



CERTIFICATION TEST REPORT

Report Number. : 12204512-E6V2

Applicant : APPLE INC.
1 APPLE PARK WAY
CUPERTINO, CA. 95014, U.S.A.

Model : A2101

FCC ID : BCG-E3234A

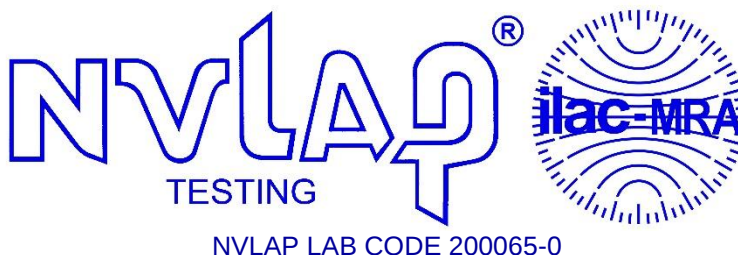
IC : 579C-E3234A

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:
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Revision History

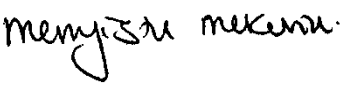
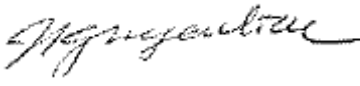
Rev.	Issue Date	Revisions	Revised By
V1	8/7/2018	Initial Review	Mengistu Mekuria
V2	8/14/2018	Address TCBs Question	Mengistu Mekuria

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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	A2101
FCC ID	BCG-E3234A
IC	579C-E3234A
EUT Description	SMARTPHONE
Serial Number	C39WK06KK3W8
Date Tested	FEBRUARY 27, 2018 to MAY 18, 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: 
Mengistu Mekuria Project Engineer UL Verification Services Inc.	Lieu Nguyen Laboratory Engineer UL Verification Services Inc.

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 v02r01, 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%.

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
KDB 412172 D01 Determining ERP and EIRP v01r01

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

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

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	33.0	-6.1	11.5	26.90	0.490	246.062	246KGXW
	EGPRS	27.5			21.40	0.138	257.9252	258KG7W
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	33.0	-6.1	7.0	24.75	0.299	246.062	246KGXW
	EGPRS	27.5			19.25	0.084	257.9252	258KG7W
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	30.8	-1.3	2.0	29.50	0.891	253.0181	253KGXW
	EGPRS	26.0			24.70	0.295	243.4275	243KG7W

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	-6.1	100.0	17.25	0.053	1273.8	1M27F9W
	1xEV-DO Rev A	25.4			17.15	0.052	1265.2	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	-6.1	11.5	19.40	0.087	1274.4	1M27F9W
	1xEV-DO Rev A	25.5			19.40	0.087	1271	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	-6.1	7.0	17.25	0.053	1274.4	1M27F9W
	1xEV-DO Rev A	25.5			17.25	0.053	1271	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	-5.8	2.0	19.70	0.093	1270.2	1M27F9W
	1xEV-DO Rev A	25.5			19.70	0.093	1267.3	1M27F9W

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	25.4	-6.1	11.5	19.30	0.085	4045.1	4M05F9W
	HSDPA	25.5			19.40	0.087	4070.9	4M07F9W
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	25.4	-6.1	7.0	17.15	0.052	4045.1	4M05F9W
	HSDPA	25.5			17.25	0.053	4070.9	4M07F9W
Part 24 / RSS 133 Band 2								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1850-1910	REL 99	25.0	-1.3	2.0	23.70	0.234	4067.5	4M07F9W
	HSDPA	25.0			23.70	0.234	4052.6	4M05F9W
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	25.0	-2.6	1.0	22.40	0.174	4074.7	4M07F9W
	HSDPA	25.0			22.40	0.174	4073.2	4M07F9W

5.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 00.28.02.

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	-6.7	-6.7	N/A	N/A
820	-6.5	-5.6	N/A	N/A
830	-6.1	-6.2	N/A	N/A
840	-6.2	-6.9	N/A	N/A
850	-6.5	-7.1	N/A	N/A
1710	-5.7	N/A	-3.4	-6.4
1720	-5.6	-4.1	-3.2	-6.2
1730	-5.5	N/A	-3.1	-6.2
1740	-5.4	-4.4	-2.8	-6.3
1750	-5.2	N/A	-2.6	-6.1
1760	-5.2	-4.3	-2.5	-5.8
1850	-5.8	N/A	N/A	-5.4
1860	-6.0	-2.9	N/A	-5.3
1870	-6.3	N/A	-1.8	-5.2
1880	-6.2	-2.4	-1.9	-5.1
1890	-6.3	N/A	-1.8	-5.2
1900	-6.2	-2.0	-1.8	-5.0
1910	-6.2	N/A	-1.3	-4.9
1920	-6.2	-1.9	-1.4	-4.9

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 BC 0, and CDMA BC 1. It was also investigated on Ant. 1/Ant. 2/Ant. 3/ Ant. 4 for GSM1900, WCDMA Band 2 and WCDMA Band 4. The worst case was determined to be at Y(Landscape) orientation for GSM850, WCDMA Band 5, CDMA BC10, and CDMA BC 0 on Ant 1, and X (Flatbed) orientation for GSM 1900,WCDMA Band 2, WCDMA B4 and CDMA BC1 on Ant 1/Ant 2/Ant 3/Ant 4 without AC Adapter and earphone.

The worst-case is EUT on the highest power. Based on average conducted output power measurement investigations, the following modes should be considered as worst-case scenario for all other measurements.

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 as the worst case.

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

he 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

CDMA BC10 band is supported in USA only

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

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

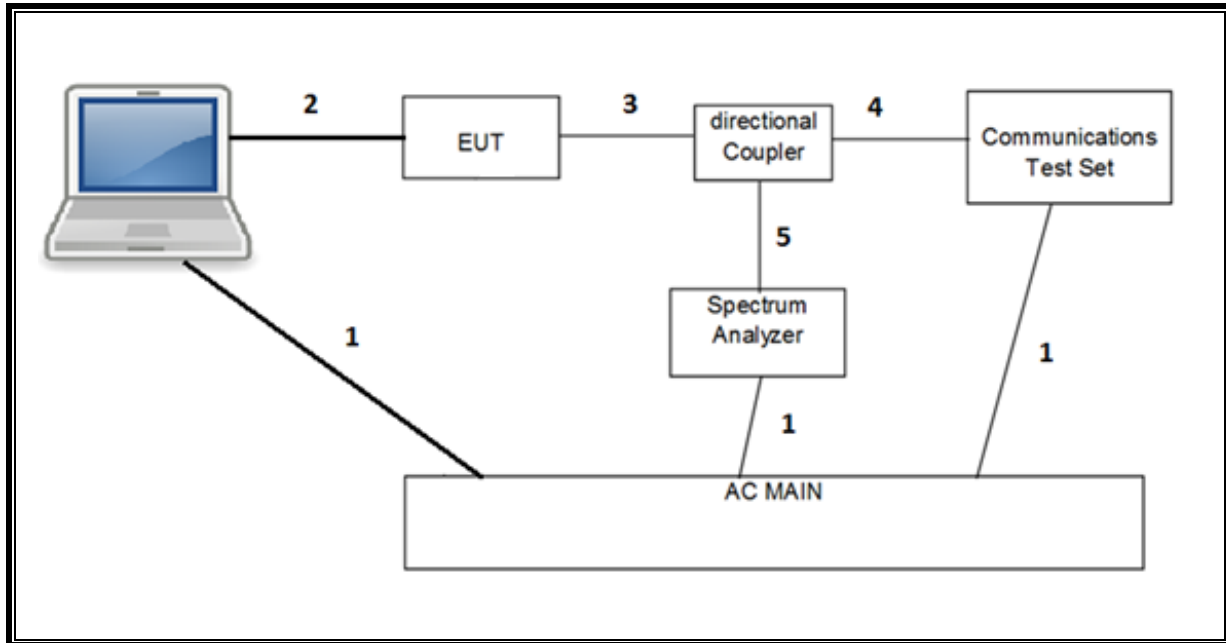
I/O CABLES (RF Conducted Test)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	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

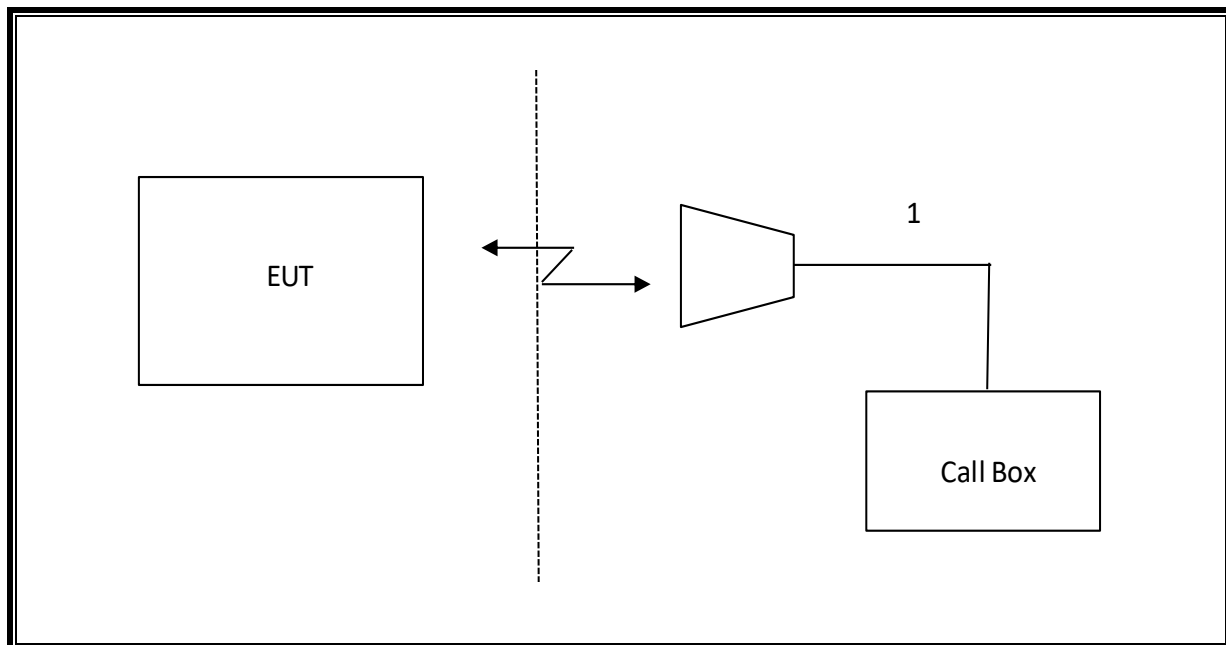
I/O CABLES (RF Radiated Test)

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

CONDUCTED SETUP



RADIATED SETUP



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, Horn 1-18GHz	ETS Lindgren	3117	T712	02/08/2019
*Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T900	05/31/2018
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T741	12/30/2018
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T285	06/24/2018
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T906	02/16/2019
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T119	04/03/2019
*Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T407	04/14/2018
*Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T491	06/01/2018
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T834	06/01/2018
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A-544	T341	11/12/2018
*Filter, HPF 1.2GHz	MICROTRONICS	WHKX1.2/15G-6ST	T1182	06/1/2018
Filter, HPF 4GHz	MICROTRONICS	HPM13351	T1239	08/11/2018
Filter, HPF 3.0GHz	MICROTRONICS	HPM17543	T487	12/04/2018
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent Technologies	E4446A	T177	04/12/2019
Power Meter, P-series single channel	Keysight	N1912A	T1272	05/1/2019
Power Sensor	Keysight	N1921A	T1225	04/10/2019
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCTWC	T1154	09/05/2018
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent Technologies	E4446A	T123	10/28/2018
*Directional Coupler	KRYTAR	152610	T1536	04/24/2018
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
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T757	09/14/2018
CLT Software	UL	UL RF	Ver 1.7, November 2015	
Power Measurement Software	UL	UL RF	Ver 2.2, June 2017	

NOTES: *Testing is completed before equipment expiration date.

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

RESULT

7.1.1. GSM 850

ID:	10643	Date:	5/3/18
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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	33.0	32.0	31.0	30.0
	190	836.6	32.6	31.6	30.8	29.8
	251	848.8	32.6	31.6	31.0	30.0

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	27.5	26.5	25.5	24.5
	190	836.6	27.1	26.2	25.2	24.3
	251	848.8	27.1	26.1	25.5	24.4

7.1.2. GSM 1900

ID:	10643	Date:	5/3/18
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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	31.5	30.5	28.7	28.0	30.8	30.0	29.0	28.0
	661	1880.0	31.4	30.4	28.9	28.2	30.7	29.9	28.8	27.9
	810	1909.8	31.5	30.4	28.7	28.0	30.6	29.8	29.0	28.0

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	26.5	25.5	23.7	23.0	26.0	25.0	24.0	23.0
	661	1880.0	26.2	25.4	24.0	23.2	25.7	24.8	23.8	22.8
	810	1909.8	26.4	25.4	23.8	23.0	25.8	24.8	23.9	22.9

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.

