

RADIO PERFORMANCE TEST REPORT

Test Report No. : OT-234-RWD-023

Reception No. : 2304001098

Applicant : TTCNC Co., Ltd

Address : AF0572 HangangDIMC TeraTower 202 Dasajigeumro, Namyangji-ci, Gyeonggi-do,
Korea

Manufacturer : TTCNC Co., Ltd

Address : AF0572 HangangDIMC TeraTower 202 Dasajigeumro, Namyangji-ci, Gyeonggi-do,
Korea

Type of Equipment : RF READER MODULE

FCC ID : 2BAYV-NC-900

Model Name : NC-900

Multiple Model Name : N/A

Serial number : N/A

Total page of Report : 22 pages (including this page)

Date of Incoming : April 13, 2023

Date of Issuing : April 19, 2023

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.



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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-234-RWD-023	April 19, 2023	Initial Release	All

1. VERIFICATION OF COMPLIANCE

-. APPLICANT : TTCNC Co., Ltd
-. ADDRESS : AF0572 HangangDIMC TeraTower 202 Dasajigeumro, Namyangji-ci, Gyeonggi-do, Korea
-. CONTACT PERSON : KHOON CHO / Director
-. TELEPHONE NO : +82-31-562-9956
-. FCC ID : 2BAYV-NC-900
-. MODEL NO. : NC-900
-. SERIAL NUMBER : N/A
-. DATE : April 19, 2023

DEVICE TYPE	DXX – Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	RF READER 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	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 Product Description

The TTCNC Co., Ltd, Model NC-900 (referred to as the EUT in this report) is an RF READER MODULE, Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	RF READER MODULE
TRANSMITTING FREQUENCY	13.56 MHz
MODULATION	ASK
ANTENNA TYPE	PCB Antenna
LIST OF EACH OSC. or CRY. FREQ.(FREQ. >= 1 MHz)	27.125 MHz

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

-. None

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 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.

2.5 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.

2.6 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
TIT-RETRANSFER-MAIN	N/A	N/A	N/A
TIT-RETRANSFER-RF-TAG	N/A	N/A	N/A
TIT-NEW-MECH-PCB	N/A	N/A	N/A
TIT-NUVIA_CIS	N/A	N/A	N/A
TIT-NUVIA_MS	N/A	N/A	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
NC-900	TTCNC Co., Ltd	RF READER MODULE (EUT)	-
GP-4303D	LG Precision	DC Power Supply	EUT
N/A	N/A	RFID Card	EUT

3.3 Mode of operation during the test

-. The EUT has 13.56 MHz RF boards for reader and tagging. For the testing, program was used for making continuous transmission mode during the test.

The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis, but the worst data was recorded in this report. For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

3.4 Configuration of Test System

Line Conducted Test : As the EUT is operated by DC Power, this test item is not requirement to be performed.

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.

3.5 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 the EUT is operated by DC Power, this test item is not requirement to be 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

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 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 : 48 % R.H. Temperature: 23 °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 : RF READER MODULE Date: April 13, 2023 ~ April 18, 2023
 Operating Condition : Transmitting Mode
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)
 Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol.	Ant. Height (m)	Ant. Factor (dB/m)	Cable Loss (dB)	Total (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.56	42.07	-	1	19.5	0.9	62.47	124	61.53

