ENGINEERING TEST REPORT

People Tracker
Model No.: PTSPLUS-05 and PTSBASIC-05
FCC ID: UBEPTSPLUS

Applicant:

SilverCom Distribution Inc
3164 Pepper Mill Court Unit #7
Mississauga, Ontario
Canada L7L 4X4

Tested in Accordance With

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

UltraTech's File No.: SDI-005F2290

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: November 20, 2006	
Report Prepared by: Mr. Dan Huynh Issued Date: November 20, 2006	Tested by: Mr. Hung Trinh Test Dates: May 24, 2006

- *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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TABLE OF CONTENTS

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 Test Setup Photos	OK
2	External Photos of EUT	External EUT Photos	OK
3	Internal Photos of EUT	Internal EUT Photos	OK
4	Cover Letters	Cover Letter	OK
5	Attestation Statements	Letter from the Applicant to Appoint Ultratech to Act as an Agent	OK
6	ID Label/Location Info	▪ ID Label ▪ Location of ID Label	OK
7	Block Diagrams	Block Diagram	OK
8	Schematic Diagrams	Schematic	OK
9	Parts List/Tune Up Info	Alignment procedure and programming for PTSPLUS-05 and PTSBASIC-05	OK
10	Operational Description	Circuit Description	OK
11	RF Exposure Info	See Section 6.6 for MPE evaluation	OK
12	Users Manual	Users Guide	OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2, 22 and 90
Title:	Code of Federal Regulations (CFR), Title 47 Telecommunication – Parts 2, 22 & 90
Purpose of Test:	To obtain FCC Certification Authorization for Radio operating in the Frequency Band 450-470 MHz (25 kHz and 12.5 kHz Channel Spacings).
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with TIA/EIA Standard TIA/EIA-603 (01-Nov-2002) – Land Mobile FM or PM Communications Equipment Measurement and performance Standards.

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 16-1-1	2004	Specification for Radio Disturbance and Immunity measuring apparatus and methods
TIA/EIA 603, Edition C	2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	SilverCom Distribution Inc
Address:	3164 Pepper Mill Court, Unit #7 Mississauga, Ontario Canada L5L 4X4
Contact Person:	Mr. David Silverthorne Phone #: 905-607-4567 Fax #: 905-607-4044 Email Address: silvercom@on.aibn.com

MANUFACTURER	
Name:	Tracan Electronics
Address:	2735 Matheson Blvd. East Mississauga, Ontario Canada L4W 4M8
Contact Person:	Mr. Eric Loit Phone #: 905-890-6400 Fax #: n/a Email Address: eloit@tracan.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:	SilverCom Distribution Inc
Product Name:	People Tracker
Model Name or Number:	PTSPLUS-05 and PTSBASIC-05
Serial Number:	Test sample
Type of Equipment:	Licensed Non-Broadcast Station Transmitter
External Power Supply:	N/A
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	Radio paging system

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile
Intended Operating Environment:	Commercial, Industrial or Business
Power Supply Requirement:	12 VDC nominal
RF Output Power Rating:	4.5 W
Operating Frequency Range:	450-470 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	25 kHz and 12.5 kHz
Emission Designation*:	20K0F2D; 11K2F2D
Antenna Connector Type:	BNC
Antenna Description:	Manufacturer: Radiall/ Larsen Antenna Type: Whip-90 degree-1/4 Wave Model Number: SPNY15450 Operating Frequency: 450 MHz Gain: Unity

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	Power Connector	1	Power Jack	Non-shielded
2	Keyboard Connector	1	PS/2	Non-shielded
3	RS-232 Serial Ports	2	DB-9	Shielded
4	Encoder Output	1	DB-9	Shielded
5	Telephone Line Jack	1	RJ11	Non-shielded
6	Antenna Connector	1	BNC	Shielded
7	Alarm Inputs	1	DB-25	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:	12VDC Nominal

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:	N/A
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT is tested with the antenna port terminated to a 50 Ohms RF Load.

Transmitter Test Signals	
Frequency Band(s):	450-470 MHz
Test Frequencies: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	450 MHz, 460 MHz, 470 MHz
Transmitter Wanted Output Test Signals: Transmitter Power (measured maximum output power): Normal Test Modulation: Modulating signal source:	 36.94 dBm F2D 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.

Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site 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 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049-1). Last Date of Site Calibration: June 20, 2005.

