



**FCC OET BULLETIN 65 SUPPLEMENT C
SAR EVALUATION REPORT**

FOR

**Intel® Centrino® Advanced-N + WiMAX 6250
(Tested inside of Lenovo ThinkPad X200/X201 Tablet Series)**

FCC ID: PD9622ANXHU

MODEL: 622ANXHMW

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Prepared for

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Revision History

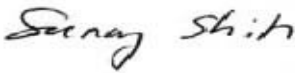
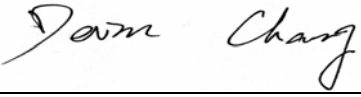
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--	March 29, 2010	Initial Issue	--
A	May 7, 2010	Updated report, including: 1. Re-measured SAR linearity for all bandwidth/modulation 2. Updated report based on reviewer's comments	Sunny Shih
A1	May 24, 2010	Added Section 19 setup photo for SAR linearity measurement	Sunny Shih
A2	May 25, 2010	Updated report, including: 1. Updated KDB form 616217 to 447498 2. Added Section 2a Control Signal Description 3. Added Bluetooth's FCC ID and output power in Section 5	Sunny Shih
B	June 10, 2010	Updated report on the following pages Page 20 – Added equation Page 29 – Added setup photo and separation distance.	Sunny Shih

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	INTEL CORPORATION 2111 N.E. 25TH AVENUE HILLSBORO, OR 97124, USA		
EUT DESCRIPTION:	Intel® Centrino® Advanced-N + WiMAX 6250 (Tested inside of Lenovo ThinkPad X200/X201 Tablet Series)		
MODEL NUMBER:	622ANXHMW		
DEVICE CATEGORY:	Portable		
EXPOSURE CATEGORY:	General Population/Uncontrolled Exposure		
DATE TESTED:	January 10 - 13 , 2010 May 5, 2010 (Re-measured SAR linearity)		
FCC rule parts	Freq. range (MHz)	Highest 1-g SAR (W/kg)	Limit (W/kg)
27	2498.5 – 2687.5	0.119 W/kg (Secondary landscape)	1.6
Applicable Standards			Test Results
FCC OET Bulletin 65 Supplement C 01-01 and the following SAR test procedures: <ul style="list-style-type: none"> KDB 615223 - 802 16e WiMax SAR Guidance KDB 447498 Mobile Portable RF Exposure 			Pass
<p>Compliance Certification Services, Inc. (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 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by 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 SUPERVISOR COMPLIANCE CERTIFICATION SERVICES		DEVIN CHANG EMC ENGINEER COMPLIANCE CERTIFICATION SERVICES	

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C 01-01 and the following SAR test procedures:

- KDB 447498 Mobile Portable RF Exposure
- KDB 615223 802 16e WiMax SAR Guidance

2a. Control Signal Description

During normal operation of the Intel 6250 as a mobile WiMAX system the control channels may occupy up to 5 slots. A slot is a sub-channel with the duration of 3 symbols. A maximum of two simultaneous Fast Channel Feedback (CQICH) reports used to feedback channel state information are possible, which can occupy up to two slots. A maximum of three slots can be used for Hybrid Automatic Repeat Request (HARQ) ACK/NAK by the five possible DL HARQ bursts in the previous DL frame. The 5 ACK/NAK bits each occupy $\frac{1}{2}$ slot.

3. FACILITIES AND ACCREDITATION

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

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
Robot - Six Axes	Stäubli	RX90BL	N/A			N/A
Robot Remote Control	Stäubli	CS7MB	3403-91535			N/A
DASY4 Measurement Server	SPEAG	SEUMS001BA	1041			N/A
Probe Alignment Unit	SPEAG	LB (V2)	261			N/A
SAM Phantom (SAM1)	SPEAG	QD000P40CA	1185			N/A
SAM Phantom (SAM2)	SPEAG	QD000P40CA	1050			N/A
Oval Flat Phantom (ELI 4.0)	SPEAG	QD OVA001 B	1003			N/A
Electronic Probe kit	HP	85070C	N/A			N/A
S-Parameter Network Analyzer	Agilent	8753ES-6	MY40001647	11	22	2010
Signal Generator	Agilent	8753ES-6	MY40001647	11	22	2010
E-Field Probe	SPEAG	EX3DV4	3686	3	22	2010
E-Field Probe	SPEAG	EX3DV3	3531	2	22	2011
Thermometer	ERTCO	639-1S	1718	4	28	2011
Data Acquisition Electronics	SPEAG	DAE3 V1	500	9	15	2010
System Validation Dipole	SPEAG	D2600V2*	1006	4	21	2012
ESG Vector Signal Generator	Agilent	E4438C	US44271090	9	17	2010
Amplifier	Mini-Circuits	ZVE-8G	90606			N/A
Amplifier	Mini-Circuits	ZHL-42W	D072701-5			N/A

* **Note:** Per KDB 450824 D02 requirements for dipole calibration, CCS has adopted three years calibration intervals. On annual basis, each measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement (test data on file in CCS)
4. Impedance is within 5 Ω of calibrated measurement (test data on file in CCS)

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) @ Body 2600 MHz	5.50	Normal	1	1	5.50
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	2.52	Normal	1	0.64	1.61
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty	3.02	Normal	1	0.6	1.81
Combined Standard Uncertainty Uc(y) =					9.75
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =					19.49 %
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =					1.55 dB

5. EQUIPMENT UNDER TEST

Intel® Centrino® Advanced-N + WiMAX 6250

(Tested inside of Lenovo ThinkPad X200/X201 Tablet Series)

Intel® Centrino® Advanced-N + WiMAX 6250 is an embedded IEEE 802.16e and 802.11a/b/g/n wireless network adapter that operates in the 2.4 GHz and 5 GHz spectra for WiFi and 2.6 GHz for WiMAX. The adapter is installed inside the Lenovo host. This adapter is capable of delivering up to 300 Mbps Tx/Rx over WiFi and up to 4 Mbps UL/10 Mbps DL over WiMAX.

WiMAX 6250 transmits on 5 ms frames using 5 MHz and 10 MHz channels. The 10 MHz channel bandwidth uses 1024 sub-carriers and 35 sub-channels, with 184 null sub-carriers and 840 available for transmission, consisting of 560 data sub-carriers and 280 pilot sub-carriers. The 5 MHz channel bandwidth uses 512 sub-carriers and 17 sub-channels, with 104 null sub-carriers and 408 available for transmission, consisting 272 data sub-carriers and 136 pilot sub-carriers.

WiMAX and 802.11 a/b/g/n co-location conditions:

The 802.16e WiMAX and 802.11 a/b/g/n WiFi radio will not transmit simultaneously. When the 622ANXHMW is installed in the typical laptop computer, once the network is chosen by the end user during WiMAX/WiFi network, only the WiMAX radio or WiFi radio will transmit.

Normal operation:

- Laptop - Lap-held with display open at 90° to the keyboard
- Tablet bottom face
- Tablet edges - Multiple display orientations supporting both portrait and landscape configurations

Antenna tested:

<u>Vendor</u>	<u>Antenna</u>	<u>Part Number</u>
ACON	Main	25.90675.001
WNC	Main	25.90669.001

Antenna-to-user distances:

Refer to antenna specification for details.

Assessment for SAR evaluation for Simultaneous transmission:

WiMAX – Bluetooth:

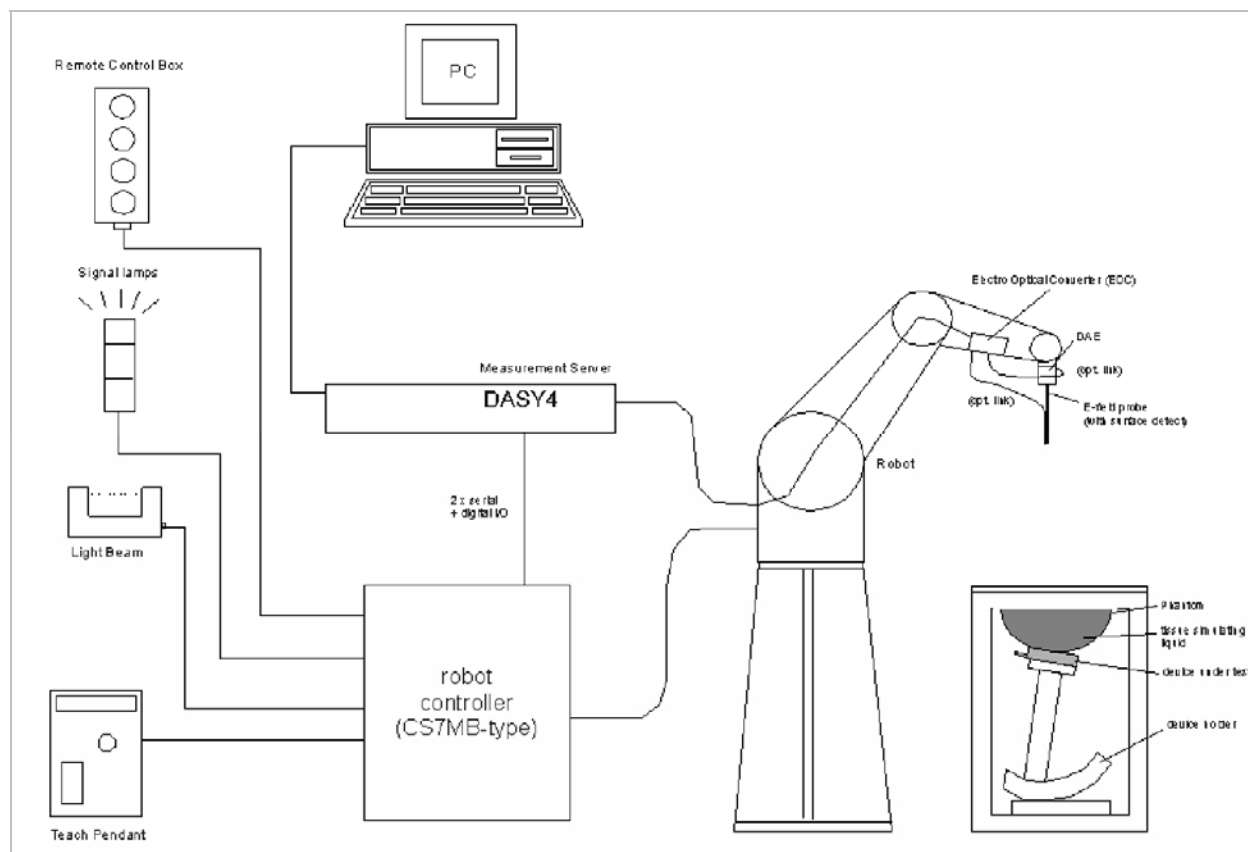
The antenna separation distance between the WLAN and Bluetooth is greater than 20 cm, so both are not considered as co-located transmitters each other.

