10. SAR Exposure Limits

SAR assessments have been made in line with the requirements of ANSI/IEEE C95.1-1992

Type Exposure	Limit (mW/g)	
	General Population / Uncontrolled Exposure Environment	Occupational / Controlled Exposure Environment
Spatial Average SAR (whole body)	0.08	0.4
Spatial Peak SAR (1g cube tissue for head and trunk)	1.60	8.0
Spatial Peak SAR (10g for limb)	4.0	20.0

Population/Uncontrolled Environments: are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments: are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

11. Conducted Power Measurement Results

WLAN Conducted Power

For 2.4GHz WLAN SAR testing, highest average RF output power channel for the lowest data rate for 802.11b were for SAR evaluation. 802.11g/n were not investigated since the average putput powers over all channels and data rates were not more than 0.25dB higher than the tested channel in the lowest data rate of 802.11b mode.

WIFI					
Mode	Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Conducted Average Power (dBm)	Data rate
802.11b	1	2412	18.80	16.04	1 Mbps
	6	2437	18.71	15.97	1 Mbps
	11	2462	18.85	16.07	1 Mbps
802.11g	1	2412	17.92	14.04	6 Mbps
	6	2437	17.87	13.96	6 Mbps
	11	2462	17.87	13.98	6 Mbps
802.11n(H20)	1	2412	16.65	12.70	6.5 Mbps
	6	2437	16.47	12.54	6.5 Mbps
	11	2462	16.86	12.83	6.5 Mbps
802.11n(H40)	3	2422	16.28	12.41	13.5 Mbps
	6	2437	16.12	12.27	13.5 Mbps
	9	2452	16.33	12.43	13.5 Mbps

*Note:*The output power was test all data rate and recorded worst case at recorded data rate.

WIFI-5G 802.11a				
Mode	Channel	Frequency (MHz)	Conducted power (dBm)	Data rate
U-NII-1	36	5180	19.45	6Mbps
	40	5200	19.38	6Mbps
	44	5220	19.25	6Mbps
	48	5240	19.19	6Mbps
U-NII-3	132	5660	19.42	6Mbps
	149	5745	19.34	6Mbps
	165	5825	19.58	6Mbps

WIFI-5G 802.11n(HT20)				
Mode	Channel	Frequency (MHz)	Conducted power (dBm)	Data rate
U-NII-1	36	5180	18.76	MSC0
	40	5200	18.58	MSC0
	44	5220	18.36	MSC0
	48	5240	18.25	MSC0
U-NII-3	132	5660	18.52	MSC0
	149	5745	18.16	MSC0
	165	5825	18.09	MSC0

*Note:*The output power was test all data rate and recorded worst case at recorded data rate.

Bluetooth Conducted Power

Bluetooth			
Mode	Channel	Frequency (MHz)	Conducted power (dBm)
GFSK	00	2402	3.63
	39	2441	3.12
	78	2480	2.87
π/4QPSK	00	2402	2.14
	39	2441	2.56
	78	2480	2.53
8DPSK	00	2402	1.79
	39	2441	2.12
	78	2480	2.24
BLE	0	2402	-1.78
	19	2440	-1.84
	39	2480	-1.69

Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100MHz to 6GHz at test separation distances ≦50mm are determined by:

[(max. Power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)] ≦3.0 for 1-g SAR

Band/Mode	F(GHz)	Position	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.45	Body	9.6	4	2.51	Yes

Per KDB 447498 D01, when the minimum test separation distance is <5mm, a distance of 5mm is applied to determine SAR test exclusion.

The test exclusion thereshold is ≦3, SAR testing is not required.

