

TBCG3-RN2 Comb Generator

1 Introduction

The TBCG3-RN2 comb generator is primarily intended for testing radiated emission setups. It is a useful tool for validating the proper operation of the antenna and pre-amplifier, as well as the accurate set-up and configuration of the spectrum analyzer. It is well characterized in an anechoic chamber and the radiated emission plots can be used as a reference to compare an EUT in a non-ideal setup against the comb generator in the same location.

You can select between five fixed comb frequencies and an external comb frequency input with a range of 5 kHz to 200 MHz using a rotary switch. A switchable RF amplifier may increase the output signal by 20 decibels (dB).

The comb generator is supplied with two monopole antennas, a 30 cm monopole for frequencies below 300-500 MHz and a 10 cm monopole for frequencies above that.

The radiated comb spectrum is characterized from 5 MHz – 6 GHz.



Picture 1: TBCG3-RN2 comb generator

The TBCG3-RN2 has a 50 Ohm output with a female N-connector. The unit operates on six AA NiMH batteries and is supplied with an external charger.

The housing is machined from solid aluminium. The bottom lid is fitted with a 1/4" - 20 UNC thread that accepts regular tripod bolts.

TBCG3-RN2 Comb Generator

2 Specification

Characterized frequency range: 5 MHz - 3 GHz
Comb spectrum flatness up to 1.5 GHz, amplifier off: typically 8 dB at the RF connector
Comb spectrum flatness up to 1.5 GHz, amplifier on: typically 12 dB at the RF connector
Output impedance: 50 Ohm
Output power: -5 dBm max. @ 100 MHz f_{comb} ; decreasing 6 dB with every $f_{\text{comb}}/2$
Amplitude stability: < 0.2 dB; <0.1 dB after 15 minutes
Aging: < 0.5 dB over 12 months
Output connector: N type-female
Selectable, fixed comb frequencies: 100 MHz, 50 MHz, 25 MHz, 10 MHz, 5 MHz
Frequency stability: 50 ppm
External excitation input: 5 kHz – 200 MHz @ square input signal; 3.3 Vpp max
100 kHz – 200 MHz @ sinusoidal input signal; 3.3 Vpp max
External input impedance: 50 Ohm
Input connector: SMA-female
Indicators: Power On LED, Low Battery LED
Power supply: 6 x AA NiMH cells (e.g. Varta Mignon 2700, **not supplied**)
Charger: external; Ansmann ACS310
Antennas: 30 cm monopole for $f < 300 \dots 500$ MHz; 10 cm monopole for $f > 300 \dots 500$ MHz
Operation time: battery capacity / 96 mA (ampl. off) or 181 mA (ampl on)
Temperature range: -10°C to +45 °C; lower operating temperature dependent on battery type
Housing diameter: 180 mm
Housing height: 60 mm
Weight: 1250 g

Warning: the TBCG3-RN2 radiates across a wide spectrum, significantly exceeding radiated emission limits specified in any CISPR standard. Use it only in a shielded environment to avoid interference with other electronic products.

3 Characterization

The comb generator was tested in an anechoic chamber at 1 meter height and 3 meters from the antenna. The antenna was mounted at a fixed height of 1m.

The test plan, test report, and the associated CVS files contain the raw data (antenna voltage) and can be downloaded from the Tekbox website. Due to a restriction of the test tool, the amplitude axis of the charts in the test report is incorrectly labelled dB μ V/m. It is, in reality, dB μ V.

The data package also includes the data sheets and antenna factors for the measurement antennas involved. The processed raw data including conversion into electric field-strength are stored in the Excel file *TBCG3-RN2-summary.xlsx*.

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4 Spectrum plots, conducted output spectrum

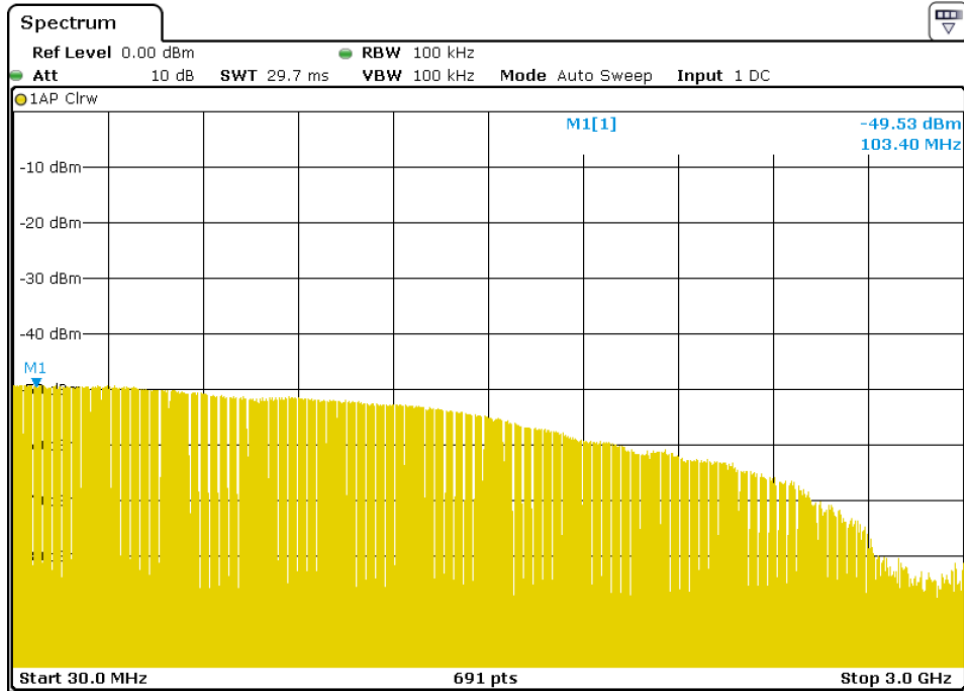


Figure 1 – 5 MHz comb frequency; amplifier off

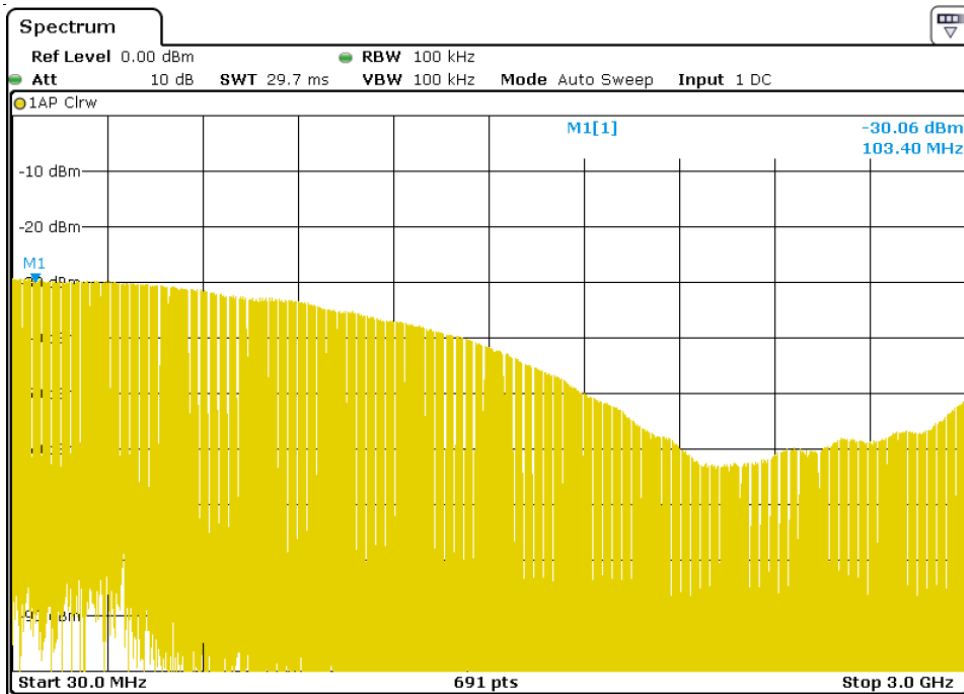


Figure 2 – 5 MHz comb frequency; amplifier on

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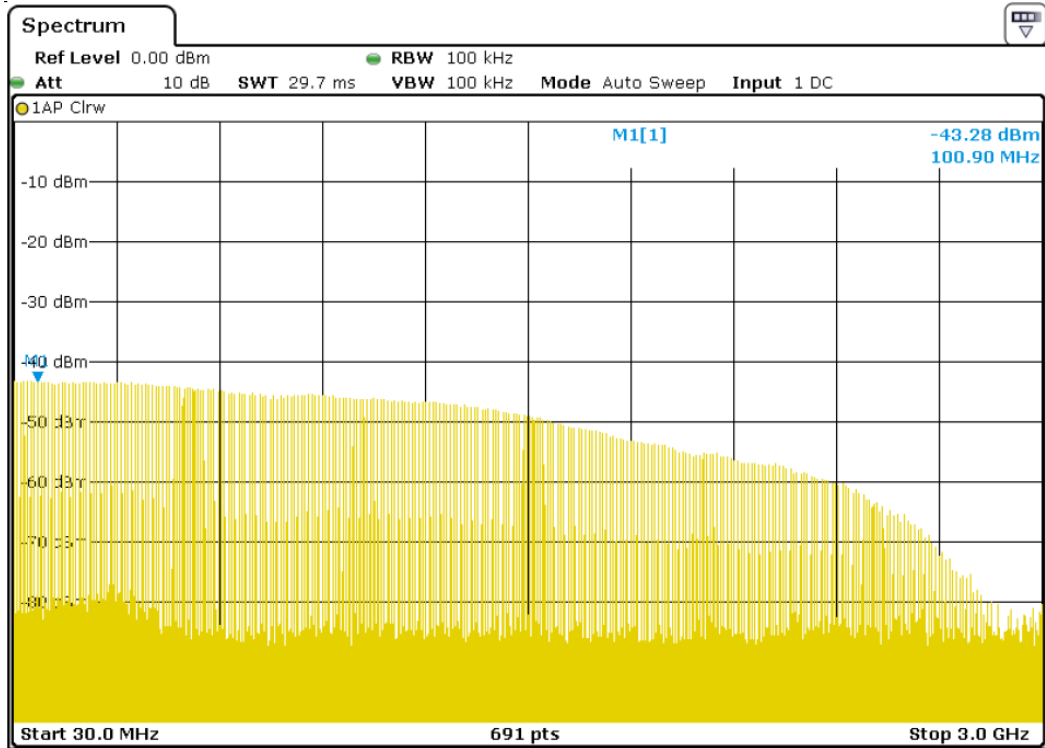


Figure 3 – 10 MHz comb frequency; amplifier off

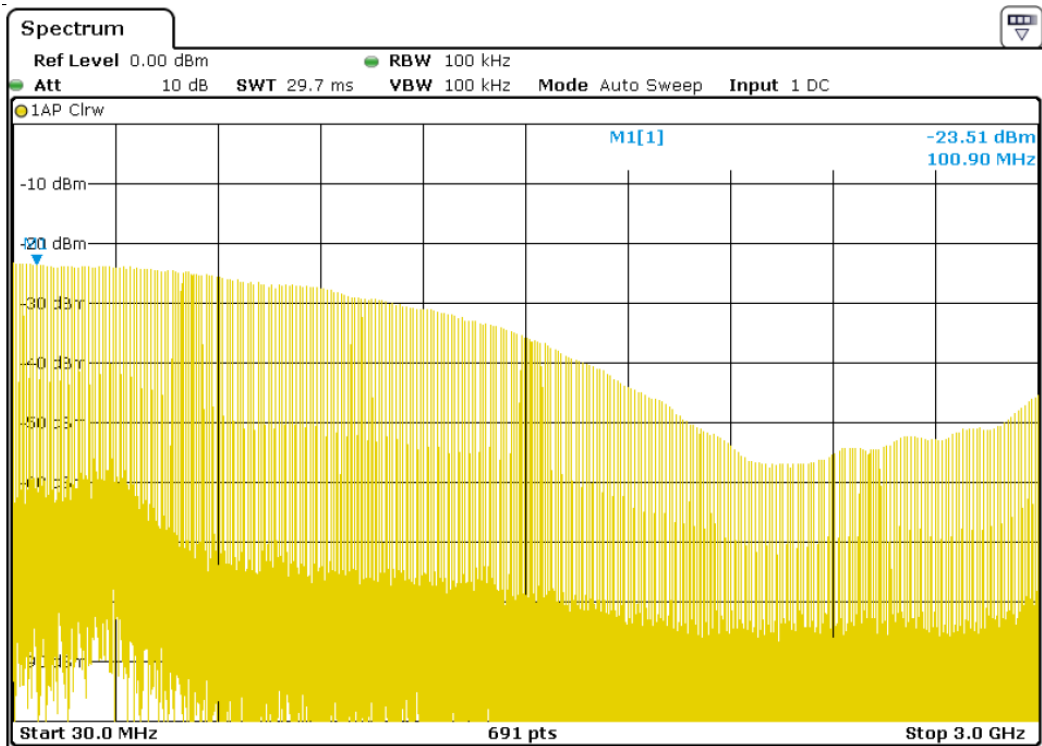


Figure 4 – 10 MHz comb frequency; amplifier on

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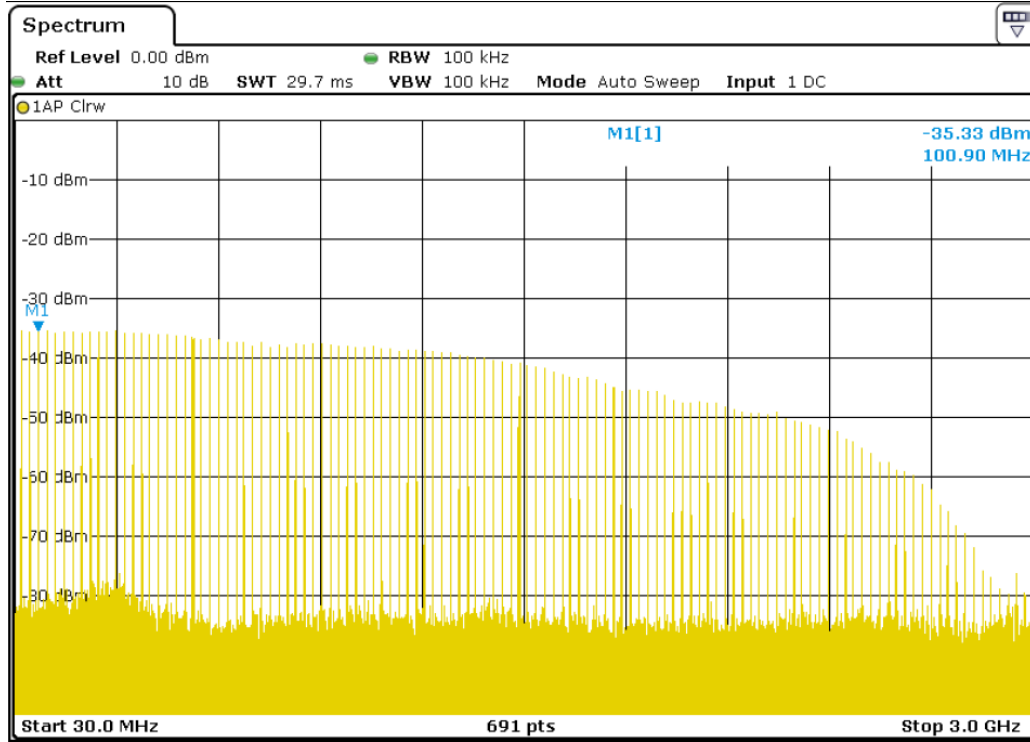


