



Test report No:

**NIE:** 47376RRF.001

## Test report

### REFERENCE STANDARDS:

FCC 47CFR Part 2.1093, Published RF Exposure KDB Procedures,  
IC RSS -102 Issue 5:2015

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identification of item tested.....:       | Aircraft pitot static tester (hand terminal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Trade .....                               | ADTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Model and /or type reference .....        | ADTS TOUCH-ER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Other identification of the product ..... | Hand terminal for ADTS base unit – used to test pilot static ports on aircraft<br>FCC ID: 2AAVWADTSTOUCH-02<br>IC: 12097A-ADTSTOUCH02                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Final HW version .....                    | IA4532-2-V0 revA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Final SW version .....                    | V02.00.16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Features .....                            | Bluetooth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Manufacturer .....                        | Company name: DRUCK LTD.<br>Postal Address: Fir Tree Lane, Groby, LEICESTER, Leicestershire, LE6 0FH<br>Contact Person: Tom Piggin<br>Telephone: 0116 231 7100<br>e-mail: tom.piggin@ge.com                                                                                                                                                                                                                                                                                                                                                                                               |
| Test method requested, standard.....:     | <ol style="list-style-type: none"> <li>1. FCC 47 CFR Part 2.1093. (10-1-14 Edition) Radiofrequency radiation exposure evaluation: portable devices.</li> <li>2. FCC OET KDB 447498 D01 General RF Exposure Guidance v05r02 (February 2014)</li> <li>3. FCC OET KDB 865664 D01 v01r03 – SAR Measurement Requirements for 100 MHz to 6 GHz (February 2014).</li> <li>4. FCC OET KDB 616217 D04 SAR for laptop and tablets v01r01 (May 2013)</li> <li>5. IC RSS-102 Issue 5 (2015-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)</li> </ol> |

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Summary .....                                   | <p>Considering the results of the performed test according to FCC 47CFR Part 2.1093, the item under test is IN COMPLIANCE with the requested specifications specified in the standards.</p> <p>The maximum 1g volume averaged SAR found during this test has been 0.163 W/kg, for Bluetooth BR mode.</p> <p>NOTE: The results presented in this Test Report apply only to the particular item under test established in page 1 of this document, as presented for test on the date(s) shown in section, “USAGE OF SAMPLES, TESTING PERIOD AND ENVIRONMENTAL CONDITIONS”.</p> |
| Approved by (name / position & signature) ..... | <p>A. Llamas</p> <p>RF Lab. Manager</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Date of issue .....                             | 2015-10-30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Report template No.....                         | FDT08_17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

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## Competences and guarantees

AT4 wireless is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance program for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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## General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

## Uncertainty

Uncertainty (factor  $k=2$ ) was calculated according to the following documents:

1. FCC OET KDB 865664 D01 - SAR Measurement 100 MHz to 6 GHz (February 2014).

## Usage of samples

Samples undergoing test have been selected by: the client

Sample M/01 is composed of the following elements:

| Control N° | Description  | Model        | Serial N° | Date of reception |
|------------|--------------|--------------|-----------|-------------------|
| 47376B/001 | Demonstrator | ADTSS552F    | 4407046   | 11/09/2015        |
| 47376B/002 | Mains cord   | --           | --        | 11/09/2015        |
| 47376B/003 | ADTS Touch   | ADTSTOUCH-ER | 4434050   | 11/09/2015        |

1. Sample M/01 has undergone the test(s) specified in subclause "Test method requested": SAR evaluation for Bluetooth BR mode.

## Test sample description

The test sample consists of an Aircraft pitot static tester (hand terminal).

## Identification of the client

Company name: TÜV SÜD Product Service

Postal Address: Octagon House, Concorde Way, Segensworth North, Fareham, Hampshire, PO15 5RL

Contact Person: Ryan Henley

Job title / Department: Project Manager / Telecoms Business Line

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## Testing period

The performed test started on 2015-09-11 and finished on 2015-09-11.

The tests have been performed at AT4 wireless.

## Environmental conditions

In the laboratory for measurements, the following limits were not exceeded during the test:

|                          |                                    |
|--------------------------|------------------------------------|
| <b>Temperature</b>       | Min. = 21.62 °C<br>Max. = 23.90 °C |
| <b>Relative humidity</b> | Min. = 47.46 %<br>Max. = 59.48 %   |

## Remarks and comments

1: Only the highest output power mode for this technology has been tested, due to a reported 1-g SAR far below to 0.8 W/Kg and a maximum measured conducted output power more than 0.5 dB higher than the other modes.

2: Edges with a distance far above 25 mm from the radiating antenna haven't been tested.

3: Testing of other required channels within the operating mode of current frequency band is not required according to "FCC OET KDB 447498 D01 General RF Exposure Guidance v05r02", paragraph "4.3.3. SAR test reduction considerations".

4: Only the plots of the highest reported SAR for each test position and mode/band are included in appendix C.

## Used instrumentation

1. Dosimetric E-field probes SPEAG ES3DV3
2. Data acquisition device SPEAG DAE4
3. Electro-optical converter SPEAG EOC3
4. 2450 MHz dipole validation kit SPEAG D2450V2
5. Robot Stäubli RX60BL
6. Robot controller Stäubli CM7MB
7. SAR measurement software SPEAG DASY52 V52.8.8.1222
8. SAR post processing software SPEAG SEMCAD X
9. Measurement server SPEAG DASY5 SE UMS 011 BS
10. Oval flat phantom SPEAG ELI 4
11. Body Tissue Equivalent Liquid for 2450MHz band
12. Vector network analyzer Agilent FieldFox N9923A and Agilent E5071C.
13. Dielectric probe kit SPEAG DAK-3.5
14. Power meter Agilent E4419B
15. RF Generator R&S SMU200A
16. DC Power supply Agilent U8002A
17. Dual directional coupler NARDA FSCM 99899
18. Power amplifier MITEQ AMF-4D-00400600-50-30P
19. Device positioner SM LH1 001 AC

## Testing verdicts

|                      |   |     |
|----------------------|---|-----|
| Not applicable ..... | : | N/A |
| Pass .....           | : | P   |
| Fail .....           | : | F   |
| Not measured .....   | : | N/M |

### 2450 MHz band

| FCC 47CFR Part 2.1093 Paragraph | VERDICT |                |   |    |
|---------------------------------|---------|----------------|---|----|
|                                 | NA      | P              | F | NM |
| (d)(2) Bluetooth BR             |         | P              |   |    |
| (d)(2) Bluetooth EDR2           |         | P <sup>1</sup> |   |    |
| (d)(2) Bluetooth EDR3           |         | P <sup>1</sup> |   |    |

1: See Remarks and Comments

## Appendix A – Test configuration

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## 1. GENERAL INTRODUCTION

### 1.1. Application Standard

The Federal Communications Commission (FCC) sets the limits for General Population / Uncontrolled exposure to radio frequency electromagnetic fields for transmitting devices designed to be used within 20 centimetres of the body of the user under FCC 47 CFR Part 2.1093 - “Radiofrequency radiation exposure evaluation: portable devices”, paragraph (d)(2).

### 1.2. General requirements

The SAR measurement has been performed continuing the following considerations and environment conditions:

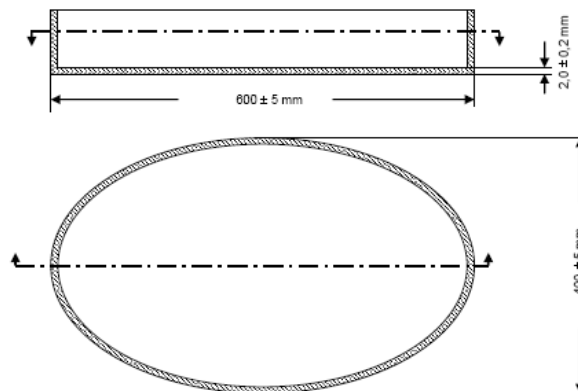
- The ambient temperature shall be in the range of 18°C to 25°C and the variation shall not exceed +/- 2°C during the test.
- The ambient humidity shall be in the range of and 30% - 70%.
- The device battery shall be fully charged before each measurement.

### 1.3. Measurement system requirements

The measurement system used for SAR tests fulfils the procedural and technical requirements described at the reference standards used.

