Proficiency Test Program

APLAC T061 Electromagnetic Interference

(Part II: Circulation of Europe & South America Area

+ New Zealand)

November 2012

Voluntary EMC Laboratory Accreditation Center Inc.

CONTENTS

1. Introduction

Electro-magnetic interference emission level of electric & electronics products, especially in view of the protection of radio services, is strictly limited by the mandated regulations in each country and area.

This PT program has received approval by APLAC PT Committee in 2008. 69 EMC testing laboratories joined this program in total. 38 laboratories of them were nominated from the accreditation bodies of APLAC members and 31 laboratories were nominated by EA, IAAC and other accreditation bodies outside APLAC.

The program started in October, 2008. The circulation schedule was divided to six blocks in consideration of the check period of artifact.

All laboratories nominated from the APLAC members have completed their tests by the third round. The data up to the third round were summarized and evaluated in the report of Part I.

And the circulation of laboratories in Europe and South America area, that is, from the Round-4 to the Round-6, were completed by November, 2011. As an addition, the Retest round was carried out from December, 2011 to May, 2012, since failure occurred in the artifact during the circulation of Round-4. The reason of accident was a slack of the screw which connects antenna balun with a comb generator output used in the artifact.

Therefore, the Round-5 and Round-6 were performed with the repaired artifact. After the completion of Round 6, we announced to ABs of Round-3 and Round-4 to perform the retest round. The whole data of Round-5, Round-6 and Retest Round were summarized and evaluated in this report.

Finally, as an informative data, some data of the Round-4 before the accident have been included in the report of part II.

2. Objectives

The main objective of the program is to evaluate the competence of EMC testing laboratories appropriately maintaining characteristics of their measuring facilities and instruments for the radiated and conducted electromagnetic interference measurement.

In this program, that is the commonly accepted procedure for the inter-laboratory comparison, one comb generator was circulated to the participated laboratory as an artifact.

Test results from participants were evaluated according to the statistical techniques outlined in ISO/IEC 17043:2010[(1)] and APLAC PT 002[(2)]. Z-Score was used as a numerical indicator to assess individual participant's competence.

However, we took an additional treatment with the difference from median value. Namely, the "Difference from Median Value in dB" was evaluated along with Z-Score. That is, Z-Score values of the participating test laboratories become generally small when their measured data intervals spread uniformly. And oppositely a single isolated datum will easily exceed a value of three if the overall data interval is small. These situations are very commonly seen whenever the measurement data is collected in logarithmic units, such as the dBμV and dBμV/m used in the EMI Testing, because the logarithmic data should be converted to linear scale data before the robust Z-Score calculation. The "Differences from Median Value in dB" were also taken into account to decide if a high Z-Score is meaningful.

3. Artifact of this program

For evaluating the technical competence of laboratory in the EMI test, it is indispensable to perform two different tests of the radiated emission and conducted emission measurement. Therefore, an impulsive noise generator (comb generator) which is operated by AC mains voltage from 100 V to 240 V was circulated to the participated laboratories as an EUT (Equipment Under Test) for this program. For the present proficiency testing program, the operating voltage of artifact was specified to AC 100 V±2 V. Also for the measurement of radiated emission measurement, a VHF-LISN (Very High Frequency – Line Impedance Stabilization Network) was supplied by VLAC to stabilize the common mode impedance between the AC mains cables and ground at the test site. The VHF-LISN was circulated together with the artifact.
The comb generator selected as the artifact for APLAC T061 program has the following specifications.

Basic frequency: 15.1 MHz
Frequency step: 15 MHz
Range of comb generator: 15 MHz to 1 GHz
Rated voltage: AC100 V to AC240 V

4. Tests Procedure

4.1 Measurement method

The measurement method based on CISPR22 [(3)] has been instructed to be followed if not specified in this program.
For the test arrangement of radiated emission measurement, EUT was instructed to be connected through the VHF-LISN as shown in Figure 20.
And for the test arrangement of the conducted emission measurement, EUT was instructed to set according to CISPR 22 and is supplied to the AC mains through AMN (Artificial Mains Network) equipped in the test site.

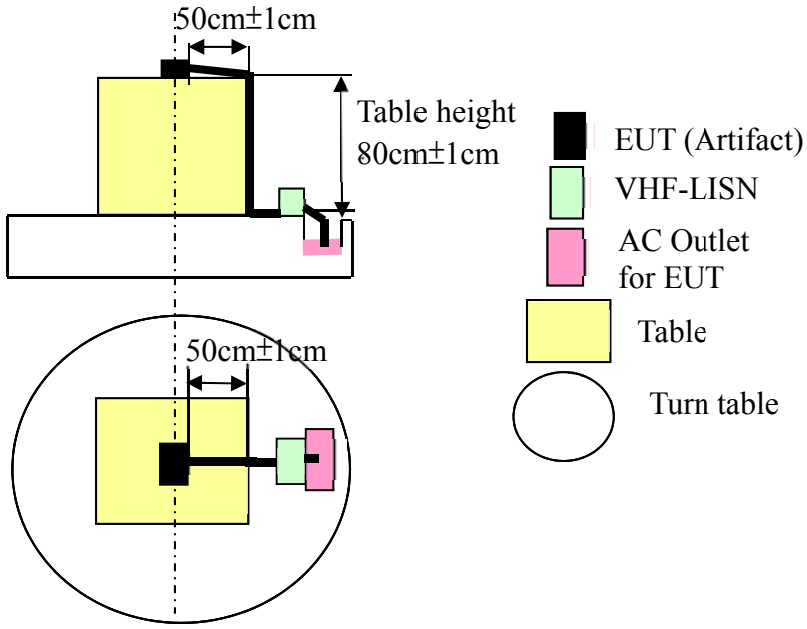

Figure 20 Test arrangement of radiated emission measurement

4.2 **Measurement frequency**

(1) Radiated emission (Electric field strength) measurement at 3 meters distance
Maximum radiated emission levels at 10 frequencies of 45.4 MHz, 60.5 MHz, 75.6 MHz, 105.9 MHz, 151.3 MHz, 212.0 MHz, 317.3 MHz, 453.4 MHz, 740.7 MHz and 981.8 MHz have been instructed to measure in two conditions of horizontal and vertical polarization.

(2) Conducted emission (Voltage) measurement at AC mains port
Conducted emission levels at 6 frequencies of 219 kHz, 439 kHz, 2.62 MHz, 3.71 MHz, 7.45 MHz and 15.1 MHz have been instructed to measure the maximum disturbance voltage of each AC mains line at the output terminal of AMN equipped in the test site.

4.3 **Measurement uncertainty**

As for the measurement uncertainty for the conducted emission and radiated emission measurements described in CISPR22, the calculation basis has been provided in the CISPR16-4-2[(4)] standard. However, the measurement uncertainty specified in the CISPR 16-4-2 describes the measurement uncertainty related to the measurement instrumentation and it is not offering the combined measurement uncertainty which is called Standard Compliance Uncertainty including other part of uncertainties, such as the operating condition of EUT, test arrangement of EUT and measurement procedure.

Measurement Instrumentation Uncertainty described in CISPR16-4-2:2011 are as follows,
Conducted disturbance measurement: 3.44 dB
Radiated disturbance measurement: 5.06 to 5.17 dB

4.4 Stability of artifact

The stability of the artifact was confirmed with measuring the radiated emission power level of the artifact installed in the G-TEM cell before and after the round. Refer to Appendix III for the measuring method and the measurement result.

As the result, there was a problem in stability at 151 MHz and 211.4 MHz before and after Round-5. Therefore, the evaluation at these frequencies is used for information only.

5. Test results

5.1 Result of Round-4 + Round-5 + Round-6 + Retest Round

The report of Part II has contained the result of 31 laboratories nominated from EA, IAAC and other accreditation bodies outside APLAC in the Round-4, Round-5, Round-6 and Retest Round. Each participant was given a unique laboratory code and the code is used throughout the program to keep the confidentiality. The number from 19 to 55 was randomly allocated to the participated laboratories in Round-4 to Round-6.

Unfortunately, since the accident occurred in the artifact during the circulation of Round-4, we announced the retest round to ABs of Round-3 and Round-4 after the completion of Round 6.

One laboratory from INAB (Ireland), two laboratories from SWEDAC (Sweden) and three laboratories from FINAS (Finland) of Round-4 joined in the Retest round. Additionally, two laboratories from IANZ (New Zealand) of Round-3 joined in the Retest round by their request.

However, some AB(s) of Round-4 did not participate in the Retest Round. Therefore, some results of Round-4 before the accident are included as an informative data evaluation. (One laboratory from BELAC for radiated emission and three laboratories for conducted emission, nominated from each BELAC, EAK and FINAS.)

Finally, the merged data of the Round-4, Round-5, Round-6 and the retest round were used to determine the assigned value in this report of Part II.

Test results and the evaluation results of Round-4, Round-5, Round-6 and Retest-round are shown from the Table 31 to Table 44.

Measurement data submitted from participants are presented in Table 31 through Table 41.

Table 31: Data in dBμV of the conducted emission measurement

Table 32: Data in dBμV/m of the radiated emission measurement; Horizontal Polarization

Table 33: Data in dBμV/m of the radiated emission measurement; Vertical Polarization

Table 34: Z score by linear scale data of the conducted emission measurement

Table 35: Z score by dB scale data of the radiated emission measurement; Horizontal Polarization

Table 36: Z score by linear scale data of the radiated emission measurement; Horizontal Polarization

Table 37: Z score by dB scale data of the radiated emission measurement; Vertical Polarization

Table 38: Z score by linear scale data of the radiated emission measurement; Vertical Polarization

Table 39: Difference from Median Value of the conducted emission measurement

Table 40: Difference from Median Value of the radiated emission measurement; Horizontal Polarization

Table 41: Difference from Median Value of the radiated emission measurement; Vertical Polarization

Table 31 Data of the conducted emission measurement (in dBμV) NOTE (1): No result at this frequency was given from the laboratory.

Frequency (MHz)	19	33	20	31	32	28	29	23	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	53	50	51	52	54	55
0.219	54.3	55.5	54.9	54.7	52.0	54.7	55.2	53.6	54.7	53.6	55.3	36.5	54.6	49.9	53.2	53.0	54.0	53.2	52.8	54.8	54.9	53.6	54.7	53.1	54.6	55.0	56.4	55.0	55.8	56.4	55.9
0.439	45.3	46.2	45.4	45.5	44.7	46.6	45.5	45.1	45.6	45.2	44.3	44.5	46.0	38.7	45.4	43.3	46.1	45.1	44.3	45.8	44.4	45.3	46.0	45.5	46.6	46.0	47.4	46.6	46.0	46.5	44.6
2.62	38.0	39.1	37.3	37.9	37.6	40.7	37.1	38.9	38.3	38.2	36.4	21.4	38.1	22.2	38.3	38.3	39.4	38.8	38.0	40.1	36.3	37.2	39.4	38.2	40.3	35.2	30.2	40.3	35.6	39.3	---(1)
3.71	42.1	42.1	37.4	40.5	40.6	44.0	39.3	43.0	41.8	39.5	41.0	29.2	41.9	23.9	42.4	40.8	41.9	42.4	38.5	42.8	40.2	41.1	42.3	42.4	42.4	40.7	38.5	43.5	35.9	42.7	41.4
7.45	36.2	33.1	34.1	32.6	34.9	35.8	28.1	34.0	33.9	35.2	33.6	29.5	35.1	29.8	29.8	33.6	36.9	34.3	32.0	33.8	32.5	33.1	36.4	35.0	35.2	35.3	37.2	35.3	27.5	35.4	32.6
15.1	64.8	62.8	65.5	59.4	57.9	60.0	61.2	62.8	62.1	60.8	59.6	62.5	57.1	58.8	58.4	59.3	58.5	59.1	64.3	60.5	65.4	59.8	57.9	59.9	60.9	61.3	28.0	59.7	62.6	60.2	63.2

Table 32 Data of the radiated emission measurement (in dBμV/m) NOTE (2): No result was given from the laboratory, since the test chamber doesn't pass the NSA requirement.

Frequency (MHz)	19	33	31	32	28	29	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	54	55
45.4	55.8	57.4	---(2)	51.5	56.2	54.9	53.9	58.7	60.3	48.8	58.7	65.1	58.9	55.3	53.8	56.7	69.4	58.4	49.2	56.0	60.5	55.3	64.2	50.2	55.8	57.8	52.2	52.1
60.5	38.9	42.7	---(2)	42.5	38.9	41.5	41.9	38.8	37.7	39.1	36.8	44.4	49.7	40.9	38.8	39.8	47.0	34.5	29.4	41.0	46.1	43.7	50.6	31.6	41.4	44.3	37.3	37.4
75.6	60.1	61.3	59.7	61.2	59.3	61.3	59.9	66.0	63.6	45.3	59.8	55.1	63.7	63.4	61.9	62.3	64.0	57.9	55.4	57.5	59.4	62.2	61.9	42.5	59.9	63.4	58.2	56.7
105.9	59.3	68.1	63.6	68.1	68.0	64.8	67.1	70.6	71.6	65.2	68.7	64.2	73.0	66.1	68.5	74.9	79.4	70.5	66.9	66.6	69.5	69.6	67.9	25.7	65.4	70.8	59.9	63.6
151.3	65.3	65.8	66.3	64.0	61.8	65.5	62.0	74.1	71.0	50.4	67.2	58.3	66.6	73.2	59.5	69.5	66.0	68.7	62.6	55.7	61.7	62.2	56.5	21.0	66.2	65.3	64.1	63.0
212.0	69.5	72.7	70.1	72.7	70.7	71.6	70.5	63.1	62.7	68.6	59.5	51.6	74.9	63.7	69.5	60.6	68.6	68.6	57.4	66.4	70.4	71.6	71.7	27.3	71.4	73.4	67.1	69.8
317.3	73.1	68.9	70.9	68.6	68.5	67.2	68.5	72.2	72.9	64.7	66.2	59.6	77.1	72.5	67.2	68.9	63.4	64.2	60.9	68.4	69.7	71.5	66.2	65.9	68.5	71.7	70.7	68.1
453.4	63.0	59.2	61.0	56.0	56.6	43.3	55.9	63.5	61.6	50.2	58.6	51.4	64.0	57.3	59.4	55.8	56.0	58.4	55.2	53.3	61.1	54.3	55.1	59.4	57.3	60.0	60.6	56.7
740.7	51.7	50.8	51.0	48.5	49.9	23.5	46.5	54.0	52.4	46.9	56.8	44.5	52.6	50.5	49.2	52.3	56.5	51.2	46.3	48.3	45.4	46.1	49.7	48.8	48.1	49.8	48.2	44.0
981.8	50.6	50.1	52.1	48.2	41.3	46.9	49.2	53.1	42.4	36.2	51.2	29.9	53.4	46.5	50.3	44.8	59.7	45.1	40.0	50.1	49.7	46.1	48.8	37.2	49.3	51.5	46.2	43.2

Table 33 Data of the radiated emission measurement (in dBμV/m) NOTE (2): No result was given from the laboratory, since the test chamber doesn't pass the NSA requirement.

Frequency (MHz)	19	33	31	32	28	29	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	54	55
45.4	70.2	70.2	---(2)	68.3	69.2	71.4	72.1	72.8	76.1	71.17	74.8	64.1	78	65.896	69.434	70.7	62.2	69.99	63.04	71.2	74.4	72.1	76.98	50.2	68.8	74.69	67.2	68.7
60.5	46.1	53.4	---(2)	51.7	48.9	54.1	52.1	51.3	46.2	55.35	48.6	45.9	56.9	49.091	42.882	54.7	50.98	50.97	39.51	49.0	55.4	49.4	57.36	31.6	50.9	53.18	46.3	49.5
75.6	62	60.1	64.5	60.5	62.6	61.1	60.9	64.9	68.6	62.24	55.9	56.8	71.1	62.269	62.413	61.6	63.07	63.96	56.35	62.4	62.6	68.4	62.50	42.5	63.4	66.92	62.8	58.7
105.9	63.1	68.5	66.9	64.6	69.3	65.5	69	73.3	75.5	66.79	70.8	71.9	77.3	69.175	70.679	71	66.4	75.13	69.08	73.1	73.1	76.3	68.90	25.7	69.5	71.86	64.5	68.9
151.3	64.2	67.6	62.6	63.4	59.5	62.8	59.4	58.6	68.2	46.34	61.2	56.4	61	55.720	59.762	62.9	68.47	64.33	68.46	53.7	56.5	60.7	63.21	21	65.5	61.79	62.9	62.5
212.0	64.8	65.1	66	61.2	67.9	62.4	66.5	71.9	57.2	69.41	68	54.2	71.3	67.798	71.611	69.6	71.35	68.23	58.93	66.2	66.2	68.3	69.80	27.3	65.1	67.80	66.4	63.3
317.3	72	62.2	68.2	66.1	64.7	62	65.8	66.5	70.6	61.05	65.4	58.4	72	67.338	67.548	64.1	62.36	66.75	62.36	67.9	68.7	65.9	68.30	65.9	69.4	36.38	68.6	64.1
453.4	65	58.7	59.4	61.7	57.5	56.6	56.5	59.5	62.6	56.74	54	53.5	62.9	58.348	57.591	53.7	57.56	58.49	56.11	55.7	60.2	56.6	55.20	59.4	59	64.43	62.0	55.1
740.7	53.8	52.3	51.3	50.6	49	23.5	49	48.3	51.8	42.07	55.4	44.6	54.7	47.996	49.962	46	56.98	46.84	45.74	49.3	51.5	48.3	50.68	48.8	51.3	55.47	49.0	46.5
981.8	55.4	52.2	52.5	47.6	48.2	45.9	47.1	49.1	49.7	33.47	51.8	43.7	51.8	42.055	50.696	46.6	59.75	47.49	40.4	50.5	48.0	48.1	48.93	37.2	47	54.81	50.2	43.1

Table 34 Z-score by linear data of the conducted emission measurement NOTE (1): No result at this frequency was given from the laboratory.

Frequency (MHz)	19	33	20	31	32	28	29	23	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	53	50	51	52	54	55
0.219	5	0.56	0.14	0.00	-1.55	0.00	0.34	-0.69	0.00	-0.69	0.41	-5.09	-0.09	-2.46	-0.93	-1.05	-0.45	-0.92	-1.14	0.04	0.15	-0.69	0.00	-0.98	-0.09	0.21	1.28	0.20	0.78	1.25	0.83
0.439	-0.23	0.85	-0.12	0.00	-0.89	1.36	0.00	-0.45	0.12	-0.34	-1.30	-1.13	0.60	-5.48	-0.08	-2.22	0.72	-0.45	-1.35	0.39	-1.20	-0.23	0.60	0.00	1.36	0.60	2.43	1.36	0.60	1.23	-0.99
2.62	-0.08	0.47	-0.40	-0.13	-0.27	1.42	-0.49	0.37	0.06	0.01	-0.77	-3.58	-0.01	-3.52	0.08	0.05	0.64	0.31	-0.08	1.04	-0.80	-0.44	0.64	0.01	1.16	-1.21	-2.51	1.16	-1.07	0.58	---(1)
3.71	0.28	0.28	-1.16	-0.30	-0.27	1.13	-0.67	0.66	0.16	-0.61	-0.13	-2.39	0.22	-2.74	0.39	-0.20	0.20	0.40	-0.90	0.57	-0.39	-0.09	0.36	0.40	0.39	-0.25	-0.88	0.89	-1.48	0.53	0.00
7.45	0.75	-0.25	0.03	-0.39	0.28	0.60	-1.28	0.00	-0.03	0.38	-0.12	-1.05	0.36	-0.99	-0.99	-0.11	1.03	0.09	-0.53	-0.05	-0.42	-0.25	0.82	0.32	0.38	0.40	1.14	0.42	-1.36	0.45	-0.40
15.1	3.29	1.64	3.96	-0.41	-1.09	-0.11	0.57	1.64	1.15	0.34	-0.31	1.41	-1.41	-0.70	-0.87	-0.48	-0.84	-0.56	2.83	0.17	3.83	-0.21	-1.09	-0.16	0.39	0.63	-4.59	-0.26	1.50	0.00	1.90

Table 35 Z-score by dB data of the Horizontal Polarization radiated emission NOTE (2): No result was given from the laboratory, since the test chamber doesn't pass the NSA requirement.

Frequency (MHz)	19	33	31	32	28	29	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	54	55
45.4	-0.06	0.39	---(2)	-1.26	0.06	-0.31	-0.59	0.75	1.20	-2.02	0.75	2.54	0.81	-0.19	-0.60	0.20	3.75	0.67	-1.91	0.00	1.26	-0.20	2.29	-1.62	-0.06	0.51	-1.06	-1.09
60.5	-0.53	0.50	---(2)	0.45	-0.53	0.17	0.28	-0.56	-0.86	-0.47	-1.11	0.96	2.41	0.00	-0.55	-0.29	1.68	-1.73	-3.12	0.04	1.43	0.77	2.65	-2.52	0.15	0.94	-0.97	-0.94
75.6	0.03	0.43	-0.10	0.40	-0.23	0.43	-0.03	1.98	1.19	-4.83	-0.07	-1.61	1.22	1.11	0.62	0.76	1.33	-0.69	-1.50	-0.82	-0.20	0.72	0.61	-5.76	-0.03	1.12	-0.59	-1.09
105.9	-2.47	0.04	-1.24	0.04	0.01	-0.90	-0.24	0.76	1.04	-0.78	0.21	-1.07	1.44	-0.51	0.15	1.98	3.27	0.74	-0.31	-0.39	0.44	0.47	-0.01	-12.06	-0.73	0.82	-2.30	-1.24
151.3	0.18	0.32	0.47	-0.20	-0.85	0.24	-0.79	2.76	1.85	-4.20	0.73	-1.88	0.56	2.48	-1.53	1.41	0.39	1.18	-0.61	-2.64	-0.88	-0.73	-2.42	-12.81	0.44	0.17	-0.17	-0.50
212.0	0.00	0.55	0.11	0.55	0.21	0.36	0.18	-1.09	-1.16	-0.16	-1.71	-3.07	0.93	-0.98	0.00	-1.52	-0.15	-0.15	-2.08	-0.53	0.16	0.36	0.39	-7.23	0.33	0.66	-0.41	0.06
317.3	1.28	0.11	0.67	0.03	0.00	-0.36	0.00	1.03	1.22	-1.06	-0.64	-2.47	2.39	1.12	-0.37	0.11	-1.41	-1.19	-2.12	-0.03	0.33	0.83	-0.65	-0.72	0.00	0.89	0.61	-0.11
453.4	1.72	0.57	1.12	-0.39	-0.21	-4.21	-0.42	1.87	1.30	-2.15	0.39	-1.77	2.02	0.00	0.63	-0.45	-0.40	0.33	-0.64	-1.20	1.15	-0.90	-0.66	0.63	0.00	0.81	1.00	-0.18
740.7	0.68	0.41	0.47	-0.28	0.14	-7.77	-0.88	1.36	0.88	-0.76	2.20	-1.48	0.94	0.30	-0.08	0.85	2.12	0.52	-0.95	-0.34	-1.21	-1.00	0.08	-0.19	-0.40	0.11	-0.37	-1.63
981.8	0.48	0.36	0.82	-0.07	-1.63	-0.36	0.16	1.04	-1.38	-2.78	0.61	-4.21	1.11	-0.45	0.40	-0.84	2.53	-0.78	-1.92	0.37	0.27	-0.54	0.07	-2.56	0.18	0.67	-0.52	-1.20

Table 36 Z-score by linear data of the Horizontal Polarization radiated emission NOTE (2): No result was given from the laboratory, since the test chamber doesn't pass the NSA requirement.

Frequency (MHz)	19	33	31	32	28	29	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	54	55
45.4	-0.05	0.41	---	-0.94	0.05	-0.28	-0.50	0.85	1.49	-1.31	0.85	4.29	0.92	-0.17	-0.51	0.19	8.56	0.74	-1.26	0.00	1.57	-0.18	3.64	-1.13	-0.05	0.55	-0.82	-0.84
60.5	-0.48	0.56	---	0.49	-0.48	0.18	0.30	-0.50	-0.72	-0.43	-0.88	1.19	4.19	0.00	-0.49	-0.27	2.46	-1.23	-1.73	0.04	1.96	0.92	4.90	-1.55	0.15	1.15	-0.80	-0.78
75.6	0.03	0.45	-0.09	0.41	-0.22	0.45	-0.03	2.76	1.43	-2.26	-0.06	-1.20	1.47	1.31	0.67	0.84	1.64	-0.59	-1.13	-0.69	-0.19	0.80	0.66	-2.41	-0.03	1.33	-0.52	-0.88
105.9	-1.63	0.04	-1.02	0.04	0.01	-0.79	-0.24	0.92	1.35	-0.70	0.23	-0.91	2.04	-0.48	0.16	3.17	7.08	0.89	-0.30	-0.37	0.50	0.54	-0.01	-2.56	-0.66	1.01	-1.56	-1.02
151.3	0.19	0.36	0.54	-0.21	-0.77	0.26	-0.73	5.27	2.88	-2.19	0.90	-1.41	0.66	4.45	-1.23	1.99	0.44	1.58	-0.59	-1.75	-0.79	-0.68	-1.66	-2.69	0.51	0.19	-0.19	-0.49
212.0	0.00	0.81	0.13	0.81	0.27	0.50	0.23	-0.94	-0.98	-0.18	-1.23	-1.57	1.56	-0.87	0.00	-1.16	-0.18	-0.18	-1.36	-0.54	0.20	0.50	0.53	-1.79	0.45	1.01	-0.43	0.07
317.3	1.64	0.11	0.75	0.03	0.00	-0.33	0.00	1.25	1.55	-0.83	-0.55	-1.50	3.97	1.38	-0.33	0.11	-1.04	-0.91	-1.37	-0.03	0.35	0.97	-0.55	-0.61	0.00	1.05	0.68	-0.11
453.4	2.24	0.59	1.28	-0.33	-0.18	-1.93	-0.36	2.52	1.55	-1.35	0.39	-1.19	2.81	0.00	0.66	-0.38	-0.35	0.32	-0.52	-0.89	1.33	-0.70	-0.54	0.66	0.00	0.87	1.12	-0.16
740.7	0.80	0.45	0.53	-0.28	0.14	-2.56	-0.78	1.85	1.09	-0.68	3.58	-1.17	1.18	0.33	-0.09	1.04	3.37	0.59	-0.82	-0.33	-1.00	-0.86	0.09	-0.19	-0.39	0.12	-0.36	-1.25
981.8	0.60	0.44	1.13	-0.08	-1.24	-0.37	0.18	1.54	-1.11	-1.67	0.80	-1.94	1.67	-0.45	0.50	-0.76	5.78	-0.72	-1.37	0.45	0.32	-0.53	0.08	-1.60	0.21	0.90	-0.51	-1.01

Table 37 Z-score by dB data of the Vertical Polarization radiated emission NOTE (2): No result was given from the laboratory, since the test chamber doesn't pass the NSA requirement.

Frequency (MHz)	19	33	31	32	28	29	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	54	55
45.4	-0.09	-0.09	---(2)	-0.74	-0.43	0.33	0.57	0.81	1.95	0.25	1.50	-2.20	2.61	-1.58	-0.35	0.09	-2.85	-0.16	-2.56	0.26	1.37	0.57	2.26	-7.00	-0.57	1.47	-1.12	-0.61
60.5	-1.40	0.71	---(2)	0.22	-0.59	0.91	0.34	0.11	-1.37	1.28	-0.67	-1.45	1.72	-0.53	-2.33	1.09	0.01	0.01	-3.30	-0.56	1.29	-0.44	1.86	-5.59	-0.01	0.65	-1.34	-0.41
75.6	-0.21	-1.16	1.05	-0.96	0.09	-0.66	-0.76	1.25	3.11	-0.09	-3.28	-2.83	4.37	-0.07	0.00	-0.41	0.33	0.78	-3.05	-0.01	0.09	3.01	0.04	-10.02	0.50	2.27	0.19	-1.87
105.9	-1.74	-0.22	-0.67	-1.32	0.00	-1.07	-0.08	1.12	1.74	-0.71	0.42	0.73	2.25	-0.04	0.39	0.48	-0.82	1.64	-0.06	1.07	1.07	1.97	-0.11	-12.25	0.06	0.72	-1.35	-0.11
151.3	0.53	1.58	0.03	0.28	-0.93	0.09	-0.96	-1.21	1.77	-5.01	-0.40	-1.89	-0.47	-2.10	-0.85	0.12	1.85	0.57	1.85	-2.73	-1.86	-0.56	0.22	-12.87	0.93	-0.22	0.12	0.00
212.0	-0.59	-0.48	-0.17	-1.83	0.48	-1.42	0.00	1.87	-3.21	1.01	0.52	-4.25	1.66	0.45	1.77	1.07	1.68	0.60	-2.62	-0.10	-0.10	0.62	1.14	-13.54	-0.48	0.45	-0.03	-1.11
317.3	1.59	-1.05	0.56	0.00	-0.38	-1.10	-0.08	0.11	1.21	-1.36	-0.19	-2.07	1.59	0.33	0.39	-0.54	-1.01	0.17	-1.01	0.48	0.70	-0.05	0.59	-0.05	0.89	-7.99	0.67	-0.54
453.4	2.82	0.42	0.69	1.56	-0.03	-0.38	-0.42	0.73	1.91	-0.32	-1.37	-1.56	2.02	0.29	0.00	-1.48	-0.01	0.34	-0.56	-0.72	0.99	-0.38	-0.91	0.69	0.54	2.60	1.68	-0.95
740.7	1.42	0.94	0.62	0.40	-0.11	-8.24	-0.11	-0.33	0.78	-2.32	1.93	-1.51	1.71	-0.43	0.20	-1.06	2.44	-0.80	-1.15	0.00	0.69	-0.33	0.43	-0.17	0.62	1.95	-0.11	-0.91
981.8	2.18	1.21	1.30	-0.18	0.00	-0.70	-0.33	0.27	0.45	-4.47	1.09	-1.36	1.09	-1.86	0.76	-0.49	3.50	-0.22	-2.37	0.71	-0.06	-0.03	0.22	-3.34	-0.36	2.00	0.61	-1.55

Table 38 Z-score by linear data of the Vertical Polarization radiated emission NOTE (2): No result was given from the laboratory, since the test chamber doesn't pass the NSA requirement.

Frequency (MHz)	19	33	31	32	28	29	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	54	55
45.4	-0.13	-0.13	---(2)	-0.54	-0.35	0.19	0.39	0.61	1.93	0.12	1.35	-1.19	2.95	-0.95	-0.30	0.00	-1.40	-0.18	-1.31	0.13	1.19	0.39	2.37	-2.02	-0.44	1.30	-0.74	-0.46
60.5	-0.96	0.72	---(2)	0.20	-0.47	0.97	0.31	0.09	-0.94	1.47	-0.53	-0.99	2.19	-0.43	-1.35	1.20	0.00	0.00	-1.64	-0.45	1.49	-0.37	2.43	-1.99	-0.02	0.65	-0.93	-0.35
75.6	-0.19	-0.90	1.00	-0.76	0.06	-0.55	-0.62	1.23	3.88	-0.09	-2.00	-1.81	6.43	-0.08	-0.02	-0.35	0.28	0.71	-1.91	-0.02	0.06	3.71	0.02	-3.39	0.43	2.53	0.15	-1.32
105.9	-1.04	-0.20	-0.51	-0.86	-0.02	-0.73	-0.09	1.15	2.06	-0.52	0.35	0.67	3.00	-0.05	0.32	0.41	-0.59	1.89	-0.07	1.07	1.07	2.45	-0.11	-2.01	0.02	0.66	-0.87	-0.11
151.3	0.55	2.08	0.02	0.27	-0.78	0.08	-0.80	-0.96	2.42	-2.23	-0.38	-1.34	-0.43	-1.43	-0.72	0.11	2.57	0.60	2.57	-1.68	-1.32	-0.51	0.21	-2.61	1.07	-0.22	0.11	-0.02
212.0	-0.62	-0.55	-0.33	-1.29	0.23	-1.10	-0.19	1.88	-1.77	0.76	0.26	-2.01	1.58	0.19	1.73	0.84	1.60	0.34	-1.59	-0.28	-0.28	0.36	0.92	-2.57	-0.55	0.19	-0.22	-0.93
317.3	2.36	-0.96	0.62	-0.06	-0.43	-1.00	-0.14	0.06	1.63	-1.16	-0.25	-1.52	2.36	0.32	0.39	-0.57	-0.93	0.13	-0.93	0.52	0.81	-0.12	0.66	-0.12	1.09	-2.47	0.77	-0.57
453.4	3.24	0.23	0.46	1.39	-0.14	-0.38	-0.41	0.50	1.83	-0.35	-0.96	-1.05	1.98	0.11	-0.11	-1.01	-0.12	0.16	-0.50	-0.60	0.76	-0.38	-0.71	0.46	0.33	2.87	1.53	-0.73
740.7	1.65	0.96	0.56	0.31	-0.20	-2.57	-0.20	-0.39	0.76	-1.58	2.54	-1.19	2.13	-0.47	0.10	-0.93	3.58	-0.75	-0.98	-0.10	0.64	-0.39	0.34	-0.25	0.56	2.58	-0.20	-0.82
981.8	2.58	1.12	1.23	-0.23	-0.09	-0.57	-0.34	0.14	0.30	-1.78	0.97	-0.93	0.97	-1.14	0.60	-0.44	5.66	-0.25	-1.32	0.55	-0.14	-0.11	0.09	-1.58	-0.36	2.27	0.44	-1.01

Table 39 Difference from Median value of the conducted emission measurement (in dB) NOTE (1): No result at this frequency was given from the laboratory.

