AT4 wireless, S.A.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
www.at4wireless.com · C.I.F. A29 507 456

ENSAYOS Nº 51/LE147

Informe de ensayo nº:
Test report No:

NIE: 43721RRF.002A1

Test report (Modification 1)
REFERENCE STANDARDS:
FCC 47CFR Part 2.1093, Published RF Exposure KDB Procedures, IC RSS -102 Issue 4:2010

Identificación del objeto ensayado.....: Identification of item tested	Wireless audio transmitter for hearing impaired people
Marca .....: Trade	---
Modelo y/o referencia tipo .....: Model and /or type reference	TX17-1V1
Other identification of the product .....:	Commercial name: ROGER PEN 1.1 FCC ID: KWCTX17-1V1 IC: 2262A-TX171V1
Final HW version .....:	5.0
Final SW version .....:	SVN4921
IMEI TAC .....:	---
Características .....: Features	2.4 GHz 40 channels frequency hopping proprietary mode
Peticionario .....: Applicant	PHONAK COMMUNICATIONS AG Laenggasse 17, 3280 Murten, Switzerland. VAT: CHE-116.306.385 Contact person: Neviana Nikoloski Telephone: +41 26 672 9672 e-mail: neviana.nikoloski@phonak.com
Método de ensayo solicitado, norma.....: Test method requested, standard	1. FCC 47 CFR Part 2.1093. (10-1-11 Edition) – Radiofrequency radiation exposure evaluation: portable devices. 2. FCC OET KDB 450824 – SAR Probe Calibration and System Verification Considerations for measurements at 150 MHz – 3 GHz (January 2007). 3. KDB 447498 D01 v05r02 – Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies. (February 2014) 4. KDB 865664D01 v01r03 – FCC OET SAR measurement requirements 100 MHz to 6 GHz. (February 2014) 5. KDB 865664D02 v01r01 – RF Exposure Compliance Reporting and Documentation Considerations. (May 2013) 6. KDB 648474 D04 v01r02 – SAR Evaluation Considerations for Wireless Handsets. (December 2013)

	7. RSS-102 Issue 4 (2010-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) 8. Canada`s Safety Code No.6 – Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
Resultado.....: Summary	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. The maximum 1g volume reported SAR found during this test has been 0.713 W/kg, for DM transmission mode. 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".
Aprobado por (nombre / cargo y firma) .....: Approved by (name / position & signature)	A. Llamas RF Lab. Manager  Firmado digitalmente por Alejandro Llamas Rodríguez Fecha: 2014.12.19 14:29:55 +01'00'
Fecha de realización .....: Date of issue	2014-12-19
Formato de informe No.....: Report template No	FDT11_15

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Uncertainty

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

1. FCC OET KDB 865664 D01 – SAR Measurements Requirements for 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 Nº	Description	Model	Serial Nº	Date of reception
43721/07	AC/DC adapter	GPE053B-050100-Z	--	2014-10-10
43721/08	Plug	--	--	2014-10-10
43721/10	USB cable	--	--	2014-10-10
43721/12	PCB for Roger PEN	--	--	2014-10-10

Sample M/02 is composed of the followinla08g elements:

Control Nº	Description	Model	Serial Nº	Date of reception
43721/06	Roger PEN	--	--	2014-10-10
43721/07	AC/DC adapter	GPE053B-050100-Z	--	2014-10-10
43721/08	Plug	--	--	2014-10-10
43721/10	USB cable	--	--	2014-10-10

1. Sample M/01 has undergone the test(s) specified in subclause "Test method requested": Conducted average output power.
2. Sample M/02 has undergone the test(s) specified in subclause "Test method requested": SAR evaluation for GFSK mode.

Test sample description

The test sample consists of a wireless audio transmitter for hearing impaired people.

Test samples supplier

Same as applicant

Testing period

The performed test started on 2014-10-15 and finished on 2014-10-16.

The tests have been performed at AT4 wireless.

