Head Tissue Simulating Liquids

Head Tissue	Parameters according to IEEE Std 1528-2013 / IEC 62209 / FCC KDB 865664 D01		
Narrow-Band Solutions (±5% tolerance)	**Product**	**Test Frequency (MHz)**	**Main Ingredients**
	HSL300V2	300	Water, Sugar
	HSL450V2	450	Water, Sugar
	HSL750V2	750	Water, Sugar
	HSL900V2	835, 900	Water, Sugar
	HSL1450V2	1450, 1500, 1640	Water, DGBE
	HSL1750V2	1750	Water, DGBE
	HSL1800V2	1800, 1900	Water, DGBE
	HSL1900V2	1900	Water, DGBE
	HSL1950V2	1950, 2000	Water, DGBE
	HSL2450V2	2450, 2600	Water, DGBE
Broad-Band Solutions (±5% tolerance)	**Product**	**Test Frequency (MHz)**	**Main Ingredients**
	HBBL30-250V3	30-250	Water, Tween
	HBBL1350-1850V3	1400-1800	Water, Tween
	HBBL1550-1950V3	1750-1900	Water, Tween
	HBBL1900-3800V3	1950-3000	Water, Tween
	HBBL3500-5800V5	3500-5800	Water, Oil

Body Tissue Simulating Liquids

Body Tissue (Muscle)	Parameters according to FCC KDB 865664 D01		
Narrow-Band Solutions (±5% tolerance)	**Product**	**Test Frequency (MHz)**	**Main Ingredients**
	MSL300V2	300	Water, Sugar
	MSL450V2	400, 450	Water, Sugar
	MSL750V2	750	Water, Sugar
	MSL900V2	835, 900	Water, Sugar
	MSL1450V2	1450, 1500, 1640	Water, DGBE
	MSL1750V2	1750	Water, DGBE
	MSL1800V2	1800, 1900	Water, DGBE
	MSL1900V2	1900	Water, DGBE
	MSL1950V2	1950, 2100	Water, DGBE
	MSL2450V2	2450, 2600	Water, DGBE
Broad-Band Solutions (±5% tolerance)	**Product**	**Test Frequency (MHz)**	**Main Ingredients**
	MBBL130-250V3	130-250	Water, Tween
	MBBL1350-1850V3	1350-1800	Water, Tween
	MBBL1550-1950V3	1550-1850	Water, Tween
	MBBL1900-3800V3	1950-3800	Water, Tween
	MBBL3500-5800V5	3500-5800	Water, Oil

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Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HSL900V2)**
Product No.	SL AAH 090 BB (Charge: 140818-1)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe.

Setup Validation

Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

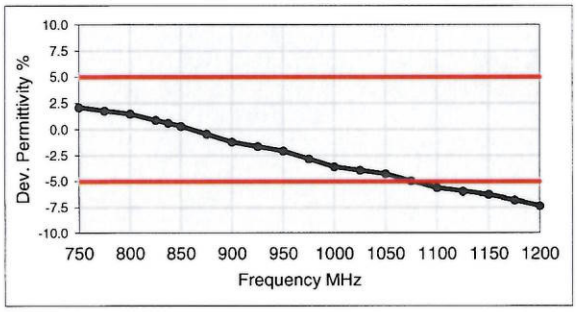
Test Condition

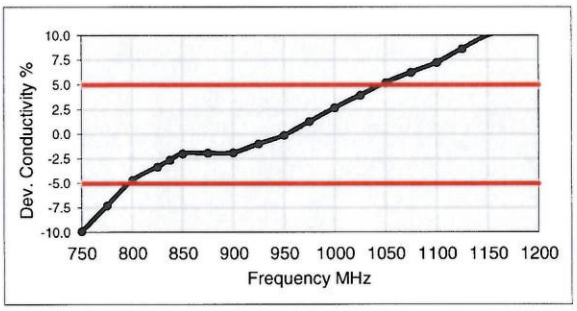
Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	20-Aug-14
Operator	IEN

