

Prüfbericht-Nr.: Test Report No.:	CN23WRCB 001	Auftrags-Nr.: Order No.:	178187350	Seite 1 von 36 Page 1 of 36
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	08.09.2023	
Auftraggeber: Client:	SHANDONG RIPPA MACHINERY GROUP CO., LTD. No. 6 Industrial Park, No. 2166 Chongwen Avenue, High tech Zone, Jining City, Shandong Province 272000, P.R. China			
Prüfgegenstand: Test item:	Hydraulic Excavator			
Bezeichnung / Typ-Nr.: Identification / Type No.:	NDI313, NDI320, NDI322			
Auftrags-Inhalt: Order content:	EMC test			
Prüfgrundlage: Test specification:	[Emission] with reference to: EN ISO 13766-1:2018 [Immunity] with reference to: EN ISO 13766-1:2018 <i>ISO 10605:2008, IEC 61800-3:2004+A1, Clause A.3.2.2</i>			
Wareneingangsdatum: Date of receipt:	08.09.2023			
Prüfmuster-Nr.: Test sample No.:	Engineer sample			
Prüfzeitraum: Testing period:	Refer to test report			
Ort der Prüfung: Place of testing:	Jining			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland/CCIC (Qingdao) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:	 X Signed by: Geoff Guo		genehmigt von: authorized by:	 X Signed by: Hunter Yu
Datum: Date:	12.09.2023 Signed by: Geoff Guo		Ausstellungsdatum: Issue date:	12.09.2023 Signed by: Hunter Yu
Stellung / Position:	Project Engineer		Stellung / Position:	Authorizer
Sonstiges / Other: 1. This EMC test report is issued according to client's requirements. 2. All test methods are confirmed with SHANDONG RIPPA MACHINERY GROUP CO., LTD. Immunity test procedure to electromagnetic radiation will be with reference to IEC 61800-3:2004+A1, Clause A.3.2.2. 3. In electrical characteristics, NDI322 and NDI320 are the same, the only difference between them is machinery construction. Therefore, all EMC tests were performed on model NDI313 and NDI320.				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

TEST SUMMARY

4.1 Broadband EMISSION IN THE FREQUENCY RANGE UP TO 30 MHz

Result:

Passed

4.2 Narrow EMISSION IN THE FREQUENCY RANGE ABOVE 30 MHz

Result:

Passed

5.1 ELECTROSTATIC DISCHARGE

Result:

Passed

5.2 RADIO FREQUENCY ELECTROMAGNETIC FIELD

Result:

Passed

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1 Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland / CCIC (Qingdao) Co., Ltd.

Address: 6F, No. 2Bldg., No. 175 Zhuzhou Rd., Qingdao 266101, P.R. China

The used test equipment is in accordance with CISPR 16-1 series standards for measurement of radio interference.

Tests on this test report are on-site EMC tests. Tests were performed at customer's premise located at " No. 6 Industrial Park, No. 2166 Chongwen Avenue, High tech Zone, Jining City, Shandong Province 272000, P.R. China".

Due to the tests were performed on-site, there were some deviations from the laboratory test; for details, please refer to relevant clause.

1.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

No.	Equipment	Model	Inventory no.	Cal. due date
1.	EMI Test Receiver	ESR	1316.3003K03-101	21.05.2024
2.	ESD Generator	HF500	100023	21.05.2024
3.	Broadband Antenna	VULB9163	752	21.05.2024
4.	Multiband Transceiver	VX-6	n.a.	n.a.
5.	Cellular Telephone	Iphone X	n.a.	n.a.

2 General Product Information

2.1 Product Function and Intended Use

The EUTs (equipment under test) are ordinary Excavators. For the further information, refer to the user's manual.

2.2 Ratings and System Details

Rated voltage	: DC 12V
Engine Power	: 7.5kW for NDI313 10.2kW for NDI320 and NDI322
Operating Mass	: 1096kg for NDI313 1207kg for NDI320 and NDI322
Protection class	: III

2.3 Independent Operation Modes

The basic operation mode is "ON" and "OFF".
Refer to operation manual for further information.

2.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit diagram for further information.

2.5 Submitted Documents

User manual, circuit diagram, components list and rating label etc.

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible emission level. The test conditions were adapted accordingly in reference to the instructions for use.

Refer to the related paragraph of this report.

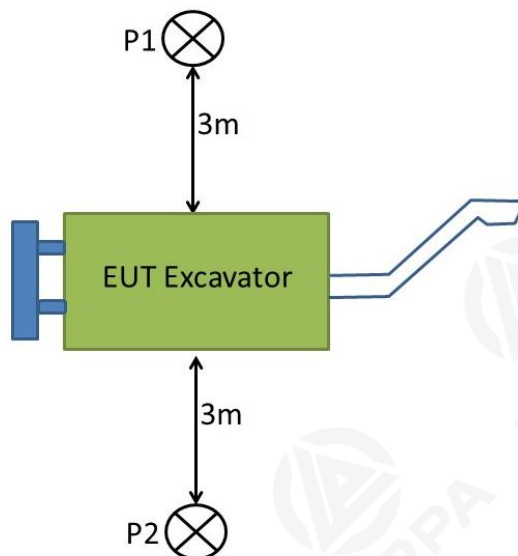
Immunity: The equipment under test (EUT) was configured to have its highest possible susceptibility against the tested phenomena. The test conditions were adapted accordingly in reference to the instructions for use.

Refer to the related paragraph of this report.

3.2 Physical Configuration for Testing

Refer to the related paragraph of this report.

EUT layout and antenna positions:



3.3 Test Operation and Test Software

Refer to the related paragraph of this report. No software was used.

3.4 Special Accessories and Auxiliary Equipment

None.

3.5 Countermeasures to achieve EMC Compliance

No special measure is employed to achieve the requirement.

4 Test Results EMISSION

4.1 Broadband Emission in the Frequency Range above 30 MHz

Result:	Passed
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Date of testing : 11.09.2023
 Test procedure : EN ISO 13766-1:2018
 Frequency range : 30 - 1000MHz
 Limits : Quasi-peak limits (3m measurement distance): 30-75MHz, 44dB μ V/m; 75-400MHz, 44 to 55 dB μ V/m increasing with frequency; 400-1000MHz, 55dB μ V/m
 Margin : No less than 2dB
 requirement:
 Kind of test site : On-site testing
 Height of the : 1.8m
 receiving antenna
 Test distance : 3m
 Operation modes : Engine and all electronic systems on
 Ambient : Temperature: 27°C, relative humidity: 65%
 conditions

The test was performed with the EUT in the operation modes as described above. Following are the measurement results for horizontal polarization and vertical polarization respectively. The measurement results may also include the contribution of the ambient interference; due to that the disturbance emanated from the EUT combined with the ambient interference did exceed the corresponding limit, no further investigation was made to discriminate whether the EUT or the ambient interference is the main contributor. In the following figures, the symbols “◆” means quasi-peak values which were measured in final measurement.

Figure 1: Spectral diagrams and measurement results for 30-1000MHz, ambient noise, horizontal polarization, broadband

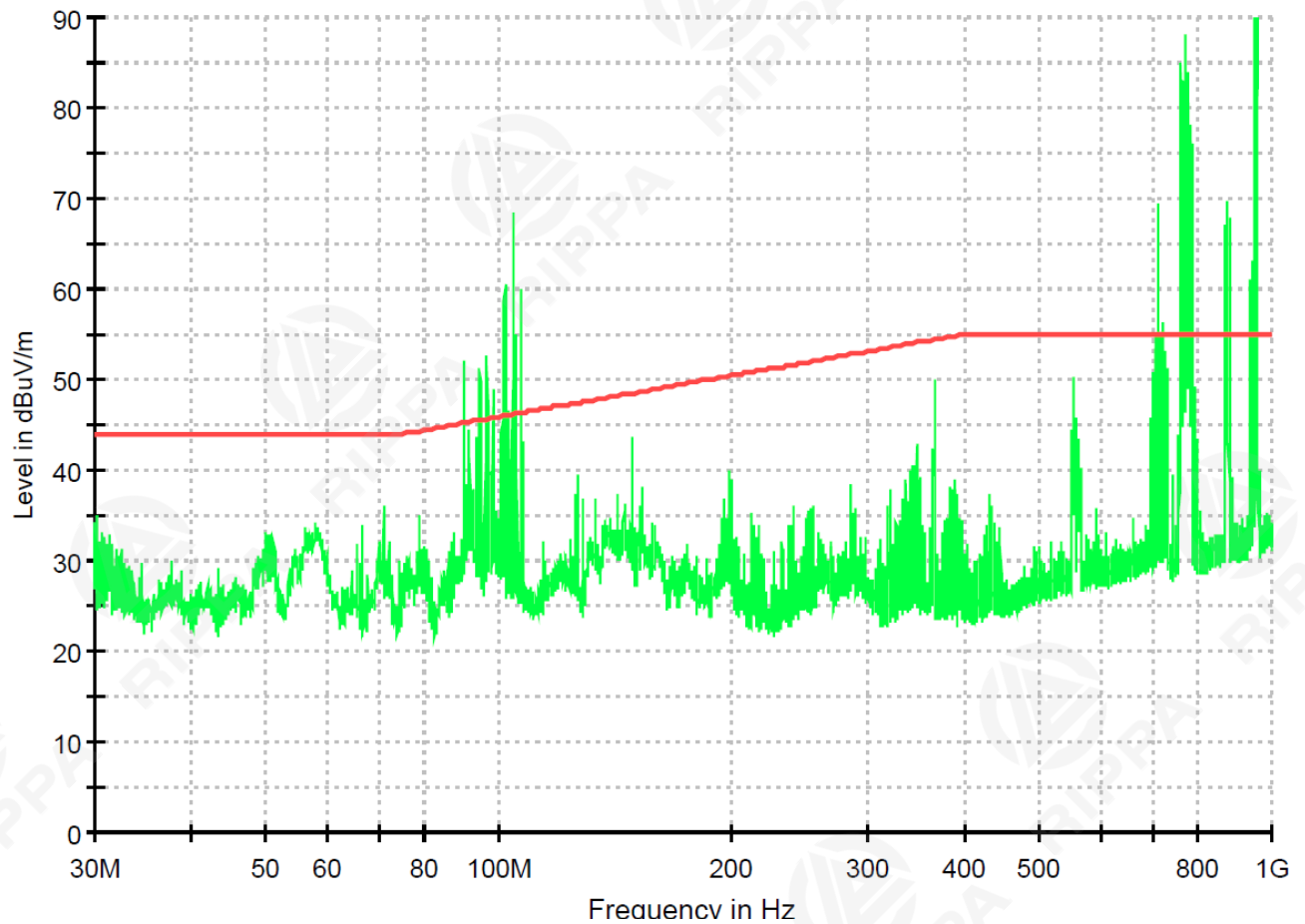


Figure 2: Spectral diagrams and measurement results for 30-1000MHz, ambient noise, vertical polarization, broadband

