



**FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE STD 1528:2003**

SAR EVALUATION REPORT

For

**TD-CDMA PCI Express Mini Module
(Tested inside of Panasonic Laptop PC CF-19)**

**MODEL: WW11A
FCC ID: ACJ9TGWW11A**

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Prepared for

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Revision History

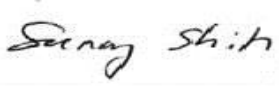

Rev.	Issue Date	Revisions	Revised By
--	February 10, 2012	Initial Issue	--
A	March 7, 2012	Updated report based on reviewer's comments. 1. Sec. 1: Fixed typo with correct SAR Data for Simultaneous transmission condition. 2. Sec. 11: Revised Note 1. 3. Sec. 15: Revised Note 1. 4. Sec. 14, 18 & 19: Revised Configuration Labels. 5. Sec. 15: Updated Simultaneous Transmission SAR Analysis Table.	Bobby Bayani

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1. Attestation of Test Results

Applicant name:	Panasonic Corporation Of North America		
EUT description:	TD-CDMA PCI Express Mini Module (Tested inside of Panasonic Tablet PC, Model CF-19)		
Model number:	WW11A		
Device category:	Portable		
Exposure category:	General Population/Uncontrolled Exposure		
Date tested:	January 20-27, 2012		
FCC Rule Parts	Freq. Range [MHz]	Highest 1g SAR [mW/g]	Limit [mW/g]
27	2506 – 2685	1.060 mW/g (Edge 4)	1.6
Simultaneous transmission condition:		1.10 mW/g (p.33) (The highest SAR across exposure conditions)	
Applicable Standards			Test Results
OET Bulletin 65 Supplement C 01-01, IEEE STD 1528: 2003			Pass
<p>Compliance Certification Services, Inc. (UL CCS) 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 CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account 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.</p> <p>Note: The results documented in this report apply only to the tested sample, 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS 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 NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.</p>			
Approved & Released For CCS By:		Tested By:	
			
Sunny Shih Engineering Team Leader Compliance Certification Services (UL CCS)		Bobby Bayani SAR Engineer Compliance Certification Services (UL CCS)	

2. Test Methodology

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C Edition 01-01, IEEE STD 1528:2003 and the following KDBs Procedures.

- 447498 D01 Mobile Portable RF Exposure v04
- 615223 D01 802.16e WiMax SAR Guidance v01
- 616217 D03 SAR Supp Note and Netbook Laptop V01
- TCB Presentation dated October 2010
- 971168 D01 Power Meas License Digital Systems v01

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

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

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
Dielectric Probe Kit	HP	85070C	N/A	N/A		
Network Analyzer	Agilent	E5071B	MY42100131	2	2	2012
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3751	12	19	2012
Thermometer	EXTECH	Thermometer	SCL29766	5	17	2012
Data Acquisition Electronics	SPEAG	DAE4	1239	9	18	2012
System Validation Dipole	SPEAG	D2600V2	1036	4	15	2012
System Validation Dipole	SPEAG	D5GHzV2	1003	8	23	2012
Power Meter	Boonton	4541	12405	4	5	2012
Power Sensor	Boonton	57006	6940	3	31	2012
Directional Coupler	Warlatone	C8060-102	2141	N/A		
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	SPEAG	MSL2600	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	MSL5800	N/A	Within 24 hrs of first test		

4.2. Measurement Uncertainty

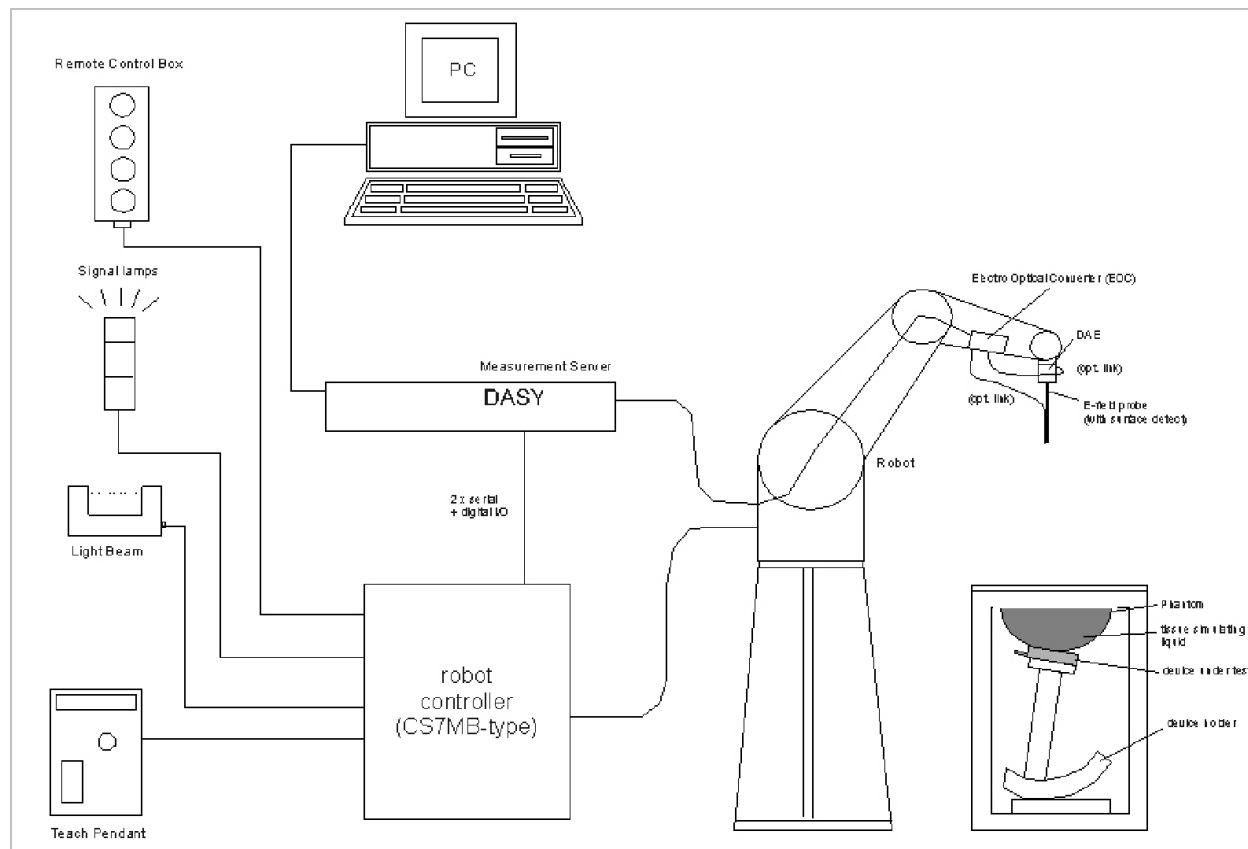
Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram					
Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	6.00	Normal	1	1	6.00
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement	3.08	Normal	1	0.64	1.97
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement	3.79	Normal	1	0.6	2.27
Combined Standard Uncertainty Uc(y) =					10.19
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				20.39	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.61	dB

3 to 6 GHz averaged over 1 gram					
Component	error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1) @ 5GHz	6.55	Normal	1	1	6.55
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	1.00	Normal	1	1	1.00
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	3.90	Rectangular	1.732	1	2.25
Test Sample Related					
Test Sample Positioning	1.10	Normal	1	1	1.10
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement	4.26	Normal	1	0.64	2.73
Liquid Permittivity - deviation from target	10.00	Rectangular	1.732	0.6	3.46
Liquid Permittivity - measurement uncertainty	3.76	Normal	1	0.6	2.26
Combined Standard Uncertainty Uc(y), %:					11.03
Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =				21.63	%
Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =				1.70	dB

5. Equipment Under Test

The EUT is the TD-CDMA PCI Express Mini Module. Tested inside Panasonic Tablet PC, CF-19					
Normal operation:	Multiple display orientations supporting both portrait and landscape configurations.				
Antenna tested:	<table border="0"> <tr> <td><u>Manufactured:</u></td> <td><u>Part Number:</u></td> </tr> <tr> <td>Panasonic</td> <td>Chain A: DFUP2071ZA(1) Chain B: DFUP2071ZA(1)</td> </tr> </table>	<u>Manufactured:</u>	<u>Part Number:</u>	Panasonic	Chain A: DFUP2071ZA(1) Chain B: DFUP2071ZA(1)
<u>Manufactured:</u>	<u>Part Number:</u>				
Panasonic	Chain A: DFUP2071ZA(1) Chain B: DFUP2071ZA(1)				
Antenna-to-antenna/user separation distances:	See Section 19 for details of antenna locations and separation distances.				
Simultaneous transmission:	<ul style="list-style-type: none"> • WWAN can transmit simultaneously with WiFi • WWAN can transmit simultaneously with Bluetooth • WiFi can transmit simultaneously with Bluetooth 				
Assessment for SAR evaluation for Simultaneous transmission:	<p>WiFi and BT Due to Bluetooth's maximum output is < 60/f(GHz) mW and standalone SAR is not required, that WiFi and Bluetooth are not considered as co-located transmitters each other. (Bluetooth – FCC ID: ACJ9TGGBT11A, IC: 216ACFBT11A)</p> <p>WWAN and BT Same as WiFi and BT</p> <p>WWAN and WiFi Simultaneous transmission SAR (Volume Scan) is required because the $\sum (SAR_{1g})$ is > 1.6 W/kg and SPLSR > 0.3. (Refer to Sec. 15 Simultaneous Transmission SAR Analysis.)</p>				

6. System Specification



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

- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition 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 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY software.
- Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

7. Composition of Ingredients for Tissue Simulating Liquids

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)										
	450		835		915		1900		2450		2600
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04	0.05
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	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
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	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	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7	27.2
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78	2.16

Salt: 99+% Pure Sodium Chloride Sugar: 98+% Pure Sucrose
 Water: De-ionized, 16 MΩ+ resistivity HEC: Hydroxyethyl Cellulose
 DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
 Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

MSL/HSL750 (Body and Head liquids for 700 – 800 MHz)

Item	Head Tissue Simulation Liquids HSL750 Muscle (body) Tissue Simulation Liquids MSL750
Type No	SL AAH 075
Manufacturer	SPEAG
The item is composed of the following ingredients:	
H ² O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40-60%
NaCl	Sodium Chloride, 0-6%
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyl-3(2H)-isothiazolone, 0.1-0.7%

MSL/HSL1750 (Body and Head liquids for 1700 – 1800 MHz)

Item	Head Tissue Simulation Liquids HSL1750 Muscle (body) Tissue Simulation Liquids MSL1750
Type No	SL AAM 175
Manufacturer	SPEAG
The item is composed of the following ingredients:	
H ² O	Water, 52 – 75%
C8H18O3	Diethylene glycol monobutyl ether (DGBE), 25-48%
NaCl	Sodium Chloride, <1.0%

8. Liquid Parameters

The simulating liquids are checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. For frequencies in 300 MHz to just under 2 GHz, the measured conductivity and relative permittivity were within $\pm 5\%$ of the target values. For frequencies above 2 GHz the measured conductivity was within $\pm 5\%$ of the target values. The measured relative permittivity tolerance was within $\pm 10\%$ of the target value.

