ENGINEERING TEST REPORT

Radio Modem
Model No.: AP-1M
FCC ID: ITC-AP-1

Applicant: **CRN Telemetry Devices Inc.**
1515 Middle Country Road
Centerreach, NY
USA, 11720

Tested in Accordance With

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

UltraTech's File No.: CRN02_90

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: Mike Tom	Tested by: Hung Trinh, RFI Engineer
	
Issued Date: June 19, 2001	Test Dates: June 4, 2001

- *The results in this Test Report apply only to the sample(s) tested, which was randomly selected.*
- *Under no circumstances may this report 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

Exhibit	Exhibit Type	Description of Contents	Quality Check (OK)
1-8	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 at OFTS	Ok
10	External Photos of EUT	Photos # 1 to 3	Ok
11	Internal Photos of EUT	Photos # 4 to 5	Ok
12	Cover Letters	• Letter from UltraTech for Certification Request • Letter from the Applicant to appoint UltraTech to act as an agent	Ok Ok
13	ID Label/Location Info	• ID Label • Location of ID Label	Ok Ok
14	Operational Description	• Technical description	Ok
15	Users Manual	• Operating Instructions	Ok
16	RF Exposure Info	• MPE Evaluation data	Refer to this test report, section 6.6

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 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 bands 806-821 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.

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

None

2.3. 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:	CRN Telemetry Devices Inc.
Address:	1515 Middle Country Road Centerreach, 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 Centerreach, 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:	Radio Modem
Model Name or Number:	AP-1M
Serial Number:	Pre-Production
Type of Equipment:	Non-Broadcast Radio Communication Equipment
External Power Supply:	Yes, 12Vdc
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	Alarm reporting device that monitors up to four contact closures or contact open inputs and transmits these signals to a receiver when one of these contacts are activated

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	[ ] Portable [X] Mobile [X] Base station (fixed use)
Intended Operating Environment:	[X] Commercial [X] Light Industry & Heavy Industry
Power Supply Requirement:	12Vdc, 2.5 Amps
RF Output Power Rating:	2 Watts
Operating Frequency Range:	806-821 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	25 kHz
Emission Designation*:	20K0F1D
Antenna Connector Type:	MMCX

3.4. LIST OF ANCILLARY EQUIPMENT

The radio device was connected to the following ancillary/peripheral equipment necessary to exercise the functions and features of the EUT.

1. IBM Laptop, Model 2625, SN: 78-WWM48 96/05, FCC ID: AN0KAJIPENCP
2. RIM OEM Interface and Test Board, Part Number: PCB-02120-001 Rev. B

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, 2.5 Amps

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:	None
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the transmitter antenna port terminated to a 50 Ohms RF Load.

Transmitter Test Signals	
Frequency Band(s): ▪ 806-821 MHz band:	Near lowest, near middle & near highest frequencies in each frequency bands that the transmitter covers: ▪ 806 MHz, 813.5 MHz, 821 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): ▪ Normal Test Modulation ▪ Modulating signal source:	 ▪ 32.7 dBm @ 821 MHz ▪ FM Data ▪ 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 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: Sep. 20, 1999.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	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
90.213 & 2.1055	Frequency Stability	See Note 1
90.242(b)(8) & 2.1047(a)	Audio Frequency Response	See Note 1
90.210 & 2.1047(b)	Modulation Limiting	See Note 1
90.209 90.210 & 2.1049	Emission Limitation & Emission Mask	See Note 1
90.210, 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	See Note 1
90.210, 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes

Note 1: *There are no changes to the FCC certified radio modem manufactured by Research In Motion Ltd. (RIM), FCC ID: L6AR802D-2-O, therefore this test is not required to be performed. For more details, please refer to the FCC ID mentioned above.*

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 C63.4:1992 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.

