UltraTech
Group of Labs

May 30, 2001

TIMCO ENGINEERING INC.
849 NW State Road 45
Newberry, Florida 32669
USA

Subject: **Type Acceptance Application under FCC CFR 47, Parts 2 and 24 (Subpart E) - Personal Communications Services in the Frequency Band 1850 - 1910 MHz (uplink) and 1930-1990 MHz (downlink).**

Applicant: **KAVAL WIRELESS TECHNOLOGIES INC.**
Product: **PCS 1900 MHz Bi-Directional Amplifier**
Model: **LNKC1900**
FCC ID: **H6M-LNKC1900**

Dear Sir/Madam,

As appointed agent for **KAVAL WIRELESS TECHNOLOGIES INC.**, we would like to submit the application to the Federal Communications Commission for certification of the above product. Please review all necessary files uploaded to your website site for detailed information.

If you have any queries, please do not hesitate to contact us by our TOLL FREE numbers:

OUR TELEPHONE NO.: 1-877-765-4173

Yours truly,

Tri Minh Luu, P. Eng.,
V.P., Engineering

TML/DH

Encl.

3000 Bristol Circle,
Oakville, Ontario, Canada
L6H 6G4

Telephone (905) 829-1570
Facsimile (905) 829-8050

Website: www.ultratech-labs.com
Email: vhk.ultratech@sympatico.ca

UltraTech
Group of Labs

May 30, 2001

KAVAL WIRELESS TECHNOLOGIES INC.
60 Gough Road
Markham, Ontario
Canada, L3R 8X7

Attn.: **Mr. Alan Aslett**

Subject: **Certification Testing in accordance with FCC CFR 47, Parts 2 and 24 (Subpart E) - Personal Communications Services in the Frequency Band 1850 - 1910 MHz (uplink) and 1930-1990 MHz (down link).**

Product: **PCS 1900 MHz Bi-Directional Amplifier**
Model: **LNKC1900**

Dear Mr. Aslett,

The product sample has been tested in accordance with **FCC CFR 47, Parts 2 and 24 (Subpart E) - Personal Communications Services in the Frequency Band 1850 - 1910 MHz (uplink) and 1930-1990 MHz (down link),** and the results and observation were recorded in the engineering report, Our File No.: KTI-016FCC

Enclosed you will find copy of the engineering report. If you have any queries, please do not hesitate to contact us.

Yours truly,

Tri Minh Luu, P.Eng
Vice President - Engineering

Encl.

3000 Bristol Circle,
Oakville, Ontario, Canada
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ENGINEERING TEST REPORT

PCS 1900 MHz Bi-Directional Amplifier
Model No.: LNKC1900
FCC ID: H6M-LNKC1900

Applicant: **KAVAL WIRELESS TECHNOLOGIES INC.**
60 Gough Road
Markham, Ontario
Canada, L3R 8X7

Tested in Accordance With

Federal Communications Commission (FCC)
PERSONAL COMMUNICATIONS SERVICES
CFR 47, PARTS 2 and 24 (Subpart E)

UltraTech's File No.: KTI-016FCC

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs

Date: May 30, 2001

Report Prepared by: Tri M. Luu	Tested by: Mr. Hung Trinh, EMI/RFI Technician
Issued Date: May 30, 2001	Test Dates: May 18 - May 23, 2001

The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.

UltraTech

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EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
1 through 8	Test Report	• Exhibit 1: Submittal check lists • Exhibit 2: Introduction • Exhibit 3: Performance Assessment • Exhibit 4: EUT Operation and Configuration during Tests • Exhibit 5: Summary of test Results • Exhibit 6: Measurement Data • Exhibit 7: Measurement Uncertainty • Exhibit 8: Measurement Methods	
1	Test Report - Plots of Measurement Data	Plots # 1 to 69	
2	Test Setup Photos	Photos # 1 to 2	
3	External Photos of EUT	Photos # 1 to 6	
4	Internal Photos of EUT	Photos # 1 to 14	
5	Cover Letters	• Letter from Ultratech for Certification Request • Letter from the Applicant to appoint Ultratech to act as an agent • Letter from the Applicant to request for Confidentiality Filing	OK OK OK
6	Attestation Statements	• Manufacturer's Declaration for Equipment Specifications, Installation (if it is professionally installed) and Production Quality Production Assurance. • Manufacturer's Declaration of Conformity (FCC DoC) for compliance with FCC Part 15, Sub. B, Class B - Computing Devices - if required	N/A
7	ID Label/Location Info	• ID Label • Location of ID Label	OK
8	Block Diagrams	Please refer to Page 5 of the users manual	OK
9	Schematic Diagrams	• Schematic diagrams # 1 to 4	OK
10	Parts List/Tune Up Info	None	None
11	Operational Description	Please refer to users' manual	
12	RF Exposure Info	Not applicable for base station	N/A
13	Users Manual		OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 24 (Subpart E): 1998
Title	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2 & 24
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency band 1850 - 1910 MHz (uplink) and 1930-1990 MHz (down link).
Test Procedures	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - 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.

2.2. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 2 and 24	1998	Code of Federal Regulations – Telecommunication
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
CISPR 22 & EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1		Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	KAVAL WIRELESS TECHNOLOGIES INC.
Address:	60 Gough Road Markham, Ontario Canada, L3R 8X7
Contact Person:	Mr. Alan Aslett Phone #: 905-946-3397 Fax #: 905-946-3392 Email Address: asslet@kaval.com

MANUFACTURER	
Name:	KAVAL WIRELESS TECHNOLOGIES INC.
Address:	60 Gough Road Markham, Ontario Canada, L3R 8X7
Contact Person:	Mr. Alan Aslett Phone #: 905-946-3397 Fax #: 905-946-3392 Email Address: asslet@kaval.com

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	KAVAL WIRELESS TECHNOLOGIES INC.
Product Name:	PCS 1900 MHz Bi-Directional Amplifier
Model Name or Number:	LNKC1900
Serial Number:	Pre-porduction
Type of Equipment:	Personal Communications Services
External Power Supply:	None
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	The most common LINKNET CDMA PCS Module applications are the extension of the above ground signals into building, tunnels, vehicles or the extension of radio coverage patterns into outdoor shaded areas such as deep valleys.