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

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

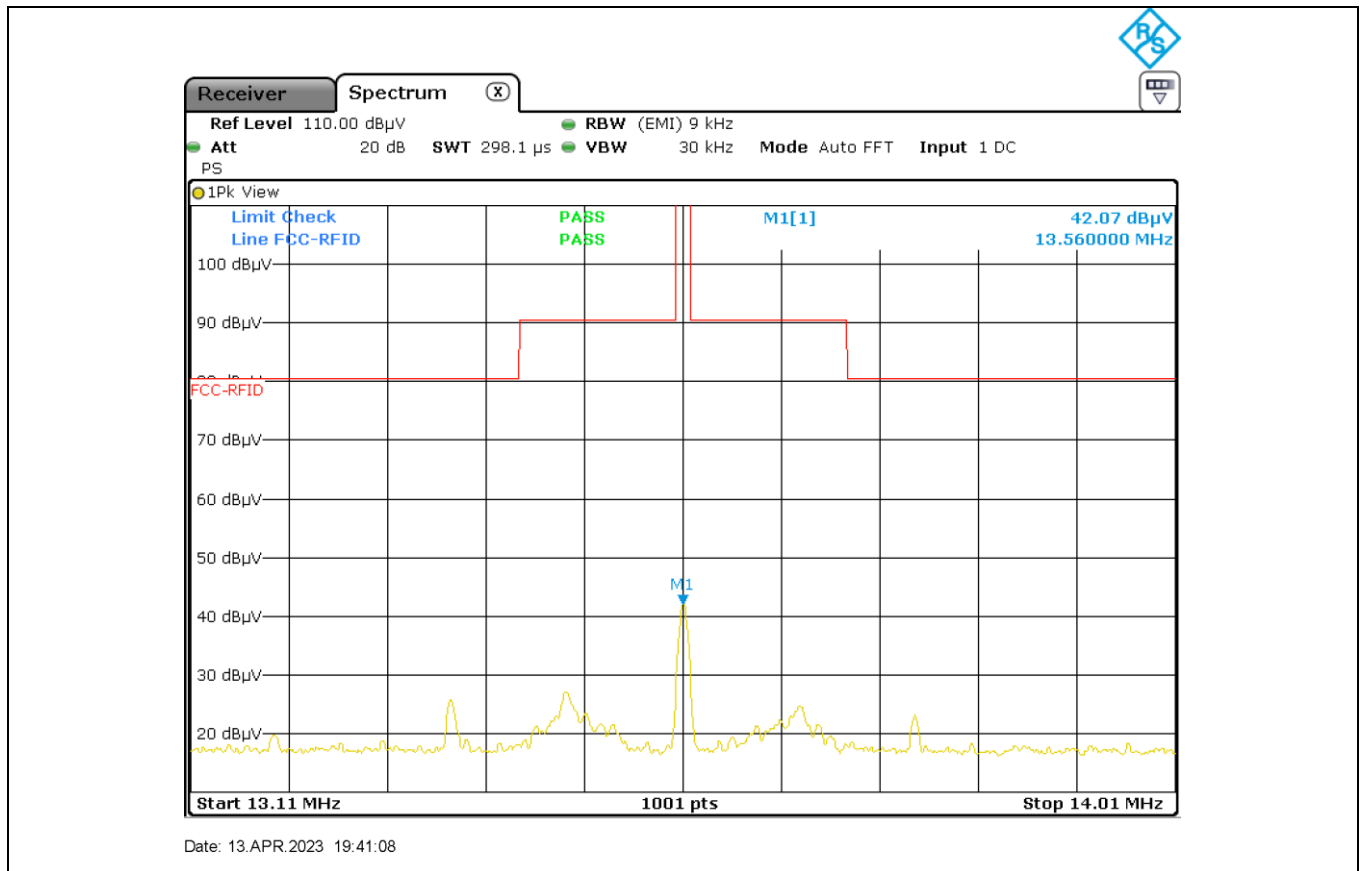
The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 48 % R.H. Temperature: 23 °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 : RF READER MODULE

Date: April 13, 2023 ~ April 18, 2023

Operating Condition : Transmitting Mode



cc. to above test data, the field strength level of 13.561 5 MHz is 42.07 dBuV/m and the worst limit subject to 15.225 (b) and (c) is 60.15 dBuV/m, so the EUT meets the requirement.

5.2 SPURIOUS EMISSION TEST

5.2.1 Spurious Radiated Emission Below 30 MHz

Humidity Level : 48 % R.H. Temperature: 23 °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

