CERTIFICATION TEST REPORT

Report Number. : 12204475-E6V2

Applicant	:	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	:	A2098
FCC ID	:	BCG-E3233A
IC	:	579C-E3233A
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC CFR47 PART 22H, 24E, 27L AND 90S IC RSS-132 ISSUE 3, RSS-133 ISSUE 6 AND RSS-139 ISSUE 3

Date Of Issue:
JULY 24, 2018

Prepared by:
UL Verification Services Inc.
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	7/17/2018	Initial Review	Chin Pang
V2	7/24/2018	Address TCB's Questions	Mengistu Mekuria

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1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	A2098
FCC ID	BCG-E3233A
IC	579C-E3233A
EUT Description	SMARTPHONE
Serial Number	C39WG035JVWF
Date Tested	MARCH 07, 2018 to JUNE 12, 2018
Applicable Standards	FCC CFR 47 Part 22H, 24E, 27L, AND 90S IC RSS-132 ISSUE 3, RSS-133 ISSUE 6, AND RSS-139 ISSUE 3
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:	Prepared By:
Chin Pang Senior Test Engineer UL Verification Services Inc.	Lieu Nguyen Laboratory Engineer UL Verification Services Inc.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, Part 22, Part 24, Part 27, Part 90, FCC KDB 971168 D01 v03r01/ D02 v02r0, and FCC KDB 412172 D01 Determining ERP and EIRP v01r01. ANSI C63.26:2015, IC RSS-132, RSS-133 and RSS-139.

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. 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:22541-1)
☐ Chamber B (IC:2324B-2)	☒ Chamber E (IC:22541-2)
☐ Chamber C (IC:2324B-3)	☒ Chamber F (IC:22541-3)
	☐ Chamber G (IC:22541-4)
	☒ Chamber H (IC:22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.
UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at NVLAP Lab Search.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Radiated Disturbance,1000 to 18000 MHz	4.32 dB
Radiated Disturbance,18000 to 26000 MHz	4.45 dB
Radiated Disturbance,26000 to 40000 MHz	5.24 dB
Occupied Channel Bandwidth	±0.39 %
Temperature	±0.9 °C
Supply voltages	±0.45 %
Time	±0.02 %

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

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The Apple iPhone, is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, TD-SCDMA, CDMA, IEEE 802.11a/b/g/n/ac, Bluetooth, GPS and NFC. All models support at least one UICC based SIM. The second SIM is either UICC based, electronic SIM (e-SIM), or second SIM is not present. The device has a built-in inductive charging receiver which is not user accessible. The rechargeable battery is not user accessible.

5.2. MAXIMUM OUTPUT POWER

ERP/EIRP LIMIT

FCC: §2.1046, §22.913, §24.232, §27.50 and §90.635
IC: RSS132§5.4; RSS133§6.4 and RSS139§6.5.

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015/ KDB 971168 D01 Section 5.6

ERP/EIRP = PMeas + GT − LC
where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);
PMeas = 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.

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 and ERP/EIRP output powers as follows:

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GSM MODES

RSS 132 850MHz								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824- 849	GPRS	30.0	-5.5	11.5	24.50	0.282	249.54	250KGXW
	EGPRS	24.5			19.00	0.079	240.84	241KG7W
Part 22 850MHz								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824- 849	GPRS	30.0	-5.5	7.0	22.35	0.172	249.54	250KGXW
	EGPRS	24.5			16.85	0.048	240.84	241KG7W
Part 24 / RSS 133 1900MHz								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1850-1910	GPRS	30.0	-3.6	2.0	26.40	0.437	244.49	244KGXW
	EGPRS	25.0			21.40	0.138	246.1	246KG7W

CDMA MODES

Part 90 BC10								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
816-824	1xRTT	25.5	-5.6	100.0	17.75	0.060	1266	1M27F9W
	1xEV-DO Rev A	25.5			17.75	0.060	1270	1M27F9W
RSS 132 BC0								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824-849	1xRTT	25.5	-5.5	11.5	20.00	0.100	1271	1M27F9W
	1xEV-DO Rev A	25.5			20.00	0.100	1267	1M27F9W
Part 22 BC0								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824-849	1xRTT	25.5	-5.5	7.0	17.85	0.061	1271	1M27F9W
	1xEV-DO Rev A	25.5			17.85	0.061	1267	1M27F9W
Part 24 / RSS 133 BC1								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1850-1910	1xRTT	25.5	-3.6	2.0	21.90	0.155	1279	1M28F9W
	1xEV-DO Rev A	25.5			21.90	0.155	1276	1M28F9W

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WCDMA MODE

RSS 132 Band 5								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824-849	REL 99	25.5	-5.5	11.5	20.00	0.100	4065	4M07F9W
	HSDPA	25.5			20.00	0.100	4082	4M08F9W
Part 22 Band 5								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824-849	REL 99	25.5	-5.5	7.0	17.85	0.061	4065	4M07F9W
	HSDPA	25.5			17.85	0.061	4082	4M08F9W
Part 24 / RSS 133 Band 2								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1850-1910	REL 99	25.5	-3.6	2.0	21.90	0.155	4065	4M07F9W
	HSDPA	25.4			21.80	0.151	4075	4M08F9W
Part 27 / RSS 139 Band 4								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1710-1755	REL 99	25.5	-4.2	1.0	21.30	0.135	4076	4M08F9W
	HSDPA	25.5			21.30	0.135	4081	4M08F9W

5.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 0.26.01

5.4. MAXIMUM ANTENNA GAIN

Frequency Range (MHz)	Ant 1 Gain (dBi)	Ant 2 Gain (dBi)	Ant 3 Gain (dBi)	Ant 4 Gain (dBi)
810	-6.6	-6.7	N/A	N/A
820	-6.4	-6.9	N/A	N/A
830	-5.6	-6.7	N/A	N/A
840	-5.5	-6.7	N/A	N/A
850	-5.8	-6.8	N/A	N/A
1700	-4.2	-3.1	-6.3	-8.2
1720	-4.2	-3.4	-5.0	-7.5
1740	-4.5	-4.5	-4.2	-7.4
1760	-4.9	-4.9	-3.3	-7.0
1840	-3.6	-3.9	-3.4	N/A
1860	-3.9	-3.9	-3.9	N/A
1880	-4.0	-3.8	-4.2	N/A
1900	-4.1	-3.5	-4.2	-4.8
1920	-4.4	-3.8	-4.4	-4.6

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5.5. WORST-CASE CONFIGURATION AND MODE

Radiated test was investigated in three orthogonal orientations X, Y and Z on Ant. 1/ Ant. 2 for GSM850, WCDMA Band 5, CDMA BC10, CDMA BC0, and CDMA BC1. And Ant. 1/ Ant.2/ Ant. 3/ Ant. 4 for GSM1900, WCDMA Band 2 and WCDMA Band 4, it was determined that Y (Landscape) orientation was the worst case orientation for all GSM Bands, CDMA Bands and WCDMA Bands without AC/DC adapter.

Based on average conducted output power measurement investigations. The worst-case is Ant1 with the highest power.

Therefore, Ant 1 was used to perform all conducted tests.

Radiated spurious emissions were investigated below 30MHz, 30MHz-1GHz and above 1GHz. There were no emissions found on below 30MHz and 30MHz-1GHz within 20dB of the limit.

The worst-case scenario for all measurements as followed:

Worst-case modes:
- GSM GPRS
- GSM EGPRS
- CDMA 2000 1xRTT
- CDMA 2000 1xEV-DO REV. A
- WCDMA REL 99
- WCDMA HSDPA

For simultaneous transmission of multiple channels in the 2.4 / 5GHz and Cellular bands. No noticeable new emission was found.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Laptop AC/DC adapter	Delta Electronic	A1343	ADP-85EBT V85
Laptop	Apple	Macbook Pro	73008ACB7XJ

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	AC	3	US 115V	Un-shielded	2.0m	N/A
2	USB	1	DC	Un-shielded	1.0m	N/A
3	RF In/Out	1	EUT	Un-shielded	0.6m	N/A
4	RF In/Out	1	Communication Test Set	Un-shielded	1.2m	N/A
5	RF In/Out	1	Barrel	N/A	N/A	N/A

I/O CABLES (RF Radiated Test)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	RF In/Out	1	Antenna	Un-shielded	5.0m	N/A

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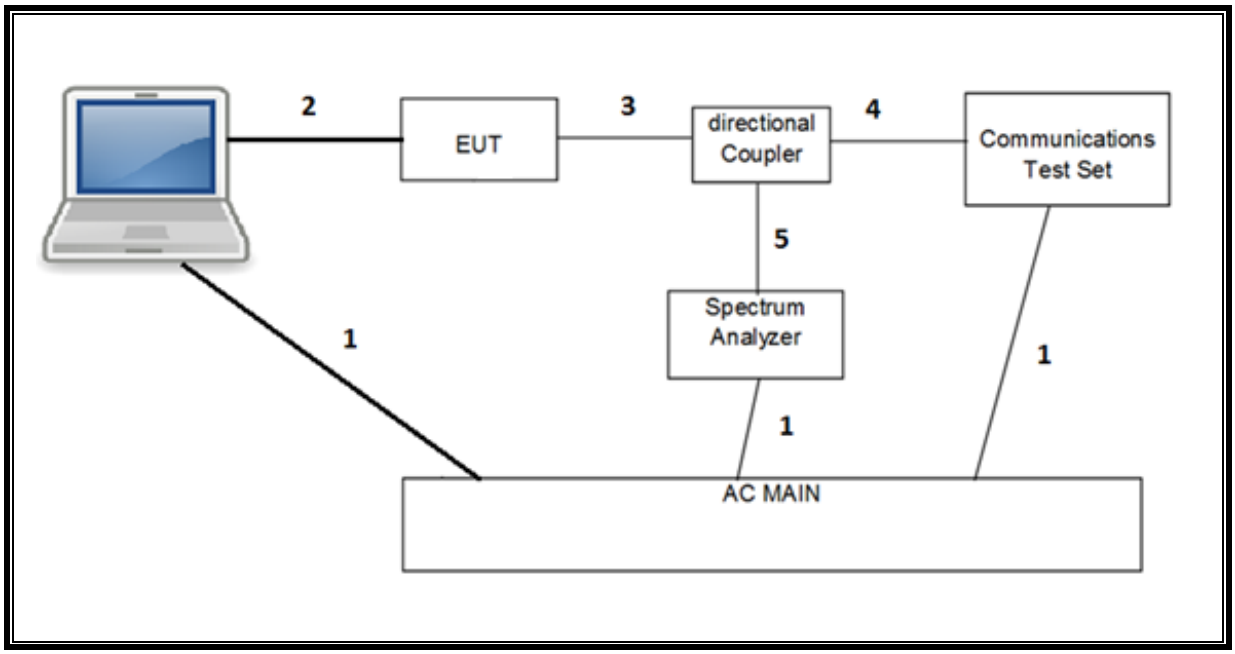
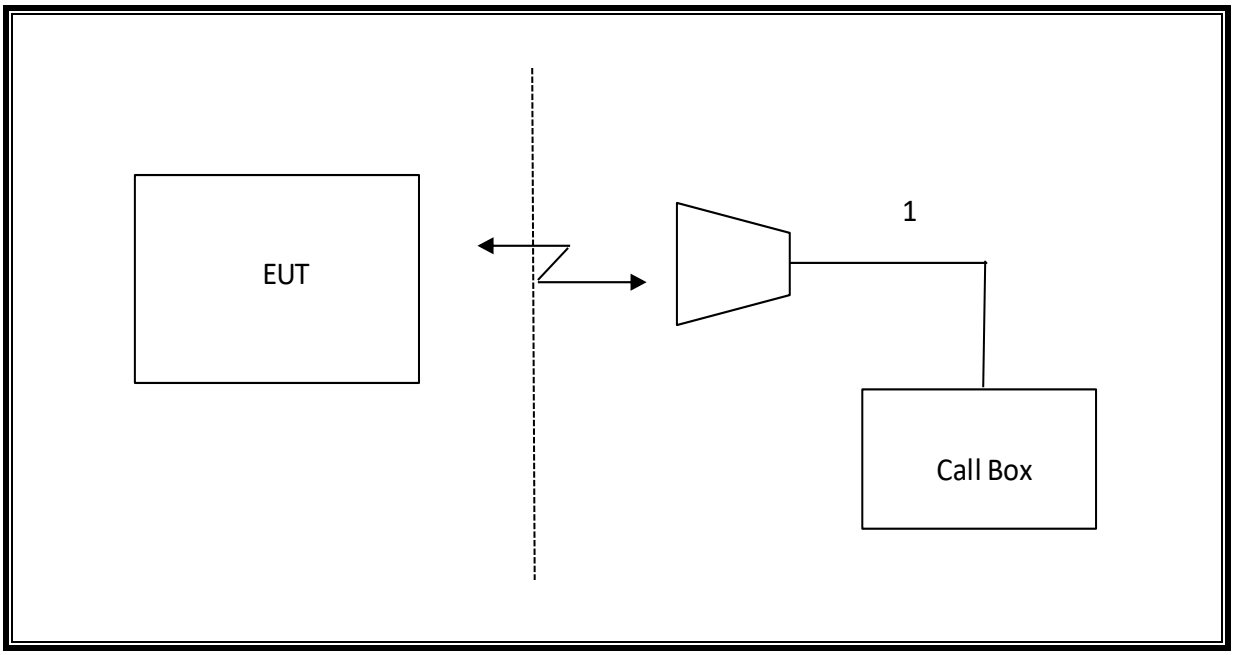
CONDUCTED SETUP



RADIATED SETUP



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6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	T243	11/02/2018
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T10	02/14/2019
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T712	02/08/2019
*Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T900	05/31/2018
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T285	06/24/2018
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T741	12/30/2018
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T711	01/30/2019
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T408	12/15/2018
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T742	12/04/2018
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T173	06/24/2018
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent (Keysight) Technologies	E4446A	T177	04/12/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/08/2019
Power Meter, P-series single channel	Keysight	N1912A	T1273	07/17/2018
Power Sensor	Keysight	N1921A	T1226	08/30/2018
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	T978	08/31/2018
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	T949	02/21/2019
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	T959	02/17/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T342	02/22/2019
*Directional Coupler	KRYTAR	152610	T1536	04/24/2018
*Directional Coupler	KRYTAR	152610	T1537	04/24/2018
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T1154	09/05/2018
Antenna, Active Loop 9KHz to 30MHz	EMCO	6502	T35	12/15/2018
*Filter, HPF 1.2GHz	MICROTRONICS	WHKX1.2/15G-6ST	T1182	06/1/2018
Filter, HPF 3.0GHz	MICROTRONICS	HPM17543	T487	12/04/2018
UL AUTOMATION SOFTWARE				
CLT Software	UL	UL RF	Ver 1.7, November 2015	
Power Measurement Software	UL	UL RF	Ver 2.2, June 2017	

NOTES: *The testing is completed before equipment expiration date

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7. 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:

7.1. 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	

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RESULT

7.1.1. GSM 850

ID:	50820	Date:	5/29/18

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Ant 1		Ant 2	
			1 slot	2 slots	1 slot	2 slots
850.0	128	824.2	30.0	28.9	**28.0**	27.0
	190	836.6	**30.0**	29.0	27.9	26.9
	251	848.8	30.0	28.9	27.9	26.9

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Ant 1		Ant 2	
			1 slot	2 slots	1 slot	2 slots
850.0	128	824.2	**24.5**	23.5	**22.5**	21.5
	190	836.6	24.4	23.4	22.4	21.4
	251	848.8	24.4	23.4	22.4	21.4

7.1.2. GSM 1900

ID:	50820	Date:	5/29/18

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Ant 1		Ant 2		Ant 3		Ant 4	
			1 slot	2 slots	1 slot	2 slots	1 slot	2 slots	1 slot	2 slots
1900.0	512	1850.2	29.7	28.9	27.5	26.4	29.1	28.3	27.3	26.3
	661	1880.0	**30.0**	29.0	27.5	26.4	**29.5**	28.5	27.4	26.4
	810	1909.8	29.9	28.9	**27.5**	26.5	29.3	28.4	**27.5**	26.5

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Ant 1		Ant 2		Ant 3		Ant 4	
			1 slot	2 slots	1 slot	2 slots	1 slot	2 slots	1 slot	2 slots
1900.0	512	1850.2	24.9	23.9	22.4	21.3	24.4	23.4	22.5	21.4
	661	1880.0	**25.0**	24.0	22.4	21.4	**24.5**	23.4	**22.5**	21.4
	810	1909.8	24.9	23.9	**22.5**	21.5	24.4	23.5	22.5	21.5

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7.2. CDMA

Maximum output power is verified on the Low, Middle and High channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E for 1xRTT, section 3.1.2.3.4 of 3GPP2 C.S0033-0/TIA-866 for Rel. 0 and section 4.3.4 of 3GPP2 C.S0033-A for Rev. A

