TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 15B

MEASUREMENT AND TEST REPORT

For

Shanghai HowayGIS Co., Ltd

RM230,Fawkes Building, No. 1985, Road Chunshen, Shanghai, China

FCC ID: 2AAZD-TGU1-S3

Report Type:	**Product Type:**
Original Report	High Precision Mobile GNSS Receiver

Test Engineer:	Annie Xuan
Report Number:	RKSA171222002-00C
Report Date:	2018-06-25
Reviewed By:	Ray Wang EMC Leader
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan,Jiangsu province, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Shanghai HowayGIS Co., Ltd
Test Model	TG-U2
Product	High Precision Mobile GNSS Receiver
Rate Voltage	DC 12V from adapter, DC 7.2V by rechargeable battery
Highest Operation Frequency	2480MHz
Dimension	210 mm (L)*60 mm (W)*110mm(H)

Adapter Information:
Model: A122-1201000ID
Input: AC100-240 V 50-60Hz 0.4A
Output: DC12V,1000mA

Note: The product's series model number: TG-U1, TG-U3, X1. The difference between them was explained in the attached declaration letter .

**All measurement and test data in this report was gathered from production sample serial number: 20171222004. (Assigned by the BACL. The EUT supplied by the applicant was received on 2017-12-22).*

Objective

This report is prepared on behalf of Shanghai HowayGIS Co., Ltd in accordance with Part 2-Subpart J, and Part 15-Subparts A and B of the Federal Communication Commission's rules.

The objective of the manufacturer is to determine the compliance of EUT with FCC Part 15, Class B digital device.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS & DSS submittals with FCC ID: 2AAZD-TGU1-S3.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

Test mode: Data Link & GPS on

EUT Exercise Software

Notebook and EUT data transmission by “U-Center.exe”.
Mobile Phone and EUT to communication by “GNSS viewer”.

Special Accessories

No special accessory was used.

Equipment Modifications

No modification was made to the EUT tested.

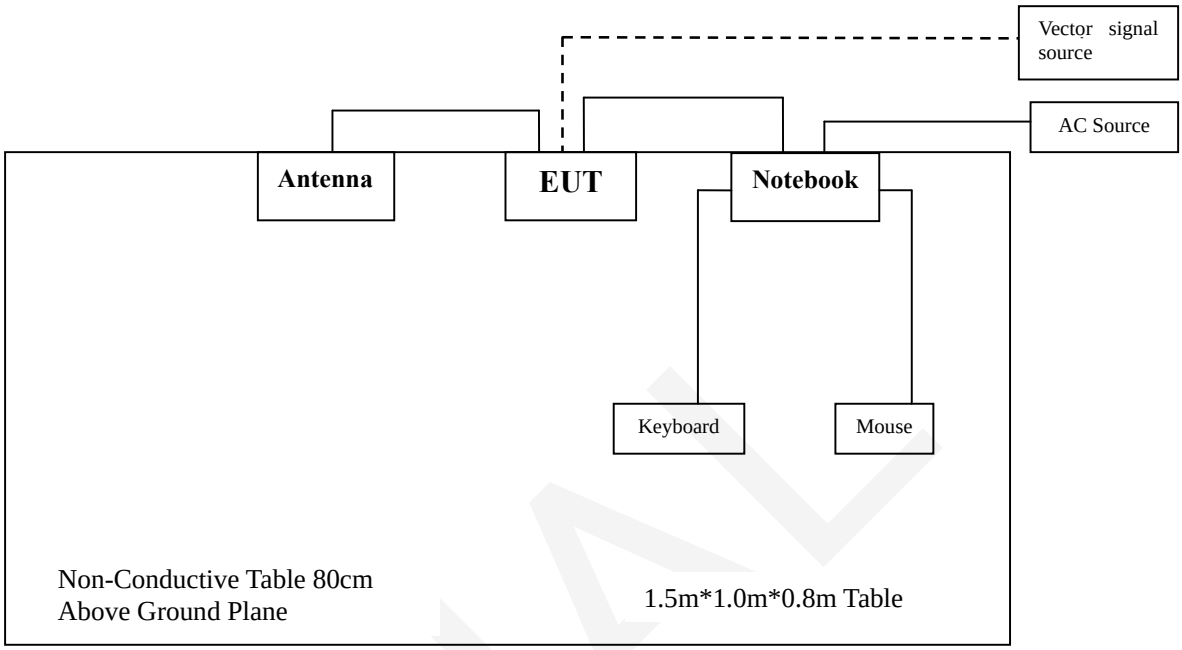
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
keysight	Vector signal source	N5182B	MY53051592
DELL	Notebook	E6410	3094742521
Logitech	Keyboard	Y-U0009	1648MG010PW8
Logitech	Mouse	M-U0026	HS529HB
Shanghai HowayGIS Infotech Co., Ltd	Antenna	/	/
HUAWEI	Mobile phone	EVA-TL00	862266039775394

