ENGINEERING TEST REPORT

Alarmpath Echo
Model No.: AP-4700V
FCC ID: ITC-AP-4700V

Applicant:

CRN Telemetry Devices Inc.
1515 Middle Country Road
Centereach, NY
USA, 11720

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, Parts 2 and 90 (Subpart S)

UltraTech's File No.: CRN-007FCC90

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: May 16, 2005	
Report Prepared by: Anca Dobre Issued Date: May 16, 2005	Tested by: Hung Trinh, EMI/RFI Technician Test Dates: May 04-05, 2005

- *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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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 Emission Setup Photos	OK
2	External Photos of EUT	External Photos	OK
3	Internal Photos of EUT	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	Attestation Letter	OK
6	ID Label/Location Info	ID Label and Location of ID Label	OK
7	Block Diagrams	Block Diagram --RIM Radio Module	OK
8	Schematic Diagrams	Schematics--RIM Radio Module	OK
9	Parts List/Tune Up Info	Parts List/ Tuning Procedures –RIM Radio Module	OK
10	Operational Description	Operational Description	OK
11	RF Exposure Info	See Section 6.6 of this test report for MPE evaluation	OK
12	Users Manual	Users 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 and 90 (Subpart S).
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency band 896-901 MHz (25 kHz 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.
Environmental Classification:	• Commercial, industrial or business • Residential

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

None.

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2005	Code of Federal Regulations – Telecommunication
ANSI C63.4	2004	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	2003 2003	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1	2003	Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	CRN Telemetry Devices Inc.
Address:	1515 Middle Country Road Centereach, NY USA, 11720
Contact Person:	Mr. Herb Krieger Phone #: 631-696-2769 Fax #: 631-698-7943 Email Address: hkrieger@crnwireless.com

MANUFACTURER	
Name:	CRN Telemetry Devices Inc.
Address:	1515 Middle Country Road Centereach, NY USA, 11720
Contact Person:	Mr. Herb Krieger Phone #: 631-696-2769 Fax #: 631-698-7943 Email Address: hkrieger@crnwireless.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:	CRN Telemetry Devices Inc.
Product Name:	Alarmpath Echo
Model Name or Number:	AP-4700V
Type of Equipment:	Non-broadcast Radio Communication Equipment
Input Power Supply:	12 Vdc
Primary User functions of EUT:	To provide alarm condition signals through the air using the AlarmPath Network to any Central Station via standard communicator techniques.
Transmitting/Receiving Antenna Type:	Non-Integral

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile
Intended Operating Environment:	• Commercial, industrial or business environment • Residential
Power Supply Requirement:	12 Vdc
RF Output Power Rating:	2.4 watts
Operating Frequency Range:	896-901 MHz
RF Output Impedance:	50 Ohms
Channel Spacing	12.5 kHz
Emission Designation:	12K8F1D
Antenna Connector Type:	Screw terminal
Antenna Description:	• Colinear and ¼ wave rigid whip • Max. Gain: 5.18 dBi

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	Alarm contacts	1	Terminal Block	Non-shielded
2	Power contacts	1	Terminal Block	Non-shielded
3	Radio Interface I/O	1	FPC	Non-shielded
4	Antenna Port	1	Screw	N/A

3.5. ANCILLARY EQUIPMENT

Ancillary Equipment # 1	
Description:	3.3V serial to RS232 serial converter
Brand name:	N/A
Model Name or Number:	N/A
Serial Number:	Pre-production
Connected to EUT's Port:	FPC

Ancillary Equipment # 2	
Description:	Laptop PC
Brand name:	IBM Thinkpad
Model Name or Number:	Model 2625
Serial Number:	78-WWM48 96/05
Connected to EUT's Port:	3.3V serial to RS232 converter interface

