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Test Report No.: RF170607N068



Certificate # 2951.01

## TEST REPORT

Applicant	FUZHOU SWELL ELECTRONIC CO.,LTD
Address	FL. 3RD, BLDG. A1, NO. 56 JINYAN ROAD JINSHAN INDUSTRIAL ZONE, FUZHOU, CHINA.

Manufacturer or Supplier	FUZHOU SWELL ELECTRONIC CO.,LTD
Address	FL. 3RD, BLDG. A1, NO. 56 JINYAN ROAD JINSHAN INDUSTRIAL ZONE, FUZHOU, CHINA.
Product	WIRELESS WEATHER STATION
Brand Name	N/A
Model	S657PC
Additional Model & Model Difference	N/A
Date of tests	Jun. 07, 2017 ~ Jun. 26, 2017

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

FCC Part 15, Subpart C, Section 15.231e (2015-10)

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

Tested by Andy Zhu Project Engineer / EMC Department	Approved by Chris Chen Manager / EMC Department

Date: Jul. 10, 2017

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BUREAU  
VERITAS

Test Report No.: RF170607N068

## TABLE OF CONTENTS

<b>RELEASE CONTROL RECORD.....</b>	<b>4</b>
<b>1 SUMMARY OF TEST RESULTS .....</b>	<b>5</b>
<b>2 MEASUREMENT UNCERTAINTY .....</b>	<b>5</b>
<b>3 GENERAL INFORMATION.....</b>	<b>6</b>
3.1 GENERAL DESCRIPTION OF EUT .....	6
3.2 DESCRIPTION OF TEST MODES .....	7
3.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL.....	7
3.4 GENERAL DESCRIPTION OF APPLIED STANDARDS .....	9
3.5 DESCRIPTION OF SUPPORT UNITS .....	9
<b>4. TEST TYPES AND RESULTS.....</b>	<b>10</b>
4.1 RADIATED EMISSION MEASUREMENT .....	10
4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT.....	10
4.1.2 TEST INSTRUMENTS .....	11
4.1.3 TEST PROCEDURES.....	12
4.1.4 DEVIATION FROM TEST STANDARD .....	12
4.1.5 TEST SETUP .....	13
4.1.6 EUT OPERATING CONDITIONS .....	13
4.1.7 TEST RESULTS.....	14
4.2 20dB BANDWIDTH MEASUREMENT.....	18
4.2.1 LIMITS OF 20dB BANDWIDTH MEASUREMENT .....	18
4.2.2 TEST INSTRUMENTS .....	18
4.2.3 TEST PROCEDURE .....	19
4.2.4 DEVIATION FROM TEST STANDARD .....	19
4.2.5 TEST SETUP .....	19
4.2.6 EUT OPERATING CONDITIONS .....	19
4.2.7 TEST RESULTS.....	20
4.3 DEACTIVATION TIME MEASUREMENT .....	21
4.3.1 LIMITS OF DEACTIVATION TIME MEASUREMENT.....	21



**BUREAU  
VERITAS**

**Test Report No.: RF170607N068**

4.3.2	TEST INSTRUMENTS .....	21
4.3.3	TEST PROCEDURE .....	21
4.3.4	DEVIATION FROM TEST STANDARD.....	22
4.3.5	TEST SETUP .....	22
4.3.6	EUT OPERATING CONDITIONS .....	22
4.3.7	TEST RESULTS.....	23
<b>5</b>	<b>PHOTOGRAPHS OF THE TEST CONFIGURATION .....</b>	<b>24</b>
<b>6</b>	<b>APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB .....</b>	<b>25</b>



**BUREAU  
VERITAS**

**Test Report No.: RF170607N068**

## **RELEASE CONTROL RECORD**

<b>ISSUE NO.</b>	<b>REASON FOR CHANGE</b>	<b>DATE ISSUED</b>
RF170607N068	Original release	Jul. 10, 2017



BUREAU  
VERITAS

Test Report No.: RF170607N068

## 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
§15.203	Antenna Requirement	PASS	No antenna connector is used
§15.207 (a)	AC Power Conducted Emission	N/A	EUT is powered by battery
§15.209 §15.231(e)	Radiated Emission	PASS	Compliant
§15.231 (e)	Deactivation Testing	PASS	Compliant
§15.231(c)	20dB Bandwidth Test	PASS	Compliant

