC BW [MHz] | PCC (UL) Ch. | PCC (UL) Freq. [MHz] | Mod. | PCC UL# RB | PCC UL RB Offset | PCC (DL) Channel | PCC (DL) Freq. [MHz] | SCC Band | SCC BW [MHz] | SCC (DL) Channel | SCC (DL) Freq. [MHz] | LTE Tx.Power with DL CA Enabled (dBm) | LTE Single Carrier Tx Power (dBm) |
| CA 2A-5A (1)  | LTE B2   | 10           | 18900        | 1880                 | QPSK | 1          | 25               | 900              | 1960                 | LTE B5   | 10           | 2525             | 881.5                | 24.18                                 | 24.80                             |
| CA 2A-12A (2) | LTE B2   | 10           | 18900        | 1880                 | QPSK | 1          | 25               | 900              | 1960                 | LTE B12  | 10           | 5095             | 737.5                | 24.08                                 | 24.80                             |

|                                    |                                                                                                                                   |                           |                                                                                                 |                                 |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFX320AA                  |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR EVALUATION REPORT     |  <b>LG</b> | Reviewed by:<br>Quality Manager |
| Test Dates:<br>05/21/19 - 06/10/19 | DUT Type:<br>Portable Handset                                                                                                     | APPENDIX G<br>Page 3 of 3 |                                                                                                 |                                 |