KDB 865664 D01 SAR Measurement 100MHz to 6GHz
FCC 47 CFR part 2 (2.1093)

SAR EVALUATION REPORT

For

Single Mode UTRA Mobile Phone with *Bluetooth* and RFID

FCC ID: UCE115064A
Model: P-01H

Report Number UL-SAR-RP10833755JD09A V2.0
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Prepared for

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REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
--	28 August 2015	Initial Issue	--
1	21 September 2014	The following amendments were made in the report: 1. Typo corrected in section 12.3 2. Typo corrected in section 10.1.2 3. Typo corrected in section 10.2	Sandhya Menon

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1. Attestation of Test Results

Applicant Name:	Panasonic Mobile Communications Development of Europe Ltd			
Application Purpose	☒ Original Grant			
FCC ID:	UCE115064A			
DUT Description	Single Mode UTRA Mobile Phone with Bluetooth and RFID			
Test Device is	An identical prototype			
Device category	Portable			
SAR Limits				
Exposure Category	Peak Spatial-average (1g of tissue)			
General Population / Uncontrolled Exposure	1.6 W/kg			
The highest reported SAR				
RF Exposure Conditions	**Equipment Class**			
	Licensed	**DTS**	**U-NII**	**DSS**
Head	0.719 W/kg	N/A	N/A	N/A
Body-worn	1.452 W/kg	N/A	N/A	N/A
Simultaneous Transmission	1.485 W/kg	N/A	N/A	1.485 W/kg
Applicable Standards	FCC 47 CFR part 2 (2.1093) Published RF Exposure KDB Procedures IEEE Std 1528-2013			
Date Tested	14 August 2015 to 27 August 2015			
Test Results	Pass			

UL VS Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL VS Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties are in accordance with the above standard and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample(s), under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL VS Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL VS Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by UKAS. This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released By:	Prepared By:
	
Naseer Mirza Project Lead UL VS Ltd.	Sandhya Menon Senior Engineer UL VS Ltd.

2. Test Specification, Methods and Procedures

2.1. Test Specification

Reference:	KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
Title:	SAR Measurement Requirements for 100 MHz to 6 GHz
Purpose of Test:	Field probes, tissue dielectric properties, SAR scans, measurement accuracy and variability of the measured results are discussed. The field probe and SAR scan requirements are derived from criteria considered in standard IEEE 1528-2013.
The Equipment Under Test complied with the Specific Absorption Rate for general population/uncontrolled exposure limit of 1.6 W/kg as specified in FCC 47 CFR part 2 (2.1093).	

2.2. Methods and Procedures Reference Documentation

The test documents in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013, the following FCC Published RF exposure KDB procedures and TCB methods and procedures workshop updates:

IEEE 1528 - 2013
IEEE 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:
447498 D01 General RF Exposure Guidance v05r02
648474 D04 Handset SAR v01r02
865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
865664 D02 RF Exposure Reporting v01r01
941225 D01 3G SAR Procedures v03

2.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Section 4.2 contains a list of the test equipment used.

