
EMC TEST REPORT

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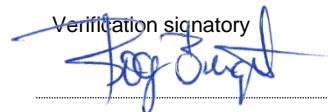
Customer Nasjonal Kommunikasjonsmyndighet, Nygård 1, 4790 Lillesand, Norway

Project Test of three different instruments used for measuring field strength and power density. The instruments are tested against a calibrated field strength with different modulation schemes and the instrument's measurement capabilities (deviations) have been recorded.

The object has been tested according to the specifications of the following standards.

- EN IEC 61000-4-3:2020, Ed.4.0
-

Date
2022-08-31

Verification signatory


R.Berget

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THIS REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATION(S) TESTED.

Test results

The reported expanded uncertainty of measurement is stated as standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a probability of approx. 95%.

The measurement uncertainty is not taken into account for determining compliance with the specifications, as long as the uncertainty is within the maximum requirements by IEC/CISPR.

Calibration of Nemko measurement equipment

All instruments used in the tests of this test report are calibrated and traceable to national or international standards. Between calibrations all test set-ups are controlled and verified on a regular basis by intermediate checks to ensure, with 95% confidence that the instruments remain within the calibrated levels.

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Project Details

Assigned by:	Nasjonal Kommunikasjonsmyndighet
Contact:	Helene Unander
Reference:	467088
Project description:	<p>The scope of this test is to check a selection of instruments typically used to measure field strength and power density related to RF-radiation.</p> <p>The instruments have been tested against a calibrated electric field at 4 different levels, unmodulated and also 3 different modulation types have been applied.</p> <p>The frequencies, modulations and polarity have been chosen based on matters related to RF-radiation.</p> <p>Frequency:</p> <ul style="list-style-type: none">- 869 MHz (AMS)- 1830 MHz (4G, LTE1800)- 2450 MHz (2,4 GHz WiFi)- 3650 MHz (5G, NR3500) <p>Signal type:</p> <ul style="list-style-type: none">- Continuous Wave (CW)- Pulsed RF, duty cycle 1:8 at 200Hz (PM)- Sine wave 80% AM at 1 kHz (AM)- Pulsed 80% AM at 1 kHz, duty cycle 1:8 at 200Hz (AM w/PM) <p>Field level:</p> <ul style="list-style-type: none">- 1 V/m- 3 V/m- 10 V/m- 30 V/m <p>Polarization</p> <ul style="list-style-type: none">- Vertical

Product Details

Product 1:

Manufacturer Cornet Microsystem Inc.
Model/type ED88TPlus
Serial number 2001000969
Specified frequency range 100MHz – 8GHz
Operating voltage 9V DC battery
Settings when tested Mode:RF mode
Unit: mW/m²

Product 2:

Manufacturer Gigahertz Solutions
Model/type HFW59D
Serial number 053000042761
Antenna: 053030046900
Specified frequency range 2.4GHz – 10GHz (only for pulsed signals)
Operating voltage 9.6V DC rechargeable battery
Settings when tested Range: max - VBW Maximum -
Peak hold («Clear» for each measurement)
Ext. Adapt: +20 dB - Attenuator: 20dB

Product 3:

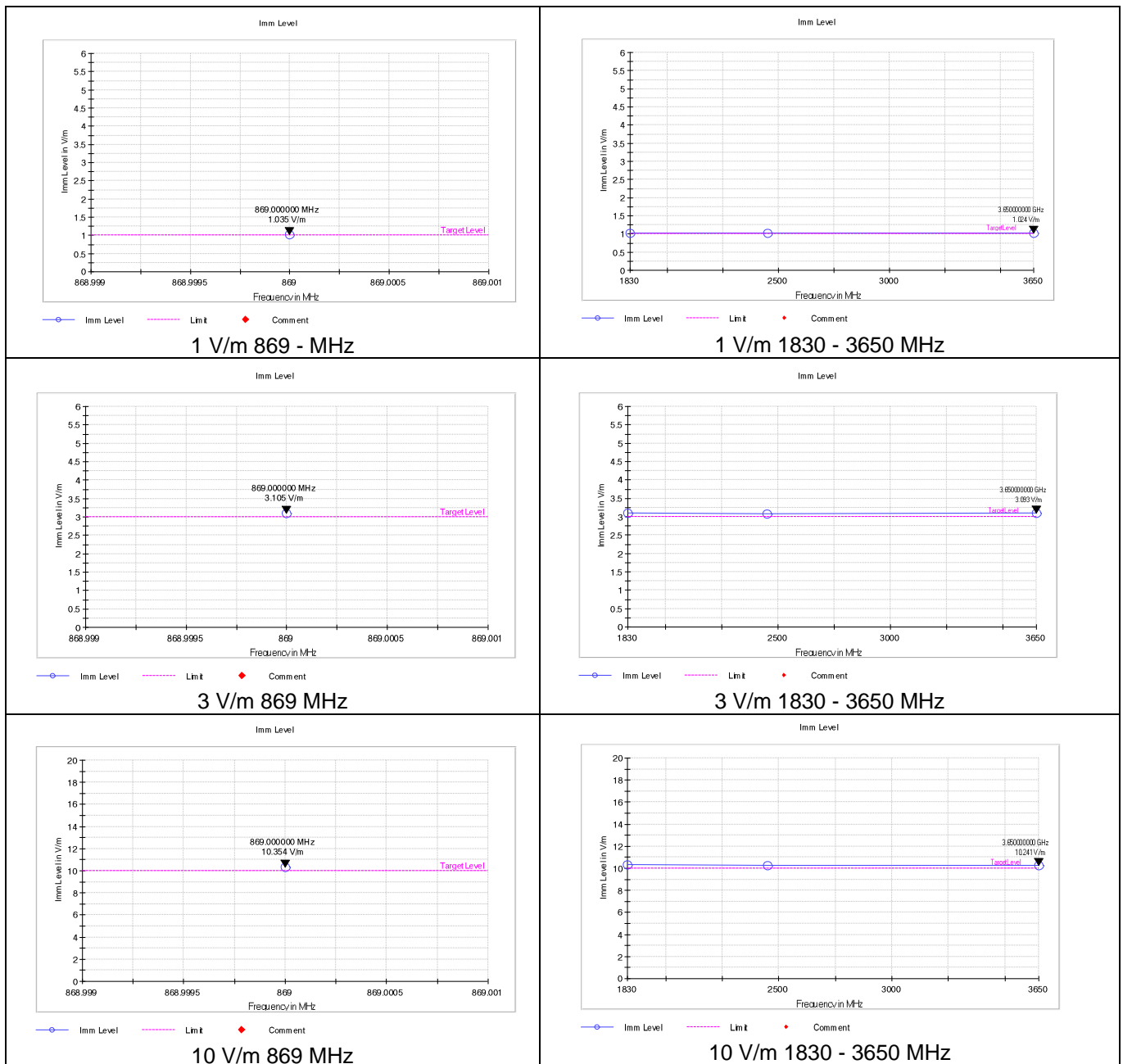
Manufacturer Gigahertz Solutions
Model/type HF35C
Serial number 0530000441115
Antenna: 053030048850
Specified frequency range 800MHz – 2.7GHz
Operating voltage 9V DC battery
Settings when tested RMS
1999 μ W/m²

Additional attenuator:

Manufacturer Gigahertz Solutions
Model/type Attenuator DG20_G10
Serial number 0530200003048
Specified frequency range 10MHz – 10GHz
Attenuation 20 dB \pm 0.4 dB

Calibration of field level

Method: EN IEC 61000-4-3:2020
 Additional info: Field probe LSProbe 1.2 was placed according to drawing 2 - test setup (see also Photos in Annexes).
 Unmodulated signal (CW) was used to calibrate relevant frequencies and field levels.
 See figure 1 for calibrated spectrum.
 Field probe LSProbe 1.2 was also used during tests to monitor the field strength.