## 2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.67dB
Radiated emissions	9KHz ~ 30MHz	2.74dB
	30MHz ~ 1GHz	4.36dB
	1GHz ~ 18GHz	3.9dB
	18GHz ~ 40GHz	1.94dB

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



BUREAU  
VERITAS

Test Report No.: RF170607N068

### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	WIRELESS WEATHER STATION
MODEL NO.	S657PC
FCC ID	ZJQ-KJHNG
NOMINAL VOLTAGE	DC 3V (1.5V*AAA*2) from Battery
MODULATION TYPE	ASK
OPERATING FREQUENCY	433.92MHz
NUMBER OF CHANNEL	1
ANTENNA TYPE	Spring Antenna
I/O PORTS	Refer to the user's manual

#### NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions, but only the worst case was shown in test report.
3. Please refer to the EUT photo document (Reference No.:170607N068) for detailed product photo.



BUREAU  
VERITAS

Test Report No.: RF170607N068

### 3.2 DESCRIPTION OF TEST MODES

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 plane for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

FREQUENCY	TEST MODES
433.92MHz	Transmitting

### 3.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO						DESCRIPTION
	RE $\geq$ 1G	RE $<$ 1G	PLC	EB	DT	DC	
-	✓	✓	-	✓	✓	✓	DC 3V from New Battery

Where RE  $\geq$  1G: Radiated Emission above 1GHz

RE  $<$  1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

EB: 20dB Bandwidth measurement

DT: Deactivation Time measurement

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

#### POWER LINE CONDUCTED EMISSION TEST:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

#### RADIATED EMISSION TEST:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK



BUREAU  
VERITAS

Test Report No.: RF170607N068

**EMISSION BANDWIDTH MEASUREMENT:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

**DEACTIVATION TIME MEASUREMENT:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE	TESTED BY
RE≥1G	23deg. C, 54%RH	DC 3V from New Battery	Xue Wang
RE<1G	23deg. C, 54%RH	DC 3V from New Battery	Xue Wang
EB	25deg. C, 60%RH	DC 3V from New Battery	Andy
DT	25deg. C, 60%RH	DC 3V from New Battery	Andy



BUREAU  
VERITAS

Test Report No.: RF170607N068

### 3.4 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 15.231e (2015-10)**

**ANSI C63.10-2013**

All test items have been performed and recorded as per the above standards.

### 3.5 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	N/A	N/A	N/A	N/A	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A



BUREAU  
VERITAS

Test Report No.: RF170607N068

## 4. TEST TYPES AND RESULTS

### 4.1 RADIATED EMISSION MEASUREMENT

#### 4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

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

According to §15.231(e), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66–40.70	1,000	100
70–130	500	50
130–174	500 to 1,500 <sup>1</sup>	50 to 150 <sup>1</sup>
174–260	1,500	150
260–470	1,500 to 5,000 <sup>1</sup>	150 to 500 <sup>1</sup>
Above 470	5,000	500

#### NOTE:

- <sup>1</sup> Linear interpolations.
- The lower limit shall apply at the transition frequencies.
- Emission level (dB<sub>V</sub>/m) = 20 log Emission level (uV/m).
- 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.



BUREAU  
VERITAS

Test Report No.: RF170607N068

#### 4.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESU40	100449	Mar. 12,17	Mar. 11,18
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV7	102331	Nov. 04,16	Nov. 03,17
Bilog Antenna (30MHz~1GHz)	Teseq	CBL 6111D	30643	Jul. 14, 16	Jul. 13, 17
Loop antenna (9KHz ~30MHz)	Daze	ZN30900A	0708	Mar. 12,17	Mar. 11,18
Horn Antenna (1GHz -18GHz)	ETS -Lindgren	3117	00062558	May 18,17	May 17,18
GPS Generator+ Antenna	TOJOIN	GNSS-5000A	E1-010119	Aug. 08, 16	Aug. 07, 17
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	NSEMC003	Mar. 12,17	Mar. 11,18
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A
Horn Antenna (18GHz-40GHz)	SCHWARZBEC K	BBHA 9170	BBHA9170242	Mar. 15,17	Mar. 14,18
Amplifier (9kHz-1GHz)	SONOMA	310D	186955	Mar. 04,17	Mar. 03, 18
Broadband Preamplifier (1GHz~18GHz)	SCHWARZBEC K	BBV9718	305	Mar. 09,17	Mar. 08,18
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Nov. 04,16	Nov. 03,17
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A

