



# FCC CFR47 PART 22 SUBPART H FCC CFR47 PART 24 SUBPART E CLASS II PERMISSIVE CHANGE

### **CERTIFICATION TEST REPORT**

FOR 3G 4G MODULE

MODEL NUMBER: M600 FCC ID: XHG-M600

REPORT NUMBER: 12U14462-1, Revision A ISSUE DATE: JULY 10, 2012

Prepared for

**FORTINET** 

Franklin Technology Inc. 906 JEI Platz, 459-11, Gasan-Dong, Gumcheon-Gu Seoul, 152-803, South Korea

Prepared by

COMPLIANCE CERTIFICATION SERVICES (UL CCS)
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000

FAX: (510) 661-0888



# **Revision History**

	Issue		
Rev.	Date	Revisions	Revised By
	06/26/12	Initial Issue	T. Chan
Α	07/10/12	Added the Antenna Section to the report	A. Zaffar

# **TABLE OF CONTENTS**

1. AT	TESTATION OF TEST RESULTS	4
2. TE	ST METHODOLOGY	5
3. FA	CILITIES AND ACCREDITATION	5
4. CA	LIBRATION AND UNCERTAINTY	5
4.1.	MEASURING INSTRUMENT CALIBRATION	5
4.2.	SAMPLE CALCULATION	5
4.3.	MEASUREMENT UNCERTAINTY	5
5. EQ	UIPMENT UNDER TEST	6
5.1.	DESCRIPTION OF EUT	6
5.2.	MAXIMUM OUTPUT POWER	6
5.3.	DESCRIPTION OF AVAILABLE ANTENNAS	6
5.4.	DESCRIPTION OF CLASS II PERMISSIVE CHANGE	6
5.5.	SOFTWARE AND FIRMWARE	6
5.6.	WORST-CASE CONFIGURATION AND MODE	6
5.7.	DESCRIPTION OF TEST SETUP	8
6. TE	ST AND MEASUREMENT EQUIPMENT	10
7. RA	DIATED TEST RESULTS	11
7.1.	RADIATED POWER (ERP & EIRP)	11
7.2.	FIELD STRENGTH OF SPURIOUS RADIATION	16

### 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** FORTINET

FRANKLIN TECHNOLOGY INC.

906 JEI PLATZ, 459-11, GASAN-DONG, GUMCHEON-GU

SEOUL, 152-803, SOUTH KOREA

**EUT DESCRIPTION**: 3G 4G MODULE

MODEL: M600

SERIAL NUMBER: F463490466C4

**DATE TESTED:** JUNE 21-22, 2012

**APPLICABLE STANDARDS** 

STANDARD TEST RESULTS

FCC PART 22H AND 24E PASS

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By: Tested By:

THU CHAN

**ENGINEERING MANAGER** 

**UL CCS** 

CHIN PANG EMC ENGINEER

Chin Pany

UL CCS

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, FCC CFR 47 Part 2, FCC CFR 47 Part 22, and FCC CFR Part 24.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <a href="http://www.ccsemc.com">http://www.ccsemc.com</a>.

## 4. CALIBRATION AND UNCERTAINTY

## 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards

#### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) - Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB - 26.9 dB = 28.9 dBuV/m

#### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is 3G 4G Module

### 5.2. MAXIMUM OUTPUT POWER

The RF conducted measurement passed within ± 0.5dBm of the original output power.

The RF radiated measurement with maximum peak ERP / EIRP output powers are as follows:

Part 22 Cellular Band

Frequency range	Modulation	ERP		
(MHz)	Modulation	dBm	mW	
824.7 – 848.31	1XRTT	30.81	1205.0	
824.7 – 848.31	EVDO	31.14	1300.2	

#### Part 24 PCS Band

Frequency range	Modulation	Modulation		
(MHz)	Modulation	dBm	mW	
1851.25-1908.75	1xRTT	26.72	469.9	
1851.25-1908.75	EVDO	27.12	515.2	

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The major change filed under this application is adding dipole antennas. Antenna peak gain for 850MHz is 2.0±0.5dBi, antenna peak gain for 1900MHz is 1.0±0.5dBi.

### 5.4. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is adding dipole antennas.

#### 5.5. SOFTWARE AND FIRMWARE

The EUT is linked with Agilent Communication Test Set.