Reference Values of Tissue Dielectric Parameters for Head & Body Phantom

The body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

Target Frequency (MHz)	Head		Body	
	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.8
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
750	41.96	0.89	55.6	0.96
835	41.5	0.9	55.2	0.97
900	41.5	0.97	55	1.05
915	41.5	0.98	55	1.06
1450	40.5	1.2	54	1.3
1610	40.3	1.29	53.8	1.4
1750	40.08	1.37	53.44	1.49
1800 – 2000	40	1.4	53.3	1.52
2450	39.2	1.8	52.7	1.95
2500	---	---	52.6	2.02
2600	---	---	52.5	2.16
2690	---	---	52.4	2.29
3000	38.5	2.4	52	2.73
5800	35.3	5.27	48.2	6

Reference Values of Tissue Dielectric Parameters for Body Phantom (for 3000 MHz – 5800 MHz)

In the current guidelines and draft standards for compliance testing of mobile phones (i.e., IEEE P1528, OET 65 Supplement C), the dielectric parameters suggested for head and body tissue simulating liquid are given only at 3.0 GHz and 5.8 GHz. As an intermediate solution, dielectric parameters for the frequencies between 5 to 5.8 GHz were obtained using linear interpolation (see table below).

SPEAG has developed suitable head and body tissue simulating liquids consisting of the following ingredients: de-ionized water, salt and a special composition including mineral oil and an emulsifier. Dielectric parameters of these liquids were measured using an HP 8570C Dielectric Probe Kit in conjunction with an HP 8753ES Network Analyzer (30 kHz – 6G Hz). The differences with respect to the interpolated values were well within the desired $\pm 5\%$ for the whole 5 to 5.8 GHz range.

f (MHz)	Body Tissue		Reference
	rel. permittivity	conductivity	
3000	52.0	2.73	Standard
5100	49.1	5.18	Interpolated
5200	49.0	5.30	Interpolated
5300	48.9	5.42	Interpolated
5400	48.7	5.53	Interpolated
5500	48.6	5.65	Interpolated
5600	48.5	5.77	Interpolated
5700	48.3	5.88	Interpolated
5800	48.2	6.00	Standard

(ϵ_r = relative permittivity, σ = conductivity and $\rho = 1000 \text{ kg/m}^3$)

8.1. Simulating Liquid Check Results

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
01/20/2012	Body 2600	e'	51.9117	Relative Permittivity (ϵ_r):	51.91	52.51	-1.14	5
		e"	15.3876	Conductivity (σ):	2.22	2.16	2.95	5
	Body 2505	e'	52.1620	Relative Permittivity (ϵ_r):	52.16	52.63	-0.89	5
		e"	14.9507	Conductivity (σ):	2.08	2.03	2.72	5
	Body 2595	e'	51.8983	Relative Permittivity (ϵ_r):	51.90	52.52	-1.18	5
		e"	15.3861	Conductivity (σ):	2.22	2.15	3.08	5
Body 2685	e'	51.5469	Relative Permittivity (ϵ_r):	51.55	52.40	-1.63	5	
	e"	15.7423	Conductivity (σ):	2.35	2.28	3.07	5	
Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
01/23/2012	Body 2600	e'	51.1031	Relative Permittivity (ϵ_r):	51.10	52.51	-2.68	5
		e"	15.3184	Conductivity (σ):	2.21	2.16	2.49	5
	Body 2505	e'	51.5371	Relative Permittivity (ϵ_r):	51.54	52.63	-2.08	5
		e"	14.9168	Conductivity (σ):	2.08	2.03	2.49	5
	Body 2595	e'	51.1354	Relative Permittivity (ϵ_r):	51.14	52.52	-2.63	5
		e"	15.3147	Conductivity (σ):	2.21	2.15	2.60	5
Body 2685	e'	50.7634	Relative Permittivity (ϵ_r):	50.76	52.40	-3.13	5	
	e"	15.7390	Conductivity (σ):	2.35	2.28	3.05	5	
Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
01/24/2012	Body 2600	e'	51.9546	Relative Permittivity (ϵ_r):	51.95	52.51	-1.06	5
		e"	15.2922	Conductivity (σ):	2.21	2.16	2.31	5
	Body 2505	e'	52.3592	Relative Permittivity (ϵ_r):	52.36	52.63	-0.52	5
		e"	14.8457	Conductivity (σ):	2.07	2.03	2.00	5
	Body 2595	e'	52.0014	Relative Permittivity (ϵ_r):	52.00	52.52	-0.98	5
		e"	15.2453	Conductivity (σ):	2.20	2.15	2.13	5
Body 2685	e'	51.6311	Relative Permittivity (ϵ_r):	51.63	52.40	-1.47	5	
	e"	15.7165	Conductivity (σ):	2.35	2.28	2.90	5	
Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
01/25/2012	Body 2600	e'	53.7896	Relative Permittivity (ϵ_r):	53.79	52.51	2.44	5
		e"	15.3460	Conductivity (σ):	2.22	2.16	2.67	5
	Body 2505	e'	54.1239	Relative Permittivity (ϵ_r):	54.12	52.63	2.84	5
		e"	14.9108	Conductivity (σ):	2.08	2.03	2.44	5
	Body 2595	e'	53.8739	Relative Permittivity (ϵ_r):	53.87	52.52	2.58	5
		e"	15.2756	Conductivity (σ):	2.20	2.15	2.34	5
Body 2685	e'	53.4246	Relative Permittivity (ϵ_r):	53.42	52.40	1.95	5	
	e"	15.6273	Conductivity (σ):	2.33	2.28	2.32	5	

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
01/25/2012	Body 5180	e'	48.2835	Relative Permittivity (ϵ_r):	48.28	49.05	-1.56	10
		e"	18.7507	Conductivity (σ):	5.40	5.27	2.45	5
	Body 5200	e'	48.3093	Relative Permittivity (ϵ_r):	48.31	49.02	-1.45	10
		e"	18.8035	Conductivity (σ):	5.44	5.29	2.68	5
	Body 5500	e'	47.7196	Relative Permittivity (ϵ_r):	47.72	48.61	-1.84	10
		e"	19.0469	Conductivity (σ):	5.82	5.64	3.20	5
	Body 5800	e'	47.2501	Relative Permittivity (ϵ_r):	47.25	48.20	-1.97	10
		e"	19.3390	Conductivity (σ):	6.24	6.00	3.95	5
Body 5825	e'	47.2082	Relative Permittivity (ϵ_r):	47.21	48.20	-2.06	10	
	e"	19.3139	Conductivity (σ):	6.26	6.00	4.26	5	
Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
01/26/2012	Body 5180	e'	47.6183	Relative Permittivity (ϵ_r):	47.62	49.05	-2.91	10
		e"	17.8339	Conductivity (σ):	5.14	5.27	-2.56	5
	Body 5200	e'	47.6173	Relative Permittivity (ϵ_r):	47.62	49.02	-2.86	10
		e"	17.8607	Conductivity (σ):	5.16	5.29	-2.47	5
	Body 5500	e'	46.9994	Relative Permittivity (ϵ_r):	47.00	48.61	-3.32	10
		e"	17.9319	Conductivity (σ):	5.48	5.64	-2.84	5
	Body 5800	e'	46.4151	Relative Permittivity (ϵ_r):	46.42	48.20	-3.70	10
		e"	18.0034	Conductivity (σ):	5.81	6.00	-3.23	5
Body 5825	e'	46.3853	Relative Permittivity (ϵ_r):	46.39	48.20	-3.76	10	
	e"	17.9877	Conductivity (σ):	5.83	6.00	-2.90	5	
Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
01/27/2012	Body 2600	e'	54.2010	Relative Permittivity (ϵ_r):	54.20	52.51	3.22	5
		e"	15.2047	Conductivity (σ):	2.20	2.16	1.73	5
	Body 2505	e'	54.6239	Relative Permittivity (ϵ_r):	54.62	52.63	3.79	5
		e"	14.6848	Conductivity (σ):	2.05	2.03	0.89	5
	Body 2595	e'	54.1768	Relative Permittivity (ϵ_r):	54.18	52.52	3.16	5
		e"	15.2441	Conductivity (σ):	2.20	2.15	2.13	5
Body 2685	e'	53.9283	Relative Permittivity (ϵ_r):	53.93	52.40	2.91	5	
	e"	15.5656	Conductivity (σ):	2.32	2.28	1.91	5	

9. System Verification

The system performance check is performed prior to any usage of the system in order to verify SAR system accuracy. The system performance check verifies that the system operates within its specifications of $\pm 10\%$.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ± 0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The DASY5 system with an Isotropic E-Field Probe EX3DV4 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (2.4 GHz) fine cube was chosen for cube integration and Special 8x8x10 (5 GHz) fine cube was chosen for cube integration
- Distance between probe sensors and phantom surface was set to 2.5 mm.
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input powers (forward power) were 100 mW.
- The results are normalized to 1 W input power.

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.

Cal. certificate #	Validation dipole	Cal. date	Freq. (MHz)	Ref. SAR values (mW/g) (from cal. certificate)		
				Tissue:	Head	Body
D2600V2-1036_Apr11	D2600V2 SN: 1036	4/15/11	2600	1g SAR:	59.60	59.20
				10g SAR:	26.40	26.00
D5GHz-1003_Aug11	D5GHzV2 SN: 1003	8/23/11	5200	1g SAR:	76.5	74.5
				10g SAR:	21.8	20.8
			5500	1g SAR:	80.9	80
				10g SAR:	23.1	22.3
			5800	1g SAR:	76.3	76.3
				10g SAR:	21.7	21.2

9.1. System Check Results

Date Tested	System Validation Dipole	Freq. (MHz)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
			1g SAR:	10g SAR:			
01/20/12	D2600V2-1036 Body	2600	1g SAR:	61.30	59.20	3.55	±10
			10g SAR:	26.90	26.00	3.46	
01/23/12	D2600V2-1036 Body	2600	1g SAR:	61.20	59.20	3.38	±10
			10g SAR:	27.00	26.00	3.85	
01/24/12	D2600V2-1036 Body	2600	1g SAR:	59.10	59.20	-0.17	±10
			10g SAR:	26.00	26.00	0.00	
01/25/12	D2600V2-1036 Body	2600	1g SAR:	58.90	59.20	-0.51	±10
			10g SAR:	25.80	26.00	-0.77	
01/25/12	D5GHzV2 Body	5200	1g SAR:	77.4	74.5	3.89	±10
			10g SAR:	21.9	20.8	5.29	
01/26/12	D5GHzV2 Body	5500	1g SAR:	78.1	80.0	-2.38	±10
			10g SAR:	21.9	22.3	-1.79	
	D5GHzV2 Body	5800	1g SAR:	78.1	76.3	2.36	±10
			10g SAR:	22.0	21.2	3.77	
01/27/12	D2600V2-1036 Body	2600	1g SAR:	60.00	59.20	1.35	±10
			10g SAR:	26.60	26.00	2.31	

10. SAR Measurement Procedures

10.1. Normal SAR Measurement Procedures

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 DASYS5 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 IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). 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.

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 $\geq 7 \times 7 \times 9$ (above 4.5 GHz) or $5 \times 5 \times 7$ (below 3 GHz) points 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.

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

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.

10.2. Volume Scan Procedures

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 DASYS 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 IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). 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.

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 $\geq 7 \times 7 \times 9$ (above 4.5 GHz) or $5 \times 5 \times 7$ (below 3 GHz) points 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.

Step 4: 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 5: 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.

