



## FCC Test Report

Report No: FCS202212149W01

Issued for

Applicant:	GUANGDONG SHUNDE OURED TECHNOLOGY CO.,LTD
Address:	Gongye 4th Rd, Leliu, Shunde, FOSHAN Guangdong
Product Name:	power inverter
Brand Name:	GIANDEL
Model Name:	PM-2000KCR
Series Model:	N/A
FCC ID:	2A9W8-PM-2000KCR
Issued By: Flux Compliance Service Laboratory Add: Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan Tel: 769-27280901 Fax:769-27280901 <a href="http://www.FCS-lab.com">http://www.FCS-lab.com</a>	

## TEST RESULT CERTIFICATION

Applicant's Name.....: GUANGDONG SHUNDE OURED TECHNOLOGY CO.,LTD  
Address.....: Gongye 4th Rd, Leliu, Shunde, FOSHAN Guangdong  
Manufacture's Name.....: GUANGDONG SHUNDE OURED TECHNOLOGY CO.,LTD  
Address.....: Gongye 4th Rd, Leliu, Shunde, FOSHAN Guangdong

### Product Description

Product Name.....: power inverter  
Brand Name .....: GIANDEL  
Model Name.....: PM-2000KCR  
Series Model.....: N/A  
Test Standards.....: FCC Rules and Regulations Part 15 Subpart C, Section 231  
Test Procedure.....: ANSI C63.10:2013

This device described above has been tested FCS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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### Date of Test.....:

Date (s) of performance of tests.: Dec 22, 2022 ~ Dec 30, 2022

Date of Issue.....: Dec 30, 2022

Test Result.....: Pass

Tested by : Scott Shen

(Scott Shen)

Reviewed by : Duke Qian

(Duke Qian)

Approved by : Jack Wang

(Jack Wang)

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Revision History

Rev.	Issue Date	Effect Page	Contents
00	Dec 30, 2022	All	Initial Issue

## 1. SUMMARY OF TEST RESULTS

<b>FCC Part 15.231,Subpart C</b>			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	--
15.209, 15.231(b)	Radiated Emission	PASS	--
15.231(a) (1)	Transmitter time	PASS	--
15.231(c)	20dB Bandwidth	PASS	
15.231	Duty cycle	PASS	--
15.203	Antenna Requirement	PASS	--

### NOTE:

- (1)" N/A" denotes test is not applicable in this Test Report
- (2) All tests are according to ANSI C63.10-2013

## 1.1 TEST FACTORY

Company Name:	Flux Compliance Service Laboratory
Address:	Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan
Telephone:	+86-769-27280901
Fax:	+86-769-27280901
FCC Test Firm Registration Number: 514908 Designation number: CN0127 A2LA accreditation number: 5545.01	

## 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately **95 %**.

No.	Item	Uncertainty
1	RF output power, conducted	$\pm 0.71$ dB
2	Unwanted Emissions, conducted	$\pm 2.98$ dB
3	Conducted Emission (9KHz-150KHz)	$\pm 4.13$ dB
4	Conducted Emission (150KHz-30MHz)	$\pm 4.74$ dB
5	All emissions, radiated(<1G) 30MHz-1000MHz	$\pm 3.2$ dB
6	All emissions, radiated (1GHz -18GHz)	$\pm 3.66$ dB
7	All emissions, radiated (18GHz -40GHz)	$\pm 4.31$ dB

## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	power inverter
Trade Name	GIANDEL
Model Name	PM-2000KCR
Series Model	N/A
Model Difference	N/A
Frequency	433.92MHZ
Modulation	ASK
Antenna type	PCB antenna
Power Supply	DC 3V
Hardware version number	V1.0
Software version number	V1.0
Connecting I/O Port(s)	Please 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. Table for Filed Antenna

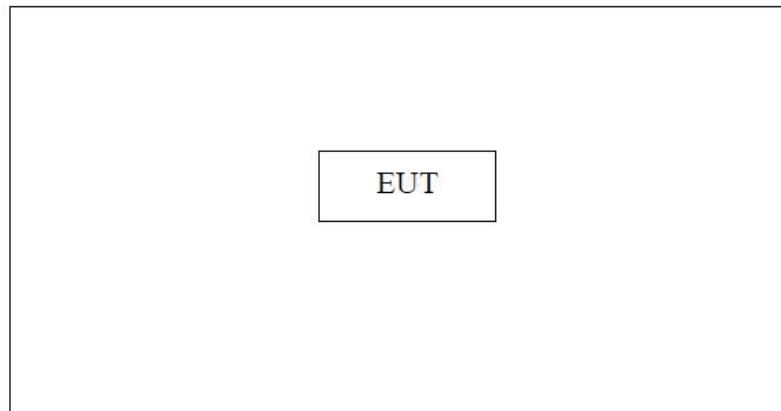
Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	RC6621A	PCB Antenna	N/A	1.0dBi	Antenna

### 2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

This sample triggers the emission frequency via the remote control.

