

## FCC PART 90

## TEST REPORT

For

### Hytera Communications Co., Ltd.

HYT Tower, Hi-Tech Industrial Park North, Nanshan District, Shenzhen, China

**FCC ID: YAMZ1PF5**

<b>Report Type:</b> Original Report	<b>Product Type:</b> TETRA Terminal
<b>Test Engineer:</b> Candy Li <i>Candy Li</i>	
<b>Report Number:</b> RSZ150205006-00A Rev	
<b>Report Date:</b> 2015-04-23	
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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

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### Product Description for Equipment under Test (EUT)

The *Hytera Communications Co., Ltd.*'s product, model number: *Z1p F5(FCC ID: YAMZ1PF5)* or the "EUT" in this report was a *TETRA Terminal*, the handset unit was measured approximately: 12.5 cm (L) x 6.0 cm (W) x 2.2 cm (H), rated with input voltage: DC 7.4V battery; charger unit was measured approximately: 8.4 cm (L) x 10.6 cm (W) x 4.7 cm (H), rated with input voltage: DC 12.0V from adapter.

#### Adapter Information:

Model: HKA01212010-2F

Input: 100~240V, 50~60Hz, 0.5A

Output: 12.0V, 1.0A

*\* All measurement and test data in this report was gathered from production sample serial number: 1502051 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2015-02-05.*

### Objective

This test report is prepared on behalf of *Hytera Communications Co., Ltd.* in accordance with Part 2, and Part 90 of the Federal Communication Commission rules.

### Related Submittal(s)/Grant(s)

Part 15.247 DSS submissions with FCC ID: YAMZ1PF5.

### Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-D and ANSI 63.4-2009.

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.

Measurement uncertainty with radiated emission is 5.91 dB for 30MHz-1GHz.and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

## Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3<sup>rd</sup> 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 December 06, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

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

The system was configured for testing in a test mode which has been done in the factory.

### Equipment Modifications

No modification was made to the EUT tested.

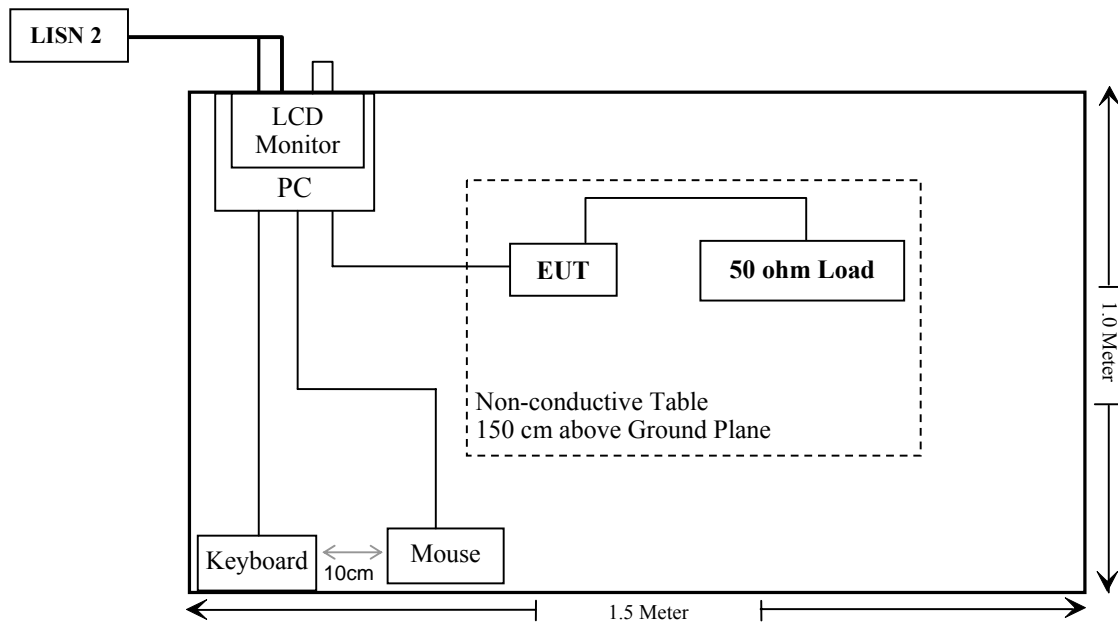
### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	PC	VOSTRO 220S	127BP2X
DELL	LCD Monitor	E178WFPC	CN-OWY564-64180-7C4-2SQH
DELL	Keyboard	L100	CNORH656658907BL05DC
DELL	Mouse	MOC5UO	G1900NKD
N/A	50 ohm Load	N/A	N/A

### External I/O Cable

Cable Description	Length (m)	From/Port	To
Shielding Detachable K/B Cable	1.5	Host PC	Keyboard
Shielding Detachable Mouse Cable	1.5	Host PC	Mouse
Shielding Detachable VGA Cable	1.5	Host PC	Monitor
Shielding Detachable RS232 Cable	1.0	Host PC	EUT

## Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Results
§1.1307(b), §2.1093	RF Exposure	Compliance
§2.1046; §90.205	RF Output Power	Compliance
§90.210; §90.221	Adjacent Channel Power	Compliance
§2.1047; §90.207	Modulation Characteristic	Not Applicable*
§2.1049; §90.209; §90.210; §90.691	Occupied Bandwidth & Emission Mask	Compliance
§2.1051; §90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053; §90.210	Spurious Radiated Emissions	Compliance
§2.1055; §90.213	Frequency Stability	Compliance
§90.214	Transient Frequency Behavior	Not Applicable

Not applicable\*: Modulation Characteristic test item is not required for digital device



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## **FCC §1.1307(b) & §2.1093 - RF EXPOSURE**

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### **Applicable Standard**

According to FCC §1.1307(b) and §2.1093, portable device operates Part 90 should be subjected to routine environmental evaluation for RF exposure prior or equipment authorization or use.

