FCC CFR47 PART 22 SUBPART H
FCC CFR47 PART 24 SUBPART E

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone + Bluetooth and WLAN 2.4GHz b/g/n

MODEL NUMBER: SM-G150N0, SM-G155S

FCC ID: A3LSMG150

REPORT NUMBER: 15I20924-E1

ISSUE DATE: JUNE 15, 2015

Prepared for
SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 443-742, KOREA

Prepared by
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
-	6/15/15	Initial	P. Zhang

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS 5
2. TEST METHODOLOGY 6
3. FACILITIES AND ACCREDITATION 6
4. CALIBRATION AND UNCERTAINTY 7
4.1. MEASURING INSTRUMENT CALIBRATION 7
4.2. SAMPLE CALCULATION 7
4.3. MEASUREMENT UNCERTAINTY 7
5. EQUIPMENT UNDER TEST 8
5.1. DESCRIPTION OF EUT 8
5.2. MAXIMUM OUTPUT POWER 8
5.3. MAXIMUM OUTPUT POWER (LTE) 9
5.4. DESCRIPTION OF AVAILABLE ANTENNAS 10
5.5. DESCRIPTION OF TEST SETUP 11
6. TEST AND MEASUREMENT EQUIPMENT 14
7. Summary Table 15
8. RF POWER OUTPUT VERIFICATION 16
8.1. GSM/GPRS/EDGE 16
8.1.1. GSM OUTPUT POWER RESULT 17
8.2. UMTS REL 99 18
8.2.1. UMTS REL 99 OUTPUT POWER RESULT 18
8.3. UMTS HSDPA 19
8.3.1. UMTS HSDPA OUTPUT POWER RESULT 20
8.4. UMTS HSUPA 21
8.4.1. UMTS HSUPA OUTPUT POWER RESULT 22
8.5. LTE OUTPUT VERIFICATION 23
8.5.1. LTE OUTPUT RESULT 23
9. PEAK TO AVERAGE RATIO 25
9.1. CONDUCTED PEAK TO AVERAGE RESULT 25
10. LIMITS AND CONDUCTED RESULTS 30
10.1. OCCUPIED BANDWIDTH 30
10.1.1. OCCUPIED BANDWIDTH RESULTS 31
10.1.2. LTE OCCUPIED BANDWIDTH RESULTS 32

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10.1.1. OCCUPIED BANDWIDTH PLOTS 33
10.1.2. BAND EDGE PLOTS 39
10.2. OUT OF BAND EMISSIONS 50
10.2.1. OUT OF BAND EMISSIONS RESULT 51
10.2.2. OUT OF BAND EMISSIONS PLOTS.....53
10.3. FREQUENCY STABILITY 58
10.3.1. FREQUENCY STABILITY RESULTS.....59
11. RADIATED TEST RESULTS 61
11.1. RADIATED POWER (ERP & EIRP).....61
11.1.1. ERP/EIRP Results.....62
11.1.2. LTE ERP/EIRP Results 63
11.1.3. ERP/EIRP PLOTS.....64
11.2. FIELD STRENGTH OF SPURIOUS RADIATION 77
11.2.1. SPURIOUS RADIATION PLOTS.....78
12. SETUP PHOTOS 91
END OF REPORT 92

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE PHONE + BLUETOOTH and WLAN DTS b/g/n
MODEL:	SM-G150N0, SM-G155S
SERIAL NUMBER:	R38G40TQMVX (Conducted), R38G40TQM9X (Radiated)
DATE TESTED:	JUNE 2- 15, 2015

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 22H and 24E	PASS

UL Verification Services Inc. 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 Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 Verification Services Inc. By:

PENG ZHANG
CONSUMER TECHNOLOGY DIVISION
PROJECT LEAD
UL VERIFICATION SERVICES INC

Tested By:

STEVEN TRAN
CONSUMER TECHNOLOGY DIVISION
LAB ENGINEER
UL VERIFICATION SERVICES INC

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, 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 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☒ Chamber A(IC: 2324B-1)	☐ Chamber D(IC: 2324B-4)
☐ Chamber B(IC: 2324B-2)	☐ Chamber E(IC: 2324B-5)
☒ Chamber C(IC: 2324B-3)	☐ Chamber F(IC: 2324B-6)
	☐ Chamber G(IC: 2324B-7)
	☐ Chamber H(IC: 2324B-8)

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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:

EIRP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna)

(Path loss = Signal generator output – PSA reading with substitution antenna)

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 18000 MHz	4.94 dB

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

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone + Bluetooth and WLAN b/g/n.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted and radiated ERP / EIRP output powers as follows:

FCC Part 22/24						
Band	Frequency Range(MHz)	Modulation mW	Conducted		Radiated	
			AVG(dBm)	AVG(mW)	AVG(dBm)	AVG(mW)
GSM1900	1850~1910	GMSK	30.00	1000.00		
	1850~1910	GPRS	30.00	1000.00	32.76	1887.99
Band 5	824~849	REL99	21.90	154.88	20.45	110.92
	824~849	HSDPA	22.40	173.78	19.88	97.27
	824~849	HSUPA	22.40	173.78		
Band 2	1850~1910	REL99	23.10	204.17	26.61	458.14
	1850~1910	HSDPA	22.40	173.78	25.88	387.26
	1850~1910	HSUPA	22.40	173.78		

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

5.3. MAXIMUM OUTPUT POWER (LTE)

LTE Band 5

FCC Part 22							
Band	Frequency Range(MHz)	BandWidth (MHz)	Modulation	Conducted		Radiated	
			mW	AVG(dBm)	AVG(mW)	AVG(dBm)	AVG(mW)
LTE5	824~849	10MHz	QPSK	23.50	223.87	21.76	149.97
			16QAM	22.50	177.83	20.72	118.03
		5MHz	QPSK	23.50	223.87	21.50	141.25
			16QAM	22.50	177.83	19.98	99.54
		3MHz	QPSK	23.50	223.87	21.40	138.04
			16QAM	22.50	177.83	21.31	135.21
		1.4MHz	QPSK	23.50	223.87	21.94	156.31
			16QAM	22.50	177.83	21.75	149.62

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna for the [List the bands supported] with a maximum peak gain as follow:

Frequency (MHz)	Peak Gain (dBi)
Band 5, 824~849MHz	-2.9
Band 2, 1850~1910MHz	1.1

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC Adapter	Samsung	ETA0U83KWK	DK1FB05HS	N/A
Earphone	Samsung	N/A	N/A	N/A

I/O CABLES (CONDUCTED SETUP)

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	RF Out	1	Spectrum Analyzer	Shielded	None	NA
2	Antenna Port	1	EUT	Shielded	0.1m	NA
3	RF In/Out	1	Communication Test Set	Shielded	1m	NA

I/O CABLES (RADIATED SETUP)

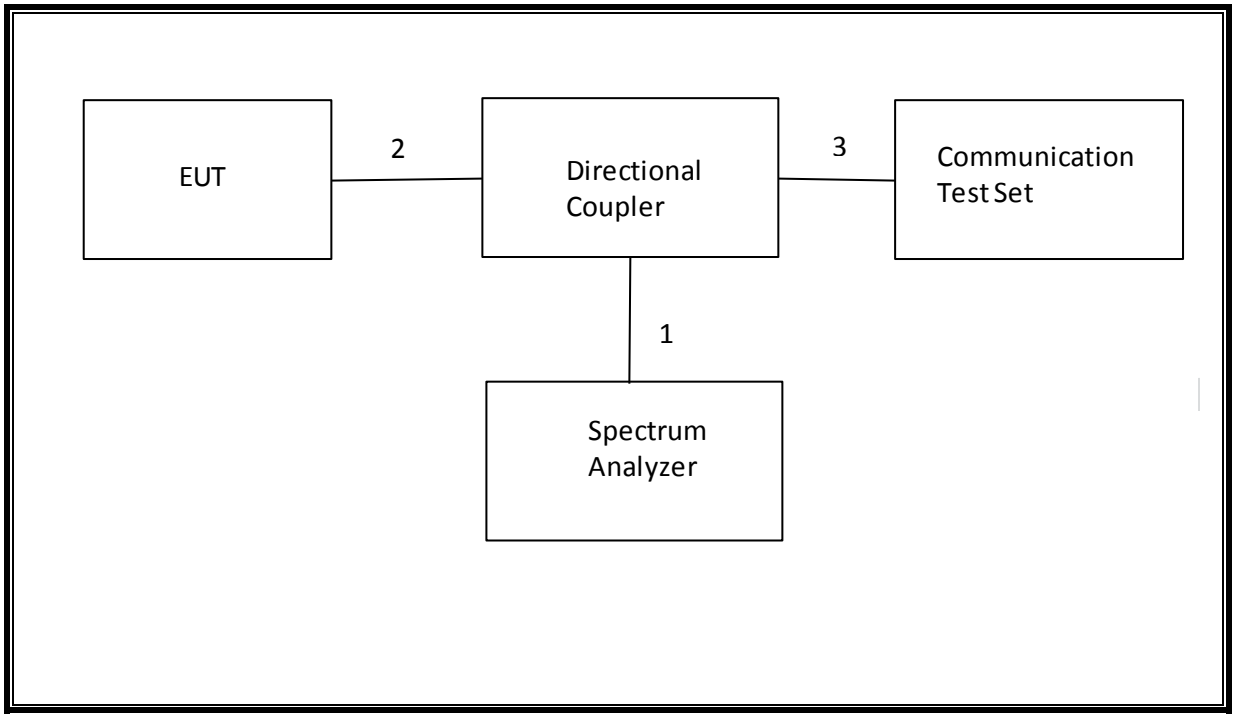
I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	USB	1	AC Adapter	Un-shielded	1.2m	No
2	Jack	1	Headset	Shielded	1m	No
3	RF In/out	1	Communication Test Set	Un-shielded	2m	Yes

TEST SETUP

The EUT is continuously communicated to the call box during the tests.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

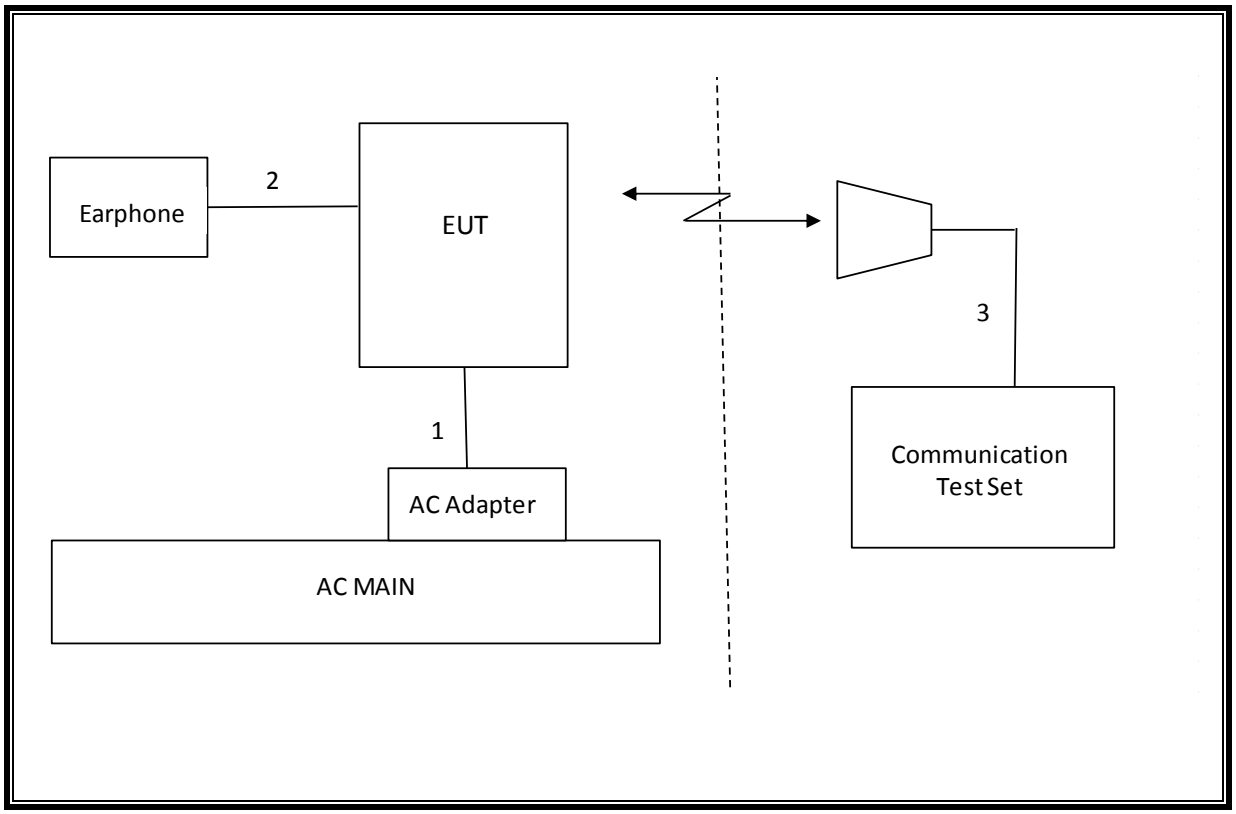
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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**
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01179	05/01/16
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	04/22/16
Antenna, Horn, 18 GHz	EMCO	3115	C00783	10/25/15
Antenna, Horn, 18 GHz	EMCO	3115	C00784	10/25/15
Highpass Filter, 2.7 GHz	Micro-Tronics	HPM13194	N02687	CNR
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM13193	N02688	CNR
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	05/11/16
Communications Test Set	R&S	CMW500	T159	07/02/16
DC power supply, 8 V @ 3 A or 15 V	Agilent / HP	E3610A	None	CNR
Vector signal generator, 6 GHz	Agilent / HP	E4438C	None	06/18/15
Antenna, Tuned Dipole 400~1000	ETS	3121C DB4	C00993	02/11/16
Directional Coupler	RF-Lambda	RFDC5M06G15	None	CNR
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	12/17/15
Multimeter	Fluke	26111	74320701	4/15/2016

Test Software List			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Version 9.5, 07/22/14
Conducted Software	UL	UL EMC	Version 9.5, 05/17/14
CLT Software	UL	UL RF	Version 1.0, 02/02/15
Antenna Port Software	UL	UL RF	Version 2.1.1.1, 1/20/15

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

7. Summary Table

FCC Part Section	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Note
2.1049	N/A	Occupied Band width (99%)	N/A	Conducted	Pass	8.98 MHz
22.917(a) 24.238(a) 27.53(g) 90.691	RSS-132(4.5.1) RSS-133(6.5.1) RSS-139(6.5.1)	Band Edge / Conducted Spurious Emission	-13dBm		Pass	-15.64 dBm
2.1046	N/A	Conducted output power	N/A		Pass	30 dBm
22.355 24.235 27.54 90.213	RSS-132(4.3) RSS-133(6.3) RSS-139(6.3) RSS-199(4.3)	Frequency Stability	2.5PPM		Pass	0.014 PPM
22.913(a)(2)	RSS-132(4.4)	Effective Radiated Power	38 dBm	Radiated	Pass	21.94 dBm
24.232(c) 27.50(h)(2)	RSS-133(6.4) RSS-199(4.4)	Equivalent Isotropic Radiated Power	33dBm		Pass	32.76 dBm
22.917(a) 24.238(a) 27.53(g)	RSS-132(4.5.1) RSS-133(6.5.1) RSS-139(6.5.1)	Radiated Spurious Emission	-13dBm		Pass	-28.5 dBm

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8. RF POWER OUTPUT VERIFICATION

8.1. GSM/GPRS/EDGE

Function: Menu select > GSM Mobile Station > GSM 850/900/1800/1900

Press Connection control to choose the different menus

Press RESET > choose all to reset all settings

Connection Press Signal Off to turn off the signal and change settings

Network Support > GSM+GPRS or GSM+EGPRS

Main Service > Packet Data

Service selection > Test Mode A – Auto Slot Config. off

MS Signal Press Slot Config bottom on the right twice to select and change the number of time slots and power setting

> Slot configuration > Uplink/Gamma

> 33 dBm for GPRS 850/900

> 30 dBm for GPRS1800/1900

BS Signal Enter the same channel number for TCH channel (test channel) and BCCH channel

Frequency Offset > + 0 Hz

Mode > BCCH and TCH

BCCH Level > -85 dBm (May need to adjust if link is not stable)

BCCH Channel > choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]

Channel Type > Off

P0> 4 dB

Slot Config > Unchanged (if already set under MS Signal)

TCH > choose desired test channel

Hopping > Off

Main Timeslot > 3 (Default)

Network Coding Scheme > CS4 (GPRS) and MCS5 ~ MCS9 (EGPRS)

Bit Stream > 2E9-1PSR Bit Pattern

AF/RF Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input

Connection Press Signal On to turn on the signal and change settings

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.1.1. GSM OUTPUT POWER RESULT

Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)
GSM (Voice)	CS1	1	512	1850.2	30.0
			661	1880.0	30.0
			810	1909.8	30.0
GPRS (GMSK)	CS1	1	512	1850.2	30.0
			661	1880.0	30.0
			810	1909.8	30.0
		2	512	1850.2	27.8
			661	1880.0	28.0
			810	1909.8	27.8
		3	512	1850.2	26.5
			661	1880.0	26.7
			810	1909.8	26.5
		4	512	1850.2	25.4
			661	1880.0	25.5
			810	1909.8	25.4

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.2. UMTS REL 99

TEST PROCEDURE

The following summary of these settings are illustrated below:

	Mode	Rel99
	Subtest	-
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	HSDPA FRC	Not Applicable
	HSUPA Test	Not Applicable
	Power Control Algorithm	Algorithm2
	βc	Not Applicable
	βd	Not Applicable
	βec	Not Applicable
	βc/βd	8/15
	βhs	Not Applicable
	βed	Not Applicable

8.2.1. UMTS REL 99 OUTPUT POWER RESULT

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	0	21.8
		4183	836.6	0	21.9
		4233	846.6	0	21.9

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	0	23.0
		9400	1880.0	0	23.1
		9538	1907.6	0	23.0

