



BUREAU
VERITAS

Test Report No.: RF180830W001



FCC TEST REPORT

(Part 15, Subpart C)

Applicant:	Beijing Niu Technology Co., Ltd
Address:	11F, Fangheng Times Center Block A (Lianluo Building), No. 10 Wangjing street, Chaoyang, Beijing, China

Manufacturer or Supplier:	Jiangsu Niu Electric Technology Co., Ltd.
Address:	No.5 Lingxiang Rd, WEZ, Wujin, Changzhou, Jiangsu Province
Product:	Remote Controller
Brand Name:	NIU
Model Name:	D23
FCC ID:	2AQ95-NIUD23
Date of tests:	Dec. 04, 2018 ~ Jan. 04, 2019

The tests have been carried out according to the requirements of the following standard:

- ☒ FCC Part 15, Subpart C, Section 15.231
- ☒ ANSI C63.10-2013

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Roger Li Engineer / Mobile Department	Approved by Sam Tung Manager / Mobile Department
 Date: Jan. 07, 2019	 Date: Jan. 07, 2019

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF180830W001	Original release	Jan. 07, 2019



1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.231)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	N/A	N/A
15.231(b)	Field strength of the Fundamental Signal	PASS	Meet the requirement of limit. Minimum passing margin is -26.83dB at 315.18MHz
15.231(b) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -6.04dB at 944.71MHz.
15.231(a)(1)	20dB bandwidth	PASS	Meet the requirement of limit.
15.231(a)(1)	Dwell Time	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used

1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in ETSI TR 100 028-2001:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.66dB
Radiated emissions	9KHz ~ 30MHz	2.68dB
	30MHz ~ 1GMHz	3.26dB
	1GHz ~ 18GHz	4.48dB
	18GHz ~ 40GHz	4.12dB

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



2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Remote Controller
BRAND NAME	NIU
MODEL NAME	D23
NOMINAL VOLTAGE	3Vdc (button battery)
MODULATION TECHNOLOGY	ASK
MODULATION TYPE	ASK
OPERATING FREQUENCY	315MHz
ANTENNA TYPE	PCB Antenna with 1.5dBi gain
HW VERSION	HRXN-D23-2150L-FCC-C20180926
SW VERSION	HR-2150L-V1.0-C1CF
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	N/A

NOTE:

- For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
- The EUT incorporates a SISO function. Physically, the EUT provides one transmitter.

MODULATION MODE	TX/RX FUNCTION
315MHz	1TX /1RX

- For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.



2.2 DESCRIPTION OF TEST MODES

TEST MODE	FREQUENCY	STATUS
Transmitting mode	315 MHz	Keep the EUT in transmitting mode

2.2.1 CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photographs of the test configuration for reference.

2.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports.
The worst case was found when positioned on Y axis for radiated emission. Following test modes were selected for the final test, and the final worst case is marked in boldface and recorded in the report:

EUT CONFIGURE MODE	APPLICABLE TO				MODE
	RE<1G	RE≥1G	PLC	APCM	
-	√	√	-	-	-

Where **RE<1G**: Radiated Emission below 1GHz **RE≥1G**: Radiated Emission above 1GHz
PLC: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement

NOTE: No need to concern of Conducted Emission due to the EUT is powered by battery.

2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C, Section 15.231

ANSI C63.10-2013

Note:

1. All test items have been performed and recorded as per the above standards.
2. The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (Certification). The test report has been issued separately.

2.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	-	-	-	-	-

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA

3 TEST TYPES AND RESULTS

3.1 RADIATED EMISSION MEASUREMENT

3.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Field strength limits defined in Section 15.231(b), radiated emission limits specified in Section 15.209(a).

