

FCC Co-Location Test Report

FCC ID	:	SQG-SU60SOMC
Equipment	:	802.11ac Professional Wi-Fi + BT5.0 Module
Model No.	:	SU60-SOMC-2G (453-00004)
Brand Name	:	Laird Connectivity
Applicant	:	Laird Connectivity
Address	:	W66N220 Commerce Court, Cedarburg, Wisconsin 53012, USA
Standard	:	47 CFR FCC Part 15.247 47 CFR FCC Part 15.407
Received Date	:	Aug. 19, 2019
Tested Date	:	Jan. 08 ~ Feb. 24, 2020

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:

long Chem





Along Cherk/ Assistant Manager

Gary Chang / Manager

Approved by:



Table of Contents

1	GENERAL DESCRIPTION	5
1.1	Information	5
1.2	The Equipment List	
1.3	Test Standards	9
1.4	Deviation from Test Standard and Measurement Procedure	9
1.5	Measurement Uncertainty	9
2	TEST CONFIGURATION	10
2.1	Testing Condition	10
2.2	The Worst Test Modes and Channel Details	
3	TRANSMITTER TEST RESULTS	11
3.1	Unwanted Emissions into Restricted Frequency Bands	11
4	TEST LABORATORY INFORMATION	45



Release Record

Report No.	Version	Description	Issued Date
FR8N2101-03	Rev. 01	Initial issue	Apr. 24, 2020
FR8N2101-03	Rev. 02	Updated brand name	May 25, 2020



Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.247(d)			
15.407(b)	Radiated Emissions	[dBuV/m at 3m]: 123.36MHz 42.48(Margin -1.02dB) - QP	Pass
15.209			

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

Operating Frequency	802.11b/g/n: 2412 MHz ~ 2462 MHz 802.11a/n/ac: 5180 MHz ~ 5240 MHz; 5260 MHz ~ 5320 MHz; 5500 MHz ~ 5720 MHz, 5745 ~ 5825 MHz
Modulation Type	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11a/g/n/ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
вт	
Operating Frequency	2402 MHz ~ 2480 MHz
Modulaton Type	Bluetooth 4.2 LE: GFSK Bluetooth BR(1Mbps): GFSK Bluetooth EDR (2Mbps): π/4-DQPSK Bluetooth EDR (3Mbps): 8-DPSK

Note 1: The module is installed in below host and Bluetooth function is disabled.

1.1.2 Information of Host

Brand Name	Laird
Product name	Sentrius [™] IG60 Bluetooth 5, Wi-Fi, & LTE Cat 1 Gateway
Model name	Sentrius [™] IG60-BL654-LTE
Certified module (installed in the system)	BT BL654 Module: SQGBL654 WWAN Module: SQG-IGUPCAT1

1.1.3 Antenna Details of Specific platform

For Wi-Fi

Model	Туре	Connector	Operating Frequencies (MHz) / Antenna Gain				lBi)
mouel	1,100		2400~2483.5	5150~5250	5250~5350	5470~5725	5725~5850
LSR/001-0009	Dipole	IPEX U.FL	2	2	2	2	2

ВΤ

Manufacturer	Laird Part Number	Туре	Connector	Gain (dBi)
WALSIN	RFDPA870900SBAB8G1	Dipole	RP-SMA Male	2



For WWAN

Brand / Model	Туре	Connector	Gain (dBi)	Operating Band
Laird/DBA6927C1	Dipole	SMA_MALE	2.2	LTE Band 2 / PCS 1900
			2.2	LTE Band 4 / WCDMA II / WCDMA Band IV
			0.5	LTE Band 5 / GSM850 / WCDMA Band V
			0.5	LTE Band 12

1.1.4 Host Accessories

	Host Accessories				
No.	Equipment	Description			
1	AC adapter	Brand: FRECOM Model: F30L2-120250SPACP Power Rating: I/P: 100-240Vac, 50/60Hz, 0.8A O/P: 12Vdc, 2.5A Power Line: 1.5m non-shielded without core			
2	AC Adapter	Brand Name: FRECOM Model Name: F48L-120400SPAU Power Rating: I/P: 100-240Vac, 50/60Hz, 1.4A O/P: 12Vdc, 4A Power Line: 1.5m non-shielded cable w/o core			
3	DC cable	3m non-shielded without core			



1.2 The Equipment List

nber 3 / (03CH03 - Jan. 10, 2020 Ifacturer R&S R&S ARZBECK ARZBECK ARZBECK R&S K KABEL	Model No. FSV40 ESR3 VULB9168 BBHA 9120 D BBHA 9170 HFH2-Z2	Serial No. 101498 101658 VULB9168-6855 BBHA 9120 D 1206 BBHA 91705177 100330	Calibration Date Dec. 17, 2019 Dec. 12, 2019 Apr. 17, 2019 Dec. 27, 2019 Nov. 15, 2019	Calibration Until Dec. 16, 2020 Dec. 10, 2020 Apr. 16, 2020 Dec. 26, 2020 Nov. 14, 2020
Ifacturer R&S R&S ARZBECK ARZBECK ARZBECK R&S	FSV40 ESR3 VULB9168 BBHA 9120 D BBHA 9170	101498 101658 VULB9168-685 BBHA 9120 D 1206 BBHA 9170517	Dec. 17, 2019 Dec. 12, 2019 Apr. 17, 2019 Dec. 27, 2019 Nov. 15, 2019	Dec. 16, 2020 Dec. 10, 2020 Apr. 16, 2020 Dec. 26, 2020
R&S R&S ARZBECK ARZBECK ARZBECK ARZBECK R&S	FSV40 ESR3 VULB9168 BBHA 9120 D BBHA 9170	101498 101658 VULB9168-685 BBHA 9120 D 1206 BBHA 9170517	Dec. 17, 2019 Dec. 12, 2019 Apr. 17, 2019 Dec. 27, 2019 Nov. 15, 2019	Dec. 16, 2020 Dec. 10, 2020 Apr. 16, 2020 Dec. 26, 2020
R&S ARZBECK ARZBECK ARZBECK R&S	ESR3 VULB9168 BBHA 9120 D BBHA 9170	101658 VULB9168-685 BBHA 9120 D 1206 BBHA 9170517	Dec. 12, 2019 Apr. 17, 2019 Dec. 27, 2019 Nov. 15, 2019	Dec. 10, 2020 Apr. 16, 2020 Dec. 26, 2020
ARZBECK ARZBECK ARZBECK R&S	VULB9168 BBHA 9120 D BBHA 9170	VULB9168-685 BBHA 9120 D 1206 BBHA 9170517	Apr. 17, 2019 Dec. 27, 2019 Nov. 15, 2019	Apr. 16, 2020 Dec. 26, 2020
ARZBECK ARZBECK R&S	BBHA 9120 D BBHA 9170	BBHA 9120 D 1206 BBHA 9170517	Dec. 27, 2019 Nov. 15, 2019	Dec. 26, 2020
ARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2019	
R&S				Nov. 14, 2020
	HFH2-Z2	100330		
			Nov. 13, 2019	Nov. 12, 2020
A NADEL	101354-BW	101354-BW	Oct. 07, 2019	Oct. 06, 2020
EMC	EMC02325	980187	Aug. 14, 2019	Aug. 13, 2020
gilent	83017A	MY53270014	Aug. 07, 2019	Aug. 06, 2020
EMC	EMC184045B	980192	Aug. 01, 2019	Jul. 31, 2020
+SUHNER S	SUCOFLEX104	MY22620/ 4	Sep. 27, 2019	Sep. 26, 2020
EMC	MC104-SM-SM-80 00	181107	Sep. 27, 2019	Sep. 26, 2020
+SUHNER S	SUCOFLEX104	MY22624/4	Sep. 27, 2019	Sep. 26, 2020
EMC EM	MC8D-NM-NM-800	EMC8D-NM-NM-800 -001	Sep. 27, 2019	Sep. 26, 2020
EMC	MC8D-NM-NM-300 0	131103	Sep. 27, 2019	Sep. 26, 2020
EMC	MC8D-NM-NM-130 00	131104	Sep. 27, 2019	Sep. 26, 2020
	e3	6.120210g	NA	NA
	-MC	EMC EMC8D-NM-NM-130 00	EMC EMC8D-NM-NM-300 0 131103 EMC EMC8D-NM-NM-130 00 131104 EMC e3 6.120210g	EMC EMC8D-NM-NM-300 0 131103 Sep. 27, 2019 EMC EMC8D-NM-NM-130 00 131104 Sep. 27, 2019



Test Item	Radiated Emission							
Test Site	966 chamber 3 / (03CH03-WS)							
Tested Date	Feb. 24, 2020							
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until			
Spectrum Analyzer	R&S	FSV40	101499	Jan. 09, 2020	Jan. 08, 2021			
Receiver	R&S	ESR3	101658	Dec. 12, 2019	Dec. 10, 2020			
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 17, 2019	Apr. 16, 2020			
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Dec. 27, 2019	Dec. 26, 2020			
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2019	Nov. 14, 2020			
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2019	Nov. 12, 2020			
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 07, 2019	Oct. 06, 2020			
Preamplifier	EMC	EMC02325	980187	Aug. 14, 2019	Aug. 13, 2020			
Preamplifier	Agilent	83017A	MY53270014	Aug. 07, 2019	Aug. 06, 2020			
Preamplifier	EMC	EMC184045B	980192	Aug. 01, 2019	Jul. 31, 2020			
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/ 4	Sep. 27, 2019	Sep. 26, 2020			
RF cable-8M	EMC	EMC104-SM-SM-80 00	181107	Sep. 27, 2019	Sep. 26, 2020			
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Sep. 27, 2019	Sep. 26, 2020			
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800 -001	Sep. 27, 2019	Sep. 26, 2020			
LF cable-3M	EMC	EMC8D-NM-NM-300 0	131103	Sep. 27, 2019	Sep. 26, 2020			
LF cable-13M	EMC	EMC8D-NM-NM-130 00	131104	Sep. 27, 2019	Sep. 26, 2020			
Measurement Software	AUDIX	e3	6.120210g	NA	NA			



