UltraTech
Group of Labs

31040/SIT

C-1376

46390-2049

200093-0

00-034

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May 08, 2002

BIOSCRYPT INC.
5000 Van Nuys Blvd., Suite 300
Sherman Oaks, CA
USA, 91403

Attn.: **Mr. Curt Harkless**

Subject: **FCC Certification Application Testing under FCC PART 15, Subpart C, Sec. 15.209 – Low Power Transmitters operating at 125 kHz.**

Product: **V-PROX**
Model No.: **V-PROX, A**
FCC ID: **QC4-VPROXAH4065**

Dear Mr. Harkless,

The product sample, as provided by you, has been tested and found to comply with **FCC PART 15, Subpart C, Sec. 15.209 - Low Power Transmitters operating at 125 kHz.**

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

Yours truly,

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

Encl

ENGINEERING TEST REPORT

V-PROX
Model No.: V-PROX, A

FCC ID: QC4-VPROXAH4065

Applicant: **BIOSCRYPT INC.**
5000 Van Nuys Blvd., Suite 300
Sherman Oaks, CA
USA, 91403

In Accordance With

FEDERAL COMMUNICATIONS COMMISSION (FCC)
PART 15, SUBPART C, SEC. 15.209
Low Power Transmitters operating at 125 kHz

UltraTech's File No.: MYT-032F15.209

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: May 08, 2002	
Report Prepared by: Tri Luu . Issued Date: May 08, 2002	Tested by: Hung Trinh, RFI Technician Test Dates: May 07, 2002

- *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.*

UltraTech

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FC	VCCI	Canada	NVLAP	IT	UL	entela
31040/SIT	C-1376	46390-2049	200093-0	00-034		

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EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
	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	OK
1	Test Setup Photos	Photos # 1 to 3	OK
2	External Photos of EUT	Photos # 1 to 2	OK
3	Internal Photos of EUT	Photos of 1 to 7	OK
4	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
5	ID Label/Location Info	• ID Label • Location of ID Label	OK OK
6	Block Diagrams	Block Diagrams	OK
7	Schematic Diagrams	Schematic Diagrams	OK
8	Parts List/Tune Up Info	Parts List/Tune Up Info	OK
10	Operational Description	Operational Description	
11	Users Manual	Users Manual	OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.209
Title	Telecommunication - Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Low Power Transmitters operating at 125 kHz .
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.
Environmental Classification:	• Light-industry, Commercial • Industry

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

None

2.3. NORMATIVE REFERENCES

Publication	YEAR	Title
FCC CFR Parts 0-19	2001	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:	BIOSCRYPT INC.
Address:	5000 Van Nuys Blvd., Suite 300 Sherman Oaks, CA USA, 91403
Contact Person:	Mr. Curt Harkless Phone #: 818-501-3908 (x13) Fax #: 818-561-0843 Email Address: curt.harkless@bioscrypt.com

MANUFACTURER:	
Name:	Knight Wah Technology Ltd.
Address:	16-19, 3/F, Tower B, Regent Centre 63-73 Wo Yi Hop Road Kwai Chung, NT Hong Kong
Contact Person:	Phone #: 852-2619-0162 Fax #: 852-2619-0132

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	BIOSCRYPT INC.
Product Name	V-PROX
Model Name or Number	V-PROX, A
Serial Number	Preproduction
Type of Equipment	Low Power Transmitters
Input Power Supply Type	• External DC Sources

Description of Equipment under Test -- V-Prox, A

Important Note: This device to be considered as an access control system unit accessory

V-Prox product contents:
V-Prox: Contents include: Authentec Sensor, Bioscrypt's Propriety MV1200 VeriSeries DSP module and HID Corp. OEM proximity reader module Model Number 4065.

Information on applicable standards still required. Ryan is in discussions with John Menzel, HID Director of integration technology.

V-Prox application and field operation:
The field application of this device will provide additional security within an existing access control environment. The user presents portable token (proximity card) that is transferred to V-Prox by means of radio frequency. V-Prox has internally linked user's credentials for the portable token, as well as the template with unique characteristics of user's fingerprint. V-Prox releases user's credentials to an access control panel only if there is a positive verification of user's fingerprint against the template.

The V-Prox product setup consisted of a 12VDC Battery, V-Prox product and a 3-meter non-shielded serial communications cable. All relevant signal grounds were tied to the power supply return (GND) to provide a means of termination for each communication protocol used by the system.