External I/O Cable

Cable Description	Length (m)	From/Port	To
Power Cable	1.0	Adapter	EUT
Keyboard USB Cable	1.0	Notebook	Keyboard
Mouse USB Cable	1.0	Notebook	Mouse
9pin Fisher Plug Cable	1.2	Notebook	EUT
Antenna Cable	1.0	EUT	Antenna

Block Diagram of Radiated Emissions Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§15.107	Conducted Emissions	Compliance
§15.109	Radiated Emissions	Compliance

FCC §15.107 –CONDUCTED EMISSIONS

Applicable Standard

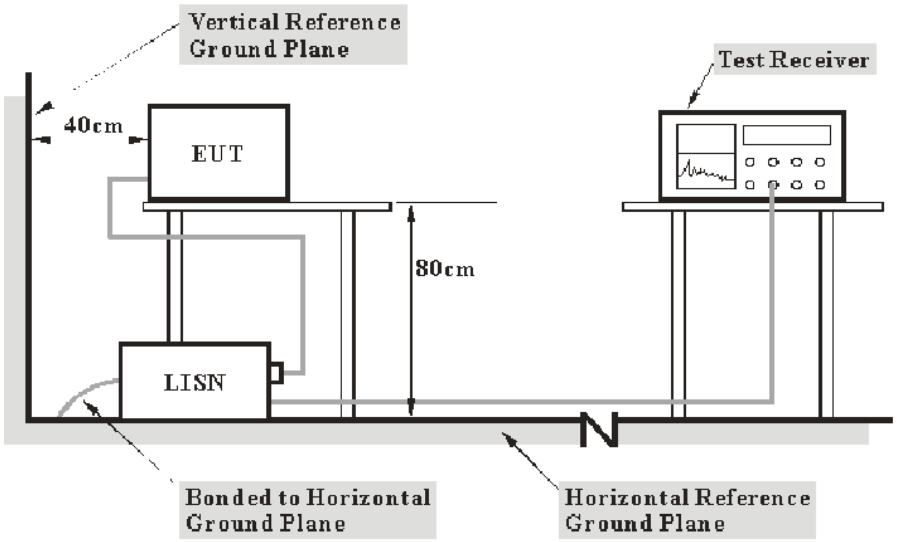
According to FCC§15.107

Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN and receiver, LISN voltage division factor, LISN VDF frequency interpolation and receiver related input quantities, etc.

Item		Measurement Uncertainty	U_{cispr}
AMN	150kHz~30MHz	3.19 dB	3.4 dB

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with ANSI C63.4-2014. The related limit was specified in FCC Part 15.107 Class B.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2017-11-12	2018-11-11
ROHDE&SCHWARZ	LISN	ENV216	3560655016	2017-11-12	2018-11-11
BACL	Auto test Software	BACL-EMC	CE001	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2017-08-15	2018-08-14

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correction Amplitude = Meter Reading + VDF + Cable Loss + Transient Limiter Attenuation

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 emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Data

Environmental Conditions

Temperature:	24℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Annie Xuan on 2018-04-18.