1xRTT

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

Application	Rev, License
CDMA2000 Mobile Test	B.15.18, L

- Protocol Rev > 6 (IS-2000-0)
- System ID: 18; NID: 65535, Reg. Ch. #.: 610 for Cell, 600 for PCS & 450 for AWS
- Radio Config (RC) > RC1 or RC3
- Service Option (SO) Setup > SO55 or SO32
- Traffic Data Rate > Full
- Rvs Power Ctrl > All Up bits (Maximum TxPout)

1xEV-DO - Release 0 (REL 0)

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

EVDO Release 0 - RTAP

- Call Setup > Shift & Preset
- Call Control:
  - Access Network Info > Cell Parameters > Sector ID > 00000000 : 00000000 : 00000000 : 00000000 > Subnet Mask > 0
  - Generator Info > Termination Parameters > Max Forward Packet Duration > 16 Slots
- Call Parms:
  - Cell Power > -105.5 dBm/1.23 MHz
  - Channel > (Enter channel number)
  - Application Config > Enhanced Test Application Protocol > RTAP
  - RTAP Rate > 153.6 kbps
  - Rvs Power Ctrl > Active bits
  - Protocol Rel > 0 (1xEV-DO)
- Press “Start Data Connection” when “Session Open” appear in “Active Cell”
- Rvs Power Ctrl > All Up bits (Maximum TxPout)

EVDO Release 0 - FTAP

- Call Setup > Shift & Preset
- Call Control:
  - Access Network Info > Cell Parameters > Sector ID > 00000000 : 00000000 : 00000000 : 00000000 > Subnet Mask > 0
  - Generator Info > Termination Parameters > Max Forward Packet Duration > 16 Slots
- Call Parms:
  - Cell Power > -105.5 dBm/1.23 MHz
  - Cell Band > (Select US Cellular or US PCS)
  - Channel > (Enter channel number)
  - Application Config > Enhanced Test Application Protocol > FTAP (default)
  - FTAP Rate > 307.2 kbps (2 Slot, QPSK)
  - Rvs Power Ctrl > Active bits
  - Protocol Rel > 0 (1xEV-DO)
- Press “Start Data Connection” when “Session Open” appear in “Active Cell”
- Rvs Power Ctrl > All Up bits (Maximum TxPout)

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1xEV-DO - Revision A (REV A)

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

Application	Rev, License
1xEV-DO Terminal Test	A.09.13

EVDO Rev. A – RETAP

- Call Setup > Shift & Preset
- Cell Power > -60 dBm/1.23 MHz
- Protocol Rev > A (1xEV-DO-A)
- Application Config > Enhanced Test Application Protocol > RETAP
- R-Data Pkt Size > 4096
- Protocol Subtype Config > Release A Physical Layer Subtype > Subtype 2
    - PL Subtype 2 Access Channel MAC Subtype > Default (Subtype 0)
- Access Network Info > Cell Parameters
    - Sector ID > 00000000: 00000000: 00000000: 00000000
    - Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration >16 Slots
    - ACK R-Data After > Subpacket 0 (All ACK)
- Rvs Power Ctrl > All Up bits (to get the maximum power)

EVDO Rev. A - FETAP

- Call Setup > Shift & Preset
- Cell Power > -60 dBm/1.23 MHz
- Protocol Rev > A (1xEV-DO-A)
- Application Config > Enhanced Test Application Protocol > FETAP
- F-Traffic Format > 4 (1024, 2,128) Canonical (307.2k, QPSK)
- Protocol Subtype Config > Release A Physical Layer Subtype > Subtype 2
    - PL Subtype 2 Access Channel MAC Subtype > Default (Subtype 0)
- Access Network Info > Cell Parameters > Sector ID > 00000000: 00000000: 00000000: 00000000
    - Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration >16 Slots
    - ACK R-Data After > Subpacket 0 (All ACK)
- Rvs Power Ctrl > All Up bits (to get the maximum power)

RESULT

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7.2.1. CDMA BC10

ID:	39004	Date:	4/13/18

Band	Mode	Radio Configuration (RC)	Service Option (SO)	Ch No.	Freq. (MHz)	Average Power (dBm)	
						Ant 1	Ant 2
BC10 (800MHz)	1xRTT	RC1	2 (Loopback)	450	817.25	25.4	24.4
				560	820.00	25.4	24.4
				670	822.75	25.4	24.5
			55 (Loopback)	450	817.25	24.5	24.4
				560	820.00	25.4	24.3
				670	822.75	25.5	24.5
		RC2	9 (Loopback)	450	817.25	**25.5**	24.4
				560	820.00	25.4	**24.5**
				670	822.75	25.4	24.4
			55 (Loopback)	450	817.25	25.4	24.5
				560	820.00	25.5	24.4
				670	822.75	25.4	24.4
		RC3	2 (Loopback)	450	817.25	25.4	24.4
				560	820.00	25.4	24.5
				670	822.75	25.5	24.4
			55 (Loopback)	450	817.25	24.5	24.4
				560	820.00	25.5	24.5
				670	822.75	25.4	24.5
			32 (+ F-SCH)	450	817.25	25.3	24.2
				560	820.00	25.4	24.3
				670	822.75	25.4	24.2
			32 (+ SCH)	450	817.25	25.5	24.1
				560	820.00	25.4	24.2
				670	822.75	25.4	24.1
		RC4	2 (Loopback)	450	817.25	25.4	24.5
				560	820.00	25.5	24.4
				670	822.75	25.4	24.5
			55 (Loopback)	450	817.25	25.5	24.4
				560	820.00	25.4	24.4
				670	822.75	25.5	24.5
			32 (+ F-SCH)	450	817.25	25.4	24.2
				560	820.00	25.4	24.2
				670	822.75	25.5	24.1
			32 (+ SCH)	450	817.25	25.4	24.3
				560	820.00	25.5	24.2
				670	822.75	25.3	24.2
		RC5	9 (Loopback)	450	817.25	25.4	24.5
				560	820.00	25.5	24.4
				670	822.75	25.4	24.4
			55 (Loopback)	450	817.25	25.5	24.5
				560	820.00	25.5	24.4
				670	822.75	25.4	24.4
	1xAdvanced	RC11	2 (Loopback)	450	817.25	25.3	24.3
				560	820.00	25.1	24.3
				670	822.75	25.0	24.4
			75 (Loopback)	450	817.25	24.8	24.3
				560	820.00	24.9	24.2
				670	822.75	24.9	24.3
			32 (+ F-SCH)	450	817.25	25.3	24.4
				560	820.00	25.2	24.5
				670	822.75	25.1	24.4
			32 (+ SCH)	450	817.25	25.1	24.4
				560	820.00	24.9	24.4
				670	822.75	25.0	24.3
	1xEVDO Rel. 0	FTAP Rate: 307.2 kbps(2 slot, QPSK)	RTAP Rate: 153.6 kbps	450	817.25	25.2	24.4
				560	820.00	25.3	24.4
				670	822.75	25.3	24.5
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK	RETAP: 4096	450	817.25	**25.5**	24.4
				560	820.00	25.4	24.5
				670	822.75	25.4	**24.5**

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7.2.2. CDMA BC0

ID:	39004	Date:	4/13/18

Band	Mode	Radio Configuration (RC)	Service Option (SO)	Ch No.	Freq. (MHz)	Average Power (dBm)	
						Ant 1	Ant 2
BC0 (850MHz)	1xRTT	RC1	2 (Loopback)	1013	824.70	25.4	24.5
				384	836.52	25.2	24.4
				777	848.31	25.3	24.5
			55 (Loopback)	1013	824.70	25.5	24.4
				384	836.52	25.3	24.5
				777	848.31	25.2	24.4
		RC2	9 (Loopback)	1013	824.70	**25.5**	24.5
				384	836.52	25.3	24.4
				777	848.31	25.5	**24.5**
			55 (Loopback)	1013	824.70	25.4	24.4
				384	836.52	25.2	24.4
				777	848.31	25.3	24.5
		RC3	2 (Loopback)	1013	824.70	25.4	24.4
				384	836.52	25.3	24.4
				777	848.31	25.3	24.5
			55 (Loopback)	1013	824.70	25.5	24.5
				384	836.52	25.4	24.4
				777	848.31	25.3	24.5
			32 (+ F-SCH)	1013	824.70	25.3	24.0
				384	836.52	25.2	24.1
				777	848.31	25.4	24.0
			32 (+ SCH)	1013	824.70	25.3	24.1
				384	836.52	25.4	24.2
				777	848.31	25.3	24.0
		RC4	2 (Loopback)	1013	824.70	25.5	24.4
				384	836.52	25.5	24.5
				777	848.31	25.4	24.4
			55 (Loopback)	1013	824.70	25.5	24.5
				384	836.52	25.4	24.4
				777	848.31	25.4	24.4
			32 (+ F-SCH)	1013	824.70	25.4	24.1
				384	836.52	25.3	24.2
				777	848.31	25.3	24.1
			32 (+ SCH)	1013	824.70	25.4	24.2
				384	836.52	25.3	24.1
				777	848.31	25.3	24.0
		RC5	9 (Loopback)	1013	824.70	25.5	24.4
				384	836.52	25.5	24.5
				777	848.31	25.4	24.4
			55 (Loopback)	1013	824.70	25.5	24.5
				384	836.52	25.5	24.4
				777	848.31	25.4	24.4
	1xAdvanced	RC11	2 (Loopback)	1013	824.70	24.6	24.2
				384	836.52	24.5	24.3
				777	848.31	24.5	24.2
			75 (Loopback)	1013	824.70	24.6	24.3
				384	836.52	24.6	24.3
				777	848.31	24.5	24.3
			32 (+ F-SCH)	1013	824.70	25.4	24.4
				384	836.52	25.5	24.3
				777	848.31	25.4	24.4
			32 (+ SCH)	1013	824.70	25.3	24.2
				384	836.52	25.3	24.5
				777	848.31	25.4	24.3
	1xEVDO Rel. 0	FTAP Rate: 307.2 kbps(2 slot, QPSK)	RTAP Rate: 153.6 kbps	1013	824.70	25.4	24.4
				384	836.52	25.3	24.4
				777	848.31	25.2	24.4
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK	RETAP: 4096	1013	824.70	**25.5**	**24.5**
				384	836.52	25.1	24.4
				777	848.31	25.2	24.5

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7.2.3. CDMA BC1

ID:	39004	Date:	4/13/18

Band	Mode	Radio Configuration (RC)	Service Option (SO)	Ch No.	Freq. (MHz)	Average Power (dBm)	
						Ant 1	Ant 2
BC1 (1900MHz)	1xRTT	RC1	2 (Loopback)	25	1851.25	25.4	18.4
				600	1880.00	25.4	18.4
				1175	1908.75	25.5	18.3
			55 (Loopback)	25	1851.25	25.4	18.3
				600	1880.00	25.4	18.3
				1175	1908.75	25.4	18.3
		RC2	9 (Loopback)	25	1851.25	25.4	**18.5**
				600	1880.00	25.5	18.4
				1175	1908.75	**25.5**	18.4
			55 (Loopback)	25	1851.25	25.5	18.3
				600	1880.00	25.4	18.4
				1175	1908.75	25.4	18.4
		RC3	2 (Loopback)	25	1851.25	25.5	18.2
				600	1880.00	25.5	18.4
				1175	1908.75	25.4	18.3
			55 (Loopback)	25	1851.25	25.4	18.4
				600	1880.00	25.5	18.3
				1175	1908.75	25.4	18.3
			32 (+ F-SCH)	25	1851.25	25.3	18.4
				600	1880.00	25.4	18.4
				1175	1908.75	25.4	18.4
			32 (+ SCH)	25	1851.25	25.4	18.3
				600	1880.00	25.5	18.3
				1175	1908.75	25.4	18.2
		RC4	2 (Loopback)	25	1851.25	25.5	18.3
				600	1880.00	25.4	18.2
				1175	1908.75	25.5	18.2
			55 (Loopback)	25	1851.25	25.5	18.2
				600	1880.00	25.4	18.2
				1175	1908.75	25.5	18.2
			32 (+ F-SCH)	25	1851.25	25.4	18.3
				600	1880.00	25.5	18.3
				1175	1908.75	25.4	18.3
			32 (+ SCH)	25	1851.25	25.5	18.2
				600	1880.00	25.4	18.3
				1175	1908.75	25.4	18.2
		RC5	9 (Loopback)	25	1851.25	25.5	18.3
				600	1880.00	25.4	18.2
				1175	1908.75	25.4	18.2
			55 (Loopback)	25	1851.25	25.5	18.4
				600	1880.00	25.4	18.3
				1175	1908.75	25.4	18.3
	1xAdvanced	RC11	2 (Loopback)	25	1851.25	24.9	18.3
				600	1880.00	25.1	18.4
				1175	1908.75	25.2	18.4
			75 (Loopback)	25	1851.25	24.9	18.3
				600	1880.00	25.0	18.4
				1175	1908.75	24.7	18.4
			32 (+ F-SCH)	25	1851.25	25.4	18.4
				600	1880.00	25.3	18.4
				1175	1908.75	25.2	18.4
			32 (+ SCH)	25	1851.25	25.2	18.4
				600	1880.00	25.1	18.4
				1175	1908.75	25.1	18.4
	1xEVDO Rel. 0	FTAP Rate: 307.2 kbps(2 slot, QPSK)	RTAP Rate: 153.6 kbps	25	1851.25	25.4	18.3
				600	1880	25.3	18.2
				1175	1908.75	25.4	18.3
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK	RETAP: 4096	25	1851.25	**25.5**	18.4
				600	1880	25.4	**18.5**
				1175	1908.75	25.3	18.3

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7.3. 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 ≥ RBW.≥ 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
	βc/βd	8/15

HSDPA REL 5

The following 4 Sub-tests were completed according to Release 5 procedures in table C.10.1.4 of 3GPP TS 34.121-1
A summary of these settings are illustrated below:

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1, Note 2)*	**CM** (dB) *(Note 3)*	**MPR** (dB) *(Note 3)*
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 *(Note 4)*	15/15 *(Note 4)*	64	12/15 *(Note 4)*	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

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HSPA REL 6 (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in table C.11.1.3 of 3GPP TS 34.121-1. A summary of these settings are illustrated below:

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c . For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with β_{hs} = 5/15 * β_c .

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

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

The following 4 Sub-tests for DC-HSDPA were completed according to Release 8 procedures in table C08.1.12 of 3GPP TS 34.121-1. A summary of subtest settings are illustrated below:

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.

RESULT

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7.3.1. WCDMA BAND 5

ID:	50820	Date:	3/21/18

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Average Power	
						Ant 1	Ant 2
W-CDMA Band 5 (850MHz)	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	25.3	24.3
			4183	836.6	N/A	**25.5**	**24.5**
			4233	846.6	N/A	25.4	24.4
	HSDPA	Subtest 1	4132	826.4	0	25.3	24.3
			4183	836.6	0	**25.5**	**24.5**
			4233	846.6	0	25.5	24.5
		Subtest 2	4132	826.4	0	25.3	24.4
			4183	836.6	0	25.4	24.3
			4233	846.6	0	25.4	24.3
		Subtest 3	4132	826.4	0.5	24.8	24.0
			4183	836.6	0.5	25.0	24.0
			4233	846.6	0.5	25.0	23.9
		Subtest 4	4132	826.4	0.5	24.8	23.8
			4183	836.6	0.5	24.9	23.8
			4233	846.6	0.5	25.0	23.9
	HSPA (HSDPA & HSUPA)	Subtest 1	4132	826.4	0	24.8	24.3
			4183	836.6	0	24.9	24.2
			4233	846.6	0	24.8	24.3
		Subtest 2	4132	826.4	2	22.9	22.4
			4183	836.6	2	22.8	22.2
			4233	846.6	2	22.9	22.0
		Subtest 3	4132	826.4	1	23.9	23.4
			4183	836.6	1	24.0	23.2
			4233	846.6	1	24.0	23.3
		Subtest 4	4132	826.4	2	22.7	22.3
			4183	836.6	2	22.8	22.5
			4233	846.6	2	22.8	22.3
		Subtest 5	4132	826.4	0	24.7	24.3
			4183	836.6	0	24.6	24.2
			4233	846.6	0	24.5	24.3
	DC-HSDPA	Subtest 1	4132	826.4	0	25.1	24.1
			4183	836.6	0	25.1	24.2
			4233	846.6	0	25.1	24.0
		Subtest 2	4132	826.4	0	25.1	23.8
			4183	836.6	0	25.1	23.9
			4233	846.6	0	25.2	23.8
		Subtest 3	4132	826.4	0.5	24.6	23.6
			4183	836.6	0.5	24.5	23.7
			4233	846.6	0.5	24.5	23.5
		Subtest 4	4132	826.4	0.5	24.6	23.4
			4183	836.6	0.5	24.6	23.4
			4233	846.6	0.5	24.5	23.3

