

GPS Industries Inc., 5 Inch Color Hand Held Unit

CE Mark EMC Directive Compliance Test Report

per

ETSI EN301 489-1 V1.4.1 (2002-08)

**Electromagnetic Compatibility and Radio Spectrum
Matters (ERM)**

**Electromagnetic Compatibility (EMC) Standard for
Radio Equipment and Services**

Part 1: Common Technical Requirements

and

**EN61000-6-1:2001 Light Industrial/Residential Immunity
Requirements Standard**

and

Report of Measurements

per

FCC CFR47 Part 15/B; FCC CFR47 Part 15/C – 15.247

and

Industry Canada RSS-210

Revision 1.0

November 30, 2004

Approved by		
Checked by	Robert Stirling, P.Eng.	Date

Protocol Labs, Abbotsford BC, Canada

FCC Registration Number 96437

Industry Canada Registration Number IC3384

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Section I: CE Mark EMC Directive Compliance Test Report **FCC CFR47 Part 15/B Report of Measurements**

Testing Details

TESTED BY: David Johanson/ Bev Funk

TEST CONDITIONS: Temperature and Humidity: 13.2°C, 63%

TEST VOLTAGE: 120 Vac 60Hz, 240 Vac 50Hz

Test Facilities

Protocol Labs
28945 McTavish Rd.
Abbotsford BC, Canada, V4X 2E7

FCC Registration Number 96437
Industry Canada Registration Number IC3384

Test Equipment List

EMISSIONS:

Device	Model Number	Serial No.	Last Cal.	Next Cal
Antenna	EMCO 3141 Bilog	1127	10/27/03	10/27/04
LISN	Solar 8012-50-R-24-BNC	863092	10/22/03	10/22/04
Spectrum Analyzer	Hewlett Packard 8566B	2241A02102	11/14/03	11/14/04
RF-Preselector	Hewlett Packard 85685A	3107A01222	11/14/03	11/14/04
Quasi-Peak Adapter	Hewlett Packard 85650A	2043A00240	03/04/04	03/04/05
Harmonic Mixer 11971K	Hewlett Packard 11971K	2332A01250	04/18/02	04/18/05
Tower	Rhientech Labs	Custom	NR	NR
Turntable	Protocol	Custom	NR	NR
Personal Computer	Pentium IV Clone with Monitor, mouse, keyboard, Windows98	012271828	NR	NR
Wireless Network Access Point	Orinoco AP-500	03UT14230024	NR	NR

Company Tested:

NAME: GPS Industries Inc.

ADDRESS: #214 5500 – 152nd Street
Surrey, BC Canada V3S 5J9

CONTACT: Mr. Vladimir Volchkov

NUMBER: 604-576-7442

Equipment Under Test

THE TEST SYSTEM: EUT 1: 5 Inch Color Hand Held Unit

Manufacturer: GPS Industries Inc.

Part Number: 200-100030

Serial Number: 0143

Battery

Manufacturer: GPS Industries Inc.

Part Number: 200-100001

Test Software: CHH. EXE

Rev #: 1.5

CABLING: Not Required

CONCLUSION: The 5 Inch Color Hand Held Unit complies with the requirements of ETSI EN301 489-1 V1.4.1 and FCC CFR47 part 15/B.

Section Ia: CE Mark Emissions Testing

Summary of ETSI EN 301 489-1 V1.4.1 (2002-08) Emission Requirements Standard

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with ETSI EN 301 489-1 V1.4.1 (2000-08) Emission Requirements Standards and self-declaration of the CE Mark requirements under the EMC Directive.

Test Results

Testing was performed per the following standards, pursuant to ETSI EN 301 489-1 V1.4.1

Radiated and Power Line Conducted Emission tests were performed using measurement procedure ETSI EN 301 489-1 V1.4.1. Radiated emissions were performed on an open area 3-m test site.

Test	Standard	Description	Result
Conducted Emissions subclause 8.3	EN55022[5] Class A Limits	The Conducted Emissions are measured on the phase and Neutral Power lines in the 0.15 - 30.0 MHz range.	N/R
Radiated Emissions subclause 8.2	EN55022[6] Class A Limits	The radiated emissions are measured in the 30-1000Mhz range	Complies
Power Line Harmonics subclause 8.5	EN 61000-3-2 Class D Limits	Maximum 1.08, 2.3, 0.43, 1.14, 0.3, 0.77, 0.23 A.... for 2nd to nth Harmonic	N/R Not line connected
Power line Fluctuations (Flicker) subclause 8.6	EN 61000-3-3 $P_{st} < 1$, $P_{lt} < 0.65$	Maximum 3% total Harmonic Distortion	N/R

Part 1 - Radiated Emission Testing

DATE: May 31, 2004

TEST STANDARD: EN55022 [6] and ETSI EN301 489-1 V1.4.1subclause 8.2

TEST VOLTAGE: 240 VAC, 50 Hz

MINIMUM STANDARD: Class B Limits:

Frequency (MHz)	Quasi-peak Limits dB(μV/m) at 10 m
30 - 230	30.0
230 - 1000	37.0
Notes:	
1. The lower limit shall apply at the transition frequency	
2. Additional provisions may be required for cases where interference occurs	

METHOD OF MEASUREMENT: The equipment was set up in a 3 meter open field test site, using the manufacturer's specified normal cabling configuration, with all cables over 1 meter in length bundled at 1 meter and retained from the floor. A typical application was tested.

In accordance to CISPR 22 - 10.2.1 Antenna – to – EUT distance. Note: If the field-strength measurement at 10-m cannot be made because of high ambient noise levels, or for other reasons, measurement of class B EUT's may be made at a closer distance, for example 3-m.

Emissions in both horizontal and vertical polarization were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots.

In cases where the presence of high ambient noise makes it impossible to measure an emission at the required distance, the measurement is performed at a closer distance and the limit is adjusted per EN61000-6-3:2001

$$L_2 = L_1(d_1/d_2)$$

Where L1 is the specified limit in μV/m at the distance d1 L2 is the new limit at the new distance d2

MEASUREMENT DATA: See Appendix B for Plots

EMISSIONS DATA: See Table 2 in Appendix B for corresponding frequencies.

PERFORMANCE: Complies.

Section Ib: FCC CFR47 Part 15/C Report of Measurements

General

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15/C Intentional Radiators.

Radiated tests were performed using measurement procedure outlined in the above standard. Conducted Emissions was performed but was found not to be required.

FCC Labeling and Marking Requirements:

Markings

According to FCC Section 15.19, and ICES 003, a statement similar to the following must be included on an identification label, which also uniquely identifies the Manufactured date, either explicitly or through a Serial number etc.:

"This equipment complies with FCC Rules, Part 15 and Industry Canada's ICES 003 for a Class B Digital Device. Operation is subject to two conditions:

- 1) This device may not cause harmful interference, and
- 2) This device must accept any interference that may cause any undesired operation"

Additionally, If the manufacturer markets product to Quebec, the following supplemental information should be added to the label:

"Cet Appareil numerique de la Classe B respecte toutes les exigences du Reglement sur le material brouilleur du Canada."

Labeling

According to FCC Section 15.105, and ICES 003, the following statement must be included in a prominent location your User's Manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules and ICES 03. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

It is also required according to FCC Part B Section 15.21 that a caution is included such as:

Caution: Changes or modifications to this equipment, not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Part 1 - Radiated Emission Testing

DATE: June 02, 2004

TEST STANDARD: FCC CFR47, Part 15, Subpart C 15.209

TEST SETUP: The equipment was set up in a 10-meter open field test site. Emissions in both horizontal and vertical polarization were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots. In cases where the presence of high ambient noise or test site limitations makes it impossible to measure an emission at the required distance, the measurement is performed at a closer distance and the limit is adjusted accordingly using the procedures outlined in 15.31.

MINIMUM STANDARD:

Frequency (MHz)	Field Strength (microvolts/meter)	Field Strength dBμV/m	Measurement Distance
0.009 - 0.490	2400/F(kHz)	67.6/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	87.6/F(kHz)	30
1.705 – 30.0	30	29.5	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54	3

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test Section, above, for EUT Descriptions.

CABLE DESCRIPTIONS: Not Required

MEASUREMENT DATA: See Appendix B for Plots.

EMISSIONS DATA: See Table 1 in Appendix B for corresponding frequencies.

PERFORMANCE: Complies.

Part 2 - Antenna Requirement - 15.203

APPLICABLE REGULATIONS 2.1:

15.203 - An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

RESULT 2.2:

This unit meets this requirement. The antenna is a 2.4 GHz $\frac{1}{4}$ wave whip antenna that is permanently installed into the units' housing. It is normally installed at the factory, but replacement Antenna's can be ordered from the factory and only installed by qualified and trained personnel.

Part 3 - Digitally Modulated Spread Spectrum Operation - 15.247

APPLICABLE REGULATIONS 4.1:

15.247

(a) - Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions. (Please note that only the applicable regulations are listed):

(2) Systems using digital modulation techniques may operate in the 2400 - 2483.5 MHz bands. The minimum 6-dB bandwidth shall be at least 500 kHz.

(b) The maximum peak output power of the intentional radiator shall not exceed the following:

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

(c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

The limits used for this product under test is that for emissions that do not fall within the restricted bands of 15.205(a), the limit for the emissions is 20 dB below the highest peak.

For emissions that do fall within the restricted bands, the limit is 53.98 dBμV/m at 3 meters. Since all measured frequencies of concern are over 1.0 GHz, we can also use the Average measurement.

Since an average detector was not used, the Calculation of the Average Correction Factor is computed by analyzing the worst case on time in any 100 mSec-time period and using the formula: Correction Factor (dB) = 20*log (worst case on time/100mSec).

For this product an analysis of the system transmitter worst case "ON" time in any 100mSec time period is an on time of 5.14 mSec. Therefore:

Correction Factor (dB) = 20*log (5.14/100) = -25.78 dB

15.247

(c) specifies that the Average Correction Factor is limited to a maximum of – 20 dB. Since we are affected by this limit, the Average Correction factor is – 20.00 dB for this product.

(d) For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Part 4 - Test Procedures 4.2

TEST STANDARD:	FCC CFR47, Part 15, Subpart C 15.247 OET Bulletin FCC 97-114 Appendix C – Guidance on Measurements for Direct Sequence Spread Spectrum	
DEVICE DESCRIPTIONS:	Refer to the Equipment Under Test Section, above, for EUT Descriptions.	
TEST SETUP:	Freq. Range Measured	30 MHz – 10000 MHz
	Test Distance	1 to 10m
	Test Instrumentation resolution	120 KHz (30 MHz to 1000 MHz) 1MHz (1000 MHz to 25000 MHz)
	Receive Ant. Scan Height	1m – 4m
	Receive Ant. Polarization	Vertical and Horizontal.
	The equipment was set up in a 10-meter open field test site. Emissions in both horizontal and vertical polarizations were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots. The emissions were tested using radiated test procedures instead of conducted measurement procedures. The emissions were measured while the unit was in a standby mode and not communicating with any devices (hereafter referred to as Quiescent Mode). This unit was also measured while it was transmitting data (hereafter referred to as Transmit Mode). To perform the Transmit Mode measurements, the unit was set-up to communicate with a wireless hub (hereafter referred to as Hub) which was connected to a desktop personal computer communicating via standard 10/100 MHz LAN cable and network card (hereafter referred to as PC). This unit was designed to communicate on any one of 11 channels within the 2400.0 to 2474.0 MHz band. The unit would automatically transmit/receive data on the specified channel that was programmed into the Hub. Furthermore, the transmissions bit-rate was programmable with settings in the range of 1,2,5.5 and 11 Mbit/second. These units are only designed to communicate point-to-point. Measurements were performed at the lowest, middle and highest operating frequencies (Channel 1: 2412 MHz; Channel 6: 2437 MHz; Channel 11: 2462 MHz). Each frequency was then also tested when receiving a file and when transmitting a file at each of the four bit rates. The main part of the transceiver is a PCMCIA card that is installed inside the hand-held unit. The manufacturing information for this PCMCIA card is: Manufacturer: Agere Systems Nerland B.V. Model: PC-24-11-FC/R FCC ID: IMRWLPC2411R	
MODIFICATIONS:	No modifications have been made to the EUT in order to achieve compliance.	
CABLING DETAILS:	The EUT was set up using the supplied battery module. There are no required cables.	

