

10 - ANTENNA REQUIREMENT

10.1 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.

And according to § 15.247 (1)), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

10.2 Antenna Connected Construction

The directional gain of antenna used for transmitting is 0 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

11 – RF SAFETY REQUIREMENTS TO 2.1091

According to section 3 of Supplement C to OET Bulletin 65, Part 15 Transmitters are categorically excluded from Routine Environmental Evaluation by measurement or precise computations unless otherwise required by the Commissions.

The unit under evaluation has an external antenna of 0 dBi gain with a measured output power of 0.018 Watts at the antenna terminals.

Due to the low power of the EUT, environmental evaluation should be deemed unnecessary since the EUT's operational frequency range is 2.4-2.4835 GHz and the ERP is considerably less than 3 Watts.

12 – SPURIOUS RADIATED EMISSION DATA

12.1 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.

12.2 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 EUT was connected to a 110 VAC / 60 Hz power source and it was placed center and the back edge of the test table. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.

The spacing between the peripherals was 10 centimeters.

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

12.3 Spectrum Analyzer Setup

According to FCC Rules, 47 CFR §15.33 (a) (1), since the clock was 2.4 GHz, the system was tested to 24000 MHz.

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

Start Frequency	30 MHz
Stop Frequency	24000 MHz
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

12.4 Test Procedure

For the radiated emissions test, both the EUT and all support equipment power cords was 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 (less than -4 dB μ V), and are distinguished with a "Qp" in the data table.

12.5 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 Class B. The equation for margin calculation is as follows:

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

12.6 Summary of Test Results

According to the data in section 11.7, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207, and 15.247, and had the worst margin of:

For Base:

- 2.0 dB μ V at 7205.53 MHz in the **Horizontal** polarization at Low Channel, 30 to 24000MHz, 3 meters.

- 2.3 dB μ V at 7326.99 MHz in the **Horizontal** polarization at Middle Channel, 30 to 24000MHz, 3 meters.

- 2.5 dB μ V at 7446.42 MHz in the **Vertical** polarization at Middle Channel, 30 to 24000MHz, 3 meters.

For Handset:

- 1.8 dB μ V at 7207.14 MHz in the **Vertical** polarization at Low Channel, 30 to 24000MHz, 3 meters.

- 7.3 dB μ V at 4884.14MHz in the **Vertical** polarization at Middle Channel, 30 to 24000MHz, 3 meters.

- 2.4 dB μ V at 7446.03 MHz in the **Vertical** polarization at High Channel, 30 to 24000MHz, 3 meters.

12.7.3.a Final Scan, Base, Low Channel.

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart C		
Frequency MHz	Ampl. dBµV/m	Direction Degree	Height Meter	Polar H/V	Antenna dBµV/m	Cable Loss dBµV/m	Amp. dB	Corr. Ampl. dBµV/m	Limit dBµV/m	Margin dB	Mode
2402.27	78.5	45	1.7	H	28.1	3.4	22.0	88.0			
2402.27	74.5	45	1.7	V	28.1	3.4	22.0	84.0			
7205.53	53.3	45	1.7	h	35.1	5.6	22.0	72.0	74	-2.0	Peak
4804.54	36.0	90	2.5	h	32.5	4.9	22.0	51.4	54	-2.6	Average
7205.53	32.1	45	1.5	h	35.1	5.6	22.0	50.8	54	-3.2	Average
7205.53	51.0	45	1.5	v	35.1	5.6	22.0	69.7	74	-4.3	Peak
4804.54	54.0	90	2.5	h	32.5	4.9	22.0	69.4	74	-4.6	Peak
9609.08	30.3	160	2.0	h	35.1	5.6	22.0	49.0	54	-5.0	Average
7205.53	30.0	45	1.3	v	35.1	5.6	22.0	48.7	54	-5.3	Average
9609.08	50.0	90	1.5	v	35.1	5.6	22.0	68.7	74	-5.3	Peak
9609.08	30.0	90	1.5	v	35.1	5.6	22.0	48.7	54	-5.3	Average
4804.54	32.1	90	2.5	v	32.5	4.9	22.0	47.5	54	-6.5	Average
4804.54	47.0	90	2.5	v	32.5	4.9	22.0	62.4	74	-11.6	Peak
9609.08	32.0	160	2.0	h	35.1	5.6	22.0	50.7	74	-23.3	Peak

12.7.3.b Final Scan, Base, Middle Channel.

