

# FCC Co-Location Test Report

**FCC ID** : 2ABLK-844FX-X  
**Equipment** : GigaCenter  
**Model No.** : 844FB-1 ; 844F-1 ; 844FB-2 ; 844F-2  
(refer to item 1.1.1 for more details)  
**Brand Name** : Calix Inc  
**Applicant** : Calix Inc  
**Address** : 1035 N. McDowell Blvd. Petaluma, CA 94954  
**Standard** : 47 CFR FCC Part 15.247  
47 CFR FCC Part 15.407  
**Received Date** : Jan. 10, 2017  
**Tested Date** : Feb. 07 ~ Mar. 07, 2017

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:

  
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Along Chen / Assistant Manager

Approved by:

  
\_\_\_\_\_  
Gary Chang / Manager



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## Release Record

Report No.	Version	Description	Issued Date
FR712305CO	Rev. 01	Initial issue	Apr. 17, 2017

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## Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.247(d) 15.407(b) 15.209	Radiated Emissions	[dBuV/m at 3m]: 499.99MHz 42.79 (Margin -3.21dB) - QP	Pass

# 1 General Description

## 1.1 Information

### 1.1.1 Product Details

The device has 4 configurations as below table.

RF function is identical to each configuration. Differences between 4 configurations are only non-RF function by depopulation of components without PCB Modifications.

Model Name	844FB-1	844FB-2	844F-1	844F-2
LAN / WAN function	4 LAN ports	4 LAN ports 1WAN port	4 LAN ports	4 LAN ports 1WAN port
G.fast function	bonding G.fast	bonding G.fast	Single G.fast	Single G.fast
Power Supply	1. Adapter 2. UPS	Adapter (DC jack)	1. Adapter 2. UPS	Adapter (DC jack)
Housing Type	Housing 1	Housing 2	Housing 1	Housing 2
Frequency band (GHz)	2.412 ~ 2.462 / 5.15 ~ 5.25 / 5.725 ~ 5.85			
Bean forming mode	Supported			
Master or Client	Master			
USB function	USB3.0			
VOIP function	VOIP (FXS)			

Note: Four models (844FB-1, 844FB-2, 844F-1 and 844F-2) had been covered during the pretest, and found that 844F-1 was the worst case and was selected for final test.

### 1.1.2 Specification of the Equipment under Test (EUT)

WLAN	
Operating Frequency	802.11b/g/n: 2412 MHz ~ 2462 MHz 802.11a/n/ac: 5180 MHz ~ 5240 MHz; 5745 ~ 5825 MHz
Modulation Type	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11a/g/n/ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)

### 1.1.3 Antenna Details

Ant. No.	Model	Type	Connector	Operating Frequency (MHz) / Gain (dBi)		
				2400~2483.5	5150~5250	5725~5850
1	PCB antenna	Dipole	IPEX	0	-0.8	-1.2
2	PCB antenna	Dipole	IPEX	0	-0.8	-1.2
3	PCB antenna	Dipole	IPEX	0	-0.8	-1.2
4	PCB antenna	Dipole	IPEX	0	-0.8	-1.2

#### 1.1.4 Power Supply Type of Equipment under Test (EUT)

<b>Power Supply Type</b>	12Vdc from AC adapter 12Vdc from UPS
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#### 1.1.5 Accessories

Accessories		
No.	Equipment	Description
1	AC adapter	Brand: MASS POWER Model: NBS65A120410M2 Power Rating: I/P: 100-240Vac, 50/60Hz, 1.5A O/P: 12Vdc, 4.1A Power Line: DC 1.2m non-shielded without core AC 1.5m non-shielded without core
2	UPS	Brand: Cyber Power Model: DTC50U12V3-G Power Rating: I/P: 100-240Vac, 50-60Hz, 1.5A O/P: 12Vdc, 50W Power Line: DC 1.2m non-shielded without core AC 2.45m non-shielded without core