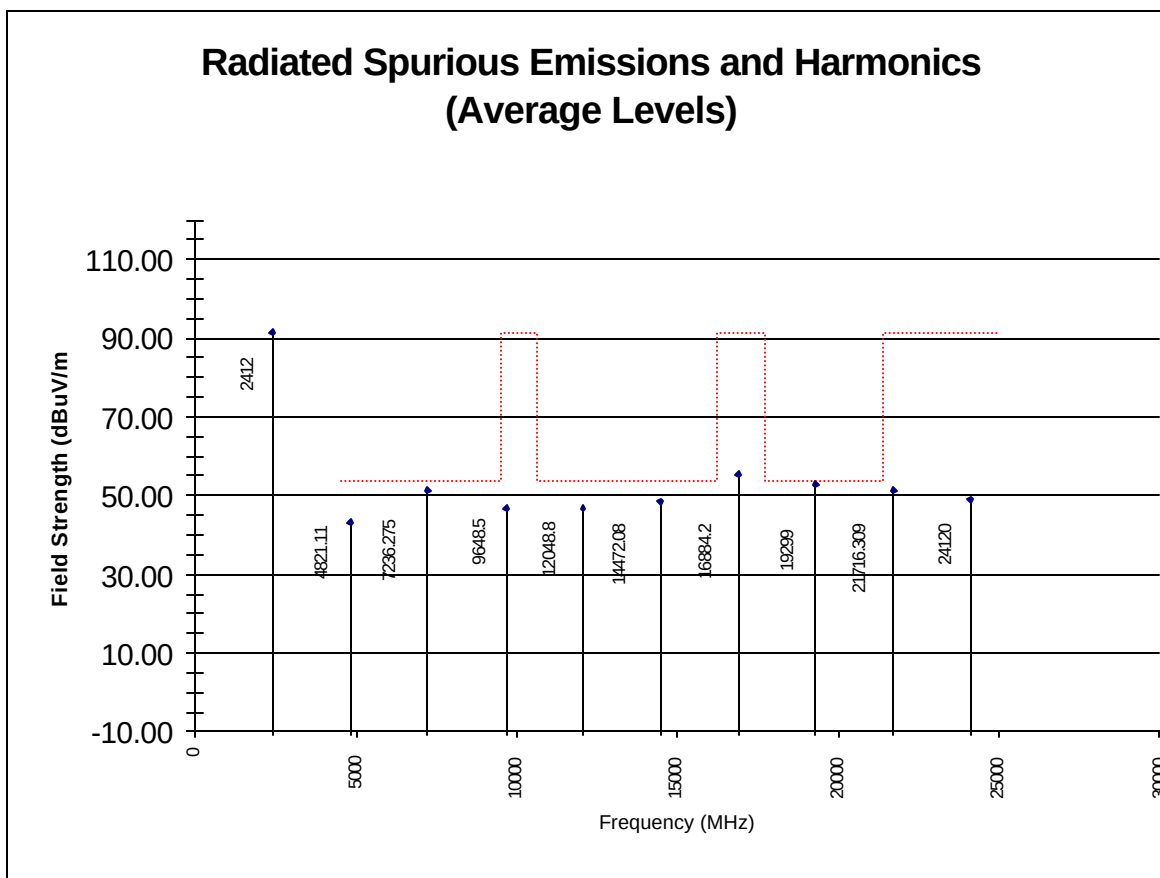
RESULTS 4.3:

To verify compliance, the radiated emission tests were carried out in accordance with part 15.109, 15.205, 15.209 and 15.247. The spectrum was scanned from 0.4MHz to 25000 MHz looking for all Spurious and Harmonic emissions in Quiescent, and Transmit modes. The Transmit mode was tested while receiving and sending a file.

The Quiescent Mode and Transmit mode measurements and plots for unintentional emissions 30-1000 MHz are contained in Appendix B.

The results of the harmonics and spurious frequencies 1000-25000 MHz are contained in the following pages:

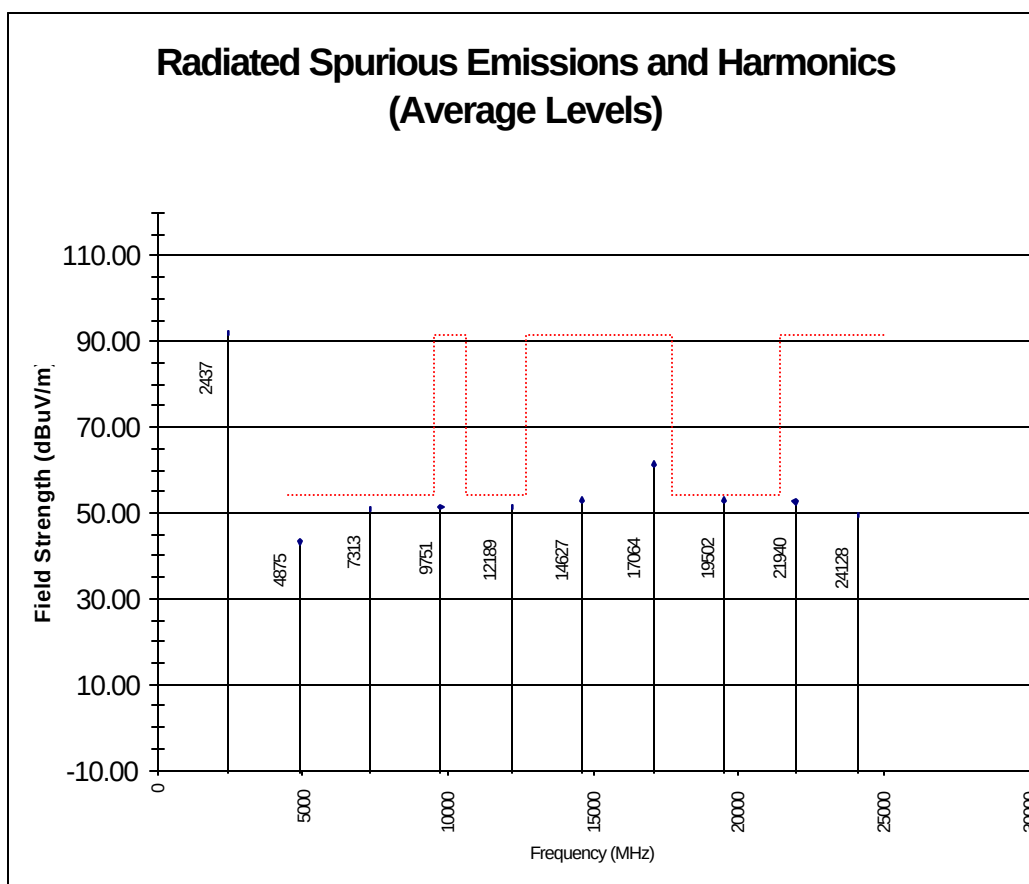
15.247(b,c): 2412 MHz, Low Channel Harmonic Emissions (at 3 Meters 2.4-17GHz; at 1 meter 18-24)



Freq. (MHz)	Harmonic	Restricted bands (15.205(a))	Measured Signal (dBμV) (note 1)	Equipment Attenuation (dB)	Corrected Peak Signal (dBμV)	Calculated Averaged Signal (dBμV) (* see 3.1)	Limit Lines (dBμV) (* see 3.1 and 4.1)	Delta Limit Peak For Freq. outside restricted bands (dBc)	Delta Limit Average For Freq. inside restricted bands (dBc)
2412.000	1st	N/A	80.1	31.5	111.6	91.60	91.60	NA	NA
4821.110	2nd	4500-5150	25.3	38.1	63.4	43.40	54.00		-48.2
7236.275	3rd	N/A	29.8	41.4	71.2	51.20	91.60	-40.4	
9648.500	4th	N/A	25.4	41.2	66.6	46.60	91.60	-45.0	
12048.80 0	5th	10600- 12700	25.2	41.3	66.5	46.50	54.00		-45.1
14472.08 0	6th	14470- 14500	25.4	43.2	68.6	48.60	54.00		-43.0
16884.20 0	7th	N/A	27.6	47.9	75.5	55.50	91.60	-36.1	
19299.00 0	8th	17700- 21400	29.8	42.9	72.7	52.70	54.00		-38.9

21716.30 9	9th	N/A	30.2	41.0	71.2	51.20	91.60	-40.4	
24120.00 0	10th	N/A	30.5	38.6	69.1	49.10	91.60	-42.5	
Limit lines - 54 (Average limit) for Freq. in Restricted bands; else 91.6.6 dB (Peak levels; 111.6 –20db) for other Freq.									

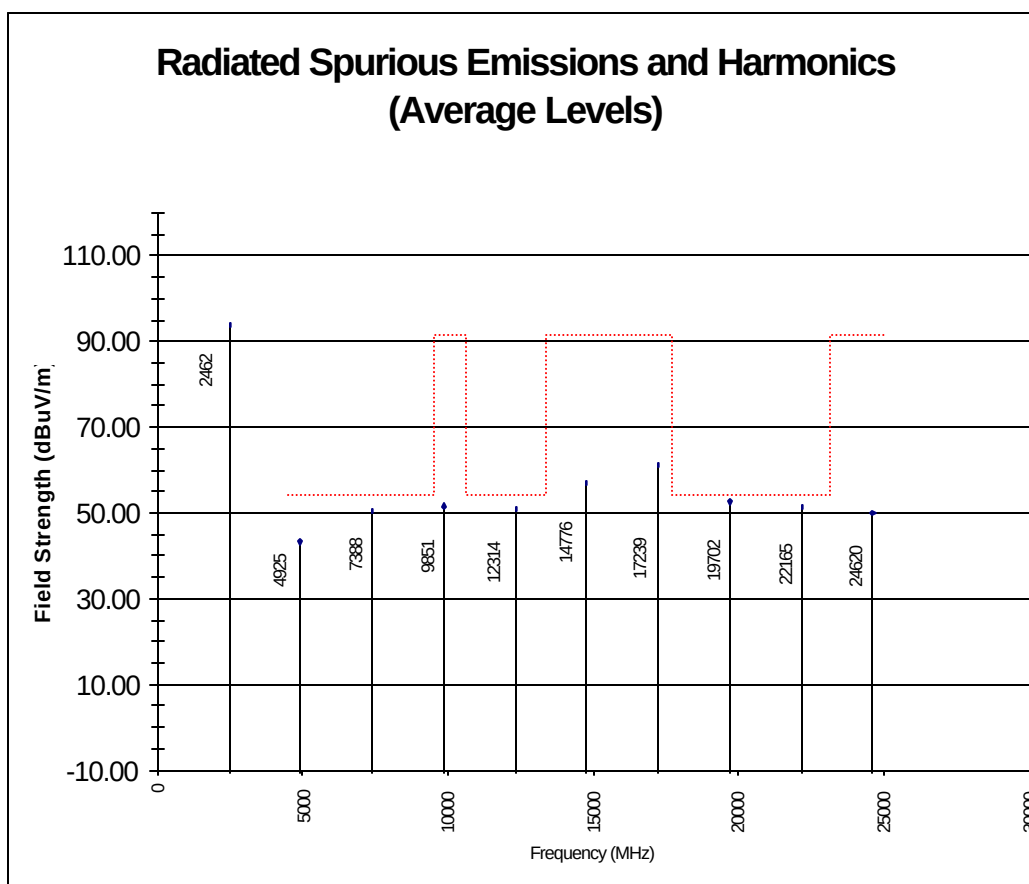
15.247(b,c): 2437 MHz, Mid Channel Harmonic Emissions (at 3 Meters 2.4-17GHz; at 1 meter 18-24)