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.3. UMTS HSDPA

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	Rel5 HSDPA			
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs =βhs/βc	30/15			

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.3.1. UMTS HSDPA OUTPUT POWER RESULT

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	22.3
		4183	836.6	0	22.4
		4233	846.6	0	21.8
	Subtest 2	4132	826.4	0	22.3
		4183	836.6	0	22.4
		4233	846.6	0	21.8
	Subtest 3	4132	826.4	0.5	22.0
		4183	836.6	0.5	22.0
		4233	846.6	0.5	21.8
	Subtest 4	4132	826.4	0.5	22.0
		4183	836.6	0.5	22.0
		4233	846.6	0.5	21.8

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band II	Subtest 1	9262	1852.4	0	22.4
		9400	1880.0	0	22.2
		9538	1907.6	0	20.5
	Subtest 2	9262	1852.4	0	22.3
		9400	1880.0	0	22.2
		9538	1907.6	0	20.6
	Subtest 3	9262	1852.4	0.5	22.0
		9400	1880.0	0.5	22.0
		9538	1907.6	0.5	20.6
	Subtest 4	9262	1852.4	0.5	22.0
		9400	1880.0	0.5	22.0
		9538	1907.6	0.5	20.6

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.4. UMTS HSUPA

TEST PROCEDURE

The following summary of these settings are illustrated below: (ETSI TS 134.121-1 Table C.11.1)

	Mode	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	P-CPICH (dB)	-10				
	P-CCPCH (dB)	-12				
	SCH (dB)	-12				
	PICH(dB)	-15				
	DPCH (dB)	-9				
	HS-SCCH_1 (dB)	-8				
	HS-PDSCH (dB)	-3				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	Bc	11/15	6/15	15/15	2/15	15/15
	Bd	15/15	15/15	9/15	15/15	15/15
	Bec	209/225	12/15	30/15	2/15	5/15
	βc/βd	11/15	6/15	15/9	2/15	15/15
	Bhs	22/15	12/15	30/15	4/15	30/15
	βed (note1)	1309/225	94/75	47/15 47/15	56/75	134/15
	MPR	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	Reference E-TFCIs	5	5	2	5	5
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

Note1: βed cannot be set directly, it is set by Absolute Grant Value.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.4.1. UMTS HSUPA OUTPUT POWER RESULT

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	22.3
		4183	836.6	0	22.4
		4233	846.6	0	21.8
	Subtest 2	4132	826.4	2	20.5
		4183	836.6	2	20.5
		4233	846.6	2	20.5
	Subtest 3	4132	826.4	1	21.5
		4183	836.6	1	21.5
		4233	846.6	1	21.5
	Subtest 4	4132	826.4	2	20.5
		4183	836.6	2	20.5
		4233	846.6	2	20.5
	Subtest 5	4132	826.4	0	22.3
		4183	836.6	0	22.4
		4233	846.6	0	21.8

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band II	Subtest 1	9262	1852.4	0	22.3
		9400	1880.0	0	22.4
		9538	1907.6	0	22.4
	Subtest 2	9262	1852.4	2	19.2
		9400	1880.0	2	19.2
		9538	1907.6	2	19.2
	Subtest 3	9262	1852.4	1	19.5
		9400	1880.0	1	19.5
		9538	1907.6	1	19.5
	Subtest 4	9262	1852.4	2	19.2
		9400	1880.0	2	19.2
		9538	1907.6	2	19.2
	Subtest 5	9262	1852.4	0	22.3
		9400	1880.0	0	22.4
		9538	1907.6	0	22.4

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.5. LTE OUTPUT VERIFICATION

8.5.1. LTE OUTPUT RESULT

LTE Band 5

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Avg Pwr (dBm)		
						20450	20525	20600
						829 MHz	836.5 MHz	844 MHz
LTE Band 5	10	QPSK	1	0	0	23.5	23.5	23.5
			1	25	0	23.5	23.5	23.5
			1	49	0	23.5	23.5	23.5
			25	0	1	22.3	22.1	22.2
			25	12	1	22.3	22.2	22.2
			25	25	1	22.3	22.1	22.1
			50	0	1	22.3	22.1	22.2
		16QAM	1	0	1	22.5	22.5	22.5
			1	25	1	22.5	22.5	22.5
			1	49	1	22.5	22.5	22.5
			25	0	2	21.3	21.2	21.1
			25	12	2	21.2	21.2	21.1
			25	25	2	21.3	21.1	21.1
			50	0	2	21.2	21.0	21.1
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Avg Pwr (dBm)		
						20425	20525	20625
						826.5 MHz	836.5 MHz	846.5 MHz
LTE Band 5	5	QPSK	1	0	0	23.5	23.5	23.5
			1	12	0	23.5	23.5	23.5
			1	24	0	23.5	23.5	23.4
			12	0	1	22.4	22.1	22.3
			12	7	1	22.3	22.2	22.2
			12	13	1	22.3	22.2	22.1
			25	0	1	22.4	22.1	22.2
		16QAM	1	0	1	22.5	22.3	22.5
			1	12	1	22.5	22.3	22.4
			1	24	1	22.5	22.2	22.4
			12	0	2	21.3	21.1	21.2
			12	7	2	21.2	21.1	21.1
			12	13	2	21.3	21.1	21.0
			25	0	2	21.4	21.0	21.2

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Avg Pwr (dBm)		
						20415	20525	20635
						825.5 MHz	836.5 MHz	847.5 MHz
LTE Band 5	3	QPSK	1	0	0	23.5	23.5	23.5
			1	8	0	23.5	23.5	23.5
			1	14	0	23.5	23.5	23.4
			8	0	1	22.4	22.1	22.2
			8	4	1	22.4	22.2	22.2
			8	7	1	22.4	22.2	22.1
			15	0	1	22.3	22.1	22.1
		16QAM	1	0	1	22.5	22.5	22.5
			1	8	1	22.5	22.5	22.5
			1	14	1	22.5	22.5	22.5
			8	0	2	21.3	20.9	21.1
			8	4	2	21.2	20.9	21.1
			8	7	2	21.2	20.9	21.1
			15	0	2	21.2	21.1	20.9

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Avg Pwr (dBm)		
						20407	20525	20643
						824.7 MHz	836.5 MHz	848.3 MHz
LTE Band 5	1.4	QPSK	1	0	0	23.5	23.4	23.4
			1	3	0	23.5	23.5	23.4
			1	5	0	23.5	23.5	23.4
			3	0	0	23.5	23.3	23.4
			3	1	0	23.5	23.4	23.4
			3	3	0	23.4	23.3	23.4
			6	0	1	22.3	22.2	22.2
		16QAM	1	0	1	22.5	22.5	22.5
			1	3	1	22.5	22.5	22.5
			1	5	1	22.5	22.5	22.5
			3	0	1	22.4	22.1	22.2
			3	1	1	22.3	22.1	22.2
			3	3	1	22.3	22.0	22.1
			6	0	2	21.3	20.9	21.0

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9. PEAK TO AVERAGE RATIO

Test Procedure

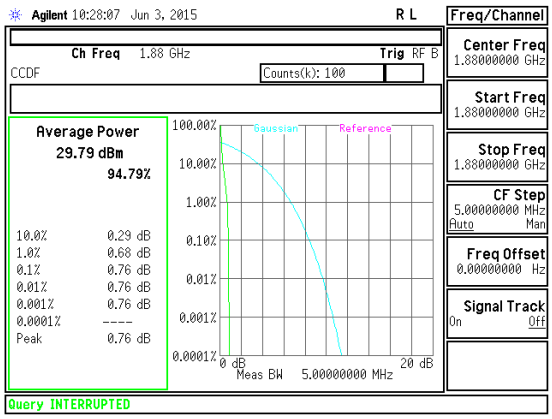
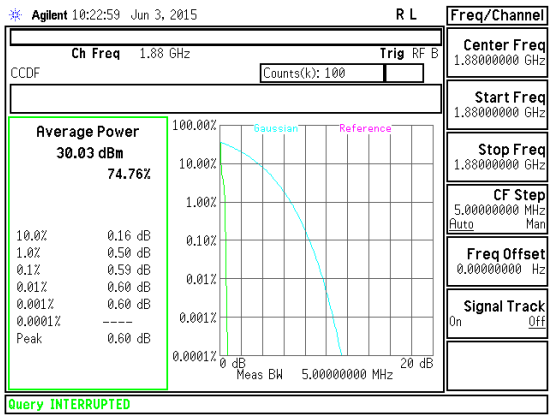
Per KDB 971168 D01 Power Meas License Digital Systems v02r02

Test Spec

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

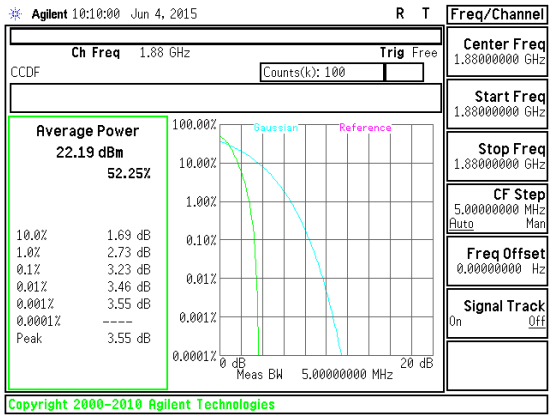
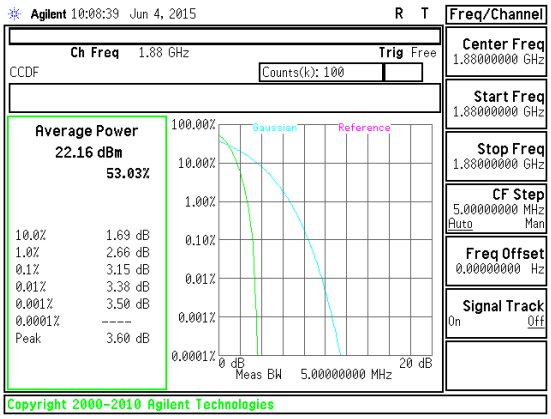
9.1. CONDUCTED PEAK TO AVERAGE RESULT

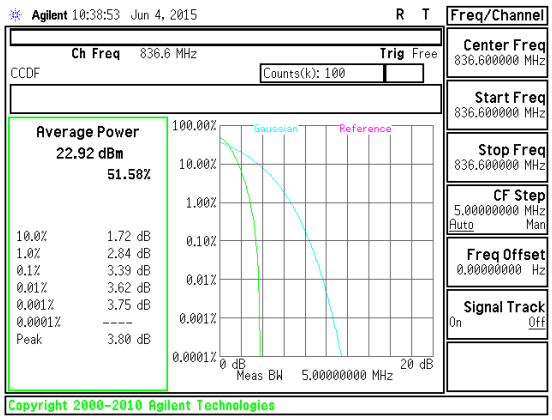
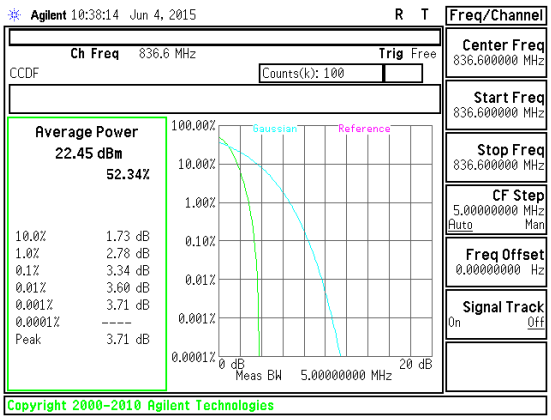
GSM

Band GSM1900 EGPRS	 Band GSM1900 EGPRS Mid channel	 Band GSM1900 GPRS Mid channel

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

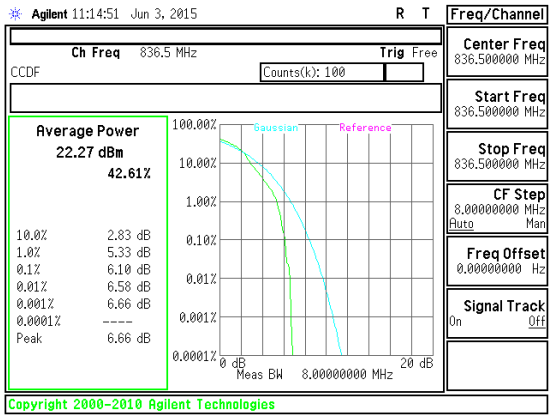
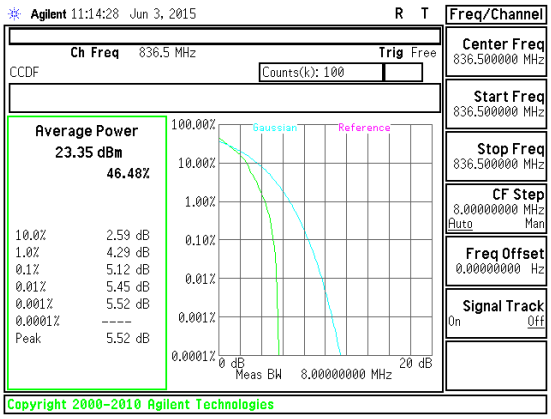
WCDMA

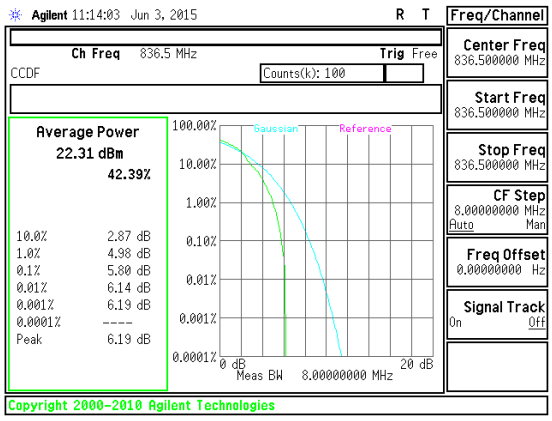
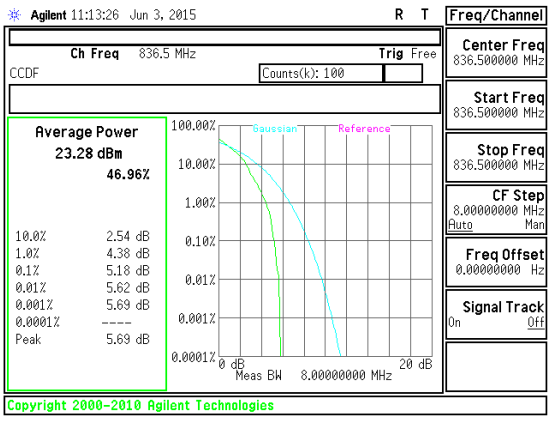
Band		
Band 2 HSDPA	 Band WCDMA B2 HSDPA	 Band WCDMA B2 REL99

Band		
Band 5 HSDPA	 Band WCDMA B5 HSDPA	 Band WCDMA B5 REL99

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

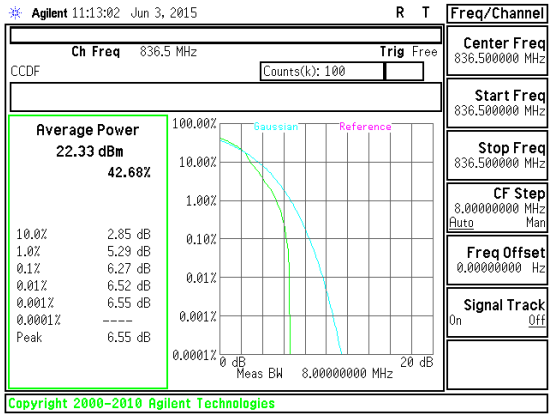
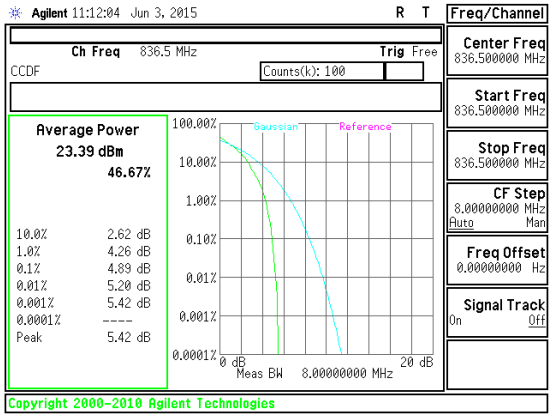
LTE Band 5

Band LTE5 10MHz 16QAM	 Band LTE5 10MHz 16QAM Mid channel	 Band LTE5 10MHz QPSK Mid channel

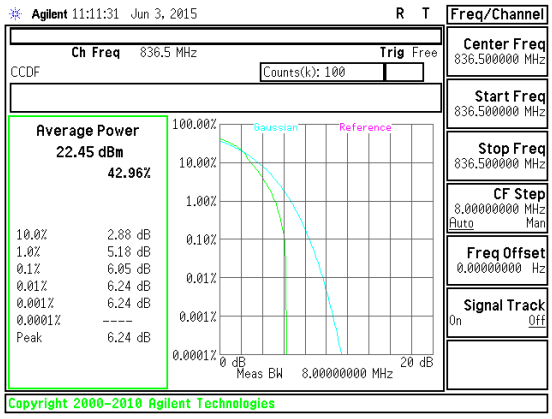
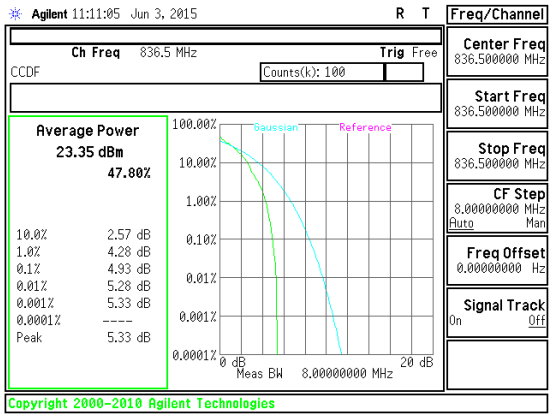
Band LTE5 5MHz 16QAM	 Band LTE5 5MHz 16QAM Mid channel	 Band LTE5 5MHz QPSK Mid channel