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile Base station (fixed use)
Intended Operating Environment:	Commercial, light industry & heavy industry
Power Supply Requirement:	120V 60Hz
RF Output Power Rating:	• +36.3 dBm for 1 channel input/output • +24.7 dBm per channel for 2 channel inputs/outputs • +23.0 dBm per channel for 3 channel inputs/outputs
Amplifier Gain:	81.8 dB maximum
Operating Frequency Range:	1850 - 1910 MHz (uplink) and 1930-1990 MHz (down link) (15 MHz switching bands)
RF Output Impedance:	50 Ohms
Channel Spacing:	30 kHz
Occupied Bandwidth (99%):	40 kHz
Emission Designation*:	EXTENDER

3.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	RF Input Port	1	SMA	Shielded
2	RF Output Port (Note 2)	1	SMA	Shielded
3	Control Port	1	DB15	Shielded

NOTES:

(1) ***Ports of the EUT which in normal operation*** *were connected to ancillary equipment through interconnecting cables via a representative interconnecting cable to simulate the input/output characteristics. RF input/output was correctly terminated to the 50 Ohm RF Load.*

(2) ***Ports which are not connected to cables during normal intended operation*** *(for factory/technical services uses only)*

3.5. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

3.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	ThinkPad Laptop
Brand name:	IBM
Model Name or Number:	2625
FCC ID:	ANOKAJIPENCP
Serial Number:	78-WWM4A
Connected to EUT's Port:	RS-232
Notes:	This laptop computer is used for technical services only; therefore, and it is used for control purpose only but not for testing.

3.7. TEST SETUP

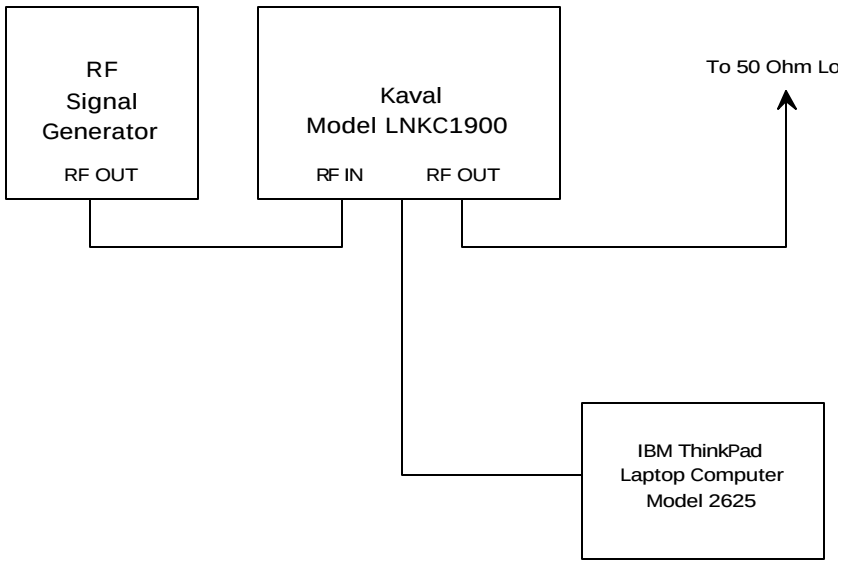


EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21^{o}C
Humidity:	51%
Pressure:	102 kPa
Power input source:	120V 60Hz

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	The utility test software provided by Kaval was used for operating and changing the equipment parameters.
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the transmitter antenna port terminated to a 50 Ohms RF Load.

Transmitter Test Signals	
Frequency Band(s): ▪ 1850 - 1910 MHz (uplink) ▪ 1930-1990 MHz (down link)	Near lowest, near middle & near highest frequencies each frequency bands that the transmitter covers: ▪ 1857.5, 1880 & 1902.5 MHz ▪ 1937.5, 1960 & 1982.5 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power):	 • 1 channel input: 36.3 dBm • 2 channel input: 24.7 dBm ▪ 3 channel input: 23.0 dBm
Modulation	CDMA is used for testing wherever it is applicable in this report.

EXHIBIT 5. SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

  The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Sep. 20, 1999.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
24.229	Frequencies	Yes
24.232 & 2.1046	Effective Radiated Power (ERP) Limits	Yes
24.235 & 2.1055	Frequency Stability	Not applicable for Amplifier since the output signal tracks input signal exactly.
24.238 & 2.1051	Emission Limits (Conducted)	Yes
24.236 & 24.238, 2.1057 & 2.1053	Emission Limits (Radiated)	Yes

PCS 1900 MHz Bi-Directional Amplifier, **Model No.: LNKC1900**, by **KAVAL WIRELESS TECHNOLOGIES INC.** has also been tested and found to comply with **FCC Part 15, Subpart B – Radio Receivers and Class B Digital Devices**. The engineering test report has been documented and kept in file and it is available anytime upon FCC request.

EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 8 of this report

6.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3. MEASUREMENT EQUIPMENT USED:

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4:1992 and CISPR 16-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER:

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

6.5. FREQUENCIES @ FCC 24.229

6.5.1. Limits

The frequencies available in the Broadband PCS Service are listed a follows:

(a) The following frequency blocks are available for assignment on an MTA (Major Trading Areas) basis
- Block A: 1850-1865 MHz (Mobile) paired with 1930-1945 MHz (Base)
- Block B: 1870-1885 MHz (Mobile) paired with 1950-1965 MHz (Base)

(b) The following frequency blocks are available for assignment on an BTA (Basic Trading Areas) basis
- Block C: 1895-1910 MHz (Mobile) paired with 1975-1990 MHz (Base)
- Block D: 1865-1870 MHz (Mobile) paired with 1945-1950 MHz (Base)
- Block E: 1885-1890 MHz (Mobile) paired with 1965-1970 MHz (Base)
- Block F: 1890-1895 MHz (Mobile) paired with 1970-1975 MHz (Base)

6.5.2. Analysis

The EUT conforms with all frequency Blocks A, B, C, D, E and F for Portable/Mobile uses

6.6. RF POWER OUTPUT AND INTERMODULATION @ FCC §2.1046 & §24.232

6.6.1. Limits

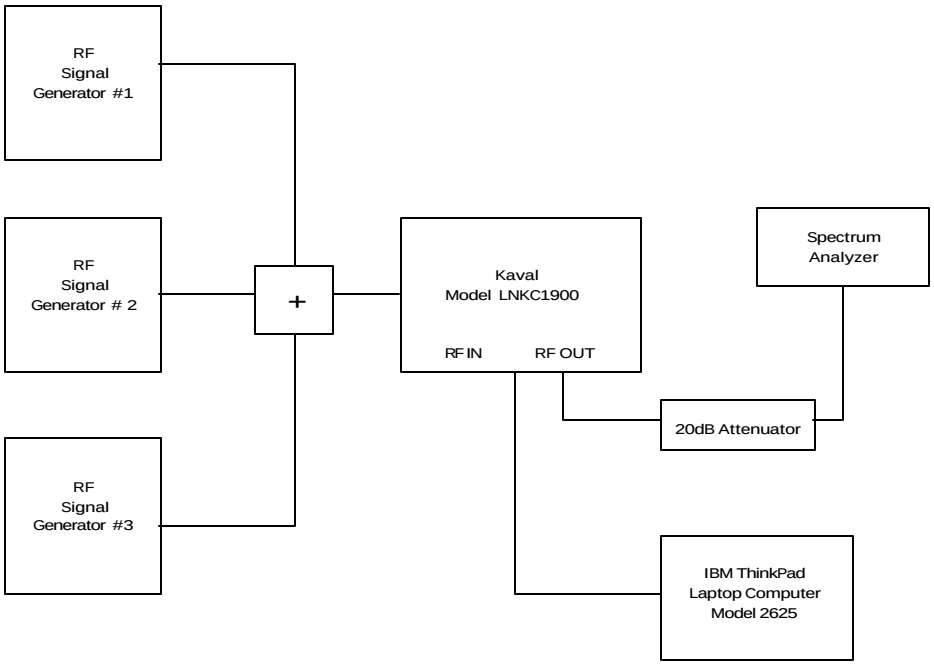
The equivalent isotropic radiated power (EIRP) of transmitters in the Personal Communications Services must not exceed the limits in this section:

	Maximum Peak ERP (Watts)	Antenna Height
Base Transmitters (1930-1975 MHz)	• 1640 Watts • ….	• 300 meters • ….
Portable & Mobile Transmitters & Auxiliary Test Transmitters (1850-1910 MHz)	2 Watts or 33 dBm	N/A

6.6.2. Method of Measurements

The conducted power and intermodulation were tested instead of the EIRP since the the amplifie was sold without antenna. The EIRP and and RF Exposure Limits were calculated using maximum anetnna gain allowed by the manufacturer.

6.6.3. Test Arrangement



6.6.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
RF Signal Generator #1	Hewlett Packard	HP E4432B	064005419	250 kHz – 3 GHz
RF Signal Generator #2	Gigatronics	GT9000	91026	0.01 –20 GHz
RF Signal Generator #3	Eaton Advance Electronics	382AM	118-18210	10 MHz – 2 GHz
Power Divider	Weinschel	1515	LW725	DC – 18 GHz
Power Divider	Weinschel	1515	LW400	DC – 18 GHz
Power Meter	Hewlett Packard	436A	1725A02249	10 kHz to 50 GHz

6.6.5. Plots

Please refer to Plots # 1 to 18 for Intermodulation and power measurements

6.6.6. Test Data

Remarks: The total peak power was unchanged with and without modulation CDMA modulation (99% BW=3.2 MHz)

6.6.6.1. 1850 - 1910 MHz (Uplink)

Fundamental Frequency (MHz)	Modulation *	Number of Channels	Measured Peak Power (dBm)	Manufacturer's Power Rating (dBm)
1857.5	Unmodulated / CDMA	1	+36.2	+36.3
1857.5 & 1857.7	Unmodulated	2	+24.6	+24.7
1857.5, 1857.7 & 1857.9	Unmodulated	3	+22.3	+23.0

Fundamental Frequency (MHz)	Modulation *	Number of Channels	Measured Peak Power (dBm)	Manufacturer's Power Rating (dBm)
1880	Unmodulated / CDMA	1	+36.2	+36.3
1880 & 1880.2	Unmodulated	2	+24.5	+24.7
1879.8, 1880 & 1880.2	Unmodulated	3	+22.3	+23.0

Fundamental Frequency (MHz)	Modulation *	Number of Channels	Measured Peak Power (dBm)	Manufacturer's Power Rating (dBm)
1902.5	Unmodulated / CDMA	1	+36.3	+36.3
1902.3 & 1902.5	Unmodulated	2	+24.5	+24.7
1902.1, 1902.3 & 1902.5	Unmodulated	3	+22.6	+23.0

6.6.6.2. 1930 –1990 MHz (Downlink)

Fundamental Frequency (MHz)	Modulation *	Number of Channels	Measured Peak Power (dBm)	Manufacturer's Power Rating (dBm)
1937.5	Unmodulated / CDMA	1	+36.3	+36.3
1937.5 & 1937.7	Unmodulated	2	+24.7	+24.7
1937.5,1937.7 & 1937.9	Unmodulated	3	+22.4	+23.0

Fundamental Frequency (MHz)	Modulation *	Number of Channels	Measured Peak Power (dBm)	Manufacturer's Power Rating (dBm)
1960	Unmodulated / CDMA	1	+36.2	+36.3
1960 & 1960.2	Unmodulated	2	+24.5	+24.7
1959.8, 1960 & 1960.2	Unmodulated	3	+23.0	+23.0

Fundamental Frequency (MHz)	Modulation *	Number of Channels	Measured Peak Power (dBm)	Manufacturer's Power Rating (dBm)
1982.5	Unmodulated / CDMA	1	+36.2	+36.3
1982.3 & 1982.5	Unmodulated	2	+24.4	+24.7
1982.1, 1982.3 & 1982.5	Unmodulated	3	+22.3	+23.0

6.7. EMISSION LIMITS (CONDUCTED) & OCCUPIED BANDWIDTH @ FCC §24.238 & §2.1049

6.7.1. Limits

On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43+10log(P) dB.

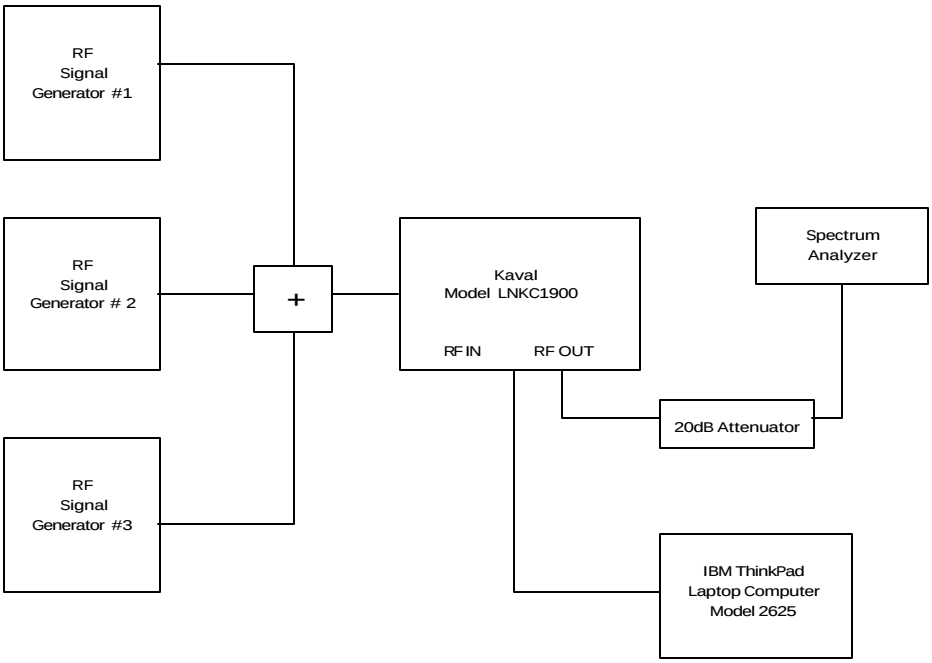
6.7.2. Method of Measurements

Please refer to FCC 24.238(b) - (d) and Exhibit 8, Section 8.2 for detailed test procedures.

