Shenzhen CTL Testing Technology Co., Ltd.
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TEST REPORT

47 CFR FCC Part 15 Subpart C 15.231

Report Reference No.....:	**CTL2311282032-WF**	
Compiled by: (position+printed name+signature)	Happy Guo (File administrators)	Happy Guo
Tested by: (position+printed name+signature)	Wuqiang Wu (Test Engineer)	Wuqiang Wu
Approved by: (position+printed name+signature)	Ivan Xie (Manager)	Ivan Xie

Product Name..... :	433MHz Transceiver (USB or RS232-C)
Model/Type reference.....:	AZ433-USB
List Model(s).....:	AZ433-R232C
Trade Mark..... :	LEADER
FCC ID..... :	**2BEEK-AZ433USB**
Applicant's name..... :	**Antigo Neon LLC**
Address of applicant.....:	1412 Delglise St., Antigo, WI 54409, USA
Test Firm.....:	**Shenzhen CTL Testing Technology Co., Ltd.**
Address of Test Firm.....:	Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055
Test specification.....:	
Standard..... :	**47 CFR FCC Part 15 Subpart C 15.231**
TRF Originator..... :	Shenzhen CTL Testing Technology Co., Ltd.
Master TRF..... :	Dated 2011-01
Date of receipt of test item..... :	Nov. 30, 2023
Date of Test Date..... :	Dec. 06, 2023-May 16, 2024
Date of Issue.....:	May 16, 2024
Result..... :	**Pass**

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TEST REPORT

Test Report No. :	CTL2311282032-WF	May 16, 2024 Date of issue

Equipment under Test	:	433MHz Transceiver (USB or RS232-C)
Sample No.	:	CTL2311282032
Model /Type	:	AZ433-USB
Listed Models	:	AZ433-R232C
Applicant	:	**Antigo Neon LLC**
Address	:	1412 Delglise St., Antigo, WI 54409, USA
Manufacturer	:	**Dongguan Leader Electronics Co., Ltd**
Address	:	Room 302, No. 235 Huanchang South Road, Changping Town, Dongguan City

Test result	Pass *

∗ In the configuration tested, the EUT complied with the standards specified page 5.

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.

** Modified History **

Version	Description	Issued Data	Report No.	Remark
Version 1.0	Initial Test Report Release	May 16, 2024	CTL2311282032-WF	Tracy Qi

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1. SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.231: Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

ANSI C63.10:2013 : American National Standard for Testing Unlicensed Wireless Devices

1.2. Test Description

FCC and IC Requirements		
FCC Part 15.207	Conducted Emission	PASS
FCC Part 15.231(a)(1)	Automatically Deactivate	PASS
FCC Part 15.231(b)	Electric Field Strength of Fundamental Emission	PASS
FCC Part 15.205 &15.209& 15.231(b)	Electric Field Strength of Spurious Emission	PASS
FCC Part 15.231(c)	-20dB bandwidth	PASS
FCC Part 15.203	Antenna requirement.	PASS

Remark: The measurement uncertainty is not included in the test result.

1.3. Test Facility

1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L7497

Shenzhen CTL Testing Technology Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No. 4343.01

Shenzhen CTL Testing Technology Co., Ltd, EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

IC Registration No.: 9618B

CAB identifier: CN0041

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with Registration No.: 9618B.

FCC-Registration No.: 399832

Designation No.: CN1216

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 399832.

1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power Radiated	±2.20 dB	(1)
Radiated Emission9KHz~30MHz	±3.66dB	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
DTS Bandwidth	±1.9%	(1)

Maximum Conducted Output Power	± 1.18 dB	(1)
Maximum Power Spectral Density Level	±0.98 dB	(1)
Band-edge	±1.21dB	(1)
Unwanted Emissions In Non-restricted Freq Bands	9kHz-7GHz:±1.09dB 7GHz-26.5GHz: ±3.27dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95%
(2) confidence level using a coverage factor of k=1.96.

1.5. Auxiliary test equipment information

Manufacturer	Description	Model	Serial Number
HUAWEI TECHNOLOGIES CO.LTD	Laptops	KPL-W00	---
HUAWEI TECHNOLOGIES CO.LTD	Adapter	HW-200200CP1	---

2. GENERAL INFORMATION

2.1. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

2.2. General Description of EUT

Product Name:	433MHz Transceiver (USB or RS232-C)
Model/Type reference:	AZ433-USB
Power supply:	DC 5V
Modulation:	GFSK
Operation frequency:	424.125MHz~431.125MHz
Channel number:	8
Antenna type:	External Antenna
Antenna gain:	1.83dBi

Note: For more details, please refer to the user's manual of the EUT.

2.3. Description of Test Modes and Test Frequency

Operation Frequency：

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	**424.125**	5	428.125
2	425.125	6	429.125
3	426.125	7	430.125
4	427.125	**8**	**431.125**

Note1: In section 15.31(m), regards to the operating frequency range less than 10MHz, one near top and one near bottom point in the frequency range of operation should selected to measure.
Note2: The line display in grey was the channel selected for test.

Power Level：

Power Level	Power(dBm)
1	22
2	17
3	13
4	10

Note: All power levels have been tested and only the worst power level 1 data is represented.

2.4. Equipments Used during the Test

Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
EMI Test Receiver		ROHDE & SCHWARZ	ESCI	1166.5950.03	2023/05/04	2024/05/03
LISN		ROHDE & SCHWARZ	ESH2-Z5	860014/010	2023/05/04	2024/05/03
Limitator		ROHDE & SCHWARZ	ESH3-Z2	100408	2023/05/04	2024/05/03
Software:						
Name of Software:				Version:		
ES-K1				V1.71		

Radiated Emissions and Band Edge					
Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
Active Loop Antenna	Da Ze	ZN30900A	/	2021/05/13	2024/05/12
Double cone logarithmic antenna	Schwarzbeck	VULB 9168	824	2023/02/13	2026/02/12
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2021/12/23	2024/12/22
Horn Antenna	Ocean Microwave	OBH100400	26999002	2021/12/22	2024/12/21
Amplifier	MRT-AP01M06	MRT	S-001	2023/05/04	2024/05/03
Amplifier	Agilent	8449B	3008A02306	2023/05/04	2024/05/03
Amplifier	Brief&Smart	LNA-4018	2104197	2023/05/05	2024/05/04
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	1166.5950.03	2023/05/04	2024/05/03
Spectrum Analyzer	RS	FSP	1164.4391.38	2023/05/05	2024/05/04
Test software					
Name of Software			Version		
EZ_EMC(Below 1GHz)			V1.1.4.2		
EZ_EMC(Above 1GHz)			V1.1.4.2		

Automatically Deactivate & -20dB bandwidth					
Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
Spectrum Analyzer	Keysight	N9020A	MY53420874	2024/05/02	2025/05/01
Temperature/Humidity Meter	Ji Yu	MC501	/	2024/05/04	2025/05/03
Test Software					

Name of Software	Version
TST-PASS	V2.0

2.5. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.231 of the FCC Part 15, Subpart C Rules.

2.6. Modifications

No modifications were implemented to meet testing criteria.

3. TEST CONDITIONS AND RESULTS

3.1. Conducted Emission (AC Main)

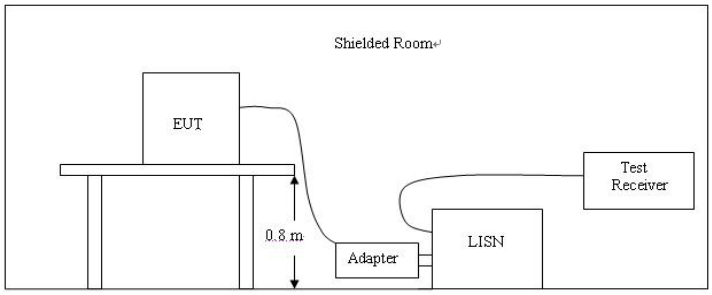
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a flood stand system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
2. Support equipment, if needed, was placed as per ANSI C63.10-2013
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
4. If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

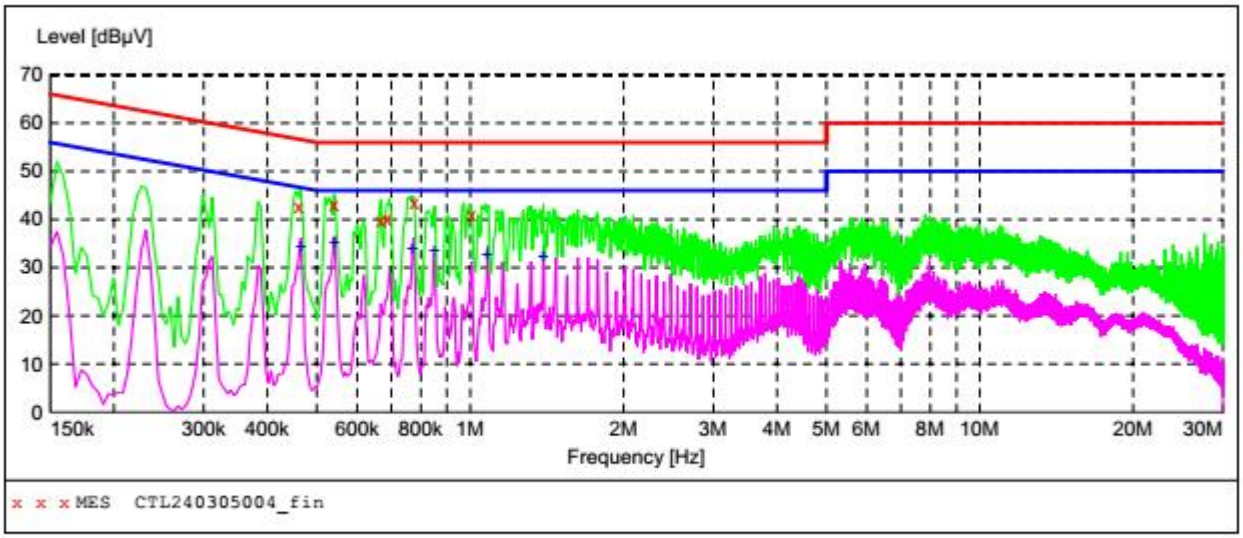
TEST RESULTS

AZ433-USB

Test Mode	TX	Line:	L

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL240305004_fin"

3/5/2024 9:02AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.460500	42.70	10.0	57	14.0	QP	L1	GND
0.541500	43.20	10.0	56	12.8	QP	L1	GND
0.667500	39.60	10.0	56	16.4	QP	L1	GND
0.685500	40.30	10.0	56	15.7	QP	L1	GND
0.775500	43.40	10.0	56	12.6	QP	L1	GND
1.005000	41.20	10.1	56	14.8	QP	L1	GND

MEASUREMENT RESULT: "CTL240305004_fin2"

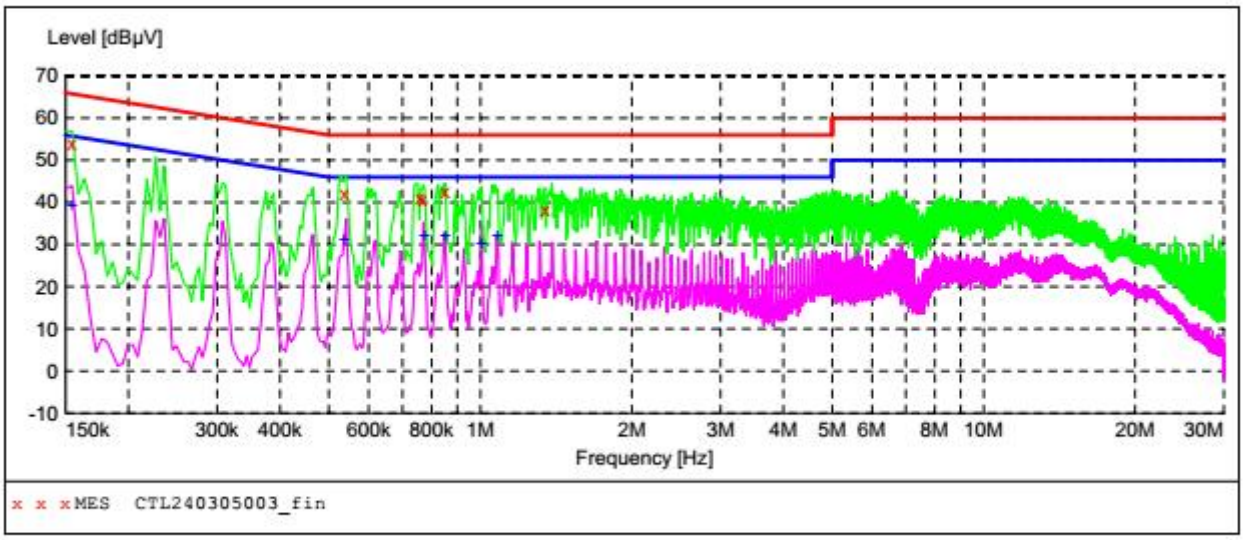
3/5/2024 9:02AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.465000	34.50	10.0	47	12.1	AV	L1	GND
0.541500	35.30	10.0	46	10.7	AV	L1	GND
0.771000	33.90	10.0	46	12.1	AV	L1	GND
0.852000	33.60	10.1	46	12.4	AV	L1	GND
1.081500	32.70	10.1	46	13.3	AV	L1	GND
1.392000	32.30	10.1	46	13.7	AV	L1	GND

Test Mode	TX	Line:	N

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL240305003_fin"

3/5/2024 8:58AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154500	54.10	10.0	66	11.7	QP	N	GND
0.537000	42.10	10.0	56	13.9	QP	N	GND
0.757500	41.10	10.0	56	14.9	QP	N	GND
0.766500	40.90	10.0	56	15.1	QP	N	GND
0.852000	42.80	10.1	56	13.2	QP	N	GND
1.347000	38.10	10.1	56	17.9	QP	N	GND

MEASUREMENT RESULT: "CTL240305003_fin2"

