

FCC PART 95A
MEASUREMENT AND TEST REPORT

For

BTECH (BaoFeng Tech)

702 N Industrial Ave, Arlington, SD 57212 United States

FCC ID: 2AGND-GMRS-V1

Report Type: Original Report	Product Type: GMRS Transceiver
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Report Number: <u>RSZ160127810-00</u>	
Report Date: <u>2016-08-10</u>	
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Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *BTECH (BaoFeng Tech)*'s product, model number: *GMRS-V1 (FCC ID: 2AGND-GMRS-V1)* or the "EUT" in this report was a *GMRS Transceiver*, which was measured approximately: 28.2 cm (L) x 6.0 cm (W) x 4.5 cm (H), rated input voltage: DC 7.4 V battery.

** All measurement and test data in this report was gathered from production sample serial number: 1601271 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2016-01-27.*

Objective

This report is prepared on behalf of BTECH (BaoFeng Tech) in accordance with Part 2 and Part 95 Subpart A & Subpart E of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

No related submittal(s)/grant(s).

Test Methodology

All tests and measurements indicated in this document were performed in accordance with Part 95 Subpart A and Subpart E of the Federal Communication Commissions rules with TIA-603-D, Land Mobile FM or PM-Communications Equipment-Measurement and Performance Standards.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Shenzhen). 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. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on October 31, 2013. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For GMRS mode, Channels available:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
GMRS01	462.5500	GMRS13	462.7000
GMRS02	462.5625	GMRS14	462.7125
GMRS03	462.5750	GMRS15	462.7250
GMRS04	462.5875	GMRS16	467.5500
GMRS05	462.6000	GMRS17	467.5750
GMRS06	462.6125	GMRS18	467.6000
GMRS07	462.6250	GMRS19	467.6250
GMRS08	462.6375	GMRS20	467.6500
GMRS09	462.6500	GMRS21	467.6750
GMRS10	462.6625	GMRS22	467.7000
GMRS11	462.6750	GMRS23	467.7250
GMRS12	462.6875	/	/

With pre-scan, worst cases were tested with Channel GMRS07 and GMRS19.

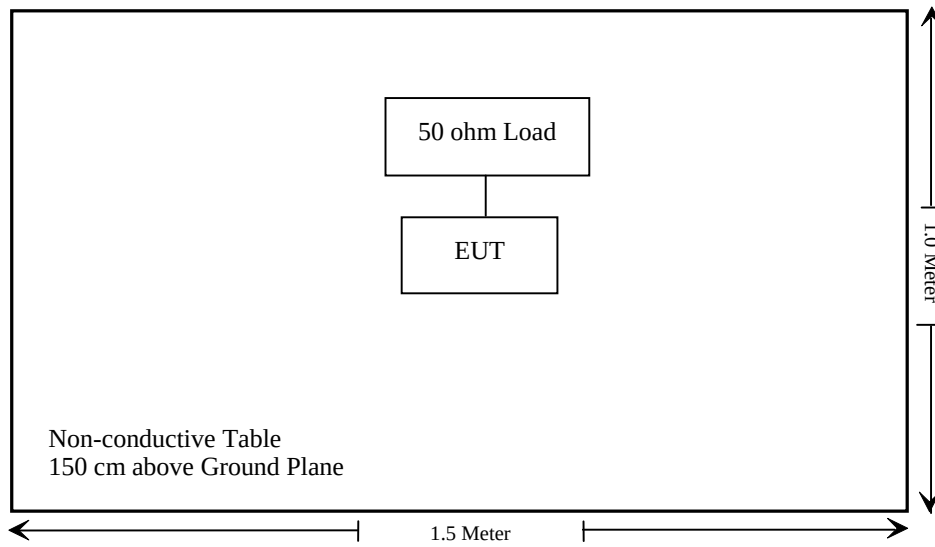
Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
N/A	50 ohm Load	N/A	N/A

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§2.1093	RF Exposure	Compliance
§2.1046, §95.639(a), §95.639(d)	RF Output Power	Compliance
§2.1047, §95.637(a)	Modulation Characteristic	Compliance
§2.1049, §95.633(a) (c)	Authorized Bandwidth & Emission Mask	Compliance
§2.1053, §95.635(b) (7)	Spurious Radiated Emissions	Compliance
§2.1055(d), §95.626(b), §95.621	Frequency Stability	Compliance

FCC §2.1093 - RF EXPOSURE INFORMATION

Applicable Standard

Please refer to SAR Report Number: RSZ160127810-20.

FCC §2.1046, §95.639(a) - RF OUTPUT POWER**Applicable Standard**

Per FCC §95.639 (a) (1), No GMRS transmitter, under any condition of modulation, shall exceed 50 W Carrier power when transmitting emission type A1D, F1D, G1D, A3E, F3E or G3E.

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

Spectrum Analyzer Setting:

R B/W Video B/W
100 kHz 300 kHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	RF Communication Test Set	HP8920A	3438A05201	2016-06-13	2017-06-13
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
Aeroflex	30dB attenuator	53-30-43	CAGE 93459	2016-06-18	2017-06-18

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

Test Data**Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2016-08-08.

Test Mode: Transmitting

Test Result: Compliance.

Frequency (MHz)	Output Power	Output Power	Result
	(dBm)	(W)	
462.625	32.76	1.89	Pass
467.625	32.94	1.97	Pass

The applicant declared that the rated power is 2W.

FCC §2.1047 & §95.637(a) - MODULATION CHARACTERISTIC**Applicable Standard**

Per FCC §2.1047 and §95.637(a): A GMRS transmitter that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 5 kHz. A FRS unit that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 2.5 kHz, and the audio frequency response must not exceed 3.125 kHz .

