Lab Code: 200167-0

FCC PART 15.247

EMI MEASUREMENT AND TEST REPORT

For

Bluegiga Technologies Inc.

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Finland

FCCID: QOQWT11E
Model: WT11-E

This Report Concerns:	**Product Type:**
☒ Class II Permissive Change	**Bluetooth® 2.0+EDR (Enhanced Data Rates) module**

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Report Number:	R0703073-247
Report Date:	2007-03-22
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1 GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Bluegiga Technologies Inc.'s product, , FCC ID:* QOQWT11E, or the "EUT" as referred to this report is a next-generation, class 1, Bluetooth® 2.0+EDR (Enhanced Data Rates) module. It is a mobile device and introduces three times faster data rates compared to existing Bluetooth® 1.2 modules even with lower power consumption! WT11 is a highly integrated and sophisticated Bluetooth® module, containing all the necessary elements from Bluetooth® radio to antenna and a fully implemented protocol stack. Therefore WT11 provides an ideal solution for developers who want to integrate Bluetooth® wireless technology into their design with limited knowledge of Bluetooth® and RF technologies.

By default WT11 module is equipped with powerful and easy-to-use iWRAP firmware. iWRAP enables users to access Bluetooth® functionality with simple ASCII commands delivered to the module over serial interface - it's just like a bluetooth® modem.

1.2 Antenna Description

The newly added antenna is an integral antenna from Tyco Electronics, P/N: 1513151-1. It has minimum matching circuits required, wide bandwidth, and a maximum gain of 4 dBi in a compact size. It also enhances hemispherical pattern, improves RF link reliability of portable devices. It measures 16 mmD x 6 mmH.

The Original submittal used the following antennae for the EUT:

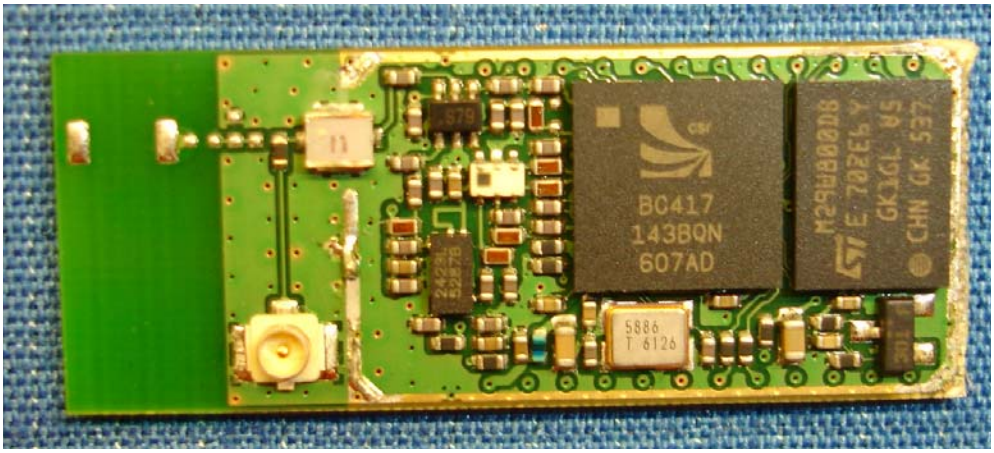
Item Number	Model/Type	
Antenna1.	Model:	MMTX-EA-79A Bluetooth 2.4 GHz SMA M
	Manufacturer:	EAD
	Frequency Range:	2.4-2.5 GHz
	Antenna Gain:	2 dBi
Antenna 2.	Model:	Titanis
	Manufacturer:	GiaAnt
	Frequency Range:	2.4-2.5 GHz
	Antenna Gain:	4.4 dBi
Antenna 3.	Model:	MTX-BT-Blade
	Manufacturer:	EAD
	Frequency Range:	2.45GHz and 5.2 GHz
	Antenna Gain:	2 dBi
Antenna 4.	Model:	BT-Stubby
	Manufacturer:	EAD
	Frequency Range:	2.4 GHz
	Antenna Gain:	0 dBi
Antenna5.	Model:	AT3216
	Manufacturer:	ACX
	Frequency Range:	2.4-2.5 GHz
	Antenna Gain:	0.5 dBi

1.3 Mechanical Description

The *Bluegiga Technologies Inc.'s product, , FCC ID:* QOQWT11E, or the "EUT" as referred to this report measures approximately 35 mm L x 15 mmW x 2 mmH. The EUT operates at the frequency range of 2402– 2480 MHz.