6.5. RF POWER OUTPUT @ FCC 2.1046 & 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

Refer to Exhibit 8, § 8.1 of this report for measurement details

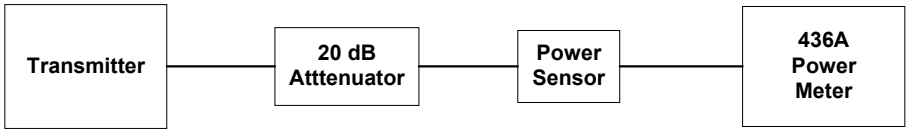
- *The transmitter terminal was coupled to the Spectrum Analyzer through a 20 dB attenuator*
- *Power of the transmitter channel near the lowest, middle and highest of each frequency block/band were measured using the power meter, and the reading was corrected by added the calibrated attenuator's attenuation 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.	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(s)	Bird	…	…	DC – 22 GHz
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz – 26.5 GHz
Attenuator(s)	Weinschel Corp	24-20-34	BJ2357	DC – 8.5 GHz
Dipole Antenna	EMCO	3121C	8907-440	30 MHz – 1 GHz
Dipole Antenna	EMCO	3121C	8907-434	30 MHz – 1 GHz
Synthesized RF Signal Generator	Gigatronic	6061A	5130408	10kHz – 1050 MHz

6.5.4. Test Arrangement

- Power at RF Power Output Terminals



6.5.5. Test Data

Conducted Power

Transmitter Channel Output	Fundamental Frequency (MHz)	Measured Power (dBm)	Power Rating (dBm)
Near Lowest	806.0	32.4	33.0
Near Middle	813.5	32.6	33.0
Near Highest	821.0	32.7	33.0

6.6. RF EXPOSURE REQUIRMENTS @ 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).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
(B) Limits for General Population/Uncontrolled Exposure				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

F = Frequency in MHz

6.6.2. Method of Measurements

Refer to FCC @ 1.1310, 2.1091 and Public Notice DA 00-705 (March 30, 2000)

- 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:

$S = PG/4\Pi r^2$

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

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

FCC radio frequency exposure limits may not be exceeded at distances closer than r cm from the antenna of this device

Calculation Example using a 6 dBi antenna gain

For General Population/Uncontrolled Exposure, Power Density (S) = F/1500 mW/cm^2

For the operating frequency range of 806-821 MHz for this device,

F = lowest operating frequency of 806 MHz, therefore Power Density (S) = 806/1500 = 0.537 mW/cm^2

P = 32.7 dBm = 1862.088 mW
G = 6 dBi = $10^{(6/10)}$ = 3.98 numeric
S = 0.537 mW/cm^2

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

Then $r = \sqrt{1862.088 \text{ mW} \times 3.98 \text{ numeric} / 4 \times \Pi \times S}$

= 34 cm

Therefore, the minimum separation distance of 34 cm (with antenna gain equal to or less than 6 dBi) is necessary to comply with RF Exposure requirements. The following RF exposure warning statement will be placed in the installation manual.

RF Exposure Warning:

To ensure user's safety and to satisfy RF exposure requirements,
this unit must be installed so that a minimum separation distance of 34 cm is always maintained between the antenna of the transmitting device and the body of nearby persons. Operations at closer than this distance is not recommended.

6.6.3. Test Data

Maximum Antenna Gain (G) (dBi)	Frequency (MHz)	Measured Conducted Power (P) (dBm)	Calculated Minimum RF Safety Distance r (cm)	Laboratory's Recommended Minimum RF Safety Distance r (cm)
6	806.0	32.4	32.0	34
6	813.5	32.6	32.8	34
6	821.0	32.7	33.1	34

Note 1: RF EXPOSURE DISTANCE LIMITS: $r = \sqrt{PG/4\Pi S}$

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum calculated separation distance between antenna and persons required: 34 cm	Manufacturer' instruction for separation distance between antenna and persons required: 34 cm. Please refer to the User's Manual and FCC RF Exposure folder
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Please refer to the Users/ Manual and FCC RF Exposure folder
Any other RF exposure related issues that may affect MPE compliance	None.

