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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to

Industry Canada RSS-Gen Issue 1 / RSS 210 Issue 6 FCC Part 15 Subpart C on the Vivotech Transmitter Model: Vivopay 4500

UPN:	5141A-VP4500
FCC ID:	Q55VIVOPAY4500
GRANTEE:	Vivotech 451 El Camino Real Santa Clara, CA 95050
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
REPORT DATE:	May 1, 2006
FINAL TEST DATES:	April 5, April 21 and April 25, 2006
AUTHORIZED SIGNATORY:	David W. Bare Chief Technical Officer

ACCREDITED
2016-01

Equipment Name and Model:

Transceiver Vivopay 4500

Manufacturer:

Vivotech
451 El Camino Real
Santa Clara, CA 95050

Tested to applicable standard:

Industry Canada RSS-Gen Issue 1
RSS 210 Issue 6 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"

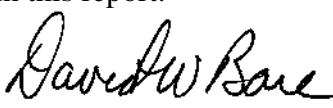
Test Report Prepared For:
Dan Anchondo
Vivotech
451 El Camino Real
Santa Clara, CA 95050

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 SV1 Dated August 16, 2007
Departmental Acknowledgement Number: IC2845 SV2 Dated August 16, 2007
Departmental Acknowledgement Number: IC2845 SV3 Dated August 16, 2007

Declaration of Compliance

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of ANSI C63.4: 2003 as referenced by FCC Part 15 and by section 1.0 of RSS-212, Issue 1, "Test Facilities and Test Methods for Radio Equipment" / RSS-Gen Issue 1); and that the equipment performed in accordance with the data submitted in this report.

Signature 
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USA

Date: May 1, 2006

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SCOPE

An electromagnetic emissions test has been performed on the Vivotech model Vivopay 4500 pursuant to the following rules:

Industry Canada RSS-Gen Issue 1
RSS 210 Issue 6 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C, Section 15.225

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in Elliott Laboratories test procedures:

ANSI C63.4:2003
RSS-212 Issue 1 Test Facilities and Test Methods for Radio Equipment

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Vivotech model Vivopay 4500 and therefore apply only to the tested sample. The sample was selected and prepared by Dan Anchondo of Vivotech

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section. Certification of these devices is required as a prerequisite to marketing in the US and Canada.

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section. Certification of these devices is required as a prerequisite to marketing in the US. Devices categorized as Class II equipment do not require certification by Industry Canada.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Vivotech model Vivopay 4500 complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 1
RSS 210 Issue 6 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product that may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

TEST RESULTS SUMMARY

DEVICES OPERATING IN THE 13.56 MHz BAND (RSS 210 and FCC 15 C)

FCC Part 15 Reference	RSS Reference	Description	Measured Value / Comments	Limit / Requirement	Result
15.225 (a) – (d)	RSS 210 A2.6	Transmitter Fundamental Signal Emissions, 13.56MHz	43.6 dBuV/m @ 13.56 MHz	84 dBuV/m (13.553 - 13.567MHz), 50.5 dBuV/m (13.410 - 13.553 and 13.567 - 13.71MHz) and 40.5 dBuV/m (13.11 – 13.41 and 13.71 – 14.01 MHz)	Complies
15.209	RSS 210 Tables 2 and 3	Transmitter Radiated Spurious Emissions, 13.56 – 135.6 MHz	10.3dBµV/m @ 27.122MHz	Refer to standard	Complies
15.225 (e)	RSS 210 A2.6	Frequency Stability – 13.56 MHz band	-0.0006%	±0.01%	Complies
-	RSS GEN 4.4.1	Occupied Bandwidth	6 kHz	Measurement only	Complies

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below were calculated using the approach described in CISPR 16-4-2:2003 using a coverage factor of k=2, which gives a level of confidence of approximately 95%. The levels were found to be below levels of *U*cispr and therefore no adjustment of the data for measurement uncertainty is required.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	0.015 to 30	± 4.0
Radiated Emissions	30 to 1000	± 3.6

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Vivotech model Vivopay 4500 is a RF tag reader that is designed to emit a magnetic field to detect a RF tag in the field. It communicates with the RF tag and retrieves payment information. The card information is then transmitted to a POS (Point of Sale) device via direct serial interface. Since the EUT would be placed on a table top during operation, the EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 9 Volts DC, 300 mAmps.