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

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)
40.66-40.70	2250
70-130	1250
130-174	1250 to 3750(note4)
174-260	3750
260-470	3750 to 12500(note4)
Above 470	12500

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
4. Liner interpolations:315M
Limits= $315 \times ((12500-3750)/(470-269)) + 3750 - 260 \times ((12500-3750)/(470-269)) = 6041.7 \text{ uV/m}$



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3.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	Apr. 21,18	Apr. 20,19
Bilog Antenna	ETS-LINDGREN	3143B	00161965	Mar. 15,18	Mar. 14,19
Horn Antenna	ETS-LINDGREN	3117	00168728	Mar. 15,18	Mar. 14,19
Loop antenna	Daze	ZN30900A	0708	Oct. 23,18	Oct. 22, 19
Horn Antenna (18GHz-40GHz)	N/A	QWH-SL-18-40-K-SG/QMS-00361	15433	Nov. 21, 18	Nov. 20, 19
Test Software	E3	V 9.160323	N/A	N/A	N/A
Test Software	ADT	ADT_Radiated V7.6.15.9.2	N/A	N/A	N/A
10dB Attenuator	JFW/USA	50HF-010-SMA	1505	Jul. 09,18	Jul. 08,19
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 16,18	Mar. 15,19
Signal Pre-Amplifier	EMSI	EMC 9135	980249	Jul. 09,18	Jul. 08,19
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	Jul. 09,18	Jul. 08,19
Signal Pre-Amplifier	EMSI	EMC 184045B	980259	Jul. 09,18	Jul. 08,19

- NOTE:**
1. The calibration interval of the above test instruments is 12 months or 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
 2. The test was performed in 3m Chamber.
 3. The FCC Site Registration No. is 525120; The Designation No. is CN1171.



