

## FCC PART 90

## TEST REPORT

For

### Hytera Communications Co., Ltd.

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

**FCC ID: YAMMT680F5**

<b>Report Type:</b> Amended Report	<b>Product Type:</b> Mobile Terminal TETRA
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<b>Report Number:</b> RSZ140923009-00A1	
<b>Report Date:</b> 2014-12-17	
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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: *MT680 F5*(FCC ID: *YAMMT680F5*) or the "EUT" in this report was a *Mobile Terminal TETRA*, which was measured approximately: 140 mm (L) x 61 mm (W) x 38 mm (H), rated with input voltage: DC 13.2V.

*\* All measurement and test data in this report was gathered from production sample serial number: 1409178 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2014-09-23*

### 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 Commissions rules.

This is a CIIPC application of the device basing on the FCC ID: YAMMT680F5 which was certified on 2012/07/21, the differences between the original device and the current one are as follows:

1. The applicant request to extend the frequency band from 817~824 MHz/862~869 MHz to 809~824 MHz/854~869 MHz.

For the change made to the device, all the test items were performed.

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

No related submittal.

### 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 an engineering mode provided by manufacturer.

### Equipment Modifications

No modification was made to the EUT.

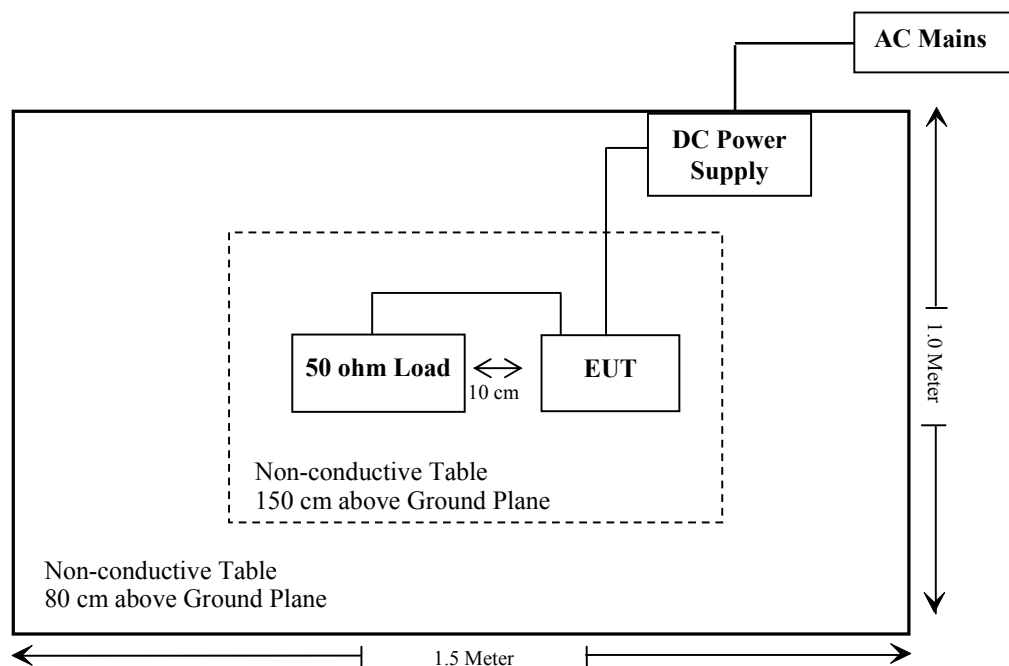
### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Agilent	MXA Signal Analyzer	N9020A	ATO-97512SERMY50510262
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	1.2	DC Power	EUT

### 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*
§90.210; §90.221	Occupied Bandwidth & Emission Mask	Compliance
§90.210; §90.221	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

**§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)

<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

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<sup>2</sup>);

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		With 50% Duty cycle Power (mW)	Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
	(dBi)	(numeric)	(dBm)	(mW)	(mW)			
809.05	7.0	5.01	39.66	9246.98	4623.49	108	0.16	0.54

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 108cm 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 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	2014-05-31	2015-05-31

### Test Data

#### Environmental Conditions

Temperature:	22-25 °C
Relative Humidity:	42-55 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2014-09-28 and 2014-12-01

Test Mode: Transmitting

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

Frequency	Channel Spacing (kHz)	Conducted Output Power (dBm)	Conducted Output Power (W)
809.05	25	39.66	9.25
816.95		39.44	8.79
854.05		39.65	9.23
861.95		39.32	8.55

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 EUT was connected to the TETRA signal analyzer

