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Confidential Report

EMC Test Report for Vox Power Ltd

Report Reference: 20E8799-1

Vox Power Product: VCCS300 Series

15TH SEPTEMBER 2020

COMPLIANCE ENGINEERING IRELAND LTD.

Client:	Test of:
Vox Power Ltd **Attention: Mr. Brian McDonald**	**300W conduction cooled power supply** **To:** **EN 55011: 2009 + A1: 2010** **EN 60601-1-2: 2007 (3rd Edition)** **EN 60601-1-2: 2014 (4th Edition)** **EN 61000-3-2: 2014** **EN 61000-3-3: 2013** **Mil STD 461F (Parts of):RE102, CE102, RS101, RS103, CS114, CS115, CS116** **MIL-STD-704F (Parts of)** **MIL-STD-1399:Section 300A (Parts of)**

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REPORT REF: 20E8799-1	**TESTED BY: L Brien, D Ikeh**
DATE RECEIVED: 22nd July 2020	**REPORT BY: L Brien**
ISSUE DATE: 15th September 2020	**APPROVED SIGNATORY: J McAuley**
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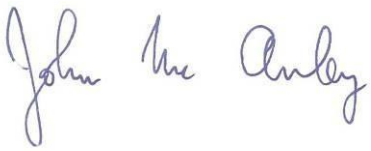

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Executive Summary

The equipment under test fulfils the standards listed below

Standard	Test result
EN 60601-1-2: 2014 (4th Edition) Title: Medical Electrical Equipment Section 1.2: Collateral standard: Electromagnetic Compatibility – Requirements and tests.	**Pass**
EN 60601-1-2: 2007 (3rd Edition) Title: Medical Electrical Equipment Section 1.2: Collateral standard: Electromagnetic Compatibility – Requirements and tests.	**Pass**

Declaration of Conformity.
The intention of these tests is such that the following statement can be added to the Declaration of Conformity i.e. DoC

This product complies with the EMC directive 2014/30/EU, EMC Directive
Conformity was demonstrated by testing to and passing the limits set in the following standards.

EN 55011: 2009 + A1: 2010 Class B
EN 60601-1-2: 2007 (3rd Edition)
EN 60601-1-2: 2014 (4th Edition)
EN 61000-3-2: 2014
EN 61000-3-3: 2013

Guidance and manufacturer's declaration – electromagnetic emissions		
The VCCS300 Power supply is intended for use in the electromagnetic environment specified below. The customer or the user of the VCCS300 Power supply should assure that it is used in such an environment		
Emissions test	**Compliance**	
RF Emissions CISPR 11 EN 55011: 2009 + A1: 2010	Group 1	The VCCS300 Power supply must emit electromagnetic energy in order to perform its intended function. Nearby electronic equipment may be affected.
RF Emissions CISPR 11 EN 55011: 2009 + A1: 2010	Class B	Class B equipment is equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes. In the documentation for the user, a statement shall be included drawing attention to the fact that there may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.
Harmonic emissions IEC 61000-3-2 EN 61000-3-2: 2014	Class A	
Voltage fluctuations / flicker emissions IEC 61000-3-3 EN 61000-3-3: 2013	All Parameters	

Table 201 – Guidance and manufacturer's declaration – electromagnetic emissions – for all equipment and systems

Guidance and manufacturer's declaration – electromagnetic immunity			
The VCCS300 Power supply is intended for use in the electromagnetic environment specified below. The customer or the user of the VCCS300 Power supply should assure that it is used in such an environment			
Immunity test	**IEC 60601 Test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2 EN 61000-4-2: 2009	±8 kV contact ±15 kV air	±2, 4, 6 & 8 kV contact ±2, 4, 8 & 15 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4 EN 61000-4-4: 2012	±2kV for power supply lines ±1 kV for input/output lines	±2kV for power supply lines ±1kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment
Surge IEC 61000-4-5 EN 61000-4-5: 2006	±1kV differential mode ±2 kV common mode	±0.5 & 1kV differential mode ±0.5, 1 & 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11 EN 61000-4-11: 2004	<5 % Ut (>95 % dip in Ut) for 0.5 cycle @ 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° 70 % Ut (30 % dip in Ut) for 25 cycles <5 % Ut (>95 % dip in Ut) for 5 sec <5 % Ut (>95 % dip in Ut) for 1 cycle 40 % Ut (>60 % dip in Ut) for 5 cycle	<5 % Ut (>95 % dip in Ut) for 0.5 cycle @ 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° 70 % Ut (30 % dip in Ut) for 25 cycles <5 % Ut (>95 % dip in Ut) for 5 sec <5 % Ut (>95 % dip in Ut) for 1 cycle 40 % Ut (>60 % dip in Ut) for 5 cycle	Mains power quality should be that of a typical commercial or hospital environment. If the user of the VCCS300 Power supply requires continued operation during power mains operation, it is recommended that the VCCS300 Power supply must be powered from an uninterruptible power supply or battery
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8 EN 61000-4-8: 2010	30 A/m	30 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment
Note: Ut is the a.c.mains voltage prior to application of the test level			

Table 202 – Guidance and manufacturer's declaration – electromagnetic immunity – for all equipment and systems

Guidance and manufacturer's declaration – electromagnetic immunity			
The VCCS300 Power supply is intended for use in the electromagnetic environment specified below. The customer or the user of the VCCS300 Power supply should assure that it is used in such an environment			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
			Portable and mobile RF communications equipment should be used no closer to any part of the VCCS300 Power Supply, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF IEC 61000-4-6 EN 61000-4-6: 2014	3 Vrms outside industrial, scientific and medical (ISM) and amateur radio bands. 6 Vrms in ISM and amateur radio bands 150 kHz to 80 MHz	6 Vrms 150 kHz to 80 MHz	d = [1.17]□P
Radiated RF IEC 61000-4-3 EN 61000-4-3: 2010	10 V/m 80 MHz to 2.7 GHz	10 V/m 80 MHz to 2.7 GHz	d = [1.17]□P…80MHz to 800 MHz d = [2.33]□P…800 MHz to 2.5GHz
	27 V/m, 18 Hz PM 385 MHz	27 V/m, 18 Hz PM 385 MHz	Where P is the maximum output power rating of the transmitter in Watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m)
	28 V/m, 50 %18 Hz PM 450 MHz	28 V/m, 50 %18 Hz PM 450 MHz	
	9 V/m, 217 Hz PM 710 MHz	9 V/m, 217 Hz PM 710 MHz	Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [a] should be less than the compliance level in each frequency range. [b]
	9 V/m, 217 Hz PM 745 MHz	9 V/m, 217 Hz PM 745 MHz	
	9 V/m, 217 Hz PM 780 MHz	9 V/m, 217 Hz PM 780 MHz	Interference may occur in the vicinity of equipment marked with the following symbol
	28V/m, 18 Hz PM 810 MHz	28V/m, 18 Hz PM 810 MHz	
	28 V/m, 18 Hz PM 870 MHz	28 V/m, 18 Hz PM 870 MHz	
	28 V/m, 18 Hz PM 930 MHz	28 V/m, 18 Hz PM 930 MHz	
	28V/m, 217 Hz PM 1720 MHz	28V/m, 217 Hz PM 1720 MHz	
	28 V/m, 217 Hz PM 1845 MHz	28 V/m, 217 Hz PM 1845 MHz	
	28 V/m, 217 Hz PM 1970 MHz	28 V/m, 217 Hz PM 1970 MHz	
	27 V/m, 217 Hz PM 2450 MHz	27 V/m, 217 Hz PM 2450 MHz	

	9V/m, 217 Hz PM 5240 MHz 9 V/m, 217 Hz PM 5500 MHz 9 V/m, 217 Hz PM 5785 MHz	9V/m, 217 Hz PM 5240 MHz 9 V/m, 217 Hz PM 5500 MHz 9 V/m, 217 Hz PM 5785 MHz	

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the VCCS300 Power Supply is used exceeds the applicable RF compliance level above, the VCCS300 Power Supply should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orientating or relocating the VCCS300 Power Supply.

b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than $[V_1]$V/m

Table 204 – Guidance and manufacturer's declaration – electromagnetic immunity – for equipment and systems that are not life-supporting

Recommended separation distances between portable and mobile RF communication equipment and the VCCS300

The VCCS300 Power supply is intended for use in an electromagnetic environment specified in Table 201. The customer or the user of the VCCS300 Power supply can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the VCCS300 Power supply as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 MHz d = [1.17]□P	80 MHz to 800 MHz d = [1.17]□P	800 MHz to 2.5GHz d = [2.33]□P
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.75
1	1.17	1.17	2.33
10	3.70	3.70	7.36
100	11.70	11.70	23.30

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (w) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Table 206 – Recommended separation distances between portable and mobile RF communications equipment and the equipment and system – for equipment and systems that are not life supporting

CONTENTS

Test Of: VCCS300

1 Equipment Under Test (EUT)

1.1 Identification of EUT

Brand Name:	VCCS300
Description:	Conduction Cooled 4x2” single output power supply
Model Name:	VCCS300-12, VCCS300-24, VCCS300-48
Serial Number:	2027C0S0046, 2027C0T041, 2027C0S026

1.2 Description of E.U.T.

Conduction Cooled 4x2” single output power supply for use in industrial, medical and military applications

1.3 Modifications

To show the effect of an enclosure on radiated emissions, the EUT was covered in conductive fabric for the 48V enclosed RE102 scan between 2 and 30MHz.

1.4 Support Equipment List

300W Resistive load

1.5 Date of Test

Testing was carried out on 1 samples of the EUT between the 22nd July and the 8th August 2020.

2 Test Specification, Methods and Procedures

2.1 Emissions Test Specification

Radiated Emissions Requirements

EN 55011: 2009 + A1: 2010 (CISPR 11)
Title:
Industrial, Scientific and Medical equipment– Radio disturbance characteristics – Limits and methods of measurement

EN 61000-3-2: 2014
Title:
Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

EN 61000-3-3: 2013
Title:
Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection

2.2 Immunity

Immunity was assessed to the parts of the following standard as requested by the manufacturer:

EN 60601-1-2: 2014 (4th Edition)
Title:
Medical Electrical Equipment
Section 1.2: Collateral standard: Electromagnetic Compatibility – Requirements and tests.

EN 60601-1-2: 2007 (3rd Edition)
Title:
Medical Electrical Equipment
Section 1.2: Collateral standard: Electromagnetic Compatibility – Requirements and tests.

EN 61000-4-2: 2009	Electromagnetic Compatibility (EMC) Part4: Testing and measurement techniques Section2: Electrostatic discharge immunity test
EN 61000-4-3: 2010	Electromagnetic Compatibility (EMC) Part4: Testing and measurement techniques Section3: Radiated, radio-frequency, electromagnetic field immunity test

EN 61000-4-4: 2012	Electromagnetic Compatibility (EMC) Part4: Testing and measurement techniques Section4: Electrical fast transient/burst immunity test
EN 61000-4-5: 2006	Electromagnetic compatibility (EMC) Part 4. Testing and measurement techniques. Section 5: Surge immunity test.
EN 61000-4-6: 2014	Electromagnetic compatibility (EMC) Part 4. Testing and measurement techniques. Section 6: Immunity to Conducted disturbances, induced by radio-frequency fields.
EN 61000-4-8: 2010	Electromagnetic Compatibility (EMC) Part4: Testing and measurement techniques Section4: Power frequency magnetic field immunity test
EN 61000-4-11: 2004	Electromagnetic Compatibility (EMC) Part4: Testing and measurement techniques Section11: Voltage dips, short interruptions and voltage variations immunity test.

2.3 Apparatus and Methods:

Measuring apparatus used during tests was designed and built to the requirements of: C.I.S.P.R. 16.

3 Deviations or Exclusions from the Test Specifications

3.1 Deviations

Up to date versions of the basic standards have been used in this test programme. Where necessary, we have verified that the requirements of any older basic standards as may be referred to in the product standard have been complied with.

3.2 Exclusions

There were no exclusions from the test specification.

4 Operation of E.U.T. During Testing

4.1 Operating Environment

Supply Voltage: 230 Vac (50 Hz)

The following were the conditions at the time of immunity testing.

Temperature: 19-21˚C
Humidity: 49-52% RH

4.2 Operating Mode

The EUT was configured as 24V output, unless stated otherwise.

5 Results

5.1 Conducted Emissions

Measurements of conducted emissions were carried out using the receiver analysis feature, which uses three detectors, peak, quasi peak and average. Using this mode the voltage emission spectrum could be scanned in peak detection mode and emissions, which exceeded a sub range margin relevant to the respective limits, could be further measured. The receiver bandwidth was set to 10 kHz.

The EUT complied with the Class B conducted emission specification of EN 55011. See Appendix 5 for results.

5.1.1 Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for the conducted emissions test was ±3.5 dB.

5.2 Radiated Emissions

Compliant measurements of radiated emissions were carried out in a semi anechoic chamber from 30 MHz to 1 GHz. The equipment and cable orientation were investigated to ensure that maximum emissions were obtained at critical frequencies. The antenna height was also adjusted through the range of 1m - 4m.
The receiver bandwidth was set to 120 kHz for frequencies between 30 MHz and 1 GHz.

The EUT complied with the Class B radiated emission specification of EN 55011.

5.2.1 Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for the radiated emissions test was ±5.3 dB (from 30 to 100 MHz), ±4.7 dB (from 100 to 300 MHz) and ±3.9 dB (from 300 to 1000 MHz).

5.3 Immunity to Radiated, Radio Frequency Electromagnetic Fields

a) Radiated RF EM fields

Port:	Enclosure
Limit:	10 V/m (80% AM 1 kHz modulation)
Frequency range:	80-2700 MHz
Dwell time:	3 second dwell

The EUT was placed in the anechoic chamber.

The step sizes from 80-2700MHz were in 1% steps. The dwell time at each frequency was 3 seconds. The test level was maintained at over 10 V/m at all frequencies in accordance with EN 60601-1-2.

The distance of the antenna from the EUT was 2.2 metres. The tests were carried out with the antenna oriented in horizontal and vertical polarisations for each side of the EUT.

The EUT was deemed to comply in accordance with the manufacturer's specification.

The EUT output was monitored with an oscilloscope to confirm correct level

Radiated Immunity Tests

Frequency MHz	Modulation Frequency	Polarisation (V/H)	Level (V/m)	Result
80-2700 MHz	1 kHz	V and H	10	Complied

b) Proximity fields from RF wireless communications equipment

Port: Enclosure
Dwell time: 3 second dwell

The EUT was placed in the anechoic chamber.

The testing was carried out on the spot frequencies as listed below. The dwell time at each frequency was at least 3 seconds.

A field sensor was placed in close proximity to the system. The tests were carried out with the antenna oriented in horizontal and vertical polarisations for each side of the EUT.

The EUT was deemed to comply with Performance Criteria A when tested in accordance with the manufacturer's specification.

The EUT output was monitored with an oscilloscope to confirm correct level

Radiated Immunity Tests

Frequency MHz	Modulation Frequency	Polarisation (V/H)	Level (V/m)	Result
385	18 Hz Pulse Modulation	V and H	27	Complied
450	50% 18 Hz Pulse Modulation	V and H	28	Complied
710	217 Hz Pulse Modulation	V and H	9	Complied
745	217 Hz Pulse Modulation	V and H	9	Complied
780	217 Hz Pulse Modulation	V and H	9	Complied
810	18 Hz Pulse Modulation	V and H	28	Complied
870	18 Hz Pulse Modulation	V and H	28	Complied
930	18 Hz Pulse Modulation	V and H	28	Complied
1720	217 Hz Pulse Modulation	V and H	28	Complied
1845	217 Hz Pulse Modulation	V and H	28	Complied
1970	217 Hz Pulse Modulation	V and H	28	Complied
2450	217 Hz Pulse Modulation	V and H	28	Complied
5240	217 Hz Pulse Modulation	V and H	9	Complied
5500	217 Hz Pulse Modulation	V and H	9	Complied
5785	217 Hz Pulse Modulation	V and H	9	Complied

5.4 Electrostatic Discharge Test

Port:	Enclosure
Basic Standard:	EN 61000-4-2
Limit:	±2, 4 & 8 kV contact discharges
	±2, 4, 8 & 15 kV air discharges
EUT Tested:	VCCS300-48

The ESD generator contained a discharge capacitor of 150pF and resistor of 330□ in accordance with the requirements of EN 61000-4-2. The tests were carried out using both positive and negative discharges. Discharges were applied to the EUT to comply with EN 610004-2.

Only parts of the equipment that can be touched during normal operation were subjected to discharges.

Air discharges of ±2, 4, 8 & 15 kV, were applied to different points on the enclosure. Contact discharges of ±2, 4 & 8 kV, were applied to conductive points on the enclosure, in addition to the horizontal and vertical coupling planes. 10 discharges of each polarity were applied at each location.

The EUT while powered complied with Performance Criteria A during and after the application of discharges. Discharges were applied to chassis screws and chassis only.

The EUT output was monitored with an oscilloscope to confirm correct level

5.5 Conducted RF Immunity

Ports: AC mains
Basic Standard: EN 61000-4-6
Limit: 10 Vemf, 80% AM 1 kHz modulation
Frequency range: 150 kHz to 80 MHz

The EUT was placed 0.1m above the ground plane and the mains cable was arranged 0.03m above the ground plane. All peripheral equipment was also placed 0.1m above the ground plane.

The current was injected on the mains cable in common mode. The EM Clamp was located at 0.1m from the EUT AC power port. Each surface of the EUT was more than 0.5m from other metal surfaces.

The test configuration used was the EM Clamp injection method. The system was calibrated to provide a current input level equivalent to an injected voltage level of 10 Vemf into a 150 ohm system.

The test was carried out at 230 Vac

The EUT functioned as normal during and after the testing.

The EUT output was monitored with an oscilloscope to confirm correct level

Port	Disturbance type	Result
Mains	10 Vemf, 150 kHz – 80 MHz	Complied

Results of Conducted Immunity testing

5.6 Electrical Fast Transient Test

Ports:	AC Mains
Basic Standard:	EN 61000-4-4
Limit:	±0.5, 1 & 2 kV mains power ports ±0.5 & 1 kV signal port
Repetition Rate:	5 kHz & 100 kHz

Positive and negative fast transient discharges of amplitude ±0.5, 1 & 2 kV were applied to the mains input & ±0.5 & 1 kV to the signal port in accordance with the requirements of EN 61000-4-4.

The test was carried out at 230 Vac

The EUT functioned as normal during and after the testing.

The EUT output was monitored with an oscilloscope to confirm correct level
.

Test port	Level	Result
Live	±0.5, 1 & 2 kV	Complied
Neutral	±0.5, 1 & 2 kV	Complied
Earth	±0.5, 1 & 2 kV	Complied
L-N-E	±0.5, 1 & 2 kV	Complied

Results of Fast transient testing

5.7 Surge Immunity Test

Ports:	AC Mains
Basic Standard:	EN 61000-4-5
Performance Criterion:	A
Limit, Line to Line:	± 0.5 kV & 1 kV
Line to Earth:	± 0.5 kV, 1 kV & 2 kV

Positive and negative surges were applied to each of the mains inputs in accordance with the requirements of EN 61000-4-5.

Surges were applied to the mains conductors coupled line to line.

The tests were carried out with positive and negative surges. The test was repeated every 60 seconds for a total of 5 times in each polarity and in all coupling modes. The tests were performed at 0°, 90°, 180º and 270° phases for both polarities.

The test was carried out at 230 Vac

The EUT functioned as normal during and after the testing.

The EUT output was monitored with an oscilloscope to confirm correct level

Port	Mode of conduction	Disturbance level	Result
PSU	L-N	± 0.5 kV & 1 kV	Complied
PSU	L-E	± 0.5 kV, 1 kV & 2 kV	Complied
PSU	N-E	± 0.5 kV, 1 kV & 2 kV	Complied

Results of Surge Immunity testing

5.8 Voltage Dips & Interruptions Test

Ports: AC Mains
Basic Standard: EN 61000-4-11

Dips: Mains port - > 95% dip 0.5 cycles
Mains port - >95% dip 1 cycle
Mains port – 30% dip 25 cycles
Mains port – 60% dip 10 cycles

Interruption: Mains port – Interruption 250 cycles

Dips and interruptions were applied to the mains input in accordance with the requirements of EN 61000-4-11.

The test was carried out at 100 & 240 Vac

Data is recorded for the duration of the test and analysed after the test.

The EUT continued to operate throughout the duration of the test although with some degradation in performance. Degradation B was a momentary drop in output voltage to 0V.