**Result:** Compliance.

Please refer to SAR Report Number: RSZ150205006-20A.

**FCC §2.1046 & §90.205- RF OUTPUT POWER****Applicable Standard**

FCC §2.1046 and §90.205

**Test Procedure**

Conducted RF Output Power:

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
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2014-08-22	2015-08-22

\* **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:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Candy Li on 2015-02-13.

Test Mode: Transmitting

**Test Result:** Compliance. Please refer to following table.

Frequency (MHz)	Channel Spacing (kHz)	Conducted Output Power (dBm)	Conducted Output Power (W)
809.0125	25	32.78	1.897
823.9875		32.80	1.905
854.0125		32.81	1.910
868.9875		32.91	1.954

Note: The rated power is 1.8 Watt.

## FCC §2.1046, §90.210& §90.221- ADJACENT CHANNEL POWER

### Applicable Standard

FCC §2.1046, §90.210& §90.221

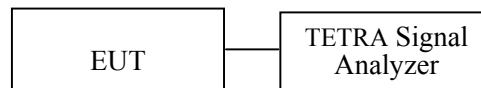
According to FCC§90.221 (c) (1), Maximum adjacent power levels for frequencies in the 809-824/854-869 MHz band:

Frequency offset	Maximum ACP (dBc) for devices less than 15 watts	Maximum ACP (dBc) for devices 15 watts and above
25 kHz	-55 dBc	-55 dBc
50 kHz	-65 dBc	-65 dBc
75 kHz	-65 dBc	-70 dBc

(2) In any case, no requirement in excess of -36 dBm shall apply

### Test Procedure

The EUT was connected to the TETRA signal analyzer



### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
IFR	TETRA Signal Analyzer	2310	231001/173	2014-03-11	2015-03-11

\* **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

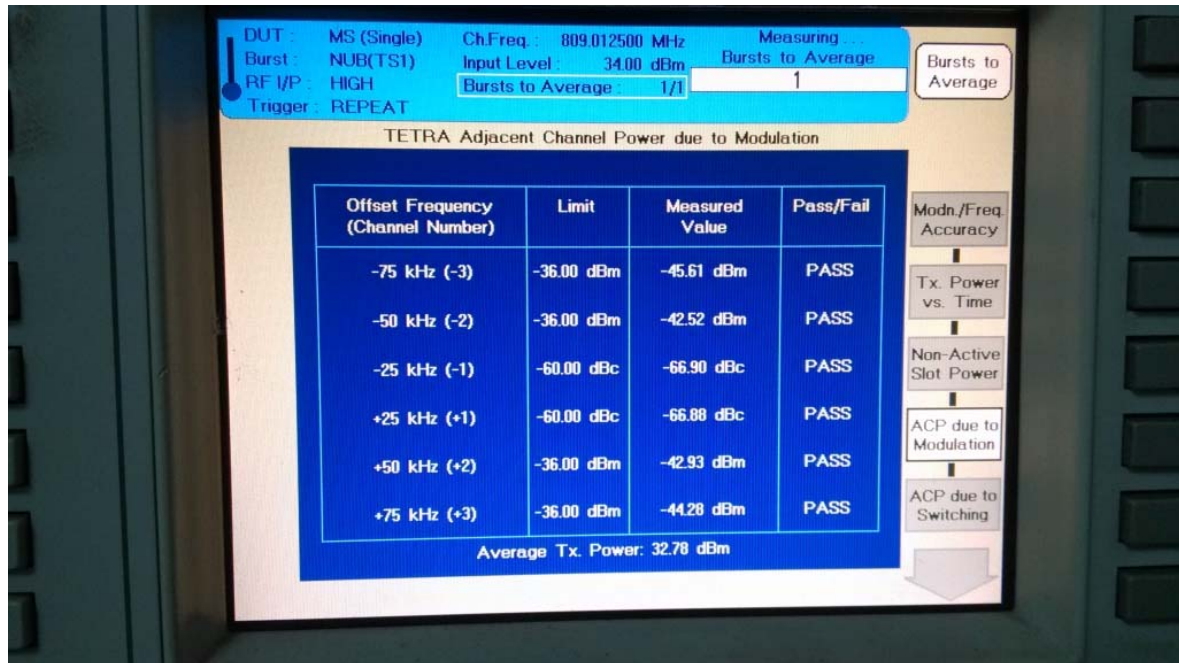
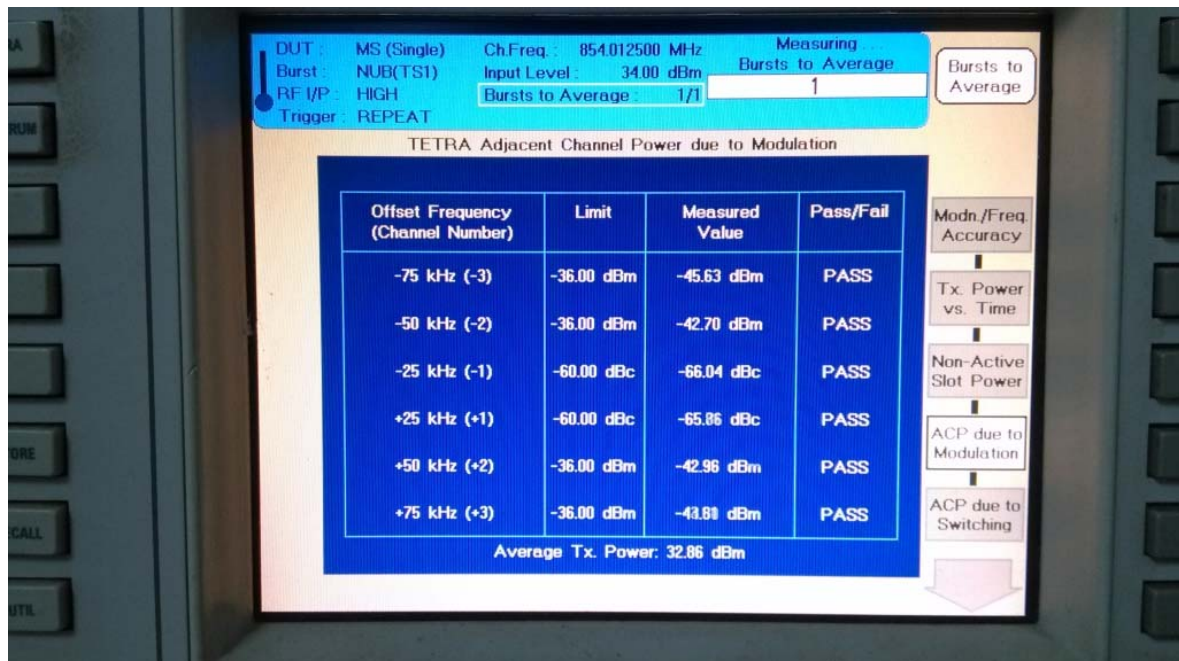
Temperature:	24 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Candy Li on 2015-02-13.

