



**World Standardization Certification & Testing CO., LTD**  
**World Standardization Safety and EMC Testing Centre**

**FCC 47 CFR PART 15 SUBPART C**

## **TEST REPORT**

**Report Number: WSCT07120061E-RF**

**FCC ID: VZ5AT2009**

**For**

**Transmitter**

**Model: AT2009**

**Trade Name: N/A**

*Prepared for*

**Guang Zhou Autorail Co., Ltd.**  
**Building A, WangYuan Industry Zone, Huangcun Dongpu,**  
**Tianhe District, Guangzhou, China**

*Prepared by*

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*Applicant: Guang Zhou Autorail Co., Ltd*  
*REPORT NUMBER: WSCT07120061E-RF      FCC ID: VZ5AT2009*



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## 1. TEST RESULT CERTIFICATION

**Applicant:** Guang Zhou Autorail Co., Ltd.  
Building A, WangYuan Industry Zone, Huangcun Dongpu,  
Tianhe District, Guangzhou, China

**Equipment Under Test:** Transmitter

**Trade Name:** N/A

**Model:** AT2009

**Date of Test:** January 07~25, 2008

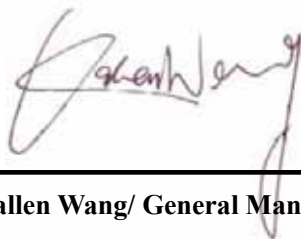
APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C Section 15.231	No non-compliance noted

### We hereby certify that:

The above equipment was tested by World Standardization Certification & Testing Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4-2003 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.207, 15.209 and Part 15.231.

The test results of this report relate only to the tested sample identified in this report.

Approved by:



**Kallen Wang/ General Manager**

Tested By:



**Sula Huang/ Testing Engineer**



## **2. EUT DESCRIPTION**

<b>Product</b>	Transmitter
<b>Trade Name</b>	N/A
<b>Model Number</b>	AT2009
<b>Model Difference</b>	N/A
<b>Power Supply</b>	DC 3V powered by the battery
<b>Frequency Range</b>	433.92 MHz
<b>Antenna Designation</b>	PCB Antenna

**Remark:** This submittal(s) (test report) is intended for FCC ID: VZ5AT2009 filing to comply with Section 15.207, 15.209 and 15.231 of the FCC Part 15, Subpart C Rules.



### **3. TEST METHODOLOGY**

The tests documented in this report were performed in accordance with ANSI C63.4 (2003) and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.231.

#### **3.1 EUT CONFIGURATION**

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

#### **3.2 EUT EXERCISE**

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

#### **3.3 GENERAL TEST PROCEDURES**

##### **Conducted Emissions**

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

##### **Radiated Emissions**

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.

### 3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41	322 - 335.4		

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

- (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

### 3.5 DESCRIPTION OF TEST MODES

The EUT has been tested under engineering test mode condition and the EUT staying in continuous transmitting mode.



#### **4. INSTRUMENT CALIBRATION**

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.



## **5. FACILITIES AND ACCREDITATIONS**

### **5.1 FACILITIES**

All measurement facilities used to collect the measurement data are located at 1-2/F, Dachong Science&Technology Building, No.28 of Tonggu Road, Nanshan District, ShenZhen.PRC.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

### **5.2 EQUIPMENT**

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### **5.3 LABORATORY ACCREDITATIONS AND LISTING**

The test facilities used to perform radiated and conducted emissions tests are accredited by FCC. Oct 06.2007. The certificate registration number is 276008 to perform Electromagnetic Interference tests according to FCC PART 15 and CISPR 22 requirements.