EUT                      TETRA Signal  
   Analyzer

### Test Equipment List and Details

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

### Test Data

#### Environmental Conditions

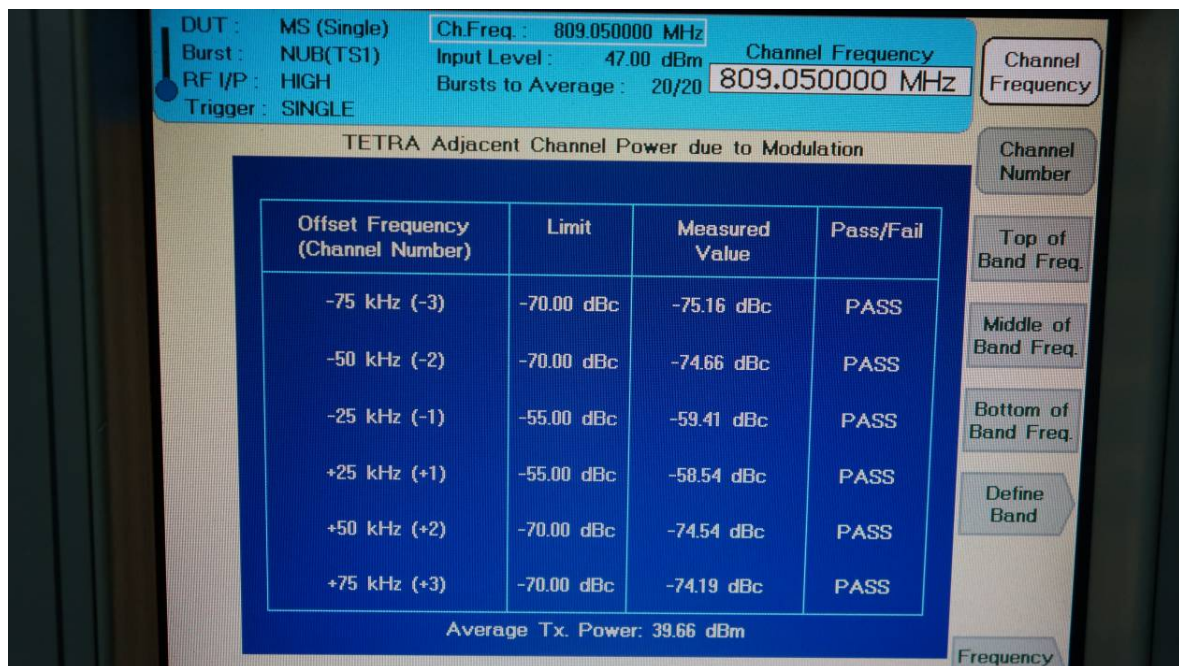
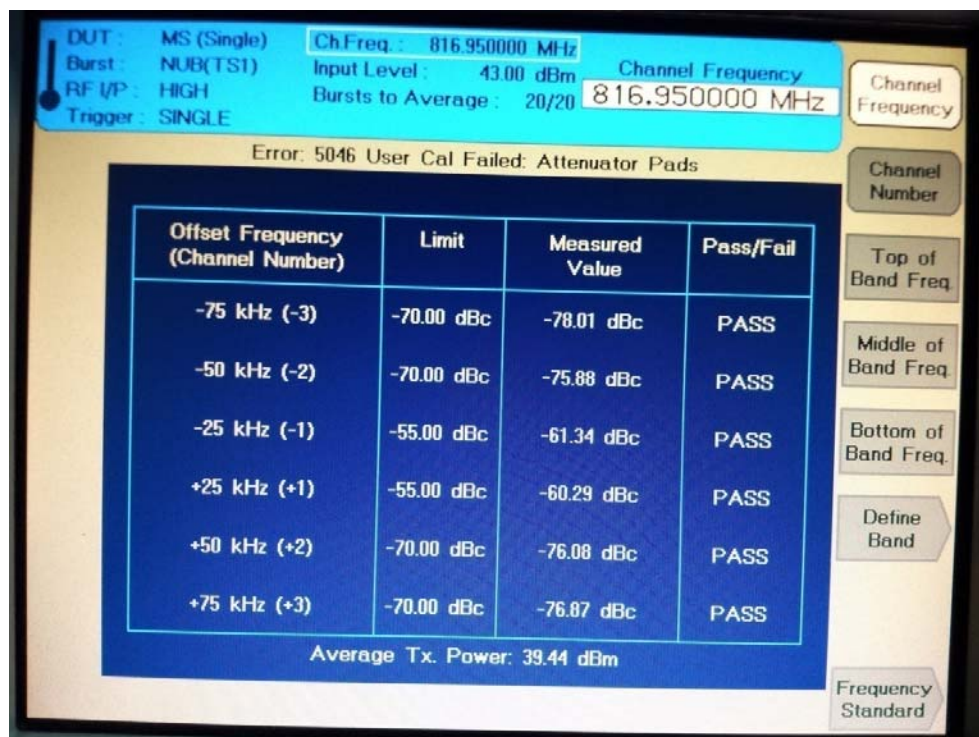
Temperature:	22-25 °C
Relative Humidity:	42-55 %
ATM Pressure:	101.0 kPa

