UTStarcom Canada

Kestrel iPA 1900 Translator

Report of Measurements

as per

FCC CFR47 Part 15/B and FCC CFR47 Part 24

Revision 1.0

April 8, 2005

Approval		
Checked By:	Robert Stirling, P.Eng	Apr. 8, 2005 Date

Protocol Labs, Abbotsford BC, Canada
FCC Registration Number 96437
Industry Canada Registration Numbers IC3384

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Section I: Information for Test Report of Measurements

Testing Details

TESTED BY: David Johanson

TEST CONDITIONS: Temperature and Humidity: 10.8° C, 62%

TEST VOLTAGE: 120Vac, 60Hz

Test Facilities

Protocol Labs
28945 McTavish Rd.
Abbotsford BC, Canada, V4X 2E7

FCC Registration Number 96437
Industry Canada Registration Number IC3384

Test Equipment List

EMISSIONS:

Device	Model Number	Serial No.	Last Cal.	Next Cal
Antenna	EMCO LPA-30	178	13/10/04	13/10/05
Antenna	EMCO EM 6912	380	11/10/04	11/010/05
LISN	Solar 8012-50-R-24-BNC	863092	22/10/04	22/10/05
Spectrum Analyzer	Agilent E4440	M444303599	01/01/05	01/01/06
Tower	Rhientech Labs	Custom	NR	NR
Turntable	Protocol	Custom	NR	NR

Company Tested For

NAME: UTStarcom Canada

ADDRESS: 4600 Jacombs Road
Richmond, BC V6V 3B1

CONTACT PERSON: Mr. Joe Perrella

PHONE NUMBER: 604-276-0055

Company on Test SIte

NAME: Unity Wireless Systems Corporation

ADDRESS: 7438 Fraser Park Drive
Burnaby, BC V5J 5B9

CONTACT PERSON: Mr. Rami Kenig

EMAIL: ramik@unitywireless.com

PHONE NUMBER: 604-267-2737

Equipment Under Test

THE TEST SYSTEM:

EUT: Frequency Translating iPA (repeater

Manufacturer: Unity Wireless Systems Corporation, OEM UTStarcom Canada
Part Number: 3000 0005 002

Aux Equip 1: Signal Generator

Manufacturer: Hewlett Packard
Part Number: HP8646C
Serial Number: 3537A02338

Aux Equip 2: Laptop PC

Manufacturer: Toshiba
Part Number: PS22SC-N91J4
Serial Number: 60013470

Aux Equip 3: 19.2 MHz Frequency Reference Jig
Manufacturer: Unity Wireless

TEST SETUP: The EUT was setup in its approved operating configuration as per the requested requirements of the manufacturer.

CABLING:

Cable	Connector	Load/Termination	Shielded	Ferrites
RG174	SMA Male	19.2 Mμ2 Ref	Yes	No
RG58	N Male	50 Ohm Load	Yes	No
RG174	SMA Male	Frequency Generator	Yes	No
RG6	N Male	Attenuators/Spectrum Analyzer	Yes	No
Power Cord	3 Prong AC Plug	120VAC	No	No
RS-232 Serial	DB-9 male	PC Serial Port	Yes	No

MODIFICATIONS: No modifications were required for this unit to pass.

CONCLUSION: The Kestrel iPA 1900 Translator that was tested complies with the requirements of FCC CFR47 Part 15/B, and FCC CFR47 Part 24

Section II: FCC CFR47 Part 15/B Report of Measurements

General

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15B - Unintentional Radiators, Class A.

Both the Radiated and Power Line Conducted Emission tests were performed using measurement procedure outlined in the above standard.

FCC Labeling and Marking Requirements:

Markings

According to FCC Section 15.19, and ICES 003, a statement similar to the following must be included on an identification label, which also uniquely identifies the manufactured date, either explicitly or through a serial number etc.:

> "This equipment complies with FCC Rules, Part 15 and Industry Canada's ICES 003 for a Class A Digital Device. Operation is subject to two conditions:
>
> 1) This device may not cause harmful interference, and
> 2) This device must accept any interference that may cause any undesired operation"

Additionally, if the manufacturer markets product to Quebec, the following supplemental information should be added to the label:

> "Cet Apparreil numerique de la Classe A respecte toutes les exigences du Reglement sur le material broilleur du Canada."

