APREL Laboratories

MPE Probe

ELECTRIC-FIELD PROBE MEASUREMENT SYSTEM, CALIBRATION METHOD & SPECIFICATIONS

MPE Probe Calibration

1.0 ELECTRIC-FIELD PROBE MEASUREMENT SYSTEM CALIBRATION

This section describes the tasks necessary to characterize the electrical performance of the E-field probe.

Test Equipment

The required test equipment, hardware and software, is identified in each individual procedure. Equipment may be substituted or updated from time to time. Should this occur, such change shall be noted in the test report.

Standard Environmental Conditions

All measurements and calibration should be performed under normal laboratory conditions for physical properties and electrical characteristics as stipulated by ISO/IEC Guide 25. The nominal temperature for physical property measurements and for electrical characterization are 20°C and 23°C, respectively.

The Probe

The E-field probe measurement system has two main components: a) the probe, which is connected to the inputs of b) the summing amplifier. The probe is connected to the summing amplifier and then connected to the DC voltage meter by means of shielded cables. The probe and amplifier is calibrated as one unit, not as individual components. If any component is modified or replaced, the system must be re-calibrated.

The system calibration is performed by determination of the free space E-field from the probe outputs in a test RF field.

1.1 Determining E-Field Probe Sensitivities at Frequencies up to 1 GHz

1.1.1 References

- "Calibration of Low Frequency Electric and Magnetic Field Probes", W. Köhler, EMC '96, International Symposium on Electromagnetic Compatibility, Rome, Italy, September 1996
- "Calibration of Electromagnetic Field Probes in Different Measurement Sites: Comparison of Results", G. Agnello, P. Bertotto, M. Borsero, G. Pierucci, V. Squizzato, EMC '96, International Symposium on Electromagnetic Compatibility, Rome, Italy, September 1996
- "Electric Field Probes for Cellular Phone Dosimetry", H.I. Bassen, Center for Devices and Radiological Health, FDA, Attachment 6a, Minutes IEEE Standards Coordinating Committee - 34, Subcommittee – 2 (Certification of Wireless Handsets), Qualcomm, La Jolla, California, 3&4 December, 1997.
- "New Perspective in Broad Band Sensors Calibration", Licitra, Francia, Giusti, Pocai, EMC '96, International Symposium on Electromagnetic Compatibility, Rome, Italy, September 1996

1.1.2 Definition

The sensitivity of the probe is a DC voltage produced at the outputs of the summing amplifier with the probes exposed to a specified free space electrical field power density.

1.1.3 Minimum Standard

The sensitivity of the probes depends on the manufacturer of the probes and individual components used to manufacture the probes. As such, there is no minimum requirement for sensitivity of the probes.

1.1.4 Test Equipment

Description	Manufacturer	Model
RF Signal Generator	Hewlett Packard	83640B
RF Amplifier	APREL	-
TEM Test Cell	Fischer Custom Communications	FCC-TEM-JM1
RF Power Meter	Hewlett Packard	438A
E-field probe	APREL	MPE-APL-2
Digital Multimeter	Fluke	8505A
20dB Attenuator	Narda	4774-20

