FCC PART 90

TEST REPORT

For

Hytera Communications Corporation Ltd.

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

FCC ID: YAMMT680PF5

Report Type:	**Product Type:**
Original Report	TETRA MOBILE TERMINAL

Test Engineer:	Sewen Guo
Report Number:	RSZ150714010-00
Report Date:	2015-08-03
Reviewed By:	Jimmy Xiao RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Hytera Communications Corporation Ltd.'s* product, model number:*MT680 Plus F5 (FCC ID: YAMMT680PF5)* or the "EUT" in this report was a *TETRA MOBILE TERMINAL,* which was measured approximately:180 mm (L)×180 mm (W)×65 mm (H) rated with input voltage: DC 13.2V.

**All measurement and test data in this report was gathered from production sample serial number: 1505726 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2015-07-14.*

Objective

This test report is prepared on behalf of *Hytera Communications Corporation 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: YAMMT680PF5.

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 October 31, 2013. 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.

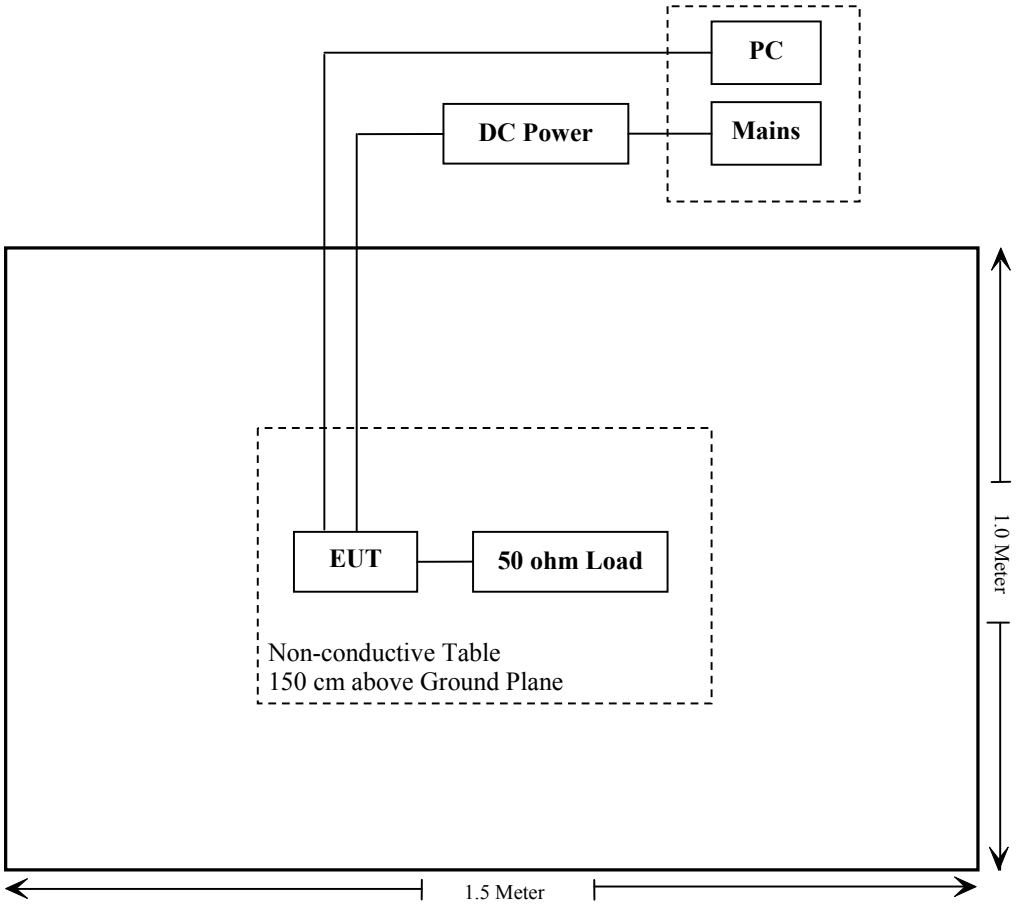
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
N/A	50 ohm Load	N/A	N/A
AEROFLEX	TETRA Signal Analyzer	2310	2310011173
INSTEK	DC Power Supply	GPS-303000	N/A

External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-shielding Detachable DC Power Cable	3.0	DC Power	EUT
Un-shielding Detachable Control Cable	3.0	PC	EUT (Accessory Connector port)

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1307(b), §2.1091	Maximum Permissible exposure (MPE)	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	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
Note: Equipment meets the Adjacent Channel Power limits of §90.221, so emission mask of §90.210 is not tested.

FCC §1.1307 (b) (1) & §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247(i)and subpart §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(A) Limits for Occupational/Controlled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f²	6
30–300	61.4	0.163	1.0	6
300–1500	/	/	f/300	6
1500–100,000	/	/	5.0	6

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S= power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Frequency (MHz)	**Antenna Gain**		**Conducted Power**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
	(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
868.9875	7.0	5.01	39.93	9840.11	50	1.57	2.90

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 50 cm from nearby persons.

