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Panasonic Corporation of North America

SAR TEST REPORT

SCOPE OF WORK:
SAR report for FCC

Model:
EYADA112WA, EYADA112WB,
EYADA212WA, EYADA212WB,
EYADA218WA, EYADA218WB,
EYADA407WA, EYADA407WB

REPORT NUMBER
230700847SHA-003

ISSUE DATE
December 21, 2023

DOCUMENT CONTROL NUMBER
TTRFFCCSAR_V1

APPLICANT:	Panasonic Corporation of North America Two Riverfront Plaza, NEWARK NJ 07102
MANUFACTURER:	Panasonic Corporation 1006, Oaza Kadoma, Kadoma City, Osaka 571-8501, Japan
Factory:	Panasonic Corporation 1006, Oaza Kadoma, Kadoma City, Osaka 571-8501, Japan
FCC ID:	ACJ-EYADA

Summary

The equipment complies with the requirements according to the following standard(s) or Specification:
47CFR § 2.1093: Radio frequency Radiation Exposure Evaluation: Portable Device IEC/IEEE 62209-1528: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques FCC KDB Publication 865664 D01: SAR measurement 100 MHz to 6 GHz v01r04 describes SAR measurement procedures for devices operating between 100 MHz to 6 GHz;

PREPARED BY:	**REVIEWED BY:**
	
Project Engineer Damon Ding	Reviewer Eric Li

Contents

Revision History

Report No.	Version	Description	Issued Date
230700847SHA-003	Rev. 01	Initial issue of report	December 21, 2023

SAR Summary

Highest Standalone SAR Summary

Exposure Position	FrequencyBand	Measured SAR-1g 1g-SAR(W/kg)	Highest Scaled 1g-SAR(W/kg)
Body-supported (0mm Gap)	WIFI 2.4G	0.0843	0.219
Body-supported (0mm Gap)	WIFI 5.2G	0.393	0.539

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name	:	Screwdriver
Type/Model	:	EYADA112WA, EYADA112WB, EYADA212WA, EYADA212WB, EYADA218WA, EYADA218WB, EYADA407WA, EYADA407WB
Description of EUT	:	The EUT is Screwdriver with WLAN function, There are eight models. Details refer to model list. We tested all of models and put the worst test data into this report. 8 model codes of EYADA** all have same wireless communication features for WLAN. The difference between model codes are RPM, Torque, and availability of Torque value output. RPM and Torque are achieved by difference of mechanical components
Exposure Category	:	Population/Uncontrolled
Rating	:	30V,90W Adapter: Input : 100-240Vac , 50/60Hz , 2.6A Max ; Output : 30Vdc, 3A
Hardware version	:	/
Software version	:	/
Sample received date	:	October 24, 2023
Date of test	:	October 30, 2023 ~ November 08, 2023

Model list:

Product No.	RPM	Torque	*Torque value output
EYADA112WA	1200	0,1-1,0Nm	Available
EYADA112WB			N/A
EYADA212WA		0,3-2,5Nm	Available
EYADA212WB			N/A
EYADA218WA	1800	0,3-2,0Nm	Available
EYADA218WB			N/A
EYADA407WA	650	1,5-4,4Nm	Available
EYADA407WB			N/A

*With Torque value output function, recording the torque value of each fastened screw is possible.

1.2 RF Technical Information

Supported Band	:	WIFI 2.4GHz: 2400-2483.5MHz WIFI 5.2GHz: 5150-5250MHz
Tested Band	:	WIFI 2.4GHz: 2400-2483.5MHz WIFI 5.2GHz: 5150-5250MHz
Modulation	:	WIFI(OFDM/DSSS)

Wireless Technology and Frequency Range				
Wireless Technology	Modulation	Operating mode	Tx (MHz)	Rx (MHz)
Wi-Fi 2.4G	DSSS, OFDM	802.11b/g/n-HT20	2412 ~ 2462	2412 ~ 2462
Wi-Fi 5.2G	OFDM	802.11a/n-HT20	5180 ~ 5240	5180 ~ 5240
Does this device support 2.4G/5.2G MIMO? ☐ Yes ☒ No				

1.3 Description of Test Facility

Name	:	Intertek Testing Services Shanghai
Address	:	No.999 Gaolang East Road, WuXi, Jiangsu, P.R.China
Telephone	:	86 21 61278200
Telefax	:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations	:	FCC Accredited Lab Designation Number: CN0175 IC Registration Lab CAB identifier.: CN0014 A2LA Accreditation Lab Certificate Number: 3309.02

Tests were sub-contracted.

