Radio Test Report

XYZ Reality Limited
ATOM Hard hat, Model: XYZ-13-01

In accordance with ARIB STD-T66
(2.4 GHz Bluetooth Low Energy, 2.4 GHz WLAN & 2.4 GHz Proprietary)

Add value.
Inspire trust.

Prepared for: XYZ Reality Limited
Unit G0, G02, 338-346
Goswell Road
Angel
Clerkenwell
EC1V 7LQ
UNITED KINGDOM

COMMERCIAL-IN-CONFIDENCE

Document 75957296-05 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Matthew Russell	Chief Engineer	Authorised Signatory	16 May 2023

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

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with ARIB STD-T66: 3.7 (2014-10) 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-May-2023

Table 1

1.2 Introduction

Applicant	XYZ Reality Limited
Manufacturer	XYZ Reality Limited
Model Number(s)	XYZ-13-01
Serial Number(s)	130009
Hardware Version(s)	XYZ-13-01
Software Version(s)	Windows certification build with DRT software
Number of Samples Tested	1
Test Specification/Issue/Date	ARIB STD-T66: 3.7 (2014-10)
Order Number	PO-XYZAM0356
Date	16-December-2022
Date of Receipt of EUT	04-May-2023
Start of Test	04-May-2023
Finish of Test	05-May-2023
Name of Engineer(s)	Ahmad Javid
Related Document(s)	Radio Equipment Regulations, Article 24

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with ARIB STD-T66 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Receive				
2.1	3.3 (1)	Limit on Secondary Radiation	Pass	

Table 2

1.4 Application Form

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment)*	The Hard Hat is a construction-grade, safety-certified AR wearable device, that consists of AR waveguides, cameras, 850nm IR detectors, Wi-Fi 2.4GHz, BLE 5.0, Proprietary 2.4GHz, and multiple processors including an x86 i7 computer module
Manufacturer:	XYZ Reality Limited
Model:	Atom Hard Hat
Part Number:	XYZ-13-01
Hardware Version:	XYZ-13-01
Software Version:	2023-02-21-img_DRT_test

Table 3

Transmitter Technical Characteristics – Frequency Characteristics - BLE

Transmitter channel switching frequency range:	2402 to 2480 MHz
Transmitter frequency alignment range:	2402 to 2480 MHz
Please confirm that the OFDM system shall have one or more carriers per 1MHz Bandwidth	☒ Yes ☐ No

Table 4

Transmitter Technical Characteristics – Frequency Characteristics – 2.4GHz Proprietary

Transmitter channel switching frequency range:	2402 to 2480 MHz
Transmitter frequency alignment range:	2402 to 2480 MHz
Please confirm that the OFDM system shall have one or more carriers per 1MHz Bandwidth	☐ Yes ☒ No

Table 5

Transmitter Technical Characteristics – Frequency Characteristics - WiFi

Transmitter channel switching frequency range:	2412 to 2472 MHz
Transmitter frequency alignment range:	2412 to 2472 MHz
Please confirm that the OFDM system shall have one or more carriers per 1MHz Bandwidth	☒ Yes ☐ No

Table 6

Transmitter Power Characteristics - BLE

Maximum effective rated power (rated as stated by the manufacturer):	0.016 W
Average effected radiated power (rated as stated by the manufacturer):	0.016 W
Is transmitter intended for continuous duty	☒ Yes ☐ No
Is transmitter intended for intermittent duty	☐ Yes ☐ No
If intermittent state DUTY CYCLE	
Transmitter ON seconds Transmitter OFF seconds	
Is transmitter output power variable:	
Continuous duty	☐ Yes ☒ No
Maximum power	W
Continuously variable ☐ Stepped ☐	
dB per step	
Maximum RF output power	W
Minimum RF output power	W

Table 7

Transmitter Power Characteristics – 2.4GHz Proprietary

Maximum effective rated power (rated as stated by the manufacturer):	0.001 W
Average effected radiated power (rated as stated by the manufacturer):	0.001 W
Is transmitter intended for continuous duty	☒ Yes ☐ No
Is transmitter intended for intermittent duty	☐ Yes ☐ No
If intermittent state DUTY CYCLE	
Transmitter ON seconds Transmitter OFF seconds	
Is transmitter output power variable:	
Continuous duty	☒ Yes ☐ No
Maximum power	0.001 W
Continuously variable ☐ Stepped ☒	
dB per step	6
Maximum RF output power	0.001 W
Minimum RF output power	0.000015849 W (-18dB)