Test Mode: Transmitting

**Test Result:** Compliance. Please refer to following table and plots.

Channel Frequency (MHz)	Channel Separation (kHz)	Adjacent Channel (kHz)	Adjacent Channel Ratio (dB)	FCC Part 90
				Limit (dB)
809.0125	25	-75	-78.39	-65
		-50	-75.30	-65
		-25	-66.90	-55
		+25	-66.88	-55
		+50	-75.71	-65
		+75	-77.06	-65
854.0125	25	-75	-78.49	-65
		-50	-75.56	-65
		-25	-66.04	-55
		+25	-65.86	-55
		+50	-75.82	-65
		+75	-76.66	-65

**Adjacent Channel Power for Frequency 809.0125 MHz****Adjacent Channel Power for Frequency 854.0125 MHz**

## **FCC §2.1049 & §90.209, §90.210§90.691 – OCCUPIED BANDWIDTH & EMISSION MASK**

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### **Applicable Standard**

FCC §2.1049, §90.209, §90.210 and §90.691

Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P)$  dB.

Emission Mask I. For transmitters that are equipped with an audio low pass filter, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency of more than 6.8 kHz, but no more than 9.0 kHz: At least 25 dB;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency of more than 9.0 kHz, but no more than 15 kHz: At least 35 dB;
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency of more than 15 kHz: At least  $43 + 10 \log (P)$  dB, or 70 dB, whichever is the lesser attenuation.

Emission mask requirements for EA-based systems.

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least  $116 \log_{10}(f/6.1)$  decibels or  $50 + 10 \log_{10}(P)$  decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10}(P)$  decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

## Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the frequency band  $\pm 50$  kHz from the carrier frequency.

## Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2014-08-22	2015-08-22

\* **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:	22 °C
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

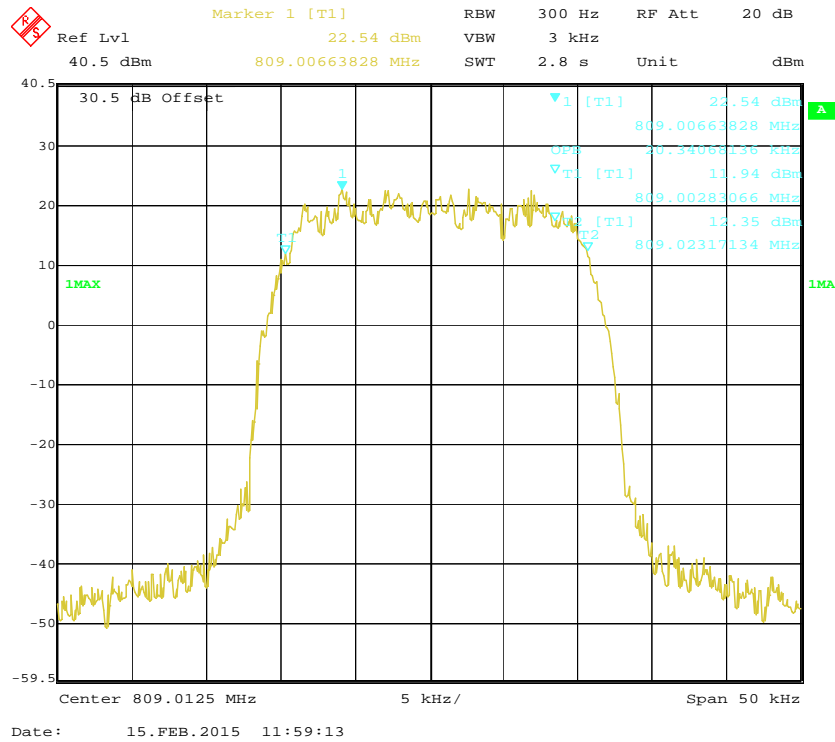
The testing was performed by Candy Li on 2015-02-15.