<u>Application</u>	<u>Rev, License</u>
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 Params:
 - 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 Params:
 - 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)

1xEV-DO - Revision A (REV A)

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

<u>Application</u>	<u>Rev, License</u>
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

7.2.1. CDMA BC10

ID:	39004	Date:	5/29/18
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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	25.3	24.2
				560	820.00	25.5	24.5
				670	822.75	25.0	24.4
			55 (Loopback)	450	817.25	25.1	24.1
				560	820.00	25.2	24.1
				670	822.75	25.1	24.3
		RC2	9 (Loopback)	450	817.25	25.1	24.1
				560	820.00	25.2	24.1
				670	822.75	25.2	24.1
			55 (Loopback)	450	817.25	25.2	24.2
				560	820.00	25.3	24.1
				670	822.75	25.1	24.2
		RC3	2 (Loopback)	450	817.25	25.1	24.2
				560	820.00	25.3	24.1
				670	822.75	25.2	24.1
			55 (Loopback)	450	817.25	25.1	24.2
				560	820.00	25.2	24.1
				670	822.75	25.2	24.1
			32 (+ F-SCH)	450	817.25	25.1	24.0
				560	820.00	25.1	23.9
				670	822.75	25.0	23.8
			32 (+ SCH)	450	817.25	24.9	23.8
				560	820.00	24.8	23.8
				670	822.75	24.9	23.8
		RC4	2 (Loopback)	450	817.25	25.0	24.1
				560	820.00	25.1	24.2
				670	822.75	25.1	24.1
			55 (Loopback)	450	817.25	25.2	24.2
				560	820.00	25.1	24.1
				670	822.75	25.1	24.1
			32 (+ F-SCH)	450	817.25	24.8	24.2
				560	820.00	24.9	24.2
				670	822.75	24.8	24.2
			32 (+ SCH)	450	817.25	24.9	24.2
				560	820.00	24.8	24.2
				670	822.75	24.9	24.2
		RC5	9 (Loopback)	450	817.25	25.3	24.2
				560	820.00	25.3	24.2
				670	822.75	25.2	24.2
			55 (Loopback)	450	817.25	25.3	24.2
				560	820.00	25.4	24.1
				670	822.75	25.2	24.1
	1xAdvanced	RC11	2 (Loopback)	450	817.25	25.4	24.4
				560	820.00	25.3	24.5
				670	822.75	25.4	24.4
			75 (Loopback)	450	817.25	25.4	24.4
				560	820.00	25.4	24.4
				670	822.75	25.4	24.4
			32 (+ F-SCH)	450	817.25	25.3	24.3
				560	820.00	25.3	24.4
				670	822.75	25.2	24.3
			32 (+ SCH)	450	817.25	25.3	24.1
				560	820.00	25.3	24.2
				670	822.75	25.3	24.1
	1xEVDO Rel. 0	FTAP Rate: 307.2 kbps(2 slot, QPSK)	RTAP Rate: 153.6 kbps	450	817.25	25.3	24.4
				560	820.00	24.2	24.3
				670	822.75	25.2	24.3
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK	RETAP: 4096	450	817.25	25.4	24.5
				560	820.00	25.3	24.4
				670	822.75	25.3	24.3

7.2.2. CDMA BC0

ID:	39004	Date:	5/29/18
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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	25.5	24.5
				384	836.52	25.4	24.1
				777	848.31	25.2	24.2
			55 (Loopback)	1013	824.70	25.5	24.1
				384	836.52	25.2	24.2
				777	848.31	25.4	24.3
		RC2	9 (Loopback)	1013	824.70	25.3	24.2
				384	836.52	25.1	24.2
				777	848.31	25.2	24.2
			55 (Loopback)	1013	824.70	25.4	24.2
				384	836.52	25.3	24.1
				777	848.31	25.3	24.2
		RC3	2 (Loopback)	1013	824.70	25.3	24.2
				384	836.52	25.1	24.1
				777	848.31	25.1	24.3
			55 (Loopback)	1013	824.70	25.3	24.2
				384	836.52	25.2	24.2
				777	848.31	25.3	24.2
			32 (+ F-SCH)	1013	824.70	25.3	24.1
				384	836.52	25.3	24.2
				777	848.31	25.4	24.2
			32 (+ SCH)	1013	824.70	25.1	24.0
				384	836.52	25.0	0.3
				777	848.31	25.0	23.9
		RC4	2 (Loopback)	1013	824.70	25.4	24.1
				384	836.52	25.2	24.3
				777	848.31	25.3	24.2
			55 (Loopback)	1013	824.70	25.3	24.2
				384	836.52	25.3	24.2
				777	848.31	25.2	24.1
			32 (+ F-SCH)	1013	824.70	25.4	24.2
				384	836.52	25.3	24.1
				777	848.31	25.4	24.2
			32 (+ SCH)	1013	824.70	25.1	24.0
				384	836.52	25.0	23.9
				777	848.31	25.1	23.9
		RC5	9 (Loopback)	1013	824.70	25.4	24.2
				384	836.52	25.4	24.2
				777	848.31	25.4	24.1
			55 (Loopback)	1013	824.70	25.5	24.3
				384	836.52	25.4	24.2
				777	848.31	25.3	24.2
	1xAdvanced	RC11	2 (Loopback)	1013	824.70	25.3	24.4
				384	836.52	25.4	24.4
				777	848.31	25.4	24.4
			75 (Loopback)	1013	824.70	25.4	24.3
				384	836.52	25.4	24.4
				777	848.31	25.3	24.4
			32 (+ F-SCH)	1013	824.70	25.4	24.3
				384	836.52	25.4	24.2
				777	848.31	25.3	24.3
			32 (+ SCH)	1013	824.70	25.4	24.2
				384	836.52	25.3	24.1
				777	848.31	25.2	24.2
	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	24.3
				777	848.31	25.4	24.4
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK	RETAP: 4096	1013	824.70	25.0	24.3
				384	836.52	25.3	24.3
				777	848.31	25.5	24.5

7.2.3. CDMA BC1

ID:	39004	Date:	5/29/18
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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	25.5	20.4
				600	1880.00	25.2	20.1
				1175	1908.75	25.1	20.2
			55 (Loopback)	25	1851.25	25.3	20.2
				600	1880.00	25.3	20.1
				1175	1908.75	25.1	20.1
		RC2	9 (Loopback)	25	1851.25	25.3	20.1
				600	1880.00	25.1	20.1
				1175	1908.75	25.1	20.1
			55 (Loopback)	25	1851.25	25.3	20.1
				600	1880.00	25.2	20.2
				1175	1908.75	25.3	20.1
		RC3	2 (Loopback)	25	1851.25	25.2	20.0
				600	1880.00	25.1	20.0
				1175	1908.75	25.2	20.1
			55 (Loopback)	25	1851.25	25.3	20.0
				600	1880.00	25.0	20.0
				1175	1908.75	25.2	20.0
			32 (+ F-SCH)	25	1851.25	25.3	20.1
				600	1880.00	25.4	20.3
				1175	1908.75	25.2	20.2
			32 (+ SCH)	25	1851.25	25.2	20.1
				600	1880.00	25.1	20.2
				1175	1908.75	25.0	20.2
		RC4	2 (Loopback)	25	1851.25	25.4	20.0
				600	1880.00	25.2	19.8
				1175	1908.75	25.0	19.9
			55 (Loopback)	25	1851.25	25.2	19.9
				600	1880.00	25.1	19.7
				1175	1908.75	25.1	19.9
			32 (+ F-SCH)	25	1851.25	25.3	20.1
				600	1880.00	25.1	20.1
				1175	1908.75	25.0	20.0
			32 (+ SCH)	25	1851.25	25.2	20.2
				600	1880.00	25.1	20.1
				1175	1908.75	25.0	20.1
		RC5	9 (Loopback)	25	1851.25	25.2	20.2
				600	1880.00	25.2	19.9
				1175	1908.75	25.2	19.9
			55 (Loopback)	25	1851.25	25.2	20.3
				600	1880.00	25.2	19.9
				1175	1908.75	25.2	20.0
	1xAdvanced	RC11	2 (Loopback)	25	1851.25	25.2	20.2
				600	1880.00	25.4	20.3
				1175	1908.75	25.3	20.2
			75 (Loopback)	25	1851.25	25.3	20.3
				600	1880.00	25.4	20.1
				1175	1908.75	25.2	20.1
			32 (+ F-SCH)	25	1851.25	25.2	20.4
				600	1880.00	25.2	20.3
				1175	1908.75	25.3	20.2
			32 (+ SCH)	25	1851.25	25.2	20.3
				600	1880.00	25.2	20.2
				1175	1908.75	25.4	20.1
	1xEVDO Rel. 0	FTAP Rate: 307.2 kbps(2 slot, QPSK)	RTAP Rate: 153.6 kbps	25	1851.25	25.3	20.3
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK	RETAP: 4096	600	1880	25.4	20.1
				1175	1908.75	25.3	20.2
				25	1851.25	25.4	20.4
				600	1880	25.5	20.1
				1175	1908.75	25.4	20.5

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 $\geq$ 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 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} (Note 1, 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 $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$.

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 $\Delta_{NACK} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$, and $\Delta_{CQI} = 24/15$ with $\beta_{hs} = 24/15 * \beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCCH, 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 $\beta_c = 11/15$ and $\beta_d = 15/15$.

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} (Note 1)	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	209/25	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	β_{ed1} : 47/15 β_{ed2} : 47/15	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 $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$. For sub-test 5, Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 5/15$ with $\beta_{hs} = 5/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. 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 $\beta_c = 10/15$ and $\beta_d = 15/15$.

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

7.3.1. WCDMA BAND 5

ID:	10643	Date:	5/3/18				
Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Average Power (dBm)	
						Ant 1	Ant 2
W-CDMA Band 5 (850MHz)	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	25.2	24.2
			4183	836.6	N/A	25.4	24.5
			4233	846.6	N/A	25.4	24.5
	HSDPA	Subtest 1	4132	826.4	0	25.3	24.2
			4183	836.6	0	25.4	24.5
			4233	846.6	0	25.5	24.5
		Subtest 2	4132	826.4	0	25.2	24.3
			4183	836.6	0	25.4	24.2
			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	23.8
		Subtest 4	4132	826.4	0.5	24.7	23.8
			4183	836.6	0.5	24.8	23.8
			4233	846.6	0.5	25.0	24.0
	HSPA (HSDPA & HSUPA)	Subtest 1	4132	826.4	0	24.8	24.1
			4183	836.6	0	25.0	24.0
			4233	846.6	0	25.0	24.0
		Subtest 2	4132	826.4	2	22.9	22.2
			4183	836.6	2	23.0	22.2
			4233	846.6	2	23.0	22.3
		Subtest 3	4132	826.4	1	24.0	23.1
			4183	836.6	1	24.2	23.2
			4233	846.6	1	24.1	23.2
		Subtest 4	4132	826.4	2	22.9	22.3
			4183	836.6	2	22.7	22.2
			4233	846.6	2	23.0	22.2
		Subtest 5	4132	826.4	0	24.8	24.1
			4183	836.6	0	25.0	24.0
			4233	846.6	0	25.0	24.0
	DC-HSDPA	Subtest 1	4132	826.4	0	25.2	24.2
			4183	836.6	0	25.3	24.4
			4233	846.6	0	25.5	24.5
		Subtest 2	4132	826.4	0	25.2	24.3
			4183	836.6	0	25.4	24.2
			4233	846.6	0	25.3	24.2
		Subtest 3	4132	826.4	0.5	24.8	23.9
			4183	836.6	0.5	24.8	24.0
			4233	846.6	0.5	24.7	24.0
		Subtest 4	4132	826.4	0.5	24.8	23.8
			4183	836.6	0.5	25.0	23.8
			4233	846.6	0.5	24.9	23.9

7.3.2. WCDMA BAND 2

ID:	10643	Date:	5/3/18						
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	20.3	24.9	21.2
			9400	1880.0	N/A	25.5	20.5	25.0	21.0
			9538	1907.6	N/A	25.4	20.4	24.8	20.9
	HSDPA	Subtest 1	9262	1852.4	0	25.3	20.3	24.9	21.1
			9400	1880.0	0	25.5	20.5	25.0	21.0
			9538	1907.6	0	25.3	20.4	24.9	21.0
		Subtest 2	9262	1852.4	0	25.2	20.0	24.7	21.0
			9400	1880.0	0	25.4	20.3	25.0	20.7
			9538	1907.6	0	25.3	20.4	24.9	20.7
		Subtest 3	9262	1852.4	0.5	24.7	20.0	24.4	20.4
			9400	1880.0	0.5	25.0	20.0	24.5	20.4
			9538	1907.6	0.5	24.9	19.9	24.4	20.4
		Subtest 4	9262	1852.4	0.5	24.5	19.9	24.4	20.5
			9400	1880.0	0.5	25.0	19.8	24.4	20.4
			9538	1907.6	0.5	24.9	20.0	24.3	20.4
	HSPA (HSDPA & HSUPA)	Subtest 1	9262	1852.4	0	24.8	20.0	24.5	20.6
			9400	1880.0	0	25.0	20.2	24.6	20.6
			9538	1907.6	0	24.9	20.1	24.4	20.7
		Subtest 2	9262	1852.4	2	22.9	17.2	22.6	18.8
			9400	1880.0	2	23.0	17.4	22.5	18.6
			9538	1907.6	2	22.9	17.3	22.6	18.6
		Subtest 3	9262	1852.4	1	24.0	17.7	23.6	19.7
			9400	1880.0	1	24.1	18.2	23.5	19.6
			9538	1907.6	1	23.9	18.3	23.7	19.4
		Subtest 4	9262	1852.4	2	23.0	17.5	22.7	18.6
			9400	1880.0	2	22.9	17.3	22.5	18.7
			9538	1907.6	2	23.0	17.4	22.6	18.8
		Subtest 5	9262	1852.4	0	24.7	19.9	24.6	20.5
			9400	1880.0	0	24.9	20.0	24.6	20.5
			9538	1907.6	0	24.8	20.2	24.5	20.6
	DC-HSDPA	Subtest 1	9262	1852.4	0	25.2	20.3	24.7	21.0
			9400	1880.0	0	25.4	20.3	24.6	21.0
			9538	1907.6	0	25.3	20.4	24.9	20.9
		Subtest 2	9262	1852.4	0	25.2	20.2	24.8	20.0
			9400	1880.0	0	25.4	20.2	24.8	20.7
			9538	1907.6	0	25.3	20.1	24.9	20.7
		Subtest 3	9262	1852.4	0.5	24.7	19.8	24.5	20.4
			9400	1880.0	0.5	25.0	20.0	24.4	20.5
			9538	1907.6	0.5	24.9	19.8	24.5	20.4
		Subtest 4	9262	1852.4	0.5	24.5	19.9	24.4	20.4
			9400	1880.0	0.5	25.0	19.7	24.5	20.2
			9538	1907.6	0.5	24.9	19.6	24.6	20.4

