



# FCC PART 90 TEST REPORT

For

## Hytera Communications Corporation Ltd.

HYT Tower, Hi-Tech Industrial Park North, Nanshan District, Shenzhen China. 518057

**FCC ID: YAMDS-6210U2C4**

<b>Report Type:</b> Original Report	<b>Product Type:</b> DMR Trunking base station
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<b>Report Number:</b> R1DG120406003-00	
<b>Report Date:</b> 2012-04-23	
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\* This report contains data that are not covered by the NVLAP accreditation and are marked with an asterisk "★" (Rev.2)

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## GENERAL INFORMATION

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

The *Hytera Communications Corporation Ltd.*'s product, model number: *DS-6210U2C4* (FCC ID: *YAMDS-6210U2C4*) (the "EUT") in this report is a *DMR Trunking base station*, which was measured approximately 60cm(H) x 60 cm(W) x 157 cm(H), rated input voltage: AC 120V/60Hz.

\* All measurement and test data in this report was gathered from production sample serial number: 1204063 (Assigned by *BACL, Shenzhen*). The EUT was received on 2012-04-10.

### 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 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.

### Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) 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 February 02, 2012. 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.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratories Corp. (Shenzhen) is an ISO/IEC 17025 accredited laboratory, and is accredited by National Voluntary Laboratory Accredited Program (Lab Code 200707-0).



The current scope of accreditations can be found at <http://ts.nist.gov/Standards/scopes/2007070.htm>.

## SYSTEM TEST CONFIGURATION

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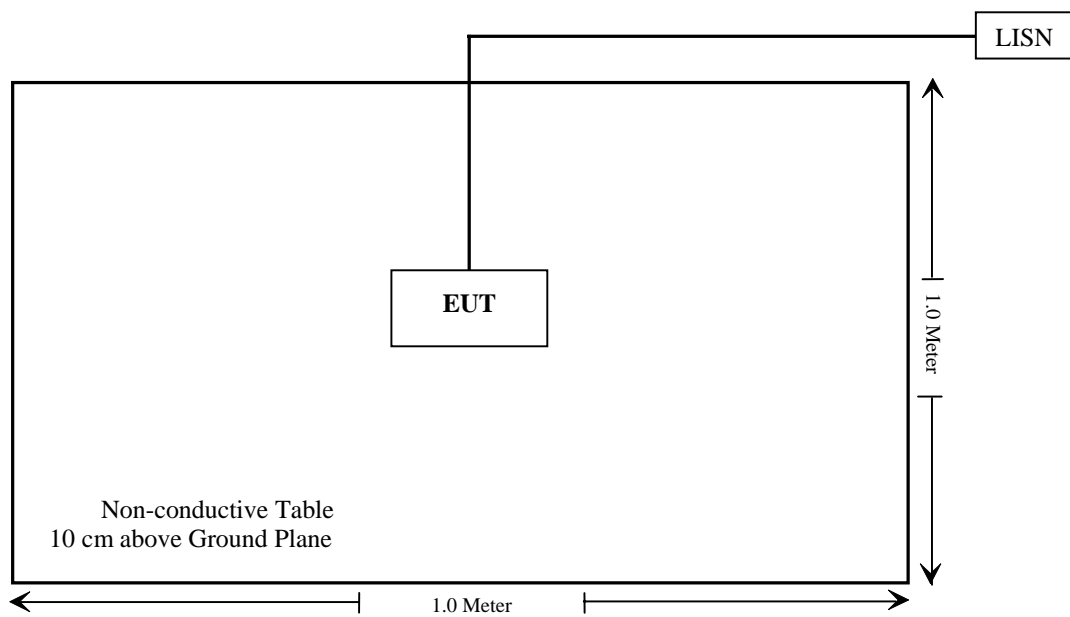
### Description of Test Configuration

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

### Equipment Modifications

No modifications were made to the unit tested.

### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Results</b>
§1.1307 (b) (1); §2.1091	Maximum Permissible Exposure (MPE)	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: The uncertainty of any RF tests which use conducted method measurement is  $\pm 0.96$  dB.

The uncertainty of any radiation emissions measurement is  $\pm 4.0$  dB.

