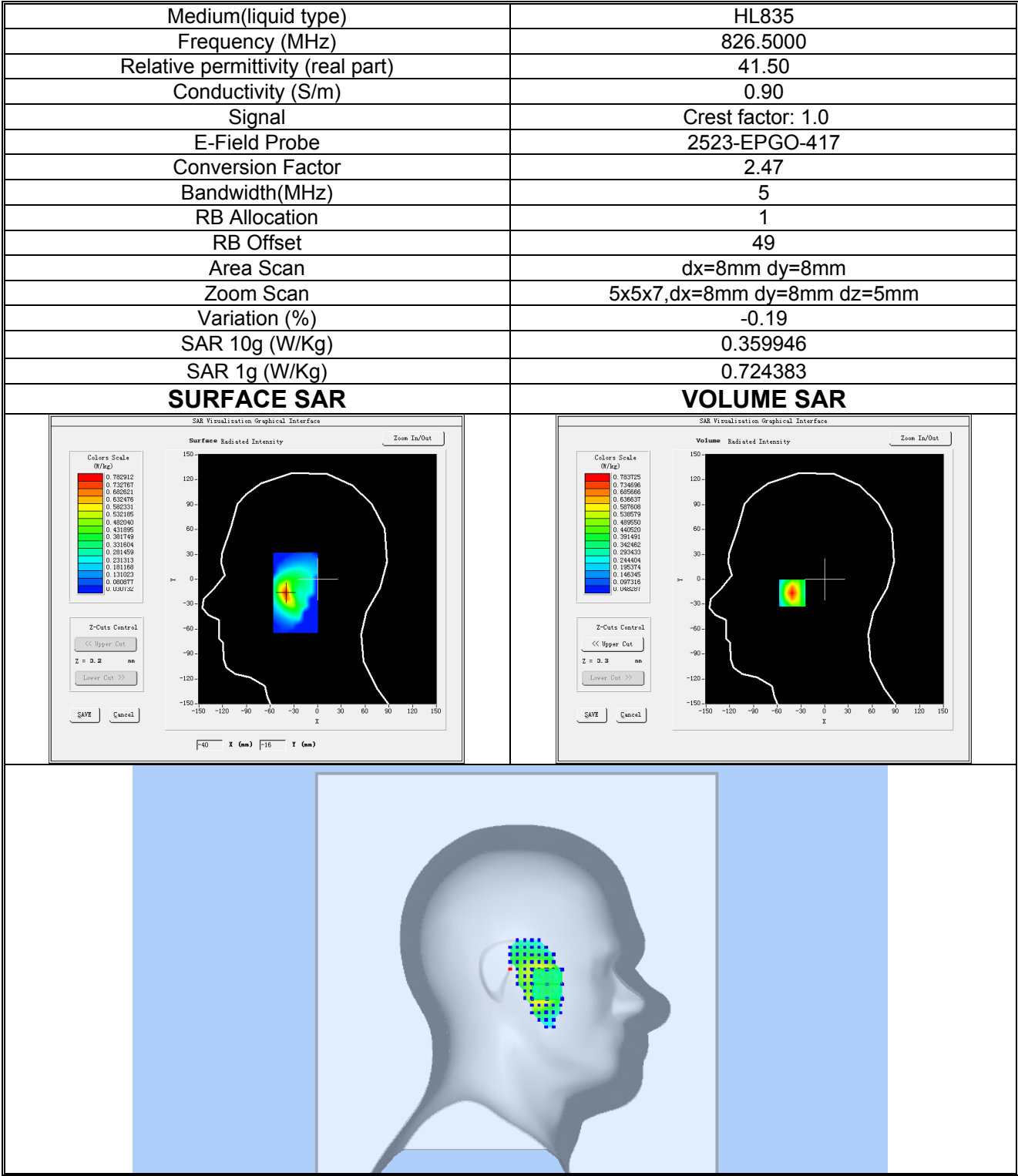
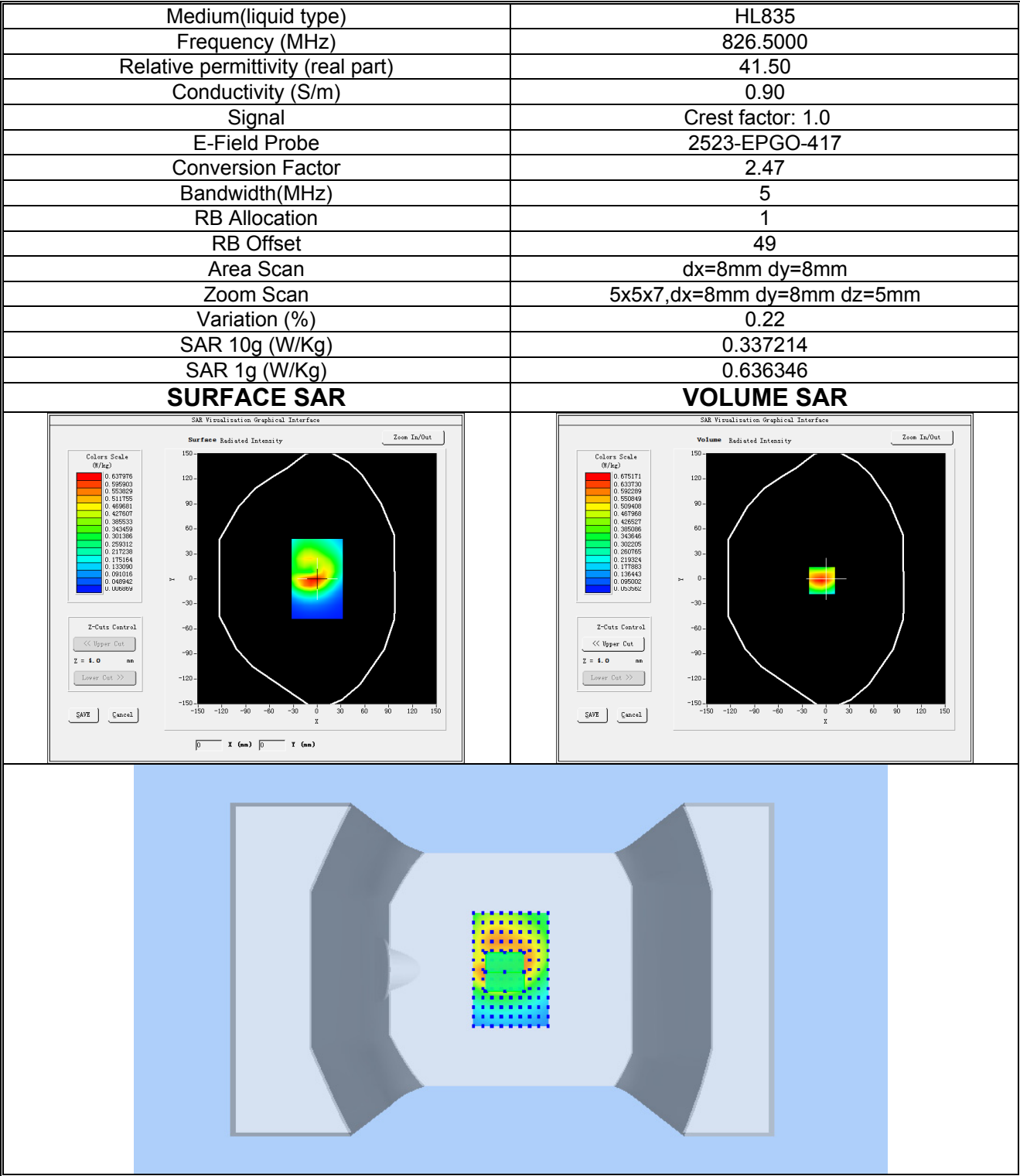


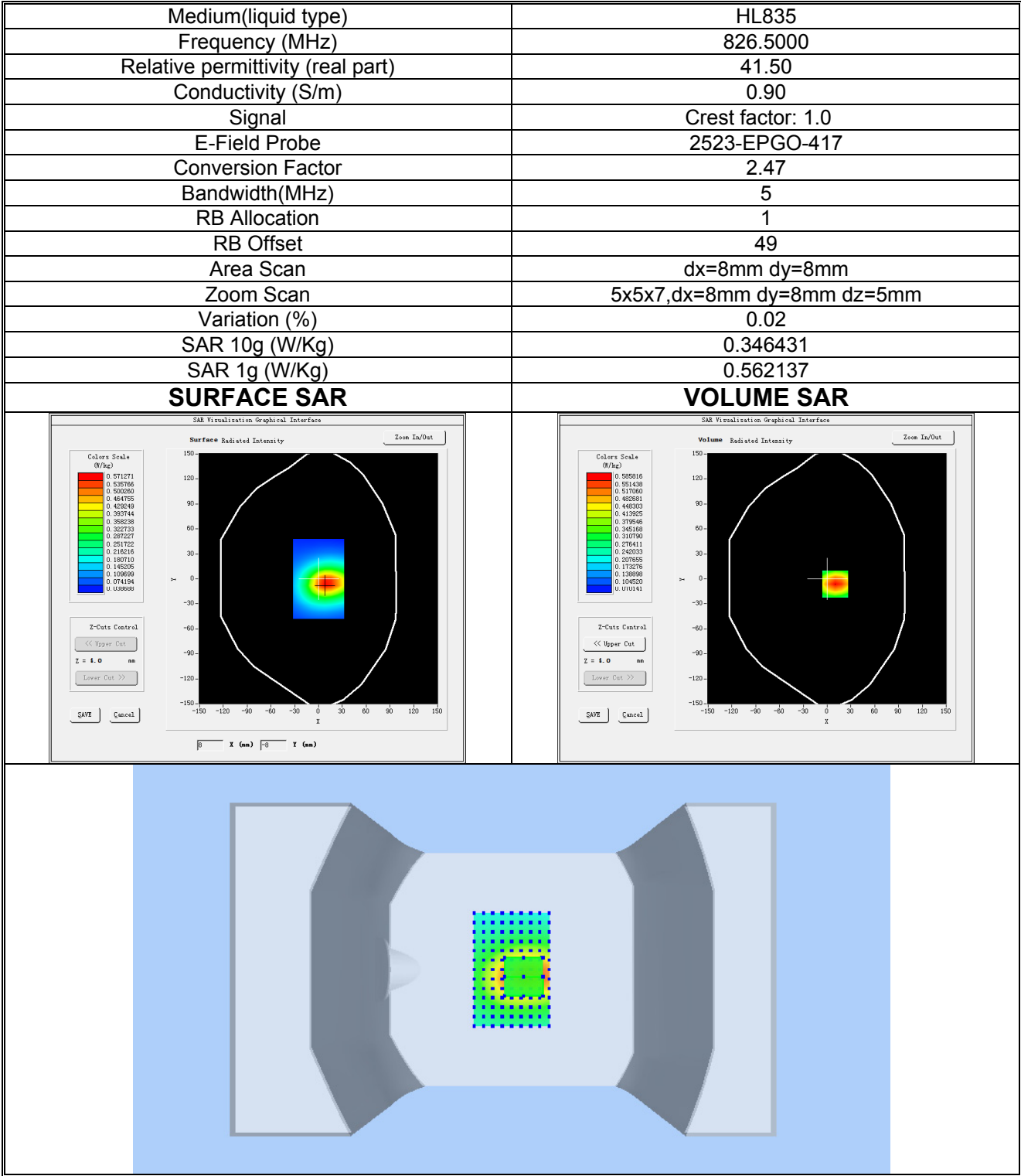
Plot 22:LTE BAND 5, Low channel (Left Head Cheek)
Product Description: Smart Phone
Test Date: 2025-12-02



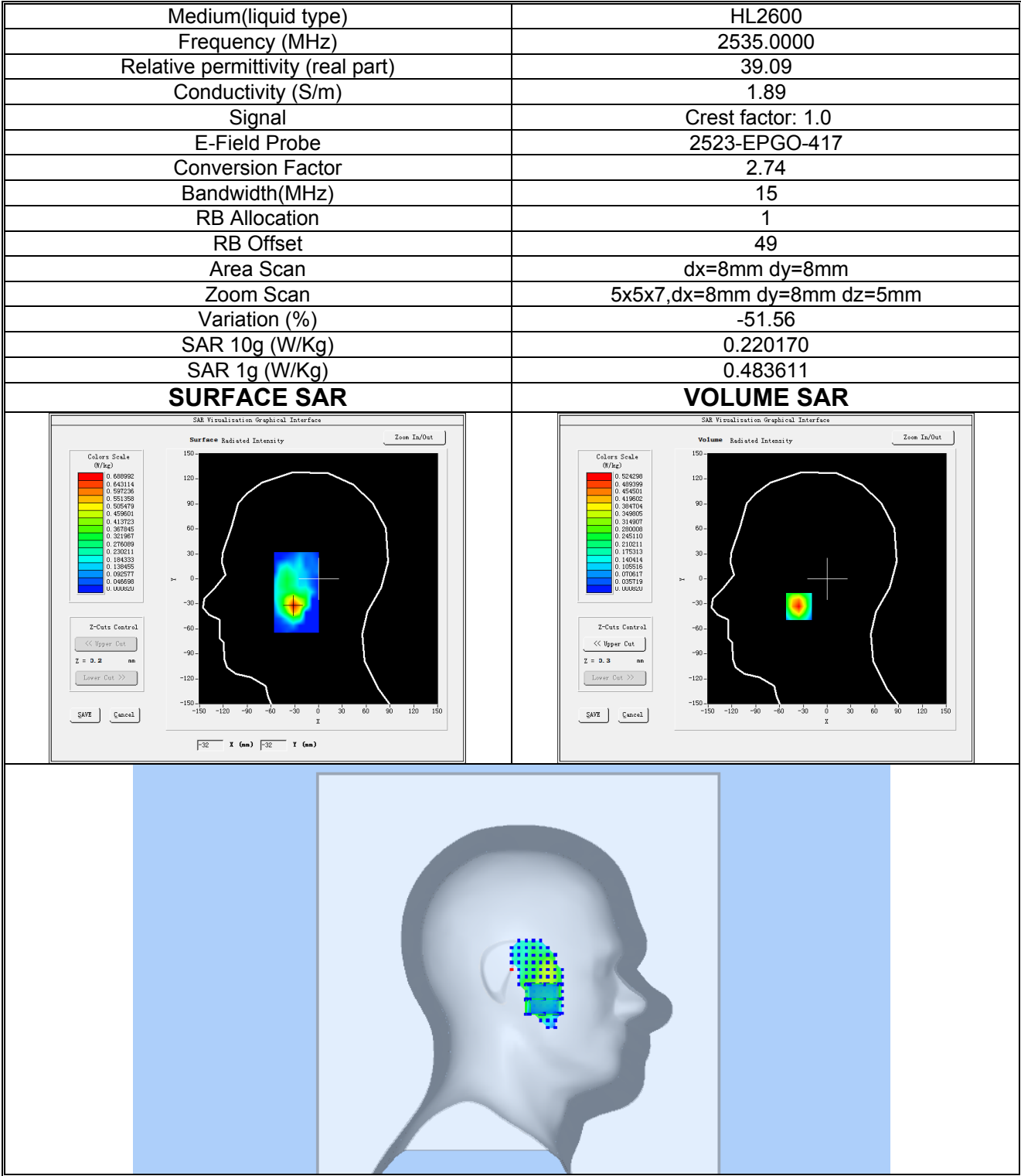
Plot 23: LTE BAND 5, Low channel (Body-worn, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-02