3/5/2024 8:58AM

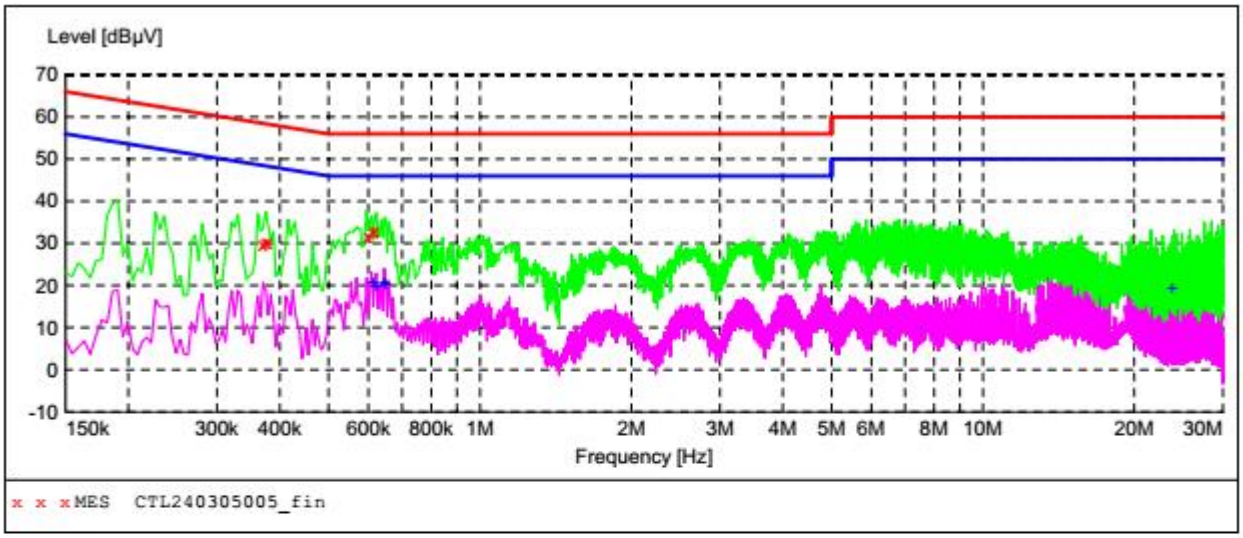
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154500	39.40	10.0	56	16.4	AV	N	GND
0.537000	31.30	10.0	46	14.7	AV	N	GND
0.775500	31.90	10.0	46	14.1	AV	N	GND
0.852000	32.30	10.1	46	13.7	AV	N	GND
1.005000	30.40	10.1	46	15.6	AV	N	GND
1.081500	32.30	10.1	46	13.7	AV	N	GND

AZ433-R232C

Test Mode	TX	Line:	L

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL240305005_fin"

3/5/2024 9:07AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.370500	29.90	10.0	59	28.6	QP	L1	GND
0.375000	30.10	10.0	58	28.3	QP	L1	GND
0.379500	30.00	10.0	58	28.3	QP	L1	GND
0.600000	31.60	10.0	56	24.4	QP	L1	GND
0.613500	32.70	10.0	56	23.3	QP	L1	GND
0.618000	33.10	10.0	56	22.9	QP	L1	GND

MEASUREMENT RESULT: "CTL240305005_fin2"

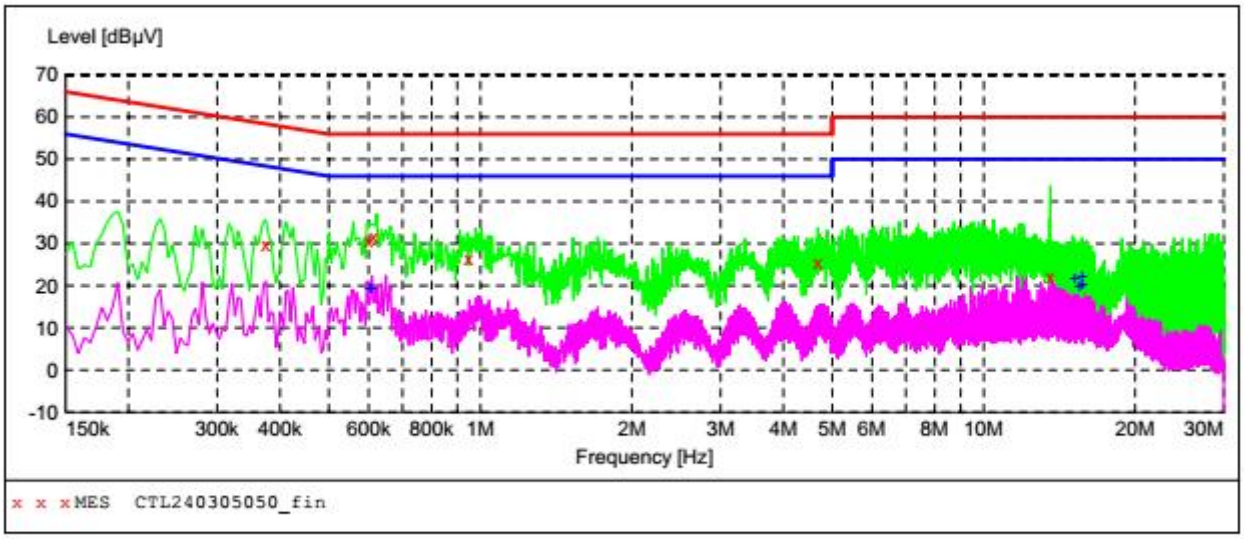
3/5/2024 9:07AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.613500	20.50	10.0	46	25.5	AV	L1	GND
0.622500	20.00	10.0	46	26.0	AV	L1	GND
0.645000	20.90	10.0	46	25.1	AV	L1	GND
0.649500	20.30	10.0	46	25.7	AV	L1	GND
23.775000	19.50	10.7	50	30.5	AV	L1	GND

Test Mode	TX	Line:	N

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL240305050_fin"

3/5/2024 10:02AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.375000	29.90	10.0	58	28.5	QP	N	GND
0.600000	30.70	10.0	56	25.3	QP	N	GND
0.613500	31.50	10.0	56	24.5	QP	N	GND
0.946500	26.20	10.1	56	29.8	QP	N	GND
4.681500	25.50	10.1	56	30.5	QP	N	GND
13.551000	22.00	11.0	60	38.0	QP	N	GND

MEASUREMENT RESULT: "CTL240305050_fin2"

3/5/2024 10:02AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.604500	19.10	10.0	46	26.9	AV	N	GND
0.609000	19.20	10.0	46	26.8	AV	N	GND
15.180000	21.80	11.2	50	28.2	AV	N	GND
15.522000	19.90	11.2	50	30.1	AV	N	GND
15.684000	21.90	11.2	50	28.1	AV	N	GND
15.688500	20.20	11.2	50	29.8	AV	N	GND

3.2. Radiated Emission

Limit

For intentional device, according to 15.209(a) the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

In addition to the provisions of 15.231(b) and RSS 210-A1.1.2, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

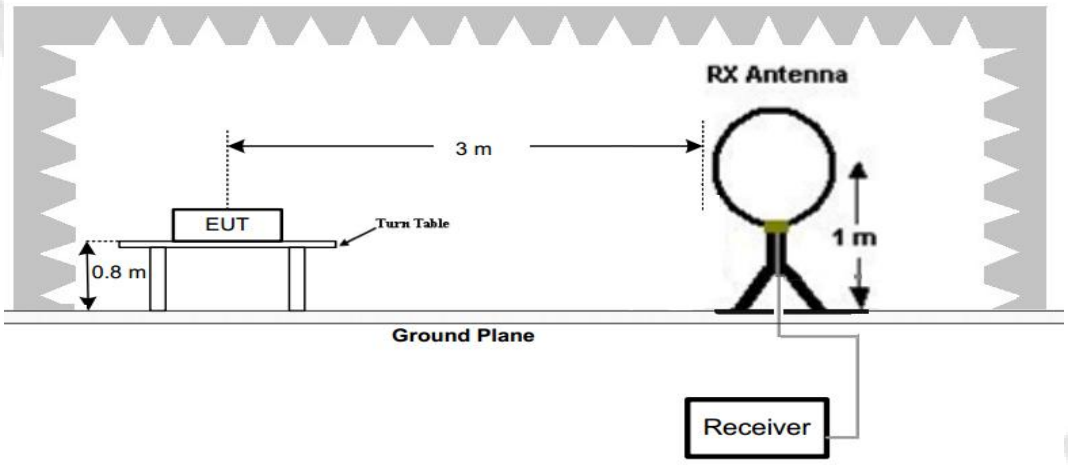
Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66–40.70.	2,250	225
70–130	1,250	125
130–174	[1] 1,250 to 3,750	[1] 125 to 375
174–260	3,750	375
260–470	[1] 3,750 to 12,500	[1] 375 to 1,250
Above 470	12,500	1,250

[1] Linear interpolations.

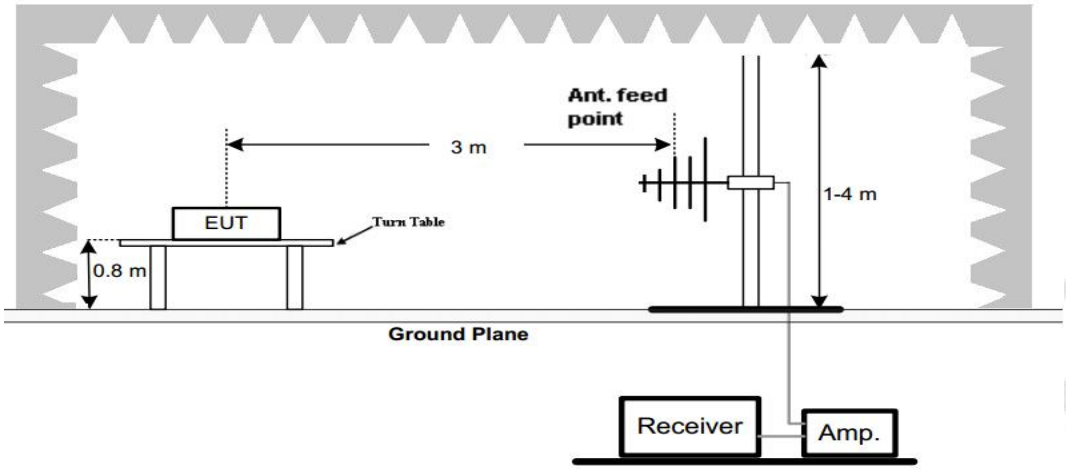
[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 260-470 MHz, μV/m at 3 meters =41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

TEST CONFIGURATION

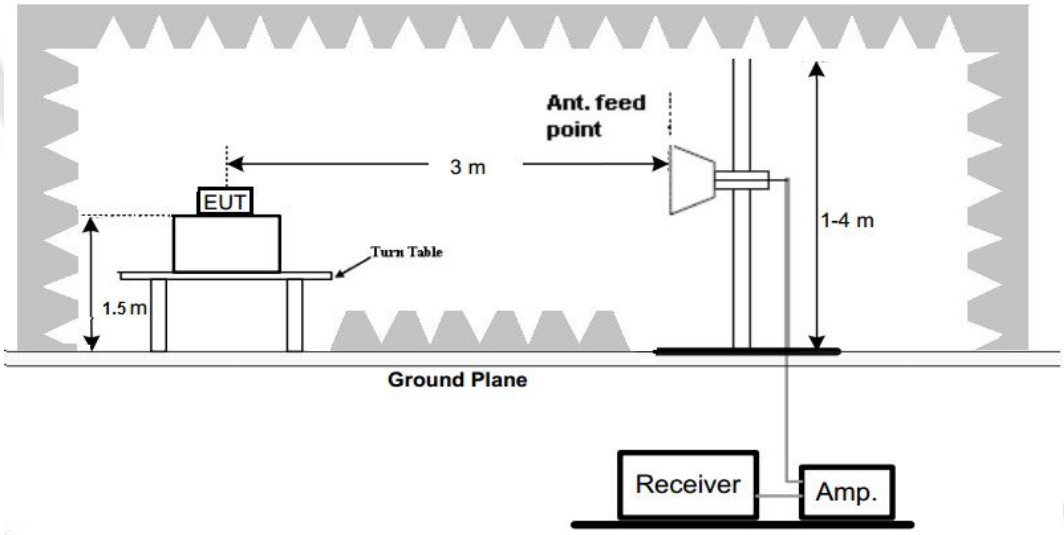
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



Test Procedure

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.

TEST RESULTS

The emissions from 30MHz to 5GHz are measured with PEAK detector; and average level calculated with Duty cycle correction according 15.35(c), detailed test data please see below. Besides, we tested 3 directions and recorded the worst data

AZ433-USB

Test frequency:424.125MHz

Emission Styles	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Direction (H/V)
Fundamental	424.125	72.23	100.50	28.27	PK	H
Spurious	760.700	31.54	46.00	14.46	PK	H
Harmonics	848.250	50.74	80.50	29.76	PK	H
Harmonics	3393.000	50.65	80.50	29.85	PK	H
--	--	--	--	--	--	--
Fundamental	424.125	62.22	100.50	38.28	PK	V
Spurious	782.350	30.86	46.00	15.14	PK	V
Harmonics	848.250	48.74	80.50	31.76	PK	V
Harmonics	3393.000	51.55	80.50	28.95	PK	V
--	--	--	--	--	--	--

Note: Margin= Limit-Emission level

Emission Styles	Frequency (MHz)	PK Emission Level (dBuV/m)	AV Factor (dB/m)	AV Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Direction (H/V)
Fundamental	424.125	72.23	-0.63	71.60	80.50	8.90	H
Harmonics	848.250	50.74	-0.63	50.11	60.50	10.39	H
Harmonics	3393.000	50.65	-0.63	50.02	60.50	10.48	H
--	--	--	--	--	--	--	--
Fundamental	424.125	62.22	-0.63	61.59	80.50	18.91	V
Harmonics	848.250	48.74	-0.63	48.11	60.50	12.39	V
Harmonics	3393.000	51.55	-0.63	50.92	60.50	9.58	V
--	--	--	--	--	--	--	--

Test frequency:431.125MHz

Emission Styles	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Direction (H/V)
Fundamental	431.125	71.57	100.73	29.16	PK	H
Spurious	844.750	32.42	46.00	13.58	PK	H
Harmonics	862.250	51.35	80.73	29.38	PK	H
Harmonics	1293.375	52.77	80.73	27.96	PK	H
--	--	--	--	--	--	--
Fundamental	431.125	60.54	100.73	40.19	PK	V

Spurious	842.260	31.78	46.00	14.22	PK	V
Harmonics	862.250	42.55	80.73	38.18	PK	V
Harmonics	3017.875	51.46	80.73	29.27	PK	V
--	--	--	--	--	--	--

