



**Add value.
Inspire trust.**

Report On

Specific Absorption Rate Testing of the Sepura Ltd, SC2128 Tetra
Radio (2.4GHz WLAN Transmitter)

Covering FCC 47CFR 2.1093, RSS 102 Issue 5 and related
documents.

FCC ID: XX6SC2128

IC: 8739A-SC2128

COMMERCIAL-IN-CONFIDENCE

Document 75950098 Report 05 Issue 01

June 2021



TÜV SÜD, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuv-sud.co.uk

COMMERCIAL-IN-CONFIDENCE

REPORT ON

Specific Absorption Rate Testing of the
Sepura Ltd, SC2128 Tetra Radio (2.4GHz WLAN Transmitter)

Document 75950098 Report 5 Issue 1

June 2021

PREPARED FOR

Sepura Ltd
9000 Cambridge Research Park
Beach Drive
Waterbeach
Cambridge
Cambridgeshire
CB25 9TL

PREPARED BY

Mohamud Mohamud
Shift Technician (SAR and RF)

Additional Testing:

Stephen Dodd
Engineer (SAR and RF)

APPROVED BY

Jon Kenny
Authorised Signatory

DATED

29 June 2021



CONTENTS

Section	Page No
1	REPORT SUMMARY 3
1.3	Brief Summary of Results 5
1.4	Test Results Summary 6
1.5	FCC Power Measurements 12
2	TEST DETAILS 13
2.1	DASY5 Measurement System 14
2.2	WLAN 2450 MHz - 802.11b - 1Mbps - Body SAR Test Results 18
2.3	WLAN 2450 MHz - 802.11b - 1Mbps - Head SAR Test Results 20
2.4	WLAN 2450 MHz - 802.11b - 1Mbps - Front of Face SAR Test Results 23
3	TEST EQUIPMENT USED 24
3.1	Test Equipment Used 25
3.2	Test Software 27
3.3	Dielectric Properties of Simulant Liquids 28
3.4	Test Conditions 29
3.5	Measurement Uncertainty 30
4	PHOTOGRAPHS 31
4.1	Test Positional Photographs 32
4.2	Photographs of Equipment Under Test (EUT) 38
5	ACCREDITATION, DISCLAIMERS AND COPYRIGHT 40
5.1	Accreditation, Disclaimers and Copyright 41
ANNEX A	Probe Calibration Reports A.2
ANNEX B	Dipole Calibration Reports B.2



SECTION 1

REPORT SUMMARY

Specific Absorption Rate Testing of the
Sepura SC2128 Tetra Radio (2.4GHz WLAN Transmitter)



1.1 REPORT MODIFICATION RECORD

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	29 June 2021

1.2 INTRODUCTION

The information contained in this report is intended to show verification of the Specific Absorption Rate Testing of the Sepura Ltd, SC2128 Tetra Radio (2.4GHz WLAN Transmitter) to the requirements of of KDB 447498 D01 v06 General RF Exposure Guidance.

Objective	To perform Specific Absorption Rate Testing to determine the Equipment Under Test's (EUT's) compliance with the requirements specified of KDB 447498 D01 v06 General RF Exposure Guidance, for the series of tests carried out.
Applicant	Sepura Ltd
Manufacturer	Sepura Ltd
Manufacturing Description	Tetra Radio
Model Number	SC2128
Serial Number(s)	1PR002013GMJ3UC (SC2128) 1PR001909GM18RZ (WLAN conducted sample SC2124)
Number of Samples Tested	2
Hardware Version	Production Unit
Software Version	2001 797 07367
Battery Model Number	300-01852 (1160mAh) 300-01853 (1880mAh)
Test Specification/Issue/Date	KDB 447498 D01 v06 General RF Exposure Guidance
Start of Test	27 December 2020
Finish of Test	07 April 2021
Related Document(s)	FCC 47CFR 2.1093: 2015 KDB 865664 – D01 v01r04 KDB 648474 – D01 v01r03 KDB 447498 – D01 v06 KDB 248227 – D01 v02r02 IEEE 1528 – 2013 RSS-102 Issue 5
Name of Engineer(s)	Mohamud Mohamud Stephen Dodd



1.3 BRIEF SUMMARY OF RESULTS

The measurements shown in this report were made in accordance with the procedures specified KDB 447498 D01 v06 General RF Exposure Guidance.

The maximum 1g volume averaged stand-alone SAR found during this Assessment:

Max 1g SAR (W/kg) Body	0.17 (Measured)	0.21 (Scaled)
Max 1g SAR (W/kg) Head	0.15 (Measured)	0.18 (Scaled)
Max 1g SAR (W/kg) Front of Face	0.02 (Measured)	0.02 (Scaled)
The maximum 1 g volume averaged SAR level measured for all the tests performed did not exceed the limits for Occupational Use/ Controlled Exposure (W/kg) Partial Body of 8.0 W/kg which is the relevant limit for testing according to the KDB 447498 D01 v06 General RF Exposure Guidance.		



1.4 TEST RESULTS SUMMARY

1.4.1 System Performance / Validation Check Results

Prior to formal testing being performed a System Check was performed in accordance with KDB 447498 D01 v06 General RF Exposure Guidance and the results were compared against published data in Standard IEEE 1528-2013. The following results were obtained:

System performance / Validation results

Date	Frequency (MHz)	Fluid Type	Measured Max 1g SAR (W/kg) *	Max 1g SAR (W/kg) Target	Percentage Drift on Reference
27/12/2020	2450	MBBL	50.56	51.20	-1.25
06/04/2021	2450	HBBL	54.14	52.40	3.32
07/04/2021	2450	HBBL	54.14	52.40	3.32

*Normalised to a forward power of 1W



1.4.2 Results Summary Tables

WLAN 2450 MHz - 802.11b - 20MHz – 1Mbps - Nylon Holster (300-01916) - 1160mAh battery (300-01852): Body Specific Absorbion Rate (Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Rear Facing	11	2462.0	15.62	16.5	0.09	0.11	2
Limit for Occupation (Controlled Exposure) 8.0 W/kg (1 g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: $\leq 0.8\text{W/kg}$ when the transmission band is $\leq 100\text{MHz}$ $\leq 0.6\text{W/kg}$ when the transmission band is between 100MHz and 200MHz $\leq 0.4\text{W/kg}$ when the transmission band is $\geq 200\text{MHz}$ KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2							

WLAN 2450 MHz - 802.11b - 20MHz – 1Mbps - Nylon Holster (300-01916) - 1880mAh battery (300-01853): Body Specific Absorbion Rate (Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Rear Facing	11	2462.0	15.52	16.5	0.06	0.08	3
Limit for Occupation (Controlled Exposure) 8.0 W/kg (1 g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: $\leq 0.8\text{W/kg}$ when the transmission band is $\leq 100\text{MHz}$ $\leq 0.6\text{W/kg}$ when the transmission band is between 100MHz and 200MHz $\leq 0.4\text{W/kg}$ when the transmission band is $\geq 200\text{MHz}$ KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2							

WLAN 2450 MHz - 802.11b - 20MHz – 1Mbps - No Holster - 1880mAh battery (300-01853): Body Specific Absorbion Rate (Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Rear Facing	11	2462.0	15.52	16.5	0.17	0.21	4
Limit for Occupation (Controlled Exposure) 8.0 W/kg (1 g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: $\leq 0.8\text{W/kg}$ when the transmission band is $\leq 100\text{MHz}$ $\leq 0.6\text{W/kg}$ when the transmission band is between 100MHz and 200MHz $\leq 0.4\text{W/kg}$ when the transmission band is $\geq 200\text{MHz}$ KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2							



WLAN 2450 MHz - 802.11b - 20MHz – 1Mbps - No Holster (300-01916) - 1160mAh battery
(300-01852): Body Specific Absorbption Rate (Maximum SAR) 1g Results

Test Position	Channel Number	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
0mm Rear Facing	11	2462.0	15.52	16.5	0.16	0.19	5
Limit for Occupation (Controlled Exposure) 8.0 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: $\leq 0.8\text{W/kg}$ when the transmission band is $\leq 100\text{MHz}$ $\leq 0.6\text{W/kg}$ when the transmission band is between 100MHz and 200MHz $\leq 0.4\text{W/kg}$ when the transmission band is $\geq 200\text{MHz}$ KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2							

WLAN 2450MHz - 802.11b 20 MHz 1Mbps - 1880mAh Battery
Head Specific Absorbption Rate (Maximum SAR) 1g Results

Test Position	Channel	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
Left Cheek	11	2462	15.62	16.50	0.15	0.18	Figure 6
Left Tilt	11	2462	15.62	16.50	0.02	0.02	Figure 7
Right Cheek	11	2462	15.62	16.50	0.09	0.11	Figure 8
Right Tilt	11	2462	15.62	16.50	0.01	0.01	Figure 9
Limit for Occupation (Controlled Exposure) 8.0 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: $\leq 0.8\text{W/kg}$ when the transmission band is $\leq 100\text{MHz}$ $\leq 0.6\text{W/kg}$ when the transmission band is between 100MHz and 200MHz $\leq 0.4\text{W/kg}$ when the transmission band is $\geq 200\text{MHz}$ KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2							

WLAN 2450MHz - 802.11b 20 MHz 1Mbps - 1160mAh Battery
Head Specific Absorbption Rate (Maximum SAR) 1g Results

Test Position	Channel	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
Left Cheek	11	2462	15.62	16.50	0.14	0.18	Figure 10
Limit for Occupation (Controlled Exposure) 8.0 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: $\leq 0.8\text{W/kg}$ when the transmission band is $\leq 100\text{MHz}$ $\leq 0.6\text{W/kg}$ when the transmission band is between 100MHz and 200MHz $\leq 0.4\text{W/kg}$ when the transmission band is $\geq 200\text{MHz}$ KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2 This position was retested using the low capacity battery as it was the worst case configuration using the high capacity battery (Before rounding of results to 2 decimal places).							



WLAN 2450MHz - 802.11b 20 MHz 1Mbps - 1880mAh Battery
Front of Face Specific Absorbption Rate (Maximum SAR) 1g Results

Test Position	Channel	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
25mm Front face	11	2462	15.62	16.50	0.02	0.02	Figure 11
Limit for Occupation (Controlled Exposure) 8.0 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: $\leq 0.8\text{W/kg}$ when the transmission band is $\leq 100\text{MHz}$ $\leq 0.6\text{W/kg}$ when the transmission band is between 100MHz and 200MHz $\leq 0.4\text{W/kg}$ when the transmission band is $\geq 200\text{MHz}$ KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2							

WLAN 2450MHz - 802.11b 20 MHz 1Mbps - 1160mAh Battery
Front of Face Specific Absorbption Rate (Maximum SAR) 1g Results

Test Position	Channel	Frequency (MHz)	Measured Average Power (dBm)	Tune Up (dBm)	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Scan Figure Number
25mm Front face	11	2462	15.62	16.50	0.02	0.02	Figure 12
Limit for Occupation (Controlled Exposure) 8.0 W/kg (1g) KDB 447498 D01 - Testing of other required channels within the operation mode of a frequency band is not required when the reported 1g SAR for mid-band or highest output power channel is: $\leq 0.8\text{W/kg}$ when the transmission band is $\leq 100\text{MHz}$ $\leq 0.6\text{W/kg}$ when the transmission band is between 100MHz and 200MHz $\leq 0.4\text{W/kg}$ when the transmission band is $\geq 200\text{MHz}$ KDB 248227 D01 v02 - Testing was not required for OFDM as per Section 5.2.2							

1.4.3 Standalone SAR Estimation

When the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion. The estimated SAR is only used to determine simultaneous transmission SAR test exclusion; When SAR is estimated, it must be applied to determine the sum of 1-g SAR test exclusion. When SAR to peak location separation ratio test exclusion is applied, the highest reported SAR for simultaneous transmission can be an estimated standalone SAR if the estimated SAR is the highest among the simultaneously transmitting antennas (see KDB 690783).

$(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})} / 7.5] \text{ W/kg}$ for test separation distances $\leq 50 \text{ mm}$;

where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR

when the minimum test separation distance is $< 5\text{mm}$, a distance of 5mm is applied.

