RADIO PERFORMANCE TEST REPORT

Test Report No. : **OT-245-RWD-028**

Reception No. : **2405001576**

Applicant : **EVAR Corp.**

Address : **42, Changeop-ro, Sujeong-gu, Seongnam-si, Gyeonggi-do, Korea**

Manufacturer : **EVAR Corp.**

Address : **42, Changeop-ro, Sujeong-gu, Seongnam-si, Gyeonggi-do, Korea**

Type of Equipment : **NFC Module**

FCC ID : **2BBSQ-E02WR01**

Model Name : **E02WR01**

Multiple Model Name : **N/A**

Serial number : **N/A**

Total page of Report : **19 pages (including this page)**

Date of Incoming : **April 03, 2024**

Date of Issuing : **May 27, 2024**

SUMMARY

The equipment complies with the requirements of ***FCC CFR 47 PART 15 SUBPART C Section 15.225***

This test report contains only the result of a single test of the sample supplied for the examination.

It is not a general valid assessment of the features of the respective products of the mass-production.

This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.

Tested by	Reviewed by	Approved by
Dong-Yeon, Han / Prj. Engineer	Tae-Ho, Kim / Chief Engineer	Jae-Ho, Lee / Chief Engineer
ONETECH Corp.	ONETECH Corp.	ONETECH Corp.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-245-RWD-028	May 27, 2024	Initial Release	All

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1. VERIFICATION OF COMPLIANCE

Applicant : EVAR Corp.

Address : 42, Changeop-ro, Sujeong-gu, Seongnam-si, Gyeonggi-do, Korea

Contact Person : Kijae, Kim

Telephone No. : +82-31-759-5646

FCC ID : 2BBSQ-E02WR01

Model Name : E02WR01

Brand Name : -

Serial Number : N/A

Date : May 27, 2024

DEVICE TYPE	DXX – Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	NFC Module
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC CFR47 Part 15 Subpart C Section 15.225
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	3 m Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

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2. GENERAL INFORMATION

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
RSS-210, B.6 (i)(ii)(iii)	Field Strength of Fundamental Emissions	Met the Limit / PASS
RSS-210, B.6 (iv) & RSS-GEN 8.9	Radiated Emission Limits	Met the Limit / PASS
RSS-GEN 6.7	OCCUPIED BANDWIDTH	Met the Limit / PASS
RSS-210, B.6 (b)	FREQUENCY STABILITY WITH TEMPERATURE VARIATION / FREQUENCY STABILITY WITH VOLTAGE VARIATION	Met the Limit / PASS
RSS-GEN 8.8	Conducted Limits	N/A (See Note)
RSS-GEN 6.8	Antenna Requirement	Met requirement / PASS

Note: As this product is only using DC power, AC conducted emission test has not been performed.

2.2 Product Description

The EVAR Corp., Model E02WR01 (referred to as the EUT in this report) is a NFC Module. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	NFC Module
OPERATING FREQUENCY	13.56 MHz
MODULATION TYPE	ASK
ANTENNA TYPE	PCB Antenna
POWER REQUIREMENT	DC 5.0 V
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>=1 MHz)	13.56 MHz, 16 MHz, 27.12 MHz

2.3 Model Differences

-. None

2.4 Related Submittal(s) / Grant(s)

Original submittal only

2.5 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.225.

2.6 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013.

Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.7 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. SYSTEM TEST CONFIGURATION

3.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	EVAR Corp.	N/A	-

3.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
E02WR01	EVAR Corp.	NFC Module(EUT)	-
GP-4303D	LG Precision Co., Ltd	DC Power Supply	-

3.3 Mode of operation during the test

-. The EUT has 13.56 MHz RF board and program was used for making continuous transmission mode during the test.

