ENGINEERING TEST REPORT

Point of Sale Device
Model No.: NURIT 8000
FCC ID: O2SNURIT8000SWM

Applicant:

Lipman USA, Inc.
50 Gordon Dr.
Syosset, NY
USA, 11791

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, PARTS 2 and 90 (Subpart I)

UltraTech's File No.: LEE-009FCC90

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: January 5, 2004	
Report Prepared by: Dan Huynh Issued Date: January 5, 2004	Tested by: Mr.Hung Trinh, RFI Technician Test Dates: November 6 - 9, 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.*

UltraTech

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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	Radiated Emissions Setup Photos	OK
2	External EUT Photos	External Photos	OK
3	Internal EUT Photos	Internal Photos	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
5	Attestation Statements	Part 90.203(e)	OK
6	ID Label/Location Info	▪ ID Label ▪ Location of ID Label	OK
7	Block Diagrams	Block Diagram	OK
8	Schematic Diagrams	Schematics	OK
9	Parts List/Tune Up Info	Parts List of Module	OK
10	Operational Description	System Description	OK
11	RF Exposure Info	See SAR Test Reports for Details	OK
12	Users Manual	User Manual	OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 90
Title:	Code of Federal Regulations (CFR), Title 47 - Telecommunication, Parts 2 & 90
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency band 896-901MHz (12.5kHz Channel Spacing)
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 SUBMITTAL(S)/GRANT(S)

None.

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	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	2002 2003	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1	1999	Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Lipman USA, Inc.
Address:	50 Gorgon Dr. Syosset, NY 11791 USA
Contact Person:	Mr. John Carpino Phone #: (516) 484-9898 Ext:214 Fax #: (516) 484-9057 Email: jcarpino@lipmanusa.com

MANUFACTURER	
Name:	Lipman Electronics Engineering Ltd.
Address:	11 Haamal Street, Park Afek Rosh-Haayin 48092 Israel
Contact Person:	Mr.Avi Galili Phone #: 972-3-9029730 Fax #: 972-3-9029731 Email Address: avi@lipman.co.il

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:	Lipman
Product Name:	Point of Sale Device
Model Name or Number:	NURIT 8000
Type of Equipment:	Licensed Non-broadcast Radio Communication Equipment
Power Supply:	Lipman Li-ion Battery Pack Model No.: BAT09501-M02-BLU
Transmitting/Receiving Antenna Type:	Integral
Primary User Functions of EUT:	Wireless hand held POS/EDC terminal for credit, debit and ERT transactions

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	Commercial, industrial or business environment
Power Supply Requirement:	7.4 V Li-on Battery Pack
RF Output Power Rating:	2.0 Watts Nominal
Operating Frequency Range:	896-901 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	12.5 kHz
Duty Cycle:	The duty cycle limit is set at 12.5%
Occupied Bandwidth (99%):	8 KHz
Modulation Type:	2 Level 8 kbps GMSK (2 kHz max. frequency deviation)
Emission Designation*:	12K0F1D
Antenna Connector Type:	Integral
Antenna Description:	Manufacturer: Mars Antennas & RF System Ltd. Type: Embedded Model: MA89940VOMML Frequency Range: TX: 896-906 MHz, RX: 935-941 MHz Gain (dBi): 0

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

For FM Digital Modulation:

Channel Spacing = 12.5 KHz, D = 2.0 KHz max., K = 1, M = Data Rate in kb/s / Level of FM,
Level of FM = 2
M = 8/2 kb/s
B_n = 2M + 2DK = 2(8/2) + 2(2.0)(1) = **12 KHz**

Emission designation: 12K0F1D

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	Data I/O	1	RS 232	Shielded
2	Power	1	Miniature Power	Non-shielded

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:	7.4 V Li-on Battery Pack

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:	Software provided by Lipman to configure the unit for testing purposes.
Special Hardware Used:	N/A
Transmitter Test Antenna:	Integral part of the EUT

Transmitter Test Signals	
Frequency Band(s):	896 – 901 MHz
Frequency(ies) Tested: (Near lowest & near highest frequencies in the frequency range of operation.)	896 and 901 MHz
Transmitter Wanted Output Test Signals:	
▪ RF Power Output (measured maximum output power):	2.1 Watts max.
▪ Normal Test Modulation:	FM data
▪ Modulating signal source:	Internal

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, 24'(L) by 16'(W) by 8'(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: November 4, 2003.