Each GMRS transmitter, except a mobile station transmitter with a power output of 2.5 W or less, must automatically prevent a greater than normal audio level from causing over-modulation. The transmitter also must include audio frequency low pass filtering, unless it complies with the applicable paragraphs of § 95.631 (without filtering.) The filter must be between the modulation limiter and the modulated stage of the transmitter. At any frequency (f in kHz) between 3 and 20 kHz, the filter must have an attenuation of at least $60 \log_{10} (f/3)$ dB greater than the attenuation at 1 kHz. Above 20 kHz, it must have an attenuation of at least 50 dB greater than the attenuation at 1 kHz.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
HP	RF Communication Test Set	HP8920A	3438A05201	2016-06-13	2017-06-13

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

Test Procedure

Test Method: TIA/EIA-603-D

Test Data**Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2016-08-08.

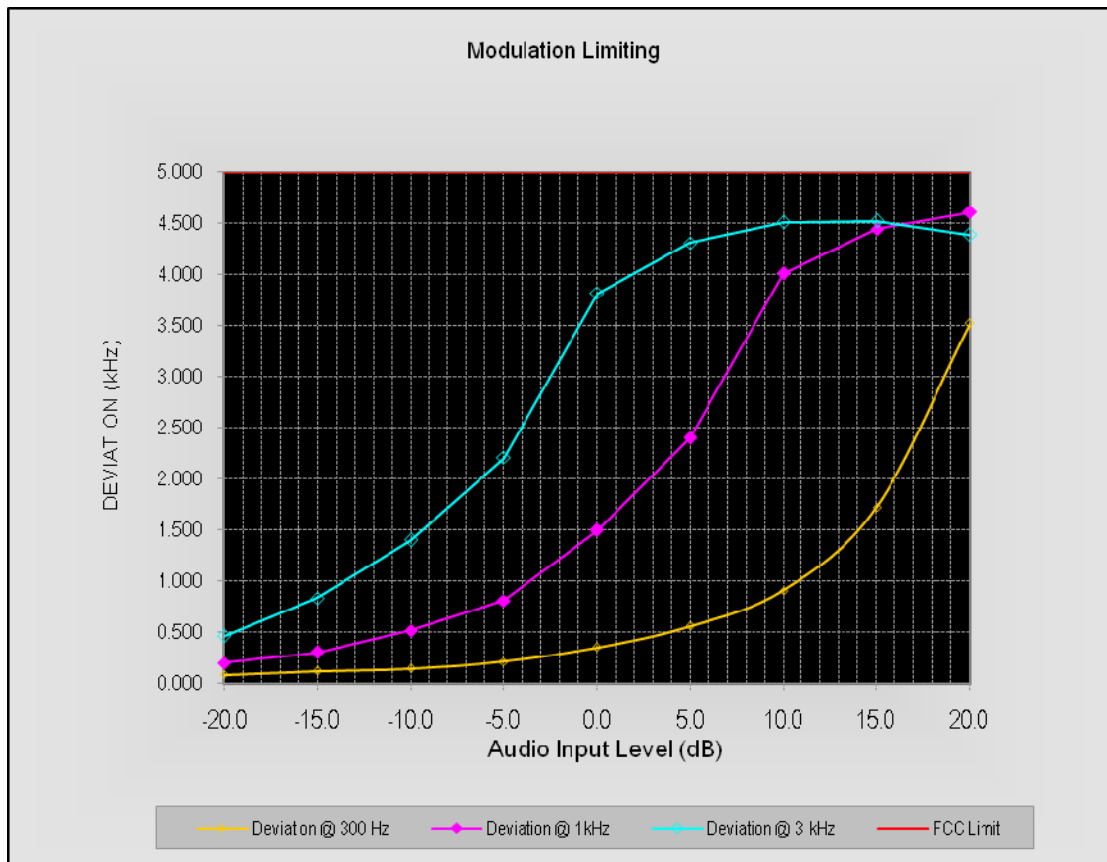
Please refer to the following tables and plots.

Test Mode: Transmitting

MODULATION LIMITING

GMRS (462.625 MHz)