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

**Applicable Standard**

According to 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
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

**MPE Calculation**

**Predication of MPE limit at a given distance**

$$S = PG/4\pi R^2$$

Where: 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

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
	(dBi)	(numeric)	(dBm)	(mW)			
450.0125	8.5	7.08	42.65	18408	220	0.214	0.300
475.0125	8.5	7.08	42.87	19364	220	0.226	0.317
500.0125	8.5	7.08	42.85	19275	220	0.224	0.333
519.9875	8.5	7.08	42.88	19409	220	0.226	0.347

**Result:** Pass

## FCC §2.1046 & §90.205- RF OUTPUT POWER

### Applicable Standard

FCC §2.1046 and §90.205.

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ 26	609358	2011-11-24	2012-11-23

\* **Statement of Tractability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

### Test Procedure

Conducted RF Output Power:

TIA-603-D section 2.2.1

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

Spectrum Analyzer setting:

<u><i>RBW</i></u>	<u><i>Video B/W</i></u>
<i>100 kHz</i>	<i>300 kHz</i>



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

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56%
<b>ATM Pressure:</b>	100.1 kPa

*The testing was performed by Leon Chen on 2012-04-16.*

*Test Mode: Transmitting*

**Test Result:** Compliance.

Please refer to following table.

<b>Test Chanel</b>	<b>Measured Power (dBm)</b>	<b>Rated power (dBm)</b>
450.0125MHz	42.65	43.5±1.5
475.0125MHz	42.87	43.5±1.5
500.0125MHz	42.85	43.5±1.5
519.9875MHz	42.88	43.5±1.5

## 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:  $50 + 10 \log P$

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ 26	609358	2011-11-24	2012-11-23

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### 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 and the spectrum was recorded in the frequency band  $\pm 35$  kHz from the carrier frequency.

### Test Data

#### Environmental Conditions

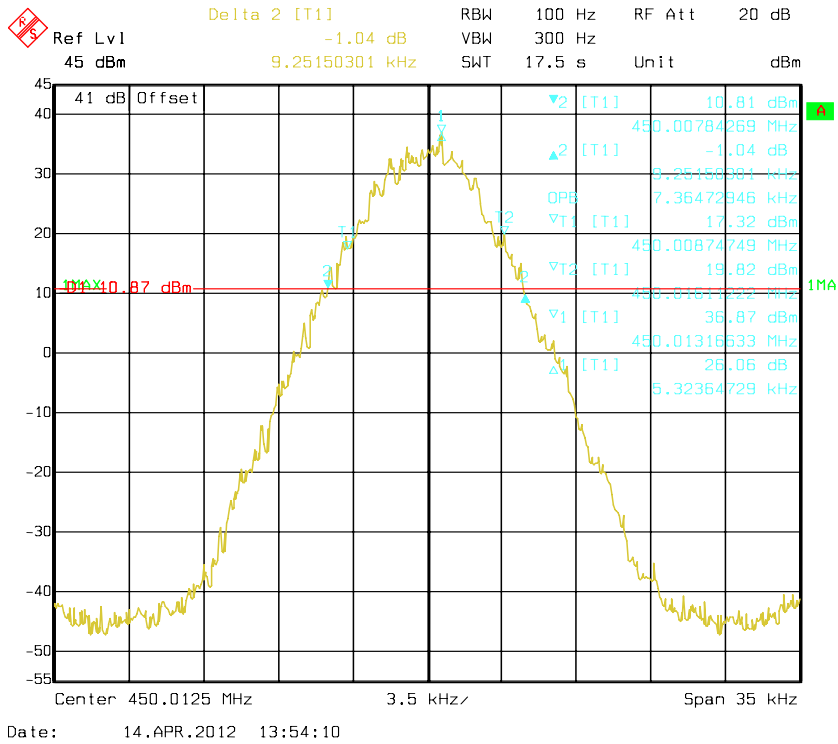
Temperature:	25 °C
Relative Humidity:	56%
ATM Pressure:	100.1 kPa

