Table 13.2-4: Reported SAR of initial test configuration

802.11 mode	a	n		ac		
BW(MHz)	**20**	**20**	**40**	**20**	**40**	**80**
U-NII-1	36/40/44/48 U-NII-2A exclusion applied	36/40/44/48	38/46	36/40/44/48	38/46	42
U-NII-2A	52/56/60/64 **0.11**	52/56/60/64	54/62	52/56/60/64	54/62	58
U-NII-2C	100/104/108/112/116/120/ 124/128/132/136/140 **0.17**	100/104/108/112 116/132/136/140	102/110/118/ 126/134	100/104/108/112 116/132/136/140	102/110 /134	106/ 122
U-NII-3	149/153/157/161/165 **0.09**	149/153/157/161/ 165	151/159	149/153/157/161 /165	151/159	155
U-NII-1 and U-NII-2A bands have the same specified maximum output and tolerance; SAR is measured for U-NII-2A band first. Adjusted SAR of U-NII-2A band is ≤ 1.2W/kg, SAR is not required for U-NII-1 band. Highest measured output power channel tested initially are in yellow highlight.						

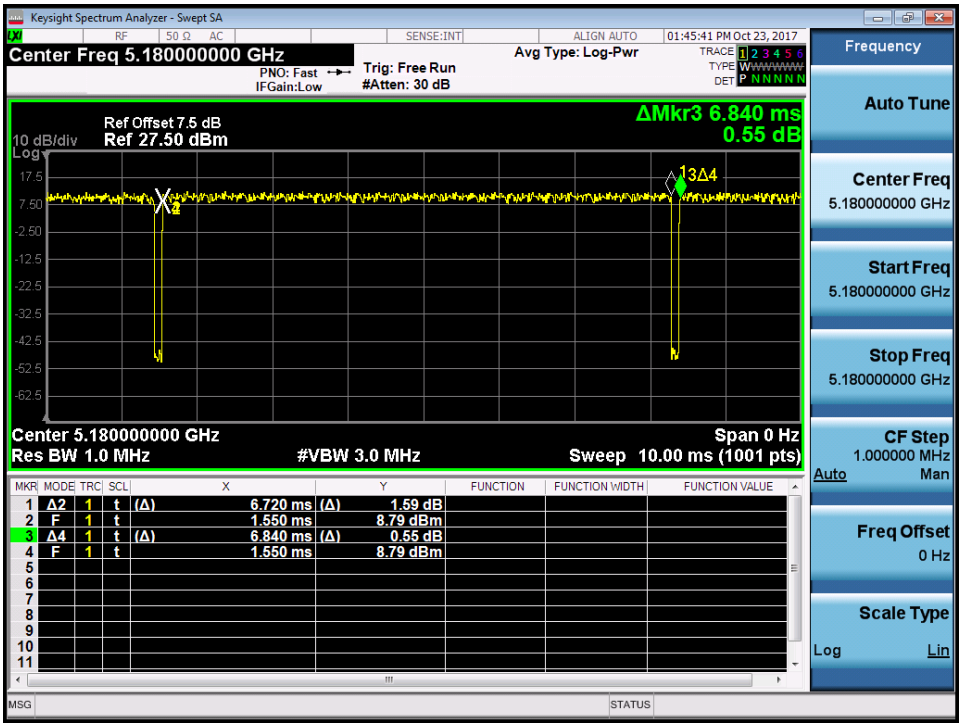
Table 13.2-5: SAR Values

Frequency		Mode	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)
MHz	Ch.								
5260	52	11a	/	19.83	21	0.033	**0.04**	0.083	**0.11**
5600	120	11a	Fig.2	21.74	23	0.043	**0.06**	0.125	**0.17**
5825	165	11a	/	21.71	23	0.026	**0.03**	0.070	**0.09**

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. The scaled reported SAR is presented as below.

Table 13.2-6: SAR Values (Scaled Reported SAR)

Frequency		Mode	Actual duty factor	maximum duty factor	Reported SAR (1g) (W/kg)	Scaled reported SAR (1g) (W/kg)
MHz	Ch.					
5600	120	11a	98.25%	100%	**0.17**	**0.17**