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

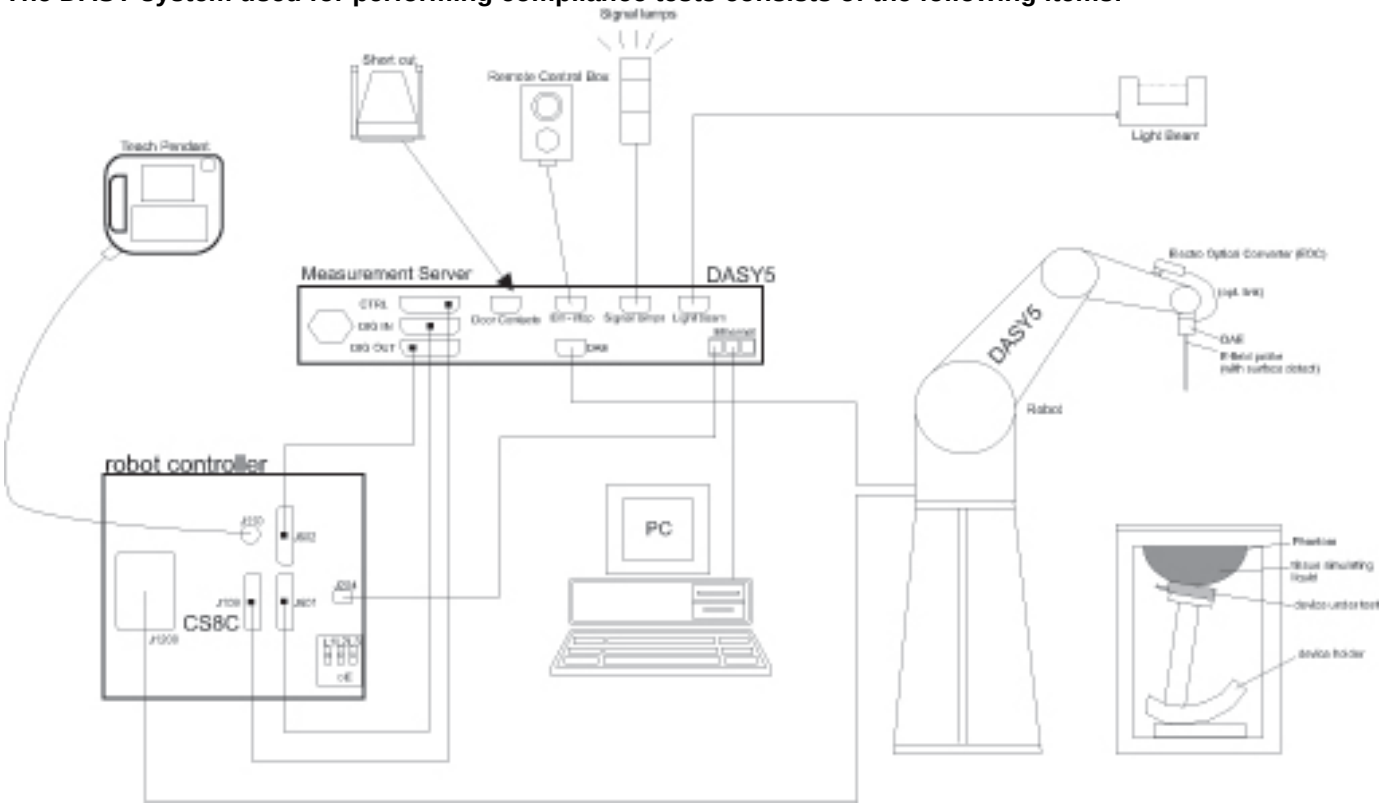
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG UK	Facility Type
SAR Lab 60	Controlled Environment Chamber

UL VS Limited is accredited by UKAS (United Kingdom Accreditation Service, Accredited to ISO/IEC 17025: 2005), Laboratory UKAS Code 0644.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

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



- A standard high precision 6-axis robot 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 WinXP or Win7 and the DASY 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.

4.2. SAR Measurement Procedure

4.2.1. Normal SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in following standards: IEEE 1528 -2013 and IEC 62209-1: 2005 / IEC 62209-2: 2010 standards. If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04

<table>
<tr><td></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 mm ± 1 mm</td><td>½·δ·ln(2) mm ± 0.5 mm</td></tr>
<tr><td>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 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>
</table>

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

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 *reported* 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.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.