Freq. (MHz)	Harmonic	Restricted bands (15.205(a))	Measured Signal (dBμV) (note 1)	Equipment Attenuation (dB)	Corrected Peak Signal (dBμV)	Calculated Averaged Signal (dBμV) (* see 3.1)	Limit Lines (dBμV) (* see 3.1 and 4.1)	Delta Limit Peak For Freq. outside restricted bands (dBc)	Delta Limit Average For Freq. inside restricted bands (dBc)
2437.000	1st	N/A	80.5	31.5	112.0	92.00	92	NA	NA
4875.000	2nd	4500-5150	25.12	38.1	63.2	43.20	54		-48.8
7313.000	3rd	7250-7750	29.64	41.4	71.0	51.00	54		-41.0
9751.000	4th	N/A	30.08	41.2	71.3	51.30	92	-40.7	
12189.000	5th	10600-12700	30	41.3	71.3	51.30	54		-51.3
14627.000	6th	N/A	29.8	43.2	73.0	53.00	92	-39.0	
17064.000	7th	N/A	33.44	47.9	81.3	61.30	92	-30.7	
19502.000	8th	17700-21400	30.2	42.8	73.0	53.0	54		-39
21940.000	9th	N/A	31.6	41.0	72.6	52.6	92	-39.4	

0									
24128.00 0	10th	N/A	30.9	38.6	69.5	49.5	92		
Limit lines - 54 (Average limit) for Freq. in Restricted bands (as per 15.205 and 15.209) ; else 92.0 dB (Peak levels; 112.00 –20db) (as per 15.247(c))									

15.247(b,c): 2462 MHz, High Channel Harmonic Emissions (at 3 Meters 2.4-17GHz; at 1 meter 18-24)



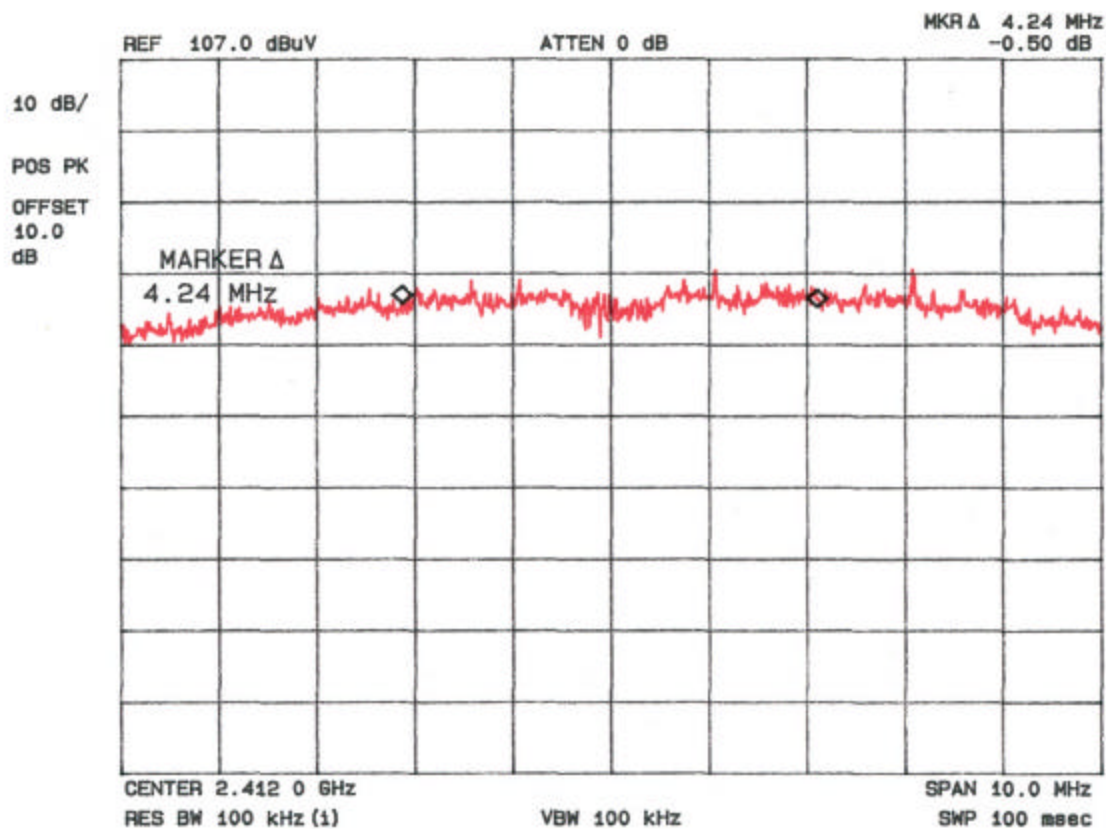
Freq. (MHz)	Harmonic	Restricted bands (15.205(a))	Measured Signal (dBμV) (note 1)	Equipment Attenuation (dB)	Corrected Peak Signal (dBμV)	Calculated Averaged Signal (dBμV) (*) see 3.1)	Limit Lines (dBμV) (* see 3.1 and 4.1)	Delta Limit Peak For Freq. outside restricted bands (dBc)	Delta Limit Average For Freq. inside restricted bands (dBc)
2462.000	1st	N/A	82.3	31.5	113.8	93.8	93.8	NA	NA
4925.000	2nd	4500-5150	25.2	38.1	63.3	43.3	54.0		-50.5
7388.000	3rd	7250-7750	29.1	41.4	70.5	50.5	54.0		-43.3
9851.000	4th	N/A	30.4	41.2	71.6	51.6	93.8	-42.2	
12314.000	5th	10600-12700	29.6	41.3	70.9	50.9	54.0		-42.9
14776.000	6th	N/A	33.9	43.2	77.1	57.1	93.8	-36.7	
17239.000	7th	N/A	33.3	47.9	81.2	61.2	93.8	-32.6	
19702.000	8th	17700-21400	29.8	42.8	72.6	52.6	54.0		-41.2
22165.000	9th	22010-23120	30.3	41.0	71.3	51.3	54.0		-42.5
24620.000	10th	N/A	31.5	38.6	70.1	50.1	93.8	-43.7	

0									
Limit lines - 54 (Average limit) for Freq. in Restricted bands (as per 15.205 and 15.209) ; else 92.0 dB (Peak levels; 112.00 –20db) (as per 15.247(c))									

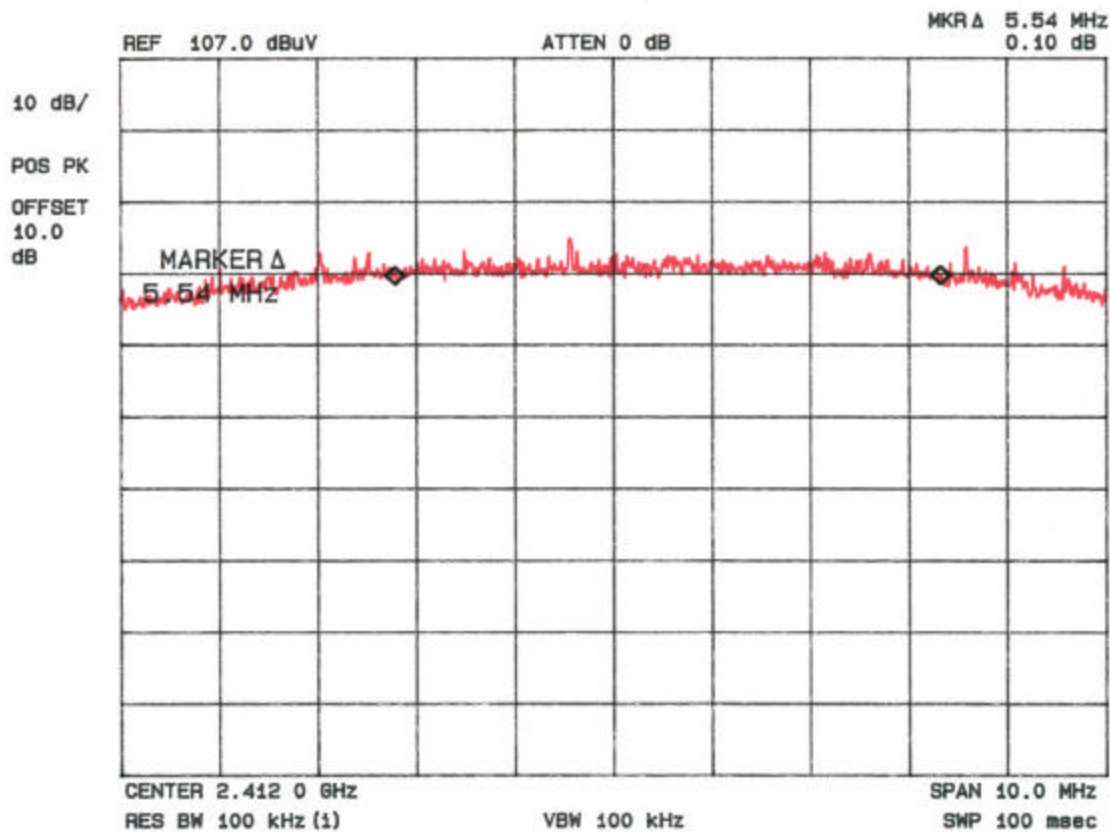
15.247(a)(2) – 6dB Bandwidth

Due to the high number of variables, the following plots are samples of the “worst case” found for various configurations.

Comparison plots of the Receive Mode and Transmit Mode of the Narrowest bandwidth found for the EUT: Channel 1 when operating at 1Mbyte per second.