Bluetooth - FCC ID: QDS-BRCM1046, Output power is 3.06 mW (<60/f(GHz mW)

WiMAX – WLAN:

The 802.16e WiMAX and 802.11 a/b/g/n WiFi radio will not transmit simultaneously.

6. SYSTEM DESCRIPTION



The DASY4 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.
- DASY4 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

8. TISSUE DIELECTRIC PARAMETERS CHECK

The simulating liquids should be 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 2 GHz, the measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values. For frequencies in the range of 2–3 GHz and above the measured conductivity should be within $\pm 5\%$ of the target values. The measured relative permittivity tolerance can be relaxed to no more than $\pm 10\%$.

Reference Values of Tissue Dielectric Parameters for 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)	Body	
	ϵ_r	σ (S/m)
2450	52.7	1.95
2500	52.6	2.02
2600	52.5	2.16
2690	52.4	2.29

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

8.1. TISSUE PARAMETERS CHECK RESULTS

Simulating Liquid Dielectric Parameter Check Result @ Body 2600 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2500	e'	51.5383	Relative Permittivity (ϵ_r):	51.538	52.6	-2.02	± 5
	e"	14.2908	Conductivity (σ):	1.988	2.02	-1.61	± 5
2590	e'	51.2724	Relative Permittivity (ϵ_r):	51.272	52.5	-2.34	± 5
	e"	14.5762	Conductivity (σ):	2.100	2.15	-2.32	± 5
2600	e'	51.2203	Relative Permittivity (ϵ_r):	51.220	52.5	-2.46	± 5
	e"	14.6402	Conductivity (σ):	2.118	2.16	-2.00	± 5
2690	e'	50.9755	Relative Permittivity (ϵ_r):	50.976	52.4	-2.72	± 5
	e"	14.9176	Conductivity (σ):	2.232	2.29	-2.52	± 5

Liquid Check

Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C

January 10, 2010 05:45 PM

Frequency	e'	e"
2480000000.	51.6182	14.1446
2490000000.	51.5704	14.2194
2500000000.	51.5383	14.2908
2510000000.	51.4760	14.3624
2520000000.	51.4421	14.4000
2530000000.	51.4488	14.4554
2540000000.	51.4345	14.5103
2550000000.	51.4082	14.5417
2560000000.	51.3605	14.5282
2570000000.	51.3466	14.4985
2580000000.	51.3173	14.5219
2590000000.	51.2724	14.5762
2600000000.	51.2203	14.6402
2610000000.	51.1681	14.7012
2620000000.	51.1150	14.7325
2630000000.	51.0884	14.7840
2640000000.	51.0758	14.8358
2650000000.	51.0426	14.8747
2660000000.	51.0254	14.8967
2670000000.	51.0191	14.8913
2680000000.	51.0086	14.9056
2690000000.	50.9755	14.9176
2700000000.	50.9170	14.9724
2710000000.	50.8416	15.0095

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

where $f = \text{target } f * 10^6$

$$\epsilon_0 = 8.854 * 10^{-12}$$

Simulating Liquid Dielectric Parameter Check Result @ Body 2600 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2500	e'	51.399	Relative Permittivity (ϵ_r):	51.399	52.6	-2.28	± 5
	e"	14.592	Conductivity (σ):	2.029	2.02	0.47	± 5
2590	e'	51.130	Relative Permittivity (ϵ_r):	51.130	52.5	-2.61	± 5
	e"	14.849	Conductivity (σ):	2.139	2.15	-0.49	± 5
2600	e'	51.062	Relative Permittivity (ϵ_r):	51.062	52.5	-2.76	± 5
	e"	14.920	Conductivity (σ):	2.158	2.16	-0.13	± 5
2690	e'	50.816	Relative Permittivity (ϵ_r):	50.816	52.4	-3.02	± 5
	e"	15.191	Conductivity (σ):	2.273	2.29	-0.73	± 5

Liquid Check

Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C

January 11, 2010 03:49 PM

Frequency	e'	e"
2480000000.	51.4731	14.4253
2490000000.	51.4391	14.5059
2500000000.	51.3992	14.5923
2510000000.	51.3437	14.6487
2520000000.	51.3138	14.6946
2530000000.	51.3211	14.7347
2540000000.	51.3090	14.7861
2550000000.	51.2734	14.8092
2560000000.	51.2266	14.7957
2570000000.	51.2004	14.7719
2580000000.	51.1668	14.7913
2590000000.	51.1301	14.8488
2600000000.	51.0623	14.9201
2610000000.	51.0243	14.9800
2620000000.	50.9806	15.0348
2630000000.	50.9429	15.0823
2640000000.	50.9280	15.1422
2650000000.	50.8945	15.1721
2660000000.	50.8733	15.1838
2670000000.	50.8723	15.1670
2680000000.	50.8577	15.1711
2690000000.	50.8160	15.1908
2700000000.	50.7620	15.2406
2710000000.	50.6867	15.2908
2720000000.	50.6233	15.3228

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

where $f = \text{target } f * 10^6$

$$\epsilon_0 = 8.854 * 10^{-12}$$

9. SYSTEM VERIFICATION

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

Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Head or Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV4 SN3686 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 fine cube was chosen for cube
- Distance between probe sensors and phantom surface was set to 3 mm.
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW
- The results are normalized to 1 W input power.

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

System validation dipole	Cal. certificate #	Cal. due date	SAR Avg (mW/g)		
			Tissue:	Head	Body
D2600V2	D2600V2-1006_Apr09	4/21/12	SAR _{1g} :		57.6
			SAR _{10g} :		25.8

9.1. SYSTEM PERFORMANCE CHECK RESULTS

Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Devin Chang

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D2600V2	01/11/10	SAR _{1g} :	56.7	57.6	-1.56	±10
		SAR _{10g} :	25.0	25.8	-3.10	

SYSTEM CHECK PLOT

Date/Time: 1/11/2010 6:33:01 PM

Test Laboratory: Compliance Certification Services

System Performance Check - D2600V2

DUT: Dipole ; Type: D2600V2; Serial: 1006

Communication System: System Check Signal - CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.12$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(6.4, 6.4, 6.4); Calibrated: 3/23/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=100mW/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

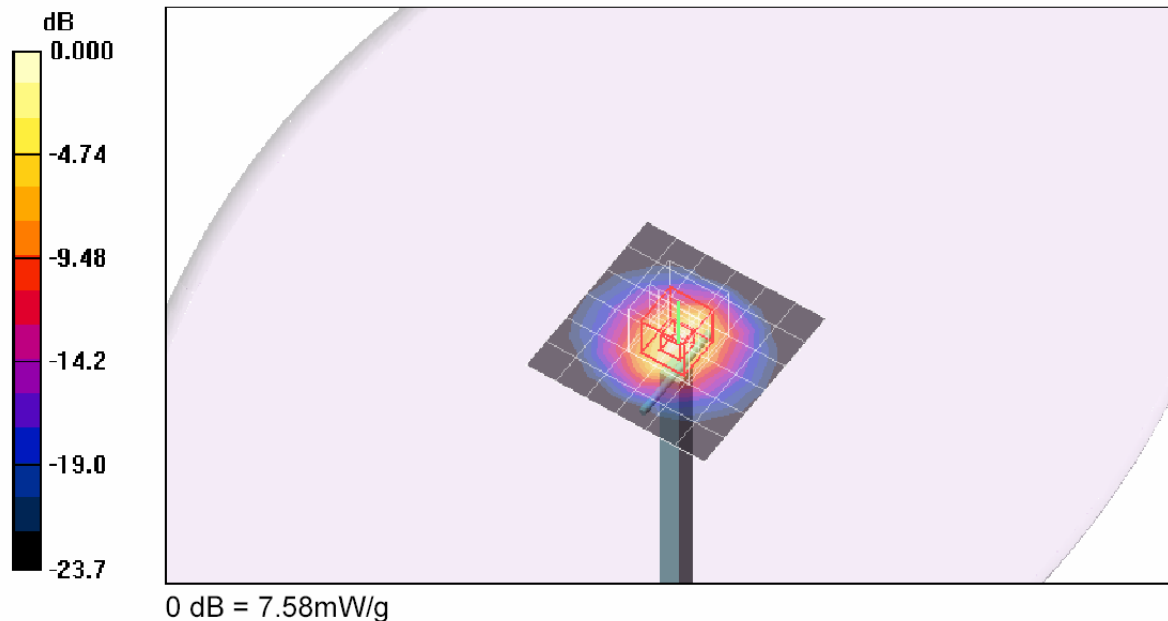
Maximum value of SAR (measured) = 7.58 mW/g

d=10mm, Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 60.4 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 12.1 W/kg

