FCC and ISED Test Report

Logic Energy Ltd
Wind Speed Logger, Model: WINDCRANE

In accordance with FCC 47 CFR Part 15B and ICES-003

Prepared for: Logic Energy Ltd
PO Box 26237
Kilmarnock
Scotland
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UNITED KINGDOM

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Document 75956499-02 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
John Laydon	General Manager	Authorised Signatory	16 November 2022

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15B and ICES-003. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Ravi Kishore Darshanam	16 November 2022	

FCC Accreditation
330364 Bearley Test Laboratory

Industry Canada Accreditation
2932E Bearley Test Laboratory

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15B 2021 and ICES-003: Issue 7: 2020 for the tests detailed in section 1.3.

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Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	16 November 2022

Table 1

1.2 Introduction

Applicant	Logic Energy Ltd
Manufacturer	Logic Energy Ltd
Model Number(s)	WINDCRANE
Serial Number(s)	195683602456
Hardware Version(s)	1.12
Software Version(s)	w1.12
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B 2021 ICES-003: Issue 7: 2020
Order Number Date	188542 Rev: 1 05-September-2022
Date of Receipt of EUT	12-September-2022
Start of Test	30-September-2022
Finish of Test	07-October-2022
Name of Engineer(s)	Ravi Kishore Darshanam
Related Document(s)	ANSI C63.4: 2014

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15B and ICES-003 is shown below.

Section	Specification Clause		Test Description	Modification State	Result	Comments/Base Standard
	FCC	ICES				
Configuration and Mode: DC Powered - 2G and LTE Idle						
2.1	15.109	3.2	Radiated Disturbance	0	Pass	ANSI C63.4: 2014

Table 2

1.4 Declaration of Build Status

Technical Description of EUT * (a brief description of the intended use and operation)	Wind speed logger with cellular telemetry
Primary Function of EUT*	Measure wind speed and transmitting the data to a Logic Energy web platform
Manufacturer	Logic Energy Ltd
Country of Origin	United Kingdom (GB)
UK Agent (If applicable)	n/a
Model Name	WINDCRANE
Model Number	3013
Manufacturers Declared Variants (if applicable) **	none
Part Number	n/a
Serial Number	195683641405, 195683602555, 195683602456
Drawing Number	
Build Status *e.g. Pre-production / Full production / Standard unit with no modifications*	Full production
Software Version	w1.12
Hardware Version	1.12
Voltage Rating	9-32 VDC
Highest Internal Frequency (Generated or used within EUT)	2170 MHz (LTE-M Band 2 / GSM PCS1900)
Intended Operating Environment	Industrial

Signature
Representatives of Customer _____

Date _____

BSD Serial Number

Note: This document has been prepared to enable manufacturers with no mechanism for producing their own Build State Declaration, to declare the build state of the equipment submitted for test.

No responsibility will be accepted by TÜV SÜD as to the accuracy of the information declared on this Build State Declaration by the manufacturer.

* EUT – Equipment under test
* * Worst case selection criteria for series of apparatus with similarities

1.5 Product Information

1.5.1 Technical Description

The Equipment under test (EUT) was a Wind speed logger with cellular telemetry.

The primary function of the EUT is to measure wind speed and transmitting the data to a Logic Energy web platform.

Figure 1 - EUT - Profile

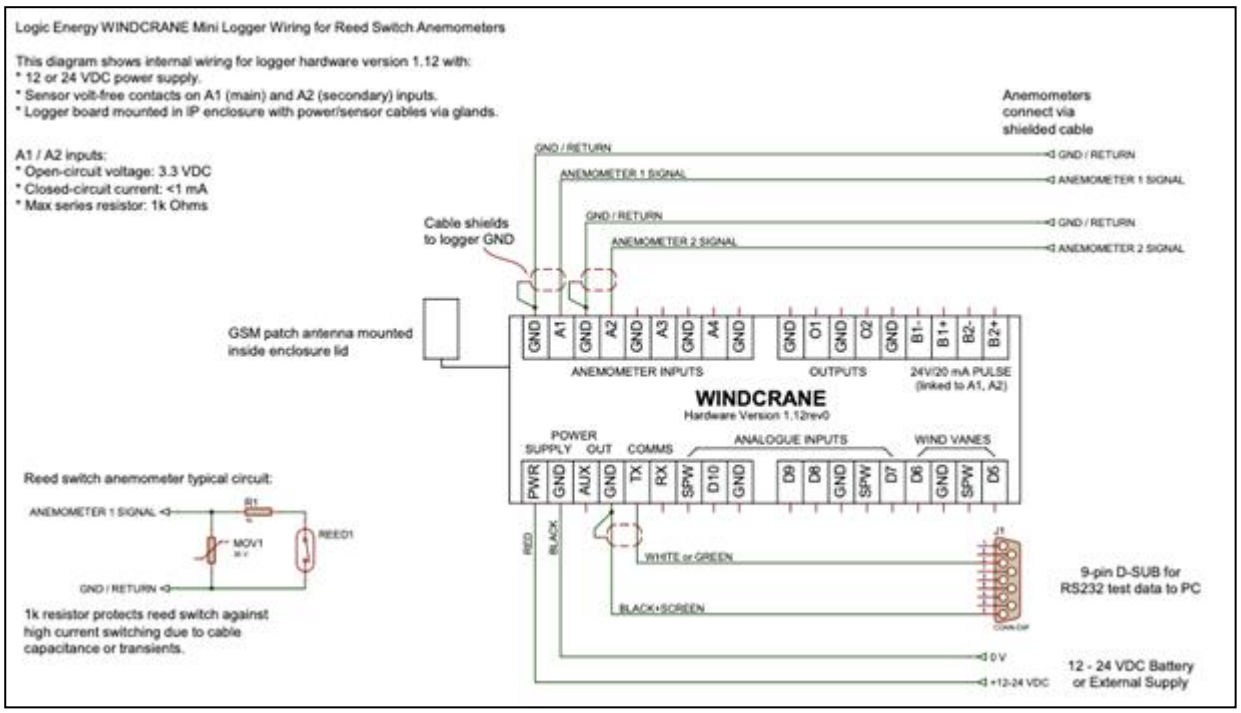

Figure 2 – EUT - Wiring Diagram

1.5.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Configuration and Mode: DC Powered - 2G and LTE Idle				
DC Power Port	3m	DC power (24 V) for EUT	2 core, 0.5 mm^2	No
Signal cable - Anemometers	3m	Signal for 1 or 2 anemometers	2/4 core, 0.34mm^2	Yes

Table 3

1.5.3 Test Configuration

Configuration	Description
DC Powered	EUT is powered at 24VDC, Anemometer connected to sensor input cable or sensor input short-circuited & for immunity RS232 output to support laptop

Table 4

1.5.4 Modes of Operation

Mode	Description
2G and LTE Idle	Continuous operation with logger sampling the sensor inputs; cellular modem registered with idle.

Table 5

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Model: WINDCRANE, Serial Number: 195683602456			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 6

1.8 Test Location

TÜV SÜD conducted the following tests at our Bearley Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: DC Powered - 2G and LTE Idle		
Radiated Disturbance	Ravi Kishore Darshanam	UKAS

Table 7

Office Address:

Snitterfield Road
Bearley
Warwickshire
CV37 OEX
United Kingdom

2 Test Details

2.1 Radiated Disturbance

2.1.1 Specification Reference

FCC 47 CFR Part 15B and ICES-003, Clause 15.109 and 3.2

2.1.2 Equipment Under Test and Modification State

WINDCRANE, S/N: 195683602456 – Modification State 0

2.1.3 Date of Test

30-September-2022 to 07-October-2022

2.1.4 Test Method

The EUT was set up on a non-conductive table 0.8 m above a reference ground plane within a semi-anechoic chamber on a remotely controlled turntable.

A pre-scan of the EUT emissions profile using a peak detector was made at a 3 m antenna distance whilst varying the antenna-to-EUT azimuth and polarisation.

For an EUT which could reasonable be used in multiple planes, pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

Using a list of the highest emissions detected during the pre-scan along with their bearing and associated antenna polarisation, the EUT was then formally measured using a Quasi-Peak, Peak or CISPR Average detector as appropriate.

The readings were maximised by adjusting the antenna height, polarisation and turntable azimuth, in accordance with the specification.

