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## MCL-T Broadband Tissue Equivalent Liquid: 30 MHz to 6 GHz

The MCL-T broadband test liquid matches the electrical properties of human tissues in the frequency range 30 MHz to 6 GHz. It is intended to be used for SAR testing or in radio radiation pattern testing phantoms. The formulation has been developed and optimised in parallel with the preparation of IEC62209-2. The dielectric properties meet the requirements of IEC62209-1, EN62209:2006, and IEEE1528-2003 over the frequency range 300 MHz to 3 GHz and IEC29906-2:2007 in the range 30 MHz to 6 GHz.

The physical and dielectric properties of this liquid, as well as the material safety data sheet, are presented below.

For specific technical and sales enquiries, please contact us

### Physical and chemical properties

The general physical and chemical properties of the active component of the BBL are as follows:

Appearance	Viscous liquid
Flash Point	160°C
Pour Point	-5.0°C
Active content	100% mass
PH. 10% sol.	8.3
Solubility in water	dispersible
Colour	Red-Brown
Viscosity	15.0 cSt
Density	0.94 kg m <sup>-3</sup>

### Dielectric Properties at 20°C

*(Representative batch)*

The relative permittivity and conductivity (in S/m) at 20°C are presented (Table 1 and Figure 1) at spot frequencies between 30 MHz and 6 GHz and compared to the target values specified in the following standards:

- IEC 62209-2. Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - human models, instrumentation, and procedures. Part 2: procedure to determine the specific absorption rate (SAR) in the head and body for 30 MHz to 6 GHz handheld and body-mounted devices used in close proximity to the body.
- IEC 62209-1: 2005. Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - human models, instrumentation, and procedures. Part 1: procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range 300 MHz to 3 GHz)

- CENELEC, EN 62209:2006. Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures. Part 1: procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range 300 MHz to 3 GHz)
- IEEE Std 1528T-2003. Recommended practice for determining the peak spatial- average specific absorption rate (SAR) in the human head from wireless communications devices: measurement techniques.

**Note:** IEC 62209-1, EN 62209:2006 and IEEE 1528:2003 cover the range 300 MHz to 3 GHz and allow 5% deviation from the target, IEC 62209-2 extends to 6 GHz and allows 10% deviation.

**Table 1. The dielectric properties of MCL-T BBL at 20°C compared to the corresponding target values**

Frequency (MHz)	Measured values at 20°C		Current target [1-3 and 6]		Difference %	
	Relative permittivity, $\epsilon_r$	Conductivity, $\sigma$ (S/m)	Relative permittivity, $\epsilon_r$	Conductivity, $\sigma$ (S/m)	$\delta\epsilon$	$\delta\sigma$
30*	54.7	0.78	55.0	0.75	0.5	-4.0
150**	46.7	0.79	52.3	0.76	10.8	-3.9
300**	45.1	0.83	45.3	0.87	0.6	4.6
450	42.3	0.84	43.5	0.87	2.8	3.4
835	40.6	0.96	41.5	0.90	2.2	-6.7
900	40.6	0.98	41.5	0.97	2.2	-1.0
1450	40.2	1.19	40.5	1.20	0.7	0.8
1800	38.9	1.42	40.0	1.40	2.8	-1.4
1900	38.8	1.46	40.0	1.40	3.0	-4.3
1950	38.7	1.49	40.0	1.40	3.2	-6.4
2000	38.7	1.52	40.0	1.40	3.2	-8.6
2100	38.6	1.60	39.8	1.49	3.0	-7.4
2450	37.9	1.83	39.2	1.80	3.3	-1.7
3000	37.3	2.27	38.5	2.40	3.1	5.4
4000	35.8	3.18	37.4	3.43	4.3	7.3
5000	34.0	4.29	36.2	4.45	6.1	3.6
5200	33.7	4.51	36.0	4.65	6.4	3.0
5400	33.3	4.73	35.8	4.86	7.0	2.7
5600	32.9	4.97	35.5	5.06	7.3	1.8
5800	32.5	5.21	35.4	5.27	8.2	1.1
6000	32.2	5.44	35.1	5.48	8.3	0.7