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7.3.2. WCDMA BAND 2

ID:	50820	Date:	3/20/18

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Average Power (dBm)		Average Power (dBm)	
						Ant 1	Ant 2	Ant 3	Ant 4
W-CDMA Band 2 (1900MHz)	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	25.3	18.3	24.5	20.3
			9400	1880.0	N/A	**25.5**	**18.5**	24.7	20.3
			9538	1907.6	N/A	25.4	18.4	**25.0**	**20.5**
	HSDPA	Subtest 1	9262	1852.4	0	25.3	18.4	24.8	20.4
			9400	1880.0	0	**25.4**	**18.5**	24.7	20.3
			9538	1907.6	0	25.2	18.5	**25.0**	**20.5**
		Subtest 2	9262	1852.4	0	25.2	18.5	24.8	20.5
			9400	1880.0	0	25.2	18.4	24.8	20.3
			9538	1907.6	0	25.2	18.5	25.0	20.2
		Subtest 3	9262	1852.4	0.5	24.8	18.1	24.5	20.0
			9400	1880.0	0.5	24.8	18.0	24.7	20.1
			9538	1907.6	0.5	24.9	17.9	24.6	20.0
		Subtest 4	9262	1852.4	0.5	25.0	17.9	24.5	20.2
			9400	1880.0	0.5	24.9	18.0	24.6	20.1
			9538	1907.6	0.5	25.0	18.0	24.6	20.0
	HSPA (HSDPA & HSUPA)	Subtest 1	9262	1852.4	0	24.0	17.8	24.0	19.9
			9400	1880.0	0	24.4	17.8	24.2	20.0
			9538	1907.6	0	24.4	18.0	24.3	20.0
		Subtest 2	9262	1852.4	2	22.1	15.5	22.1	17.7
			9400	1880.0	2	22.2	15.8	22.2	18.0
			9538	1907.6	2	22.3	15.7	22.2	18.0
		Subtest 3	9262	1852.4	1	23.2	16.9	23.1	19.0
			9400	1880.0	1	23.1	16.8	23.2	18.9
			9538	1907.6	1	23.2	16.6	23.2	18.8
		Subtest 4	9262	1852.4	2	22.5	16.1	22.2	17.9
			9400	1880.0	2	22.4	16.0	22.1	18.0
			9538	1907.6	2	22.2	16.1	22.2	18.1
		Subtest 5	9262	1852.4	0	24.3	17.9	24.2	20.0
			9400	1880.0	0	24.2	17.9	24.1	19.9
			9538	1907.6	0	24.4	18.0	24.2	20.0
	DC-HSDPA	Subtest 1	9262	1852.4	0	25.0	18.4	24.5	20.3
			9400	1880.0	0	25.2	18.5	24.4	20.1
			9538	1907.6	0	25.2	18.4	24.4	20.2
		Subtest 2	9262	1852.4	0	25.2	18.3	24.3	20.2
			9400	1880.0	0	25.1	18.4	24.2	20.3
			9538	1907.6	0	25.2	18.3	24.3	20.2
		Subtest 3	9262	1852.4	0.5	24.7	18.0	23.9	19.7
			9400	1880.0	0.5	24.8	17.9	24.0	19.8
			9538	1907.6	0.5	24.7	17.9	23.9	19.8
		Subtest 4	9262	1852.4	0.5	24.6	17.9	24.0	20.0
			9400	1880.0	0.5	24.7	17.8	24.0	19.9
			9538	1907.6	0.5	24.8	17.9	23.9	19.9

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7.3.3. WCDMA BAND 4

ID:	50820	Date:	5/29/18

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Average Power (dBm)		Average Power (dBm)	
						Ant 1	Ant 2	Ant 3	Ant 4
W-CDMA Band 4 (1700MHz)	Rel 99	RMC, 12.2 kbps	1312	1712.4	N/A	25.3	20.2	24.8	22.2
			1413	1732.6	N/A	25.4	20.2	24.8	22.5
			1513	1752.6	N/A	**25.5**	**20.2**	**25.0**	**22.5**
	HSDPA	Subtest 1	1312	1712.4	0	25.3	20.2	24.8	22.2
			1413	1732.6	0	25.4	20.2	24.8	22.5
			1513	1752.6	0	**25.5**	**20.2**	**25.0**	**22.5**
		Subtest 2	1312	1712.4	0	25.3	20.2	24.8	22.5
			1413	1732.6	0	25.4	20.2	24.8	22.4
			1513	1752.6	0	25.4	20.1	25.0	22.2
		Subtest 3	1312	1712.4	0.5	24.8	19.9	24.5	22.0
			1413	1732.6	0.5	25.0	19.8	24.4	22.0
			1513	1752.6	0.5	25.0	19.7	24.5	22.0
		Subtest 4	1312	1712.4	0.5	24.7	19.7	24.6	22.1
			1413	1732.6	0.5	24.9	19.6	24.5	22.1
			1513	1752.6	0.5	25.0	19.7	24.5	22.0
	HSPA (HSDPA & HSUPA)	Subtest 1	1312	1712.4	0	24.5	20.2	24.2	22.1
			1413	1732.6	0	24.5	20.1	24.3	22.2
			1513	1752.6	0	24.4	20.1	24.4	22.3
		Subtest 2	1312	1712.4	2	22.5	18.2	22.4	20.2
			1413	1732.6	2	22.3	18.2	22.3	20.1
			1513	1752.6	2	22.5	18.3	22.5	20.1
		Subtest 3	1312	1712.4	1	23.5	19.3	23.4	21.2
			1413	1732.6	1	23.2	19.2	23.5	21.1
			1513	1752.6	1	23.4	19.1	23.4	21.0
		Subtest 4	1312	1712.4	2	22.3	18.3	22.2	20.3
			1413	1732.6	2	22.5	18.4	22.4	20.3
			1513	1752.6	2	22.6	18.3	22.5	20.4
		Subtest 5	1312	1712.4	0	24.6	20.0	24.4	22.2
			1413	1732.6	0	24.5	20.2	24.3	22.1
			1513	1752.6	0	24.7	20.1	24.4	22.1
	DC-HSDPA	Subtest 1	1312	1712.4	0	25.2	20.1	24.5	22.4
			1413	1732.6	0	25.2	20.0	24.4	22.2
			1513	1752.6	0	25.3	20.0	24.5	22.2
		Subtest 2	1312	1712.4	0	25.2	20.1	24.4	22.3
			1413	1732.6	0	25.2	20.0	24.4	22.2
			1513	1752.6	0	25.2	20.2	24.3	22.3
		Subtest 3	1312	1712.4	0.5	24.9	19.7	24.0	22.0
			1413	1732.6	0.5	24.8	19.6	24.0	22.0
			1513	1752.6	0.5	24.7	19.5	23.9	21.9
		Subtest 4	1312	1712.4	0.5	24.8	19.7	24.0	22.0
			1413	1732.6	0.5	24.9	19.6	23.8	22.0
			1513	1752.6	0.5	24.8	19.7	23.9	22.1

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8. CONDUCTED TEST RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049
IC: RSS132; RSS133§2.3; RSS139

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.

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)
850MHz	GPRS	190	836.6	249.54	317.3
	EGPRS			240.84	303.6
1900MHz	GPRS	661	1880.0	244.49	317.0
	EGPRS			246.10	312.3

CDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BC10	1xRTT	560	820.0	1.266	1.422
	1xEV-DO Rev A			1.270	1.427
BC0	1xRTT	384	836.5	1.271	1.423
	1xEV-DO Rev A			1.267	1.421
BC1	1xRTT	600	1880.0	1.279	1.419
	1xEV-DO Rev A			1.276	1.422

WCDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BAND 5	REL 99	4408	836.6	4.0653	4.583
	HSDPA			4.0818	4.605
BAND 2	REL 99	9800	1880.0	4.0648	4.643
	HSDPA			4.0751	4.650
BAND 4	REL 99	1638	1732.6	4.0763	4.636
	HSDPA			4.0812	4.605

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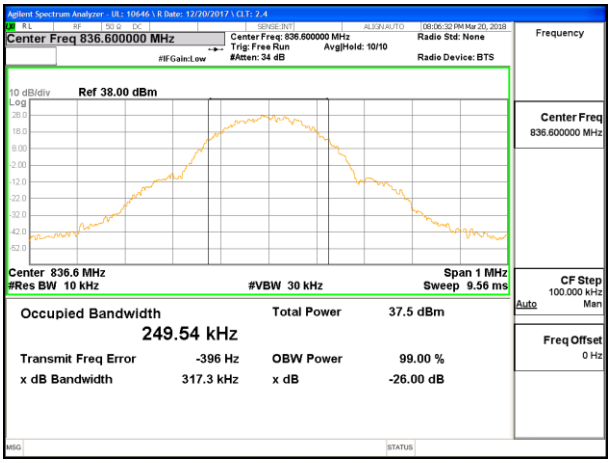
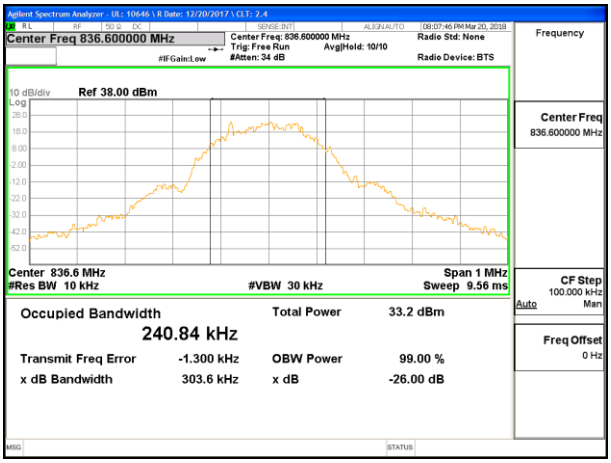
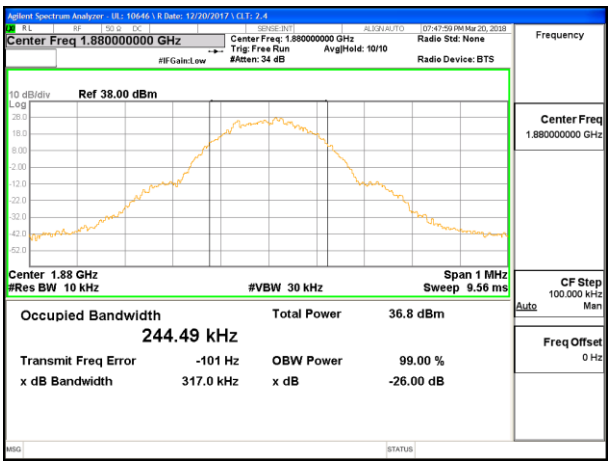
8.1.1. GSM



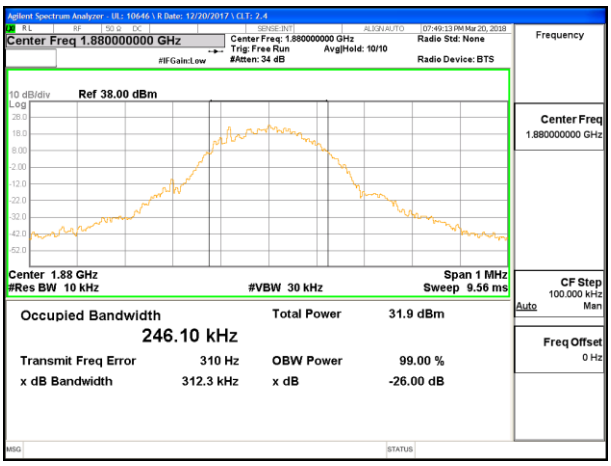
GSM 850MHz GPRS Middle Channel



GSM 850MHz EGPRS Middle Channel



GSM 1900MHz GPRS Middle Channel



GSM 1900MHz EGPRS Middle Channel

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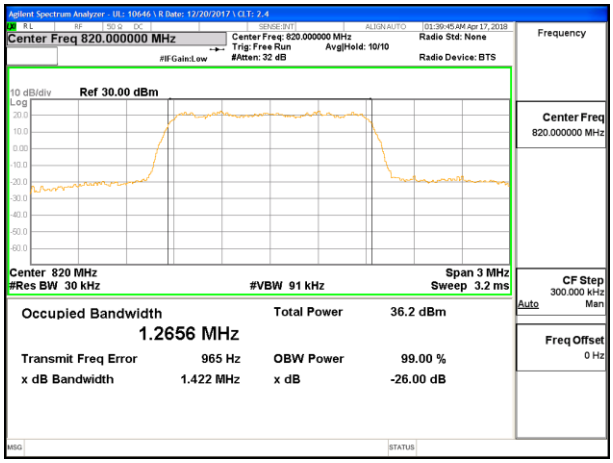
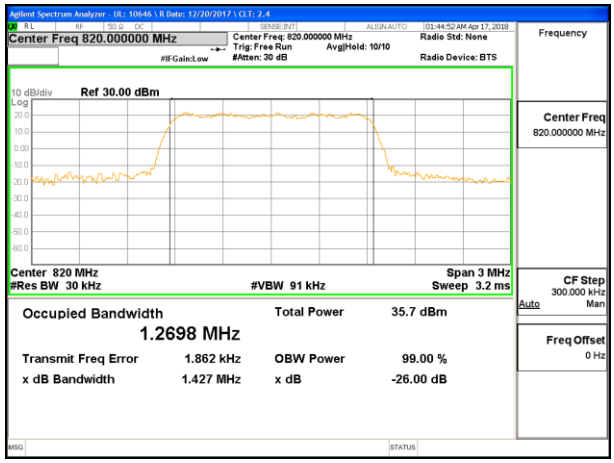
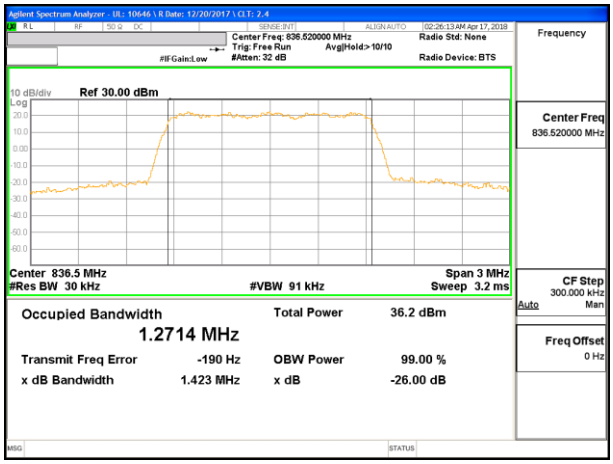
8.1.2. CDMA