The sample was received on April 5, 2006 and tested on April 5, April 21 and April 25, 2006. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Vivotech	VP4500	RF tag reader	3013	Q55VIVOPAY4500

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 10.5 cm wide by 1.0 cm deep by 12.5 cm high and folds in the center.

ANTENNA

The EUT antenna is integral to the product.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with emissions specifications.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Manufacturer	Model	Description	Serial Number
Vivotech	DS-1000 p/n 220-1015-00	card reader interface for various terminals	none
Vivotech	J-COP card	SIM card	none
Vivotech	None	resistor loads for RS-232	none
OEM	AD-0760DT	Power supply	none

No remote support equipment was used during emissions testing.

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Vivopay 4500 DC	All in One cable	screwed in power cable	Shielded	0.9
All in One cable	Serial	Cat 5 cable extender	resistor load	0.9
All in One cable	Power	Power Supply	Unshielded	1.5
All in One cable	DS-1000 port	RS-232 port	Unshielded	1.0

EUT OPERATION

During emissions testing the EUT had special polling software installed in the firmware. The reader polled the card every two seconds and then reset and caused to poll. The indicator of a card read was the beep and LED s light up in succession.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on April 5, April 21 and April 25, 2006 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission.

ANSI C63.4:2003 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4:2003 and RSS 212.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003 and RSS 212. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003 / RSS 212.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

POWER METER

Power measurements are made using either a power meter (typically with a peak power sensor) or as detailed in FCC KDB558074 using a spectrum analyzer and either the built-in channel power measurement function or software to integrate the power over the displayed spectrum.

When using the integration method the analyzer's internal function or software account for the equivalent noise bandwidth of the resolution bandwidth used when performing the integration. The bandwidths, detector (peak or sample) and trace data (max held or power averaging) are detailed in the test data. When using a power averaging function the device is either in a continuous transmit mode or the analyzer is configured to only sweep when the transmitter is active to ensure that the averaging is performed over a transmit burst and not over quiet periods.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4:2003 and RSS 212 secify that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions, which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and Elliott's test procedures for the type of radio being tested.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207, RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

GENERAL RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D) and the limits for all emissions for a low power device operating under the general rules of RSS 210, FCC Part 15 Subpart C.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of 3m from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{3} \text{ microvolts per meter}$$

where P is the eirp (Watts)

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions, 13 - 30 MHz, 21-Apr-06
Engineer: Mehran Birgani

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Magnetic Loop Antenna, 10kHz-30MHz	6502	1299	20-Dec-06
Rohde & Schwarz	Test Receiver, 0.009-2750 MHz	ESN	1332	23-May-06

Conducted Emissions - AC Power Ports, 21-Apr-06
Engineer: Mehran Birgani

Manufacturer	Description	Model #	Asset #	Cal Due
Elliott Laboratories	FCC / CISPR LISN	LISN-3, OATS	304	08-Jul-06
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	372	06-Sep-06
Rohde & Schwarz	Test Receiver, 0.009-2750 MHz	ESN	1332	23-May-06

Conducted Emissions - AC Power Ports, 25-Apr-06
Engineer: David Bare

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Spectrum Analyzer, Display Section	85662A	43	13-Jun-06
Hewlett Packard	Spectrum Analyzer, RF Section	85680B	44	13-Jun-06
Solar	LISN	8028-50-TS-24-BNC	904	08-Jul-06
Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	215	03-Mar-07
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1389	03-Feb-07

Radiated Emissions, 30 - 1,000 MHz, 05-Apr-06
Engineer: Chris Groat

Manufacturer	Description	Model #	Asset #	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54	07-Mar-07
Elliott Laboratories	Log Periodic Antenna 300-1000 MHz	EL300.1000	297	31-Jan-07
Rohde & Schwarz	Test Receiver, 20-1300 MHz	ESVP	1317	18-Jul-06

EXHIBIT 2: Test Measurement Data

15 Pages

Elliott

EMC Test Data

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	Test-Log Number:	T63513
		Project Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Emissions Spec:	EN55022, FCC	Class:	B
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Vivotech

Model

VP4500

Date of Last Test: 4/25/2006

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	Test-Log Number:	T63513
		Project Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Emissions Spec:	EN55022, FCC	Class:	B
Immunity Spec:	-	Environment:	-

EUT INFORMATION

The client agreed provide the following information after the test session(s).