Labeling

According to FCC Section 15.105, and ICES 003, the following statement must be included in a prominent location your User's Manual:

> NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

It is also required according to FCC Part B Section 15.21 that a caution is included such as:

> Caution: Changes or modifications to this equipment, not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Part 1 - Conducted Emission Testing

DATE: March 9, 2005

TEST STANDARD: FCC CFR47, Part 15, Subpart B

TEST VOLTAGE: 120Vac, 60Hz

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus.

MINIMUM STANDARD: Class A Limit:

Frequency (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15 - 0.50	79	66
5.00 - 30.0	73	60

METHOD OF MEASUREMENT: Measurements were made using a spectrum analyzer, Peak detector. Any emissions that are close to the limit are measured using a test receiver and CISPR Quasi-Peak detector.

DEVICE DESCRIPTIONS: As described in the Equipment Under Test Section, above.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

CABLING:

Cable	Connector	Load/Termination	Shielded	Ferrites
RG174	SMA Male	19.2 $M\mu_2$ Ref	Yes	No
RG58	N Male	50 Ohm Load	Yes	No
RG174	SMA Male	Frequency Generator	Yes	No
RG6	N Male	Attenuators/Spectrum Analyzer	Yes	No
Power Cord	3 Prong AC Plug	120VAC	No	No
RS-232 Serial	DB-9 male	PC Serial Port	Yes	No

MODIFICATIONS: No modifications were required for the device to pass the test.

MEASUREMENT DATA: See Appendix B for Plots,

EMISSIONS DATA: See Tables 1 and 2 in Appendix B for corresponding frequencies.

PERFORMANCE: Complies with standard.

Part 2 - Radiated Emission Testing

DATE: March 9, 2005

TEST STANDARD: FCC CFR47, Part 15, Subpart B

TEST VOLTAGE: 120Vac, 60Hz

TEST SETUP: The equipment was set up in a 10-meter open field test site. Emissions in both horizontal and vertical polarizations were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots.

MINIMUM STANDARD: Class A Limit:

Frequency MHz	Field Strength at 10m	
	Microvolts/Meter	dB microvolts per meter
30 - 88	90	39.08
88 - 216	150	43.52
216 - 960	210	46.44
960 - above	300	49.54

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test Section.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

CABLING:

Cable	Connector	Load/Termination	Shielded	Ferrites
RG174	SMA Male	19.2 Mμ2 Ref	Yes	No
RG58	N Male	50 Ohm Load	Yes	No
RG174	SMA Male	Frequency Generator	Yes	No
RG6	N Male	Attenuators/Spectrum Analyzer	Yes	No
Power Cord	3 Prong AC Plug	120VAC	No	No
RS-232 Serial	DB-9 male	PC Serial Port	Yes	No

MODIFICATIONS: No modifications were required for the device to pass the test.

EMISSIONS DATA: See Table in Appendix B for corresponding frequencies.

PERFORMANCE: Complies with standard.

Section III: FCC CFR47 Part 24 Report of Measurements

General

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 24 – Personal Communication Services.

The Radiated Emission tests were performed using measurement procedure outlined in the above standard and in the applicable parts of CFR47 Part 2.

Part 1 - Field Strength of Spurious Radiation measurements

DATE:	March 11, 2005
TEST STANDARD:	47CFR2.1053, 24.238(A)
TEST VOLTAGE:	120Vac, 60Hz
TEST SETUP:	As required by §2.1053, field strength of spurious radiation measurements were made in accordance with the general procedures of ANSI C63.4-1992 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz". The final measurements were made on a 10-meter open area test site. The unit was scanned over the frequency range of 9 kHz to 20 GHz. The EUT was connected to the appropriate generators, terminators and a laptop PC. The RF output was set to 42.3 dBm as per the manufacturers tuning procedures.
MINIMUM STANDARD:	As per 24.238(a), the spurious emissions must be attenuated by 43 + 10log(P) below the transmitting power level. The power level is: 17W Therefore, the attenuation level limit for spurious emissions is set at: 55.3dBm The field strength limit is calculated by using the plane wave relation at 3m: Emissions less then 1GHz E = √(49.2x17)/3 = 151.82dBμV/m Attenuation level = 151.8 – 55.3 = 96.5dBμV Emissions greater then 1GHz E = 151.82 – 20Log√(1.64) = 149.7dBμV/m Attenuation level = 149.7 – 55.3 = 94.4dBμV
MODIFICATIONS:	No modifications were required for the device to pass the test.
EMISSIONS DATA:	See the following pages for the data.
PERFORMANCE:	Complies with standard.

