



CERTIFICATION TEST REPORT

Report Number. : 12440876-E1V2

Applicant : Samsung Electronics Co., Ltd.
129 Samsung-Ro, Yeongtong-Gu,
Suwon-Si, Gyeonggi-Do, 16677, Korea

Models : SM-A750FN/DS, SM-A750FN and SM-A750X

FCC ID : A3LSMA750FN

EUT Description : GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac, ANT+
and NFC

Test Standard(s) : FCC CFR47 PART 22 SUBPART H
FCC CFR47 PART 24 SUBPART E
FCC CFR47 PART 27 SUBPART M

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Revision History

Rev.	Issue Date	Revisions	Revised By
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1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	Samsung Electronics Co., Ltd. 129 Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 16677, Korea		
Models	SM-A750FN/DS, SM-A750FN and SM-A750X		
FCC ID	A3LSMA750FN		
EUT Description	GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac, ANT+ and NFC		
Date Tested (Spotcheck)	AUGUST 28, 2018 to AUGUST 30, 2018		
Date Tested (Original)	AUGUST 06, 2018 to AUGUST 15, 2018		
Applicable Standards	FCC CFR 47 PART 22H, 24E, and 27M		
Test Results	COMPLIES		
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 (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.			
Approved & Released By:		Reviewed By:	
			
Dan Corona Operations Leader UL Verification Services Inc.		Steven Tran Project Engineer UL Verification Services Inc.	

2. INTRODUCTION OF TEST DATA REUSE

2.1. INTRODUCTION

According to the manufacturer, the WLAN, Bluetooth, ANT+ and WWAN hardware of A3LSMA750FN are identical to A3LSMA750GN. In addition A3LSMA750FN digital circuit is identical to A3LSMA750GN. Therefore the following report/data of A3LSMA750FN may be represented from A3LSMA750GN along with the spot check verification data.

- WLAN
- Bluetooth
- ANT+
- NFC
- WWAN

2.2. DEVICES DIFFERENCES

Difference between A3LSMA750FN and A3LSMA750GN:

Samsung Electronics Co., Ltd. hereby declares that between A3LSMA750FN and A3LSMA750GN:

Hardware:

- AP/CP, PMIC, BT/WIFI, Layout, A/W are same.
- The difference is that SM-A750FN/DS don't support 3G B4, LTE B2,4,12,13,17,28,66.

Software:

- UTRA band B4 and EUTRA band B2,4,12,13,17,28,66 disable.
- PROTOCOL part is same.
- MMS, SATK/USATK, SMS, SS, DM, VT, VoLTE feature are same.

Therefore the WLAN, Bluetooth, ANT+, NFC, WWAN report and data of A3LSMA750GN may represent for A3LSMA750FN.

2.1. SPOT CHECK VERIFICATION RESULTS SUMMARY

Spot check verification has been done on device A3LSMA750FN for radiated harmonic spurious. The data from the application has been verified through appropriate spot checks to demonstrate compliance for this device as shown in the summary below.

SM-A750F/DS SPOT CHECK RESULTS							
Technology	Mode	Test Item	Channel	Measured Frequency	SM-A750GN/DS	SM-A750FN/DS	Delta (dB)
					Reading (dBm)	Reading (dBm)	
GSM	GPRS 850	RSE	Mid	2.51GHz	-56.14	-57.8	-1.66
	EGPRS 850	RSE	Low	2.473GHz	-55.82	-54.46	-0.77
	GPRS 1900	RSE	High	7.623GHz	-53.69	-56.9	-1.08
	EGPRS 1900	RSE	Low	7.393GHz	-53.14	-53.85	-0.71
WCDMA	REL99 B5	RSE	Low	3.299GHz	-55.97	-56.31	-0.34
	HSDPA B5	RSE	Low	2.476GHz	-55.67	-55.72	-2.54
	REL99 B2	RSE	Mid	5.667GHz	-53.18	-56.15	-0.48
	HSDPA B2	RSE	High	7.636GHz	-53.43	-51.43	2
LTE 5	QPSK (10MHz)	RSE	Low	3.281GHz	-55.02	-57.48	-2.46
	16QAM (10MHz)	RSE	Mid	3.449GHz	-55.13	-58.14	-3.01
LTE 41	QPSK (20MHz)	RSE	Mid	10.372GHz	-48.98	-50.6	-1.62
	16QAM (20MHz)	RSE	Mid	10.372GHz	-49.01	-49.47	-0.46

Comparison of two models, higher deviation is within 3dB range and all test are under FCC Technical Limits.

3. SPOT CHECK DATA

3.1.1. GSM

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/28/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	GPRS 850MHz
Chamber #:	Chamber K

Mid Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.502	-66.56	Pk	32.3	-35.2	10	-59.46	-13	-46.46	0-360	150	H
2.506	-66.1	Pk	32.3	-35.2	11.2	-57.8	-13	-44.8	0-360	150	V

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/28/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	EGPRS 850MHz
Chamber #:	Chamber K

Low Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.465	-64.6	Pk	32.2	-35.3	10.8	-56.9	-13	-43.9	0-360	150	H
2.461	-65.79	Pk	32.2	-35.4	10.9	-58.09	-13	-45.09	0-360	150	V

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/28/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	GPRS1900MHz
Chamber #:	Chamber K

High Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7.627	-73.86	Pk	35.6	-26.6	10.4	-54.46	-13	-41.46	0-360	150	H
7.612	-73.87	Pk	35.6	-26.6	10.6	-54.27	-13	-41.27	0-360	150	V

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/28/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	EGPRS1900MHz
Chamber #:	Chamber K

Low Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7.395	-73.15	Pk	35.6	-27	10.7	-53.85	-13	-40.85	0-360	150	H
7.38	-72.27	Pk	35.5	-27	10.7	-53.07	-13	-40.07	0-360	150	V

3.1.2. WCDMA

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/28/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	REL99 B5
Chamber #:	Chamber K

Low Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3.298	-66.21	Pk	32.8	-33.4	10.5	-56.31	-13	-43.31	0-360	150	H
3.299	-68.64	Pk	32.8	-33.4	10.9	-58.34	-13	-45.34	0-360	150	V

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/28/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	HSDPA B5
Chamber #:	Chamber K

Low Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.476	-63.95	Pk	32.3	-35.3	10.8	-56.15	-13	-43.15	0-360	150	H
2.473	-66.12	Pk	32.3	-35.3	11	-58.12	-13	-45.12	0-360	150	V

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/28/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	REL99 B2
Chamber #:	Chamber K

Mid Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5.67	-71.52	Pk	34.7	-29.4	10.5	-55.72	-13	-42.72	0-360	150	H
5.672	-72.31	Pk	34.7	-29.4	10.7	-56.31	-13	-43.31	0-360	150	V

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/28/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	HSDPA B2
Chamber #:	Chamber K

High Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7.637	-73.59	Pk	35.6	-26.6	10.4	-54.19	-13	-41.19	0-360	150	H
7.639	-71.03	Pk	35.6	-26.6	10.6	-51.43	-13	-38.43	0-360	150	V

3.1.3. LTE BAND 5

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/29/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	LTE 5 QPSK 10MHz
Chamber #:	Chamber K

Mid Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3.283	-67.48	Pk	32.9	-33.7	10.8	-57.48	-13	-44.48	0-360	150	H
3.275	-67.98	Pk	32.9	-33.5	11	-57.58	-13	-44.58	0-360	150	V

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/29/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	LTE 5 16QAM 10MHz
Chamber #:	Chamber K

Low Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3.449	-68.64	Pk	32.6	-33.2	11.1	-58.14	-13	-45.14	0-360	150	H
3.448	-68.5	Pk	32.6	-33.2	11.3	-57.8	-13	-44.8	0-360	150	V

3.1.4. LTE BAND 41

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/29/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	LTE 41 QPSK 20MHz
Chamber #:	Chamber K

Mid Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
10.369	-74.9	Pk	37.4	-23.5	10.4	-50.6	-13	-37.6	0-360	150	H
10.333	-74.37	Pk	37.4	-23.7	10.9	-49.77	-13	-36.77	0-360	150	V

Company:	SAMSUNG ELECTRONICS CO., LTD.
Project #:	12440876
Date:	8/29/18
Test Engineer:	16869 OG
Configuration:	EUT+ Support Equipment
Mode:	LTE 41 16QAM 20MHz
Chamber #:	Chamber K

Mid Channel											
Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Harmonic Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
10.373	-73.67	Pk	37.4	-23.5	10.3	-49.47	-13	-36.47	0-360	150	H
10.372	-75.36	Pk	37.4	-23.5	10.5	-50.96	-13	-37.96	0-360	150	V

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.26:2015, TIA-603-E, FCC CFR 47 Part 2, Part 22, Part 24, Part 27, Part 90, FCC KDB 971168 D01 v3r1.

5. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, 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	47658 Kato Rd.
☐ Chamber A (IC:2324B-1)	☐ Chamber D (IC:22541-1)	☐ Chamber I (IC: 2324A-5)
☐ Chamber B (IC:2324B-2)	☐ Chamber E (IC:22541-2)	☐ Chamber J (IC: 2324A-6)
☐ Chamber C (IC:2324B-3)	☐ Chamber F (IC:22541-3)	☒ Chamber K (IC: 2324A-1)
	☐ Chamber G (IC:22541-4)	☐ Chamber L (IC: 2324A-3)
	☐ Chamber H (IC:22541-5)	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

6. CALIBRATION AND UNCERTAINTY

6.1. 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.

6.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \\ &\text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

6.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

7. EQUIPMENT UNDER TEST

7.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac, ANT+ and NFC.