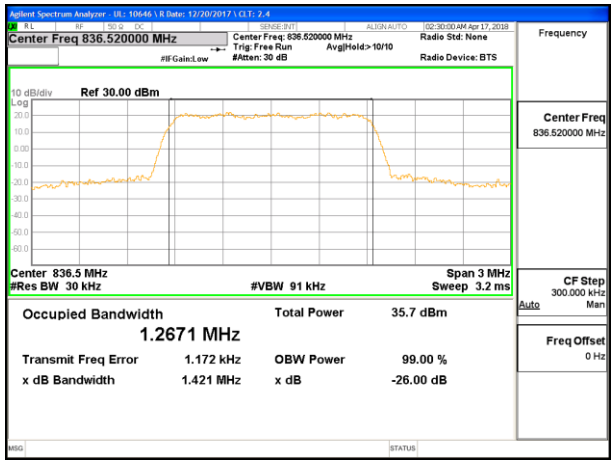
CDMA BC10 1xRTT Middle Channel



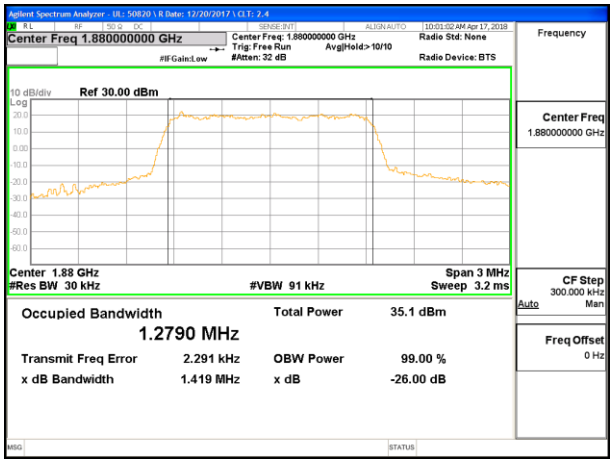
CDMA BC10 1xEV-DO Rev A Middle Channel



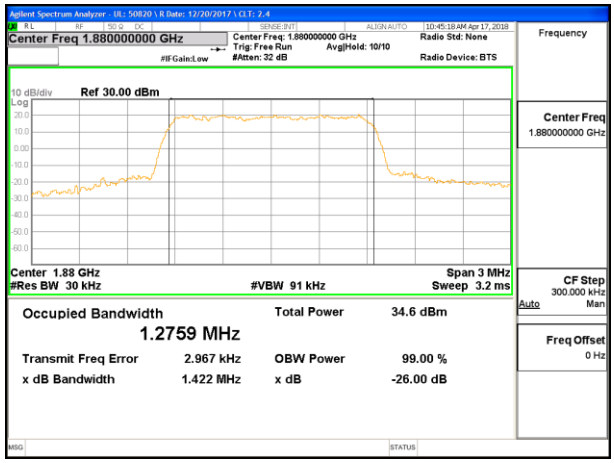
CDMA BC0 1xRTT Middle Channel



CDMA BC0 1xEV-DO Rev A Middle Channel



CDMA BC1 1xRTT Middle Channel



CDMA BC1 1xEV-DO Rev A Middle Channel

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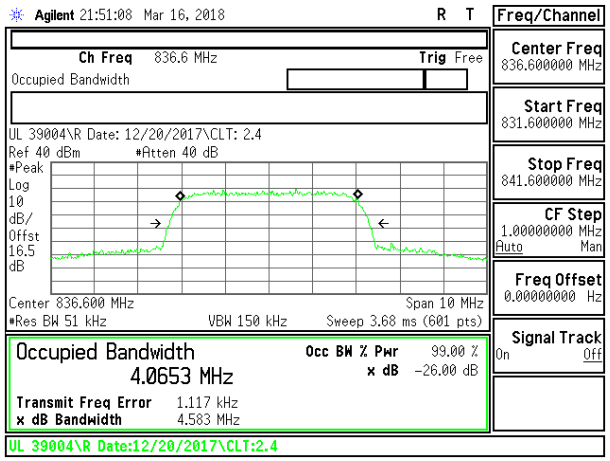
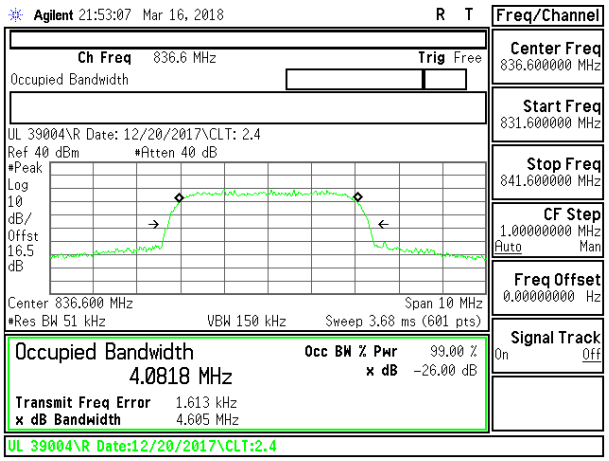
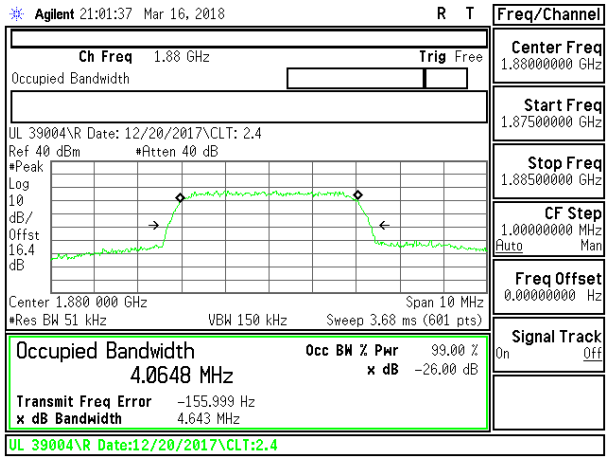
8.1.3. WCDMA



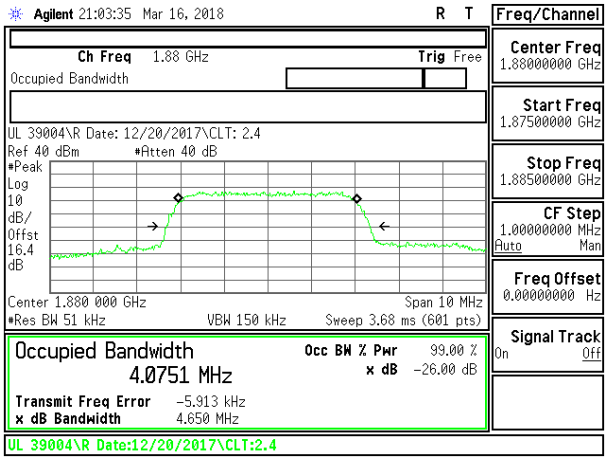
WCDMA Band 5 Rel 99 Middle Channel



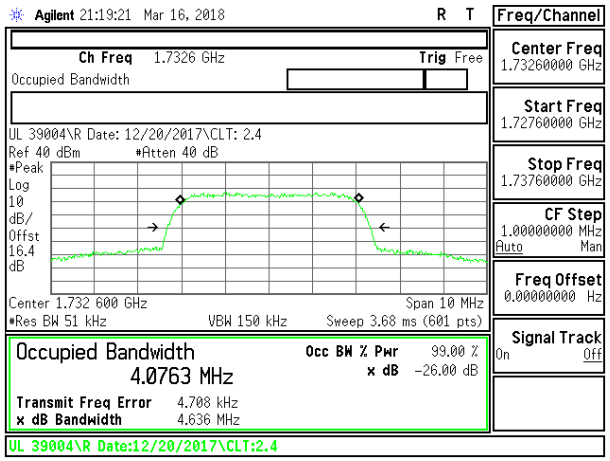
WCDMA Band 5 HSDPA Middle Channel



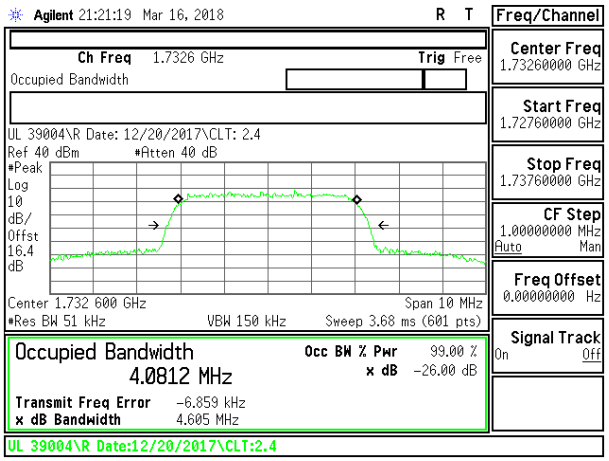
WCDMA Band 2 Rel 99 Middle Channel



WCDMA Band 2 HSDPA Middle Channel



WCDMA Band 4 Rel 99 Middle Channel



WCDMA Band 4 HSDPA Middle Channel

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8.2. BAND EDGE AND EMISSION MASK

RULE PART(S)

FCC: §2.1051, §22.917, §24.238, §27.53 and §90.691
IC: RSS132§5.5; RSS133§6.5 and RSS139§6.6

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 Log10(f/6.1) decibels or 50 + 10 Log10(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 + 10Log10(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.

RSS132§5.5
Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts).
(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS133§6.5
Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment’s operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts).
(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS139§6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment’s smallest operating frequency block,Footnote2 which can contain the equipment’s occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least43 + 10 log10 p (watts) dB.
(ii) After the first 1.0 MHz outside the equipment’s smallest operating frequency block, which can contain the equipment’s occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

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TEST PROCEDURE

The transmitter output was connected to a R&S 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:

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

RESULTS

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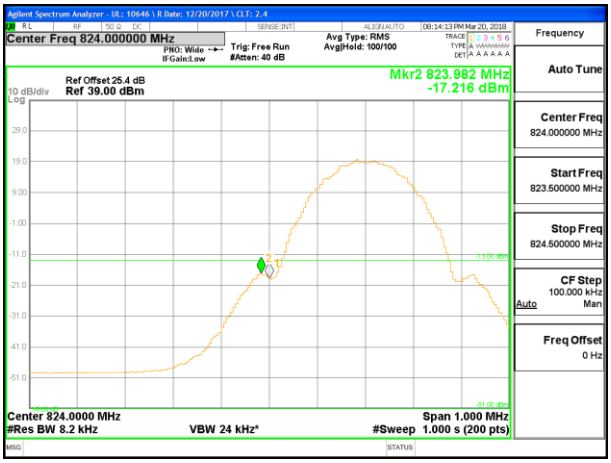
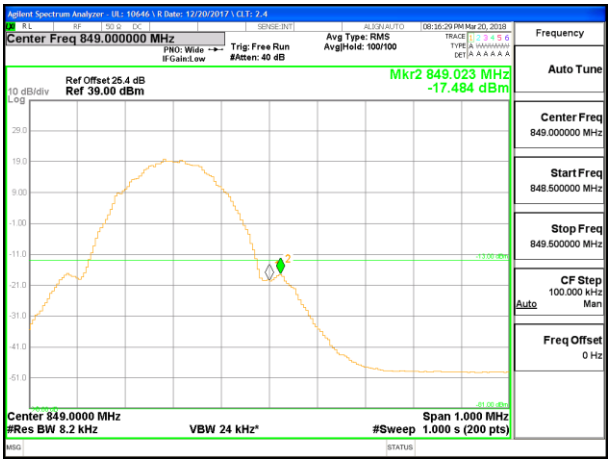
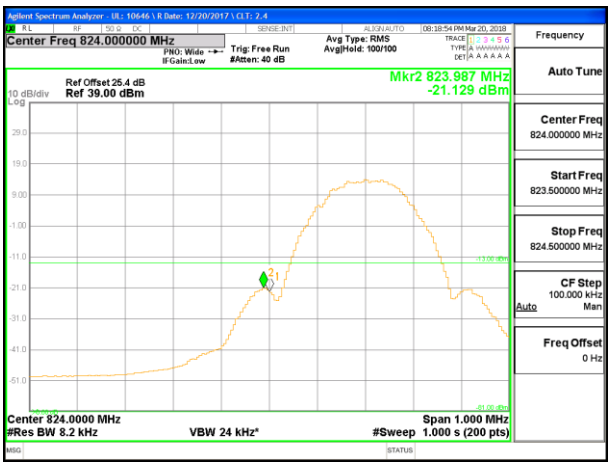
8.2.1. GSM 850



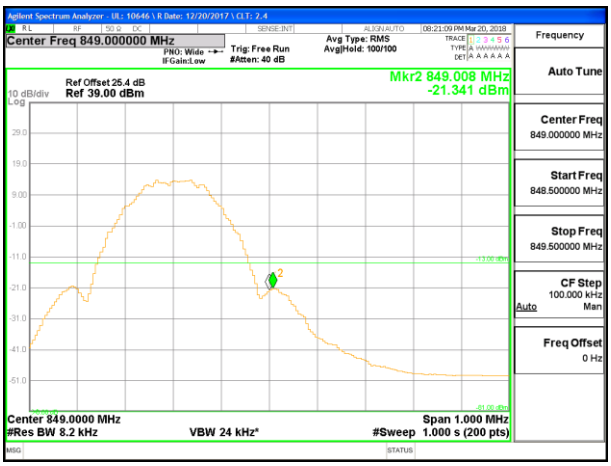
GSM 850MHz GPRS Low Channel



GSM 850MHz GPRS High Channel



GSM 850MHz EGPRS Low Channel



GSM 850MHz EGPRS High Channel

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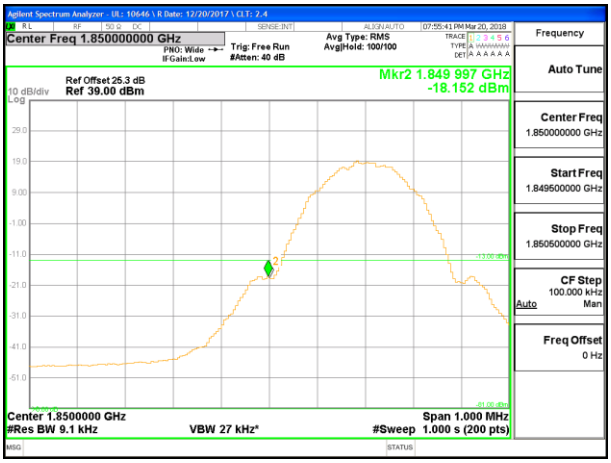
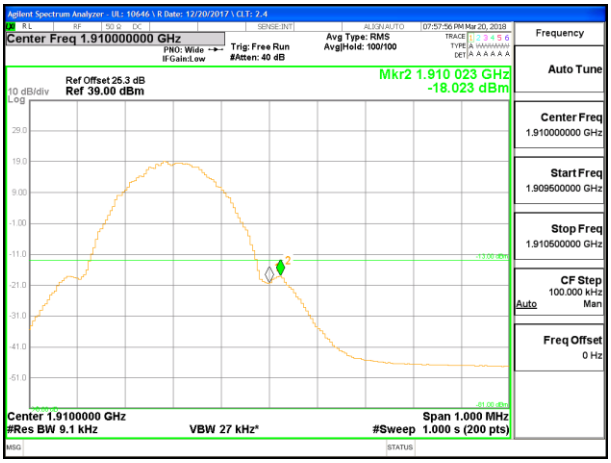
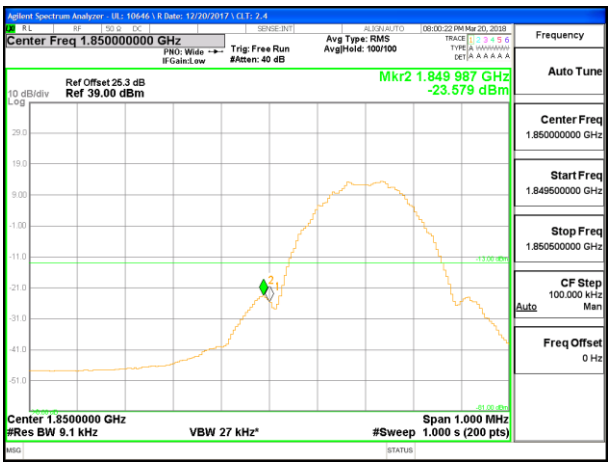
8.2.2. GSM 1900



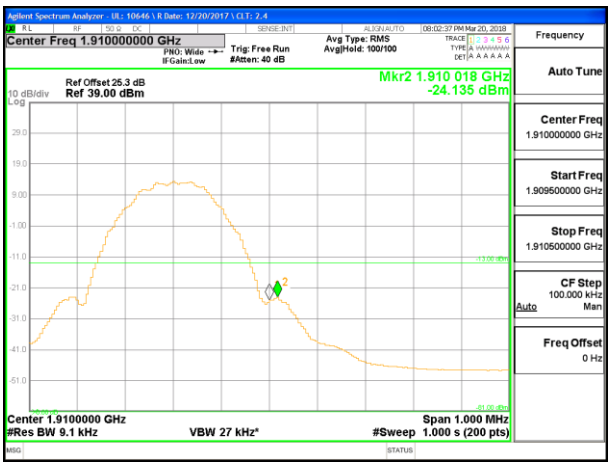
GSM 1900MHz GPRS Low Channel



GSM 1900MHz GPRS High Channel



GSM 1900MHz EGPRS Low Channel



GSM 1900MHz EGPRS High Channel

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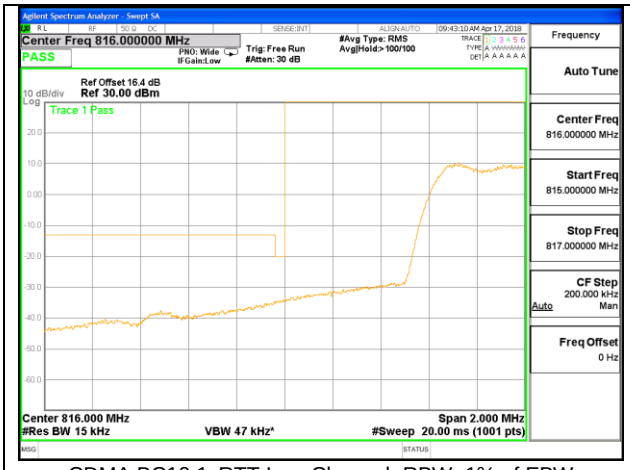
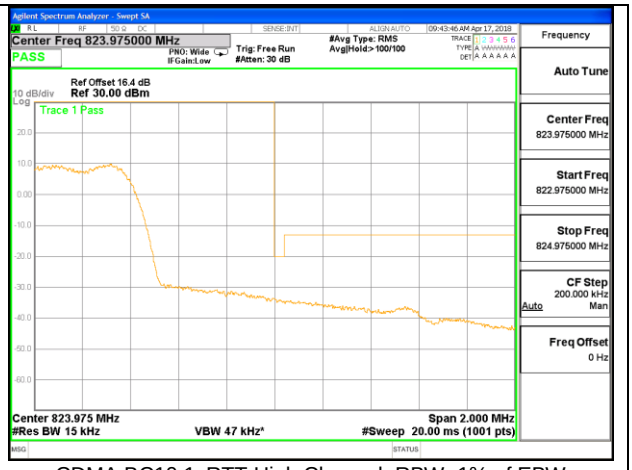
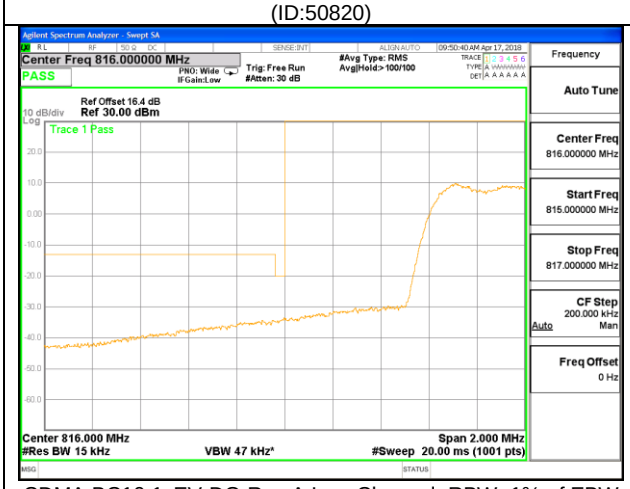
8.2.3. CDMA BC10



