

FCC PART 15 Subpart C
EMI MEASUREMENT AND TEST REPORT

For

VTech Telecommunications Ltd.

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57 Ting Kok Road, Tai Po NT, Hong Kong

FCC ID: EW780-1005-00

July 11, 2002

This Report Concerns: ☒ Original Report	Equipment Type: Cordless Phone
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Report No.: R0206111	
Test Date: June 15, 2002	
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TABLE OF CONTENTS

1 - GENERAL INFORMATION.....	3
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	4
1.6 TEST EQUIPMENT LIST	4
1.8 LOCAL SUPPORT EQUIPMENT LIST AND DETAILS.....	5
1.9 EXTERNAL I/O CABLING LIST AND DETAILS	5
2 - SYSTEM TEST CONFIGURATION.....	6
2.1 DESCRIPTION OF TEST CONFIGURATION	6
2.2 EQUIPMENT MODIFICATIONS	6
2.3 CONFIGURATION OF TEST SYSTEM.....	7
2.4 TEST SETUP BLOCK DIAGRAM	7
3 - CONDUCTED EMISSION	8
3.1 MEASUREMENT UNCERTAINTY	8
3.2 EUT SETUP	8
3.3 SPECTRUM ANALYZER SETUP	8
3.4 TEST PROCEDURE	9
3.5 SUMMARY OF TEST RESULTS	9
3.6 CONDUCTED EMISSIONS TEST DATA	9
3.7 PLOT OF CONDUCTED EMISSIONS TEST DATA	9
4 - RADIATED EMISSION.....	11
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	13
4.7 RADIATED EMISSIONS TEST RESULT DATA	14
5 - BAND EDGES TESTING	16
5.1 TEST PROCEDURE	16
5.2 TEST EQUIPMENT	16
5.3 TEST RESULTS	16

1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *VTech Telecommunications Ltd.*'s product, model name: Companion II Cordless 8009 or "EUT" as referred to in this report is an email device using wireless communication between terminal and base. The terminal unit measures approximately 12.0"L x 8.1"W x 5.9"H. The base unit measures approximately 6.00"L x 5.45"W x 6.00"H.

The EUT designs for the whole family to access email for their friends or relatives at home with one touch operation. Besides, it provides organizer functions, address book for their daily uses.

The CIIc supports up to 5 users while each one will be identified by his own password. In other words, each user will have his own mail box and organizer.

The EUT was powered by 3.6V rechargeable battery. A 320x140 dots (53 characters x 14 lines) with 2 color LCD displays with full-size keyboard provides comfortable working and display area. One cartridge system acts as an expansion of memory for email storage.

Besides, print functions enable users to print out their own files.

** The test data was good for test sample only. It may have deviation for other product 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 C63.4-2002.

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)/grant(s).

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2000, 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.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation 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 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 C63.4-2000.

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, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, IEC/CISPR 22: 1998, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8564E	08303	12/6/2002
HP	Spectrum Analyzer	8593B	2919A00242	12/20/2002
HP	Amplifier	8349B	2644A02662	12/20/2002
HP	Quasi-Peak Adapter	85650A	917059	12/6/2002
HP	Amplifier	8447E	1937A01046	12/6/2002
A.H. System	Horn Antenna	SAS0200/571	261	12/27/2002
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/2002
Com-Power	Biconical Antenna	AB-100	14012	11/2/2002
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/2002
Com-Power	LISN	LI-200	12208	12/20/2002
Com-Power	LISN	LI-200	12005	12/20/2002
BACL	Data Entry Software	DES1	0001	12/20/2002

***Statement of Traceability: Bay Area Compliance Laboratory Corp.** Certifies that all calibration has been performed using suitable standards traceable to the NATIONAL INSTITUTE of STANDARDS and TECHNOLOGY.