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band LTE5 3MHz 16QAM	 Band LTE5 3MHz 16QAM Mid channel	 Band LTE5 3MHz QPSK Mid channel

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band LTE5 1.4MHz 16QAM	 Band LTE5 1.4MHz 16QAM Mid channel	 Band LTE5 1.4MHz QPSK Mid channel

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10. LIMITS AND CONDUCTED RESULTS

10.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

IC: RSS-132, 4.5; RSS-133, 6.5

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

(KDB 971168 D01 Power Meas License Digital Systems v02r02)

MODES TESTED

GSM, WCDMA, and LTE

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10.1.1. OCCUPIED BANDWIDTH RESULTS

GSM

Band	Mode	Channel	f (MHz)	99% BW (kHz)	-26dB (kHz)
GSM 1900	GPRS	512	1850.2	243.70	303.40
		661	1880	236.30	303.00
		810	1909.8	245.00	296.90

WCDMA

Band	Mode	Channel	f (MHz)	99% BW (MHz)	-26dB (MHz)
Band 5	REL99	4132	826.4	4.154	4.698
		4183	836.6	4.121	4.681
		4233	846.6	4.155	4.699
	HSDPA	4132	826.4	4.156	4.713
		4183	836.6	4.139	4.712
		4233	846.6	4.141	4.678
Band 2	REL99	9262	1852.4	4.129	4.718
		9400	1880	4.151	4.685
		9538	1907.6	4.125	4.717
	HSDPA	9262	1852.4	4.164	4.714
		9400	1880	4.158	4.699
		9538	1907.6	4.12	4.702

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

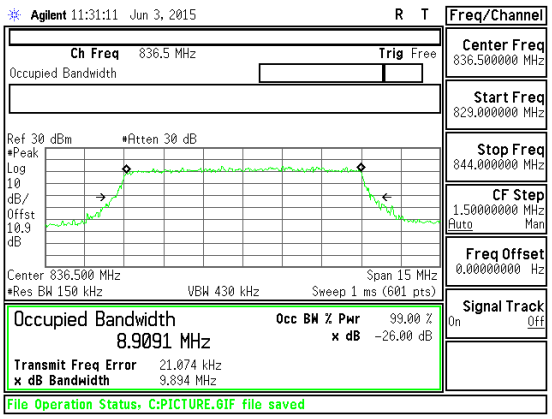
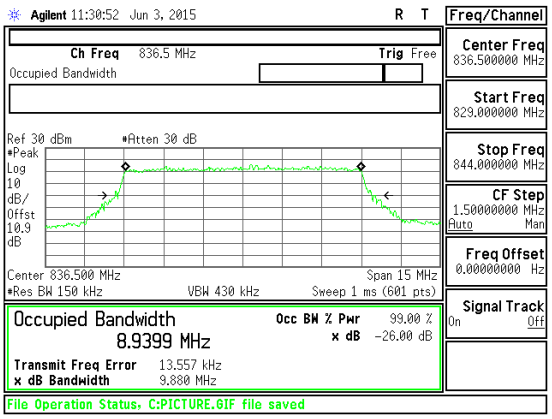
10.1.2. LTE OCCUPIED BANDWIDTH RESULTS

LTE Band 5

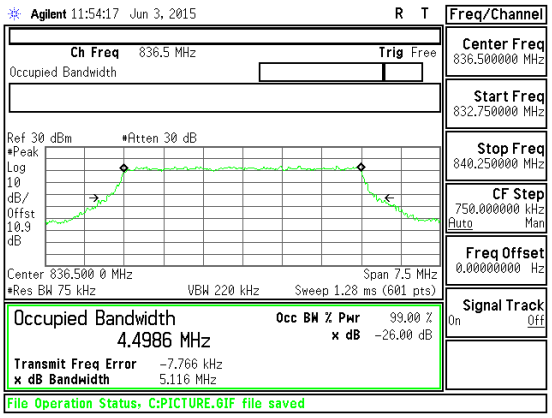
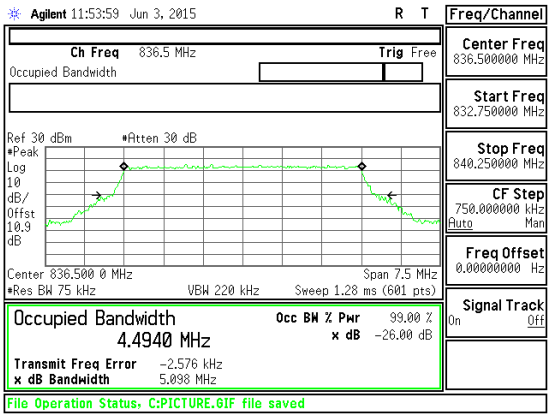
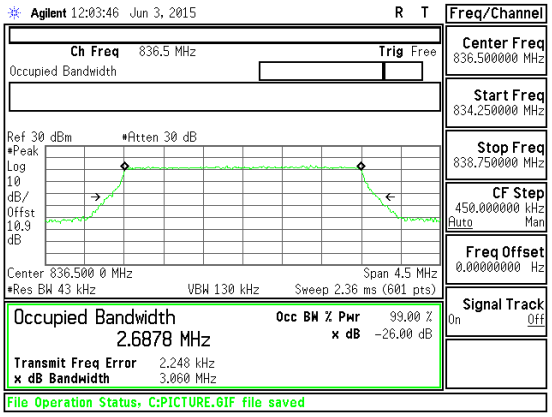
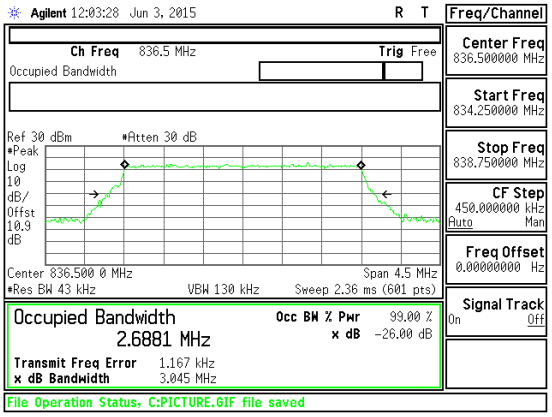
Band	BW(MHz)	Mode	RB/RB Size	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE5	10	QPSK	50/0	829	8.974	10.12
			50/0	836.5	8.94	9.88
			50/0	844	8.976	10.2
		16QAM	50/0	829	8.95	10.15
			50/0	836.5	8.909	9.894
			50/0	844	8.944	10.12
	5	QPSK	25/0	826.5	4.521	5.235
			25/0	836.5	4.499	5.176
			25/0	846.5	4.491	5.211
		16QAM	25/0	826.5	4.504	5.19
			25/0	836.5	4.487	5.172
			25/0	846.5	4.507	5.285
	3	QPSK	15/0	825.5	2.687	3.052
			15/0	836.5	2.688	3.045
			15/0	847.5	2.693	3.081
		16QAM	15/0	825.5	2.684	3.08
			15/0	836.5	2.688	3.06
			15/0	847.5	2.694	3.025
	1.4	QPSK	6/0	824.7	1.091	1.366
			6/0	836.5	1.087	1.29
			6/0	848.3	1.095	1.34
		16QAM	6/0	824.7	1.091	1.379
			6/0	836.5	1.087	1.338
			6/0	848.3	1.086	1.332

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10.1.1. OCCUPIED BANDWIDTH PLOTS

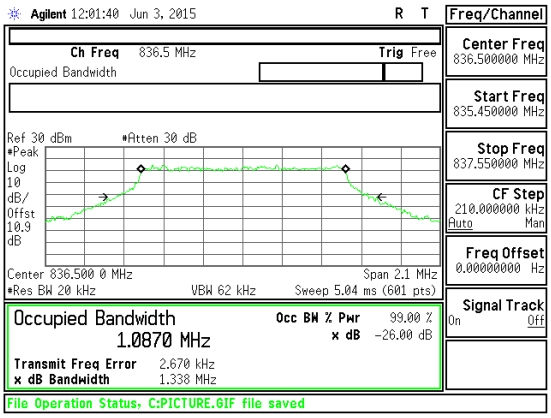
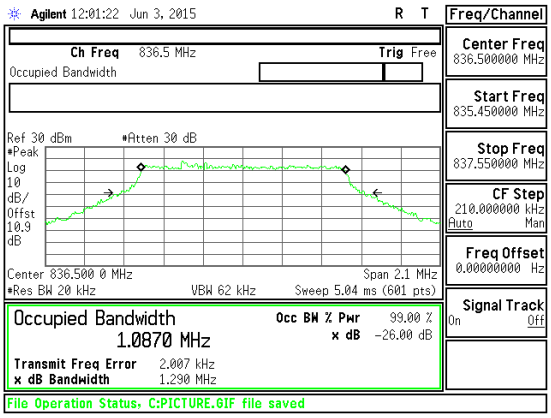
Band LTE5 10MHz 16QAM	 Band LTE5 10MHz OBW 16QAM Mid Channel FRB.gif	 Band LTE5 10MHz OBW QPSK Mid Channel FRB.gif

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band LTE5 5MHz 16QAM	 Band LTE5 5MHz OBW 16QAM Mid Channel FRB.gif	 Band LTE5 5MHz OBW QPSK Mid Channel FRB.gif
Band LTE5 3MHz 16QAM	 Band LTE5 3MHz OBW 16QAM Mid Channel FRB.gif	 Band LTE5 3MHz OBW QPSK Mid Channel FRB.gif

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

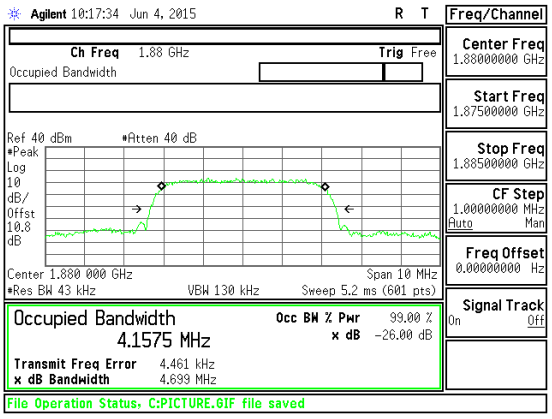
Band LTE5 1.4MHz 16QAM	 Band LTE5 1.4MHz OBW 16QAM Mid Channel FRB.gif	 Band LTE5 1.4MHz OBW QPSK Mid Channel FRB.gif

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

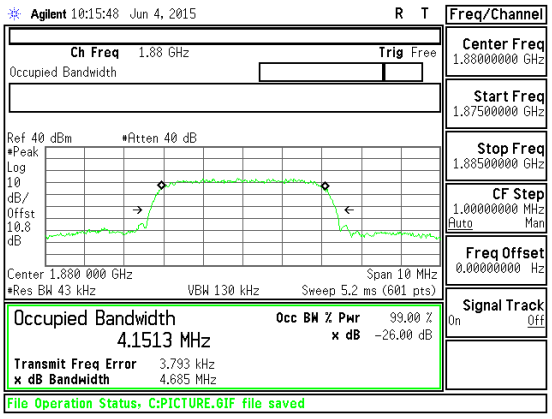
Band

Band 2

HSDPA



Band WCDMA B2 HSDPA OBW

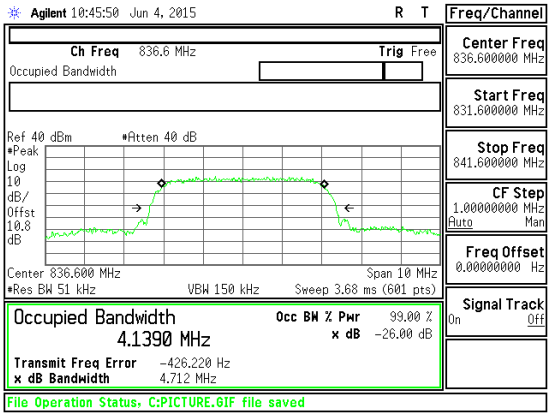


Band WCDMA B2 REL99 OBW

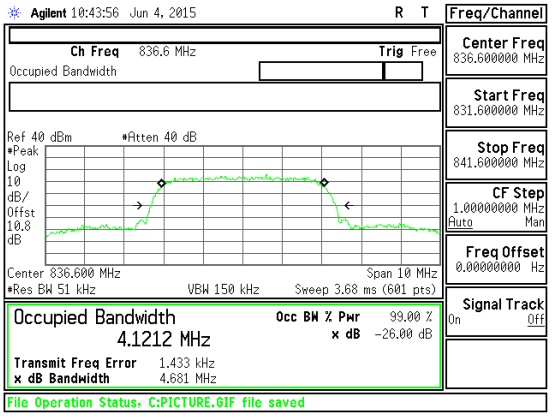
Band

Band 5

HSDPA



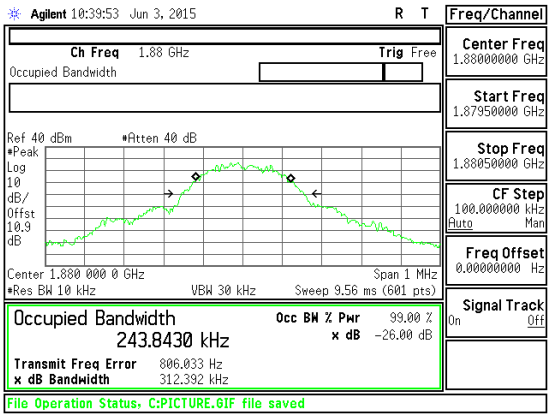
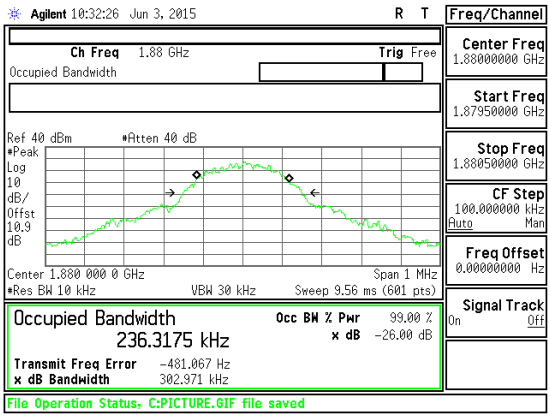
Band WCDMA B5 HSDPA OBW



Band WCDMA B5 REL99 OBW

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band GSM 1900 EGPRS	 Band GSM1900 EGPRS OBW Mid channel	 Band GSM1900 GPRS OBW Mid channel

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

BAND EDGE EMISSIONS

RULE PART(S)

FCC: §22.359, §24.238

LIMITS

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

Per KDB 971168 D01 Power Meas License Digital Systems v02r02
The transmitter output was connected to an Agilent 8960 or a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

MODES TESTED

GSM, WCDMA, and LTE

RESULTS

Note: GSM reading need add 9dB DCCF factor due to duty cycle is 12.5% during test.

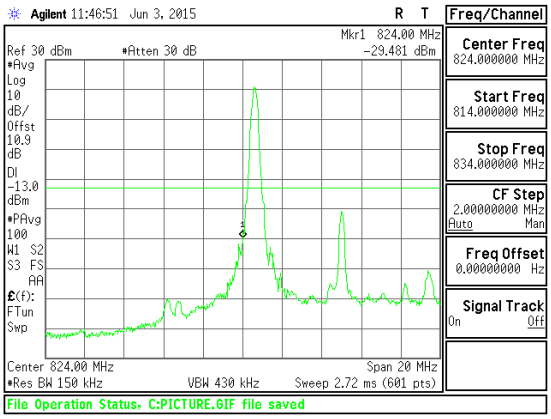
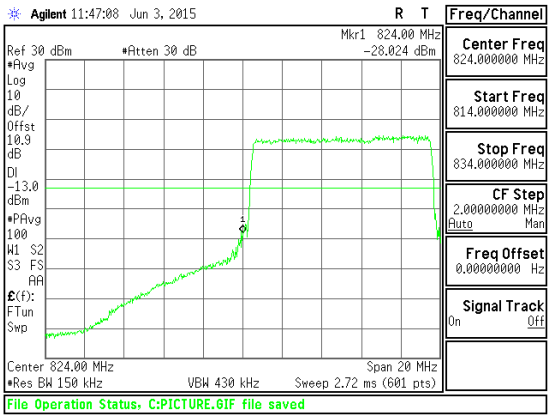
LTE 41 Reading need apply 4.44dB duty cycle factor (20log (6/10)).

