



## FCC PART 90

### TEST REPORT

For

**Fujian Beifeng Telecom Technology Co., Ltd.**

A-15, Huaqiao Economic Development Zone, Shuangyang, Luojiang,  
Quanzhou, Fujian, China

**FCC ID: 2AARFBFTD50301**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Digital Radio
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<b>Report Number:</b> <u>RSZ150114001-00</u>	
<b>Report Date:</b> <u>2015-07-27</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 *Fujian Beifeng Telecom Technology Co., Ltd.*'s product, model number: *BF-TD503 (FCC ID: 2AARFBFB-TD503 01)* or the "EUT" in this report was a *Digital Radio*, which was measured approximately: 129 mm (L) x 64 mm (W) x 40 mm (H), rated with input voltage: DC 7.4V battery or DC 9V from adapter.

#### Adapter Information:

Model: RH-09100010A

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

Output: 9V, 1000mA

*\* All measurement and test data in this report was gathered from production sample serial number: 1501190 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2015-01-14.*

### Objective

This test report is prepared on behalf of *Fujian Beifeng Telecom Technology Co., Ltd.* in accordance with Part 2 and Part 90 of the Federal Communication Commissions rules.

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

No related submittal(s)

### 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 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 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.

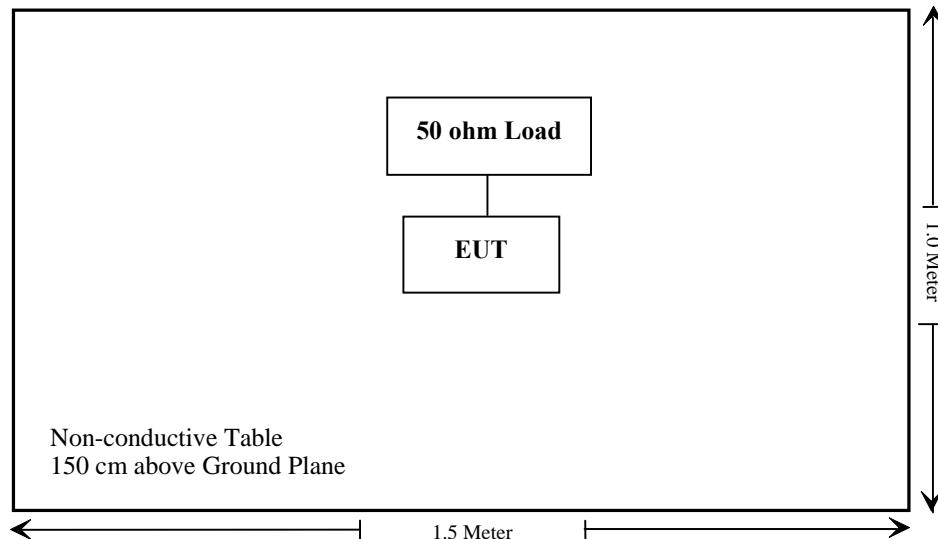
### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment List and Details

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

### Block Diagram of Test Setup



## SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1307 (b)(1), §2.1093	RF Exposure	Compliance
§2.1046; §90.205	RF Output Power	Compliance
§2.1047; §90.207	Modulation Characteristic	Not Applicable
§2.1049; §90.209; §90.210	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	Compliance

Note:

Not Applicable: there is no specific requirement for digital modulation

## MEASUREMENT UNCERTAINTY

Test Items	Measurement uncertainty
RF Output Power	± 1.95dB
Modulation Limiting	± 0.2kHz
Audio Frequency Response	± 1.95dB
Audio Frequency Low Pass Filter Response	± 1.95dB
Occupied Bandwidth	± 0.2kHz
Spurious Emission at Antenna Terminal	± 1.95dB
Spurious Radiated Emissions	± 4.92dB
Frequency Stability	± 0.1ppm
Emission Mask	± 1.95dB
Transient Frequency Behavior	± 0.2kHz

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

### **Applicable Standard**

According to FCC §1.1307(b) and §2.1093, protable 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: RSZ150114001-20.

## 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
HP Agilent	RF Communication test set	8920A	3325U00859	2014-06-03	2015-06-03

\* **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:	24.7 °C
Relative Humidity:	48 %
ATM Pressure:	100.7 kPa

The testing was performed by Mike Hu on 2015-04-02.