Measuring Bandwidths:

- Outside the permitted band block: RBW = 1 MHz, VBW $\geq$ RBW
- Inside or on the permitted band block: RBW = 1% of -26dBc Bandwidth, VBW $\geq$ RBW

6.7.3. Test Arrangement



6.7.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz – 26.5 GHz
Attenuator(s)	Bird	..	…	DC – 22 GHz

6.7.5. Test Data

Remarks: For worst case of out-of-band-emissions, the RF signal with CDMA modulation, the 99% OBW = 3.2 MHz and maximum input level of –45 dBm was applied to the RF input port. And tests were condcuted at lowest, middle and highest frequenices of the bands.

6.7.5.1. 99% Occupied Bandwidths And -26dBc Bandwidth

Frequency (MHz)	99% Occupied Bandwidth (MHz)	-26dBc Bandwidth (MHz)
1857.5	3.2	3.8
1937.5	3.0	3.8
The RBW = 30 kHz will be used for Emission inside the permitted, band and RWB = 1 MHz is used for Emission outside the permitted band. Refer to plots # 27 in Annex 1 for detailed measurement data.		

6.7.5.2. Occupied Bandwidth and Conducted Spurious Emissions

Plots # 28 to 39 show the RF input and output emissions inside the permitted band ± 2 MHz. The RF input and output signals are modulated using CDMA with 3 MHz 99% bandwidth.

6.7.5.3. Conducted Spurious Emissions

Plots # 40 to ## 69 for rf emissions outside the permitted band

6.7.5.3.1. Near Lowest Frequency in 1850-1910 MHz band

Carrier Frequencies: No. of input/output channels : Modulation: RF output:		1857.5 MHz 1 CDMA +36.2 dBm		
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
2505.00	-33.3	-13.0	-20.3	PASS
3436.00	-35.3	-13.0	-22.3	PASS
3715.00	-30.1	-13.0	-17.1	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 40-41 in Annex 1 for detailed measurement data.

Carrier Frequencies: No. of input/output channels : Modulation: RF output:		1857.5 & 1857.7 MHz 2 CDMA +24.6 dBm / Channel		
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
1716.00	-31.4	-13.0	-18.4	PASS
3715.00	-56.7	-13.0	-43.7	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 52-53 in Annex 1 for detailed measurement data.

Carrier Frequencies:		1857.5 & 1857.7 & 1857.9 MHz		
No. of input/output channels :		3		
Modulation:		CDMA		
RF output:		+22.3 dBm / Channel		
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
1716.00	-32.9	-13.0	-19.9	PASS
3715.00	-58.2	-13.0	-45.2	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 58-59 in Annex 1 for detailed measurement data.

6.7.5.3.2. Near Middle Frequency in 1850-1910 MHz band

Carrier Frequencies:		1880 MHz		
No. of input/output channels :		1		
Modulation:		CDMA		
RF output:		+36.2		
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
2583.00	-29.8	-13.0	-16.8	PASS
3760.0	-30.7	-13.0	-17.7	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 42-43 in Annex 1 for detailed measurement data.

Carrier Frequencies:		1880 & 1880.2 MHz		
No. of input/output channels :		2		
Modulation:		CDMA		
RF output:		+24.5dBm / Channel		
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
1732.00	-27.7	-13.0	-14.7	PASS
3760.00	-53.2	-13.0	-40.2	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 54-55 in Annex 1 for detailed measurement data.

Carrier Frequencies:	1879.8, 1880 & 880.2MHz
No. of input/output channels :	3
Modulation:	CDMA
RF output:	+22.3dBm / Channel

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1741.00	-19.3	-13.0	-6.3	PASS
3760.00	-53.3	-13.0	-40.3	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 54-55 in Annex 1 for detailed measurement data.

6.7.5.3.3. Near Highest Frequency in 1850-1910 MHz band

Carrier Frequency:	1902.5 MHz
No. of input/output channels :	1
Modulation:	CDMA
RF output:	+36.3 dBm

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2635.00	-29.8	-13.0	-16.8	PASS
3805.00	-30.7	-13.0	-17.7	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 44-45 in Annex 1 for detailed measurement data.

Carrier Frequencies:	1902.3 & 1902.5 MHz
No. of input/output channels :	2
Modulation:	CDMA
RF output:	+24.5dBm / Channel

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
1761.00	-23.3	-13.0	-10.3	PASS
3805.00	-48.8	-13.0	-35.8	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 56-57 in Annex 1 for detailed measurement data.

Carrier Frequencies:		1902., 1902.3 & 1902.5 MHz		
No. of input/output channels :		3		
Modulation:		CDMA		
RF output:		+22.6 dBm / Channel		
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
1761.00	-23.5	-13.0	-10.5	PASS
3805.00	-49.9	-13.0	-36.9	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 62-63 in Annex 1 for detailed measurement data.

6.7.5.3.4. Near Lowest Frequency in 1930-1990 MHz band

Carrier Frequency:		1937.5 MHz		
No. of input/output channels :		1		
Modulation:		CDMA		
RF output:		+36.3 dBm		
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
2737.00	-26.4	-13.0	-25.0	PASS
3875.00	-32.0	-13.0	-19.0	PASS
5812.50	-38.0	-13.0	-25.0	PASS
7750.00	-40.9	-13.0	-27.9	PASS
9687.50	-36.9	-13.0	-23.9	PASS
11625.00	-34.1	-13.0	-21.1	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 46-47 in Annex 1 for detailed measurement data.

Carrier Frequency:	1937.5 & 1937.7 MHz
No. of input/output channels :	2
Modulation:	CDMA
RF output:	+24.7 dBm /Channel

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
3875.00	-53.3	-13.0	-40.3	PASS
5812.50	-63.6	-13.0	-50.6	PASS
6217.00	-66.8	-13.0	-53.8	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 64-65 in Annex 1 for detailed measurement data.

6.7.5.3.5. Near Middle Frequency in 1930-1990 MHz band

Carrier Frequencies:	1960.0
No. of input/output channels :	1
Modulation:	CDMA
RF output:	36.2 dBm

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2789.00	-27.8	-13.0	-14.8	PASS
3920.00	-33.4	-13.0	-20.4	PASS
5880.00	-37.9	-13.0	-24.9	PASS
7840.00	-37.9	-13.0	-24.9	PASS
9800.00	-35.0	-13.0	-22.0	PASS
11760.00	-31.5	-13.0	-18.5	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 48-49 in Annex 1 for detailed measurement data.

Carrier Frequency:	1960 & 1960.2 MHz			
No. of input/output channels :	2			
Modulation:	CDMA			
RF output:	+24.5 dBm /Channel			
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
3920.00	-50.0	-13.0	-37.0	PASS
5880.00	-63.4	-13.0	-50.4	PASS
6269.00	-63.3	-13.0	-50.3	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 66-67 in Annex 1 for detailed measurement data.