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

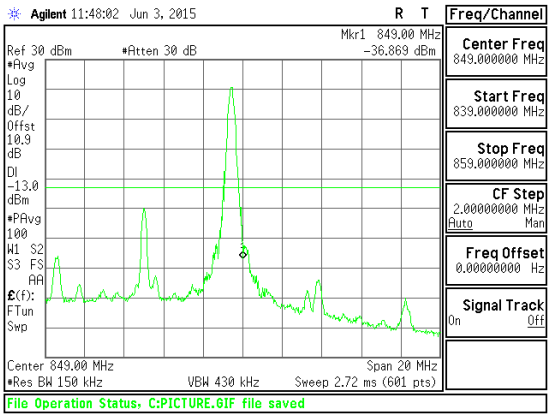
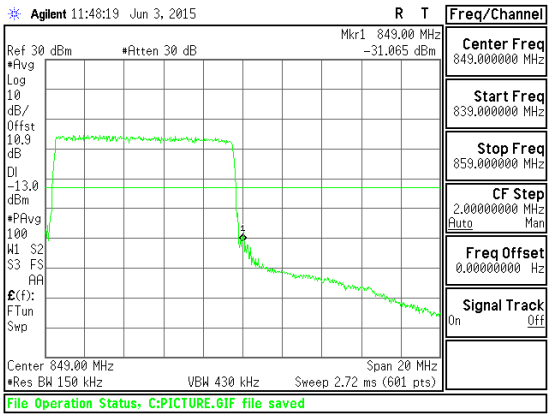
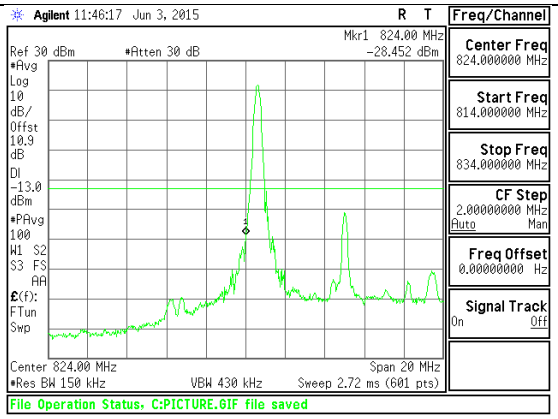
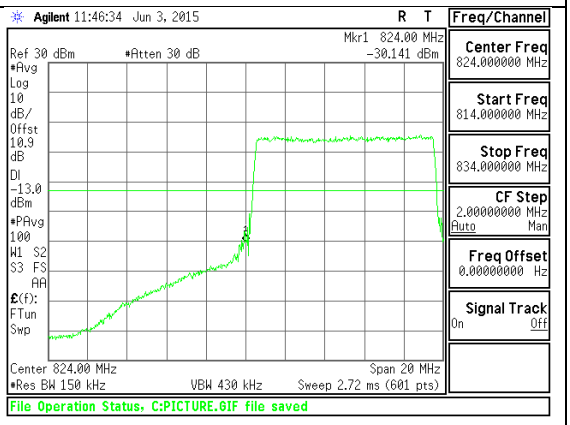
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10.1.2. BAND EDGE PLOTS

LTE Band 5

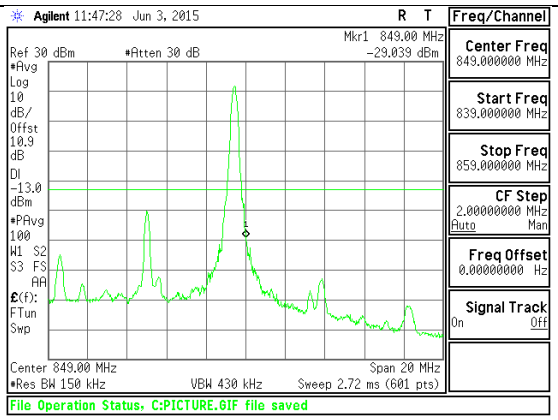
Band LTE5 10MHz 16QAM	 Band LTE5 10MHz CBE 16QAM Low Channel 1RB.gif	 Band LTE5 10MHz CBE 16QAM Low Channel FRB.gif

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

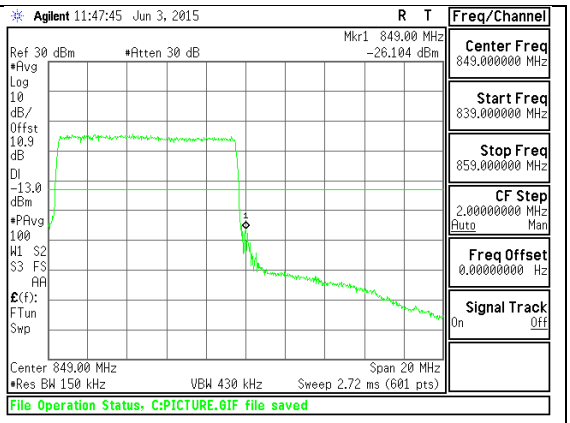
Band LTE5 10MHz 16QAM	 Band LTE5 10MHz CBE 16QAM High Channel 1RB.gif	 Band LTE5 10MHz CBE 16QAM High Channel FRB.gif
Band LTE5 10MHz QPSK	 Band LTE5 10MHz CBE QPSK Low Channel 1RB.gif	 Band LTE5 10MHz CBE QPSK Low Channel FRB.gif

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band LTE5 10MHz QPSK

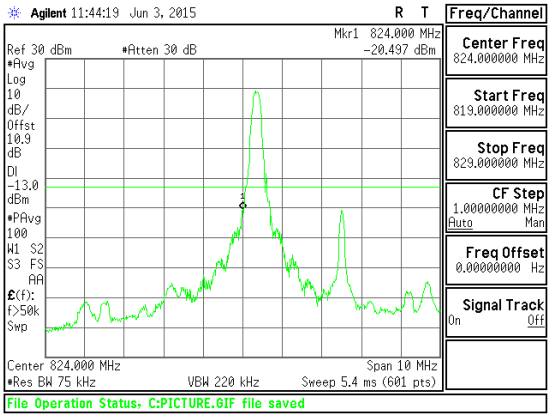


Band LTE5 10MHz CBE QPSK High Channel 1RB.gif

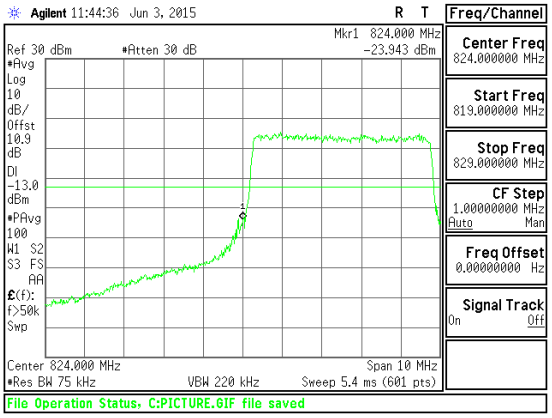


Band LTE5 10MHz CBE QPSK High Channel FRB.gif

Band LTE5 5MHz 16QAM



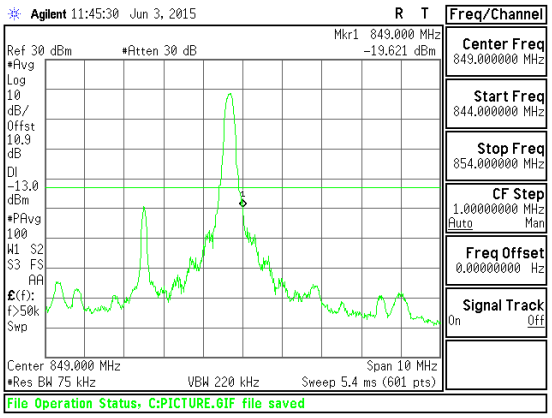
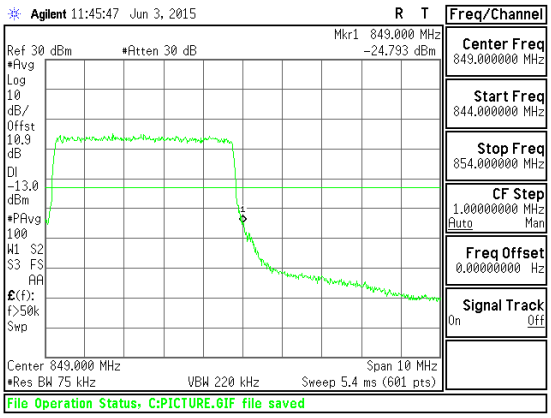
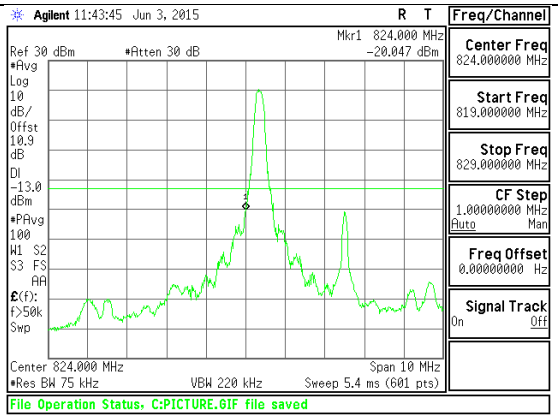
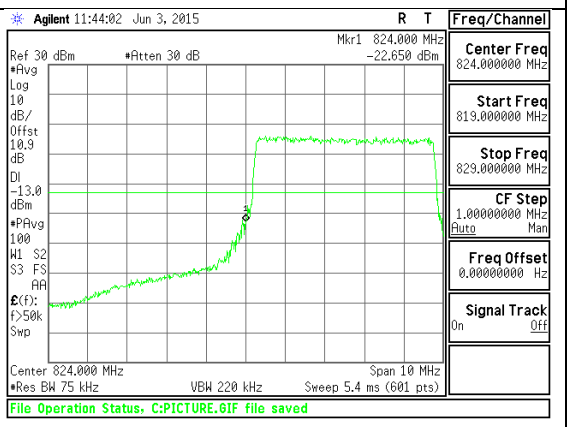
Band LTE5 5MHz CBE 16QAM Low Channel 1RB.gif



Band LTE5 5MHz CBE 16QAM Low Channel FRB.gif

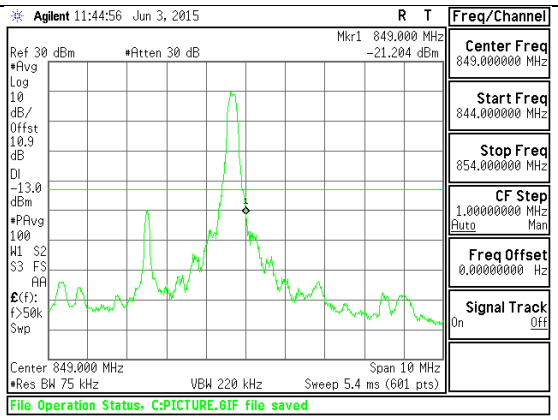
UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

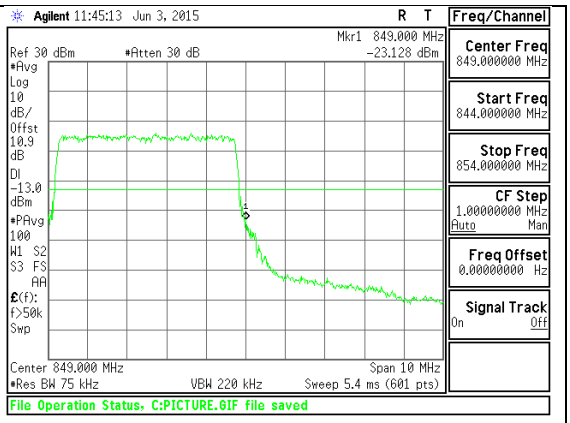
Band LTE5 5MHz 16QAM	 Band LTE5 5MHz CBE 16QAM High Channel 1RB.gif	 Band LTE5 5MHz CBE 16QAM High Channel FRB.gif
Band LTE5 5MHz QPSK	 Band LTE5 5MHz CBE QPSK Low Channel 1RB.gif	 Band LTE5 5MHz CBE QPSK Low Channel FRB.gif

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band LTE5 5MHz QPSK

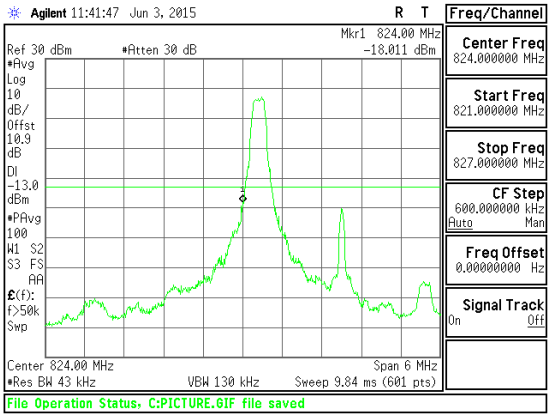


Band LTE5 5MHz CBE QPSK High Channel 1RB.gif

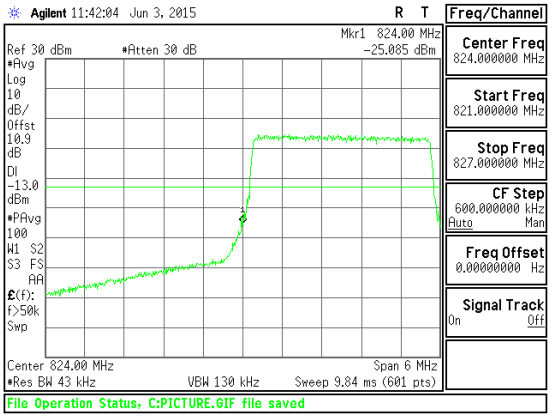


Band LTE5 5MHz CBE QPSK High Channel FRB.gif

Band LTE5 3MHz 16QAM

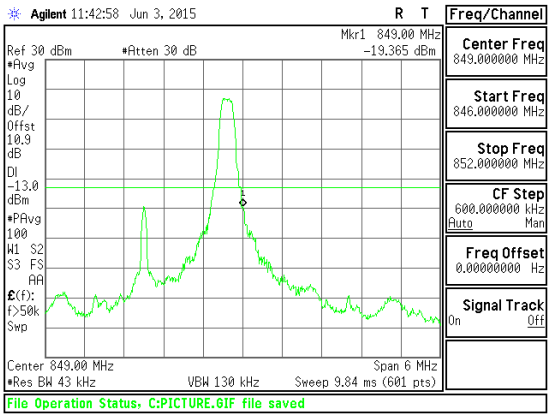
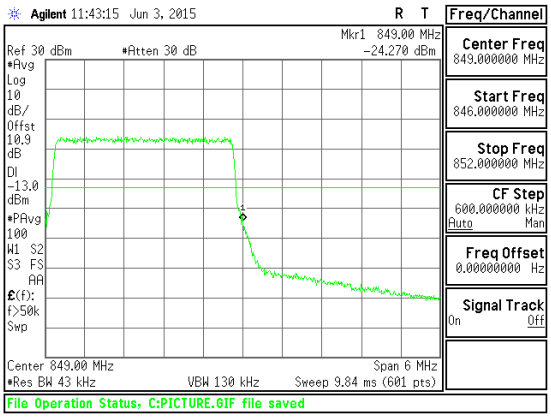
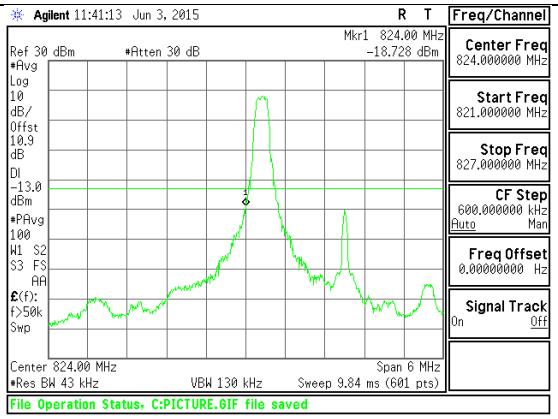
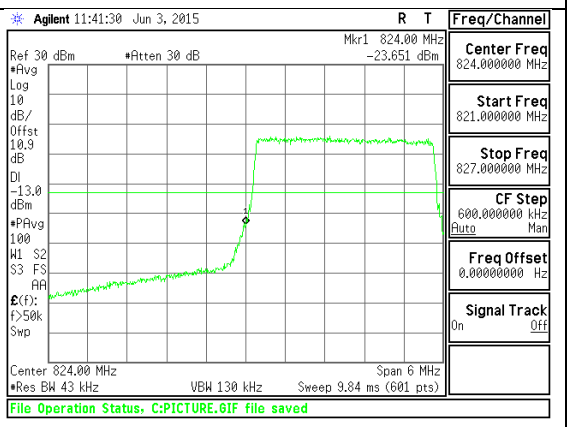


Band LTE5 3MHz CBE 16QAM Low Channel 1RB.gif

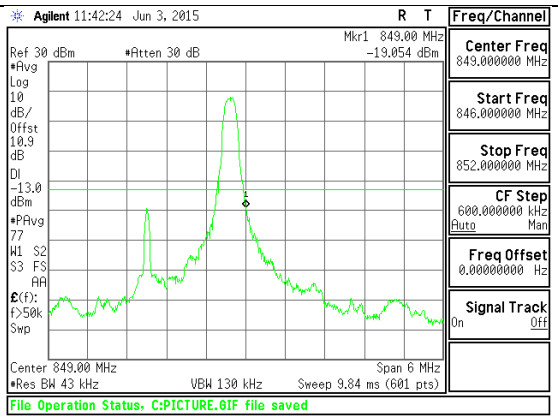
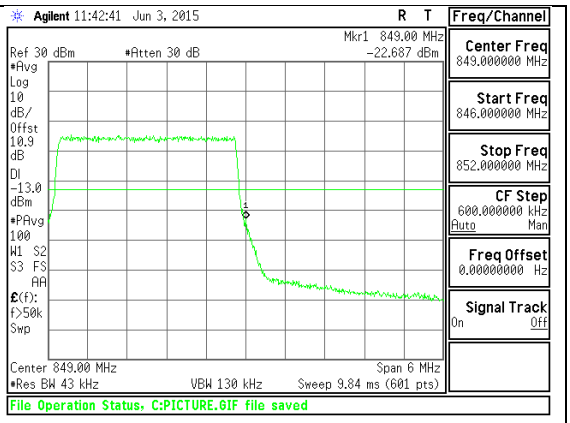
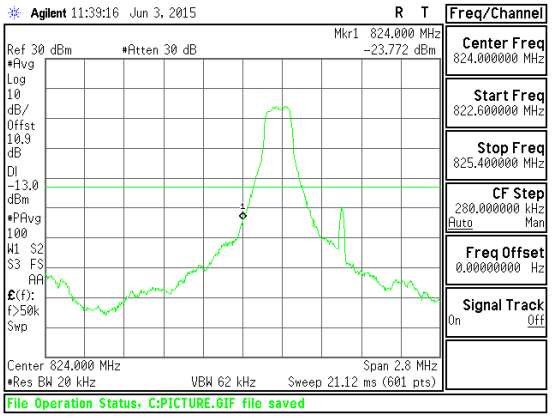
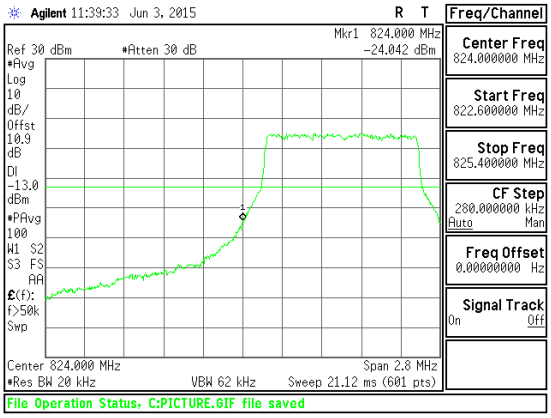