11. RF Output Power Verification

BW (MHz)	Mode	Ch.	Freq. (MHz)	Original Average Output Power		Actual Average Output power	
				dBm	mW	dBm	mW
10	QPSK	Low	2506.0	24.36	272.9	24.43	277.1
		Middle	2593.0	24.67	293.1	24.50	281.8
		High	2685.0	24.26	266.7	24.28	267.9
	16QAM	Low	2506.0	24.37	273.5	24.43	277.2
		Middle	2593.0	24.66	292.4	24.51	282.5
		High	2685.0	24.20	263.0	24.36	272.9
	64QAM	Low	2506.0	24.37	273.5	24.44	277.7
		Middle	2593.0	24.61	289.1	24.52	283.1
		High	2685.0	24.17	261.2	24.37	273.5

BW (MHz)	Mode	Ch.	Freq. (MHz)	Original Average Output Power		Actual Average Output power	
				dBm	mW	dBm	mW
5	QPSK	Low	2506.0	24.3	271.6	24.13	258.8
		Middle	2593.0	24.6	289.7	24.40	275.4
		High	2685.0	24.1	254.7	24.25	266.1
	16QAM	Low	2506.0	24.4	272.9	24.23	264.8
		Middle	2593.0	24.6	291.1	24.39	274.8
		High	2685.0	24.1	255.3	24.24	265.5
	64QAM	Low	2506.0	24.3	269.8	24.18	262.1
		Middle	2593.0	24.6	291.1	24.34	271.6
		High	2685.0	24.1	255.3	24.22	264.2

Note(s):

- Original output power is from EMC report "11J13998-1B FCC CFR47 Part 27 Subpart M Certification Test Report (Issue date: October 31, 2011) which was included in the TC165491 (KDB882008) and the original grant (issue date: Feb. 9, 2012)".

12. Peak-to-Average Power Ratio (PAR)

Peak and Average Output power measurements were made in accordance with KDB971168.

BW (MHz)	Mode	Freq. (MHz)	Output power (dBm)		PAR
			Peak	Average	
10	QPSK	2593.0	27.474	24.500	2.97
	16QAM	2593.0	27.530	24.510	3.02
	64QAM	2593.0	27.600	24.520	3.08

BW (MHz)	Mode	Freq. (MHz)	Output power (dBm)		PAR
			Peak	Average	
5	QPSK	2593.0	27.390	24.400	2.99
	16QAM	2593.0	27.400	24.390	3.01
	64QAM	2593.0	27.420	24.340	3.08

13. SAR Test Results

Edge 4

The test reduction for WiMax SAR is based on the TCB Workshop Presentation dated October 2010.

BW (MHz)	Mode	Calculated		Ch.	Freq. (MHz)	Average Output power		SAR (mW/g)	
		Duty Cycle (%)	Crest Factor			dBm	mW	1g	10g
10	QPSK	33.00	3.00	Low	2506.0	24.43	277.1	0.646	0.315
				Middle	2593.0	24.50	281.8	1.060	0.501
				High	2685.0	24.28	267.9	0.741	0.344
	16QAM	33.00	3.00	Low	2506.0	24.43	277.2		
				Middle	2593.0	24.51	282.5	1.060	0.500
				High	2685.0	24.36	272.9		
	64QAM	33.00	3.00	Low	2506.0	24.44	277.7		
				Middle	2593.0	24.52	283.1	1.030	0.490
				High	2685.0	24.37	273.5		

BW (MHz)	Mode	Calculated		Ch.	Freq. (MHz)	Average Output power		SAR (mW/g)	
		Duty Cycle (%)	Crest Factor			dBm	mW	1g	10g
5	QPSK	33.00	3.00	Low	2506.0	24.13	258.8	0.655	0.320
				Middle	2593.0	24.40	275.4	1.040	0.495
				High	2685.0	24.25	266.1	0.752	0.347
	16QAM	33.00	3.00	Low	2506.0	24.23	264.8		
				Middle	2593.0	24.39	274.8	1.040	0.496
				High	2685.0	24.24	265.5		
	64QAM	33.00	3.00	Low	2506.0	24.18	262.1		
				Middle	2593.0	24.34	271.6	1.050	0.497
				High	2685.0	24.22	264.2		

Note(s):

1. Crest Factor = 100 / Duty Cycle (%)

Edge 1

The test reduction for WiMax SAR is based on the TCB Workshop Presentation dated October 2010.

BW (MHz)	Mode	Calculated		Ch.	Freq. (MHz)	Average Output power		SAR (mW/g)	
		Duty Cycle (%)	Crest Factor			dBm	mW	1g	10g
10	QPSK	33.00	3.00	Low	2506.0	24.43	277.1		
				Middle	2593.0	24.50	281.8	0.034	0.017
				High	2685.0	24.28	267.9		
	16QAM	33.00	3.00	Low	2506.0	24.43	277.2		
				Middle	2593.0	24.51	282.5		
				High	2685.0	24.36	272.9		
	64QAM	33.00	3.00	Low	2506.0	24.44	277.7		
				Middle	2593.0	24.52	283.1		
				High	2685.0	24.37	273.5		

BW (MHz)	Mode	Calculated		Ch.	Freq. (MHz)	Average Output power		SAR (mW/g)	
		Duty Cycle (%)	Crest Factor			dBm	mW	1g	10g
5	QPSK	33.00	3.00	Low	2506.0	24.13	258.8		
				Middle	2593.0	24.40	275.4	0.027	0.012
				High	2685.0	24.25	266.1		
	16QAM	33.00	3.00	Low	2506.0	24.23	264.8		
				Middle	2593.0	24.39	274.8		
				High	2685.0	24.24	265.5		
	64QAM	33.00	3.00	Low	2506.0	24.18	262.1		
				Middle	2593.0	24.34	271.6		
				High	2685.0	24.22	264.2		

Note(s):

1. Crest Factor = 100 / Duty Cycle (%)

Bottom/Base

The test reduction for WiMax SAR is based on the TCB Workshop Presentation dated October 2010.

BW (MHz)	Mode	Calculated		Ch.	Freq. (MHz)	Average Output power		SAR (mW/g)	
		Duty Cycle (%)	Crest Factor			dBm	mW	1g	10g
10	QPSK	33.00	3.00	Low	2506.0	24.43	277.1		
				Middle	2593.0	24.50	281.8	0.021	0.011
				High	2685.0	24.28	267.9		
	16QAM	33.00	3.00	Low	2506.0	24.43	277.2		
				Middle	2593.0	24.51	282.5		
				High	2685.0	24.36	272.9		
	64QAM	33.00	3.00	Low	2506.0	24.44	277.7		
				Middle	2593.0	24.52	283.1		
				High	2685.0	24.37	273.5		

BW (MHz)	Mode	Calculated		Ch.	Freq. (MHz)	Average Output power		SAR (mW/g)	
		Duty Cycle (%)	Crest Factor			dBm	mW	1g	10g
5	QPSK	33.00	3.00	Low	2506.0	24.13	258.8		
				Middle	2593.0	24.40	275.4	0.014	0.005
				High	2685.0	24.25	266.1		
	16QAM	33.00	3.00	Low	2506.0	24.23	264.8		
				Middle	2593.0	24.39	274.8		
				High	2685.0	24.24	265.5		
	64QAM	33.00	3.00	Low	2506.0	24.18	262.1		
				Middle	2593.0	24.34	271.6		
				High	2685.0	24.22	264.2		

Note(s):

1. Crest Factor = 100 / Duty Cycle (%)

Lap-held

The test reduction for WiMax SAR is based on the TCB Workshop Presentation dated October 2010.

BW (MHz)	Mode	Calculated		Ch.	Freq. (MHz)	Output power		SAR (mW/g)	
		Duty Cycle (%)	Crest Factor			dBm	mW	1g	10g
10	QPSK	33.00	3.00	Low	2506.0	24.43	277.1		
				Middle	2593.0	24.50	281.8	0.00609	0.00353
				High	2685.0	24.28	267.9		
	16QAM	33.00	3.00	Low	2506.0	24.43	277.2		
				Middle	2593.0	24.51	282.5		
				High	2685.0	24.36	272.9		
	64QAM	33.00	3.00	Low	2506.0	24.44	277.7		
				Middle	2593.0	24.52	283.1		
				High	2685.0	24.37	273.5		

BW (MHz)	Mode	Calculated		Ch.	Freq. (MHz)	Output power		SAR (mW/g)	
		Duty Cycle (%)	Crest Factor			dBm	mW	1g	10g
5	QPSK	33.00	3.00	Low	2506.0	24.13	258.8		
				Middle	2593.0	24.40	275.4	0.00613	0.00309
				High	2685.0	24.25	266.1		
	16QAM	33.00	3.00	Low	2506.0	24.23	264.8		
				Middle	2593.0	24.39	274.8		
				High	2685.0	24.24	265.5		
	64QAM	33.00	3.00	Low	2506.0	24.18	262.1		
				Middle	2593.0	24.34	271.6		
				High	2685.0	24.22	264.2		

Note(s):

1. Crest Factor = 100 / Duty Cycle (%)

14. Worst case SAR Plots

Test Laboratory: UL CCS SAR Lab C

Date: 1/23/2012

TD-CDMA 2.6GHz Band_Body_Edge 4

Frequency: 2593 MHz; Duty Cycle: 1:3.0; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): $f = 2593$ MHz; $\sigma = 2.206$ mho/m; $\epsilon_r = 51.131$; $\rho = 1000$ kg/m³

DASY5 Configuration:

- Electronics: DAE4 Sn1239; Calibrated: 10/18/2011
- Probe: EX3DV4 - SN3751; ConvF(6.4, 6.4, 6.4); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1117

QPSK_BW-10MHz_Mid-Ch/Area Scan (9x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.318 mW/g

QPSK_BW-10MHz_Mid-Ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

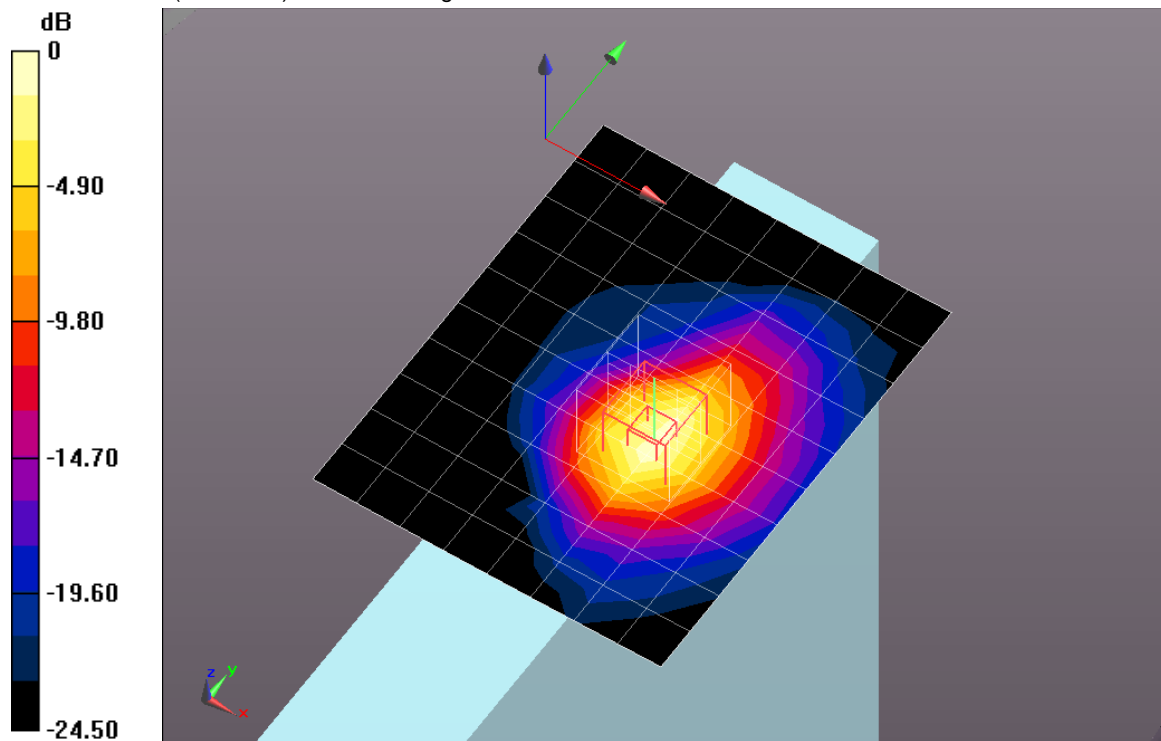
Reference Value = 24.502 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 2.1120

SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.501 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.459 mW/g



0 dB = 1.460mW/g = 3.29 dB mW/g

Test Laboratory: UL CCS SAR Lab C

Date: 1/23/2012

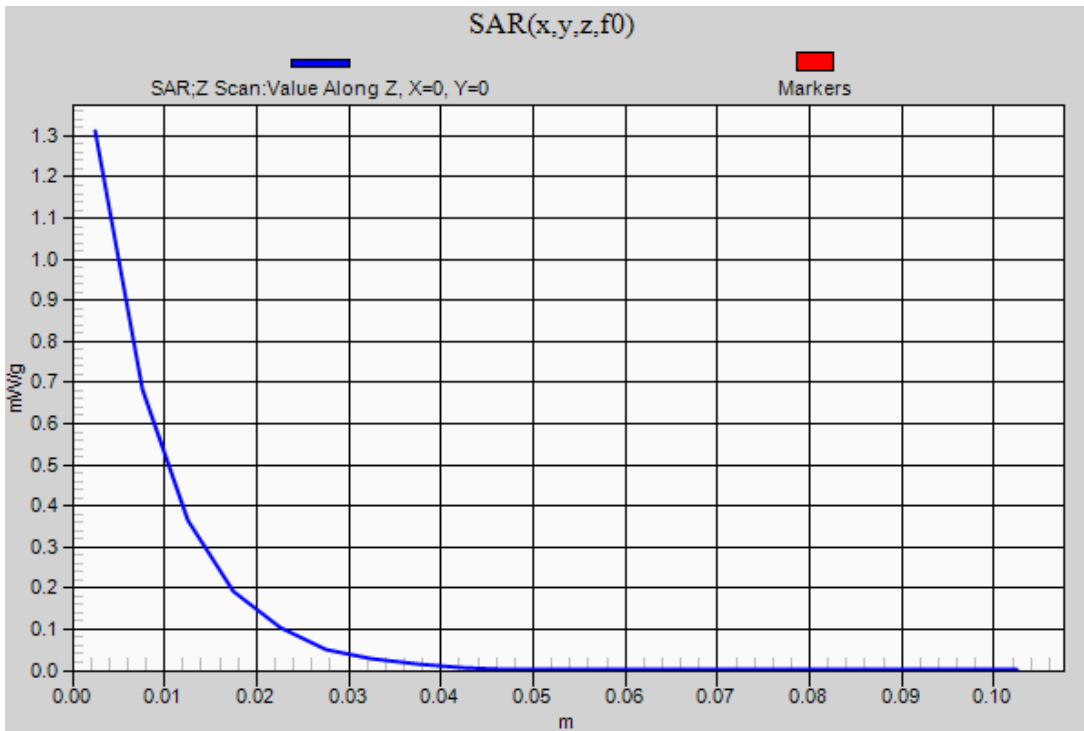
TD-CDMA 2.6GHz Band_Body_Edge 4

Frequency: 2593 MHz; Duty Cycle: 1:3.0

QPSK_BW-10MHz_Mid-Ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.311 mW/g



15. Simultaneous Transmission SAR Analysis

15.1. Sum of 1g SAR

WWAN + WiFi 2.4 GHz

Test configuration	(1) TD-CDMA	(2)* WiFi Main	(3)* WiFi Aux	Sum of 1g SAR (mW/g)
Laptop Mode Lapheld	0.00613	0.031	0.025	0.06
Tablet Mode Bottom Face	0.021	0.018	0.072	0.11
Edge 4	1.060	- *2	0.093	1.15

Conclusions:

Simultaneous transmission SAR (Volume Scan) is not required because the sum of the 1-g SAR is < 1.6 W/kg.

Note(s)

1. *: WiFi max. 1g SAR from SAR report "11J14001-2A1 SAR report" which are in this TC185805 with this 11J14156-2A WWAN SAR report.
2. *: This test configuration was not applied or WiFi measure.

This WiFi module supports MIMO operation in all bands in 802.11n modes and the simultaneous evaluation has included an evaluation with both WLAN antennas operational with the WWAN antenna based on the worst case SAR in each band for each individual WLAN antenna.

WWAN + WiFi 5.2 GHz

Test configuration	(1) TD-CDMA	(2)* WiFi Main	(3)* WiFi Aux	Sum of 1g SAR (mW/g)
Laptop Mode Lapheld	0.00613	0.000104	0.018	0.02
Tablet Mode Bottom Face	0.021	0.024	0.033	0.08
Edge 4	1.060	- *2	0.565	1.63

SAR to Peak Location Separation Distance

Test Position	Worst-case combination		Σ 1-g SAR (mW/g)	3D distance (cm)	SPLSR
	(1) TD-CDMA	(3) WiFi Aux			
Edge 4	1.060	0.565	1.63	3.72	0.437

Conclusions:

Simultaneous transmission SAR (Volume Scan) is required because the sum of the 1-g SAR is > 1.6 W/kg and SPLSR > 0.3.

Note(s)

- *: WiFi max. 1g SAR from SAR report "11J14001-2A1 SAR report" which are in this TC185805 with this 11J14156-2A WWAN SAR report.
- *: This test configuration was not applied or WiFi measure.

This WiFi module supports MIMO operation in all bands in 802.11n modes and the simultaneous evaluation has included an evaluation with both WLAN antennas operational with the WWAN antenna based on the worst case SAR in each band for each individual WLAN antenna.

WWAN + WiFi 5.3 GHz

Test configuration	(1) TD-CDMA	(2)* WiFi Main	(3)* WiFi Aux	Sum of 1g SAR (mW/g)
Laptop Mode Lapheld	0.00613	0.000383	0.0193	0.03
Tablet Mode Bottom Face	0.021	0.033	0.038	0.09
Edge 4	1.060	- *2	0.718	1.78

SAR to Peak Location Separation Distance

Test Position	Worst-case combination		Σ 1-g SAR (mW/g)	3D distance (cm)	SPLSR
	(1) TD-CDMA	(3) WiFi Aux			
Edge 4	1.060	0.718	1.78	3.72	0.478

Conclusions:

Simultaneous transmission SAR (Volume Scan) is required because the sum of the 1-g SAR is > 1.6 W/kg and SPLSR > 0.3.

Note(s)

- *: WiFi max. 1g SAR from SAR report "11J14001-2A1 SAR report" which are in this TC185805 with this 11J14156-2A WWAN SAR report.
- *: This test configuration was not applied or WiFi measure.

This WiFi module supports MIMO operation in all bands in 802.11n modes and the simultaneous evaluation has included an evaluation with both WLAN antennas operational with the WWAN antenna based on the worst case SAR in each band for each individual WLAN antenna.

WWAN + WiFi 5.5 GHz

Test configuration	(1) TD-CDMA	(2)* WiFi Main	(3)* WiFi Aux	Sum of 1g SAR (mW/g)
Laptop Mode Lapheld	0.00613	0.00222	0.297	0.31
Tablet Mode Bottom Face	0.021	0.046	0.058	0.13
Edge 4	1.060	- *2	0.857	1.92

SAR to Peak Location Separation Distance

Test Position	Worst-case combination		Σ 1-g SAR (mW/g)	3D distance (cm)	SPLSR
	(1) TD-CDMA	(3) WiFi Aux			
Edge 4	1.060	0.857	1.92	4.48	0.428

Conclusions:

Simultaneous transmission SAR (Volume Scan) is required because the sum of the 1-g SAR is > 1.6 W/kg and SPLSR > 0.3.

Note(s)

- *: WiFi max. 1g SAR from SAR report "11J14001-2A1 SAR report" which are in this TC185805 with this 11J14156-2A WWAN SAR report.
- *: This test configuration was not applied or WiFi measure.

This WiFi module supports MIMO operation in all bands in 802.11n modes and the simultaneous evaluation has included an evaluation with both WLAN antennas operational with the WWAN antenna based on the worst case SAR in each band for each individual WLAN antenna.

WWAN + WiFi 5.8 GHz

Test configuration	(1) TD-CDMA	(2)* WiFi Main	(3)* WiFi Aux	Sum of 1g SAR (mW/g)
Laptop Mode Lapheld	0.00613	0.014	0.029	0.05
Tablet Mode Bottom Face	0.021	0.028	0.049	0.10
Edge 4	1.060	- *2	0.665	1.73

SAR to Peak Location Separation Distance

Test Position	Worst-case combination		Σ 1-g SAR (mW/g)	3D distance (cm)	SPLSR
	(1) TD-CDMA	(3) WiFi Aux			
Edge 4	1.060	0.665	1.73	4.21	0.410

Conclusions:

Simultaneous transmission SAR (Volume Scan) is required because the sum of the 1-g SAR is > 1.6 W/kg and SPLSR > 0.3.