6.7.5.3.6. Near Highest Frequency in 1930-1990 MHz band

Carrier Frequencies:	1982.5MHz			
No. of input/output channels :	1			
Modulation:	CDMA			
RF output:	36.2 dBm			
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
2840.00	-32.2	-13.0	-18.8	PASS
3965.00	-41.4	-13.0	-28.4	PASS
4822.50	-31.8	-13.0	-18.8	PASS
5947.50	-38.3	-13.0	-25.3	PASS
7930.00	-38.2	-13.0	-25.2	PASS
8787.50	-34.8	-13.0	-21.8	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 50-51 in Annex 1 for detailed measurement data.

Carrier Frequency:		1982.5 & 1982.3 MHz		
No. of input/output channels :		2		
Modulation:		CDMA		
RF output:		+24.4 dBm /Channel		
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
3965.00	-47.9	-13.0	-34.9	PASS
5947.50	-64.9	-13.0	-51.9	PASS
6371.00	-63.6	-13.0	-50.6	PASS

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- Refer to plots # 68-69 in Annex 1 for detailed measurement data.

6.8. EMISSION LIMITS (RADIATED) @ FCC 2.1049, 24.236 & 24.238

6.8.1. Limits

- The predicted or measured field strength at any location on the border of the PCS Service area shall not exceed 47 dBμV/m unless the parties agree to higher field strength.
- On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43+10lo(P) dB.

6.8.2. Method of Measurements

Please refer to the Exhibit 8, Sec. 8. 4 of this test report and ANSI C63-4:1992 for radiated emissions test method.

Measuring Bandwidths:

- Outside the permitted band block: RBW = 1 MHz, VBW ≥ RBW
- Inside or on the permitted band block: RBW = 1% of -26dBc Bandwidth, VBW ≥ RBW

6.8.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz to 32 GHz with external mixer for frequency above 32 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A	3116A00661	1 GHz to 26.5 GHz
Active Loop Antenna	EMCO	6507	8906-1167	1 kHz – 30 MHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna with Mixer	EMCO	3160-09	1007	18 GHz – 26.5 GHz
Horn Antenna with Mixer	EMCO	3160-10	1001	26.5 GHz – 40 GHz

6.8.4. Photographs of Test Setup

Please refer to Photos # 1 to 2 for detailed information of the test setup

6.8.5. Test Data

Remark: According to the RF Spurious/Harmonic Conducted Emission measurements in Section 6.7 of this test report, the rf emissions with 1 channel input /output was found to be the worst case of interference. Therefore, transmitter radiated emissions with 1 channel input/output were be performed and represented the worst case of interfernce.

6.8.5.1. Near Lowest Frequency (1857.5 MHz) in 1850 – 1910 MHz

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)
3715.00	33.7	-63.8	PEAK	V	-13.0	-50.8
3715.00	33.6	-63.9	PEAK	H	-13.0	-50.9
5572.50	40.9	-56.6	PEAK	V	-13.0	-43.6
5572.50	42.5	-55.0	PEAK	H	-13.0	-42.0
7430.00	45.4	-52.1	PEAK	V	-13.0	-39.1
7430.00	44.8	-52.7	PEAK	H	-13.0	-39.7

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- The transmitter is predicted to meet FCC 24.236 (Limit = 47 dBμV/m) since its highest field strength (of the of fundamental) is 44.8 dBμV/m at 3 meters or –5.7 dBμV/m within 1 km at the border of the PCS services area

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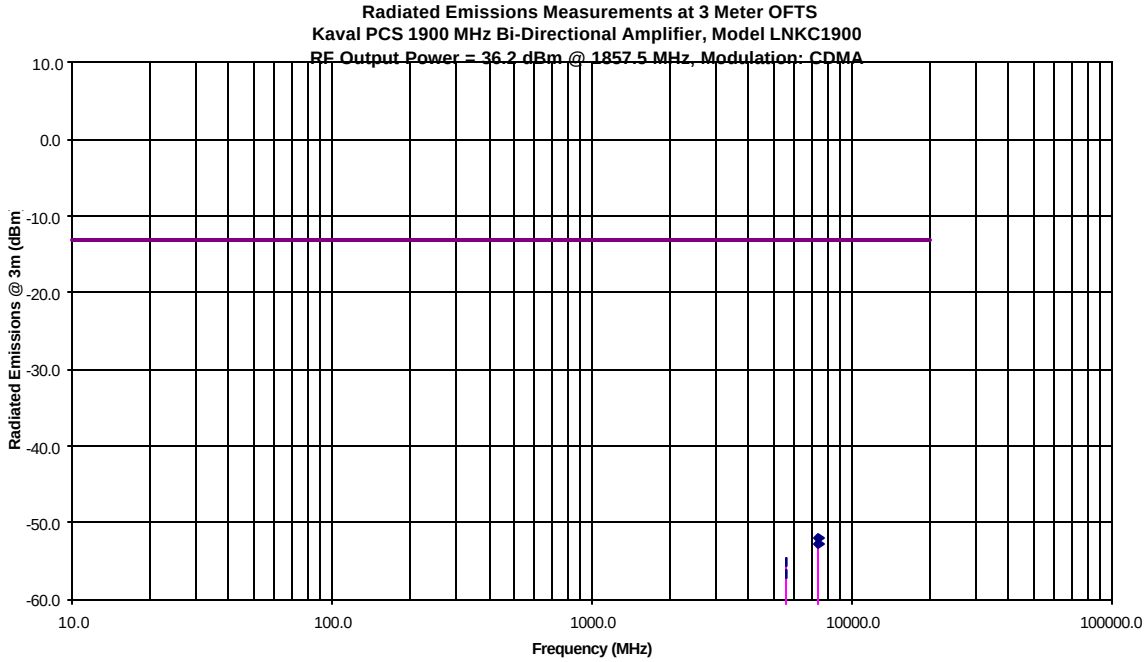

6.8.5.2. Near Middle Frequency (1880.0 MHz)) in 1850 – 1910 MHz

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)
3760.00	33.8	-63.7	PEAK	V	-13.0	-50.7
3760.00	34.7	-62.8	PEAK	H	-13.0	-49.8
5640.00	39.4	-58.1	PEAK	V	-13.0	-45.1
5640.00	46.7	-50.8	PEAK	H	-13.0	-37.8
7520.00	52.3	-45.2	PEAK	V	-13.0	-32.2
7520.00	50.3	-47.2	PEAK	H	-13.0	-34.2

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- The transmitter is predicted to meet FCC 24.236 (Limit = 47 dBμV/m) since its highest field strength (of the of fundamental) is 52.3 dBμV/m at 3 meters or +1.8 dBμV/m within 1 km at the border of the PCS services area