Figure 5 – 25 MHz comb frequency; amplifier off

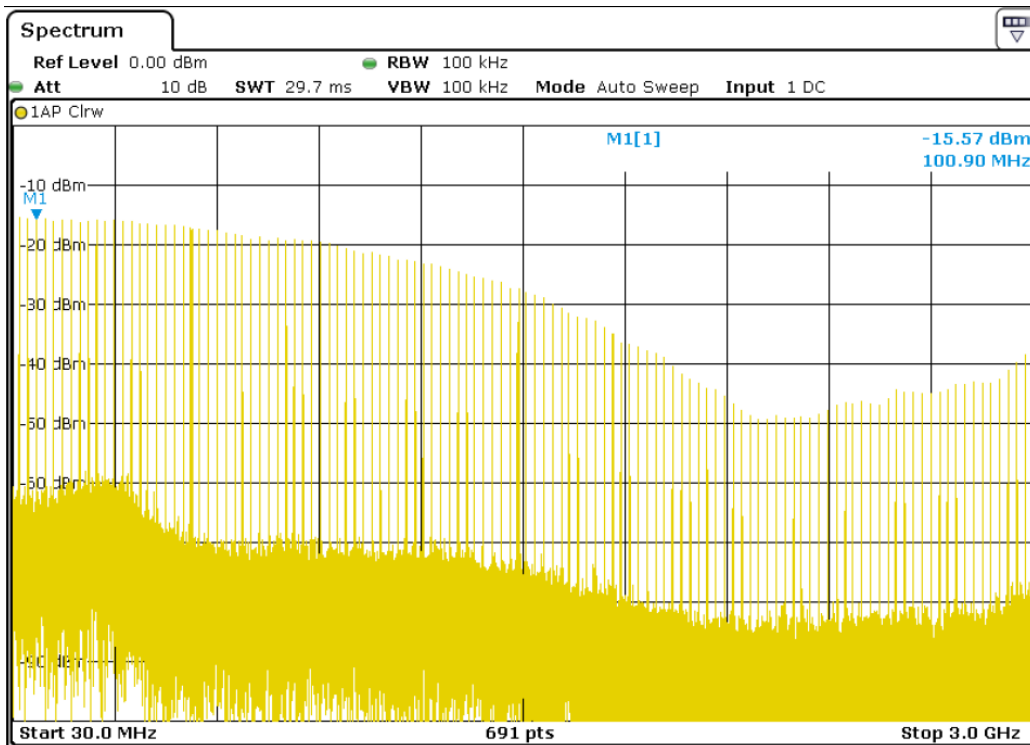


Figure 6 – 25 MHz comb frequency; amplifier on

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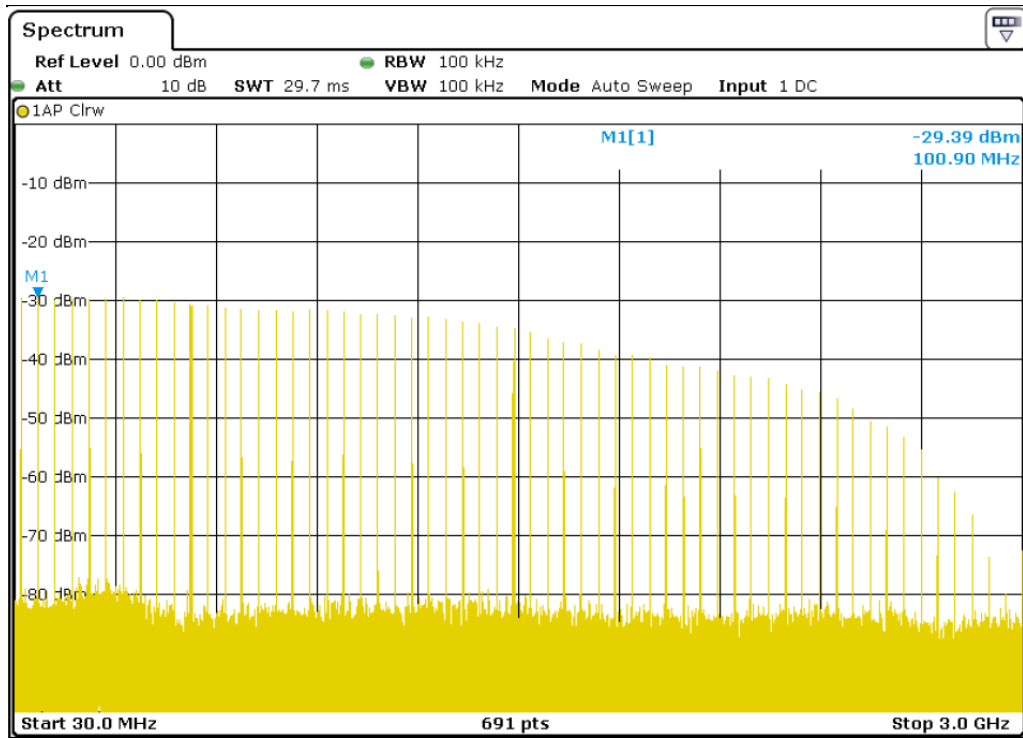


Figure 7 – 50 MHz comb frequency; amplifier off

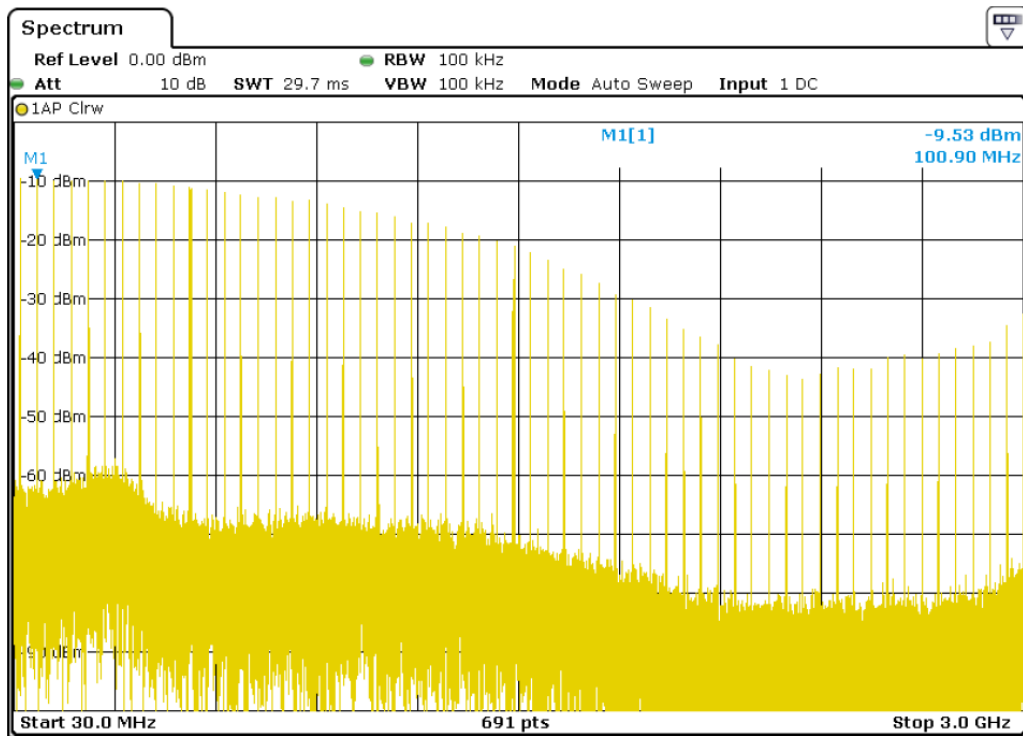


Figure 8 – 50 MHz comb frequency; amplifier on

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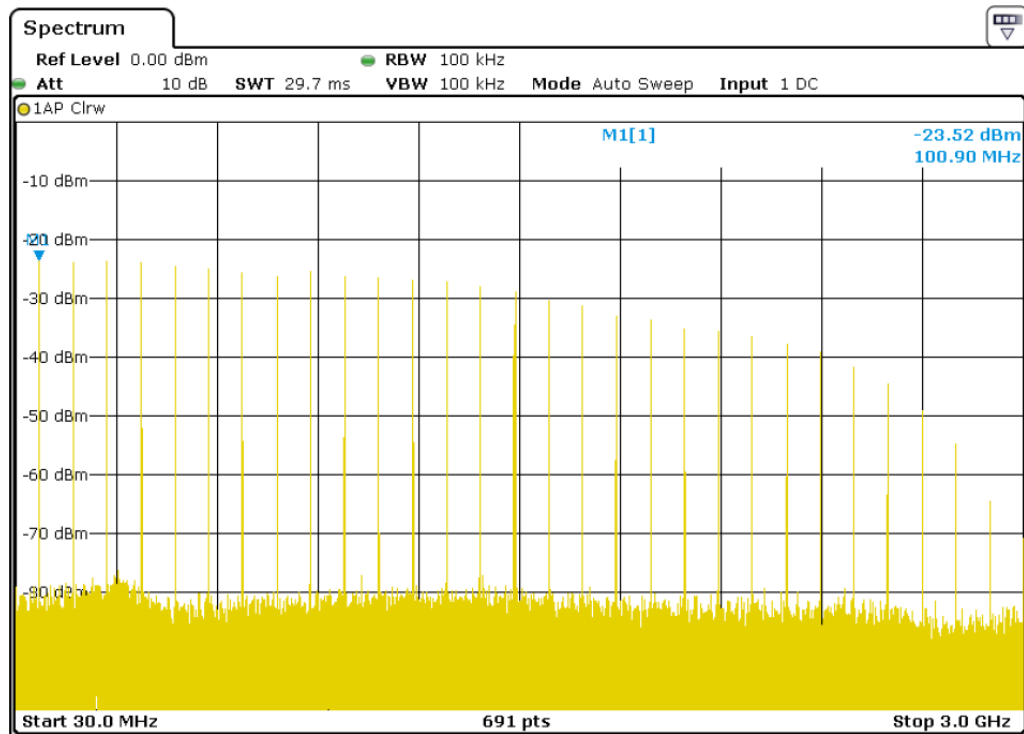


Figure 9 – 100 MHz comb frequency; amplifier off

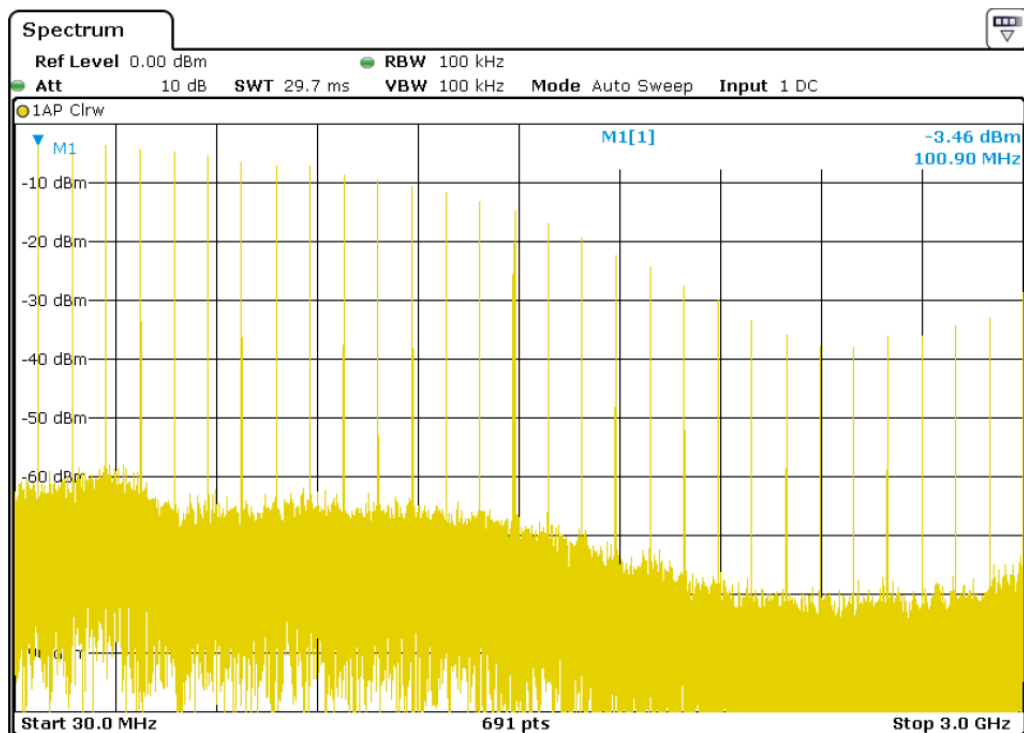


Figure 10 – 100 MHz comb frequency; amplifier on

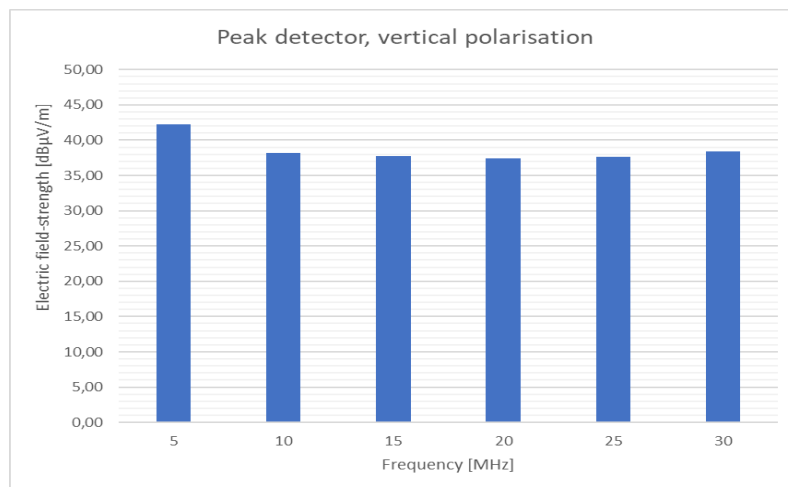
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5 Spectrum plots, radiated spectrum

5.1 5 MHz comb frequency, 30 cm antenna, amplifier off, 5 MHz – 30 MHz

Frequency [MHz]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
5	41,90	42,22
10	37,79	38,24
15	37,26	37,80
20	36,85	37,39
25	37,00	37,58
30	37,73	38,39

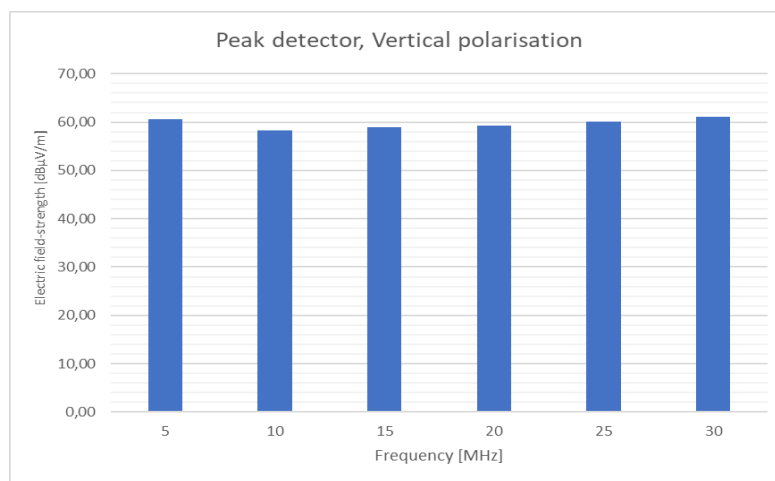
Measured with monopole antenna
3m distance, 1 meter height