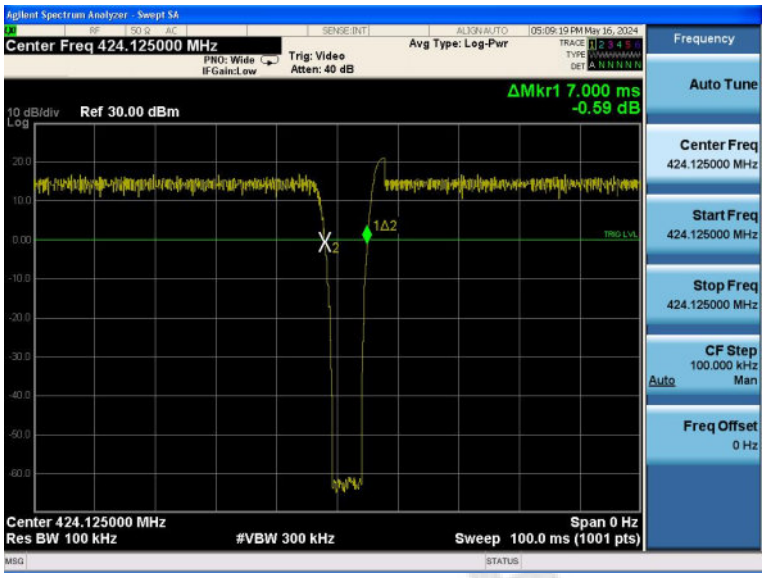
Note: Margin= Limit-Emission level

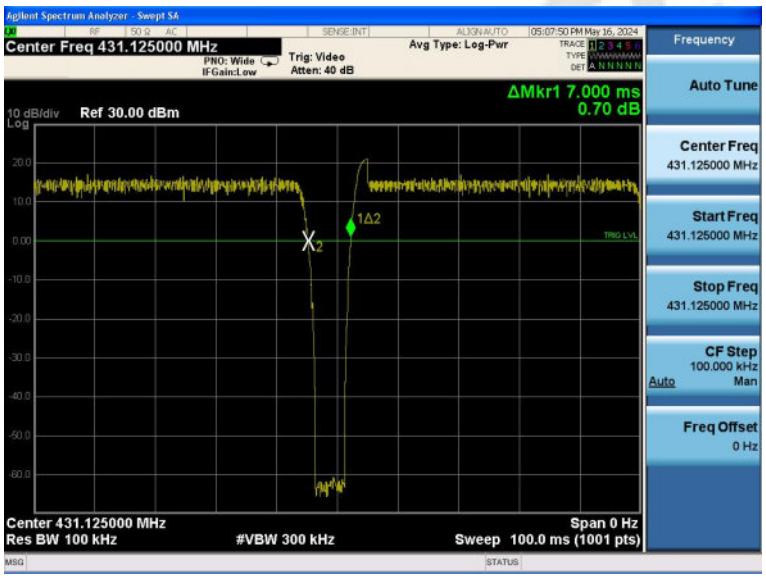
Emission Styles	Frequency (MHz)	PK Emission Level (dBuV/m)	AV Factor (dB/m)	AV Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Direction (H/V)
Fundamental	431.125	71.57	-0.63	70.94	80.73	9.79	H
Harmonics	862.250	51.35	-0.63	50.72	60.73	10.01	H
Harmonics	1293.375	52.77	-0.63	52.14	60.73	8.59	H
--	--	--	--	--	--	--	--
Fundamental	431.125	60.54	-0.63	59.91	80.73	20.82	V
Harmonics	862.250	42.55	-0.63	41.92	60.73	18.81	V
Harmonics	3017.875	51.46	-0.63	50.83	60.73	9.90	V
--	--	--	--	--	--	--	--

Note:

1. AV Level (dBuV/m)= PK Emission Level (dBuV/m)+ AV Factor(dB)
2. Duty Cycle= (100-7)/100.0=0.93 (Note: According to C63.10 if the transmit cycle period longer than 100ms, then 100ms is used calculation.)
3. AV Factor=20*log(Duty Cycle)=20*log(0.93)=-0.63

(The plot of Duty Cycle See the follow page)




Agilent Spectrum Analyzer - Swept SA
Center Freq 431.125000 MHz
PNO: Wide
IFGain:Low
Trig: Video
Atten: 40 dB
Avg Type: Log-Pwr
05:07:50 PM May 16, 2024
ΔMkr1 7.000 ms
0.70 dB
10 dB/div
Log
Ref 30.00 dBm
1Δ2
Center 431.125000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 100.0 ms (1001 pts)
Frequency
Auto Tune
Center Freq
431.125000 MHz
Start Freq
431.125000 MHz
Stop Freq
431.125000 MHz
CF Step
100.000 kHz
Auto
Man
Freq Offset
0 Hz

AZ433-RS232C

Test frequency:424.125MHz

Emission Styles	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Direction (H/V)
Fundamental	424.125	72.14	100.50	28.36	PK	H
Spurious	760.700	31.42	46.00	14.58	PK	H
Harmonics	848.250	50.55	80.50	29.95	PK	H
Harmonics	3393.000	50.49	80.50	30.01	PK	H
--	--	--	--	--	--	--
Fundamental	424.125	62.14	100.50	38.36	PK	V
Spurious	782.350	30.64	46.00	15.36	PK	V
Harmonics	848.250	48.78	80.50	31.72	PK	V
Harmonics	3393.000	51.57	80.50	28.93	PK	V
--	--	--	--	--	--	--

Note: Margin= Limit-Emission level

Emission Styles	Frequency (MHz)	PK Emission Level (dBuV/m)	AV Factor (dB/m)	AV Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Direction (H/V)
Fundamental	424.125	72.14	-0.63	71.51	80.50	8.99	H
Harmonics	848.250	50.55	-0.63	49.92	60.50	10.58	H
Harmonics	3393.000	50.49	-0.63	49.86	60.50	10.64	H
--	--	--	--	--	--	--	--
Fundamental	424.125	62.14	-0.63	71.51	80.50	8.99	V
Harmonics	848.250	48.78	-0.63	49.92	60.50	10.58	V
Harmonics	3393.000	51.57	-0.63	49.86	60.50	10.64	V
--	--	--	--	--	--	--	--

Test frequency:431.125MHz

Emission Styles	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Direction (H/V)
Fundamental	431.125	71.58	100.73	29.15	PK	H
Spurious	844.750	32.45	46.00	13.55	PK	H
Harmonics	862.250	51.39	80.73	29.34	PK	H
Harmonics	1293.375	52.55	80.73	28.18	PK	H
--	--	--	--	--	--	--
Fundamental	431.125	60.74	100.73	39.99	PK	V
Spurious	842.260	31.83	46.00	14.17	PK	V
Harmonics	862.250	42.55	80.73	38.18	PK	V
Harmonics	3017.875	51.69	80.73	29.04	PK	V
--	--	--	--	--	--	--

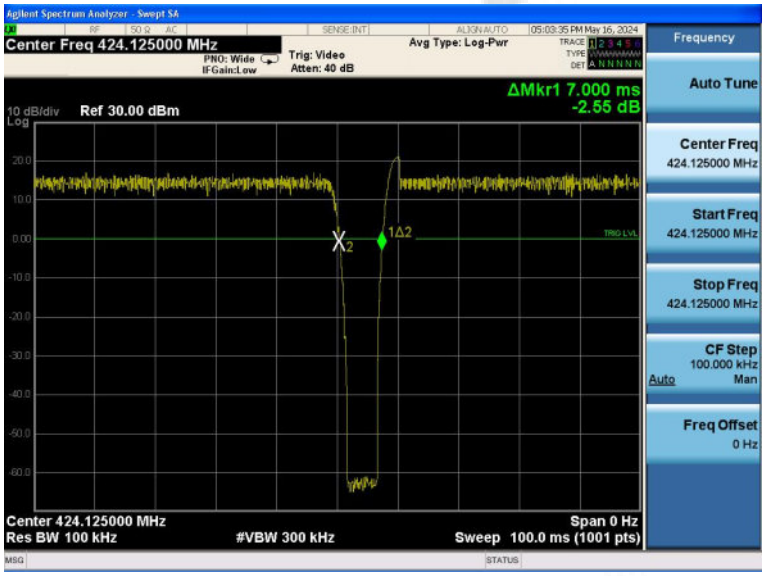
Note: Margin= Limit-Emission level

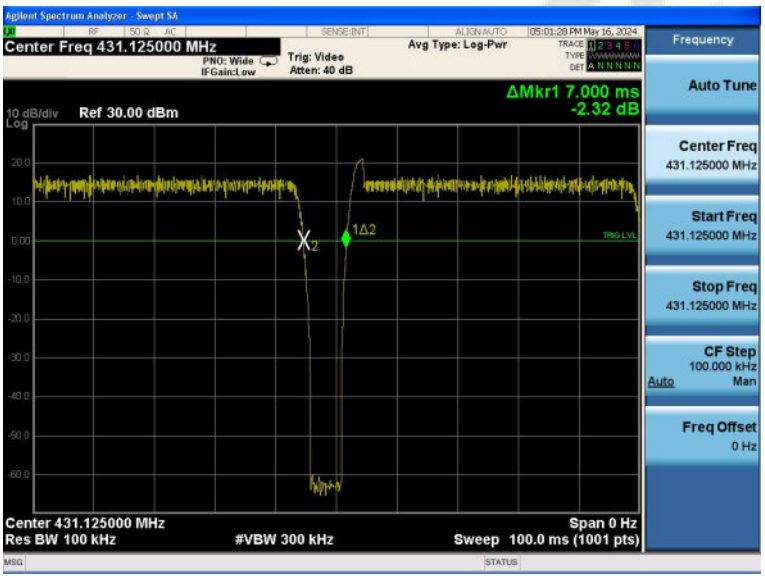
Emission Styles	Frequency (MHz)	PK Emission Level (dBuV/m)	AV Factor (dB/m)	AV Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Direction (H/V)
Fundamental	431.125	71.58	-0.63	68.8	80.73	11.93	H
Harmonics	862.250	51.39	-0.63	48.61	60.73	12.12	H
Harmonics	1293.375	52.55	-0.63	49.77	60.73	10.96	H
--	--	--	--	--	--	--	--
Fundamental	431.125	60.74	-0.63	57.96	80.73	22.77	V
Harmonics	862.250	42.55	-0.63	39.77	60.73	20.96	V
Harmonics	3017.875	51.69	-0.63	48.91	60.73	11.82	V
--	--	--	--	--	--	--	--

Note:

4. AV Level (dBuV/m)= PK Emission Level (dBuV/m)+ AV Factor(dB)
5. Duty Cycle= (100-7)/100.0=0.93 (Note: According to C63.10 if the transmit cycle period longer than 100ms, then 100ms is used calculation.)
6. AV Factor=20*log(Duty Cycle)=20*log(0.93)=-0.63

(The plot of Duty Cycle See the follow page)




Agilent Spectrum Analyzer - Swept SA
Center Freq 431.125000 MHz
PNO: Wide
IFGain:Low
Trig: Video
Atten: 40 dB
Avg Type: Log-Pwr
05:01:28 PM May 16, 2024
ΔMkr1 7.000 ms
-2.32 dB
10 dB/div
Log
Ref 30.00 dBm
Center 431.125000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 100.0 ms (1001 pts)
Frequency
Auto Tune
Center Freq
431.125000 MHz
Start Freq
431.125000 MHz
Stop Freq
431.125000 MHz
CF Step
100.000 kHz
Auto
Man
Freq Offset
0 Hz

3.3. 20dB Bandwidth

Limit

According to 47 CFR 15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the centre frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20dB down from the modulated carrier.

Test Configuration

Test Procedure

The 20dB bandwidth and 99% bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

The occupied bandwidth (OBW), that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

Test Results

AZ433-USB

Modulation	Channel Frequency (MHz)	99% OBW (KHz)	20dB bandwidth (KHz)	Limit (KHz)	Result
GFSK	424.125	710.77	805.7	0.25%*424125=1062.81	Pass
	431.125	707.07	819.4	0.25%*431125=1077.81	Pass

Test plot as follows:

424.125MHz

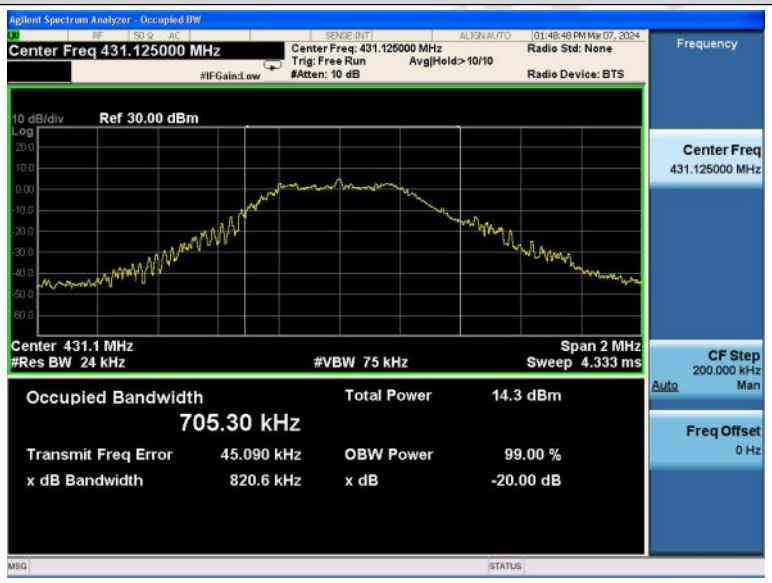
431.125MHz

AZ433-RS232C

Modulation	Channel Frequency (MHz)	99% OBW (KHz)	20dB bandwidth (KHz)	Limit (KHz)	Result
GFSK	424.125	704.26	808.6	0.25%*424125=1062.81	Pass
	431.125	705.30	820.6	0.25%*431125=1077.81	Pass

Test plot as follows:

424.125MHz

431.125MHz


Agilent Spectrum Analyzer - Occupied BW
Center Freq 431.125000 MHz
Center Freq: 431.125000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 30.00 dBm
Center Freq
431.125000 MHz
Center 431.1 MHz
#Res BW 24 kHz
#VBW 75 kHz
Span 2 MHz
Sweep 4.333 ms
CF Step
200.000 kHz
Auto
Man
Occupied Bandwidth
705.30 kHz
Total Power
14.3 dBm
Transmit Freq Error
45.090 kHz
OBW Power
99.00 %
x dB Bandwidth
820.6 kHz
x dB
-20.00 dB
Freq Offset
0 Hz
MSG
STATUS

3.4. Deactivation Time

Limit

According to FCC §15.231(a)(1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test Configuration

Test Procedure

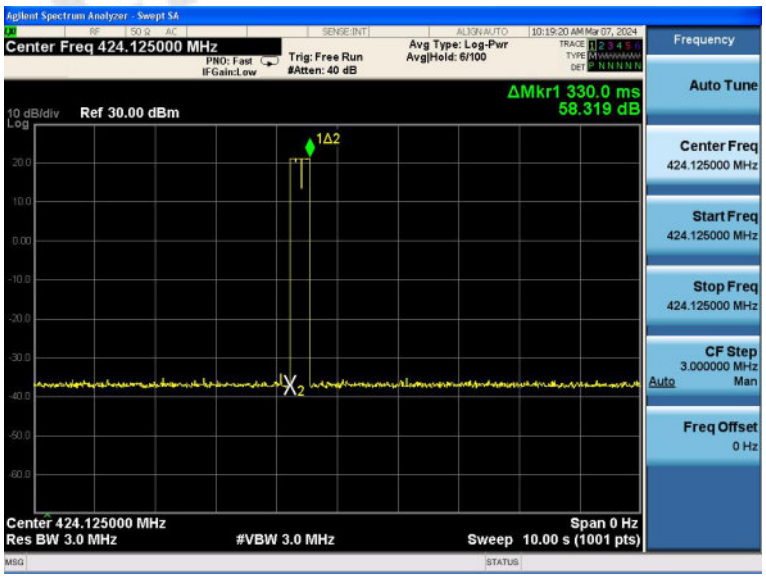
1. The EUT was placed on a wooded table which is 0.8m height and close to receiver antenna of spectrum analyzer.
2. The spectrum analyzer resolution bandwidth was set to 1 MHz and video bandwidth was set to 1 MHz to encompass all significant spectral components during the test. The spectrum analyzer was operated in linear scale and zero span mode after tuning to the transmitter carrier frequency.