6.7. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 90.210

6.7.1. 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 (g)	-20

6.7.2. Method of Measurements

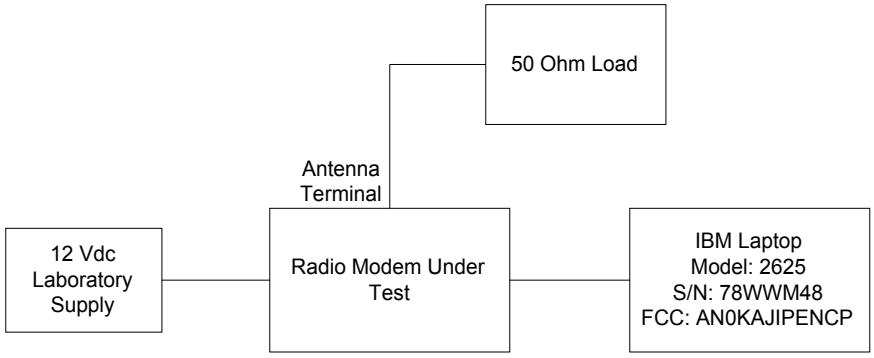
Refer to Exhibit 8, § 8.3 of this report for measurement details

6.7.3. 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	3116A00661	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 with Mixer	EMCO	3160-09	1007	18 GHz – 26.5 GHz
Horn Antenna with Mixer	EMCO	3160-10	1001	26.5 GHz – 40 GHz

6.7.4. Test Arrangement

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



6.7.5. Test Data

Remarks:

- The rf spurious/harmonic emission characteristics between 2 different channel spacing operations are identical. Therefore, the following radiated emissions were performed on the radio set with 12.5 kHz Channel Spacing operation, and the results were compared with the lowest limit of –20 dBm for the worst case.
- The Radiated emission measurements were performed at 3 meters distance using a Peak Detector.

6.7.5.1. Near Lowest Frequency (806 MHz)

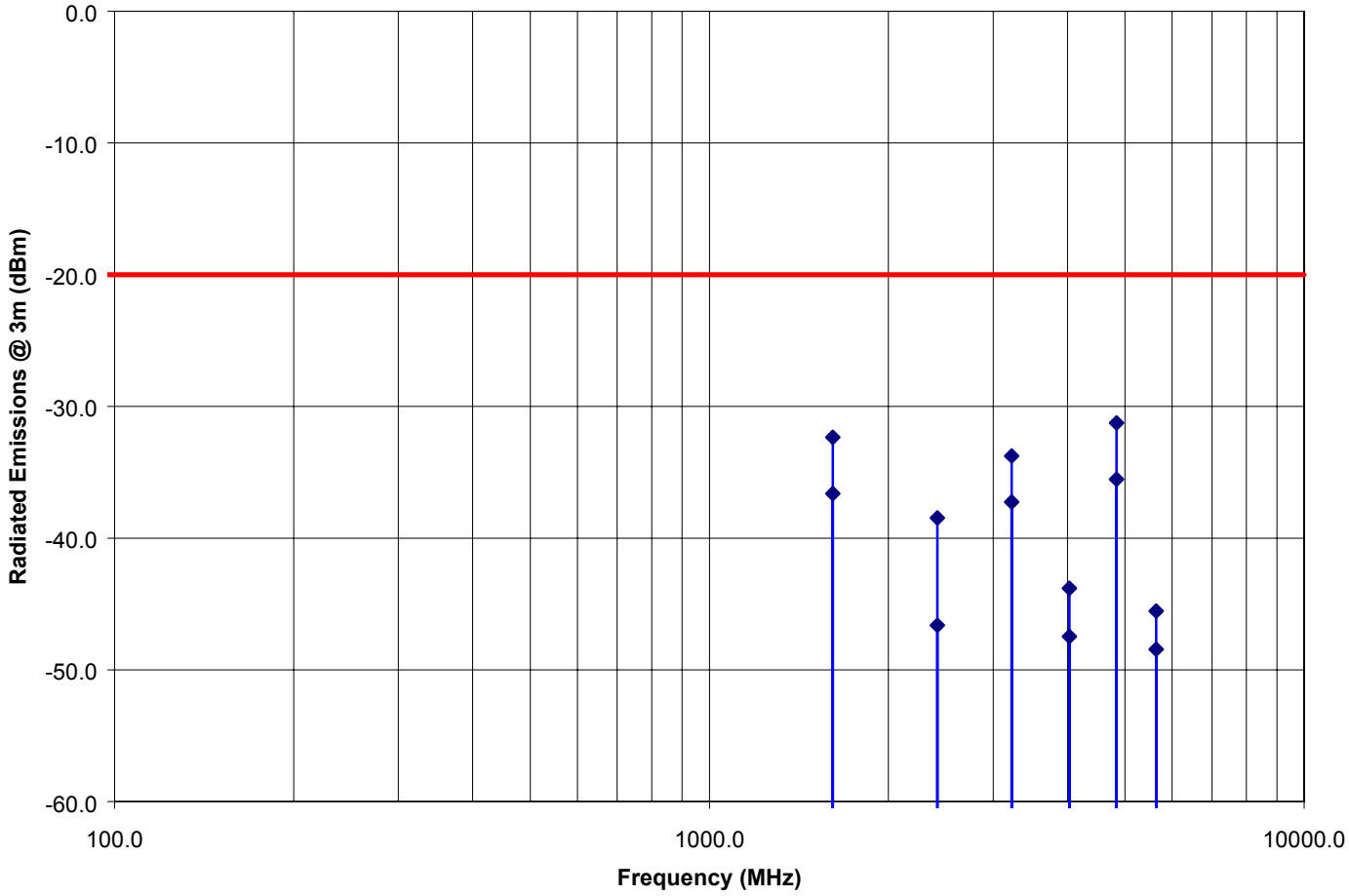
Fundamental Frequency:	806 MHz
RF Output Power:	32.4 dBm