7.3.3. WCDMA BAND 4

ID:	10643	Date:	5/3/18						
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	25.4	21.4	25.0	21.8
			1413	1732.6	N/A	25.2	21.4	25.0	22.0
			1513	1752.6	N/A	25.4	21.5	24.9	21.7
	HSDPA	Subtest 1	1312	1712.4	0	25.4	21.4	25.0	21.9
			1413	1732.6	0	25.2	21.4	25.0	22.0
			1513	1752.6	0	25.4	21.5	25.0	21.9
		Subtest 2	1312	1712.4	0	25.3	21.4	24.9	21.9
			1413	1732.6	0	25.2	21.4	25.0	21.8
			1513	1752.6	0	25.3	21.3	24.9	21.9
		Subtest 3	1312	1712.4	0.5	24.9	21.0	24.5	21.6
			1413	1732.6	0.5	25.0	20.8	24.4	21.5
			1513	1752.6	0.5	24.9	20.9	24.5	21.5
		Subtest 4	1312	1712.4	0.5	24.6	21.0	24.4	21.6
			1413	1732.6	0.5	25.0	20.8	24.4	21.5
			1513	1752.6	0.5	25.0	20.7	24.5	21.5
	HSPA (HSDPA & HSUPA)	Subtest 1	1312	1712.4	0	24.9	21.2	24.5	21.8
			1413	1732.6	0	24.8	21.1	24.6	21.7
			1513	1752.6	0	24.9	21.2	24.4	21.7
		Subtest 2	1312	1712.4	2	23.0	19.2	22.5	19.7
			1413	1732.6	2	23.2	19.0	22.5	19.6
			1513	1752.6	2	23.3	19.1	22.5	19.7
		Subtest 3	1312	1712.4	1	24.0	20.2	23.6	20.9
			1413	1732.6	1	24.0	20.1	23.5	20.8
			1513	1752.6	1	23.9	20.2	23.5	20.8
		Subtest 4	1312	1712.4	2	23.0	19.2	22.5	19.8
			1413	1732.6	2	22.9	19.3	22.6	20.0
			1513	1752.6	2	23.0	19.4	22.5	19.7
		Subtest 5	1312	1712.4	0	24.8	21.2	24.5	21.8
			1413	1732.6	0	24.7	21.0	24.6	21.7
			1513	1752.6	0	24.8	21.2	24.5	21.7
	DC-HSDPA	Subtest 1	1312	1712.4	0	25.3	21.4	25.0	22.0
			1413	1732.6	0	25.2	21.3	25.0	21.9
			1513	1752.6	0	25.3	21.5	24.9	21.7
		Subtest 2	1312	1712.4	0	25.3	21.4	25.0	21.9
			1413	1732.6	0	25.3	21.3	25.0	21.8
			1513	1752.6	0	25.4	21.2	24.9	21.8
		Subtest 3	1312	1712.4	0.5	25.0	20.9	24.5	21.5
			1413	1732.6	0.5	24.9	21.0	24.5	21.5
			1513	1752.6	0.5	25.0	21.0	24.4	21.6
		Subtest 4	1312	1712.4	0.5	25.0	20.9	24.4	21.6
			1413	1732.6	0.5	24.9	20.8	24.5	21.5
			1513	1752.6	0.5	24.9	21.0	24.5	21.5

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	246.0620	312.306
	EGPRS			257.9252	329.573
1900MHz	GPRS	661	1880.0	253.0181	314.074
	EGPRS			243.4275	310.892

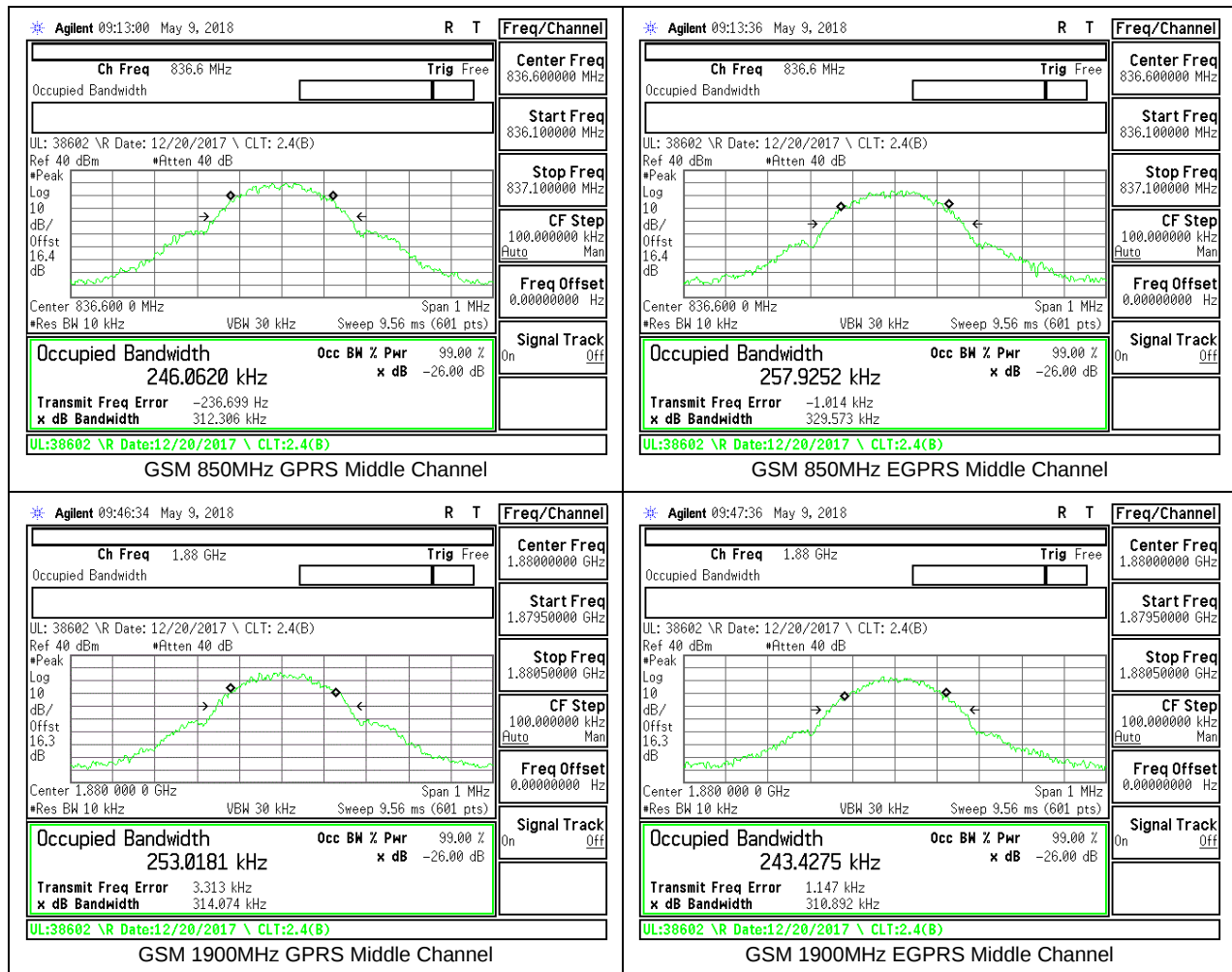
CDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BC10	1xRTT	560	820.0	1.2738	1.423
	1xEV-DO Rev A			1.2652	1.421
BC0	1xRTT	384	836.5	1.2744	1.432
	1xEV-DO Rev A			1.2710	1.414
BC1	1xRTT	600	1880.0	1.2702	1.425
	1xEV-DO Rev A			1.2673	1.417

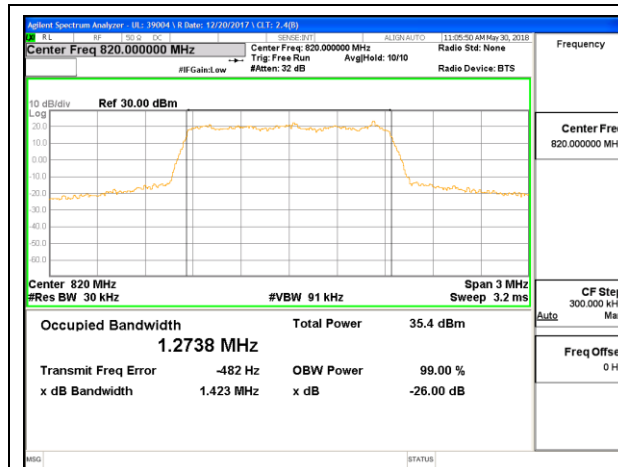
WCDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BAND 5	REL 99	4408	836.6	4.0451	4.621
	HSDPA			4.0709	4.622
BAND 2	REL 99	9800	1880.0	4.0675	4.629
	HSDPA			4.0526	4.587
BAND 4	REL 99	1638	1732.6	4.0747	4.622
	HSDPA			4.0732	4.598

