FCC and ISED Test Report

MPI Holdings FZE
ISS (Intelligent Safety System)

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

Prepared for: MPI Holdings FZE
The Offices 3 – One Central
Smart desk 375-16
Dubai World Trade Centre
Dubai
0000

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COMMERCIAL-IN-CONFIDENCE

Document 75960007-01 Issue 02

SIGNATURE			
A.J. Lawson			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Andrew Lawson	Chief Engineer, EMC	Authorised Signatory	27 September 2024

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 and ISED RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Connor Lee	27 September 2024	

FCC Accreditation
492497/UK2010 Octagon House, Fareham Test Laboratory
553713/UK2026 Concorde Park, Fareham Test Laboratory

ISED Accreditation
12669A Octagon House, Fareham Test Laboratory
28798 Concorde Park, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15B, ICES-003 and ISED RSS-GEN: 2021, Issue 7: 2020 and Issue 5 and A2 (2021-02) for the tests detailed in section 1.3.

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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-May-2024
2	Second Issue – change in declared variant names	27-Sept-2024

Table 1

1.2 Introduction

Applicant	MPI Holdings FZE
Manufacturer	MPI Holdings FZE
Component Number(s)	GDU (Graphical Display Unit) - 641-9401 (no LTE) GDU (Graphical Display Unit) - 641-9395 – (compact) GDU (Graphical Display Unit) – 641-9400 (With LTE) Power Hub CCU (Central Control Unit) – 641-9399 White RCM (Radio Communication Module) – 641-9389 RTD (Real Time Detection) Unit – 641-9404 E6 Handset – 641-9403
Manufacturers Declared Variant Model(s)	"IMS-HME" consists of the Power Hub CCU (641-9399), E6-Handset (641-9403), GDU (641-9400 or 641-9401) and RTD (641-9404). "IMS-Antenna" consists of just the White 915 MHz RCM (641-9389). "IMS-LV" consists of the GDU Compact (641-9395).
Serial Number(s)	GDU (Graphical Display Unit) – S/N: 250240 Power Hub CCU (Central Control Unit) – S/N: 251684 White RCM (Radio Communication Module) - S/N: 253990 RTD (Real Time Detection) Unit – S/N: 249477 E6 Handset – S/N: 254506
Hardware Version(s)	GDU-1V6 CCU-1V4 RCM-2V2 RTD+-1V2 E6-1V3

Software Version(s)	GDU (Graphical Display Unit) – S/N: IMS_IMS-GDU_1V53_6MAR2024_143344 Power Hub CCU (Central Control Unit) – S/N: MHE2_IMS-CCU_1V42_1DEC2023_140746 White RCM (Radio Communication Module) - S/N: IMS_IMS-RCM2_1V30_12FEB2024_082125 RTD (Real Time Detection) Unit – S/N: IMS_IMS-RTD2_1V7_11DEC2023_093723 E6 Handset – S/N: MHE2_MCS-E6_1V8_17JAN2024_101125
Number of Samples Tested	One system comprised of 5 individual items.
Test Specification/Issue/Date	FCC 47 CFR Part 15B, ICES-003 and ISED RSS-GEN: 2021, Issue 7: 2020 and Issue 5 and A2 (2021-02)
Order Number	003752
Date	06-December-2023
Date of Receipt of EUT	05-February-2024
Start of Test	28-February-2024
Finish of Test	28-February-2024
Name of Engineer(s)	Connor Lee
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 and ISED RSS-GEN is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: DC Powered - Idle				
2.1	15.109, 3.2 and 7.1	Radiated Disturbance	Pass	ANSI C63.4: 2014

Table 2

1.4 Manufacturers Declared Variant(s)

The customer has declared the following variants to the items tested:

1. "IMS-Antenna" consists of just the White 915 MHz RCM (641-9389)
2. "IMS-LV" consists of the GDU Compact (641-9395)
3. "IMS-HME" consists of the Power Hub CCU (641-9399), E6-Handset (641-9403), GDU (641-9400 or 641-9401) and RTD (641-9404).

1.5 Declaration of Build Status

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment including the technologies the product supports)*	Vehicle Intelligent Safety System (ISS) which serves as a semi-autonomous, modular component-based collision avoidance system (CAS) for both Controlled Level 8 and 9 applications. The system encapsulates various RF technologies that being Wi-Fi, Bluetooth, LTE, UWB/RTLS, as well as GNSS and an RF ISM band. The system functionality for the previously stated RF technologies is as follows: - Wi-Fi is responsible to uploading event and position data to an online tracking platform. - Bluetooth is tasked with initiating firmware uploads, software configuration adjustments as well as log downloads of both event and position data. - LTE uploads event and position data to the online tracking platform via cellular networks or service providers. - UWB/RTLS augments the GNSS data to provide real time distance data of surrounding systems as fail to safe in the event of weak GNSS signal strength which include under-roof and dead zone scenarios. - GNSS and an ISM RF band (915 MHz) are collectively responsible for retrieving augmented location based data such as time, latitude, longitude etc from surrounding constellation satellites (GPS, GLONASS, BeiDou, Galileo) on a vehicle/machine system to broadcast, on the configured ISM band (915 MHz in this case), to surrounding system units to be processed via a series of complex algorithms in order to determine the potential risk of collision whilst a vehicle/machine maintains a certain trajectory.
Manufacturer:	MHE Electronics
Hardware Version:	GDU-1V6 CCU-1V4 RCM-2V2 E6-1V3 RTD+-1V2

Table 3

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

Name: Shayne Watson
Position held: Director
Date: 13 December 2023

1.6 Product Information

1.6.1 Technical Description

The Equipment under test (EUT) was a MHE Electronics (Pty) Ltd, ISS (Intelligent Safety System).