## Configuration and peripherals



### Test environment conditions

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

Temperature range: 21-25°C

Humidity range: 40-75%

Pressure range: 86-106kPa

### 2.3 DESCRIPTION OF NECESSARY ACCESSORIES AND 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.

#### Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

#### Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

#### Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) "YES" is means "shielded" "with core"; "NO" is means "unshielded" "without core".
- (4) It uses new battery during testing.

## 2.4 EQUIPMENTS LIST

### Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESRP 3	FCS-E001	2022.01.28	2023.01.27
Signal Analyzer	R&S	FSV40-N	FCS-E012	2022.01.28	2023.01.27
Active loop Antenna	ZHINAN	ZN30900C	FCS-E013	2022.01.28	2023.01.27
Bilog Antenna	SCHWARZBECK	VULB 9168	FCS-E002	2022.01.28	2023.01.27
Horn Antenna	SCHWARZBECK	BBHA 9120D	FCS-E003	2022.03.17	2023.03.16
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	FCS-E018	2022.01.28	2023.01.27
Pre-Amplifier(0.1M-3G Hz)	EMCI	EM330N	FCS-E004	2022.01.28	2023.01.27
Pre-Amplifier (1G-18GHz)	N/A	TSAMP-0518SE	FCS-E014	2022.01.28	2023.01.27
Pre-Amplifier (18G-40GHz)	TERA-MW	TRLA-0400	FCS-E019	2022.01.28	2023.01.27
Temperature & Humidity	HTC-1	victor	FCS-E005	2022.01.28	2023.01.27

### Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESPI	FCS-E020	2022.01.28	2023.01.27
LISN	R&S	ENV216	FCS-E007	2022.01.28	2023.01.27
LISN	ETS	3810/2NM	FCS-E009	2022.01.28	2023.01.27
Temperature & Humidity	HTC-1	victor	FCS-E008	2022.01.28	2023.01.27

### RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
Spectrum Analyzer	Keysight	N9020A	FCS-E015	2022.01.28	2023.01.27
Spectrum Analyzer	Agilent	E4447A	MY50180039	2022.01.28	2023.01.27
Spectrum Analyzer	R&S	FSV-40	101499	2022.01.28	2023.01.27

### 3. RADIATED EMISSION MEASUREMENT

#### 3.1 LIMIT

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed

#### LIMITS OF RADIATED EMISSION MEASUREMENT (0.009mhz - 1000mhz)

Frequencies (MHz)	Field Strength (micorvolts/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

#### LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

#### LIMITS OF FIELD STRENGTH OF THE FUNDAMENTAL SIGNAL

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
433.92	100.83	80.83

Note: (1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector

(2) At frequencies below 30MHz, measurement may be performed at a distance closer than that specified, and the limit at closer measurement distance can be extrapolated by below formula:  
Limit3m(dBuV/m)= Limit300m(dBuV/m) + 40Log(300m/3m) = Limit300m(dBuV/m) + 80  
Limit3m(dBuV/m)= Limit30m(dBuV/m) + 40Log(30m/3m) = Limit30m(dBuV/m) + 40

#### (3) Limit for this EUT

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions include fundamental emission shall not exceed FCC 15.231 section (b) limit of comply with FCC 15.209 limit which permit higher emission level.

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

### 3.2 TEST PROCEDURE

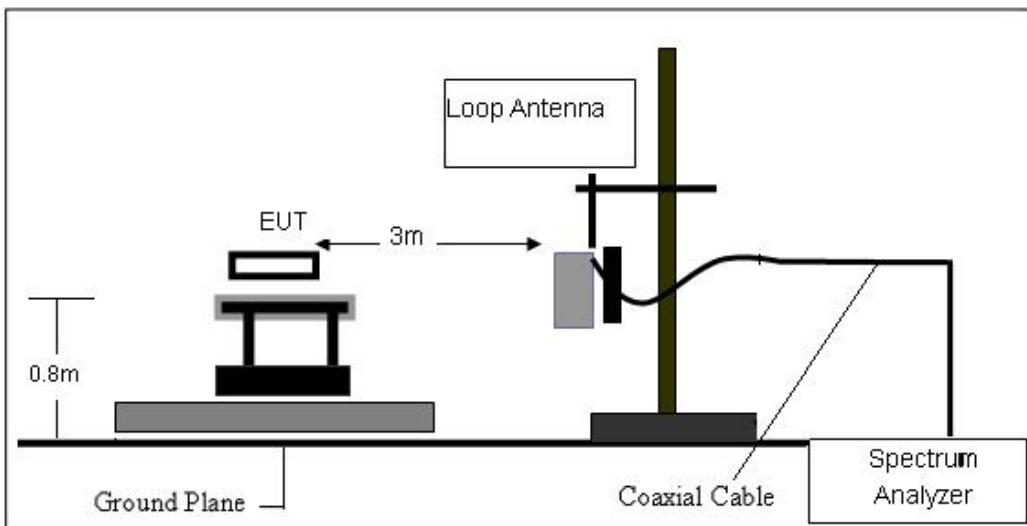
- a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- b. The EUT was placed on the top of a rotating table 0.8 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then QuasiPeak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