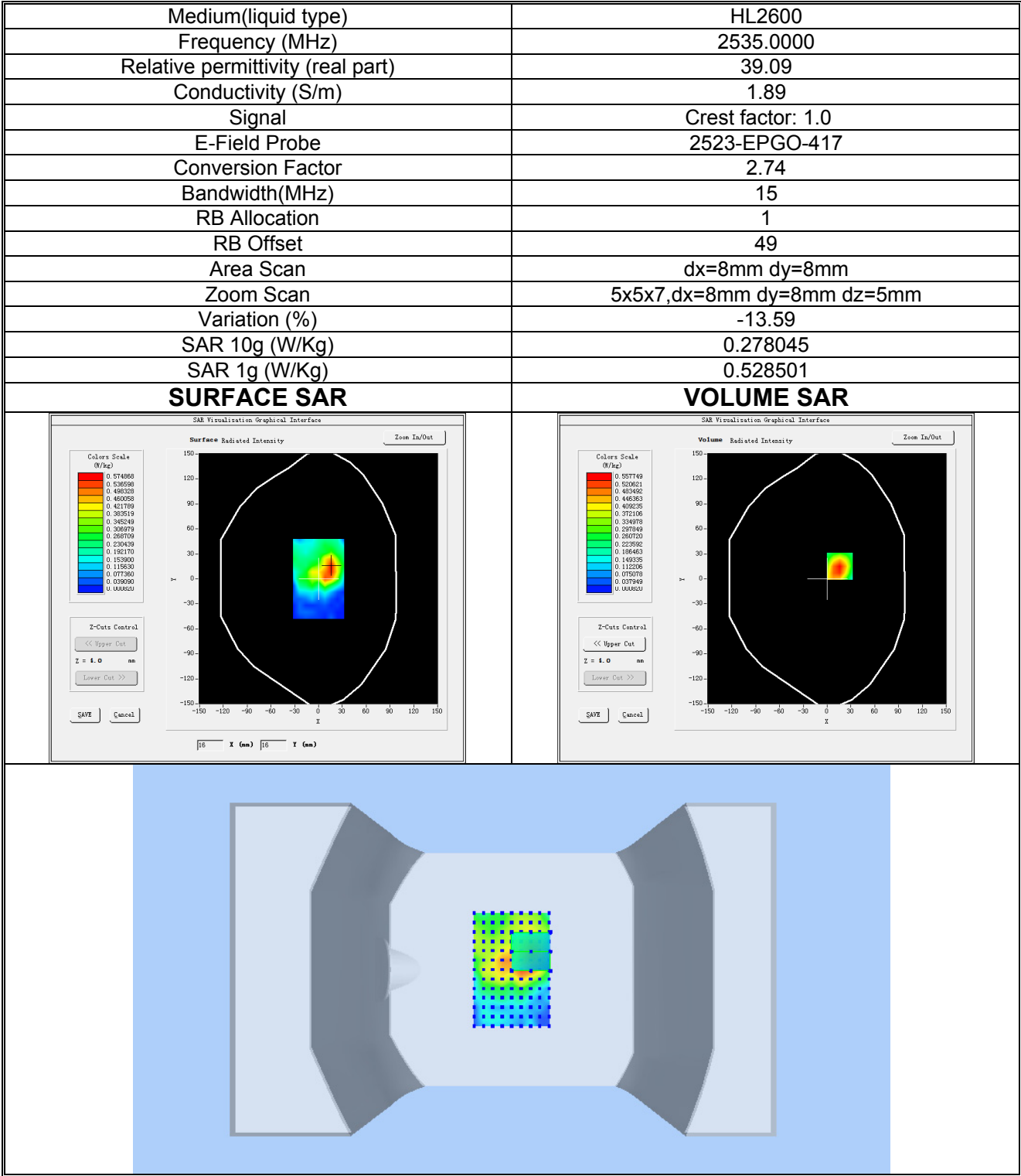
Plot 24: LTE BAND 5, Low channel (Hotspot, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-02



Plot 25:LTE BAND 7, Middle channel (Left Head Cheek)
Product Description: Smart Phone
Test Date: 2025-11-30



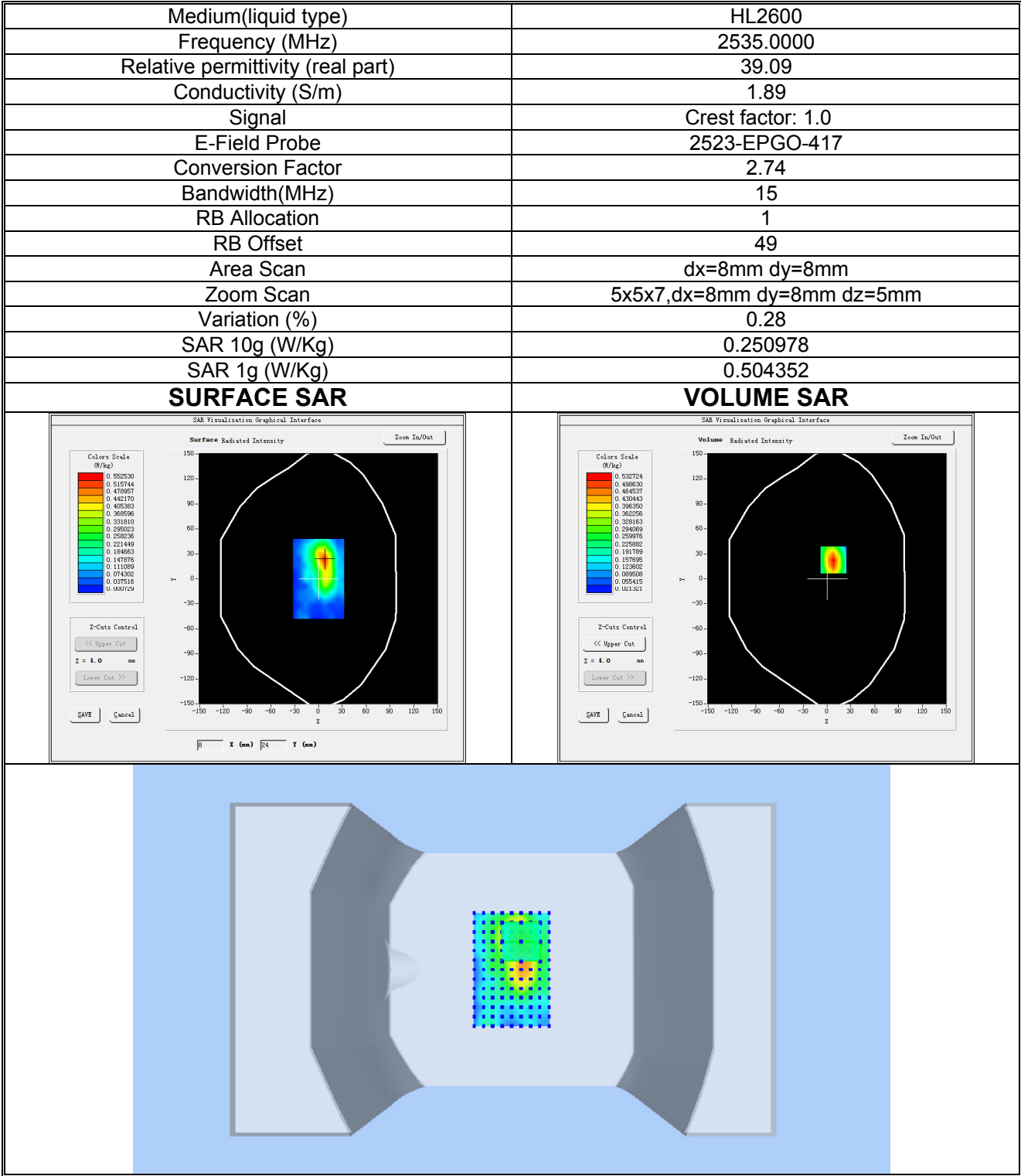
Plot 26: LTE BAND 7, Middle channel (Body-worn, Back Side)
Product Description: Smart Phone
Test Date: 2025-11-30



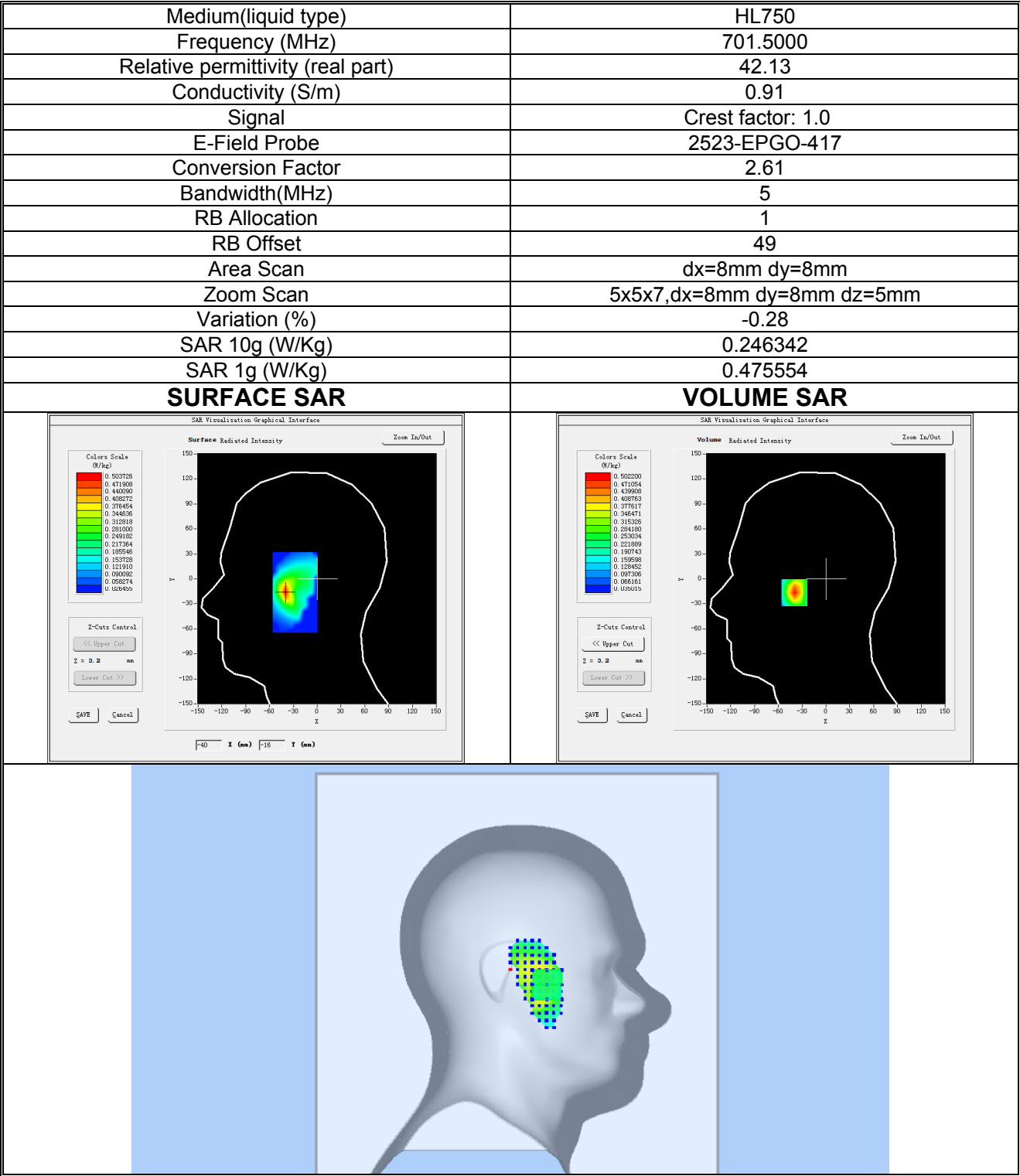
Plot 27: LTE BAND 7, Middle channel (Hotspot, Bottom Edge)