* The test data gathered are from a typical production sample, serial number: 20050926, Version: 1.0, provided by the manufacturer.

1.4 EUT Photo



Additional photos in Exhibit C

1.5 Objective

This type approval report is prepared on behalf of *Bluegiga Technologies Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, C of the Federal Communication Commissions rules. Infineon Technologies authorizes Trimble Navigation Limited to submit a FCC Class II Permissive Change to the Bluetooth® 2.0+EDR (Enhanced Data Rates) module.

The objective is to determine continued compliance with FCC 15.247 Standard's limits rules for Antenna Requirements and Radiated Spurious Emissions after the class II permissive change initiated by *Bluegiga Technologies Inc.*

FCC ID: QOQWT11E is electrically identical to the device of the same FCC ID tested by SGS Taiwan Ltd. in report number: EF/2006/20016. This Class II Permissive Change, adds a new antenna manufactured by, Tyco with a maximum gain of 4 dBi. Please refer to Bluegiga Technologies Inc. description letter filed along with this submission.

1.6 Related Submittal(s)/Grant(s)

This is a Permissive Change II application. The original application was granted on 2006-08-29. Please refer to original report, which was prepared by SGS Taiwan Ltd., report number: EF/2006/20016.

1.7 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003.

1.8 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

Detailed instrumentation measurement uncertainties can be found in BACL Corp. report QAP-018.

1.9 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11, 1997 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the test methods and procedures set forth in ANSI C63.4-2003 & TIA/EIA-603.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: R-2463 and C-2698. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is a National Institute of Standards and Technology (NIST) accredited laboratory under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm.

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2003.

The EUT was built in Trimble support board with Tyco antenna installed and tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The software is provided by customer. The EUT exercise program used during radiated testing was designed to exercise the system components.

2.3 Special Accessories

As shown in following test block diagram.

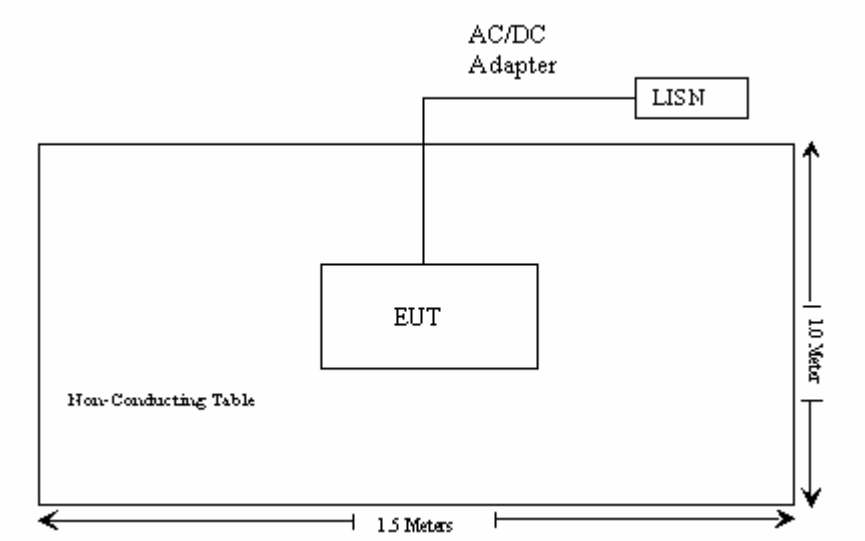
2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Power Supply Information