Bluetooth SAR Estimation

Test Configuration	Frequency (MHz)	Maximum Power (mW)	Distance (mm)	Estimated SAR (W/kg)
Body	2480	5.47	5	0.23
Head	2480	5.47	5	0.23
Front of face	2480	5.47	25	0.05



1.4.4 Standalone SAR Test Exclusion Considerations (KDB 447498 D01)

The 1g SAR Test exclusion thresholds for 100 MHz to 6 GHz *test separation distances* ≤ 50 mm are determined by:

$[(\text{max power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] / \sqrt{f \text{ (GHz)}} \leq 3.0$, where

- $f \text{ (GHz)}$ is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison.
- When the maximum test separation distance is < 5 mm, a distance of 5 mm is applied.

RAT & Band	Frequency (MHz)	Power (dBm)	Power (mW)	Test Position	Distance (mm)	Threshold	Test Exclusion
Bluetooth 2450 MHz	2480	7.38	5.47	Head	5	1.7	Yes
Bluetooth 2450 MHz	2480	7.38	5.47	Body	5	1.7	Yes
Bluetooth 2450 MHz	2480	7.38	5.47	Front of Face	25	0.3	Yes
WLAN 2450 MHz	2462	16.5	44.67	Head	5	14.0	No
WLAN 2450 MHz	2462	16.5	44.67	Body	5	14.0	No
WLAN 2450 MHz	2462	16.5	44.67	Front of Face	25	2.9	Yes



1.4.5 Technical Description

The equipment under test (EUT) was a Sepura SC2128 A full technical description can be found in the manufacturer's documentation.

1.4.6 Test Configuration and Modes of Operation

The testing was performed with two battery variants (1160 mAh and 1880 mAh) which were supplied and manufactured by Sepura Limited. The batteries were fully charged before each measurement and there were no external connections.

For body SAR assessment, testing was performed for the WLAN 2.4GHz frequency bands at maximum power, using Nylon Holster (Model Number 300-01916) which contains metal components. Body SAR testing was carried out with the device inside the holster using two battery variants. (Part Numbers: 300-01852 (1160 mAh) and 300-01853 (1880 mAh)) Various body worn accessories are compatible with the radio, Nylon Holster (Model Number 300-01916) provides the smallest separation distance between the body and the radio. Additional testing was performed without any body worn accessories attached at 0 mm separation distance between the device under test and the Elliptical Flat Phantom.

WLAN Head SAR assessment was performed with no body worn accessories using the 1880 mAh battery, the worst-case position was retested using 1160 mAh battery.

WLAN Front of Face SAR assessment was not required as this meets the exclusion criteria specified in KDB 447498 D01, however testing was applied and performed with no body worn accessories using the 1880 mAh and 1160 mAh battery.

The Elliptical Flat Phantom dimensions are 600 mm major axis and 400 mm minor axis with a shell thickness of 2.00 mm. The phantom was filled to a minimum depth of 150 mm with the appropriate Body simulant liquid. The dielectric properties were measured and found to be in accordance with the requirements specified in KDB 865664 D01

WLAN testing was achieved using the devices internal software, customer supplied software and settings supplied by the customer. For each scan, the EUT was configured into a continuous transmission test mode

802.11g/n OFDM configurations met the test exclusion requirements of KDB 248227 D01 section 5.2.2. The highest reported SAR for DSSS was adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR was ≤ 1.2 W/kg.

Included in this report are descriptions of the test method; the equipment used and an analysis of the test uncertainties applicable and diagrams indicating the locations of maximum SAR for each test position along with photographs indicating the positioning of the handset against the body as appropriate.



1.5 FCC POWER MEASUREMENTS

1.5.1 Method

Conducted power measurements were made using a power meter.

1.5.2 Conducted Power Measurements

WLAN 2450 MHz

Technology	Frequency (MHz)	Rate (Mbps)	Channel Bandwidth (MHz)	Measured Power (dBm)
802.11b	2412	1	20	15.19
802.11b	2437	1	20	15.60
802.11b	2462	1	20	15.62

Conducted power measurements were made using a power meter.
Maximum Declared output power for WLAN is 16.5 dBm

WLAN Conducted power measurements were performed on a modified Sepura SC2124 from document 06 under project number 75947270. The SC2124 and SC2128 use the same plug in Bluetooth/Wi-Fi module.



SECTION 2

TEST DETAILS

Specific Absorption Rate Testing of the
Sepura SC2128 Tetra Radio (2.4GHz WLAN Transmitter)

2.1 DASY5 MEASUREMENT SYSTEM

2.1.1 System Description

The DASY5 system for performing compliance tests consists of the following items:

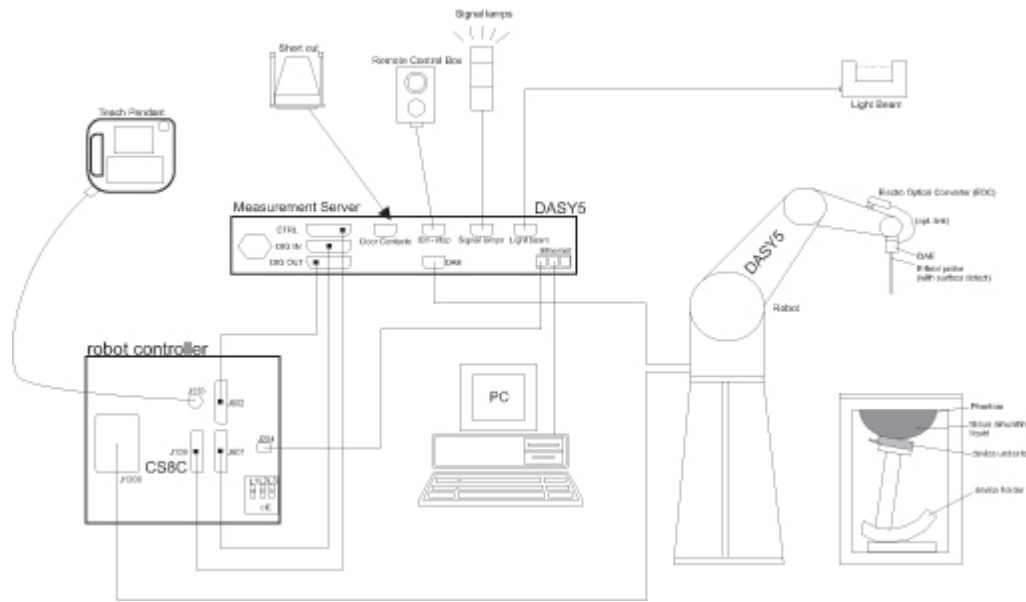


Figure 1 System Description Diagram

A standard high precision 6-axis robot (Stäubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).

An isotropic field probe optimized and calibrated for the targeted measurement.

A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.

The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.

The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.

Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.

The phantom, the device holder and other accessories according to the targeted measurement.



2.1.2 Probe Specification

The probes used by the DASY system are isotropic E-field probes, constructed with a symmetric design and a triangular core. The probes have built-in shielding against static charges and are contained within a PEEK enclosure material. These probes are specially designed and calibrated for use in liquids with high permittivities. The frequency range of the probes are from 6 MHz to 6 GHz.

2.1.3 Data Acquisition Electronics

The data acquisition electronics (DAE4 or DAE3) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of both the DAE4 as well as of the DAE3 box is 200M Ω ; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

2.1.4 SAR Evaluation Description

The DASY5 software includes all numerical procedures necessary to evaluate the spatial peak SAR values.

Based on the IEEE 1528 standard, a new algorithm has been implemented. The spatial-peak SAR can be computed over any required mass.

The base for the evaluation is a "cube" measurement in a volume of 30mm³ (7x7x7 points). The measured volume must include the 1 g and 10 g cubes with the highest averaged SAR values. For that purpose, the centre of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan. If the 10g cube or both cubes are not entirely inside the measured volumes, the system issues a warning regarding the evaluated spatial peak values within the Post processing engine (SEMCAD X). This means that if the measured volume is shifted, higher values might be possible. To get the correct values you can use a finer measurement grid for the area scan. In complicated field distributions, a large grid spacing for the area scan might miss some details and give an incorrectly interpolated peak location.

The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD X). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. extraction of the measured data (grid and values) from the Zoom Scan
2. calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. generation of a high-resolution mesh within the measured volume
4. interpolation of all measured values from the measurement grid to the high-resolution grid
5. extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. calculation of the averaged SAR within masses of 1 g and 10 g



2.1.5 Interpolation, Extrapolation and Detection of Maxima

The probe is calibrated at the centre of the dipole sensors which is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated.

In DASY5, the choice of the coordinate system defining the location of the measurement points has no influence on the uncertainty of the interpolation, Maxima Search and extrapolation routines. The interpolation, extrapolation and maximum search routines are all based on the modified Quadratic Shepard's method. Thereby, the interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. The DASY5 routines construct a once-continuously differentiable function that interpolates the measurement values as follows:

For each measurement point a trivariate (3-D) / bivariate (2-D) quadratic is computed. It interpolates the measurement values at the data point and forms a least-square fit to neighbouring measurement values. The spatial location of the quadratic with respect to the measurement values is attenuated by an inverse distance weighting. This is performed since the calculated quadratic will fit measurement values at nearby points more accurate than at points located further away.

After the quadratics are calculated for at all measurement points, the interpolating function is calculated as a weighted average of the quadratics.

There are two control parameters that govern the behaviour of the interpolation method. One specifies the number of measurement points to be used in computing the least-square fits for the local quadratics. These measurement points are the ones nearest the input point for which the quadratic is being computed. The second parameter specifies the number of measurement points that will be used in calculating the weights for the quadratics to produce the final function. The input data points used there are the ones nearest the point at which the interpolation is desired. Appropriate defaults are chosen for each of the control parameters

The trivariate quadratics that have been previously computed for the 3-D interpolation and whose input data are at the closest distance from the phantom surface, are used in order to extrapolate the fields to the surface of the phantom.

In order to determine all the field maxima in 2-D (Area Scan) and 3-D (Zoom Scan), the measurement grid is refined by a default factor of 10 and the interpolation function is used to evaluate all field values between corresponding measurement points. Subsequently, a linear search is applied to find all the candidate maxima. In a last step, nonphysical maxima are removed and only those maxima which are within 2 dB of the global maximum value are retained.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extrema of the SAR distribution. The uncertainty on the locations of the extrema is less than 1/20 of the grid size. Only local maxima within 2 dB of the global maximum are searched and passed for the Zoom Scan measurement.

In the Zoom Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5mm.



2.1.6 Averaging and Determination of Spatial Peak SAR

The interpolated data is used to average the SAR over the 1g and 10g cubes by spatially discretising the entire measured volume. The resolution of this spatial grid used to calculate the averaged SAR is 1mm or about 42875 interpolated points. The resulting volumes are defined as cubical volumes containing the appropriate tissue parameters that are centered at the location. The location is defined as the centre of the incremental volume (voxel).

The spatial-peak SAR must be evaluated in cubical volumes containing a mass that is within 5% of the required mass. The cubical volume centered at each location, as defined above, should be expanded in all directions until the desired value for the mass is reached, with no surface boundaries of the averaging volume extending beyond the outermost surface of the considered region. In addition, the cubical volume should not consist of more than 10% of air. If these conditions are not satisfied, then the centre of the averaging volume is moved to the next location. Otherwise, the exact size of the final sampling cube is found using an inverse polynomial approximation algorithm, leading to results with improved accuracy. If one boundary of the averaging volume reaches the boundary of the measured volume during its expansion, it will not be evaluated at all. Reference is kept of all locations used and those not used for averaging the SAR. All average SAR values are finally assigned to the centered location in each valid averaging volume.

All locations included in an averaging volume are marked to indicate that they have been used at least once. If a location has been marked as used but has never been assigned to the centre of a cube, the highest averaged SAR value of all other cubical volumes which have used this location for averaging is assigned to this location. Only those locations that are not part of any valid averaging volume should be marked as unused. For the case of an unused location, a new averaging volume must be constructed which will have the unused location centered at one surface of the cube. The remaining five surfaces are expanded evenly in all directions until the required mass is enclosed, regardless of the amount of included air. Of the six possible cubes with one surface centered on the unused location, the smallest cube is used, which still contains the required mass.

If the final cube containing the highest averaged SAR touches the surface of the measured volume, an appropriate warning is issued within the Post-processing engine.