Result: Compliance

FCC §2.1046 & §90.205- RF OUTPUT POWER

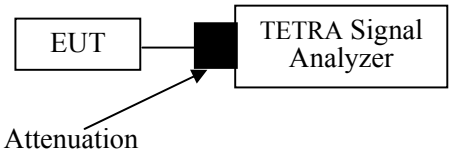
Applicable Standard

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 TETRA Signal Analyzer through sufficient attenuation.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
AEROFLEX	TETRA Signal Analyzer	2310	231001/173	2015-03-11	2016-03-10

*** 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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Sewen Guo on 2015-07-27.

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	39.83	9.62
823.9875		39.90	9.77
854.0125		39.90	9.77
868.9875		39.93	9.84

Note: The rated power is 10W. The limit is 8W-12W.

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

Applicable Standard

FCC §2.1046, §90.210& §90.221

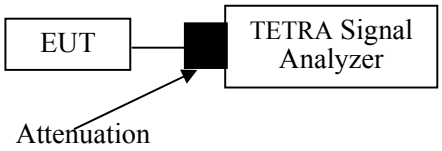
According to FCC§90.221 (c) (1), Maximum adjacent power levels for frequencies in the 809-824/854-869 MHz band:

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 RF output of the transmitter was connected to the input of the TETRA Signal Analyzer through sufficient attenuation.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
AEROFLEX	TETRA Signal Analyzer	2310	231001/173	2015-03-11	2016-03-10

*** 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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

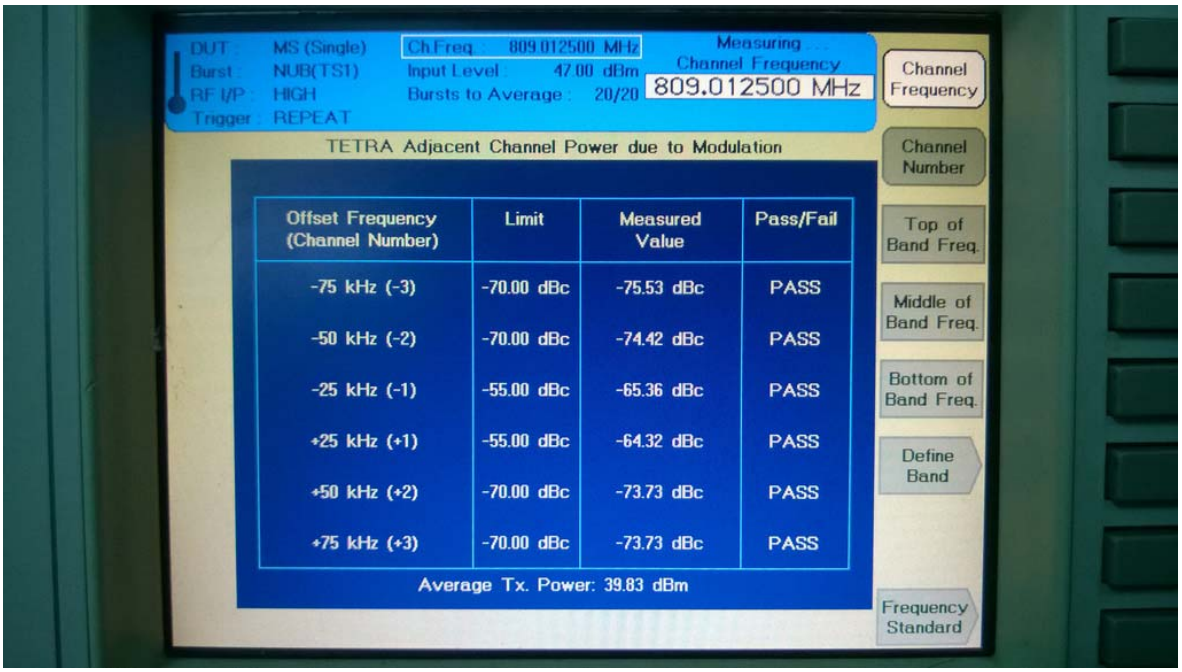
The testing was performed by Sewen Guo on 2015-07-27.

Test Mode: Transmitting

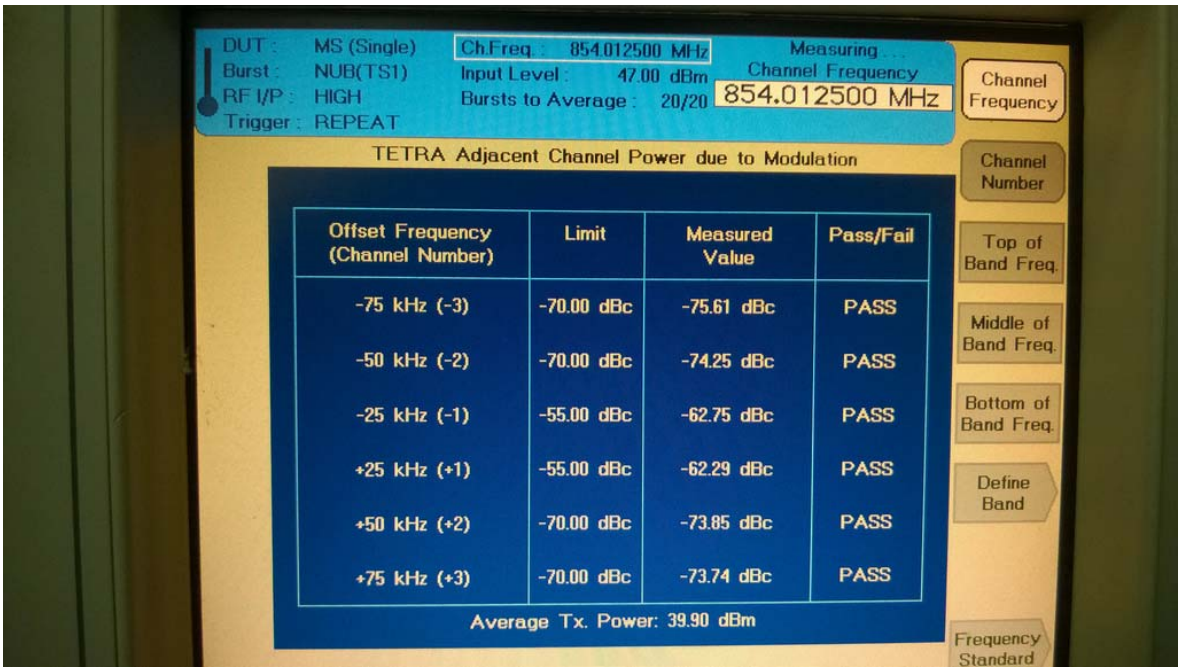
Test Result: Compliance. Please refer to following table and plots.