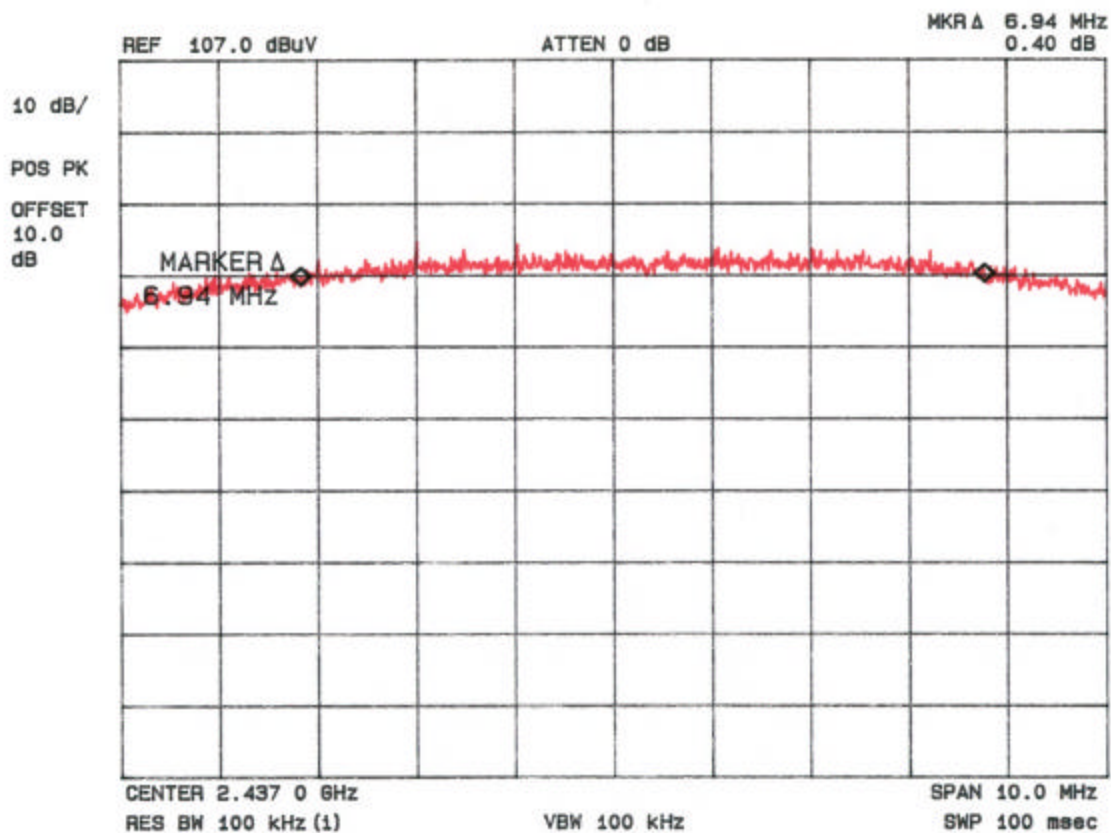


Channel 1 (2.412GHz) – operating in Receive Mode; 1Mbytes per second; High Power

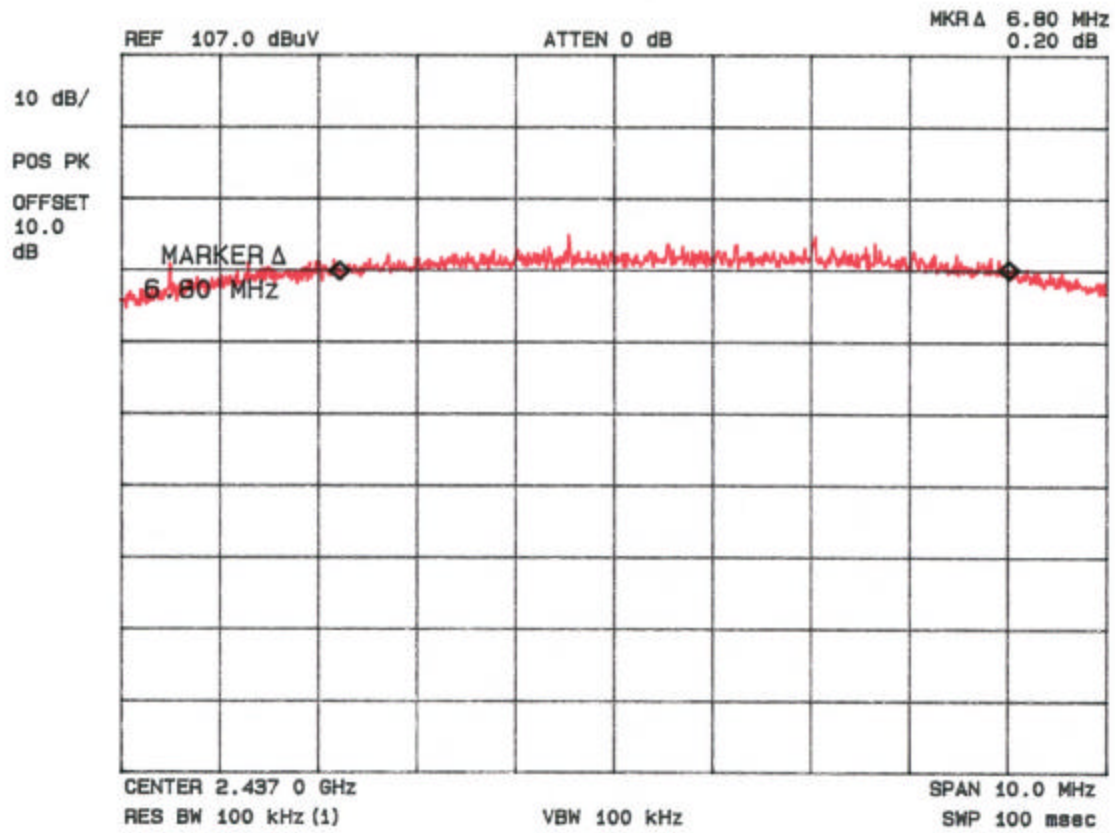


Channel 1 (2.412GHz) – operating in Transmit Mode; 1Mbytes per second; High Power

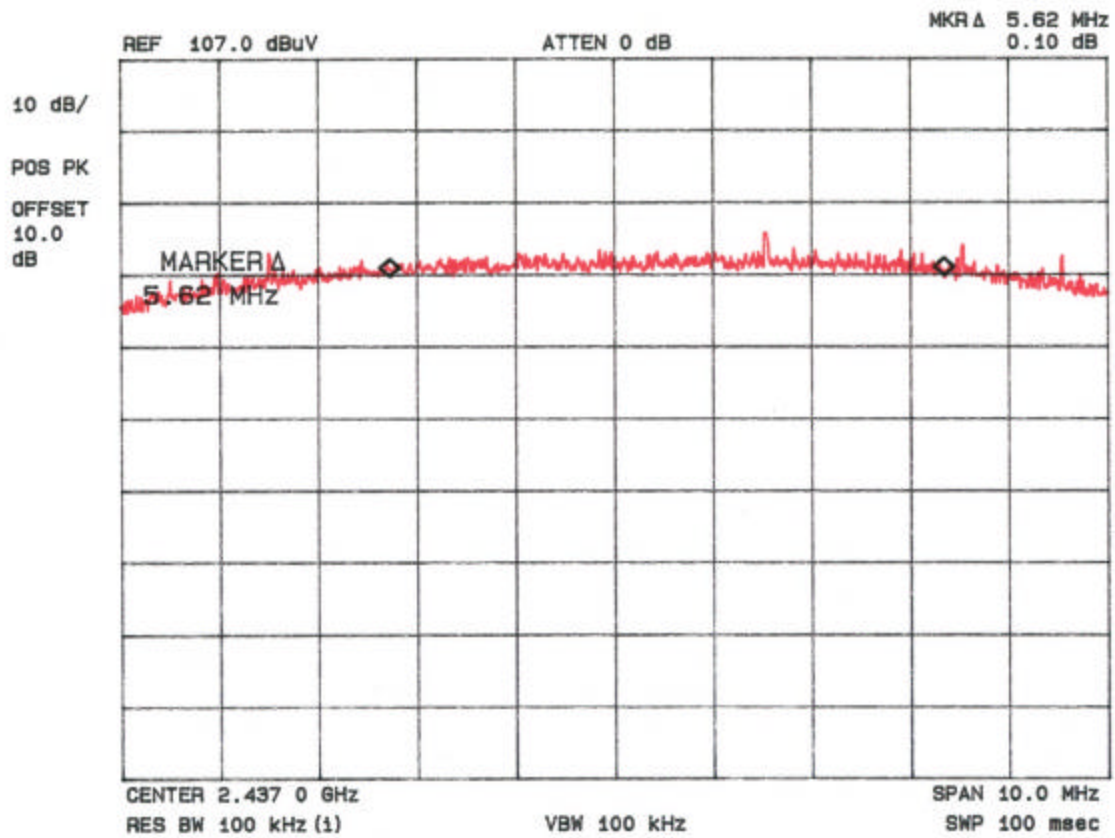
Comparison plots of the affects to the Bandwidth when using the various bit rates while in the Transmit Mode of the Low power option for the EUT when operating at 1, 2, 5.5 and 11Mbyte per second.



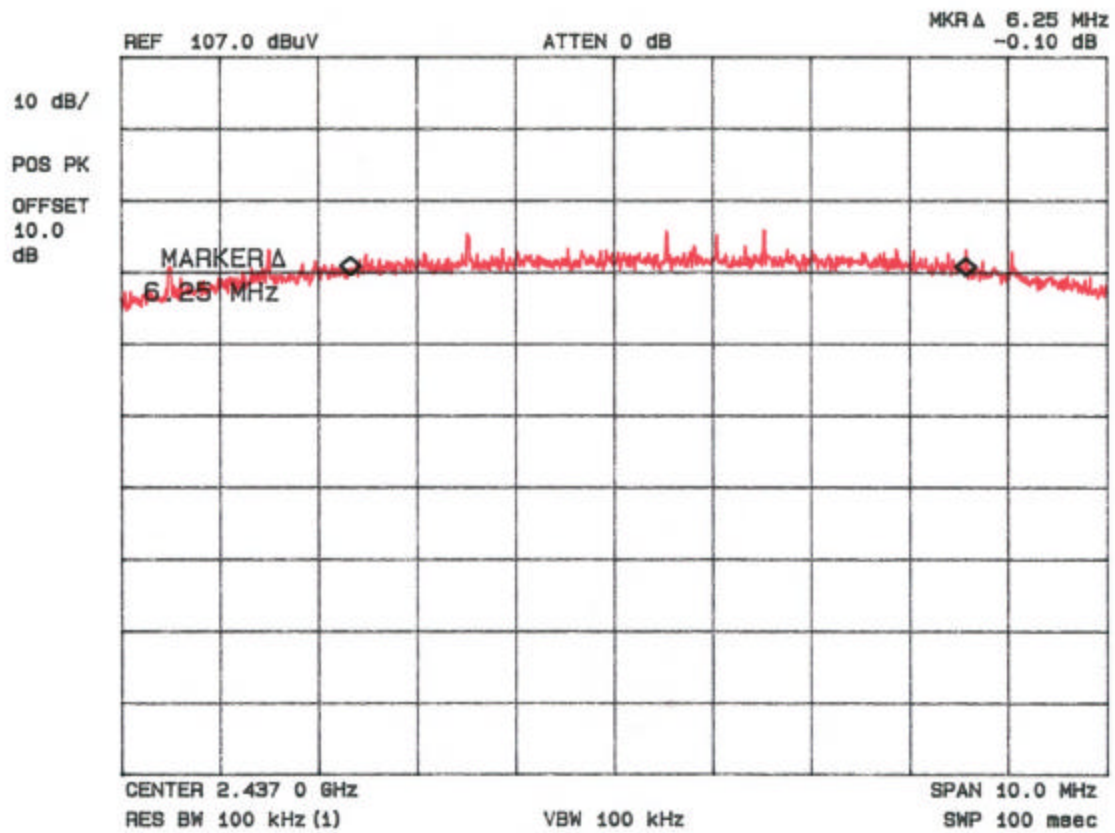
Channel 6 (2.437GHz) – operating in Transmit Mode; 1Mbytes per second; Low Power