7.2. MAXIMUM OUTPUT POWER

ERP/EIRP LIMIT

FCC: §2.1046, §22.913, §24.232, and §27.50

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015/ TIA-603-E Clause 2.2.17

KDB 971168 D01Section 5.6

KDB 412172 D01

$ERP/EIRP = P_{Meas} + GT - LC$

where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as P_{Meas} , typically dBW or dBm);

P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

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

GSM MODES

Part 22 850MHz								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824.2-848.8	GPRS	33.0	-5.95	7.0	24.90	0.309	237.2	237KGXW
	EGPRS	26.9			18.80	0.076	240.8	241KG7W
Part 24 1900MHz								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1850.2-1909.8	GPRS	29.7	2.59	2.0	32.29	1.694	242.4	242KGXW
	EGPRS	25.4			27.99	0.630	245.1	245KG7W

WCDMA MODE

Part 22 Band 5								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
826.4-846.6	REL 99	24.2	-5.95	7.0	16.10	0.041	4153	4M15F9W
	HSDPA	23.2			15.10	0.032	4161	4M16F9W
Part 24 Band 2								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1852.4-1907.6	REL 99	23.4	2.59	2.0	25.99	0.397	4147	4M15F9W
	HSDPA	22.4			24.99	0.316	4165	4M17F9W

LTE BAND 5

Part 22H								
ERP Limit (W)		7.00						
Antenna Gain (dBi)		-5.95						
Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	ERP Average (dBm)	ERP Average (W)	99% BW (kHz)	Emission Designator
1.4	QPSK	824.7	848.3	23.2	15.10	0.032	1090	1M09G7W
	16QAM			22.1	14.00	0.025	1090	1M09D7W
3.0	QPSK	825.5	847.5	23.3	15.20	0.033	2710	2M71G7W
	16QAM			22.1	14.00	0.025	2710	2M71D7W
5.0	QPSK	826.5	846.5	23.1	15.00	0.032	4510	4M51G7W
	16QAM			21.9	13.80	0.024	4500	4M50D7W
10.0	QPSK	829.0	844.0	23.1	15.00	0.032	8980	8M98G7W
	16QAM			22.0	13.90	0.025	8990	8M99D7W

LTE BAND 41

Part 27								
EIRP Limit (W)		2.00						
Antenna Gain (dBi)		-0.31						
Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	99% BW (kHz)	Emission Designator
5.0	QPSK	2498.5	2687.5	23.8	23.49	0.223	4500	4M50G7W
	16QAM			22.6	22.29	0.169	4510	4M51D7W
10.0	QPSK	2501.0	2685.0	23.8	23.49	0.223	8970	8M97G7W
	16QAM			22.8	22.49	0.177	8990	8M99D7W
15.0	QPSK	2503.5	2682.5	23.8	23.49	0.223	13460	13M5G7W
	16QAM			23.2	22.89	0.195	13480	13M5D7W
20.0	QPSK	2506.0	2680.0	23.8	23.49	0.223	17920	17M9G7W
	16QAM			22.7	22.39	0.173	17980	18M0D7W

7.3. SOFTWARE AND FIRMWARE

The test utility software used during testing was A750GN.001

7.4. MAXIMUM ANTENNA GAIN

Please see table below:

LTE Bands	Peak Antenna Gain (dBi)
GSM850, 824-849MHz	-5.95
GSM1900, 1850-1910MHz	2.59
WCDMA Band 2, 1850-1910 MHz	2.59
WCDMA Band 5, 824-849 MHz	-5.95
LTE BAND 5, 824 - 849 MHz	-5.95
LTE BAND 41 (FCC), 2496 - 2690 MHz	-0.31

7.5. WORST-CASE CONFIGURATION AND MODE

The EUT supports LTE Bands of:
Band 5 and Band 41.

The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK and 16QAM modulations. All testing was performed using QPSK, and 16QAM modulations to represent the worst case.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, & Z, and it was determined that X-Axis with AC/DC Adapter and headset was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X-Axis with AC/DC Adapter and headset orientation.

7.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Samsung	EP-TA50EWE	DW3J719AS/A-E	N/A
Earphone	Samsung	N/A	N/A	N/A

I/O CABLES (RF Conducted Test)

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

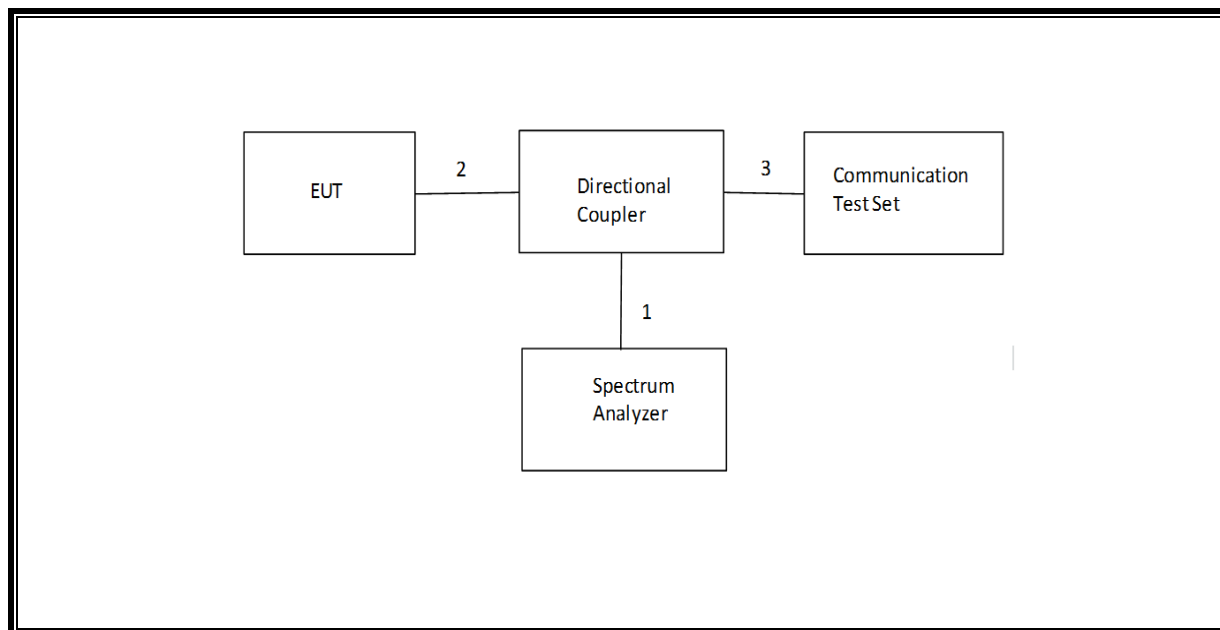
I/O CABLES (RF Radiated Test)

I/O Cable List						
Cable No	Port	# of identic	Connector Type	Cable Type	Cable Length	Remarks
1	USB	1	AC Adapter	Un-shielded	1.2m	No
2	Earphone	1	USB	Un-shielded	1m	No
3	RF In/out	1	Communication Test Set	Un-shielded	2m	No

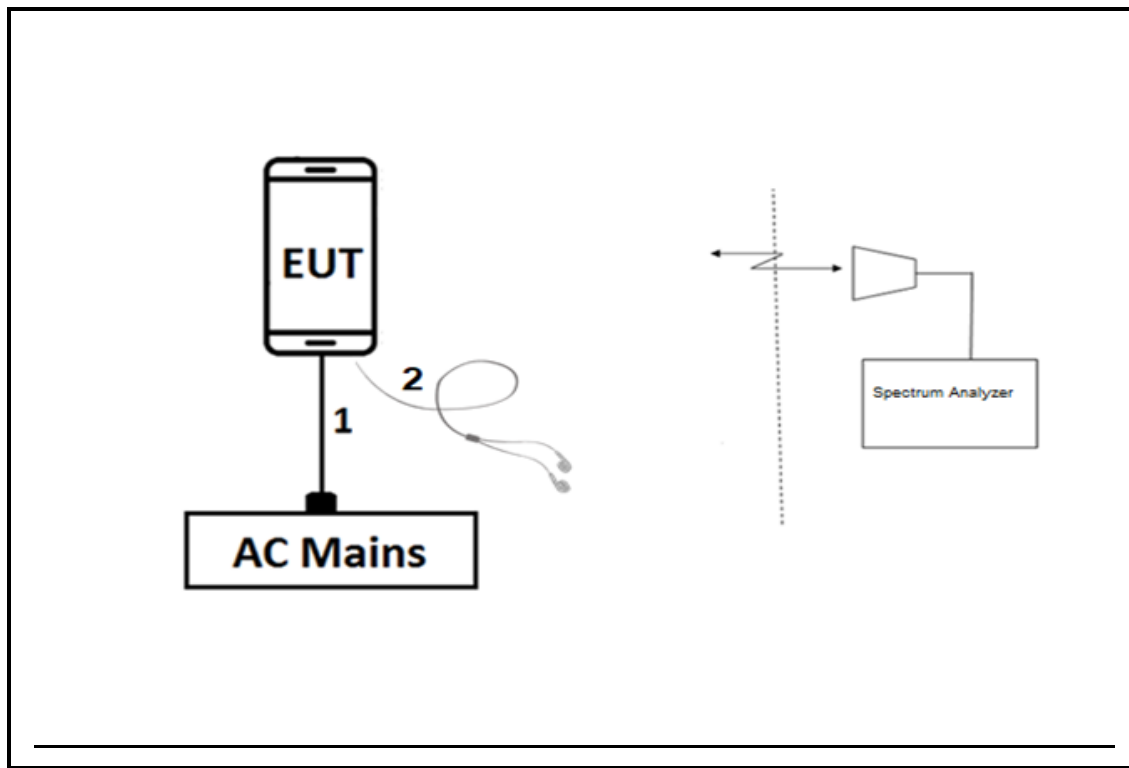
TEST SETUP

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

CONDUCTED TEST SETUP DIAGRAM



RADIATED TEST SETUP DIAGRAM



8. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST (ORIGINAL)					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
Highpass Filter, 2.7 GHz	Micro-Circuits	H2G518G6	T772	07/05/19	07/05/18
Highpass Filter, 1 GHz	Micro-Tronics	HPM18129	T889	02/21/19	02/21/18
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM50114	T1852	07/16/19	07/16/18
Highpass Filter, 4GHz	Micro-Tronics	HPM13351	T1241	07/19/19	07/19/18
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T4942	04/30/19	04/30/18
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	04/30/19	04/30/18
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	T1568	06/21/19	06/21/18
RF Amplifier	AMPLICAL	AMP1G18-35	T5969	06/03/19	06/03/18
Directional Coupler	Mini-Circuits	ZUDC10-183+	T1136	06/18/19	06/18/18
Wideband Communication Test Set, Call Box	R&S	CMW500	T972	05/29/19	05/29/18
Wideband Communication Test Set, Call Box	R&S	CMW500	T1872	02/15/19	02/15/18
Wideband Communication Test Set, Call Box	R&S	CMW500	T949	02/21/19	02/21/18
Chamber, Environmental	Thermotron	SE-600-10-10	T80	02/22/19	02/22/18
Spectrum Analyzer	Agilent (Keysight) Technologies	E4446A	T146	07/18/19	07/18/18
Spectrum Analyzer	Agilent	CCS01178-1C	T200	10/18/18	10/18/17
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1450	02/05/19	02/05/18
EMI TEST RECEIVER	R&S	ESW44	PRE0179522	05/11/19	05/11/18
EMI TEST RECEIVER	R&S	ESW44	PRE0179377	05/03/19	05/03/18
DC power supply, 8 V @ 3 A or 15 V @ 2 A	Agilent / HP	E3610A	None	CNR	CNR
DC power supply 15V	Spresen	XT15-4	T463	CNR	CNR

UL AUTOMATION SOFTWARE			
CLT Software	UL	UL RF	Ver 7.6, November 11, 2017
Power Measurement Software	UL	UL RF	Ver 2.2, June 2017

NOTES:

- Equipment listed above that calibrated during the testing period was set for test after the calibration.
- Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

TEST EQUIPMENT LIST (SPOTCHECK)					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
Highpass Filter, 2.7 GHz	Micro-Circuits	H2G518G6	T772	07/05/19	07/05/18
Highpass Filter, 1 GHz	Micro-Tronics	HPM18129	T889	02/21/19	02/21/18
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM50114	T1852	07/16/19	07/16/18
Highpass Filter, 4GHz	Micro-Tronics	HPM13351	T1241	07/19/19	07/19/18
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T4942	04/30/19	04/30/18
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	04/30/19	04/30/18
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	T1568	06/21/19	06/21/18
RF Amplifier	AMPLICAL	AMP1G18-35	T1569	06/03/19	06/03/18
Wideband Communication Test Set, Call Box	R&S	CMW500	T972	05/29/19	05/29/18
Wideband Communication Test Set, Call Box	R&S	CMW500	T1872	02/15/19	02/15/18
Wideband Communication Test Set, Call Box	R&S	CMW500	T949	02/21/19	02/21/18
Spectrum Analyzer	Agilent (Keysight) Technologies	E4446A	T146	07/18/19	07/18/18
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179377	5/3/2019	5/3/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1450	02/05/19	02/05/18

