

FCC PART 15 C
EMI MEASUREMENT AND TEST REPORT

For

ShenZhen ZhongWang Electronic Co., Ltd.

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FCC ID: Q74ZT-815T

June 24, 2004

This Report Concerns: ☒ Original Report	Equipment Type: 2.4GHz Wireless A/V Color Camera
Test Engineer: William Chan	
Report No.: RSZ04052507	
Test Date: June 11-16, 2004	
Reviewed By: Chris Zheng	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The ShenZhen ZhongWang Electronic Co., Ltd.'s product, model number: ZT-815T or the "EUT" as referred to in this report is a 2.4GHz Wireless A/V Color Camera. The EUT is measured approximately 5.5"L x 4.2"W x 4.2"H.

The EUT was fed by ZhongWang's Adaptor: M/N SY-07020, input: 120VAC/60Hz; output: 8VDC/200mA

Cable:

Cable Description	Length (M)	From/Port	To
Unshielded Undetachable DC Cable	1.5	EUT	Adapter

** The test data gathered are from production sample, serial number: 040537, provided by the manufacturer.*

Objective

This document is a 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 - 2001.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209, and 15.249 rules.

Related Submittal(s)/Grant(s)

No Related Submittals

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 - 2001, 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 Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

Test site at Bay Area Compliance Laboratory Corporation 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 C63.4-2001.

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.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

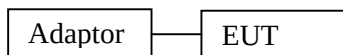
The EUT was configured for testing according to ANSI C63.4-2001.

The final qualification test was performed with the EUT operating at normal mode

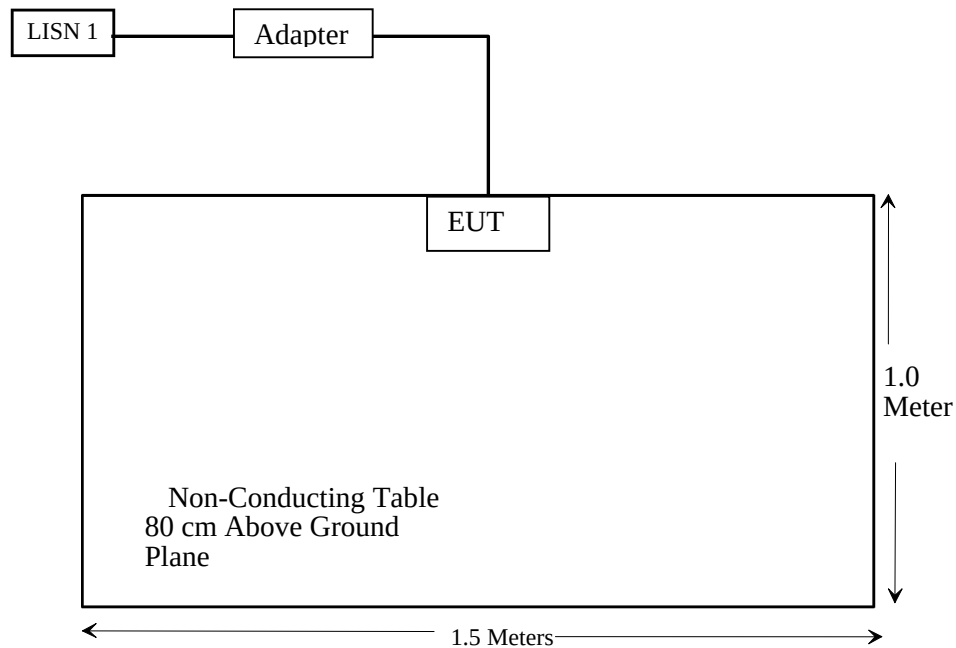
Equipment Modifications

No modifications were made to the EUT.

Configuration of Test System



Test Setup Block Diagram



SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Pass
§15.205	Restricted Bands of Operation	Pass
§15.207 (a)	Conducted Emission	Pass
§15.209 (a), §15.249 (a)	Radiated Emission	Pass
§15.249 (c)	Band Edge Testing	Pass

§15.203 - ANTENNA REQUIREMENT

Standard Applicable

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.

Antenna Connected Construction

The antenna connector is designed with permanent attachment and no consideration of replacement.