#### NOTE:

1. The test was performed in 966 Chamber.
2. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to CEPREI/CHINA, GRRGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 502831.



BUREAU  
VERITAS

Test Report No.: RF170607N068

#### 4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber. 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. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

#### NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. Fundamental AV value =PK Emission +20\*log(duty cycle)
4. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation

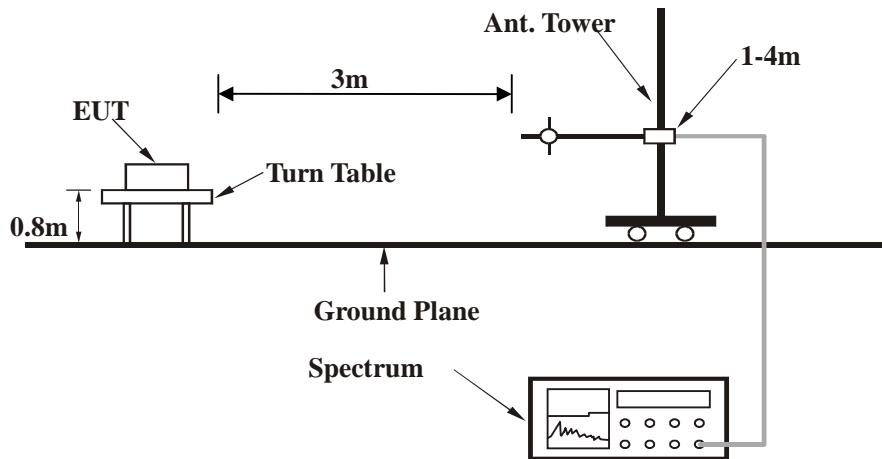


BUREAU  
VERITAS

Test Report No.: RF170607N068

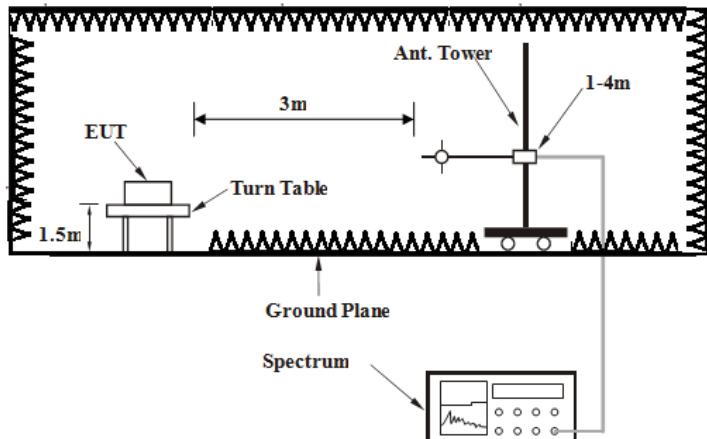
#### 4.1.5 TEST SETUP

##### Below 1GHz test setup



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

##### Above 1GHz test setup



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

#### 4.1.6 EUT OPERATING CONDITIONS

- Turned on the power of all equipment.
- EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.



