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Report On

Specific Absorption Rate Testing of the
Axnes AS, PNG MP50 Transceiver,
UHF 405-470 MHz Band.

FCC ID: 2AOHP MP50A

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REPORT ON

Specific Absorption Rate Testing of the
Axnes AS, PNG MP50 Transceiver,
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Document 75940027 Report 06 Issue 1

January 2019

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16 January 2019

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SECTION 1

REPORT SUMMARY

Specific Absorption Rate Testing of the
Axnes AS, PNG MP50 Transceiver,
UHF 405-470 MHz Band.

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Specific Absorption Rate Testing of the Axnes AS, PNG MP50, UHF 405-470 MHz Band to the requirements 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	Axnes AS
Manufacturer	Axnes AS
Manufacturing Description	PNG MP50 Transceiver, component used in the PNG wireless intercom system
Model Number	PNG MP50
Serial/IMEI Number(s)	000 451
Number of Samples Tested	1
Hardware Version	R13
Software Version	AXS-SW-0221
Test Specification/Issue/Date	KDB 447498 D01 v06 General RF Exposure Guidance
Start of Test	01 November 2017
Finish of Test	01 November 2017
Related Document(s)	FCC 47CFR 2.1093: 2016 KDB 865664 – D01 v01r04 KDB 865664 – D02 v01r02 KDB 648474 – D04 v01r03 KDB 643646 – D01 v01r03 IEEE 1528 - 2013
Name of Engineer(s)	Stephen Dodd

1.2 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) Head	**0.08** (Measured)	**0.33** (Scaled)
Max 1g SAR (W/kg) Body	**0.12** (Measured)	**0.46** (Scaled)
The maximum 1g volume averaged SAR level measured for all the tests performed did not exceed the limits for General Population/Uncontrolled Exposure (W/kg) Partial Body of 1.6 W/kg.		

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1.3 TEST RESULTS SUMMARY

1.3.1 System Performance / Validation Check Results

Prior to formal testing being performed a System Check was performed in accordance with KDB 865664 and the results were compared against published data in Standard IEEE 1528-2013. The following results were obtained: -

System performance / Validation results

Date	Fluid and Frequency (MHz)	Max 1g SAR (W/kg)*	Percentage Drift on Reference
01/11/2017	Body 450	4.34	-7.46
01/11/2017	Head 450	4.58	0.00

*Normalised to a forward power of 1W

1.3.2 Results Summary Tables

Low Range Antenna 390 – 430 MHz (AXS-ANT-0300): PTT Front Of Face Specific Absorbtion 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)	75 % Duty Factor Scaled 1g SAR (W/kg)	Scan Figure Number
25mm Front Face	F5	425.0	26.50	27.00	0.04	0.04	0.17	Figure 2
Limit for General Population (Uncontrolled Exposure) 1.6 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: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz KDB 447498 D01 Section 6.1 A duty factor of 75% may be applied for PTT radios with voice activated transmission capabilities to avoid the justification required for using a lower duty factor than what is supported by certain features built-in within the radio.								

Mid Range Antenna 410 - 450 MHz (AXS-ANT-0310): PTT Front Of Face Specific Absorbtion 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)	75 % Duty Factor Scaled 1g SAR (W/kg)	Scan Figure Number
25mm Front Face	F8	437.5	26.65	27.00	0.08	0.09	**0.33**	Figure 3
Limit for General Population (Uncontrolled Exposure) 1.6 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: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz KDB 447498 D01 Section 6.1 A duty factor of 75% may be applied for PTT radios with voice activated transmission capabilities to avoid the justification required for using a lower duty factor than what is supported by certain features built-in within the radio.								

High Range Antenna 430 - 470 MHz (AXS-ANT-0320): PTT Front Of Face Specific Absorbtion 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)	75 % Duty Factor Scaled 1g SAR (W/kg)	Scan Figure Number
25mm Front Face	F9	452.5	26.90	27.00	0.07	0.07	0.27	Figure 4
Limit for General Population (Uncontrolled Exposure) 1.6 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: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz KDB 447498 D01 Section 6.1 A duty factor of 75% may be applied for PTT radios with voice activated transmission capabilities to avoid the justification required for using a lower duty factor than what is supported by certain features built-in within the radio.								

Low Range Antenna 390 – 430 MHz (AXS-ANT-0300): Body Specific Absorbtion 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)	75 % Duty Factor Scaled 1g SAR (W/kg))	Scan Figure Number
5mm Front Facing	F5	425.0	26.50	27.00	0.07	0.08	0.29	Figure 5
5mm Rear Facing	F5	425.0	26.50	27.00	0.07	0.08	0.29	Figure 6
5mm Left Edge	F5	425.0	26.50	27.00	0.07	0.08	0.29	Figure 7
Limit for General Population (Uncontrolled Exposure) 1.6 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: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz KDB 447498 D01 Section 6.1 A duty factor of 75% may be applied for PTT radios with voice activated transmission capabilities to avoid the justification required for using a lower duty factor than what is supported by certain features built-in within the radio.								

Mid Range Antenna 410 - 450 MHz (AXS-ANT-0310): Body Specific Absorbtion 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)	75 % Duty Factor Scaled 1g SAR (W/kg)	Scan Figure Number
5mm Front Facing	F8	437.5	26.65	27.00	0.11	0.12	0.45	Figure 8
5mm Rear Facing	F8	437.5	26.65	27.00	0.11	0.12	0.45	Figure 9
5mm Left Edge	F8	437.5	26.65	27.00	0.11	0.12	0.45	Figure 10
Limit for General Population (Uncontrolled Exposure) 1.6 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: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz KDB 447498 D01 Section 6.1 A duty factor of 75% may be applied for PTT radios with voice activated transmission capabilities to avoid the justification required for using a lower duty factor than what is supported by certain features built-in within the radio.								

High Range Antenna 430 - 470 MHz (AXS-ANT-0320): Body Specific Absorbtion 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)	75% Duty Factor Scaled 1g SAR (W/kg)	Scan Figure Number
5mm Front Facing	F9	452.5	26.90	27.00	0.10	0.10	0.38	Figure 11
5mm Rear Facing	F9	452.5	26.90	27.00	0.10	0.10	0.38	Figure 12
5mm Left Edge	F9	452.5	26.90	27.00	0.12	0.12	**0.46**	Figure 13
Limit for General Population (Uncontrolled Exposure) 1.6 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: ≤ 0.8W/kg when the transmission band is ≤ 100MHz ≤ 0.6W/kg when the transmission band is between 100MHz and 200MHz ≤ 0.4W/kg when the transmission band is ≥ 200MHz KDB 447498 D01 Section 6.1 A duty factor of 75% may be applied for PTT radios with voice activated transmission capabilities to avoid the justification required for using a lower duty factor than what is supported by certain features built-in within the radio.								

1.3.3 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:

[(*max power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] [√f (GHz)]* ≤ 3.0, where

- f (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.

Frequency (MHz)	Power (dBm)	Power (mW)	Test Position	Distance (mm)	Threshold	Test Exclusion
425.0	27.0	501.2	Head	25	13.1	No
437.5	27.0	501.2	Head	25	13.3	No
452.5	27.0	501.2	Head	25	13.5	No
425.0	27.0	501.2	Body	5	65.3	No
437.5	27.0	501.2	Body	5	66.3	No
452.5	27.0	501.2	Body	5	67.4	No

1.3.4 Technical Description

The equipment under test (EUT) was a Axnes AS, PNG MP50 Transceiver, a component used in the PNG wireless intercom system. The MP50 Transceiver operates in the VHF frequency band for maritime use (156-163 MHz) and in the UHF frequency band (405-470 MHz) when used by aircraft crew members. The transceiver supports GPS. The radio is mainly used via a headset or helmet but can be used in the front-of-face configuration. The radio is also capable of operating as an AIS alerting device. A full technical description can be found in the manufacturer’s documentation.

1.3.5 Test Configuration and Modes of Operation

The testing was performed with an integral battery supplied and manufactured by Axnes AS. The battery was fully charged before each measurement and there were no external connections.

For front of face - PTT head SAR assessment, testing was performed with the device in the declared normal position of operation for the 405 – 470 MHz frequency band, which was tested over three different ranges as dictated by the three supplied antennas at maximum power. The device was placed at a distance of 25 mm from the bottom of the Elliptical Flat Phantom for all PTT testing. 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 head simulant liquid. The dielectric properties were in accordance with the requirements specified in KDB 865665.