Product Description: Smart Phone

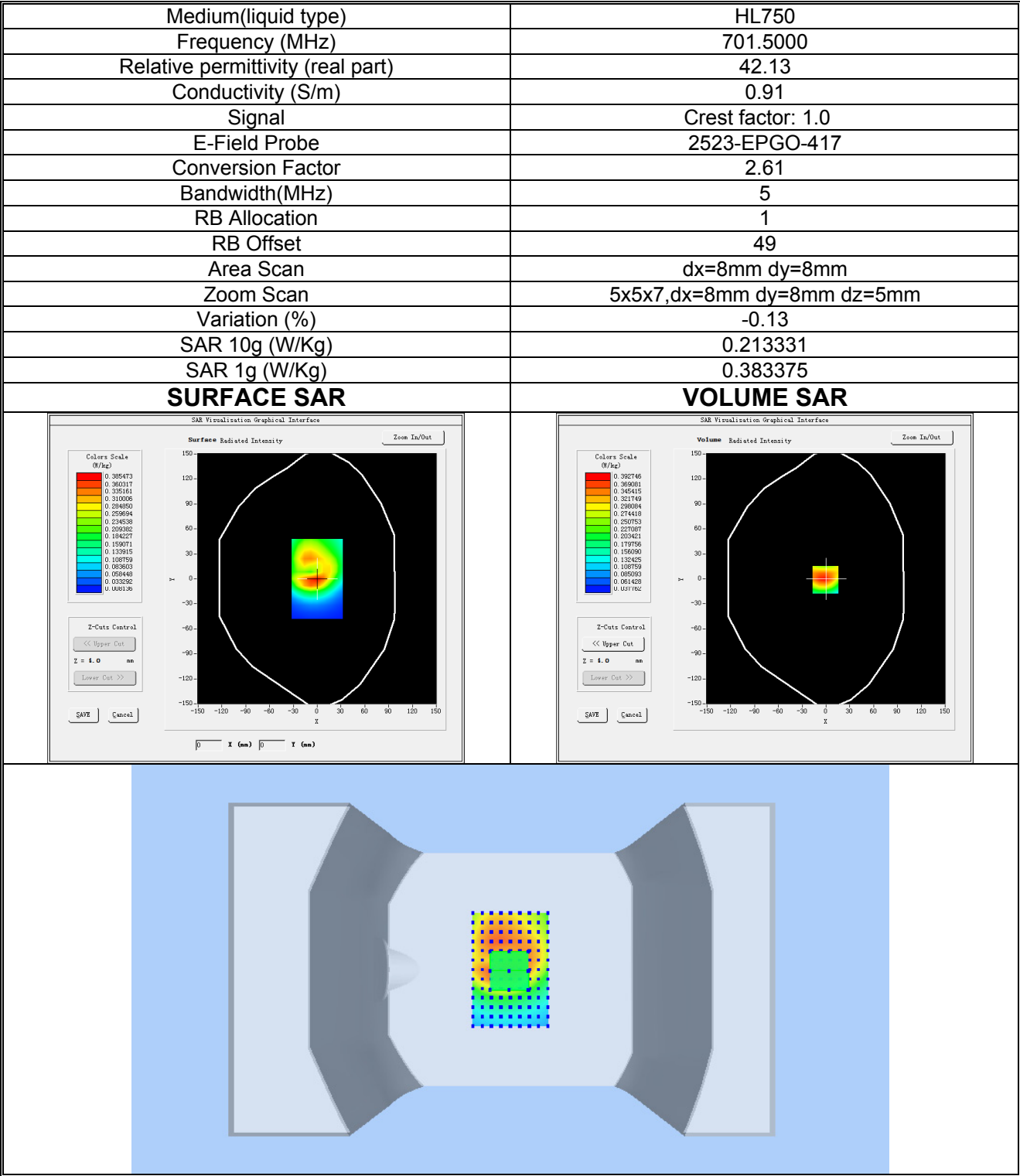
Test Date: 2025-11-30



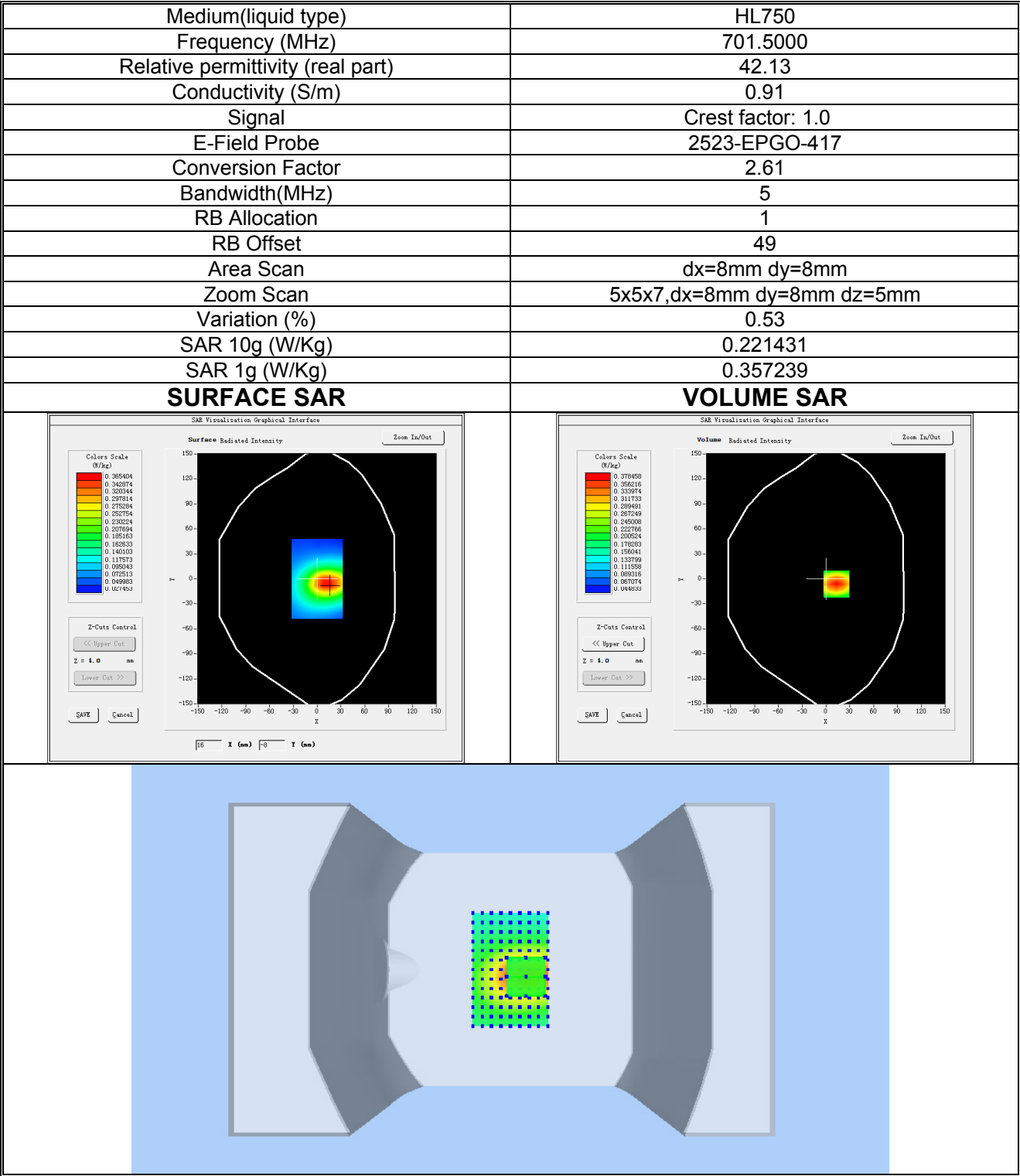
Plot 28:LTE BAND 12, Low channel (Left Head Cheek)
Product Description: Smart Phone
Test Date: 2025-12-02



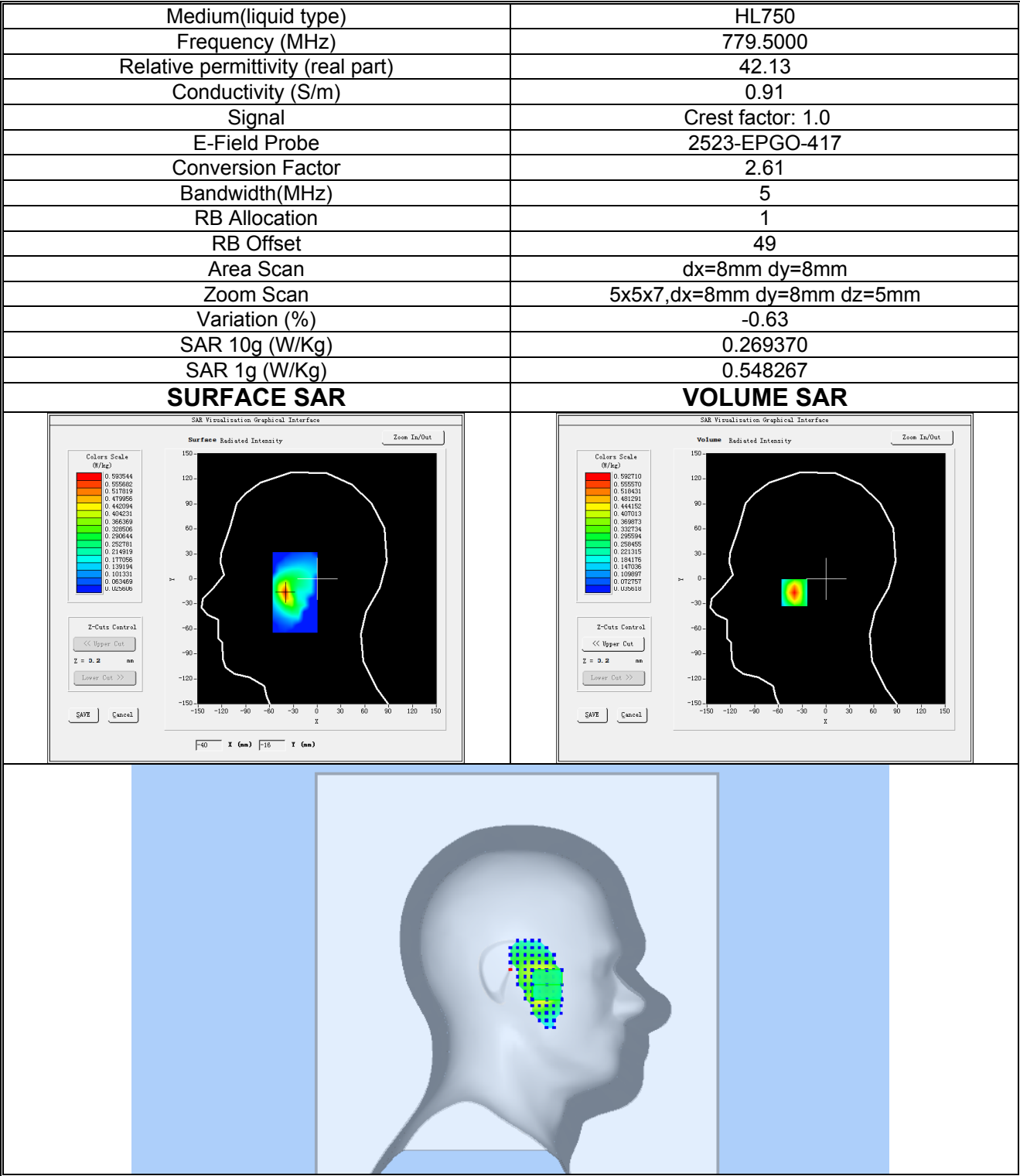
Plot 29: LTE BAND 12, Low channel (Body-worn, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-02



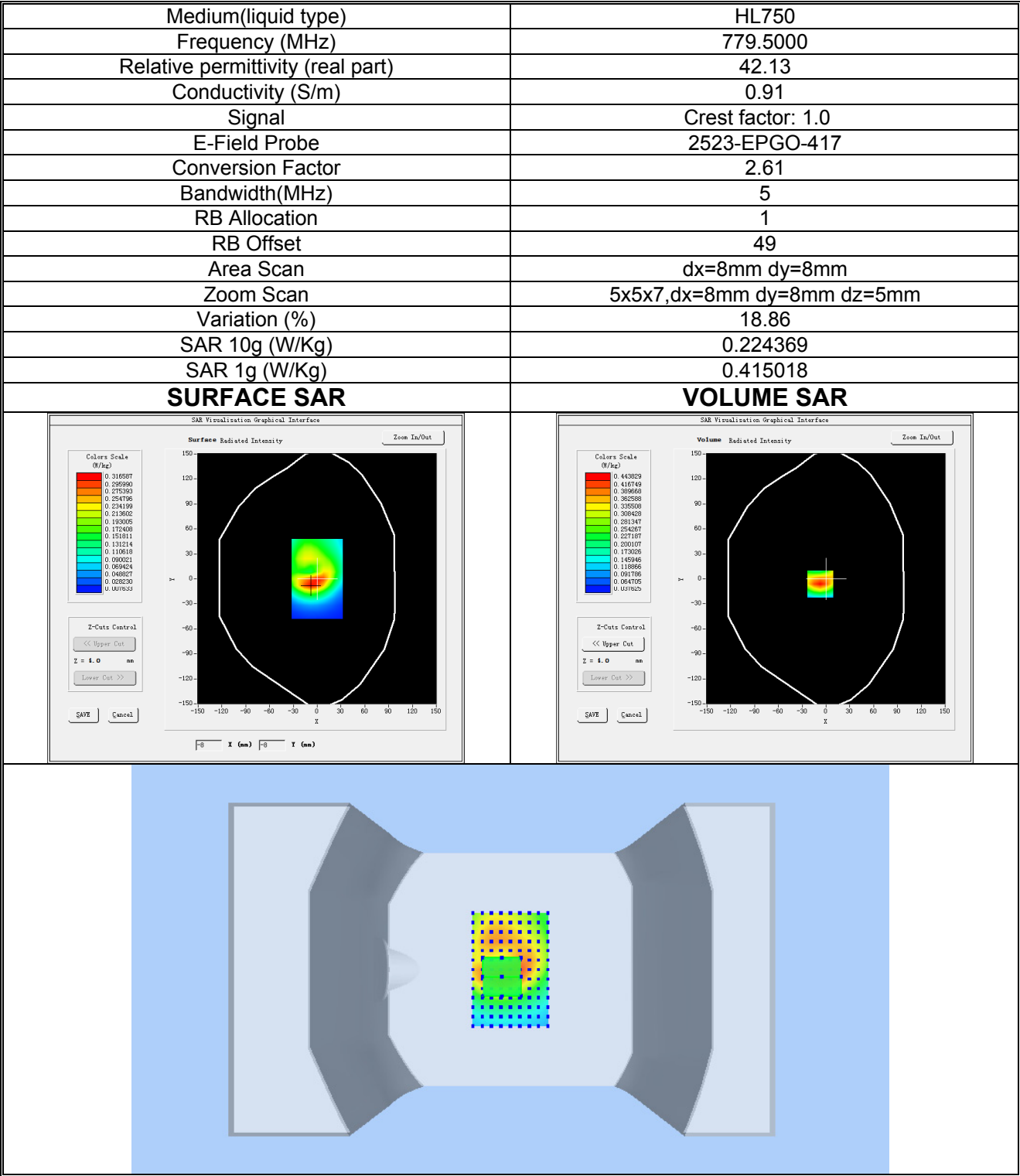
Plot 30: LTE BAND 12, Low channel (Hotspot, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-02