5.2 5 MHz comb frequency, 30 cm antenna, amplifier on, 5 MHz – 30 MHz

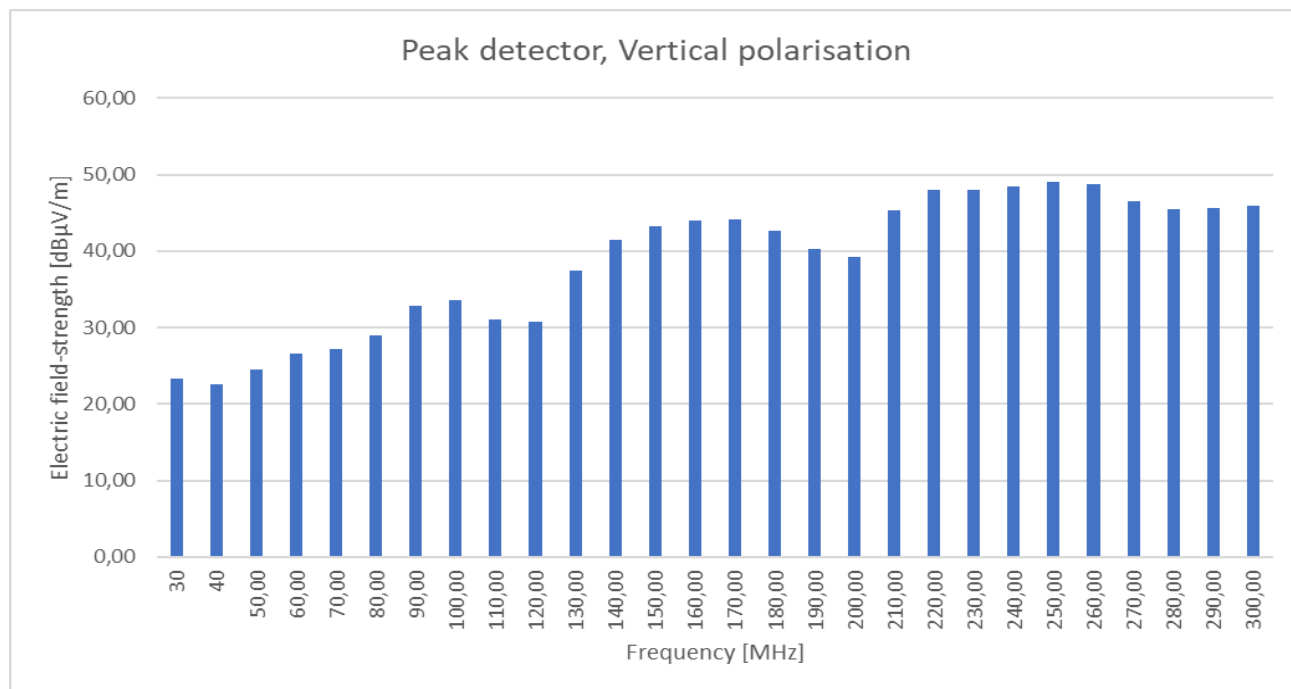
Frequency [MHz]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
5	60,46203465	60,52186436
10	58,18131657	58,25656147
15	58,9213401	58,9933921
20	59,24687763	59,31687351
25	59,94397008	60,01258504
30	60,97456223	61,04570252

Measured with monopole antenna
3m distance, 1 meter height



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5.3 10 MHz comb frequency, 30 cm antenna, amplifier off, 30 MHz – 300 MHz

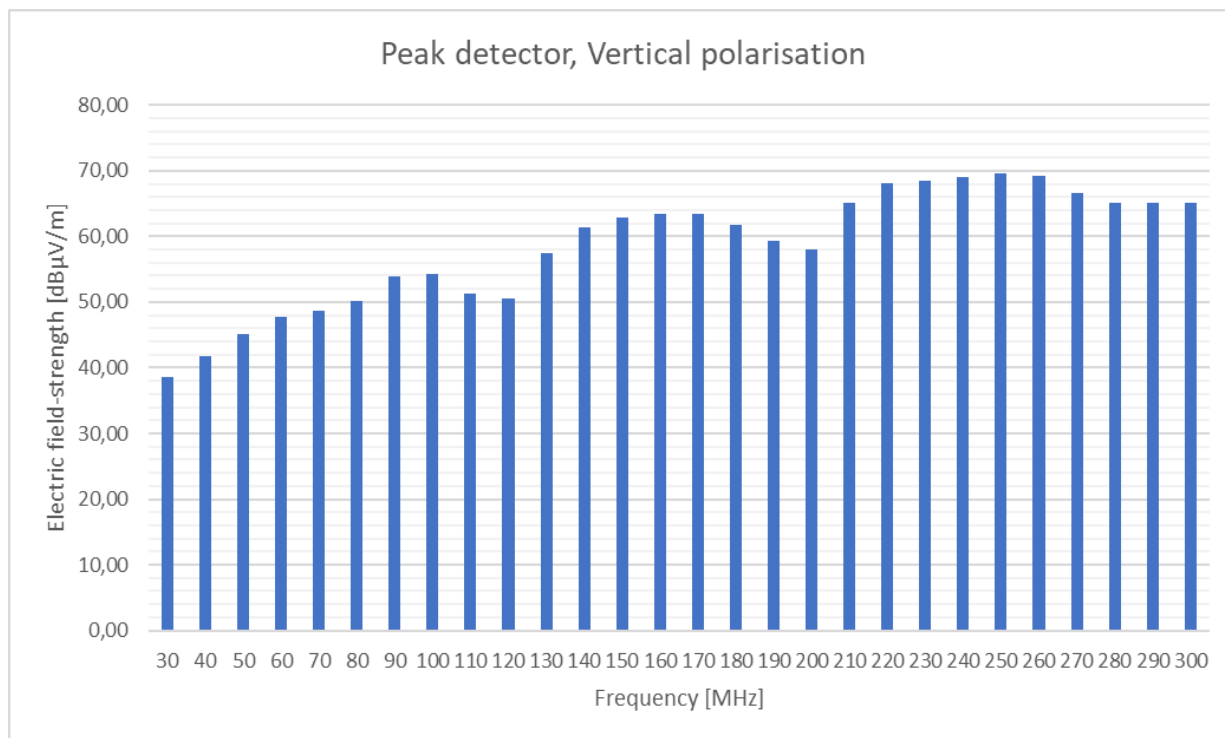


Measured with biconical antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]	Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
30	0,33	20,47	13,48	23,27	170	21,69	25,61	43,70	44,10
40	-5,46	13,92	18,17	22,60	180	17,09	22,80	42,17	42,68
50	-7,46	11,10	22,36	24,48	190	16,09	22,81	39,52	40,22
60	-7,19	9,37	25,38	26,57	200	12,93	21,44	38,53	39,29
70	-11,57	6,86	26,42	27,23	210	7,11	19,65	44,87	45,28
80	-10,14	7,00	28,22	28,95	220	19,81	24,83	47,61	47,95
90	-5,78	9,42	32,24	32,81	230	24,22	27,78	47,68	48,02
100	0,68	12,57	32,95	33,61	240	21,47	26,09	48,02	48,38
110	-0,49	13,34	30,10	31,10	250	21,44	26,68	48,75	49,08
120	1,25	14,37	29,59	30,76	260	23,68	27,77	48,34	48,68
130	0,92	16,20	36,91	37,51	270	21,14	26,24	46,07	46,46
140	8,92	18,28	41,04	41,46	280	27,21	30,67	44,88	45,41
150	15,07	21,42	42,85	43,26	290	21,44	26,95	45,02	45,56
160	19,59	24,12	43,66	44,05	300	16,28	25,51	45,24	45,90

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5.4 10 MHz comb frequency, 30 cm antenna, amplifier on, 30 MHz – 300 MHz

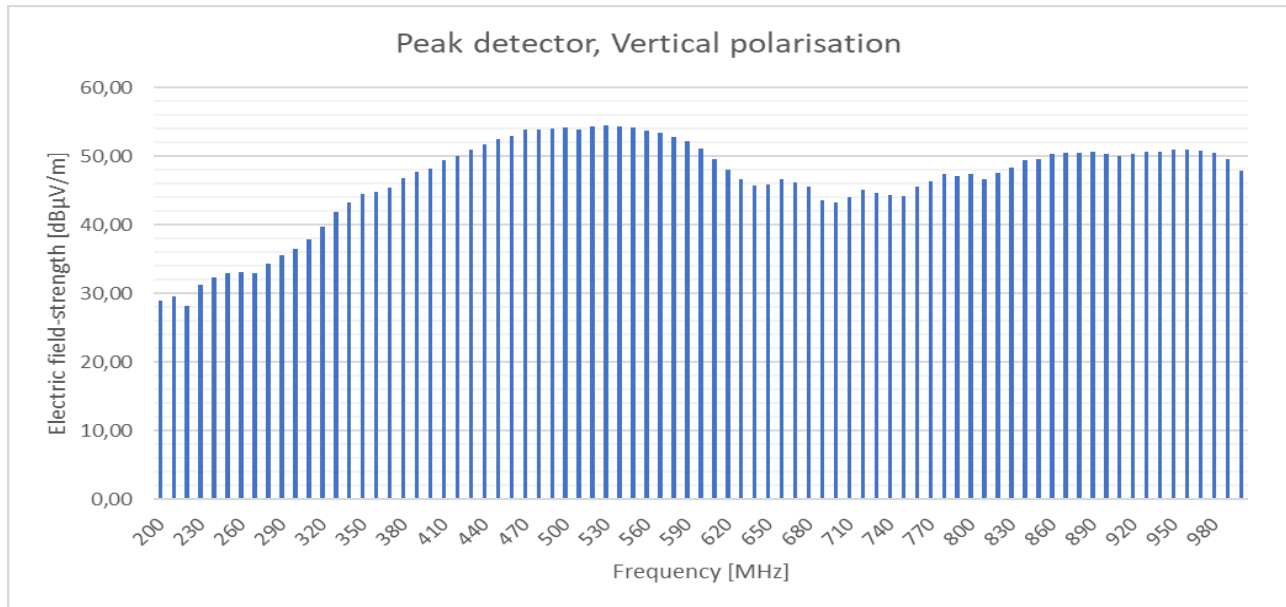


Measured with biconical antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]	Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
30	2,67	20,77	37,44	38,56	170	41,61	42,06	63,22	63,37
40	1,00	15,92	41,31	41,74	180	37,14	37,96	61,58	61,73
50	8,90	15,84	44,96	45,19	190	36,39	37,31	59,11	59,27
60	15,38	18,63	47,64	47,81	200	34,00	35,18	57,82	57,99
70	7,97	13,16	48,44	48,59	210	29,50	31,61	64,90	65,06
80	10,82	15,15	50,05	50,19	220	40,89	41,53	67,86	68,02
90	17,16	20,17	53,73	53,87	230	45,20	45,61	68,25	68,42
100	23,33	25,18	54,10	54,24	240	42,79	43,36	68,86	69,03
110	21,68	24,05	51,08	51,23	250	42,71	43,35	69,47	69,66
120	21,70	24,28	50,31	50,48	260	44,83	45,33	68,96	69,14
130	23,14	25,77	57,34	57,49	270	42,54	43,13	66,42	66,60
140	30,51	31,86	61,14	61,29	280	47,69	48,09	64,98	65,15
150	35,59	36,42	62,70	62,84	290	42,05	42,83	64,84	65,05
160	39,81	40,38	63,38	63,52	300	37,53	38,97	64,87	65,08

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5.5 10 MHz comb frequency, 10 cm antenna, amplifier off, 200 MHz – 1 GHz

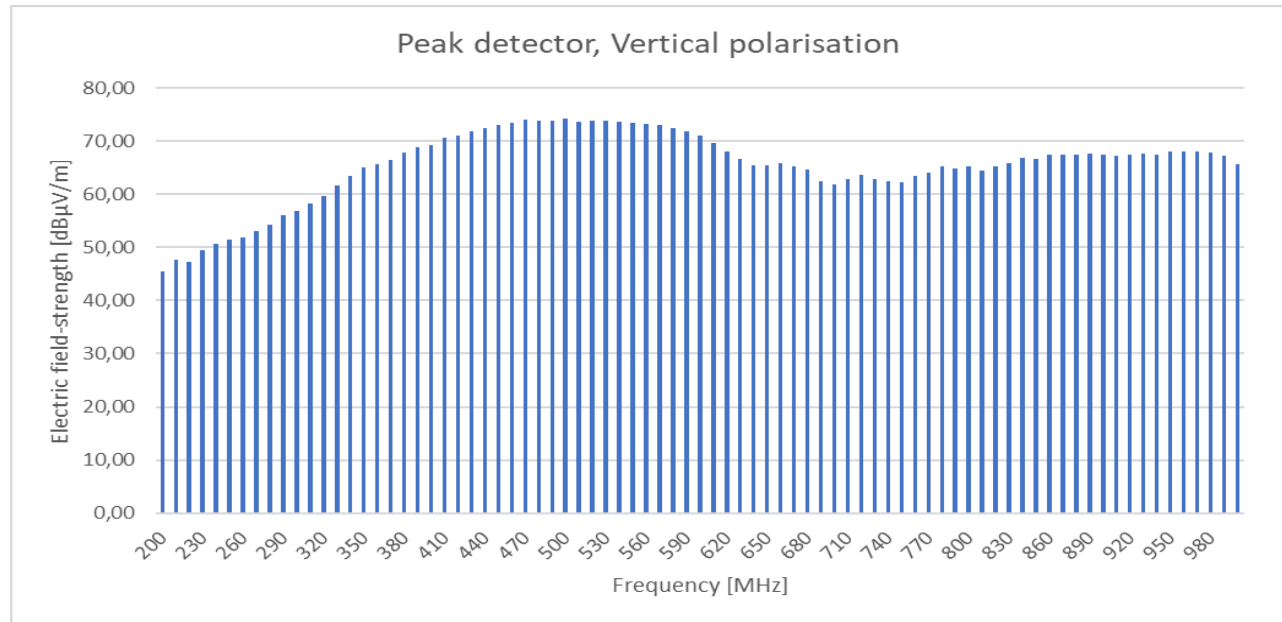


Measured with logarithmic periodic antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]	Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
200	5,05	16,57	27,39	28,96	610	18,78	26,12	49,16	49,51
210	8,84	17,40	28,29	29,65	620	16,49	25,29	47,68	48,11
220	5,75	16,40	26,51	28,22	630	10,72	23,09	46,18	46,68
230	-3,34	13,65	30,02	31,26	640	20,49	27,69	45,16	45,75
240	0,04	14,36	31,26	32,28	650	19,98	27,09	45,41	45,94
250	-0,17	14,41	31,91	32,92	660	10,26	23,54	46,08	46,63
260	5,15	16,59	32,10	33,14	670	11,02	23,87	45,55	46,19
270	7,58	17,24	31,89	32,92	680	20,13	27,40	44,96	45,56
280	6,93	17,71	33,27	34,29	690	18,84	27,20	42,79	43,56
290	15,81	21,48	34,72	35,65	700	21,15	27,83	42,39	43,25
300	13,16	20,26	35,61	36,50	710	23,19	29,02	43,31	44,10
310	13,80	20,70	37,10	37,89	720	18,54	26,82	44,34	45,05
320	12,96	21,21	39,14	39,71	730	7,62	24,17	43,85	44,66
330	9,46	19,76	41,37	41,86	740	22,35	28,52	43,60	44,37
340	9,43	19,49	42,75	43,20	750	21,50	27,81	43,53	44,26
350	20,24	24,60	44,08	44,50	760	19,17	27,67	45,02	45,64
360	18,03	23,71	44,42	44,81	770	17,65	26,82	45,81	46,40
370	9,99	20,23	45,14	45,50	780	19,61	27,41	46,85	47,41
380	18,65	23,88	46,40	46,78	790	19,69	27,41	46,54	47,09
390	22,45	26,33	47,46	47,77	800	23,88	29,75	46,90	47,50
400	21,83	25,89	47,87	48,18	810	24,22	29,71	46,02	46,62
410	16,40	22,90	49,22	49,48	820	22,94	29,10	46,98	47,56
420	18,96	24,54	49,73	50,01	830	24,98	30,39	47,90	48,43
430	21,26	25,98	50,65	50,89	840	27,16	31,85	48,96	49,43
440	19,20	25,06	51,50	51,75	850	27,59	32,10	49,16	49,64
450	11,15	22,03	52,25	52,45	860	26,97	31,53	49,89	50,34
460	10,62	21,57	52,73	52,92	870	25,84	30,88	50,05	50,49
470	22,89	27,33	53,67	53,84	880	24,26	30,63	50,01	50,45
480	25,27	28,98	53,74	53,93	890	24,63	30,60	50,20	50,66
490	23,35	27,77	53,82	54,00	900	23,83	30,13	49,86	50,31
500	29,53	31,97	54,02	54,20	910	15,80	27,12	49,51	50,04
510	31,66	33,53	53,65	53,81	920	24,29	30,65	49,86	50,33
520	31,20	33,26	54,23	54,40	930	28,74	32,96	50,14	50,62
530	25,81	29,52	54,40	54,57	940	28,51	32,80	50,15	50,61
540	22,55	27,41	54,15	54,33	950	27,54	32,65	50,56	50,99
550	14,54	23,57	53,94	54,13	960	28,48	33,06	50,58	51,02
560	21,51	27,54	53,59	53,79	970	26,24	31,84	50,43	50,88
570	25,87	29,80	53,18	53,39	980	25,50	31,18	50,02	50,54
580	23,03	28,41	52,60	52,83	990	26,18	31,57	49,06	49,60
590	23,33	28,47	51,87	52,15	1000	20,72	29,52	47,11	47,83
600	24,01	29,13	50,85	51,15					