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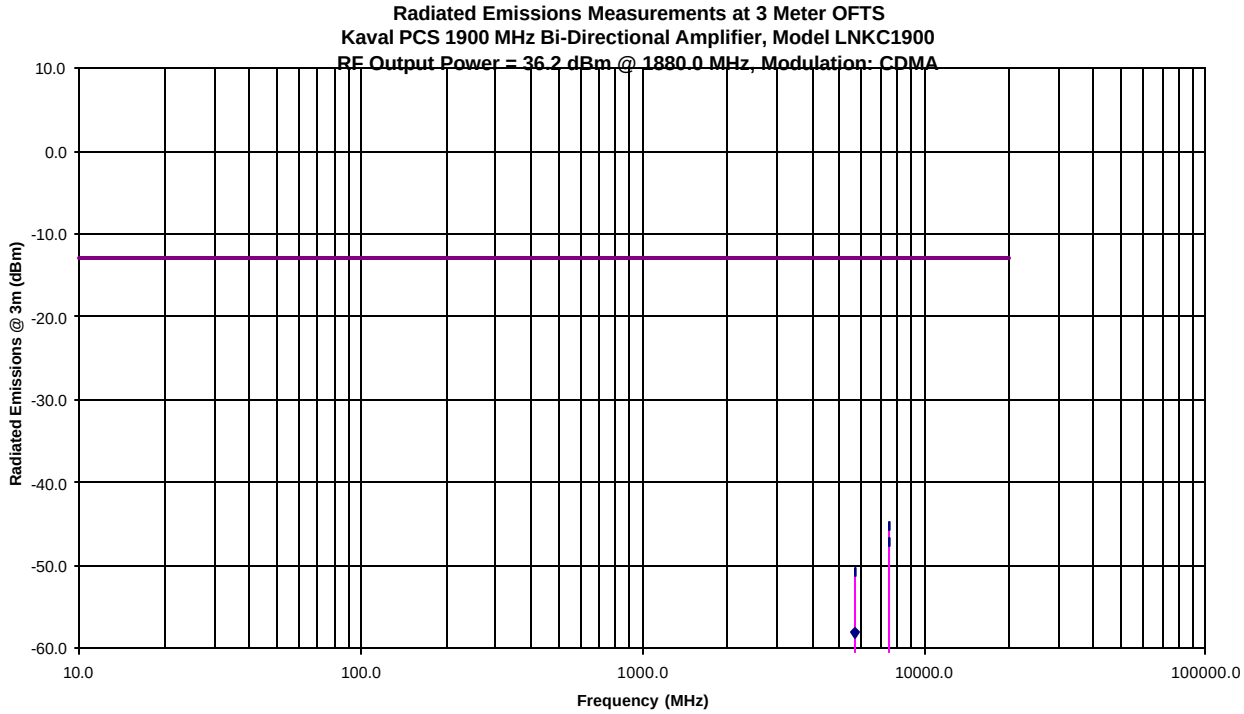

6.8.5.3. Near Highest Frequency (1910 MHz)) in 1850 – 1910 MHz

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)
3805.00	36.8	-60.7	PEAK	V	-13.0	-47.7
3805.00	35.0	-62.5	PEAK	H	-13.0	-49.5
5707.50	46.3	-51.2	PEAK	V	-13.0	-38.2
5707.50	44.0	-53.5	PEAK	H	-13.0	-40.5
7610.00	48.7	-48.8	PEAK	V	-13.0	-35.8
7610.00	47.9	-49.6	PEAK	H	-13.0	-36.6

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- The transmitter is predicted to meet FCC 24.236 (Limit = 47 dBμV/m) since its highest field strength (of the of fundamental) is 48.7 dBμV/m at 3 meters or –1.8 dBμV/m within 1 km at the border of the PCS services area

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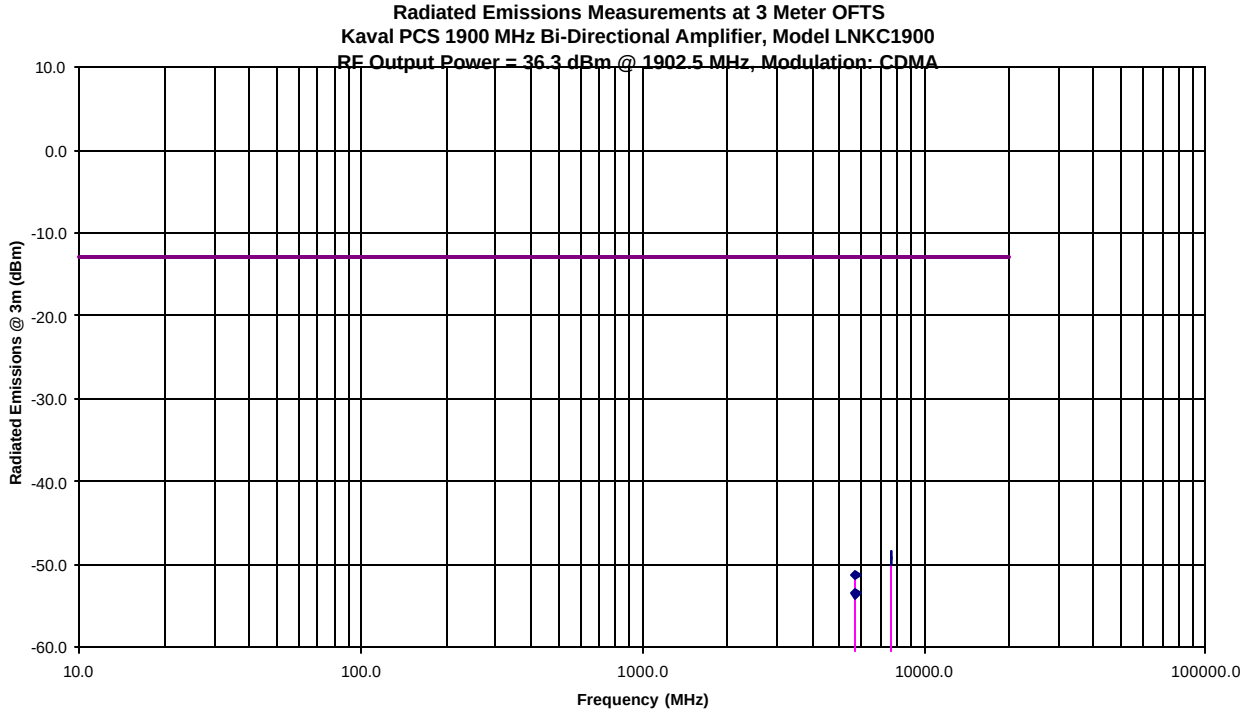

6.8.5.4. Near Lowest Frequency (1937.5 MHz) in 1930 – 1990 MHz

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)
3875.00	36.8	-60.7	PEAK	V	-13.0	-47.7
3875.00	36.5	-61.0	PEAK	H	-13.0	-48.0
5812.50	57.3	-40.2	PEAK	V	-13.0	-27.2
5812.50	58.9	-38.6	PEAK	H	-13.0	-25.6
7750.00	45.0	-52.5	PEAK	V	-13.0	-39.5
7750.00	49.7	-47.8	PEAK	H	-13.0	-34.8