3.4 Equipment Modifications

-. None

3.5 Configuration of Test System

Line Conducted Test: -

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. The radiated emissions measurements were performed on the 10 m Semi Anechoic Chamber.
For frequencies from 150 kHz to 30 MHz measurements were made of the magnetic H field. The measuring antenna is an electrically screened loop antenna.
The frequency spectrum from 30 MHz to 1 000 MHz was scanned and maximum emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

3.6 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The transmitter antenna of the EUT is a PCB Antenna so there is no consideration of replacement by the user.

4. PRELIMINARY TEST

4.1 AC Power line Conducted Emissions Tests

As this product is only using DC power, AC conducted emission test has not been performed.

4.2 Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

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5. FINAL RESULT OF MEASUREMENT

5.1 RADIATED EMISSION TEST

5.1.1 Operation frequency band: (13.553 ~ 13.567) MHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 56 % R.H. Temperature: 25 ºC

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.225

Type of Test : Low Power Communication Device Transmitter

Result : PASSED

EUT : NFC Module Date: April 18, 2024 ~ May 01, 2024

Operating Condition : Transmitting Mode

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)

Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Ant. Factor (dB/m)	Cable Loss	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
13.56	51.85	H	1	19	2.5	73.35	124	50.65
13.56	44.47	V	1	19	2.5	65.97	124	58.03

Remark. The EUT was tested at 3 m, so conversation factor was included at above limit.

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5.1.2 Operation frequency band: Below 13.553 MHz and above 13.567 MHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 56 % R.H. Temperature: 25 ºC

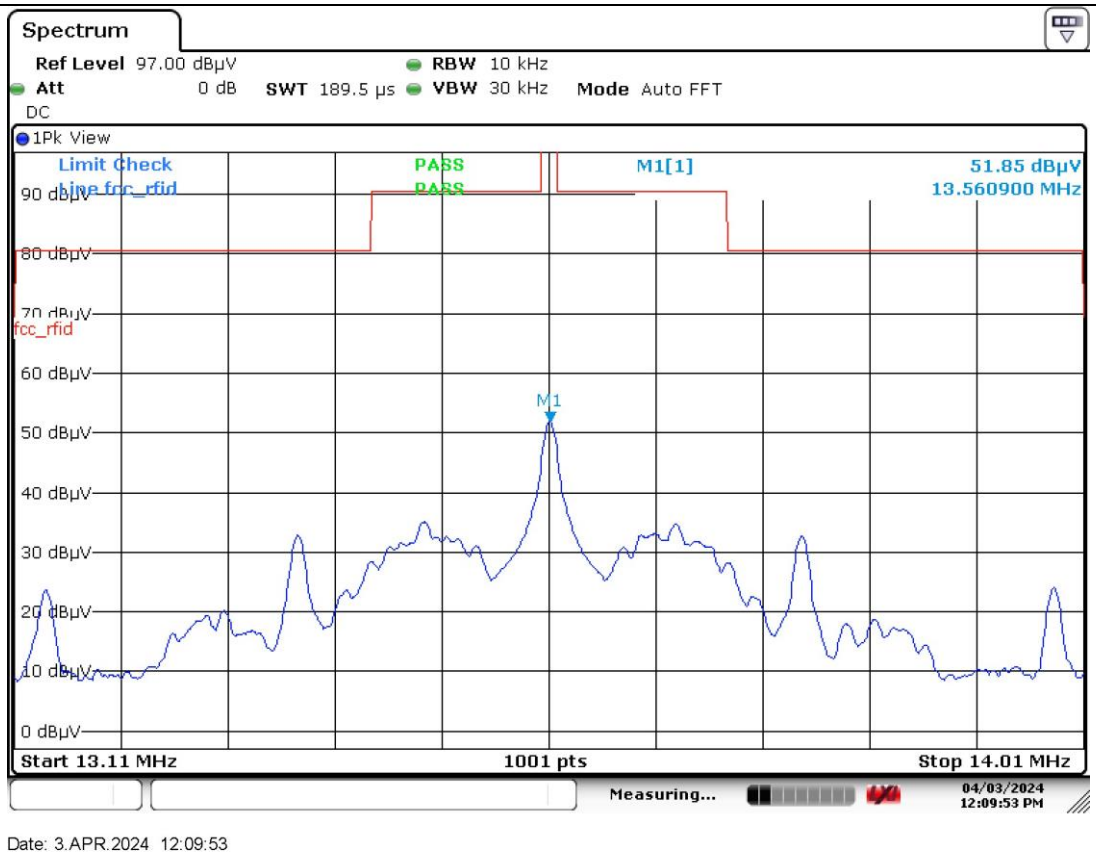
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.225