### 1.4. Phantom requirements

The phantom model for body measurements is an elliptical open-top container with a flat bottom, with the following shape and dimension:



**Figure 1:** Proportions and shape of Phantom shell

### 1.5. Measurement Liquids requirements.

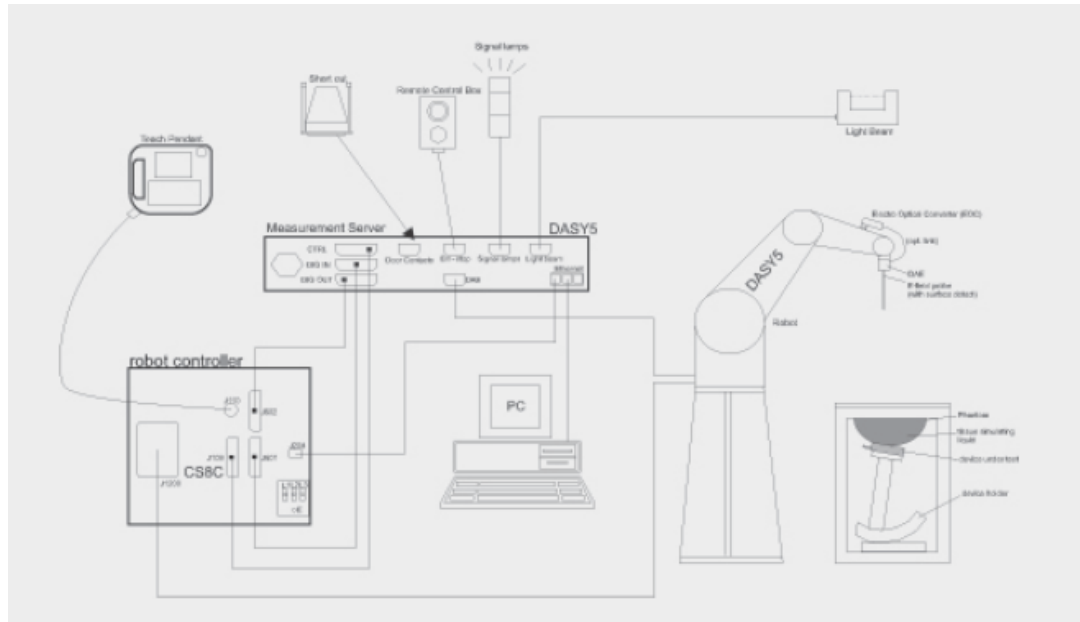
The liquids used to simulate the human tissues, must fulfils the requirements of the dielectric properties required. These target dielectric properties per FCC OET KDB 450824 instructions come from the dipole and probe calibration data which are included in Appendix B, Section 3, of this document.

To minimize the effect of reflections on peak spatial-average SAR values, from the upper surface of the tissue-equivalent liquid, the depth of the liquid should be at least 15 cm.

## 2. MEASUREMENT SYSTEM

### 2.1. Measurement System

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



**Figure 2:** SAR Measurement system

- 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.

| Manufacturer                    | Device                            | Type                   |
|---------------------------------|-----------------------------------|------------------------|
| Schmid & Partner Engineering AG | Dosimetric E-Field Probe          | ES3DV3                 |
| Schmid & Partner Engineering AG | Data Acquisition Electronics      | DAE4                   |
| Schmid & Partner Engineering AG | Electro-Optical Converter         | EOC3                   |
| Stäubli                         | Robot                             | RX60BL                 |
| Stäubli                         | Robot controller                  | CS7MB                  |
| Schmid & Partner Engineering AG | Measurement Server                | DASY5 SE UMS 011 BS    |
| Schmid & Partner Engineering AG | Oval flat phantom                 | SPEAG ELI 4            |
| Schmid & Partner Engineering AG | Notebook Positioner               | SM LH1 001 AC          |
| Schmid & Partner Engineering AG | Measurement Software              | DASY52 V52.8.8.1222    |
| Schmid & Partner Engineering AG | Postprocessing Software           | SEMCAD X               |
| Rohde & Schwarz                 | RF Generator                      | SMU 200A               |
| MITEQ                           | Power amplifier                   | AMF-4D-00400600-50-30P |
| Agilent                         | DC Power supply                   | U8002A                 |
| NARDA                           | Directional coupler               | FSCM 99899             |
| Weinschel                       | 6dB attenuator                    | 75A-6-11               |
| Agilent                         | Power Meter                       | E4419B                 |
| Schmid & Partner Engineering AG | 2450 MHz System Validation Dipole | D2450V2                |
| Agilent                         | Vector Network Analyser           | FieldFox N9923A        |
| Schmid & Partner Engineering AG | Dielectric Probe Kit              | DAK-3.5                |

**Table 1:** Measurement Equipment

## DOSIMETRIC E-FIELD PROBE

### ES3DV3

#### Isotropic E-Field Probe for Dosimetric Measurements



Symmetrical design with triangular core  
 Interleaved sensors  
 Built-in shielding against static charges  
 PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

|                      |                                                                                                                                |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Calibration</b>   | ISO/IEC 17025                                                                                                                  |
| <b>Frequency</b>     | 10 MHz to 4 GHz;<br>Linearity: $\pm 0.2$ dB (30 MHz to 4 GHz)                                                                  |
| <b>Directivity</b>   | $\pm 0.2$ dB in TSL (rotation around probe axis)<br>$\pm 0.3$ dB in TSL (rotation normal to probe axis)                        |
| <b>Dynamic Range</b> | 5 $\mu$ W/g to > 100 mW/g;<br>Linearity: $\pm 0.2$ dB                                                                          |
| <b>Dimensions</b>    | Overall length: 337 mm (Tip: 20 mm)<br>Tip diameter: 3.9 mm (Body: 12 mm)<br>Distance from probe tip to dipole centers: 2.0 mm |

## DATA ACQUISITION ELECTRONICS

### DAE4 - Data Acquisition Electronics



Signal amplifier, multiplexer, A/D converter, and control logic  
 Serial optical link for communication with DASY4/5 embedded system (fully remote controlled)  
 Two-step probe touch detector for mechanical surface detection and emergency robot stop

|                             |                                                                        |
|-----------------------------|------------------------------------------------------------------------|
| <b>Measurement Range</b>    | -100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV) |
| <b>Input Offset Voltage</b> | < 5 $\mu$ V (with auto zero)                                           |
| <b>Input Resistance</b>     | 200 MOhm                                                               |
| <b>Input Bias Current</b>   | < 50 fA                                                                |

## OVAL FLAT PHANTOM

### ELI



Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

ELI V5.0 has the same shell geometry and is manufactured from the same material as ELI4, but has reinforced top structure.

|                             |                                                                       |
|-----------------------------|-----------------------------------------------------------------------|
| <b>Material</b>             | Vinylester, glass fiber reinforced (VE-GF)                            |
| <b>Liquid Compatibility</b> | Compatible with all SPEAG tissue simulating liquids (incl. DGBE type) |
| <b>Shell Thickness</b>      | 2.0 $\pm$ 0.2 mm (bottom plate)                                       |
| <b>Dimensions</b>           | Major axis: 600 mm<br>Minor axis: 400 mm                              |
| <b>Filling Volume</b>       | approx. 30 liters                                                     |
| <b>Wooden Support</b>       | SPEAG standard phantom table                                          |

## NOTEBOOK POSITIONER



### MD4LAPV5 - Mounting Device for Laptops and other Body-Worn Transmitters

In combination with the Twin SAM V5.0/V5.0c or ELI Phantoms, the Mounting Device (Body-Worn) enables testing of transmitter devices according to IEC 62209-2 specifications. The device holder can be locked for positioning at flat phantom section.

**Material:** Polyoxymethylene (POM), PET-G, Foam

## DIPOLES

### System Validation Kits 300 MHz – 6 GHz



Symmetrical dipole with 1/4 balun  
 Enables measurement of feedpoint impedance with NWA  
 Matched for use near flat phantoms filled with tissue simulating solutions

|                                                        |                                                                                                                                                                                       |                      |                       |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------------------|
| <b>Calibration</b>                                     | ISO/IEC 17025                                                                                                                                                                         |                      |                       |
| <b>Frequency</b>                                       | 300, 400, 450, 600, 733, 750, 835, 850, 900, 1300, 1450, 1500, 1640, 1750, 1800, 1900, 1950, 2000, 2100, 2300, 2450, 2550, 2600, 3000, 3300, 3500, 3700 MHz and D5GHz (5100-5800 MHz) |                      |                       |
| <b>Return Loss</b>                                     | > 20 dB at specified validation position                                                                                                                                              |                      |                       |
| <b>Power Capability</b>                                | > 100 W (f < 1GHz); > 40 W (f > 1GHz)                                                                                                                                                 |                      |                       |
| <b>Dimensions</b><br>(length and overall height in mm) | <b>Product</b>                                                                                                                                                                        | <b>Dipole length</b> | <b>Overall height</b> |
|                                                        | D750V3                                                                                                                                                                                | 179.0                | 330.0                 |
|                                                        | D900V2                                                                                                                                                                                | 148.5                | 340.0                 |
|                                                        | D1800V2                                                                                                                                                                               | 72.5                 | 300.0                 |
|                                                        | D2000V2                                                                                                                                                                               | 65.0                 | 300.0                 |
|                                                        | D2450V2                                                                                                                                                                               | 52.0                 | 290.0                 |
|                                                        | D2600V2                                                                                                                                                                               | 49.2                 | 290.0                 |
|                                                        | D5GHzV2                                                                                                                                                                               | 20.6                 | 300.0                 |

## 2.2. Test Positions of device relative to body

Following the FCC OET KDB 616217 D04 “SAR for laptop and tablets v01r01”, the device has been tested for 1-g SAR at 0 mm distance to the flat phantom on all surfaces and side edges with a transmitting antenna located at  $\leq 25$  mm from that surface or edge.

## 2.3. Test to be performed

DUT will be placed at the center of flat phantom. The DUT position used during the body SAR tests will be the one where the maximum peak SAR was found. Each data mode, wireless technology and frequency band supported by the device must be tested. Low and high channels for each band should be tested at this position.

If the DUT is also designed to transmit with other configurations (antenna fully extended/retracted, keypad cover opened/closed...), all tests described above shall be performed for each configuration. When considering multi-mode and multi-band mobile phones, all of the tests shall be performed at each transmitting mode/band with the corresponding maximum peak power level.