The primary function of the EUT is to prevent vehicle collisions.

Additionally, the EUT supports Cellular, Bluetooth, Wi-Fi, UWB and ISM band technologies.

Figure 1 - General

1.6.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
DC Power	3 m	Power	2 Core	No
Power Cable Port	6 m	DC power to CCU normally from vehicle battery	Twisted pair automotive cable	No
GDU Cable Port	3 m	CCU to GDU (DC power and CAN comms)	4 core dual twisted pair cable	No
RCM2 Cable Port	6 m	CCU to RCM 2 (DC power and CAN comms)	4 core dual twisted pair cable	No
RTD Cable Port	10 m	RCM2 to RTD (DC power and CAN comms)	4 core dual twisted pair cable	No
E6 Cable Port	4 m	CCU to E6 (DC power and CAN comms)	4 core device net cable	No

Table 4

1.6.3 Test Configuration

Configuration	Description
DC Powered	The EUT was powered from a 24 V DC supply. The EUT was comprised of the following: - Power Hub CCU (Central Control Unit) - White RCM (Radio Communication Module) - GDU (Graphical Display Unit) - RTD (Real Time Detection) Unit - E6 Handset An Ignition Switch was used to load the EUT for support purposes only.

Table 5

1.6.4 Modes of Operation

Mode	Description
Idle	The EUT was powered with its intentional transmitters disabled.

Table 6

1.7 Deviations from the Standard

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

1.8 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
Power Hub CCU (Central Control Unit), Serial Number: 251684			
0	As supplied by the customer	Not Applicable	Not Applicable
White RCM (Radio Communication Module), Serial Number: 253990			
0	As supplied by the customer	Not Applicable	Not Applicable
GDU (Graphical Display Unit), Serial Number: 250240			
0	As supplied by the customer	Not Applicable	Not Applicable
RTD (Real Time Detection) Unit, Serial Number: 249477			
0	As supplied by the customer	Not Applicable	Not Applicable
E6 Handset, Serial Number: 254506			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 7

1.9 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: DC Powered - Idle		
Radiated Disturbance	Connor Lee	UKAS

Table 8

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, ICES-003 and ISED RSS-GEN, Clause 15.109, 3.2 and 7.1

2.1.2 Equipment Under Test and Modification State

GDU (Graphical Display Unit), Serial Number: 250240
Power Hub CCU (Central Control Unit), Serial Number: 251684
White RCM (Radio Communication Module), Serial Number: 253990
RTD (Real Time Detection) Unit, Serial Number: 249477
E6 Handset, Serial Number: 254506