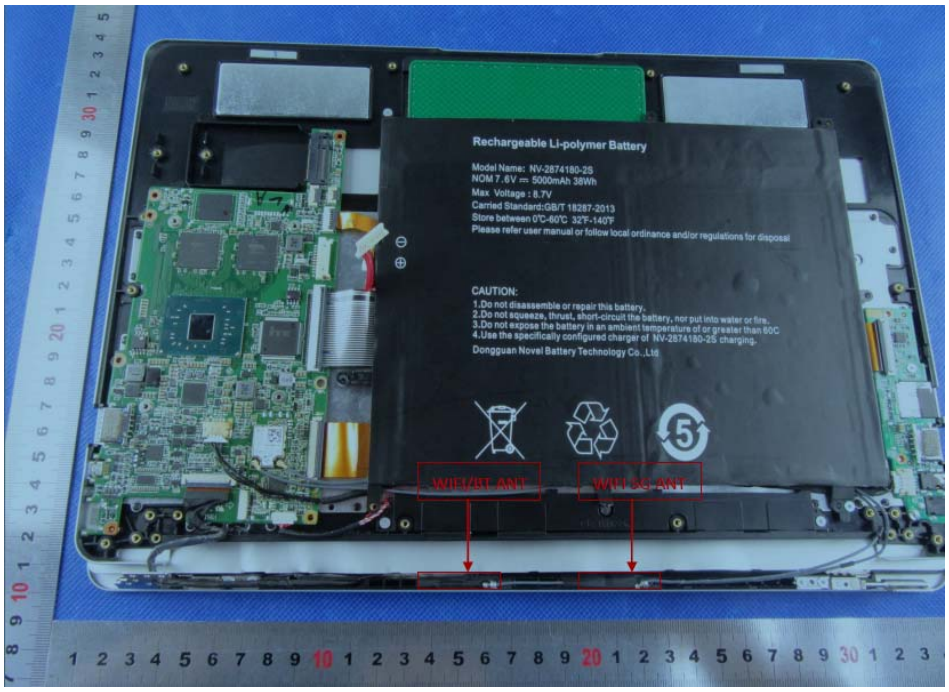
12. Maximum Tune-up Limit

2.4G WLAN		
Mode	Peak Power (dBm)	Burst Average Power (dBm)
802.11b	19.00	16.50
802.11g	18.00	14.50
802.11n(H20)	17.00	13.00
802.11n(H40)	17.00	13.00

5G WLAN		
Band	Mode	Burst Average Power (dBm)
U-NII-1	802.11a	20.00
	802.11n(H20)	19.00
U-NII-3	802.11a	20.00
	802.11n(H20)	19.00

Bluetooth			
Mode	Channel	Frequency (MHz)	Conducted power (dBm)
GFSK	00	2402	4.00
	39	2441	4.00
	78	2480	3.00
π/4QPSK	00	2402	3.00
	39	2441	3.00
	78	2480	3.00
8DPSK	00	2402	2.00
	39	2441	3.00
	78	2480	3.00
BLE	0	2402	-1.00
	19	2440	-1.00
	39	2480	-1.00

13. Antenna Location



14. SAR Measurement Results

WLAN-2.4G										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (mW/g)	Report SAR(1g) (mW/g)	Test Plot
		CH	MHz							
802.11b 1Mbps	Back	1	2412	16.04	16.50	1.11	0.07	0.638	0.71	-
		6	2437	15.97	16.50	1.13	0.10	0.617	0.70	-
		11	2462	16.07	16.50	1.11	0.03	0.656	0.73	B1

Note:
1. The value with blue color is the maximum SAR Value of each test band.
2. According to the above table, the initial test position for body is “Back”, and its reported SAR is≤ 0.4W/kg. Thus further SAR measurement is not required for the other (remaining) test positions. Because the reported SAR of the highest measured maximum output power channel for the exposureconfiguration is ≤ 0.8W/kg, no further SAR testing is required for 802.11b DSSS in that exposureconfiguration.

WLAN- Scaled Reported SAR							
Mode	Test Position	Frequency		Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
		CH	MHz				
802.11b	Back	11	2462	98.93%	100%	0.73	**0.74**

Note:
1. According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. A maximum transmission duty factor of 98.93%is achievable for WLAN in this project.

WLAN-5G										
mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Test Plot
		CH	MHz							
U-NII-1	Rear	36	5180	19.45	20.00	1.14	0.11	0.373	0.43	-
U-NII-3	Rear	165	5825	19.58	20.00	1.10	-0.03	0.418	0.46	B2

Note:
1. The value with blue color is the maximum SAR Value of each test band.
2. When there are multiple 802.11 a/g/n/ac mode configurations in a standalone or aggregate frequency band with the same specified maximum output power for the same channel bandwidth, modulation and data rate, according to largest channel bandwidth, lowest order modulation and lowest data rate selection criteria in 5.3.2, the lower order/sequence 802.11 mode (i.e. a, g, n then ac) is selected for the initial test configuration.
3. When multiple test channels have the same measured maximum output power, choose the channel closest to mid-band frequency for the initial test configuration. When two test channels have the same measured maximum output power and also with equal separation from mid-band frequency; for example, high and low channels or multiple mid-band channels, the higher frequency channel is selected.