Type of Test : Low Power Communication Device Transmitter

Result : PASSED

EUT : NFC Module Date: April 18, 2024 ~ May 01, 2024

Operating Condition : Transmitting Mode



cc. to above test data, the field strength level of 13.56 MHz is 51.85 dBuV/m and the worst limit subject to 15.225 (b) and (c) is 80.5 dBuV/m, so the EUT meets the requirement.

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5.2 SPURIOUS EMISSION TEST

5.2.1 Spurious Radiated Emission Below 30 MHz

Humidity Level : 56 % R.H. Temperature: 25 ºC

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209

Type of Test : Low Power Communication Device Transmitter

Frequency Range : 9 kHz ~ 30 MHz

Result : PASSED

EUT : NFC Module Date: April 18, 2024 ~ May 01, 2024

Operating Condition : Transmitting Mode

Distance : 3 m

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

5.2.2 Spurious Radiated Emission below 1 GHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 56 % R.H. Temperature: 25 ºC

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209

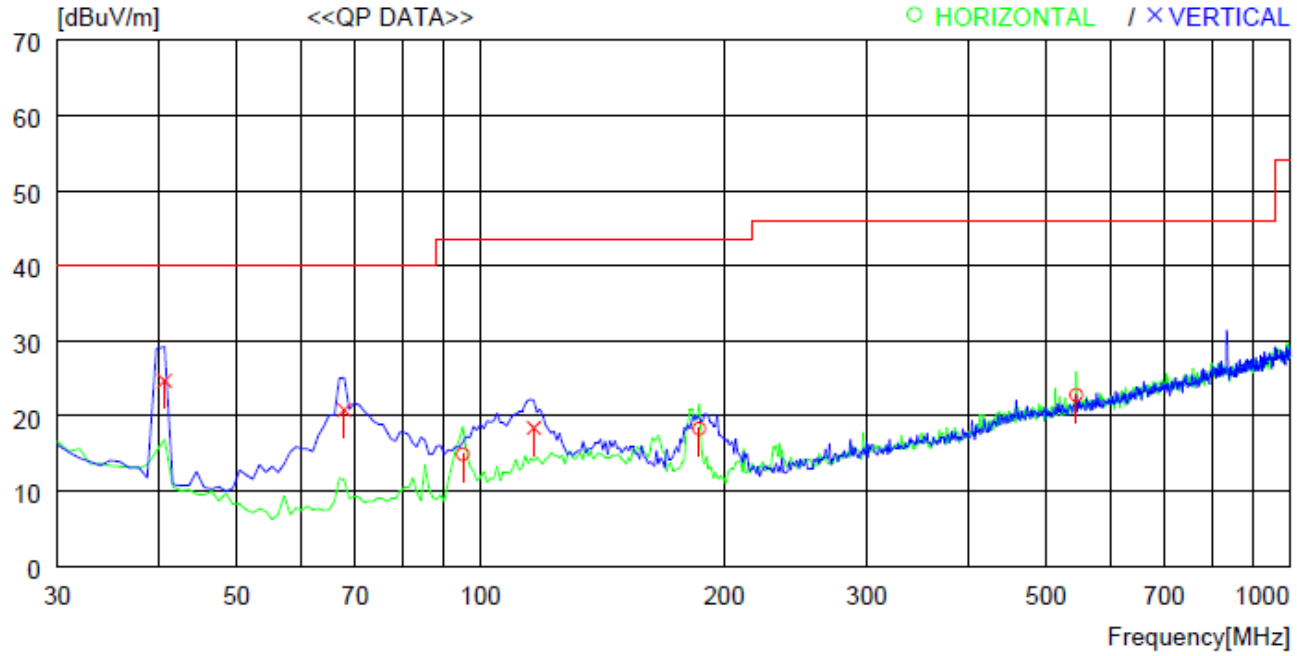
Type of Test : Low Power Communication Device Transmitter