2.1.3 Date of Test

28-February-2024

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

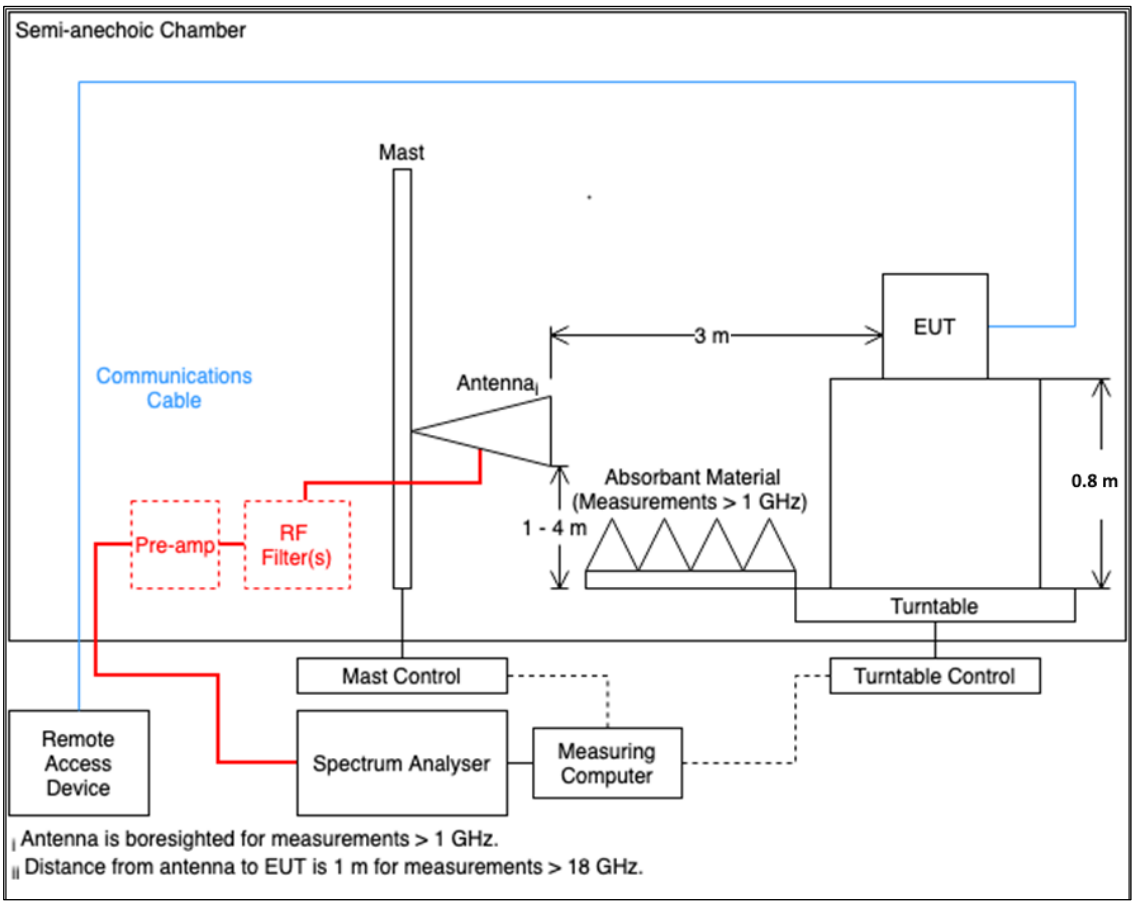

Figure 2 - Radiated Disturbance Example Test Setup

2.1.7 Environmental Conditions

Ambient Temperature	21.2 °C
Relative Humidity	37.1 %
Atmospheric Pressure	998.0 mbar

2.1.8 Specification Limits

Required Specification Limits, Magnetic Field Strength FCC CFR 15.209 at a 3 m Measurement Distance					
Frequency (MHz)	Test Limit (µV/m)	Test Limit (dBµV/m)	Distance (m)	3 m Measurement Distance Correction	Quasi-Peak Test Limit At 3 m
0.009	266.67	48.52	300.00	40.00	88.52
0.49	4.90	13.80	300.00	40.00	53.80
0.49	4.90	13.80	30.00	20.00	53.80
1.705	1.41	2.97	30.00	20.00	42.97
1.705	30.00	29.54	30.00	20.00	49.54
30	30.00	29.54	30.00	20.00	49.54

Table 9

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 10

2.1.9 Test Results

Results for Configuration and Mode: DC Powered - 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: 6 GHz.
Which necessitates an upper frequency test limit of: 30 GHz.

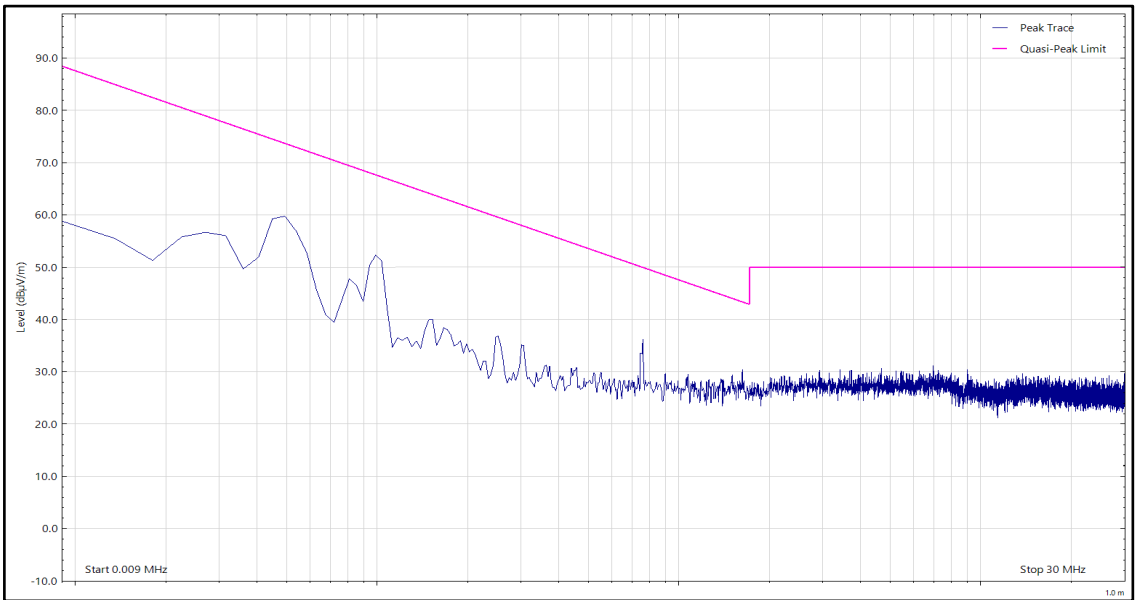

Figure 3 - 9kHz - 30 MHz, Quasi-Peak, Front On

Frequency (MHz)	Level (dBµA/m)	Limit (dBµA/m)	Margin (dB)	Detector	Angle (°)
*					

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.