BUREAU  
VERITAS

Test Report No.: RF170607N068

#### 4.1.7 TEST RESULTS

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	30.00 PK	-11.27	29.18	17.91	40.00	-22.09	350	0
2	359.80 PK	-10.25	35.04	24.79	46.00	-21.21	200	270
3	*433.92 PK	-7.56	85.75	78.19	92.87	-14.68	100	58
4	*433.92 AV	-	-	65.78	72.87	-7.09	-	-
5	765.81 PK	-0.61	29.79	29.18	46.00	-16.82	100	27
6	#867.84 PK	1.35	47.37	48.72	72.87	-24.15	180	90
7	#867.84 AV	-	-	36.31	52.87	-16.56	-	-
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	30.00 PK	-11.27	37.12	25.85	40.00	-14.15	350	110
2	35.54 PK	-14.04	40.27	26.23	40.00	-13.77	200	0
3	*433.92 PK	-7.56	90.62	83.06	92.87	-9.81	100	312
4	*433.92 AV	-	-	70.65	72.87	-2.22	-	-
5	460.96 PK	-7.23	44.72	37.49	46.00	-8.51	100	334
6	#867.84 PK	1.35	50.48	51.83	72.87	-21.04	100	0
7	#867.84 AV	-	-	39.42	52.87	-13.45	-	-

##### NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.
6. " # ": Harmonic frequency
7. Fundamental AV value =PK Emission +20\*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20 log (23.97%) = -12.41dB, Please see page 16~17 for plotted duty.
8. The emission levels of other frequencies were less than 20dB margin against the limit.



BUREAU  
VERITAS

Test Report No.: RF170607N068

ABOVE 1GHz WORST-CASE DATA:

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	#1301.76PK	-3.63	52.88	49.25	74.00	-24.75	150	18
2	#1301.76AV	-	-	36.84	54.00	-17.16	-	-
3	#1735.68PK	-0.68	43.94	43.26	72.87	-29.61	150	40
4	#1735.68AV	-	-	30.85	52.87	-22.02	-	-

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	#1301.76PK	-3.63	58.84	55.21	74.00	-18.79	150	214
2	#1301.76AV	-	-	42.80	54.00	-11.20	-	-
3	#1735.68PK	-0.68	50.23	49.55	72.87	-23.32	160	0
4	#1735.68AV	-	-	37.14	52.87	-15.73	-	-

NOTE:

- 1 The resolution bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection (PK) at frequency above 1GHz.
- 2 Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
- 3 Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
- 4 Margin value = Emission level – Limit value.
- 5 " # ": Harmonic frequency
- 6 Fundamental AV value =PK Emission +20\*log(duty cycle)Where the duty factor is calculated from following formula:20 log (Duty cycle) = 20 log (23.97%) = -12.41dB, Please see page 16~17 for plotted duty.