## **6. SETUP OF EQUIPMENT UNDER TEST**

### **6.1 SETUP CONFIGURATION OF EUT**

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

### **6.2 SUPPORT EQUIPMENT**

Device Type	Brand	Model	FCC ID	Series No.	Data Cable	Power Cord
N/A						

***Remark:***

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
- 2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

## **7. FCC PART 15.231 REQUIREMENTS**

### **7.1 20 DB BANDWIDTH**

#### **LIMIT**

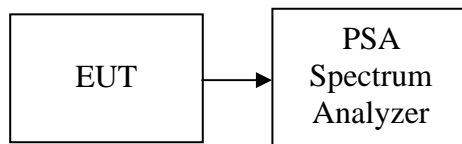
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated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

#### **MEASUREMENT EQUIPMENT USED**

<b>Name of Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Due</b>
PSA Spectrum Analyzer	Agilent	E4446A	US44300398	02/08/2008

*Remark: Each piece of equipment is scheduled for calibration once a year.*

#### **Test Configuration**



#### **TEST PROCEDURE**

The transmitter output is connected to the spectrum analyzer. The spectrum analyzer center frequency is set to the transmitter frequency. The RBW is set to 10 kHz and VBW is set 30kHz.

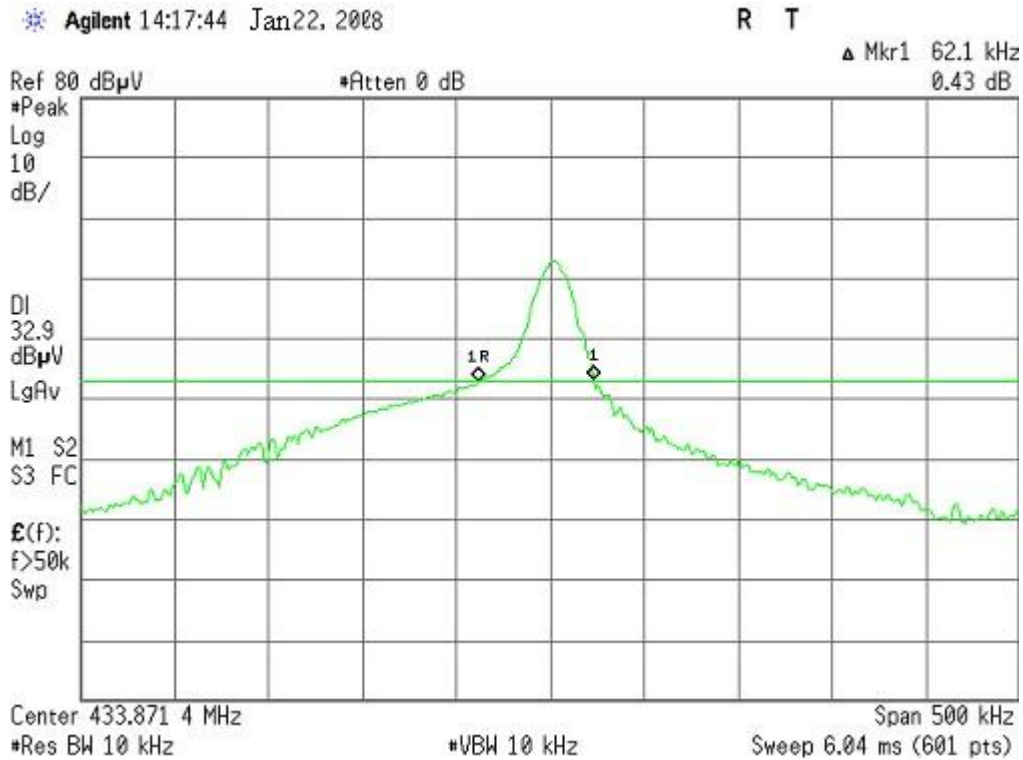
#### **TEST RESULTS**

*No non-compliance noted.*

#### **Test Data**

<b>Frequency (MHz)</b>	<b>20 dB Bandwidth (kHz)</b>	<b>Limit (MHz)</b>	<b>Result</b>
433.87	62.10	1.0847	PASS