2.1.5 Example Calculation

Below 1 GHz:

Quasi-Peak level (dBµV/m) = Receiver level (dBµV) + Correction Factor (dB/m)
Margin (dB) = Quasi-Peak level (dBµV/m) – Limit (dBµV/m)

Above 1 GHz:

CISPR Average level (dBµV/m) = Receiver level (dBµV) + Correction Factor (dB/m)
Margin (dB) = CISPR Average level (dBµV/m) – Limit (dBµV/m)

Peak level (dBµV/m) = Receiver level (dBµV) + Correction Factor (dB/m)
Margin (dB) = Peak level (dBµV/m) – Limit (dBµV/m)

2.1.6 Example Test Setup Diagram

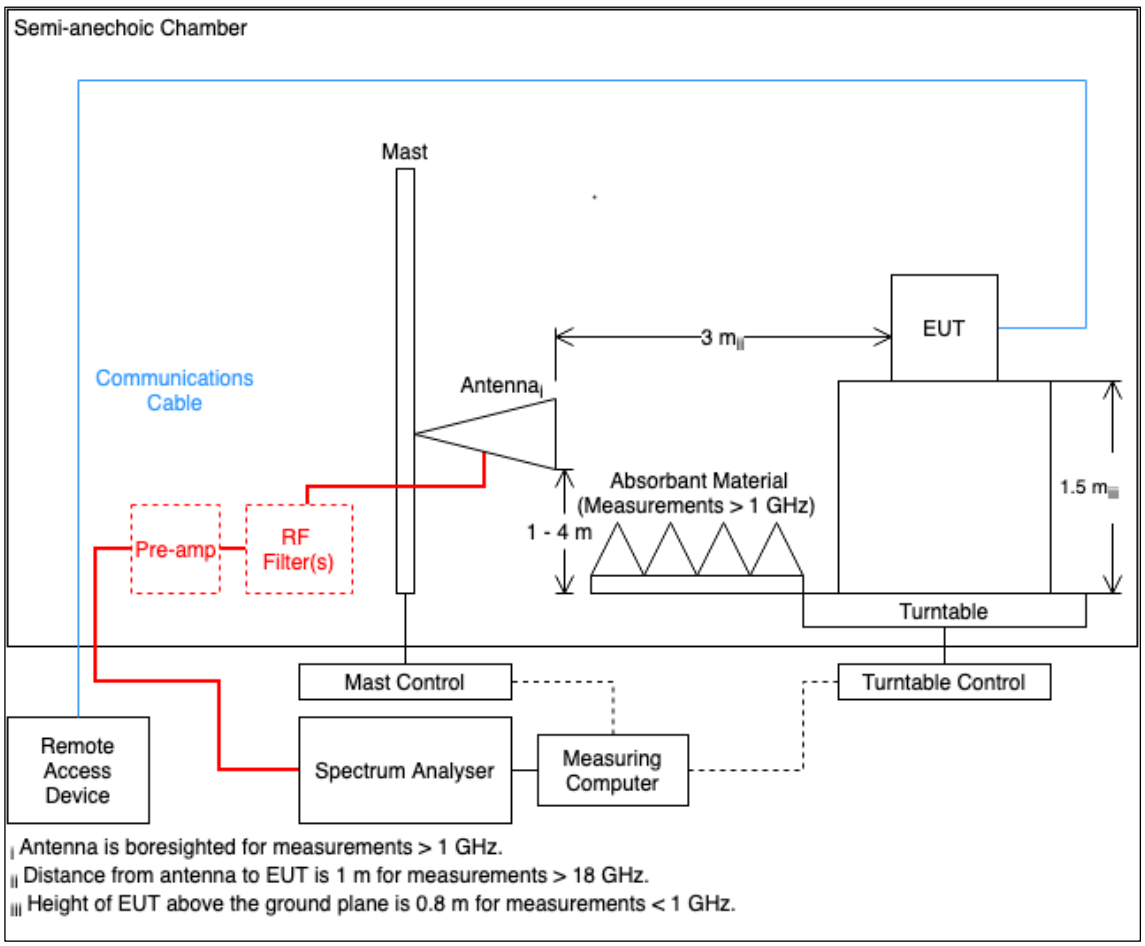

Figure 3

2.1.7 Environmental Conditions

Ambient Temperature	17.3 °C
Relative Humidity	68.3 %
Atmospheric Pressure	1007.0 mbar

2.1.8 Specification Limits

Required Specification Limits, Field Strength - Class A Test Limit at a 10 m Measurement Distance		
Frequency Range (MHz)	Test Limit (µV/m)	Test Limit (dBµV/m)
30 to 88	90	39.1
88 to 216	150	43.5
216 to 960	210	46.4
Above 960	300	49.5
Supplementary information: Note 1. A Quasi-Peak detector is to be used for measurements below 1 GHz. Note 2. A CISPR Average detector is to be used for measurements above 1 GHz. Note 3. The Peak test limit above 1 GHz is 20 dB higher than the CISPR Average test limit.		

Table 8

Note: - Radiated emissions were measured in a 3-metre chamber and the results were then extrapolated to show a 10-metre measurement using an inverse proportionality factor of 20dB per decade.

Note: - For the 30-1000MHz frequency range tests were performed against the Class B requirements

2.1.9 Test Results

Results for Configuration and Mode: DC Powered - 2G and LTE Idle.

This test was performed to the requirements of the Class A limits.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Highest frequency generated or used within the EUT: 2170 MHz
Which necessitates an upper frequency test limit of: 12.5 GHz

The EUT is handheld, body-worn, or ceiling-mounted equipment and has therefore been tested in three different orientations in accordance with ANSI C63.4, Clause 6.3.2.1.

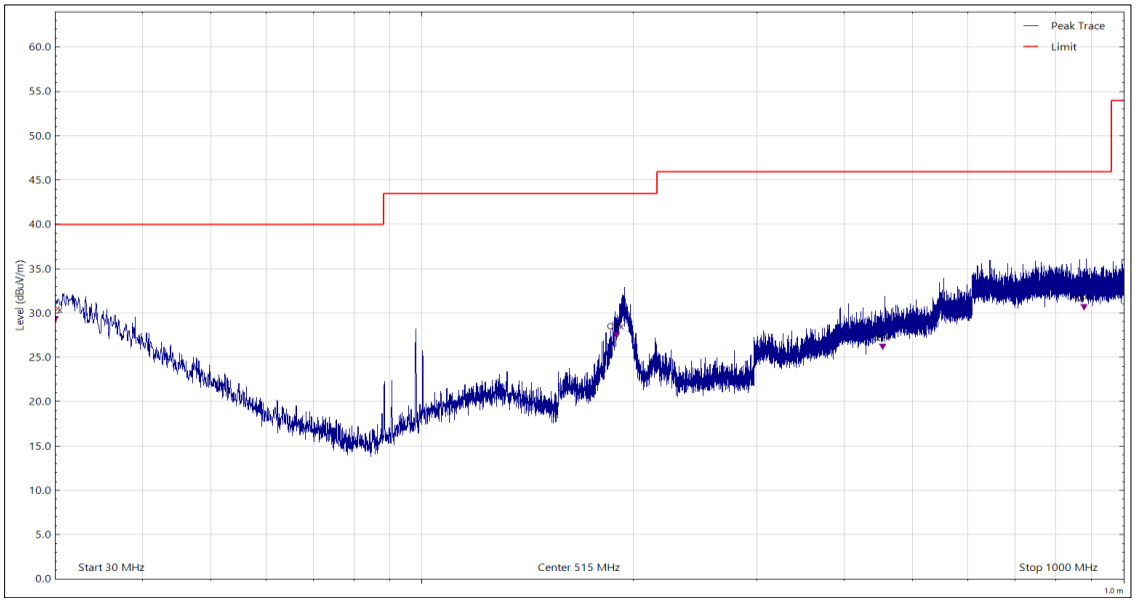

Figure 4 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal - X Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
30.036	28.83	40.00	-11.17	Q-Peak	32	110	Horizontal
189.258	26.96	43.50	-16.54	Q-Peak	114	100	Horizontal
453.902	25.67	46.00	-20.33	Q-Peak	322	179	Horizontal
879.021	30.12	46.00	-15.88	Q-Peak	70	106	Horizontal

Table 9

No other final measurements were made as all other peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