**Note:**

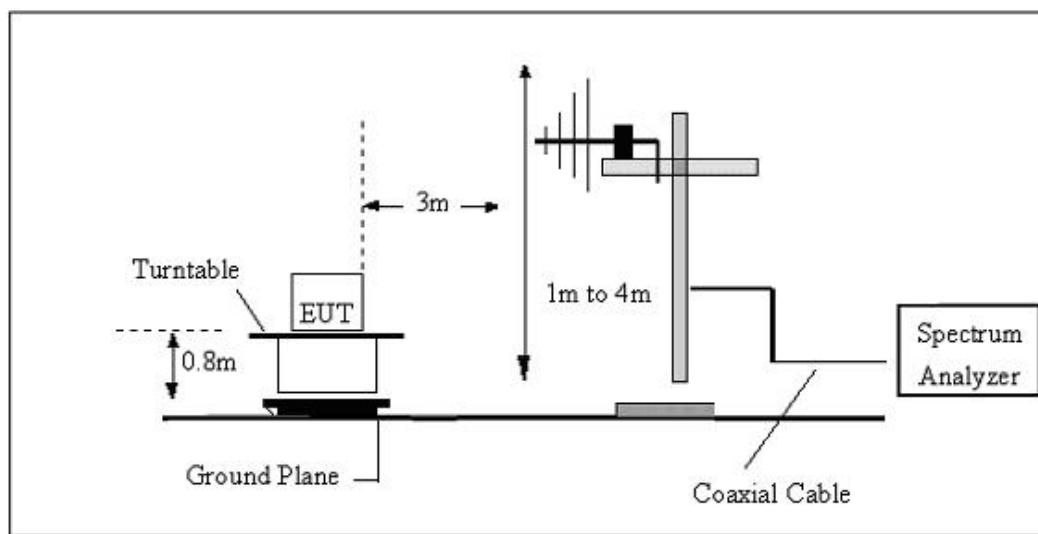
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

### 3.3 TEST SETUP

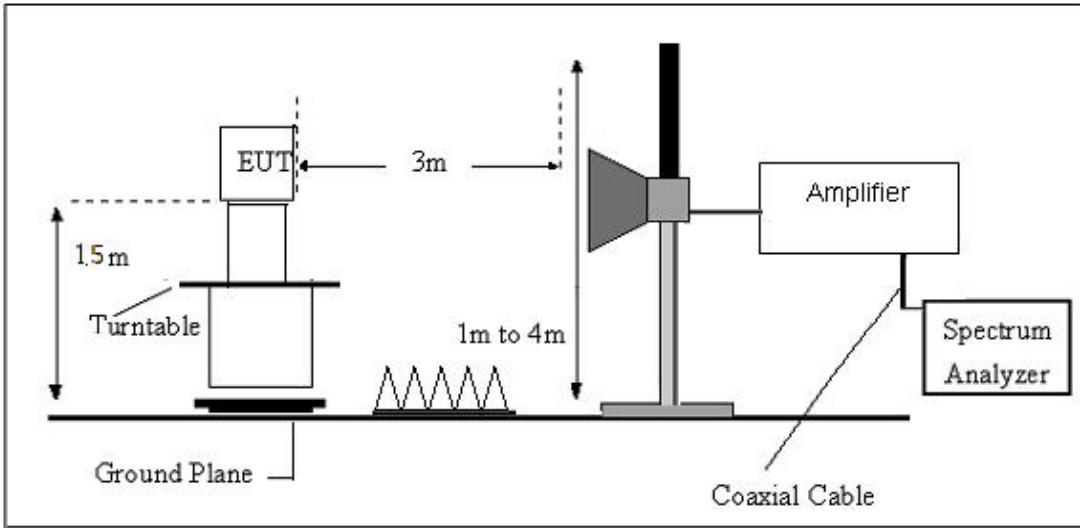
#### (A) Radiated Emission Test-Up Frequency Below 30MHz