## 2.4. Description of interpolation/extrapolation scheme

The local SAR inside the Phantom is measured using small dipole sensing elements inside a probe element. The probe tip must not be in contact with the Phantom's surface in order to minimise measurement errors, but the highest local SAR is obtained from measurements at a certain distance from the shell through extrapolation. The accurate assessment of the maximum SAR averaged over 1 gr and 10 gr. requires a very fine resolution in the three dimensional scanned data array. Since the measurements have to be performed over a limited time, the measured data have to be interpolated to provide an array of sufficient resolution.

The interpolation of 2D area scan is used after the initial area scan, at a fixed distance from the Phantom shell wall. The initial scan data is collected with approx. 15 mm spatial resolution and this interpolation is used to find the location of the local maximum for positioning the subsequent 3D scanning within a 1 mm resolution.

For the 3D scan, data is collected on a spatially regular 3D grid having 5 mm steps in both directions. After the data collection by the SAR probe, the data are extrapolated in the depth direction to assign values to points in the 3D array closer to the shell wall. A notional extrapolation value is also assigned to the first point outside the shell wall so that subsequent interpolation schemes will be applicable right up to the shell wall boundary.

## 2.5. Determination of the largest peak spatial-average SAR

To determine the maximum value of the peak spatial-average SAR of a DUT, all device positions, configurations and operational modes should be tested for each frequency band.

The averaging volume shall be chosen as 1gr. of contiguous tissue. The cubic volumes, over which the SAR measurements are averaged after extrapolation and interpolation, are chosen in order to include the highest values of local SAR.

The maximum SAR level for the DUT will be the maximum level obtained of the performed measurements, and indicated in the previous points.

## 2.6. System Validation

Prior to the SAR measurements, system verification is done to verify the system accuracy. A complete SAR evaluation is done using a half-wavelength dipole as source with the frequency of the mid-band channel of the operating band, or within 10% of this channel.

The measured 1 gr. and 10 gr. SAR should be within 10% of the expected target values specified in the calibration certificate of the dipole, for the specific tissue and frequency used.

### 3. UNCERTAINTY

#### Uncertainty for 300 MHz – 6 GHz

| ERROR SOURCES                                                                | Uncertainty value (± %)                       | Probability distribution | Divisor | (c <sub>i</sub> ) 1g | (c <sub>i</sub> ) 10g | Standard uncertainty (1g) (± %) | Standard uncertainty (10g) (± %) |
|------------------------------------------------------------------------------|-----------------------------------------------|--------------------------|---------|----------------------|-----------------------|---------------------------------|----------------------------------|
| <b>Measurement Equipment</b>                                                 |                                               |                          |         |                      |                       |                                 |                                  |
| Probe Calibration                                                            | 6.550                                         | N                        | 1       | 1                    | 1                     | 6.550                           | 6.550                            |
| Isotropy                                                                     | 7.558                                         | R                        | √3      | 1                    | 1                     | 4.364                           | 4.364                            |
| Linearity                                                                    | 4.700                                         | R                        | √3      | 1                    | 1                     | 2.714                           | 2.714                            |
| Probe modulation response                                                    | 2.300                                         | R                        | √3      | 1                    | 1                     | 1.328                           | 1.328                            |
| Detection limits                                                             | 0.250                                         | R                        | √3      | 1                    | 1                     | 0.144                           | 0.144                            |
| Boundary effect                                                              | 2.000                                         | R                        | √3      | 1                    | 1                     | 1.155                           | 1.155                            |
| Readout electronics                                                          | 0.300                                         | N                        | 1       | 1                    | 1                     | 0.300                           | 0.300                            |
| Response time                                                                | 0.000                                         | R                        | √3      | 1                    | 1                     | 0.000                           | 0.000                            |
| Integration time                                                             | 1.900                                         | R                        | √3      | 1                    | 1                     | 1.097                           | 1.097                            |
| RF Ambien conditions - noise                                                 | 3.000                                         | R                        | √3      | 1                    | 1                     | 1.732                           | 1.732                            |
| RF Ambien conditions – reflections                                           | 3.000                                         | R                        | √3      | 1                    | 1                     | 1.732                           | 1.732                            |
| Probe positioner mech. restrictions                                          | 0.400                                         | R                        | √3      | 1                    | 1                     | 0.231                           | 0.231                            |
| Probe positioning with respect to phantom shell                              | 6.700                                         | R                        | √3      | 1                    | 1                     | 3.868                           | 3.868                            |
| Post-processing                                                              | 4.000                                         | R                        | √3      | 1                    | 1                     | 2.309                           | 2.309                            |
| <b>Test Sample Related</b>                                                   |                                               |                          |         |                      |                       |                                 |                                  |
| Device holder uncertainty                                                    | 2.900                                         | N                        | 1       | 1                    | 1                     | 2.900                           | 2.900                            |
| Test sample positioning                                                      | 3.600                                         | N                        | 1       | 1                    | 1                     | 3.600                           | 3.600                            |
| Drift of output power                                                        | 5.000                                         | R                        | √3      | 1                    | 1                     | 2.887                           | 2.887                            |
| <b>Phantom and Setup</b>                                                     |                                               |                          |         |                      |                       |                                 |                                  |
| Phantom uncertainty (shape and thickness tolerances)                         | 7.900                                         | R                        | √3      | 1                    | 1                     | 4.561                           | 4.561                            |
| Algorithm for correcting SAR for deviations in permittivity and conductivity | 1.900                                         | N                        | 1       | 1                    | 0.84                  | 1.900                           | 1.596                            |
| Liquid conductivity (meas.)                                                  | 3.350                                         | N                        | 1       | 0.78                 | 0.71                  | 2.613                           | 2.379                            |
| Liquid permittivity (meas.)                                                  | 1.500                                         | N                        | 1       | 0.23                 | 0.26                  | 0.345                           | 0.390                            |
| Liquid conductivity – temperature uncertainty                                | 0.440                                         | R                        | √3      | 0.78                 | 0.71                  | 0.198                           | 0.180                            |
| Liquid permittivity – temperature uncertainty                                | 3.120                                         | R                        | √3      | 0.23                 | 0.26                  | 0.414                           | 0.468                            |
| <b>Combined standard uncertainty</b>                                         | $u_c = \sqrt{\sum_{i=1}^m c_i^2 \cdot u_i^2}$ |                          |         |                      |                       | <b>12.70</b>                    | <b>12.62</b>                     |
| <b>Expanded uncertainty (confidence interval of 95%)</b>                     | $u_e = 2.00 u_c$                              |                          |         |                      |                       | <b>25.40</b>                    | <b>25.23</b>                     |

**Table 2:** Uncertainty Assessment for 300 MHz - 6 GHz

#### 4. SAR LIMIT

Having a worst case measurement, the SAR limit is valid for general population/uncontrolled exposure.

The SAR values have to be averaged over a mass of 1 gr. (SAR 1 gr.) with the shape of a cube and averaged over a mass of 10 gr (Extremity SAR 10 gr). These levels couldn't exceed the values indicated in the application Standard:

| Standard                                   | SAR                  | SAR Limit (W/Kg) |
|--------------------------------------------|----------------------|------------------|
| FCC 47 CFR Part 2.1093<br>Paragraph (d)(2) | SAR <sub>1 gr.</sub> | 1.6              |

**Table 3:** SAR limit

#### 5. DEVICE UNDER TEST

##### 5.1. Dimensions

| Dimensions             | Millimetres          |
|------------------------|----------------------|
| Height x Width x Depth | 220.0 x 150.0 x 55.0 |
| Overall Diagonal:      | 250                  |
| Display Diagonal:      | 175.0                |

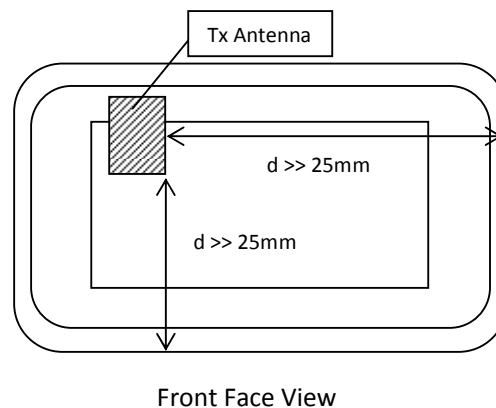
**Table 4:** DUT dimensions

##### 5.2. Wireless Technology

| Wireless Technology | Frequency Bands | Modes          |
|---------------------|-----------------|----------------|
| Bluetooth           | 2.4 GHz         | BR, EDR2, EDR3 |

**Table 5:** DUT supported modes

##### 5.3. DUT Antenna Location



**Figure 3:** DUT Antenna diagram location

## Appendix B – Test results

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## 1. TEST CONDITIONS

### 1.1. Power supply (V):

$V_n = 10.8$  V rechargeable battery

Type of power supply = DC Voltage from rechargeable Li-Ion 10.8 V battery.

### 1.2. Temperature (°C):

$T_n = +21.00$  to  $+25.00$

The subscript n indicates normal test conditions.

### 1.3. Test signal, Output Power and Frequencies

For Bluetooth mode, the device was put into operation by using a manufacturer proprietary test mode, setting the maximum output power for each mode.