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 15.247 Meas Guidance v05r02 FCC KDB 662911 D01 Multiple Transmitter Output v02r01 FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01 FCC KDB 412172 D01 Determining ERP and EIRP v01r01

1.4 Deviation from Test Standard and Measurement Procedure

None

1.5 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 ≤ 1GHz	±3.96 dB		
Radiated emission > 1GHz	±4.51 dB		



2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
Radiated Emissions	03CH03-WS	23°C / 62-65% 22°C / 67%	Roger Lu

➢ FCC Designation No.: TW0009

➢ FCC site registration No.: 207696

> ISED#: 10807A

➤ CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Test mode			
Radiated Emissions	BLE 125K CH39 + 2.4G 11g CH06 + 2G GSM850 CH251			
	BLE 125K CH39 + 2.4G 11g CH06 + 2G PCS1900 CH512			
	BLE 125K CH39 + 2.4G 11g CH06 + 3G WCDMA Band4 CH1513			
	BLE 125K CH39 + 2.4G 11g CH06 + LTE Band 12, CH23095			
	BLE 125K CH39 + 5G 11ac CH48 + 2G GSM850 CH251			
	BLE 125K CH39 + 5G 11ac CH48 + 2G PCS1900 CH512			
	BLE 125K CH39 + 5G 11ac CH48 + 3G WCDMA Band4 CH1513			
	BLE 125K CH39 + 5G 11ac CH48 + LTE Band 12, CH23095			

NOTE:

1. The selected channel is the maximum power channel of Wi-Fi mode + WWAN mode + BT mode.

2. The EUT was pretested at power supplied by Adapter and DC power. The power supplied by Adapter was found to be the worst case and was selected for final test.

3. Two adapters (F30L2-120250SPACP and F48L-120400SPAV) had been covered during the pretest, and found that Adapter F30L2-120250SPACP was the worst case and was selected 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

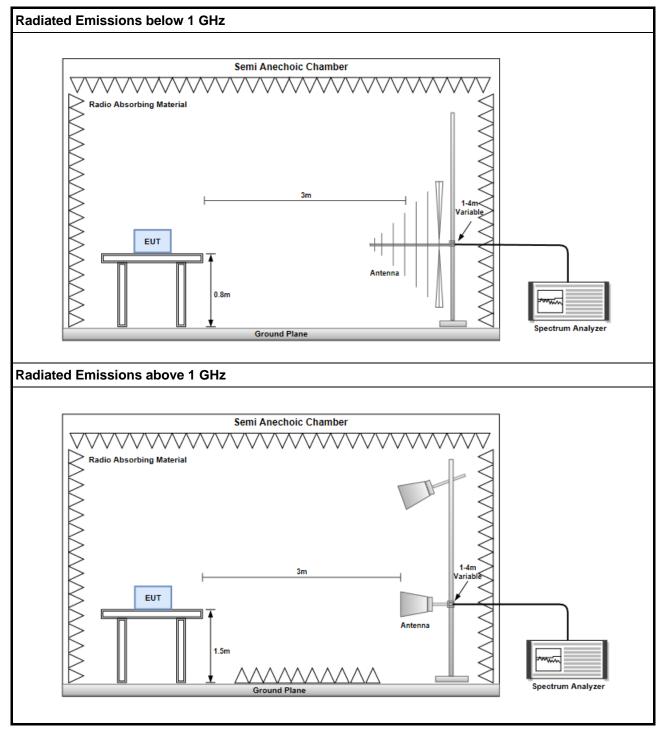
- Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission 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.
- 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:

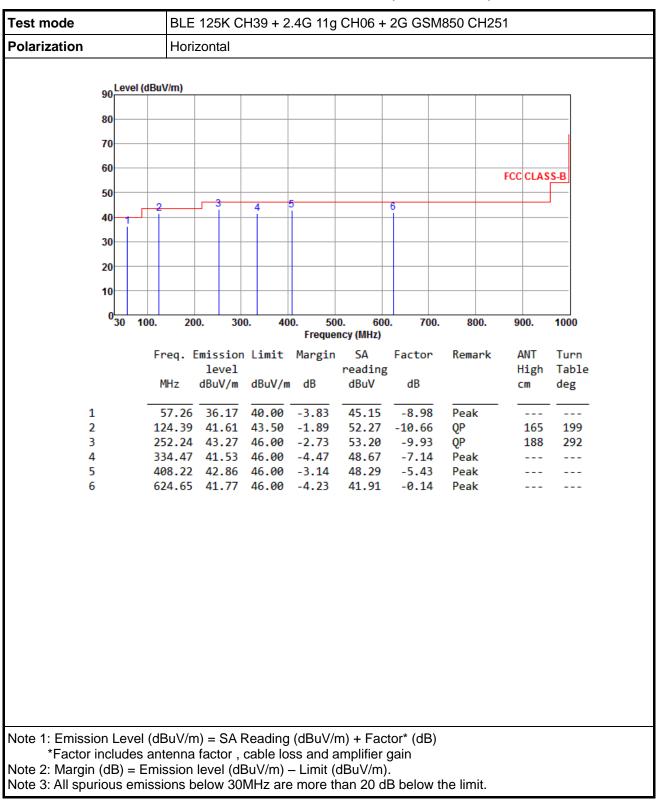
- 1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
- 2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
- 3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission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