#### (B) Radiated Emission Test-Up Frequency 30MHz~1GHz



#### (C) Radiated Emission Test-Up Frequency Above 1GHz



### 3.4 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Mode:	ASK	Test Voltage:	DC 3V

For field strength of the fundamental signal

#### Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over limit (dB)	polarization
433.92	87.21	17.53	3.02	29.43	78.33	100.83	-22.50	Horizontal
433.92	90.12	17.53	3.02	29.43	81.24	100.83	-19.59	Vertical

#### Average value:

Frequency (MHz)	Peak Value (dBuV/m)	factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
433.92	78.33	-14.61	63.72	80.83	-17.11	Horizontal
433.92	81.24	-14.61	66.63	80.83	-14.20	Vertical

#### Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. Average value = Peak value + Duty cycle factor

For spurious emission

#### (9KHz-30MHz)

Freq. (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	State P/F	Test Result
--	--	--	--	--	PASS
--	--	--	--	--	PASS

#### Note:

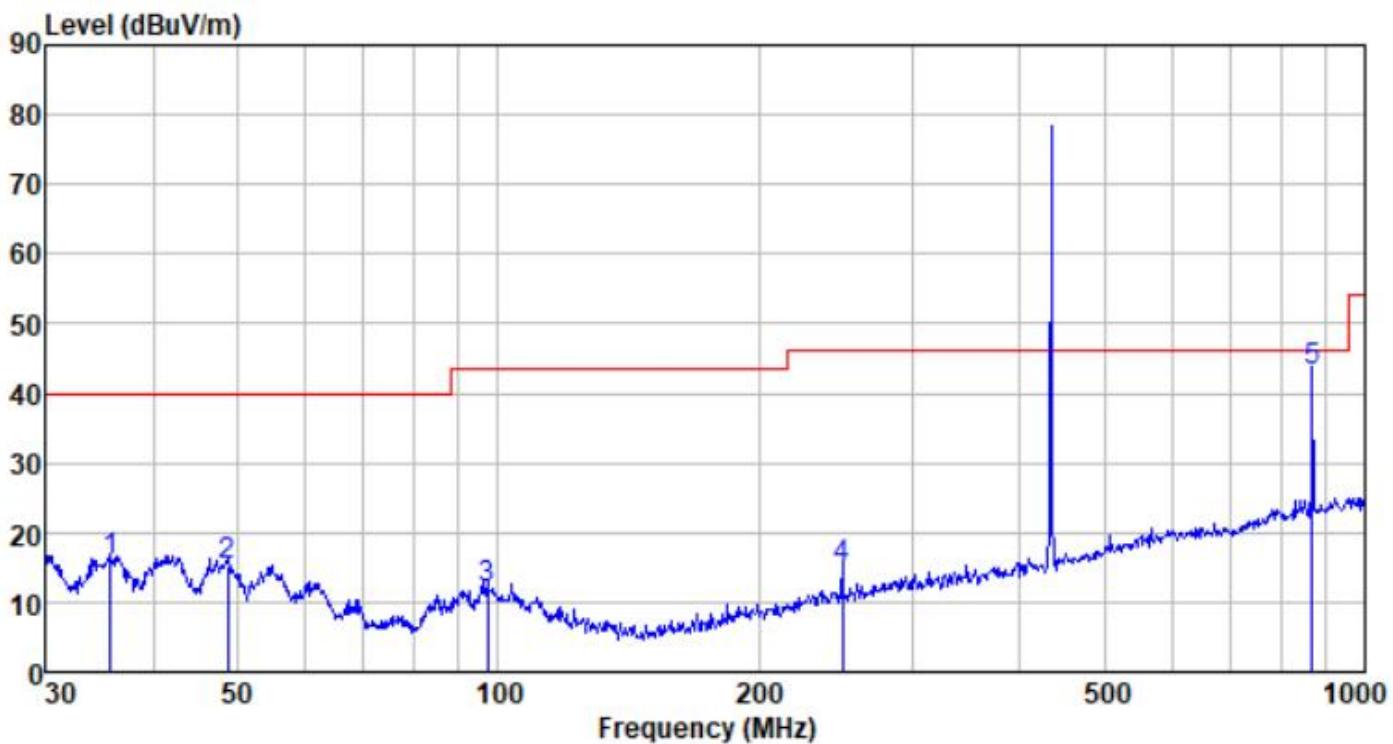
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance}/\text{test distance})$  (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