1.8 Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Base				
HP	PC System	Pavillion 6830	MX10606093	DOC
Microsoft	KB	NC-2000	A00G003112	KGXNIE-2000
Compaq	Mouse	X03-48591	6818005-00000	C3KKMPS
Sony	Monitor	P81501M	Q664908112	GSS21002
South Telecom	Phone Set	None	None	DOC
VTech	Tester	None	None	DOC
Terminal				
HP	PC System	Pavillion 6830	MX10606093	DOC
Microsoft	KB	NC-2000	A00G003112	KGXNIE-2000
Compaq	Mouse	X03-48591	6818005-00000	C3KKMPS
Sony	Monitor	P81501M	Q664908112	GSS21002
Citizen	Printer	LSP-10	5047999-82	DLK66TLSP-10
VTech	Tester	None	None	DOC

1.9 External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Base			
Shielded KB Cable	1.6	PS/2 KB Port/PC	KB
Shielded Mouse Cable	1.8	PS/2 Mouse Port/PC	Mouse
Shielded Video Cable	2.0	VGA Port/PC	Monitor
Shielded RJ232 Cable	1.0	RS232 Port/Tester	PC
Shielded RS232 Cable	0.5	RS232 Port/Tester	Base
Unshielded RJ11 Cable	20.0	RJ11 Port/Base	Phone Set
Terminal			
Shielded KB Cable	1.6	PS/2 KB Port/PC	KB
Shielded Mouse Cable	1.8	PS/2 Mouse Port/PC	Mouse
Shielded Video Cable	2.0	VGA Port/PC	Monitor
Shielded Parallel Cable	2.0	Parallel Port/Terminal	Printer
Shielded RJ232 Cable	1.0	RS232 Port/Tester	PC
Shielded RS232 Cable	0.5	RS232 Port/Tester	Terminal

2 - SYSTEM TEST CONFIGURATION

2.1 Description of Test Configuration

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

Terminal being tested: The Handset unit was placed on the wooden table and tested in three orthogonal axis. The Low, middle, and high channels were tested. The handset was transmitting to and receiving from the Base unit. The EUT was investigated for emissions while off hook. The conducted as well as radiated data was taken in this mode of operation. All initial and final investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the 2.4.

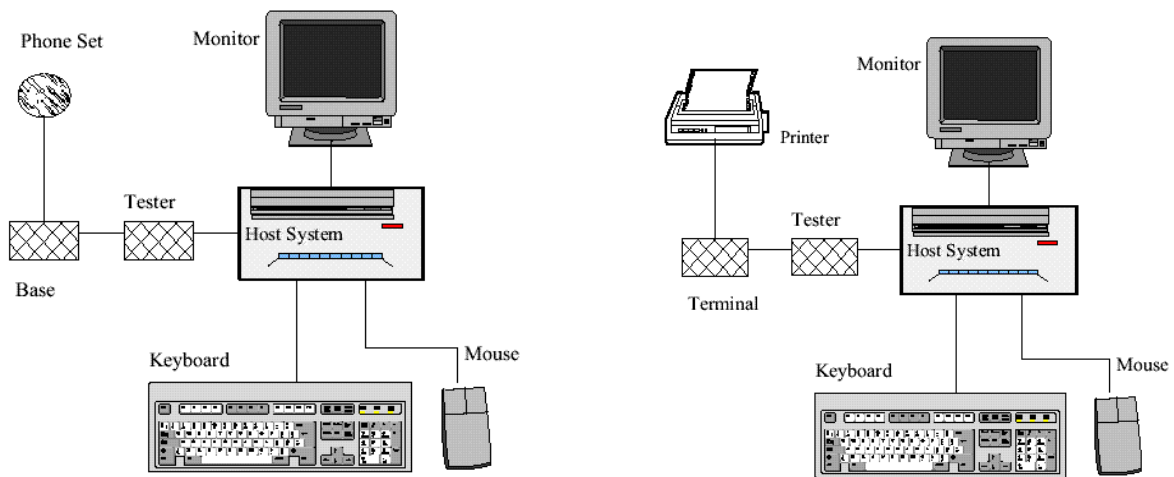
Base being tested: The Base unit was placed on the wooden table. The Low, middle, and high channels were tested. The base was connected to the line simulator and an AC adapter via its Tel Line and power ports, respectively. The base was transmitting and receiving from the Handset. The conducted as well as radiated data was taken in this mode of operation. All initial and final investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the 2.4.