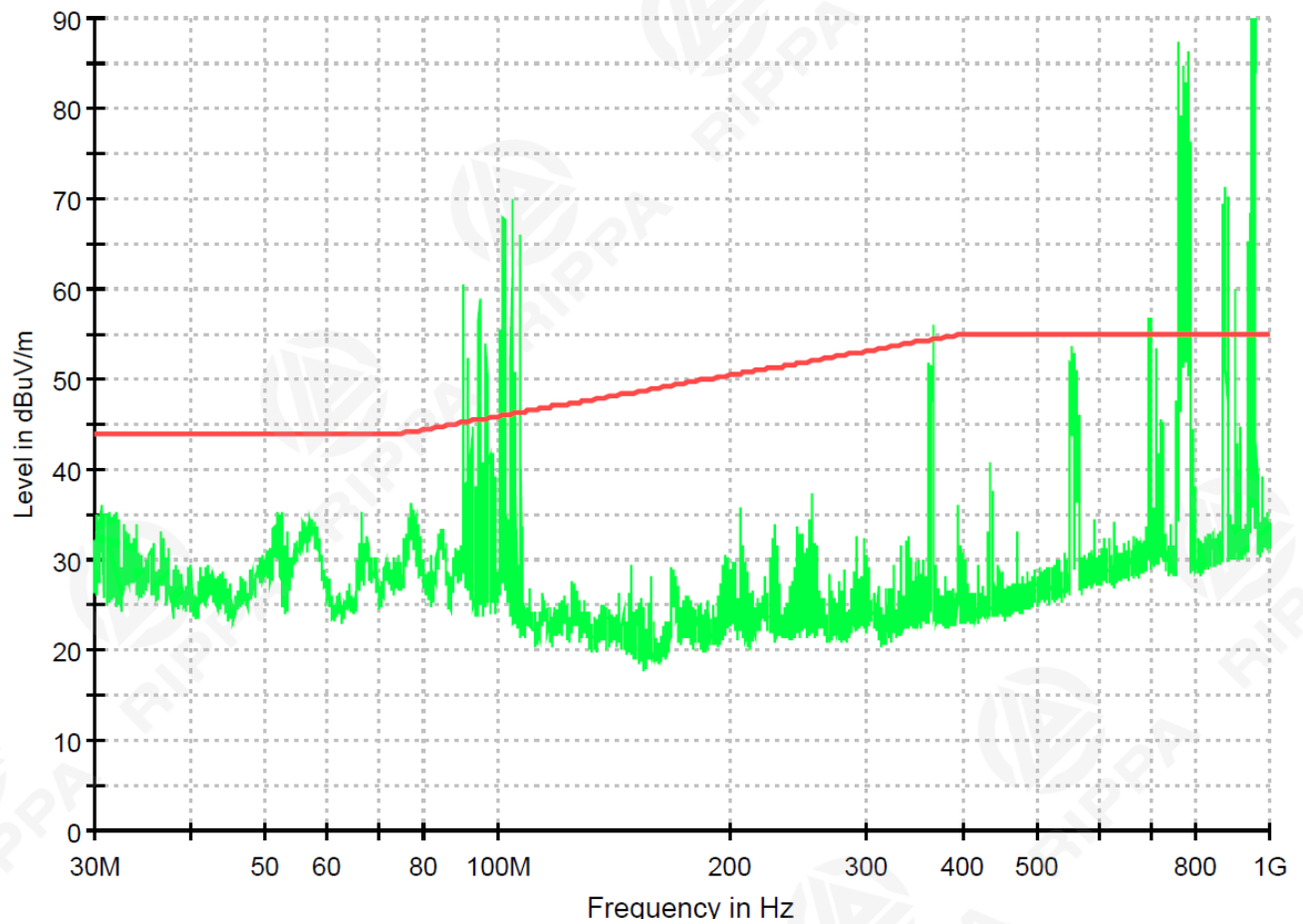
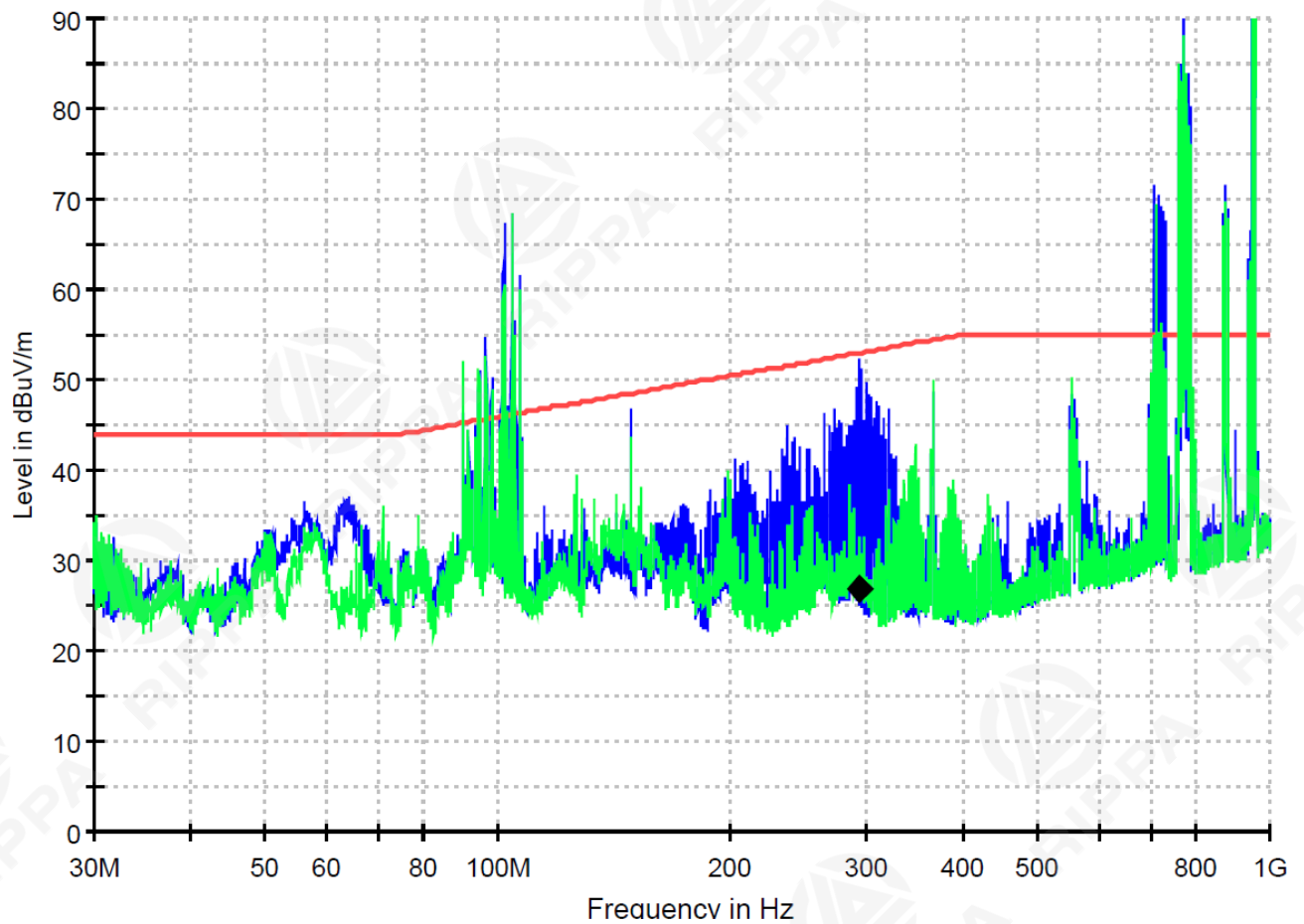


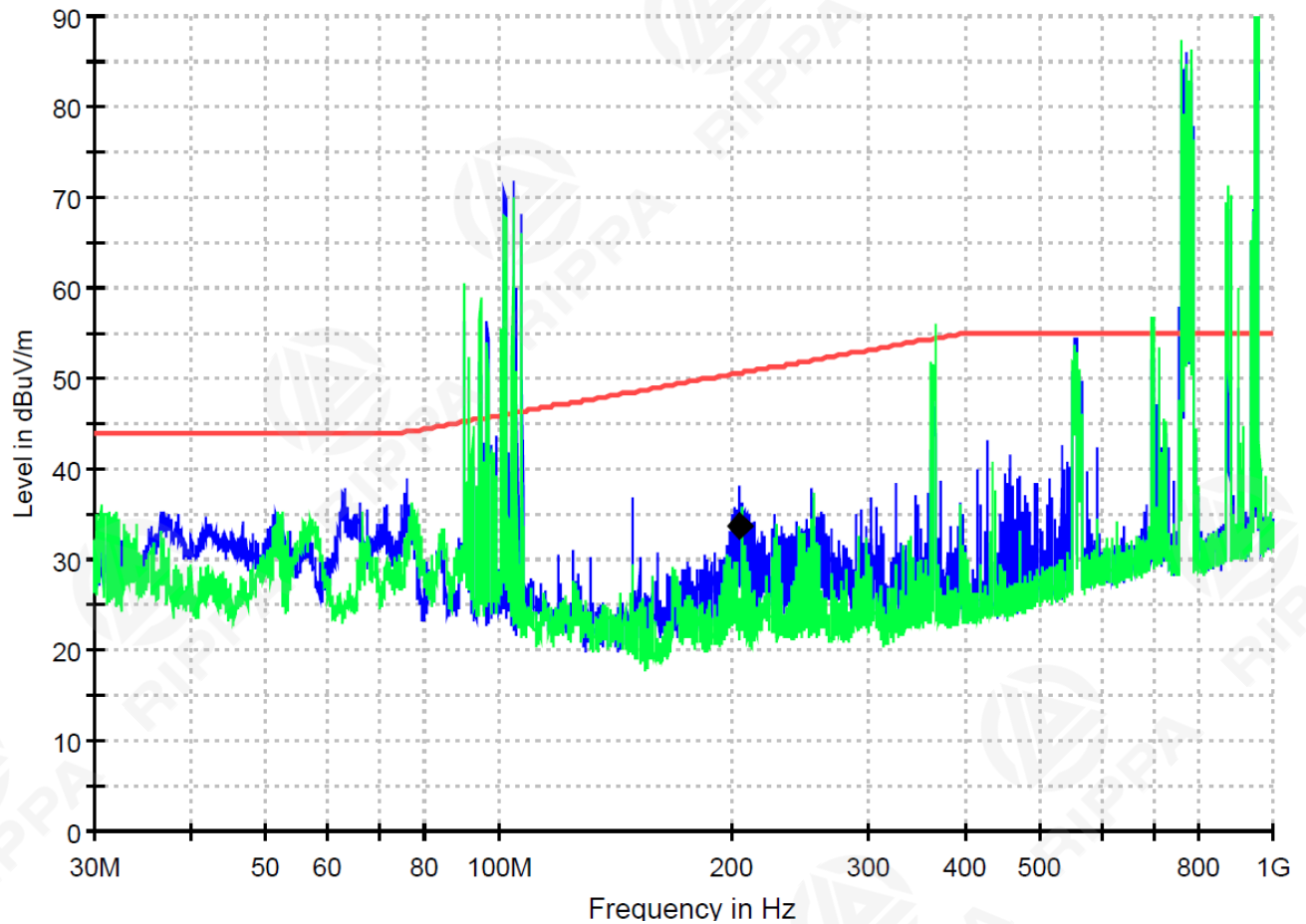
Figure 3: Spectral diagrams and measurement results for 30-1000MHz, Horizontal polarization, P1 for NDI313



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBuV/m)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
294.680000	26.9	26.1	53.0