Test Result: Pass

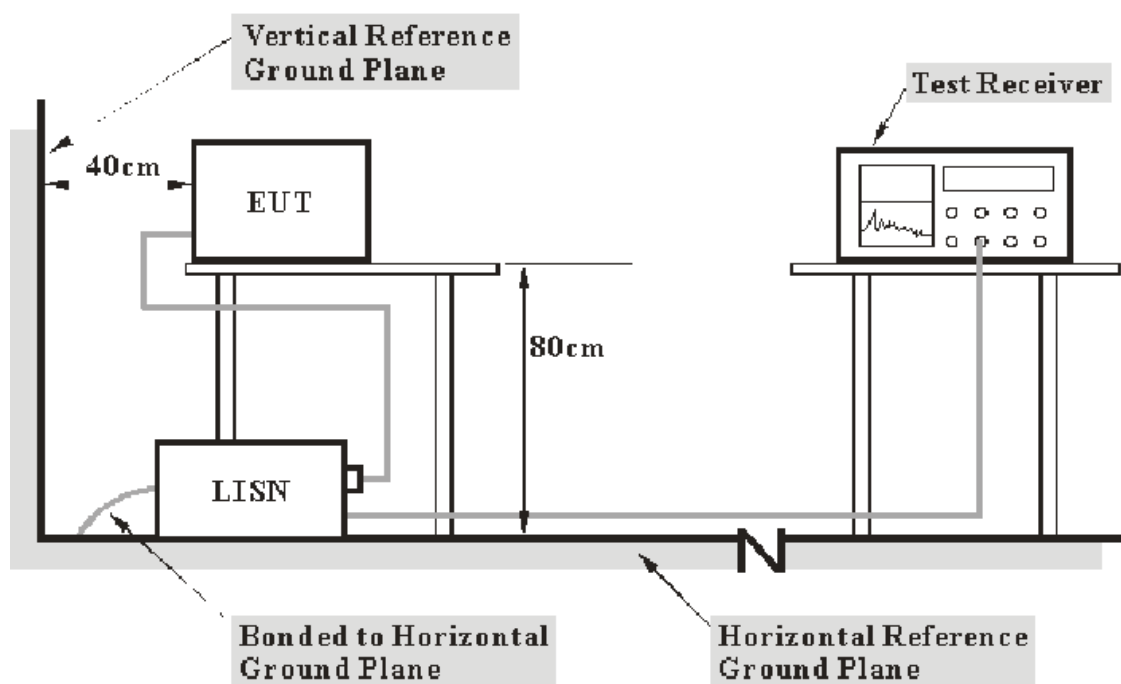
§ 15.207 - CONDUCTED EMISSION

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 ± 2.4 dB.

EUT Setup



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.4-2001 measurement procedure. The specification used was with the FCC 15.207 limits.

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

Spectrum Analyzer Setup

The spectrum analyzer was set to investigate the spectrum from 150 KHz to 30MHz.

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

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>
150KHz - 30MHz	10KHz	10KHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
COM Power	LISN	LI-200	12208	2003-10-30	2004-10-29
COM Power	LISN	LI-200	12005	2003-10-30	2004-10-29
HP	Spectrum Analyzer	8568B	2517A01610	2003-10-30	2004-10-29
HP	Spectrum Analyzer Display Unit	8568B	2517A10039	2003-10-30	2004-10-29
HP	Quasi-Peak Adapter	8565A	3107A01572	2003-10-30	2004-10-29
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
FLUKE	True RMS Multimeter	187	78540402	2004-3-23	2005-3-22

*** Statement of Traceability: BACL Corp.** attests that all calibrations had been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

During the conducted emission test, the EUT was connected to the outlet of the LISN.

Maximizing procedure were performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak detection mode.