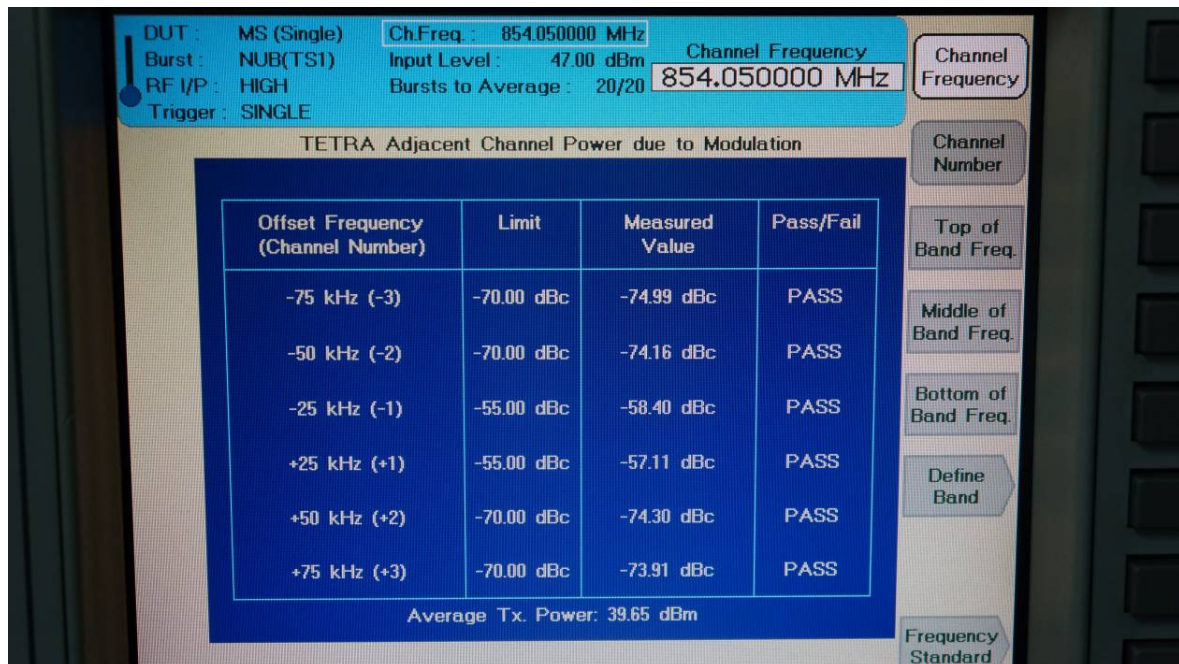
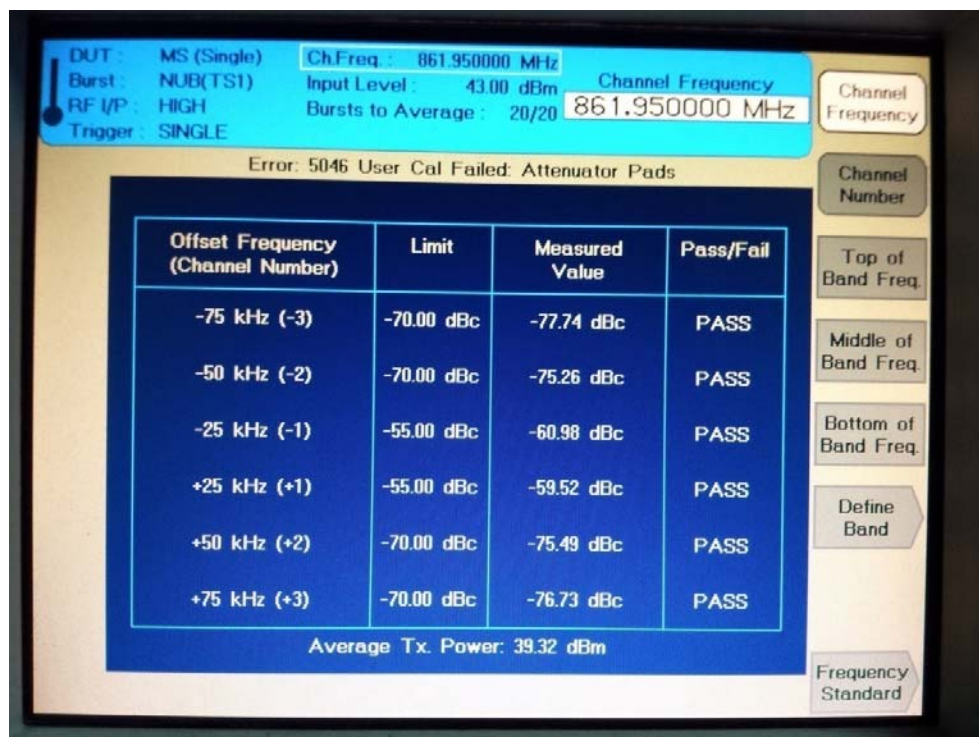
*The testing was performed by Rocky Kang on 2014-09-28 and 2014-12-01*

*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)
809.05	25	-75	-75.16	-70
		-50	-74.66	-65
		-25	-59.41	-55
		+25	-58.54	-55
		+50	-74.54	-65
		+75	-74.19	-70
816.95	25	-75	-78.01	-70
		-50	-75.88	-65
		-25	-61.34	-55
		+25	-60.29	-55
		+50	-76.08	-65
		+75	-76.87	-70
854.05	25	-75	-74.99	-70
		-50	-74.16	-65
		-25	-58.40	-55
		+25	-57.11	-55
		+50	-74.30	-65
		+75	-73.91	-70
861.95	25	-75	-77.74	-70
		-50	-75.26	-65
		-25	-60.98	-55
		+25	-59.52	-55
		+50	-75.49	-65
		+75	-76.73	-70

**Adjacent Channel Power for Frequency 809.05 MHz****Adjacent Channel Power for Frequency 816.95 MHz**

**Adjacent Channel Power for Frequency 809.05 MHz****Adjacent Channel Power for Frequency 861.95 MHz**

**FCC §90.210 §90.221 – OCCUPIED BANDWIDTH & EMISSION MASK****Applicable Standard**

FCC §90.210 and §90.221

Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of §90.691 of this chapter.

Equipment may alternatively meet the Adjacent Channel Power limits of §90.221

§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.

(d) On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least  $43 + 10 \log (P_{\text{watts}})$  dB.



## 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
Agilent	MAX Signal Analyzer	N9020A	AT0-97512SER MY50510262	2014-03-11	2015-03-11