NOTES:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

9. RF OUTPUT POWER VERIFICATION

EUT includes different power levels for head use configuration and body use configuration and the below tables contain the highest of all configurations average conducted output powers as follows

9.1. GSM

Using CMW500 Communication Test Set

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 > 27 dBm for EGPRS 850/900 > 30 dBm for GPRS1800/1900 > 26 dBm for EGPRS1800/1900
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 > CS 4 (GPRS) and MCS5 (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

RESULT

9.1.1. GSM850

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GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Power	
			1 slot	2 slots
850.0	128	824.2	32.9	30.2
	190	836.6	33.0	30.5
	251	848.8	33.0	30.4

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Power	
			1 slot	2 slots
850.0	128	824.2	26.6	23.9
	190	836.6	26.9	24.2
	251	848.8	26.7	24.2

9.1.2. GSM1900

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GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Power	
			1 slot	2 slots
1900.0	512	1850.2	29.4	26.8
	661	1880.0	29.7	27.2
	810	1909.8	29.7	27.1

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Power	
			1 slot	2 slots
1900.0	512	1850.2	25.1	23.1
	661	1880.0	25.4	23.2
	810	1909.8	25.4	23.3

9.2. WCDMA

TEST PROCEDURE

The transmitter output was connected to the input terminal of Directional Coupler via calibrated coaxial cable. The output coupling terminal of the Directional Coupler was directly connected to a spectrum analyzer while the output through terminal connected to the communication test set via calibrated coaxial cable.

The output power was measured with the spectrum analyzer at the low, middle and high channel in each band.

- Set the spectrum analyzer span wide enough or greater than the modulated signal BW.
- Set a spectrum analyzer at peak detection mode with VBW $\geq$ RBW $\geq$ 26dB BW, typically 5MHz.
- Set a marker to point the corresponding peak value.

REL 99

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c/β_d	8/15

HSDPA REL 5

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	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm 2			
	Bc	2/15	11/15	15/15	15/15
	Bd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	11/15	15/8	15/4
	Bhs	4/15	24/15	30/15	30/15
HSDPA Specific Settings	MPR (dB)	0	0	0.5	0.5
	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= β_{hs}/β_c	30/15			

HSPA REL 6 (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSPA				
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2 kbps RMC				
	HSDPA FRC	H-Set 1				
	HSUPA Test	HSPA				
	Power Control Algorithm	Algorithm 2				Algorithm 1
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	0
	β_{ec}	209/225	12/15	30/15	2/15	5/15
	β_c/β_d	11/15	6/15	15/9	2/15	-
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	β_{ed}	1309/225	94/75	47/15	56/75	47/15
HSDPA Specific Settings	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
HSUPA Specific Settings	A _{hs} = β_{hs}/β_c	30/15				
	E-DPDCCH	6	8	8	5	0
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	12
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	67
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E-TFCIs	5	5	2	5	1
	Reference E-TFCI	11	11	11	11	67
	Reference E-TFCI PO	4	4	4	4	18
	Reference E-TFCI	67	67	92	67	67
	Reference E-TFCI PO	18	18	18	18	18
	Reference E-TFCI	71	71	71	71	71
	Reference E-TFCI PO	23	23	23	23	23
	Reference E-TFCI	75	75	75	75	75
	Reference E-TFCI PO	26	26	26	26	26
	Reference E-TFCI	81	81	81	81	81
	Reference E-TFCI PO	27	27	27	27	27
	Maximum Channelization Codes	2xSF2				SF4

DUAL CARRIER HSDPA (DC-HSDPA (REL 8, CAT 24)

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH_Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table.		
Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

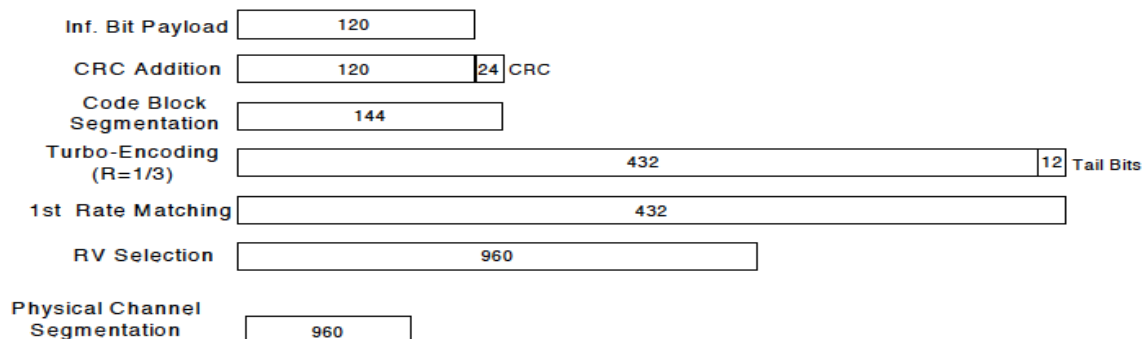


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

The following 4 Sub-tests for HSDPA were completed according to Release 8 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm2			
	β_c	2/15	11/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	β_d (SF)	64			
	β_c/β_d	2/15	12/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
HSDPA Specific Settings	MPR (dB)	0	0	0.5	0.5
	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	$A_{hs} = \beta_{hs} / \beta_c$	30/15			

HSPA+

The following 1 Sub-test was completed according to Release 7 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

Table C.11.1.4: β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM

Sub-test	β_c (Note3)	β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	β_{ed1} : 30/15 β_{ed2} : 30/15	β_{ed3} : 24/15 β_{ed4} : 24/15	3.5	2.5	14	105	105
Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$. Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0). Note 3: DPDCH is not configured, therefore the β_c is set to 1 and $\beta_d = 0$ by default. Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value. Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signalled to use the extrapolation algorithm.											

RESULT

9.2.1. WCDMA BAND5

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Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Average (dBm)
W-CDMA Band 5 (850MHz)	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	24.0
			4183	836.6	N/A	24.2
			4233	846.6	N/A	24.2
	HSDPA	Subtest 1	4132	826.4	0	22.9
			4183	836.6	0	23.1
			4233	846.6	0	23.1
		Subtest 2	4132	826.4	0	22.0
			4183	836.6	0	22.3
			4233	846.6	0	22.3
		Subtest 3	4132	826.4	0.5	20.9
			4183	836.6	0.5	21.2
			4233	846.6	0.5	21.1
		Subtest 4	4132	826.4	0.5	20.9
			4183	836.6	0.5	21.2
			4233	846.6	0.5	21.1
	HSPA (HSDPA & HSUPA)	Subtest 1	4132	826.4	0	20.1
			4183	836.6	0	20.2
			4233	846.6	0	20.2
		Subtest 2	4132	826.4	2	18.1
			4183	836.6	2	18.1
			4233	846.6	2	18.3
		Subtest 3	4132	826.4	1	21.0
			4183	836.6	1	21.3
			4233	846.6	1	21.2
		Subtest 4	4132	826.4	2	18.1
			4183	836.6	2	18.2
			4233	846.6	2	18.2
		Subtest 5	4132	826.4	0	23.0
			4183	836.6	0	23.2
			4233	846.6	0	23.2
	DC-HSDPA	Subtest 1	4132	826.4	0	22.9
			4183	836.6	0	23.1
			4233	846.6	0	23.1
		Subtest 2	4132	826.4	0	22.0
			4183	836.6	0	22.3
			4233	846.6	0	22.3
		Subtest 3	4132	826.4	0.5	20.9
			4183	836.6	0.5	21.2
			4233	846.6	0.5	21.1
		Subtest 4	4132	826.4	0.5	20.9
			4183	836.6	0.5	21.2
			4233	846.6	0.5	21.1

9.2.2. WCDMA BAND2

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Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Average (dBm)
W-CDMA Band 2 (1900MHz)	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	23.1
			9400	1880.0	N/A	23.3
			9538	1907.6	N/A	23.4
	HSDPA	Subtest 1	9262	1852.4	0	22.2
			9400	1880.0	0	22.3
			9538	1907.6	0	22.4
		Subtest 2	9262	1852.4	0	22.2
			9400	1880.0	0	22.3
			9538	1907.6	0	22.4
		Subtest 3	9262	1852.4	0.5	21.3
			9400	1880.0	0.5	21.5
			9538	1907.6	0.5	21.6
		Subtest 4	9262	1852.4	0.5	21.2
			9400	1880.0	0.5	21.3
			9538	1907.6	0.5	21.4
	HSPA (HSDPA & HSUPA)	Subtest 1	9262	1852.4	0	21.1
			9400	1880.0	0	21.3
			9538	1907.6	0	21.4
		Subtest 2	9262	1852.4	2	19.2
			9400	1880.0	2	19.5
			9538	1907.6	2	19.6
		Subtest 3	9262	1852.4	1	20.3
			9400	1880.0	1	20.5
			9538	1907.6	1	20.5
		Subtest 4	9262	1852.4	2	19.2
			9400	1880.0	2	19.5
			9538	1907.6	2	19.6
		Subtest 5	9262	1852.4	0	22.1
			9400	1880.0	0	22.3
			9538	1907.6	0	22.4
	DC-HSDPA	Subtest 1	9262	1852.4	0	22.2
			9400	1880.0	0	22.3
			9538	1907.6	0	22.4
		Subtest 2	9262	1852.4	0	22.2
			9400	1880.0	0	22.3
			9538	1907.6	0	22.4
		Subtest 3	9262	1852.4	0.5	21.3
			9400	1880.0	0.5	21.5
			9538	1907.6	0.5	21.6
		Subtest 4	9262	1852.4	0.5	21.2
			9400	1880.0	0.5	21.3
			9538	1907.6	0.5	21.4

9.3. LTE

CONDUCTED OUTPUT POWER MEASUREMENT PROCEDURE

All LTE bands conducted average power is obtained from the CMW500 telecommunication test set.

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS_01".³

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4, 10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10, 15, 20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23 ¹	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
...					
NS_32	-	-	-	-	-

Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.