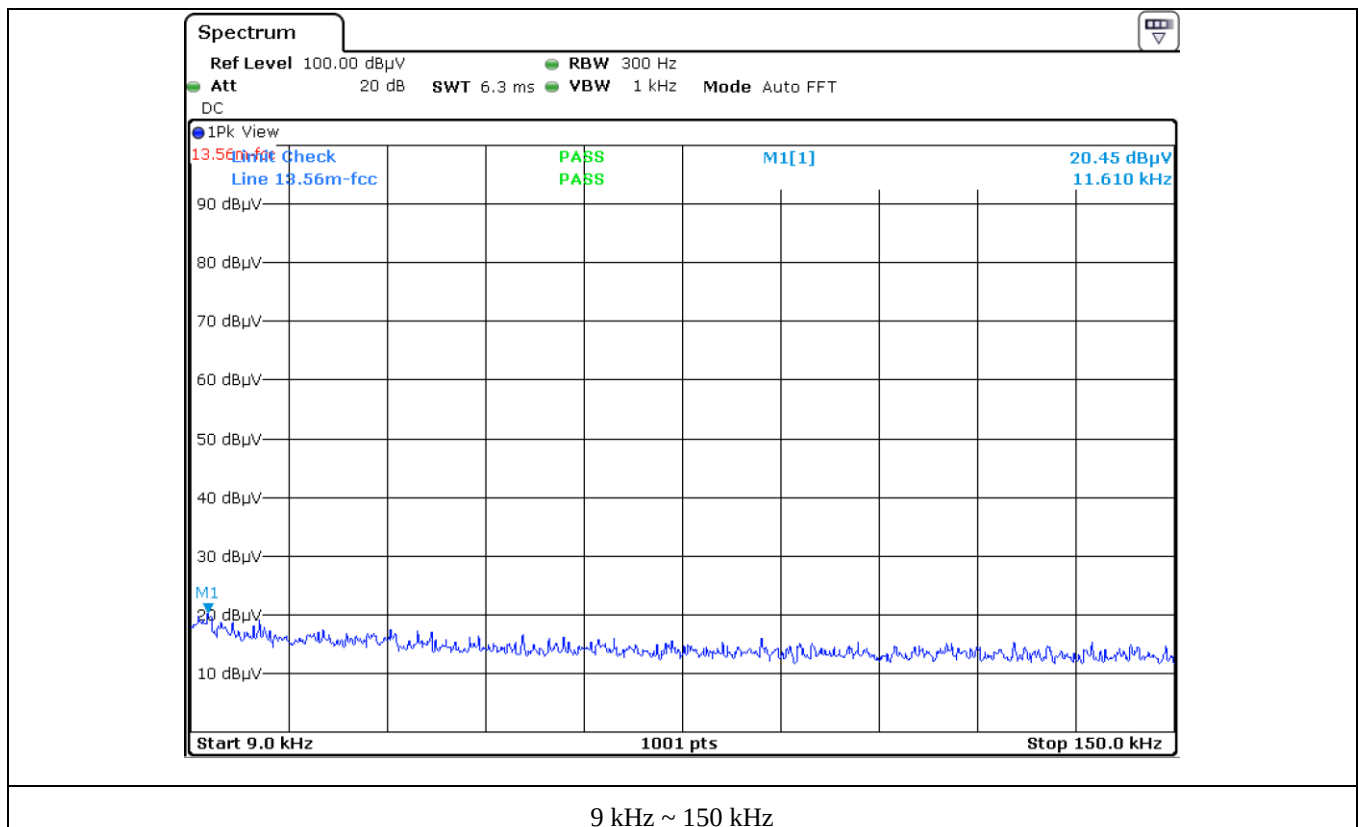
EUT : RF READER MODULE

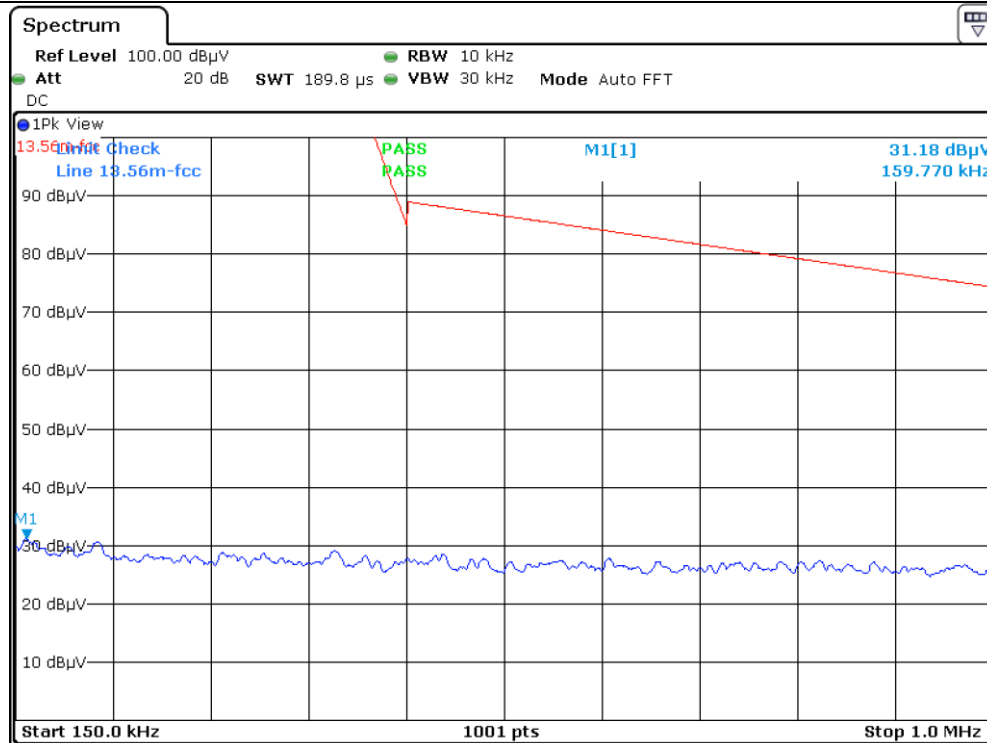
Date: April 13, 2023 ~ April 18, 2023

Operating Condition : Transmitting Mode

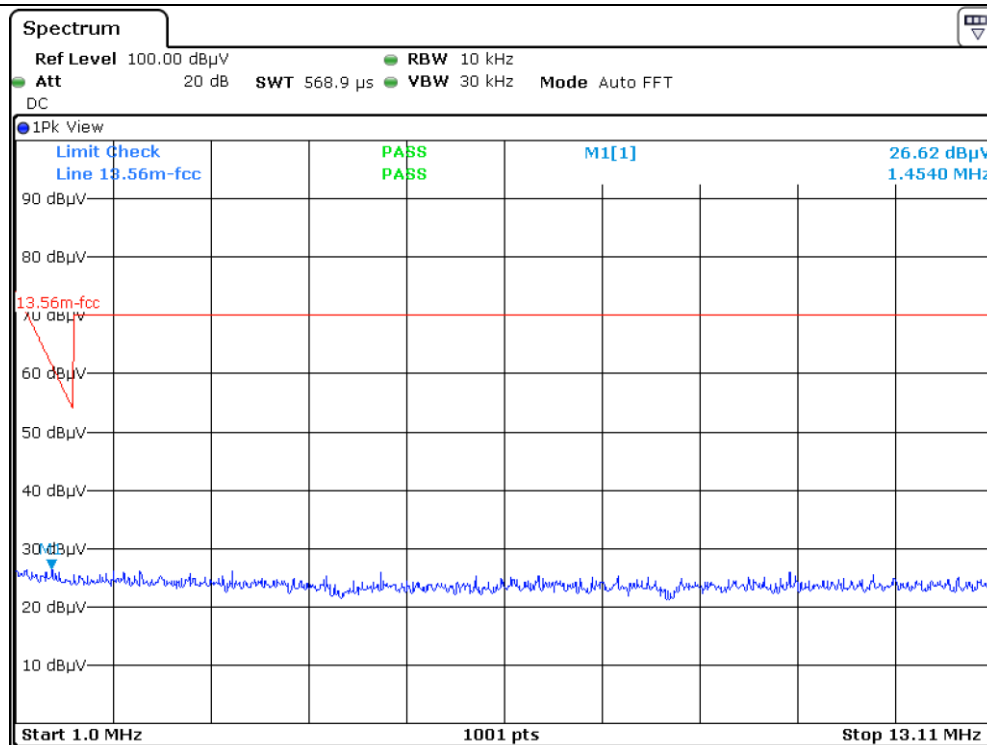
Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol.	Ant. Factor (dB/m)	Cable Loss (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
It was not observed any emissions from the EUT.							