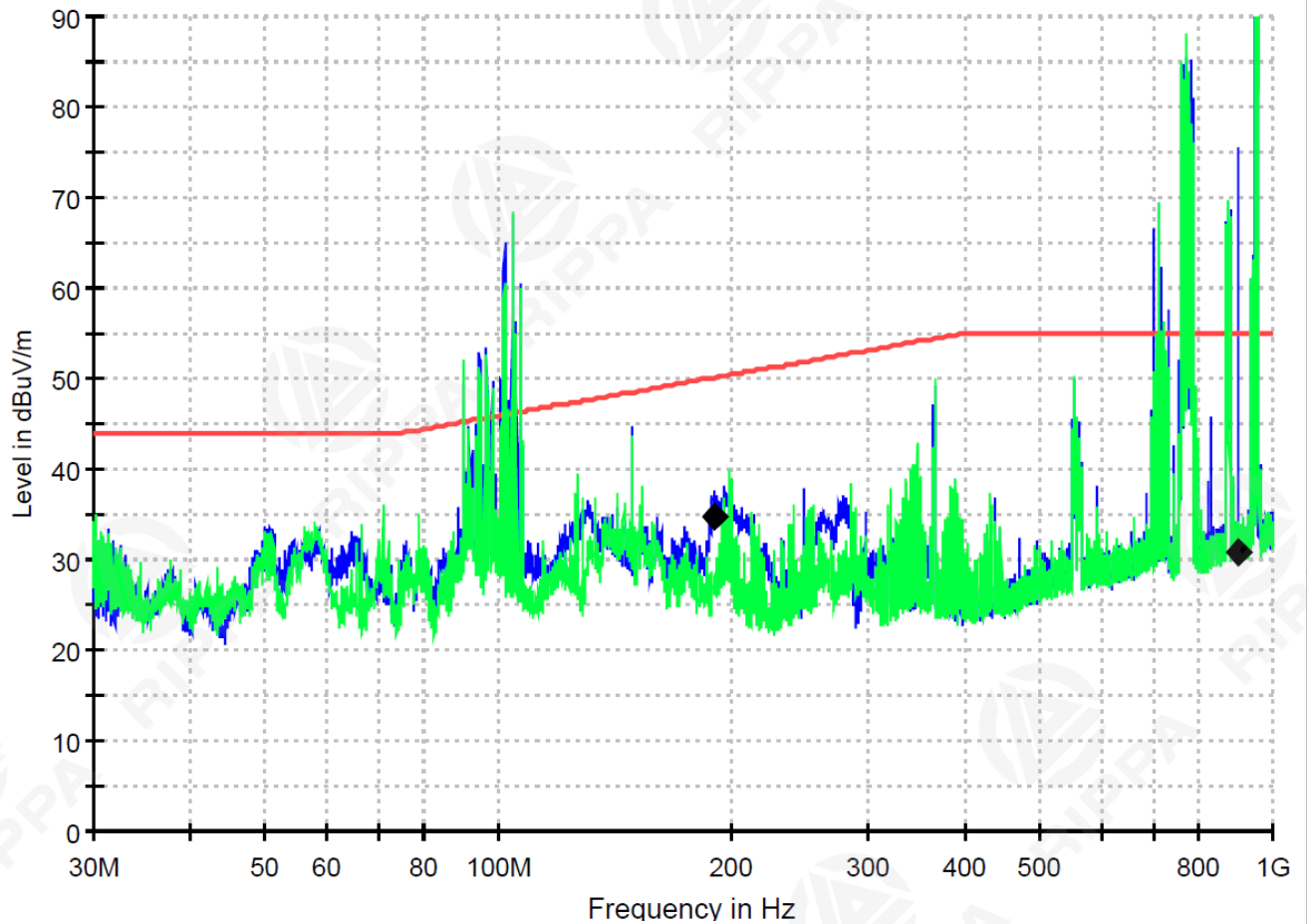
Figure 4: Spectral diagrams and measurement results for 30-1000MHz, Vertical polarization, P1 for NDI313



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBuV/m)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
204.160000	33.8	16.8	50.6

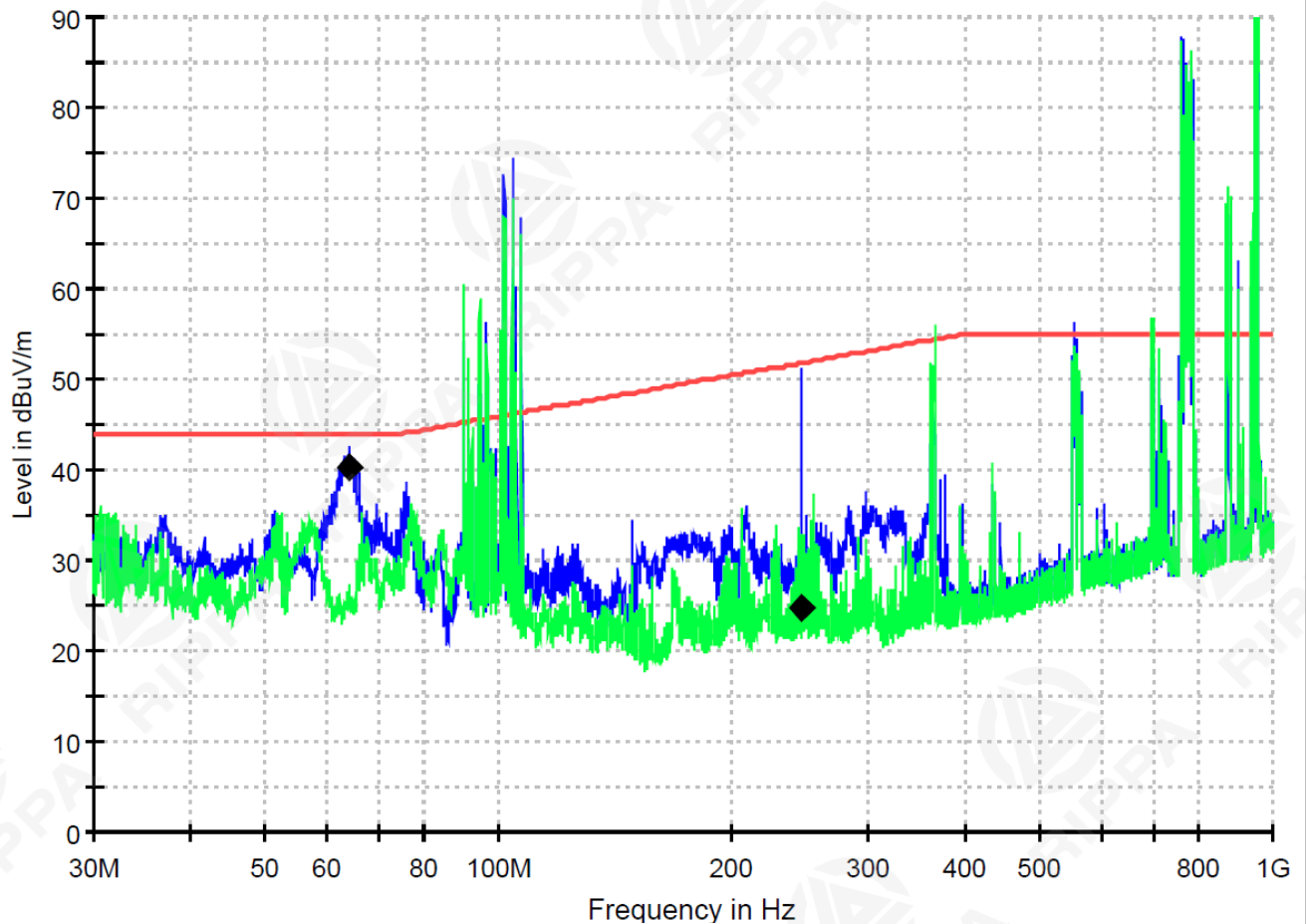
Figure 5: Spectral diagrams and measurement results for 30-1000MHz, Horizontal polarization, P2 for NDI313



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBuV/m)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
190.040000	34.8	15.3	50.1
899.400000	30.9	24.1	55.0

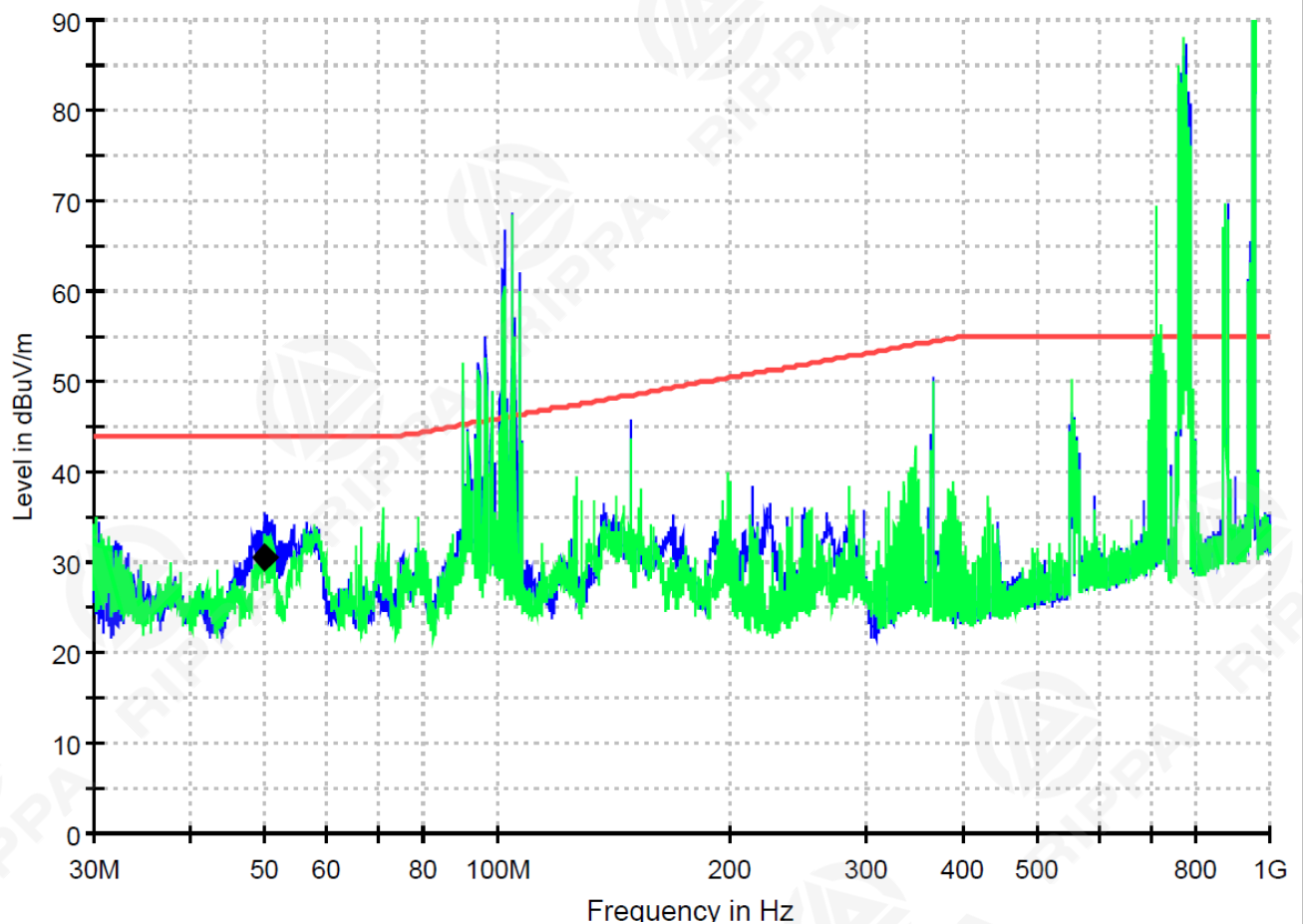
Figure 6: Spectral diagrams and measurement results for 30-1000MHz, Vertical polarization, P2 for NDI313



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBuV/m)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
64.000000	40.3	3.7	44.0
246.760000	24.7	27.1	51.8

