

FCC PART 15 Subpart C  
EMI MEASUREMENT AND TEST REPORT



For

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**FCC ID: Q74ZT809**

2003-06-05

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> 2.4GHz Wireless A/V Color Camera
<b>Test Engineer:</b> Ling Zhang / 	
<b>Report No.:</b> R0305194	
<b>Test Date:</b> 2003-05-29	
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**TABLE OF CONTENTS**

<b>1 - GENERAL INFORMATION.....</b>	<b>3</b>
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	3
1.2 OBJECTIVE .....	3
1.3 RELATED SUBMITTAL(S)/GRANT(S) .....	3
1.4 TEST METHODOLOGY .....	3
1.5 TEST FACILITY .....	3
1.6 TEST EQUIPMENT LIST .....	4
1.7 POWER SUPPLY INFORMATION.....	4
<b>2 - SYSTEM TEST CONFIGURATION.....</b>	<b>5</b>
2.1 DESCRIPTION OF TEST CONFIGURATION .....	5
2.2 EUT EXERCISE SOFTWARE .....	5
2.3 SPECIAL ACCESSORIES .....	5
2.4 SCHEMATICS AND BLOCK DIAGRAM .....	5
2.5 EQUIPMENT MODIFICATIONS .....	5
2.6 CONFIGURATION OF TEST SYSTEM.....	5
2.7 TEST SETUP BLOCK DIAGRAM .....	6
<b>3 - CONDUCTED EMISSIONS TEST DATA.....</b>	<b>7</b>
3.1 MEASUREMENT UNCERTAINTY .....	7
3.2 EUT SETUP .....	7
3.3 SPECTRUM ANALYZER SETUP .....	7
3.4 TEST PROCEDURE .....	7
3.5 SUMMARY OF TEST RESULTS .....	8
3.6 CONDUCTED EMISSIONS TEST DATA .....	8
3.7 PLOT OF CONDUCTED EMISSIONS TEST DATA .....	8
<b>4 - RADIATED EMISSION DATA .....</b>	<b>11</b>
4.1 MEASUREMENT UNCERTAINTY .....	11
4.2 EUT SETUP .....	11
4.3 SPECTRUM ANALYZER SETUP .....	11
4.4 TEST PROCEDURE .....	12
4.5 CORRECTED AMPLITUDE & MARGIN CALCULATION .....	12
4.6 SUMMARY OF TEST RESULTS .....	12
4.7 RADIATED EMISSIONS TEST RESULT DATA .....	13
<b>5 - BAND EDGES TESTING .....</b>	<b>15</b>
5.1 TEST PROCEDURE .....	15
5.2 TEST EQUIPMENT .....	15
5.3 TEST RESULTS .....	15

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## 1 - GENERAL INFORMATION

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### 1.1 Product Description for Equipment Under Test (EUT)

The *Shenzhen ZhongWang Electronic Co., Ltd.* 's ZT-809 and ZT-811 or the "EUT" as referred to in this report is transmitter of a 2.4GHz Wireless Camera which is measured approximately 1.69" L x 0.9" W x 0.9"H.

*\* The test data was good for test sample only. It may have deviation for other test samples.*

### 1.2 Objective

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the EUT. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 1992.

The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the specification limits defined by FCC Title 47, Part 15, Subpart C, section 15.205, 15.207, and 15.249.

### 1.3 Related Submittal(s)/Grant(s)

No Related Submittal(s).

### 1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 –1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at BACL. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

### 1.5 Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods.

## 1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8568B	2517A01610	2003-10-30
HP	Spectrum Analyzer	8593A	29190A00242	2004-05-01
HP	Amplifier	8447E	1937A01054	2004-05-01
HP	Quasi-Peak Adapter	85650A	2521A00718	2004-05-01
Com-Power	Biconical Antenna	AB-100	14012	2004-05-01
Com-Power	LISN	LI-200	12005	2004-03-28
Com-Power	LISN	LI-200	12008	2004-03-28
Com-Power	Log Periodic Antenna	AL-100	16091	2004-05-01
Com-Power	Log Periodic Antenna	AB-900	15049	2004-05-01
Rohde & Schwarz	EMI Test Receiver	ESPI	1147 8007 07	2003-12-03
Agilent	Spectrum Analyzer (9KHz – 40GHz)	8564E	08303	2003-08-01
Agilent	Spectrum Analyzer (9KHz – 50GHz)	8565EC	06042	2004-05-03
HP	Amplifier (1-26.5GHz)	8449B	3147A00400	2004-03-14
A.H.System	Horn Antenna (700MHz-18GHz)	SAS-200/571	261	2004-05-31

**\*Statement of Traceability: Bay Area Compliance Laboratory Corp.** Certifies that all calibration has been performed using suitable standards traceable to the NIST.