For body SAR assessment of the 405 – 470 MHz frequency band, which was tested over three different ranges as dictated by the three supplied antennas at maximum power, as no body worn accessories are supplied with the EUT, testing was performed on the front, rear and left hand surface of the device as these surfaces were within 25 mm proximity of the antenna. The device was placed at a distance of 5 mm from the bottom of the Elliptical Flat Phantom for all body testing. 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 in accordance with the requirements specified in KDB 865665.

The MP50 cannot transmit without the BST50 base station present as timing and timeslot allocations are handled by the BST50 so the CP50 control panel and base station were positioned outside the test chamber with its antenna in the chamber. In order for the handset to transmit at full power a step attenuator was used between the base station main unit and the base station antenna to simulate a virtual distance. The attenuaton level was increased until the MP50 transciever was transmitting at full power with the basestation still receiving a stable signal. The received signal was monitored on the CP50 control panel display. Prior to SAR evaluations the power levels were measured to ensure the EUT was transmitting at the maximum level.

The three antenna variants and frequency ranges used over the 405 – 470 MHz frequency band, are tabulated below.

Antenna	Frequency Range	Part Number
Low Range Antenna	390 - 430 MHz	AXS-ANT-0300
Mid Range Antenna	410 - 450 MHz	AXS-ANT-0310
High Range Antenna	430 - 470 MHz	AXS-ANT-0320

Testing was performed in each position on the channel that gave the highest output power for each antenna frequency range.

As the EUT has voice activated transmission capabilities a 75 % duty factor scaling was applied as per KDB 447498 D01 section 6.1

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.

1.4 FCC POWER MEASUREMENTS

1.4.1 Method

Conducted power measurements were made using a power meter.

1.4.2 Conducted Power Measurements

Mode	Channel	Frequency (MHz)	Duty Cycle (%)	Burst Average Power (dBm)	Tune -Up-Value (dBm)
Voice	F1	405.0125	20	26.42	27.00
Voice	F2	410.0000	20	26.45	27.00
Voice	F3	414.9875	20	26.45	27.00
Voice	F4	415.0125	20	26.47	27.00
Voice	F5	425.0000	20	26.50	27.00
Voice	F6	434.9875	20	26.58	27.00
Voice	F7	435.0125	20	26.60	27.00
Voice	F8	437.5000	20	26.65	27.00
Voice	F9	452.5000	20	26.90	27.00
Voice	FA	469.9875	20	26.45	27.00

SECTION 2

TEST DETAILS

Specific Absorption Rate Testing of the
Axnes AS, PNG MP50 Transceiver,
UHF 405-470 MHz Band.

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2.1 DASY5 MEASUREMENT SYSTEM

2.1.1 System Description

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

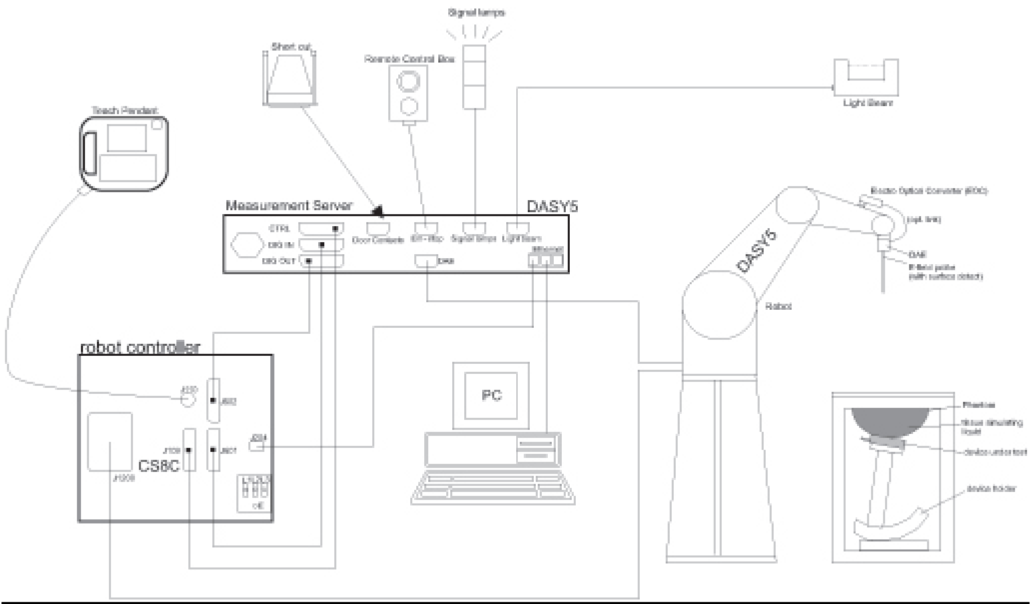

Figure 1 System Description Diagram

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.

A computer running Win7 professional operating system and the DASY5 software.

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.

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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 200MOhm; 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 [1].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, non physical 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 Spacial 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 cantered 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 centred 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 centred 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 centred 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 centred 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.

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2.2 FRONT OF FACE - PTT - HEAD SAR TEST RESULTS

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	21.3 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	48.5 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	0.891 S/m
DUT CONFIGURATION:	Low range antenna (AXS-ANT-0300)	**RELATIVE PERMITTIVITY:**	55.505 ε_r
DUT POSITION:	25mm - Front Face	**LIQUID TEMPERATURE:**	20.3 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	425.0 MHz	**DRIFT:**	0.01 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.06 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.17 W/kg

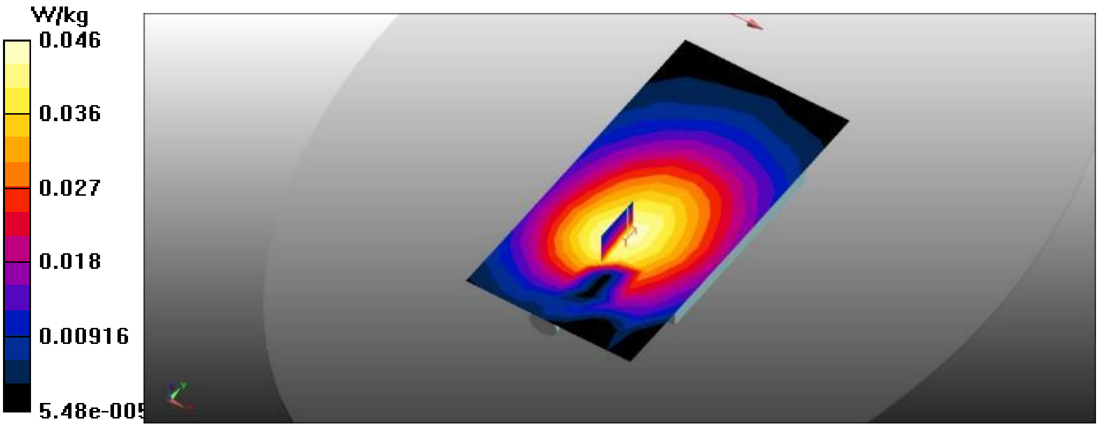

Figure 2: SAR Head Testing Results for PNG MP50 Transceiver at 425.0 MHz.