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart C		
Frequency MHz	Ampl. dBμV/m	Direction Degree	Height Meter	Polar H/V	Antenna dBμV/m	Cable Loss dBμV/m	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB	Mode
2442.33	80.0	170	1.4	V	28.1	3.4	22.0	89.5			
2442.33	78.1	225	1.4	H	28.1	3.4	22.0	87.6			
7326.99	33.0	180	1.5	H	35.1	5.6	22.0	51.7	54	-2.3	Average
4884.66	36.0	170	1.5	H	32.5	4.9	22.0	51.4	54	-2.6	Average
7326.99	32.0	180	1.5	V	35.1	5.6	22.0	50.7	54	-3.3	Average
9769.32	31.5	125	2.1	V	35.1	5.6	22.0	50.2	54	-3.8	Average
9769.32	31.0	225	1.8	H	35.1	5.6	22.0	49.7	54	-4.3	Average
7326.99	50.7	180	1.5	V	35.1	5.6	22.0	69.4	74	-4.6	Peak
7326.99	50.0	180	1.5	H	35.1	5.6	22.0	68.7	74	-5.3	Peak
4884.66	53.0	170	1.5	H	32.5	4.9	22.0	68.4	74	-5.6	Peak
9769.32	49.0	225	1.8	H	35.1	5.6	22.0	67.7	74	-6.3	Peak
4884.66	31.8	170	1.5	V	32.5	4.9	22.0	47.2	54	-6.8	Average
4884.66	46.0	170	1.5	V	32.5	4.9	22.0	61.4	74	-12.6	Peak
9769.32	32.6	125	2.1	V	35.1	5.6	22.0	51.3	74	-22.7	Peak

12.7.3.c Final Scan, Base, High Channel.

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	
2482.14	80.0	120	1.3	V	28.1	3.4	22.0	89.5			
2482.14	81.0	120	1.3	H	28.1	3.4	22.0	90.5			
7446.42	52.8	180	1.4	V	35.1	5.6	22.0	71.5	74	-2.5	Peak
4964.28	36.0	90	1.4	V	32.5	4.9	22.0	51.4	54	-2.6	Average
9928.56	32.3	180	1.4	V	35.1	5.6	22.0	51.0	54	-3.0	Average
7446.42	52.1	180	1.4	V	35.1	5.6	22.0	70.8	74	-3.2	Peak
4964.28	55.3	180	1.4	V	32.5	4.9	22.0	70.7	74	-3.3	Peak
7446.42	31.9	180	1.4	V	35.1	5.6	22.0	50.6	54	-3.4	Average
9928.56	31.7	180	1.4	H	35.1	5.6	22.0	50.4	54	-3.6	Average
4964.28	33.7	90	2.5	H	32.5	4.9	22.0	49.1	54	-4.9	Average
7446.42	30.1	180	1.4	V	35.1	5.6	22.0	48.8	54	-5.2	Average
9928.56	49.5	180	1.4	H	35.1	5.6	22.0	68.2	74	-5.8	Peak
4964.28	43.2	180	2.5	H	32.5	4.9	22.0	58.6	74	-15.4	Peak
9928.56	39.4	180	1.4	V	35.1	5.6	22.0	58.1	74	-15.9	Peak

12.7.3.d Final Scan, Handset, Low Channel.