### Test Plot



## 7.2 LIMIT OF TRANSMISSION TIME

### LIMIT

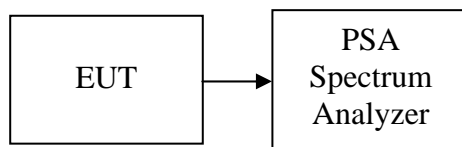
According to 15.231 (a)(1), a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Spectrum Analyzer	Agilent	E4446A	US44300398	02/08/2008

*Remark: Each piece of equipment is scheduled for calibration once a year.*

### Test Configuration



### TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The spectrum analyzer center frequency is set to the transmitter frequency. The RBW and VBW are set to 1MHz.

### TEST RESULTS

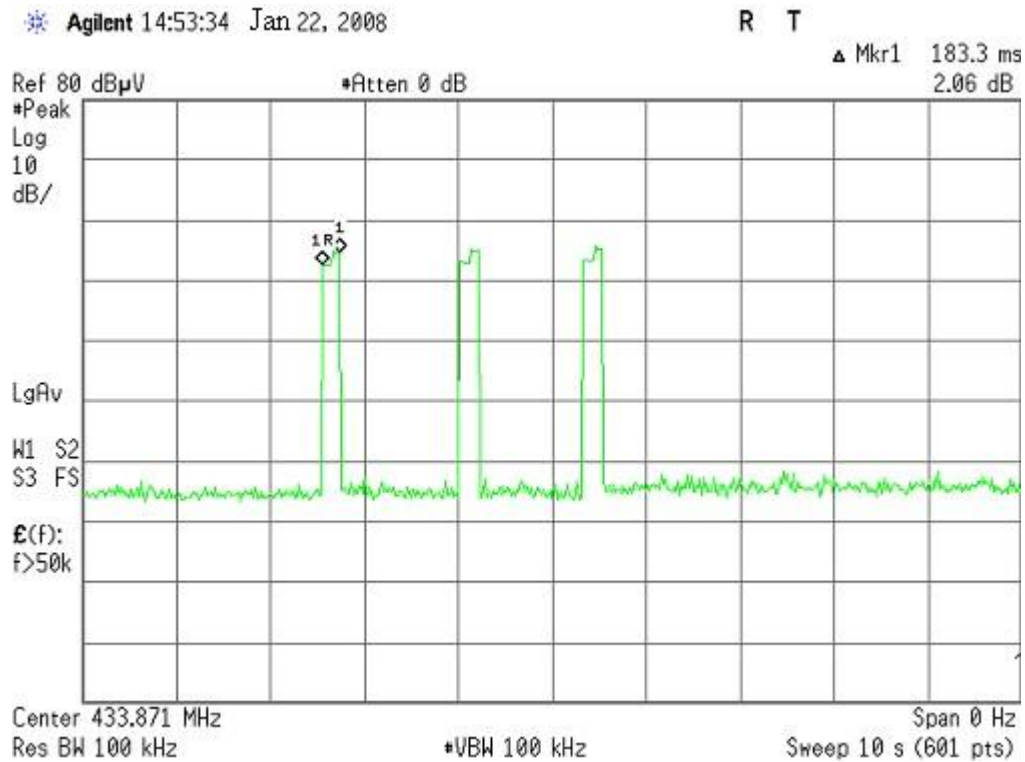
*No non-compliance noted*

### Test Data

Frequency (MHz)	Transmission time (ms)	Limit (Second)	Result
433.87	183.30	5.00	PASS



### Test Plot



### 7.3 DUTY CYCLE

#### LIMIT

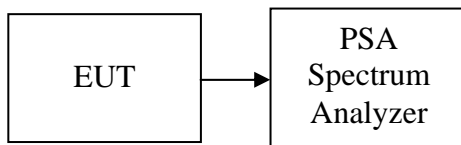
Nil (No dedicated limit specified in the Rules)

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Spectrum Analyzer	Agilent	E4446A	US44300398	02/06/2008

*Remark: Each piece of equipment is scheduled for calibration once a year.*

#### Test Configuration



#### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span = 0Hz, Adjust Sweep = 30s
5. Repeat above procedures until all frequency measured were complete.