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	21.3 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	48.5 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	0.902 S/m
DUT CONFIGURATION:	Mid range antenna (AXS-ANT-0310)	**RELATIVE PERMITTIVITY:**	55.267 ε_r
DUT POSITION:	25mm - Front Face	**LIQUID TEMPERATURE:**	20.3 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	437.5 MHz	**DRIFT:**	0.16 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.10 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.33 W/kg

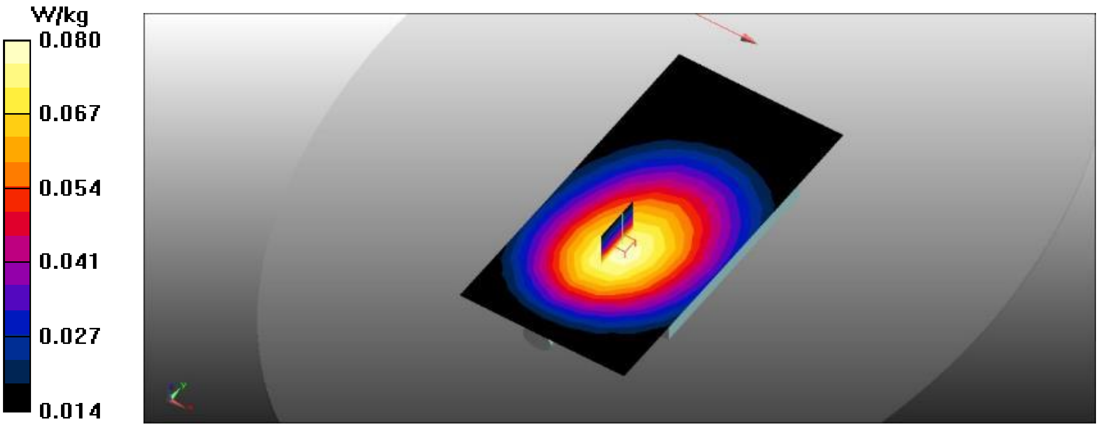

Figure 3: SAR Head Testing Results for PNG MP50 Transceiver at 437.5 MHz.

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SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	21.3 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	48.5 %
PHANTOM:	QD OVA 004 Ax	**CONDUCTIVITY:**	0.915 S/m
DUT CONFIGURATION:	High range antenna (AXS-ANT-0320)	**RELATIVE PERMITTIVITY:**	54.993 ε_r
DUT POSITION:	25mm - Front Face	**LIQUID TEMPERATURE:**	20.3 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	452.5 MHz	**DRIFT:**	-0.03 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.09 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.27 W/kg

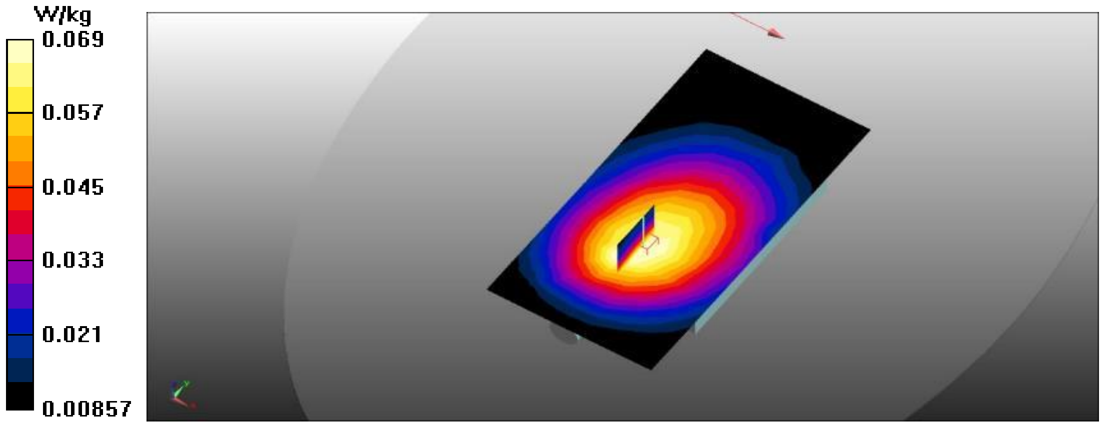

Figure 4: SAR Head Testing Results for PNG MP50 Transceiver at 452.5 MHz.

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2.3 BODY SAR TEST RESULTS

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	20.8 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	46.2 %
PHANTOM:	QDOVA003-FB	**CONDUCTIVITY:**	0.891 S/m
DUT CONFIGURATION:	Low range antenna (AXS-ANT-0300)	**RELATIVE PERMITTIVITY:**	55.505 ε_r
DUT POSITION:	5mm - Front Facing	**LIQUID TEMPERATURE:**	20.0 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	425.0 MHz	**DRIFT:**	0.06 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.10 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.29 W/kg

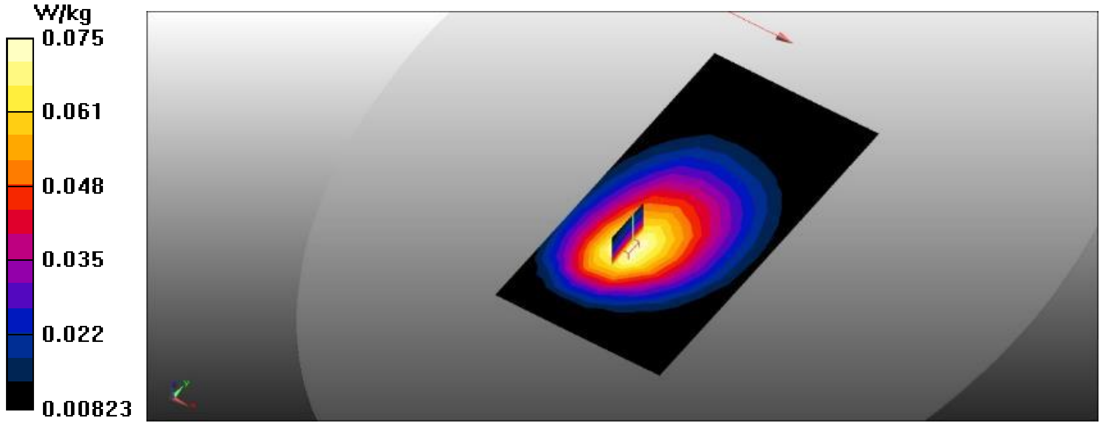

Figure 5: SAR Body Testing Results for PNG MP50 Transceiver at 425.0 MHz.

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	20.8 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	46.2 %
PHANTOM:	QDOVA003-FB	**CONDUCTIVITY:**	0.891 S/m
DUT CONFIGURATION:	Low range antenna (AXS-ANT-0300)	**RELATIVE PERMITTIVITY:**	55.505 ε_r
DUT POSITION:	5mm - Rear Facing	**LIQUID TEMPERATURE:**	20.0 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	425.0 MHz	**DRIFT:**	0.06 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.09 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.29 W/kg

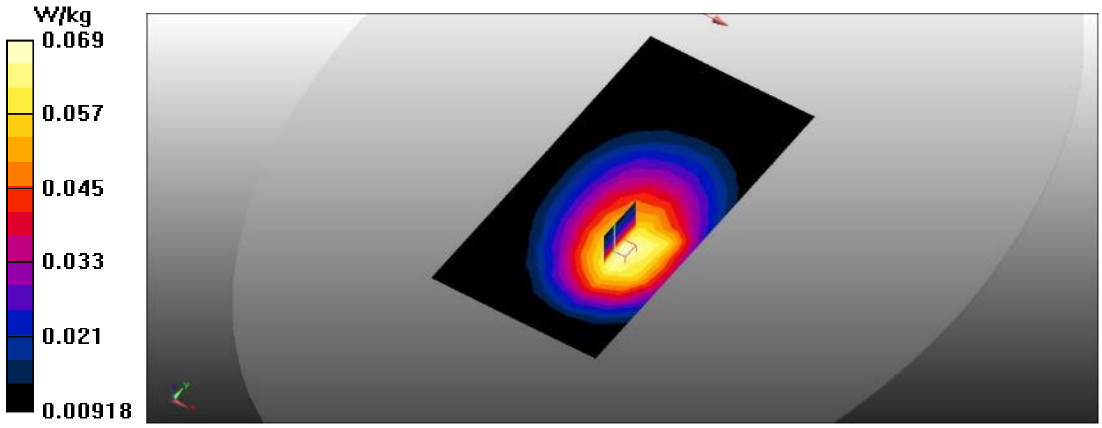

Figure 6: SAR Body Testing Results for PNG MP50 Transceiver at 425.0 MHz.