WLAN- Scaled Reported SAR							
Mode	Test Position	Frequency		Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
		CH	MHz				
U-NII-3	Rear	165	5825	96.89%	100%	0.46	0.47

Note:
1. According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. A maximum transmission duty factor of 96.89%is achievable for WLAN in this project.

SAR Test Data Plots

Test mode:	WLAN 802.11b	Test Position:	Rear Side	Test Plot:	B1

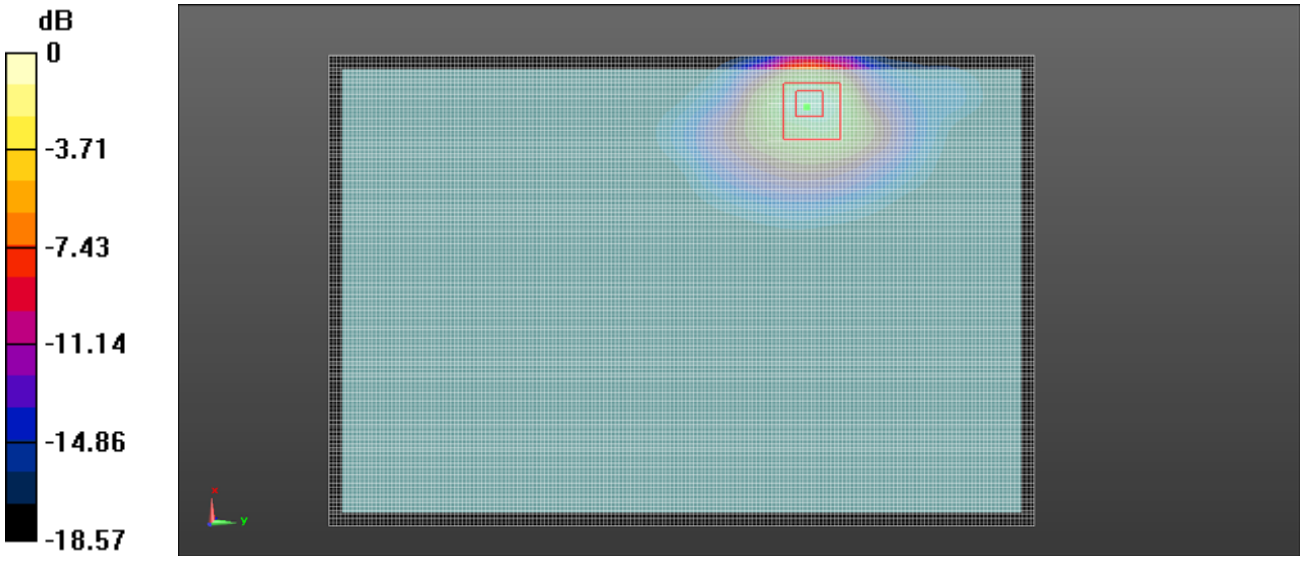
Date:2017-06-28
Communication System: Customer System; Frequency: 2462.0 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f= 2462.0 MHz; σ=1.94S/m; εr=52.53; ρ=1000 kg/m3
Phantom section : Flat Section

DASY5 Configuration:
• Probe: ES3DV3 - SN3292; ConvF(4.70,4.70,4.70); Calibrated: 02/09/2016;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 26/07/2016
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (121x181x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) =0.715 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.930 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.981 mW/g
SAR(1 g) = 0.656mW/g; SAR(10 g) = 0.337 mW/g

Maximum value of SAR (measured) = 0.721 W/kg



Rear side (WLAN 802.11b)