Frequency (MHz)	Channel Spacing (kHz)	99% Occupied Bandwidth (kHz)	Limited (kHz)
809.0125	25.0	20.34	22
823.9875	25.0	20.24	22
854.0125	25.0	20.14	22
868.9875	25.0	20.04	22

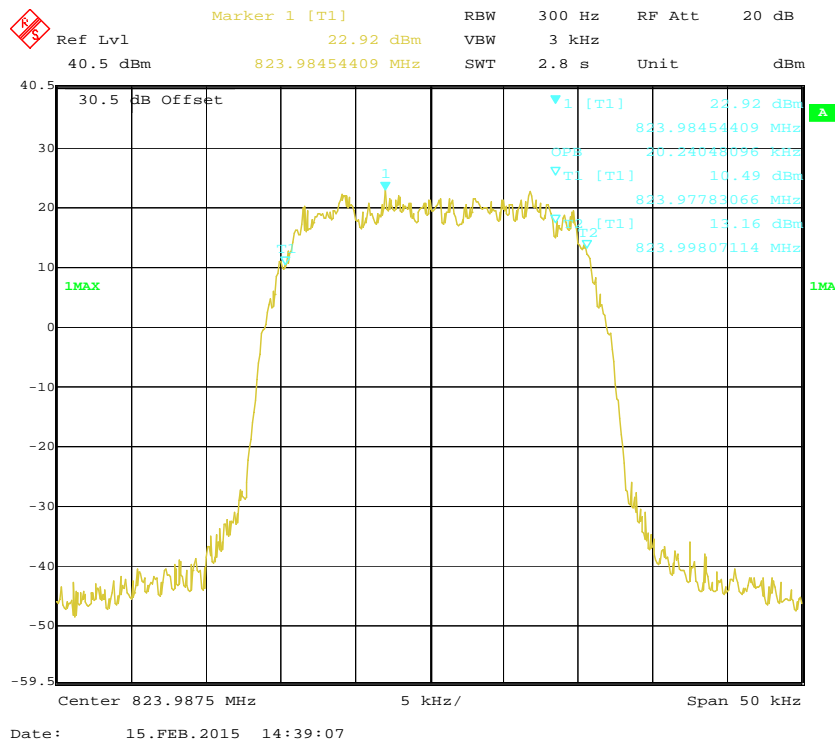
Note: Equipment meets the Adjacent Channel Power limits of §90.221, so emission mask is not tested.



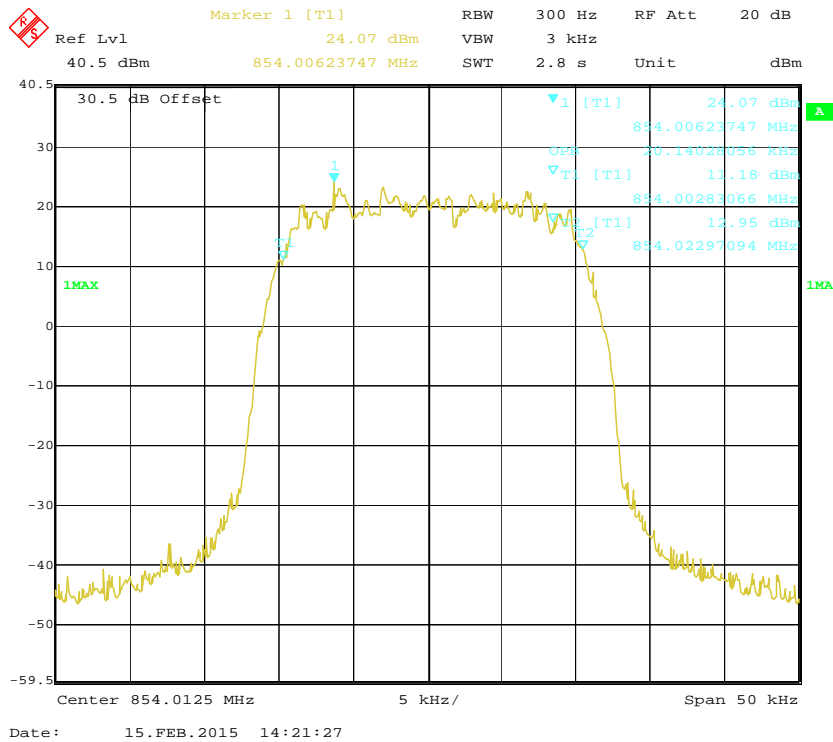
### 809.0125 MHz: 99% Occupied Bandwidth