Carrier Emission: 17 watts; Fundamental of 1930.000MHz

Frequency	Ant. Pol	Ant. Hgt	Ang	Uncor-Pk	Tot Corr	Test distance	Corrected Peak	Limit	Margin
(MHz)		(m)	(deg)	(dBμV)	(dB)	(m)	(dBμV/m)	(dBμV)	(dB)
49.009920	V	1	0	20.9	10.36	3	31.26	96.5	65.24
62.21124	V	1	250	13.2	6.28	3	19.48	96.5	77.02
73.51903	V	1	180	16.6	7.5	3	24.1	96.5	72.4
1930.000	V	1	170	46.94	33.3	1	80.24		

No Radiated Emissions were observed between 1930 and 20GHz

Correction Factor = Antenna Factor + Cable Loss – Preamplifier Gain + Distance Correction

Part 2 – Occupied Bandwidth

DATE: March 9, 2005

TEST STANDARD: FCC CFR47, Part 2.1049

TEST VOLTAGE: 120Vac, 60Hz

TEST SETUP: As required by §2.1049 of CFR 47, occupied bandwidth measurements were made on the Translator pre- and post- Translation. A digital signal generator was configured to transmit a CDMA IS-95 modulated carrier signal. Using an IF bandwidth of 30kHz, we determined the occupied bandwidth of the emission at the lowest and highest select-able channel range was determined.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

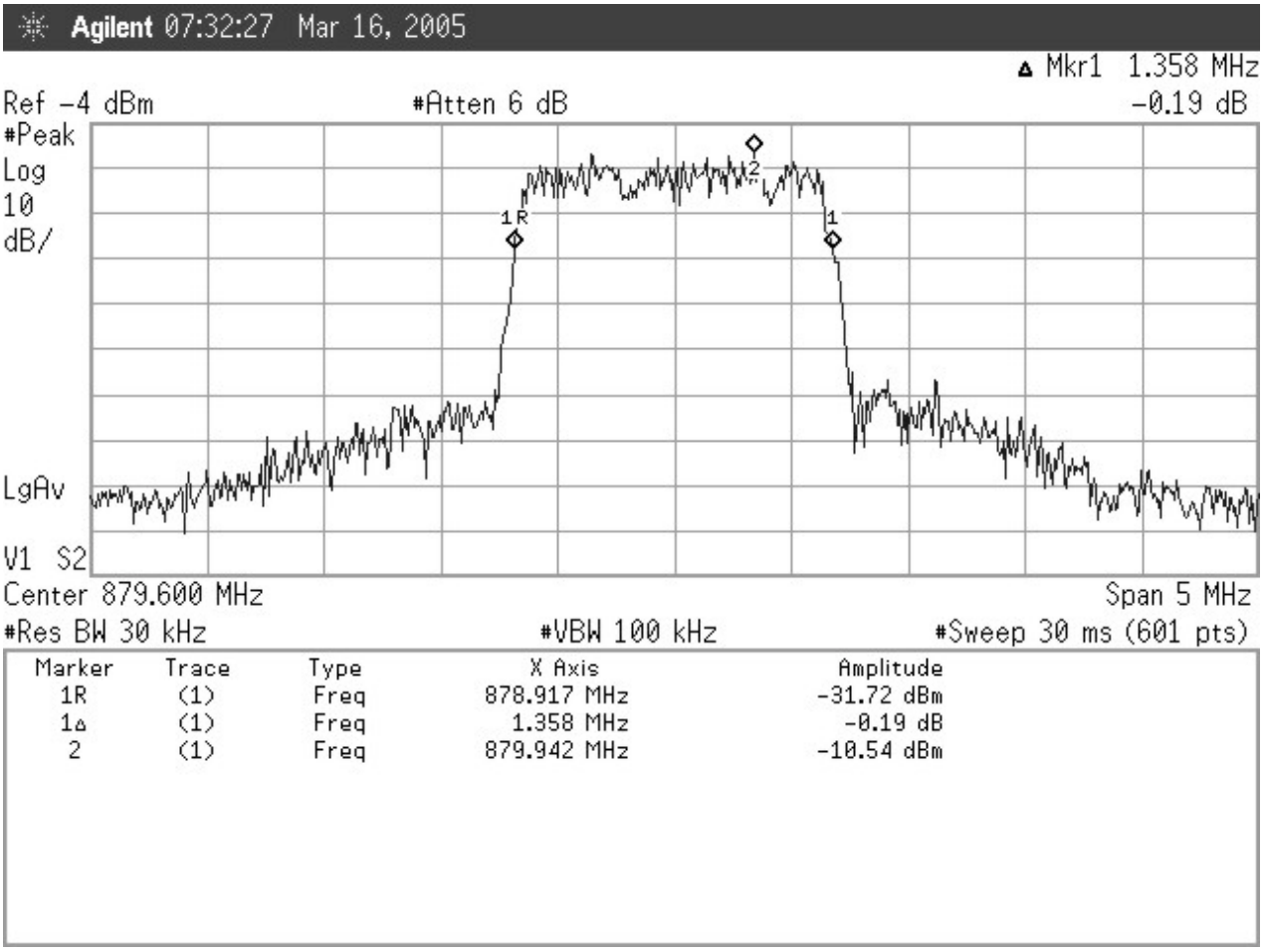
CABLING:

Cable	Connector	Load/Termination	Shielded	Ferrites
RG174	SMA Male	19.2 Mμ2 Ref	Yes	No
RG58	N Male	50 Ohm Load	Yes	No
RG174	SMA Male	Frequency Generator	Yes	No
RG6	N Male	Attenuators/Spectrum Analyzer	Yes	No
Power Cord	3 Prong AC Plug	120VAC	No	No
RS-232 Serial	DB-9 male	PC Serial Port	Yes	No

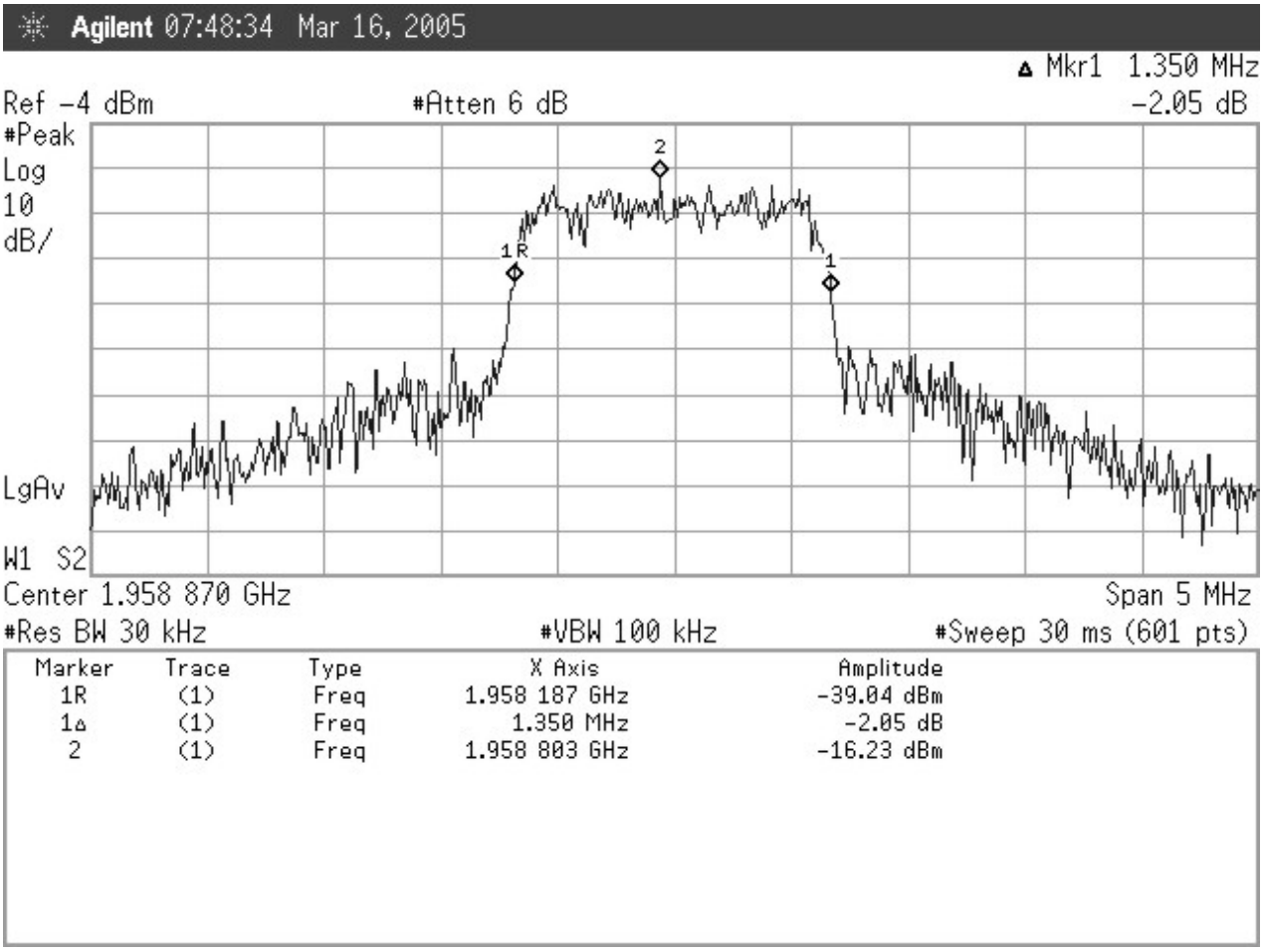
MODIFICATIONS: No modifications were required for the device to pass the test.

EMISSIONS DATA: See the following pages for the Plots.

PERFORMANCE: Complies with standard.



Occupied Bandwidth - Input side of Translator



Occupied Bandwidth - Output side of Translator

Part 3 – RF Power Output

DATE: March 9, 2005

TEST STANDARD: FCC CFR47, Part 2.1046 and 24.132(b)(c)

TEST VOLTAGE: 120Vac, 60Hz

TEST SETUP: As required by §2.1046 of CFR 47, *RF Power Output measurements* were made at the RF output terminals using an Attenuator and spectrum analyzer. This test was performed with a digital signal generator configured to transmit a CDMA IS-95 modulated carrier signal. The output level is adjusted by the level of the input signal. The input level was adjusted until the measured output level of the built in output power meter reached the manufacturers recommended level of 42.3dBm as outlined in the Manufacturers tune-up procedures. The EUT was preset at the factory to turn off the output if the internal output power level meter exceeded 45.2dBm. The output levels were measured at 3 frequencies and at both the Factory preferred levels as well as the maximum level before the system turned off the RF output.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

CABLING:

Cable	Connector	Load/Termination	Shielded	Ferrites
RG174	SMA Male	19.2 $M\mu_2$ Ref	Yes	No
RG58	N Male	50 Ohm Load	Yes	No
RG174	SMA Male	Frequency Generator	Yes	No
RG6	N Male	Attenuators/Spectrum Analyzer	Yes	No
Power Cord	3 Prong AC Plug	120VAC	No	No
RS-232 Serial	DB-9 male	PC Serial Port	Yes	No

MODIFICATIONS: No modifications were required for the device to pass the test.