Table 8

Transmitter Power Characteristics - WiFi

Maximum effective rated power (rated as stated by the manufacturer):	0.1W in FCC, 0.0354W by default
Average effected radiated power (rated as stated by the manufacturer):	0.1W
Is transmitter intended for continuous duty	☐ Yes ☒ No
Is transmitter intended for intermittent duty	☐ Yes ☒ No
If intermittent state DUTY CYCLE	
Transmitter ON seconds	Transmitter OFF seconds
Is transmitter output power variable:	
Continuous duty	☐ Yes ☒ No
Maximum power	W
Continuously variable ☐	Stepped ☐
dB per step	
Maximum RF output power	W
Minimum RF output power	W

Table 9

Transmitter – Modulation -BLE

Frequency ☒	Phase ☐	Other ☒
If other supply details: GFSK, DPSK		

Table 10

Transmitter – Modulation – 2.4GHz Proprietary

Frequency ☒	Phase ☐	Other ☒
If other supply details: GFSK		

Table 11

Transmitter – Modulation - WiFi

Frequency ☐	Phase ☒	Other ☒
If other supply details: QAM		

Table 12

Receiver Technical Characteristics – Frequency Characteristics - BLE

Receiver channel switching frequency range:	2402 to 2480 MHz
Receiver frequency alignment range:	2402 to 2480 MHz

Table 13

Receiver Technical Characteristics – Frequency Characteristics – 2.4GHz Proprietary

Receiver channel switching frequency range:	2402 to 2480 MHz
Receiver frequency alignment range:	2402 to 2480 MHz

Table 14

Receiver Technical Characteristics – Frequency Characteristics - WiFi

Receiver channel switching frequency range:	2412 to 2472 MHz
Receiver frequency alignment range:	2412 to 2472 MHz

Table 15

Channel Separation - BLE

Channel Separation	1 MHz
State the maximum number of channels over which the equipment can operate:	40

Table 16

Channel Separation – 2.4GHz Proprietary

Channel Separation	1 MHz
State the maximum number of channels over which the equipment can operate:	79

Table 17

Channel Separation - WiFi

Channel Separation	5 MHz
State the maximum number of channels over which the equipment can operate:	13

Table 18

Automatic Equipment Switch Off

If the equipment is designed to automatically switch off at a predetermined voltage level which is higher or lower in value than the battery minimum and minimum calculated values this shall be clearly stated.	
Applies ☐ Does Not Apply ☒	
	V Cut off Voltage

Table 19

AC Power Source

AC supply frequency:	N/A	Hz
Voltage		V
Max current:		A
Single Phase ☐ Three Phase ☐		

Table 20

DC Power Source

Nominal voltage:	20	V
Extreme upper voltage:	20	V
Extreme lower voltage:	20	V
Max current:	5	A

Table 21

Battery Power Source

Voltage:	7.2	V
End-point voltage:	5	V *(Point at which the battery will terminate)*
Alkaline ☐ Leclanche ☐ Lithium ☐ Nickel Cadmium ☐ Lead Acid* ☐ **(Vehicle regulated)*		
Other ☒ Please detail:	Li ion	

Table 22

Antenna Information

Frequency	2.4GHz – 2.5GHz
Gain	2.8dBi
Impedance	50 Ohms
VSWR	< 1.925
Weight	<2g
Length	34.90mm x 9.00mm
Diameter	Cable Ø1.13mm
Finish	Poly Flexible material
Connector	MHF1
Operating Temperature	-40℃ to 85℃
Flame Rating	N/A patch antenna
Polarisation	Linear
RoHS Compliant	Yes
Pattern (i.e Omni Directional)	Omni Directional

Table 23

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

Name: Loek Janssen
Position held: Lead Hardware Engineer
Date: 03 March 2023

1.5 Product Information

1.5.1 Technical Description

The equipment is an engineering grade augmented reality product that is used to accurately overlay and manipulate a 3D model in real time

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: XYZ-13-01, Serial Number: 130009			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 24

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: Receive		
Limit on Secondary Radiation	Ahmad Javid	UKAS

Table 25

Office Address:

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

2 Test Details

2.1 Limit on Secondary Radiation

2.1.1 Specification Reference

ARIB STD-T66, Clause 3.3 (1)

2.1.2 Equipment Under Test and Modification State

XYZ-13-01, S/N: 130009 - Modification State 0

2.1.3 Date of Test

04-May-2023 to 05-May-2023

2.1.4 Test Method

The test was carried out according to ARIB STD-T66, clause 3.3 (1) conducted method in receive mode.