Channel Frequency (MHz)	Channel Separation (kHz)	Adjacent Channel (kHz)	Adjacent Channel Ratio (dB)	FCC Part 90
				Limit (dB)
809.0125	25	-75	-75.53	-70
		-50	-74.42	-65
		-25	-65.36	-55
		+25	-64.32	-55
		+50	-73.73	-65
		+75	-73.73	-70
854.0125	25	-75	-75.61	-70
		-50	-74.25	-65
		-25	-62.75	-55
		+25	-62.29	-55
		+50	-73.85	-65
		+75	-73.74	-70

Adjacent Channel Power for Frequency 809.0125 MHz



Adjacent Channel Power for Frequency 854.0125 MHz



FCC §2.1049 & §90.209 – OCCUPIED BANDWIDTH

Applicable Standard

FCC §2.1049, §90.209

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 300 Hz.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2014-12-11	2015-12-11

*** 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

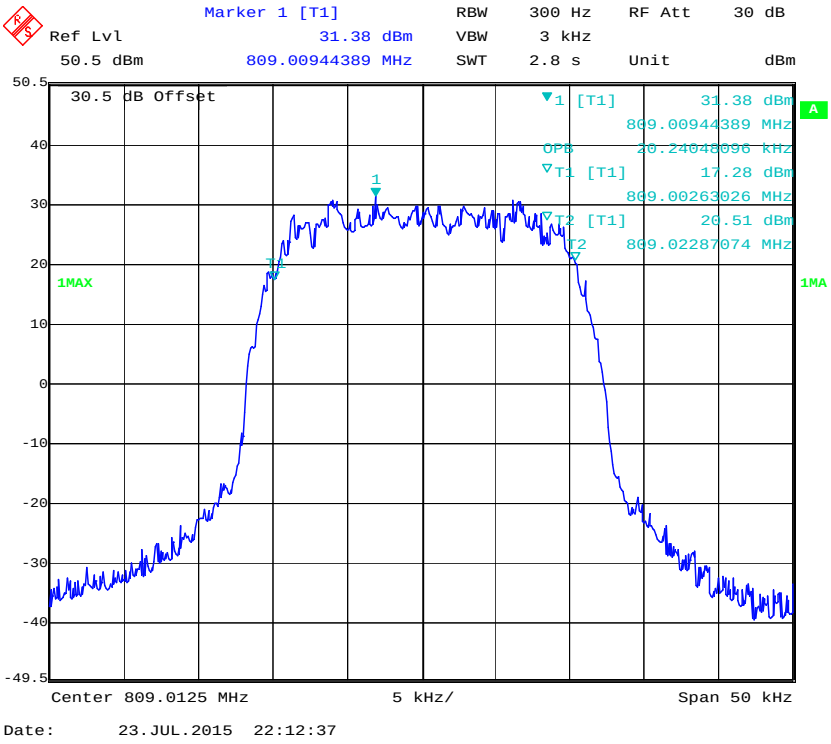
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

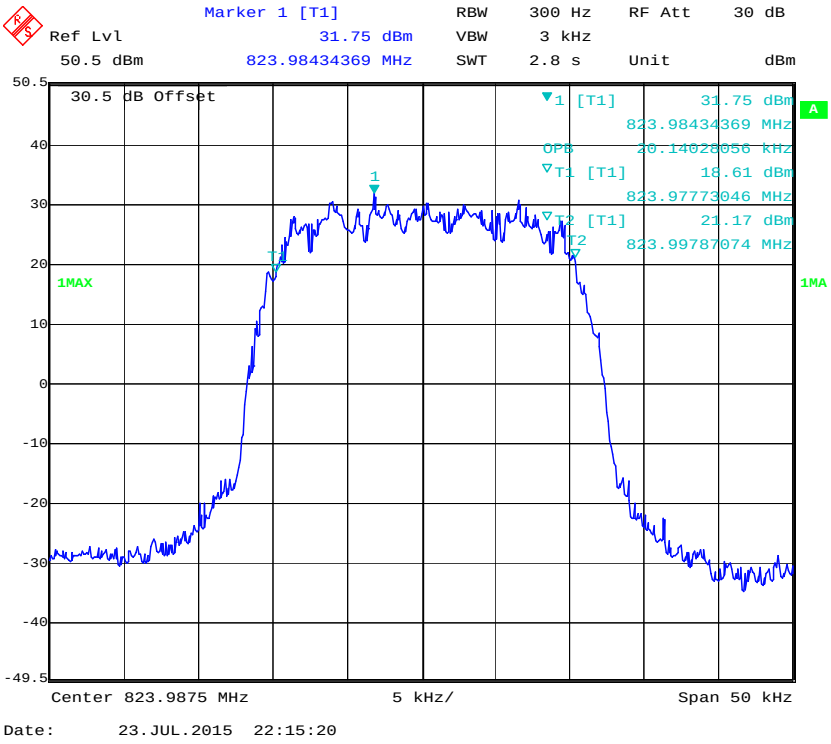
The testing was performed by Sewen Guo on 2015-07-23.

