SAR TEST REPORT

For

WiFi Watch

Model Number: MT10G

FCC ID: 2ACCJBC06

Report Number: WT178001448

Test Laboratory	:	Shenzhen Academy of Metrology and Quality Inspection National Digital Electronic Product Testing Center
Site Location	:	NETC Building, No.4 Tongfa Road, Xili Town, Nanshan District, Shenzhen, Guangdong, China
Tel	:	0086-755-86928965
Fax	:	0086-755-86009898-31396
Web	:	www.smq.com.cn
Email	:	emcrf@smq.com.cn

Test report declaration

Applicant	:	TCL Communication Ltd
Address	:	5F, C-Tower,No.232,Liangjing Road, Zhangjiang High-tech Park, Pudong, Shanghai,China
Manufacturer	:	TCL Communication Ltd
Address	:	5F, C-Tower,No.232,Liangjing Road, Zhangjiang High-tech Park, Pudong, Shanghai,China
EUT Description	:	WiFi Watch
Model No	:	MT10G
Trade mark	:	Alcatel/TCL
FCC ID	:	2ACCJBC06

Test Standards:

FCC 47 CFR Part 2 (2.1093), ANSI Std C95.1-1992, IEEE Std 1528-2013, KDB941225 D06, KDB447498 D01, KDB248227 D01,KDB 865664 D01,KDB865664 D02,KDB690783 D01

The EUT described above is tested by Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory to determine the compliance of the applicable standards stated above. Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory is assumed full responsibility for the accuracy of the test results.

The results documented in this report only apply to the tested sample, under the conditions and modes of operation as described herein.

The test report shall not be reproduced in part without written approval of the laboratory.

Project Engineer:	(Zhou Li)	Date:	Apr 05, 2017
Checked by:	(Lin Yixiang)	Date:	Apr 05, 2017
Approved by:	(Lin Bin)	Date:	Apr 05, 2017

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1. REPORTED SAR SUMMARY

1.1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing are as follows.

Band	Max Reported SAR(W/kg)
	10-g Gap(0mm)
Wi-Fi 2.4G	0.105
The highest simultaneous SAR value is 0.105 W/kg per KDB690783-D01	

Table 1: Summary of test result

Note:

*For body-worn operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal and that positions the handset a minimum of 0mm from the body. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

The device is in compliance with Specific Absorption Rate (SAR) for general population/ uncontrolled exposure limits according to the FCC rule 2.1093 , the ANSI/IEEE C95.1:1992, the NCRP Report Number 86 for uncontrolled environment, according to the Industry Canada Radio Standards Specification RSS-102 for General Population/ Uncontrolled exposure, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013& IEEE Std 1528a-2005.

1.2. RF exposure limits (ICNIRP Guidelines)

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR*(Brain/Body)	1.60mW/g	8.00mW/g
Spatial Average SAR** (Whole Body)	0.08mW/g	0.40mW/g
Spatial Peak SAR***(Limbs)	**4.00mW/g**	20.00mW/g

Table 2: RF exposure limits

The limit applied in this test report is shown in bold letters

Notes:

* The Spatial Peak value of the SAR averaged over any 1 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 1 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure,(i.e. as a result if employment or occupation.)

1.3 Ratings and System Details

Device type :	Portable Device	
DUT Name:	WiFi Watch	
Type Identification:	MT10G	
IMEI No :	--	
Exposure category:	Uncontrolled environment / General population	
Test Device Production information	Production Unit	
Operating Mode(s)	WiFi2.4G	
Test modulation	Wi-Fi(OFDM/DSSS)	
Device Class :	B	
HSDPA Category	14	
HSUPA Category	6	
DC-HSDPA Category	24	
LTE Release Rel	9	
Operating Frequency Range(s)	Transmitter Frequency Range	Receiver Frequency Range
Wi-Fi(tested):	2400-2483.5 MHz	
BT:	2400-2483.5 MHz	
Power Class :	--	
Test Channels (low-mid-high) :	1-6-11(Wi-Fi 802.11b)	
Hardware version :	V3.0	
Software version :	MT10G_SW_00_V0.91	
Antenna type :	Integrated Antenna	
Battery options :	TCL HYPERPOWER BATTERIES INC.	TCL HYPERPOWER BATTERIES INC. Li-polymer Battery Battery Model: TLp003BC Rated capacity: Nominal Voltage: ⎓ +3.80V Charge Voltage: ⎓ +4.35V

1.4 Product Function and Intended Use

MT10G is subscriber equipment in the Wi-Fi and BT system.