1.1.5 Test Configuration

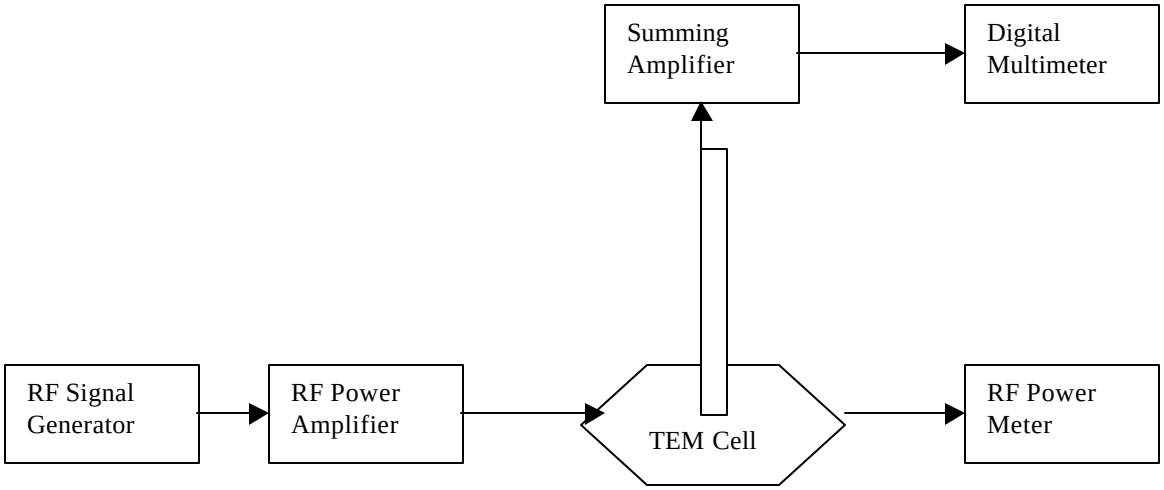


Figure 1.1

1.1.6 Test Procedure

1. Connect the equipment as shown in the test configuration.
2. Set the RF generator frequency to 806MHz.
3. Adjust the RF generator output so that the power density inside the TEM Cell is 0.001mW/cm^2. (For the FCC Model FCC-TEM-JM1 Cell, the relevant input power level can be calculated from power density value and can be monitored by a power meter.)
4. Mount the MPE probe system to be calibrated in the support fixture.
5. Insert the probe through the side aperture of the TEM Cell. The probe handle should be at the geometric center of the aperture, i.e. midway between the septum and the upper surface, and orthogonal to the side of the Cell. The sensing portion of the probe should be located at a point halfway across the depth of the cell (volumetric center).
6. Once the prescribed position is obtained, it must be maintained during the rest of the measurement.
7. Set the multimeter to DC voltage mode. Record the voltage reading.
8. Increase the power density step by step up to 1.0mW/cm^2 . Record voltage reading for each power density.
9. Set the RF generator to 821MHz and 901MHz respectively. Repeat steps 3 through 8.