SAR(1 g) = 5.67 mW/g; SAR(10 g) = 2.5 mW/g



SYSTEM CHECK Z-PLOT

Date/Time: 1/11/2010 6:50:42 PM

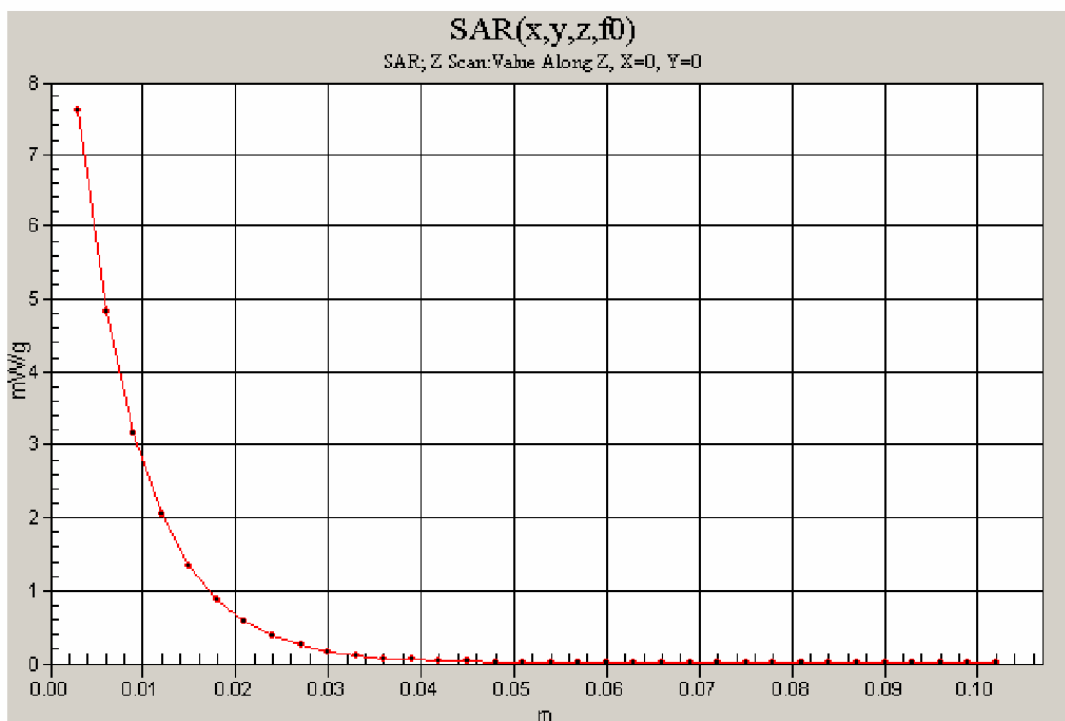
Test Laboratory: Compliance Certification Services

System Performance Check - D2600V2

DUT: Dipole ; Type: D2600V2; Serial: 1006

Communication System: System Check Signal - CW; Frequency: 2600 MHz; Duty Cycle: 1:1

d=10mm, Pin=100mW/Z Scan (1x1x34): Measurement grid: dx=20mm, dy=20mm, dz=3mm
Maximum value of SAR (measured) = 7.61 mW/g



10. WIMAX / 802.16e DEVICE SPECIFICATION

10.1. WiMax Zone Types

The device and its system are both transmitting using only PUSC zone type. This enables multiple users to transmit simultaneously within the system. FUSC, AMC and other zone types are not used by Link 5150 for uplink transmission. The maximum DL:UL symbol ratio can be determined according to the PUSC requirements. The system transmit an odd number of symbols using DL-PUSL consisting of even multiples of traffics and control symbols plus one symbol for the preamble. Multiples of three symbols are transmitted by the device using UL-PUSC. The OFDMA symbol time allows up to 48 downlink and uplink symbols in each 5 ms frame. TTG and RTG are also included in each frame as DL/UL transmission gaps; therefore, the system can only allow 47 or less symbols per frame. The maximum DL:UL symbol ratio is determined according to these PUSC parameters for evaluating SAR compliance.

WiMAX chipset is capable of supporting the following Downlink / Uplink based upon 802.16e.

Description	Down Link	Up Link
Number of OFDM Symbols in Down Link and Up Link for 5 MHz and 10 MHz Bandwidth	35	12
	34	13
	32	15
	31	16
	30	17
	29	18
	28	19
	27	20
	26	21

10.2. DUTY FACTOR CONSIDERATIONS

- a. All Test Vector are performing with all UL symbols at maximum power
- b. Although the chipset can supply higher downlink-to-uplink (DL/UL) symbol ratios, Link 5150 is only supplied to BRS/EBS WiMAX operators with agreements to transmit at a maximum DL/UL symbol ratio of 29:18. Link 5150 is limited by firmware and the corresponding WiMAX system to operate at or below this maximum duty factor. Therefore, the maximum transmission duty factor supported by the chipset is not applicable for this device. The system can transmit up to 48 OFDMA symbols in each 5 ms frame, including 1.6 symbols for TTG and RTG.
- c. UL Burst Max. Average Power was measured using spectrum analyzer gated to measure the power only during Tx "On" stage.

Mode	Test Vector file name	Ch. No	f (MHz)	Max. Avg Pwr	
				(dBm)	(mW)
16QAM 10M	DQ4_12_UQ16_12_10M	368	2593	23.60	229.09
QPSK 10M	DQ64_UQ4_12_21S_10M	368	2593	23.21	209.41
16QAM 5M	DQ4_12_UQ16_34_5M	378	2593	23.93	247.17
QPSK 5M	DQ64_56_UQ4_12_5M	378	2593	23.89	244.91

- d. The control channels may occupy up to 5 slots during normal operation. A slot is a sub-channel with the duration of 3 symbols. There are a total of 35 slots in the 10 MHz channel configuration.
- e. The control channels may occupy up to 5 slots during normal operation. A slot is a sub-channel with the duration of 3 symbols. There are a total of 17 slots in the 5 MHz channel configuration.
- f. Max. Rated / Certified Power:

Modulation	Channel Bandwidth	Power (mW)
16QAM	10 MHz	221.3
QPSK	10 Mhz	229.1
16QAM	5 MHz	269.2
QPSK	5 Mhz	269.2

- g. By comparing to the measured output power (Section 10.2 item c) Vs the Max. Rated / Certified Power (Section 10.2 item f), the following max. Power is used to calculate the scaling factor.

Max. Power Used to Calculated the Scaling Factor		
Modulation	Channel Bandwidth	Power (mW)
16QAM	10 MHz	229.09
QPSK	10 Mhz	229.10
16QAM	5 MHz	269.20
QPSK	5 Mhz	269.20

- h. When the device is transmitting at max rated power, the output power for the control symbol and the target output power for UL:DL ratio of 29:18 is calculated as the following:

Modulation	Ch. BW	Max pwr (mW)	Max pwr control symbol (max. pwr x 5 / 35)	29:18 DL:UL ration Pwr (mW) ((ctrl_symb_pwr x 3) +(max_pwr x 15))
16QAM	10 MHz	229.09	32.73	3534.53
QPSK	10 Mhz	229.10	32.73	3534.69
Modulation	Ch. BW	Max pwr (mW)	Max pwr control symbol (max. pwr x 5 / 17)	29:18 DL:UL ration Pwr (mW) ((ctrl_symb_pwr x 3) +(max_pwr x 15))
16QAM	5 MHz	269.20	79.18	4275.53
QPSK	5 Mhz	269.20	79.18	4275.53

i. Test Vector waveform power

10 MHz BW / 16QAM: DQ4_12_UQ16_12_10M (32:15 DL:UL Ratio)

Ch. #	Freq. (MHz)	Measured Pwr (mW)	Number of Traffic Symbols	Traffic Symbols Pwr (mW) (Measured power * No. of Traffic symbol]
0	2501	217.27	12	2607.24
368	2593	229.09	12	2749.08
736	2685	208.45	12	2501.40