TBCG3-RN2 Comb Generator

5.6 10 MHz comb frequency, 10 cm antenna, amplifier on, 200 MHz – 1 GHz

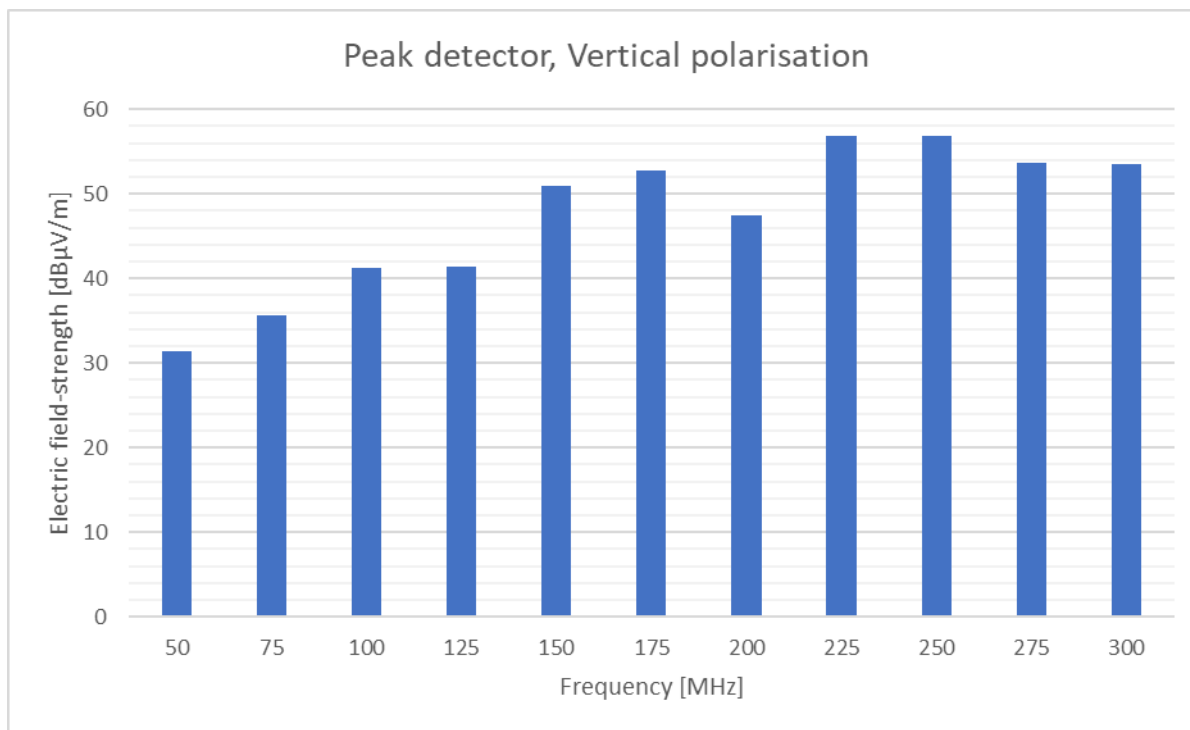


Measured with logarithmic periodic antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]	Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
200	26,52	28,16	45,22	45,50	610	39,40	40,50	69,66	69,72
210	28,86	30,20	47,43	47,67	620	38,95	40,05	68,02	68,08
220	27,81	29,26	47,15	47,37	630	31,76	34,02	66,51	66,57
230	14,79	19,96	49,29	49,51	640	42,46	43,24	65,44	65,52
240	20,01	23,66	50,37	50,59	650	42,25	43,06	65,47	65,54
250	20,45	23,59	51,26	51,46	660	34,26	36,12	65,86	65,92
260	26,21	28,09	51,71	51,92	670	31,55	34,07	65,25	65,33
270	31,36	32,56	52,82	53,03	680	40,82	41,77	64,53	64,61
280	25,57	27,77	54,02	54,22	690	39,79	40,86	62,32	62,43
290	35,99	36,86	55,82	56,04	700	41,68	42,61	61,82	61,93
300	33,68	34,64	56,68	56,90	710	43,33	44,12	62,75	62,85
310	34,98	35,89	58,02	58,24	720	38,55	39,86	63,58	63,67
320	34,72	35,75	59,39	59,60	730	25,42	30,88	62,82	62,93
330	31,86	33,24	61,51	61,74	740	41,79	42,68	62,40	62,50
340	32,73	34,24	63,18	63,39	750	41,02	41,98	62,13	62,23
350	42,17	42,65	64,85	65,03	760	38,84	40,07	63,38	63,47
360	40,00	40,61	65,45	65,63	770	37,65	39,08	64,06	64,15
370	33,43	34,66	66,33	66,49	780	39,58	40,83	65,13	65,21
380	40,29	40,85	67,70	67,86	790	39,69	40,84	64,80	64,88
390	43,90	44,33	68,82	68,96	800	43,39	44,24	65,23	65,31
400	43,42	43,90	69,18	69,32	810	43,46	44,24	64,36	64,45
410	38,11	38,94	70,57	70,68	820	41,94	42,89	65,15	65,23
420	40,88	41,49	70,89	71,02	830	43,58	44,41	65,87	65,94
430	42,50	43,02	71,70	71,81	840	45,37	46,09	66,79	66,86
440	38,69	39,54	72,41	72,51	850	45,56	46,25	66,68	66,76
450	37,07	38,07	72,98	73,08	860	44,94	45,71	67,34	67,41
460	31,90	33,59	73,30	73,39	870	43,98	44,85	67,45	67,53
470	44,07	44,55	73,98	74,05	880	42,76	43,74	67,38	67,46
480	46,02	46,42	73,87	73,95	890	43,06	44,18	67,65	67,72
490	43,82	44,34	73,85	73,93	900	42,15	43,27	67,49	67,55
500	49,74	50,01	74,10	74,17	910	34,40	36,81	67,11	67,18
510	51,75	51,97	73,53	73,60	920	42,35	43,50	67,40	67,47
520	51,71	51,94	73,81	73,87	930	46,58	47,36	67,57	67,64
530	46,83	47,21	73,81	73,87	940	46,42	47,07	67,48	67,55
540	42,85	43,51	73,59	73,65	950	45,53	46,29	67,91	67,98
550	33,76	35,41	73,49	73,55	960	46,47	47,17	68,03	68,10
560	41,65	42,39	73,28	73,34	970	44,42	45,30	67,97	68,04
570	46,22	46,66	72,98	73,04	980	44,03	44,95	67,77	67,84
580	43,57	44,23	72,49	72,54	990	44,99	45,85	67,13	67,21
590	43,87	44,52	71,86	71,93	1000	40,01	41,52	65,50	65,60
600	44,63	45,23	71,05	71,10					

TBCG3-RN2 Comb Generator

5.7 25 MHz comb frequency, 30 cm antenna, amplifier off, 30 MHz – 300 MHz

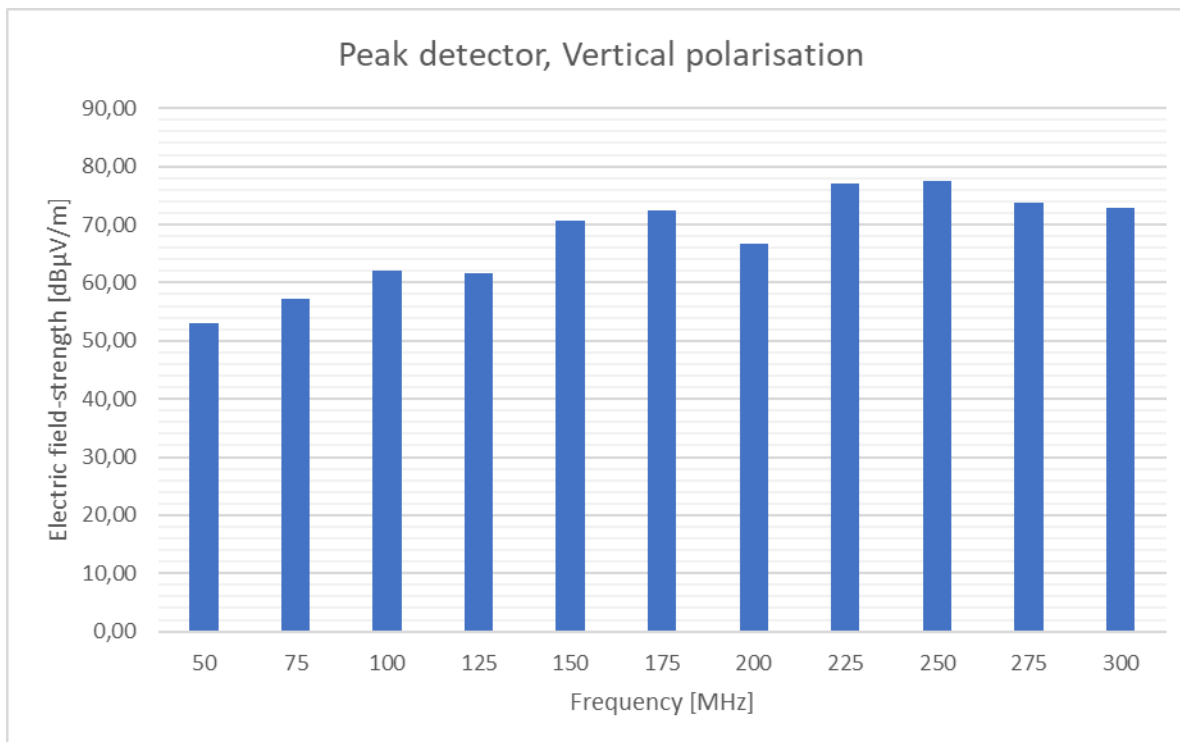


Measured with biconical antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
50	-5,04	12	30,48	31,43
75	-6,15	8,15	35,37	35,68
100	9,57	16,05	40,93	41,19
125	7,97	17,14	41,1	41,47
150	23,33	26,54	50,82	50,98
175	32,19	33,59	52,67	52,82
200	21,47	25,6	47,17	47,46
225	34,82	36,14	56,73	56,86
250	29,8	32,27	56,65	56,79
275	29,2	31,75	53,42	53,61
300	25,1	29,87	53,21	53,47

TBCG3-RN2 Comb Generator

5.8 25 MHz comb frequency, 30 cm antenna, amplifier on, 30 MHz – 300 MHz

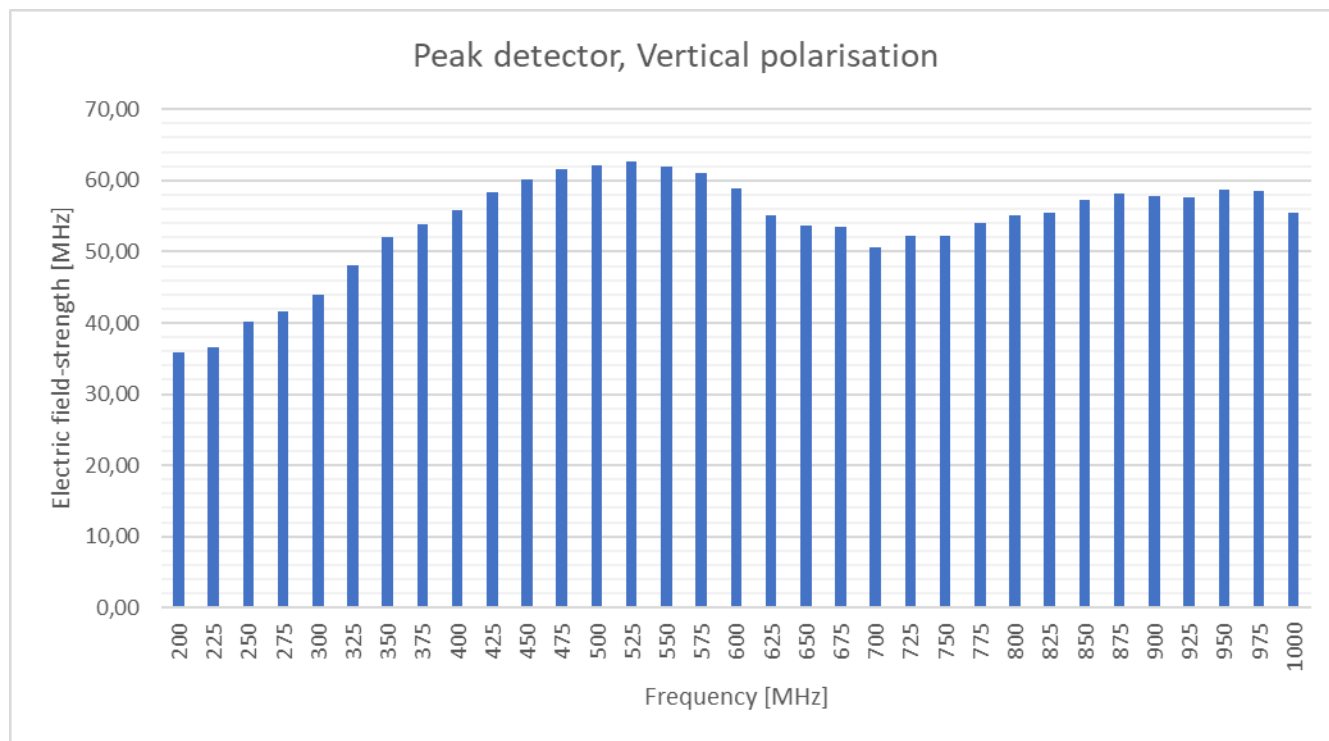


Measured with biconical antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
50	17,46	20,81	52,94	53,03
75	16,88	19,18	57,20	57,26
100	31,67	32,40	62,09	62,15
125	28,77	30,17	61,54	61,61
150	43,61	43,94	70,68	70,74
175	51,89	52,06	72,35	72,41
200	41,98	42,52	66,53	66,60
225	55,26	55,40	77,04	77,11
250	50,84	51,09	77,41	77,48
275	48,99	49,29	73,63	73,71
300	45,72	46,25	72,82	72,90