The base and terminal used VTech AC/DC power adapter, M/N: U090030D12 and 280603003C0.

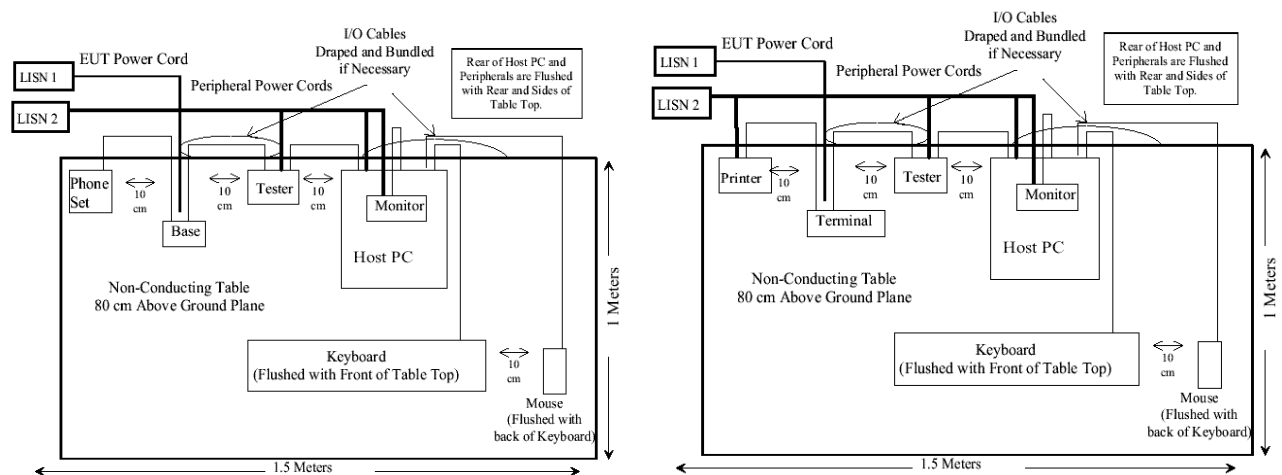
2.2 Equipment Modifications

No modification(s) to the EUT were made by BACL to comply with the applicable limits.

2.3 Configuration of Test System



2.4 Test Setup Block Diagram



3 - CONDUCTED EMISSION

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 ± 2.4 dB.

3.2 EUT Setup

The measurement was performed at the **Open Area Test Site**, using the same setup per ANSI C63.4-2000 measurement procedure. Specification used was with the FCC Class B limits.

Base configuration

The base utilized 120Vac/60Hz power source. The PC was put on the center back edge of the test table with the monitor on the top. The tester, the EUT and the phone set were placed along with the PC in order. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop. The keyboard was put directly in front of the PC. The mouse was put next to the keyboard and flushed with the rear of the keyboard.

Terminal configuration

The terminal utilized 120Vac/60Hz power source. The PC was put on the center back edge of the test table with the monitor on the top. The tester, the EUT and the printer were placed along with the PC in order. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop. The keyboard was put directly in front of the PC. The mouse was put next to the keyboard and flushed with the rear of the keyboard.

The spacing between the peripherals was 10 centimeters.