V-Prox internal firmware and operation **simulated** the presence of this portable token (Proximity Card) containing the users fingerprint and identity. Based on an overall operational cycle time of 7 seconds consecutively. The device sits idle for a period of 4 seconds, initializes and performs an artificial verification on a template stored within the device followed by an audible tone for successful verification.

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	▪ Base station (fixed use)
Intended Operating Environment:	▪ Commercial, light industry & heavy industry
Power Supply Requirement:	8 - 12 Vdc
RF Output Power Rating:	61.5 dBuV/m measured at 3m
Operating Frequency Range:	125 kHz
RF Output Impedance:	50 Ohms
Channel Spacing:	1
Duty Cycle:	18.8%
26 dB Bandwidth:	7.1 kHz
Modulation Type:	On-off pulse
Channel Spacing	N/A
Emission Designation:	7K1N0N
Oscillator Frequencies:	25 MHz, 16 MHz, 14.745 MHz, 4 MHz
Antenna Connector Type:	• Integral, permanently attached
Antenna Description:	Small loop antenna surface around the Authentec fingerprint sensor

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	Multi-purpose I/O and DC Power Port	1	DB15/Wiring Harness	Non-shielded

3.5. ANCILLARY EQUIPMENT

None

3.6. GENERAL TEST SETUP

Bioscrypt Inc.
V-PROX
Model: V-PROX, A

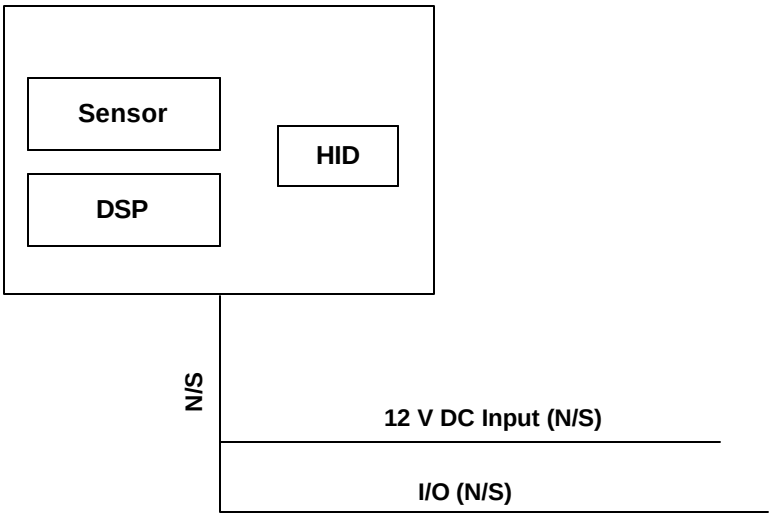


EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

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:	8 - 12 Vdc

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	transmitting a pulse RF signal @ 125 kHz continuously
Special Test Software:	None
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as an integral antenna equipment.

Transmitter Test Signals:	
Frequencies: ▪ 125 kHz band:	Lowest, middle and highest channel frequencies tested:
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): ▪ Normal Test Modulation ▪ Modulating signal source:	 ▪ 61.5 dBuV/m measured at 3m ▪ unmodulated ▪ None

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: Aug. 08, 2001.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
15.203	Antenna Requirement	Yes. Permanently attached small loop antenna.
15.209 & 15.205	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious	Yes
	26 dB Bandwidth	Yes
15.107(a)	AC Power Line Conducted Emissions Measurements (Transmit & Receive)	N/A for DC supplied device
The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class A Digital Devices, the associated Radio Receiver operating in 125 kHz is exempted from FCC authorization . The engineering test report can be provided upon FCC requests.		

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

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, ANSI C63-4:1992.

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 C64-3:1992, FCC 15.209 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. TRANSMITTER SPURIOUS EMISSIONS (RADIATED @ 3 METERS), FCC CFR 47, PARA. 15.209 & 15.205

6.5.1. Limits

The fundamental frequency shall not fall within any restricted frequency band specified in 15.205
All rf other emissions shall not exceed the general radiated emission limits specified in @ 15.209(a).

FCC CFR 47, Part 15, Subpart C, Para. 15.205(a) - Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 – 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 – 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 – 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 – 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 – 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 – 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 – 156.9	2200 - 2300	9000 - 9200	

FCC CFR 47, Part 15, Subpart C, Para. 15.209(a)
-- Field Strength Limits within Restricted Frequency Bands --

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

6.5.2. Method of Measurements

Refer to Exhibit 8, Sec. 8.2 of this test report and **ANSI 63.4-1992, Para. 8** for detailed radiated emissions measurement procedures.