Frequency MHz)	19	33	20	31	32	28	29	23	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	53	50	51	52	54	55
0.219	-0.4	0.8	0.2	0.0	-2.7	0.0	0.5	-1.1	0.0	-1.1	0.6	-18.2	-0.1	-4.8	-1.5	-1.7	-0.7	-1.5	-1.9	0.1	0.2	-1.1	0.0	-1.6	-0.1	0.3	1.7	0.3	1.1	1.7	1.2
0.439	-0.2	0.7	-0.1	0.0	-0.8	1.1	0.0	-0.4	0.1	-0.3	-1.2	-1.0	0.5	-6.8	-0.1	-2.2	0.6	-0.4	-1.3	0.3	-1.1	-0.2	0.5	0.0	1.1	0.5	1.9	1.1	0.5	1.0	-0.9
2.62	-0.2	0.9	-0.9	-0.3	-0.6	2.5	-1.1	0.7	0.1	0.0	-1.8	-16.8	0.0	-16.0	0.2	0.1	1.2	0.6	-0.2	1.9	-1.9	-1.0	1.2	0.0	2.1	-3.0	-8.0	2.1	-2.6	1.1	---(1)
3.71	0.7	0.7	-4.0	-0.9	-0.8	2.6	-2.1	1.6	0.4	-1.9	-0.4	-12.2	0.6	-17.5	1.0	-0.6	0.5	1.0	-2.9	1.4	-1.1	-0.3	0.9	1.0	1.0	-0.7	-2.8	2.1	-5.5	1.3	0.0
7.45	2.2	-0.9	0.1	-1.4	0.9	1.8	-5.9	0.0	-0.1	1.2	-0.4	-4.5	1.1	-4.2	-4.2	-0.4	2.9	0.3	-2.0	-0.2	-1.5	-0.9	2.4	1.0	1.2	1.3	3.2	1.3	-6.5	1.4	-1.5
15.1	4.6	2.6	5.3	-0.8	-2.3	-0.2	1.0	2.6	1.9	0.6	-0.6	2.3	-3.1	-1.4	-1.8	-0.9	-1.7	-1.1	4.1	0.3	5.2	-0.4	-2.3	-0.3	0.7	1.1	-32.3	-0.5	2.4	0.0	3.0

Table 40 Difference from Median value of the Horizontal Polarization radiated emission (in dB) NOTE (2): No result was given from the laboratory, since the test chamber doesn't pass the NSA requirement.

Frequency (MHz)	19	33	31	32	28	29	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	54	55
45.4	-0.2	1.4	---(2)	-4.5	0.2	-1.1	-2.1	2.7	4.3	-7.2	2.7	9.1	2.9	-0.7	-2.2	0.7	13.4	2.4	-6.8	0.0	4.5	-0.7	8.2	-5.8	-0.2	1.8	-3.8	-3.9
60.5	-2.0	1.8	---(2)	1.6	-2.0	0.6	1.0	-2.1	-3.2	-1.7	-4.1	3.5	8.8	0.0	-2.0	-1.1	6.2	-6.4	-11.4	0.1	5.2	2.8	9.7	-9.3	0.5	3.4	-3.6	-3.5
75.6	0.1	1.3	-0.3	1.2	-0.7	1.3	-0.1	6.0	3.6	-14.7	-0.2	-4.9	3.7	3.4	1.9	2.3	4.0	-2.1	-4.6	-2.5	-0.6	2.2	1.9	-17.5	-0.1	3.4	-1.8	-3.3
105.9	-8.7	0.1	-4.4	0.1	0.0	-3.2	-0.9	2.6	3.6	-2.7	0.8	-3.8	5.1	-1.8	0.5	7.0	11.5	2.6	-1.1	-1.4	1.6	1.6	0.0	-42.3	-2.6	2.9	-8.1	-4.4
151.3	0.6	1.1	1.6	-0.7	-2.9	0.8	-2.7	9.4	6.3	-14.3	2.5	-6.4	1.9	8.5	-5.2	4.8	1.3	4.0	-2.1	-9.0	-3.0	-2.5	-8.2	-43.7	1.5	0.6	-0.6	-1.7
212.0	0.0	3.2	0.6	3.2	1.2	2.1	1.0	-6.4	-6.8	-0.9	-10.0	-17.9	5.4	-5.7	0.0	-8.9	-0.9	-0.9	-12.1	-3.1	0.9	2.1	2.3	-42.2	1.9	3.9	-2.4	0.3
317.3	4.6	0.4	2.4	0.1	0.0	-1.3	0.0	3.7	4.4	-3.8	-2.3	-8.9	8.6	4.0	-1.3	0.4	-5.1	-4.3	-7.7	-0.1	1.2	3.0	-2.3	-2.6	0.0	3.2	2.2	-0.4
453.4	5.7	1.9	3.7	-1.3	-0.7	-14.0	-1.4	6.2	4.3	-7.1	1.3	-5.9	6.7	0.0	2.1	-1.5	-1.3	1.1	-2.1	-4.0	3.8	-3.0	-2.2	2.1	0.0	2.7	3.3	-0.6
740.7	2.3	1.4	1.6	-0.9	0.5	-25.9	-2.9	4.6	3.0	-2.5	7.4	-4.9	3.2	1.0	-0.3	2.9	7.1	1.7	-3.2	-1.1	-4.0	-3.3	0.3	-0.6	-1.3	0.4	-1.2	-5.4
981.8	2.1	1.6	3.6	-0.3	-7.2	-1.6	0.7	4.6	-6.1	-12.3	2.7	-18.6	4.9	-2.0	1.8	-3.7	11.2	-3.4	-8.5	1.6	1.2	-2.4	0.3	-11.3	0.8	3.0	-2.3	-5.3

Table 41 Difference from Median value of the Vertical Polarization radiated emission (in dB) NOTE (2): No result was given from the laboratory, since the test chamber doesn't pass the NSA requirement.

Frequency (MHz)	19	33	31	32	28	29	30	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	54	55
45.4	-0.5	-0.5	---(2)	-2.4	-1.5	0.7	1.4	2.1	5.4	0.5	4.1	-6.6	7.3	-4.8	-1.3	0.0	-8.5	-0.7	-7.7	0.5	3.7	1.4	6.3	-20.5	-1.9	4.0	-3.5	-2.0
60.5	-4.9	2.4	---(2)	0.7	-2.1	3.1	1.1	0.3	-4.8	4.4	-2.4	-5.1	5.9	-1.9	-8.1	3.7	0.0	0.0	-11.5	-2.0	4.4	-1.6	6.4	-19.4	-0.1	2.2	-4.7	-1.5
75.6	-0.5	-2.4	2.0	-2.0	0.1	-1.4	-1.6	2.4	6.1	-0.2	-6.6	-5.7	8.6	-0.2	0.0	-0.9	0.6	1.5	-6.1	-0.1	0.1	5.9	0.0	-20.0	0.9	4.5	0.3	-3.8
105.9	-6.3	-0.9	-2.5	-4.8	-0.1	-3.9	-0.4	3.9	6.1	-2.6	1.4	2.5	7.9	-0.2	1.3	1.6	-3.0	5.7	-0.3	3.7	3.7	6.9	-0.5	-43.7	0.1	2.5	-4.9	-0.5
151.3	1.7	5.1	0.1	0.9	-3.1	0.3	-3.2	-4.0	5.7	-16.2	-1.3	-6.2	-1.6	-6.8	-2.8	0.4	5.9	1.8	5.9	-8.8	-6.1	-1.8	0.7	-41.6	3.0	-0.8	0.4	0.0
212.0	-2.4	-2.1	-1.2	-6.0	0.8	-4.8	-0.7	4.8	-10.0	2.3	0.8	-13.0	4.1	0.6	4.5	2.4	4.2	1.1	-8.2	-1.0	-1.0	1.1	2.6	-39.9	-2.1	0.6	-0.8	-3.9
317.3	5.7	-4.1	1.9	-0.2	-1.6	-4.3	-0.5	0.2	4.3	-5.3	-0.9	-7.9	5.7	1.0	1.2	-2.2	-3.9	0.5	-3.9	1.6	2.4	-0.4	2.0	-0.4	3.1	-29.9	2.3	-2.2
453.4	7.0	0.7	1.4	3.7	-0.5	-1.4	-1.5	1.5	4.6	-1.2	-4.0	-4.5	4.9	0.4	-0.4	-4.3	-0.4	0.5	-1.9	-2.3	2.2	-1.4	-2.8	1.4	1.0	6.5	4.0	-2.9
740.7	4.2	2.7	1.7	1.0	-0.6	-26.2	-0.6	-1.4	2.2	-7.6	5.8	-5.1	5.1	-1.7	0.3	-3.7	7.3	-2.8	-3.9	-0.3	1.9	-1.4	1.0	-0.9	1.7	5.8	-0.6	-3.2
981.8	6.8	3.6	3.9	-1.0	-0.4	-2.7	-1.5	0.5	1.1	-15.1	3.2	-4.9	3.2	-6.5	2.1	-2.0	11.2	-1.1	-8.2	2.0	-0.6	-0.5	0.4	-11.4	-1.6	6.2	1.6	-5.5

5.2 Statistical Evaluation

The statistical evaluation was performed to see the validity of measurement data from both the Z-score and the difference from median value.

In the results of circulation; Round 4, Round 5, Round 6 and Retest Round, when Z score has been calculated with the linear data, the Z score of the data below a median value was compressed in some frequencies. Namely, we thought a suitable Z score was not obtained, because the CV (Coefficient Variation) value of the data became 30 % to 40 % and the data dispersion in some frequencies had become much wider value compared with the value in the report of Part-I.

The reason of high data dispersion is under investigation. But we have presumed from the results that many test laboratories used the complex (hybrid) antenna which can be used from 30 MHz to 1 GHz as the receiving antenna of radiated emission measurement.

As the results, Z score was calculated by both the dB expression and the linear expression data for the horizontal polarization and the vertical polarization of the radiated emission measurement.

When Z score has been calculated with the dB expression data, the dispersion characteristics were similar to the actual measurement data dispersion. These results were shown in Fig. 24, Fig.25 and Fig. 26 for Horizontal Polarization, and Fig. 28, Fig. 29 and Fig. 30 for Vertical Polarization.

Therefore, as for the evaluation of the radiated emission measurement results in Part II, the following interpretation table should be applied to the Z score calculated by dB expression data and the difference from median value.

And the Z score for the conducted emission measurement result was calculated by linear data, since the data dispersion in each frequency was almost same as the report of Part I.

Measurement results of the conducted and radiated emission, the Z-score by linear data, the Z-score by logarithmic data and the difference from median value are shown in the following tables and figures.

- Measurement results: Table 31 through Table 33 and Fig. 21, Fig. 24 and Fig. 28.
- Z-Scores by linear and dB-expression data: Table 34 through Table 38,
  Fig. 22, Fig. 25, Fig. 26, Fig. 29 and Fig. 30.
- Differences from median value: Table 39 through Table 41, Fig. 23, Fig. 27 and Fig.31

Z-Score is interpreted as follows:

(a)	$\|z\| \leq 2.0$	Satisfactory
(b)	$2.0 < \|z\| < 3.0$	Questionable
(c)	$3.0 \leq \|z\|$	Doubtful; shall be reviewed

Differences from the median value is interpreted as follows,

(d)	$\|d\| \leq 6.0$ dB	Satisfactory
(e)	6.0 dB $< \|d\|$	Doubtful; shall be reviewed

From the above two factors, the following conditions are considered to be 'unsatisfactory'.

(c) and (e)	$3.0 \leq \|z\|$ and 6.0 dB $< \|d\|$	Unsatisfactory

(1) Conducted emission measurement

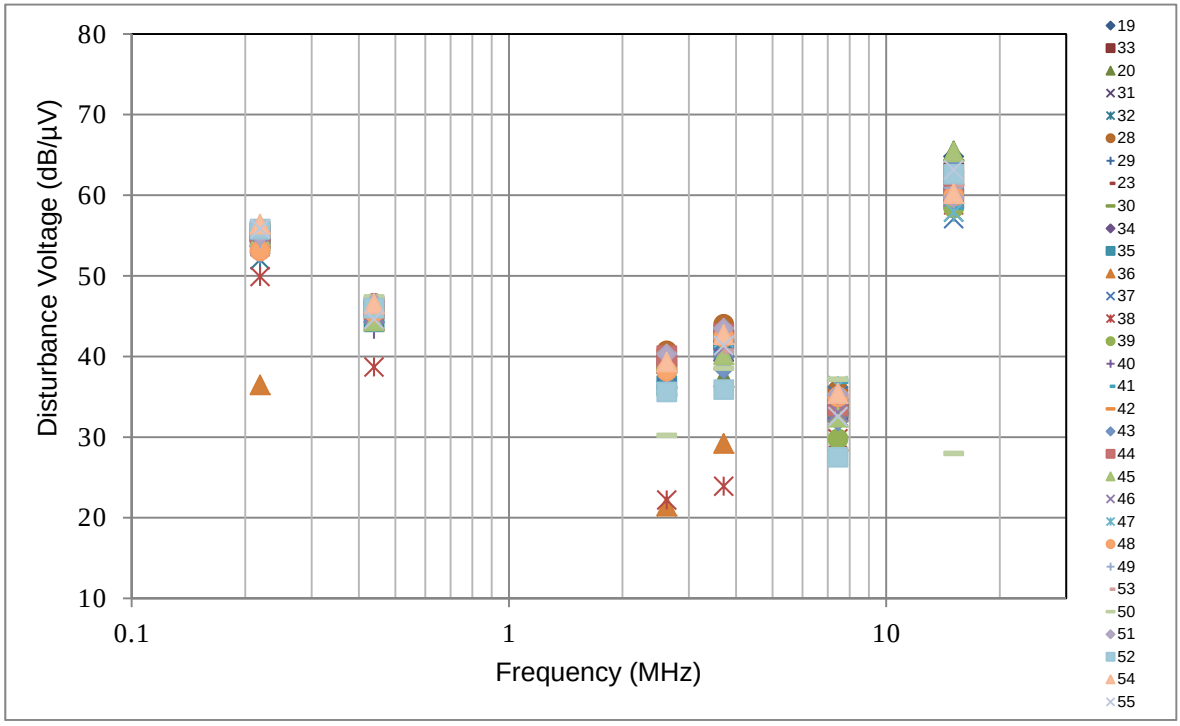

Fig. 21 Conducted emission measurement result in dBµV

Table 42 Basic data of the Z-score calculation for the conducted emission measurement

Frequency	Q1	Q2	Q3	IQR	N-IQR	Robust CV	Average	Standard Deviation
(MHz)	Linear scale data (µV)					%	dB scale(dBµV)	
0.219	467.86	543.25	562.50	94.64	70.16	12.91	53.75	3.47
0.439	175.84	188.36	199.55	23.72	17.58	9.33	45.28	1.49
2.62	71.82	81.00	89.64	17.82	13.21	16.31	36.81	4.53
3.71	98.49	116.95	131.45	32.96	24.43	20.89	40.12	4.10
7.45	42.54	50.12	57.74	15.21	11.27	22.49	33.58	2.47
15.1	910.69	1023.29	1339.71	429.02	318.03	31.08	59.83	6.32

NOTE:

Q1, Q2, Q3, IQR and N-IQR described in Table 42, Table 43, and Table 44 consist of the following definitions.

Q1: 25th percentile (or 1st quartile) of the participant results

Q2: 50th percentile (or 2nd quartile) of the participant results

Q3: 75th percentile (or 3rd quartile) of the participant results

IQR: Inter Quartile Ratio

N-IQR: Normalized IQR = 0.7413 x (Q3 – Q1)

Robust CV: Robust Coefficient of Variation = N-IQR x 100 / Q2 (%)

Z-score is calculated by the following formula,

Z-score = (Result – Q2) / N-IQR

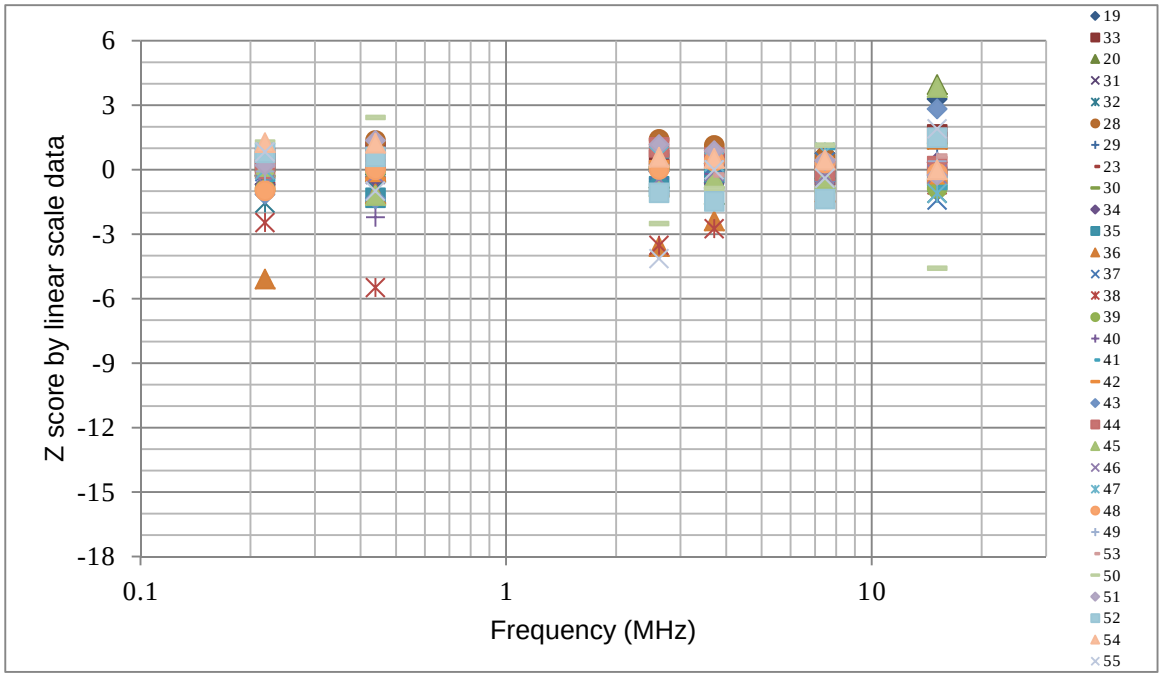

Fig. 22 Z-score by linear scale data of the conducted emission measurement

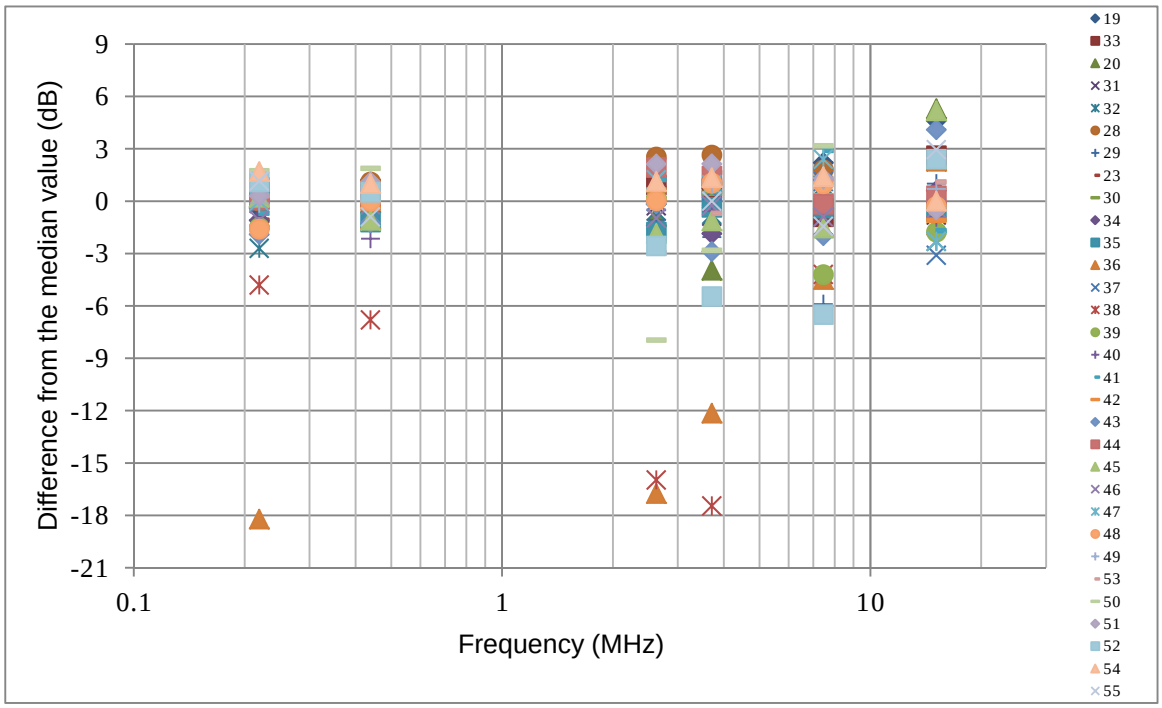

Fig. 23 Difference from the median value of conducted emission measurement

(2) Horizontal Polarization radiated emission measurement

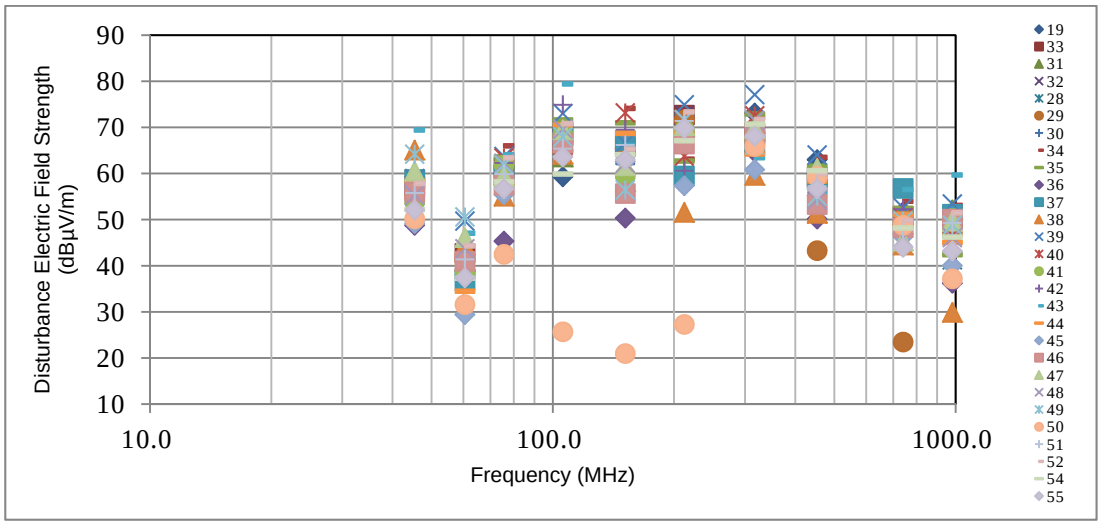

Fig. 24 Horizontal Polarization radiated emission measurement result in dBμV/m

Table 43 Basic data of the Z-score calculation for Horizontal polarization radiated emission

(a) Data in linear scale

Frequency	Q1	Q2	Q3	IQR	N-IQR	Robust CV	Average	Standard Deviation
(MHz)	Linear scale data (μV/m)					%	Linear scale data(μV/m)	
45.4	493.86	630.96	860.99	367.14	272.16	43.13	792.87	551.67
60.5	81.92	110.40	144.78	62.87	46.60	42.21	124.46	71.73
75.6	806.16	1000.07	1291.98	485.82	360.14	36.01	932.23	407.79
105.9	1800.80	2497.51	3105.27	1304.48	967.01	38.72	2076.09	1683.15
151.3	1226.75	1720.95	2083.53	856.78	635.13	36.91	1352.00	1126.10
212.0	1511.58	2977.33	3736.99	2225.41	1649.70	55.41	2058.16	1353.66
317.3	2039.98	2660.73	3570.23	1530.25	1134.38	42.63	2640.87	1255.41
453.4	605.98	732.11	1015.29	409.32	303.43	41.45	731.59	343.89
740.7	219.01	296.86	367.83	148.82	110.32	37.16	272.13	140.93
981.8	166.47	266.23	329.60	163.12	120.92	45.42	221.24	175.79

(b) Data in dB scale

Frequency	Q1	Q2	Q3	IQR	N-IQR	Robust CV	Average	Standard Deviation
(MHz)	dB scale data (dBμV/m)					%	dB scale data (dBμV/m)	
45.4	53.87	56.00	58.70	4.83	3.58	6.39	56.16	5.03
60.5	38.25	40.86	43.20	4.95	3.67	8.98	41.33	5.94
75.6	58.13	60.00	62.23	4.10	3.04	5.06	59.39	5.02
105.9	65.11	67.95	69.83	4.73	3.50	5.15	66.34	8.83
151.3	61.78	64.70	66.38	4.60	3.41	5.27	62.62	9.46
212.0	63.58	69.48	71.45	7.87	5.83	8.39	66.27	9.18
317.3	66.19	68.50	71.05	4.86	3.60	5.26	68.43	3.75
453.4	55.65	57.29	60.13	4.48	3.32	5.80	57.29	4.31
740.7	46.81	49.45	51.31	4.50	3.34	6.75	48.70	5.78
981.8	44.40	48.50	50.36	5.96	4.42	9.11	46.90	5.97

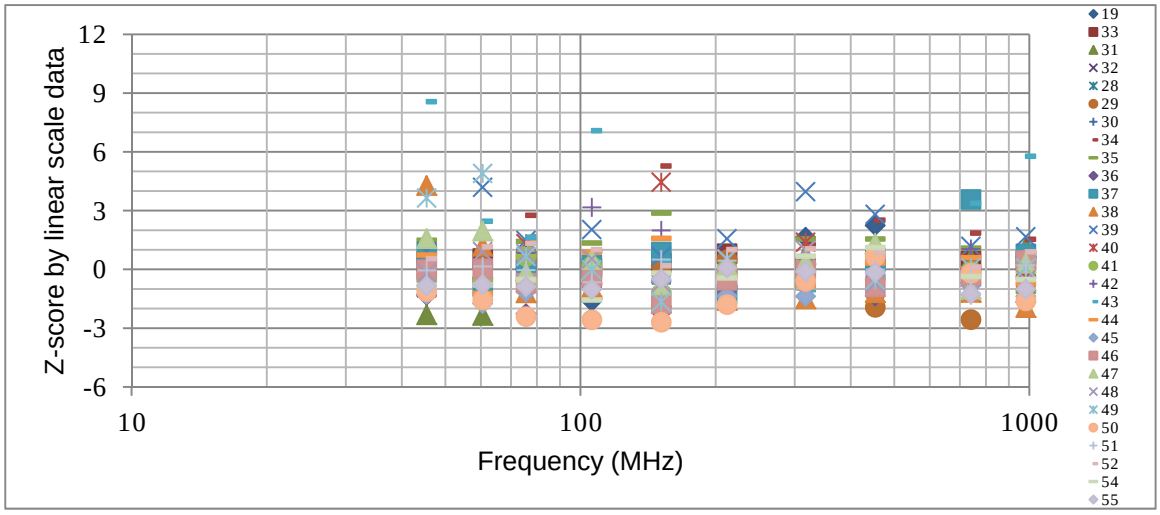

Fig. 25 Z-score by linear scale data of Horizontal Polarization radiated emission measurement

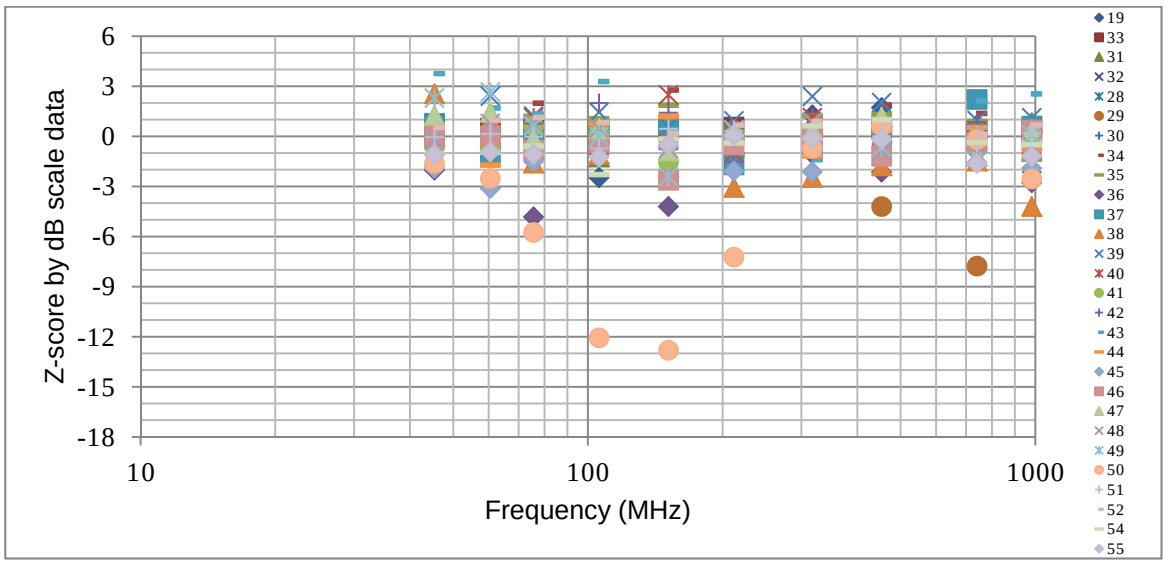

Fig. 26 Z-score by dB scale data of Horizontal Polarization radiated emission measurement

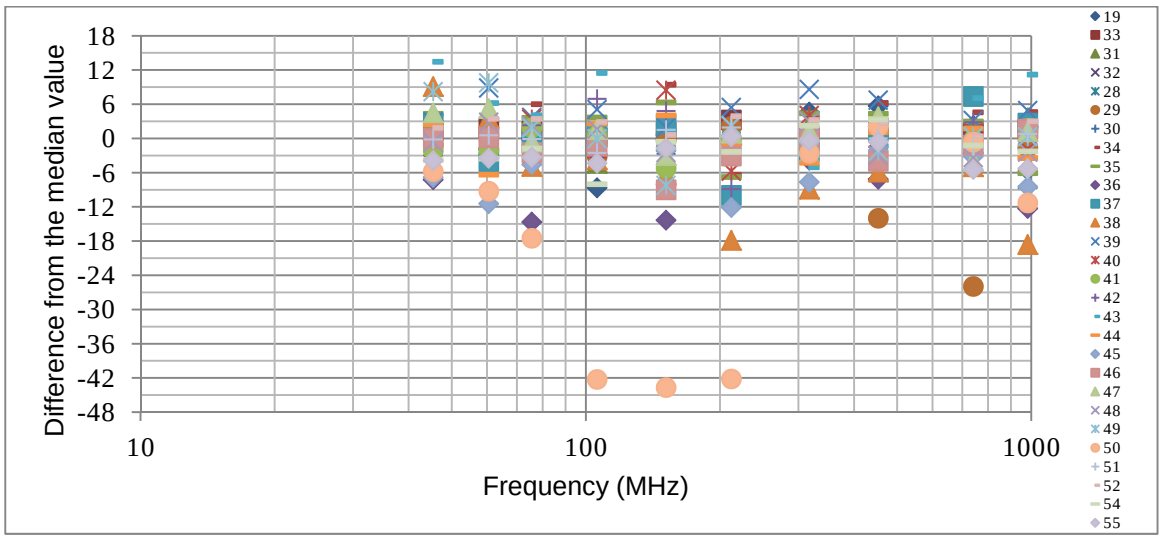

Fig. 27 Difference from the median value of Horizontal Polarization radiated emission measurement

