UltraTech
Group of Labs

31040/SIT

C-1376

Canada
46390-2049

NVLAP
200093-0

00-034

BSMI
SL2-IN-E-1119R

entela

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

Tel.: (905) 829-1570
Fax.: (905) 829-8050

Website: www.ultratech-labs.com
Email: vic@ultratech-labs.com

June 17, 2003

FEDERAL COMMUNICATIONS COMMISSION
7435 Oakland Mills Road
Columbia, MD 21046
USA

Subject: **Type Acceptance Application under FCC CFR 47, Parts 2, 22, 24 and 90 - Non-Broadcast Bi-directional Radio Amplifiers Operating in the frequency bands 1930-1990 MHz (PCS), 869-894 MHz (Base Cellular), 928-941 MHz (Paging) and 851-869 MHz (Trunking).**

Applicant: **KAVAL WIRELESS TECHNOLOGIES INC.**
Product: **SATELINK RF - FIBER INTERFACE MODULE**
Model: **LNKFIB-R**
FCC ID: **H6M-LNKFIB-RA**

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 FCC OET site for detailed information.

Note:

This application for the extension of the frequency band from 851-869 MHz to 851-869 MHz of the FCC Grant FCC ID: H6M-LNKFIB-R certified by FCC on Oct. 23, 2003. There is no mechanical/electrical design change for this product.

Since there is no mechanical/electrical change applied to this device for extension of operating band from 851-869 MHz to 851-869 MHz. The test plan was discussed with Mr. Mr. Steven Dayhoff at FCC and agreed to perform the following tests at 869 MHz:

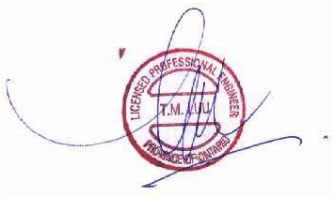
(1) RF Output Power
(2) 99% Occupied BW
(3) Emission Mask
(4) Transmitter Spurious Conducted Emissions
(5) Transmitter Spurious Radiated Emissions

Other tests are referred to the original test reports that are re-submitted to FCC for review.

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

UltraTech
Group of Labs

31040/SIT

C-1376

Canada
46390-2049

NVLAP
200093-0

00-034

BSMI
SL2-IN-E-1119R

UL

entela

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

Tel.: (905) 829-1570
Fax.: (905) 829-8050

Website: www.ultratech-labs.com
Email: vic@ultratech-labs.com

June 17, 2003

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 90 - Non-Broadcast Bi-directional Radio Amplifiers Operating in the frequency bands 851-869 MHz (Trunking).**

Product: **SATELINK RF - FIBER INTERFACE MODULE**
Model: **LNKFIB-R**
FCC ID: **H6M-LNKFIB-RA**

Dear Mr. Aslett,

The product sample has been tested in accordance with **FCC CFR 47, Part 90 - Non-Broadcast Bi-directional Radio Amplifiers Operating in the frequency bands 851-869 MHz (Trunking),** and the results and observation were recorded in the engineering report, Our File No.: KTI-028FCC

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.

ENGINEERING TEST REPORT

SATELINK RF - FIBER INTERFACE MODULE
Model No.: LNKFIB-R
FCC ID: H6M-LNKFIB-RA

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

Tested in Accordance With

Federal Communications Commission (FCC)
CFR 47, Parts 2, 22, 24 & 90

UltraTech's File No.: KTI-028FCC

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: June 17, 2003	
Report Prepared by: Tri M. Luu Issued Date: June 17, 2003	Tested by: Mr. Hung Trinh, EMI/RFI Technician Test Dates: June 10 -11, 2003

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

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050
Website: www.ultratech-labs.com Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com

TABLE OF CONTENTS

EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	FCC Original Test Report, File # KTI-015FCC And Additional test Report KTI-028FCC	• 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	OK
1	Test Report - Plots of Measurement Data	Annex 1A - I.M., 20dB BW of the Amplifier & Spurious Emissions: Plots # 1 to 126 Annex 1B – Emission Mask Plots # 1 to 30	OK OK
2	Test Setup Photos	Photos # 1 to 2	OK
3	External Photos of EUT	Photos # 1 to 5	OK
4	Internal Photos of EUT	Photos of 1 to 19	OK
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	ID Label/Location Info	ID Label Location of ID Label	OK OK
7	Block Diagrams	Refer to Users Manual , Annex 11	OK
8	Schematic Diagrams	Schematic diagrams # 1 to 4 (SCH000000039, SCH000000046, SCH000000047 & SCH000000048)	OK
9	Parts List/Tune Up Info		None
10	Operational Description	Refer to Users Manual, Annex 11	OK
11	Users Manual		OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2, 22, 24 and 90
Title:	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2, 22, 24 & 90
Purpose of Test:	To obtain FCC Authorization for extending the existing FCC operating frequency band from 851-869 MHz to 851-869 MHz.
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. RELATED SUBMITAL(S)/GRANT(S)

None

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 2, 22, 24 , 90	2002	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:	SATELINK RF - FIBER INTERFACE MODULE
Model Name or Number:	LNKFIB-R
Serial Number:	Pre-porduction
Type of Equipment:	Non-broadcast Bi-directional Amplifier
External Power Supply:	None
Transmitting/Receiving Antenna Type:	Maximum 8 non-integral antennas can be used with the SatelLink LNKFIB-R bi-directional amplifier.
Primary User Functions of EUT:	Bi-directional amplifier for use with CDMA,GSM and TDMA radio signals.

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Base station (fixed use)
Intended Operating Environment:	[x] Commercial [x] Light Industry & Heavy Industry
Power Supply Requirement:	120V 60Hz
Operating Frequency Range & RF Nominal Output Power:	▪ **1930 – 1990 MHz (PCS) WITH 15 MHz SWITCHING BAND** * 1 input/output signal: 0.112 Watts * 2 input/output signals: 0.098 Watts * 3 input/output signals: 0.051 Watts ▪ **869 – 894 MHz (Base Cellular)** * 1 input/output signal: 0.302 Watts * 2 input/output signals: 0.234 Watts * 3 input/output signals: 0.120 Watts * 4 input/output signals: 0.107 Watts ▪ **928 – 941 MHz (Paging)** * 1 input/output signal: 0.245 Watts * 2 input/output signals: 0.186 Watts * 3 input/output signals: 0.098 Watts * 4 input/output signals: 0.0.81 Watts ▪ **851 – 869 MHz (Trunking)** * 1 input/output signal: 0.347 Watts * 2 input/output signals: 0.251 Watts * 3 input/output signals: 0.161 Watts * 4 input/output signals: 0.123 Watts Please Page 12 of Users Manual for Power Ratings for 1 to 30 signal inputs/outputs
Gain	+28 dB nominal
RF Output Impedance:	50 Ohms
Channel Spacing:	N/A
Occupied Bandwidth (99%):	N/A
Emission Designation*:	EXTENDER
Antenna Connector Type:	SMA

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	1 RF Input Port (PCS, Cellular & Paging/Trunking)	1	SMA	Shielded
2	6 RF Output Ports	1	SMA	Shielded
3	RS-232 (Note 2)	1	DB	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 for factory/technical services uses only

3.5. 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.