10 MHz BW / QPSK: DQ64_UQ4_12_21S_10M (23:24 DL:UL Ratio)

Ch. #	Freq. (MHz)	Measured Pwr (mW)	Number of Traffic Symbols	Traffic Symbols Pwr (mW) (Measured power * No. of Traffic symbol]
0	2501	208.45	21	4377.45
368	2593	209.41	21	4397.61
736	2685	203.24	21	4268.04

5 MHz BW / 16QAM: DQ4_12_UQ16_34_5M (26:21 DL:UL Ratio)

Ch. #	Freq. (MHz)	Measured Pwr (mW)	Number of Traffic Symbols	Traffic Symbols Pwr (mW) (Measured power * No. of Traffic symbol]
0	2498.5	228.56	18	4114.08
378	2593	247.17	18	4449.06
756	2687.5	236.05	18	4248.90

5 MHz BW / QPSK: DQ64_UQ4_12_5M (26:21 DL:UL Ratio)

Ch. #	Freq. (MHz)	Measured Pwr (mW)	Number of Traffic Symbols	Traffic Symbols Pwr (mW) (Measured power * No. of Traffic symbol]
0	2498.5	220.29	18	3965.22
378	2593	244.91	18	4408.38
756	2687.5	231.21	18	4161.78

Calculation example:

Traffic Symbols Pwr = Measured power * No. of Traffic Symbol

10M 16QAM
= 229.09 * 12
= 2749.08

10M QPSK
= 209.41 * 21
= 4397.61

10.3. DUTY FACTOR SCALING TO DL:UL RATIO OF 29:18

10 MHz BW / 16QAM: DQ4_12_UQ16_12_10M (32:15 DL:UL Ratio)

Ch. #	Freq. (MHz)	29:18 Rated Pwr	Traffic Symbol Pwr	Scaling Factor (Rated Pwr/Traffic Pwr)
0	2501	3534.53	2607.24	1.36
368	2593	3534.53	2749.08	1.29
736	2685	3534.53	2501.40	1.41

10 MHz BW / QPSK: DQ64_UQ4_12_21S_10M (23:24 DL:UL Ratio)

Ch. #	Freq. (MHz)	29:18 Rated Pwr	Traffic Symbol Pwr	Scaling Factor (Rated Pwr/Traffic Pwr)
0	2501	3534.69	4377.45	0.81
368	2593	3534.69	4397.61	0.80
736	2685	3534.69	4268.04	0.83

5 MHz BW / 16QAM: DQ4_12_UQ16_34_5M (26:21 DL:UL Ratio)

Ch. #	Freq. (MHz)	29:18 Rated Pwr	Traffic Symbol Pwr	Scaling Factor (Rated Pwr/Traffic Pwr)
0	2498.5	4275.53	4114.08	1.04
378	2593	4275.53	4449.06	0.96
756	2687.5	4275.53	4248.90	1.01

5 MHz BW / QPSK: DQ64_UQ4_12_5M (26:21 DL:UL Ratio)

Ch. #	Freq. (MHz)	29:18 Rated Pwr	Traffic Symbol Pwr	Scaling Factor (Rated Pwr/Traffic Pwr)
0	2498.5	4275.53	3965.22	1.08
378	2593	4275.53	4408.38	0.97
756	2687.5	4275.53	4416.78	0.97

10.4. CONVERSION FACTOR & SAR SCALE FACTOR

Mode	Test Vector file name	DL:UL Ratio	Duty factor (%) (Calculated)	Conversion factor (100/duty cycle)	Scale factor DL:UL symbol ratio of 29:18
16QAM 10M	DQ4_12_UQ16_12_10M	32 :15	24.7	4.05	1.29
QPSK 10M	DQ64_UQ4_12_21S_10M	23 :24	43.2	2.31	0.80
16QAM 5M	DQ4_12_UQ16_34_5M	26 :21	37.0	2.70	0.96
QPSK 5M	DQ64_56_UQ4_12_5M	26 :21	37.0	2.70	0.97

Note: The duty factor can be given as: (number of traffic symbols*102.857us)/5000us

11. TEST SOFTWARE

The test software tool (WiMAX VaTU SW application) is installed on the host device, WiMAX, to transmit at max. output power. During normal operation, the output power of WiMAX client module is controlled by a WiMAX basestation, which also determines the characteristics of the transmission. For testing purposes, the device output power is kept at this max. using WiMAX VATU SW application loaded in the host device. The uplink transmission is maintained at a stable condition by the radio profile loaded in Vector signal generator. This enables the WiMAX module to transmit at max. power with a constant duty factor according to the specific radio profile. The test software serves only one purpose, to configure the WiMAX module to transmit at the max. power during SAR measurement.

The driver software installed in the host support equipment during testing was WiMAX VaTU, version: 5.0.0.1

VaTU SW Application

The screenshot displays the WiMAX VaTU application window. The title bar reads "WiMAX VaTU". Below the title bar are two tabs: "Main Menu" and "Setup". The "Setup" tab is active, showing a toolbar with icons for Configuration, Reload Profiles, Start, Stop, and Save Snapshot. Below the toolbar is a section labeled "Rx/Tx Test Mode".

The main area of the application is titled "Band Profile" in blue text. It contains several input fields and checkboxes:

- Radio Profile:** A dropdown menu showing "Prof3.A_2.496-10".
- Test Vector File:** A text field showing "C:\HvT\Test Vectors\10MHz\".
- Channel BW [MHz] / FFT:** A text field showing "10 / 1024".
- Center Frequency Step [kHz]:** A text field showing "250".
- Start Frequency [MHz]:** A text field showing "2501".
- Channel No. / Freq [MHz]:** A dropdown menu showing "368 / 2593".
- Selection:** Two radio buttons, "All Channels" (selected) and "Partial".

Below the "Band Profile" section are two main panels: "Rx" and "Tx".

The "Rx" panel contains settings for two chains:

- Rx Chain 1:** Includes checkboxes for "Ch Enabled" (checked), "MRC", "RSSI [dBm]", and "CINR [dB]".
- Rx Chain 2:** Includes checkboxes for "Ch Enabled" (checked), "BER", and "[Frames]".

The "Tx" panel includes a "Power Out [dBm]" field showing "23", a vertical slider for power level (ranging from -40 to 30), and a "Tpc" button.

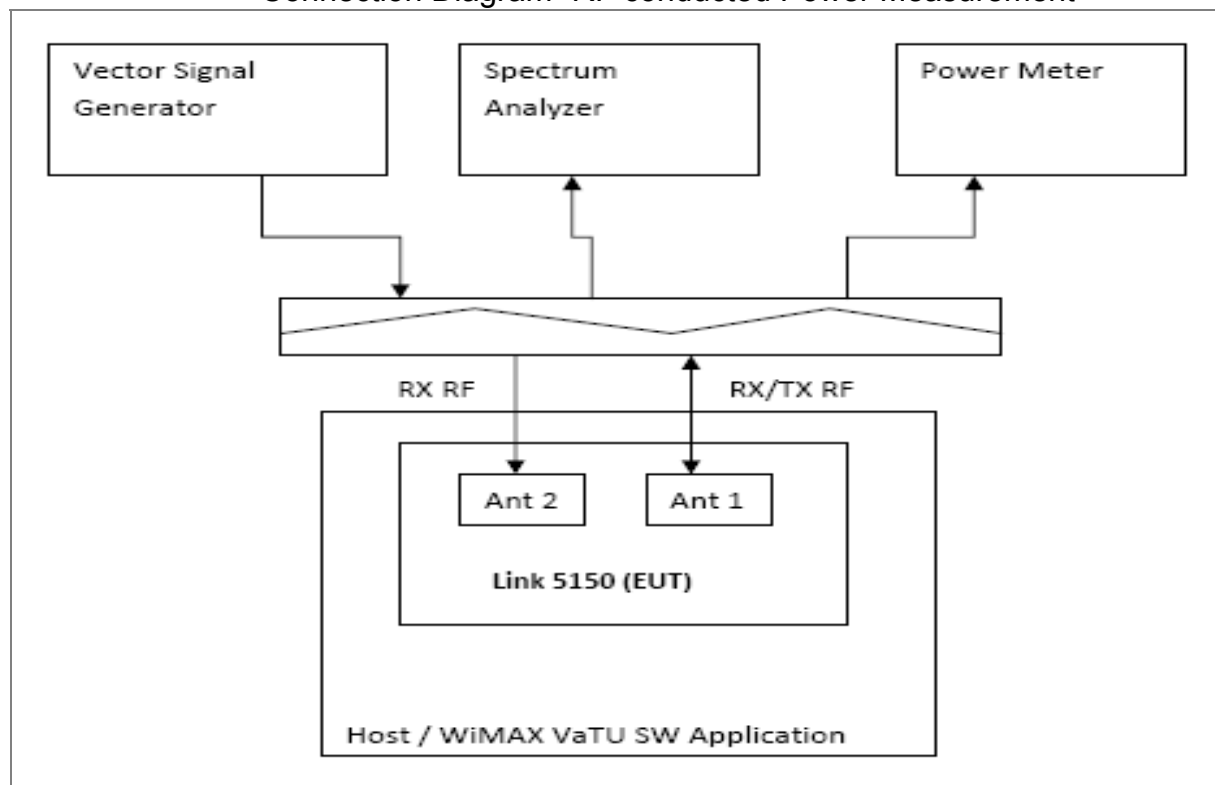
The status bar at the bottom left shows "Ready" and a small icon.