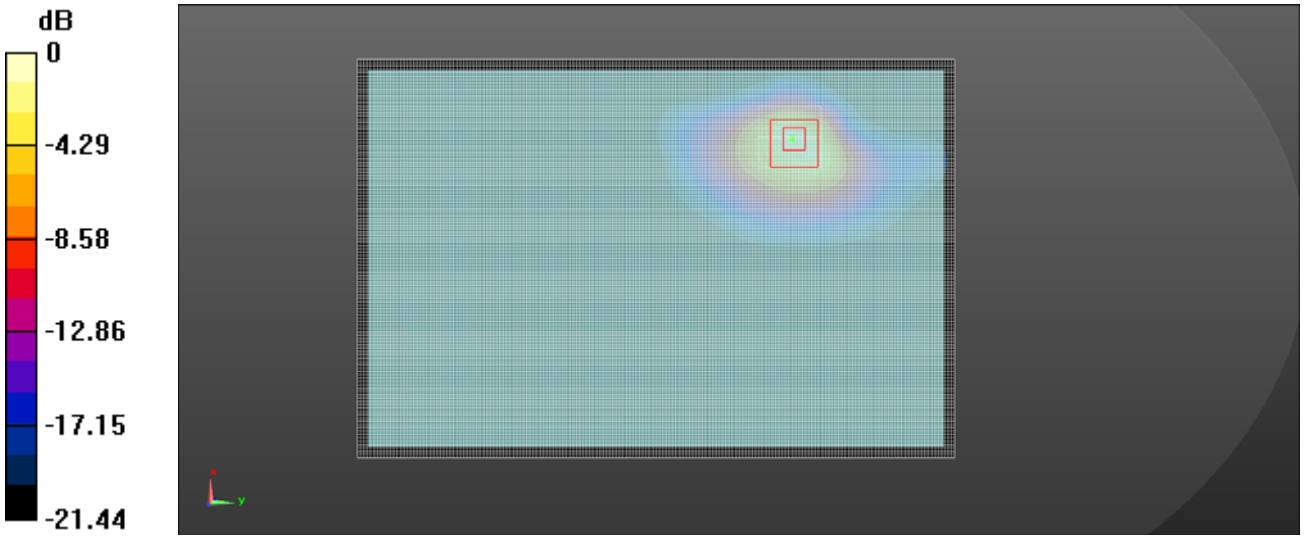
Test mode:	Wifi 802.11a	Test Position:	Rear Side	Test Plot:	B2

Date:2017-07-01
Communication System: Customer System; Frequency: 5825 MHz;Duty Cycle:1:1
Medium parameters used: f = 5825 MHz; σ =6.061 mho/m; εr = 48.87; ρ = 1000 kg/m3
Phantom section : Flat Section

DASY5 Configuration:
•Probe: EX3DV4 - SN3836; ConvF(4.30,4.30,4.30);
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 26/07/2016
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