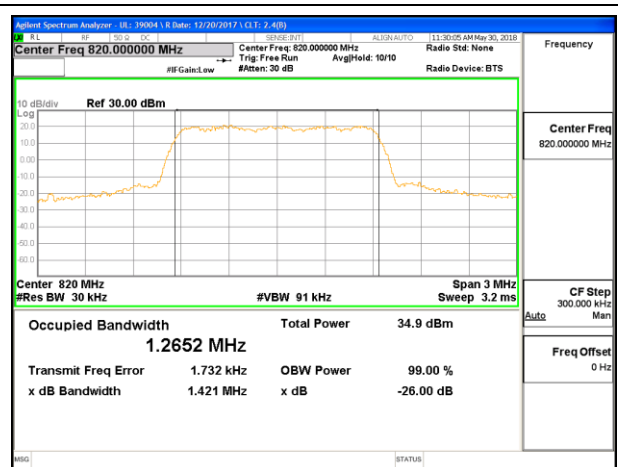
8.1.1. GSM



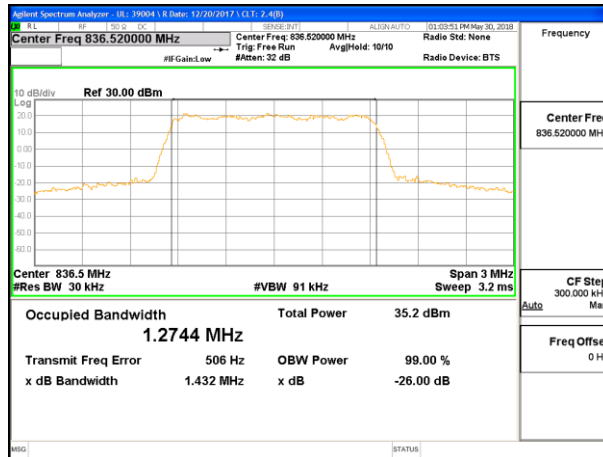
8.1.2. CDMA



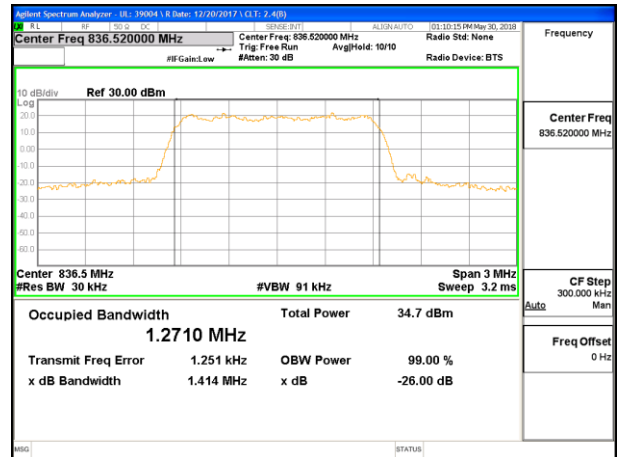
CDMA BC10 1xRTT Middle Channel



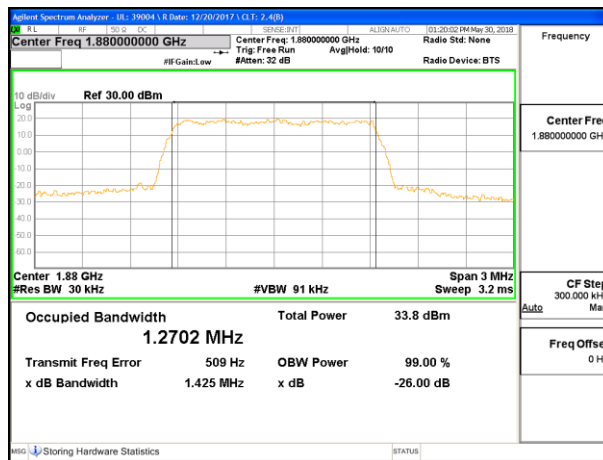
CDMA BC10 1xEV-DO Rev A Middle Channel



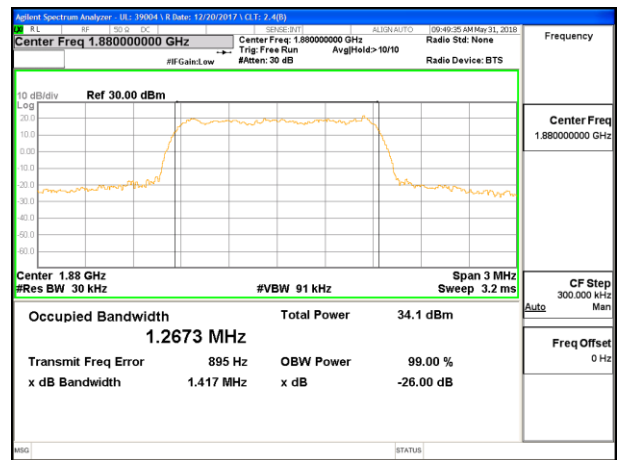
CDMA BC0 1xRTT Middle Channel



CDMA BC0 1xEV-DO Rev A Middle Channel

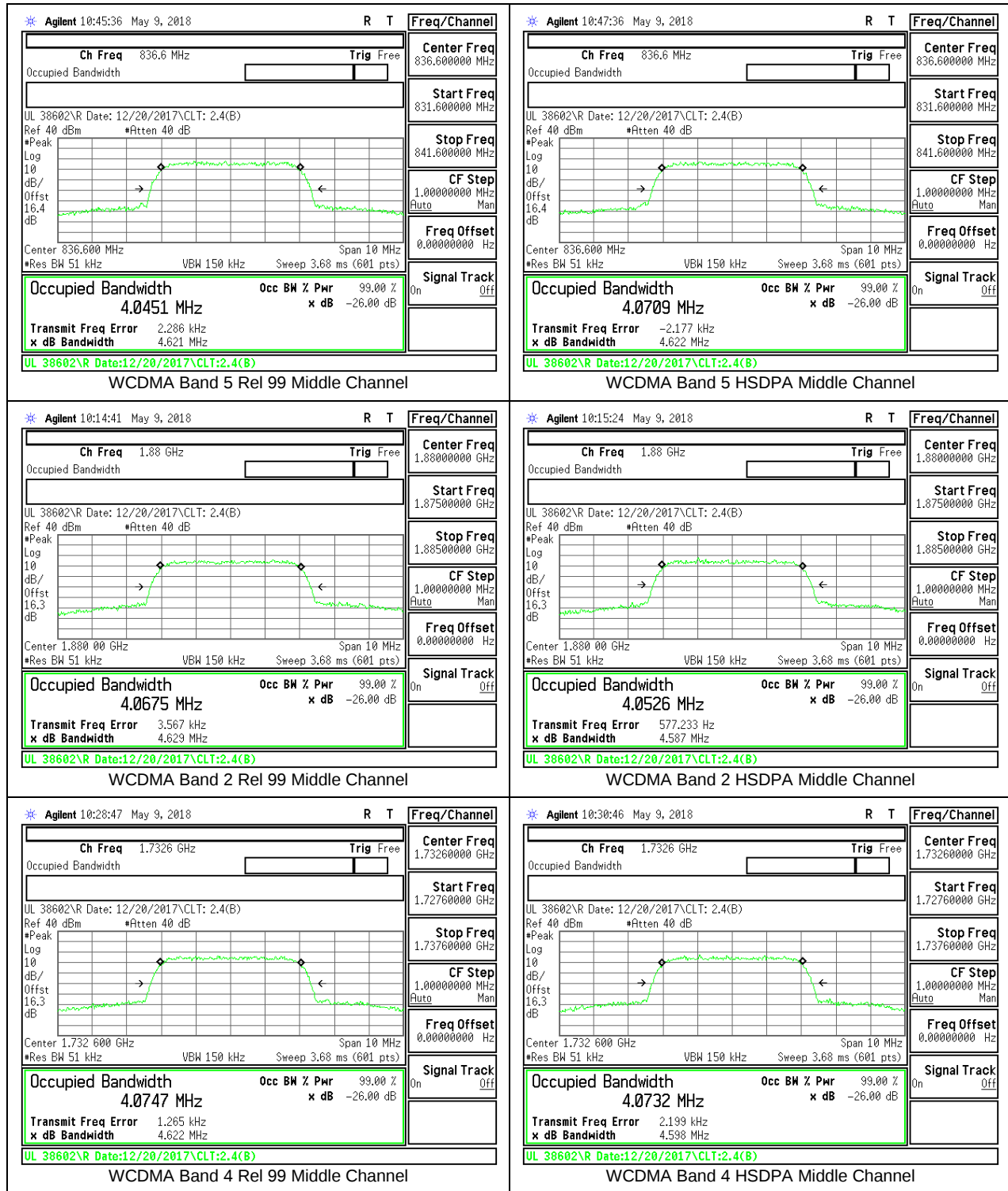


CDMA BC1 1xRTT Middle Channel



CDMA BC1 1xEV-DO Rev A Middle Channel

8.1.3. WCDMA



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 $116 \log_{10}(f/6.1)$ 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.

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 $43 + 10 \log_{10}p$ (watts).
- (ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10}p$ (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 $43 + 10 \log_{10}p$ (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 $43 + 10 \log_{10}p$ (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, Footnote 2 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 least $43 + 10 \log_{10}p$ (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 $43 + 10 \log_{10}p$ (watts) dB.

TEST PROCEDURE

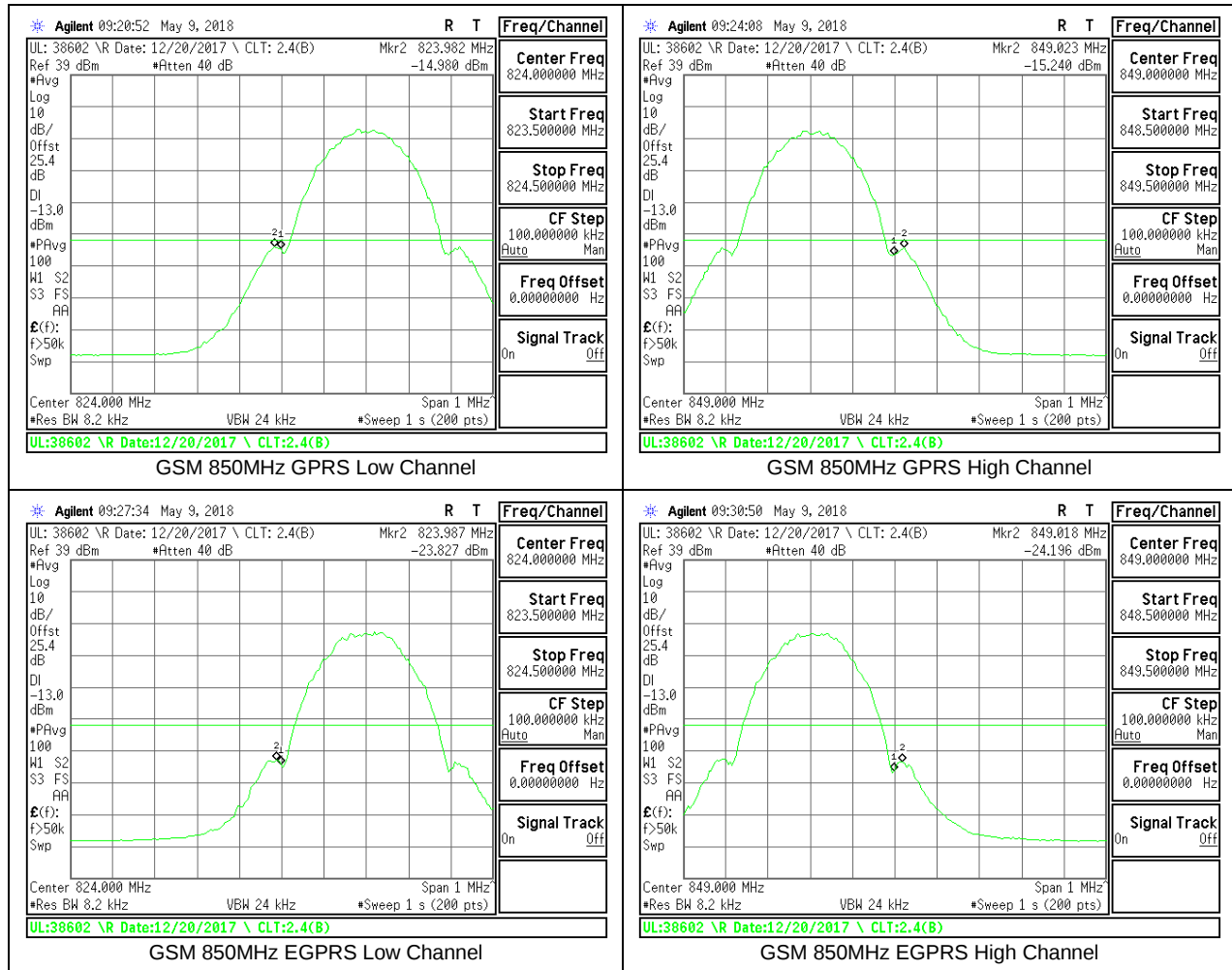
The transmitter output was connected to a R&S CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each band edge measurement:

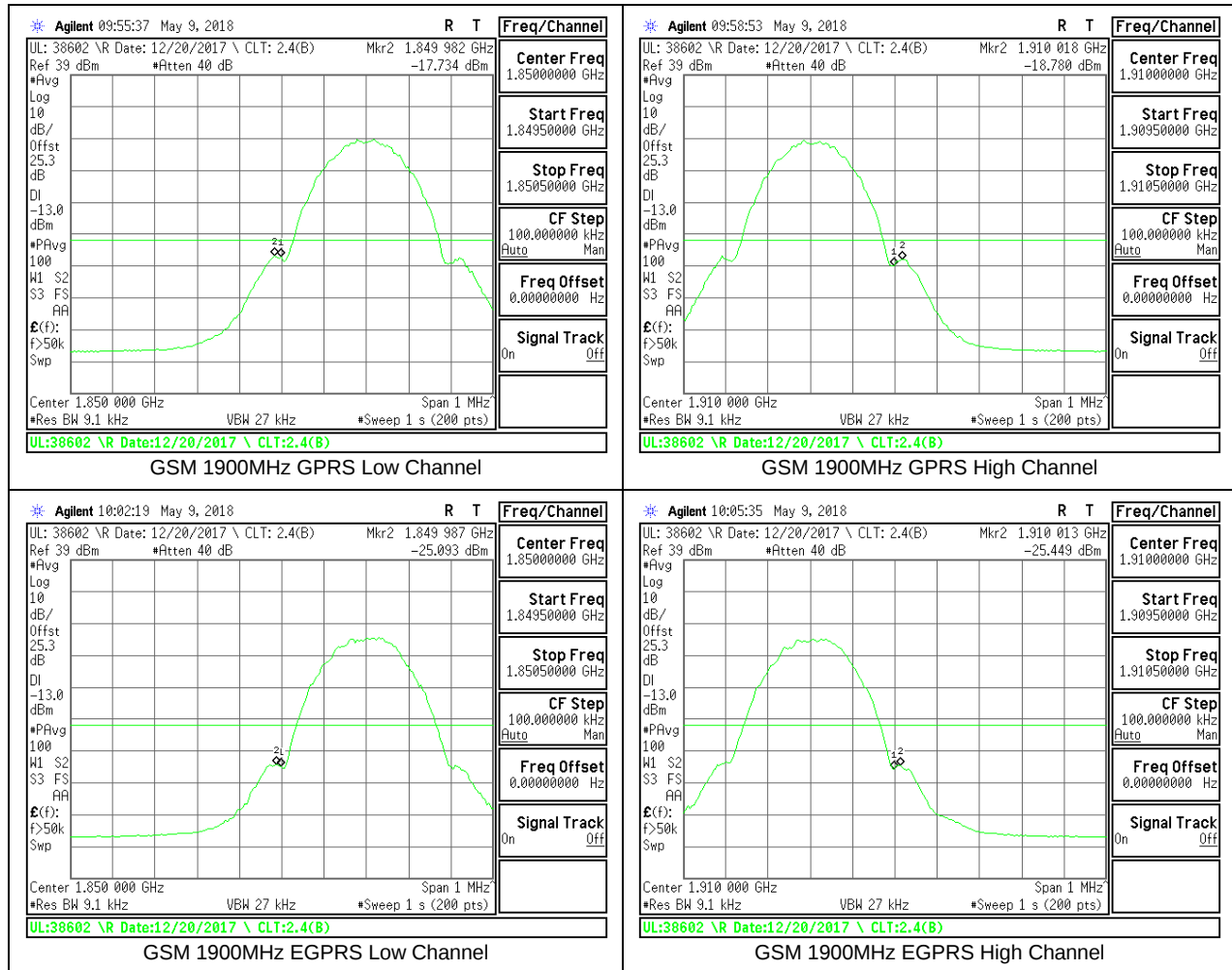
- Set the spectrum analyzer span to include the block edge frequency.
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

RESULTS

8.2.1. GSM 850

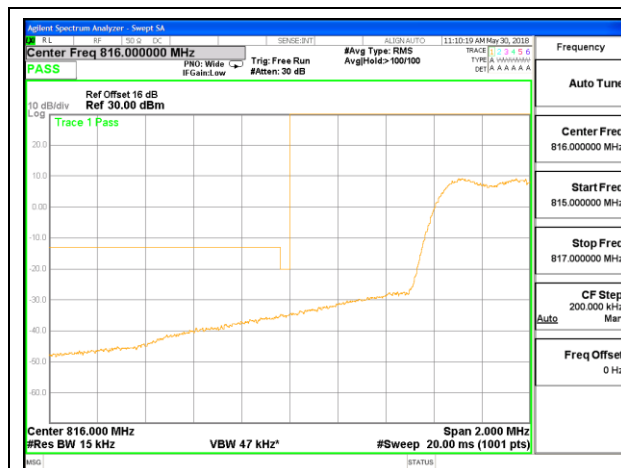


8.2.2. GSM 1900

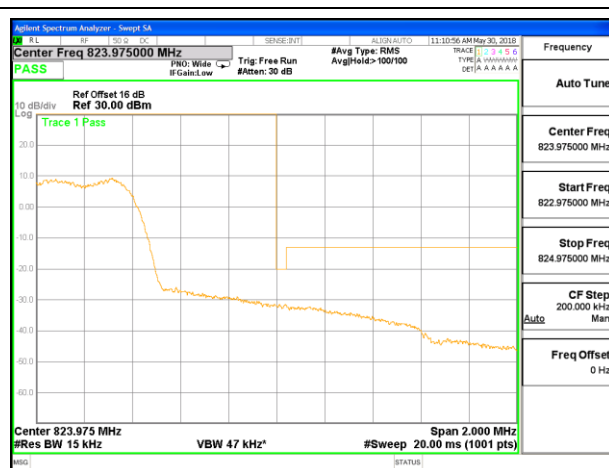


8.2.3. CDMA BC10

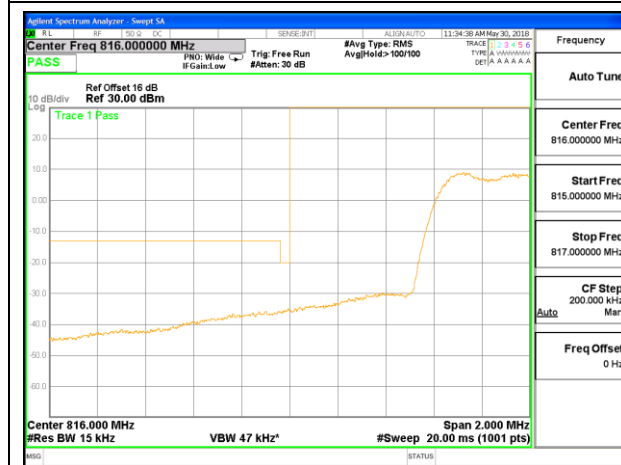
ID:	38602	Date:	5/20/18
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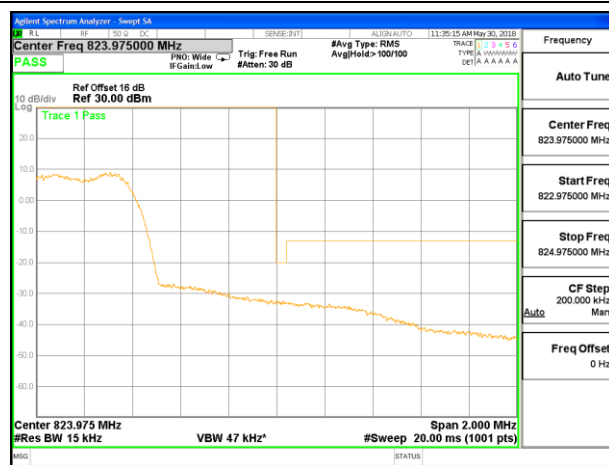
CDMA BC10 1xRTT Low Channel, RBW=1% of EBW