The EUT output was monitored with an oscilloscope to confirm correct level. Criteria B behaviour was recorded and shown in appendix 6

Port	Disturbance type	Result
Mains supply 240 Vac	>95% dip 0.5 cycles 0º, 45º, 90º, 135º, 180º, 225º, 270º, 315º	Complied A
Mains supply 240 Vac	>95% dip 1 cycles	Complied B
Mains supply 240 Vac	30% dip 25 cycles	Complied A
Mains supply 240 Vac	60% dip 10 cycles	Complied A
Mains supply 240 Vac	>95% interruption 250 cycles	Complied B

Results of Voltage Dips & Interruptions testing 48V

Port	Disturbance type	Result
Mains supply 100 Vac	>95% dip 0.5 cycles 0º, 45º, 90º, 135º, 180º, 225º, 270º, 315º	Complied A
Mains supply 100 Vac	>95% dip 1 cycles	Complied B
Mains supply 100 Vac	30% dip 25 cycles	Complied B
Mains supply 100 Vac	60% dip 10 cycles	Complied B
Mains supply 100 Vac	>95% interruption 250 cycles	Complied B

Results of Voltage Dips & Interruptions testing 48V

Port	Disturbance type	Result
Mains supply 240 Vac	>95% dip 0.5 cycles 0º, 45º, 90º, 135º, 180º, 225º, 270º, 315º	Complied A
Mains supply 240 Vac	>95% dip 1 cycles	Complied A
Mains supply 240 Vac	30% dip 25 cycles	Complied A
Mains supply 240 Vac	60% dip 10 cycles	Complied A
Mains supply 240 Vac	>95% interruption 250 cycles	Complied B

Results of Voltage Dips & Interruptions testing 24V

Port	Disturbance type	Result
Mains supply 100 Vac	>95% dip 0.5 cycles 0º, 45º, 90º, 135º, 180º, 225º, 270º, 315º	Complied A
Mains supply 100 Vac	>95% dip 1 cycles	Complied A
Mains supply 100 Vac	30% dip 25 cycles	Complied B
Mains supply 100 Vac	60% dip 10 cycles	Complied B
Mains supply 100 Vac	>95% interruption 250 cycles	Complied B

Results of Voltage Dips & Interruptions testing 24V

Port	Disturbance type	Result
Mains supply 240 Vac	>95% dip 0.5 cycles 0º, 45º, 90º, 135º, 180º, 225º, 270º, 315º	Complied A
Mains supply 240 Vac	>95% dip 1 cycles	Complied A
Mains supply 240 Vac	30% dip 25 cycles	Complied A
Mains supply 240 Vac	60% dip 10 cycles	Complied A
Mains supply 240 Vac	>95% interruption 250 cycles	Complied B

Results of Voltage Dips & Interruptions testing 12V

Port	Disturbance type	Result
Mains supply 100 Vac	>95% dip 0.5 cycles 0º, 45º, 90º, 135º, 180º, 225º, 270º, 315º	Complied A
Mains supply 100 Vac	>95% dip 1 cycles	Complied A
Mains supply 100 Vac	30% dip 25 cycles	Complied B
Mains supply 100 Vac	60% dip 10 cycles	Complied B
Mains supply 100 Vac	>95% interruption 250 cycles	Complied B

Results of Voltage Dips & Interruptions testing 12V

5.9 Power Frequency Magnetic Field Immunity Test

Basic Standard: EN 61000-4-8
Level: 30 A/m (50 Hz & 60 Hz)

The unit was placed on a non-conductive table of 0.8 meter height from the ground plane.

The current level was set to 30 A/m and the unit was centred in the middle of the loop. The EUT was tested with the loop in both horizontal and vertical positions for one minute. The test was carried out at 230 Vac. The test was performed at 50 & 60 Hz.

The level of any interference seen was checked to ensure it remained within specified limits.

The EUT operated as normal for the duration of the test.

The EUT output was monitored with an oscilloscope to confirm correct level.

5.10 Fluctuating Harmonics

Ports: AC mains
Basic Standard: EN 61000-3-2
Class: A

The test measures the current at each of the harmonic frequencies from the second harmonic up to the fortieth harmonic.

A 50 Hertz, 230 Volt AC source was used to power the unit in compliance with
EN 61000-3-2. The current harmonic levels were measured and compared with the limit levels for Class A waveforms. See Appendix 5 for results.

5.11 Flicker

Ports: AC mains
Basic Standard: EN 61000-3-3

The E.U.T. was connected to an impedance network and a 50 Hertz, 230 Volt AC source to power the unit in compliance with EN 61000-3-3.

The mains voltage flicker test was performed for 120 minutes. The E.U.T. flicker levels were significantly below the limit. See Appendix 6 for results.

6 MIL-STD-461F SUSCEPTIBILITY TESTS

Throughout the Mil Std 461F susceptibility tests the equipment was operated and monitored by the Compliance Engineering Ireland Ltd. Engineer present for any malfunctions or degradation in performance.

6.1 RS103. RF Radiated Susceptibility, Electric Field

The equipment was set up in accordance with the requirements of RS103-1 of Mil Std 461F. The E-field sensor procedure was used for the tests between 2 MHz-6 GHz.

All fields levelling was performed on the peak of the modulated signal

The EUT output was monitored with an oscilloscope to confirm correct level.

6.1.1 RS103. RF Radiated Susceptibility. Electric Field (2MHz to 6 GHz)

The system was then subjected to 1kHz 50 % pulse modulated radiated electric fields via aerials spaced 1m from the system at levels shown in the tables below:-

Frequency MHz	Polarity	Level V/m RS103 Space Limits
2	H/V	20
4	H/V	20
6	H/V	20
8	H/V	20
10	H/V	20
20	H/V	20
40	H/V	20
60	H/V	20
80	H/V	20
100	H/V	20
200	H/V	20
400	H/V	20
600	H/V	20
800	H/V	20
1000	H/V	20
2000	H/V	20
3000	H/V	20
4000	H/V	20
5000	H/V	20
6000	H/V	20

RESULTS No malfunctions or degradations of performance occurred.

6.2 RS101, Radiated Susceptibility, Magnetic Fields, (30 Hz to 100 kHz)

The equipment was set up in accordance with RS 101.

The pre-calibration test procedures were performed with the RS-101 specified Radiating Loop and the RS-101 specified loop sensor.

The EUT was subjected to radiated Magnetic fields at frequencies according to the table below. The radiated level was at least 10dB higher than specified in the table.
The surfaces of the EUT sides and connectors were subjected to the Magnetic field at a distance of 5cm from the surfaces.

Frequency Range	Field strength RS101 Army Limits	Antenna
30 Hz to 60 Hz	180dBpT	RE101 Radiating loop
60 Hz to 100 kHz	180 dBpT to 116 dBpT	RE101 Radiating loop

The EUT output was monitored with an oscilloscope to confirm correct level.

RESULTS No malfunctions or degradations of performance occurred.

6.3 CS101, Conducted Susceptibility, Power Leads, (30 Hz to 150 kHz)

The equipment was set up in accordance with CS101. The secondary winding of the coupling transformer was placed in series with the power cable at the closest point feasible to the EUT.

The pre-calibration test procedure was performed with using a 0.5 Ω resistor using the Power limit specified in CS101-2 and data recorded according to the table below,

The EUT Mains cable was subjected to Conducted Electrical Interference at frequencies specified in Table III STD461F from 30 Hz to 150 kHZ and levels according to the table below. The frequencies were modulated at 1 kHz at 50% modulation.

The EUT output was monitored with an oscilloscope to confirm correct level.

Frequency Hz	Limit Vrms (0.5Ω) CS101 above 28V Supply limits
30	6.32
51	6.32
62	6.32
102	6.32
201	6.32
398	6.32
588	6.32
789	6.32
1,006	6.32
2,092	6.32
3,945	6.32
6,120	4.74
8,201	4.47
10,467	3.16
20,725	2.23
49,876	0.89
81,243	0.46
98,752	0.20
153,196	0.10

The output voltage of the EUT were monitored during test to determine susceptibility

RESULTS No malfunctions or degradations of performance occurred.

6.4 CS114, Conducted Susceptibility, Bulk Cable Injection, (10kHz to 200 MHz)

The equipment was set up in accordance with CS114. The Current probe was placed 5 cm from the Mains entry point on the EUT. The Current Injection probe was placed 5 cm from the Current probe.

The pre-calibration test procedures were performed with the Current injection and Current probes.

The EUT Mains cable was subjected to Conducted Electrical Interference at frequencies according to the table below. The frequencies were modulated at 1kHz at 50% modulation.

Frequency Range	Conducted Level CS114 Ground Limits
10 kHz to 1 MHz	49 dBµA to 89 dBµA
1 MHz to 30 MHz	97 dBµA
30 MHz to 200 MHz	97 dBµA to 89 dBµA

The EUT output was monitored with an oscilloscope to confirm correct level.

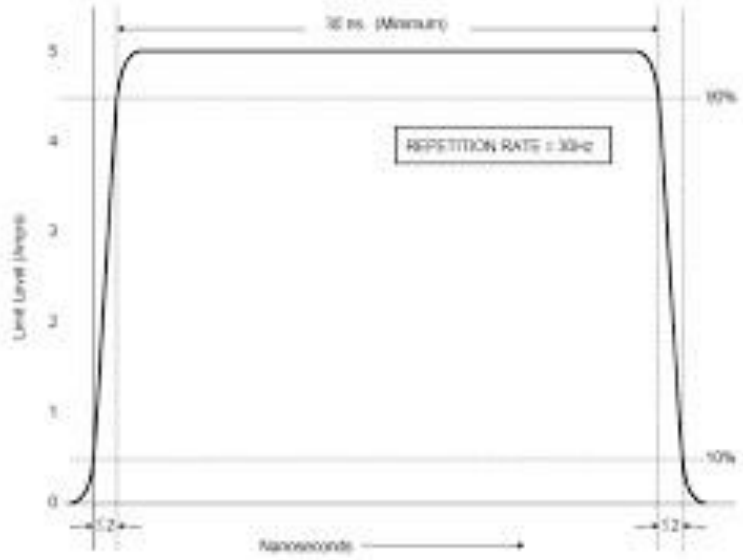
RESULTS No malfunctions or degradations of performance occurred.

6.5 CS115, Conducted Susceptibility, Bulk Cable Injection, (10 kHz to 400 MHz)

The equipment was set up in accordance with CS115. The Current probe was placed as close to the EUT as feasible. The Current Injection probe was placed 5 cm from the Current probe.

The pre-calibration test procedures were performed with the Current injection and Current probes.

The EUT Mains cable was subjected to the following Conducted Electrical Impulses according to CS115-1



The EUT output was monitored with an oscilloscope to confirm correct level.

RESULTS No malfunctions or degradations of performance occurred.

6.6 CS116, Conducted Susceptibility, Damped Sinusoid Transients, Cables and Power Leads, (10kHz to 100 MHz)

The equipment was set up in accordance with CS116. The Current probe was placed as close to the EUT as feasible. The Current Injection probe was placed 5 cm from the Current probe.

The pre-calibration test procedures were performed with the Current injection and Current probes.

The EUT Mains cable was subjected to the following Conducted Damped Sinusoid Transients according to CS116-2

Transient Frequency	Conducted Level
100 kHz	10 mA (pk)
1 MHz	10 A (pk)
10 MHz	10 A (pk)
20 MHz	10 A (pk)

The EUT output was monitored with an oscilloscope to confirm correct level.

RESULTS No malfunctions or degradations of performance occurred.

6.7 MIL-STD-1399, SECTION 300A, Shipboard Electric Power. Voltage and Frequency Tolerance

The equipment was set up in accordance with MIL-STD-1399, 300A for type I 60Hz Power supply. The voltage and frequency were varied in accordance to requirements specified in 5.1 Table II

Power Supply Type	Voltage Tolerance	Frequency Tolerance
Type I, 1 Phase	Voltage Tolerance	58.2 to 61.8
	Frequency Tolerance	418 to 462
	Frequency Modulation	0.5%
	Frequency Transient	4%
	Voltage Modulation	2%
	Voltage Transient	16%

The EUT output was monitored with an oscilloscope to confirm correct level.

RESULTS No malfunctions or degradations of performance occurred.

6.8 MIL-STD-704F, SECTION 2, SECTION 6, AIRCRAFT ELECTRIC POWER CHARACTERISTICS.

The equipment was exposed to the test characteristics described with MIL-STD-704F, SECTION 2, SECTION 6 according to MIL-HDBK-704-2 and MIL-HDBK-704-6. The voltage and frequency were varied in accordance to requirements specified in the MIL-STD-704F.

Power Supply Type	Test Suite	Test Description
SAC	102	Steady State Limits for Voltage and Frequency
SAC	104	Voltage Modulation
SAC	105	Frequency Modulation
SAC	109	Normal Voltage Transients
SAC	110	Normal Frequency Transients
SXF	102	Steady State Limits for Voltage and Frequency
SXF	104	Voltage Modulation
SXF	105	Frequency Modulation
SXF	109	Normal Voltage Transients
SXF	110	Normal Frequency Transients

The EUT output was monitored with an oscilloscope to confirm correct level.

RESULTS No malfunctions or degradations of performance occurred.

7 Analysis of Test Results, Conclusions

7.1 Measurement Uncertainties

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4 with a confidence level of 95%.

7.2 Radiated Emissions

The EUT complied with the Class B radiated emission specification of EN 55011 and the Navy, Fixed and Air Force Limits of MIL-STD-461F RE102 when mounted in enclosure

7.3 Conducted Emissions

The EUT complied with the Class B conducted emission specification of EN 55011 and the 115V Curve Limit of MIL-STD-461F CE102.

7.4 Immunity

The EUT complied with the immunity tests carried out to demonstrate compliance with EN 60601-1-2.

The EUT also complied with the selected tests from MIL-STD-461F, MIL-STD-704F and MIL-STD 1399 300A

7.5 Fluctuating Harmonics

The E.U.T. complied with the tests carried out to demonstrate compliance with EN 61000-3-2.

7.6 Flicker

The E.U.T. complied with the tests carried out to demonstrate compliance with EN 61000-3-3.

Appendix 1: Test Equipment Used

Instrument	Mftr.	Model	Serial No.
Measuring Receiver	Rohde and Schwarz	ESVS30	607
Measuring Receiver	Rohde and Schwarz	ESHS30	605
LISN	Rohde and Schwarz	ESH3-Z5	604
Bilog Antenna	Schwarzbeck	VULB 9160	889
Signal Generator	Rohde and Schwarz	SME 03	765
Signal Generator	Rohde and Schwarz	SME 03	782
Power Amplifier	Schaffner	CBA 9433	-
Power Amplifier	Milmega	AS0825-125	-
Power Amplifier	Amplifier Research	150L	-
EM Clamp	Schaffner	KEMZ 801	727
Directional Coupler	Lab Plant	RX 1026	738
Magnetic Loop	CEI		-
Electrostatic Discharge Simulator	Schaffner	NSG435	611
Signal Generator	Rohde and Schwarz	SME 06	912
Power Metre	Rohde and Schwarz	NRVS-Z5	619
Power Metre	Rohde and Schwarz	NRVS-Z5	842
Transient Simulator	EMC Partner	Tema 4000	921
Programmable Power Supply	Chroma	61505	1014
Current Probe	Eaton	94111-1	829
Current Injection Probe	Solar Electronics	9217	632
Transient Simulator	Schaffner	Best Plus	199749A016SC
Pulse Generator	Noiseken	INS420	E144176
Transient Pulse Generator	Solar	9354-1	944226

Appendix 2: Test Configurations

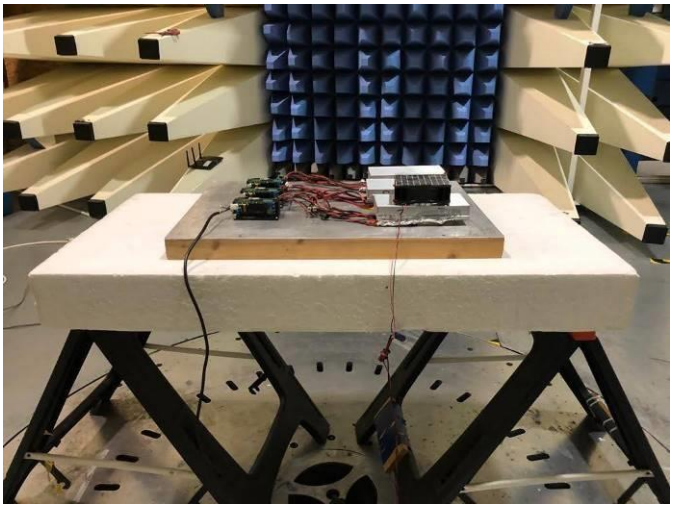


Figure 1: Radiated Emissions Test Set up

Figure 2: Radiated Immunity Test Set up

Figure 3: ESD Test Set up

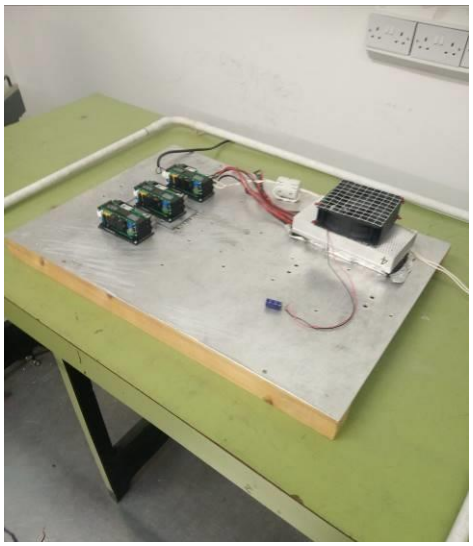


Figure 4: Magnetic Field Test Set up

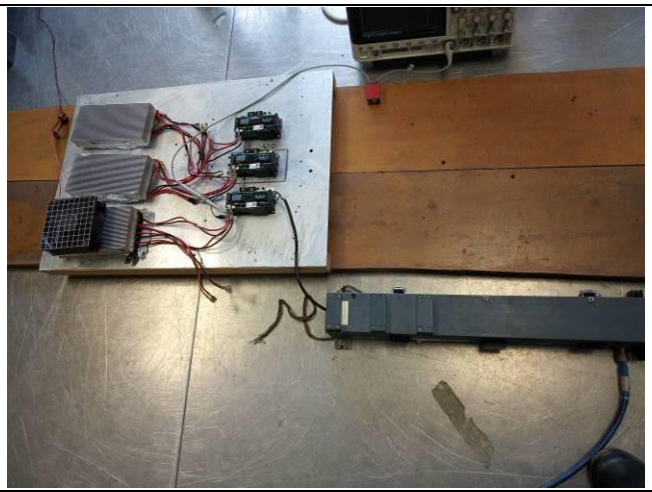


Figure 5: Conducted Immunity Test Set up

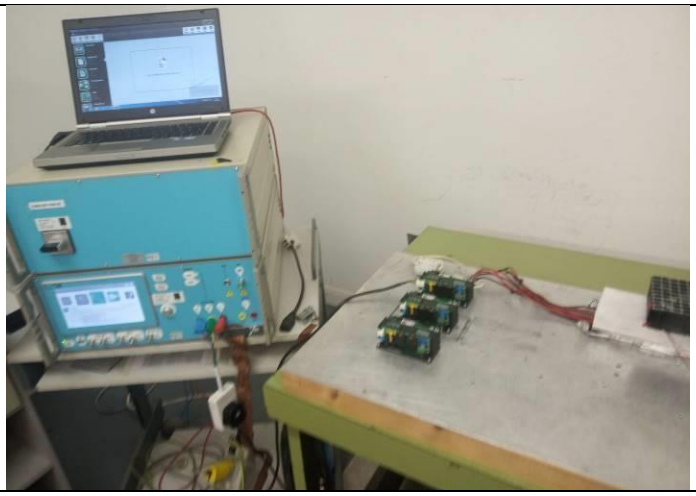


Figure 6: Fast Transient Test Set up

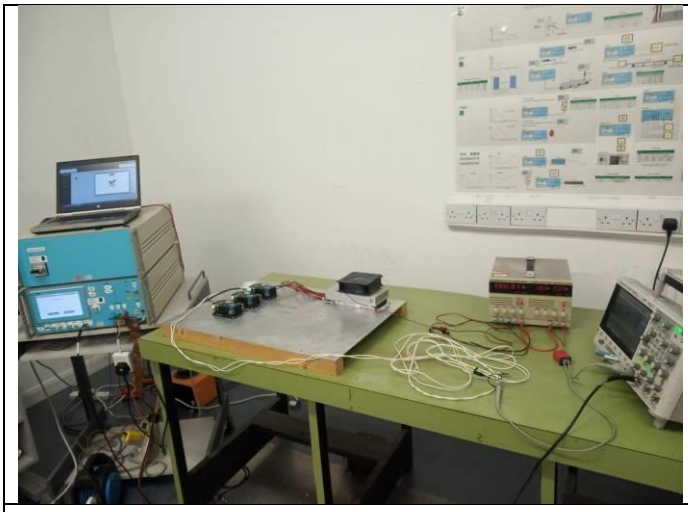


Figure 7: Surge/Dips Test Set up

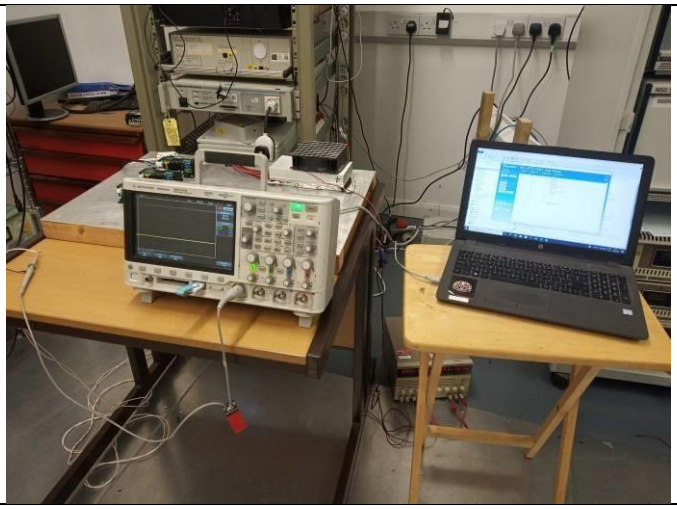


Figure 8: 704F and 1399 Testing

Figure 9: RE102 30 to 1000 MHz

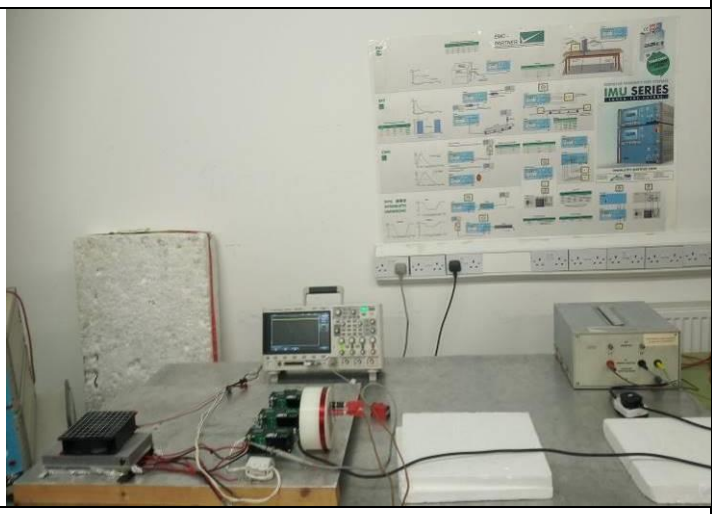


Figure 10: RS101

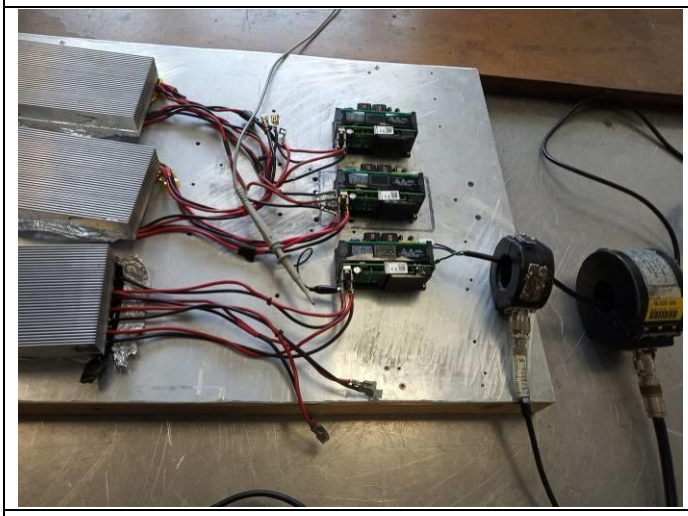


Figure 11: CS114, CS115, CS116

Figure 12: CS101

Figure 13: RE102 2 to 30 MHz

Figure 14: RE102 2 to 30 MHz Enclosed

Appendix 3: Radiated Emissions Test Results

22. Jul 20 10:02
Scan Settings (1 Range)
|--------- Frequencies ----------||---------- Receiver Settings ----------|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 1000M 120k 120k PK 5ms 0dBLD OFF 60dB