Picture 13.2 Duty factor plot for 5G

14 Measurement Uncertainty

14.1 Measurement Uncertainty for SAR Tests (300MHz~3GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	6.0	N	1	1	1	6.0	6.0	∞
2	Axial Isotropy	B	4.7	R	$\sqrt{3}$	0	0	0	0	∞
3	Hemispherical Isotropy	B	9.6	R	$\sqrt{3}$	1	1	5.5	5.5	∞
4	Boundary effect	B	0	R	$\sqrt{3}$	1	1	0	0	∞
5	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
6	System Detection limit	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
7	Modulation Response	B	2.4	R	$\sqrt{3}$	1	1	1.4	1.4	∞
8	Readout electronics	B	0.3	N	1	1	1	0.3	0.3	∞
9	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
10	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
11	RF Ambient Noise	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
12	RF Ambient Reflection	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Probe Positioner	B	0.02	R	$\sqrt{3}$	1	1	0	0	∞
14	Probe Positioning	B	2.9	R	$\sqrt{3}$	1	1	1.6	1.6	∞
15	Max. SAR Eval.	B	15.0	R	$\sqrt{3}$	1	1	8.7	8.7	∞
Test sample related										
16	Device Positioning	A	3.3	N	1	1	1	3.3	3.3	71
17	Device Holder	A	3.4	N	1	1	1	3.4	3.4	5
18	Power Drift	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
19	Power Scaling	B	0	R	$\sqrt{3}$	1	1	0	0	∞
Phantom and set-up										
20	Phantom uncertainty	B	6.1	R	$\sqrt{3}$	1	1	3.5	3.5	∞
21	SAR correction	B	1.9	N	1	1	0.84	1.9	1.6	∞
22	Liquid conductivity (meas.)	A	2.06	N	1	0.78	0.71	1.61	1.46	43
23	Liquid permittivity (meas.)	A	1.45	N	1	0.26	0.26	0.38	0.38	521
24	Temp. Unc. Conductivity	B	3.4	R	$\sqrt{3}$	0.78	0.71	1.5	1.4	∞
25	Temp. Unc. Permittivity	B	0.4	R	$\sqrt{3}$	0.23	0.26	0.1	0.1	∞
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{25} c_i^2 u_i^2}$						14.6	14.5	1591
Expanded uncertainty (Confidence interval of 95 %)		$u_e = 2u_c$						29.1	28.9	

14.2 Measurement Uncertainty for SAR Tests (3~6GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	6.55	N	1	1	1	6.55	6.55	∞
2	Axial Isotropy	B	4.7	R	$\sqrt{3}$	0	0	0	0	∞
3	Hemispherical Isotropy	B	9.6	R	$\sqrt{3}$	1	1	5.5	5.5	∞
4	Boundary effect	B	0	R	$\sqrt{3}$	1	1	0	0	∞
5	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
6	System Detection limit	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
7	Modulation Response	B	2.4	R	$\sqrt{3}$	1	1	1.4	1.4	∞
8	Readout electronics	B	0.3	N	1	1	1	0.3	0.3	∞
9	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
10	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
11	RF Ambient Noise	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
12	RF Ambient Reflection	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Probe Positioner	B	0.04	R	$\sqrt{3}$	1	1	0	0	∞
14	Probe Positioning	B	6.7	R	$\sqrt{3}$	1	1	3.8	3.8	∞
15	Max. SAR Eval.	B	12.0	R	$\sqrt{3}$	1	1	6.9	6.9	∞
Test sample related										
16	Device Positioning	A	3.3	N	1	1	1	3.3	3.3	71
17	Device Holder	A	3.4	N	1	1	1	3.4	3.4	5
18	Power Drift	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
19	Power Scaling	B	0	R	$\sqrt{3}$	1	1	0	0	∞
Phantom and set-up										
20	Phantom uncertainty	B	6.6	R	$\sqrt{3}$	1	1	3.8	3.8	∞
21	SAR correction	B	1.9	N	1	1	0.84	1.9	1.6	∞
22	Liquid conductivity (meas.)	A	1.59	N	1	0.78	0.71	1.24	1.13	43
23	Liquid permittivity (meas.)	A	1.6	N	1	0.26	0.26	0.42	0.42	521
24	Temp. Unc. Conductivity	B	3.4	R	$\sqrt{3}$	0.78	0.71	1.5	1.4	∞
25	Temp. Unc. Permittivity	B	0.4	R	$\sqrt{3}$	0.23	0.26	0.1	0.1	∞
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{25} c_i^2 u_i^2}$						14.3	14.2	1464
Expanded uncertainty (Confidence interval of 95 %)		$u_e = 2u_c$						28.6	28.4	

15 MAIN TEST INSTRUMENTS

Table 15.1: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	January 13, 2017	One year
02	Power meter	NRVD	102083	November 1, 2017	One year
03	Power sensor	NRV-Z5	100542		
04	Signal Generator	E4438C	MY49071430	January 13, 2017	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	E-field Probe	SPEAG EX3DV4	3617	January 23, 2017	One year
07	DAE	SPEAG DAE4	549	December 13, 2016	One year
08	Dipole Validation Kit	SPEAG D2450V2	853	July 21, 2017	One year
09	Dipole Validation Kit	SPEAG D5GHzV2	1060	July 25, 2017	One year