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	
2402.38	89.0	180	2.2	V	28.1	3.4	22.0	98.5			
2402.38	90.0	180	1.7	H	28.1	3.4	22.0	99.5			
7207.14	33.5	180	2.0	V	35.1	5.6	22.0	52.2	54	-1.8	Average
9633.52	32.9	45	2.5	V	35.1	5.6	22.0	51.6	54	-2.4	Average
7207.14	32.5	180	2.0	H	35.1	5.6	22.0	51.2	54	-2.8	Average
4804.79	35.1	190	2.2	V	32.5	4.9	22.0	50.5	54	-3.5	Average
9633.52	31.5	45	2.5	H	35.1	5.6	22.0	50.2	54	-3.8	Average
9633.52	50.7	45	1.5	H	35.1	5.6	22.0	69.4	74	-4.6	Peak
7207.14	50.1	180	1.7	H	35.1	5.6	22.0	68.8	74	-5.2	Peak
7207.14	52.6	180	1.7	V	32.5	5.6	22.0	68.7	74	-5.3	Peak
4804.79	32.8	190	2.0	H	32.5	4.9	22.0	48.2	54	-5.8	Average
4804.79	52.3	180	2.2	V	32.5	4.9	22.0	67.7	74	-6.3	Peak
4804.79	46.2	180	2.0	H	32.5	4.9	22.0	61.6	74	-12.4	Peak
9633.52	35.6	45	1.5	V	35.1	5.6	22.0	54.3	74	-19.7	Peak

12.7.3.e Final Scan, Handset, Middle Channel.

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	
2442.07	88.7	180	2.0	V	28.1	3.4	22.0	98.2			
2442.07	89.0	225	1.6	H	28.1	3.4	22.0	98.5			
4884.14	51.3	180	2.2	V	32.5	4.9	22.0	66.7	74	-7.3	Peak
7326.21	32.9	45	2.5	V	35.1	5.6	22.0	51.6	54	-2.4	Average
9768.28	30.2	120	1.5	V	35.1	5.6	22.0	48.9	54	-5.1	Average
7326.21	51.2	45	2.5	V	35.1	5.6	22.0	69.9	74	-4.1	Peak
4884.14	33.5	180	2.2	V	32.5	4.9	22.0	48.9	54	-5.1	Average
7326.21	30.1	45	2.5	H	35.1	5.6	22.0	48.8	54	-5.2	Average
9768.28	31.9	120	1.5	V	35.1	5.6	22.0	50.6	54	-3.4	Average
9768.28	49.3	120	1.5	H	35.1	5.6	22.0	68.0	74	-6.0	Peak
7326.21	48.9	45	2.5	H	35.1	5.6	22.0	67.6	74	-6.4	Peak
4884.14	31.4	180	1.7	H	32.5	4.9	22.0	46.8	54	-7.2	Average
4884.14	49.7	180	1.7	H	32.5	4.9	22.0	65.1	74	-8.9	Peak
9768.28	36.2	120	1.5	H	35.1	5.6	22.0	54.9	74	-19.1	Peak

12.7.3.f Final Scan, Handset, High Channel.

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart C		
Frequency MHz	Ampl. dBμV/m	Direction Degree	Height Meter	Polar H/V	Antenna dBμV/m	Cable Loss dBμV/m	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB	Mode
2482.01	86.0	170	2.2	V	28.1	3.4	22.0	95.5			
2482.01	86.7	90	2.2	h	28.1	3.4	22.0	96.2			
7446.03	32.9	170	2.0	V	35.1	5.6	22.0	51.6	54	-2.4	Average
4964.02	35.4	180	2.2	V	32.5	4.9	22.0	50.8	54	-3.2	Average
9928.04	31.5	120	1.5	V	35.1	5.6	22.0	50.2	54	-3.8	Average
4964.02	34.7	180	2.2	H	32.5	4.9	22.0	50.1	54	-3.9	Average
7446.03	30.9	170	2.0	H	35.1	5.6	22.0	49.6	54	-4.4	Average
7446.03	50.7	170	2.0	V	35.1	5.6	22.0	69.4	74	-4.6	Peak
9928.04	50.4	120	1.5	H	35.1	5.6	22.0	69.1	74	-4.9	Peak
9928.04	30.0	120	1.5	H	35.1	5.6	22.0	48.7	54	-5.3	Average
4964.02	52.1	180	2.2	V	32.5	4.9	22.0	67.5	74	-6.5	Peak
7446.03	47.4	170	2.0	H	35.1	5.6	22.0	66.1	74	-7.9	Peak
4964.02	49.3	180	2.2	H	32.5	4.9	22.0	64.7	74	-9.3	Peak
9928.04	35.7	120	1.5	V	35.1	5.6	22.0	54.4	74	-19.6	Peak