3.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

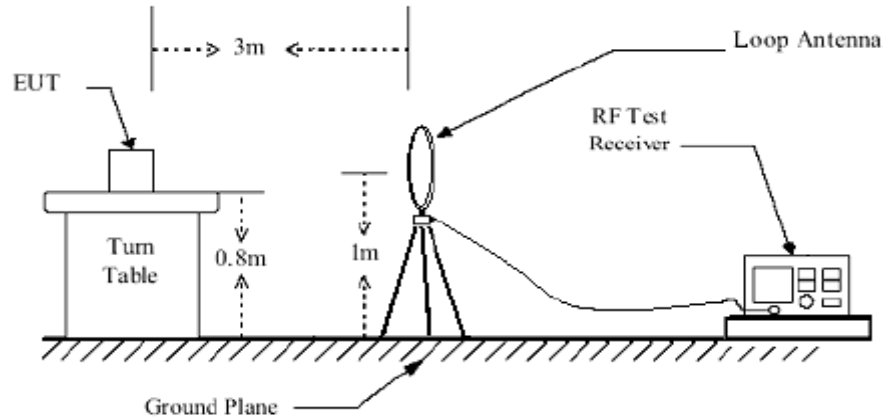
3.1.4 DEVIATION FROM TEST STANDARD

No deviation

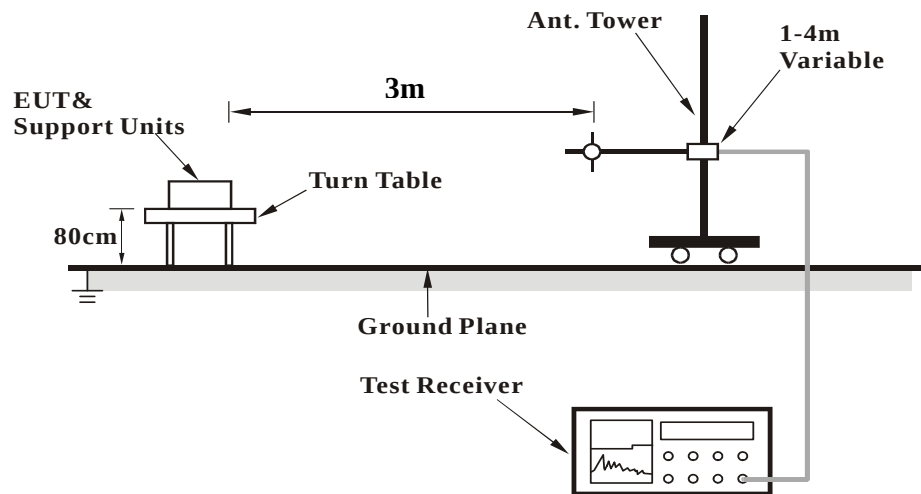


3.1.5 TEST SETUP

< Frequency Range below 30MHz >

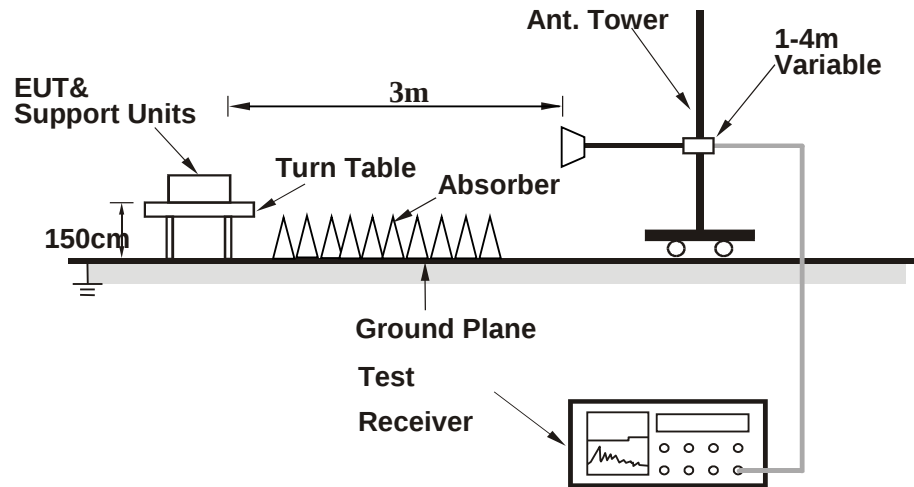


< Frequency Range 30MHz~1GHz >





<Frequency Range above 1GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.1.6 EUT OPERATING CONDITIONS

- Set the EUT under full load condition and placed them on a testing table.
- Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the EUT in full functions.



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3.1.7 TEST RESULTS

FIELD STRENGTH OF THE FUNDAMENTAL

ANTENNA POLARITY & TEST DISTANCE: PEAK AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	POLARIZATI ON
315.18	60.31	80.27	95.62	-35.31	14.3	2.27	36.53	100	0	Horizontal
315.18	62.9	82.86	95.62	-32.72	14.3	2.27	36.53	100	0	Vertical
ANTENNA POLARITY & TEST DISTANCE: AVERAGE AT 3 M										
FREQ. (MHz)	PEAK LEVEL (dBuV/m)	AVERAGE FACTOR	AVERAGE VALUE	LIMIT LINE(dBuV/m)	MARGIN (dB)	POLARIZATION				
315.18	60.31	-14.11	46.2	75.62	-29.42	Horizontal				
315.18	62.9	-14.11	48.79	75.62	-26.83	Vertical				

REMARK:

Average value=Peak value + Duty cycle factor

**BELOW 1GHz WORST-CASE DATA:**

9 KHz – 30 MHz data: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required in the report.

30 MHz – 1GHz data:

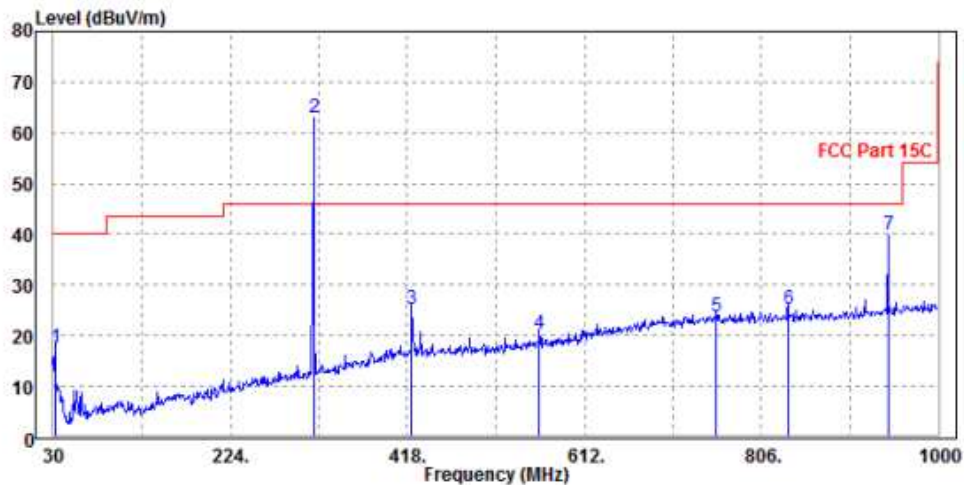
802.11g

CHANNEL	315M	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
31.94	17.73	38.56	40	-22.27	15.91	0.8	37.54	200	154	QP
422.85	25.34	42.1	46	-20.66	17.31	2.7	36.77	100	287	QP
562.53	20.31	35.1	46	-25.69	19.25	3.1	37.14	100	247	QP
756.53	23.62	34.53	46	-22.38	22.87	3.73	37.51	115	156	QP
835.1	25.12	35.66	46	-20.88	23.14	3.94	37.62	100	178	QP
944.71	39.96	49.44	46	-6.04	23.8	4.23	37.51	100	54	QP

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
2. 315MHz: Fundamental frequency.



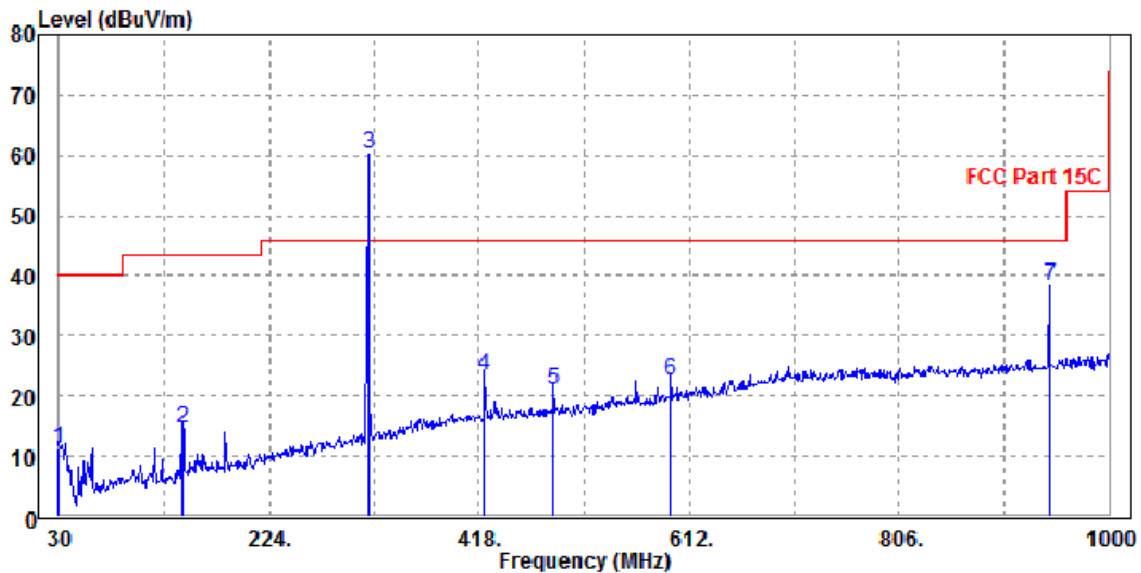


CHANNEL	TX Channel 315	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
30	11.36	31.15	40	-28.64	17	0.77	37.56	200	360	QP
144.46	14.46	40.52	43.5	-29.04	9.2	1.56	36.82	200	306	QP
422.85	23.42	40.18	46	-22.58	17.31	2.7	36.77	100	360	QP
486.87	20.92	37.03	46	-25.08	17.88	2.94	36.93	177	296	QP
594.54	22.44	36.63	46	-23.56	19.89	3.15	37.23	107	274	QP
944.71	38.33	47.81	46	-7.67	23.8	4.23	37.51	104	259	QP

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
2. 315MHz: Fundamental frequency.





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ABOVE 1GHz WORST-CASE DATA:

Note: For higher frequency, the "--" emission is too low to be detected.