END OF REPORT BODY

ANNEX A Graph Results

Wifi 802.11b Channel 1

Date: 2017-12-1
Electronics: DAE4 Sn549
Medium: Head 2450 MHz
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.80 mho/m; ε_r = 40.4; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: WLan 2450 Frequency: 2412 MHz
Probe: EX3DV4– SN3617 ConvF(7.74, 7.74, 7.74)

Area Scan:
SAR(1 g) = 0.179 W/kg; SAR(10 g) = 0.094 W/kg

Zoom Scan:
SAR(1 g) = 0.205 W/kg; SAR(10 g) = 0.113 W/kg

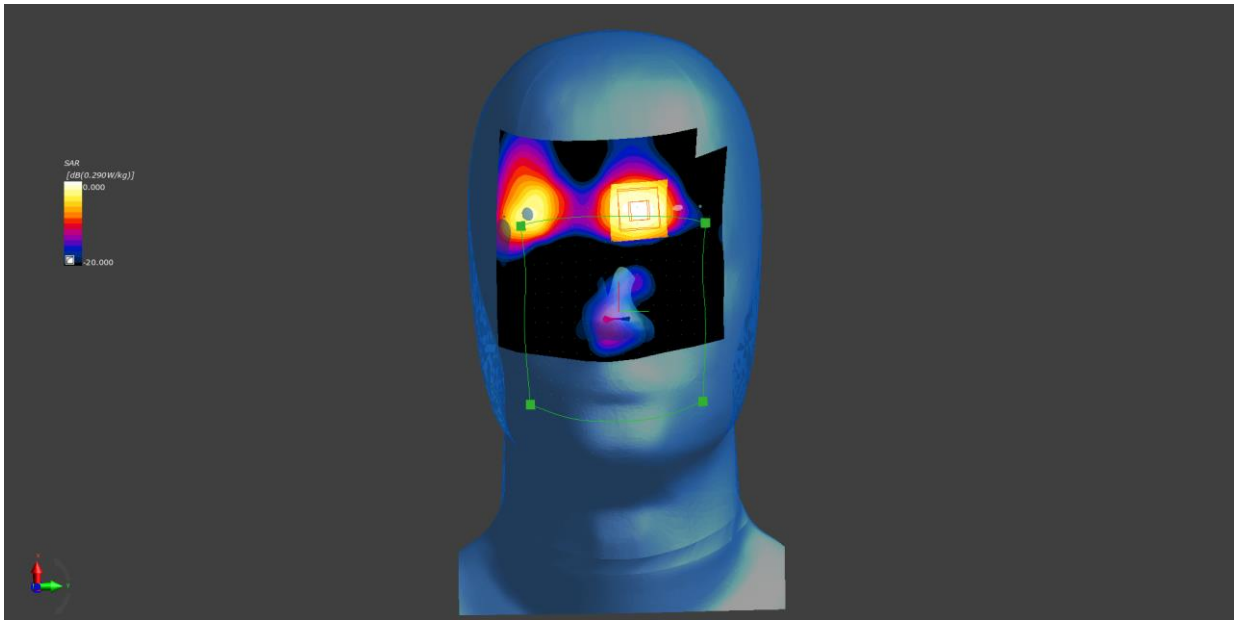


Fig.1 2450 MHz

Wifi 802.11a Channel 120

Date: 2017-12-1

Electronics: DAE4 Sn549

Medium: Head 5 GHz

Medium parameters used: f = 5600 MHz; σ = 4.98 mho/m; ε_r = 34.8; ρ = 1000 kg/m^3

Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC

Communication System: WLan 5G Frequency: 5600 MHz

Probe: EX3DV4 – SN3617 ConvF(5.08, 5.08, 5.08)

Area Scan:

SAR(1 g) = 0.135 W/kg; SAR(10 g) = 0.049 W/kg

Zoom Scan:

SAR(1 g) = 0.125 W/kg; SAR(10 g) = 0.043 W/kg

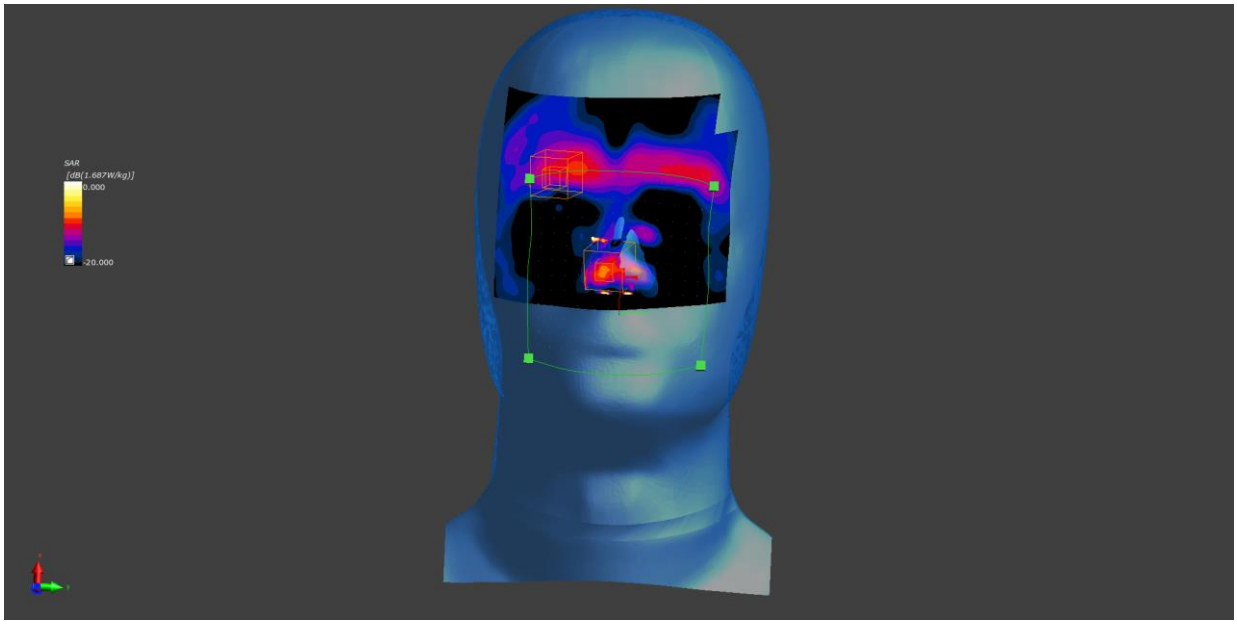


Fig.2 5GHz

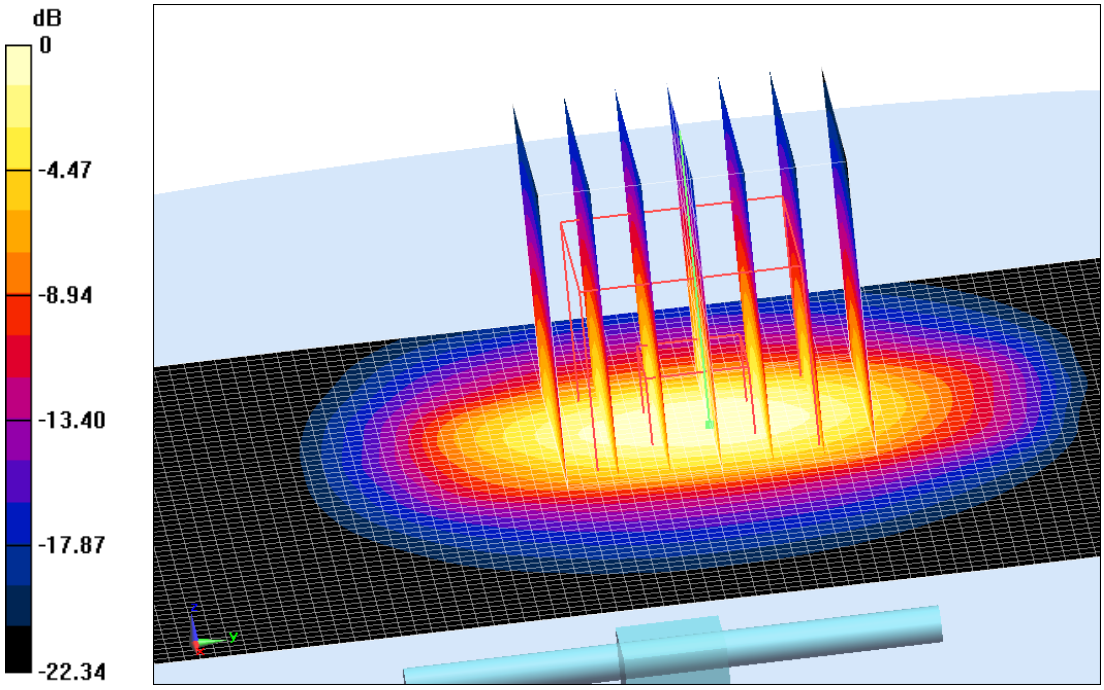
ANNEX B System Verification Results

2450MHz

Date: 2017-12-1
Electronics: DAE4 Sn549
Medium: Head 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.83 mho/m; ε_r = 40.3; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3617 ConvF(7.74, 7.74, 7.74)

System Validation /Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.8 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.66 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 27.51 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.37 W/kg
Maximum value of SAR (measured) = 16.6 W/kg



0 dB = 16.6 W/kg = 12.20 dBW/kg

Fig.B.1 validation 2450MHz 250mW