FCC Test Report
LB Foster Railway Technologies
Flood Pole, Model: FLD-A-001-001, FLD-A-019-001 and FLD-A-013-001.
Flood Master Node, Model: FLD-A-021-001
In accordance with FCC 47 CFR Part 15B (LoRa)

Add value.
Inspire trust.

Prepared for: LB Foster TEW Engineering LTD
The Midway
Lenton
Nottingham
Nottinghamshire
NG7 2TS, UNITED KINGDOM

FCC ID: 2ASEORFM95C, 2BDI4FLDA021

COMMERCIAL-IN-CONFIDENCE

Document 75959548-01 Issue 01

SIGNATURE			
A.J. Lawson			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Andrew Lawson	Chief Engineer, EMC	Authorised Signatory	21 November 2023

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. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Ahmad Javid	21 November 2023	

FCC Accreditation
492497/UK2010 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15B: 2021 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	21-November-2023

Table 1

1.2 Introduction

Applicant	LB Foster TEW Engineering Ltd
Manufacturer	LB Foster TEW Engineering Ltd
Model Number(s)	Flood Pole: FLD-A-001-001 FLD-A-013-001 FLD-A-019-001 Flood Master Node: FLD-A-021-001
Serial Number(s)	Flood Pole: 101 FB021 08FEF845 Flood Master Node: LBF019028
Hardware Version(s)	A
Software Version(s)	4.1.0
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15B: 2021
Order Number	P15072CND - QAF
Date	09-October-2023
Date of Receipt of EUT	26-October-2023
Start of Test	02-November-2023
Finish of Test	02-November-2023
Name of Engineer(s)	Ahmad Javid
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 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Flood Pole - Emissions Mode				
2.1	15.109	Radiated Disturbance	Pass	ANSI C63.4: 2014
Configuration and Mode: Flood Master Node - Emissions Mode				
2.1	15.109	Radiated Disturbance	Pass	ANSI C63.4: 2014

Table 2

1.4 Declaration of Build Status

MAIN EUT			
MANUFACTURING DESCRIPTION	Flood Monitoring Master Node		
MANUFACTURER	LB Foster		
MODEL	North America		
PART NUMBER	FLD-A-021-001		
HARDWARE VERSION	A		
SOFTWARE VERSION	4.2.1		
PSU VOLTAGE/FREQUENCY/CURRENT	12V @ 1.5A (max) (battery supply with solar back up)		
HIGHEST INTERNALLY GENERATED FREQUENCY	Teltonika router 4G GSM (1880 MHz)		
FCC ID (if applicable)	HopeRF RFM95CW-915S2R FCC id: 2ASEORFM95C Teltonika RUT955 - FCC id: 2AET4RUT955AF		
INDUSTRY CANADA ID (if applicable)			
TECHNICAL DESCRIPTION (a brief technical description of the intended use and operation)	Master node unit which provides connectivity & live camera footage for the inline flood monitoring system in remote locations powered by battery with solar back up.		
COUNTRY OF ORIGIN	England		
RF CHARACTERISTICS (if applicable)			
TRANSMITTER FREQUENCY OPERATING RANGE (MHz)	915 MHz LoRa & GSM		
RECEIVER FREQUENCY OPERATING RANGE (MHz)	915 MHz LoRa & GSM		
INTERMEDIATE FREQUENCIES			
EMISSION DESIGNATOR(S): https://fccid.io/Emissions-Designator/			
MODULATION TYPES: (i.e. GMSK, QPSK)	spread spectrum modulation LoRa, GSM		
OUTPUT POWER (W or dBm)	14.5 mW LoRa + GSM in Teltonika		
SEPARATE BATTERY/POWER SUPPLY (if applicable)			
MANUFACTURING DESCRIPTION	12V sealed lead acid battery		
MANUFACTURER	Generic		
TYPE	Sealed lead acid		
PART NUMBER	Generic		
PSU VOLTAGE/FREQUENCY/CURRENT	12V		
COUNTRY OF ORIGIN	UK		
MODULES (if applicable)			
MANUFACTURING DESCRIPTION	LoRa Module	RUT956	
MANUFACTURER	Hope RF	Teltonika	
TYPE	LoRa module	Industrial cellular router	
POWER	14.5mW		
FCC ID	2ASEORFM95C	2AET4RUT955AF	
INDUSTRY CANADA ID			
EMISSION DESIGNATOR			
DHSS/FHSS/COMBINED OR OTHER			
COUNTRY OF ORIGIN	China	Lithuania	
ANCILLARIES (if applicable)			
MANUFACTURING DESCRIPTION	PTZ Camera		
MANUFACTURER	Hanwah		
TYPE	PTZ Camera		
PART NUMBER	XNP-6120H		
SERIAL NUMBER			
COUNTRY OF ORIGIN	South Korea		