## 1.2 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Nov. 25, 2016	Nov. 24, 2017
Receiver	R&S	ESR3	101658	Nov. 24, 2016	Nov. 23, 2017
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Aug. 04, 2016	Aug. 03, 2017
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 21, 2016	Dec. 20, 2017
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Oct. 25, 2016	Oct. 24, 2017
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 10, 2016	Nov. 09, 2017
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 09, 2016	Dec. 08, 2017
Preamplifier	EMC	EMC02325	980225	Aug. 05, 2016	Aug. 04, 2017
Preamplifier	Agilent	83017A	MY39501308	Oct. 06, 2016	Oct. 05, 2017
Preamplifier	EMC	EMC184045B	980192	Aug. 24, 2016	Aug. 23, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 09, 2016	Dec. 08, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 09, 2016	Dec. 08, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 09, 2016	Dec. 08, 2017
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	16052	Dec. 09, 2016	Dec. 08, 2017
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 09, 2016	Dec. 08, 2017
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 09, 2016	Dec. 08, 2017
Measurement Software	AUDIX	e3	6.120210g	NA	NA

Note: Calibration Interval of instruments listed above is one year.

### 1.3 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247

47 CFR FCC Part 15.407

ANSI C63.10-2013

FCC KDB 558074 D01 DTS Meas Guidance v03r05

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r03

FCC KDB 412172 D01 Determining ERP and EIRP v01r01

### 1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Measurement Uncertainty	
Parameters	Uncertainty
Radiated emission $\leq$ 1GHz	$\pm 3.66$ dB
Radiated emission $>$ 1GHz	$\pm 5.63$ dB



## 2 Test Configuration

### 2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
Radiated Emissions	03CH01-WS	20-22°C / 61-64%	Vincent Yeh Kevin Lee

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- IC site registration No.: 10807A-1

### 2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate
Radiated Emissions	2.4G 11b + 5G 11a	CH6 + CH40	6Mbps + MCS 0
Note: 1. The selected channel is the maximum power channel of Wi-Fi mode 2. Two power supply (Adapter and UPS) had been covered during the pretest, and found that radiated Emissions with UPS was the worst case for final test.			