Band LTE5 3MHz CBE 16QAM Low Channel FRB.gif

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

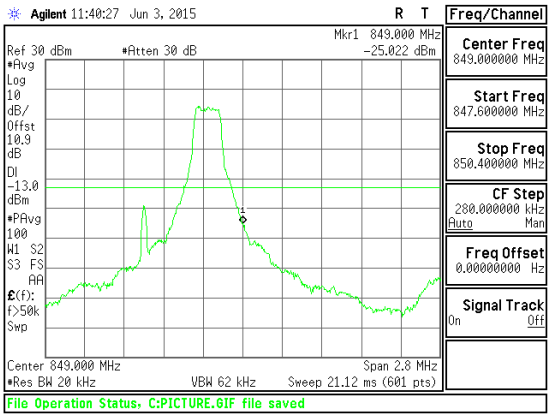
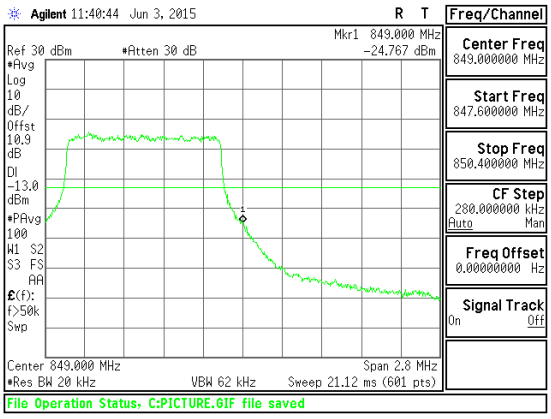
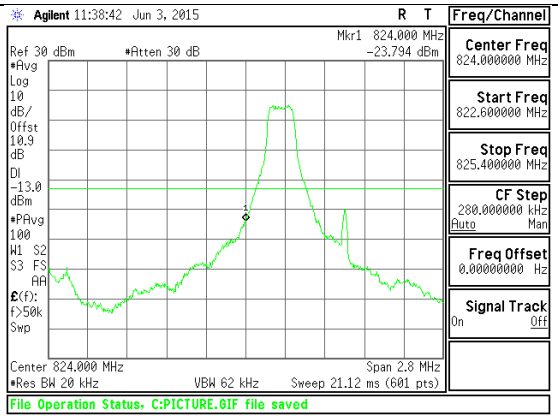
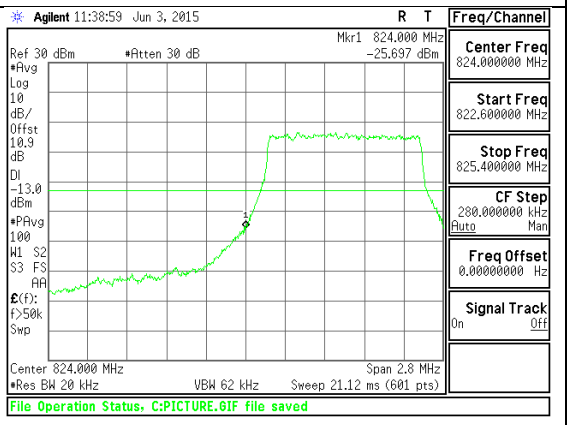
Band LTE5 3MHz 16QAM	 Band LTE5 3MHz CBE 16QAM High Channel 1RB.gif	 Band LTE5 3MHz CBE 16QAM High Channel FRB.gif
Band LTE5 3MHz QPSK	 Band LTE5 3MHz CBE QPSK Low Channel 1RB.gif	 Band LTE5 3MHz CBE QPSK Low Channel FRB.gif

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

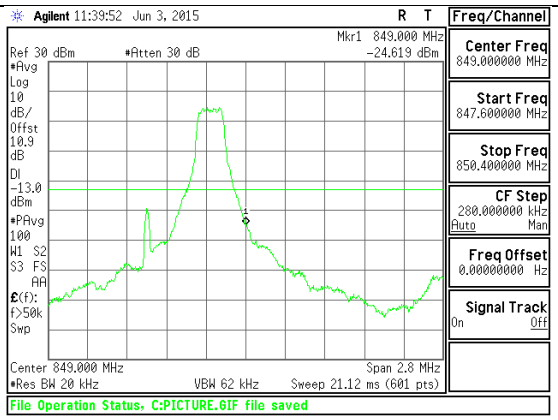
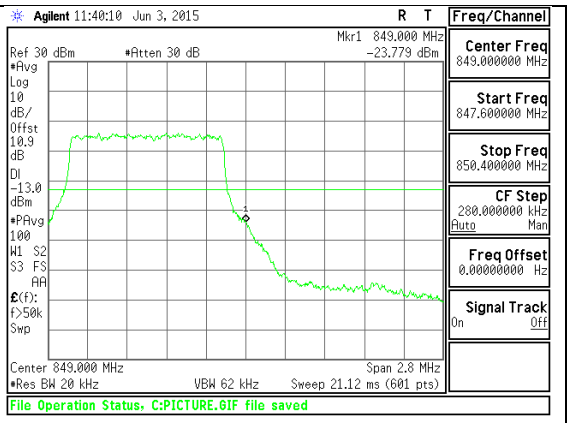
Band LTE5 3MHz QPSK	 Band LTE5 3MHz CBE QPSK High Channel 1RB.gif	 Band LTE5 3MHz CBE QPSK High Channel FRB.gif
Band LTE5 1.4MHz 16QAM	 Band LTE5 1.4MHz CBE 16QAM Low Channel 1RB.gif	 Band LTE5 1.4MHz CBE 16QAM Low Channel FRB.gif

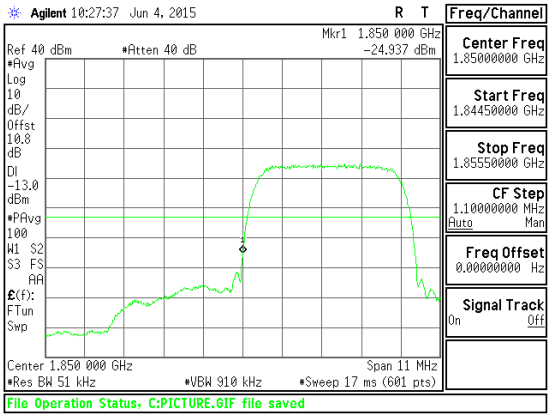
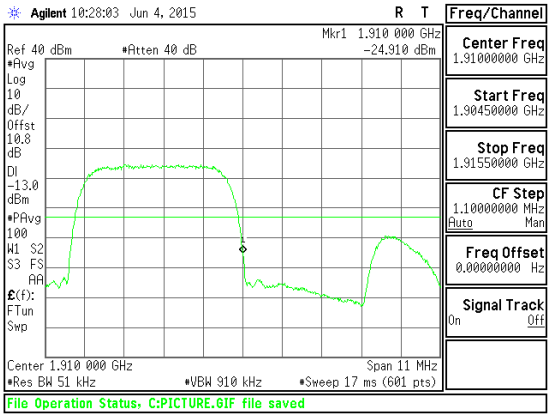
UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

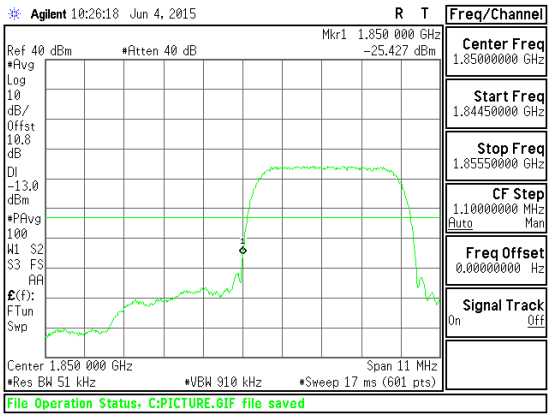
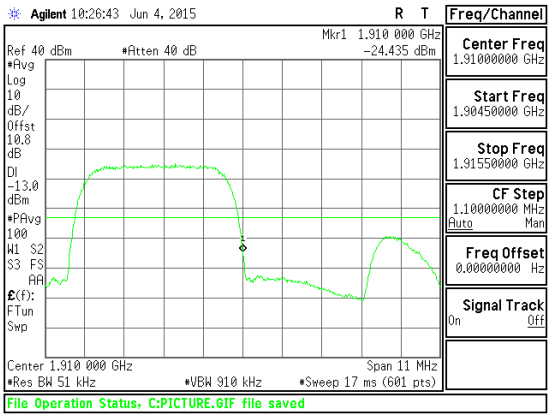
Band LTE5 1.4MHz 16QAM	 Band LTE5 1.4MHz CBE 16QAM High Channel 1RB.gif	 Band LTE5 1.4MHz CBE 16QAM High Channel FRB.gif
Band LTE5 1.4MHz QPSK	 Band LTE5 1.4MHz CBE QPSK Low Channel 1RB.gif	 Band LTE5 1.4MHz CBE QPSK Low Channel FRB.gif

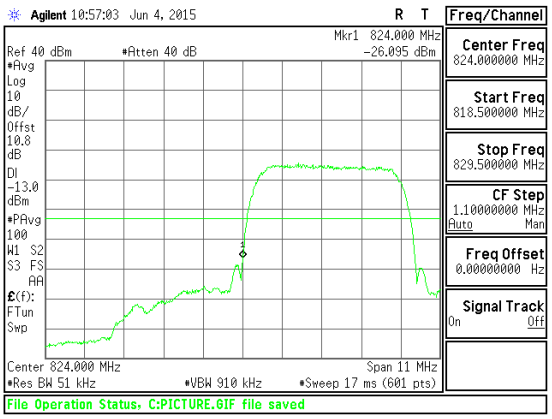
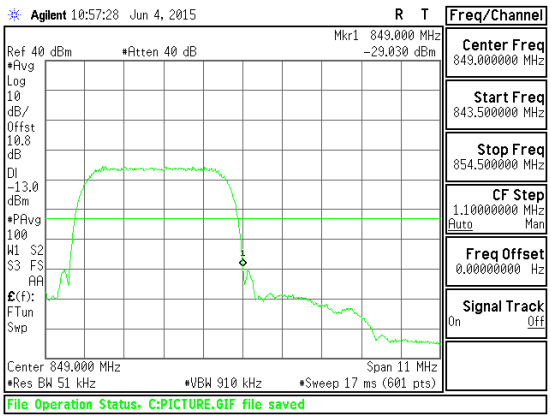
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band LTE5 1.4MHz QPSK	 Band LTE5 1.4MHz CBE QPSK High Channel 1RB.gif	 Band LTE5 1.4MHz CBE QPSK High Channel FRB.gif

Band Band 2 HSDPA	 Band WCDMA B2 HSDPA CBE	 Band WCDMA B2 HSDPA CBE

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band Band 2 REL99	 Band WCDMA B2 REL99 CBE	 Band WCDMA B2 REL99 CBE

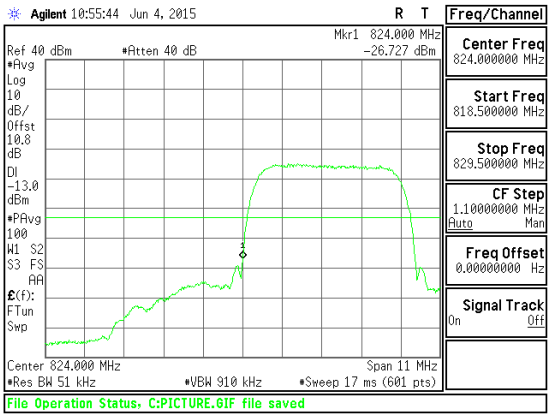
Band Band 5 HSDPA	 Band WCDMA B5 HSDPA CBE	 Band WCDMA B5 HSDPA CBE

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

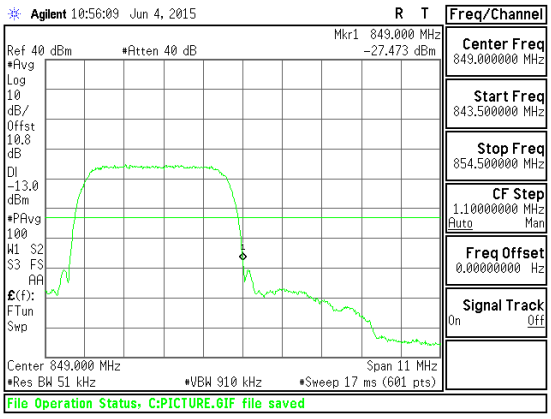
Band

Band 5

REL99



Band WCDMA B5 REL99 CBE

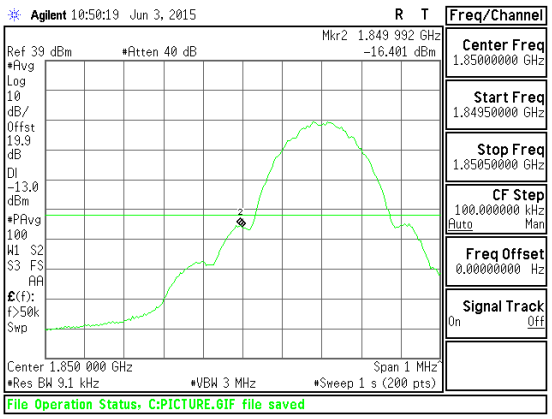


Band WCDMA B5 REL99 CBE

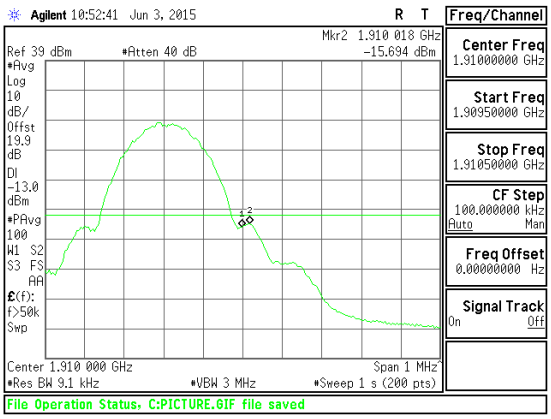
Band

GSM 1900

GPRS



Band GSM1900 GPRS CBE Low channel



Band GSM1900 GPRS CBE High channel

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10.2. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238, §27.53 and §90.691

LIMITS

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.

Part 27: (m)(4) (4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v02r02

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

MODES TESTED

GSM, WCDMA, and LTE

RESULTS

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10.2.1. OUT OF BAND EMISSIONS RESULT

GSM

Band	Mode	f (MHz)	Spur (dBm)	Spec (dBm)	Delta (dB)
GSM 1900	GPRS	1850.2	-25.477	-13	-12.477
		1880	-25.829	-13	-12.829
		1909.8	-25.38	-13	-12.38

WCDMA

Band	Mode	f (MHz)	Spur (dBm)	Spec (dBm)	Delta (dB)
Band 5	REL99	826.4	-26.846	-13	-13.846
		836.6	-25.855	-13	-12.855
		846.6	-25.119	-13	-12.119
	HSDPA	826.4	-26.37	-13	-13.37
		836.6	-26.271	-13	-13.271
		846.6	-25.671	-13	-12.671
Band 2	REL99	1852.4	-26.192	-13	-13.192
		1880	-25.728	-13	-12.728
		1907.6	-26.365	-13	-13.365
	HSDPA	1852.4	-25.326	-13	-12.326
		1880	-26.372	-13	-13.372
		1907.6	-25.374	-13	-12.374

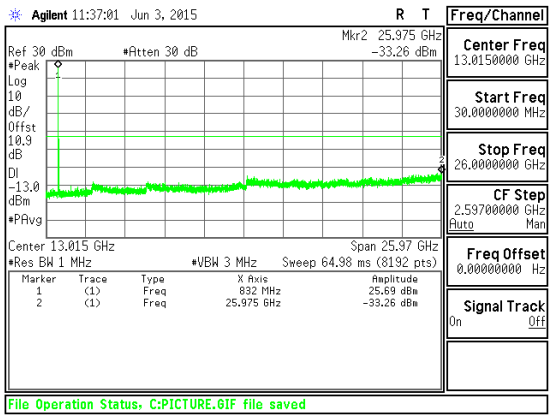
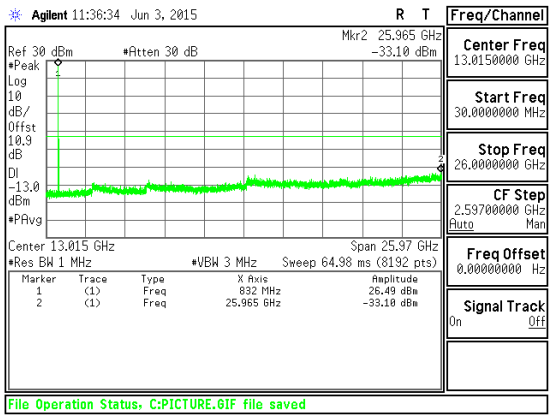
UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

LTE Band 5

Band	BW (MHz)	Mode	f (MHz)	Spur (dBm)	Spec (dBm)	Delta (dB)
LTE5	10	16QAM	829	-32.76	-13	-19.76
			836.5	-33.26	-13	-20.26
			844	-33.14	-13	-20.14
		QPSK	829	-33.43	-13	-20.43
			836.5	-33.10	-13	-20.10
			844	-33.06	-13	-20.06
	5	16QAM	826.5	-31.94	-13	-18.94
			836.5	-33.13	-13	-20.13
			846.5	-32.67	-13	-19.67
		QPSK	826.5	-32.91	-13	-19.91
			836.5	-33.17	-13	-20.17
			846.5	-32.99	-13	-19.99
	3	16QAM	825.5	-32.86	-13	-19.86
			836.5	-33.67	-13	-20.67
			847.5	-33.69	-13	-20.69
		QPSK	825.5	-33.17	-13	-20.17
			836.5	-32.62	-13	-19.62
			847.5	-32.86	-13	-19.86
	1.4	16QAM	824.7	-33.07	-13	-20.07
			836.5	-33.24	-13	-20.24
			848.3	-33.41	-13	-20.41
		QPSK	824.7	-33.14	-13	-20.14
			836.5	-33.38	-13	-20.38
			848.3	-30.91	-13	-17.91