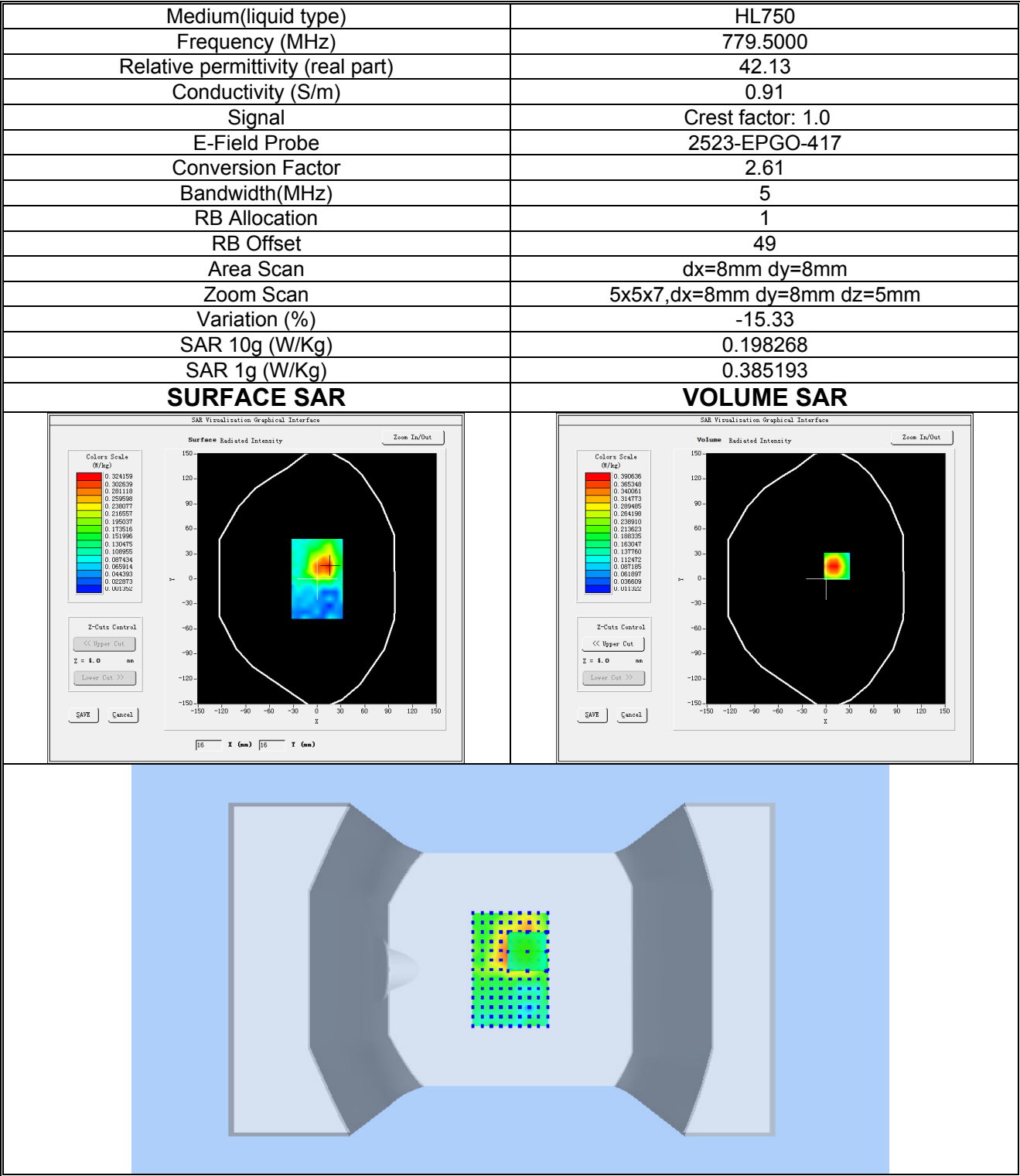
Plot 31:LTE BAND 13, Low channel (Left Head Cheek)
Product Description: Smart Phone
Test Date: 2025-12-02



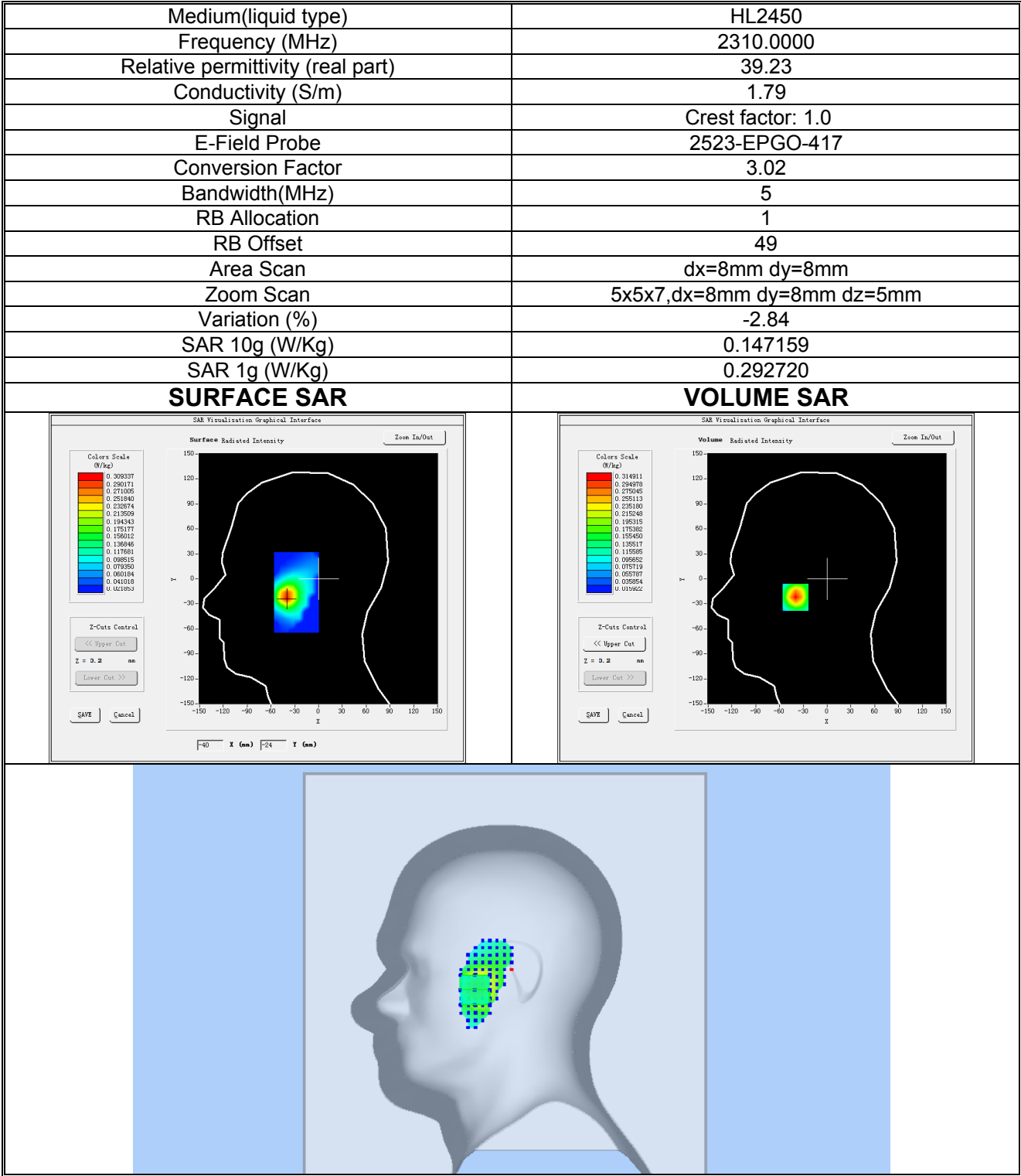
Plot 32: LTE BAND 13, Low channel (Body-worn, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-02



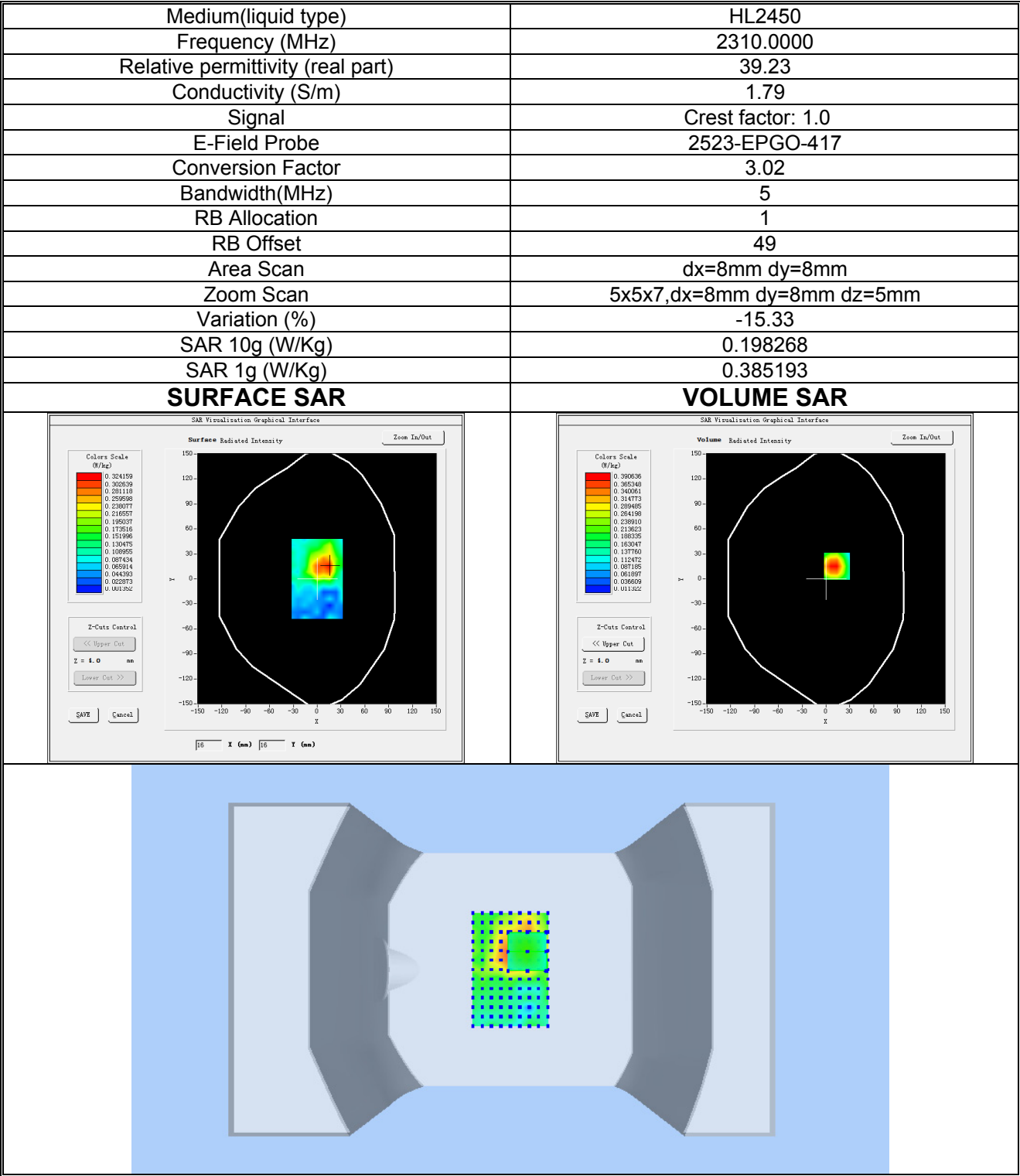
Plot 33: LTE BAND 13, Low channel (Hotspot, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-02



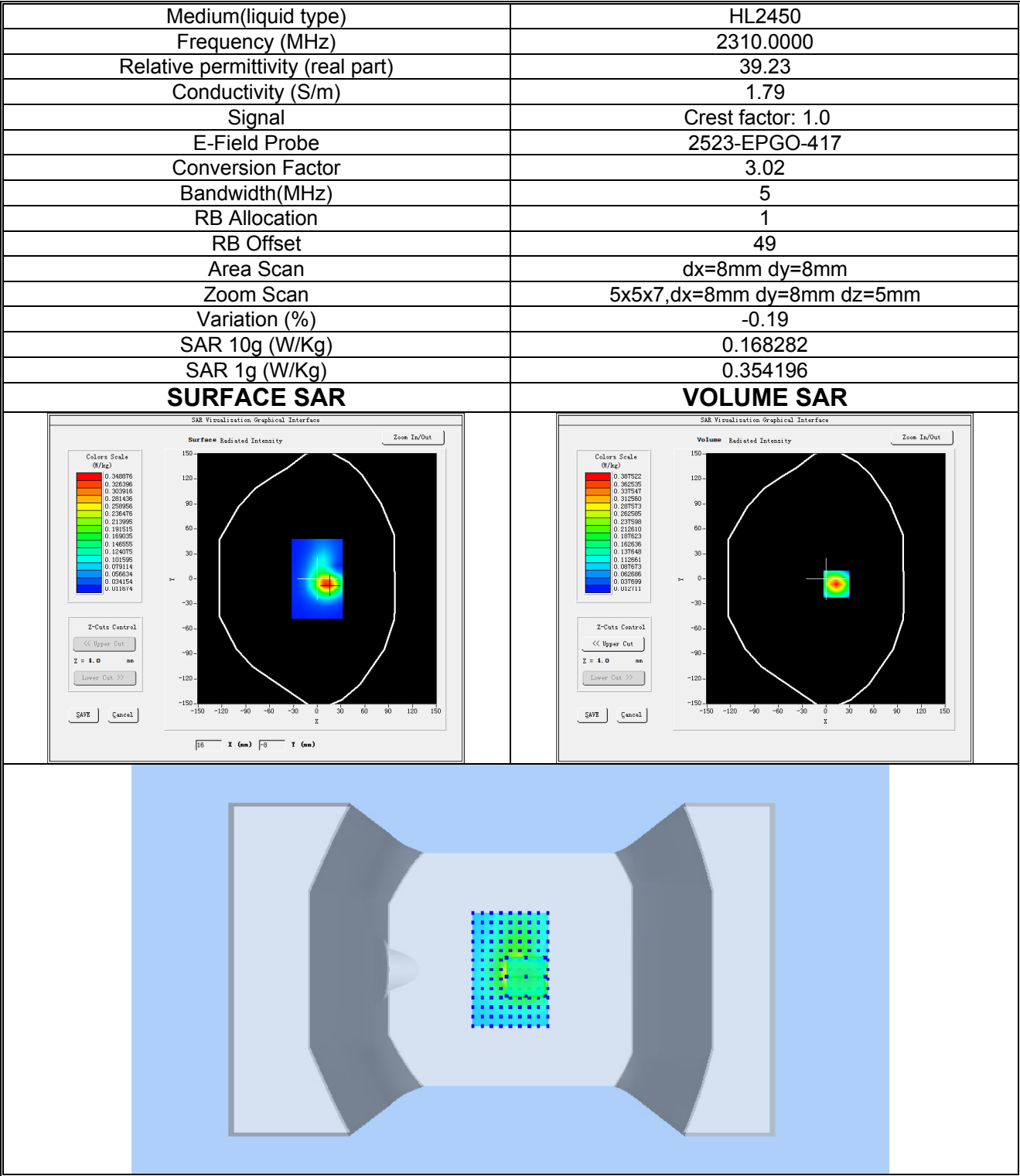
Plot 34:LTE BAND 40(2305-2315), Middle channel (Right Head Cheek)
Product Description: Smart Phone
Test Date: 2025-12-01