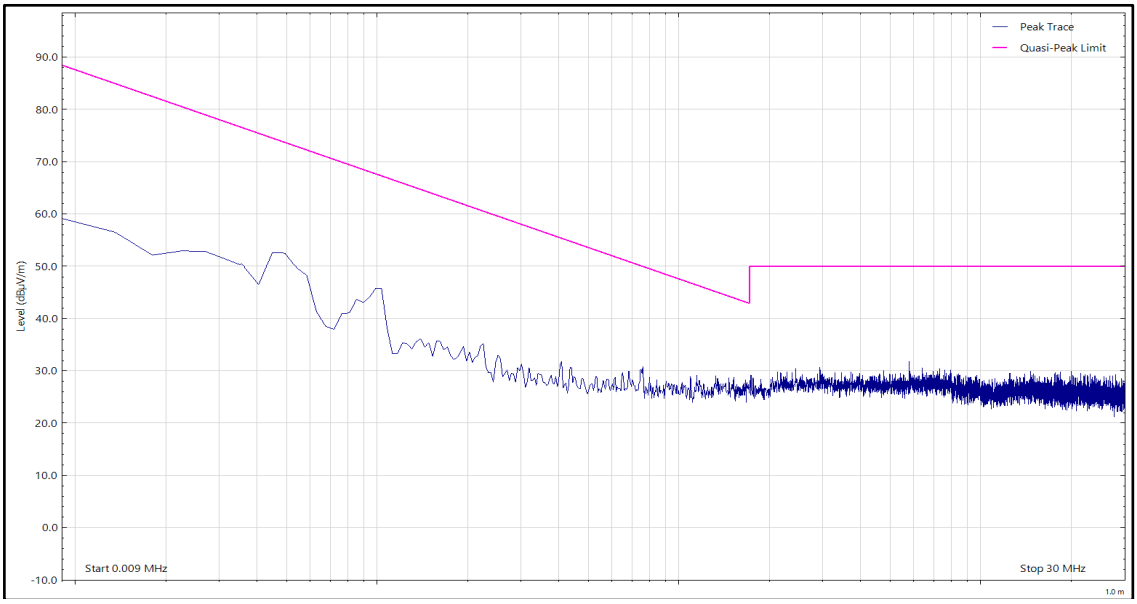

Figure 4 - 9kHz - 30 MHz, Quasi-Peak, Side On

Frequency (MHz)	Level (dBµA/m)	Limit (dBµA/m)	Margin (dB)	Detector	Angle (°)
*					

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.

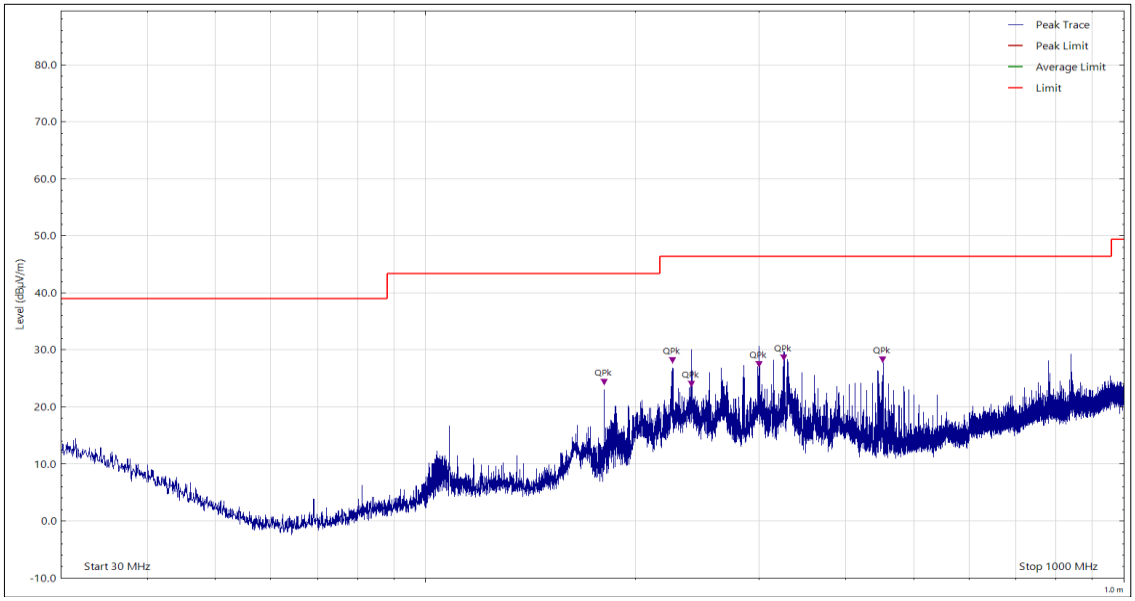

Figure 5 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
179.991	23.58	43.50	-19.92	Q-Peak	71	119	Horizontal
225.737	27.42	46.40	-18.98	Q-Peak	332	135	Horizontal
240.346	23.26	46.40	-23.14	Q-Peak	287	100	Horizontal
299.983	26.68	46.40	-19.72	Q-Peak	1	100	Horizontal
325.850	27.85	46.40	-18.55	Q-Peak	296	100	Horizontal
451.994	27.49	46.40	-18.91	Q-Peak	178	100	Horizontal