Result : PASSED

EUT : NFC Module Date: April 18, 2024 ~ May 01, 2024

Operating Condition : Transmitting Mode

Distance : 3 m



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	94.990	30.7	14.5	2.7	33.0	14.9	43.5	28.6	400	0
2	186.170	31.5	16.1	3.7	33.0	18.3	43.5	25.2	100	359
3	544.100	25.7	23.7	6.6	33.2	22.8	46.0	23.2	200	0
----- Vertical ------										
4	40.670	39.3	16.7	1.7	33.0	24.7	40.0	15.3	300	262
5	67.830	38.8	12.8	2.2	33.0	20.8	40.0	19.2	200	266
6	116.330	30.2	18.2	3.0	33.0	18.4	43.5	25.1	100	340

5.3 20 dB BANDWIDTH

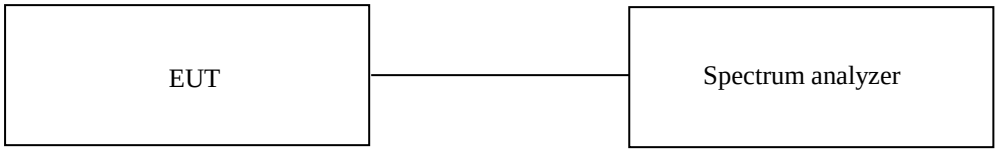
5.3.1 Operating environment

Temperature : 25 °C

Relative humidity : 56 % R.H.

5.3.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 % to 5 % of the OBW and video bandwidth (VBW) shall be approximately three times RBW. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



5.3.3 Test date

April 18, 2024 ~ May 01, 2024

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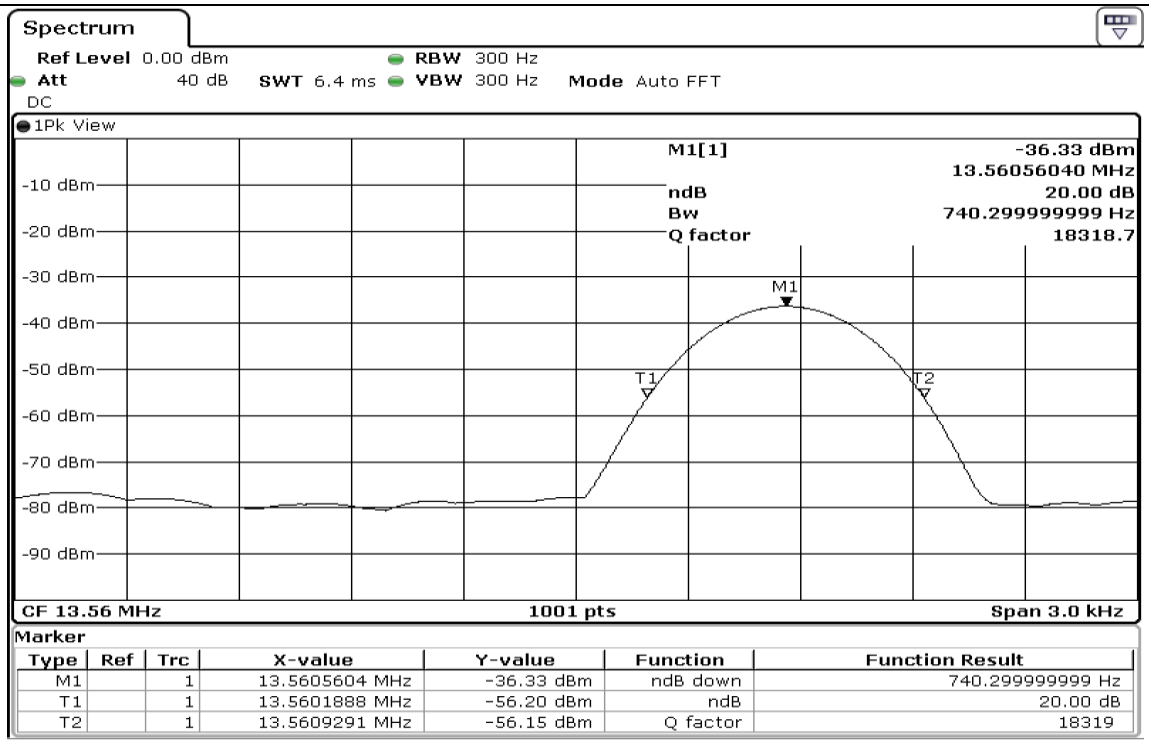
5.3.4 Test data

-. Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.215

FREQUENCY (MHz)	MEASURED VALUE (kHz)	Result
13.560 0	0.740 2	**PASS**



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5.4 FREQUENCY STABILITY WITH TEMPERATURE VARIATION

5.4.1 Operating environment

Temperature : 25 °C

Relative humidity : 56 % R.H.

5.4.2 Test set-up

Turn EUT off and set chamber temperature to -20 °C and then allow sufficient time (approximately 20 to 30 minutes after chamber reach the assigned temperature) for EUT to stabilize. Turn ON EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -20 °C to +50°C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.

5.4.3 Test date

April 18, 2024 ~ May 01, 2024

5.4.4 Test data

-. Result : PASSED

Temperature (˚C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
-20	13,560,000	13,560,522	-522	± 1 356.00
-10		13,560,567	567	
0		13,560,593	593	
10		13,560,614	614	
20		13,560,615	615	
30		13,560,571	571	
40		13,560,545	545	
50		13,560,532	532	

5.5 FREQUENCY STABILITY WITH VOLTAGE VARIATION

5.5.1 Operating environment

Temperature : 25 °C

Relative humidity : 56 % R.H.

5.5.2 Test set-up

An external AC power supply was connected to the input of the EUT. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.

5.5.3 Test date

April 18, 2024 ~ May 01, 2024

5.5.4 Test data

-. Result : PASSED

Voltage (Vac)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
5.75(115 %)	13,560,000	13,560,616	-616	± 1 356.00
5.0(100 %)		13,560,614	-614	
4.25(85 %)		13,560,613	-613	

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6. FIELD STRENGTH CALCULATION

Meter readings are compared to the specification limit correcting for antenna and cable losses.

+	Meter reading	(dBμV)
+	Cable Loss	(dB)
+	Antenna Factor	(dB/m)
=	Corrected Result	(dBμV/m)

Margin (dB)

	Specification Limit	(dBuV/m)
-	Corrected Result	(dBuV/m)
=	dB Relative to Spec	(± dB)

7. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
FSV30	Rohde & Schwarz	SIGNAL ANALYZER	101372	Jul. 10, 2023 (1Y)
ESCI	Rohde & Schwarz	Test Receiver	101013	Mar. 12, 2024 (1Y)
310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 11, 2024 (1Y)
HLP-2008	TDK	Hybrid Antenna	131313	Apr. 05, 2023 (2Y)
DT3000	Innco System	Turn Table	DT3000/093	N/A
CO3000	Innco Systems GmbH	Controller	CO3000/904	N/A
MA4000-EP	Innco Systems GmbH	Antenna Master	MA4000/332	N/A
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Apr. 15, 2024 (2Y)
SSE-43CI-A	Samkun Tech	Environmental Test chamber	60712	Jan. 16, 2024 (1Y)
GP-4303D	LG Precision Co., Ltd	DC Power Supply	5071069	Jan. 04, 2024 (1Y)