



TEST REPORT

Report Number : 13259315-E7V2

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

Model : A2341

FCC ID : BCG-E3545A

IC : 579C-E3545A

EUT Description : SMARTPHONE

Test Standard(s) : FCC CFR47 PART 22H, 24E, 27L AND 90S
ISED RSS-132 ISSUE 3, RSS-133 ISSUE 6 AND RSS-139 ISSUE 3

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Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538, U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888



Revision History

Rev.	Issue Date	Revisions	Revised By
V1	9/15/2020	Initial Review	Mengistu Mekuria
V2	9/17/2020	Addressed TCB Questions	Mengistu Mekuria

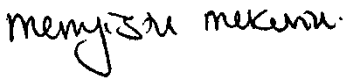
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1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE, INC 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A	
Model	A2341	
FCC ID	BCG-E3545A	
IC	579C-E3545A	
EUT Description	SMARTPHONE	
Serial Number	MODEL(A2341): G6TC404MPT9X (Conducted), C07018700UUP55J4 (Radiated)	
Date Tested	APRIL 09, 2020 to AUGUST 25, 2020	
Applicable Standards	FCC CFR47 PART 22H, 24E, 27L, AND 90S ISED 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. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report. The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise. 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 the U.S. government.		
Approved & Released By:	Reviewed By:	Prepared By:
		
Mengistu Mekuria Operations Leader UL Verification Services Inc.	Glenn Escano 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 the following:

- ANSI C63.26:2015
- FCC CFR 47 Part 2, Part 22, Part 24, Part 27 and Part 90
- [FCC KDB 971168 D01 v03r01](#): Power Meas License Digital Systems
- [FCC KDB 971168 D02 v02r01](#): Misc Rev Approv License Devices
- [FCC KDB 412172 D01 v01r01](#): Determining ERP and EIRP
- ISSED RSS-132 Issue 3, RSS-133 Issue 6, RSS-139 Issue 3.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Road
☒ Chamber A	☐ Chamber D	☐ Chamber I
☒ Chamber B	☐ Chamber E	☐ Chamber J
☐ Chamber C	☐ Chamber F	☐ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	☐ Chamber M

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

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

4. DECISION RULES AND MEASUREMENT UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

4.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U _{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 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%.

4.4. SAMPLE CALCULATION

RADIATED EMISSIONS

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

36.5 dBuV + 0 dB + 10.1 dB + 0 dB = 46.6 dBuV

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, 5G, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, NFC and WPT. All models support at least one UICC based SIM. The second SIM is either an UICC based p-SIM (physical SIM) or e-SIM (electronic SIM). The device supports a built-in inductive charging transmitter and receiver. The rechargeable battery is not user accessible.

5.2. MAXIMUM OUTPUT POWER

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015
KDB 971168 D01 Section 5.6

$$\text{ERP/EIRP} = \text{PMeas} + \text{GT} - \text{LC}$$

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:

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)		
824.2-848.8	GPRS	33.50	-5.00	11.5	28.50	0.708	244.9125	245KGXW
	EGPRS	27.63			22.63	0.183	246.0786	246KG7W
Part 22 850MHz								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824.2-848.8	GPRS	33.50	-5.00	7.0	26.35	0.432	244.9125	245KGXW
	EGPRS	27.63			20.48	0.112	246.0786	246KG7W
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)		
1850.2-1909.8	GPRS	30.91	0.90	2.0	31.81	1.517	242.6955	243KGXW
	EGPRS	25.74			26.64	0.461	233.52	234KG7W

CDMA MODES

Part 90 BC10								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Limit (W)	Conducted (Average) (W)		99% BW (kHz)	Emission Designator	
817.25-822.75	1xRTT	25.6	100.0	0.363		1278.7	1M28F9W	
	1xEV-DO Rev A	25.6		0.363		1281.8	1M28F9W	
RSS 132 BC0								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824.7-848.31	1xRTT	25.7	-5.00	11.5	20.70	0.117	1276.6	1M28F9W
	1xEV-DO Rev A	25.7			20.70	0.117	1277.5	1M28F9W
Part 22 BC0								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824.7-848.31	1xRTT	25.7	-5.00	7.0	18.55	0.072	1276.6	1M28F9W
	1xEV-DO Rev A	25.7			18.55	0.072	1277.5	1M28F9W
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)		
1851.25-1908.75	1xRTT	25.6	-2.10	2.0	23.50	0.224	1277.8	1M28F9W
	1xEV-DO Rev A	25.6			23.50	0.224	1279.1	1M28F9W