3.6. TEST SETUP

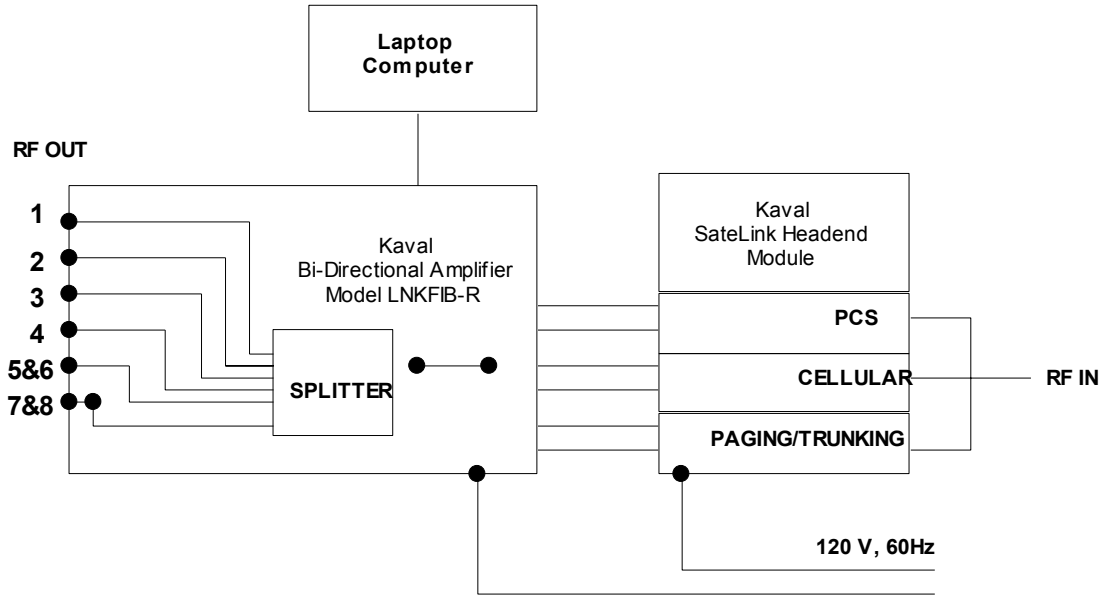


EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°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:	Utility software provided by Kaval was used for selecting frequency bands of the amplifier.
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): ▪ 1930 – 1990 MHz (PCS) ▪ 869 – 894 MHz (Base Cellular) ▪ 928 – 941 MHz (Paging) ▪ 851 – 869 MHz (Trunking)	Near lowest, near middle & near highest frequencies in each frequency bands that the transmitter covers: ▪ 1930, 1960 and 1990 MHz ▪ 869, 881.5 and 894 MHz ▪ 928, 934.5 and 941 MHz ▪ 851, 858.475, 869 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): ▪ Normal Test Modulation ▪ Modulating signal source:	 ▪ The EUT was adjusted for maximum gain output by the manufacturer. ▪ intended for use with RF input signal sources with CDMA, GSM and TDMA modulation ▪ Internal/external

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.

- AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

- 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)
90.205 & 2.1046	RF Power Output	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	N/A for base station
90.213 & 2.1055	Frequency Stability	Not applicable for Amplifier since the output signal tracks input signal exactly.
90.242(b)(8) & 2.1047(a)	Audio Frequency Response	Not applicable for Amplifier since the output signal tracks input signal exactly.
90.210 & 2.1047(b)	Modulation Limiting	Not applicable for Amplifier since the output signal tracks input signal exactly.
90.209 90.210 & 2.1049	Emission Limitation & Emission Mask	The output signal tracks input signal exactly. Therefore, only comparison tests were conducted for proof.
90.210, 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
90.210, 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes
SATELINK RF - FIBER INTERFACE MODULE, **Model No.: LNKFIB-R**, by **KAVAL WIRELESS TECHNOLOGIES INC.** has also been tested and found to comply with **FCC Part 15, Subpart B - Radio Receivers and Class A Digital Devices**. The engineering test report has been documented and kept in file and it is available anytime upon FCC request.		

Note:

Note:

This application for the extension of the frequency band from 851-869 MHz to 851-869 MHz of the FCC Grant FCC ID: H6M-LNKFIB-R certified by FCC on Oct. 23, 2003. There is no mechanical/electrical design change for this product.

Since there is no mechanical/electrical change applied to this device for extension of operating band from 851-869 MHz to 851-869 MHz. The test plan was discussed with Mr. Mr. Steven Dayhoff at FCC and agreed to perform the following tests at 869 MHz:

(1) RF Output Power
(2) 99% Occupied BW
(3) Emission Mask
(4) Transmitter Spurious Conducted Emissions
(5) Transmitter Spurious Radiated Emissions

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

5.4. DEVIATION OF STANDARD TEST PROCEDURES

None

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 MANUFACTURER:

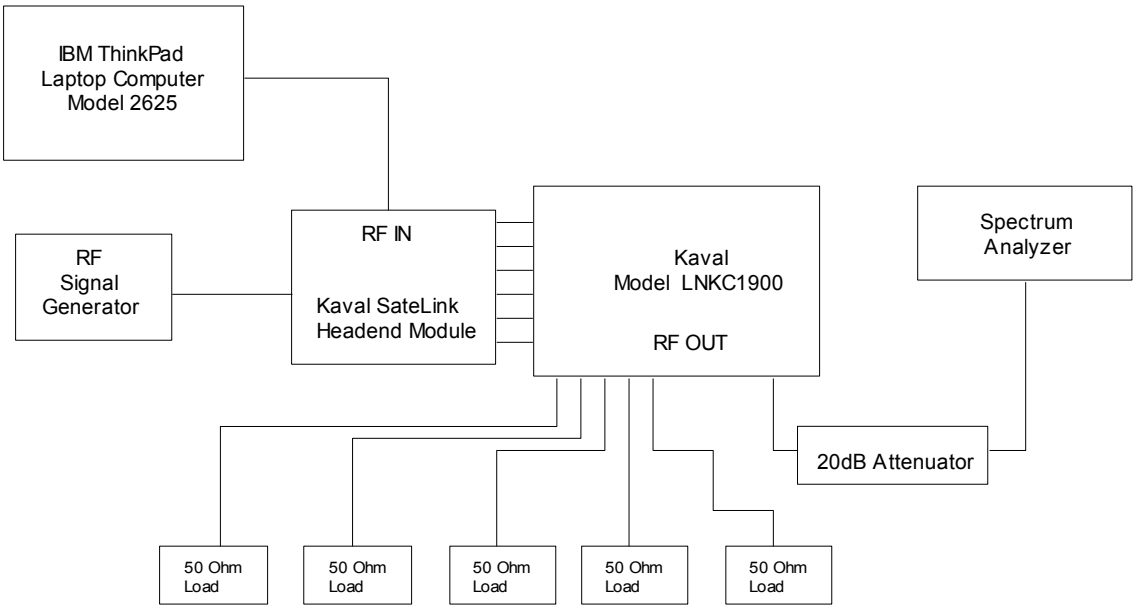
The essential function of the EUT is to correctly communicate data to and from radios over RF link.