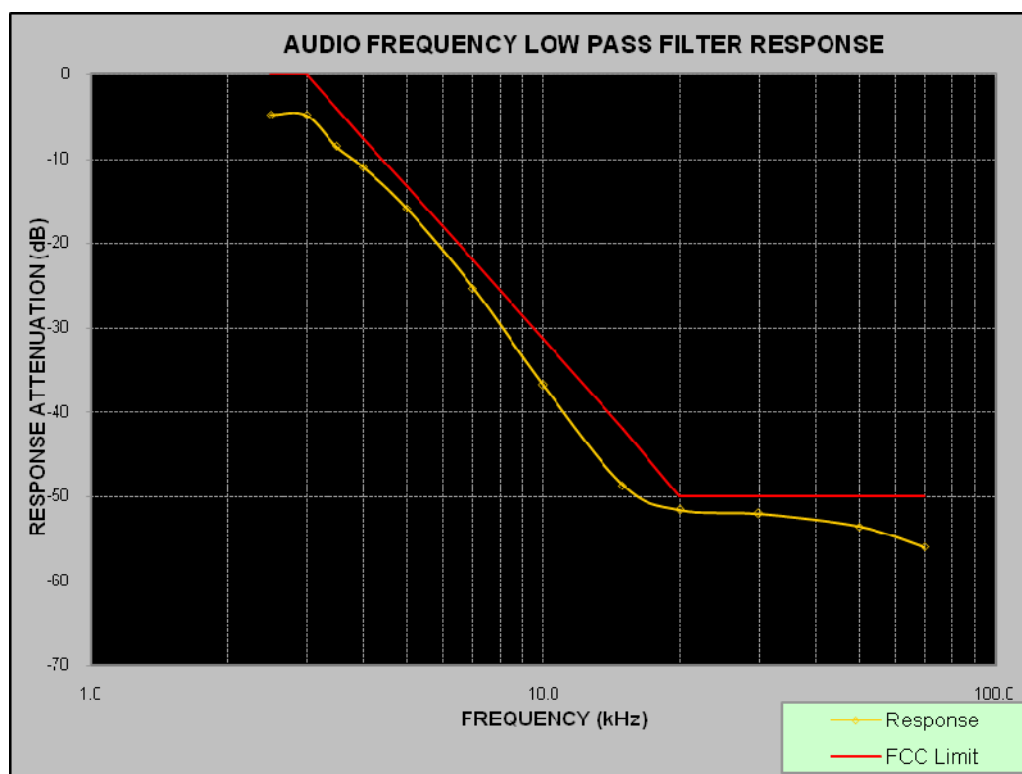
Audio Input Level (dB)	Frequency Deviation (kHz)			FCC Limit (kHz)
	(@ 300 Hz)	(@ 1000 Hz)	(@ 3000 Hz)	
20.0	3.523	4.605	4.387	5.0
15.0	1.723	4.442	4.520	5.0
10.0	0.912	4.008	4.510	5.0
5.0	0.560	2.402	4.311	5.0
0.0	0.354	1.500	3.818	5.0
-5.0	0.213	0.812	2.209	5.0
-10.0	0.145	0.519	1.404	5.0
-15.0	0.121	0.307	0.833	5.0
-20.0	0.089	0.201	0.465	5.0



Audio frequency Low Pass Filter Response

GMRS (462.625 MHz)

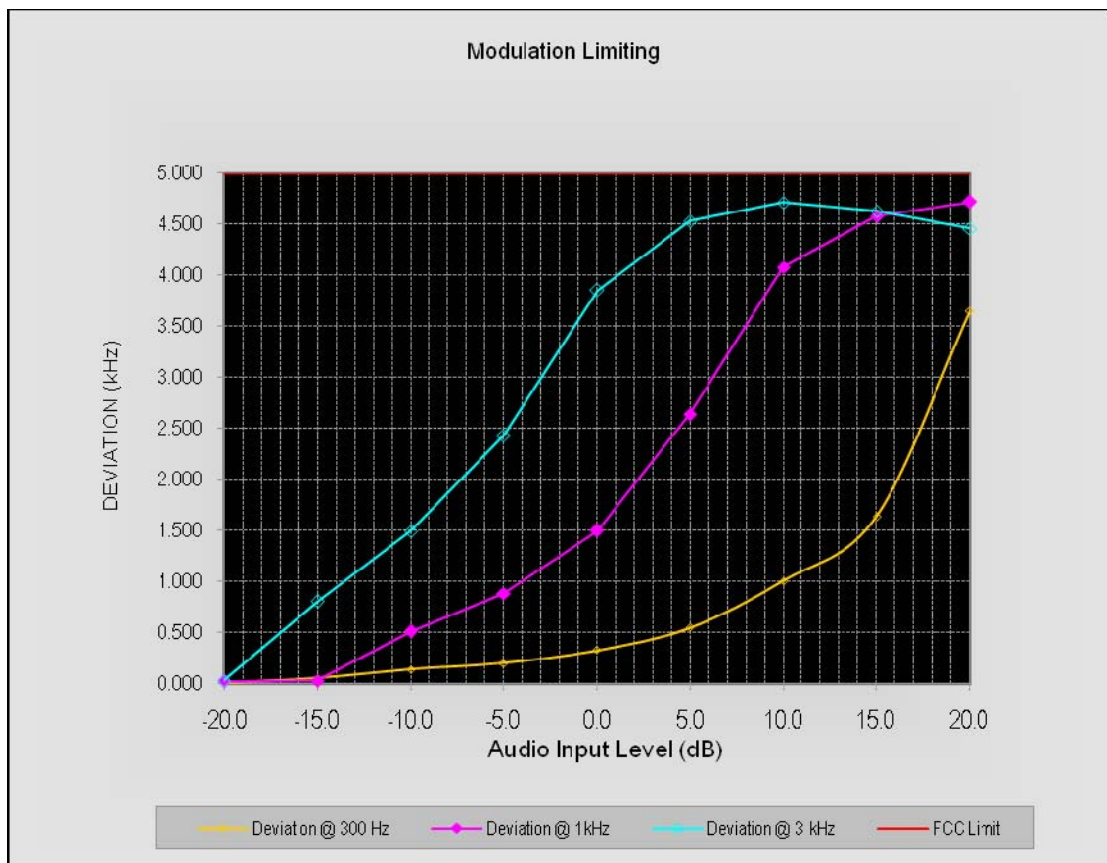
Audio Frequency (kHz)	Response Attenuation (dB)	FCC Limit (dB)
2.5	-4.72	0.0
3.0	-4.8	0.0
3.5	-8.49	-4.0
4.0	-10.96	-7.5
5.0	-15.91	-13.3
7.0	-25.33	-22.1
10.0	-36.8	-31.4
15.0	-48.75	-42.0
20.0	-51.63	-50.0
30.0	-52.08	-50.0
50.0	-53.62	-50.0
70.0	-56.04	-50.0