12. SIGNAL GENERATEOR DETAILS

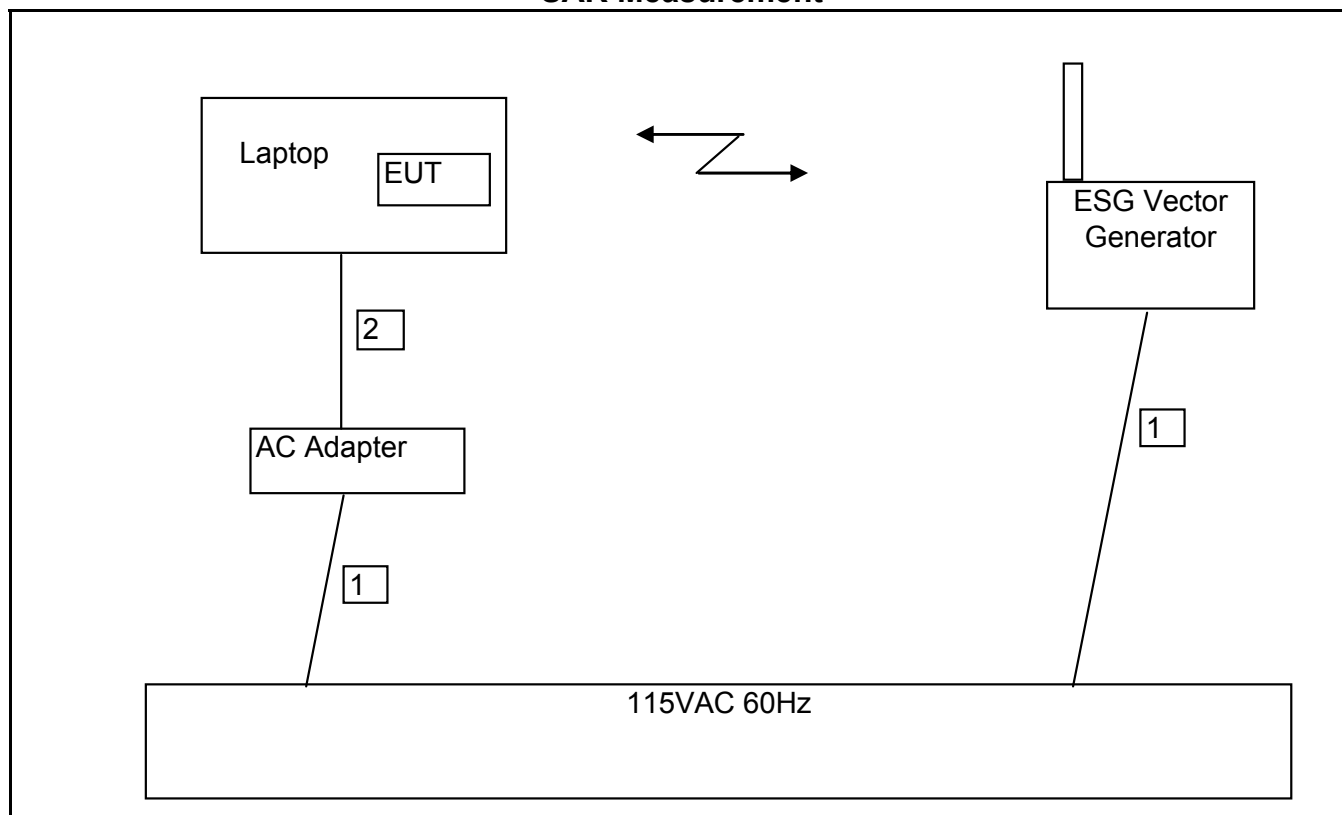
Frame Profile loaded in Vector Signal Generator:

Test Vector File Name	BW	DL:UL Symbols	UL duty Cycle (%) (Calculated)	DL Modulation	UL Modulation
DQ4_12_UQ16_12_10M	10 MHz	32:15	24.7	QPSK R1/2	QAM16 R3/4
DQ64_UQ4_12_21S_10M	10 MHz	23:24	43.2	QAM64 R5/6	QPSK R1/2
DQ4_12_UQ16_34_5M	5 MHz	26:21	37.0	QPSK R1/2	QAM16 R3/4
DQ64_56_UQ4_12_5M	5 MHz	26:21	37.0	QAM64 R5/6	QPSK R1/2

Connection Diagram- RF conducted Power Measurement



SAR Measurement



Agilent ESG Vector Signal Generator / Model: E4438C is used in conjunction with Intel supplied radio profile to configure the WiFi/WiMAX module for the SAR evaluation. ESG Vector Signal Generator is loaded with the downlink signal, containing the respective FCH, DL-MAP and UL-MAP required by the test device to configure the uplink transmission. The waveform is configured for a DL:UL symbol ratio of 32:15 for 10 MHz/16WAM; 23:24 for 10MHz/QPSK and 26:21 for 5 MHz/16WAM/QPSK using Intel Signal Waveform Software for 802.16 WiMAX, on the PC and downloaded to the VSG. The test device can synchronize itself to the signal received from VSG, both in frequency and time. It then modulates the DL-MAP and UL-MAP transmitted in the downlink sub-frame and determine the DL:UL symbol ratio. The downlink burst is repeated in each frame, every 5 ms, to simulate the normal transmission from a WiMAX base station. The UL-MAP received by the device is used to configure the uplink burst with all data symbols and sub-channels active. Since this is a one-way communication configuration, control channel transmission is neither requested nor transmitted.

For TDD systems, both uplink and downlink transmissions are at the same frequency. The output power of the VSG is kept at least 80 dB lower than the test device to avoid interfering with the SAR measurements. In addition, a horn antenna is used for the VSG and it is kept more than 1 meter away from the test device to further minimize unnecessary pickup by the SAR probe.

13. VECTOR SIGNAL GENERATOR TEST SET DETAILS

Modulation and channel bandwidth selection is loaded to Vector Signal Generator. For example, when evaluating 16QAM with 10 MHz channel Bandwidth, radio profile name "DQ4_12_UQ16_12_10M " is active on the Vector Signal Generator.

Parameter /Value	Frame definition for 10 MHz RCT		
	Test vector name		Remark
	DQ4_12_UQ16_12_10M	DQ64_UQ4_12_21S_10M	
Band Width	10MHz	10MHz	
FFT size	1024	1024	
UL Traffic Symbols	12	21	
Down link			
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS : QPSK R1/2	MCS : QAM64 R5/6	Single DIUC
Up link			
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS : QAM16 R3/4	MCS : QPSK R1/2	Single DIUC

Parameter /Value	Frame definition for 5MHz RCT		
	Test vector name		Remarks
	DQ4_12_UQ16_34_5M	DQ64_56_UQ4_12_5M	
Band Width	5MHz	5MHz	
FFT size	512	512	
UL traffic symbols	18	18	
Down link			
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS : QPSK R1/2	MCS : QAM64 R5/6	Single DIUC
Up link			
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS : QAM16 R3/4	MCS : QPSK R1/2	Single DIUC

14. OUTPUT POWER, DUTY CYCLE AND PEAK TO AVERAGE RATIO

The max average conducted output power is measured for the uplink burst in the difference modulation and channel bandwidth.

14.1. AVERAGE OUTPUT POWER

10 MHz

Mode	Test Vector file name	Ch. No	f (MHz)	Output power	
				(dBm)	(mW)
16QAM	DQ4_12_UQ16_12_10M	0	2501	23.37	217.27
		368	2593	23.60	229.09
		736	2685	23.19	208.45
QPSK	DQ64_UQ4_12_21S_10M	0	2501	23.19	208.45
		368	2593	23.21	209.41
		736	2685	23.08	203.24

5 MHz

Mode	Test Vector file name	Ch. No	f (MHz)	Output power	
				(dBm)	(mW)
16QAM	DQ4_12_UQ16_34_5M	0	2498.5	23.59	228.56
		378	2593	23.93	247.17
		756	2687.5	23.73	236.05
QPSK	DQ64_56_UQ4_12_5M	0	2498.5	23.43	220.29
		378	2593	23.89	244.91
		756	2687.5	23.64	231.21

14.2. PEAK TO AVERAGE RATIO

Peak and Average Output power measurements were made with Power Meter.

10 MHz

Mode	Test Vector file name	f (MHz)	Conducted Power (dBm)		Peak-to-average ratio (PAR)
			Peak	Average	
16QAM	DQ4_12_UQ16_12_10M	2593	31.225	23.092	8.133
QPSK	DQ64_UQ4_12_21S_10M	2593	31.028	23.327	7.701

5 MHz

Mode	Test Vector file name	f (MHz)	Conducted Power (dBm)		Peak-to-average ratio (PAR)
			Peak	Average	
16QAM	DQ4_12_UQ16_34_5M	2593	30.779	22.888	7.891
QPSK	DQ64_56_UQ4_12_5M	2593	30.744	22.983	7.761

15. SUMMARY OF TEST RESULTS

ACON antenna is used for all SAR testing with all modulation/bandwidth and test configurations. Additional SAR testing with WNC was performed at worst-case test configurations.