2.2 WLAN 2450 MHz - 802.11b - 1Mbps - BODY SAR TEST RESULTS

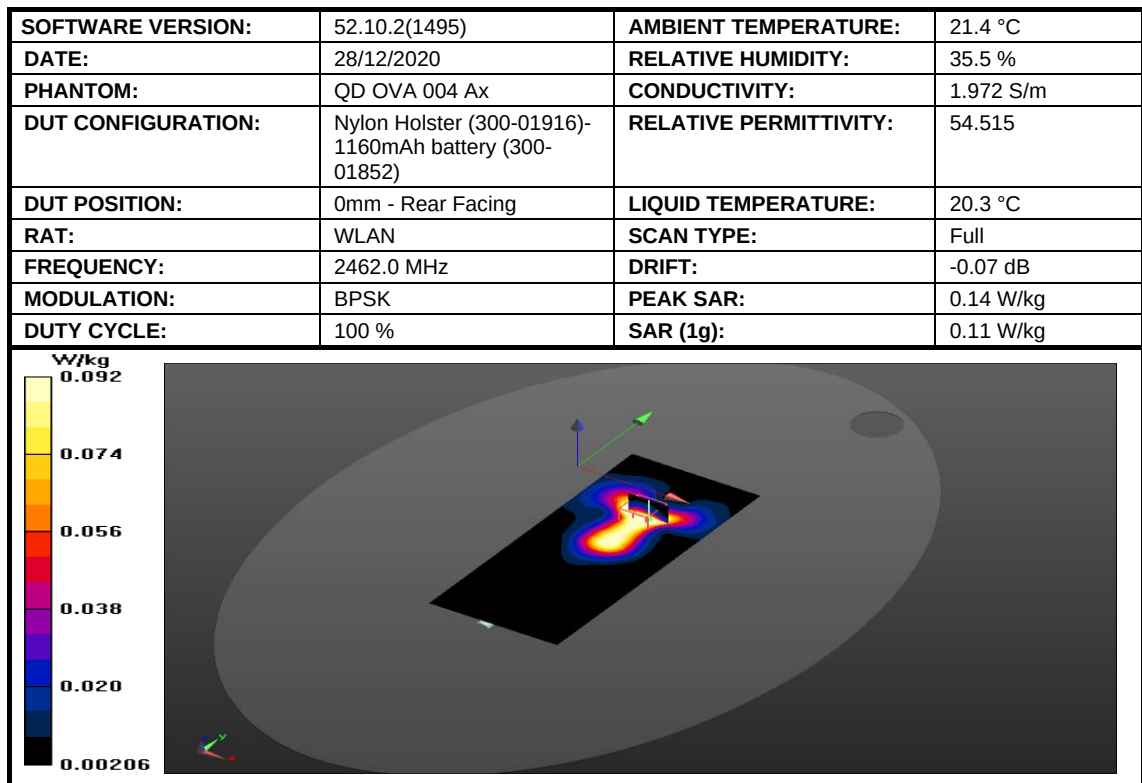


Figure 2: SAR Body Testing Results for the SC2128 at 2462.0 MHz

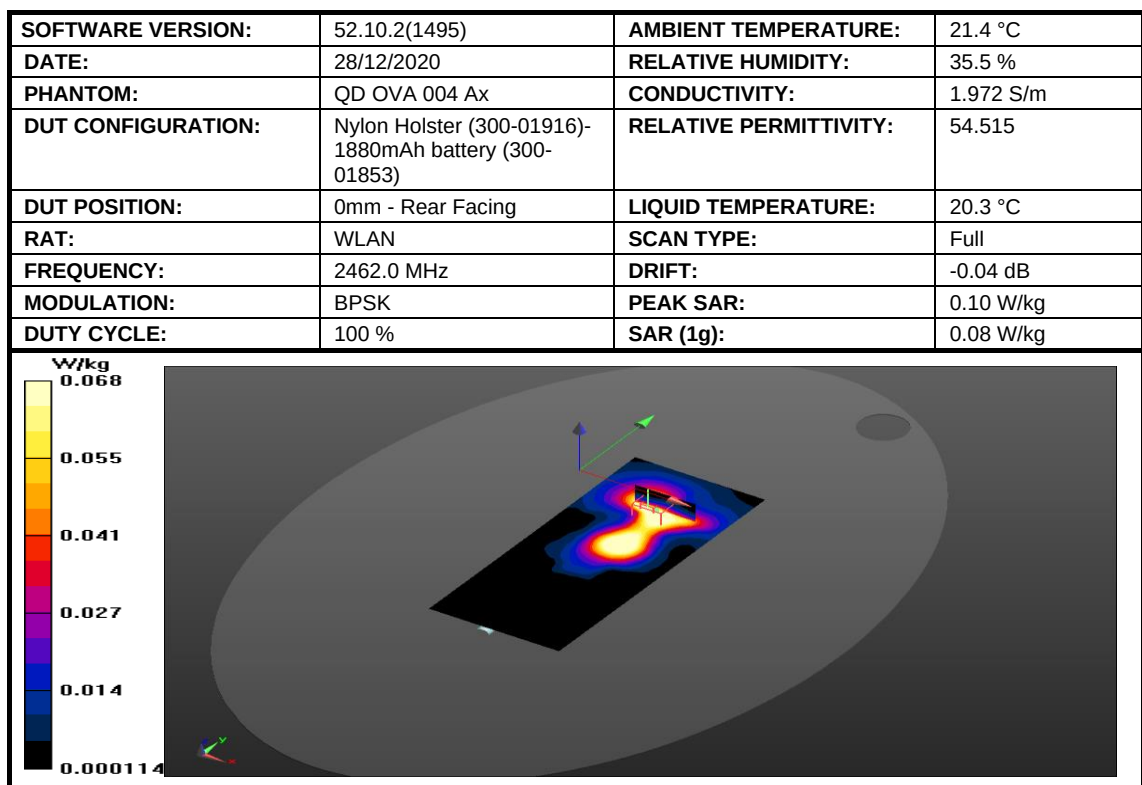


Figure 3: SAR Body Testing Results for the SC2128 at 2462.0 MHz

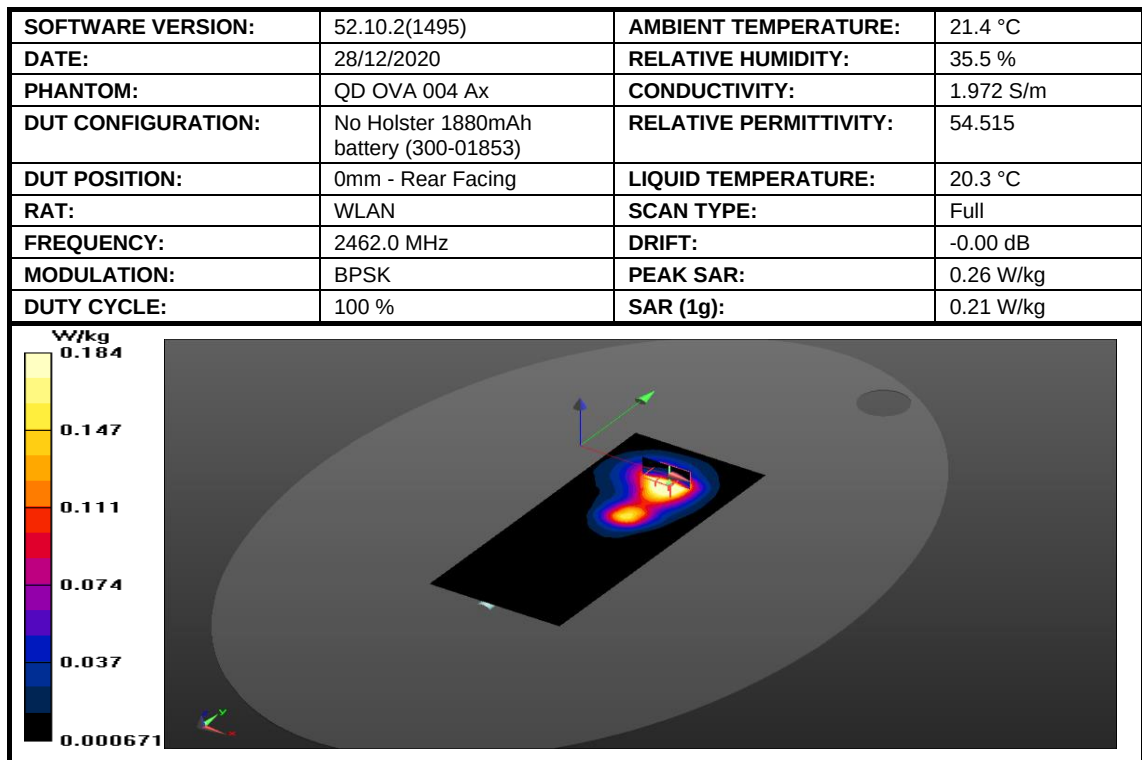


Figure 4: SAR Body Testing Results for the SC2128 at 2462.0 MHz

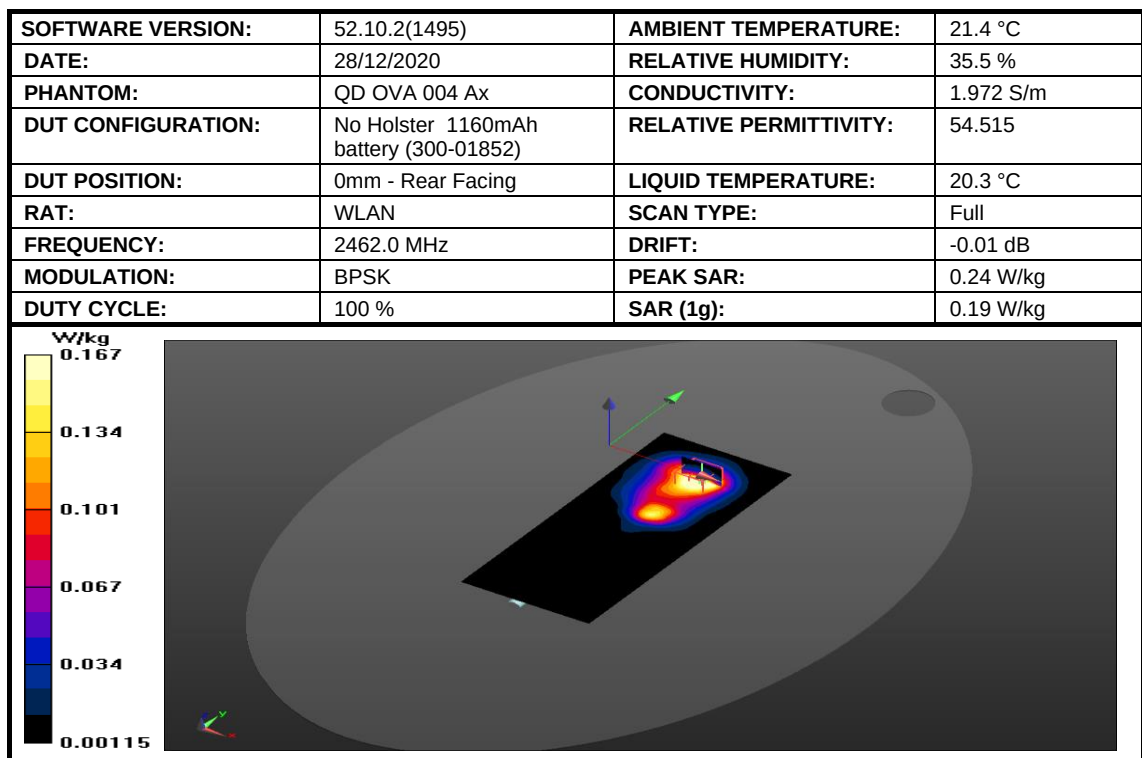


Figure 5: SAR Body Testing Results for the SC2128 at 2462.0 MHz



2.3 WLAN 2450 MHz - 802.11b - 1Mbps - HEAD SAR TEST RESULTS

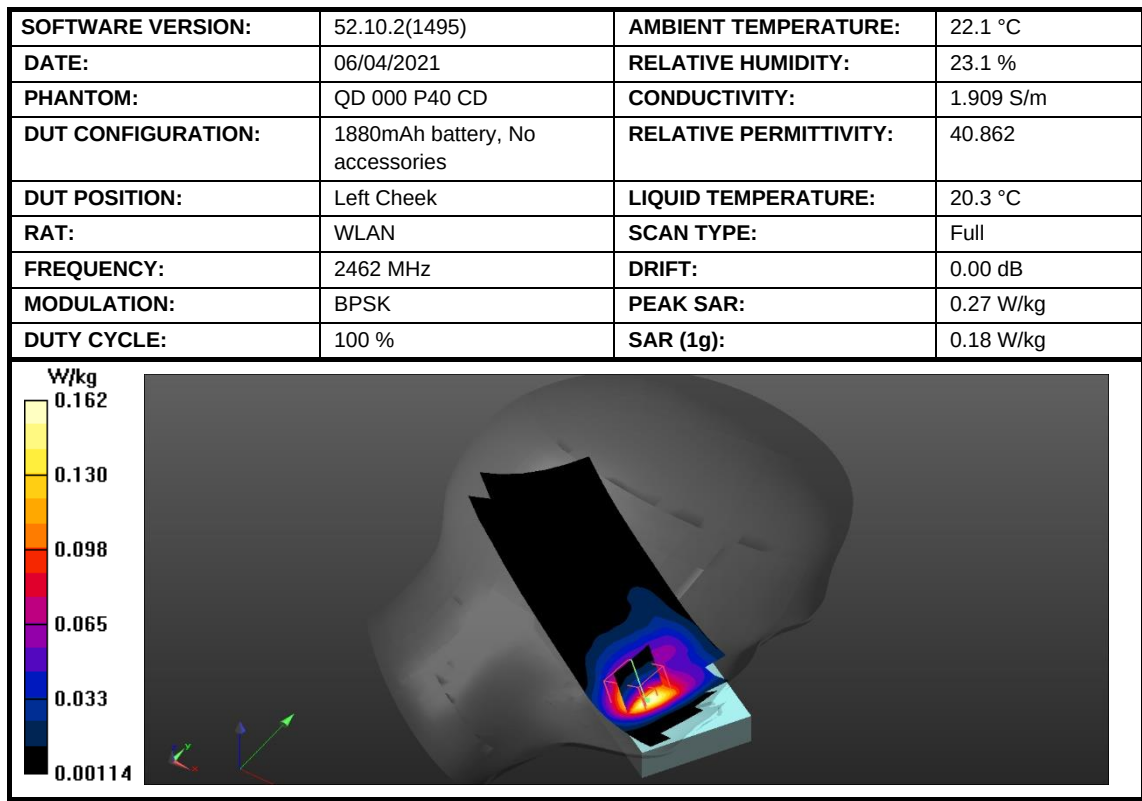


Figure 6: SAR Head Testing Results for the SC2128 at 2462 MHz.

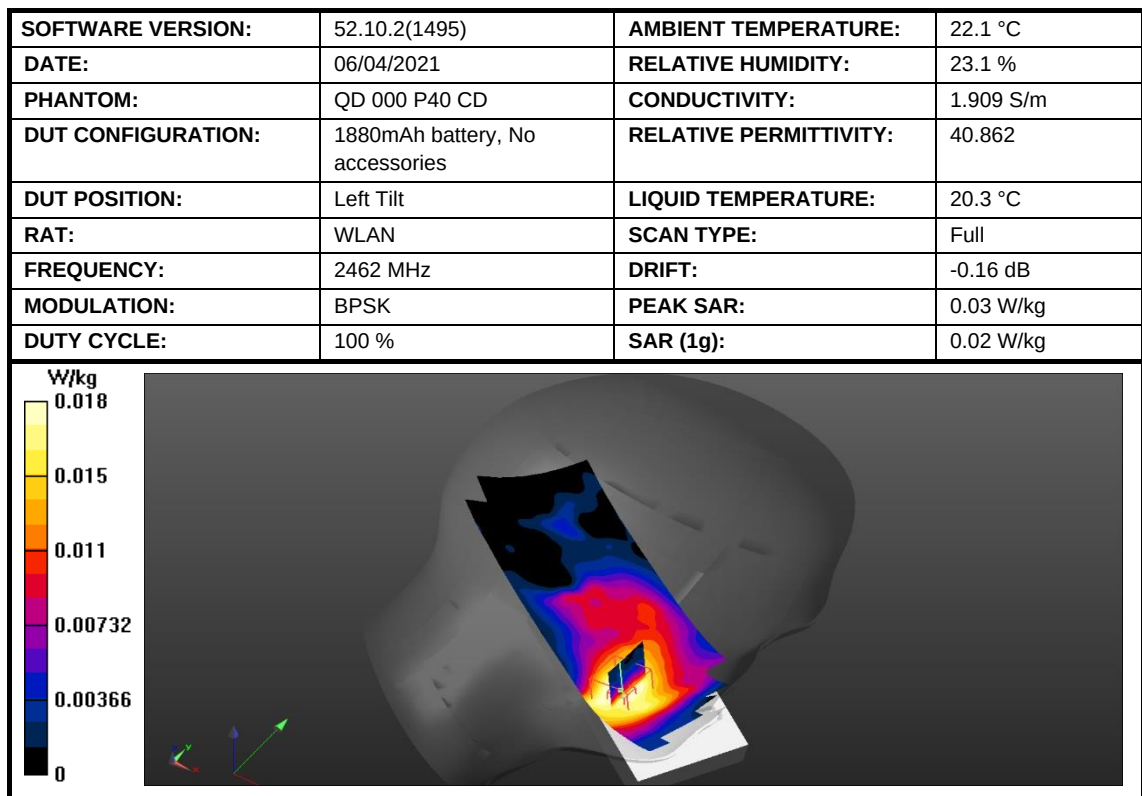