## 1.7 Power Supply Information

Manufacturer	Description	Model	Serial Number	FCC ID
ZhongWang	AC Adapter	XDC4116-355	N/A	DoC

## **2 - SYSTEM TEST CONFIGURATION**

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### **2.1 Description of Test Configuration**

The EUT was configured for testing in a typical fashion (as normally used by a typical user).

### **2.2 EUT Exercise Software**

The EUT exercising program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

### **2.3 Special Accessories**

As shown in section 2.7, all interface cables used for compliance testing are shielded as normally supplied by INMAC and their representative. The peripherals featured shielded metal connectors.

### **2.4 Schematics and Block Diagram**

Please refer to Appendix D.

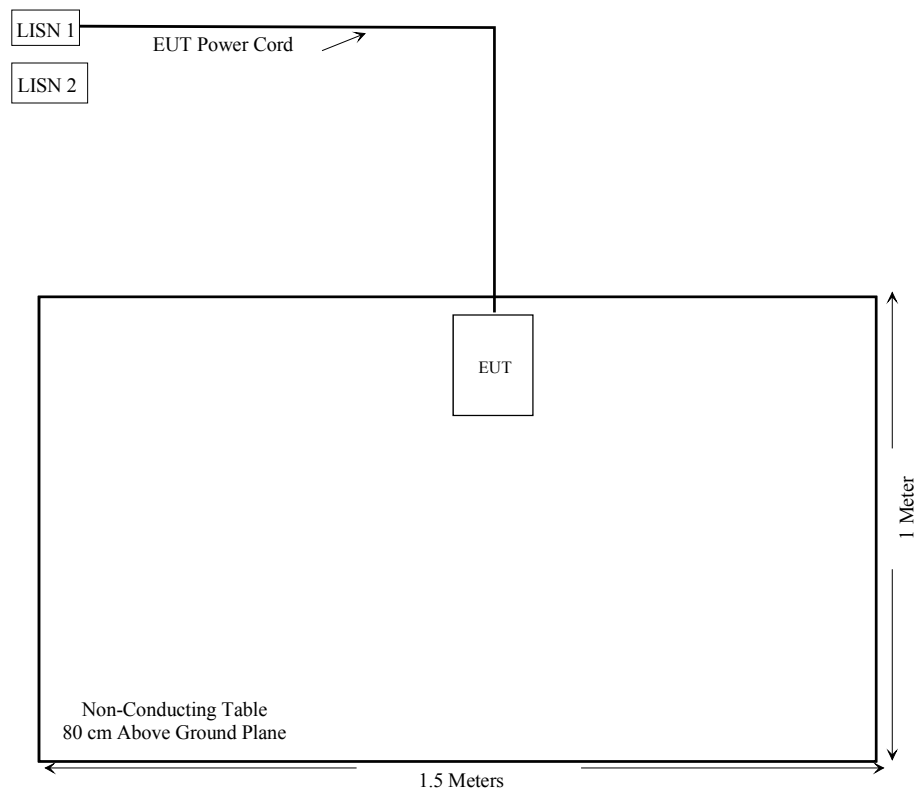
### **2.5 Equipment Modifications**

No modifications were made by BACL to ensure the EUT to comply with the applicable limits and requirements.

### **2.6 Configuration of Test System**



## 2.7 Test Setup Block Diagram



### 3 - CONDUCTED EMISSIONS TEST DATA

#### 3.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is  $\pm 2.4$  dB.

#### 3.2 EUT Setup

The measurement was performed in the shield room, using the same setup per ANSI C63.4 - 1992 measurement procedure. Specification used was with the FCC Class B limits.

The Base unit of EUT was connected to a 120 VAC / 60 Hz power source.

The spacing between the peripherals was 10 centimeters.

External Input / Output cables were draped over edge of the test table and bundle when necessary.