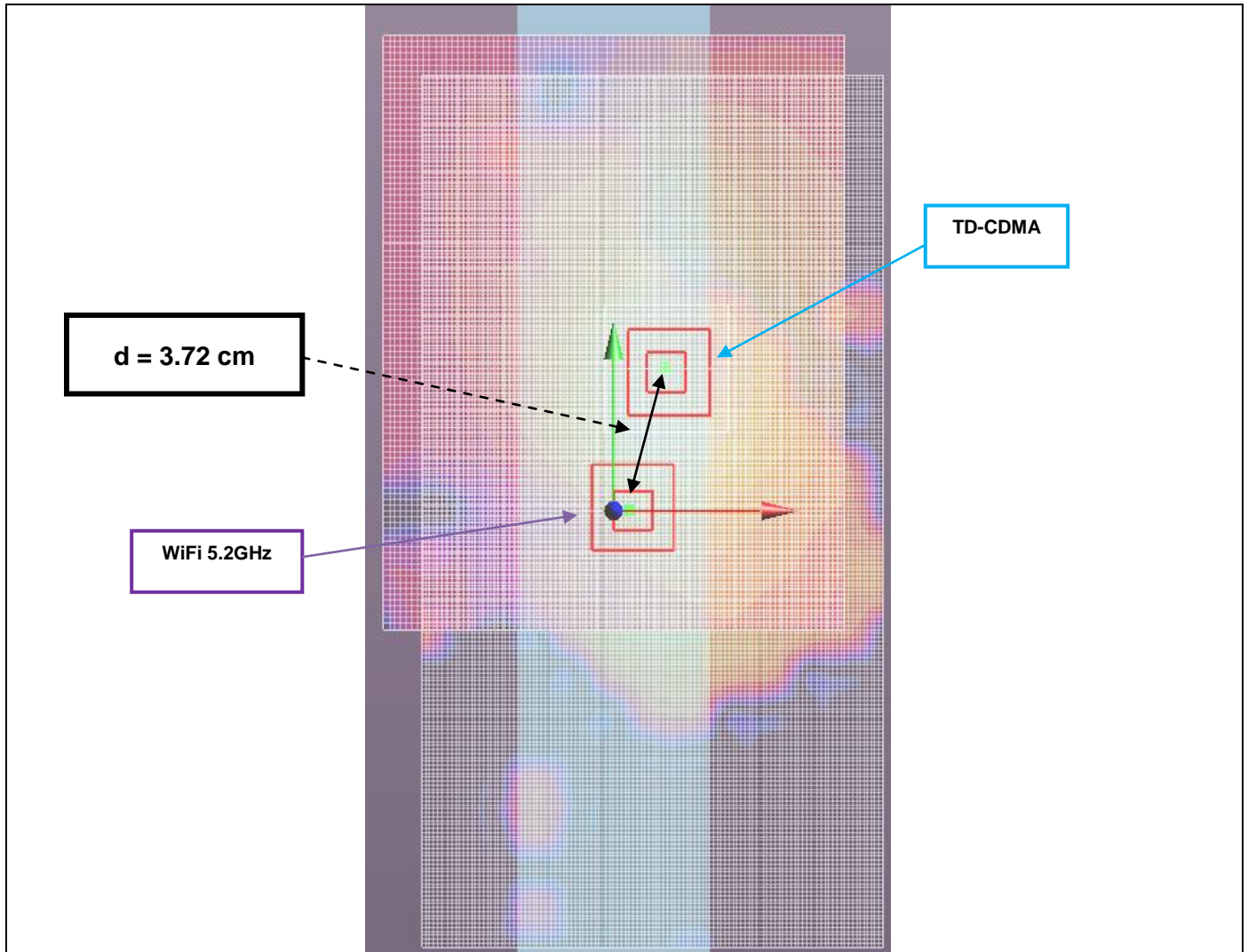
Note(s)

- *: WiFi max. 1g SAR from SAR report "11J14001-2A1 SAR report" which are in this TC185805 with this 11J14156-2A WWAN SAR report.
- *: This test configuration was not applied or WiFi measure.

This WiFi module supports MIMO operation in all bands in 802.11n modes and the simultaneous evaluation has included an evaluation with both WLAN antennas operational with the WWAN antenna based on the worst case SAR in each band for each individual WLAN antenna.

15.2. SAR to Peak Location Separation Ratio (SPLSR)

“(1)TD-CDMA” to “(3)WiFi 5.2 GHz”

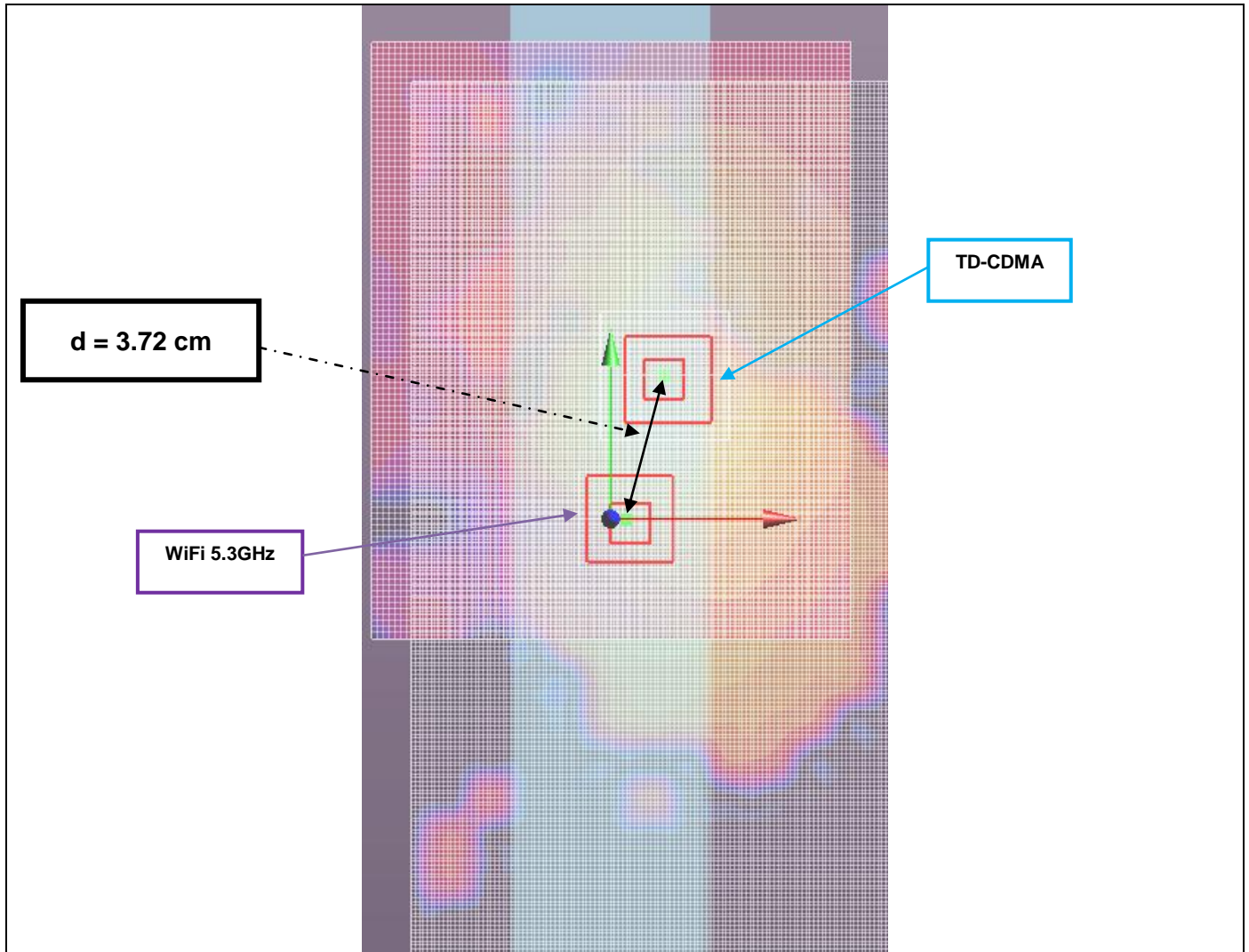


Value of SAR	X	Y	Z
mW/g	m	m	m
1.44	0.0135	0.036	-0.181
0.889	0.004	0	-0.182

TD-CDMA
 WiFi 5.2 GHz

	m	cm	
Separation distance (d) =	0.0372	3.72	
	SQRT((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)		

“(1)TD-CDMA” to “(3)WiFi 5.3 GHz”

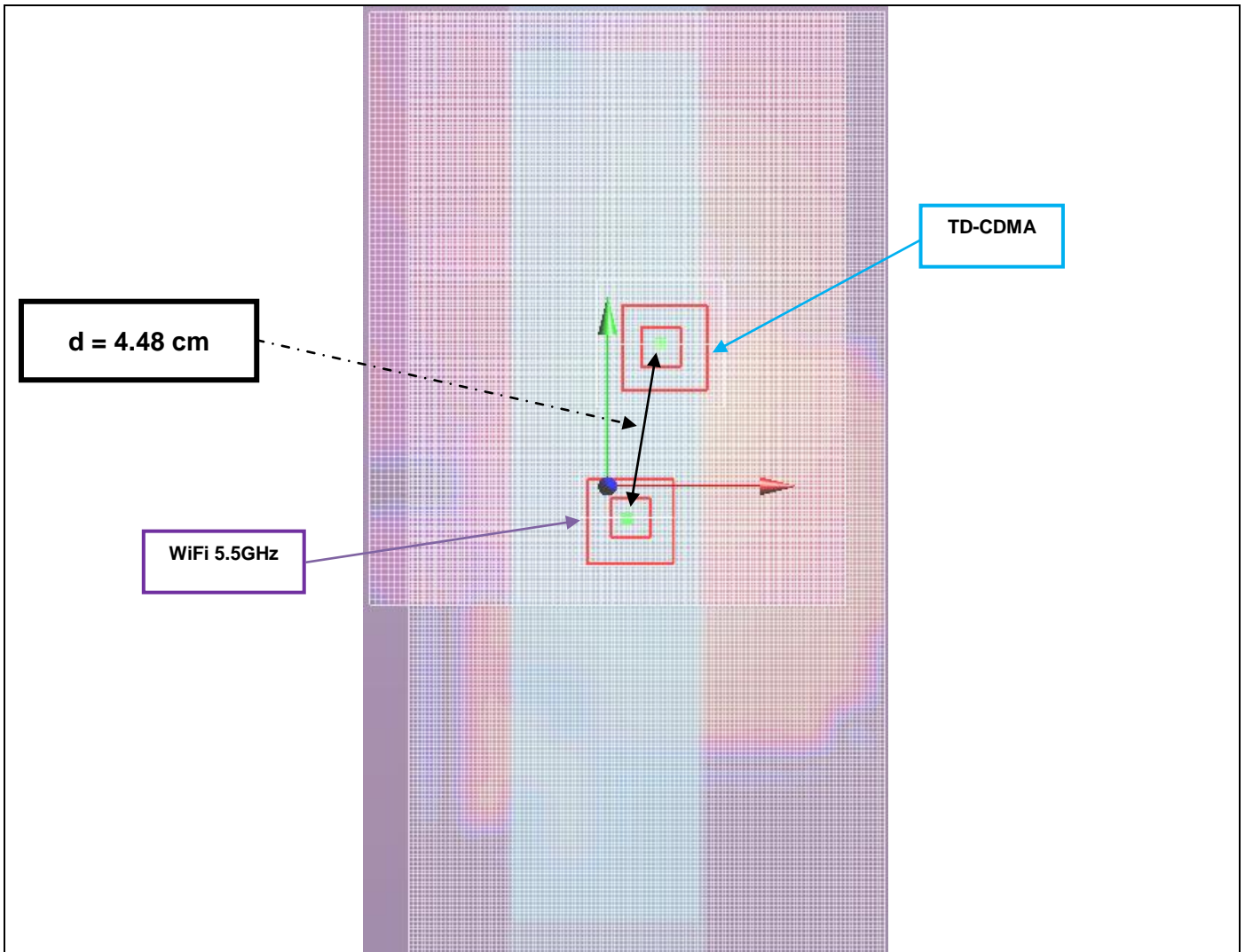


Value of SAR	X	Y	Z
mW/g	m	m	m
1.44	0.0135	0.036	-0.181
1.14	0.004	0	-0.182

TD-CDMA
 WiFi 5.3 GHz

Separation distance (d) =	m	cm	
	0.0372	3.72	
SQRT((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)			