Environmental conditions

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

Temperature	Min. = 21 ºC Max. = 25 ºC
Relative humidity	Min. = 30 % Max. = 70 %

Modifications to the reference test report

It was introduced the following modifications in respect to the test report number 43721RRF.002 related with the same samples, in the next clauses and sub-clauses:

Clauses / Sub-clauses	Modification	Justification
Appendix B. 1.3. Test signal, Output Power and Frequencies.	Duty Factor information is included	Information updated.
Appendix C - Measurement report.	DM Mode updated into plot's titles.	Information updated.

This modification test report cancels and replaces the test report 43721RRF.002.

Remarks and comments

1: Testing of Bluetooth mode is not required according to FCC OET KDB 447498 D01 General RF Exposure Guidance v05r01, paragraph "4.3.1. Standalone SAR test exclusion considerations Individual Transmitters".

2: Only the plots of the highest SAR at the worst position and mode/band are included in appendix C.

Used instrumentation

1. Dosimetric E-field probe 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 Liquids for 2450MHz band
12. Vector network analyzer Agilent FieldFox N9923A
13. Dielectric probe kit SPEAG DAK-3.5
14. Power meter R&S NRVD
15. Power sensor R&S NRV-Z51
16. Power sensor R&S NRV-Z1
17. RF Generator R&S SMU200A
18. DC Power supply R&S NGSM 32/10
19. Dual directional coupler NARDA FSCM 99899
20. Power amplifier MITEQ AMF-4D-00400600-50-30P
21. Handset positioner SPEAG Device Holder
22. Anritsu MT8852A Bluetooth testing unit.

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) DM Proprietary protocol – GFSK Hooper		P		
(d)(2) Bluetooth		P[1]		

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 18ºC to 25ºC and the variation shall not exceed +/- 2ºC 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 worn is an elliptical open-top container with a flat bottom, with the following shape and dimension:

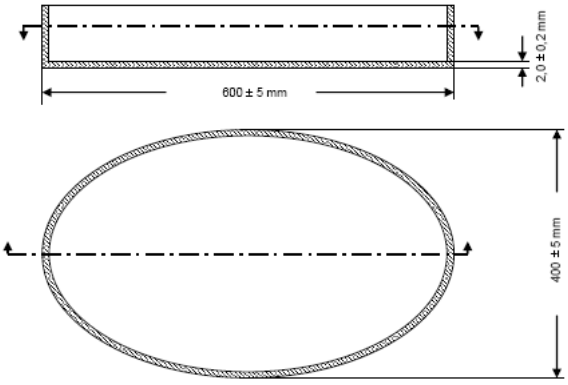

Figure 3: Proportions and shape of Phantom shell

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.

