

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 850Mhz and 1900 Mhz band, as below,

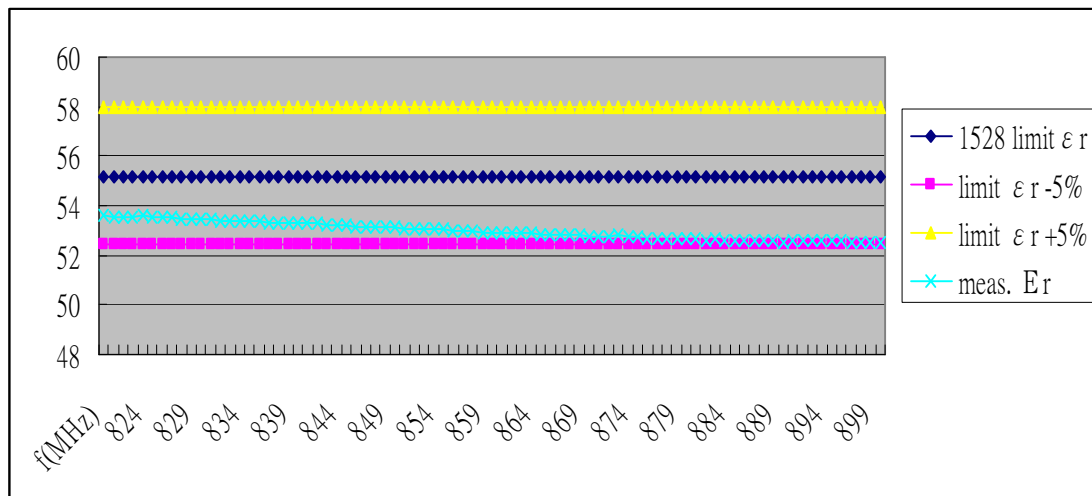
## BODY (835MHz)

### Permittivity

**IEEE1528 limit: 55.2**

**Limit +5% : 57.96**

**Limit-5% : 52.44**

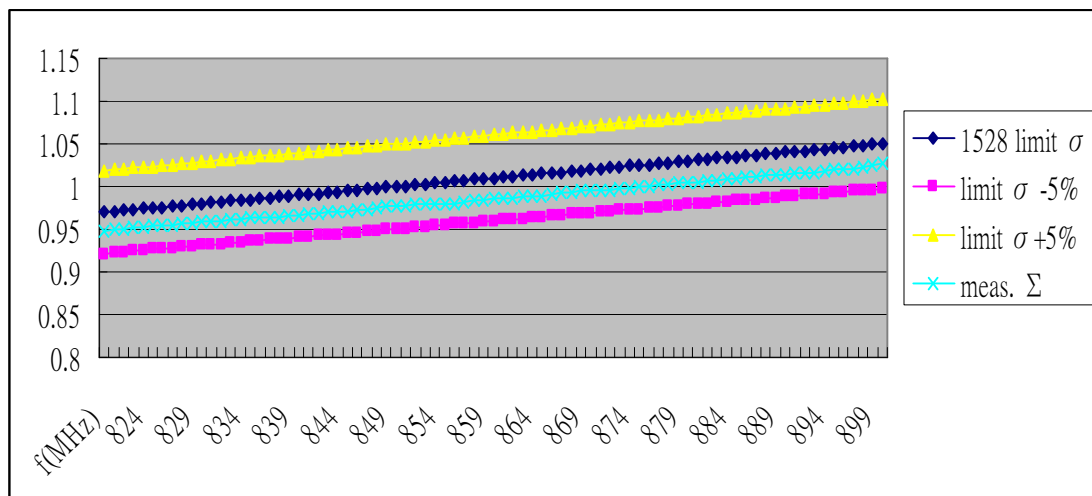


### Conductivity

**IEEE1528 limit: 0.97 at 835Mhz , 1.05 at 900Mhz**

**Limit +5% : 1.0185 at 835Mhz , 1.1025 at 900Mhz**

**Limit-5% : 0.9215 at 835Mhz, 0.9975 at 900Mhz**



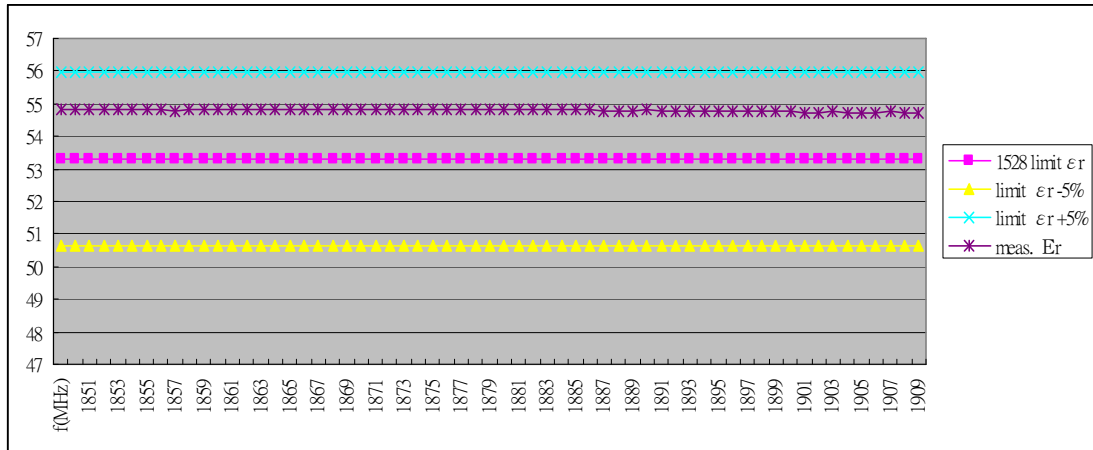
# BODY (1900MHz)