(3) Vertical Polarization radiated emission measurement

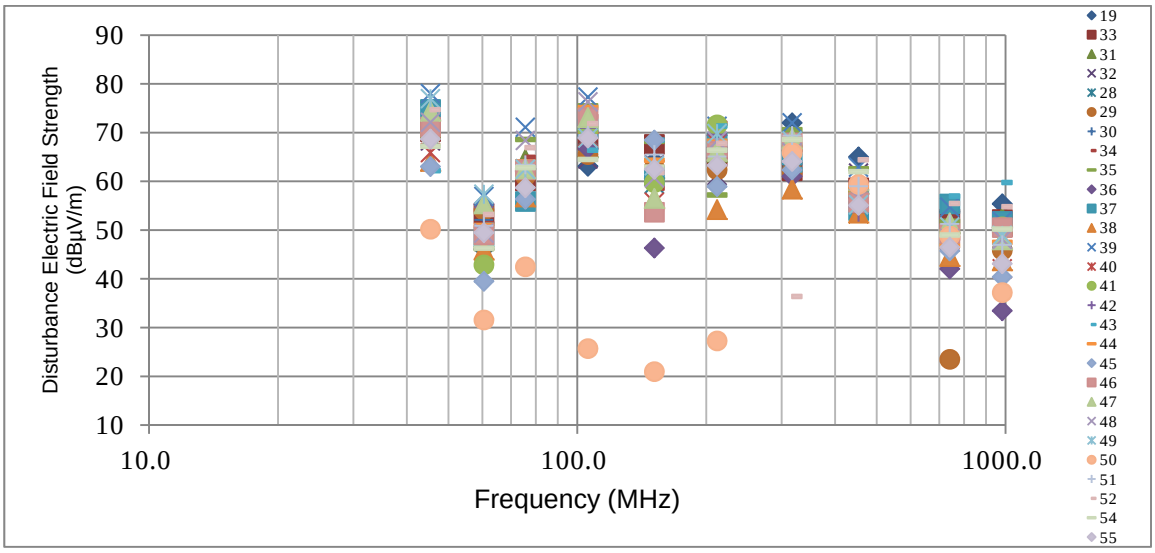

Fig. 28 Vertical Polarization radiated emission measurement result in dBμV/m

Table 44 Basic data of the Z-score calculation for Vertical polarization radiated emission

(a) Data in linear scale

Frequency	Q1	Q2	Q3	IQR	N-IQR	Robust CV	Average	Standard Deviation
(MHz)	Linear scale data (μV/m)					%	Linear scale data (μV/m)	
45.4	2738.47	3427.68	4806.62	2068.15	1533.12	44.73	3575.67	1765.68
60.5	273.88	353.59	487.36	213.48	158.25	44.76	355.97	170.25
75.6	1128.55	1326.88	1602.91	474.36	351.64	26.50	1408.31	680.40
105.9	2548.82	2951.40	4518.56	1969.74	1460.17	49.47	3333.71	1606.46
151.3	941.36	1341.24	1627.92	686.56	508.95	37.95	1290.36	670.53
212.0	1783.60	2283.80	2970.94	1187.34	880.18	38.54	2176.69	985.51
317.3	1530.48	2065.93	2623.00	1092.52	809.88	39.20	2080.99	866.05
453.4	661.01	792.32	1071.52	410.51	304.31	38.41	883.54	338.10
740.7	243.26	303.97	394.81	151.55	112.34	36.96	326.79	148.77
981.8	221.35	268.31	389.05	167.69	124.31	46.33	297.78	180.95

(b) Data in dB scale

Frequency	Q1	Q2	Q3	IQR	N-IQR	Robust CV	Average	Standard Deviation
(MHz)	DB scale data (dBμV/m)					%	dB scale data (dBμV/m)	
45.4	68.73	70.45	72.63	3.90	2.89	4.10	68.90	7.01
60.5	48.68	50.94	53.35	4.67	3.46	6.80	50.07	5.69
75.6	61.00	62.41	63.68	2.68	1.99	3.18	61.83	5.03
105.9	67.70	69.30	72.50	4.80	3.56	5.13	68.42	8.96
151.3	59.45	62.50	63.80	4.35	3.22	5.16	59.95	8.85
212.0	64.95	66.50	68.86	3.91	2.89	4.35	64.78	8.36
317.3	63.23	66.10	68.25	5.02	3.72	5.63	65.02	6.37
453.4	56.31	57.59	59.85	3.55	2.63	4.56	58.36	3.06
740.7	47.42	49.34	51.65	4.23	3.14	6.36	48.96	5.96
981.8	46.80	48.20	51.25	4.45	3.30	6.84	47.98	5.35

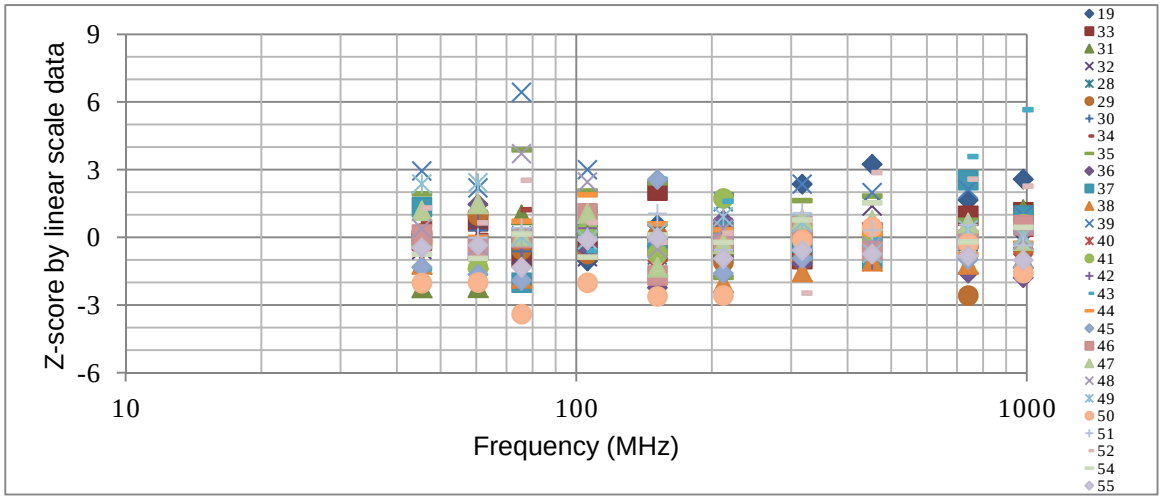

Fig. 29 Z-score by linear scale data of Vertical Polarization radiated emission measurement

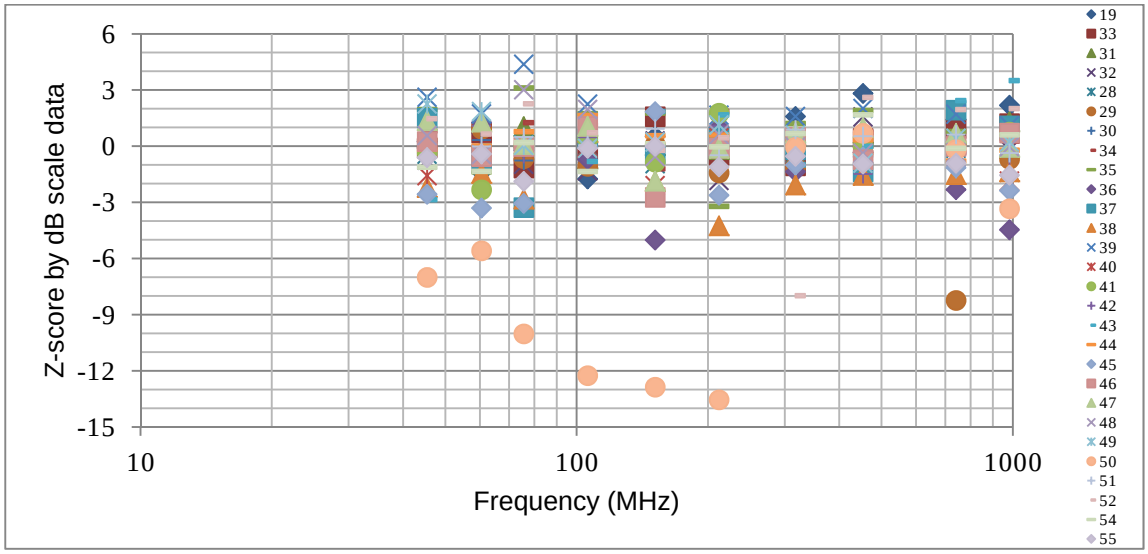

Fig. 30 Z-score by dB scale data of Vertical Polarization radiated emission measurement

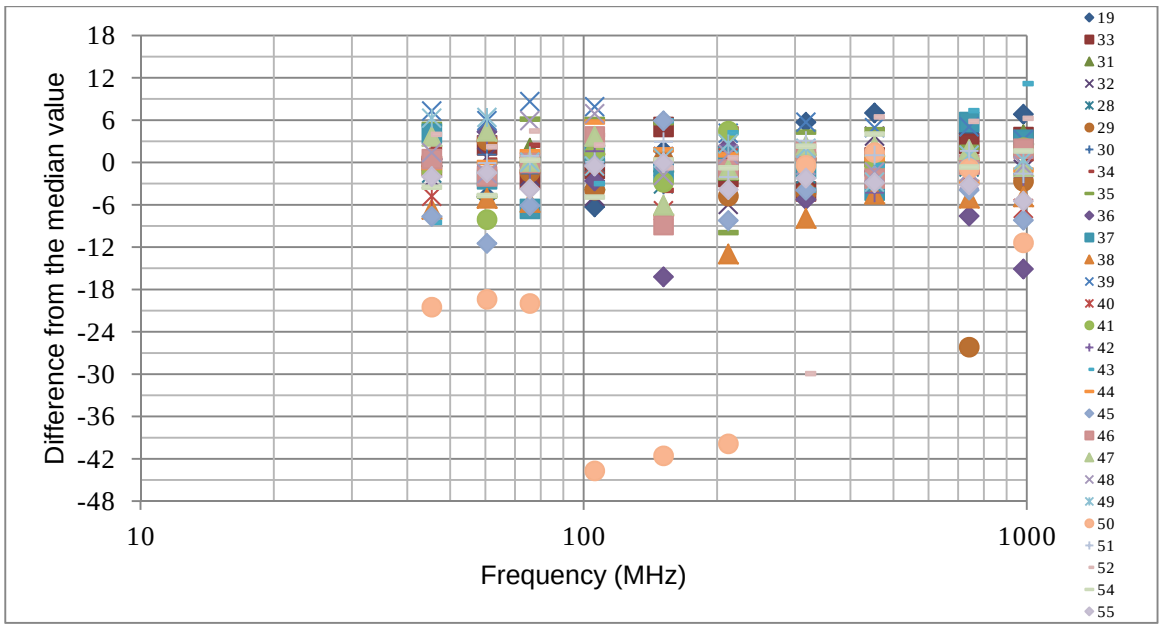

Fig. 31 Difference from the median value of the Vertical Polarization radiated emission measurement

The charts in each frequency for Z-score and for difference from median value are summarized as follows:

Chart 13-1: Z-score of the conducted emission measurement, 219 kHz
Chart 13-2: Z-score of the conducted emission measurement, 439 kHz
Chart 13-3: Z-score of the conducted emission measurement, 2.62 MHz
Chart 13-4: Z-score of the conducted emission measurement, 3.71 MHz
Chart 13-5: Z-score of the conducted emission measurement, 7.45 MHz
Chart 13-6: Z-score of the conducted emission measurement, 15.1 MHz

Chart 14-1: Z-score of the H-Pol. (Horizontal Polarization) radiated emission measurement, 45.4 MHz
Chart 14-2: Z-score of the H-Pol. radiated emission measurement, 60.5 MHz
Chart 14-3: Z-score of the H-Pol. radiated emission measurement, 75.6 MHz
Chart 14-4: Z-score of the H-Pol. radiated emission measurement, 105.9 MHz
Chart 14-5: Z-score of the H-Pol. radiated emission measurement, 151.3 MHz
Chart 14-6: Z-score of the H-Pol. radiated emission measurement, 212.0 MHz
Chart 14-7: Z-score of the H-Pol. radiated emission measurement, 317.3 MHz
Chart 14-8: Z-score of the H-Pol. radiated emission measurement, 453.4 MHz
Chart 14-9: Z-score of the H-Pol. radiated emission measurement, 740.7 MHz
Chart 14-10: Z-score of the H-Pol. radiated emission measurement, 981.8 MHz

Chart 15-1: Z-score of the V-Pol. (Vertical Polarization) radiated emission measurement, 45.4 MHz
Chart 15-2: Z-score of the V-Pol. radiated emission measurement, 60.5 MHz
Chart 15-3: Z-score of the V-Pol. radiated emission measurement, 75.6 MHz
Chart 15-4: Z-score of the V-Pol. radiated emission measurement, 105.9 MHz
Chart 15-5: Z-score of the V-Pol. radiated emission measurement, 151.3 MHz
Chart 15-6: Z-score of the V-Pol. radiated emission measurement, 212.0 MHz
Chart 15-7: Z-score of the V-Pol. radiated emission measurement, 317.3 MHz
Chart 15-8: Z-score of the V-Pol. radiated emission measurement, 453.4 MHz
Chart 15-9: Z-score of the V-Pol. radiated emission measurement, 740.7 MHz
Chart 15-10: Z-score of the V-Pol. radiated emission measurement, 981.8 MHz

Chart 16-1: Difference from the Median Value of conducted emission measurement, 219 kHz
Chart 16-2: Difference from the Median Value of conducted emission measurement, 439 kHz
Chart 16-3: Difference from the Median Value of conducted emission measurement, 2.62 MHz
Chart 16-4: Difference from the Median Value of conducted emission measurement, 3.71 MHz
Chart 16-5: Difference from the Median Value of conducted emission measurement, 7.45 MHz
Chart 16-6: Difference from the Median Value of conducted emission measurement, 15.1 MHz

Chart 17-1: Difference from the Median Value of H-Pol. radiated emission measurement, 45.4 MHz
Chart 17-2: Difference from the Median Value of H-Pol. radiated emission measurement, 60.5 MHz
Chart 17-3: Difference from the Median Value of H-Pol. radiated emission measurement, 75.6 MHz
Chart 17-4: Difference from the Median Value of H-Pol. radiated emission measurement, 105.9 MHz
Chart 17-5: Difference from the Median Value of H-Pol. radiated emission measurement, 151.3 MHz
Chart 17-6: Difference from the Median Value of H-Pol. radiated emission measurement, 212.0 MHz
Chart 17-7: Difference from the Median Value of H-Pol. radiated emission measurement, 317.3 MHz
Chart 17-8: Difference from the Median Value of H-Pol. radiated emission measurement, 453.4 MHz
Chart 17-9: Difference from the Median Value of H-Pol. radiated emission measurement, 740.7 MHz
Chart 17-10: Difference from the Median Value of H-Pol. radiated emission measurement, 981.8 MHz

Chart 18-1: Difference from the Median Value of V-Pol. radiated emission measurement, 45.4 MHz
Chart 18-2: Difference from the Median Value of V-Pol. radiated emission measurement, 60.5 MHz
Chart 18-3: Difference from the Median Value of V-Pol. radiated emission measurement, 75.6 MHz
Chart 18-4: Difference from the Median Value of V-Pol. radiated emission measurement, 105.9 MHz
Chart 18-5: Difference from the Median Value of V-Pol. radiated emission measurement, 151.3 MHz
Chart 18-6: Difference from the Median Value of V-Pol. radiated emission measurement, 212.0 MHz
Chart 18-7: Difference from the Median Value of V-Pol. radiated emission measurement, 317.3 MHz
Chart 18-8: Difference from the Median Value of V-Pol. radiated emission measurement, 453.4 MHz
Chart 18-9: Difference from the Median Value of V-Pol. radiated emission measurement, 740.7 MHz
Chart 18-10: Difference from the Median Value of V-Pol. radiated emission measurement, 981.8 MHz

5.3 Chart Data of Round-4, 5, 6 & Retest

[Z-score by linear scale data of the conducted emission measurement]

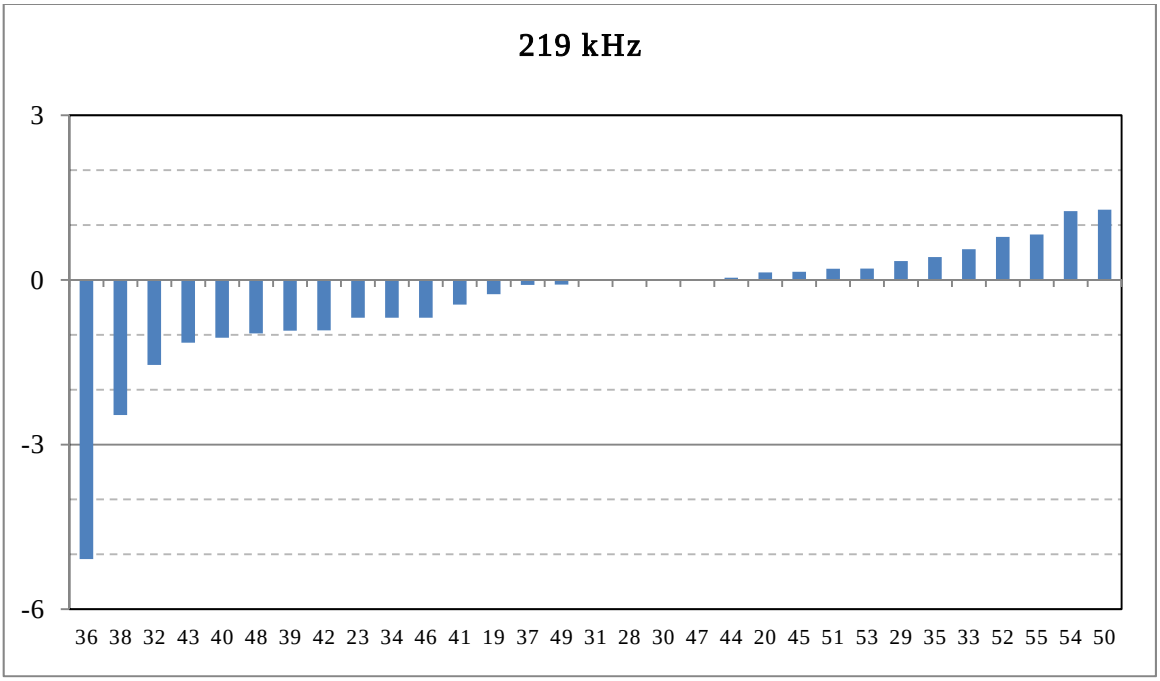

Chart 13-1: Z-score of the conducted emission measurement, 219 kHz

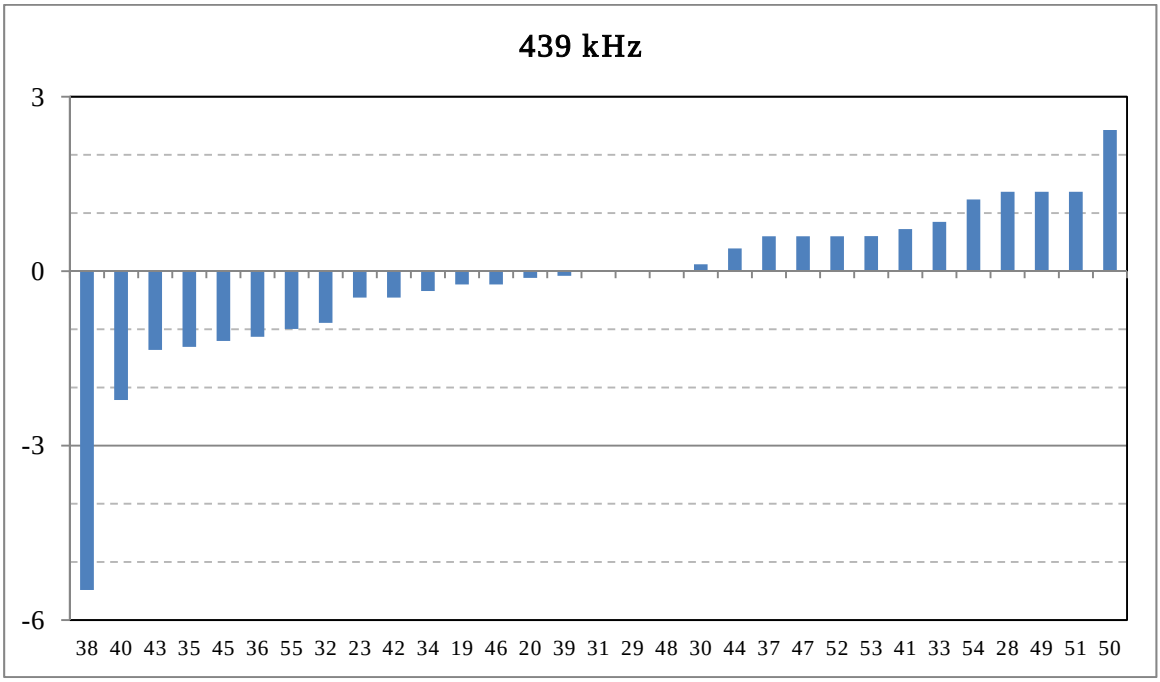

Chart 13-2: Z-score of the conducted emission measurement, 439 kHz

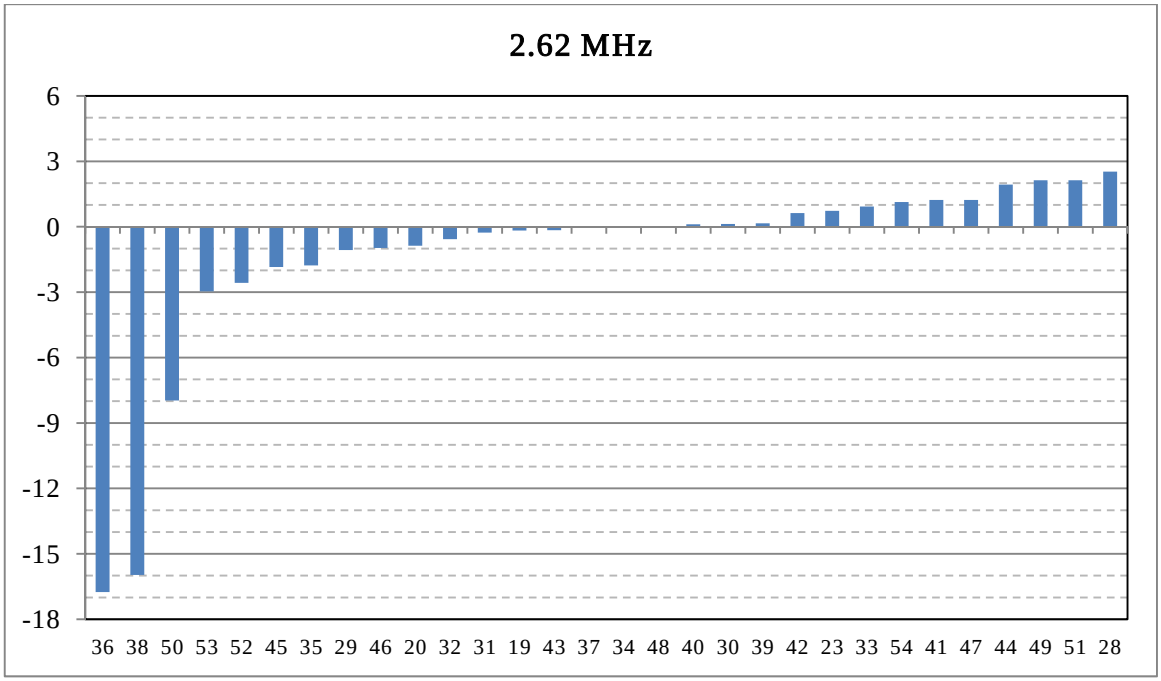

Chart 13-3: Z-score of the conducted emission measurement, 2.62 MHz

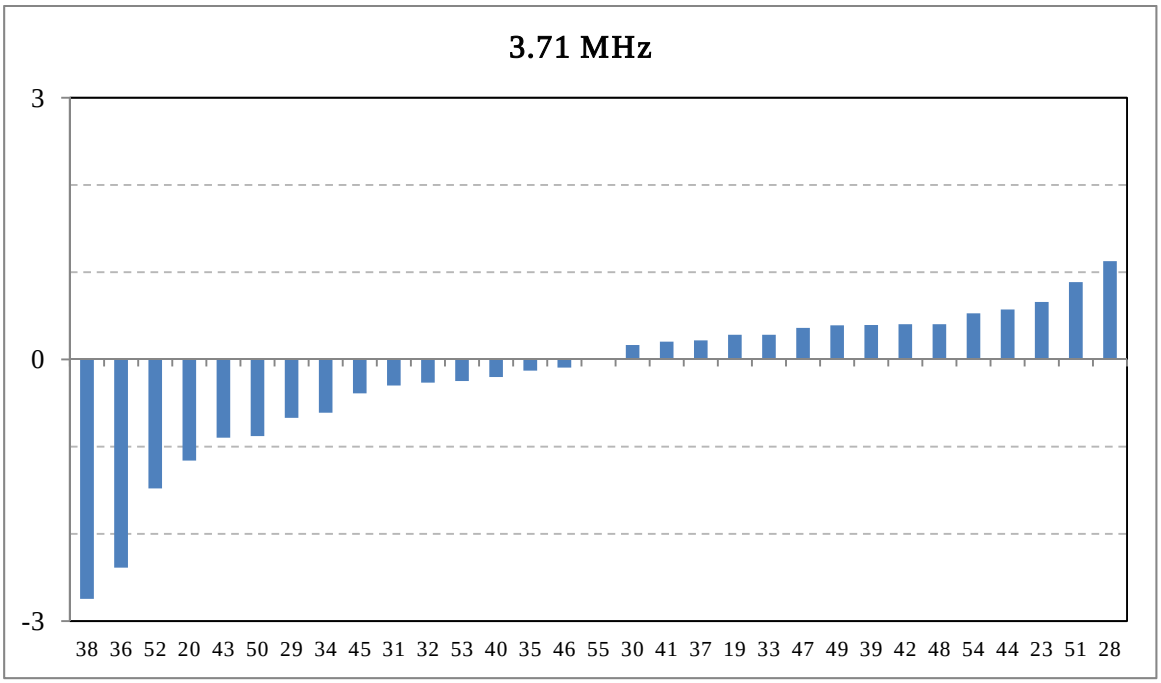

Chart 13-4: Z-score of the conducted emission measurement, 3.71 MHz

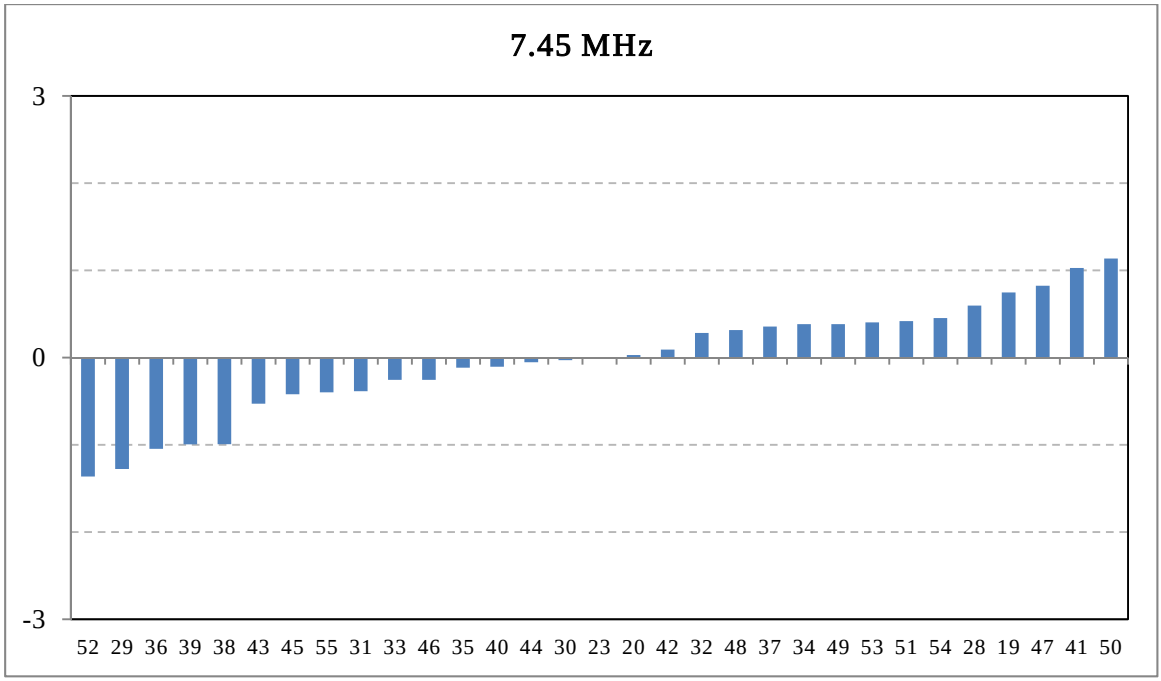

Chart 13-5: Z-score of the conducted emission measurement, 7.45 MHz

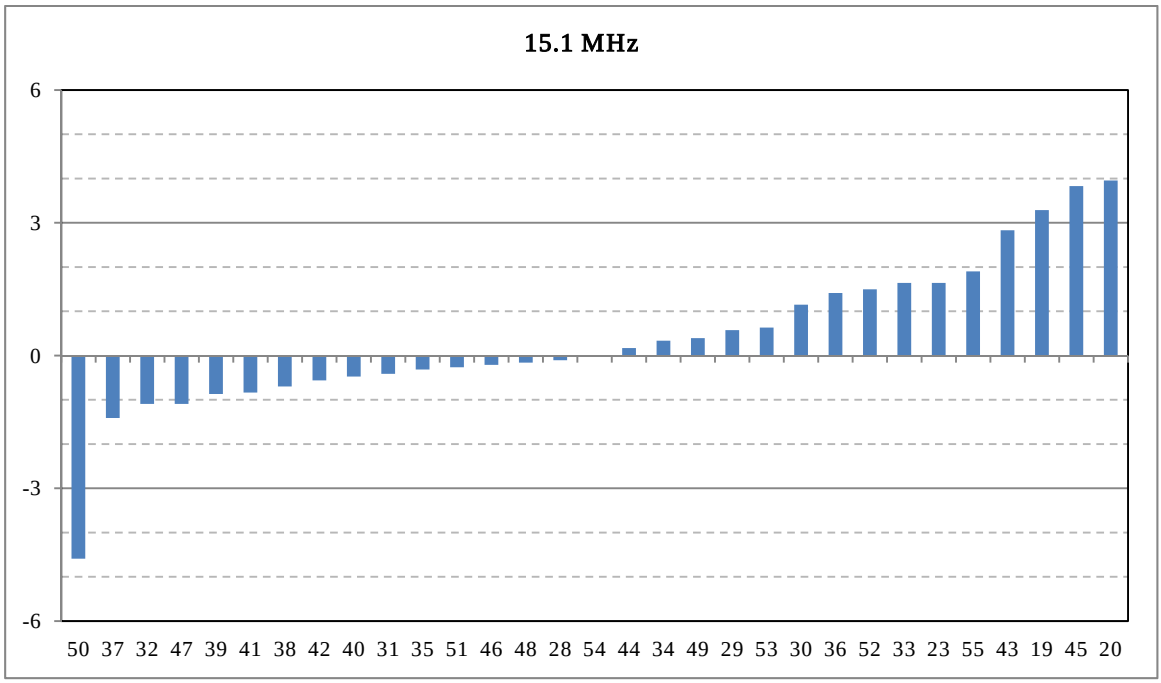

Chart 13-6: Z-score of the conducted emission measurement, 15.1 MHz

[Z-score by dB scale data (dBμV/m) of the radiated emission measurement]
(Horizontal Polarization)]