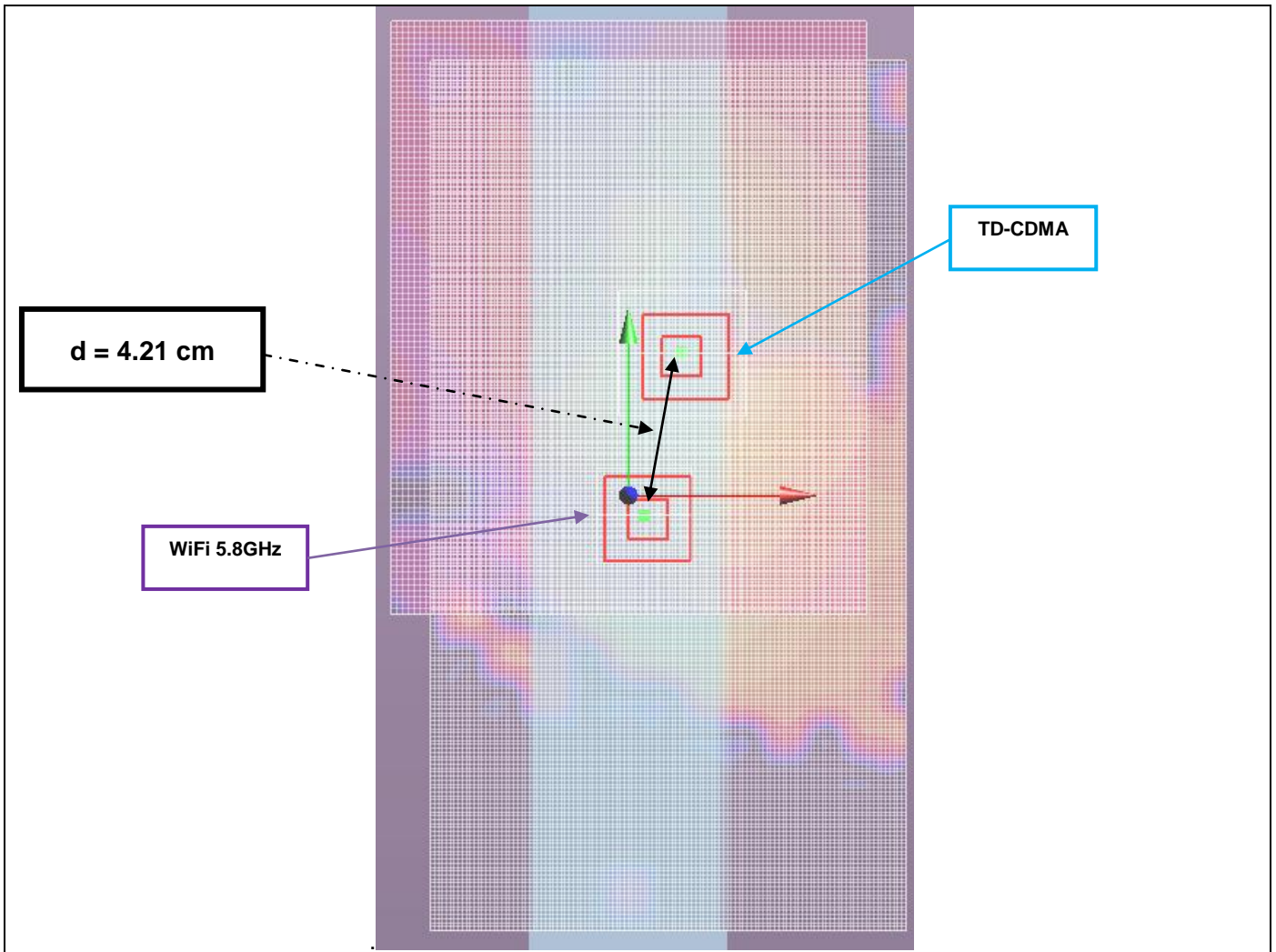
“(1)TD-CDMA” to “(3)WiFi 5.5 GHz”



Value of SAR mW/g	X m	Y m	Z m
1.44	0.0135	0.036	-0.181
1.37	0.005	-0.008	-0.182

	m	cm	
TD-CDMA			
WiFi 5.5 GHz			
Separation distance (d) =	0.0448	4.48	
	$\text{SQRT}((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)$		

“(1)TD-CDMA” to “(3)WiFi 5.8 GHz”



TD-CDMA
 WiFi 5.8 GHz
 m

Value of SAR mW/g	X m	Y m	Z m
1.44	0.0135	0.036	-0.181
1.27	0.004	-0.005	-0.182

Separation distance (d) =	0.0421	4.21	
	SQRT((X1-X2) ² +(Y1-Y2) ² +(Z1-Z2) ²)		

15.2.1. Volume Scans & Combined Results

Test position	Combination	Test Results (mW/g)		
		Zoom Scan	Volume scan	Combined Results
Edge 4	(1) TD-CDMA	1.060	1.060	1.07
	(3) WiFi 5.2GHz	0.565	0.484	
	(1) TD-CDMA	1.060	1.060	1.10
	(3) WiFi 5.3GHz	0.718	0.707	
	(1) TD-CDMA	1.060	1.060	1.06
	(3) WiFi 5.5GHz	0.857	0.774	
	(1) TD-CDMA	1.060	1.060	1.06
	(3) WiFi 5.8GHz	0.665	0.693	

Note(s):

1. See Appendix 17.3 for SAR Test Plots for Volume Scans.
2. See Appendix 17.4 for SAR Test Plots for Multi Band Results.

16. PAR and SAR Error Consideration

In order to estimate the measurement error due to PAR(Peak to Average Ratio) issues, the configuration with the highest SAR in each channel bandwidth and frequency band is measured at various power levels, from approximately 15.0 mW at approx. 3 dB steps, until the maximum power is reached.

In order to estimate the measurement error due to PAR issues, the configuration with the highest SAR in each channel bandwidth and frequency band is measured at various power levels, from approximately 10 mW at approx. 3 dB steps, until the maximum power is reached.

Procedure:

1. Position the EUT at flat phantom with the Edge 4 of the Tablet PC in direct contact against a flat phantom.
2. Perform single point SAR evaluation with EUT power to be tuned at approximately 10 – 15 mW.
3. Record the highest single point SAR value for each power setting as indicated above.
4. Without changing probe and EUT position increase the EUT power by 3 dB steps.

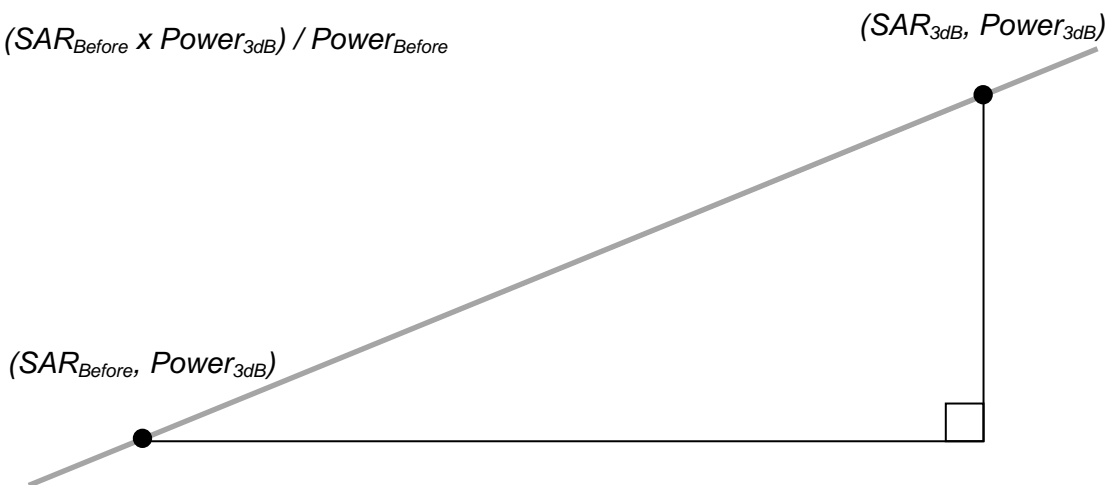
Assumption:

- 1) First single point SAR at power = 0 mW the SAR = 0 mW/g
- 2) SAR is linear to power only when the measurement probe sensors are operating within the square-law region.

Linear Line:

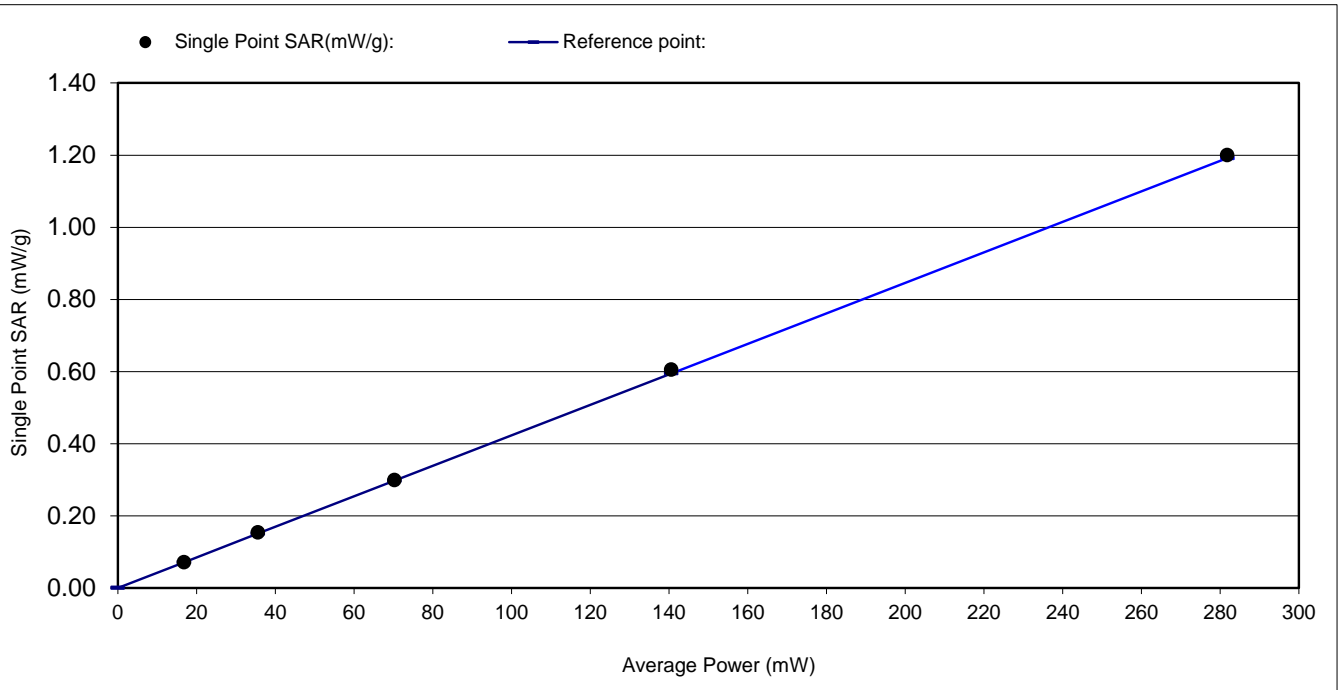
The actual measure output power has an tolerance due to the accuracy of the power sensors, RF cable and attenuator therefore the measure power will exhibited a +/- 0.05 % error. When power is set to 10 mW and SAR value “x” is known the next value on the Linear Line at approximately 3 dB up can be calculated as follow:

$$SAR_{3dB} = (SAR_{Before} \times Power_{3dB}) / Power_{Before}$$



Measurement Result for Band Width 10 MHz, Modulation QPSK

3dB Steps:	2nd	3rd	4th	5th	6th
Average Power (dBm):	12.25	15.51	18.47	21.48	24.50
Average Power (mW):	16.79	35.56	70.31	140.60	281.84
Single Point SAR(mW/g):	0.071	0.154	0.299	0.605	1.200
Reference point:	0.071	0.150	0.297	0.595	1.192
Estimated (%):	0.000	2.391	0.557	1.741	0.675