BUREAU  
VERITAS

Test Report No.: RF170607N068

### Duty Cycle:

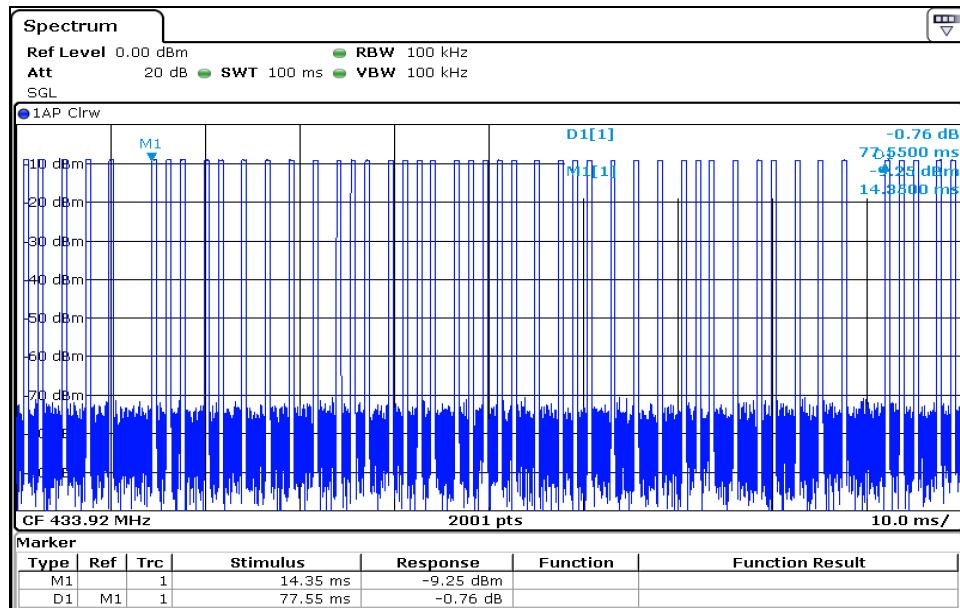
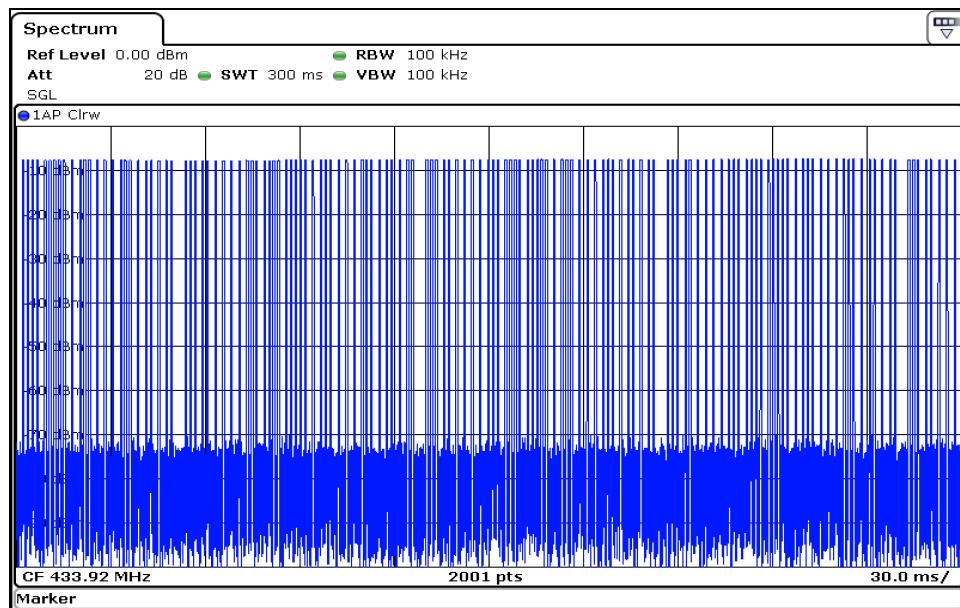
$$Tp = 77.55\text{ms}$$

$$Ton = Ton1 * Number = 0.502333 * 37 = 18.586321\text{ms}$$

$$\text{Duty Cycle} = Ton / Tp * 100\% = 18.586321 / 77.55 * 100\% = 23.97\%$$

$$\text{Factor} = 20\text{Log}(\text{Duty Cycle}) = 20\text{Log}(23.97\%) = -12.41\text{dB}$$