Test Mode: Transmitting

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

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	Conducted Output Power (dBm)	Conducted Output Power (W)
Digital	12.5	400.0125	High	37.33	5.41
			Low	30.28	1.07
	12.5	435.0125	High	37.03	5.05
			Low	29.84	0.96
	12.5	469.9875	High	36.41	4.38
			Low	30.66	1.16

Note: The rated high power is 5W. The limit of the high output power is 4W-6W.  
The rated low power is 1W. The limit of the low output power is 0.8W-1.2W.

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

### Applicable Standard

FCC §2.1049, §90.209 and §90.210

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) For any frequency removed from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ , 0dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 ( $f_d - 2.88$  kHz) dB.
- 3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz: At least  $50 + 10 \log (P)$  dB or 70 dB, whichever is the lesser attenuation.

### 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
HP	RF Communication Test Set	8920A	3438A05201	2014-06-14	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 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 Data

### Environmental Conditions

<b>Temperature:</b>	20 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

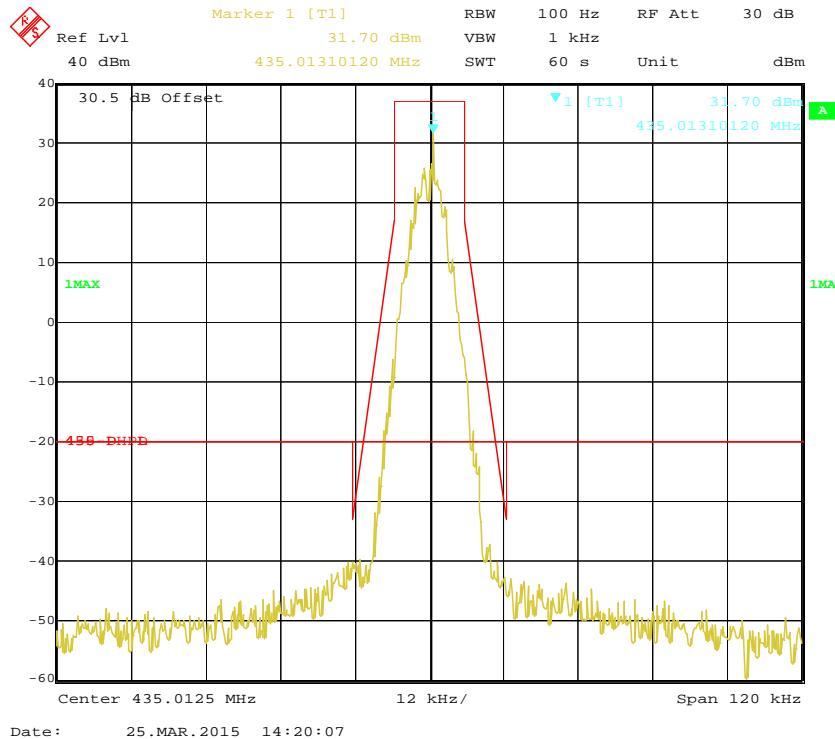
The testing was performed by Mike Hu on 2015-03-25.