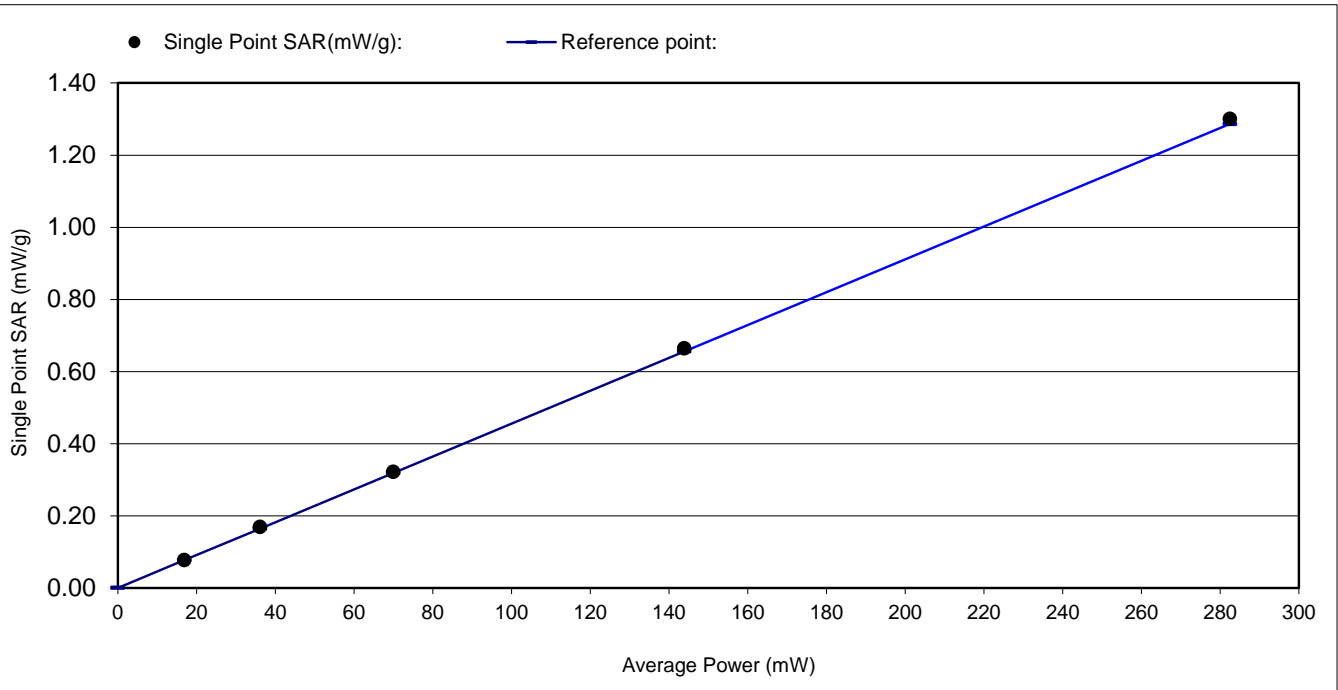


Procedure in establishing linear line (SAR):

1st reference point = 0 mW/g when power = 0 mW
 2nd reference point: 0.071 mW/g @ 16.79 mW
 3rd reference point: $(0.071 * 35.56 \text{ mW}) / 16.79 \text{ mW} = 0.150$
 4th reference point: $(0.150 * 70.31 \text{ mW}) / 35.56 \text{ mW} = 0.297$
 5th reference point: $(0.297 * 140.60 \text{ mW}) / 70.31 \text{ mW} = 0.595$
 6th reference point: $(0.595 * 281.84 \text{ mW}) / 140.60 \text{ mW} = 1.192$
 Draw a reference line from first reference point to sixth reference point.

Measurement Result for Band Width 10 MHz, Modulation 16QAM

3dB Steps:	2nd	3rd	4th	5th	6th
Average Power (dBm):	12.28	15.58	18.45	21.58	24.51
Average Power (mW):	16.90	36.14	69.98	143.88	282.49
Single Point SAR(mW/g):	0.077	0.169	0.322	0.664	1.300
Reference point:	0.077	0.165	0.319	0.655	1.287
Estimated (%):	0.000	2.659	1.010	1.316	1.031

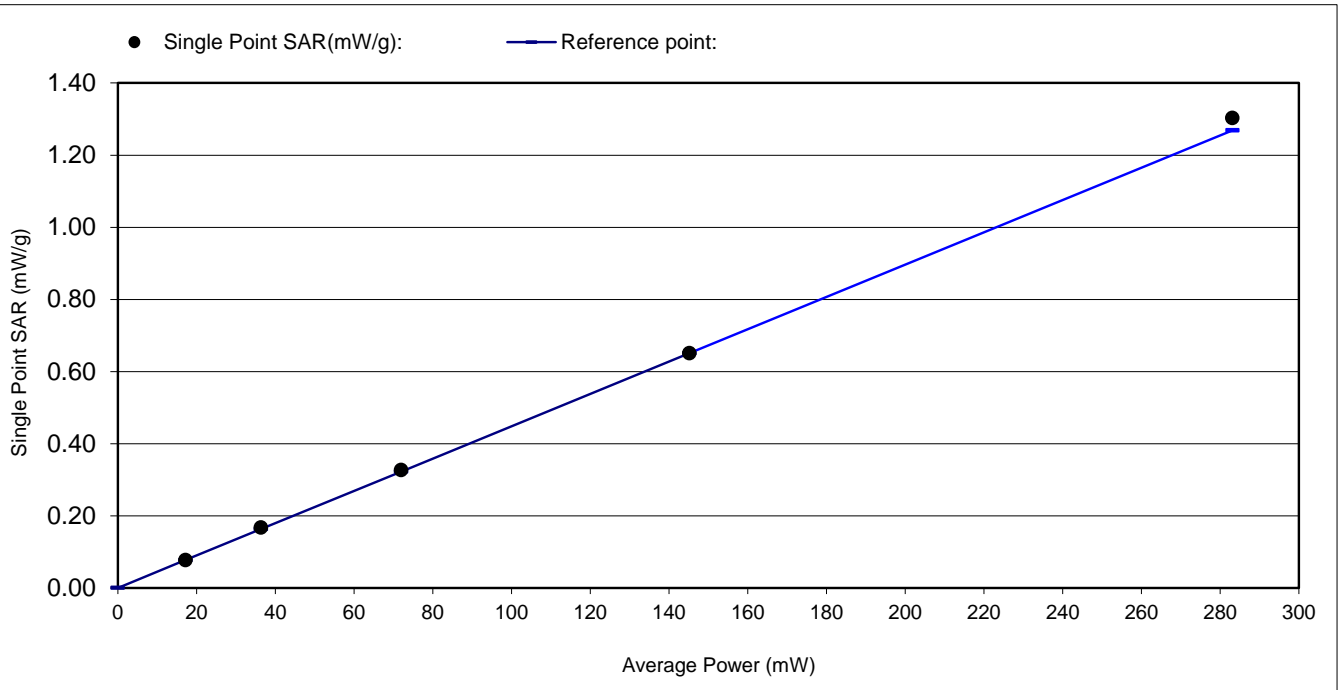


Procedure in establishing linear line (SAR):

First reference point = 0 mW/g when power = 0 mW
 Second reference point: 0.0770 mW/g @ 16.90 mW
 Third reference point: $(0.0770 * 36.14 \text{ mW}) / 16.90 \text{ mW} = 0.1646$
 Fourth reference point: $(0.1646 * 69.98 \text{ mW}) / 36.14 \text{ mW} = 0.3188$
 Fifth reference point: $(0.3188 * 143.88 \text{ mW}) / 69.98 \text{ mW} = 0.6554$
 Sixth reference point: $(0.6554 * 282.49 \text{ mW}) / 143.88 \text{ mW} = 1.2867$
 Draw a reference line from first reference point to sixth reference point.

Measurement Result for Band Width 10 MHz, Modulation 64QAM

3dB Steps:	2nd	3rd	4th	5th	6th
Average Power (dBm):	12.35	15.61	18.57	21.62	24.52
Average Power (mW):	17.18	36.39	71.94	145.21	283.14
Single Point SAR(mW/g):	0.077	0.167	0.327	0.651	1.3030
Reference point:	0.077	0.163	0.322	0.651	1.2691
Estimated (%):	0.000	2.383	1.404	0.021	2.6724

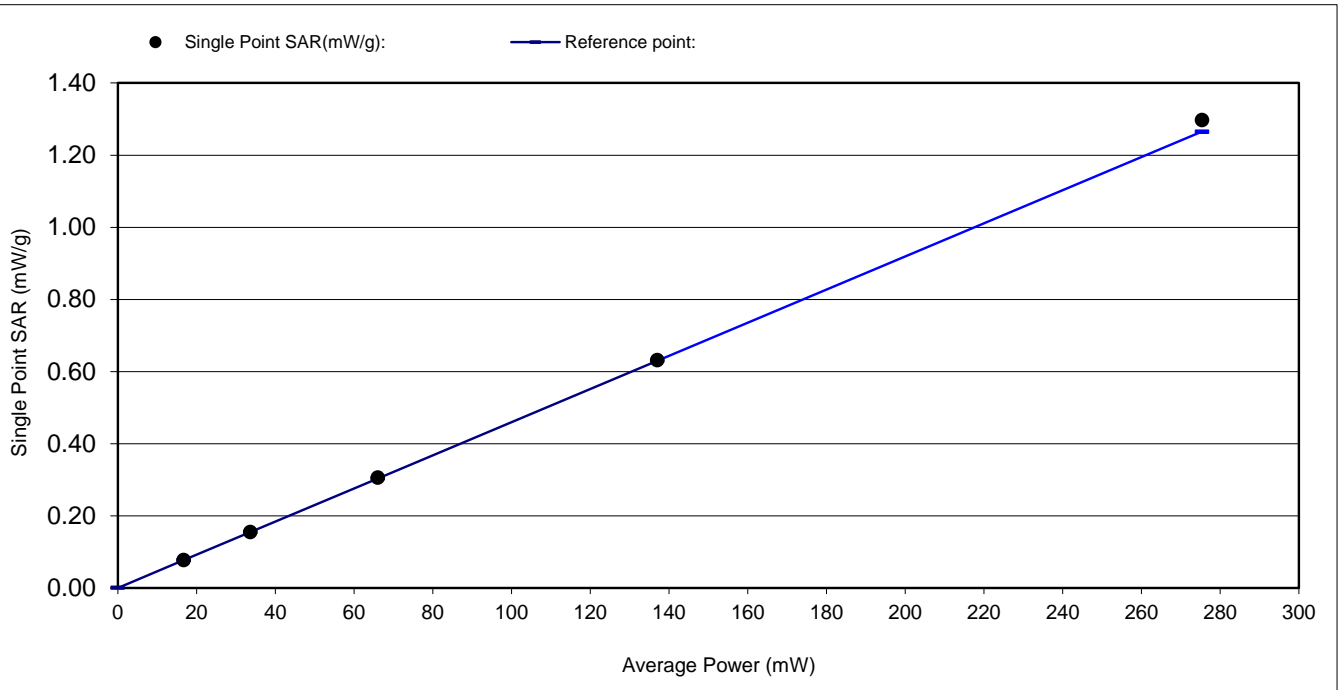


Procedure in establishing linear line (SAR):

First reference point = 0 mW/g when power = 0 mW
 Second reference point: 0.0770 mW/g @ 17.18 mW
 Third reference point: $(0.0770 * 36.39 \text{ mW}) / 17.18 \text{ mW} = 0.1631$
 Fourth reference point: $(0.1631 * 71.94 \text{ mW}) / 36.39 \text{ mW} = 0.3225$
 Fifth reference point: $(0.3225 * 145.21 \text{ mW}) / 71.94 \text{ mW} = 0.6509$
 Sixth reference point: $(0.6509 * 283.14 \text{ mW}) / 145.21 \text{ mW} = 1.2691$
 Draw a reference line from first reference point to sixth reference point.