EMISSIONS DATA:

Frequency (GHz)	Output level (dBm)	Measured (dBm)	Correction (dB)	Total (dBm)	Total (W)
1.930	42.3	-2.37	43.31	40.94	12.42
1.960	42.3	0.95	43.31	44.26	26.68
1.989	42.5	-2.02	43.31	41.29	13.45
1.930	45.2	0.53	43.31	43.84	24.21
1.960	45.2	3.85	43.31	47.16	51.99
1.989	45.2	0.68	43.31	43.99	25.06

PERFORMANCE: Maximum output power level measured: 47.16dBm (52Watts)

Part 4 – Spurious Emissions at Antenna Terminals

DATE: March 9, 2005

TEST STANDARD: FCC CFR47, Part 2.1051; 24.238(a)

TEST VOLTAGE: 120Vac, 60Hz

TEST SETUP: As required by §2.1051 of CFR 47, spurious emissions at antenna terminal measurements were made at the RF output terminals using a 50 Ohṃattenuator and spectrum analyzer set for a 1MHz bandwidth. Tests were also performed at 10kHz bandwidth to confirm frequency presence. This test was performed with a digital signal generator configured to transmit a CDMA IS-95 modulated carrier signal. The frequency spectrum was investigated from 9.0 kHz to 20.0 GHz.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

CABLING:

Cable	Connector	Load/Termination	Shielded	Ferrites
RG174	SMA Male	19.2 Mμ2 Ref	Yes	No
RG58	N Male	50 Ohm Load	Yes	No
RG174	SMA Male	Frequency Generator	Yes	No
RG6	N Male	Attenuators/Spectrum Analyzer	Yes	No
Power Cord	3 Prong AC Plug	120VAC	No	No
RS-232 Serial	DB-9 male	PC Serial Port	Yes	No

MODIFICATIONS: No modifications were required for the device to pass the test.

STANDARD: The mean power of emissions must be attenuated below the mean power of the unmodulated carrier on any frequency twice of more then twice the fundamental emission by at least (43 +10logP) = (43 + 10Log17) = 55.30dB
Limit line is: 42.3dBm – 55.30dB = -13dBm = 94.0dBμV

EMISSIONS DATA: See the following pages for the data.

PERFORMANCE: Complies with standard.

Low Channel 1.930 GHz set to 42.3dBm output. Modulated with CDMA – IS95

Frequency (MHz)	Harmonic	Measured Signal (dBm) @1MHz	Limit Lines (dBm)	Delta Limit Peak (dBc)
1930.000	1st	40.94	NA	NA
3860.000	2nd	-69.85	-13.0	56.85
5790.000	3rd	-61.15	-13.0	48.15
7720.000	4th	-67.69	-13.0	54.69
9650.000	5th	-67.20	-13.0	54.20
11580.000	6th	-68.30	-13.0	55.30
13510.000	7th	-66.33	-13.0	53.33
15440.000	8th	-67.16	-13.0	54.16
17370.000	9th	-66.61	-13.0	53.61
19300.000	10th	-66.40	-13.0	53.40

Other then 3rd harmonic, no frequencies detected above the fundamental frequencies.

Mid Channel 1.960 GHz set to 42.3dBm output. Modulated with CDMA – IS95

Frequency (MHz)	Harmonic	Measured Signal (dBm) @1Mhz	Limit Lines dBm)	Delta Limit Peak (dBc)
1960.000	1st	44.25	NA	NA
3920.000	2nd	-67.35	-13.0	53.35
5880.000	3rd	-58.32	-13.0	45.32
7840.000	4th	-67.30	-13.0	54.30
9800.000	5th	-68.45	-13.0	55.45
11760.000	6th	-67.23	-13.0	54.23
13720.000	7th	-66.51	-13.0	53.51
15680.000	8th	-68.56	-13.0	55.56
17640.000	9th	-66.54	-13.0	53.54
19600.000	10th	-67.12	-13.0	54.12

Other then 3rd harmonic, no frequencies detected above the fundamental frequencies.