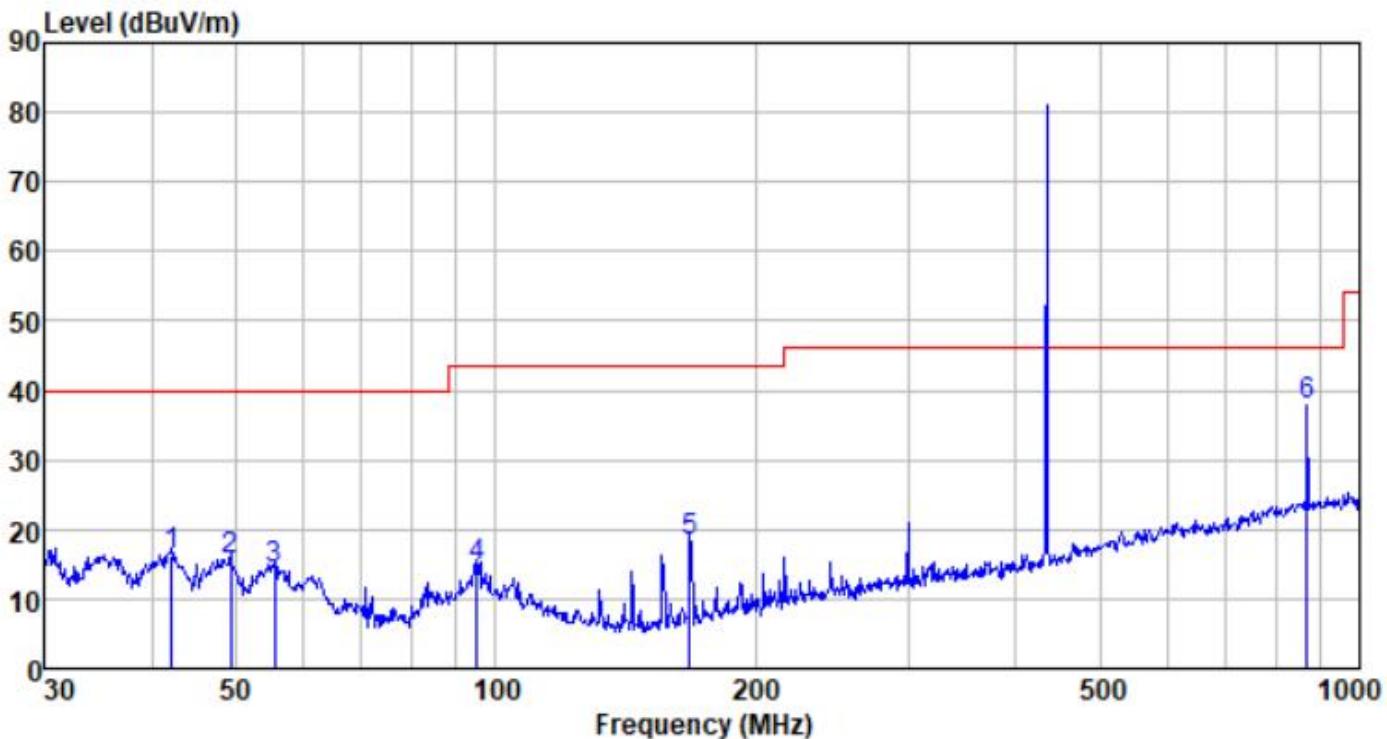
(30MHZ-1000MHZ)

Temperature:	23.7°C	Relative Humidity:	61%
Test Voltage:	DC 3V	Phase:	Horizontal
Test Mode:	ASK		



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
35.749	39.26	11.46	0.62	35.41	15.93	40.00	-24.07	QP
48.672	38.40	12.29	0.76	36.12	15.33	40.00	-24.67	QP
97.115	35.67	11.79	1.17	36.70	11.93	43.50	-31.57	QP
249.425	38.00	12.15	2.12	37.38	14.89	46.00	-31.11	QP
869.130	54.11	22.02	4.74	37.61	43.26	46.00	-2.74	QP

Temperature:	22.7°C	Relative Humidity:	61%
Test Voltage:	DC 3V	Phase:	Vertical
Test Mode:	ASK		



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
42.154	39.00	12.22	0.69	35.79	16.12	40.00	-23.88	QP
49.359	38.57	12.29	0.77	36.15	15.48	40.00	-24.52	QP
55.415	38.11	11.75	0.82	36.26	14.42	40.00	-25.58	QP
95.093	38.62	11.52	1.15	36.68	14.61	43.50	-28.89	QP
167.824	45.28	8.46	1.67	37.18	18.23	43.50	-25.27	QP
869.130	48.73	22.02	4.74	37.61	37.88	46.00	-8.12	QP

(ABOVE ~ 1GHZ)