6.5. RF OUTPUT PORT SUBJECT TO TESTS

6.5.1. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Power Meter	Hewlett Packard	436A	1725A02249	10 kHz – 50 GHz, sensor dependent
Power Sensor	Hewlett Packard	8481A	2702A68983	10 MHz – 18 GHz
Attenuator(s)	Bird	…	…	DC – 22 GHz
Synthesized RF Signal Generator	Gigatronic	6061A	5130408	10kHz – 1050 MHz

6.5.2. Test Arrangement



6.5.3. Test Data

6.5.3.1. 1930 –1990 MHz (PCS)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.5.3.2. 869 – 894 (Base Cellular)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.5.3.3. 928 – 941 MHz (Paging)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.5.3.4. 851 – 869 MHz (Trunking)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

Additional test at 869 MHz

Frequency (MHz)	RF Output Port Label #	Un-modulated Input Signal (dBm)	Un-modulated Output Signal (dBm)	Gain (dB)
869	1	-5.0	18.0	23.0
	2	-5.0	17.0	22.0
	3	-5.0	17.9	22.9
	4	-5.0	19.5	24.5
	5 + 6	-5.0	21.0	26.0
	7 + 8	-5.0	22.0	27.0
PORT # 7+8 WOULD BE USED THROUGH OUT THE REMAINING TESTS FOR THE WORST CASE				

6.5.4. RF Output port Port used for Worst Case Test

According to the above tests, RF Output Port labeled 7+8 will be used for the rest of rest of the remaining tests in this test report. Other ports from 1 through 5+6 are terminated by 50-ohm RF loads.

6.6. RF POWER OUTPUTS & INTERMODULATION @ FCC 2.1046, 22.913, 24.232 & 90.205

6.6.1. Limits

Please refer to FCC CFR 47, Paragraphs 22.913, 24.232 and 90.205 for power limits in different frequency bands:

EUT's Operating Frequency Band (MHz)	FCC Allowable Frequency band (MHz)	FCC Rules	FCC Maximum Power Limits (Watts)
1930-1990 MHz (PCS Base)	1930-1990	24.232	1640 Watts peak EIRP
869-894 MHz (Cellular Base)	869-894	22.913	500 Watts ERP
928-941 MHz (Paging Base)	929-930 & 935-940	90.494	1 kilo-Watts ERP
851-869 MHz (Trunking)	851 – 869 MHz	90.635	1 kilo-Watts ERP

6.6.2. Limits @ FCC 24.232

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

	Maximum Average ERP (Watts)	Antenna Height
Base Transmitters (1930-1975 MHz)	• 1640 Watts • ….	• 300 meters • ….

6.6.3. Limits @ FCC 90.205

Please refer to FCC CFR 47, Part 90, Subpart I, Para. 90.205 for specification details.

6.6.4. Method of Measurements

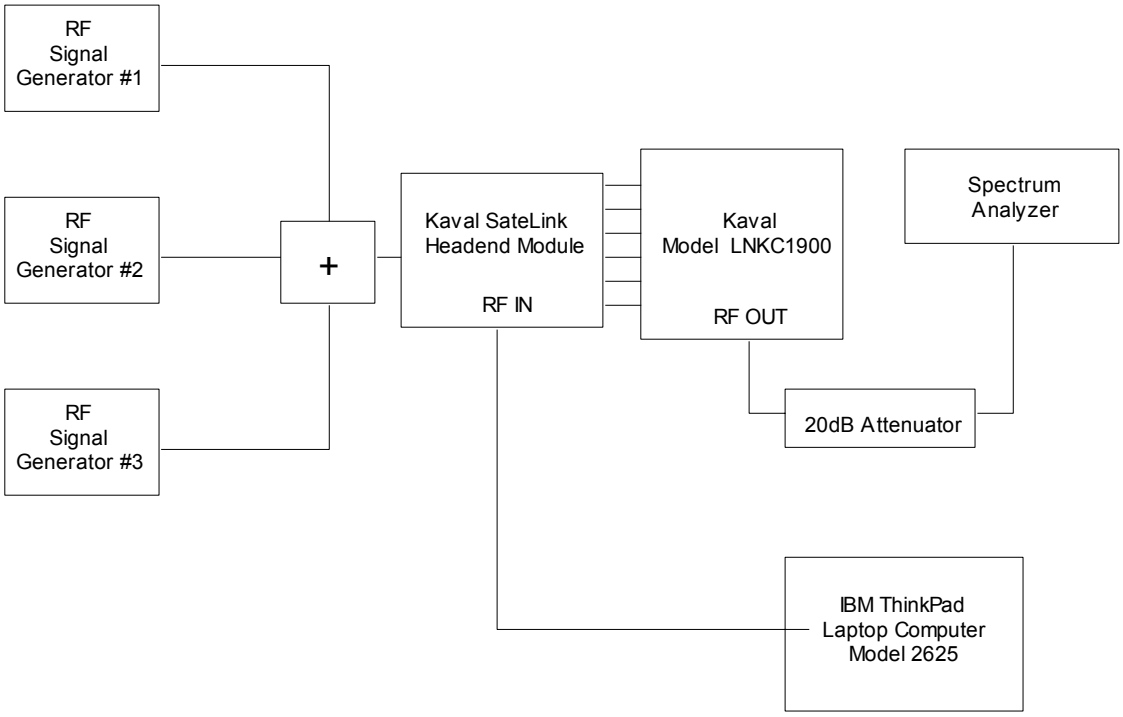
Refer to Exhibit 8, § 8.1 of this report for measurement details

- *The transmitter terminal was coupled to the power meter through a 20 dB attenuator*
- *Power of the transmitter channel near the lowest, middle and highest of each frequency block/band were measured using the power meter, and the reading was corrected by added the calibrated attenuator's attenuation value and cable loss.*
- *The RF Output was turned on with standard modulation applied.*

6.6.5. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Power Meter	Hewlett Packard	436A	1725A02249	10 kHz – 50 GHz, sensor dependent
Power Sensor	Hewlett Packard	8481A	2702A68983	10 MHz – 18 GHz
Attenuator(s)	Bird	…	…	DC – 22 GHz
Synthesized RF Signal Generator	Gigatronic	6061A	5130408	10kHz – 1050 MHz