## 5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power.

 REPORT NO: 12U14462-1A
 DATE: JULY 10, 2012

 EUT: 3G 4G MODULE
 FCC ID: XHG-M600

## 5.7. DESCRIPTION OF TEST SETUP

#### **SUPPORT EQUIPMENT**

PERIPHERAL SUPPORT EQUIPMENT LIST								
Description Manufacturer Model Serial Number								
Tablet Laptop	Lenovo	ThinkPad R60	LV-BB670	DoC				
AC Adapter	Lenovo	42T4426	11S42T4426Z1ZF3F04C4FW	DoC				
Communications Test Set	Agilent / HP	E5515C	GB47050526	NA				
Antenna, Horn, 18 GHz	ETS	3117	9702-5118	NA				

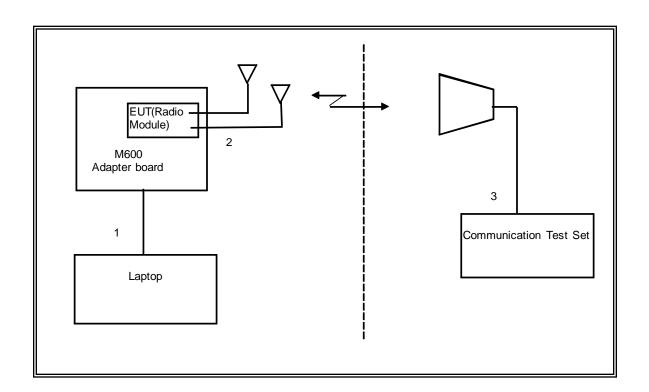
### I/O CABLES

	I/O CABLE LIST									
Cable	Port	# of	Connector	Cable						
No.		Identic	Type	Туре	Length					
		Ports								
1	USB	1	MINI USB	UN-SHELDED	1.0m	N/A				
2	RF	1	Dipole Antenna	UN-SHELDED	0.1m	N/A				
3	RF In/Out	1	Horn	UN-SHELDED	3m	N/A				

### **TEST SETUP**

The EUT is a stand-alone device. A link is established between the EUT and the Agilent communication test set.

## **SETUP DIAGRAM FOR RF RADIATED TESTS**



# 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST							
Description	Manufacturer	Model	Asset	Cal Due			
Antenna, Horn, 18 GHz	EMCO	3115	C00945	10/06/12			
Antenna, Horn, 18 GHz	EMCO	2238	C00872	09/20/12			
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	11/11/12			
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	02/16/13			
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	07/12/12			
Communications Test Set	Agilent / HP	E5515C	1000732	09/27/12			
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM13193	N02689`	CNR			
Highpass Filter, 2.7 GHz	Micro-Tronics	HPM13194	N02687	CNR			
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/16/12			
Signal Generator, 20 GHz	Agilent / HP	83732B	C00774	07/14/12			
Antenna, Tuned Dipole 400~1000	ETS	3121C DB4	C00993	07/16/12			

## 7. RADIATED TEST RESULTS

# 7.1. RADIATED POWER (ERP & EIRP)

### **RULE PART(S)**

FCC: §2.1046, §22.913, §24.232

#### **LIMITS**

22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

24.232(c) - Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

#### **TEST PROCEDURE**

ANSI / TIA / EIA 603C

### **MODES TESTED**

• CDMA2000, 1xRTT and EVDO Rev 0.

### **RESULTS**

				ERP		
	Mode	Channel	f (MHz)	dBm	mW	
		1013	824.70	29.47	885.12	
	1xRTT	384	836.52	30.81	1205.04	
CDMA2000		777	848.31	30.61	1150.80	
CDIVIAZOOO	EVDO	1013	824.70	29.58	907.82	
		384	836.52	31.14	1300.17	
		777	848.31	30.64	1158.78	

				EIF	RP
	Mode	Channel	f (MHz)	dBm	mW
		25	1851.25	26.72	469.89
	1xRTT	600	1880.00	25.31	339.63
CDMA2000		1175	1908.75	24.63	290.40
CDIVIAZOOO	EVDO	25	1851.25	27.12	515.23
		600	1880.00	26.31	427.56
		1175	1908.75	26.93	493.17

### CDMA2000 (Cellular Band)

**High Frequency Substitution Measurement** Compliance Certification Services Chamber B

Company: Fortinet Project #: 12U14462 Date: 06/21/12 Test Engineer: Chin Pang Configuration: EUT with Antenna

Mode: TX, 850 MHz BAND, CDMA 1xRTT MODE

#### Test Equipment:

Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT) Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.