1.5 Test specification(s)

ANSI Std C95.1-1992	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz-300GHz.(IEEE Std C95.1-1991)
IEEE Std 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate(SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
IEEE Std 1528a-2005	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate(SAR) in the Human head from Wireless Communications Devices: Measurement Techniques Amendment1: CAD File for Human Head Model(SAM Phantom)
FCC 47 CFR Part 2 (2.1093)	FCC Limits for Maximum Permissible Exposure (MPE)
KDB447498 D01 General RF Exposure Guidance v06	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB 248227 D01 802 11 Wi-Fi SAR v02r02	SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04	SAR Measurement Requirements for 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting v01r02	RF Exposure Compliance Reporting and Documentation Considerations
KDB 690783 D01 SAR Listings on Grants v01r03	SAR Listings on Equipment Authorization Grants

1.6 List of Test and Measurement Instruments

No	Equipment	Model No.	Serial No.	Manufacturer	Last Calibration Date	Period
1	SAR test system	TX60L	F08/5AY8A1/A/01+F08/	SPEAG	NCR	NCR
2	Electronic Data Transmitter	DAE4	876	SPEAG	2017.03.09	1year
3	SAR Probe	ES3DV3	3203	SPEAG	2017.01.13	1year
4	Software	85070	--	SPEAG	--	--
5	Software	DASY5	--	SPEAG	--	--
6	System Validation Dipole,2450MHz	D2450V2	818	SPEAG	2015.09.14	3year
7	Dielectric Probe Kit	85070E	MY44300455	Agilent	NCR	NCR
8	Dual-directional coupler,2.00-18GHz	772D	MY46151160	Agilent	NCR	NCR
9	Coaxial attenuator	8491A	MY39266348	Agilent	NCR	NCR
10	Power Amplifier	ZVE-8G	SC280800926	Agilent	NCR	NCR
11	Power Amplifier	ZHL42W	81709	MINI-CIRCUITS	NCR	NCR
12	Signal Generator	SMR20	100047	R&S	2016.04.25	1year
13	Power Sensor	NRP-Z21	105057-XP	R&S	2017.03.22	1year
14	Power Sensor	NRP-Z21	105056-GI	R&S	2017.03.22	1year
15	Network Analyzer	E5071C	MY46109550	Agilent	2016.04.22	1Year
16	Flat Phantom	ELI4.0	TP-1904	SPEAG	NCR	NCR
17	Twin Phantom	SAM	TP-1504	SPEAG	NCR	NCR

Table 3: List of Test and Measurement Equipment

Note: All the test equipments are calibrated once a year, except the dipoles, which are calibrated every three years. Moreover, we have self-calibration every year to the dipoles.

2. GENERAL INFORMATION

2.1. Report information

This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that SMQ approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that SMQ in any way guarantees the later performance of the product/equipment.

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Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through SMQ, unless the applicant has authorized SMQ in writing to do so.

2.2. Laboratory Accreditation and Relationship to Customer

The testing report were performed by the Shenzhen Academy of Metrology and quality Insp ection EMC Laboratory (Guangdong EMC compliance testing center), in their facilities locat ed at NETC Building, No.4 Tongfa Rd., Xili, Nanshan, Shenzhen, China. At the time of testi ng, Laboratory is accredited by the following organizations:

China National Accreditation Service for Conformity Assessment (CNAS) accredits the Lab oratory for conformance to FCC standards, EMC international standards and EN standards. The Registration Number is CNAS L0579.