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

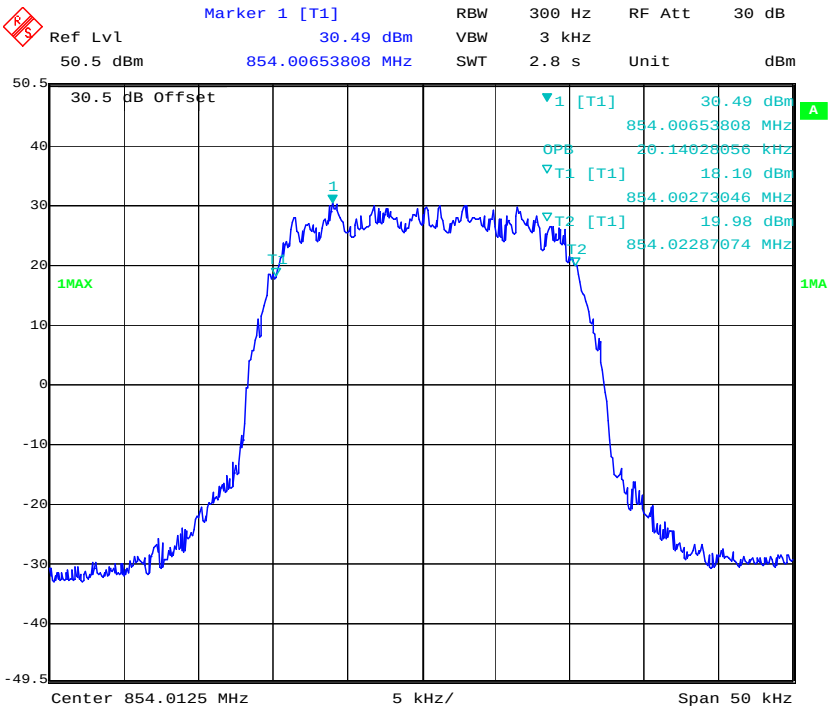
809.0125 MHz: 99% Occupied Bandwidth



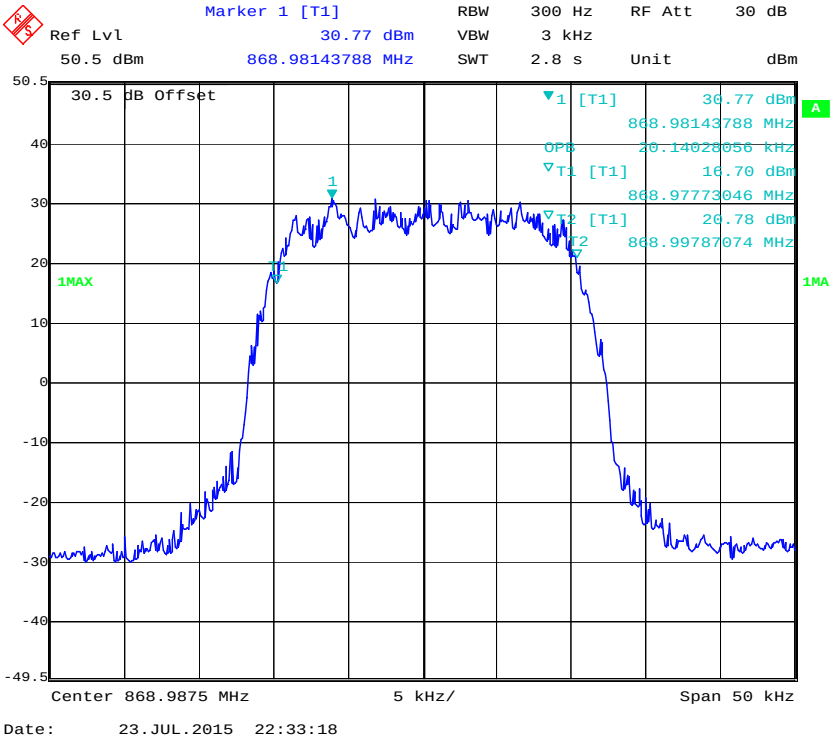
823.9875 MHz: 99% Occupied Bandwidth



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 10th harmonic.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2014-12-11	2015-12-11