**Peak value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1735.68	53.62	25.05	4.82	34.00	49.49	74.00	-24.51	Vertical
2169.60	40.11	27.74	5.15	34.27	38.73	80.83	-42.10	Vertical
2603.52	40.86	27.82	5.58	33.78	40.48	80.83	-40.35	Vertical
1735.68	50.33	25.05	4.82	34.00	46.20	74.00	-27.80	Horizontal
2169.60	41.55	27.74	5.15	34.27	40.17	80.83	-40.66	Horizontal
2603.52	41.71	27.82	5.58	33.78	41.33	80.83	-39.50	Horizontal

**Average value:**

Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1735.68	49.49	-14.61	34.88	54.00	-19.12	Vertical
2169.60	38.73	-14.61	24.12	60.83	-36.71	Vertical
2603.52	40.48	-14.61	25.87	60.83	-34.96	Vertical
1735.68	46.20	-14.61	31.59	54.00	-22.41	Horizontal
2169.60	40.17	-14.61	25.56	60.83	-35.27	Horizontal
2603.52	41.33	-14.61	26.72	60.83	-34.11	Horizontal

**Remarks:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. Average value=Peak value + Duty cycle factor

## 4. TRANSMITTER TIME

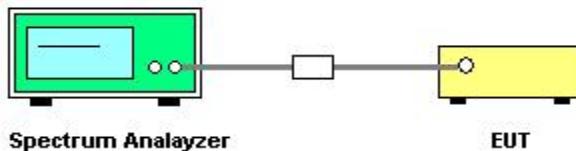
### 4.1 LIMIT

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

### 4.2 TEST PROCEDURE

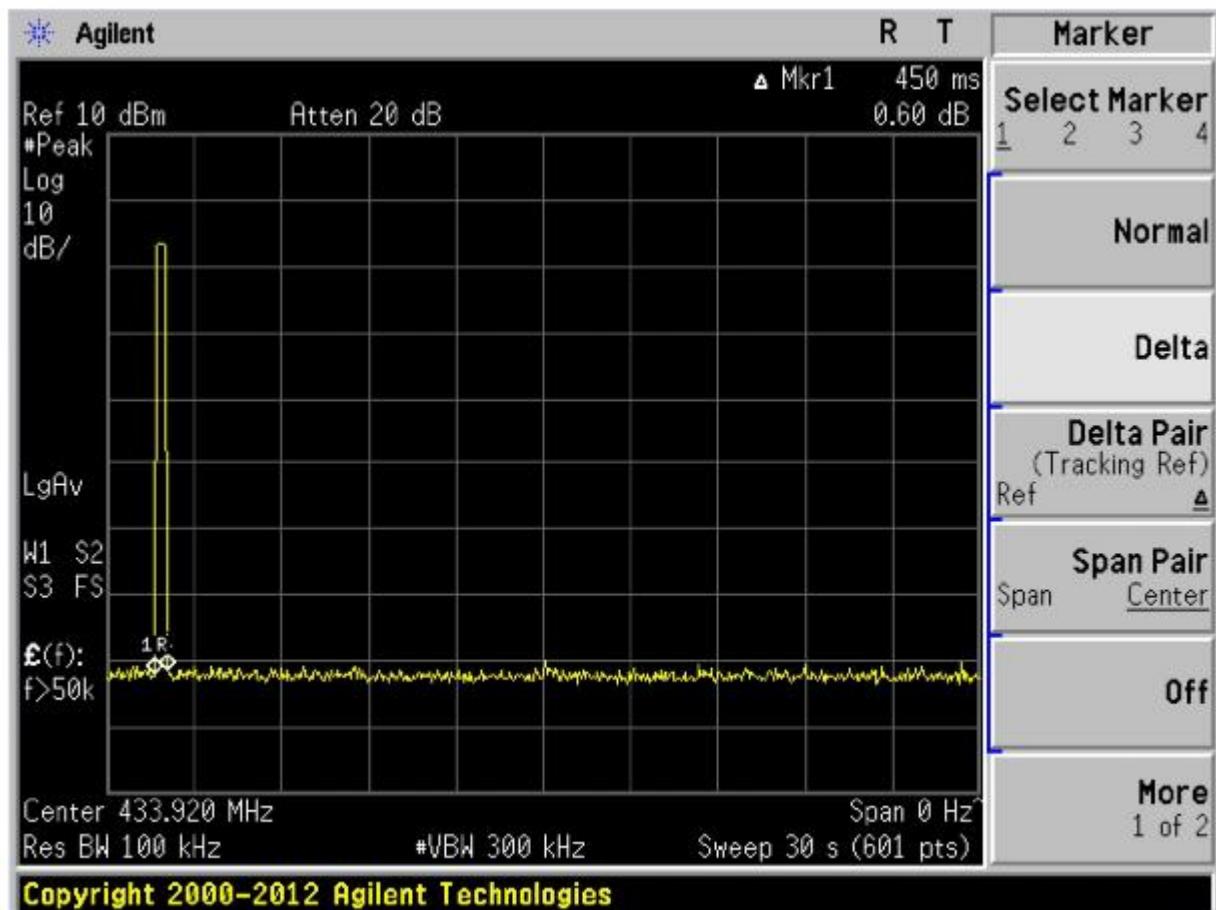
- a. The EUT's RF signal was coupled to spectrum analyzer by antenna connected to spectrum analyzer.
- b. Set the spectrum to zero span mode, and centered of EUT frequency.
- c. Measure the stop transmitting time after release EUT button