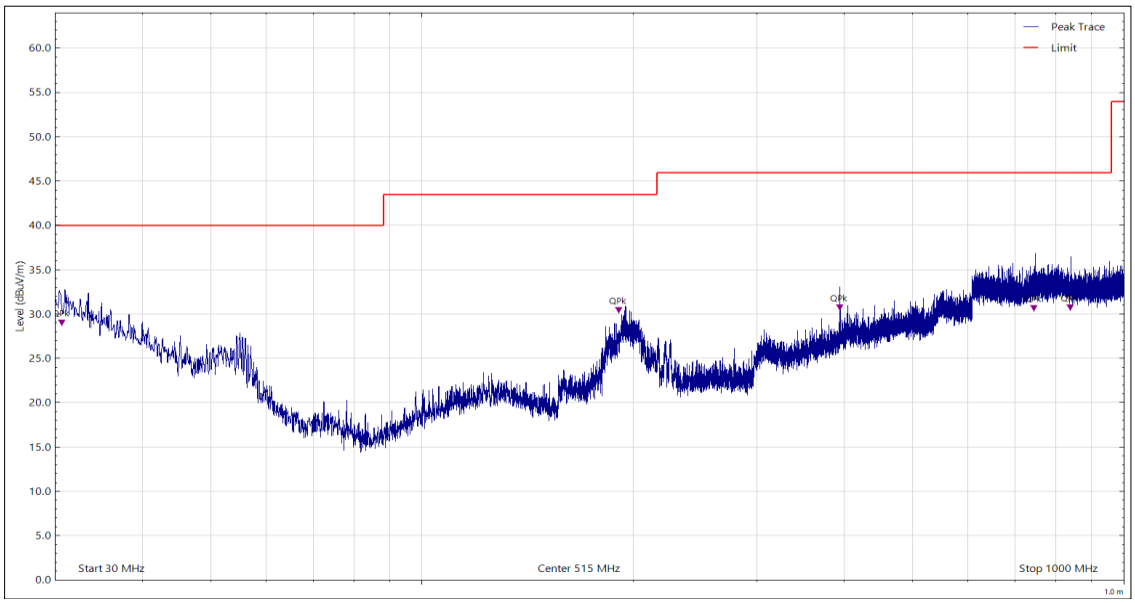

Figure 5 - 30 MHz to 1 GHz, Quasi-Peak, Vertical - X Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
30.688	28.48	40.00	-11.52	Q-Peak	88	105	Vertical
190.908	29.91	43.50	-13.59	Q-Peak	53	146	Vertical
393.751	30.21	46.00	-15.79	Q-Peak	187	236	Vertical
744.557	30.16	46.00	-15.84	Q-Peak	328	277	Vertical
839.687	30.21	46.00	-15.79	Q-Peak	119	158	Vertical

Table 10

No other final measurements were made as all other peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

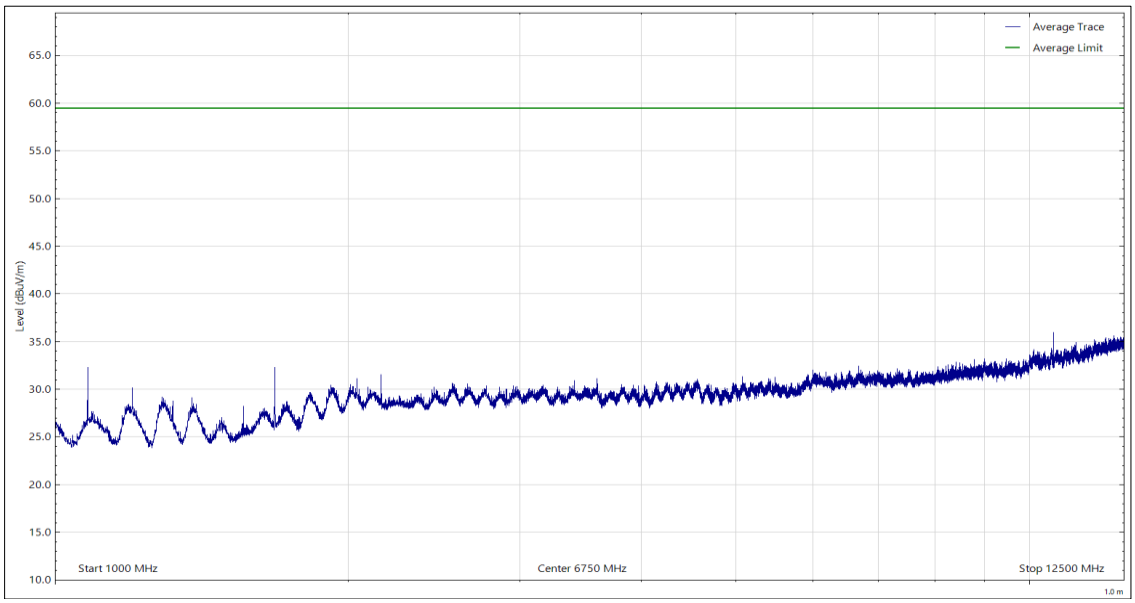

Figure 6 - 1 GHz to 12.5 GHz, CISPR Average, Horizontal - X Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 11

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

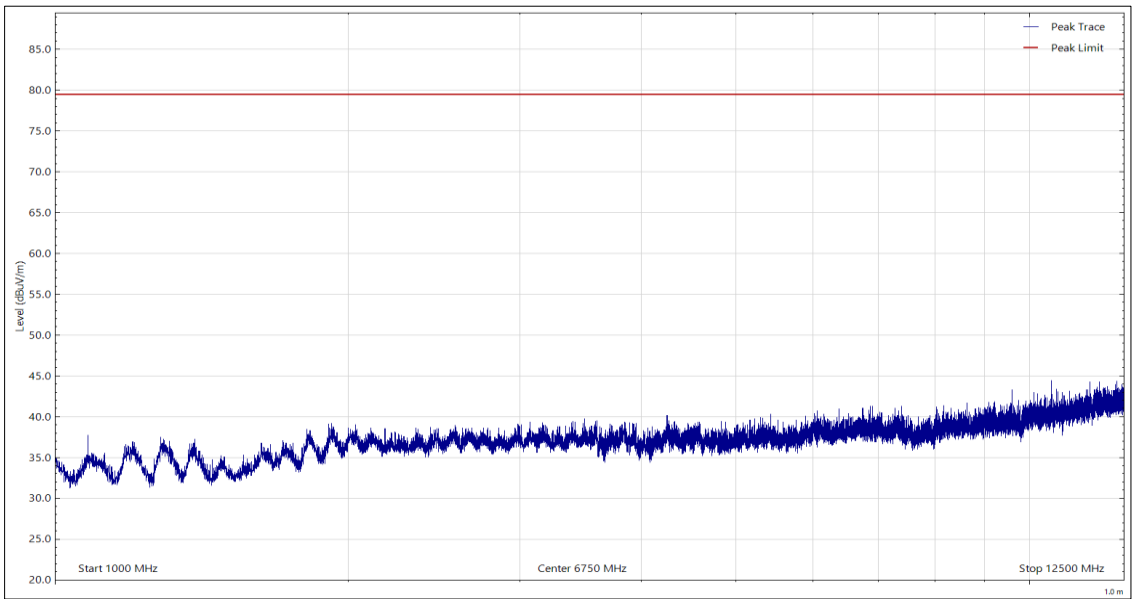

Figure 7 - 1 GHz to 12.5 GHz, Peak, Horizontal - X Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 12

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

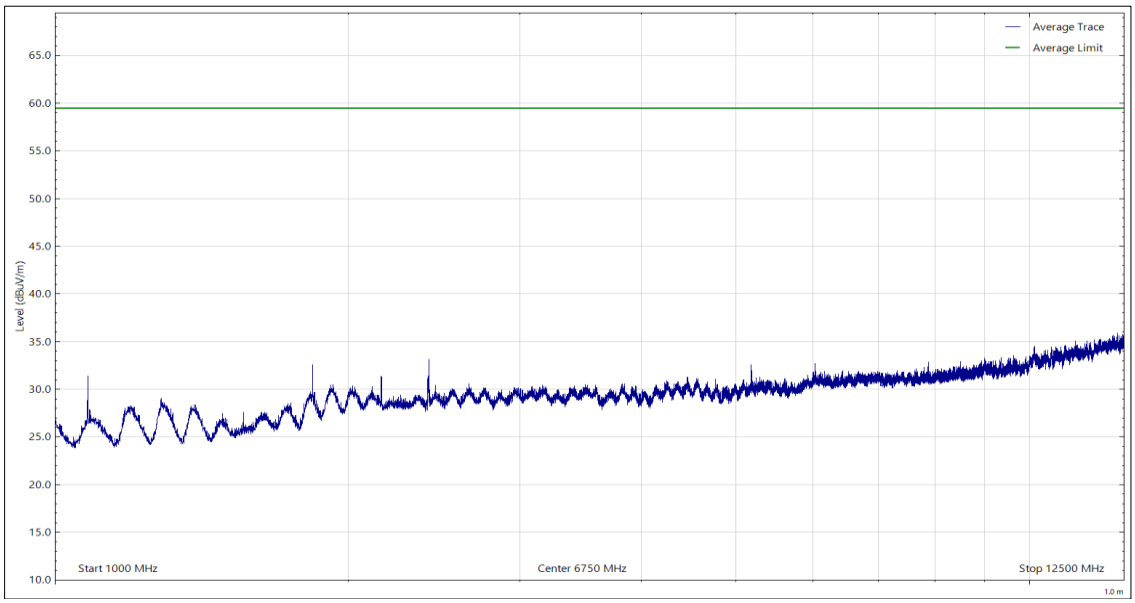

Figure 8 - 1 GHz to 12.5 GHz, CISPR Average, Vertical - X Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 13