4.3. Volumetric Scan Procedure

Step 1: Repeat Step 1-4 in Section 4.3

Step 2: Volume Scan

Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

Step 3: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

4.4. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

Dielectric Property Measurements & System Check

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A2547	Data Acquisition Electronics	SPEAG	DAE4	1438	29 Apr 2015	12
A2112	Probe	SPEAG	ET3 DV6	1586	22 May 2015	12
A2201	900 MHz Dipole Kit	SPEAG	D900V2	035	23 Jan 2015	12
G0611	Robot Power Supply	SPEAG	DASY52	None	Calibrated before use	-
M1876	Robot Arm	Staubli	TX60 L	F14/5T5ZA1/A/01	Calibrated before use	-
M1860	Spectrum Analyser	HP	8590E	3911A01646	Calibrated before use	-
A1182	Handset Positioner	SPEAG	V3.0	None	-	-
A2442	Handset Positioner	SPEAG	MD4HHTV5	None	-	-
M1755	DAK Fluid Probe	SPEAG	SM DAK 040 CA	1089	Calibrated before use	-
M1565	Communication Test Set	Agilent	8960 Series 10 (E5515C)	GB46311280	10 Dec 2014	12
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	26 Oct 2014	12
A2621	Digital Camera	Nikon	S3600	41010357	-	-
M1908	Signal Generator	R & S	SMIQ03B	1125555503	02 Dec 2014	12
M1841	Dual Channel Power Meter	R & S	NRVD	834501/069	27 Mar 2015	12
M1044	Power Sensor	R & S	ZRPZ1	893350/0019	03 Sep 2014	12
M1842	Power Sensor	R & S	ZRPZ1	890212/015	27 Mar 2015	12
A2100	Directional Coupler	RF-Lambda	11101300748	None	Calibrated as part of system	-
A2403	Amplifier	Mini-Circuits	ZHL-42W	15542	Calibrated as part of system	-
S0570	SAR Lab	UL	Site 60	N/A	Calibrated before use	-
A2552	SAM Phantom	SPEAG	SAM a	1836	Calibrated before use	-

4.5. SAR System Specifications

Robot System	
Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Repeatability:	±0.030 mm
No. of Axis:	6
Serial Number:	F14/5T5ZA1/A/01
Reach:	920 mm
Payload:	2.0 kg
Control Unit:	CS8C
Programming Language:	V+
Data Acquisition Electronic (DAE) System	
Serial Number:	DAE4 SN: 1438
PC Controller	
PC:	Dell Precision 340
Operating System:	Windows 2000
Data Card:	DASY4 Measurement Server
Serial Number:	1080
Data Converter	
Features:	Signal Amplifier, multiplexer, A/D converted and control logic.
Software:	DASY5 Software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock.
PC Interface Card	
Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 16 nit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.
E-Field Probe	
Model:	ET3DV6
Serial No:	1586
Construction:	Triangular core
Frequency:	10 MHz to 2.55GHz
Linearity:	±0.2 dB (30 MHz to 2.55GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	10
Tip Diameter (mm):	6.8
Sensor X Offset (mm):	2.7
Sensor Y Offset (mm):	2.7
Sensor Z Offset (mm):	2.7
Phantom	
Phantom:	SAM Phantom
Shell Material:	Fibreglass
Thickness:	2.0 ±0.1 mm

5. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Test Name	Confidence Level	Calculated Uncertainty
WCDMA FDD 5 Head Configuration 1g	95%	±18.77%
WCDMA FDD 5 Body Configurations 1g	95%	±18.36%

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

5.1. Uncertainty – WCDMA 5 Head Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.510	2.510	normal (k=1)	1.0000	1.0000	2.510	2.510	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.950	2.950	normal (k=1)	1.0000	0.6400	1.888	1.888	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	2.840	2.840	normal (k=1)	1.0000	0.6000	1.704	1.704	5
	Combined standard uncertainty			t-distribution			9.58	9.58	>500
	Expanded uncertainty			k = 1.96			18.77	18.77	>500