Channel 6 (2.437GHz) – operating in Transmit Mode; 2Mbytes per second; Low Power



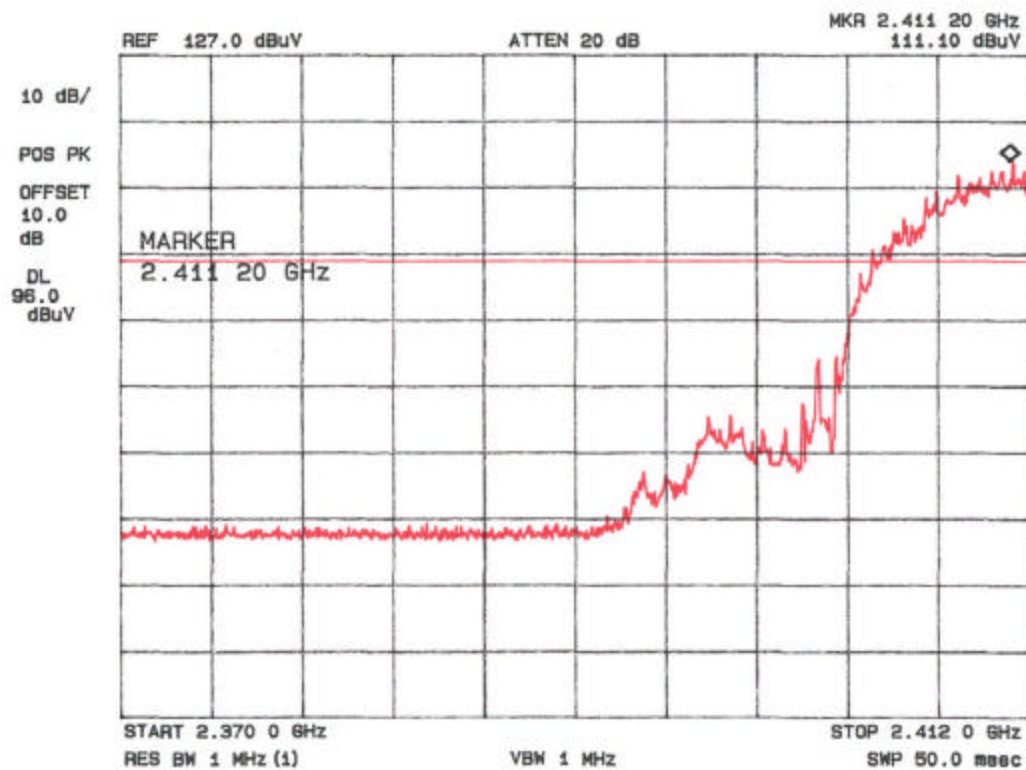
Channel 6 (2.437GHz) – operating in Transmit Mode; 5.5Mbytes per second; Low Power



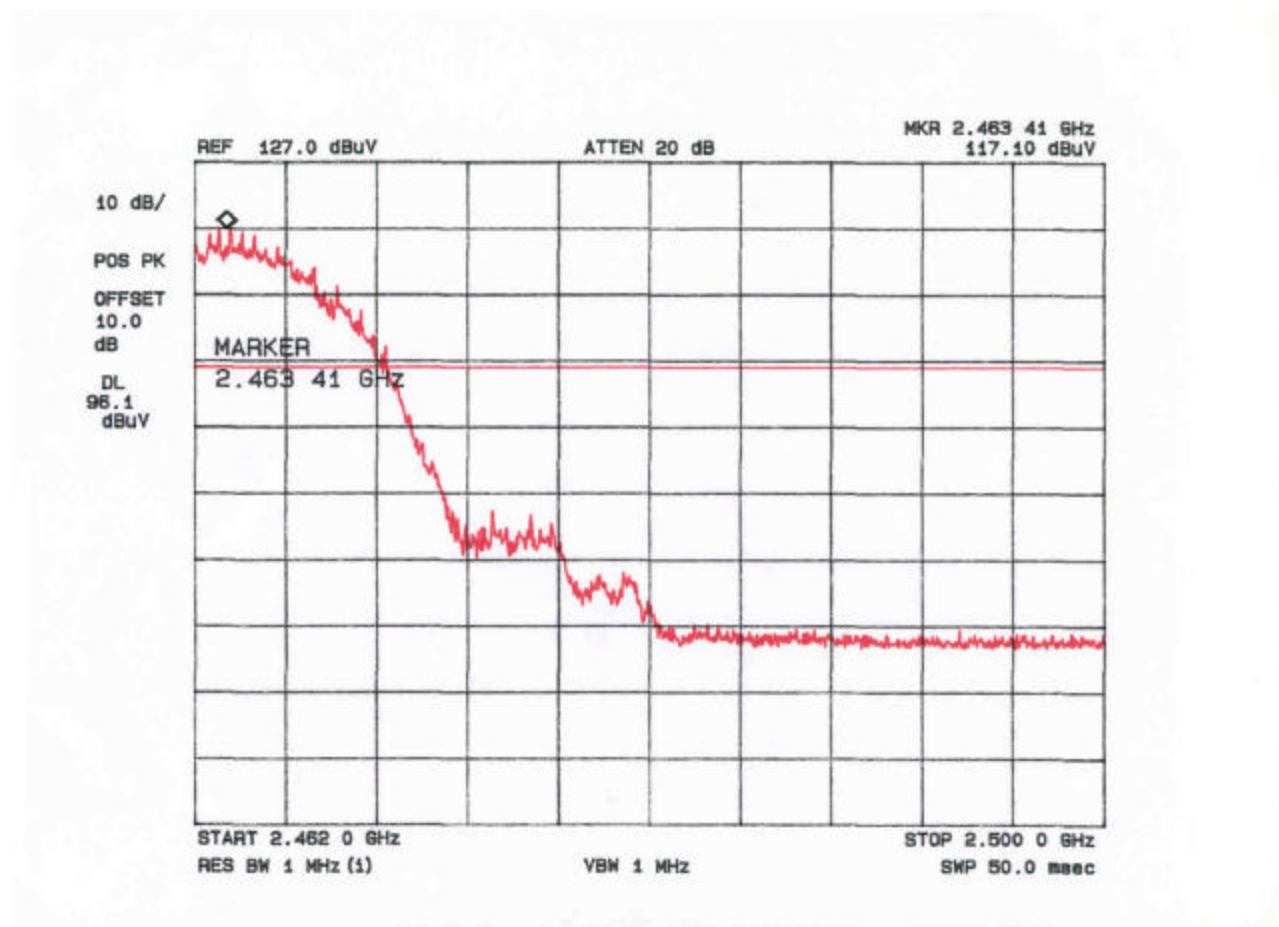
Channel 6 (2.437GHz) – operating in Transmit Mode; 11Mbytes per second; Low Power

15.247(c) – Band-edge compliance test

The following are the plots for the lowest and highest channels of operation. These plots were taken while the EUT was in Transmit Mode, on highest power setting, and transferring a test file at 11Mbytes per second.



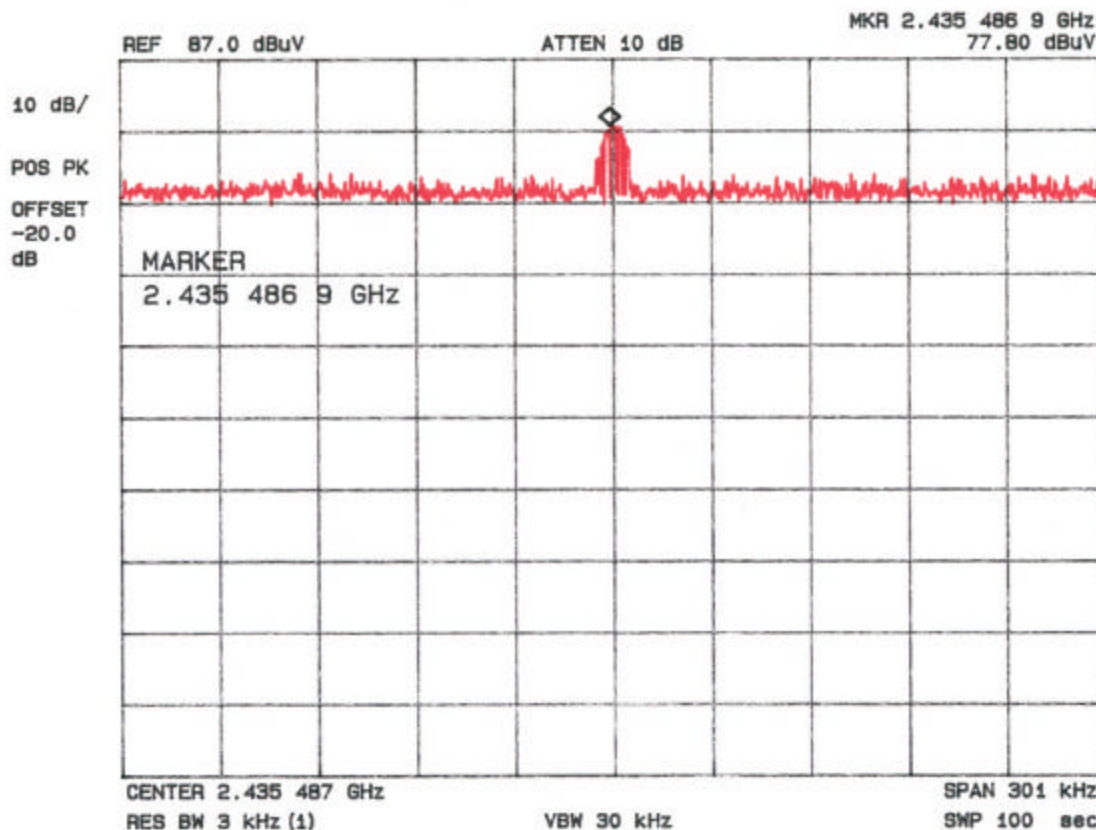
Channel 1 (2.412GHz) – operating in Transmit Mode; 11Mbytes per second; High Power



Channel 11 (2.463GHz) – operating in Transmit Mode; 11Mbytes per second; High Power