Table 3

MAIN EUT			
MANUFACTURING DESCRIPTION	Flood Monitoring Flood Pole + Flood Battery + Flood Electronics		
MANUFACTURER	LB Foster		
MODEL	North America		
PART NUMBER	FLD-A-001-001 + FLD-A-013-001 + FLD-A-019-001		
HARDWARE VERSION	A		
SOFTWARE VERSION	4.1.1		
PSU VOLTAGE/FREQUENCY/CURRENT	4.5 V DC (battery supply)		
HIGHEST INTERNALLY GENERATED FREQUENCY	915 MHz LoRa Module		
FCC ID (if applicable)	HopeRF RFM95CW-915S2R FCC id: 2ASEORFM95C		
INDUSTRY CANADA ID (if applicable)			
TECHNICAL DESCRIPTION (a brief technical description of the intended use and operation)	Low power flood pole, normally in low power mode. Wake on time interval or water presence. Takes water level reading and reports back to master node via LoRa		
COUNTRY OF ORIGIN	England		
RF CHARACTERISTICS (if applicable)			
TRANSMITTER FREQUENCY OPERATING RANGE (MHz)	915 MHz LoRa		
RECEIVER FREQUENCY OPERATING RANGE (MHz)	915 MHz LoRa		
INTERMEDIATE FREQUENCIES			
EMISSION DESIGNATOR(S): https://fccid.io/Emissions-Designator/			
MODULATION TYPES: (i.e. GMSK, QPSK)	spread spectrum modulation LoRa		
OUTPUT POWER (W or dBm)	14.5 mW LoRa		
SEPARATE BATTERY/POWER SUPPLY (if applicable)			
MANUFACTURING DESCRIPTION	4.5V 120Ah 2X2SBP + 3B x 2 Blocks Alkaline Pack		
MANUFACTURER	Cellpack Solutions		
TYPE	Alkaline		
PART NUMBER	FLD-A-013-001 (including battery pack CPS2513/2)		
PSU VOLTAGE/FREQUENCY/CURRENT	4.5V		
COUNTRY OF ORIGIN	UK		
MODULES (if applicable)			
MANUFACTURING DESCRIPTION	LoRa Module		
MANUFACTURER	Hope RF		
TYPE	LoRa module		
POWER	14.5mW		
FCC ID	2ASEORFM95C		
INDUSTRY CANADA ID			
EMISSION DESIGNATOR			
DHSS/FHSS/COMBINED OR OTHER			
COUNTRY OF ORIGIN	China		
ANCILLARIES (if applicable)			

Table 4

I hereby declare that the information supplied is correct and complete.

Name: Michael Cane
Position held: Senior Electronics Systems Engineer
Date: 25-October-2023

1.5 Product Information

1.5.1 Technical Description

The equipment under test (EUTs) were the LB Foster TEW Engineering Ltd Flood Pole, Model: FLD-A-001-001, FLD-A-013-001 and FLD-A-019-001 and Flood Master Node, Model: FLD-A-021-001.

The Master node unit provides connectivity & live camera footage for the inline flood monitoring system in remote locations powered by battery with solar back up.

The Flood pole, normally in low power mode, wakes on time interval or water presence. It takes a water level reading and reports back to the master node via LoRa.

1.5.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Configuration and Mode: All Configurations And Modes				
DC Power - Solar	< 8 m	DC Power From Solar Panel	PV1-F Solar	No
DC Power – Camera	5 m	DC Power To Camera	2 x 1mm^2 stranded	No
RJ45 Ethernet	5 m	Camera Network Cable	Cat 5 Ethernet	No
GSM Antenna	1 m	Cable From GSM Antenna	RF195 N-Type to SMA	Yes

Table 5

1.5.3 Test Configuration

Master Node

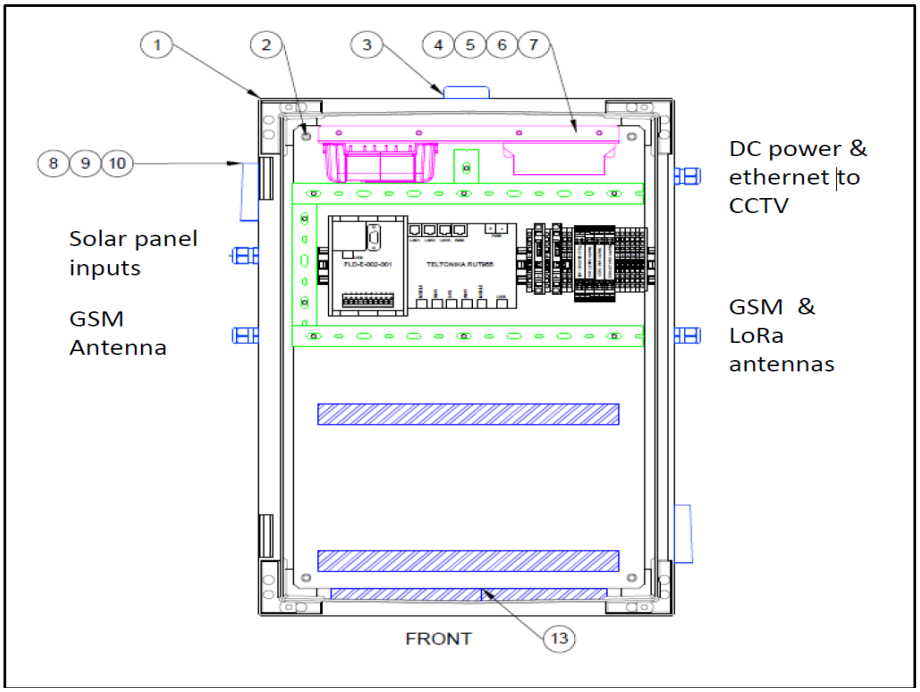

Figure 1

All antennas fitted to the unit.

Solar panel inputs connected to a DC power supply 20 V 1 A via 8 m cable.