A fully charged battery was used for every test sequence. In all operating bands and test positions, the measurements were performed on the channel with maximum average output power. In each band, for those positions where the maximum averaged SAR was found, measurements were performed on the remaining required channels except those with applicable test reductions <sup>2</sup>

2: See remarks and comments

The target power alignment for RF components declared by the manufacturer is:

| Protocol  | Declared Target Power    |                       |                         |
|-----------|--------------------------|-----------------------|-------------------------|
|           | Max. Average Power (dBm) | Tuning tolerance (dB) | Max. Output Power (dBm) |
| Bluetooth | 9                        | +0/-0                 | 9                       |

### 1.4. DUT and test-site configurations

The DUT incorporates a Bluetooth transmitter, supporting BR, EDR2 and EDR3 modes, with GFSK,  $\pi/4$ -DQPSK and 8-DQPSK modulations respectively.

For body exposure testing the device under test was placed with each face and edge against the flat phantom at 0 mm test separation distance, except for those edges with a distance far above 25 mm distance from a radiating antenna.

## 2. CONDUCTED AVERAGE POWER MEASUREMENTS

### 2.1. Bluetooth

These measured conducted output power values have been measured by the client: TÜV SÜD Product Service.

| Band    | Mode | Modulation     | Freq (MHz) | Average Output Power (dBm) |
|---------|------|----------------|------------|----------------------------|
| 2.4 GHz | BR   | GFSK           | 2402       | 6.52                       |
|         |      |                | 2441       | 8.41                       |
|         |      |                | 2480       | 8.97                       |
|         | EDR2 | $\pi/4$ -DQPSK | 2402       | 6.22                       |
|         |      |                | 2441       | 7.31                       |
|         |      |                | 2480       | 6.69                       |
|         | EDR3 | 8-DPSK         | 2402       | 5.61                       |
|         |      |                | 2441       | 7.31                       |
|         |      |                | 2480       | 6.67                       |

## 3. TISSUE PARAMETERS MEASUREMENTS

| Frequency (MHz) | Target Body Tissue: Parameters used in Probe Calibration |                    | Target Body Tissue: Parameters used in Dipole Calibration |                    | Measured Body Tissue |                    | Measured Date |
|-----------------|----------------------------------------------------------|--------------------|-----------------------------------------------------------|--------------------|----------------------|--------------------|---------------|
|                 | Permittivity                                             | Conductivity [S/m] | Permittivity                                              | Conductivity [S/m] | Permittivity         | Conductivity [S/m] |               |
| 2450            | 52.7 ± 5%                                                | 1.95 ± 5%          | 52.4 ± 6%                                                 | 2.03 ± 6%          | 51.00 ± 5%           | 1.94 ± 5%          | 2015-09-10    |

Note: The dielectric properties have been measured by the contact probe method at 23° C.

### - Composition / Information on ingredients

#### Head and Muscle Tissue Simulation Liquids HBBL1900-3800V3/M HBBL1900-3800V3

|                              |                                                                                                                |
|------------------------------|----------------------------------------------------------------------------------------------------------------|
| Water                        | 50 – 73 %                                                                                                      |
| Non-ionic detergents         | 27 – 50 % polyoxyethylenesorbitan monolaurate                                                                  |
| NaCl                         | 0 – 2 %                                                                                                        |
| Preservative                 | 0.05 – 0.1% Preventol-D7                                                                                       |
| Safety relevant ingredients: |                                                                                                                |
| CAS-No. 55965-84-9           | < 0.1 % aqueous preparation, containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyl-3(2H)-isothiazolone |
| CAS-No. 9005-64-5            | <50 % polyoxyethylenesorbitan monolaurate                                                                      |

## 4. SYSTEM CHECK MEASUREMENTS

### 4.1. Validation results in 2450 MHz Band for Body TSL

| DATE       | SAR over | Target SAR | Measured SAR | Drift (%) | ± 10% Limit | SAR   |
|------------|----------|------------|--------------|-----------|-------------|-------|
| 10/09/2015 | 1 gr.    | 52.1       | 48.97        | -6.00     | √           | 12.30 |
|            | 10 gr.   | 24.4       | 22.74        | -6.82     | √           | 5.71  |

## 5. MEASUREMENT RESULTS FOR SAR (SPECIFIC ABSORPTION RATE)

### 5.1. Summary maximum results for 1-g body SAR measurements.

| Band     | Mode <sup>1</sup> | Modulation | Side / Position | Channel (Frequency) | Reported SAR (1g avg) (W/Kg) | SAR limit (1g avg) (W/Kg) |
|----------|-------------------|------------|-----------------|---------------------|------------------------------|---------------------------|
| 2450 MHz | BR                | GFSK       | Top edge 0 mm   | CH 79 (2480 MHz)    | 0.163                        | 1.6                       |

1: See Remarks and Comment

### 5.2. Results for Bluetooth, 2450 MHz Band.

| Side / Position | Dist (mm) | Mode | Modulation | Ch #. (Freq)     | 1-g SAR (W/Kg)  | Power Drift (%) | Max Output Power (dBm) | Max. Reported 1-g SAR | Plot No. |
|-----------------|-----------|------|------------|------------------|-----------------|-----------------|------------------------|-----------------------|----------|
| Front face      | 0         | BR   | GFSK       | CH 79 (2480 Mhz) | 0.059           | -0.12           | 9                      | 0.059                 |          |
| Back face       | 0         | BR   | GFSK       | CH 79 (2480 Mhz) | 0.102           | 1.86            | 9                      | 0.103                 |          |
| Left edge       | 0         | BR   | GFSK       | CH 79 (2480 Mhz) | 0.094           | 0.58            | 9                      | 0.095                 |          |
| Right edge      | 0         | BR   | GFSK       | CH 79 (2480 Mhz) | NM <sup>2</sup> | -               | 9                      | -                     |          |
| Top edge        | 0         | BR   | GFSK       | CH 79 (2480 Mhz) | 0.162           | -0.46           | 9                      | 0.163                 | 1        |
| Bottom edge     | 0         | BR   | GFSK       | CH 79 (2480 Mhz) | NM <sup>2</sup> | -               | 9                      | -                     |          |
|                 |           |      |            |                  |                 |                 |                        |                       |          |
| Top edge        | 0         | BR   | GFSK       | CH 1 (2402 Mhz)  | NM <sup>3</sup> | -               | 9                      | -                     |          |
| Top edge        | 0         | BR   | GFSK       | CH 40 (2441 Mhz) | NM <sup>3</sup> | -               | 9                      | -                     |          |

2 and 3: See remarks and comments

## Appendix C – Measurement report

## **BT- BR - GFSK – 2450MHz –Body – Top Edge, d=0 mm – Highest Channel – Plot N° 1**

**Test Laboratory: AT4 Wireless; Date: 11/09/2015**

**DUT: ADTS ; Type: ADTS TOUCH; Serial: 4434050**

Communication System: UID 10032 - CAA, IEEE 802.15.1 Bluetooth (GFSK, DH5); Frequency: 2480 MHz; Duty Cycle: 1:1.30617

Medium parameters used:  $f = 2480$  MHz;  $\sigma = 1.99$  S/m;  $\epsilon_r = 50.89$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: ES3DV3 - SN3052; ConvF(4.31, 4.31, 4.31); Calibrated: 20/07/2015;
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 13/07/2015
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

### **Flat Phantom Side - 2450MHz/High CH, Bluetooth, Top Edge, d=0mm/Area Scan (101x241x1):**

Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.202 W/kg

### **Flat Phantom Side - 2450MHz/High CH, Bluetooth, Top Edge, d=0mm/Zoom Scan (7x7x7)/Cube 0:**

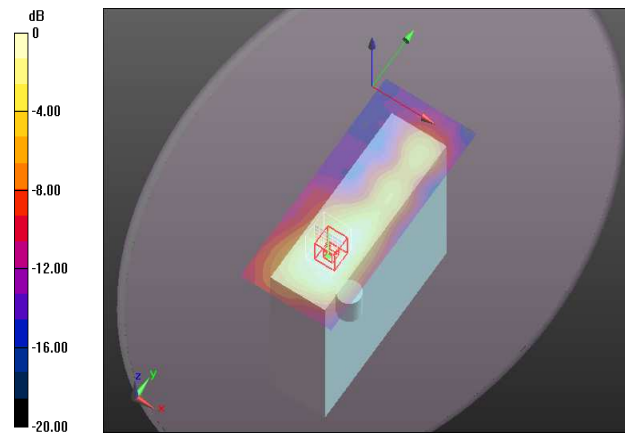
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.732 V/m; Power Drift = -0.04 dB