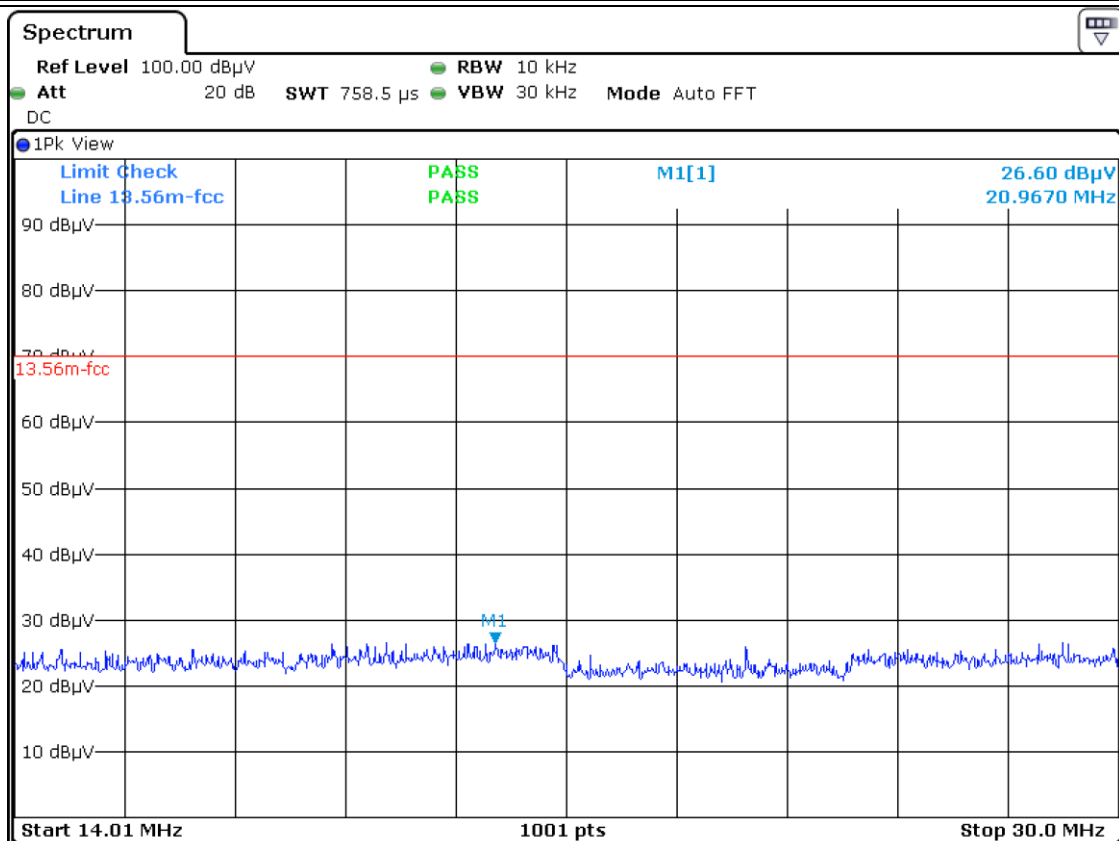




150 kHz ~ 1 MHz



1 MHz ~ 13.11 MHz



14.01 MHz ~ 30.00 MHz

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.