### 3 Transmitter Test Results

#### 3.1 Unwanted Emissions into Restricted Frequency Bands

##### 3.1.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

**Note 1:**  
Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

**Note 2:**  
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

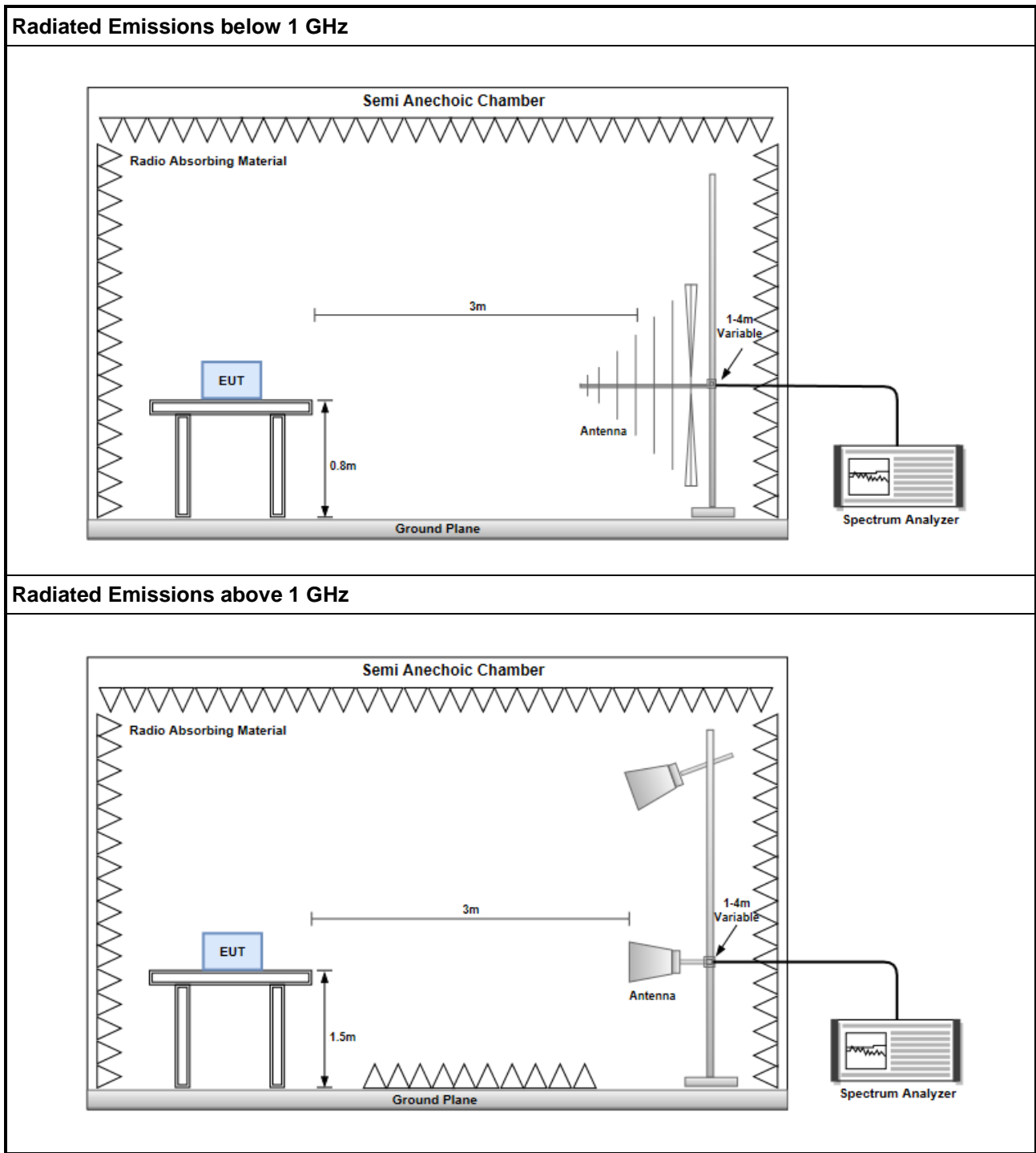
##### 3.1.2 Test Procedures

1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m.
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