Figure 7: SAR Head Testing Results for the SC2128 at 2462 MHz.

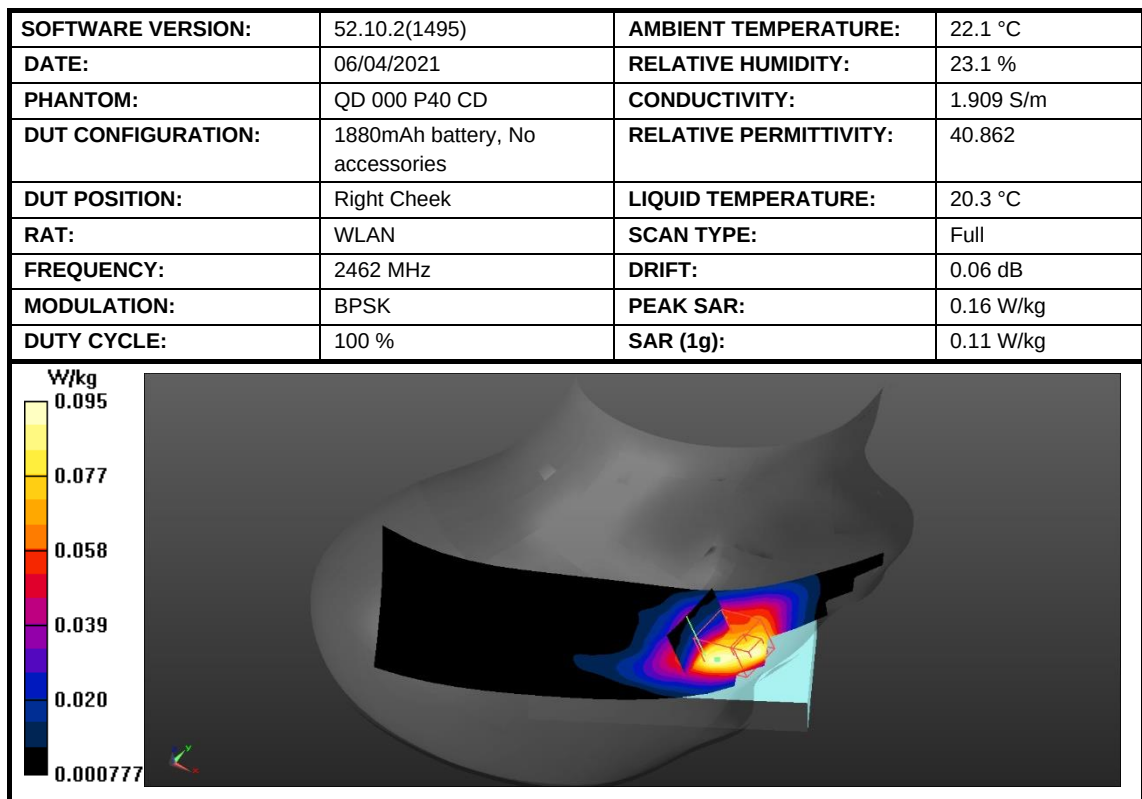


Figure 8: SAR Head Testing Results for the SC2128 at 2462 MHz.

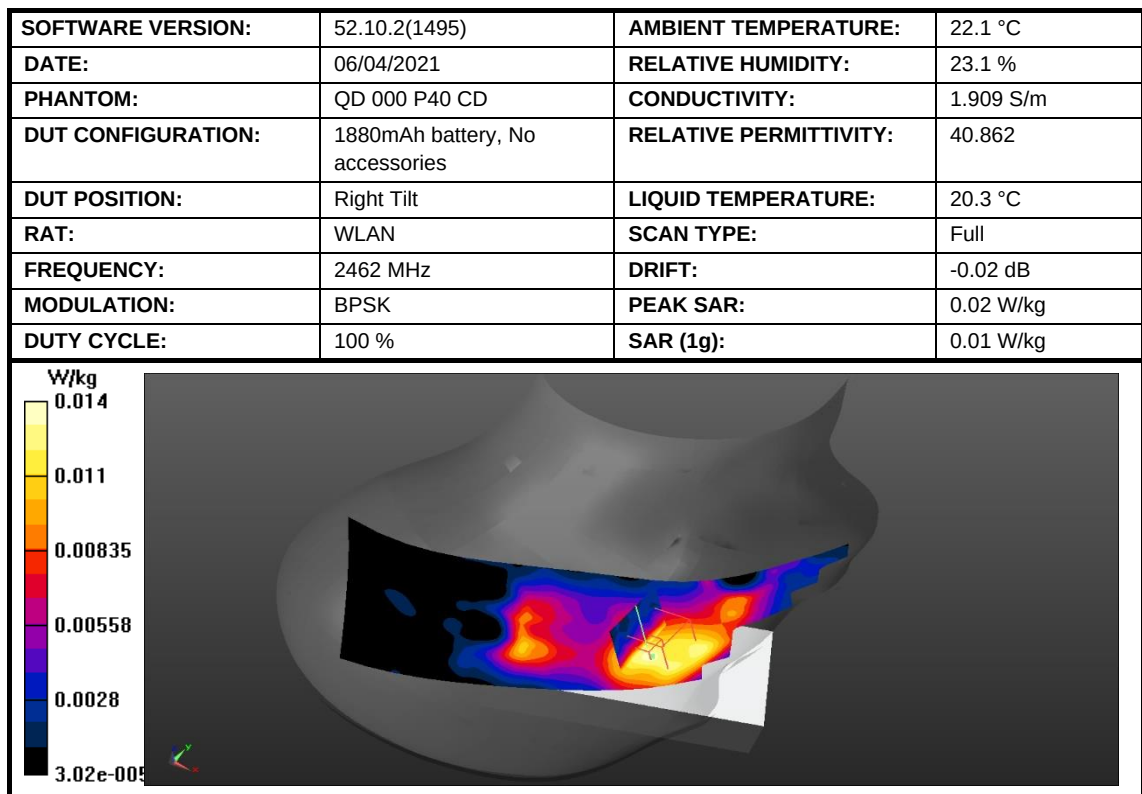


Figure 9: SAR Head Testing Results for the SC2128 at 2462 MHz.



SOFTWARE VERSION:	52.10.2(1495)	AMBIENT TEMPERATURE:	22.4 °C
DATE:	07/04/2021	RELATIVE HUMIDITY:	17.5 %
PHANTOM:	QD 000 P40 CD	CONDUCTIVITY:	1.909 S/m
DUT CONFIGURATION:	1160mAh battery, No accessories	RELATIVE PERMITTIVITY:	40.862
DUT POSITION:	Left Cheek	LIQUID TEMPERATURE:	20.1 °C
RAT:	WLAN	SCAN TYPE:	Full
FREQUENCY:	2462 MHz	DRIFT:	-0.17 dB
MODULATION:	BPSK	PEAK SAR:	0.27 W/kg
DUTY CYCLE:	100 %	SAR (1g):	0.18 W/kg

Figure 10: SAR Head Testing Results for the SC2128 at 2462 MHz.