External I/O 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.....	450 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:

-17.2 dB μ V at 0.45 MHz in the Neutral mode, Base unit

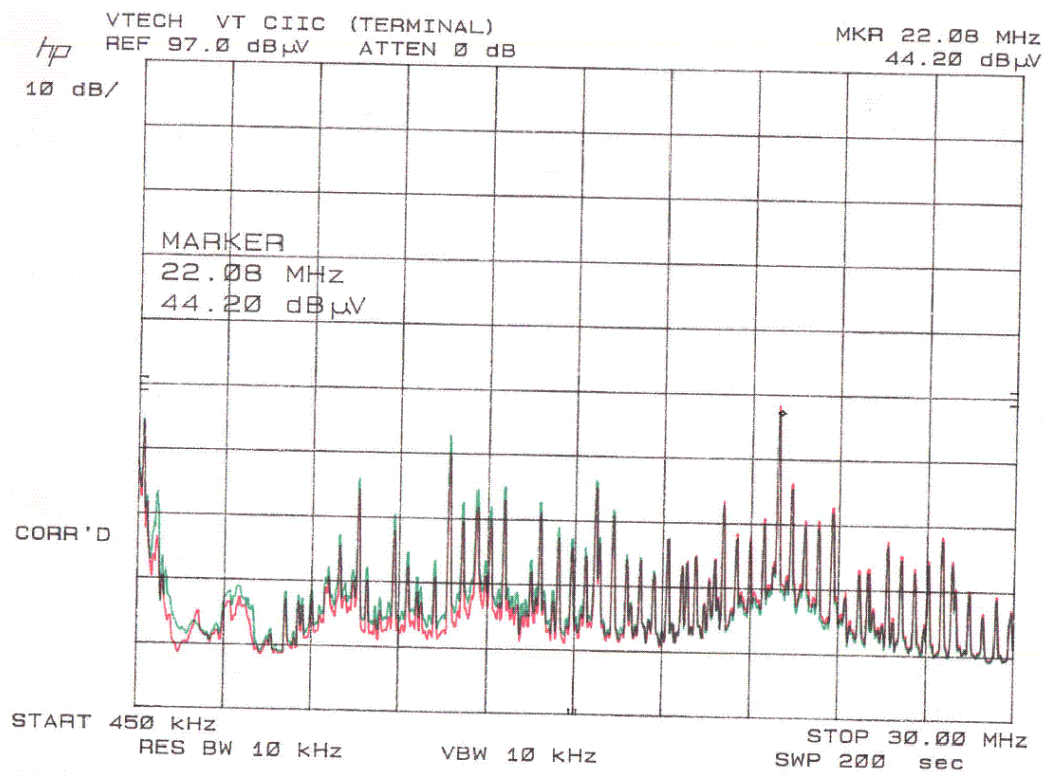
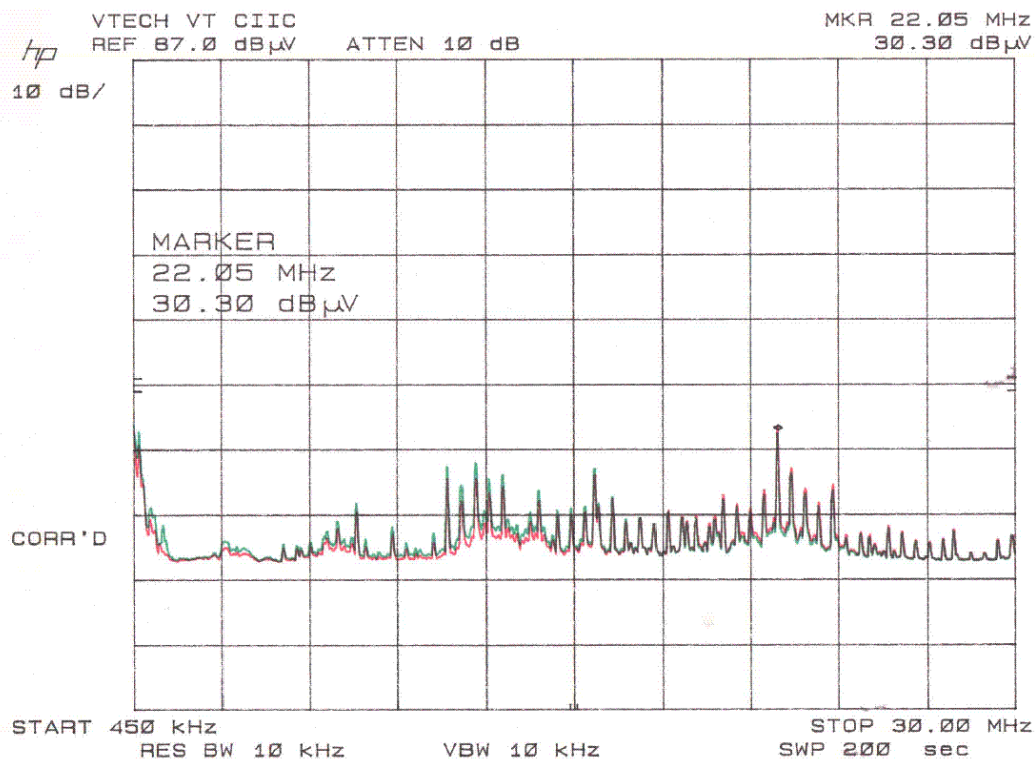
-2.7 dB μ V at 22.12 MHz in the Line mode, Terminal unit