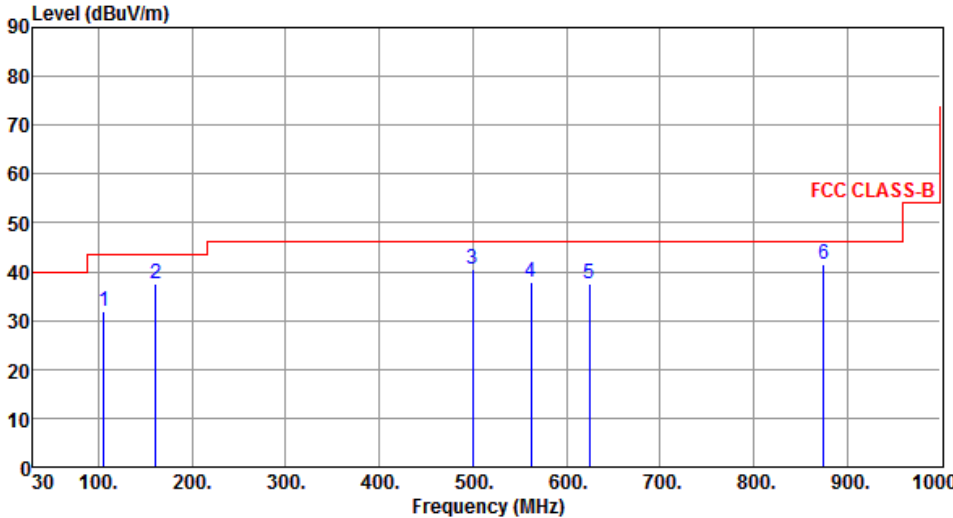
**Note:**

1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

### 3.1.3 Test Setup



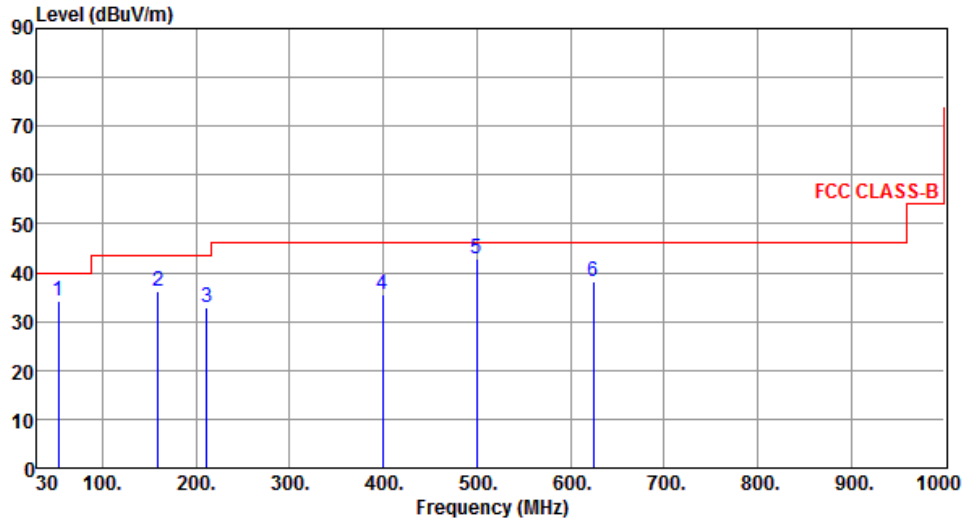
### 3.1.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Mode	2.4G 11b + 5G 11a		Test Freq. (MHz)	CH06 + CH40					
Polarization	Horizontal								
									
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	105.66	32.01	43.50	-11.49	43.92	-11.91	Peak	---	---
2	160.95	37.68	43.50	-5.82	45.80	-8.12	Peak	---	---
3	499.48	40.66	46.00	-5.34	43.48	-2.82	Peak	---	---
4	562.53	37.77	46.00	-8.23	39.32	-1.55	Peak	---	---
5	624.61	37.54	46.00	-8.46	37.89	-0.35	Peak	---	---
6	874.87	41.66	46.00	-4.34	37.88	3.78	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)  
\*Factor includes antenna factor , cable loss and amplifier gain  
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).  
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

<b>Mode</b>	2.4G 11b + 5G 11a	<b>Test Freq. (MHz)</b>	CH06 + CH40
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<b>Polarization</b>	Vertical
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	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	52.56	34.13	40.00	-5.87	42.10	-7.97	QP	100	266
2	159.01	36.20	43.50	-7.30	44.28	-8.08	Peak	---	---
3	211.39	32.91	43.50	-10.59	43.61	-10.70	Peak	---	---
4	399.57	35.59	46.00	-10.41	40.59	-5.00	Peak	---	---
5	499.99	42.79	46.00	-3.21	45.60	-2.81	QP	106	37
6	624.61	38.12	46.00	-7.88	38.47	-0.35	Peak	---	---

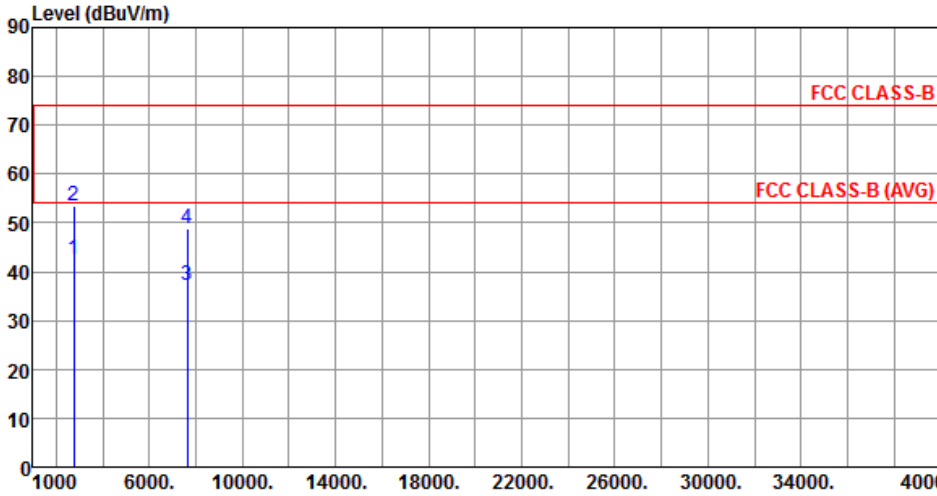
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