*The testing was performed by Leon Chen from 2012-04-14 to 2012-04-16.*

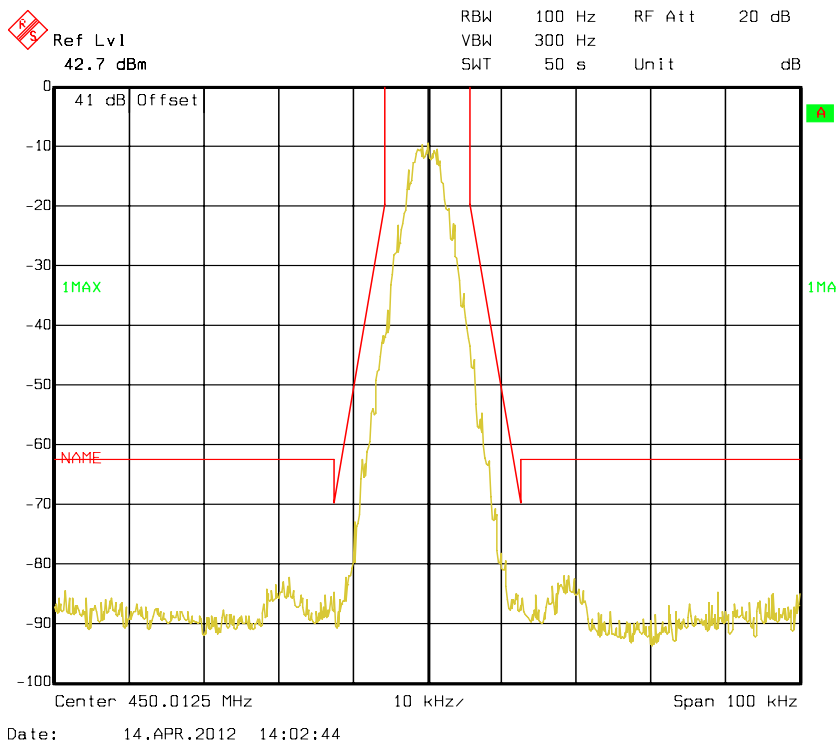
<b>Channel</b>	<b>99% Occupied Bandwidth (kHz)</b>	<b>26 dB Bandwidth (kHz)</b>
450.0125	7.36	9.25
519.9875	7.36	9.32

Please refer to the emission mask hereinafter plots.