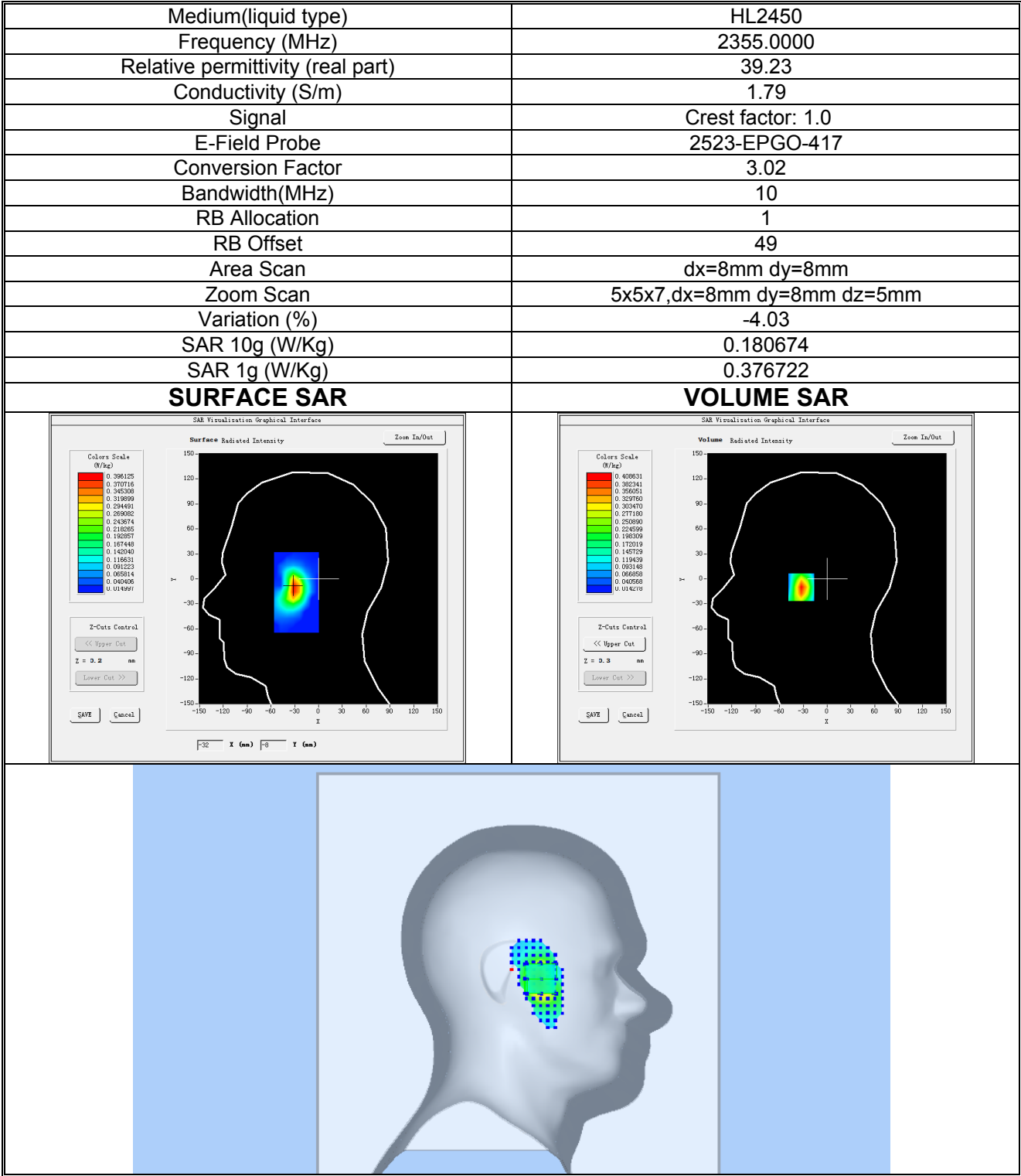
Plot 35: LTE BAND 40(2305-2315), Middle channel (Body-worn, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-01



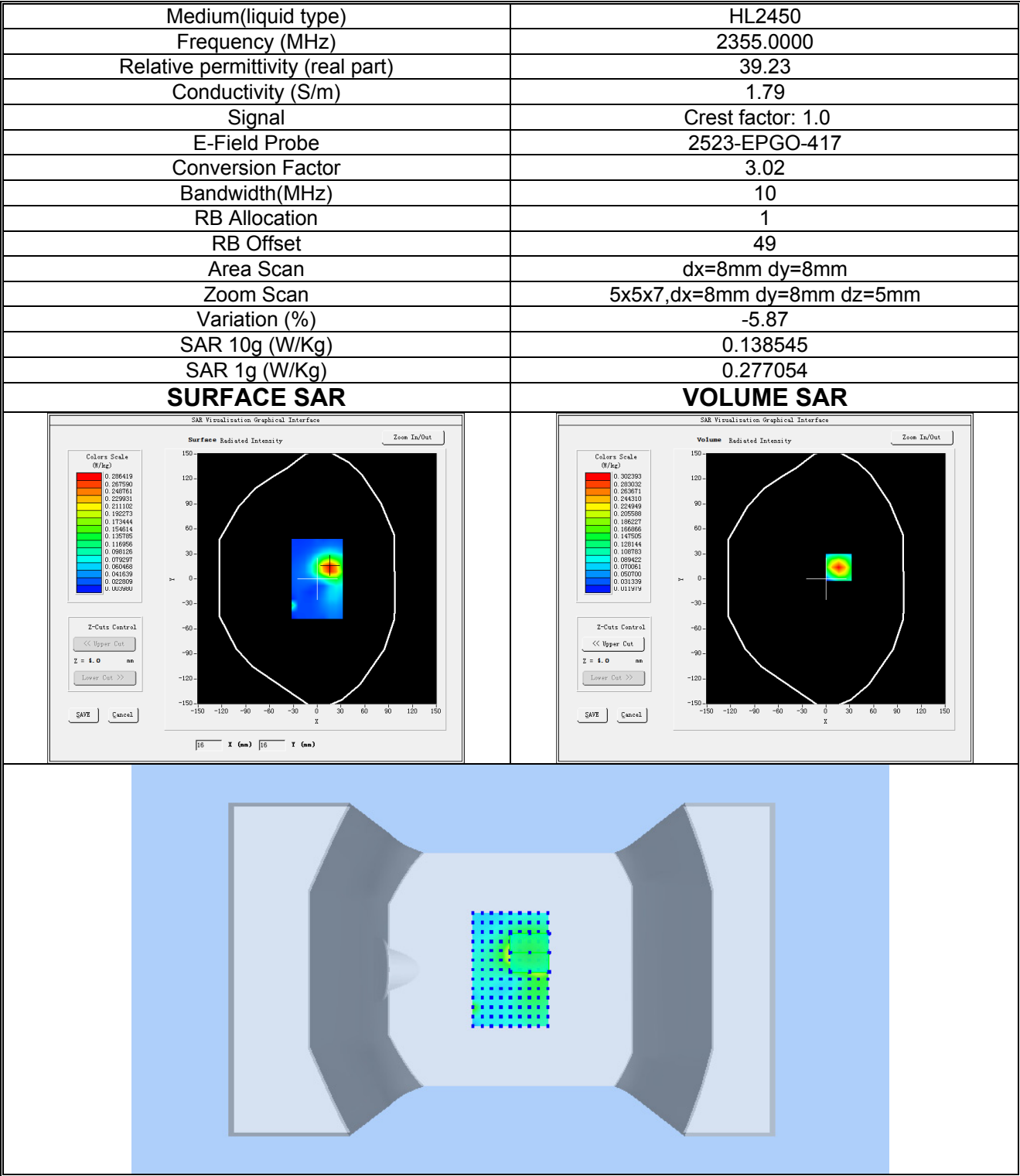
Plot 36: LTE BAND 40(2305-2315), Middle channel (Hotspot, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-01



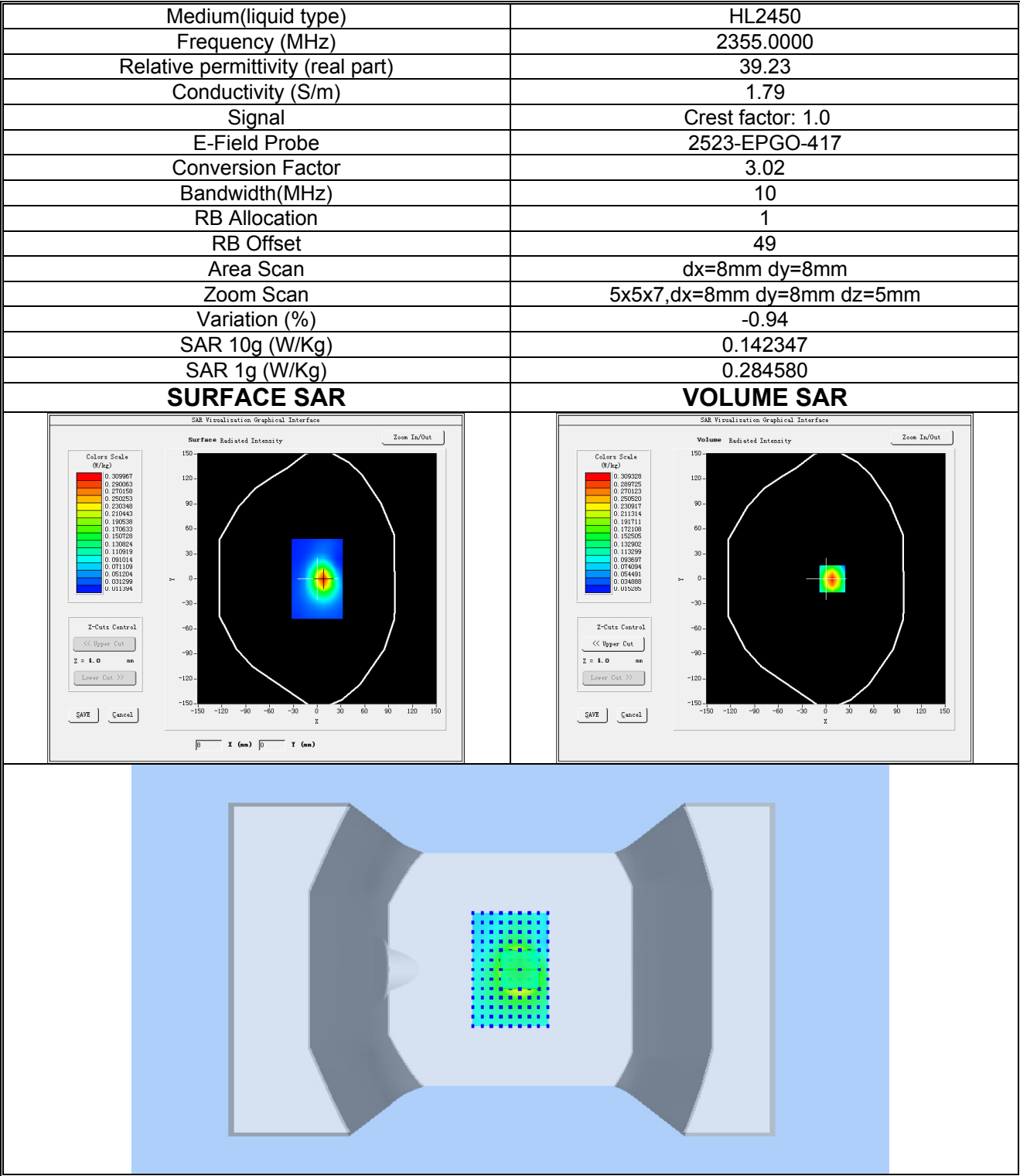
Plot 37:LTE BAND 40(2350-2360), Low channel (Left Head Cheek)
Product Description: Smart Phone
Test Date: 2025-12-01



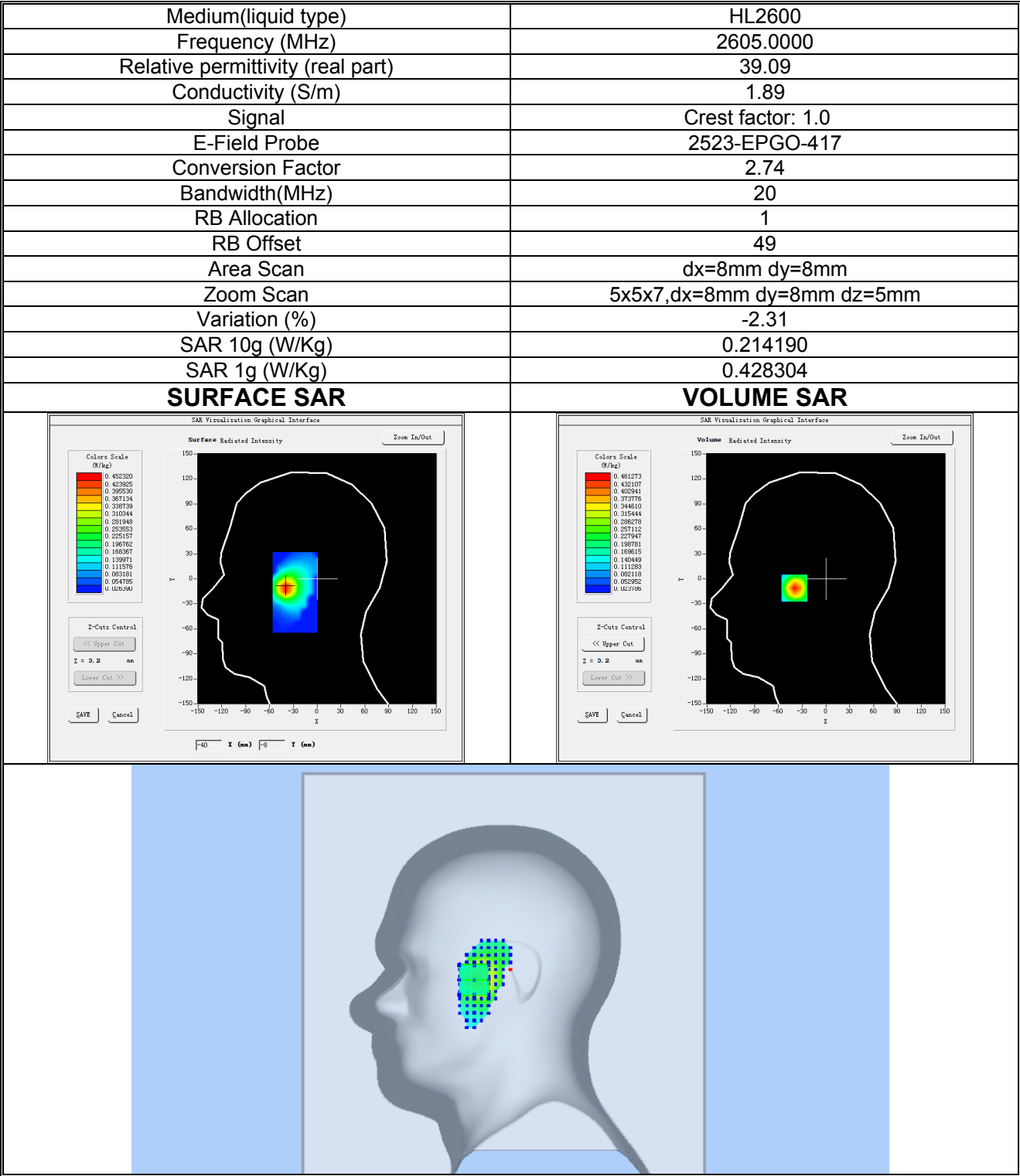
Plot 38: LTE BAND 40(2350-2360), Low channel (Body-worn, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-01