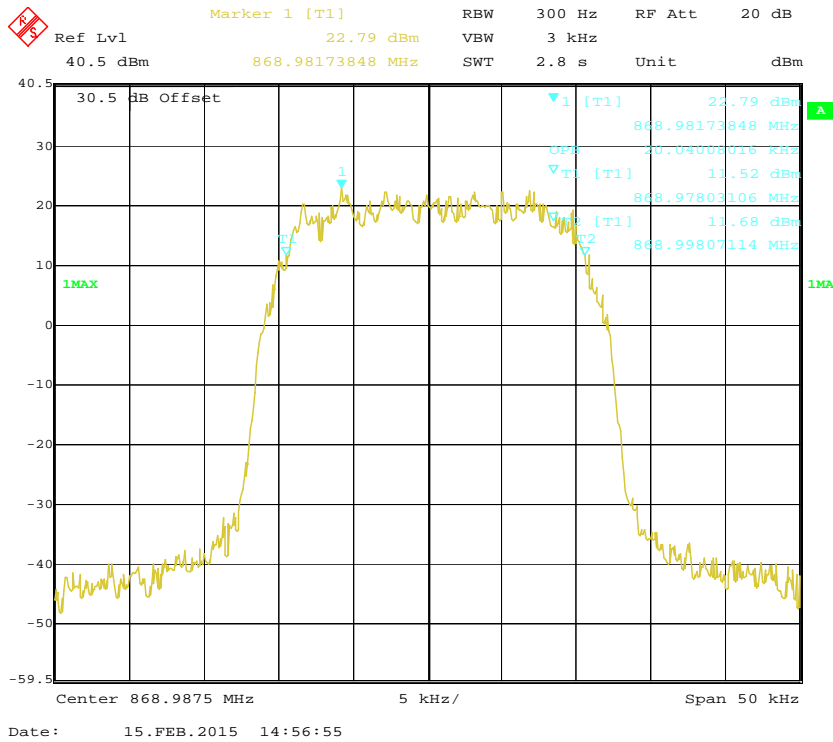
### 823.9875 MHz: 99% Occupied Bandwidth



### 854.0125 MHz: 99% Occupied Bandwidth



### 868.9875 MHz: 99% Occupied Bandwidth



## FCC §2.1051 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### Applicable Standard

Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P)$  dB.

### Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100kHz for below 1GHz, and 1MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2014-08-22	2015-08-22
Rohde & Schwarz	EMI Test Receiver	ESR	1316.3003K03-101746-zn	2014-06-13	2015-06-13

\* **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:	22 °C
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

*The testing was performed by Candy Li on 2015-02-15.*

*Test Mode: Transmitting*

The screenshot shows a Spectrum Analyzer interface. At the top, the title is "Spectrum". Below it, the settings are: Ref Level 40.50 dBm, Offset 30.50 dB, RBW 100 kHz, Att 20 dB, SWT 9.7 ms, VBW 300 kHz, Mode Auto Sweep, and Input 1 AC. The main display area shows a spectrum plot with a vertical yellow line at 821.00 MHz, labeled M1[1] at the top and M1 at the bottom. The peak level is -37.21 dBm. A red horizontal line at -13.000 dBm is labeled D1. The x-axis is labeled "Start 30.0 MHz", "691 pts", and "Stop 1.0 GHz". The y-axis is labeled from -50 dBm to 30 dBm in 10 dB increments. The plot shows a noisy baseline around -45 dBm.

Date: 15.FEB.2015 15:40:19

Ref Lvl 20.5 dBm Marker 1 [T1] -43.13 dBm RBW 1 MHz RF Att 0 dB  
 6.93386774 GHz VBW 3 MHz SWT 100 ms Unit dBm