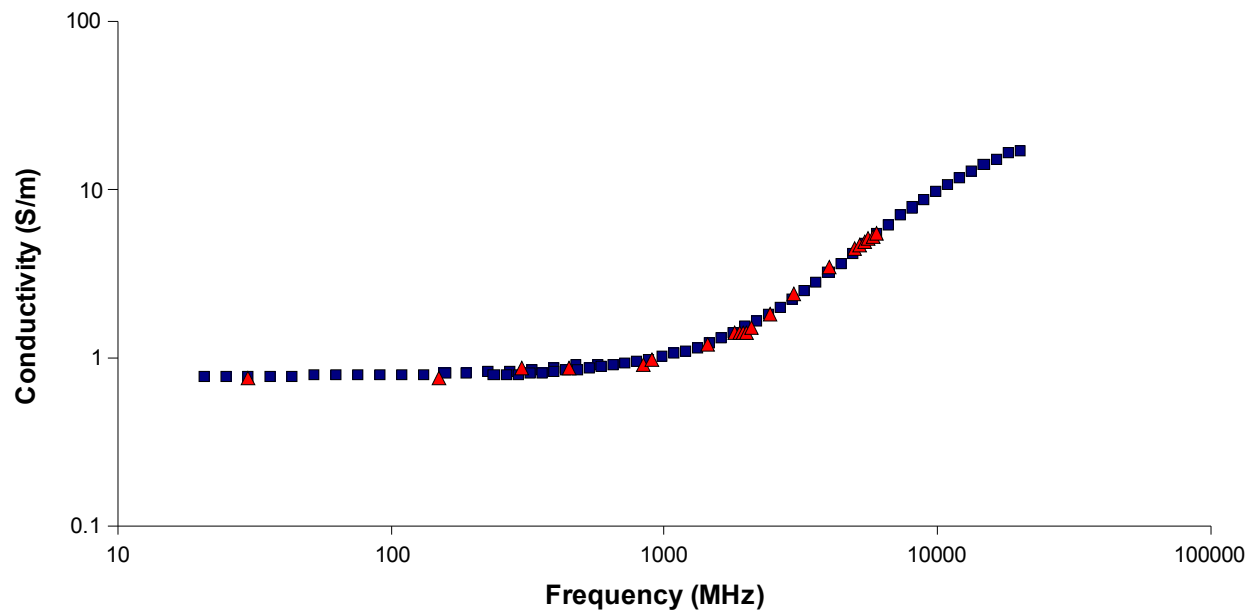
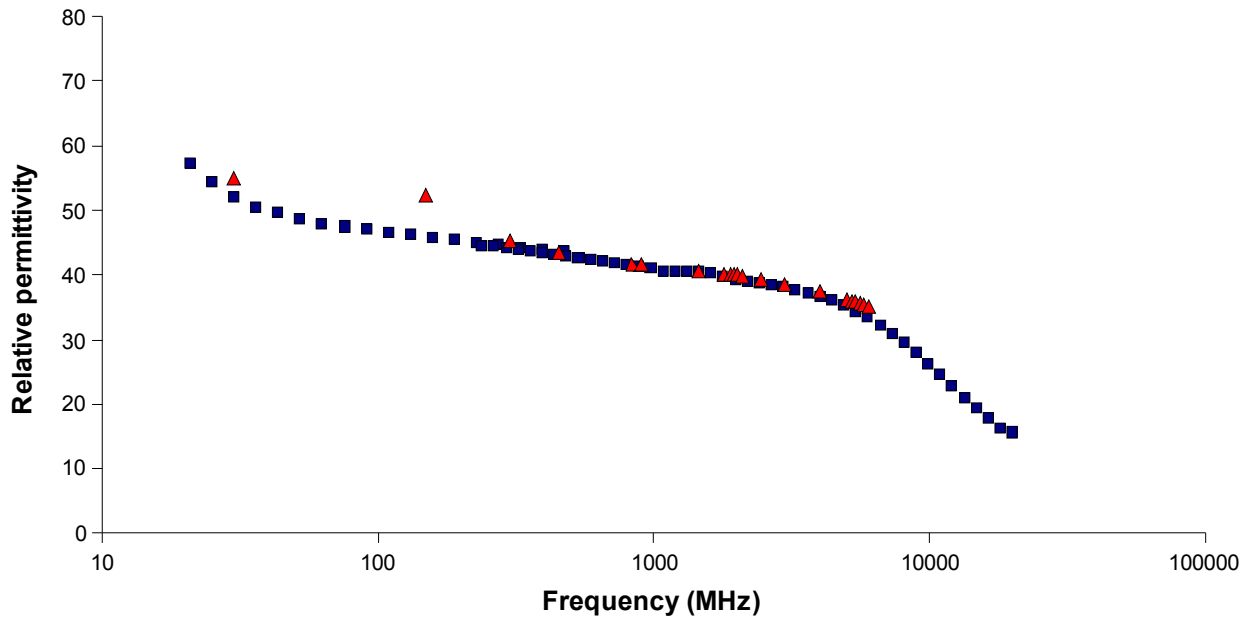