MODULATION LIMITING

GMRS (467.625 MHz)

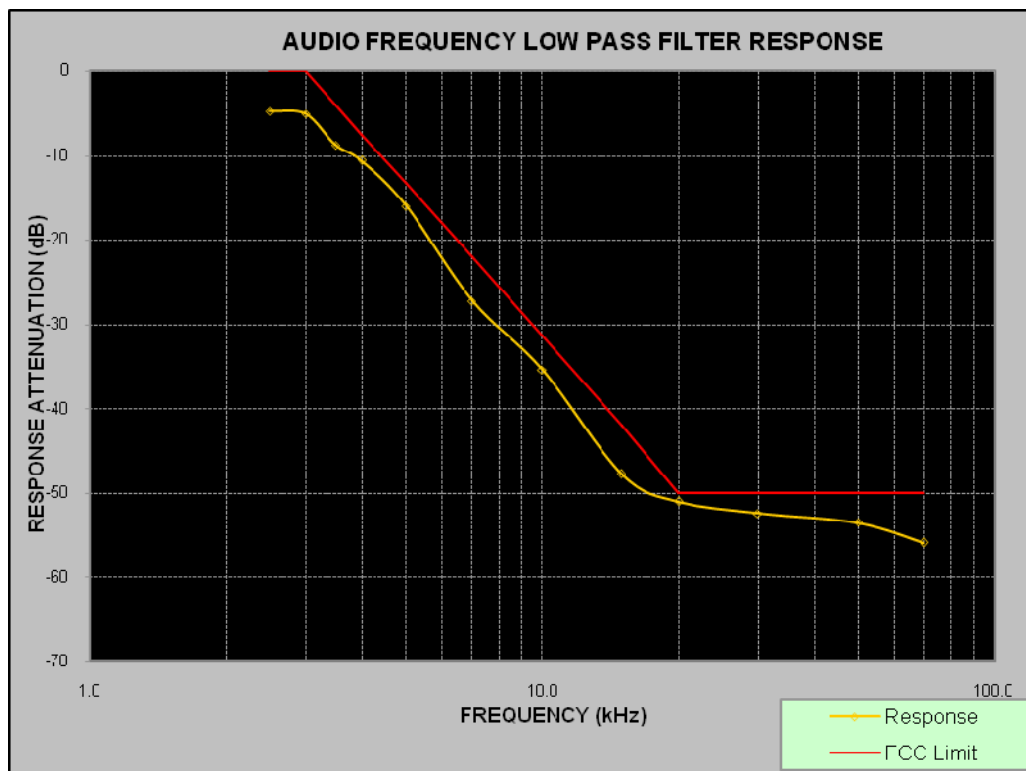
Audio Input Level (dB)	Frequency Deviation (kHz)			FCC Limit (kHz)
	(@ 300 Hz)	(@ 1000 Hz)	(@ 3000 Hz)	
20.0	3.651	4.717	4.458	5.0
15.0	1.641	4.575	4.624	5.0
10.0	1.007	4.077	4.712	5.0
5.0	0.550	2.638	4.529	5.0
0.0	0.332	1.500	3.850	5.0
-5.0	0.204	0.884	2.431	5.0
-10.0	0.139	0.510	1.493	5.0
-15.0	0.056	0.032	0.807	5.0
-20.0	0.011	0.023	0.031	5.0



Audio frequency Low Pass Filter Response

GMRS (467.625 MHz)

Audio Frequency (kHz)	Response Attenuation (dB)	FCC Limit (dB)
2.5	-4.74	0.0
3.0	-5.06	0.0
3.5	-8.71	-4.0
4.0	-10.63	-7.5
5.0	-16.01	-13.3
7.0	-27.22	-22.1
10.0	-35.39	-31.4
15.0	-47.78	-42.0
20.0	-51.02	-50.0
30.0	-52.45	-50.0
50.0	-53.51	-50.0
70.0	-55.9	-50.0



FCC §2.1049 & §95.633(a) (c) - AUTHORIZED BANDWIDTH AND EMISSION MASK

Applicable Standard

According to §95.633(c), the authorized bandwidth for emission type F3E or F2D transmitted by a FRS unit is 12.5 kHz. The authorized bandwidth for emission type F1D, G1D, F3E or G3E is 20kHz.

The power of each unwanted emission shall be less than TP as specified in the applicable paragraphs listed in the following :

- 1) At least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.
- 2) At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.
- 3) At least $43 + 10 \log_{10}(T)$ dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

Test Procedure

TIA-603-D, section 2.2.11

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	RF Communication Test Set	HP8920A	3438A05201	2016-06-13	2017-06-13
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
Aeroflex	30dB attenuator	53-30-43	CAGE 93459	2016-06-18	2017-06-18