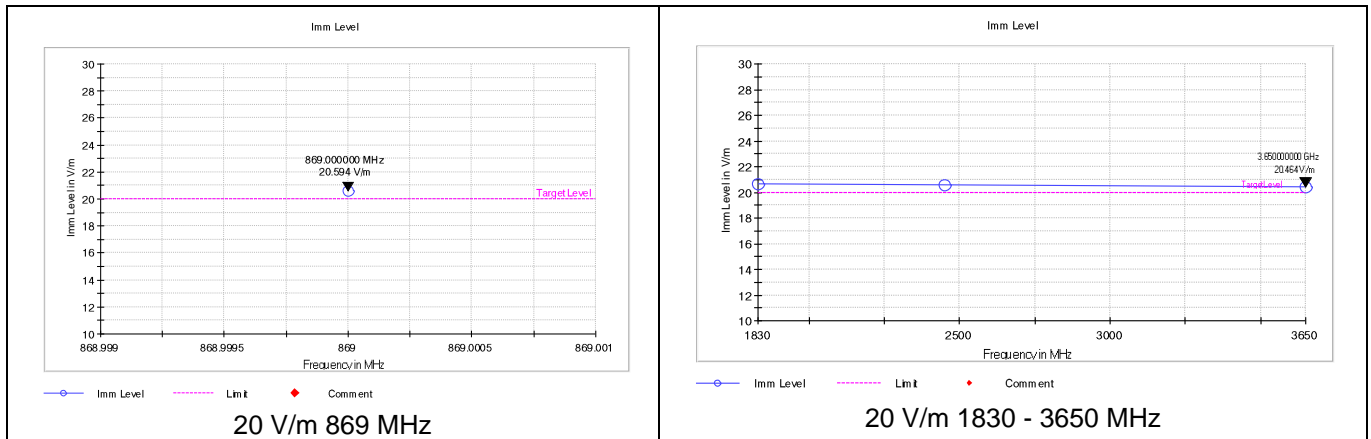


Figure 1- Calibrated spectrum

Test equipment

Equipment	Manufacturer	Model	Inventory Number	Calibration Due Date
Amplifier, GF	Bonn	BLMA 1060-200/100DS	N-4879	N/A
Amplifier, RF	Bonn	BLWA 0810-1000/400	N-4878	N/A
Antenna	Schwarzbeck	STLP 9129	N-4872	N/A
Field Probe	LumiLoop	LSProbe 1.2	N-4856	04/2023
Generator, RF	R&S	SMB100A	N-4877	04/2023
Power Sensor	R&S	NRP8SN	N-4841	03/2023
Power Sensor	R&S	NRP8SN	N-4842	03/2023

Table 1 - Test equipment

Standards

EN IEC 61000-4-3:2020, Ed.4.0

Electromagnetic compatibility (EMC) Part 4-3: Testing and measurement techniques Radiated, radio-frequency, electromagnetic field immunity test

Tests

Test setup

The reference method for this test is according to EN IEC 61000-4-3:2020. The tests were performed at 3-meter antenna distance in an anechoic chamber. The specimen was placed on a styrodur/styrofoam table 150 cm above the floor. The specimen was placed within the calibrated volume. Both receiver- and transmitter antenna were set vertically. Dwell time during test at each frequency was 30 seconds. A camera with fiber connection was used to monitor the displays of the tested instruments.

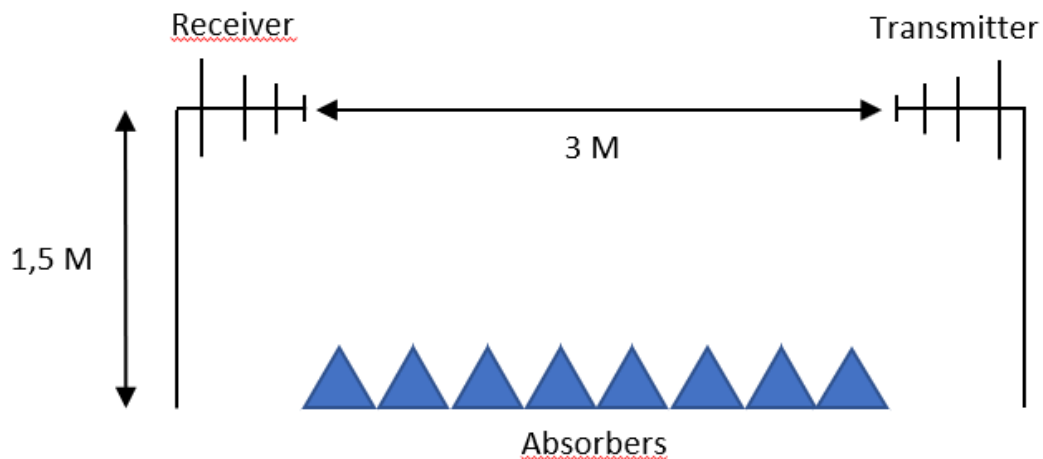


Figure 2 - Test setup

Test results

Recorded measurement value on instrument used in test is mW/m². For easier comparison with calibrated signals, table 2 contains recalculated measurement values in V/m and columns for percentage of deviation.