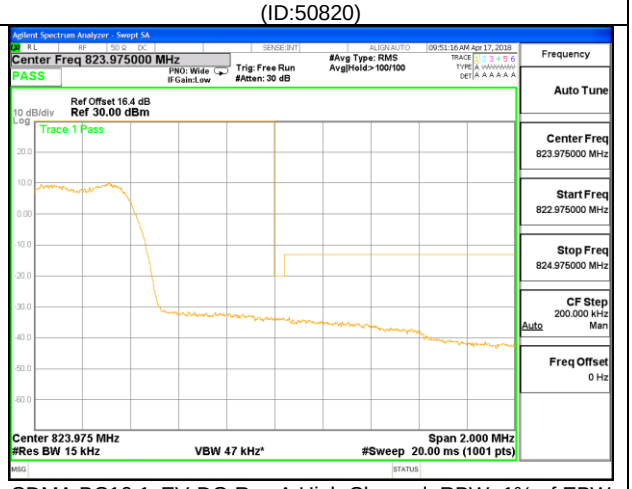
CDMA BC10 1xRTT Low Channel, RBW=1% of EBW (ID:50820)



CDMA BC10 1xRTT High Channel, RBW=1% of EBW (ID:50820)



CDMA BC10 1xEV-DO Rev A Low Channel, RBW=1% of EBW (ID:50820)



CDMA BC10 1xEV-DO Rev A High Channel, RBW=1% of EBW (ID:50820)

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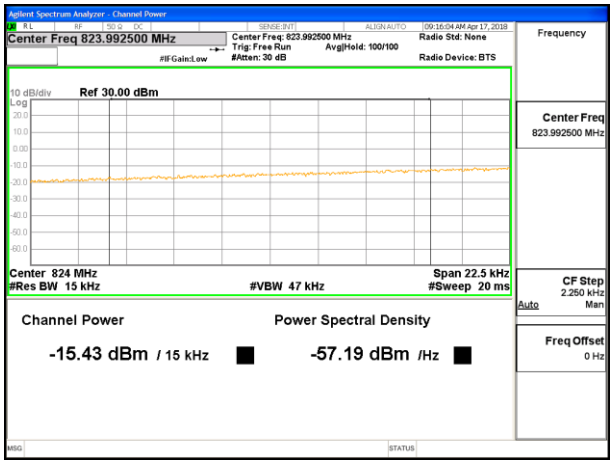
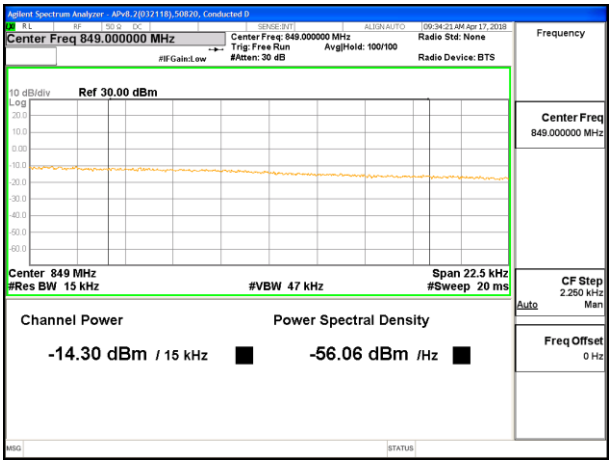
8.2.4. CDMA BC0



CDMA BC0 1xRTT Low Channel (ID:50820)



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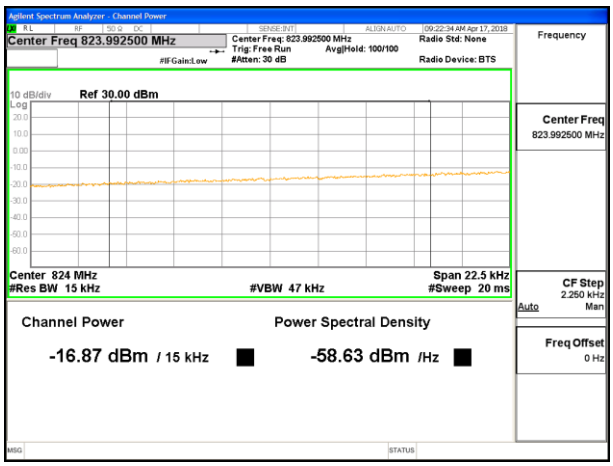

CDMA BC0 1xEV-DO Rev A Low Channel (ID:50820)

CDMA BC0 1xEV-DO Rev A High Channel (ID:50820)

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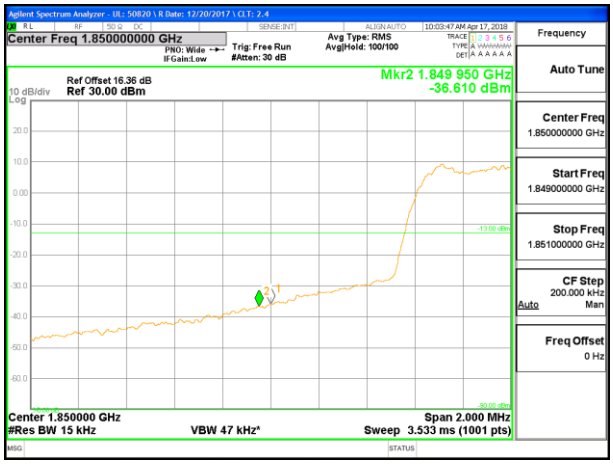
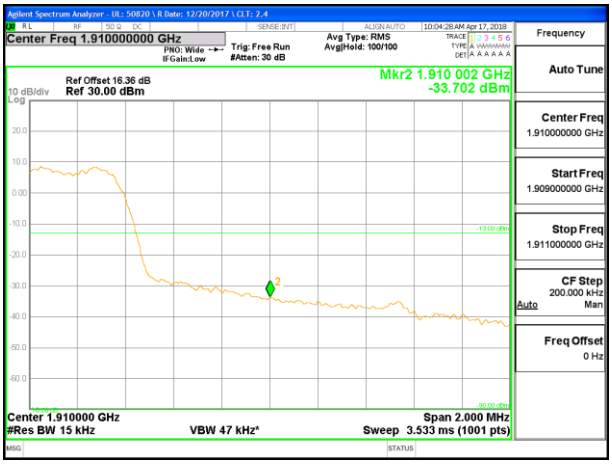
8.2.5. CDMA BC1



CDMA BC1 1xRTT Low Channel (ID:50820)



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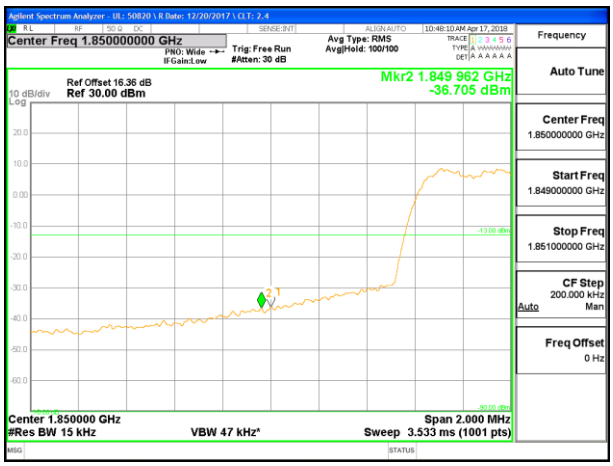
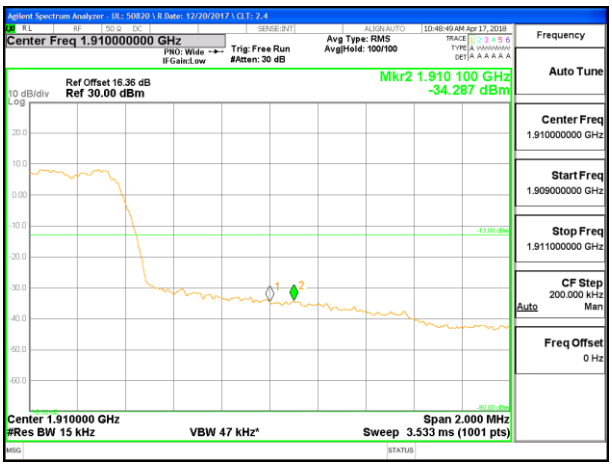


CDMA BC1 1xEV-DO Rev A Low Channel (ID:50820)



CDMA BC1 1xEV-DO Rev A High Channel (ID:50820)

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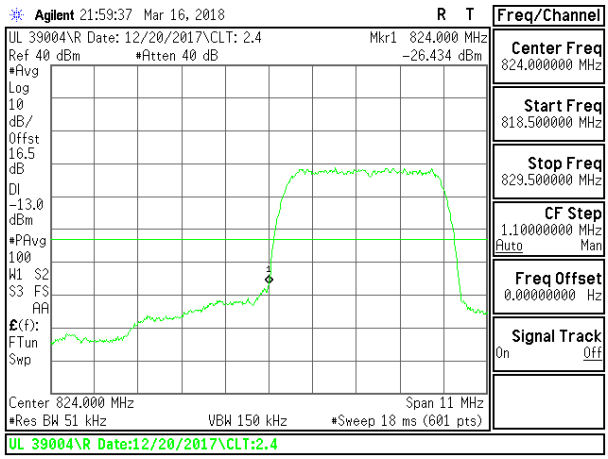
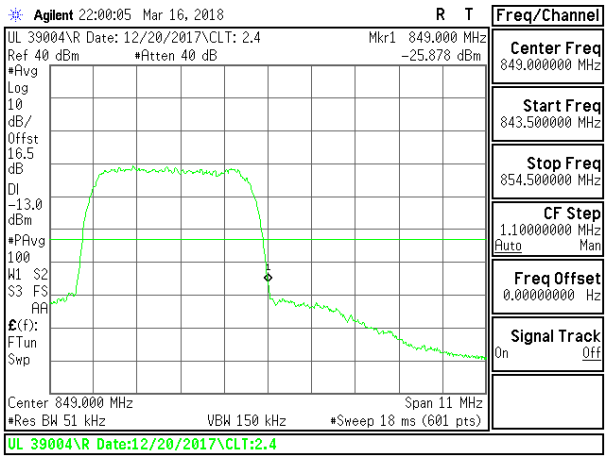
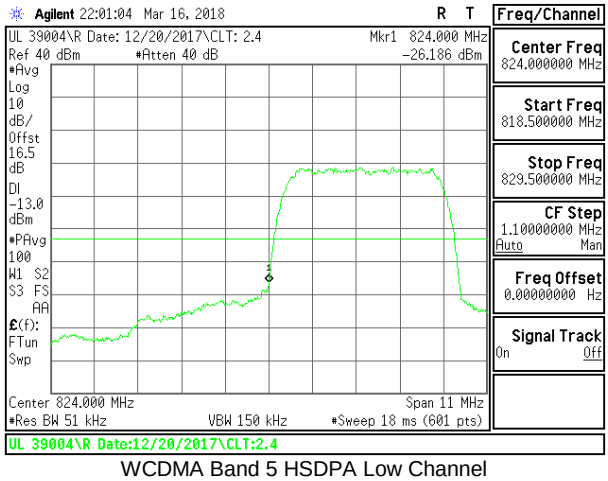
8.2.6. WCDMA BAND 5



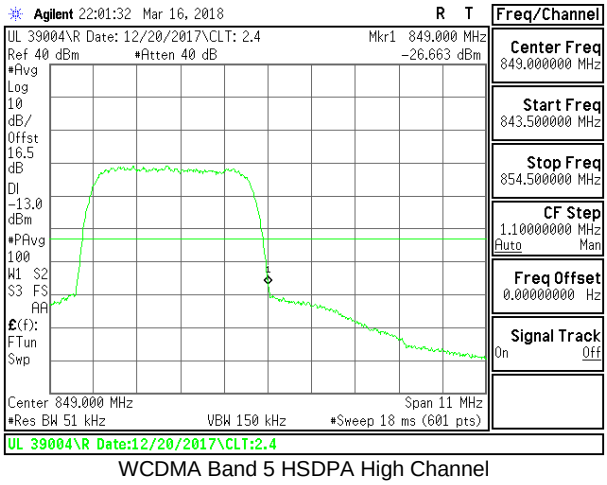
WCDMA Band 5 Rel 99 Low Channel



WCDMA Band 5 Rel 99 High Channel



WCDMA Band 5 HSDPA Low Channel



WCDMA Band 5 HSDPA High Channel

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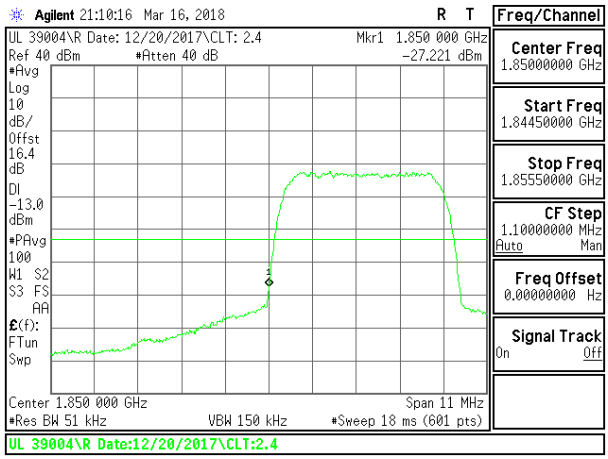
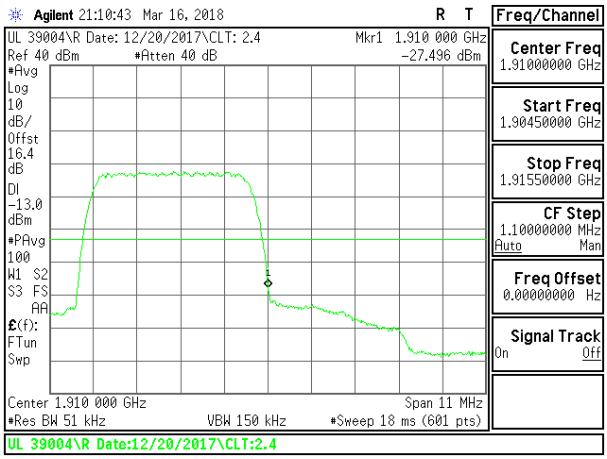
8.2.7. WCDMA BAND 2



WCDMA Band 2 Rel 99 Low Channel



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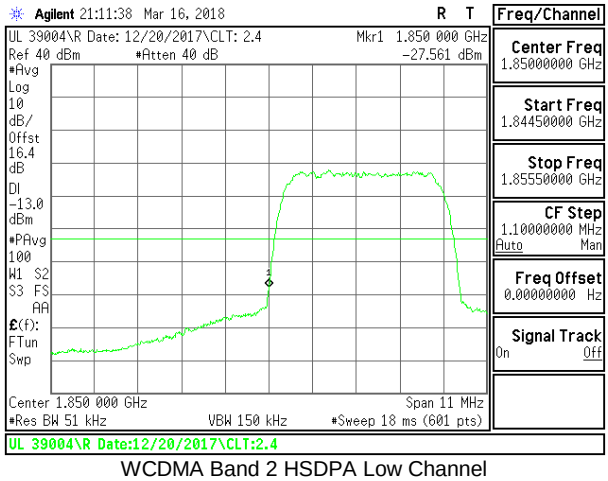
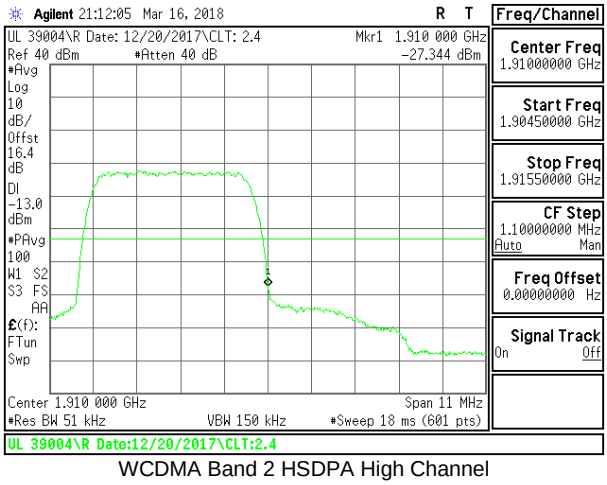