### 4.3 TEST SETUP



### 4.4 TEST RESULTS

Frequency(MHz)	Limit	Result
433.92	$\leq 5s$	Pass



## 5. 20 DB BANDWIDTH TEST

### 5.1 LIMIT

The bandwidth of the emission shall be no wider than 0.25% of the center frequency of devices operation above 70MHz and below 900MHz.

### 5.2 TEST PROCEDURE

Connect EUT' s antenna output to spectrum analyzer by RF cable.

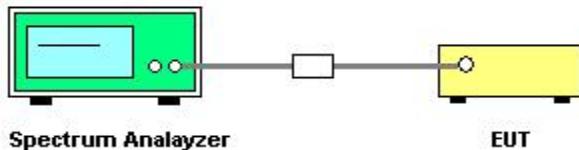
a.

The bandwidth of the fundamental frequency was measured by spectrum analyzer with

300Hz RBW and 1kHz VBW. The 20dB bandwidth is defined as the total spectrum the

b. power of which is higher than peak power minus 20dB

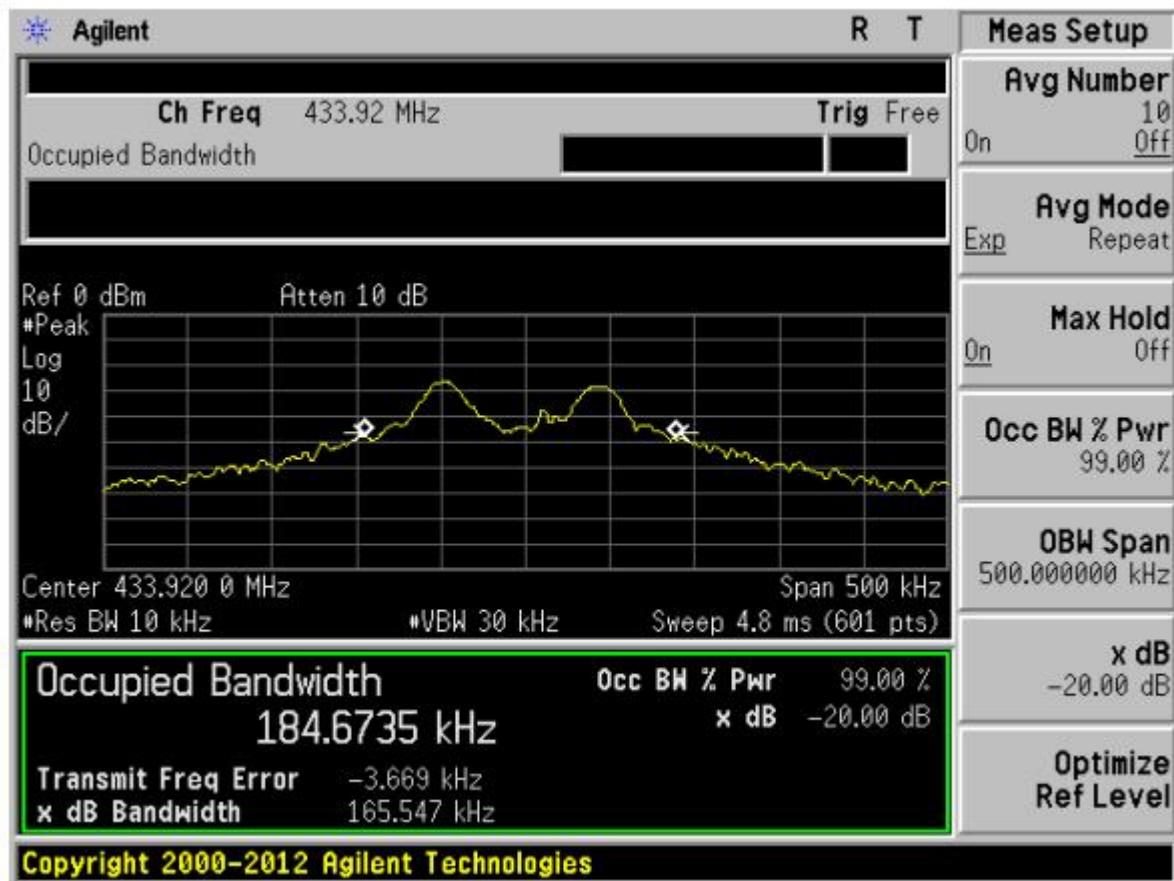
### 5.3 TEST SETUP



## 5.4 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	ASK	Test Voltage:	DC 3V

Frequency	20dB Bandwidth (KHz)	Result
433.92 MHz	165.547	PASS



## 6. DUTY CYCLE

### 6.1 LIMIT

None: for reporting purposes only.

