

RADIO PERFORMANCE TEST REPORT

Test Report No. : OT-25O-RWD-008
Reception No. : 2509003012
Applicant : UNION biometrics Co., Ltd.
Address : 12F, Munjeong Daemyeong Valeon bldg, 127 Beobwon-ro Songpa-gu, Seoul, South Korea
Manufacturer : UNION biometrics Co., Ltd.
Address : 12F, Munjeong Daemyeong Valeon bldg, 127 Beobwon-ro Songpa-gu, Seoul, South Korea
Type of Equipment : Access controller
FCC ID. : XX2-U-AC5100
Model Name : AC-5100
Multiple Model Name : AC-5000IK, AC-5000PLUS
Serial number : N/A
Total page of Report : 21 pages (including this page)
Date of Incoming : September 05, 2025
Date of issue : October 15, 2025

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 test report is not associated with the accreditation granted by the Korean Laboratory Accreditation Scheme (KOLAS).





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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-25O-RWD-008	October 15, 2025	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : UNION biometrics Co., Ltd.

Address : 12F, Munjeong Daemyeong Valeon bldg, 127 Beobwon-ro Songpa-gu, Seoul, South Korea

Contact Person : Dong Ho Lee

Telephone No. : +82-2-6488-3054

FCC ID : XX2-U-AC5100

Model Name : AC-5100

Brand Name : -

Serial Number : N/A

Date : October 15, 2025

DEVICE TYPE	DXX – Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	Access controller
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2020
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	10 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.

2. GENERAL INFORMATION

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.225 (a) (b) (c)	Field Strength of Fundamental Emissions	Met the Limit / PASS
15.225 (d) & 15.209	Radiated Emission Limits	Met the Limit / PASS
2.1049	20 dB Bandwidth	Met the Limit / PASS
15.225(e)	FREQUENCY STABILITY WITH TEMPERATURE VARIATION / FREQUENCY STABILITY WITH VOLTAGE VARIATION	Met the Limit / PASS
15.207	Conducted Limits	Met requirement / PASS
15.203	Antenna Requirement	Met requirement / PASS

2.2 Product Description

The UNION biometrics Co., Ltd., Model AC-5100 (referred to as the EUT in this report) is a Access controller. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Access controller
OPERATING FREQUENCY	Bluetooth LE 1 Mbps: 2 402 MHz ~ 2 480 MHz
	RFID: 13.56 MHz
MODULATION TYPE	Bluetooth LE 1 Mbps: GFSK
	RFID: ASK
RF OUTPUT POWER	Bluetooth LE 1 Mbps: -7.41 dBm
ANTENNA TYPE	PCB Antenna
ANTENNA GAIN	2.88 dBi
List of each Osc. or crystal Freq.(Freq. $\geq$ 1 MHz)	536 MHz
RATED SUPPLY VOLTAGE	DC 12.0 V

2.3 Alternative type(s)/model(s); also covered by this test report.

-. The following lists consist of the added model and their differences.

Model Name	Differences	Tested
AC-5100	Basic Model	☒
AC-5000IK, AC-5000PLUS	The model is identical to basic model except for the model name only.	☐

Note: 1. Applicant consigns only basic model to test. Therefore this test report just guarantees the units, which have been tested.

2. The Applicant/manufacture is responsible for the compliance of all variants.

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: 2020. 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

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	N/A	PAC5000MA01	N/A
SUB Board 1	N/A	PAC5000PW01	N/A
SUB Board 2	N/A	PAC5000SR01	N/A
SUB Board 3	N/A	PAC5000KP01	N/A
SUB Board 4	N/A	PAC5000LI01	N/A
Bluetooth Module	N/A	PBLN51822m-R	N/A
13.56 MHz Antenna Board	N/A	PAC5000SA01	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
AC-5100	UNION biometrics Co., Ltd.	Access controller (EUT)	-
GP-4303D	LG Precision Co.,Ltd	DC Power Supply	EUT

3.3 Mode of operation during the test

-. The EUT has 13.56 MHz RF boards for reading Card 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 : The EUT was connected to adaptor and the power of adaptor was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2020 to determine the worse operating conditions.