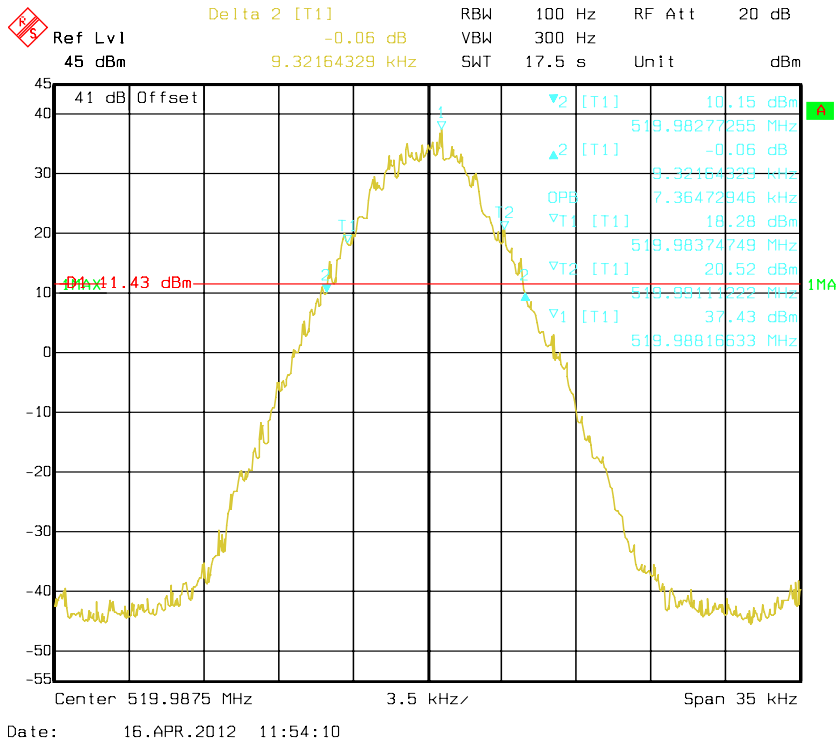
### Occupied Bandwidth – Low Channel



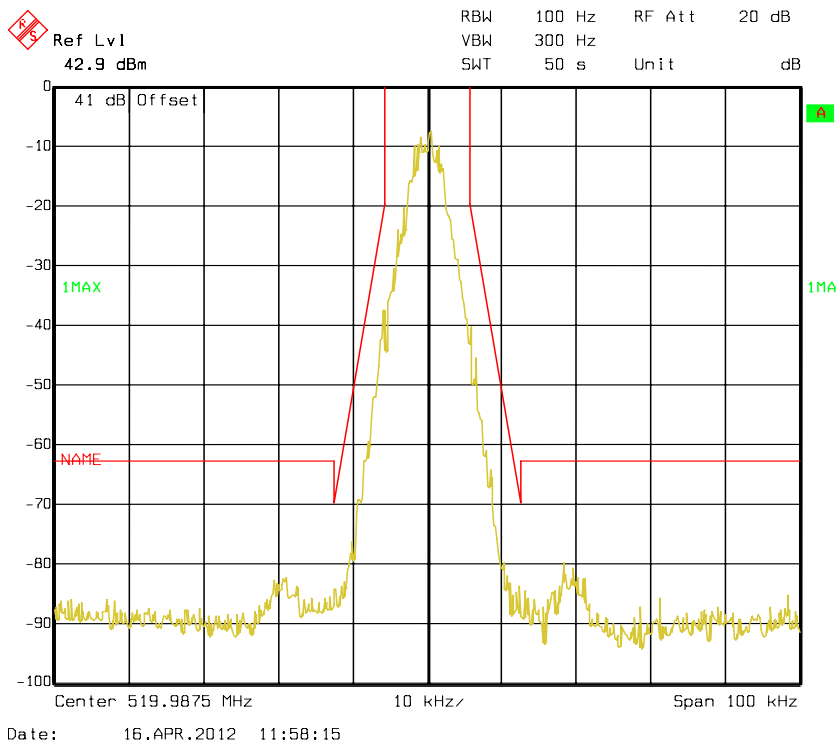
### Emission Mask- Low Channel



### Occupied Bandwidth – High Channel



### Emission Mask- High Channel



## 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:

$$50 + 10 \log P = 50 + 10 \log (P) \text{ dB}$$

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ 26	609358	2011-11-24	2012-11-23

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### 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 1MHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56%
<b>ATM Pressure:</b>	100.1 kPa