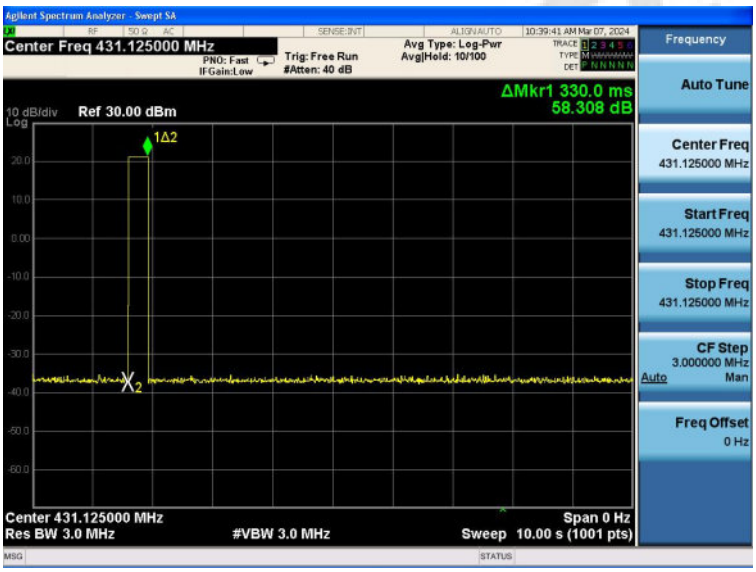
TEST RESULTS

Note : Multiple groups of channels are tested, only the poor frequencies are recorded, other frequencies meet the requirements.

AZ433-USB

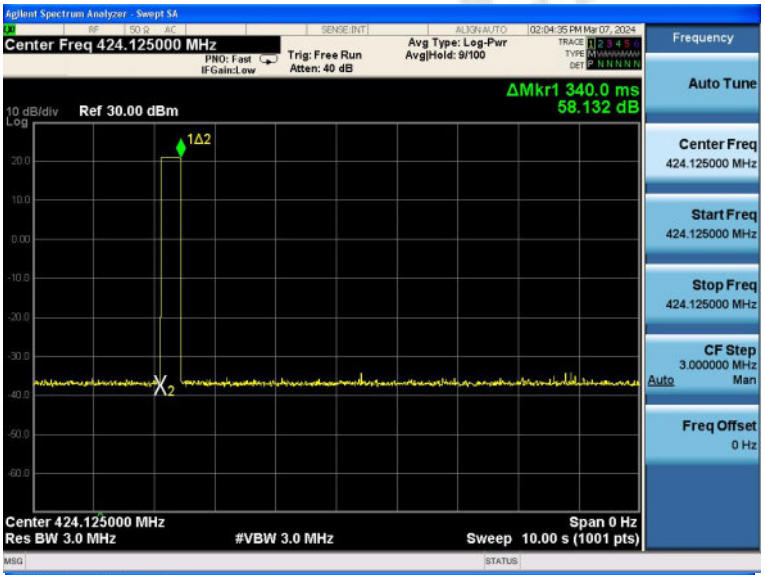
Frequency (MHz)	One transmission time (S)	Limit(S)	Result
424.125	0.3300	5	Pass
431.125	0.3300	5	Pass

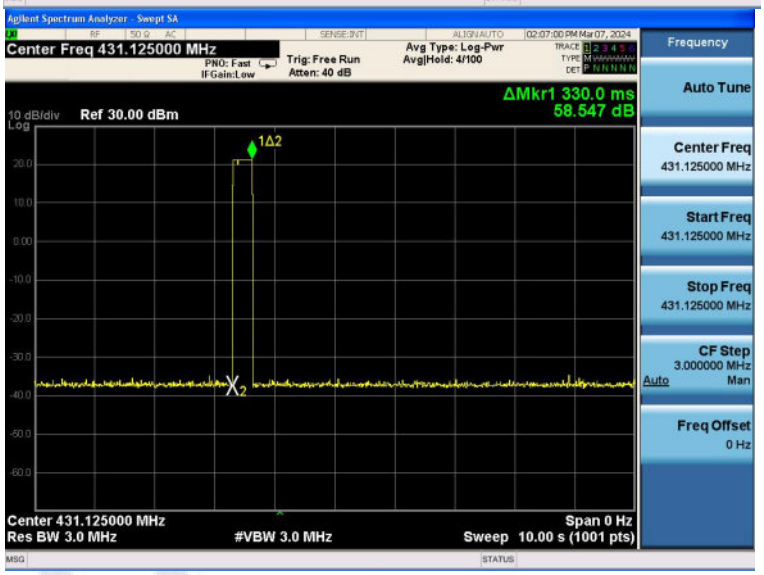




AZ433-RS232C

Frequency (MHz)	One transmission time (S)	Limit(S)	Result
424.125	0.3400	5	Pass
431.125	0.3300	5	Pass





3.5. Antenna Requirement

Standard Applicable

According to FCC Part 15C 15.203

a) An intentional radiator shall be de-signed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

b) The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Refer to statement below for compliance.

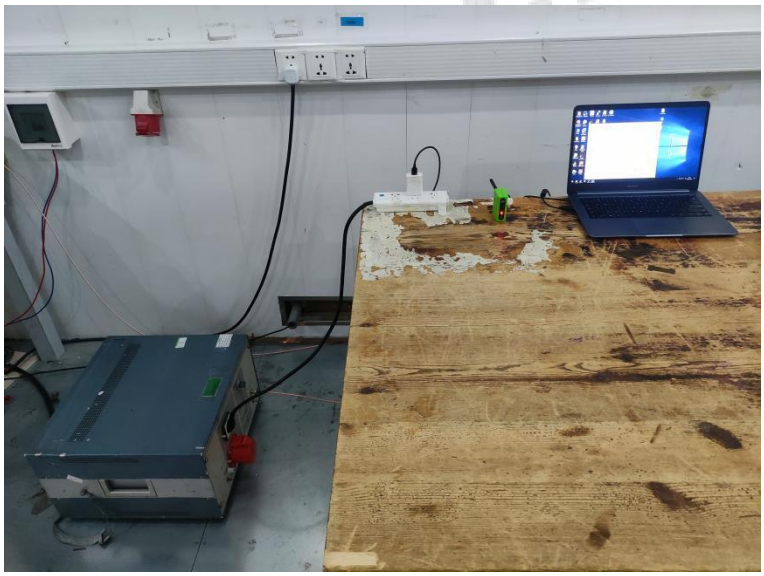
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

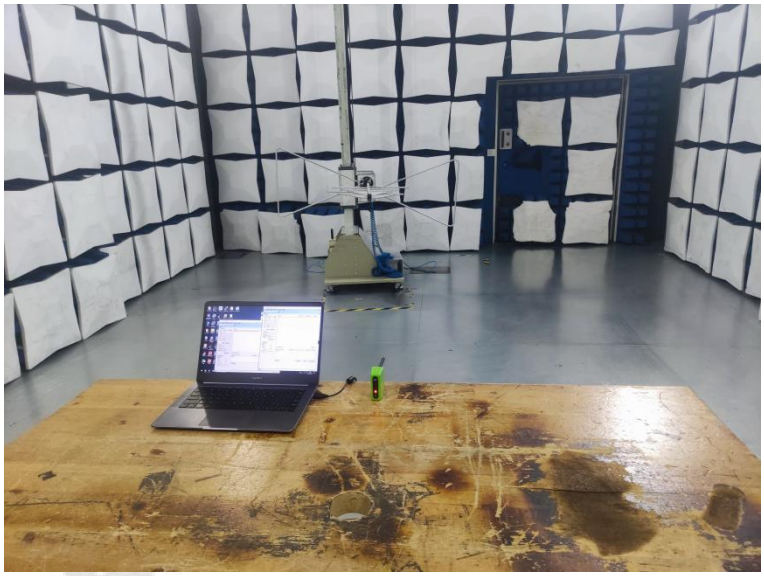
Antenna Connected Construction

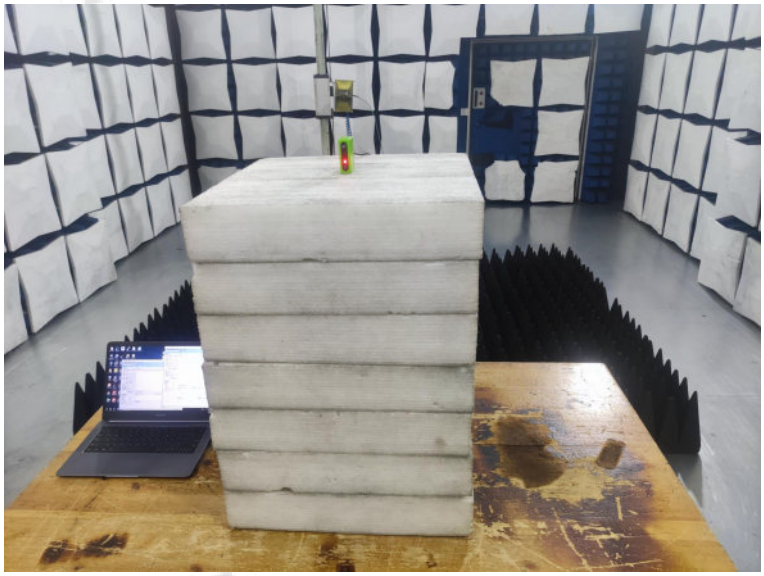
The antenna used in this product is an external antenna, The directional gains of antenna used for transmitting is 1.83dBi.