Radiated Emission Test : Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2020 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

During Preliminary Tests, the following operating mode was investigated

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

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

5. FINAL RESULT OF MEASUREMENT

Preliminary test was done in normal operation mode. And the final measurement was selected for the maximized emission level.

5.1 Conducted Emission Test

Humidity Level : 48 % R.H.

Temperature: 25 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART B, SECTION 15.207(a)

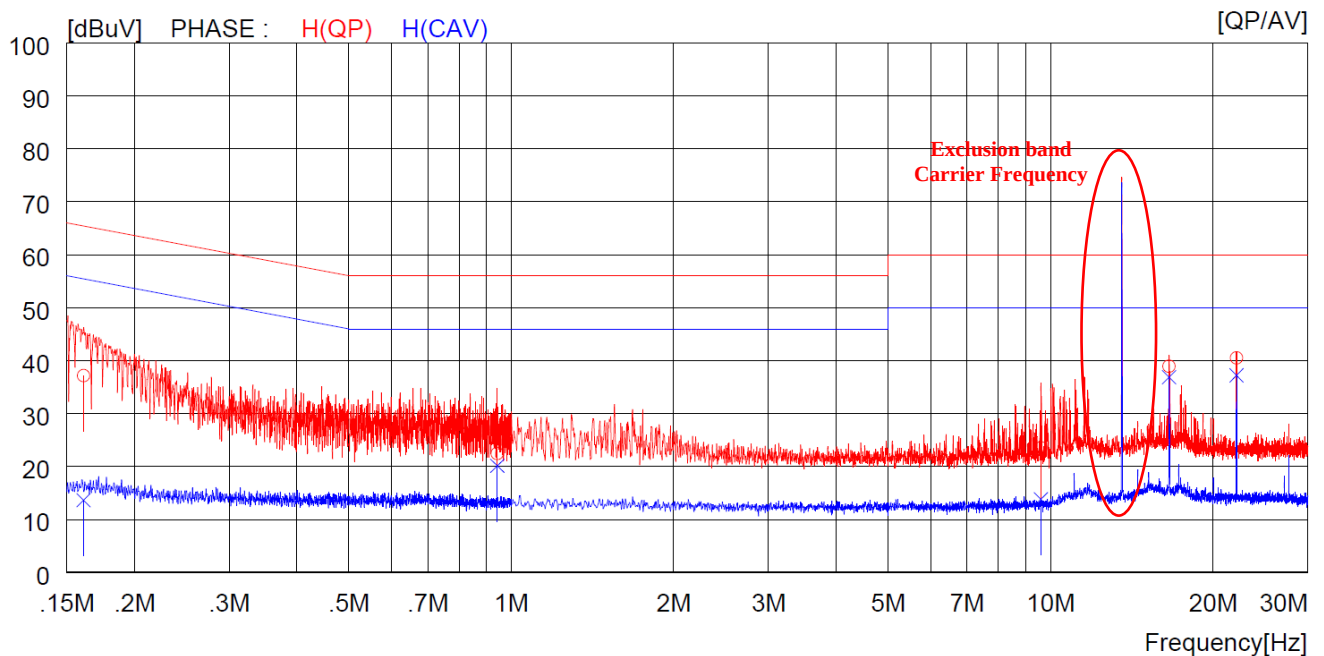
Result : PASSED

EUT : Access controller

Date: September 12, 2025 ~ September 29, 2025

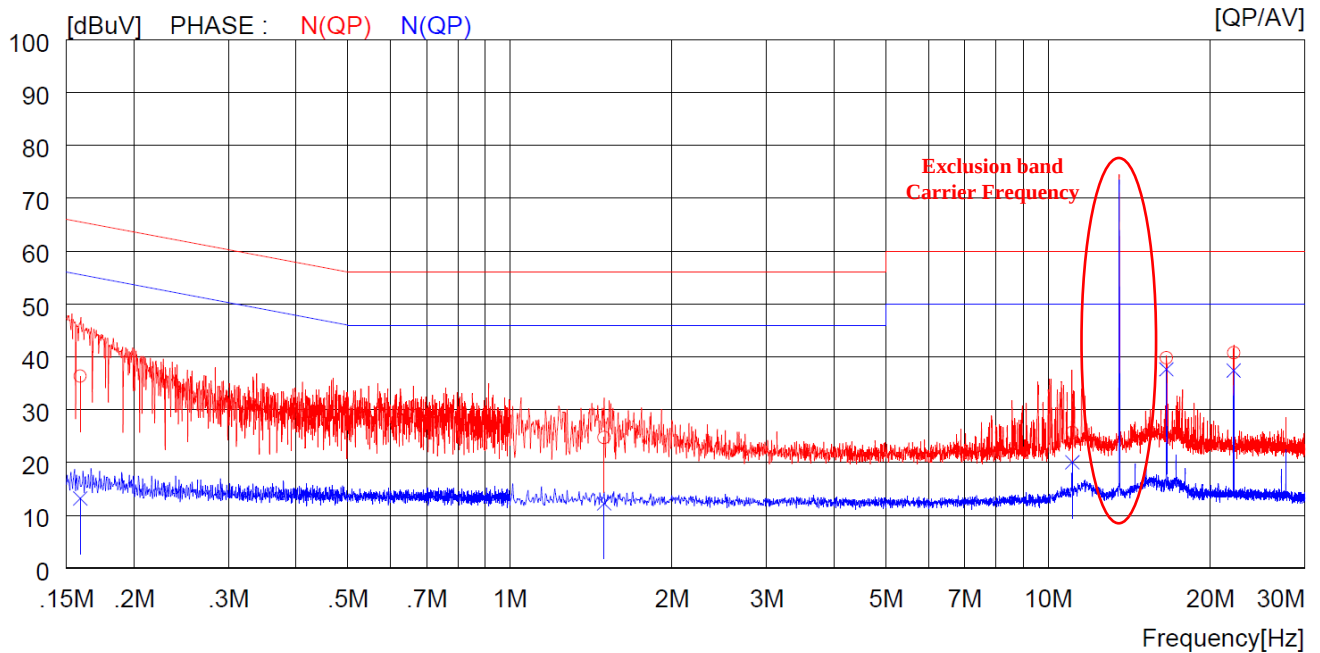
Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)

Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.16100	27.0	----	10.1	37.1	----	65.4	----	28.3	----	H (QP)
2	0.94200	12.3	----	10.1	22.4	----	56.0	----	33.6	----	H (QP)
3	9.59500	13.0	----	10.5	23.5	----	60.0	----	36.5	----	H (QP)
4	16.59000	28.0	----	10.9	38.9	----	60.0	----	21.1	----	H (QP)
5	22.12000	29.3	----	11.2	40.5	----	60.0	----	19.5	----	H (QP)