*The testing was performed by Leon Chen from 2012-04-14 to 2012-04-16.*

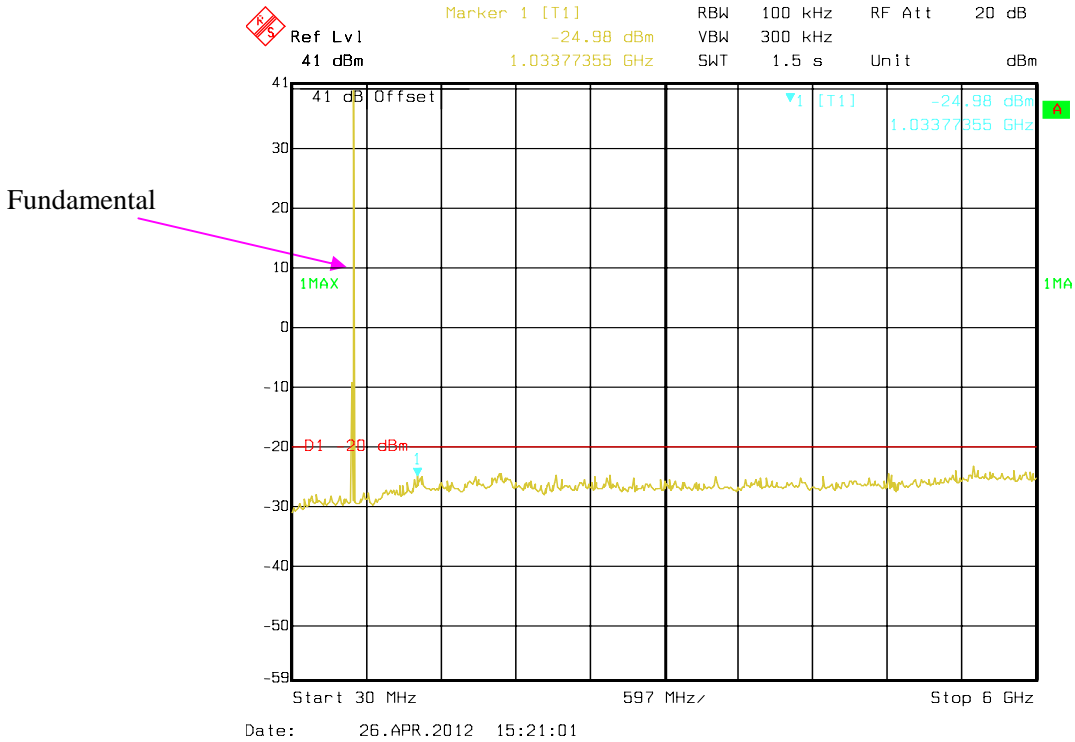
*Test Mode: Transmitting*

Please refer to the following plots.

### 30 MHz - 6 GHz (Low Channel)



### 30 MHz - 6 GHz (High Channel)



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

### Applicable Standard

FCC §2.1053 and §90.210

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Sunol Sciences	Horn Antenna	DRH-118	A052604	2011-05-05	2012-05-04
COM POWER	Dipole Antenna	AD-100	041000	2011-09-25	2012-09-24
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2011-07-05	2012-07-04
Rohde & Schwarz	Signal Analyzer	FSIQ 26	609358	2011-11-24	2012-11-23
HP	Signal Generator	HP8657A	2849U00982	2011-10-21	2012-10-20
A.H. System	Horn Antenna	SAS-200/571	135	2012-02-11	2013-02-10
HP	Synthesized Sweeper	8341B	2624A00116	2011-10-11	2012-10-10

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### 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)

Spurious attenuation limit in dB = 50 + 10 Log<sub>10</sub> (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.



**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56%
<b>ATM Pressure:</b>	100.1 kPa

The testing was performed by Leon Chen on 2012-04-16.

Test Mode: Transmitting

Frequency (MHz)	Indicated		Substituted				Limit (dBm)	Margin (dB)
	Reading (dBμV)	Polar (H/V)	S.G. Level (dBm)	Antenna Gain Correction (dB)	Cable Loss (dB)	Absolute Level (dBm)		
<b>Low channel</b>								
540.22	32.06	H	-69.9	0	0.38	-70.28	-20	50.28
620.73	31.14	H	-70.8	0	0.41	-71.21	-20	51.21
660.50	30.47	H	-69.5	0	0.41	-69.91	-20	49.91
780.78	32.78	H	-67.2	0	0.57	-67.77	-20	47.77
820.55	30.74	H	-67.0	0	0.57	-67.57	-20	47.57
900.03	29.94	H	-55.4	0	0.62	-56.02	-20	36.02
1045.96	38.30	H	-56.7	7.2	0.68	-50.18	-20	30.18
68.80	42.58	V	-57.4	0	0.23	-57.63	-20	37.63
540.22	34.72	V	-64.2	0	0.38	-64.58	-20	44.58
660.50	33.11	V	-65.8	0	0.41	-66.21	-20	46.21
780.78	35.01	V	-62.9	0	0.57	-63.47	-20	43.47
820.55	33.96	V	-64.0	0	0.57	-64.57	-20	44.57
900.03	32.74	V	-65.2	0	0.62	-65.82	-20	45.82
1042.01	38.12	V	-56.8	7.2	0.68	-50.28	-20	30.28
<b>High channel</b>								
540.22	33.63	H	-68.3	0	0.38	-68.68	-20	48.68
579.99	28.24	H	-73.7	0	0.41	-74.11	-20	54.11
620.73	32.42	H	-69.5	0	0.41	-69.91	-20	49.91
660.50	35.63	H	-64.3	0	0.41	-64.71	-20	44.71
780.78	33.80	H	-66.2	0	0.57	-66.77	-20	46.77
820.55	31.34	H	-66.6	0	0.57	-67.17	-20	47.17
1072.44	38.46	H	-56.5	7.2	0.68	-49.98	-20	29.98
68.80	42.84	V	-57.1	0	0.23	-57.33	-20	37.33
540.22	33.98	V	-65.0	0	0.38	-65.38	-20	45.38
660.50	31.50	V	-67.0	0	0.41	-67.41	-20	47.41
780.78	34.88	V	-63.1	0	0.57	-63.67	-20	43.67
820.55	30.68	V	-67.3	0	0.57	-67.87	-20	47.87
1072.44	36.09	V	-58.9	7.2	0.68	-52.38	-20	32.38