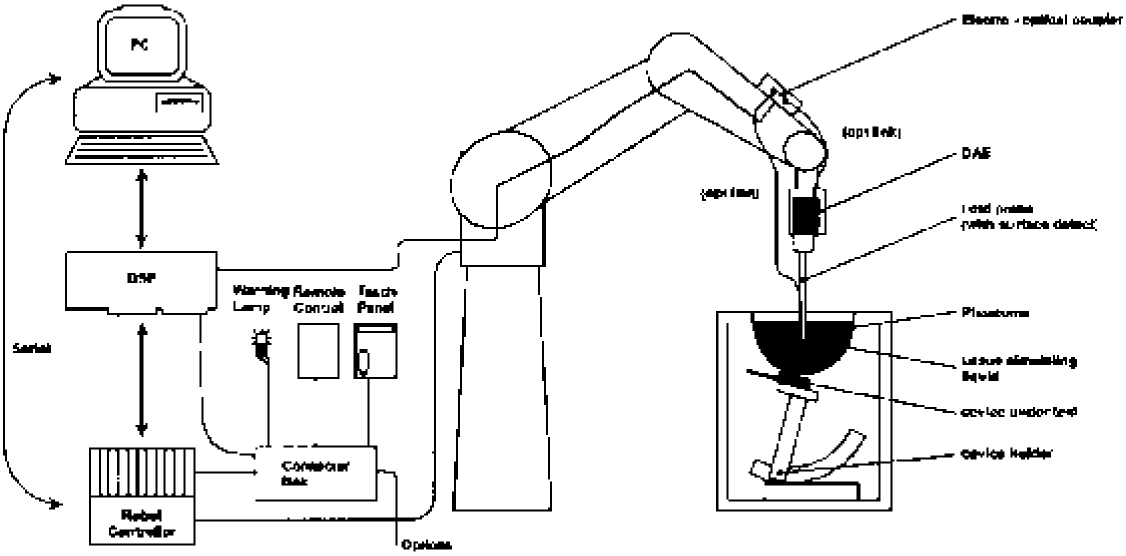
The Laboratory is listed in the United States of American Federal Communications Commis sion (FCC), and the registration number are 446246 806614 994606(semi anechoic chamb er).

The Laboratory is registered to perform emission tests with Industry Canada (IC), and the r egistration number is 11177A-1 11177A-2.

TUV Rhineland accredits the Laboratory for conformance to IEC and EN standards, the regi stration number is E2024086Z02.

3. SAR MEASUREMENT SYSTEM CONFIGURATION

3.1. SAR Measurement Set-up



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

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

• A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

• A data acquisition electronic (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.

• A unit to operate the optical surface detector which is connected to the EOC.

• The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.

• The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. • A computer operating Windows XP.

• DASY5 software and SEMCAD data evaluation software.

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

- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System checks dipoles allowing validating the proper functioning of the system.
- Test environment
- The DASY5 measurement system is placed at the head end of a room with dimensions:

4.5 x 4 x 3 m^3, the SAM phantom is placed in a distance of 1.3 m from the side walls and 1.1m from the rear wall.

Picture 1 of the photo documentation shows a complete view of the test environment.

3.2. Probe description

Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

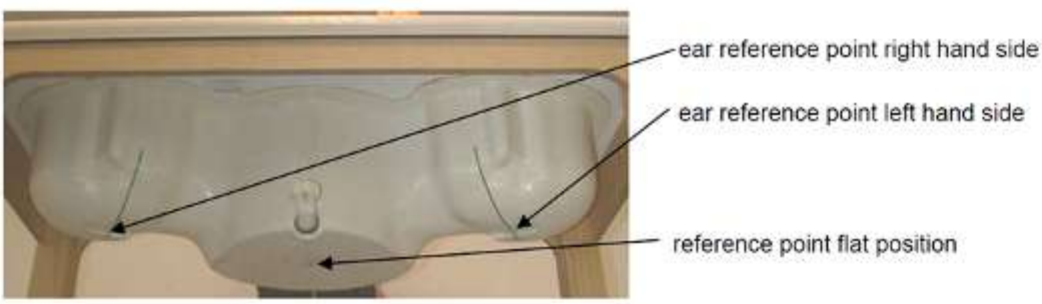
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to >6 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic range	10 μW/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically<1 μW/g)
Dimensions	Overall length: 337 mm (Tip: 20mm) Tip length: 2.5 mm (Body: 12mm) Typical distance from probe tip to dipole centers: 1mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

Isotropic E-Field Probe ES3DV3 for Dosimetric Measurements

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)	
Dynamic range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones	

3.3. Phantom description

The used SAM Phantom meets the requirements specified in Edition 01-01 of Supplement C to OET Bulletin 65 for Specific Absorption Rate (SAR) measurements.
The phantom consists of a fibreglass shell integrated in a wooden table. It allows left-hand and right-hand head as well as body-worn measurements with a maximum liquid depth of 18 cm in head position and 22 cm in planar position (body measurements). The thickness of the Phantom shell is 2 mm +/- 0.1 mm.



ELI4 Phantom

Shell Thickness	2mm+/- 0.2mm
Filling Volume	Approximately 30 liters
Measurement Areas	Flat phantom
The ELI4 phantom is in intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6GHz. ELI4 is fully compatible with the lastest draft of the standard IEC 62209-2 and all known tissue simulating liquids.	

The phantom shell material is resistant to all ingredients used in the tissue-equivalent liquid recipes. The shell of the phantom including ear spacers is constructed from low permittivity and low loss material, with a relative permittivity≤5 and a loss tangent ≤0.05.