6	0.16100	----	3.5	10.1	----	13.6	----	55.4	----	41.8	H (CAV)
7	0.94200	----	10.0	10.1	----	20.1	----	46.0	----	25.9	H (CAV)
8	9.59500	----	3.3	10.5	----	13.8	----	50.0	----	36.2	H (CAV)
9	16.59000	----	26.0	10.9	----	36.9	----	50.0	----	13.1	H (CAV)
10	22.12000	----	26.0	11.2	----	37.2	----	50.0	----	12.8	H (CAV)

Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.15900	26.2	----	10.1	36.3	----	65.5	----	29.2	----	N (QP)
2	1.49600	14.6	----	10.1	24.7	----	56.0	----	31.3	----	N (QP)
3	11.09000	15.0	----	10.6	25.6	----	60.0	----	34.4	----	N (QP)
4	16.59000	28.9	----	10.9	39.8	----	60.0	----	20.2	----	N (QP)
5	22.12000	29.5	----	11.2	40.7	----	60.0	----	19.3	----	N (QP)
6	0.15900	----	3.1	10.1	----	13.2	----	55.5	----	42.3	N (CAV)
7	1.49600	----	2.1	10.1	----	12.2	----	46.0	----	33.8	N (CAV)
8	11.09000	----	9.4	10.6	----	20.0	----	50.0	----	30.0	N (CAV)
9	16.59000	----	26.7	10.9	----	37.6	----	50.0	----	12.4	N (CAV)
10	22.12000	----	26.2	11.2	----	37.4	----	50.0	----	12.6	N (CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

5.2 RADIATED EMISSION TEST

5.2.1 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 : 48 % R.H. Temperature: 25 °C