General Description

The EUT is a RF tag reader that is designed to emit a magnetic field to detect a RF tag in the field. It communicates with the RF tag and retrieves payment information. The card information is then transmitted to a POS (Point of Sale) device via direct serial interface. Since the EUT would be placed on a table top during operation, the EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 9 Volts DC, 300 mAmps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Vivotech	VP4500	RF tag reader	3013	Q55VIVOPAY4500

Other EUT Details

The following EUT details should be noted: The reader emits a magnetic field at 13.56 MHz so when a contactless card is placed in the magnetic field a modem on the card handshakes to the reader and the card at that time downloads card information to the reader through encrypted RS232 data which then goes to the POS.

EUT Antenna (Intentional Radiators Only)

The antenna is integral to the device.

EUT Enclosure

The EUT enclosure is primarily constructed of plastic. It measures approximately 10.5 cm wide by 1.0 cm deep by 12.5 cm high and folds in the center.

Modification History

Mod. #	Test	Date	Modification
1			
2			
3			

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Project Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Emissions Spec:	EN55022, FCC	Class:	B
Immunity Spec:	-	Environment:	-

Test Configuration #1

The client agreed provide the following information after the test session(s).

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Vivotech	DS-1000 p/n 220-1015-00	card reader interface for various terminals	none	none
Vivotech	J-COP card	SIM card	none	none
Vivotech	None	Resistor loads for RS-232	none	none
OEM	AD-0760DT	Power supply	none	none

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None	-	-	-	-

Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Vivopay 4500 DC	All in One cable	Screwed in power cable	Shielded	0.9
All in One cable	Serial	Cat 5 cable extender	Resistor load	0.9
All in One cable	Power	Power Supply	Unshielded	1.5
All in One cable	DS-1000 port	RS-232 port	Unshielded	1.0

EUT Operation During Emissions Tests

During emissions testing the EUT had special polling software installed in the firmware. The reader polled the card every two seconds and then reset and caused to poll . The indicator of a card read was the beep and LED s light up in succession.

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 4/5/2006
Test Engineer: Chris Groat
Test Location: SVOATS #1
Config. Used: 1
Config Change: none
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

The test distance and extrapolation factor (if used) are detailed under each run description.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

Ambient Conditions:

Temperature: 22 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 1000MHz, Maximized Emissions	FCC B	Pass	29.9dBµV/m @ 81.36MHz (-10.1dB)

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Run #1: Preliminary Radiated Emissions, 30-1000 MHz

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 1000 MHz	3	3	0

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
81.360	29.9	V	40.0	-10.1	QP	144	1.0	
216.969	33.2	H	46.0	-12.8	QP	85	1.9	
176.287	30.5	V	43.5	-13.0	QP	65	1.3	
122.040	30.3	H	43.5	-13.2	QP	268	2.5	
189.848	28.9	V	43.5	-14.6	QP	93	1.0	
216.960	31.4	V	46.0	-14.6	QP	185	1.0	
176.280	27.7	H	43.5	-15.8	QP	200	2.4	
81.360	23.5	H	40.0	-16.5	QP	325	3.1	
203.410	26.1	H	43.5	-17.4	QP	345	3.1	
203.410	25.9	V	43.5	-17.6	QP	15	1.0	
244.000	27.1	H	46.0	-18.9	QP	250	3.7	
149.160	23.7	V	43.5	-19.8	QP	60	1.0	
149.160	23.5	H	43.5	-20.0	QP	85	2.4	
189.848	22.7	H	43.5	-20.8	QP	75	4.0	
244.000	24.0	V	46.0	-22.0	QP	90	1.2	
122.040	20.5	V	43.5	-23.0	QP	125	1.0	
135.600	16.5	V	43.5	-27.0	QP	144	1.0	

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 4/21/2006
Test Engineer: Mehran Birgani
Test Location: SVOATS #2
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