13 - CONDUCTED EMISSIONS TEST DATA

13.1 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.

13.2 EUT Setup

The measurement was performed at the **Open Area Test Site**, using the same setup per ANSI C63.4 - 1992 measurement procedure. The specification used was with FCC Class B limits.

13.3 Spectrum Analyzer Setup

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

Start Frequency	450 kHz
Stop Frequency	30 MHz
Sweep Speed.....	Auto
IF Bandwidth.....	100 kHz
Video Bandwidth.....	100 kHz
Quasi-Peak Adapter Bandwidth.....	9 kHz
Quasi-Peak Adapter Mode	Normal

13.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with 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 (less than -4 dB μ V). Quasi-peak readings are distinguished with a "Qp".

13.5 Summary of Test Results

According to the data in section 12.6, the EUT complied with the FCC Conducted margin for a Class B device and these test results is deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

-9.0 dB μ V at 0.660 MHz in the Neutral mode.

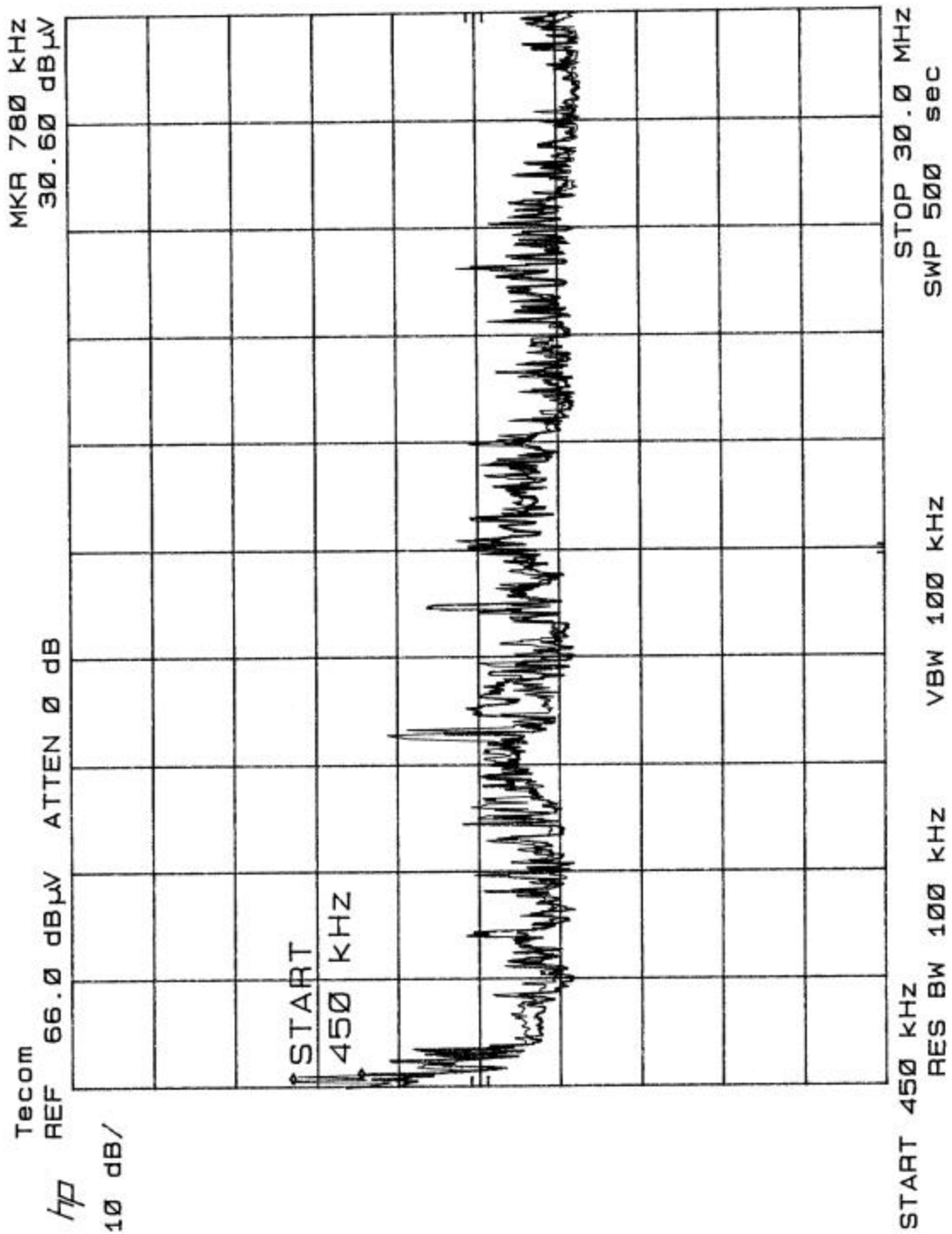
13.6 Conducted Emissions Test Data