MODES TESTED

- LTE 5
- LTE 41

RESULTS

EUT includes different power levels for head use configuration and body use configuration and the below tables contain the highest of all configurations average conducted output powers as follows:

9.3.1. LTE 5

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OUTPUT POWER FOR LTE BAND 5 (1.4 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power		
				Conducted Average (dBm)		
				20407 824.7 MHz	20525 836.5 MHz	20643 848.3 MHz
1.4	QPSK	1	0	23.0	23.2	23.2
		1	2	23.1	23.2	23.2
		1	5	23.1	23.1	23.2
		3	0	23.0	23.1	23.2
		3	1	23.0	23.1	23.2
		3	2	23.0	23.1	23.1
		6	0	21.9	22.0	22.0
	16QAM	1	0	21.5	21.8	21.8
		1	2	21.5	21.8	21.8
		1	5	21.5	21.9	21.8
		3	0	22.0	22.1	22.1
		3	1	22.0	21.9	22.1
		3	2	22.0	22.0	22.1
		6	0	20.8	20.8	21.0

OUTPUT POWER FOR LTE BAND 5 (3.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power		
				Conducted Average (dBm)		
				20415 825.5 MHz	20525 836.5 MHz	20635 847.5 MHz
3.0	QPSK	1	0	23.0	23.2	23.3
		1	7	23.0	23.2	23.2
		1	14	23.0	23.2	23.2
		8	0	21.9	22.0	22.1
		8	4	21.9	22.0	22.1
		8	7	21.9	22.0	22.0
		15	0	22.0	22.1	22.1
	16QAM	1	0	21.9	22.1	22.0
		1	7	21.9	21.9	22.1
		1	14	22.0	22.0	22.0
		8	0	20.8	20.9	20.9
		8	4	20.8	20.9	20.9
		8	7	20.7	20.9	20.9
		15	0	20.8	20.9	20.9

OUTPUT POWER FOR LTE BAND 5 (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power		
				Conducted Average (dBm)		
				20425	20525	20625
				826.5 MHz	836.5 MHz	846.5 MHz
5.0	QPSK	1	0	23.0	23.1	23.1
		1	12	22.9	23.1	23.0
		1	24	23.0	23.1	23.0
		12	0	22.0	22.0	22.1
		12	6	21.9	22.0	22.1
		12	11	21.9	22.0	22.0
		25	0	21.9	22.1	22.1
	16QAM	1	0	21.8	21.9	21.9
		1	12	21.7	21.8	21.8
		1	24	21.7	21.9	21.8
		12	0	20.8	20.9	21.0
		12	6	20.8	20.9	20.9
		12	11	20.8	20.9	20.9
		25	0	20.8	20.9	20.9

OUTPUT POWER FOR LTE BAND 5 (10.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power		
				Conducted Average (dBm)		
				20450	20525	20600
				829.0 MHz	836.5 MHz	844.0 MHz
10.0	QPSK	1	0	23.0	23.1	23.0
		1	24	23.0	23.1	23.0
		1	49	23.1	23.1	23.1
		25	0	22.0	22.0	22.0
		25	12	22.0	22.0	22.2
		25	24	22.0	22.0	22.1
		50	0	22.1	22.1	22.1
	16QAM	1	0	21.9	22.0	21.8
		1	24	21.9	21.9	21.8
		1	49	21.9	22.0	21.8
		25	0	20.9	21.0	20.8
		25	12	21.0	21.0	21.0
		25	24	21.0	21.0	21.0
		50	0	21.0	21.0	21.0

9.3.2. LTE 41

ID:	38515	Date:	8/7/18
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OUTPUT POWER FOR LTE BAND 41 (FCC) (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power		
				Conducted Average (dBm)		
				39675 2498.5 MHz	40620 2593.0 MHz	41565 2687.5 MHz
5.0	QPSK	1	0	22.6	23.1	23.8
		1	12	22.6	23.1	23.8
		1	24	22.6	23.2	23.8
		12	0	21.6	22.2	22.7
		12	6	21.6	22.2	22.7
		12	11	21.7	22.2	22.7
		25	0	21.6	22.2	22.7
	16QAM	1	0	21.4	21.7	22.6
		1	12	21.4	21.7	22.6
		1	24	21.4	21.7	22.6
		12	0	20.7	21.1	21.7
		12	6	20.7	21.1	21.7
		12	11	20.7	21.1	21.7
		25	0	20.7	21.2	21.8

OUTPUT POWER FOR LTE BAND 41 (FCC) (10.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power		
				Conducted Average (dBm)		
				39700 2501.0 MHz	40620 2593.0 MHz	41540 2685.0 MHz
10.0	QPSK	1	0	22.5	23.2	23.7
		1	24	22.6	23.2	23.7
		1	49	22.6	23.2	23.8
		25	0	21.6	22.2	22.8
		25	12	21.6	22.2	22.8
		25	24	21.6	22.2	22.8
		50	0	21.6	22.2	22.8
	16QAM	1	0	21.3	21.7	22.8
		1	24	21.3	21.7	22.8
		1	49	21.3	21.7	22.8
		25	0	20.7	21.1	21.8
		25	12	20.7	21.2	21.8
		25	24	20.7	21.2	21.8
		50	0	20.7	21.2	21.8

OUTPUT POWER FOR LTE BAND 41 (FCC) (15.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power		
				Conducted Average (dBm)		
				39725	40620	41515
				2503.5 MHz	2593.0 MHz	2682.5 MHz
15.0	QPSK	1	0	22.5	23.2	23.8
		1	37	22.5	23.2	23.8
		1	74	22.5	23.2	23.8
		36	0	21.6	22.2	22.8
		36	16	21.6	22.2	22.8
		36	35	21.7	22.2	22.8
		75	0	21.7	22.2	22.8
	16QAM	1	0	21.1	21.9	22.6
		1	37	21.2	21.9	22.7
		1	74	21.3	21.9	23.2
		36	0	20.7	21.3	21.8
		36	16	20.6	21.2	21.8
		36	35	20.7	21.2	21.9
		75	0	20.7	21.2	21.8

OUTPUT POWER FOR LTE BAND 41 (FCC) (20.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power		
				Conducted Average (dBm)		
				39750	40620	41490
				2506.0 MHz	2593.0 MHz	2680.0 MHz
20.0	QPSK	1	0	22.6	23.1	23.7
		1	49	22.7	23.1	23.8
		1	99	22.7	23.1	23.8
		50	0	21.6	22.1	22.8
		50	24	21.6	22.2	22.8
		50	49	21.6	22.2	22.8
		100	0	21.6	22.2	22.8
	16QAM	1	0	21.3	21.7	22.6
		1	49	21.3	22.0	22.7
		1	99	21.5	21.7	22.7
		50	0	20.6	21.2	21.8
		50	24	20.6	21.2	21.8
		50	49	20.6	21.2	21.9
		100	0	20.6	21.2	21.8

10. CONDUCTED TEST RESULTS

10.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

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 middle channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

MODES TESTED

- GSM 850
- GSM 1900
- WCDM Band 5
- WCDM Band 2
- LTE Band 5
- LTE Band 41

RESULTS

There is no limit required and power is the same for low, middle and high channel; therefore, only middle channel was tested.

GSM

Band	Modulation	Channel	f(MHz)	99% BW (KHz)	-26dB BW (KHz)
GSM850	GPRS	190	836.6	237.2	312.6
	EGPRS			240.8	304.6
GSM1900	GPRS	661	1880.0	242.4	304.6
	EGPRS			245.1	325.0

WCDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BAND5	REL 99	4408	836.6	4.153	4.706
	HSDPA			4.161	4.713
BAND2	REL 99	9800	1880.0	4.147	4.728
	HSDPA			4.165	4.692

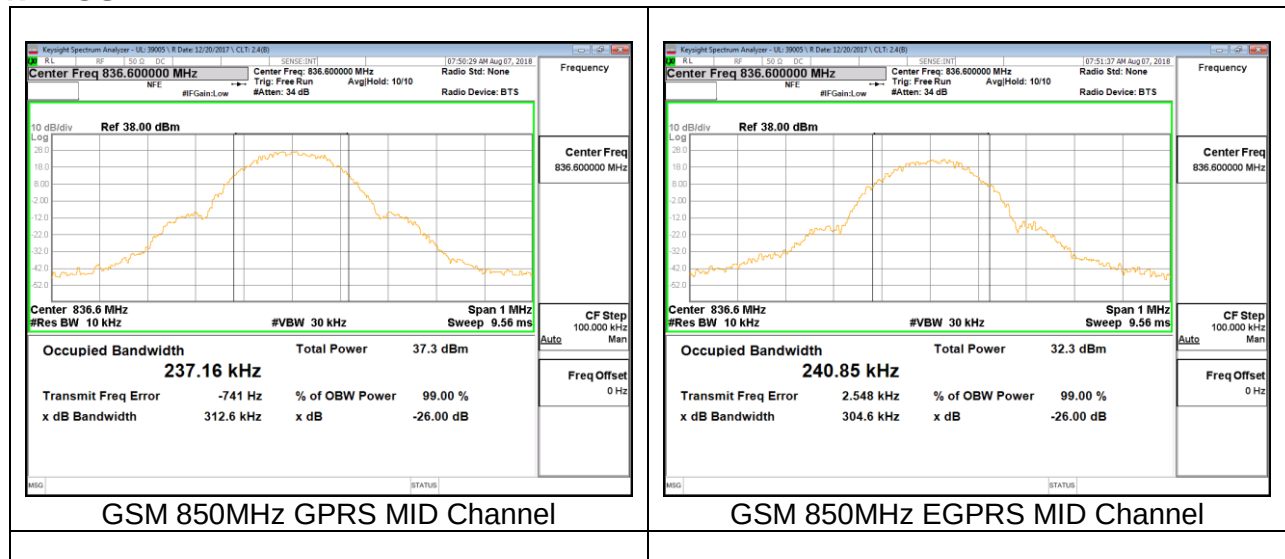
LTE5

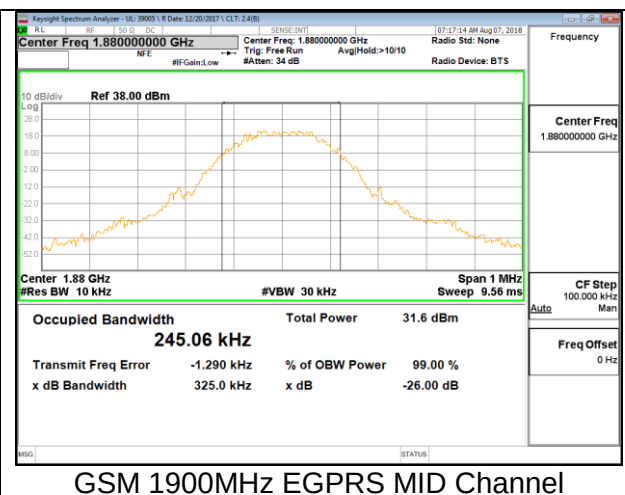
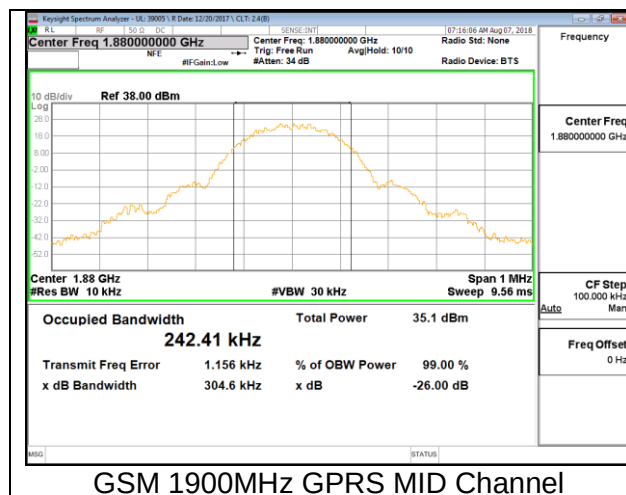
Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 5	1.4 MHz, QPSK	6/0	836.5	1.09	1.30
	1.4 MHz, 16QAM			1.09	1.32
	3 MHz, QPSK	15/0		2.71	3.07
	3 MHz, 16QAM			2.71	3.08
	5 MHz, QPSK	25/0		4.51	5.31
	5 MHz, 16QAM			4.50	5.22
	10 MHz, QPSK	50/0		8.98	10.16
	10 MHz, 16QAM			8.99	10.21