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	20.8 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	46.2 %
PHANTOM:	QDOVA003-FB	**CONDUCTIVITY:**	0.891 S/m
DUT CONFIGURATION:	Low range antenna (AXS-ANT-0300))	**RELATIVE PERMITTIVITY:**	55.505 ε_r
DUT POSITION:	5mm - Left Edge	**LIQUID TEMPERATURE:**	20.0 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	425.0 MHz	**DRIFT:**	-0.01 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.10 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.29 W/kg

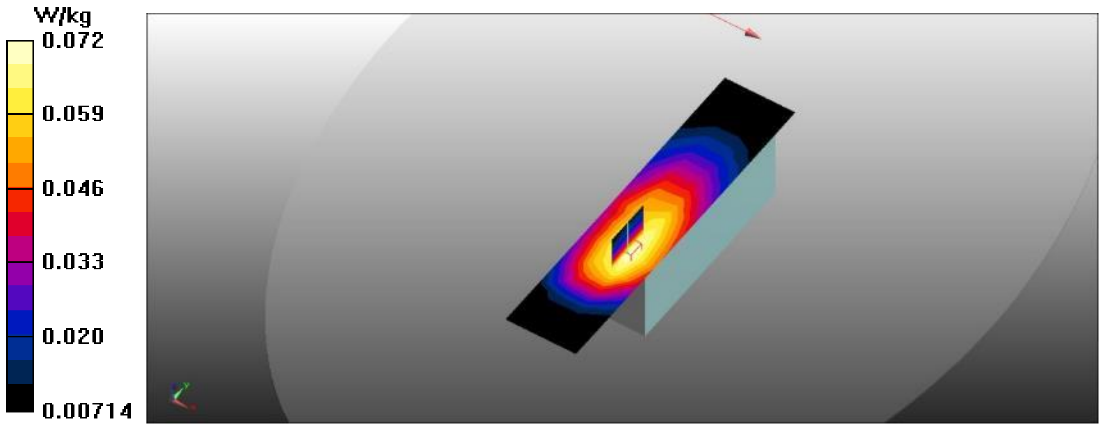

Figure 7: SAR Body Testing Results for PNG MP50 Transceiver at 425.0 MHz.

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	20.8 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	46.2 %
PHANTOM:	QDOVA003-FB	**CONDUCTIVITY:**	0.902 S/m
DUT CONFIGURATION:	Mid range antenna (AXS-ANT-0310)	**RELATIVE PERMITTIVITY:**	55.267 ε_r
DUT POSITION:	5mm - Front Facing	**LIQUID TEMPERATURE:**	20.0 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	437.5 MHz	**DRIFT:**	0.01 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.15 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.45 W/kg

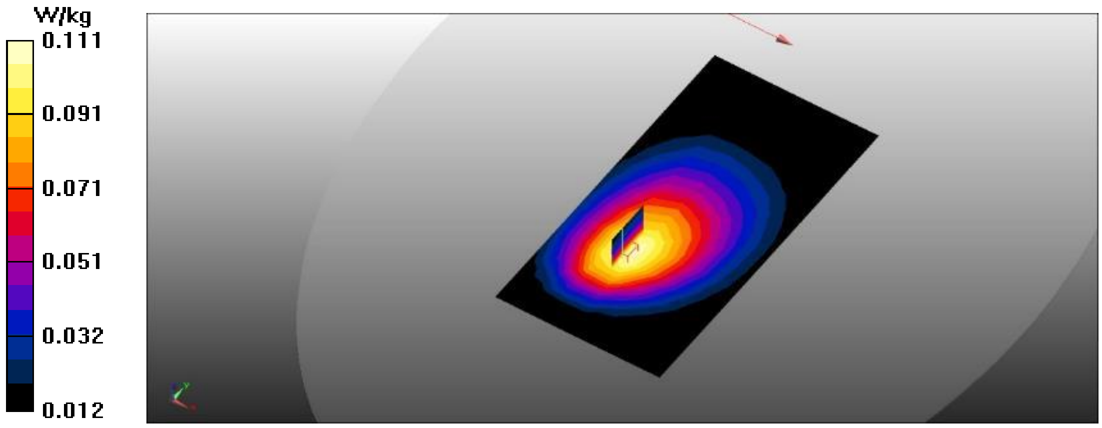

Figure 8: SAR Body Testing Results for PNG MP50 Transceiver at 437.5 MHz.

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	20.8 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	46.2 %
PHANTOM:	QDOVA003-FB	**CONDUCTIVITY:**	0.902 S/m
DUT CONFIGURATION:	Mid range antenna (AXS-ANT-0310)	**RELATIVE PERMITTIVITY:**	55.267 ε_r
DUT POSITION:	5mm - Rear Facing	**LIQUID TEMPERATURE:**	20.0 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	437.5 MHz	**DRIFT:**	0.04 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.16 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.45 W/kg

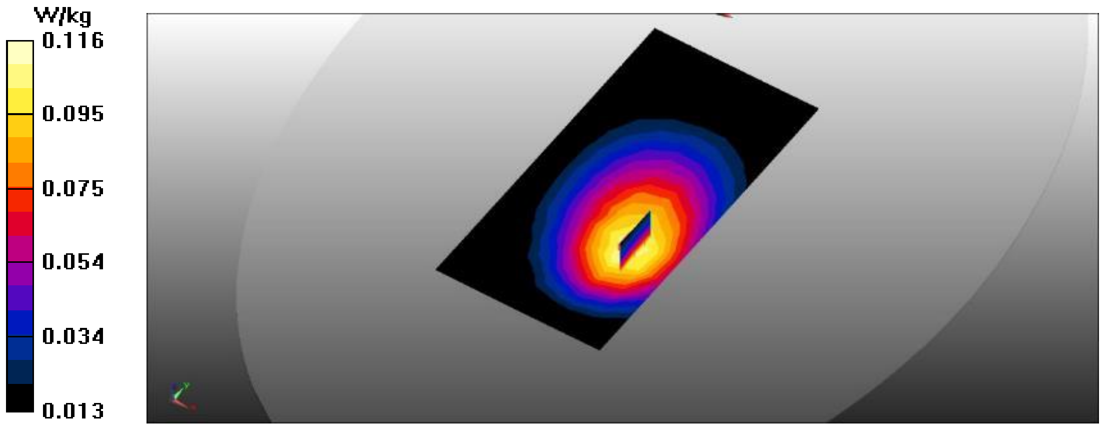

Figure 9: SAR Body Testing Results for PNG MP50 Transceiver at 437.5 MHz.

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	20.8 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	46.2 %
PHANTOM:	QDOVA003-FB	**CONDUCTIVITY:**	0.902 S/m
DUT CONFIGURATION:	Mid range antenna (AXS-ANT-0310)	**RELATIVE PERMITTIVITY:**	55.267 ε_r
DUT POSITION:	5mm - Left Edge	**LIQUID TEMPERATURE:**	20.0 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	437.5 MHz	**DRIFT:**	0.01 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.16 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.45 W/kg

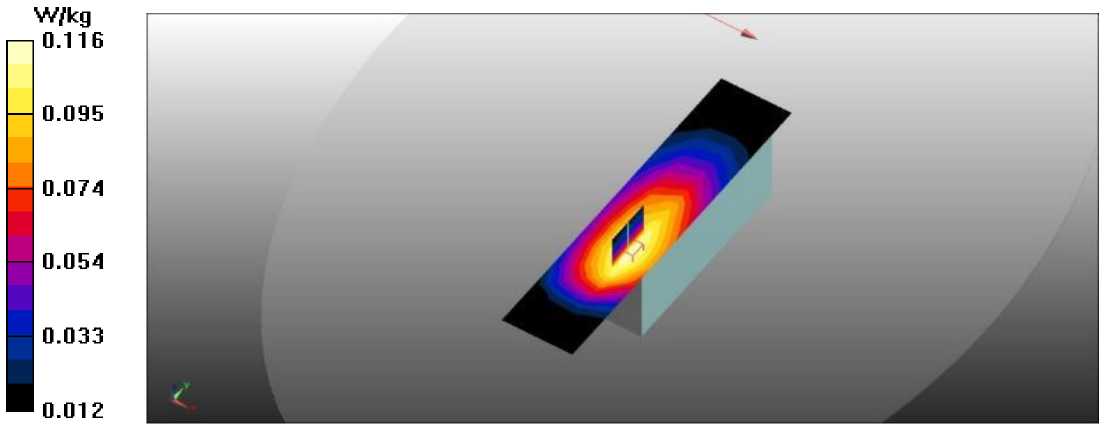

Figure 10: SAR Body Testing Results for PNG MP50 Transceiver at 437.5 MHz.