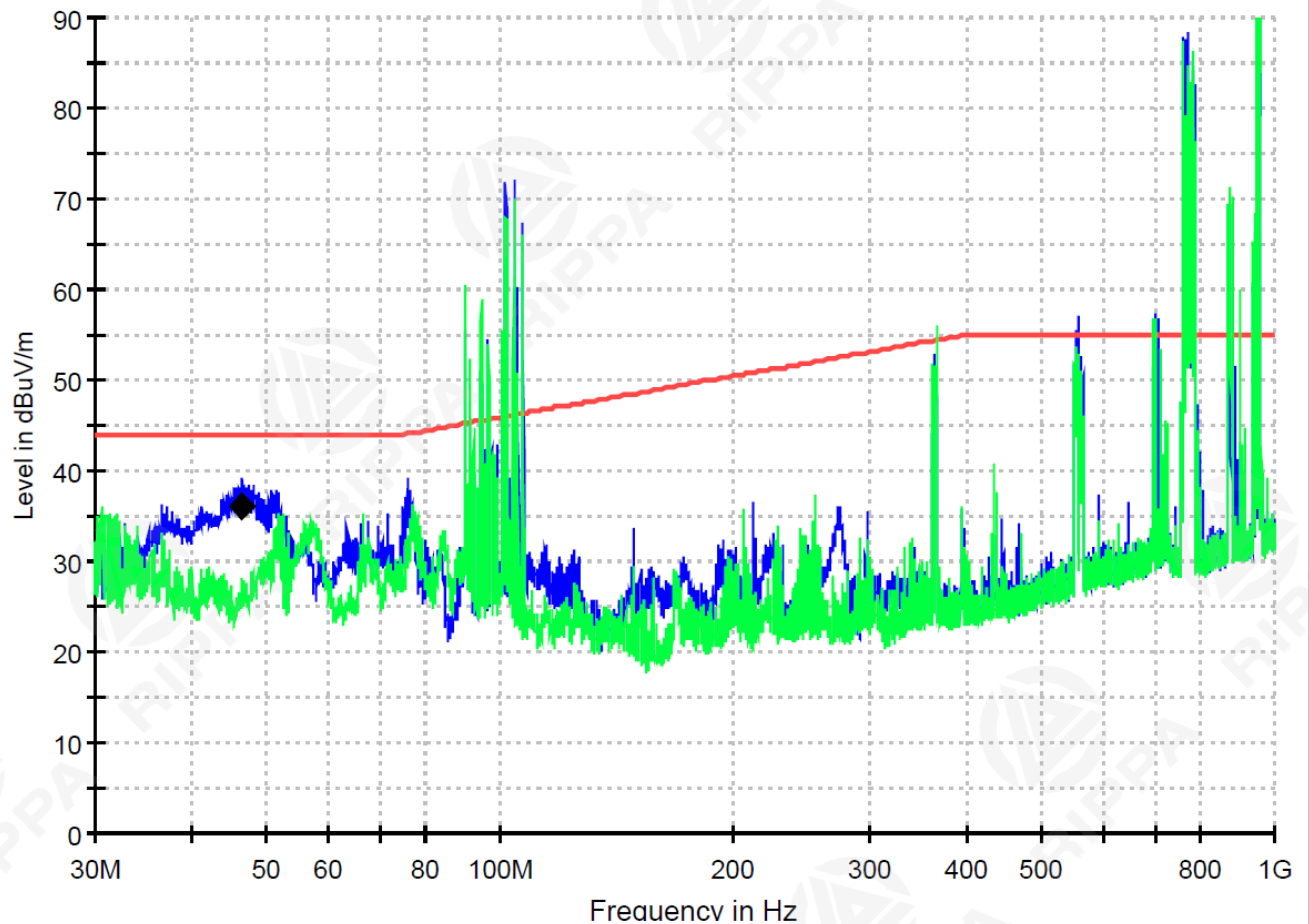
Figure 7: Spectral diagrams and measurement results for 30-1000MHz, Horizontal polarization, P1 for NDI320



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBuV/m)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
49.800000	30.5	13.5	44.0

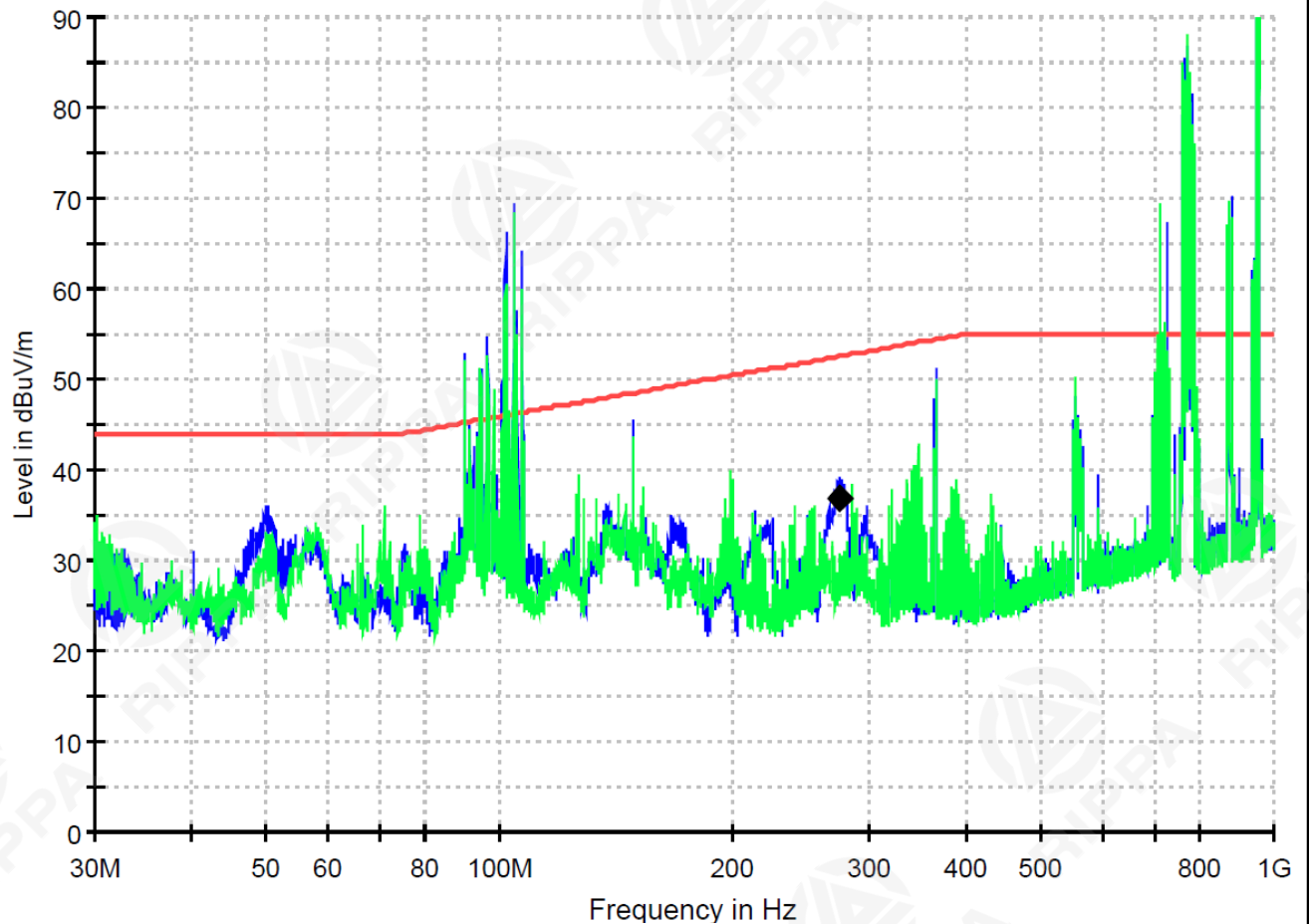
Figure 8: Spectral diagrams and measurement results for 30-1000MHz, Vertical polarization, P1 for NDI320



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBuV/m)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
46.520000	36.0	8.0	44.0

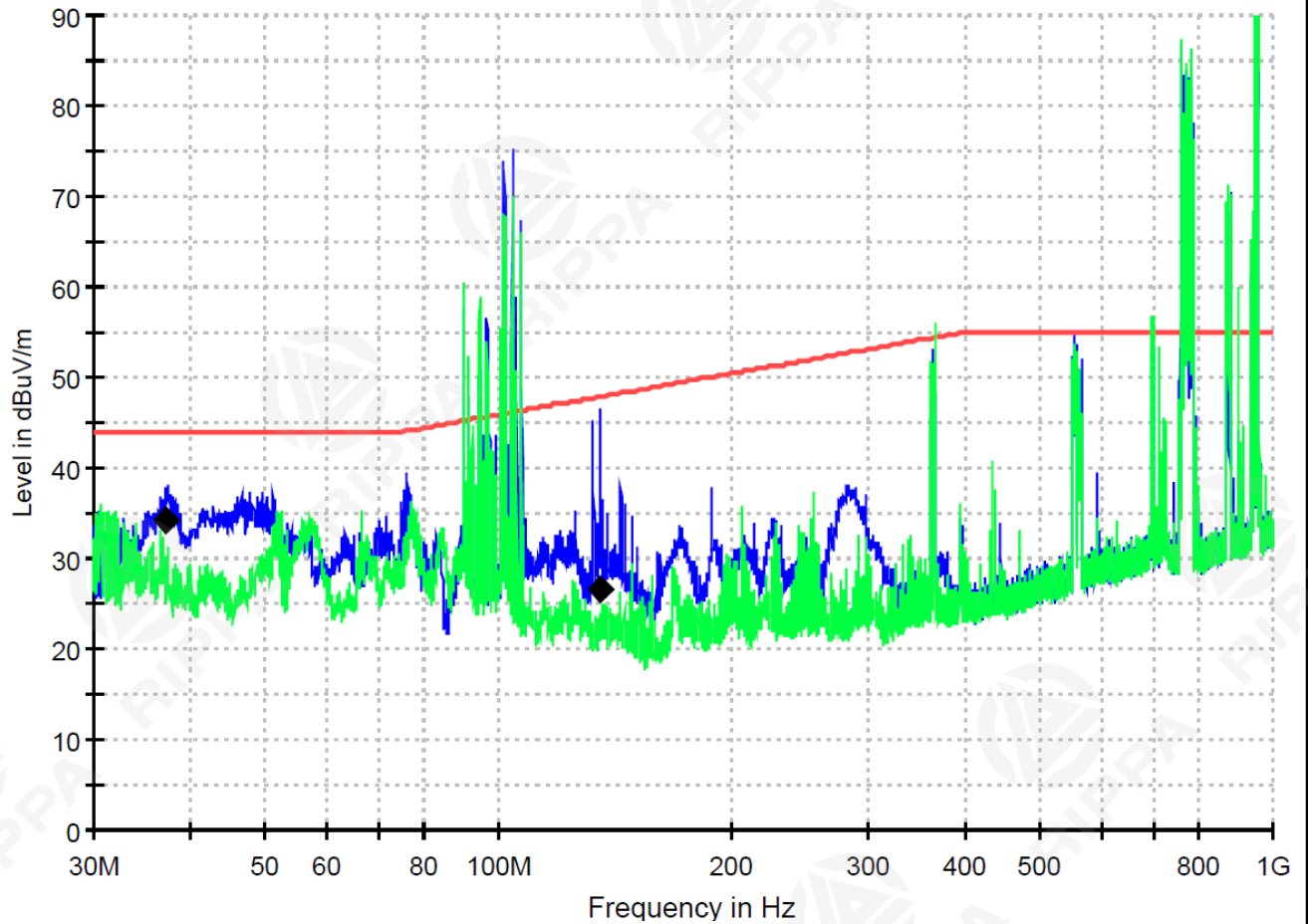
Figure 9: Spectral diagrams and measurement results for 30-1000MHz, Horizontal polarization, P2 for NDI320



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBuV/m)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
274.120000	36.8	15.7	52.5

Figure 10: Spectral diagrams and measurement results for 30-1000MHz, Vertical polarization, P2 for NDI320



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBuV/m)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
37.160000	34.3	9.7	44.0
135.000000	26.6	21.3	47.9

4.2 Narrowband Emission in the Frequency Range above 30 MHz

Result:**Passed**

Date of testing : 11.09.2023
Test procedure : EN ISO 13766-1:2018
Frequency range : 30 - 1000MHz
Limits : Limits (3m measurement distance): 30-75MHz, 34dB μ V/m; 75-400MHz, 34 to 45 dB μ V/m increasing with frequency; 400-1000MHz, 45dB μ V/m
Margin requirement: : No less than 2dB
Kind of test site : On-site testing
Height of the receiving antenna : 1.8m
Test distance : 3m
Operation modes : Engine off; All other electronic systems on.
Ambient conditions : Temperature: 27°C, relative humidity: 65%

The test was performed with the EUT in the operation modes as described above. Following are the measurement results for horizontal polarization and vertical polarization respectively. The measurement results may also include the contribution of the ambient interference; due to that the disturbance emanated from the EUT combined with the ambient interference did exceed the corresponding limit, no further investigation was made to discriminate whether the EUT or the ambient interference is the main contributor. In the following figures, the symbols “♦” means average values which were measured in final measurement.