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

Test Data

Environmental Conditions

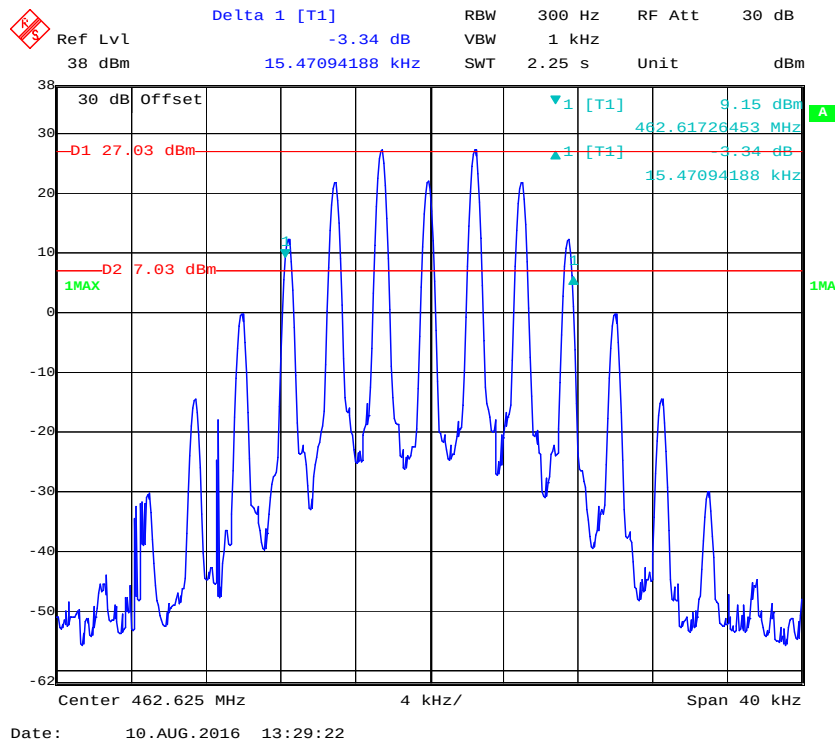
Temperature:	23 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2016-08-10.

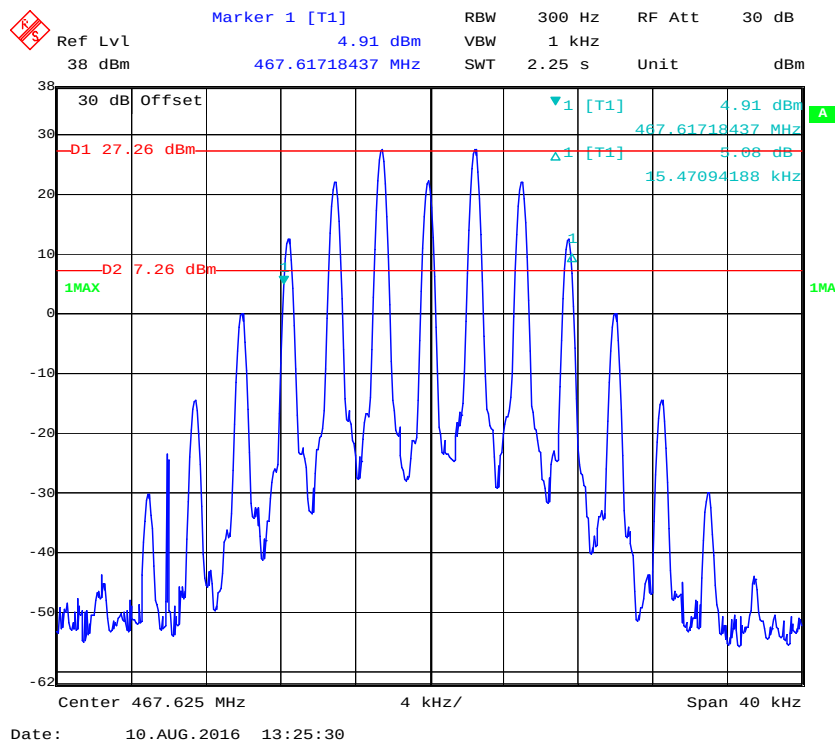
Test Mode: Transmitting

Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
462.625	15.47	20	Pass
467.625	15.47		Pass

GMRS (462.625 MHz)

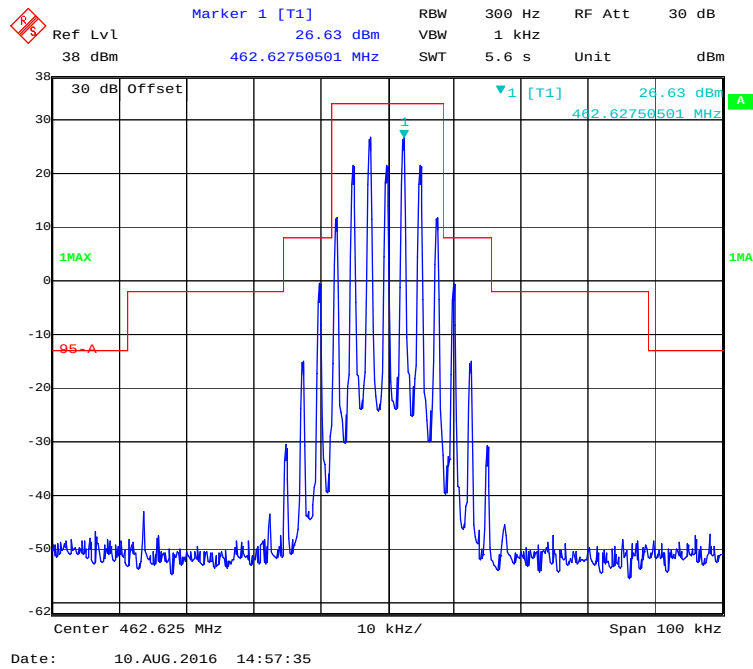


GMRS (467.625 MHz)

