ENGINEERING TEST REPORT

PowerLOC Mobile Device
Model No.: VLD103
FCC ID: PASVLD103

Applicant: **PowerLOC Technologies Inc.**
25 Leek Crescent
Richmond Hill, Ontario
Canada, L4B 4B3

Tested in Accordance With

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

UltraTech's File No.: PWL-2FTX

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

Date: ………………………

Report Prepared by: Dan Huynh	Tested by: Mr Hung Trinh, RFI/EMI Technician
Issued Date: November 27, 2000	Test Dates: November 9, 2000

The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.

UltraTech

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EXHIBIT 1. SUBMITTAL CHECK LIST

Exhibit No.	Exhibit Type	Description of Contents	Quality Check (OK)
1 through 8	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
9	Test Setup Photos	Radiated Emissions Test Setup	OK
10	External Photos of EUT	External VLD 103 Photos	OK
11	Internal Photos of EUT	Internal VLD 103 Photos	OK
12	Cover Letters	• Letter from Ultratech for Certification Request • Letter from the Applicant to appoint Ultratech to act as an agent • Letter from RIM	OK
13	ID Label/Location Info	• ID Label • Location of ID Label	OK
14	Users Manual	Information/instructions that will be intended in the installation/operation pertains to: • Correct output power settings required for compliance operation for every antenna proposed for use with EUT • Point-to-point operational requirements and responsibilities • RF exposure compliance requirements, if any	OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 90 (Subpart 90)
Title	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2 & 90
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency band 896-901 MHz.
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. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	1998	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:	PowerLOC Technologies Inc.
Address:	25 Leek Crescent Richmond Hill, Ontario Canada, L4B 4B3
Contact Person:	Mr. Alexei Gavriline Phone #: (905) 707-7968 Fax #: (416) 352-5889 Email Address: agavriline@powerloc.com

MANUFACTURER	
Name:	PowerLOC Technologies Inc.
Address:	25 Leek Crescent Richmond Hill, Ontario Canada, L4B 4B3
Contact Person:	Mr. Alexei Gavriline Phone #: (905) 707-7968 Fax #: (416) 352-5889 Email Address: agavriline@powerloc.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:	PowerLOC Technologies Inc.
Product Name:	PowerLOC Mobile Device
Model Name or Number:	VLD103
Serial Number:	Preproduction
Type of Equipment:	Radio Communication Equipment
External Power Supply:	N/A
Transmitting/Receiving Antenna Type:	Integral
Primary User Functions of EUT:	Correctly communicate data to and from radios over RF link.

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile Base station (fixed use)
Intended Operating Environment:	Commercial, light industry & heavy industry
Power Supply Requirement:	12 VDC
RF Output Power Rating:	2 Watt (direct at antenna port)
Operating Frequency Range:	896-901 MHz
RF Output Impedance:	50 Ohms
Emission Designation*:	12K8F1D
Digital Oscillator Frequency:	50 MHz
Radio Oscillator Frequencies:	90 MHz
Antenna Connector Type:	MMCX
Antenna Description:	**Mobitex:** 900 MHz strip antenna. Frequency range: 880 – 960 MHz. Gain: 3Dbi Polarization: Linear Azimuth 3dB Beamwidth: 240 Degrees. Elevation 3dB Beamwidth: 80 Degrees Impedance: 50 Ohms. Maximum input power: 50 watts VSWR (Minimum Performance): 1.5:1 Connector: MMCX Construction: Copper on flex PC. Operating Temperature: -40 Degrees C to +70 Degrees C

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	RS232	2	DB9	**Shielded**
2	Power and relayed I/O	1	12-pin Terminal Block	**Non-shielded**

NOTES:

(1) ***Ports of the EUT which in normal operation*** *were connected to ancillary equipment through interconnecting cables via a representative interconnecting cable to simulate the input/output characteristics. RF input/output was correctly terminated to the 50 Ohm RF Load.*

(2) ***Ports which are not connected to cables during normal intended operation*** *(for factory/technical services uses only)*

None.