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)		
826.4-846.6	REL 99	25.7	-5.00	11.5	20.70	0.117	4123.9	4M12F9W
	HSDPA	24.8			19.80	0.095	4126.7	4M13F9W
Part 22 Band 5								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
826.4-846.6	REL 99	25.7	-5.00	7.0	18.55	0.072	4123.9	4M12F9W
	HSDPA	24.8			17.65	0.058	4126.7	4M13F9W
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)		
1852.4-1907.6	REL 99	24.7	0.90	2.0	25.60	0.363	4146.9	4M15F9W
	HSDPA	23.8			24.70	0.295	4125.3	4M13F9W
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)		
1712.4-1752.6	REL 99	25.7	-1.90	1.0	23.80	0.240	4134.6	4M13F9W
	HSDPA	24.7			22.80	0.191	4131.6	4M13F9W

5.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 0.28.03-1.

5.4. MAXIMUM ANTENNA GAIN

Frequency Range (MHz)	ANT 1 Antenna Gain (dBi)	ANT 2 Antenna Gain (dBi)	ANT 3 Antenna Gain (dBi)	ANT 4 Antenna Gain (dBi)
816 - 824	-5.0	-6.5	N/A	N/A
824 - 849	-5.0	-6.4	N/A	N/A
1850 - 1910	-2.1	-3.9	0.9	-1.5
1710 - 1755	-1.9	-3.9	-1.5	-2.7

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was investigated in three orthogonal orientations X/Y/Z on Ant1/Ant2 for GSM850, WCDMA Band 5, CDMA BC10, CDMA BC0, and CDMA BC1. And Ant1/ Ant2/ Ant3/ Ant4 for GSM1900, WCDMA Band 2 and WCDMA Band 4, it was determined that Y and X - orientation was the worst-case orientation for cell and secondary bands to ANT1 and ANT2 respectively. For PCS and AWS bands, Y- orientation to ANT1, Z- orientation to ANT2, ANT3, and - orientation to ANT4 were the worst-case orientation without AC/DC adapter, headphones or laptop.

Based on average conducted output power measurement investigations. The worst-case is Ant. 1 with the highest power. Therefore, Ant. 1 was used to perform all conducted tests.

The worst-case scenario for all measurements as followed:

- 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.

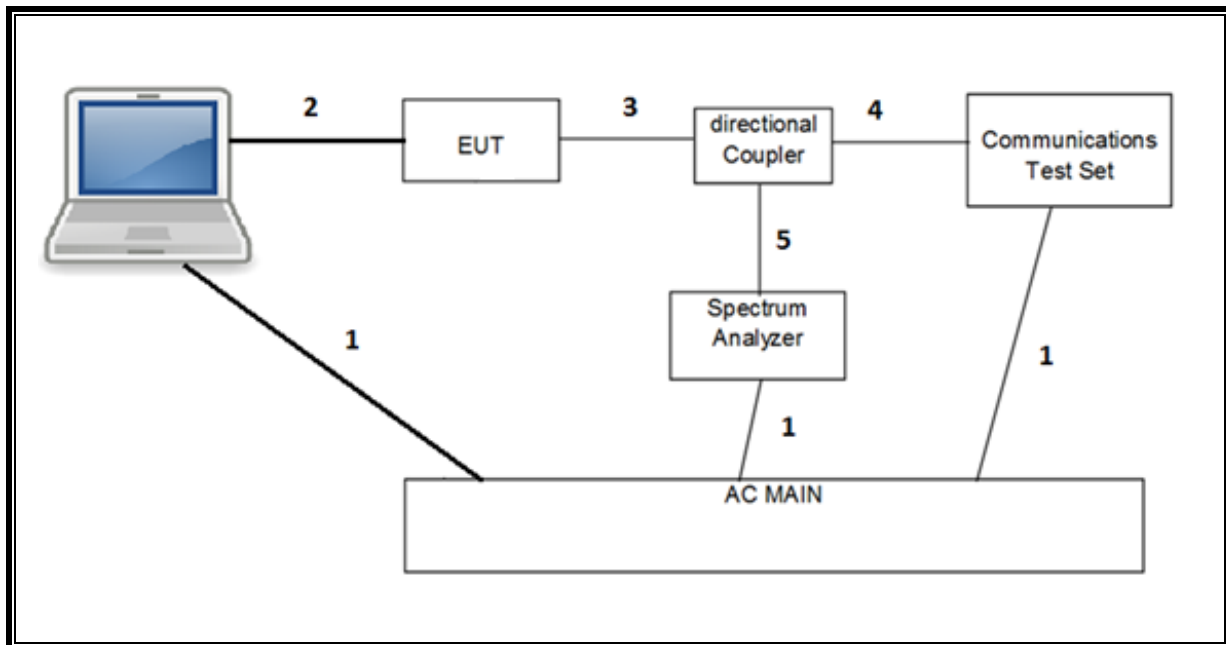
Radiated spurious emissions were investigated from 9kHz to 30MHz, 30MHz-1GHz and above 1GHz. There were no emissions found with less than 20dB of margin from 9kHz to 1GHz.