5.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Applicability (Yes/No)
90.205 & 2.1046	RF Power Output	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes (see Note 1)
90.213 & 2.1055	Frequency Stability	Yes (see Note 2)
90.242(b)(8) & 2.1047(a)	Audio Frequency Response	N/A
90.210 & 2.1047(b)	Modulation Limiting	Yes (see Note 2)
90.210 & 2.1049	Emission Limitation & Emission Mask	Yes
90.210, 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Yes (see Note 2)
90.210, 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes

Note 1: Refer to SAR test report for details.

Note 2: Since, there is no change in RF characteristic, circuitry and functional capabilities in the Wavenet Technology Pty Ltd. Boomer III OEM Modem Module (FCC ID: PQS-BM3900M) approved as a Modular Transceiver, tests are not required to be repeated. Please refer to Wavenet Technology Pty Ltd. Test Report for further details.

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

5.4. DEVIATION FROM 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.

6.4.1. RF POWER OUTPUT [§§ 2.1046 & 90.205]

6.4.2. Limits

Please refer to FCC 47 CFR, Section 90.205 for power limit for frequency band:

EUT's Operating Frequency Band (MHz)	FCC Allowable Frequency band (MHz)	FCC Rules	FCC Maximum ERP Limits (Watts)
896-901 MHz	896-901	90.635	100 Watts peak ERP for mobile station.

6.4.3. Method of Measurements

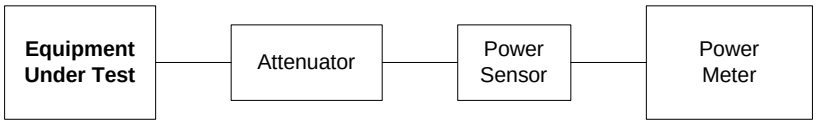
Refer to Exhibit 8, Section 8.1 (Conducted) and 8.2 (Radiated) of this report for measurement details

6.4.4. 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	Weinschel Corp	46-20-34	BM1347	DC – 8.5 GHz

6.4.5. Test Arrangement

Power at RF Power Output Terminals



6.4.6. Test Data

Transmitter Channel Output	Fundamental Frequency (MHz)	Measured (Peak) Power (dBm)	Power Rating (dBm)
Lowest	896.0	33.23	33.0
Highest	901.0	33.28	33.0

6.5. OCCUPIED BANDWIDTH & EMISSION MASK [§§ 2.1049, 90.209 & 90.210]

6.5.1. Limits

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

Frequency Range (MHz)	Maximum Authorized BW (KHz)	Channel Spacing (KHz)	Recommended Max. Frequency Deviation (KHz)	FCC Applicable Mask
896-901	13.6	12.5	2.5	MASK J (Data)

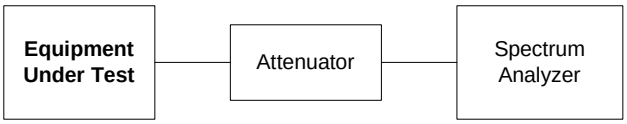
6.5.2. Method of Measurements

Refer to Exhibit 8, Section 8.4 of this report for measurement details

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rhode & Schwarz	FSEK20/B4/B21	834157/005	9kHz – 40GHz
Attenuator	Weinschel Corp	46-20-34	BM1347	DC – 8.5 GHz