6.6.6. Test Arrangement



6.6.7. Test Data

6.6.7.1. 1930 –1990 MHz (PCS)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.6.7.2. 869 – 894 (Base Cellular)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.6.7.3. 928 – 941 MHz (Paging)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.6.7.4. 851 – 869 MHz (Trunking)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.7. EMISSION MASK @ FCC 2.1049, 22.217, 24.238 & 90.210

6.7.1. Limits

Emissions shall be attenuated below the mean output power of the transmitter as follows:

Frequency Range (MHz)	FCC Rules	FCC Applicable Mask
1930-1990 MHz (PCS)	Part 24	24.238 • Block A (1930-1945 MHz) • Block (1945-1950 MHz) • Block B (1950-1965 MHz) • Block E (1965-1970 MHz) • Block C (1975-1990)
869-894 MHz (Base Cellular)	Part 22	• 22.217(b) for Analog Voice • 22.217(d) for Digital
929-930 MHz 935-940 MHz (Paging-928-941 MHz)	Part 90	• 90.210(b)&(g) - Mask B for Voice & G for Data • 90.210(i)&(j) – Mask I for Voice and J for Data
851-869 MHz (Trunking)	Part 90	• 90.210(b) – Mask B for Voice • 90.210(g) – Mask G for Data

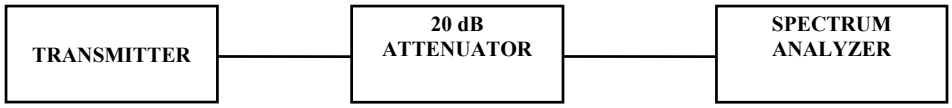
6.7.2. Method of Measurements

Refer to FCC Rules 2.1049, 24.238, 22.217 and 90.210

6.7.3. 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
Attenuator(s)	Bird	..	…	DC – 22 GHz
Audio Oscillator	Hewlett Packard	HP 204C	0989A08798	DC to 1.2 MHz

6.7.4. Test Arrangement



6.7.5. Test Data

Note: Since the output signal tracks input signal exactly, only comparison tests were conducted for proof

6.7.5.1. 1930 –1990 MHz (PCS)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.7.5.2. 869 – 894 (Base Cellular)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.7.5.3. 928 – 941 MHz (Paging)

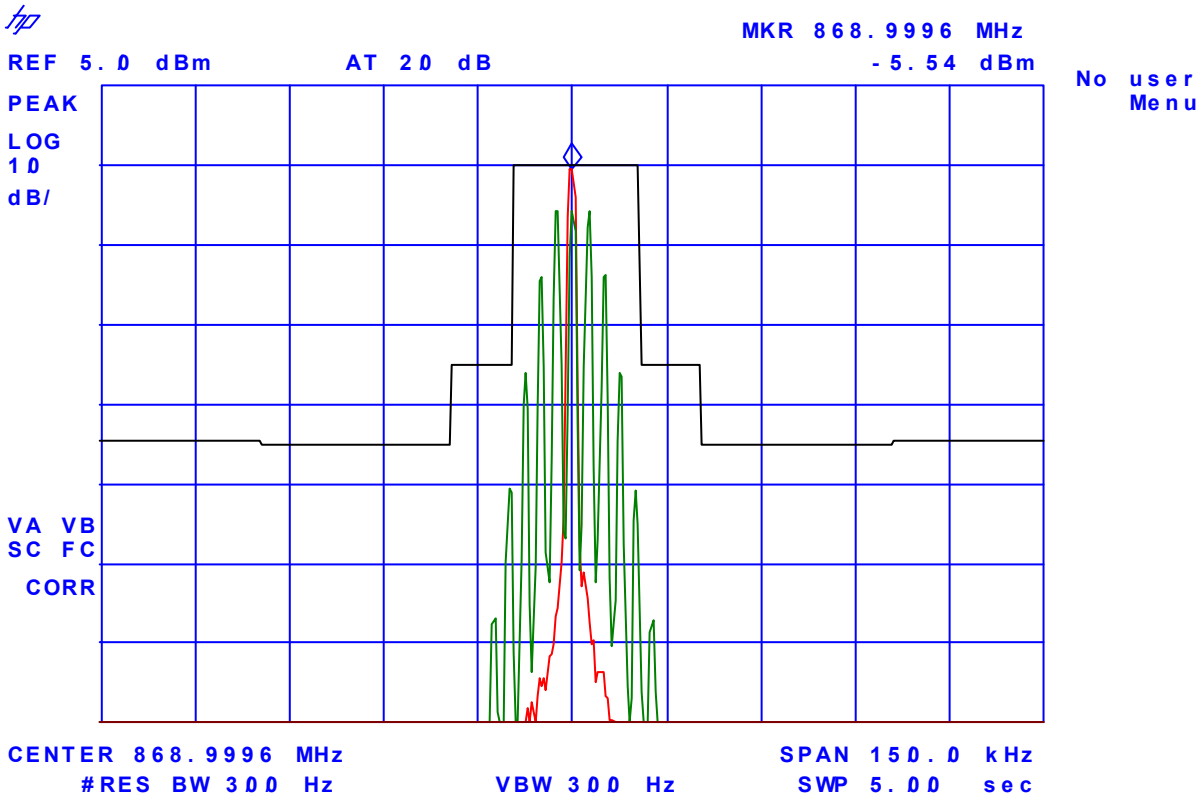
*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.7.5.4. 851 – 869 MHz (Trunking)