3.4. Device holder description

The DASY5 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. This device holder is used for standard mobile phones or PDA's only. If necessary an additional support of polystyrene material is used.

Larger DUT's (e.g. notebooks) cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values.

Therefore those devices are normally only tested at the flat part of the SAM.

4. SAR MEASUREMENT PROCEDURE

4.1. Scanning procedure

- The DASY5 installation includes predefined files with recommended procedures for measurements and system check. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.
- The reference and drift measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT's output power and should vary max. +/- 5 %.
- The surface check measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)
- The area scan measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strenth is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The standard scan uses large grid spacing for faster measurement. Standard grid spacing for head measurements is 15 mm in x- and y- dimension(≤ 2GHz) , 12 mm in x- and y- dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz). If a finer resolution is needed, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation.

Results of this coarse scan are shown in Appendix B.

● A “zoom scan” measures the field in a volume around the 2D peak SAR value acquired in the previous “coarse” scan. This is a fine grid with maximum scan spatial resolution: Δxzoom, Δyzoom ≤2GHZ≤ 8 mm, 2-4GHz - ≤ 5 mm and 4-6 GHz-≤ 4 mm; Δzzoom ≤ 3GHz - ≤ 5 mm, 3-4 GHz- ≤ 4 mm and 4-6GHz-≤2mm where the robot additionally moves the probe along the z-axis away from the bottom of the Phantom. DASY5 is also able to perform repeated zoom scans if more than 1 peak is found during area scan. Test results relevant for the specified standard (see chapter 1.5.) are shown in table form in chapter 3.2.

● A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 2mm steps. This measurement shows the continuity of the liquid and can – depending in the field strength- also show the liquid depth. A z-axis scan of the measurement with maximum SAR value is shown in Appendix B.

The following table summarizes the area scan and zoom scan resolutions per FCC KDB 865664D01:

Frequency	Maximum Area Scan resolution (Δxarea, Δyarea)	Maximum Zoom Scan spatial resolution(Δxzoom Δyzoom)	Maximum Zoom Scan spatial resolution			Minimum zoom scan volume (x,y,z)
			Uniform Grid	Graded Grad		
			Δzzoom(n)	Δzzoom(1)	Δzzoom(n>1)	
≤2GHz	≤15mm	≤8mm	≤5mm	≤4mm	≤ 1.5* Δzzoom(n-1)	≥30mm
2-3GHz	≤12mm	≤5mm	≤5mm	≤4mm	≤ 1.5* Δzzoom(n-1)	≥30mm
3-4GHz	≤10mm	≤5mm	≤4mm	≤3mm	≤ 1.5* Δzzoom(n-1)	≥28mm
4-5GHz	≤10mm	≤4mm	≤3mm	≤2.5mm	≤ 1.5* Δzzoom(n-1)	≥25mm
5-6GHz	≤10mm	≤4mm	≤2mm	≤2mm	≤ 1.5* Δzzoom(n-1)	≥22mm

Spatial Peak SAR Evaluation

● The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The bases of the evaluation are the SAR values measured at the points of the fine cube grid consisting of 5 x 5 x 7 points (with 8mm horizontal resolution) or 7 x 7 x 7 points (with 5mm horizontal resolution).

- The algorithm that finds the maximal averaged volume is separated into three different stages.
- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting 'Graph Evaluated'.
- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.
- All neighboring volumes are evaluated until no neigh boring volume with a higher average value is found.
- Extrapolation
- The extrapolation is based on a least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

Interpolation

- The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff].
- Volume Averaging
- At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.
- Advanced Extrapolation
- DASY5 uses the advanced extrapolation option which is able to compansate boundary effects on E-field probes.

4.1.1.Data Storage and Evaluation

Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension DAE4. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters: - Sensitivity Normi, ai0, ai1, ai2

- Conversion factor ConvFi

- Diode compression point Dcpi

Device parameters: - Frequency f

- Crest factor cf

Media parameters: - Conductivity σ

- Density ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$Vi = Ui + Ui2 \bullet cf/dcpi$$

with Vi = compensated signal of channel i (i = x, y, z)

Ui = input signal of channel i (i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

dcpi = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes: $Ei = (Vi / Normi \bullet ConvF)1/2$

H-field probes: $Hi = (Vi)1/2 \bullet (ai0 + ai1f + ai2f2)/f$

with Vi = compensated signal of channel i (i = x, y, z)

Normi = sensor sensitivity of channel i (i = x, y, z)

[mV/(V/m)2] for E-field Probes

ConvF = sensitivity enhancement in solution

aij = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

Ei = electric field strength of channel i in V/m

Hi = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$Etot = (Ex2 + EY2 + Ez2)1/2$

The primary field data are used to calculate the derived field units.