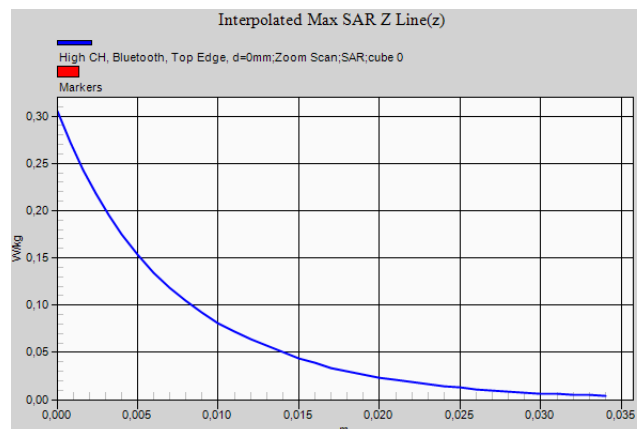
Peak SAR (extrapolated) = 0.305 W/kg

**SAR(1 g) = 0.162 W/kg; SAR(10 g) = 0.090 W/kg** (SAR corrected for target medium)

Maximum value of SAR (measured) = 0.175 W/kg



0 dB = 0.175 W/kg = -7.57 dBW/kg



## Appendix D – System Validation Reports

## Validation results in 2450 MHz Band for Body TSL

**Test Laboratory: AT4 Wireless; Date: 10/09/2015**

**DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:756**

Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.94$  S/m;  $\epsilon_r = 51$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: ES3DV3 - SN3052; ConvF(4.31, 4.31, 4.31); Calibrated: 20/07/2015;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 13/07/2015
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**System Validation Configuration 2450MHz Dipole Body/d=10mm, Pin=250 mW/Area Scan (91x91x1):**

Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 17.3 W/kg

**System Validation Configuration 2450MHz Dipole Body/d=10mm, Pin=250 mW/Zoom Scan (7x7x7)/Cube 0:**

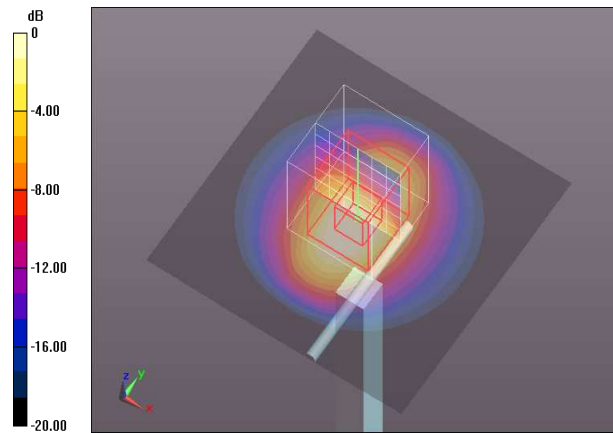
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.05 V/m; Power Drift = -0.10 dB

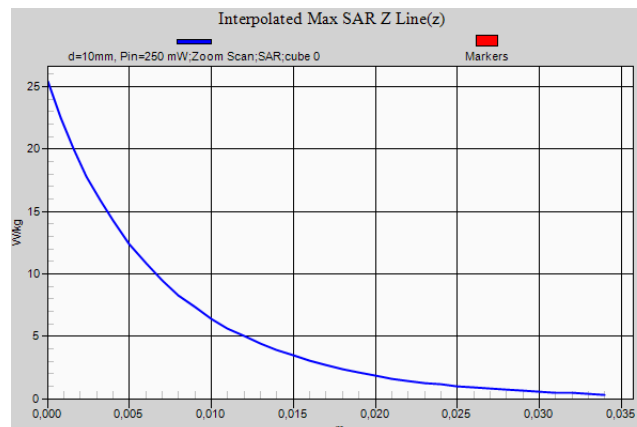
Peak SAR (extrapolated) = 25.4 W/kg

**SAR(1 g) = 12.3 W/kg; SAR(10 g) = 5.71 W/kg** (SAR corrected for target medium)

Maximum value of SAR (measured) = 14.3 W/kg



0 dB = 14.3 W/kg = 11.55 dBW/kg



## Appendix E – Calibration data

**Calibration Laboratory of  
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Zeughausstrasse 43, 8004 Zurich, Switzerland



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **AT4 Wireless**

Certificate No: **DAE4-669\_Jul15**

## CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 669**

Calibration procedure(s) **QA CAL-06.v29**  
**Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **July 13, 2015**

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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards             | ID #               | Cal Date (Certificate No.) | Scheduled Calibration  |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278        | 03-Oct-14 (No:15573)       | Oct-15                 |
| Secondary Standards           | ID #               | Check Date (in house)      | Scheduled Check        |
| Auto DAE Calibration Unit     | SE UWS 053 AA 1001 | 06-Jan-15 (in house check) | In house check: Jan-16 |
| Calibrator Box V2.1           | SE UMS 006 AA 1002 | 06-Jan-15 (in house check) | In house check: Jan-16 |

Calibrated by: **Name**  
**Eric Hainfeld**

**Function**  
**Technician**

**Signature**

Approved by: **Fin Bornholt**

**Deputy Technical Manager**

Issued: July 13, 2015

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

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 Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: **SCS 0108**

## Glossary

**DAE** data acquisition electronics  
**Connector angle** information used in DASY system to align probe sensor X to the robot coordinate system.

## Methods Applied and Interpretation of Parameters

- **DC Voltage Measurement:** Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- **Connector angle:** The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - **DC Voltage Measurement Linearity:** Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - **Common mode sensitivity:** Influence of a positive or negative common mode voltage on the differential measurement.
  - **Channel separation:** Influence of a voltage on the neighbor channels not subject to an input voltage.
  - **AD Converter Values with inputs shorted:** Values on the internal AD converter corresponding to zero input voltage
  - **Input Offset Measurement:** Output voltage and statistical results over a large number of zero voltage measurements.
  - **Input Offset Current:** Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - **Input resistance:** Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - **Low Battery Alarm Voltage:** Typical value for information. Below this voltage, a battery alarm signal is generated.
  - **Power consumption:** Typical value for information. Supply currents in various operating modes.

## DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1  $\mu$ V , full range = -100...+300 mV

Low Range: 1LSB = 61 nV , full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X                         | Y                         | Z                         |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range          | 403.316 $\pm$ 0.02% (k=2) | 403.856 $\pm$ 0.02% (k=2) | 404.236 $\pm$ 0.02% (k=2) |
| Low Range           | 3.95586 $\pm$ 1.50% (k=2) | 3.97459 $\pm$ 1.50% (k=2) | 3.97433 $\pm$ 1.50% (k=2) |

## Connector Angle

|                                           |                   |
|-------------------------------------------|-------------------|
| Connector Angle to be used in DASY system | 192.5 ° $\pm$ 1 ° |
|-------------------------------------------|-------------------|

## Appendix (Additional assessments outside the scope of SCS0108)

### 1. DC Voltage Linearity

| High Range |         | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|------------|---------|---------------------------|------------------------------|-----------|
| Channel X  | + Input | 200039.20                 | 0.36                         | 0.00      |
| Channel X  | + Input | 20009.81                  | 5.49                         | 0.03      |
| Channel X  | - Input | -20001.49                 | 3.94                         | -0.02     |
| Channel Y  | + Input | 200034.48                 | -4.78                        | -0.00     |
| Channel Y  | + Input | 20009.04                  | 4.84                         | 0.02      |
| Channel Y  | - Input | -20002.50                 | 3.09                         | -0.02     |
| Channel Z  | + Input | 200039.88                 | 4.95                         | 0.00      |
| Channel Z  | + Input | 20008.37                  | 4.22                         | 0.02      |
| Channel Z  | - Input | -20004.02                 | 1.52                         | -0.01     |

| Low Range |         | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-----------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 2000.99                   | 0.18                         | 0.01      |
| Channel X | + Input | 201.17                    | 0.42                         | 0.21      |
| Channel X | - Input | -198.81                   | 0.15                         | -0.08     |
| Channel Y | + Input | 2000.78                   | -0.00                        | -0.00     |
| Channel Y | + Input | 200.28                    | -0.43                        | -0.22     |
| Channel Y | - Input | -199.96                   | -0.88                        | 0.44      |
| Channel Z | + Input | 2000.74                   | 0.05                         | 0.00      |
| Channel Z | + Input | 199.41                    | -1.31                        | -0.65     |
| Channel Z | - Input | -200.05                   | -0.90                        | 0.45      |

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | Common mode<br>Input Voltage (mV) | High Range<br>Average Reading ( $\mu\text{V}$ ) | Low Range<br>Average Reading ( $\mu\text{V}$ ) |
|-----------|-----------------------------------|-------------------------------------------------|------------------------------------------------|
| Channel X | 200                               | 2.14                                            | 0.76                                           |
|           | - 200                             | -0.53                                           | -1.17                                          |
| Channel Y | 200                               | 11.12                                           | 11.00                                          |
|           | - 200                             | -12.56                                          | -12.76                                         |
| Channel Z | 200                               | -9.30                                           | -9.86                                          |
|           | - 200                             | 7.61                                            | 7.45                                           |

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | Input Voltage (mV) | Channel X ( $\mu\text{V}$ ) | Channel Y ( $\mu\text{V}$ ) | Channel Z ( $\mu\text{V}$ ) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200                | -                           | -1.77                       | -3.34                       |
| Channel Y | 200                | 9.21                        | -                           | -1.30                       |
| Channel Z | 200                | 4.15                        | 6.67                        | -                           |

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16075            | 15845           |
| Channel Y | 15795            | 15291           |
| Channel Z | 15997            | 15303           |

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M $\Omega$

|           | Average ( $\mu$ V) | min. Offset ( $\mu$ V) | max. Offset ( $\mu$ V) | Std. Deviation ( $\mu$ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 0.38               | -1.20                  | 1.34                   | 0.45                      |
| Channel Y | 0.48               | -0.62                  | 1.36                   | 0.40                      |
| Channel Z | 0.10               | -1.36                  | 1.40                   | 0.47                      |