The following measurement procedures were also applied:

- Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.
- For 9 kHz ≤ frequencies ≤ 150 kHz: RBW = 1 KHz, VBW ≥ 1 KHz, SWEEP=AUTO.
- For 150 MHz ≤ frequencies ≤ 30 MHz: RBW = 10 KHz, VBW ≥ 10 KHz, SWEEP=AUTO.
- For 30 MHz ≤ frequencies ≤ 1 GHz: RBW = 100 KHz, VBW ≥ 100 KHz, SWEEP=AUTO.
- For frequencies ≥ 1 GHz: RBW = 1 MHz, VBW = 1 MHz (Peak) & VBW = 10 Hz (Average), SWEEP=AUTO.
- If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

6.5.3. 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		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

6.5.4. Photographs of Test Setup

Refer to the Photographs #1 to #3 in Annex 1 for setup and arrangement of equipment under tests and its ancillary equipment.

6.5.5. Test Data

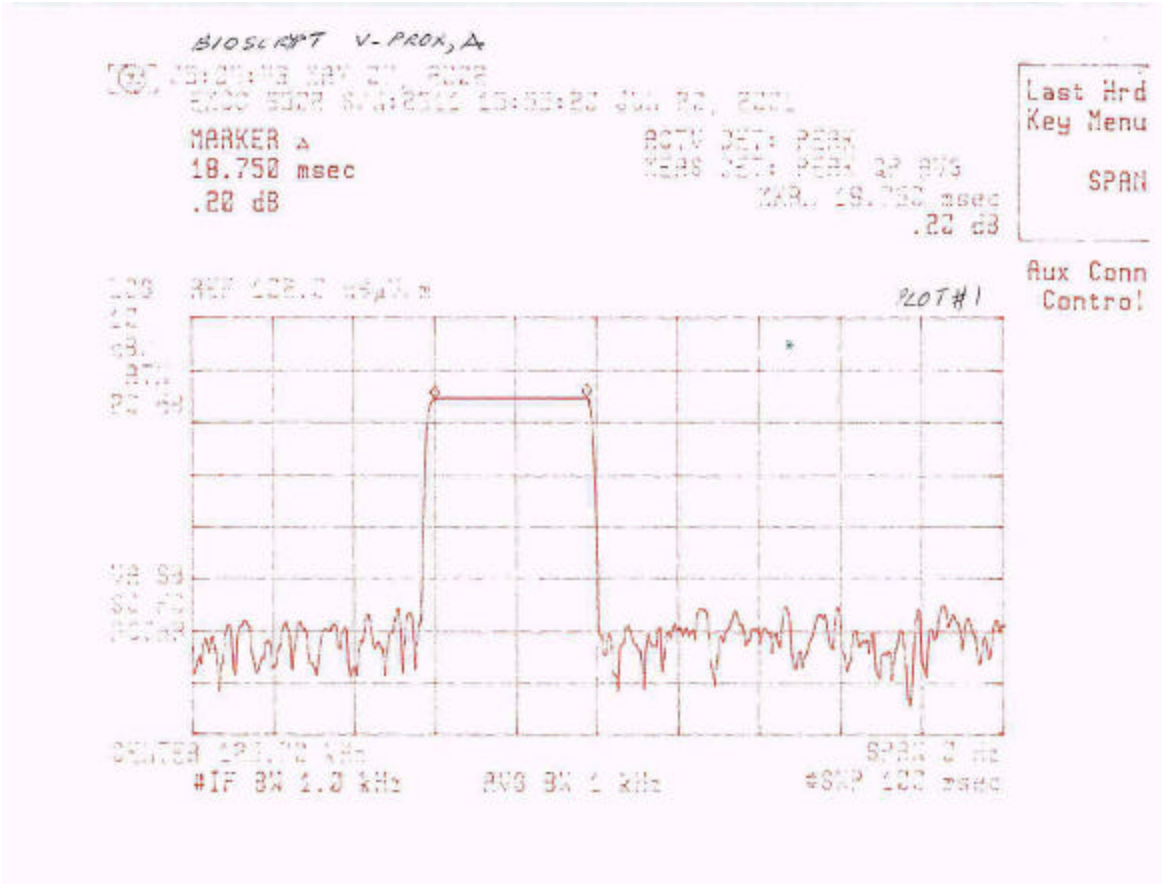
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT MARGIN (dB)	PASS/ FAIL	Distance (m)
0.125	No significant signal found	No significant signal found	V & H	84.7	<<	PASS	10
0.125	76.0	61.5	V	105.7	-44.2	PASS	3
0.125	73.3	58.8	H	105.7	-46.9	PASS	3
0.010 - 1000	No significant signal found	No significant signal found	V & H	Refer to 15.209	<<	PASS	3
• The emissions were scanned from 10 kHz to 1 GHz . Except for the fundamental, all spurious/harmonic emissions (from the transmitters) within 40 dB below the limits were recorded. • Highest measurements were recorded when the transmitter was tested with 3 different orthogonal positions as shown in Photos # 1 to 3 in Annex 1.							