2. MEASUREMENT SYSTEM

2.1. Measurement System

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

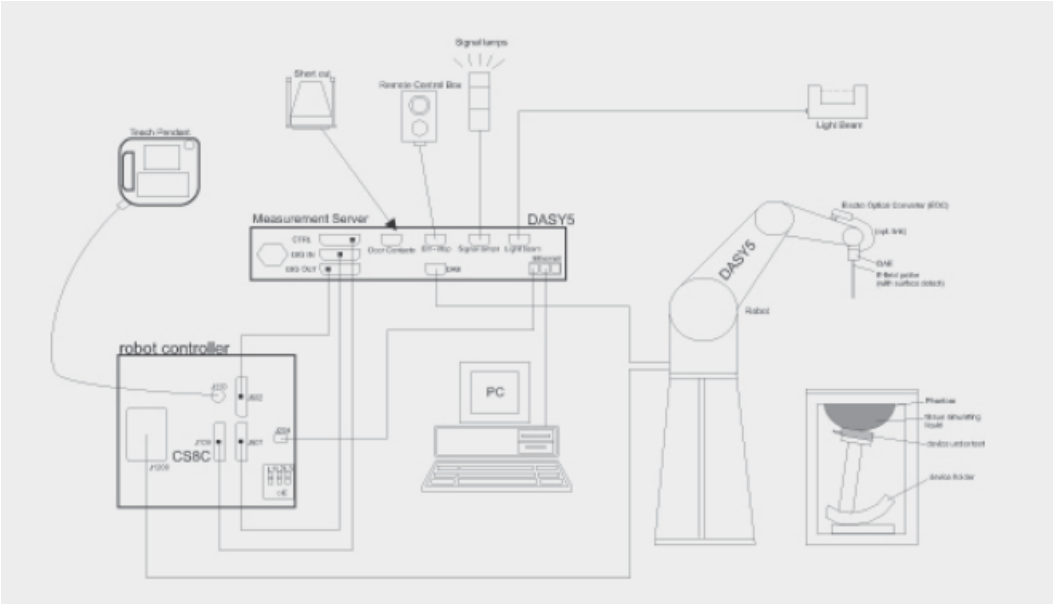

Figure 4: SAR Measurement system

- 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	Handset Positioner	SD000 HD1HA
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
Rohde & Schwarz	DC Power supply	NGSM 32/10
NARDA	Directional coupler	FSCM 99899
Weinschel	6dB attenuator	75A-6-11
Rohde & Schwarz	Power Meter	NRVD
Rohde & Schwarz	Power Sensor	NRV-Z51
Rohde & Schwarz	Power Sensor	NRV-Z1
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)
Calibration	ISO/IEC 17025
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in TSL (rotation around probe axis) ± 0.3 dB in TSL (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

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
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset Voltage	< 5 µV (with auto zero)
Input Resistance	200 MOhm
Input Bias Current	< 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.
Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters
Wooden Support	SPEAG standard phantom table

HANDSET POSITIONER

	**Mounting Device for Hand-Held Transmitters** In combination with the Twin SAM V5.0/V5.0c or ELI Phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). **Material:** Polyoxymethylene (POM)

DIPOLES

System Validation Kits 300 MHz – 6 GHz			
	Symmetrical dipole with I/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with tissue simulating solutions		
Calibration	ISO/IEC 17025		
Frequency	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)		
Return Loss	> 20 dB at specified validation position		
Power Capability	> 100 W (f < 1GHz); > 40 W (f > 1GHz)		
Dimensions (length and overall height in mm)	**Product**	**Dipole length**	**Overall height**
	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

The device has been tested for 1-g SAR on all surfaces and side edges at 0 mm from a flat phantom.

2.3. Test to be performed

As noted above, measurements shall be performed using a flat phantom for body worn configuration. EUT will be placed at the center of flat phantom at the maximum output power conducted channel. The EUT position using during the body SAR tests will be the one where the maximum peak SAR was found. The other channels for each band should be tested at this position.

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 Phantoms surface in order to minimise measurement errors, but the highest local SAR is obtained from measurements at a certain distances from the shell trough extrapolation. The accurate assessment of the maximum SAR averaged over 1 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 1mm 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 EUT, 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 EUT 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 daily 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 one-gram 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_i) 1g	(c_i) 10g	Standard uncertainty (1g) (± %)	Standard uncertainty (10g) (± %)
Measurement Equipment							
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
Test Sample Related							
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
Phantom and Setup							
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
Combined standard uncertainty	$u_c = \sqrt{\sum_{1=1}^{m} c_i^2 \cdot u_i^2}$					**12.70**	**12.62**
Expanded uncertainty (confidence interval of 95%)	*ue =2.00 uc*					**25.40**	**25.23**

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. This level couldn't exceed the values indicated in the application Standard:

Standard	SAR	SAR Limit (W/Kg)
FCC 47 CFR Part 2.1093 Paragraph (d)(2)	SAR $_{1\ gr.}$	1.6

Table 3: SAR limit

5. DEVICE UNDER TEST

5.1. Dimmensions

Dimmensions	Millimetres
Height x Width x Depth	142.0 x 15.0 x 15.0

Table 4: Dimmensions

5.2. Wireless Technology

Wireless Technology	Frequency Bands	Modes
DM	2.4 GHz	- DM Proprietary Protocol GFSK Hopper
Bluetooth	2.4 GHz	- Bluetooth

Table 5: Supported modes

Appendix B – Test results

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1. TEST CONDITIONS

1.1. Power supply (V):

V_n = 5 Li-polymer rechargeable battery

Type of power supply = DC Voltage from rechargeable Li-Ion 5 V battery.