2.1.5 Environmental Conditions

Ambient Temperature	20.5 - 21.2 °C
Relative Humidity	38.0 - 39.4 %

2.1.6 Test Results

Receive

20 V DC Supply

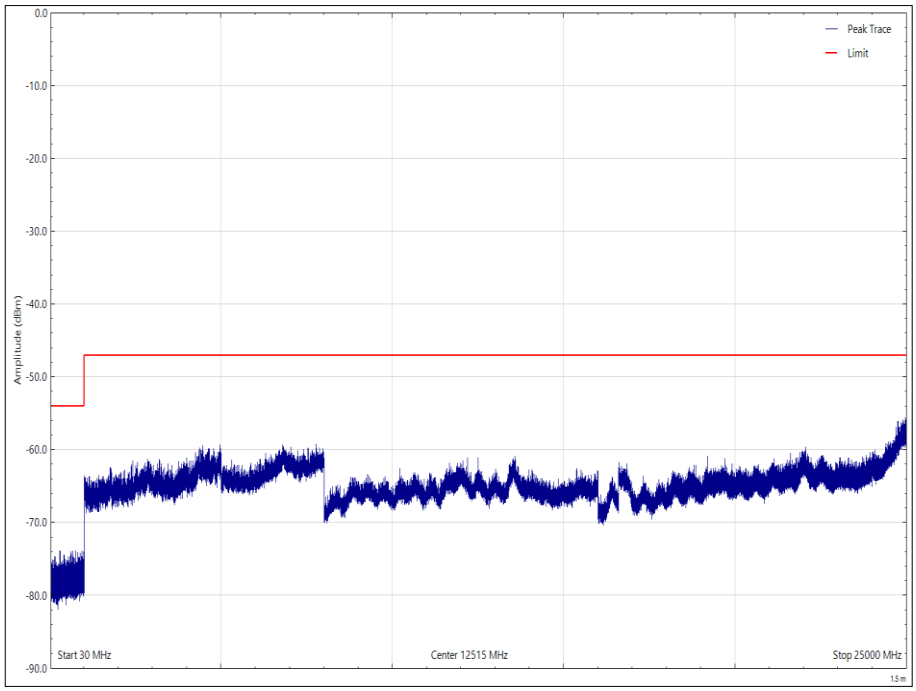

Figure 1 - 2402 MHz - 30 MHz to 25000 MHz, BLE

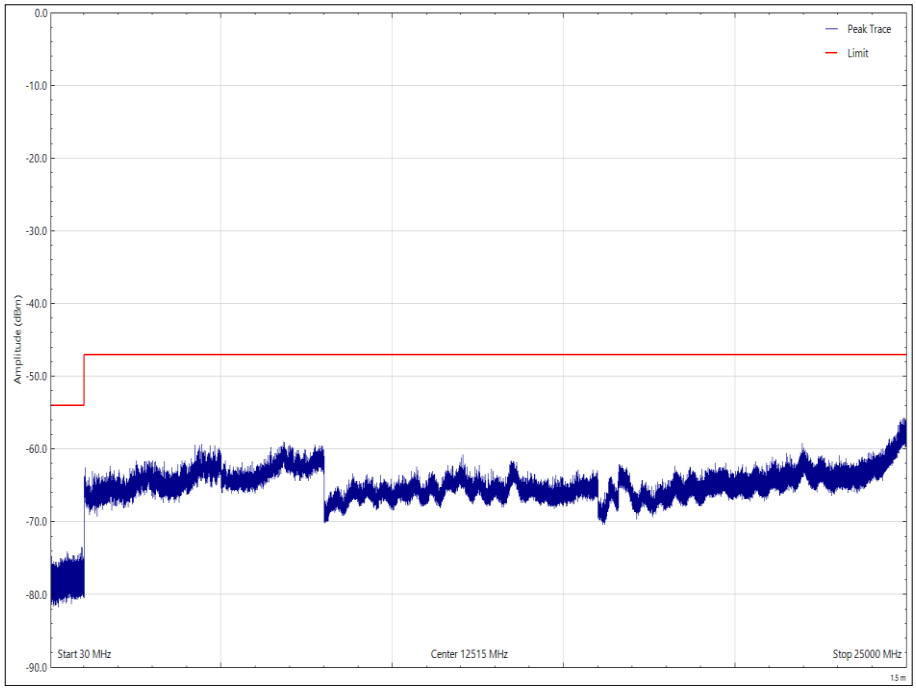

Figure 2 - 2440 MHz - 30 MHz to 25000 MHz, BLE

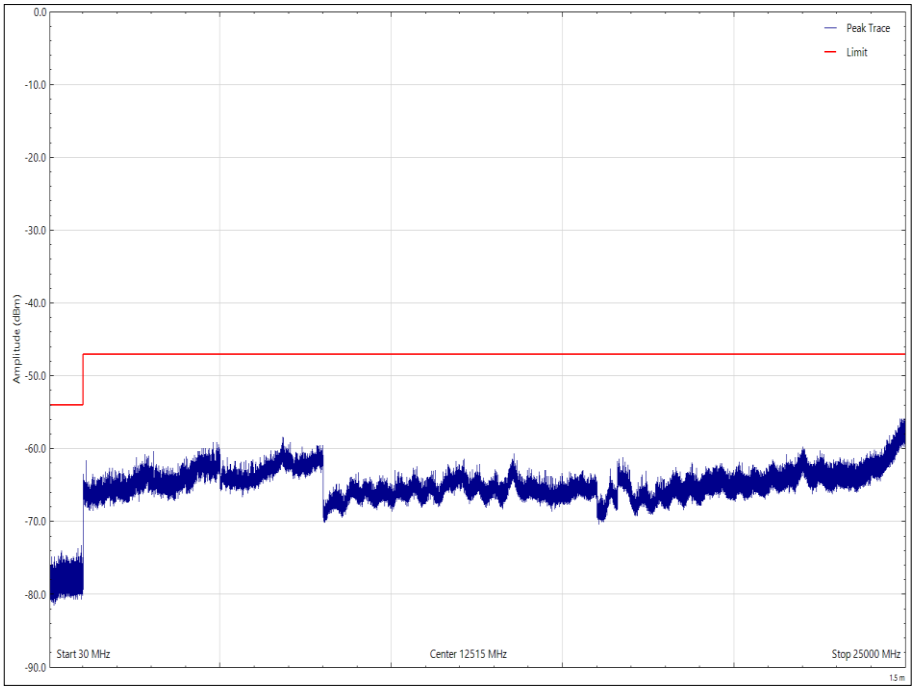

Figure 3 -2480 MHz - 30 MHz to 25000 MHz, BLE

