

According to FCC KDB450824, if probe used for SAR testing is >50MHz of centered frequency of Dipole antenna. The dielectric property of tissue should be evaluated to make sure that within +/- 5% tolerance of target value (in IEEE1528)

Here we checked the Body tissue on 850 MHz and 1900 MHz band, as below,

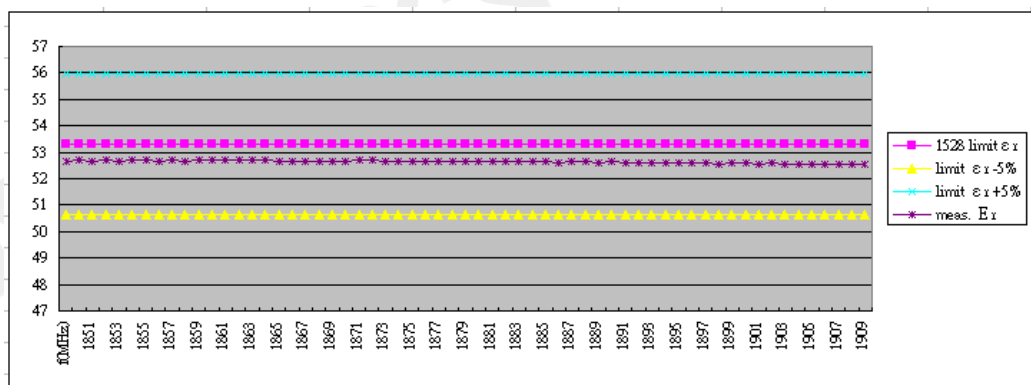
BODY (1900MHz)

Permittivity

IEEE1528 limit: 53.3

Limit +5% : 55.965

Limit-5% : 50.635

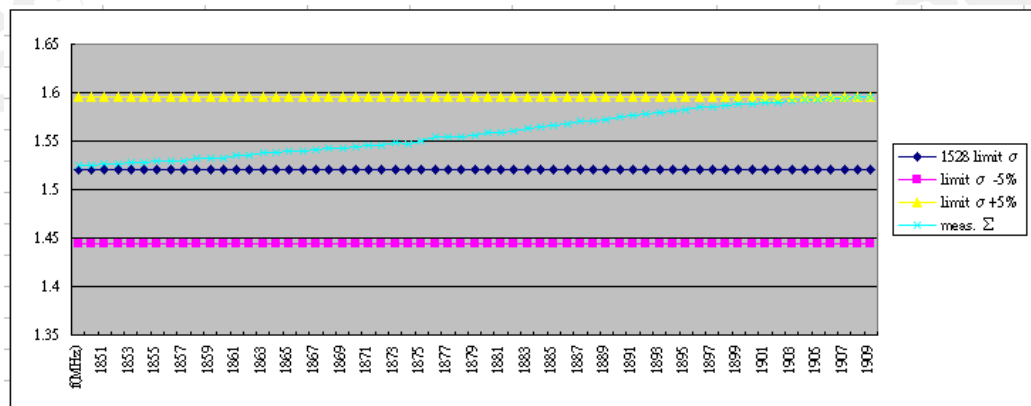


Conductivity

IEEE1528 limit: 1.52

Limit +5% : 1.596

Limit-5% : 1.444



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The graphs below show measured permittivity and conductivity values stayed within their respective tolerances of $\pm 5\%$ of target as required by KDB 450824

Then we recalculate the SAR , considering the delta value of σ (conductivity) and ϵ (permittivity)

The original testing frequency , and the SAR value is listed as below

Frequency	Channel	MHz	Conducted Output Power (Average)	Measured(W/kg) 1g
1900MHz	512	1850.2	29.33dbm	0.021
	661	1880	29.25dbm	0.017
	810	1909.8	29.22dbm	0.00876

And the liquid property (and the errors to target value) for above frequency are listed below (data from the first two pages, from real measurement of liquid)

f(MHz)	1528 limit ϵ_r	meas. ϵ_r	delta %	1528 limit σ	meas. σ	delta %
1851	53.3	52.6841	-1.12%	1.52	1.52	0.00%
1880	53.3	52.646	-1.22%	1.52	1.556	2.37%
1909	53.3	52.5533	-1.40%	1.52	1.595	4.93%

With the SAR sensitivity calculation formula

$$S(x) = \frac{dSAR/SAR}{dx/x}$$

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And the sensitivity table in IEEE1528

Parameter	ϵ	σ	ρ
$f=1900\text{ MHz, } d=10\text{ mm}$ $(\epsilon_r=40.0, \sigma=1.40\text{ S/m})$			
SAR Peak	- 0.73	+ 0.93	-
SAR 1 g	- 0.53	+ 0.51	0.14
SAR 10 g	- 0.39	+ 0.22	0.24

$$dSAR = SAR * \{[\text{sensitivity}(\text{permittivity}) * (dx/x(\text{permittivity}))] + [\text{sensitivity}(\text{conductivity}) * (dx/x(\text{conductivity}))]\}$$

We've got the table below.

re-calculated SAR	Freq.(Mhz)	Orig. SAR	dSAR	per. Sens.	dx/x per.	cond. Sens.	dx/x cond.
0.021124656	1851.25	0.021	0.000125	-0.53	-1.12%	0.51	0.00%
0.017315401	1880	0.017	0.000315	-0.53	-1.22%	0.51	2.37%
0.009045252	1908.75	0.00876	0.000285	-0.53	-1.40%	0.51	4.93%

So, we've got the new SAR value corrected by liquid property.

As shown below.

Frequency	Channel	MHz	Conducted Output Power (Average)	Measured(W/kg) 1g	Corrected SAR (W/kg) 1g
1900MHz	25	1851.25	24.63dbm	0.021	0.021124656
	600	1880	24.59dbm	0.017	0.017315401
	1175	1908.75	24.52dbm	0.00876	0.009045252

End of Analysis

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