LTE41 (FCC)

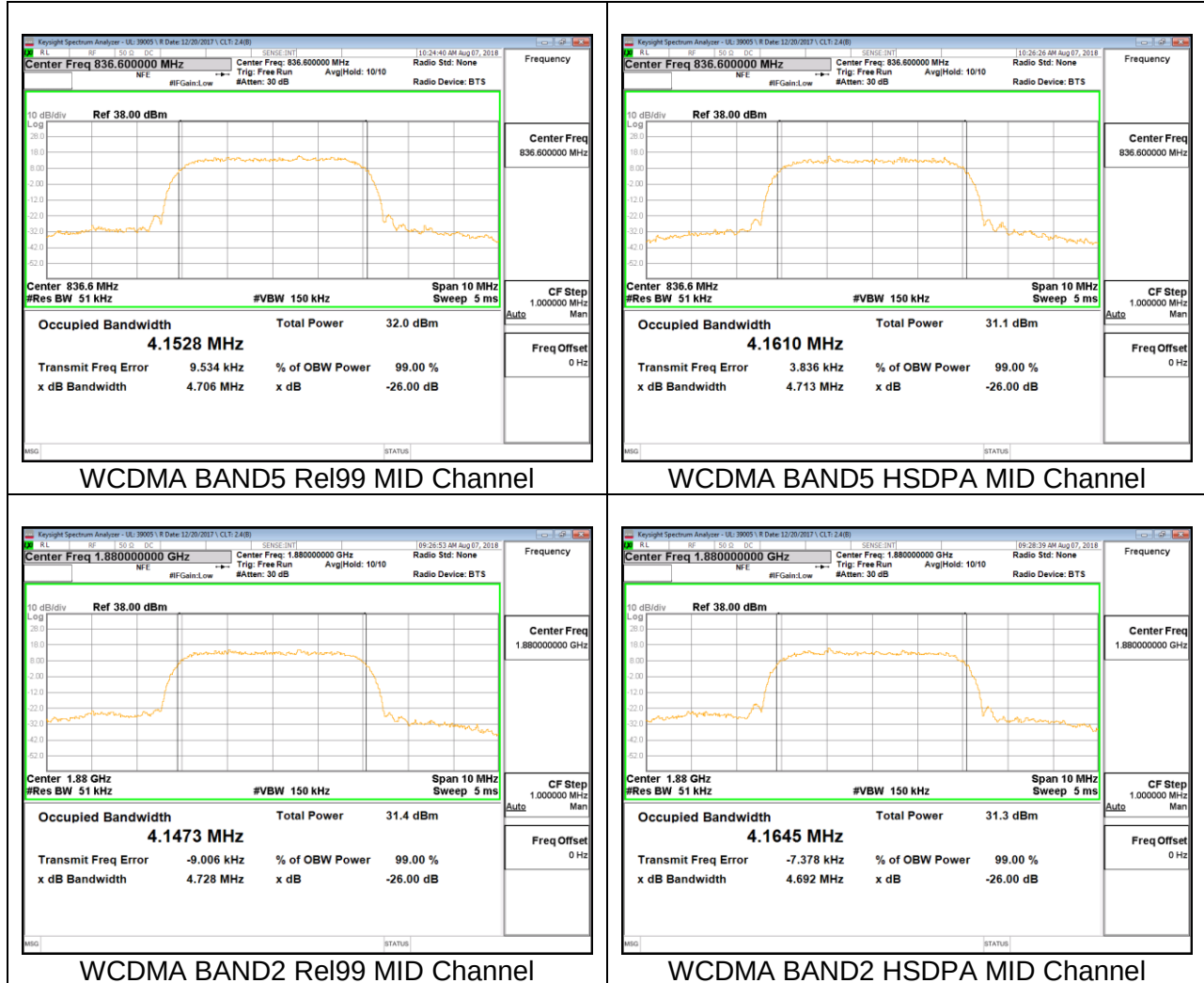
Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 41	5 MHz, QPSK	25/0	2593.0	4.50	5.26
	5 MHz, 16QAM			4.51	5.33
	10 MHz, QPSK	50/0		8.97	10.46
	10 MHz, 16QAM			8.99	10.23
	15 MHz, QPSK	75/0		13.46	15.22
	15 MHz, 16QAM			13.48	15.07
	20 MHz, QPSK	100/0		17.92	19.98
	20 MHz, 16QAM			17.98	19.68