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

Type of Test : Low Power Communication Device Transmitter

Result : PASSED

EUT : Access controller Date: September 12, 2025 ~ September 29, 2025

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	48.06	H	1	20.80	0.87	69.73	124.00	54.27
13.56	44.07	V	1	20.80	0.87	65.74	124.00	58.26

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

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

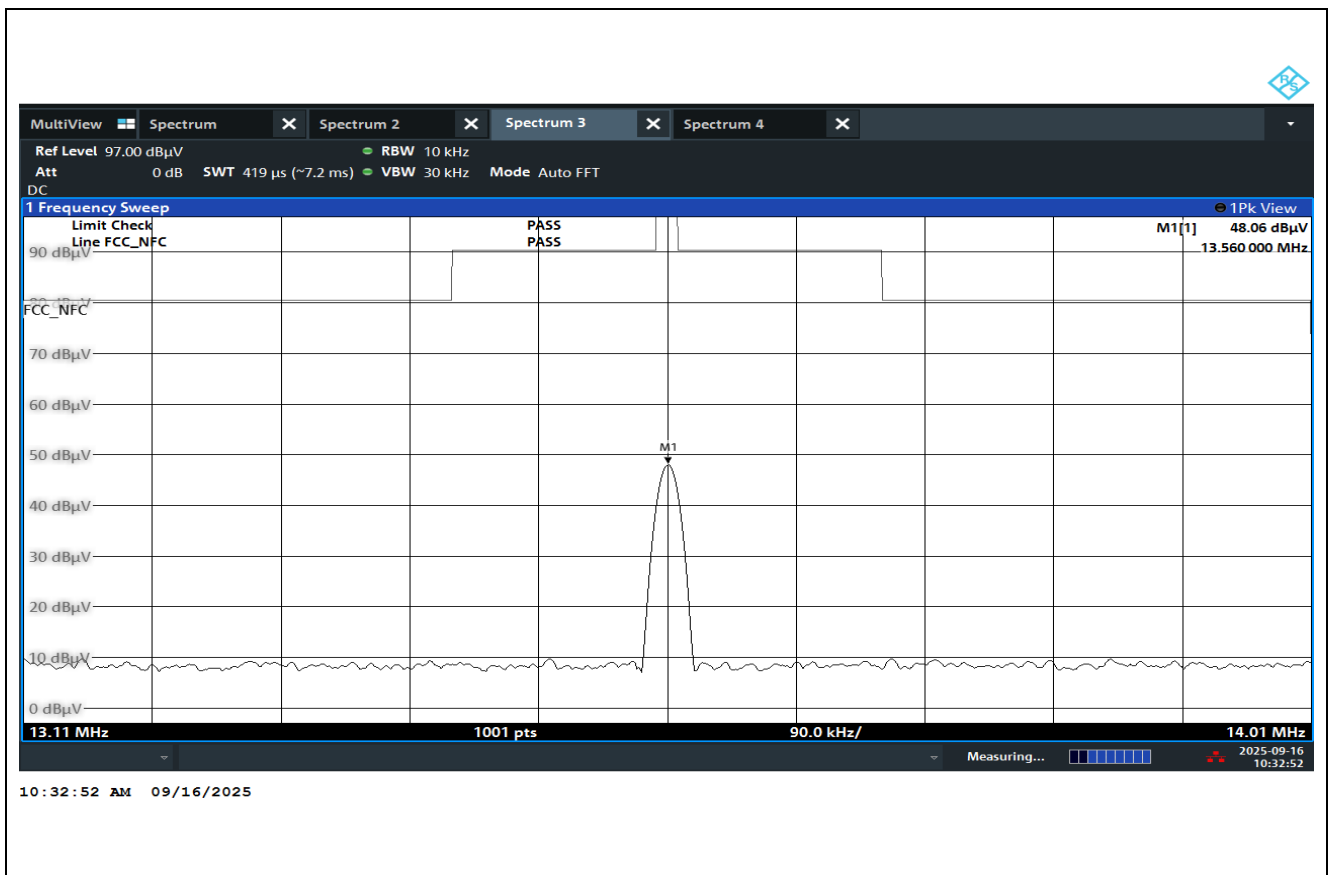
The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level	: <u>48 % R.H.</u>	Temperature: <u>25 °C</u>
Limits apply to	: <u>FCC CFR 47, PART 15, SUBPART C, SECTION 15.225</u>	
Type of Test	: <u>Low Power Communication Device Transmitter</u>	
Result	: <u>PASSED</u>	

EUT : Access controller

Date: September 12, 2025 ~ September 29, 2025

Operating Condition : Transmitting Mode



cc. to above test data, the field strength level of 13.56 MHz is 48.06 dBuV/m and the worst limit subject to 15.225 (b) and (c) is 80.5 dBuV/m, so the EUT meets the requirement.