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

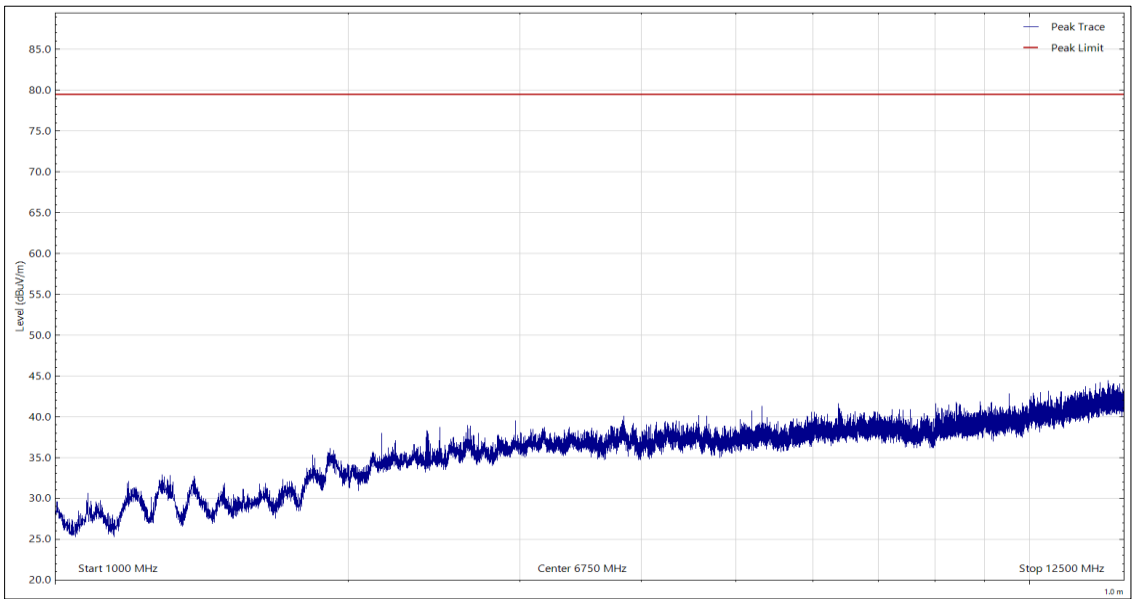

Figure 9 - 1 GHz to 12.5 GHz, Peak, Vertical - X Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 14

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

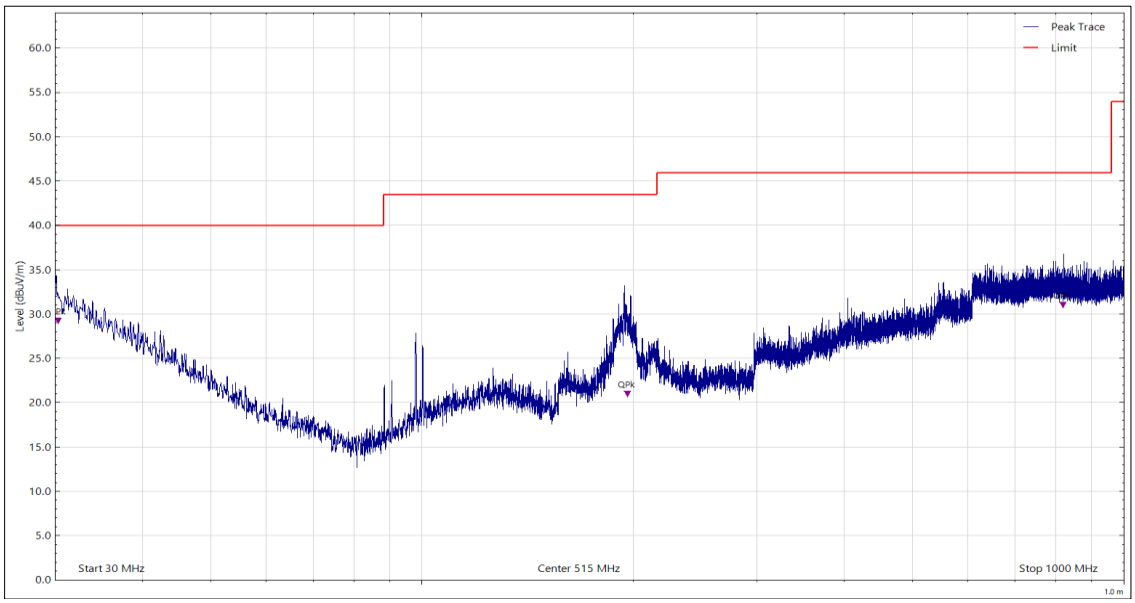

Figure 10 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal - Y Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
30.302	28.70	40.00	-11.30	Q-Peak	2	101	Horizontal
196.261	20.51	43.50	-22.99	Q-Peak	352	261	Horizontal
820.302	30.53	46.00	-15.47	Q-Peak	146	274	Horizontal

Table 15

No other final measurements were made as all other peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

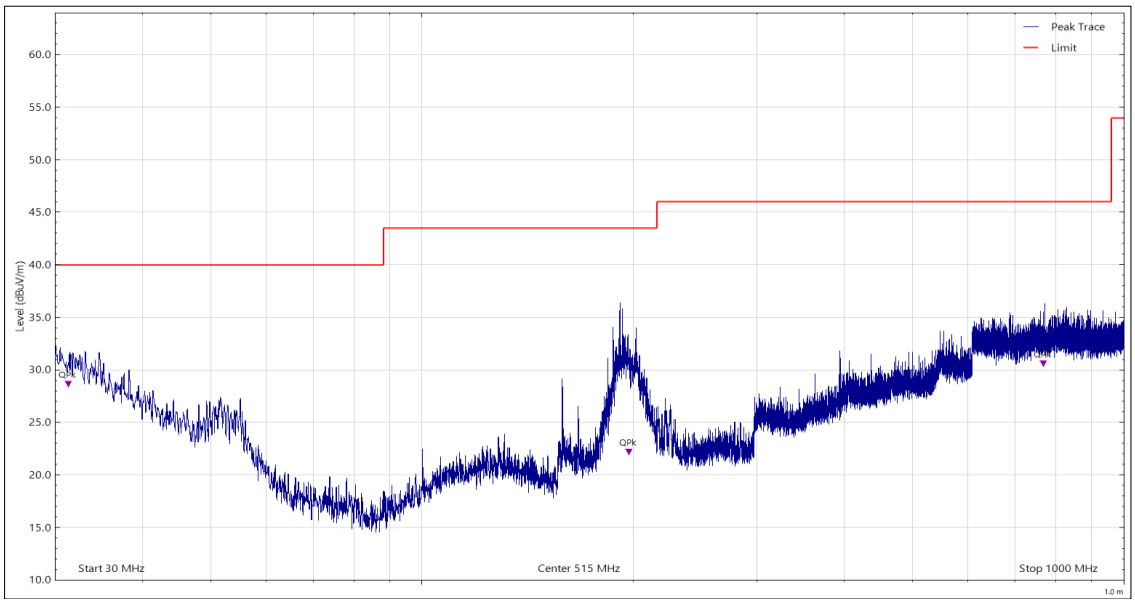

Figure 11 - 30 MHz to 1 GHz, Quasi-Peak, Vertical - Y Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
31.332	28.23	40.00	-11.77	Q-Peak	247	384	Vertical
197.161	21.73	43.50	-21.77	Q-Peak	360	100	Vertical
768.715	30.15	46.00	-15.85	Q-Peak	182	108	Vertical

Table 16

No other final measurements were made as all other peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

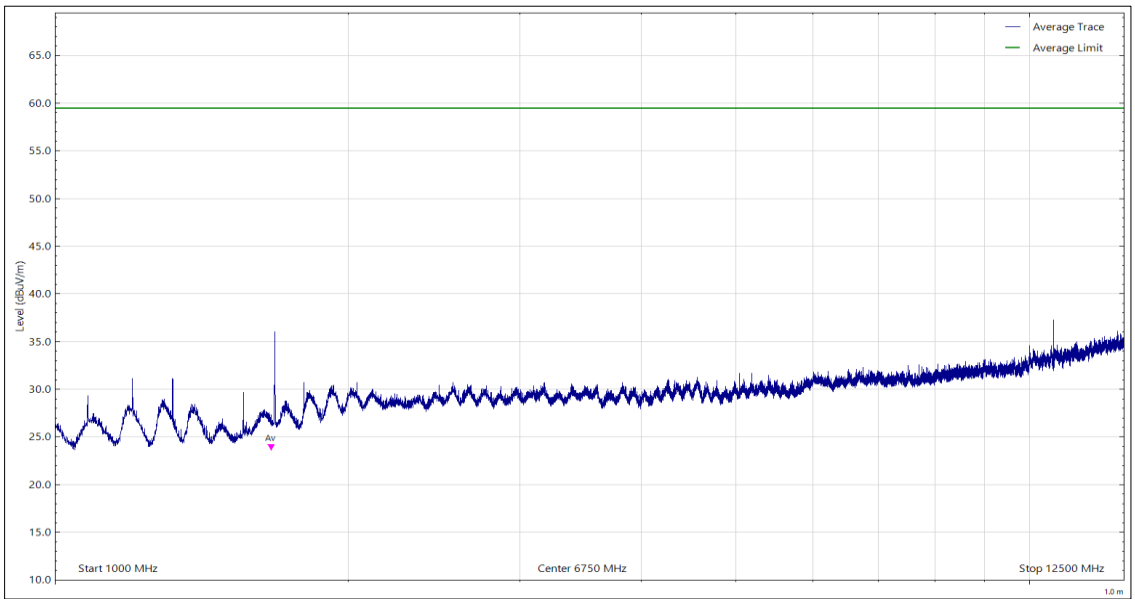

Figure 12 - 1 GHz to 12.5 GHz, CISPR Average, Horizontal - Y Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
1667.381	23.42	59.50	-36.08	CISPR Avg	210	123	Horizontal