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

#### 7. Input Resistance (Typical values for information)

|           | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200            | 200              |
| Channel Y | 200            | 200              |
| Channel Z | 200            | 200              |

#### 8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9              |
| Supply (- Vcc) | -7.6              |

#### 9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01             | +6            | +14               |
| Supply (- Vcc) | -0.01             | -8            | -9                |

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **AT4 Wireless**

Certificate No: **ES3-3052\_Jul15**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3052**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-12.v9, QA CAL-23.v5, QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**

Calibration date: **July 20, 2015**

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 E4419B         | GB41293874      | 01-Apr-15 (No. 217-02128)         | Mar-16                 |
| Power sensor E4412A        | MY41498087      | 01-Apr-15 (No. 217-02128)         | Mar-16                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 01-Apr-15 (No. 217-02129)         | Mar-16                 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 01-Apr-15 (No. 217-02132)         | Mar-16                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 01-Apr-15 (No. 217-02133)         | Mar-16                 |
| Reference Probe ES3DV2     | SN: 3013        | 30-Dec-14 (No. ES3-3013_Dec14)    | Dec-15                 |
| DAE4                       | SN: 660         | 14-Jan-15 (No. DAE4-660_Jan15)    | Jan-16                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-13)  | In house check: Apr-16 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

|                |                              |                                   |               |
|----------------|------------------------------|-----------------------------------|---------------|
| Calibrated by: | Name<br><b>Israe Elnaouq</b> | Function<br>Laboratory Technician | Signature<br> |
| Approved by:   | <b>Katja Pokovic</b>         | Technical Manager                 |               |

Issued: July 21, 2015

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**Calibration Laboratory of  
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#### Glossary:

|                          |                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| TSL                      | tissue simulating liquid                                                                                                                                |
| NORM <sub>x,y,z</sub>    | sensitivity in free space                                                                                                                               |
| ConvF                    | sensitivity in TSL / NORM <sub>x,y,z</sub>                                                                                                              |
| DCP                      | diode compression point                                                                                                                                 |
| CF                       | crest factor (1/duty_cycle) of the RF signal                                                                                                            |
| A, B, C, D               | modulation dependent linearization parameters                                                                                                           |
| Polarization $\phi$      | $\phi$ rotation around probe axis                                                                                                                       |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>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, "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
- 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<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* 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<sub>x,y,z</sub>**: 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<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: 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<sub>x,y,z</sub> \* 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  $\pm 50$  MHz to  $\pm 100$  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<sub>x</sub> (no uncertainty required).

ES3DV3 – SN:3052

July 20, 2015

# Probe ES3DV3

## SN:3052

Manufactured: September 30, 2003  
Calibrated: July 20, 2015

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

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July 20, 2015

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3052

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|-----------------------------------------------------------|----------|----------|----------|-----------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.13     | 0.42     | 1.10     | ± 10.1 %  |
| DCP (mV) <sup>B</sup>                                     | 105.6    | 103.0    | 104.7    |           |

### Modulation Calibration Parameters

| UID       | Communication System Name                     |   | A<br>dB | B<br>dB $\sqrt{\mu\text{V}}$ | C    | D<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-----------|-----------------------------------------------|---|---------|------------------------------|------|---------|----------|---------------------------|
| 0         | CW                                            | X | 0.0     | 0.0                          | 1.0  | 0.00    | 196.8    | ±3.5 %                    |
|           |                                               | Y | 0.0     | 0.0                          | 1.0  |         | 195.5    |                           |
|           |                                               | Z | 0.0     | 0.0                          | 1.0  |         | 190.9    |                           |
| 10011-CAB | UMTS-FDD (WCDMA)                              | X | 3.28    | 67.5                         | 19.0 | 2.91    | 134.3    | ±0.5 %                    |
|           |                                               | Y | 3.02    | 65.2                         | 17.2 |         | 132.7    |                           |
|           |                                               | Z | 3.21    | 66.9                         | 18.4 |         | 131.4    |                           |
| 10012-CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)      | X | 3.20    | 71.2                         | 20.2 | 1.87    | 135.6    | ±0.7 %                    |
|           |                                               | Y | 2.41    | 65.5                         | 16.8 |         | 132.2    |                           |
|           |                                               | Z | 2.69    | 67.7                         | 18.2 |         | 133.4    |                           |
| 10013-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps) | X | 10.80   | 70.2                         | 23.2 | 9.46    | 129.4    | ±3.0 %                    |
|           |                                               | Y | 10.48   | 68.4                         | 21.5 |         | 127.3    |                           |
|           |                                               | Z | 10.64   | 69.8                         | 22.9 |         | 126.0    |                           |
| 10021-DAB | GSM-FDD (TDMA, GMSK)                          | X | 8.94    | 85.5                         | 23.0 | 9.39    | 128.9    | ±2.2 %                    |
|           |                                               | Y | 1.93    | 64.2                         | 13.0 |         | 81.7     |                           |
|           |                                               | Z | 8.27    | 84.0                         | 22.0 |         | 147.6    |                           |
| 10023-DAB | GPRS-FDD (TDMA, GMSK, TN 0)                   | X | 11.80   | 90.3                         | 24.8 | 9.57    | 145.8    | ±2.2 %                    |
|           |                                               | Y | 1.85    | 63.9                         | 13.3 |         | 77.7     |                           |
|           |                                               | Z | 8.69    | 85.2                         | 22.7 |         | 141.4    |                           |
| 10024-DAB | GPRS-FDD (TDMA, GMSK, TN 0-1)                 | X | 30.54   | 99.9                         | 24.9 | 6.56    | 134.0    | ±1.9 %                    |
|           |                                               | Y | 2.66    | 70.1                         | 14.2 |         | 131.9    |                           |
|           |                                               | Z | 8.78    | 82.5                         | 19.3 |         | 131.5    |                           |
| 10025-DAB | EDGE-FDD (TDMA, 8PSK, TN 0)                   | X | 13.11   | 100.0                        | 39.2 | 12.62   | 137.2    | ±3.0 %                    |
|           |                                               | Y | 4.64    | 68.8                         | 23.6 |         | 54.0     |                           |
|           |                                               | Z | 12.46   | 98.9                         | 38.8 |         | 133.8    |                           |
| 10026-DAB | EDGE-FDD (TDMA, 8PSK, TN 0-1)                 | X | 11.91   | 94.5                         | 33.8 | 9.55    | 133.4    | ±2.2 %                    |
|           |                                               | Y | 4.88    | 72.4                         | 23.4 |         | 112.2    |                           |
|           |                                               | Z | 9.35    | 88.0                         | 30.9 |         | 130.6    |                           |
| 10027-DAB | GPRS-FDD (TDMA, GMSK, TN 0-1-2)               | X | 36.19   | 99.9                         | 23.5 | 4.80    | 125.9    | ±2.2 %                    |
|           |                                               | Y | 7.11    | 80.8                         | 16.5 |         | 138.0    |                           |
|           |                                               | Z | 44.98   | 99.6                         | 22.5 |         | 126.0    |                           |
| 10028-DAB | GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)             | X | 47.58   | 100.0                        | 22.2 | 3.55    | 138.3    | ±2.5 %                    |
|           |                                               | Y | 1.96    | 68.0                         | 11.0 |         | 130.2    |                           |
|           |                                               | Z | 68.44   | 99.7                         | 20.9 |         | 136.7    |                           |
| 10029-DAB | EDGE-FDD (TDMA, 8PSK, TN 0-1-2)               | X | 9.15    | 87.4                         | 29.4 | 7.78    | 128.1    | ±1.9 %                    |
|           |                                               | Y | 4.67    | 72.7                         | 22.5 |         | 135.1    |                           |
|           |                                               | Z | 10.25   | 90.6                         | 30.6 |         | 126.8    |                           |