4. Test Setup Photos of the EUT

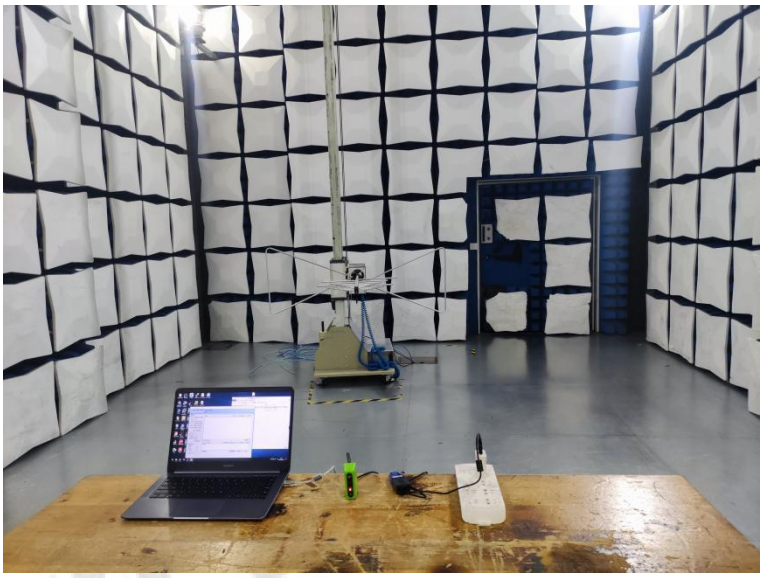
AZ433-USB







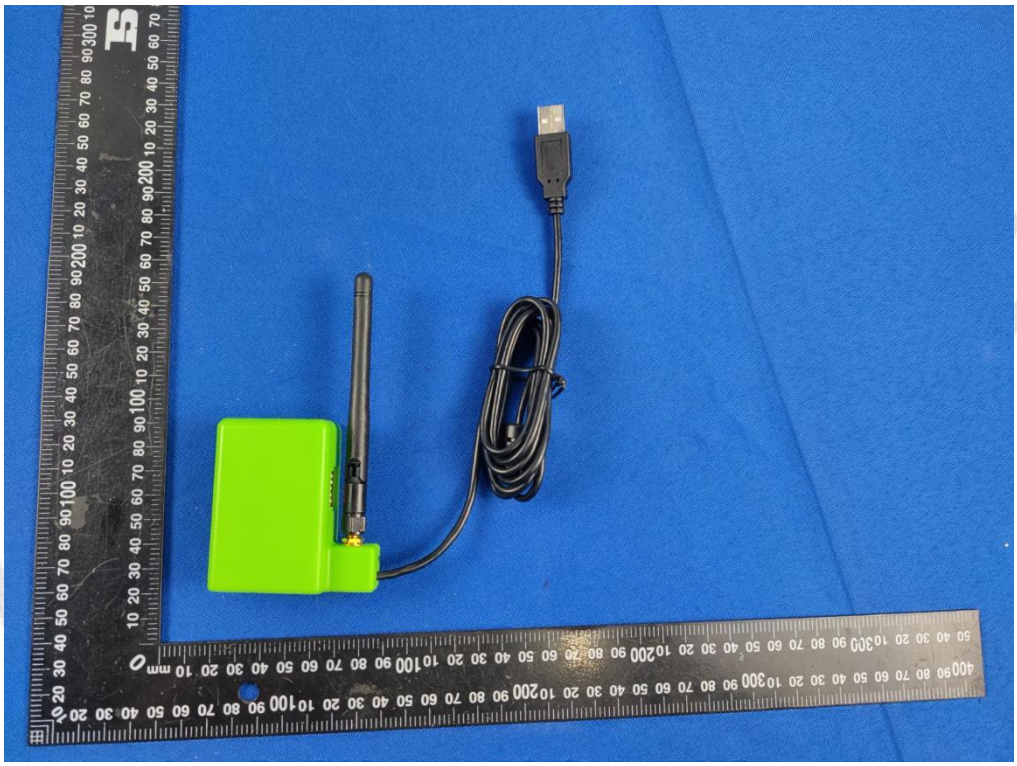
AZ433-RS232C

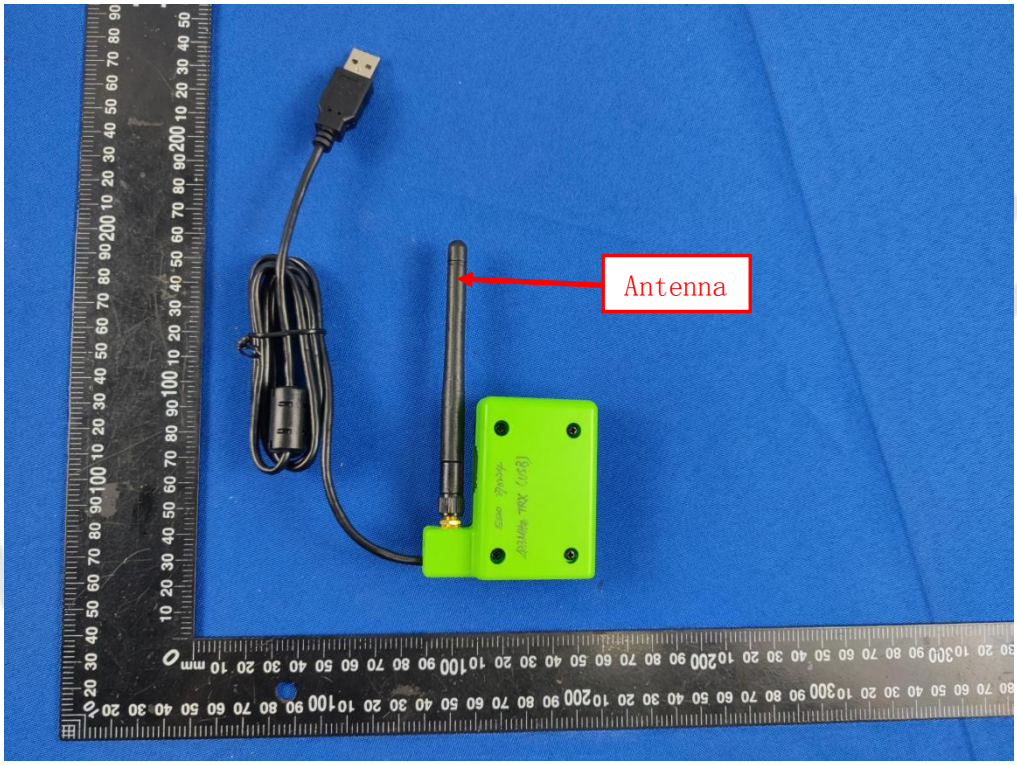


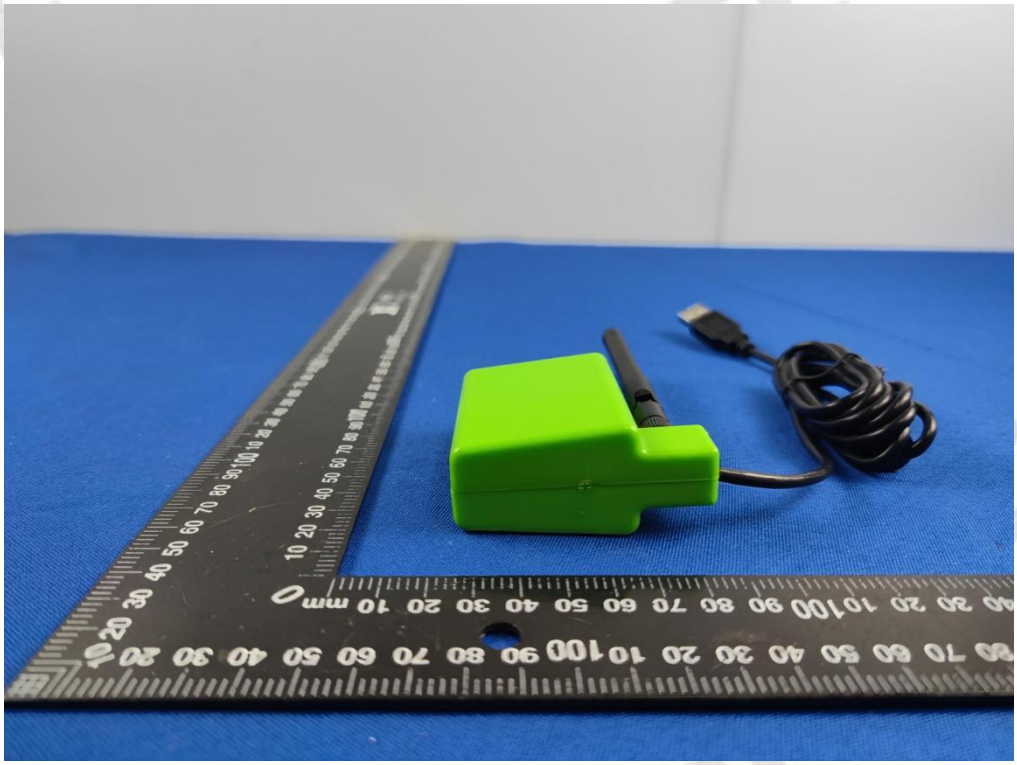
5. External and Internal Photos of the EUT