1) Laptop - Lap-held (16.98 cm from Tx main antenna-to-user)

Bandwidth	Mode	Test vector file name	f (MHz)	1g_SAR (mW/g)	Scale Up Factor to DL:UL Symbol ratio of 29:18	Corrected 1g_SAR (mW/g)
10MHz	16QAM	DQ4_12_UQ16_12_10M	2593	0.037	1.29	0.048

Note: 10MHz 16QAM mode was chosen based on worst-case test result in 3) Secondary landscape.

2) Tablet edge - Primary Landscape (14 cm from Tx main antenna-to-user)

Bandwidth	Mode	Test vector file name	f (MHz)	1g_SAR (mW/g)	Scale Up Factor to DL:UL Symbol ratio of 29:18	Corrected 1g_SAR (mW/g)
10MHz	16QAM	DQ4_12_UQ16_12_10M	2593	0.032	1.29	0.041

Note: 10MHz 16QAM mode was chosen based on worst-case test result in 3) Secondary landscape.

3) Tablet edge: Secondary Landscape (4.0 cm from Tx main antenna-to-user) (Worst-case test configuration)

Bandwidth	Mode	Test vector file name	f (MHz)	1g_SAR (mW/g)	Scale Up Factor to DL:UL Symbol ratio of 29:18	Corrected 1g_SAR (mW/g)
10MHz	16QAM	DQ4_12_UQ16_12_10M	2593	0.092	1.29	0.119
	QPSK	DQ64_UQ4_12_21S_10M	2593	0.064	0.8	0.051
5MHz	16QAM	DQ4_12_UQ16_34_5M	2593	0.081	0.96	0.078
	QPSK	DQ64_56_UQ4_12_5M	2593	0.063	0.97	0.061

WNC Antenna

10MHz	16QAM	DQ4_12_UQ16_12_10M	2593	0.025	1.29	0.032
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4) Tablet edge: Primary Portrait (> 20 cm from Tx antenna-to-user)

SAR is not required due to large distance (>20 cm from Tx antenna-to-user)

5) Tablet edge: Secondary Portrait (0.2 cm from Tx main antenna-to-user)

Tx disabled by software at this orientation, thus, SAR is not required.

6) Tablet bottom face (3.05 cm from Tx main antenna-to-user)

Bandwidth	Mode	Test vector file name	f (MHz)	1g_SAR (mW/g)	Scale Up Factor to DL:UL Symbol ratio of 29:18	Corrected 1g_SAR (mW/g)
10MHz	16QAM	DQ4_12_UQ16_12_10M	2593	0.028	1.29	0.037

Note: 10MHz 16QAM mode was chosen based on worst-case test result in 3) Secondary landscape.

Worst Case 16QAM 10 MHz Ch. BW SAR Plot & Data

Date/Time: 1/11/2010 7:36:41 PM

Test Laboratory: Compliance Certification Services

Tablet - Secondary landscape_10MHz

DUT: Lenovo; Type: NA; Serial: NA

Communication System: WIMAX 2.6G 10M; Frequency: 2593 MHz; Duty Cycle: 1:4.05

Medium parameters used (interpolated): $f = 2593$ MHz; $\sigma = 2.15$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(6.4, 6.4, 6.4); Calibrated: 3/23/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

10MHz_16QAM_M-ch/Area Scan (7x8x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.079 mW/g

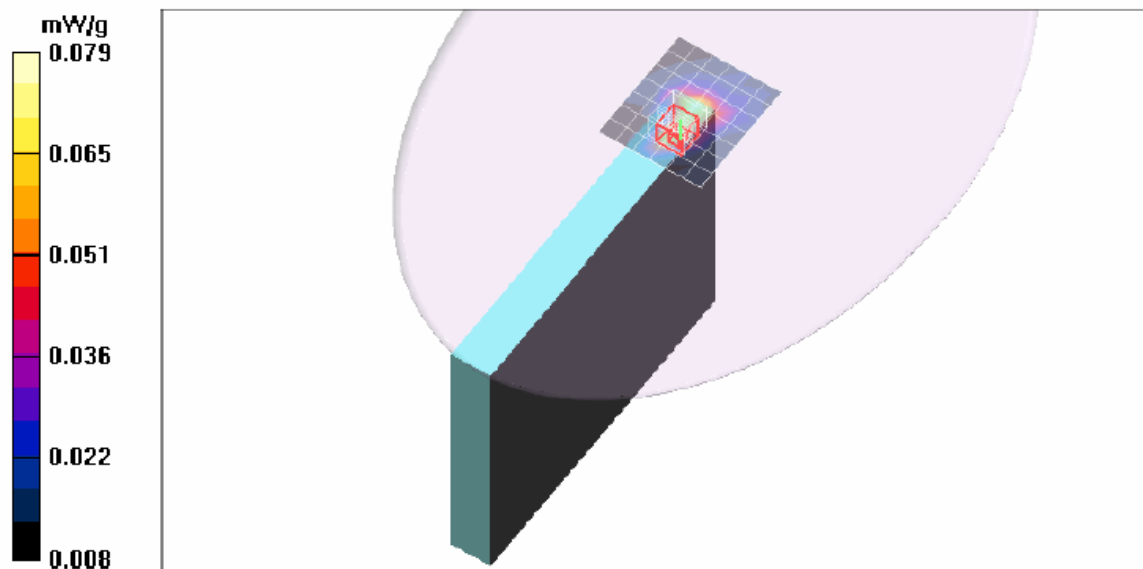
10MHz_16QAM_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Peak SAR (extrapolated) = 0.254 W/kg

SAR(1 g) = 0.092 mW/g; SAR(10 g) = 0.043 mW/g

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

Maximum value of SAR (measured) = 0.119 mW/g



16. PAR AND SAR ERROR CONSIDERATION

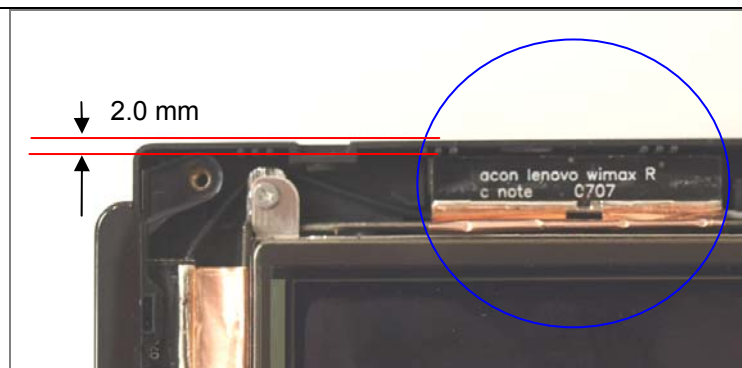
In order to estimate the measurement error due to PAR issues, the configuration with the highest SAR in each channel bandwidth and frequency band is measured at various power levels, from approximately 12.5 mW at approx. 3 dB steps, until the maximum power is reached.

Setup photo for SAR linearity measurement (secondary portrait)

For the purpose of evaluation but not consider as normal operation



Separation distance between Tx antenna-to-flat phantom (2.0mm)



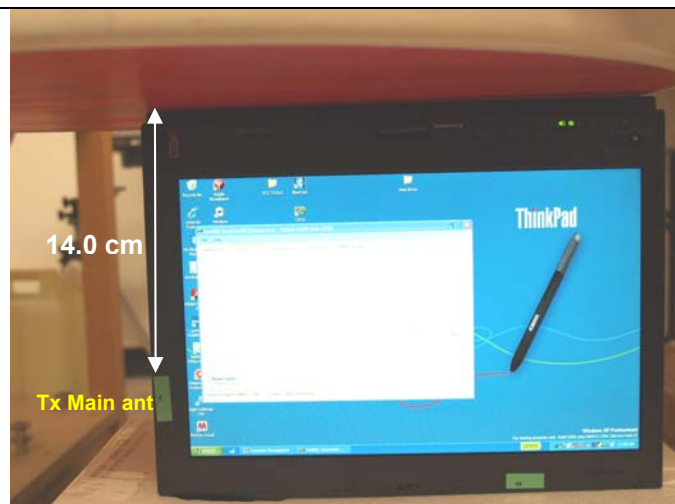
Setup Photo for SAR measurement (secondary portrait)

There is no SAR measurement for this configuration because Tx is disabled by software according to the antenna specifications (see page 25/26 of WiMax Antenna Info CL3_W pdf & page 26/27 of WiMax Antenna Info CL3_A pdf).