Transducer No. Start Stop Name
1 9 20M 1000M 830CAB
21 30M 1000M BILOG889

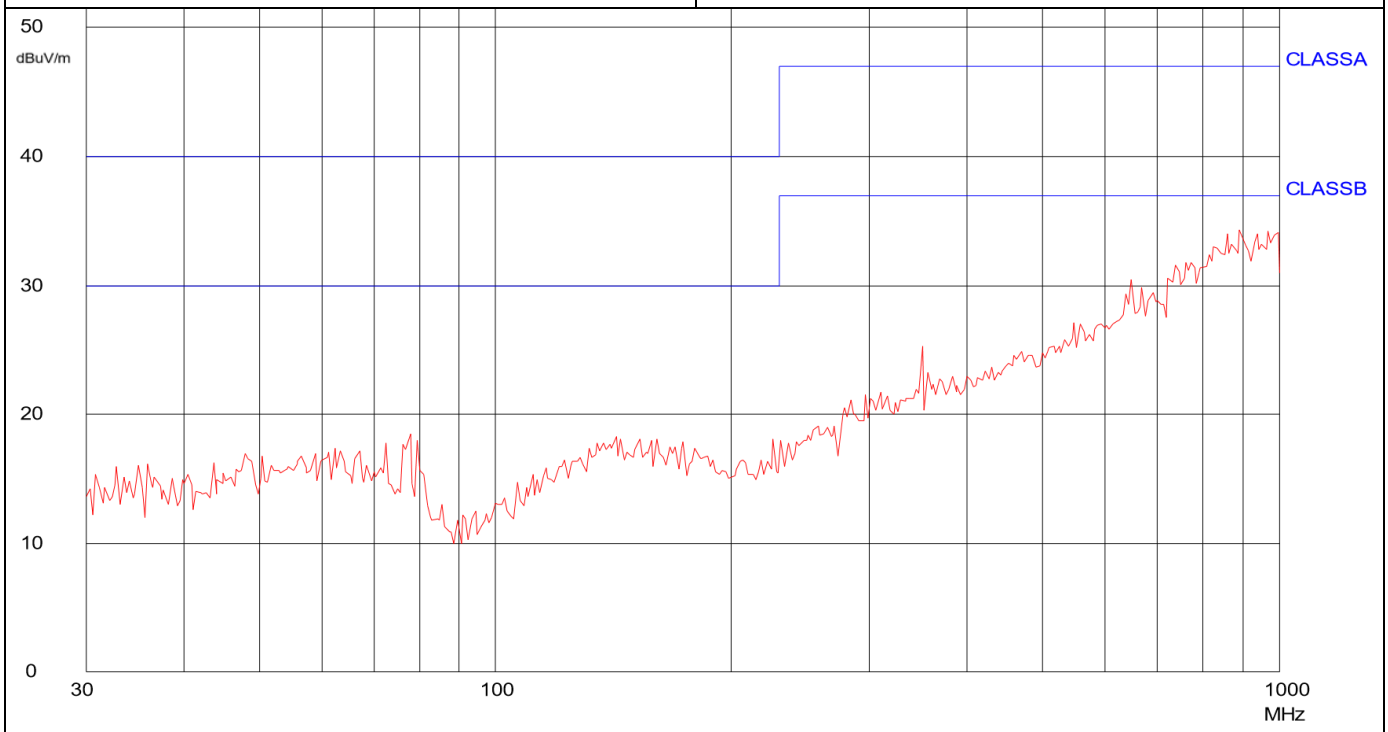


Figure 1: Radiated Emissions 12V, Horizontal

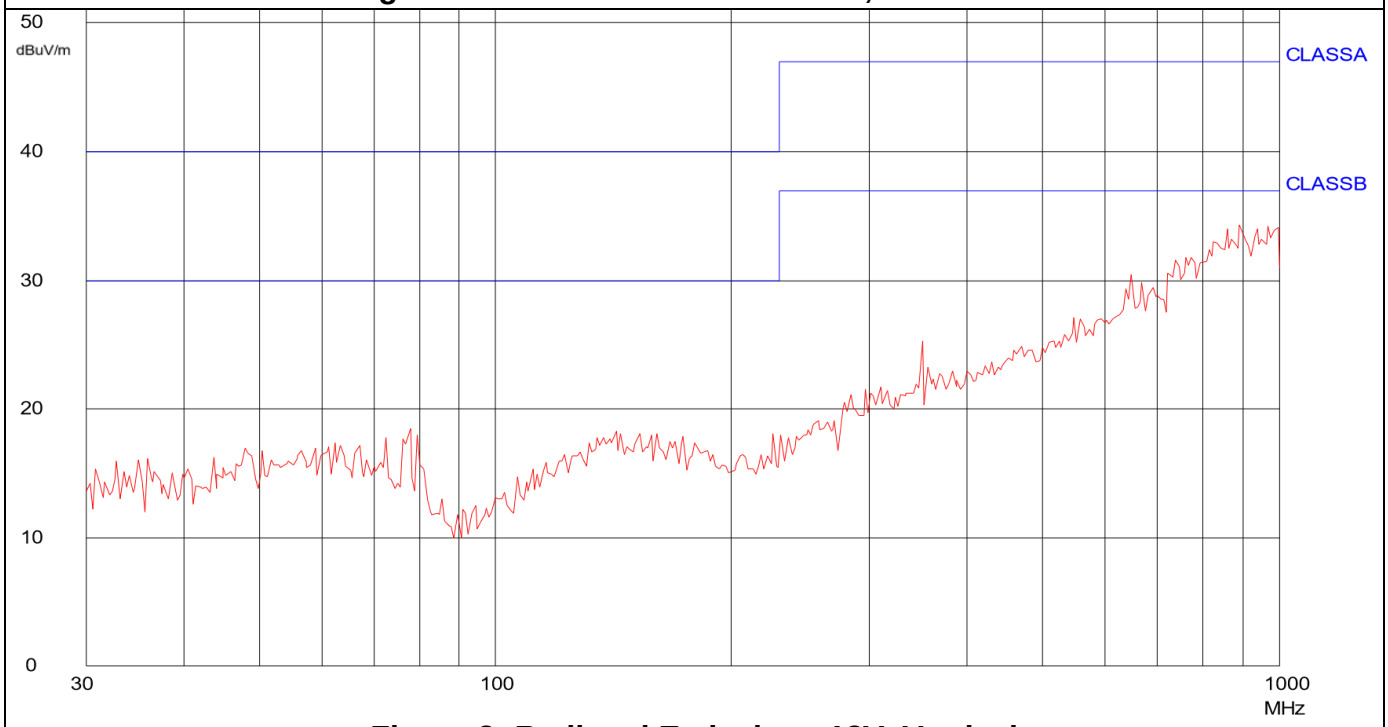


Figure 2: Radiated Emissions 12V, Vertical

Freq (MHz)	Q.P. Level dB(µV/m)	EN 55011 Class B dB(µV/m)	Antenna Pol. Vertical/Horizontal	Antenna Height (m)	Pass /Fail
78.866	16.6	30	Vertical	1	Pass

Table 1: Radiated Emissions, 12V, Class B Limits – Anechoic Chamber at 10 metres

22. Jul 20 09:44
Scan Settings (1 Range)

Transducer No. Start Stop Name
1 9 20M 1000M 830CAB

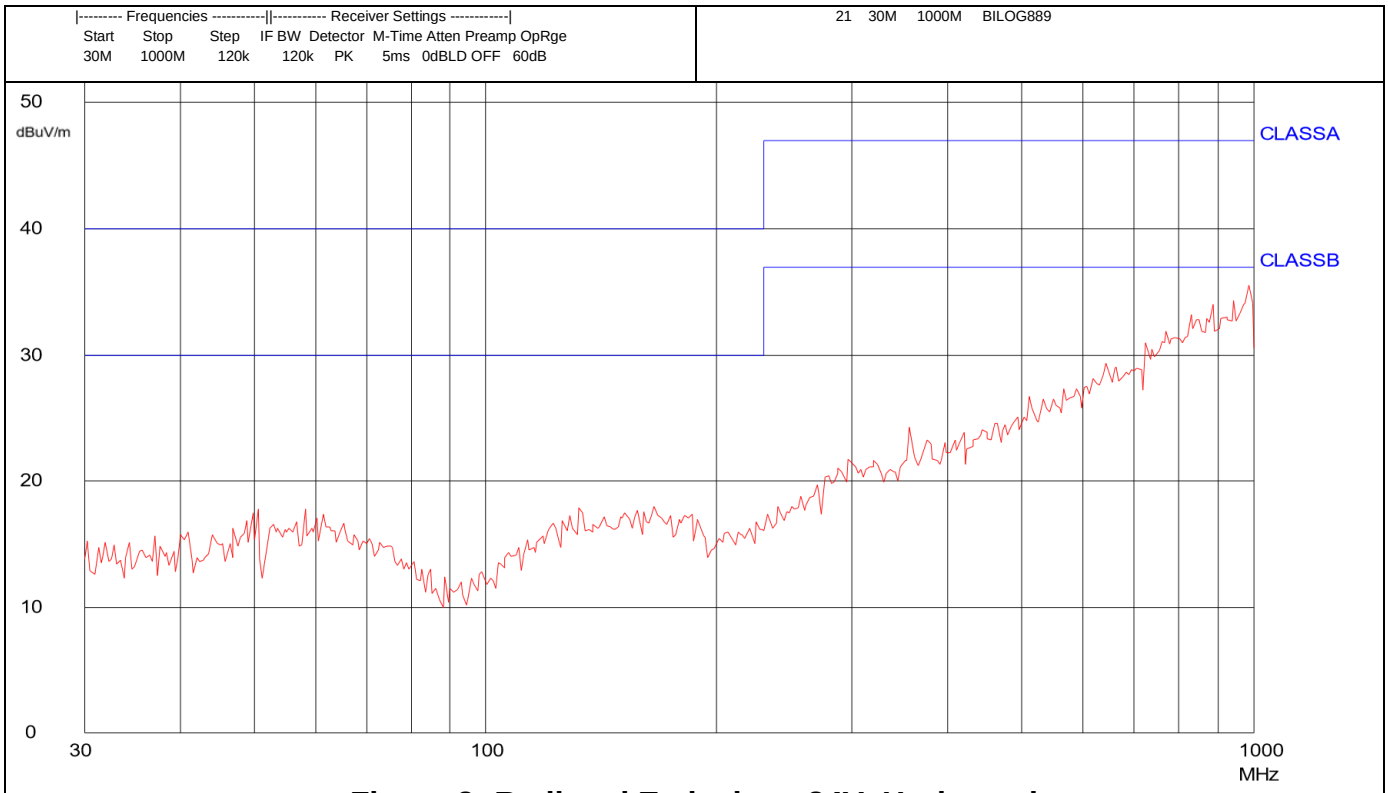


Figure 3: Radiated Emissions 24V, Horizontal

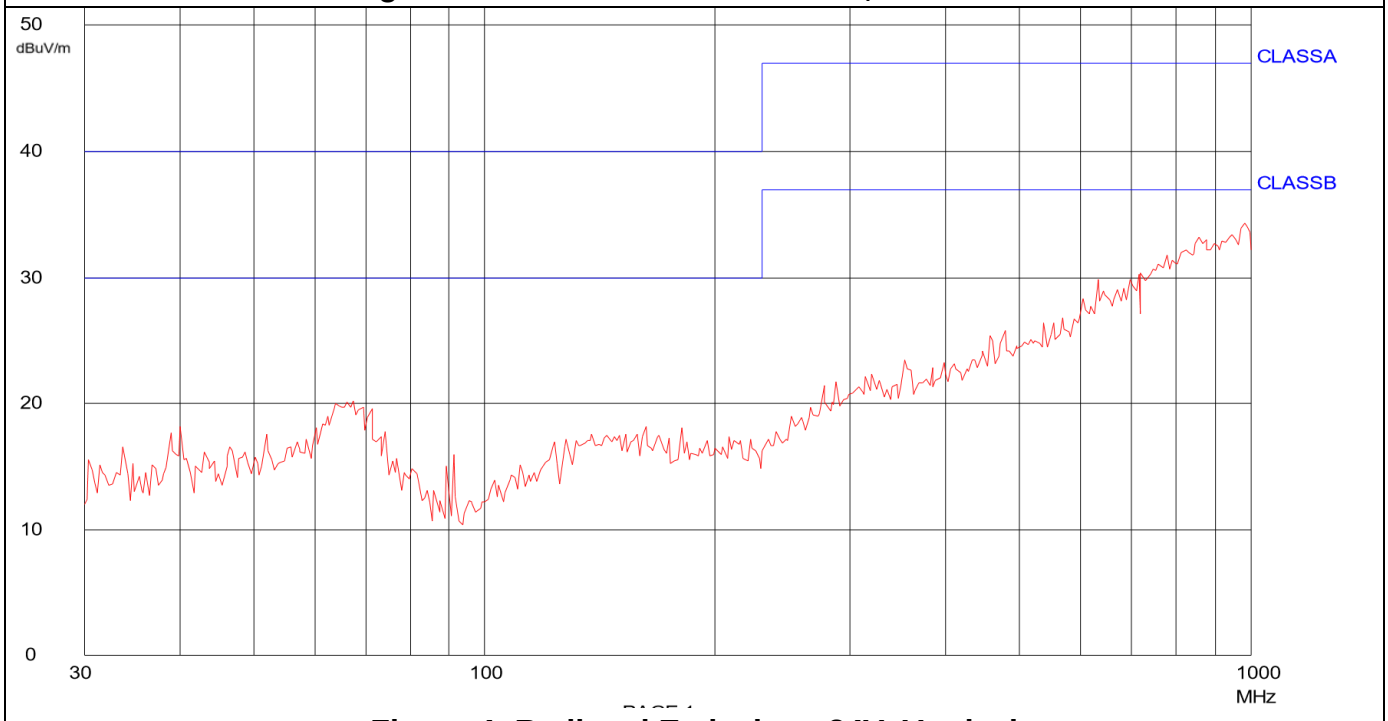


Figure 4: Radiated Emissions 24V, Vertical

Freq (MHz)	Q.P. Level dB(µV/m)	EN 55011 Class B dB(µV/m)	Antenna Pol. Vertical/Horizontal	Antenna Height (m)	Pass /Fail
78.866	16.6	30	Vertical	1	Pass