$SAR = (Etot2 \bullet \sigma) / (\rho \bullet 1000)$

with SAR = local specific absorption rate in mW/g

Etot = total field strength in V/m

σ = conductivity in [mho/m] or [Siemens/m]

ρ = equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

P_{pwe} = Etot2 / 3770 or P_{pwe} = Htot2 • 37.7

with P_{pwe} = equivalent power density of a plane wave in mW/cm2

Etot = total electric field strength in V/m

Htot = total magnetic field strength in A/m

5. SYSTEM VERIFICATION PROCEDURE

5.1. Tissue Verification

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ±5% of the target values.

The following materials are used for producing the tissue-equivalent materials

Ingredients(% of weight)	Body Tissue
Frequency Band(MHz)	2450
Water	73.2
Salt(NaCl)	0.04
Sugar	0.0
HEC	0.0
Bactericide	0.0
Triton X-100	0.0
DGBE	26.7

Table 4 : Tissue Dielectric Properties

Salt: 99+% Pure Sodium Chloride; Sugar”98+% Pure Sucrose; Water: De-ionized, 16MΩ+ resistivity

HEC: Hydroxyethyl Cellulose; DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100(ultra pure): Polyethylene glycol mono[4-(1,1,3,3-tetramethylbutyl)phenyl]ether

Body Tissue-equivalent liquid measurements:

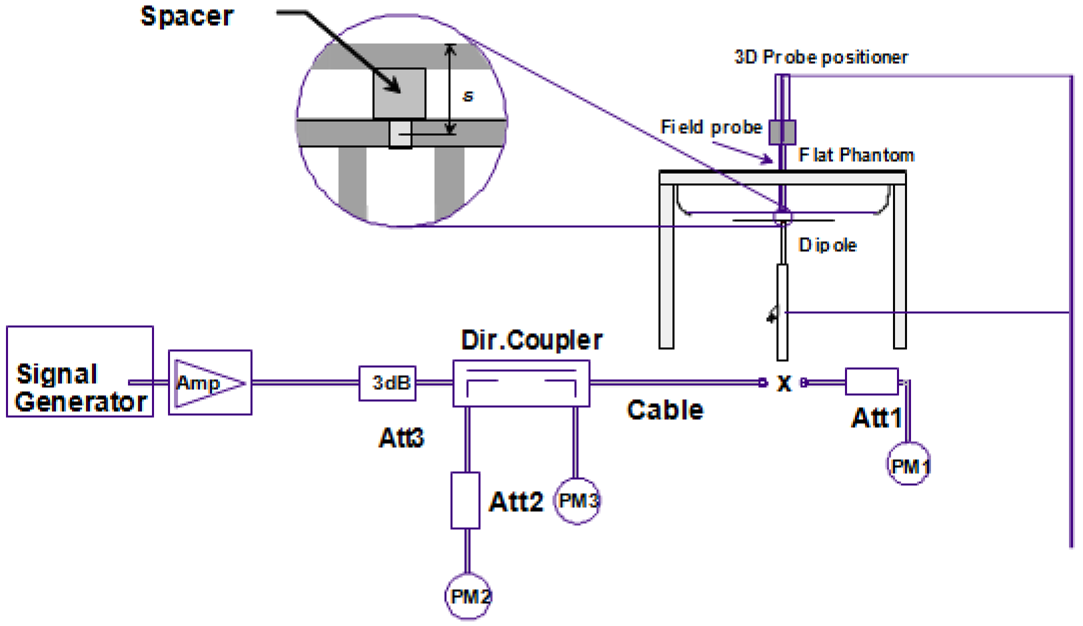
Used Target Frequency	Target Tissue		Measured Tissue		Liquid Temp	Test Date
	εr (+/-5%)	σ(S/m) (+/-5%)	εr	σ (S/m)		
2450MHz Body	52.7 (50.07~55.34)	1.95 (1.85~2.05)	51.1	1.94	22°C	2017.03.30
ε_r= Relative permittivity, σ= Conductivity						

System checking, Body Tissue-equivalent liquid:

System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (W/kg)	10-g (W/kg)	1-g (W/kg)	10-g (W/kg)		
D2450V2 Body	51.1 (46.0~56.2)	23.9 (21.5~26.3)	49.2	23.0	22°C	2017.03.30

System Checking

The manufacturer calibrates the probes annually. A system check measurement was made following the determination of the dielectric parameters of the tissue-equivalent liquid, using the dipole validation kit. A power level of 250mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom.