3.6 Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dB μ V	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dB μ V	Margin dB
Base					
0.45	30.8	QP	Neutral	48	-17.2
22.05	30.3	QP	Line	48	-17.7
0.62	29.9	QP	Neutral	48	-18.1
0.45	29.7	QP	Line	48	-18.3
22.08	29.3	QP	Neutral	48	-18.7
0.63	27.7	QP	Line	48	-20.3
Terminal					
22.12	45.3	QP	Line	48	-2.7
22.08	43.2	QP	Neutral	48	-4.8
0.65	41.5	QP	Line	48	-6.5
0.63	40.4	QP	Neutral	48	-7.6
11.05	40.1	QP	Line	48	-7.9
11.20	35.9	QP	Neutral	48	-12.1

3.7 Plot of Conducted Emissions Test Data

Plot of Conducted Emissions test data was presented hereinafter as reference.



4 - RADIATED EMISSION

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 ± 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 C63.4-2000. The specification used was the FCC 15 Subpart C limits.

Base configuration

The base utilized 120Vac/60Hz power source. The PC was put on the center back edge of the test table with the monitor on the top. The tester, the EUT and the phone set were placed along with the PC in order. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop. The keyboard was put directly in front of the PC. The mouse was put next to the keyboard and flushed with the rear of the keyboard.

Terminal configuration

The terminal utilized 120Vac/60Hz power source. The PC was put on the center back edge of the test table with the monitor on the top. The tester, the EUT and the printer were placed along with the PC in order. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop. The keyboard was put directly in front of the PC. The mouse was put next to the keyboard and flushed with the rear of the keyboard.

The spacing between the peripherals was 10 centimeters.

The external I/O 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 10GHz.

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

Start Frequency	30 MHz
Stop Frequency	10GHz
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 μ V means the emission is 7dB μ V below the maximum limit for applicable limits. The equation for margin calculation is as follows:

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

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 10th harmonics as required by FCC and had the worst margin of:

Base, 30MHz to 10GHz, 3 Meters

- 3.5 dBμV (Fund.) at 902.30 MHz in the Horizontal polarization at Low Frequency
- 3.2 dBμV (Un.) at 938.00 MHz in the Vertical polarization at Middle Frequency
- 3.5 dBμV (Un.) at 935.30 MHz in the Vertical polarization at High Frequency

Terminal 30MHz to 10GHz, 3 Meters

- 3.1 dBμV (Fund.) at 923.10 MHz in the Vertical polarization at Low Frequency
- 3.0 dBμV (Fund.) at 925.20 MHz in the Vertical polarization at Middle Frequency
- 1.2 dBμV (Fund.) at 927.75 MHz in the Vertical polarization at High Frequency