Frequency (MHz)	RF Field Level @ 3 m (dBµV/m)	RF Power Level (dBm)	Antenna Plane (H/V)	Limit (dBm)	Margin (dB)	Pass/ Fail
1612.0	60.9	-36.6	H	-20.0	-16.6	PASS
1612.0	65.2	-32.3	V	-20.0	-12.3	PASS
2418.0	50.9	-46.6	H	-20.0	-26.6	PASS
2418.0	59.0	-38.5	V	-20.0	-18.5	PASS
3224.0	60.3	-37.3	H	-20.0	-17.3	PASS
3224.0	63.8	-33.8	V	-20.0	-13.8	PASS
4030.0	50.0	-47.5	H	-20.0	-27.5	PASS
4030.0	53.7	-43.8	V	-20.0	-23.8	PASS
4836.0	62.0	-35.5	H	-20.0	-15.5	PASS
4836.0	66.3	-31.3	V	-20.0	-11.3	PASS
5642.0	49.1	-48.4	H	-20.0	-28.4	PASS
5642.0	52.0	-45.5	V	-20.0	-25.5	PASS

The harmonic emissions of the fundamental frequency were scanned from 100 MHz to 10 GHz and all emissions at least 11 dB below the limits were recorded.

Refer to the following plot which is representative of the above test data.

Tx Frequency: 806 MHz
Transmitter Radiated Emissions Measurements at 3 meters OFTS