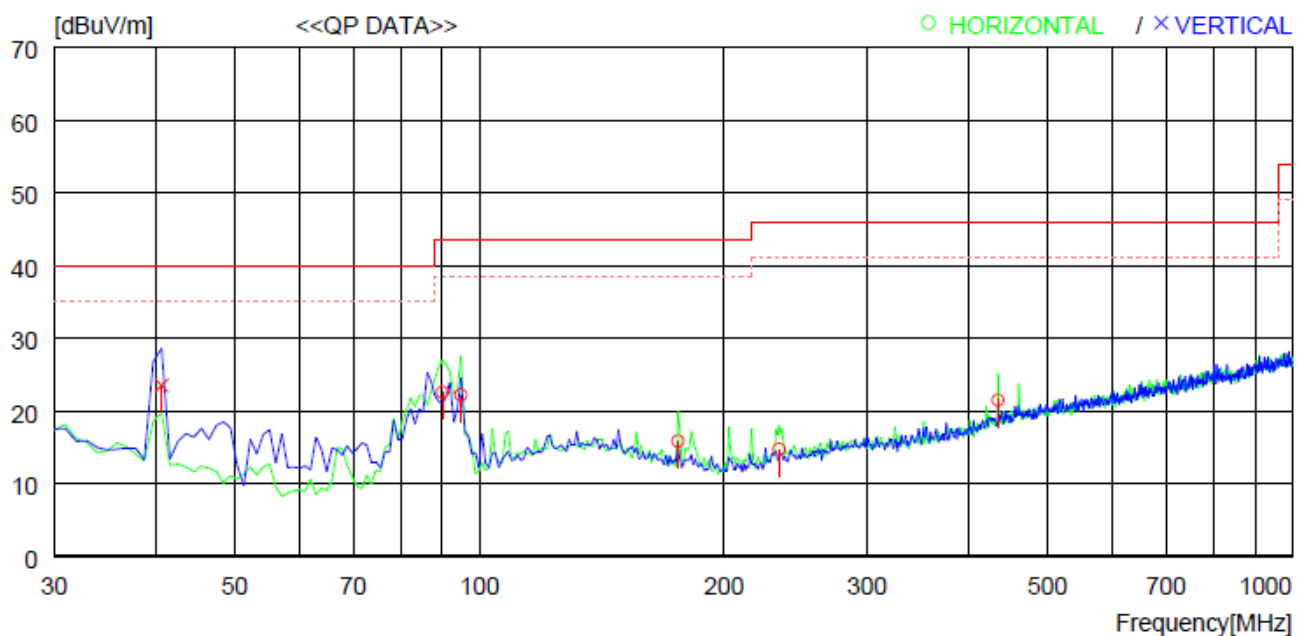
Humidity Level : 48 % R.H. Temperature: 23 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Communication Device Transmitter
 Frequency range : 30 MHz ~ 960 MHz
 Result : PASSED

EUT : RF READER MODULE

Date: April 13, 2023 ~ April 18, 2023

Operating Condition : Transmitting Mode

Distance : 3 m



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
---- Horizontal ----										
1	90.140	40.0	13.8	1.9	33.1	22.6	43.5	20.9	400	0
2	94.990	38.9	14.5	1.9	33.1	22.2	43.5	21.3	200	0
3	175.500	29.5	16.8	2.5	33.0	15.8	43.5	27.7	200	86
4	233.700	27.9	16.8	3.0	33.0	14.7	46.0	31.3	200	38
5	434.491	28.4	22.1	4.1	33.1	21.5	46.0	24.5	200	118
---- Vertical ----										
6	40.670	38.7	16.7	1.2	33.1	23.5	40.0	16.5	100	106

6. 20 dB BANDWIDTH

6.1 Operating environment

Temperature : 23 °C
Relative humidity : 48 % R.H.

6.2 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.