Flood Pole

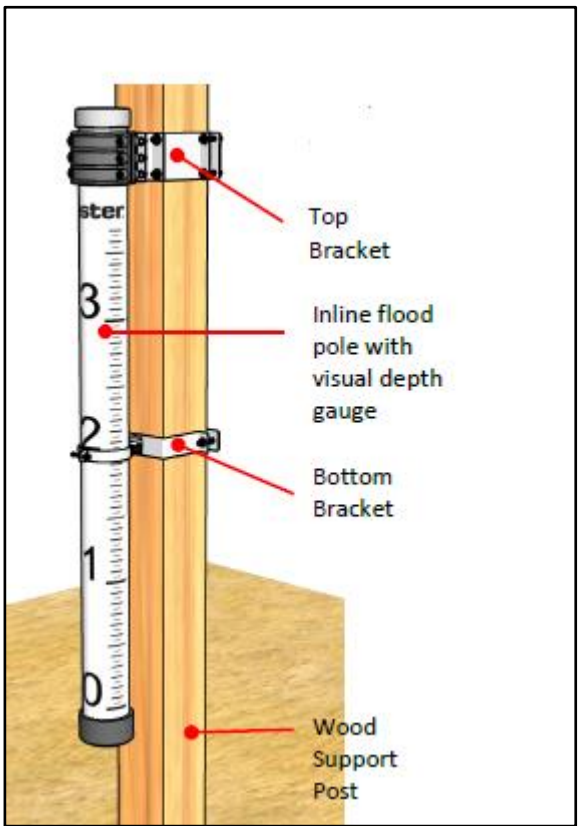

Figure 2

1.5.4 Modes of Operation

- Normal operating mode
- Continuous LoRa transmit with router permanently powered.

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: FLD-A-001-001, Serial Number: 101			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: FLD-A-019-001, Serial Number: 08FEF845			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: FLD-A-013-001, Serial Number: FB021			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: FLD-A-021-001, Serial Number: LBF019028			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 6

1.8 Test Location

TÜV SÜD conducted the following tests at our Octagon House Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Flood Pole - Emissions Mode		
Radiated Disturbance	Ahmad Javid	UKAS
Configuration and Mode: Flood Master Node - Emissions Mode		
Radiated Disturbance	Ahmad Javid	UKAS

Table 7

Office Address:

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Radiated Disturbance

2.1.1 Specification Reference

FCC 47 CFR Part 15B, Clause 15.109

2.1.2 Equipment Under Test and Modification State

Model Number FLD-A-001-001, S/N: 101 - Modification State 0
Model Number FLD-A-019-001, S/N: 08FEF845 - Modification State 0
Model Number FLD-A-013-001, S/N: FB021 - Modification State 0
Model Number FLD-A-021-001, S/N: LBF019028 - Modification State 0

2.1.3 Date of Test

02-November-2023

2.1.4 Test Method

The EUT was set up on a non-conductive insulated support 0.1 m above a ground reference 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.

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

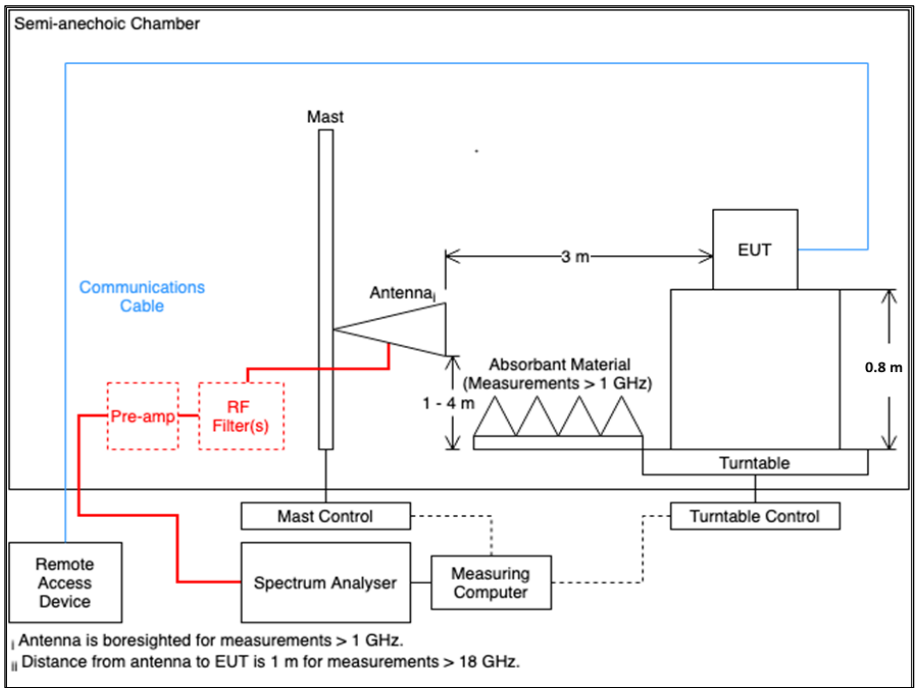

Figure 3 - Radiated Disturbance Example Test Setup

2.1.7 Environmental Conditions

Ambient Temperature	21.4 °C
Relative Humidity	49.3 %
Atmospheric Pressure	1016.0 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

2.1.9 Test Results

Results for Configuration and Mode: Flood Pole - Emissions Mode.