*** 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

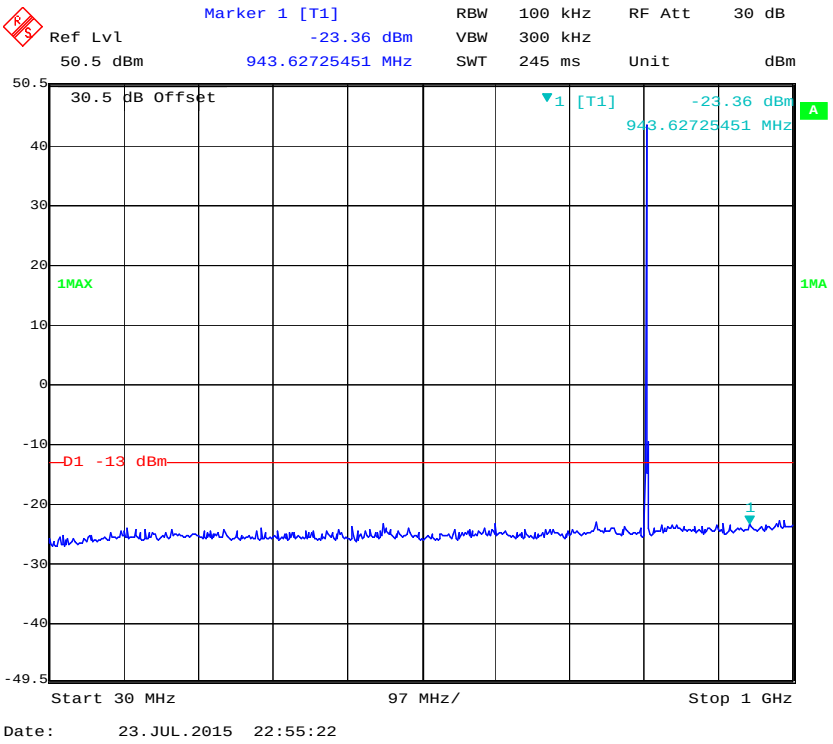
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

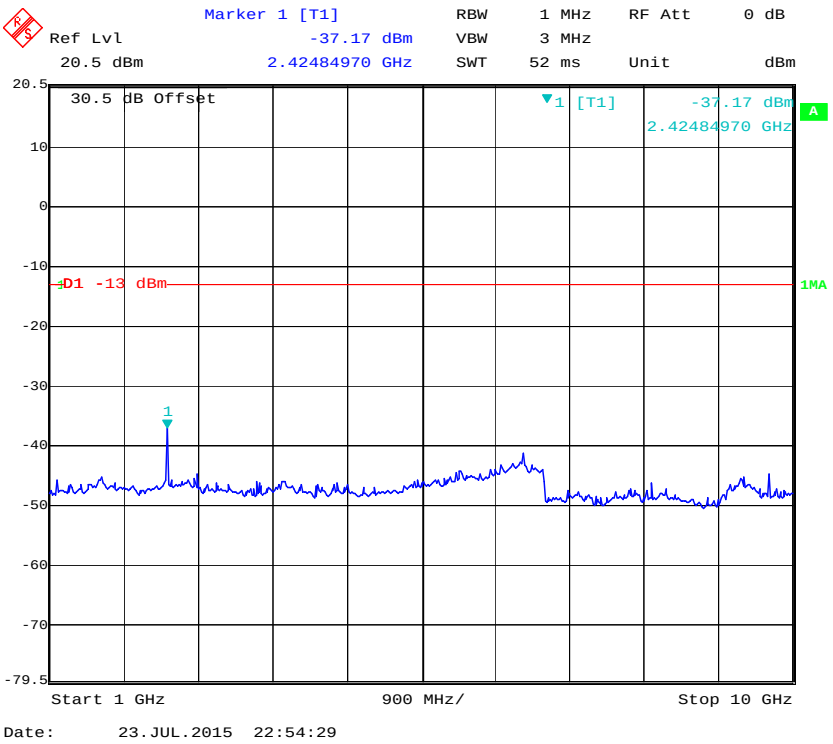
The testing was performed by Sewen Guo on 2015-07-23.

Test Mode: Transmitting

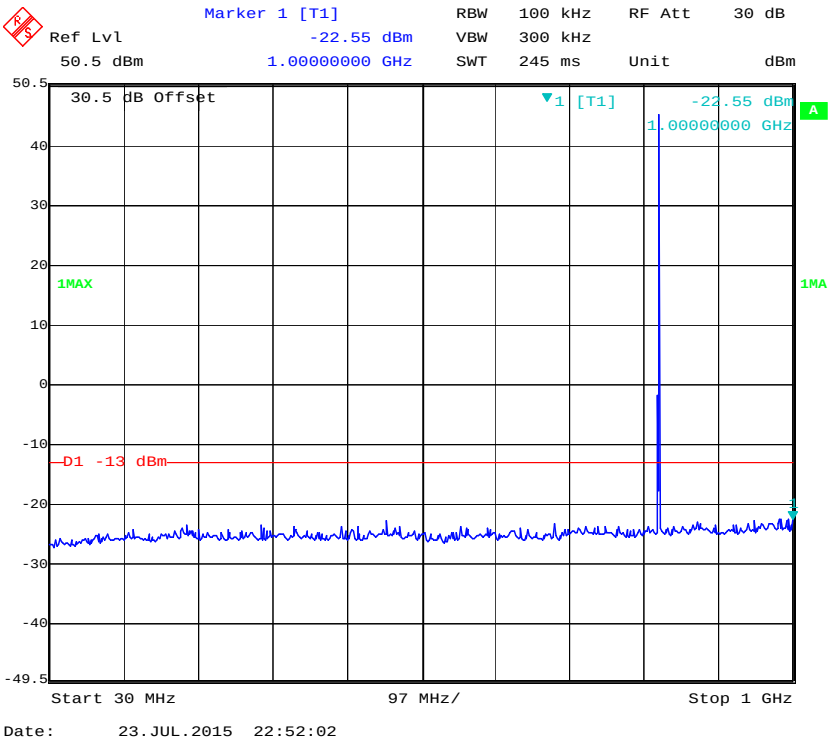
809.0125 MHz: 30 MHz~1 GHz, Channel Spacing 25 kHz