Remarks:

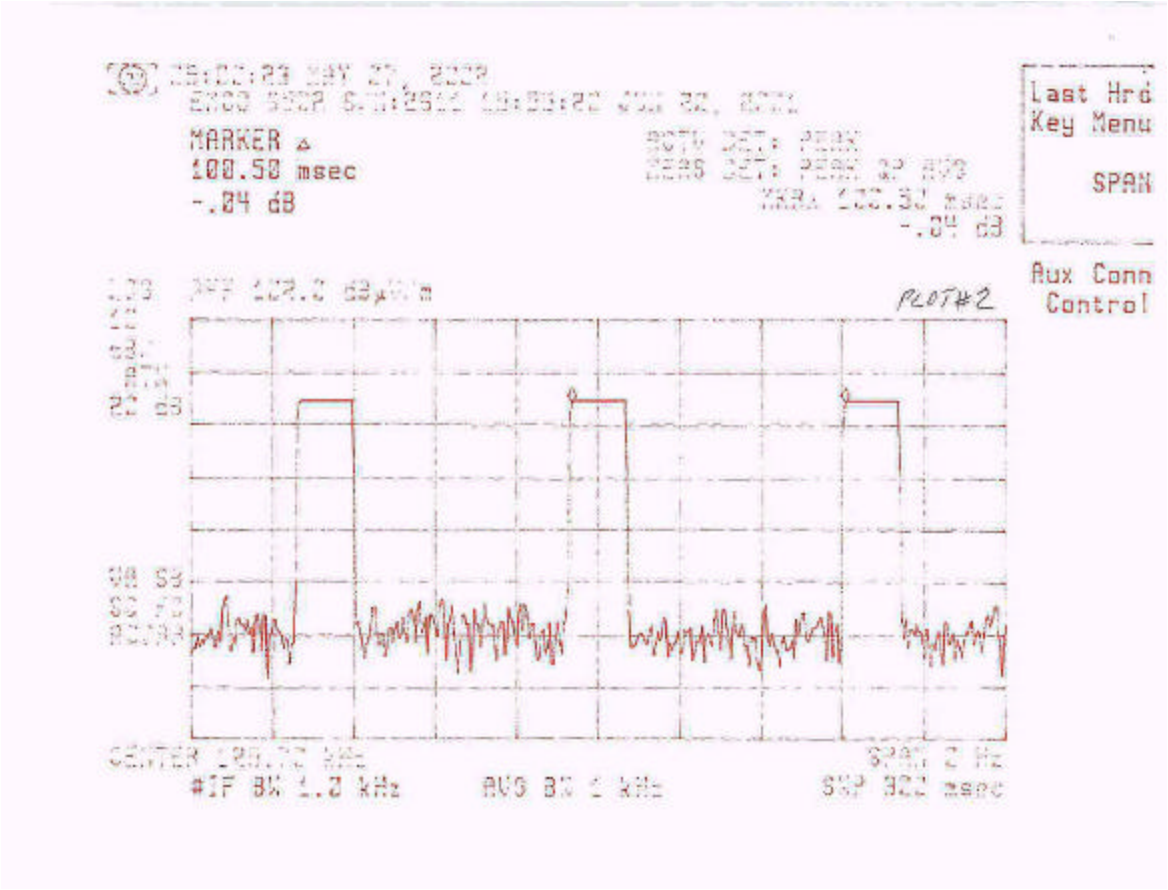
(1) Duty Cycle = 18.75mS/100 mS = 0.1875
Peak-to-Average factor = 20*log (0.1875) = -14.5 dB
Please refer to Plots # 1 & 2 below for detailed measurements.