1.2. Temperature (ºC):

T_n = +21.12 to +24.81

The subscript n indicates normal test conditions.

1.3. Test signal, Output Power and Frequencies

A fully charged battery was used for every test sequence. In all operating bands and test position, the measurements were performed on middle channels. In each band, for those positions with the maximum averaged SAR was found, measurements were performed on lowest and highest channels.

For the DM mode, the sample **(43721/06)** was put into operation by using a manufacturer proprietary test mode, setting output power and duty factor to maximum (aprox. 100%).

The maximum time-average conducted power of the device for each mode was measured with a Power meter R&S NRVD and a thermo-coupled power sensor NRV-Z51.

The actual SAR samples does not have accessible antenna connectors for conducted measurements, so the conducted average output power was measured using another identical sample (**43721/12)** provided by the manufacturer with auxiliary external connectors that makes the measurements representative and applicable for all the tested samples. See 'usage of samples' paragraph of this report.

1.4. EUT and test-site configurations

For DM Mode, the EUT was tested over body exposure conditions placed in each side position against the flat phantom surface.

The separation distance between EUT and flat phantom surface was 0 mm for body use.

2. CONDUCTED AVERAGE POWER MEASUREMENTS

2.1. DM GFSK Hopper (2.4 GHz)

		Average Conducted Power (dBm)		
Band	**Mode**	**CH Low (2402 MHz)**	**CH Mid (2440 MHz)**	**CH High (2480 MHz)**
2450 MHz	DM – Proprietary Protocol	14.40	14.18	13.49

2.2. Bluetooth (2.4 GHz)

		Average Conducted Power (dBm)		
Band	**Mode**	**CH Low (2402 MHz)**	**CH Mid (2441 MHz)**	**CH High (2480 MHz)**
2450 MHz	GFSK	0.005	1.83	2.20
2450 MH	π/4 DQPSK	-0.91	0.78	1.23
2450 MH	8-DPSK	-0.37	1.27	1.75

Based on the paragraph "4.3.1. Standalone SAR test exclusion considerations" of the KDB 447498 D01 - General RF Exposure Guidance:

[(*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

Communication System	**Time Average Max Conducted Power**		**Max Average output power declared by manufacturer**		**Min. Test separation distance (mm)**	**Frequency (Ghz)**	**Result**	**Test Exclusion**
	(dBm)	**(mW)**	**(dBm)**	**(mW)**				
Bluetooth	2.2	1.66	3	1.99	5	2480	0.63	√
GFSK Hopper	14.40	27.54	15	31.623	5	2402	9.80	X

The computed value for Bluetooth is < 3.0, therefore, Bluetooth mode qualifies for Standalone SAR test exclusion for 1-g SAR and 10-g.

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%	50.5 ± 6%	2.01 ± 6%	52.42	2.03	2014-10-16

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-methyyl-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	Fast SAR	±3%
2014-10-16	1 gr.	51.10	55.36	8.33	√	14.00	13.90	√
	10 gr.	23.90	25.70	7.54	√	6.50	-	-

5. MEASUREMENT RESULTS FOR SAR (SPECIFIC ABSORPTION RATE)

5.1. Summary maximum results for body measurements

Band	Mode	Side / Position	Dist (mm)	Channel (Frequency)	Reported SAR (1g avg) (W/Kg)	SAR limit (1g avg) (W/Kg)
2450 MHz	DM	1	0	Mid (2440 Hz)	0.713	1.6

