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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 B (Receivers) FCC Part 15 Subpart C on the Microwave Data Systems Transmitter Model: Mercury OFDM

UPN:	3738A-MERCURY9
FCC ID:	E5MDS-MERCURY900
GRANTEE:	Microwave Data Systems 175 Science Parkway Rochester, NY 14620
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
REPORT DATE:	July 20, 2006
FINAL TEST DATE:	March 23, March 24, July 14 and July 18, 2006

AUTHORIZED SIGNATORY: _____

Juan Martinez
Senior EMC Engineer

A2LA ACCREDITED
2016-01

REVISION HISTORY

Revision #	Date	Comments	Modified By
1	August 11, 2006	Initial Release	David Guidotti

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SCOPE

An electromagnetic emissions test has been performed on the Microwave Data Systems model Mercury OFDM 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 B (Receivers)
FCC Part 15 Subpart C

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 Microwave Data Systems model Mercury OFDM and therefore apply only to the tested sample. The sample was selected and prepared by Dennis McCarthy of Microwave Data Systems

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

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 Microwave Data Systems model Mercury OFDM 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 B (Receivers)
FCC Part 15 Subpart C

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.).

TEST RESULTS SUMMARY

DIGITAL TRANSMISSION SYSTEMS (902 – 928 MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 210 A8.2	Digital Modulation	Systems uses OFDM techniques	-	Complies
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth	3.133 MHz	>500kHz	Complies
	RSP100	99% Bandwidth	3.494 MHz	Information only	Complies
15.247 (b) (3)	RSS 210 A8.2 (4)	Output Power, 902 – 928 MHz	29.1 dBm (0.813 Watts) EIRP = 3.89 W Note 1	1Watt, EIRP limited to 4 Watts.	Complies
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density	2.5 dBm / 3 kHz	8dBm/3kHz	Complies
15.247(c)	RSS 210 A8.5	Antenna Port Spurious Emissions 30MHz – 9.28 GHz	All spurious emissions < -30dBc	< -30dBc Note 2	Complies
15.247(c) / 15.209	RSS 210 A8.5 Table 2, 3	Radiated Spurious Emissions 30MHz – 9.28 GHz	52.9 dBuV/m @ 2711.3 MHz (-1.1 dB)	15.207 in restricted bands, all others <-30dBc Note 2	Complies

Note 1: EIRP calculated using antenna gain of dBi (12) for the highest EIRP system.
Note 2: Limit of -30dBc used because the power was measured using the UNII test procedure (maximum power averaged over a transmission burst).

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Reverse polarity		Complies
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	45.3 dBuV/m @ 944.999 MHz		Complies (- 0.7 dB)
15.207	RSS GEN Table 2	AC Conducted Emissions	40.7 dBuV/m @ 27.158 MHz	Refer to standard	Complies (- 9.3 dB)
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in Exhibit 11, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
	RSP 100 RSS GEN 7.1.5	User Manual		Statement required regarding non-interference	

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 are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	0.015 to 30	± 3.0
Radiated Emissions	30 to 1000	± 3.6
Radiated Emissions	1000 to 40000	± 6.0

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Microwave Data Systems model Mercury OFDM is a 900 MHz wireless transceiver for ethernet data networks. There are two versions of the radio, a base unit and a remote unit. The rf circuitry in both devices is identical. The digital device (modem) boards are the only difference between the two units. The master unit was tested for all radio-related emissions (preliminary radiated emissions scans on both master and remote units demonstrated that the transmitter- and receiver-related emissions from both devices were not significantly different). Digital device radiated and AC conducted emissions tests were performed on both units.

The sample was received on March 23, 2006 and tested on March 23, March 24, July 14 and July 18, 2006. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
MDS	Mercury 900-R	900 MHz TRx (Remote)	1234567	E5MDS-Mercury900
MDS	Mercury 900-AP	900 MHz TRx (Base)	none	E5MDS-Mercury900

OTHER EUT DETAILS

List any items from the test log.

ANTENNA SYSTEM

The EUT is designed to use two different types of antenna - "omni-directional" (as in the MaxRad MFB915 series) and a log periodic. The highest gain antennas of these types are the Microwave Data Systems 97-3194A14 (Antennex Y8966) Log-Periodic with a gain of 9dBd (11.2dBi) and the Maxrad MFB9157NF Omni directional with a gain of 7dBi. Radiated emissions measurements were made with each of the highest gain omni and log-periodic antennas.
The EUT requires professional installation and therefore is exempt from the requirement of 15.203. The output power is configured for each antenna to ensure the EIRP does not exceed 4 Watts, and the output power at the rf connector cannot exceed the maximum value reported in this test data. Radiated emissions were measured with the output power set to maximum and with the EUT antennas connected via a short length of cable, with negligible loss at the fundamental frequency.

ENCLOSURE

The EUT enclosure is primarily constructed of cast aluminum. It measures approximately 18 cm wide by 10 cm deep by 4 cm high.

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:

Transmitter radiated and rf power port measurements

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	Latitiude D510	Laptop	Not serialized	DoC
-		AC-DC Adapter	-	-

Receiver radiated spurious and AC Conducted Emissions

Manufacturer	Model	Description	Serial Number	FCC ID
ACER	710TE	Laptop	9147A0132184900016M	DoC
IBM	ThinkPad (2371-87U)	Laptop	KV-41187	DoC
Protek	PUP55-13-HD	AC-DC adapter	336	N/A

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)
EUT ethernet	Laptop (Dell or IBM)	CAT 5	Unshielded	3.0
EUT serial	Laptop (Dell or ACER)		Shielded	3.0
AC-DC adapter AC	AC Mains	3 wire	Unshielded	1.5
DC	AC-DC adpater	2 wire	Unshielded	1.0

Note: The serial ports were not connected during testing. The manufacturer stated that these are for maintenance purposes and therefore would not normally be connected.

EUT OPERATION

During transmitter-related testing the EUT was transmitting continuously on the specified channel.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on March 23, March 24, July 14 and July 18, 2006at the Elliott Laboratories Open Area Test Site #1 & 2 located at 684 West Maude Avenue, Sunnyvale, California or 41039 Boyce Road, Fremont, 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. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak 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. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

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.

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 loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then 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. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4:2003 and RSS 212 specify 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.

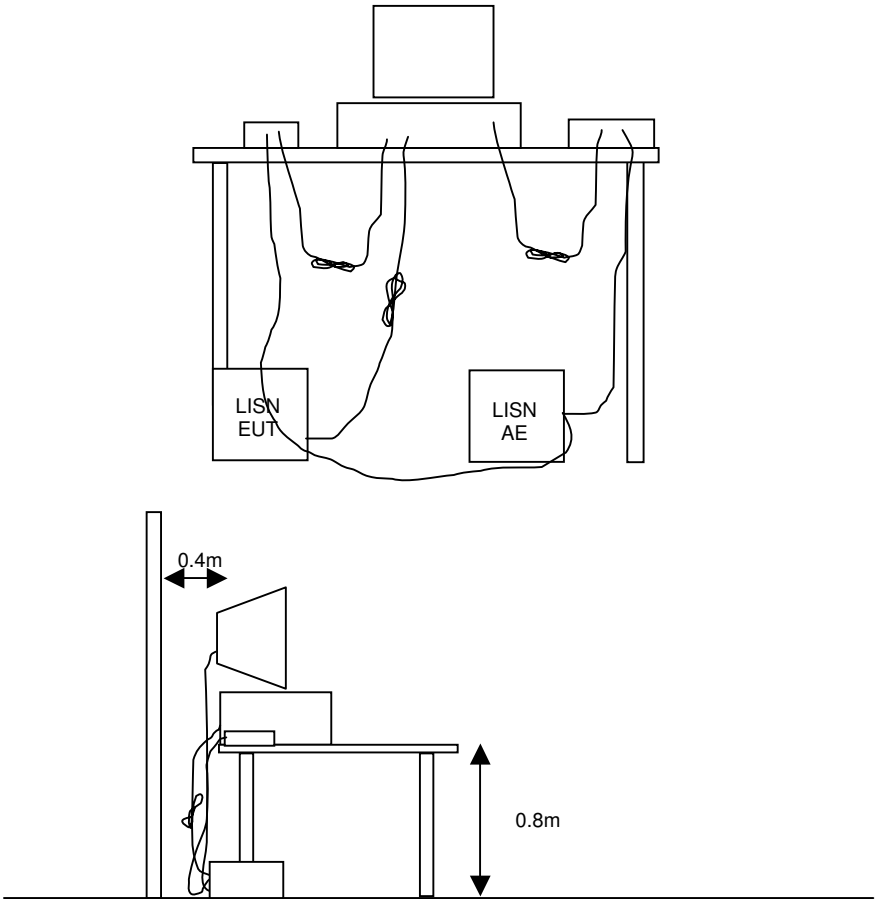
TEST PROCEDURES

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.

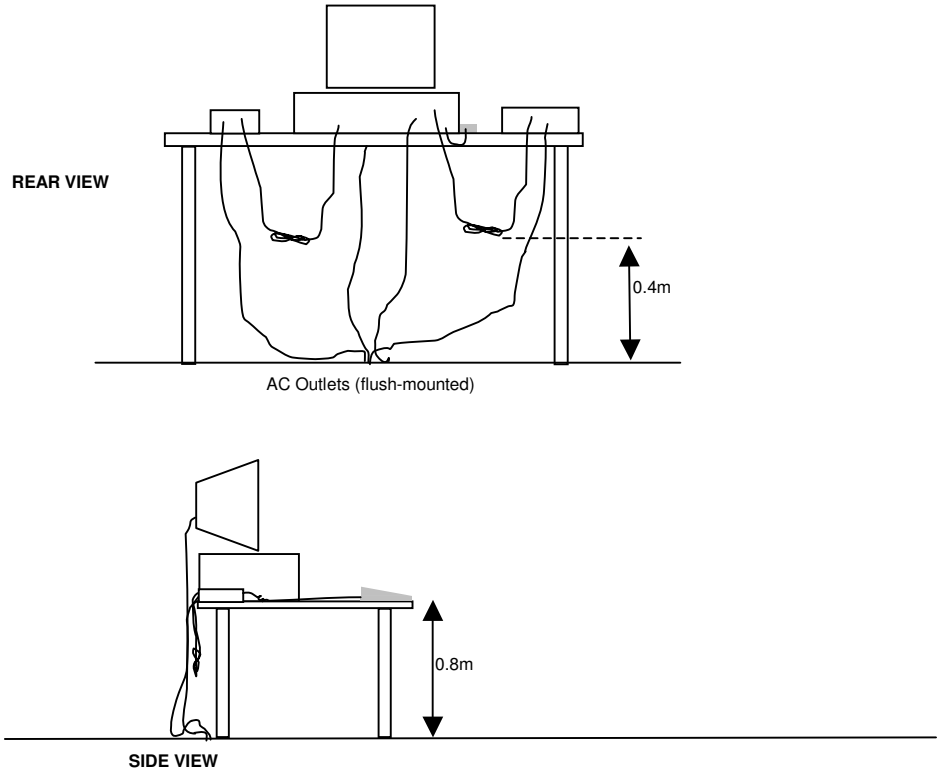


RADIATED EMISSIONS

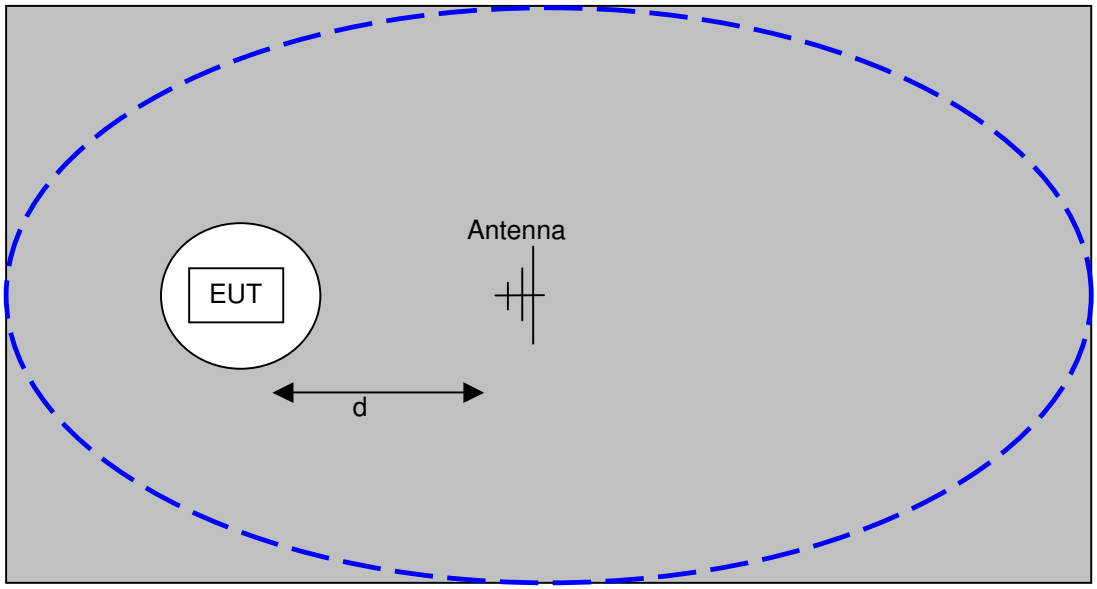
A preliminary scan of the radiated emissions is perfromed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

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.