Figure 1. Dielectric spectrum of the BBL at 20°C (blue) and target values (red)

# Material safety data sheet

## 1. COMPOSITION / INFORMATION ON INGREDIENTS

<b>Identity</b>	MCL-T Broadband Liquid
<b>Chemical family</b>	Industrial oils
<b>Classification</b>	No classification needed according to 67/548/EC and 1999/45/EC
<b>Human health</b>	Inhalation of vapours and/or mists may irritate respiratory tract. Prolonged skin contact will cause defatting and possible irritation. Eye contact may cause Irritation
<b>Environment</b>	Slow rate of biodegradation. Risk for contamination of earth.
<b>Physical / Chemical hazard</b>	At elevated Temperatures, flammable vapours and decomposition products will be released. Spillage on floors will cause slippery surface

## 2. FIRST AID MEASURES

<b>Eyes</b>	Rinse the eye with water immediately. Continue to rinse for at least 15 min and get medical attention
<b>Skin</b>	Immediately remove contaminated clothing. Wash skin thoroughly with soap and water. Get medical attention if irritation persists after washing.
<b>Ingestion</b>	Do not induce vomiting. Drink plenty of water. Get medical attention if any discomfort continues.
<b>Inhalation</b>	Provide rest, warmth and fresh air. Get medical attention if any discomfort continues.
<b>General</b>	Get medical attention if any discomfort continues

## 3. FIRE-FIGHTING MEASURES

<b>Extinguishing media</b>	Water spray, fog or mist, powder, foam or CO <sub>2</sub> .
<b>Special fire fighting precautions</b>	Avoid breathing fire vapours. Avoid water in straight hose stream; will scatter and spread fire
<b>Unusual fire and explosion hazards</b>	May form explosive or toxic mixtures with air
<b>Combustion Products</b>	Toxic fumes may be evolved on burning or exposed to heat. See stability and reactivity

## 4. HANDLING AND STORAGE

<b>Usage precautions</b>	Keep containers closed when not in use. Avoid spilling, skin and eye contact. Wear recommended personal protection equipment.
<b>Storage precautions</b>	Do not expose to extreme temperatures. Keep at 5-35°C

## 5. EXPOSURE CONTROLS / PERSONAL PROTECTION

<b>Protective equipment</b>	Eye goggles , protective gloves
<b>Process conditions</b>	Provide eye wash station
<b>Ventilation</b>	Provide adequate general and local exhaust ventilation
<b>Respirators</b>	Respiratory protection must be used if air concentration exceeds acceptable level
<b>Protective gloves</b>	Chemical resistant gloves required for prolonged or repeated contact. Use protective gloves made of nitrile or butyl rubber
<b>Eye protection</b>	Wear splash proof eye goggles to prevent any possibility of eye contact.
<b>Hygienic work practices</b>	Do not smoke in work area. Wash at the end of each work shift and before eating, smoking and using toilet

## 6. TOXICOLOGICAL INFORMATION

<b>Eyes</b>	Spray and vapour in the eyes may cause irritation and smarting.
<b>Skin</b>	Prolonged or repeated contact leads to drying of skin. May cause defatting of the skin, but is not an irritant
<b>Ingestion</b>	May cause discomfort if swallowed.
<b>Inhalation</b>	At normal ambient temperatures this product will be unlikely to present an inhalation hazard because of its low volatility. May be harmful by inhalation if exposure to vapour, mists or fumes resulting from thermal decomposition products occurs.