Additional Information

TSL Density	1.280 g/cm^3
TSL Heat-capacity	2.942 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	**HP-e'**	**HP-e"**	**sigma**	eps	sigma	**Δ-eps**	**Δ-sigma**
700	43.7	19.64	0.76	42.2	0.89	3.5	-14.0
725	43.3	19.47	0.78	42.1	0.89	2.8	-11.9
750	42.8	19.30	0.81	41.9	0.89	2.1	-9.9
775	42.6	19.26	0.83	41.8	0.90	1.8	-7.3
800	42.3	19.21	0.86	41.7	0.90	1.5	-4.7
825	42.0	19.10	0.88	41.6	0.91	0.9	-3.3
838	41.8	19.05	0.89	41.5	0.91	0.6	-2.6
850	41.6	18.99	0.90	41.5	0.92	0.3	-2.0
875	41.3	19.00	0.92	41.5	0.94	-0.4	-1.9
900	41.0	19.01	0.95	41.5	0.97	-1.2	-1.9
925	40.8	18.90	0.97	41.5	0.98	-1.6	-1.0
950	40.6	18.79	0.99	41.4	0.99	-2.1	-0.1
975	40.2	18.76	1.02	41.4	1.00	-2.8	1.3
1000	39.9	18.74	1.04	41.3	1.01	-3.6	2.7
1025	39.7	18.69	1.07	41.3	1.03	-3.9	4.0
1050	39.5	18.65	1.09	41.2	1.04	-4.3	5.2
1075	39.2	18.58	1.11	41.2	1.05	-4.9	6.2
1100	38.8	18.51	1.13	41.2	1.06	-5.6	7.3
1125	38.7	18.51	1.16	41.1	1.07	-5.9	8.6
1150	38.5	18.51	1.18	41.1	1.08	-6.3	10.0
1175	38.2	18.40	1.20	41.0	1.09	-6.8	10.7
1200	38.0	18.29	1.22	41.0	1.10	-7.3	11.3





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Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HBBL1550-1950V3)**
Product No.	SL AAH 181 AA (Charge: 140916-1)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe.

Setup Validation

Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

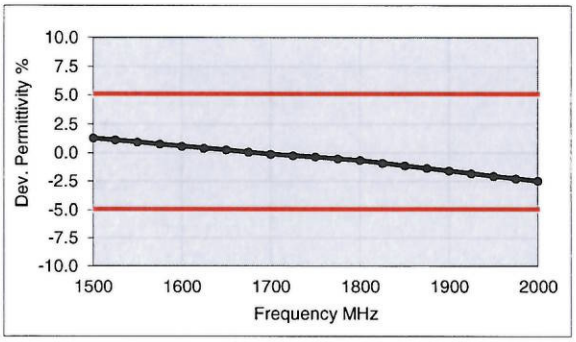
Test Condition

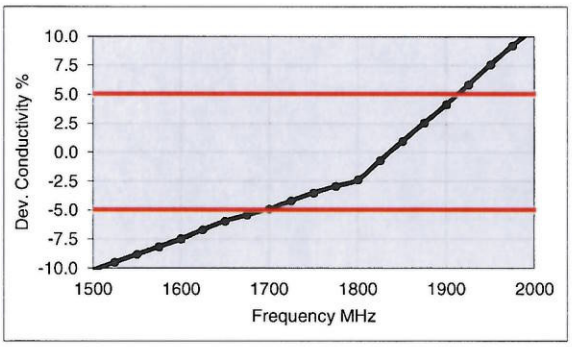
Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	17-Sep-14
Operator	IEN