For simultaneous transmission of multiple channels in the 2.4GHz/5GH WLAN, UWB, and Cellular bands, tests were conducted for various configurations having the highest power, least separation in frequencies and widest operation bandwidths. No noticeable new emission was found.

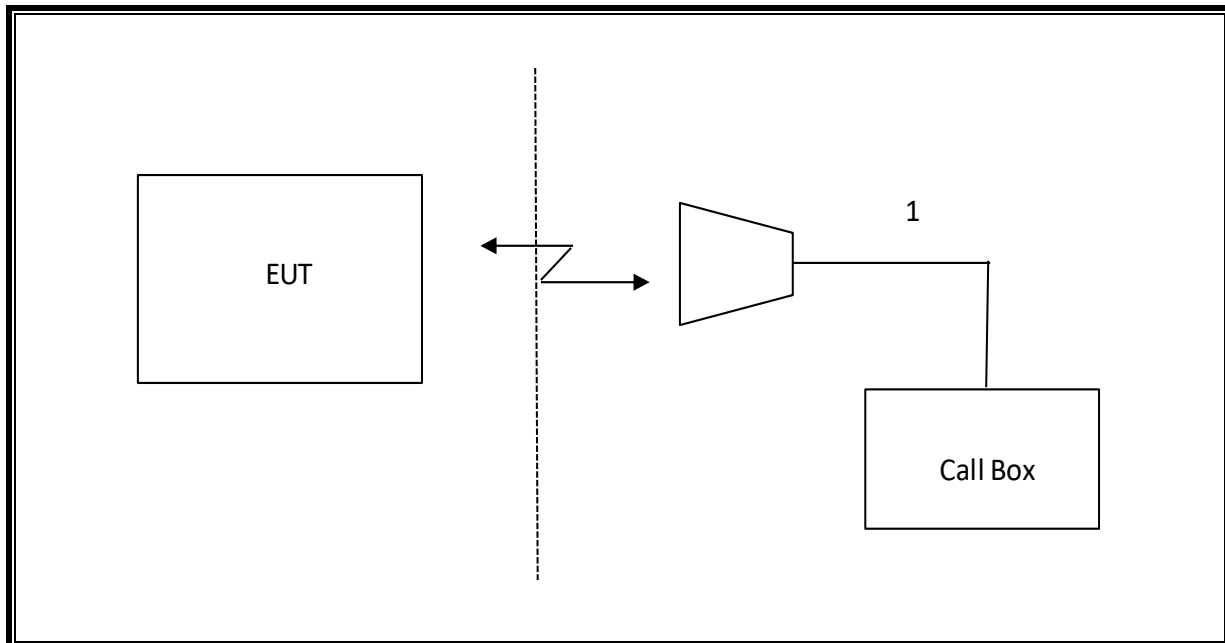
5.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		Manufacturer	Model	Serial Number		FCC ID/ DoC
Laptop		Apple	A1398	C02PM012G3QD		QDS-BRCM1069
Laptop AC/DC adapter		Liteon Technology	PA-1450-BA1	B123		N/A
I/O CABLES (RF CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	3	US 115V	Un-shielded	2.0	N/A
2	USB	1	DC	Un-shielded	1.0	N/A
3	RF In/Out	1	EUT	Un-shielded	0.6	N/A
4	RF In/Out	1	Communication Test Set	Un-shielded	1.2	N/A
5	RF In/Out	1	Barrel	N/A	N/A	N/A
I/O CABLES (RF RADIATED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	RF In/Out	1	Antenna	Un-shielded	5.0	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	A.H. Systems, Inc.	SAS-571	T962	01/25/2021
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T346	07/20/2021
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T136	07/07/2021
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T407	05/20/2021
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	PRE0184052	11/12/2020
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	PRE0181575	09/05/2020
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T757	10/01/2020
Antenna Horn, 18 to 26GHz	ARA	SWH-28	T125	04/17/2021
Antenna, Horn 26-40GHz	ARA	MWH-2640/B	PRE0182203	04/17/2021
*Amplifier, 1 to 18GHz	MITEQ	AFS42-00101800-25-S-42	T1165	05/18/2020
Amplifier, 1 to 18GHz	MITEQ	AFS42-00101800-25-S-42	PRE0181078	05/06/2021
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	PRE0180176	07/14/2021
Amplifier, 100KHz to 1GHz, 32dB	Keysight	8447D	T15	10/26/2020
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	PRE0180175	05/29/2020
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	04/8/2021
Amplifier, 26-40GHz	Miteq	TTA2640	T1864	04/08/2021
Filter, BRF 1850 – 1910 MHz	Micro-Tronics	BRM50714-02	T1796	06/23/2021
Filter, BRF 824 – 848 MHz	Micro-Tronics	BRM20025	PRE0191180	06/23/2021
Filter, HPF 1.2 GHz	MICRO-TRONICS	MICRO-TRONICS	T1737	06/23/2021