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10.2.2. OUT OF BAND EMISSIONS PLOTS

Band LTE5 10MHz 16QAM	 Band LTE5 10MHz CSE 16QAM Mid channel	 Band LTE5 10MHz CSE QPSK Mid channel

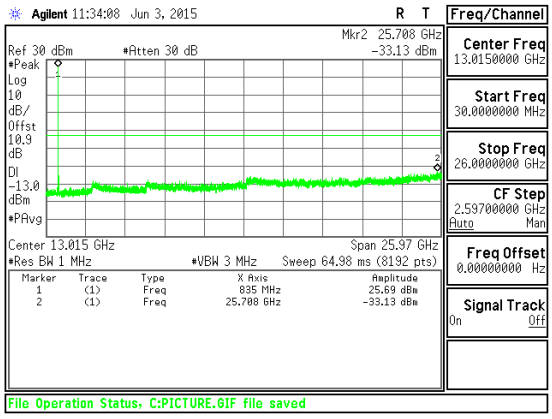
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

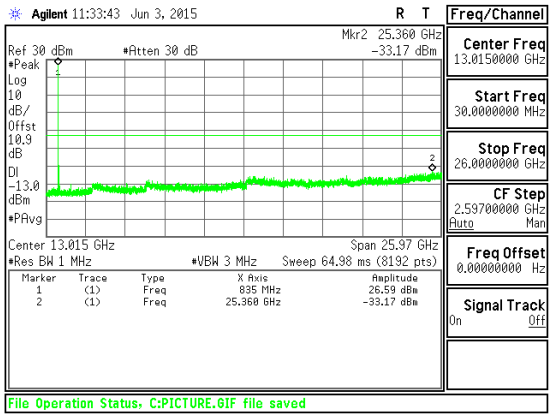
LTE5

5MHz

16QAM



Band LTE5 5MHz CSE 16QAM Mid channel



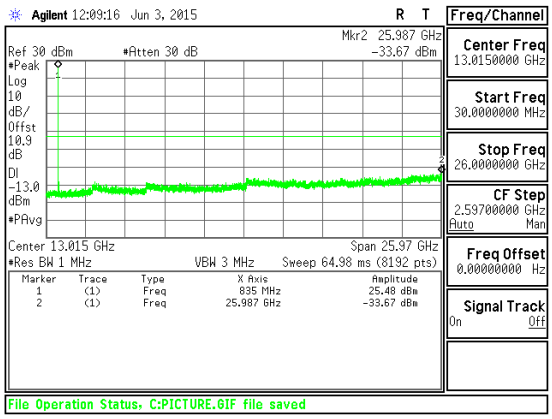
Band LTE5 5MHz CSE QPSK Mid channel

Band

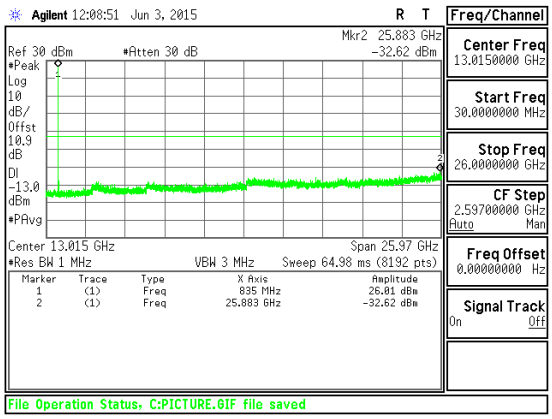
LTE5

3MHz

16QAM



Band LTE5 3MHz CSE 16QAM Mid channel



Band LTE5 3MHz CSE QPSK Mid channel

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

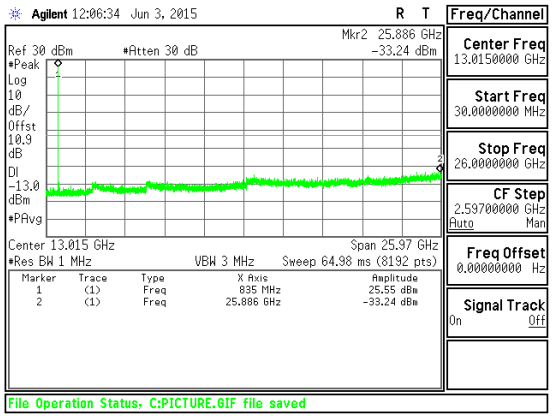
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

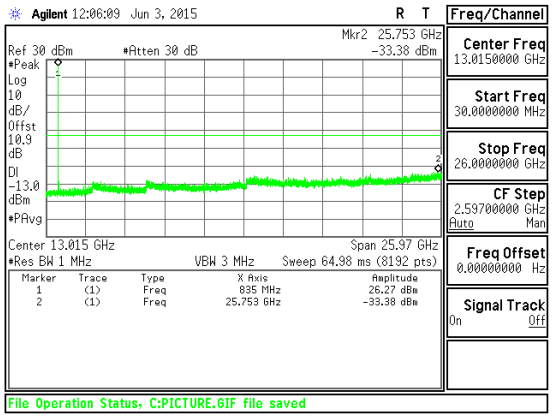
LTE5

1.4MHz

16QAM



Band LTE5 1.4MHz CSE 16QAM Mid channel

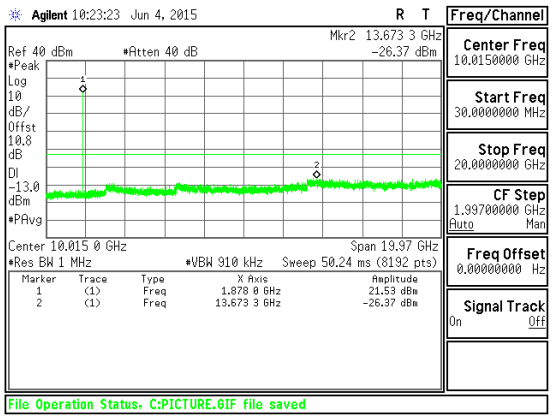


Band LTE5 1.4MHz CSE QPSK Mid channel

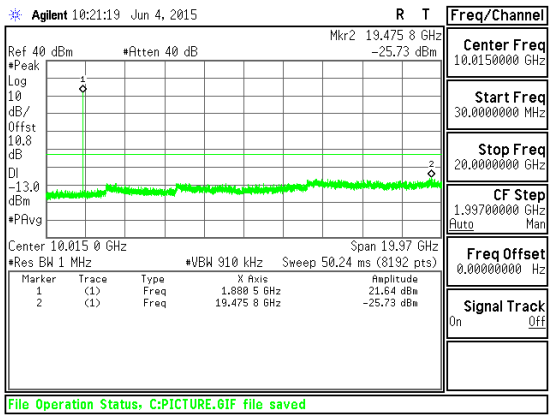
Band

Band 2

HSDPA



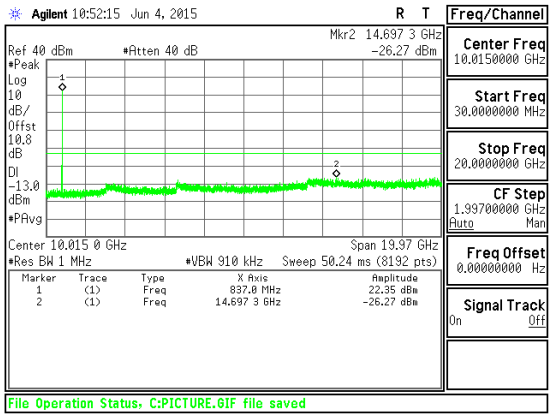
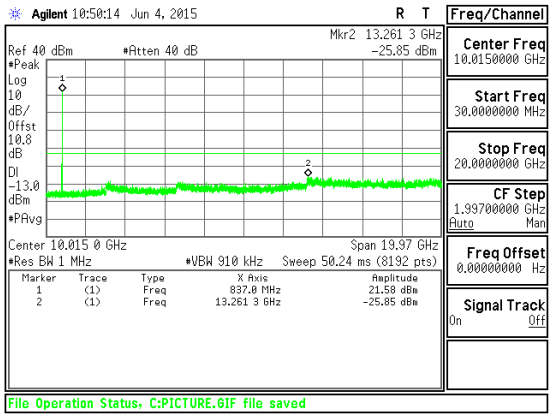
Band WCDMA B2 HSDPA CSE



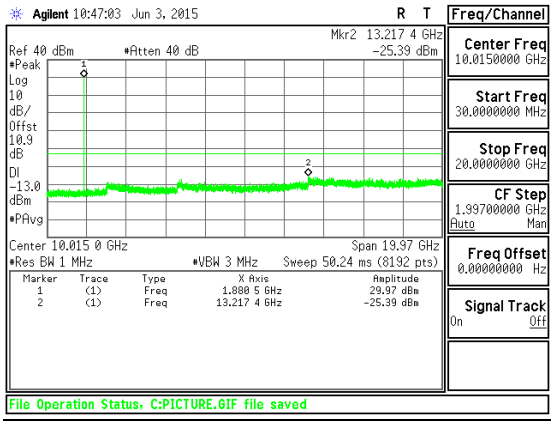
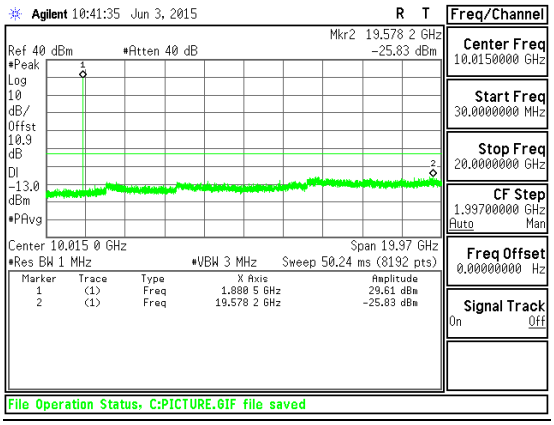
Band WCDMA B2 REL99 CSE

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band Band 5 HSDPA	 Band WCDMA B5 HSDPA CSE	 Band WCDMA B5 REL99 CSE

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band **GSM1900** **EGPRS**	 **Band GSM1900 EGPRS CSE Mid channel**	 **Band GSM1900 GPRS CSE Mid channel**

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10.3. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235, §27.54 and §90.213

LIMITS

§22.355 - The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

§24.235 - The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

§27.54 - The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

§90.213 - The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v02r02

MODES TESTED

RESULTS

See the following pages.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10.3.1. FREQUENCY STABILITY RESULTS

WCDMA B5 – MID CHANNEL

Reference Frequency: Cell Mid Channel		836.6	MHz @ 20°C	
Limit: to stay +- 2.5 ppm =		2091.500	Hz	
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse (MHz)	Delta (ppm)	Limit (ppm)
3.80	50	836.599994	0.002	2.5
3.80	40	836.599995	0.001	2.5
3.80	30	836.599996	0.000	2.5
3.80	***20***	**836.599996**	**0**	***2.5***
3.80	10	836.600007	-0.014	2.5
3.80	0	836.599995	0.001	2.5
3.80	-10	836.599995	0.000	2.5
3.80	-20	836.599994	0.001	2.5
3.80	-30	836.599995	0.001	2.5

Reference Frequency: Cell Mid Channel		836.6	MHz @ 20°C	
Limit: to stay +- 2.5 ppm =		2091.500	Hz	
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse (MHz)	Delta (ppm)	Limit (ppm)
3.80	***20***	***836.599995***	***0***	***2.5***
4.37	20	836.5999956	*0.000*	2.5
3.23(End of volt)	20	836.5999964	*-0.001*	2.5

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

WCDMA B2 – MID CHANNEL

Reference Frequency: PCS Mid Channel 1880 MHz @ 20°C Limit: to stay +- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	**Environment Temperature (°C)**	**Frequency Deviation Measureed with Time Elapse**		
		(MHz)	**Delta (ppm)**	**Limit (ppm)**
3.80	50	1879.999987	0.002	2.5
3.80	40	1879.999989	0.001	2.5
3.80	30	1879.999991	0.000	2.5
3.80	***20***	**1879.999992**	**0**	***2.5***
3.80	10	1879.999990	0.001	2.5
3.80	0	1879.999990	0.001	2.5
3.80	-10	1879.999992	0.000	2.5
3.80	-20	1879.999979	0.006	2.5
3.80	-30	1879.999989	0.001	2.5

Reference Frequency: PCS Mid Channel 1880 MHz @ 20°C Limit: to stay +- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	**Environment Temperature (°C)**	**Frequency Deviation Measureed with Time Elapse**		
		(MHz)	**Delta (ppm)**	**Limit (ppm)**
3.80	***20***	***1879.999992***	***0***	***2.5***
4.37	20	1879.999993	*-0.001*	2.5
3.23(End of volt)	20	1879.999988	*0.002*	2.5

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

11. RADIATED TEST RESULTS

11.1. 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 Clause 2.2.17; PSA setting reference to 971168 D01 v02r02

For peak power measurement with a PSA:

a) Set the RBW ≥ OBW; b) Set VBW ≥ 3 × RBW; c) Set span ≥ 2 x RBW; d) Sweep time = auto couple; e) Detector = peak; f) Ensure that the number of measurement points ≥ span/RBW; g) Trace mode = max hold;

For average power measurement with a PSA:

a) Set span to at least 1.5 times the OBW; b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz; c) Set VBW ≥ 3 x RBW; d) Set number of points in sweep ≥ 2 × span / RBW; e) Sweep time = auto-couple; f) Detector = RMS (power averaging); g) Use free run trigger If burst duty cycle ≥ 98; h) Use trigger to capture bursts If burst duty cycle < 98; i) Trace average at least 100 traces in power averaging (*i.e.*, RMS) mode. j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function.

MODES TESTED

GSM, WCDMA, and LTE

TEST RESULTS

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

11.1.1. ERP/EIRP Results

GSM

Band	Mode	Channel	f(MHz)	ERP / EIRP	
				dBm	mW
GSM1900	GPRS	512	1850.2	32.21	1663.41
		661	1880	32.31	1702.16
		810	1909.8	32.76	1887.99

WCDMA

Band	Mode	Channel	f(MHz)	ERP / EIRP	
				dBm	mW
Band 2	REL99	9262	1852.4	26.25	421.7
		9400	1880	25.53	357.27
		9538	1907.6	26.61	458.14
	HSDPA	9262	1852.4	25.11	324.34
		9400	1880	24.17	261.22
		9538	1907.6	25.88	387.26

Band	Mode	Channel	f(MHz)	ERP / EIRP	
				dBm	mW
Band 5	REL99	4132	826.4	20.451	110.94
		4183	836.6	19.271	84.55
		4233	846.6	20.191	104.5
	HSDPA	4132	826.4	19.541	89.97
		4183	836.6	19.081	80.93
		4233	846.6	19.881	97.3

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

11.1.2. LTE ERP/EIRP Results

LTE Band 5

Band	BW (MHz)	Mode	RB/RB Size	f (MHz)	ERP / EIRP	
					dBm	mW
LTE5	10	QPSK	1/0	829	20.09	102.09
			1/0	836.5	18.88	77.27
			1/0	844	21.76	149.97
		16QAM	1/0	829	19.89	97.5
			1/0	836.5	17.89	61.52
			1/0	844	20.72	118.03
	5	QPSK	1/0	826.5	20.1	102.33
			1/0	836.5	20.5	112.2
			1/0	846.5	21.5	141.25
		16QAM	1/0	826.5	19.98	99.54
			1/0	836.5	19.75	94.41
			1/0	846.5	19.6	91.2
	3	QPSK	1/0	825.5	19.97	99.31
			1/0	836.5	20.44	110.66
			1/0	847.5	21.4	138.04
		16QAM	1/0	825.5	19.82	95.94
			1/0	836.5	20.36	108.64
			1/0	847.5	21.31	135.21
	1.4	QPSK	1/0	824.7	21.94	156.31
			1/0	836.5	20.8	120.23
			1/0	848.3	21.02	126.47
		16QAM	1/0	824.7	21.75	149.62
			1/0	836.5	19.93	98.4
			1/0	848.3	20.47	111.43

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

11.1.3. ERP/EIRP PLOTS

GSM

Band

GSM 1900

GPRS

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 15I20924
Date: 6/8/2015
Test Engineer: S.Tran
Configuration: EUT Only
Mode: GPRS 1900

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T59 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
1850.20	24.48	V	0.9	8.0	31.59	33.0	-1.4	
1850.20	25.10	H	0.9	8.0	32.21	33.0	-0.8	
Mid Ch								
1880.00	24.16	V	0.9	8.0	31.27	33.0	-1.7	
1880.00	25.20	H	0.9	8.0	32.31	33.0	-0.7	
High Ch								
1909.80	23.54	V	0.9	8.0	30.65	33.0	-2.3	
1909.80	25.65	H	0.9	8.0	32.76	33.0	-0.2	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

WCDMA

Band

Band 2

HSDPA

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT Only (2134042)
Mode: HSDPA B2

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T59 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
1852.40	10.59	V	0.9	8.0	17.70	33.0	-15.3	
1852.40	18.00	H	0.9	8.0	25.11	33.0	-7.9	
Mid Ch								
1880.00	10.22	V	0.9	8.0	17.33	33.0	-15.7	
1880.00	17.06	H	0.9	8.0	24.17	33.0	-8.8	
High Ch								
1907.60	15.80	V	0.9	8.0	22.91	33.0	-10.1	
1907.60	18.77	H	0.9	8.0	25.88	33.0	-7.1	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

Band 2

REL99

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT Only (2134042)
Mode: Rel99 B2

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T59 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
1852.40	12.03	V	0.9	8.0	19.14	33.0	-13.9	
1852.40	19.14	H	0.9	8.0	26.25	33.0	-6.8	
Mid Ch								
1880.00	11.16	V	0.9	8.0	18.27	33.0	-14.7	
1880.00	18.42	H	0.9	8.0	25.53	33.0	-7.5	
High Ch								
1907.60	17.21	V	0.9	8.0	24.32	33.0	-8.7	
1907.60	19.50	H	0.9	8.0	26.61	33.0	-6.4	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

Band 5

HSDPA

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 15I20924
Date: 06/08/15
Test Engineer: D. Mun
Configuration: X-pos EUT
Mode: WCDMA Band 5 HSDPA

Test Equipment:
Receiving: Sunol T185, and 3m Chamber C N-type Cable
Substitution: Dipole T416, 6ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
826.40	13.32	V	0.9	0.0	12.42	38.5	-26.0	
826.40	20.44	H	0.9	0.0	19.54	38.5	-18.9	
Mid Ch								
836.60	13.81	V	0.9	0.0	12.91	38.5	-25.5	
836.60	19.98	H	0.9	0.0	19.08	38.5	-19.4	
High Ch								
846.60	14.05	V	0.9	0.0	13.15	38.5	-25.3	
846.60	20.78	H	0.9	0.0	19.88	38.5		

Rev. 3.17.11
Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

Band 5

REL99

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 15I20924
Date: 06/08/15
Test Engineer: D. Mun
Configuration: X-pos EUT
Mode: REL99 B5 FUND

Test Equipment:
Receiving: Sunol T185, and 3m Chamber C N-type Cable
Substitution: Dipole T416, 6ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
826.40	13.75	V	0.9	0.0	12.85	38.5	-25.6	
826.40	21.35	H	0.9	0.0	20.45	38.5	-18.0	
Mid Ch								
836.60	14.11	V	0.9	0.0	13.21	38.5	-25.2	
836.60	20.17	H	0.9	0.0	19.27	38.5	-19.2	
High Ch								
846.60	14.38	V	0.9	0.0	13.48	38.5	-25.0	
846.60	21.09	H	0.9	0.0	20.19	38.5	-18.3	

Rev. 3.17.11
Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

LTE Band 5

Band

LTE5

10MHz

16QAM

High Frequency Substitution Measurement
UL Verification Services, Inc.