5.2. Results for DM – GFSK Hopper

Side / Position	Dist (mm)	Mode	Ch #. (Freq)	SAR extrapolated 1-g (W/Kg)	SAR Max. 1-g (W/Kg)	±0.1 (W/Kg)	Power Drift (%)	Max Output Power (dBm)	Max. Reported 1-g SAR	Plot
1	0	DM	CH Low (2402 Mhz)	0.627	0.596	√	1.98	15	0.684	1
2	0	DM	CH Low (2402 Mhz)	0.484	0.463	√	-0.23	15	0.532	
3	0	DM	CH Low (2402 Mhz)	0.42	0.408	√	0.81	15	0.468	
4	0	DM	CH Low (2402 Mhz)	0.501	0.494	√	-1.49	15	0.567	
Top edge	0	DM	CH Low (2402 Mhz)	0.116	0.115	√	1.86	15	0.132	
Bottom edge	0	DM	CH Low (2402 Mhz)	0.05	0.05	√	2.68	15	0.057	
1	0	DM	CH Mid (2440Mhz)	0.573	0.59	√	2.57	15	0.713	2
1	0	DM	CH High (2480Mhz)	0.434	0.433	√	0.35	15	0.612	3

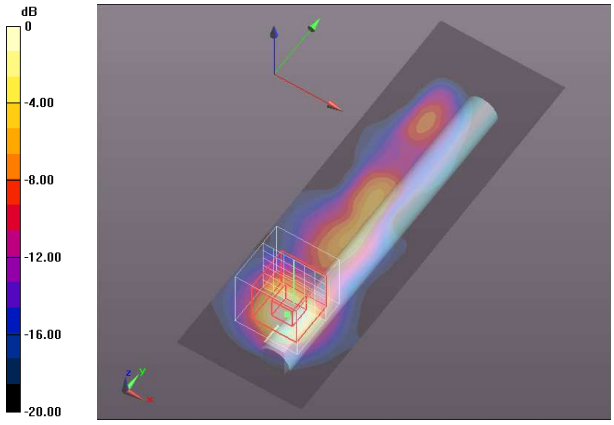
Appendix C – Measurement report

DM Mode– GFSK – Side 1 – 0 mm – Lowest Channel – Plot Nº 1

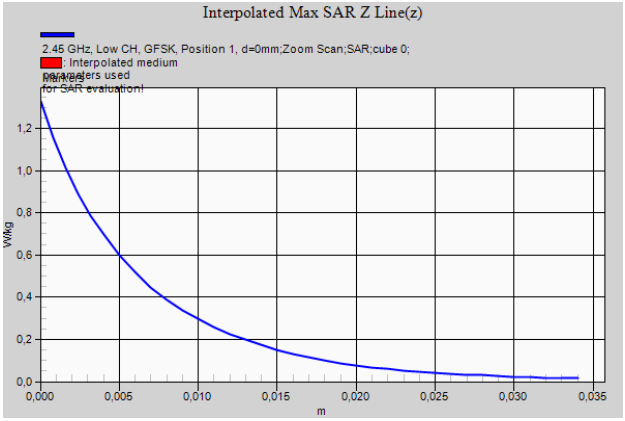
Test Laboratory: AT4 Wireless; Date: 16/10/2014
DUT: Roger Pen; Type: Pen; Serial: V 1.1
Communication System: UID 0, Bluetooth (0); Frequency: 2402 MHz; Duty Cycle: 1:3.1886
Medium parameters used (interpolated): f = 2402 MHz; σ = 1.822 S/m; ε_r = 51.76; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: ES3DV3 - SN3052; ConvF(4.3, 4.3, 4.3); Calibrated: 24/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 08/07/2014
- 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/2.45 GHz, Low CH, GFSK, Position 1, d=0mm/Area Scan (61x191x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.857 W/kg

Flat Phantom Side - 2450MHz/2.45 GHz, Low CH, GFSK, Position 1, d=0mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.23 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 1.33 W/kg
SAR(1 g) = 0.596 W/kg; SAR(10 g) = 0.239 W/kg (SAR corrected for target medium)
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.673 W/kg