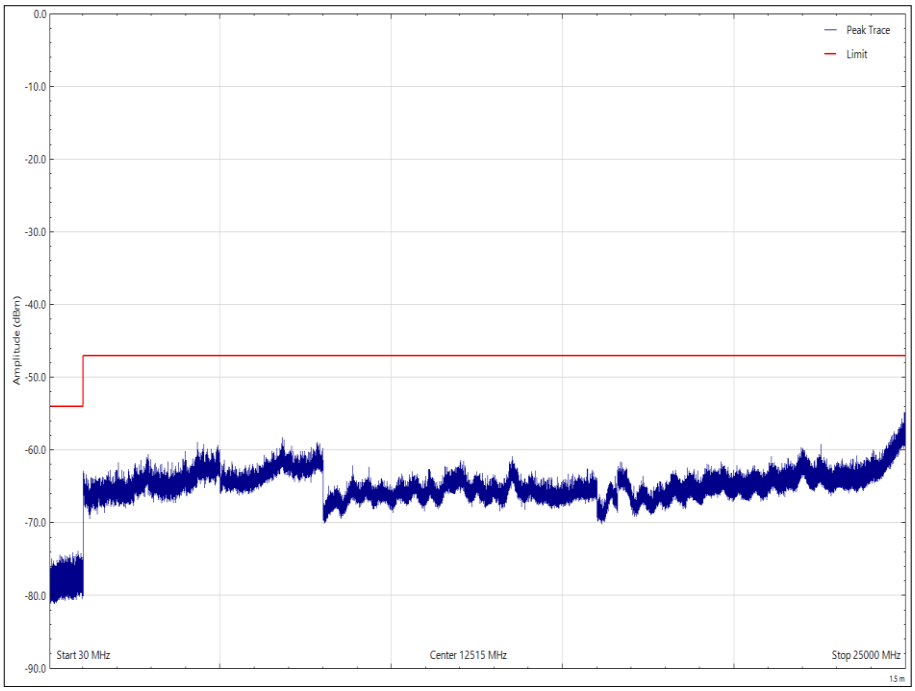

Figure 4 - 2412 MHz - 30 MHz to 25000 MHz, 2.4GHz WLAN

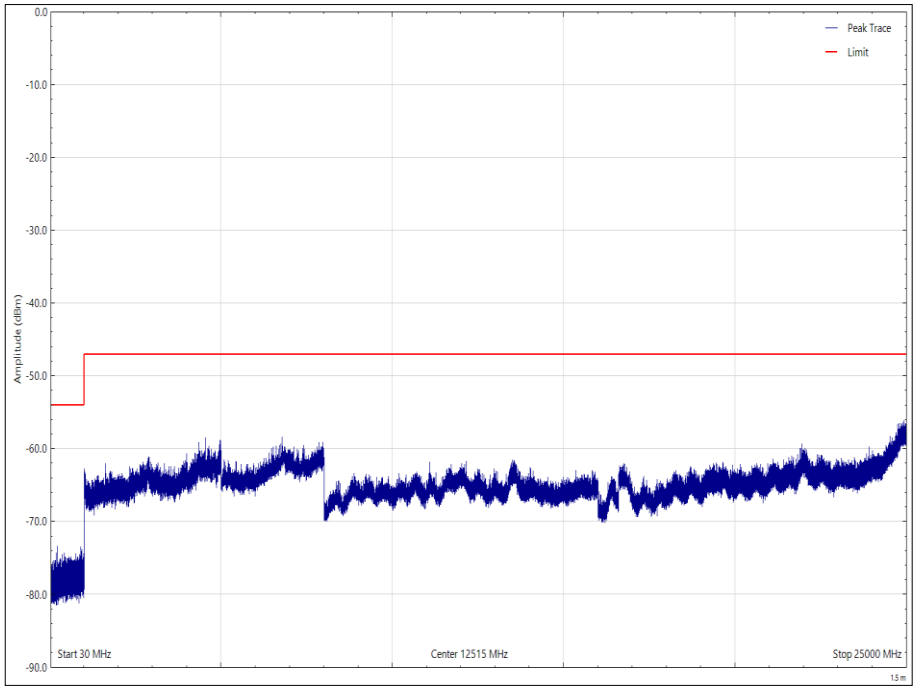

Figure 5 - 2442 MHz - 30 MHz to 25000 MHz, 2.4GHz WLAN

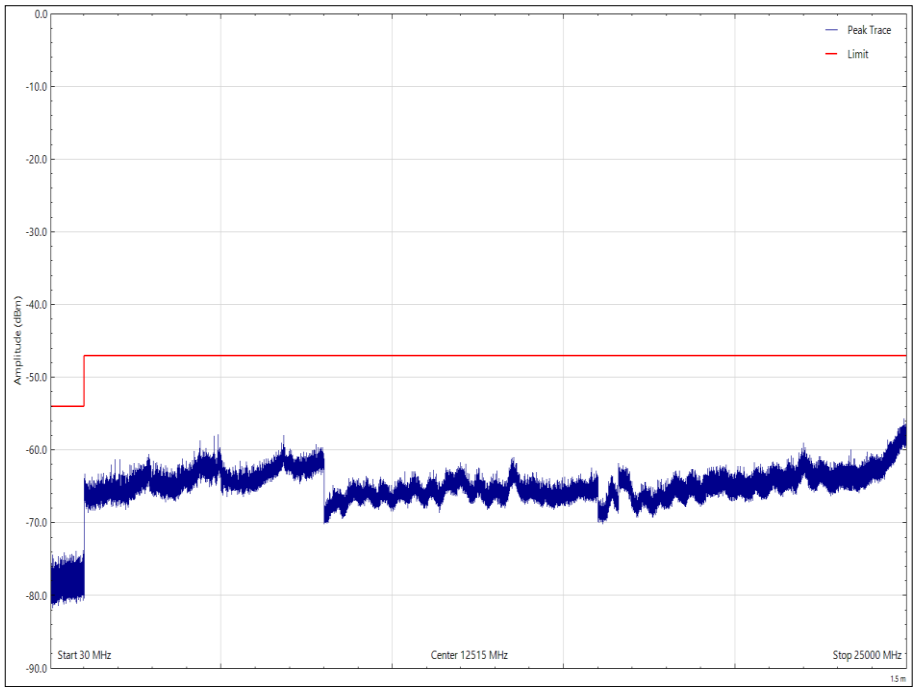

Figure 6 -2472 MHz - 30 MHz to 25000 MHz, 2.4GHz WLAN

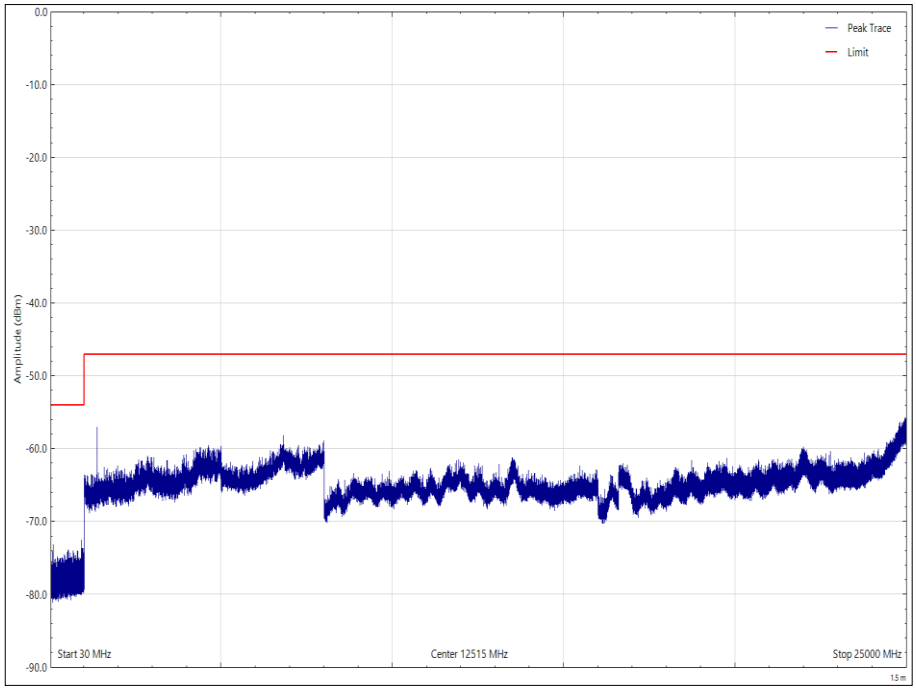

Figure 7 - 2402 MHz - 30 MHz to 25000 MHz, Proprietary