CDMA BC10 1xRTT High Channel, RBW=1% of EBW

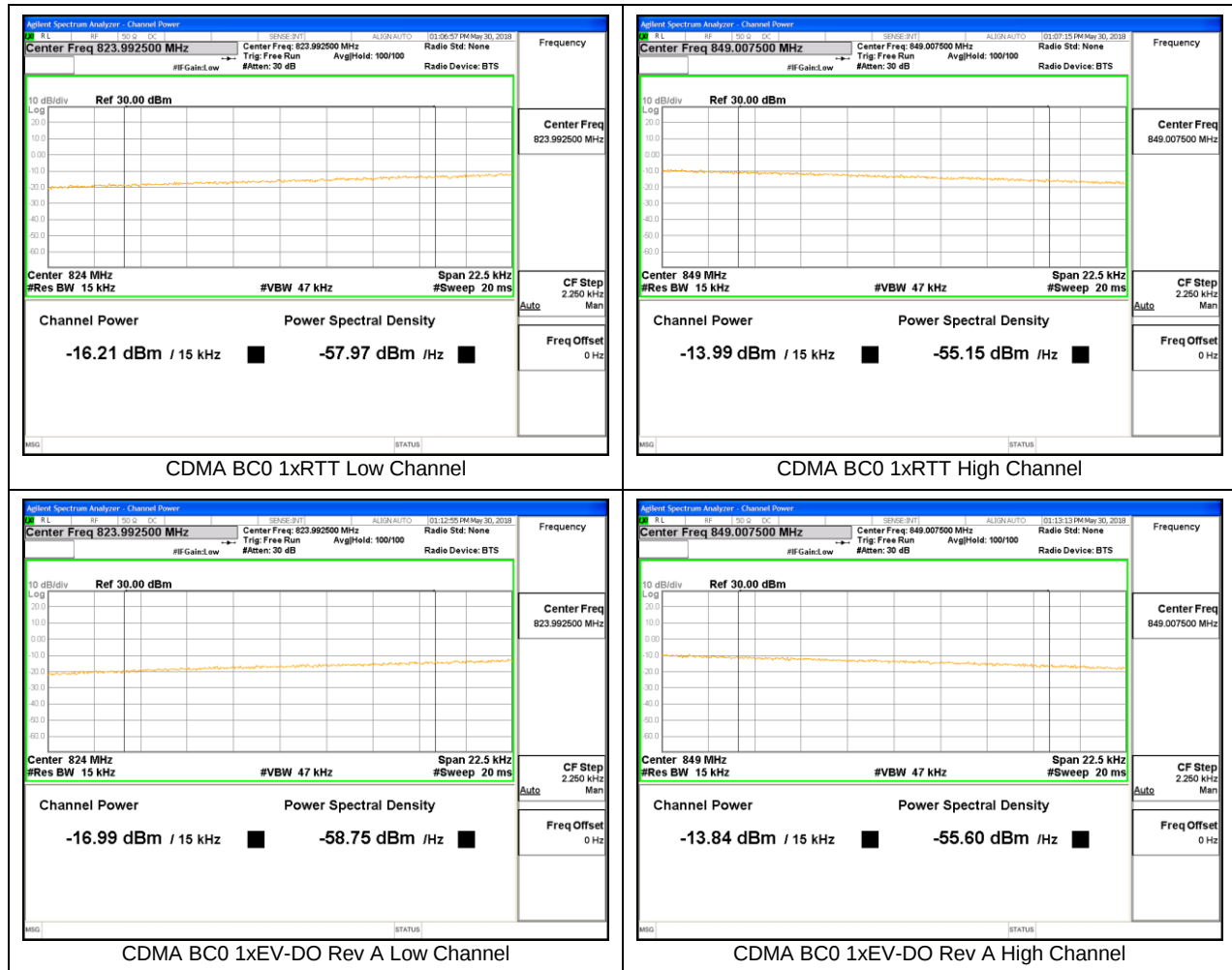


CDMA BC10 1xEV-DO Rev A Low Channel, RBW=1% of EBW

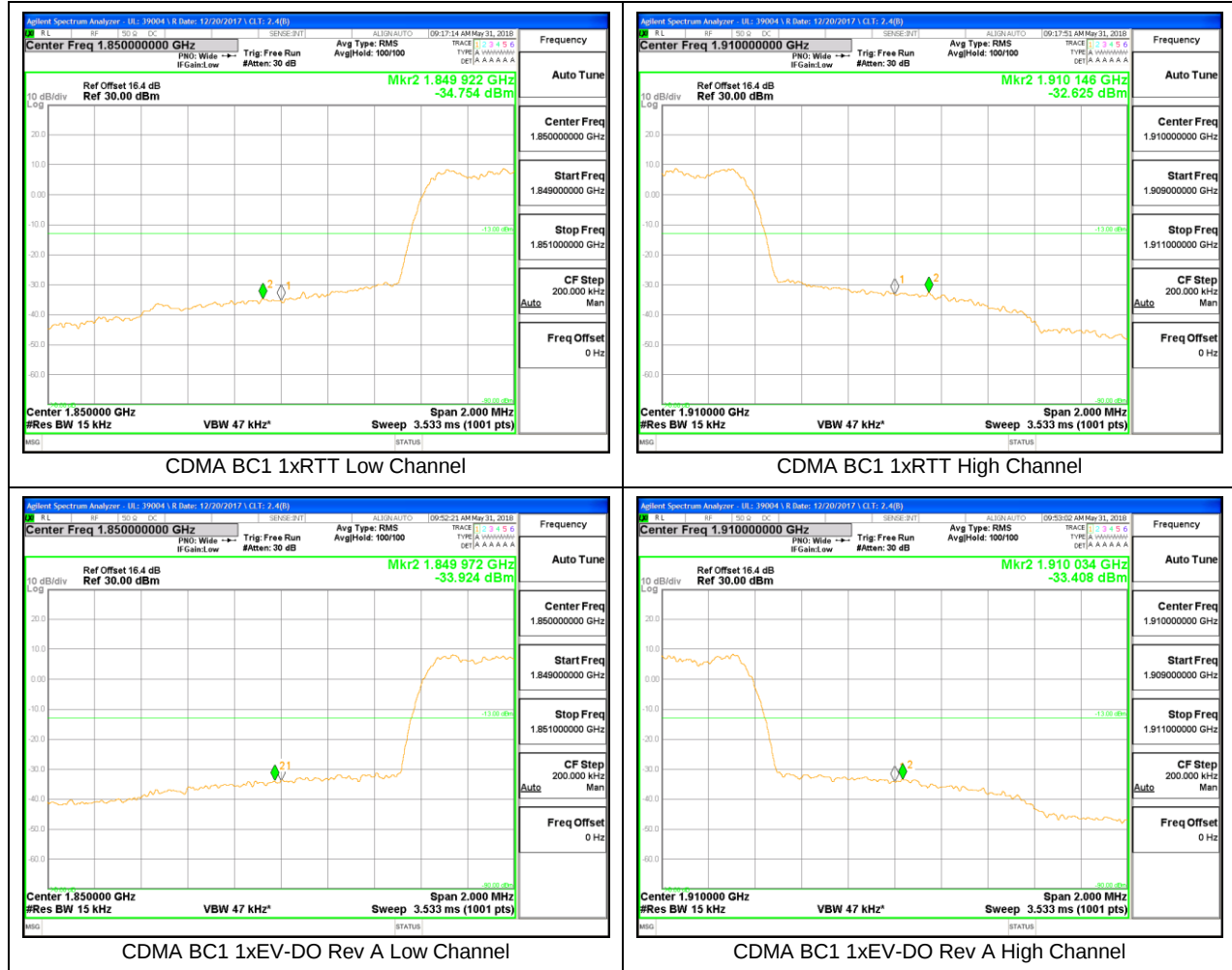


CDMA BC10 1xEV-DO Rev A High Channel, RBW=1% of EBW

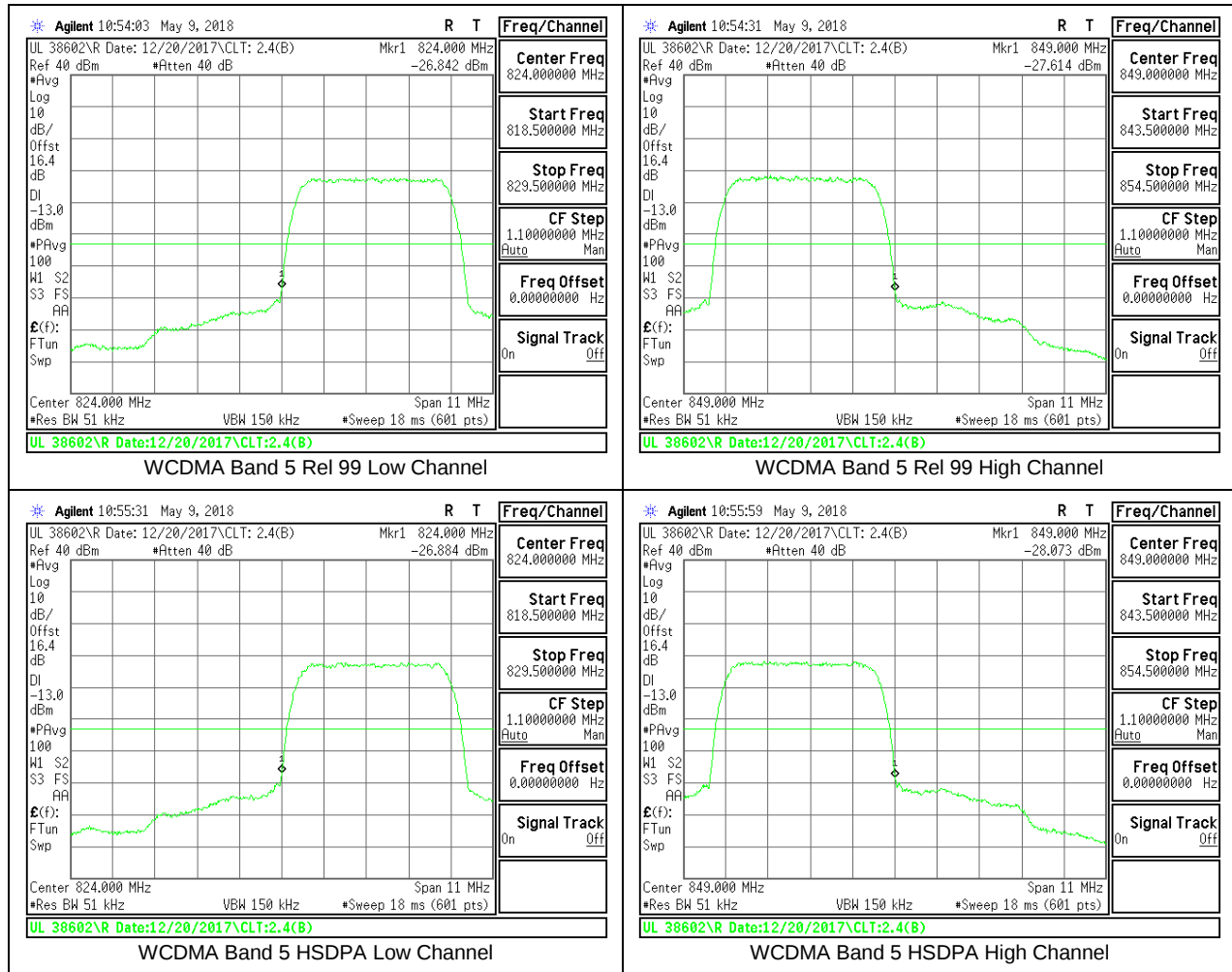
8.2.4. CDMA BC0



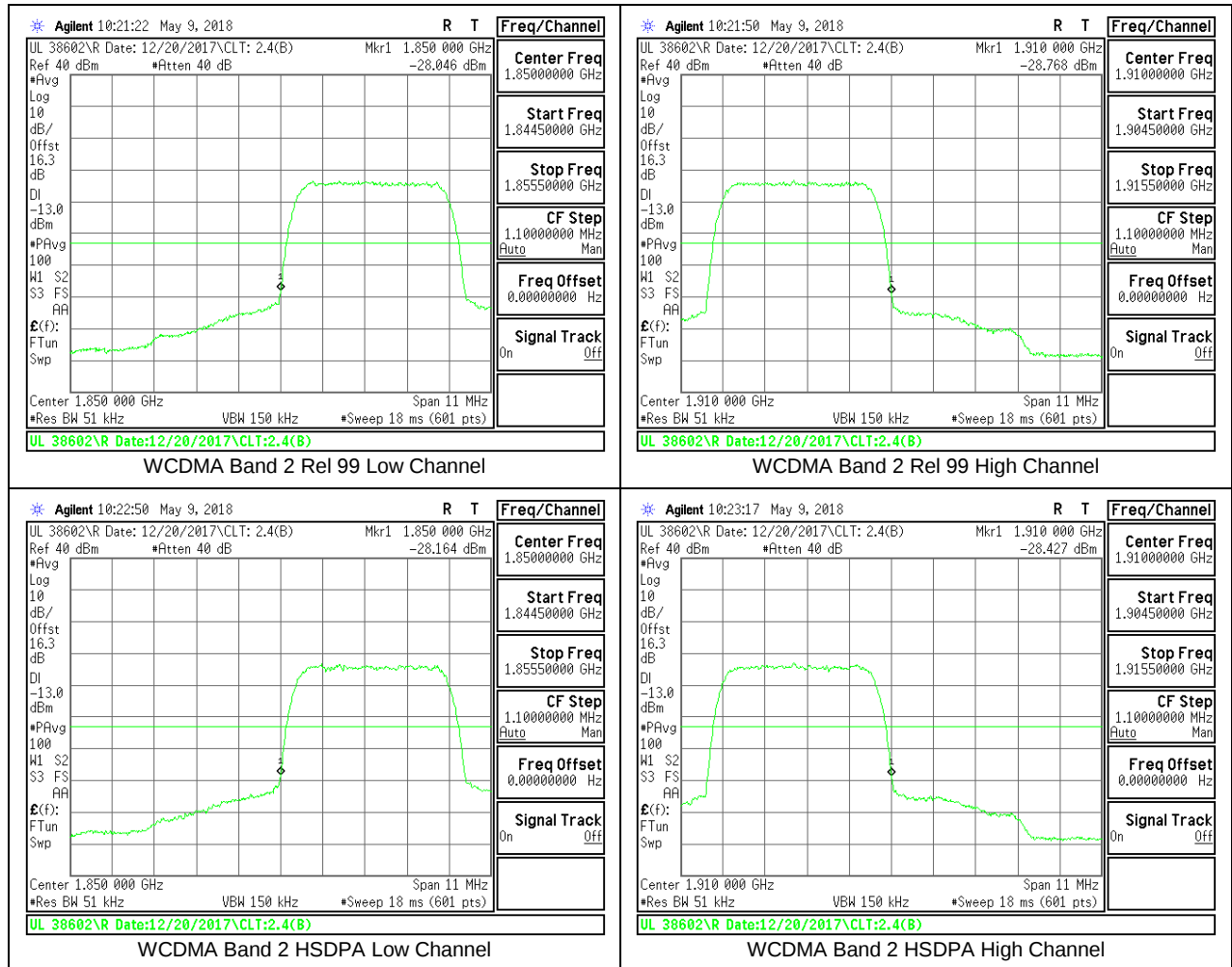
8.2.5. CDMA BC1



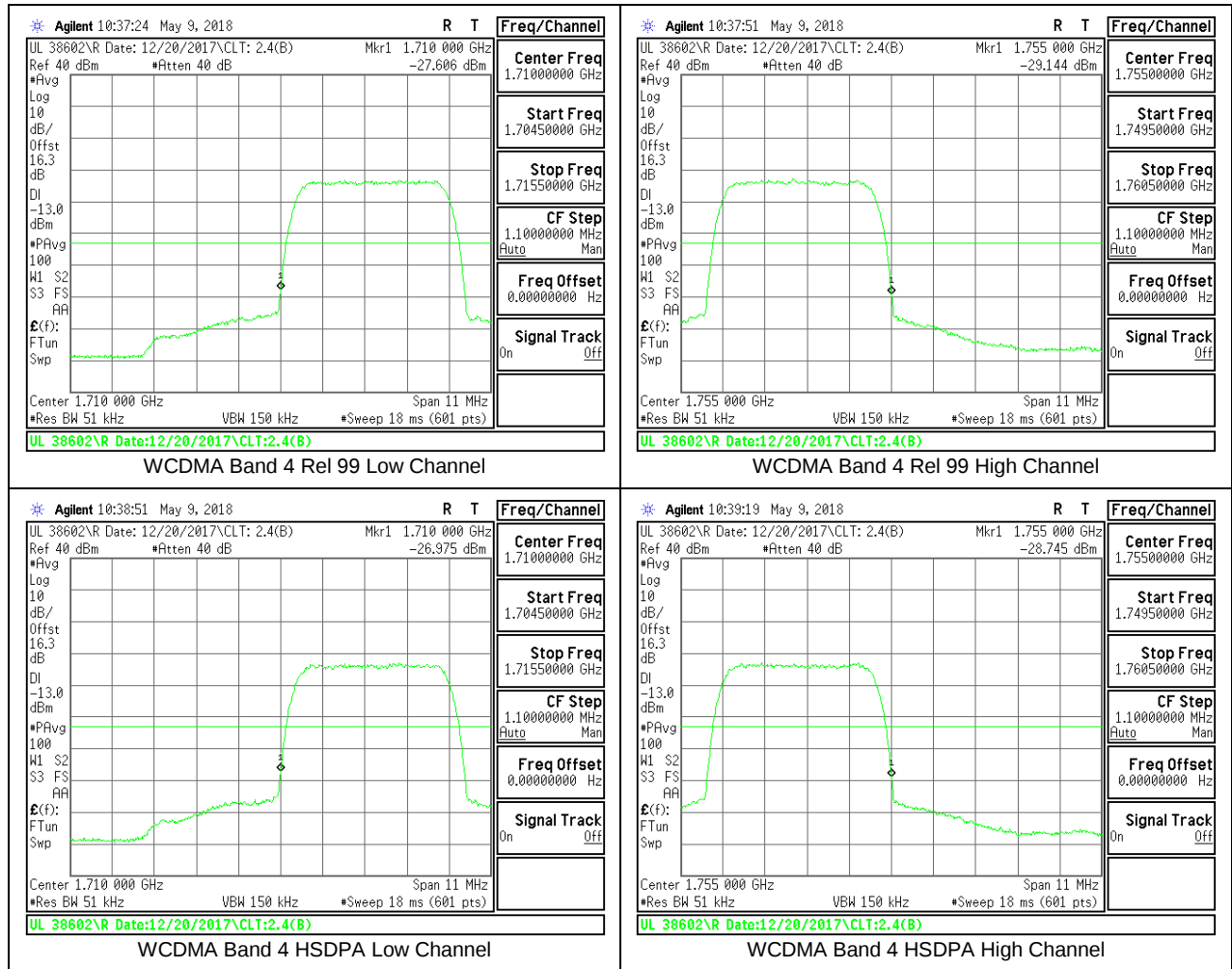
8.2.6. WCDMA BAND 5



8.2.7. WCDMA BAND 2