10.1.1. GSM

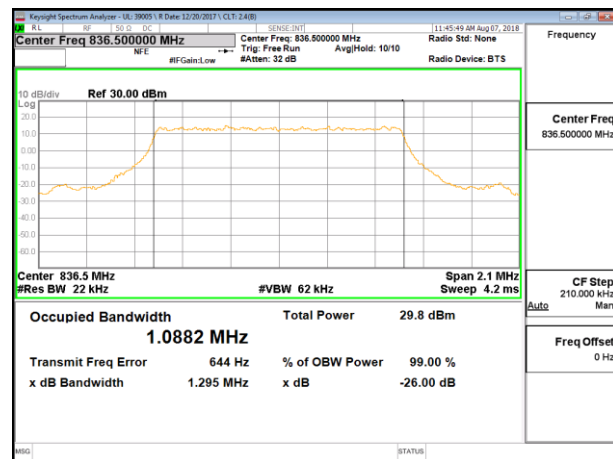




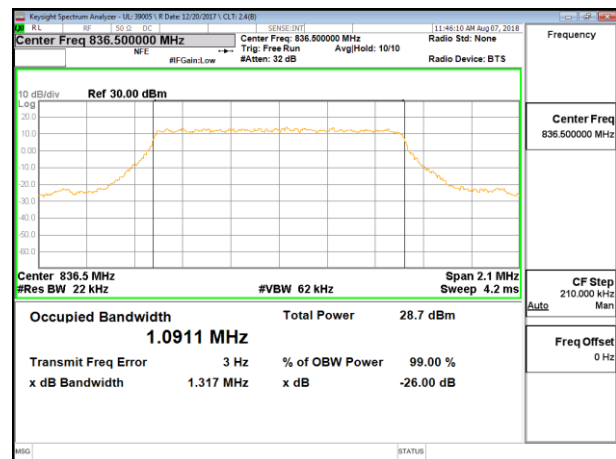
10.1.2. WCDMA



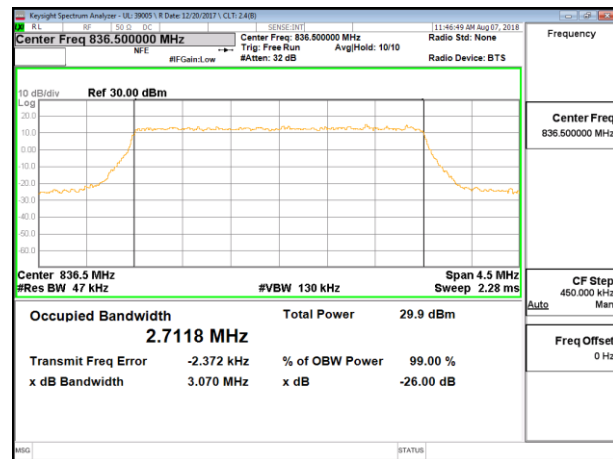
10.1.3. LTE BAND 5



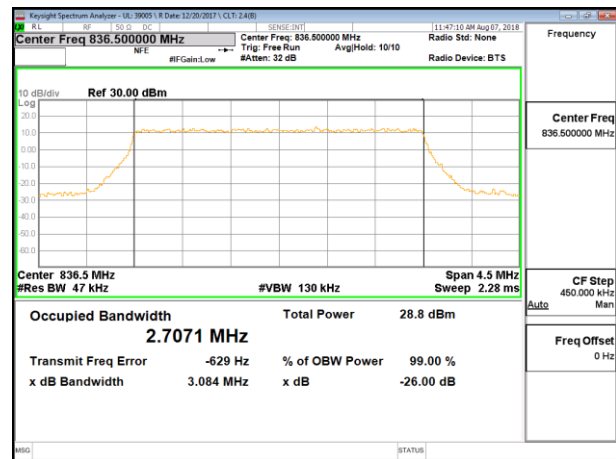
LTE B5 1.4MHz QPSK Mid Channel RB6-0



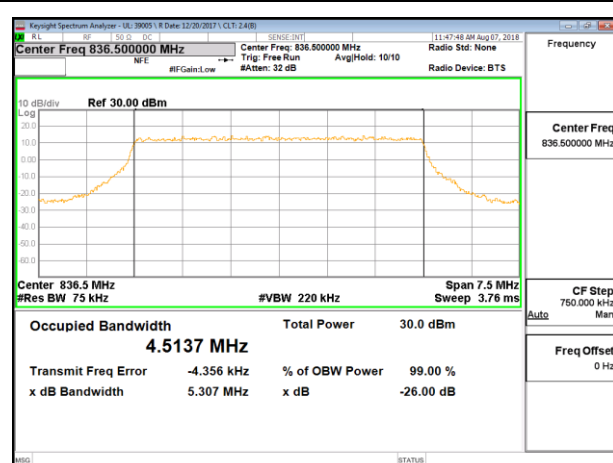
LTE B5 1.4MHz 16QAM Mid Channel RB6-0



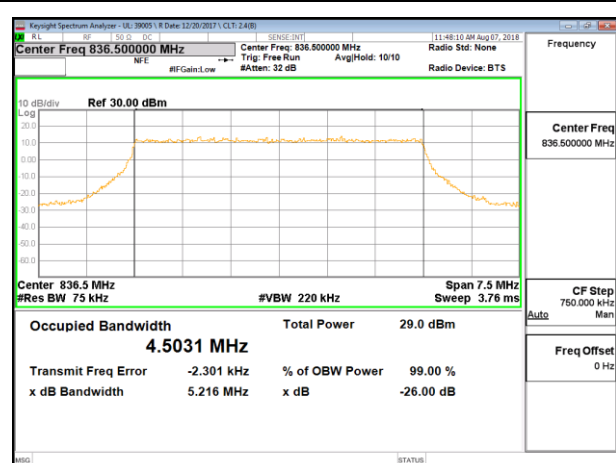
LTE B5 3MHz QPSK Mid Channel RB15-0



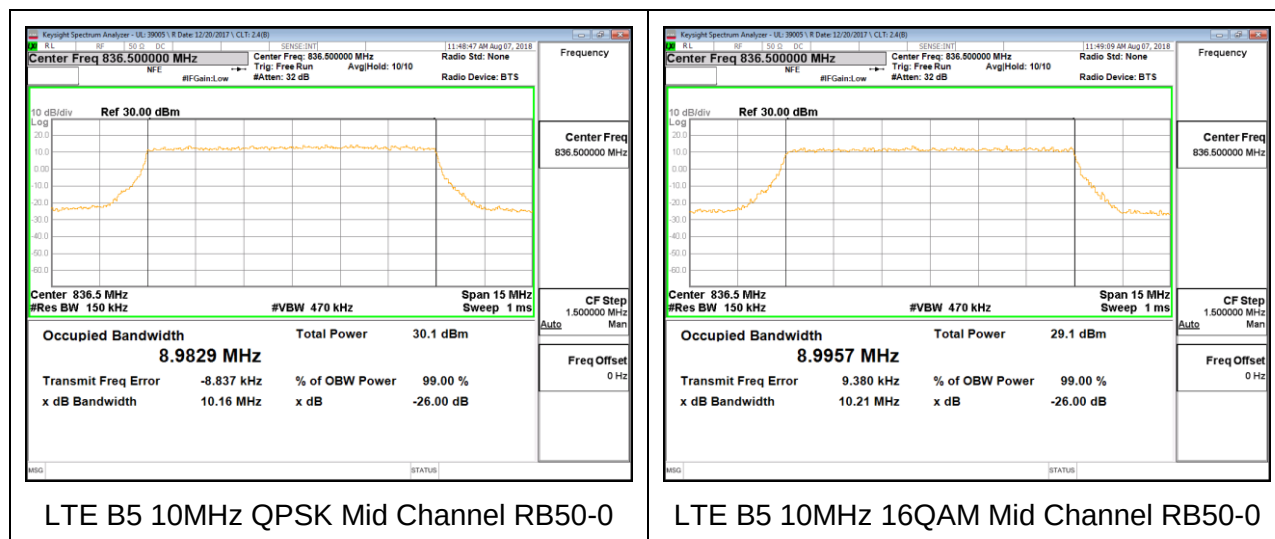
LTE B5 3MHz 16QAM Mid Channel RB15-0



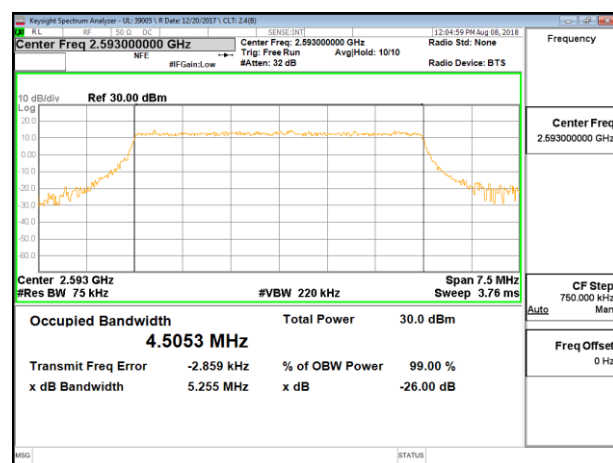
LTE B5 5MHz QPSK Mid Channel RB25-0



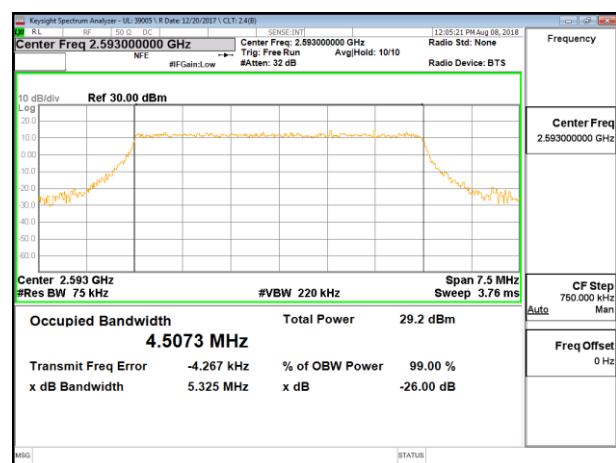
LTE B5 5MHz 16QAM Mid Channel RB25-0



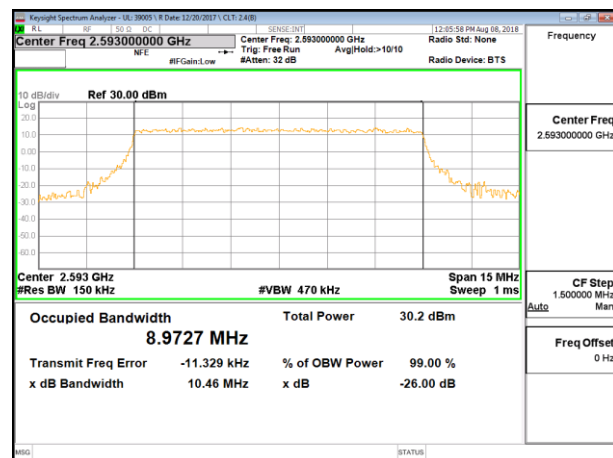
10.1.4. LTE BAND 41 (FCC)



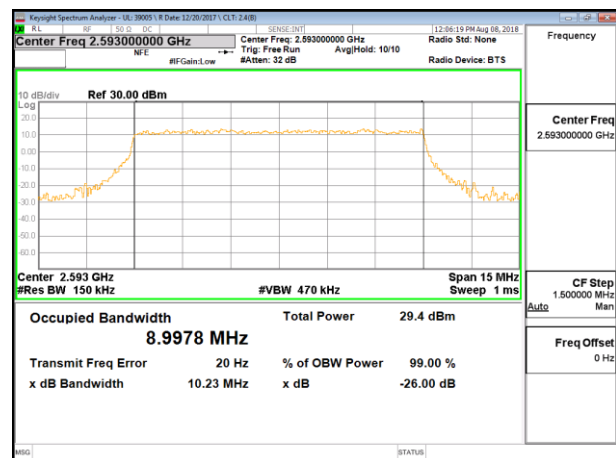
LTE B41 5MHz QPSK Mid Channel RB25-0



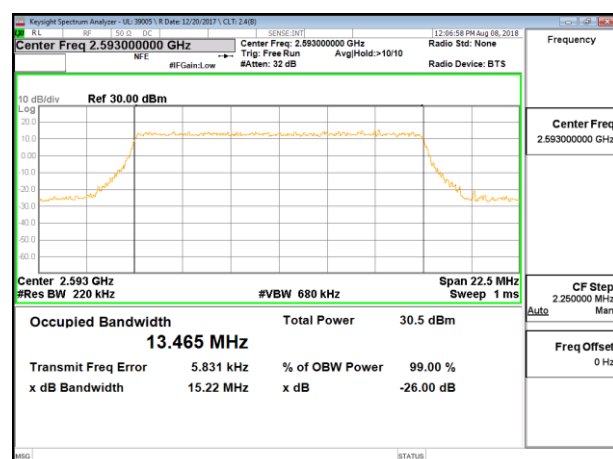
LTE B41 5MHz 16QAM Mid Channel RB25-0



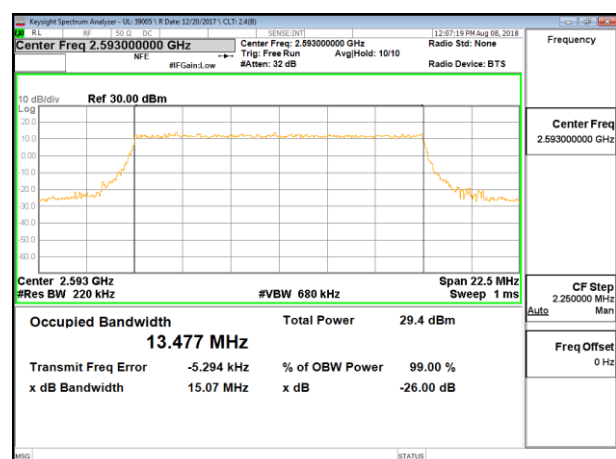
LTE B41 10MHz QPSK Mid Channel RB50-0



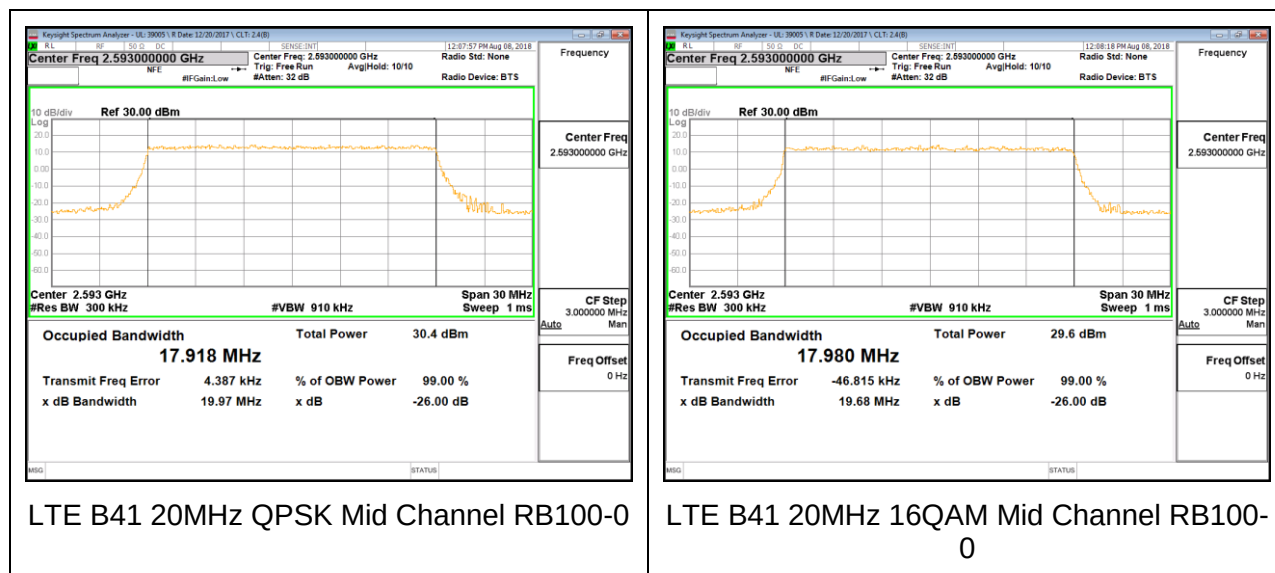
LTE B41 10MHz 16QAM Mid Channel RB50-0



LTE B41 15MHz QPSK Mid Channel RB75-0



LTE B41 15MHz 16QAM Mid Channel RB75-0



10.2. BAND EDGE AND EMISSION MASK

RULE PART(S)

FCC: §2.1051, §22.917, §24.238, §27.53

LIMITS

FCC: §22.917, §24.238, §27.53(h)

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.

FCC: §90.691 Emission mask requirements for EA-based systems.

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

FCC: §27.53 (Band 13)

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;

(5) Compliance with the provisions of paragraphs (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(6) Compliance with the provisions of paragraphs (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(f) Emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals. (-70 dBW/MHz = -40dBm/MHz).