6.5.4. Test Arrangement



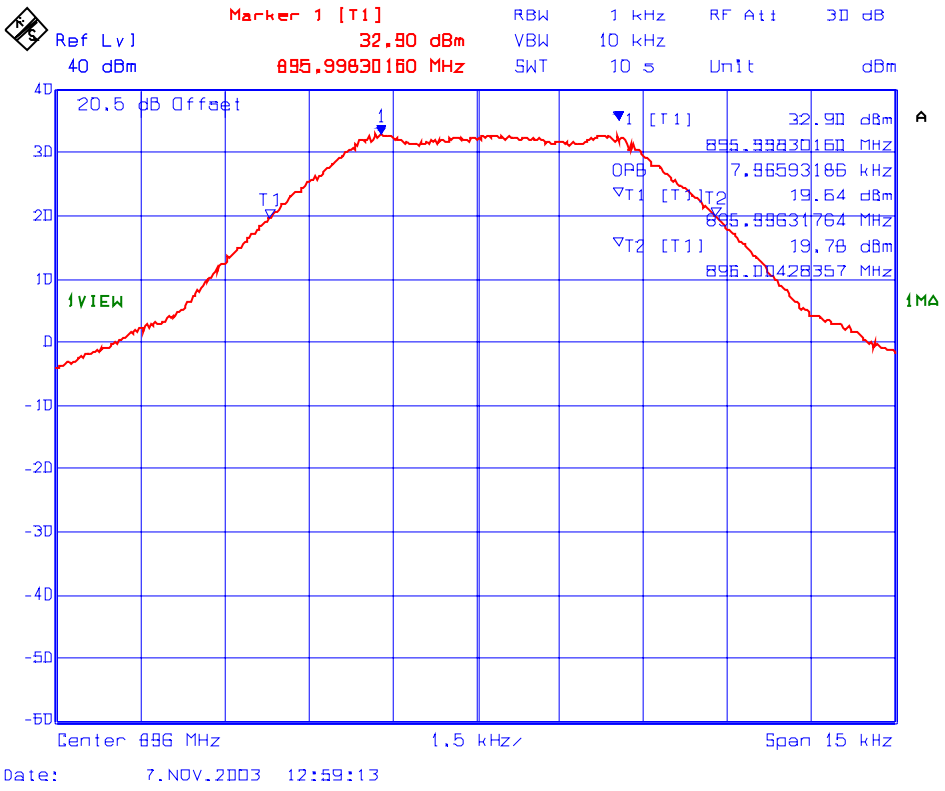
6.5.5. Test Data

6.5.5.1. 99% Occupied Bandwidth

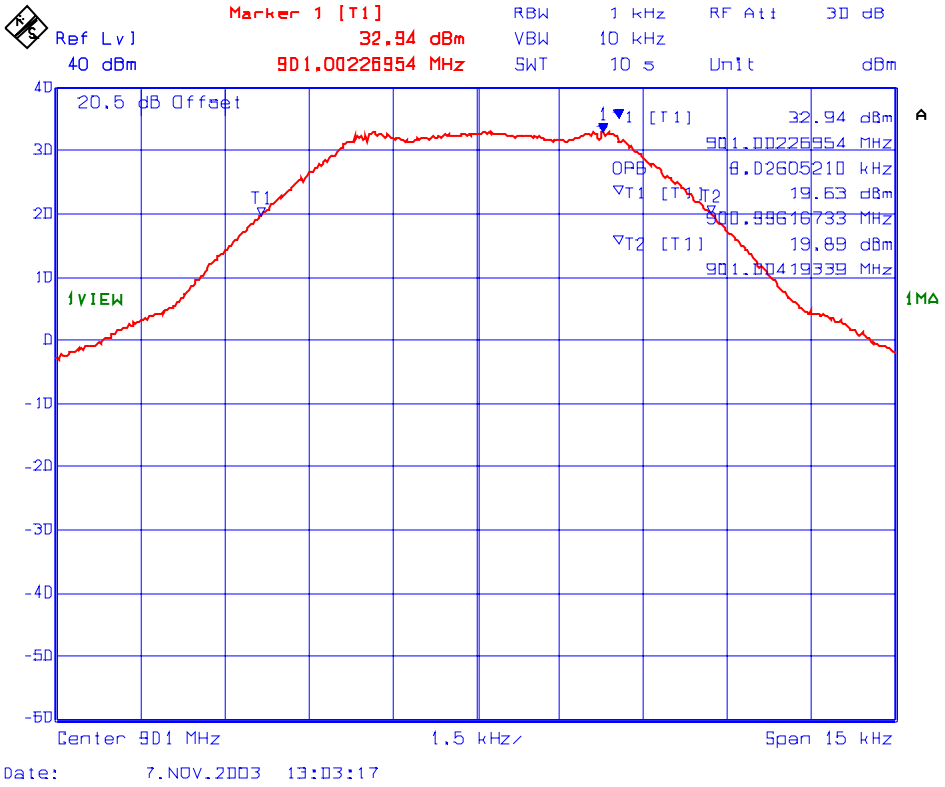
Frequency (MHz)	Channel Spacing (kHz)	*Measured 99% OBW (kHz)	Max. Authorized BW (kHz)
896.0	12.5	7.97	13.6
901.0	12.5	8.03	13.6

*See plot # 1 to 2 for details of measurement.