5.3 SPURIOUS EMISSION TEST

5.3.1 Spurious Radiated Emission Below 30 MHz

Humidity Level : 48 % R.H. Temperature: 25 °C
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 : Access controller Date: September 12, 2025 ~ September 29, 2025
Operating Condition : Transmitting Mode
Distance : 3 m

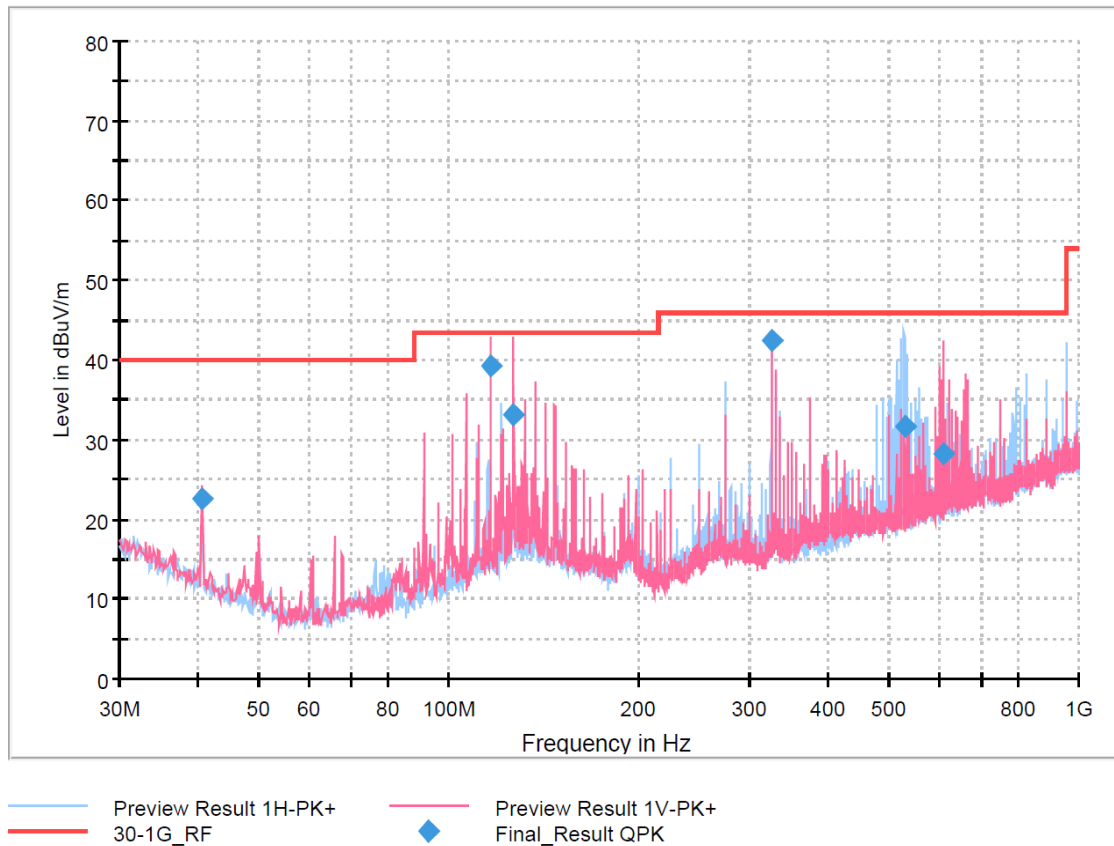
Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

5.3.2 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	: <u>48 % R.H.</u>	Temperature: <u>25 °C</u>
Limits apply to	: <u>FCC CFR 47, PART 15, SUBPART C, SECTION 15.209</u>	
Type of Test	: <u>Low Power Communication Device Transmitter</u>	
Frequency range	: <u>30 MHz ~ 960 MHz</u>	
Result	: <u>PASSED</u>	