## Test Data

### Environmental Conditions

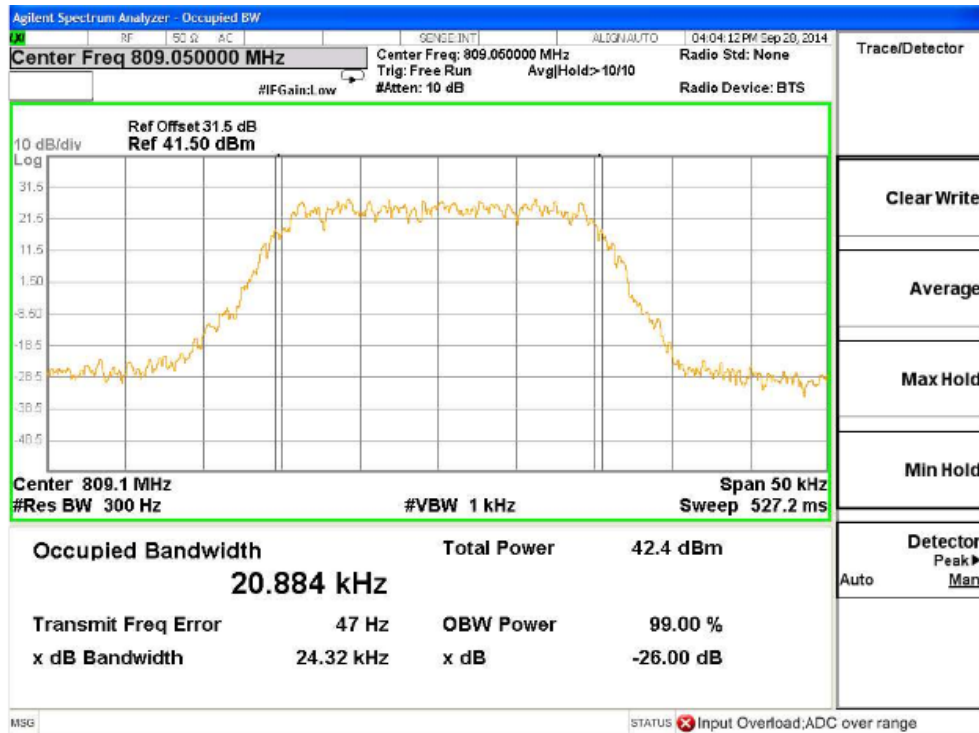
Temperature:	22-25 °C
Relative Humidity:	42-55 %
ATM Pressure:	101.0 kPa

*The testing was performed by Rocky Kang on 2014-09-28 and 2014-12-05*

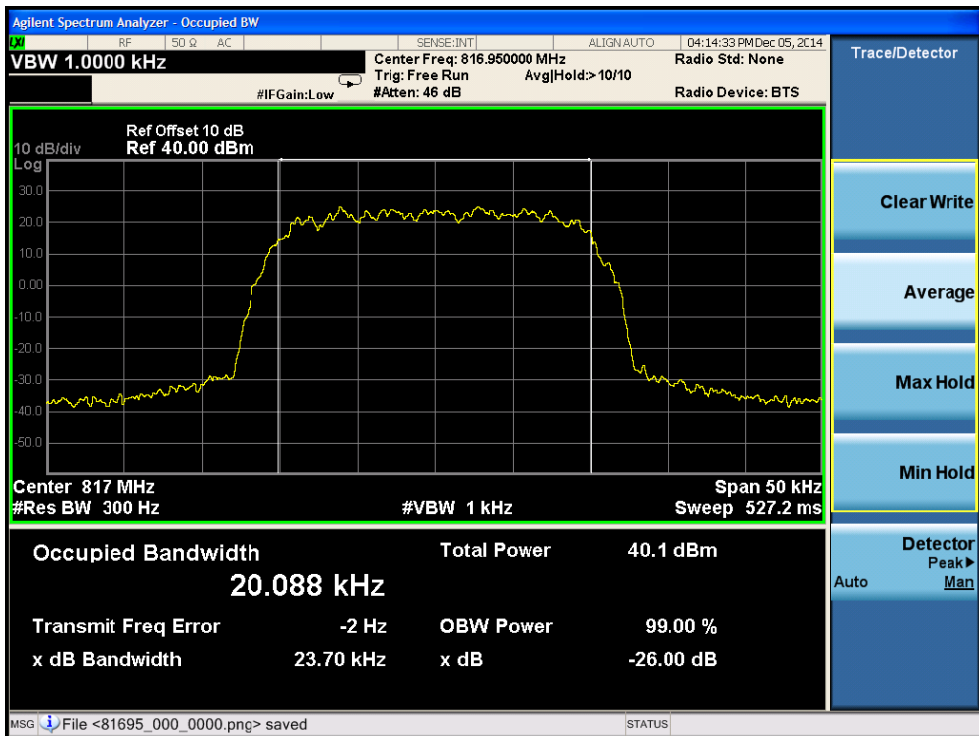
Frequency (MHz)	Channel Spacing (kHz)	99% Occupied Bandwidth (kHz)	Limited (kHz)
809.05	25.0	20.884	22
816.95	25.0	20.075	22
854.05	25.0	20.508	22
861.95	25.0	20.029	22