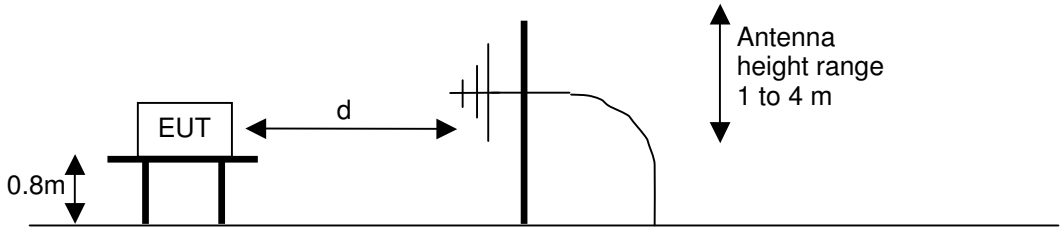
Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). 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.



Typical Test Configuration for Radiated Field Strength Measurements



The ground plane extends beyond the ellipse defined in CISPR 16 / CISPR 22 / ANSI C63.4 and is large enough to accommodate test distances (d) of 3m and 10m. Refer to the test data tables for the actual measurement distance.



Test Configuration for Radiated Field Strength Measurements
OATS- Plan and Side Views

BANDWIDTH MEASUREMENTS

The 6dB, 20dB and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in RSS GEN.

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; FCC 15.107(a), 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 TRANSMITTER 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 RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

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

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109, RSS 210 Table 2, RSS GEN Table 1 and RSS 310 Table 3. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
902 – 928	1 Watt (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3kHz
5725 – 5850	1 Watt (30 dBm)	8 dBm/3kHz

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

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

SAMPLE CALCULATIONS - RADIATED EMISSIONS

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, 1000 - 10,000 MHz, 24-Mar-06
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer 9KHz-26.5GHz, non programmable	8563E	284	22-Apr-06
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	13-Jan-07
EMCO	Horn antenna, D. Ridge 1-18GHz (SA40 system antenna)30Hz sunnyvale	3115	1142	11-Jun-06
Hewlett Packard	High Pass filter, 1.5GHz	P/N 84300-80037 (84125C)	1154	09-Jun-06

Preliminary Scans - Radiated Emissions (Receiver/Digital Device - Master Unit), 14-Jul-06
Engineer: Mark Briggs

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Log Periodic Antenna, 0.3-1 GHz	3146A	364	17-Nov-06
Hewlett Packard	EMC Spectrum Analyzer, 9 kHz - 6.5 GHz	8595EM	780	26-Aug-06
EMCO	Biconical Antenna, 30-300 MHz	3110B	801	03-Aug-06
Hewlett Packard	Microwave Preamplifier 0.5-26.5 GHz	83017A	1257	28-Sep-06
EMCO	Antenna, Horn, 1-18 GHz	3117	1662	07-Apr-07
Hewlett Packard	Preamplifier	8447D OPT 010	1826	02-May-07

EXHIBIT 2: Test Measurement Data

31 Pages

Elliott

EMC Test Data

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	Test-Log Number:	T63365
		Project Manager:	Esther Zhu
Contact:	Rich		
Emissions Spec:	FCC 15.247 / FCC 15 B	Class:	A
Immunity Spec:	N/A	Environment:	N/A

EMC Test Data

For The

Microwave Data Systems

Model

Mercury Project

Date of Last Test: 7/18/2006

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	Test-Log Number:	T63365
		Project Manager:	Esther Zhu
Contact:	Rich		
Emissions Spec:	FCC 15.247 / FCC 15 B	Class:	A
Immunity Spec:	N/A	Environment:	N/A

EUT INFORMATION

The following information was collected during the test sessions(s).

General Description

The EUT is a 900 MHz wireless transceiver for ethernet data networks. There are two versions of the radio, a base unit and a remote unit. The rf circuitry in both devices is identical. The digital device (modem) boards are the only difference between the two units. The master unit was tested for all radio-related emissions (preliminary radiated emissions scans on both master and remote units demonstrated that the transmitter- and receiver-related emissions from both devices were not significantly different). Digital device radiated and AC conducted emissions tests were performed on both units.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
MDS	Mercury 900-R	900 MHz TRx (Remote)	1234567	E5MDS-Mercury900
MDS	Mercury 900-AP	900 MHz TRx (Base)	none	E5MDS-Mercury900

EUT Antenna (Intentional Radiators Only)

The EUT is designed to use two different types of antenna - "omni-directional" (as in the MaxRad MFB915 series) and a log periodic. The highest gain antennas of these types are the Microwave Data Systems 97-3194A14(Antennex Y8966) Log-Periodic with a gain of 9dBd (11.2dBi) and the Maxrad MFB9157NF Omni directional with a gain of 7dBi. Radiated emissions measurements were made with each of the highest gain omni and log-periodic antennas.
The EUT requires professional installation and therefore is exempt from the requirement of 15.203. The output power is configured for each antenna to ensure the EIRP does not exceed 4 Watts, and the output power at the rf connector cannot exceed the maximum value reported in this test data. Radiated emissions were measured with the output power set to maximum and with the EUT antennas connected via a short length of cable, with negligible loss at the fundamental frequency.

EUT Enclosure

The EUT enclosure is primarily constructed of cast aluminum . It measures approximately 18 cm wide by 10 cm deep by 4 cm high.

Modification History

Mod. #	Test	Date	Modification
1	Radiated emissions -	6/14/2006	Digital board revised to rev 2 To reduce digital device emissions.
2	Radiated emissions -	6/14/2006	Firmware change to test software to reduce tx LO leakage
3			

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

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Project Manager:	Esther Zhu
Contact:	Rich		
Emissions Spec:	FCC 15.247 / FCC 15 B	Class:	A
Immunity Spec:	N/A	Environment:	N/A

Test Configuration #1

The following information was collected during the test sessions(s).

Local Support Equipment - Transmitter radiated and rf power port measurements

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	Latitiude D510	Laptop	Not serialized	DoC
-		AC-DC Adapter	-	-

Local Support Equipment - Receiver radiated spurious and AC Conducted Emissions

Manufacturer	Model	Description	Serial Number	FCC ID
ACER	710TE	Laptop	9147A0132184900016M	DoC
IBM	ThinkPad (2371-87U)	Laptop	KV-41187	DoC
Protek	PUP55-13-HD	AC-DC adapter	336	N/A

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)
EUT ethernet	Laptop (Dell or IBM)	CAT 5	Unshielded	3.0
EUT serial	Laptop (Dell or ACER)		Shielded	3.0
AC-DC adapter AC	AC Mains	3 wire	Unshielded	1.5
DC	AC-DC adpater	2 wire	Unshielded	1.0

Note: The serial ports were not connected during testing. The manufacturer stated that these are for maintenance purposes and therefore would not normally be connected.

EUT Operation - Receiver Radiated Spurious Emissions Tests

During emissions testing the EUT was excercised via pings on the Ethernet interface and was set in a receive mode on top/center and high channel.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Project Manager:	Esther Zhu
Contact:	Rich		
Emissions Spec:	FCC 15.247 / FCC 15 B	Class:	A
Immunity Spec:	N/A	Environment:	N/A

EUT Operation - AC Conducted Emissions Tests

During emissions testing the EUT was excercised via pings on the Ethernet interface and was set in a a continuous transmit mode on the center channel.

EUT Operation During Radio Tests

During transmitter-related testing the EUT was transmitting continuously on the specified channel.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	A

Receive-Mode 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: 7/14/2006
Test Engineer: Mark Briggs
Test Location: Chamber #2
Config. Used: #1
Config Change: -
EUT Voltage: 120V/60Hz (External AC-DC adapter)

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 applicable) 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.

Summary of Results

Run #	Test Performed	Limit	Result	Margin
2	RE, 30 - 3000MHz, Maximized Emissions	FCC 15.109 / RSS 210	Pass	45.3dBµV/m (184.1µV/m) @ 944.999MHz (-0.7dB)

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:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	A

Run #1: Preliminary Radiated Emissions, 30-3000 MHz - Receiver Spurious Emissions

Date of Test: 7/14/2006 Config. Used: #1
Test Engineer: Mark Briggs Config Change: None
Test Location: Chamber #2 EUT Voltage: 120V/60Hz (External AC-DC adapter)

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 1000 MHz	3	3	0.0
1000 - 3000 MHz	1	3	-9.5

Frequency	Level	Pol	FCC 15.109/RSS210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
958.982	39.3	V	46.0	-6.7	Peak	178	1.7	EUT at 915 MHz
944.999	39.1	V	46.0	-6.9	Peak	177	1.7	EUT at 904 MHz
967.994	39.7	V	54.0	-14.3	Peak	192	1.7	EUT at 926 MHz

Note 1:	Tested with Yagi antenna connected.
Note 2:	All receiver-related emissions above 1GHz were 20dB or more below the limit.

Run #2: Maximized Readings From Run #1

Date of Test: 7/18/2006 Config. Used: #1
Test Engineer: Rafael Varelas Config Change: None
Test Location: SVOATS #2 EUT Voltage: 120V/60Hz (External AC-DC adapter)
Temperature: 32 °C
Rel. Humidity: 36 %

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 3000 MHz	3	3	0.0

Yagi Antenna

Frequency	Level	Pol	FCC 15.109/RSS210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
944.999	45.3	V	46.0	-0.7	QP	360	1.2	EUT at 904 MHz
958.982	42.0	V	46.0	-4.0	QP	345	1.0	EUT at 915 MHz
944.999	36.2	H	46.0	-9.8	QP	325	2.3	EUT at 904 MHz
969.994	43.8	V	54.0	-10.2	QP	353	1.0	EUT at 926 MHz
958.982	32.4	H	46.0	-13.6	QP	332	1.2	EUT at 915 MHz
969.994	34.3	H	54.0	-19.7	QP	345	1.2	EUT at 926 MHz

6dBd Omni Antenna

Frequency	Level	Pol	FCC 15.109/RSS210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
944.999	39.0	V	46.0	-7.0	QP	330	2.1	EUT at 904 MHz
958.982	38.0	V	46.0	-8.0	QP	280	1.9	EUT at 915 MHz
969.994	36.4	V	54.0	-17.6	QP	320	2.1	EUT at 926 MHz

Note 1:	For measurements with the measurement antenna vertical the EUT antenna was vertical. For measurements with the measurement antenna horizontal the Yagi antenna was horizontal (Omni antenna remained verical).

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

FCC 15.247 DTS - Power, Bandwidth and Spurious 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: See Individual Run
Test Engineer: See Individual Run
Test Location: See Individual Run

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 spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	Antenna Port Conducted Emissions	15.247(a)	Pass	Out of band all more than -30dBc
2a	6dB Bandwidth	15.247(a)	Pass	3.133 MHz
2b	99% bandwidth	RSS GEN	N/A	3.494 MHz
3	Output Power (Max)	15.247(b)	Pass	29.1 dBm
3	Output Power (Min)	15.247(b)	Pass	29.1 dBm
4	Power Spectral Density (PSD)	15.247(d)	Pass	2.5dBm/3kHz

Modifications Made During Testing:

Modifications are detailed under each run description.