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: 915 MHz
Which necessitates an upper frequency test limit of 5 GHz

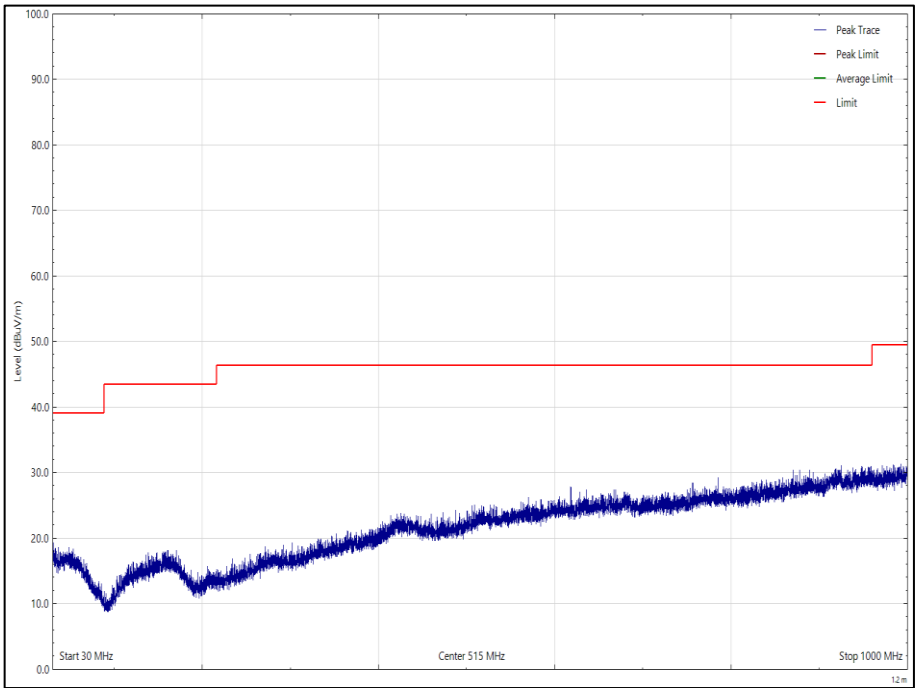

Figure 4 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal

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 Quasi-Peak test limit.

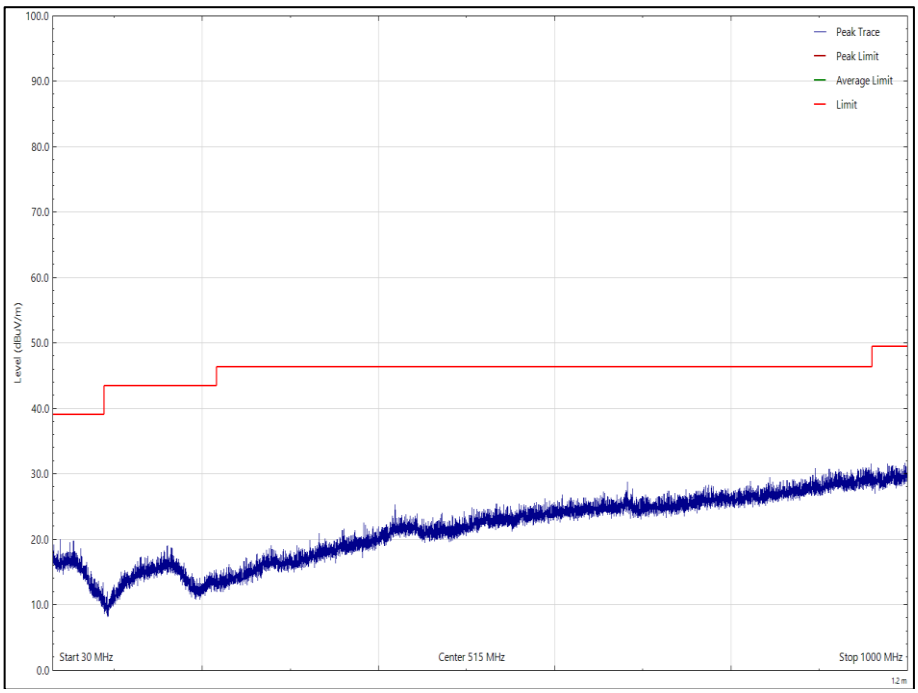

Figure 5 - 30 MHz to 1 GHz, Quasi-Peak, Vertical

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 Quasi-Peak test limit.

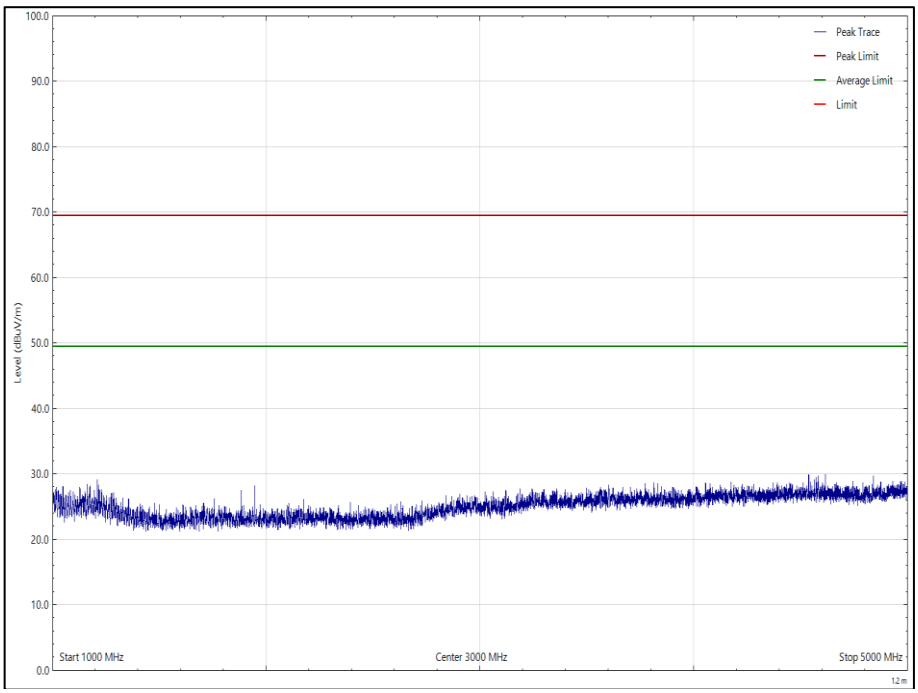

Figure 6 - 1 GHz to 5 GHz, Peak, Horizontal

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 CISPR Average test limit.