Name	:	Shenzhen UnionTrust Quality and Technology Co., Ltd.
Address	:	Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng Science and Technology Park, Longhua District, Shenzhen, China
Telephone	:	+86 (0) 755 2823 0888
Telefax	:	+86 (0) 755 2823 0886

The test facility is recognized, certified, or accredited by these organizations	:	CNAS Accreditation Lab Registration No. CNAS L9069 FCC Accredited Lab Designation Number: CN1194 A2LA Accreditation Lab Certificate Number: 4312.01

1.4 Instrument list

Equipment	Manufacturer	Type	Internal no.	Due Date
System Validation Dipole	SPEAG	D2450V2	1014	May 19, 2021
System Validation Dipole	SPEAG	D5GHzV2	1280	May. 17, 2021
Dosimetric E-Field Probe	SPEAG	ES3DV3	3090	Mar. 15, 2023
Dosimetric E-Field Probe	SPEAG	EX3DV4	7506	Jun. 29, 2023
Data Acquisition Electronics	SPEAG	DAE4	662	Mar. 08, 2023
ENA Series Network Analyzer	Agilent	8753ES	US39170317	Oct. 31, 2023
Dielectric Assessment Kit	SPEAG	DAK-3.5	1056	N/A
USB/GPIB Interface	Agilent	82357B	N10149	N/A
Signal Generator	R&S	SMB100A	103718	Apr. 14, 2023
POWER METER	R&S	NRP	101293	Oct. 27, 2023
Thermometer	Shanghai Gao Zhi Precision Instrument Co., Ltd.	HB6801	18022507	Oct. 30, 2023
Dual Directional Coupler	Agilent	778D	MY52180234	Oct. 27, 2023
Amplifier	Mini-Circuit	ZHL42	QA1252001	Apr. 15, 2023
DC Source	Agilent	66319B	MY43000795	Oct. 31, 2023

2 Measurement Uncertainty

Source of Uncertainty	Tolerance (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g) (± %)	Standard Uncertainty (10g) (± %)	Vi Veff
Measurement System								
Probe Calibration (< 3 GHz)	7.5	N (k=2)	2	1	1	3.75	3.75	∞
Probe Calibration (> 3 GHz)	6.3	N (k=2)	2	1	1	3.15	3.15	∞
Axial Isotropy	1.2	N (k=2)	2	0.7	0.7	0.42	0.42	∞
Hemispherical Isotropy	3.2	N (k=2)	2	0.7	0.7	1.12	1.12	∞
Boundary Effects	2	Rectangular	√3	1	1	1.15	1.15	∞
Linearity	0.9	N (k=2)	2	1	1	0.45	0.45	∞
Detection Limits	0.25	Rectangular	√3	1	1	0.14	0.14	∞
Modulation Response	2.4	Rectangular	√3	1	1	1.39	1.39	∞
Readout Electronics	0.3	Normal	1	1	1	0.30	0.30	∞
Response Time	0	Rectangular	√3	1	1	0.00	0.00	∞
Integration Time	1.7	Rectangular	√3	1	1	0.98	0.98	∞
RF Ambient – Noise	3	Rectangular	√3	1	1	1.73	1.73	∞
RF Ambient – Reflections	3	Rectangular	√3	1	1	1.73	1.73	∞
Probe Positioner	0.4	Rectangular	√3	1	1	0.23	0.23	∞
Probe Positioning	6.7	Rectangular	√3	1	1	3.87	3.87	∞
Max. SAR Evaluation	4	Rectangular	√3	1	1	2.31	2.31	∞
Test Sample Related								
Device Positioning	2.3 / 2.4	Normal	1	1	1	2.30	2.40	30
Device Holder	2.8 / 2.8	Normal	1	1	1	2.80	2.80	30
Power Drift	5	Rectangular	√3	1	1	2.89	2.89	∞
Power Scaling	0	Rectangular	√3	1	1	0.00	0.00	∞
Phantom and Setup								
Phantom Uncertainty	7.9	Rectangular	√3	1	1	4.56	4.56	∞
SAR correction	1.2 / 0.97	Rectangular	√3	1	0.84	0.69	0.47	∞
Liquid Conductivity (Meas.)	2.5	Rectangular	√3	0.78	0.71	1.13	1.02	∞
Liquid Permittivity (Meas.)	2.5	Rectangular	√3	0.26	0.26	0.38	0.38	∞
Temp. unc. - Conductivity	3.4	Rectangular	√3	0.78	0.71	1.53	1.39	∞
Temp. unc. - Permittivity	0.4	Rectangular	√3	0.23	0.26	0.05	0.06	∞
Combined Standard Uncertainty (k = 1) (≤ 3 GHz)						9.64	9.62	
Combined Standard Uncertainty (k = 1) (> 3 GHz)						9.42	9.40	
Max. Expanded Uncertainty (k = 2)						**19.27**	**19.23**	