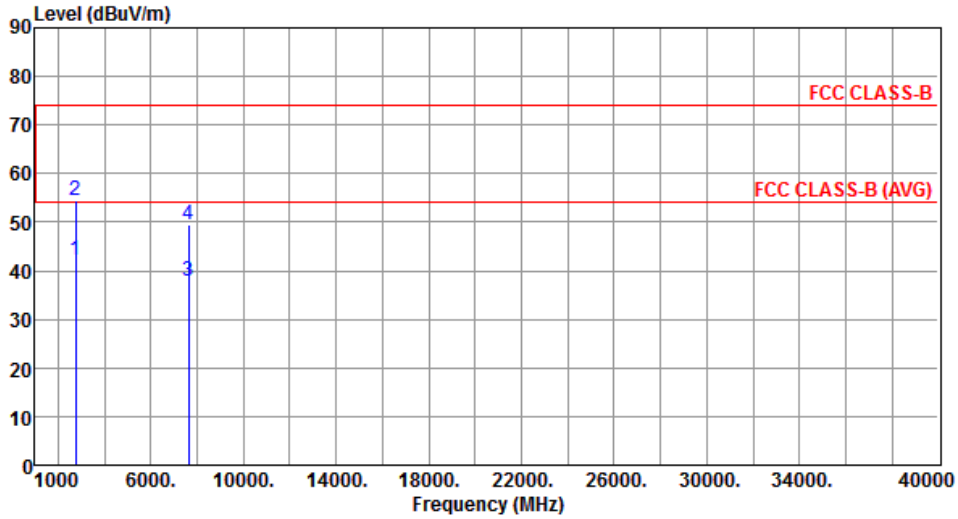
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

### 3.1.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Mode	2.4G 11b+ 5G 11a	Test Freq. (MHz)	CH06 + CH40						
Polarization	Horizontal								
 <p>The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (1000 to 40000). Two horizontal red lines represent FCC CLASS-B (at ~75 dBuV/m) and FCC CLASS-B (AVG) (at ~55 dBuV/m). Four vertical blue lines indicate emission peaks labeled 1, 2, 3, and 4. Peak 1 is at 2763 MHz, peak 2 is at 2763 MHz, peak 3 is at 7637 MHz, and peak 4 is at 7637 MHz.</p>									
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2763.00	42.35	54.00	-11.65	44.19	-1.84	Average	379	277
2	2763.00	53.58	74.00	-20.42	55.42	-1.84	Peak	379	277
3	7637.00	37.21	54.00	-16.79	28.40	8.81	Average	100	83
4	7637.00	48.95	74.00	-25.05	40.14	8.81	Peak	100	83
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)            *Factor includes antenna factor , cable loss and amplifier gain            Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).</p>									

<b>Mode</b>	2.4G 11b + 5G 11a	<b>Test Freq. (MHz)</b>	CH06 + CH40
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<b>Polarization</b>	Vertical
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	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2763.00	42.15	54.00	-11.85	43.99	-1.84	Average	163	273
2	2763.00	54.40	74.00	-19.60	56.24	-1.84	Peak	163	273
3	7637.00	37.89	54.00	-16.11	29.08	8.81	Average	140	320
4	7637.00	49.58	74.00	-24.42	40.77	8.81	Peak	140	320

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

## 4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

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