3.1.3 Test Setup

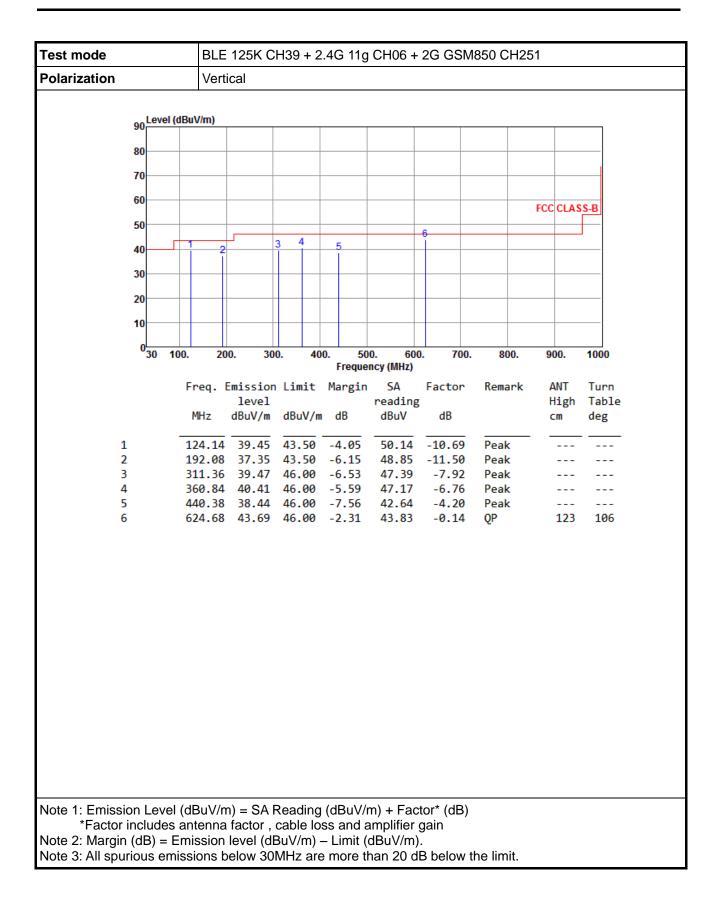




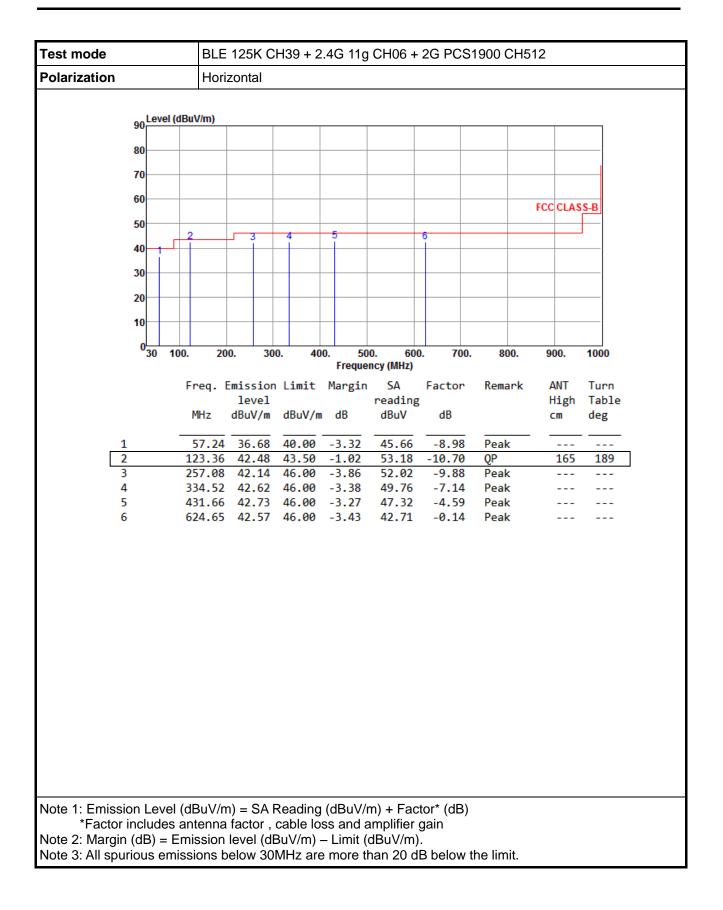


3.1.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

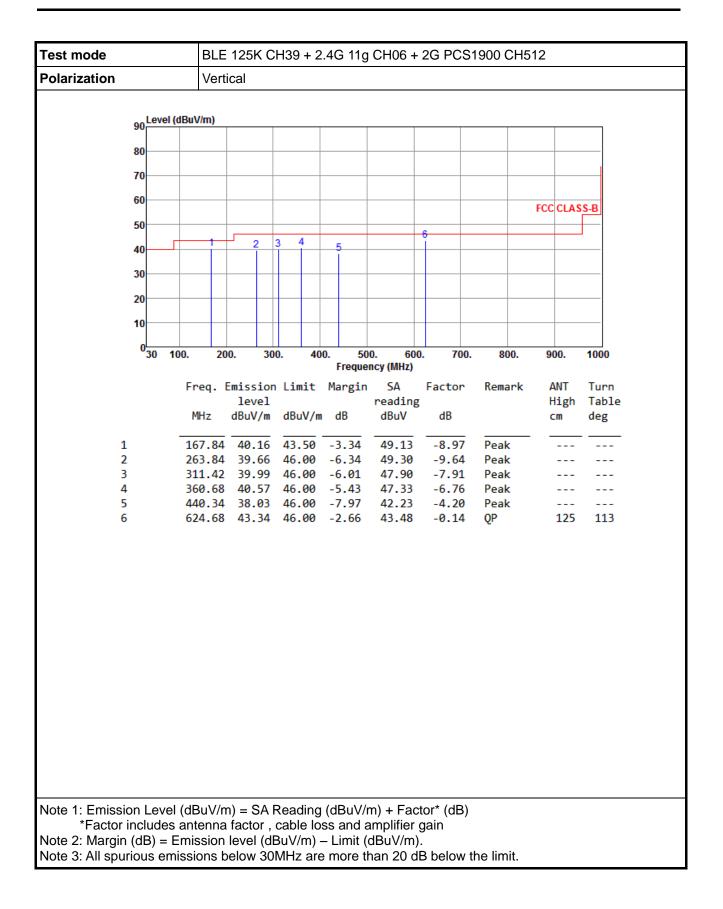




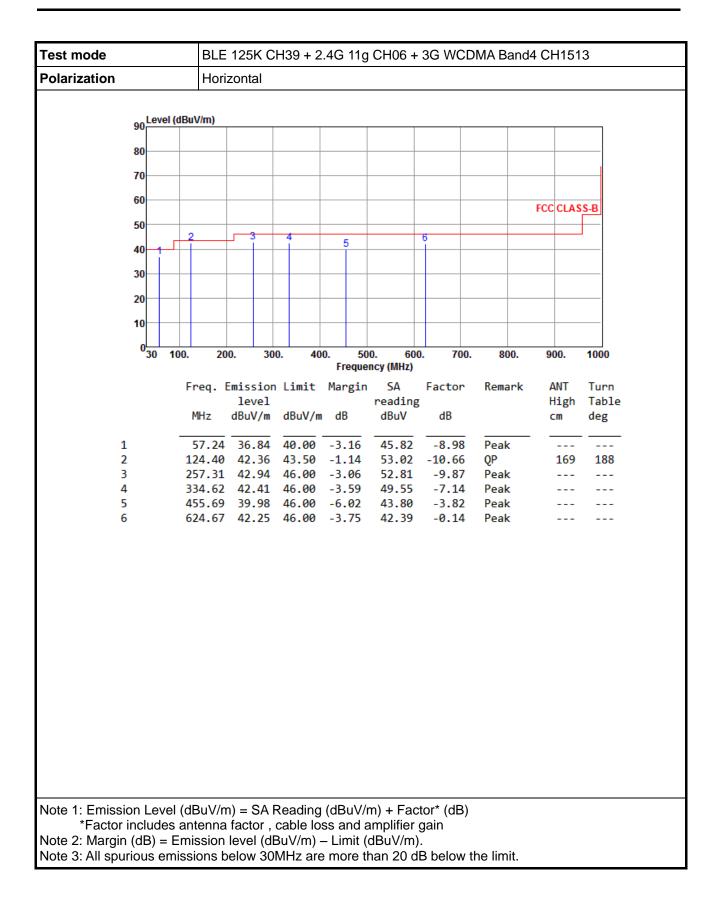




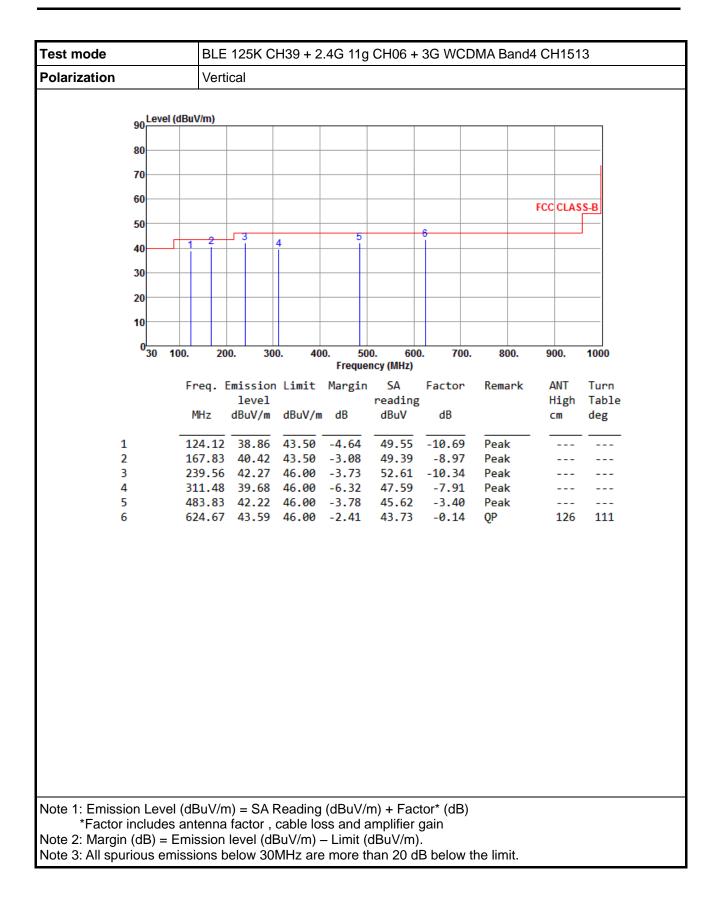




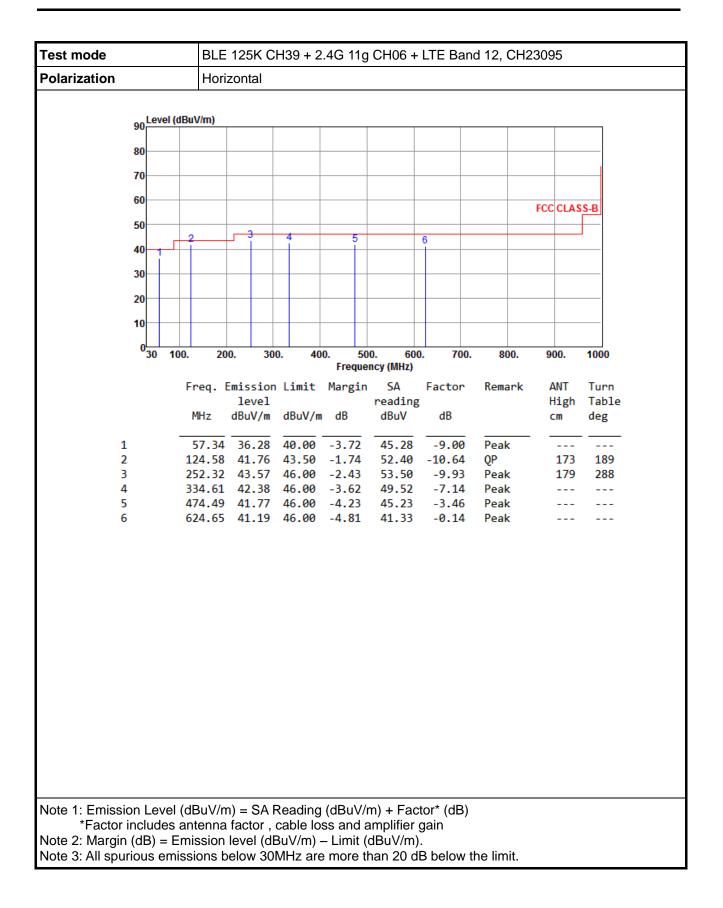