12.6.1 Test Data, 0.45 - 30 MHz.

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency	Amplitude	Detector	Phase	Limit	Margin
MHz	dB μ V	Qp/Ave/Peak	Line/Neutral	dB μ V	dB
0.660	39.0	Peak	Neutral	48	-9.0
0.780	30.6	Peak	Line	48	-17.4
10.170	27.3	Peak	Neutral	48	-20.7
13.630	22.2	Peak	Line	48	-25.8
10.170	20.2	Peak	Line	48	-27.8
15.520	18.6	Peak	Neutral	48	-29.4

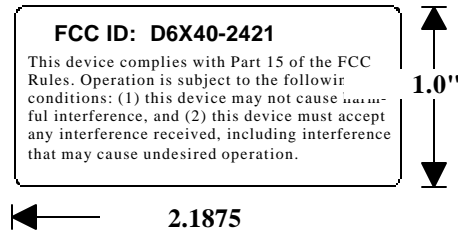
13.7 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented in the following page as reference.



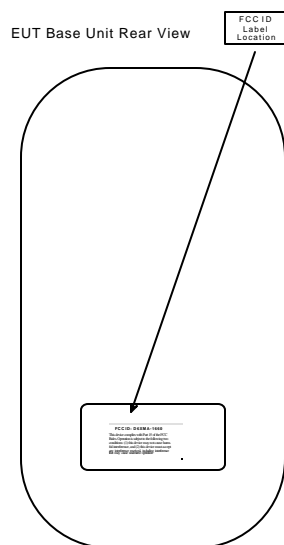
14 – FCC PRODUCT LABELING AND WARNING STATEMENT

14.1 FCC ID Label



Specifications: Text is black or white in color and is left justified. Labels are silk-screened and shall be “permanently affixed” at a conspicuous location on the EUT.

14.2 Proposed Label Location on EUT



14.3 FCC Warning Statement

The users manual or instruction manual for an intentional or unintentional radiator shall caution the use that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio / TV technician for help

Appendix A – AGENT AUTHORIZATION LETTER



TECOM CO., LTD.