Table 17

No other final measurements were made as all other peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

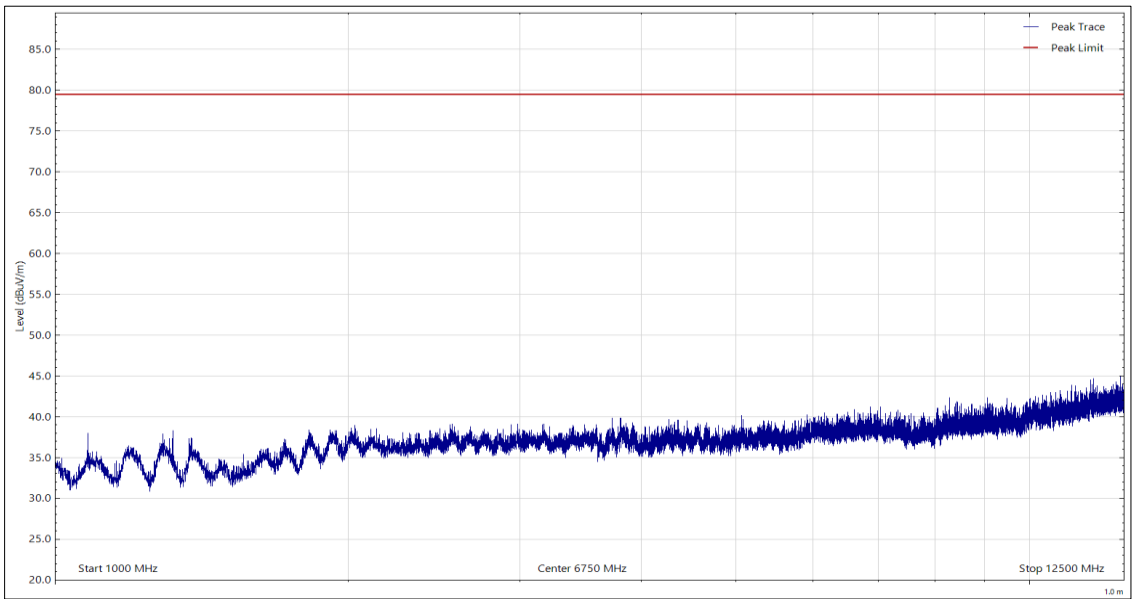

Figure 13 - 1 GHz to 12.5 GHz, Peak, Horizontal - Y Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 18

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

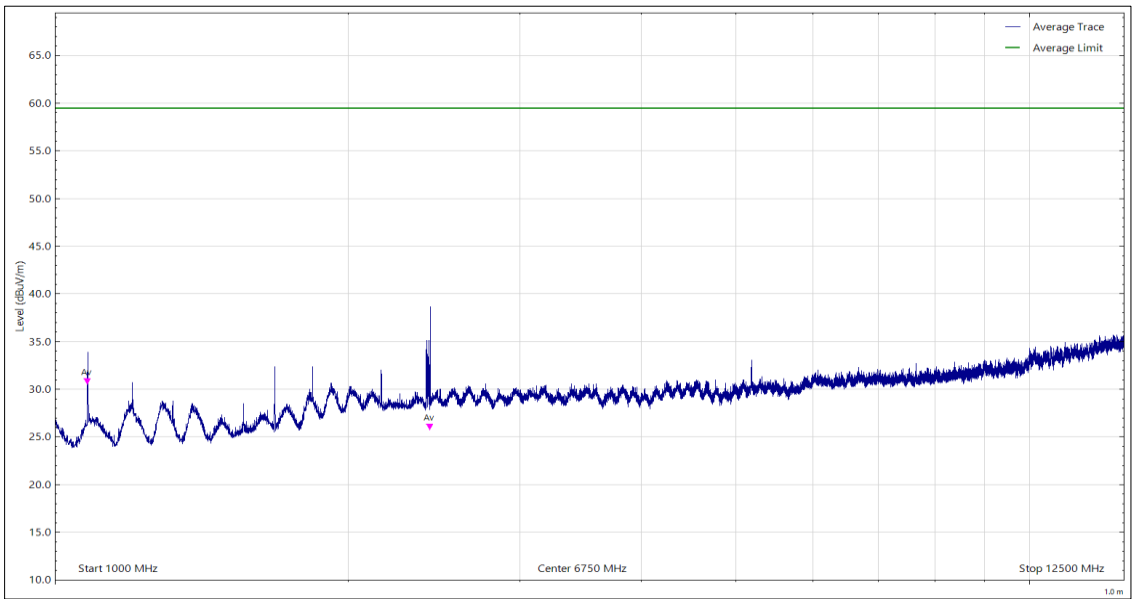

Figure 14 - 1 GHz to 12.5 GHz, CISPR Average, Vertical - Y Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
1080.053	30.36	59.50	-29.14	CISPR Avg	190	100	Vertical
2425.912	25.61	59.50	-33.89	CISPR Avg	0	178	Vertical

Table 19

No other final measurements were made as all other peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

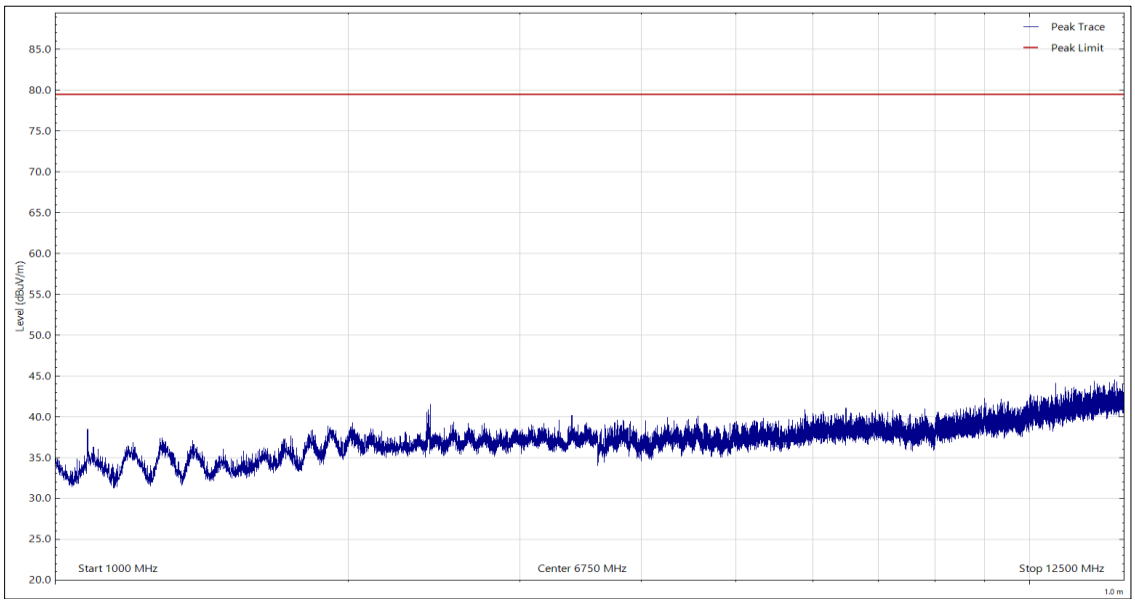

Figure 15 - 1 GHz to 12.5 GHz, Peak, Vertical - Y Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 20