8.2.8. WCDMA BAND 4



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

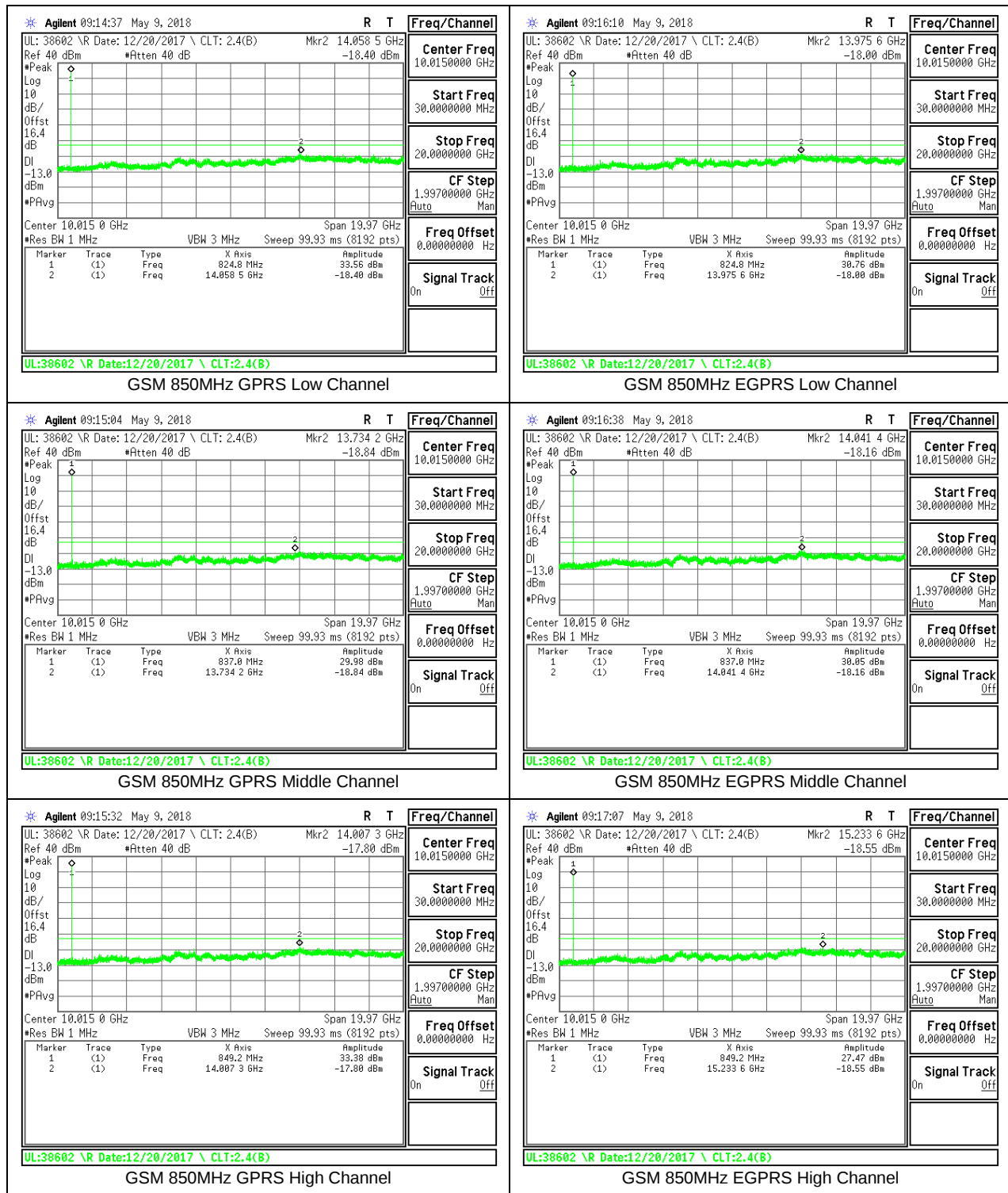
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case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

For each out of band emissions measurement:

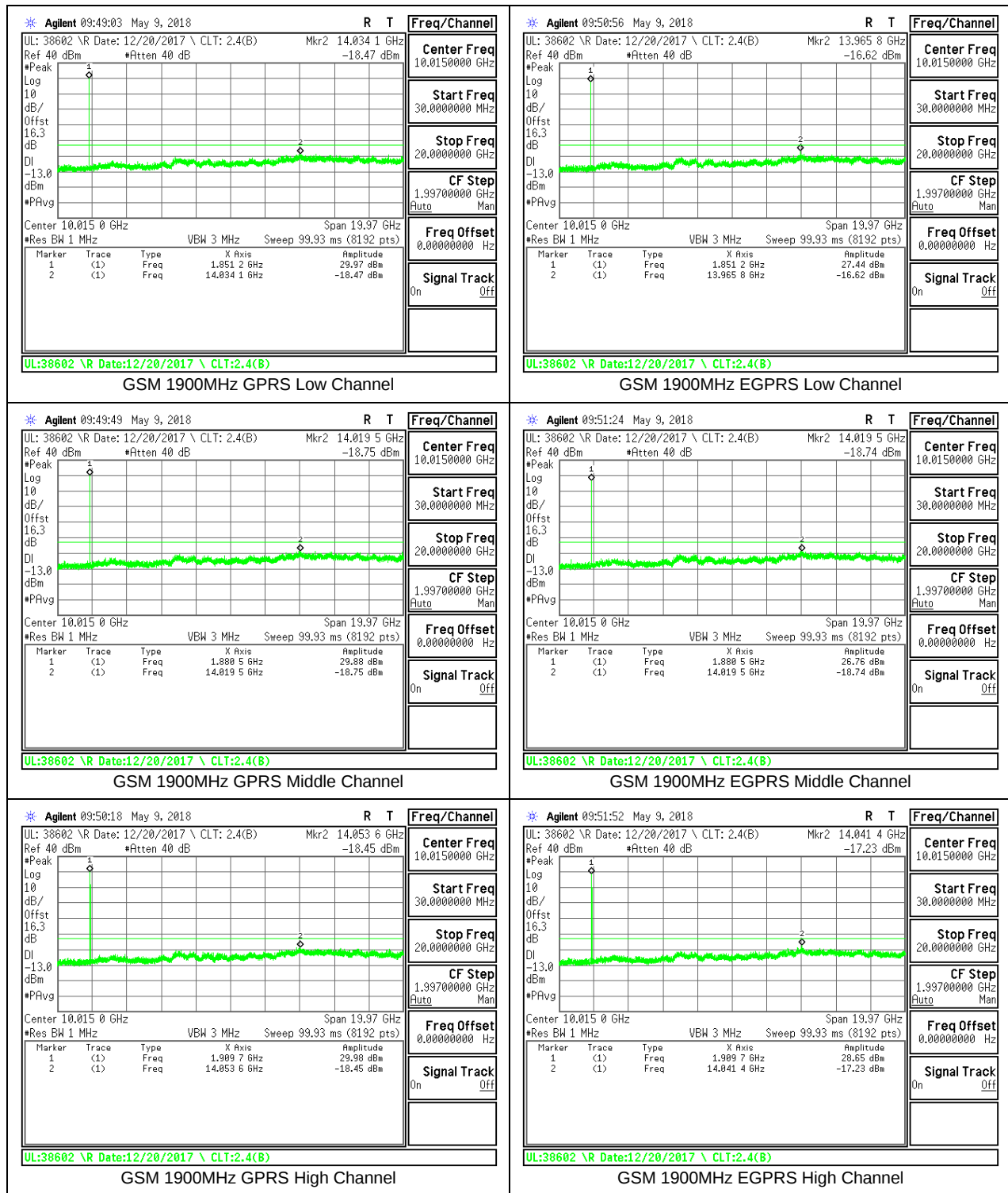
- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.
(NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