Attenuator DG20_G10 was used on HFW59D and HF35C when the measured field strength required attenuation. n/a (not applicable) is noted when the modulation and/or frequency is outside the instrument's specifications.

ED88TPlus can show the frequency of the detected signal, but at 3650 MHz the display on the instrument showed a frequency between 1198 MHz and 2529 MHz.

According to user manual for ED88TPlus the instrument has a RF measuring range from 0,5 μW/m² to 1,8 W/m². There was no warning on display when instrument exceeded upper limits other than showing the value 1827 mW/m²

Level	Signal	MHz	mW/m ²			V/m			Percentage of deviation		
			ED88T Plus	HFW59D	HF35C	ED88T Plus	HFW59D	HF35C	ED88T Plus	HFW59D	HF35C
1V/m	CW	869	2,147	n/a	2,6 ²	0,91	n/a	0,99	-9	n/a	-1
		1830	11,06	n/a	1,4 ²	2,04	n/a	0,73	104	n/a	-27
		2450	2,766	n/a	0,5 ²	1,02	n/a	0,43	2	n/a	-57
		3650	6,94 ¹	n/a	n/a	1,62	n/a	n/a	62	n/a	n/a
	PM	869	2,147	n/a	0,382 ²³	0,91	n/a	0,38	-9	n/a	-62
		1830	10,27	n/a	0,256 ²³	1,97	n/a	0,31	97	n/a	-69
		2450	2,831	0,13 ²	0,118 ²³	1,03	0,22	0,21	3	-78	-79
		3650	6,48 ¹	4,43 ²	n/a	1,56	1,29	n/a	56	29	n/a
	AM	869	6,94	n/a	3,7 ²	1,62	n/a	1,18	62	n/a	18
		1830	33,26	n/a	2 ²	3,54	n/a	0,87	254	n/a	-13
		2450	9,16	n/a	0,8 ²	1,86	n/a	0,55	86	n/a	-45
		3650	21,97	n/a	n/a	2,88	n/a	n/a	188	n/a	n/a
	AM w/PM	869	5,52	n/a	0,432 ²³	1,4	n/a	0,4	40	n/a	-60
		1830	28,97	n/a	0,152 ²³	3,3	n/a	0,24	230	n/a	-76
		2450	8,74	2,09 ²	0,224 ²³	1,82	0,89	0,29	82	-11	-71
		3650	8,54 ¹	12,26 ²	n/a	1,79	2,15	n/a	79	115	n/a
3V/m	CW	869	18,27	n/a	25,5	2,62	n/a	3,1	-12,67	n/a	3,33
		1830	91,6	n/a	14,8	5,88	n/a	2,36	96	n/a	-21,33
		2450	24,09	n/a	6,5	3,08	n/a	1,57	2,67	n/a	-47,67
		3650	61,9 ¹	n/a	n/a	4,83	n/a	n/a	61	n/a	n/a
	PM	869	18,27	n/a	3,2 ³	2,62	n/a	1,1	-12,67	n/a	-63,33
		1830	91,6	n/a	1,8 ³	5,88	n/a	0,82	96	n/a	-72,67
		2450	24,65	5	0,7 ³	3,05	1,37	0,51	1,67	-54,33	-83
		3650	57,8 ¹	27	n/a	4,67	3,19	n/a	55,67	6,33	n/a
	AM	869	61,9	n/a	33,6	4,83	n/a	3,56	61	n/a	18,67
		1830	289,7	n/a	19,5	10,45	n/a	2,71	248,33	n/a	-9,67
		2450	79,7	n/a	8,7	5,48	n/a	1,81	82,67	n/a	39,67
		3650	191,4 ¹	n/a	n/a	8,49	n/a	n/a	183	n/a	n/a
		869	52,71	n/a	2,1 ³	4,46	n/a	0,89	48,67	n/a	-70,33