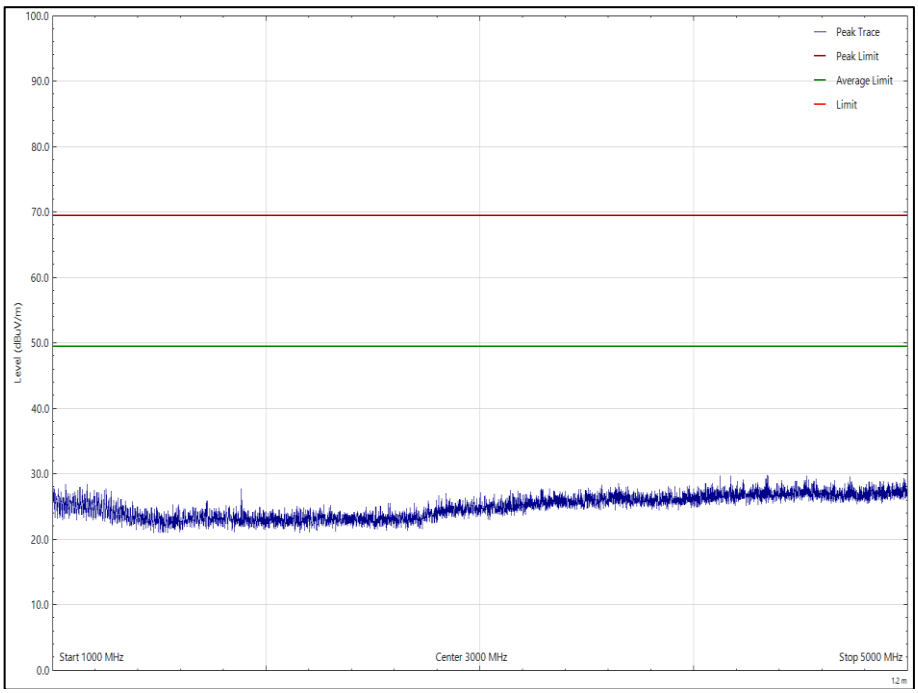

Figure 7 - 1 GHz to 5 GHz, Peak, Vertical

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 CISPR Average test limit.