0 dB = 0.673 W/kg = -1.72 dBW/kg

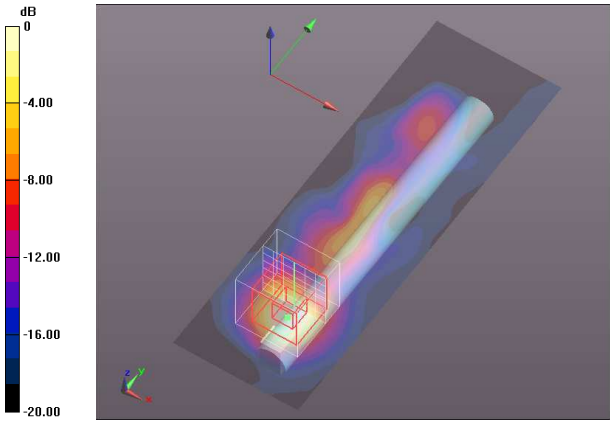


DM Mode– GFSK – Side 1 – 0 mm – Middle Channel – Plot Nº 2

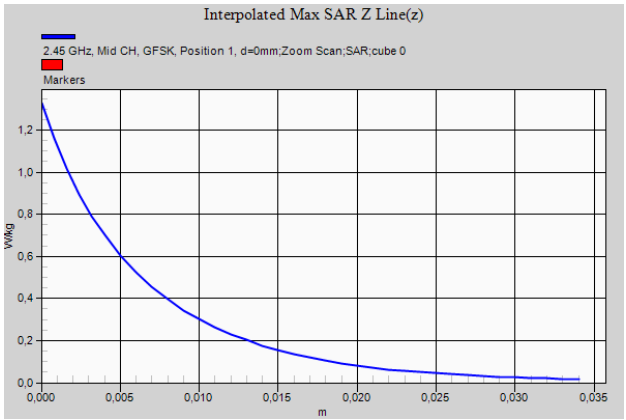
Test Laboratory: AT4 Wireless; Date: 16/10/2014
DUT: Roger Pen; Type: Pen; Serial: V 1.1
Communication System: UID 0, Bluetooth (0); Frequency: 2440 MHz; Duty Cycle: 1:3.1886
Medium parameters used: f = 2440 MHz; σ = 2.01 S/m; ε_r = 52.14; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: ES3DV3 - SN3052; ConvF(4.3, 4.3, 4.3); Calibrated: 24/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 08/07/2014
- 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/2.45 GHz, Mid CH, GFSK, Position 1, d=0mm/Area Scan (61x191x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.792 W/kg

Flat Phantom Side - 2450MHz/2.45 GHz, Mid CH, GFSK, Position 1, d=0mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.35 V/m; Power Drift = 0.22 dB
Peak SAR (extrapolated) = 1.33 W/kg
SAR(1 g) = 0.590 W/kg; SAR(10 g) = 0.242 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.672 W/kg