TBCG3-RN2 Comb Generator

5.9 25 MHz comb frequency, 10 cm antenna, amplifier off, 200 MHz – 1 GHz

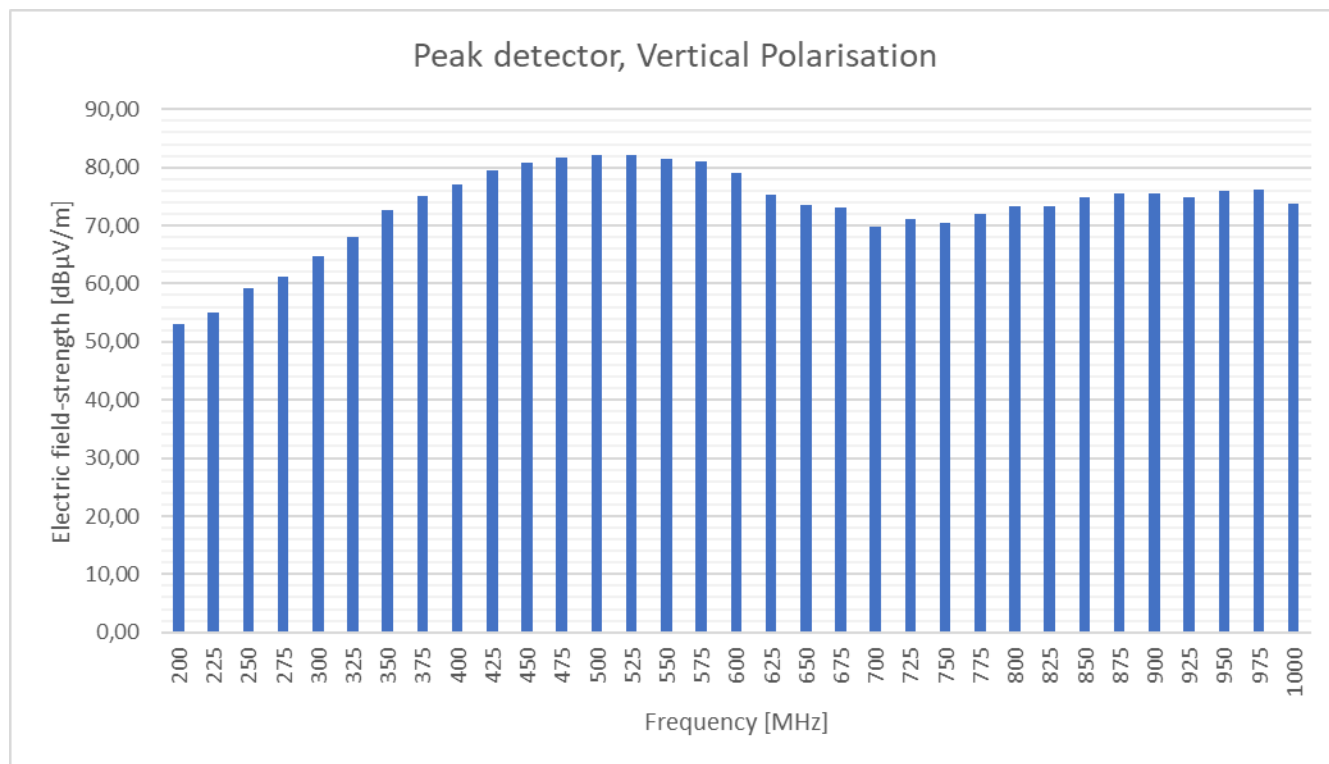


Measured with logarithmic periodic antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]	Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
200	13,38	19,15	35,28	35,93	625	3,80	22,13	54,94	55,13
225	1,98	15,07	35,99	36,59	650	27,30	31,07	53,43	53,66
250	9,92	17,72	39,83	40,26	675	29,27	32,56	53,29	53,52
275	13,48	19,98	41,11	41,56	700	28,68	32,22	50,33	50,68
300	22,34	25,41	43,60	43,93	725	25,73	30,61	52,03	52,32
325	21,19	25,14	47,81	48,03	750	31,55	34,17	51,89	52,22
350	28,91	30,70	51,81	51,99	775	27,67	31,45	53,75	53,98
375	14,88	21,83	53,76	53,90	800	31,49	34,25	54,89	55,13
400	28,13	30,36	55,76	55,89	825	30,70	34,07	55,21	55,44
425	25,18	28,66	58,34	58,43	850	34,84	36,99	57,16	57,35
450	23,49	27,31	60,12	60,20	875	30,14	33,77	58,06	58,24
475	36,08	37,36	61,50	61,59	900	29,64	33,49	57,88	58,05
500	38,94	39,84	61,99	62,07	925	34,59	36,91	57,41	57,62
525	39,74	40,57	62,54	62,61	950	35,53	37,76	58,48	58,67
550	26,99	30,34	61,83	61,91	975	34,82	37,36	58,43	58,61
575	29,89	32,76	61,05	61,14	1000	29,72	34,04	55,12	55,41
600	29,05	32,21	58,78	58,91					

TBCG3-RN2 Comb Generator

5.10 25 MHz comb frequency, 10 cm antenna, amplifier on, 200 MHz – 1 GHz

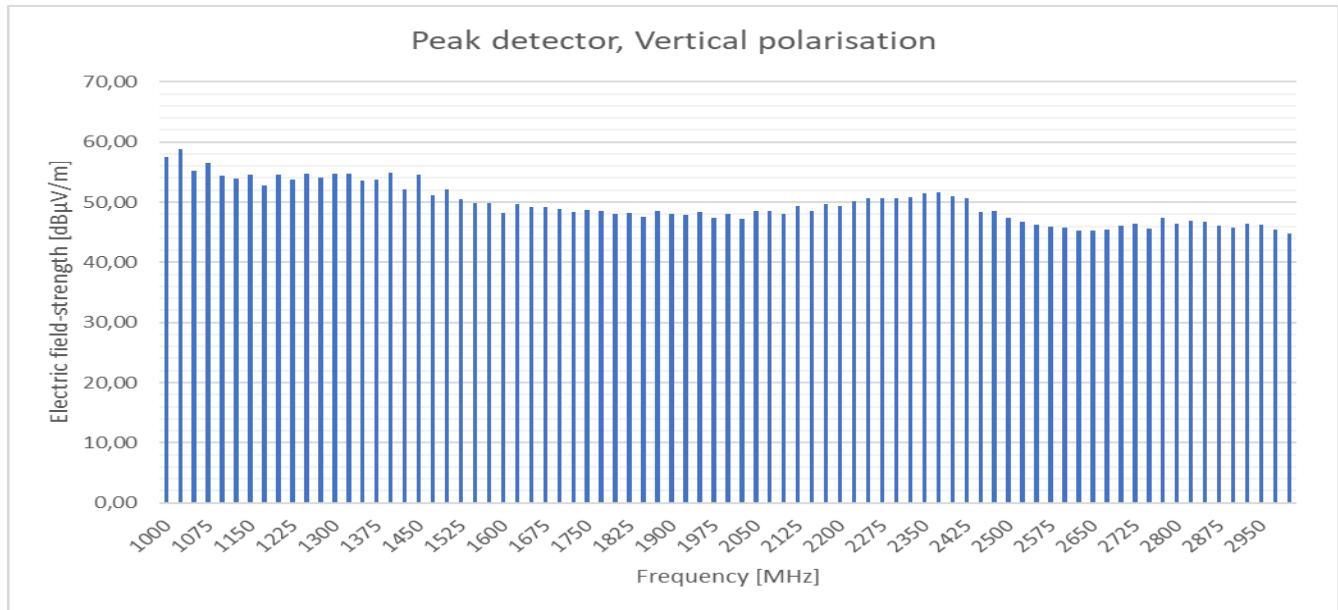


Measured with logarithmic periodic antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]	Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
200	35,84	36,48	52,98	53,09	625	34,66	36,50	75,29	75,33
225	24,94	26,87	55,02	55,12	650	49,02	49,44	73,49	73,52
250	28,43	29,89	59,16	59,25	675	47,28	47,75	72,97	73,01
275	26,22	28,30	61,02	61,11	700	49,18	49,60	69,79	69,83
300	40,52	40,99	64,67	64,77	725	44,04	44,76	71,17	71,22
325	44,42	44,75	67,88	67,96	750	49,40	49,78	70,48	70,53
350	49,04	49,26	72,57	72,65	775	46,08	46,66	71,99	72,03
375	42,12	42,58	75,03	75,09	800	51,02	51,39	73,23	73,27
400	49,43	49,69	77,10	77,16	825	50,23	50,61	73,32	73,36
425	49,46	49,72	79,44	79,49	850	52,45	52,81	74,77	74,81
450	44,74	45,18	80,86	80,90	875	50,79	51,22	75,46	75,50
475	53,50	53,67	81,70	81,75	900	49,91	50,44	75,56	75,59
500	58,34	58,44	82,09	82,13	925	51,53	51,93	74,92	74,96
525	58,57	58,67	82,00	82,03	950	53,81	54,11	75,92	75,95
550	42,28	42,94	81,40	81,43	975	51,90	52,29	76,17	76,21
575	52,54	52,78	80,92	80,95	1000	48,23	48,85	73,60	73,65
600	52,02	52,29	79,01	79,05					

TBCG3-RN2 Comb Generator

5.11 25 MHz comb frequency, 10 cm antenna, amplifier off, 1 GHz – 3 GHz

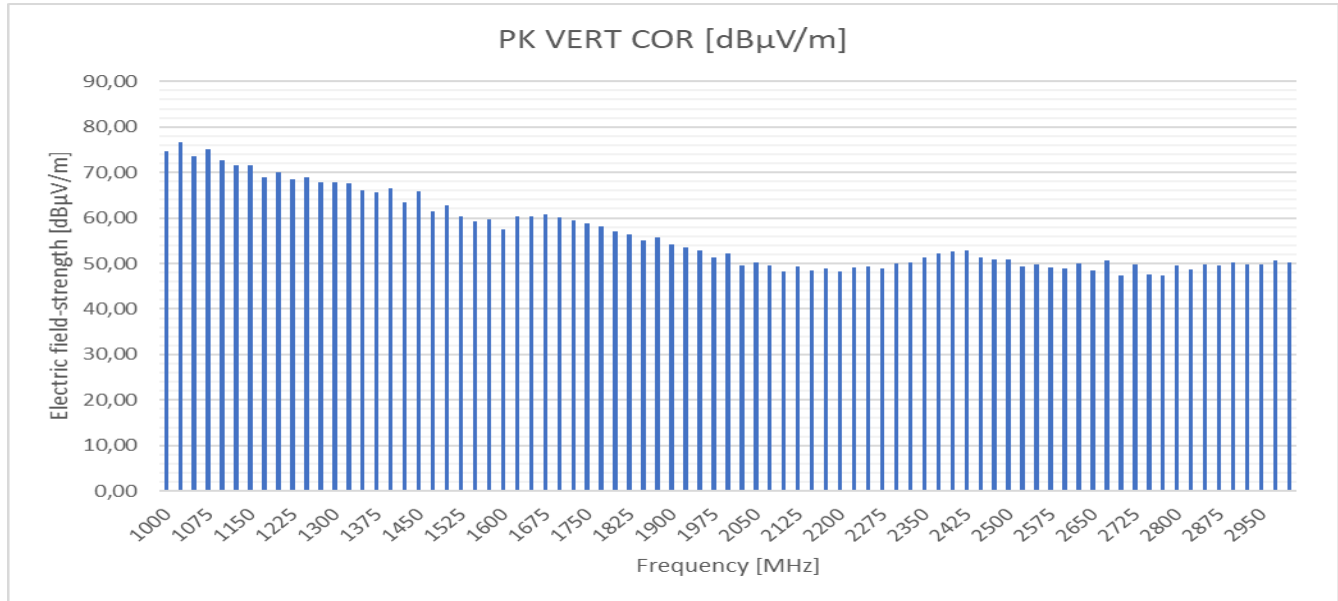


Measured with horn antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]	Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
1000	29,42	42,14	56,23	57,42	2025	28,94	42,70	41,03	47,20
1025	29,16	41,31	57,73	58,81	2050	29,15	42,09	43,42	48,47
1050	26,58	39,44	54,01	55,29	2075	29,61	42,96	42,71	48,59
1075	26,38	39,12	55,38	56,44	2100	30,02	43,11	41,17	47,96
1100	26,09	39,37	53,01	54,45	2125	30,48	43,93	43,49	49,26
1125	26,16	39,25	52,31	53,91	2150	30,99	44,76	42,14	48,54
1150	27,32	40,91	53,02	54,54	2175	31,37	45,13	44,02	49,74
1175	26,64	39,67	50,86	52,82	2200	31,79	44,83	42,80	49,40
1200	27,32	39,98	52,95	54,56	2225	32,02	44,48	43,90	50,23
1225	27,11	39,69	51,99	53,82	2250	32,16	45,38	45,10	50,63
1250	26,69	39,61	53,05	54,65	2275	32,01	44,76	44,12	50,61
1275	26,63	41,03	52,44	54,08	2300	31,84	45,68	45,22	50,61
1300	26,66	39,80	53,07	54,73	2325	32,12	45,06	44,88	50,76
1325	26,58	39,82	53,21	54,78	2350	32,63	45,34	45,49	51,47
1350	26,60	39,92	52,04	53,65	2375	33,45	46,25	44,32	51,61
1375	26,56	39,38	51,95	53,71	2400	34,21	46,78	42,85	50,97
1400	26,78	39,70	53,32	54,89	2425	33,72	47,16	42,21	50,70
1425	26,68	40,25	50,02	52,06	2450	33,01	46,74	38,21	48,43
1450	26,94	40,03	52,80	54,50	2475	32,72	46,01	37,87	48,48
1475	27,08	40,16	48,29	51,08	2500	32,62	45,28	36,34	47,41
1500	27,30	40,77	49,76	52,19	2525	32,31	45,40	34,41	46,81
1525	27,48	40,45	47,41	50,55	2550	32,10	45,01	34,15	46,23
1550	27,70	41,53	46,47	49,79	2575	32,03	45,00	33,15	45,86
1575	27,80	40,43	46,68	49,84	2600	31,87	44,80	32,84	45,74
1600	27,46	40,42	44,21	48,14	2625	31,93	44,71	32,99	45,23
1625	27,34	39,83	46,51	49,75	2650	32,13	45,45	32,55	45,30
1650	27,32	39,93	45,77	49,11	2675	32,26	45,07	32,75	45,48
1675	27,26	40,52	45,88	49,23	2700	32,48	45,87	32,46	46,01
1700	27,27	40,39	45,21	48,80	2725	32,59	45,59	32,68	46,47
1725	27,54	40,60	44,70	48,39	2750	32,77	45,53	32,79	45,64
1750	27,87	40,56	44,42	48,66	2775	33,63	46,53	33,58	47,43
1775	28,00	40,94	44,16	48,56	2800	33,41	47,57	33,37	46,41
1800	27,68	40,58	43,68	47,98	2825	33,69	47,10	33,64	46,87
1825	27,80	40,69	43,83	48,15	2850	33,87	47,23	33,83	46,77
1850	27,70	41,63	43,17	47,61	2875	33,04	46,25	33,00	46,02
1875	27,93	40,92	44,49	48,45	2900	32,99	45,98	32,94	45,82
1900	28,08	42,54	43,44	48,00	2925	32,64	45,76	32,59	46,39
1925	28,20	41,37	43,28	47,87	2950	32,49	45,42	32,47	46,28
1950	28,48	41,84	43,19	48,35	2975	32,30	45,91	32,25	45,41
1975	28,47	41,18	42,18	47,42	3000	31,85	44,98	31,84	44,82
2000	28,55	41,93	43,39	48,12					