3 Tissue Dielectric Parameter Measurements

3.1 Target for Tissue Dielectric Parameter

The temperature of the tissue-equivalent medium used during measurement must also be within 18℃ to 25℃and within ± 2℃ of the temperature when the tissue parameters are characterized. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 24 hours of use; or earlier if the dielectric parameters can become out of tolerance.

Recommended Dielectric Performance of Tissue

Ingredients (% by weight)	Frequency (MHz)											
	450		835		915		1900		2450		2600	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.46	52.4	41.05	56.0	54.9	40.4	62.7	73.2	55.24	64.49
Salt (Nacl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04	0.5	0.024
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0	44.45	32.25
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.2	52.5	39.0	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.80	1.78	1.96	2.16

Frequency: 5200/5400/5600/5800MHz	
Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

Target Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue	
	ε_r	σ(S/m)
750	41.9	0.89
835	41.5	0.90
1750	40.1	1.37
1900	40.0	1.40
2000	40.0	1.40
2300	39.5	1.67
2450	39.2	1.80
2600	39.0	1.96
5250	35.9	4.71
5600	35.5	5.07
5750	35.4	5.22

3.2 Verification results

Frequency (MHz)	Test Date	Temp ℃	Measured Dielectric Parameters		Target Dielectric Parameters		Limit (Within ±5%)	
			ε_r	σ(s/m)	ε_r	σ(s/m)	Dev ε_r(%)	Dev σ(%)
2450	Oct. 31, 2023	21.6	39.440	1.832	39.20	1.80	0.61	1.78
5250	Nov. 07, 2023	21.5	35.930	4.706	35.93	4.71	0.00	-0.08
Note: The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.								