Company: Samsung
Project #: 15I20924
Date: 6/8/2015
Test Engineer: D. Mun
Configuration: X-pos EUT
Location: Chamber C
Mode: LTE_16QAM Band 5 Fundamentals, 10MHz Bandwidth

Test Equipment:
Receiving: Hybrid T185, and Chamber C SMA Cables
Substitution: Dipole T416, 6ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
829.00	12.61	V	0.9	0.0	11.71	38.5	-26.8	
829.00	20.79	H	0.9	0.0	19.89	38.5	-18.6	
Mid Ch								
836.50	12.68	V	0.9	0.0	11.78	38.5	-26.7	
836.50	18.79	H	0.9	0.0	17.89	38.5	-20.6	
High Ch								
844.00	13.39	V	0.9	0.0	12.49	38.5	-26.0	
844.00	21.62	H	0.9	0.0	20.72	38.5	-17.8	

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

LTE5

10MHz

QPSK

High Frequency Substitution Measurement
UL Verification Services, Inc.

Company: Samsung
Project #: 15I20924
Date: 4/24/2015
Test Engineer: D. Mun
Configuration: X-pos EUT
Location: Chamber C
Mode: LTE_QPSK Band 5 Fundamentals, 10 MHz Bandwidth

Test Equpment:
Receiving: Hybrid T185, and Chamber C SMA Cables
Substitution: Dipole T416, 6ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
829.00	13.52	V	0.9	0.0	12.62	38.5	-25.9	
829.00	20.99	H	0.9	0.0	20.09	38.5	-18.4	
Mid Ch								
836.50	13.68	V	0.9	0.0	12.78	38.5	-25.7	
836.50	19.78	H	0.9	0.0	18.88	38.5	-19.6	
High Ch								
844.00	14.05	V	0.9	0.0	13.15	38.5	-25.4	
844.00	22.66	H	0.9	0.0	21.76	38.5	-16.7	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

LTE5

5MHz

16QAM

High Frequency Substitution Measurement
UL Verification Services, Inc.

Company: Samsung
Project #: 15I20924
Date: 6/8/2015
Test Engineer: D. Mun
Configuration: X-pos EUT
Location: Chamber C
Mode: LTE_16QAM Band 5 Fundamentals, 5MHz Bandwidth

Test Equipment:
Receiving: Hybrid T185, and Chamber C SMA Cables
Substitution: Dipole T416, 6ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.50	13.70	V	0.9	0.0	12.80	38.5	-25.7	
826.50	20.88	H	0.9	0.0	19.98	38.5	-18.5	
Mid Ch								
836.50	14.46	V	0.9	0.0	13.56	38.5	-24.9	
836.50	20.65	H	0.9	0.0	19.75	38.5	-18.8	
High Ch								
846.50	13.82	V	0.9	0.0	12.92	38.5	-25.6	
846.50	20.50	H	0.9	0.0	19.60	38.5	-18.9	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

LTE5

5MHz

QPSK

High Frequency Substitution Measurement
UL Verification Services, Inc.

Company: Samsung
Project #: 15I20924
Date: 6/8/2015
Test Engineer: D. Mun
Configuration: X-pos EUT
Location: Chamber C
Mode: LTE_QPSK Band 5 Fundamentals, 5MHz Bandwidth

Test Equpment:
Receiving: Hybrid T185, and Chamber C SMA Cables
Substitution: Dipole T416, 6ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.50	13.82	V	0.9	0.0	12.92	38.5	-25.6	
826.50	21.00	H	0.9	0.0	20.10	38.5	-18.4	
Mid Ch								
836.50	15.19	V	0.9	0.0	14.29	38.5	-24.2	
836.50	21.40	H	0.9	0.0	20.50	38.5	-18.0	
High Ch								
846.50	15.74	V	0.9	0.0	14.84	38.5	-23.7	
846.50	22.40	H	0.9	0.0	21.50	38.5	-17.0	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

LTE5

3MHz

16QAM

High Frequency Substitution Measurement
UL Verification Services, Inc.

Company: Samsung
Project #: 15I20924
Date: 6/8/2015
Test Engineer: D. Mun
Configuration: X-pos EUT
Location: Chamber C
Mode: LTE_16QAM Band 5 Fundamentals, 3MHz Bandwidth

Test Equpment:
Receiving: Hybrid T185, and Chamber C SMA Cables
Substitution: Dipole T416, 6ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
825.50	13.50	V	0.9	0.0	12.60	38.5	-25.9	
825.50	20.72	H	0.9	0.0	19.82	38.5	-18.7	
Mid Ch								
836.50	13.84	V	0.9	0.0	12.94	38.5	-25.6	
836.50	21.26	H	0.9	0.0	20.36	38.5	-18.1	
High Ch								
847.50	14.15	V	0.9	0.0	13.25	38.5	-25.3	
847.50	22.21	H	0.9	0.0	21.31	38.5	-17.2	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

LTE5

3MHz

QPSK

High Frequency Substitution Measurement
UL Verification Services, Inc.

Company: Samsung
Project #: 15I20924
Date: 6/8/2015
Test Engineer: D. Mun
Configuration: X-pos EUT
Location: Chamber C
Mode: LTE_QPSK Band 5 Fundamentals, 3MHz Bandwidth

Test Equpment:
Receiving: Hybrid T185, and Chamber C SMA Cables
Substitution: Dipole T416, 6ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
825.50	13.70	V	0.9	0.0	12.80	38.5	-25.7	
825.50	20.87	H	0.9	0.0	19.97	38.5	-18.5	
Mid Ch								
836.50	14.23	V	0.9	0.0	13.33	38.5	-25.2	
836.50	21.34	H	0.9	0.0	20.44	38.5	-18.1	
High Ch								
847.50	15.62	V	0.9	0.0	14.72	38.5	-23.8	
847.50	22.30	H	0.9	0.0	21.40	38.5	-17.1	

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

LTE5

1.4MHz

16QAM

High Frequency Substitution Measurement
UL Verification Services, Inc.

Company: Samsung
Project #: 15I20924
Date: 6/8/2015
Test Engineer: D. Mun
Configuration: X-pos EUT
Location: Chamber C
Mode: LTE_16QAM Band 5 Fundamentals, 1.4MHz Bandwidth

Test Equpment:
Receiving: Hybrid T185, and Chamber C SMA Cables
Substitution: Dipole T416, 6ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
824.70	15.39	V	0.9	0.0	14.49	38.5	-24.0	
824.70	22.65	H	0.9	0.0	21.75	38.5	-16.8	
Mid Ch								
836.50	14.59	V	0.9	0.0	13.69	38.5	-24.8	
836.50	20.83	H	0.9	0.0	19.93	38.5	-18.6	
High Ch								
848.30	14.65	V	0.9	0.0	13.75	38.5	-24.8	
848.30	21.37	H	0.9	0.0	20.47	38.5	-18.0	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

LTE5

1.4MHz

QPSK

High Frequency Substitution Measurement
UL Verification Services, Inc.

Company: Samsung
Project #: 15I20924
Date: 6/8/2015
Test Engineer: D. Mun
Configuration: X-pos EUT
Location: Chamber C
Mode: LTE_QPSK Band 5 Fundamentals, 1.4MHz Bandwidth

Test Equpment:
Receiving: Hybrid T185, and Chamber C SMA Cables
Substitution: Dipole T416, 6ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
824.70	15.74	V	0.9	0.0	14.84	38.5	-23.7	
824.70	22.84	H	0.9	0.0	21.94	38.5	-16.6	
Mid Ch								
836.50	15.51	V	0.9	0.0	14.61	38.5	-23.9	
836.50	21.70	H	0.9	0.0	20.80	38.5	-17.7	
High Ch								
848.30	15.28	V	0.9	0.0	14.38	38.5	-24.1	
848.30	21.92	H	0.9	0.0	21.02	38.5	-17.5	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

11.2. 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

GSM, WCDMA, and LTE

RESULTS

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

11.2.1. SPURIOUS RADIATION PLOTS

GSM

Band

GSM 1900

GPRS

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/8/2015
Test Engineer: S.Tran
Configuration: EUT Only (2134042)
Location: Chamber C
Mode: GPRS 1900 MHz Harmonics

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1850.2									
3700.40	-22.7	V	3.0	35.9	1.0	-57.6	-13.0	-44.6	
5550.60	-17.5	V	3.0	35.5	1.0	-52.0	-13.0	-39.0	
7400.80	-8.9	V	3.0	35.7	1.0	-43.6	-13.0	-30.6	
3700.40	-22.4	H	3.0	35.9	1.0	-57.3	-13.0	-44.3	
5550.60	-18.3	H	3.0	35.5	1.0	-52.8	-13.0	-39.8	
7400.80	-11.0	H	3.0	35.7	1.0	-45.8	-13.0	-32.8	
Mid Ch, 1880									
3760.00	-23.3	V	3.0	35.8	1.0	-58.1	-13.0	-45.1	
5640.00	-19.1	V	3.0	35.5	1.0	-53.6	-13.0	-40.6	
7520.00	-16.3	V	3.0	35.7	1.0	-51.1	-13.0	-38.1	
3760.00	-21.1	H	3.0	35.8	1.0	-55.9	-13.0	-42.9	
5640.00	-20.4	H	3.0	35.5	1.0	-54.8	-13.0	-41.8	
7520.00	-16.3	H	3.0	35.7	1.0	-51.1	-13.0	-38.1	
High Ch, 1909.8									
3819.60	-23.3	V	3.0	35.8	1.0	-58.1	-13.0	-45.1	
5729.40	-14.3	V	3.0	35.5	1.0	-48.8	-13.0	-35.8	
7639.20	-16.8	V	3.0	35.8	1.0	-51.5	-13.0	-38.5	
3819.60	-21.9	H	3.0	35.8	1.0	-56.6	-13.0	-43.6	
5729.40	-17.8	H	3.0	35.5	1.0	-52.3	-13.0	-39.3	
7639.20	-15.4	H	3.0	35.8	1.0	-50.1	-13.0	-37.1	

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

WCDMA

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT + Charger + HS
Location: Chamber C
Mode: HSDPA Band 2 Harmonics

Band

Band 2

HSDPA

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1852.4									
3704.80	-20.6	V	3.0	35.9	1.0	-55.5	-13.0	-42.5	
5557.20	-17.6	V	3.0	35.5	1.0	-52.1	-13.0	-39.1	
7409.60	-14.2	V	3.0	35.7	1.0	-49.0	-13.0	-36.0	
3704.80	-19.4	H	3.0	35.9	1.0	-54.3	-13.0	-41.3	
5557.20	-16.9	H	3.0	35.5	1.0	-51.3	-13.0	-38.3	
7409.60	-13.4	H	3.0	35.7	1.0	-48.1	-13.0	-35.1	
Mid Ch, 1880									
3760.00	-20.8	V	3.0	35.8	1.0	-55.6	-13.0	-42.6	
5640.00	-17.0	V	3.0	35.5	1.0	-51.4	-13.0	-38.4	
7520.00	-13.7	V	3.0	35.7	1.0	-48.5	-13.0	-35.5	
3760.00	-19.8	H	3.0	35.8	1.0	-54.7	-13.0	-41.7	
5640.00	-16.3	H	3.0	35.5	1.0	-50.8	-13.0	-37.8	
7520.00	-12.6	H	3.0	35.7	1.0	-47.3	-13.0	-34.3	
High Ch, 1907.6									
3815.20	-20.2	V	3.0	35.8	1.0	-55.0	-13.0	-42.0	
5722.80	-16.2	V	3.0	35.5	1.0	-50.7	-13.0	-37.7	
7630.40	-13.4	V	3.0	35.8	1.0	-48.2	-13.0	-35.2	
3815.20	-20.7	H	3.0	35.8	1.0	-55.5	-13.0	-42.5	
5722.80	-15.5	H	3.0	35.5	1.0	-50.0	-13.0	-37.0	
7630.40	-12.6	H	3.0	35.8	1.0	-47.3	-13.0	-34.3	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT + Charger + HS
Location: Chamber C
Mode: Rel99 Band 2 Harmonics

Band

Band 2

REL99

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1852.4									
3704.80	-19.9	V	3.0	35.9	1.0	-54.7	-13.0	-41.7	
5557.20	-16.7	V	3.0	35.5	1.0	-51.2	-13.0	-38.2	
7409.60	-13.3	V	3.0	35.7	1.0	-48.0	-13.0	-35.0	
3704.80	-18.7	H	3.0	35.9	1.0	-53.5	-13.0	-40.5	
5557.20	-16.4	H	3.0	35.5	1.0	-50.9	-13.0	-37.9	
7409.60	-12.6	H	3.0	35.7	1.0	-47.3	-13.0	-34.3	
Mid Ch, 1880									
3760.00	-20.4	V	3.0	35.8	1.0	-55.2	-13.0	-42.2	
5640.00	-16.3	V	3.0	35.5	1.0	-50.8	-13.0	-37.8	
7520.00	-13.0	V	3.0	35.7	1.0	-47.7	-13.0	-34.7	
3760.00	-19.8	H	3.0	35.8	1.0	-54.6	-13.0	-41.6	
5640.00	-15.7	H	3.0	35.5	1.0	-50.2	-13.0	-37.2	
7520.00	-12.1	H	3.0	35.7	1.0	-46.9	-13.0	-33.9	
High Ch, 1907.6									
3815.20	-20.0	V	3.0	35.8	1.0	-54.8	-13.0	-41.8	
5722.80	-14.2	V	3.0	35.5	1.0	-48.7	-13.0	-35.7	
7630.40	-12.5	V	3.0	35.8	1.0	-47.2	-13.0	-34.2	
3815.20	-20.3	H	3.0	35.8	1.0	-55.1	-13.0	-42.1	
5722.80	-14.8	H	3.0	35.5	1.0	-49.3	-13.0	-36.3	
7630.40	-11.8	H	3.0	35.8	1.0	-46.5	-13.0	-33.5	

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

Band 5

HSDPA

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT w/ AC Adapter + Headset
Location: Chamber B
Mode: HSDPA Band 5 Harmonics

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 826.4									
1652.80	-23.7	V	3.0	37.0	1.0	-59.7	-13.0	-46.7	
2479.20	7.8	V	3.0	36.4	1.0	-27.6	-13.0	-14.6	
3305.60	-21.2	V	3.0	36.1	1.0	-56.3	-13.0	-43.3	
1652.80	-23.4	H	3.0	37.0	1.0	-59.4	-13.0	-46.4	
2479.20	8.9	H	3.0	36.4	1.0	-26.5	-13.0	-13.5	
3305.60	-22.1	H	3.0	36.1	1.0	-57.2	-13.0	-44.2	
Mid Ch, 836.6									
1673.20	-21.3	V	3.0	37.0	1.0	-57.3	-13.0	-44.3	
2509.80	4.6	V	3.0	36.4	1.0	-30.8	-13.0	-17.8	
3346.40	-21.3	V	3.0	36.1	1.0	-56.4	-13.0	-43.4	
1673.20	-18.1	H	3.0	37.0	1.0	-54.1	-13.0	-41.1	
2509.80	6.6	H	3.0	36.4	1.0	-28.8	-13.0	-15.8	
3346.40	-21.7	H	3.0	36.1	1.0	-56.8	-13.0	-43.8	
High Ch, 846.6									
1693.20	-23.5	V	3.0	37.0	1.0	-59.5	-13.0	-46.5	
2539.80	1.9	V	3.0	36.4	1.0	-33.5	-13.0	-20.5	
3386.40	-21.3	V	3.0	36.1	1.0	-56.4	-13.0	-43.4	
1693.20	-24.2	H	3.0	37.0	1.0	-60.2	-13.0	-47.2	
2539.80	6.2	H	3.0	36.4	1.0	-29.2	-13.0	-16.2	
3386.40	-21.5	H	3.0	36.1	1.0	-56.6	-13.0	-43.6	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

Band 5

REL99

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT w/ AC Adapter + Headset
Location: Chamber B
Mode: Rel99 Band 5 Harmonics