TBCG3-RN2 Comb Generator

5.12 25 MHz comb frequency, 10 cm antenna, amplifier on, 1 GHz – 3 GHz

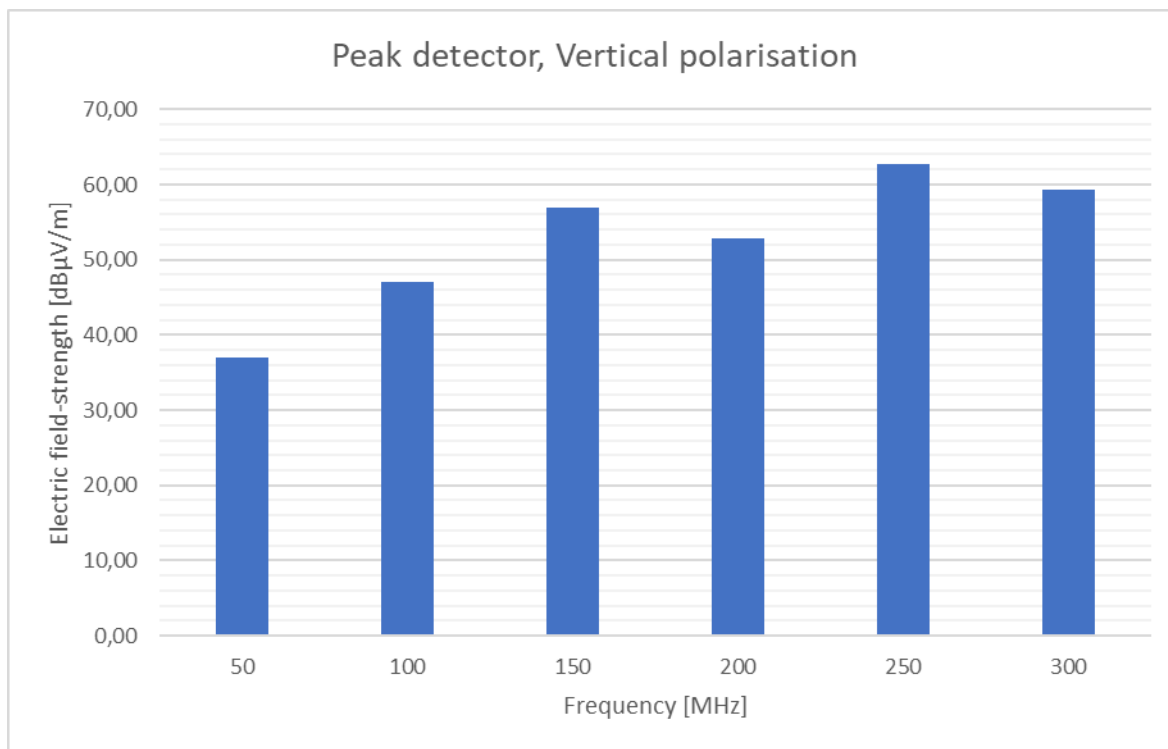


Measured with horn antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dB μ V/m]	PK HOR [dB μ V/m]	AVG VERT [dB μ V/m]	PK VERT [dB μ V/m]	Frequency [MHz]	AVG HOR [dB μ V/m]	PK HOR [dB μ V/m]	AVG VERT [dB μ V/m]	PK VERT [dB μ V/m]
1000	43,69	48,09	74,59	74,75	2025	28,94	42,37	45,11	49,46
1025	43,07	48,05	76,57	76,71	2050	29,15	42,14	46,44	50,33
1050	38,97	44,42	73,43	73,58	2075	29,62	42,27	44,97	49,47
1075	38,40	44,39	74,96	75,09	2100	30,01	43,32	42,47	48,31
1100	33,14	41,90	72,56	72,73	2125	30,47	43,60	43,83	49,39
1125	31,17	41,87	71,41	71,61	2150	30,98	44,10	41,83	48,41
1150	38,15	44,20	71,35	71,56	2175	31,35	44,85	42,57	49,00
1175	29,38	40,71	68,55	68,87	2200	31,77	45,35	40,74	48,29
1200	31,66	41,97	69,84	70,10	2225	32,00	45,19	41,42	49,04
1225	35,30	43,20	68,24	68,54	2250	32,13	45,12	42,36	49,31
1250	29,89	41,14	68,68	68,95	2275	32,00	44,80	41,69	48,96
1275	27,53	40,27	67,49	67,82	2300	31,83	45,01	43,47	50,03
1300	29,90	41,73	67,55	67,87	2325	32,11	45,57	43,96	50,26
1325	28,68	40,61	67,29	67,63	2350	32,62	46,11	45,77	51,29
1350	29,22	41,20	65,67	66,08	2375	33,47	46,59	46,49	52,21
1375	28,47	40,77	65,26	65,65	2400	34,20	47,45	46,58	52,64
1400	29,12	40,46	66,20	66,58	2425	33,76	46,87	47,44	52,94
1425	27,44	40,06	62,80	63,36	2450	33,04	45,95	44,63	51,35
1450	27,12	40,07	65,45	65,88	2475	32,74	45,88	44,86	50,79
1475	27,44	40,61	60,72	61,43	2500	32,63	46,08	44,36	50,90
1500	30,63	41,78	62,22	62,84	2525	32,32	45,01	41,84	49,33
1525	27,92	40,58	59,47	60,34	2550	32,26	44,98	43,11	49,78
1550	28,22	41,79	58,27	59,26	2575	32,04	44,86	41,33	49,13
1575	31,24	42,14	58,67	59,59	2600	32,86	45,17	41,86	48,81
1600	28,26	41,08	56,46	57,57	2625	32,25	45,50	44,26	49,93
1625	27,56	40,94	59,43	60,31	2650	32,29	45,42	40,73	48,53
1650	27,56	40,58	59,39	60,26	2675	32,26	45,18	44,89	50,62
1675	27,68	40,55	59,93	60,76	2700	32,61	46,32	35,35	47,43
1700	30,78	41,85	59,38	60,23	2725	32,61	45,82	42,67	49,87
1725	31,95	42,17	58,65	59,56	2750	32,92	46,14	36,78	47,59
1750	31,56	42,31	57,81	58,87	2775	33,79	46,96	34,57	47,31
1775	30,20	42,00	56,90	58,12	2800	33,48	46,54	38,66	49,52
1800	28,14	40,92	55,54	56,94	2825	33,72	47,01	37,47	48,72
1825	28,74	41,21	55,03	56,46	2850	34,04	46,70	41,13	49,87
1850	28,41	41,06	53,61	55,14	2875	33,18	46,05	41,23	49,50
1875	28,15	41,59	54,10	55,67	2900	33,96	46,67	43,09	50,28
1900	28,38	41,42	52,18	54,10	2925	33,05	46,27	42,84	49,83
1925	28,50	41,06	51,21	53,48	2950	32,60	45,96	42,93	49,76
1950	28,65	42,65	50,26	52,88	2975	32,82	46,19	44,92	50,73
1975	28,51	41,39	48,38	51,31	3000	31,93	45,60	44,29	50,22
2000	28,57	41,33	48,91	52,30					

TBCG3-RN2 Comb Generator

5.13 50 MHz comb frequency, 30 cm antenna, amplifier off, 30 MHz – 300 MHz

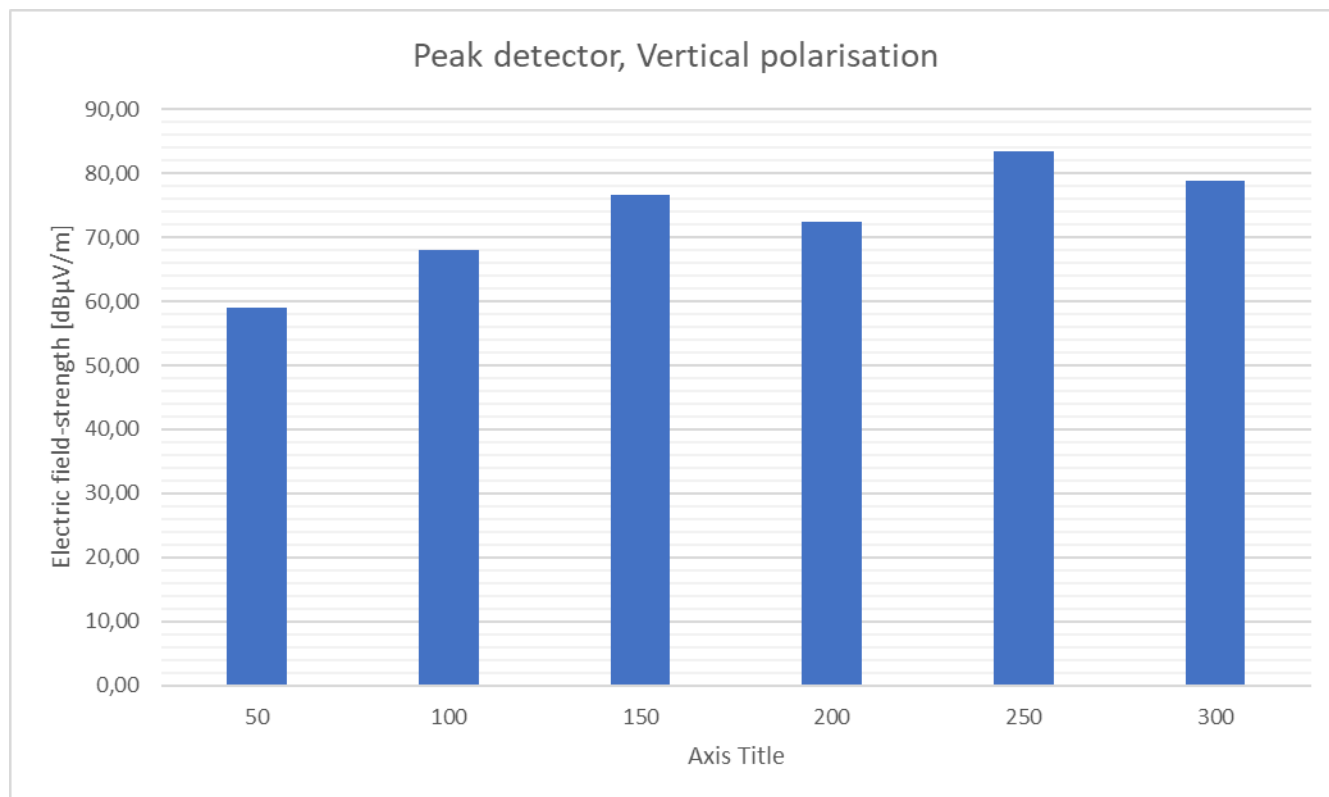


Measured with biconical antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
50	-0,35	13,09	36,45	36,92
100	16,00	20,18	46,90	47,05
150	29,54	31,11	56,76	56,85
200	28,24	30,42	52,72	52,88
250	35,96	37,26	62,63	62,70
300	31,69	34,17	59,21	59,34

TBCG3-RN2 Comb Generator

5.14 50 MHz comb frequency, 30 cm antenna, amplifier on, 30 MHz – 300 MHz

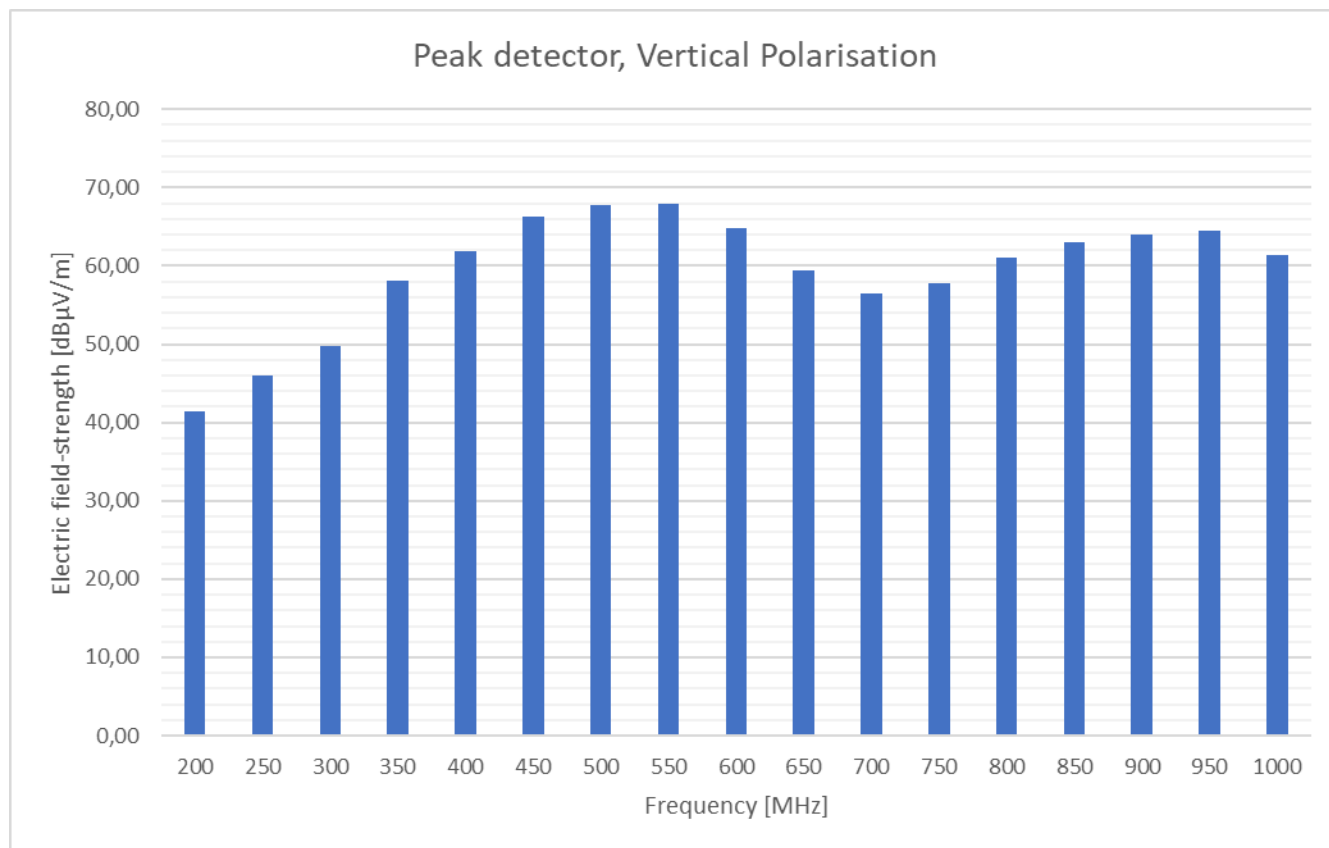


Measured with biconical antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
50	23,58	25,53	58,90	58,95
100	37,66	38,05	68,09	68,12
150	49,56	49,74	76,64	76,67
200	48,16	48,43	72,43	72,48
250	56,87	56,99	83,41	83,45
300	51,71	52,00	78,84	78,89

TBCG3-RN2 Comb Generator

5.15 50 MHz comb frequency, 10 cm antenna, amplifier off, 200 MHz – 1000 MHz

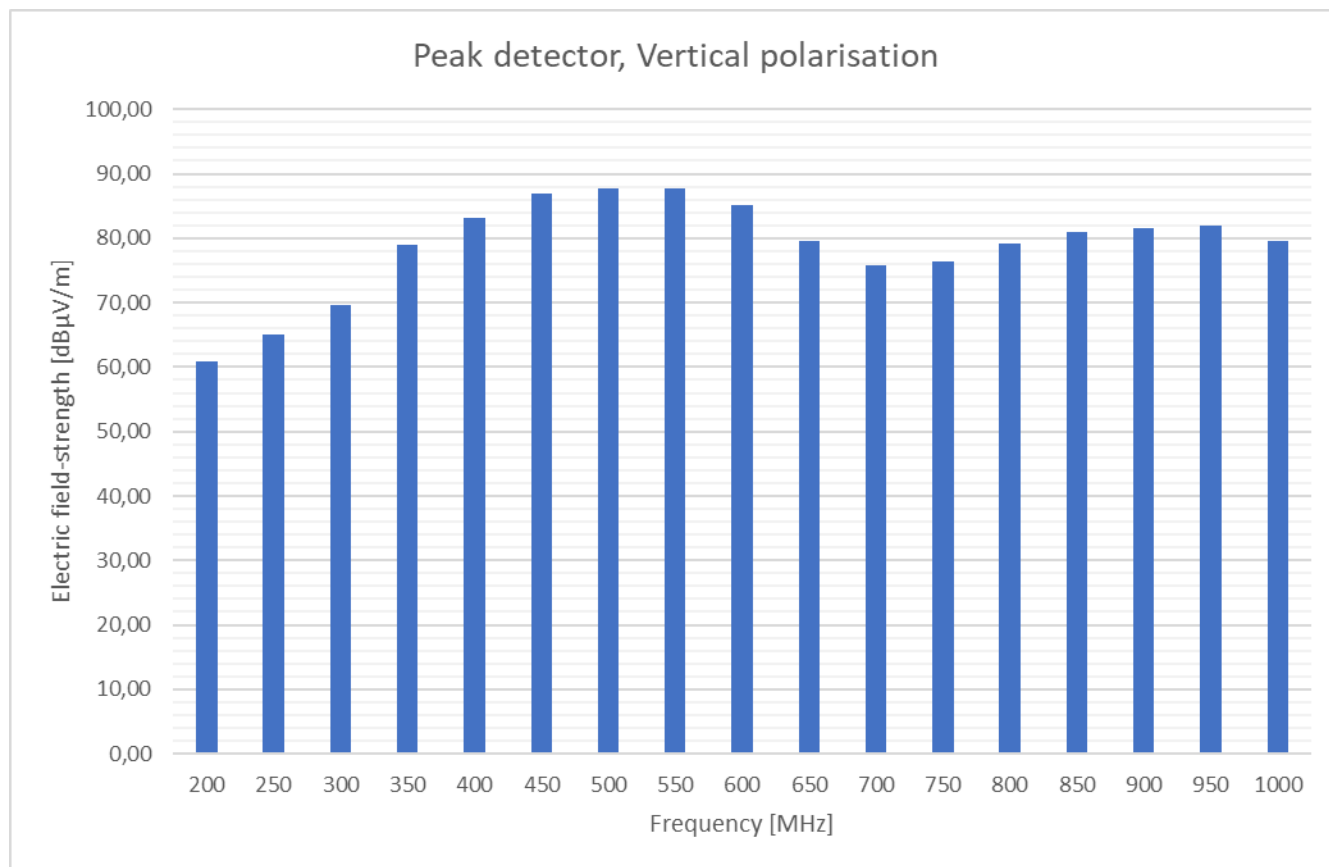


Measured with logarithmic periodic antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
200	19,38	22,79	41,03	41,38
250	16,35	20,97	45,83	46,05
300	28,65	30,41	49,63	49,80
350	35,32	36,29	57,97	58,05
400	34,19	35,33	61,77	61,84
450	29,87	32,03	66,23	66,27
500	44,61	45,11	67,72	67,77
550	33,35	35,16	67,85	67,89
600	35,11	36,84	64,79	64,86
650	33,31	35,41	59,39	59,50
700	34,80	36,80	56,24	56,42
750	37,37	38,79	57,62	57,77
800	37,63	39,12	60,91	61,03
850	40,58	41,74	62,86	62,96
900	36,08	38,19	63,97	64,06
950	41,46	42,62	64,39	64,48
1000	36,00	38,24	61,21	61,35