For radiated emissions testing below 30 MHz the measurement antenna was located 10 meters from the EUT, unless otherwise noted. Radiated magnetic field measurements were made with the loop antenna located one meter above the ground plane, with the loop of the antenna either parallel or perpendicular to the EUT.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

Ambient Conditions:

Temperature: 19 °C
Rel. Humidity: 65 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 13.56 - 30 MHz Maximized Emissions	FCC 15.225	Pass	22.4dBµV/m @ 13.770MHz (-18.1dB)
2	RSS GEN Occupied bandwidth	-	Pass	6 kHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

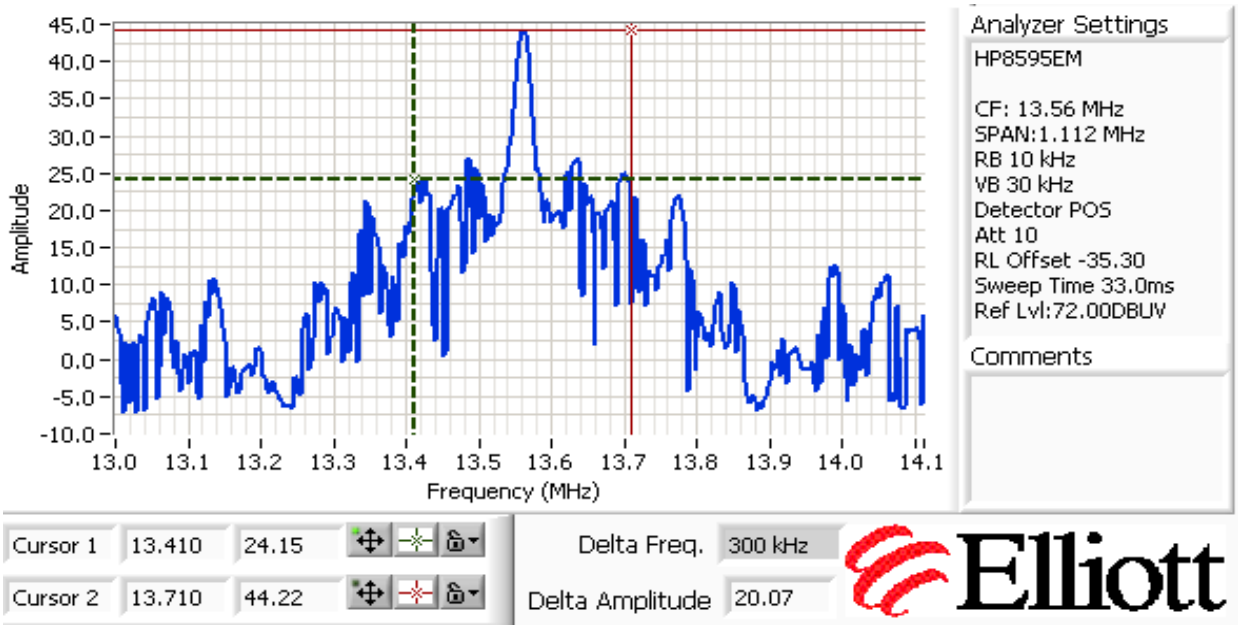
Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Run #1: Maximized Radiated Emissions, 13.56 - 30 MHz

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
13.5 - 30 MHz	10	30	-19.1

Frequency	Level	Pol	FCC 15.225		Detector	Azimuth	Height	Comments
MHz	dBµV/m	O/C	Limit	Margin	Pk/QP/Avg	degrees	meters	
13.770	22.4	O	40.5	-18.1	QP	99	2.2	Highest emission in 13.11-13.41 or 13.71-14.01 bands
27.122	10.3	O	29.5	-19.2	QP	99	2.2	
13.630	27.1	O	50.5	-23.4	QP	99	2.2	Highest emissions in 13.41-13.553 or 13.567-13.710 MHz bands
27.122	-7.6	O	29.5	-37.1	QP	182	1.0	
13.560	43.6	O	84.0	-40.4	QP	99	2.2	
13.560	41.5	O	84.0	-42.5	QP	182	1.0	