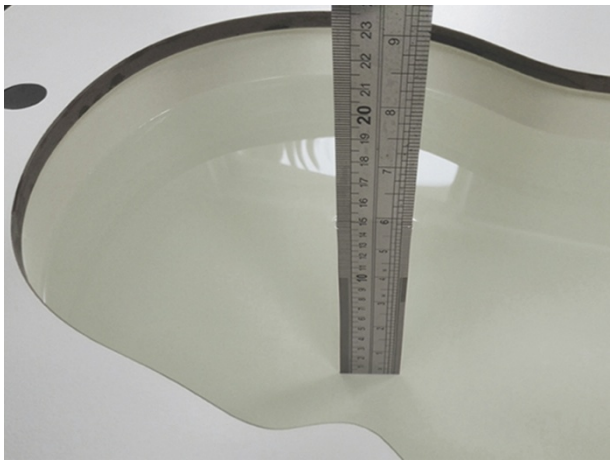
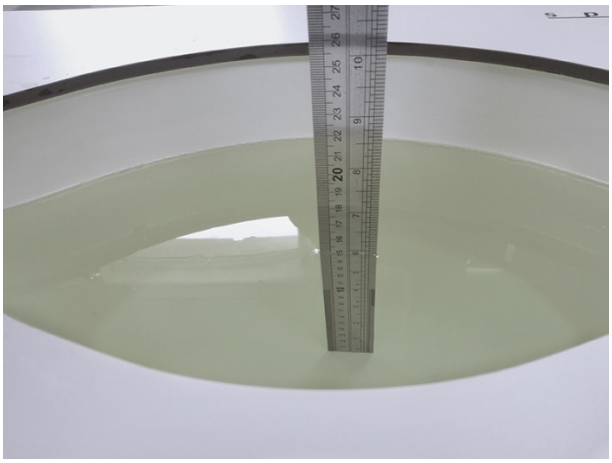
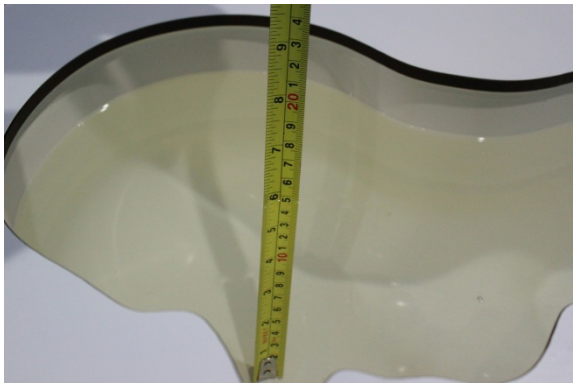
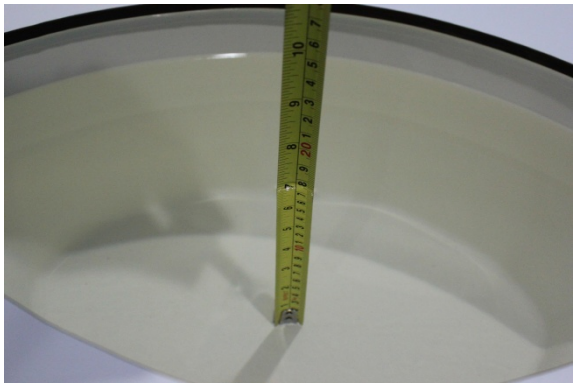
Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) =0.550W/kg

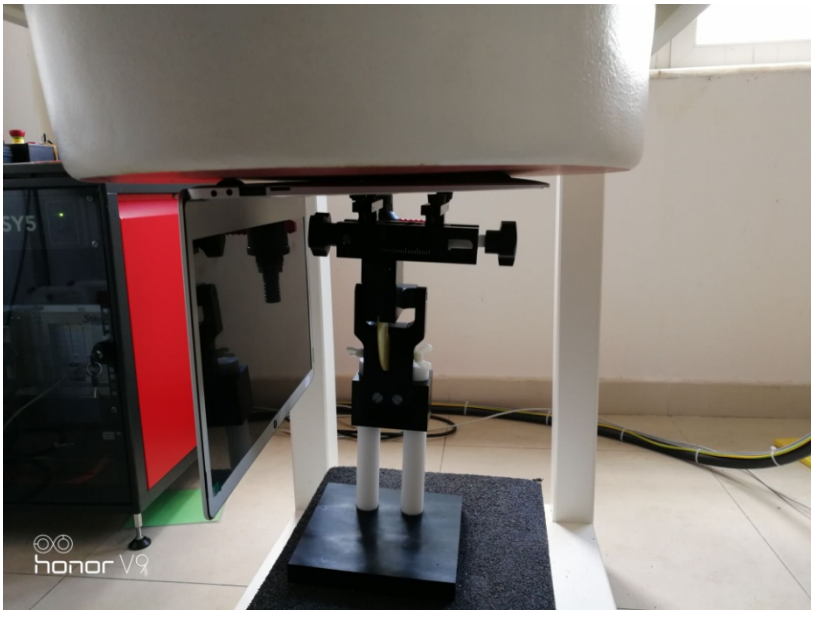
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.345 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.772 mW/g
SAR(1 g) = 0.418 mW/g; SAR(10 g) = 0.219 mW/g
Maximum value of SAR (measured) = 0.512 W/kg



Body- worn Rear side

15. TestSetup Photos

	
Liquid depth in the head phantom (2450MHz)	Liquid depth in the body phantom (2450MHz)
	
Liquid depth in the head phantom (5GHz)	Liquid depth in the body phantom (5GHz)



---------End of Report----------