Table 13

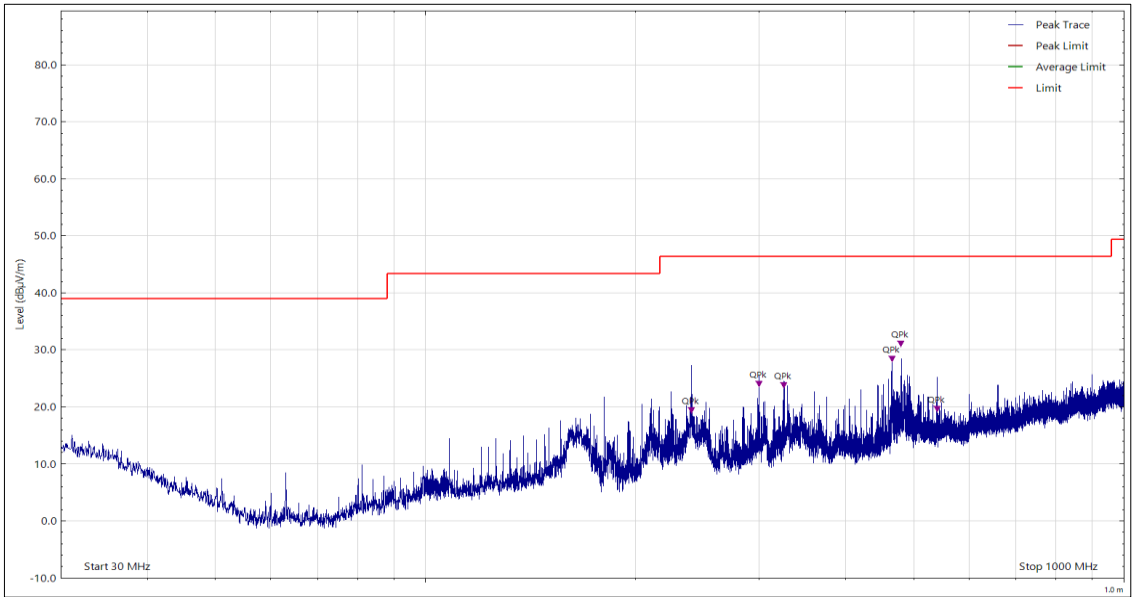

Figure 6 - 30 MHz to 1 GHz, Quasi-Peak, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
240.346	18.55	46.40	-27.85	Q-Peak	285	107	Vertical
299.983	23.27	46.40	-23.13	Q-Peak	61	188	Vertical
325.850	22.98	46.40	-23.42	Q-Peak	186	140	Vertical
465.363	27.57	46.40	-18.83	Q-Peak	350	122	Vertical
479.972	30.33	46.40	-16.07	Q-Peak	3	109	Vertical
539.909	18.84	46.40	-27.56	Q-Peak	2	106	Vertical