WCDMA Band 2 HSDPA Low Channel



WCDMA Band 2 HSDPA High Channel

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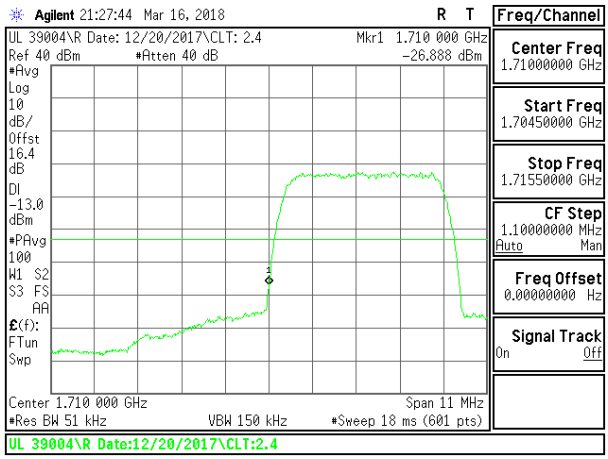
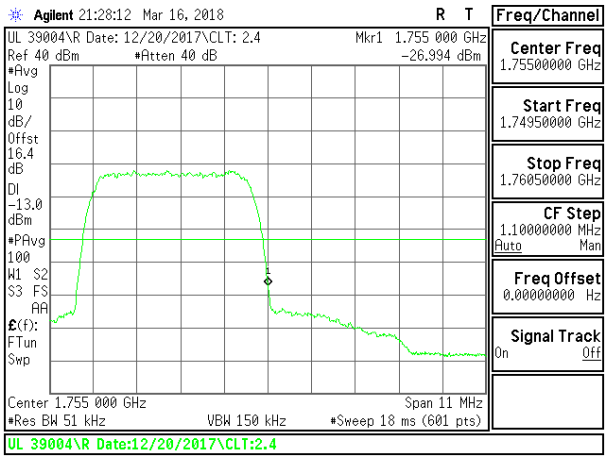
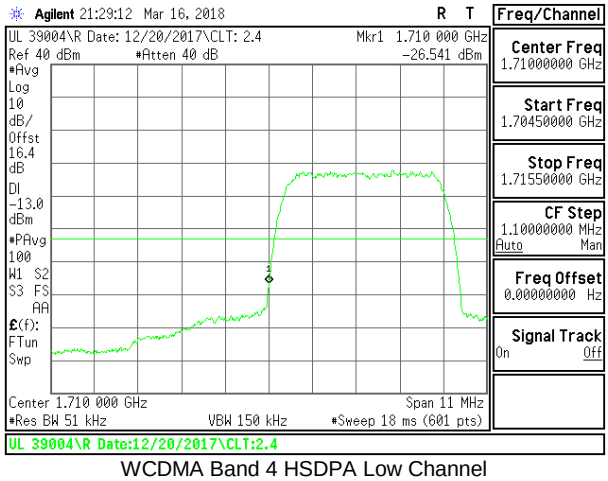
8.2.8. WCDMA BAND 4



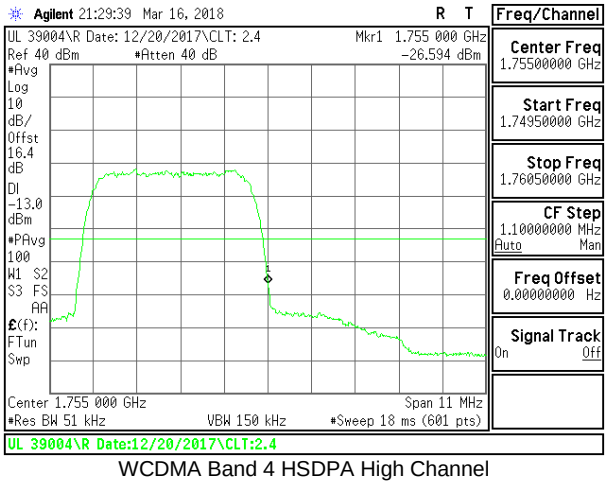
WCDMA Band 4 Rel 99 Low Channel



WCDMA Band 4 Rel 99 High Channel



WCDMA Band 4 HSDPA Low Channel



WCDMA Band 4 HSDPA High Channel

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8.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.917, §24.238, §27.53 and §90.691
IC: RSS132§5.5; RSS133§6.5 and RSS139§6.6

LIMITS

FCC: §22.917, §24.238, §27.53 (h), §90.691
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

RSS132§5.5, RSS133§6.5, RSS139§6.6
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

TEST PROCEDURE

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.

For each out of band emissions measurement:

- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

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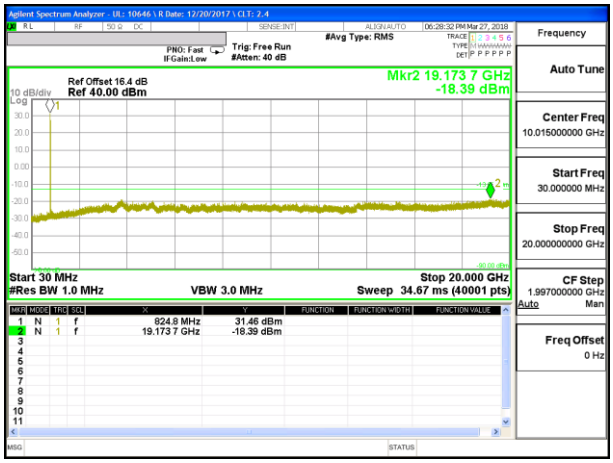
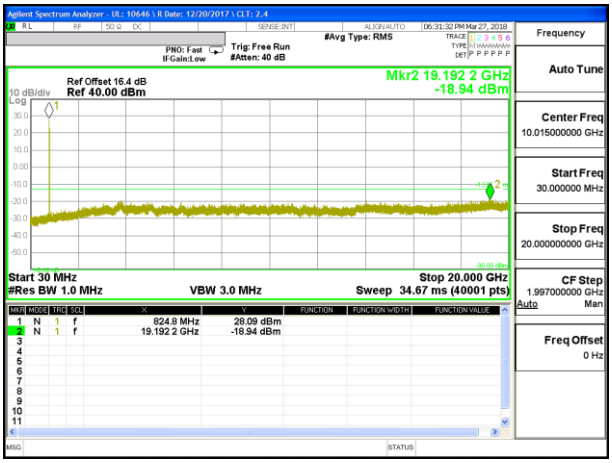
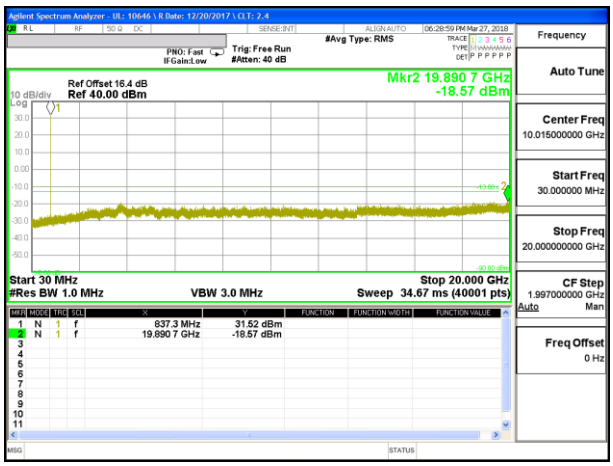
8.3.1. GSM 850MHz



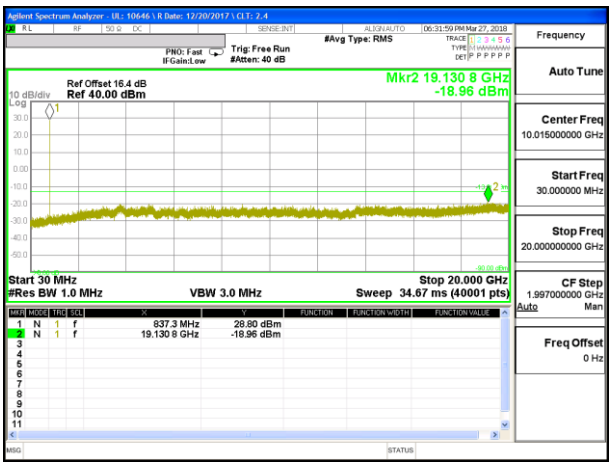
GSM 850MHz GPRS Low Channel



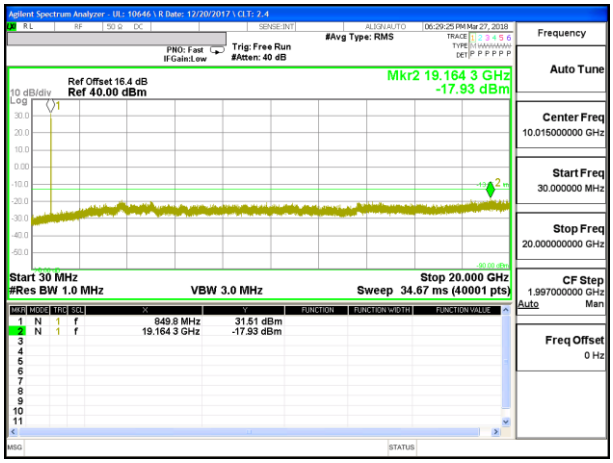
GSM 850MHz EGPRS Low Channel



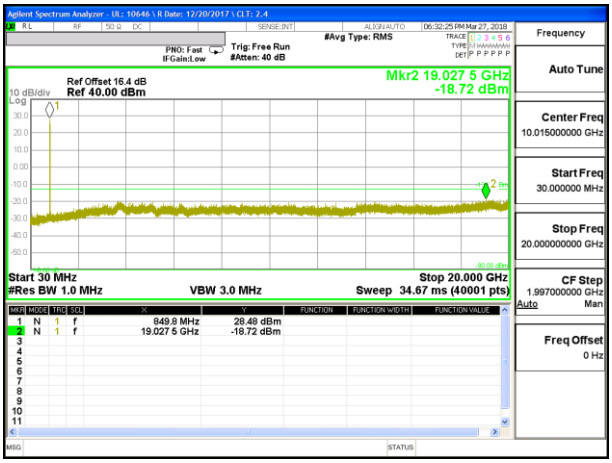
GSM 850MHz GPRS Middle Channel



GSM 850MHz EGPRS Middle Channel



GSM 850MHz GPRS High Channel



GSM 850MHz EGPRS High Channel

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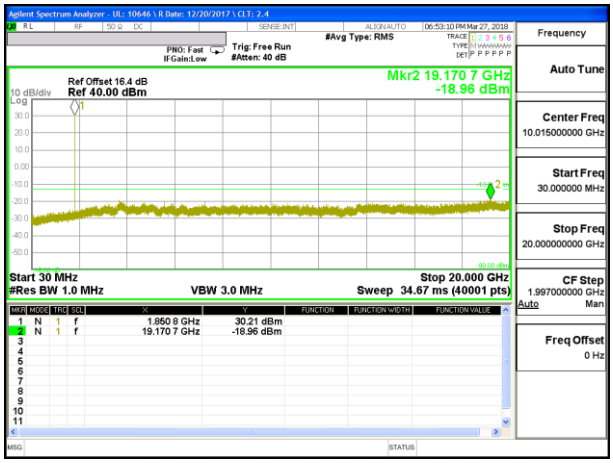
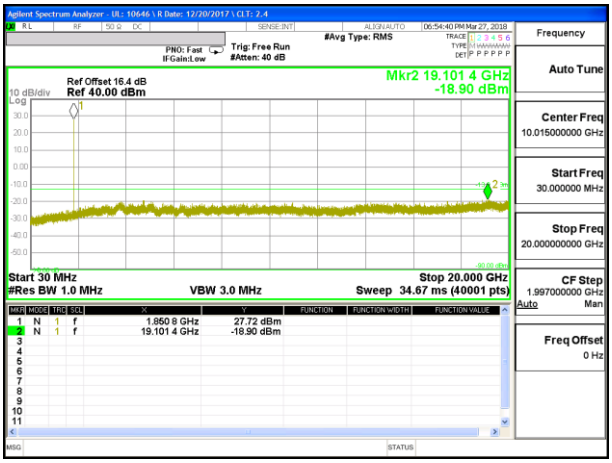
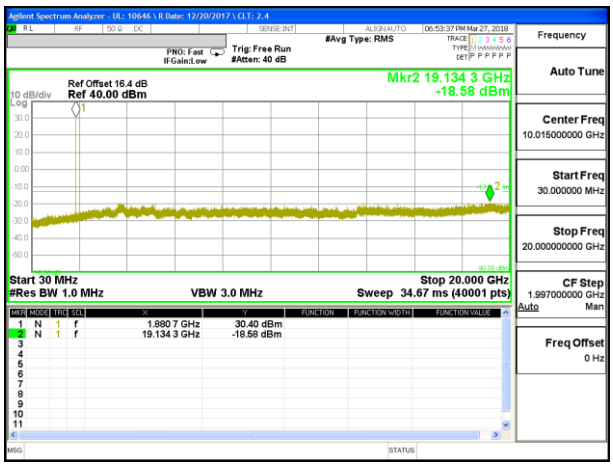
8.3.2. GSM 1900MHz



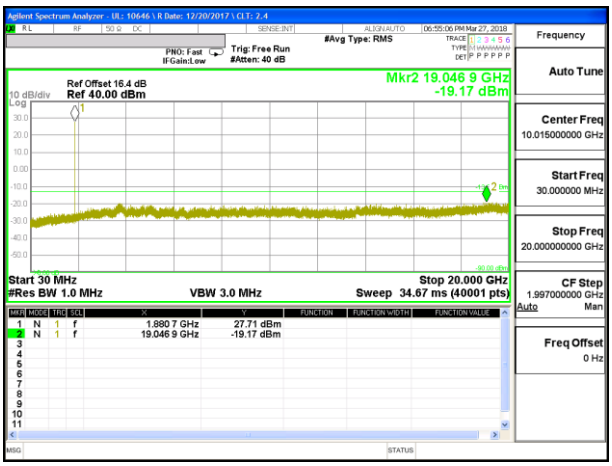
GSM 1900MHz GPRS Low Channel



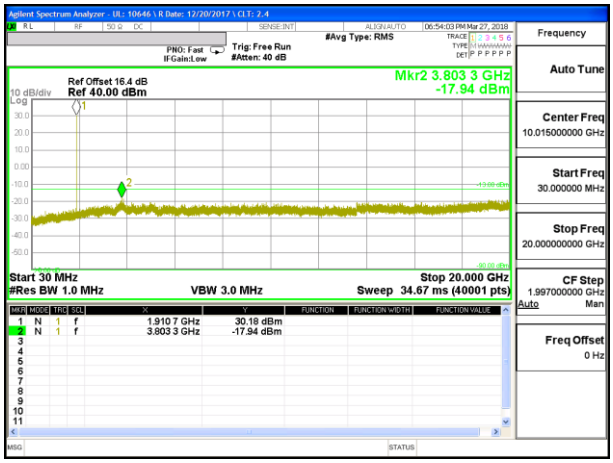
GSM 1900MHz EGPRS Low Channel



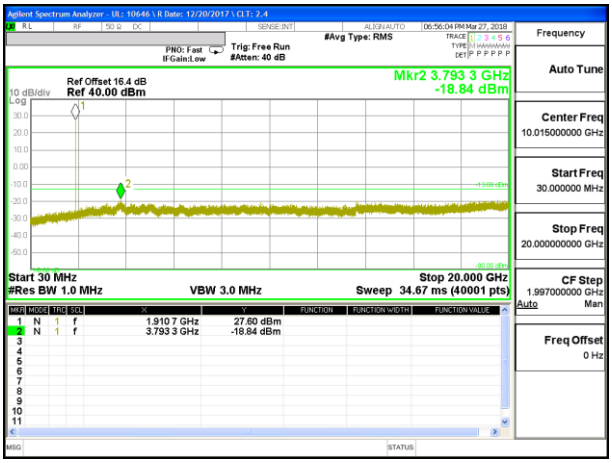
GSM 1900MHz GPRS Middle Channel



GSM 1900MHz EGPRS Middle Channel



GSM 1900MHz GPRS High Channel



GSM 1900MHz EGPRS High Channel

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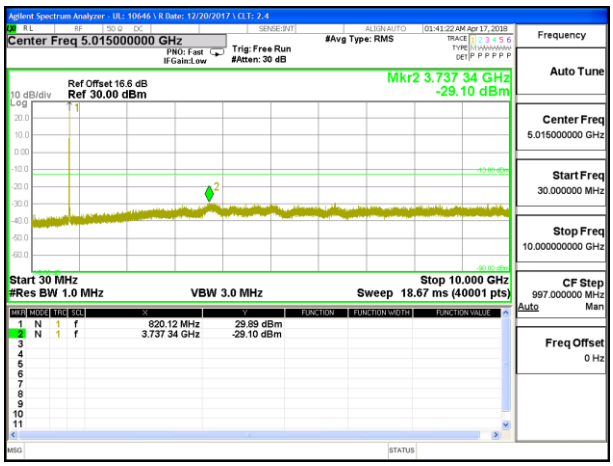
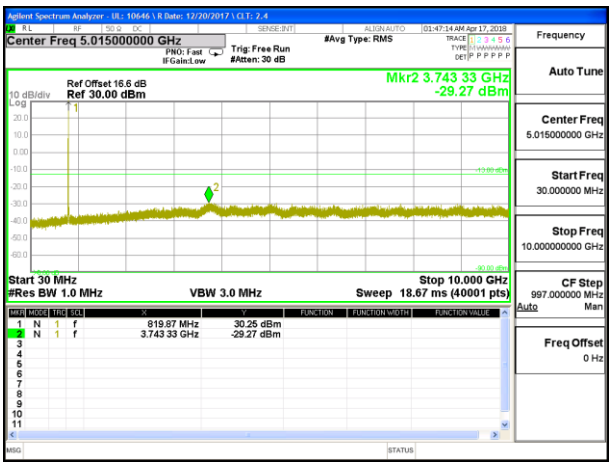
8.3.3. CDMA BC10