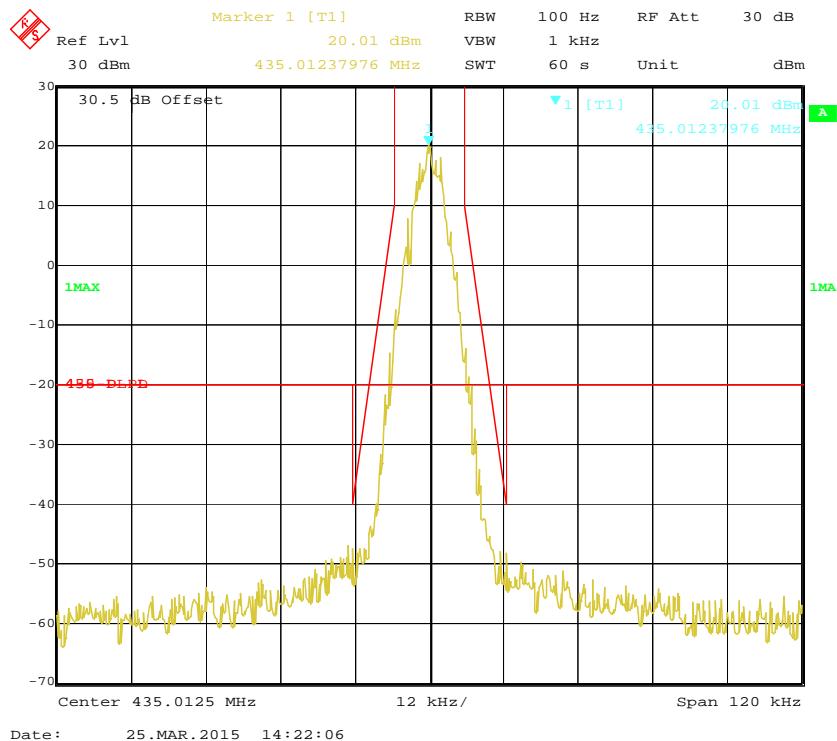
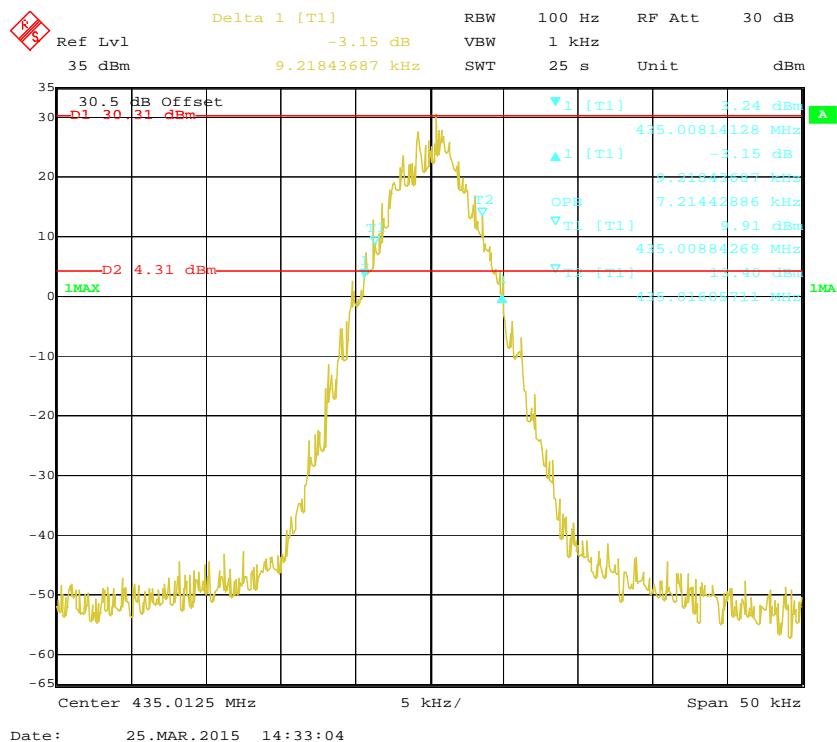
Test Mode: Transmitting

Modulation	Channel Spacing (kHz)	Frequency (MHz)	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)	Power Lever
Digital	12.5	435.0125	7.21	9.21	High power
			7.21	9.62	Low power