4.7 Radiated Emissions Test Result Data**Base Unit, 30 MHz to 10GHz, 3 meters**

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart C		
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Mode
MHz	dBμV/m	Degree	Meter	H/V	dBμV/m	dBμV/m	dB	dBμV/m	dBμV/m	dB	
Low Channel											
902.30	87.7	0	1.2	H	24.8	3.0	25.0	90.5	94.0	-3.5	Fund.
935.75	38.3	180	1.0	H	24.6	3.7	25.0	41.6	46.0	-4.4	Un.
902.30	86.0	330	1.2	V	24.8	3.0	25.0	88.8	94.0	-5.2	Fund.
1804.60	49.8	90	1.0	V	25.3	2.6	30.0	47.7	54.0	-6.3	Avg.
1804.60	45.1	60	1.0	H	25.3	2.6	30.0	43.0	54.0	-11.0	Avg.
935.75	31.2	0	1.0	V	24.6	3.7	25.0	34.5	46.0	-11.5	Un.
272.05	39.7	0	1.2	H	13.9	5.2	25.0	33.8	46	-12.2	Un.
2706.90	36.8	270	1.2	H	29.0	3.7	30.0	39.5	54.0	-14.5	Avg.
2706.90	35.6	210	1.2	V	29.0	3.7	30.0	38.3	54.0	-15.7	Avg.
272.05	34.8	45	1.2	V	13.9	5.2	25.0	28.9	46.0	-17.1	Un.
Middle Channel											
938.00	39.5	90	1.2	V	24.6	3.7	25.0	42.8	46.0	-3.2	Un.
904.85	85.9	30	1.5	V	24.8	3.0	25.0	88.7	94.0	-5.3	Fund.
1809.70	47.9	330	1.2	V	25.3	2.6	30.0	45.8	54.0	-8.2	Avg.
938.00	33.4	120	1.2	H	24.6	3.7	25.0	36.7	46.0	-9.3	Un.
904.85	81.6	210	1.2	H	24.8	3.0	25.0	84.4	94.0	-9.6	Fund.
1809.70	45.8	330	1.0	H	25.3	2.6	30.0	43.7	54.0	-10.3	Avg.
392.62	41.2	270	1.0	H	16.5	2.8	25.0	35.5	46.0	-10.5	Un.
2714.55	38.3	90	1.0	V	29.0	3.7	30.0	41.0	54.0	-13.0	Avg.
2714.55	36.9	110	1.0	H	29.0	3.7	30.0	39.6	54.0	-14.4	Avg.
392.62	36.5	90	1.2	V	16.5	2.8	25.0	30.8	46.0	-15.2	Un.
High Channel											
935.30	39.2	60	1.5	V	24.6	3.7	25.0	42.5	46.0	-3.5	Un.
1813.30	49.3	270	1.5	V	25.3	2.6	30.0	47.2	54.0	-6.8	Avg.
906.65	84.0	330	1.2	H	24.8	3.0	25.0	86.8	94.0	-7.2	Fund.
906.65	83.1	45	1.2	V	24.8	3.0	25.0	85.9	94.0	-8.1	Fund.
1813.30	47.2	180	1.5	H	25.3	2.6	30.0	45.1	54.0	-8.9	Avg.
935.30	32.7	0	1.5	H	24.6	3.7	25.0	36.0	46.0	-10.0	Un.
488.47	39.5	30	1.2	H	18.7	2.5	25.0	35.7	46.0	-10.3	Un.
488.47	39.0	45	1.0	V	18.7	2.5	25.0	35.2	46.0	-10.8	Un.
2719.95	38.5	120	1.5	V	29.0	3.7	30.0	41.2	54.0	-12.8	Avg.
2719.95	37.1	150	1.2	H	29.0	3.7	30.0	39.8	54.0	-14.2	Avg.

Fund. : Fundamental

Avg.: Average

Un.: Unintentional

Note: There was no apparent emission found after the third harmonics.