*Directional Coupler	KRYTAR	152610	T1536	06/09/2020
*Directional Coupler	KRYTAR	152610	T1161	08/14/2020
*Directional Coupler	KRYTAR	152613	T1537	06/08/2020
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T340	01/22/2021
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T1454	07/15/2021
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T907	01/22/2021
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight	N9030A	T908	05/05/2021
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Keysight	E4440A	T198	01/28/2021
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight	E4440A	T200	01/24/2021
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179522	02/18/2021
Wireless Communications Test Set, 8960 Series 10	Agilent	E5515C	T211	02/18/2021
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T948	08/10/2021
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T1871	02/25/2021
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T972	02/24/2021
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T260	02/19/2021
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T959	02/19/2021
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T754	12/22/2020
Environmental Chamber	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T1154	12/22/2020
Power Meter, P-series single channel	Keysight	N1912A	T1245	01/22/2021
Power Sensor	Keysight	N1921A	T1225	02/23/2021
UL AUTOMATION SOFTWARE				
CLT Software	UL	UL RF	Ver 7.6, November 11, 2017	
Power Measurement Software	UL	UL RF	Ver 2.7, 2019	
Radiated test software	UL	UL RF	Ver 9.5 June 15, 2019	

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 1 (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

Test Engineer ID:	38602	Test Date:	5/28/2020 – 6/4/2020
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Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Conducted Average Power (dBm)	
					ANT 1	ANT 2
GPRS (GMSK)	CS1	1	128	824.2	33.42	31.97
			190	836.6	33.50	31.90
			251	848.8	33.44	31.85
		2	128	824.2	31.77	30.16
			190	836.6	31.61	31.85
			251	848.8	31.27	29.63
EGPRS (8PSK)	MCS5	1	128	824.2	27.62	25.99
			190	836.6	27.63	25.89
			251	848.8	27.60	25.86
		2	128	824.2	26.40	24.84
			190	836.6	26.30	24.74
			251	848.8	26.37	24.70