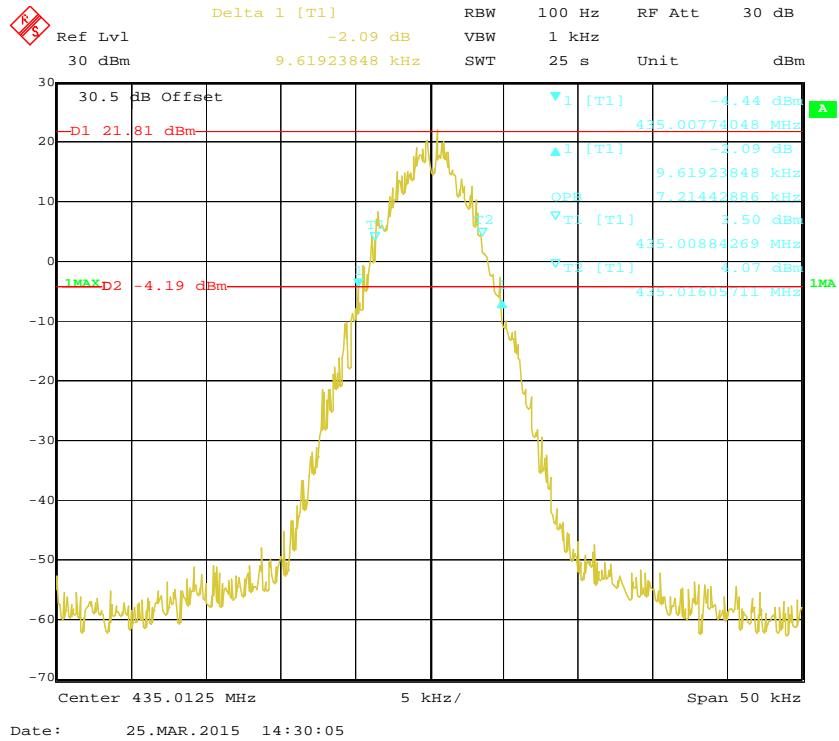
### Digital Modulation (Channel Spacing 12.5 kHz):

#### 435.0125 MHz, 99% Occupied & 26 dB Bandwidth with High Power



**435.0125 MHz, 99% Occupied & 26 dB Bandwidth with Low Power****435.0125 MHz, Emission Mask with High Power**

## 435.0125 MHz, Emission Mask with Low Power



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

### Applicable Standard

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) For any frequency removed from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ , 0 dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 ( $f_d - 2.88$  kHz) dB.
- 3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz: At least  $50 + 10 \log (P)$  dB or 70 dB, whichever is the lesser attenuation.

### 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
ANRITSU CORP. MADE IN JAPAN	HP Filter(VHF band)	MP526 D	995245	2014-11-03	2015-11-03

\* **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 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 100 kHz 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 Data

#### Environmental Conditions

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

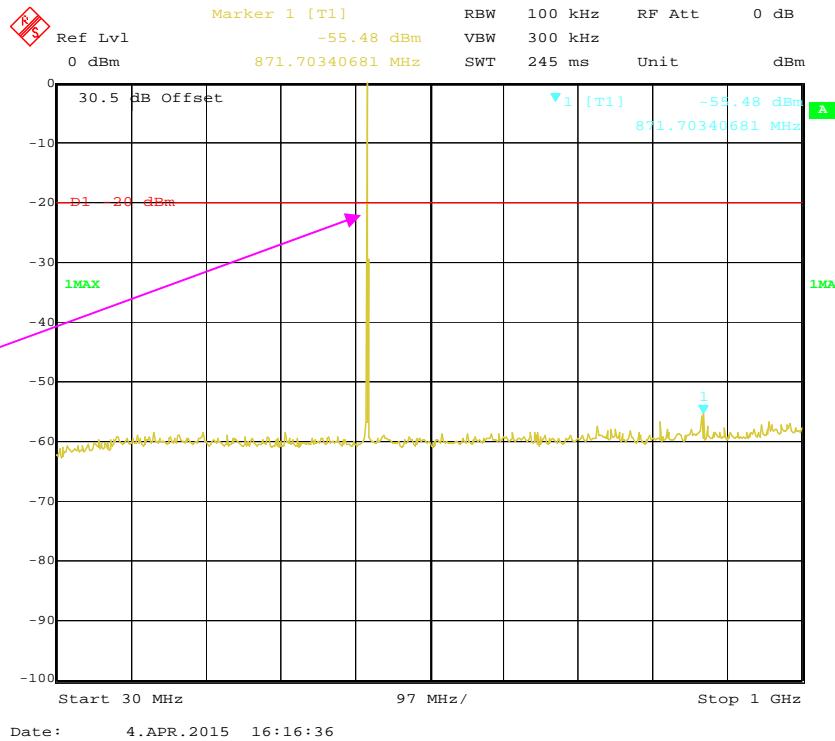
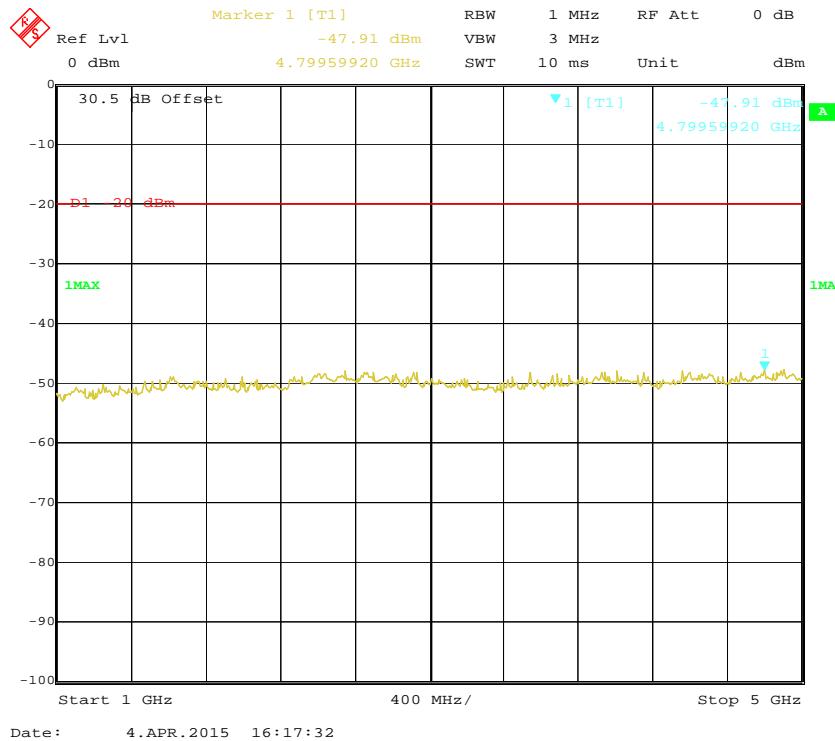
The testing was performed by Mike Hu on 2015-04-04.