High Channel 1.989 GHz set to 42.3dBm output. Modulated with CDMA – IS95

Frequency (MHz)	Harmonic	Measured Signal (dBm) @1Mhz	Limit Lines (dBm)	Delta Limit Peak (dBc)
1989.000	1st	41.25	NA	NA
3978.000	2nd	-66.55	-13.0	53.55
5967.000	3rd	-60.85	-13.0	47.85
7956.000	4th	-66.40	-13.0	53.40
9945.000	5th	-67.34	-13.0	54.34
11934.000	6th	-68.52	-13.0	55.52
13923.000	7th	-67.25	-13.0	54.25
15912.000	8th	-68.74	-13.0	55.74
17901.000	9th	-68.36	-13.0	55.36
19890.000	10th	-67.95	-13.0	54.95

Other then 3rd harmonic, no frequencies detected above the fundamental frequencies.

Appendix A: EUT Photos

Emissions Test Setup Front View

Emissions Test Setup Back View of Cables

Appendix B: Measurement Data and Plots

UTStarcom Canada – Kestrel iPA 1900 Translator

Conducted Emissions

Table 1: Line 1 - 120Vac 60Hz

Frequency (MHz)	Peak (dBµV)	DelLim-Pk (dB)
0.9925	60.9	0.90
1.103	59.9	-0.1
1.214	58.5	-1.5
0.8834	58.1	-1.9
0.5515	56.7	-3.3
0.778	54.1	-5.9
AVERAGE		
0.9925	57.9	-2.1
1.109	56.9	-3.1
1.22	55.6	-4.4
0.8881	55.0	-5.0

Table 2: Line 2 - 120Vac 60Hz

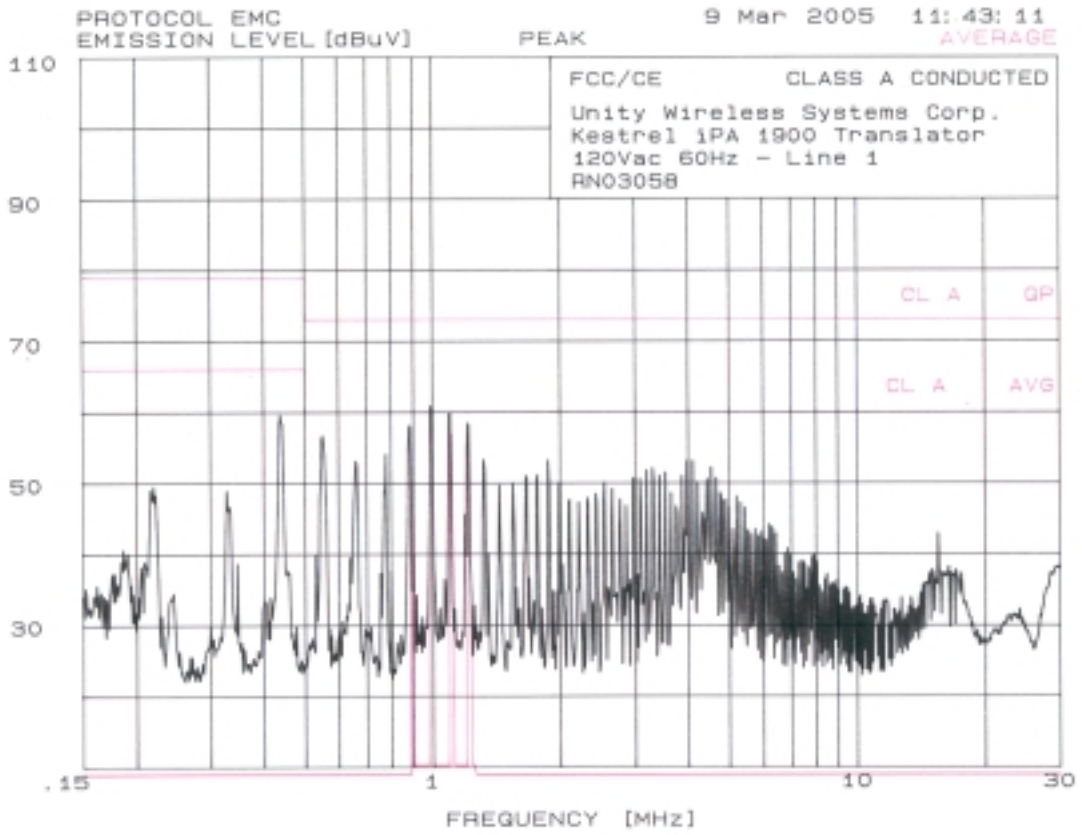
Frequency (MHz)	Peak (dBµV)	DelLim-Pk (dB)
0.9925	60.7	0.7
1.121	60.3	0.3
1.098	59.9	-0.1
1.22	58.4	-1.6
0.8834	58.3	-1.7
0.5486	56.3	-3.7
AVERAGE		
0.9925	57.9	-2.1
1.103	56.8	-3.2
1.22	55.4	-4.6
0.8834	55.1	-4.9