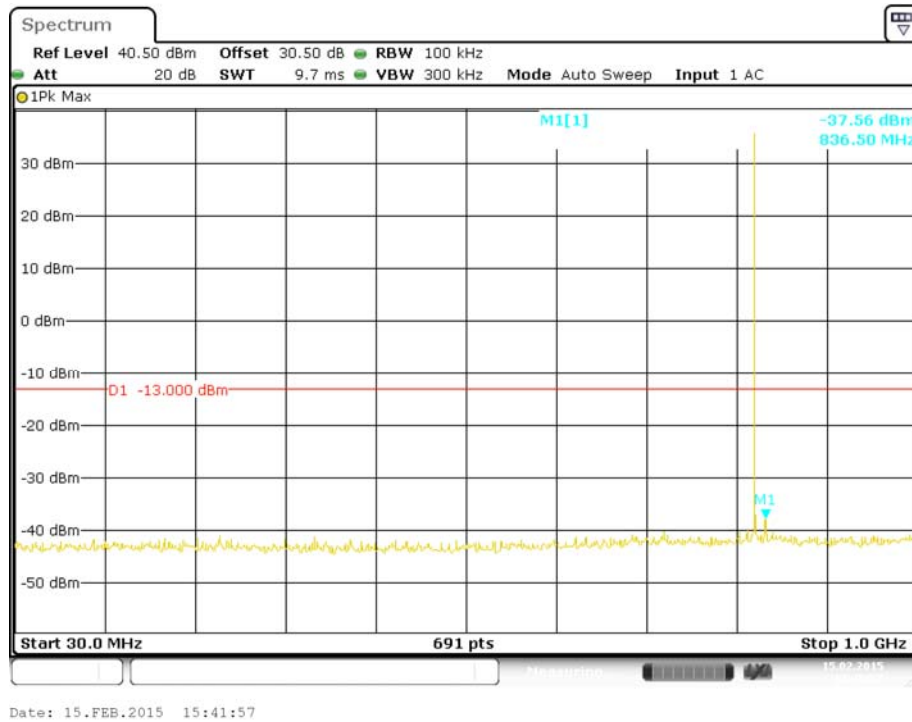
30.5 dB Offset

-13 dBm

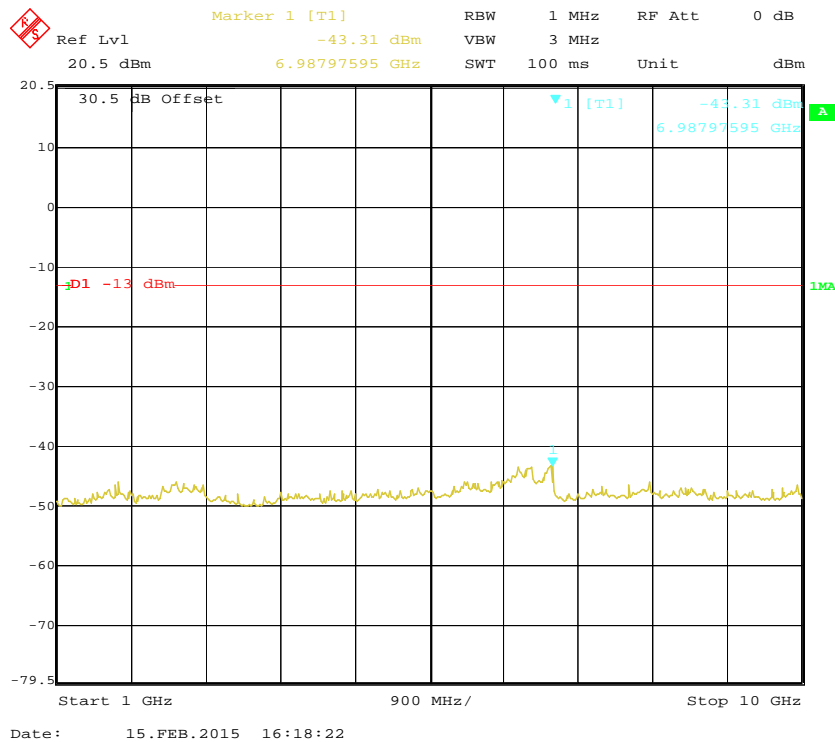
Start 1 GHz 900 MHz/ Stop 10 GHz

Date: 15.FEB.2015 16:21:15

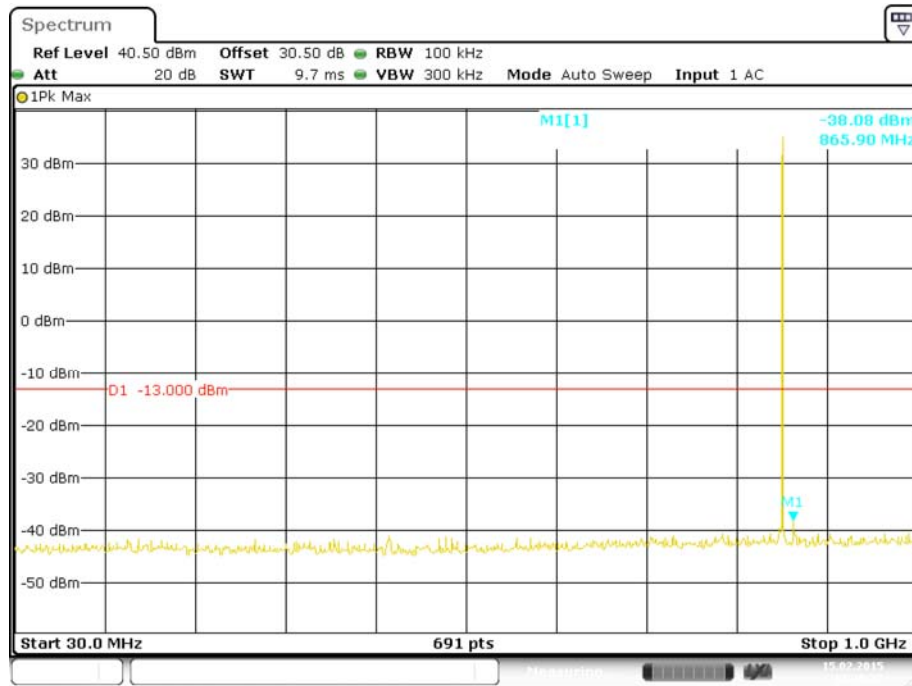
### 823.9875 MHz: 30 MHz~1 GHz, Channel Spacing 25 kHz