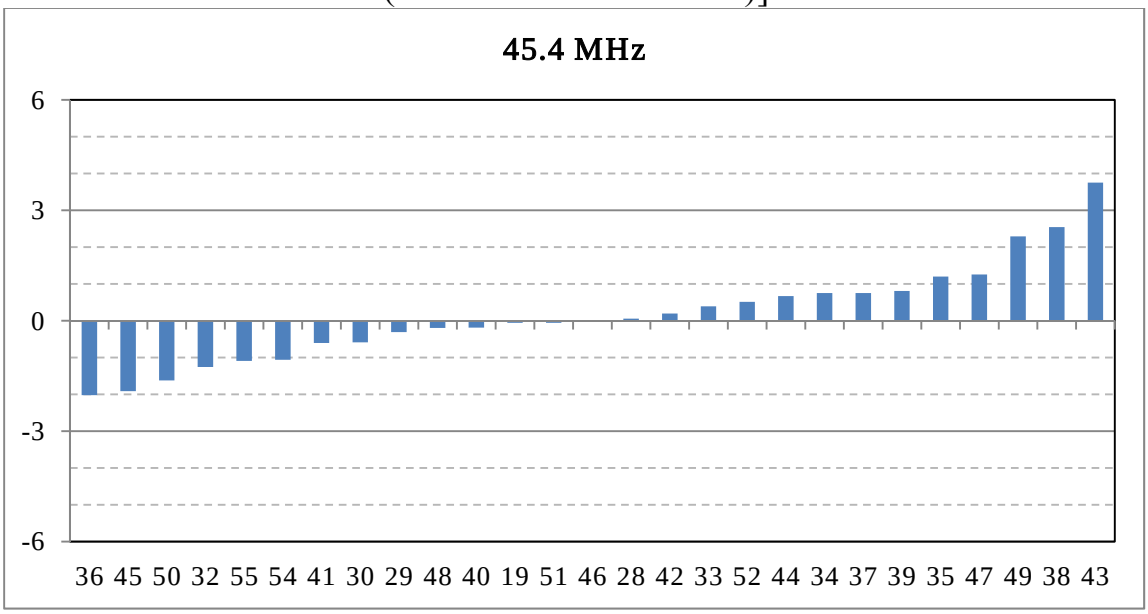

Chart 14-1: Z-score of the H-Pol. (Horizontal Polarization) radiated emission measurement, 45.4 MHz

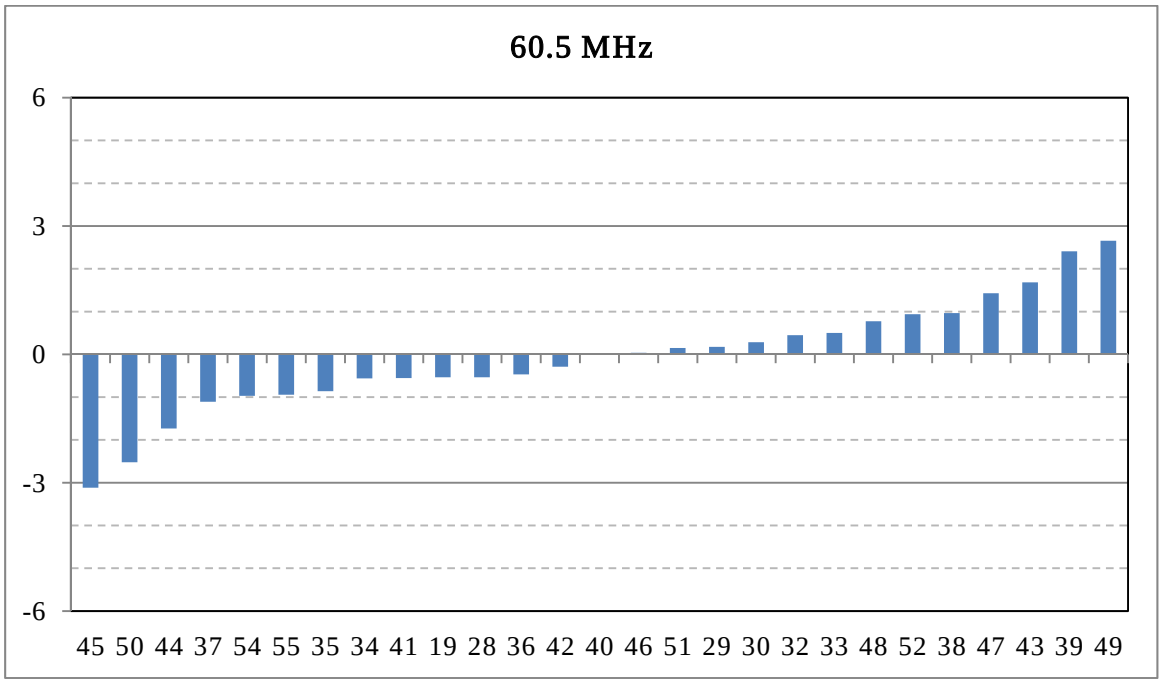

Chart 14-2: Z-score of the H-Pol. radiated emission measurement, 60.5 MHz

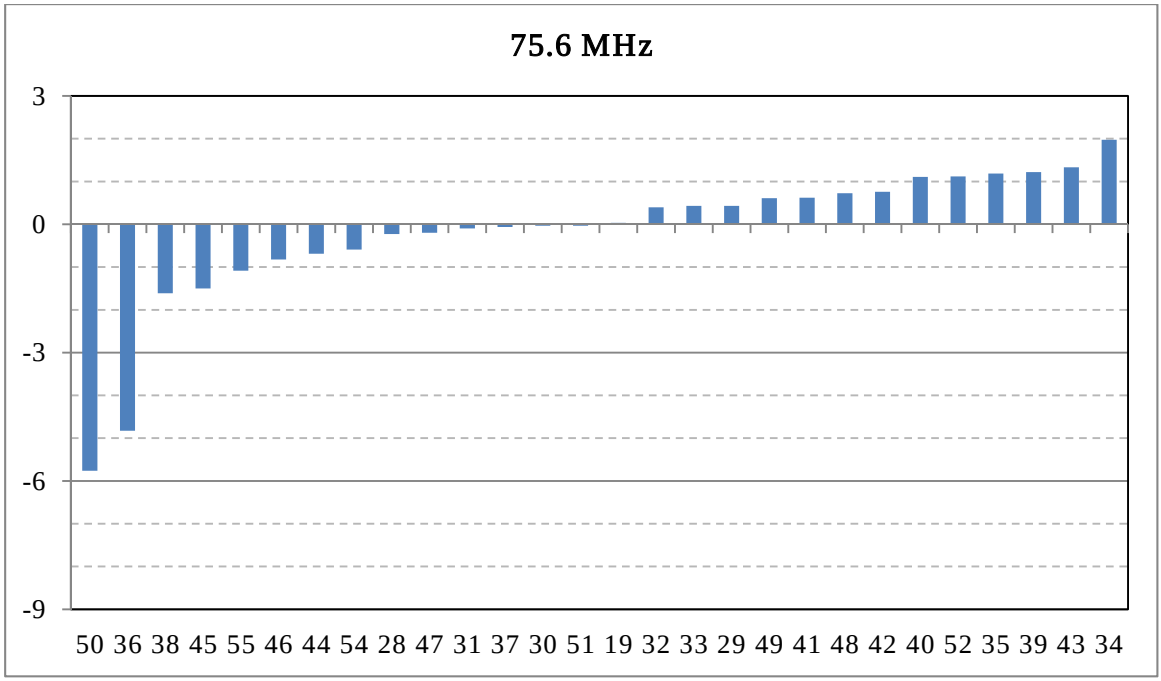

Chart 14-3: Z-score of the H-Pol. radiated emission measurement, 75.6 MHz

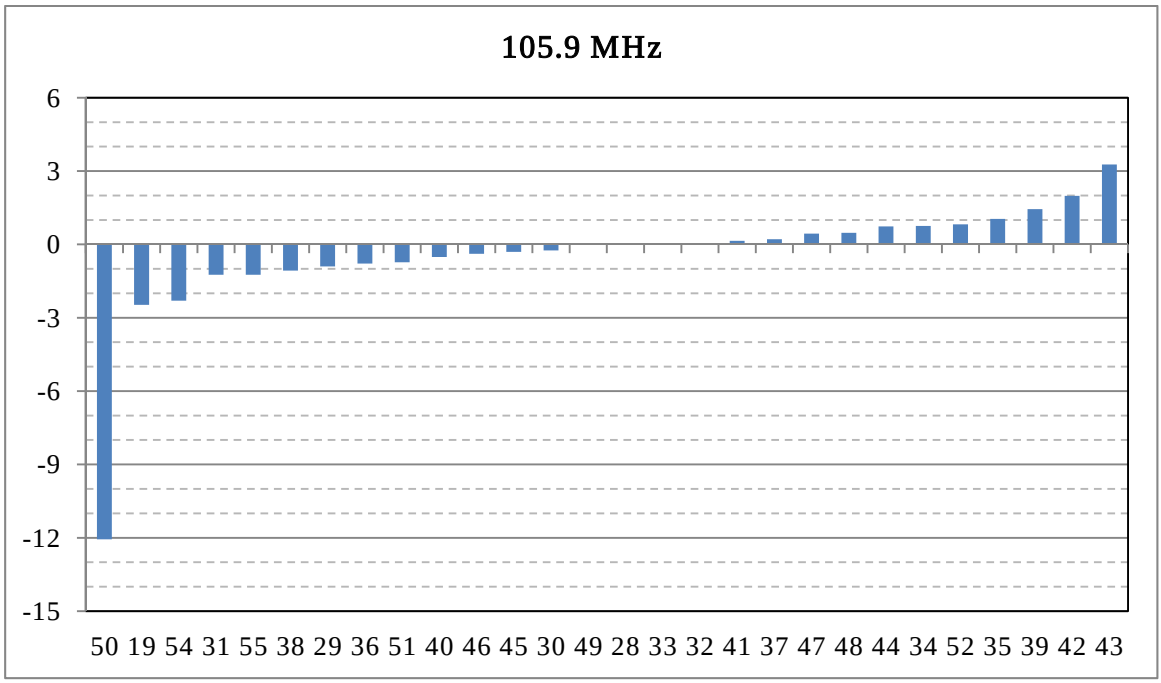

Chart 14-4: Z-score of the H-Pol. radiated emission measurement, 105.9 MHz

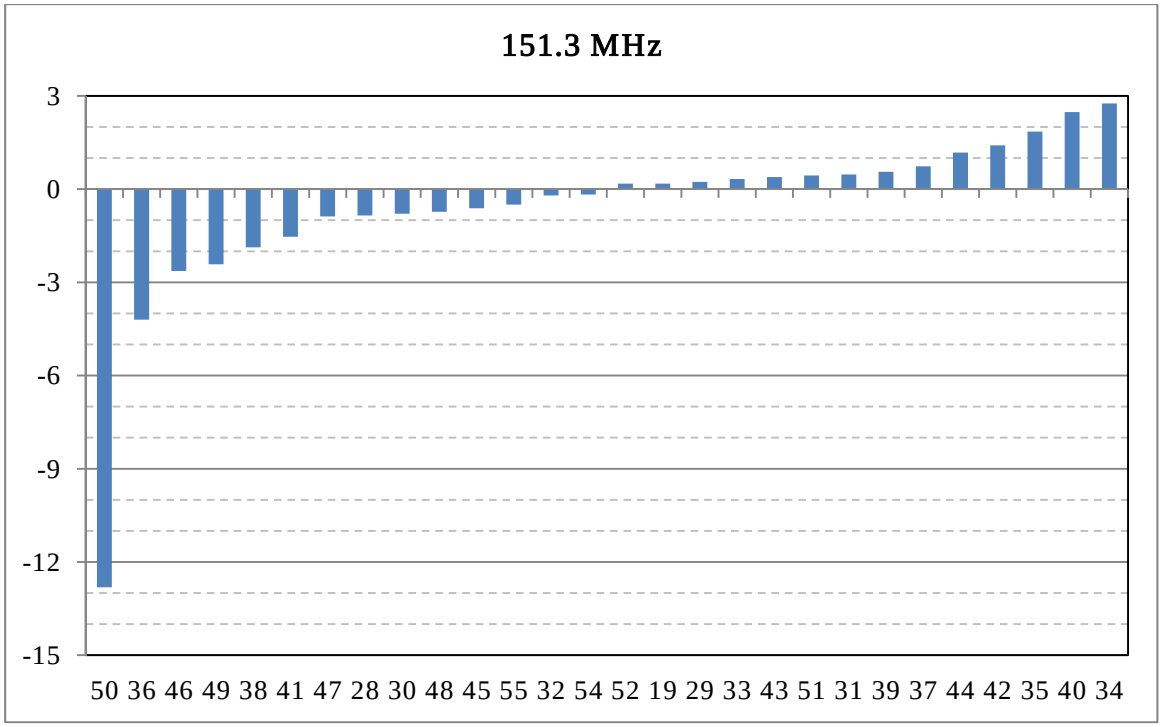

Chart 14-5: Z-score of the H-Pol. radiated emission measurement, 151.3 MHz

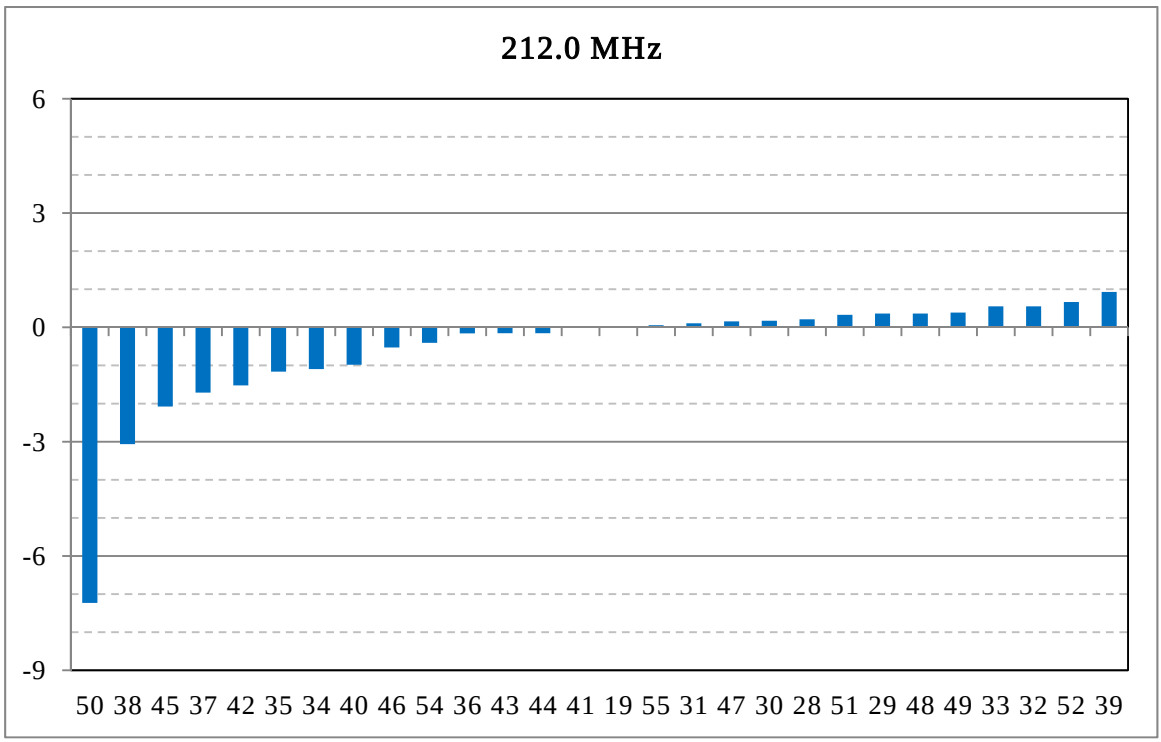

Chart 14-6: Z-score of the H-Pol. radiated emission measurement, 212.0 MHz

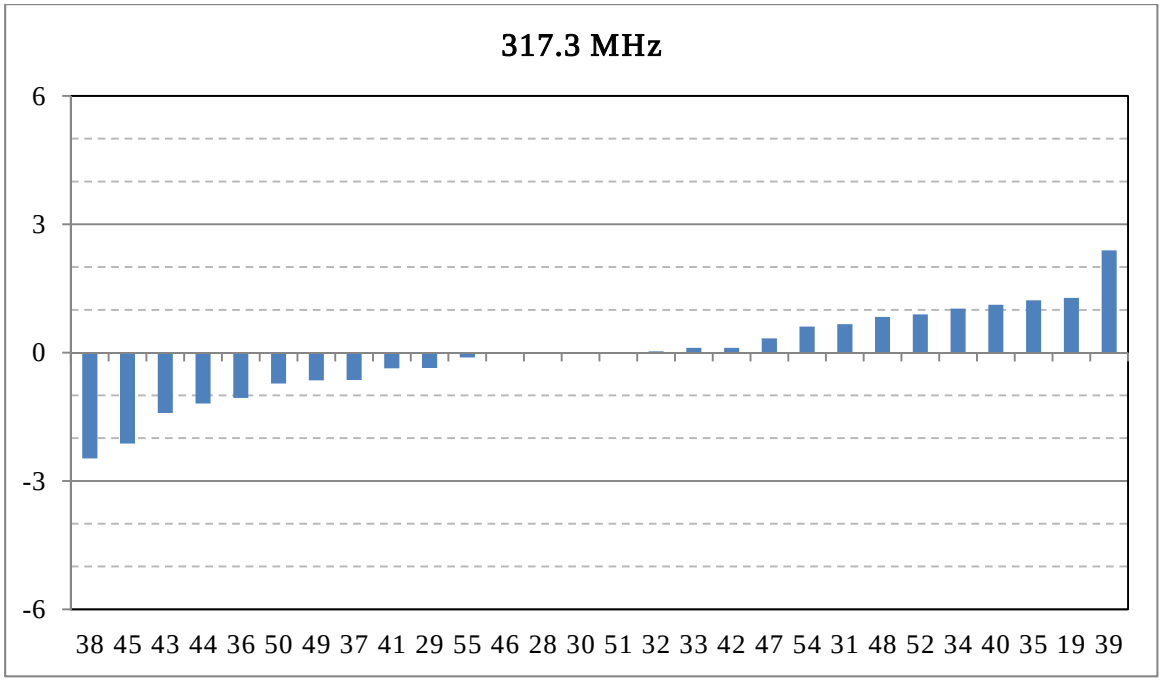

Chart 14-7: Z-score of the H-Pol. radiated emission measurement, 317.3 MHz

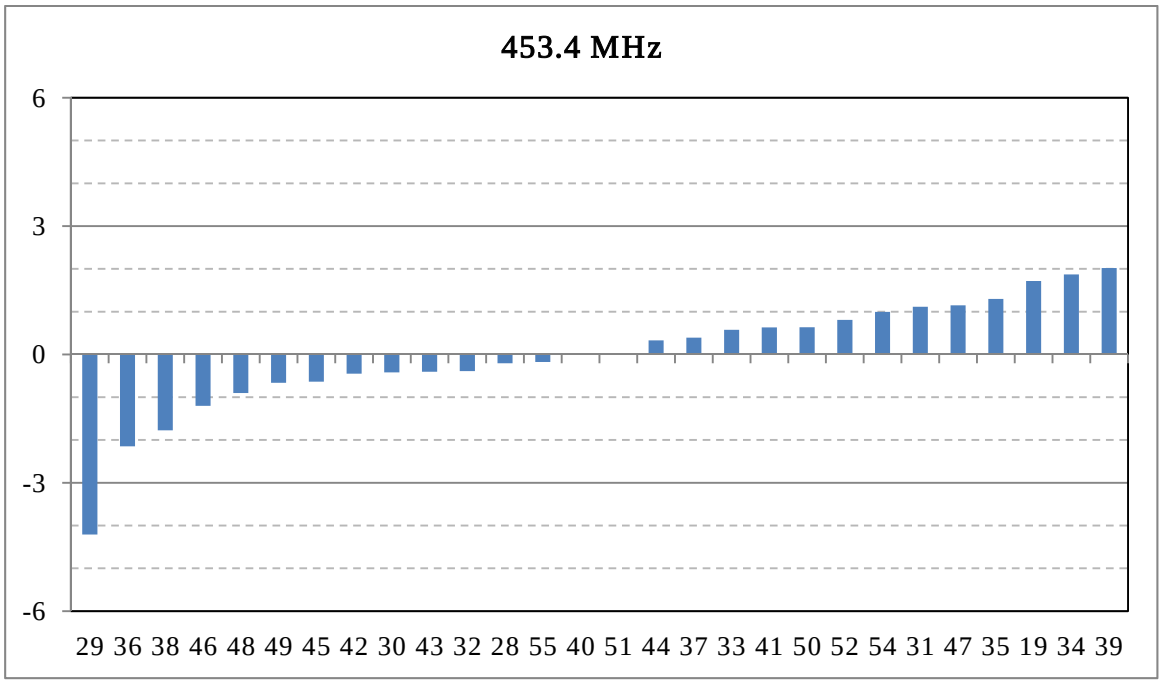

Chart 14-8: Z-score of the H-Pol. radiated emission measurement, 453.4 MHz

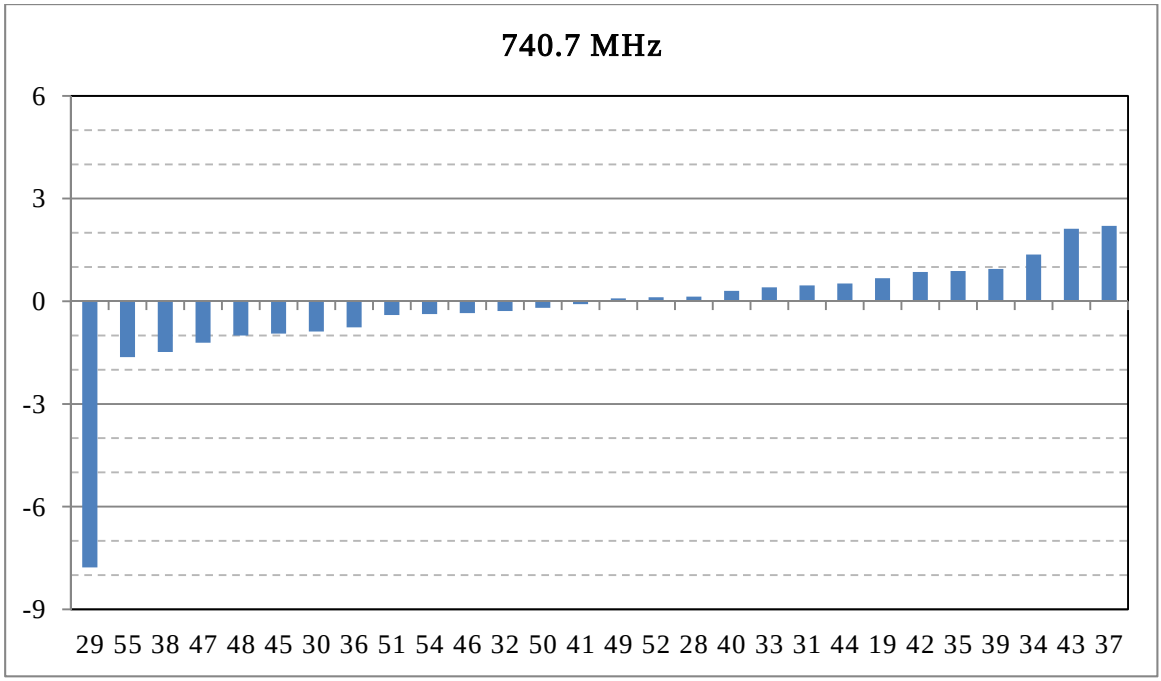

Chart 14-9: Z-score of the H-Pol. radiated emission measurement, 740.7 MHz

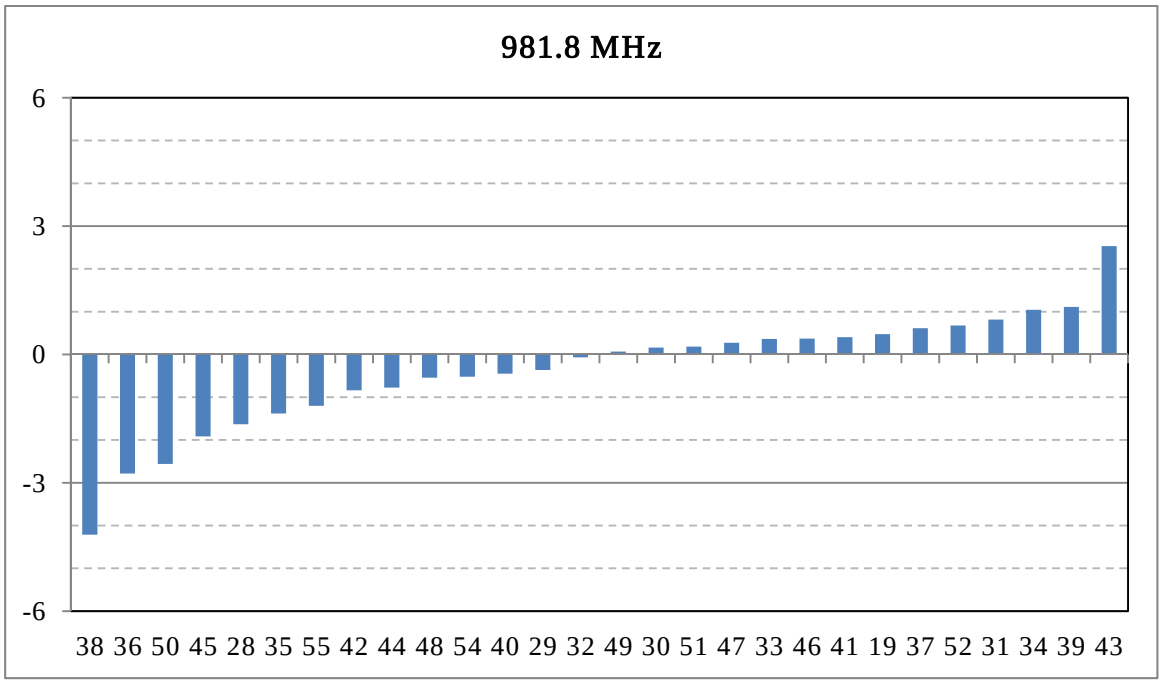

Chart 14-10: Z-score of the H-Pol. radiated emission measurement, 981.8 MHz

[Z-score by dB scale data (dBμV/m) of the radiated emission measurement]
(Vertical Polarization)]

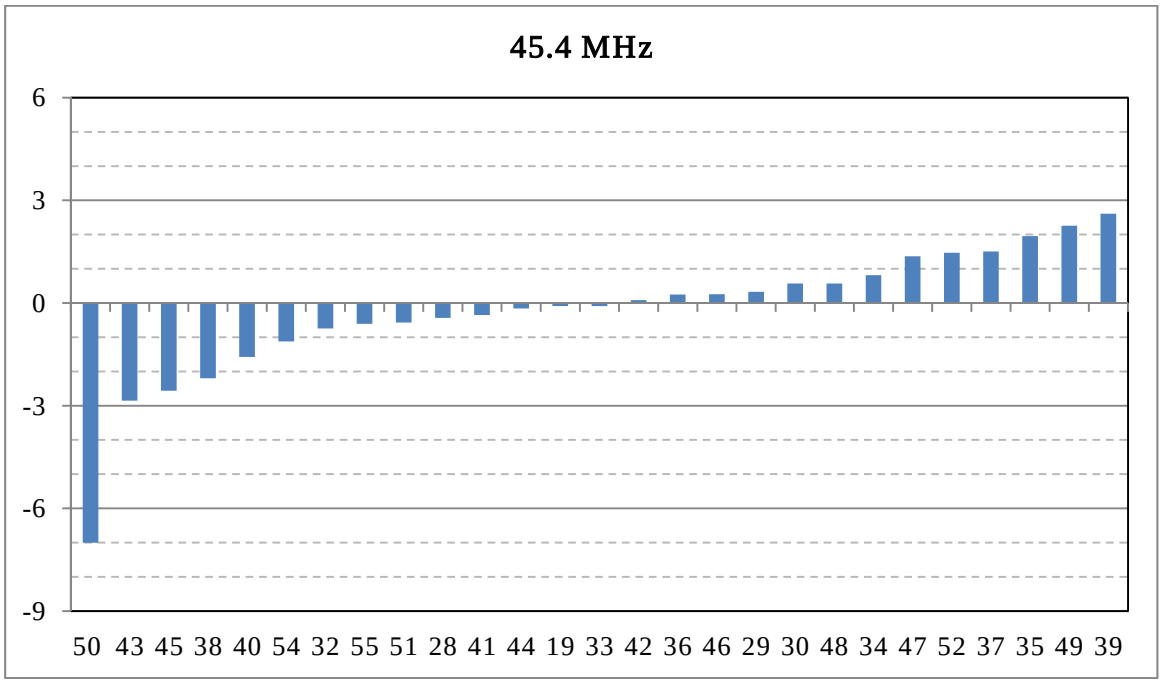

Chart 15-1: Z-score of the V-Pol. (Vertical Polarization) radiated emission measurement, 45.4 MHz