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 826.4									
1652.80	-23.3	V	3.0	37.0	1.0	-59.4	-13.0	-46.4	
2479.20	8.0	V	3.0	36.4	1.0	-27.5	-13.0	-14.5	
3305.60	-20.9	V	3.0	36.1	1.0	-56.1	-13.0	-43.1	
1652.80	-23.1	H	3.0	37.0	1.0	-59.1	-13.0	-46.1	
2479.20	9.2	H	3.0	36.4	1.0	-26.2	-13.0	-13.2	
3305.60	-21.3	H	3.0	36.1	1.0	-56.4	-13.0	-43.4	
Mid Ch, 836.6									
1673.20	-21.0	V	3.0	37.0	1.0	-57.0	-13.0	-44.0	
2509.80	4.9	V	3.0	36.4	1.0	-30.5	-13.0	-17.5	
3346.40	-20.9	V	3.0	36.1	1.0	-56.0	-13.0	-43.0	
1673.20	-17.7	H	3.0	37.0	1.0	-53.7	-13.0	-40.7	
2509.80	6.9	H	3.0	36.4	1.0	-28.5	-13.0	-15.5	
3346.40	-21.2	H	3.0	36.1	1.0	-56.3	-13.0	-43.3	
High Ch, 846.6									
1693.20	-23.0	V	3.0	37.0	1.0	-58.9	-13.0	-45.9	
2539.80	2.1	V	3.0	36.4	1.0	-33.3	-13.0	-20.3	
3386.40	-20.6	V	3.0	36.1	1.0	-55.7	-13.0	-42.7	
1693.20	-23.7	H	3.0	37.0	1.0	-59.7	-13.0	-46.7	
2539.80	6.6	H	3.0	36.4	1.0	-28.9	-13.0	-15.9	
3386.40	-21.2	H	3.0	36.1	1.0	-56.3	-13.0	-43.3	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

LTE Band 5

Band

LTE5

10MHz

16QAM

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT/ AC Charger/ Headset
Location: Chamber C
Mode: LTE_16QAM Band 5 Harmonics, 10MHz Bandwidth

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 829									
1658.00	-28.9	V	3.0	37.0	1.0	-65.0	-13.0	-52.0	
2487.00	-21.9	V	3.0	36.4	1.0	-57.3	-13.0	-44.3	
3316.00	-21.8	V	3.0	36.1	1.0	-57.0	-13.0	-44.0	
1658.00	-28.5	H	3.0	37.0	1.0	-64.5	-13.0	-51.5	
2487.00	-18.8	H	3.0	36.4	1.0	-54.2	-13.0	-41.2	
3316.00	-21.5	H	3.0	36.1	1.0	-56.7	-13.0	-43.7	
Mid Ch, 836.5									
1673.00	-28.0	V	3.0	37.0	1.0	-64.0	-13.0	-51.0	
2509.50	-23.7	V	3.0	36.4	1.0	-59.1	-13.0	-46.1	
3346.00	-21.5	V	3.0	36.1	1.0	-56.6	-13.0	-43.6	
1673.00	-27.9	H	3.0	37.0	1.0	-63.9	-13.0	-50.9	
2509.50	-25.7	H	3.0	36.4	1.0	-61.1	-13.0	-48.1	
3346.00	-21.1	H	3.0	36.1	1.0	-56.2	-13.0	-43.2	
High Ch, 844									
1688.00	-28.1	V	3.0	37.0	1.0	-64.1	-13.0	-51.1	
2532.00	-15.9	V	3.0	36.4	1.0	-51.3	-13.0	-38.3	
3376.00	-21.8	V	3.0	36.1	1.0	-56.9	-13.0	-43.9	
1688.00	-28.3	H	3.0	37.0	1.0	-64.2	-13.0	-51.2	
2532.00	-11.2	H	3.0	36.4	1.0	-46.6	-13.0	-33.6	
3376.00	-21.5	H	3.0	36.1	1.0	-56.6	-13.0	-43.6	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT/ AC Charger/ Headset
Location: Chamber C
Mode: LTE_QPSK Band 5 Harmonics, 10MHz Bandwidth

Band LTE5 10MHz QPSK

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 829									
1658.00	-28.8	V	3.0	37.0	1.0	-64.9	-13.0	-51.9	
2487.00	-21.9	V	3.0	36.4	1.0	-57.3	-13.0	-44.3	
3316.00	-21.5	V	3.0	36.1	1.0	-56.6	-13.0	-43.6	
1658.00	-28.3	H	3.0	37.0	1.0	-64.3	-13.0	-51.3	
2487.00	-18.5	H	3.0	36.4	1.0	-53.9	-13.0	-40.9	
3316.00	-21.4	H	3.0	36.1	1.0	-56.5	-13.0	-43.5	
Mid Ch, 836.5									
1673.00	-27.8	V	3.0	37.0	1.0	-63.8	-13.0	-50.8	
2509.50	-23.3	V	3.0	36.4	1.0	-58.7	-13.0	-45.7	
3346.00	-21.3	V	3.0	36.1	1.0	-56.4	-13.0	-43.4	
1673.00	-27.8	H	3.0	37.0	1.0	-63.8	-13.0	-50.8	
2509.50	-26.4	H	3.0	36.4	1.0	-61.8	-13.0	-48.8	
3346.00	-21.3	H	3.0	36.1	1.0	-56.4	-13.0	-43.4	
High Ch, 844									
1688.00	-28.1	V	3.0	37.0	1.0	-64.0	-13.0	-51.0	
2532.00	-15.4	V	3.0	36.4	1.0	-50.8	-13.0	-37.8	
3376.00	-21.4	V	3.0	36.1	1.0	-56.5	-13.0	-43.5	
1688.00	-27.9	H	3.0	37.0	1.0	-63.9	-13.0	-50.9	
2532.00	-10.4	H	3.0	36.4	1.0	-45.8	-13.0	-32.8	
3376.00	-21.4	H	3.0	36.1	1.0	-56.5	-13.0	-43.5	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT/ AC Charger/ Headset
Location: Chamber C
Mode: LTE_16QAM Band 5 Harmonics, 5MHz Bandwidth

Band
LTE5
5MHz
16QAM

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 826.5									
1653.00	-17.5	V	3.0	37.0	1.0	-53.5	-13.0	-40.5	
2479.50	-14.2	V	3.0	36.4	1.0	-49.6	-13.0	-36.6	
3306.00	-21.6	V	3.0	36.1	1.0	-56.8	-13.0	-43.8	
1653.00	-27.0	H	3.0	37.0	1.0	-63.0	-13.0	-50.0	
2479.50	-19.5	H	3.0	36.4	1.0	-54.9	-13.0	-41.9	
3306.00	-21.3	H	3.0	36.1	1.0	-56.5	-13.0	-43.5	
Mid Ch, 836.5									
1673.00	-19.5	V	3.0	37.0	1.0	-55.5	-13.0	-42.5	
2509.50	-14.7	V	3.0	36.4	1.0	-50.2	-13.0	-37.2	
3346.00	-21.0	V	3.0	36.1	1.0	-56.2	-13.0	-43.2	
1673.00	-23.9	H	3.0	37.0	1.0	-59.9	-13.0	-46.9	
2509.50	-15.6	H	3.0	36.4	1.0	-51.0	-13.0	-38.0	
3346.00	-21.8	H	3.0	36.1	1.0	-56.9	-13.0	-43.9	
High Ch, 846.5									
1693.00	-21.5	V	3.0	37.0	1.0	-57.5	-13.0	-44.5	
2539.50	-23.6	V	3.0	36.4	1.0	-59.0	-13.0	-46.0	
3386.00	-21.0	V	3.0	36.1	1.0	-56.1	-13.0	-43.1	
1693.00	-20.5	H	3.0	37.0	1.0	-56.5	-13.0	-43.5	
2539.50	-25.4	H	3.0	36.4	1.0	-60.8	-13.0	-47.8	
3386.00	-21.7	H	3.0	36.1	1.0	-56.8	-13.0	-43.8	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT/ AC Charger/ Headset
Location: Chamber C
Mode: LTE_QPSK Band 5 Harmonics, 5MHz Bandwidth

Band LTE5 5MHz QPSK

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 826.5									
1653.00	-16.4	V	3.0	37.0	1.0	-52.5	-13.0	-39.5	
2479.50	-14.1	V	3.0	36.4	1.0	-49.5	-13.0	-36.5	
3306.00	-21.2	V	3.0	36.1	1.0	-56.3	-13.0	-43.3	
1653.00	-26.3	H	3.0	37.0	1.0	-62.3	-13.0	-49.3	
2479.50	-18.8	H	3.0	36.4	1.0	-54.2	-13.0	-41.2	
3306.00	-21.7	H	3.0	36.1	1.0	-56.8	-13.0	-43.8	
Mid Ch, 836.5									
1673.00	-19.6	V	3.0	37.0	1.0	-55.6	-13.0	-42.6	
2509.50	-14.2	V	3.0	36.4	1.0	-49.6	-13.0	-36.6	
3346.00	-20.7	V	3.0	36.1	1.0	-55.8	-13.0	-42.8	
1673.00	-22.8	H	3.0	37.0	1.0	-58.8	-13.0	-45.8	
2509.50	-15.5	H	3.0	36.4	1.0	-50.9	-13.0	-37.9	
3346.00	-20.5	H	3.0	36.1	1.0	-55.7	-13.0	-42.7	
High Ch, 846.5									
1693.00	-21.0	V	3.0	37.0	1.0	-57.0	-13.0	-44.0	
2539.50	-23.3	V	3.0	36.4	1.0	-58.7	-13.0	-45.7	
3386.00	-21.2	V	3.0	36.1	1.0	-56.3	-13.0	-43.3	
1693.00	-20.5	H	3.0	37.0	1.0	-56.5	-13.0	-43.5	
2539.50	-25.4	H	3.0	36.4	1.0	-60.8	-13.0	-47.8	
3386.00	-21.3	H	3.0	36.1	1.0	-56.4	-13.0	-43.4	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT/ AC Charger/ Headset
Location: Chamber C
Mode: LTE_16QAM Band 5 Harmonics, 3MHz Bandwidth

Band
LTE5
3MHz
16QAM

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 825.5									
1651.00	-17.6	V	3.0	37.0	1.0	-53.6	-13.0	-40.6	
2476.50	-2.4	V	3.0	36.4	1.0	-37.8	-13.0	-24.8	
3302.00	-21.6	V	3.0	36.2	1.0	-56.8	-13.0	-43.8	
1651.00	-26.8	H	3.0	37.0	1.0	-62.8	-13.0	-49.8	
2476.50	-19.4	H	3.0	36.4	1.0	-54.8	-13.0	-41.8	
3302.00	-21.3	H	3.0	36.2	1.0	-56.4	-13.0	-43.4	
Mid Ch, 836.5									
1673.00	-20.1	V	3.0	37.0	1.0	-56.1	-13.0	-43.1	
2509.50	-13.9	V	3.0	36.4	1.0	-49.3	-13.0	-36.3	
3346.00	-20.3	V	3.0	36.1	1.0	-55.4	-13.0	-42.4	
1673.00	-25.2	H	3.0	37.0	1.0	-61.2	-13.0	-48.2	
2509.50	-17.5	H	3.0	36.4	1.0	-52.9	-13.0	-39.9	
3346.00	-21.3	H	3.0	36.1	1.0	-56.4	-13.0	-43.4	
High Ch, 847.5									
1695.00	-21.2	V	3.0	37.0	1.0	-57.2	-13.0	-44.2	
2542.50	-0.7	V	3.0	36.4	1.0	-36.1	-13.0	-23.1	
3390.00	-21.5	V	3.0	36.1	1.0	-56.6	-13.0	-43.6	
1695.00	-28.0	H	3.0	37.0	1.0	-63.9	-13.0	-50.9	
2542.50	-14.7	H	3.0	36.4	1.0	-50.1	-13.0	-37.1	
3390.00	-21.4	H	3.0	36.1	1.0	-56.5	-13.0	-43.5	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Band

LTE5

3MHz

QPSK

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT/ AC Charger/ Headset
Location: Chamber C
Mode: LTE_QPSK Band 5 Harmonics, 3MHz Bandwidth

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 825.5									
1651.00	-16.4	V	3.0	37.0	1.0	-52.4	-13.0	-39.4	
2476.50	-1.6	V	3.0	36.4	1.0	-37.0	-13.0	-24.0	
3302.00	-21.2	V	3.0	36.2	1.0	-56.3	-13.0	-43.3	
1651.00	-26.3	H	3.0	37.0	1.0	-62.3	-13.0	-49.3	
2476.50	-18.8	H	3.0	36.4	1.0	-54.2	-13.0	-41.2	
3302.00	-21.7	H	3.0	36.2	1.0	-56.8	-13.0	-43.8	
Mid Ch, 836.5									
1673.00	-19.5	V	3.0	37.0	1.0	-55.5	-13.0	-42.5	
2509.50	-13.3	V	3.0	36.4	1.0	-48.7	-13.0	-35.7	
3346.00	-19.3	V	3.0	36.1	1.0	-54.4	-13.0	-41.4	
1673.00	-24.7	H	3.0	37.0	1.0	-60.7	-13.0	-47.7	
2509.50	-16.6	H	3.0	36.4	1.0	-52.0	-13.0	-39.0	
3346.00	-20.3	H	3.0	36.1	1.0	-55.4	-13.0	-42.4	
High Ch, 847.5									
1695.00	-20.9	V	3.0	37.0	1.0	-56.9	-13.0	-43.9	
2542.50	-0.4	V	3.0	36.4	1.0	-35.8	-13.0	-22.8	
3390.00	-21.2	V	3.0	36.1	1.0	-56.2	-13.0	-43.2	
1695.00	-26.6	H	3.0	37.0	1.0	-62.6	-13.0	-49.6	
2542.50	-14.2	H	3.0	36.4	1.0	-49.6	-13.0	-36.6	
3390.00	-21.1	H	3.0	36.1	1.0	-56.2	-13.0	-43.2	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT/ AC Charger/ Headset
Location: Chamber C
Mode: LTE_16QAM Band 5 Harmonics, 1.4MHz Bandwidth

Band
LTE5
1.4MHz
16QAM

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 824.7									
1649.40	-17.6	V	3.0	37.0	1.0	-53.6	-13.0	-40.6	
2474.10	-2.5	V	3.0	36.4	1.0	-37.9	-13.0	-24.9	
3298.80	-21.4	V	3.0	36.2	1.0	-56.6	-13.0	-43.6	
1649.40	-26.8	H	3.0	37.0	1.0	-62.8	-13.0	-49.8	
2474.10	-19.4	H	3.0	36.4	1.0	-54.9	-13.0	-41.9	
3298.80	-21.3	H	3.0	36.2	1.0	-56.5	-13.0	-43.5	
Mid Ch, 836.5									
1673.00	-20.1	V	3.0	37.0	1.0	-56.1	-13.0	-43.1	
2509.50	-14.0	V	3.0	36.4	1.0	-49.4	-13.0	-36.4	
3346.00	-20.3	V	3.0	36.1	1.0	-55.4	-13.0	-42.4	
1673.00	-25.2	H	3.0	37.0	1.0	-61.2	-13.0	-48.2	
2509.50	-17.3	H	3.0	36.4	1.0	-52.7	-13.0	-39.7	
3346.00	-21.3	H	3.0	36.1	1.0	-56.5	-13.0	-43.5	
High Ch, 848.3									
1696.60	-21.2	V	3.0	37.0	1.0	-57.2	-13.0	-44.2	
2544.90	-0.6	V	3.0	36.4	1.0	-36.1	-13.0	-23.1	
3393.20	-21.5	V	3.0	36.1	1.0	-56.6	-13.0	-43.6	
1696.60	-27.4	H	3.0	37.0	1.0	-63.4	-13.0	-50.4	
2544.90	-14.5	H	3.0	36.4	1.0	-49.9	-13.0	-36.9	
3393.20	-21.2	H	3.0	36.1	1.0	-56.3	-13.0	-43.3	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15I20924
Date: 6/5/2015
Test Engineer: R.A
Configuration: EUT/ AC Charger/ Headset
Location: Chamber C
Mode: LTE_QPSK Band 5 Harmonics, 1.4MHz Bandwidth

Band LTE5 1.4MHz QPSK

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 824.7									
1649.40	-16.4	V	3.0	37.0	1.0	-52.4	-13.0	-39.4	
2474.10	-1.6	V	3.0	36.4	1.0	-37.0	-13.0	-24.0	
3298.80	-21.2	V	3.0	36.2	1.0	-56.4	-13.0	-43.4	
1649.40	-26.3	H	3.0	37.0	1.0	-62.3	-13.0	-49.3	
2474.10	-18.9	H	3.0	36.4	1.0	-54.3	-13.0	-41.3	
3298.80	-21.8	H	3.0	36.2	1.0	-57.0	-13.0	-44.0	
Mid Ch, 836.5									
1673.00	-19.7	V	3.0	37.0	1.0	-55.7	-13.0	-42.7	
2509.50	-13.3	V	3.0	36.4	1.0	-48.7	-13.0	-35.7	
3346.00	-19.4	V	3.0	36.1	1.0	-54.5	-13.0	-41.5	
1673.00	-24.6	H	3.0	37.0	1.0	-60.5	-13.0	-47.5	
2509.50	-16.6	H	3.0	36.4	1.0	-52.0	-13.0	-39.0	
3346.00	-20.3	H	3.0	36.1	1.0	-55.5	-13.0	-42.5	
High Ch, 848.3									
1696.60	-20.8	V	3.0	37.0	1.0	-56.8	-13.0	-43.8	
2544.90	-0.3	V	3.0	36.4	1.0	-35.8	-13.0	-22.8	
3393.20	-21.2	V	3.0	36.1	1.0	-56.3	-13.0	-43.3	
1696.60	-26.6	H	3.0	37.0	1.0	-62.5	-13.0	-49.5	
2544.90	-14.1	H	3.0	36.4	1.0	-49.5	-13.0	-36.5	
3393.20	-21.2	H	3.0	36.1	1.0	-56.2	-13.0	-43.2	

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701H
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.