TBCG3-RN2 Comb Generator

5.16 50 MHz comb frequency, 10 cm antenna, amplifier on, 200 MHz – 1000 MHz

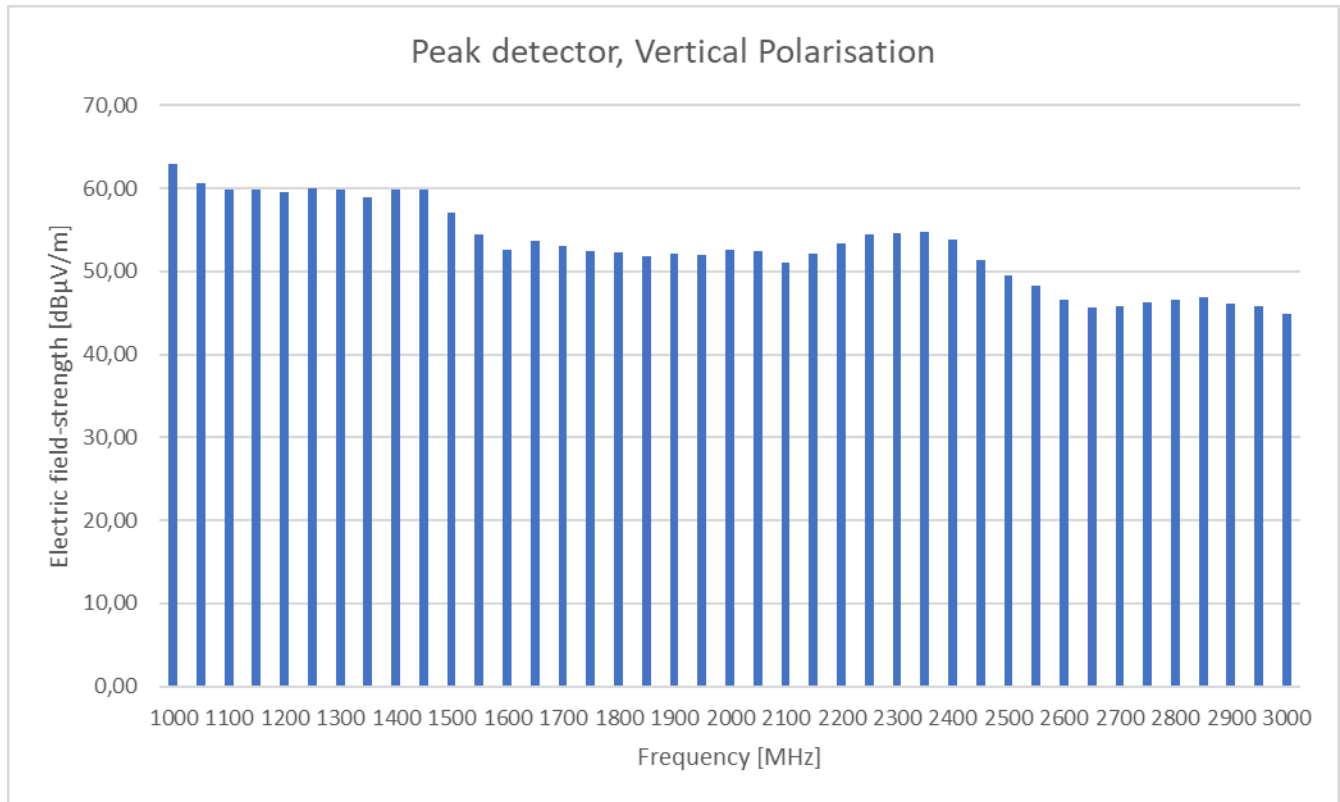


Measured with logarithmic periodic antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG COR [dBμV/m]	PK HOR [dBμV/m]	AVG COR [dBμV/m]	PK COR [dBμV/m]
200	42,32	42,61	60,81	60,86
250	34,57	35,31	65,10	65,14
300	46,56	46,81	69,57	69,62
350	55,20	55,31	78,92	78,97
400	55,50	55,61	83,06	83,10
450	50,91	51,11	86,94	86,97
500	64,36	64,42	87,71	87,74
550	47,25	47,65	87,60	87,63
600	58,25	58,38	85,13	85,16
650	55,14	55,32	79,62	79,65
700	55,19	55,41	75,67	75,71
750	55,23	55,43	76,33	76,36
800	57,18	57,35	79,22	79,25
850	58,36	58,52	80,91	80,94
900	56,18	56,40	81,52	81,55
950	59,86	60,01	81,96	81,99
1000	54,67	54,97	79,58	79,61

TBCG3-RN2 Comb Generator

5.17 50 MHz comb frequency, 10 cm antenna, amplifier off, 1 GHz – 3 GHz

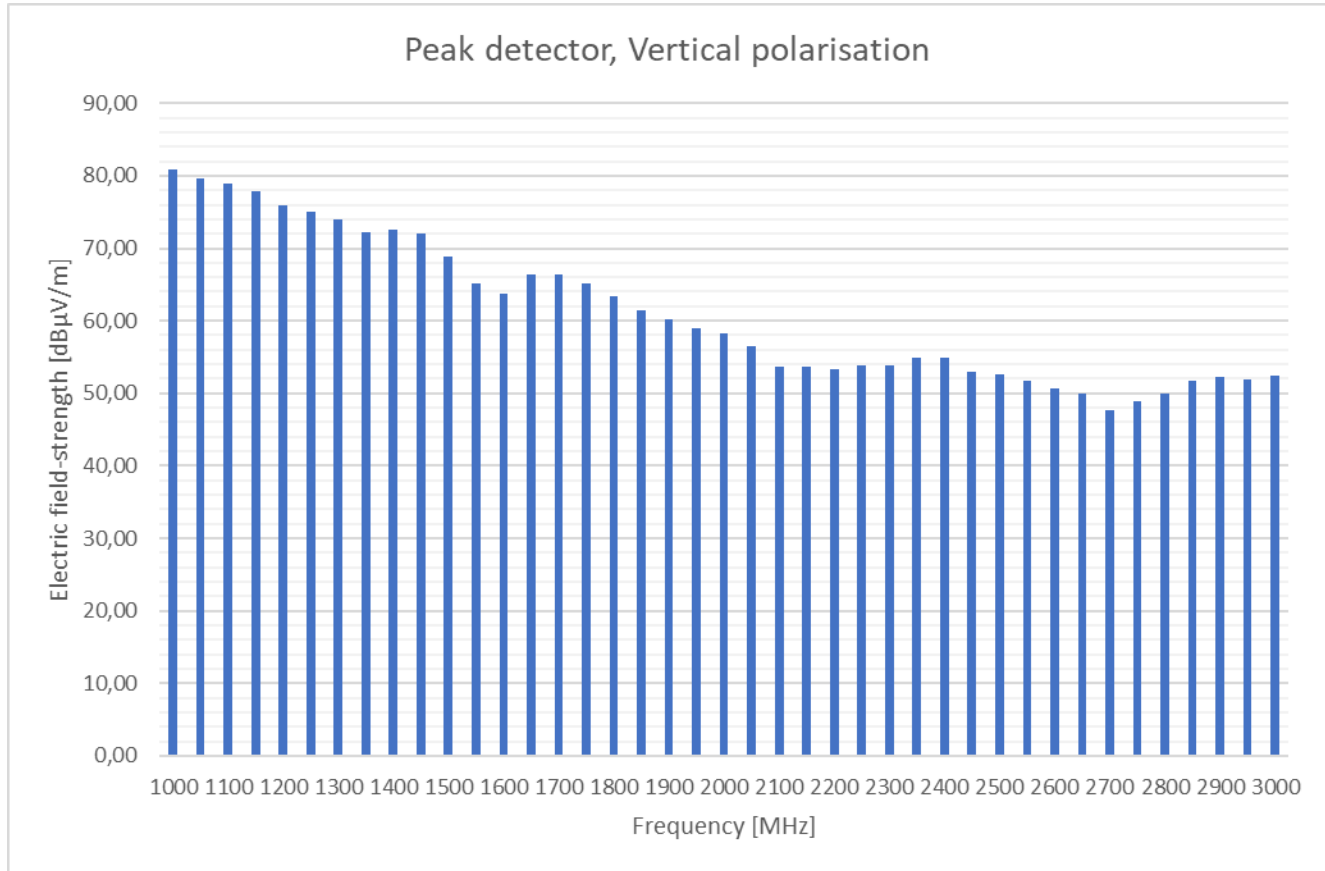


Measured with horn antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]	Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
1000	32,42	44,08	62,29	62,95	2050	29,18	41,95	49,56	52,38
1050	28,40	40,43	59,95	60,65	2100	30,09	42,85	47,18	51,05
1100	59,10	59,88	59,10	59,88	2150	31,14	44,73	48,37	52,19
1150	28,60	41,10	59,17	59,91	2200	31,90	46,08	48,94	53,30
1200	27,31	40,07	58,63	59,50	2250	32,17	45,31	51,02	54,38
1250	27,18	39,78	59,18	60,00	2300	31,90	44,97	51,48	54,59
1300	27,19	40,25	59,02	59,79	2350	32,69	45,56	51,58	54,82
1350	26,92	39,75	58,04	58,97	2400	34,21	47,29	48,96	53,77
1400	26,75	39,67	59,12	59,90	2450	33,04	46,37	44,17	51,36
1450	27,09	39,85	58,89	59,82	2500	32,62	45,55	41,90	49,50
1500	28,12	41,01	55,94	57,12	2550	32,14	45,19	38,47	48,21
1550	28,03	41,09	52,43	54,41	2600	31,94	45,16	34,92	46,51
1600	27,57	40,70	50,34	52,65	2650	32,13	45,79	33,38	45,64
1650	27,32	40,89	51,84	53,68	2700	32,47	46,10	32,46	45,76
1700	27,78	40,40	51,15	53,07	2750	32,77	45,95	32,89	46,23
1750	28,23	41,30	50,40	52,51	2800	33,41	46,60	33,46	46,56
1800	27,75	40,83	49,96	52,22	2850	33,87	47,03	33,90	46,94
1850	27,91	40,66	49,23	51,79	2900	32,98	45,96	32,98	46,12
1900	28,26	41,11	49,37	52,08	2950	32,49	45,81	32,47	45,76
1950	28,60	41,30	49,19	52,01	3000	31,84	45,40	31,91	44,92
2000	28,52	41,51	49,95	52,56					

TBCG3-RN2 Comb Generator

5.18 50 MHz comb frequency, 10 cm antenna, amplifier on, 1 GHz – 3 GHz



Measured with horn antenna, 3m distance, 1 meter height

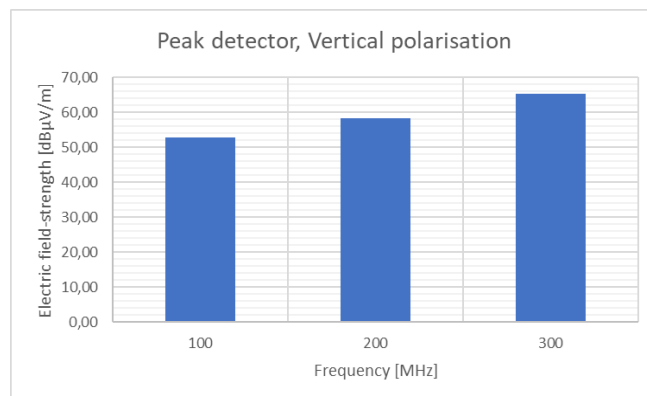
Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]	Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
1000	49,82	52,24	80,76	80,84	2050	29,26	42,64	54,79	56,46
1050	44,93	48,37	79,64	79,71	2100	30,21	43,27	50,92	53,66
1100	38,95	44,38	78,80	78,88	2150	31,25	43,90	50,46	53,64
1150	44,89	48,28	77,84	77,93	2200	31,91	45,68	49,60	53,28
1200	37,39	44,63	75,79	75,92	2250	32,16	44,99	50,30	53,88
1250	35,11	43,27	74,98	75,12	2300	31,87	45,41	50,48	53,85
1300	33,57	42,86	73,76	73,91	2350	32,69	46,01	51,43	54,87
1350	33,49	42,48	71,95	72,14	2400	34,21	47,03	51,03	54,87
1400	33,76	42,79	72,46	72,62	2450	33,13	46,65	48,57	53,00
1450	27,62	40,64	71,76	71,96	2500	32,66	45,22	47,88	52,69
1500	34,11	43,32	68,54	68,86	2550	32,52	45,79	47,10	51,79
1550	29,90	41,86	64,68	65,16	2600	33,85	46,36	45,40	50,71
1600	29,85	41,67	63,17	63,75	2650	32,43	46,47	44,13	50,04
1650	28,12	41,08	66,00	66,44	2700	32,87	46,40	37,76	47,75
1700	35,79	44,33	66,00	66,39	2750	33,22	46,04	40,29	48,98
1750	36,07	44,01	64,57	65,08	2800	33,55	46,50	42,36	49,95
1800	30,85	42,00	62,82	63,40	2850	34,24	47,14	44,89	51,67
1850	30,73	42,14	60,65	61,39	2900	35,21	47,17	47,13	52,32
1900	29,93	41,95	59,28	60,17	2950	32,90	45,84	46,86	51,88
1950	29,62	42,18	57,70	58,90	3000	32,06	45,14	48,46	52,48
2000	28,71	41,68	56,97	58,31					

TBCG3-RN2 Comb Generator

5.19 100 MHz comb frequency, 30 cm antenna, amplifier off, 30 MHz – 300 MHz

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
100	22,13	24,08	52,77	52,84
200	34,14	35,42	58,29	58,37
300	37,69	39,13	65,26	65,33

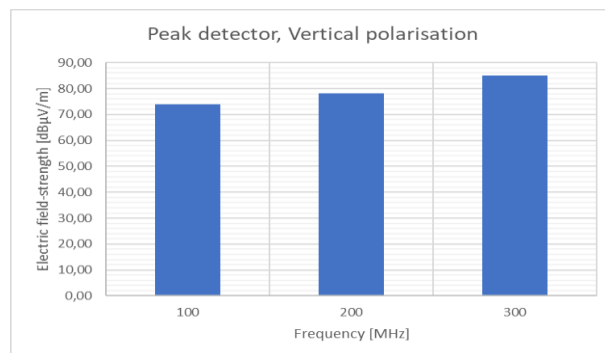
Measured with biconical antenna,
3m distance, 1m height



5.20 100 MHz comb frequency, 30 cm antenna, amplifier on, 30 MHz – 300 MHz

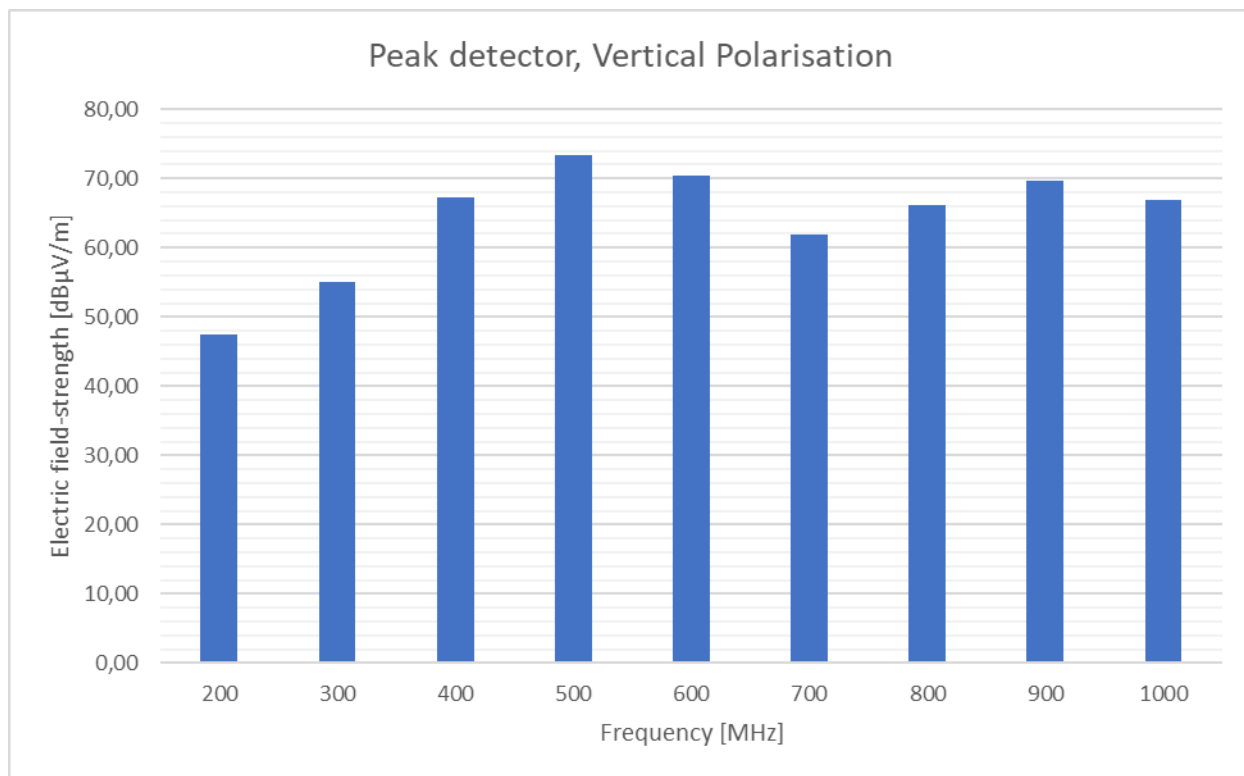
Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
100	43,59	43,79	73,98	74,01
200	53,93	54,06	78,16	78,19
300	57,66	57,83	85,02	85,05