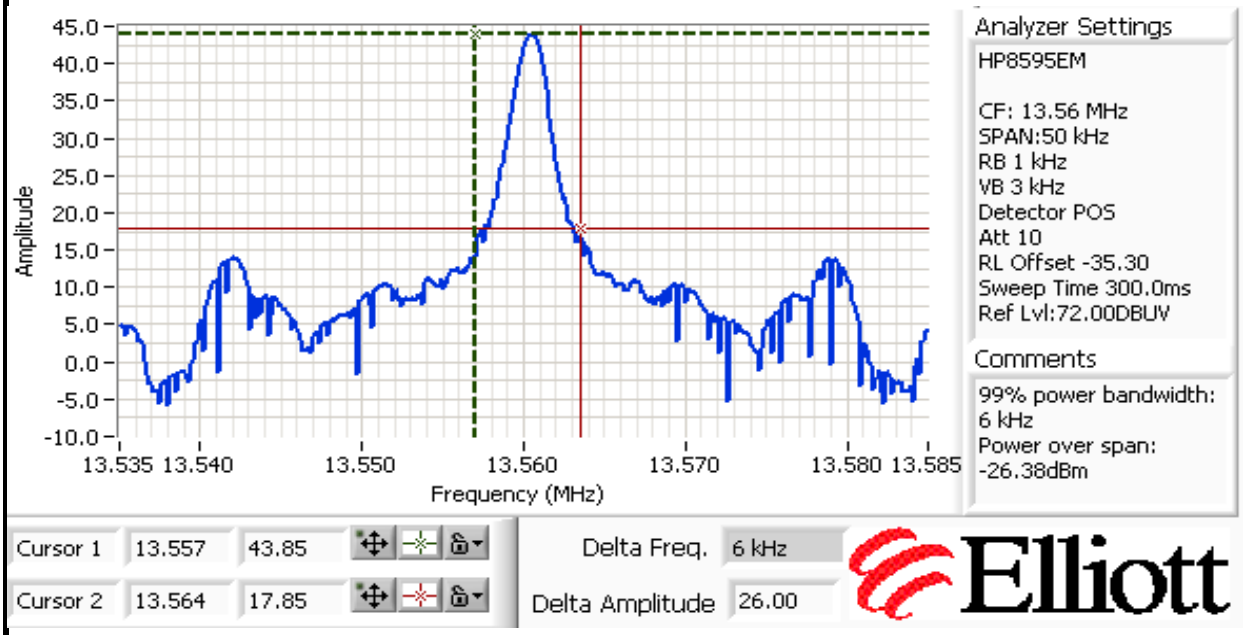
Note 1:	Polarization O=open loop (Parallel) C=close loop (Perpendicular)



Bandedge plots for determining maximum field strength

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Run #2: 99% Bandwidth



Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Radio Performance Test - Frequency Stability

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 4/21/2006
Test Engineer: Rafael Varelas
Test Location: Environmental #1
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT's rf port was connected to the measurement instrument's rf port, via an attenuator or dc-block if necessary. EUT was place inside an environmental chamber.

Summary of Results

Run #	Test Performed	Limit	Result	Value / Margin
1,2	Frequency Stability Over Temperature and Voltage	0.01%	Pass	0.0006%

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Run #1: Temperature Vs. Frequency

T (°C)	Ref Frequency[1] (MHz)	Frequency at T (MHz)	Drift (Hz)	Drift (%)
-20	13.560338	13.560375	37	0.0003
-10	13.560338	13.560350	12	0.0001
0	13.560338	13.560300	-38	-0.0003
10	13.560338	13.560263	-75	-0.0006
20	13.560338	13.560338	0	0.0000
30	13.560338	13.560388	50	0.0004
40	13.560338	13.560300	-38	-0.0003
50	13.560338	13.560300	-38	-0.0003
		Frequency drift:	+50/-75Hz	+0.000/-0.001%

Note 1:	Ref. Frequency: Frequency measured at 20°C and nominal input voltage(s). EUT transmitting CW signal. Measurements made with RB=300Hz, VB=3MHz, Span = 5kHz.