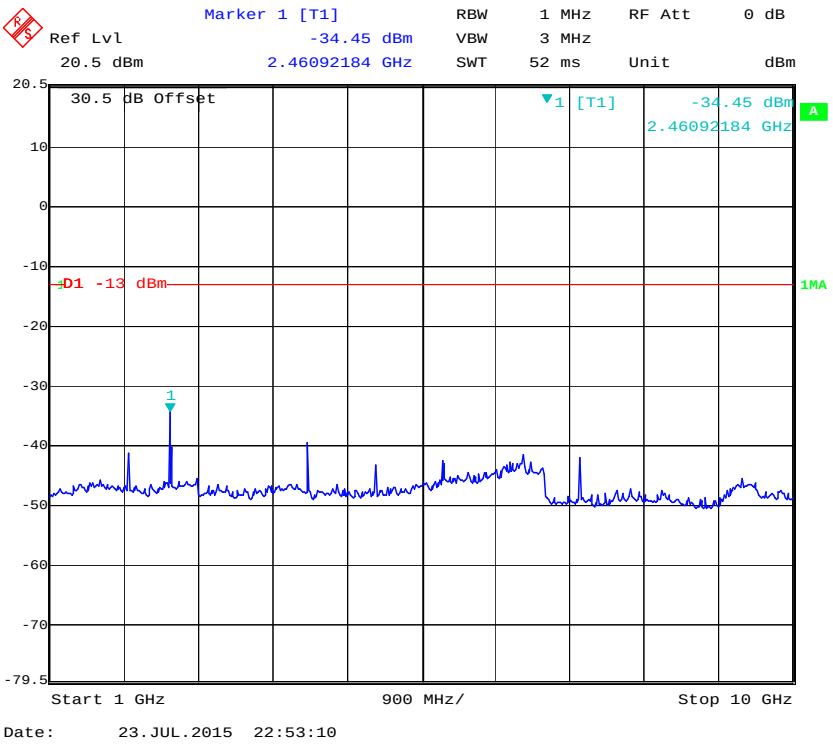
809.0125 MHz: 1~10 GHz, Channel Spacing 25 kHz



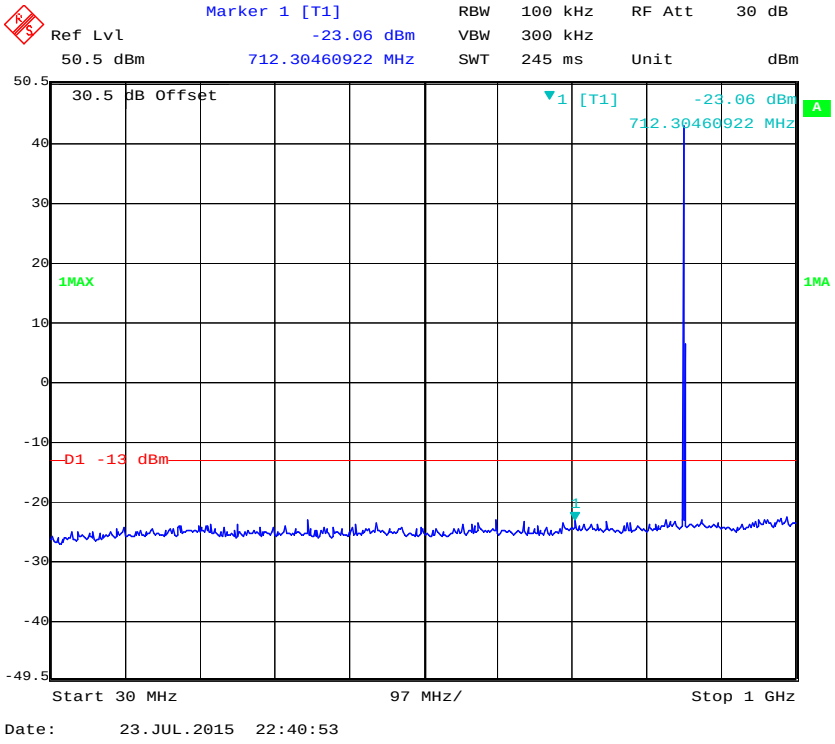
823.9875 MHz: 30 MHz~1 GHz, Channel Spacing 25 kHz