15.247(d) – Power Spectral Density

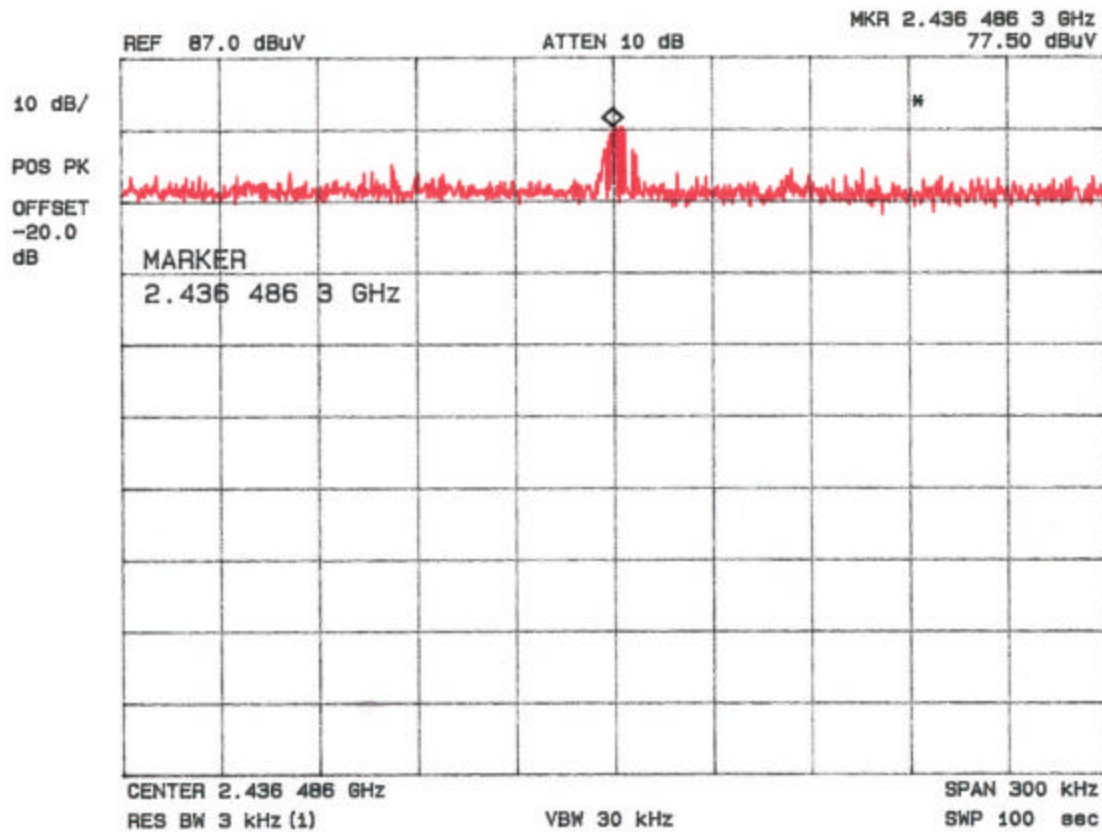
Each Channel was investigated to identify the peak level. Channel 6 was found to have the highest levels. Channel 6 was then operated in low and high power modes of operation as well as Receive and Transmit mode. The following plots are the results of Channel 6, comparing the various bit rates while in Transmit and High Power operating modes. These plots were taken while the EUT was transferring files to the Wireless Access Port.



Power Spectral Density

Channel 6 (2.437GHz) – operating in Transmit Mode; 1Mbytes per second; High Power

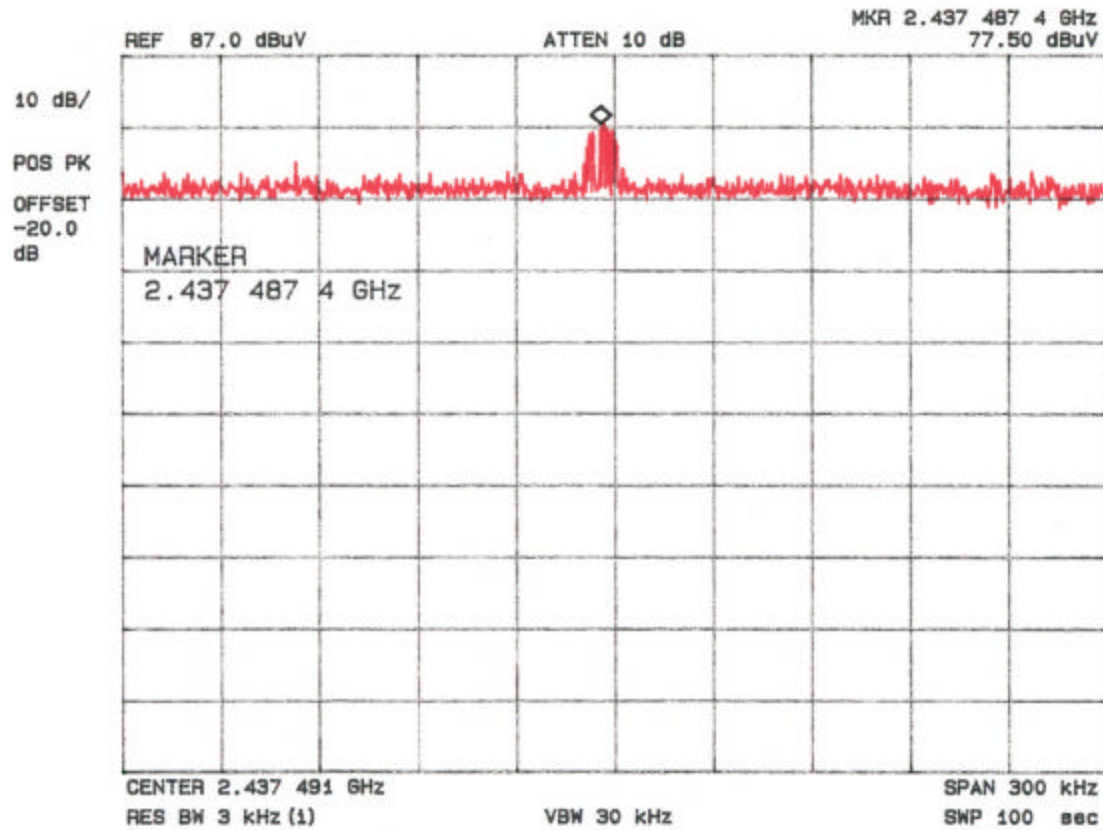
Measured Level: $(77.8\text{dBuV} - 107) = -29.2\text{dBm}$



Power Spectral Density

Channel 6 (2.437GHz) – operating in Transmit Mode; 2Mbytes per second; High Power

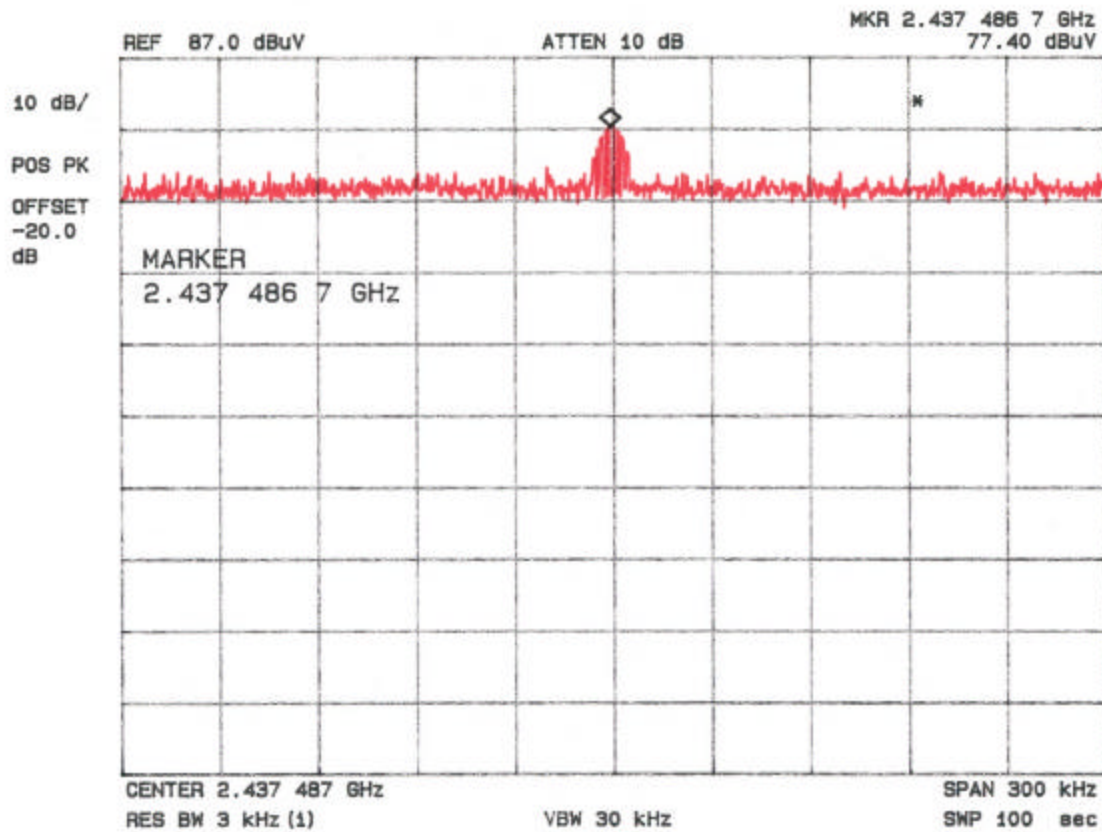
Measured Level: $(77.5\text{dBuV} - 107) = -29.5\text{dBm}$



Power Spectral Density

Channel 6 (2.437GHz) – operating in Transmit Mode; 5.5Mbytes per second; High Power

Measured Level: $(77.5\text{dBuV} - 107) = -29.5\text{dBm}$



Power Spectral Density

Channel 6 (2.437GHz) – operating in Transmit Mode; 11Mbytes per second; High Power

Measured Level: $(77.4\text{dBuV} - 107) = -29.6\text{dBm}$

Section II: Immunity Testing

EN61000-6-1: 2001 Light Industrial/Residential Immunity Requirements Standard

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Summary of EN61000-6-1: 2001 Light Industrial/Residential Immunity Requirements Standard, and self-declaration of the CE Mark requirements under the EMC Directive.

Testing Summary

Testing was performed per the following standards, pursuant to EN61000-6-1:2001 Light Industrial/Residential Immunity Requirements Standard

Applicable Standard	Test or Measurement	Required by EN61000-6-2: 2001	Description	Required Criterion	Result
Electrostatic Discharge EN 61000-4-2:1995 +A2:2000-11	Air Contact	$\pm 8\text{KV}$ $\pm 4\text{KV}$	Air Discharge ESD at 8 kV and Contact Discharge at 4 kV at several locations on and around the chassis, with 10 positive and 10 negative 'hits' each	B	B
Radiated Immunity EN 61000-4-3:1995 +A2:2001-11	Subject to electromagnetic field of 3V/m from 80 MHz to 1 GHz	Modulated Frequency Field	1 kHz 80% AM 80 - 1000MHz 10 V/m	Manufacturer Specified	
Electrical Fast Transient/Burst EN 61000-4-4:1995 +A2:2001-07	AC Line (Direct Injection) Process Lines (Cap. Clamp) Signal Lines > 3m (Cap. Clamp)	$\pm 2\text{ kV}$ $\pm 1\text{ kV}$ $\pm 1\text{ kV}$	EFT/Burst of $\pm 2\text{ kV}$ is coupled to the Power line, and $\pm 1\text{ kV}$ to process lines and all I/O lines > 3m. (Capacitive Clamp)	B	N/A
Surge Transient EN 61000-4-5:1995 +A1:2000-11	5 Positive and 5 negative surges are applied to the power terminals at 0, 90 and 180	Common Mode Differential Mode	$\pm 2\text{ kV}$ $\pm 1\text{ kV}$	B B	N/A
Conducted Immunity EN 61000-4-6:1996 +A1:2000-11	3 VRMS is coupled to Power and all I/O & control signals at 0.15 to 80 MHz.	Power Line / Signal Lines Frequency Field Modulation	0.15 - 80 MHz 10 V/m 80% AM, 1 kHz	A	N/A
Voltage Dips and Interruptions EN61000-4-11:1994 +A1:2001	Voltage on the Power Lines Is reduced by 30 % and 60 %. and interrupted for 5 seconds	Dips 30% & 60% Interruptions 95%	30%, 0.5 period 60%, 5 period 95%, 250 periods	B C C	N/A N/A N/A

Note: Performance Criterion determines the Pass/Fail result of the test. Under Performance Criterion A, the equipment must continue to operate during and after the test. In Criterion B, the Equipment performance is allowed to degrade during the test, but must recover to the original state, and not lose any data. Under performance criterion C, temporary loss of function is permitted, but all functionality must be recoverable by the operation of external controls. And, under Manufacturer's Specification please see individual test.