Run #2: Voltage Vs. Frequency

Nominal Voltage is: 120 Vac

Voltage (Dc)	Ref Frequency[1] (MHz)	Frequency Drift (MHz)	Drift (Hz)	Drift (%)	Comment
85%	13.560338	13.5603	0	0.0000	102.0 v
115%	13.560338	13.5603	0	0.0000	138.0 v
		Frequency drift:	+0/-0Hz	+0/-0%	

Note 1:	Ref. Frequency: Frequency measured at 20°C and nominal input voltage(s). EUT transmitting CW signal. Measurements made with RB=300Hz, VB=3MHz, Span = 5kHz.

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Conducted Emissions - Power Ports

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 4/21/2006
Test Engineer: Mehran Birgani
Test Location: SVOATS #2
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT was located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN.

Ambient Conditions:

Temperature: 19 °C
Rel. Humidity: 65 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	FCC 15.207	Pass	47.4dBµV @ 27.122MHz (-2.6dB)

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

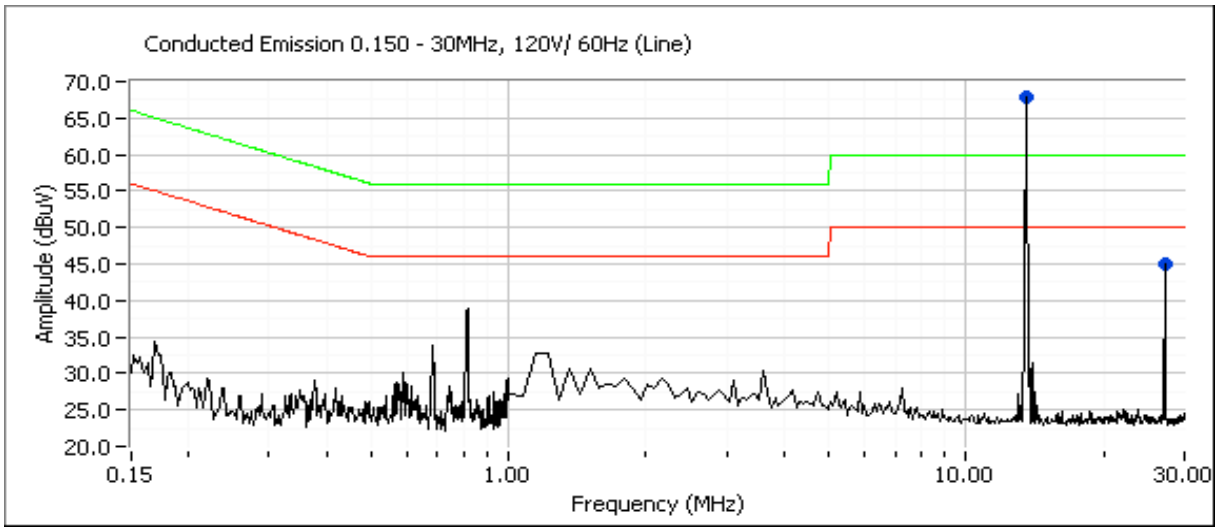
Elliott

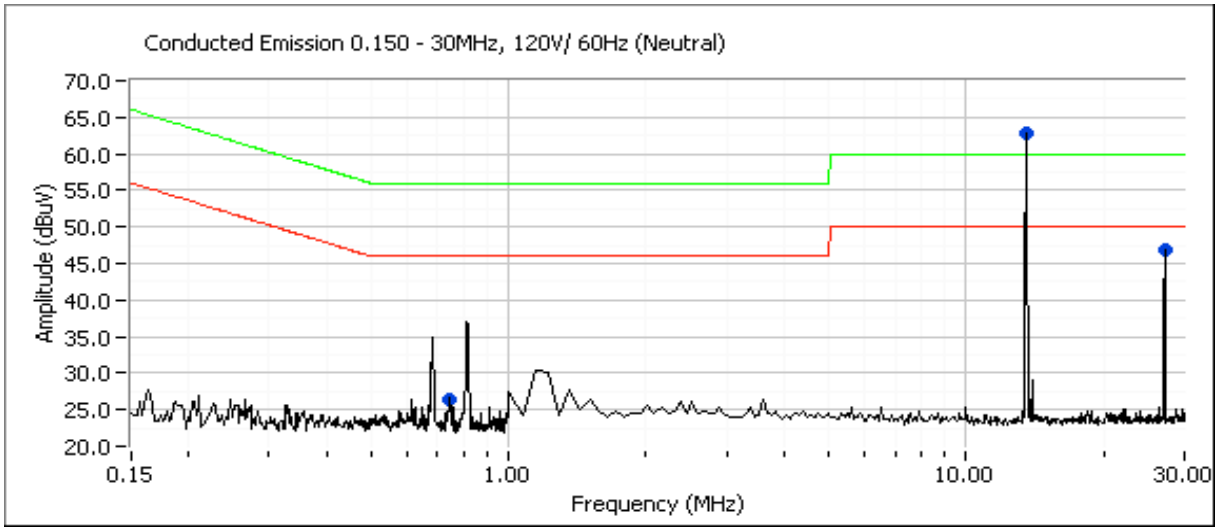
EMC Test Data

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/ 60Hz

EUT antenna not terminated





Elliott

EMC Test Data

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/ 60Hz

Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
27.122	47.4	Neutral	50.0	-2.6	Average	
27.121	45.2	Line	50.0	-4.8	Average	
27.122	48.0	Neutral	60.0	-12.0	QP	
27.121	45.8	Line	60.0	-14.2	QP	
0.743	26.4	Neutral	46.0	-19.6	Peak	Peak reading with Average limit
0.813	40.9	Line	NA	NA	Peak	Ambient
13.561	68.1	Line	50.0	**18.1**	Average	Tx Fundamental, For reference only (See 4-26-06 data)
13.561	63.3	Neutral	50.0	**13.3**	Average	Tx Fundamental, For reference only (See 4-26-06 data)
13.561	68.8	Line	60.0	**8.8**	QP	Tx Fundamental, For reference only (See 4-26-06 data)
13.561	63.4	Neutral	60.0	**3.4**	QP	Tx Fundamental, For reference only (See 4-26-06 data)

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Conducted Emissions - Power Ports

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 4/25/2006