ANTENNA POLARITY & TEST DISTANCE: PEAK AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	POLARIZATION
1261	35.21	49.67	74	-38.79	28.91	3.36	46.73	108	0	Horizontal
1575	37.03	50.12	74	-36.97	29.68	3.8	46.57	108	0	Horizontal
1890	39.11	49.54	74	-34.89	31.7	4.29	46.42	108	0	Horizontal
2205	39.47	48.5	74	-34.53	32.65	4.68	46.36	108	0	Horizontal
--										Horizontal
1260	36.52	50.98	74	-37.48	28.91	3.36	46.73	108	360	Vertical
1575	37.26	50.35	74	-36.74	29.68	3.8	46.57	108	360	Vertical
1890	39.17	49.6	74	-34.83	31.7	4.29	46.42	108	360	Vertical
2205	40.66	49.69	74	-33.34	32.65	4.68	46.36	108	360	Vertical
--										Vertical
ANTENNA POLARITY & TEST DISTANCE: AVERAGE AT 3 M										
FREQ. (MHz)	PEAK LEVEL (dBuV/m)	AVERAGE FACTOR	AVERAGE VALUE	LIMIT LINE(dBuV/m)	MARGIN (dB)	POLARIZATION				
1261	35.21	-14.11	21.1	54	-32.9	Horizontal				
1575	37.03	-14.11	22.92	54	-31.08	Horizontal				
1890	39.11	-14.11	25	54	-29	Horizontal				
2205	39.47	-14.11	25.36	54	-28.64	Horizontal				
--						Horizontal				
1260	36.52	-14.11	22.41	54	-31.59	Vertical				
1575	37.26	-14.11	23.15	54	-30.85	Vertical				
1890	39.17	-14.11	25.06	54	-28.94	Vertical				
2205	40.66	-14.11	26.55	54	-27.45	Vertical				
--						Vertical				

REMARKS:

- Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.



3.2 20 dB BANDWIDTH MEASUREMENT

3.2.1 LIMITS OF 20dB BANDWIDTH MEASUREMENT

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

3.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Power Meter	ANRITSU	ML2495A	1506002	Mar. 02,18	Mar. 01,19
EXA Signal Analyzer	KEYSIGHT	N9010A-526	MY54510322	Mar. 16,18	Mar. 15,19
EXA Signal Analyzer	KEYSIGHT	N9010A-544	MY54510355	Mar. 16,18	Mar. 15,19
Power Sensor	ANRITSU	MA2411B	1339352	Mar. 16,18	Mar. 15,19

NOTE:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in RF Oven room.

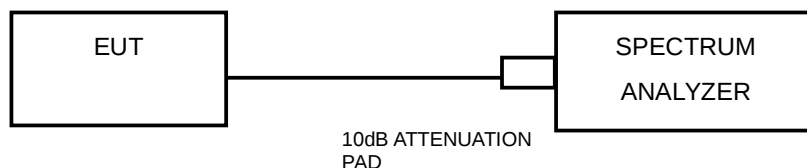
3.2.3 TEST PROCEDURE

1. Set RBW = 1%~5%OBW.
2. Set the video bandwidth (VBW) $\geq$ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

3.2.4 DEVIATION FROM TEST STANDARD

No deviation.

3.2.5 TEST SETUP



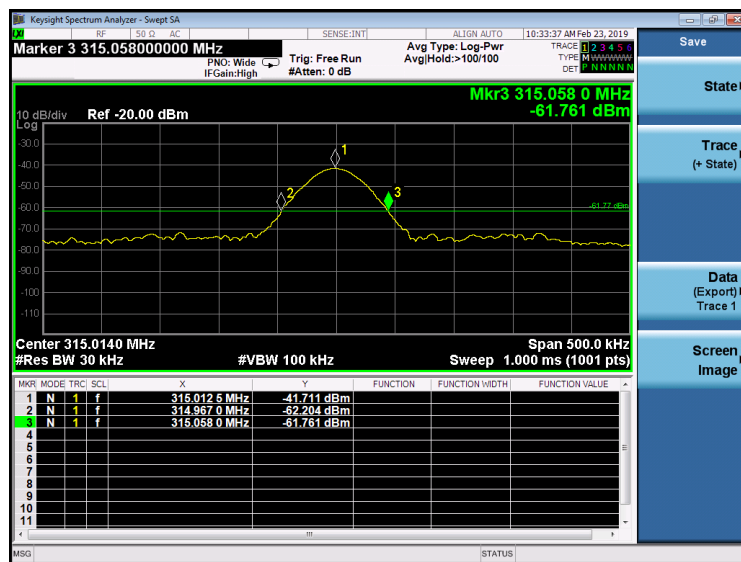
3.2.6 EUT OPERATING CONDITION

Keep the EUT in transmitting mode.