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

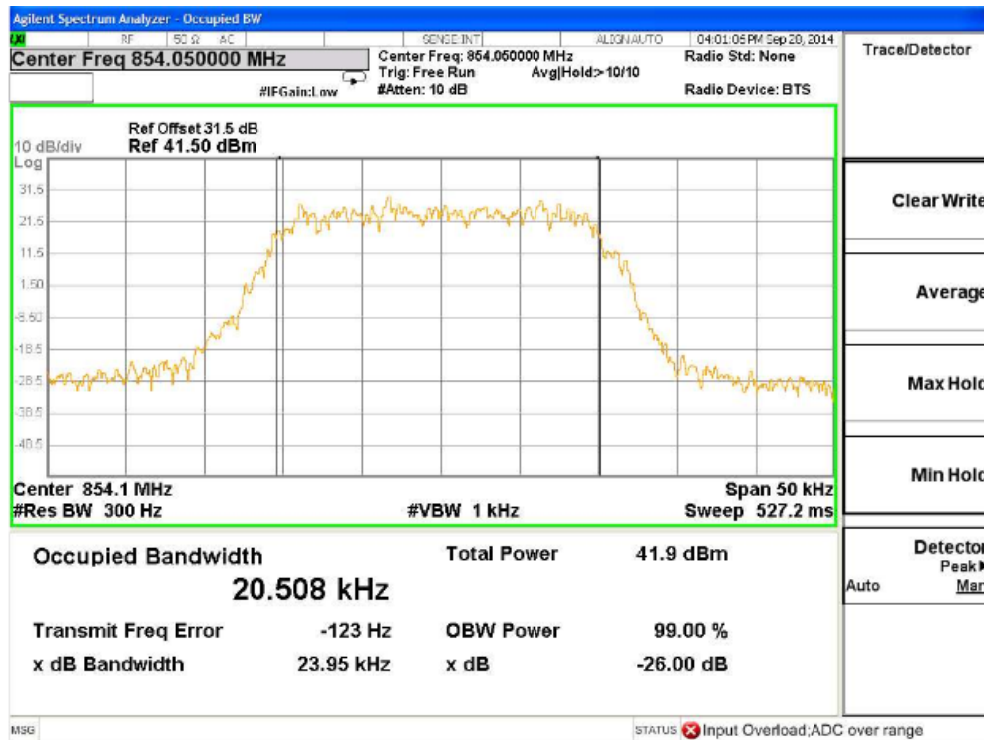
### 809.05 MHz: 99% Occupied Bandwidth



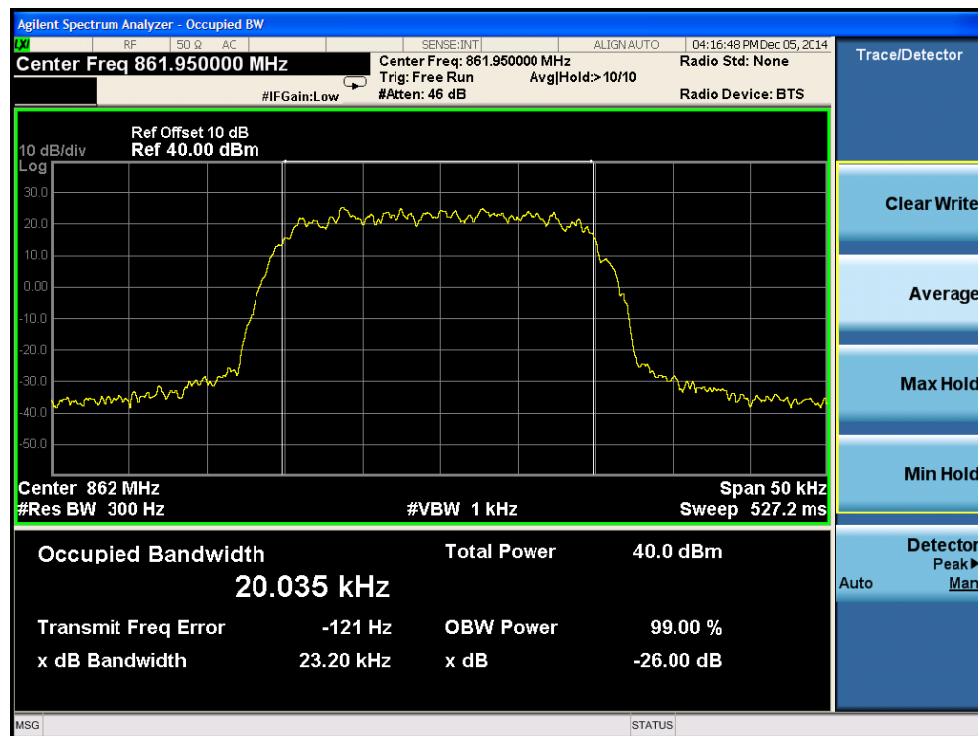
### 816.95 MHz: 99% Occupied Bandwidth



### 854.05 MHz: 99% Occupied Bandwidth



### 861.95 MHz: 99% Occupied Bandwidth





## FCC §2.1051 & §90.210 & §90.221 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### Applicable Standard

On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least  $43 + 10 \log (P_{\text{watts}})$  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
Agilent	MAX Signal Analyzer	N9020A	AT0-97512SER MY50510262	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