Test Equipment List

IMMUNITY:

Device	Model Number	Serial No.	Last Cal.	Next Cal
Bulk Injection Clamp	EMCO 95236-1	50958	02/27/04	02/27/05
RF Amplifier	EIN 3100L	309	NR	NR
RF Amplifier	Amplifier Research 30W1000M7	22606	NR	NR
Field Probe	Amplifier Research FP4000	21776	17/04/04	17/04/05
Test Cell	Amplifier Research TC2000	22666	14/05/03	14/05/04
Signal Generator	Hewlett Packard 8657A	2913A00373	09/05/03	09/05/04
ESD Simulator:	Schaffner NSG 432	01052	22/12/04	22/12/05
CE Combination Tester *	Keytek CE Master CM-BASE	5611222	05/31/04	05/31/05
Coupling Network	Schaffner CDN 125	310	09/05/03	09/05/04

* The CE-Master CM-BASE will perform the Electrical Fast Transient test, the Surge Transient Test, the Power Frequency Magnetic Field Test, the pulsed Magnetic Field test and the Voltage Dips and Interruptions test.

Equipment Under Test

THE TEST SYSTEM:	EUT:	5 Inch Color Hand Held Unit
	Manufacturer:	GPS Industries Inc.
	Part Number:	200-100030
	Serial Number:	0143
	Auxiliary Equipment	Battery Pack
	Part Number:	200-100001
	Test Software:	CHH. EXE
	Rev #:	1.5

CABLING: No Cables - tested as a standalone unit.

CONCLUSION: The 5 Inch Color Hand Held Unit complies with the requirements of ETSI EN301 489-1 V1.4.1, FCC CFR47 part 15/B and EN61000-6-1:2001 Light Industrial/Residential Immunity Requirements Standard.

Part 1 - ESD Testing

DATE: July 16, 2004

TEST STANDARD: EN 61000-4-2:1995+A2:2000-11

TEST CONDITIONS: Average Temperature and Humidity: 25°C, 40% RH

TEST VOLTAGE: 240Vdc, 50Hz

MINIMUM STANDARD: Criterion B: The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended.

METHOD OF MEASUREMENT: When the equipment is subjected to a contact and/or air discharge of the selected severity level, the equipment shall meet the performance Criteria B described above. Each operator accessible connector and control shall be discharged.

Each point is subjected to minimally 10 positive and 10 negative discharges per point at each voltage level for contact and air discharge.

The horizontal and vertical coupling planes are required to have at least 10 discharges per polarity at each voltage level on each side of the EUT

TEST VOLTAGE: +/-1, 2, 4 kV Contact Discharge

+/-2, 4, 8 kV Air Discharge

MEASUREMENT DATA: See attached Test Data

PERFORMANCE: Complies with Criterion B

TEST POINTS:

Contact Discharge	Air Discharge
Driver Button	Driver Button
Enter Button	Enter Button
+/- Button	+/- Button
Right Side	Right Side
Left Side	Left Side
Bottom of Battery Pack	Bottom of Battery Pack
Antenna	Antenna
Top Right Screw	Top Right Screw
Top Left Screw	Top Left Screw
Bottom Left Screw	Bottom Left Screw
Bottom Right Screw	Bottom Right Screw
Screen	Screen

AIR DISCHARGE:

 $\pm 2\text{kV}$ Air Discharge

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
Point 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 4	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 6	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 7	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 8	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 9	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 10	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 11	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 12	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

 $\pm 4\text{kV}$ Air Discharge

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
Point 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 4	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 6	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 7	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 8	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 9	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 10	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 11	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 12	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

 $\pm 8\text{kV}$ Air Discharge

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
Point 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 4	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 6	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 7	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 8	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 9	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 10	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 11	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Point 12	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
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CONTACT DISCHARGE ESD:

 $\pm 1\text{kV}$ Contact Discharge

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
Point 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 4	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 6	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 7	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 8	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 9	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 10	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 11	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 12	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

 $\pm 2\text{kV}$ Contact Discharge

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
Point 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 4	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 6	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 7	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 8	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 9	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 10	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 11	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 12	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

 $\pm 4\text{kV}$ Contact Discharge

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
Point 1	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 4	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 6	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 7	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 8	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 9	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 10	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Point 11	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Point 12	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
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COUPLING PLANES:

1kV negative direct

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
VCP (4 Sides)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
HCP (4 Edges)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

1kV positive direct

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
VCP (4 Sides)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
HCP (4 Edges)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

2kV negative direct

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
VCP (4 Sides)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
HCP (4 Edges)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

2kV positive direct

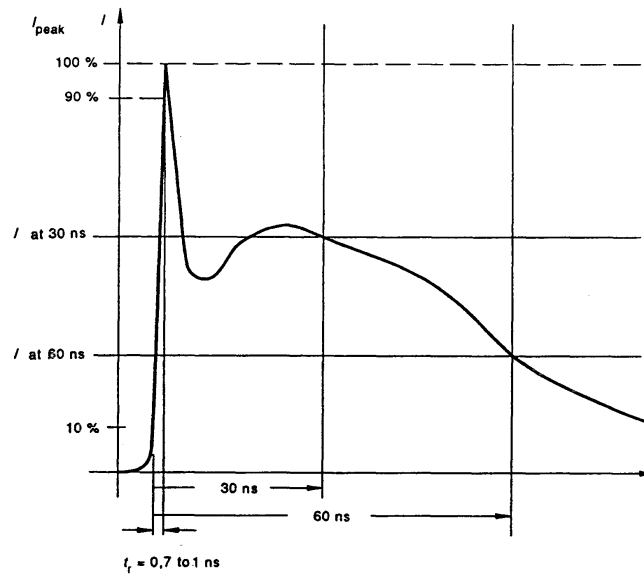
	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
VCP (4 Sides)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
HCP (4 Edges)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

4kV negative indirect

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
VCP (4 Sides)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
HCP (4 Edges)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

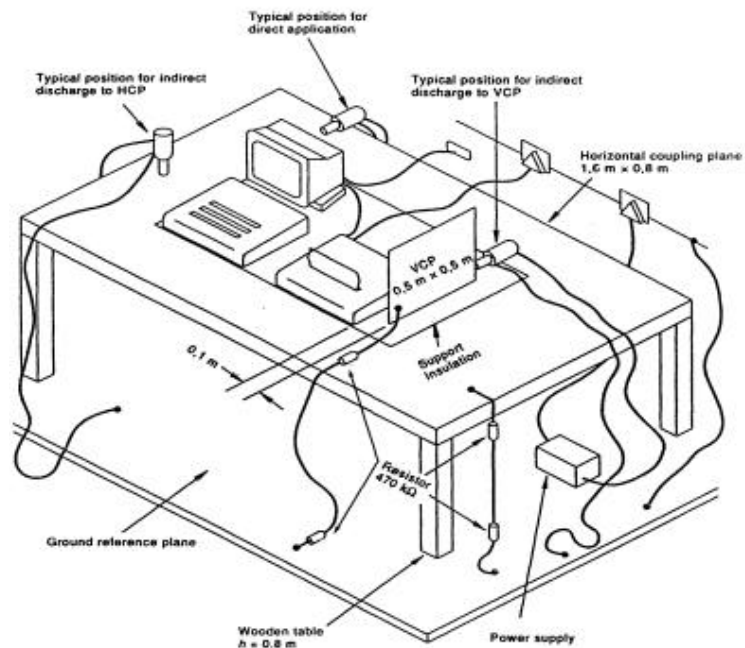
4kV positive indirect

	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Hit 6	Hit 7	Hit 8	Hit 9	Hit 10
VCP (4 Sides)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
HCP (4 Edges)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass



Typical waveform of the output current of the ESD generator

IEC 801-2, EN61000-4-2 ESD Waveform



Example of test set-up for table-top equipment, laboratory tests

IEC 801-2, EN61000-4-2 ESD Test Setup

Part 2 - Radiated Immunity Testing (A.M.)

DATE: July 13, 2004

TEST STANDARD: EN 61000-4-3:1995+A2:2001-11

TEST CONDITIONS: Average Temperature and Humidity: 25°C, 40% RH

TEST VOLTAGE: 240Vdc, 50 Hz

MINIMUM STANDARD: Criterion A: The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended.

METHOD OF MEASUREMENT: The EUT is configured within a semi-Anechoic Chamber and subjected to an Electromagnetic field of 3 V/m across the frequency range 80 MHz to 1 GHz. Step and dwell time are as noted below:

Amplitude: 3 V/m

Frequency Range: 80 - 1000 MHz

Modulation: 80% AM (1kHz tone)

Sweep Rate: Less than 1.5×10^{-3} decades/s

Step Size: 1 % of previous Frequency (i.e. Previous Frequency X 1.01)