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

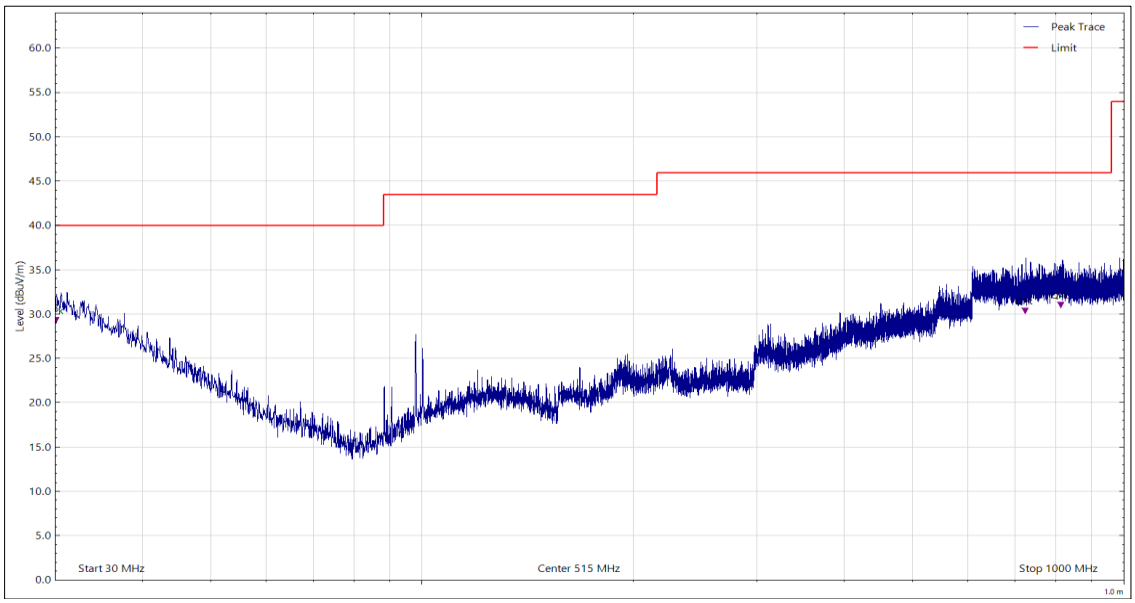

Figure 16 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal - Z Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
30.134	28.82	40.00	-11.18	Q-Peak	350	110	Horizontal
724.471	29.86	46.00	-16.14	Q-Peak	355	398	Horizontal
813.632	30.55	46.00	-15.45	Q-Peak	53	161	Horizontal

Table 21

No other final measurements were made as all other peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

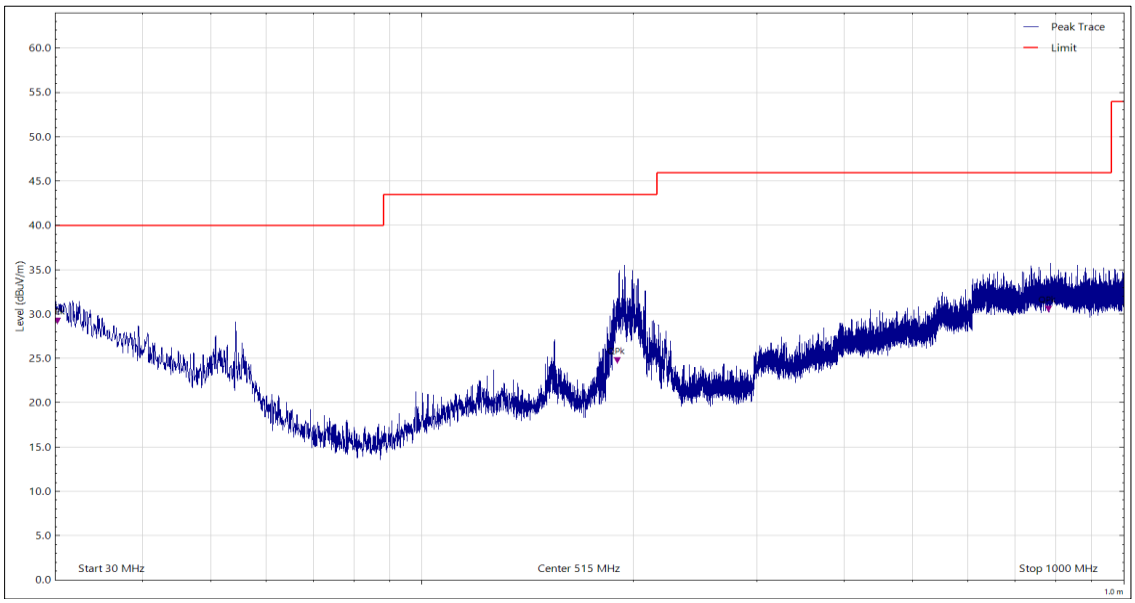

Figure 17 - 30 MHz to 1 GHz, Quasi-Peak, Vertical - Z Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
30.256	28.73	40.00	-11.27	Q-Peak	341	215	Vertical
190.009	24.26	43.50	-19.24	Q-Peak	253	203	Vertical
781.997	30.05	46.00	-15.95	Q-Peak	133	208	Vertical

Table 22

No other final measurements were made as all other peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

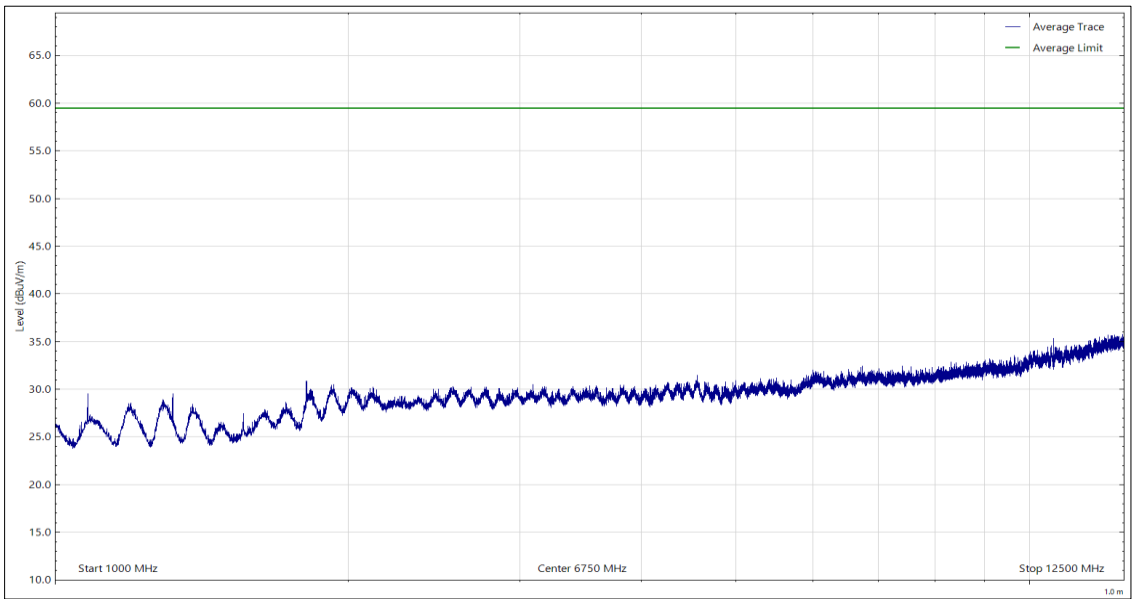

Figure 18 - 1 GHz to 12.5 GHz, CISPR Average, Horizontal - Z Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 23

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

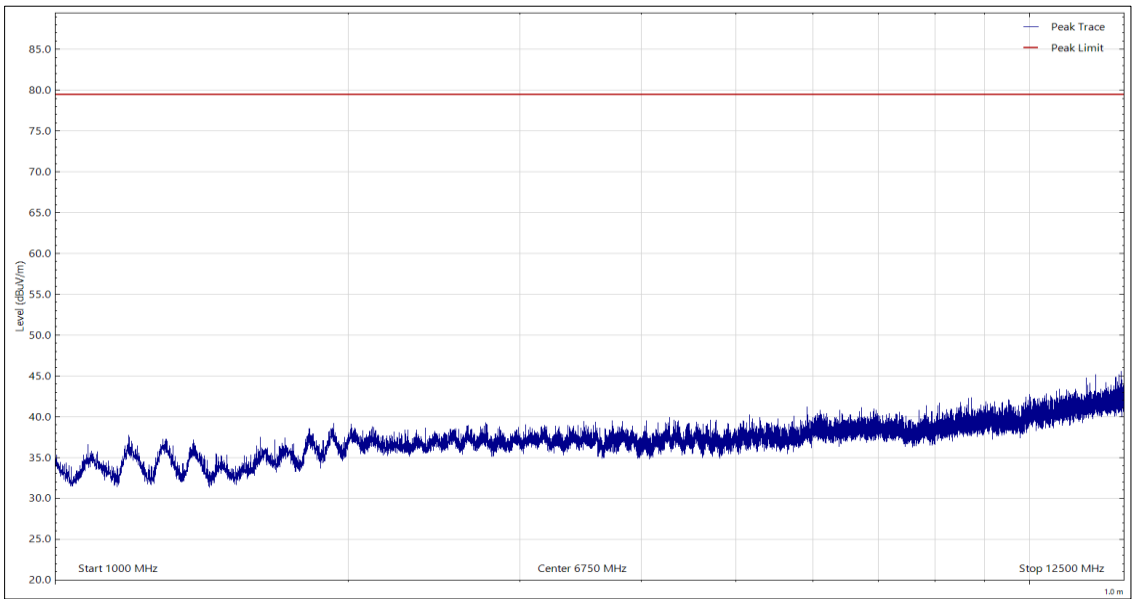

Figure 19 - 1 GHz to 12.5 GHz, Peak, Horizontal - Z Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 24