Table 14

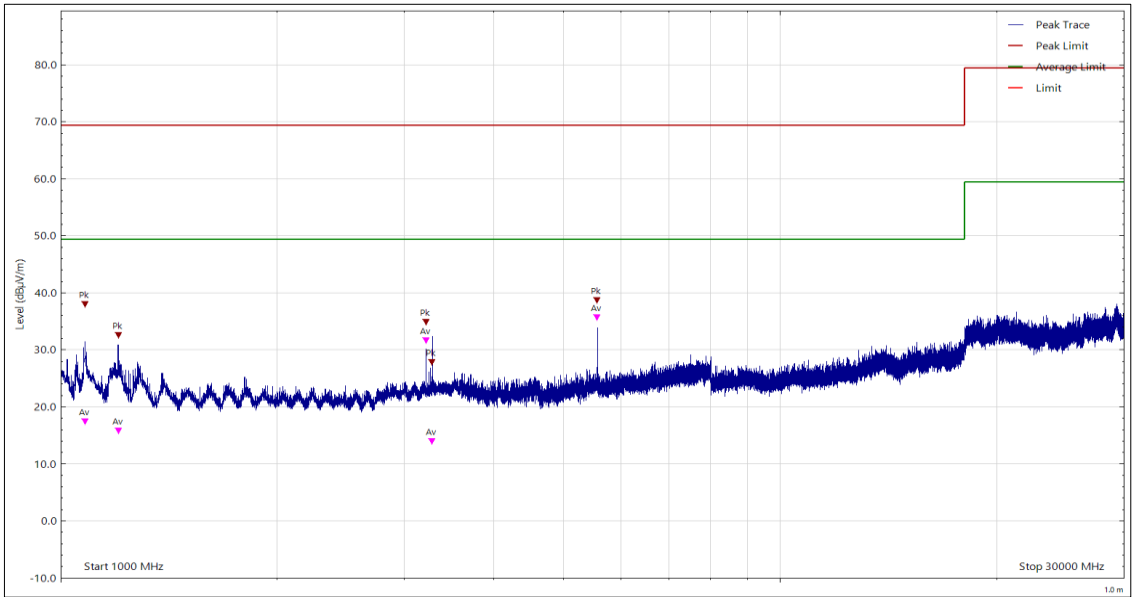

Figure 7 - 1 GHz to 30 GHz, CISPR Average, Horizontal

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
1080.025	37.20	69.50	-32.30	Peak	287	107	Horizontal
1080.025	16.67	49.50	-32.83	CISPR Avg	287	107	Horizontal
1204.216	31.76	69.50	-37.74	Peak	0	100	Horizontal
1204.216	14.99	49.50	-34.51	CISPR Avg	0	100	Horizontal
3215.994	34.11	69.50	-35.39	Peak	250	247	Horizontal
3215.994	30.90	49.50	-18.60	CISPR Avg	250	247	Horizontal
3282.700	27.06	69.50	-42.44	Peak	360	268	Horizontal
3282.700	13.12	49.50	-36.38	CISPR Avg	360	268	Horizontal
5561.950	37.93	69.50	-31.57	Peak	265	100	Horizontal
5561.950	34.85	49.50	-14.65	CISPR Avg	265	100	Horizontal

Table 15

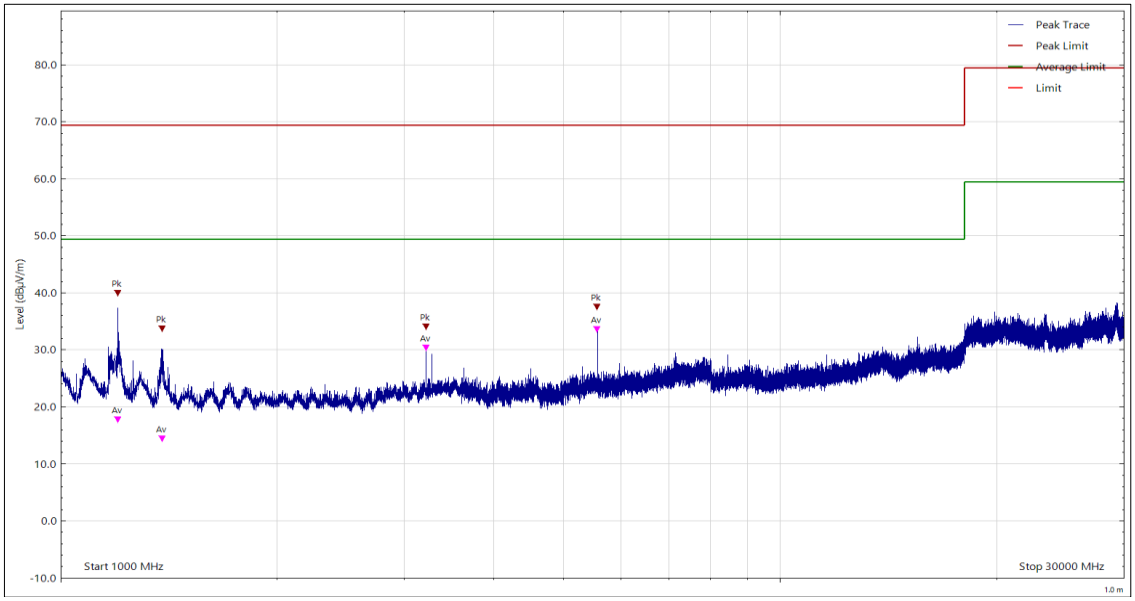

Figure 8 - 1 GHz to 30 GHz, CISPR Average, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
1199.500	39.18	69.50	-30.32	Peak	328	101	Vertical
1199.500	16.97	49.50	-32.53	CISPR Avg	328	101	Vertical
1383.999	32.95	69.50	-36.55	Peak	296	107	Vertical
1383.999	13.63	49.50	-35.87	CISPR Avg	296	107	Vertical
3215.995	33.26	69.50	-36.24	Peak	122	100	Vertical
3215.995	29.61	49.50	-19.89	CISPR Avg	122	100	Vertical
5562.007	36.80	69.50	-32.70	Peak	255	101	Vertical
5562.007	32.78	49.50	-16.72	CISPR Avg	255	101	Vertical