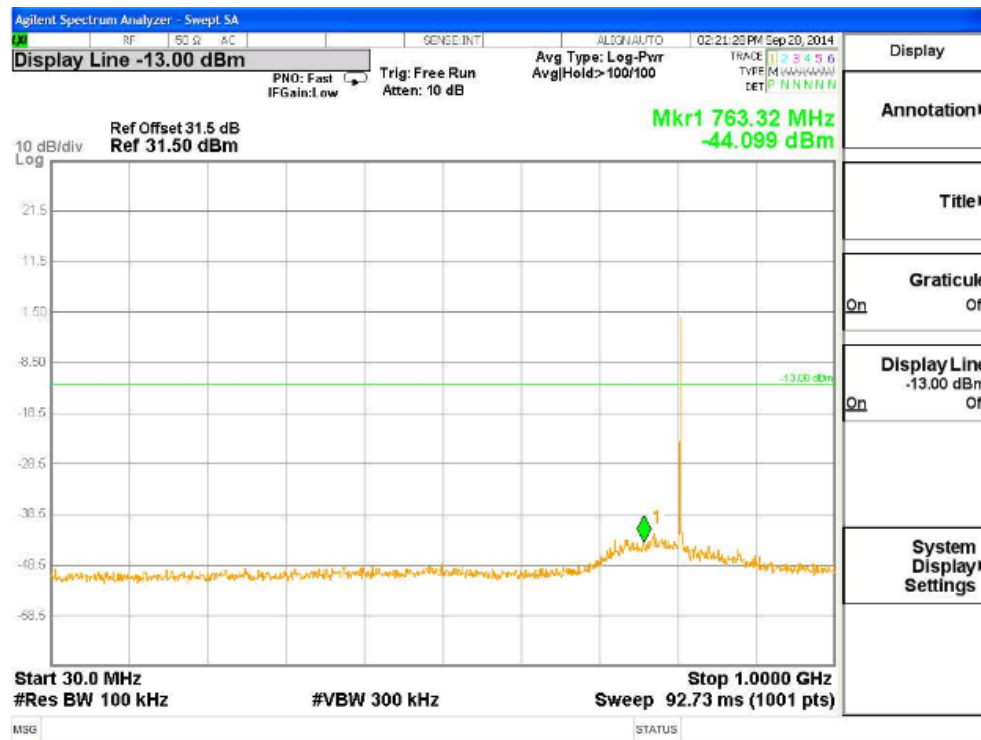
#### Environmental Conditions

Temperature:	22-25 °C
Relative Humidity:	42-55 %
ATM Pressure:	101.0 kPa

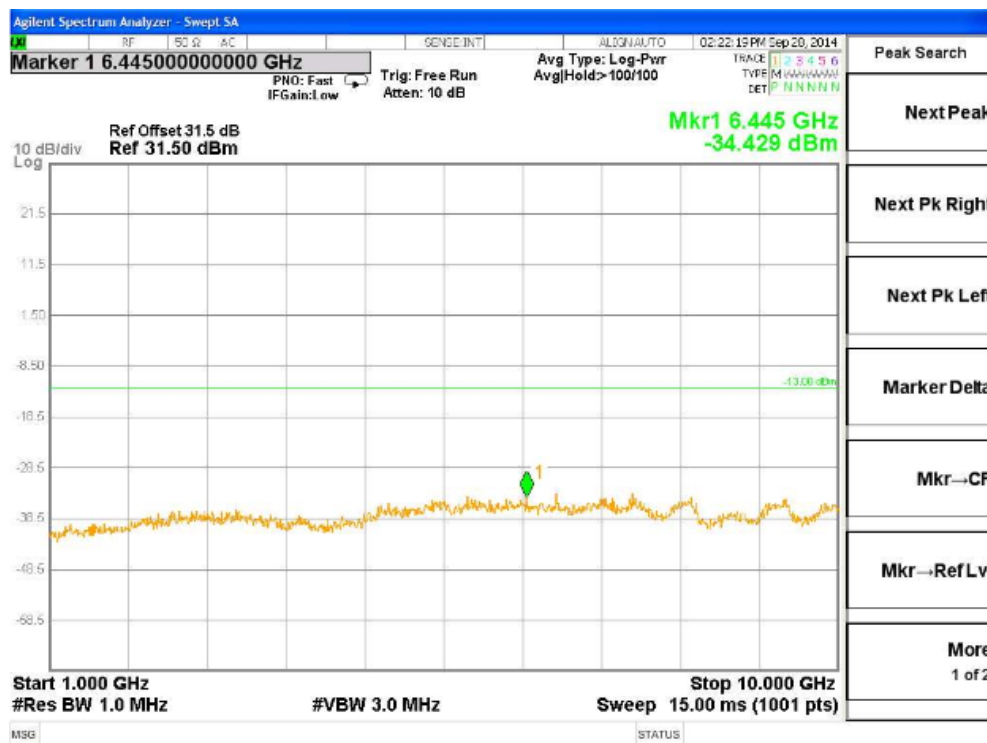
*The testing was performed by Rocky Kang on 2014-09-28 and 2014-12-05*

*Test Mode: Transmitting*

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



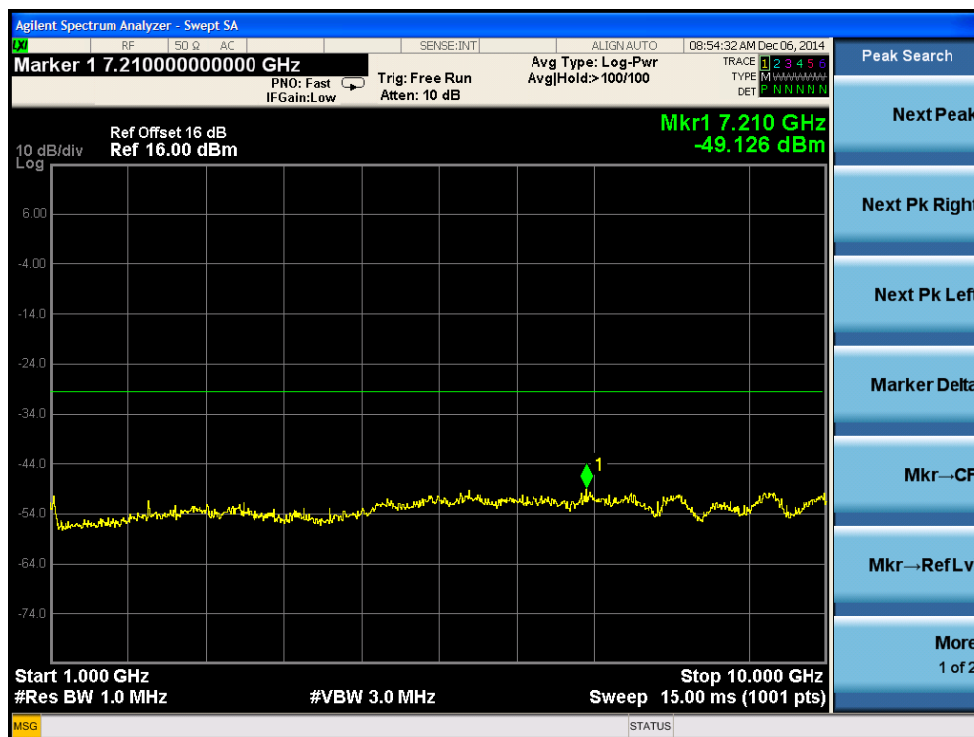
## 809.05 MHz: 1~10 GHz, Spacing Channel 25 kHz