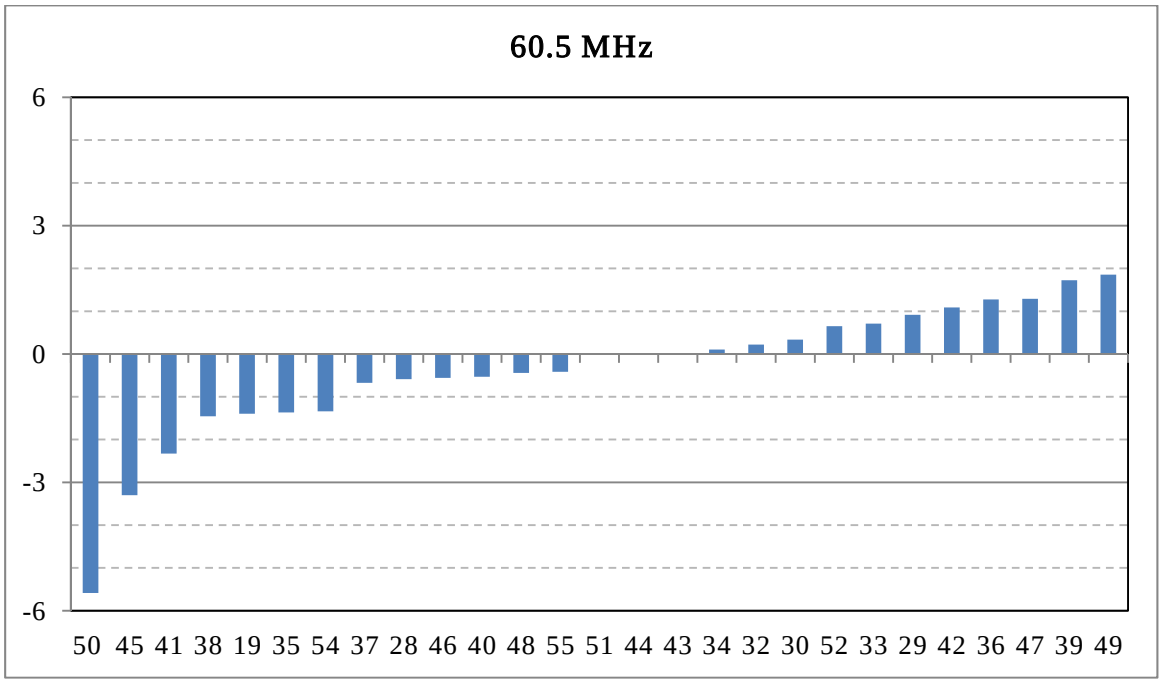

Chart 15-2: Z-score of the V-Pol. radiated emission measurement, 60.5 MHz

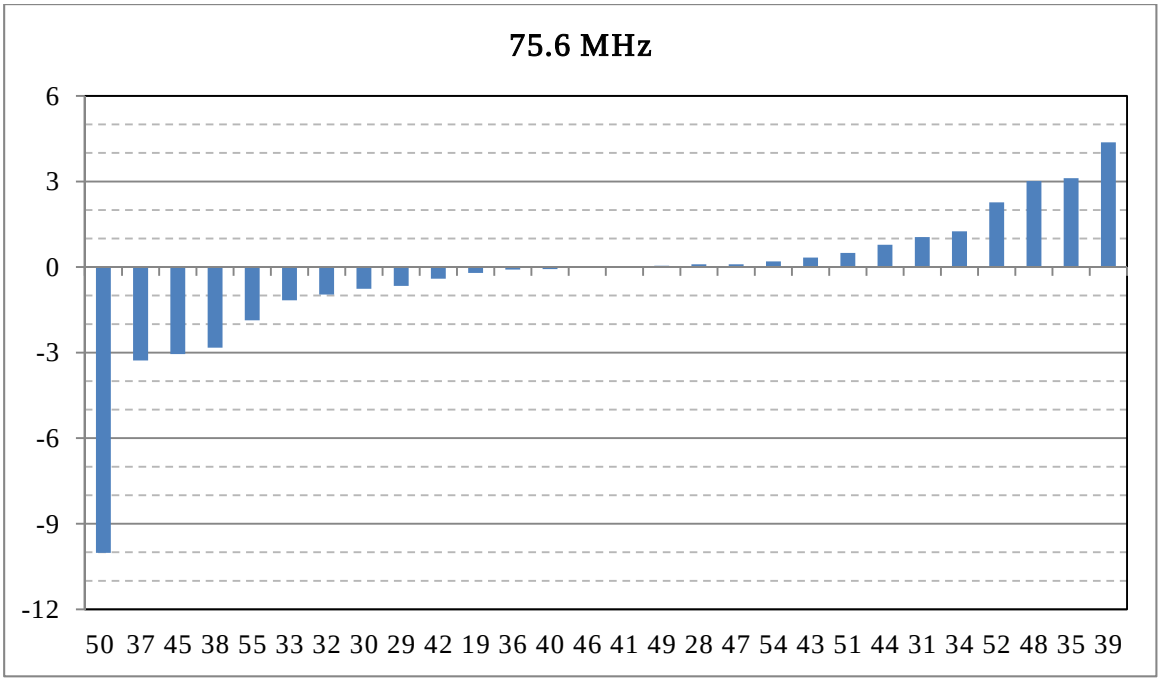

Chart 15-3: Z-score of the V-Pol. radiated emission measurement, 75.6 MHz

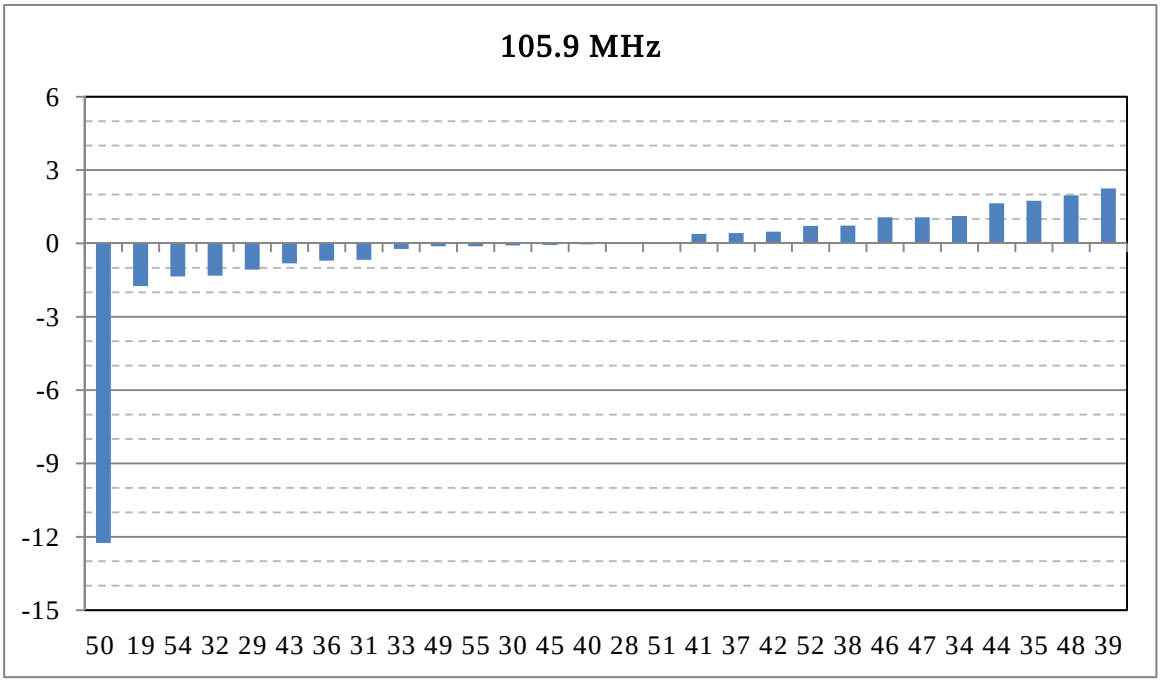

Chart 15-4: Z-score of the V-Pol. radiated emission measurement, 105.9 MHz

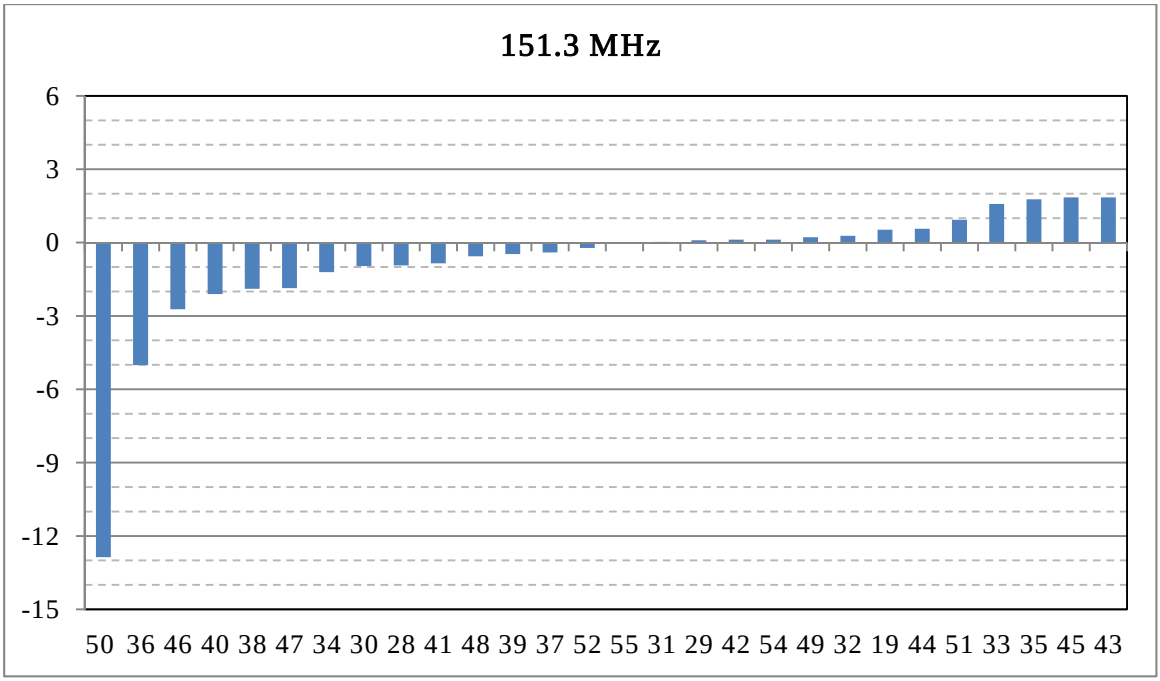

Chart 15-5: Z-score of the V-Pol. radiated emission measurement, 151.3 MHz

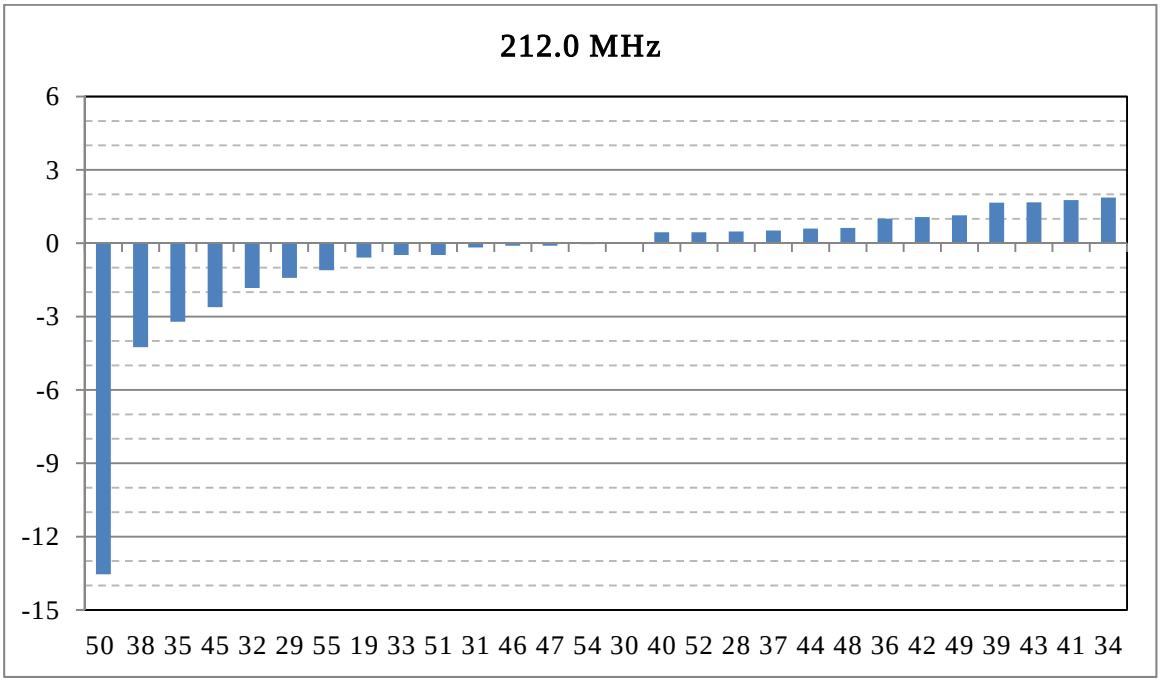

Chart 15-6: Z-score of the V-Pol. radiated emission measurement, 212.0 MHz

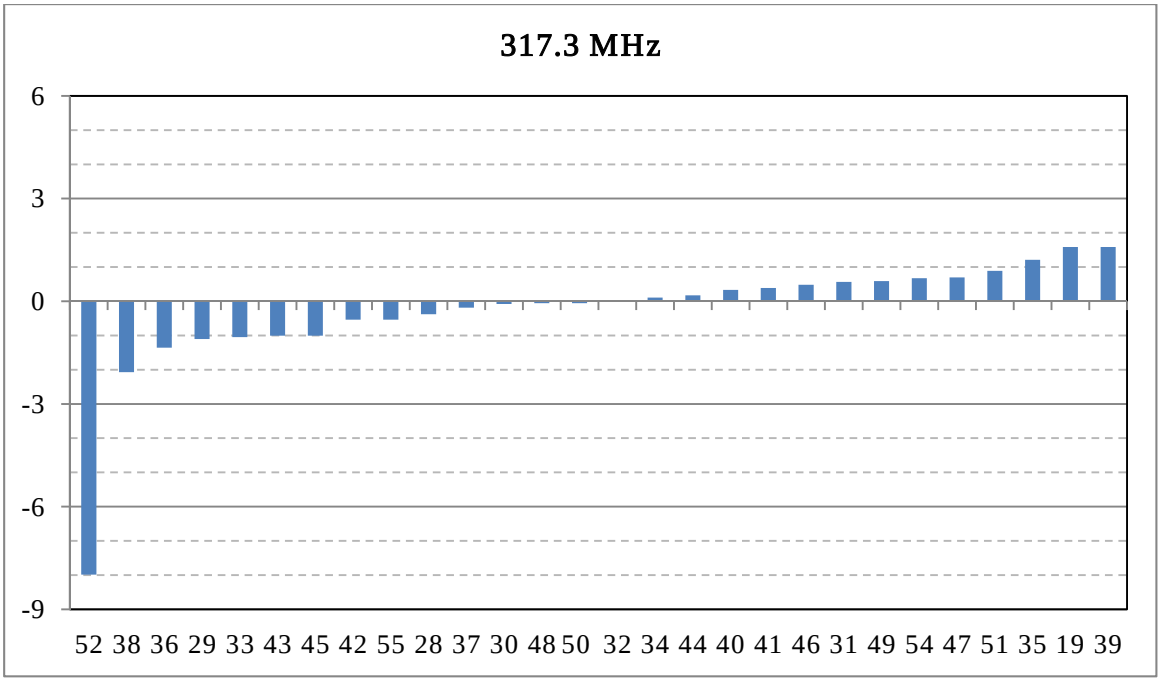

Chart 15-7: Z-score of the V-Pol. radiated emission measurement, 317.3 MHz

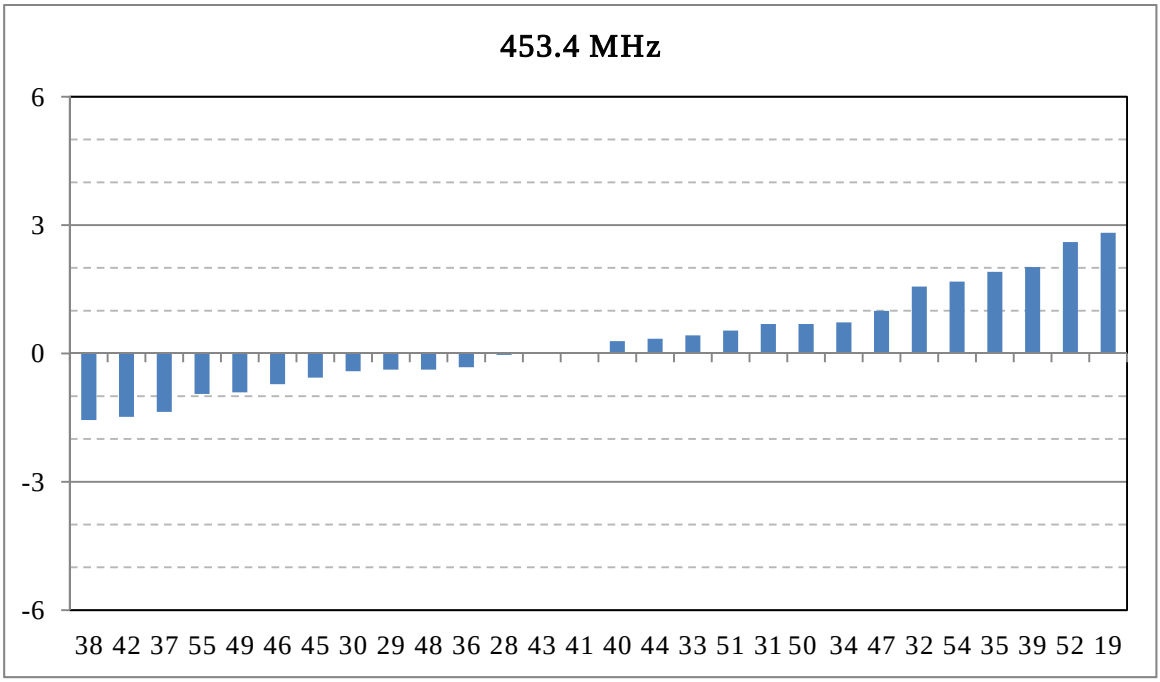

Chart 15-8: Z-score of the V-Pol. radiated emission measurement, 453.4 MHz

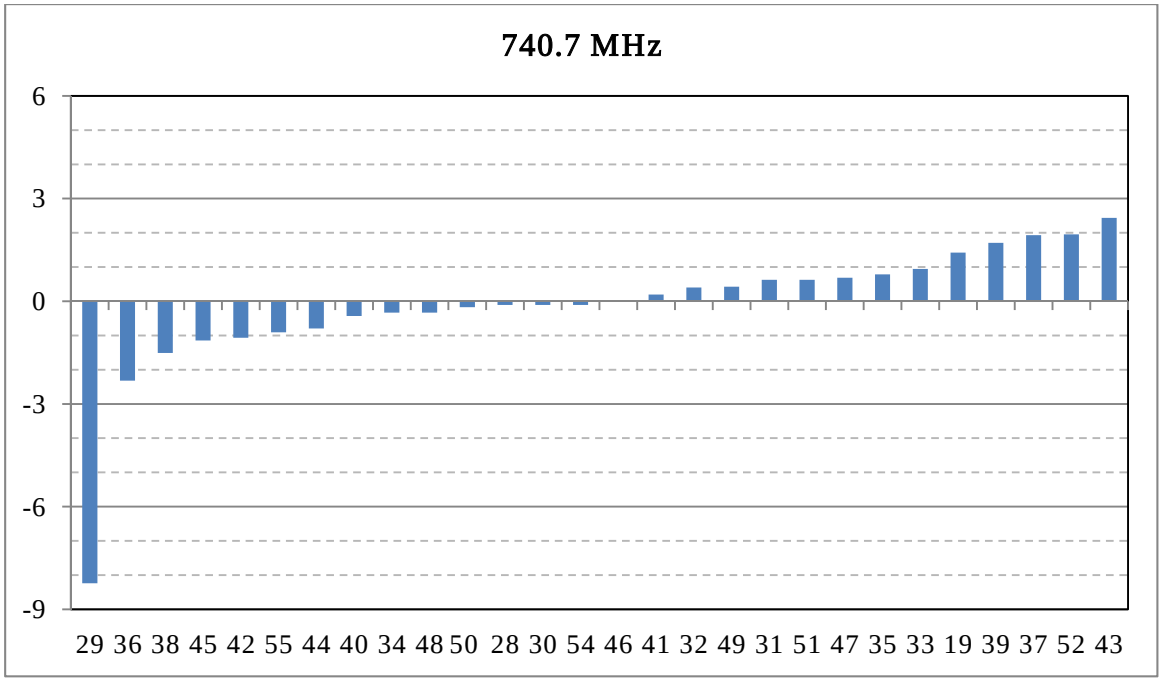

Chart 15-9: Z-score of the V-Pol. radiated emission measurement, 740.7 MHz

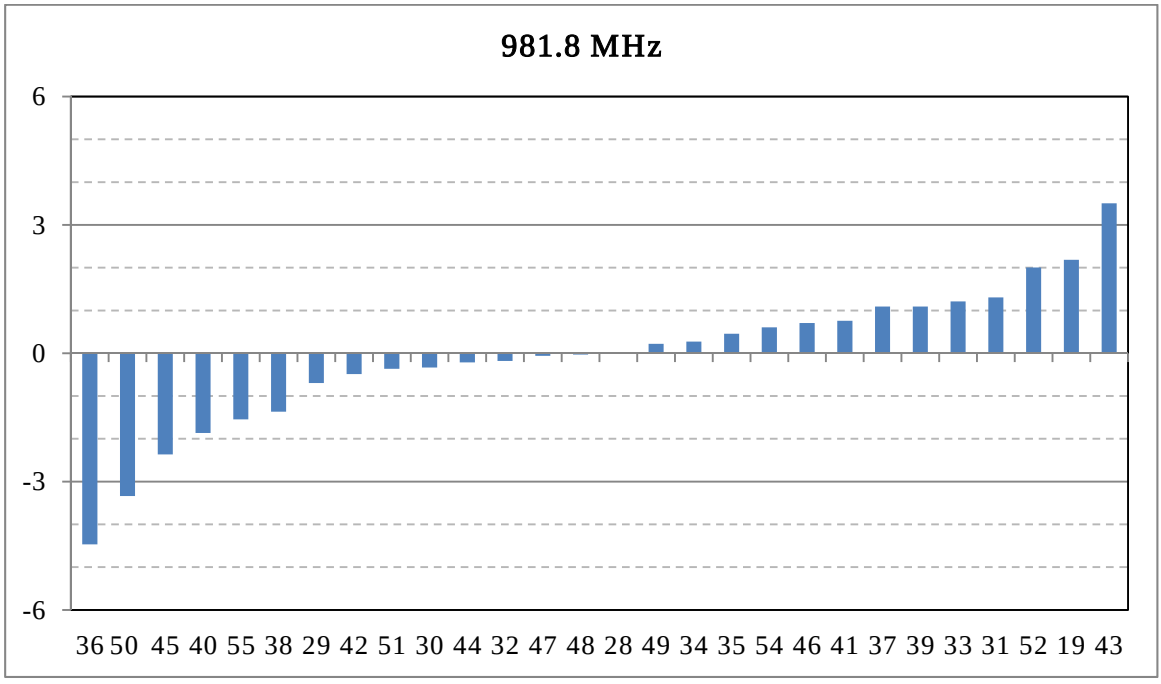

Chart 15-10: Z-score of the V-Pol. radiated emission measurement, 981.8 MHz

[Difference from median Value of the conducted emission measurement]

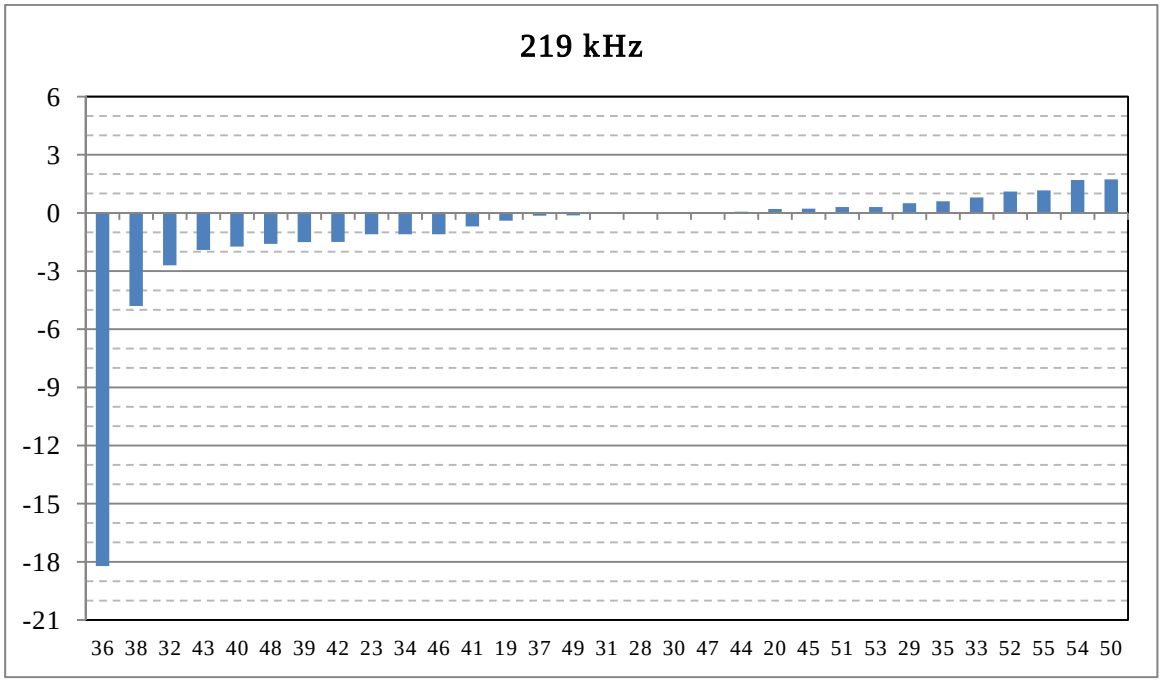

Chart 16-1: Difference from Median Value of the conducted emission measurement, 219 kHz

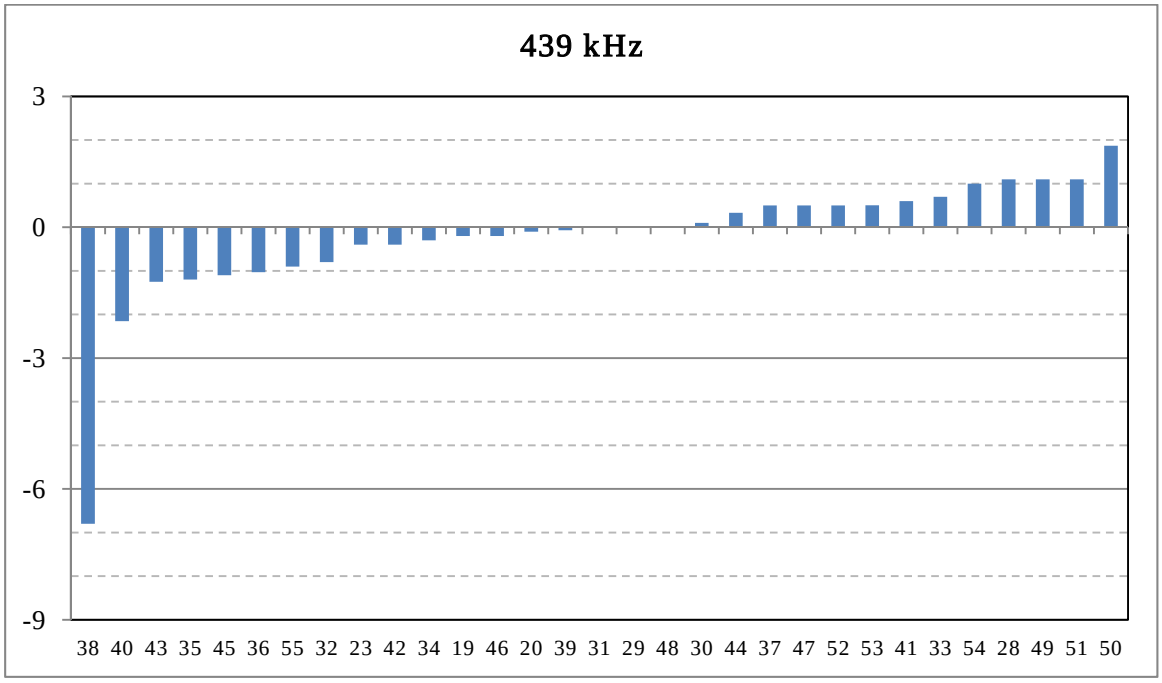

Chart 16-2: Difference from Median Value of the conducted emission measurement, 439 kHz

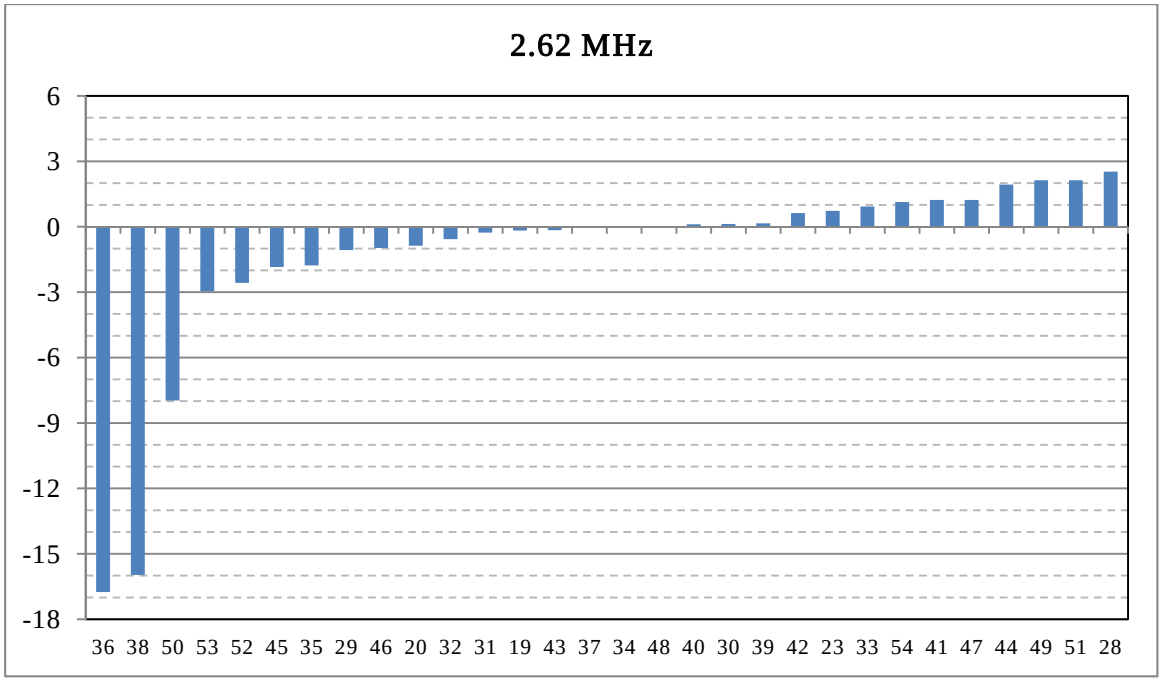

Chart 16-3: Difference from Median Value of the conducted emission measurement, 2.62 MHz

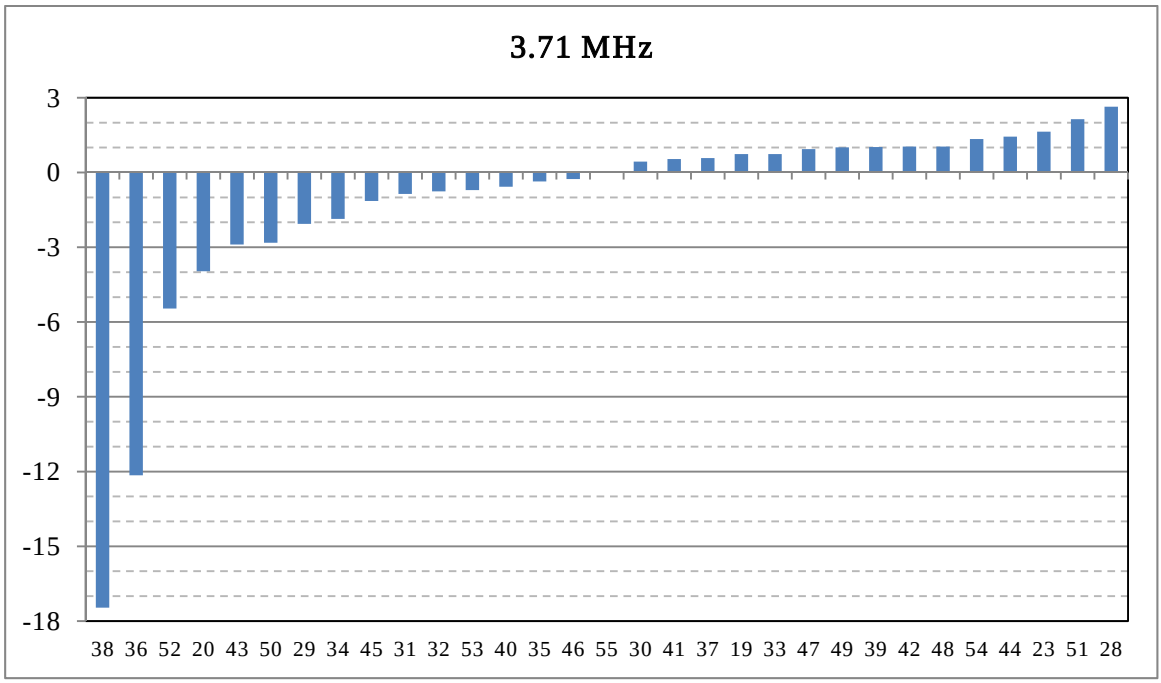

Chart 16-4: Difference from Median Value of the conducted emission measurement, 3.71 MHz

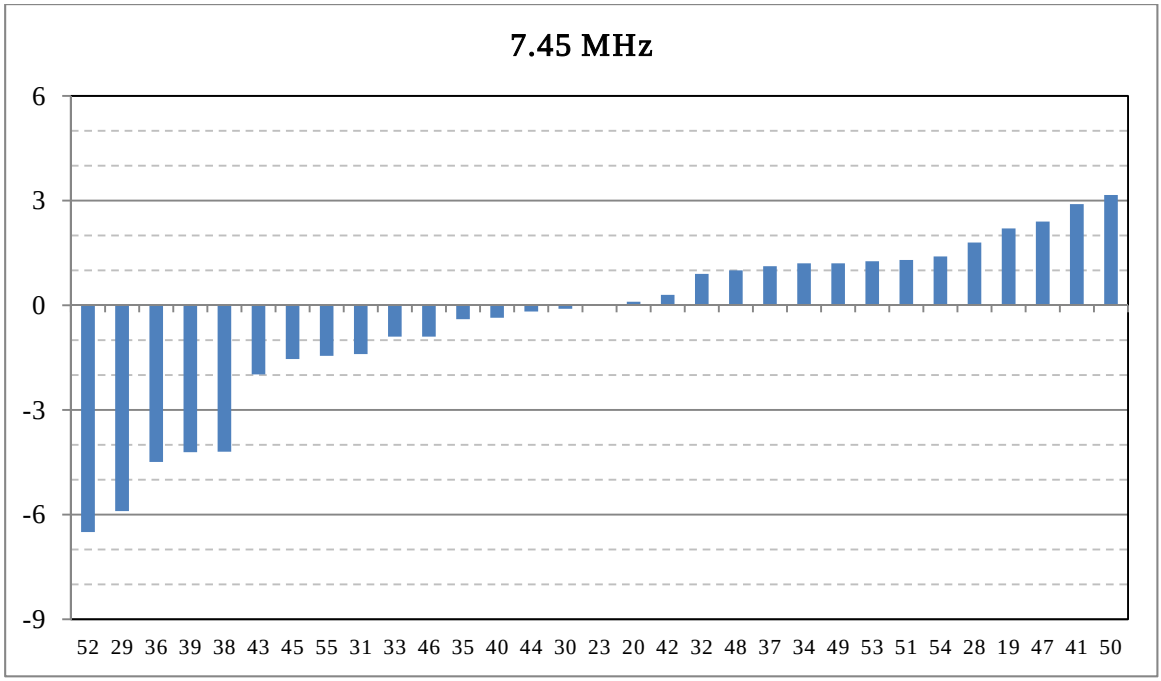

Chart 16-5: Difference from Median Value of the conducted emission measurement, 7.45 MHz