Additional Information

TSL Density	1.052 g/cm^3
TSL Heat-capacity	3.322 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	**HP-e'**	**HP-e''**	**sigma**	eps	sigma	**Δ-eps**	**Δ-sigma**
1500	41.0	13.22	1.10	40.4	1.23	1.3	-10.2
1525	40.9	13.26	1.12	40.4	1.24	1.1	-9.5
1550	40.8	13.29	1.15	40.4	1.26	1.0	-8.8
1575	40.7	13.32	1.17	40.3	1.27	0.8	-8.1
1600	40.6	13.35	1.19	40.3	1.28	0.6	-7.5
1625	40.4	13.40	1.21	40.3	1.30	0.4	-6.7
1650	40.3	13.46	1.24	40.2	1.31	0.3	-5.9
1675	40.2	13.48	1.26	40.2	1.33	0.1	-5.4
1700	40.1	13.50	1.28	40.2	1.34	-0.1	-4.9
1725	40.0	13.55	1.30	40.1	1.36	-0.2	-4.2
1750	39.9	13.59	1.32	40.1	1.37	-0.3	-3.5
1775	39.8	13.62	1.35	40.0	1.39	-0.5	-2.9
1800	39.7	13.65	1.37	40.0	1.40	-0.6	-2.4
1825	39.6	13.69	1.39	40.0	1.40	-0.9	-0.7
1850	39.6	13.74	1.41	40.0	1.40	-1.1	1.0
1875	39.5	13.77	1.44	40.0	1.40	-1.3	2.6
1900	39.4	13.79	1.46	40.0	1.40	-1.6	4.1
1925	39.3	13.84	1.48	40.0	1.40	-1.8	5.9
1950	39.2	13.88	1.51	40.0	1.40	-2.0	7.6
1975	39.1	13.91	1.53	40.0	1.40	-2.3	9.2
2000	39.0	13.94	1.55	40.0	1.40	-2.5	10.8





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Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HBBL1900-3800V3)**
Product No.	SL AAH 196 AB (Charge: 140729-2)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe.

Setup Validation

Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

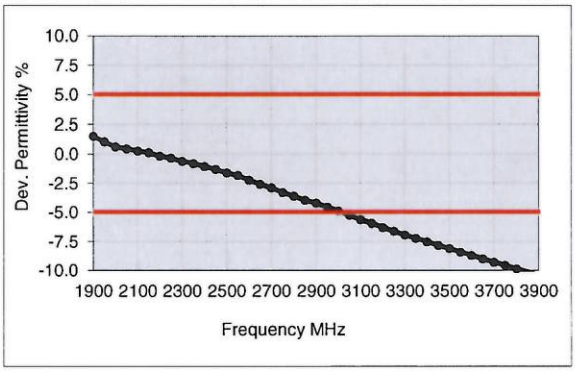
Test Condition

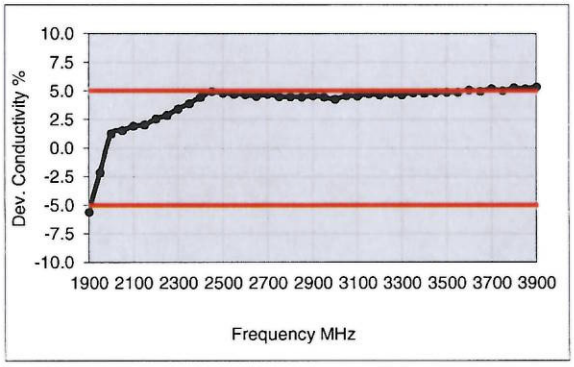
Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	30-Jul-14
Operator	CL