5.2. APPLICABILITY & SUMMARY OF 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, 22.355 & 90.213	Frequency Stability	See Note Below
2.1047(a) & 90.242(b)(8)	Audio Frequency Response	See Note Below
2.1047(b) & 90.210	Modulation Limiting	See Note Below
2.1049 & 90.210	Emission Limitation & Emission Mask	See Note Below
2.1057, 2.1051 & 90.210,	Emission Limits - Spurious Emissions at Antenna Terminal	See Note Below
2.1053, 2.1057, 22.359 & 90.210	Emission Limits - Field Strength of Spurious Emissions	Yes
90.214	Transient Frequency Behavior	See Note Below
The People Tracker, **Model No.: PTSPLUS-05 and PTSBASIC-05**, by **SilverCom Distribution Inc** has also been tested and found to comply with **FCC Part 15, Subpart B - Class A Digital Devices**. The engineering test report has been documented and kept on file and it is available upon request.		

Note: See original filing test report (FCC ID: PT9SDU-2000) for details.

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 and CISPR 16-1-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

Radio paging system.

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

6.5.1. Limits

Refer to FCC 47 CFR 90.205 for specification details.

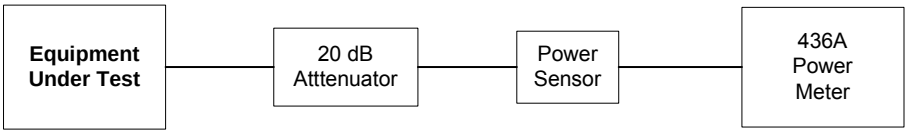
6.5.2. Method of Measurements

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

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Attenuator	Weinschel Corp	46-20-34	BM0653	DC – 18 GHz
Power Meter	Hewlett Packard	436A	2709A27515	100 KHz – 50 GHz, sensor dependent
Power Sensor	Hewlett Packard	8481A	2552A51276	10 MHz – 18 GHz

6.5.4. Test Arrangement



6.5.5. Test Data

Fundamental Frequency (MHz)	Measured (Average) Power (dBm)	Power Rating (dBm)
450	36.94	36.53
460	36.90	36.53
470	36.92	36.53

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

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum calculated separation distance between antenna and persons required: **33 cm**	Manufacturer' instruction for separation distance between antenna and persons required: **33 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	Refer to User's Manual for RF Exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None.

Remarks:

(1) The calculation is based on the lowest frequency (450 MHz) and the highest conducted power (36.94 dBm) for the worst case.
(2) The minimum separation distance between the antenna and bodies of users are calculated using the following equation:

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

$EIRP = 39.09\ dBm = 10^{(39.09/10)}\ mW = 8110\ mw = 4055\ mW$ (at 50% duty cycle)
$S = f/1500 = 450/1500\ mW/cm^2$ (General Population/ Uncontrolled Exposure)

$r = (EIRP/4\Pi S)^{1/2} = 4055 / (4\Pi(450/1500))^{1/2} = 33\ cm$

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

6.7.1. Limits

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

FCC Rules	Frequency Range	Attenuation Limit (dBc)
22.359(a)	30 MHz to Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	At least 43 + 10 log(P) or -13 dBm
90.210(c)	30 MHz to Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	At least 43 + 10 log(P) or -13 dBm
90.210(d)	30 MHz to Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

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 to 40 GHz
RF Amplifier	Com-Power	PA-102		1 MHz to 1 GHz, 30 dB gain nominal
Microwave Amplifier	Hewlett Packard	HP 8449B	3008A00769	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

Remarks:

- The RF spurious/harmonic emission characteristics for different channel spacing are indistinguishable. Therefore, the following radiated emissions were performed at 12.5 KHz channel spacing operation, and the results were compared with the more stringent limit of 50+10*log(P in Watts) for the worst-case.
- The emissions were scanned from 30 MHz to 10th harmonic of the highest frequency; all emissions within 20 dB below the limits were recorded.