Manufacturer	Description	Model	Serial Number
Phihong	AC/DC Adapter	PSA05R-050	-

2.6 Test Setup Block Diagram



3 SUMMARY OF TEST RESULTS FOR FCC PART 15

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§15.205, §15.209 & §15.247(c)	Radiated Emissions	Compliant

4 §15.203 - ANTENNA REQUIREMENT

4.1 Applicable Standard

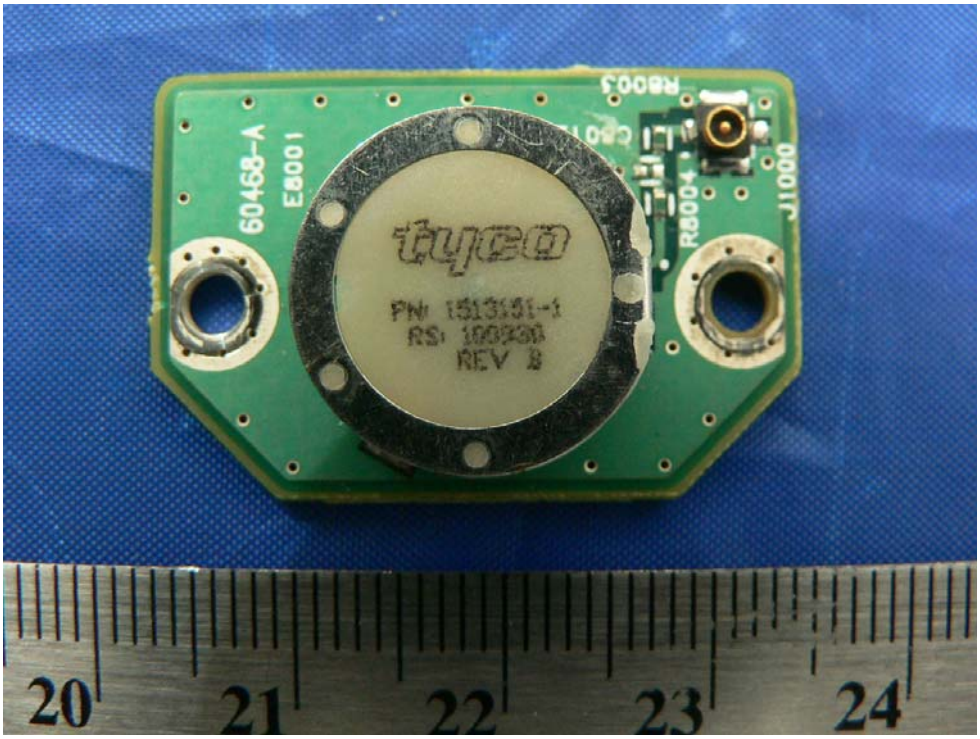
According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to § 15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2 Result

The antenna for this device is internal antenna connected to the main board in a fashion not readily accessible to the end user with a maximum gain of 4 dBi which is under the 6 dBi limit.

Compliant. Please refer to the following antenna photo for details.



4 dBi (Tyco internal antenna)

5 §15.205, §15.209(a) & §15.247(d) - RADIATED EMISSIONS

5.1 Applicable Standard

As per 15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per 15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/m)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As Per 15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

5.2 Test Setup

The radiated emissions tests were performed in the shielded room, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonoma Instruments	Pre amplifier	317	260406	2006-02-03
Agilent	Pre amplifier	8449B	3008A01978	2006-08-21
Sunol Science	Combination Antenna	JB3 Antenna	A013105	2006-03-15
DRG	Horn Antenna	SAS-200/571	261	2006-04-20
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100044	2007-02-19
Sunol Science	System Controller	SC99V	122303-1	N/R
Agilent	Spectrum analyzer	8565EC	3946A00131	2006-11-12

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

5.4 Environmental Conditions

Temperature:	20-22° C
Relative Humidity:	40-50 %
ATM Pressure:	1012-1014 mbar

**The testing was performed by Choon Sian Ooi on 2007-03-06.*

5.5 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emissions was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