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	20.8 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	46.2 %
PHANTOM:	QDOVA003-FB	**CONDUCTIVITY:**	0.915 S/m
DUT CONFIGURATION:	High range antenna (AXS-ANT-0320)	**RELATIVE PERMITTIVITY:**	54.993 ε_r
DUT POSITION:	5mm - Front Facing	**LIQUID TEMPERATURE:**	20.0 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	452.5 MHz	**DRIFT:**	0.12 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.15 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.38 W/kg

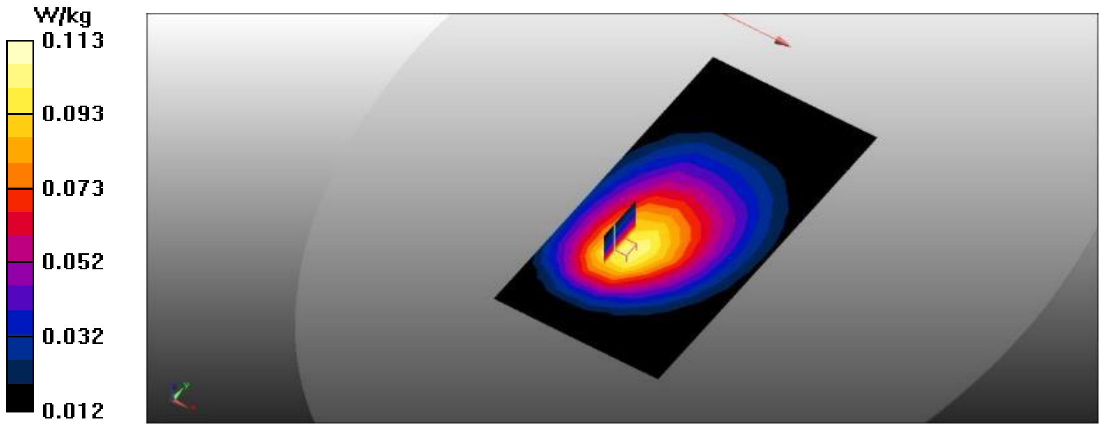

Figure 11: SAR Body Testing Results for PNG MP50 Transceiver at 452.5 MHz.

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	20.8 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	46.2 %
PHANTOM:	QDOVA003-FB	**CONDUCTIVITY:**	0.915 S/m
DUT CONFIGURATION:	High range antenna (AXS-ANT-0320)	**RELATIVE PERMITTIVITY:**	54.993 ε_r
DUT POSITION:	5mm - Rear Facing	**LIQUID TEMPERATURE:**	20.0 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	452.5 MHz	**DRIFT:**	-0.12 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.15 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.38 W/kg

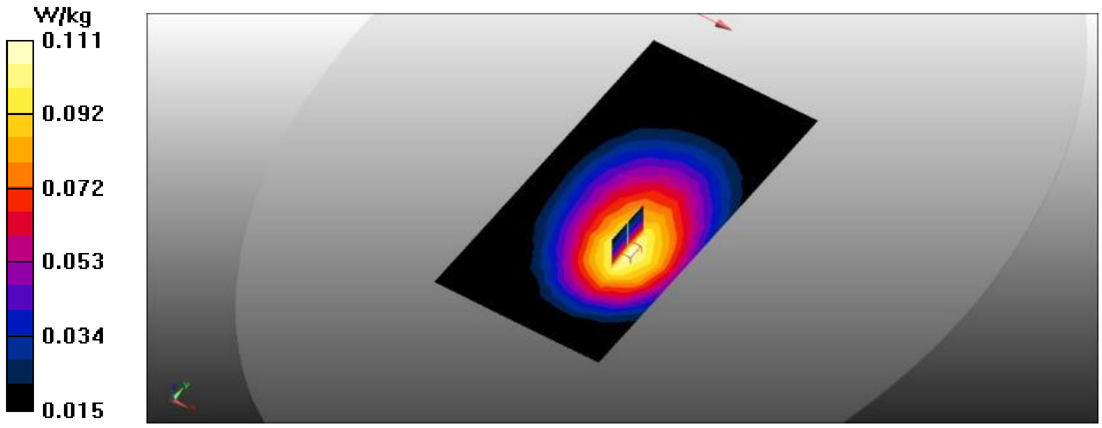

Figure 12: SAR Body Testing Results for PNG MP50 Transceiver at 452.5 MHz.

Product Service

SOFTWARE VERSION:	52.8.8(1258)	**AMBIENT TEMPERATURE:**	20.8 °C
DATE:	01/11/2017	**RELATIVE HUMIDITY:**	46.2 %
PHANTOM:	QDOVA003-FB	**CONDUCTIVITY:**	0.915 S/m
DUT CONFIGURATION:	High range antenna (AXS-ANT-0320)	**RELATIVE PERMITTIVITY:**	54.993 ε_r
DUT POSITION:	5mm - Left Edge	**LIQUID TEMPERATURE:**	20.0 °C
RAT:	N/A	**SCAN TYPE:**	Full
FREQUENCY:	452.5 MHz	**DRIFT:**	-0.06 dB
MODULATION:	16 QAM	**PEAK SAR:**	0.17 W/kg
DUTY CYCLE:	20 %	**SCALED SAR (1g):**	0.46 W/kg

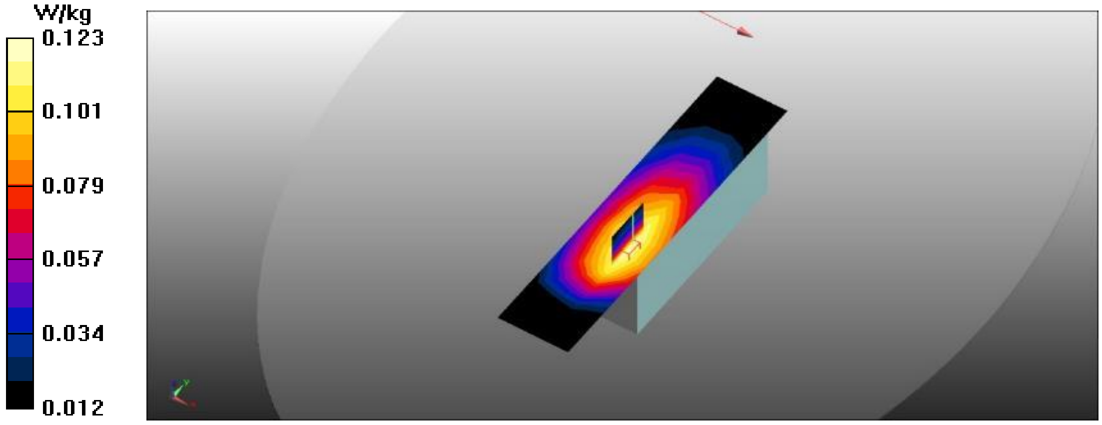

Figure 13: SAR Body Testing Results for PNG MP50 Transceiver at 452.5 MHz.

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

The following test equipment was used at TÜV SÜD Product Service:

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Signal Generator	Hewlett Packard	ESG4000A	61	12	14-July-2018
10MHz - 2.5GHz, 3W, Amplifier	Vectawave Technology	VTL5400	51	-	TU
Thermometer	Digitron	T208	64	12	18-May-2018
Thermocouple (Type K)	TUV SUD Product Service	TYPE K	65	12	18-May-2018
Power Sensor	Rohde & Schwarz	NRV-Z1	178	12	08-Jun-2018
Attenuator (30dB, 100W)	Weinschel	48-30-43	4863	12	03-May-2018
Cable (1m N(m) - N(m))	Reynolds	269-0088-1000	2397	-	O/P Mon
Cable (2m, SMA-SMA)	Reynolds	262-0248-2000	2400	-	O/P Mon
Directional Coupler	Narda	3020A	0419	-	O/P Mon
Hygrometer	Rotronic	I-1000	2784	12	04-May-2018
Power Meter	Rohde & Schwarz	NRVD	2979	12	08-Jun-2018
Power Sensor	Rohde & Schwarz	NRV-Z1	3563	12	08-Jun-2018
Power Sensor	Rohde & Schwarz	NRV-Z1	178	12	08-Jun-2018
SAR phone holder	Speag	n/a	3870	-	TU
Data Acquisition Electronics	Speag	DAE 4 - SD 000 D04 BM	4689	12	12-Dec-2017
Measurement Server	Speag	DASY 5 Measurement Server	4692	-	TU
Dosimetric SAR Probe	Speag	EX3DV4	4700	12	16-Dec-2017
Mounting Platform for TX90XL Robot and Phantoms	Speag	MP6C-TX90XL Mounting Platform Extended	4702	-	TU
Robot	Speag	TX90 XLspeag Robot	4704	-	TU
Eliptical Phantom	Speag	ELI v8.0	4833	-	TU
Eliptical Phantom	Speag	ELI v6.0	4699	-	TU
450MHz Dipole	Speag	D450v3	4796	12	08-Dec-2017
MSL450 Body Fluid	Speag	Batch 1	N/A	1 week	06-Nov -2017
HSL450 Head Fluid	Speag	Batch 1	N/A	1 week	06-Nov -2017
Step Attenuator	Hewlett Packard	11713A	0116	-	TU
Atteuator	Hewlett Packard	8494H	2785	-	TU
Atteuator	Hewlett Packard	8494H	2786	-	TU