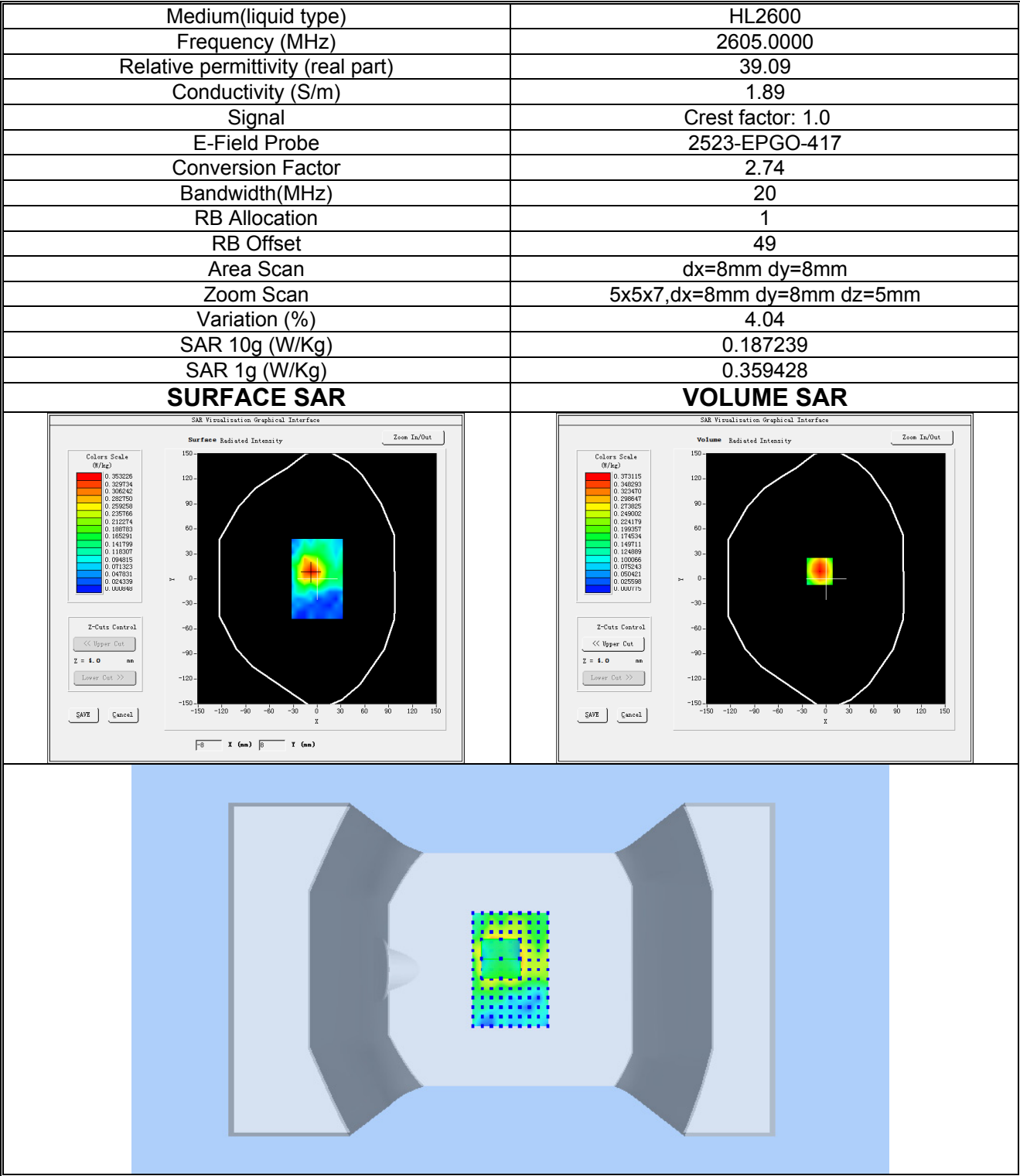
Plot 39: LTE BAND 40(2350-2360), Low channel (Hotspot, Top Edge)
Product Description: Smart Phone
Test Date: 2025-12-01



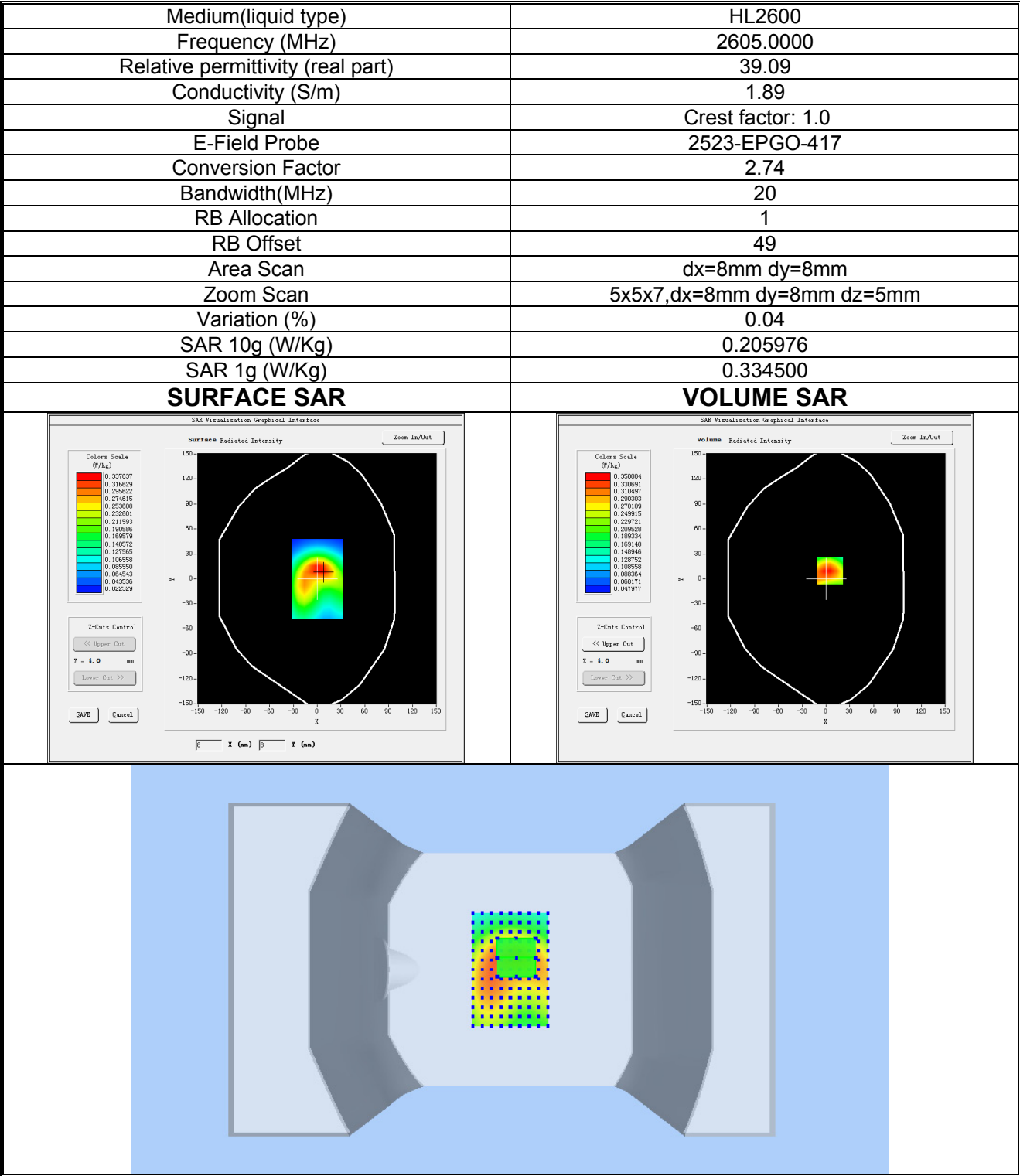
Plot 40:LTE BAND 41, Middle channel (Right Head Cheek)
Product Description: Smart Phone
Test Date: 2025-11-30



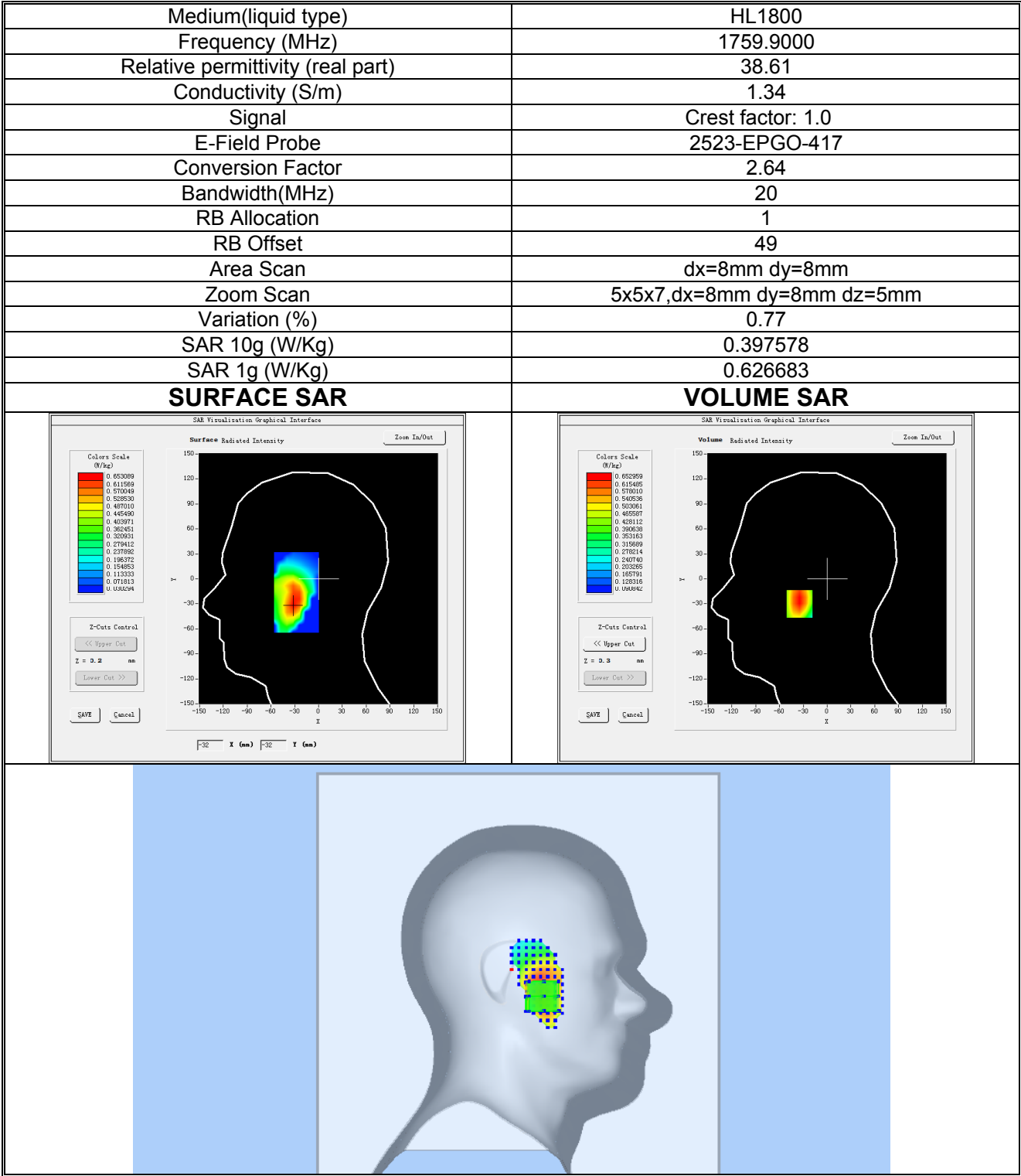
Plot 41: LTE BAND 41, Middle channel (Body-worn, Front Side)
Product Description: Smart Phone
Test Date: 2025-11-30



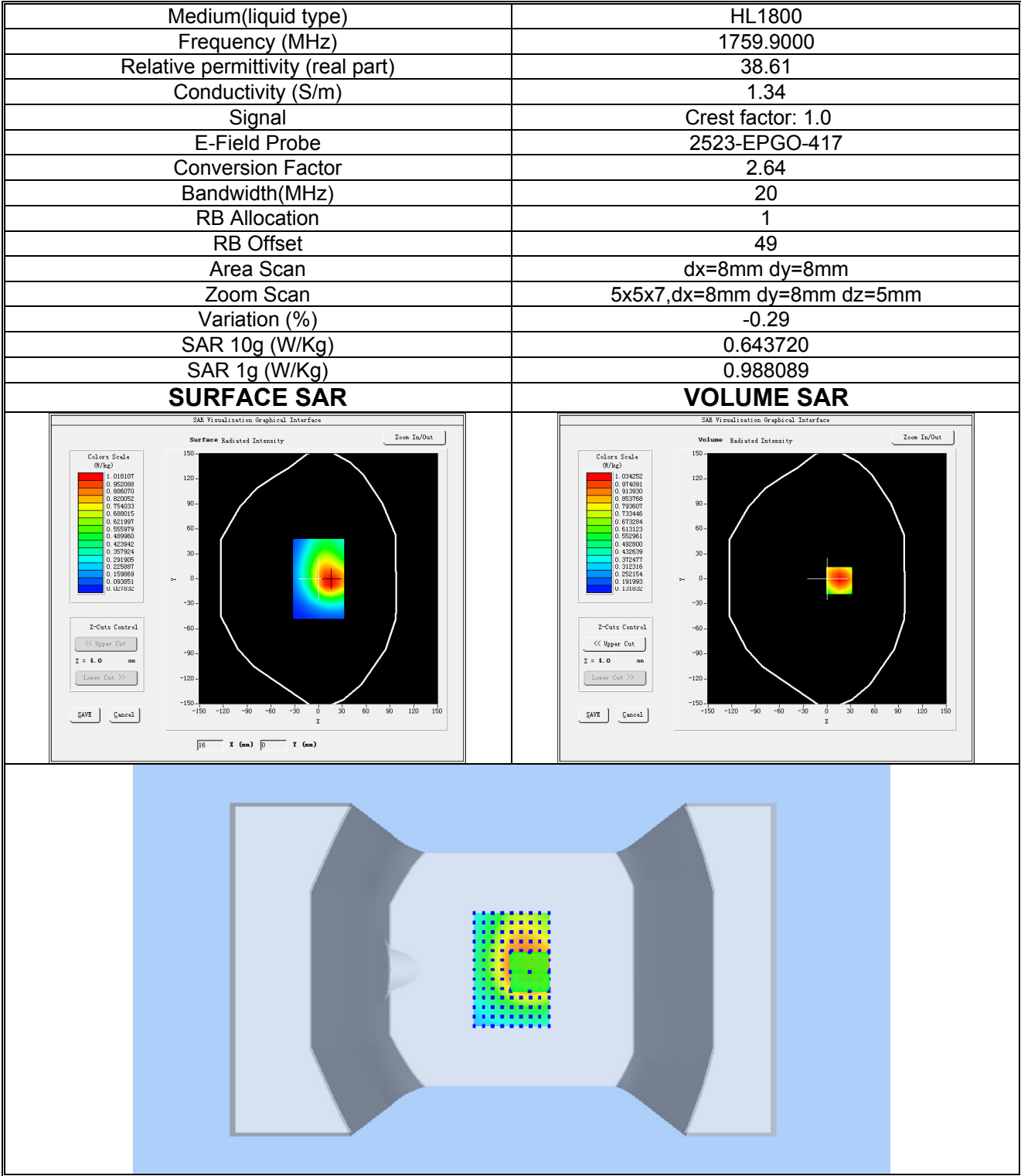
Plot 42: LTE BAND 41, Middle channel (Hotspot, Front Side)
Product Description: Smart Phone
Test Date: 2025-11-30