5.2. Uncertainty – WCDMA 5 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration /Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.510	2.510	normal (k=1)	1.0000	1.0000	2.510	2.510	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.000	2.000	normal (k=1)	1.0000	0.6400	1.280	1.280	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	1.560	1.560	normal (k=1)	1.0000	0.6000	0.936	0.936	5
	Combined standard uncertainty			t-distribution			9.37	9.37	>500
	Expanded uncertainty			k = 1.96			18.36	18.36	>500

6. Equipment Under Test (EUT)

6.1. Identification of Equipment Under Test (EUT)

Serial Number/ IMEI Number:	**Radiated Samples:** 351772070005110 – Was used to perform Cellular Head and Body SAR measurements. **Conducted Sample:** 351772070005243 – Was used to perform Cellular conducted power measurements.
Hardware Version Number:	Rev C
Software Version Number:	ACPU: B-D52CS1-01.03.007 CCPU: D52CS1_Cv18122302
Country of Manufacture:	Japan
Date of Receipt:	13 August 2015

DUT Descriptions	The EUT supports WCDMA FDD Band 5 with Bluetooth band and RFID.
Operating Configurations	Held to head Body-worn
Device dimension	Overall (Length x Width x Depth): 211.7mm x 51.2mm x 8.7mm (EUT Open) Overall (Length x Width x Depth): 112.3mm x 51.2mm x 16.6mm (EUT Closed)
Back Cover	☒ Normal Battery Cover ☐ Normal Battery Cover with NFC ☐ Wireless Charger Battery Cover ☐ Wireless Charger Battery Cover with NFC
Accessory	☒ Headset
Battery Options	☒ Standard – Lithium-ion battery ☐ Extended (large capacity)

Support Equipment

Description	Stereo Earphone
Brand Name	DoCoMo
Model Number	01
Hardware Version Number:	Production
Software Version Number:	Not Applicable

Description	Rechargeable Li-ion Battery Pack
Brand Name	P32
Model Number	None Stated
Hardware Version Number:	Production
Software Version Number:	Not Applicable

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle
W-CDMA (FDD)	Band 5	WCDMA Rel. 99 HSDPA (Rel. 5, Cat 8) HSUPA (Rel. 6, Cat 6)	Rel. 99 / HSDPA / HSUPA: 100%
Bluetooth	-	BR EDR	<100%

Transmitter Frequency Range:	WCDMA FDD 5	(826 to 847) MHz			
	Bluetooth	(2402 to 2480) MHz			
Transmitter Frequency Allocation of EUT When Under Test:	**Bands**	**Channel Number**	**Channel Description**	**Frequency (MHz)**	
	WCDMA FDD 5	4132	Low	826.4	
		4183	Middle	836.6	
		4233	High	846.6	
	Bluetooth	0	Low	2402.0	
		39	Middle	2441.0	
		78	High	2480.0	
Antenna Type:	Internal integral				
Antenna Length:	As specified in Appendix 12.1				
Number of Antenna Positions:	WWAN ~ WCDMA (Cellular)				1 fixed
	WPAN ~ Bluetooth				1 fixed

6.3. Nominal and Maximum Output Power

(From customer)

		RF Output Power (dBm)	
RF Air interface	**Mode**	**Target (dBm)**	**Max. tune-up tolerance limit (dB)**
WCDMA FDD 5	Voice / RMC 12.2 Kbps	23.0	-2.0 ~ +1.5
	HSDPA Sub test 1	23.0	-2.0 ~ +1.5
	HSDPA Sub test 2	23.0	-2.0 ~ +1.5
	HSDPA Sub test 3	22.5	-2.0 ~ +1.5
	HSDPA Sub test 4	22.5	-2.0 ~ +1.5
	HSUPA Sub test 1	23.0	-2.0 ~ +1.5
	HSUPA Sub test 2	21.0	-2.0 ~ +1.5
	HSUPA Sub test 3	22.0	-2.0 ~ +1.5
	HSUPA Sub test 4	21.0	-2.0 ~ +1.5
	HSUPA Sub test 5	23.0	-2.0 ~ +1.5
Bluetooth	BR	0.0	-4.0 ~ +2.0
	EDR	0.0	-4.0 ~ +2.0