### 823.9875 MHz: 1~10 GHz, Channel Spacing 25 kHz

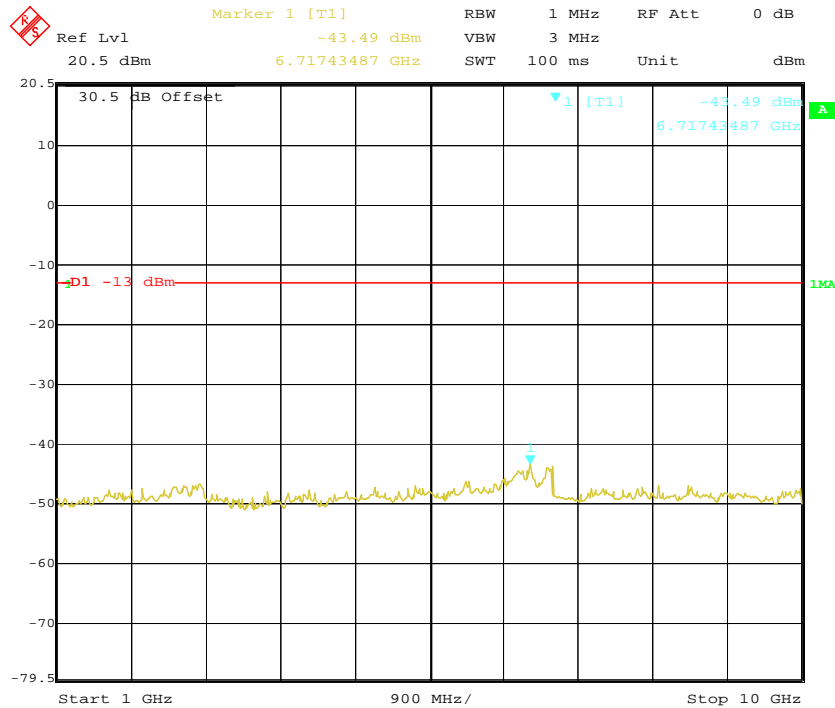


### 854.0125 MHz: 30 MHz~1 GHz, Channel Spacing 25 kHz



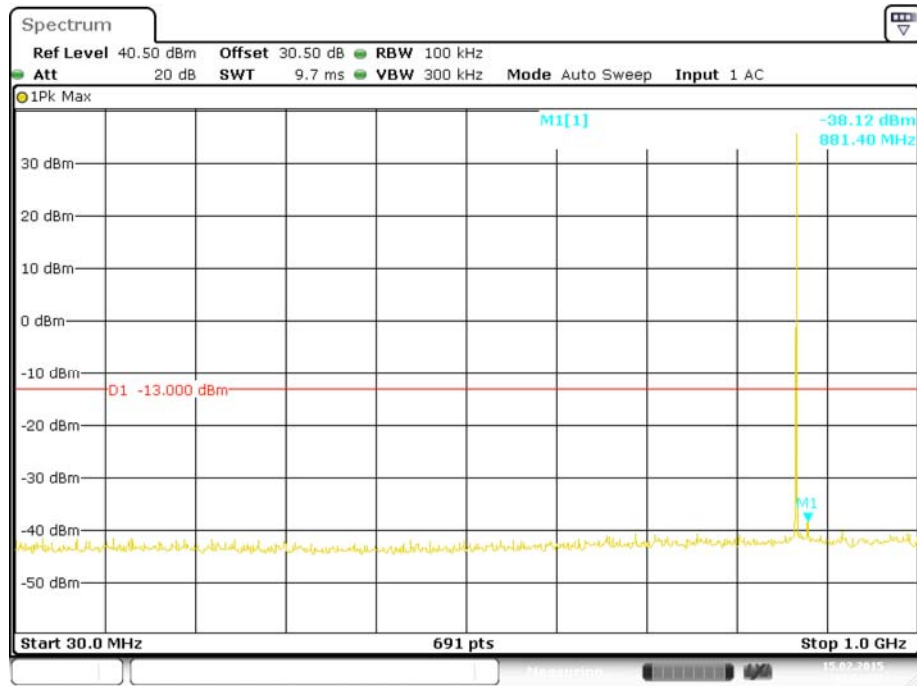
Date: 15.FEB.2015 15:48:31

### 854.0125 MHz: 1~10 GHz, Channel Spacing 25 kHz



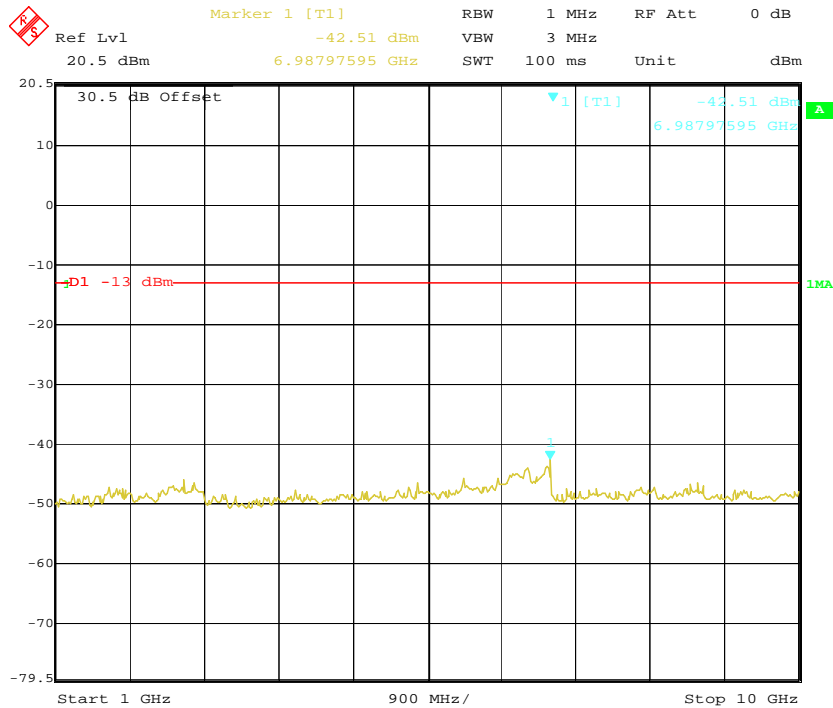
Date: 15.FEB.2015 16:11:55

## 868.9875 MHz: 30 MHz~1 GHz, Channel Spacing 25 kHz



Date: 15.FEB.2015 15:51:21

## 868.9875 MHz: 1~10 GHz, Channel Spacing 25 kHz



Date: 15.FEB.2015 16:09:26

## FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

### Applicable Standard

FCC §2.1053, §90.210

### 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 teeth 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 Log<sub>10</sub> (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Sunol Sciences	Horn Antenna	DRH-118	A052304	2014-12-01	2015-11-30
Sunol Sciences	Broadband Antenna	JB3	A111513	2014-06-18	2017-06-17
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2014-08-22	2015-08-22
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2014-11-03	2015-11-03
HP	Amplifier	8447E	1937A01046	2014-05-06	2015-05-06
Mini	Amplifier	ZVA-183-S+	5969001149	2014-04-23	2015-04-23
HP	Signal Generator	8657A	3217A04699	2014-12-19	2015-12-18
A.H. System	Horn Antenna	SAS-200/571	135	2013-02-11	2016-02-10
HP	Synthesized Sweeper	8341B	2624A00116	2014-06-03	2015-06-03
COM POWER	Dipole Antenna	AD-100	041000	NCR	NCR

\* **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**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

The testing was performed by Candy Li on 2015-02-13.

Test Mode: Transmitting

**30MHz - 10GHz:**

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 90	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
809.0125MHz, Channel Spacing 25 kHz										
701.24	42.22	306	1.9	H	-54.8	0.62	0	-55.42	-13	42.42
701.24	37.65	237	2.0	V	-59.3	0.62	0	-59.92	-13	46.92
1031.86	46.74	205	2.0	H	-54.8	0.90	6.00	-49.70	-13	36.70
1031.86	45.92	134	2.0	V	-56.2	0.90	6.00	-51.10	-13	38.10
2427.04	39.79	269	1.4	H	-56.5	1.40	8.50	-49.40	-13	36.40