## Permittivity

IEEE1528 limit: 53.3

Limit +5% : 55.965

Limit-5% : 50.635

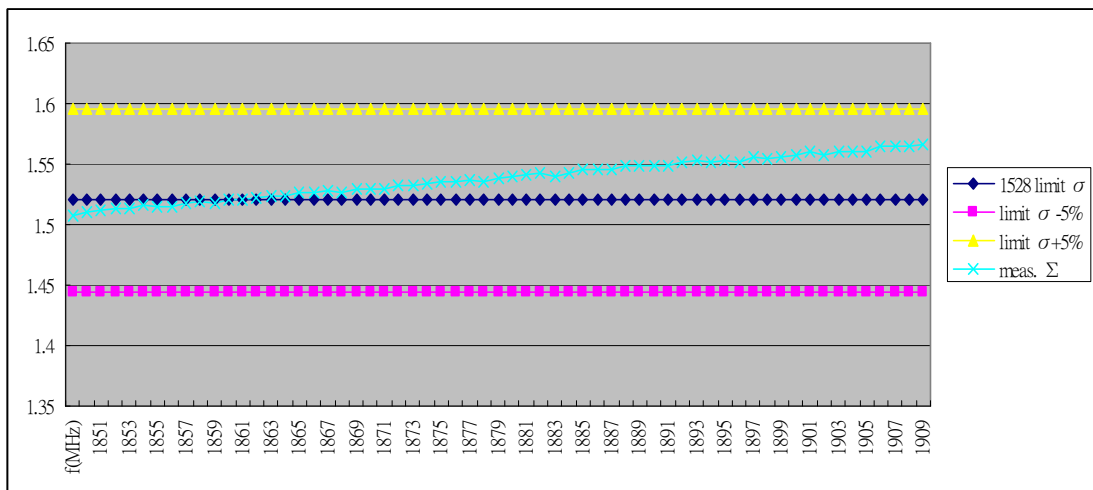


## Conductivity

IEEE1528 limit: 1.52

Limit +5% : 1.596

Limit-5% : 1.444



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  $\sigma$  (conductivity) and  $\epsilon$  (permittivity)

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

Frequency	Channel	MHz	Conducted Output Power (Average)	Measured(W/kg) 1g
850MHz	128	824.2	24.78dbm	0.027
	190	836.6	24.88dbm	0.033
	251	848.8	24.68dbm	0.046

Frequency	Channel	MHz	Conducted Output Power (Average)	Measured(W/kg) 1g
1900MHz	25	1851.25	24.63dbm	0.057
	600	1880	24.59dbm	0.068
	1175	1908.75	24.52dbm	0.061

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 $\epsilon_r$	meas. $\epsilon_r$	delta %	1528 limit $\sigma$	meas. $\sigma$	delta %
824	55.2	53.59549	-2.91%	0.97	0.9525	-1.80%
837	55.2	53.33249	-3.38%	0.97	0.9637	-0.65%
849	55.2	53.12009	-3.77%	0.97	0.9763	0.65%

f(MHz)	1528 limit $\epsilon_r$	meas. $\epsilon_r$	delta %	1528 limit $\sigma$	meas. $\sigma$	delta %
1851	53.3	54.8281	2.87%	1.52	1.51	-0.66%
1880	53.3	54.801	2.82%	1.52	1.538	1.18%
1909	53.3	54.7262	2.68%	1.52	1.564	2.89%

With the SAR sensitivity calculation formula

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

And the sensitivity table in IEEE1528

Parameter	$\epsilon$	$\sigma$	$\rho$
<b>f=800 MHz, d=15 mm</b>			
<b>(<math>\epsilon_r=41.5</math>, <math>\sigma=0.90</math> S/m)</b>			
SAR Peak	- 0.70	+ 0.86	-
SAR 1 g	- 0.57	+ 0.59	0.10
SAR 10 g	- 0.45	+ 0.35	0.18
<b>f=1900 MHz, d=10 mm</b>			
<b>(<math>\epsilon_r=40.0</math>, <math>\sigma=1.40</math> S/m)</b>			
SAR Peak	- 0.73	+ 0.93	-
SAR 1 g	- 0.53	+ 0.51	0.14
SAR 10 g	- 0.39	+ 0.22	0.24

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

We got the table below.

re-calculated SAR	Freq.(Mhz)	Orig. SAR	dSAR	per. Sens.	dx/x per.	cond. Sens.	dx/x cond.
0.027161	824.2	0.027	0.000161	-0.57	-2.91%	0.59	-1.80%
0.033509	836.6	0.033	0.000509	-0.57	-3.38%	0.59	-0.65%
0.047165	848.8	0.046	0.001165	-0.57	-3.77%	0.59	0.65%
0.055941	1851.25	0.057	-0.001059	-0.53	2.87%	0.51	-0.66%
0.067393	1880	0.068	-0.000607	-0.53	2.82%	0.51	1.18%
0.061033	1908.75	0.061	0.000033	-0.53	2.68%	0.51	2.89%

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

As below.

Frequency	Channel	MHz	Conducted Output Power (Average)	Measured(W/kg) 1g	Corrected SAR (W/kg) 1g
850MHz	128	824.2	24.78dbm	0.027	0.027161
	190	836.6	24.88dbm	0.033	0.033509
	251	848.8	24.68dbm	0.046	0.047165

Frequency	Channel	MHz	Conducted Output Power (Average)	Measured(W/kg) 1g	Corrected SAR (W/kg) 1g
1900MHz	25	1851.25	24.63dbm	0.057	0.055941
	600	1880	24.59dbm	0.068	0.067393
	1175	1908.75	24.52dbm	0.061	0.061033

End of Analysis.