*Tp*

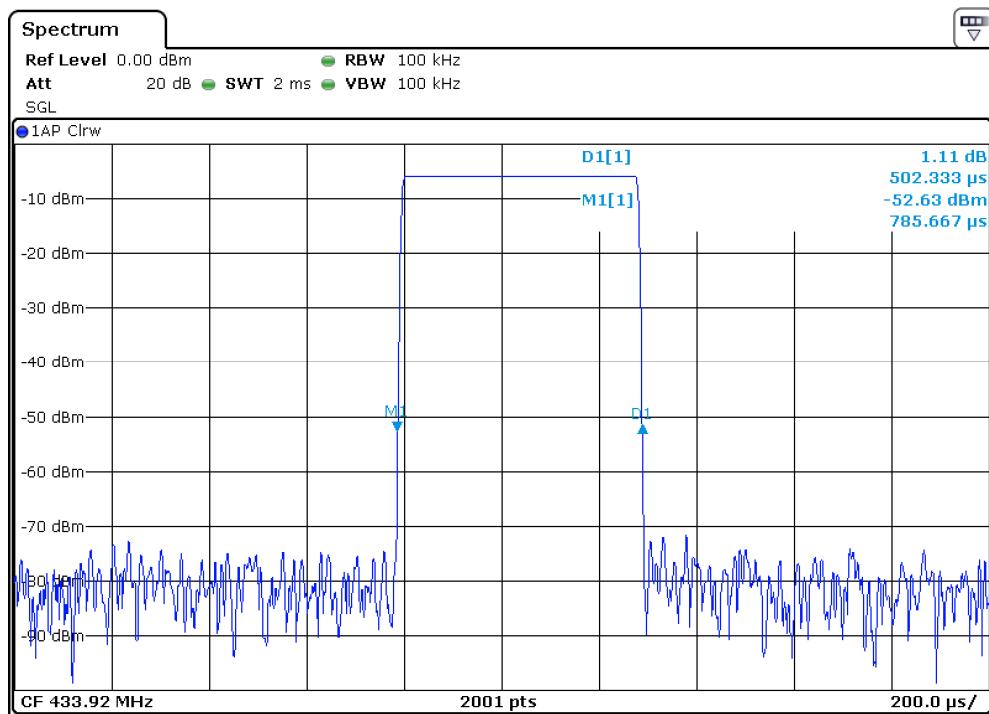




BUREAU  
VERITAS

Test Report No.: RF170607N068

Ton= Ton \* Number =0.502333\*37 = 18.586321ms





BUREAU  
VERITAS

Test Report No.: RF170607N068

## 4.2 20dB BANDWIDTH MEASUREMENT

### 4.2.1 LIMITS OF 20dB BANDWIDTH MEASUREMENT

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

$$\text{Limit} = \text{Fundamental Frequency} \times 0.25\% = 433.92 \text{ MHz} \times 0.25\% = 1084.8 \text{ kHz}$$

### 4.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Power Sensor	Keysight	U2021XA	MY55060016	May 04,17	May 03,18
Power Sensor	Keysight	U2021XA	MY55060018	May 04,17	May 03,18
Digital Multimeter	FLUKE	15B	A1220010DG	Oct. 13, 16	Oct.12, 17
Humid & Temp Programmable Tester	Haida	HD-2257	110807201	Sep.05,16	Sep. 04,17
Oscilloscope	Agilent	DSO9254A	MY51260160	Nov. 04,16	Nov. 03,17
Signal Analyzer	Rohde & Schwarz	FSV7	102331	Nov. 04,16	Nov. 03,17
Signal Generator	Agilent	N5183A	MY50140980	Nov. 04,16	Nov. 03,17
Agile Signal Generator	Agilent	8645A	Agilent	Aug.08, 16	Aug.07, 17
Spectrum Analyzer	Keysight	N9020A	MY55400499	Apr. 05,17	Apr. 04,18
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY56200288	Dec.05, 16	Dec. 04, 17
Attenuator	MINI	BW-S10W2+	S130129FGE2	N/A	N/A

**NOTE:** 1. The test was performed in RF Oven room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRT/CHINA and NIM/CHINA.



BUREAU  
VERITAS

Test Report No.: RF170607N068

#### 4.2.3 TEST PROCEDURE

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set the frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.

#### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.2.5 TEST SETUP



#### 4.2.6 EUT OPERATING CONDITIONS

- a. Placed the EUT on the testing table.
- b. Enable EUT under transmission condition continuously at specific channel frequency.



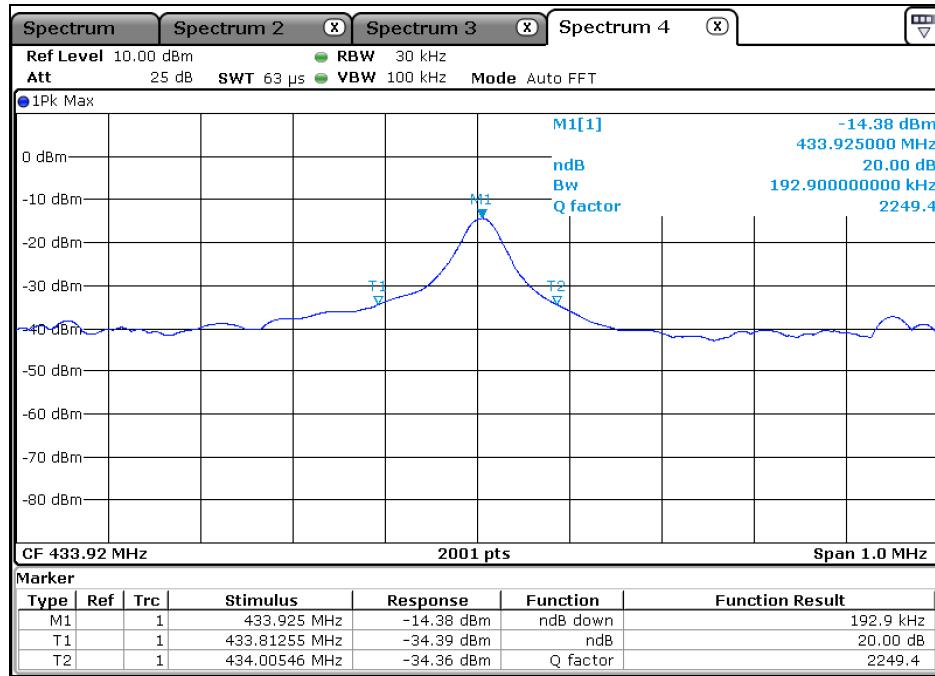
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Test Report No.: RF170607N068