3.2.7 TEST RESULTS

Test Frequency(MHz)	20dB bandwith(MHz)	Limit(MHz)	Result
315	0.091	0.7875	Pass

Note: Limit = Fundamental frequency $\times 0.25\% = 0.7875\text{MHz}$





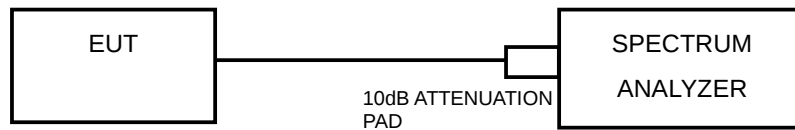
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3.3 DWELL TIME

3.3.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

3.3.2 TEST SETUP



3.3.3 TEST INSTRUMENTS

Refer to section 3.3.2 to get information of above instrument.

3.3.4 TEST PROCEDURE

References ANSI C63.10:213

3.3.5 DEVIATION FROM TEST STANDARD

No deviation.

3.3.6 EUT OPERATING CONDITION

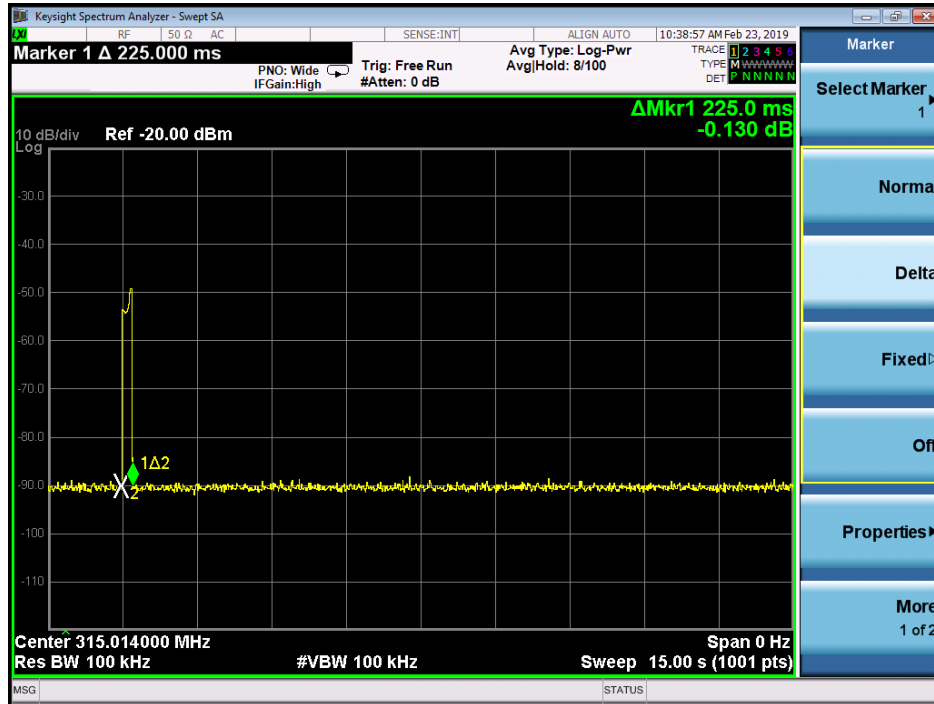
Keep the EUT in transmitting mode.



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3.3.7 TEST RESULTS

Test Frequency(MHz)	Duration of each TX(second)	Limit(second)	Result
315.00	0.225	<5	Pass



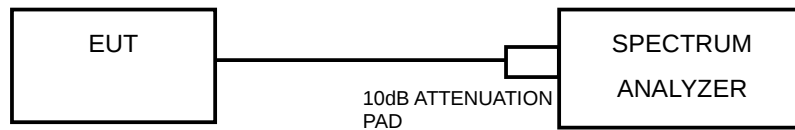


3.4 DUTY CYCLE

3.4.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

No dedicated limit specified in the Rules.

3.4.2 TEST SETUP



3.4.3 TEST INSTRUMENTS

Refer to section 3.3.2 to get information of above instrument.