TU = Traceability Unscheduled
O/P Mon = Output Monitored

Product Service

3.2 TEST SOFTWARE

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

Instrument	Version Number
DASY system	52.8.8(1258)

3.3 DIELECTRIC PROPERTIES OF SIMULANT LIQUIDS

The fluid properties of the simulant fluids used during routine SAR evaluation meet the dielectric properties required KDB 865665.

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

Fluid Type and Frequency	Relative Permittivity Target	Relative Permittivity Measured	Conductivity Target	Conductivity Measured
Head 450 MHz	43.50	47.07	0.87	0.88
Body 450 MHz	56.70	55.04	0.94	0.91

Product Service

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 20.8°C to 21.3°C.
The actual humidity during the testing ranged from 46.2% to 48.5% RH.

3.4.2 Test Fluid Temperature Range

Frequency	Body / Head Fluid	Min Temperature °C	Max Temperature °C
450 MHz	Head	20.3	20.3
450 MHz	Body	20.0	20.0

3.4.3 SAR Drift

The SAR Drift was within acceptable limits during scans. The maximum SAR Drift was recorded as 0.160 dB for head and 0.120 dB for body.

3.5 MEASUREMENT UNCERTAINTY

Head, Full SAR Measurements, 300 MHz to 3 GHz Using Probe EX3DV4 - SN3759

Source of Uncertainty	Uncertainty ± %	Probability distribution	Div	c_i (1g)	Standard Uncertainty ± % (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	0.1	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**			10.8	361
Expanded Standard Uncertainty		**K=2**			21.5	

Product Service

Body, Full SAR Measurements, 300 MHz to 3 GHz Using Probe EX3DV4 - SN3759

Source of Uncertainty	Uncertainty ± %	Probability distribution	Div	c_i (1g)	Standard Uncertainty ± % (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	0.1	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**			10.8	361
Expanded Standard Uncertainty		**K=2**			21.5	

Product Service

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

Product Service

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

UKAS
TESTING
0141

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).

ANNEX A

PROBE CALIBRATION REPORT

TÜV SÜD Product Service

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**

Client **TüV SÜD UK**

Certificate No: **EX3-3759_Dec16**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3759
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	December 16, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	7-Dec-16 (No. DAE4-660_Dec16)	Dec-17
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: December 19, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Product Service

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
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,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., ϑ = 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:

a) 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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) 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
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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*.
- *DCPx,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
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,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 ≤ 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 *NORMx,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 *NORMx* (no uncertainty required).

Product Service

Probe EX3DV4

SN:3759

Manufactured: March 16, 2010
Calibrated: December 16, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

Product Service

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3759

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.47	0.42	0.45	± 10.1 %
DCP (mV)[B]	101.1	99.1	101.2	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	149.0	±3.5 %
		Y	0.0	0.0	1.0		147.4	
		Z	0.0	0.0	1.0		138.4	

Note: For details on UID parameters see Appendix.

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	45.34	339.8	35.83	13.18	1.015	4.992	0.942	0.363	1.005
Y	51.23	384.3	35.89	14.75	0.946	5.017	1.083	0.33	1.006
Z	48.36	361.1	35.6	14.31	1.297	4.99	0.629	0.453	1.004

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 E^2-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.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3759

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)
450	43.5	0.87	10.95	10.95	10.95	0.15	1.30	± 13.3 %
750	41.9	0.89	10.45	10.45	10.45	0.28	1.01	± 12.0 %
835	41.5	0.90	10.04	10.04	10.04	0.16	1.40	± 12.0 %
900	41.5	0.97	9.94	9.94	9.94	0.24	0.97	± 12.0 %
1640	40.3	1.29	8.63	8.63	8.63	0.19	0.80	± 12.0 %
1750	40.1	1.37	8.58	8.58	8.58	0.18	0.96	± 12.0 %
1900	40.0	1.40	8.32	8.32	8.32	0.14	0.86	± 12.0 %
2100	39.8	1.49	8.45	8.45	8.45	0.23	0.84	± 12.0 %
2300	39.5	1.67	7.80	7.80	7.80	0.15	1.07	± 12.0 %
2450	39.2	1.80	7.42	7.42	7.42	0.23	0.86	± 12.0 %
2600	39.0	1.96	7.16	7.16	7.16	0.20	1.08	± 12.0 %
5200	36.0	4.66	5.68	5.68	5.68	0.30	1.80	± 13.1 %
5300	35.9	4.76	5.46	5.46	5.46	0.30	1.80	± 13.1 %
5500	35.6	4.96	5.05	5.05	5.05	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.72	4.72	4.72	0.40	1.80	± 13.1 %
5800	35.3	5.27	5.02	5.02	5.02	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. 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.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3759

Calibration Parameter Determined in Body Tissue Simulating Media

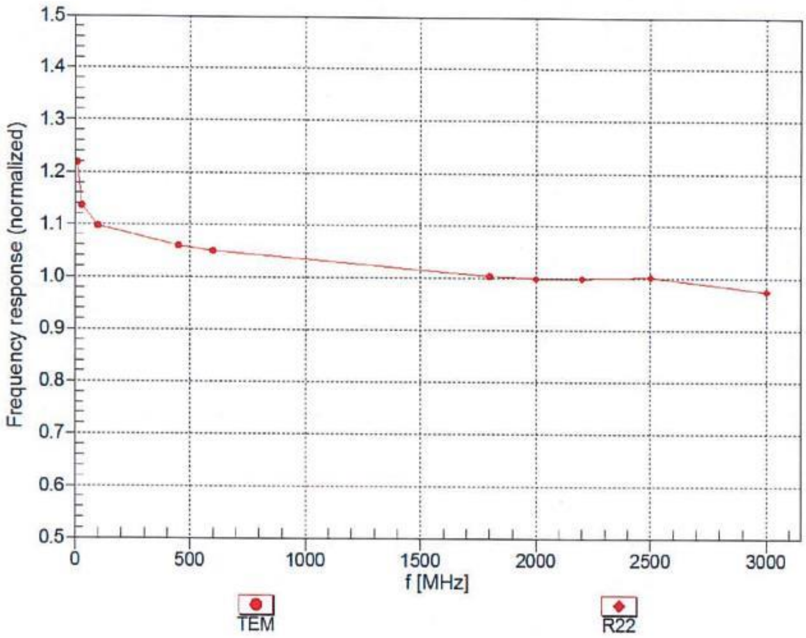
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
450	56.7	0.94	11.67	11.67	11.67	0.05	1.20	± 13.3 %
750	55.5	0.96	10.25	10.25	10.25	0.31	0.85	± 12.0 %
835	55.2	0.97	9.85	9.85	9.85	0.16	1.31	± 12.0 %
900	55.0	1.05	9.83	9.83	9.83	0.29	0.86	± 12.0 %
1640	53.8	1.40	8.63	8.63	8.63	0.26	0.80	± 12.0 %
1750	53.4	1.49	8.16	8.16	8.16	0.27	0.86	± 12.0 %
1900	53.3	1.52	7.87	7.87	7.87	0.21	0.96	± 12.0 %
2100	53.2	1.62	8.26	8.26	8.26	0.16	1.04	± 12.0 %
2300	52.9	1.81	7.56	7.56	7.56	0.29	0.80	± 12.0 %
2450	52.7	1.95	7.49	7.49	7.49	0.11	0.99	± 12.0 %
2600	52.5	2.16	7.31	7.31	7.31	0.14	1.10	± 12.0 %
5200	49.0	5.30	5.00	5.00	5.00	0.35	1.90	± 13.1 %
5300	48.9	5.42	4.78	4.78	4.78	0.35	1.90	± 13.1 %
5500	48.6	5.65	4.27	4.27	4.27	0.40	1.90	± 13.1 %
5600	48.5	5.77	3.98	3.98	3.98	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.20	4.20	4.20	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. 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.