Measured with biconical antenna,
3m distance, 1m height



TBCG3-RN2 Comb Generator

5.21 100 MHz comb frequency, 10 cm antenna, amplifier off, 200 MHz – 1 GHz

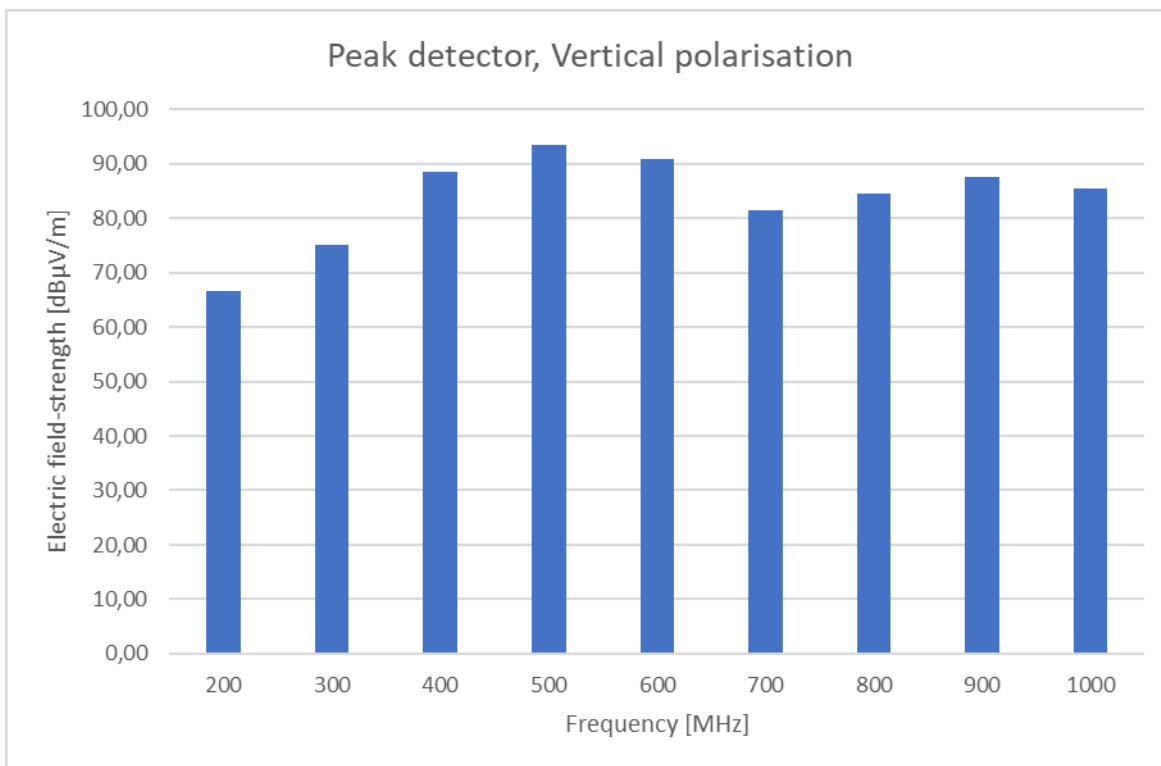


Measured with logarithmic periodic antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
200	27,18	28,68	47,21	47,37
300	33,78	34,73	54,95	55,05
400	41,27	41,79	67,17	67,20
500	49,24	49,52	73,42	73,45
600	43,55	44,19	70,38	70,42
700	41,05	42,00	61,75	61,85
800	43,50	44,23	66,02	66,09
900	43,94	44,77	69,65	69,70
1000	41,44	42,74	66,76	66,84

TBCG3-RN2 Comb Generator

5.22 100 MHz comb frequency, 10 cm antenna, amplifier on, 200 MHz – 1 GHz

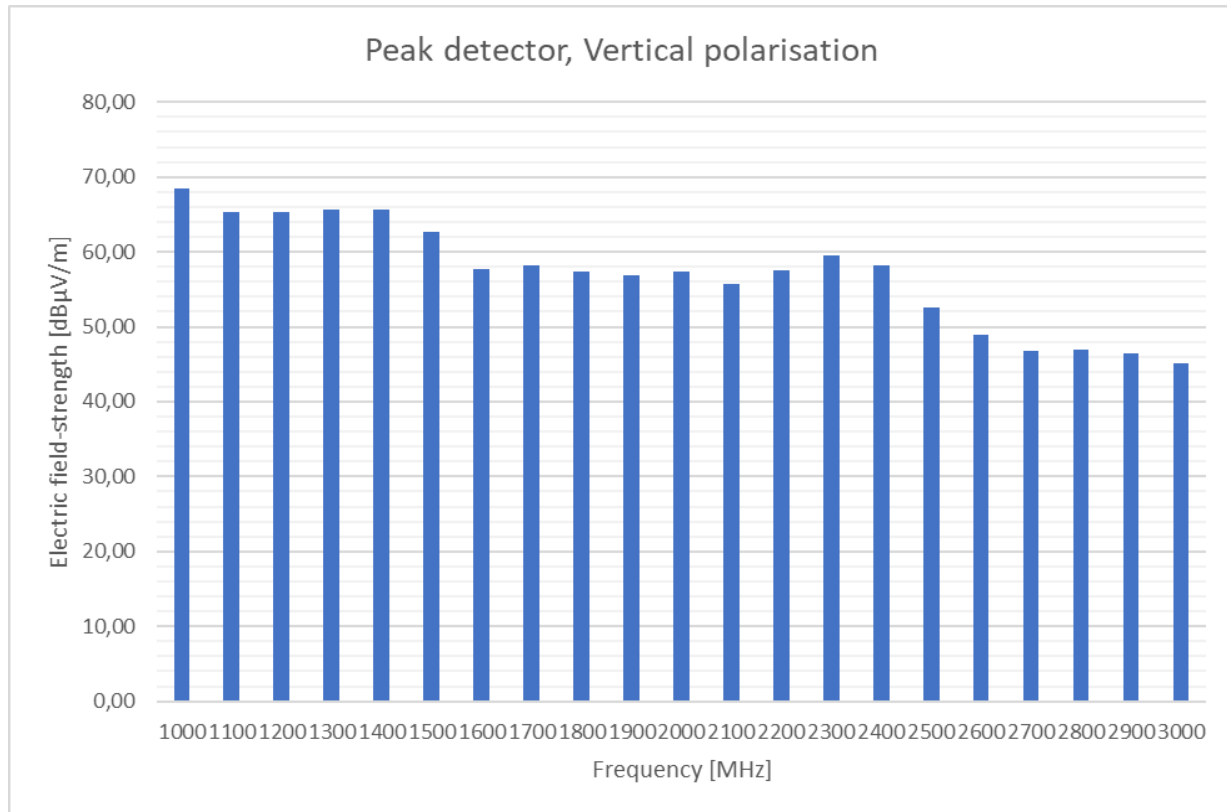


Measured with logarithmic periodic antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
200	46,99	47,17	66,49	66,52
300	53,95	54,06	75,05	75,08
400	62,73	62,78	88,58	88,61
500	69,08	69,12	93,45	93,47
600	64,05	64,11	90,91	90,94
700	60,88	60,98	81,41	81,44
800	62,10	62,19	84,59	84,62
900	61,77	61,87	87,48	87,50
1000	59,99	60,16	85,37	85,40

TBCG3-RN2 Comb Generator

5.23 100 MHz comb frequency, 10 cm antenna, amplifier off, 1 GHz – 3 GHz

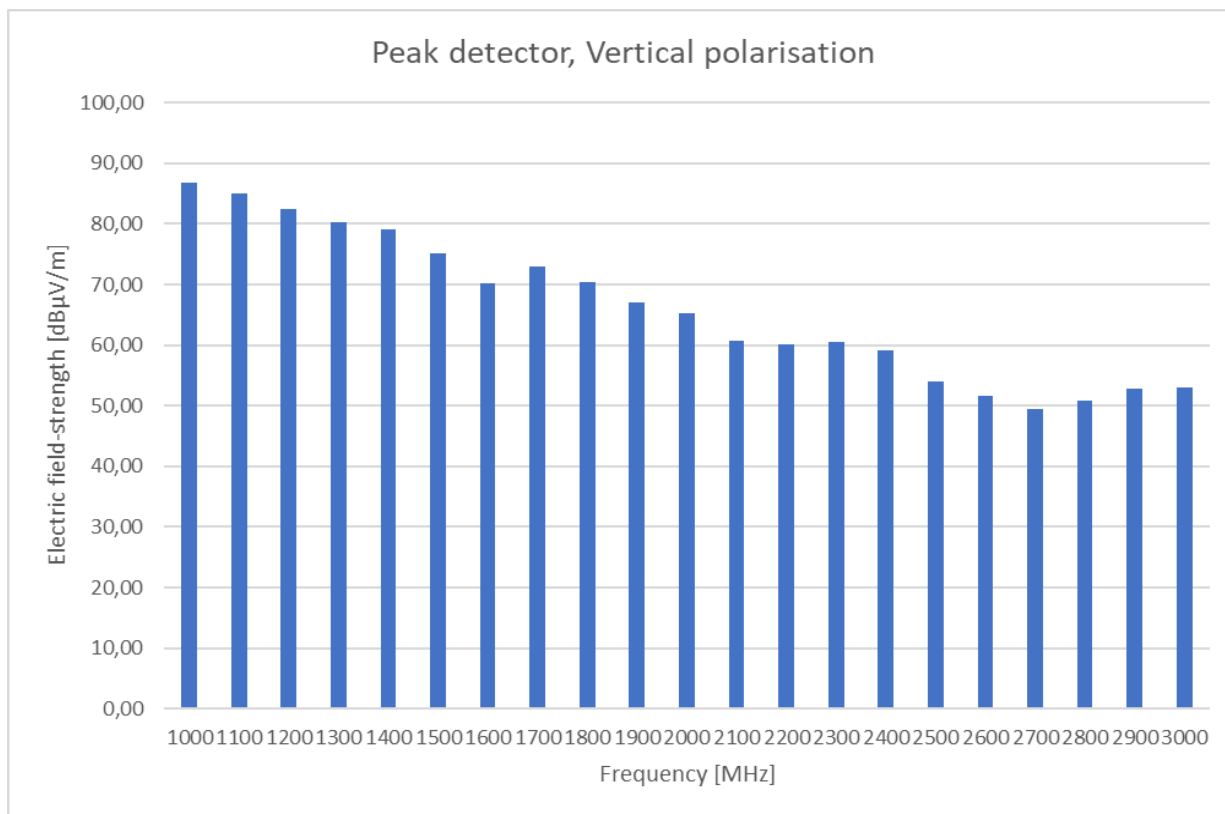


Measured with horn antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR COR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
1000	37,48	44,71	68,10	68,45
1100	28,04	40,27	64,93	65,31
1200	29,40	41,22	64,94	65,36
1300	28,56	40,83	65,22	65,64
1400	28,91	40,52	65,28	65,68
1500	30,44	42,02	61,99	62,65
1600	29,15	41,46	56,55	57,72
1700	29,14	40,98	57,12	58,16
1800	28,55	40,78	56,27	57,42
1900	28,93	42,05	55,43	56,83
2000	28,99	42,00	55,91	57,33
2100	30,62	43,41	53,55	55,66
2200	32,55	44,94	55,39	57,52
2300	32,35	45,52	58,01	59,54
2400	34,25	47,19	55,37	58,12
2500	32,65	45,88	47,98	52,63
2600	32,56	46,43	40,64	48,87
2700	32,53	45,21	33,98	46,72
2800	33,41	46,55	33,70	46,94
2900	33,00	46,08	33,71	46,52
3000	31,83	45,18	31,80	45,10

TBCG3-RN2 Comb Generator

5.24 100 MHz comb frequency, 10 cm antenna, amplifier on, 1 GHz – 3 GHz



Measured with horn antenna, 3m distance, 1 meter height

Frequency [MHz]	AVG HOR [dBμV/m]	PK HOR COR [dBμV/m]	AVG VERT [dBμV/m]	PK VERT [dBμV/m]
1000	55,78	57,12	86,74	86,79
1100	44,80	48,45	84,92	84,96
1200	43,81	48,03	82,36	82,42
1300	39,69	45,31	80,26	80,34
1400	39,81	45,83	79,00	79,09
1500	41,02	46,25	75,00	75,16
1600	35,16	43,65	69,90	70,16
1700	42,45	46,90	72,71	72,90
1800	36,45	44,09	70,05	70,32
1900	34,33	44,09	66,61	67,03
2000	30,46	42,78	64,76	65,31
2100	31,85	43,65	59,49	60,64
2200	32,95	45,69	58,64	60,19
2300	32,47	45,18	59,18	60,49
2400	34,25	47,51	56,76	59,04
2500	32,67	45,22	49,88	53,99
2600	34,49	46,01	46,73	51,61
2700	32,91	45,96	39,38	49,35
2800	33,63	46,55	42,66	50,80
2900	35,56	47,23	48,19	52,73
3000	32,15	45,24	48,87	52,96

TBCG3-RN2 Comb Generator

6 Accessories

The TBCG3-RN2 includes a charger and two monopole antennas as standard accessories. A coaxial interfacing cable for LISN is available as optional accessory.



TBCG3-RN2 accessories

7 Inserting / replacing batteries

Due to airfreight regulations concerning batteries, the TBCG3 is not supplied with batteries. Loosen the SMA-connector nut a few turns. Remove the six screws at the bottom of the comb generator housing and take off the bottom lid.

Use a suitably large screwdriver with Pozidriv tip. Phillips screwdrivers may slip and damage the screw head.

Insert six AA rechargeable 1.2V NiMH batteries in the battery compartments taking care to follow the polarity indicated on the PCB.

Reattach the bottom lid, then tighten the screws and the SMA-connector nut as well.

Before connecting the charger plug to the unit connector, please check that the centre tip polarity is shown as (positive) “+”.

Never connect the charger to the comb generator, without batteries inserted. The universal charger is pulsing with high voltage to detect the battery pack and may damage the internal polyfuse, if no batteries are inserted. Align the charger tip as shown below.



TBCG3-RN2 Comb Generator

8 Ordering Information

Part Number	Description
TBCG3-RN2	Comb generator, Ansmann ACS310 charger, 30 cm monopole, 10 cm monopole

9 History

Version	Date	Author	Changes
V 1.0	4.2.2023	Mayerhofer	Creation
V 1.1	19.6.2023	Minh Nguyen	Update Charger part number
V 1.2	10.4.2024	Mayerhofer	Chapter 7 updated
V 1.3	13.4.2024	Mayerhofer	Chapter 7 updated
V 1.4	30.6.2024	Mayerhofer	Chapter 4 corrected, utilized antennas