6.7.5.2. Near Middle Frequency (813.5 MHz)

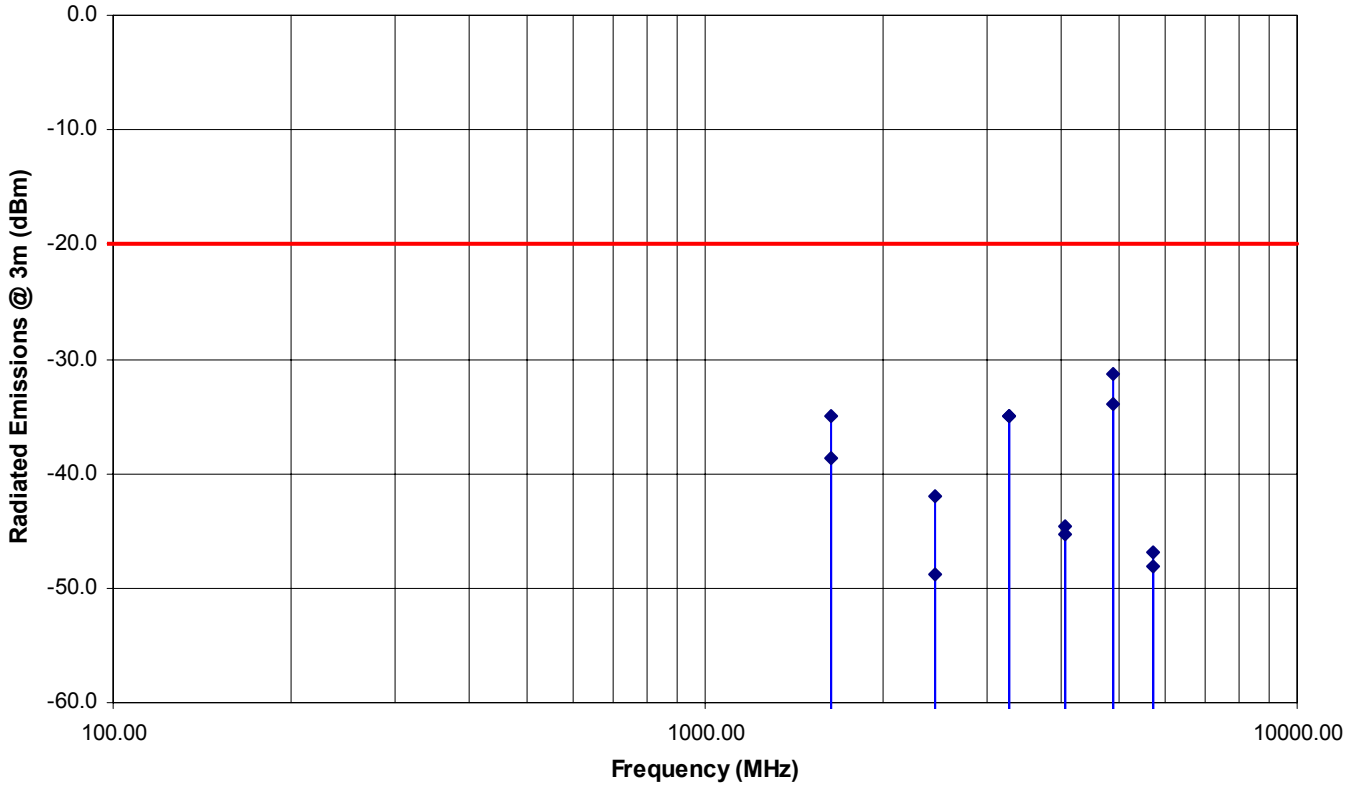
Fundamental Frequency:	813.5 MHz					
RF Output Power:	32.6 dBm					
Frequency (MHz)	RF Field Level @ 3 m (dBµV/m)	RF Power Level (dBm)	Antenna Plane (H/V)	Limit @ 3 m (dBm)	Margin (dB)	Pass/ Fail
1627.00	62.60	-34.9	V	-20.0	-14.9	PASS
1627.00	58.88	-38.6	H	-20.0	-18.6	PASS
2440.50	55.56	-41.9	V	-20.0	-21.9	PASS
2440.50	48.69	-48.8	H	-20.0	-28.8	PASS
3254.00	62.44	-35.1	V	-20.0	-15.1	PASS
3254.00	62.47	-35.0	H	-20.0	-15.0	PASS
4067.50	52.97	-44.5	V	-20.0	-24.5	PASS
4067.50	52.25	-45.3	H	-20.0	-25.3	PASS
4881.00	66.16	-31.3	V	-20.0	-11.3	PASS
4881.00	63.53	-34.0	H	-20.0	-14.0	PASS
5694.50	50.68	-46.8	V	-20.0	-26.8	PASS
5694.50	49.36	-48.1	H	-20.0	-28.1	PASS

The emissions were scanned from 100 MHz to 10 GHz and all emissions at least 11 dB below the limits were recorded.