7.1.2. GSM 1900

Test Engineer ID:	38602	Test Date:	5/28/2020 – 6/18/2020
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Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Conducted Average Power (dBm)			
					ANT 1	ANT 2	ANT 3	ANT 4
GPRS (GMSK)	CS1	1	512	1850.2	31.92	29.39	30.84	28.55
			661	1880	31.87	29.43	30.83	29.00
			810	1909.8	31.70	29.28	30.91	28.89
		2	512	1850.2	29.23	27.82	28.86	26.62
			661	1880	29.27	27.90	28.95	26.89
			810	1909.8	29.16	27.74	28.87	26.69
EGPRS (8PSK)	MCS5	1	512	1850.2	25.94	23.54	25.52	22.63
			661	1880	25.71	23.71	25.74	23.12
			810	1909.8	25.64	23.71	25.65	23.06
		2	512	1850.2	24.80	22.47	24.51	21.75
			661	1880	24.54	22.67	24.66	22.01
			810	1909.8	24.49	22.67	24.53	21.93

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>
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CDMA2000 Mobile Test	B.15.18, L
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- 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)

1x Advanced Setup Procedures used to establish the test signals

Call box setup procedure

- Protocol Rev > 6 (IS-2000-0)
- System ID: 331; NID: 65535, Reg. Ch. #.:
- Radio Config (RC) > Fwd11,Rvs8
- Service Option (SO) Setup > SO75 (Loopback)
- Traffic Data Rate > Full
- Rvs Power Ctrl > All Up bits (Maximum TxPout)
- Reverse Power Control Mode: 00-200 to 400 bps
- Smart blanking was disabled.

RESULT

7.2.1. CDMA BC10

Test Engineer ID:	39004	Test Date:	8/6/2020
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Band	Mode	Radio Configuration (RC)	Service Option (SO)	Ch No.	Freq. (MHz)	Conducted Average Power (dBm)	
						ANT 1	ANT 2
BC10 (800MHz)	1xRTT	RC1	2 (Loopback)	450	817.25	25.6	23.3
				560	820.00	25.6	23.3
				670	822.75	25.6	23.2
			55 (Loopback)	450	817.25	25.6	23.3
				560	820.00	25.6	23.2
				670	822.75	25.6	23.2
		RC2	9 (Loopback)	450	817.25	25.6	23.3
				560	820.00	25.6	23.2
				670	822.75	25.6	23.2
			55 (Loopback)	450	817.25	25.6	23.2
				560	820.00	25.6	23.2
				670	822.75	25.6	23.2
		RC3	2 (Loopback)	450	817.25	25.6	23.4
				560	820.00	25.6	23.2
				670	822.75	25.6	23.2
			55 (Loopback)	450	817.25	25.6	23.3
				560	820.00	25.6	23.2
				670	822.75	25.6	23.2
			32 (+F-SCH)	450	817.25	25.1	23.3
				560	820.00	25.1	23.3
				670	822.75	25.0	23.2
			32 (+SCH)	450	817.25	25.0	23.3
				560	820.00	25.1	23.2
				670	822.75	25.0	23.3
		RC4	2 (Loopback)	450	817.25	25.6	23.3
				560	820.00	25.6	23.2
				670	822.75	25.6	23.2
			55 (Loopback)	450	817.25	25.6	23.3
				560	820.00	25.6	23.3
				670	822.75	25.6	23.2
			32 (+F-SCH)	450	817.25	25.2	23.3
				560	820.00	25.1	23.2
				670	822.75	25.1	23.2
			32 (+SCH)	450	817.25	25.1	23.2
				560	820.00	25.1	23.3
				670	822.75	25.1	23.2
		RC5	9 (Loopback)	450	817.25	25.2	23.3
				560	820.00	25.2	23.2
				670	822.75	25.2	23.2
			55 (Loopback)	450	817.25	25.2	23.3
				560	820.00	25.2	23.3
				670	822.75	25.2	23.2
	1xAdvanced	RC11	2 (Loopback)	450	817.25	25.2	23.3
				560	820.00	25.2	23.3
				670	822.75	25.1	23.2
			75 (Loopback)	450	817.25	25.3	23.4
				560	820.00	25.2	23.2
				670	822.75	25.2	23.2
			32 (+F-SCH)	450	817.25	25.1	23.3
				560	820.00	25.1	23.2
				670	822.75	25.2	23.2
			32 (+SCH)	450	817.25	25.2	23.4
				560	820.00	25.1	23.2
				670	822.75	25.1	23.3
	1xEVDO Rel. 0	FTAP Rate: 307.2 kbps(2 slot, QPSK)	RTAP Rate: 153.6 kbps	450	817.25	25.6	23.4
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK	RETAP: 4096	560	820.00	25.5	23.2
				670	822.75	25.5	23.4
				450	817.25	25.5	23.4
				560	820.00	25.5	23.4
				670	822.75	25.5	23.4