Plot # 1:
99% Occupied Bandwidth
Test Frequency: 896 MHz, Modulation: 2-Level 8kbps GMSK

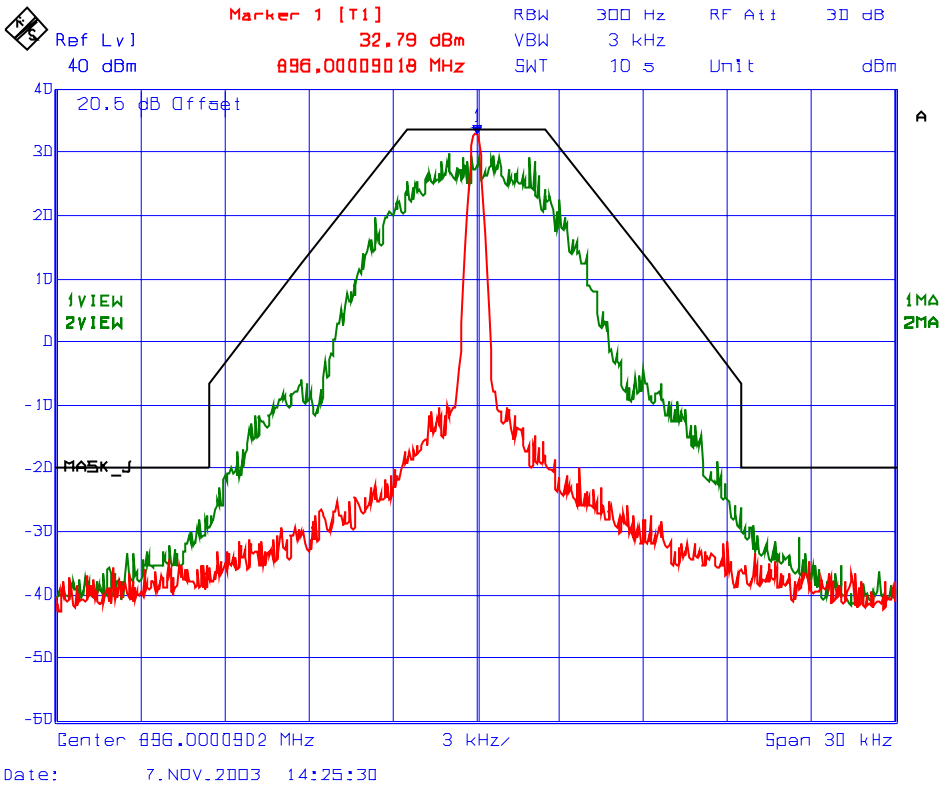


Plot # 2:
99% Occupied Bandwidth
Test Frequency: 901 MHz, Modulation: 2-Level 8kbps GMSK