2.4 WLAN 2450 MHz - 802.11B - 1MBPS - FRONT OF FACE SAR TEST RESULTS

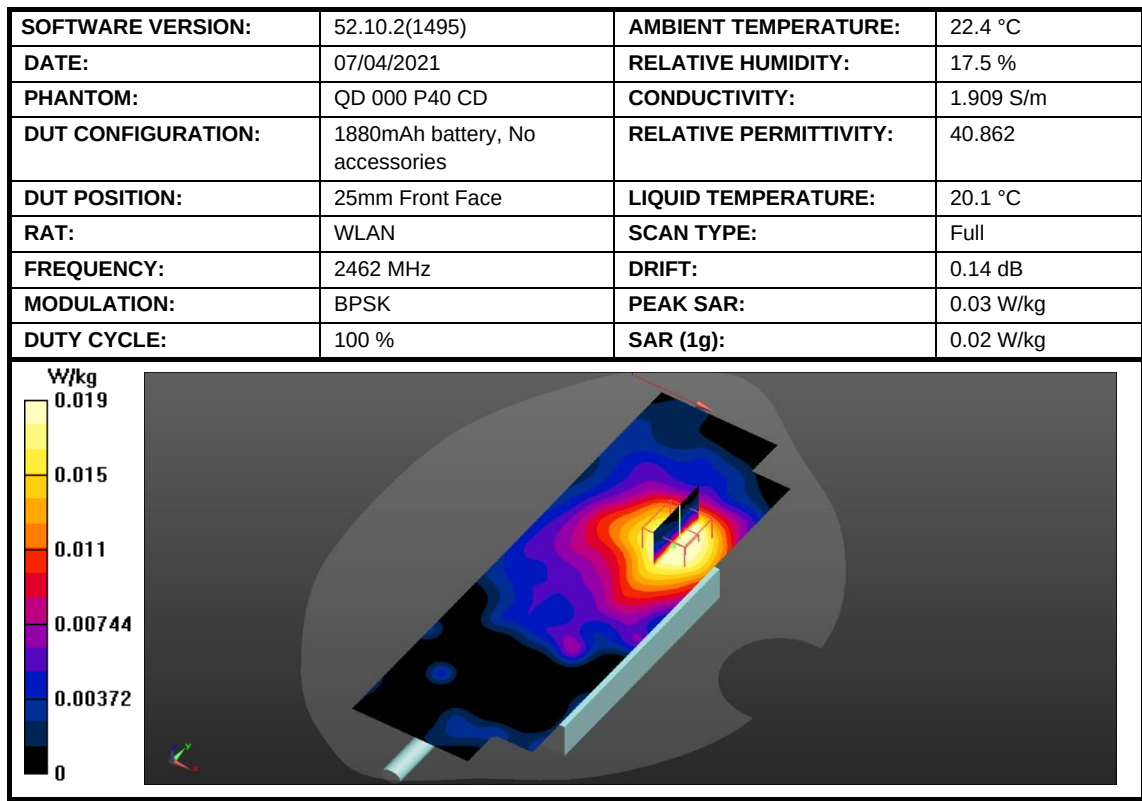


Figure 11: SAR Head Testing Results for the SC2128 at 2462 MHz.

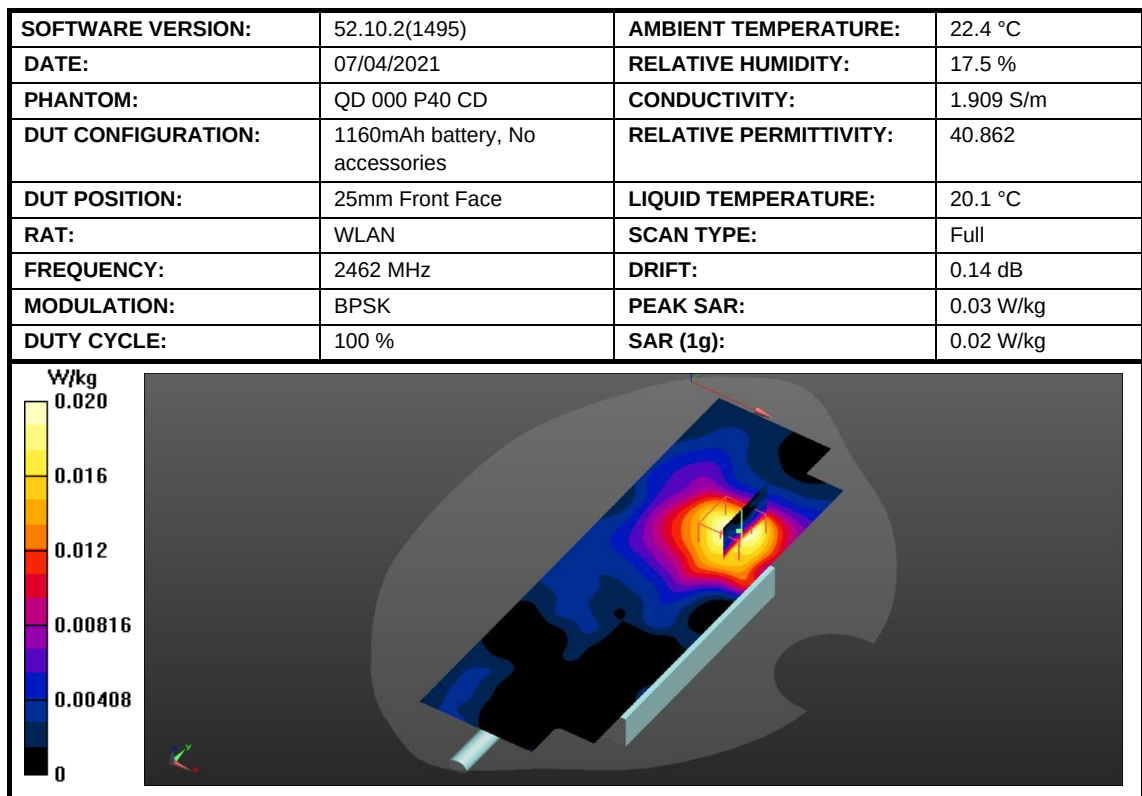


Figure 12: SAR Head Testing Results for the SC2128 at 2462 MHz.



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

The following test equipment was used at TÜV SÜD for Body SAR Testing:

Instrument Description	Manufacturer	Model Type	TE Number	Cal Period (months)	Calibration Due Date
10MHz - 2.5GHz, 3W, Amplifier	Vectawave Technology	VTL5400	51	-	TU
Signal Generator	Hewlett Packard	ESG4000A	61	12	21-Jul-2021
Thermometer	Digitron	T208	64	12	29-Oct-2021
Attenuator (20dB, 10W)	Weinschel	37-20-34	482	12	15-Jan-2021
Bi-directional Coupler	IndexSar Ltd	7401 (VDC0830-20)	2414	-	TU
Power Sensor	Rohde & Schwarz	NRV- Z5	2878	12	10-Jun-2021
Power Meter	Rohde & Schwarz	NRVD	2979	12	10-Jun-2021
Power Sensor	Rohde & Schwarz	NRV-Z1	3563	12	10-Jun-2021
Dielectric Assessment Kit	Speag	DAK 200MHz to 20GHz	4690	-	TU
Dielectric Probe Stand	Speag	Stand	4691	-	TU
Device Holder	Speag	MDA4WTV5RLAP	4694	-	TU
Network Analyser	Keysight Technologies	E5063A	5018	12	18-Jul-2021
Data Acquisition Electronics	Speag	DAE 4 - SD 000 D04 BN	5327	12	09-Jun-2021
Validation Dipole (2450MHz)	Speag	D2450V2	5329	12	24-Jun-2021
Dosimetric SAR Probe	Speag	EX3DV4	5330	12	22-Jun-2021
Body Phantom	Speag	Oval Flat Phantom ELI v8.0	5333	-	TU
Measurement server	Speag	DASY 6 Measurement Server	5337	-	TU
Robot	Speag	TX90 XL Stäubli Robot	5340	-	TU
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5424	12	22-Jun-2021
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5425	12	22-Jun-2021
Tissue simulant Liquid	Speag	MBBL600-6000V6	Batch 3	Weekly (while in use)	15-Jan-2021

TU - Traceability Unscheduled



The following test equipment was used at TÜV SÜD for Head and Front of Face SAR Testing:

Instrument Description	Manufacturer	Model Type	TE Number	Cal Period (months)	Calibration Due Date
10MHz - 2.5GHz, 3W, Amplifier	Vectawave Technology	VTL5400	51	-	TU
Signal Generator	Hewlett Packard	ESG4000A	61	12	21-Jul-2021
Thermometer	Digitron	T208	64	12	29-Oct-2021
Thermocouple (Type K)	TUV SUD	TYPE K	65	12	29-Oct-2021
Attenuator (20dB, 10W)	Weinschel	37-20-34	482	12	14-Jan-2022
Bi-directional Coupler	IndexSar Ltd	7401 (VDC0830-20)	2414	-	TU
Power Sensor	Rohde & Schwarz	NRV- Z5	2878	12	10-Jun-2021
Power Meter	Rohde & Schwarz	NRVD	2979	12	10-Jun-2021
Hygrometer	Rotronic	I-1000	3068	12	27-Jul-2021
Power Sensor	Rohde & Schwarz	NRV-Z1	3563	12	10-Jun-2021
SAR 2450 MHz dipole	Speag	D2450V2	3875	12	10-Dec-2021
Data Acquisition Electronics	Speag	DAE 4 - SD 000 D04 BM	4689	12	08-Dec-2021
Dielectric Assessment Kit	Speag	DAK 200MHz to 20GHz	4690	-	TU
Dielectric Probe Stand	Speag	Stand	4691	-	TU
Measurement Server	Speag	DASY 5 Measurement Server	4692	-	TU
Device Holder	Speag	MD4HHTV5	3870	-	TU
Dosimetric SAR Probe	Speag	EX3DV4	4700	12	17-Dec-2021
Head Phantom	Speag	Twin Sam Phantom	4703	-	TU
Robot	Speag	TX90 XL Robot	4704	-	TU
Network Analyser	Keysight Technologies	E5063A	5018	12	18-Jul-2021
Electronic Calibration Module	Keysight Technologies	85093C	5188	12	08-Jul-2021
Measurement server	Speag	DASY 6 Measurement Server	5337	-	TU
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5425	12	22-Jun-2021
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5429	12	22-Jun-2021
Signal Generator	Hewlett Packard	ESG4000A	61	12	21-Jul-2021
Thermometer	Digitron	T208	64	12	29-Oct-2021
Tissue simulant Liquid	Speag	HBBL600-6000V6	Batch 3	Weekly (while in use)	13-Apr-2021

TU -Traceability Unscheduled



3.2 TEST SOFTWARE

The following software was used to control the TÜV SÜD DASY System.

Instrument	Version Number
DASY system	52.10.2(1495)



3.3 DIELECTRIC PROPERTIES OF SIMULANT LIQUIDS

The fluid properties of the simulant fluids used during routine SAR evaluation meet the dielectric properties required of KDB 865664

The dielectric properties of the tissue simulant liquids used for the SAR testing at TÜV SÜD are as follows: -

Fluid Type and Frequency	Relative Permittivity Target	Relative Permittivity Measured	Conductivity Target (S/m)	Conductivity Measured (S/m)	Date	Fluid Temperature °C
MBBL-Batch 3 @2450 MHz	1.95	1.96	52.77	54.53	27-12-20	20.3
HBBL-Batch 3 @2450 MHz	1.80	1.90	39.20	40.89	06-04-21	20.3



3.4 TEST CONDITIONS

3.4.1 Test Laboratory Conditions

Ambient temperature: Within +15°C to +35°C.

The actual temperature during the testing ranged from 21.4°C to 22.1°C.

The actual humidity during the testing ranged from 17.5% to 35.5% RH.

3.4.2 Test Fluid Temperature Range

Frequency	Body / Head Fluid	Min Temperature °C	Max Temperature °C
2450 MHz	Body	20.3	20.3
2450 MHz	Head	20.1	20.1

3.4.3 SAR Drift

The SAR Drift was within acceptable limits during scans. The maximum SAR Drift was recorded as -0.17 dB.