Refer to the following plot which is representative of the above test data.

Tx Frequency: 813.5 MHz

Transmitter Radiated Emissions Measurements at 3 meters OFTS



6.7.5.3. Near Highest Frequency (821 MHz)

Fundamental Frequency: 821 MHz
RF Output Power: 32.7 dBm

Frequency (MHz)	RF Field Level @ 3 m (dBµV/m)	RF Power Level (dBm)	Antenna Plane (H/V)	Limit @ 3 m (dBm)	Margin (dB)	Pass/ Fail
1642.00	60.50	-37.0	V	-20.0	-17.0	PASS
1642.00	57.59	-39.9	H	-20.0	-19.9	PASS
2463.00	55.91	-41.6	V	-20.0	-21.6	PASS
2463.00	47.94	-49.6	H	-20.0	-29.6	PASS
3284.00	65.34	-32.2	V	-20.0	-12.2	PASS
3284.00	61.53	-36.0	H	-20.0	-16.0	PASS
4105.00	53.59	-43.9	V	-20.0	-23.9	PASS
4105.00	52.91	-44.6	H	-20.0	-24.6	PASS
4926.00	64.78	-32.7	V	-20.0	-12.7	PASS
4926.00	65.53	-32.0	H	-20.0	-12.0	PASS
5747.00	50.91	-46.6	V	-20.0	-26.6	PASS
5747.00	49.76	-47.7	H	-20.0	-27.7	PASS

The emissions were scanned from 10 MHz to 10 GHz and all emissions at least 12 dB below the limits were recorded.

Refer to the following plot which is representative of the above test data.