f	SG reading	Ant. Pol.	Cable Loss	Antenna Gain	ERP	Limit	Margin	Notes
MHz	(dBm)	(H/V)	(dB)	(dBd)	(dBm)	(dBm)	(dB)	
Low Ch								
824.70	29.97	V	0.5	0.0	29.47	38.5	-9.0	
824.70	18.50	Н	0.5	0.0	18.00	38.5	-20.4	
Mid Ch								
836.52	31.31	V	0.5	0.0	30.81	38.5	-7.6	
836.52	17.30	Н	0.5	0.0	16.80	38.5	-21.7	
High Ch								
848.31	31.11	V	0.5	0.0	30.61	38.5	-7.8	
848.31	17.50	Н	0.5	0.0	17.00	38.5	-21.4	

Rev. 3.17.11

### **EVDO (Cellular Band)**

**High Frequency Substitution Measurement** 

Compliance Certification Services Chamber B

Company: Fortinet Project #: 12U14462 Date: 06/22/12 Chin Pang Test Engineer: Configuration: EUT with Antenna

Mode: TX, 850 MHz BAND, CDMA EVDO

Test Equipment:

Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)

Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.

f	SG reading	Ant. Pol.	Cable Loss	Antenna Gain	ERP	Limit	Margin	Notes
MHz	(dBm)	(H/V)	(dB)	(dBd)	(dBm)	(dBm)	(dB)	
Low Ch								
824.70	30.08	V	0.5	0.0	29.58	38.5	-8.9	
824.70	19.90	Н	0.5	0.0	19.40	38.5	-19.0	
Mid Ch								
836.52	31.64	V	0.5	0.0	31.14	38.5	-7.3	
836.52	18.70	Н	0.5	0.0	18.20	38.5	-20.3	
High Ch								
848.31	31.14	V	0.5	0.0	30.64	38.5	-7.8	
848.31	18.50	Н	0.5	0.0	18.00	38.5	-20.4	

Rev. 3.17.11

### 1xRTT (PCS Band)

High Frequency Fundamental Measurement Compliance Certification Services Chamber B

 Company:
 Fortinet

 Project #:
 12U14462

 Date:
 06/21/12

 Test Engineer:
 Chin Pang

 Configuration:
 EUT with antenna

Mode: TX, 1900 MHz BAND, CDMA2000, 1xRTT

Test Equipment:

Receiving: Horn T59, and Camber B SMA Cables

Substitution: Horn T217 Substitution, 4ft SMA Cable (244639001) Warehouse

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
1.851	19.0	V	0.85	8.62	26.72	33.0	-6.3	
1.851	10.8	Н	0.85	8.47	18.38	33.0	-14.6	
Mid Ch								
1.880	17.7	V	0.85	8.46	25.31	33.0	-7.7	
1.880	11.3	Н	0.85	8.36	18.83	33.0	-14.2	
High Ch								
1.909	17.2	V	0.85	8.30	24.63	33.0	-8.4	
1.909	11.5	Н	0.85	8.25	18.86	33.0	-14.1	

Rev. 3.17.11

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### **EVDO (PCS Band)**

High Frequency Fundamental Measurement Compliance Certification Services Chamber B

 Company:
 Fortinet

 Project #:
 12U14462

 Date:
 06/23/12

 Test Engineer:
 Chin Pang

 Configuration:
 EUT with antenna

Mode: TX, 1900 MHz BAND, CDMA2000, EVDO

Test Equipment:

Receiving: Horn T59, and Camber B SMA Cables

Substitution: Horn T217 Substitution, 4ft SMA Cable (244639001) Warehouse

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
1.851	19.4	V	0.85	8.62	27.12	33.0	-5.9	
1.851	11.0	Н	0.85	8.47	18.58	33.0	-14.4	
Mid Ch								
1.880	18.7	V	0.85	8.46	26.31	33.0	-6.7	
1.880	10.8	Н	0.85	8.36	18.33	33.0	-14.7	
High Ch								
1.909	19.5	V	0.85	8.30	26.93	33.0	-6.1	
1.909	11.3	Н	0.85	8.25	18.66	33.0	-14.3	

Rev. 3.17.11

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### 7.2. FIELD STRENGTH OF SPURIOUS RADIATION