5.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emissions are 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Class B Limit

5.7 Summary of Test Results for Tyco Antenna

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15 sections 15.205, 15.209 and Subpart C 15.247 standards' limits, and had the margin from the limit of:

-1.1 dB at **4803.9 MHz** in the **Vertical & Horizontal** polarization, 1GHz –25GHz**, Low Channel**

-1.2 dB at **4881.9 MHz** in the **Vertical** polarization, 1GHz – 25GHz**, Middle Channel**

-1.5dB at **4960 MHz** in the **Vertical** polarization, 1GHz – 25GHz**, High Channel**

5.8 Radiated Spurious Emissions Test Data Above 1GHZ:

Low Channel: 2402 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth (Degree)	Height (Meter)	Polar. (H / V)	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBµV/m)	15.247 Limit (dBµV/m)	15.247 Margin (dB)	Comments
2402.00	111.7	324	1.3	V	28.7	1.5	37.4	104.4			Fund/Peak
2402.00	110.8	123	1.0	H	28.7	1.5	37.4	103.6			Fund/Peak
2402.00	75.2	324	1.3	V	28.7	1.5	37.4	67.9			Ave
2402.00	74.8	123	1.0	H	28.7	1.5	37.4	67.6			Ave
4803.90	73.3	47	1.6	V	32.5	1.9	34.8	72.9	74	-1.1	Peak
4803.90	53.3	47	1.6	V	32.5	1.9	34.8	52.9	54	-1.1	Ave
4803.90	52.3	234	1.6	H	32.5	1.9	34.8	51.9	54	-2.1	Ave
12010.00	38.2	312	1.5	V	40.4	4.3	34.4	48.6	54	-5.5	Ave
4803.90	68.0	234	1.6	H	32.5	1.9	34.8	67.6	74	-6.4	Peak
7206.00	39.2	174	1.6	V	36.7	4.2	34.9	45.2	54	-8.8	Ave
12010.00	54.8	312	1.5	V	40.4	4.3	34.4	65.2	74	-8.8	Peak
12010.00	33.8	212	1.5	H	40.4	4.3	34.4	44.2	54	-9.8	Ave
9607.00	37.3	217	1.5	V	38.1	3.7	36.9	42.2	54	-11.8	Ave
7206.00	35.8	109	1.6	H	36.7	4.2	34.9	41.8	54	-12.2	Ave
7206.00	54.3	174	1.6	V	36.7	4.2	34.9	60.3	74	-13.7	Peak
12010.00	48.3	212	1.5	H	40.4	4.3	34.4	58.7	74	-15.3	Peak
9607.00	33.7	212	1.5	H	38.1	3.7	36.9	38.6	54	-15.4	Ave
9607.00	53.0	217	1.5	V	38.1	3.7	36.9	57.9	74	-16.1	Peak
7206.00	49.2	109	1.6	H	36.7	4.2	34.9	55.2	74	-18.8	Peak
9607.00	47.2	212	1.5	H	38.1	3.7	36.9	52.1	74	-21.9	Peak