3.5 MEASUREMENT UNCERTAINTY

Body, Full SAR Measurements, 300 MHz to 3 GHz

Source of Uncertainty	Uncertainty $\pm$ %	Probability distribution	Div	c_i (1g)	Standard Uncertainty $\pm$ % (1g)	V_i (V_{eff})
Measurement System						
Probe calibration	6.0	N	1.00	1.00	6.0	Infinity
Axial Isotropy	4.7	R	1.73	0.70	1.9	Infinity
Hemispherical Isotropy	9.6	R	1.73	0.70	3.9	Infinity
Boundary effect	1.0	R	1.73	1.00	0.6	Infinity
Linearity	4.7	R	1.73	1.00	2.7	Infinity
System Detection limits	1.0	R	1.73	1.00	0.6	Infinity
Modulation response	2.4	R	1.73	1.00	1.4	Infinity
Readout electronics	0.3	N	1.00	1.00	0.3	Infinity
Response time	0.8	R	1.73	1.00	0.5	Infinity
Integration time	2.6	R	1.73	1.00	1.5	Infinity
RF ambient noise	3.0	R	1.73	1.00	1.7	Infinity
RF ambient reflections	3.0	R	1.73	1.00	1.7	Infinity
Probe positioner	0.4	R	1.73	1.00	0.2	Infinity
Probe positioning	2.9	R	1.73	1.00	1.7	Infinity
Max SAR Evaluation	2.0	R	1.73	1.00	1.2	Infinity
Test sample related						
Device Positioning	2.9	N	1.00	1.00	2.9	145
Device Holder	3.6	N	1.00	1.00	3.6	5
Input Power and SAR Drift	5.0	R	1.73	1.00	2.9	Infinity
Phantom and Setup						
Phantom uncertainty	6.1	R	1.73	1.00	3.5	Infinity
SAR Correction	1.9	R	1.73	1.00	1.1	Infinity
Liquid conductivity Meas.	2.5	R	1.73	0.78	1.1	Infinity
Liquid Permittivity Meas.	2.5	R	1.73	0.23	0.3	Infinity
Temp. Unc. Conductivity	3.4	R	1.73	0.78	1.5	Infinity
Temp. Unc. Permittivity	0.4	R	1.73	0.23	0.1	Infinity
Combined Standard Uncertainty		RSS			11.1	361
Expanded Standard Uncertainty		K=2			22.2	



SECTION 4

PHOTOGRAPHS



4.1 TEST POSITIONAL PHOTOGRAPHS

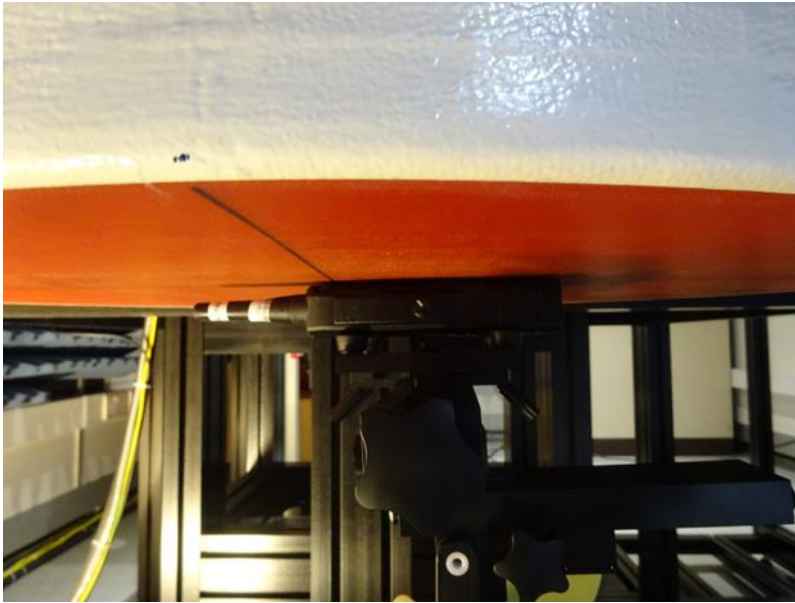


Figure 13: Rear- 1160 mAh Battery Fitted (No Holster Fitted) – 0mm Separation Distance.



Figure 14: Rear face 1160 mAh Battery Fitted (Nylon Holster Fitted) – 0mm Separation Distance.

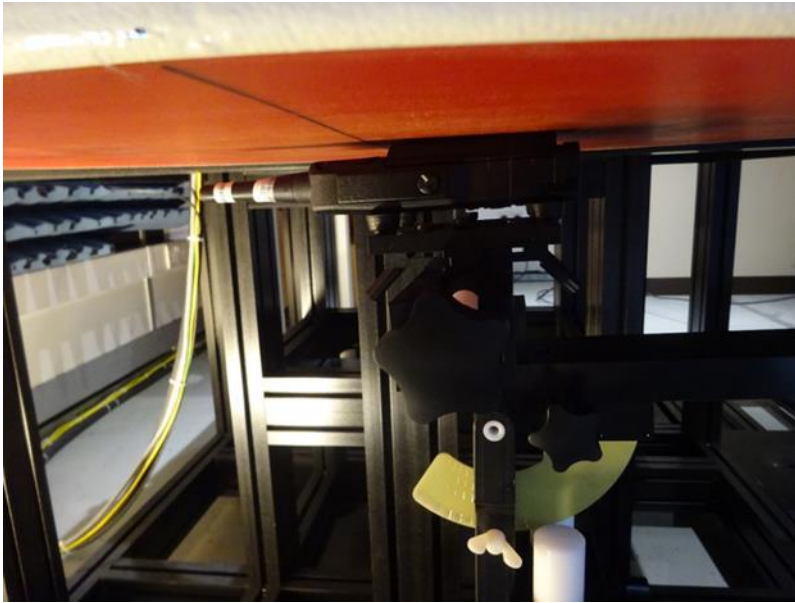


Figure 15: Rear – 1880 mAh Battery Fitted (No Nylon Holster Fitted) – 0mm Separation Distance.



Figure 16: Rear - 1880 mAh Battery Fitted (Nylon Holster Fitted) – 0mm Separation Distance.

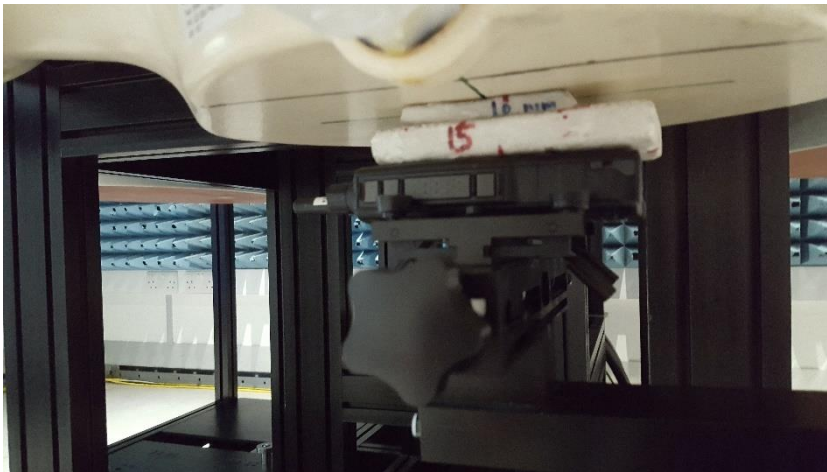


Figure 17: Front - 1160 mAh Battery Fitted – 25mm Separation Distance.

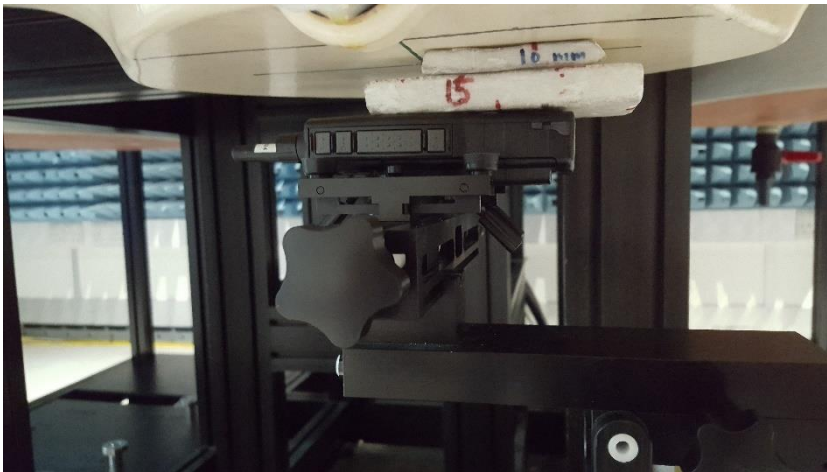


Figure 18: Front - 1880 mAh Battery Fitted – 25mm Separation Distance.



Figure 19: Left Cheek - 1880 mAh Battery Fitted.

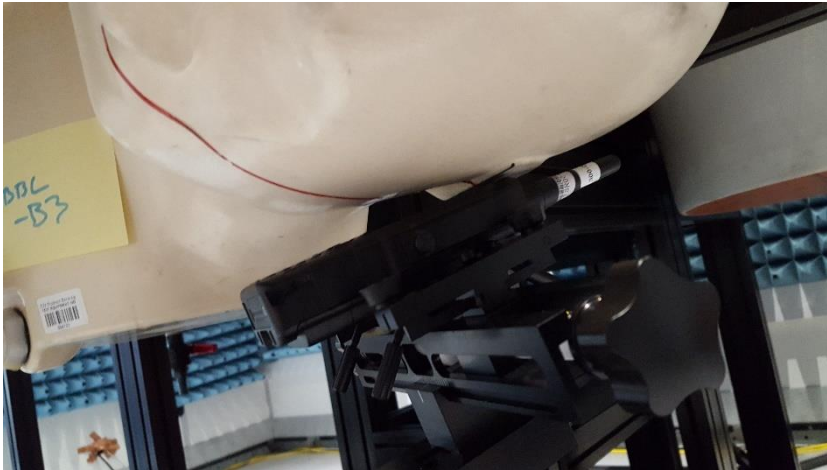


Figure 20: Left Tilt - 1880 mAh Battery Fitted.

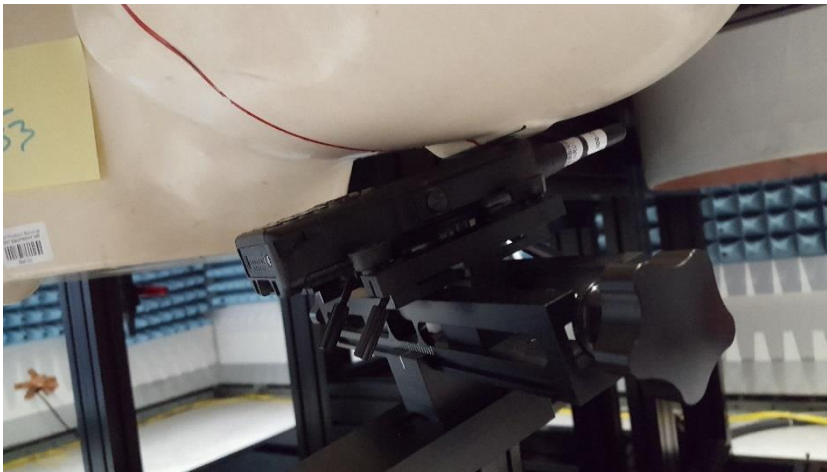


Figure 21: Left Tilt - 1160 mAh Battery Fitted.

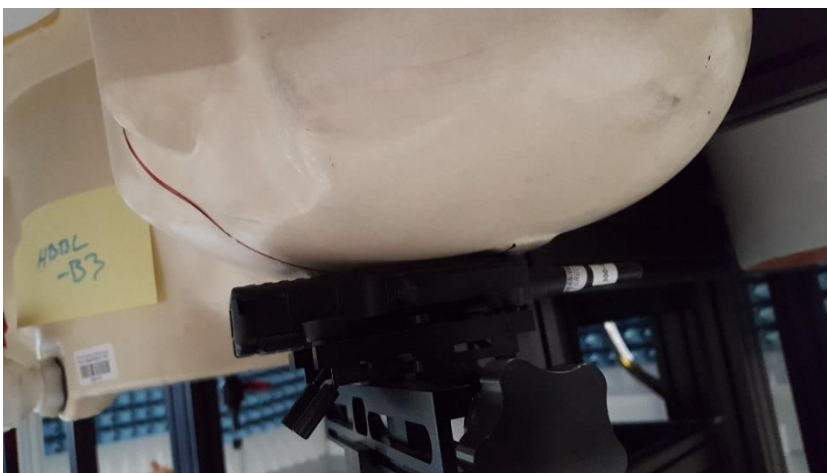


Figure 22: Left Cheek - 1160 mAh Battery Fitted.