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Figure 11: Spectral diagrams and measurement results for 30-1000MHz, ambient noise, horizontal polarization, narrowband

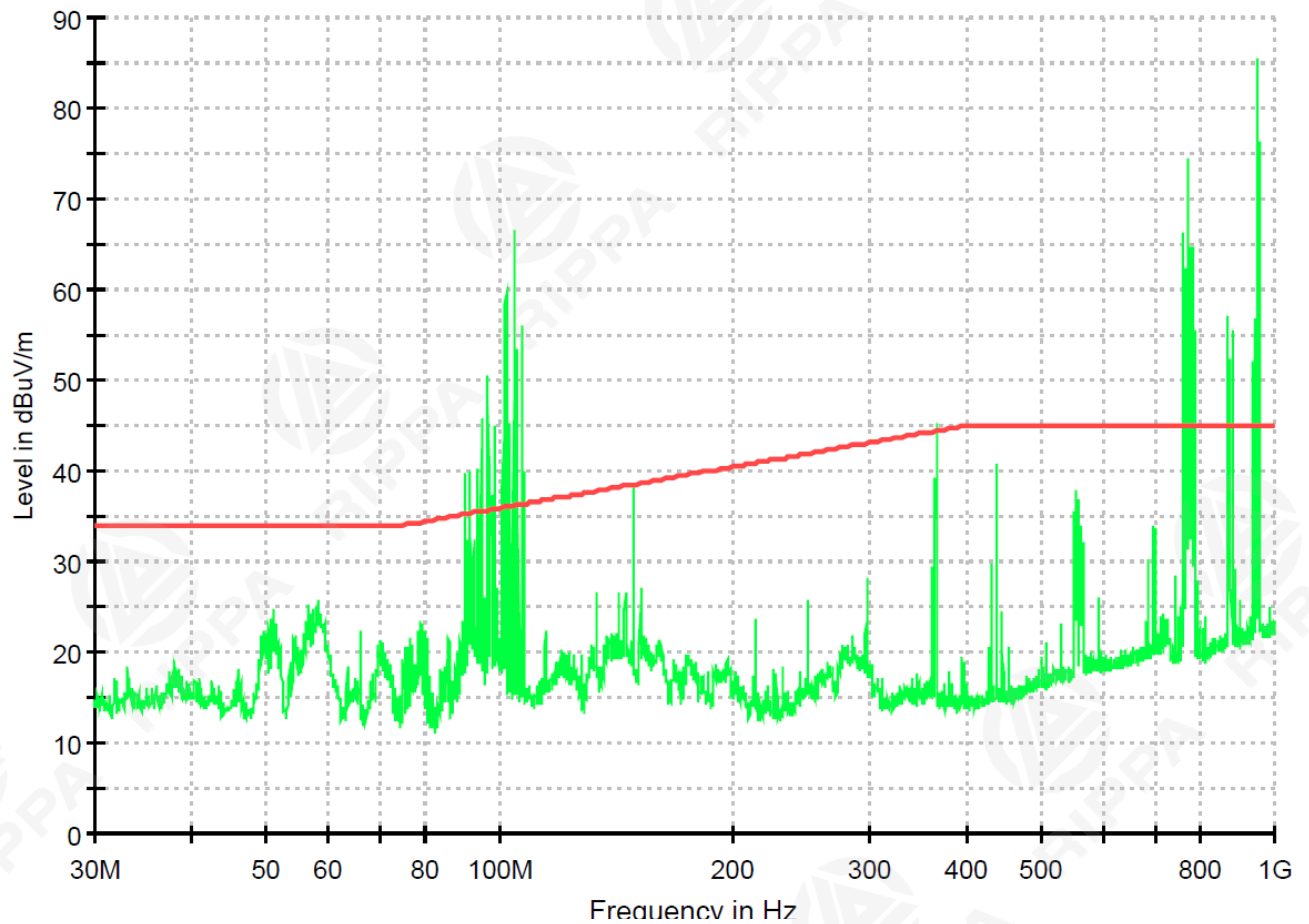


Figure 12: Spectral diagrams and measurement results for 30-1000MHz, ambient noise, vertical polarization, narrowband

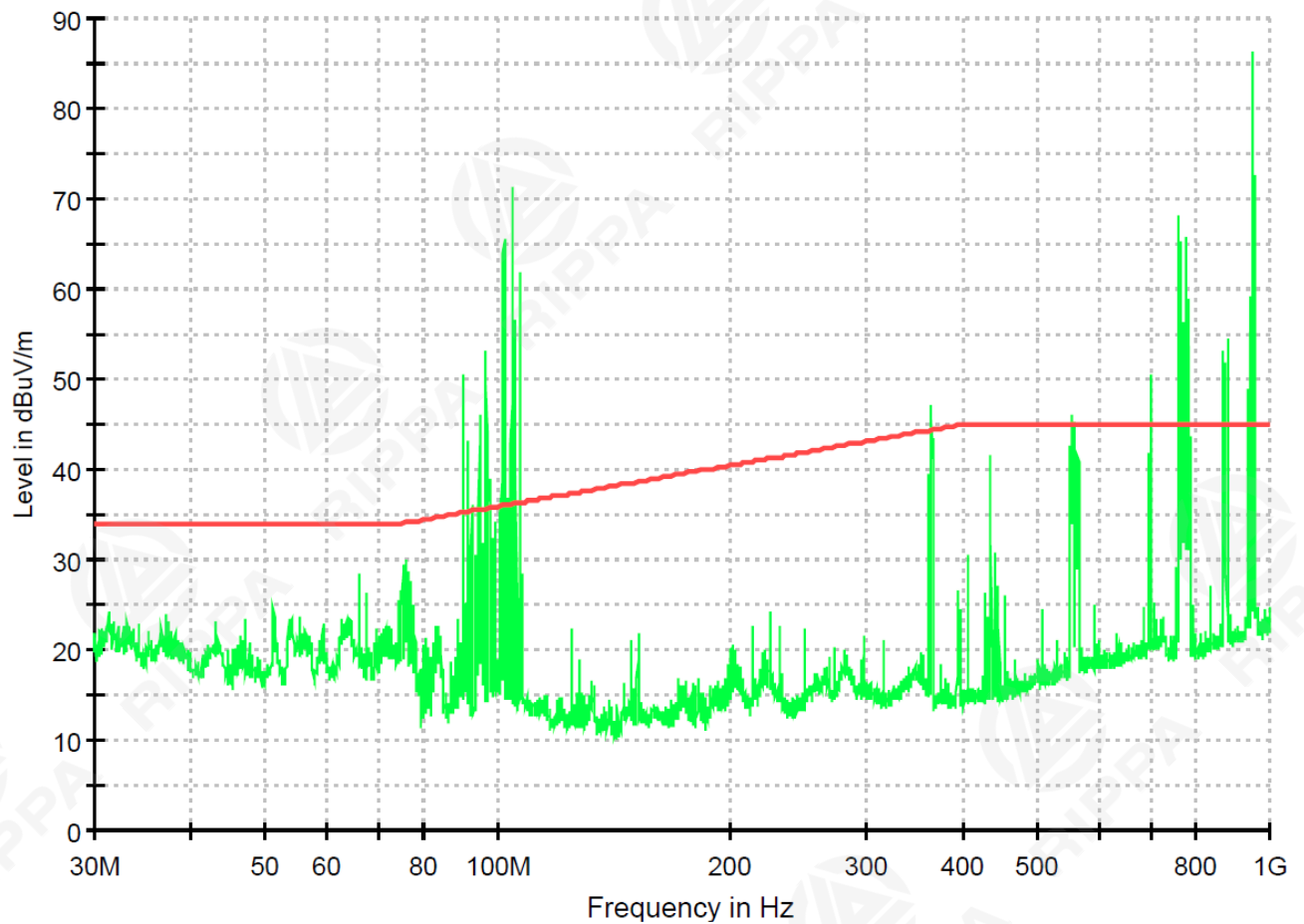
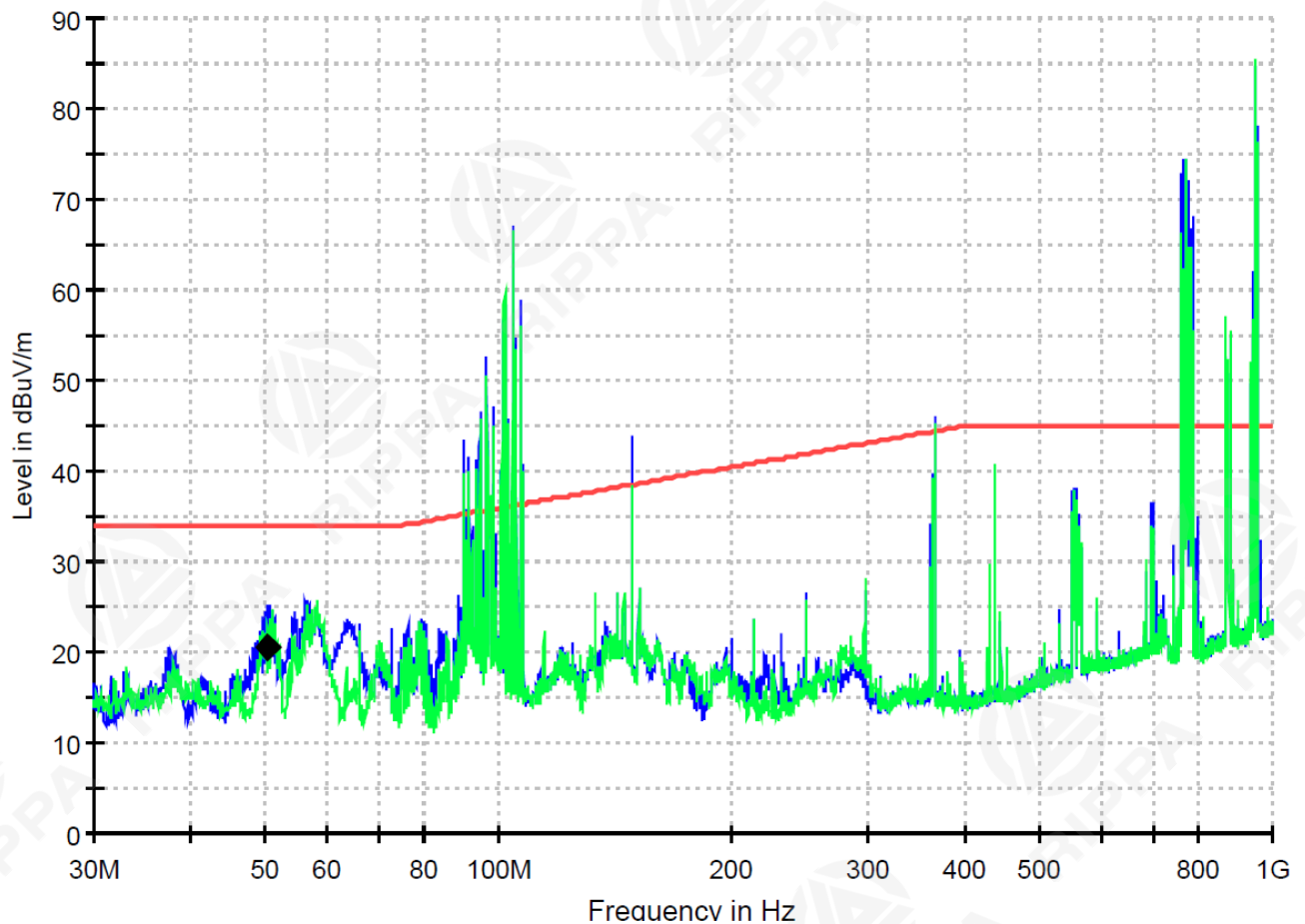