Product Service

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)



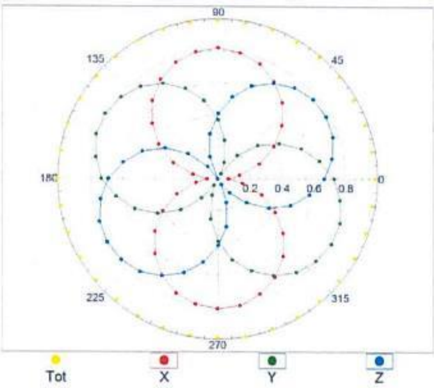
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

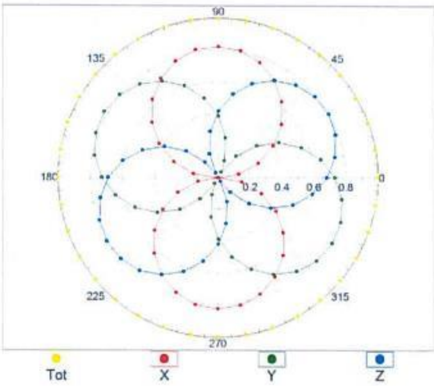
Product Service

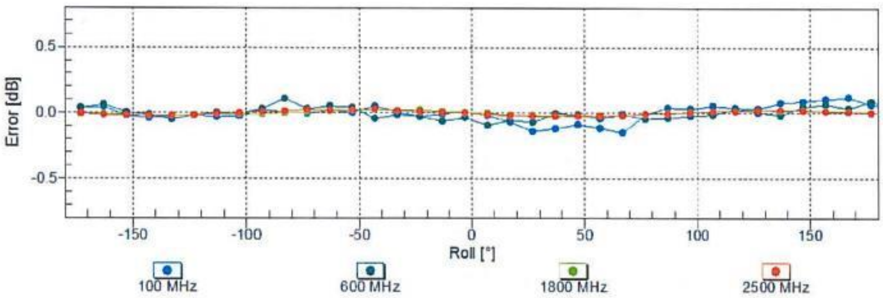
Receiving Pattern (φ), ϑ = 0°

f=600 MHz,TEM

f=1800 MHz,R22





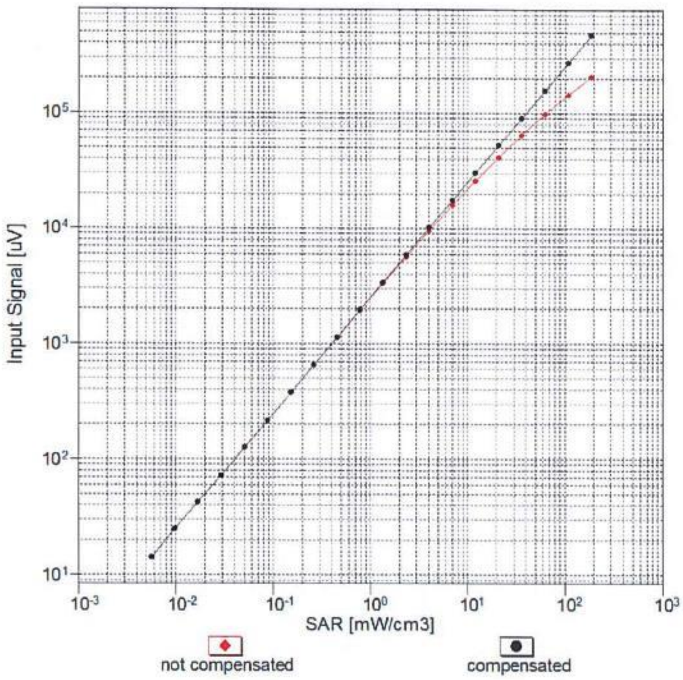


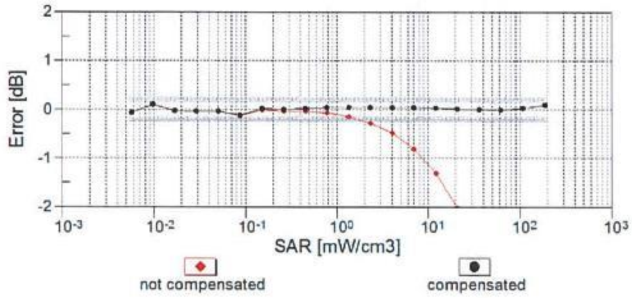
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Product Service

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)





Uncertainty of Linearity Assessment: ± 0.6% (k=2)

TÜV SÜD Product Service

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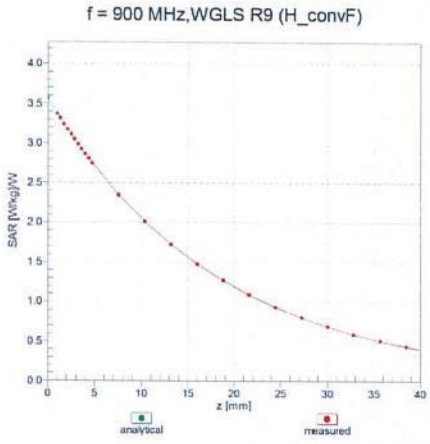
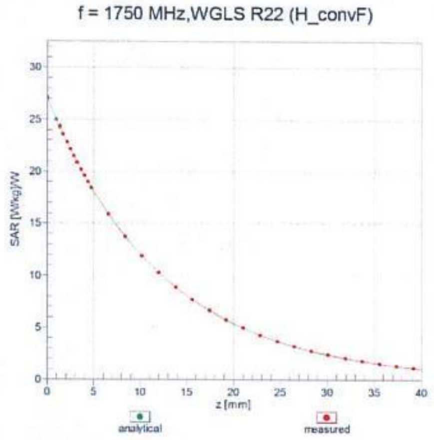
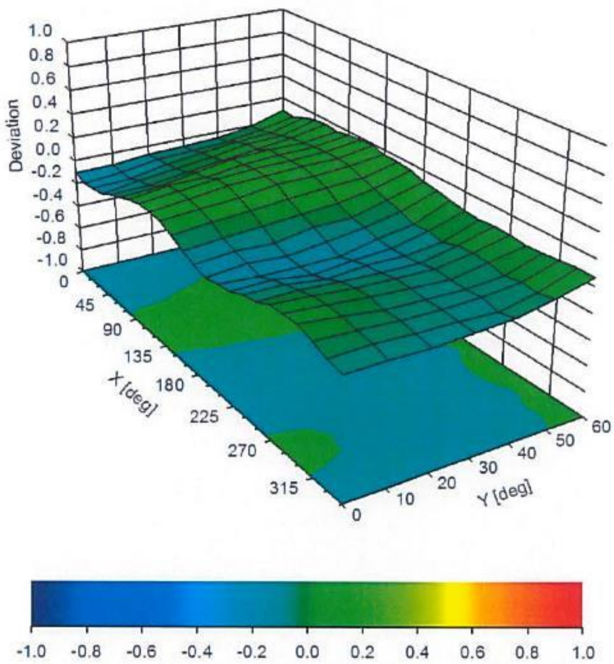
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Product Service

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3759

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-3
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