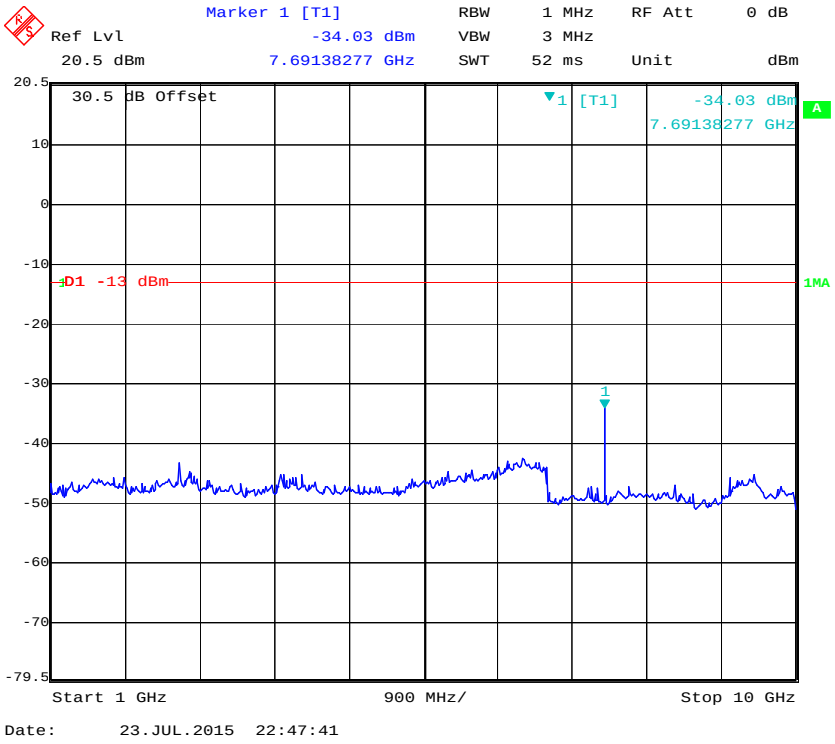
823.9875 MHz: 1~10 GHz, Channel Spacing 25 kHz



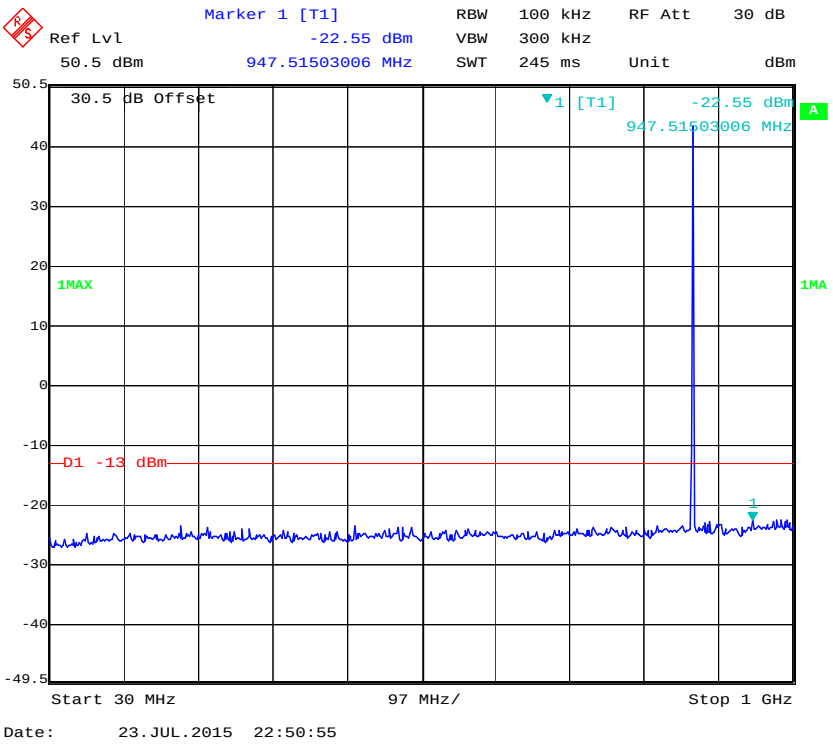
854.0125 MHz: 30 MHz~1 GHz, Channel Spacing 25 kHz



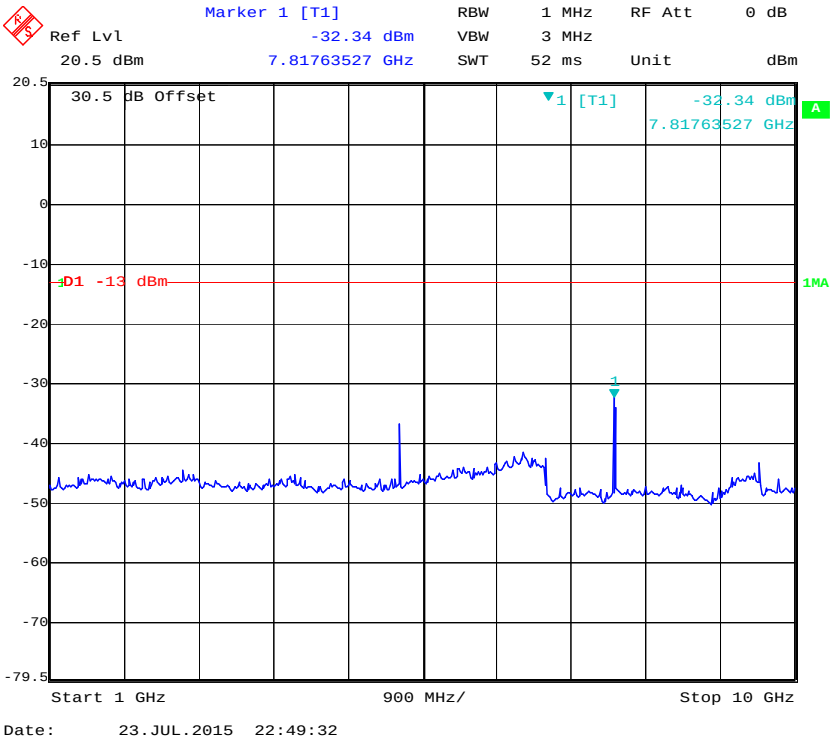
854.0125 MHz: 1~10 GHz, Channel Spacing 25 kHz