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|           |                                             |   |       |      |      |       |       |         |
|-----------|---------------------------------------------|---|-------|------|------|-------|-------|---------|
| 10032-CAA | IEEE 802.15.1 Bluetooth (GFSK, DH5)         | X | 12.49 | 99.0 | 22.5 | 1.16  | 132.4 | ±1.9 %  |
|           |                                             | Y | 0.19  | 57.1 | 3.6  |       | 128.4 |         |
|           |                                             | Z | 99.74 | 91.8 | 15.1 |       | 132.7 |         |
| 10035-CAA | IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)   | X | 4.62  | 73.2 | 21.7 | 3.83  | 145.0 | ±0.7 %  |
|           |                                             | Y | 3.53  | 67.5 | 18.5 |       | 140.4 |         |
|           |                                             | Z | 4.35  | 71.9 | 20.9 |       | 145.0 |         |
| 10038-CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH5)       | X | 4.62  | 72.1 | 21.5 | 4.10  | 145.3 | ±0.9 %  |
|           |                                             | Y | 3.67  | 67.0 | 18.5 |       | 142.5 |         |
|           |                                             | Z | 4.37  | 70.9 | 20.7 |       | 145.0 |         |
| 10048-CAA | DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)   | X | 6.02  | 80.0 | 24.4 | 13.80 | 81.1  | ±1.4 %  |
|           |                                             | Y | 1.92  | 61.0 | 14.1 |       | 30.0  |         |
|           |                                             | Z | 5.26  | 77.4 | 23.1 |       | 79.5  |         |
| 10049-CAA | DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12) | X | 12.05 | 90.8 | 25.8 | 10.79 | 127.7 | ±1.7 %  |
|           |                                             | Y | 2.25  | 65.9 | 14.9 |       | 60.7  |         |
|           |                                             | Z | 12.63 | 91.6 | 25.7 |       | 148.9 |         |
| 10058-DAB | EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)           | X | 7.97  | 84.6 | 27.5 | 6.52  | 135.1 | ±1.9 %  |
|           |                                             | Y | 4.16  | 71.4 | 21.3 |       | 128.6 |         |
|           |                                             | Z | 7.97  | 84.8 | 27.3 |       | 135.0 |         |
| 10097-CAB | UMTS-FDD (HSDPA)                            | X | 4.59  | 67.1 | 19.0 | 3.98  | 139.7 | ±0.7 %  |
|           |                                             | Y | 4.40  | 65.5 | 17.6 |       | 141.5 |         |
|           |                                             | Z | 4.49  | 66.6 | 18.5 |       | 140.0 |         |
| 10098-CAB | UMTS-FDD (HSUPA, Subtest 2)                 | X | 4.59  | 67.0 | 18.9 | 3.98  | 140.4 | ±0.7 %  |
|           |                                             | Y | 4.44  | 65.7 | 17.7 |       | 142.1 |         |
|           |                                             | Z | 4.51  | 66.6 | 18.5 |       | 140.7 |         |
| 10100-CAB | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)    | X | 6.53  | 68.2 | 20.3 | 5.67  | 148.2 | ±1.4 %  |
|           |                                             | Y | 6.32  | 66.8 | 19.0 |       | 147.7 |         |
|           |                                             | Z | 6.43  | 67.8 | 19.9 |       | 148.2 |         |
| 10102-CAB | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)  | X | 7.58  | 67.7 | 20.2 | 6.60  | 134.6 | ±1.4 %  |
|           |                                             | Y | 7.48  | 66.7 | 19.2 |       | 135.0 |         |
|           |                                             | Z | 7.51  | 67.5 | 20.0 |       | 135.0 |         |
| 10101-CAB | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)  | X | 7.58  | 67.7 | 20.2 | 6.42  | 134.6 | ±12.2 % |
|           |                                             | Y | 7.48  | 66.7 | 19.2 |       | 135.0 |         |
|           |                                             | Z | 7.51  | 67.5 | 20.0 |       | 135.0 |         |
| 10108-CAC | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)    | X | 6.38  | 67.8 | 20.2 | 5.80  | 146.1 | ±1.7 %  |
|           |                                             | Y | 6.21  | 66.3 | 18.8 |       | 145.5 |         |
|           |                                             | Z | 6.28  | 67.4 | 19.8 |       | 145.6 |         |
| 10110-CAC | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)     | X | 6.01  | 67.1 | 19.8 | 5.75  | 141.5 | ±1.2 %  |
|           |                                             | Y | 5.86  | 65.7 | 18.6 |       | 141.5 |         |
|           |                                             | Z | 5.95  | 66.8 | 19.6 |       | 141.4 |         |
| 10154-CAC | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)     | X | 6.01  | 67.1 | 19.8 | 5.75  | 141.5 | ±12.2 % |
|           |                                             | Y | 5.86  | 65.7 | 18.6 |       | 141.5 |         |
|           |                                             | Z | 5.95  | 66.8 | 19.6 |       | 141.4 |         |
| 10112-CAC | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)  | X | 7.27  | 67.3 | 20.1 | 6.59  | 130.6 | ±1.4 %  |
|           |                                             | Y | 7.21  | 66.4 | 19.1 |       | 130.3 |         |
|           |                                             | Z | 7.19  | 67.0 | 19.8 |       | 130.8 |         |

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|           |                                            |   |       |      |      |      |       |         |
|-----------|--------------------------------------------|---|-------|------|------|------|-------|---------|
| 10109-CAC | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM) | X | 7.27  | 67.3 | 20.1 | 6.43 | 130.6 | ±12.2 % |
|           |                                            | Y | 7.21  | 66.4 | 19.1 |      | 130.3 |         |
|           |                                            | Z | 7.19  | 67.0 | 19.8 |      | 130.8 |         |
| 10150-CAB | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)  | X | 7.27  | 67.3 | 20.1 | 6.60 | 130.6 | ±12.2 % |
|           |                                            | Y | 7.21  | 66.4 | 19.1 |      | 130.3 |         |
|           |                                            | Z | 7.19  | 67.0 | 19.8 |      | 130.8 |         |
| 10149-CAB | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)  | X | 7.27  | 67.3 | 20.1 | 6.42 | 130.6 | ±12.2 % |
|           |                                            | Y | 7.21  | 66.4 | 19.1 |      | 130.3 |         |
|           |                                            | Z | 7.19  | 67.0 | 19.8 |      | 130.8 |         |
| 10117-CAB | IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)   | X | 10.22 | 69.2 | 21.6 | 8.07 | 136.5 | ±2.2 %  |
|           |                                            | Y | 10.07 | 68.1 | 20.5 |      | 135.4 |         |
|           |                                            | Z | 10.17 | 69.1 | 21.5 |      | 136.3 |         |
| 10140-CAB | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM) | X | 7.51  | 67.7 | 20.2 | 6.49 | 135.6 | ±1.4 %  |
|           |                                            | Y | 7.45  | 66.8 | 19.3 |      | 136.7 |         |
|           |                                            | Z | 7.43  | 67.4 | 20.0 |      | 135.7 |         |
| 10141-CAB | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM) | X | 7.51  | 67.7 | 20.2 | 6.53 | 135.6 | ±12.2 % |
|           |                                            | Y | 7.45  | 66.8 | 19.3 |      | 136.7 |         |
|           |                                            | Z | 7.43  | 67.4 | 20.0 |      | 135.7 |         |
| 10158-CAC | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)  | X | 7.03  | 67.1 | 20.1 | 6.62 | 127.5 | ±1.4 %  |
|           |                                            | Y | 6.93  | 66.1 | 19.1 |      | 127.0 |         |
|           |                                            | Z | 6.98  | 67.0 | 19.9 |      | 127.3 |         |
| 10111-CAC | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)  | X | 7.03  | 67.1 | 20.1 | 6.44 | 127.5 | ±12.2 % |
|           |                                            | Y | 6.93  | 66.1 | 19.1 |      | 127.0 |         |
|           |                                            | Z | 6.98  | 67.0 | 19.9 |      | 127.3 |         |
| 10113-CAC | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)  | X | 7.03  | 67.1 | 20.1 | 6.62 | 127.5 | ±12.2 % |
|           |                                            | Y | 6.93  | 66.1 | 19.1 |      | 127.0 |         |
|           |                                            | Z | 6.98  | 67.0 | 19.9 |      | 127.3 |         |
| 10155-CAC | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)  | X | 7.03  | 67.1 | 20.1 | 6.43 | 127.5 | ±12.2 % |
|           |                                            | Y | 6.93  | 66.1 | 19.1 |      | 127.0 |         |
|           |                                            | Z | 6.98  | 67.0 | 19.9 |      | 127.3 |         |
| 10161-CAB | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)  | X | 7.03  | 67.1 | 20.1 | 6.43 | 127.5 | ±12.2 % |
|           |                                            | Y | 6.93  | 66.1 | 19.1 |      | 127.0 |         |
|           |                                            | Z | 6.98  | 67.0 | 19.9 |      | 127.3 |         |
| 10162-CAB | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)  | X | 7.03  | 67.1 | 20.1 | 6.58 | 127.5 | ±12.2 % |
|           |                                            | Y | 6.93  | 66.1 | 19.1 |      | 127.0 |         |
|           |                                            | Z | 6.98  | 67.0 | 19.9 |      | 127.3 |         |
| 10173-CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)    | X | 8.13  | 78.1 | 28.1 | 9.48 | 136.8 | ±2.5 %  |
|           |                                            | Y | 6.23  | 70.5 | 23.4 |      | 146.9 |         |
|           |                                            | Z | 7.81  | 77.0 | 27.5 |      | 135.6 |         |
| 10226-CAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)   | X | 8.13  | 78.1 | 28.1 | 9.49 | 136.8 | ±12.2 % |
|           |                                            | Y | 6.23  | 70.5 | 23.4 |      | 146.9 |         |
|           |                                            | Z | 7.81  | 77.0 | 27.5 |      | 135.6 |         |
| 10235-CAB | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)    | X | 8.13  | 78.1 | 28.1 | 9.48 | 136.8 | ±12.2 % |
|           |                                            | Y | 6.23  | 70.5 | 23.4 |      | 146.9 |         |
|           |                                            | Z | 7.81  | 77.0 | 27.5 |      | 135.6 |         |