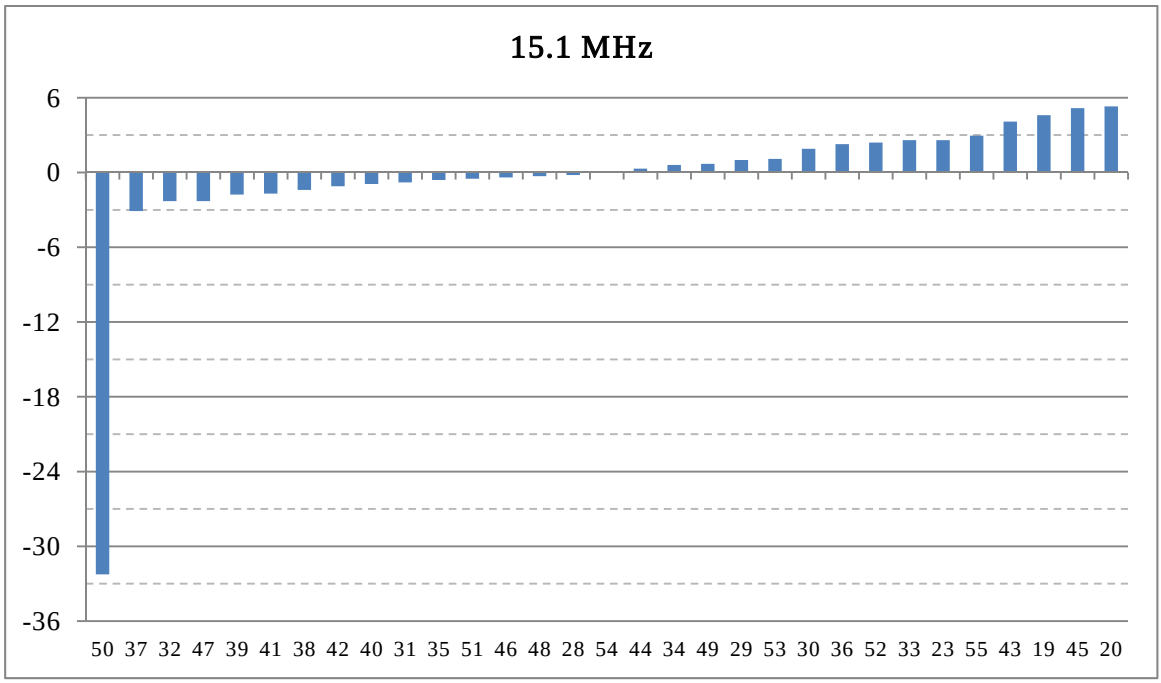

Chart 16-6: Difference from Median Value of the conducted emission measurement, 15.1 MHz

[Difference from Median Value of radiated emission measurement]
(Horizontal Polarization)

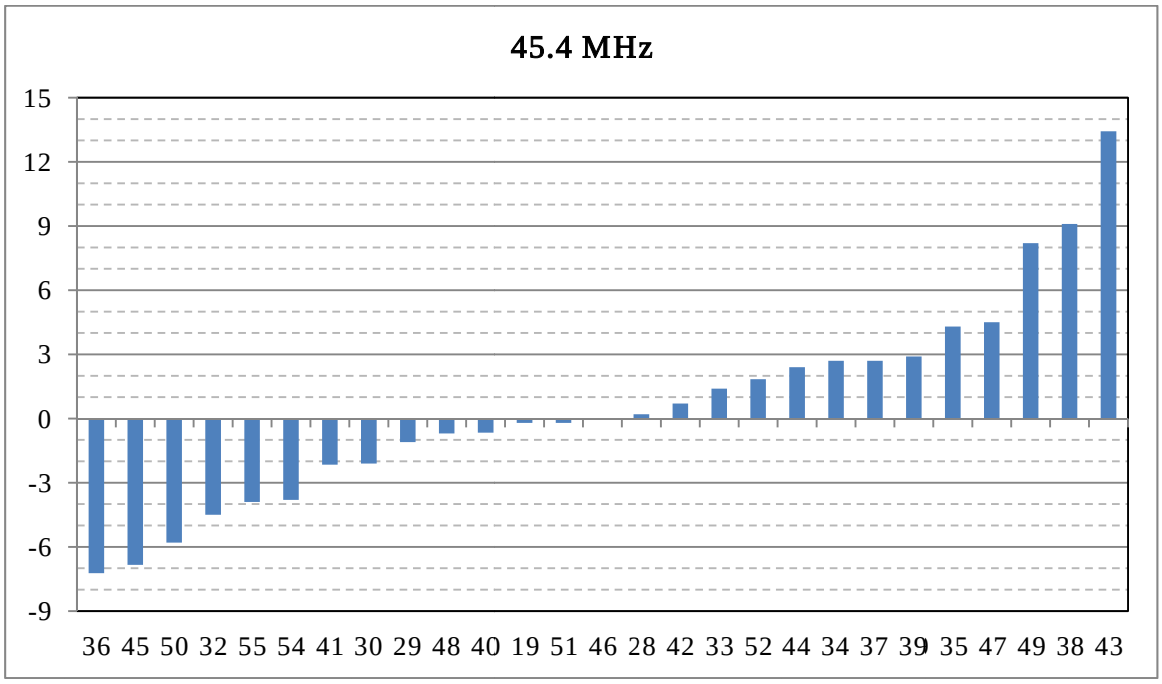

Chart 17-1: Difference from Median Value of the H-Pol. radiated emission measurement, 45.4 MHz

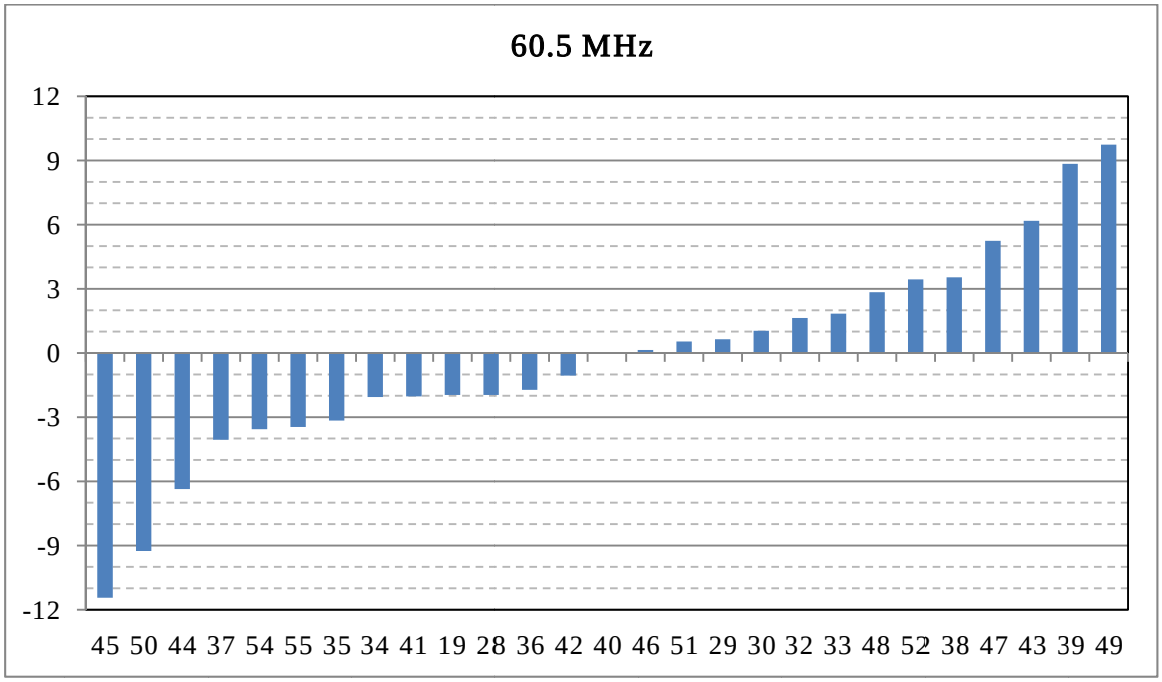

Chart 17-2: Difference from Median Value of the H-Pol. radiated emission measurement, 60.5 MHz

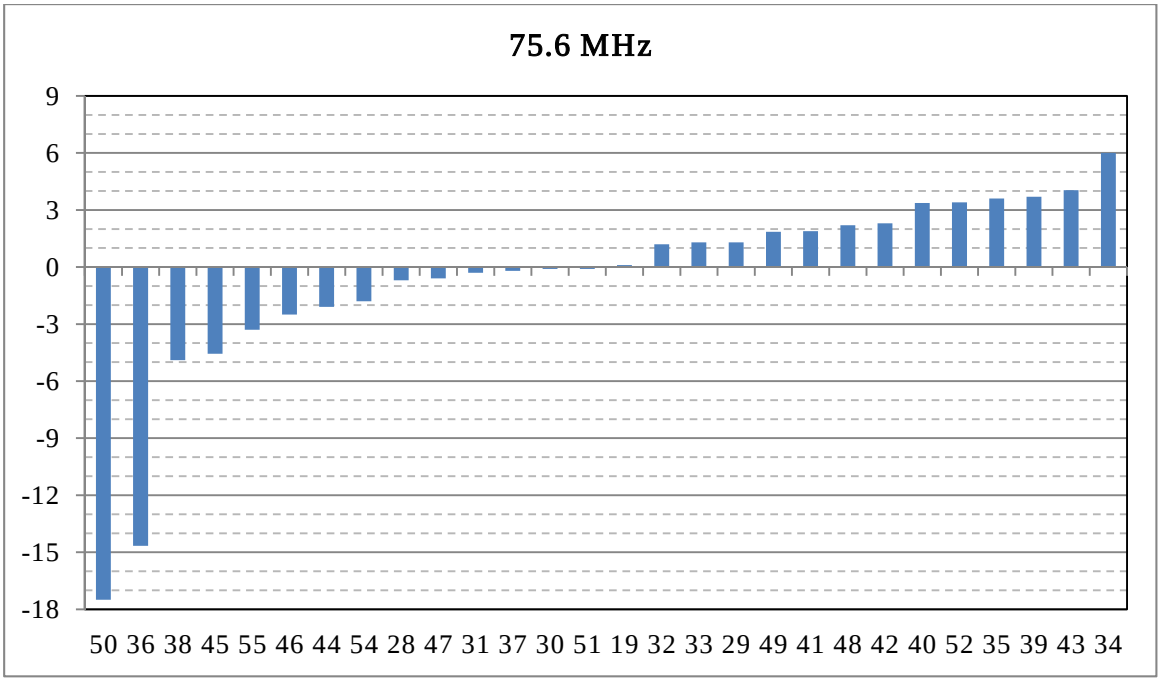

Chart 17-3: Difference from Median Value of the H-Pol. radiated emission measurement, 75.6 MHz

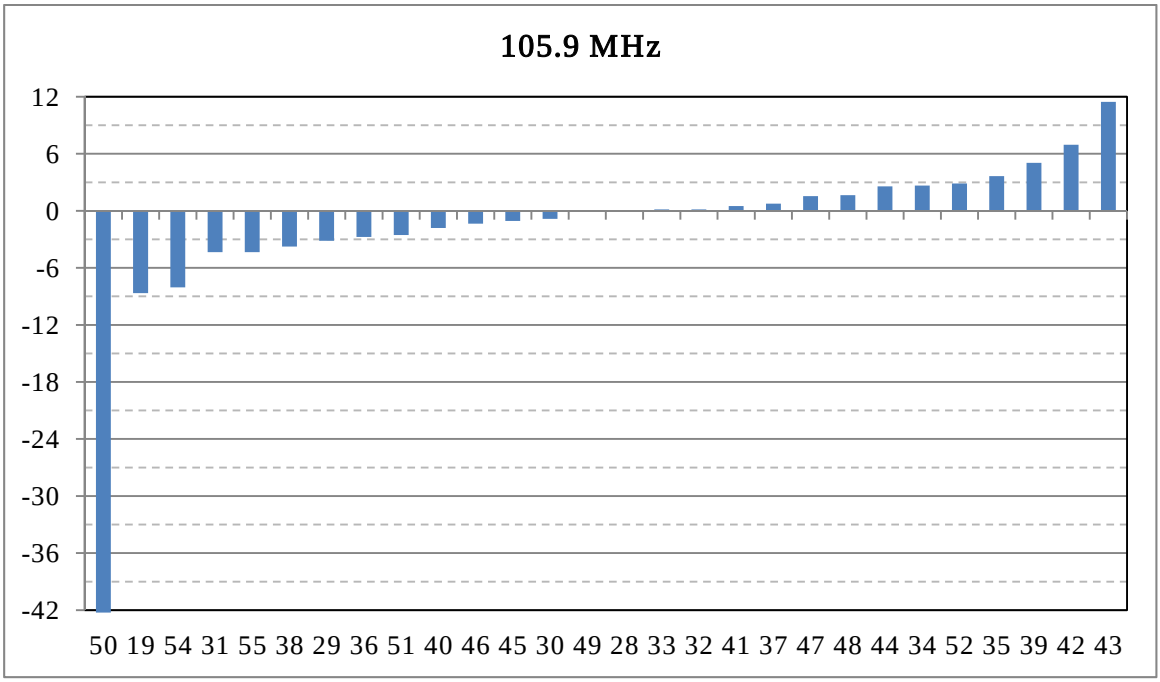

Chart 17-4: Difference from Median Value of the H-Pol. radiated emission measurement, 105.9 MHz

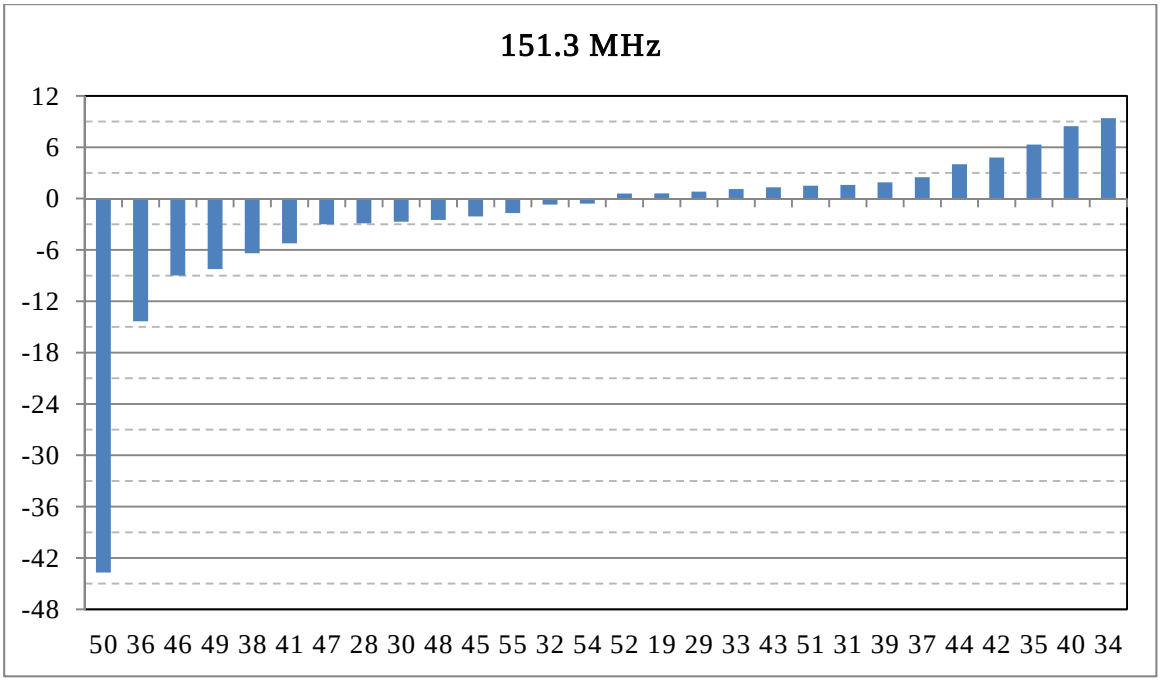

Chart 17-5: Difference from Median Value of the H-Pol. radiated emission measurement, 151.3 MHz

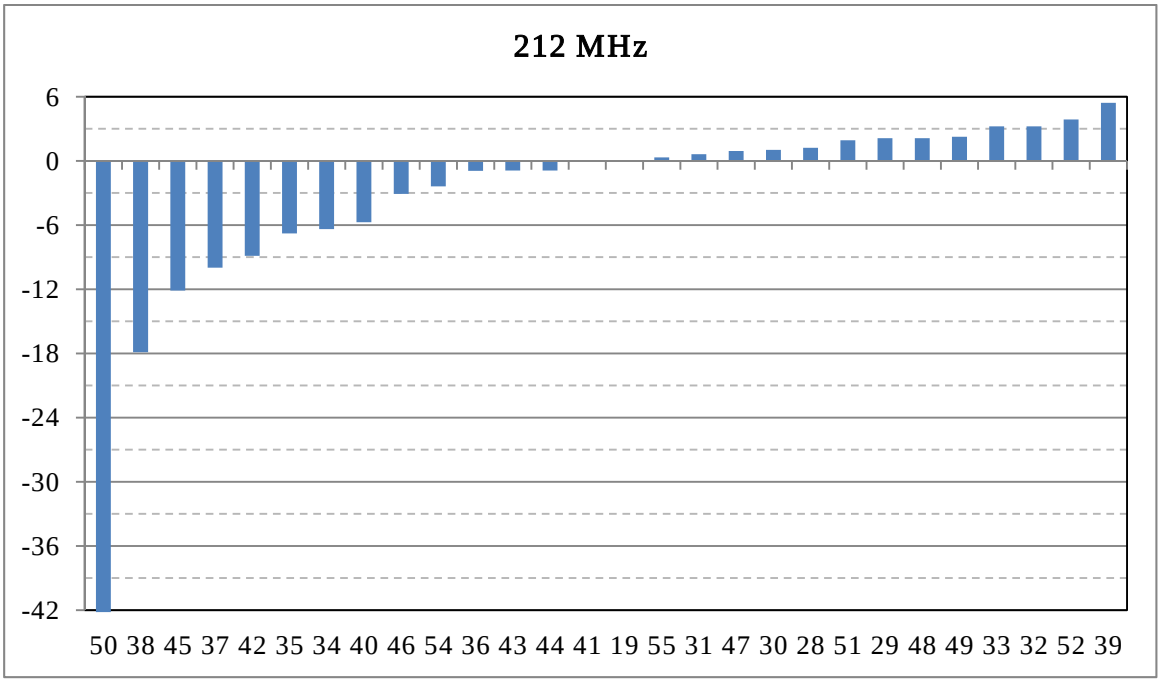

Chart 17-6: Difference from Median Value of the H-Pol. radiated emission measurement, 212.0 MHz

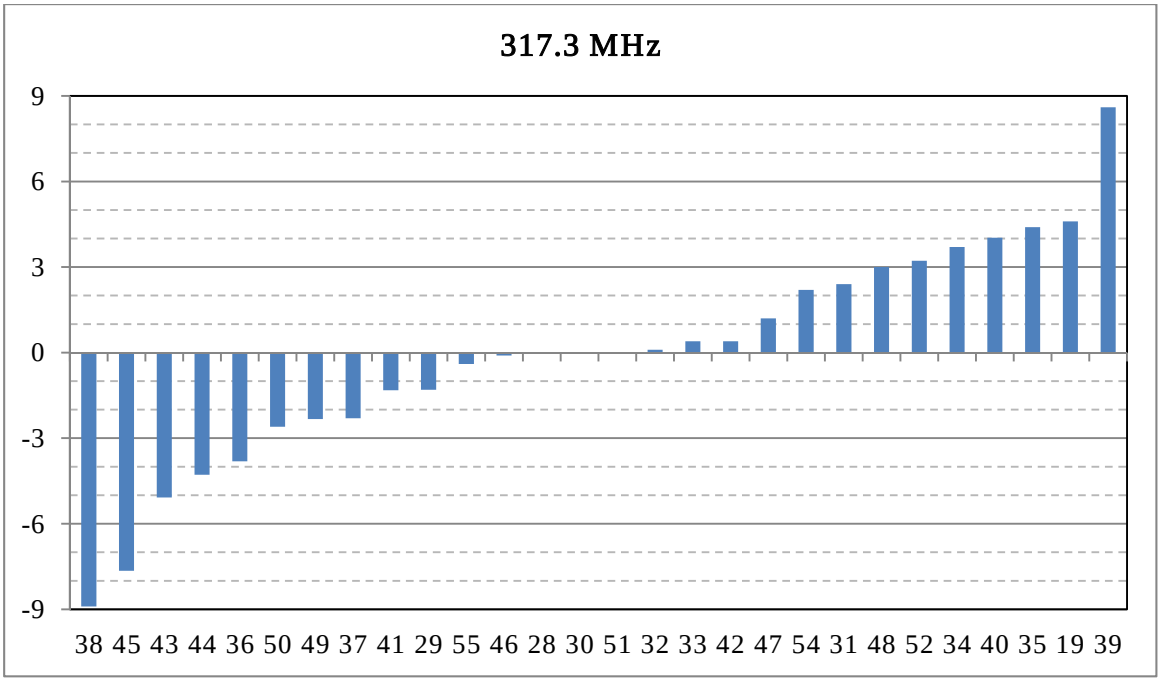

Chart 17-7: Difference from Median Value of the H-Pol. radiated emission measurement, 317.3 MHz

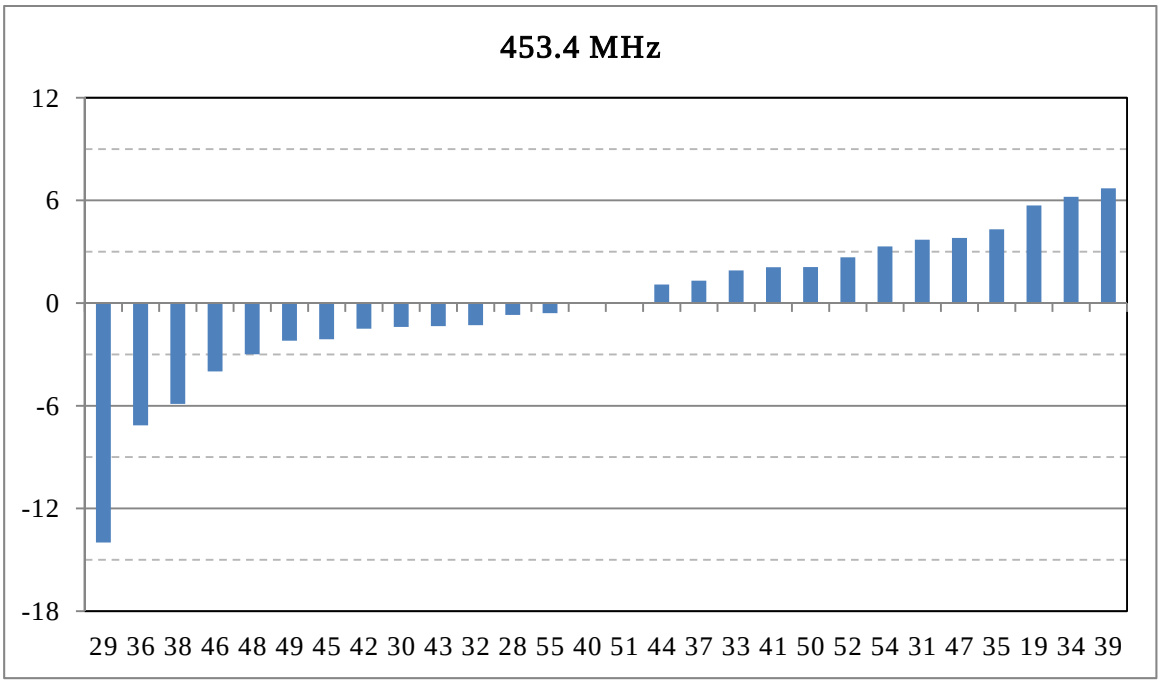

Chart 17-8: Difference from Median Value of the H-Pol. radiated emission measurement, 453.4 MHz

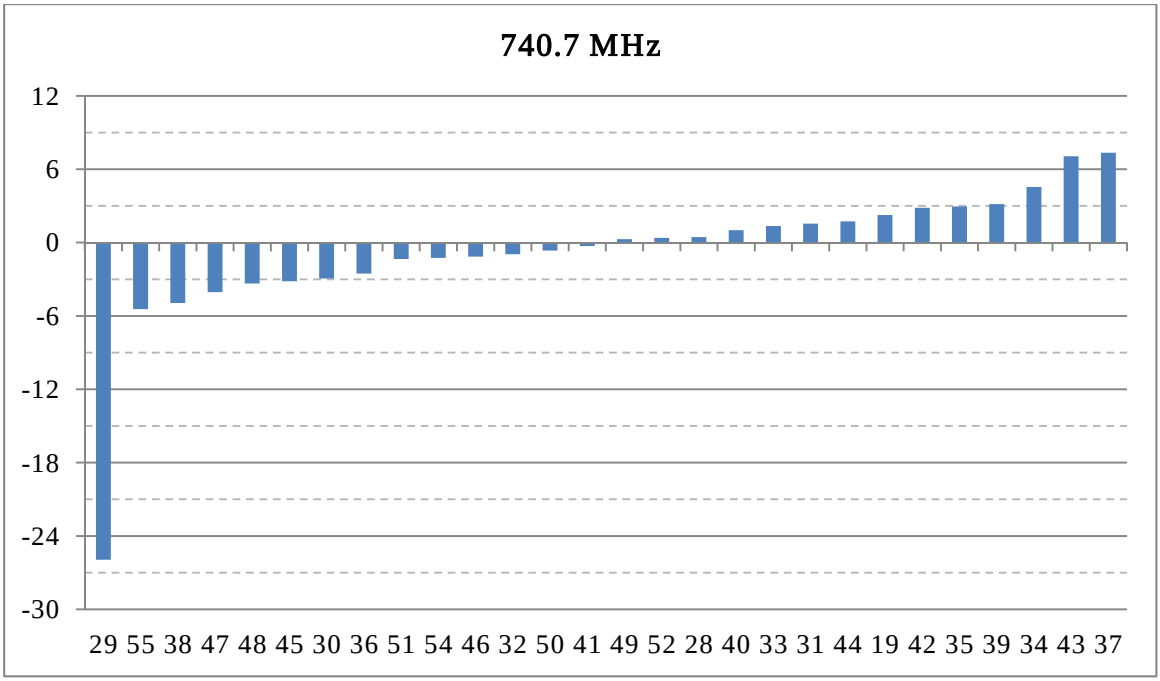

Chart 17-9: Difference from Median Value of the H-Pol. radiated emission measurement, 740.7 MHz

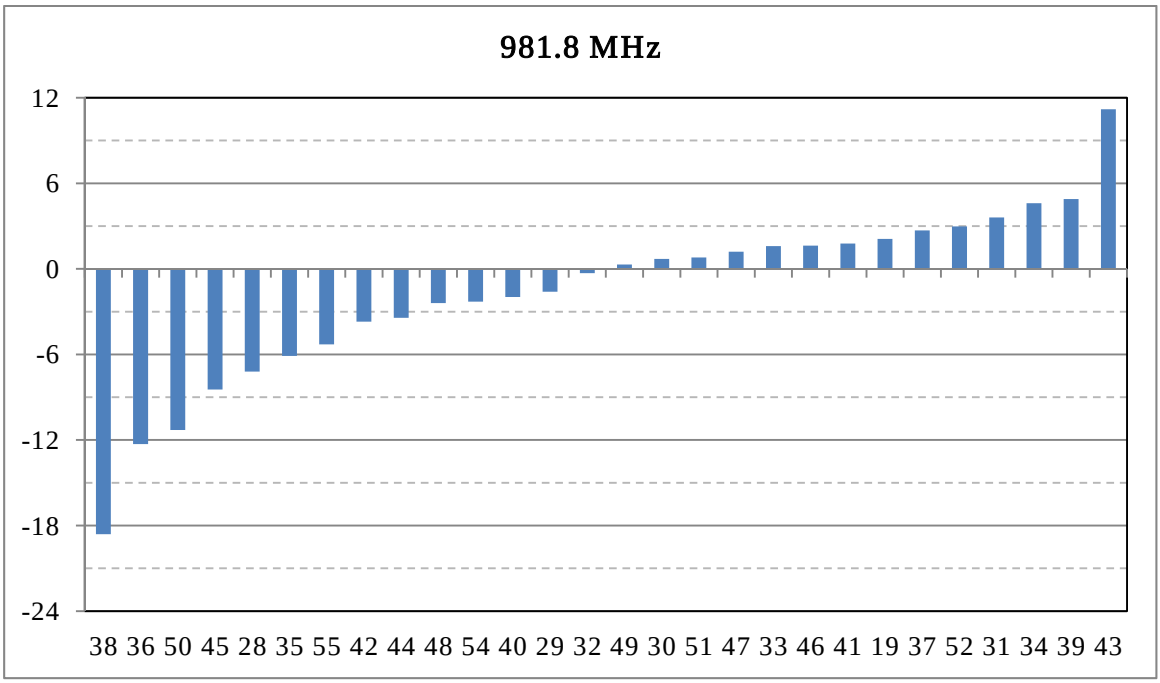

Chart 17-10: Difference from Median Value of the H-Pol. radiated emission measurement, 981.8 MHz

[Difference from Median Value of the radiated emission measurement]
(Vertical Polarization)

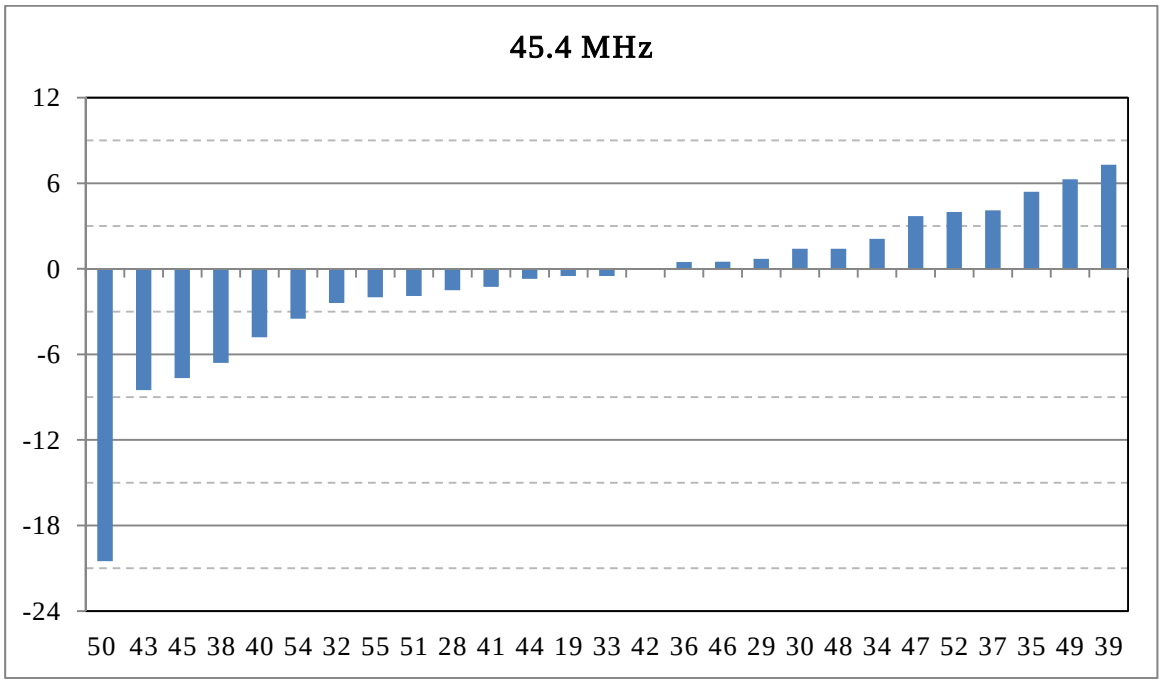

Chart 18-1: Difference from Median Value of the V-Pol. radiated emission measurement, 45.4 MHz