Table 1: Radiated Emissions, 12V, Class B Limits – Anechoic Chamber at 10 metres

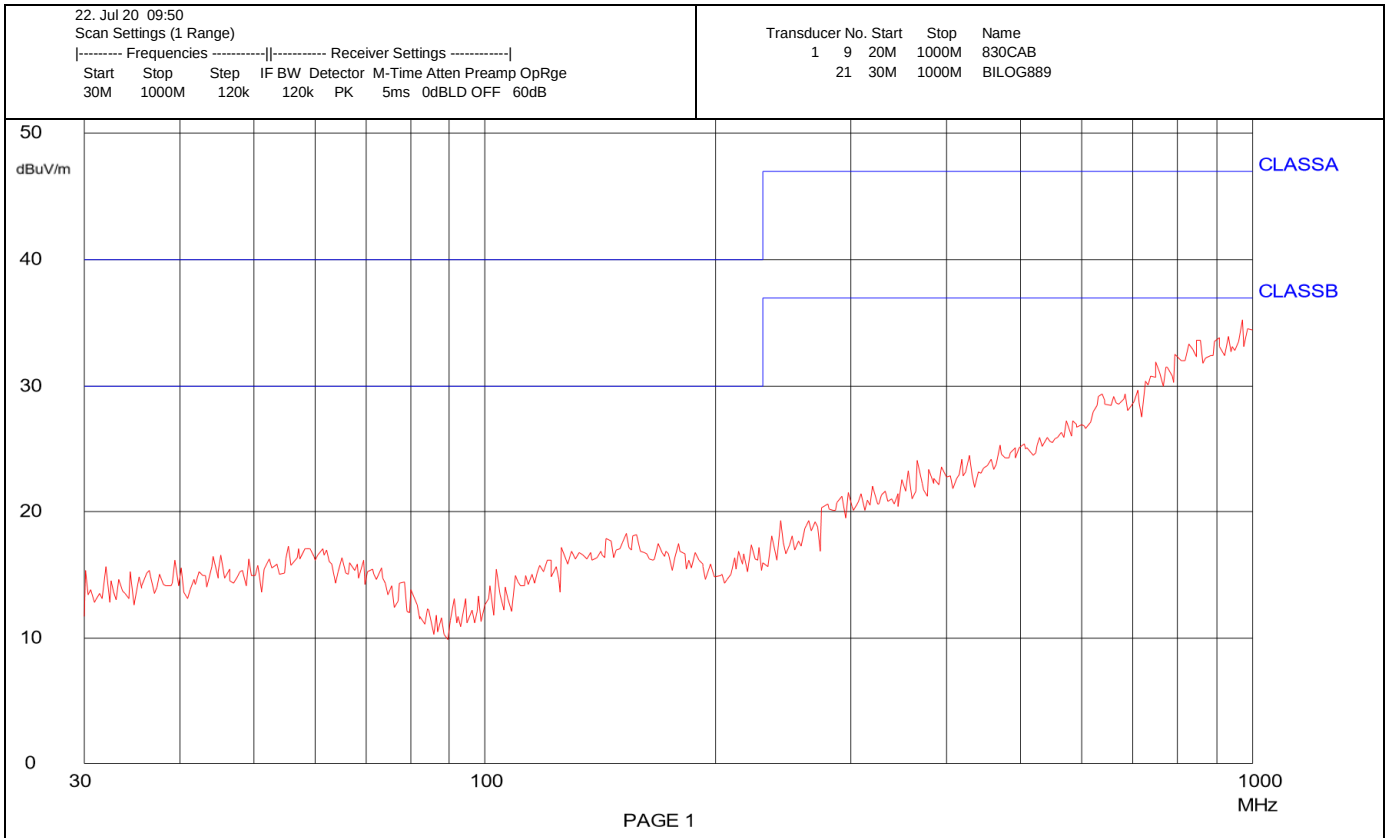


Figure 5: Radiated Emissions 48V, Horizontal

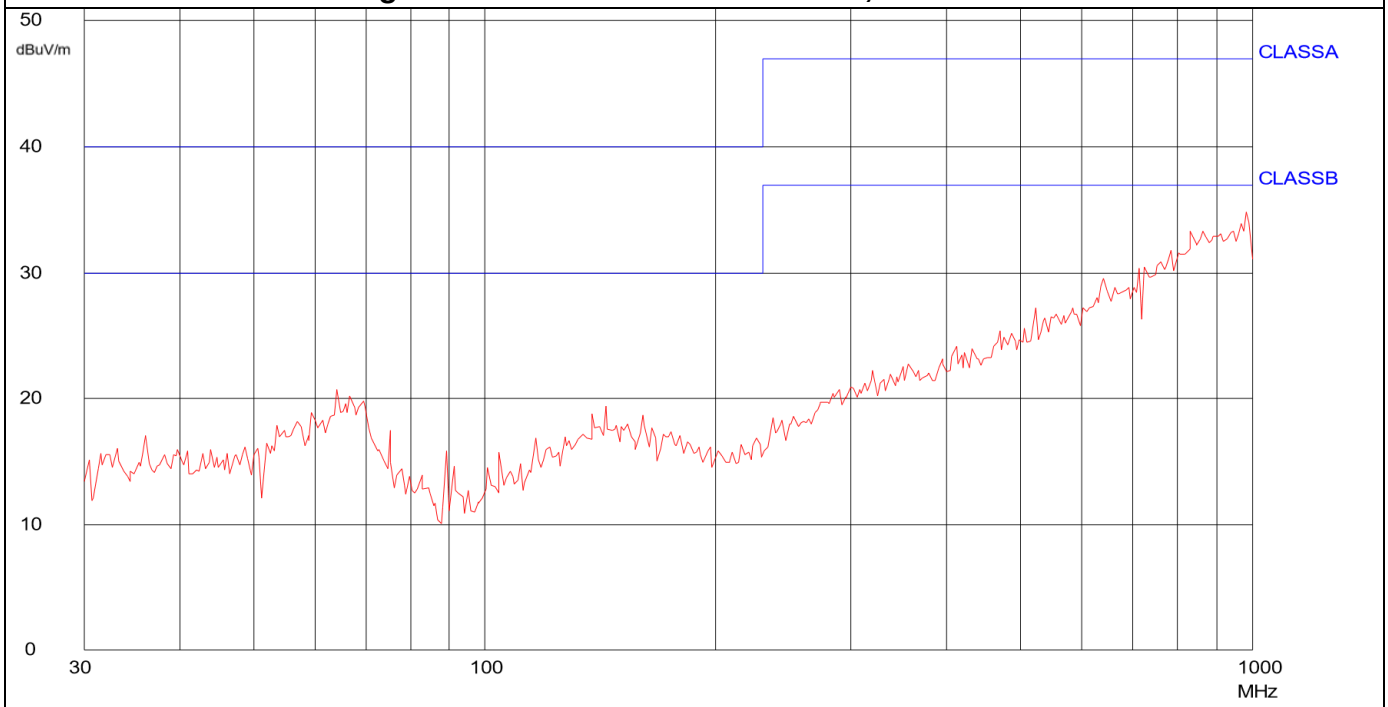


Figure 6: Radiated Emissions 48V, Vertical

Freq (MHz)	Q.P. Level dB(µV/m)	EN 55011 Class B dB(µV/m)	Antenna Pol. Vertical/Horizontal	Antenna Height (m)	Pass /Fail
63.909	19.6	30	Vertical	1	Pass

Table 3: Radiated Emissions, 48V, Class B Limits – Anechoic Chamber at 10 metres

22. Jul 20 10:05
Scan Settings (1 Range)
|-------- Frequencies ----------||---------- Receiver Settings ----------|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 1000M 120k 120k PK 5ms 0dBLD OFF 60dB

Transducer No. Start Stop Name
1 9 20M 1000M 830CAB
21 30M 1000M BILOG889

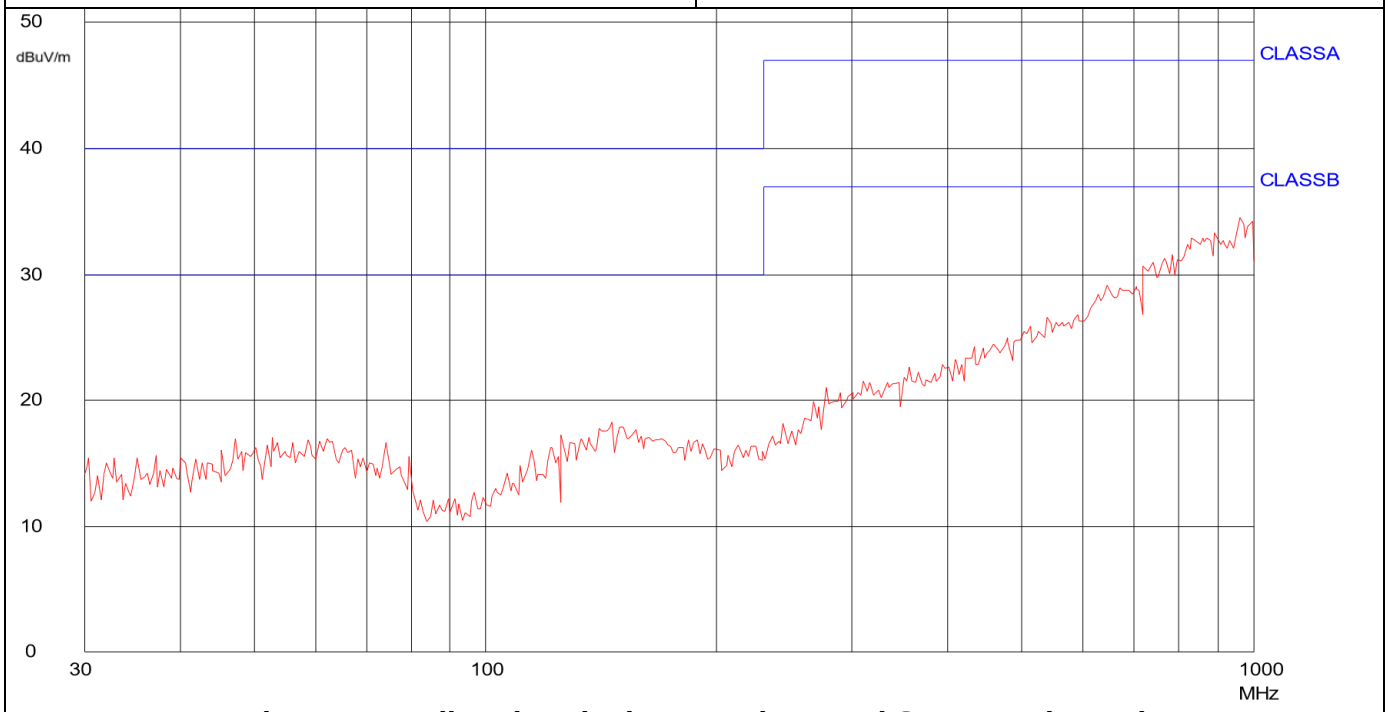


Figure 7: Radiated Emissions Background Scan, Horizontal

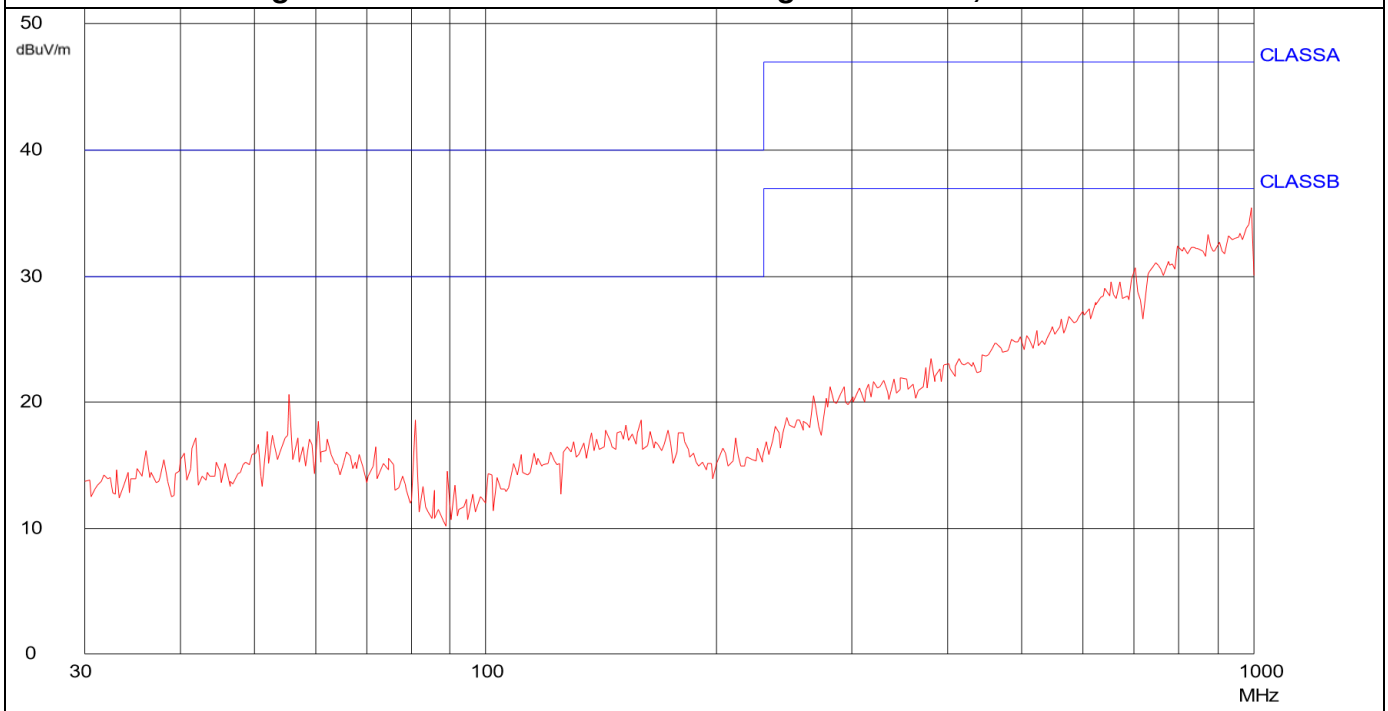


Figure 8: Radiated Emissions Background Scan, Vertical

22. Jul 20 10:35
Scan Settings (1 Range)
|--------- Frequencies ----------||---------- Receiver Settings ----------|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 1000M 120k 120k PK 5ms 0dBLD OFF 60dB

Transducer No. Start Stop Name
1 16 30M 1000M 963CABLE
21 30M 1000M BILOG889

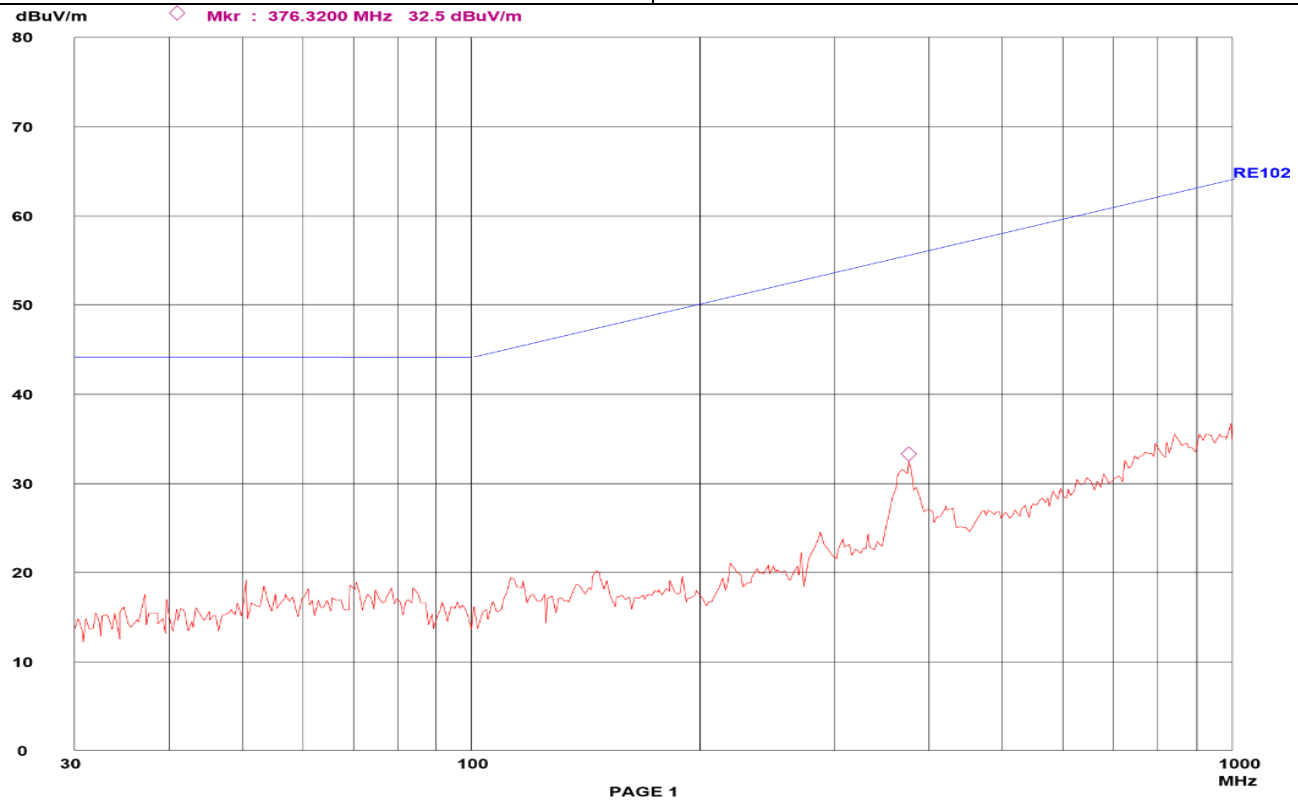


Figure 9: RE102 30 to 1000MHz Radiated Emissions 12V, Horizontal

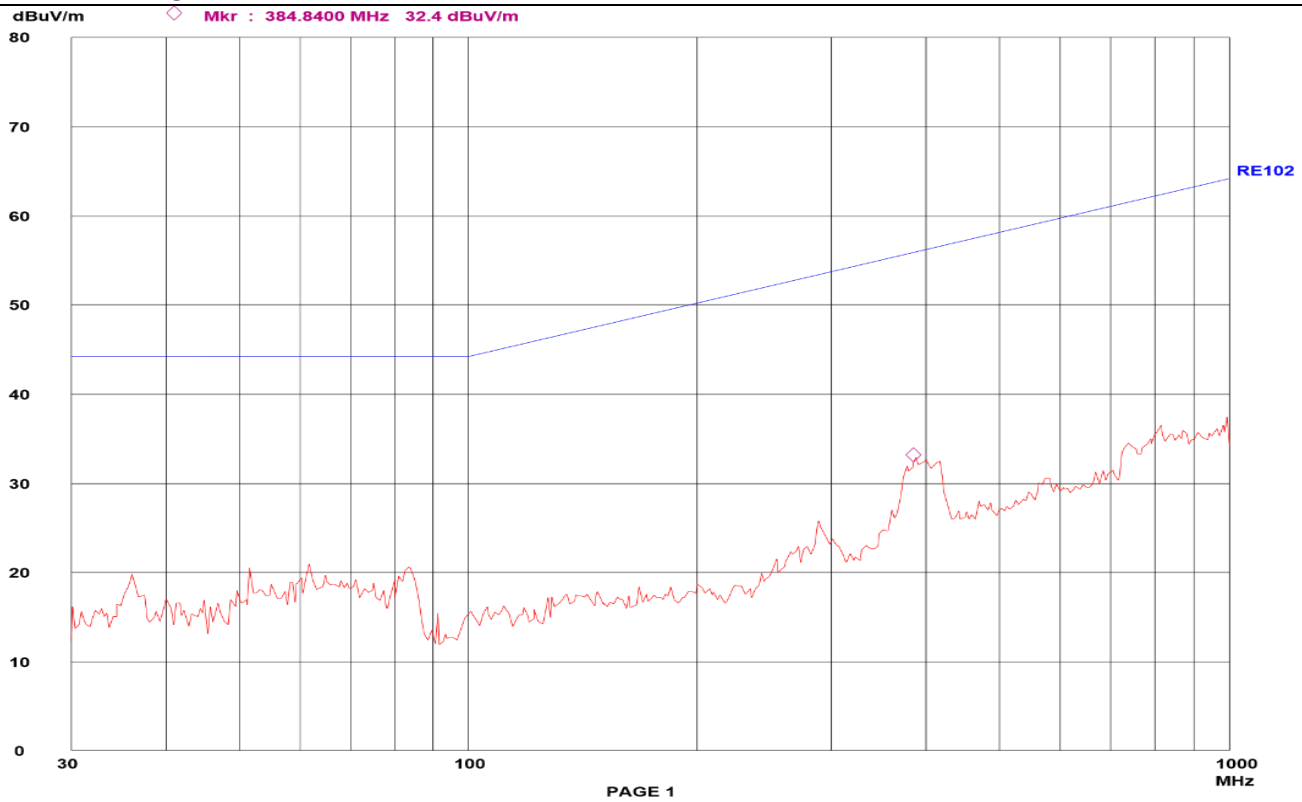


Figure 10: RE102 30 to 1000MHz Radiated Emissions 12V, Vertical

22. Jul 20 10:46
Scan Settings (1 Range)
|-------- Frequencies ----------||---------- Receiver Settings ----------|

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
2M	30M	50k	120k	PK	5ms	10dBLN	OFF

Transducer No.	Start	Stop	Name
4	10k	30M	LISN

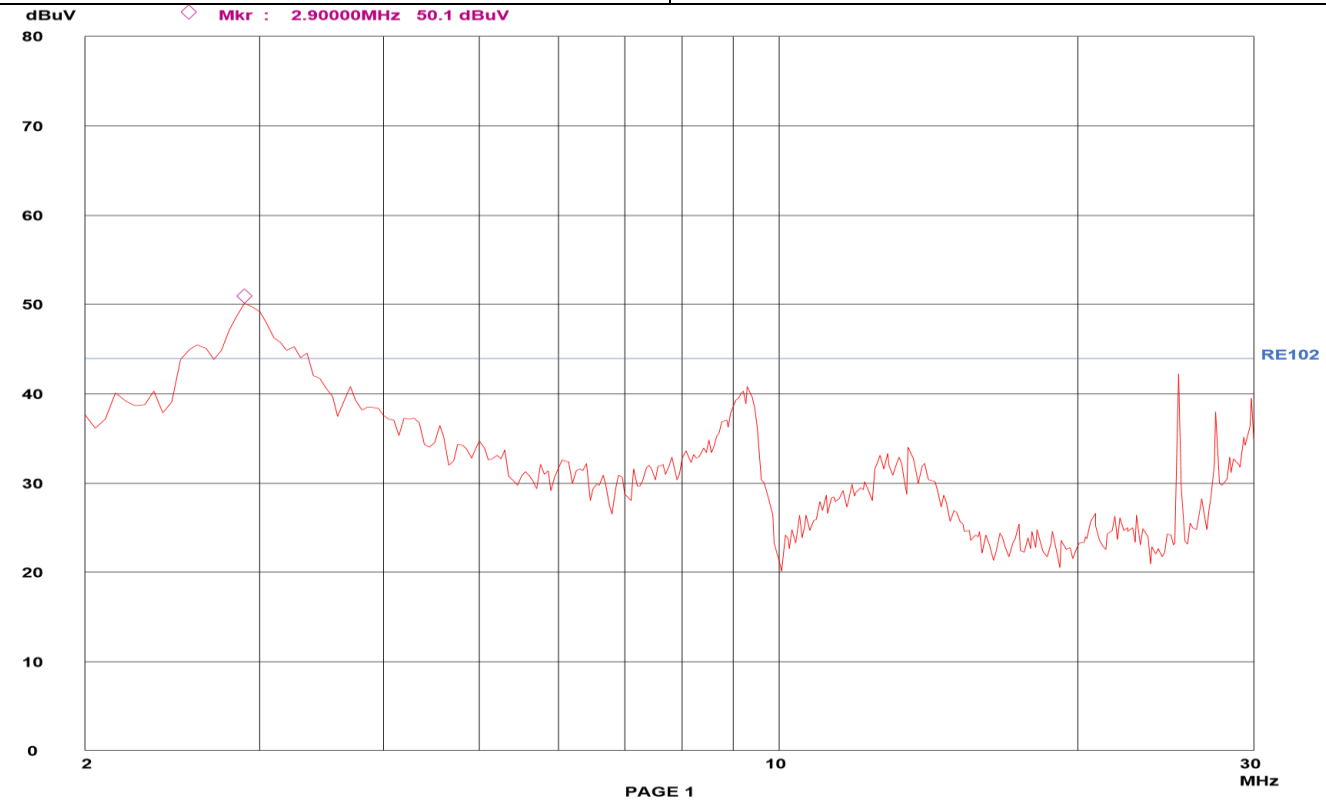


Figure 11: RE102 2 to 30MHz Radiated Emissions 12V

22. Jul 20 10:46
Scan Settings (1 Range)
|--------- Frequencies ----------||---------- Receiver Settings ----------|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 1000M 120k 120k PK 5ms 0dBLD OFF 60dB