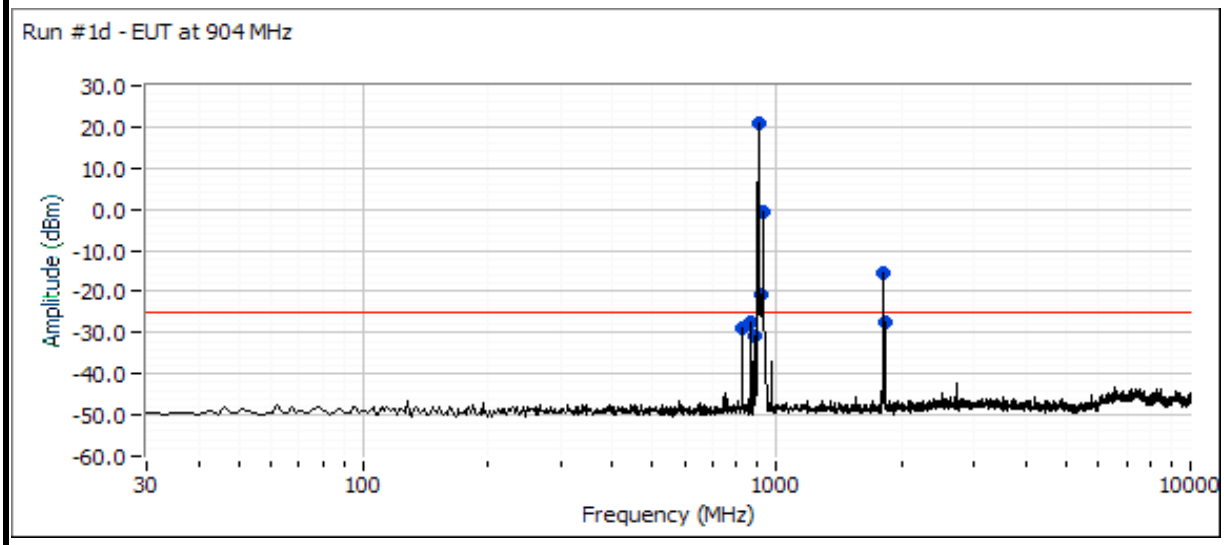
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Run #1: Antenna Conducted Spurious Emissions, 30 - 10,000 MHz.
Scans made using RBW=VB=100 KHz. The limit line in the plot is not the FCC limit and should be ignored. The limit line was set 30dB below the highest in-band signal level, based on the use of power averaging for the power measurements.

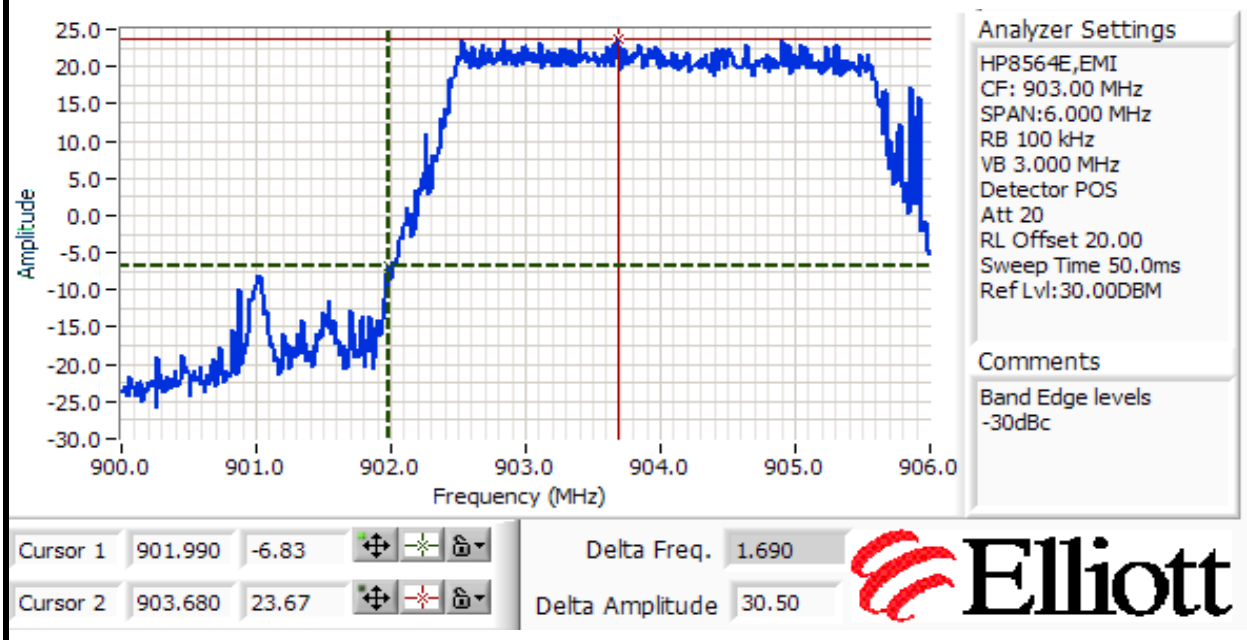
Run #1a: Antenna Conducted Spurious Emissions, 30 - 10,000 MHz, EUT at 904 MHz

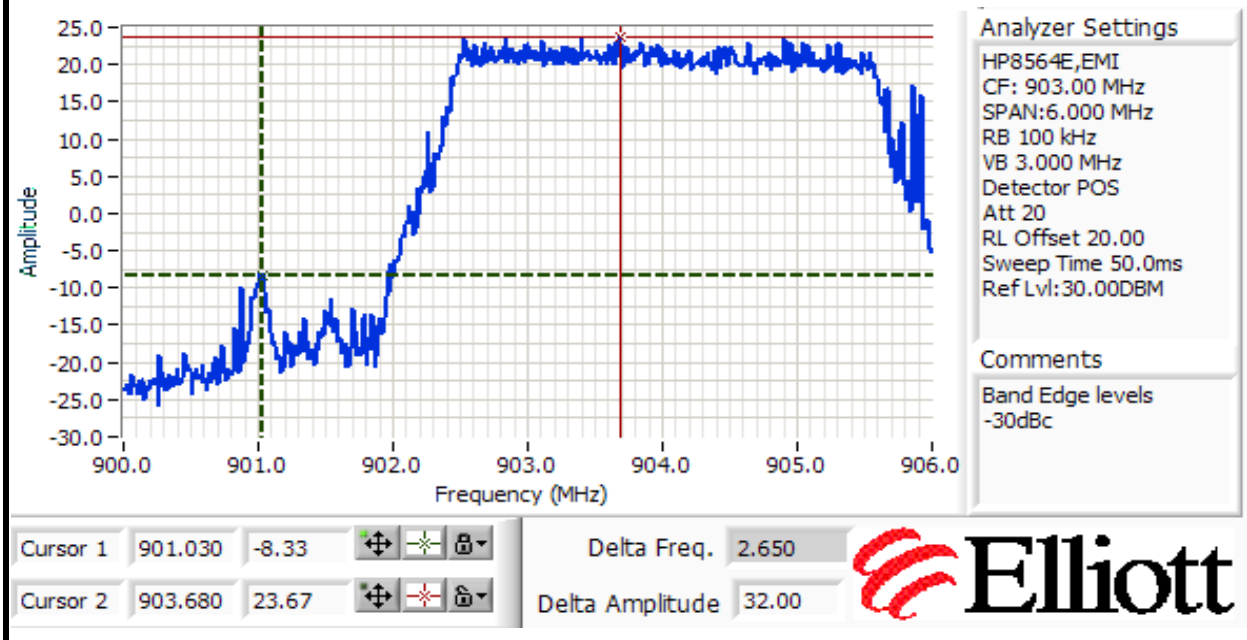


Frequency MHz	Level dBm	Port	FCC 15.247/RSS 210 Limit	FCC 15.247/RSS 210 Margin	Detector Pk/QP/Avg	Comments
901.990	-6.8	RF Port	-6.3	**-0.5**	Peak	See plot on next page.
901.030	-8.3	RF Port	-6.3	**-2.0**	Peak	See plot on next page.
928.000	-22.0	RF Port	-6.3	-15.7	Peak	See plot on next page.
1808.259	-15.5	RF Port	-6.3	-9.2	Peak	Not in restricted band
914.833	-20.7	RF Port	-6.3	-14.4	Peak	Not in restricted band
864.867	-27.3	RF Port	-6.3	-21.0	Peak	Not in restricted band
1829.667	-27.7	RF Port	-6.3	-21.4	Peak	Not in restricted band
825.661	-28.8	RF Port	-6.3	-22.5	Peak	Not in restricted band
881.857	-31.0	RF Port	-6.3	-24.7	Peak	Not in restricted band
904.011	23.7	RF Port	-	-	Peak	Fundamental, see plot on next page
925.719	-0.5	RF Port	-	-	Peak	Signal falls in allocated band (902 - 928 MHz)

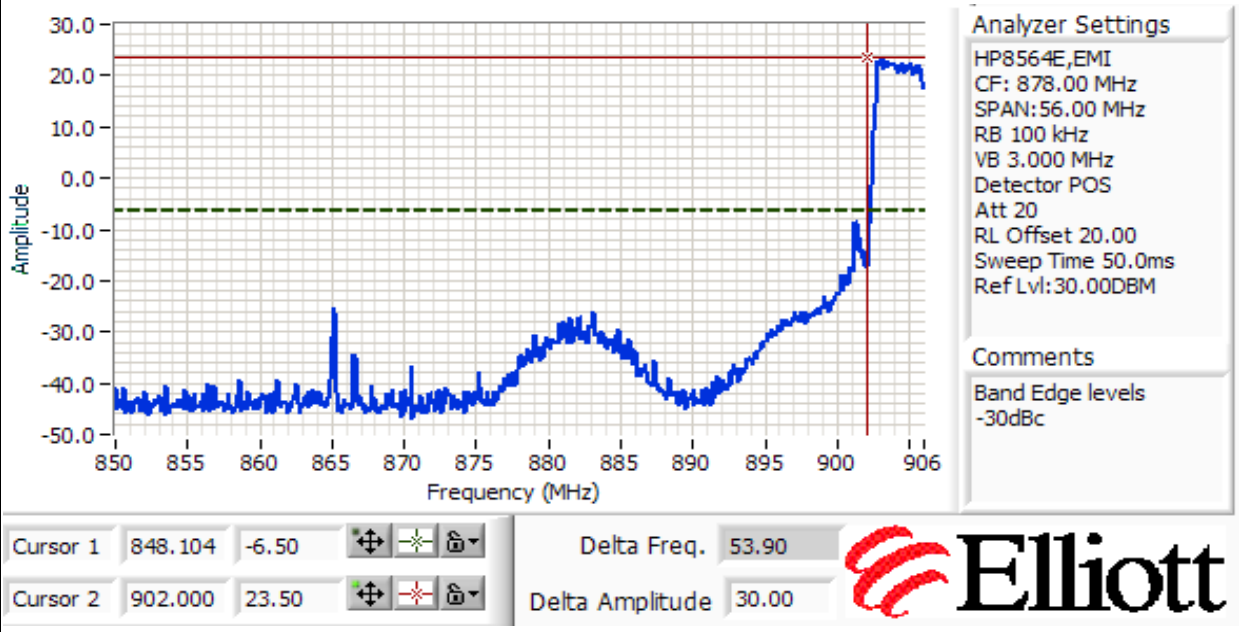
Note 1:	The limit was set 30dB below the level of the fundamental.