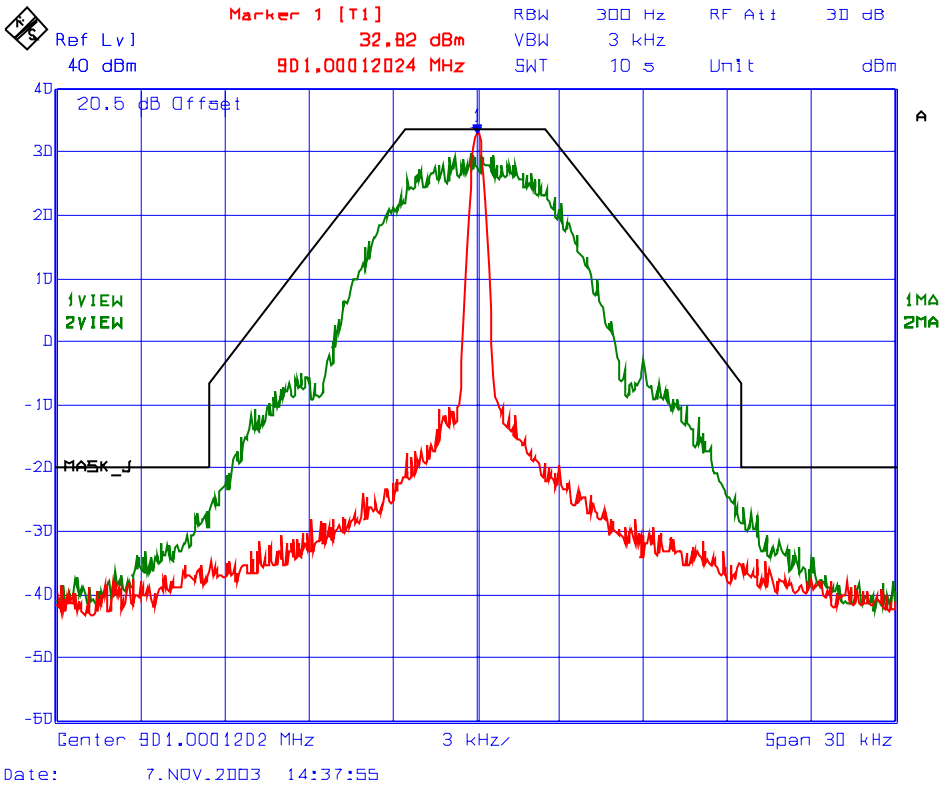


6.5.5.2. Emission Masks

Plot # 3:
Emission Mask J, RF Output, High Power Setting
Test Frequency: 896 MHz, Modulation: 2-Level 8kbps GMSK



Plot # 4:
Emission Mask J, RF Output, High Power Setting
Test Frequency: 901 MHz, Modulation: 2-Level 8kbps GMSK



6.6. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§ 90.210]

6.6.1. Limits

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

Frequency Band	Frequency Range	Attenuation Limit (dBc)
896-901/935-940MHz	30 MHz or Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	At least $157\log_{10}(f_d/5.3)$, $50+10\log_{10}$ (P) or 70 dB, whichever is the lesser attenuation.

6.6.2. Method of Measurements

The spurious/harmonic ERP measurements are using substitution method specified in Exhibit 8, § 8.2 of this report and its value in dBc is calculated as follows:

(1) If the transmitter's antenna is an integral part of the EUT, the ERP is measured using substitution method.
(2) If the transmitter's antenna is non-integral and diverse, the lowest ERP of the carrier with 0 dBi antenna gain is used for calculation of the spurious/harmonic emissions in dBc:
Lowest ERP of the carrier = EIRP – 2.15 dB = Pc + G - 2.15 dB = Pc dBm (conducted) + 0 dBi – 2.15 dB
(3) Spurious /harmonic emissions levels expressed in dBc (dB below carrier) are as follows:

ERP of spurious/harmonic (dBc) = ERP of carrier (dBm) – ERP of spurious/harmonic emission (dBm)

6.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rhode & Schwarz	FSEK20/B4/B21	834157/005	9kHz – 40GHz
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz, 30 dB nominal
Biconilog Antenna	EMCO	3142	10005	30 MHz to 2 GHz
Dipole Antenna	EMCO	3121C	8907-434	30 GHz – 1 GHz
Dipole Antenna	EMCO	3121C	8907-440	30 GHz – 1 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3155	9911-5955	1 GHz – 18 GHz
RF Signal Generator	Hewlett Packard	HP 83752B	3610A00457	0.01 – 20 GHz

6.6.4. TEST DATA

6.6.4.1. Low Frequency (896 MHz)

Fundamental Frequency: 896 MHz
RF Output Power: 33.23 dBm (Conducted)
Modulation: 2 level 8kbps GMSK
Test Frequency Range: 10 MHz – 10 GHz

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method		Limit (dBc)	Margin (dB)	Pass / Fail
				(dBm)	(dBc)			
1792	66.86	Peak	H	-37.13	-70.36	-53.23	-17.13	Pass
2688	64.66	Peak	H	-36.47	-69.70	-53.23	-16.47	Pass
5376	71.38	Peak	V	-31.64	-64.87	-53.23	-11.64	Pass
5376	69.17	Peak	H	-33.27	-66.50	-53.23	-13.27	Pass
All spurious emissions and harmonics within 20 dB below the limit were recorded.								