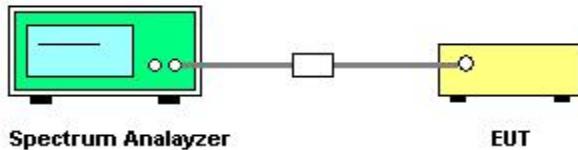
### 6.2 TEST PROCEDURE

Set the Centre frequency of the spectrum analyzer to the transmitting frequency;

- a. Set the span=0MHz, RBW=100KHz, VBW=300KHz, Sweep time=100ms;

Trace mode = Single hold

### 6.3 TEST SETUP



## 6.4 TEST RESULTS

Frequency	Duty Cycle
433.92 MHz	18.59%

The duty cycle is simply the on time divided by the period:

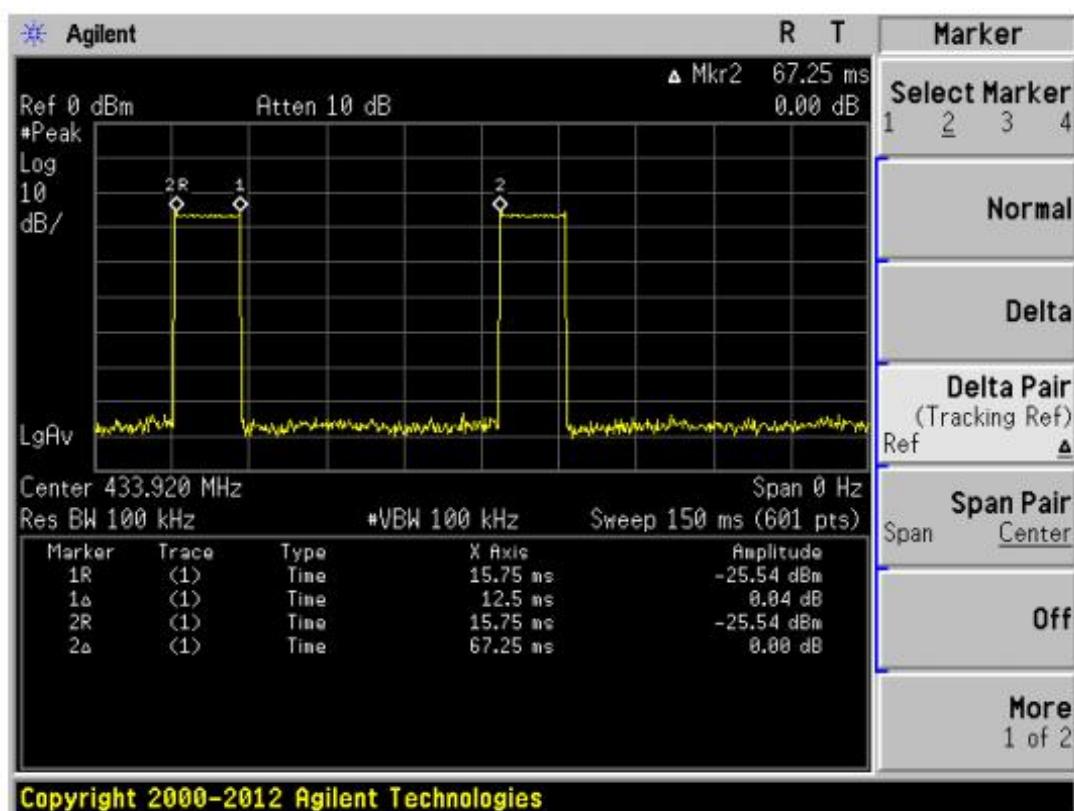
T on time =12.50 (ms)

T period =67.25 (ms)

Duty cycle=12.50/67.255=18.59%

Duty cycle factor =20 log(18.59)=-14.61dB

Original test data



## 7 ANTENNA REQUIREMENT

### 7.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 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.

### 7.2 EUT ANTENNA

The antennas used for this product are PCB antenna and other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 1.0dBi.

\*\*\*\*\*END OF THE REPORT\*\*\*\*\*