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- The transmitter is predicted to meet FCC 24.236 (Limit = 47 dBμV/m) since its highest field strength (of the of fundamental) is 58.9 dBμV/m at 3 meters or 8.4 dBμV/m within 1 km at the border of the PCS services area

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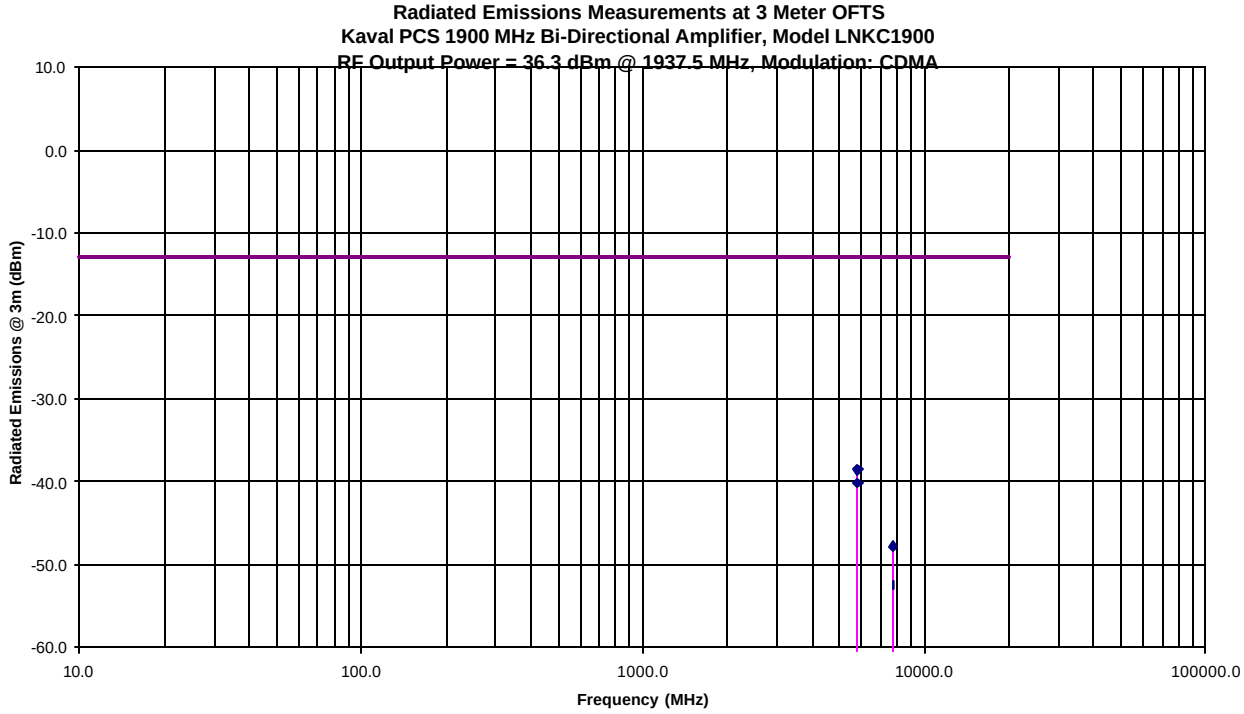

6.8.5.5. Near Middle Frequency (1880.0 MHz)) in 1930 – 1990 MHz

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)
3920.00	37.3	-60.2	PEAK	V	-13.0	-47.2
3920.00	37.7	-59.8	PEAK	H	-13.0	-46.8
5880.00	60.4	-37.1	PEAK	V	-13.0	-24.1
5880.00	60.9	-36.6	PEAK	H	-13.0	-23.6
7840.00	48.0	-49.5	PEAK	V	-13.0	-36.5
7840.00	49.5	-48.0	PEAK	H	-13.0	-35.0

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- The transmitter is predicted to meet FCC 24.236 (Limit = 47 dBμV/m) since its highest field strength (of the of fundamental) is 60.9 dBμV/m at 3 meters or 10.4 dBμV/m within 1 km at the border of the PCS services area

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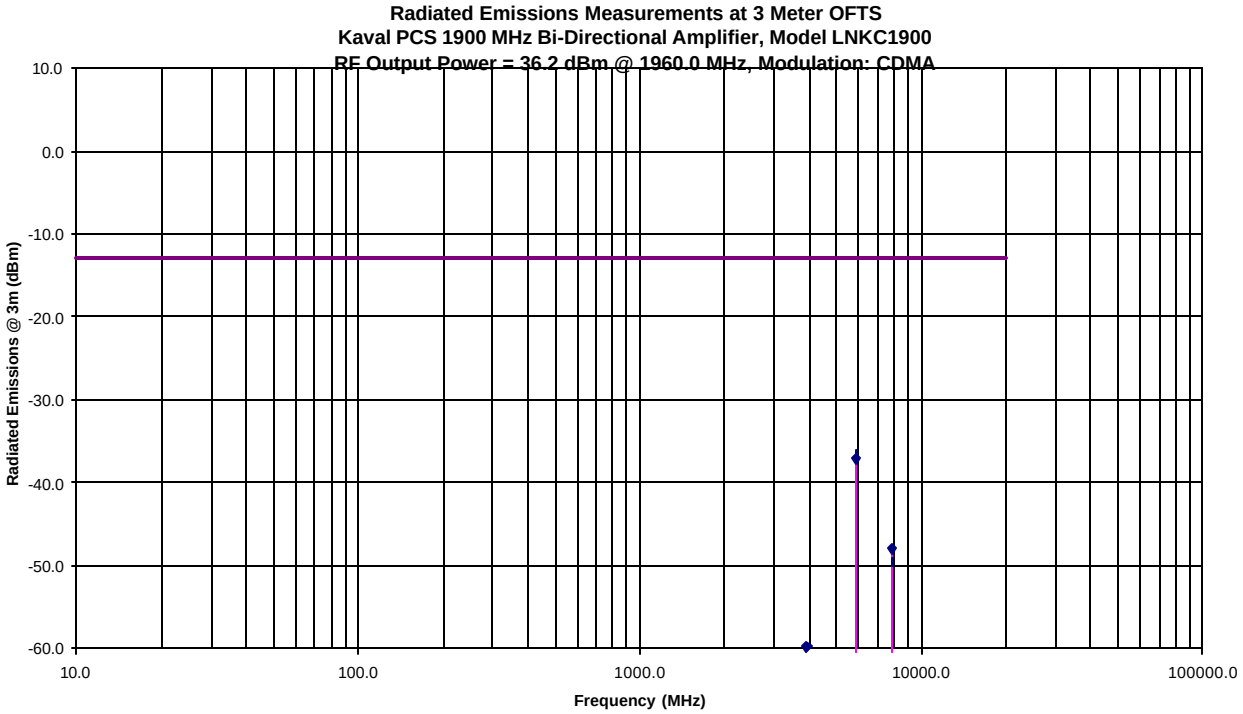