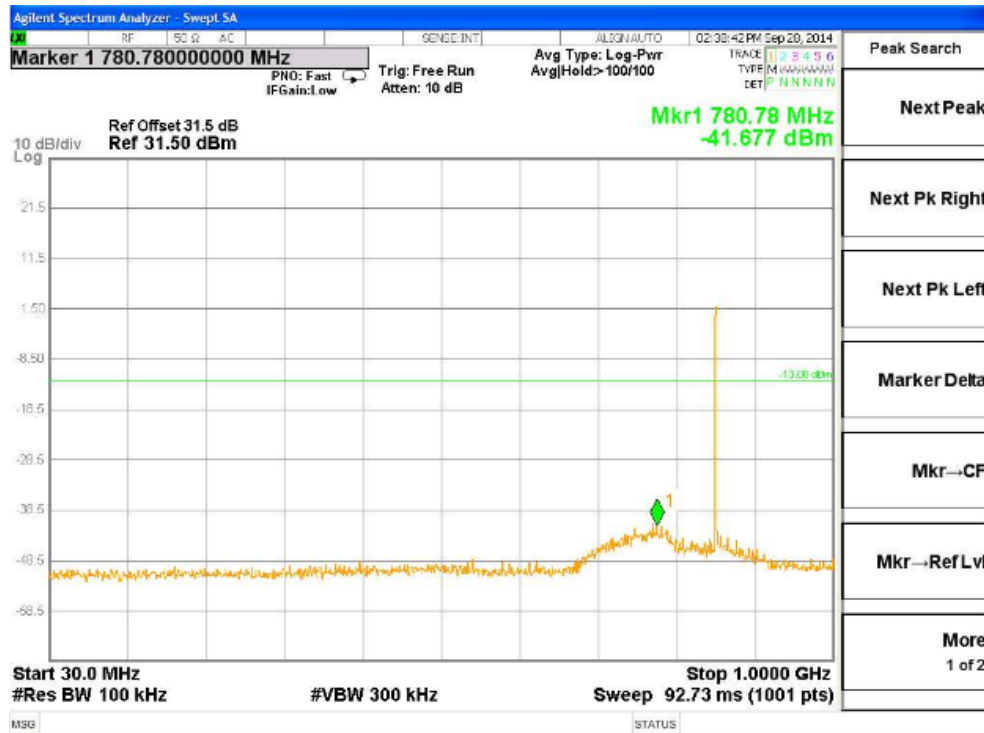
816.95 MHz: 30 MHz~1 GHz, Spacing Channel 25 kHz



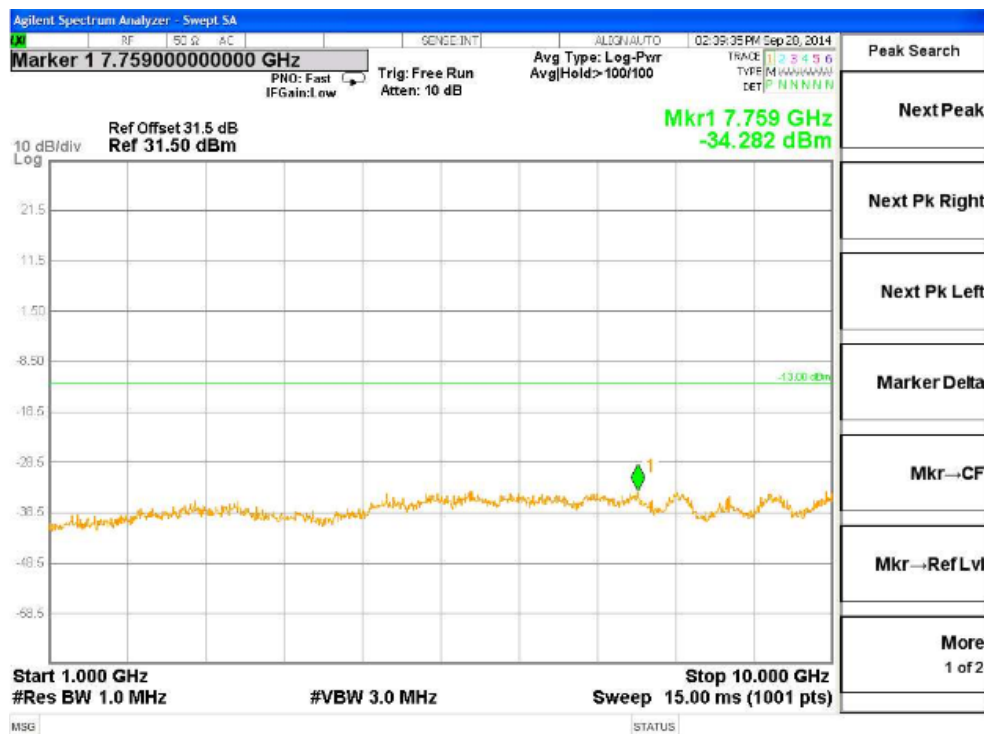
816.95 MHz: 1~10 GHz, Spacing Channel 25 kHz