Test mode: Data Link & GPS on

Line:

Frequency (MHz)	Reading (dBμV)	Correction (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/AV/QP)
0.150	40.44	16.06	66.00	25.56	QP
0.150	26.30	16.06	56.00	29.70	AV
0.240	36.69	16.02	63.43	26.74	QP
0.240	25.73	16.02	53.43	27.70	AV
0.370	35.55	16.05	59.71	24.16	QP
0.370	34.83	16.05	49.71	14.88	AV
1.600	32.13	15.86	56.00	23.87	QP
1.600	23.06	15.86	46.00	22.94	AV
6.850	33.55	15.97	60.00	26.45	QP
6.850	19.55	15.97	50.00	30.45	AV
22.100	35.81	16.45	60.00	24.19	QP
22.000	15.93	16.45	50.00	34.07	AV

Neutral:

Frequency (MHz)	Reading (dBμV)	Correction (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/AV/QP)
0.160	40.81	16.06	65.71	24.90	QP
0.160	29.51	16.06	55.71	26.20	AV
0.255	40.41	16.06	63.00	22.59	QP
0.255	28.49	16.06	53.00	24.51	AV
0.390	34.61	16.09	59.14	24.53	QP
0.390	28.16	16.09	49.14	20.98	AV
0.650	30.95	16.02	56.00	25.05	QP
0.650	20.16	16.02	46.00	25.84	AV
6.900	38.26	15.92	60.00	21.74	QP
6.900	25.51	15.92	50.00	24.49	AV
21.850	34.98	16.19	60.00	25.02	QP
21.850	18.75	16.19	50.00	31.25	AV

FCC §15.109 - RADIATED EMISSIONS

Applicable Standard

FCC §15.109

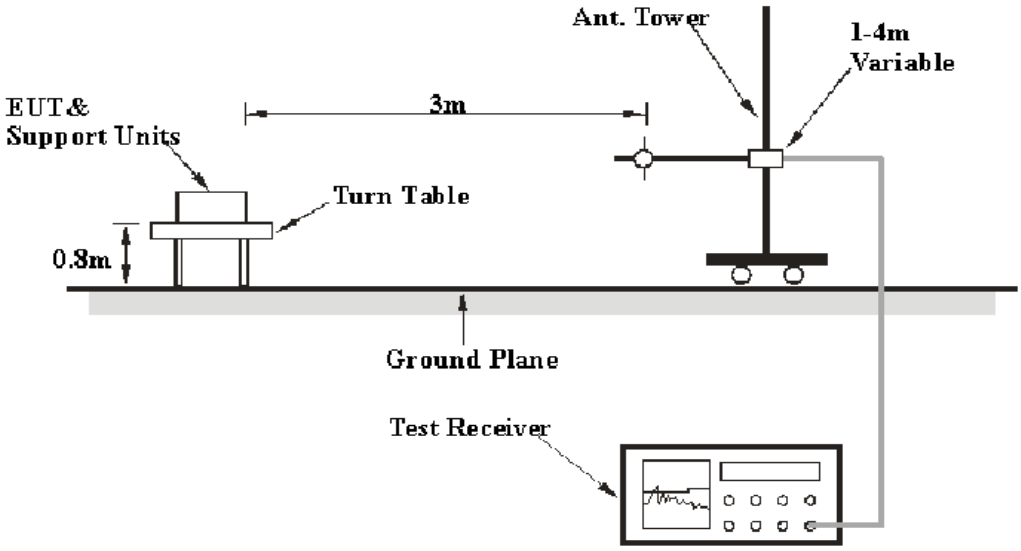
Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in 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.