FCC: §27.53 (Band 12, 17)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

FCC: §27.53 (Band 7, 41)

(m)(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 than $43 + 10 \log (P)$ 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

The transmitter output was connected to 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.

For each band edge measurement:

1. Set the spectrum analyzer span to include the block edge frequency.
2. Set a marker to point the corresponding band edge frequency in each test case.
3. Set display line at -13 dBm
4. Set resolution bandwidth to at least 1% of emission bandwidth.

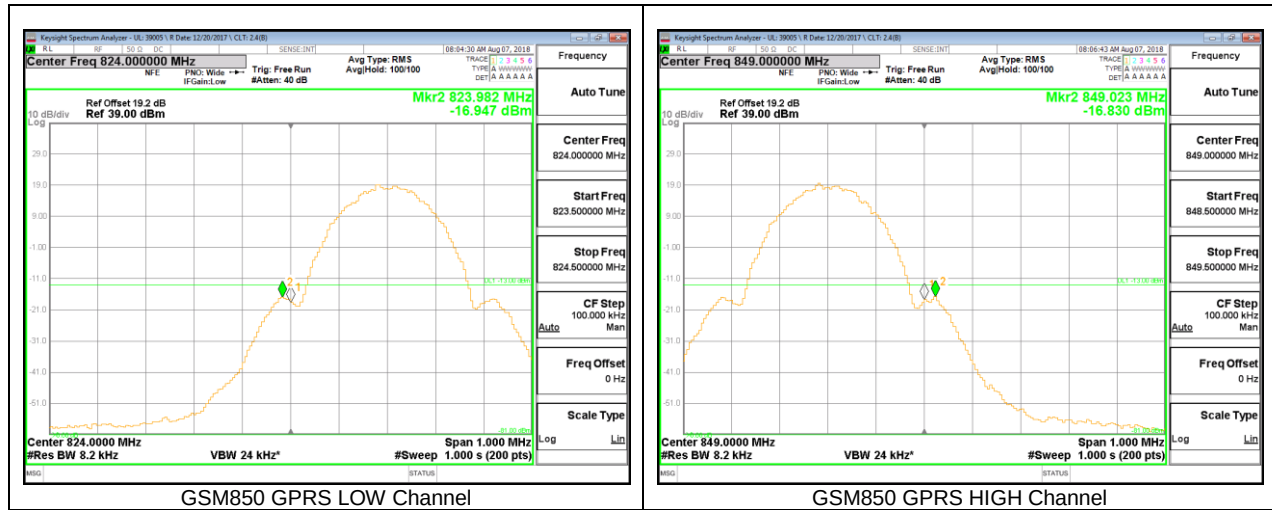
MODES TESTED

- GSM 850
- GSM 1900
- WCDM Band 5
- WCDM Band 2
- LTE Band 5
- LTE Band 41

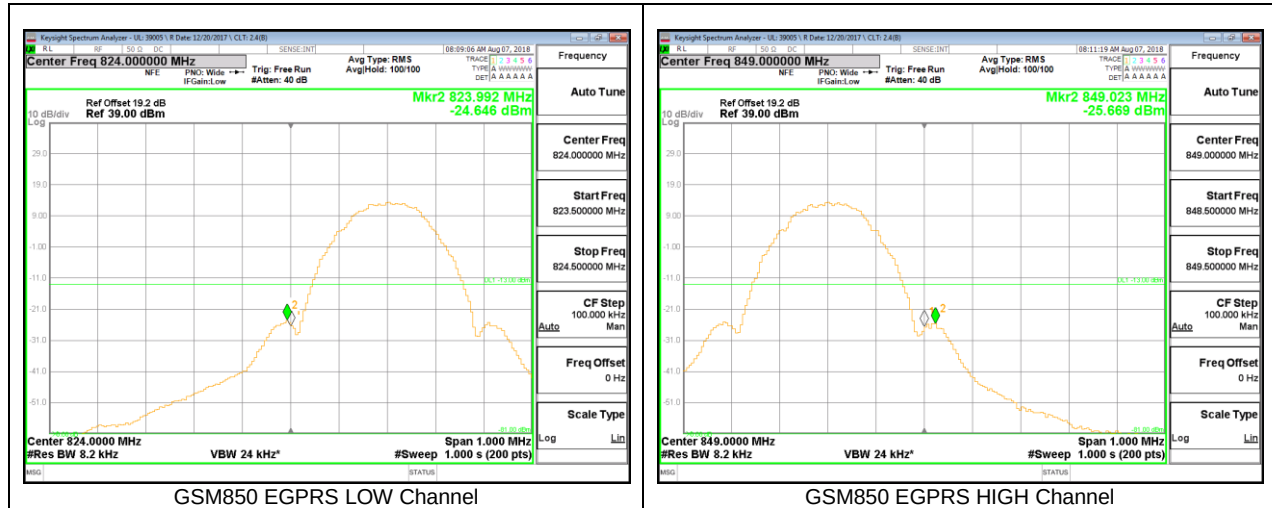
