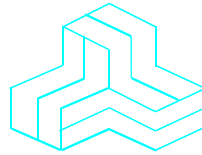


ENGINEERING TEST REPORT



Bi-Directional Amplifier
Model No.: SB400
FCC ID: H6M-SB400
(FCC Class II Permisive Modification)

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 and 90 (Subpart I)

UltraTech's File No.: KTI-029Q

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

Date: Dec. 16, 2003



Report Prepared by: Dharmajit Solanki, RFI Engineer

Tested by: Hung Trinh, RFI Technician

Issued Date: Dec. 16, 2003

Test Dates: Dec. 16, 2003

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

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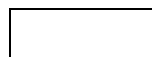
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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Parts 2 and 90
Title:	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2 & 90
Purpose of Test:	To obtain FCC Class II Permissive Modification Authorization for Radio operating in the frequency bands 403 - 512 MHz (12.5 kHz and 25 kHz Channel Spacing).
Modifications:	The outdoor antenna gain limit is changed from 10 dBi to 20 dBi with respective separation distance is change from 138 cm to 10 meters. There are no changes in either mechanical and electrical design of the certified equipment.

1.2. RELATED SUBMITAL(S)/GRANT(S)

None

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2002	Code of Federal Regulations – Telecommunication

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. 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) 946-3396 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) 946-3396 Email Address: asslet@kaval.com

2.2. 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 In-Hancer Plus
Product Name:	Bi-Directional Amplifier
Model Name or Number:	SB400
Serial Number:	Pre-Production
Type of Equipment:	Non-broadcast Radio Communication Amplifier
External Power Supply:	120V, 60 Hz
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	Bi-directional amplifier for operation in UHF band.

ULTRATECH GROUP OF LABS

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File #: KTI-029Q

- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	<input checked="" type="checkbox"/> Base station (fixed use)
Intended Operating Environment:	<input checked="" type="checkbox"/> Commercial <input checked="" type="checkbox"/> Light Industry & Heavy Industry
Power Supply Requirement:	120VAC, 60 Hz
RF Output Power Rating:	<ul style="list-style-type: none"> ▪ 1 input/output: 6.50 Watts or 38.1 dBm ▪ 2 inputs/outputs: 0.30 Watts or 24.8 dBm ▪ 3 inputs/outputs: 0.21 Watts or 23.2 dBm
Operating Frequency Range:	403-512 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	12.5 KHz & 25 kHz
Occupied Bandwidth (99%):	Extender
Emission Designation*:	11K0F3E 16K0F3E 14K6F1D 19K6F1D
Antenna Connector Type:	N
Antenna Description:	Antenna Gain Limit = 20 dBi

* For an average case of commercial telephony, the Necessary Bandwidth is calculated as follows:

1. For FM Voice Modulation:

Channel Spacing = 12.5 KHz, D = 2.5 KHz max., K = 1, M = 3 KHz
 $B_n = 2M + 2DK = 2(3) + 2(2.5)(1) = \mathbf{11\ KHz}$
 emission designation: 11K0F3E

Channel Spacing = 25 KHz, D = 5 KHz max., K = 1, M = 3 KHz
 $B_n = 2M + 2DK = 2(3) + 2(5)(1) = \mathbf{16\ KHz}$
 emission designation: 16K0F3E

2. For FM Digital Modulation:

(a) Channel Spacing = 12.5 KHz, D = 2.5 KHz max., K = 1, M = Data Rate in kb/s / Level of FM
 $M = 9.6\ \text{kb/s} / 2$
 $B_n = 2M + 2DK = 2(9.6/2) + 2(2.5)(1) = \mathbf{14.6\ KHz}$
 emission designation: 14K6F1D

(a) Channel Spacing = 25 KHz, D = 2.5 KHz max., K = 1, M = Data Rate in kb/s / Level of FM
 $M = 9.6\ \text{kb/s} / 2$
 $B_n = 2M + 2DK = 2(9.6/2) + 2(5)(1) = \mathbf{19.6\ KHz}$
 emission designation: 19K6F1D

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2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Power Port	1	3 prong	Non-shielded
2	In Port	1	N	Shielded
3	Out Port	1	N	Shielded

2.5. ANCILLARY EQUIPMENT

None

EXHIBIT 3. SUMMARY OF TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
90.205 & 2.1046	RF Power Output & Intermodulation	Note (1)
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
90.213 & 2.1055	Frequency Stability	Note (1)
90.242(b)(8) & 2.1047(a)	Audio Frequency Response	Note (1)
90.210 & 2.1047(b)	Modulation Limiting	Note (1)
90.210 & 2.1049	Emission Limitation & Emission Mask	Note (1)
90.210, 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Note (1)
90.210, 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Note (1)
90.214	Transient Frequency Behavior	N/A for amplifier
Bi-Directional Amplifier, Model No.: SB400 , by 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 (1): No re-test required since there are no modifications applied to the original certified product.

3.1. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

3.2. DEVIATION OF STANDARD TEST PROCEDURES

None

3.2.1.1. RF EXPOSURE REQUIREMENTS @ 1.1310 & 2.1091

3.2.2. Limits

- **FCC 1.1310**:- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
300-1500	F/300	6
(B) Limits for General Population/Uncontrolled Exposure				
300-1500	F/1500	6

F = Frequency in MHz

3.2.3. Method of Measurements

Refer to FCC @ 1.1310, 2.1091 and Public Notice DA 00-705 (March 30, 2000)

- In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:
 - (1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
 - (2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
 - (3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
 - (4) Any other RF exposure related issues that may affect MPE compliance

- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

Calculation Method of RF Safety Distance:

$$S = PG/4\pi r^2 = EIRP/4\pi r^2$$

Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm²
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

$$r = \sqrt{PG/4\pi S}$$

FCC radio frequency exposure limits may not be exceeded at distances closer than r cm from the antenna of this device

- For portable transmitters (see Section 2.1093), or devices designed to operate next to a person's body, compliance is determined with respect to the SAR limit (define in the body tissues) for near-field exposure conditions. If the maximum average output power, operating condition configurations and exposure conditions are comparable to those of existing cellular and PCS phones., an SAR evaluation may be required in order to determine if such a device complies with SAR limit. When SAR evaluation data is not available, and the additional supporting information cannot assure compliance, the Commission may request that an SAR evaluation be performed, as provided for in Section 1.1307(d)

3.2.4. Test Data

Antenna Gain Limit specified by Manufacturer: 20 dBi

Frequency (MHz)	Measured RF Conducted (dBm)	Calculated EIRP (dBm)	Laboratory's Recommended Minimum RF Safety Distance r (cm)
450	38.1	58.1	437.0

Note 1: RF EXPOSURE DISTANCE LIMITS: $r = (PG/4\pi S)^{1/2} = (EIRP/4\pi S)^{1/2}$
 For worst case: $S = F/1500 = 403/1500 = 0.269 \text{ mW/cm}^2$

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	Compliance with FCC Rules
Minimum calculated separation distance between antenna and persons required: 437 cm	Manufacturer' instruction for separation distance between antenna and persons required: 10 meters Please refer to page # 25 of the Users/ Manual and FCC RF Exposure folder
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Please refer to page # 25 of the Users/ Manual and FCC RF Exposure folder
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Please refer to page # 25 of the Users/ Manual and FCC RF Exposure folder