Additional Information

TSL Density	1.054 g/cm^3
TSL Heat-capacity	3.389 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	HP-e'	HP-e"	sigma	eps	sigma	Δ-eps	Δ-sigma
1900	40.6	12.5	1.3	40.0	1.4	1.5	-5.6
1950	40.4	12.6	1.4	40.0	1.4	1.1	-2.1
2000	40.3	12.7	1.4	40.0	1.4	0.6	1.3
2050	40.1	12.9	1.5	39.9	1.4	0.5	1.6
2100	39.9	13.0	1.5	39.8	1.5	0.3	1.9
2150	39.8	13.1	1.6	39.7	1.5	0.1	2.0
2200	39.6	13.2	1.6	39.6	1.6	-0.2	2.6
2250	39.4	13.3	1.7	39.6	1.6	-0.3	2.9
2300	39.2	13.5	1.7	39.5	1.7	-0.6	3.4
2350	39.1	13.6	1.8	39.4	1.7	-0.8	3.9
2400	38.9	13.7	1.8	39.3	1.8	-1.0	4.5
2450	38.7	13.9	1.9	39.2	1.8	-1.3	4.9
2500	38.5	14.0	1.9	39.1	1.9	-1.6	4.8
2550	38.4	14.1	2.0	39.1	1.9	-1.8	4.8
2600	38.1	14.2	2.1	39.0	2.0	-2.2	4.7
2650	37.9	14.3	2.1	38.9	2.0	-2.6	4.6
2700	37.8	14.5	2.2	38.9	2.1	-2.9	4.7
2750	37.5	14.5	2.2	38.8	2.1	-3.3	4.5
2800	37.4	14.6	2.3	38.8	2.2	-3.6	4.5
2850	37.2	14.7	2.3	38.7	2.2	-3.9	4.5
2900	37.0	14.9	2.4	38.6	2.3	-4.2	4.6
2950	36.8	14.9	2.5	38.6	2.3	-4.5	4.5
3000	36.6	15.0	2.5	38.5	2.4	-4.9	4.3
3050	36.4	15.1	2.6	38.4	2.5	-5.2	4.6
3100	36.2	15.2	2.6	38.4	2.5	-5.6	4.6
3150	36.1	15.3	2.7	38.3	2.6	-5.9	4.8
3200	35.9	15.3	2.7	38.3	2.6	-6.3	4.7
3250	35.7	15.4	2.8	38.2	2.7	-6.6	4.8
3300	35.5	15.4	2.8	38.2	2.7	-6.9	4.7
3350	35.4	15.5	2.9	38.1	2.8	-7.2	4.9
3400	35.2	15.6	2.9	38.0	2.8	-7.5	4.8
3450	35.0	15.6	3.0	38.0	2.9	-7.8	4.9
3500	34.9	15.7	3.1	37.9	2.9	-8.1	4.9
3550	34.7	15.7	3.1	37.9	3.0	-8.4	4.9
3600	34.5	15.8	3.2	37.8	3.0	-8.7	5.1
3650	34.4	15.9	3.2	37.8	3.1	-9.0	5.0
3700	34.2	15.9	3.3	37.7	3.1	-9.3	5.2
3750	34.0	16.0	3.3	37.6	3.2	-9.6	5.0
3800	33.9	16.0	3.4	37.6	3.2	-9.9	5.3
3850	33.7	16.1	3.4	37.5	3.3	-10.1	5.2





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Measurement Certificate / Material Test

Item Name	**Body Tissue Simulating Liquid (MSL900V2)**
Product No.	SL AAM 090 CA (Charge: 140710-1)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe.