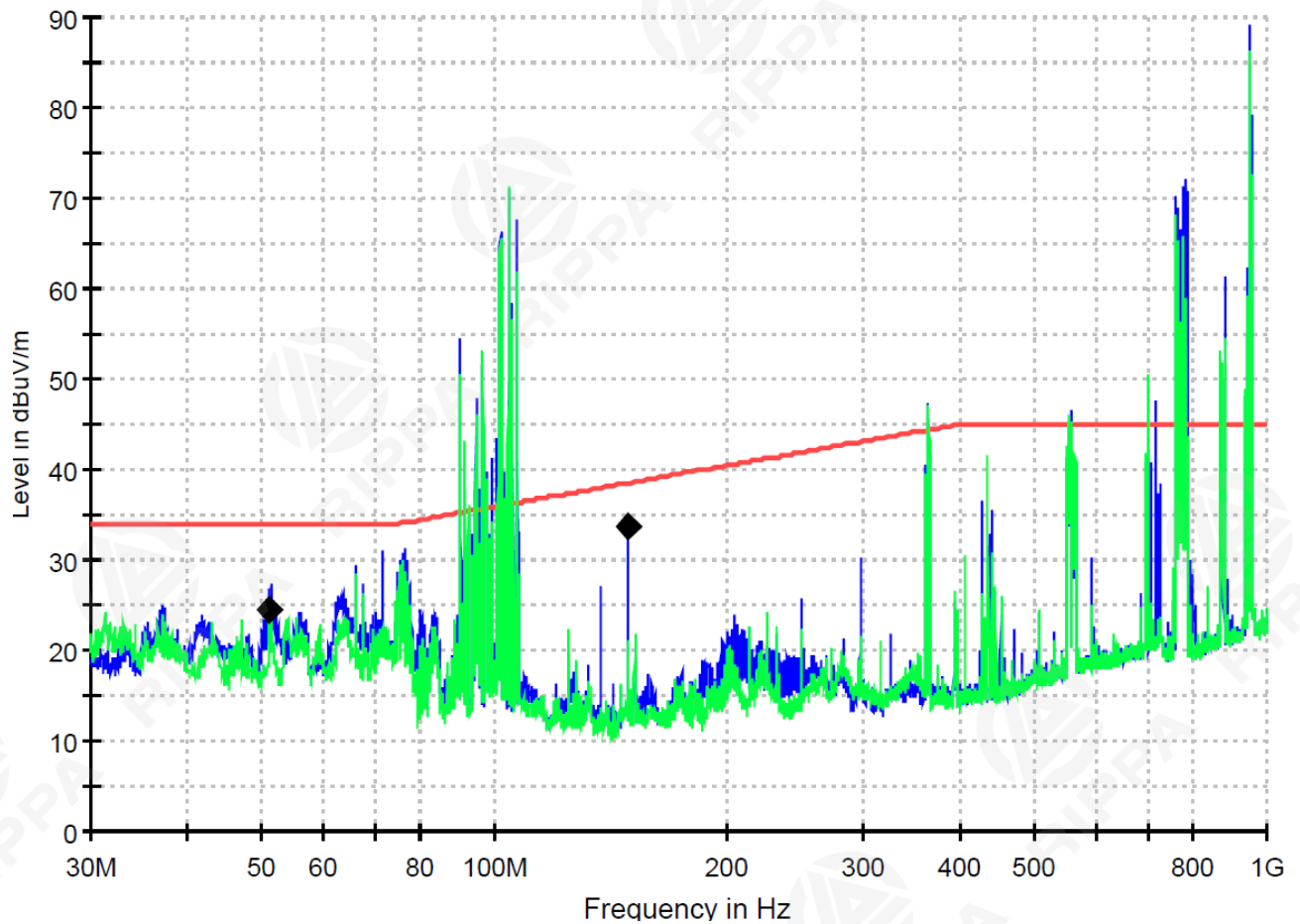
Figure 13: Spectral diagrams and measurement results for 30-1000MHz, Horizontal polarization, P1 for NDI313



Final average value measurement results:

Frequency (MHz)	CAverage (dBuV/m)	Margin - CAV (dB)	Limit - CAV (dBuV/m)
50.160000	20.6	13.4	34.0

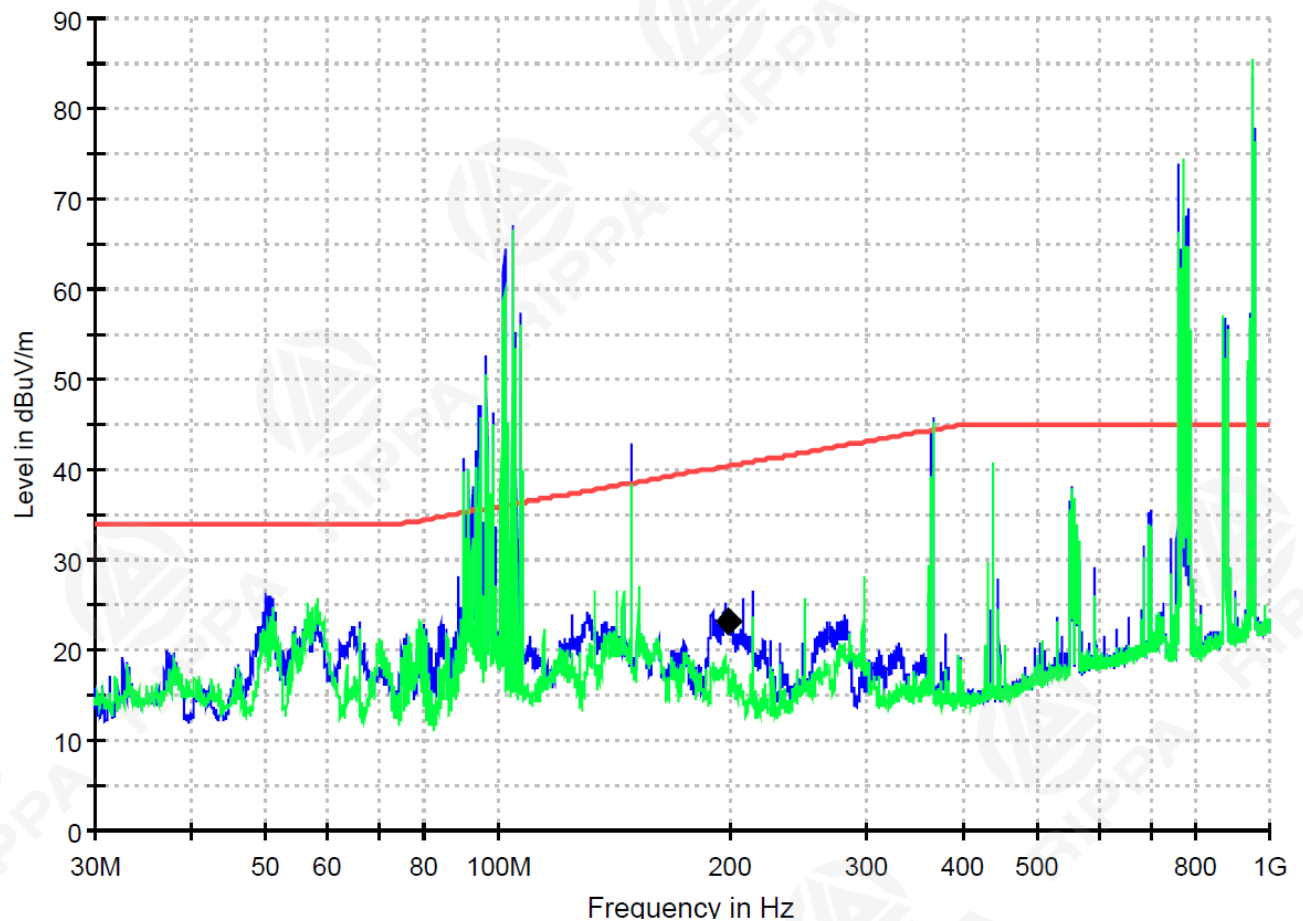
Figure 14: Spectral diagrams and measurement results for 30-1000MHz, Vertical polarization, P1 for NDI313



Final average value measurement results:

Frequency (MHz)	CAverage (dBuV/m)	Margin - CAV (dB)	Limit - CAV (dBuV/m)
51.160000	24.4	9.6	34.0
148.480000	33.7	4.8	38.5

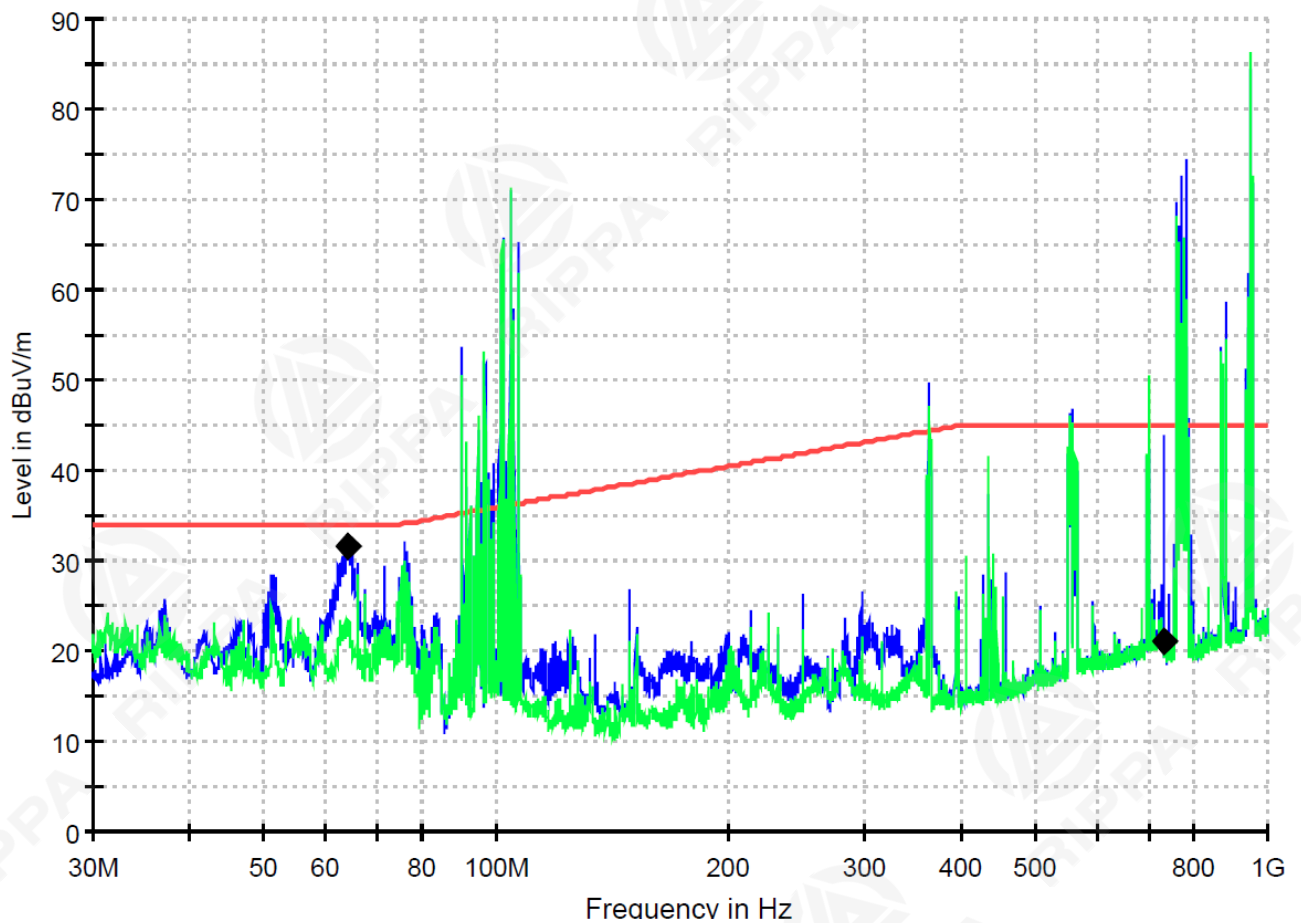
Figure 15: Spectral diagrams and measurement results for 30-1000MHz, Horizontal polarization, P2 for NDI313