External Photos of EUT

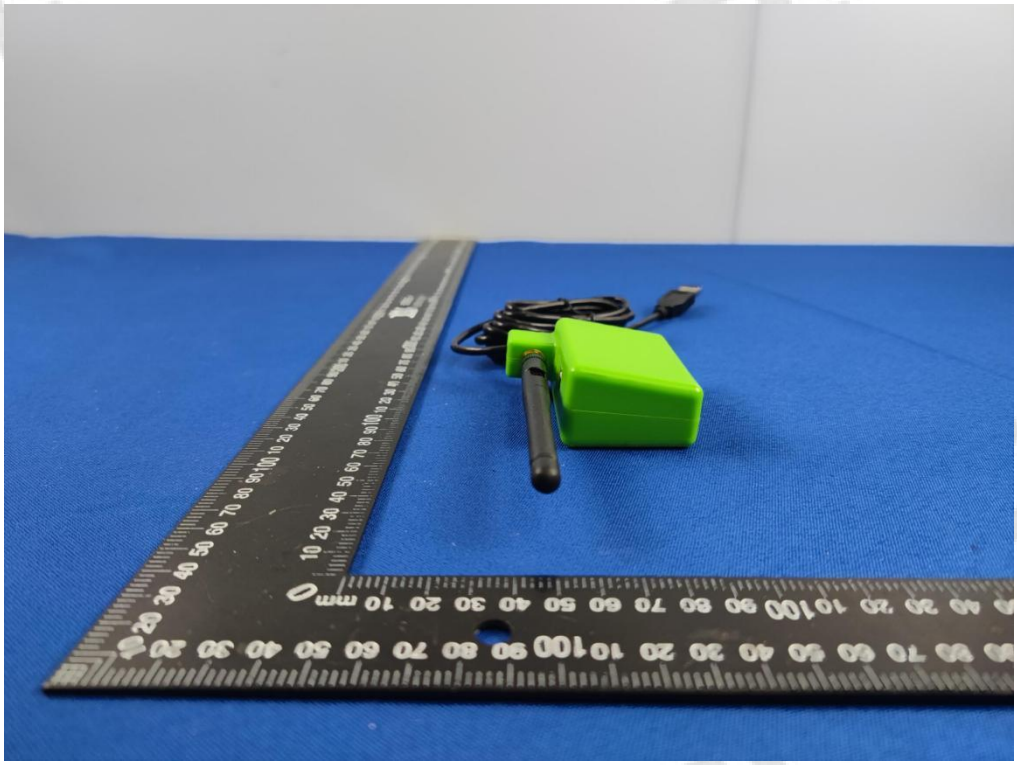
AZ433-USB

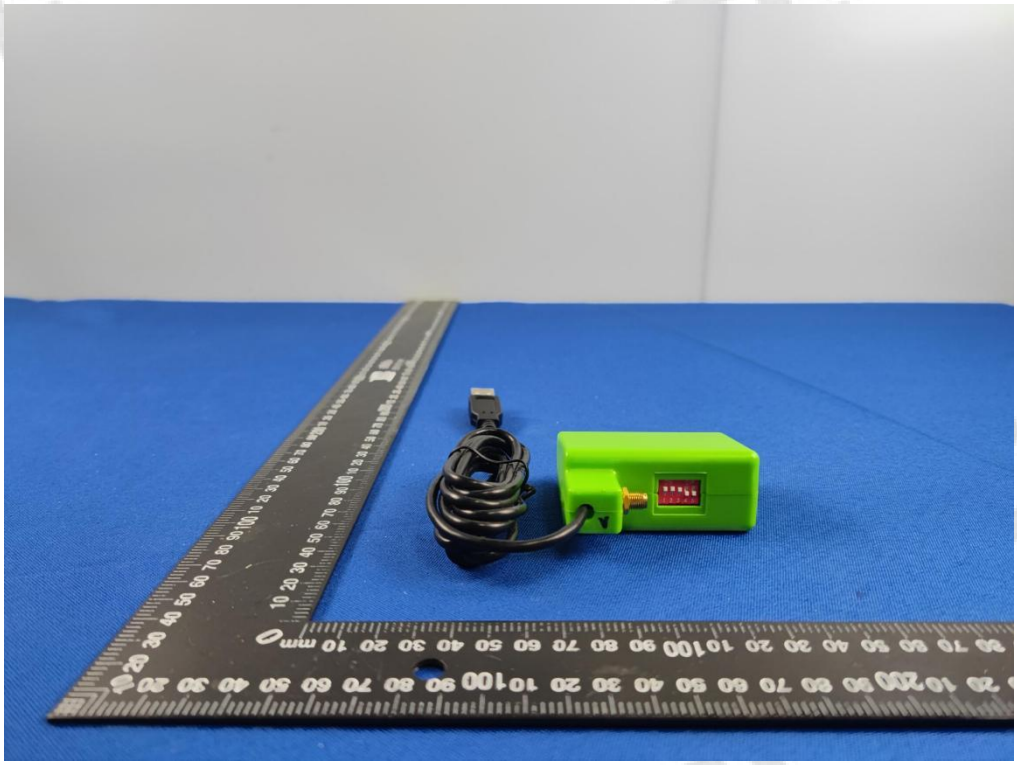




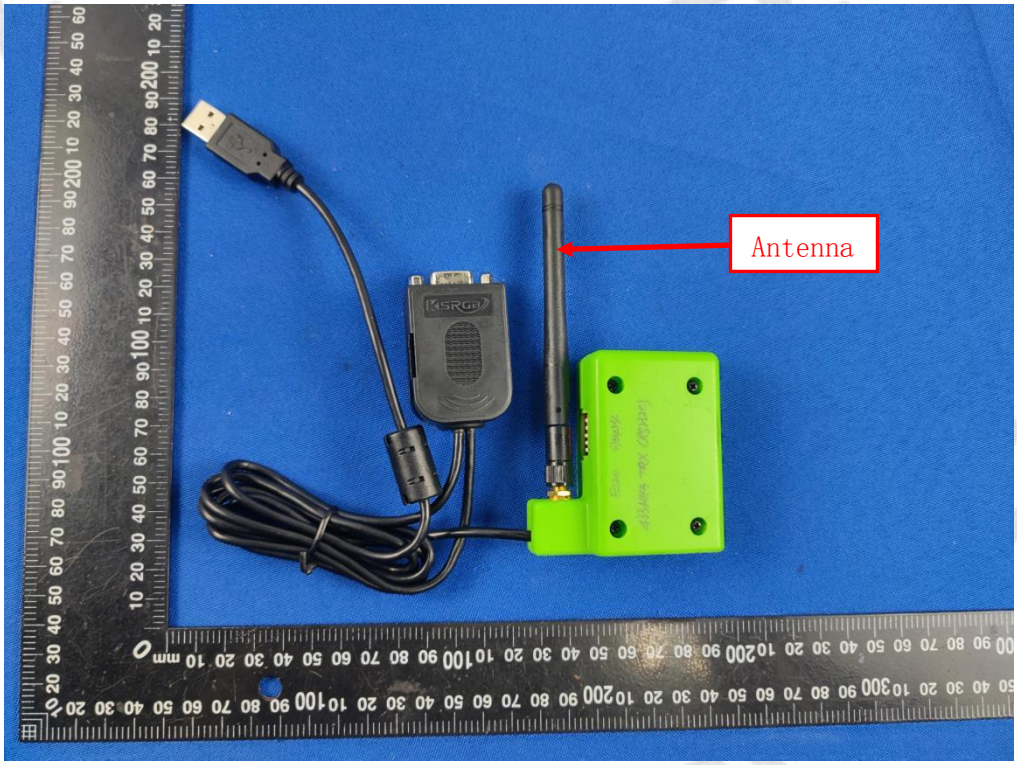


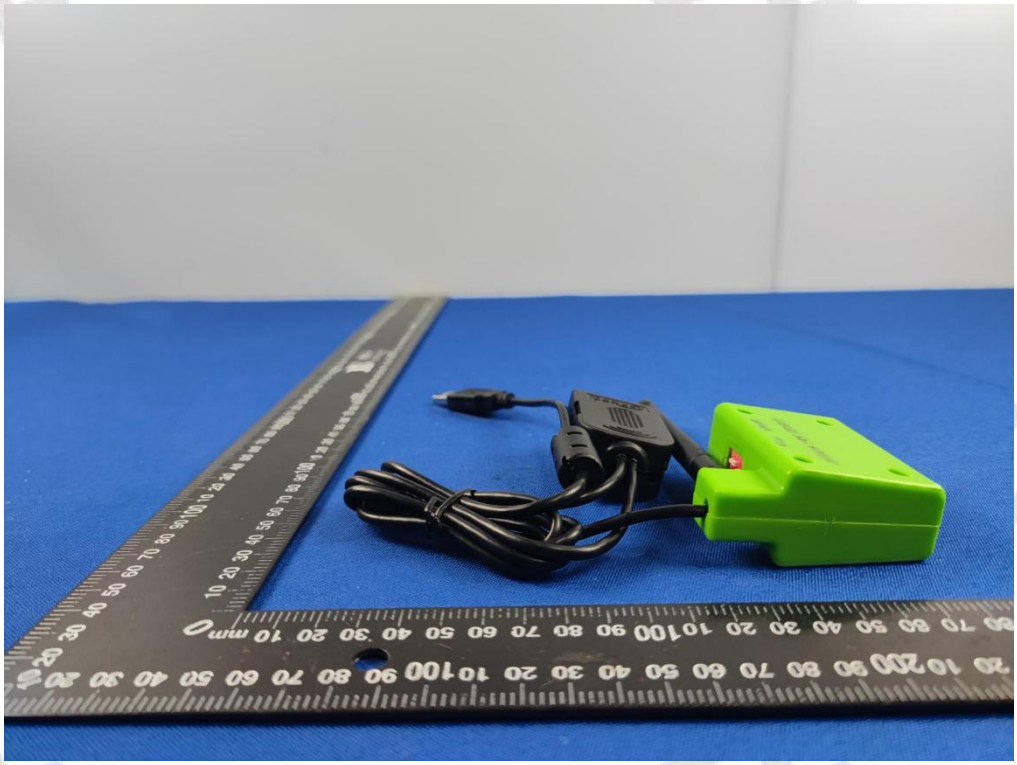
SIGNAL
POWER

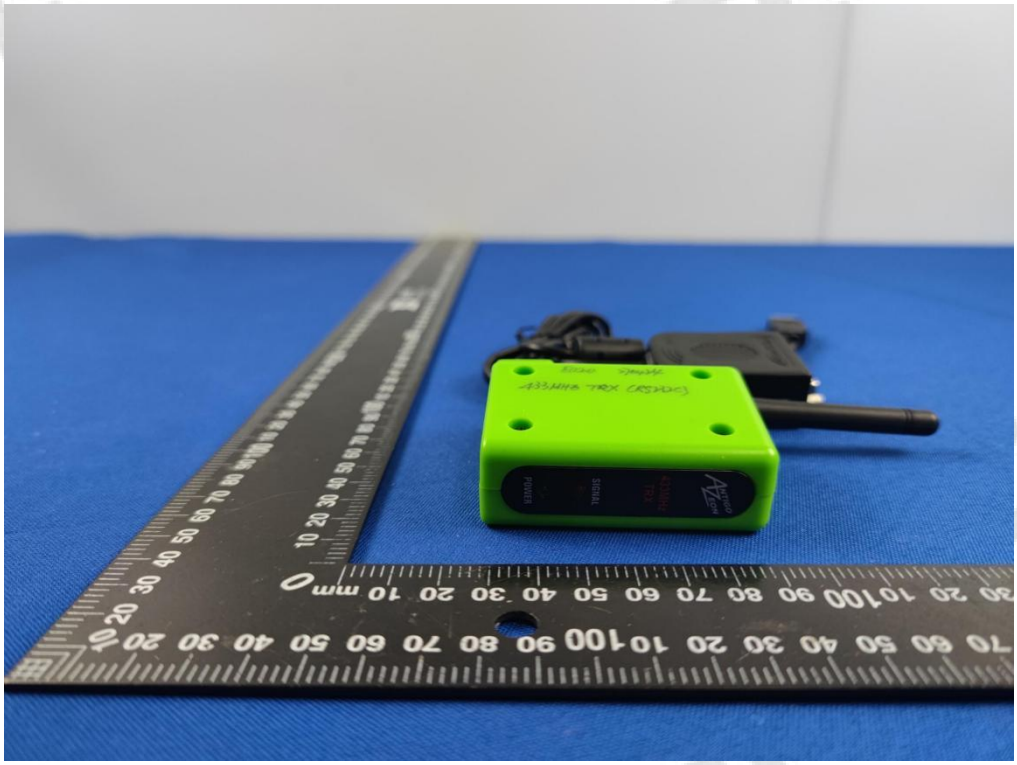


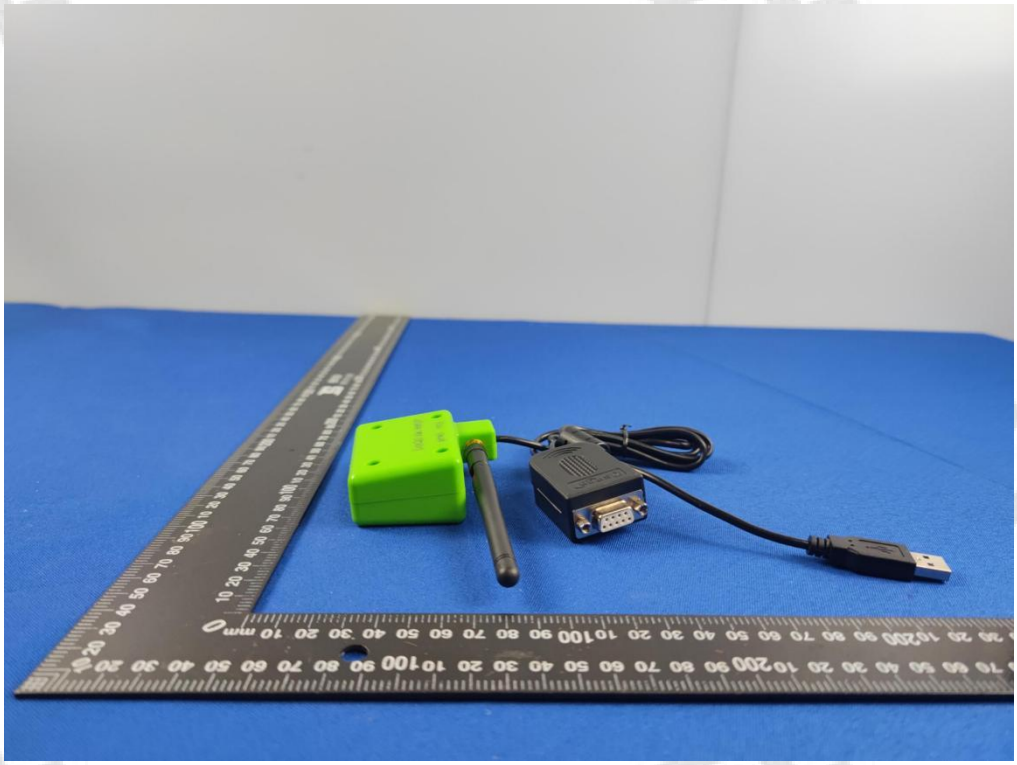


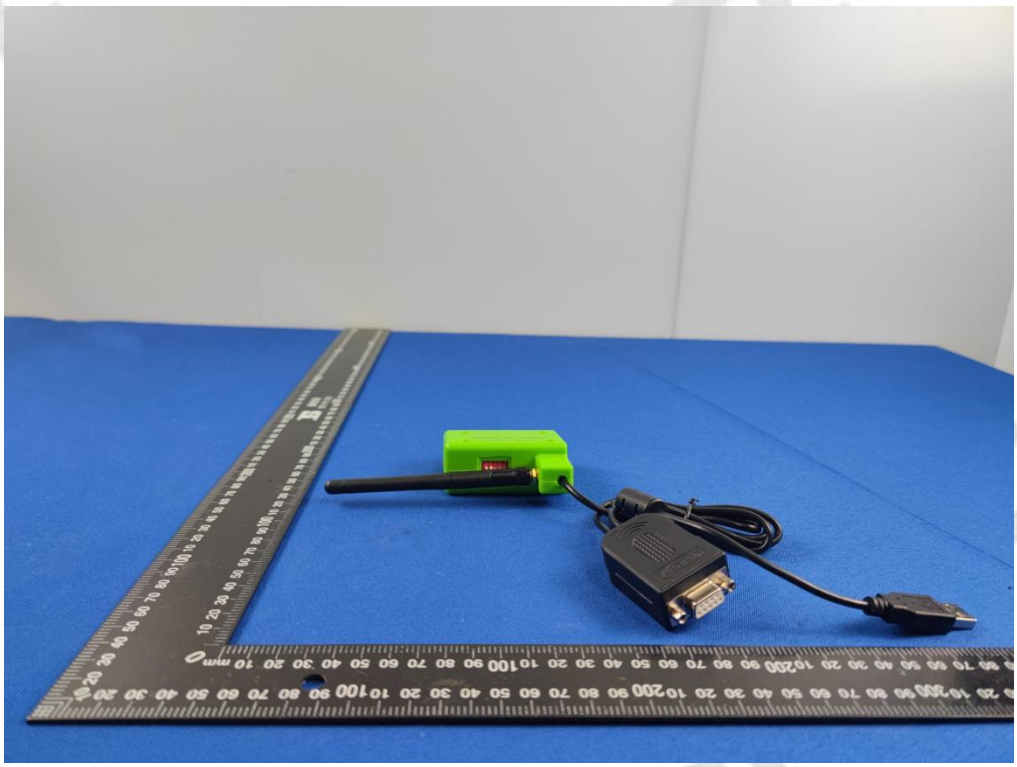
AZ433-R232C


Antenna



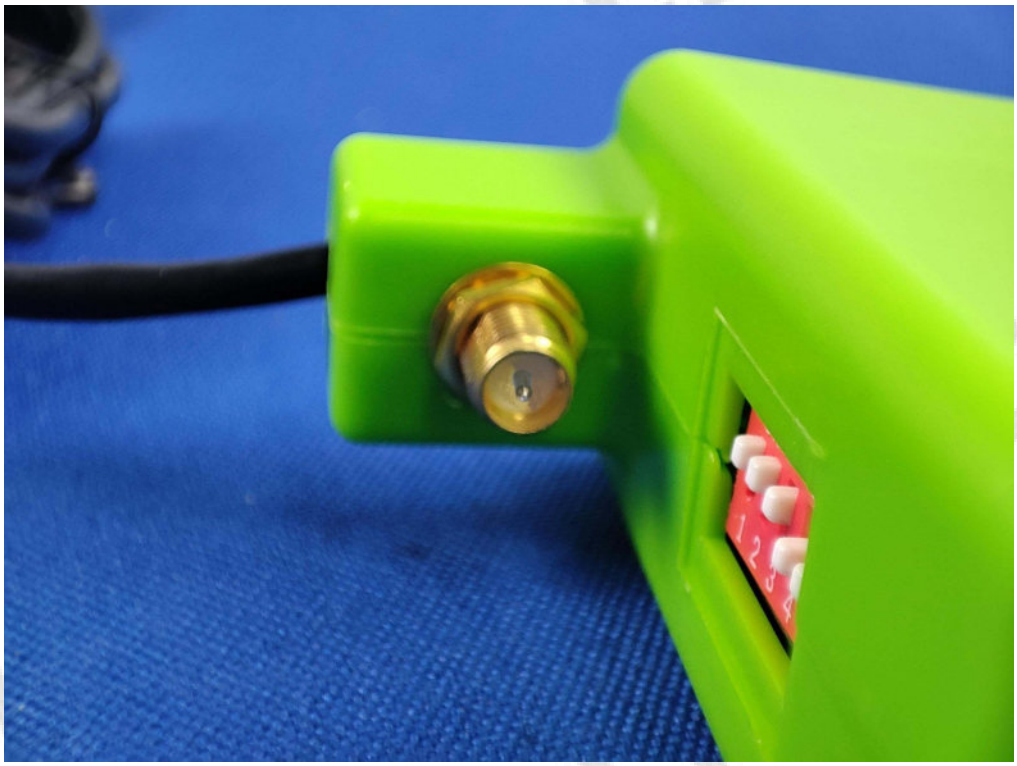

POWER
SIGNAL

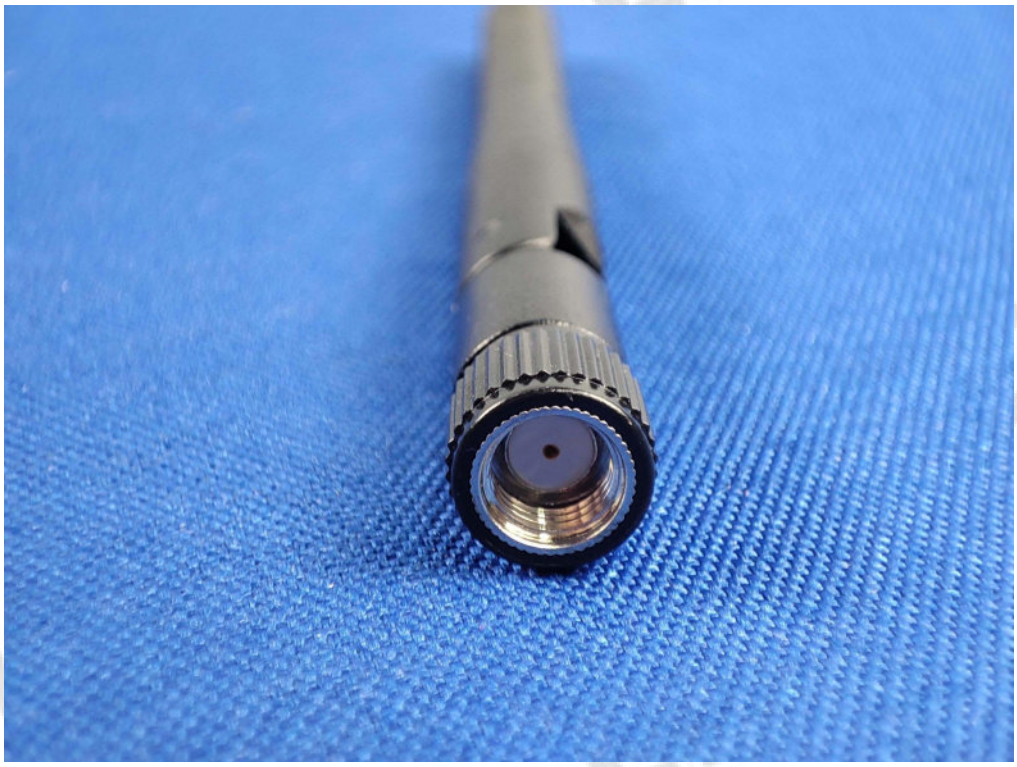