#### TEST RESULTS

*No non-compliance noted*

#### Test Data

Ton +off =106ms

Ton =0.75ms\*49+0.35ms\*29=46.90ms

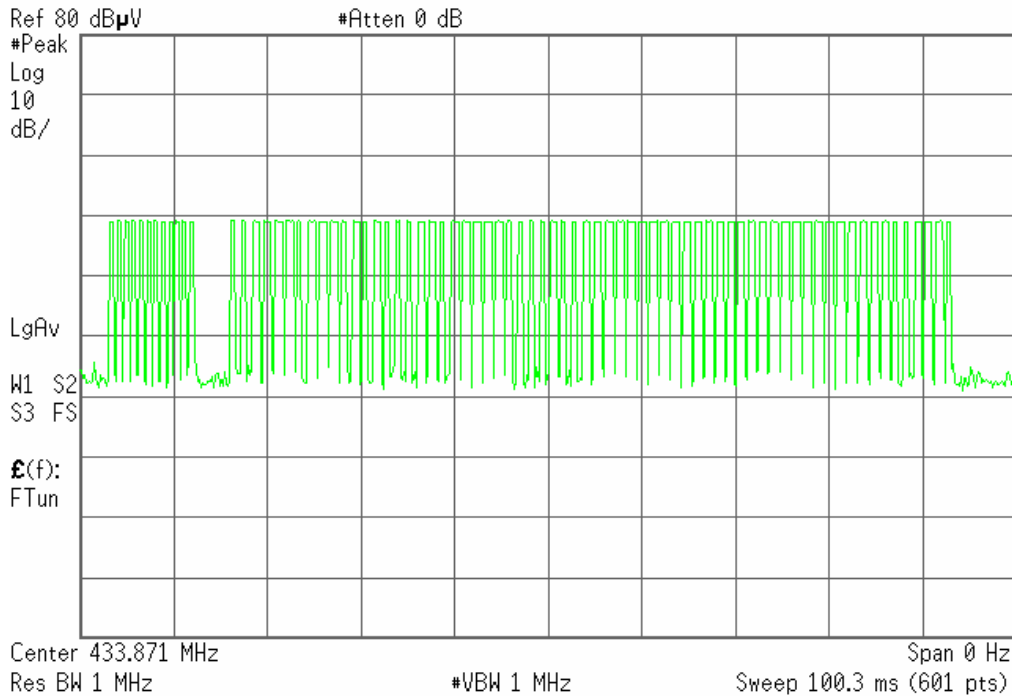
*Duty Cycle Correction Factor =  $20 * \log (Ton / Ton+off) = 20 * \log (46.90/100) = -6.58 \text{ dB}$*