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

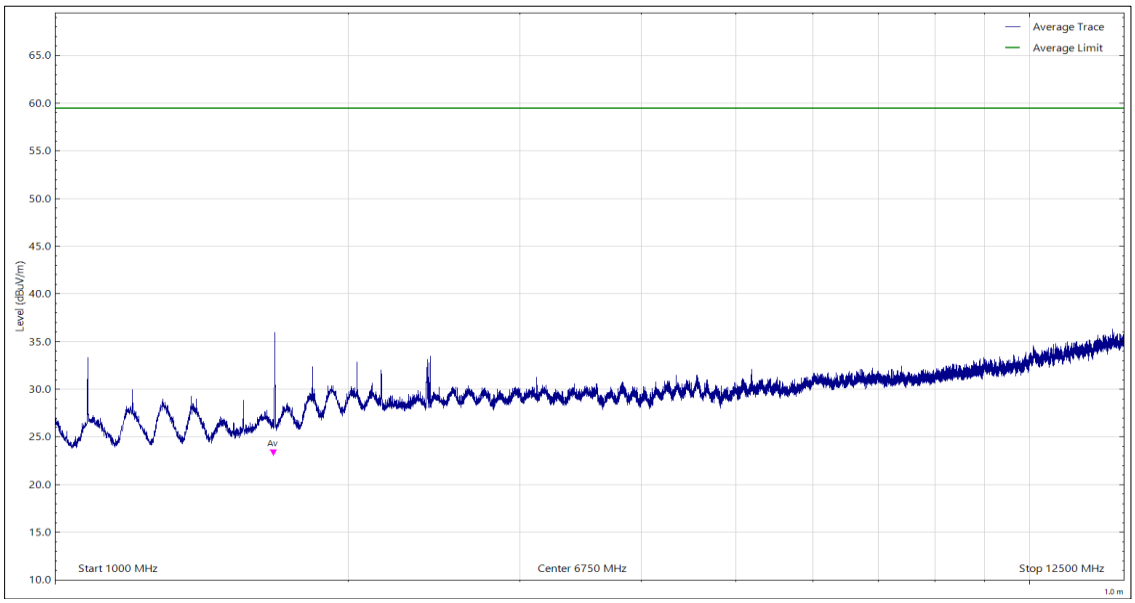

Figure 20 - 1 GHz to 12.5 GHz, CISPR Average, Vertical - Z Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
1676.573	22.90	59.50	-36.60	CISPR Avg	157	366	Vertical

Table 25

No other final measurements were made as all other peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

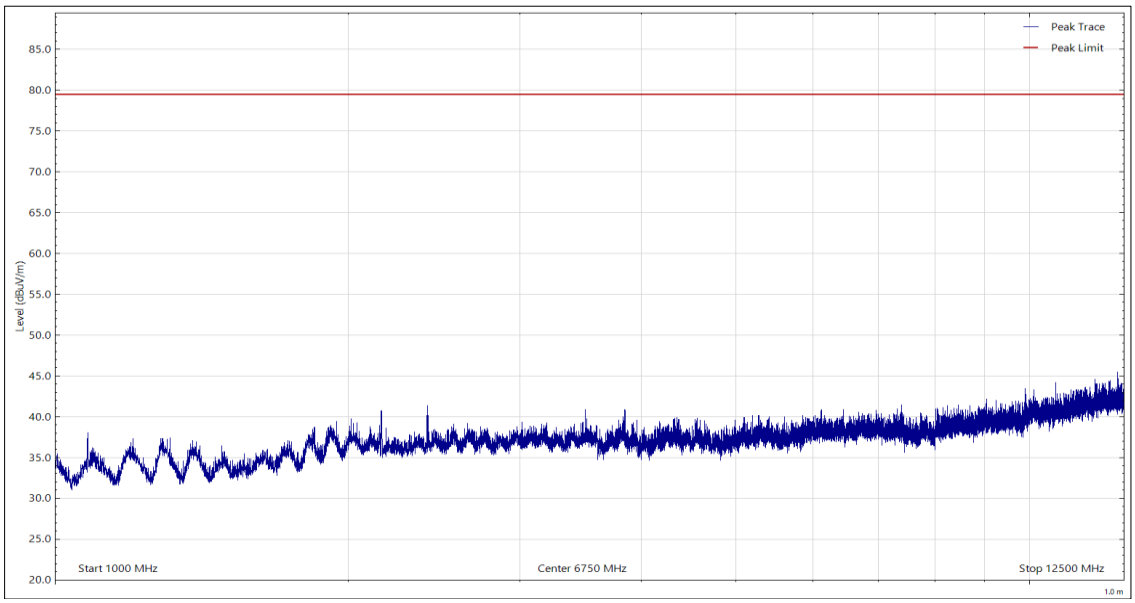

Figure 21 - 1 GHz to 12.5 GHz, Peak, Vertical - Z Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 26