3.5. SPECIAL CHANGES ON THE EUT'S HARDWARE/SOFTWARE FOR TESTING PURPOSES

None

3.6. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

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

None

3.8. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment	
Description:	Laptop
Brand name:	Toshiba
Model Name or Number:	1605CDS/4.3
Serial Number:	1027387CU
Connected to EUT's Port:	RS232

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

Transmitter Test Signals	
Frequencies: ▪ 896-901 MHz band	Near lowest & near highest frequencies each frequency bands that the transmitter covers: ▪ 896 and 900 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): ▪ Modulating signal source:	 ▪ 2 Watt (direct at antenna port) ▪ 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.

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 site 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: Sep. 20, 1999.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
90.205 & 2.985	RF Power Output	Yes
90.213 & 2.995	Frequency Stability	N/A
90.242(b)(8) & 2.987(a)	Audio Frequency Response	N/A
90.210 & 2.987(b)	Modulation Limiting	N/A
90.209, 90.210 & 2.989	Emission Limitation & Emission Masks	N/A
90.210, 2.997 & 2.991	Emission Limits - Spurious Emissions at Antenna Terminal	N/A
90.210, 2.997 & 2.993	Emission Limits - Field Strength of Spurious Emissions	Yes
90.214	Transient Frequency Behavior	N/A

PowerLOC Mobile Device, **Model No.: VLD103**, by **PowerLOC Technologies Inc.** has also been tested and found to comply with **FCC Part 15, Subpart B - Radio Receivers**. The engineering test report has been documented and kept in file and it is available anytime upon FCC request.

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 7 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 6 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 MANUACTURER:

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

6.5. RF POWER OUTPUT @ FCC 2.985 & 90.205

6.5.1. Limits @ FCC 90.205

Please refer to FCC CFR 47, Part 90, Subpart I, Para. 90.205 for specification details.

6.5.2. Method of Measurements

FCC @ 2.985 – The rf output power of the transmitter was measured at the RF output terminals when the transmitter is adjusted by the manufacturer in accordance with the tune-up procedure to give the values of the current and voltage on the circuit elements specified in 2.983(d)(5). The electrical characteristics of the radio frequency load attached to the output terminals were 50 Ohms.

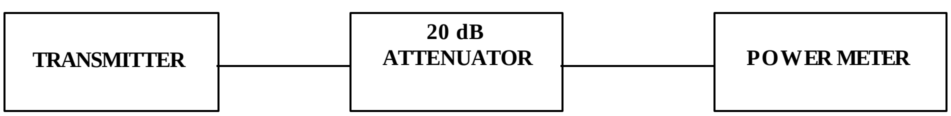
The detailed test method is as follows:

- *The transmitter terminal was coupled to the Power Meter through a 20 dB attenuator*
- *Power of the transmitter channel near the lowest and highest of each frequency block/band were measured using the power meter, and the reading was corrected by added the calibrated attenuator's attenuation value and cable loss.*
- *The RF Output was turned on with standard modulation applied.*

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Range
Power Meter	Hewlett Packard	HP 436A	1725A02249	300 mW AVG Max. Pwr
Attenuator(s)	Bird	..	…	DC – 22 GHz

6.5.4. Test Arrangement



6.5.5. Test Data

Transmitter Channel Output	Fundamental Frequency (MHz)	Measured Average Power at Antenna Port (dBm)	Antenna Gain (dBi)	Maximum Allowable EIRP (dBm)	Minimum Allowable Distance from Skin (cm)
Lowest	896	33.1	3	36.1	23.3 (note)
Highest	900	33.1	3	36.1	23.2 (note)

Note: The minimum separation distance between transmitting antenna and nearby person was calculated using the following formula:

S = PG/4Ðr^{2}

r = (PG/4ÐS)$^{1/2}$

Where: P: power input to the antenna in mW
S: power density mW/cm^{2}
G: numeric gain of antenna relative to isotropic radiator
r: distance to center of radiation in cm

6.6. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 90.210

6.6.1. Limits @ FCC 90.210

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

FCC RULES	WORST CASE EMISSIONS LIMIT	ATTENUATION LIMIT (dBc)
FCC 90.210 (b),(c)(g),(h),(i),(j),(k)	FCC 90.210 (j)	-20 dBm