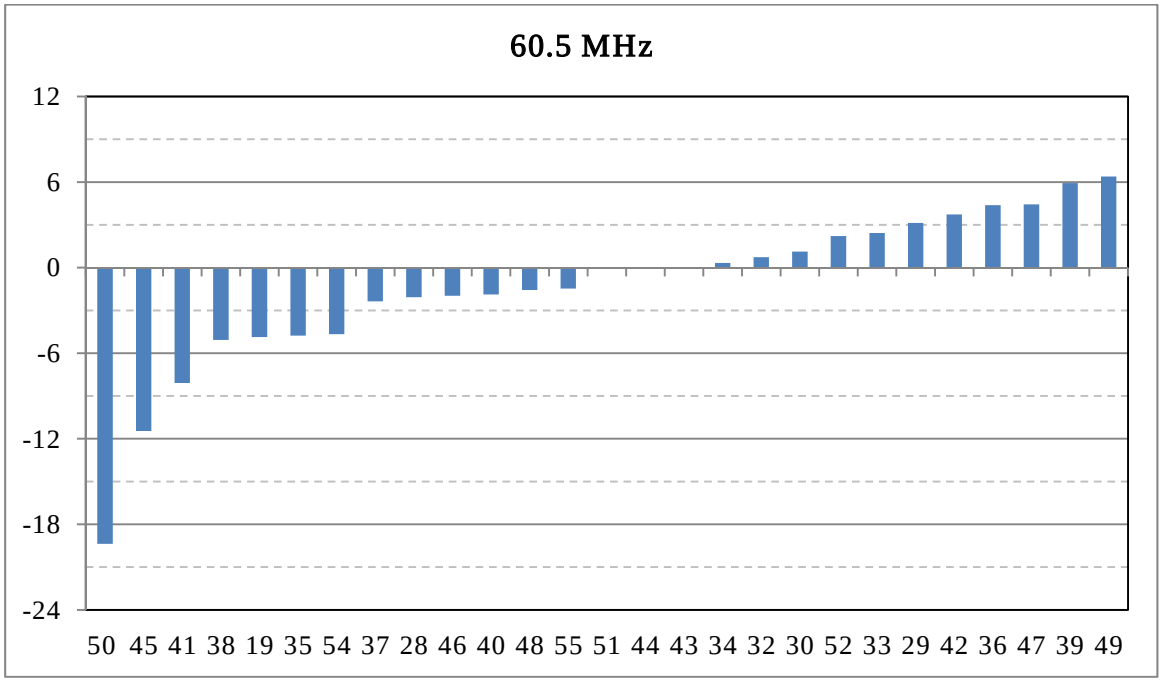

Chart 18-2: Difference from Median Value of the V-Pol. radiated emission measurement, 60.5 MHz

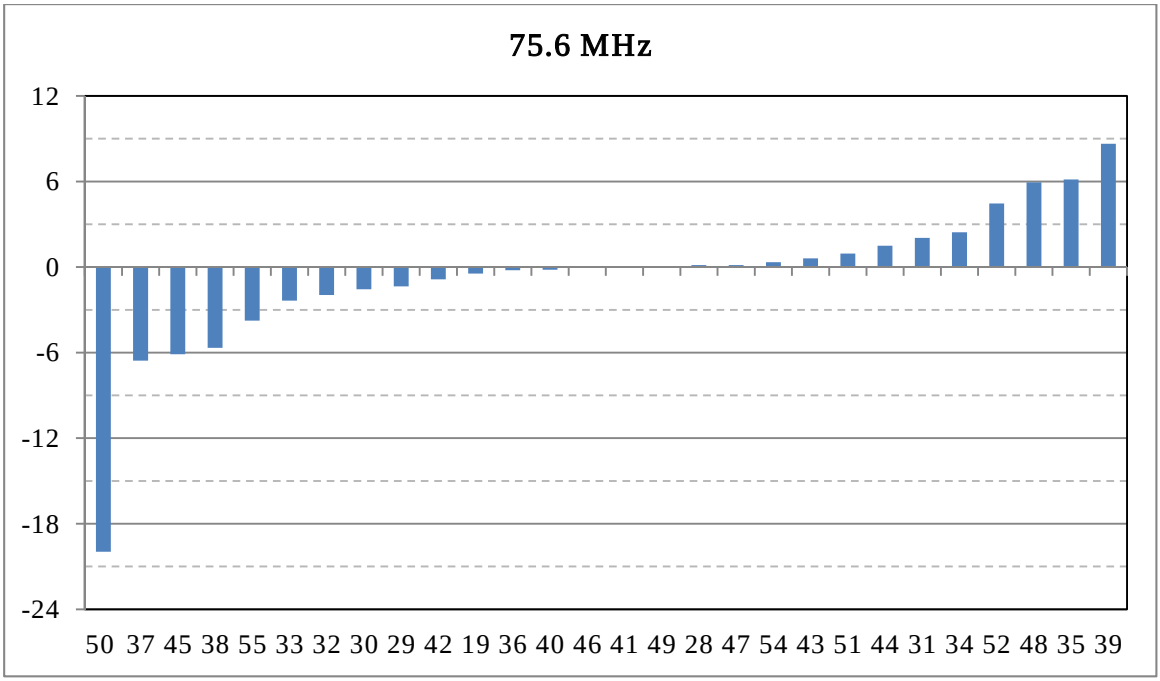

Chart 18-3: Difference from Median Value of the V-Pol. radiated emission measurement, 75.6 MHz

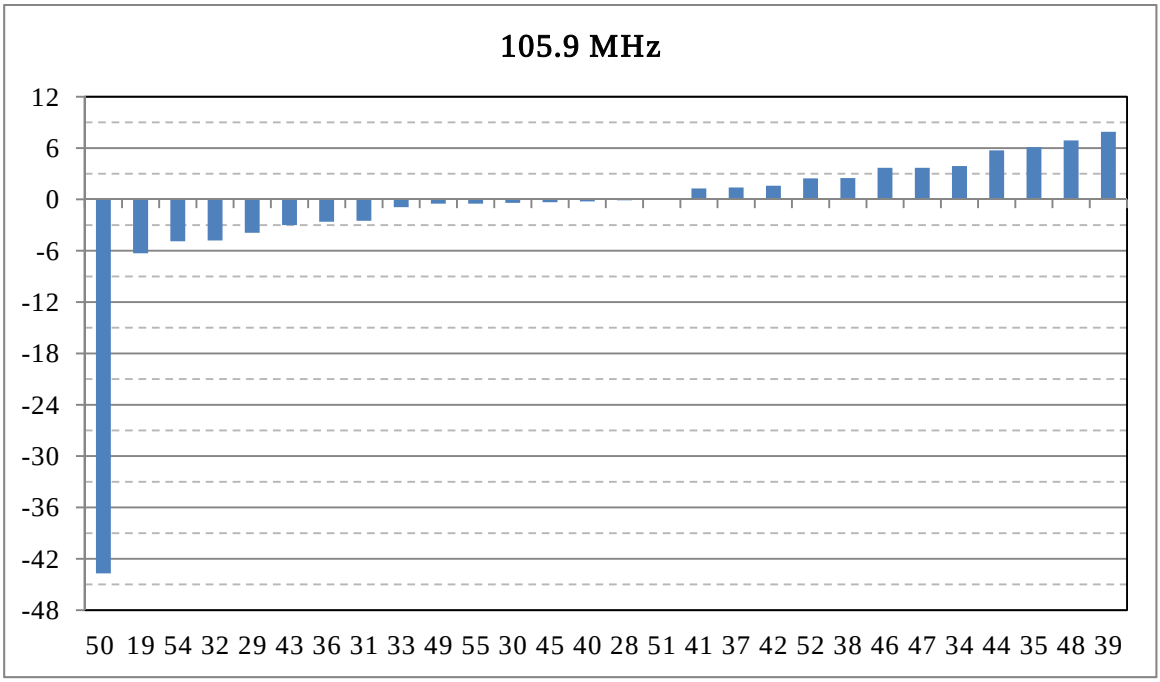

Chart 18-4: Difference from Median Value of the V-Pol. radiated emission measurement, 105.9 MHz

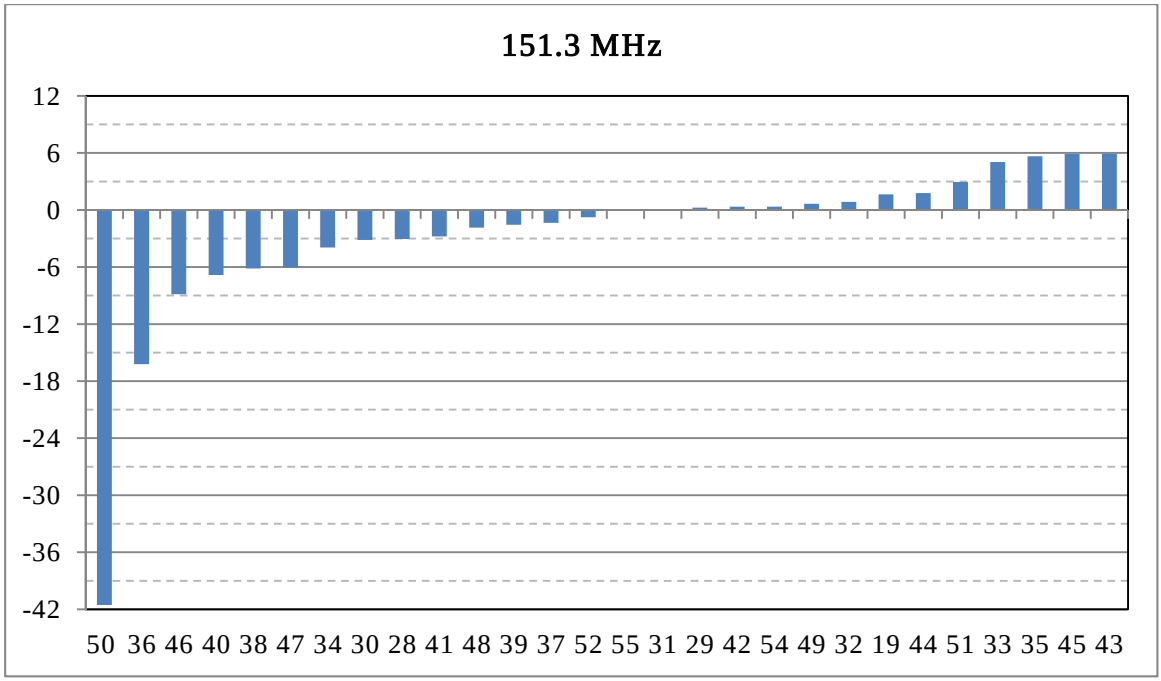

Chart 18-5: Difference from Median Value of the V-Pol. radiated emission measurement, 151.3 MHz

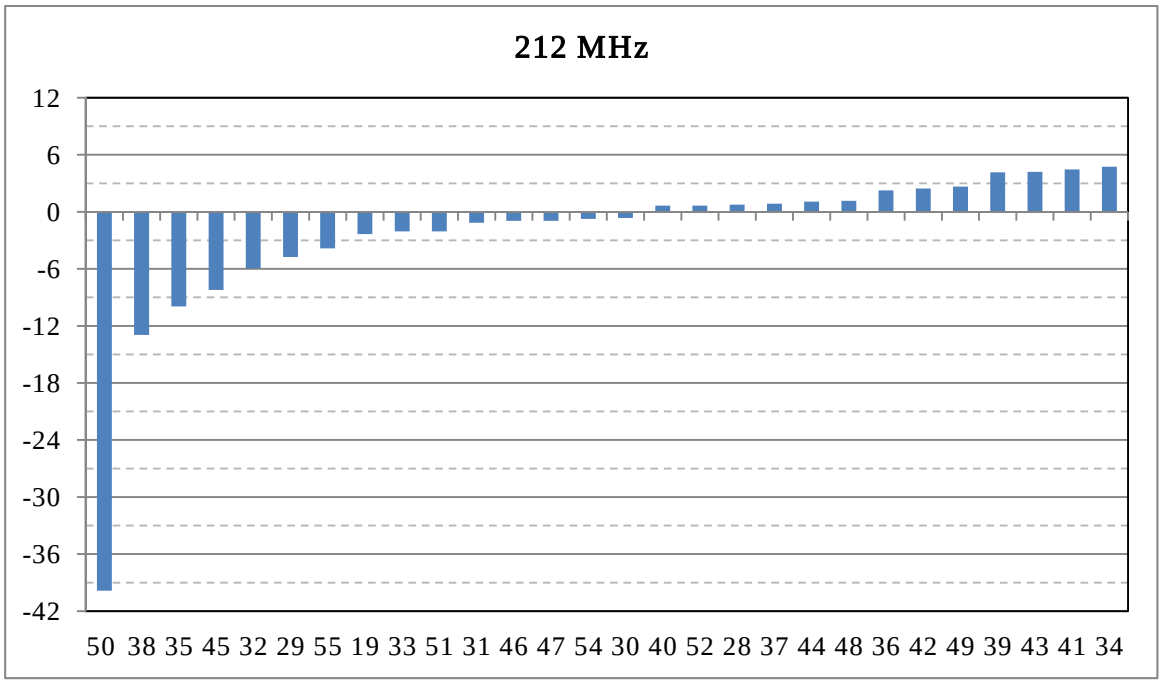

Chart 18-6: Difference from Median Value of the V-Pol. radiated emission measurement, 212.0 MHz

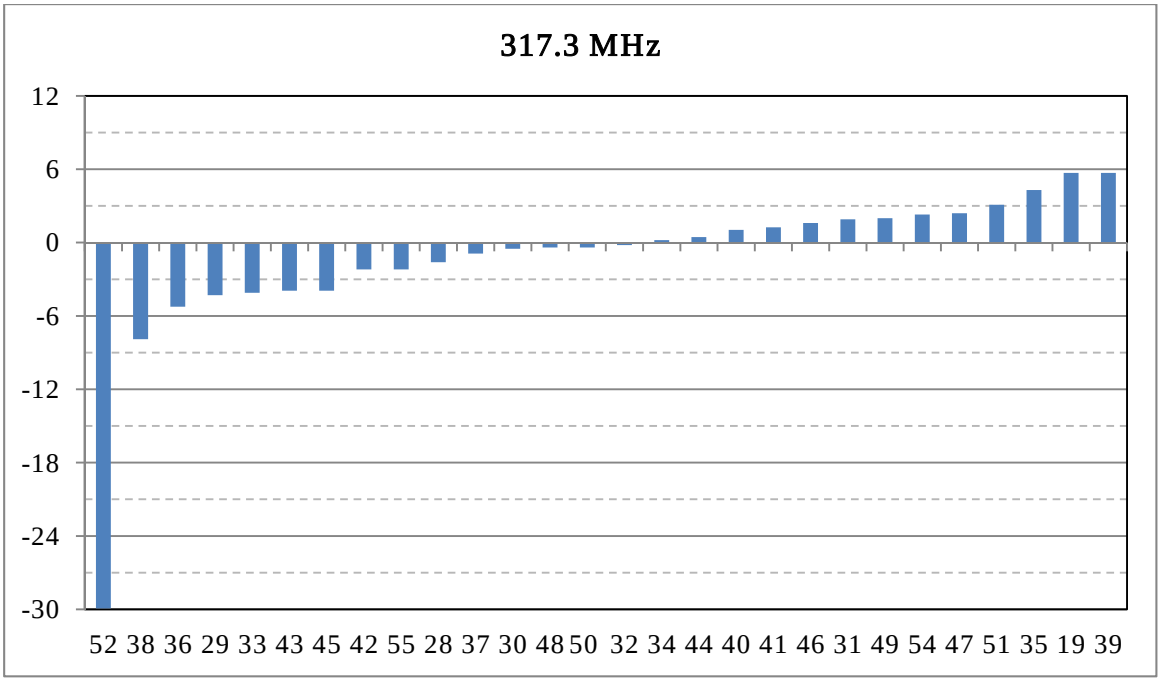

Chart 18-7: Difference from Median Value of the V-Pol. radiated emission measurement, 317.3 MHz

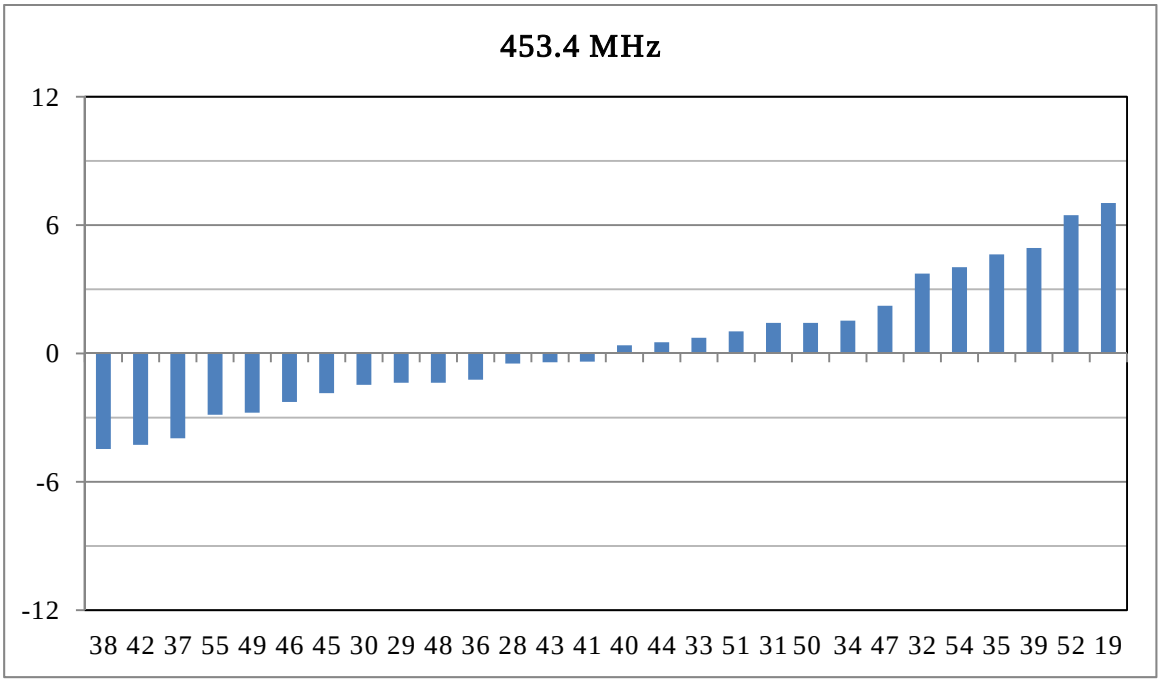

Chart 18-8: Difference from Median Value of the V-Pol. radiated emission measurement, 453.4 MHz

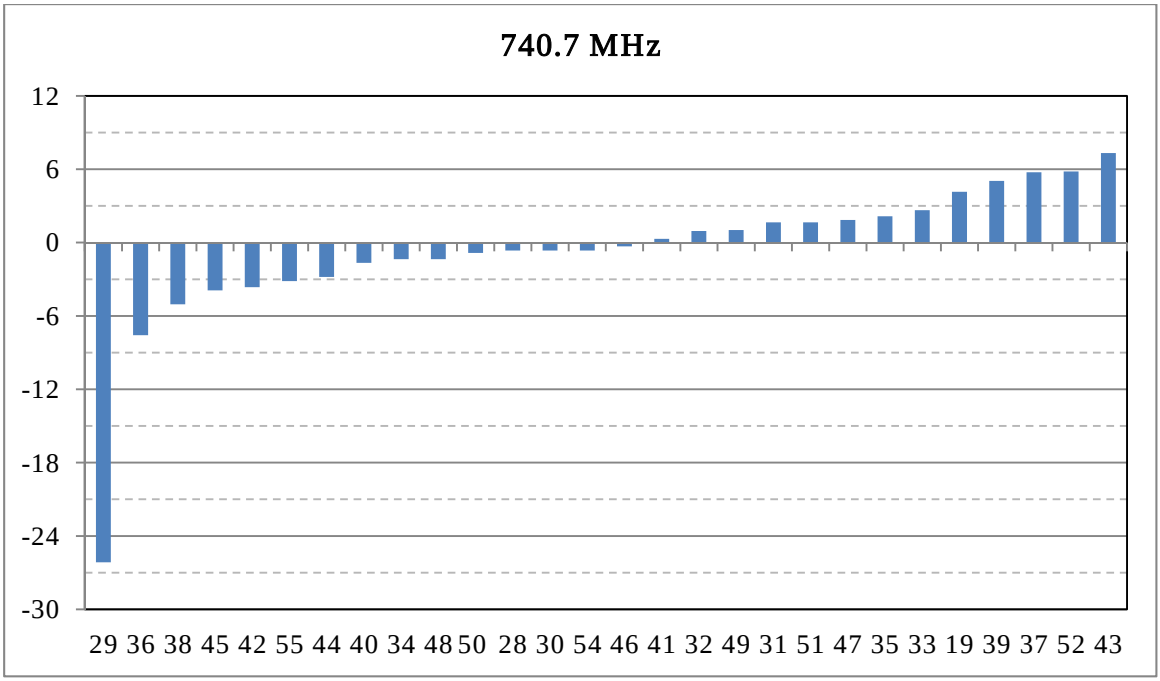

Chart 18-9: Difference from Median Value of the V-Pol. radiated emission measurement, 740.7 MHz

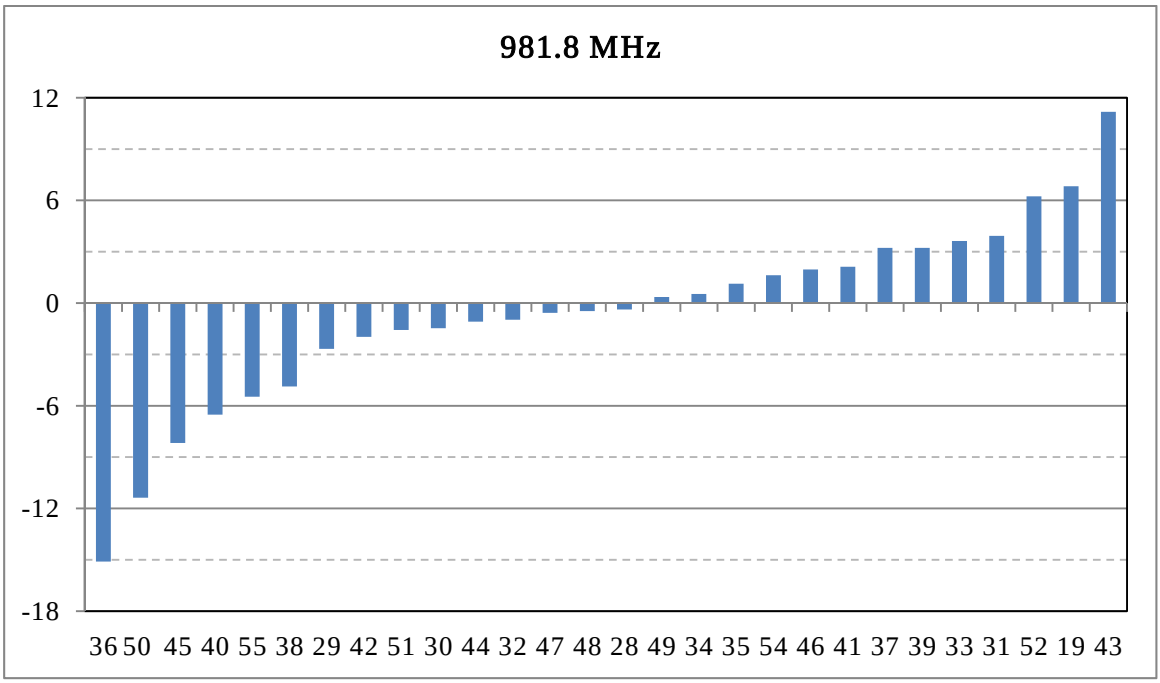

Chart 18-10: Difference from Median Value of the V-Pol. radiated emission measurement, 981.8 MHz

6. Evaluation of the result

As the evaluation result of the conducted emission measurement of Round 5, Round 6 and Retest Round, Table 45 shows the test sites whose Z score by linear scale data exceeds 3, or within 2 to 3, and also shows the test site which has the difference from median value over 6 dB with absolute value. And for the radiated emission measurement, Table 46 and 47 show the test site of which the Z score by dB scale data exceeds 3, or within 2 to 3, and also show the test site which has the difference from median value over 6 dB with absolute value.

Table 45 Conducted emission measurement

Frequency (MHz)	3≧|Z score|＞2	|Z score|＞3	|Difference from median value|＞6dB
0.219	38,	36 (1)	36
0.439	40, 50	38	38
2.62	28, 49, 51, 52, 53	36, 38, 50	36, 38, 50
3.71	36, 38		36, 38
7.45			52
15.1	43	19, 20, 45, 50	50

Note (1): The laboratory code surrounded by square frame is shown under both conditions of more than three Z scores and more than 6dB of the difference from median value. The laboratory should take an action as the unsatisfactory result. (36, 38, 50)

Table 46 Horizontal Polarization radiated emission measurement

Frequency (MHz)	3≧|Z score|＞2	|Z score|＞3	|Difference from median value|＞6dB
45.4	36, 38, 49	43 (1)	36, 38, 43, 45, 49
60.5	39, 49, 50	45	39, 43, 44, 45, 49, 50
75.6		36, 50	36, 50
105.9	19, 54	43, 50	19, 42, 43, 50, 54
151.3 (2)	34, 40, 46, 49	36, 50	34, 35, 36, 38, 40, 46, 49, 50
212.0 (2)	45	38, 50	34, 35, 37, 38, 42, 45, 50
317.3	38, 39, 45		39, 38, 45
453.4	36, 39	29	29, 34, 36, 39
740.7	37, 43	29	29, 37, 43
981.8	36, 43, 50	38	28, 35, 36, 38, 43, 45, 50

Note (1): The laboratory code surrounded by square frame is shown under both conditions of more than three Z scores and more than 6dB of the difference from median value. The laboratory should take an action as the unsatisfactory result. (29, 36, 38, 43, 45, 50)

Note (2): Evaluation of 151.3 MHz and 212 MHz gives as an informative result.

Table 47 Vertical Polarization radiated emission measurement

Frequency (MHz)	3≦|Z score|＞2	|Z score|＞3	|Difference from median value| ＞6dB
45.4	38, 39, 43, 45, 49	50 (1)	38, 39, 43, 45, 49, 50
60.5	41	45, 50	41, 45, 49, 50
75.6	38, 52	35, 37, 39, 45, 48, 50	35, 37, 39, 45, 50
105.9	39	50	19, 35, 39, 48, 50
151.3 (2)	40, 46	36, 50	36, 40, 46, 50
212.0 (2)	45	35, 38, 50	35, 38, 45, 50
317.3	38	52	38, 52
453.4	19, 39,52		19, 52
740.7	36, 43	29	29, 36, 43
981.8	19, 45	36, 43, 50	19, 36, 40, 43, 45, 50, 52

Note (1): The laboratory code surrounded by square frame is shown under both conditions of more than three Z scores and more than 6dB of the difference from median value. The laboratory should take an action as the unsatisfactory result. (29, 36, 38, 43, 45, 50)

Note (2): Evaluation of 151.3 MHz and 212 MHz gives as an informative result.

7. Remarks

Efforts and supports from all ABs and participants to this program are gratefully noted. Special thanks are also extended to APLAC PT Committee.

For further comments, participants are welcome to contact the organizers in the following address:

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3-5 Azabudai 2-chome, Minato-ku, Tokyo 106-0041, Japan
e-mail: osabe@vlac.co.jp

8. References

(1) ISO/IEC 17043:2010 “Conformity Assessment - General requirements for proficiency testing.”

(2) APLAC PT 002:2008 “Testing Inter laboratory Comparisons”

(3) CISPR 22: “Information technology equipment - Radio disturbance characteristic - Limits and methods of measurement”

(4) CISPR 16-4-2: “Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-2: Uncertainties, statistics and limit modeling - Uncertainty in EMC measurements”

APPENDIX I: Timeline of the Program

Round-4

Circulation period	Accreditation Body	Number of participated laboratory
2010/2/22-3/19	BELAC	1 (4 labs were nominated) as an informative evaluation
2010/3/29-4/2	INAB	Refer to Retest round
2010/4/12-5/7	UKAS	0 (4 labs were nominated)
2010/5/17-5/21	EAK	1 lab. as an informative evaluation (Conducted test only)
2010/5/31-6/18	SWEDAC	Refer to Retest round
2010/6/28-7/16	FINAS	Refer to Retest round

Round-5

Circulation period	Accreditation Body	Number of participated laboratory
2010/8/16-8/20	ISRAC	1
2010/9/6-10/22	ESYD	3
2010/11/8-12/6	COFRAC	4
2010/12/10-2011/1/4	IPAC	3
2011/1/5-2/9	ENAC	4
2011/2/14-3/11	HAA	1 (4 labs were nominated)

Round-6

Circulation period	Accreditation Body	Number of participated laboratory
2011/6/3-7/27	INMETRO	4 (Radiated 3, Conducted 4)
2011/9/28-10/21	OGA	0 (1 lab was nominated)

Round-Retest

Circulation period	Accreditation Body	Number of participated laboratory
2011/12/2-2012/1/13	IANZ	2
2012/2/6-3/17	INAB	1
2012/3/27-4/16	SWEDAC	2
2012/4/26-5/3	FINAS	3(Radiated 3, Conducted 4)

Number of laboratory: 28 sites for Radiated emission, 31 sites for Conducted emission

APPENDIX II: The measurement facility and condition of participated test laboratories

(1) The measurement facility and condition of conducted emission test sites

Laboratory Code	Test Facility	AMN		EMI receiver		Reference Ground	Test height	Measurement Uncertainty (dB)
		Mfr.	Model No.	Mfr.	Model No.			
19	Shielded room	R & S	ESH3-Z5	R & S	ESI26	Vertical	80 cm	1.6~2.0
33	Shielded room/OATS/SAR?	R & S	ESH3-Z5	R & S	ESHS30	Vertical	80 cm	2.8
20	OATS GRP/FAR	Schaffner	MN2050D	R & S	ESPI 3	Vertical	80cm	2.2
31	Shielded room	Schwarzbeck	NNLA 8120	R & S	ESU26	Horizontal	40cm	3.6
32	SAR	R & S	ESH3-Z5	R & S	ESU26	Vertical	80cm	1.8
28	Shielded room	Schwarzbeck	NSLK8127	R & S	ESS	Vertical	80cm	2.4~3.1
29	Shielded room/OATS/SAR?	R & S	ESH3-Z5	R & S	ESR26	Horizontal	40cm	2.8
23	Shielded room	R & S	ESH2-Z5	R & S	ESCI 3	Vertical	80cm	2.53
30	Shielded room	R & S	ESH3-Z5	R & S	ESCS30	Vertical	80cm	2.2
34	Outside shielded room	R & S	ESH2-Z5	R & S	ESH3	Vertical	80cm	3.64
35	SAC	R & S	ESH2-Z5	R & S	ESMI	Horizontal	40cm	3.2
36	Shielded room/OATS/SAR?	PMM	L2-16	R & S	FSU	Vertical	85cm	-
37	Shielded room/OATS/SAR?	R & S	ESH2-Z5	HP	8566B	Horizontal	40cm	3.86
38	Shielded room/OATS/SAR?	PMM	L2-16	R & S	ESIB40	Horizontal	40cm	3.4
39	Shielded room/OATS/SAR?	R & S	ESH2-Z5	R & S	ESCS-30	Vertical	80cm	2.1
40	Shielded room	R & S	ESH2-Z5	R & S	ESPI 3	Vertical	80cm	3.6
41	SAR	R & S	ESH3-Z5	R & S	ESIB40	Horizontal	40cm	3
42	Shielded room/OATS/SAR?	R & S	ESH3-Z5	R & S	ESCI-3	Vertical	84cm	3.1
43	Shielded room/OATS/SAR?	EMCO	381612	HP	HP8593E	Horizontal	80cm	3.93
44	Shielded room	Schaffner	NNB42	Schaffner	SMR4518	Vertical	80cm	3.04
45	Shielded room	Schwarzbeck	NSLK8126	Schwarzbeck	FCLE1535	Horizontal	40cm	3.12
46	Shielded room	R & S	ESH2-Z5	R & S	ESCI	Vertical	80cm	3.2
47	Shielded room	AFJ	LS16	AFJ	ER55CR/2.8	Horizontal	40cm	3.6
48	Shielded room	R & S	ENV216	R & S	ESCS 30	Vertical	80cm	4.2
49	Shielded room	Rolf Heine	NNB-2/16Z	HP	8542E	Vertical	80cm	3.8
53	Shielded room	R & S	ESH2-Z5	R & S	ESCI-3	Vertical	80cm	1.04~1.05
50	Shielded room	R & S	ESH3-Z5	R & S	ESPC	Vertical	80cm	4.3
51	Shielded room	ETS	Feb-25	LIG-NEX1	ER-265	Vertical	80cm	4.01
52	Shielded room/OATS/SAR?	R & S	ESH3-Z5	R & S	ESCI	Vertical	80cm	3.44
54	Shielded room	R & S	ESH2-Z5	R & S	ESHS-10	Vertical	80cm	2.3
55	Shielded room	R & S	ESH2-Z5	R & S	ESIB40	Vertical	80cm	3

Note: Re-calculation of the measurement uncertainty value based on CISPR 16-4-2 is recommended to the laboratory in which they reported on the measurement uncertainty value of less than 1dB for the conducted emission test.