The system checking results (dielectric parameters and SAR values) are given in the table below.

The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands and tissue liquids used during the tests (Graphic Plot(s) see Appendix A).

6. SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

6.1. SAR measurement variability

Per KDB865664 D01 SAR measurement 100MHz to 6GHz v01r04, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurement requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is <0.80 W/kg; step2) through 4) do not apply.
2) When the original highest measured SAR is ≥0.8 W/kg , repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is >1.20 or when the original or repeated measurement is ≥1.45 W/kg(~10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is >1.20.

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

6.2. SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100MHz to 6GHz v01r03, when the highest measured 1-g SAR within a frequency band is <1.5W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2003 is not required in SAR reports submitted for equipment approval. The equivalent ratio(1.5/1.6) is applied to extremity and occupational exposure conditions.

7. Test Configuration

Test positions as described in the tables above are in accordance with the specified test standard.

WIFI Test Configurations

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal. The Tx power is set according to tune up procedure for 802.11 b mode by software. This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1.

For the 802.11b/g/n SAR tests, a communication link is set up with the test mode software for WiFi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode.

8. TUNE-UP LIMIT

The Wi-Fi RF test procedure

Average Power：

11b： 16dBm [-2dB~~+1.0dB]

11g： 12dBm [-1dB~~+1.0dB]

11n： 12dBm [-2dB~~+1.0dB]

BT Average Power:

BT： 5dBm [-2dB~~+2.0dB]

BLE： 5dBm [0dB~~+1.0dB]

9. MEASUREMENT RESULTS

Result: Passed

Date of testing	:	2017.03.30
Ambient temperature	:	20℃~22℃
Relative humidity	:	50~68%

9.1. Conducted Power

WLAN 2.4GHz Band Conducted Power

Wi-Fi 2450MHz	Channel	Average Power (dBm) for Data Rates (Mbps)								Sar test (Yes or NO)
		1	2	5.5	11	/	/	/	/	Yes Initial Test Configuration
802.11b 2.4G(DSSS)	1(2412)	**16.64**	16.52	16.47	16.36	/	/	/	/	
	6(2437)	**15.54**	14.8	14.33	14.88	/	/	/	/	
	11(2462)	**16.33**	15.7	15.69	15.23	/	/	/	/	
802.11g 2.4G(OFDM)	Channel	6	9	12	18	24	36	48	54	Yes Subsequent Test Configuration
	1(2412)	12.95	12.2	12.25	12.17	12.09	11.97	11.75	11.63	
	6(2437)	12.73	12.54	12.51	12.57	12.62	12.29	12.01	11.86	
	11(2462)	12.47	12.3	12.25	12.05	12.10	12.00	11.62	11.48	
802.11n-HT20 2.4G(OFDM)	Channel	MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	Yes Subsequent Test Configuration
	1(2412)	12.19	11.46	11.43	11.37	11.24	11.02	10.9	10.54	
	6(2437)	12.04	11.92	11.93	11.77	11.67	11.31	11.22	11.03	
	11(2462)	11.82	11.61	11.38	11.5	11.37	11.04	10.82	10.45	

Remark:

Output Power Measurement Considerations for Wi-Fi 2.4 GHz band

1. 2.4 GHz 802.11b DSSS:

- Output power measurement is not required:

o When SAR Test Exclusion according to KDB 447498 D01 applies.

o When other power measurement reduction applies.

- Otherwise, output power measurement is required on:
o Channels 1, 6, and 11, when the output power specified for other channels is no higher than the abovementioned channels.
o The closest adjacent channels to the aforementioned channels, when the output power specified for these adjacent channels is higher.
- For ease of identification, 802.11b DSSS is identified as the Initial Test Configuration for the 2.4 GHz band.
2. 2.4 GHz 802.11g/n OFDM
- Output power measurement is not required:
o When SAR Test Exclusion according to KDB 447498 D01 applies.
o When SAR Test Exclusion procedures for 2.4 GHz 802.11g/n OFDM applies, according to the SAR measurement results from 802.11b DSSS; see Section 11 of the report for details.
- Otherwise, output power measurement is required for 2.4 GHz 802.11g/n OFDM, with the following considerations:
o If 40 MHz bandwidth configurations are supported, measure power for either Channel 6 or the highest specified output power channel.
o Output power measurement requirements for smaller bandwidth configurations are dependent on the SAR measurement results from the 40 MHz bandwidth configurations.
o If no 40 MHz bandwidth configurations are supported, then a channel selection process similar to 802.11b DSSS is applied.
- The output power measurement is required for 2.4 GHz 802.11g/n OFDM as a result of 802.11b DSSS reported SAR results, the required test configurations in 2.4 GHz 802.11g/n OFDM are identified as Subsequent Test Configurations with respect to the Initial Test Configuration status assigned to 802.11b DSSS.
- If, for a particular antenna or transmit diversity condition supported by the device, no 802.11b DSSS configurations are available, output power should also be measured as a default for 802.11g/n OFDM when SAR Test Exclusion according to KDB 447498 D01 does not apply; these 802.11g/n OFDM configurations are considered the Initial Test Configurations for the respective antenna/transmit diversity condition.