2427.04	40.37	220	1.8	V	-55.4	1.40	8.50	-48.30	-13	35.30
854.0125MHz, Channel Spacing 25 kHz										
701.24	37.23	308	2.2	H	-59.8	0.62	0	-60.42	-13	47.42
701.24	39.67	161	2.0	V	-57.3	0.62	0	-57.92	-13	44.92
1027.25	46.62	84	2.1	H	-54.9	0.90	6.00	-49.80	-13	36.80
1027.25	44.36	52	1.2	V	-57.8	0.90	6.00	-52.70	-13	39.70
2562.04	38.75	258	2.0	H	-56.0	1.70	9.20	-48.50	-13	35.50
2562.04	39.64	181	1.7	V	-55.6	1.70	9.20	-48.10	-13	35.10

Note:

Absolute Level = SG Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

**FCC §2.1055 & §90.213- FREQUENCY STABILITY****Applicable Standard**

FCC §2.1055, §90.213

**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 counter.

**Test Equipment List and Details**

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Hewlett-Packard	Frequency Counter	5343A	2232A00827	2013-05-09	2016-05-08
ESPEC	Temperature & Humidity Chamber	EL-10KA	09107726	2014-11-01	2015-11-01

\* **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**

<b>Temperature:</b>	22 °C
<b>Relative Humidity:</b>	48 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Candy Li on 2015-02-15.*

*Test Mode: Transmitting*

Reference Frequency: 809.0125 MHz, Limit: 2.5 ppm, Channel Spacing: 25 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Measured Frequency error (Hz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	7.4	-27.5	-0.0340
40	7.4	-26.9	-0.0333
30	7.4	-26.1	-0.0323
20	7.4	-26.8	-0.0331
10	7.4	-26.9	-0.0333
0	7.4	-27.3	-0.0337
-10	7.4	-28.2	-0.0349
-20	7.4	-27.6	-0.0341
-30	7.4	-26.4	-0.0326
Frequency Stability versus Input Voltage			
20	6.29	-27.2	-0.0336

Reference Frequency: 854.0125 MHz, Limit: 2.5 ppm, Channel Spacing: 25 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Measured Frequency error (Hz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	7.4	-12.4	-0.0145
40	7.4	-12.6	-0.0148
30	7.4	-11.9	-0.0139
20	7.4	-11.7	-0.0137
10	7.4	-11.0	-0.0129
0	7.4	-11.7	-0.0137
-10	7.4	-10.8	-0.0126
-20	7.4	-13.3	-0.0156
-30	7.4	-12.7	-0.0149
Frequency Stability versus Input Voltage			
20	6.29	-12.5	-0.0146

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