3.6. GENERAL TEST SETUP

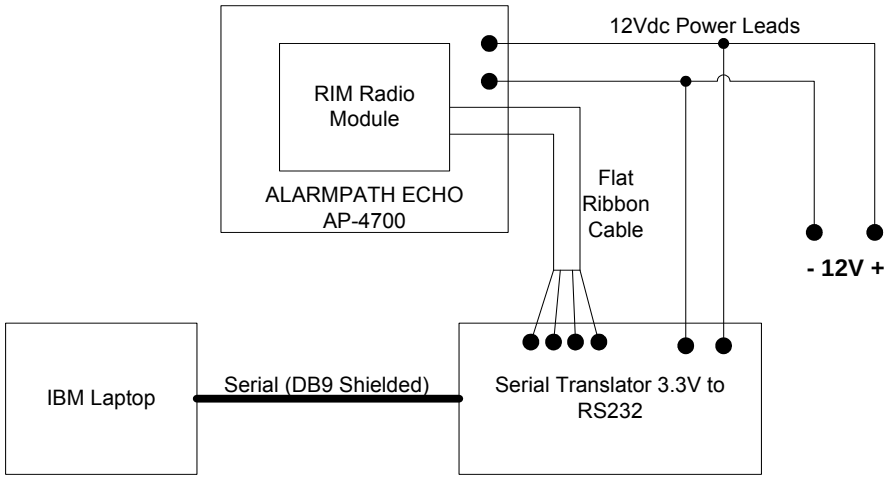


EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

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:	12 Vdc

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:	Testing software provided by the manufacturer was used to operate the radio module.
Special Hardware Used:	Hardware supplied by CRN Telemetry was used to provide the communications interface with the radio module.
Transmitter Test Antenna:	Supplied by CRN Telemetry Devices Inc.

Transmitter Test Signals	
Frequency Band(s):	896-901 MHz
Frequency(ies) Tested: (Near lowest and near highest frequencies in the frequency range of operation.)	• 896 MHz • 898.5 MHz • 901 MHz
RF Power Output (measured maximum output power):	
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 Power Line 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: January 10, 2005.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

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

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

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 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 POWER OUTPUT [§§ 2.1046 & 90.205]

6.5.1. Limits

Please refer to FCC 47 CFR 90.205 for specification details.

6.5.2. Method of Measurements

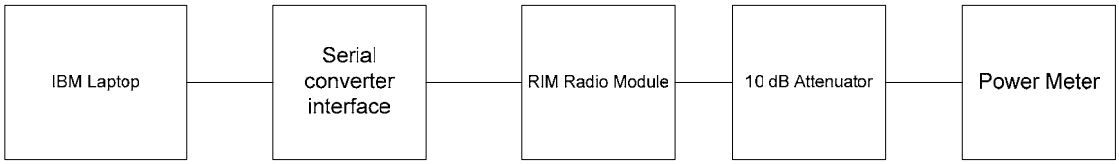
Refer to ULTRATECH Test Procedures, File # ULTR P001-2004, ANSI C63.4 and Exhibit 8 of this report for measurement details.

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Power Meter	Hewlett Packard	436A	2709A27515	10kHz – 50 GHz, sensor dependent
Attenuator	Weinschel Corp	48-30-34	BM5354	DC – 18 GHz

6.5.4. Test Arrangement

Power at RF Power Output Terminals:



6.5.5. Test Data

6.5.5.1. Conducted Power Measurements

Transmitter Channel Output	Fundamental Frequency (MHz)	Measured Conducted Power (dBm)	Power Rating (dBm)
Lowest	896	33.38	33.8
Middle	898.5	33.37	33.8
Highest	901	33.36	33.8

6.5.5.2. EIRP Measurements

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	EIRP (dBm)
896	133.76	Peak	V	38.56
	132.93	Peak	H	37.73
898.5	133.71	Peak	V	38.51
	133.33	Peak	H	38.13
901	133.54	Peak	V	38.34
	133.57	Peak	H	38.37

6.6. RF EXPOSURE REQUIREMENTS [§§ 1.1310 & 2.1091]

6.6.1. 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).

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

6.6.2. Method of Measurements

Refer to FCC @ 1.1310 and 2.1091

- 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.

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/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

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

- 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, 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).

6.6.3. Test Data

(1) Lowest Frequency (MHz)	Max. EIRP (dBm)	Max. EIRP (mW)	Exposure Condition	Calculated Minimum RF Safety Distance r (cm)*
896	38.56	7178	General population	30.94

Note:

(1) The calculation is based on the lowest frequency (896 MHz) and the highest EIRP (38.56 dBm) for the worst case.