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Appendix: Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max Unc^E (k=2)
0	CW	X	0.00	0.00	1.00	0.00	149.0	± 3.5 %
		Y	0.00	0.00	1.00		147.4	
		Z	0.00	0.00	1.00		138.4	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	3.04	67.74	11.79	10.00	20.0	± 9.6 %
		Y	3.27	68.79	12.30		20.0	
		Z	3.42	68.76	12.60		20.0	
10011-CAB	UMTS-FDD (WCDMA)	X	0.99	66.30	14.68	0.00	150.0	± 9.6 %
		Y	1.02	66.67	14.90		150.0	
		Z	0.99	66.23	14.64		150.0	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	1.17	63.37	14.79	0.41	150.0	± 9.6 %
		Y	1.18	63.58	14.98		150.0	
		Z	1.18	63.40	14.78		150.0	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	4.83	66.46	16.84	1.46	150.0	± 9.6 %
		Y	4.90	66.50	16.94		150.0	
		Z	4.87	66.45	16.82		150.0	
10021-DAC	GSM-FDD (TDMA, GMSK)	X	27.32	96.15	23.00	9.39	50.0	± 9.6 %
		Y	100.00	113.48	27.55		50.0	
		Z	18.13	91.34	22.13		50.0	
10023-DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	17.75	90.44	21.39	9.57	50.0	± 9.6 %
		Y	64.93	107.78	26.22		50.0	
		Z	13.93	87.63	21.03		50.0	
10024-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	100.00	110.23	24.91	6.56	60.0	± 9.6 %
		Y	100.00	111.43	25.52		60.0	
		Z	66.71	106.54	24.55		60.0	
10025-DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	4.69	70.97	25.39	12.57	50.0	± 9.6 %
		Y	9.43	92.86	36.24		50.0	
		Z	4.57	69.11	24.07		50.0	
10026-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	8.47	87.67	30.15	9.56	60.0	± 9.6 %
		Y	11.37	95.44	33.46		60.0	
		Z	8.88	87.57	29.82		60.0	
10027-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	100.00	109.77	23.94	4.80	80.0	± 9.6 %
		Y	100.00	111.14	24.62		80.0	
		Z	100.00	110.40	24.46		80.0	
10028-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	100.00	110.50	23.60	3.55	100.0	± 9.6 %
		Y	100.00	111.94	24.31		100.0	
		Z	100.00	110.79	23.94		100.0	
10029-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	5.65	79.24	25.77	7.80	80.0	± 9.6 %
		Y	6.78	83.68	27.89		80.0	
		Z	6.05	79.84	25.79		80.0	
10030-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	X	100.00	108.40	23.61	5.30	70.0	± 9.6 %
		Y	100.00	109.85	24.34		70.0	
		Z	39.21	99.31	21.96		70.0	
10031-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	X	100.00	109.64	22.00	1.88	100.0	± 9.6 %
		Y	100.00	111.22	22.73		100.0	
		Z	100.00	109.98	22.33		100.0	

10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	100.00	115.35	23.50	1.17	100.0	± 9.6 %
		Y	100.00	116.40	23.97		100.0	
		Z	100.00	114.90	23.50		100.0	
10033-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	X	5.50	80.43	20.01	5.30	70.0	± 9.6 %
		Y	8.78	88.43	23.32		70.0	
		Z	5.52	79.91	19.94		70.0	
10034-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	X	2.26	72.05	15.71	1.88	100.0	± 9.6 %
		Y	2.75	75.11	17.48		100.0	
		Z	2.35	72.23	15.94		100.0	
10035-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	X	1.71	69.83	14.64	1.17	100.0	± 9.6 %
		Y	1.95	71.69	15.93		100.0	
		Z	1.77	69.99	14.88		100.0	
10036-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	X	6.42	82.93	20.96	5.30	70.0	± 9.6 %
		Y	11.14	92.31	24.62		70.0	
		Z	6.34	82.16	20.81		70.0	
10037-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	X	2.14	71.45	15.43	1.88	100.0	± 9.6 %
		Y	2.61	74.51	17.21		100.0	
		Z	2.24	71.69	15.69		100.0	
10038-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	X	1.72	70.07	14.85	1.17	100.0	± 9.6 %
		Y	1.96	72.01	16.17		100.0	
		Z	1.78	70.24	15.09		100.0	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	1.67	70.78	15.04	0.00	150.0	± 9.6 %
		Y	1.78	71.15	15.56		150.0	
		Z	1.72	70.94	15.32		150.0	
10042-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	X	22.45	92.22	20.50	7.78	50.0	± 9.6 %
		Y	100.00	109.74	25.02		50.0	
		Z	17.06	89.50	20.18		50.0	
10044-CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	X	0.00	92.98	2.04	0.00	150.0	± 9.6 %
		Y	0.00	94.50	2.19		150.0	
		Z	0.00	94.03	3.01		150.0	
10048-CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	X	8.86	78.37	18.88	13.80	25.0	± 9.6 %
		Y	12.87	84.32	21.06		25.0	
		Z	8.56	78.04	19.28		25.0	
10049-CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	X	9.63	81.59	18.85	10.79	40.0	± 9.6 %
		Y	15.92	88.85	21.37		40.0	
		Z	9.22	81.13	19.17		40.0	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	9.68	84.10	21.63	9.03	50.0	± 9.6 %
		Y	14.40	91.26	24.48		50.0	
		Z	8.89	82.35	21.22		50.0	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	4.44	74.95	23.28	6.55	100.0	± 9.6 %
		Y	5.07	77.93	24.80		100.0	
		Z	4.74	75.63	23.39		100.0	
10059-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	X	1.20	64.26	15.22	0.61	110.0	± 9.6 %
		Y	1.22	64.64	15.52		110.0	
		Z	1.22	64.34	15.22		110.0	
10060-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	X	3.05	83.81	21.08	1.30	110.0	± 9.6 %
		Y	6.45	94.80	24.64		110.0	
		Z	3.16	83.51	20.82		110.0	

10061-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	X	2.26	74.64	19.29	2.04	110.0	± 9.6 %
		Y	2.80	78.34	20.99		110.0	
		Z	2.40	74.91	19.27		110.0	
10062-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	4.64	66.51	16.35	0.49	100.0	± 9.6 %
		Y	4.71	66.52	16.41		100.0	
		Z	4.68	66.50	16.34		100.0	
10063-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	X	4.65	66.58	16.42	0.72	100.0	± 9.6 %
		Y	4.72	66.60	16.50		100.0	
		Z	4.69	66.57	16.41		100.0	
10064-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	X	4.93	66.82	16.63	0.86	100.0	± 9.6 %
		Y	5.02	66.89	16.73		100.0	
		Z	4.98	66.83	16.63		100.0	
10065-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	X	4.80	66.69	16.70	1.21	100.0	± 9.6 %
		Y	4.89	66.77	16.81		100.0	
		Z	4.84	66.71	16.69		100.0	
10066-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	X	4.81	66.69	16.83	1.46	100.0	± 9.6 %
		Y	4.90	66.80	16.97		100.0	
		Z	4.86	66.71	16.83		100.0	
10067-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	X	5.10	66.85	17.25	2.04	100.0	± 9.6 %
		Y	5.19	66.91	17.37		100.0	
		Z	5.15	66.85	17.23		100.0	
10068-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	X	5.14	66.87	17.43	2.55	100.0	± 9.6 %
		Y	5.25	67.04	17.62		100.0	
		Z	5.21	66.92	17.43		100.0	
10069-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	X	5.22	66.88	17.62	2.67	100.0	± 9.6 %
		Y	5.33	67.01	17.80		100.0	
		Z	5.29	66.91	17.62		100.0	
10071-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	X	4.92	66.52	17.10	1.99	100.0	± 9.6 %
		Y	4.99	66.58	17.23		100.0	
		Z	4.96	66.52	17.09		100.0	
10072-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	X	4.90	66.80	17.28	2.30	100.0	± 9.6 %
		Y	4.98	66.91	17.43		100.0	
		Z	4.95	66.83	17.27		100.0	
10073-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	X	4.96	66.95	17.56	2.83	100.0	± 9.6 %
		Y	5.04	67.07	17.74		100.0	
		Z	5.01	66.98	17.56		100.0	
10074-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	X	4.95	66.85	17.70	3.30	100.0	± 9.6 %
		Y	5.02	66.97	17.89		100.0	
		Z	5.01	66.89	17.70		100.0	
10075-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	X	4.99	66.96	17.98	3.82	90.0	± 9.6 %
		Y	5.08	67.14	18.22		90.0	
		Z	5.06	67.04	18.00		90.0	
10076-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	X	5.01	66.78	18.11	4.15	90.0	± 9.6 %
		Y	5.08	66.91	18.32		90.0	
		Z	5.08	66.85	18.11		90.0	
10077-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	X	5.04	66.85	18.20	4.30	90.0	± 9.6 %
		Y	5.10	66.97	18.41		90.0	
		Z	5.10	66.92	18.20		90.0	