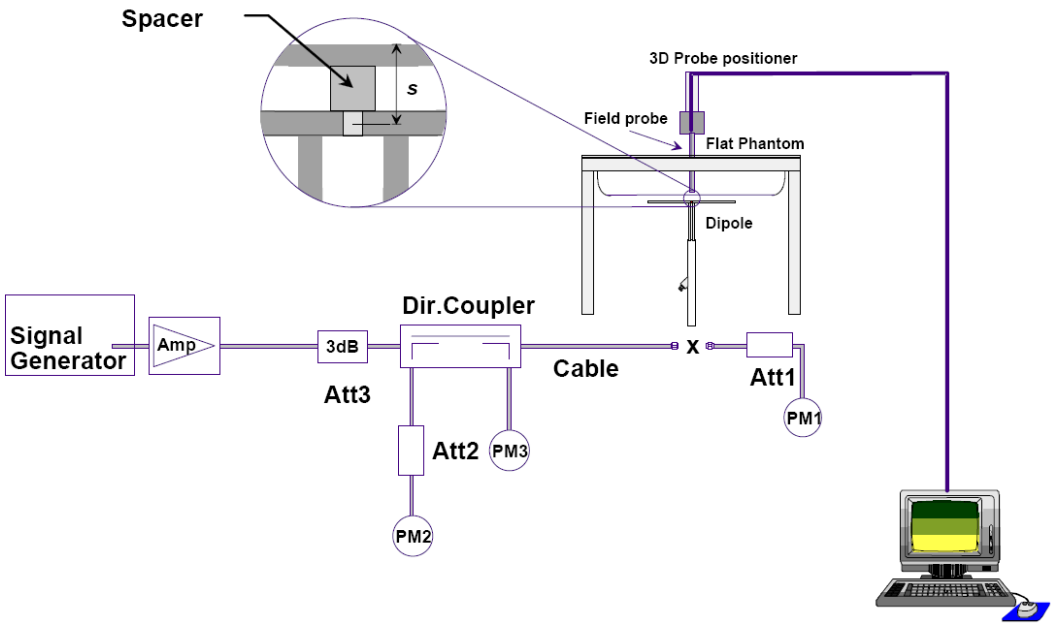
4 System Verification

4.1 System Performance Check

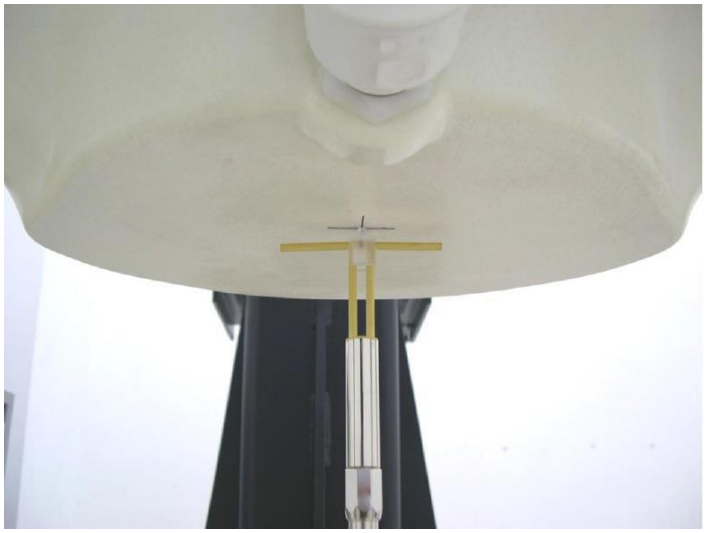
The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulates were measured using the dielectric probe kit and the network analyzer. A system check measurement for every day was made following the determination of the dielectric parameters of the Tissue simulates, using the dipole validation kit. The dipole antenna was placed under the flat section of the twin SAM phantom.

System check is performed regularly on all frequency bands where tests are performed with the DASY system.

System Performance Check setup



Dipole Setup



Target Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue	
	Target SAR_{1g}	**Target SAR_{10g}**
835	9.64	6.27
1750	35.7	18.8
1900	39.8	20.2
2100	42.9	21.1
2300	48.4	22.8
2450	52.0	23.8
2600	57.6	25.5
5250	77.6	22.2
5600	80.0	22.8
5750	77.3	21.8

4.2 System Performance Check Result

Frequency (MHz)	**Test Date**	**Temp ℃**	**Measured SAR_{1g}**	**1W Normalized SAR_{1g} (W/kg)**	**1W Target SAR_{1g} (W/kg)**	**Limit (±10%)**
2450	Oct. 31, 2023	21.7	12.500	50.00	51.80	-3.47
5250	Nov. 07, 2023	21.7	7.820	78.20	79.20	-1.26
Note： Target Values used derive from the calibration certificate Data Storage and Evaluation.						

4.3 WCDMA Measurement Procedures for SAR

The following procedures are applicable to WCDMA handsets operating under 3GPP Release99, Release 5 and Release 6. The default test configuration is to measure SAR with an established radio link between the DUT and a communication test set using a 12.2kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations (DPCCH & DPDCHn), HSDPA and HSPA (HSUPA/HSDPA) modes according to output power, exposure conditions and device operating capabilities. Both uplink and downlink should be configured with the same RMC or AMR, when required. SAR for Release 5 HSDPA and Release 6 HSPA are measured using the applicable FRC (fixed reference channel) and E-DCH reference channel configurations. Maximum output power is verified according to applicable versions of 3GPP TS 34.121 and SAR must be measured according to these maximum output conditions. When Maximum Power Reduction (MPR) is not implemented according to Cubic Metric (CM) requirements for Release 6 HSPA, the following procedures do not apply.