Tx Frequency: 821 MHz

Transmitter Radiated Emissions Measurements at 3 meters OFTS

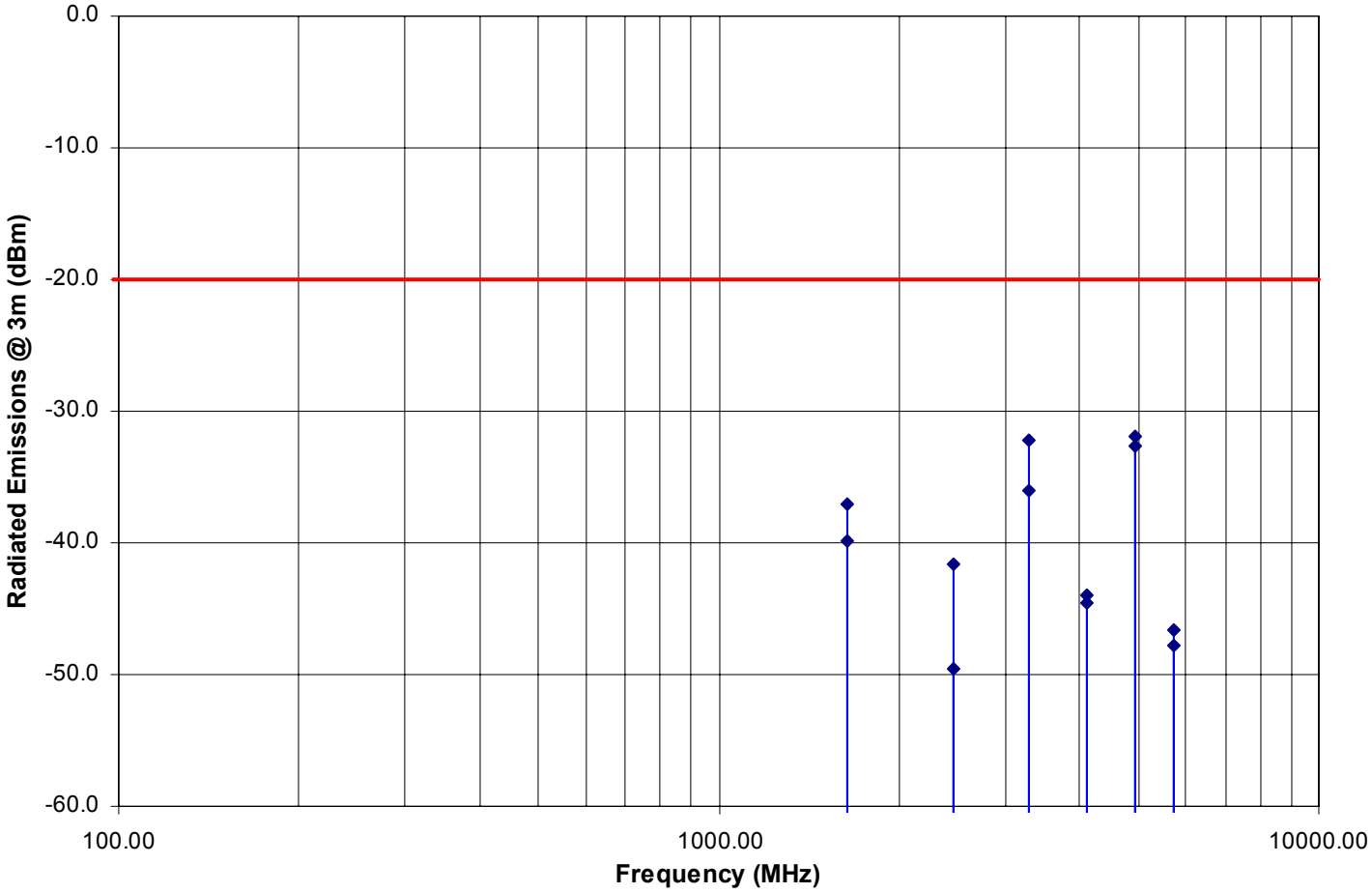


EXHIBIT 7. MEASUREMENT UNCERTAINTY

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. 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

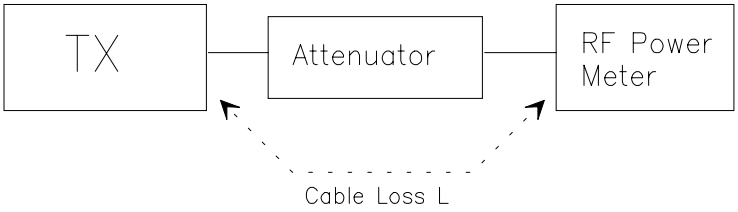
- Using a spectrum analyzer with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with 0<x<1, is measure and recorded in the test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