* The minimum separation distance between the antenna and bodies of users are calculated using the following formula:

RF EXPOSURE DISTANCE LIMITS: $r = (PG/4\Pi S)^{1/2} = (EIRP/4\Pi S)^{1/2}$

For General Population/ Uncontrolled Exposure: $S = f/1500$ mW/cm^2

$S = 896/1500 = 0.597$ mW/cm^2

For General Population: $r = EIRP/4\Pi S)^{1/2} = (7178/(4\Pi(0.597))^{½} = 30.94$ cm

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum calculated separation distance between antenna and persons required: General population: 30.94 cm	Manufacturer' instruction for separation distance between antenna and persons required: 32 cm
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 User's Manual for details.
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Please refer to User's Manual for RF Exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None.

6.7. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§§ 90.208 & 90.210]

6.7.1. Limits

At least 43 + 10log (P in watts)

6.7.2. Method of Measurements

The spurious/harmonic ERP measurements are using substitution method specified in Exhibit 8, Section 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)

6.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz
RF Amplifier	Com-Power	PA-102		1 MHz to 1 GHz, 30 dB gain nominal
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

6.7.4. Test Data

6.7.4.1. Lowest Frequency (896 MHz)

Fundamental Frequency: 896 MHz
RF Output Power: 33.38 dBm
Limit: -(43+10*log(2.18)) = - 46.38 dBc
Frequency Test Range: 30 MHz – 10 GHz

Frequency (MHz)	E-Field @3m (dBμV/m)	ERP measured by Substitution Method (dBm)	(dBc)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	Limit (dBc)	Margin (dB)	Pass/ Fail
1792	68.30	-31.71	-65.1	Peak	V	-46.38	-18.7	Pass
4480	69.79	-31.61	-65.0	Peak	V	-46.38	-18.6	Pass
4480	70.83	-30.06	-63.4	Peak	H	-46.38	-17.1	Pass
6272	72.48	-26.46	-59.8	Peak	H	-46.38	-13.5	Pass
The emissions were scanned at 3 meters distance and all emissions within 20 dB below the limits were recorded.								

6.7.4.2. Middle Frequency (898.5 MHz)

Fundamental Frequency: 898.5 MHz
RF Output Power: 33.37 dBm
Limit: -(43+10*log(2.17)) = - 46.37 dBc
Frequency Test Range: 30 MHz – 10 GHz

Frequency (MHz)	E-Field @3m (dBμV/m)	ERP measured by Substitution Method (dBm)	(dBc)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	Limit (dBc)	Margin (dB)	Pass/ Fail
1797	67.46	-32.83	-66.2	Peak	V	-46.37	-19.8	Pass
4492.5	68.69	-32.68	-66.1	Peak	V	-46.37	-19.7	Pass
4492.5	69.73	-30.63	-64.0	Peak	H	-46.37	-17.6	Pass
6289.5	70.25	-28.08	-61.5	Peak	H	-46.37	-15.1	Pass
The emissions were scanned at 3 meters distance and all emissions within 20 dB below the limits were recorded.								

6.7.4.3. Highest Frequency (901 MHz)

Fundamental Frequency:	901 MHz
RF Output Power:	33.36 dBm
Limit:	-(43+10*log(2.17)) = - 46.36 dBc
Frequency Test Range:	30 MHz – 10 GHz

Frequency (MHz)	E-Field @3m (dBμV/m)	ERP measured by Substitution Method (dBm)	(dBc)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	Limit (dBc)	Margin (dB)	Pass/ Fail
1802	67.27	-32.35	-65.7	Peak	V	-46.36	-19.4	Pass
4505	69.70	-31.55	-64.9	Peak	V	-46.36	-18.6	Pass
4505	69.73	-31.35	-64.7	Peak	H	-46.36	-18.4	Pass
6307	66.49	-32.98	-66.3	Peak	H	-46.36	-20.0	Pass
The emissions were scanned at 3 meters distance and all emissions within 20 dB below the limits 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 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 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).
- I f 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.