Table 16

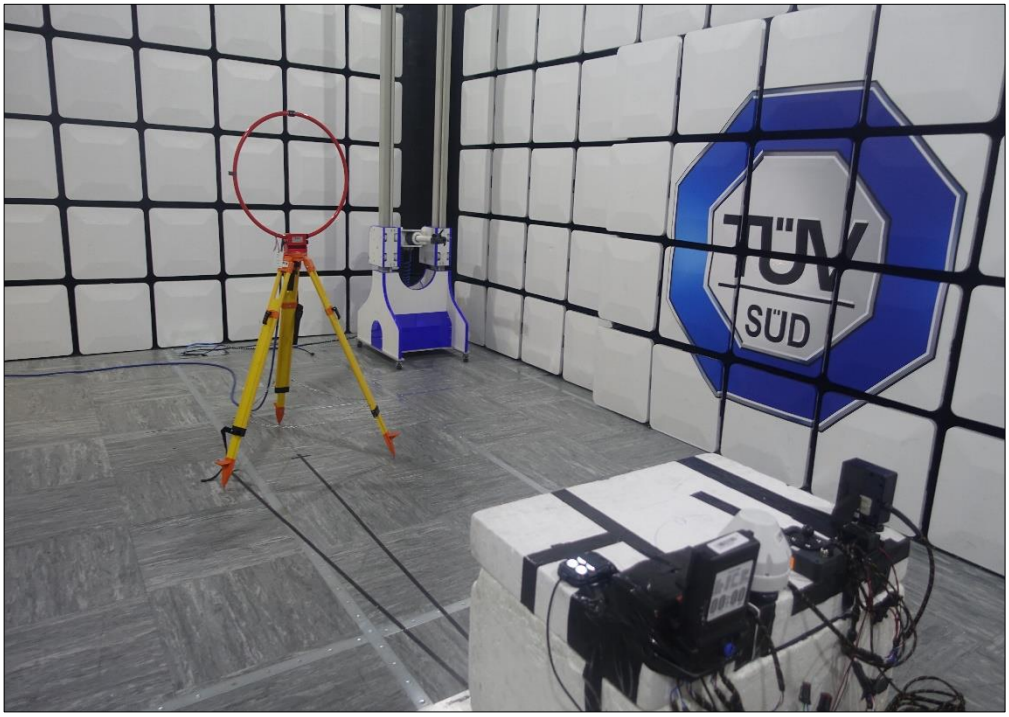

Figure 9 - Test Setup - 9 kHz to 30 MHz

Figure 10 - Test Setup - 30 MHz to 1 GHz

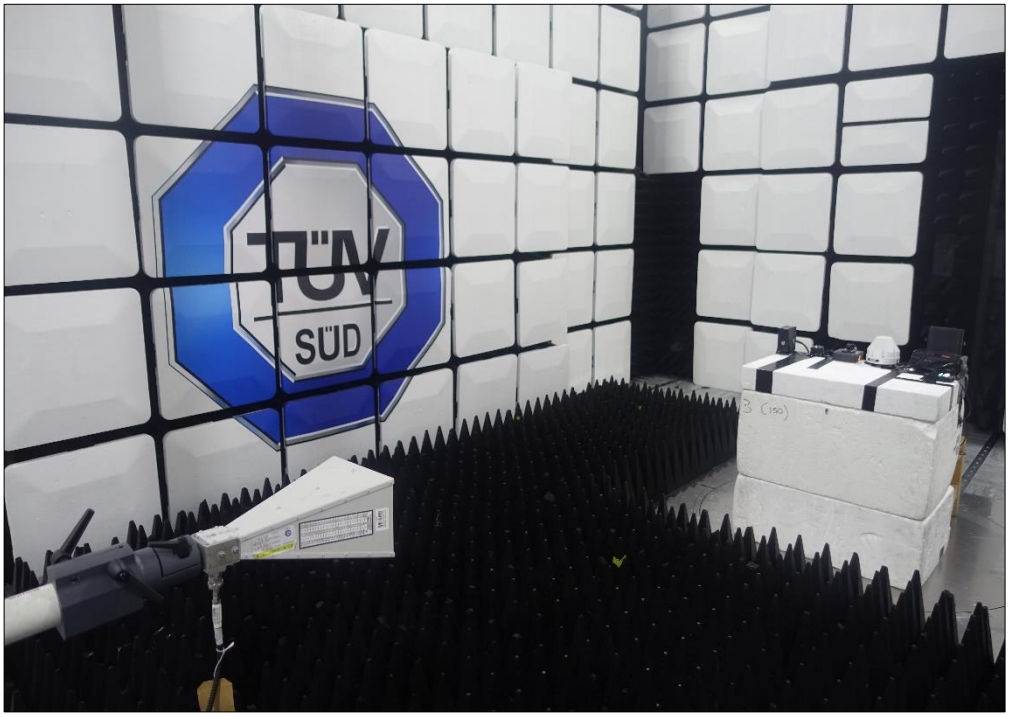

Figure 11 - Test Setup - 1 GHz to 8 GHz

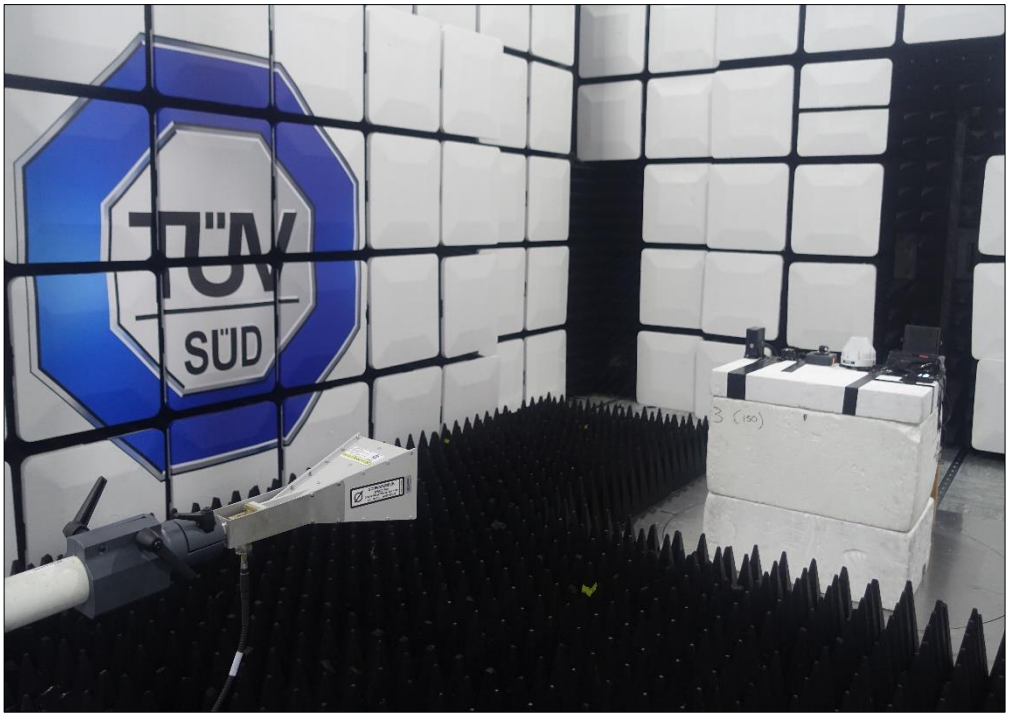

Figure 12 - Test Setup - 8 GHz to 18 GHz

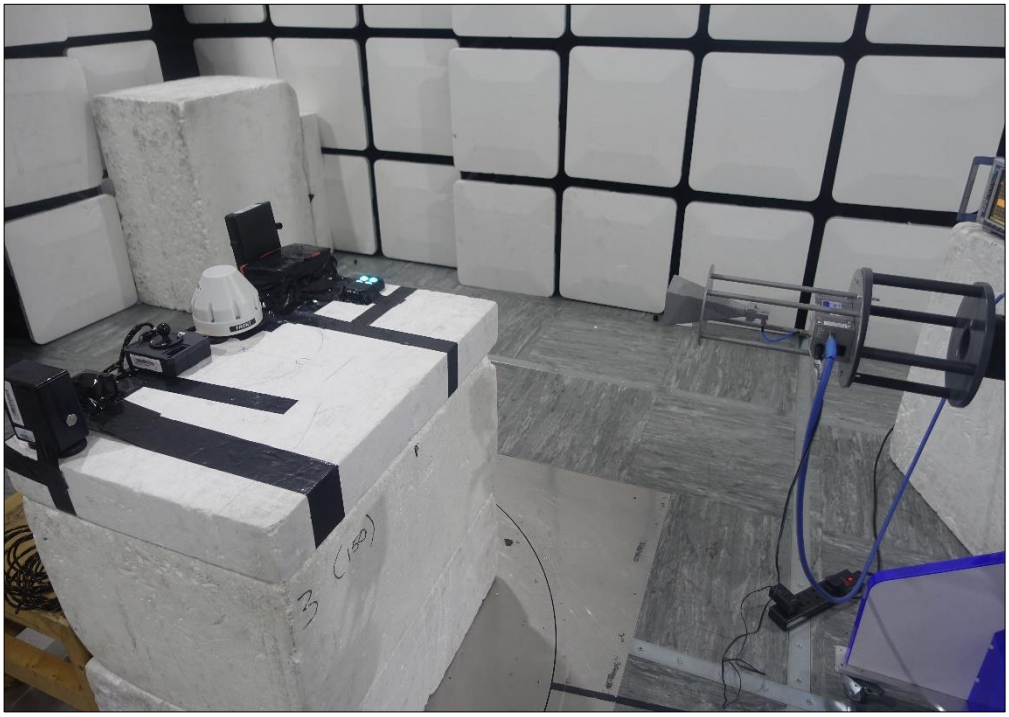

Figure 13 - Test Setup - 18 GHz to 30 GHz

2.1.10 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
3m Semi-Anechoic Chamber	MVG	Screened Room	5621	36	07-Aug-2026
Emissions Software	TUV SUD	EmX V3.2.0	5125	-	Software
Test Receiver	Rohde & Schwarz	ESU40	3506	12	30-Mar-2024
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Cable (N-Type to N-Type, 8 m)	Junkosha	MWX221-08000NMSNMS/B	6321	12	04-Feb-2025
Cable (K Type 2m)	Junkosha	MWX241-02000KMS	5421	12	08-Mar-2024
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5511	12	21-May-2024
Pre-Amplifier (1 GHz to 18 GHz)	Schwarzbeck	BBV 9718 C	5350	12	01-Dec-2024
Pre-Amplifier (8 GHz to 18 GHz)	Wright Technologies	APS06-0061	5596	12	27-Oct-2024
Antenna (Loop, 9 kHz to 30 MHz)	Teseq	HLA	5616	24	27-Jul-2024
Antenna (Bi-Log, 30 MHz to 1 GHz)	Teseq	CBL6111D	5615	24	15-Mar-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	5348	12	15-Oct-2024
Double Ridge Active Horn Antenna (18-40 GHz)	Com-Power	AHA-840	6189	24	02-Jun-2024

Table 17

TU - Traceability Unscheduled

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5471	12	28-Apr-2024

Table 18

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 19

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.