Middle Channel: 2441 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth (Degree)	Height (Meter)	Polar. (H / V)	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBµV/m)	15.247 Limit (dBµV/m)	15.247 Margin (dB)	Comments
2441.00	115.2	321	1.7	V	28.7	1.5	37.0	108.4			Fund/Peak
2441.00	113.8	266	1.6	H	28.7	1.5	37.0	107.0			Fund/Peak
2441.00	78.0	321	1.7	V	28.7	1.5	37.0	71.2			Ave
2441.00	77.0	266	1.6	H	28.7	1.5	37.0	70.2			Ave
4881.90	73.2	186	1.3	V	32.5	1.9	34.8	72.8	74	-1.2	Peak
12204.00	36.3	200	1.3	V	40.4	4.3	34.4	46.7	54	-7.3	Ave
4881.90	46.3	186	1.3	V	32.5	1.9	34.8	45.9	54	-8.1	Ave
4881.90	66.0	354	1.8	H	32.5	1.9	34.8	65.6	74	-8.4	Peak
12204.00	34.3	43	1.6	H	40.4	4.3	34.4	44.7	54	-9.3	Ave
7326.60	38.5	193	1.7	V	36.7	4.2	35.1	44.3	54	-9.7	Ave
12204.00	52.8	200	1.3	V	40.4	4.3	34.4	63.2	74	-10.8	Peak
9763.30	37.7	321	1.2	V	38.1	3.7	36.7	42.8	54	-11.2	Ave
4881.90	42.8	354	1.8	H	32.5	1.9	34.8	42.4	54	-11.6	Ave
7326.60	34.5	95	1.6	H	36.7	4.2	35.1	40.3	54	-13.7	Ave
9763.30	33.5	90	1.3	H	38.1	3.7	36.7	38.6	54	-15.4	Ave
12204.00	48.0	43	1.6	H	40.4	4.3	34.4	58.4	74	-15.6	Peak
7326.60	52.3	193	1.7	V	36.7	4.2	35.1	58.1	74	-15.9	Peak
9763.30	52.7	321	1.2	V	38.1	3.7	36.7	57.8	74	-16.2	Peak
7326.60	48.5	95	1.6	H	36.7	4.2	35.1	54.3	74	-19.7	Peak
9763.30	47.2	134	1.3	H	38.1	3.7	36.7	52.3	74	-21.7	Peak

High Channel: 2480 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth (Degree)	Height (Meter)	Polar. (H / V)	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBµV/m)	15.247 Limit (dBµV/m)	15.247 Margin (dB)	Comments
2480.00	109.7	81	1.0	V	28.7	1.5	37.2	102.6			Fund/Peak
2480.00	112.8	203	1.4	H	28.7	1.5	37.2	105.8			Fund/Peak
2480.00	70.2	81	1.0	V	28.7	1.5	37.2	63.1			Ave
2480.00	72.7	203	1.4	H	28.7	1.5	37.2	65.6			Ave
4960.00	72.8	176	1.2	V	32.5	1.9	34.8	72.5	74	-1.5	Peak
2483.50	77.5	205	1.2	V	28.7	1.5	35.8	71.8	74	-2.2	Peak
12400.00	38.8	331	1.3	V	40.4	4.3	32.0	51.6	54	-2.4	Ave
12400.00	55.2	331	1.3	V	40.4	4.3	32.0	67.9	74	-6.1	Peak
4960.00	48.0	176	1.2	V	32.5	1.9	34.8	47.6	54	-6.4	Ave
12400.00	34.7	311	1.5	H	40.4	4.3	32.0	47.4	54	-6.6	Ave
4960.00	67.5	243	1.4	H	32.5	1.9	34.8	67.1	74	-6.9	Peak
2483.50	51.7	205	1.2	V	28.7	1.5	35.8	46.0	54	-8.0	Ave
9920.00	38.0	223	1.6	V	38.1	3.7	34.2	45.6	54	-8.4	Ave
4960.00	44.7	353	1.4	H	32.5	1.9	34.8	44.3	54	-9.7	Ave
9920.00	35.8	269	1.6	H	38.1	3.7	34.2	43.5	54	-10.5	Ave
7440.00	36.8	26	1.4	V	36.7	4.2	34.7	43.1	54	-10.9	Ave
12400.00	49.7	311	1.5	H	40.4	4.3	32.0	62.4	74	-11.6	Peak
9920.00	53.7	223	1.6	V	38.1	3.7	34.2	61.3	74	-12.7	Peak
7440.00	32.8	260	1.5	H	36.7	4.2	34.7	39.1	54	-14.9	Ave
7440.00	51.3	26	1.4	V	36.7	4.2	34.7	57.6	74	-16.4	Peak
9920.00	50.0	269	1.6	H	38.1	3.7	34.2	57.6	74	-16.4	Peak
7440.00	46.7	260	1.5	H	36.7	4.2	34.7	52.9	74	-21.1	Peak

END OF REPORT