#### 3.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conducted emission test:

Start Frequency.....	150 kHz
Stop Frequency.....	30 MHz
Sweep Speed.....	Auto
IF Bandwidth.....	10 kHz
Video Bandwidth.....	10 kHz
Quasi-Peak Adapter Bandwidth .....	9 kHz
Quasi-Peak Adapter Mode.....	Normal

#### 3.4 Test Procedure

During the conducted emission test, the EUT power cord was connected to the auxiliary outlet of the first LISN with all support equipment power cords connected to the second.

The EUT was tested to represent worst-case results for the final qualification test. Therefore, these results were used for final test data recorded in the table listed under section 3.6 of this report.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance using all installation combination. All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dB of specification limit). Quasi-peak readings are distinguished with a "Qp".

### 3.5 Summary of Test Results

According to the data in section 3.6, the EUT complied with the FCC Conducted margin for a Class B device and these test results is deemed satisfactory evidence of compliance with RSS-210 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

**-24.0 dB $\mu$ V at 0.190 MHz in the Line mode, Transmitter**

### 3.6 Conducted Emissions Test Data

*Test Data for Transmitter*

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dB $\mu$ V	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dB $\mu$ V	Margin dB
0.190	40.0	QP	Line	64	-24.0
0.780	32.0	QP	Neutral	56	-24.0
0.190	39.0	QP	Neutral	64	-25.0
0.800	23.0	QP	Line	56	-33.0
0.800	8.5	AVG	Line	46	-37.5
2.650	7.0	AVG	Neutral	46	-39.0
0.780	4.0	AVG	Neutral	46	-42.0
0.190	11.5	AVG	Line	54	-42.5
0.190	11.0	AVG	Neutral	54	-43.0
29.500	5.0	AVG	Line	50	-45.0
2.650	7.0	QP	Neutral	56	-49.0
29.500	8.0	QP	Line	60	-52.0

### 3.7 Plot of Conducted Emissions Test Data

Plots of Conducted Emissions test data is presented hereinafter as reference.