Initial Test Position SAR Test Reduction

For both DSSS and OFDM wireless modes, when an Initial Test Configuration is found to require SAR measurements, an Initial Test Position is established for each applicable exposure configuration (Head, Body, etc.) using either:

- Design implementation details from the manufacturer, or
- Investigative results by the test lab, obtained by performing area scans on the Initial Test Configuration for all applicable test positions and identifying the highest measured SAR from the area scan-only measurements.

Complete SAR scans are then performed on the established Initial Test Position on each exposure configuration, using the Initial Test Configuration. When the reported SAR for this Initial Test Position is: - ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in the exposure configuration and wireless mode combination within the frequency band or aggregated band. - > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closest/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.

- For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, measure the SAR for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required test channels are considered.

Bluetooth 2.4GHz Band Conducted Power

BT 2450	Average Conducted Power (dBm)		
	0CH	39CH	78CH
DH1	6.35	6.34	5.69
DH3	6.21	6.27	5.58
DH5	6.10	6.15	5.49
3DH1	4.13	4.72	4.52
3DH3	4.04	4.61	4.44
3DH5	3.95	4.52	4.36

BLE 2450	Average Conducted Power (dBm)		
	0CH	20CH	39CH
	5.12	5.09	5.07

SAR measurement Results

WLAN Notes

Per KDB 248227 D01v02r02, for all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

Per KDB 248227 D01v02r02, for 802.11g/n SAR testing is required. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is > 1.2 W/kg.

Per KDB 248227 D01v02r02, for OFDM transmission configurations in the 2.4 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11g/n mode is used for SAR measurement, on the highest measured output power channel for each frequency band.

9.2. WIFI SAR results

WIFI Body

Distance 0mm

Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
WIFI 2.4G	802.11b	Back Side	1	2412	16.64	17	1.086	0.079	0.086
WIFI 2.4G	802.11b	Back Side	6	2437	15.54	17	1.400	0.075	0.105
WIFI 2.4G	802.11b	Back Side	11	2462	16.33	17	1.167	0.064	0.075

9.3. Repeated SAR results

Remark:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ⩾0.8W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ⩽ 1.2 and the measured SAR<1.45W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated measured SAR.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
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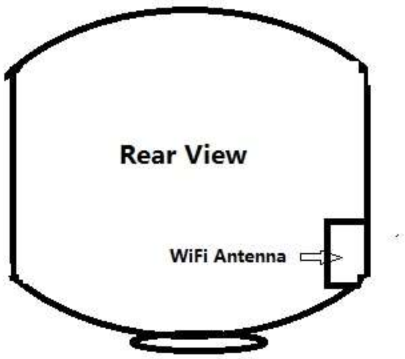
10. EXPOSURE POSITIONS CONSIDERATION

10.1. Multiple Transmitter Evaluation



Mode	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
Wi-Fi 2.4G Antenna	NO	YES	NO	NO	NO	NO

10.2. Stand-alone SAR test exclusion

Per FCC KDB447498D01v06, the 1-g SAR and 10-g SAR test exclusion thresholds for 100MHz to 6GHz at test separation distances ≤50 mm are determined by:
[(max.power of channel, including tune-up tolerance,Mw)/(min.test separation distance,mm)]*[√f(GHz)]) ≤3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

1) f(GHz) is the RF channel transmit frequency in GHz
2) Power and distance are rounded to the nearest mW and mm before calculation
3) The result is rounded to one decimal place for comparison

   When the minimum test separation distance is <5mm, a distance of 5 mm is applied to determine SAR test exclusion.