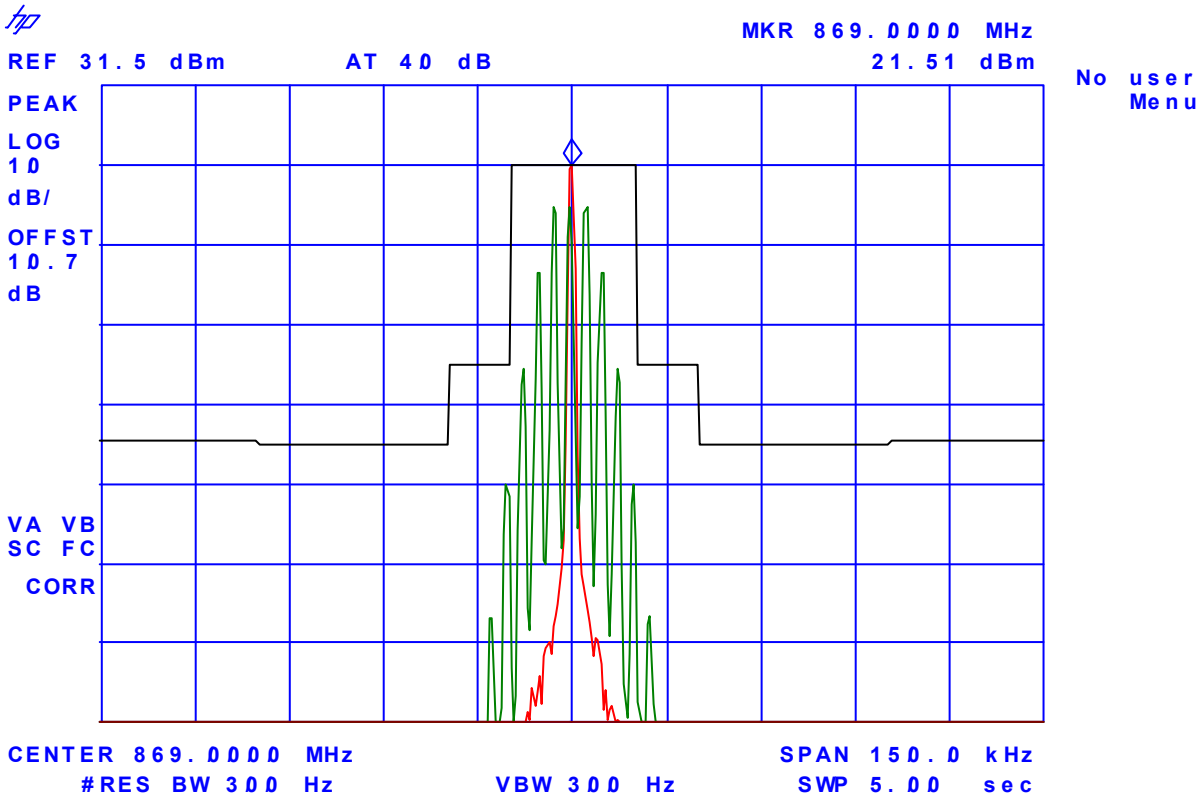
*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

Please refer to Plot A-1 to A-4 For Emissions Masks of RF Input and Output Signals at 869 MHz.

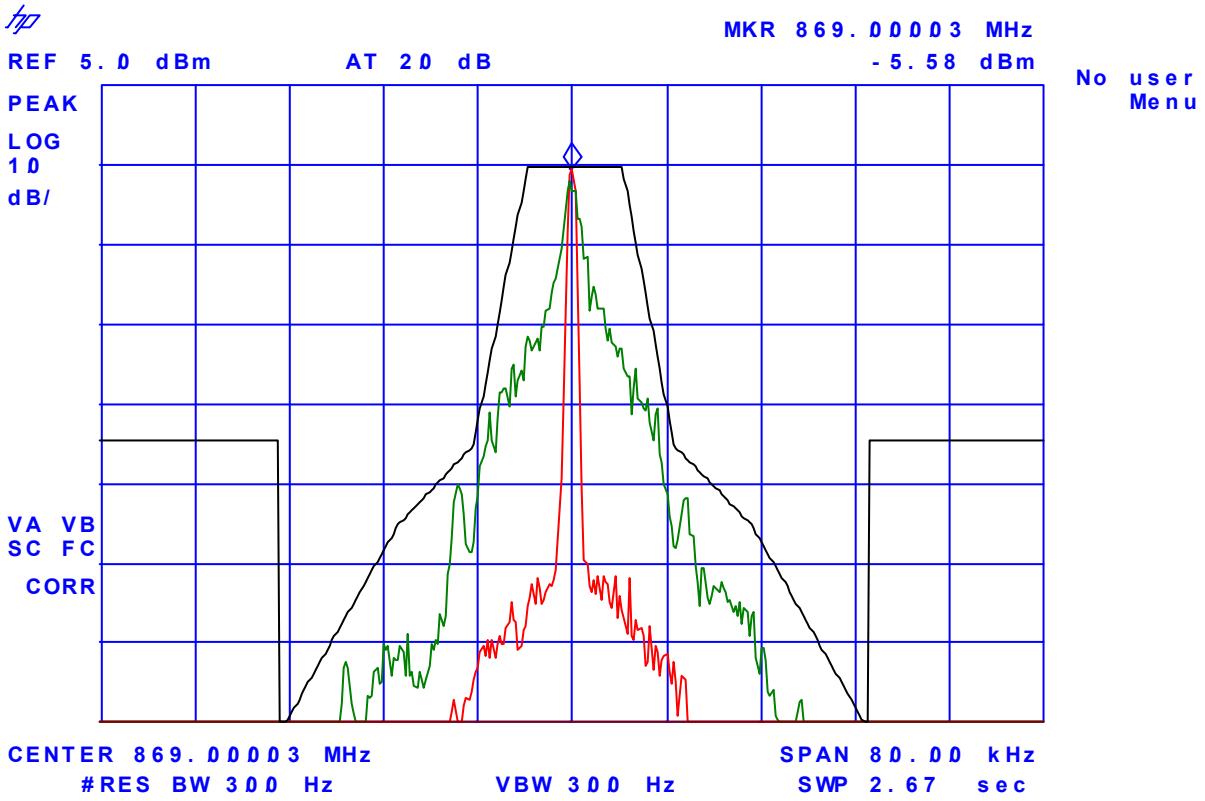
Plot A-1: **Emission Mask B, RF Input**
Frequency: 869 MHz (866 - 869 MHz)
Modulation: FM modulation with 2.5 kHz Sine Wave signal, 2.5 kHz deviation