6.8.5.6. Near Highest Frequency (1982.5 MHz)) in 1930 – 1990 MHz

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBm)	MARGIN (dB)
3965.00	37.3	-60.2	PEAK	V	-13.0	-47.2
3965.00	37.7	-59.8	PEAK	H	-13.0	-46.8
5947.50	60.4	-37.1	PEAK	V	-13.0	-24.1
5947.50	60.9	-36.6	PEAK	H	-13.0	-23.6
7930.00	48.0	-49.5	PEAK	V	-13.0	-36.5
7930.00	49.5	-48.0	PEAK	H	-13.0	-35.0

- The emissions were scanned from 10 MHz to 20 GHz and all emissions less than 60 dB below the limits were recorded.
- The transmitter is predicted to meet FCC 24.236 (Limit = 47 dBμV/m) since its highest field strength (of the of fundamental) is 60.9 dBμV/m at 3 meters or 10.4 dBμV/m within 1 km at the border of the PCS services area

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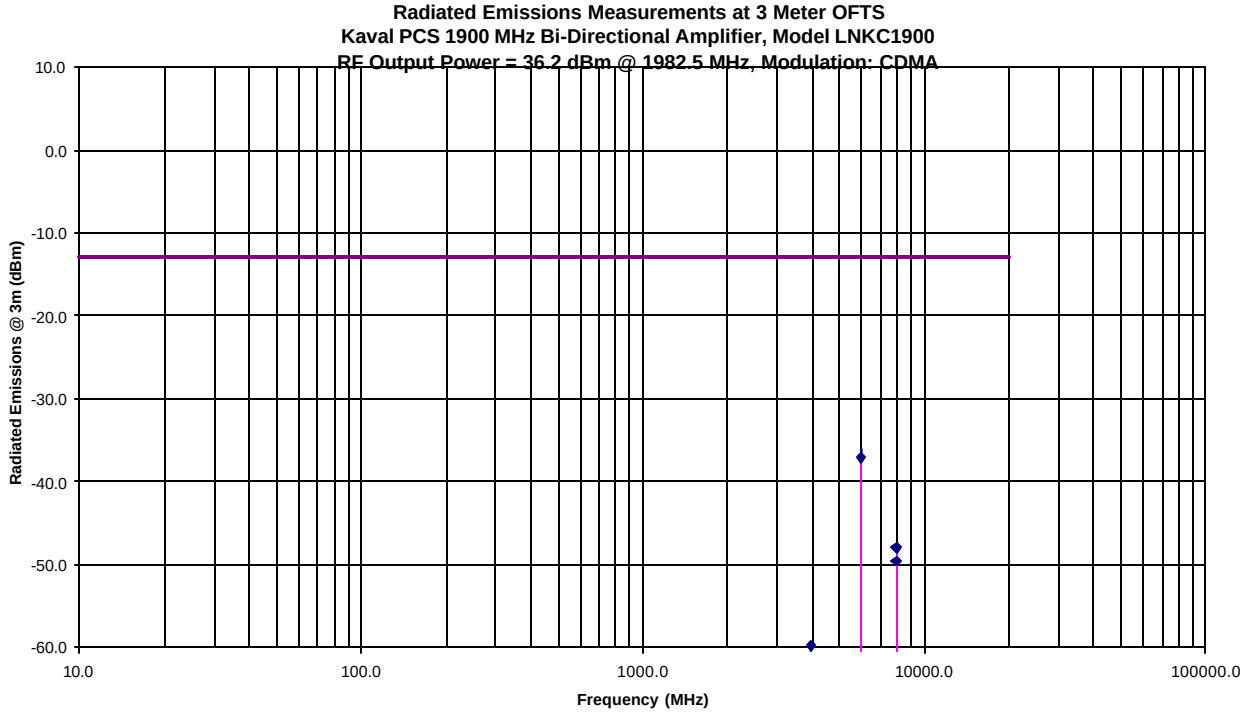

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivity	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

EXHIBIT 8. MEASUREMENT METHODS

8.1. SPURIOUS EMISSIONS (CONDUCTED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.1049, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 1 MHz, VBW $\geq$ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.1057 - Frequency spectrum to be investigated:- The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the Near Highest Frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.1051 - Spurious Emissions at Antenna Terminal:- The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

8.2. SPURIOUS EMISSIONS (RADIATED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.1049, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 1 MHz, VBW $\geq$ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.1057 - Frequency spectrum to be investigated:- The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the Near Highest Frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.1053 - Field Strength Spurious Emissions

Measurements were made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.1049(c) as appropriate. For equipment operating on frequencies below 1 GHz, an Open Field Test is normally required with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing

the location of any possible source of reflections, which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from horn antennas.

(b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
(2) All equipment operating on frequencies higher than 25 MHz
(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
(4) Other types of equipment as required, when deemed necessary by the Commission.

Maximizing RF Emission Level:

(a) The measurements was performed with standard modulation
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The biconilog Antenna (20 MHz to 1 GHz) or Horn Antenna (1 GHz to 18 GHz) was used for measuring.
(e) The spectrum analyzer was tuned to transmitter carrier frequency. The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(f) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(g) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(h) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(i) The field strength level measured at 3m is converted to the power in dBm by subtracting a constant factor of 97.5 dB

METHOD OF CALCULATION FOR TRANSMITTED POWER (P) FROM THE MEASURED FIELD STRENGTH LEVEL (E):

According to IEC 801-3, the power density can be calculated as follows:

$S = P / (4xPIxD^2)$ Where: S: Power density in watts per square feet
P: Transmitted power in watts
PI: 3.1416
D: Distance in meters

The power density S (W/m^2) and electric field E (V/m) is related by:

$S = E^2/(120xPI)$

Accordingly, the field intensity of isotropic radiator in free space can be expressed as follows:

$$E = (30xP)^{1/2}/D = 5.5x(P)^{1/2}/D$$

$$S = (1.64xP)/(4xPIxD^2)$$
$$E = (49.2xP)^{1/2}xD = 7.01x(P)^{1/2}/D$$

$$P = (ExD/7.01)^2$$

Calculation of transmitted power P (dBm) given a measured field intensity E (dBuV/m):

$$P(W) = [E(V/m)xD/7.01]^2$$
$$P(mW) = P(W)x1000$$
$$\Rightarrow \quad P(dBm) = 10logP(mW)$$
$$= 20logE(V/m) + 20log(D) - 20log(7.01) + 10log1000$$
$$= E(dBV/m) + 20logD + 13$$
$$= E(dBuV/m) - 120 + 20log(D) + 13$$
$$= E(dBuV/m) + 20log(D) - 107$$

The Transmitted Power @ D = 3 Meters

P(dBm) = E(dBuV/m) - 97.5