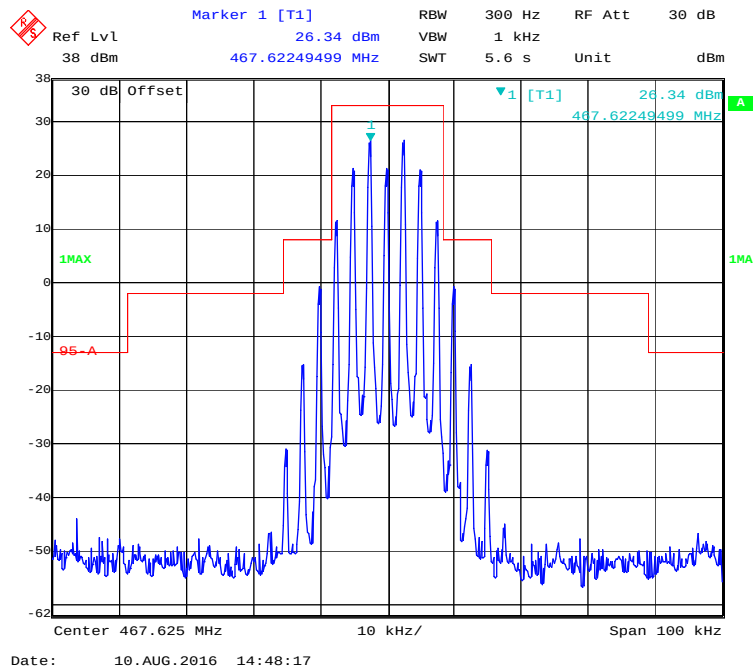


Emission Mask

GMRS (462.625 MHz)



GMRS (467.625 MHz)



FCC §2.1053 & §95.635(b) (7) - RADIATED SPURIOUS EMISSION

Applicable Standard

FCC §2.1053 and §95.635

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB = 43+10 Log₁₀ (power out in Watts)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Horn Antenna	DRH-118	A052604	2014-12-29	2017-12-28
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2014-12-07	2017-12-06
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2016-04-14	2017-04-14
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2016-04-23	2017-04-23
HP	Amplifier	HP8447E	1937A01046	2015-05-06	2017-05-06
HP	Signal Generator	HP 8341B	2624A00116	2016-07-02	2017-07-01
COM POWER	Dipole Antenna	AD-100	041000	2015-08-18	2016-08-18
A.H. System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2015-12-15	2016-12-14
Electro-Mechanics	Horn Antenna	3116	9510-2270	2013-10-14	2016-10-13
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2015-10-22	2016-10-22
Ducommun technologies	RF Cable	104PEA	218124002	2015-10-22	2016-10-22
Ducommun technologies	RF Cable	RG-214	1	2016-05-06	2017-05-06
Ducommun technologies	RF Cable	RG-214	2	2016-05-06	2017-05-06
WEINSCHEL	HIGH PASS FILTER	NHP-600	15542	2016-05-06	2017-05-06
Aeroflex	30dB attenuator	53-30-43	CAGE 93459	2016-06-18	2017-06-18

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

Test Data**Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2016-08-08 and 2016-09-06

Test Mode: Transmitting

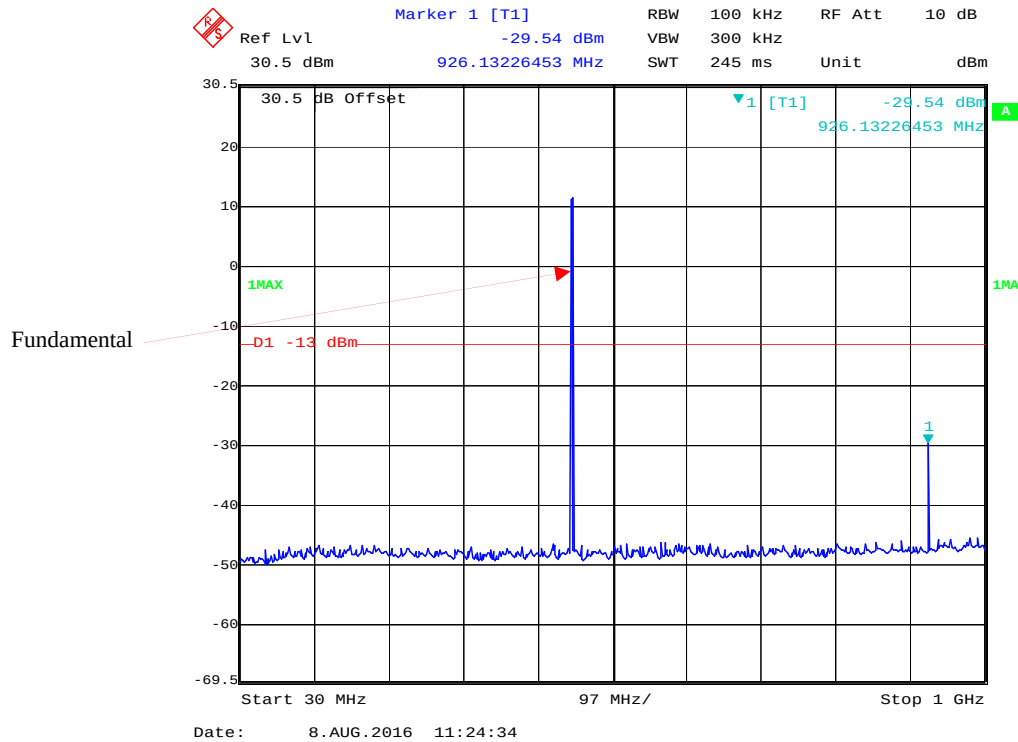
Indicated		Table Angle Degree	Test Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	Receiver Reading (dBuV)		Height (m)	Polar (H/V)	Level (dBm)	Antenna Gain	Cable Loss (dB)			
GMRS (462.625 MHz)										
462.625	103.01	69	1.5	V	33	0	0.47	32.53	/	/
462.625	102.93	254	1.6	H	32.9	0	0.47	32.43	/	/
925.25	63.2	9	2.0	H	-33.8	0.70	0	-34.50	-13	21.50
925.25	64.01	90	2.2	V	-33.0	0.70	0	-33.70	-13	20.70
1387.875	76.38	112	2.3	H	-33.3	1.20	6.40	-28.10	-13	15.10
1387.875	76.32	124	2.4	V	-33.4	1.20	6.40	-28.20	-13	15.20
1850.5	78.93	259	2.0	H	-29.1	1.40	7.30	-23.20	-13	10.20
1850.5	77.85	134	1.7	V	-30.7	1.40	7.30	-24.80	-13	11.80
GMRS (467.625 MHz)										
462.625	103.23	69	1.5	V	33.2	0	0.47	32.73	/	/
462.625	102.11	254	1.6	H	32.1	0	0.47	31.63	/	/
935.25	63.12	317	1.8	H	-33.9	0.70	0	-34.60	-13	21.60
935.25	64.29	210	1.0	V	-32.7	0.70	0	-33.40	-13	20.40
1402.875	78.21	232	2.5	H	-31.5	1.20	6.40	-26.30	-13	13.30
1402.875	77.96	16	1.9	V	-31.7	1.20	6.40	-26.50	-13	13.50
1870.5	79.2	216	1.6	H	-28.8	1.40	7.30	-22.90	-13	9.90
1870.5	76.52	200	2.2	V	-32.1	1.40	7.30	-26.20	-13	13.20