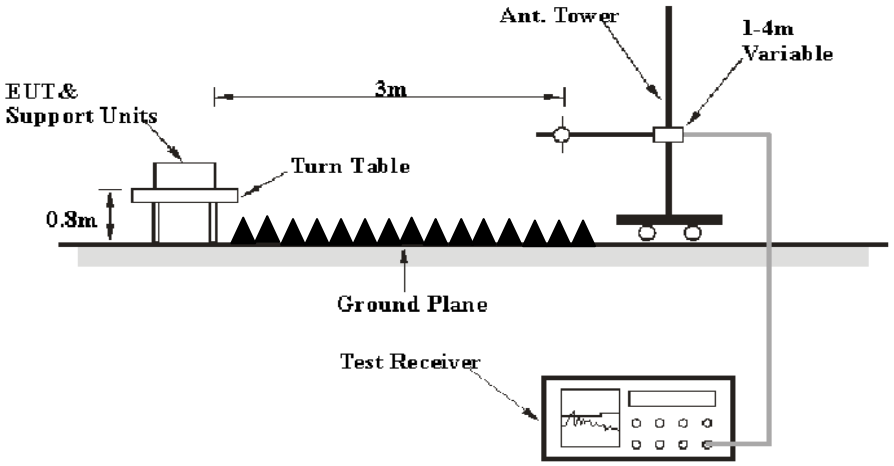
Item		Measurement Uncertainty	U_{cispr}
Radiated Emission	30MHz~1GHz	6.11dB	6.3 dB
	1GHz~6GHz	4.45dB	5.2 dB
	6 GHz ~18 GHz	5.23dB	5.5 dB

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.4-2014. The specification used was the FCC Part 15.109 Class B limits.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 18 GHz.

During the radiated emission test, the EMI test receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector Type
30MHz – 1000 MHz	120 kHz	300 kHz	120kHz	QP
Above 1 GHz	1MHz	3 MHz	/	Peak
	1MHz	3 MHz	1MHz	AVG

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz, Peak and average detection mode above 1 GHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sonoma Instrument	Amplifier	310N	171205	2017-08-15	2018-08-14
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-12	2018-11-11
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Champrotek	Chamber	Chamber A	T-KSEMC049	-	-
Champrotek	Chamber	Chamber B	T-KSEMC080	-	-
R&S	Auto test Software	EMC32	100361	-	-
ETS	Horn Antenna	3115	6229	2016-01-11	2019-01-10
Rohde & Schwarz	EMI Receiver	ESU40	100207	2017-08-27	2018-08-26
Narda	Pre-amplifier	AFS42-00101800	2001270	2017-10-22	2018-10-21
MICRO-COAX	Coaxial Cable	Cable-8	008	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-4	004	2017-12-12	2018-12-11
MICRO-COAX	Coaxial Cable	Cable-5	005	2017-12-12	2018-12-11

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Corrected Amplitude & Margin Calculation

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

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

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

Margin = Limit – Corrected Amplitude

Test Data

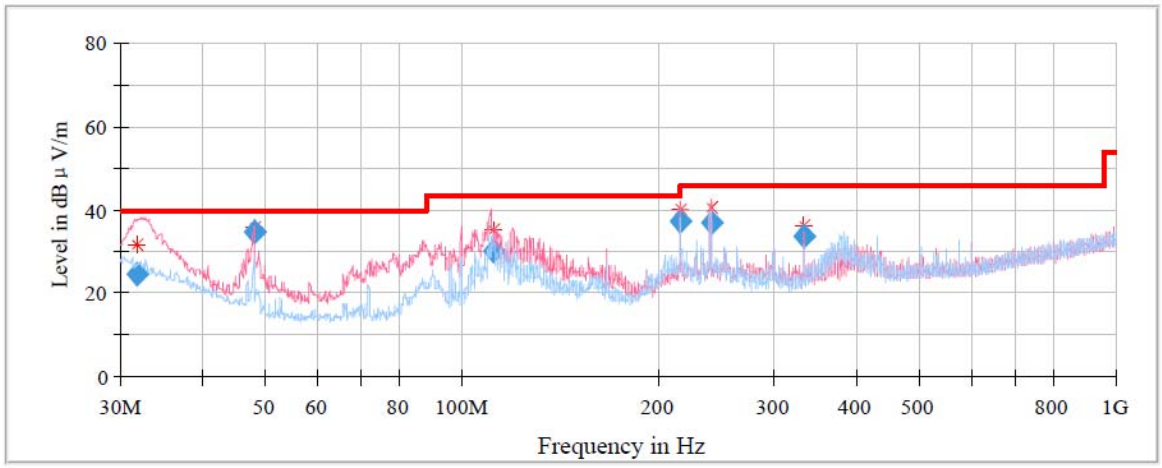
Environmental Conditions

Temperature:	20.2 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Annie Xuan on 2018-04-18.