Transducer No. Start Stop Name
1 16 30M 1000M 963CABLE
21 30M 1000M BILOG889

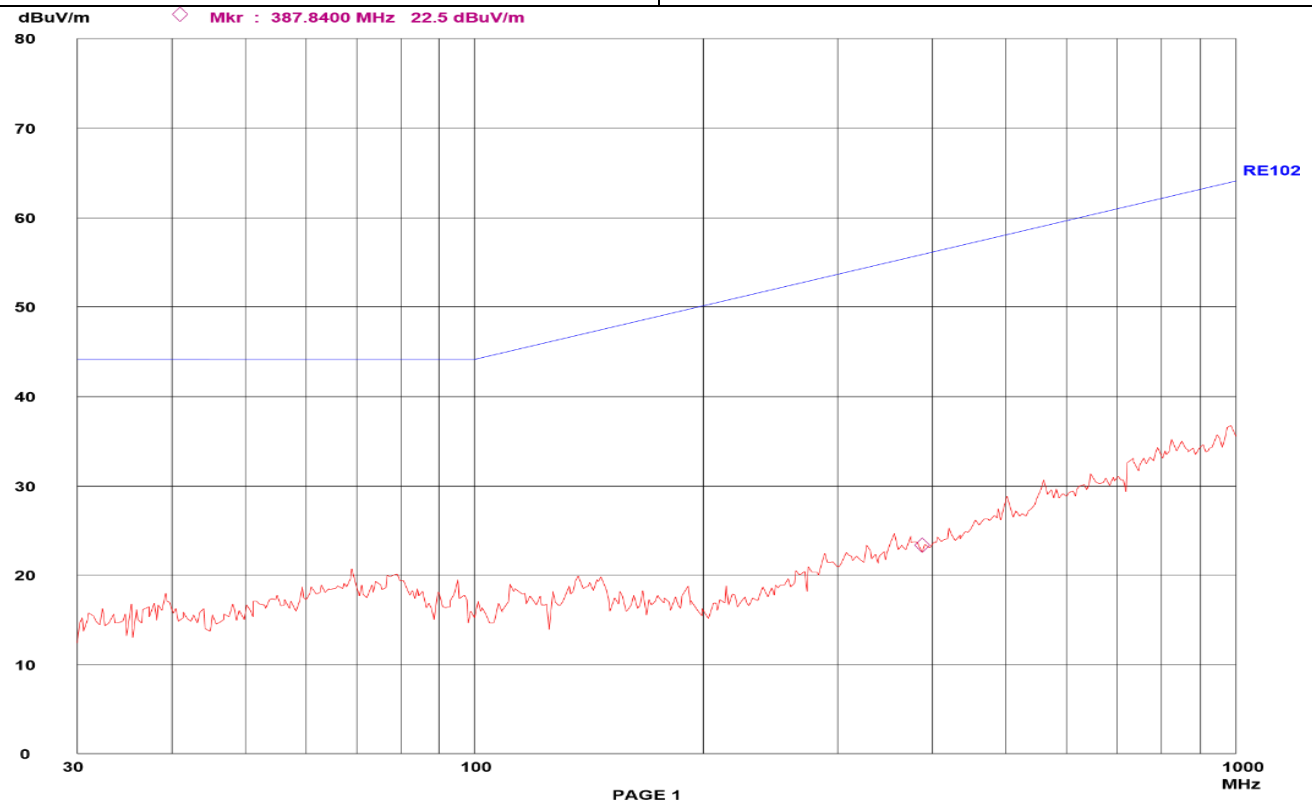


Figure 12: RE102 30 to 1000MHz Radiated Emissions 24V, Horizontal

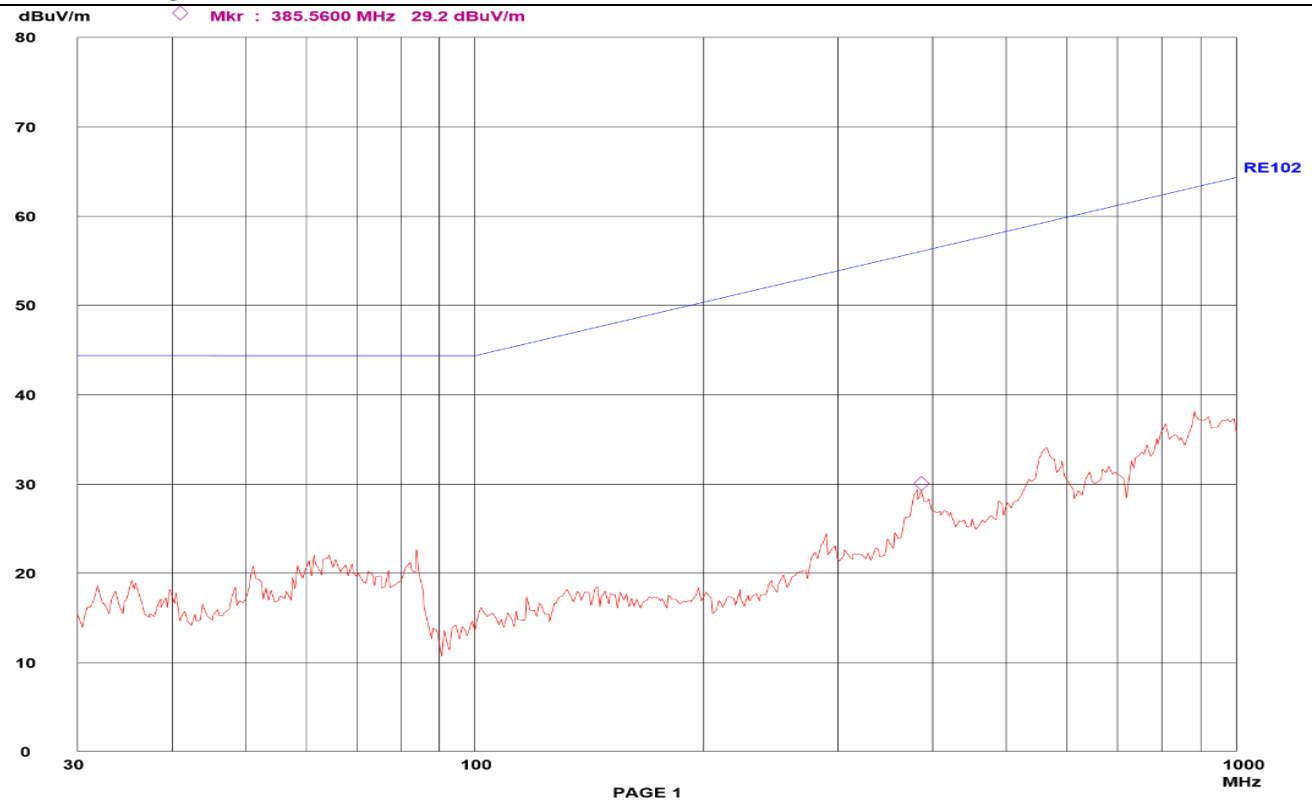


Figure 13: RE102 30 to 1000MHz Radiated Emissions 24V, Vertical

22. Jul 20 10:44
Scan Settings (1 Range)
|-------- Frequencies ----------||---------- Receiver Settings ----------|

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
2M	30M	50k	120k	PK	5ms	10dBLN	OFF

Transducer No.	Start	Stop	Name
4	10k	30M	LISN

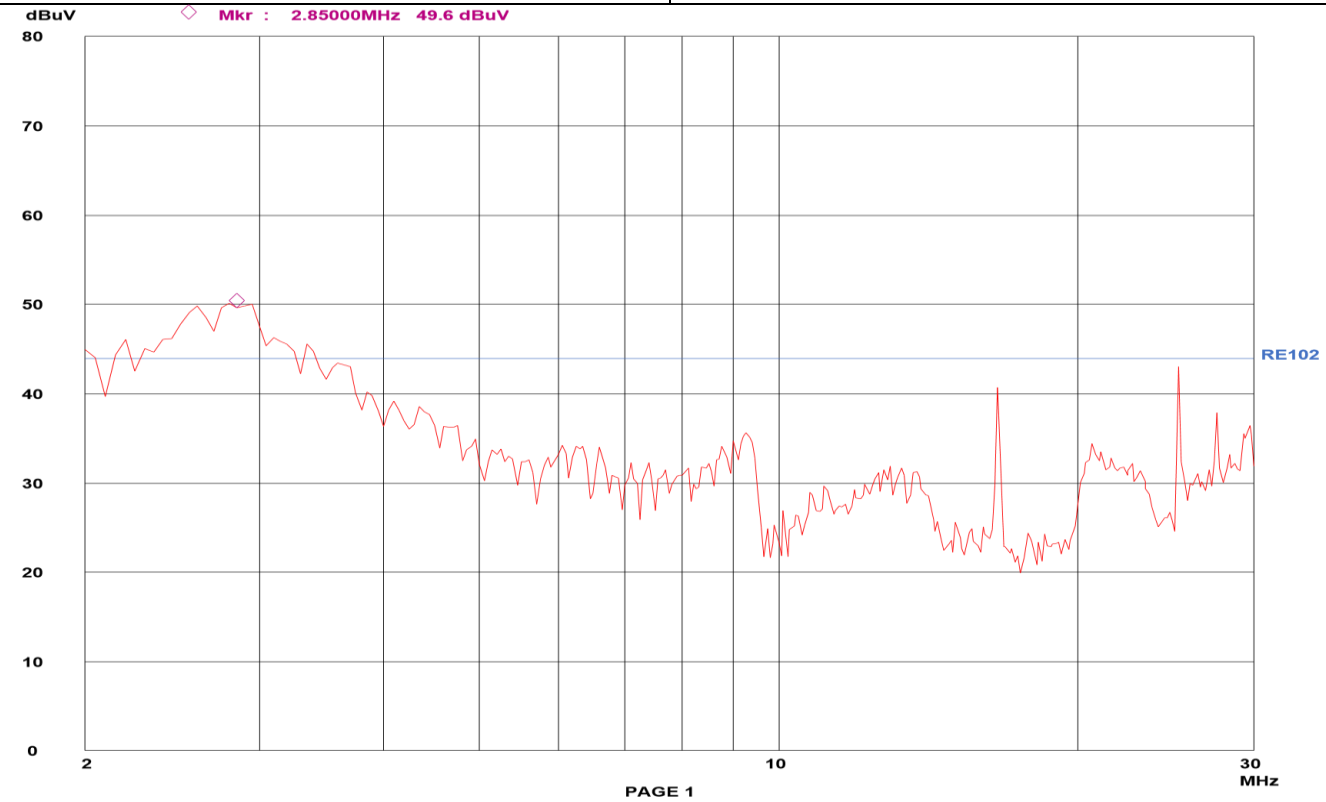


Figure 14: RE102 2 to 30MHz Radiated Emissions 24V

22. Jul 20 10:35
Scan Settings (1 Range)
|--------- Frequencies ----------||---------- Receiver Settings ----------|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 1000M 120k 120k PK 5ms 0dBLD OFF 60dB

Transducer No. Start Stop Name
1 16 30M 1000M 963CABLE
21 30M 1000M BILOG889

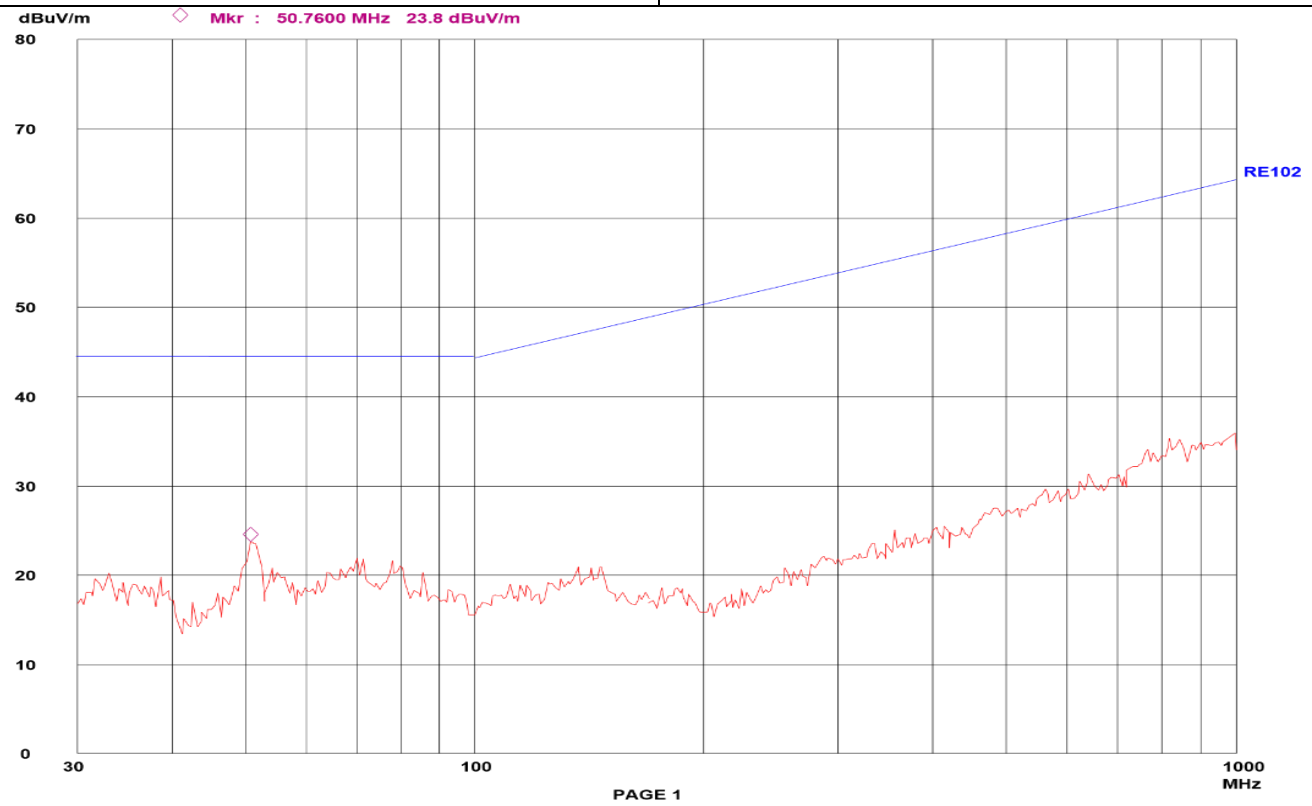


Figure 15: RE102 30 to 1000MHz Radiated Emissions 48V, Horizontal

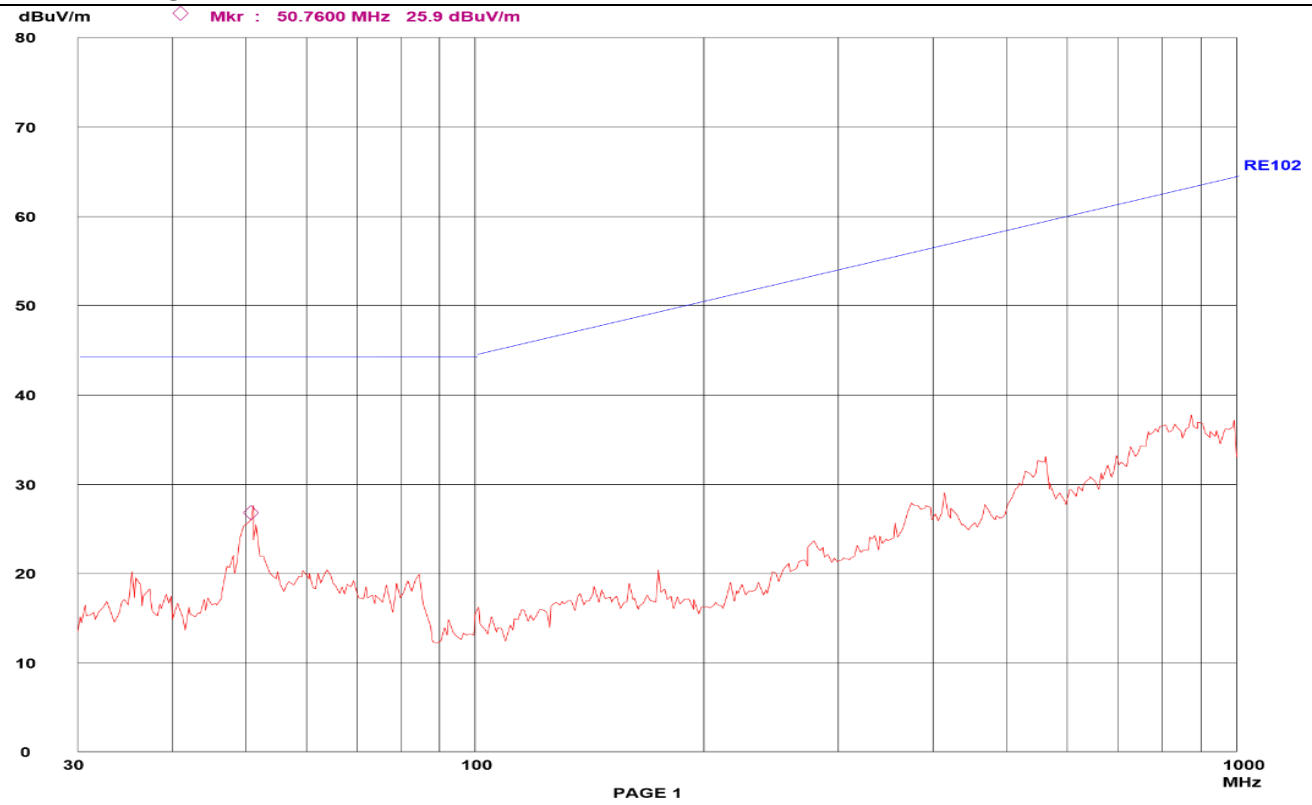


Figure 16: RE102 30 to 1000MHz Radiated Emissions 48V, Vertical

22. Jul 20 10:46
Scan Settings (1 Range)
|-------- Frequencies ----------||---------- Receiver Settings ----------|

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
2M	30M	50k	120k	PK	5ms	10dBLN	OFF