EUT	: Access controller	Date: September 12, 2025 ~ September 29, 2025
Operating Condition	: Transmitting Mode	
Distance	: 3 m	



Final Result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
40.690	22.50	40.00	17.50	3000	120	125.0	V	199
116.794	39.20	43.50	4.30	3000	120	100.0	V	51
126.979	33.08	43.50	10.42	3000	120	127.0	V	35
325.021	42.35	46.00	3.65	3000	120	106.0	H	47
528.074	31.61	46.00	14.39	3000	120	164.0	H	-6
609.311	28.23	46.00	17.77	3000	120	100.0	V	100

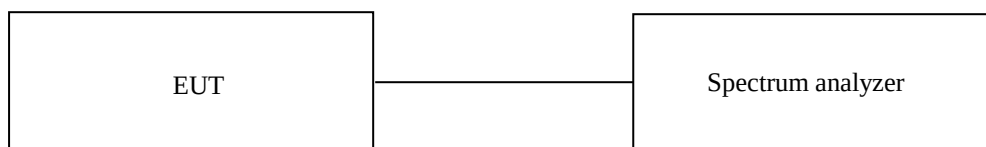
5.4 20 dB BANDWIDTH

5.4.1 Operating environment

Temperature : 25 °C
Relative humidity : 48 % R.H.

5.4.2 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.