For Release 5 HSDPA Data Devices:

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	CM/dB
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15	15/15	64	12/15	24/25	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

For Release 6 HSPA Data Devices

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (dB)	MPR (dB)	AG Index	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1039/225	4	1	1.5	1.5	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	1.5	1.5	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	1.5	1.5	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	1.5	1.5	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	1.5	1.5	21	81

Rel.8 DC-HSDPA (Cat 24)

SAR test exclusion for Rel.8 DC-HSDPA must satisfy the SAR test exclusion requirements of Rel.5 HSDPA. SAR test exclusion for DC-HSDPA devices is determined by power measurements according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to qualify for SAR test exclusion.

4.4 SAR Measurement for LTE

SAR tests for LTE are performed with a base station simulator. Closed loop power control was used so the UE transmits with maximum output power during SAR testing.
All powers were measured with the base station simulator.
SAR is evaluated separately according to the following procedures for the different test positions in each exposure condition – head, body, body-worn accessories and other use conditions. The procedures in the following subsections are applied separately to test each LTE frequency band.
1) QPSK with 1 RB allocation
Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.
2) QPSK with 50% RB allocation
The procedures required for 1 RB allocation in 1) are applied to measure the SAR for QPSK with 50% RB allocation.
3) QPSK with 100% RB allocation
For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 1) and 2) are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

TDD test:
TDD testing is performed using guidance from FCC KDB 941225 D05 and the SAR test guidance provided in April 2013 TCB works hop notes. TDD is tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225 D05. SAR testing is performed using the extended cyclic prefix listed in 3GPP TS 36.211.

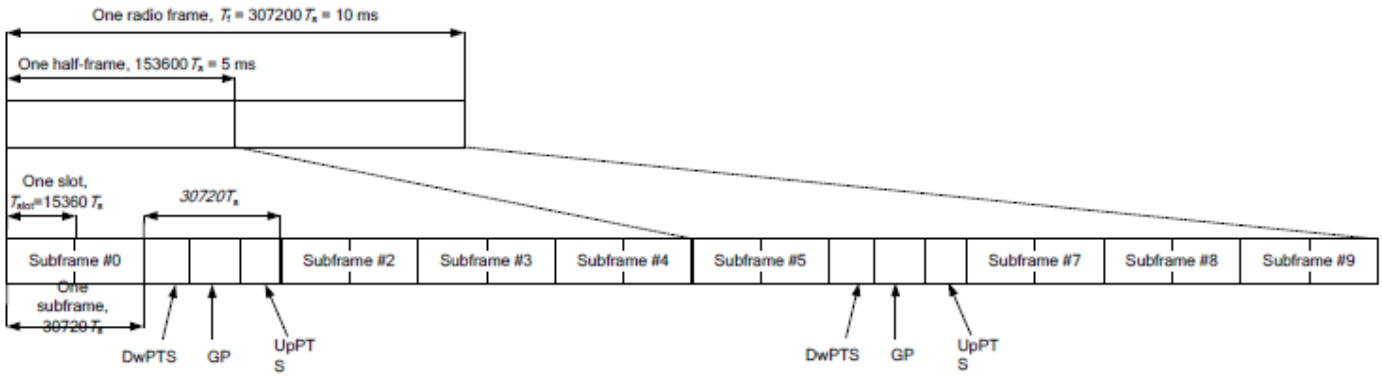


Figure 9.2: Frame structure type 2 (for 5 ms switch-point periodicity)

Configuration of special subframe (lengths of DwPTS/GP/UpPTS)

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21952 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$			$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$		
8	$24144 \cdot T_s$			-	-	-
9	$13168 \cdot T_s$			-	-	-

Uplink-downlink configurations

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

Duty factor is calculated by:
Duty factor = uplink frame*6+UpPTS*2/one frame length
= (30720.T_s * 6+5120. T_s*2)/307200.T_s
= 0.633

4.5 Bluetooth & Wi-Fi Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of 802.11 transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable. Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

4.6 Power Drift

To control the output power stability during the SAR test, DASY5 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position.
This ensures that the power drift during one measurement is within 5%.