7. RF Exposure Conditions (Test Configurations)

Refer to Appendix A.1 "Antenna Locations and Separation Distances" for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

7.1. Head

For WWAN (WCDMA)

Test Configurations	SAR Required	Note
Touch Left	Yes	
Tilt Left (15°)	Yes	
Touch Right	Yes	
Tilt Right (15°)	Yes	

7.2. Body-worn Accessory

For WWAN (WCDMA) and Bluetooth

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	A conservative minimum test separation distance for supporting off-the-shelf **body-worn** accessories that may be acquired by users of consumer handsets is used to test for body-worn accessory SAR compliance.
Front	<25 mm	Yes	15mm represents the minimum separation distance achieved with typical available carry accessories to be used with the handset, as advised by the manufacturer

Note:

1. As per KDB 447498 D01 General RF Exposure Guidance v05r02, The Frequency Bands with Rated Power including Upper tolerance, which qualify for **Standalone SAR Test Exclusion,** are as per the above table.

   The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] * [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

   - $f_{(GHz)}$ is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest *mW* and *mm* before calculation
   - The result is rounded to one decimal place for comparison

   The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

   Applying the above formula for ***Bluetooth*** **Body-worn** we get:
   - For 2.4 GHz, [(1.585)/10]*[√2.4] =0.245 ≤ 3.0

8. Conducted Output Power Measurements

8.1. RF Output Average Power Measurement: WCDMA

8.1.1. RMC / HSDPA / HSUPA

Modes		HSDPA				HSUPA					WCDMA
Sets		1	2	3	4	1	2	3	4	5	Voice / RMC 12.2kbps
Band	Channel	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]
Band 5 (850 MHz)	UL: 4132 DL: 4357	23.00	22.70	22.60	22.70	23.00	21.00	22.10	20.80	22.90	23.10
	UL: 4183 DL: 4408	23.20	22.80	22.75	22.75	23.20	21.25	22.20	21.10	23.20	23.20
	UL: 4233 DL: 4458	23.00	22.90	22.60	22.60	22.90	21.00	22.00	20.90	23.00	23.05
ßc		2	12	15	15	11	6	15	2	15	
ßd		15	15	8	4	15	15	9	15	15	
ΔACK, ΔNACK, ΔCQI		8	8	8	8	8	8	8	8	8	
AGV		-	-	-	-	20	12	15	17	21	

The module power levels were measured in both HSPA and 3G RMC 12.2kbps modes and compared to ensure the correct mode of operation had been established.

The following tables taken from FCC 3G SAR procedures (KDB 941225 D01 SAR test for 3G devices v02) below were applied using an wireless communications test set which supports 3G / HSDPA release 5 / HSUPA release 6.

Sub-test Setup for Release 5 HSDPA

Sub-test	β_c	β_d	B_d *(SF)*	β_c/β_d	β_{hs} (1)	SM (dB) (2)
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 (3)	15/15 (3)	64	12/15 (3)	24/15	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

Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $B_{hs}/\beta_c = 24/15$

Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$

Sub-test Setup for Release 6 HSUPA

Sub-test	β_c	β_d	B_d *(SF)*	β_c/β_d	β_{hs} (1)	B_{oc}	B_{od}	B_{od} *(SF)*	B_{od} *(codes)*	CM (2) (dB)	MPR (dB)	AG (4) Index	E-TFCI
1	11/15 (3)	15/15 (3)	64	11/15 (3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	31/15	B_{al1}: 47/15 B_{al2}: 47/15	4	1	2.0	1.0	15	92
4	2/15	15/15	64	2/15	2/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (4)	15/15 (4)	64	15/15 (4)	24/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $B_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH AND E-DPCCH for the Power Back-off is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$.

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Tavle 5.1g.

Note 6: B_{od} can not be set directly; it is set by Absolute Grant Value.