Setup Validation

Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

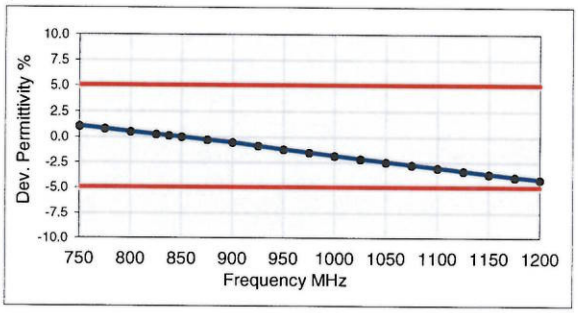
Test Condition

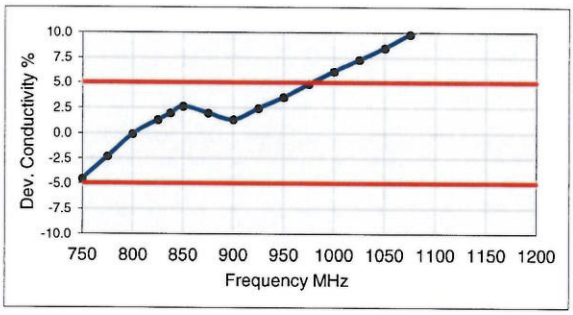
Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	16-Jul-14
Operator	IEN

Additional Information

TSL Density	1.208 g/cm3
TSL Heat-capacity	3.113 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	**HP-e'**	**HP-e''**	**sigma**	eps	sigma	**Δ-eps**	**Δ-sigma**
700	56.6	22.41	0.87	55.7	0.96	1.6	-9.0
725	56.4	22.23	0.90	55.6	0.96	1.3	-6.8
750	56.1	22.04	0.92	55.5	0.96	1.1	-4.5
775	55.9	21.88	0.94	55.4	0.97	0.8	-2.3
800	55.6	21.72	0.97	55.3	0.97	0.5	-0.1
825	55.4	21.59	0.99	55.2	0.98	0.3	1.3
838	**55.3**	**21.52**	**1.00**	**55.2**	**0.98**	**0.2**	**2.0**
850	55.2	21.46	1.01	55.2	0.99	0.0	2.6
875	54.9	21.35	1.04	55.1	1.02	-0.2	2.0
900	**54.7**	**21.25**	**1.06**	**55.0**	**1.05**	**-0.5**	**1.3**
925	54.5	21.17	1.09	55.0	1.06	-0.9	2.5
950	54.3	21.08	1.11	54.9	1.08	-1.2	3.6
975	54.1	21.01	1.14	54.9	1.09	-1.5	4.9
1000	53.8	20.95	1.17	54.8	1.10	-1.8	6.1
1025	53.6	20.88	1.19	54.8	1.11	-2.1	7.3
1050	53.4	20.81	1.22	54.7	1.12	-2.4	8.5
1075	53.2	20.79	1.24	54.7	1.13	-2.7	9.8
1100	53.0	20.76	1.27	54.7	1.14	-3.0	11.2
1125	52.8	20.71	1.30	54.6	1.15	-3.3	12.3
1150	52.6	20.66	1.32	54.6	1.17	-3.7	13.4
1175	52.4	20.64	1.35	54.5	1.18	-3.9	14.7
1200	52.2	20.63	1.38	54.5	1.19	-4.2	15.9





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Measurement Certificate / Material Test

Item Name	**Body Tissue Simulating Liquid (MBBL1550-1950V3)**
Product No.	SL AAM 181 AA (Charge: 140826-1)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe.

Setup Validation

Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

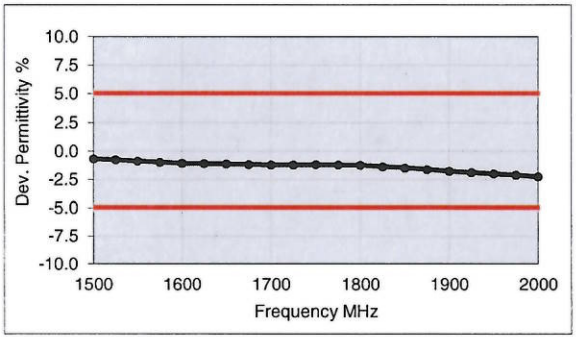
Test Condition

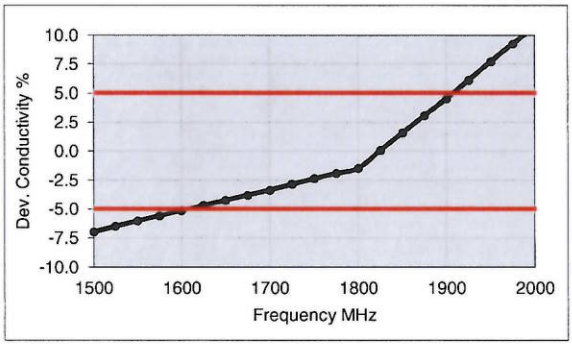
Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	27-Aug-14
Operator	IEN