Transducer No.	Start	Stop	Name
4	10k	30M	LISN

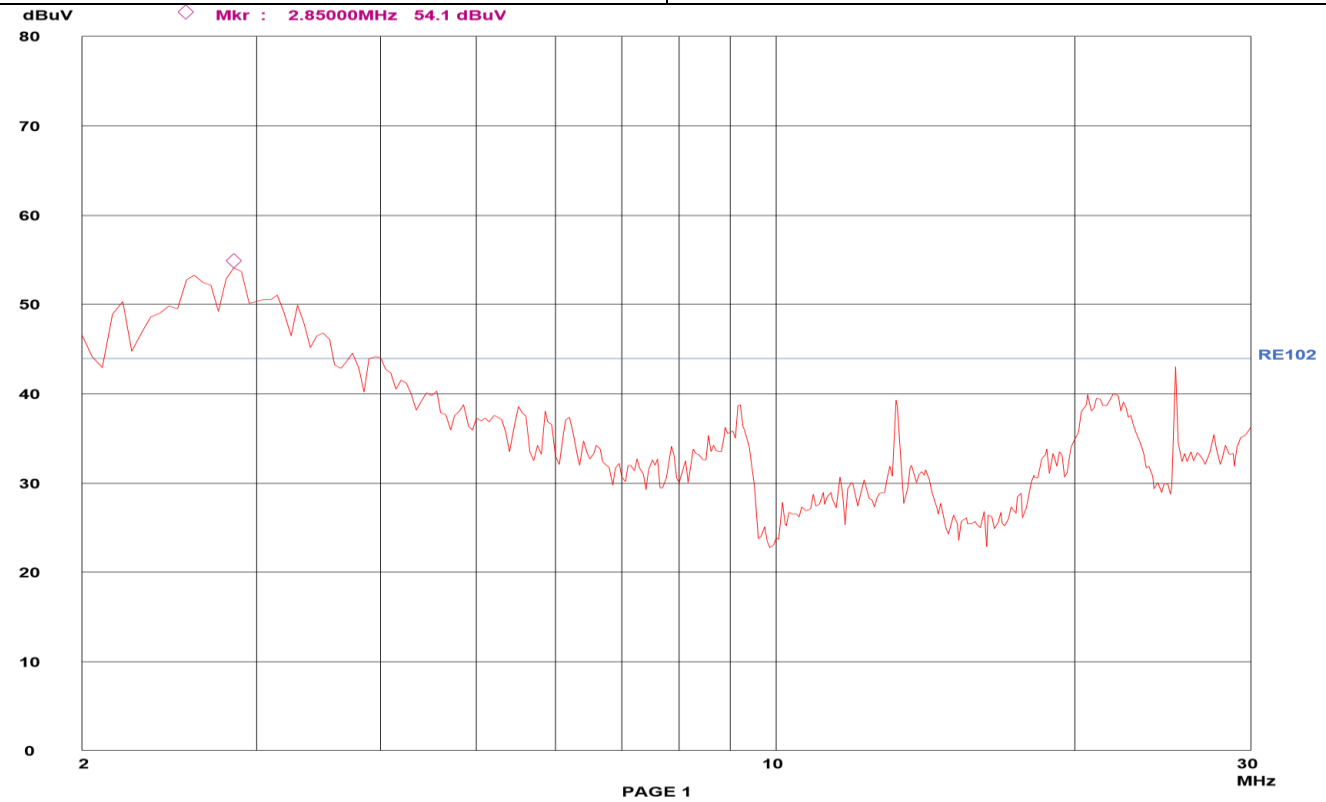


Figure 17: RE102 2 to 30MHz Radiated Emissions 48V

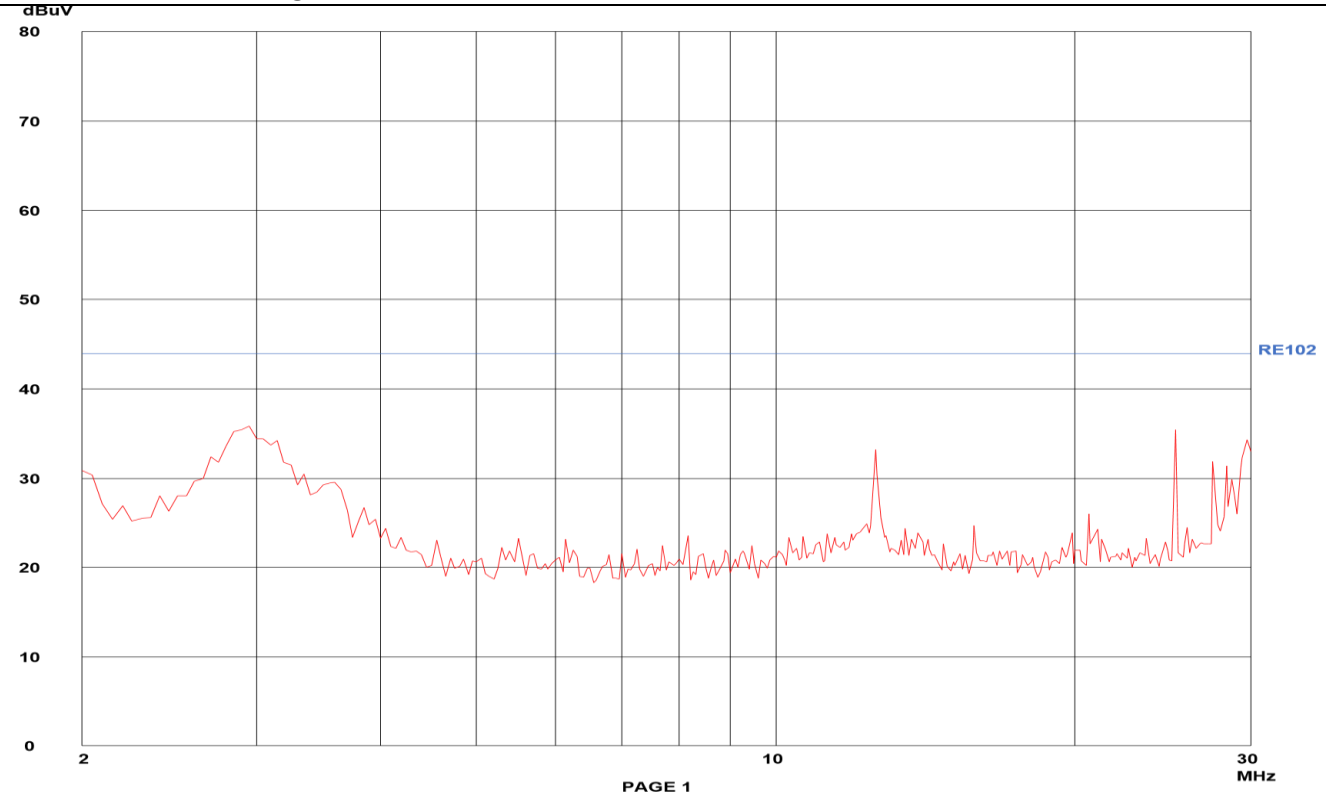


Figure 18: RE102 2 to 30MHz Radiated Emissions 48V, Enclosed

22. Jul 20 10:35
Scan Settings (1 Range)
|--------- Frequencies ----------||---------- Receiver Settings ----------|

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	1000M	120k	120k	PK	5ms	0dBLD	OFF	60dB

Transducer No.	Start	Stop	Name
1	16	30M	1000M	963CABLE
21	30M	1000M	BILOG889

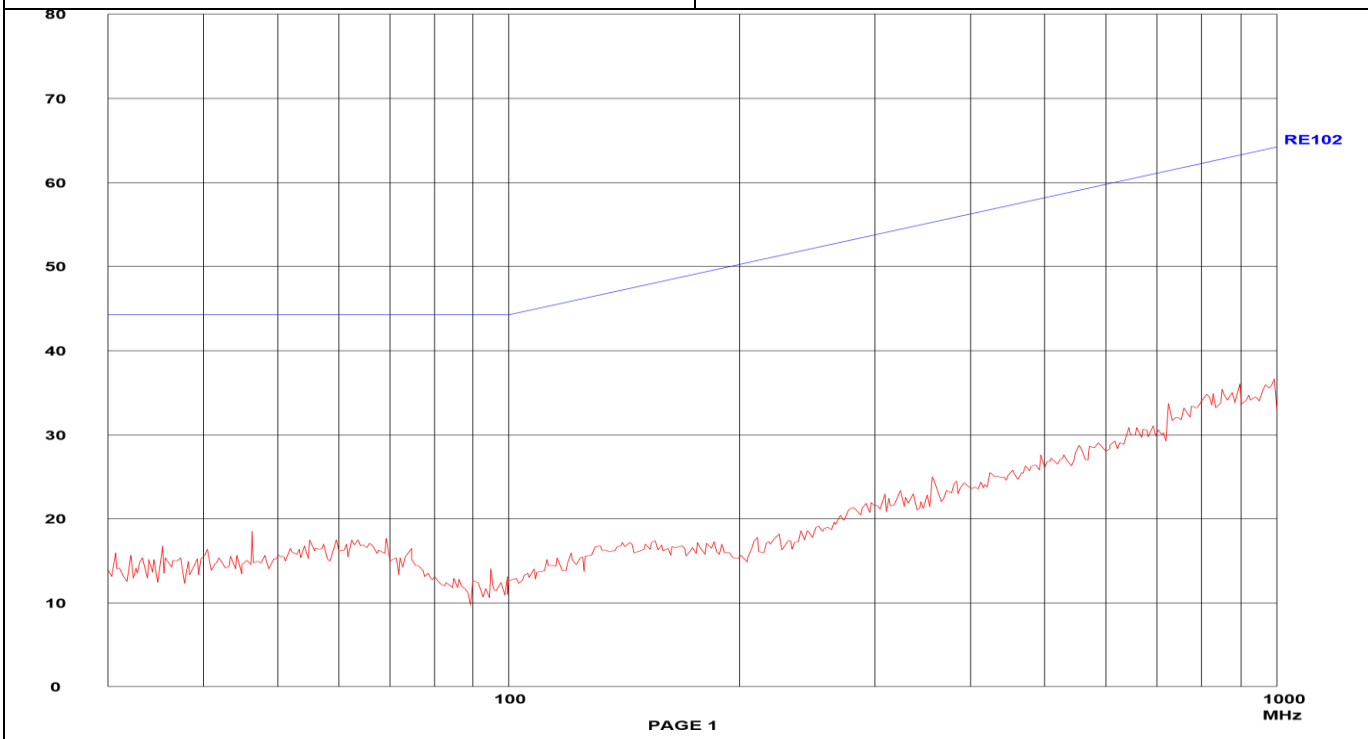


Figure 19: RE102 30 to 1000MHz Radiated Emissions Background

22. Jul 20 10:46
Scan Settings (1 Range)
|--------- Frequencies ----------||---------- Receiver Settings ----------|

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
2M	30M	50k	120k	PK	5ms	10dBLN	OFF

Transducer No.	Start	Stop	Name
4	10k	30M	LISN

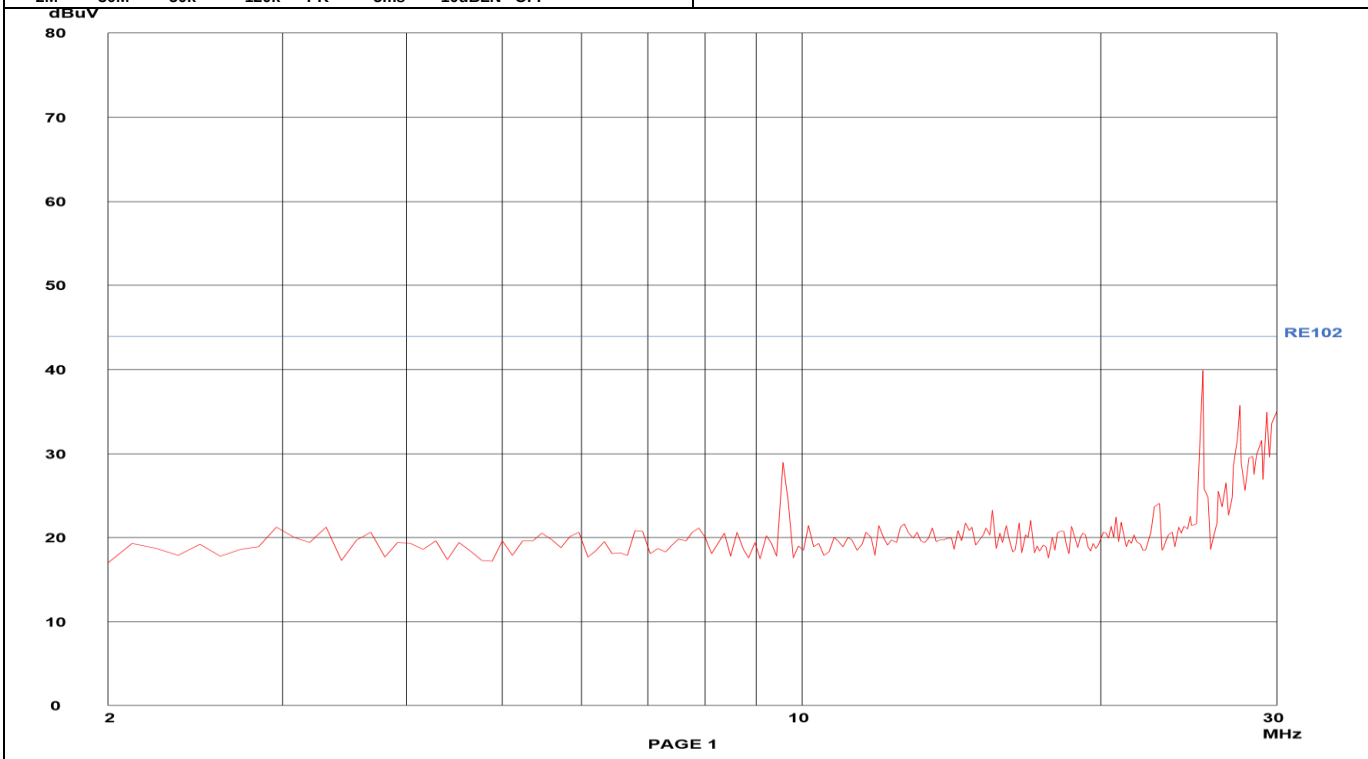


Figure 20: RE102 2 to 30MHz Radiated Emissions Background

Appendix 4: Conducted Emissions Test Results

Compliance Engineering Ireland ltd

21 Jul 2020 09:04

Conducted Emissions

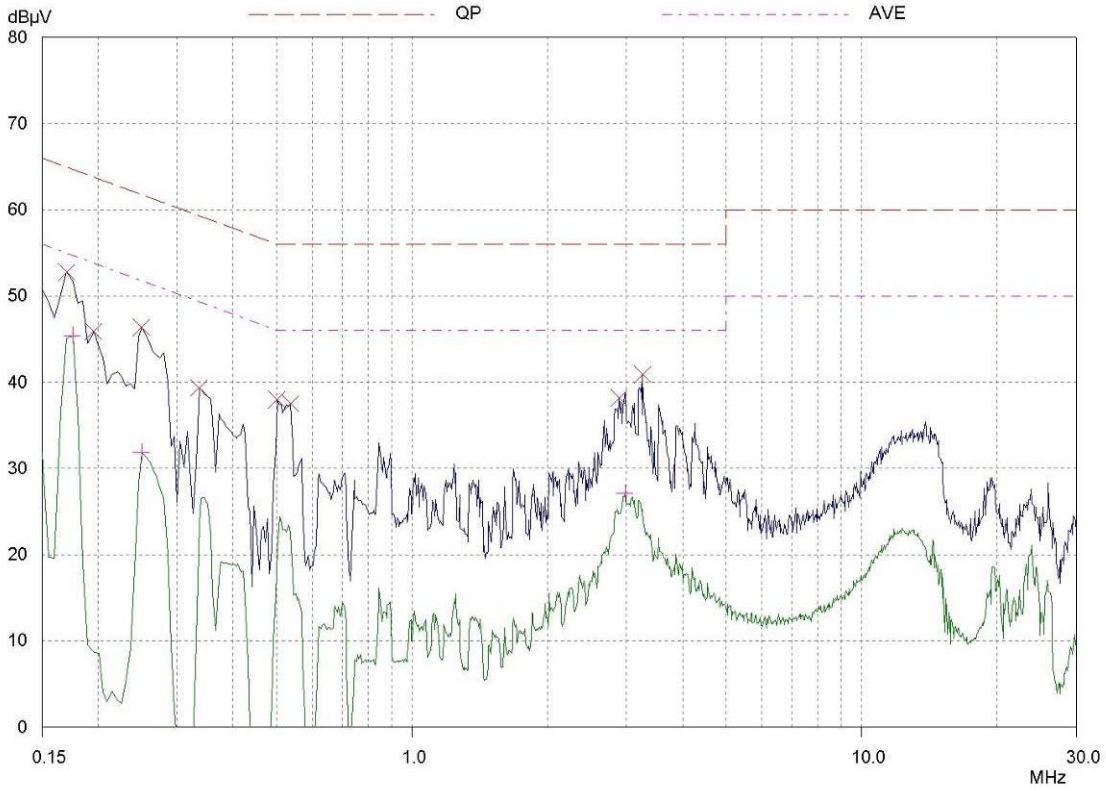
EUT:	VCCS-300-12
Manuf:	Vox Power
Op Cond:	Normal
Operator:	L Brien
Test Spec:	EN 55022 Class B
Comment:	Neutral
	20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:	Detectors:	X PK / + AV
	Meas Time:	see scan settings
	Subranges:	25
	Acc Margin:	20 dB



Compliance Engineering Ireland ltd

21 Jul 2020 09:04

Conducted Emissions

EUT: VCCS-300-12
Manuf: Vox Power
Op Cond: Normal
Operator: L Brien
Test Spec: EN 55022 Class B
Comment: Neutral
20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:
Detectors: X PK / + AV
Meas Time: see scan settings
Subranges: 25
Acc Margin: 20 dB

Peak Search Results

Frequency MHz	PK Level dBµV	PK Limit dBµV	PK Delta dB	Phase -	PE -
0.17	52.79	64.96	12.17	N	fl
0.195	45.88	63.82	17.94	N	fl
0.25	46.38	61.76	15.38	N	fl
0.335	39.35	59.33	19.98	N	fl
0.5	37.95	56.00	18.05	N	fl
0.535	37.48	56.00	18.52	N	fl
2.885	38.20	56.00	17.80	N	fl
3.25	40.87	56.00	15.13	N	fl

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.175	45.39	54.72	9.33	N	fl
0.25	31.85	51.76	19.91	N	fl
2.975	27.08	46.00	18.92	N	fl

* limit exceeded

Indicated Phase/PE shows Configuration of max. Emission

Compliance Engineering Ireland ltd

21 Jul 2020 09:17

Conducted Emissions

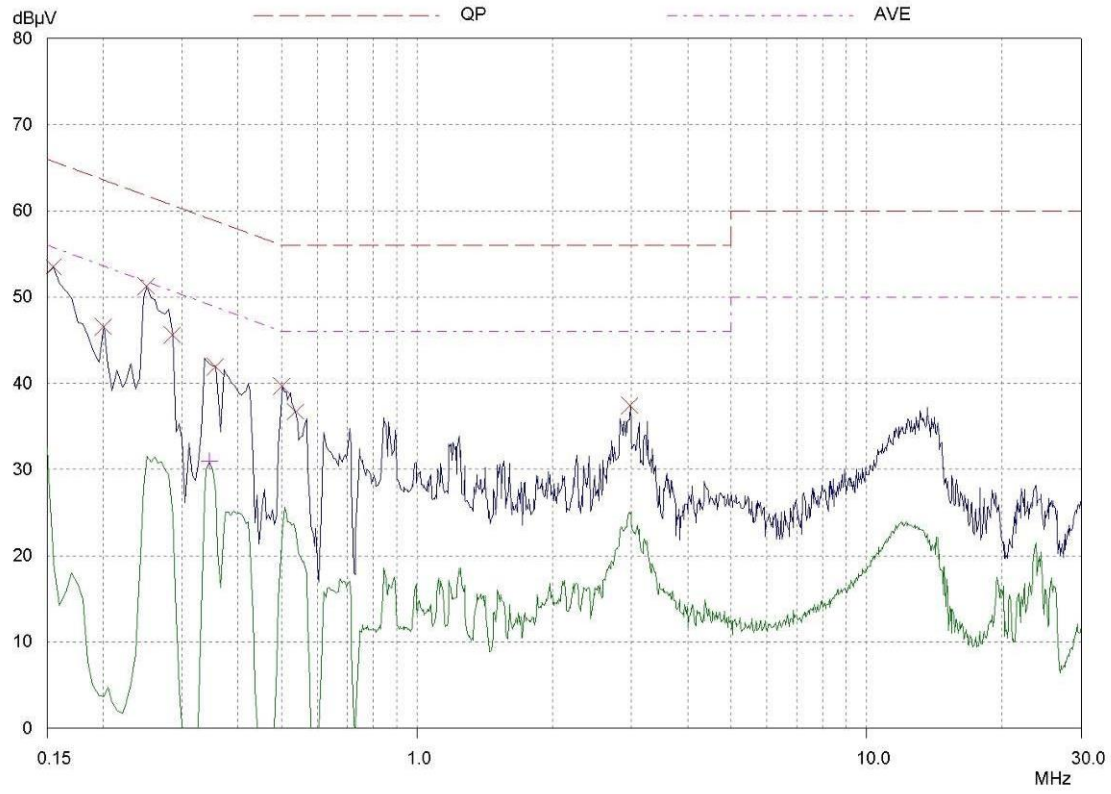
EUT:	VCCS-300-12
Manuf:	Vox Power
Op Cond:	Normal
Operator:	L Brien
Test Spec:	EN 55022 Class B
Comment:	Live
	20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:	Detectors:	X PK / + AV
	Meas Time:	see scan settings
	Subranges:	25
	Acc Margin:	20 dB



Compliance Engineering Ireland ltd

21 Jul 2020 09:17

Conducted Emissions

EUT: VCCS-300-12
Manuf: Vox Power
Op Cond: Normal
Operator: L Brien
Test Spec: EN 55022 Class B
Comment: Live
20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:
Detectors: X PK / + AV
Meas Time: see scan settings
Subranges: 25
Acc Margin: 20 dB

Peak Search Results

Frequency MHz	PK Level dBµV	PK Limit dBµV	PK Delta dB	Phase -	PE -
0.155	53.48	65.73	12.25	N	fl
0.2	46.55	63.61	17.06	N	fl
0.25	51.26	61.76	10.50	N	fl
0.285	45.60	60.67	15.07	N	fl
0.355	41.94	58.84	16.90	N	fl
0.5	39.64	56.00	16.36	N	fl
0.535	36.70	56.00	19.30	N	fl
2.97	37.45	56.00	18.55	N	fl

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.345	30.93	49.08	18.15	N	fl

* limit exceeded

Indicated Phase/PE shows Configuration of max. Emission

Compliance Engineering Ireland ltd

21 Jul 2020 09:30

Conducted Emissions

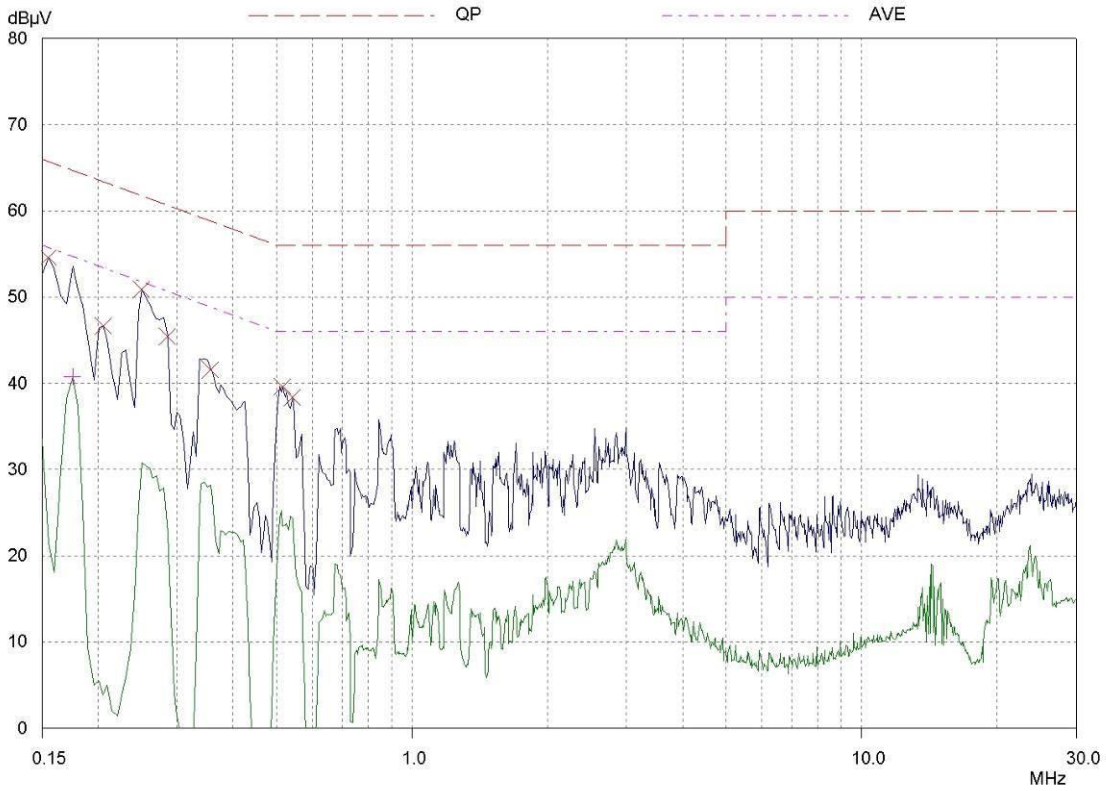
EUT:	VCCS-300-24
Manuf:	Vox Power
Op Cond:	Normal
Operator:	L Brien
Test Spec:	EN 55022 Class B
Comment:	Live
	20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:	Detectors:	X PK / + AV
	Meas Time:	see scan settings
	Subranges:	25
	Acc Margin:	20 dB