Test Data

Date of Test : June 11-16, 2004 Temperature : 25°C
 EUT : 2.4GHz Wireless A/V Color Camera Humidity : 62%
 M/N : ZT-815T Operating Mode : Channel 1
 S/N : 040537 Test Engineer: William Chan

LINE CONDUCTED EMISSIONS				FCC 15.207	
Frequency MHz	Amplitude dBμV	Detector QP/AV/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.208	52.3	AV	Neutral	53.28	-0.97
0.343	45.8	AV	Line	49.13	-3.31
0.183	50.8	AV	Neutral	54.35	-3.57
0.172	50.1	AV	Neutral	54.86	-4.72
0.174	49.8	AV	Line	54.77	-5.00
0.153	50.7	AV	Line	55.84	-5.16
0.208	57.2	QP	Neutral	63.28	-6.07
0.172	58.6	QP	Neutral	64.86	-6.22
0.183	57.8	QP	Neutral	64.35	-6.56
0.343	51.0	QP	Line	59.13	-8.10
0.174	56.6	QP	Line	64.77	-8.20
0.153	57.4	QP	Line	65.84	-8.45

Date of Test : June 11-16, 2004 Temperature : 25°C
 EUT : 2.4GHz Wireless A/V Color Camera Humidity : 62%
 M/N : ZT-815T Operating Mode : Channel 2
 S/N : 040537 Test Engineer: William Chan

LINE CONDUCTED EMISSIONS				FCC 15.207	
Frequency MHz	Amplitude dBμV	Detector QP/AV/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.354	46.9	AV	Neutral	48.87	-2.00
0.183	50.3	AV	Neutral	54.35	-4.06
0.189	50.0	AV	Line	54.08	-4.07
0.161	51.1	AV	Neutral	55.41	-4.28
0.151	51.5	AV	Line	55.94	-4.45
0.174	50.1	AV	Line	54.77	-4.66
0.354	54.1	QP	Neutral	58.87	-4.78
0.151	60.5	QP	Line	65.94	-5.44
0.189	58.3	QP	Line	64.08	-5.76
0.161	59.6	QP	Neutral	65.41	-5.80
0.183	58.4	QP	Neutral	64.35	-5.99
0.174	58.4	QP	Line	64.77	-6.35

Date of Test : June 11-16, 2004 Temperature : 25°C
 EUT : 2.4GHz Wireless A/V Color Camera Humidity : 62%
 M/N : ZT-815T Operating Mode : Channel 4
 S/N : 040537 Test Engineer: William Chan

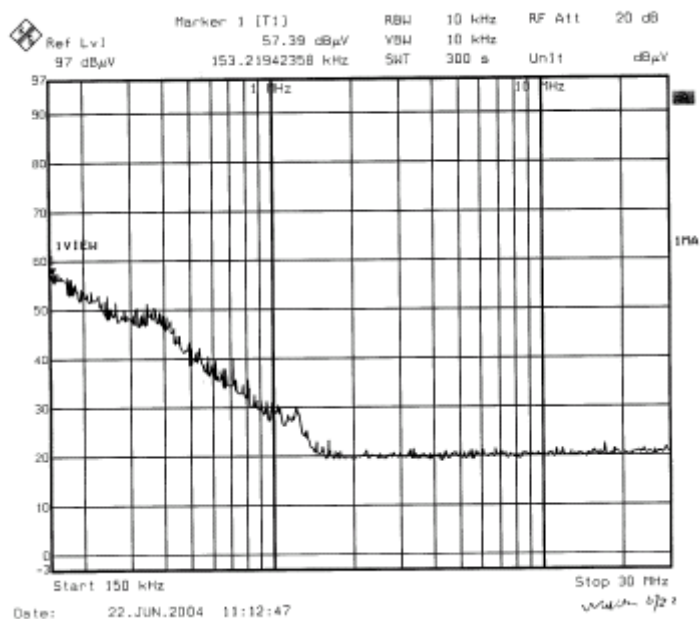
LINE CONDUCTED EMISSIONS				FCC 15.207	
Frequency MHz	Amplitude dBμV	Detector QP/AV/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.204	50.2	AV	Line	53.45	-3.22
0.390	44.7	AV	Line	48.06	-3.38
0.156	51.3	AV	Line	55.67	-4.42
0.204	58.9	QP	Line	63.45	-4.56
0.166	49.8	AV	Neutral	55.16	-5.41
0.153	50.0	AV	Neutral	55.84	-5.83
0.390	51.9	QP	Line	58.06	-6.16
0.156	59.5	QP	Line	65.67	-6.16
0.263	44.0	AV	Neutral	51.34	-7.32
0.153	58.3	QP	Neutral	65.84	-7.58
0.166	57.1	QP	Neutral	65.16	-8.11
0.263	51.3	QP	Neutral	61.34	-10.02