6.6.2. Method of Measurements

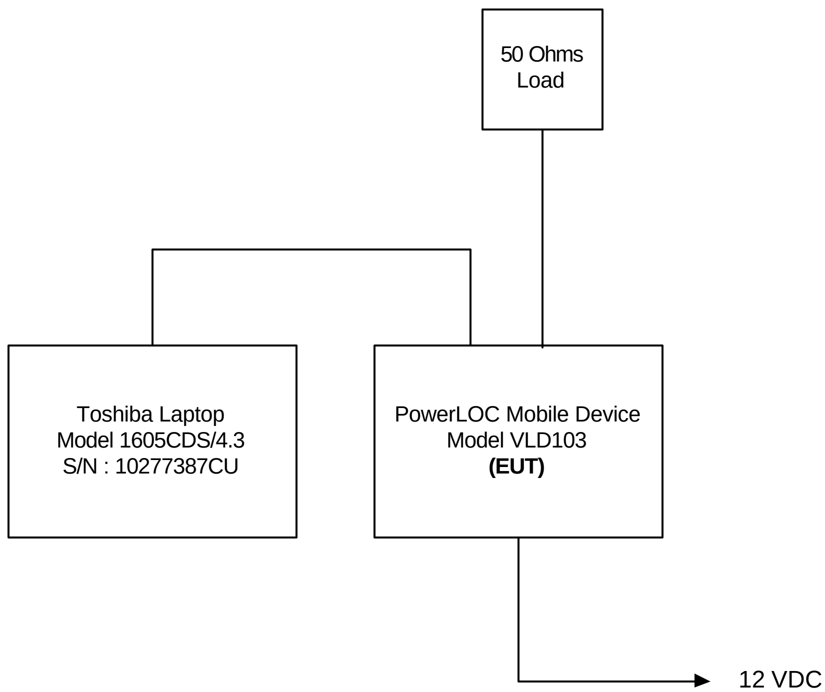
Refer to Exhibit 8, section 8.2 of this report and ANSI C63-4:1992 for radiated emissions test method.

6.6.3. 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
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3160-09	..	18 GHz – 26.5 GHz
Horn Antenna	EMCO	3160-10	..	26.5 GHz – 40 GHz
Mixer	Tektronix	118-0098-00	..	18 GHz – 26.5 GHz
Mixer	Tektronix	119-0098-00	..	26.5 GHz – 40 GHz

6.6.4. Test Arrangement

The following drawings show details of the test setup for radiated emissions measurements



6.6.5. Test Data

6.6.5.1. Near Lowest Frequency (896 MHz)

Fundamental Frequency: 896 MHz
RF Output Power: 2 Watt

Frequency (MHz)	RF Field Strength Level (dBµV/m)	RF Power Level (dBm)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Limit (dBm)	Margin (dB)	Pass/Fail
1792	51.28	-46.2	Peak	V	-20.0	-26.2	Pass
1792	46.97	-50.5	Peak	H	-20.0	-30.5	Pass
2688	51.47	-46.0	Peak	V	-20.0	-26.0	Pass
2688	52.00	-45.5	Peak	H	-20.0	-25.5	Pass
3584	58.31	-39.2	Peak	V	-20.0	-19.2	Pass
3584	61.72	-35.8	Peak	H	-20.0	-15.8	Pass
4480	55.22	-42.3	Peak	V	-20.0	-22.3	Pass
4480	63.13	-34.4	Peak	H	-20.0	-14.4	Pass
5376	56.84	-40.7	Peak	V	-20.0	-20.7	Pass
5376	54.41	-43.1	Peak	H	-20.0	-23.1	Pass
6272	59.88	-37.6	Peak	V	-20.0	-17.6	Pass
6272	56.38	-41.1	Peak	H	-20.0	-21.1	Pass
7168	57.56	-39.9	Peak	V	-20.0	-19.9	Pass
7168	57.44	-40.1	Peak	H	-20.0	-20.1	Pass
8064	64.94	-32.6	Peak	V	-20.0	-12.6	Pass
8064	63.72	-33.8	Peak	H	-20.0	-13.8	Pass

The emissions were scanned from 10 MHz to 10 GHz and all emissions less 40 dB below the limits were recorded.