## FCC §2.1055 & §90.213- FREQUENCY STABILITY

### Applicable Standard

FCC §2.1055 & §90.213

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Hewlett-Packard	Frequency Counter	5342A	2317A08289	2011-10-15	2012-10-14
Qualmark	Temperature & Humidity Chamber	Typhoon 3.0	20021115	2011-06-04	2012-06-03

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external AC 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 AC 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.

The frequency stability shall be measured with variation of primary supply voltage as follows:

- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56%
<b>ATM Pressure:</b>	100.1 kPa

*The testing was performed by Leon Chen on 2012-04-16.*

## Frequency Stability versus Input Temperature

Reference Frequency: 450.0125 MHz, Limit: $\pm 1.5$ ppm			
Test Environment		Frequency Error with Time Elapsed	
Temperature (°C)	Power Supplied (V <sub>AC</sub> )	(MHz)	(ppm)
50	120	450.012450	-0.11
40	120	450.012465	-0.08
30	120	450.012455	-0.10
20	120	450.012436	-0.14
10	120	450.012449	-0.11
0	120	450.012468	-0.07
-10	120	450.012456	-0.10
-20	120	450.012443	-0.13
-30	120	450.012433	-0.15
20	102	450.012439	-0.14
20	138	450.012436	-0.14

Reference Frequency: 519.9875 MHz, Limit: $\pm 1.5$ ppm			
Test Environment		Frequency Error with Time Elapsed	
Temperature (°C)	Power Supplied (V <sub>AC</sub> )	(MHz)	(ppm)
50	120	519.987426	-0.14
40	120	519.987425	-0.14
30	120	519.987426	-0.14
20	120	519.987433	-0.13
10	120	519.987428	-0.14
0	120	519.987441	-0.11
-10	120	519.987419	-0.16
-20	120	519.987420	-0.15
-30	120	519.987437	-0.12
20	102	519.987424	-0.15
20	138	519.987436	-0.12

## FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

### Applicable Standard

Regulations: FCC §90.214

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

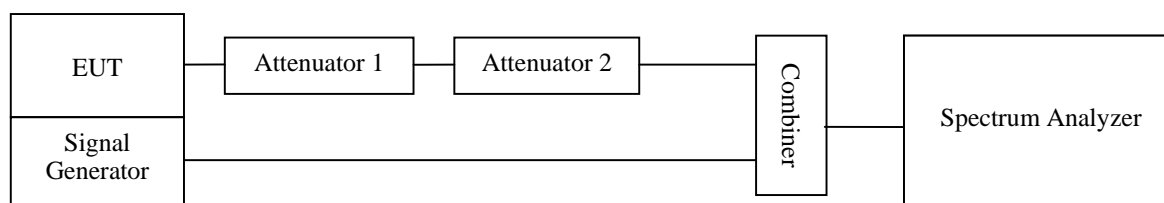
### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM	849720/019	2011-07-08	2012-07-07
Hewlett-Packard	Signal Generator	8648A	3426A00831	2011-10-09	2012-10-08

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Test Procedure

- Connect the EUT and test equipment as shown on the following block diagram.
- Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
- 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.
- Turn on the transmitter.
- 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  $P_0$ .
- Turn off the transmitter.
- 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.
- Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
- 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 "trigger offset" to -10ms for turn on and -15ms for turn off.
- 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  $t_2$ .
- 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**