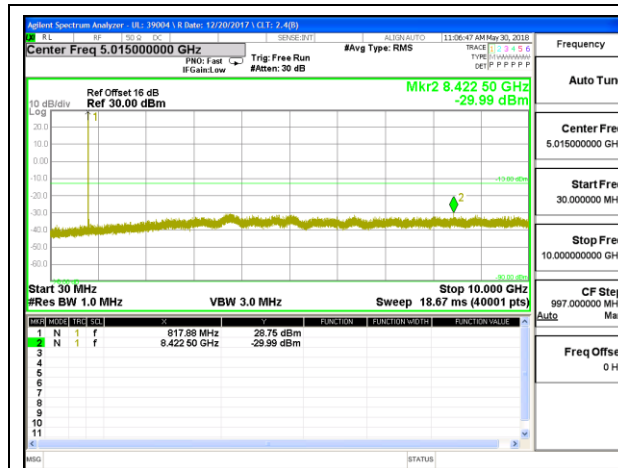
8.3.1. GSM850



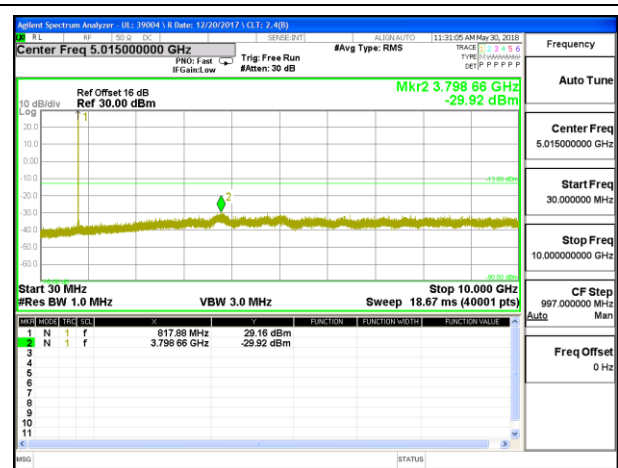
8.3.2. GSM1900



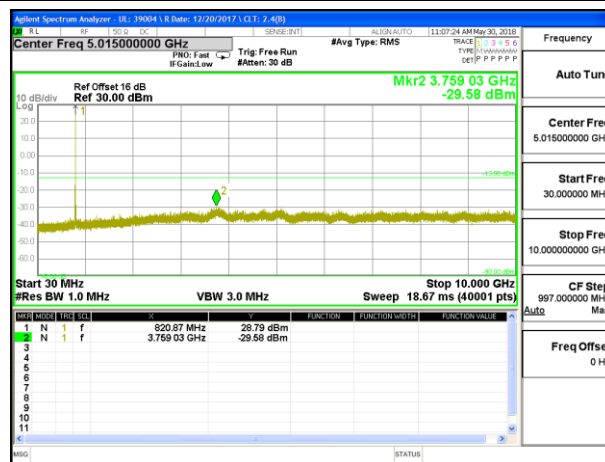
8.3.3. CDMA BC10



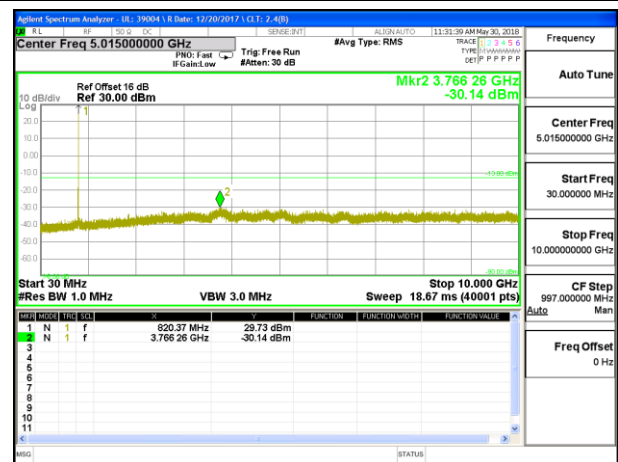
CDMA BC10 1xRTT Low Channel



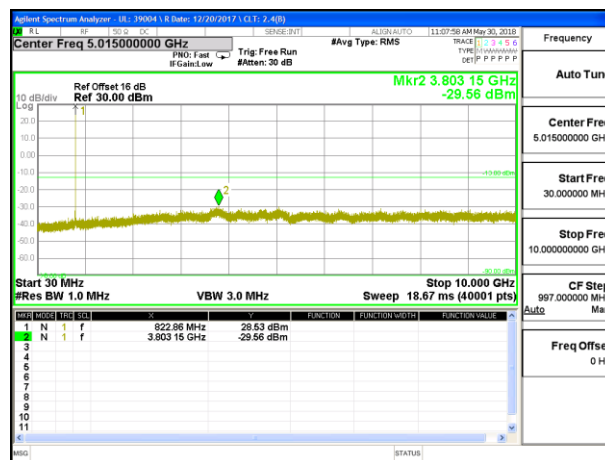
CDMA BC10 1xEV-DO Rev A Low Channel



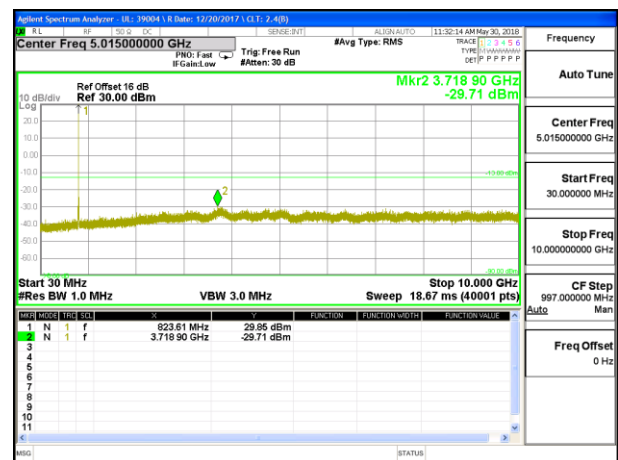
CDMA BC10 1xRTT Middle Channel



CDMA BC10 1xEV-DO Rev A Middle Channel

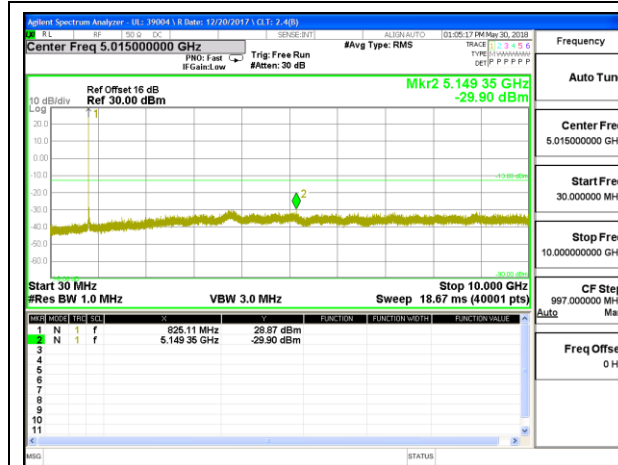


CDMA BC10 1xRTT High Channel

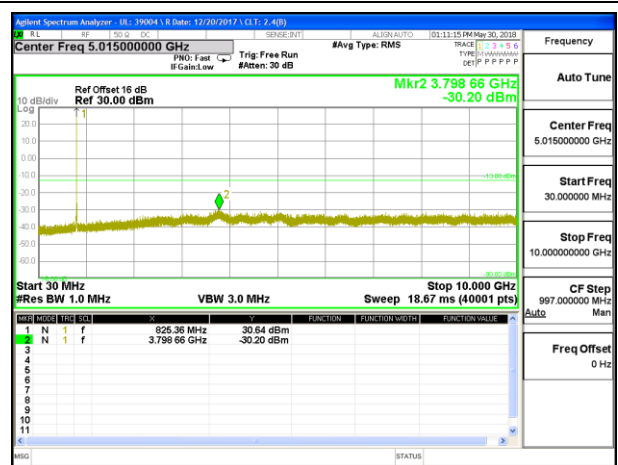


CDMA BC10 1xEV-DO Rev A High Channel

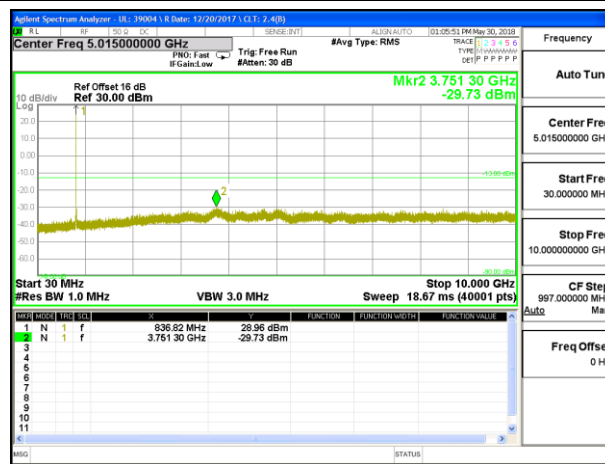
8.3.4. CDMA BC0



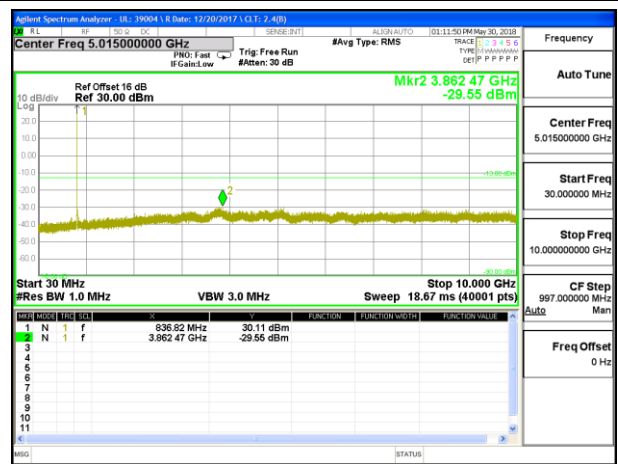
CDMA BC0 1xRTT Low Channel



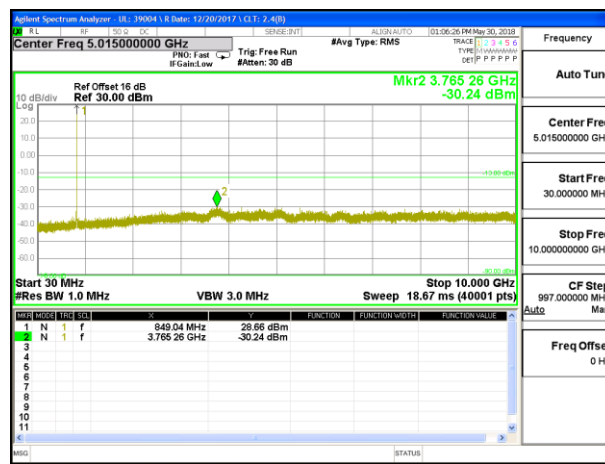
CDMA BC0 1xEV-DO Rev A Low Channel



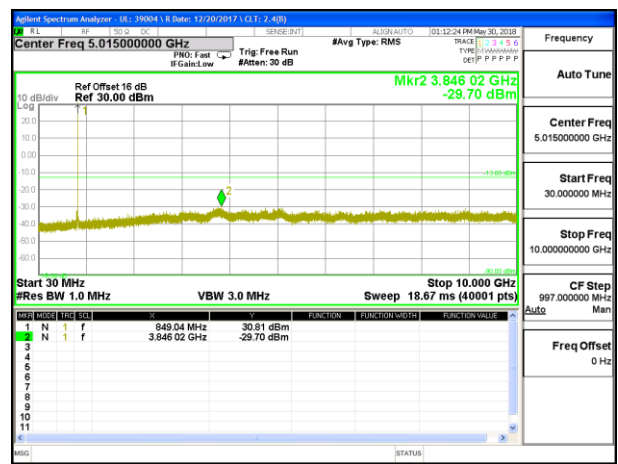
CDMA BC0 1xRTT Middle Channel



CDMA BC0 1xEV-DO Rev A Middle Channel

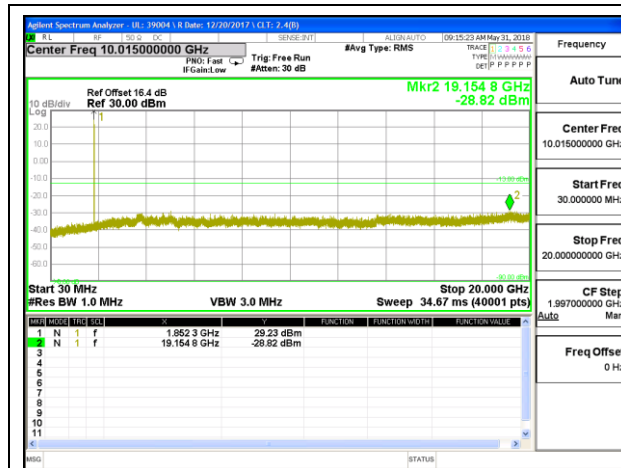


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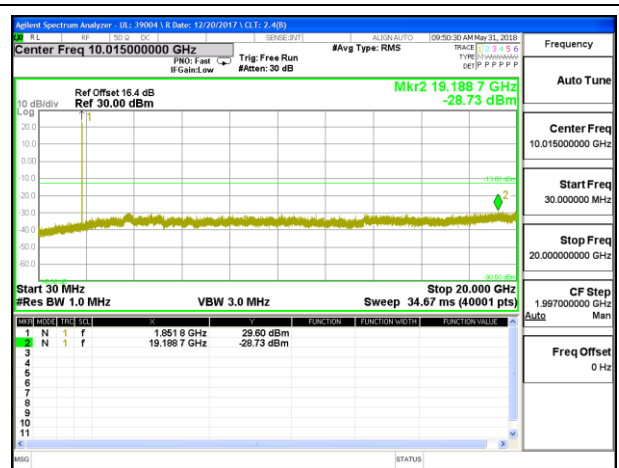