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

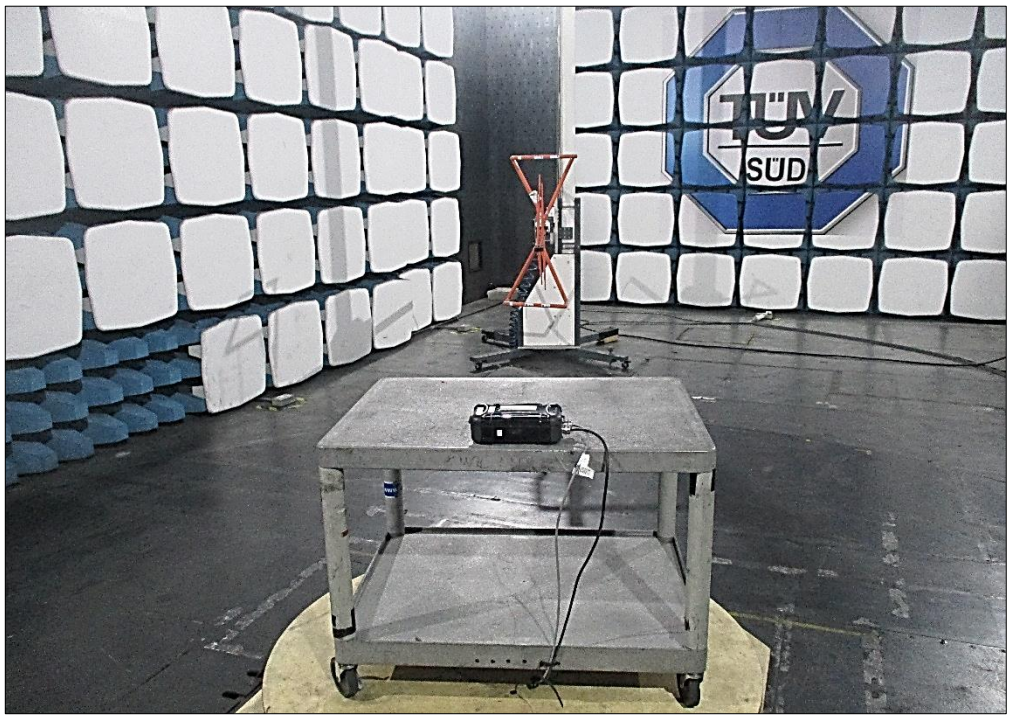

Figure 22 - Test Setup - 30 MHz to 1 GHz - X Orientation

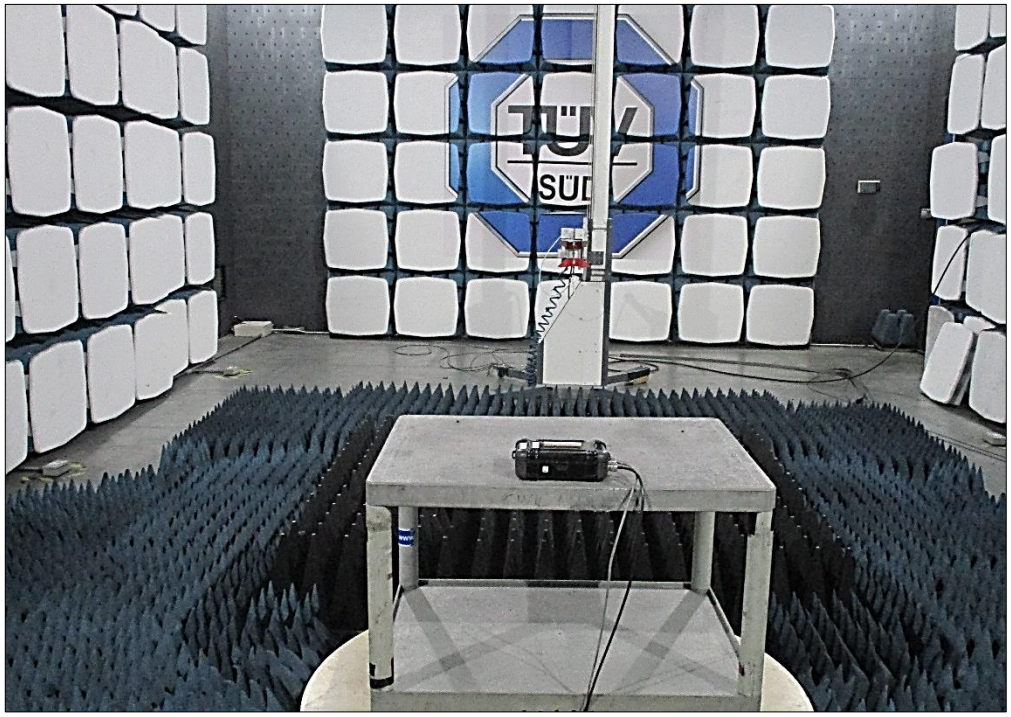

Figure 23 - Test Setup - 1 GHz to 12.5 GHz - X Orientation

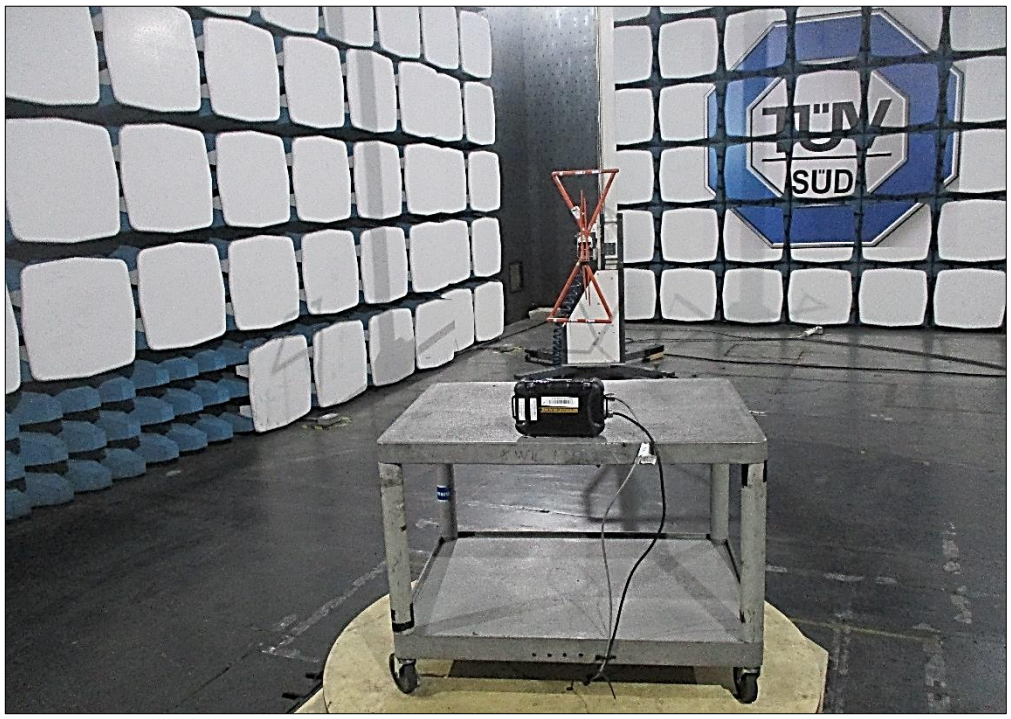

Figure 24 - Test Setup - 30 MHz to 1 GHz - Y Orientation

Figure 25 - Test Setup - 1 GHz to 12.5 GHz - Y Orientation

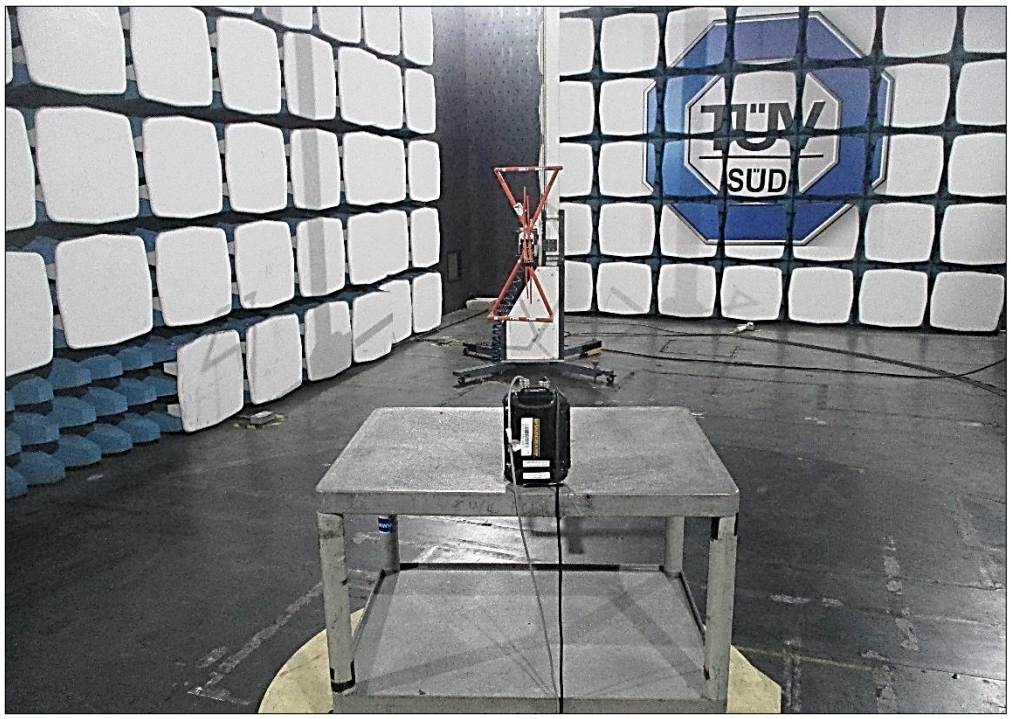

Figure 26 - Test Setup - 30 MHz to 1 GHz - Z Orientation

Figure 27 - Test Setup - 1 GHz to 12.5 GHz - Z Orientation

2.1.10 Test Location and Test Equipment Used

This test was carried out in Bearley EMC Chamber 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Antenna (Bilog, 30 MHz to 3 GHz)	Schaffner	CBL6143	1858	24	10-Nov-2022
Screened Room (1)	Rainford	Hybrid	4160	36	11-Jan-2025
Cable (N-Type to N-Type, 7 m)	Teledyne Storm	SA90-195-7MTR	4173	12	13-Apr-2023
Test Receiver	Keysight Technologies	N9038A MXE	4629	12	02-Mar-2023
Mast controller	Innco Systems	Controller CO3000	4728	-	TU
Antenna (Double Ridge Guide, 1 GHz to 18 GHz)	ETS-Lindgren	3117	4737	24	11-Mar-2024
Emissions Software	TUV SUD	EmX V3.1.4	5125	-	Software
Cable (N-Type to N-Type, 3 m)	Rosenberger	LU7-036-3000	5163	12	13-Dec-2022
Cable (18GHz SMA 1m)	Rosenberger	LU7-071-1000	5164	12	13-Dec-2022
Turntable Controller	Maturo	Maturo NCD	5275	-	TU
Attenuator (4 dB, 2 W)	Pasternack	PE7047-4	5647	24	10-Nov-2022
Broadband Pre-Amplifier (0.5 - 18 GHz)	Schwarzbeck	BBV 9718 D	5882	12	01-Mar-2023

Table 27

TU - Traceability Unscheduled

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Scientific Ambient Monitor	Testo	622	5698	12	04-Mar-2023

Table 28

3.2 Customer Support Equipment

Instrument	Manufacturer	Type No	Serial Number	Calibration Period (months)	Calibration Due
2 Anemometers	NA	NA	NA	-	-

Table 29

4 Incident Reports

No incidents reports were raised.

5 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Radiated Disturbance	30 MHz to 1 GHz, Bilog Antenna, ±5.2 dB 1 GHz to 40 GHz, Horn Antenna, ±6.3 dB

Table 30

Worst case error for both Time and Frequency measurement 12 parts in 10^6.

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2021, Clause 4.4.3 (Procedure 2). The measurement results are directly compared with the test limit to determine conformance with the requirements of the standard.

Risk: The uncertainty of measurement about the measured result is negligible with regard to the final pass/fail decision. The measurement result can be directly compared with the test limit to determine conformance with the requirement (compare IEC Guide 115). The level of risk to falsely accept and falsely reject items is further described in ILAC-G8.