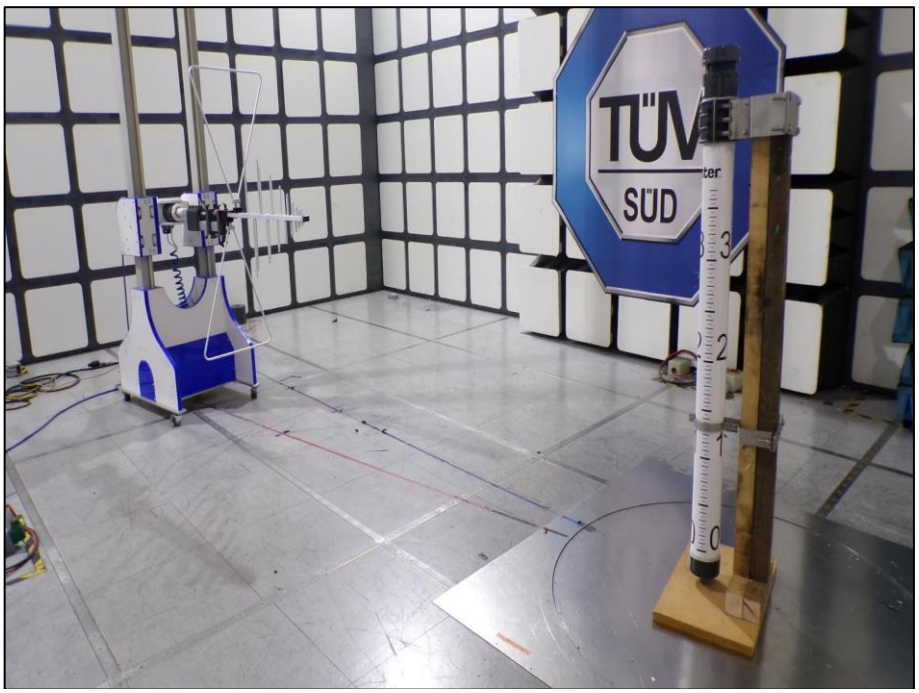

Figure 8 - Test Setup - 30 MHz to 1 GHz

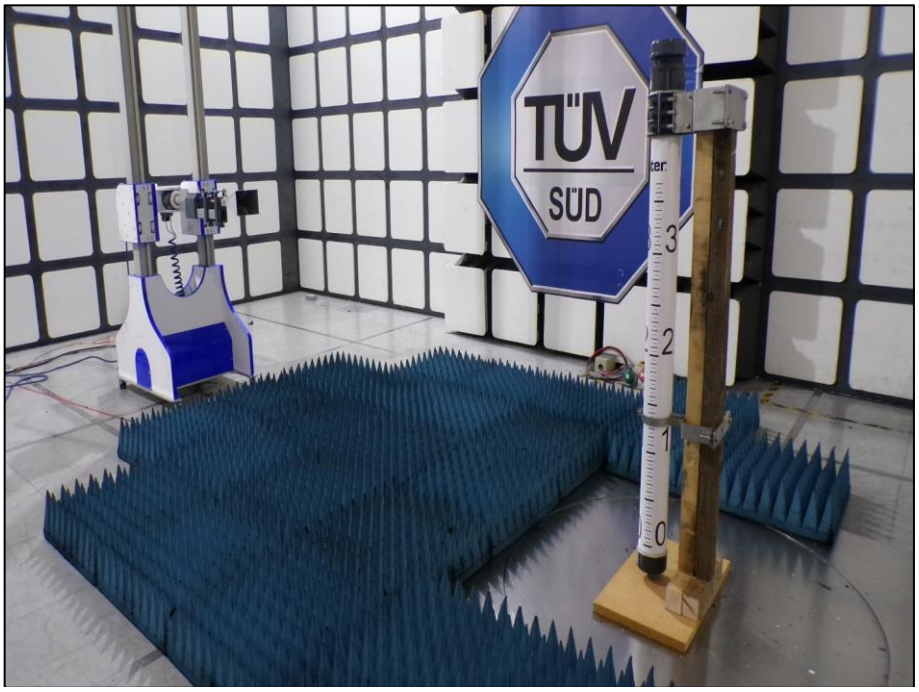

Figure 9 - Test Setup - 1 GHz to 5 GHz

Results for Configuration and Mode: Flood Master Node - Emissions Mode.

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: 1880 MHz
Which necessitates an upper frequency test limit of: 10 GHz

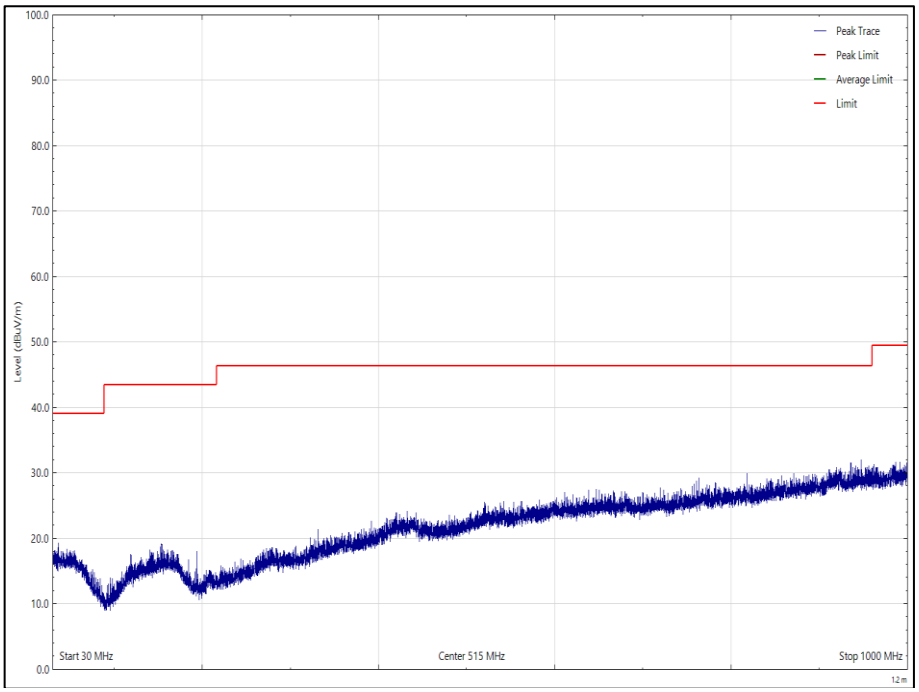

Figure 10 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal

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 Quasi-Peak test limit.

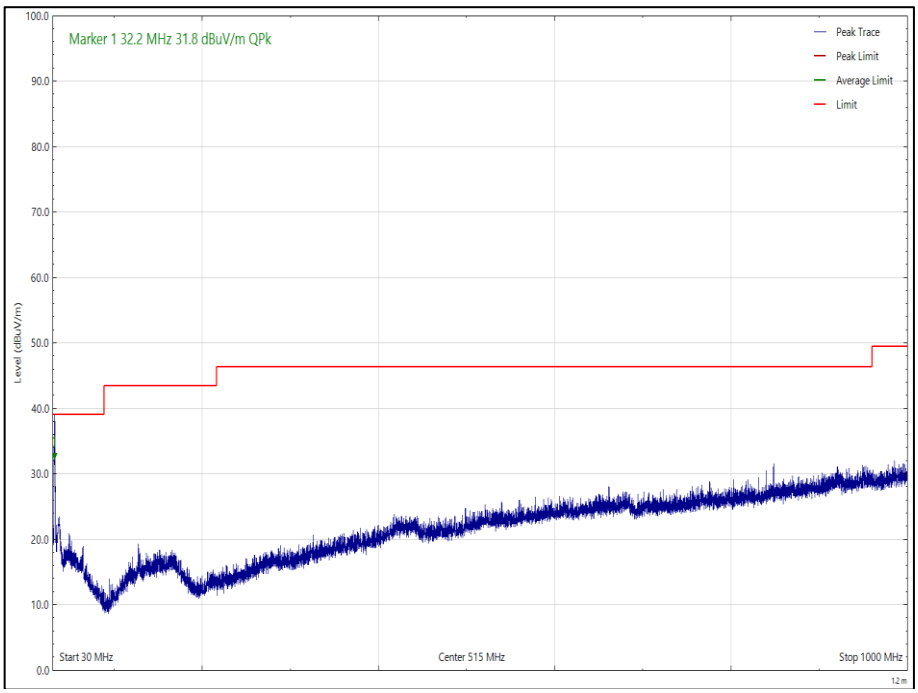

Figure 11 - 30 MHz to 1 GHz, Quasi-Peak, Vertical

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
32.186	31.80	39.10	-7.30	Q-Peak	309	115	Vertical

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 CISPR Average test limit.