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CISPR CLASS B

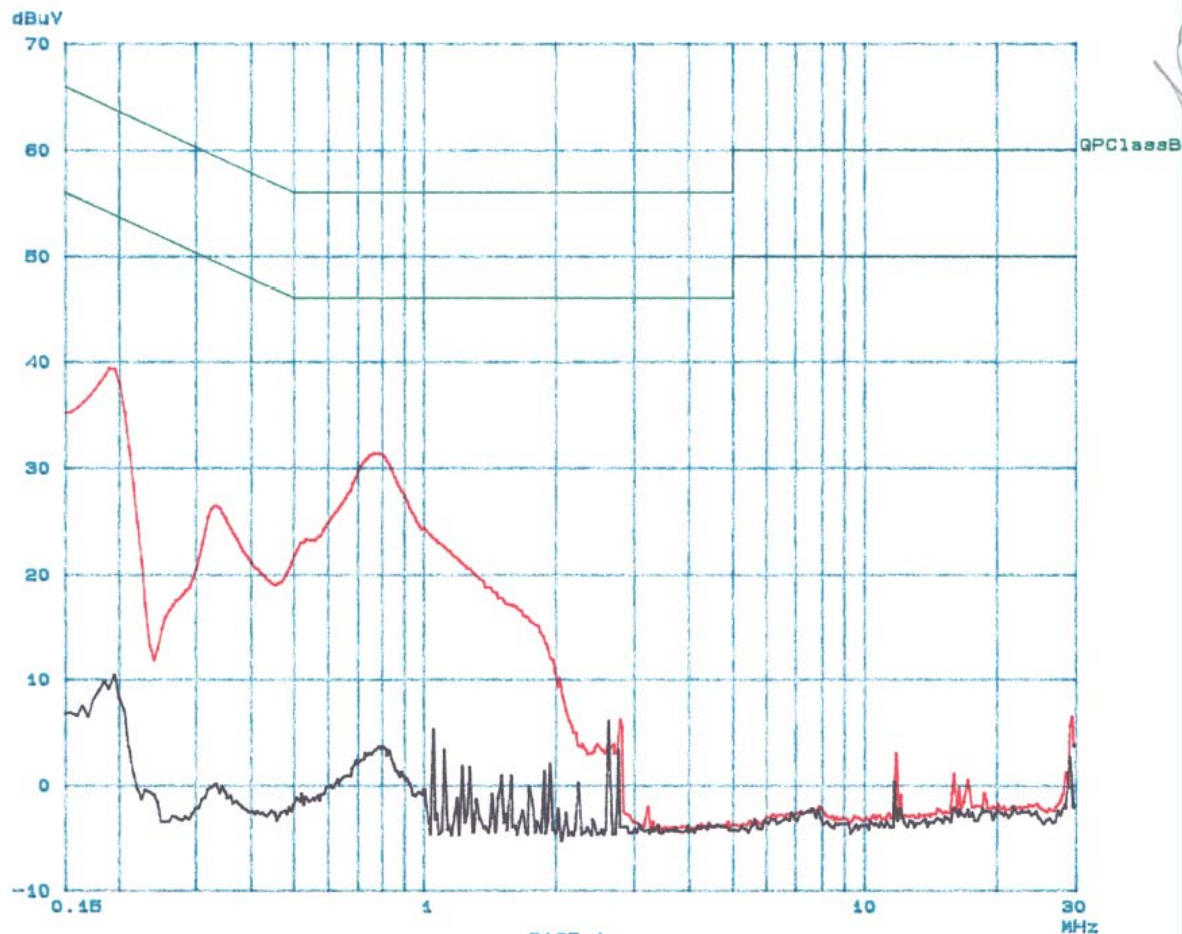
27. May 03 19:17

EUT: ZT-809  
Manuf: Shenzhen ZhongWang  
Op Cond: Normal  
Operator: James  
Comment: Neutral

## Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	10dB LN	OFF
1M	5M	10k	9k	QP+AV	1ms	10dB LN	OFF
5M	30M	100k	9k	QP+AV	1ms	10dB LN	OFF

Final Measurement: x QP / + AV  
Meas Time: 1 s  
Subranges: 25  
Acc Margin: 6dB



PAGE 1

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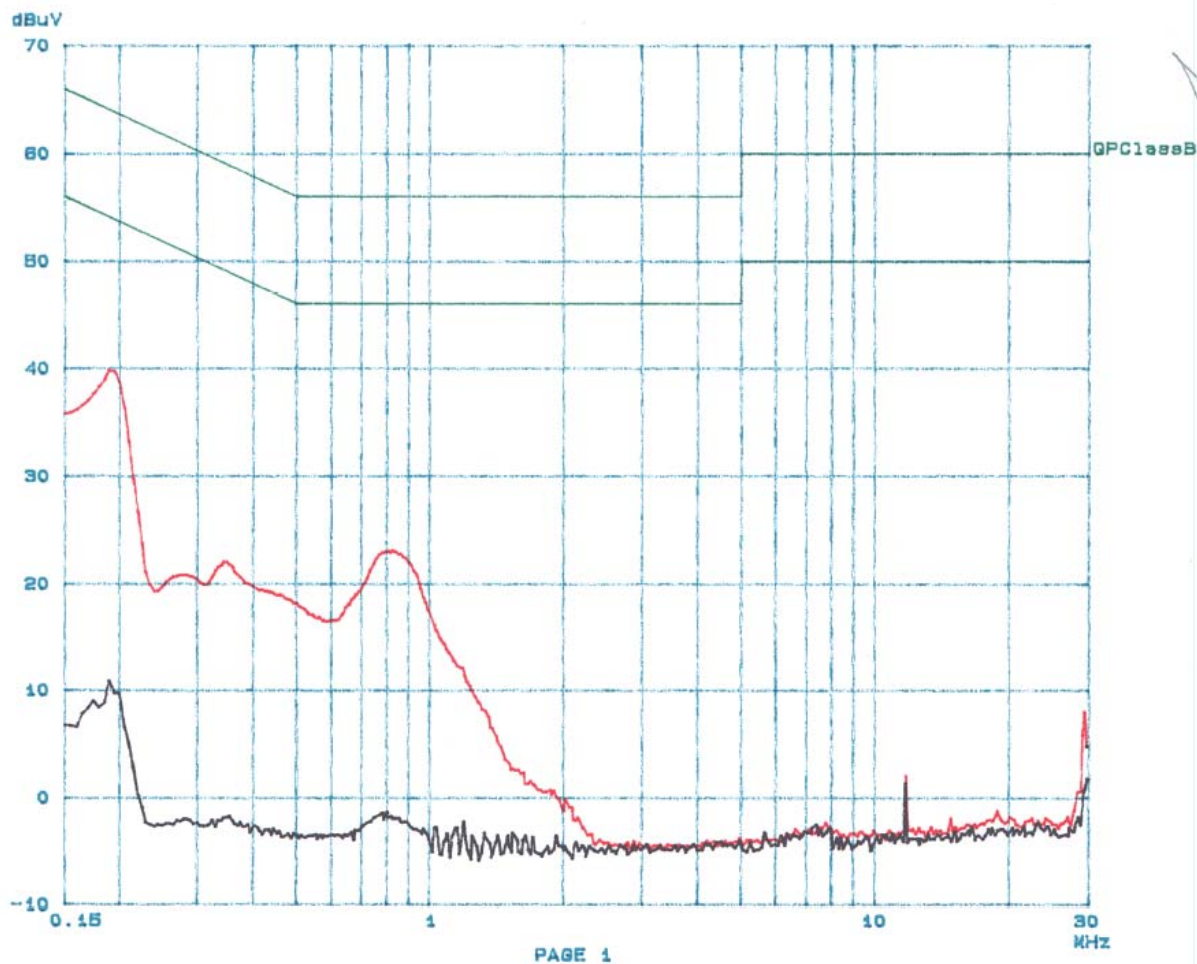
27. May 03 18:35