### **RULE PART(S)**

FCC: §2.1053, §22.917, §24.238

### **LIMIT**

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

#### **TEST PROCEDURE**

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

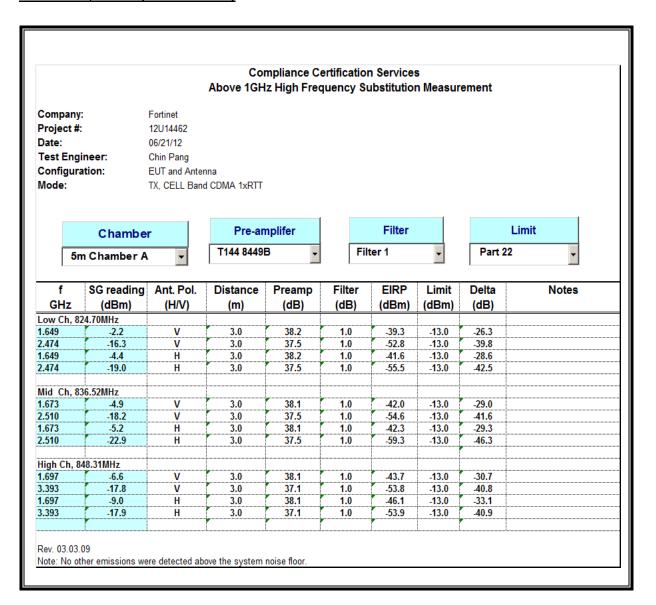
For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

#### **MODES TESTED**

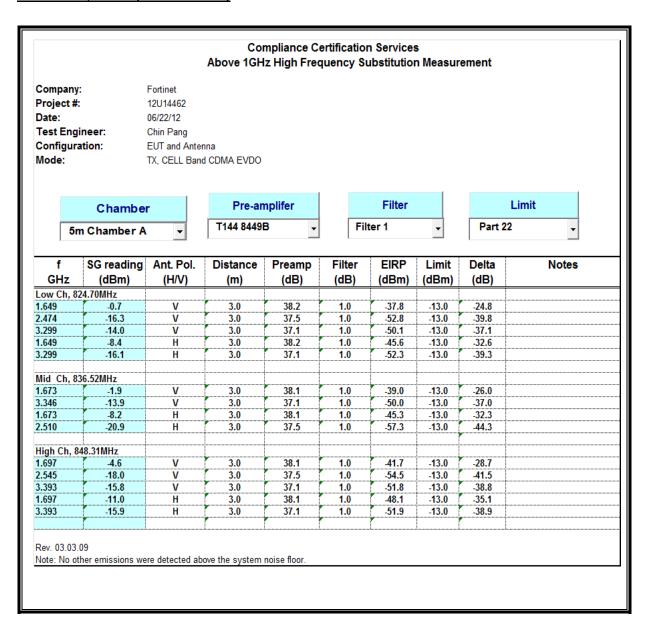
• CDMA2000, 1xRTT and EVDO

#### **RESULTS**

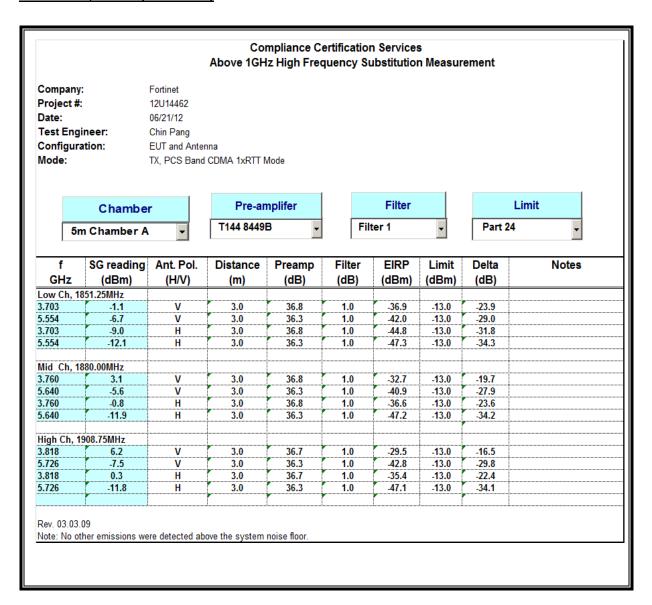
#### CDMA2000, 1xRTT (Cellular Band)



#### CDMA2000, EVDO (Cellular Band)



#### CDMA2000, 1xRTT (PCS Band)



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#### CDMA2000, EVDO (PCS Band)