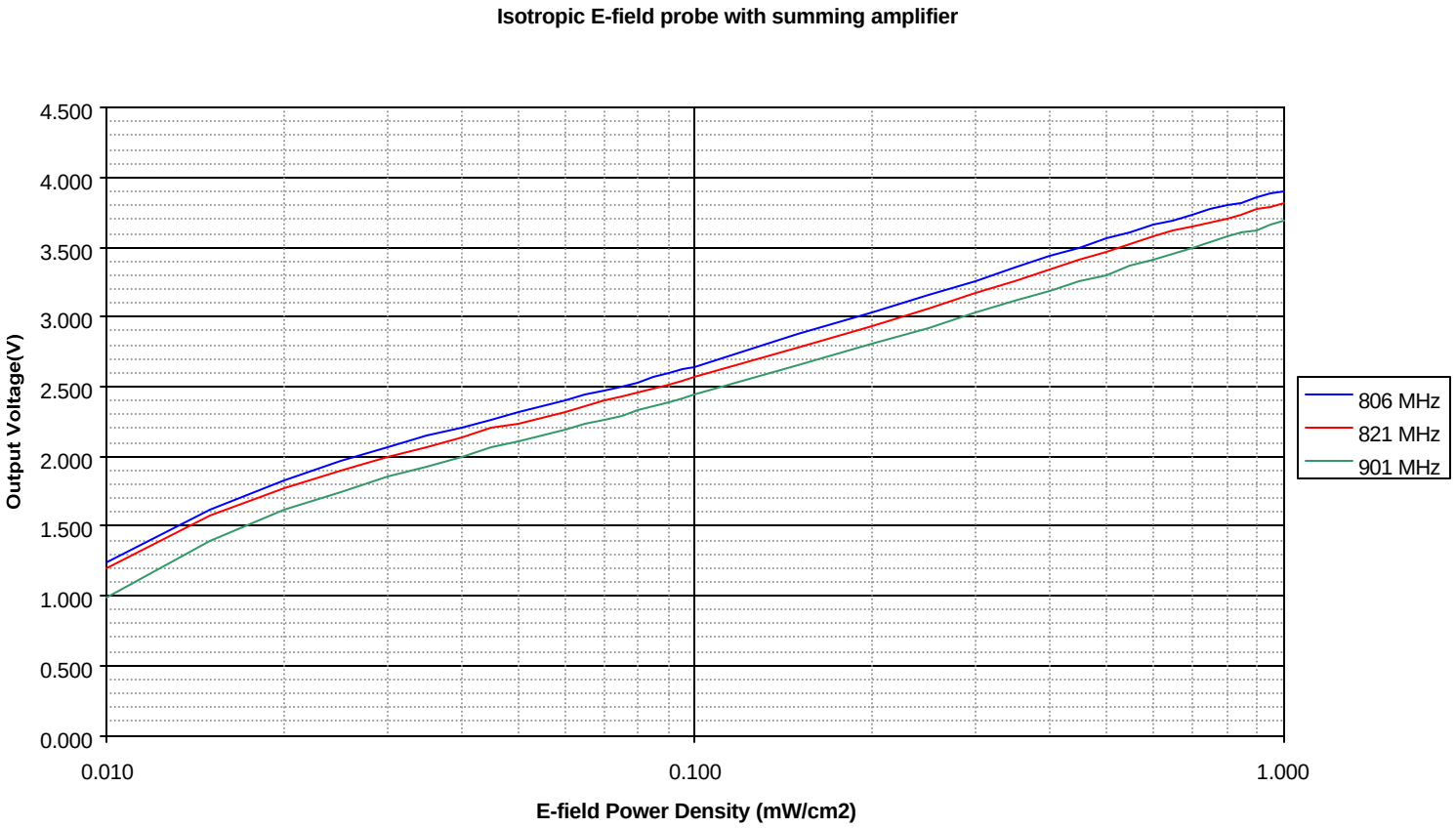
1.1.7 Calibration Data Table

The calibration data for 806MHz, 821MHz, 901MHz are recorded in the table 1.1.7a

Table 1.1.7a Calibration data

Power Density	E -field	Probe Output Voltage		
		806 MHz	821 MHz	901 MHz
mW/cm^2	V/m	V	V	V
0.001	1.941	0.104	0.105	0.100
0.005	4.340	0.600	0.590	0.500
0.010	6.138	1.240	1.192	0.989
0.015	7.517	1.620	1.579	1.398
0.020	8.680	1.833	1.774	1.623
0.025	9.705	1.968	1.903	1.745
0.030	10.631	2.068	1.999	1.852
0.035	11.483	2.143	2.066	1.934
0.040	12.276	2.210	2.134	2.003
0.045	13.020	2.267	2.200	2.060
0.050	13.725	2.314	2.240	2.106
0.055	14.395	2.366	2.280	2.158
0.060	15.035	2.408	2.326	2.192
0.065	15.649	2.439	2.367	2.234
0.070	16.239	2.470	2.396	2.266
0.075	16.809	2.501	2.428	2.295
0.080	17.361	2.532	2.458	2.332
0.085	17.895	2.567	2.486	2.360
0.090	18.414	2.601	2.512	2.387
0.095	18.918	2.624	2.541	2.416
0.100	19.410	2.646	2.569	2.445
0.150	23.772	2.874	2.787	2.649
0.200	27.449	3.028	2.940	2.809
0.250	30.689	3.160	3.065	2.920
0.300	33.618	3.262	3.169	3.034
0.350	36.312	3.354	3.260	3.118
0.400	38.819	3.434	3.342	3.192
0.450	41.174	3.500	3.404	3.252
0.500	43.401	3.563	3.469	3.303
0.550	45.520	3.613	3.522	3.370
0.600	47.544	3.665	3.572	3.408
0.650	49.485	3.698	3.618	3.458
0.700	51.353	3.730	3.654	3.497
0.750	53.156	3.770	3.680	3.536
0.800	54.899	3.804	3.712	3.573
0.850	56.588	3.824	3.734	3.610
0.900	58.229	3.860	3.769	3.627
0.950	59.825	3.887	3.785	3.661
1.000	61.379	3.903	3.820	3.686

1.1.8 Sensitivity Curve



1.1.9 Specifications

Frequency Range: 500 MHz – 6 GHz

Sensitivity of the probe: See tables; 1.1.7 and 1.1.8

Note: Calibration is performed prior to testing on that particular frequency. In this case, 806 MHz, 821 MHz and 901 MHz are calibrated as required for this specific test.