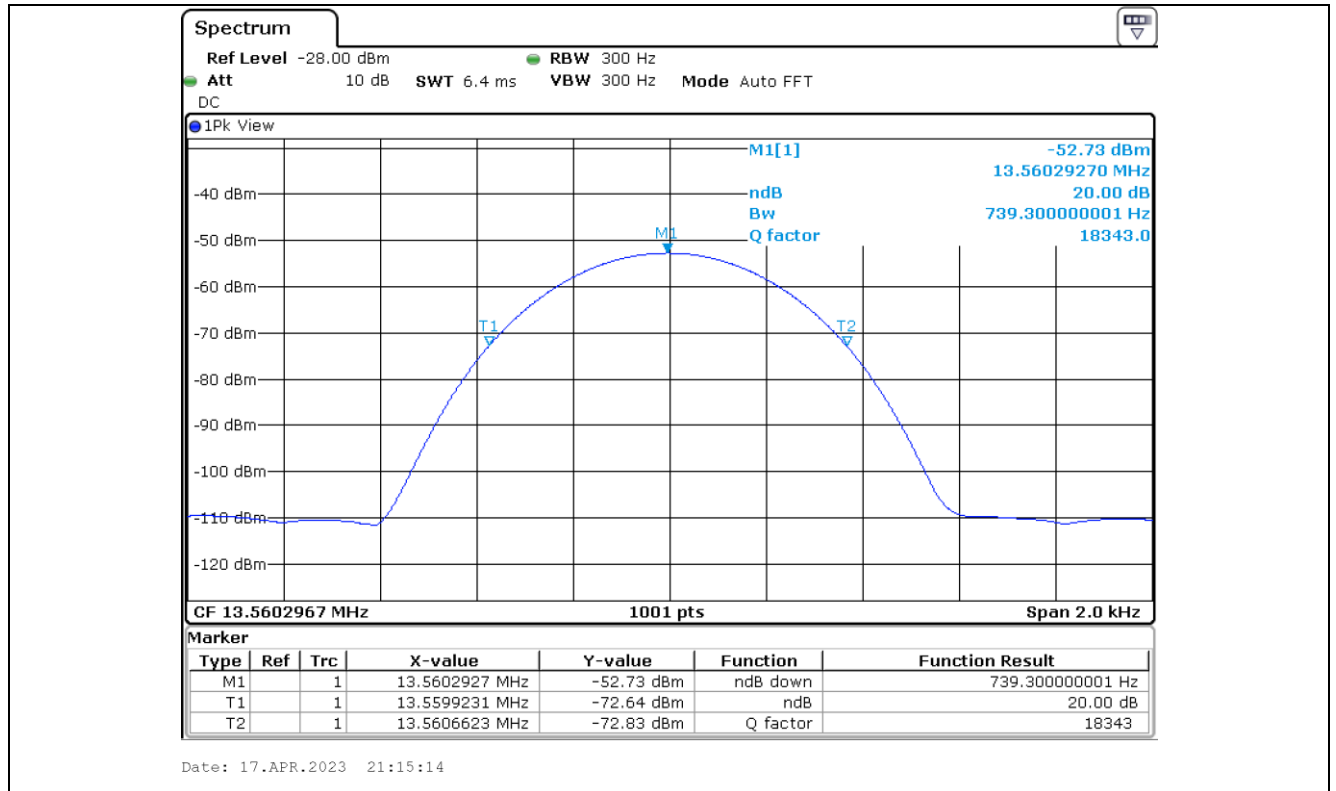
6.3 Test date

April 13, 2023 ~ April 18, 2023

6.4 Test data

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

Operating Freq. (MHz)	Minimum Freq. (MHz)	Maximum Freq. (MHz)	20 dB Bandwidth (kHz)
13.560 2	13.559 923 1	13.560 662 3	0.739 3



7 FREQUENCY STABILITY WITH TEMPERATURE VARIATION

7.1 Operating environment

Temperature : 23 °C
Relative humidity : 48 % R.H.

7.2 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.

7.3 Test date

April 13, 2023 ~ April 18, 2023

7.4 Test data

-. Result : PASSED

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
-20	13 560 296	13 560 330	-34	± 1 356.02
-10		13 560 356	60	
0		13 560 358	62	
10		13 560 346	50	
20		13 560 317	21	
30		13 560 300	4	
40		13 560 275	-21	
50		13 560 262	-34	

8 FREQUENCY STABILITY WITH VOLTAGE VARIATION

8.1 Operating environment

Temperature : 23 °C
Relative humidity : 48 % R.H.

8.2 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.

8.3 Test date

April 13, 2023 ~ April 18, 2023

8.4 Test data

-. Result : PASSED

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
17.25(115 %)	13 560 296	13 560 296	0	± 1 356.02
15.0(100 %)		13 560 295	1	
12.75(85 %)		13 560 294	2	

9. 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	(dBuV/m)
-	Corrected Result	(dBuV/m)
=	dB Relative to Spec	($\pm$ dB)

10. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 18, 2022 (1Y)
FSV30	Rohde & Schwarz	SIGNAL ANALYZER	101372	Jul. 14, 2022 (1Y)
310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 14, 2023 (1Y)
HLP-2008	TDK RF Solutions	Hybrid Antenna	131314	Mar. 07, 2023 (2Y)
DT5000-3t- Tragplatten	Innco System	Turn Table	930611	N/A
MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4640/592/ 40700517/-	N/A
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Mar. 24, 2022 (2Y)
PSL-2KP	ESPEC	Environmental Test Chamber	14009407	Jan. 18, 2023 (1Y)
CO3000	Innco Systems GmbH	Controller	1026/40960617/P	N/A
DT2000-2t	Innco Systems GmbH	Turn Table	N/A	N/A
GP-4303D	LG Precision Co.,Ltd	DC Power Supply	5071069	Jan. 04, 2023 (1Y)