9. Dielectric Property Measurements & System Check

9.1.Tissue Dielectric Parameters

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C 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 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz; IEEE1528:2013

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
750	41.9	0.89		
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1750	40.1	1.37		
1800	40.0	1.40	53.3	1.52
1900	40.0	1.40	53.3	1.52
2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00
6000	35.1	5.48		

NOTE: For convenience, permittivity and conductivity values at some frequencies that are not part of the original data from Drossos et al. [B60] or the extension to 5800 MHz are provided (i.e., the values shown in italics). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6000 MHz that were linearly extrapolated from the values at 3000 MHz and 5800 MHz.

9.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

9.3. Reference Target SAR Values

The reference SAR values are obtained from the calibration certificate of system validation dipoles. The measured values are normalised to 1 Watt.

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (mW/g)		
				1g/10g	Head	Body
D900V2	035	23/01/2015	900	1g	10.80	10.80
				10g	6.88	6.97

9.4. Dielectric Property Measurements & System Check Results

The 1-g SAR and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target. The internal limit is set to 5%.

Site 60

System check 900 Head
Date: 19/08/2015
Validation dipole and Serial Number: D900V2 / SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	900	22.0 ℃	20.0 ℃	**εr**	41.50	41.13	-0.89	5.00
				σ	0.97	0.95	-2.06	5.00
				1g	10.80	10.48	-2.96	5.00
				10g	6.88	6.92	0.58	5.00

System check 900 Body
Date: 17/08/2015
Validation dipole and Serial Number: D900V2 / SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0 ℃	22.5 ℃	**εr**	55.00	53.25	-3.18	5.00
				σ	1.05	1.03	-1.81	5.00
				1g	10.80	10.44	-3.33	5.00
				10g	6.97	6.84	-1.87	5.00

Date: 24/08/2015
Validation dipole and Serial Number: D900V2 / SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0 ℃	22.0 ℃	**εr**	55.00	54.05	-1.73	5.00
				σ	1.05	1.07	1.71	5.00
				1g	10.80	10.64	-1.48	5.00
				10g	6.97	7.00	0.43	5.00

10.Measured SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 648474 D04 Handset SAR:

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

KDB 941225 D01 SAR test for 3G devices:

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

10.1. Specific Absorption Rate - Test Results
For All SAR measurement in this report the 1g-SAR limit tested to is 1.6 W/Kg

10.1.1. WCDMA Band 5 - Head Configuration 1g

Max Reported SAR = 0.719 (W/kg)

					Power (dBm)		1g : SAR Results (W/kg)		
Mode or Modulation	Dist (mm)	Test Position	Channel No.	Freq (MHz)	Tune-up limit	Meas.	Meas.	Reported	Scan No.
Rel, 99 RMC	0	Touch Left Open	4183	836.6	24.50	23.20	0.533	0.719	1
Rel, 99 RMC	0	Tilt Left Open	4183	836.6	24.50	23.20	0.227	0.306	2
Rel, 99 RMC	0	Touch Right Open	4183	836.6	24.50	23.20	0.494	0.666	3
Rel, 99 RMC	0	Tilt Right Open	4183	836.6	24.50	23.20	0.206	0.278	4

10.1.2. WCDMA Band 5 – Body-Worn Configuration 1g

Max Reported SAR = 1.452 (W/kg)