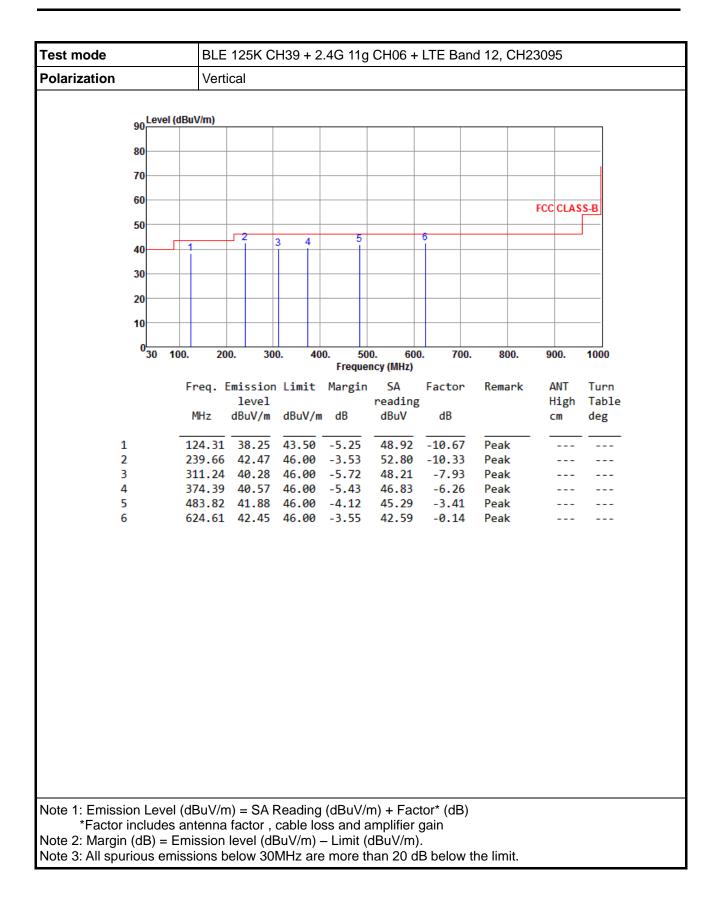




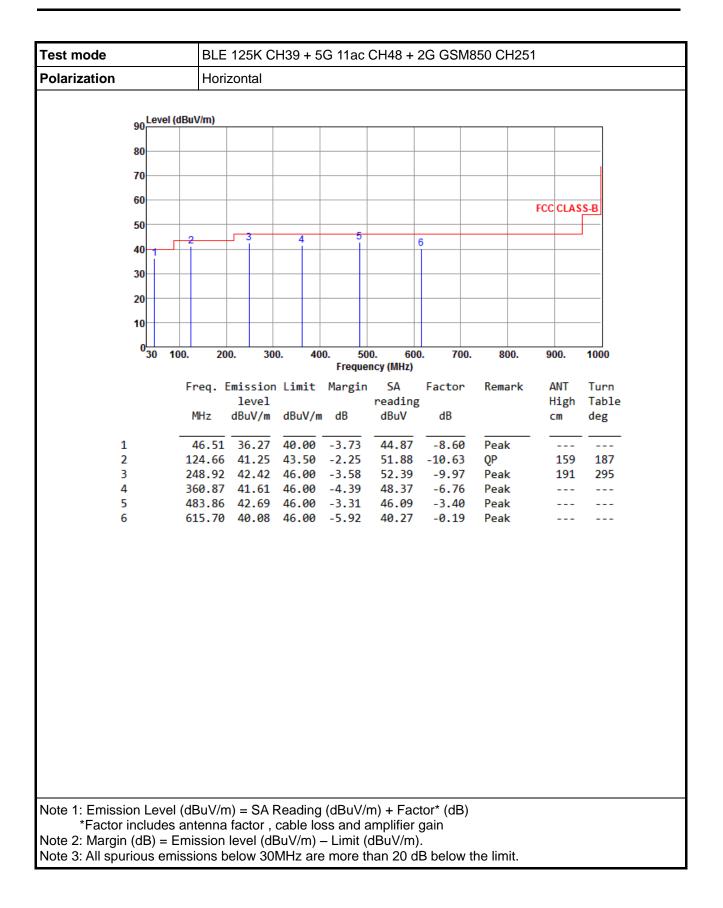




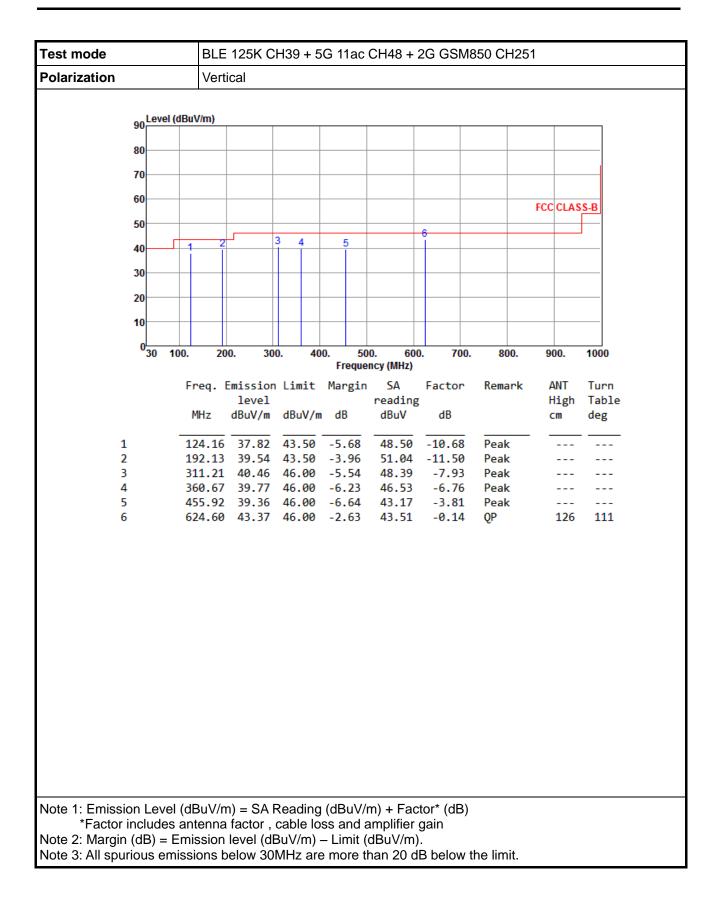




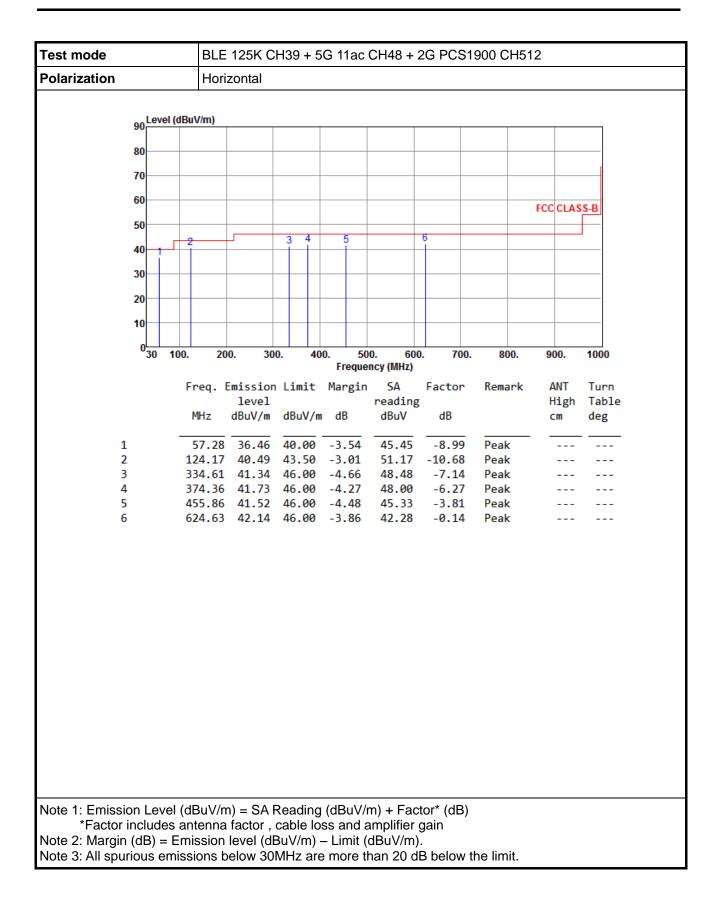




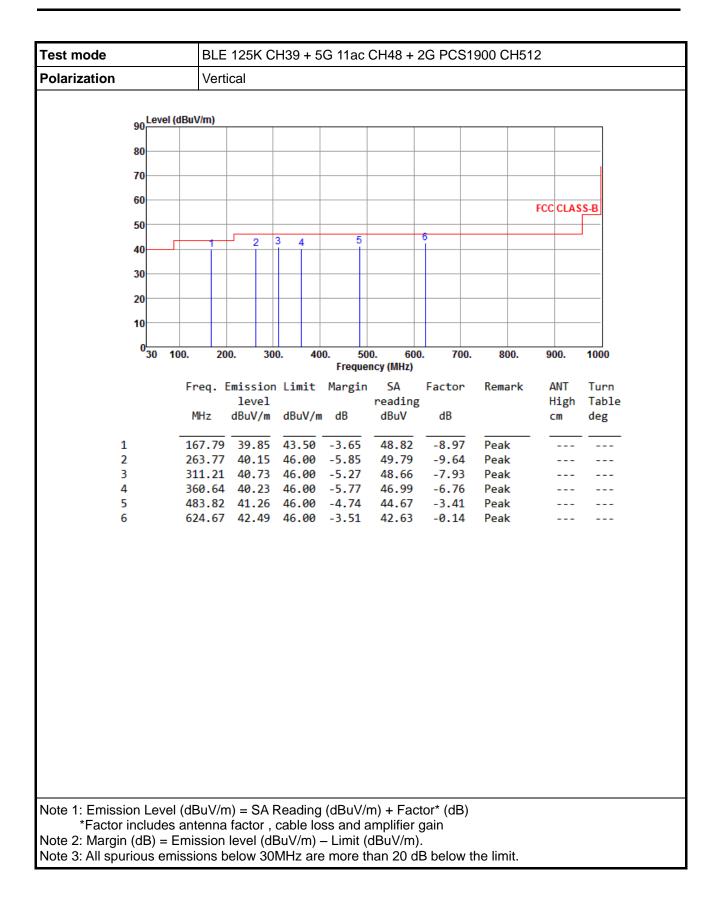




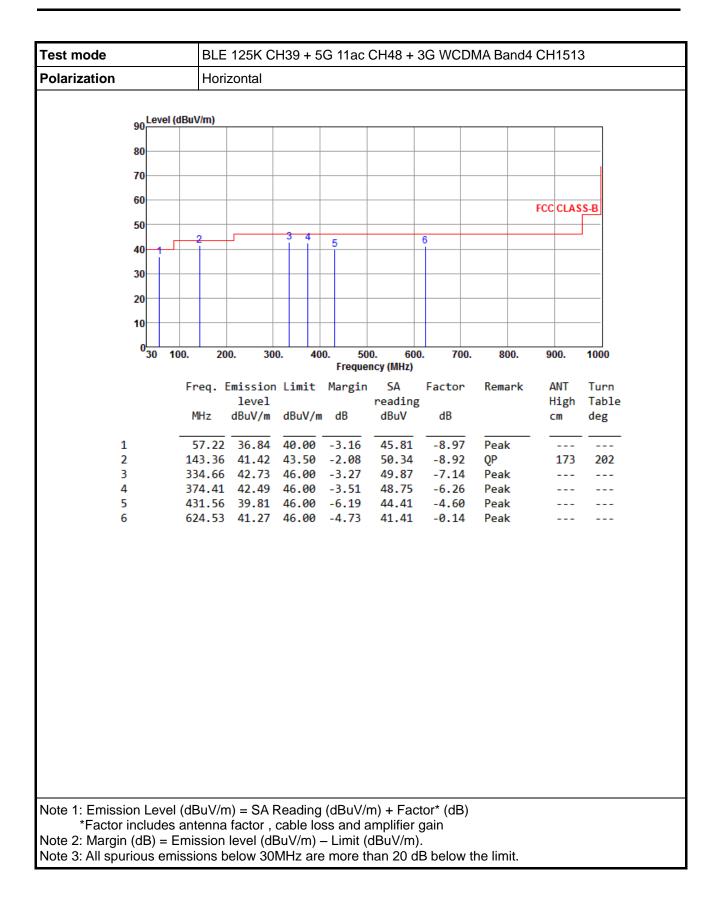




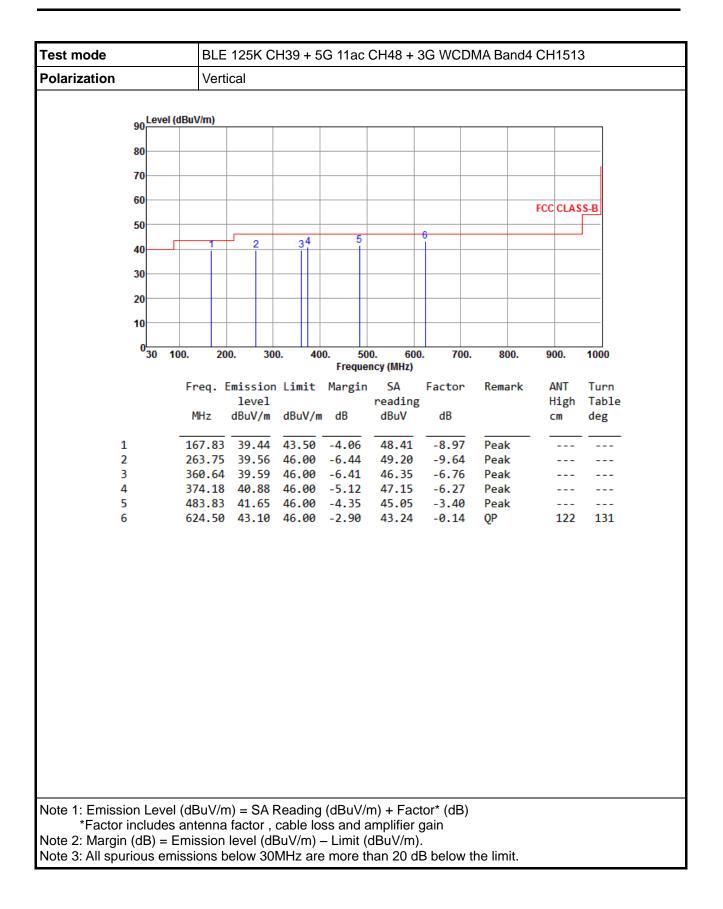




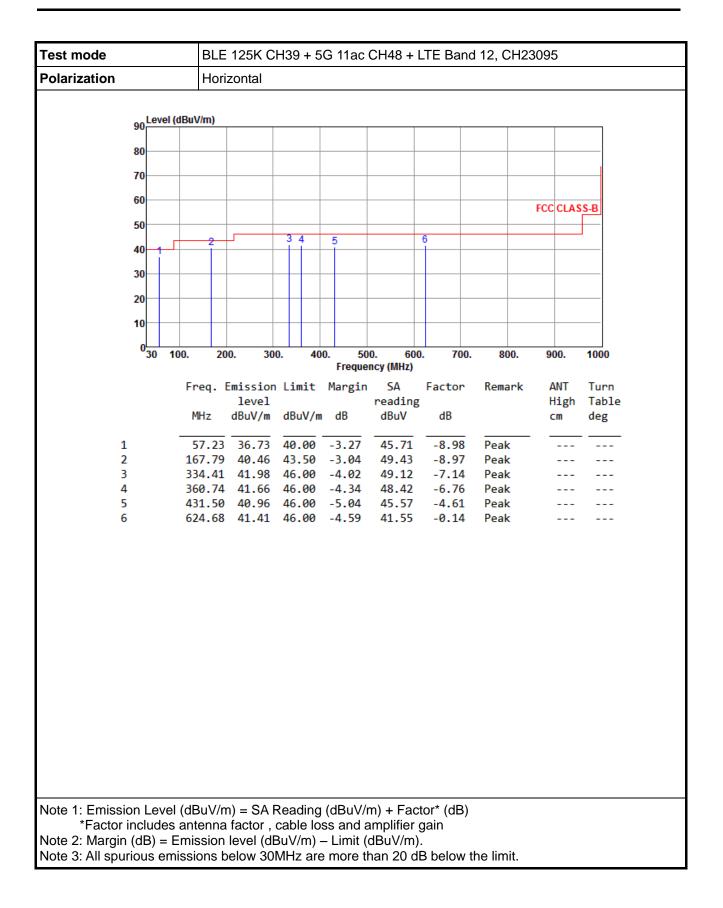