EUT: ZT-809  
Manuf: Shenzhen ZhongWang  
Op Cond: Normal  
Operator: James  
Comment: Line

## Scan Settings (3 Ranges)

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	10dB LN	OFF
1M	5M	10k	9k	QP+AV	1ms	10dB LN	OFF
5M	30M	100k	9k	QP+AV	1ms	10dB LN	OFF

Final Measurement: x QP / + AV  
Meas Time: 1 s  
Subranges: 25  
Acc Margin: 6dB



## 4 - RADIATED EMISSION DATA

### 4.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is  $\pm 4.0$  dB.

### 4.2 EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with the ANSI C63.4 - 1992. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

The external Input / Output cables were draped over edge of the test table and bundle when necessary.

### 4.3 Spectrum Analyzer Setup

According to FCC Rules, 47 CFR 15.33 (a) (1), the system was tested to 25GHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Start Frequency .....	30 MHz
Stop Frequency .....	25GHz
Sweep Speed .....	Auto
IF Bandwidth .....	1 MHz
Video Bandwidth .....	1 MHz
Quasi-Peak Adapter Bandwidth.....	120 kHz
Quasi-Peak Adapter Mode .....	Normal
Resolution Bandwidth.....	1MHz

#### 4.4 Test Procedure

For the radiated emissions test, both the EUT and all support equipment power cords were connected to the AC floor outlet since the power supply used in the EUT did not provide an accessory power outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "Qp" in the data table.

#### 4.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB $\mu$ V means the emission is 7dB $\mu$ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

#### 4.6 Summary of Test Results

According to the data in section 4.7, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207, and 15.249 after tested to 10<sup>th</sup> harmonics as required by FCC and had the worst margin of:

*For Transmitter:*

**-7.6 dB $\mu$ V at 7284.00 MHz in the Horizontal polarization at Low Frequency, 30 MHz to 25GHz**

**-7.9 dB $\mu$ V at 7344.00 MHz in the Horizontal polarization at Middle Frequency, 30 MHz to 25GHz**

**-7.8 dB $\mu$ V at 7404.00 MHz in the Horizontal polarization at High Frequency, 30 MHz to 25GHz**

**-1.7 dB $\mu$ V at 114.16 MHz in the Vertical polarization, 30 MHz to 1 GHz, Unintentional Emission**

**4.7 Radiated Emissions Test Result Data*****Test Data for Transmitter***

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV/m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable DB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
Low Frequency											
2428.00	94.5	FUND/PEAK	100	1.0	V	28.1	3.4	35.2	90.8		
2428.00	94.8	FUND/PEAK	90	2.0	H	28.1	3.4	35.2	91.1		
2428.00	76.7	FUND/AVE	100	1.0	V	28.1	3.4	35.2	73.0		
2428.00	77.8	FUND/AVE	90	2.0	H	28.1	3.4	35.2	74.1		
7284.00	39.2	AVE	45	1.4	H	35.1	5.6	33.5	46.4	54	-7.6
7284.00	38.2	AVE	330	1.2	V	35.1	5.6	33.5	45.4	54	-8.6
4856.00	38.5	AVE	30	1.5	V	32.5	4.9	33.0	42.9	54	-11.1
7284.00	55.0	PEAK	330	1.2	V	35.1	5.6	33.5	62.2	74	-11.8
4856.00	37.5	AVE	0	1.0	H	32.5	4.9	33.0	41.9	54	-12.1
7284.00	54.5	PEAK	45	1.4	H	35.1	5.6	33.5	61.7	74	-12.3
4856.00	56.5	PEAK	30	1.5	V	32.5	4.9	33.0	60.9	74	-13.1
4856.00	54.3	PEAK	0	1.0	H	32.5	4.9	33.0	58.7	74	-15.3
Middle Frequency											
2448.00	90.5	FUND/PEAK	100	1.6	V	28.1	3.4	35.2	86.8		
2448.00	92.8	FUND/PEAK	90	1.8	H	28.1	3.4	35.2	89.1		
2448.00	71.0	FUND/AVE	100	1.6	V	28.1	3.4	35.2	67.3		
2448.00	71.2	FUND/AVE	90	1.8	H	28.1	3.4	35.2	67.5		
7344.00	38.8	AVE	90	1.6	H	35.1	5.6	33.5	46.1	54	-7.9
7344.00	37.5	AVE	300	1.5	V	35.1	5.6	33.5	44.7	54	-9.3
7344.00	56.5	PEAK	90	1.6	H	35.1	5.6	33.5	63.7	74	-10.3
4896.00	38.5	AVE	150	1.5	H	32.5	4.9	33.0	42.9	54	-11.1
4896.00	38.2	AVE	180	1.2	V	32.5	4.9	33.0	42.6	54	-11.4
7344.00	54.7	PEAK	300	1.5	V	35.1	5.6	33.5	61.9	74	-12.1
4896.00	57.0	PEAK	150	1.5	H	32.5	4.9	33.0	61.4	74	-12.6
4896.00	55.3	PEAK	180	1.2	V	32.5	4.9	33.0	59.7	74	-14.3

**Test Data for Transmitter (Continued)**

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV/m	Comments	Angle Degree	Height Meter	Polar H/V	Antenna dBμV/m	Cable DB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
High Frequency											
2468.00	91.2	FUND/PEAK	0	1.2	V	28.1	3.4	35.2	87.5		
2468.00	92.5	FUND/PEAK	90	1.0	H	28.1	3.4	35.2	88.8		
2468.00	71.5	FUND/AVE	0	1.2	V	28.1	3.4	35.2	67.8		
2468.00	72.2	FUND/AVE	90	1.0	H	28.1	3.4	35.2	68.5		
7404.00	39.0	AVE	270	1.5	H	35.1	5.6	33.5	46.2	54	-7.8
7404.00	38.0	AVE	120	1.8	V	35.1	5.6	33.5	45.2	54	-8.8
4936.00	37.8	AVE	90	1.8	H	32.5	4.9	33.0	42.2	54	-11.8
4936.00	37.5	AVE	30	1.2	V	32.5	4.9	33.0	41.9	54	-12.1
7404.00	54.0	PEAK	270	1.5	H	35.1	5.6	33.5	61.2	74	-12.8
7404.00	53.2	PEAK	120	1.8	V	35.1	5.6	33.5	60.4	74	-13.6
4936.00	54.3	PEAK	30	1.2	V	32.5	4.9	33.0	58.7	74	-15.3
4936.00	54.0	PEAK	90	1.8	H	32.5	4.9	33.0	58.4	74	-15.6
Unintentional Emission											
114.16	51.0		150	1.6	V	11.3	1.5	22.0	41.8	43.5	-1.7
115.00	49.7		200	1.3	H	11.5	1.6	22.0	40.7	43.5	-2.8
71.74	47.2		180	1.0	V	9.2	1.2	22.0	35.5	40	-4.5
71.35	46.5		180	1.2	H	9.2	1.2	22.0	34.9	40	-5.1
307.00	45.7		180	1.5	V	14.4	2.3	22.0	40.4	46	-5.6
660.80	40.3		150	1.2	V	20.8	3.0	25.0	39.1	46	-6.9

**Note:**

FUND: Fundamental  
 AVE.: Average

## **5 - BAND EDGES TESTING**

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Requirements: FCC 15.249 (d), emissions radiated outside of the specified frequency bands, except for harmonics, shall be at least 50 dB below the level of the fundamental or to the general radiated emission limits in FCC 15.209, whichever is the lesser attenuation.