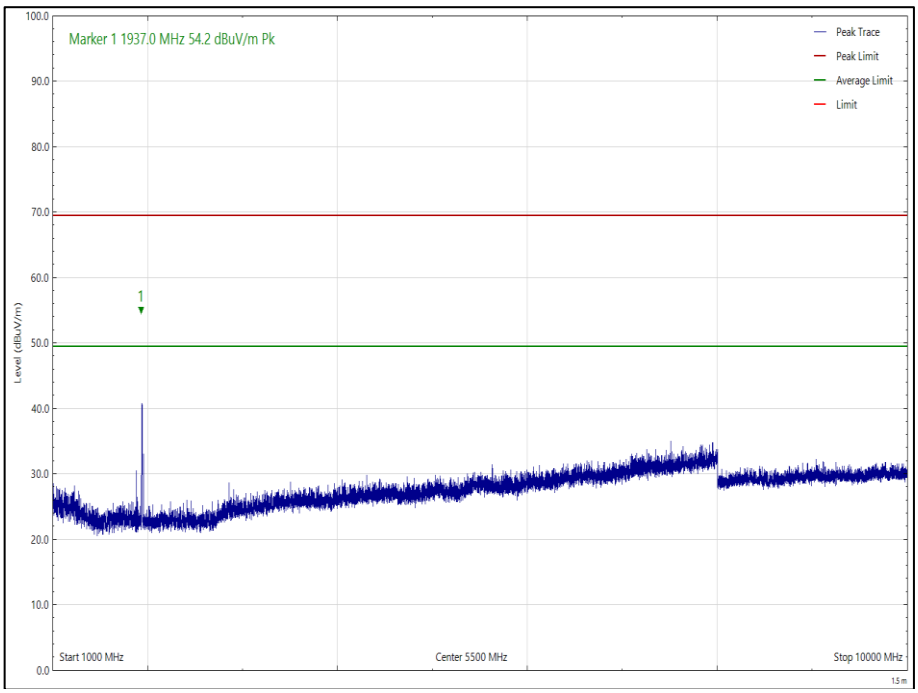

Figure 12 - 1 GHz to 10 GHz, Peak, Horizontal

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
1937.015	54.20	69.50	-15.30	Peak	40	273	Horizontal
1937.015	19.70	49.50	-29.80	CISPR Avg	40	273	Horizontal

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 CISPR Average test limit.

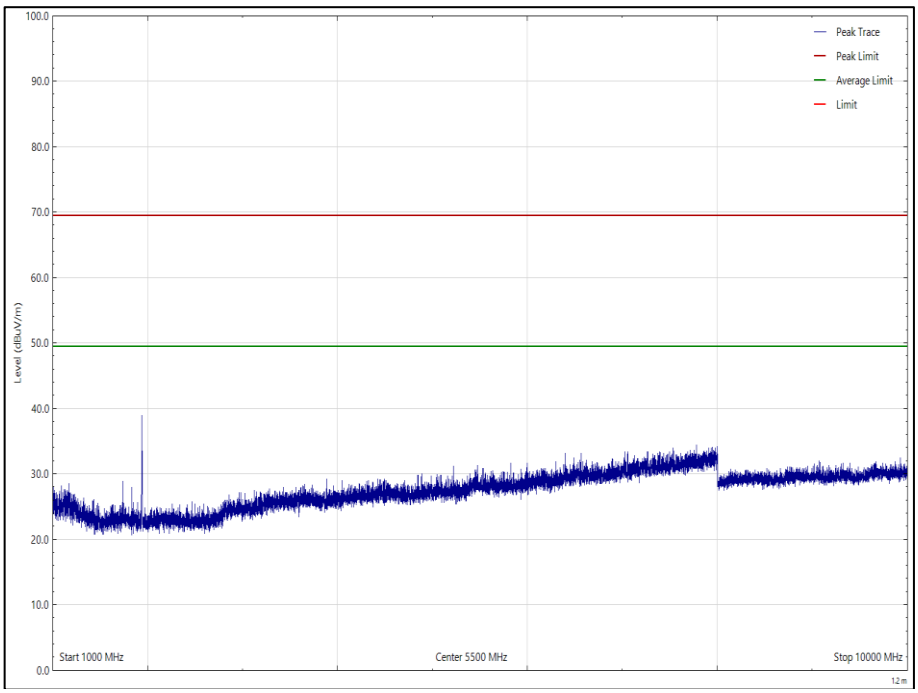

Figure 13 - 1 GHz to 10 GHz, Peak, Vertical

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 CISPR Average test limit.