Additional Information

TSL Density	1.042 g/cm^3
TSL Heat-capacity	3.475 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	HP-e'	HP-e''	sigma	eps	sigma	Δ-eps	Δ-sigma
1500	53.6	14.84	1.24	53.9	1.33	-0.7	-7.0
1525	53.5	14.85	1.26	53.9	1.35	-0.8	-6.5
1550	53.4	14.85	1.28	53.9	1.36	-0.9	-6.0
1575	53.3	14.85	1.30	53.8	1.38	-1.0	-5.6
1600	53.2	14.85	1.32	53.8	1.39	-1.1	-5.1
1625	53.2	14.86	1.34	53.8	1.41	-1.1	-4.7
1650	53.1	14.87	1.36	53.7	1.43	-1.1	-4.2
1675	53.0	14.88	1.39	53.6	1.44	-1.2	-3.8
1700	52.9	14.89	1.41	53.6	1.46	-1.2	-3.3
1725	52.9	14.91	1.43	53.5	1.47	-1.2	-2.8
1750	52.8	14.93	1.45	53.4	1.49	-1.2	-2.3
1775	52.7	14.94	1.48	53.4	1.50	-1.2	-1.9
1800	52.6	14.96	1.50	53.3	1.52	-1.2	-1.5
1825	52.6	14.98	1.52	53.3	1.52	-1.4	0.1
1850	52.5	15.01	1.54	53.3	1.52	-1.5	1.6
1875	52.4	15.02	1.57	53.3	1.52	-1.6	3.1
1900	52.4	15.03	1.59	53.3	1.52	-1.8	4.5
1925	52.3	15.06	1.61	53.3	1.52	-1.9	6.1
1950	52.2	15.09	1.64	53.3	1.52	-2.0	7.7
1975	52.2	15.11	1.66	53.3	1.52	-2.1	9.2
2000	52.1	15.13	1.68	53.3	1.52	-2.2	10.7





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Measurement Certificate / Material Test

Item Name	**Body Tissue Simulating Liquid (MBBL1900-3800V3)**
Product No.	SL AAM 196 AB (Charge: 140903-2)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe.

Setup Validation

Validation results were within ± 2.5% towards the target values of Methanol.

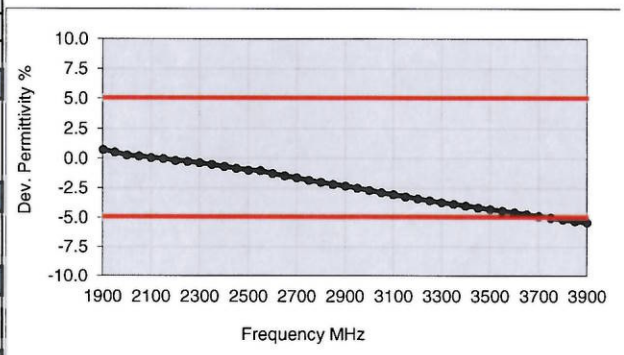
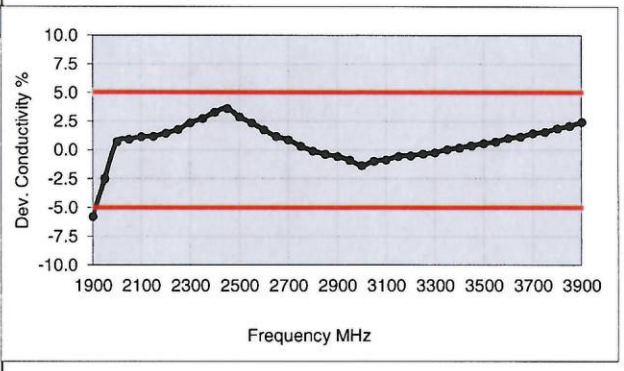
Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	3-Sep-14
Operator	CL