#### 4.2.7 TEST RESULTS

FREQUENCY (MHz)	20dB BANDWIDTH (kHz)	MAXIMUM LIMIT (kHz)	PASS/FAIL
433.92	192.9	1084.8	PASS

#### Test Data:





BUREAU  
VERITAS

Test Report No.: RF170607N068

### 4.3 DEACTIVATION TIME MEASUREMENT

#### 4.3.1 LIMITS OF DEACTIVATION TIME MEASUREMENT

According to FCC 15.231(e), In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

#### 4.3.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Power Sensor	Keysight	U2021XA	MY55060016	May 04,17	May 03,18
Power Sensor	Keysight	U2021XA	MY55060018	May 04,17	May 03,18
Digital Multimeter	FLUKE	15B	A1220010DG	Oct. 13, 16	Oct.12, 17
Humid & Temp Programmable Tester	Haida	HD-2257	110807201	Sep.05,16	Sep. 04,17
Oscilloscope	Agilent	DSO9254A	MY51260160	Nov. 04,16	Nov. 03,17
Signal Analyzer	Rohde & Schwarz	FSV7	102331	Nov. 04,16	Nov. 03,17
Signal Generator	Agilent	N5183A	MY50140980	Nov. 04,16	Nov. 03,17
Agile Signal Generator	Agilent	8645A	Agilent	Aug.08, 16	Aug.07, 17
Spectrum Analyzer	Keysight	N9020A	MY55400499	Apr. 05,17	Apr. 04,18
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY56200288	Dec.05, 16	Dec. 04, 17
Attenuator	MINI	BW-S10W2+	S130129FGE2	N/A	N/A

**NOTE:**

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

#### 4.3.3 TEST PROCEDURE

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency, then set the spectrum analyzer to Zero Span for the release time reading. During the testing, the transmission duration was measured and recorded.



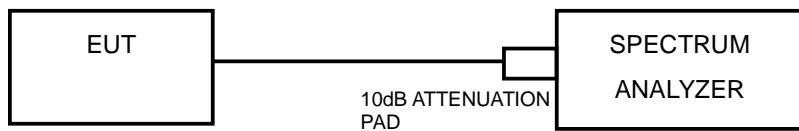
BUREAU  
VERITAS

Test Report No.: RF170607N068

#### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.3.5 TEST SETUP



#### 4.3.6 EUT OPERATING CONDITIONS

- Placed the EUT on the testing table.
- With the EUT's antenna attached, which was connected to the spectrum analyzer set to the EUT's operation frequencies.