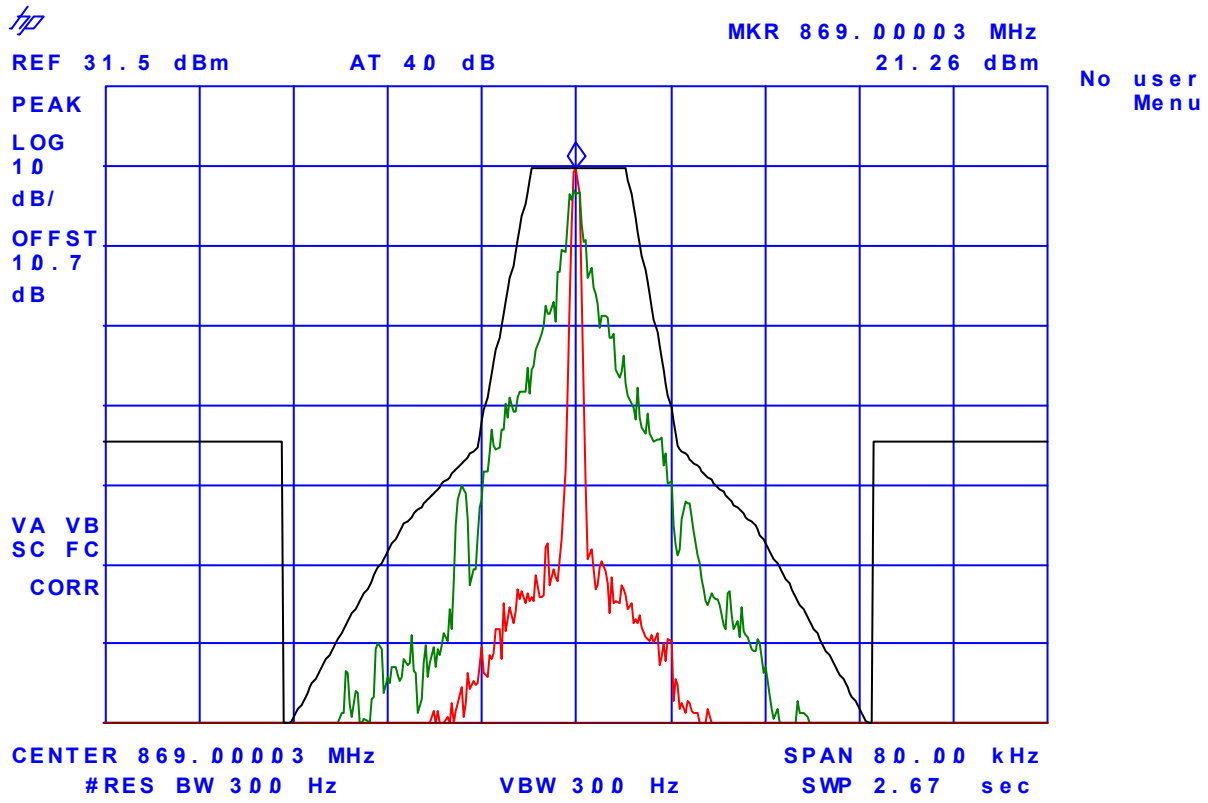
Plot # A-2: **Emission Mask B, RF Output**
Frequency: 869 MHz (866 - 869 MHz)
Modulation: FM modulation with 2.5 kHz Sine Wave signal, 2.5 kHz deviation



Plot A-3: **Emission Mask H, RF Input**
Frequency: 869 MHz (866 - 869 MHz)
Modulation: FM modulation with an external 9600 b/s random data source, 2.5 kHz deviation



Plot #A-4: **Emission Mask H, RF Output**
Frequency: 869 MHz (866 - 869 MHz)
Modulation: FM modulation with an external 9600 b/s random data source, 2.5 kHz deviation



6.8. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS @ FCC 2.1049, 22.217, 24.238 & 90.210

6.8.1. Limits

Emissions outside the permitted band shall be attenuated below the mean output power of the transmitter as follows:

Frequency Range (MHz)	FCC Rules	FCC Applicable Mask
1930-1990 MHz (PCS)	24.238 (a)	• 43+10*log(P) dBc, P is power in watts or –13 dBm,
869-894 MHz (Base Cellular)	22.217(e)	• 43+10*log(P) dBc, P is power in watts or –13 dBm
929-930 MHz 935-940 MHz (Paging-928-941 MHz)	90.210(b),(g),(I) 90.210(j)	• 43+10*log(P) dBc, P is power in watts or –13 dBm • 50+10*log(P) dBc, P is power in watts or –20 dBm
851-869 MHz (Trunking)	90.210(g) &(g)	• 43+10*log(P) dBc, P is power in watts or –13 dBm

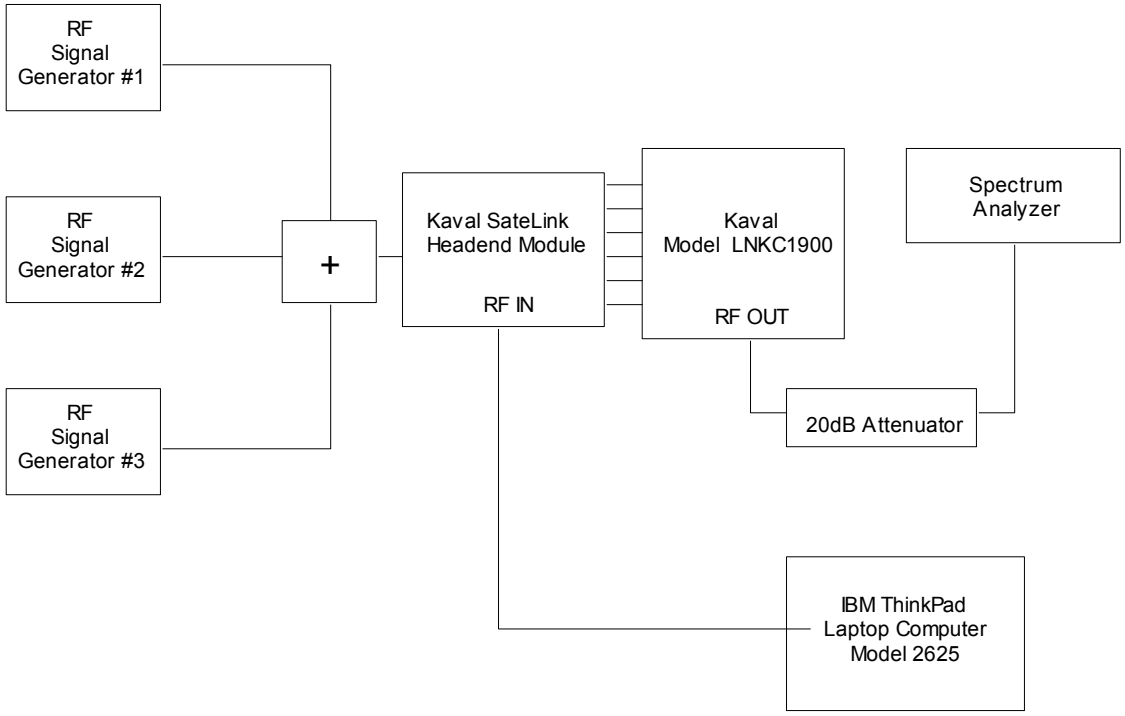
6.8.2. Method of Measurements

Refer to Exhibit 8 § 8.1 of this report for measurement details

6.8.3. 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
Attenuator(s)	Bird	..	…	DC – 22 GHz
Audio Oscillator	Hewlett Packard	HP 204C	0989A08798	DC to 1.2 MHz
Highpass Filter, Microphase	Microphase	CR220HID	IITI11000AC	Cut-off Frequency at 600 MHz, 1.3 GHz or 4 GHz

6.8.4. Test Arrangement



6.8.5. Test Data

6.8.5.1. 1930 –1990 MHz (PCS)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.8.5.2. 869 – 894 (Base Cellular)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.8.5.3. 928 – 941 MHz (Paging)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.8.5.4. 851 – 869 MHz (Trunking)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