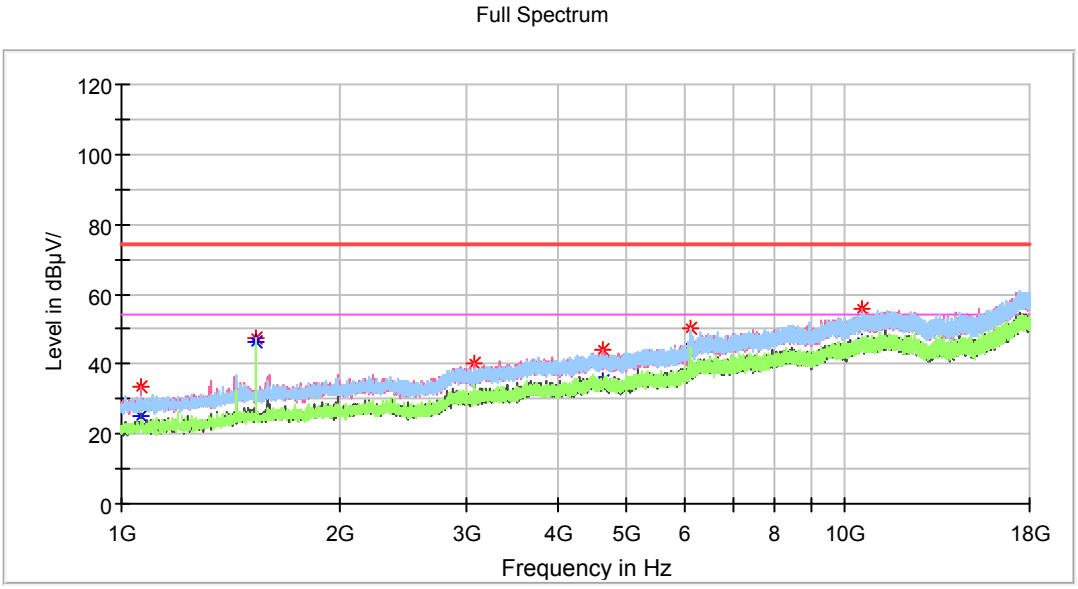
Test mode: Data Link & GPS on

30MHz ~ 1GHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
31.825450	24.80	40.00	15.20	101.0	V	27.0	-5.6
47.968100	34.76	40.00	5.24	101.0	V	84.0	-16.6
111.225500	30.24	43.50	13.26	101.0	V	199.0	-13.3
215.775700	37.61	43.50	5.89	199.0	H	45.0	-12.7
239.747200	36.64	46.00	9.36	101.0	H	156.0	-12.6
331.888350	33.55	46.00	12.45	101.0	V	167.0	-10.3

Above 1 GHz:



Frequency (MHz)	Max Peak (dB µ V/m)	Average (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1063.466667	33.56	---	74.00	40.44	200.0	V	353.0	-11.6
1063.466667	---	25.33	54.00	28.67	200.0	V	353.0	-11.6
1533.800000	47.65	---	74.00	26.35	100.0	H	43.0	-7.9
1533.800000	---	46.47	54.00	7.53	100.0	H	43.0	-7.9
3071.733333	---	36.04	54.00	17.96	100.0	V	345.0	-1.9
3071.733333	39.98	---	74.00	34.02	100.0	V	345.0	-1.9
4630.633333	---	35.10	54.00	18.90	100.0	V	288.0	2.1
4630.633333	43.85	---	74.00	30.15	100.0	V	288.0	2.1
6135.700000	---	44.40	54.00	9.60	100.0	H	128.0	6.4
6135.700000	50.32	---	74.00	23.68	100.0	H	128.0	6.4
10526.800000	---	46.08	54.00	7.92	100.0	V	122.0	17.0
10526.800000	55.79	---	74.00	18.21	100.0	V	122.0	17.0

*******END OF REPORT*******