### **5.1 Test Procedure**

The antenna was removed and a low loss RF cable was connected to the transmitter output. The other end of cable was connected to a spectrum analyzer with the START and STOP frequencies set to the operation band. Transmitter output was read off the spectrum analyzer in dBm. The power output at the transmitter was determined by adding the value of the attenuator to the spectrum analyzer reading.

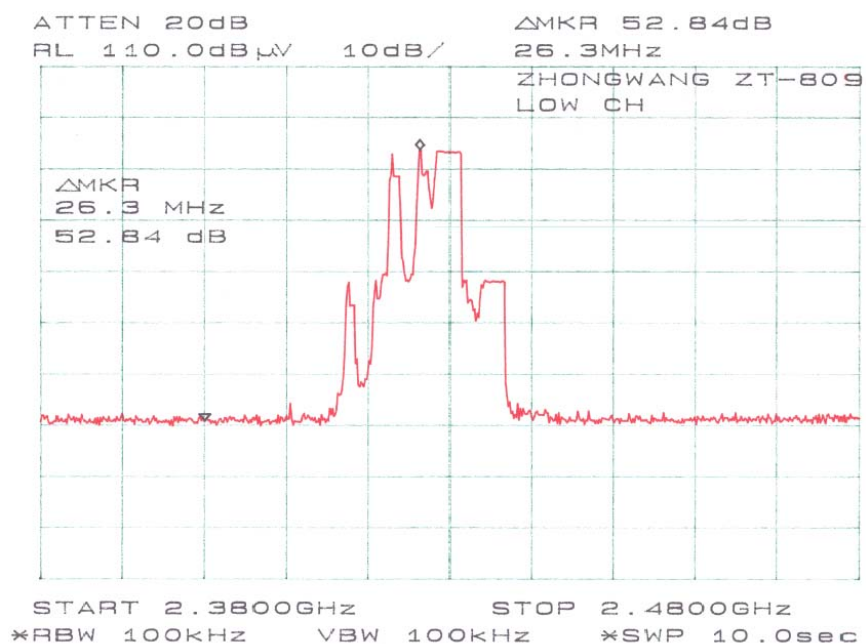
The test was performed for handset and the base respectively.

### **5.2 Test Equipment**

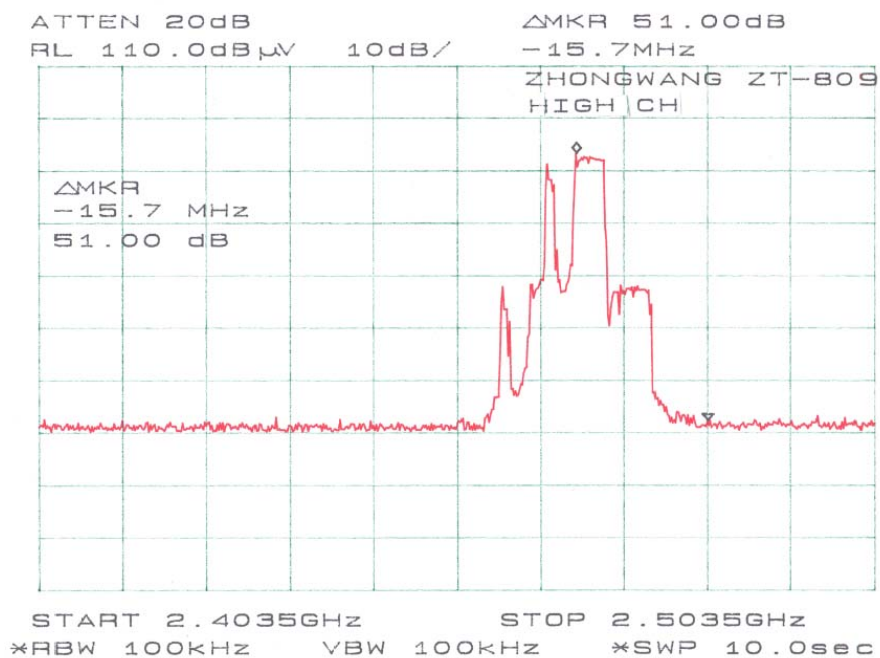
HP 8566B Spectrum Analyzer  
HP 7470A Plotter

### **5.3 Test Results**

Refer to the following plots.



no 03/5/23



no 03/5/23