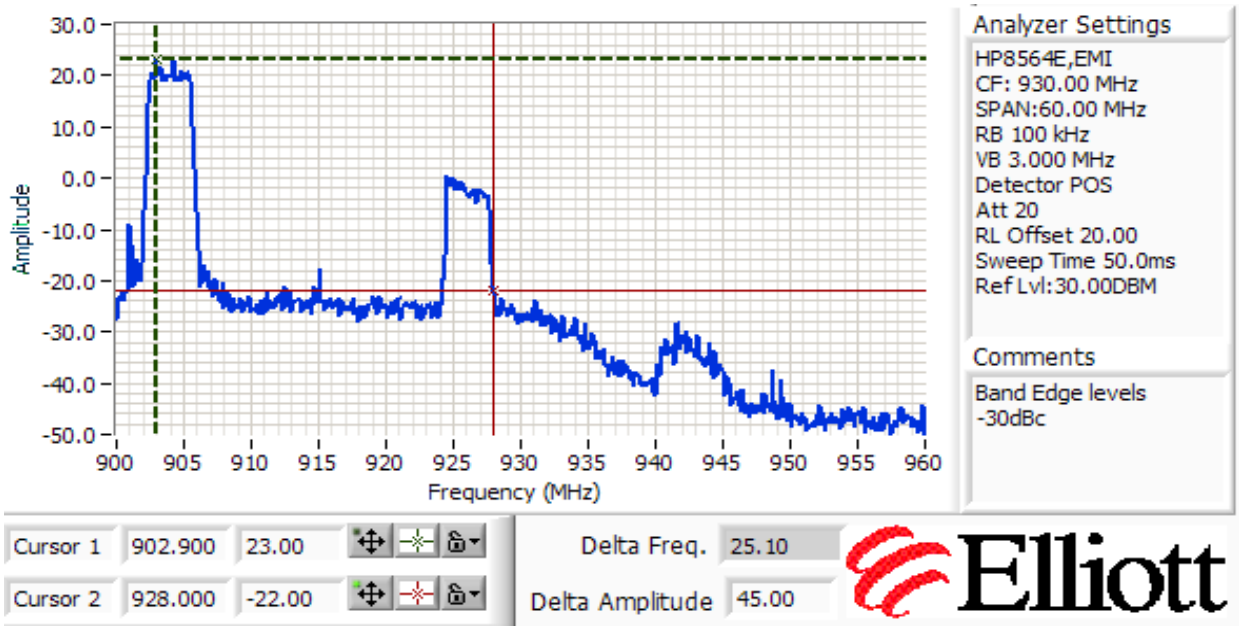
Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A





Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

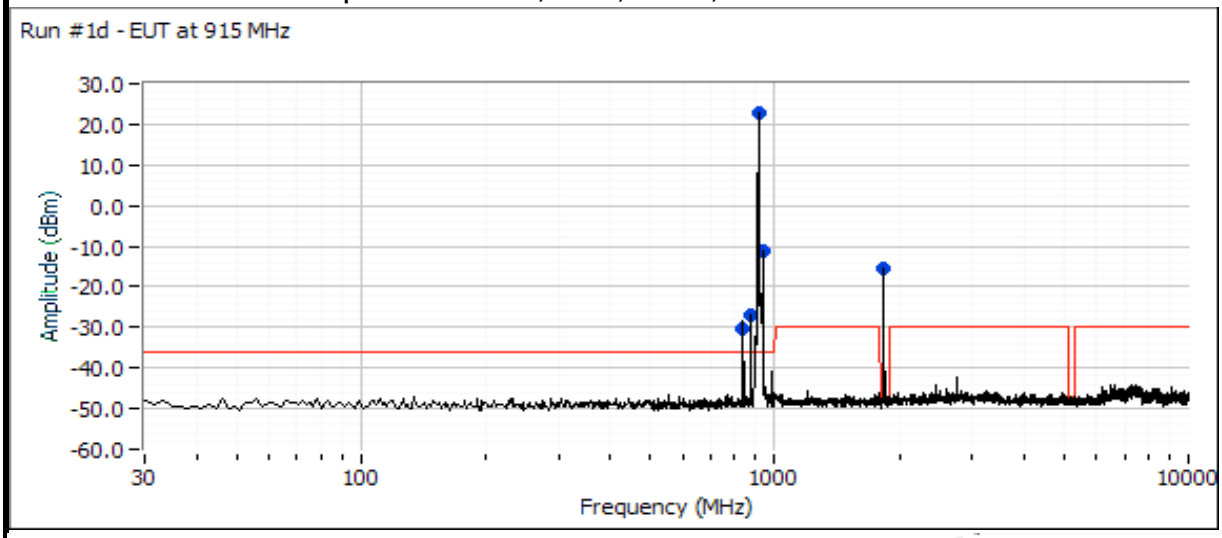


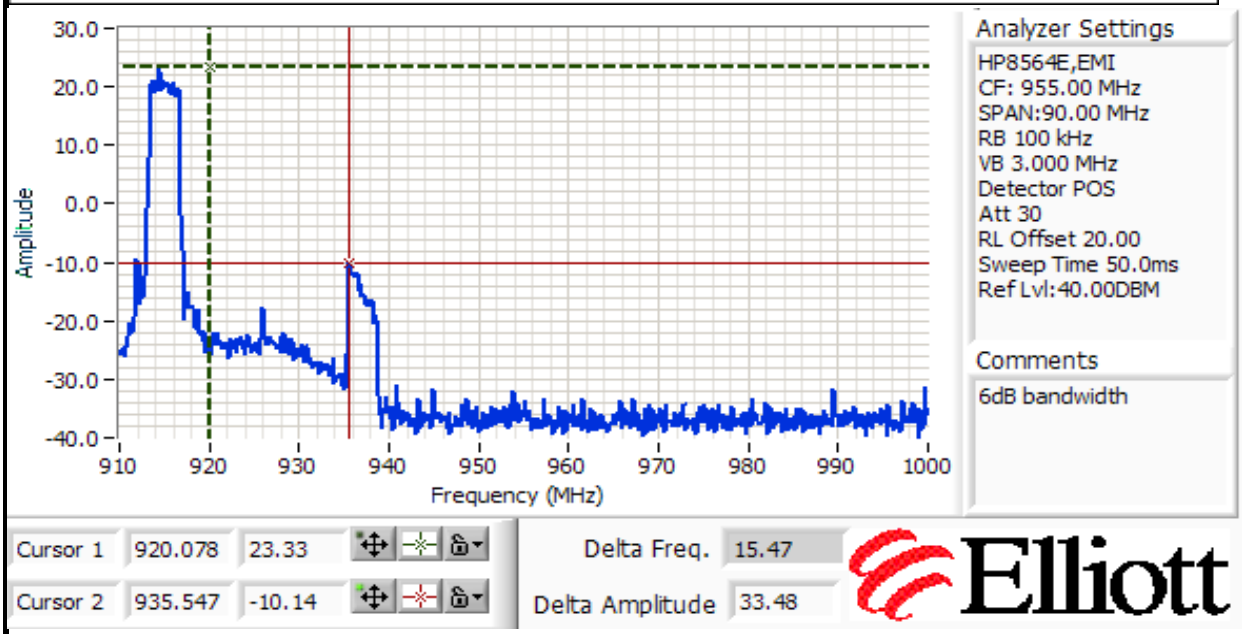


EMC Test Data

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Run #1b: Antenna Conducted Spurious Emissions, 30 - 10,000 MHz, EUT at 915 MHz





Elliott

EMC Test Data

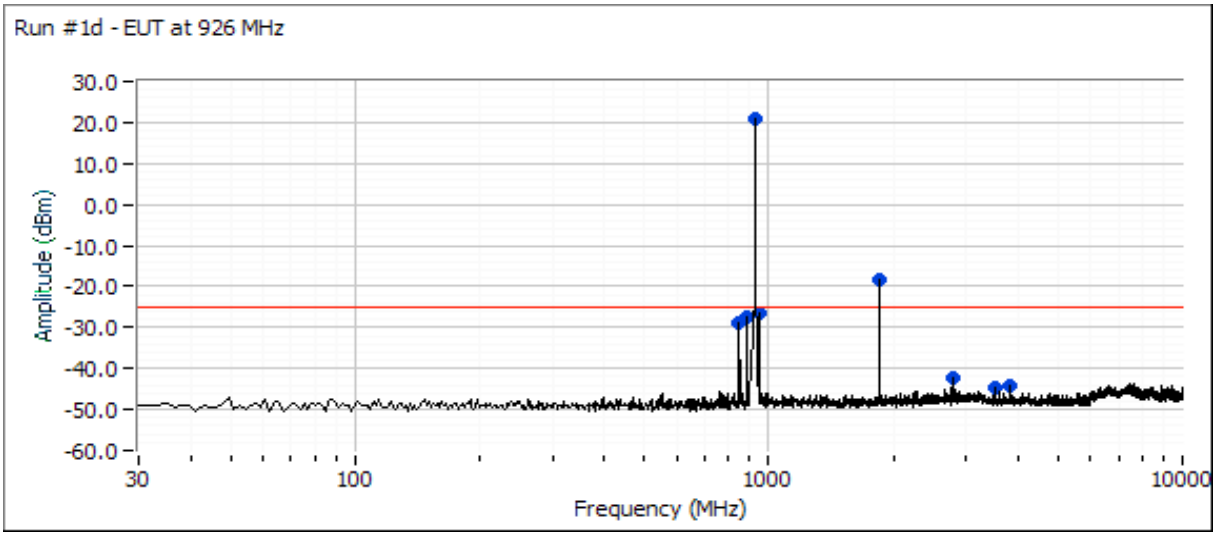
Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Frequency	Level	Port	FCC 15.247/RSS 210		Detector	Comments
MHz	dBm		Limit	Margin	Pk/QP/Avg	
915.000	23.3	RF Port	-	-	Peak	Fundamental
935.547	-10.1	RF Port	-6.7	-3.4	Peak	Not in restricted band
935.634	-11.2	RF Port	-6.7	-4.5	Peak	Not in restricted band
1830.000	-15.3	RF Port	-6.7	-8.6	Peak	Not in restricted band
875.861	-27.0	RF Port	-6.7	-20.3	Peak	Not in restricted band
837.833	-30.2	RF Port	-6.7	-23.5	Peak	Not in restricted band

Note 1: The limit was set 30dB below the level of the fundamental.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

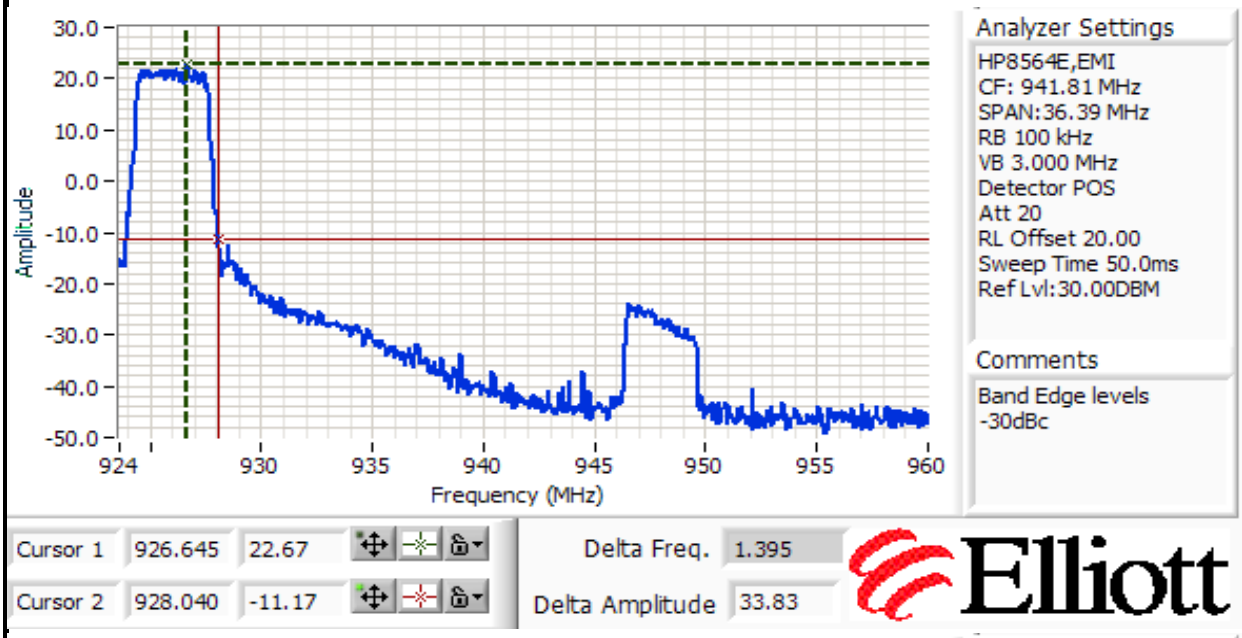
Run #1c: Antenna Conducted Spurious Emissions, 30 - 10,000 MHz, EUT at 926 MHz