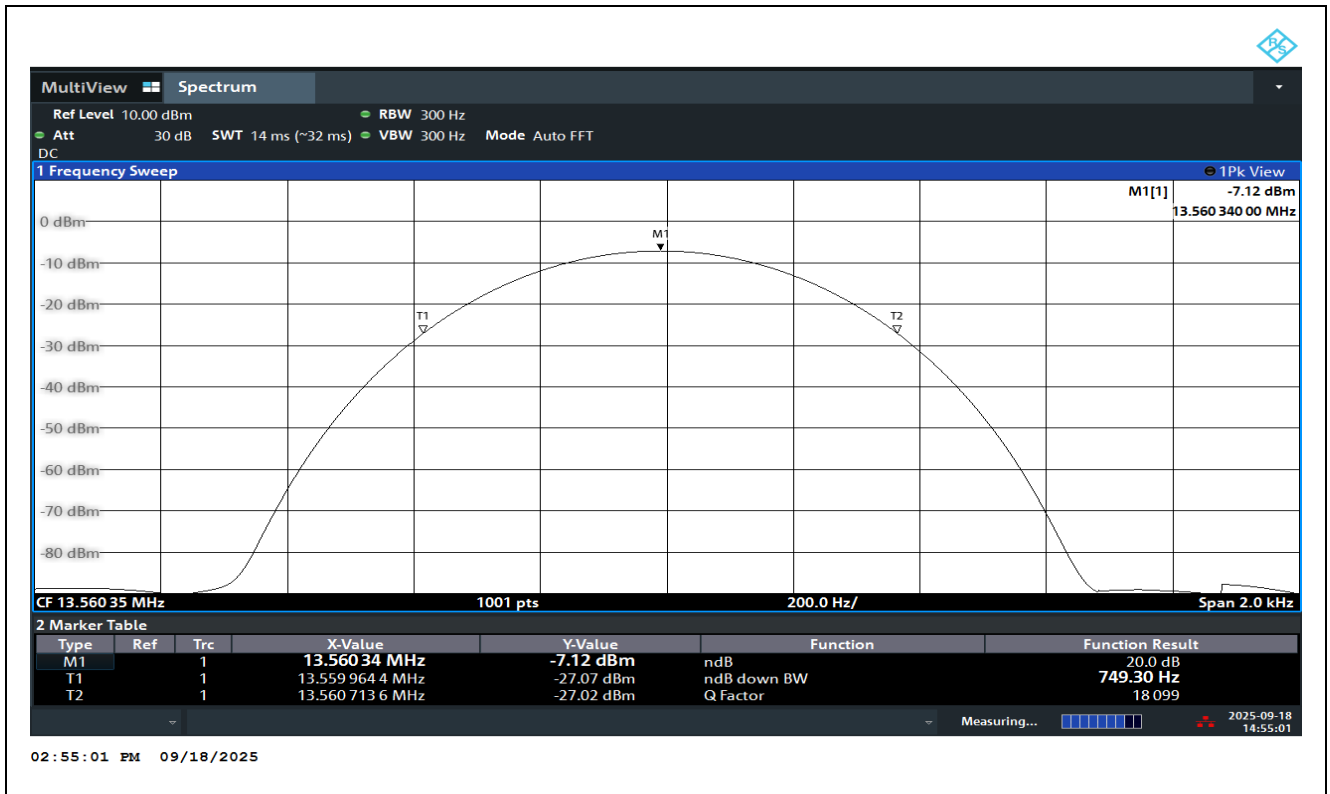
5.4.3 Test date

September 12, 2025 ~ September 29, 2025

5.4.4 Test data

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

FREQUENCY (MHz)	MEASURED VALUE (kHz)	Result
13.56	0.749 3	PASS



5.5 FREQUENCY STABILITY WITH TEMPERATURE VARIATION

5.5.1 Operating environment

Temperature : 25 °C
Relative humidity : 48 % R.H.

5.5.2 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.

5.5.3 Test date

September 12, 2025 ~ September 29, 2025

5.5.4 Test data

-. Result : PASSED

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
-20	13,560,000	13,560,295	295	± 1 356.00
-10		13,560,352	352	
0		13,560,364	364	
10		13,560,364	364	
20		13,560,338	338	
30		13,560,313	313	
40		13,560,305	305	
50		13,560,295	295	

5.6 FREQUENCY STABILITY WITH VOLTAGE VARIATION

5.6.1 Operating environment

Temperature : 25 °C
Relative humidity : 48 % R.H.

5.6.2 Test set-up

An external DC 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.

5.6.3 Test date

September 12, 2025 ~ September 29, 2025

5.6.4 Test data

-. Result : PASSED

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
13.80(115 %)	13,560,000	13,560,330	330	± 1 356.00
12.00(100 %)		13,560,331	331	
10.20(85 %)		13,560,331	331	

6. FIELD STRENGTH CALCULATION

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

+	Meter reading	(dB μ V)
-	Amplifier Gain	(dB)
+	Cable Loss	(dB)
-	Antenna Factor	(dB/m)
=	Corrected Result	(dB μ V/m)

Margin (dB)

	Specification Limit	(dB μ V/m)
-	Corrected Result	(dB μ V/m)
=	dB Relative to Spec	($\pm$ dB)

7. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jan. 13, 2025 (1Y)
FSV3044	Rohde & Schwarz	Signal & Spectrum Ananlyzer	101757	Jul. 02, 2025 (1Y)
ESR	Rohde & Schwarz	EMI Test Receiver	101470	Mar. 11, 2025 (1Y)
H-3005D	FinePower	DC Power Supply	FP09092008	Jan. 13, 2025 (1Y)
GP-4303D	LG Precision Co.,Ltd	DC Power Supply	5071069	Jan. 04, 2025 (1Y)
310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 11, 2025 (1Y)
ELNA18	EXYNOD	RF Pre Amplifier	27594	Jan. 13, 2025 (1Y)
ELNA40	EXYNOD	RF Pre Amplifier	25339-27648	Jan. 15, 2025 (1Y)
HPF 3GHz	Rohde & Schwarz	High Pass Filter (1-3 GHz)	N/A	Jan. 13, 2025 (1Y)
FMZB 1519-60D	Schwarzbeck	Active Magnetic Loop Antenna	00113	Jan. 17, 2025 (2Y)
HLP-2008	TDK	Hybrid Antenna	131313	Mar. 21, 2025 (2Y)
BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jun. 19, 2025 (1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 14, 2025 (1Y)
ESCI	Rohde & Schwarz	Test Receiver	101012	Sep. 24, 2025 (1Y)
NSLK8128	Schwarzbeck	V - LISN (4*32/50A)	8128216	Mar. 11, 2025 (1Y)
ESH3-Z2	Rohde & Schwarz	Pulse Limiter	100655	Mar. 11, 2025 (1Y)
DT3000	Innco System	Turn Table	DT3000/093	N/A
MA4000-EP	Innco System	Antenna Master	MA4000/332	N/A
CO3000	Innco System	Controller	CO3000/904	N/A