Final average value measurement results:

Frequency (MHz)	CAverage (dBuV/m)	Margin - CAV (dB)	Limit - CAV (dBuV/m)
198.080000	23.2	17.2	40.4

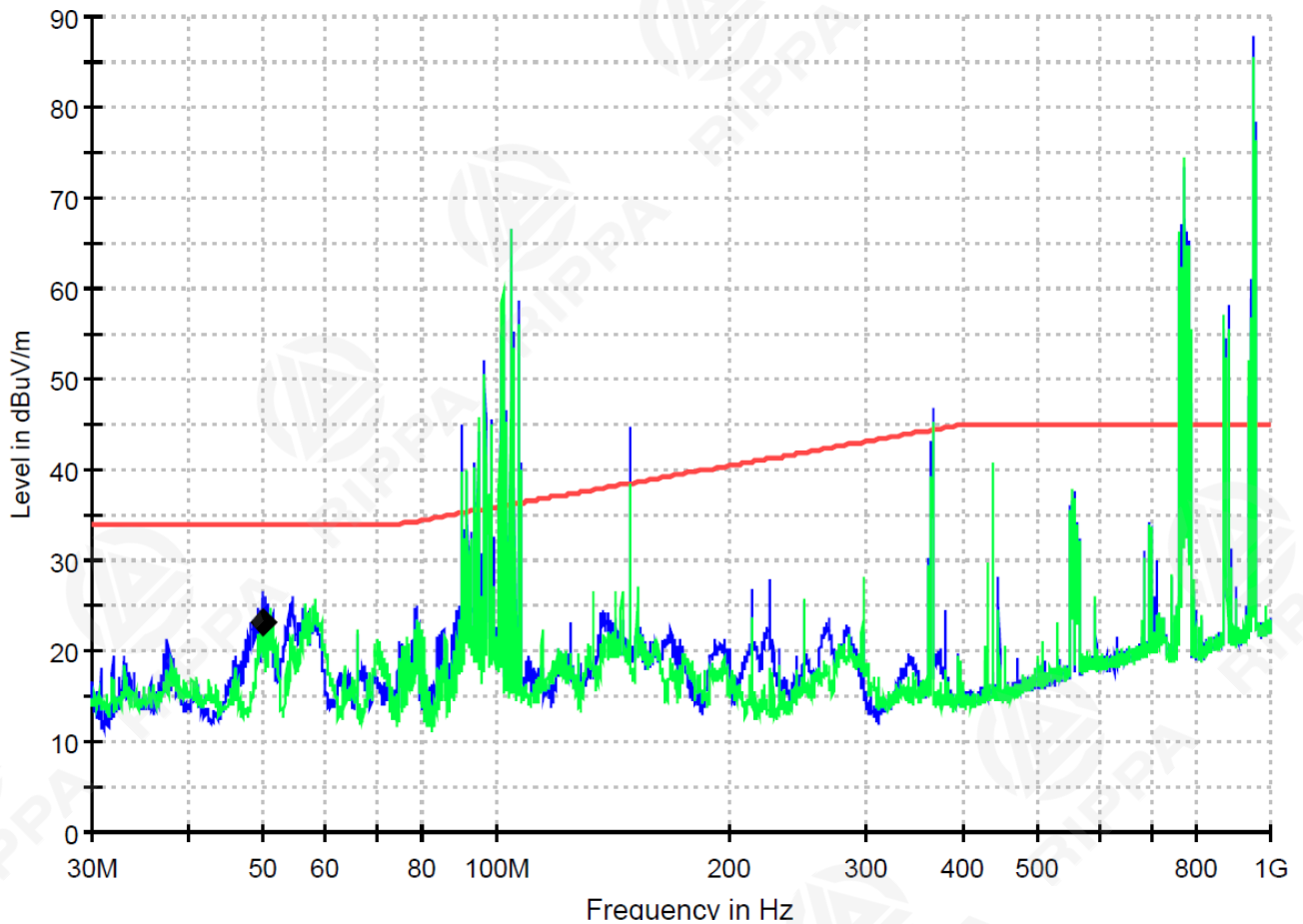
Figure 16: Spectral diagrams and measurement results for 30-1000MHz, Vertical polarization, P2 for NDI313



Final average value measurement results:

Frequency (MHz)	CAverage (dBuV/m)	Margin - CAV (dB)	Limit - CAV (dBuV/m)
64.240000	31.7	2.3	34.0
731.880000	21.1	23.9	45.0

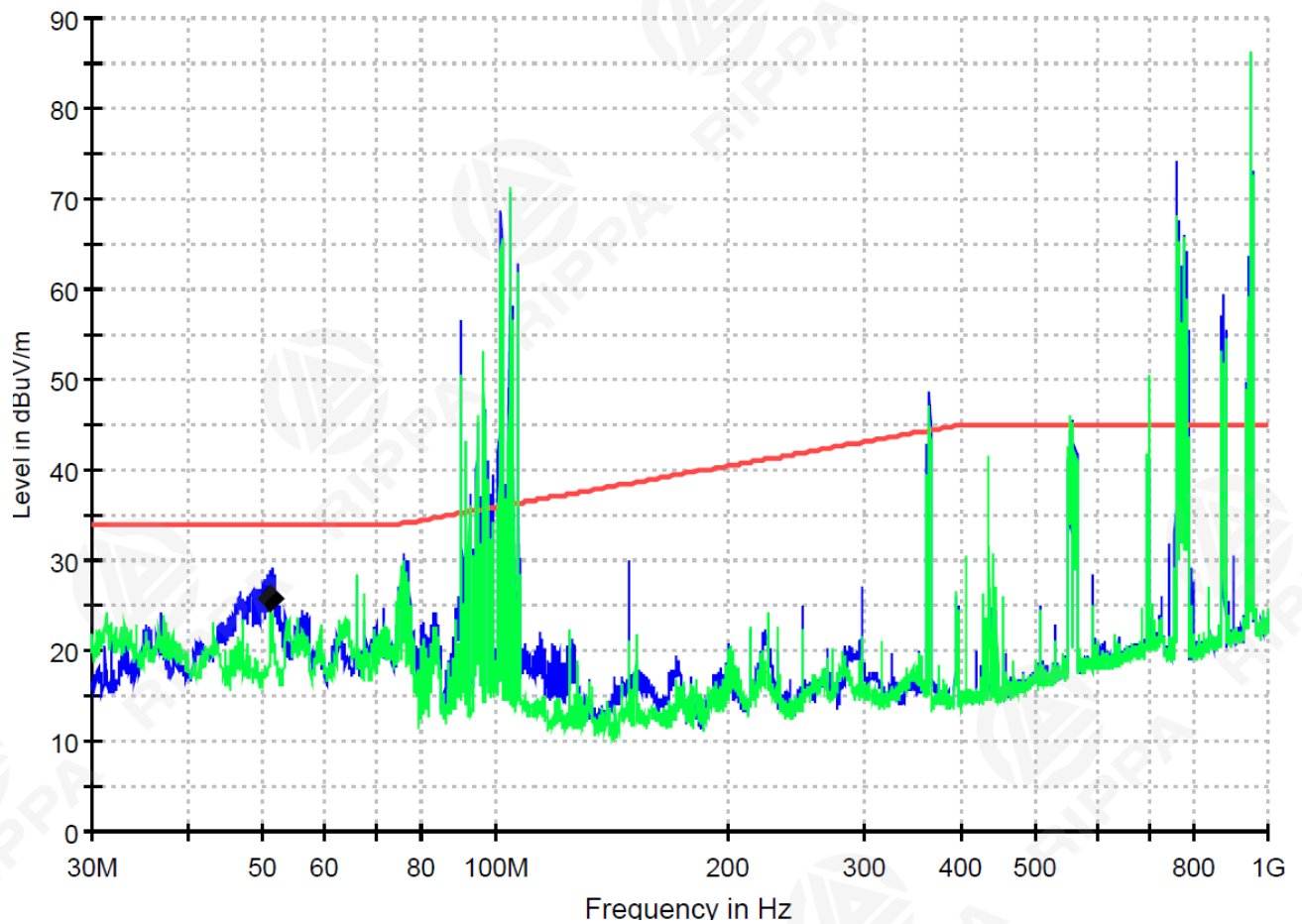
Figure 17: Spectral diagrams and measurement results for 30-1000MHz, Horizontal polarization, P1 for NDI320



Final average value measurement results:

Frequency (MHz)	CAverage (dBuV/m)	Margin - CAV (dB)	Limit - CAV (dBuV/m)
49.840000	23.2	10.8	34.0

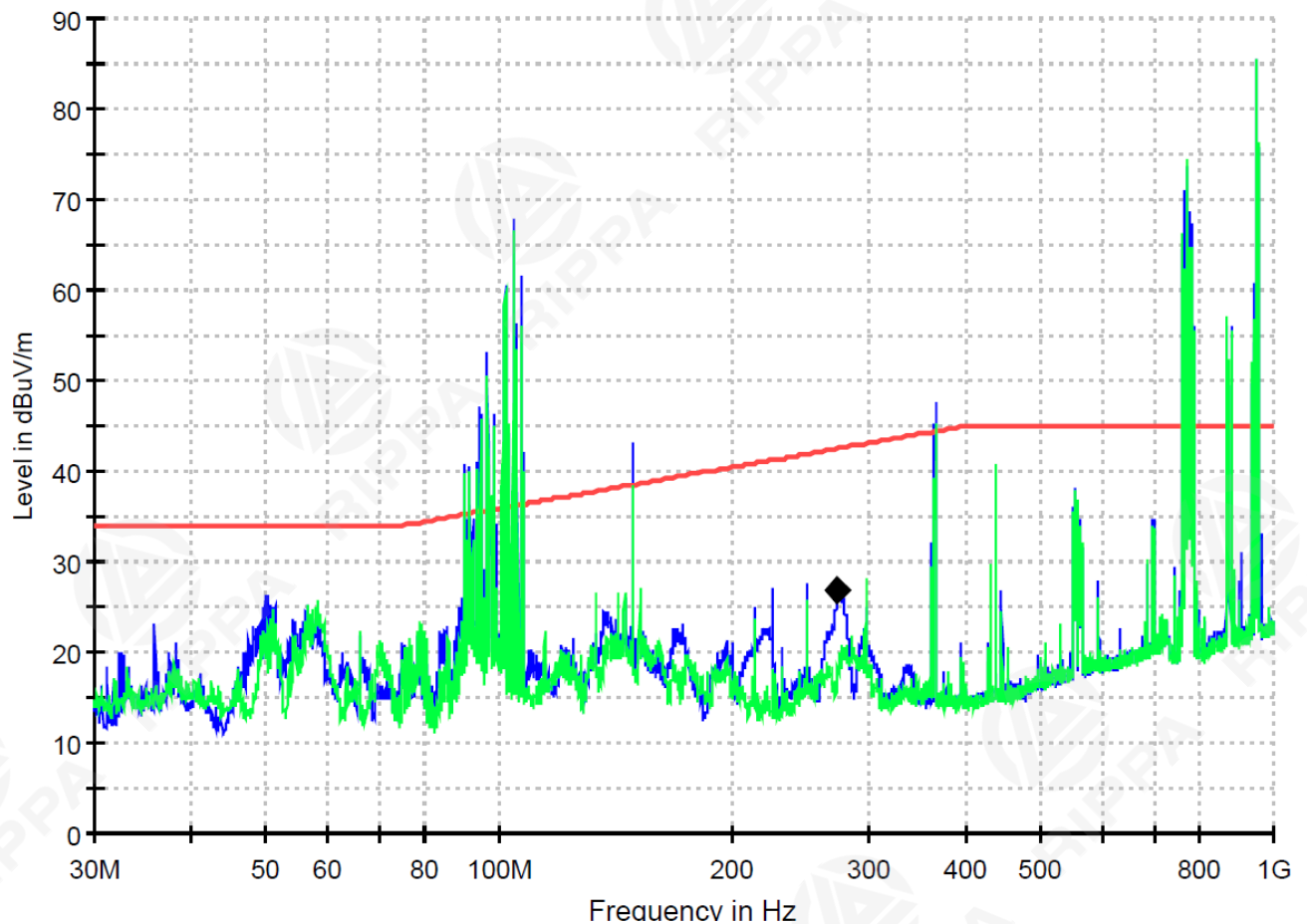
Figure 18: Spectral diagrams and measurement results for 30-1000MHz, Vertical polarization, P1 for NDI320