5 Measurement Procedures

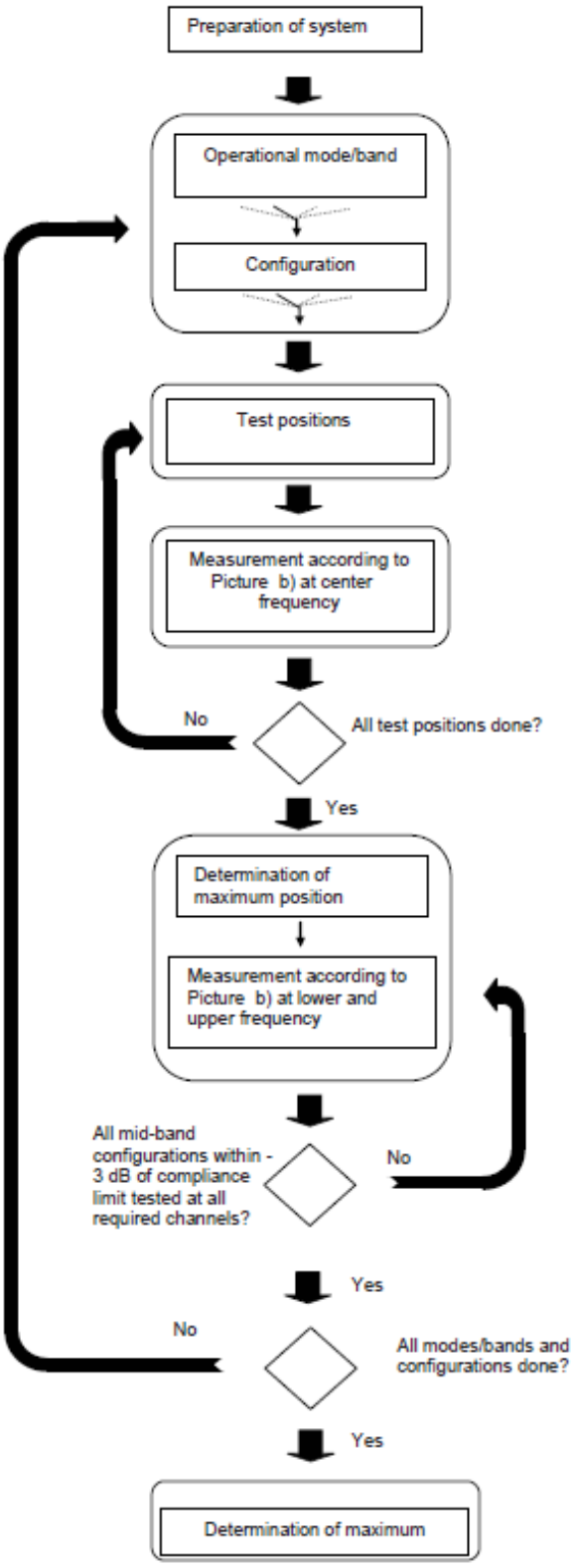
5.1 RF exposure Limit

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

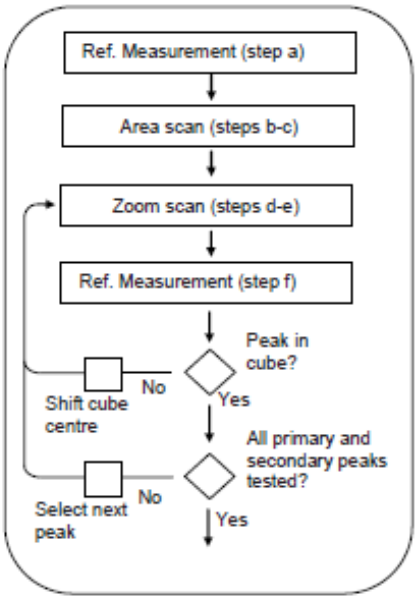
Note: 1.The limit applied in this test report is shown in bold letter;

2. * The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time;
3. ** The Spatial Average value of the SAR averaged over the whole body;
4. *** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time;

5.2 Block Diagram of Test Setup



Picture a – Tests to be performed



Picture b – General procedure

5.3 Test Conditions and Test Method

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2003. The results should be documented as part of the system validation records and may be requested to support test results when all the measurement parameters in the following table are not satisfied.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