Note:

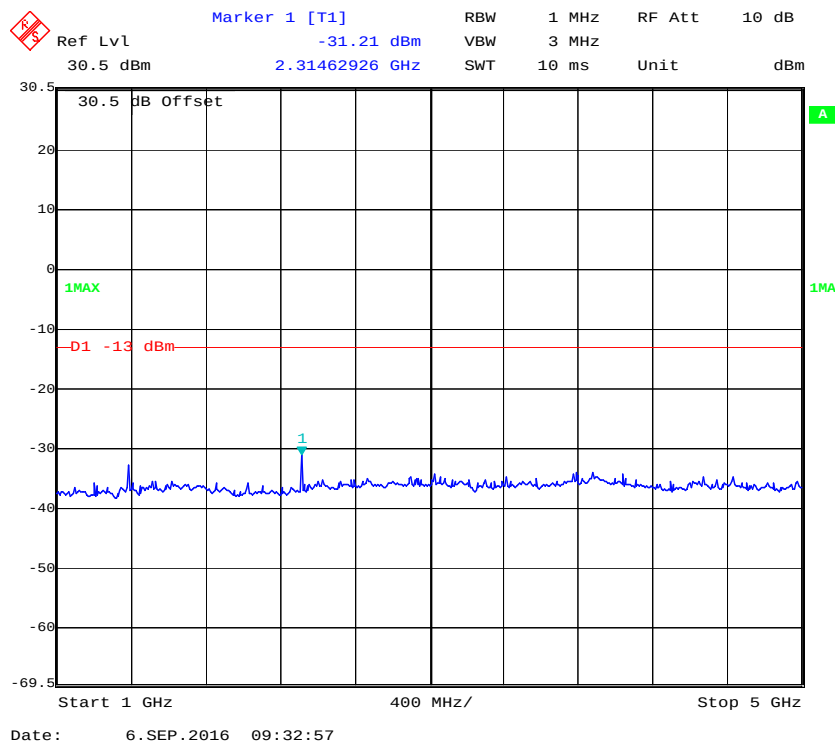
- 1) Absolute Level = SG Level - Cable loss + Antenna Gain
- 2) Margin = Limit- Absolute Level

Conducted spurious emission:

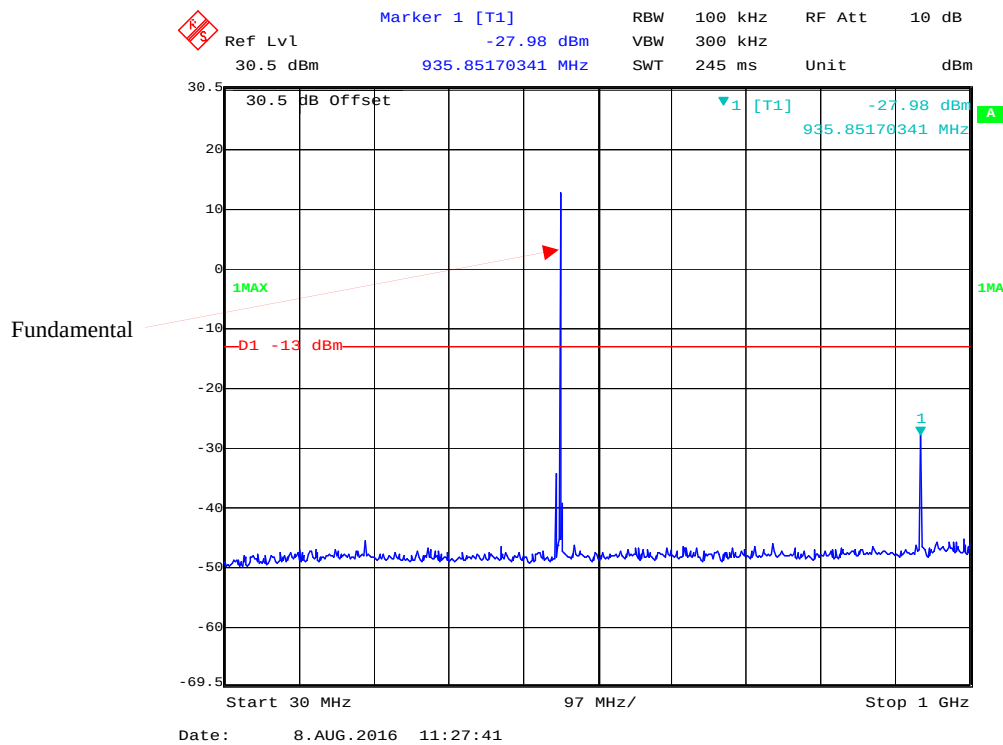
462.625 MHz (30 MHz-1 GHz)