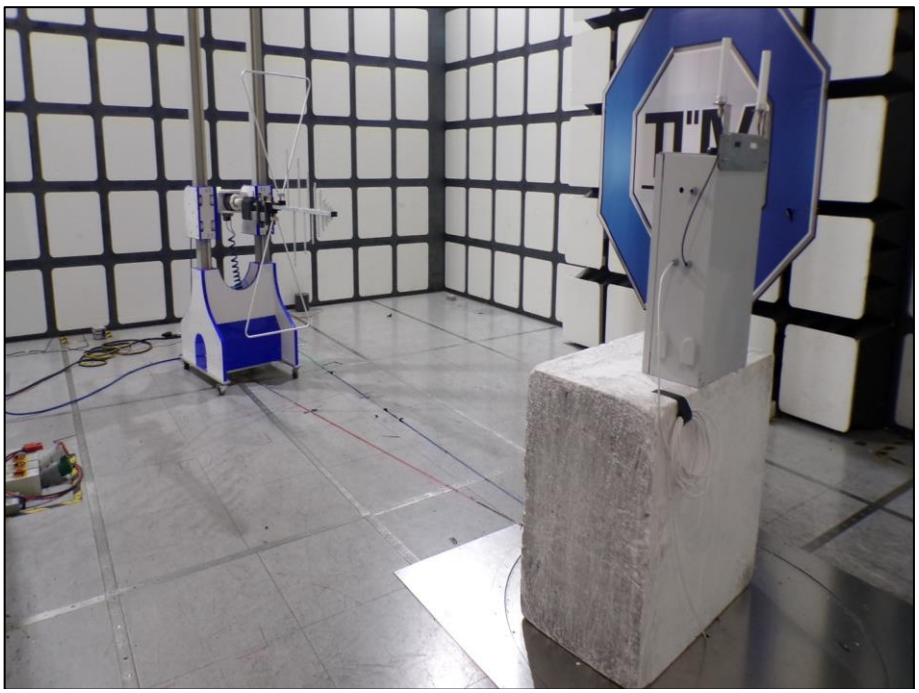

Figure 14 - Test Setup - 30 MHz to 1 GHz

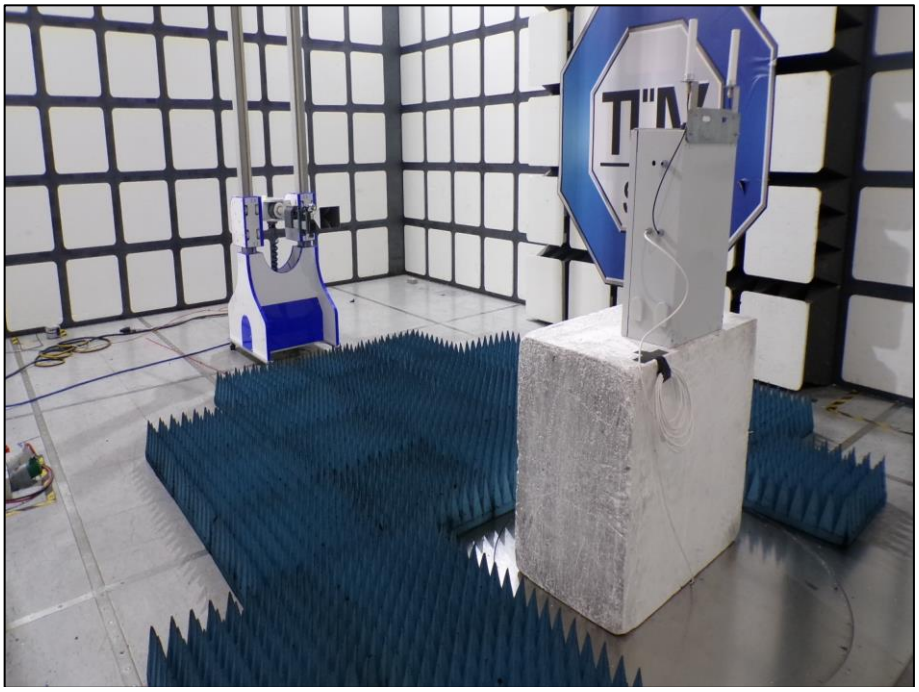

Figure 15 - Test Setup - 1 GHz to 10 GHz

2.1.10 Test Location and Test Equipment Used

This test was carried out in EMC Laboratory 5 and EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Screened Room (5)	Rainford	Rainford	1545	36	15-Apr-2024
Emissions Software	TUV SUD	EmX V3.1.12	5125	-	Software
EMI Test Receiver	Rohde & Schwarz	ESW44	5527	12	15-Jun-2024
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
Cable (SMA to SMA, 2 m)	Junkosha	MWX221-02000AMSAMS/A	5517	12	21-May-2024
Cable (N-Type to N-Type, 8 m)	Junkosha	MWX221-08000NMSNMS/B	5521	12	05-Jun-2024
Cable (K-Type to K-Type, 2 m)	Junkosha	MWX241-02000KMSKMS/B	5934	12	18-Jun-2024
Pre-amplifier (30 dB, 1GHz to 18GHz)	Schwarzbeck	BBV 9718 C	5261	12	14-Apr-2024
Attenuator 4dB	Pasternack	PE7074-4	6201	24	16-Jul-2024
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	6635	24	13-Jun-2025
Antenna (DRG, 1 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	5611	12	15-Oct-2024
Antenna (DRG, 7.5 GHz to 18 GHz)	Schwarzbeck	HWRD750	5610	12	15-Oct-2024

Table 9

TU - Traceability Unscheduled

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Hygropalm Temperature and Humidity Meter	Rotronic	HP21	4410	12	08-Aug-2024

Table 11

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, SAC, ±5.2 dB 1 GHz to 6 GHz, Horn Antenna, SAC, ±5.1 dB 6 GHz to 18 GHz, Horn Antenna, SAC, ±4.9 dB 18 GHz to 40 GHz, Horn Antenna, SAC, ±6.3 dB

Table 12

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.