6.7.4.1. Near Lowest Frequency (450 MHz)

Carrier Frequency (MHz):	450
Power (dBm):	36.94
Limit (dBc):	56.94

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method (dBm)	ERP measured by Substitution Method (dBc)	Limit (dBc)	Margin (dB)
900	66.45	Peak	V	-36.71	73.65	56.94	-16.7
900	65.38	Peak	H	-36.87	73.81	56.94	-16.9
1350	65.50	Peak	V	-36.69	73.63	56.94	-16.7
1350	65.26	Peak	H	-39.42	76.36	56.94	-19.4
1800	63.73	Peak	V	-39.81	76.75	56.94	-19.8
3600	62.87	Peak	V	-34.74	71.68	56.94	-14.7
3600	58.23	Peak	H	-38.45	75.39	56.94	-18.5

6.7.4.2. Near Middle Frequency (460 MHz)

Carrier Frequency (MHz): 460
Power (dBm): 36.90
Limit (dBc): 56.90

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method (dBm)	ERP measured by Substitution Method (dBc)	Limit (dBc)	Margin (dB)
920	73.17	Peak	V	-29.99	66.89	56.90	-10.0
920	74.25	Peak	H	-28.00	64.90	56.90	-8.0
1380	78.25	Peak	V	-23.94	60.84	56.90	-3.9
1380	74.31	Peak	H	-30.37	67.27	56.90	-10.4
3220	71.19	Peak	V	-28.92	65.82	56.90	-8.9
3220	64.06	Peak	H	-31.12	68.02	56.90	-11.1
3680	68.90	Peak	V	-31.71	68.61	56.90	-11.7
3680	60.77	Peak	H	-33.28	70.18	56.90	-13.3

6.7.4.3. Near Highest Frequency (470 MHz)

Carrier Frequency (MHz): 470
Power (dBm): 36.92
Limit (dBc): 56.92

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method (dBm)	ERP measured by Substitution Method (dBc)	Limit (dBc)	Margin (dB)
1410	75.17	Peak	V	-27.02	63.94	56.92	-7.0
1410	70.81	Peak	H	-33.87	70.79	56.92	-13.9
2820	66.22	Peak	V	-37.12	74.04	56.92	-17.1
2820	64.32	Peak	H	-38.80	75.72	56.92	-18.8
3290	63.60	Peak	V	-38.27	75.19	56.92	-18.3
3290	63.32	Peak	H	-38.29	75.21	56.92	-18.3
3760	63.99	Peak	V	-36.21	73.13	56.92	-16.2
3760	61.16	Peak	H	-37.52	74.44	56.92	-17.5

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).
- 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.

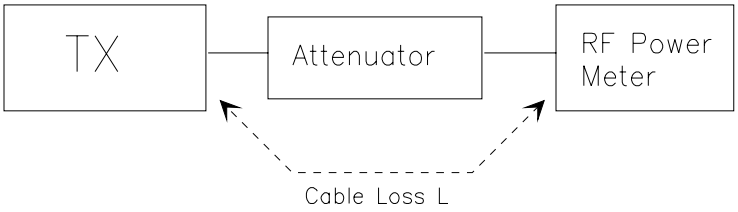
Step 2: Calculation of Average EIRP. See Figure 1

- 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 were 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 (dBμV/m) = Reading (dBμV) + 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

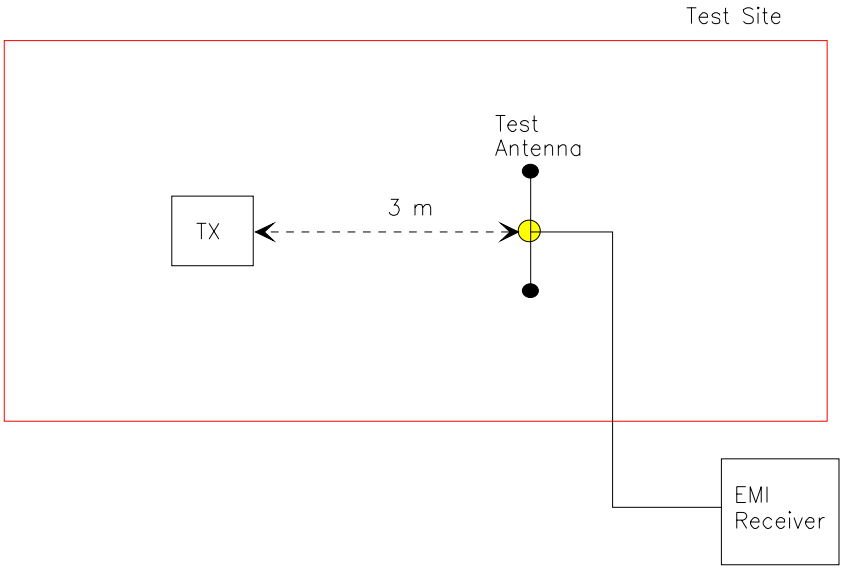


Figure 3