					Power (dBm)		1g : SAR Results (W/kg)		
Mode or Modulation	Dist (mm)	Test Position	Channel No.	Freq (MHz)	Tune-up limit	Meas.	Meas.	Reported	Scan No.
RMC 12.2 Kbps	15.0	Front Open	4183	836.6	24.50	23.20	0.439	0.592	5
RMC 12.2 Kbps	15.0	Back Open	4183	836.6	24.50	23.20	0.852	1.149	6
RMC 12.2 Kbps	15.0	Back Open	4132	826.4	24.50	23.10	0.833	1.150	7
RMC 12.2 Kbps	15.0	Back Open	4233	846.6	24.50	23.05	0.762	1.064	8
RMC 12.2 Kbps	15.0	Font Closed	4183	836.6	24.50	23.20	0.330	0.445	9
RMC 12.2 Kbps	15.0	Back Closed	4183	836.6	24.50	23.20	0.765	1.032	10
RMC 12.2 Kbps	15.0	Back Closed	4132	826.4	24.50	23.10	0.790	1.091	11
RMC 12.2 Kbps	15.0	Back Closed	4233	846.6	24.50	23.05	1.040	1.452	12*
RMC 12.2 Kbps	15.0	Back Closed with PHF	4233	846.6	24.50	23.05	0.815	1.138	13
RMC 12.2 Kbps+ HSDPA	15.0	Back Closed	4233	846.6	24.50	23.00	0.972	1.373	14
RMC 12.2 Kbps+ HSUPA	15.0	Back Closed	4233	846.6	24.50	23.00	0.991	1.400	15

***As per 865664 D01, the highest SAR measured > 0.8 W/kg has been re-measured and included in the report in section 10.3 under** *SAR Measurement Variability and Measurement Uncertainty Analysis Results* **Table.**

10.2. Bluetooth

10.2.1. Estimated SAR

1. As per FCC KDB 447498 D01, Bluetooth maximum source based time average power was below the allowed threshold for both 10 and 15mm separation distances.
   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)]·[$\sqrt{f_{(GHz)}}/x$] W/kg for test separation distances* ≤ 50 mm;
     where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.

For the estimated SAR level calculation, the Maximum Target power + Upper tolerance for *Bluetooth* = 2.0 dBm (~ 1.585 mW) is considered.

- **15mm Bluetooth estimated SAR level:**

  Estimated *Bluetooth* SAR = (1.585mW/10mm)*(√2.4 / 7.5) = 0.033 W/kg

Estimated SAR Result for Body-worn Accessory Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Rear/Front	1.585	10	2.4	0.033

10.3. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements 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; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 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 ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Repeated Measurement Results

Body Exposure Condition

Frequency band	Test Position	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Note
					Original	Repeated		
WCDMA Band 5	Back Closed	RMC 12.2Kbps	4233	846.6	1.040	1.000	1.04	1

Note(s):

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.

11. Simultaneous Transmission SAR Analysis

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the *reported* standalone SAR of each applicable simultaneous transmitting antenna.

	Simultaneous transmission conditions	
	WWAN	WPAN
#	WCMDA Voice / Data	*Bluetooth*
1	X	X

KDB 447498 D01 General RF Exposure Guidance, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / Ri$$

Where:

SAR_1 is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR_2 is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured for both antennas in the pair, it is determined by the actual x, y, and z coordinates in the 1-g SAR for each SAR Peak Location; based on the extrapolated and interpolated result in the zoom scan measurement using the formula:

$$[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$$

A new threshold of 0.04 is also introduced in the KDB 447498. Thus, in order for a pair of simultaneously transmitting antennas, with the sum of 1-g SAR > 1.6 W/kg, to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / Ri < 0.04$$

11.1. Simultaneous consideration for WWAN + WPAN

11.1.1. WCDMA Band 5 + BT

RF Exposure Conditions	EUT Position		Simultaneous Transmission Condition			
			WCDMA Band 5 ①	*Bluetooth* ②	Σ 1g SAR (W/kg)	SPLSR (Yes/No)
Body-worn Accessory	Front Open	① + ②	0.592	0.033	0.625	No
	Back Open	① + ②	1.150	0.033	1.183	No
	Front Closed	① + ②	0.445	0.033	0.478	No
	Back Closed	① + ②	1.452	0.033	1.485	No

Note: Since Bluetooth measurements are not required for Head Configurations, this was not considered for Simultaneous transmission Analysis