6 Conducted RF Output Power

6.1 GSM Measurement result

GSM850		Measured Power (dBm)			Division Factors	Averaged Power (dBm)		
		128CH	190CH	251CH		28CH	190CH	251CH
GSM (CS)		/	/	/	/	/	/	/
GPRS (GMSK)	1 Tx Slot	/	/	/	/	/	/	/
	2 Tx Slots	/	/	/	/	/	/	/
	3 Tx Slots	/	/	/	/	/	/	/
	4 Tx Slots	/	/	/	/	/	/	/
EDGE (8PSK)	1 Tx Slot	/	/	/	/	/	/	/
	2 Tx Slots	/	/	/	/	/	/	/
	3 Tx Slots	/	/	/	/	/	/	/
	4 Tx Slots	/	/	/	/	/	/	/
GSM1900		Measured Power (dBm)			Division Factors	Averaged Power (dBm)		
		512CH	661CH	810CH		512CH	661CH	810CH
GSM (CS)		/	/	/	/	/	/	/
GPRS (GMSK)	1 Tx Slot	/	/	/	/	/	/	/
	2 Tx Slots	/	/	/	/	/	/	/
	3 Tx Slots	/	/	/	/	/	/	/
	4 Tx Slots	/	/	/	/	/	/	/
EDGE (8PSK)	1 Tx Slot	/	/	/	/	/	/	/
	2 Tx Slots	/	/	/	/	/	/	/
	3 Tx Slots	/	/	/	/	/	/	/
	4 Tx Slots	/	/	/	/	/	/	/

Note: To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

6.2 WCDMA Conducted output Power

Item	band	WCDMA 850			WCDMA 1900		
	Frequency	4132	4183	4233	9262	9400	9538
	Subtest	dBm			dBm		
WCDMA	RMC 12.2Kbps	/	/	/	/	/	/
HSDPA	1	/	/	/	/	/	/
	2	/	/	/	/	/	/
	3	/	/	/	/	/	/
	4	/	/	/	/	/	/
HSUPA	1	/	/	/	/	/	/
	2	/	/	/	/	/	/
	3	/	/	/	/	/	/
	4	/	/	/	/	/	/
	5	/	/	/	/	/	/

Note: WCDMA SAR was tested under RMC 12.2kbps with HSPA Inactive .HSPA SAR was not requires since the
average output power of the HSPA subtests was not more than 0.25dB higher than the RMC level and
SAR was less than 1.2W/kg.
It is expected by the manufacturer that MPR for some HSPA subtests may be up to 2dB more than
specified by 3GPP, but also as low as 0dB according to the chipset implementation in this model

6.3 LTE Conducted peak output Power

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]						MPR (dB)
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	2

LTE FDD Band 2				Conducted Power (dBm)		
Bandwidth	Modulation	RB size	RB offset	Channel 18607	Channel 18900	Channel 19193
1.4MHz	QPSK	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
	16QAM	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
Bandwidth	Modulation	RB size	RB offset	Channel 18615	Channel 18900	Channel 19185
3MHz	QPSK	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/

	16QAM	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
Bandwidth	Modulation	RB size	RB offset	Channel 18625	Channel 18900	Channel 19175
5MHz	QPSK	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
	16QAM	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
Bandwidth	Modulation	RB size	RB offset	Channel 18650	Channel 18900	Channel 19150
10MHz	QPSK	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
	16QAM	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
Bandwidth	Modulation	RB size	RB offset	Channel 18675	Channel 18900	Channel 19125
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/

15MHz	QPSK	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
	16QAM	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
Bandwidth	Modulation	RB size	RB offset	Channel 18700	Channel 18900	Channel 19100
20MHz	QPSK	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
	16QAM	/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/
		/	/	/	/	/

6.4 WIFI Conducted Power

WLAN 2.4GHz Band Conducted Power

Channel/Freq.(MHz)	Maximum Conducted Out Power (dBm)		
	802.11b	802.11g	802.11n(HT20)
1(2412)	14.31	9.64	9.69
6(2437)	14.98	9.91	9.36
11(2462)	15.56	9.54	10.09

WLAN 5.2GHz Band Conducted Power

Channel/Freq.(MHz)	Maximum Conducted Out Power (dBm)	
	802.11a	802.11n(HT20)
36(5180)	10.13	10.73
40(5200)	11.15	10.69
48(5240)	10.80	9.54

Note: choosing the highest output power channel to test SAR and determine further SAR exclusion
For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at lowest data rate is not 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 ≤1.2W/Kg. Thus the SAR can be excluded.