Compliance Engineering Ireland ltd

21 Jul 2020 09:30

Conducted Emissions

EUT: VCCS-300-24
Manuf: Vox Power
Op Cond: Normal
Operator: L Brien
Test Spec: EN 55022 Class B
Comment: Live
20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:
Detectors: X PK / + AV
Meas Time: see scan settings
Subranges: 25
Acc Margin: 20 dB

Peak Search Results

Frequency MHz	PK Level dBµV	PK Limit dBµV	PK Delta dB	Phase -	PE -
0.155	54.59	65.73	11.14	N	fl
0.205	46.67	63.41	16.74	N	fl
0.25	50.90	61.76	10.86	N	fl
0.285	45.44	60.67	15.23	N	fl
0.355	41.58	58.84	17.26	N	fl
0.515	39.62	56.00	16.38	N	fl
0.54	38.37	56.00	17.63	N	fl

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.175	40.74	54.72	13.98	N	fl

* limit exceeded

Indicated Phase/PE shows Configuration of max. Emission

Compliance Engineering Ireland ltd

21 Jul 2020 09:55

Conducted Emissions

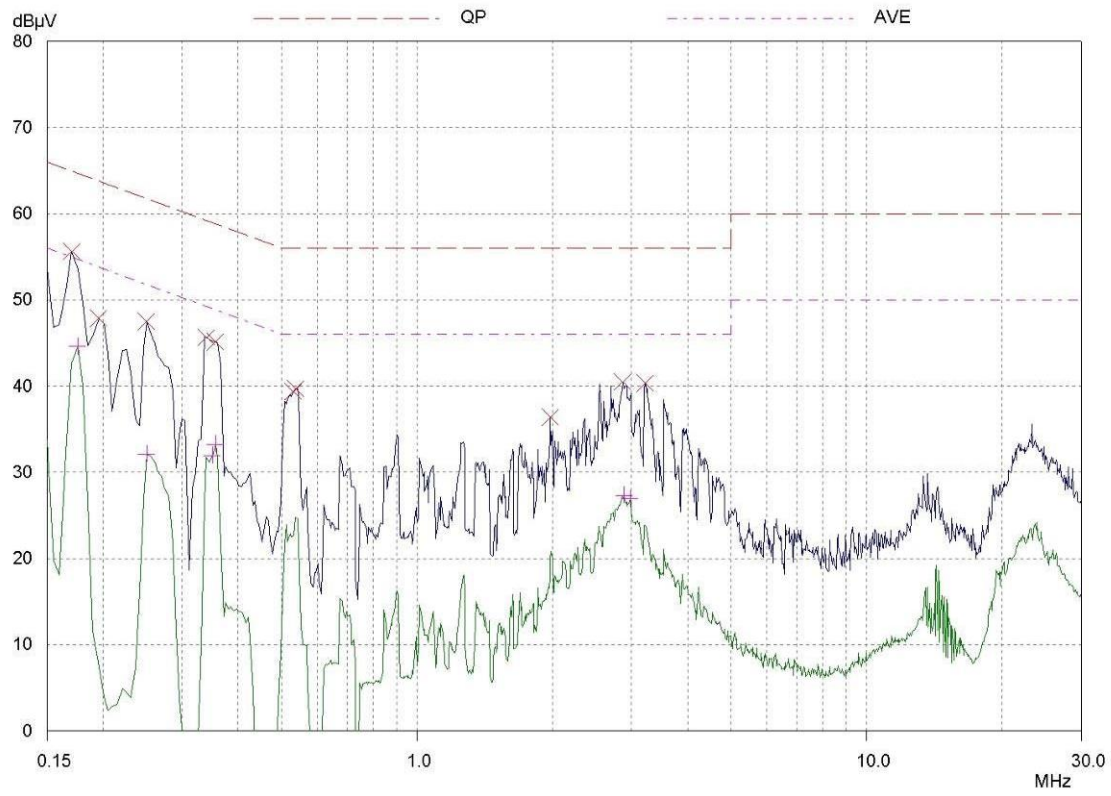
EUT:	VCCS-300-24
Manuf:	Vox Power
Op Cond:	Normal
Operator:	L Brien
Test Spec:	EN 55022 Class B
Comment:	Neutral
	20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:	Detectors:	X PK / + AV
	Meas Time:	see scan settings
	Subranges:	25
	Acc Margin:	20 dB



Compliance Engineering Ireland ltd

21 Jul 2020 09:55

Conducted Emissions

EUT: VCCS-300-24
Manuf: Vox Power
Op Cond: Normal
Operator: L Brien
Test Spec: EN 55022 Class B
Comment: Neutral
20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:
Detectors: X PK / + AV
Meas Time: see scan settings
Subranges: 25
Acc Margin: 20 dB

Peak Search Results

Frequency MHz	PK Level dBµV	PK Limit dBµV	PK Delta dB	Phase -	PE -
0.17	55.62	64.96	9.34	N	fl
0.195	47.84	63.82	15.98	N	fl
0.25	47.45	61.76	14.31	N	fl
0.34	45.65	59.20	13.55	N	fl
0.355	45.12	58.84	13.72	N	fl
0.53	39.35	56.00	16.65	N	fl
0.535	39.64	56.00	16.36	N	fl
1.98	36.41	56.00	19.59	N	fl
2.865	40.47	56.00	15.53	N	fl
3.22	40.35	56.00	15.65	N	fl

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.175	44.60	54.72	10.12	N	fl
0.25	32.10	51.76	19.66	N	fl
0.35	31.92	48.96	17.04	N	fl
0.355	33.26	48.84	15.58	N	fl
2.885	27.31	46.00	18.69	N	fl
2.975	26.87	46.00	19.13	N	fl

* limit exceeded

Indicated Phase/PE shows Configuration of max. Emission

Compliance Engineering Ireland ltd

21 Jul 2020 10:19

Conducted Emissions

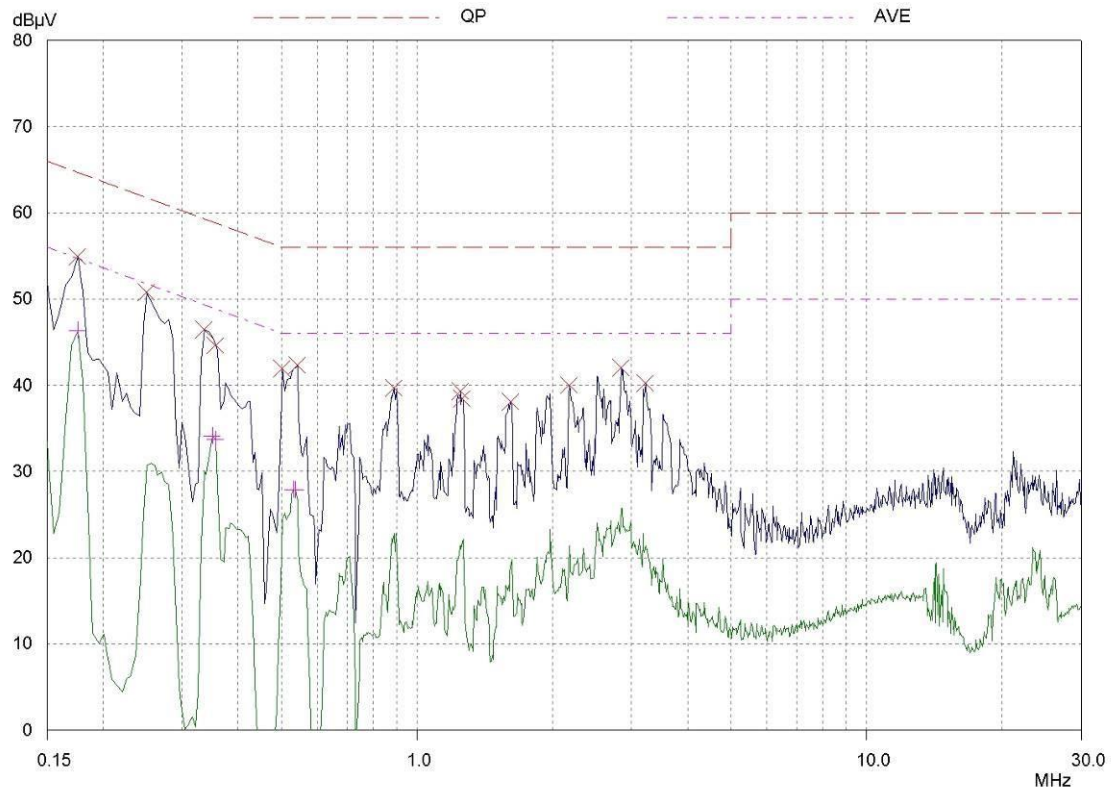
EUT:	VCCS-300-48
Manuf:	Vox Power
Op Cond:	Normal
Operator:	L Brien
Test Spec:	EN 55022 Class B
Comment:	Live
	20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:	Detectors:	X PK / + AV
	Meas Time:	see scan settings
	Subranges:	25
	Acc Margin:	20 dB



Compliance Engineering Ireland ltd

21 Jul 2020 10:19

Conducted Emissions

EUT: VCCS-300-48
Manuf: Vox Power
Op Cond: Normal
Operator: L Brien
Test Spec: EN 55022 Class B
Comment: Live
20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:
Detectors: X PK / + AV
Meas Time: see scan settings
Subranges: 25
Acc Margin: 20 dB

Peak Search Results

Frequency MHz	PK Level dBµV	PK Limit dBµV	PK Delta dB	Phase -	PE -
0.175	54.92	64.72	9.80	N	fl
0.25	50.77	61.76	10.99	N	fl
0.335	46.46	59.33	12.87	N	fl
0.355	44.62	58.84	14.22	N	fl
0.5	41.93	56.00	14.07	N	fl
0.54	42.30	56.00	13.70	N	fl
0.885	39.65	56.00	16.35	N	fl
1.245	39.30	56.00	16.70	N	fl
1.255	38.43	56.00	17.57	N	fl
1.615	38.11	56.00	17.89	N	fl
2.175	40.00	56.00	16.00	N	fl
2.84	42.02	56.00	13.98	N	fl
3.22	40.21	56.00	15.79	N	fl

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.175	46.33	54.72	8.39	N	fl
0.35	34.11	48.96	14.85	N	fl
0.355	33.70	48.84	15.14	N	fl
0.53	27.87	46.00	18.13	N	fl
0.535	27.83	46.00	18.17	N	fl

* limit exceeded

Indicated Phase/PE shows Configuration of max. Emission

Compliance Engineering Ireland ltd

21 Jul 2020 10:07

Conducted Emissions

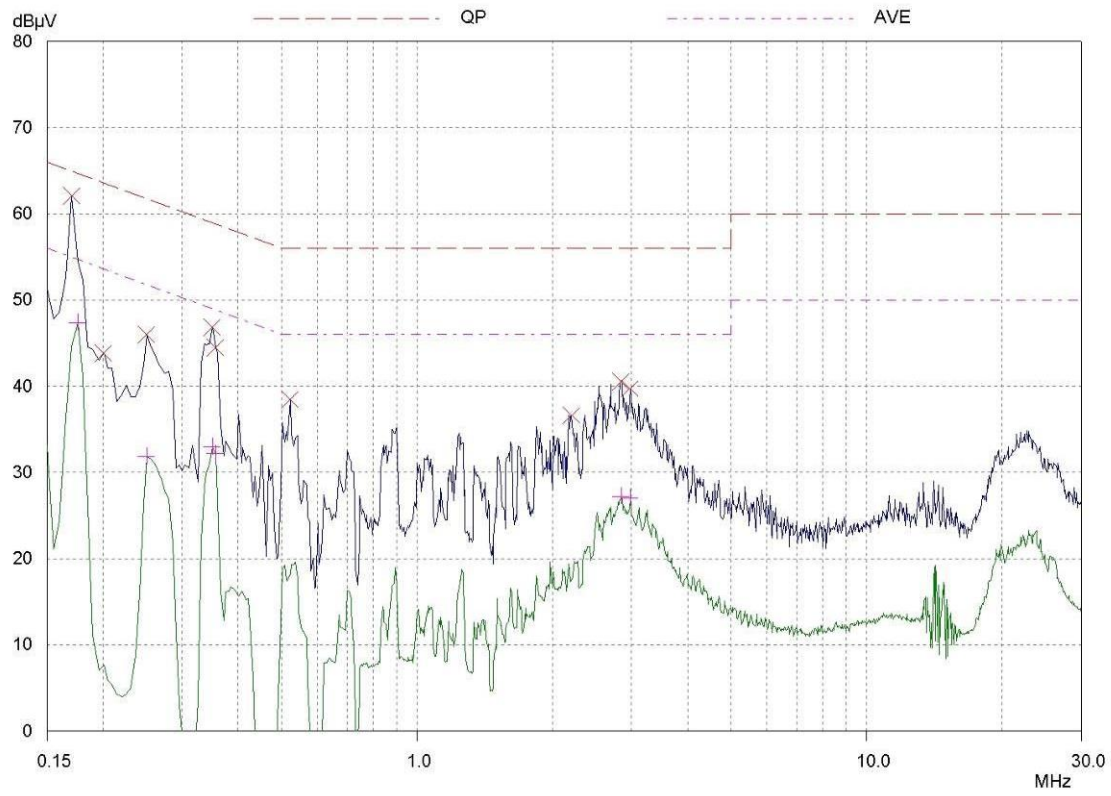
EUT:	VCCS-300-48
Manuf:	Vox Power
Op Cond:	Normal
Operator:	L Brien
Test Spec:	EN 55022 Class B
Comment:	Neutral
	20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:	Detectors:	X PK / + AV
	Meas Time:	see scan settings
	Subranges:	25
	Acc Margin:	20 dB



Compliance Engineering Ireland ltd

21 Jul 2020 10:07

Conducted Emissions

EUT: VCCS-300-48
Manuf: Vox Power
Op Cond: Normal
Operator: L Brien
Test Spec: EN 55022 Class B
Comment: Neutral
20E8799

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK+AV	20msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	lisn

Prescan Measurement:
Detectors: X PK / + AV
Meas Time: see scan settings
Subranges: 25
Acc Margin: 20 dB

Peak Search Results

Frequency MHz	PK Level dBµV	PK Limit dBµV	PK Delta dB	Phase -	PE -
0.17	62.05	64.96	2.91	N	fl
0.2	43.83	63.61	19.78	N	fl
0.25	45.95	61.76	15.81	N	fl
0.35	46.85	58.96	12.11	N	fl
0.355	44.45	58.84	14.39	N	fl
0.52	38.43	56.00	17.57	N	fl
2.205	36.62	56.00	19.38	N	fl
2.835	40.49	56.00	15.51	N	fl
2.975	39.72	56.00	16.28	N	fl

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.175	47.38	54.72	7.34	N	fl
0.25	31.84	51.76	19.92	N	fl
0.35	32.96	48.96	16.00	N	fl
0.355	32.14	48.84	16.70	N	fl
2.835	27.23	46.00	18.77	N	fl
2.975	27.04	46.00	18.96	N	fl

* limit exceeded

Indicated Phase/PE shows Configuration of max. Emission

Compliance Engineering Ireland ltd
Conducted Emissions

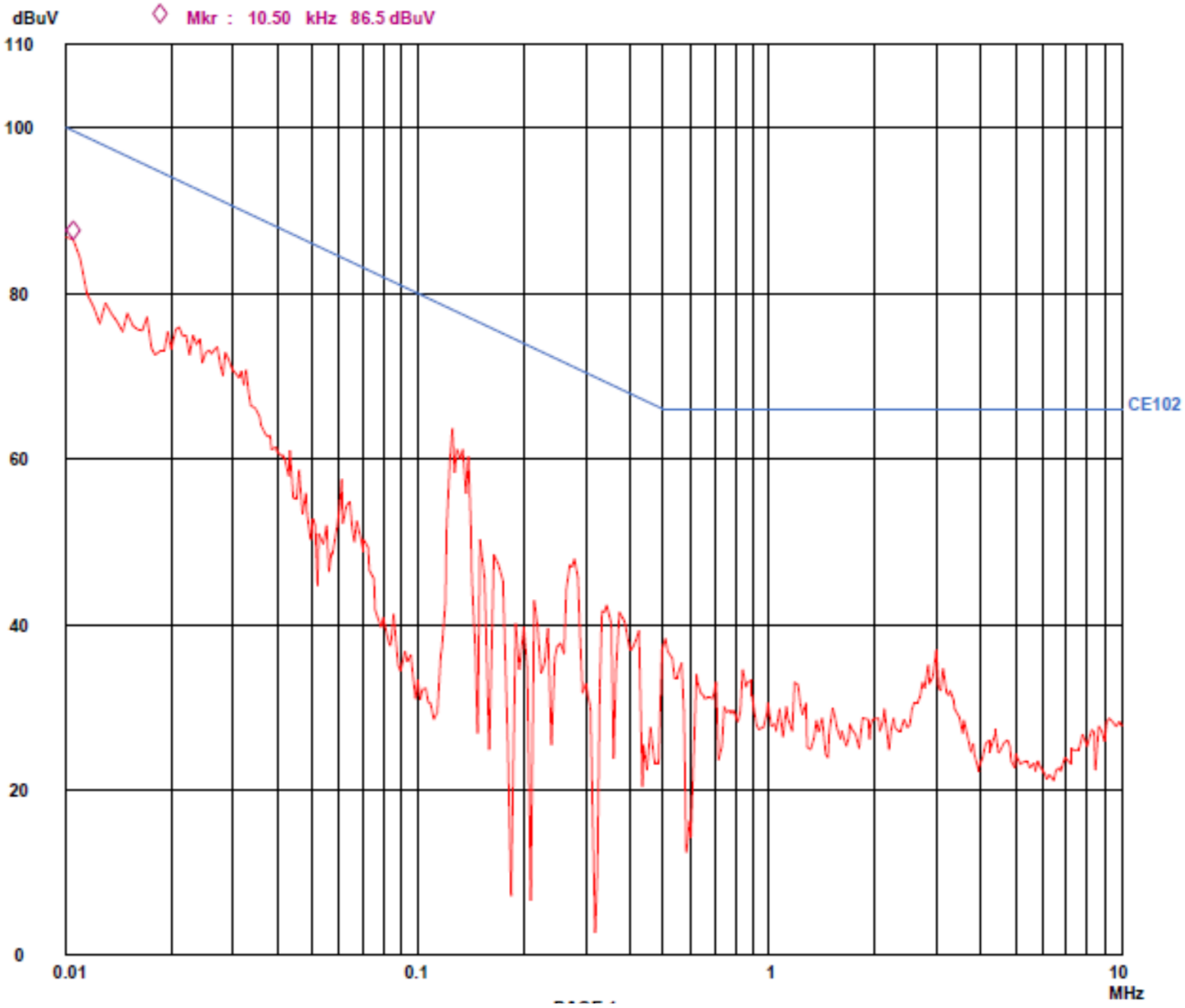
21. Jul 20 12:25

EUT: VCCS-300-48
Manuf: Vox Power
Op Cond: Normal
Operator: L Brien
Test Spec: EN 55022 Class B
Comment: Neutral
20E8799

Scan Settings (2 Ranges)

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
10k	150k	500Hz	200Hz	PK	20ms	AUTO	LN OFF	60dB
150k	10M	5k	10k	PK	5ms	AUTO	LN OFF	60dB