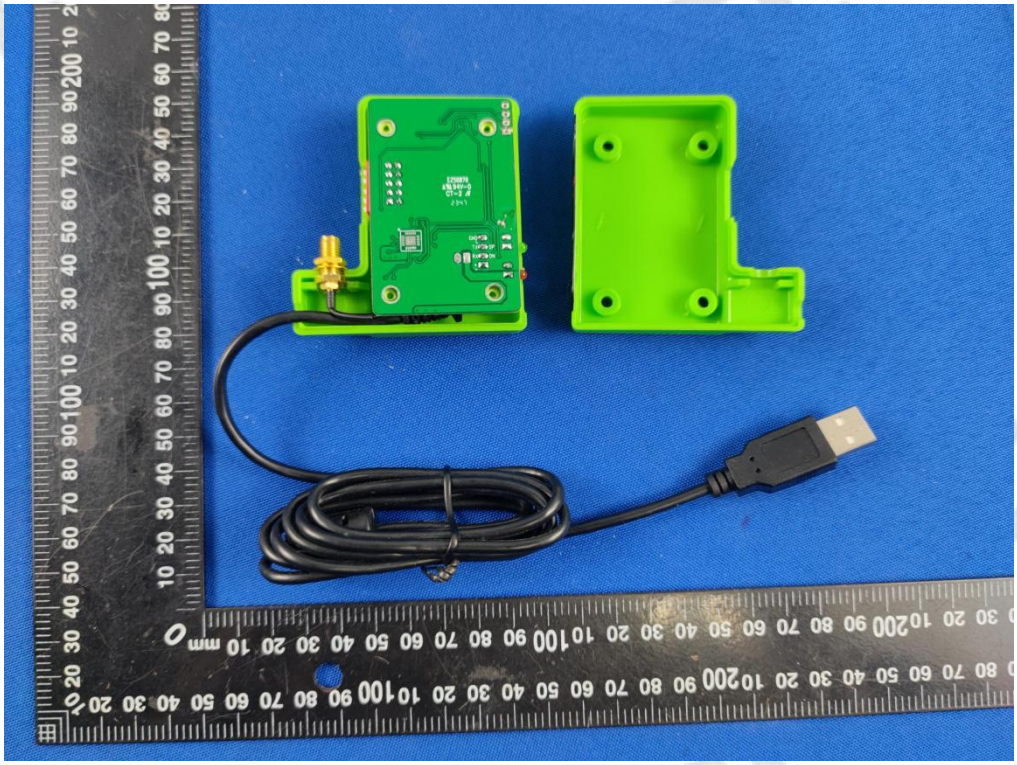


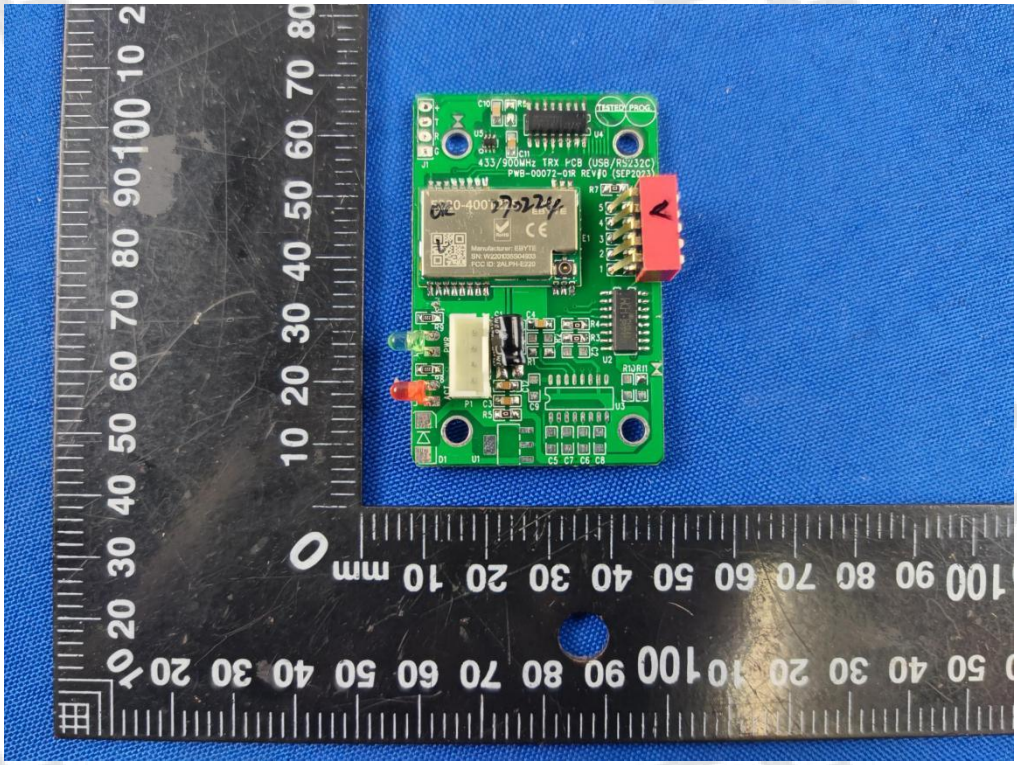
Internal Photos of EUT

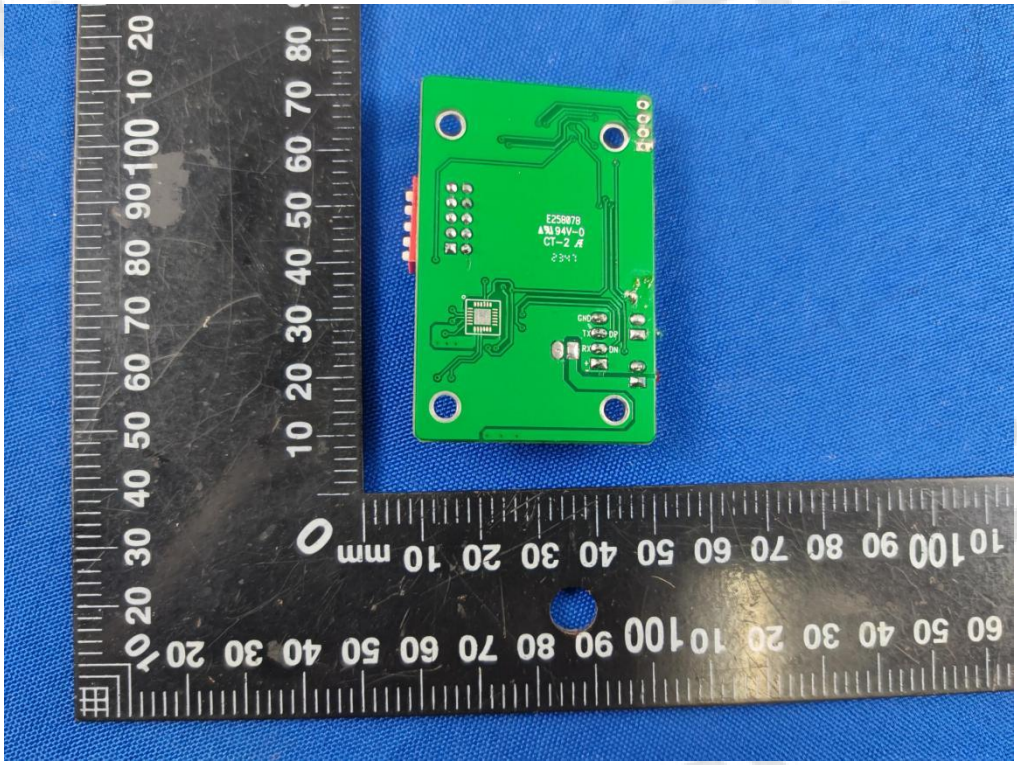
AZ433-USB








433/900MHz TRX PCB (USB/RS232C)
PWB-00072-01R REV0 (SEP2023)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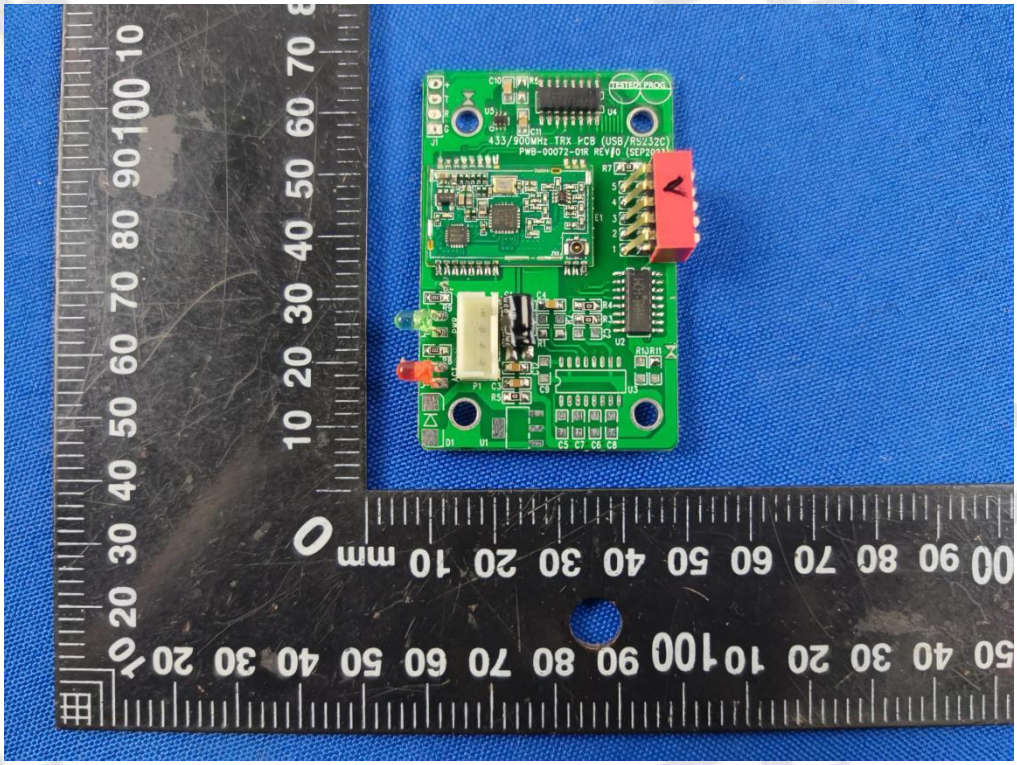
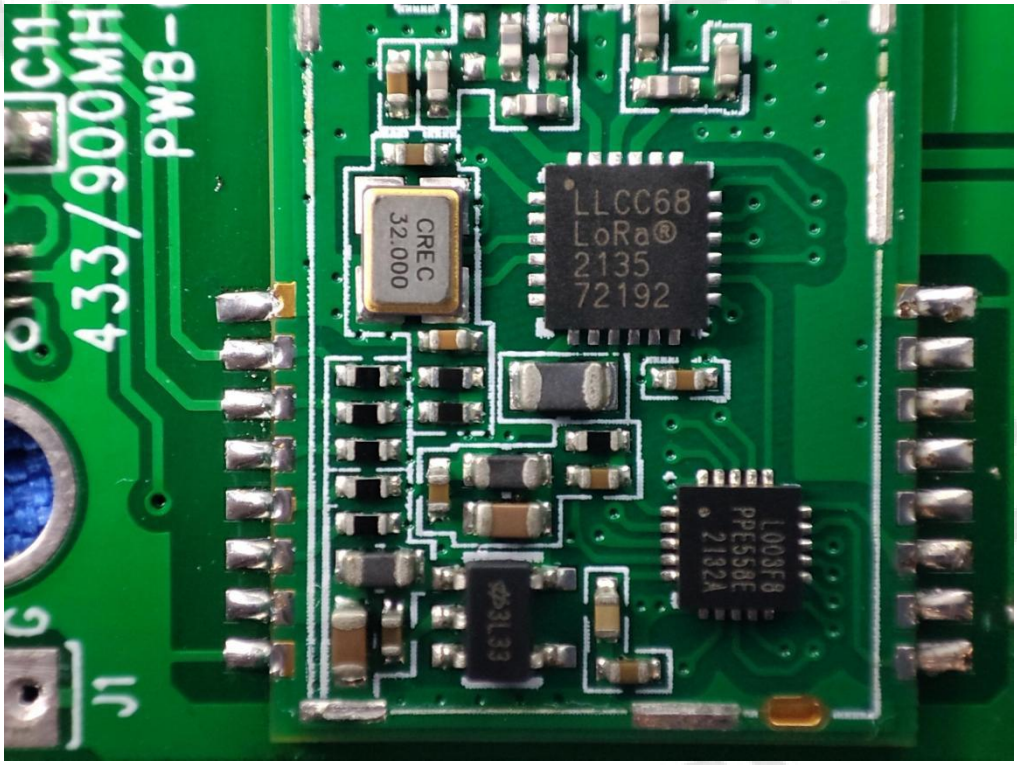
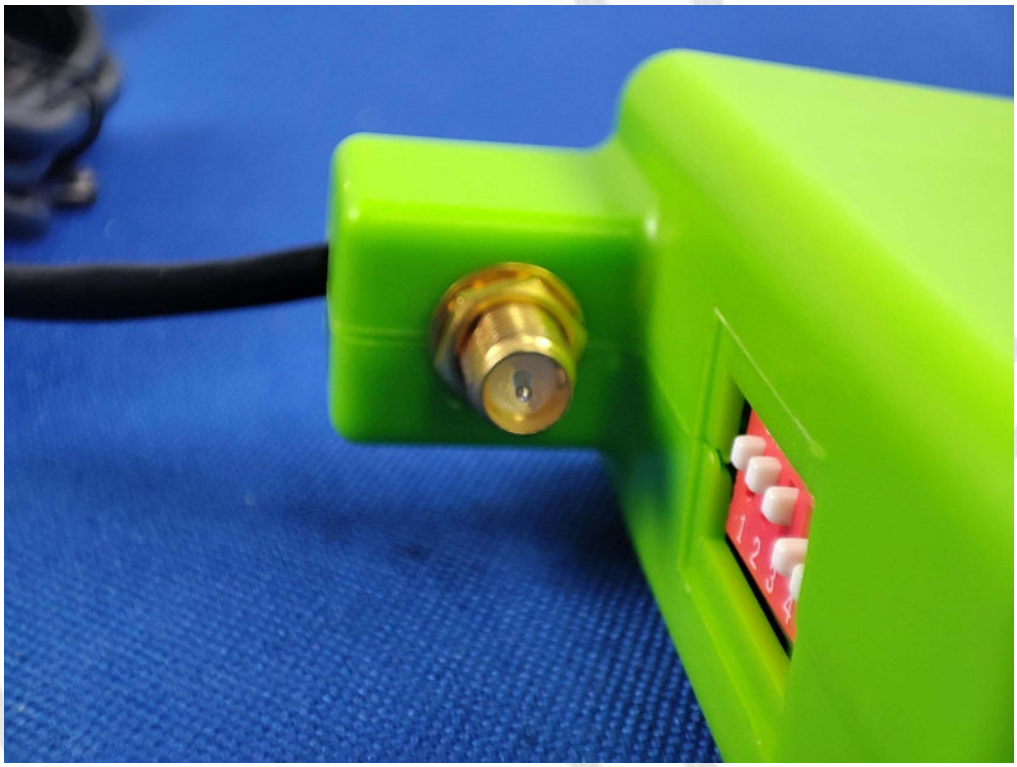
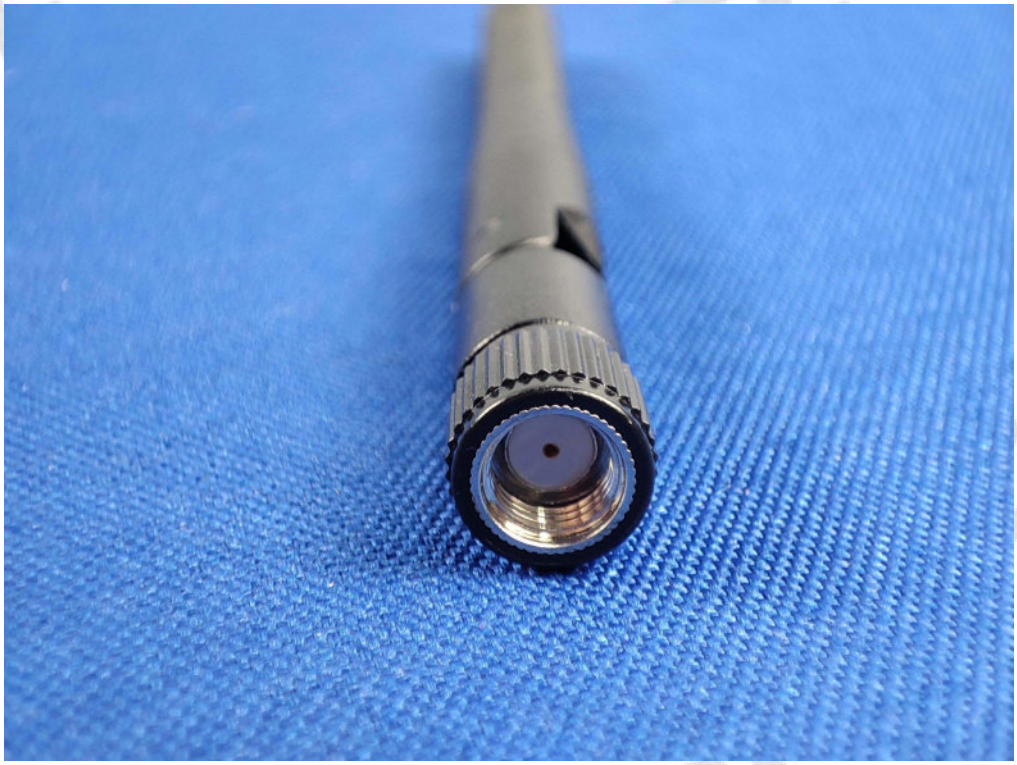
94V-0
CT-2
CHD
TX
DP
RX
DM