Test Engineer: David Bare
Test Location: SVOATS #3

Config. Used: 1
Config Change: none
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT was located above a ground plane, 80 cm from the LISN and 40cm from a vertical reference plane.

Ambient Conditions:

Temperature: 15 °C
Rel. Humidity: 57 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	FCC 15.207	Pass	36.1dBµV @ 13.561MHz (-13.9dB)

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Vivotech	Job Number:	J63495
Model:	VP4500	T-Log Number:	T63513
		Account Manager:	Nesha Lambert
Contact:	Dan Anchondo		
Spec:	EN55022, FCC	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz
Antenna replaced with termination per FCC presentation at May 2005 TCB conference

Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
13.561	36.1	Line	50.0	-13.9	AVG	
13.561	35.3	Neutral	50.0	-14.7	AVG	
13.561	37.5	Line	60.0	-22.5	QP	
13.561	36.7	Neutral	60.0	-23.3	QP	

Note 1:	FCC May 2005 TCB Conference notes: Although C63.4 is designed for Part 15 transmitters that operate above 30 MHz with a detachable antenna, we are willing to accept measurements on a 13.56 MHz transmitter done with a dummy load under the following conditions: 1) First, perform the AC line conducted tests with the antenna attached to make sure the device complies with the 15.207 limits outside the transmitter's fundamental emission band. 2) Second, retest with a dummy load to make sure the device complies with the 15.207 limits inside the transmitter's fundamental emission band. Only the fundamental TX emission band needs to be retested.

EXHIBIT 3: Photographs of Test Configurations

4 Pages

EXHIBIT 4: Proposed FCC ID Label & Label Location

EXHIBIT 5: Detailed Photographs of Vivotech Model Vivopay 4500Construction

4 Pages

EXHIBIT 6: Operator's Manual for Vivotech Model Vivopay 4500

20 Pages

EXHIBIT 7: Block Diagram of Vivotech Model Vivopay 4500

1 Page

EXHIBIT 8: Schematic Diagrams for Vivotech Model Vivopay 4500

4 Pages

EXHIBIT 9: Theory of Operation for Vivotech Model Vivopay 4500

1 Page

EXHIBIT 10: Advertising Literature

2 Pages