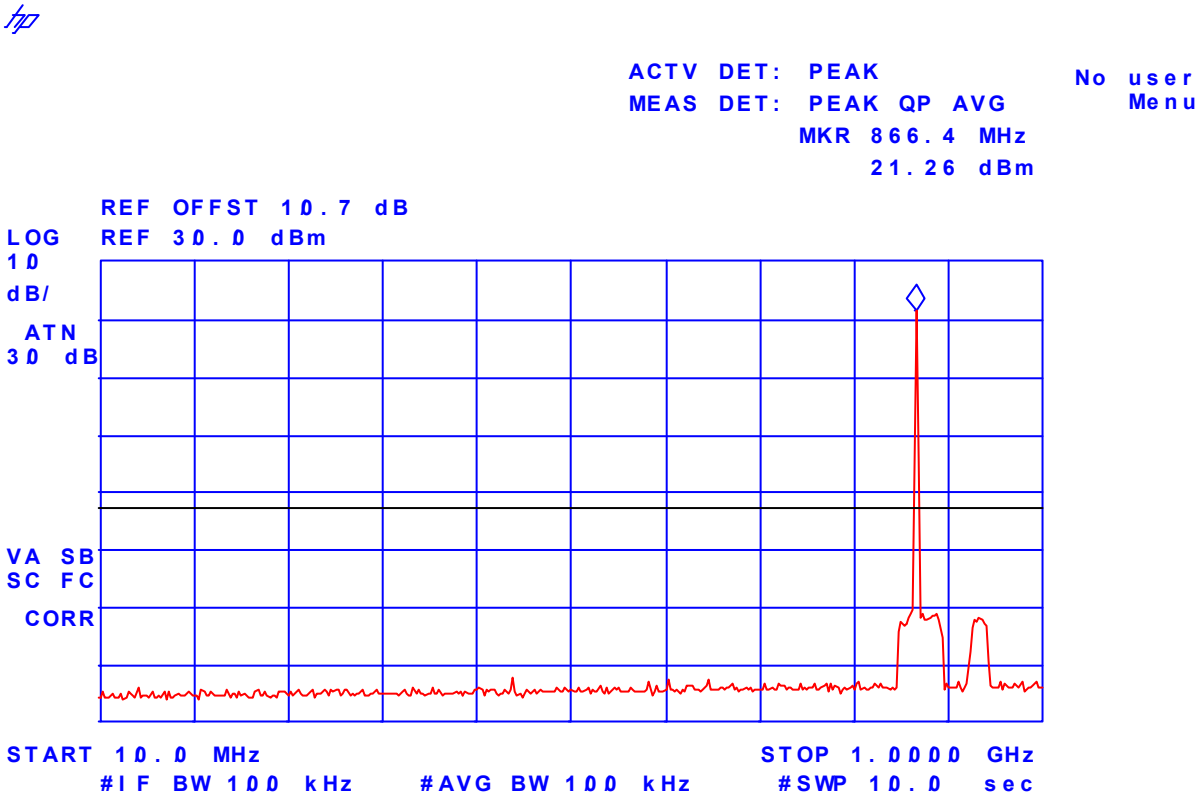
Please refer to Plot A-5 to A-7 for Transmitter Conducted Emissions Masks of RF Output Port at 896 MHz.

Fundamental Frequency: 869 MHz
RF Output Power: +22 dBm
Modulation: FM with 2.5 kHz sine wave signal

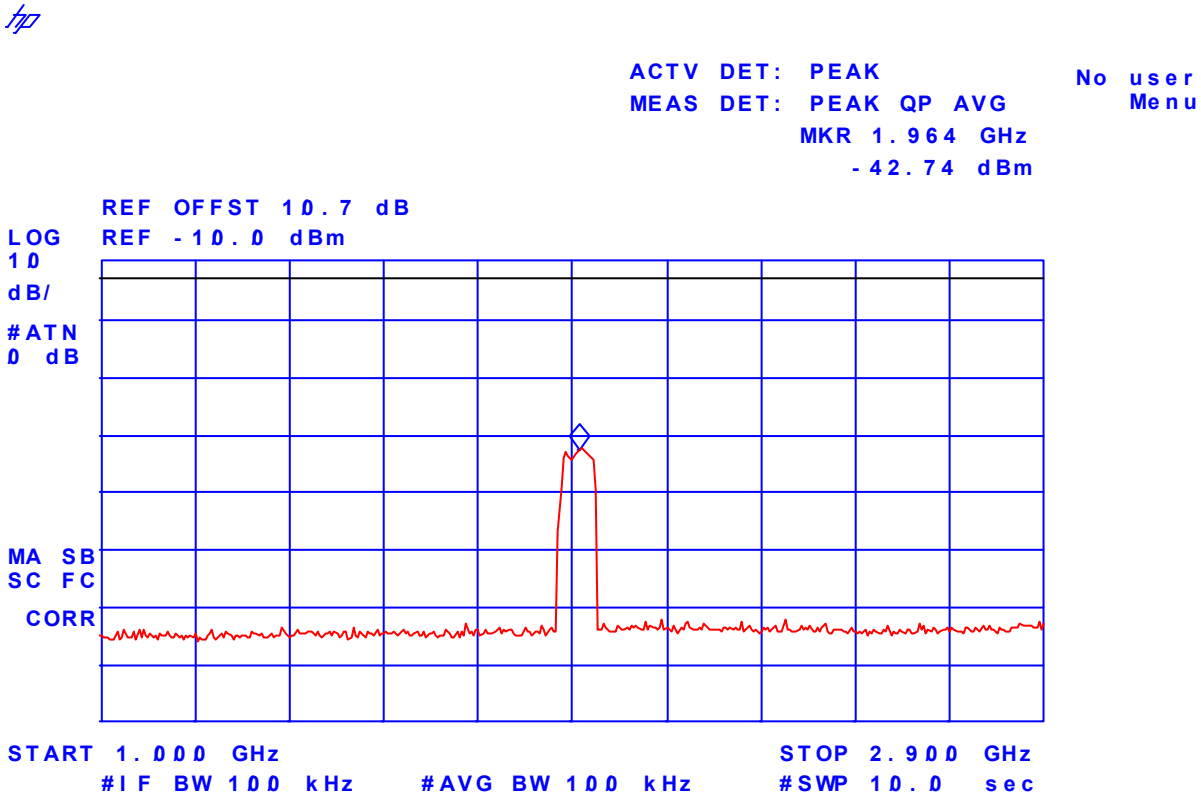
FREQUENCY	TRANSMITTER CONDUCTED ANTENNA EMISSIONS		LIMIT	MARGIN	PASS/
(MHz)	(dBm)	(dBc)	(dBc)	(dB)	FAIL
1964	-42.7	-64.7	-35.0	-29.7	PASS
4622	-49.5	-71.5	-35.0	-36.5	PASS
4965	-49.7	-71.7	-35.0	-36.7	PASS
4592	-50.2	-72.2	-35.0	-37.2	PASS

The emissions were scanned from 10 MHz to 10 GHz and all emissions within 40 dB below the limits were recorded.