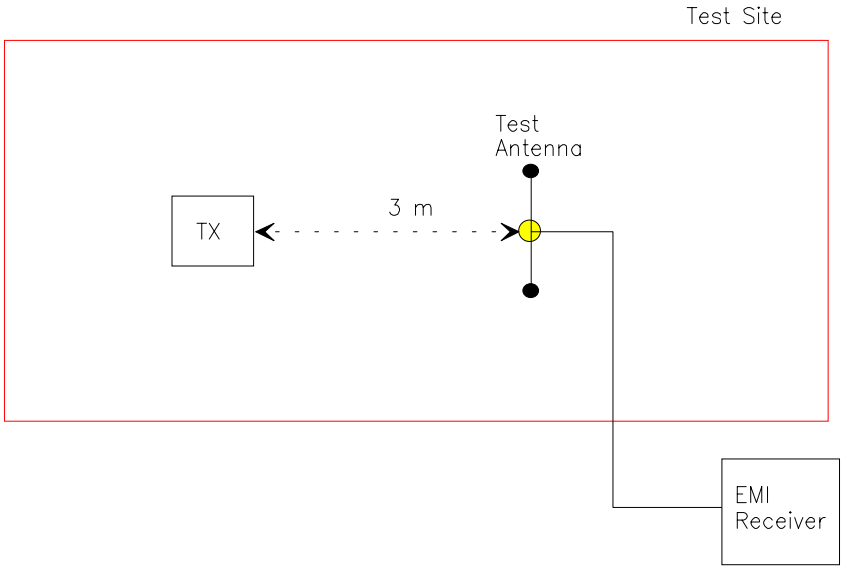
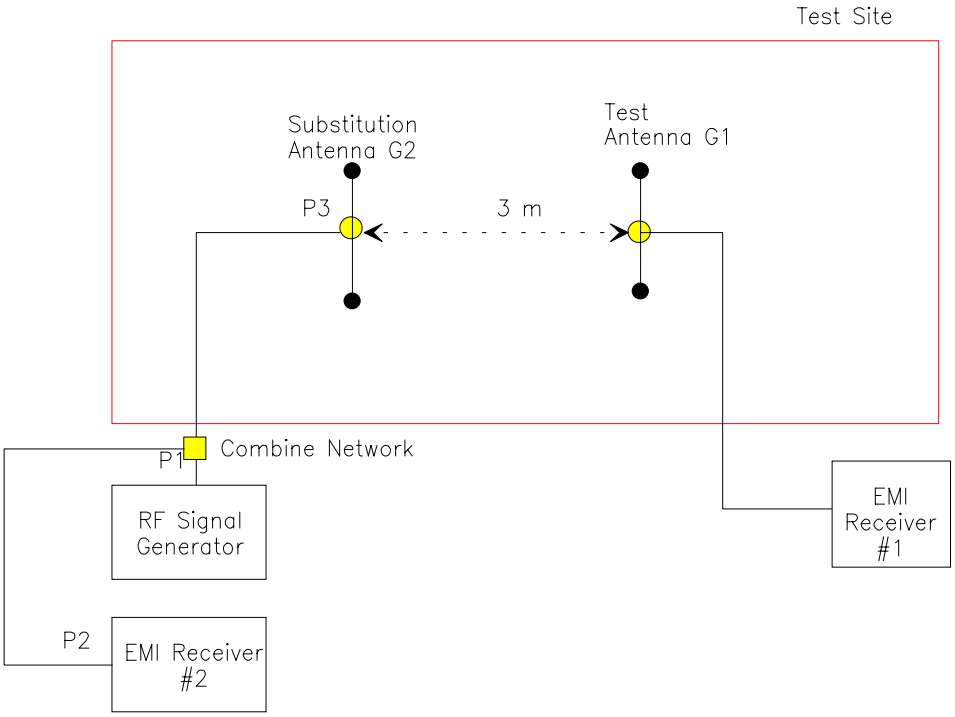


Figure 3


Test Site
Substitution Antenna G2
Test Antenna G1
P3
3 m
P1
Combine Network
RF Signal Generator
EMI Receiver #1
P2
EMI Receiver #2
P3 = P2 + Insertion Loss (P1−P3
EIRP = P3 + G2

8.2. SPURIOUS EMISSIONS (CONDUCTED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.1049, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 30 kHz minimum , VBW $\geq$ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.1057 - 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. 2.1051 - Spurious Emissions at Antenna Terminal:- The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

8.3. SPURIOUS EMISSIONS (RADIATED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.1049, 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. 2.1057 - 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. 2.1053 - 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 2.1049(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. The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(g) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.

(h) The FS level measured at 3m is converted to power (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: 3.1416
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

EXHIBIT 9. TEST SETUP PHOTOS

EXHIBIT 10. EXTERNAL PHOTOS OF EUT

EXHIBIT 11. INTERNAL PHOTOS OF EUT

EXHIBIT 12. COVER LETTERS

EXHIBIT 13. ID LABEL/LOCATION INFO

EXHIBIT 14. OPERATIONAL/TECHNICAL DESCRIPTION OF COMPLETE ASSEMBLY

EXHIBIT 15. USERS MANUAL