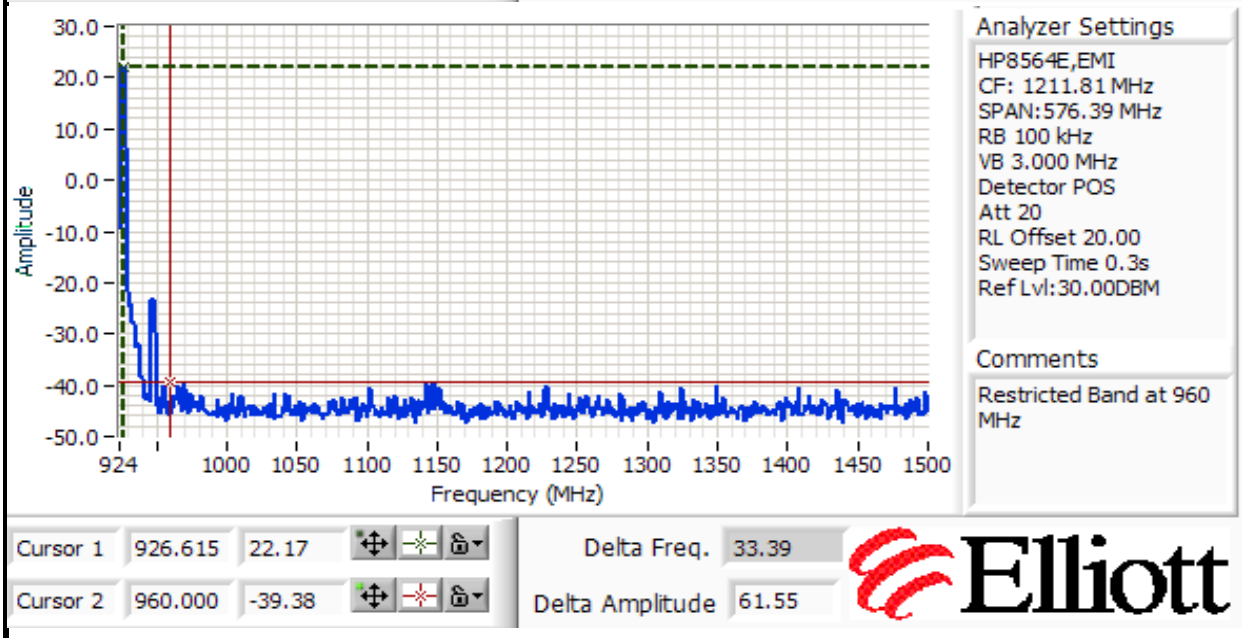


Frequency MHz	Level dBm	Port	FCC 15.247/RSS 210 Limit	Margin	Detector Pk/QP/Avg	Comments
928.040	-11.2	RF Port	-7.3	-3.9	Peak	
849.349	-29.0	RF Port	-7.3	-21.7	Peak	Not in restricted band
886.858	-27.3	RF Port	-7.3	-20.0	Peak	Not in restricted band
926.000	22.7	RF Port	-7.3	-	Peak	Fundamental
946.564	-26.5	RF Port	-7.3	-19.2	Peak	Not in restricted band
1852.465	-18.5	RF Port	-7.3	-11.2	Peak	Not in restricted band
2777.512	-42.5	RF Port	-7.3	-35.2	Peak	In A restricted Band

Note 1:	The limit was set 30dB below the level of the fundamental.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

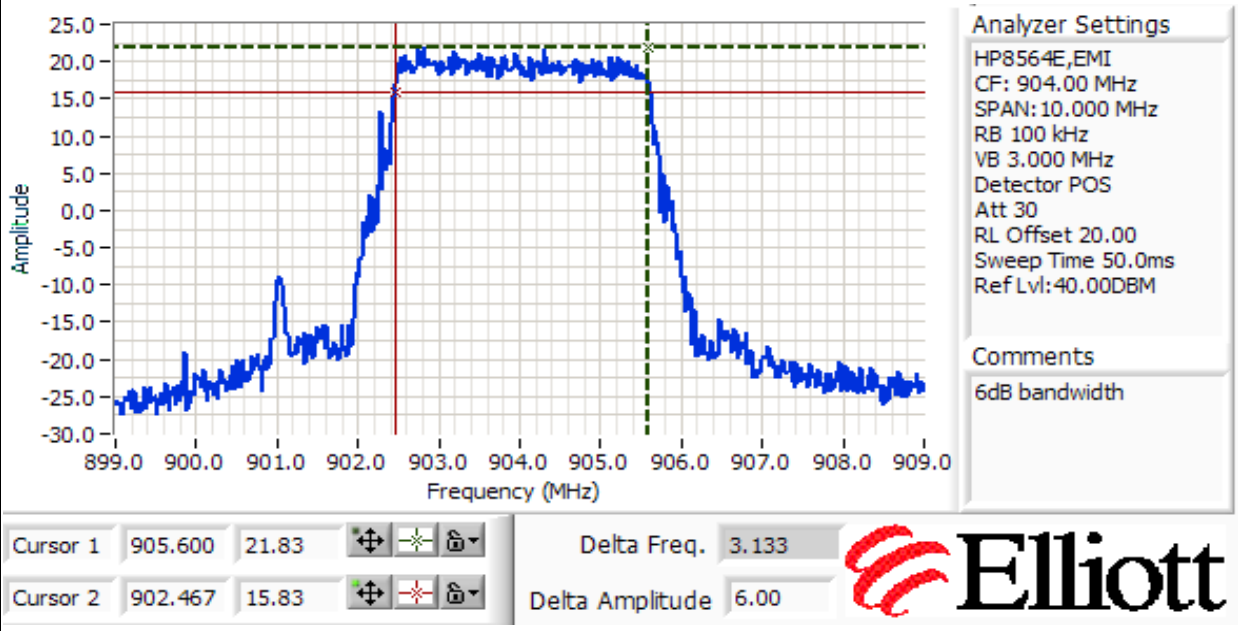




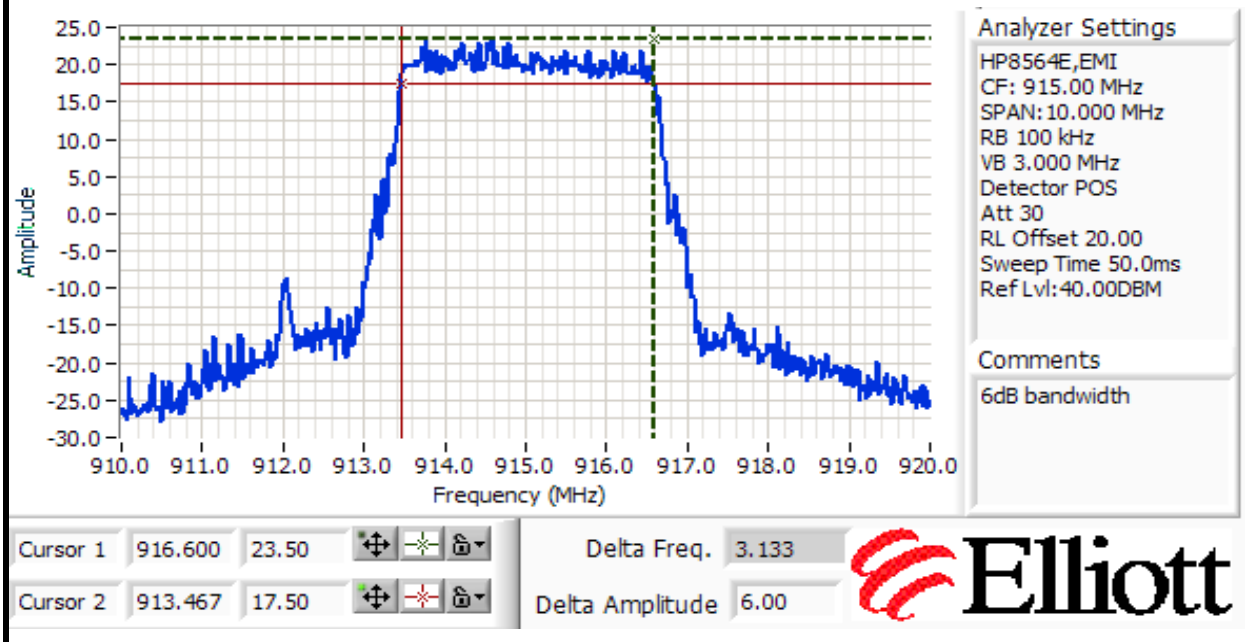
Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

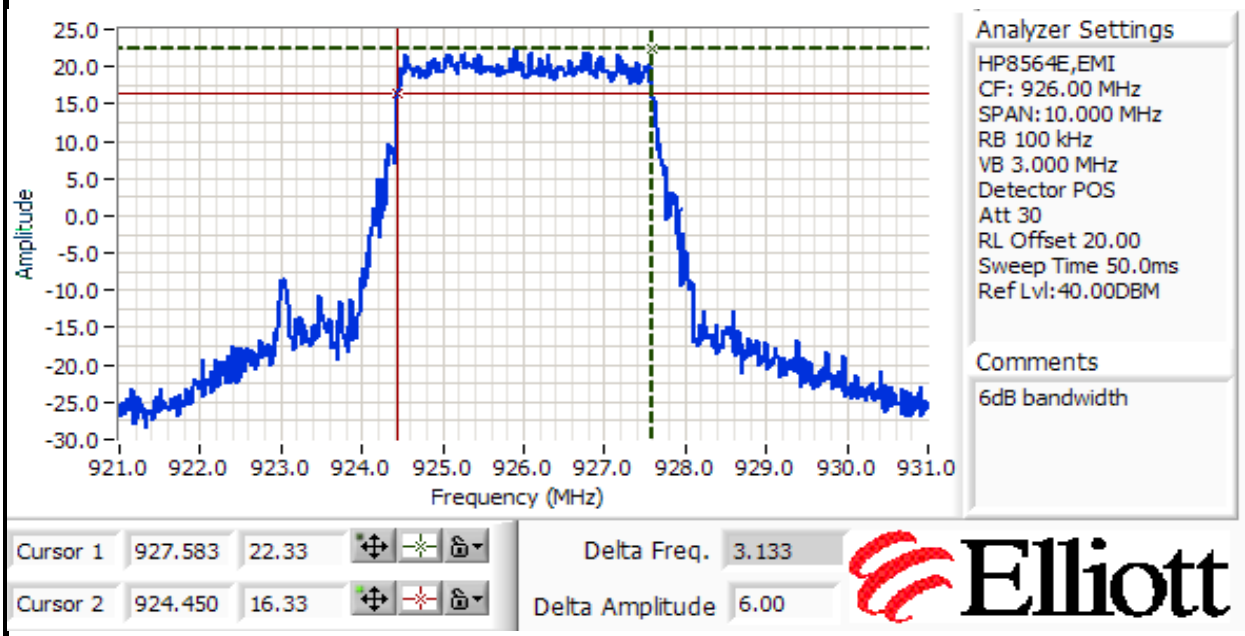
Run #2: Signal Bandwidth
Run #2a: 6dB Bandwidth

Frequency (MHz)	Resolution Bandwidth	6dB Signal Bandwidth
904	100kHz	3.133 MHz
915	100kHz	3.133 MHz
926	100kHz	3.133 MHz



Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

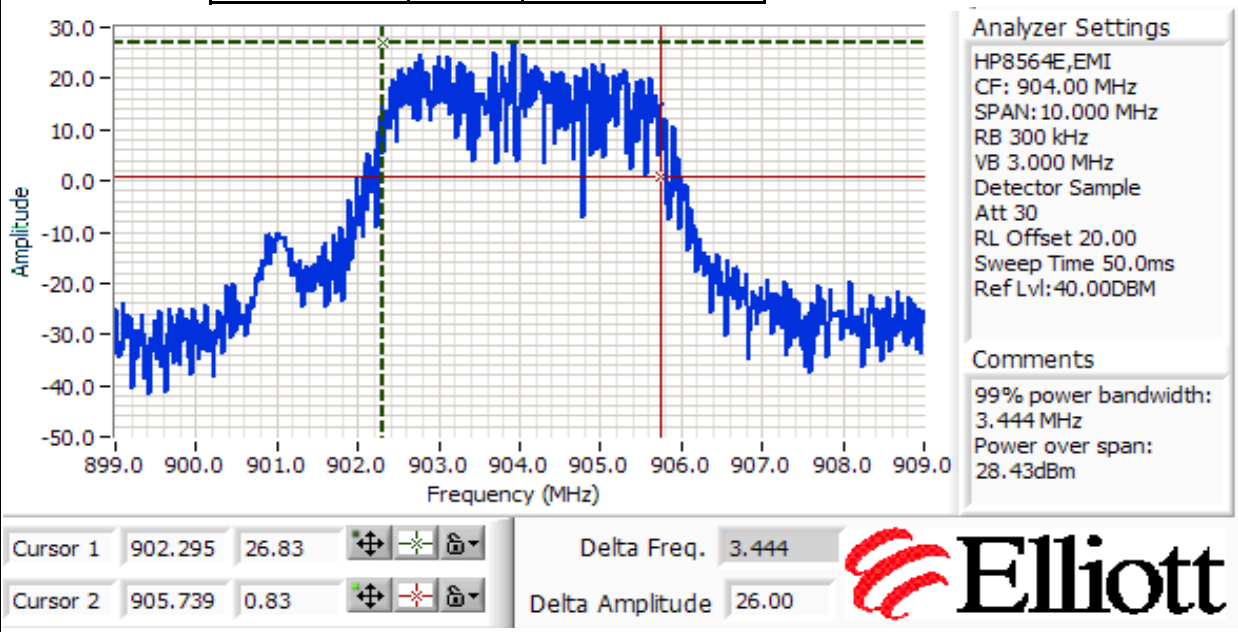




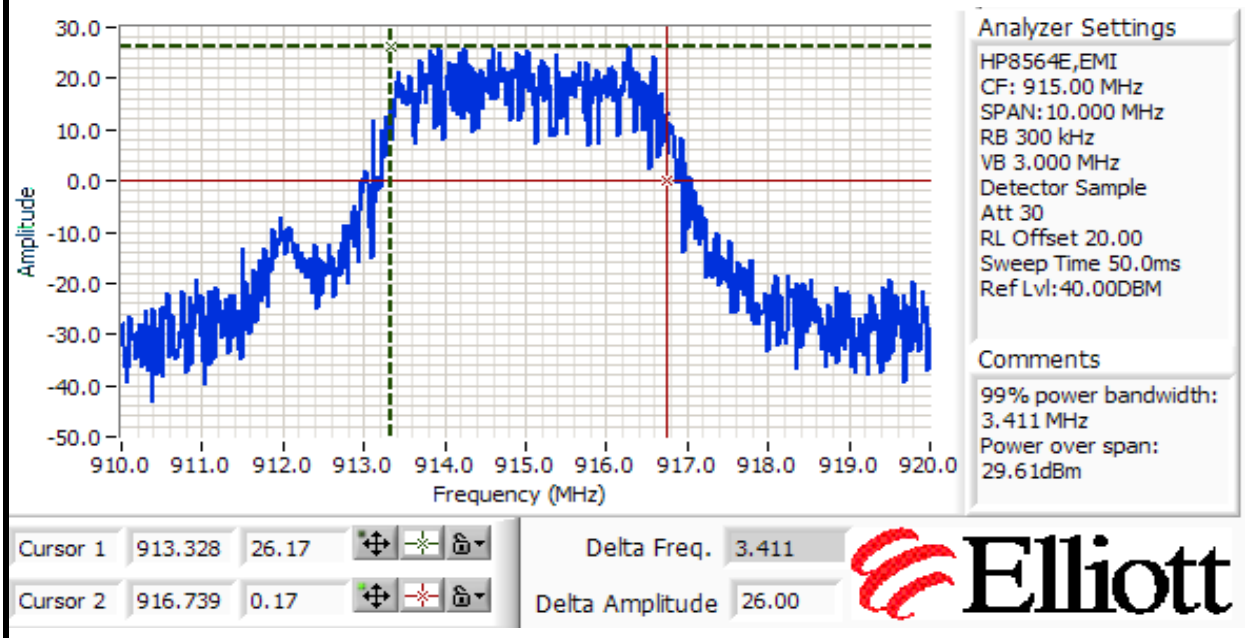
Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

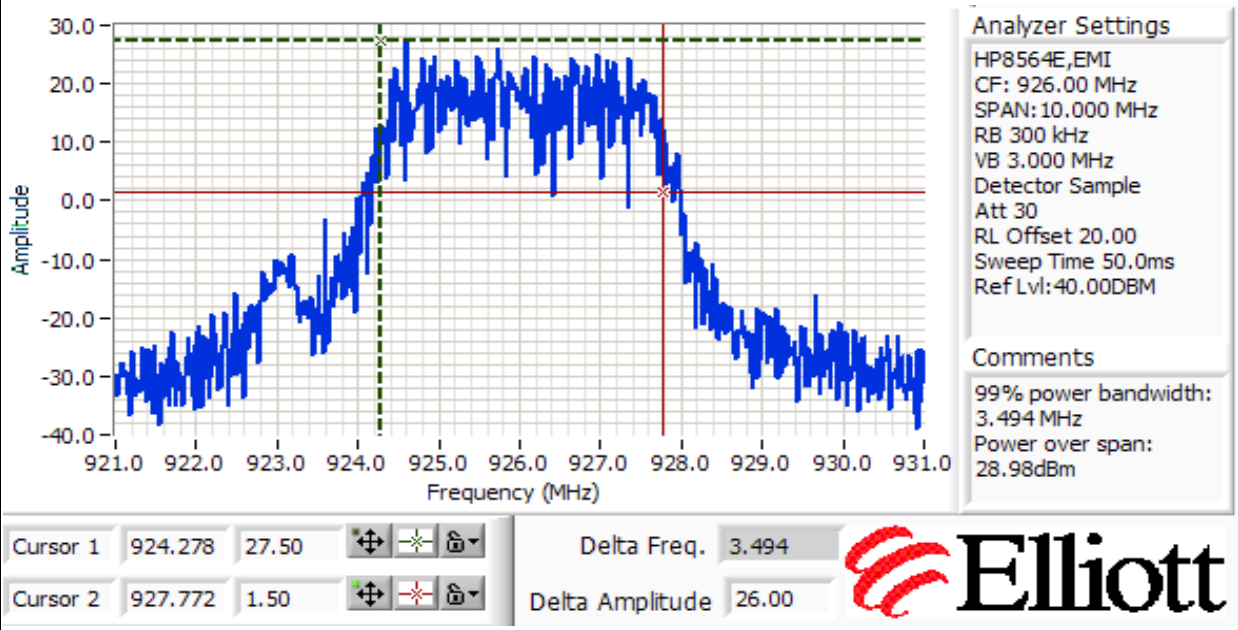
Run #2b: 99% Bandwidth

Frequency (MHz)	Resolution Bandwidth	99% Signal Bandwidth
904	300kHz	3.444 MHz
915	300kHz	3.411 MHz
926	300kHz	3.494 MHz



Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A





Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Run #3: Output Power

The output power is set by the professional installer to ensure the EIRP does not exceed 4 Watts, based on the effective gain of the antenna assembly (antenna + feed cable). The maximum output power at the rf connector is shown in the first table.

Output Power Confiugred for Maximum

Date of Test: 3/23/2006
Test Engineer: Mark Briggs
Test Location: SV Lab

Maximum antenna gain: 7 dBi

Frequency (MHz)	Res BW MHz	Output Power Note 1 dBm	Output Power Note 1 W	EIRP W	Average Power Note 2 dBm	Average Power Note 2 W
904	1	27.9	0.617	3.090		
915	1	29.1	0.813	4.074		
926	1	28.4	0.692	3.467		

Note:	Per User manual the lower cable loss to use with the system is .08 dB. Using this for 915 MHz will bring the power below the 4 Watts EIRP. 29.1 - .08 = 29.0 dBm + 7 dBi = 36.02 dBm = 3.994 Watts EIRP

Output Power Confiugred for Highest Gain Antenna (11.2dBi, assuming negligible feed cable loss))

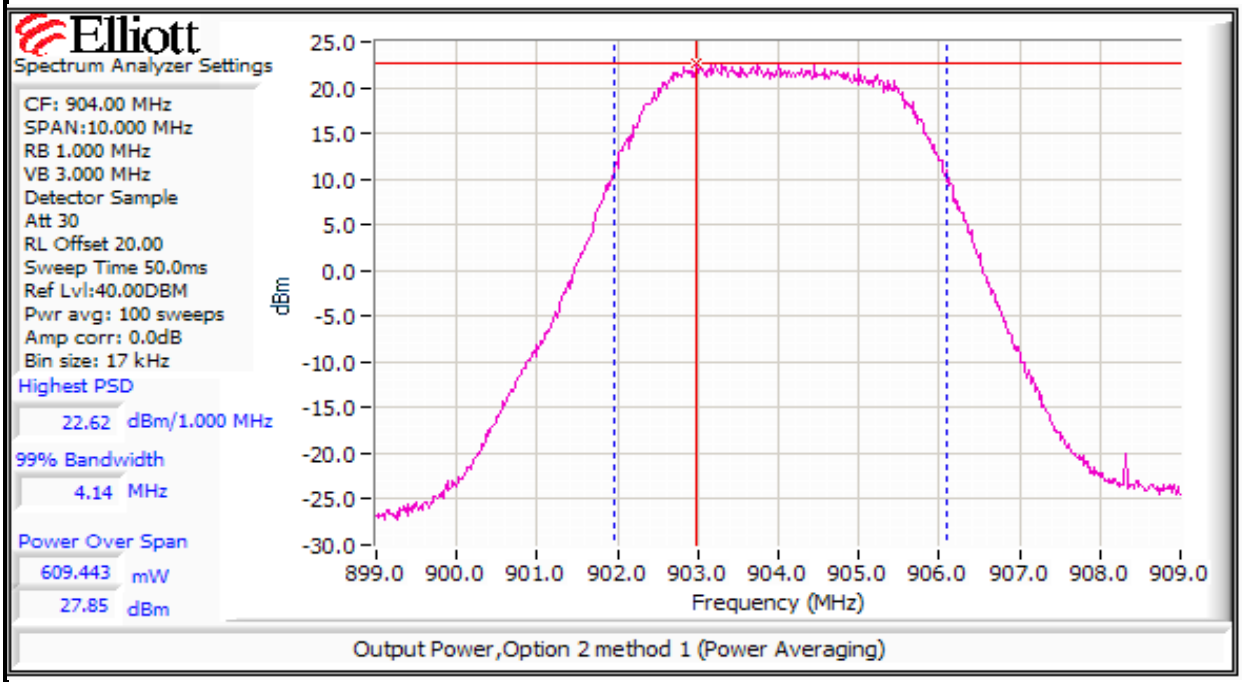
Date of Test: 7/18/2006
Test Engineer: Mark Briggs
Test Location: SV #2

Maximum antenna gain: 11.2 dBi (9dBd)

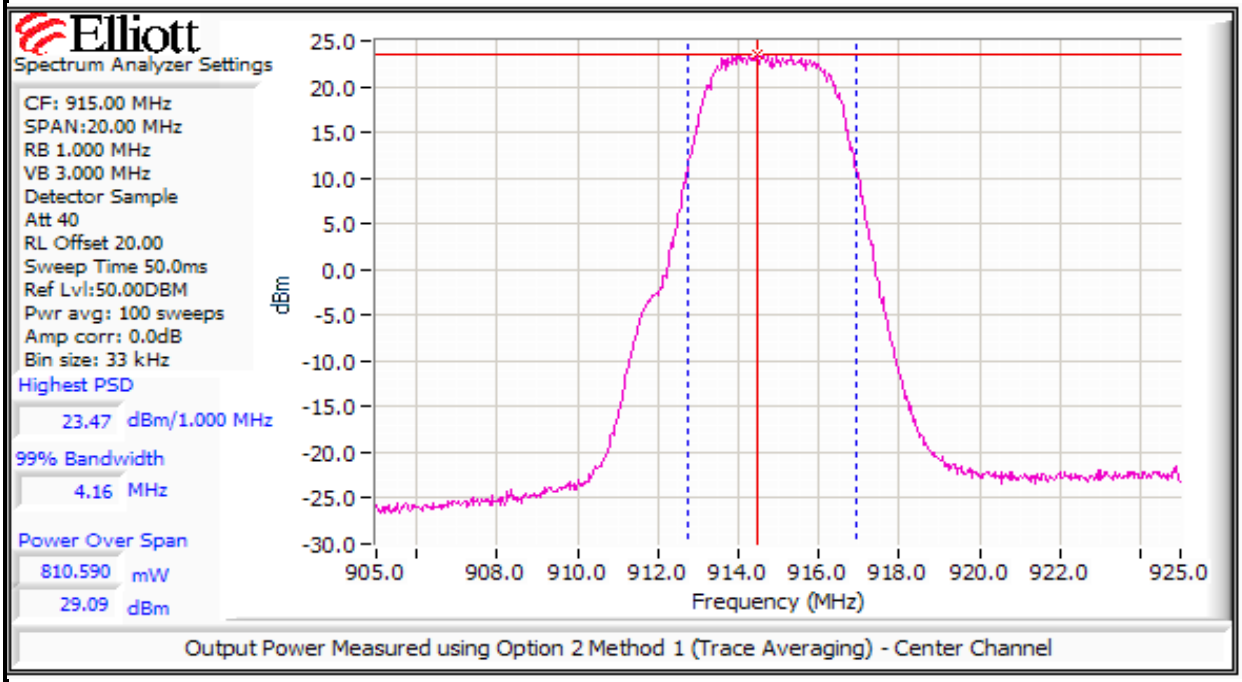
Frequency (MHz)	Res BW MHz	Output Power Note 1 dBm	Output Power Note 1 W	EIRP W	Average Power Note 2 dBm	Average Power Note 2 W
904	1	24.5	0.282	3.715		
915	1	24.6	0.288	3.802		
926	1	24.7	0.295	3.890		