### Test Plot

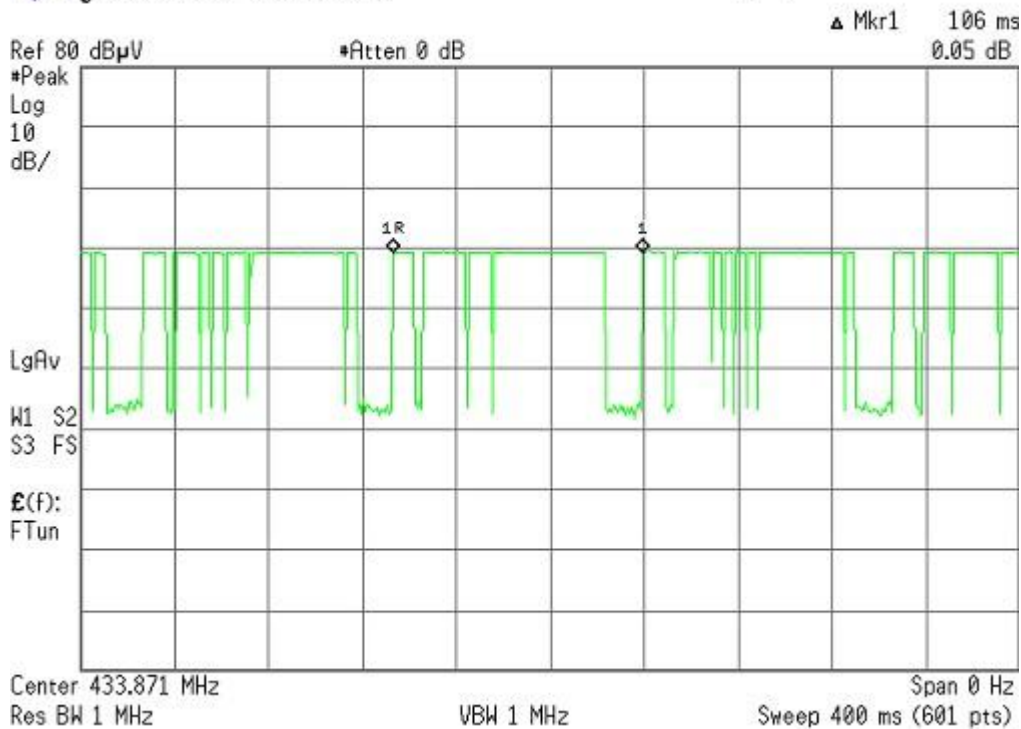
Agilent 14:44:26 Jan 22, 2008

R L



Agilent 14:22:48 Jan 22, 2008

R T

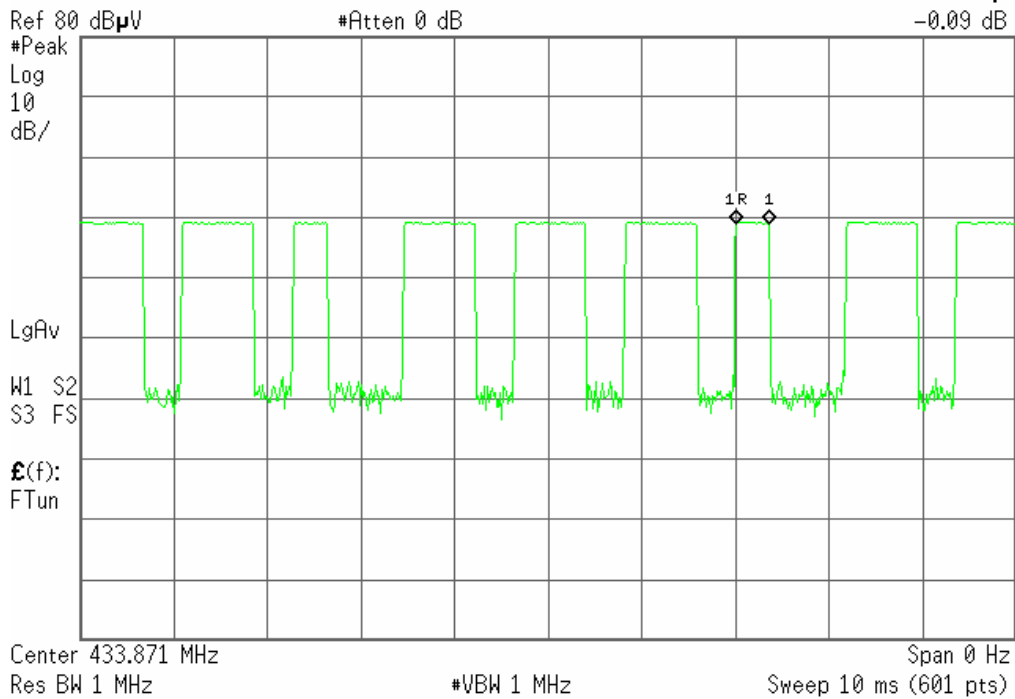




Agilent 14:47:48 Jan 22, 2008

R T

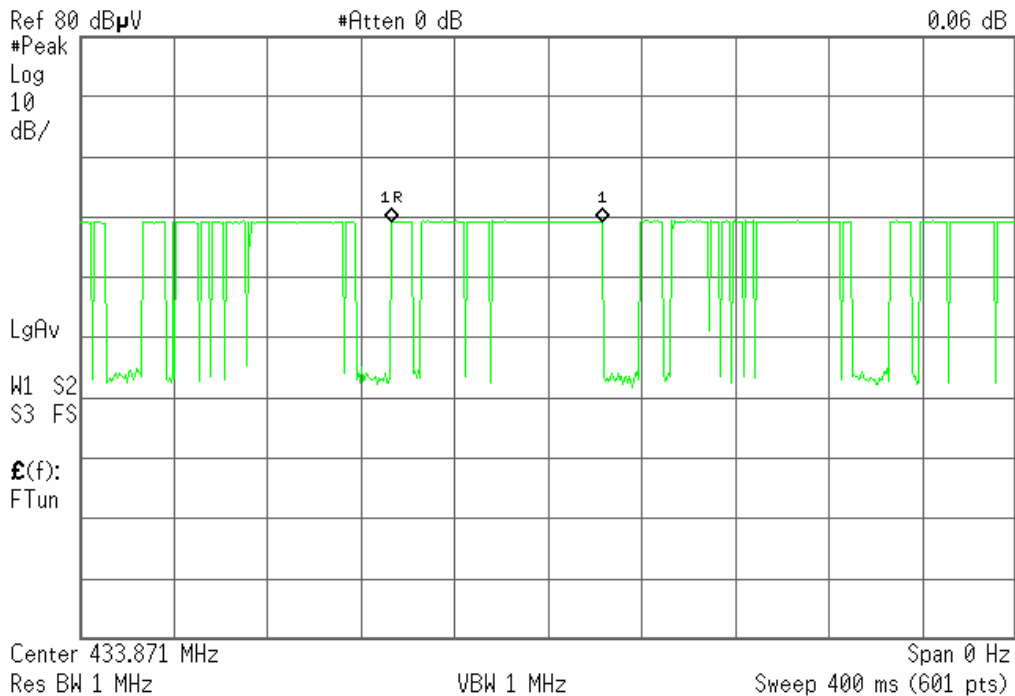
Mkr1 350  $\mu$ s  
-0.09 dB



Agilent 14:21:36 Jan 22, 2008

R T

Mkr1 90 ms  
0.06 dB





## 7.4 RADIATED EMISSIONS

### LIMIT

- According to §15.231(b), In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following: Fundamental Field Strength of Frequency Fundamental Spurious Emissions (MHz) (microvolts/meter) (microvolts/meter)

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	1,250 to 3,750 **	125 to 375 **
174 – 260	3,750	375
260 – 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

\*\* 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 130-174 MHz,  $\mu\text{V/m}$  at 3 meters =  $56.81818(F) - 6136.3636$ ; for the band 260-470 MHz,  $\mu\text{V/m}$  at 3 meters =  $41.6667(F) - 7083.3333$ . The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

- Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (mV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

**Remark:** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

- In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength ( $\mu\text{V/m}$ at 3-meter)	Field Strength (dB $\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