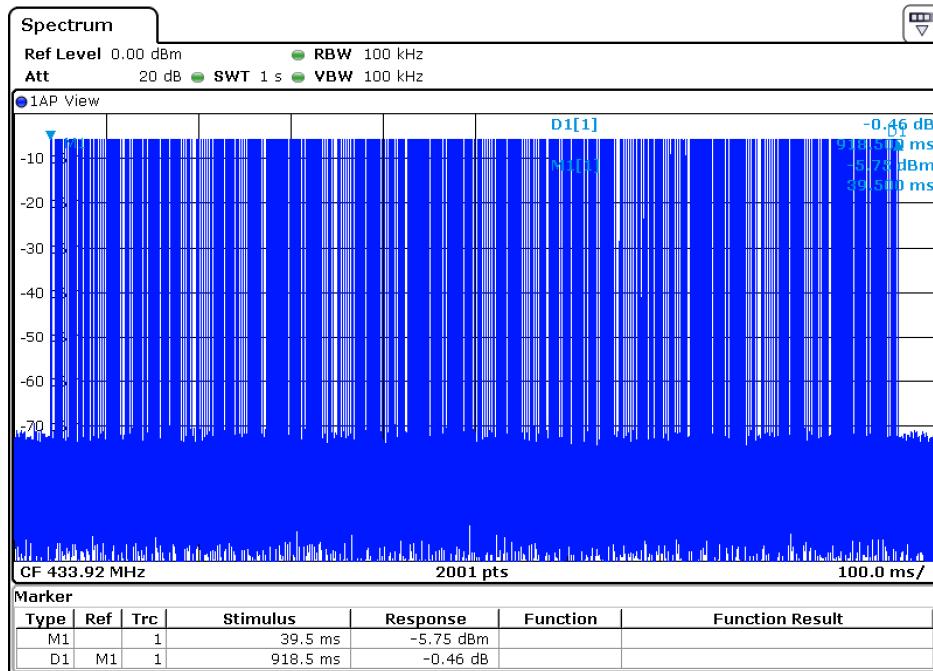


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VERITAS

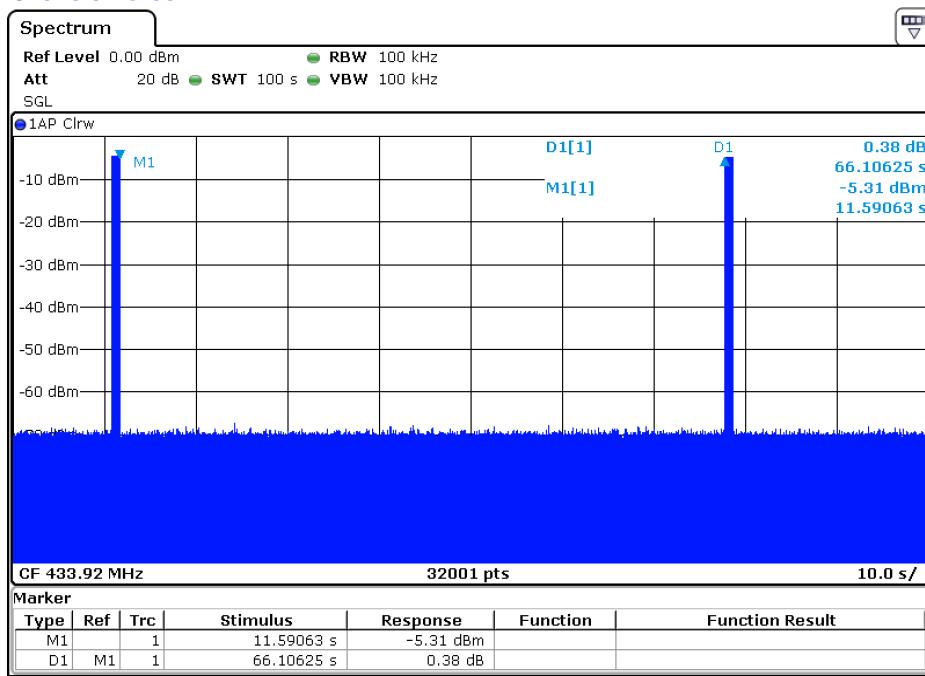
Test Report No.: RF170607N068

#### 4.3.7 TEST RESULTS

**Test Data:** Duration=918.5ms<1 second



10s<66.1s>918.5ms\*30





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VERITAS**

**Test Report No.: RF170607N068**

## **5 PHOTOGRAHPS OF THE TEST CONFIGURATION**

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



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VERITAS**

**Test Report No.: RF170607N068**

## **6 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---**