Radiated Emission Class A – 10 m

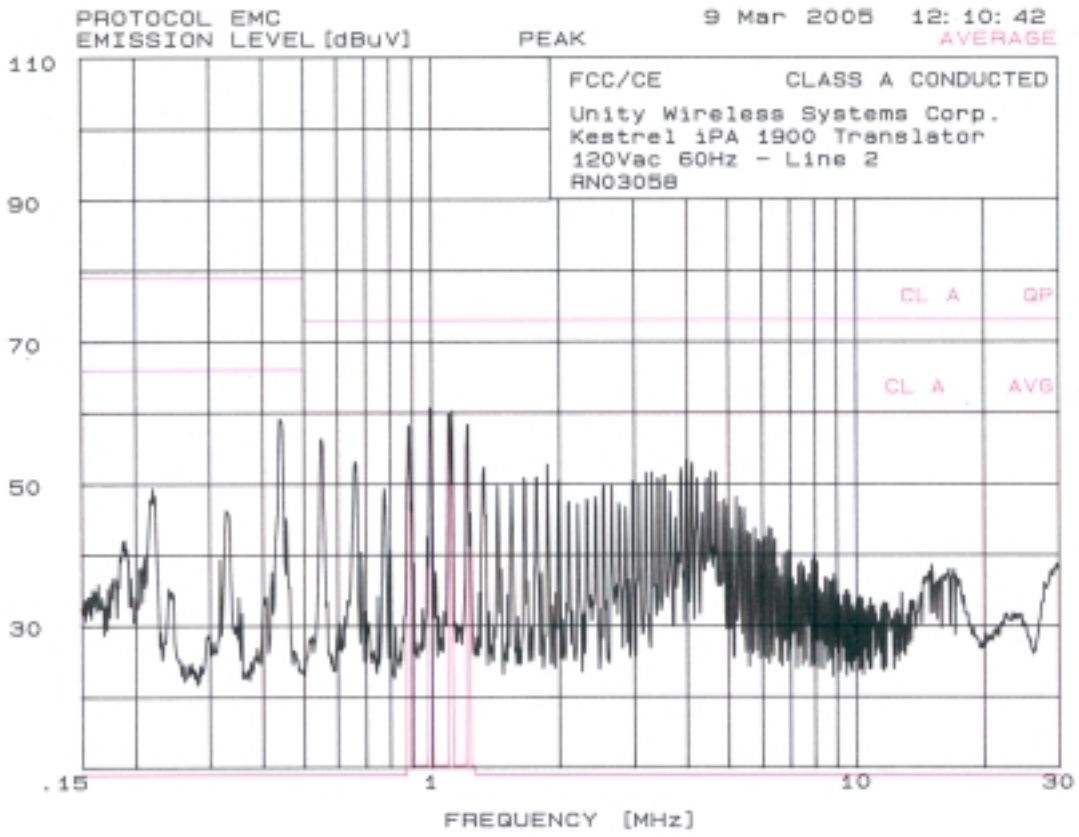
Table 5: FCC Emissions

Frequency	Ant. Pol	Ant. Hgt	Ang	Uncor- Pk	Tot Corr	Peak	QP Lmt	DelLim-Pk
(MHz)		(m)	(deg)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
49.009920	V	1	0	20.9	10.36	31.26	49.53	-18.27
62.21124	V	1	250	13.2	6.28	19.48	49.53	-30.05
73.51903	V	1	180	16.6	7.5	24.1	49.53	-25.43

Conducted Emissions



Conducted Emissions Line 1 – 120Vac, 60Hz



Conducted Emissions Line 2 – 120Vac, 60Hz