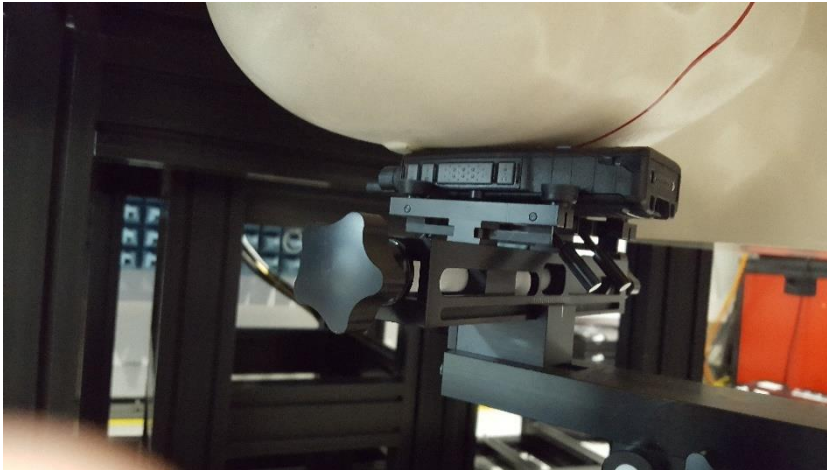


Figure 23: Right Cheek - 1160 mAh Battery Fitted.



Figure 24: Right Tilt - 1160 mAh Battery Fitted.



Figure 25: Right Tilt - 1880 mAh Battery Fitted.



Figure 26: Right Cheek- 1880 mAh Battery Fitted.

4.2 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



Figure 27: Rear – Battery Removed.



Figure 28: Rear – 1880 mAh Battery Fitted.



Figure 29: Rear – 1160 mAh Battery Fitted.



Figure 30: Front.



SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

This report must not be reproduced, except in its entirety, without the written permission of
TÜV SÜD
© 2021 TÜV SÜD



ANNEX A

PROBE CALIBRATION REPORT



**Calibration Laboratory of
Schmid & Partner
Engineering AG**
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **TüV Süd UK**

Certificate No: **EX3-7536_Jun20**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7536**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7
Calibration procedure for dosimetric E-field probes**

Calibration date: **June 22, 2020**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: CC2552 (20x)	31-Mar-20 (No. 217-03106)	Apr-21
DAE4	SN: 660	27-Dec-19 (No. DAE4-660_Dec19)	Dec-20
Reference Probe ES3DV2	SN: 3013	31-Dec-19 (No. ES3-3013_Dec19)	Dec-20
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: June 23, 2020			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



Calibration Laboratory of
Schmid & Partner
Engineering AG
 Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
 Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization ϕ	ϕ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

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"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).



EX3DV4 – SN:7536

June 22, 2020

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.56	0.62	0.66	± 10.1 %
DCP (mV) ^B	98.2	95.4	96.8	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB/μV	C	D dB	VR mV	Max dev.	Max Unc ^E (k=2)
0	CW	X	0.00	0.00	1.00	0.00	149.3	± 2.7 %	± 4.7 %
		Y	0.00	0.00	1.00		141.3		
		Z	0.00	0.00	1.00		142.8		
10352- AAA	Pulse Waveform (200Hz, 10%)	X	20.00	90.62	19.95	10.00	60.0	± 4.3 %	± 9.6 %
		Y	20.00	94.78	22.55		60.0		
		Z	15.80	86.47	18.21		60.0		
10353- AAA	Pulse Waveform (200Hz, 20%)	X	20.00	91.97	19.68	6.99	80.0	± 2.7 %	± 9.6 %
		Y	20.00	97.37	22.77		80.0		
		Z	20.00	88.94	17.99		80.0		
10354- AAA	Pulse Waveform (200Hz, 40%)	X	20.00	94.65	19.86	3.98	95.0	± 1.3 %	± 9.6 %
		Y	20.00	103.09	24.20		95.0		
		Z	20.00	91.32	18.09		95.0		
10355- AAA	Pulse Waveform (200Hz, 60%)	X	20.00	101.15	21.88	2.22	120.0	± 1.0 %	± 9.6 %
		Y	20.00	108.35	25.37		120.0		
		Z	20.00	96.39	19.51		120.0		
10387- AAA	QPSK Waveform, 1 MHz	X	1.87	66.38	15.56	1.00	150.0	± 1.6 %	± 9.6 %
		Y	1.66	64.43	14.15		150.0		
		Z	1.76	65.82	15.06		150.0		
10388- AAA	QPSK Waveform, 10 MHz	X	2.48	68.86	16.23	0.00	150.0	± 1.1 %	± 9.6 %
		Y	2.12	66.25	14.71		150.0		
		Z	2.32	67.98	15.74		150.0		
10396- AAA	64-QAM Waveform, 100 kHz	X	2.76	68.76	18.09	3.01	150.0	± 0.9 %	± 9.6 %
		Y	2.83	69.13	17.99		150.0		
		Z	3.01	70.65	18.99		150.0		
10399- AAA	64-QAM Waveform, 40 MHz	X	3.57	66.95	15.80	0.00	150.0	± 0.8 %	± 9.6 %
		Y	3.50	66.46	15.34		150.0		
		Z	3.62	67.23	15.85		150.0		
10414- AAA	WLAN CCDF, 64-QAM, 40MHz	X	4.96	65.41	15.49	0.00	150.0	± 1.8 %	± 9.6 %
		Y	4.94	65.40	15.34		150.0		
		Z	4.83	65.11	15.28		150.0		

Note: For details on UID parameters see Appendix

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



EX3DV4– SN:7536

June 22, 2020

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $ms.V^{-2}$	T2 $ms.V^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	56.0	422.59	36.26	15.30	0.00	5.03	0.27	0.38	1.00
Y	51.4	385.96	35.71	13.19	0.00	5.08	1.40	0.22	1.01
Z	51.2	384.56	35.82	15.57	0.00	5.02	1.24	0.23	1.01

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	75.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Note: Measurement distance from surface can be increased to 3-4 mm for an *Area Scan* job.



EX3DV4- SN:7536

June 22, 2020

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
2450	39.2	1.80	7.75	7.75	7.75	0.30	0.92	± 12.0 %
5200	36.0	4.66	5.44	5.44	5.44	0.40	1.80	± 13.1 %
5300	35.9	4.76	5.29	5.29	5.29	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.82	4.82	4.82	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.73	4.73	4.73	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.79	4.79	4.79	0.40	1.80	± 13.1 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



EX3DV4-- SN:7536

June 22, 2020

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7536

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
2450	52.7	1.95	7.69	7.69	7.69	0.33	0.94	± 12.0 %
5200	49.0	5.30	4.90	4.90	4.90	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.75	4.75	4.75	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.46	4.46	4.46	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.37	4.37	4.37	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.30	4.30	4.30	0.50	1.90	± 13.1 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

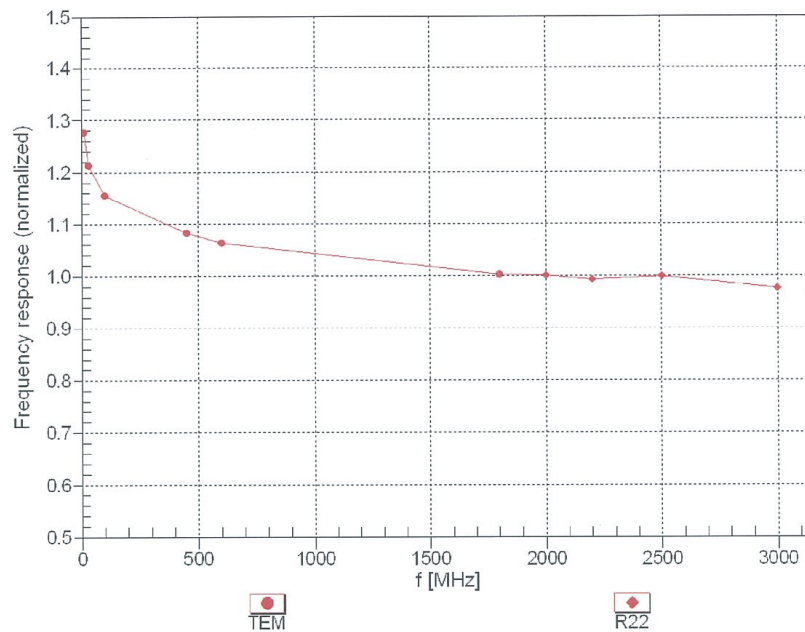
^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



EX3DV4- SN:7536

June 22, 2020

Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)



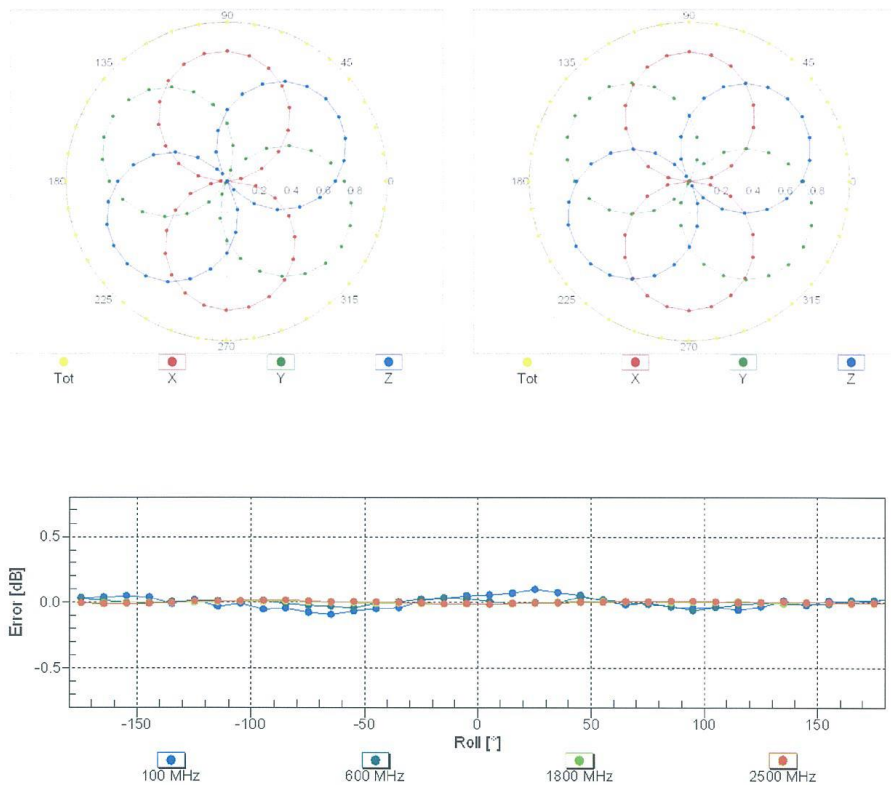
EX3DV4- SN:7536

June 22, 2020

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM

f=1800 MHz,R22

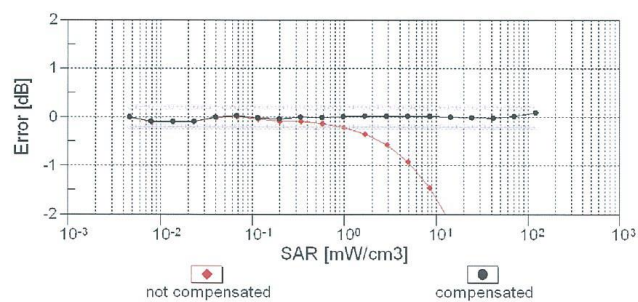
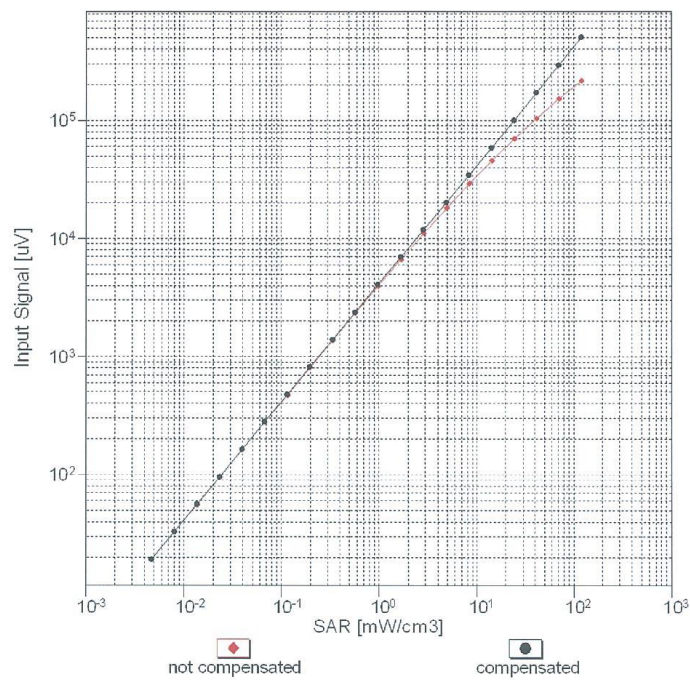
**Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)**