Note 1:	Output power measured using Option2, Method 1 - spectrum analyzer with: RBW=1MHz, VB=3 MHz, sample detector, power averaging on and power integration over 10 MHz
Note 2:	Plots are provided for measurements at the highest output power setting.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

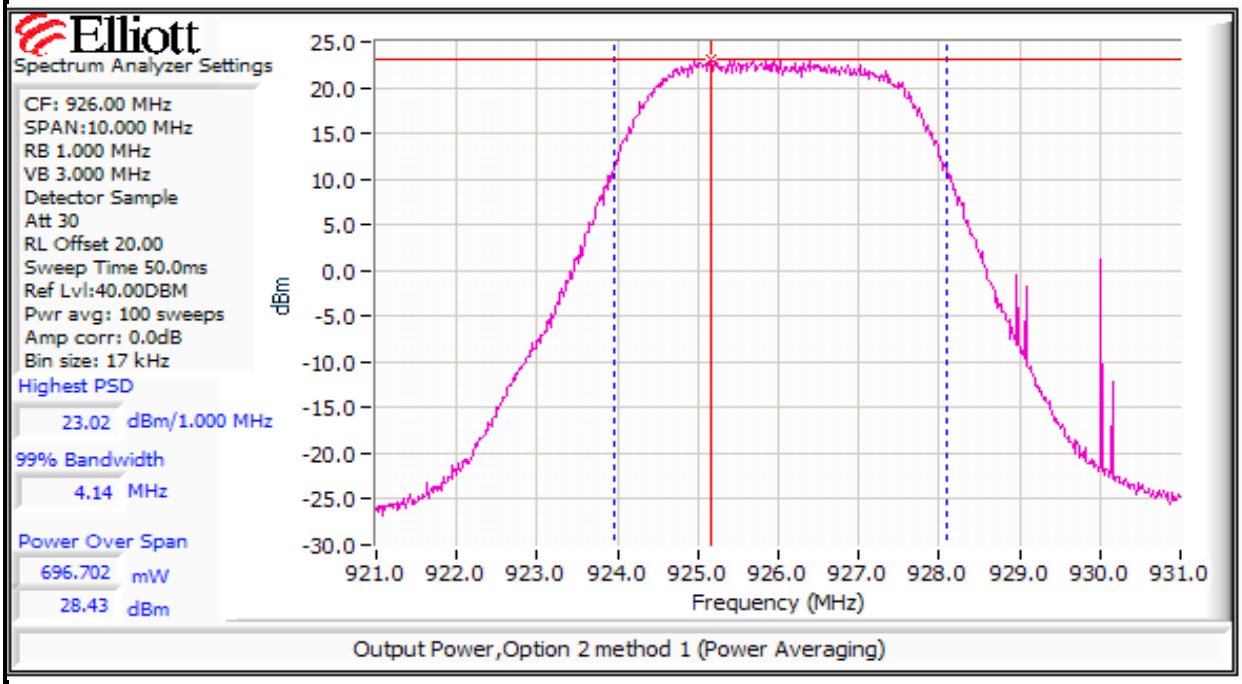


Output Power,Option 2 method 1 (Power Averaging)



Output Power Measured using Option 2 Method 1 (Trace Averaging) - Center Channel

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A



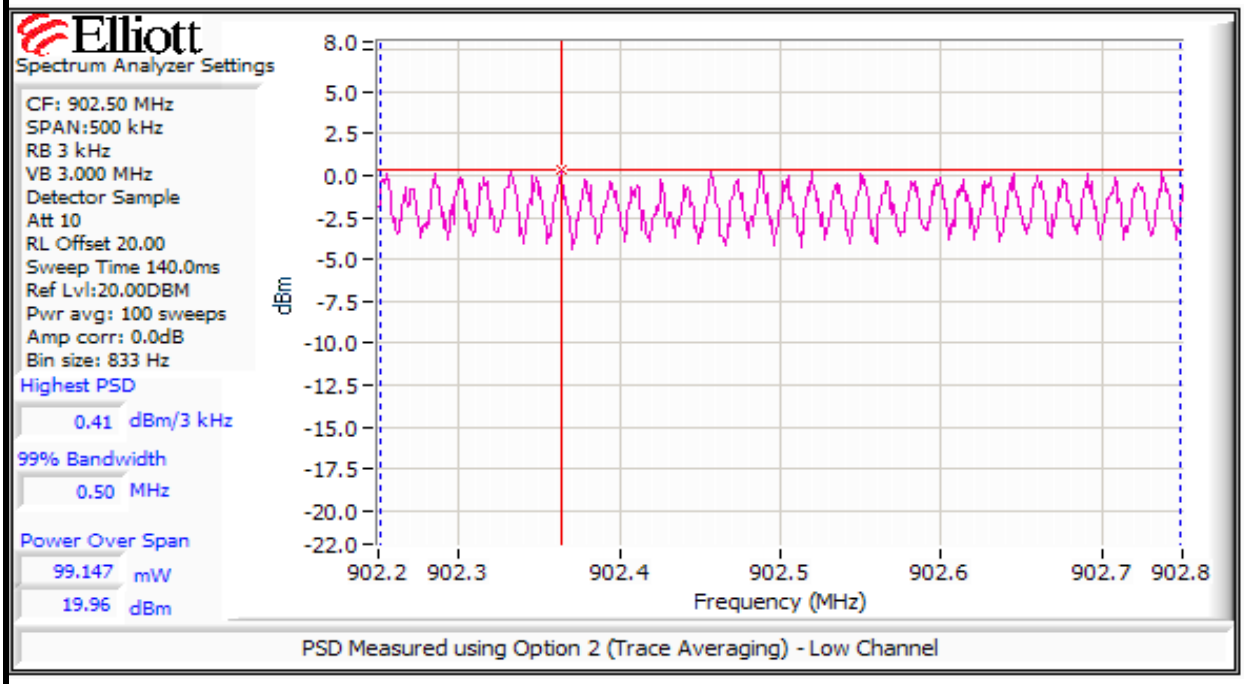
Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Run #6: Power Spectral Density

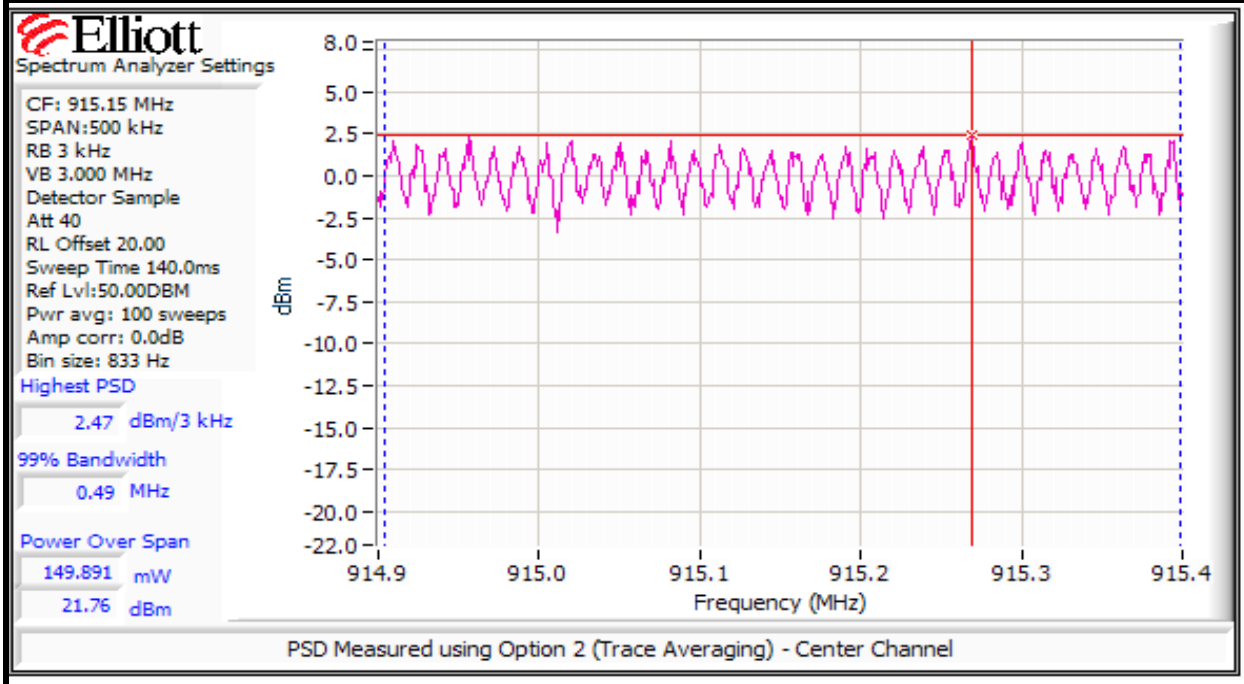
Measured at the highest output power setting

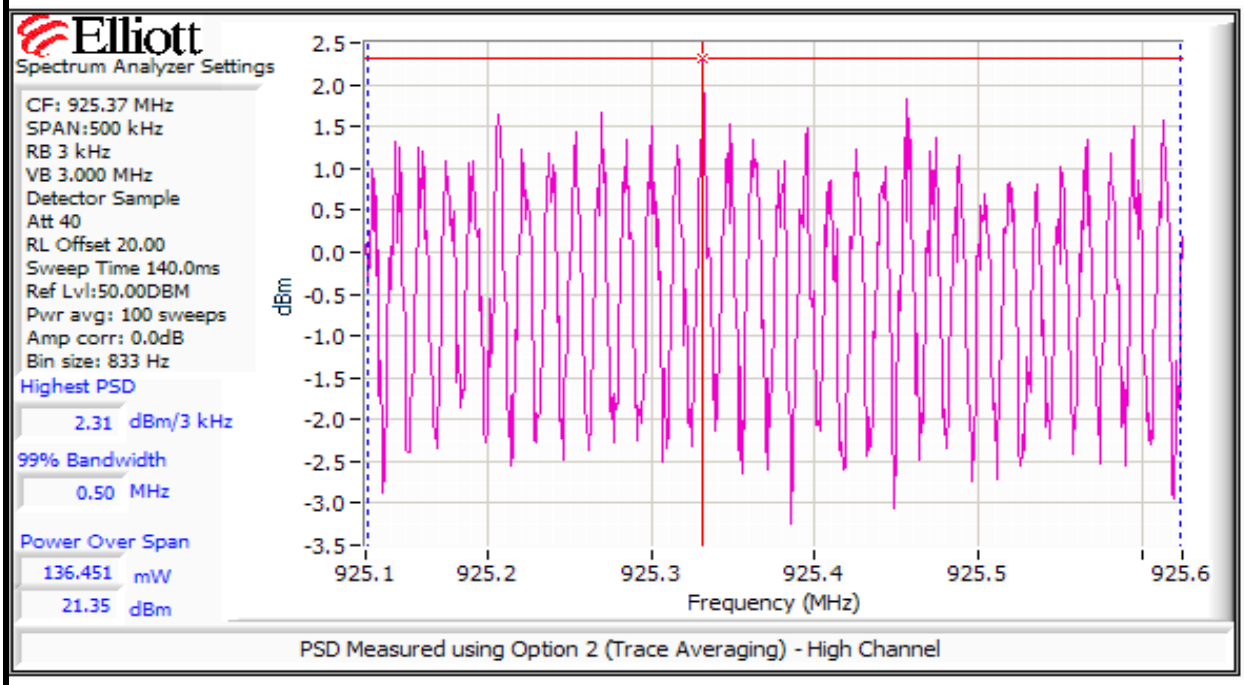
Operating Frequency (MHz)	Freq. @ PPSD	Res BW	P.S.D. (dBm/3kHz)
904	902.36	3kHz	0.4
915	915.27	3kHz	2.5
926	925.3	3kHz	2.3

Note 1:	Freq. @ PPSD: Frequency of the Peak Power Spectral Density (PPSD)
Note 2:	Power spectral density measured using RB=3 kHz, VB=3MHz and power averaging (100 sweeps). The span of the analyzer was 500kHz with 601 points, giving a "bin width" of 0.8 kHz. The bin width was less than 0.5 x RB.



Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A





Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

FCC 15.247 DTS - Transmitter Radiated Spurious Emissions 7dBi 'Omni-Directional' Antenna

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: 3/24/2006
Test Engineer: Chris Byleckie
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 spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1a-c	Radiated Spurious Emissions, 30MHz - 10GHz	FCC Part 15.209 / 15.247(c)	Pass	41.9dBµV/m (123.7µV/m) @ 4569.4MHz (-12.2dB)

Modifications Made During Testing:

Modifications are detailed under each run description.

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Run #1: Radiated Spurious Emissions, 30MHz - 10GHz
Run #1a: Radiated Spurious Emissions, 1000 - 10000MHz. Low Channel @ 904 MHz
Maxrad Omni Tx antenna
Max. Pout
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4518.770	41.6	H	54.0	-12.4	AVG	0	1.0	
4518.500	41.6	V	54.0	-12.4	AVG	0	1.0	
3616.135	39.0	H	54.0	-15.0	AVG	0	1.0	
3616.038	39.0	V	54.0	-15.0	AVG	0	1.0	
2711.700	35.3	H	54.0	-18.7	AVG	360	1.0	
2713.035	35.2	V	54.0	-18.8	AVG	0	1.0	
4518.500	53.4	V	74.0	-20.6	PK	0	1.0	
4518.770	52.4	H	74.0	-21.6	PK	0	1.0	
3616.135	50.1	H	74.0	-24.0	PK	0	1.0	
3616.038	49.5	V	74.0	-24.5	PK	0	1.0	
2711.700	46.9	H	74.0	-27.1	PK	360	1.0	
2713.035	45.7	V	74.0	-28.3	PK	0	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental.

Run #1b: Radiated Spurious Emissions, 1000 - 10000 MHz. Center Channel @ 915 MHz
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4569.350	41.9	V	54.0	-12.2	AVG	0	1.0	
4574.798	41.8	H	54.0	-12.2	AVG	360	1.0	
2744.835	61.2	V	74.0	-12.8	PK	360	1.0	
3659.265	38.7	V	54.0	-15.3	AVG	360	1.0	
3660.968	38.7	H	54.0	-15.4	AVG	360	1.0	
2744.835	35.3	V	54.0	-18.7	AVG	360	1.0	
2744.760	35.2	H	54.0	-18.8	AVG	360	1.0	
4574.798	52.7	H	74.0	-21.4	PK	360	1.0	
4569.350	52.2	V	74.0	-21.8	PK	0	1.0	
2744.760	50.3	H	74.0	-23.7	PK	360	1.0	
3660.968	50.1	H	74.0	-23.9	PK	360	1.0	
3659.265	49.4	V	74.0	-24.6	PK	360	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Run #1c: Radiated Spurious Emissions, 1000 - 10000 MHz. High Channel @ 926 MHz
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4630.623	41.8	H	54.0	-12.2	AVG	360	1.0	
4630.675	41.8	V	54.0	-12.2	AVG	360	1.0	
3705.043	38.8	H	54.0	-15.2	AVG	360	1.0	
3704.615	38.8	V	54.0	-15.2	AVG	0	1.0	
2776.950	35.1	H	54.0	-18.9	AVG	360	1.0	
2776.808	35.1	V	54.0	-18.9	AVG	0	1.0	
4630.623	53.3	H	74.0	-20.7	PK	360	1.0	
4630.675	52.8	V	74.0	-21.2	PK	360	1.0	
3705.043	50.0	H	74.0	-24.0	PK	360	1.0	
3704.615	49.5	V	74.0	-24.5	PK	0	1.0	
2776.950	46.4	H	74.0	-27.6	PK	360	1.0	
2776.808	46.0	V	74.0	-28.0	PK	0	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

FCC 15.247 DTS - Transmitter Radiated Spurious Emissions 9dBd Yagi Antenna

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: See Individual Run
Test Engineer: See Individual Run
Test Location: See Individual Run
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 spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
38719	Radiated Spurious Emissions, 30MHz - 10GHz, Tx antenna Horizontal and Vertical	FCC Part 15.209 / 15.247(c)	Pass	52.9dBµV/m (443.6µV/m) @ 2711.3MHz (-1.1dB)

Modifications Made During Testing:

Modifications are detailed under each run description.

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Run #1: Radiated Spurious Emissions, 30MHz - 10GHz
Run #1a: Radiated Spurious Emissions, 1000 - 10000MHz. Low Channel @ 904 MHz

Date of Test: 3/24/2006
Test Engineer: Chris Byleckie
Test Location: SVOATS #1

Temperature: 19 °C
Rel. Humidity: 54 %

MDS Log Periodic Tx antenna horizontal
Max. Pout
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2711.300	52.9	H	54.0	-1.1	AVG	300	2.0	
2711.300	70.2	H	74.0	-3.8	PK	300	2.0	
2709.500	48.4	V	54.0	-5.6	AVG	205	1.0	
2709.500	67.4	V	74.0	-6.6	PK	205	1.0	
3614.050	47.3	V	54.0	-6.8	AVG	250	1.0	
3614.000	67.0	H	74.0	-7.0	PK	0	1.0	
3614.000	46.8	H	54.0	-7.2	AVG	0	1.0	
3614.050	64.5	V	74.0	-9.5	PK	250	1.0	
4521.900	42.2	H	54.0	-11.8	AVG	360	1.0	
4518.898	42.1	V	54.0	-12.0	AVG	0	1.0	
4521.900	53.9	H	74.0	-20.1	PK	360	1.0	
4518.898	53.0	V	74.0	-21.0	PK	0	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Run #1b: Radiated Spurious Emissions, 1000 - 10000 MHz. Center Channel @ 915 MHz
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4575.683	42.0	H	54.0	-12.1	AVG	0	1.0	
4573.598	40.1	V	54.0	-13.9	AVG	360	1.0	
3661.380	38.9	H	54.0	-15.1	AVG	0	1.0	
3659.858	38.9	V	54.0	-15.1	AVG	0	1.0	
2744.288	35.7	V	54.0	-18.3	AVG	360	1.0	
2740.250	35.4	H	54.0	-18.6	AVG	35	1.0	
4575.683	53.3	H	74.0	-20.7	PK	0	1.0	
4573.598	51.1	V	74.0	-22.9	PK	360	1.0	
3659.858	49.9	V	74.0	-24.1	PK	0	1.0	
3661.380	49.8	H	74.0	-24.2	PK	0	1.0	
2740.250	47.6	H	74.0	-26.4	PK	35	1.0	
2744.288	46.2	V	74.0	-27.9	PK	360	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental.

Run #1c: Radiated Spurious Emissions, 1000 - 10000 MHz. High Channel @ 926 MHz
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4630.143	41.9	V	54.0	-12.2	AVG	360	1.0	
4630.548	41.8	H	54.0	-12.2	AVG	360	1.0	
3704.383	38.9	H	54.0	-15.1	AVG	360	1.0	
3704.203	38.9	V	54.0	-15.1	AVG	360	1.0	
2777.370	35.2	V	54.0	-18.8	AVG	0	1.0	
2777.340	35.2	H	54.0	-18.8	AVG	360	1.0	
4630.548	53.6	H	74.0	-20.4	PK	360	1.0	
4630.143	53.4	V	74.0	-20.6	PK	360	1.0	
3704.383	50.3	H	74.0	-23.7	PK	360	1.0	
3704.203	50.3	V	74.0	-23.8	PK	360	1.0	
2777.340	47.8	H	74.0	-26.2	PK	360	1.0	
2777.370	47.1	V	74.0	-26.9	PK	0	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Run #2: Radiated Spurious Emissions, 30MHz - 10GHz
Run #2a: Radiated Spurious Emissions, 1000 - 10000MHz. Low Channel @ 904 MHz
Tx antenna vertical
Max. Pout
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
3615.753	49.4	H	54.0	-4.6	AVG	191	1.0	
3615.753	68.2	H	74.0	-5.8	PK	191	1.0	
2711.950	47.4	V	54.0	-6.6	AVG	191	1.0	
3615.895	47.0	V	54.0	-7.0	AVG	135	1.0	
3615.895	65.8	V	74.0	-8.2	PK	135	1.0	
2711.950	65.4	V	74.0	-8.6	PK	191	1.0	
2710.988	44.1	H	54.0	-9.9	AVG	184	1.0	
4518.860	42.1	V	54.0	-11.9	AVG	0	1.0	
4518.703	42.1	H	54.0	-11.9	AVG	0	1.0	
2710.988	60.4	H	74.0	-13.6	PK	184	1.0	
4518.860	52.9	V	74.0	-21.1	PK	0	1.0	
4518.703	52.8	H	74.0	-21.2	PK	0	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental.

Run #2b: Radiated Spurious Emissions, 1000 - 10000 MHz. Center Channel @ 915 MHz
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4575.743	41.5	H	54.0	-12.5	AVG	0	1.0	
4575.578	39.9	V	54.0	-14.1	AVG	0	1.0	
3658.710	39.1	H	54.0	-14.9	AVG	135	1.0	
3666.100	39.0	V	54.0	-15.0	AVG	360	1.0	
2745.930	35.5	H	54.0	-18.5	AVG	0	1.0	
2745.608	35.4	V	54.0	-18.6	AVG	0	1.0	
4575.578	52.1	V	74.0	-21.9	PK	0	1.0	
4575.743	52.0	H	74.0	-22.0	PK	0	1.0	
3658.710	50.2	H	74.0	-23.8	PK	135	1.0	
3666.100	49.6	V	74.0	-24.4	PK	360	1.0	
2745.930	46.7	H	74.0	-27.3	PK	0	1.0	
2745.608	46.4	V	74.0	-27.6	PK	0	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental.

Client:	Microwave Data Systems	Job Number:	J63298
Model:	Mercury Project	T-Log Number:	T63365
		Account Manager:	Esther Zhu
Contact:	Rich		
Spec:	FCC 15.247 / FCC 15 B	Class:	N/A

Run #2c: Radiated Spurious Emissions, 1000 - 10000 MHz. High Channel @ 926 MHz
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4630.428	41.8	H	54.0	-12.2	AVG	360	1.0	
4629.738	41.8	H	54.0	-12.2	AVG	360	1.0	
3704.008	38.8	H	54.0	-15.2	AVG	360	1.0	
3703.588	38.8	H	54.0	-15.2	AVG	360	1.0	
2777.948	35.2	H	54.0	-18.8	AVG	360	1.0	
2776.755	35.2	H	54.0	-18.8	AVG	360	1.0	
4629.738	53.2	H	74.0	-20.8	PK	360	1.0	
4630.428	52.4	H	74.0	-21.6	PK	360	1.0	
3704.008	49.8	H	74.0	-24.2	PK	360	1.0	
3703.588	49.5	H	74.0	-24.5	PK	360	1.0	
2777.948	46.2	H	74.0	-27.8	PK	360	1.0	
2776.755	45.9	H	74.0	-28.2	PK	360	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental.

EXHIBIT 3: Photographs of Test Configurations

Uploaded as a separate attachment

EXHIBIT 4: Proposed FCC ID Label & Label Location

Uploaded as a separate attachment

EXHIBIT 5: Detailed Photographs of Microwave Data Systems Model Mercury OFDM Construction

Uploaded as a separate attachment

EXHIBIT 6: Operator's Manual for Microwave Data Systems Model Mercury OFDM

Uploaded as a separate attachment

EXHIBIT 7: Block Diagram of Microwave Data Systems Model Mercury OFDM

Uploaded as a separate attachment

EXHIBIT 8: Schematic Diagrams for Microwave Data Systems Model Mercury OFDM

Uploaded as a separate attachment

EXHIBIT 9: Theory of Operation for Microwave Data Systems Model Mercury OFDM

Uploaded as a separate attachment

EXHIBIT 10: RF Exposure Information

Pages