(2) The 300m limit was converted to 10m Limit using square factor (x) as it was found by measurements as follows:
- Limit at 10m = limit at 300 m + $20*\log(300/10)^2$ = 20*log(2400/125) + 59.0 dB = 84.7 dB
- Limit at 3m = limit at 300 m + $20*\log(300/3)^2$ = 20*log(2400/125) + 59.0 dB = 105.7 dB

PLOT #1: DUTY CYCLE MEASUREMENTS - PULSE WIDTH



PLOT #2: DUTY CYCLE MEASUREMENT - PULSE TRAIN



6.6. 26 DB OCCUPIED BANDWIDTH

6.6.1. Limits

The rf spectrum shall not stay in the restricted band specified in FCC 15.205

6.6.2. Method of Measurements

Refer to Exhibit 8, Sec. 8.4 & ANSI C63-4:1992

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna and the bandwidth of bandwidth of the fundamental frequency was measured with the spectrum analyzer with the resolution bandwidth of the spectrum analyzer set per ANSI 63-4:1992, Sec. 13.1.6.2

6.6.3. 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

6.6.4. Test Data

CHANNEL FREQUENCY (MHz)	26 dB BANDWIDTH (kHz)	MAXIMUM LIMIT (kHz)	PASS/FAIL
125	7.1	38 (stay outside of the adjacent restricted band @ 15.205)	PASS