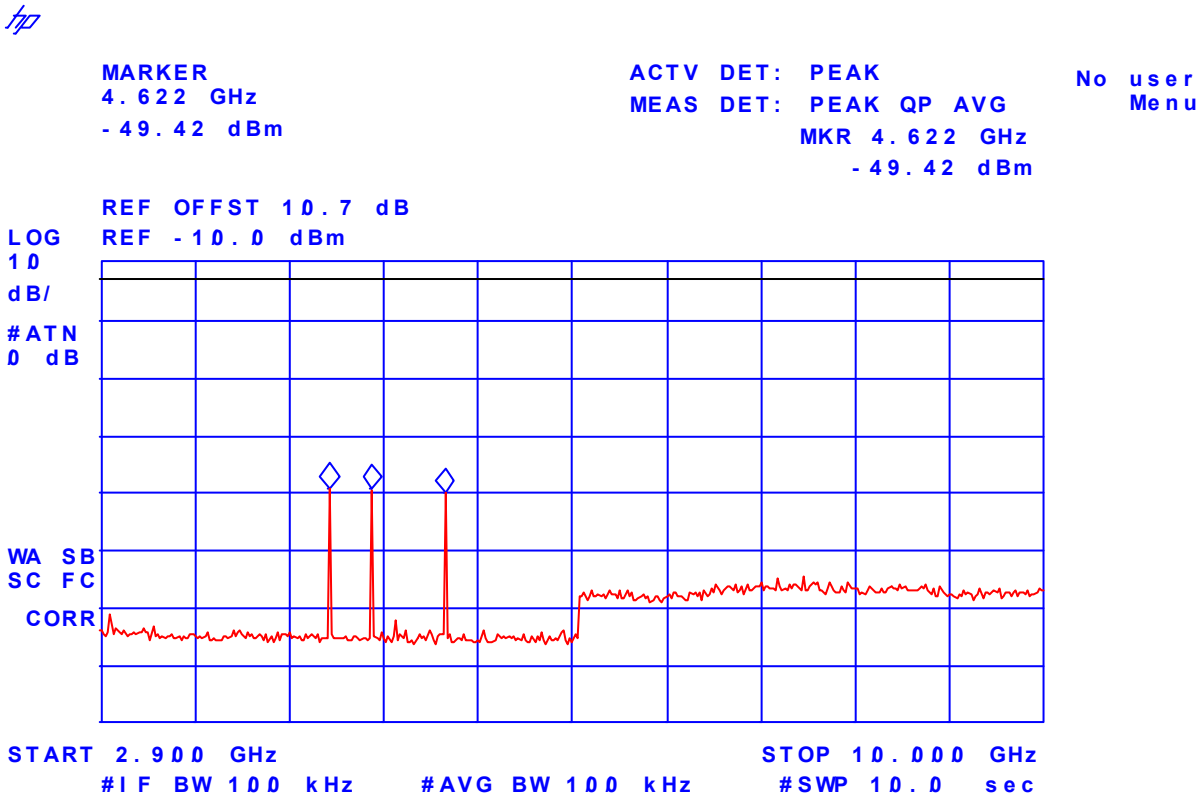
Plot #A5: **Transmitter Antenna Power Conducted Emissions**
Frequency: 869 MHz (866 - 869 MHz)
Modulation: FM modulation with 2.5 kHz Sine Wave signal, 2.5 kHz deviation



Plot #6: **Transmitter Antenna Power Conducted Emissions**
Frequency: 869 MHz (866 - 869 MHz)
Modulation: FM modulation with 2.5 kHz Sine Wave signal, 2.5 kHz deviation



Plot #7: **FM modulation with 2.5 kHz Sine Wave signal, 2.5 kHz deviation**
4.622 GHz, -49.51 dBm
4.941 GHz, -49.65 dBm
5.492 GHz, -50.24 dBm



- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
- Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
- Recognized/Listed by FCC (USA)
- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST*

6.9. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 2.1049, 22.217, 24.238 & 90.210

6.9.1. Limits

Emissions outside the permitted band shall be attenuated below the mean output power of the transmitter as follows:

Frequency Range (MHz)	FCC Rules	FCC Applicable Mask
1930-1990 MHz (PCS)	24.238 (a)	• 43+10*log(P) dBc, P is power in watts or –13 dBm,
869-894 MHz (Base Cellular)	22.217(e)	• 43+10*log(P) dBc, P is power in watts or –13 dBm
929-930 MHz 935-940 MHz (Paging-928-941 MHz)	90.210(b),(g),(I) 90.210(j)	• 43+10*log(P) dBc, P is power in watts or –13 dBm • 50+10*log(P) dBc, P is power in watts or –20 dBm
851-869 MHz (Trunking)	90.210(g) &(g)	• 43+10*log(P) dBc, P is power in watts or –13 dBm

6.9.2. Method of Measurements

Refer to Exhibit 8, § 8.2 of this report for measurement details

6.9.3. 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

6.9.4. Test Arrangement

Refer to Photograph # 1 and 2 in Annex 2 for detailed test setup.

6.9.4.1. 1930 –1990 MHz (PCS)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.9.4.2. 869 – 894 (Base Cellular)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.9.4.3. 928 – 941 MHz (Paging)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

6.9.4.4. 851 – 869 MHz (Trunking)

*** No change. Please refer to the attached original FCC Test report, File # KTI-015FCC, FCC ID: H6M-LNKFIB-R.

Additional tests at 869 MHz were performed and the results were found below:

6.9.4.4.1. Highest Frequency (889 MHz)

Fundamental Frequency: 869 MHz
RF Output Power: +22 dBm
Modulation: unmodulated,

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	ANTENNA LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
10 – 10,000	**	**	PEAK	V	-42.0	**	PASS

** The emissions were scanned from 10 MHz to 10 GHz and no significant radiated emissions within were found.

Fundamental Frequency: 869 MHz
RF Output Power: +22 dBm
Modulation: FM Voice

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	ANTENNA LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
10 – 10,000	**	**	PEAK	V	-42.0	**	PASS

** The emissions were scanned from 10 MHz to 10 GHz and no significant radiated emissions within were found.

Fundamental Frequency: 869 MHz
RF Output Power: +22 dBm
Modulation: FM Data

FREQUENCY (MHz)	RF Field Level @3m (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	ANTENNA LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
10 – 10,000	**	**	PEAK	V	-42.0	**	PASS

** The emissions were scanned from 10 MHz to 10 GHz and no significant radiated emissions within were found.

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 Directivit	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 $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$(Bi) 0.3 (Lp) Uncertainty limits $20\text{Log}(1\pm\Gamma_1\Gamma_R)$	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. GENERAL 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 = 30 kHz minimum , VBW ≥ 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 10th harmonic of the carrier frequency or to the 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 = 100 kHz minimum , VBW ≥ 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 10th harmonic of the carrier frequency or to the 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

(a) Measurements was 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 half-wave dipole 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:

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

For Halfwave dipole antenna or other antennas correlated to dipole in direction of maximum radiation:

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

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

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

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

The Transmitted Power @ D = 3 Meters

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