Dwell Time: Long enough for the E.U.T. to respond

OBSERVATIONS: Complies with Criterion A

Appendix A: Photos

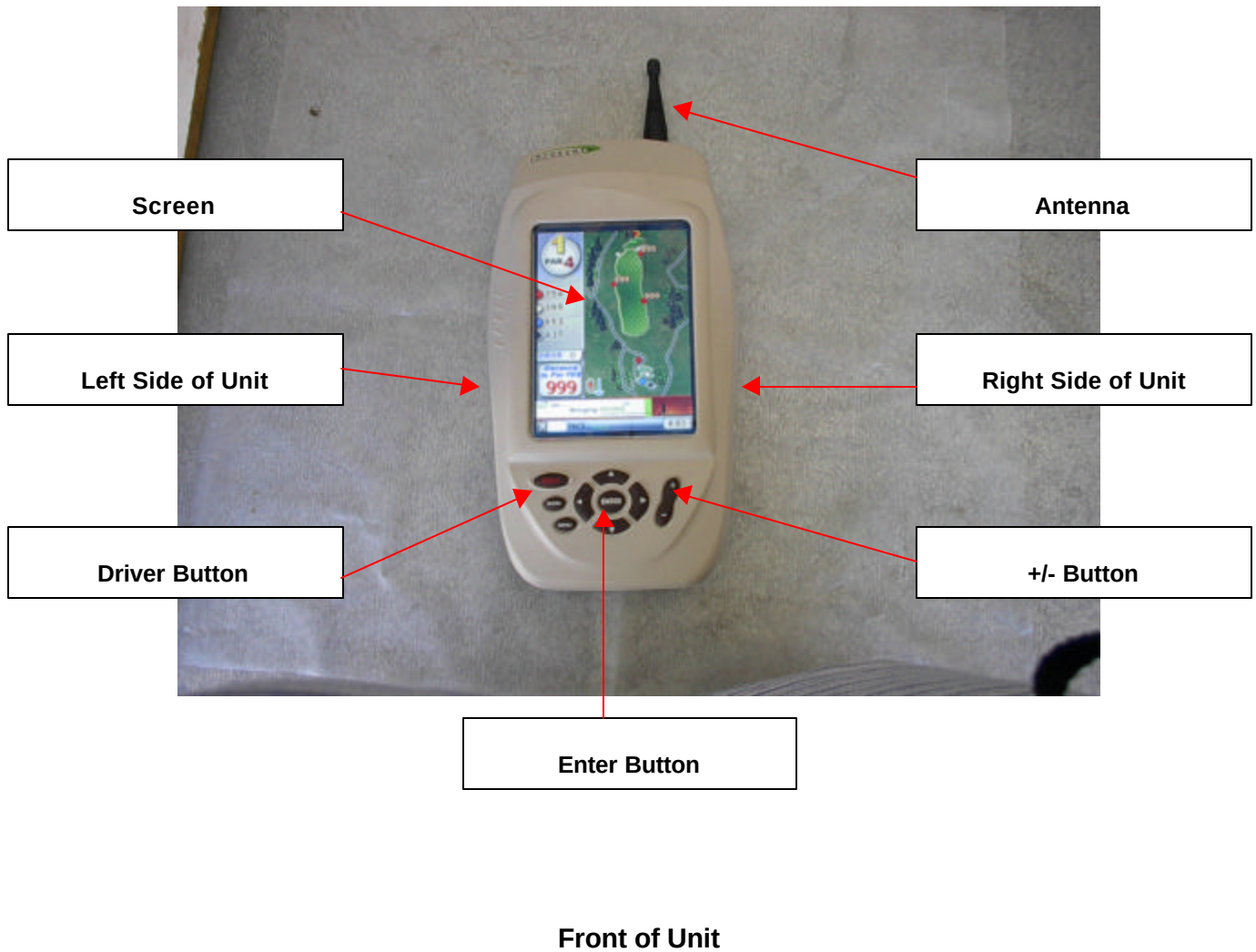


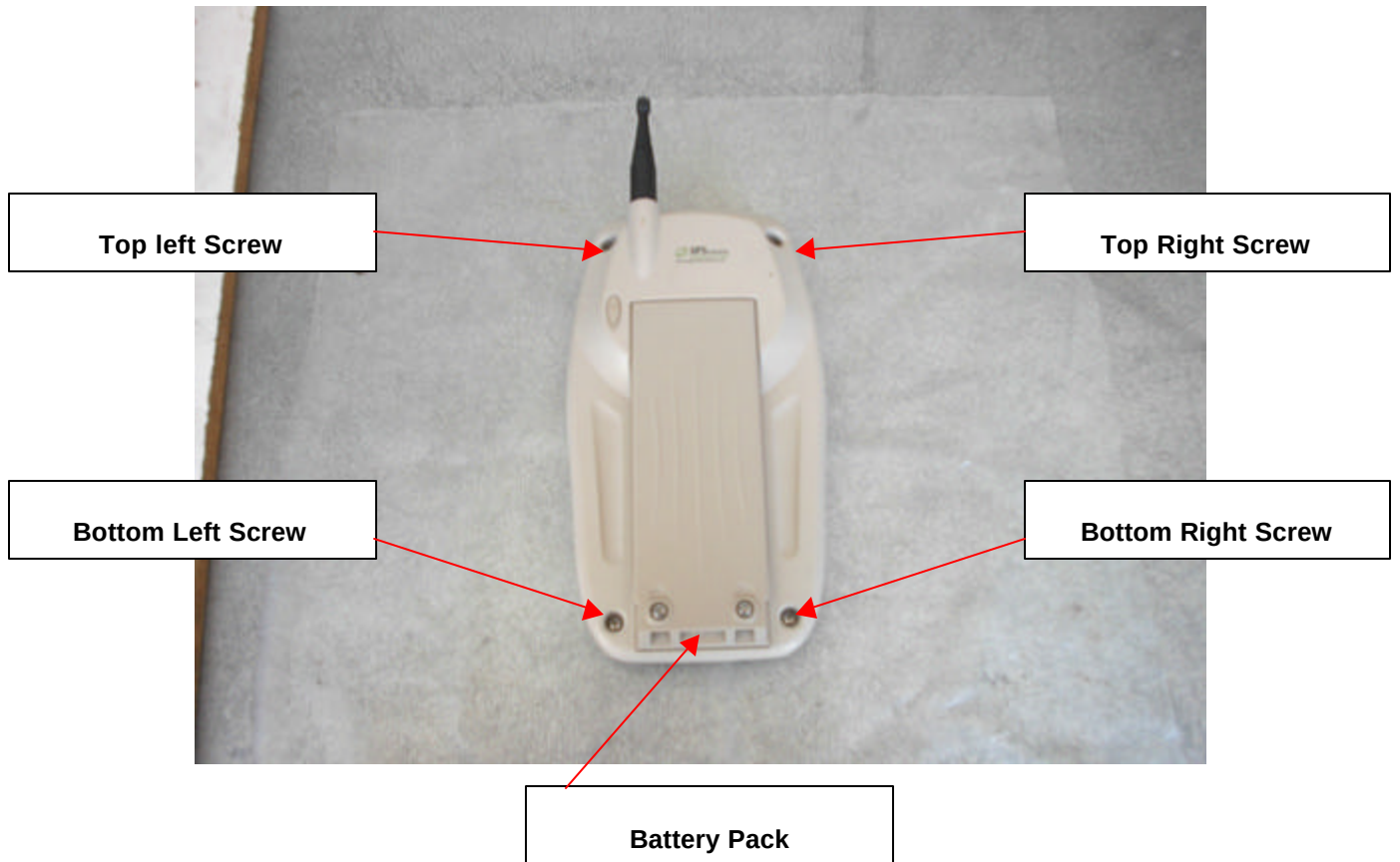
Emissions Test Setup Front View



Emissions Test Setup Rear View

ESD Photos





Back of Unit

Appendix B: Measurement Data and Plots

Measurement Data: GPS Industries – 5 Inch Color Hand Held Unit

Conducted Emissions – Not Required

Radiated Emissions – Class B

Table 1: FCC – 3m

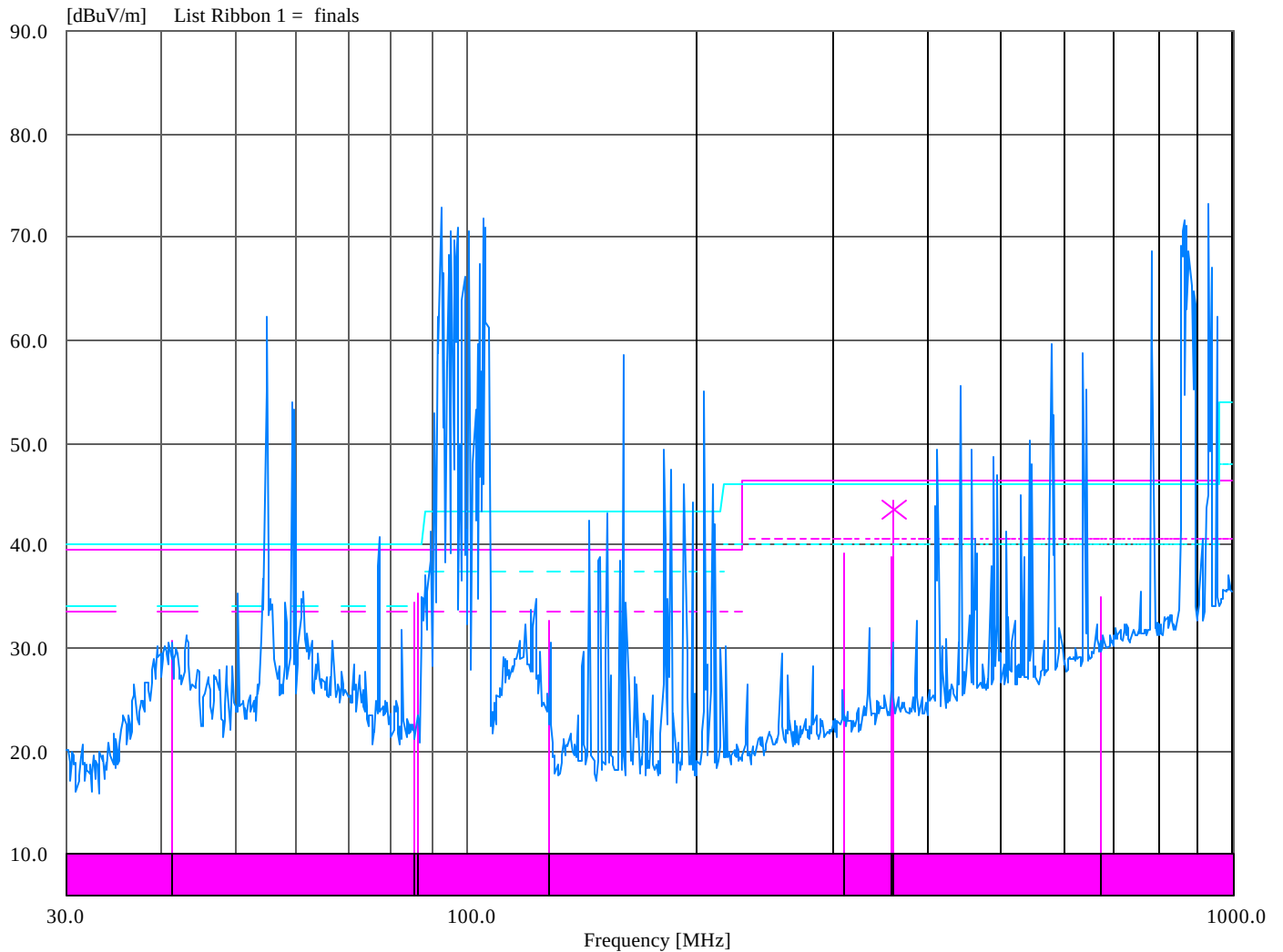
Frequency	Pol	Height	Angle	Uncor-Pk	Tot Corr Peak	Peak	DeLim-Pk	QP	DeLim-QP
(MHz)		(cm)	(deg)	(dBm V)	(dB)	(dBm V/m)	(dB)	(dBm V/m)	(dB)
41.119845	Vert	1.0	180	26.10	4.70	30.80	-9.20		
85.929614	Vert	1.0	180	23.70	10.98	34.68	-5.32		
86.435552	Vert	1.0	180	24.30	11.01	35.31	-4.69		
127.627882	Horz	1.0	250	23.30	9.56	32.86	-10.64		
311.512629	Vert	1.0	190	22.50	16.96	39.46	-6.54		
359.451022	Vert	1.0	180	20.60	18.17	38.77	-7.23		
361.288694	Vert	1.0	270	26.30	18.21	44.51	-1.49	43.48	-2.52
670.958672	Horz	1.5	180	10.00	24.95	34.95	-11.05		

Table 2: CE – 3m

Frequency	Pol	Height	Angle	Uncor-Pk	Tot Corr	Peak	DeLim-Pk	QP	DeLim-QP
(MHz)		(cm)	(deg)	(dBm V)	(dB)	(dBm V/m)	(dB)	(dBm V/m)	(dB)
41.119845	Vert	1.0	180	26.10	4.70	30.80	-8.70		
85.929614	Vert	1.0	180	23.70	10.98	34.68	-4.82		
86.435552	Vert	1.0	180	24.30	11.01	35.31	-4.19		
127.627882	Horz	1.0	250	23.30	9.56	32.86	-6.64		
311.512629	Vert	1.0	190	22.50	16.96	39.46	-7.04		
359.451022	Vert	1.0	180	20.60	18.17	38.77	-7.73		
361.288694	Vert	1.0	270	26.30	18.21	44.51	-1.99	43.48	-3.02
670.958672	Horz	1.5	180	10.00	24.95	34.95	-11.55		

Radiated Emission Plot

10-25-03 12-22-11



— FCC Limit
- - - 10 dB below FCC Limit
— CISPR Limit
- - - 10 dB below CISPR Limit



(Dark Blue Traces) All Emissions including ambient noise.



(Vertical Pink Line) – Markings of each Suspect Frequency
("X") – indicates Quasi-Peak