23, R & D ROAD 2
SCIENCE-BASED INDUSTRIAL PARK
HSIN-CHU TAIWAN R.O.C.
TELEPHONE: 886-35-775141
FAX: 886-35-778855

December 12, 2000

Federal Communications Commission
7435 Oakland Mills Road
Columbia, Maryland, 21046

Sir/Madam,

Regarding: FCC grand for model "40-2421"

This letter is an authorization to accept Bay Area Compliance Lab. Corporation as an agent for Tecom Co, LTD., 23, R&D Road 2, Science-Based Industrial Park, Hsin-Chu, Taiwan, R.O.C., to sign applications before the Commission on our behalf, to make representations to you on our behalf, and to receive and exchange data between our company and the commission in connection with certification of the following Tecom's product model 40-2421.

Under FCC docket number 20780 and general docket number 80-284 pursuant to part 15, FCC rules and regulations.

Sincerely,

Signature: *Sheng Yih Lin*

Printed Name: Sheng-Yih Lin

Title: Sr. Project Engineer

Date: December 12, 2000

Appendix B – EUT SECURITY CODE

FCC ID: D6X40-2421

DIGITAL SECURITY CODE:

The model "40-2421" has the circuitry for digital security code to provide protection against unintentional access. For each model, one of 7,529,536 kinds of digital security code is randomly selected and fixed in each telephone as it is manufactured.

Appendix C – CH PLAN

* the character of 'P' can be keyed into by pressing "function" key and then pressing "pause" key .

* the character of 'F' can be keyed into by pressing "flash" key .

CH - Plan .

Channel	RX/TX RF Frequency (MHz)	Security code
1	2402.3040	***#F9
2	2403.3280	***#FF
3	2404.3520	***#15
4	2405.3760	***#25
5	2406.4000	***#35
6	2407.4240	***#45
7	2408.4480	***#55
8	2409.4720	***#65
9	2410.4960	***#75
10	2411.5200	***#85
11	2412.5440	***#95
12	2413.5680	***#05
13	2414.5920	Cannot be used
14	2415.6160	***##5
15	2416.6400	***#P5
16	2417.6640	***#F5
17	2418.6880	***#F0
18	2419.7120	***#11
19	2420.7360	***#21
20	2421.7600	***#31
21	2422.7840	***#41
22	2423.8080	***#51
23	2424.8320	***#61
24	2425.8560	***#71
25	2426.8800	***#81
26	2427.9040	***#91
27	2428.9280	***#01
28	2429.9520	***##1
29	2430.9760	***##1
30	2432.0000	***#P1
31	2433.0240	***#F1
32	2434.0480	***#F6
33	2435.0720	***#F*
34	2436.0960	***#12
35	2437.1200	***#22
36	2438.1440	***#32
37	2439.1680	***#42
38	2440.1920	***#52

39	2441.2160	*##62
40	2442.2400	*##72
41	2443.2640	*##82
42	2444.2880	*##92
43	2445.3120	*##02
44	2446.3360	*##*2
45	2447.3600	*##*2
46(no use)	2448.3840	*##P2
47(no use)	2449.4080	*##F2
48(no use)	2450.4320	*##F7
49(no use)	2451.4560	*##F#
50(no use)	2452.4800	*##13
51	2453.5040	*##23
52	2454.5280	*##33
53	2455.5520	*##43
54	2456.5760	*##53
55	2457.6000	*##63
56	2458.6240	*##73
57	2459.6480	*##83
58	2460.6720	*##93
59	2461.6960	*##03
60	2462.7200	*##*3
61	2463.7440	*##*3
62	2464.7680	*##P3
63	2465.7920	*##F3
64	2466.8160	*##F8
65	2467.8400	*##FP
66	2468.8640	*##14
67	2469.8880	*##24
68	2470.9120	*##34
69	2471.9360	*##44
70	2472.9600	*##54
71	2473.9840	*##64
72	2475.0080	*##74
73	2476.0320	*##84
74	2477.0560	*##94
75	2478.0800	*##04
76	2479.1040	*##*4
77	2480.1280	*##*4
78	2481.1520	*##P4
79	2482.1760	*##F4