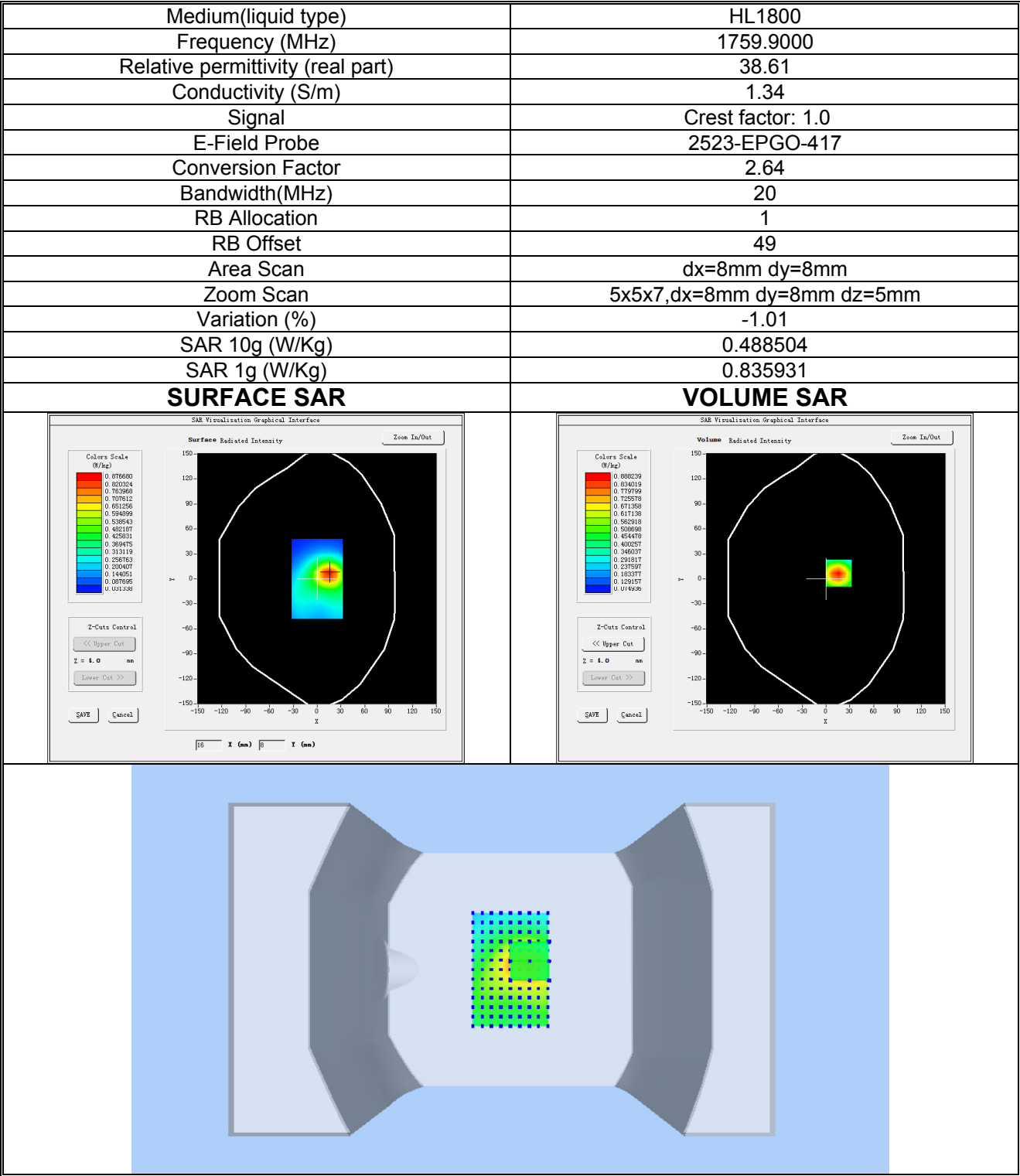
Plot 43:LTE BAND 66, High channel (Left Head Cheek)
Product Description: Smart Phone
Test Date: 2025-12-01



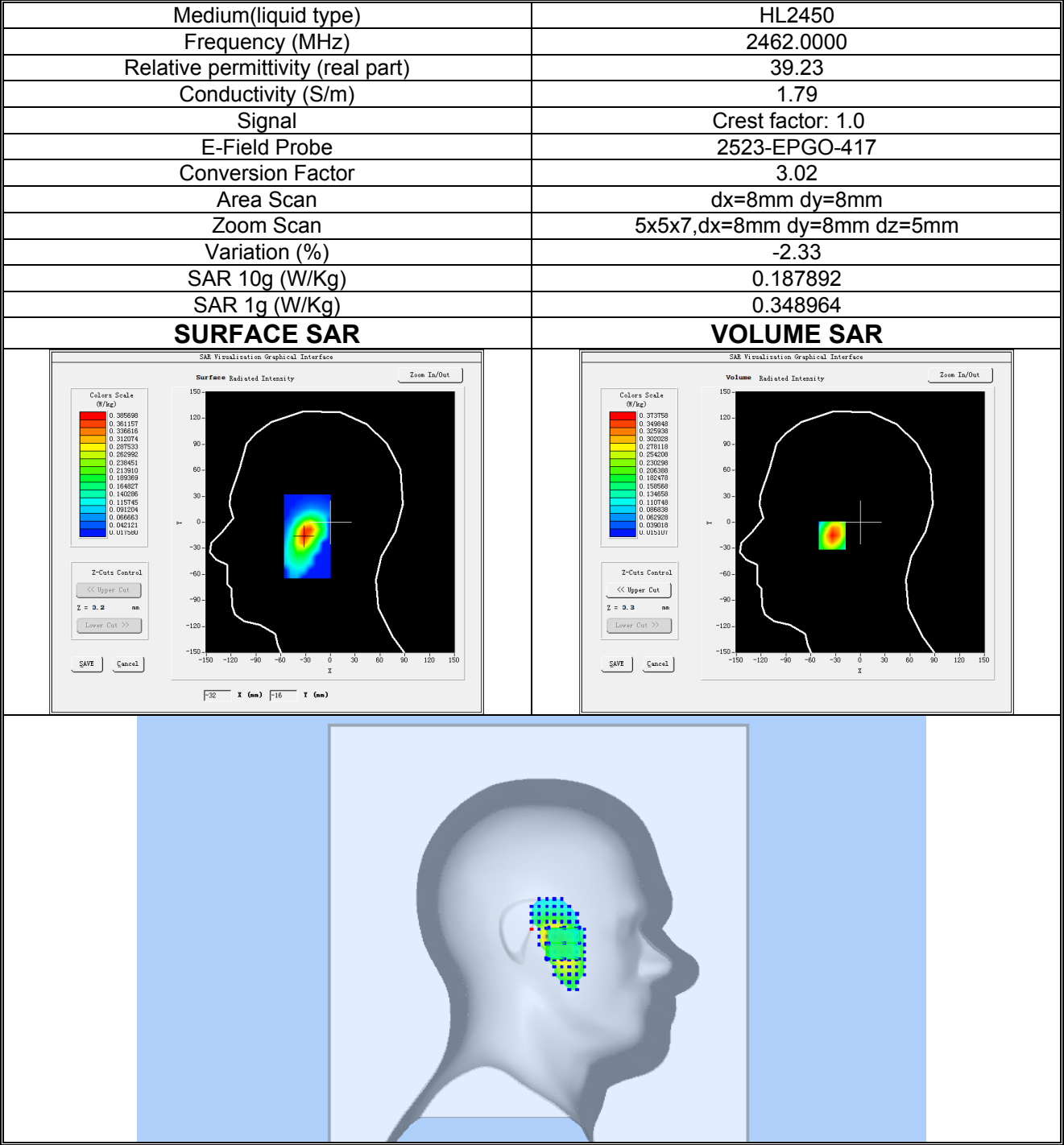
Plot 44: LTE BAND 66, High channel (Body-worn, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-01



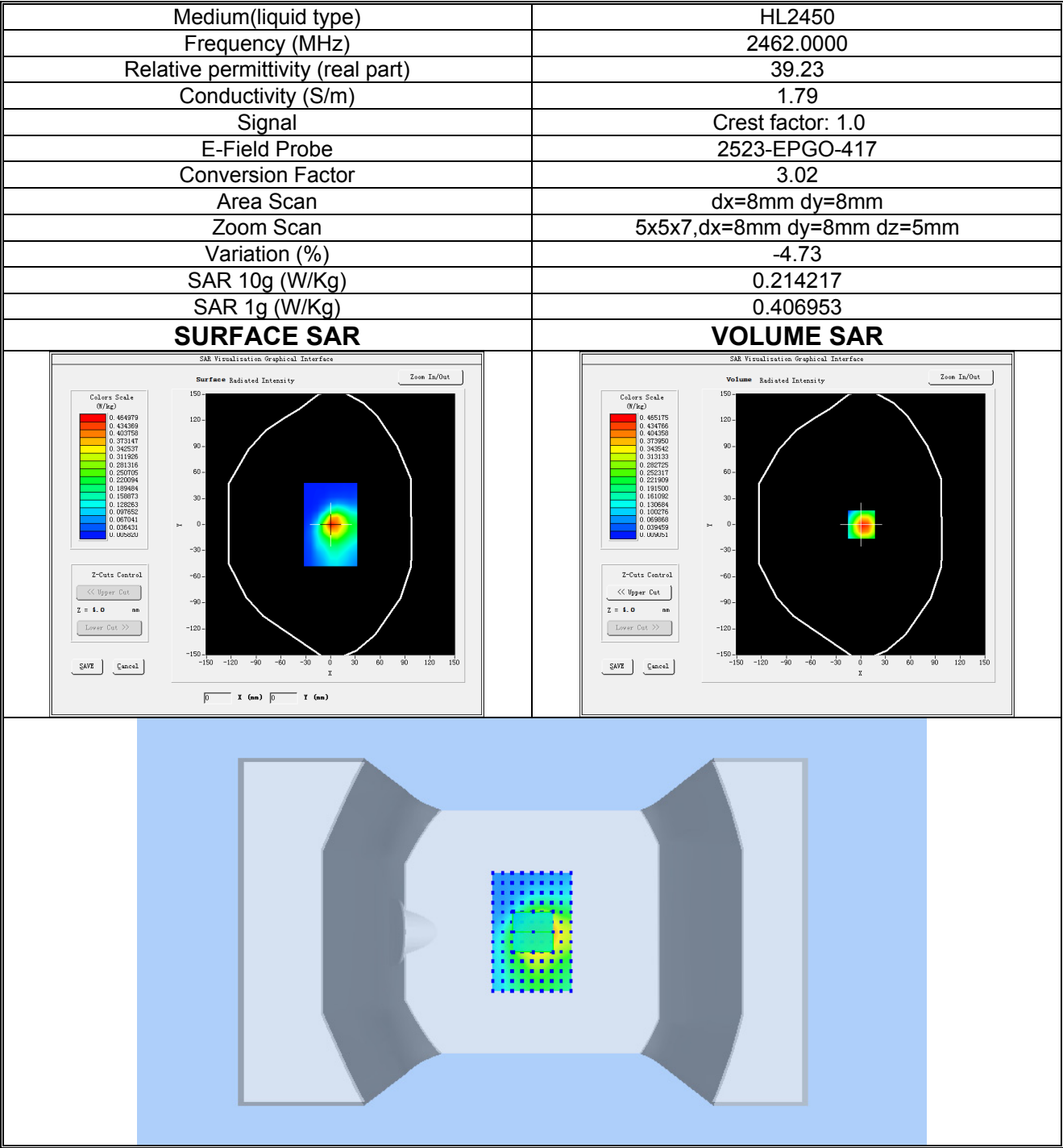
Plot 45: LTE BAND 66, High channel (Hotspot, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-01