0 dB = 0.672 W/kg = -1.73 dBW/kg

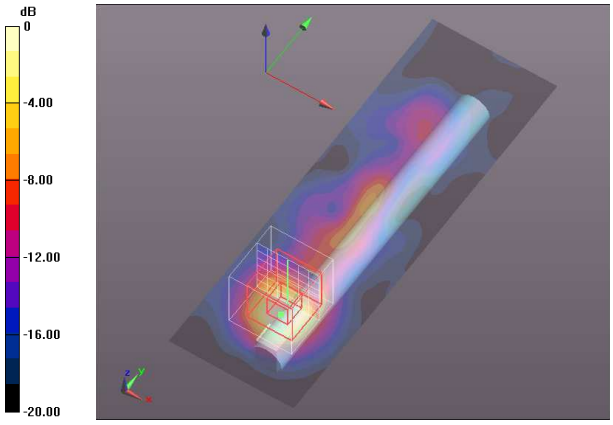


DM Mode– GFSK – Side 1 – 0 mm – Highest Channel – Plot Nº 3

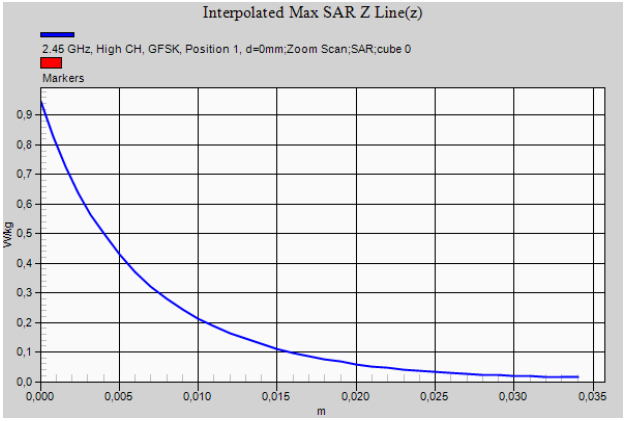
Test Laboratory: AT4 Wireless; Date: 16/10/2014
DUT: Roger Pen; Type: Pen; Serial: V 1.1
Communication System: UID 0, Bluetooth (0); Frequency: 2480 MHz; Duty Cycle: 1:3.1886
Medium parameters used: f = 2480 MHz; σ = 1.91 S/m; ε_r = 52.28; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: ES3DV3 - SN3052; ConvF(4.3, 4.3, 4.3); Calibrated: 24/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 08/07/2014
- 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/2.45 GHz, High CH, GFSK, Position 1, d=0mm/Area Scan (61x191x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.570 W/kg

Flat Phantom Side - 2450MHz/2.45 GHz, High CH, GFSK, Position 1, d=0mm/Zoom Scan (7x7x7)/Cube0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.39 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.947 W/kg
SAR(1 g) = 0.433 W/kg; SAR(10 g) = 0.180 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.496 W/kg



0 dB = 0.496 W/kg = -3.05 dBW/kg



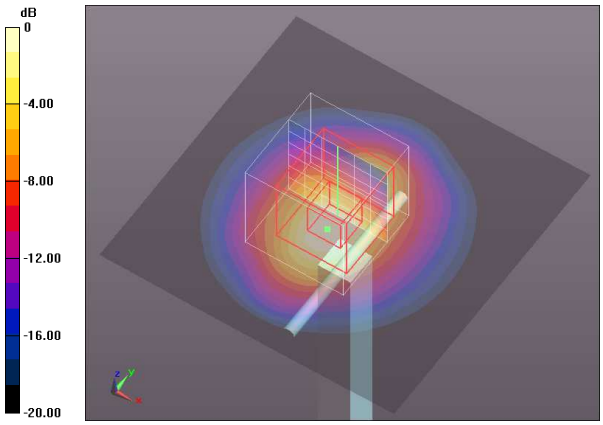
Appendix D – System Validation Reports

Validation results in 2450 MHz Band for Body TSL

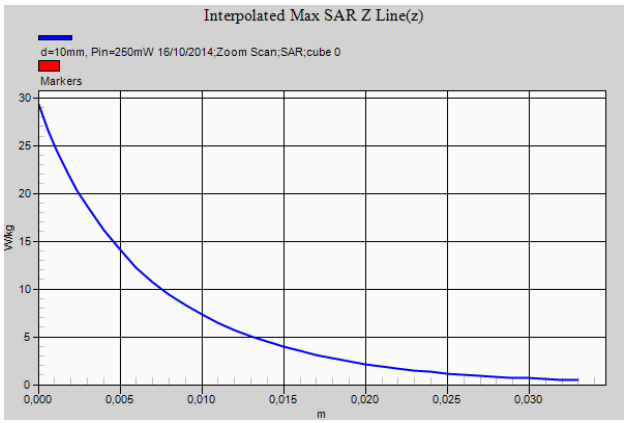
Test Laboratory: AT4 Wireless; Date: 16/10/2014
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:xxx
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 52.42; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: ES3DV3 - SN3052; ConvF(4.3, 4.3, 4.3); Calibrated: 24/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 08/07/2014
- 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 Performance Check with D2450V2 Dipole Body/d=10mm, Pin=250mW 16/10/2014/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 19.3 W/kg

System Performance Check with D2450V2 Dipole Body/d=10mm, Pin=250mW 16/10/2014/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.30 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 29.3 W/kg
SAR(1 g) = 14 W/kg; SAR(10 g) = 6.5 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 18.6 W/kg



0 dB = 18.6 W/kg = 12.70 dBW/kg



Appendix E – Calibration data