Measurement Result for Band Width 5 MHz, Modulation QPSK

3dB Steps:	2nd	3rd	4th	5th	6th
Average Power (dBm):	12.24	15.28	18.20	21.37	24.40
Average Power (mW):	16.76	33.70	66.05	137.09	275.42
Single Point SAR(mW/g):	0.077	0.155	0.306	0.631	1.297
Reference point:	0.077	0.155	0.303	0.630	1.265
Estimated (%):	0.0000	0.1477	0.8627	0.2164	2.5296

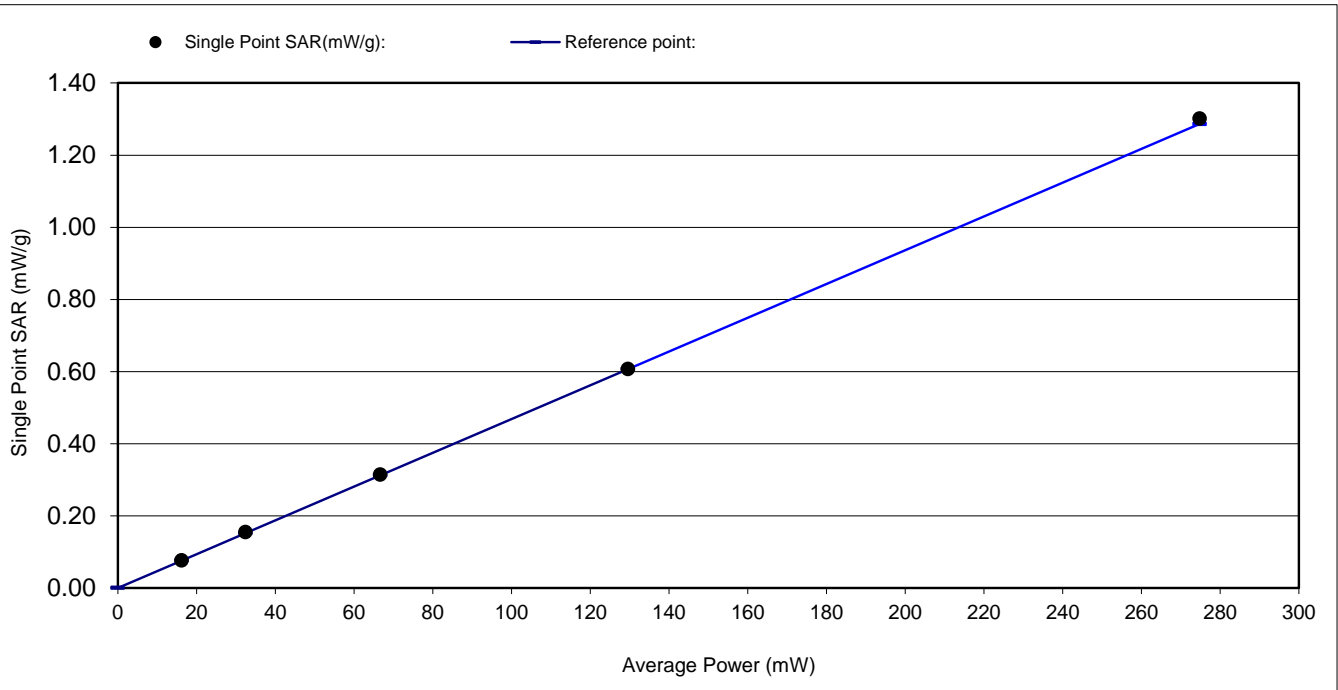


Procedure in establishing linear line (SAR):

First reference point = 0 mW/g when power = 0 mW
 Second reference point: 0.0770 mW/g @ 16.76 mW
 Third reference point: $(0.0770 * 33.70 \text{ mW}) / 16.76 \text{ mW} = 0.1548$
 Fourth reference point: $(0.1548 * 66.05 \text{ mW}) / 33.70 \text{ mW} = 0.3034$
 Fifth reference point: $(0.3034 * 137.09 \text{ mW}) / 66.05 \text{ mW} = 0.6296$
 Sixth reference point: $(0.6296 * 275.42 \text{ mW}) / 137.09 \text{ mW} = 1.2650$
 Draw a reference line from first reference point to sixth reference point.

Measurement Result for Band Width 5 MHz, Modulation 16QAM

3dB Steps:	2nd	3rd	4th	5th	6th
Average Power (dBm):	12.10	15.11	18.24	21.13	24.39
Average Power (mW):	16.23	32.43	66.65	129.57	274.79
Single Point SAR(mW/g):	0.076	0.155	0.314	0.607	1.301
Reference point:	0.076	0.152	0.312	0.607	1.287
Estimated (%):	0.0000	2.0982	0.6274	0.0634	1.1262

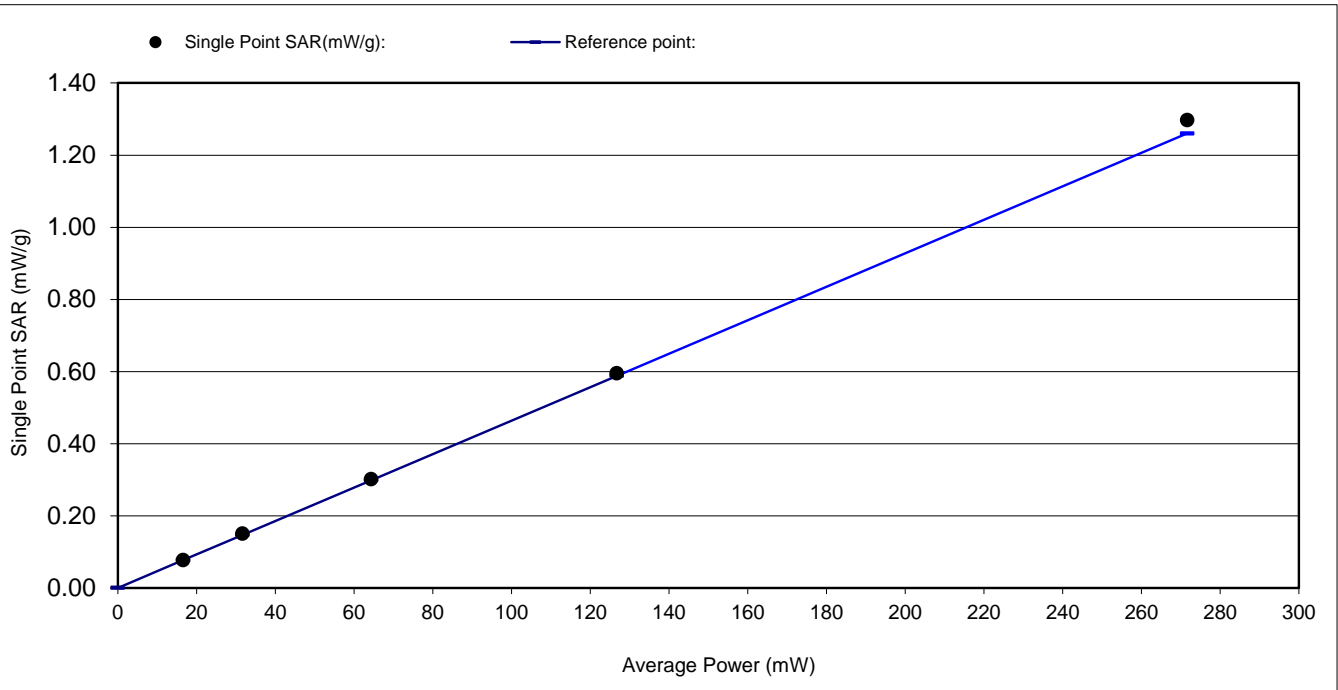


Procedure in establishing linear line (SAR):

First reference point = 0 mW/g when power = 0 mW
 Second reference point: 0.0760 mW/g @ 16.23 mW
 Third reference point: $(0.0760 * 32.43 \text{ mW}) / 16.23 \text{ mW} = 0.1518$
 Fourth reference point: $(0.1518 * 66.65 \text{ mW}) / 32.43 \text{ mW} = 0.3120$
 Fifth reference point: $(0.3120 * 129.57 \text{ mW}) / 66.65 \text{ mW} = 0.6066$
 Sixth reference point: $(0.6066 * 274.79 \text{ mW}) / 129.57 \text{ mW} = 1.2865$
 Draw a reference line from first reference point to sixth reference point.

Measurement Result for Band Width 5 MHz, Modulation 64QAM

3dB Steps:	2nd	3rd	4th	5th	6th
Average Power (dBm):	12.20	15.00	18.09	21.03	24.34
Average Power (mW):	16.60	31.65	64.37	126.77	271.64
Single Point SAR(mW/g):	0.077	0.150	0.301	0.595	1.297
Reference point:	0.077	0.147	0.299	0.588	1.260
Estimated (%):	0.0000	2.1411	0.7803	1.1641	2.9080



Procedure in establishing linear line (SAR):

First reference point = 0 mW/g when power = 0 mW
 Second reference point: 0.0770 mW/g @ 16.60 mW
 Third reference point: $(0.0770 * 31.65 \text{ mW}) / 16.60 \text{ mW} = 0.1469$
 Fourth reference point: $(0.1469 * 64.37 \text{ mW}) / 31.65 \text{ mW} = 0.2987$
 Fifth reference point: $(0.2987 * 126.77 \text{ mW}) / 64.37 \text{ mW} = 0.5882$
 Sixth reference point: $(0.5882 * 271.64 \text{ mW}) / 126.77 \text{ mW} = 1.2603$
 Draw a reference line from first reference point to sixth reference point.

17. Appendixes

Refer to separated files for the following appendixes

- 17.1. System Check Plots**
- 17.2. SAR Test Plots for TD-CDMA**
- 17.3. SAR Test Plots for Volume Scans**
- 17.4. SAR Test Plots for Multi Band Results**
- 17.5. Calibration Certificate for EX3DV4 SN 3751**
- 17.6. Calibration Certificate for D2600V2 SN 1036**
- 17.7. Calibration Certificate for D5GHzV2 SN 1003**

18. Summary of Test configurations

Configuration	Antenna-to-User distance	SAR Require	Comments
(1) Bottom/Base Tablet mode	45 mm from Main to user.	Yes	
	45 mm from Aux to user.	No	WWAN Aux is Rx only.
Edge 3	135 mm from Main to user.	No	This is not the most conservative antenna to user distance
	135 mm from Aux to user.	No	WWAN Aux is Rx only.
(2) Edge 1	25 mm from Main to user.	Yes	
	25 mm from Aux to user.	No	WWAN Aux is Rx only.
(3) Edge 4	16 mm from Main to user.	Yes	
	282 mm from Aux to user.	No	WWAN Aux is Rx only.
Edge 2	282 mm from Main to user.	No	This is not the most conservative antenna to user distance
	16 mm from Aux to user.	No	WWAN Aux is Rx only.
(4) Lap-held (Laptop mode)	170 mm from Main to user.	Yes	
	170 mm from Aux to user.	No	WWAN Aux is Rx only.