	AM w/PM	1830	270,3	n/a	2,3 ³	10,09	n/a	0,93	236,33	n/a	-69
		2450	63,3	3	1,9 ³	4,89	1,06	0,85	63	-64,67	-71,67
		3650	81,6 ¹	39	n/a	5,55	3,83	n/a	85	27,67	n/a
10V/m	CW	869	209,8	n/a	>199,9 ⁴	8,89	n/a	>8,68 ⁴	-11,1	n/a	n/a ⁴
		1830	1451	n/a	161,8	23,39	n/a	7,81	133,9	n/a	-21,9
		2450	270,3	n/a	73,9	10,09	n/a	5,28	0,9	n/a	-47,2
		3650	835 ¹	n/a	n/a	17,74	n/a	n/a	77,4	n/a	n/a
	PM	869	209,8	n/a	36,5 ³	8,89	n/a	3,71	-11,1	n/a	-62,9
		1830	1451	n/a	21 ³	23,39	n/a	2,81	133,9	n/a	-71,9
		2450	270,3	67	9,5 ³	10,09	5,03	1,89	0,9	-49,7	-81,1
		3650	797 ¹	338	n/a	17,33	11,29	n/a	73,3	12,9	n/a
	AM	869	761	n/a	>199,9 ⁴	16,94	n/a	>8,68 ⁴	69,4	n/a	n/a ⁴
		1830	1827 ⁴	n/a	>199,9 ⁴	26,24	n/a	>8,68 ⁴	162,4	n/a	n/a ⁴
		2450	1264	n/a	94,6	21,83	n/a	5,97	118,3	n/a	-40,3
		3650	1827 ¹⁴	n/a	n/a	26,24	n/a	n/a	162,4	n/a	n/a
	AM w/PM	869	356,4	n/a	20,4 ³	11,59	n/a	2,77	15,9	n/a	-72,3
		1830	1827 ⁴	n/a	43,9 ³	26,24	n/a	4,07	162,4	n/a	-59,3
		2450	916	437	6,9 ³	18,58	12,84	1,61	85,8	28,4	-83,9
		3650	1827 ⁴	1197	n/a	26,24	21,24	n/a	162,4	112,4	n/a
20V/m	CW	869	916	n/a	>199,9 ⁴	18,58	n/a	>8,68 ⁴	-7,1	n/a	n/a ⁴
		1830	1827 ⁴	n/a	>199,9 ⁴	26,24	n/a	>8,68 ⁴	31,2	n/a	n/a ⁴
		2450	1705	n/a	>199,9 ⁴	25,35	n/a	>8,68 ⁴	26,75	n/a	n/a ⁴
		3650	1827 ¹	n/a	n/a	26,24	n/a	n/a	31,2	n/a	n/a
	PM	869	1027	n/a	121,8 ³	19,68	n/a	6,78	-1,6	n/a	-66,1
		1830	1827 ⁴	n/a	73,7 ³	26,24	n/a	5,27	31,2	n/a	-73,65
		2450	1592	468	36,3 ³	24,5	13,28	3,7	22,5	n/a	-81,5
		3650	1827 ¹⁴	1306	n/a	26,24	22,19	n/a	31,2	n/a	n/a
	AM	869	1827 ⁴	n/a	>199,9 ⁴	26,24	n/a	>8,68 ⁴	31,2	n/a	n/a ⁴
		1830	1827 ⁴	n/a	>199,9 ⁴	26,24	n/a	>8,68 ⁴	31,2	n/a	n/a ⁴
		2450	1827 ⁴	n/a	>199,9 ⁴	26,24	n/a	>8,68 ⁴	31,2	n/a	n/a ⁴
		3650	1827 ¹	n/a	n/a	26,24	n/a	n/a	31,2 ⁴	n/a	n/a
	AM w/PM	869	1451	n/a	150,6 ³	23,39	n/a	7,53	16,95	n/a	-62,35
		1830	1827 ⁴	n/a	44,7 ³	26,24	n/a	4,11	31,2 ⁴	n/a	-79,45
		2450	1827 ⁴	1396	26,2 ³	26,24	22,94	3,14	31,2 ⁴	n/a	-84,3
		3650	1827 ¹⁴	>1999 ⁴	n/a	26,24	>27,45 ⁴	n/a	31,2 ⁴	n/a ⁴	n/a

Table 2 - Test results

¹ - Display shows a frequency somewhere between 1198 MHz and 2529 MHz.