EX3DV4- SN:7536

June 22, 2020

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f_{\text{eval}} = 1900 \text{ MHz}$)

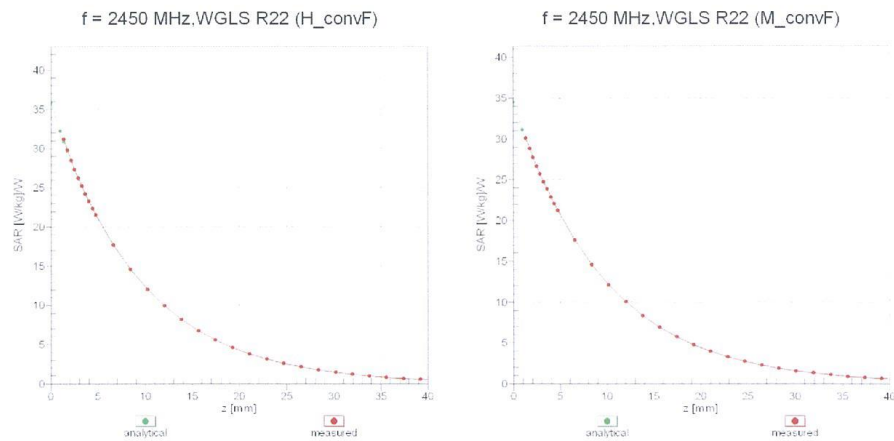
**Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)**



EX3DV4- SN:7536

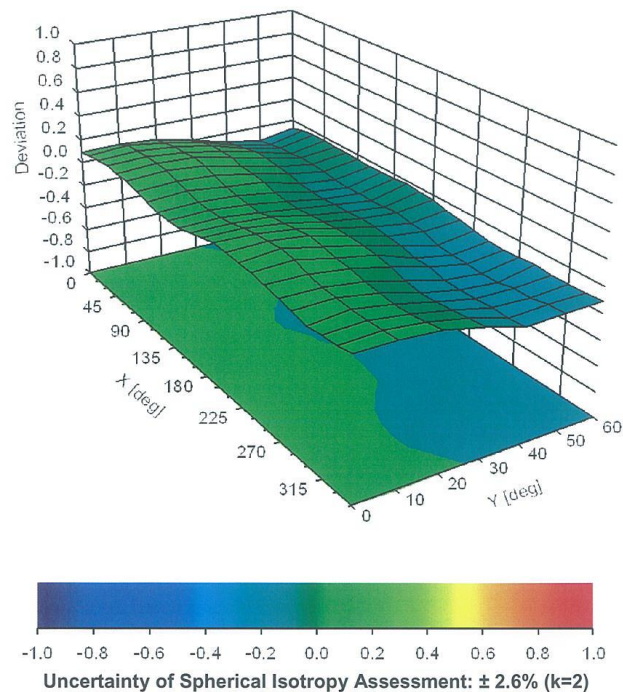
June 22, 2020

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ , ϑ), f = 900 MHz



Certificate No: EX3-7536_Jun20

Page 10 of 22



EX3DV4– SN:7536

June 22, 2020

Appendix: Modulation Calibration Parameters

UID	Rev	Communication System Name	Group	PAR (dB)	Unc ^E (k=2)
0		CW	CW	0.00	± 4.7 %
10010	CAA	SAR Validation (Square, 100ms, 10ms)	Test	10.00	± 9.6 %
10011	CAB	UMTS-FDD (WCDMA)	WCDMA	2.91	± 9.6 %
10012	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	WLAN	1.87	± 9.6 %
10013	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	WLAN	9.46	± 9.6 %
10021	DAC	GSM-FDD (TDMA, GMSK)	GSM	9.39	± 9.6 %
10023	DAC	GPRS-FDD (TDMA, GMSK, TN 0)	GSM	9.57	± 9.6 %
10024	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	GSM	6.56	± 9.6 %
10025	DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	GSM	12.62	± 9.6 %
10026	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	GSM	9.55	± 9.6 %
10027	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	GSM	4.80	± 9.6 %
10028	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	GSM	3.55	± 9.6 %
10029	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	GSM	7.78	± 9.6 %
10030	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	Bluetooth	5.30	± 9.6 %
10031	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	Bluetooth	1.87	± 9.6 %
10032	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	Bluetooth	1.16	± 9.6 %
10033	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	Bluetooth	7.74	± 9.6 %
10034	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	Bluetooth	4.53	± 9.6 %
10035	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	Bluetooth	3.83	± 9.6 %
10036	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	Bluetooth	8.01	± 9.6 %
10037	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	Bluetooth	4.77	± 9.6 %
10038	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	Bluetooth	4.10	± 9.6 %
10039	CAB	CDMA2000 (1xRTT, RC1)	CDMA2000	4.57	± 9.6 %
10042	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	AMPS	7.78	± 9.6 %
10044	CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	AMPS	0.00	± 9.6 %
10048	CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	DECT	13.80	± 9.6 %
10049	CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	DECT	10.79	± 9.6 %
10056	CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	TD-SCDMA	11.01	± 9.6 %
10058	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	GSM	6.52	± 9.6 %
10059	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	WLAN	2.12	± 9.6 %
10060	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	WLAN	2.83	± 9.6 %
10061	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	WLAN	3.60	± 9.6 %
10062	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	WLAN	8.68	± 9.6 %
10063	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	WLAN	8.63	± 9.6 %
10064	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	WLAN	9.09	± 9.6 %
10065	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	WLAN	9.00	± 9.6 %
10066	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	WLAN	9.38	± 9.6 %
10067	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	WLAN	10.12	± 9.6 %
10068	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	WLAN	10.24	± 9.6 %
10069	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	WLAN	10.56	± 9.6 %
10071	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	WLAN	9.83	± 9.6 %
10072	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	WLAN	9.62	± 9.6 %
10073	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	WLAN	9.94	± 9.6 %
10074	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	WLAN	10.30	± 9.6 %
10075	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	WLAN	10.77	± 9.6 %
10076	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	WLAN	10.94	± 9.6 %
10077	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	WLAN	11.00	± 9.6 %
10081	CAB	CDMA2000 (1xRTT, RC3)	CDMA2000	3.97	± 9.6 %
10082	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	AMPS	4.77	± 9.6 %
10090	DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	GSM	6.56	± 9.6 %
10097	CAB	UMTS-FDD (HSDPA)	WCDMA	3.98	± 9.6 %
10098	CAB	UMTS-FDD (HSUPA, Subtest 2)	WCDMA	3.98	± 9.6 %
10099	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	GSM	9.55	± 9.6 %
10100	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-FDD	5.67	± 9.6 %
10101	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	± 9.6 %
10102	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10103	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10104	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-TDD	9.97	± 9.6 %
10105	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-TDD	10.01	± 9.6 %
10108	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-FDD	5.80	± 9.6 %

Certificate No: EX3-7536_Jun20

Page 11 of 22



EX3DV4- SN:7536

June 22, 2020

10109	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10110	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-FDD	5.75	± 9.6 %
10111	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-FDD	6.44	± 9.6 %
10112	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-FDD	6.59	± 9.6 %
10113	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-FDD	6.62	± 9.6 %
10114	CAC	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	WLAN	8.10	± 9.6 %
10115	CAC	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	WLAN	8.46	± 9.6 %
10116	CAC	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	WLAN	8.15	± 9.6 %
10117	CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	WLAN	8.07	± 9.6 %
10118	CAC	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	WLAN	8.59	± 9.6 %
10119	CAC	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	WLAN	8.13	± 9.6 %
10140	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-FDD	6.49	± 9.6 %
10141	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-FDD	6.53	± 9.6 %
10142	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10143	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-FDD	6.35	± 9.6 %
10144	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-FDD	6.65	± 9.6 %
10145	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-FDD	5.76	± 9.6 %
10146	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.41	± 9.6 %
10147	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.72	± 9.6 %
10149	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	± 9.6 %
10150	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10151	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-TDD	9.28	± 9.6 %
10152	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-TDD	9.92	± 9.6 %
10153	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-TDD	10.05	± 9.6 %
10154	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-FDD	5.75	± 9.6 %
10155	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10156	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-FDD	5.79	± 9.6 %
10157	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-FDD	6.49	± 9.6 %
10158	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-FDD	6.62	± 9.6 %
10159	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-FDD	6.56	± 9.6 %
10160	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-FDD	5.82	± 9.6 %
10161	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10162	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-FDD	6.58	± 9.6 %
10166	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-FDD	5.46	± 9.6 %
10167	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.21	± 9.6 %
10168	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.79	± 9.6 %
10169	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10170	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10171	AAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-FDD	6.49	± 9.6 %
10172	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10173	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10174	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10175	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10176	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10177	CAI	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10178	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10179	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10180	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10181	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10182	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10183	AAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10184	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10185	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-FDD	6.51	± 9.6 %
10186	AAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10187	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10188	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10189	AAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10193	CAC	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	WLAN	8.09	± 9.6 %
10194	CAC	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	WLAN	8.12	± 9.6 %
10195	CAC	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	WLAN	8.21	± 9.6 %
10196	CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	WLAN	8.10	± 9.6 %
10197	CAC	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	WLAN	8.13	± 9.6 %
10198	CAC	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	WLAN	8.27	± 9.6 %
10219	CAC	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	WLAN	8.03	± 9.6 %



EX3DV4- SN:7536

June 22, 2020

10220	CAC	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	WLAN	8.13	± 9.6 %
10221	CAC	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	WLAN	8.27	± 9.6 %
10222	CAC	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	WLAN	8.06	± 9.6 %
10223	CAC	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	WLAN	8.48	± 9.6 %
10224	CAC	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	WLAN	8.08	± 9.6 %
10225	CAB	UMTS-FDD (HSPA+)	WCDMA	5.97	± 9.6 %
10226	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.49	± 9.6 %
10227	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.26	± 9.6 %
10228	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-TDD	9.22	± 9.6 %
10229	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10230	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10231	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-TDD	9.19	± 9.6 %
10232	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10233	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10234	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10235	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10236	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10237	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10238	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10239	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10240	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10241	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.82	± 9.6 %
10242	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-TDD	9.86	± 9.6 %
10243	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-TDD	9.46	± 9.6 %
10244	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10245	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-TDD	10.06	± 9.6 %
10246	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-TDD	9.30	± 9.6 %
10247	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-TDD	9.91	± 9.6 %
10248	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-TDD	10.09	± 9.6 %
10249	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10250	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-TDD	9.81	± 9.6 %
10251	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-TDD	10.17	± 9.6 %
10252	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10253	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-TDD	9.90	± 9.6 %
10254	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-TDD	10.14	± 9.6 %
10255	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-TDD	9.20	± 9.6 %
10256	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.96	± 9.6 %
10257	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.08	± 9.6 %
10258	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-TDD	9.34	± 9.6 %
10259	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-TDD	9.98	± 9.6 %
10260	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-TDD	9.97	± 9.6 %
10261	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10262	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-TDD	9.83	± 9.6 %
10263	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-TDD	10.16	± 9.6 %
10264	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-TDD	9.23	± 9.6 %
10265	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-TDD	9.92	± 9.6 %
10266	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-TDD	10.07	± 9.6 %
10267	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-TDD	9.30	± 9.6 %
10268	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10269	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-TDD	10.13	± 9.6 %
10270	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-TDD	9.58	± 9.6 %
10274	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	WCDMA	4.87	± 9.6 %
10275	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	WCDMA	3.96	± 9.6 %
10277	CAA	PHS (QPSK)	PHS	11.81	± 9.6 %
10278	CAA	PHS (QPSK, BW 884MHz, Rolloff 0.5)	PHS	11.81	± 9.6 %
10279	CAA	PHS (QPSK, BW 884MHz, Rolloff 0.38)	PHS	12.18	± 9.6 %
10290	AAB	CDMA2000, RC1, SO55, Full Rate	CDMA2000	3.91	± 9.6 %
10291	AAB	CDMA2000, RC3, SO55, Full Rate	CDMA2000	3.46	± 9.6 %
10292	AAB	CDMA2000, RC3, SO32, Full Rate	CDMA2000	3.39	± 9.6 %
10293	AAB	CDMA2000, RC3, SO3, Full Rate	CDMA2000	3.50	± 9.6 %
10295	AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	CDMA2000	12.49	± 9.6 %
10297	AAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-FDD	5.81	± 9.6 %
10298	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10299	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-FDD	6.39	± 9.6 %

Certificate No: EX3-7536_Jun20

Page 13 of 22