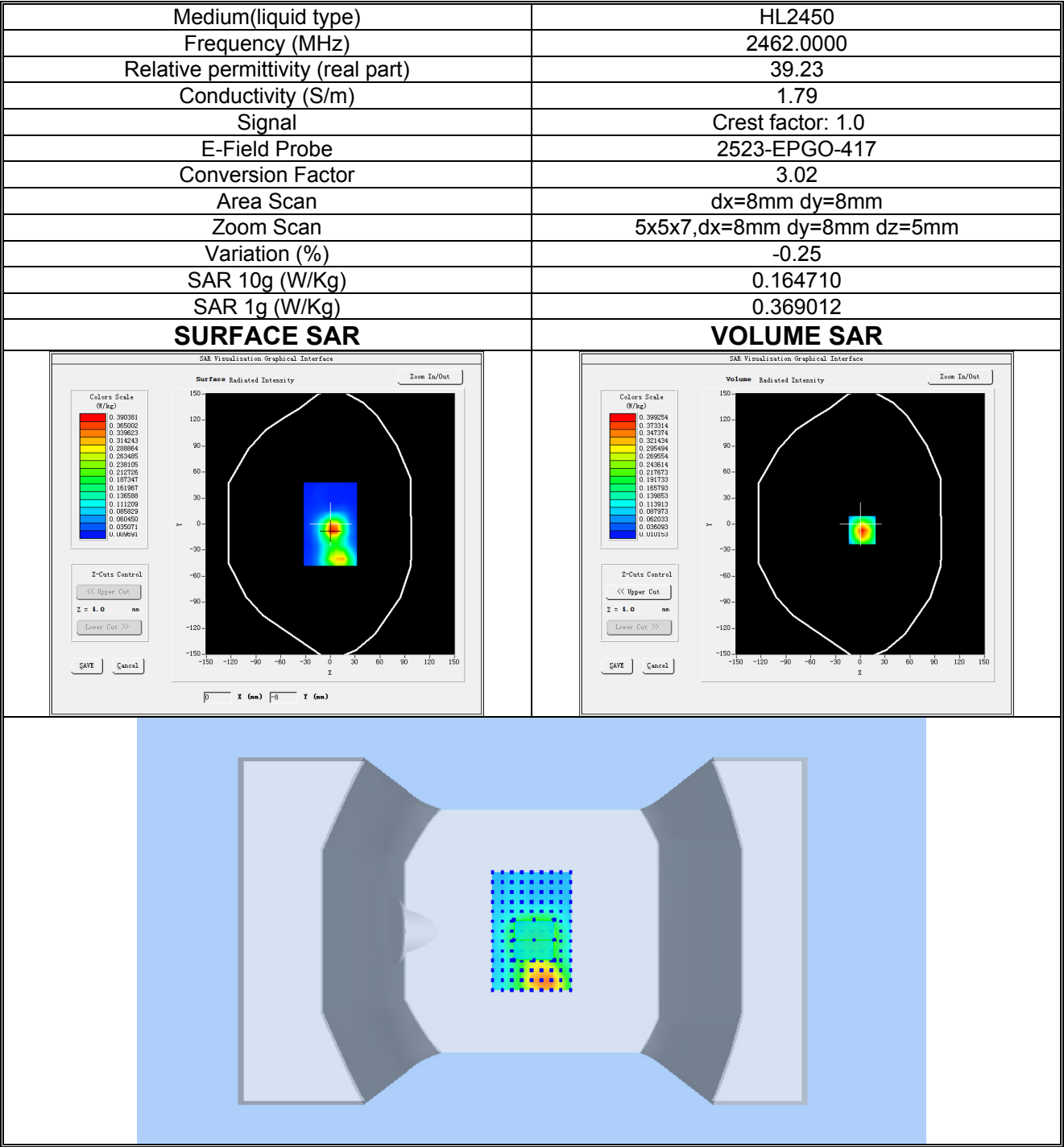
Plot 46:2.4G Wi-Fi, High channel (Left Head Cheek)
Product Description: Smart Phone
Test Date: 2025-12-01



Plot 47: 2.4G Wi-Fi, High channel (Body-worn, Back Side)
Product Description: Smart Phone
Test Date: 2025-12-01



Plot 48: 2.4G Wi-Fi, High channel (Hotspot, Top Edge)
Product Description: Smart Phone
Test Date: 2025-12-01



16 Calibration Reports-Probe and Dipole



COMOSAR E-Field Probe Calibration Report

Ref : ACR.304.21.27.BES.B

WALTEK TESTING GROUP CO., LTD
NO,77, HOUJIE SECTION, GUANTAI ROAD, HOUJIE TOWN
DONGGUAN GUANGDONG 518105, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: 2523-EPGO-417

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 07/25/2025



Accreditations #2-6789
Scope available on www.cofrac.fr

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Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed at MVG, using the CALIPROBE test bench, for use with a MVG COMOSAR system only. The test results covered by accreditation are traceable to the International System of Units (SI).

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.304.21.27.BES.B

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Cyrille ONNEE	Measurement Responsible	7/25/2025	
<i>Checked & approved by:</i>	Jérôme Luc	Technical Manager	7/25/2025	
<i>Authorized by:</i>	Yann Toutain	Laboratory Director	7/25/2025	

Yann
Toutain ID

Signature
numérique de
Yann Toutain ID
Date : 2025.07.25
09:52:33 +01'00'

	<i>Customer Name</i>
<i>Distribution :</i>	WALTEK TESTING GROUP CO., LTD

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Cyrille ONNEE	7/25/2025	Initial release

Page: 2/10

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.304.21.27.BES.B

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.304.21.27.BES.B

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	2523-EPGO-417
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-7.5GHz
Resistance of Three Dipoles at Connector	Dipole 1: $R1=0.232 \text{ M}\Omega$ Dipole 2: $R2=0.224 \text{ M}\Omega$ Dipole 3: $R3=0.209 \text{ M}\Omega$

2 PRODUCT DESCRIPTION**2.1 GENERAL INFORMATION**

MVG's COMOSAR E field Probes are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Probe

Probe Length	330 mm
Length of Individual Dipoles	24.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	2.55 mm
Distance between dipoles / probe extremity	12.7 mm

3 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their effect. All calibrations / measurements performed meet the fore-mentioned standards.

3.1 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards for frequency range 600-7500MHz and using the calorimeter cell method (transfer method) as outlined in the standards for frequency 150-450 MHz.

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3.2 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.3 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 360 degrees in 15-degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.4 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

The boundary effect uncertainty can be estimated according to the following uncertainty approximation formula based on linear and exponential extrapolations between the surface and $d_{be} + d_{step}$ along lines that are approximately normal to the surface:

$$SAR_{uncertainty} [\%] = \Delta SAR_{be} \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{(e^{-d_{be}/\delta})^2}{\delta/2} \text{ for } (d_{be} + d_{step}) < 10 \text{ mm}$$

where

$SAR_{uncertainty}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest <i>zoom-scan</i> measurement point, in millimetre
Δ_{step}	is the separation distance between the first and second measurement points that are closest to the phantom surface, in millimetre, assuming the boundary effect at the second location is negligible
δ	is the minimum penetration depth in millimetres of the head tissue-equivalent liquids defined in this standard, i.e., $\delta \approx 14 \text{ mm}$ at 3 GHz;
ΔSAR_{be}	in percent of SAR is the deviation between the measured SAR value, at the distance d_{be} from the boundary, and the analytical SAR value.

The measured worst case boundary effect SARuncertainty[%] for scanning distances larger than 4mm is 1.0% Limit ,2%).

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4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty associated with a SAR probe calibration using the waveguide or calorimetric cell technique depending on the frequency.

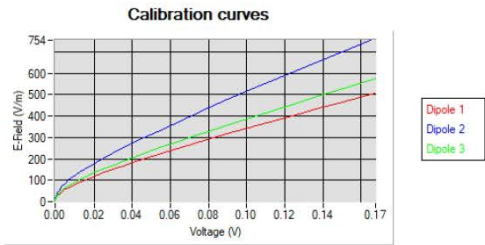
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-11% for the frequency range 150-450MHz.
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

5 CALIBRATION RESULTS

Ambient condition	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

5.1 CALIBRATION IN AIR

The following curve represents the measurement in waveguide of the voltage picked up by the probe toward the E-field generated inside the waveguide.



From this curve, the sensitivity in air is calculated using the below formula.

$$E^2 = \sum_{i=1}^3 \frac{V_i (1 + V_i / DCP_i)}{Norm_i}$$

where

- Vi=voltage readings on the 3 channels of the probe
- DCPi=diode compression point given below for the 3 channels of the probe
- Normi=dipole sensitivity given below for the 3 channels of the probe



COMOSAR E-FIELD PROBE CALIBRATION REPORT

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Normx dipole 1 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normy dipole 2 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normz dipole 3 ($\mu\text{V}/(\text{V}/\text{m})^2$)
1.63	0.74	1.32

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
110	109	107

5.2 CALIBRATION IN LIQUID

The calorimeter cell or the waveguide is used to determine the calibration in liquid using the formula below.

$$\text{ConvF} = \frac{E_{\text{liquid}}^2}{E_{\text{air}}^2}$$

The E-field in the liquid is determined from the SAR measurement according to the below formula.

$$E_{\text{liquid}}^2 = \frac{\rho \text{ SAR}}{\sigma}$$

where

σ =the conductivity of the liquid

ρ =the volumetric density of the liquid

SAR=the SAR measured from the formula that depends on the setup used. The SAR formulas are given below

For the calorimeter cell (150-450 MHz), the formula is:

$$\text{SAR} = c \frac{dT}{dt}$$

where

c =the specific heat for the liquid

dT/dt =the temperature rises over the time

For the waveguide setup (600-75000 MHz), the formula is:

$$\text{SAR} = \frac{4P_W}{ab\delta} e^{-\frac{2z}{\delta}}$$

where

a =the larger cross-sectional of the waveguide

b =the smaller cross-sectional of the waveguide

δ =the skin depth for the liquid in the waveguide

P_W =the power delivered to the liquid

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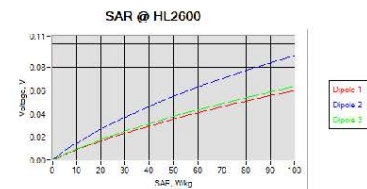
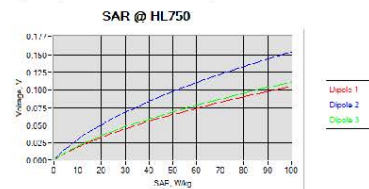
COMOSAR E-FIELD PROBE CALIBRATION REPORT

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The below table summarize the ConvF for the calibrated liquid. The curves give examples for the measured SAR depending on the voltage in some liquid.

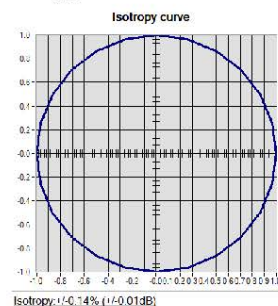
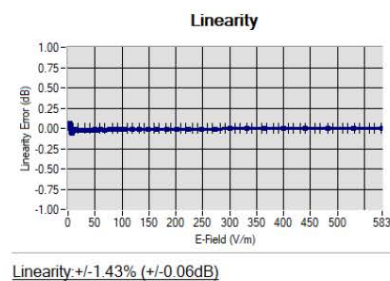
Liquid	Frequency (MHz*)	ConvF
HL750	750	2.61
HL850	835	2.47
HL900	900	2.65
HL1800	1800	2.64
HL1900	1900	2.82
HL2000	2000	3.01
HL2300	2300	2.91
HL2450	2450	3.02
HL2600	2600	2.74

(*) Frequency validity is ± 50 MHz below 600 MHz, ± 100 MHz from 600 MHz to 6 GHz and ± 700 MHz above 6 GHz



6 VERIFICATION RESULTS

The figures below represent the measured linearity and axial isotropy for this probe. The probe specification is ± 0.2 dB for linearity and ± 0.15 dB for axial isotropy.



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7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2024	08/2027
Network Analyzer	Agilent 8753ES	MY40003210	10/2023	10/2027
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2025	07/2028
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2025	03/2028
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2024	06/2027
Power Meter	Keysight U2000A	SN: MY62340002	10/2025	10/2028
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Fluoroptic Thermometer	LumaSense Luxtron 812	94264	09/2022	09/2025
Coaxial cell	MVG	SN 32/16 COAXCELL_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG2_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G600_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG4_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G900_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG6_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G500_1	Validated. No cal required.	Validated. No cal required.

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Waveguide	MVG	SN 32/16 WG8_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800B_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800H_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG10_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_3G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG12_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_5G000_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG14_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_7G000_1	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2024	06/2027



SAR Reference Dipole Calibration Report

Ref : ACR.335.8.23.BES.A

WALTEK TESTING GROUP CO., LTD.
NO.77, HOUIE SECTION, GUANTAI ROAD, HOUIE TOWN,
DONGGUAN, GUANGDONG 518105, CHINA
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 750MHZ
SERIAL NO.: SN 09/15 DIP 0G750-357

Calibrated at MVG
Z.I. de la pointe du diable
Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE

Calibration date: 08/08/2023



Accreditations #2-6789 and #2-6814

Scope available on www.cofrac.fr

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Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.395.8.23.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme Luc	Technical Manager	8/8/2023	<i>JS</i>
<i>Checked by :</i>	Jérôme Luc	Technical Manager	8/8/2023	<i>JS</i>
<i>Approved by :</i>	Yann Toutain	Laboratory Director	8/8/2023	<i>Yann TOUTAIN</i> 2023.08.08 09:25:31 +01'00'

	<i>Customer Name</i>
<i>Distribution :</i>	Waltek Testing Group Co., Ltd.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Jérôme Luc	8/8/2023	Initial release

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Template ACR.DDD.N.YY.MVGB.ISSUE SAR Reference Dipole vJ

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.335.8.23.BES.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.335.8.23.BES.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 750 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID750
Serial Number	SN 09/15 DIP 0G750-357
Product Condition (new / used)	New

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.

4.2 MECHANICAL REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.10 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm
300 - 450	0.11 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

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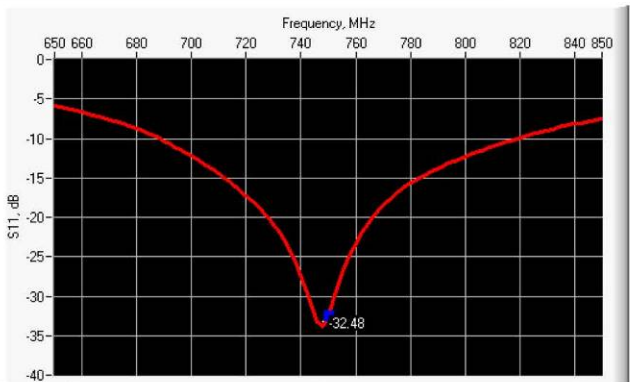
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Scan Volume	Expanded Uncertainty
1 g	20.3 % (SAR)
10 g	20.1 % (SAR)

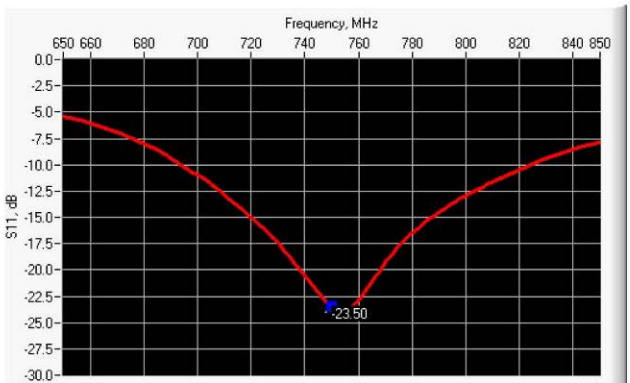
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-32.48	-20	51.6 Ω + 1.7 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-23.50	-20	48.8 Ω + 6.6 jΩ