6.6.4.2. High Frequency (901 MHz)

Fundamental Frequency: 901 MHz
RF Output Power: 33.28 dBm (Conducted)
Modulation: 2 level 8kbps GMSK
Test Frequency Range: 10 MHz – 10 GHz

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method		Limit (dBc)	Margin (dB)	Pass / Fail
				(dBm)	(dBc)			
1802	71.22	Peak	V	-30.66	-63.94	-53.28	-10.66	Pass
1802	67.94	Peak	H	-36.48	-69.76	-53.28	-16.48	Pass
2703	75.82	Peak	V	-25.60	-58.88	-53.28	-5.60	Pass
2703	70.01	Peak	H	-32.30	-65.58	-53.28	-12.30	Pass
3604	62.44	Peak	H	-39.79	-73.07	-53.28	-19.79	Pass
4505	65.64	Peak	V	-37.46	-70.74	-53.28	-17.46	Pass
4505	69.14	Peak	H	-32.88	-66.16	-53.28	-12.88	Pass
5406	76.89	Peak	V	-25.43	-58.71	-53.28	-5.43	Pass
5406	73.69	Peak	H	-28.67	-61.95	-53.28	-8.67	Pass
All spurious emissions and harmonics within 20 dB below the limit were recorded.								

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. CONDUCTED POWER MEASUREMENTS

- The following shall be applied to the combination(s) of the radio device and its intended antenna(e).
- If the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.
- The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
- The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

Step 1: Duty Cycle measurements if the transmitter's transmission is transient

- Using a EMI Receiver with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with 0<x<1, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

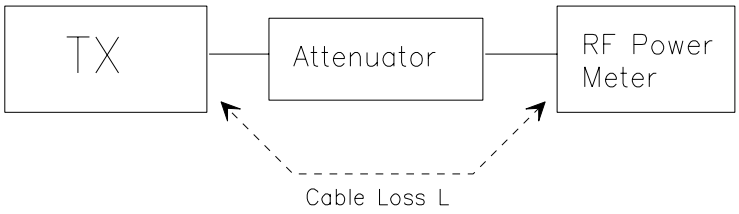
Step 2: Calculation of Average EIRP. See Figure 1

- The average output power of the transmitter shall be determined using a wideband, calibrated RF average power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

EIRP = A + G + 10log(1/x)

{X = 1 for continuous transmission => 10log(1/x) = 0 dB}

Figure 1.



8.2. RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD

8.2.1. Maximizing RF Emission Level (E-Field)

(a) The measurements was performed with full rf output power and 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) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level.

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(f) Set the EMI Receiver and #2 as follows:

Center Frequency:	test frequency
Resolution BW:	100 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(h) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
(l) Repeat for all different test signal frequencies

8.2.2. Measuring the EIRP of Spurious/Harmonic Emissions Using Substitution Method

(a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

Center Frequency:	equal to the signal source
Resolution BW:	10 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(c) Select the frequency and E-field levels obtained in the Section 8.2.1 for ERP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):
- ♦ DIPOLE antenna for frequency from 30-1000 MHz or
- ♦ HORN antenna for frequency above 1 GHz}.

(e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
(f) Use one of the following antenna as a receiving antenna:
- ♦ DIPOLE antenna for frequency from 30-1000 MHz or
- ♦ HORN antenna for frequency above 1 GHz}.

(g) If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
(h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
(i) Tune the EMI Receivers to the test frequency.
(j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(k) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
(n) Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:

P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1
EIRP = P + G1 = P3 + L2 - L1 + A + G1
ERP = EIRP – 2.15 dB
Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1

Where: P: Actual RF Power fed into the substitution antenna port after corrected.
P1: Power output from the signal generator
P2: Power measured at attenuator A input
P3: Power reading on the Average Power Meter
EIRP: EIRP after correction
ERP: ERP after correction

(o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

Figure 2:

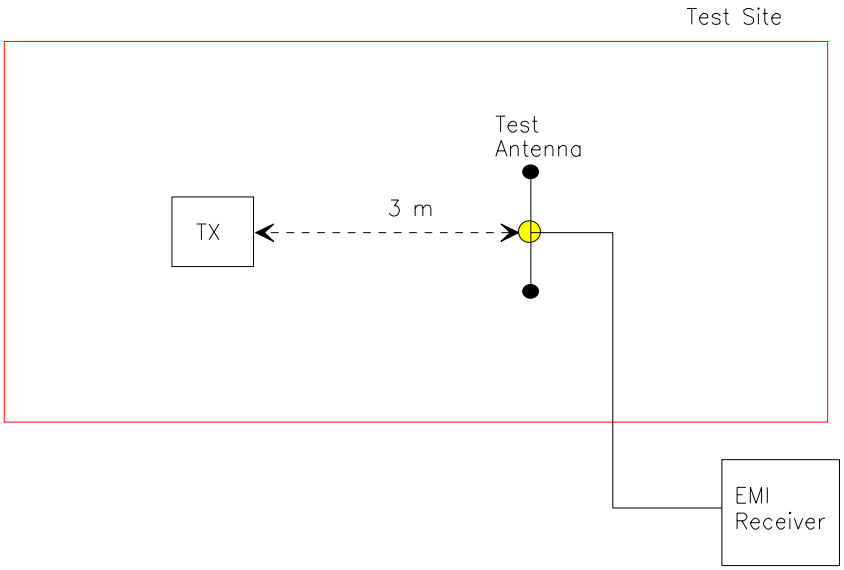
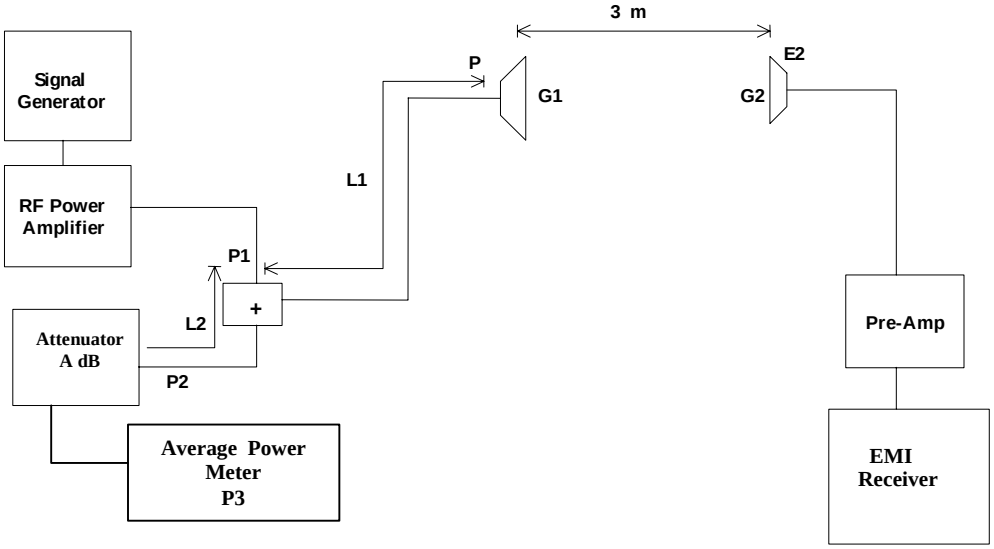


Figure 3:



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

8.3. EMISSION MASK

Voice or Digital Modulation Through a Voice Input Port @ 2.1049(c)(i):- The transmitter was modulated by a 2.5 KHz tone signal at an input level 16 dB greater than that required to produce 50% modulation (e.g.: ±2.5 KHz peak deviation at 1 KHz modulating frequency). The input level was established at the frequency of maximum response of the audio modulating circuit.

Digital Modulation Through a Data Input Port @ 2.1049(h):- Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the Emission Masks shall be shown for operation with any devices used for modifying the spectrum when such devices are operational at the discretion of the user.

The following EMI Receiver bandwidth shall be used for measurement of Emission Mask/Out-of-Band Emission Measurements:

(1) For 25 kHz Channel Spacing: RBW = 300 Hz
(2) For 12.5 kHz or 6.25 kHz Channel Spacings: RBW = 100 Hz

The all cases the Video Bandwidth shall be equal or greater than the measuring bandwidth.