6.6.5.2. Near Highest Frequency (900 MHz)

Fundamental Frequency: 900 MHz
RF Output Power: 2 Watt

Frequency (MHz)	RF Field Strength Level (dBµV/m)	RF Power Level (dBm)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Limit (dBm)	Margin (dB)	Pass/Fail
900	44.88	-52.6	Peak	H	-20.0	-32.6	Pass
1800	49.76	-47.7	Peak	V	-20.0	-27.7	Pass
1800	51.50	-46.0	Peak	H	-20.0	-26.0	Pass
2700	54.25	-43.3	Peak	V	-20.0	-23.3	Pass
2700	54.45	-43.1	Peak	H	-20.0	-23.1	Pass
3600	56.46	-41.0	Peak	V	-20.0	-21.0	Pass
3600	50.69	-46.8	Peak	H	-20.0	-26.8	Pass
4500	54.91	-42.6	Peak	V	-20.0	-22.6	Pass
4500	50.43	-47.1	Peak	H	-20.0	-27.1	Pass
5400	49.66	-47.8	Peak	V	-20.0	-27.8	Pass
5400	54.70	-42.8	Peak	H	-20.0	-22.8	Pass
6300	53.49	-44.0	Peak	V	-20.0	-24.0	Pass
6300	53.49	-44.0	Peak	H	-20.0	-24.0	Pass
7200	52.44	-45.1	Peak	V	-20.0	-25.1	Pass

The emissions were scanned from 10 MHz to 10 GHz and all emissions less 40 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 $20Log(1\pm\Gamma_1\Gamma_R)$	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. EFFECTIVE RADIATED POWER (ERP) 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

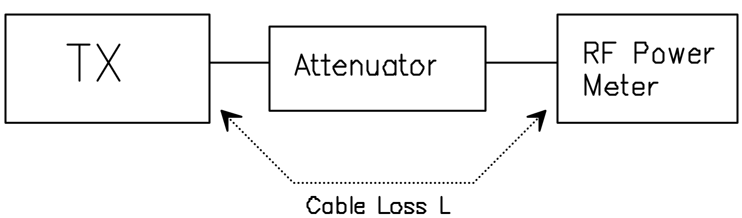
- Using a spectrum analyzer with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with $0<x<1$, is measure and recorded in the 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 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)

Figure 1.



Step 3: Substitution Method. See Figure 2

(a) The measurements was performed in the absence of modulation (un-modulated)
(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 dipole test antenna was used and tuned to the transmitter carrier frequency.
(e) The spectrum analyzer was tuned to transmitter carrier frequency. The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(f) The transmitter was rotated through 360^o about a vertical axis until a higher maximum signal was received.
(g) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.

(h) The substitution dipole antenna and the signal generator replaced the transmitter and antenna under test in the same position, and the substitution dipole antenna was placed in vertical polarization. The test dipole antenna was lowered or raised as necessary to ensure that the maximum signal is stilled received.
(i) The input signal to the substitution antenna was adjusted in level until an equal or a known related level to that detected from the transmitter was obtained in the test receiver. The maximum carrier radiated power is equal to the power supply by the generator.
(j) The substitution antenna gain and cable loss were added to the signal generator level for the corrected ERP level.
(k) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(l) Actual gain of the EUT's antenna is the difference of the measured ERP and measured RF power at the RF port. Correct the antenna gain if necessary.