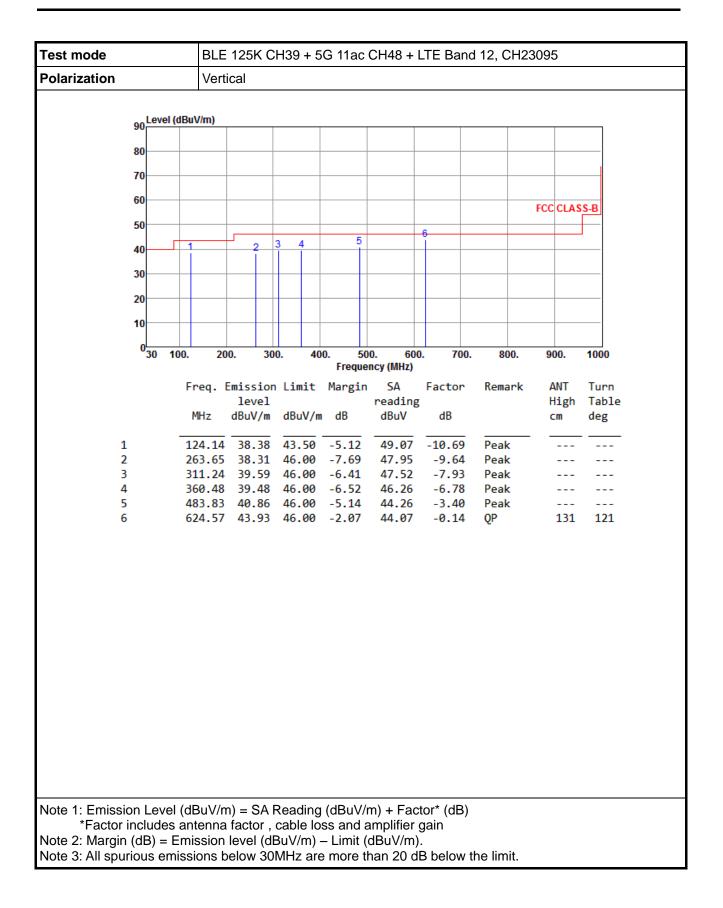




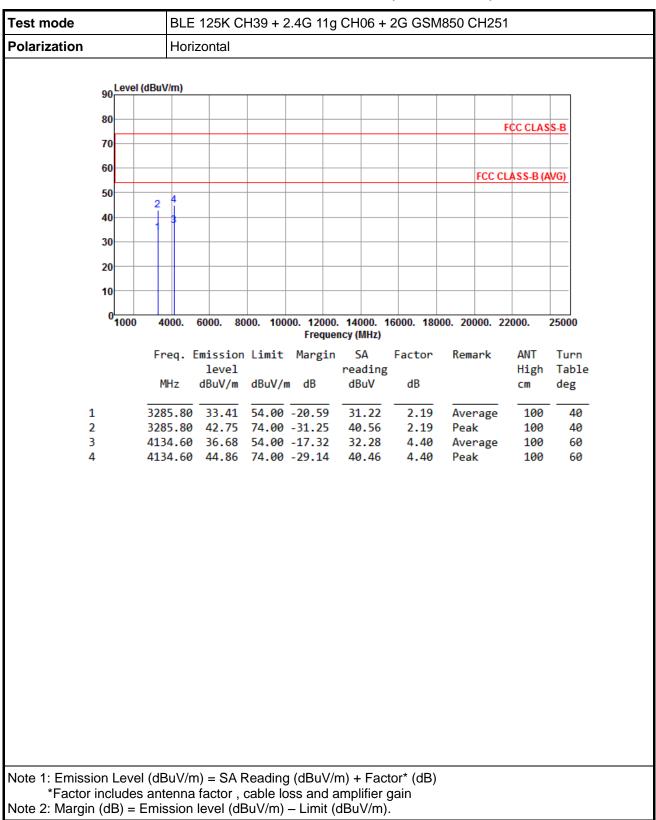






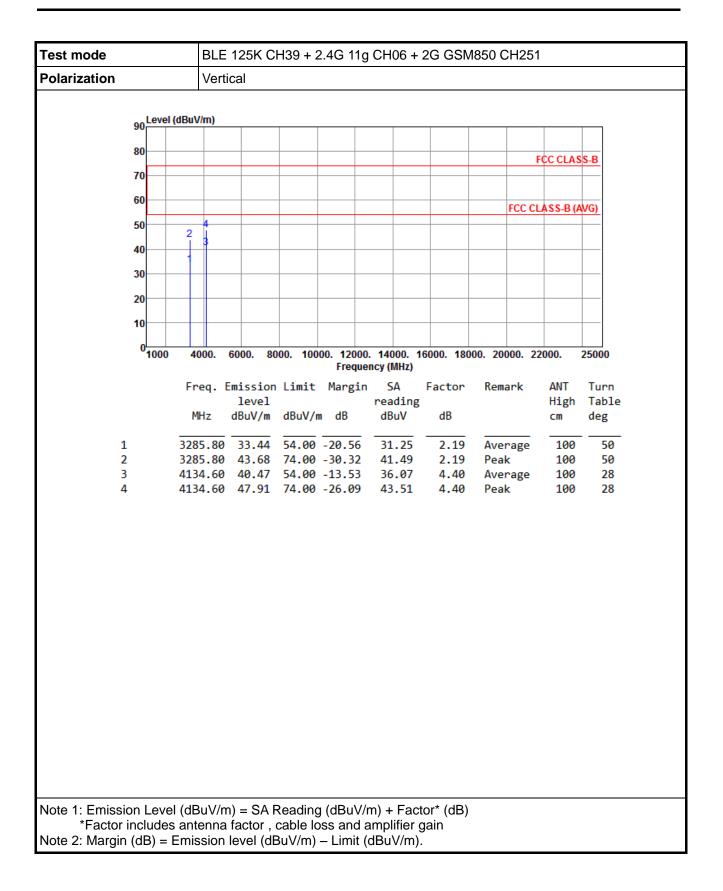




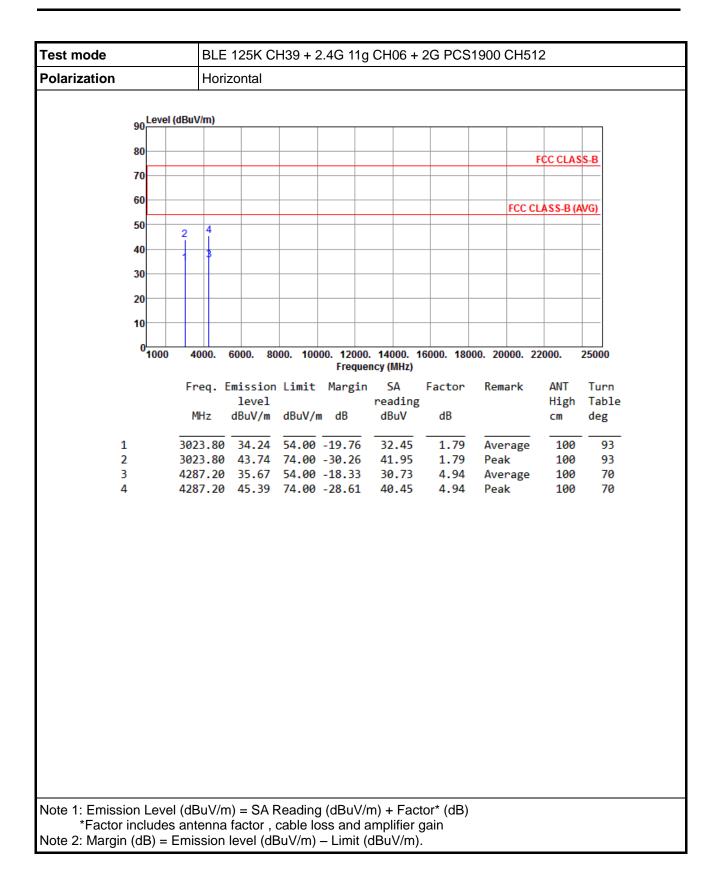


3.1.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

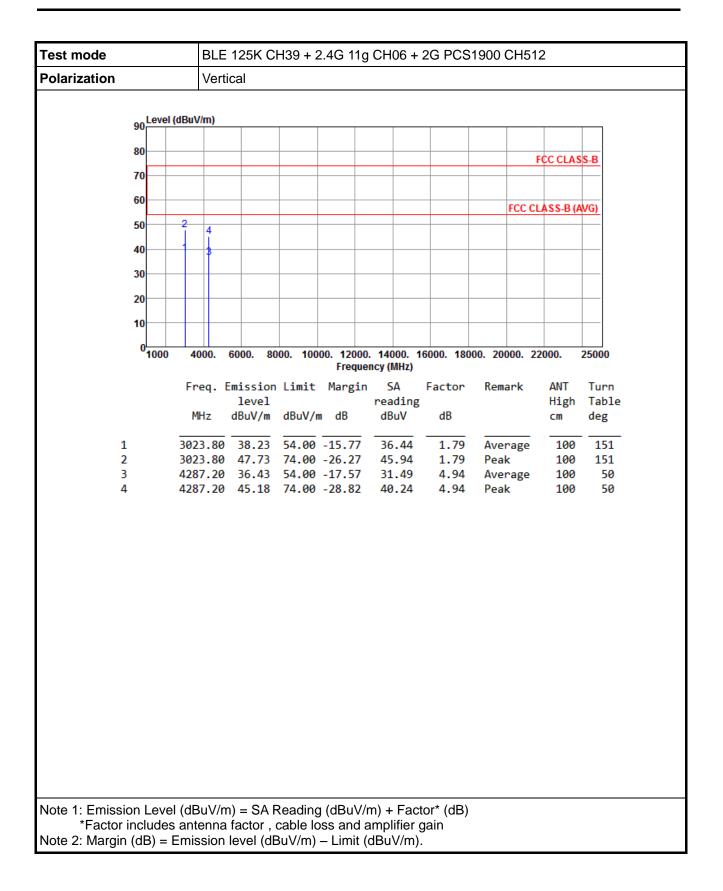




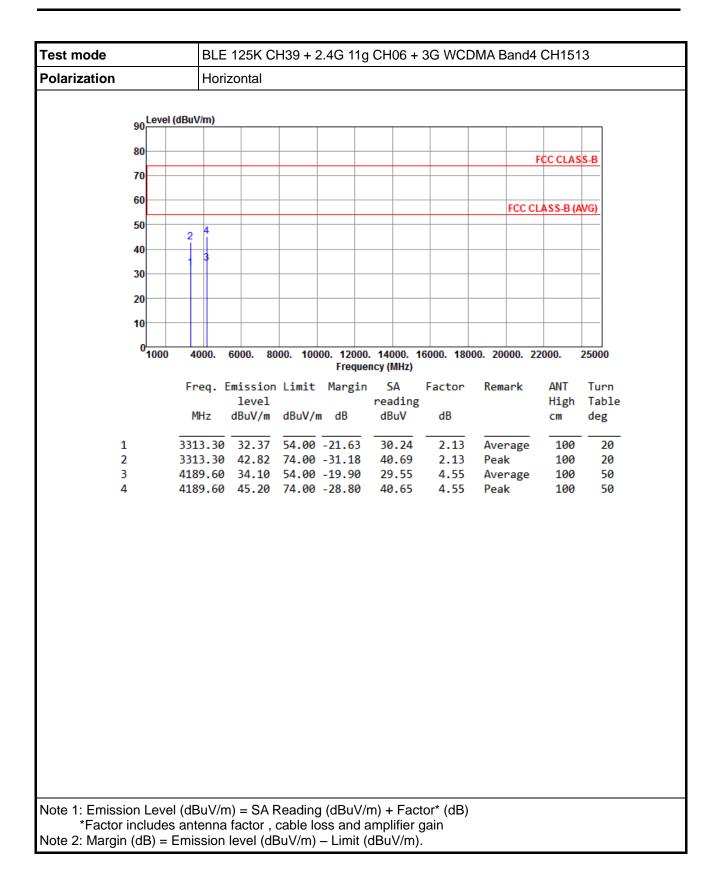