Test Result: Pass

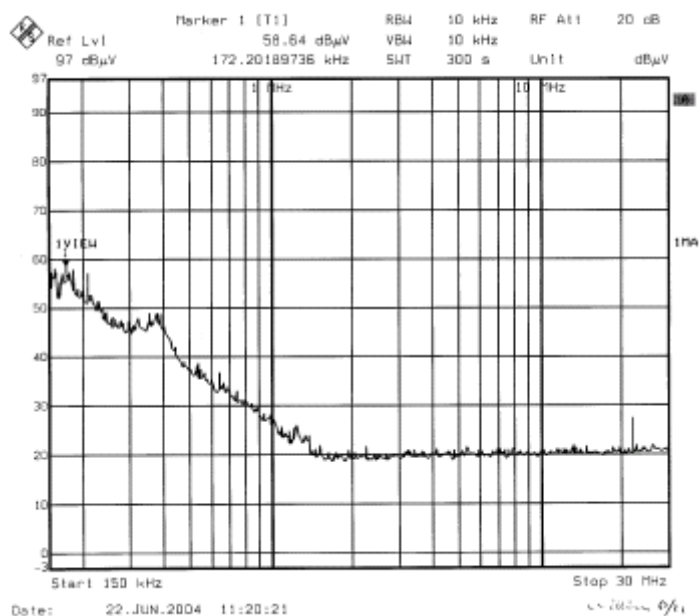
Plot(s) of Test Data

Plot(s) of Test Data is presented hereinafter as reference.

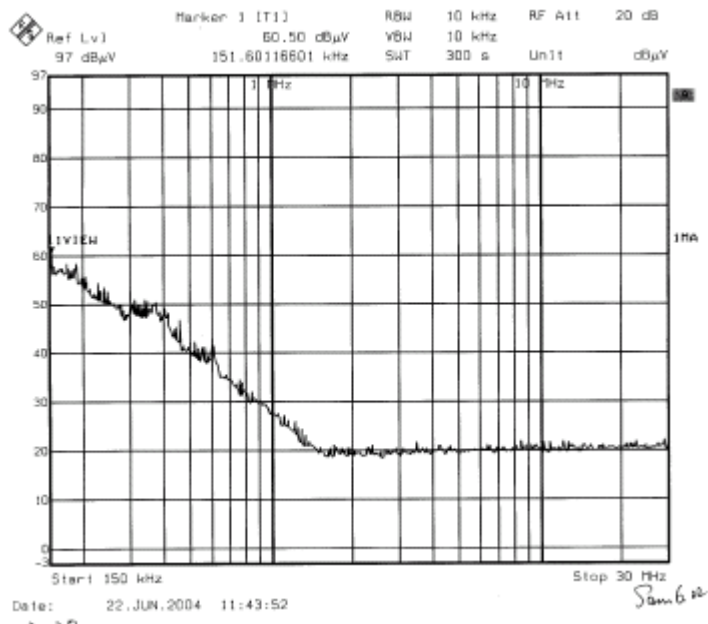
Channel 1: Line:



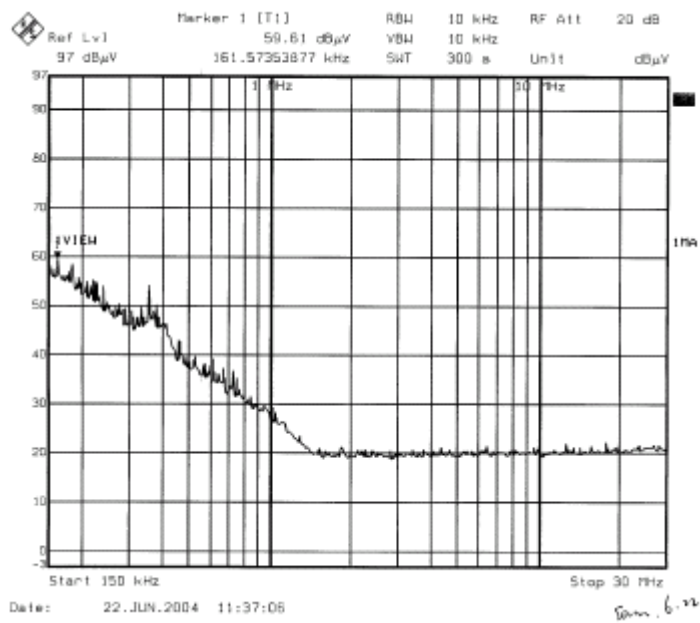
Neutral:



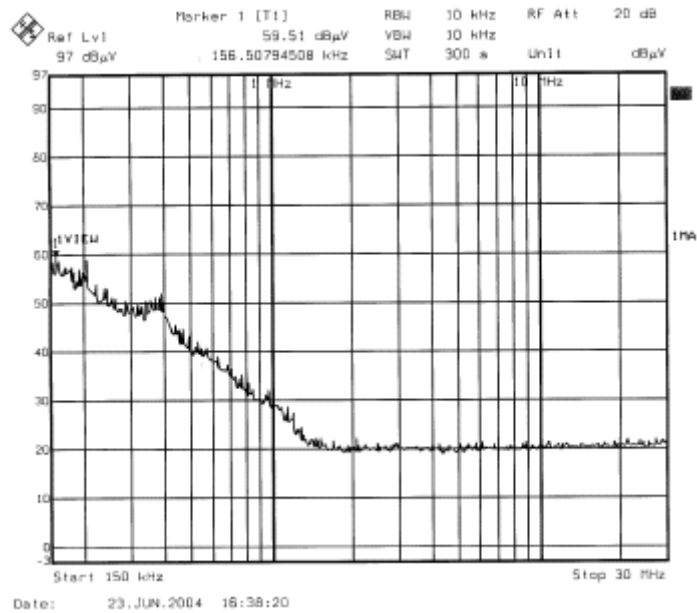
Channel 2: Line:



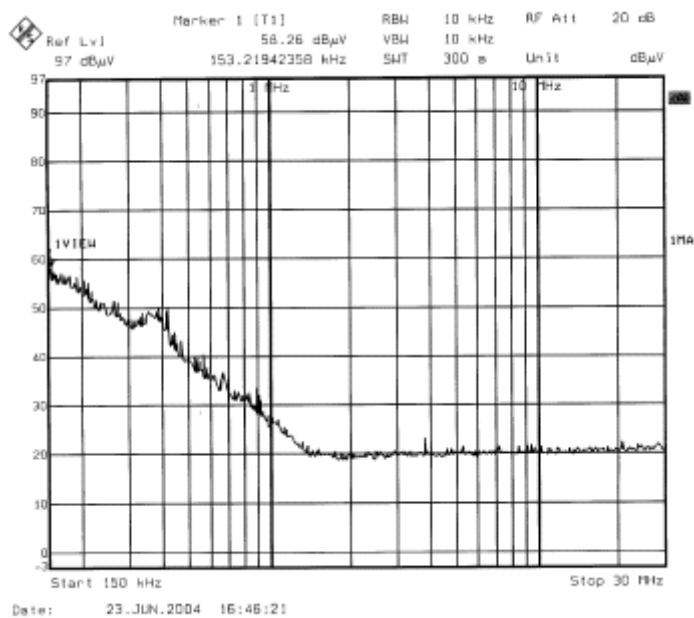
Neutral:



Channel 4:Line:



Neutral:



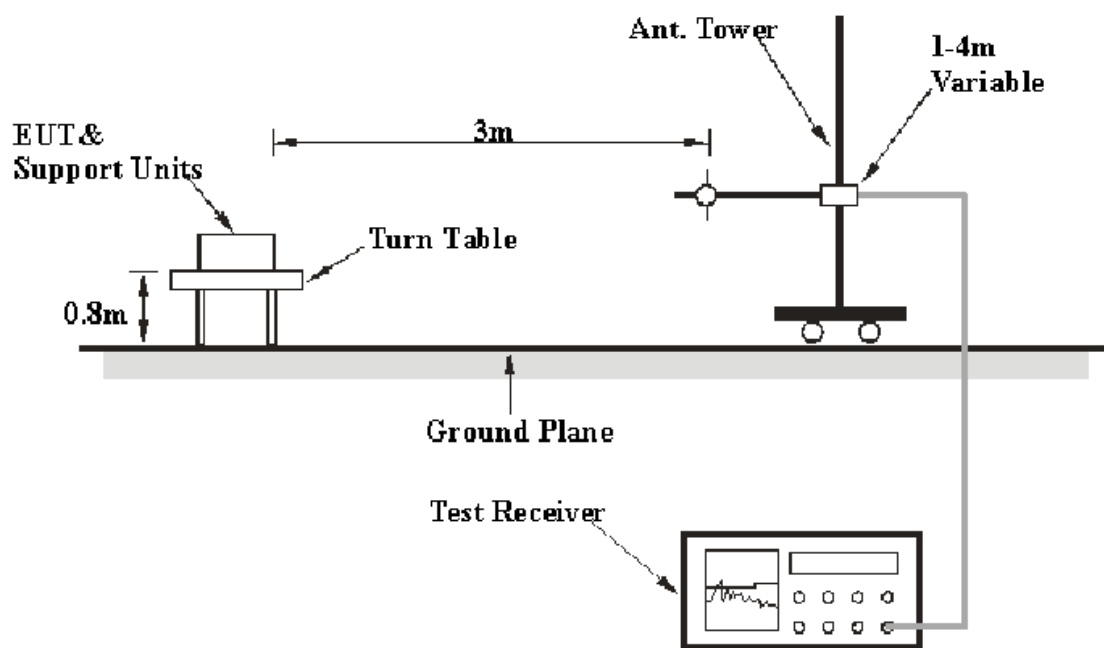
§15.209(a) §15.249(a) - RADIATED EMISSION

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 ± 4.0 dB.

EUT Setup



The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4-2001. The specification used was the FCC 15.209 and 15.249 limits.

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

Spectrum Analyzer Setup

The system was investigated from 30MHz to 25GHz.

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

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>
30 – 1000MHz	100KHz	100KHz
1000MHz – 25GHz	1MHz	1MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
HP	Amplifier	8447D	2944A09795	2003-8-5	2004-8-4
ETS	Log Periodic Antenna	3146	9603-4421	2003-8-5	2004-8-4
ETS	Biconical Antenna	3110B	3360	2003-8-5	2004-8-4
FLUKE	True RMS Multimeter	187	78540402	2004-3-23	2005-3-22
HP	Amplifier (1-26.5GHz)	8449B	3147A00400	2003-11-5	2004-11-4
A.H.System	Horn Antenna (700MHz-18GHz)	SAS-200/571	261	2003-11-5	2004-11-4
YOKOROWA	Coaxial Cable 1#	N/A	NO: 001	2003-8-5	2004-8-4
YOKOROWA	Coaxial Cable 1#	N/A	NO: 002	2003-8-5	2004-8-4

* **Statement of Traceability:** **BACL Corp.** attests that all calibrations had been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

For the radiated emissions test, the EUT power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detection mode.

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 -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

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

Test Data

Date of Test : June 11-16, 2004 Temperature : 25°C
 EUT : 2.4GHz Wireless A/V Color Camera Humidity : 45%
 M/N : ZT-815T Operating Mode : Transmitting
 S/N : 040537 Test Engineer: Jandy Su