Figure 2

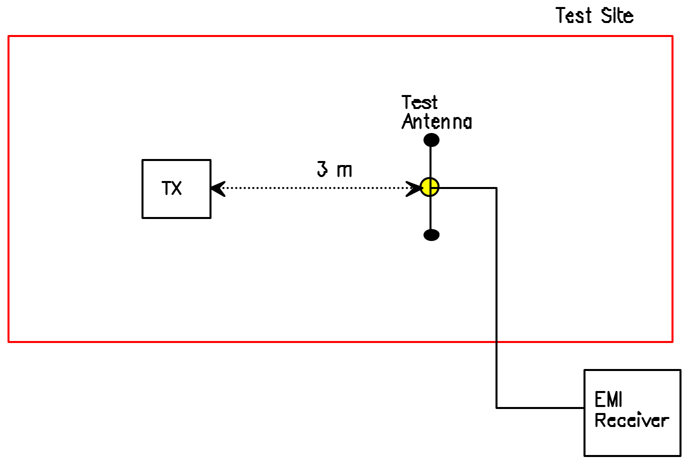
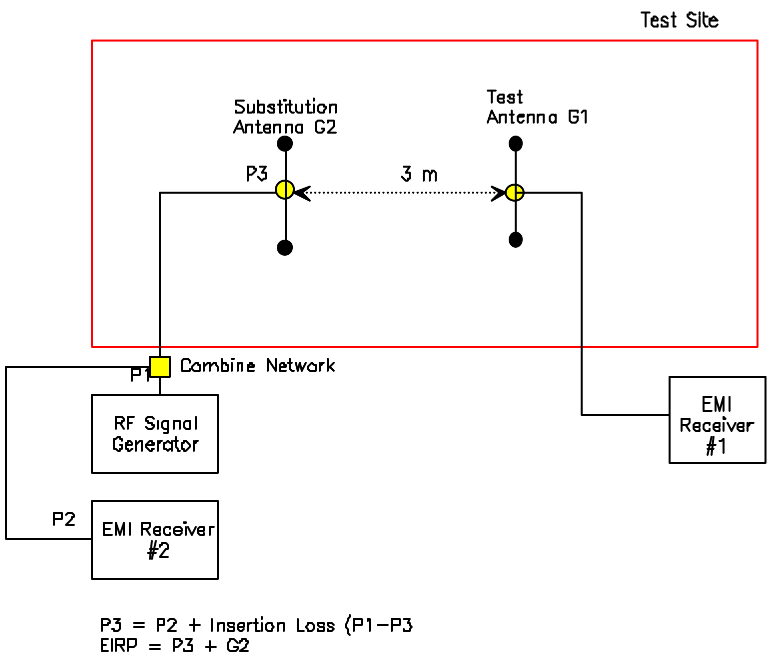


Figure 3



8.2. SPURIOUS EMISSIONS (RADIATED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.989, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 100 kHz minimum , VBW ≥ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated:- The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions

(a) Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 1 GHz , an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

(b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
(2) All equipment operating on frequencies higher than 25 MHz
(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
(4) Other types of equipment as required, when deemed necessary by the Commission.

Maximizing RF Emission Level:

(a) The measurements was performed with standard 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) The spectrum analyzer was tuned to transmitter carrier frequency. The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(f) The transmitter was rotated through 360^o about a vertical axis until a higher maximum signal was received.
(g) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(h) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.

(i) The field strength level measured at 3m is converted to the power in dBm by subtracting a constant factor of 97.5 dB

METHOD OF CALCULATION FOR TRANSMITTED POWER (P) FROM THE MEASURED FIELD STRENGTH LEVEL (E):

According to IEC 801-3, the power density can be calculated as follows:

$S = P / (4xPIxD^2)$ Where: S: Power density in watts per square feet
P: Transmitted power in watts
PI: 13.1415
D: Distance in meters

The power density S (W/m^2) and electric field E (V/m) is related by:

$$S = E^2/(120xPI)$$

Accordingly, the field intensity of isotropic radiator in free space can be expressed as follows:

$$E = (30xP)^{1/2}/D = 5.5x(P)^{1/2}/D$$

For Halfwave dipole antenna or other antennas correlated to dipole in direction of maximum radiation:

$$S = (1.64xP)/(4xPIxD^2)$$
$$E = (49.2xP)^{1/2}xD = 7.01x(P)^{1/2}/D$$

$$P = (ExD/7.01)^2$$

Calculation of transmitted power P (dBM) given a measured field intensity E (dBuV/m):

$$P(W) = [E(V/m)xD/7.01]^2$$
$$P(mW) = P(W)x1000$$
$$=> P(dBm) = 10logP(mW)$$
$$= 20logE(V/m) + 20log(D) - 20log(7.01) + 10log1000$$
$$= E(dBV/m) + 20logD + 13$$
$$= E(dBuV/m) - 120 + 20log(D) + 13$$
$$= E(dBuV/m) + 20log(D) – 107$$

The Transmitted Power @ D = 3 Meters

P(dBm) = E(dBuV/m) - 97.5