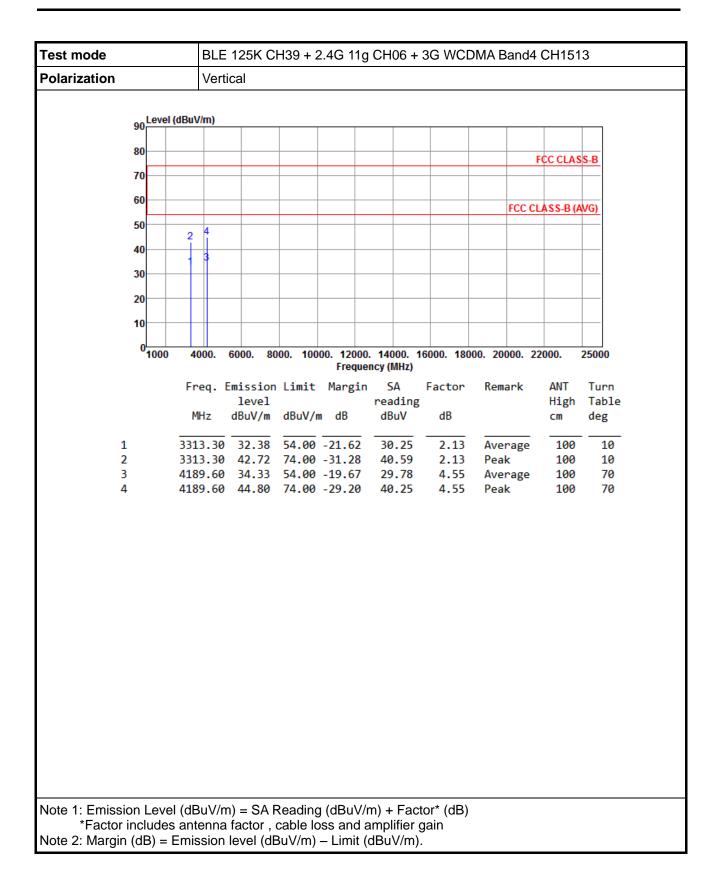




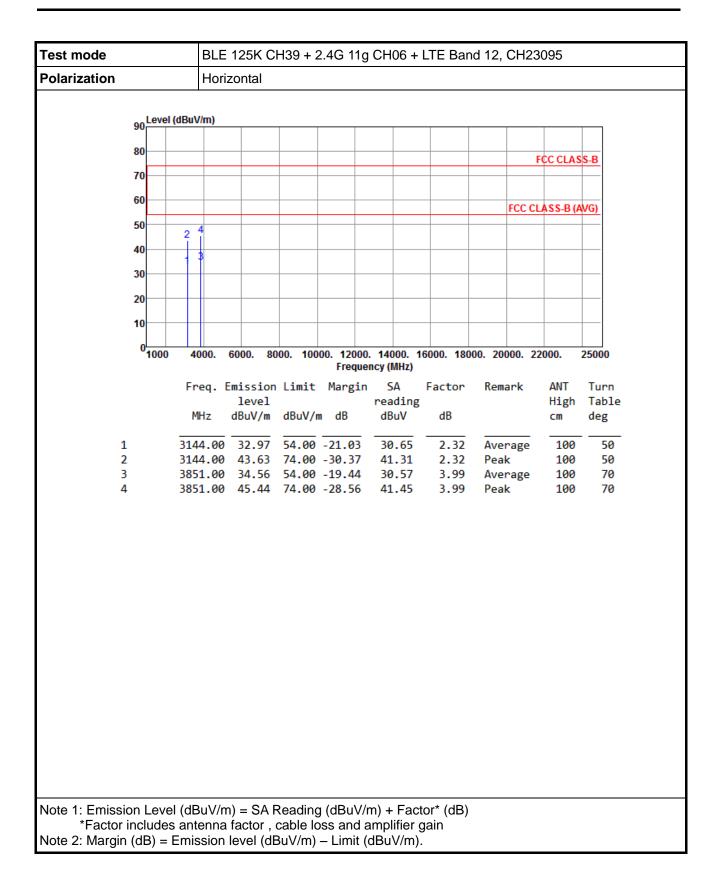




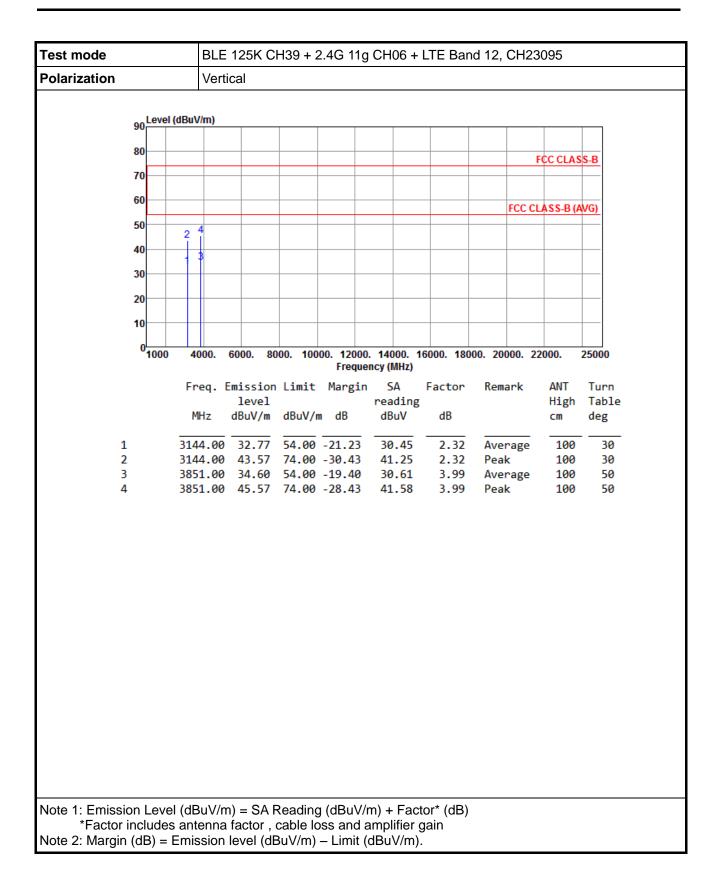




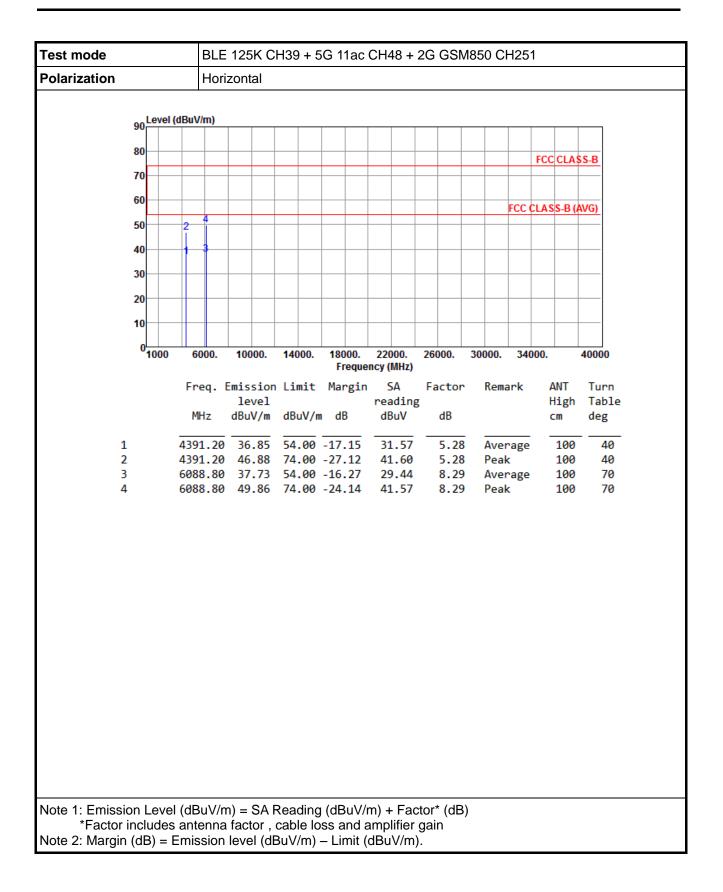




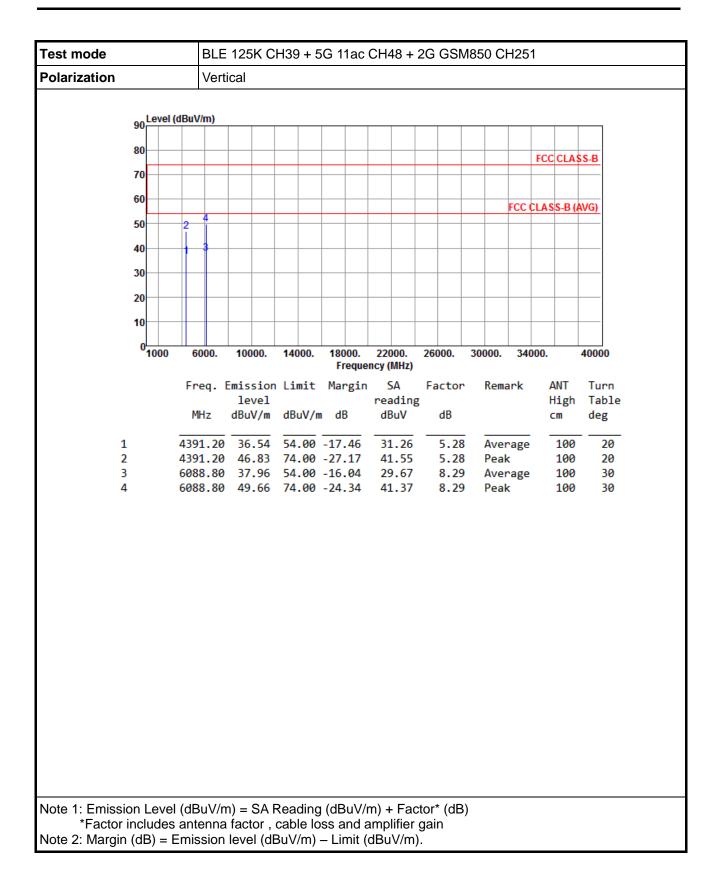




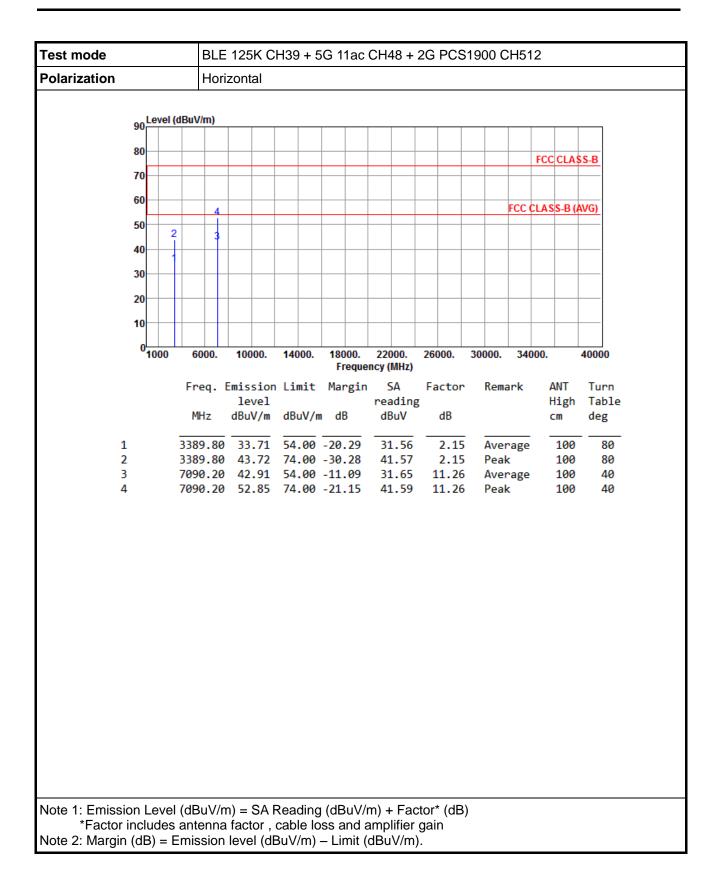




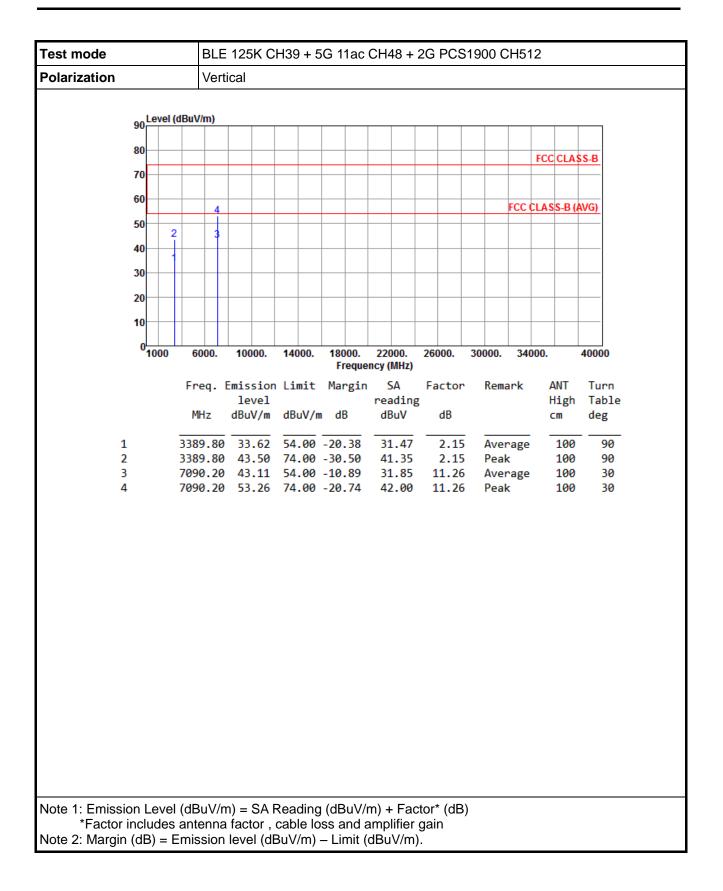