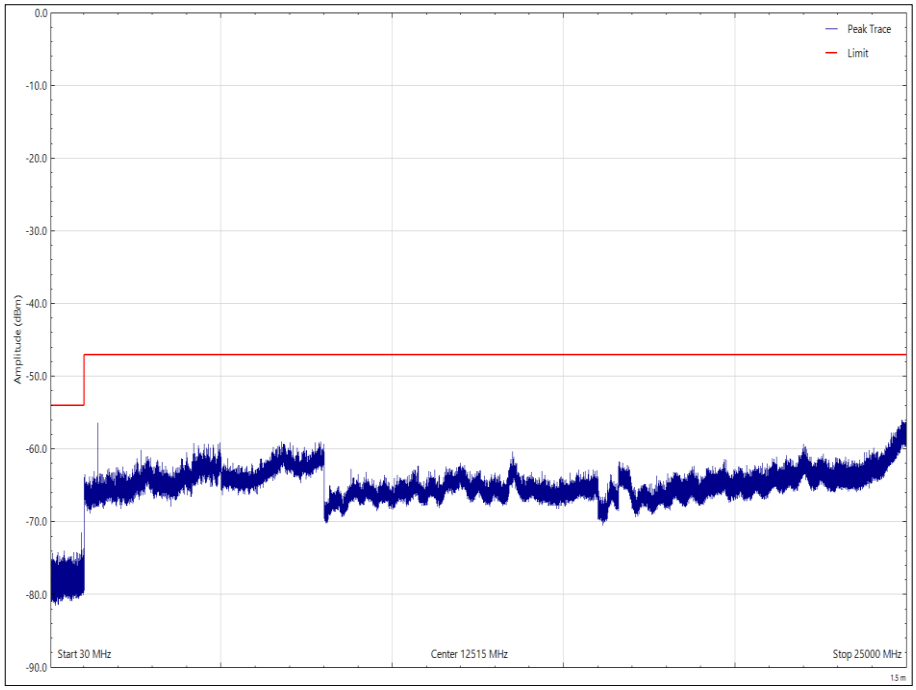

Figure 8 - 2440 MHz - 30 MHz to 25000 MHz, Proprietary

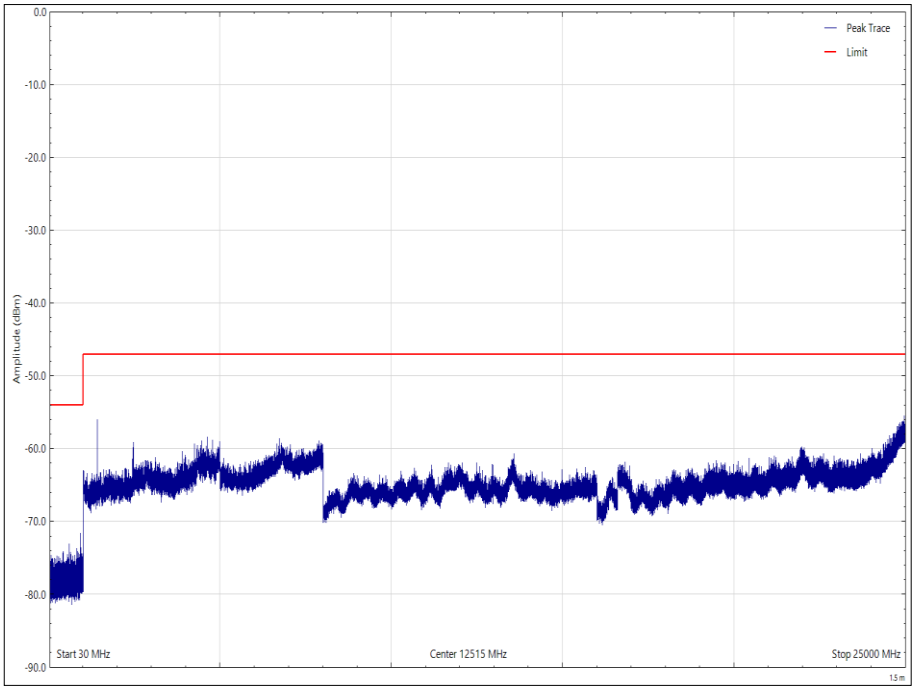

Figure 9 -2480 MHz - 30 MHz to 25000 MHz, Proprietary

ARIB STD-T66, Limit Clause 3.3 (1)

The limit at which secondary radiation will not hinder the function of other radio equipment is, if a fictional antenna circuit with the same electrical constant as the receiving antenna were to be used in calculations, at most 4nW if using a frequency below 1GHz and at most 20nW if using a frequency above or equal to 1GHz.

2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	17-May-2023
Emissions Software	TUV SUD	EmX V3.1.11	5125	-	Software
Thermo-Hygro-Barometer	PCE Instruments	OCE-THB-40	5470	12	20-Apr-2024
Attenuator 5W 10dB DC-18GHz	Aaren	AT40A-4041-D18-10	5495	12	13-Oct-2023
Cable (K Type 2m)	Junkosha	MWX241-02000KMSKMS/B	5936	12	14-May-2023

Table 26

3 Photographs

3.1 Equipment Under Test (EUT)

Figure 10 - Front View

Figure 11 - Rear View

4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Limit on Secondary Radiation	±3.45 dB

Table 27

Measurement Uncertainty Decision Rule – Accuracy Method

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.