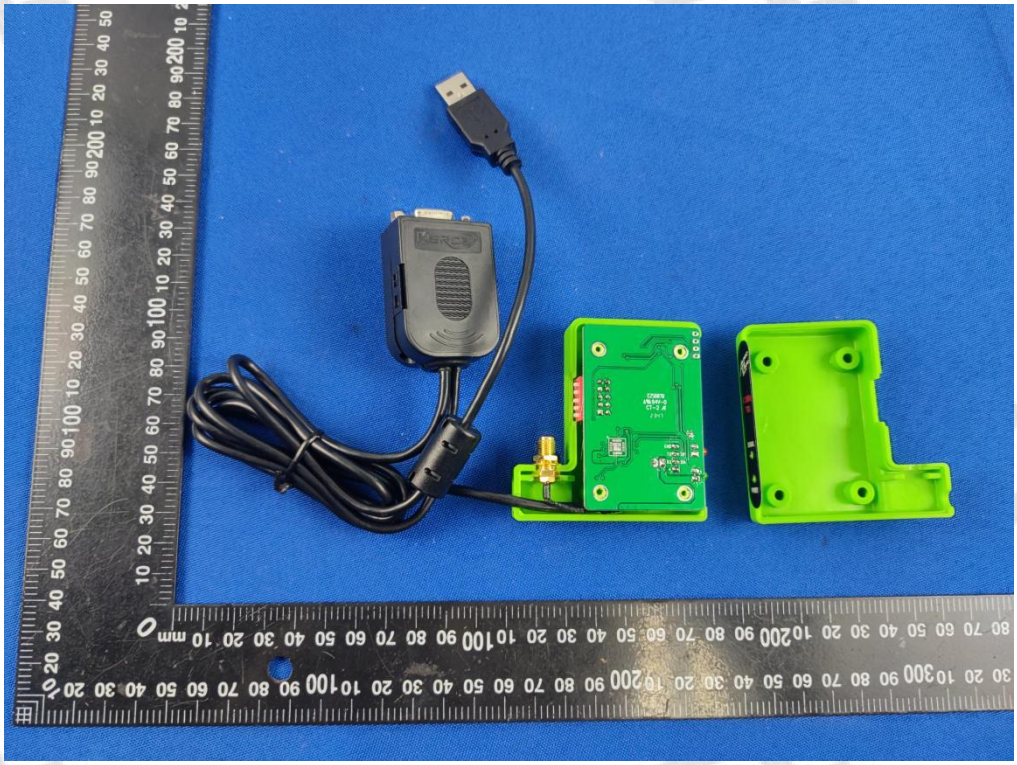

TESTER PROBE
433/900MHz TRX PCB (USB/RS232C)
PWB-00072-01R REV0 (SEP2001)

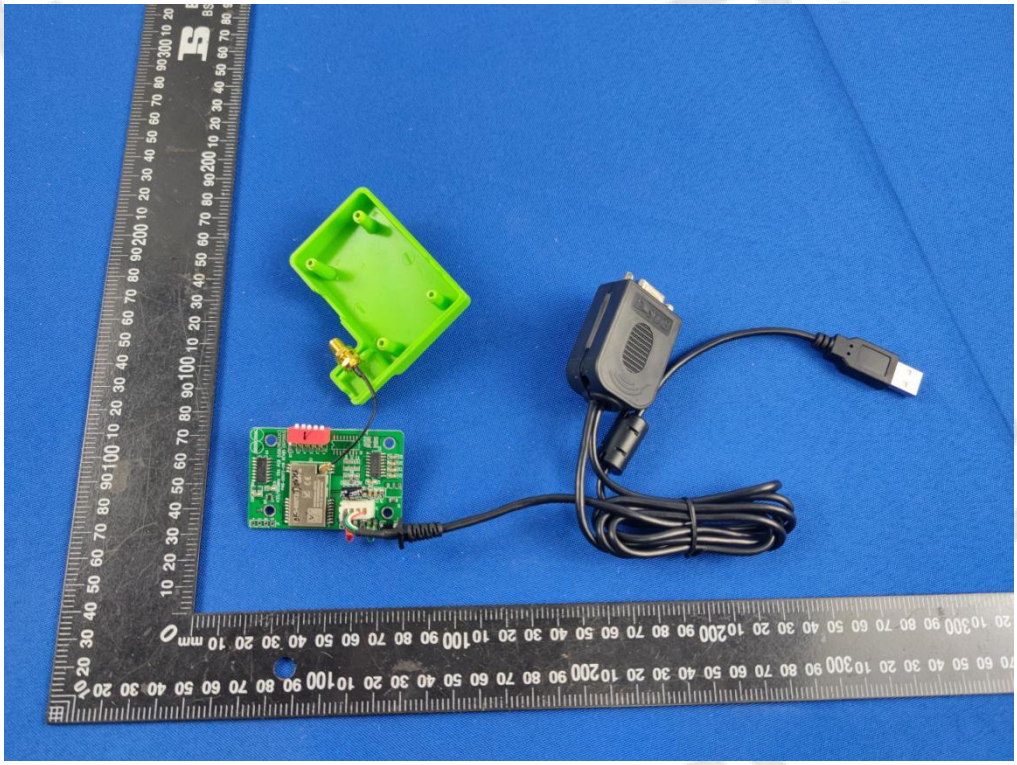

C11
433/900MH
PWB-
J1
CREC
32.000
LLCC68
LoRa®
2135
72192
3L33
L003F8
PPE558E
2132A

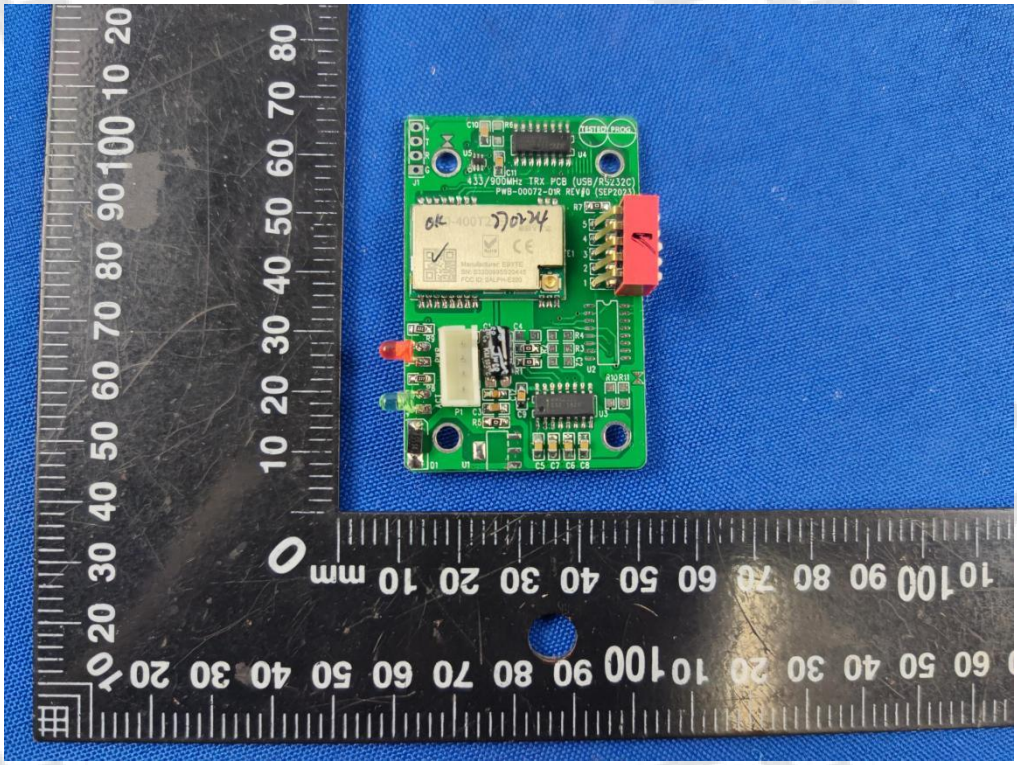
AZ433-R232C

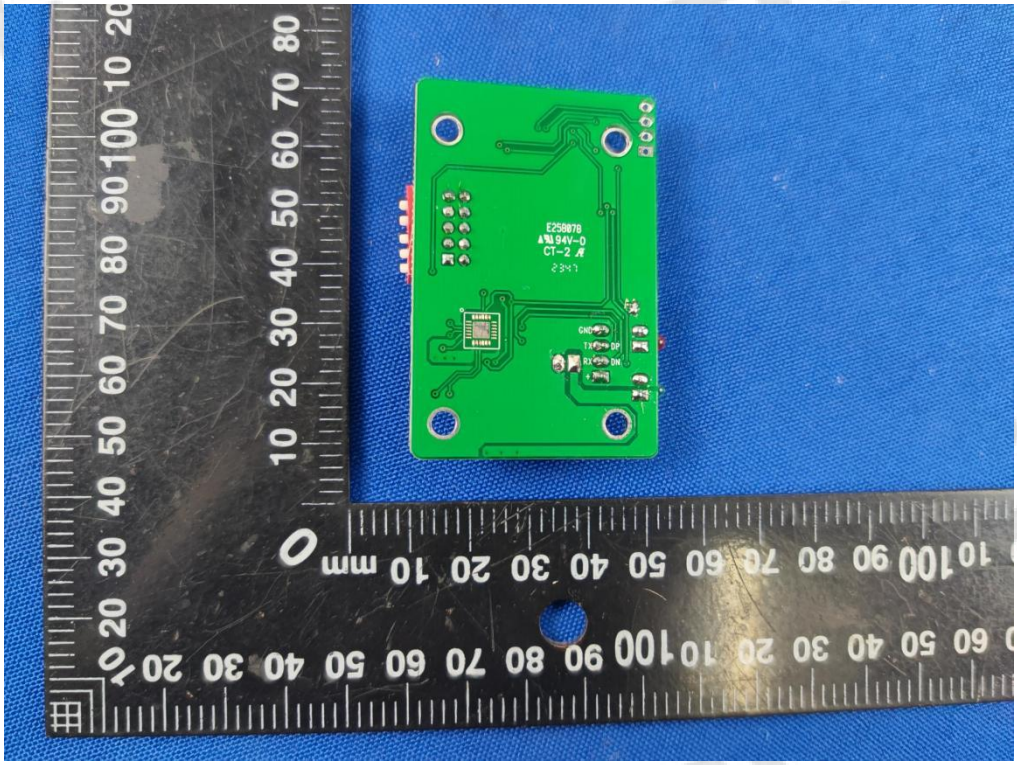

1 2 3 4

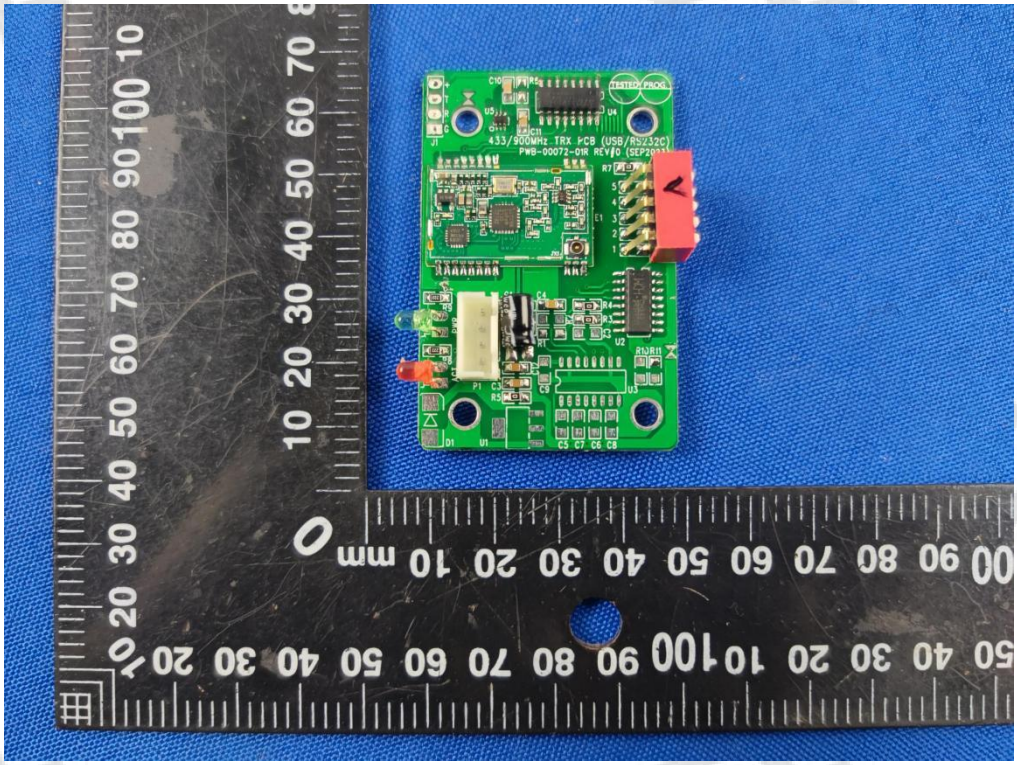


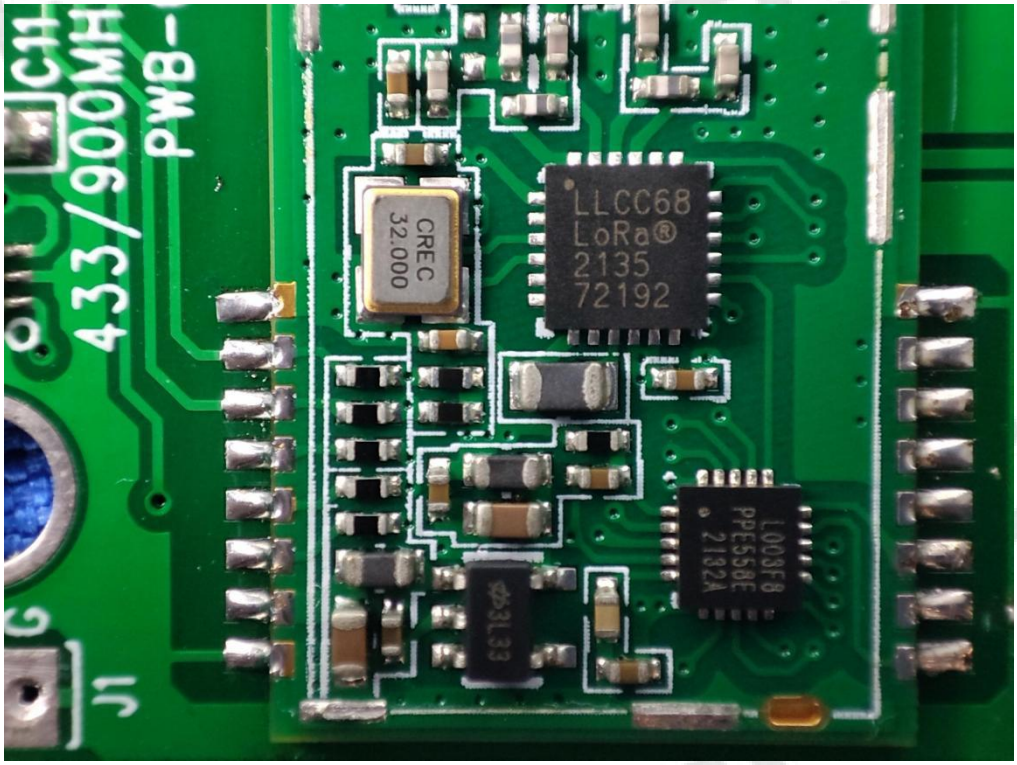





433/900MHz TRX PCB (USB/RS232C)
PWB-00072-01R REV#0 (SEP2023)


E250878
94V-0
CT-2
GND
TX
DP
RX
DN


TESTER PROBE
433/900MHz TRX PCB (USB/RS232C)
PWB-00072-01R REV0 (SEP2001)



********** End of Report **********