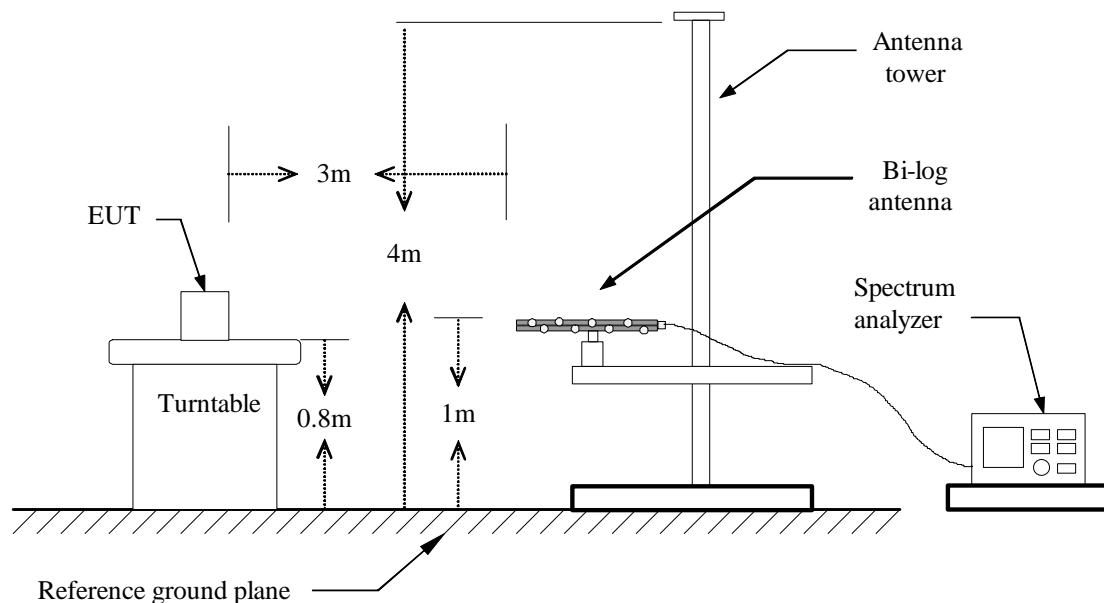
## MEASUREMENT EQUIPMENT USED

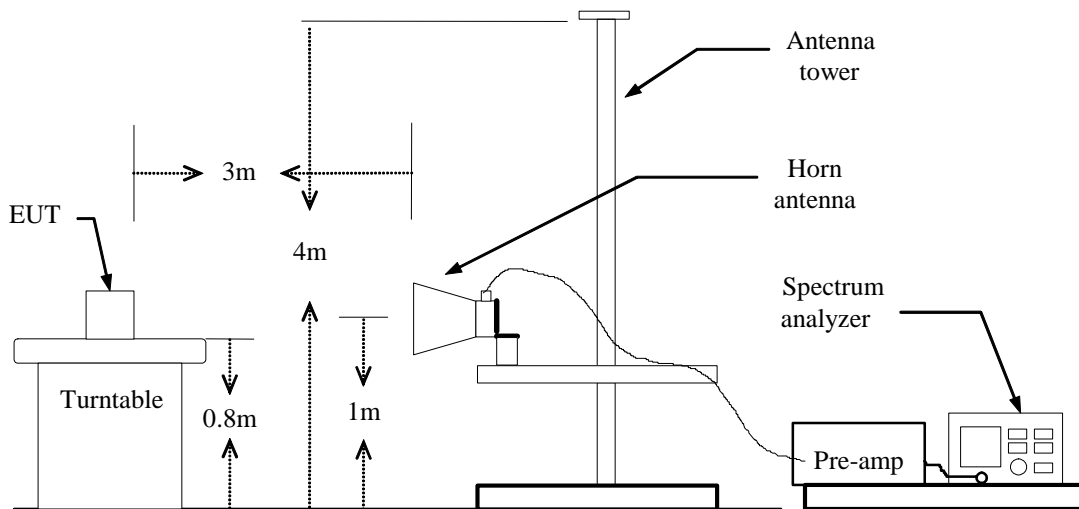
966 RF CHAMBER				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Spectrum Analyzer	Agilent	E4446A	US44300398	02/06/2008
EMI Test Receiver	R&S	ESCI	100005	04/15/2008
Pre Amplifier	HP	HP8447E	2945A02715	04/15/2008
Antenna	Sunol Sciences Corporation	JB3	A021907	05/11/2008
Turn Table	CCS	2081-1.21	N/A	N.C.R
Antenna Tower	CT	N/A	N/A	N.C.R
Controller	CCS	N/A	N/A	N.C.R
RF Comm. Test set	HP	8920B	US36142091	N.C.R
Site NSA	C&C	N/A	N/A	04/9/2008
Horn Antenna	TRC	N/A	N/A	03/04/2008
Loop Antenna	ARA	PLA-1030/B	1028	02/09/2008