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



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



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 1g (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB =43+10 Log_{10} (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	2013-12-01	2016-11-30
Sunol Sciences	Bi-log Antenna	JB1	A040904-2	2014-12-07	2017-12-06
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2014-12-11	2015-12-11
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2014-11-03	2015-11-03
HP	Amplifier	HP8447E	1937A01046	2015-05-06	2016-05-06
Mini	Amplifier	ZVA-183-S+	5969001149	2015-04-23	2016-04-23
HP	Signal Generator	8657A	3217A04699	2014-12-19	2015-12-18
A.H. System	Horn Antenna	SAS-200/571	135	2015-02-11	2016-02-10
HP	Synthesized Sweeper	8341B	2624A00116	2015-06-03	2016-06-03
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

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

The testing was performed by Sewen Guo on 2015-07-28.

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										
181.56	45.81	19	2.4	H	-51.2	0.28	0	-51.48	-13	38.48
181.56	47.75	269	1.4	V	-49.2	0.28	0	-49.48	-13	36.48
1618.03	55.59	173	1.5	H	-39.5	1.30	6.70	-34.10	-13	21.10
1618.03	58.01	85	1.7	V	-41.8	1.30	6.70	-36.40	-13	23.40
2427.04	60.51	188	1.8	H	-35.3	1.40	8.50	-28.20	-13	15.20
2427.04	62.17	21	1.6	V	-33.1	1.40	8.50	-26.00	-13	13.00
3236.05	56.89	89	2.4	H	-31.8	1.70	9.70	-23.80	-13	10.80
3236.05	54.36	134	2.4	V	-35.6	1.70	9.70	-27.60	-13	14.60
4045.06	53.66	166	1.8	H	-38.0	2.20	9.90	-30.30	-13	17.30
4045.06	50.21	91	1.3	V	-41.2	2.20	9.90	-33.50	-13	20.50
868.9875MHz, Channel Spacing 25 kHz										
181.56	45.83	249	1.1	H	-51.2	0.28	0	-51.48	-13	38.48
181.56	46.31	20	1.5	V	-50.7	0.28	0	-50.98	-13	37.98
1737.98	54.36	265	2.2	H	-41.8	1.60	6.90	-36.50	-13	23.50
1737.98	56.87	297	2.2	V	-41.4	1.60	6.90	-36.10	-13	23.10
2606.96	65.16	243	1.3	H	-29.4	1.70	9.20	-21.90	-13	8.90
2606.96	63.37	291	1.9	V	-31.6	1.70	9.20	-24.10	-13	11.10
3475.95	57.32	359	2.3	H	-34.9	1.90	10.00	-26.80	-13	13.80
3475.95	55.61	308	2.2	V	-37.2	1.90	10.00	-29.10	-13	16.10
4344.94	55.58	4	1.8	H	-34.2	2.60	9.80	-27.00	-13	14.00
4344.94	56.17	33	2.4	V	-34.3	2.60	9.80	-27.10	-13	14.10

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

Temperature:	26 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Sewen Guo on 2015-07-30.

Test Mode: Transmitting

Reference Frequency: 809.0125 MHz, Limit: 2.5 ppm, Channel Spacing: 25 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Power Supplied (V_{DC})	Measured Frequency error (Hz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.2	24.40	0.0302
40	13.2	24.35	0.0301
30	13.2	24.26	0.0300
20	13.2	24.15	0.0299
10	13.2	24.09	0.0298
0	13.2	24.06	0.0297
-10	13.2	23.99	0.0297
-20	13.2	23.88	0.0295
-30	13.2	23.85	0.0295
Frequency Stability versus Input Voltage			
20	11.22	23.97	0.0296

Reference Frequency: 854.0125 MHz, Limit: 2.5 ppm, Channel Spacing: 25 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Power Supplied (V_{DC})	Measured Frequency error (Hz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.2	32.10	0.0376
40	13.2	32.03	0.0375
30	13.2	31.99	0.0375
20	13.2	31.89	0.0373
10	13.2	31.76	0.0372
0	13.2	31.69	0.0371
-10	13.2	31.57	0.0370
-20	13.2	31.52	0.0369
-30	13.2	31.46	0.0368
Frequency Stability versus Input Voltage			
20	11.22	31.49	0.0369

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