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



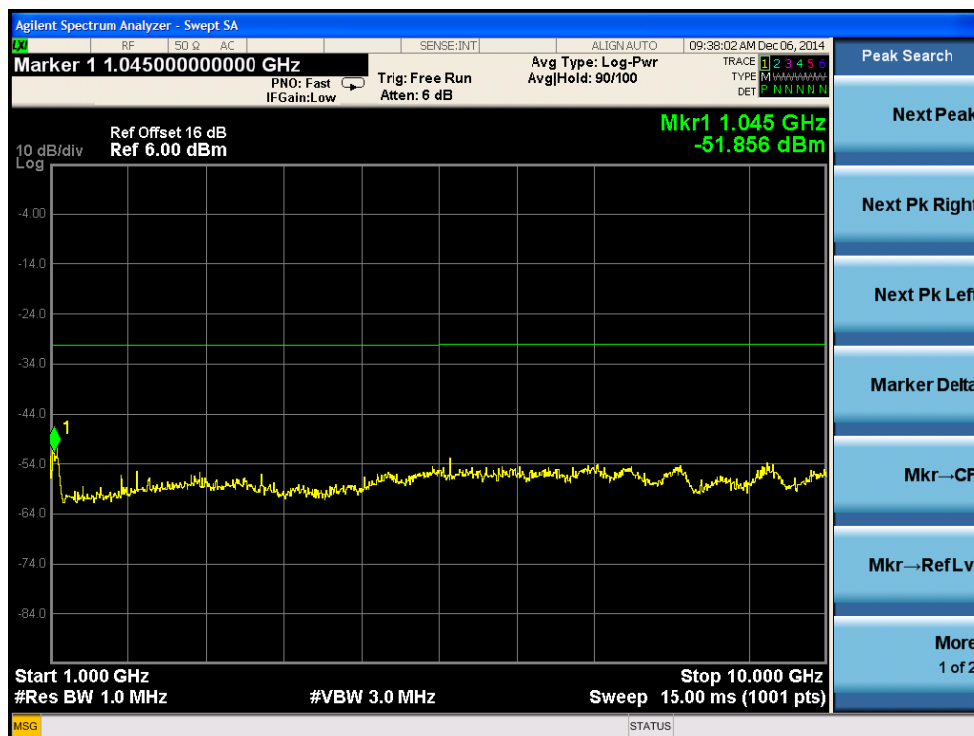
854.05 MHz: 1~10 GHz, Spacing Channel 25 kHz



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



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



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

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**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	2012-12-01	2015-11-30
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2012-11-28	2015-11-27
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2014-05-31	2015-05-31
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2014-09-25	2015-09-25
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	2013-12-19	2014-12-18
A.H. System	Horn Antenna	SAS-200/571	135	2012-02-11	2015-02-10
HP	Synthesized Sweeper	8341B	2624A00116	2014-06-03	2015-06-03
COM POWER	Dipole Antenna	AD-100	041000	NCR	NCR

**Test Data****Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	101.0 kPa

The testing was performed by Rocky Kang on 2014-09-29 and 2014-12-06

Test Mode: Transmitting (worst case)

**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)
809.05MHz, Channel Spacing 25 kHz										
331.5	37.55	48	1.3	H	-60.0	0.24	0	-60.24	-13	47.24
331.5	38.48	108	1.5	V	-59.0	0.24	0	-59.24	-13	46.24
1618.1	44.98	33	1.9	H	-58.6	0.95	9.40	-50.15	-13	37.15
1618.1	42.78	107	2.4	V	-59.3	0.95	9.40	-50.85	-13	37.85
854.05MHz, Channel Spacing 25 kHz										
331.5	36.25	98	1.4	H	-61.3	0.24	0	-61.54	-13	48.54
331.5	36.98	156	1.4	V	-60.5	0.24	0	-60.74	-13	47.74
1708.10	44.81	224	2.0	H	-58.2	0.97	9.40	-49.77	-13	36.77
1708.10	42.60	333	1.6	V	-57.9	0.97	9.40	-49.47	-13	36.47

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	2013-12-10	2015-12-10

**Test Data****Environmental Conditions**

Temperature:	22-25 °C
Relative Humidity:	42-55 %
ATM Pressure:	101.0 kPa

*The testing was performed by Rocky Kang on 2014-09-28 and 2014-12-05*

*Test Mode: Transmitting*



Reference Frequency: 809.05 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 (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.2	-39.5	-0.049
40	13.2	-39.5	-0.049
30	13.2	-35.4	-0.044
20	13.2	-37.8	-0.047
10	13.2	-36.1	-0.045
0	13.2	-33.7	-0.042
-10	13.2	-36.9	-0.046
-20	13.2	-38.6	-0.048
-30	13.2	-36.3	-0.045
Frequency Stability versus Input Voltage			
20	11.2	-41.2	-0.051

Reference Frequency: 816.95 MHz, Limit: 1.5 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	2	0.002
40	7.4	5	0.006
30	7.4	3	0.004
20	7.4	7	0.009
10	7.4	1	0.001
0	7.4	5	0.006
-10	7.4	8	0.010
-20	7.4	11	0.014
-30	7.4	13	0.016
Frequency Stability versus Input Voltage			
20	6.3	6	0.007

Reference Frequency: 854.05 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 (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	13.2	-53.4	-0.063
40	13.2	-51.2	-0.060
30	13.2	-55.2	-0.065
20	13.2	-53.0	-0.062
10	13.2	-55.9	-0.065
0	13.2	-56.8	-0.067
-10	13.2	-57.2	-0.067
-20	13.2	-55.3	-0.065
-30	13.2	-52.0	-0.061
Frequency Stability versus Input Voltage			
20	11.22	-58.9	-0.069

Reference Frequency: 861.95 MHz, Limit: 1.5 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	2.7	0.003
40	7.4	2.4	0.003
30	7.4	2.5	0.003
20	7.4	2.2	0.003
10	7.4	2.6	0.003
0	7.4	2.0	0.002
-10	7.4	2.2	0.003
-20	7.4	2.9	0.003
-30	7.4	3.4	0.004
Frequency Stability versus Input Voltage			
20	6.3	3.2	0.004

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