(2) The measurement facility and condition of radiated emission test sites

Laboratory Code	Test Facility	Antenna (VHF)		Antenna (UHF)		EMI receiver		Pre amplifier		Test table material	Measurement Uncertainty (dB)
		Mfr.	Model No.	Mfr.	Model No.	Mfr.	Model No.	Mfr.	Model No.		
19	SAC	R & S	HL562	R & S	HL562	R & S	ESI26	-	-	Wood	3.6
33	SAC	Schwarzbeck	BBA9106	Chase	UPA6108	R & S	ESVS30	-	-	Polystyrene	3.9~5.3
31	SAC	Chase	CBL6111	Chase	CBL6111	R & S	ESU26			Stylene foam	3.9~5
32	SAC	Chase	CBL6111A	Chase	CBL6111A	R & S	ESU26	HP	8447F	Wood	5.0~6.2
28	SAC	Chase	CBL6112	Chase	CBL6112	R & S	ESU8	Mini-Circuits	ZFL-1000VH2	Stylene foam	4.6
29	SAC	Chase	CBL6141A	Chase	CBL6141A	R & S	ESU26	-	-	Stylene foam	4.1~5.3(H) 4.2~5.5(V)
30	SAC	Teseq	CBL6143A	Teseq	CBL6143A	R & S	ESU26	-	-	Styrofoam	4.2
34	OATS	Schwarzbeck	VHA9103	Schwarzbeck	JHALP	R & S	ESVP	-	-	Stylene foam	4.63~4.77（H）4.75 ~4.82(V)
35	SAC	Chase	CBL6112A 2119	Chase	CBL6112A 2119	R & S	ESMI	RFPA	BA 302000-27	Wood	5.6~6.7
36	SAC	MESS-ELECTRON	VULB 9166	MESS-ELECTRON	VULB 9166	R & S	FSU	-	-	Wood	-
37	OATS	Chase	CBL6112A	Chase	CBL6112A	H.P.	8566B	-	-	Wood	4.24(H), 4.55(V)
38	SAC	EMCO	3142	EMCO	3142	R & S	ESIB40			Wood	5
39	OATS/SAC?	MESS-ELECTRON	VULB9165	MESS-ELECTRON	VULB9165	HP	85685A, 85650A 8566B	Mini-Circuits	ZKL-2	?	4.3
40	SAC	Sunol Sciences	JB6	Sunol ciences	JB6	R & S	ESIB26	SCHAFFNER	CPA9232	Wood	4.62
41	SAC	-	-	R & S	614	R & S	ESIB40	R & S	Internal	Foam	4.5
42	SAC	SCHAFFNER	CBL6143	SCHAFFNER	CBL6143	R & S	ESMI	-	-	Wood	5.1
43	OATS	EMCO	3104	EMCO	3146	HP	9583E	-	-	Wood	5.24
44	SAC	SCHAFFNER	CBL6111D	SCHAFFNER	CBL6111D	SCHAFFNER	SMR4518	-	-	Wood	6.5
45	Full Anechoic Room	Schwarzbeck	VULB6193	Schwarzbeck	VULB6193	Schwarzbeck	FCLE1535	-	-	Wood	4.96
46	SAC	Chase	CBL6111D	Chase	CBL6111D	R & S	ESIB26	R & S	ESIB26	Wood	4.7~4.8(H), 4.8~4.9(V)
47	OATS	EMCO	3142B	EMCO	3142B	AFJ	ER55CR	-	-	Wood	4.95~5.2(H), 5.06~5.2(V)
48	SAC	EMCO	3142B	EMCO	3142B	R & S	ESCS30	-	-	Acrylic	8.3
49	OATS	Electro -Metrics	BIA 25/30	Electro -Metrics	LPA 25/30	HP	8542E	Internal	-	Polystyrene	5.0~5.3(H) 5.7~6.0(V)
50	GTEM-Chamber					R & S	ESCI	-	-	Wood	3.298
51	SAC	ETS-Lindgren	3142D	ETS-Lindgren	3142D	LIG-NEX1	ER-265	Agilent	11909A	Wood	5.77
52	SAC	ETS	3142B	ETS	3142B	R & S	ESIB7	N/A	N/A	Wood	4.62(H), 4.70(V)
54	OATS							-	-	Fiber Glass	4.2(H), 4.1(V)
55	OATS	SCHAFFNER	CBL6141A	SCHAFFNER	CBL6141A	R & S	ESCS30	None		Wood	4.6

Note: Re-calculation of the measurement uncertainty value based on CISPR 16-4-2 is recommended to the laboratory in which they reported on the measurement uncertainty value of less than 2dB for the radiated emission test.

APPENDIX III: Result of stability test for the Artifact

To confirm the stability of the comb generator, the output level measurement was verified a start and end of every round of program.
Stability tests of the Artifact from the Round 4 to Retest Round were performed at the following period;

2010.7.28: After Round-4
2010.8.6: After repaired the artifact
2010.8.7: 1 day after repairing the artifact
2011.4.8: After Round 5
2011.11.16: After Round 6
2012.1.26: After Retest Round in IANZ
2012.5.24: After Retest Round in Europe region

The result are shown in Figure III.5 and III.6

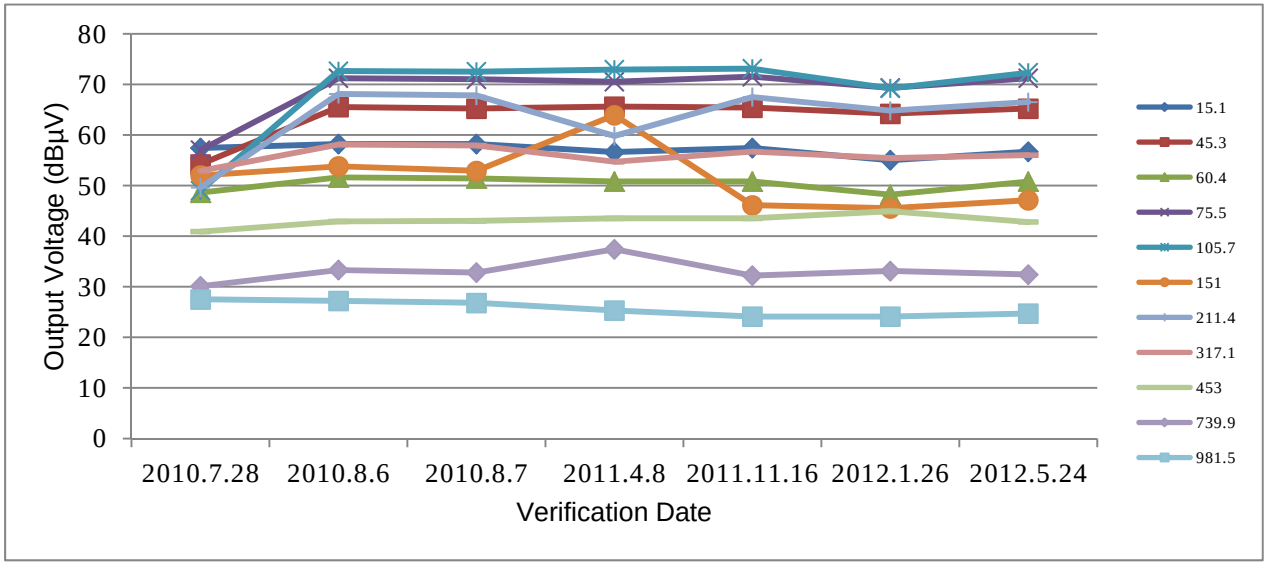


Figure III.5: Stability test result (Absolute level comparison)

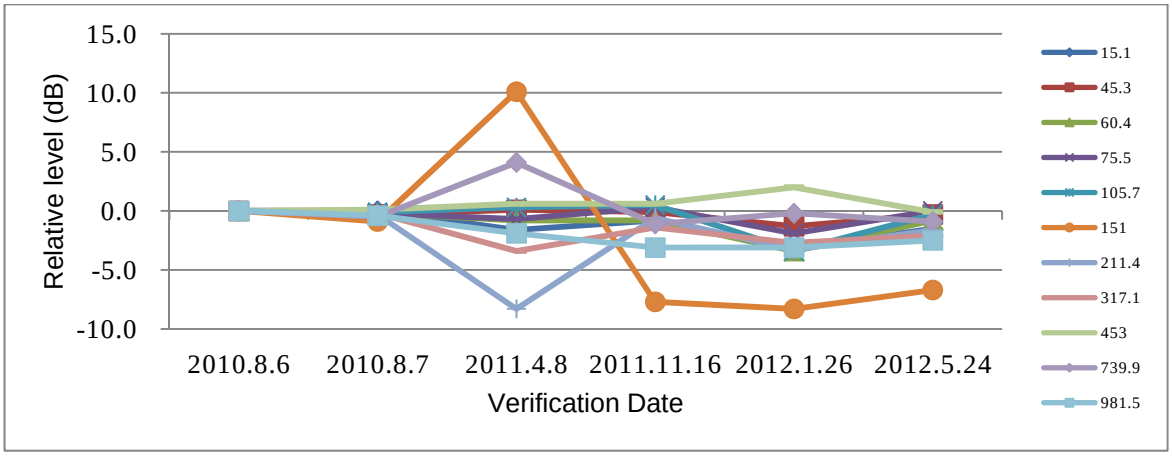


Figure III.6: Stability test result (Relative level comparison)

Evaluation of the stability: From the relative level comparison shown in Figure III.6, the data at 151MHz and 211.4 MHz had varied more than 6 dB from the reference level after the Round 5. Therefore, these two frequencies are considered as informative results.

Stability test syatem

Radiated emission level of the comb generator set inside the G-TEM cell was measured at output terminal of the cell. Test arrangement are shown in Figure III.7 and Figure III.8

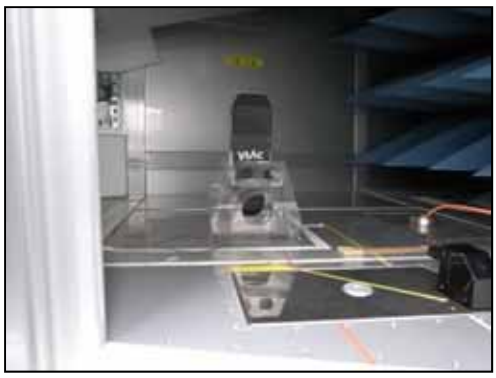


Figure III.7: Set-up of Stability Test Inside of G-TEM cell

Figure III.8: AC mains cable arrangement and processing of Artifact

APPENDIX IV: Instructions to Accreditation Bodies

Proposal for an APLAC Proficiency Testing Program on T061: Electromagnetic Interference Testing

1. Objective of the program

The main objective of the program is to evaluate the competence of EMC testing laboratories in appropriately maintaining characteristics of their measuring facilities and instruments used for measurement of radiated and conducted electromagnetic interference.

2. Program administration

The program is organized and operated by the Voluntary EMC Laboratory Accreditation Center, Inc. of Japan (VLAC) under the auspices of the Asia-Pacific Laboratory Accreditation Cooperation (APLAC). VLAC is responsible for coordinating activities relevant to this program such as inviting participants, assigning confidential codes to participants, preparing instructions, circulating an artifact (testing sample), collecting and analyzing results and preparing final report as well as the interim reports.

3. Recruitment of participants

APLAC members as well as members of EA and IAAC and ILAC unaffiliated bodies will be invited for the program. Invitations will be sent to all APLAC members and other accreditation bodies in July 2008.

4. Participants group size and handling of artifact

Participating accreditation bodies will be asked to nominate signing up laboratories with indication whether they are accredited or not. Preference should be given to laboratories that are accredited for this test.

The number of participating laboratories will be limited to 4 per accreditation body to allow time for VLAC to collect artifact and confirm its characteristics between its circulation in one accreditation body group and the next.

One week will be given to a participating laboratory including day for receiving and forwarding artifact. Two weeks will be given to a parent accreditation body for receiving and returning artifact from/to VLAC.

5. Testing method

The program participants will be requested to carry out the following measurements at specified frequencies based on CISPR22.

The instruction on testing procedure is given in **Appendix 2**

- Measurement of radiated disturbance (Electromagnetic Field Strength at 3 m distance)
- Measurement of conducted disturbance at mains port (Disturbance voltage using AMN)

6. Testing sample

An artifact is circulated to the participating laboratories as EUT (testing sample) for this program. The artifact is an impulsive noise generator (comb generator); Model PTE-2 (Serial No. 004). It can be operated by AC mains voltage from 100V to 240V. For the proficiency testing program this time, the operating voltage of artifact will be

specified to AC 100 V±2 V. Also for the measurement of radiated interferences, a VHF-LISN will be supplied by VLAC to stabilize the impedance between the line and ground of AC mains at the testing site. A VHF-LISN will be circulated together with the artifact. Measurement arrangement of the artifact and VHF-LISN is also indicated in **Appendix 2**.

7. Application fee

Free of charge.

8. Program time frame

To be determined later considering the number of enrolling accreditation bodies and laboratories under them.

Provisional schedule table

July 2008 Send out the invitation letter to the accreditation bodies

August to September 2008 Accepting the application from Accreditation Body

September 2008 Inform the circulation schedule to the Accreditation Body

From October 2008 to December 2009 Circulate the artifact

January 2010 Collect all results and analysis of data

April 2010 Issue the interim report

June 2010 Issue the final report

9. Application for participation

Application window: August 1 – September 30, 2008
Please send form in **Appendix 1** filled out to the VLAC Proficiency Testing Program Office

10. Confidentiality

For this program the participated laboratory has been allocated the code number shown on the data sheet. All reference to your laboratory in reports associated with this program will be with this code number, thus ensuring confidentiality of results.

11. Office of Proficiency Testing Program

VLAC Technical Center
PT Program Department
Convenor: Mr. Kunihiro Osabe
E-mail: osabe@vlac.co.jp
Co-convenor : Ms. Junko maeda
E-mail : jmaeda@vlac.co.jp
Phone: +81-3-3568-2152
Fax: +81-3-3568-2153

APPENDIX V: Receipt Form for Accreditation Bodies

APLAC T061: Proficiency Testing Program on Electromagnetic Interference

Registration Form for Nominated Participating Laboratories

If your laboratories wish to participate in the APLAC T061 Proficiency Testing Program, please complete this Registration Form and email the form to the contact above **by no later than 30 September, 2008:**

Date:	
Accreditation Body Name:	
Contact Name:	
Organization:	
Shipping Address:	
Economy:	
Phone No.:	
Fax No.:	
E-mail address of contact:	
Preference of testing period in between Oct. 2008 and Dec. 2009	1st Choice of Period: (YY/MM – YY/MM) 2nd Choice of Period: (YY/MM – YY/MM) 3rd Choice of Period: (YY/MM – YY/MM)

Each accreditation body is invited to nominate up to 4 laboratories to participate in this program. One week will be given to a participating laboratory including days for receiving and forwarding artifact. Two weeks will be given to the parent accreditation body for receiving and returning the artifact from/to VLAC.

The following term will be given to a participating accreditation body depending on the number of nominated laboratories. VLAC will inform the Accreditation Bodies of the final circulation schedule decided taking into consideration of Accreditation Body's preference of testing period.

Number of nominated laboratories	Term given for the Accreditation Body
1 laboratory	3 weeks
2 laboratories	4 weeks
3 laboratories	5 weeks
4 laboratories	6 weeks

<u>Nominated Laboratories:</u>

Contact Person:	
Lab Name:	
Shipping Address:	
Country:	
Phone No.:	
Fax No.:	
E-mail:	
Accredited laboratory?	**YES/NO**

Contact Person:	
Lab Name:	
Shipping Address:	
Country:	
Phone No.:	
Fax No.:	
E-mail:	
Accredited laboratory?	**YES/NO**

Contact Person:	
Lab Name:	
Shipping Address:	
Country:	
Phone No.:	
Fax No.:	
E-mail:	
Accredited laboratory?	**YES/NO**

APPENDIX VI: Instruction to Participating Laboratories

APLAC T061: The Proficiency Testing Program on Electromagnetic Interference

Office of Proficiency Testing Program, VLAC

EUT (Equipment under Test) as an Artifact

An artifact is circulated to the participating laboratories as EUT (testing sample) for this program. The artifact is an impulsive noise generator (comb generator); Model PTE-2 (Serial No. 005).

It can be operated by AC mains voltage from 100V to 240V. For this proficiency testing program, operating voltage of the artifact is specified to AC 100V±2V and the frequency is recommended to use of 50Hz (60Hz operation is acceptable).

Also for the measurement of radiated disturbances, a VHF-LISN will be supplied by VLAC to stabilize the impedance between the line and ground of AC mains at the testing site. A VHF-LISN will be circulated together with the artifact.

AC power plug of the artifact and VHF-LISN are equipped with 2 flat-pin type plug (A-type).

Test items

Items to be measured by program participants using their own measuring facilities and instruments: are as follows.

- Radiated electromagnetic interference field strength at 3m distance
- Mains port conducted interference voltage using AMN

Measuring Frequencies

- Measuring frequencies specified for the Radiated EMI
  30MHz～300MHz：45.4MHz, 60.5MHz, 75.6MHz, 105.9MHz, 151.3MHz and 212.0MHz
  300MHz～1GHz：317.3MHz, 453.4MHz, 740.7MHz and 981.8MHz
  Record the readings of maximum field strength at each specified frequency ± 1%
- Measuring frequencies specified for the Mains port conducted EMI
  219kHz, 439kHz, 2.62MHz, 3.71MHz, 7.45MHz and 15.1MHz
  Record the reading of maximum voltage at each specified frequency ± 3%

Testing method

Conditions other than specified hereunder shall be in conformance with those specified in CISPR22.

Measurement of radiated EMI (Electromagnetic field strength at **3m** separation distance)

- EUT
  Model PTE-2 (Serial No. 005) combined with VHF-LISN
- Measurement procedure
  Supply AC100V power to the EUT. Set power voltage to 100V±2V.
  Record readings of maximum field strength of horizontal polarization and vertical polarization at each frequency while rotating the EUT 360 degrees and moving the receiving antenna height in the range of 1 – 4m.

Note 1: Turn the power switch ON for the EUT after adjusting power voltage to AC100V±2V

Note 2: Do not start the measurement in 30 minutes or so after the EUT power switch is turned ON

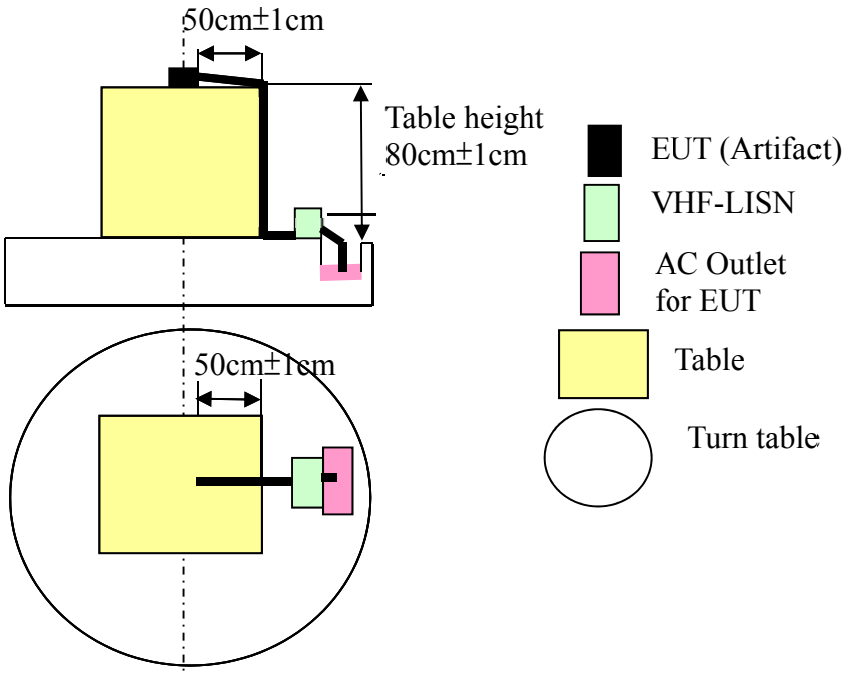
- Orientation of the EUT and testing arrangement
  Place the EUT on the EUT stand as indicated in pictures 1 and 2. Then put the loaded stand on the center of EUT table of 80cm in height to be used for the measurement of EMI by the subject laboratory. At the time of horizontal polarization measurement, set the EUT horizontally with the side displayed VLAC sign upward. At the time of vertical polarization measurement, set the EUT vertically to the position in which the character of VLAC can be normally read. Make sure the model number is not upside down. The EUT stand shall be placed on the EUT table in such a way that the side of the stand parallels the EUT table and the length of EUT power cable becomes 50cm between the EUT and the edge of the table from which the power cable dangles downward toward ground reference plane as indicated in Figure 1. (If the width of the EUT table is 1m, the EUT is put in the center point). Connect the power plug to VHF-LISN which is connected to 100V power outlet nearby. Excess length of power cable shall be laid on the ground plane. Distance between the EUT and receiving antenna shall be set based on CISPR22 standard.

  Note 3: Place VHF-LISN with the bottom plane down on the turntable electrically connected to the ground reference plane. If the surface of the turntable is electrically insulated from the body of the turntable, put VHF-LISN on a metal plane of bigger than 30cm square and secure grounding to the turntable using the metal plane.

  Test arrangement:

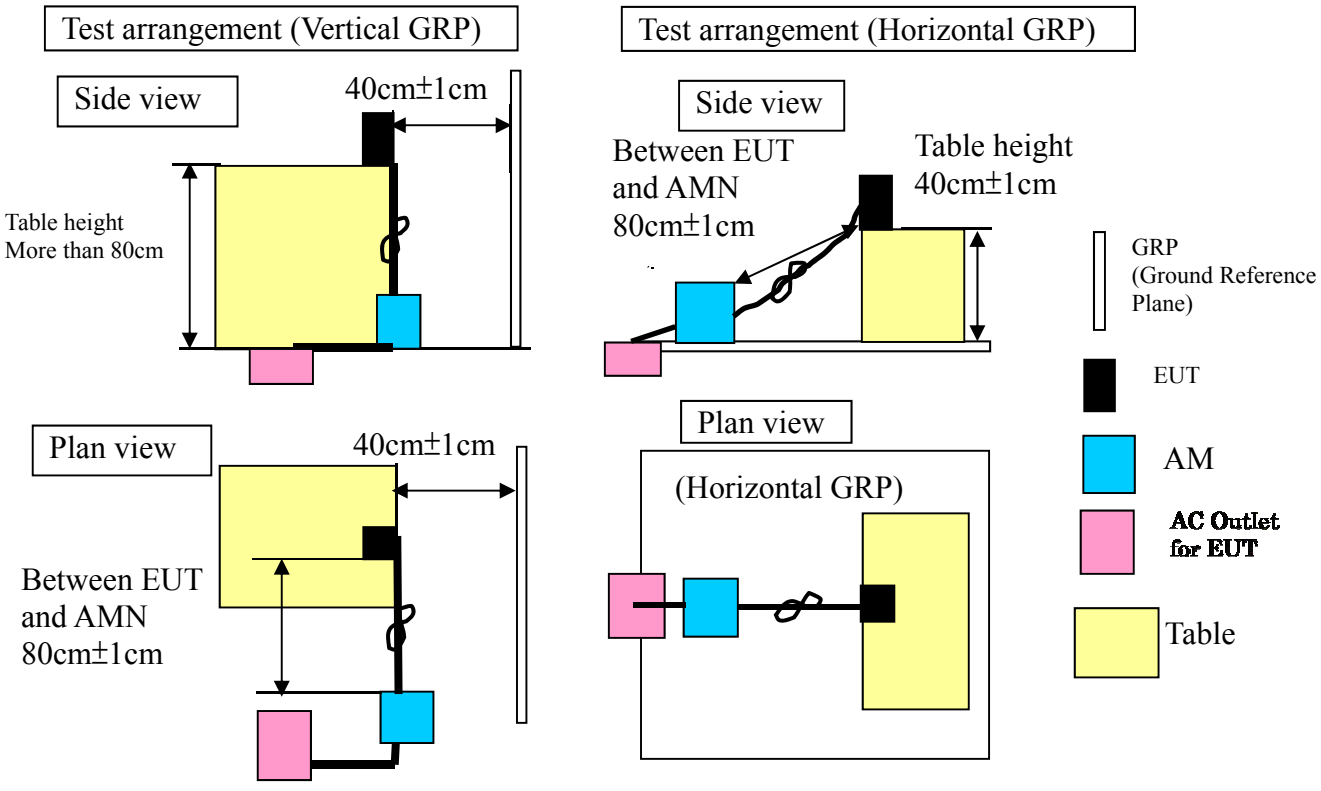
Picture 1: Horizontal polarization

Picture 2: Vertical polarization



Measurement of AC mains port conducted EMI

- EUT
  Model PTE-2 (Serial No. 005)
- Measurement procedure
  Supply AC100V power to the EUT via Artificial Mains Network (AMN) equipped with in the test site. Set power voltage to 100V±2V. Measure disturbance voltage at the specified frequency points although the frequency will be slightly fluctuated with the voltage change of power supply. **VHF-LISN attached to PTE-2 is not used for the conducted disturbance voltage measurement.**
  Record the higher value of Line1 and Line2 readings at each frequency point measured with AMN.
  Note 1: Turn the power switch ON for the EUT after adjusting power voltage to AC100V±2V. 50Hz operation is recommended (60Hz operation is acceptable).
  Note 2: Do not start the measurement in 30 minutes or so after the EUT power switch is turned ON
- Orientation of the EUT and testing arrangement
  In the case of measurement based on vertical reference plane, place the EUT vertically on the EUT stand as indicated in Picture 2. Put the loaded stand on the edge of EUT table of 80cm in height and move the EUT table so the side of EUT is 40cm away from the vertical reference plane as indicated in the left schematic of Figure 2.
  In the case of measurement based on horizontal reference plane, place the EUT vertically on the EUT stand as indicated in Picture 2. Put the loaded stand on the EUT table of 40cm in height as indicated in the right schematic of Figure 2. Describe the arrangement in the attached data sheet.
  Connect the power cable of the EUT to the AMN placed 80cm away from the EUT. Power cable shall be bundled in the middle so the total length becomes 1m.



Reporting on test results

(1) Measurement of radiated EMI (3 m)
Fill out cells of the data sheet (3 – 1 of Annex 3) with vertical and horizontal polarization readings at each frequency of 45.4MHz, 60.5MHz, 75.6MHz, 105.9MHz, 151.3MHz, 212.0MHz, 317.3MHz, 453.4MHz, 740.7MHz and 981.8MHz.
If the laboratory has uncertainty of measuring facilities and instruments calculated, please write the value of extended uncertainty in the report.

(2) Measurement of mains port conducted EMI
Fill out cells of the data sheet (3 – 2 of Annex 3) with readings at each frequency of 219kHz, 439kHz, 2.62MHz, 3.71MHz, 7.45MHz and 15.1MHz.
If the laboratory has uncertainty of measuring facilities and instruments calculated, please write the value of extended uncertainty in the report.

Statistical treatment of test results

We will statistically process test results based on ISO 15328 Robust Method. Our evaluation will be on z score in principle and additionally we will extend the evaluation of deviation from median value or the center value of a data group.

VLAC will provide participating laboratories with measurement Data Sheets (Appendix 3) for result collection. All participating laboratories are required to return the completed data sheets to their parent Accreditation Body who will then forward the collected data sheets to VLAC within two weeks after the completion of the test in the group. Late return of result sheets without justifiable reasons may be rejected and the corresponding data will not be included in the analysis.

Once all results are received, VLAC will check the data and create an interim report with them tabulated in a well-formatted table. Then VLAC will send out the report to all participating Accreditation Bodies who are then kindly requested to forward the same to the participating laboratories. Test participants are supposed to send confirmation or any clarification or correction of results to VLAC via the accreditation body within 2 weeks after receipt of the interim report.

Upon confirmations of data received from all participants, VLAC will prepare a draft report by applying z-score approach using robust median to the test data followed by statistical analysis carried out to the deviation from the center value or median value of data group. VLAC will then send the draft report to APLAC Proficiency Testing Committee for their review and comment before its general publication and distribution to participating laboratories via their parent accreditation bodies.

APPENDIX VII: Receipt Form for Participating Laboratories

Data Sheet

Appendix 3
Page 1 of 2

Accreditation Body			Registration Number: Written by VLAC	
Name of Testing laboratory				
Address				
Contact person		TEL		
		FAX		
		E-mail		

Testing item	Radiated disturbace field strength at 3 meters distance			Measurement value of AC mains voltage		
Testing standard	CISPR22 Edition 5.2		Artifact (EUT): PTE-2+VHF-LISN	Measurement voltage	AC	V
Testing facility	OATS / Semi-anechoic Chamber			AC Mains frequency		Hz
Name of Testing Facility				Measurement Instrument		
				Name of manufacturer		
Measurement date (YY/MM/DD)			Weather condition			
Measurement Engineer			Temperature	℃		
			Relative Humidity	%	Air Pressure	H.P.

Measuring Equipment	Name of Manufacturer	Model No.	Measuring Equipment	Name of Manufacturer	Model No.
Antenna(VHF)			Attenuator		
Antenna(UHF)			Pre-amplifier		
EMI Receiver			Table material	Wood・FRP・Stylene foam・other( )	

ANT Polarization	**Horizontal**				
Measurement Frequency		Max. Field Strength 1m≦h≦4m	ANT Height	Measurement Uncertainty	Ambient (Horizontal)
Specified Freq. MHz	Actual Freq. MHz	Q-Peak dB(μV/m)	cm	(dB): k=2	dB(μV/m)
45.4 (+/-1%)					
60.5(+/-1%)					
75.6(+/-1%)					
105.9(+/-1%)					
151.3(+/-1%)					
212.0(+/-1%)					
317.3(+/-1%)					
453.4(+/-1%)					
740.7(+/-1%)					
981.8(+/-1%)					

[Measurement condition of Ambient Noise]
1.EUT (Artifact): on the table
2.EUT Power Off
3. Receiving ANT height: 1m
4. ANT: Horizontal polarization

ANT Polarization	**Vertical**				
Measurement Frequency		Max. Field Strength 1m≦h≦4m	ANT Height	Measurement Uncertainty	Ambient (Vertical)
Specified Freq. MHz	Actual Freq. MHz	Q-Peak dB(μV/m)	cm	(dB): k=2	dB(μV/m)
45.4 (+/-1%)					
60.5(+/-1%)					
75.6(+/-1%)					
105.9(+/-1%)					
151.3(+/-1%)					
212.0(+/-1%)					
317.3(+/-1%)					
453.4(+/-1%)					
740.7(+/-1%)					
981.8(+/-1%)					

[Measurement condition of Ambient Noise]
1.EUT (Artifact): on the table
2.EUT Power Off
3. Receiving ANT height: 1m
4. ANT: Vertical polarization

Data Sheet

Accreditation Body		Registration Number: (Written by VLAC)	
Name of Testing laboratory			
Address			
Contact Person		TEL	
		FAX	
		E-mail	

Testing Item	Conducted Disturbance Voltage at AC Mains Port		Measurement value of AC mains voltage		
Testing Standard	CISPR22 Edition 5.2	Artifact (EUT): PTE-2	Measurement voltage	AC	V
Test facility	Shielded room/OATS/SAR		AC Mains frequency		Hz
Name of Test facility			Measurement Instrument		
			Name of manufacturer		
Measurement date (YY/MM/DD)		Weather condition			
Measurement Engineer		Temperature	℃		
		Relative Humidity	%	Air Pressur	H.P.

Measuring Equipment	Name of Manufacturer	Model No.
AMN		
EMI Receiver		
Ground Reference	Vertical ground plane / Horizontal ground plane	
Table Height	cm	

Measurement Frequency		Max. Voltage	Measurement Uncertainty (dB): k=2	Ambient	
Specified Freq.	Actual Freq.	Q-Peak dB(μV)		Q-Peak dB(μV)	
219kHz(+/-3%)					[Measurement condition of Ambient Noise] 1.EUT (Artifact): connecting to power lines 2.EUT Power Off
439kHz(+/-3%)					
2.62MHz(+/-3%)					
3.71MHz(+/-3%)					
7.45MHz(+/-3%)					
15.1MHz(+/-3%)					