Test Mode: Transmitting

Please refer to the following plots.

**Digital Modulation:****30MHz – 1 GHz, Spacing Channel 12.5 kHz**

Fund.test with  
notch filter

**1 GHz – 6 GHz, Spacing Channel 12.5 kHz**

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

### Applicable Standard

FCC §2.1053 and §90.210

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2014-11-03	2015-11-03
HP	Amplifier	8447E	1937A01046	2014-05-06	2015-05-06
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
Sunol Sciences	Horn Antenna	DRH-118	A052304	2014-12-01	2015-11-30
HP	Synthesized Sweeper	8341B	2624A00116	2014-06-03	2015-06-03
Mini-Circuits	Amplifier	ZVA-183-S+	5969001149	2014-04-23	2015-04-23
A.H. System	Horn Antenna	SAS-200/571	135	2013-02-11	2016-02-10
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 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 1g (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB = $50+10 \log_{10}$  (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

## 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 Mike Hu on 2015-04-04.

Test Mode: Transmitting

Frequency (MHz)	Receiver Reading (dB $\mu$ V)	Turn Table 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)
Digital Modulation, Frequency:435.0125 MHz, Channel Spacing 12.5 kHz										
870.0	38.82	264	2.0	H	-58.2	0.70	0	-58.90	-20	38.90
870.0	39.61	237	2.0	V	-57.4	0.70	0	-58.10	-20	38.10
1305.0	45.91	219	1.9	H	-54.4	1.30	6.30	-49.40	-20	29.40
1305.0	47.90	64	1.0	V	-52.7	1.30	6.30	-47.70	-20	27.70

**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 and §90.213

### 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
Long Wei	DC Power Supply	TPR-6420D	398363	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 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 Data

#### Environmental Conditions

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

*The testing was performed by Mike Hu on 2015-04-04.*

*Test Mode: Transmitting*

**For Digital Modulation**

<b>Reference Frequency: 435.0125 MHz, Limit: <math>\pm 2.5</math> ppm, 12.5 kHz</b>			
<b>Test Environment</b>		<b>Frequency Measure with Time Elapsed</b>	
<b>Temperature (°C)</b>	<b>Power Supplied (V<sub>DC</sub>)</b>	<b>Measured Frequency (MHz)</b>	<b>Frequency Error (ppm)</b>
Frequency Stability versus Input Temperature			
50	7.4	435.012257	-0.56
40	7.4	435.012269	-0.53
30	7.4	435.012332	-0.39
20	7.4	435.012354	-0.34
10	7.4	435.012263	-0.54
0	7.4	435.012245	-0.59
-10	7.4	435.012327	-0.40
-20	7.4	435.012353	-0.34
-30	7.4	435.012294	-0.47
Frequency Stability versus Input Voltage			
24	6.29	435.012296	-0.47
	8.51	435.012245	-0.59

## FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

### Applicable Standard

Regulations: FCC §90.214

Test method: ANSI/TIA-603-D 2010, section 2.2.19.3

### Test Equipment List and Details

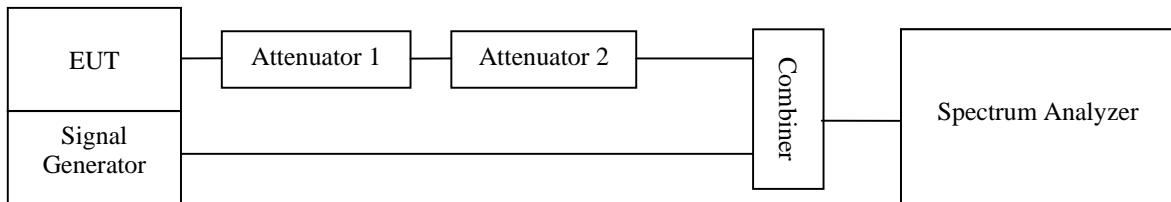
Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSIQ26	837405/023	2014-08-22	2015-08-22
HP	RF Communication Test Set	8920A	3438A05201	2015-06-14	2016-06-13

**\* 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 Procedure

- a) Connect the EUT and test equipment as shown on the following block diagram.
- b) Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
- c) Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at  $\pm 12.5$  kHz deviation and set its output level to -100dBm.
- d) Turn on the transmitter.
- e) Supply sufficient attenuation via the RF attenuator to provide an input level to the Spectrum Analyzer that is 40 dB below the maximum allowed input power when the transmitter is operating at its rated power level. Note this power level on the Spectrum Analyzer as  $P_0$ .
- f) Turn off the transmitter.
- g) Adjust the RF level of the signal generator to provide RF power equal to  $P_0$ . This signal generator RF level shall be maintained throughout the rest of the measurement.
- h) Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
- i) Adjust the vertical amplitude control of the spectrum analyzer to display the 1000 Hz at  $\pm 4$  divisions vertically centered on the display. Set trigger mode of the Spectrum Analyzer to "Video", and tune the "trigger level" on suitable level. Then set the "tiger offset" to -10ms for turn on and -15ms for turn off.
- j) Turn on the transmitter and the transient wave will be captured on the screen of Spectrum Analyzer. Observe the stored display. The instant when the 1 kHz test signal is completely suppressed is considered to be  $t_{on}$ . The trace should be maintained within the allowed divisions during the period  $t_1$  and  $t_2$ .

k) Then turn off the transmitter, and another transient wave will be captured on the screen of Spectrum Analyzer. The trace should be maintained within the allowed divisions during the period  $t_3$ .