CDMA BC0 1xEV-DO Rev A High Channel

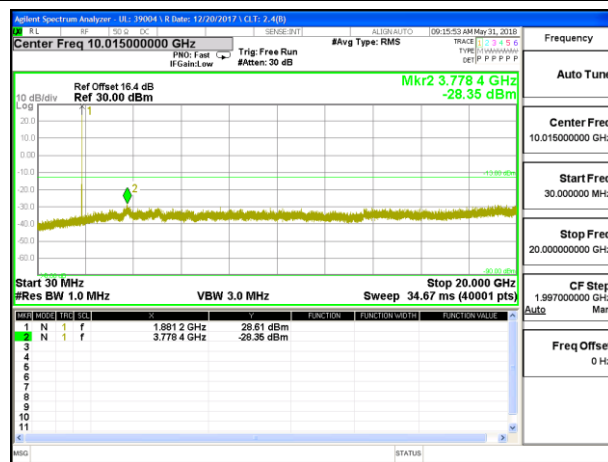
8.3.5. CDMA BC1



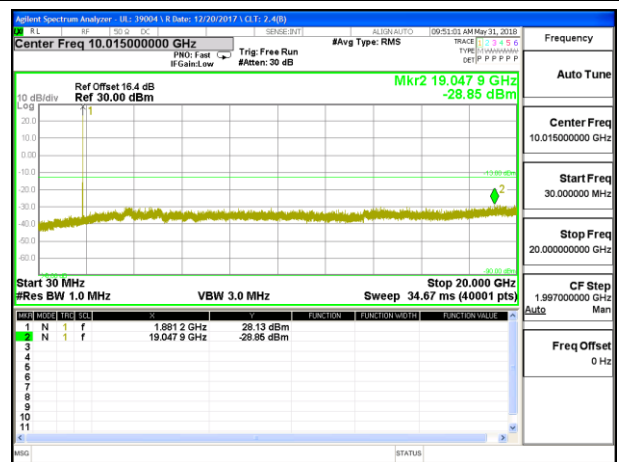
CDMA BC1 1xRTT Low Channel



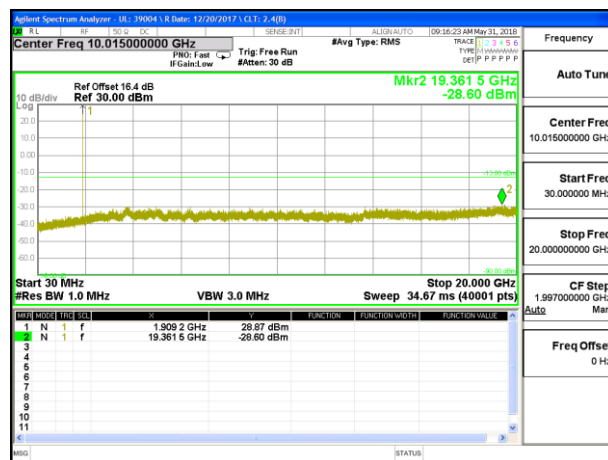
CDMA BC1 1xEV-DO Rev A Low Channel



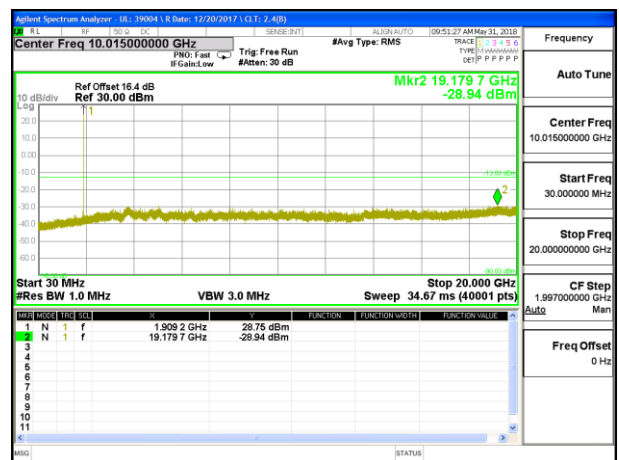
CDMA BC1 1xRTT Middle Channel



CDMA BC1 1xEV-DO Rev A Middle Channel

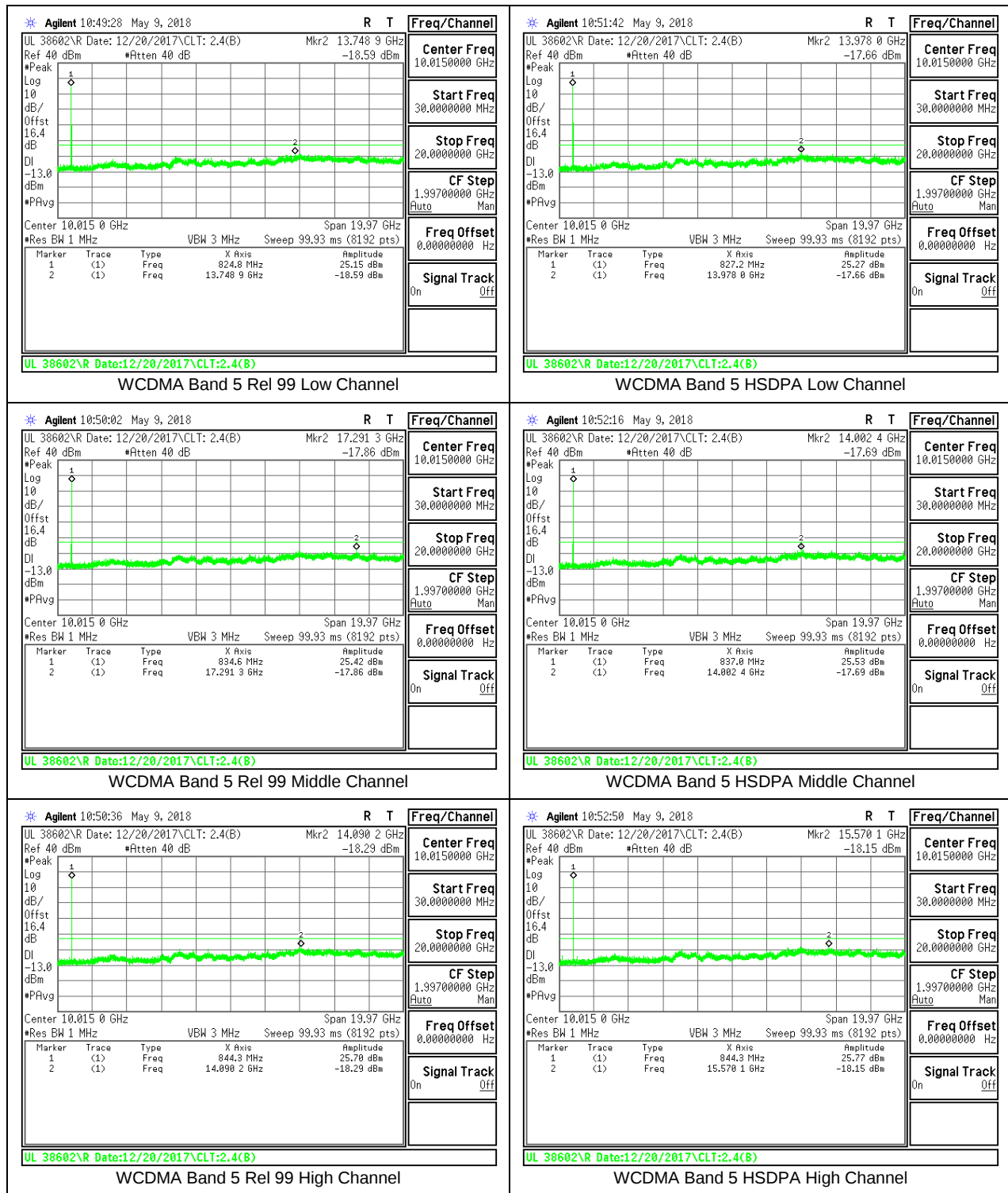


CDMA BC1 1xRTT High Channel

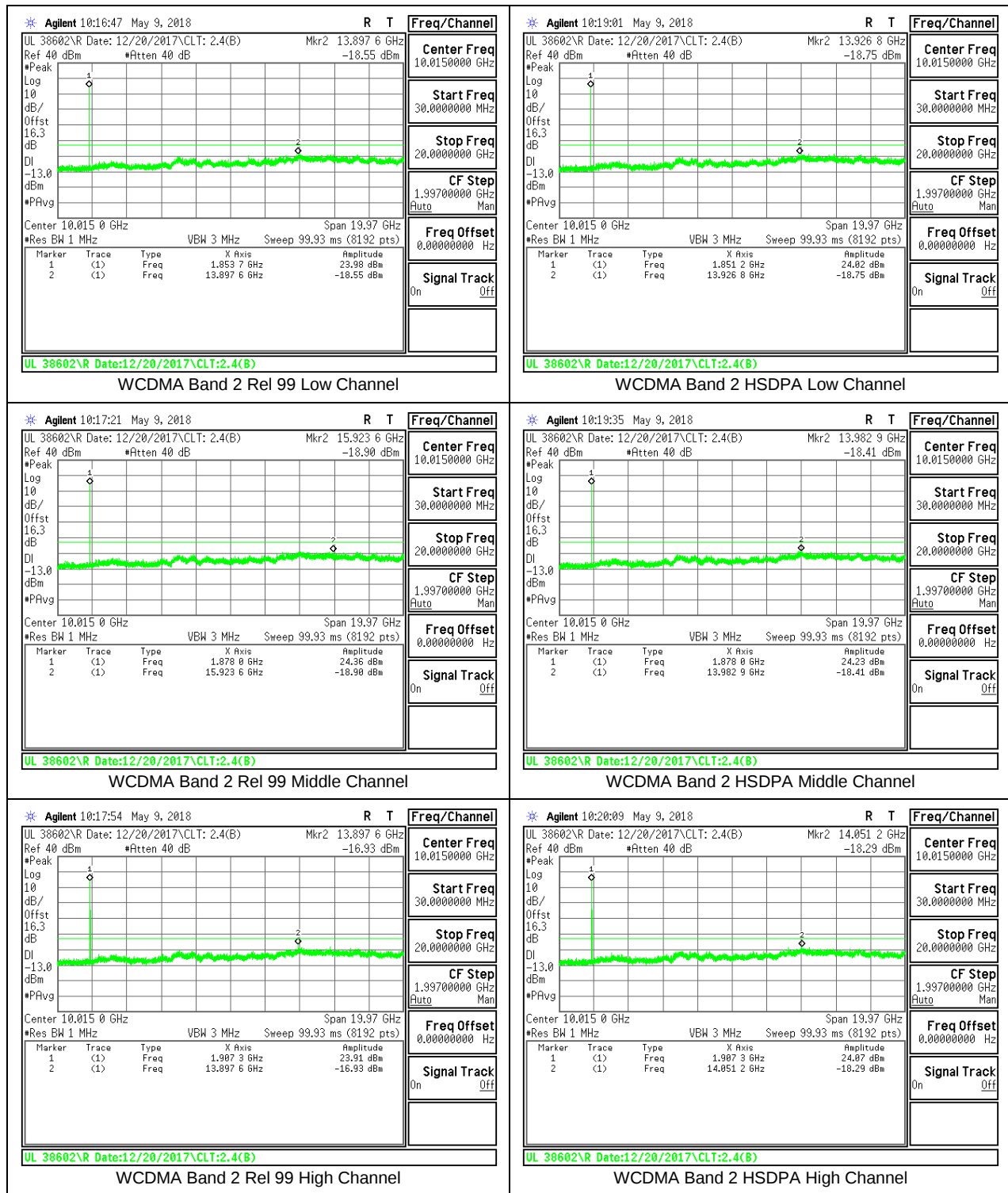


CDMA BC1 1xEV-DO Rev A High Channel

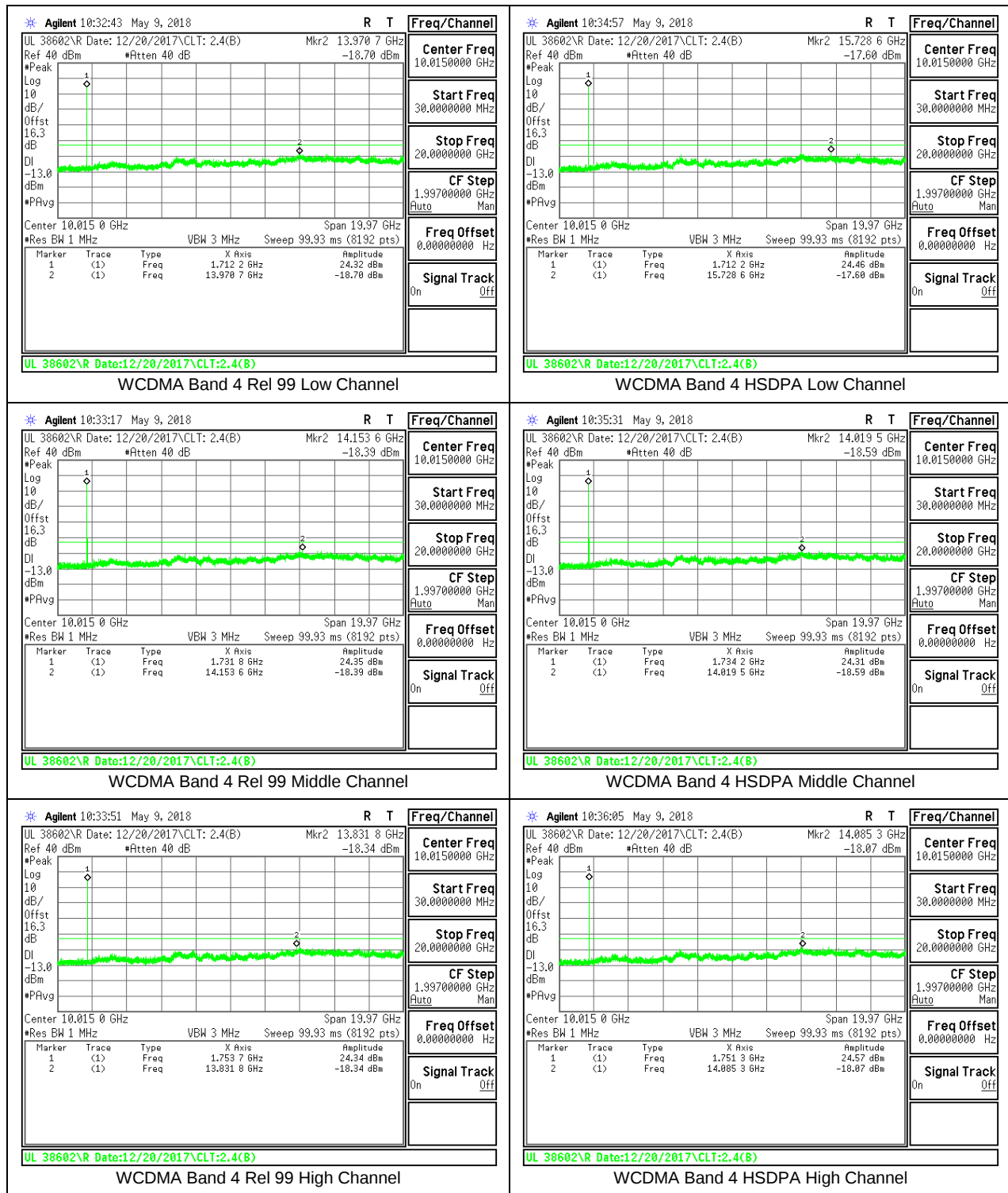
8.3.6. WCDMA BAND 5



8.3.7. WCDMA BAND 2



8.3.8. WCDMA BAND 4



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 $+50^{\circ}\text{C}$
- 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 placed inside a temperature chamber. The temperature is set to 20°C 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 $+50^{\circ}\text{C}$ is reached.

Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

RESULTS

See the following pages.