PLOT #3: 26 dB BANDWIDTH

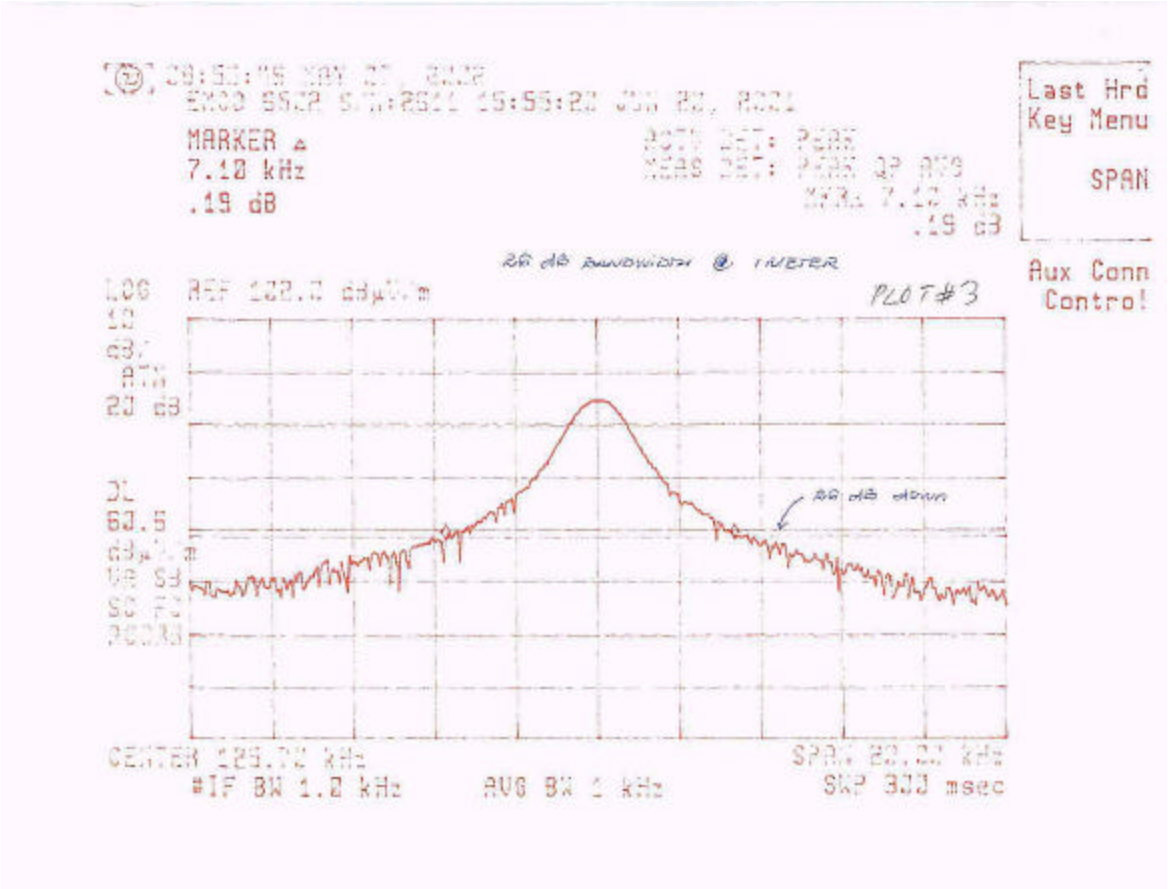


EXHIBIT 7. MEASUREMENT UNCERTAINTY

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 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. GENERAL TEST CONDITIONS

The following test conditions shall be applied throughout the tests covered in this report.

8.1.1. Normal temperature and humidity

- Normal temperature: +15°C to +35°C
- Relative Humidity: +20% to 75%

The actual values during tests shall be recorded in the test report.

8.1.2. Normal power source

8.1.2.1. Mains Voltage

The nominal test voltage of the equipment to be connected to mains shall be the nominal mains voltage which is the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of test power source corresponding to the AC mains shall be between 59 Hz and 61 Hz.

8.1.2.2. Battery Power Source.

For operation from battery power sources, the nominal test voltage shall be as declared by the equipment manufacturer. This shall be recorded in the test report.

8.1.3. Operating Condition of Equipment under Test

- All tests were carried out while the equipment operated at the following frequencies:
  - The lowest operating frequency,
  - The middle operating frequency and
  - The highest operating frequency

- Modulation were applied using the Test Data sequence
- The transmitter was operated at the highest output power, or in the case the equipment able to operate at more than one power level, at the lowest and highest output powers

8.2. SPURIOUS EMISSIONS

For both conducted and radiated measurements, the spurious emissions were scanned from the lowest frequency generated by the EUT or 10 MHz whichever is lower to 10th harmonic of the highest frequency generated by the EUT.

- The radiated emission measurements were performed at the UltraTech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC, Industry Canada, ACA/Austel, NVLap and ITI.
- Radiated emissions measurements were made using the following test instruments:

1. Calibrated EMCO BiconiLog antenna in the frequency range from 30 MHz to 2000 MHz.
2. Calibrated Emco Horn antennas in the frequency range above 1000 MHz (1GHz - 40 GHz).
3. The test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

   - RBW = 100 kHz for f < 1GHz and RBW = 1 MHz for f ≥ 1 GHz
   - VBW = RBW
   - Sweep = auto
   - Detector function = peak
   - Trace = max hold
   - Follows the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc.. A pre-amp and highpass filter are required for this test, in order to provide the measuring system with sufficient sensitivity.
   - Allow the trace to stabilize.
   - The peak reading of the emission, after being corrected by the antenna correction factor, cable loss, pre-amp gain, etc…. is the peak field strength which comply with the limit specified in Section 15.35(b)

   Calculation of Field Strength:

   The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength
RA = Receiver/Analyzer Reading
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Example: If a receiver reading of 60.0 dBuV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:
Field Level = 60 + 7.0 + 1.0 - 30 = 38.0 dBuV/m.

Field Level = $10^{(38/20)}$ = 79.43 uV/m.

- Submit this test data
- Now set the VBW to 10Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100ms, then the reading obtained may be further adjusted by a "duty cycle correction factor", derived from 10log(dwell time/100mS) in an effort to demonstrate compliance with the 15.209.
- Submit test data

Maximizing The Radiated Emissions:

- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement were explored to produce the highest amplitude signal relative to the limit.

The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.

Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.

Step4: Move the antenna over its full allowable range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.

Step5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.

Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.

Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

8.3. 26 DB BANDWIDTH MEASUREMENTS

- Couple the RF output signal to the spectrum analyzer by means of direct connection or by a receiving antenna.
- The spectrum analyzer shall be se as follows:
  - Span: Minimum span to fully display the entire emission, approximately 3 x emission BW.
  - Resolution RBW: 1% to 3% of the approximate emission BW
  - Video VBW: 3 x RBW
  - EMI Detector: Peak
  - Sweep Time: Coupled or set to a slow rate
  - Trace: Max-hold
- Place the marker at both sides of the emission slope and at -26 dB down from the peak value.
- The difference of frequencies of 2 markers will be the 26 dB bandwidth
- Record and plot the test results.