## Test Data

### Environmental Conditions

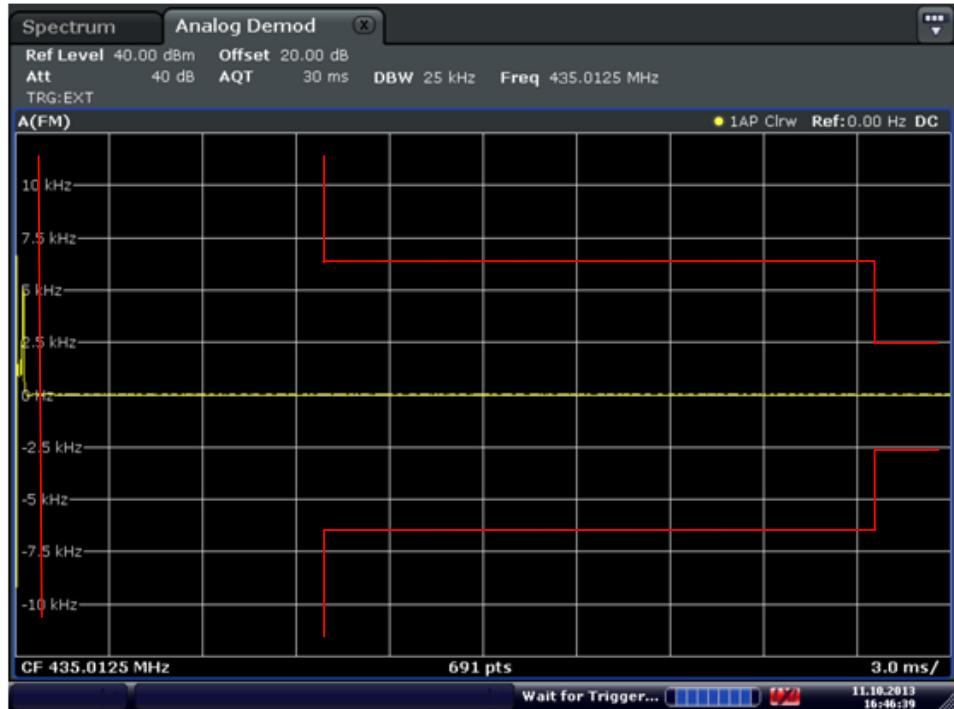
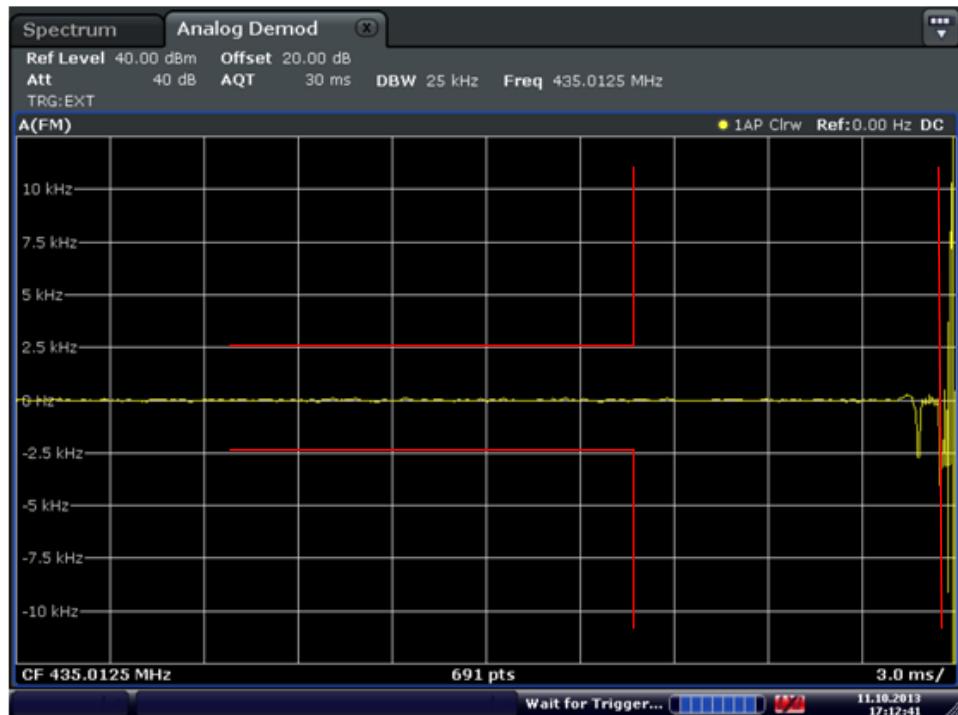
Temperature:	26 °C
Relative Humidity:	54 %
ATM Pressure:	101.0 kPa

The testing was performed by Mike Hu on 2015-07-25

Test Mode: Transmitting

Channel Separation (kHz)	Transient Period (ms)	Transient Frequency	Result
12.5	10 (t1)	<+/-12.5 kHz	Pass
	25 (t2)	<+/-6.25 kHz	
	10 (t3)	<+/-12.5 kHz	

Please refer to the following plots.

**Channel Spacing 12.5 kHz****Turn on (435.0125 MHz)****Turn off (435.0125 MHz)****\*\*\*\*\* END OF REPORT \*\*\*\*\***