CDMA BC10 1xRTT Low Channel

CDMA BC10 1xEV-DO Rev A Low Channel

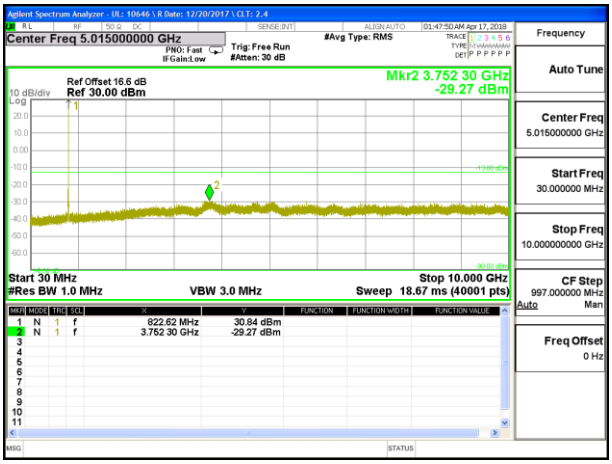


CDMA BC10 1xRTT Middle Channel



CDMA BC10 1xEV-DO Rev A Middle Channel

CDMA BC10 1xRTT High Channel



CDMA BC10 1xEV-DO Rev A High Channel

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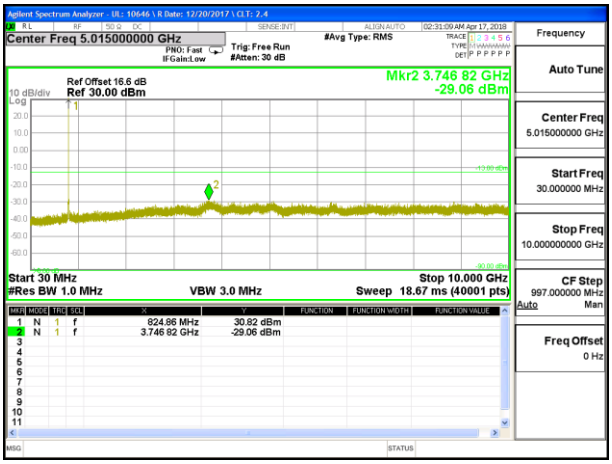
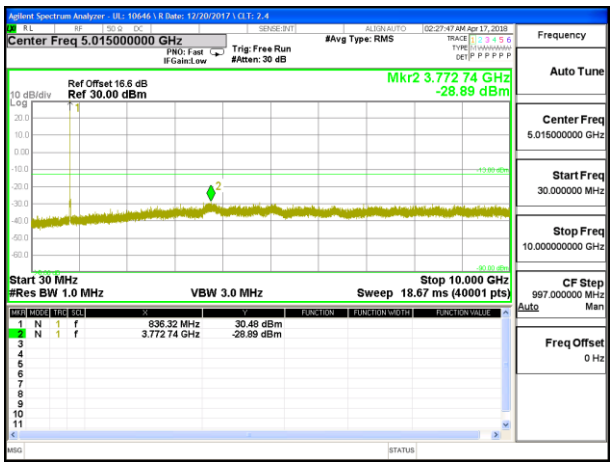
8.3.4. CDMA BC0

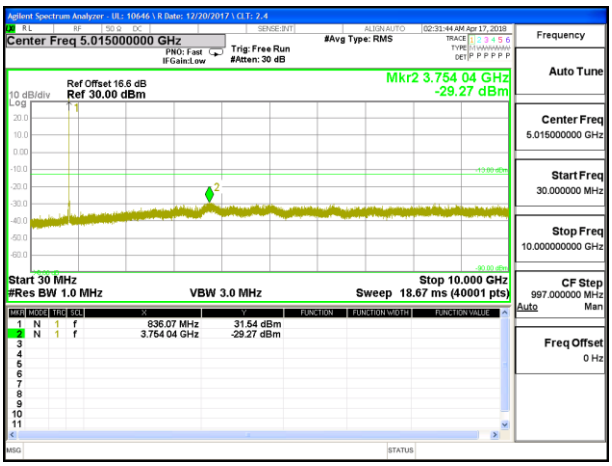
CDMA BC0 1xRTT Low Channel



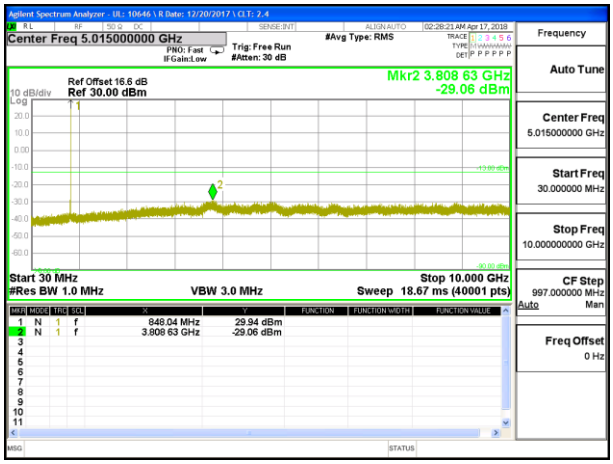
CDMA BC0 1xEV-DO Rev A Low Channel



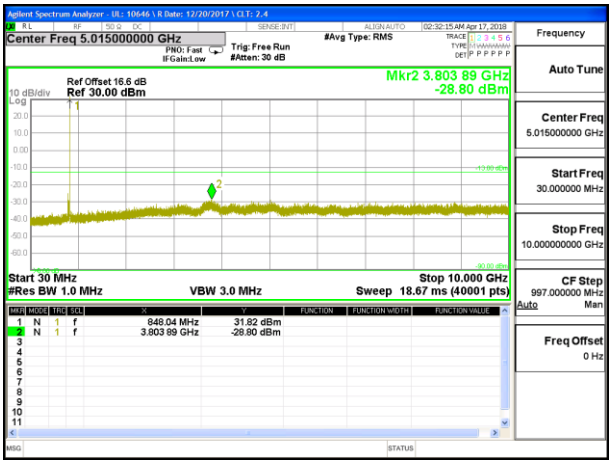
CDMA BC0 1xRTT Middle Channel



CDMA BC0 1xEV-DO Rev A Middle Channel



CDMA BC0 1xRTT High Channel



CDMA BC0 1xEV-DO Rev A High Channel

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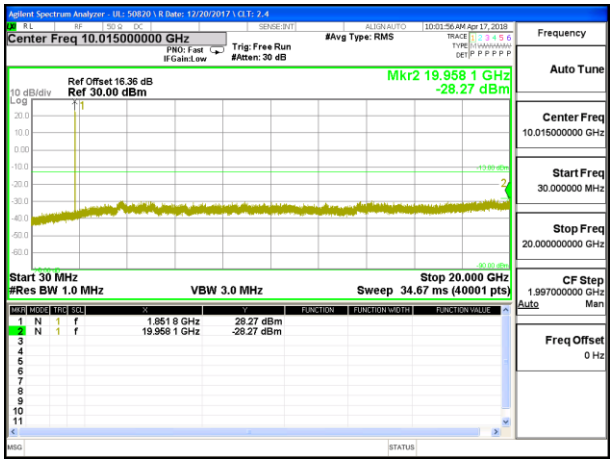
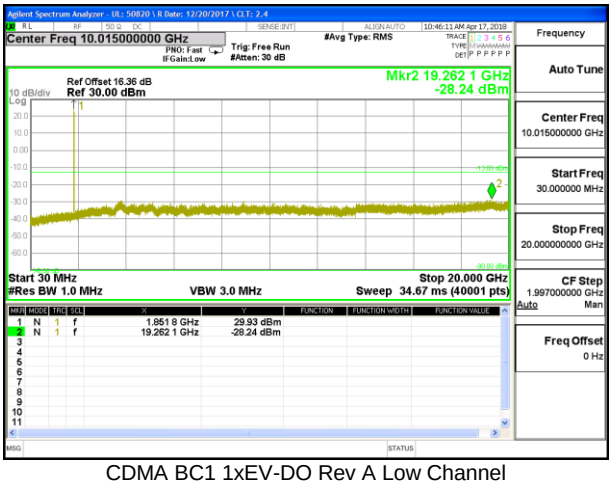
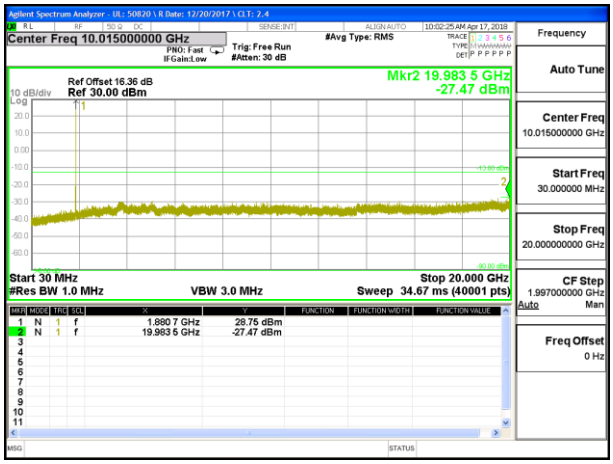
8.3.5. CDMA BC1



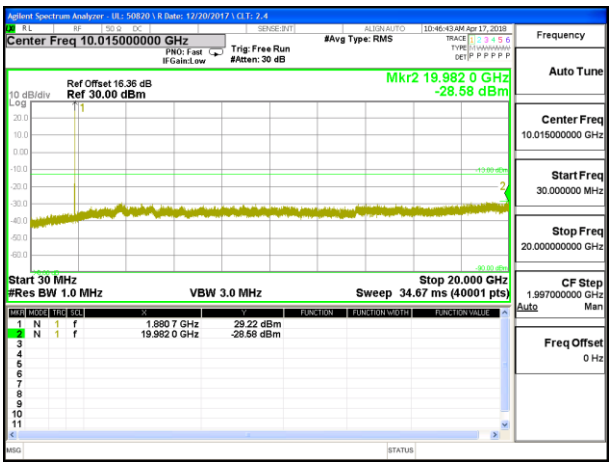
CDMA BC1 1xRTT Low Channel



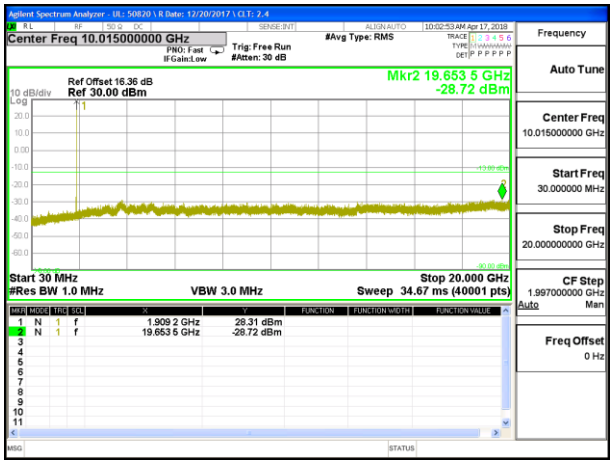
CDMA BC1 1xEV-DO Rev A Low Channel



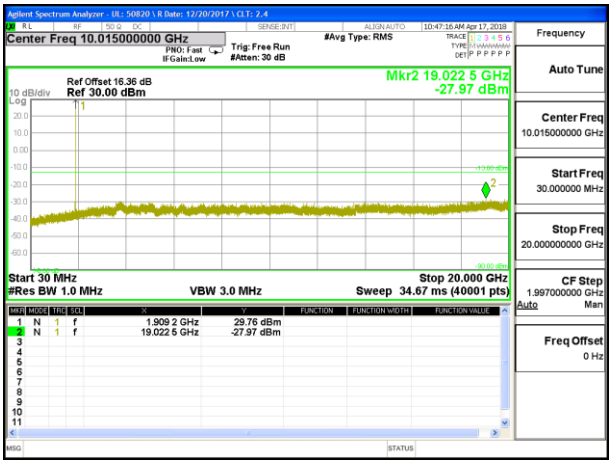
CDMA BC1 1xRTT Middle Channel



CDMA BC1 1xEV-DO Rev A Middle Channel



CDMA BC1 1xRTT High Channel



CDMA BC1 1xEV-DO Rev A High Channel

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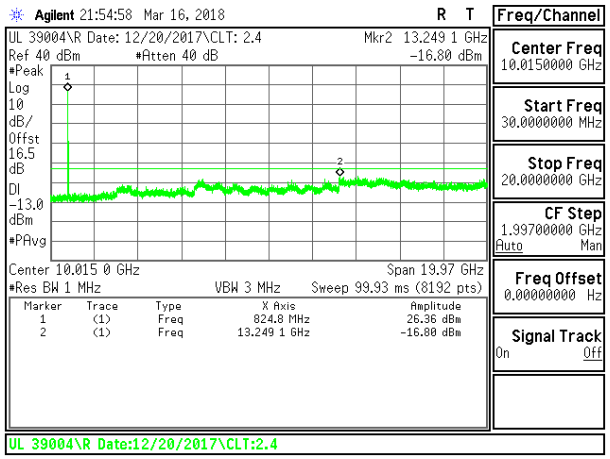
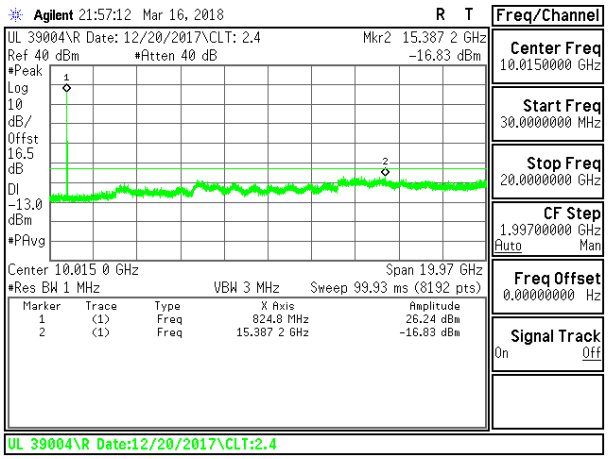
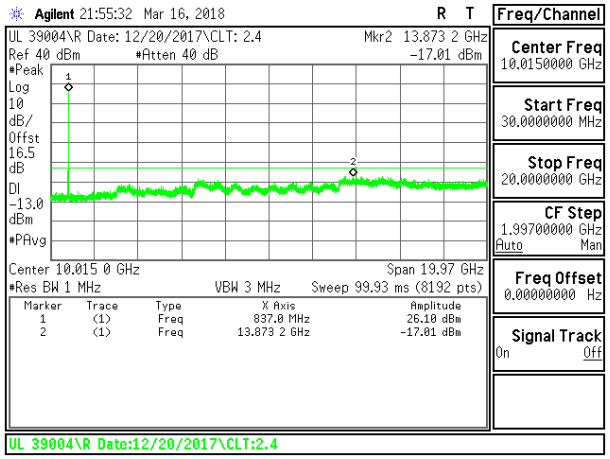
8.3.6. WCDMA BAND 5