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|           |                                          |   |      |      |      |      |       |         |
|-----------|------------------------------------------|---|------|------|------|------|-------|---------|
| 10229-CAB | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)   | X | 8.13 | 78.1 | 28.1 | 9.48 | 136.8 | ±12.2 % |
|           |                                          | Y | 6.23 | 70.5 | 23.4 |      | 146.9 |         |
|           |                                          | Z | 7.81 | 77.0 | 27.5 |      | 135.6 |         |
| 10232-CAB | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)   | X | 8.13 | 78.1 | 28.1 | 9.48 | 136.8 | ±12.2 % |
|           |                                          | Y | 6.23 | 70.5 | 23.4 |      | 146.9 |         |
|           |                                          | Z | 7.81 | 77.0 | 27.5 |      | 135.6 |         |
| 10238-CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)  | X | 8.13 | 78.1 | 28.1 | 9.48 | 136.8 | ±12.2 % |
|           |                                          | Y | 6.23 | 70.5 | 23.4 |      | 146.9 |         |
|           |                                          | Z | 7.81 | 77.0 | 27.5 |      | 135.6 |         |
| 10179-CAC | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)  | X | 5.69 | 68.4 | 21.0 | 6.50 | 143.1 | ±1.7 %  |
|           |                                          | Y | 5.23 | 66.3 | 19.4 |      | 138.0 |         |
|           |                                          | Z | 5.63 | 68.2 | 20.8 |      | 143.0 |         |
| 10170-CAB | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)  | X | 5.69 | 68.4 | 21.0 | 6.52 | 143.1 | ±12.2 % |
|           |                                          | Y | 5.23 | 66.3 | 19.4 |      | 138.0 |         |
|           |                                          | Z | 5.63 | 68.2 | 20.8 |      | 143.0 |         |
| 10176-CAC | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)  | X | 5.69 | 68.4 | 21.0 | 6.52 | 143.1 | ±12.2 % |
|           |                                          | Y | 5.23 | 66.3 | 19.4 |      | 138.0 |         |
|           |                                          | Z | 5.63 | 68.2 | 20.8 |      | 143.0 |         |
| 10188-CAC | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM) | X | 5.69 | 68.4 | 21.0 | 6.52 | 143.1 | ±12.2 % |
|           |                                          | Y | 5.23 | 66.3 | 19.4 |      | 138.0 |         |
|           |                                          | Z | 5.63 | 68.2 | 20.8 |      | 143.0 |         |
| 10180-CAC | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)   | X | 5.69 | 68.4 | 21.0 | 6.50 | 143.1 | ±12.2 % |
|           |                                          | Y | 5.23 | 66.3 | 19.4 |      | 138.0 |         |
|           |                                          | Z | 5.63 | 68.2 | 20.8 |      | 143.0 |         |
| 10178-CAC | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)   | X | 5.69 | 68.4 | 21.0 | 6.52 | 143.1 | ±12.2 % |
|           |                                          | Y | 5.23 | 66.3 | 19.4 |      | 138.0 |         |
|           |                                          | Z | 5.63 | 68.2 | 20.8 |      | 143.0 |         |
| 10182-CAB | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)  | X | 5.69 | 68.4 | 21.0 | 6.52 | 143.1 | ±12.2 % |
|           |                                          | Y | 5.23 | 66.3 | 19.4 |      | 138.0 |         |
|           |                                          | Z | 5.63 | 68.2 | 20.8 |      | 143.0 |         |
| 10185-CAC | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)   | X | 5.69 | 68.4 | 21.0 | 6.51 | 143.1 | ±12.2 % |
|           |                                          | Y | 5.23 | 66.3 | 19.4 |      | 138.0 |         |
|           |                                          | Z | 5.63 | 68.2 | 20.8 |      | 143.0 |         |
| 10187-CAC | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)   | X | 5.01 | 67.6 | 20.3 | 5.73 | 144.7 | ±1.2 %  |
|           |                                          | Y | 4.57 | 65.2 | 18.5 |      | 137.4 |         |
|           |                                          | Z | 4.93 | 67.1 | 19.9 |      | 144.3 |         |
| 10166-CAC | LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK) | X | 5.01 | 67.6 | 20.3 | 5.46 | 144.7 | ±12.2 % |
|           |                                          | Y | 4.57 | 65.2 | 18.5 |      | 137.4 |         |
|           |                                          | Z | 4.93 | 67.1 | 19.9 |      | 144.3 |         |
| 10181-CAB | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)    | X | 5.01 | 67.6 | 20.3 | 5.72 | 144.7 | ±12.2 % |
|           |                                          | Y | 4.57 | 65.2 | 18.5 |      | 137.4 |         |
|           |                                          | Z | 4.93 | 67.1 | 19.9 |      | 144.3 |         |
| 10169-CAB | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)    | X | 5.01 | 67.6 | 20.3 | 5.73 | 144.7 | ±12.2 % |
|           |                                          | Y | 4.57 | 65.2 | 18.5 |      | 137.4 |         |
|           |                                          | Z | 4.93 | 67.1 | 19.9 |      | 144.3 |         |

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|-----------|---------------------------------------------|---|------|------|------|------|-------|---------|
| 10175-CAC | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)       | X | 5.01 | 67.6 | 20.3 | 5.72 | 144.7 | ±12.2 % |
|           |                                             | Y | 4.57 | 65.2 | 18.5 |      | 137.4 |         |
|           |                                             | Z | 4.93 | 67.1 | 19.9 |      | 144.3 |         |
| 10177-CAE | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)        | X | 5.01 | 67.6 | 20.3 | 5.73 | 144.7 | ±12.2 % |
|           |                                             | Y | 4.57 | 65.2 | 18.5 |      | 137.4 |         |
|           |                                             | Z | 4.93 | 67.1 | 19.9 |      | 144.3 |         |
| 10184-CAC | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)        | X | 5.01 | 67.6 | 20.3 | 5.73 | 144.7 | ±12.2 % |
|           |                                             | Y | 4.57 | 65.2 | 18.5 |      | 137.4 |         |
|           |                                             | Z | 4.93 | 67.1 | 19.9 |      | 144.3 |         |
| 10196-CAB | IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)     | X | 9.79 | 68.8 | 21.5 | 8.10 | 129.9 | ±2.5 %  |
|           |                                             | Y | 9.69 | 67.7 | 20.3 |      | 128.7 |         |
|           |                                             | Z | 9.73 | 68.7 | 21.3 |      | 128.8 |         |
| 10225-CAB | UMTS-FDD (HSPA+)                            | X | 6.84 | 66.9 | 19.5 | 5.97 | 132.7 | ±1.2 %  |
|           |                                             | Y | 6.84 | 66.2 | 18.7 |      | 132.9 |         |
|           |                                             | Z | 6.81 | 66.8 | 19.4 |      | 132.4 |         |
| 10228-CAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)      | X | 7.79 | 77.2 | 27.7 | 9.22 | 140.4 | ±2.2 %  |
|           |                                             | Y | 6.01 | 69.8 | 23.0 |      | 149.6 |         |
|           |                                             | Z | 7.63 | 76.7 | 27.4 |      | 138.3 |         |
| 10237-CAB | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)       | X | 7.79 | 77.2 | 27.7 | 9.21 | 140.4 | ±12.2 % |
|           |                                             | Y | 6.01 | 69.8 | 23.0 |      | 149.6 |         |
|           |                                             | Z | 7.63 | 76.7 | 27.4 |      | 138.3 |         |
| 10172-CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)       | X | 7.79 | 77.2 | 27.7 | 9.21 | 140.4 | ±12.2 % |
|           |                                             | Y | 6.01 | 69.8 | 23.0 |      | 149.6 |         |
|           |                                             | Z | 7.63 | 76.7 | 27.4 |      | 138.3 |         |
| 10231-CAB | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)        | X | 7.79 | 77.2 | 27.7 | 9.19 | 140.4 | ±12.2 % |
|           |                                             | Y | 6.01 | 69.8 | 23.0 |      | 149.6 |         |
|           |                                             | Z | 7.63 | 76.7 | 27.4 |      | 138.3 |         |
| 10234-CAB | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)        | X | 7.79 | 77.2 | 27.7 | 9.21 | 140.4 | ±12.2 % |
|           |                                             | Y | 6.01 | 69.8 | 23.0 |      | 149.6 |         |
|           |                                             | Z | 7.63 | 76.7 | 27.4 |      | 138.3 |         |
| 10240-CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)       | X | 7.79 | 77.2 | 27.7 | 9.21 | 140.4 | ±12.2 % |
|           |                                             | Y | 6.01 | 69.8 | 23.0 |      | 149.6 |         |
|           |                                             | Z | 7.63 | 76.7 | 27.4 |      | 138.3 |         |
| 10246-CAB | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)      | X | 8.17 | 74.0 | 26.0 | 9.30 | 133.6 | ±2.2 %  |
|           |                                             | Y | 6.81 | 68.0 | 22.0 |      | 146.0 |         |
|           |                                             | Z | 7.98 | 73.4 | 25.6 |      | 132.0 |         |
| 10249-CAB | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)      | X | 8.17 | 74.0 | 26.0 | 9.29 | 133.6 | ±12.2 % |
|           |                                             | Y | 6.81 | 68.0 | 22.0 |      | 146.0 |         |
|           |                                             | Z | 7.98 | 73.4 | 25.6 |      | 132.0 |         |
| 10258-CAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)   | X | 8.17 | 74.0 | 26.0 | 9.34 | 133.6 | ±12.2 % |
|           |                                             | Y | 6.81 | 68.0 | 22.0 |      | 146.0 |         |
|           |                                             | Z | 7.98 | 73.4 | 25.6 |      | 132.0 |         |
| 10256-CAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM) | X | 8.92 | 74.4 | 26.6 | 9.96 | 136.3 | ±3.0 %  |
|           |                                             | Y | 7.58 | 68.8 | 22.7 |      | 149.4 |         |
|           |                                             | Z | 8.78 | 74.1 | 26.3 |      | 135.0 |         |

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