6.5 Bluetooth Output Power

Channel	Frequency (MHz)	BT5.0 Output Power(dBm)		
		GFSK	π/4-DQPSK	8-DPSK
CH 0	2402	/	/	/
CH 39	2441	/	/	/
CH 78	2480	/	/	/
Channel	Frequency (MHz)	BLE5.0 Output Power(dBm)		
		GFSK		
CH 0	2402	/		
CH 20	2442	/		
CH 39	2480	/		

7 Scaling Factor calculation

Operation Mode	Channel	Output Power(dBm)	Tune up Power in tolerance(dBm)	Scaling Factor
WIFI 2.4G_802.11b	1	14.31	15.0 ± 1.0	1.48
	6	14.98	15.0 ± 1.0	1.26
	11	15.56	15.0 ± 1.0	1.11
WIFI 5.2G_802.11a	36	10.13	10.5 ± 1.0	1.37
	40	11.15	10.5 ± 1.0	1.08
	48	10.80	10.5 ± 1.0	1.17

8 SAR test Exclusion Consideration and SAR measurement positions

8.1 SAR test Exclusion Consideration

The 1-g and 10-g SAR test exclusion thresholds for 100MHz to 6GHz at test separation distances ≤ 50mm 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.

(1) f(GHz) is the RF channel transmit frequency in GHz;
(2) Power and distance are round to the nearest mW and mm before calculation;
(3) The result is rounded to one decimal place for comparison;
(4) If the test separation distance(antenna-user) is < 5mm, 5mm is used for excluded SAR calculation;

Mode	Freq (GHz)	Position	SAR test exclusion threshold(mW)	RF power		SAR test exclusion
				dBm	mW	
WIFI	2450	Body (0mm)	10	15.56	35.97	no
WIFI	5200	Body (0mm)	7	11.15	13.03	no

8.2 SAR measurement positions

The Body SAR measurement positions of each band are as below:

Antenna	Front	Rear	Left Edge	Right Edge	Top Edge	Bottom Edge
WIFI Antenna Body-supported	Yes	Yes	Yes	Yes	No	No

Note: when antenna-to-edge>2.5cm, SAR is not required.

9 SAR Test Results

SAR Values of Wi-Fi 802.11b

Temperature: 21.7°C, humidity: 54.9%.							
Test Positions		Channel /Frequency (MHz)	SAR(W/Kg), 1.6 (1g average)				Plot No.
			SAR (W/Kg),1g	Scaled Factor	Scaled SAR (W/Kg),1g	Power drift (dB)	
Body-supported (0mm Separation)	Front Face	11/2462	0.00685	1.11	0.008	-0.12	
	Rear Face	11/2462	0.198	1.11	**0.219**	-0.10	1
	Left Side	11/2462	0.0131	1.11	0.014	0.10	
	Right Side	11/2462	0.0127	1.11	0.014	0.10	
	Rear Face	1/2412	0.104	1.48	0.153	0.08	
	Rear Face	6/2437	0.115	1.26	0.145	0.04	

SAR Values of Wi-Fi 802.11a

Temperature: 21.7°C, humidity: 54.9%.							
Test Positions		Channel /Frequency (MHz)	SAR(W/Kg), 1.6 (1g average)				Plot No.
			SAR (W/Kg),1g	Scaled Factor	Scaled SAR (W/Kg),1g	Power drift (dB)	
Body-supported (0mm Separation)	Front Face	40/5200	<0.0001	1.08	<0.001	-0.03	
	Rear Face	40/5200	0.386	1.08	0.418	-0.11	
	Left Side	40/5200	0.0285	1.08	0.031	0.00	
	Right Side	40/5200	0.0777	1.08	0.084	-0.17	
	Rear Face	36/5180	0.393	1.37	**0.539**	-0.16	2
	Rear Face	48/5240	0.414	1.17	0.486	0.06	

10 Simultaneous Transmissions Analysis

10.1 Simultaneous transmission mode

Not supported.

10.2 Simultaneous transmission for head

Not supported.

10.3 Simultaneous transmission for body

Not supported.

Appendix I: Calibration reports

See document of Appendix I

Appendix II: Test Setup

See document of Appendix II

Appendix III: Measurement Results Plots

See document of Appendix III

********** END **********