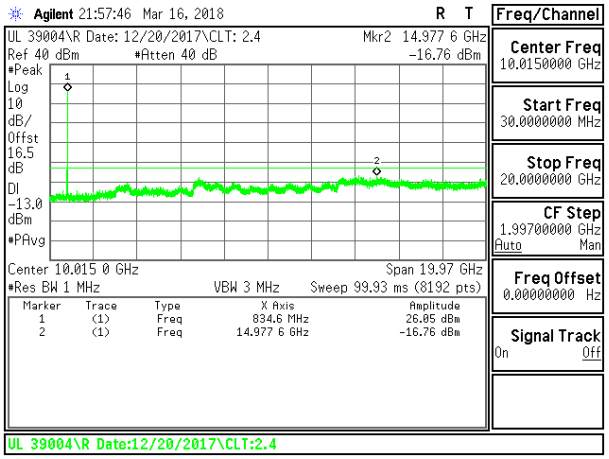
WCDMA Band 5 Rel 99 Low Channel



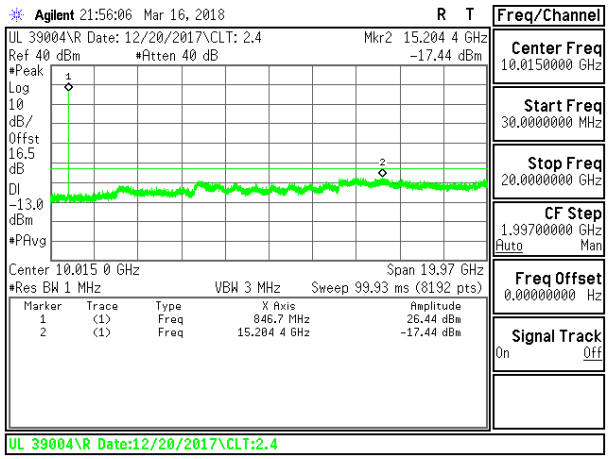
WCDMA Band 5 HSDPA Low Channel



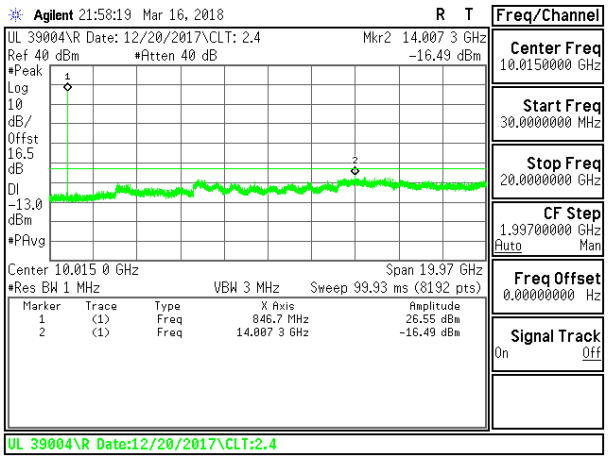
WCDMA Band 5 Rel 99 Middle Channel



WCDMA Band 5 HSDPA Middle Channel



WCDMA Band 5 Rel 99 High Channel



WCDMA Band 5 HSDPA High Channel

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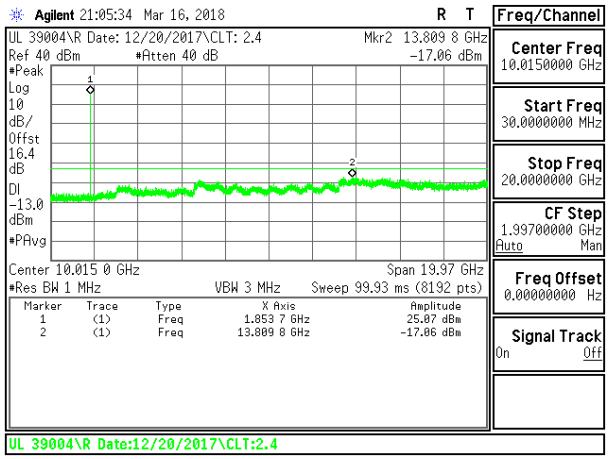
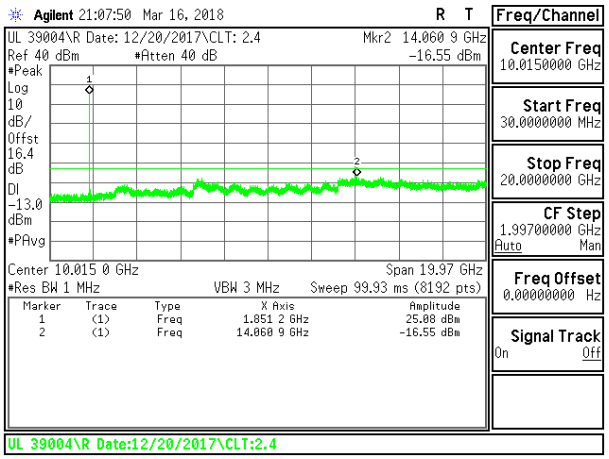
8.3.7. WCDMA BAND 2



WCDMA Band 2 Rel 99 Low Channel



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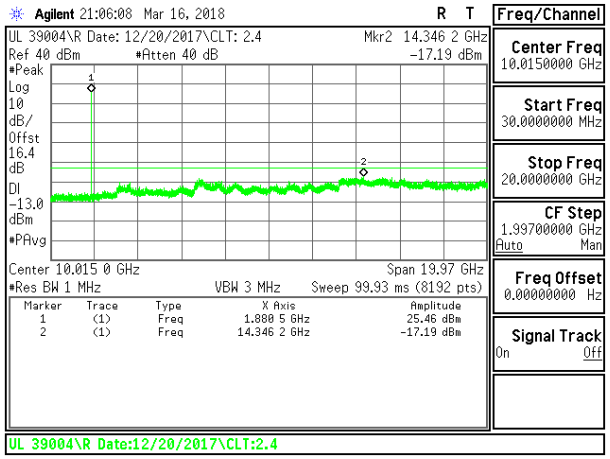
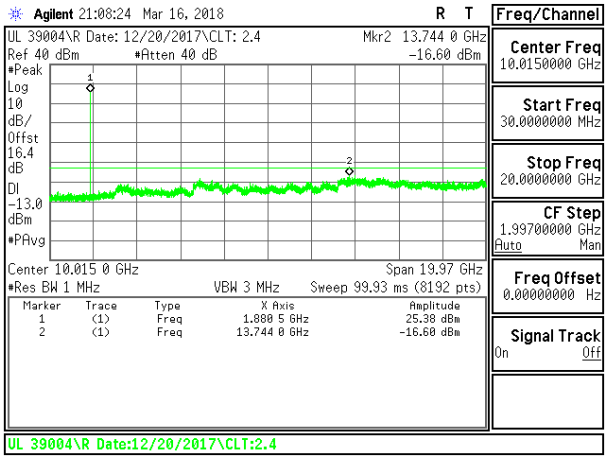
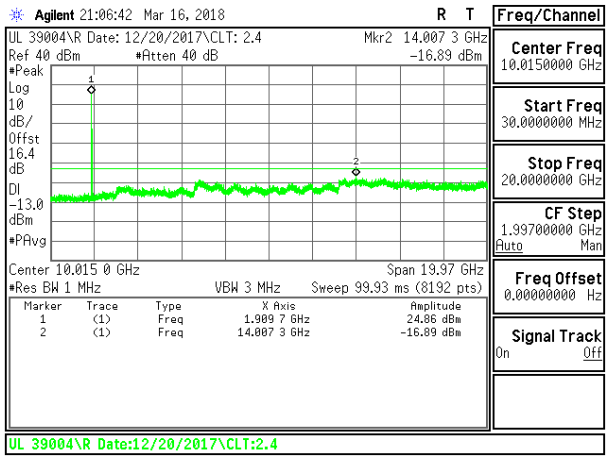


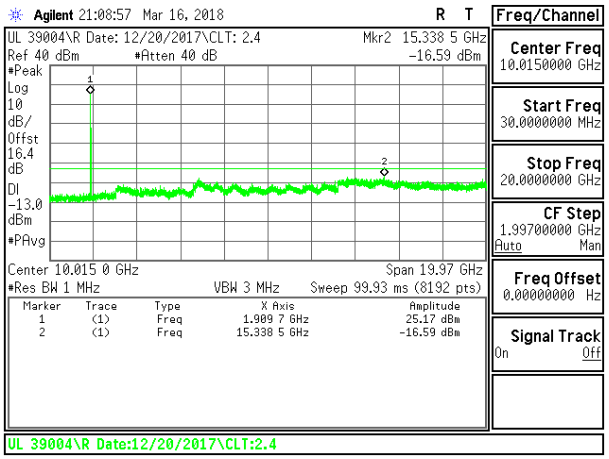
WCDMA Band 2 Rel 99 Middle Channel



WCDMA Band 2 HSDPA Middle Channel



WCDMA Band 2 Rel 99 High Channel



WCDMA Band 2 HSDPA High Channel

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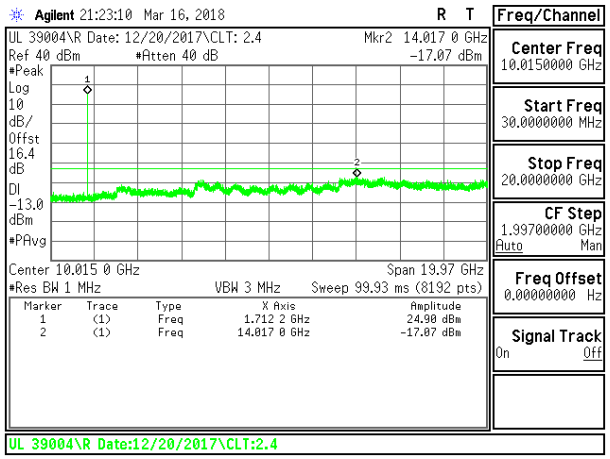
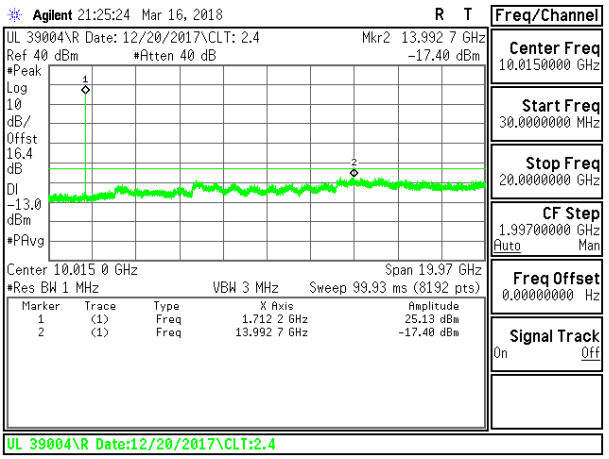
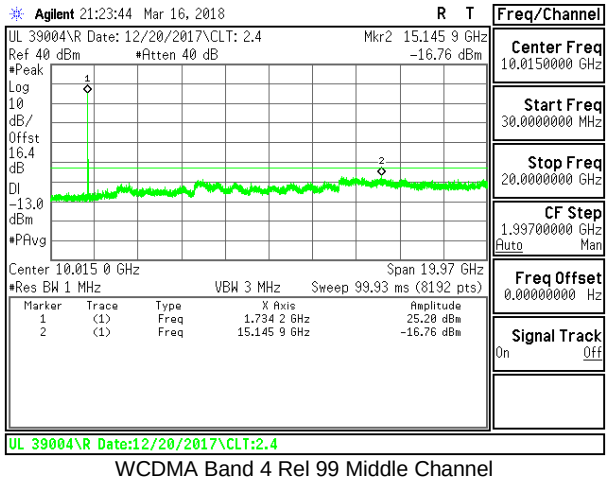
8.3.8. WCDMA BAND 4



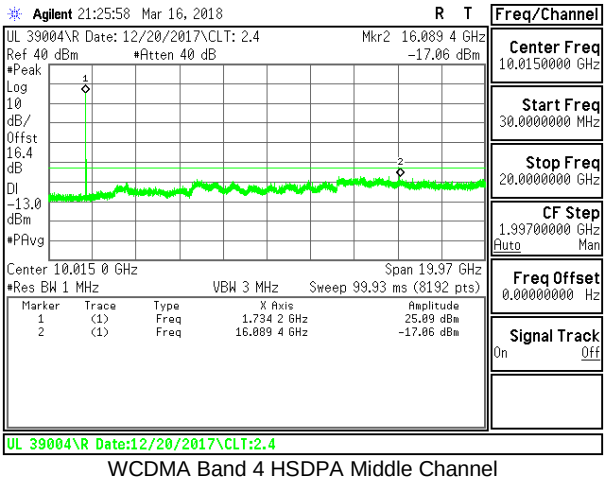
WCDMA Band 4 Rel 99 Low Channel



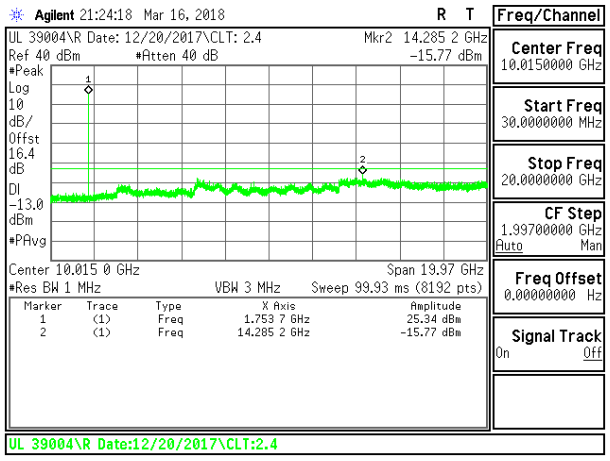
WCDMA Band 4 HSDPA Low Channel



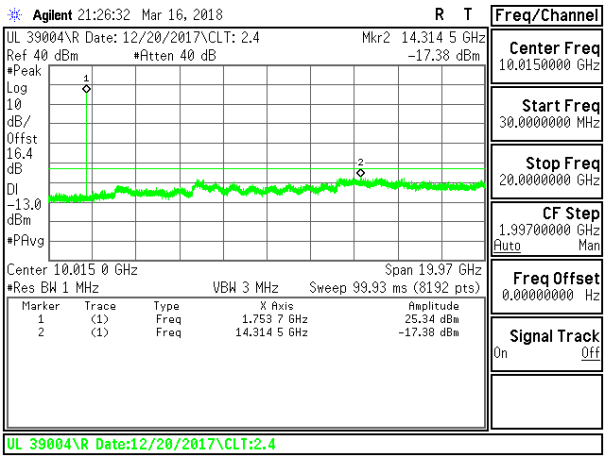
WCDMA Band 4 Rel 99 Middle Channel



WCDMA Band 4 HSDPA Middle Channel



WCDMA Band 4 Rel 99 High Channel



WCDMA Band 4 HSDPA High Channel

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8.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235, §27.54 and §90.213
IC: RSS132§5.3; RSS133§6.3 and RSS139§6.4

LIMITS

FCC §22.355, §90.213
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

FCC §24.235 & §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS132§5.3
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 SRSP for mobile stations and±1.5 ppm for base stations.
In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the occupied bandwidth stays within each of the sub-bands (see Section 5.1) when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS133§6.3
The carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and±1.0 ppm for base stations.
In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS139§6.4
The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- Temp. = −30°C to +50°C
- Voltage = (85% - 115%)

  Low voltage, 3.23VDC, Normal, 3.8VDC and High voltage, 4.37VDC.
  End Voltage, 3.2VDC.

Frequency Stability vs Temperature:
The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

Frequency Stability vs Voltage:
The peak frequency error is recorded (worst-case).

RESULTS

See the following pages.

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8.4.1. GSM

ID:	44410	Date:	3/7/18

GPRS 850MHz

Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	824.0402	848.9504		
Extreme (50C)		824.0402	848.9504	-30.0	-0.036
Extreme (40C)		824.0402	848.9504	-31.5	-0.038
Extreme (30C)		824.0402	848.9504	-29.9	-0.036
Extreme (10C)		824.0402	848.9504	-31.2	-0.037
Extreme (0C)		824.0402	848.9504	-29.3	-0.035
Extreme (-10C)		824.0402	848.9504	-35.5	-0.042
Extreme (-20C)		824.0402	848.9504	-36.5	-0.044
Extreme (-30C)		824.0402	848.9504	-40.0	-0.048
20C	15%	824.0402	848.9504	-27.6	-0.033
	-15%	824.0402	848.9504	-28.1	-0.034
	End Point	824.0402	848.9504	-29.3	-0.035

GPRS 1900MHz

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	1850.0504	1909.9573		
Extreme (50C)		1850.0503	1909.9572	-75.0	-0.040
Extreme (40C)		1850.0503	1909.9572	-78.5	-0.042
Extreme (30C)		1850.0503	1909.9572	-79.4	-0.042
Extreme (10C)		1850.0505	1909.9574	94.6	0.050
Extreme (0C)		1850.0505	1909.9574	102.8	0.055
Extreme (-10C)		1850.0505	1909.9574	97.9	0.052
Extreme (-20C)		1850.0503	1909.9572	-99.0	-0.053
Extreme (-30C)		1850.0503	1909.9572	-89.9	-0.048
20C	15%	1850.0503	1909.9572	-113.4	-0.060
	-15%	1850.0503	1909.9572	-107.1	-0.057
	End Point	1850.0503	1909.9572	-106.8	-0.057

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