Setup Photo for Low SAR measurement (Primary Landscape)

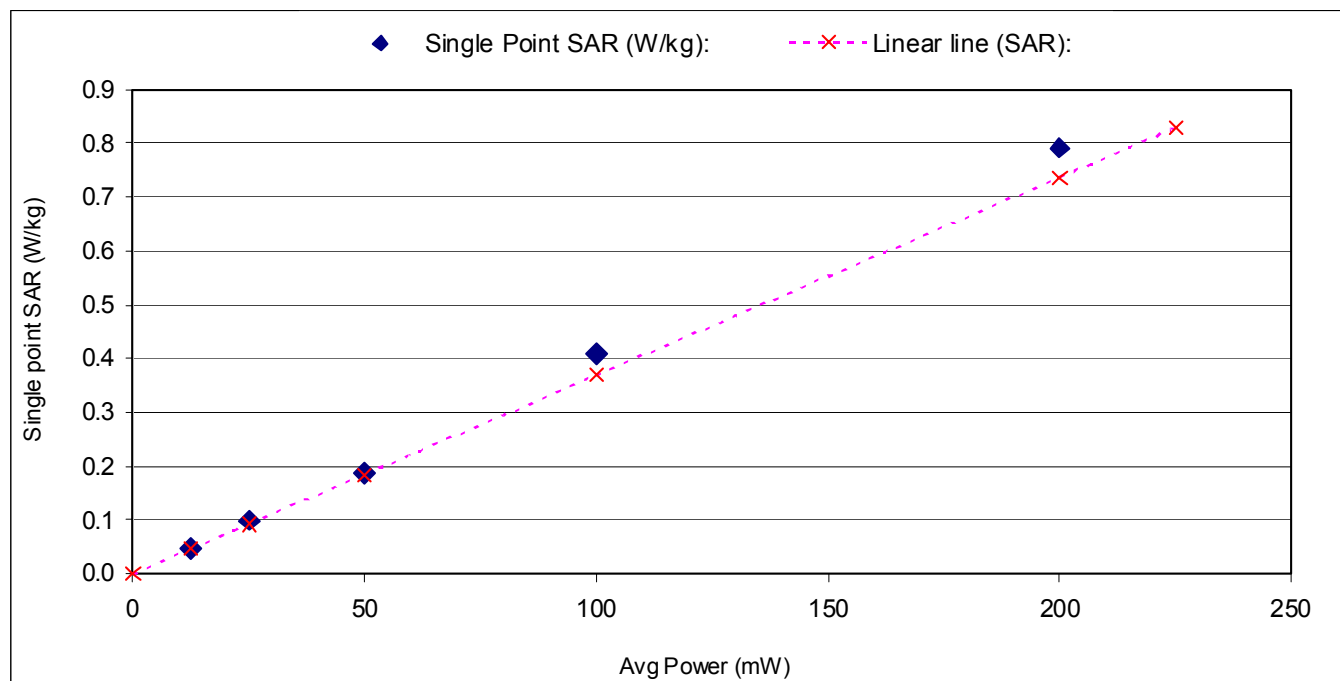
Antenna to flat phantom distance of 14cm.



Note: During the tests, the edge (Secondary Portrait) of LCD panel is positioned at 0 cm separation distance to flat phantom (for purpose of evaluation but not consider as normal operation).

10M16QAM

Average Power (mW):	12.5	25.0	50.0	100.0	200.0
Single Point SAR (W/kg):	0.046	0.099	0.187	0.408	0.791
Linear line (SAR):	0.046	0.092	0.184	0.368	0.736
Estimation (%):	0.000	7.609	1.630	10.870	7.473



Procedure:

1. Position the EUT at flat phantom with 0 cm separation distance
2. Perform single point SAR evaluation with EUT power to be tuned at 12.5 mW
3. Record the highest single point SAR value 0.046 W/kg @ 12.5 mW.
4. Without changing probe position but tune the EUT power to 25 mW (3dB step).
5. Record the highest single point SAR value 0.099 W/kg @ 25 mW - second single peak SAR
6. Repeat the step 4 and 5 to measure single peak SAR for third, fourth and fifth single peak SAR

Procedure in establishing linear line (SAR):

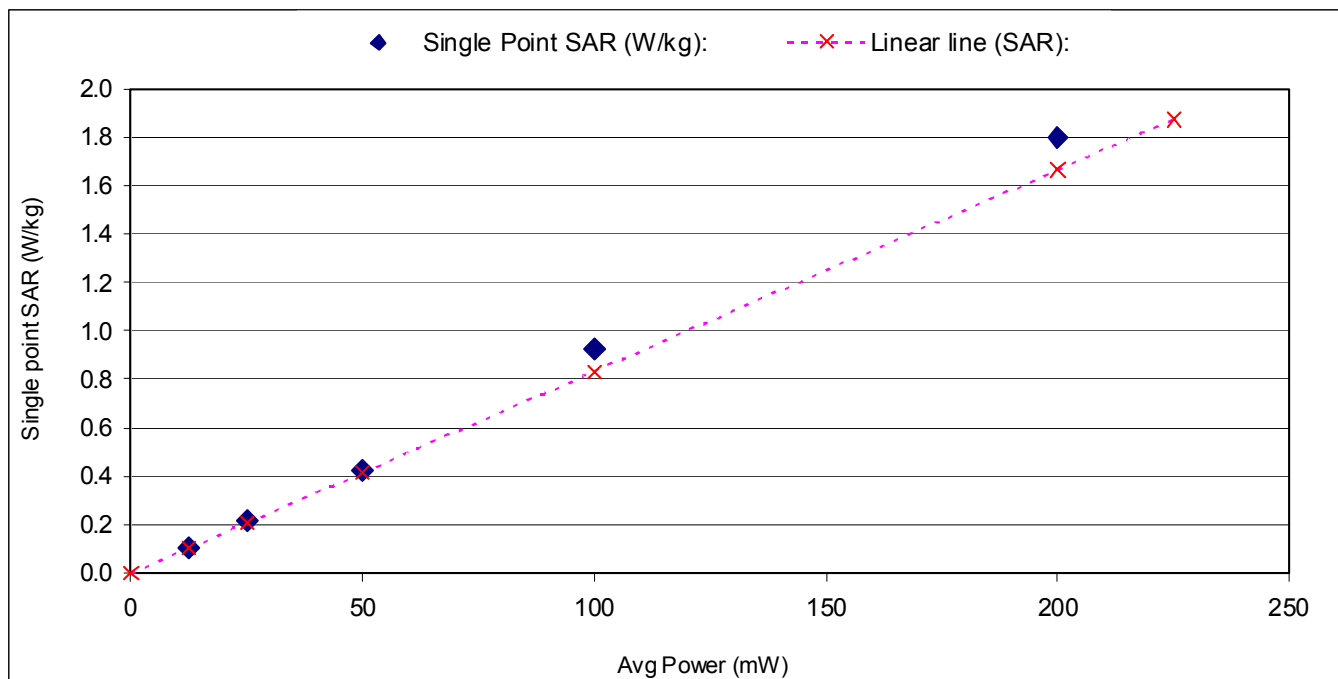
- 1) First reference Point = 0 when power = 0
- 2) Second reference Point: 0.046 W/kg @ 12.5 mW
- 3) Third reference point: $(0.046/12.5) * 25 = \underline{0.092}$ W/kg
- 4) Fourth reference point: $(0.046/12.5) * 50 = \underline{0.184}$ W/kg
- 5) Fifth h reference point: $(0.046/12.5) * 100 = \underline{0.368}$ W/kg
- 6) Sixth reference point: $(0.046/12.5) * 200 = \underline{0.736}$ W/kg

Draw a reference line from first reference point to sixth reference point.

Note: During the tests, the edge (Secondary Portrait) of LCD panel is positioned at 0 cm separation distance to flat phantom (for purpose of evaluation but not consider as normal operation).

10MQPSK

Average Power (mW):	12.5	25.0	50.0	100.0	200.0
Single Point SAR (W/kg):	0.104	0.216	0.422	0.924	1.800
Linear line (SAR):	0.104	0.208	0.416	0.832	1.664
Estimation (%):	0.000	3.846	1.442	11.058	8.173



Procedure:

1. Position the EUT at flat phantom with 0 cm separation distance
2. Perform single point SAR evaluation with EUT power to be tuned at 12.5 mW
3. Record the highest single point SAR value 0.104 W/kg @ 12.5 mW.
4. Without changing probe position but tune the EUT power to 25 mW (3dB step).
5. Record the highest single point SAR value 0.216 W/kg @ 25 mW - second single peak SAR
6. Repeat the step 4 and 5 to measure single peak SAR for third, fourth and fifth single peak SAR

Procedure in establishing linear line (SAR):