**Remark:** Each piece of equipment is scheduled for calibration once a year.

## Test Configuration

**Below 1 GHz**



**Above 1 GHz****TEST PROCEDURE**

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

7. Repeat above procedures until the measurements for all frequencies are complete.



## TEST RESULTS

**Operation Mode:** TX

**Test Date:** January 21, 2008

**Temperature:** 20°C

**Tested by:** Sula

**Humidity:** 70 % RH

**Polarity:** Ver. / Hor.

### *Fundamental:*

Freq. (MHz)	Ant. Pol (H/V)	Reading (Peak) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Duty Cycle Correction Factor (dB)	Result (Average/Quasi-peak) (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
433	V	69.10	-8.31	60.79	---	---	99.20	-38.41	Peak
433	V	69.10	-8.31	60.79	-6.58	53.21	79.20	-25.99	Average
433	H	81.50	-8.31	73.19	---	---	99.20	-26.01	Peak
433	H	81.50	-8.31	73.19	-6.58	66.61	79.20	-12.59	Average

### **Remark:**

- Average = Peak result + Duty cycle correction factor*

Freq. (MHz)	Ant. Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
100.20	V	Peak	48.56	-15.43	33.13	43.50	-10.37
102.00	V	Peak	44.90	-15.55	29.35	43.50	-14.15
110.10	V	Peak	42.50	-16.07	26.43	43.50	-17.07
157.35	V	Peak	40.57	-15.23	25.34	43.50	-18.16
868.16	V	Peak	47.30	-3.64	43.66	60.15	-16.49
N/A							
99.30	H	Peak	39.72	-15.46	24.26	43.50	-19.24
114.60	H	Peak	39.39	-16.35	23.04	43.50	-20.46
128.10	H	Peak	36.88	-16.63	20.25	43.50	-23.25
157.80	H	Peak	38.48	-15.19	23.29	43.50	-20.21
868.16	H	Peak	53.57	-3.64	49.93	60.15	-10.22
N/A							

### **Remark:**

- Measuring frequencies from 30 MHz to the 1GHz.*
- Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak detector mode.*
- Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
- The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*



<b>Operation Mode:</b>	TX	<b>Test Date:</b>	January 21, 2008
<b>Temperature:</b>	20°C	<b>Humidity:</b>	70 % RH
<b>Tested by:</b>	Sula		

**Remark:**

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.*
3. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.*
4. *Spectrum setting:*
  - a. *Spectrum Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.*
  - b. *Spectrum AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.*

## 7.5 POWERLINE CONDUCTED EMISSIONS

### LIMIT

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

### MEASUREMENT EQUIPMENT USED

Conducted Emission Test Site G				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	ROHDE&SCHWARZ	ESCS30	100343	04/15/2008
LISN	AFJ	LS16	16010222119	04/02/2008
LISN	Meestec	AN3016	04/10040	04/02/2008

*Remark: Each piece of equipment is scheduled for calibration once a year.*

### TEST CONFIGURATION

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

### TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

### TEST RESULTS

*Not applicable (Since the EUT is powered by battery)*

**APPENDIX 1  
PHOTOGRAPHS OF TEST SETUP****Radiated Emission Set up Photos**