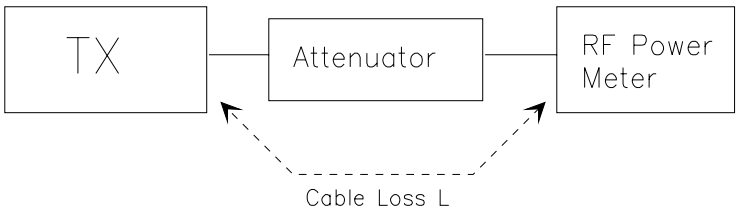
Step 2: Calculation of Average EIRP. See Figure 1

- 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

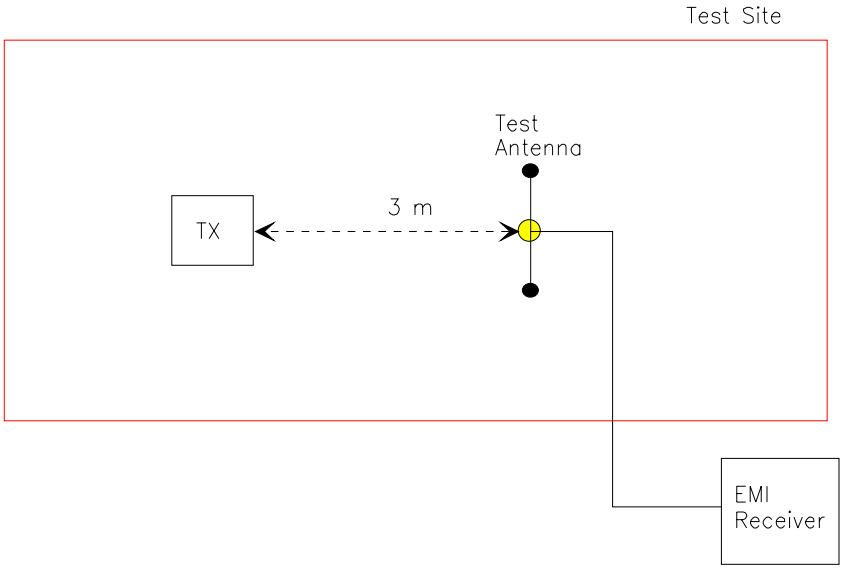
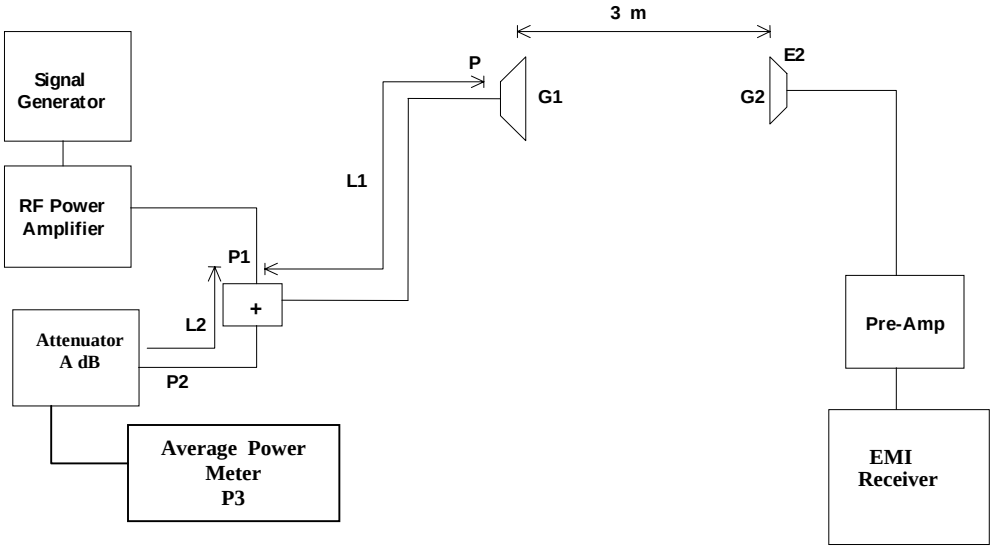


Figure 3



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