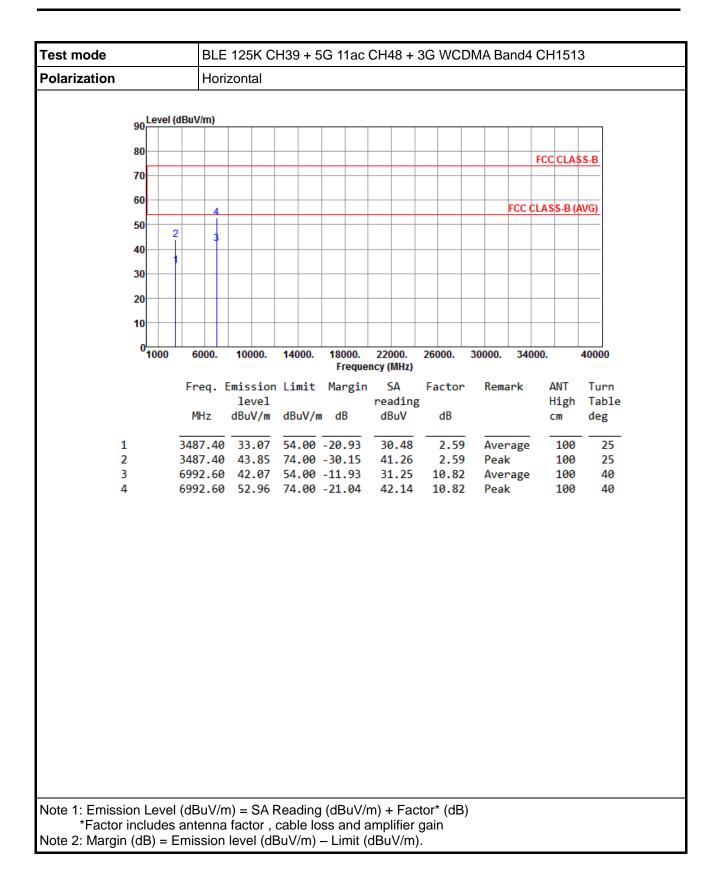




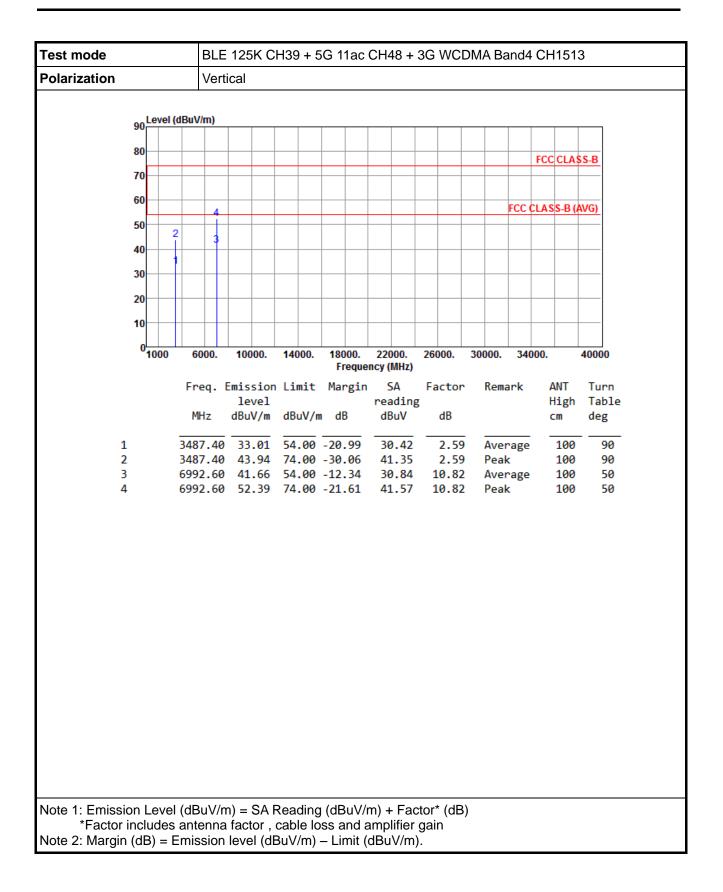




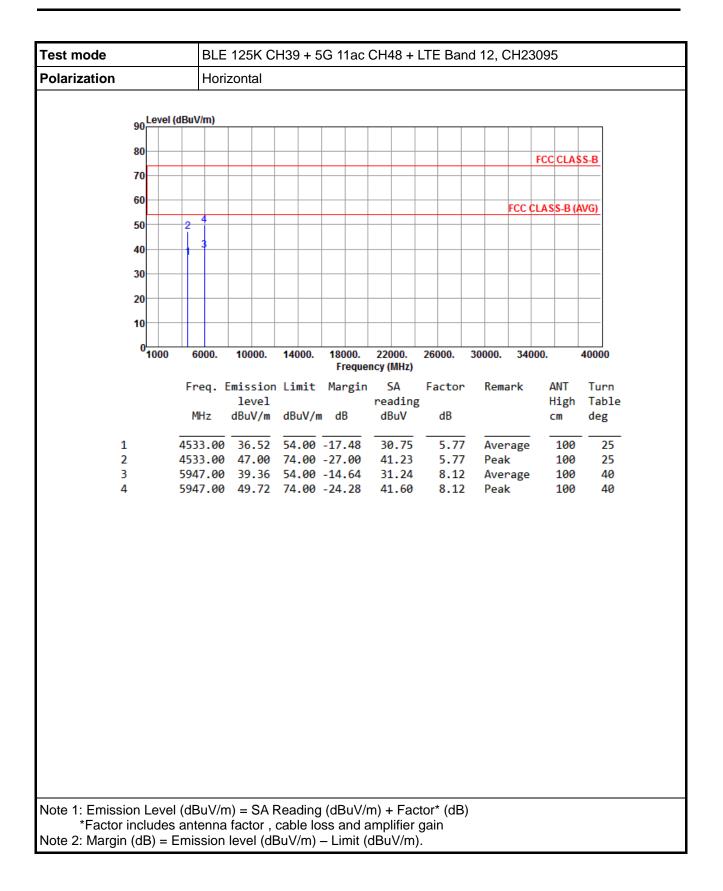




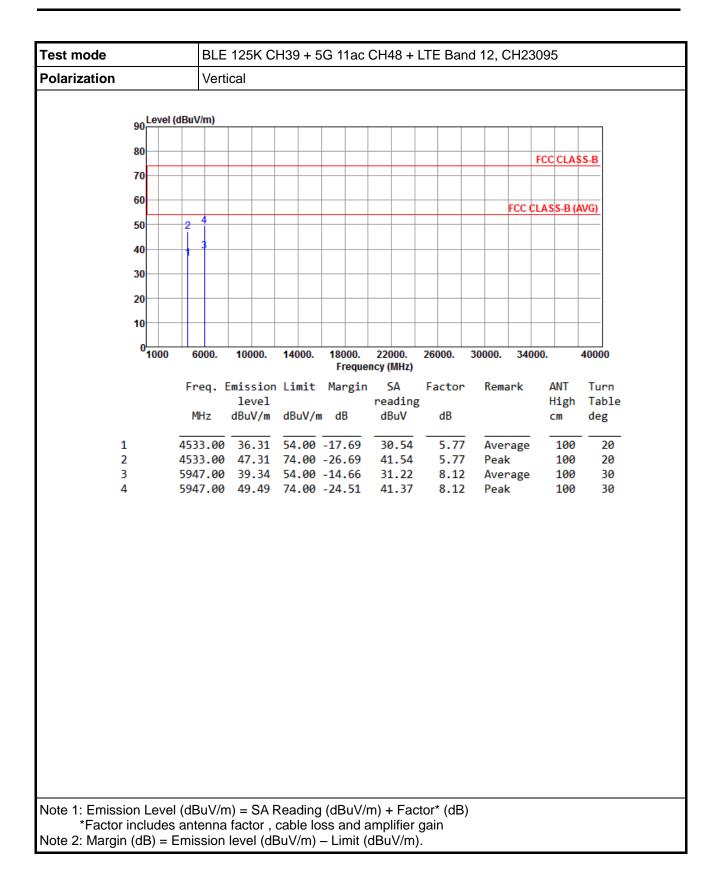














4 Test laboratory information

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 <u>http://www.icertifi.com.tw</u>.

Linkou Tel: 886-2-2601-1640 No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C. Kwei Shan Tel: 886-3-271-8666 No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C. Kwei Shan Site II Tel: 886-3-271-8640 No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C..

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666 Fax: 886-3-318-0155 Email: ICC_Service@icertifi.com.tw

—END—