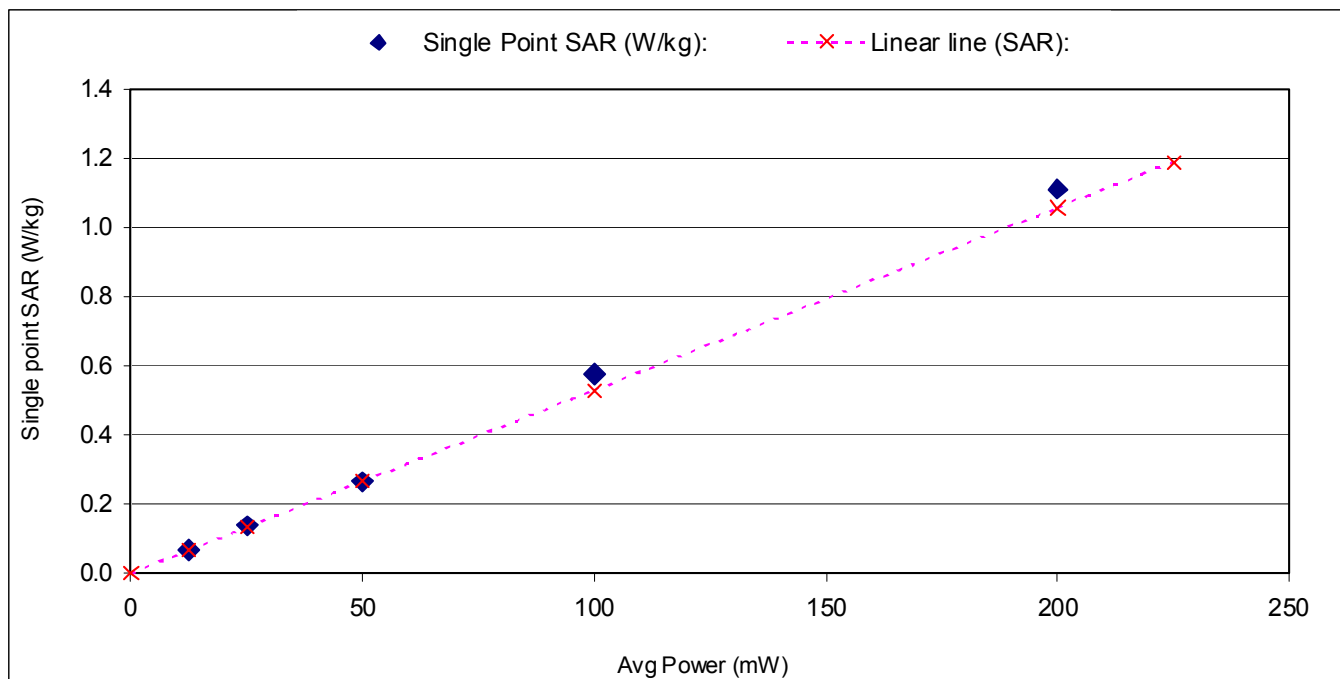
- 1) First reference Point = 0 when power = 0
- 2) Second reference Point: 0.104 W/kg @ 12.5 mW
- 3) Third reference point: $(0.104/12.5) * 25 = \underline{0.208}$ W/kg
- 4) Fourth reference point: $(0.104/12.5) * 50 = \underline{0.416}$ W/kg
- 5) Fifth h reference point: $(0.104/12.5) * 100 = \underline{0.832}$ W/kg
- 6) Sixth reference point: $(0.104/12.5) * 200 = \underline{1.664}$ W/kg

Draw a reference line from first reference point to sixth reference point.

Note: During the tests, the edge (Secondary Portrait) of LCD panel is positioned at 0 cm separation distance to flat phantom (for purpose of evaluation but not consider as normal operation).

5M16QAM

Average Power (mW):	12.5	25.0	50.0	100.0	200.0
Single Point SAR (W/kg):	0.066	0.137	0.264	0.576	1.110
Linear line (SAR):	0.066	0.132	0.264	0.528	1.056
Estimation (%):	0.000	3.788	0.000	9.091	5.114



Procedure:

1. Position the EUT at flat phantom with 0 cm separation distance
2. Perform single point SAR evaluation with EUT power to be tuned at 12.5 mW
3. Record the highest single point SAR value 0.066 W/kg @ 12.5 mW.
4. Without changing probe position but tune the EUT power to 25 mW (3dB step).
5. Record the highest single point SAR value 0.137 W/kg @ 25 mW - second single peak SAR
6. Repeat the step 4 and 5 to measure single peak SAR for third, fourth and fifth single peak SAR

Procedure in establishing linear line (SAR):

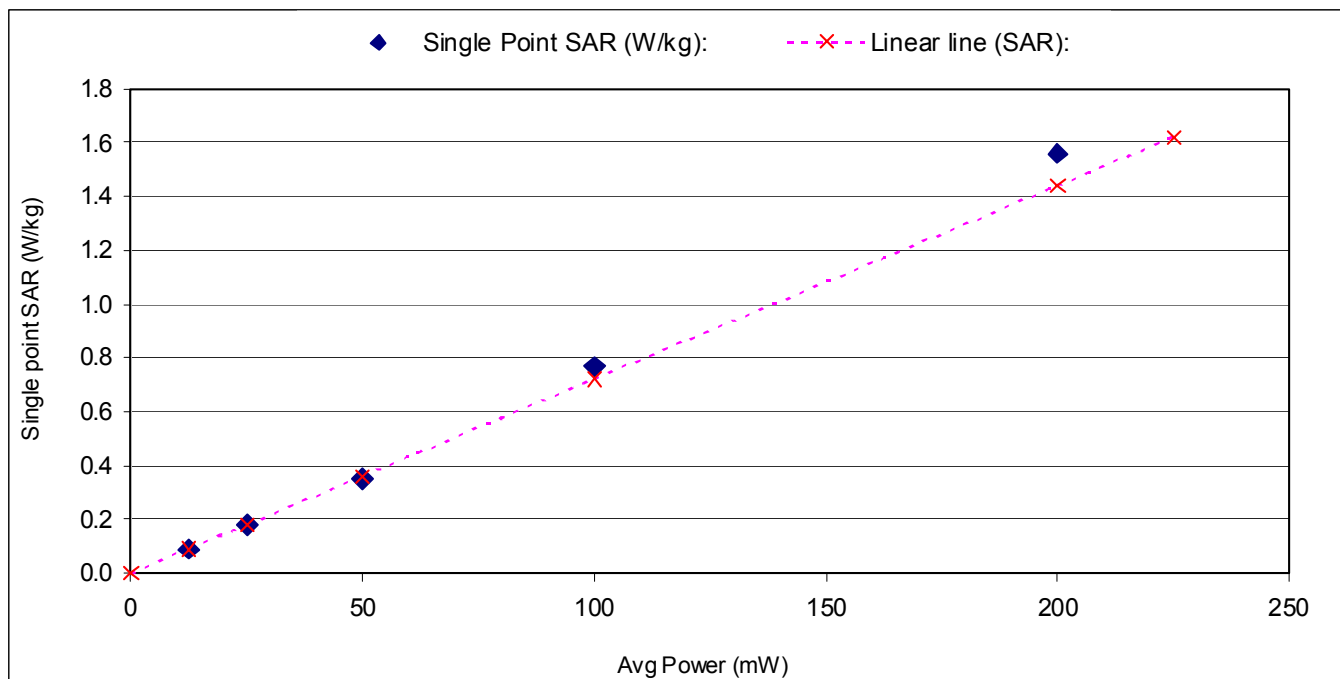
- 1) First reference Point = 0 when power = 0
- 2) Second reference Point: 0.066 W/kg @ 12.5 mW
- 3) Third reference point: $(0.066/12.5) * 25 = \underline{0.132}$ W/kg
- 4) Fourth reference point: $(0.066/12.5) * 50 = \underline{0.264}$ W/kg
- 5) Fifth h reference point: $(0.066/12.5) * 100 = \underline{0.528}$ W/kg
- 6) Sixth reference point: $(0.066/12.5) * 200 = \underline{1.056}$ W/kg

Draw a reference line from first reference point to sixth reference point.

Note: During the tests, the edge (Secondary Portrait) of LCD panel is positioned at 0 cm separation distance to flat phantom (for purpose of evaluation but not consider as normal operation).

5MQPSK

Average Power (mW):	12.5	25.0	50.0	100.0	200.0
Single Point SAR (W/kg):	0.090	0.179	0.350	0.767	1.560
Linear line (SAR):	0.090	0.180	0.360	0.720	1.440
Estimation (%):	0.000	-0.556	-2.778	6.528	8.333



Procedure:

1. Position the EUT at flat phantom with 0 cm separation distance
2. Perform single point SAR evaluation with EUT power to be tuned at 12.5 mW
3. Record the highest single point SAR value 0.090 W/kg @ 12.5 mW.
4. Without changing probe position but tune the EUT power to 25 mW (3dB step).
5. Record the highest single point SAR value 0.179 W/kg @ 25 mW - second single peak SAR
6. Repeat the step 4 and 5 to measure single peak SAR for third, fourth and fifth single peak SAR

Procedure in establishing linear line (SAR):

- 1) First reference Point = 0 when power = 0
- 2) Second reference Point: 0.090 W/kg @ 12.5 mW
- 3) Third reference point: $(0.090/12.5) * 25 = \underline{0.180}$ W/kg
- 4) Fourth reference point: $(0.090/12.5) * 50 = \underline{0.360}$ W/kg
- 5) Fifth h reference point: $(0.090/12.5) * 100 = \underline{0.720}$ W/kg
- 6) Sixth reference point: $(0.090/12.5) * 200 = \underline{1.440}$ W/kg

Draw a reference line from first reference point to sixth reference point.

17. ATTACHMENTS

<u>No.</u>	<u>Contents</u>	<u>No. of page (s)</u>
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4	Certificate of System Validation Dipole - D2600V2 - SN:1006	6