RESULTS

10.2.1. GSM GSM850

GPRS

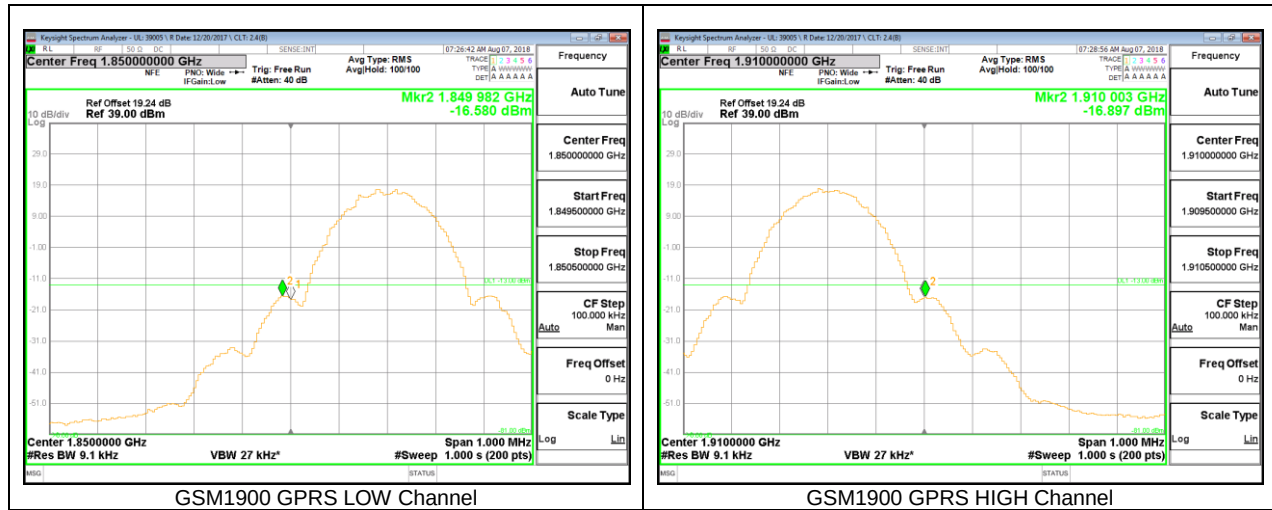


EGPRS

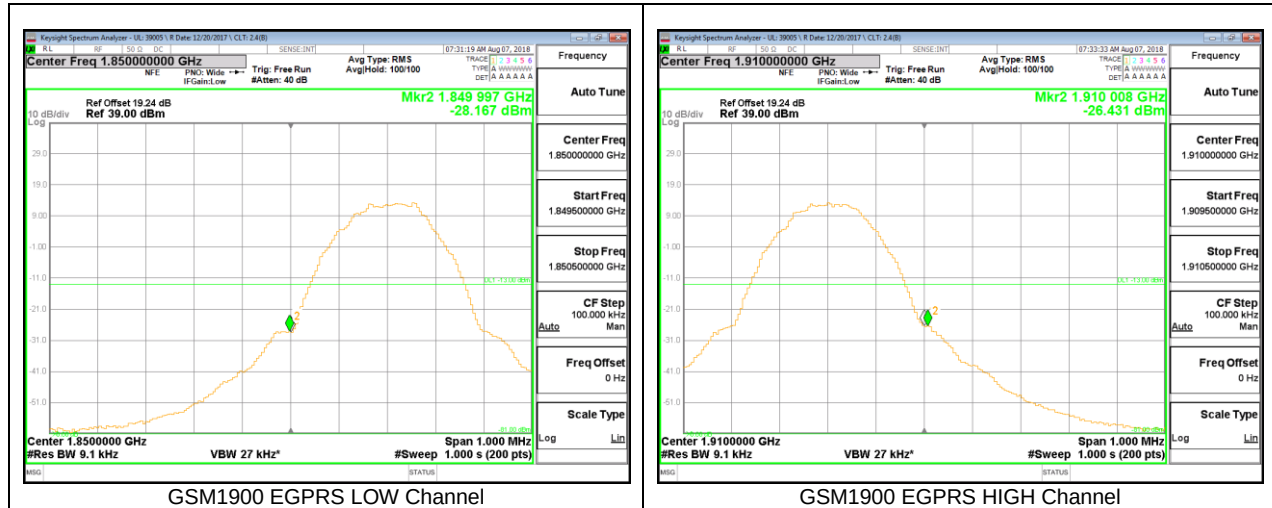


10.2.2. GSM GSM1900

GPRS

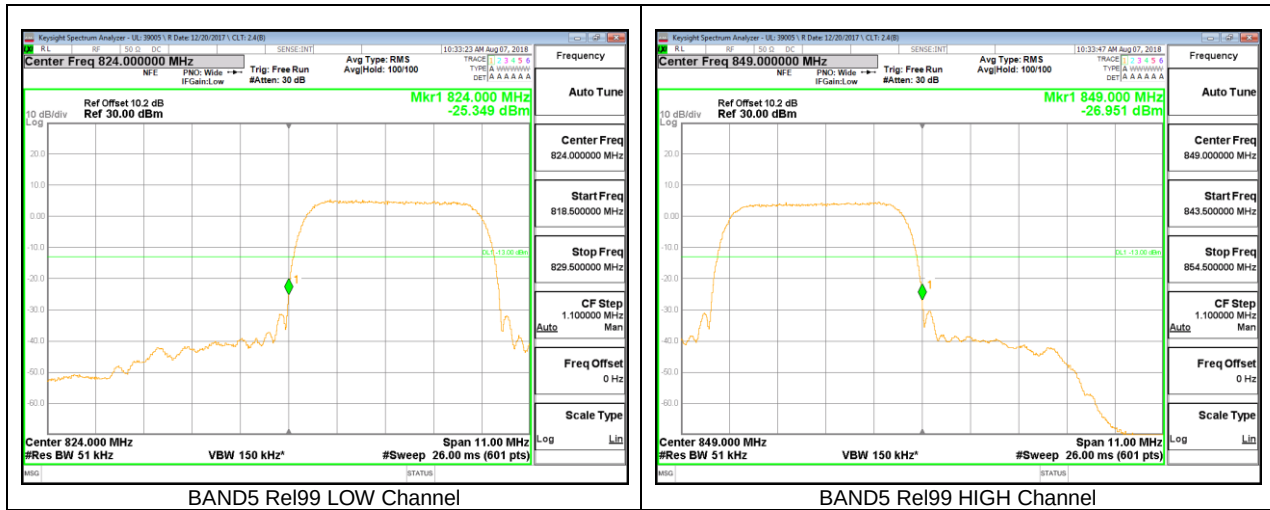


EGPRS

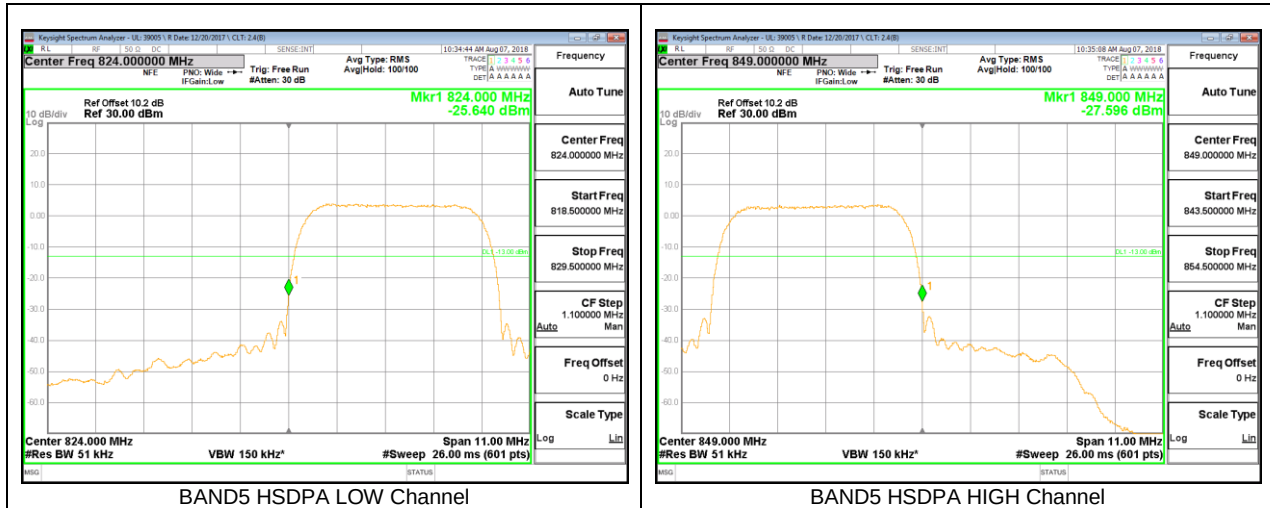


10.2.3. WCDMA BAND5

Rel99

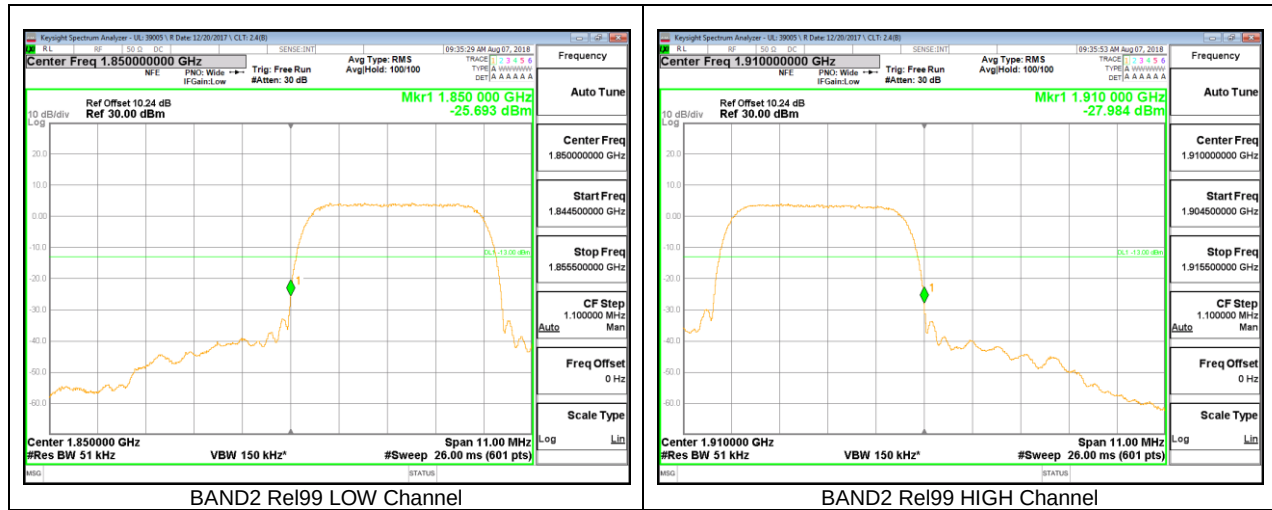


HSDPA

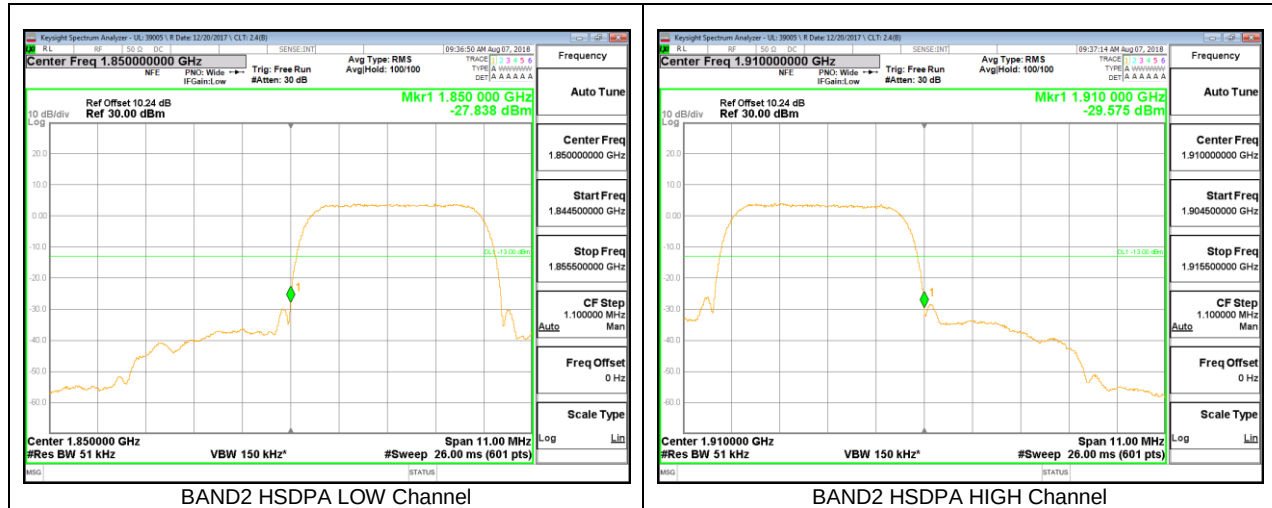


10.2.4. WCDMA BAND2

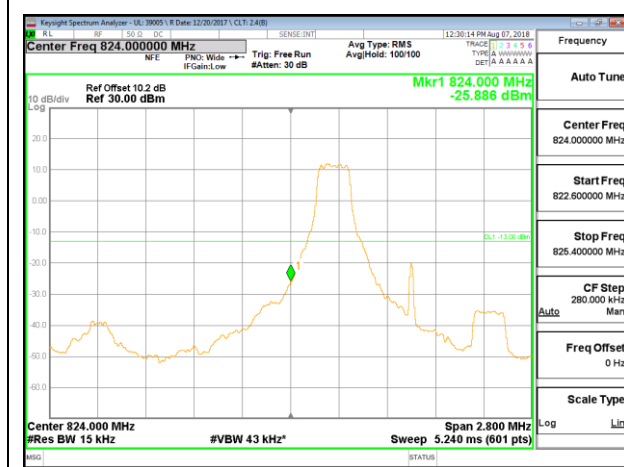
Rel99



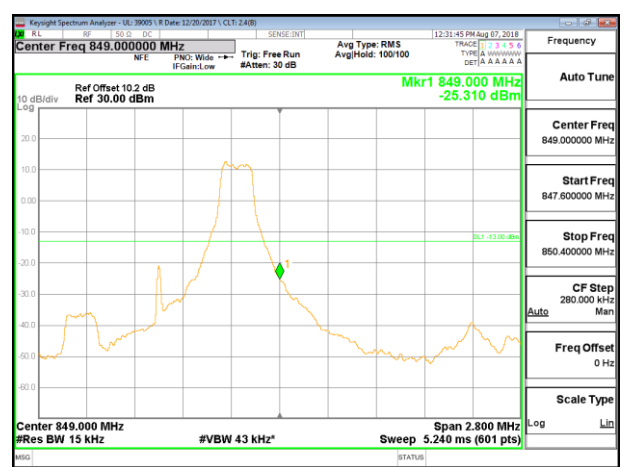
HSDPA



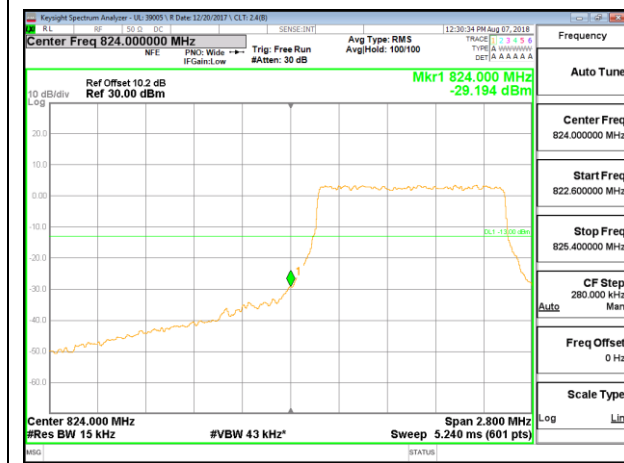
10.2.5. LTE BAND 5 BANDEDGE



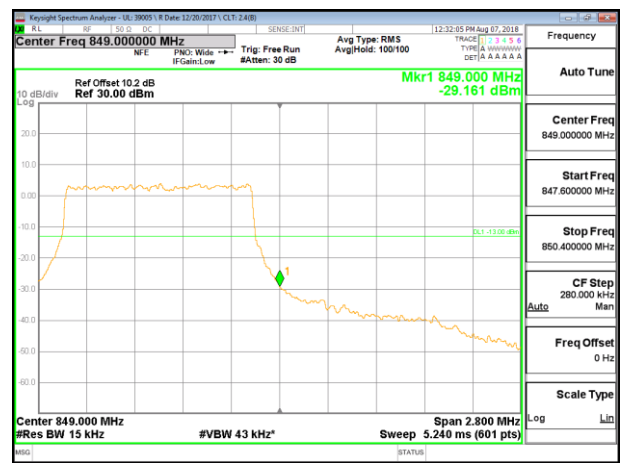
LTE B5 1.4MHz QPSK Low Channel RB1-0



LTE B5 1.4MHz QPSK High Channel RB1-0



LTE B5 1.4MHz QPSK Low Channel RB6-0



LTE B5 1.4MHz QPSK High Channel RB6-0