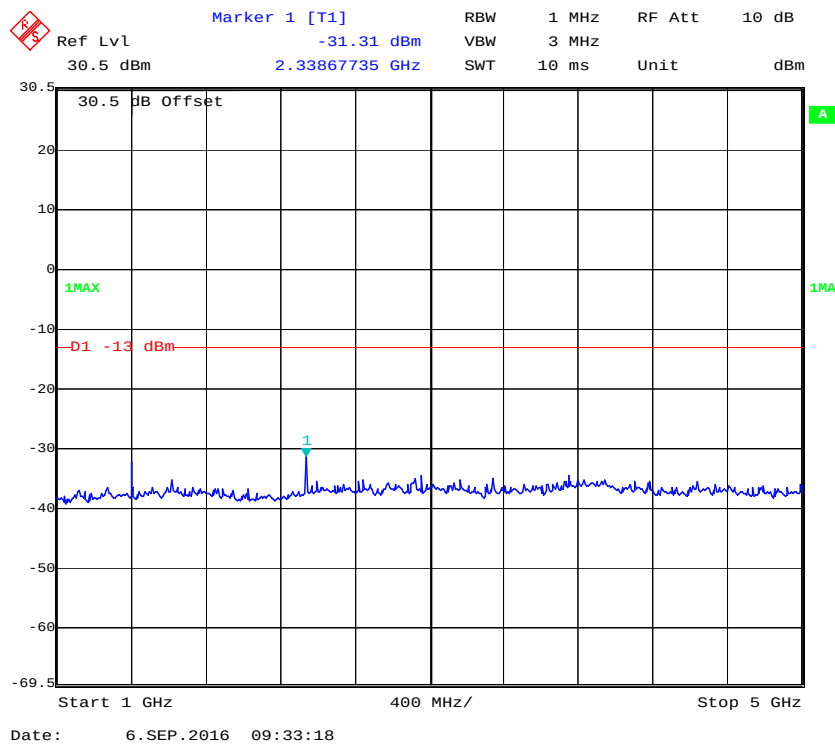
462.625 MHz (1 GHz-5 GHz)



467.625 MHz (30 MHz-1 GHz)



467.625 MHz (1 GHz-5 GHz)



FCC§2.1055 (d), §95.621 - FREQUENCY STABILITY**Applicable Standard**

According to FCC §2.1055(a) (1), the frequency stability shall be measured with variation of ambient temperature from –30 °C to +50 °C, and according to FCC 2.1055(d) (2), the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.

According to FCC §95.621, Each GMRS transmitter for mobile station, small base station and control station operation must be maintained within a frequency tolerance of 0.0005 % (5 ppm).

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a Frequency Counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Frequency Counter.

Frequency Stability vs. Voltage:

1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

The output frequency was recorded for each voltage.

Test Equipment List and Details

Manufacturer	Description	Model NO.	Serial NO.	Calibration Date	Calibration Due Date
Hewlett-Packard	Frequency Counter	5343A	2232A00827	2016-05-09	2019-05-08
WUHUAN	Temperature & Humidity Chamber	HTP205	20021115	NCR	NCR
Aeroflex	30dB attenuator	53-30-43	CAGE 93459	2016-06-18	2017-06-18

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

Test Data**Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2016-08-08.

Test Mode: Transmitting

GMRS

Reference Frequency: 462.625 MHz, Limit: ± 5 ppm			
Environment Temperature (°C)	Power Supplied (V _{DC})	Measurement Frequency (MHz)	Frequency Error (ppm)
Frequency Stability Ver. Temperature			
50	7.4	462.624895	-0.227
40	7.4	462.624892	-0.233
30	7.4	462.624894	-0.229
20	7.4	462.624897	-0.223
10	7.4	462.624890	-0.238
0	7.4	462.624895	-0.227
-10	7.4	462.624893	-0.231
-20	7.4	462.624887	-0.244
-30	7.4	462.624889	-0.240
Frequency Stability Ver. Input Voltage			
20	6.4	462.624896	-0.225

GMRS

Reference Frequency: 467.625 MHz, Limit: ± 5 ppm			
Environment Temperature (°C)	Power Supplied (V _{DC})	Measurement Frequency (MHz)	Frequency Error (ppm)
Frequency Stability Ver. Temperature			
50	7.4	467.624890	-0.2352
40	7.4	467.624879	-0.2588
30	7.4	467.624898	-0.2181
20	7.4	467.624888	-0.2395
10	7.4	467.624886	-0.2438
0	7.4	467.624894	-0.2267
-10	7.4	467.624930	-0.1497
-20	7.4	467.624892	-0.2310
-30	7.4	467.624894	-0.2267
Frequency Stability Ver. Input Voltage			
20	6.4	467.624891	-0.2331

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