Transducer No.	Start	Stop	Name
1	10k	30M	lisn



CE102 12V 10 kHz to 10 MHz

Compliance Engineering Ireland ltd
Conducted Emissions

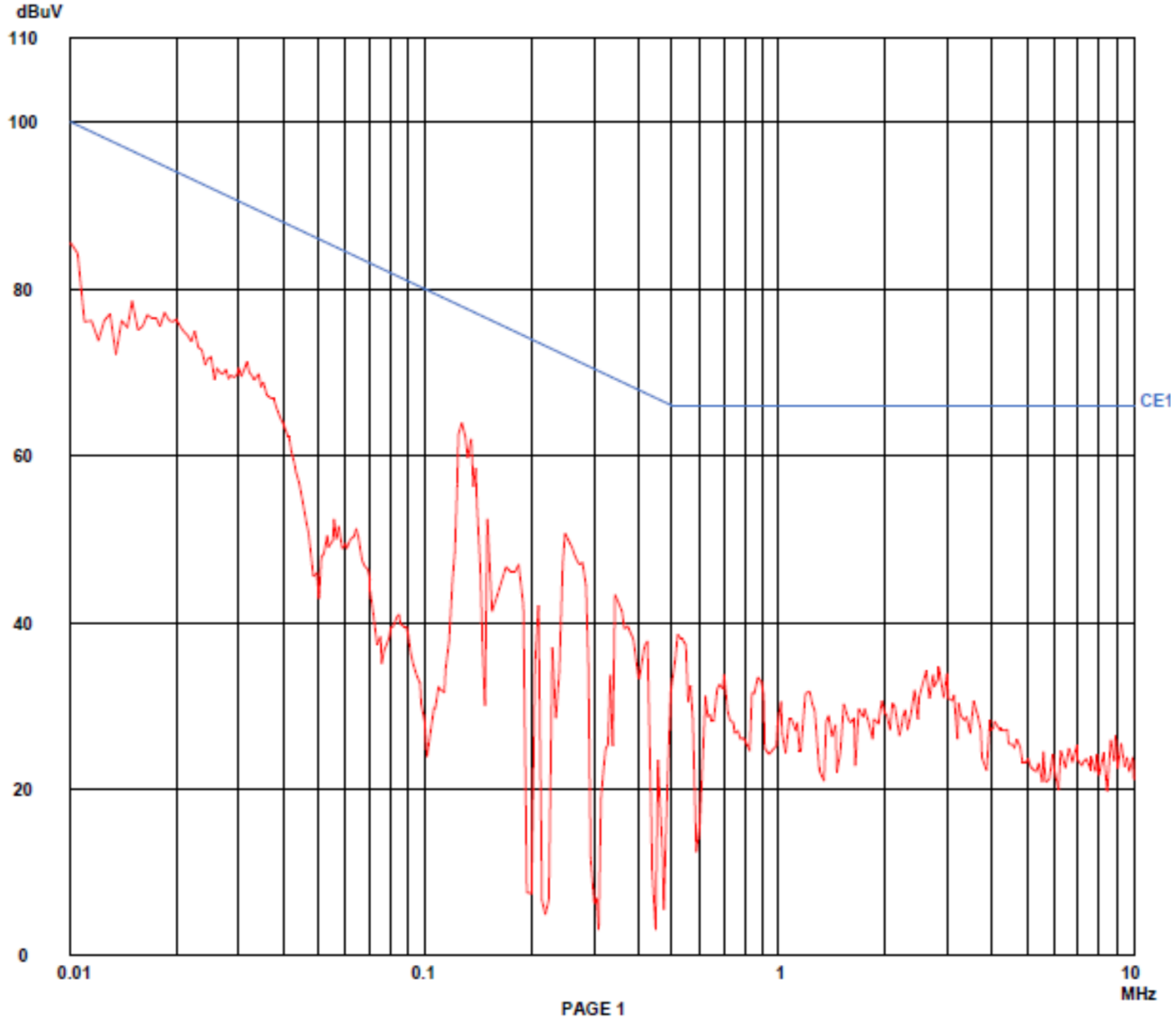
21. Jul 20 12:48

EUT: VCCS-300-48
Manuf: Vox Power
Op Cond: Normal
Operator: L Brien
Test Spec: EN 55022 Class B
Comment: Live
20E8799

Scan Settings (2 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
10k	150k	500Hz	200Hz	PK	20ms	AUTO	LN OFF	60dB
150k	10M	5k	10k	PK	5ms	AUTO	LN OFF	60dB

Transducer No.	Start	Stop	Name
1	10k	30M	lisn



PAGE 1

CE102 24V 10 kHz to 10 MHz

Compliance Engineering Ireland ltd
Conducted Emissions

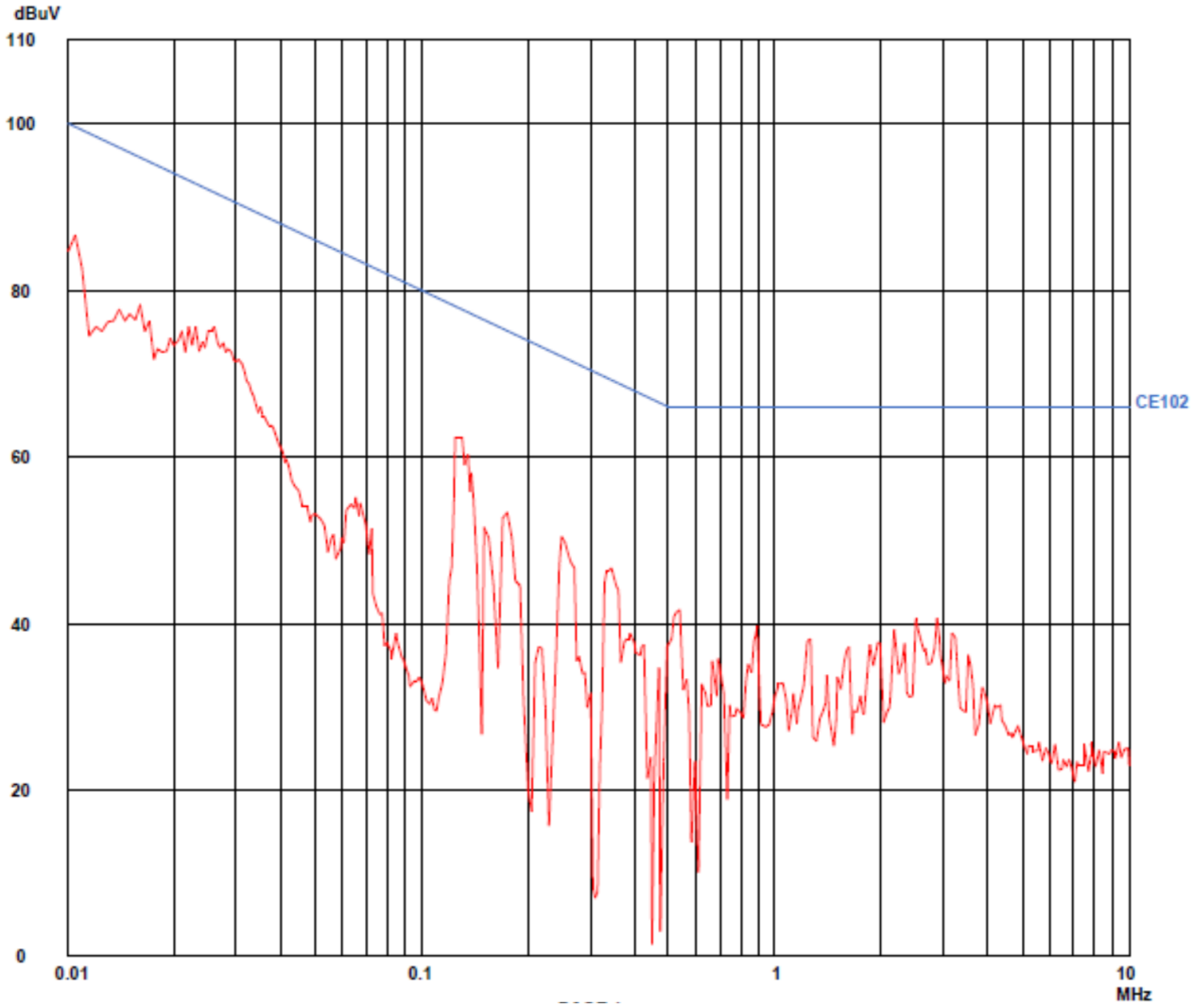
21. Jul 20 12:51

EUT: VCCS-300-48
Manuf: Vox Power
Op Cond: Normal
Operator: L Brien
Test Spec: EN 55022 Class B
Comment: Live
20E8799

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
10k	150k	500Hz	200Hz	PK	20ms	AUTO	LN OFF	60dB
150k	10M	5k	10k	PK	5ms	AUTO	LN OFF	60dB

Transducer No.	Start	Stop	Name
1	10k	30M	lisn



CE102 48V 10 kHz to 10 MHz

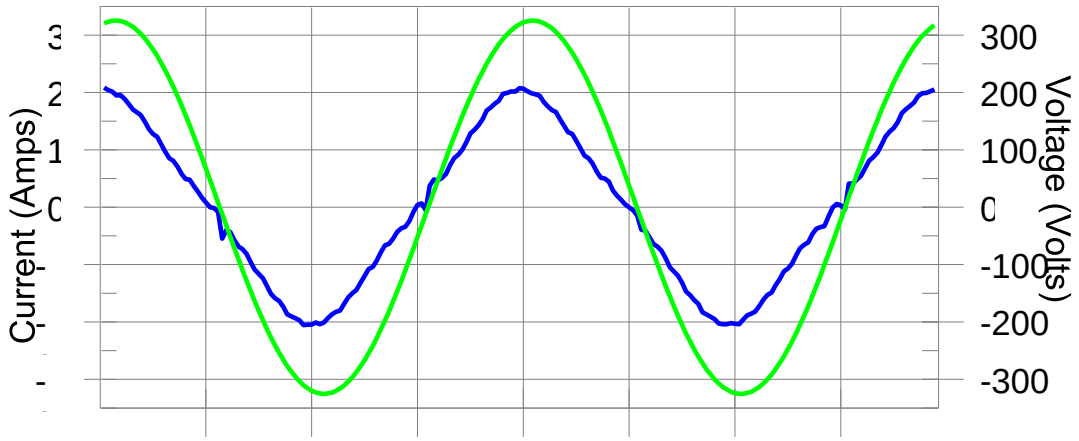
Appendix 5: Harmonics & Flicker Test Results

Harmonics – Class-A per Ed. 3.0 (2005-11)(Run time)

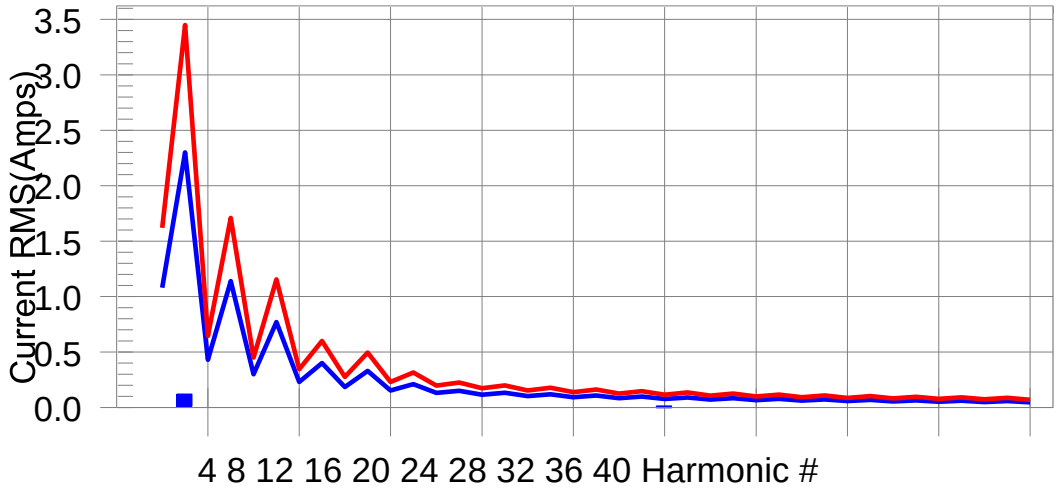
EUT: VCCS-300 **Tested by: L Brien**
Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**
Test date: 22/07/2020 **Start time: 12:33:08** **End time: 12:43:29**
Test duration (min): 10 **Data file name: H-000220.cts_data**
Comment: Comment
Customer: Vox Power

Test Result: Pass **Source qualification: Normal**

Current & voltage waveforms



Harmonics and Class A limit line **European Limits**



Test result: Pass **Worst harmonic was #24 with 16.19% of the limit.**

Current Test Result Summary (Run time)

EUT: VCCS-300 **Tested by: L Brien**
Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**
Test date: 22/07/2020 **Start time: 12:33:08** **End time: 12:43:29**
Test duration (min): 10 **Data file name: H-000220.cts_data**
Comment: Comment
Customer: Vox Power

Test Result: Pass **Source qualification: Normal**
THC(A): 0.12 **I-THD(%): 9.26** **POHC(A): 0.022** **POHC Limit(A): 0.251** **Highest parameter values during test:**

V_RMS (Volts):	**230.19**	**Frequency(Hz):**	**49.98**
I_Peak (Amps):	**2.111**	**I_RMS (Amps):**	**1.337**
I_Fund (Amps):	**1.331**	**Crest Factor:**	**1.581**
Power (Watts):	**302.3**	**Power Factor:**	**0.982**

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.001	1.080	0.1	0.002	1.620	0.13	Pass
3	0.119	2.300	5.2	0.121	3.450	3.49	Pass
4	0.001	0.430	0.2	0.002	0.645	0.24	Pass
5	0.005	1.140	0.4	0.006	1.710	0.33	Pass
6	0.001	0.300	0.2	0.001	0.450	0.22	Pass
7	0.007	0.770	1.0	0.008	1.155	0.67	Pass
8	0.001	0.230	0.2	0.001	0.345	0.27	Pass
9	0.005	0.400	1.4	0.006	0.600	0.95	Pass
10	0.001	0.184	0.5	0.001	0.276	0.49	Pass
11	0.003	0.330	0.8	0.003	0.495	0.56	Pass
12	0.001	0.153	1.0	0.002	0.230	0.88	Pass
13	0.004	0.210	1.8	0.004	0.315	1.28	Pass
14	0.002	0.131	1.4	0.003	0.197	1.30	Pass
15	0.006	0.150	4.2	0.007	0.225	2.91	Pass
16	0.002	0.115	1.8	0.003	0.173	1.58	Pass
17	0.008	0.132	5.8	0.008	0.199	3.93	Pass
18	0.002	0.102	2.1	0.003	0.153	1.85	Pass
19	0.008	0.118	6.9	0.008	0.178	4.67	Pass
20	0.002	0.092	2.3	0.003	0.138	1.96	Pass
21	0.008	0.107	7.5	0.008	0.161	5.11	Pass
22	0.002	0.084	2.6	0.003	0.125	2.23	Pass
23	0.008	0.098	8.1	0.008	0.147	5.57	Pass
24	0.012	0.077	16.2	0.014	0.115	11.78	Pass
25	0.008	0.090	8.7	0.008	0.135	5.97	Pass
26	0.003	0.071	3.6	0.003	0.106	3.13	Pass
27	0.008	0.083	9.2	0.008	0.125	6.29	Pass
28	0.002	0.066	3.4	0.003	0.099	3.04	Pass
29	0.007	0.078	9.4	0.008	0.116	6.49	Pass
30	0.002	0.061	3.4	0.003	0.092	3.13	Pass
31	0.007	0.073	9.4	0.007	0.109	6.49	Pass
32	0.002	0.058	3.4	0.003	0.086	3.10	Pass
33	0.006	0.068	9.3	0.007	0.102	6.49	Pass
34	0.002	0.054	3.2	0.002	0.081	2.99	Pass
35	0.006	0.064	9.2	0.006	0.096	6.37	Pass
36	0.002	0.051	3.1	0.002	0.077	2.86	Pass
37	0.005	0.061	9.0	0.006	0.091	6.24	Pass
38	0.001	0.048	3.0	0.002	0.073	2.67	Pass
39	0.005	0.058	8.8	0.005	0.087	6.16	Pass
40	0.001	0.046	2.6	0.002	0.069	2.41	Pass

Voltage Source Verification Data (Run time)

EUT: VCCS-300 **Tested by: L Brien**
Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**
Test date: 22/07/2020 **Start time: 12:33:08** **End time: 12:43:29**
Test duration (min): 10 **Data file name: H-000220.cts_data**
Comment: Comment
Customer: Vox Power

Test Result: Pass **Source qualification: Normal**

Highest parameter values during test:

Voltage (Vrms):	**230.19**	**Frequency(Hz):**	**49.98**
I_Peak (Amps):	**2.111**	**I_RMS (Amps):**	**1.337**
I_Fund (Amps):	**1.331**	**Crest Factor:**	**1.581**
Power (Watts):	**302.3**	**Power Factor:**	**0.982**

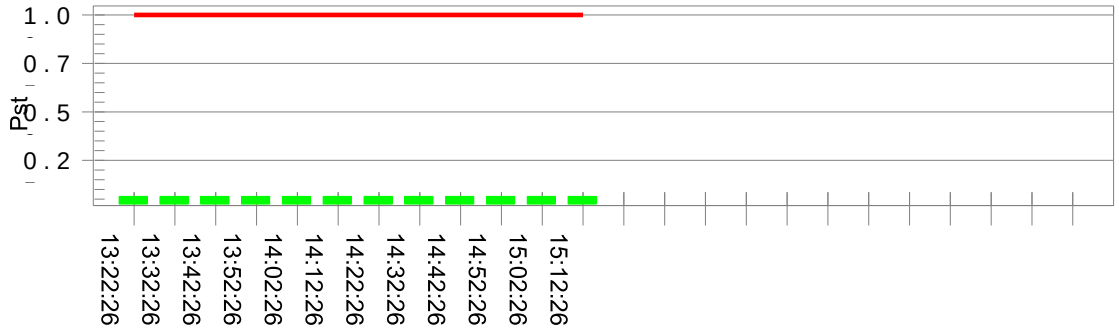
Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.223	0.460	48.42	OK
3	0.182	2.071	8.80	OK
4	0.093	0.460	20.26	OK
5	0.103	0.921	11.15	OK
6	0.047	0.460	10.28	OK
7	0.064	0.690	9.32	OK
8	0.039	0.460	8.56	OK
9	0.052	0.460	11.26	OK
10	0.030	0.460	6.61	OK
11	0.035	0.230	15.05	OK
12	0.023	0.230	10.11	OK
13	0.033	0.230	14.18	OK
14	0.022	0.230	9.58	OK
15	0.028	0.230	12.19	OK
16	0.019	0.230	8.08	OK
17	0.026	0.230	11.09	OK
18	0.016	0.230	6.74	OK
19	0.022	0.230	9.57	OK
20	0.015	0.230	6.57	OK
21	0.021	0.230	9.25	OK
22	0.016	0.230	6.75	OK
23	0.021	0.230	8.93	OK
24	0.047	0.230	20.35	OK
25	0.019	0.230	8.12	OK
26	0.013	0.230	5.78	OK
27	0.019	0.230	8.08	OK
28	0.012	0.230	5.37	OK
29	0.018	0.230	7.60	OK
30	0.012	0.230	5.40	OK
31	0.017	0.230	7.40	OK
32	0.012	0.230	5.17	OK
33	0.017	0.230	7.43	OK
34	0.011	0.230	4.70	OK
35	0.016	0.230	6.74	OK
36	0.011	0.230	4.82	OK
37	0.020	0.230	8.86	OK
38	0.011	0.230	4.71	OK
39	0.021	0.230	9.32	OK
40	0.009	0.230	4.08	OK

Flicker Test Summary per EN/IEC61000-3-3 (Run time)

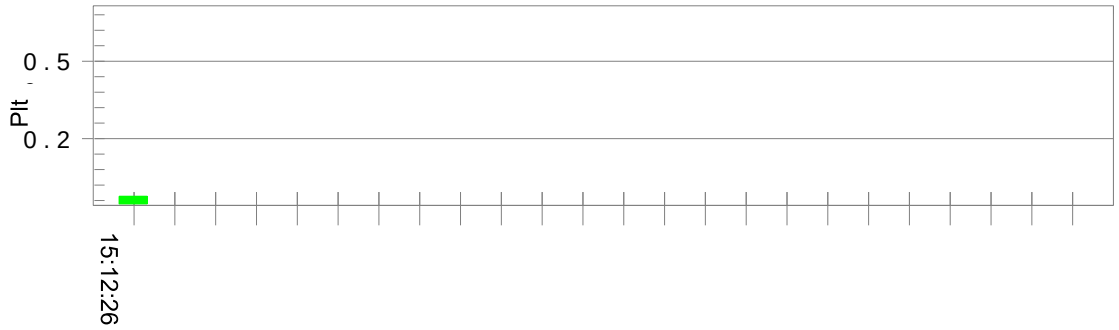
Tested by: lb
Test category: All parameters (European limits) **Test Margin: 100**
Test date: 22/07/2020 **Start time: 13:12:06** **End time: 15:12:27**
Test duration (min): 120 **Data file name: F-000221.cts_data**
Comment: Comment
Customer: vox

Test Result: Pass **Status: Test Completed**

Pst_i and limit line **European Limits**



Plt and limit line



Parameter values recorded during the test:
Vrms at the end of test (Volt): 229.95

Highest dt (%):	**0.24**	**Test limit (%):**	**3.30**	**Pass**
Time(mS) > dt:	**0.0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.14**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**0.26**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.064**	**Test limit:**	**1.000**	**Pass**
Highest Plt (2 hr. period):	**0.064**	**Test limit:**	**0.650**	**Pass**

Appendix 6: Voltage Dips Test Results

48V Dips, Criteria B response