Terminal Unit, 30 MHz to 10GHz, 3 meters

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart C		
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Mode
MHz	dBμV/m	Degree	Meter	H/V	dBμV/m	dBμV/m	dB	dBμV/m	dBμV/m	dB	
Low Channel											
923.10	86.8	0	1.5	V	24.7	4.4	25.0	90.9	94.0	-3.1	Fund.
894.45	39.2	0	1.2	V	24.8	2.7	25.0	41.7	46.0	-4.3	Un.
923.10	83.9	30	1.2	H	24.7	4.4	25.0	88.0	94.0	-6.0	Fund.
1846.20	48.6	180	1.2	V	25.3	2.6	30.0	46.5	54.0	-7.5	Avg.
894.45	34.1	50	1.2	H	24.8	2.7	25.0	36.6	46.0	-9.4	Un.
1846.20	43.5	160	1.0	H	25.3	2.6	30.0	41.4	54.0	-12.6	Avg.
271.66	38.9	30	1.5	H	13.9	5.2	25.0	33.0	46	-13.0	Un.
2769.30	37.1	230	1.2	H	29.0	3.7	30.0	39.8	54.0	-14.2	Avg.
271.66	35.4	60	1.5	V	13.9	5.2	25.0	29.5	46.0	-16.5	Un.
2769.30	34.5	210	1.0	V	29.0	3.7	30.0	37.2	54.0	-16.8	Avg.
Middle Channel											
925.20	86.9	250	2.0	V	24.7	4.4	25.0	91.0	94.0	-3.0	Fund.
891.75	39.3	0	1.0	V	24.8	2.7	25.0	41.8	46.0	-4.2	Un.
1850.40	49.6	70	1.2	V	25.3	2.6	30.0	47.5	54.0	-6.5	Avg.
925.20	82.4	270	1.5	H	24.7	4.4	25.0	86.5	94.0	-7.5	Fund.
391.13	40.5	210	1.0	H	16.5	2.8	25.0	34.8	46.0	-11.2	Un.
2775.60	38.7	110	1.5	V	29.0	3.7	30.0	41.4	54.0	-12.6	Avg.
891.75	30.7	45	1.0	H	24.8	2.7	25.0	33.2	46.0	-12.8	Un.
1850.40	41.5	90	1.2	H	25.3	2.6	30.0	39.4	54.0	-14.6	Avg.
391.13	36.6	230	1.2	V	16.5	2.8	25.0	30.9	46.0	-15.1	Un.
2775.60	35.4	130	1.2	H	29.0	3.7	30.0	38.1	54.0	-15.9	Avg.
High Channel											
927.75	85.7	250	1.2	V	24.7	4.4	25.0	89.8	94.0	-4.2	Fund.
894.30	38.6	270	1.2	V	24.8	2.7	25.0	41.1	46.0	-4.9	Un.
927.75	84.3	210	1.5	H	24.7	4.4	25.0	88.4	94.0	-5.6	Fund.
1855.50	48.5	0	1.2	H	25.3	2.6	30.0	46.4	54.0	-7.6	Avg.
894.30	35.1	240	1.2	H	24.8	2.7	25.0	37.6	46.0	-8.4	Un.
2783.25	39.9	110	1.5	V	29.0	3.7	30.0	42.6	54.0	-11.4	Avg.
480.55	36.6	45	1.2	H	18.7	2.5	25.0	32.8	46.0	-13.2	Un.
1855.50	42.4	30	1.2	V	25.3	2.6	30.0	40.3	54.0	-13.7	Avg.
2783.25	36.8	140	1.5	H	29.0	3.7	30.0	39.5	54.0	-14.5	Avg.
480.55	32.7	0	1.0	V	18.7	2.5	25.0	28.9	46.0	-17.1	Un.

Fund. : Fundamental

Avg.: Average

Un.: Unintentional

Note: There was no apparent emission found after the third harmonics.

5 - BAND EDGES TESTING

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.

5.1 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.

5.2 Test Equipment

HP 8566B Spectrum Analyzer
HP 7470A Plotter

5.3 Test Results

Refer to the attached plots.

Base - Low Frequency
Terminal - High Frequency