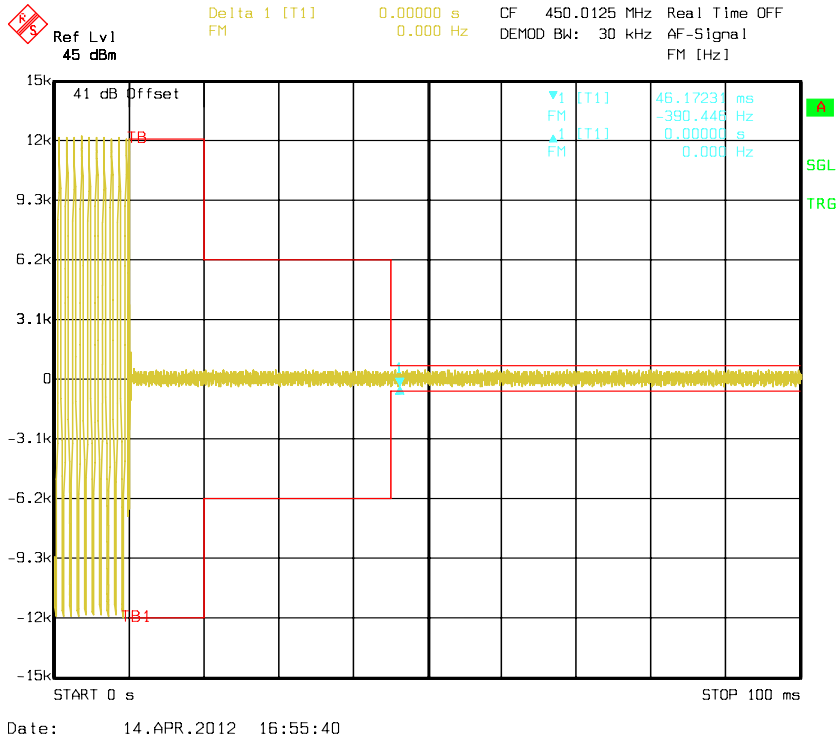
**Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56%
<b>ATM Pressure:</b>	100.1 kPa

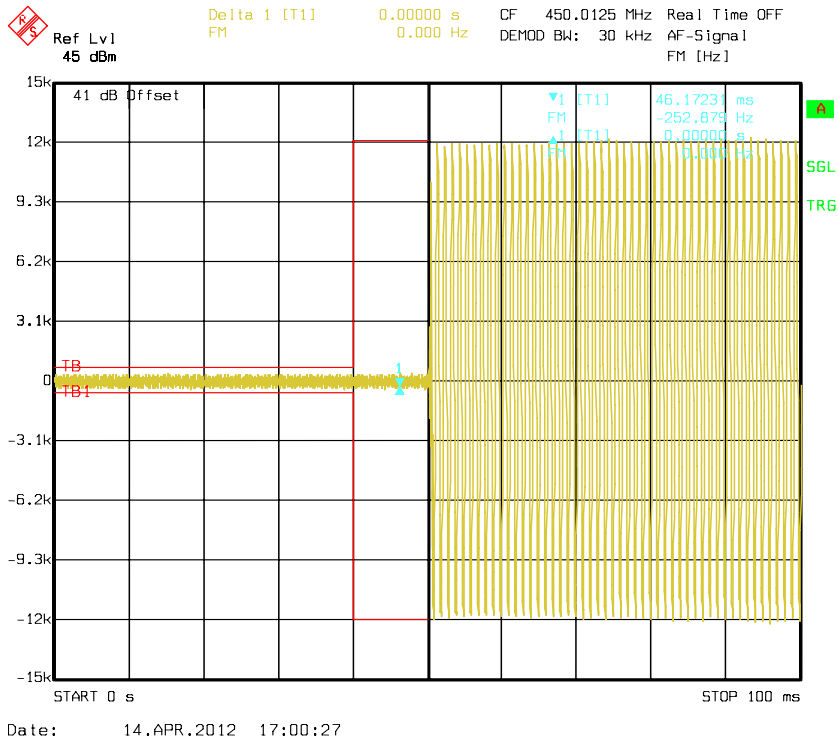
*The testing was performed by Leon Chen on 2012-04-14.*

Please refer to the following plots.

### Turn on



### Turn off



\*\*\*\*\* End of Report \*\*\*\*\*