Mode	Position	P_{max} (dBm)	P_{max} (mW)	Distance (mm)	f(GHz)	Calculation result	SAR Exclusion threshold	SAR Test exclusion
BT	Body-worn	6.35	4.32	5	2402	1.23	3	YES

Table 5 standalone SAR test exclusion for BT

Note:

1) *- maximum possible output power declared by manufacturer

2) Held to ear configurations are not applicable to Bluetooth for this device.

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

[(max.power of channel, including tune-up tolerance,Mw)/(min.test separation distance,mm)]*[√ f(GHz)/x]W/kg for test separation distances≤ 50mm,where x=7.5 for 1-g SAR and x=18.75 for 10-g SAR.

When the minimum test separation distance is <5mm, a distance of 5 mm is applied to determine SAR test exclusion

Mode	Position	Pmax (dBm)	Pmax (mW)	Distance (mm)	f(GHz)	X	Estimated SAR(W/Kg)*
BT	Body-worn	4	2.5	5	2402	7.5	0.104

Table 6： Estimated SAR calculation for BT

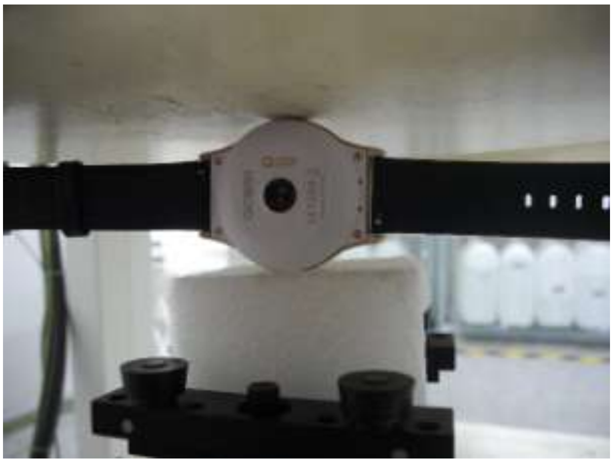
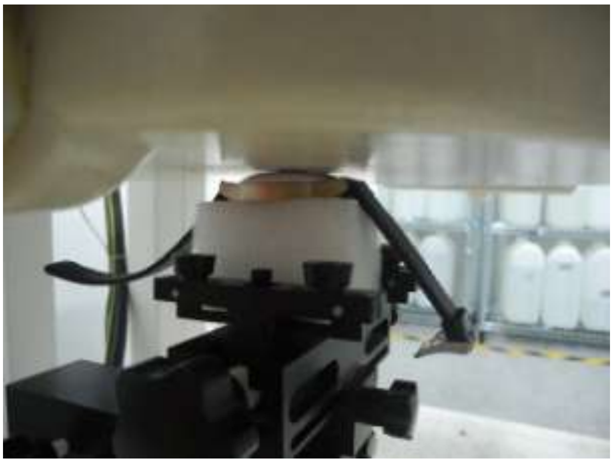
1) *- maximum possible output power declared by manufacturer

2) Held to ear configurations are not applicable to Bluetooth and therefore were not considered for simultaneous transmission.

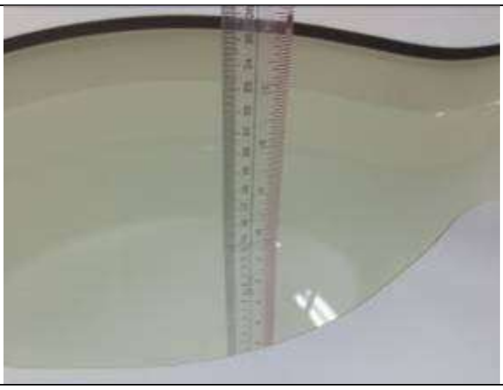
10.3.Simultaneous Transmission Conclusion

The above numeral summed SAR results and SPLSR analysis is sufficient to determine that simultaneous cases will not exceed the SAR limit and therefore simultaneous transmission SAR with Volume Scan is not required per KDB 447498 D01v06

11. PHOTOGRAPHS OF THE TEST SET-UP

Photo 1: Measurement System DASY5	Photo 2: Front View
	
Photo 3: Rear View	Photo 4: Rear Side 0mm
	

Photograph: Liquid depth

Photo 5: Body2450 Depth (15.0cm)	N/A
	N/A

Appendix A. System Check Plots

(Pls see Appendix A)

Appendix B. MEASUREMENT SCANS

(Pls see Appendix B)

AppendixC RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)

(Pls see Appendix C)

Appendix D. RELEVANT PAGES FROM DAE&DIPOLE VALIDATION KIT REPORT(S)

(Pls see Appendix D)