² - Measured without Attenuator DG20_G10.

³ - The measured value is low because the instrument is set to RMS and emitted reference signal is pulse modulated.

⁴ - The limit value for the instrument is exceeded.

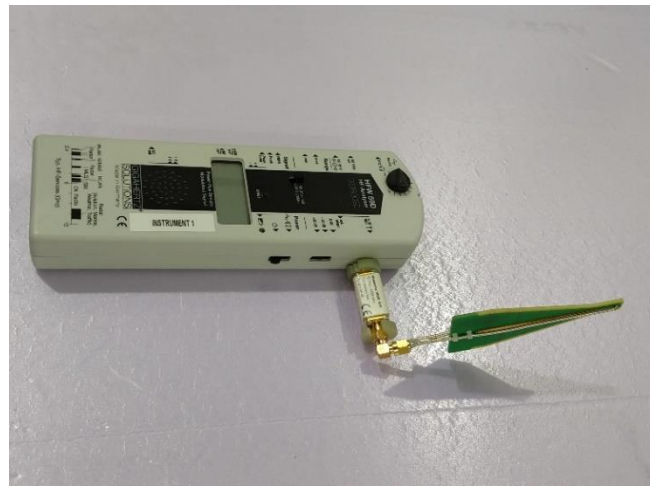
Annexes

Photos

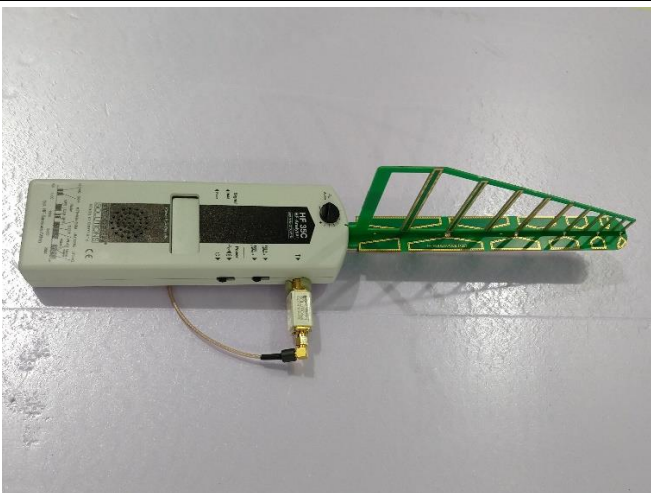
Instruments



ED88TPlus

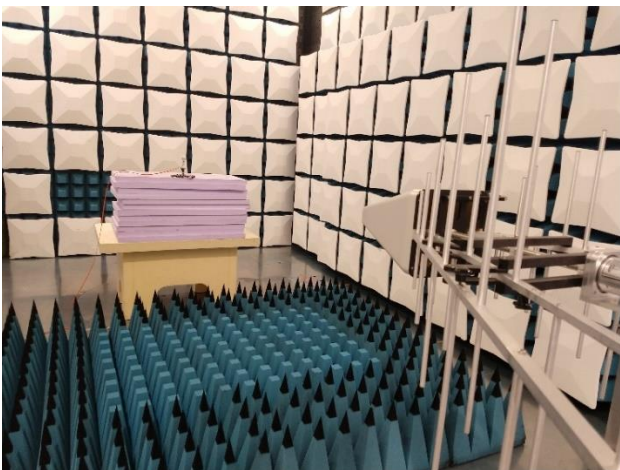


HF59D with Attenuator DG20_G10



HF35C with Attenuator DG20_G10

Set-up for EMC field strength calibration



Calibration setup



Field probe LSProbe 1.2 for calibration of electromagnetic field

Test set-up for EMC field strength measurements



ED88TPlus under test



HF59D with Attenuator DG20_G10 under test



HF35C with Attenuator DG20_G10 under test