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15.209(a), FCC 15.249(a)	
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
Channel 1											
2414	70.47	FUND/PEAK	45	1.0	v	28.7	3.4	28.7	73.87		
2414	83.57	FUND/PEAK	180	1.2	h	28.7	3.4	28.7	86.97		
2414	65.99	FUND/AVE	180	1.2	v	28.7	3.4	28.7	69.39		
2414	73.88	FUND/AVE	60	1.2	h	28.7	3.4	28.7	77.28		
4828	44.36	AVE	45	1.2	h	32.5	4.9	30.4	51.36	54	-2.64
9656	37.01	AVE	45	1.0	h	38.4	7.0	31.8	50.61	54	-3.39
7242	39.25	AVE	45	1.0	h	36.3	6.0	31.6	49.95	54	-4.05
9656	35.41	AVE	180	1.0	v	38.4	7.0	31.8	49.01	54	-4.99
4828	40.12	AVE	180	1.2	v	32.5	4.9	30.4	47.12	54	-6.88
7242	35.98	AVE	180	1.2	v	36.3	6.0	31.6	46.68	54	-7.32
4828	53.13	PEAK	180	1.2	h	32.5	4.9	30.4	60.13	74	-13.87
7242	45.63	PEAK	180	1.2	h	36.3	6.0	31.6	56.33	74	-17.67
9656	41.58	PEAK	90	1.2	h	38.4	7.0	31.8	55.18	74	-18.82
9656	40.42	PEAK	45	1.2	v	38.4	7.0	31.8	54.02	74	-19.98
Channel 2											
2432	84.72	FUND/PEAK	45	1.0	v	28.7	3.4	28.7	88.1		
2432	81.67	FUND/PEAK	180	1.2	h	28.7	3.4	28.7	85.0		
2432	75.99	FUND/AVE	180	1.2	v	28.7	3.4	28.7	79.3		
2432	72.23	FUND/AVE	60	1.2	h	28.7	3.4	28.7	75.6		
7296	40.51	AVE	180	1.2	v	36.3	6.0	31.7	51.1	54	-2.9
4864	44.02	AVE	180	1.2	v	32.5	4.9	30.4	51.0	54	-3.0
9728	37.48	AVE	180	1.0	v	38.4	7.0	31.9	51.0	54	-3.0
9728	37.01	AVE	45	1.0	h	38.4	7.0	31.9	50.6	54	-3.4
4864	43.26	AVE	45	1.2	h	32.5	4.9	30.4	50.3	54	-3.7
7296	39.68	AVE	45	1.0	h	36.3	6.0	31.7	50.3	54	-3.8
9728	54.43	PEAK	90	1.2	h	38.4	7.0	31.9	68.0	74	-6.0
9728	53.49	PEAK	45	1.2	v	38.4	7.0	31.9	67.0	74	-7.0
4864	59.04	PEAK	180	1.2	h	32.5	4.9	30.4	66.1	74	-8.0
7296	55.16	PEAK	180	1.2	h	36.3	6.0	31.7	65.7	74	-8.3
4864	57.81	PEAK	45	1.2	v	32.5	4.9	30.4	64.8	74	-9.2

7296	54.18	PEAK	45	1.0	v	36.3	6.0	31.7	64.8	74	-9.3
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Continued:

Channel 4											
2468	70.28	FUND/PEAK	45	1.0	v	28.7	3.4	28.8	73.58		
2468	81.57	FUND/PEAK	180	1.2	h	28.7	3.4	28.8	84.87		
2468	62.59	FUND/AVE	180	1.2	v	28.7	3.4	28.8	65.89		
2468	74.16	FUND/AVE	60	1.2	h	28.7	3.4	28.8	77.46		
4936	43.91	AVE	45	1.2	h	32.5	4.9	30.5	50.81	54	-3.19
9872	35.41	AVE	180	1.0	v	38.4	7.0	32	48.81	54	-5.19
9872	33.67	AVE	45	1.0	h	38.4	7.0	32	47.07	54	-6.93
7404	36.42	AVE	180	1.2	v	36.3	6.0	31.8	46.92	54	-7.08
7404	35.41	AVE	45	1.0	h	36.3	6.0	31.8	45.91	54	-8.09
4936	37.01	AVE	180	1.2	v	32.5	4.9	30.5	43.91	54	-10.09
4936	49.28	PEAK	180	1.2	h	32.5	4.9	30.5	56.18	74	-17.82
9872	40.01	PEAK	45	1.2	v	38.4	7.0	32	53.41	74	-20.59
7404	41.06	PEAK	45	1.0	v	36.3	6.0	31.8	51.56	74	-22.44
9872	37.67	PEAK	90	1.2	h	38.4	7.0	32	51.07	74	-22.93
4936	43.28	PEAK	45	1.2	v	32.5	4.9	30.5	50.18	74	-23.82
7404	39.02	PEAK	180	1.2	h	36.3	6.0	31.8	49.52	74	-24.48