3.4.4 TEST PROCEDURE

1. Set the span=0Hz
2. Set the RBW = 100 kHz, VBW $\geq 3 \times$ RBW, Detector = peak.
3. Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
4. Place the EUT on the table and set it in transmitting mode.
5. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
6. Set centre frequency of spectrum analyzer=operating frequency.
7. Set the spectrum analyzer as RBW=100kHz,VBW=100kHz,span=0Hz,Adjust Sweep=100ms to obtain the “worst-case” pulse on time
8. Repeat above procedures until all frequency measured was complete.

3.4.5 DEVIATION FROM TEST STANDARD

No deviation.

3.4.6 EUT OPERATING CONDITION

Keep the EUT in transmitting mode.

3.4.7 TEST RESULTS

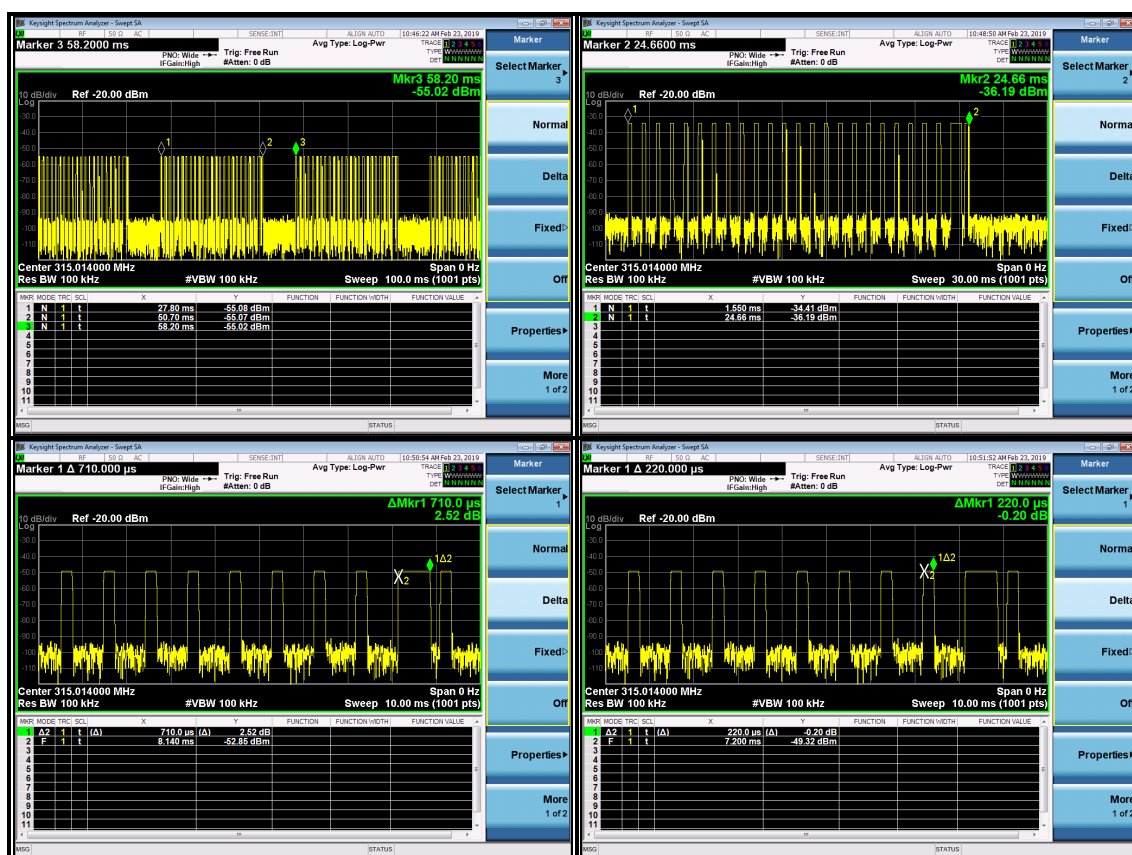
Calculate Formula: Duty cycle factor=20 log(Duty cycle)

Duty cycle=on time/0.1 seconds or period, whichever is less.

Test data: T on time=0.71+0.22x24=5.99ms=0.00599ms

T period=0.0304s

Duty cycle factor =20log(0.00599/0.0304)=-14.11





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VERITAS

4 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



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5 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

---END---