Additional Information

TSL Density	1.036 g/cm^3
TSL Heat-capacity	3.508 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	HP-e'	HP-e''	sigma	eps	sigma	Δ-eps	Δ-sigma
1900	53.7	13.5	1.43	53.3	1.52	0.8	-5.8
1950	53.6	13.7	1.48	53.3	1.52	0.5	-2.5
2000	53.4	13.8	1.53	53.3	1.52	0.3	0.7
2050	53.3	13.9	1.58	53.2	1.57	0.2	0.9
2100	53.2	14.0	1.63	53.2	1.62	0.1	1.1
2150	53.1	14.1	1.68	53.1	1.66	0.0	1.2
2200	52.9	14.2	1.74	53.0	1.71	-0.2	1.5
2250	52.8	14.3	1.79	53.0	1.76	-0.2	1.8
2300	52.7	14.5	1.85	52.9	1.81	-0.4	2.4
2350	52.6	14.6	1.91	52.8	1.85	-0.5	2.8
2400	52.4	14.7	1.97	52.8	1.90	-0.7	3.3
2450	52.3	14.8	2.02	52.7	1.95	-0.8	3.6
2500	52.1	15.0	2.08	52.6	2.02	-1.0	2.9
2550	52.0	15.1	2.14	52.6	2.09	-1.0	2.4
2600	51.9	15.2	2.20	52.5	2.16	-1.3	1.8
2650	51.7	15.3	2.26	52.4	2.23	-1.4	1.2
2700	51.5	15.5	2.33	52.4	2.30	-1.6	0.9
2750	51.4	15.6	2.38	52.3	2.38	-1.8	0.3
2800	51.2	15.7	2.44	52.3	2.45	-2.0	-0.1
2850	51.1	15.8	2.51	52.2	2.52	-2.2	-0.4
2900	50.9	16.0	2.57	52.1	2.59	-2.3	-0.6
2950	50.8	16.1	2.64	52.1	2.66	-2.5	-0.9
3000	50.6	16.1	2.69	52.0	2.73	-2.7	-1.3
3050	50.4	16.3	2.76	51.9	2.79	-2.9	-1.0
3100	50.3	16.4	2.82	51.9	2.85	-3.0	-0.9
3150	50.1	16.5	2.89	51.8	2.91	-3.2	-0.5
3200	50.0	16.6	2.95	51.7	2.96	-3.4	-0.5
3250	49.8	16.7	3.01	51.7	3.02	-3.5	-0.3
3300	49.7	16.7	3.07	51.6	3.08	-3.7	-0.2
3350	49.5	16.9	3.14	51.5	3.14	-3.9	0.1
3400	49.4	16.9	3.20	51.5	3.20	-4.0	0.2
3450	49.2	17.0	3.27	51.4	3.26	-4.2	0.4
3500	49.1	17.1	3.33	51.3	3.31	-4.3	0.6
3550	49.0	17.2	3.40	51.3	3.37	-4.5	0.7
3600	48.8	17.3	3.47	51.2	3.43	-4.6	1.0
3650	48.7	17.4	3.53	51.1	3.49	-4.7	1.1
3700	48.6	17.5	3.60	51.1	3.55	-4.9	1.5
3750	48.4	17.6	3.66	51.0	3.61	-5.0	1.6
3800	48.3	17.7	3.73	50.9	3.66	-5.2	1.9
3850	48.2	17.7	3.80	50.8	3.72	-5.3	2.1