Final average value measurement results:

Frequency (MHz)	CAverage (dBuV/m)	Margin - CAV (dB)	Limit - CAV (dBuV/m)
51.000000	25.7	8.3	34.0

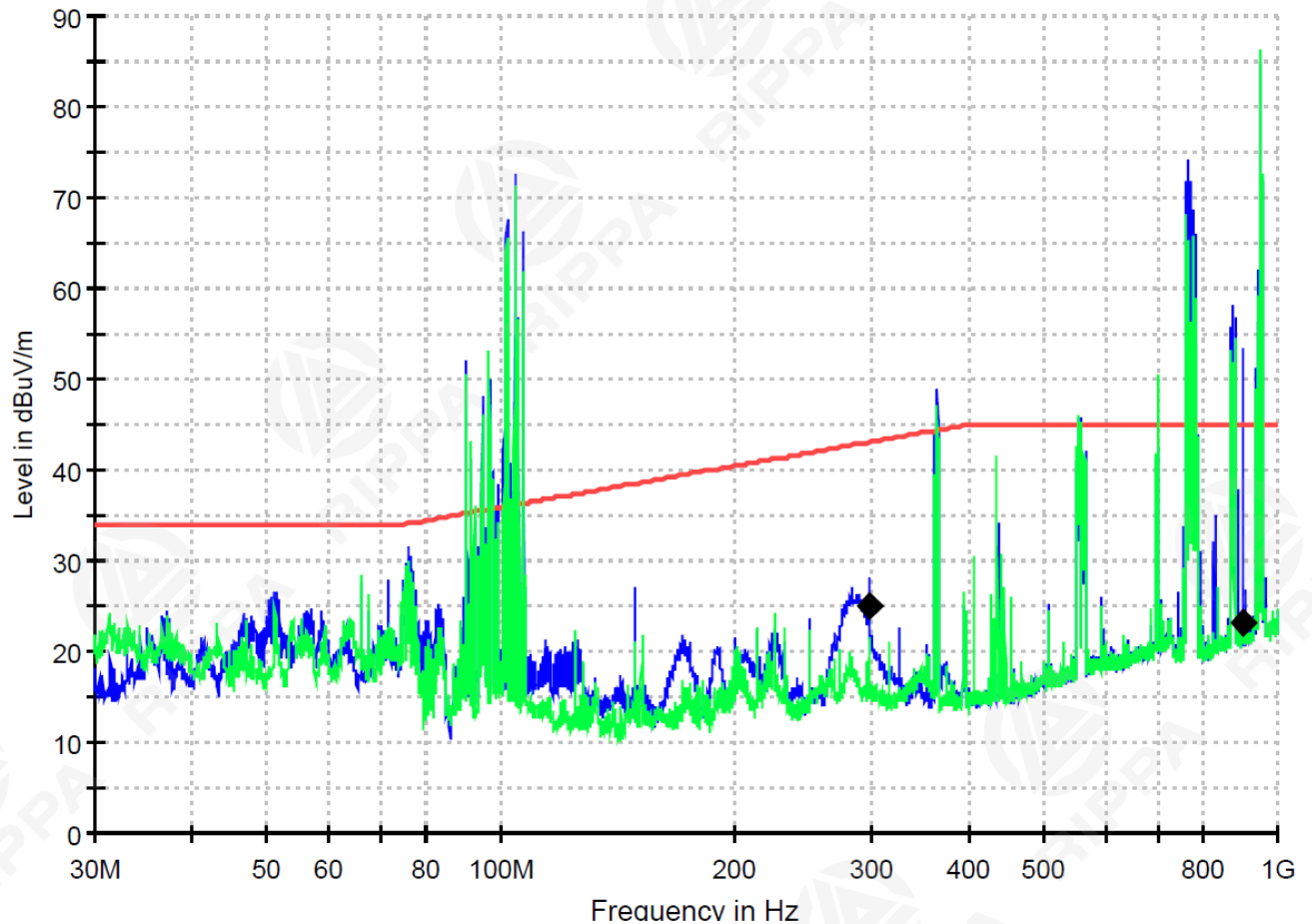
Figure 19: Spectral diagrams and measurement results for 30-1000MHz, Horizontal polarization, P2 for NDI320



Final average value measurement results:

Frequency (MHz)	CAverage (dBuV/m)	Margin - CAV (dB)	Limit - CAV (dBuV/m)
273.440000	26.9	15.6	42.5

Figure 20: Spectral diagrams and measurement results for 30-1000MHz, Vertical polarization, P2 for NDI320



Final average value measurement results:

Frequency (MHz)	CAverage (dBuV/m)	Margin - CAV (dB)	Limit - CAV (dBuV/m)
297.040000	25.1	17.9	43.0
899.440000	23.1	21.9	45.0

5 Test Results I M M U N I T Y

During the immunity tests, the EUT was operated under conditions specified by clause 3.1 of this report.

According to EN ISO 13766-1:2018, Table 3:

Functional status	Description
A (I)	All functions of a device/system perform as designed during and after exposure to a disturbance.
B (II)	All functions of a device/system perform as designed during exposure; however, one or more of them may go beyond the specified tolerance. All functions return automatically to within normal limits after exposure is removed. Memory functions shall remain criterion A.
C (III)	One or more functions of a device/system do not perform as designed during exposure but returns automatically to normal operation after exposure is removed.
D (IV)	One or more functions of a device/system do not perform as designed during exposure and does not return to normal operation until exposure is removed and the device/system is reset by simple "operator/use" action.
E (V)	One or more functions of a device/system do not perform as designed during and after exposure and cannot be returned to proper operation without repairing or replacing the device/system.

Date of testing: 11.09.2023

Site temperature : 27°C
Relative Humidity : 65%

5.1 Electrostatic Discharge

Result:
Passed

The immunity against electrostatic discharge was tested in accordance with EN ISO 13766-1:2018. Test setup and ESD-Generator are according to ISO 10605:2008 which is specified by EN ISO 13766-1:2018.

Charge voltage : $\pm 4.0\text{kV}$, $\pm 6.0\text{kV}$ (Contact Discharge)
 $\pm 4.0\text{kV}$, $\pm 8.0\text{kV}$ (Air Discharge)
Generator capacitance : 330 pF (inside of the machinery)
150 pF (outside of the machinery)
Polarity : positive / negative
Number of discharges : >10 at each point
Operation mode : Engine and all electronic systems on
Performance criteria : Class A($\pm 4.0\text{kV}$ Contact and Air discharge)
Class C($\pm 6.0\text{kV}$ Contact discharge and $\pm 8.0\text{kV}$ Air discharge)

Table 2: ESD, Positive / Negative Polarity

Position	Kind of Discharge	Result	Remarks
Control panel	Air discharge $\pm 4\text{kV}$ and $\pm 8\text{kV}$	Passed	All function perform as designed during and after exposure to a disturbance
Metal enclosure	Contact discharge $\pm 4\text{kV}$ and $\pm 6\text{kV}$	Passed	Ditto
Screws	Contact discharge $\pm 4\text{kV}$ and $\pm 6\text{kV}$	Passed	Ditto
Emergency switch	Air discharge $\pm 4\text{kV}$ and $\pm 8\text{kV}$	Passed	Ditto
LED lights	Air discharge $\pm 4\text{kV}$ and $\pm 8\text{kV}$	Passed	Ditto

5.2 Radio Frequency Electromagnetic Field

Result:
Passed

According to clause A.3.2.2 of IEC 61800-3:2004+A1, the test was only performed at some discrete frequencies.

Performance criterion is described in clause 4.1.3 of EN ISO 13766-1:2018.

When a test specimen is subjected to the immunity requirements, operator controls and any automatic controls for the machinery and any attachments or machinery shall remain functional so as to provide continued control of the machinery. This also applies to secondary or shut-down systems which are intended to be operated when the primary control has failed.

Reference standards	: IEC 61800-3:2004+A1, clause A3.2.2
Test level	: 30V/m
Frequency range	: 20M-2000MHz
Modulation	: Pulse Modulation for 915MHz Frequency Modulation for other frequencies
Test frequencies	: 52MHz: ISM frequency 145MHz: business radio band 435MHz: ISM frequency 915MHz: GSM915
Operation mode	: Engine and all electronic systems on
Performance criteria	: Clause 4.1.3 of EN ISO 13766-1:2018

Table 3: Radiated Susceptibility, Field Strength 30V/m

Position	Observation	Remarks
Enclosure of EUT	Amateur radio transceiver	Passed
Enclosure of EUT	Mobile phone	Passed

6 Photographs of the Test Set-Up

Photograph 1: Set-up for radiated electromagnetic disturbances above 30MHz



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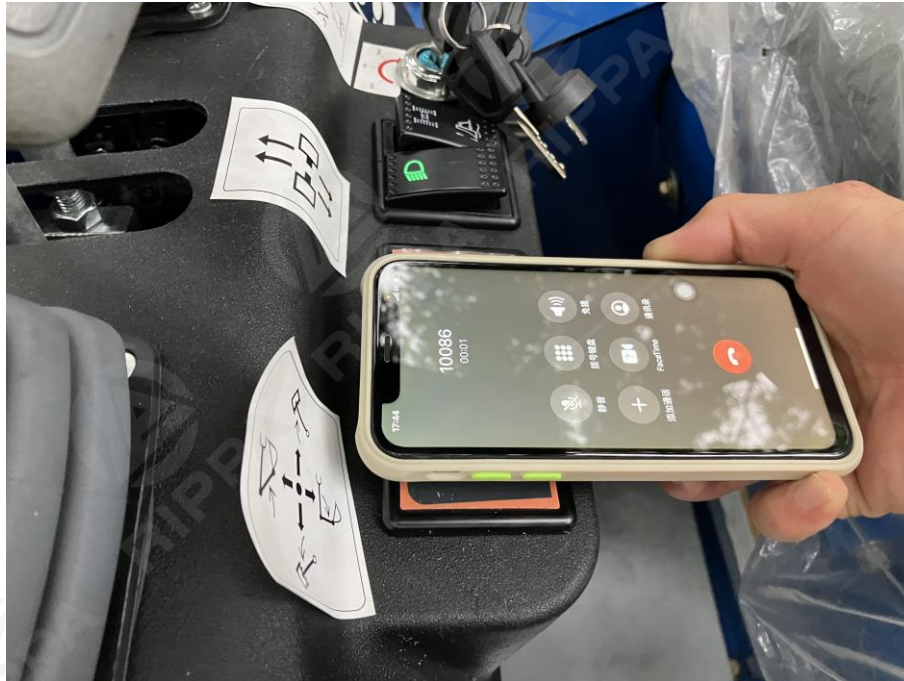
Photograph 2: Set-up for immunity test of ESD



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Photograph 3: Set-up for radio frequency electromagnetic field



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