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15.209	
Frequency MHz	Ampl. dBμV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dB	Cable dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
Unintentional Emission, 30MHz to 1000MHz										
35.47	46.29	45	1	v	13.3	0.5	25	35.1	40.0	-4.9
53.21	45.90	180	1.2	v	10.5	0.2	25	31.6	40.0	-8.4
106.46	46.18	45	1	v	11.4	1.2	25	33.8	43.5	-9.7
159.42	45.10	60	1	v	13.0	0.7	25	33.8	43.5	-9.7
106.46	44.70	270	1	h	11.4	1.2	25	32.3	43.5	-11.2
159.42	43.54	45	1.2	h	13.0	0.7	25	32.2	43.5	-11.3
177.43	40.66	90	1.2	h	13.4	0.9	25	30.0	43.5	-13.5
35.47	37.64	45	1	h	13.3	0.5	25	26.4	40.0	-13.6
141.94	41.21	90	1.2	h	13.2	0.8	26	29.2	43.5	-14.3
141.94	39.87	180	1.2	v	13.2	0.8	25	28.9	43.5	-14.6
53.21	39.09	60	1.2	h	10.5	0.2	25	24.8	40.0	-15.2
177.43	37.30	45	1.2	v	13.4	0.9	25	26.6	43.5	-16.9

Test Result: Pass

§15.249(c) - BAND EDGES TESTING

Standard Applicable

Requirements: FCC 15.249 (c), the emission power at the START and STOP frequencies 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.

Test Procedure

With the EUT's antenna attached, the EUT's radiated emission power was received by the test antenna which was connected to the spectrum analyzer with the START and STOP frequencies set to the EUT's operation band.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-5-8	2004-5-7
HP	Amplifier	8447D	2944A09795	2003-5-8	2004-5-8
ETS	Log Periodic Antenna	3146	9603-4421	2003-5-9	2004-5-7
ETS	Biconical Antenna	3110B	3360	2003-5-8	2004-5-7
FLUKE	True RMS Multimeter	187	78540402	2004-3-24	2004-3-23
HP	Amplifier (1-26.5GHz)	8449B	3147A00400	2003-11-5	2004-11-4
A.H.System	Horn Antenna (700MHz-18GHz)	SAS-200/571	261	2003-11-5	2004-11-4

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

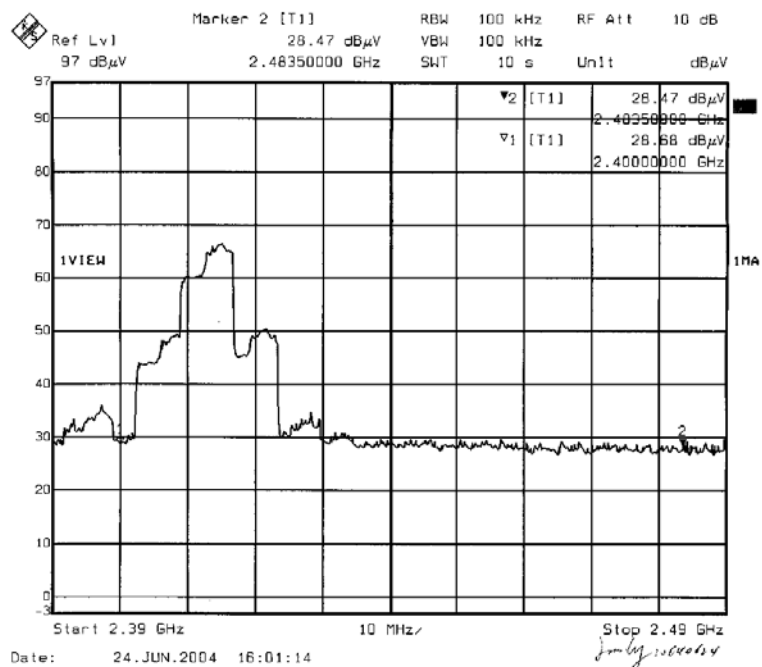
Environmental Conditions

Temperature:	24 °C
Relative Humidity:	59%
ATM Pressure:	1178mbar

Test Result: Pass

Refer to the attached plots.

Low Channel



High Channel