7.2.2. CDMA BC0

Test Engineer ID:	39004	Test Date:	8/6/2020
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Band	Mode	Radio Configuration (RC)	Service Option (SO)	Ch No.	Freq. (MHz)	Conducted Average Power (dBm)	
						ANT 1	ANT 2
BC0 (850MHz)	1xRTT	RC1	2 (Loopback)	1013	824.70	25.6	23.6
				384	836.52	25.6	23.6
				777	848.31	25.5	23.6
			55 (Loopback)	1013	824.70	25.6	23.6
				384	836.52	25.5	23.6
				777	848.31	25.5	23.6
		RC2	9 (Loopback)	1013	824.70	25.5	23.6
				384	836.52	25.5	23.6
				777	848.31	25.5	23.6
			55 (Loopback)	1013	824.70	25.6	23.6
				384	836.52	25.7	23.6
				777	848.31	25.5	23.6
		RC3	2 (Loopback)	1013	824.70	25.5	23.6
				384	836.52	25.6	23.6
				777	848.31	25.5	23.6
			55 (Loopback)	1013	824.70	25.5	23.6
				384	836.52	25.5	23.6
				777	848.31	25.6	23.6
			32 (+F-SCH)	1013	824.70	25.2	23.3
				384	836.52	25.1	23.4
				777	848.31	25.1	23.3
			32 (+SCH)	1013	824.70	25.1	23.3
				384	836.52	25.1	23.3
				777	848.31	25.1	23.3
		RC4	2 (Loopback)	1013	824.70	25.6	23.6
				384	836.52	25.5	23.6
				777	848.31	25.5	23.6
			55 (Loopback)	1013	824.70	25.2	23.6
				384	836.52	25.1	23.6
				777	848.31	25.2	23.6
			32 (+F-SCH)	1013	824.70	25.1	23.3
				384	836.52	25.2	23.3
				777	848.31	25.2	23.4
			32 (+SCH)	1013	824.70	25.2	23.3
				384	836.52	25.2	23.3
				777	848.31	25.1	23.3
		RC5	9 (Loopback)	1013	824.70	25.2	23.6
				384	836.52	25.2	23.6
				777	848.31	25.1	23.6
			55 (Loopback)	1013	824.70	25.2	23.6
				384	836.52	25.1	23.6
				777	848.31	25.1	23.6
	1xAdvanced	RC11	9 (Loopback)	1013	824.70	25.2	23.4
				384	836.52	25.2	23.4
				777	848.31	25.2	23.5
			55 (Loopback)	1013	824.70	25.1	23.4
				384	836.52	25.1	23.4
				777	848.31	25.2	23.5
			32 (+F-SCH)	1013	824.70	25.2	23.3
				384	836.52	25.2	23.4
				777	848.31	25.2	23.5
			32 (+SCH)	1013	824.70	25.2	23.5
				384	836.52	25.1	23.4
				777	848.31	25.3	23.5
	1xEVDO Rel. 0	FTAP Rate: 307.2 kbps(2 slot, QPSK)	RTAP Rate: 153.6 kbps	1013	824.70	25.7	23.6
				384	836.52	25.7	23.6
				777	848.31	25.3	23.3
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK	RETAP: 4096	1013	824.70	25.7	23.5
				384	836.52	25.7	23.5
				777	848.31	25.1	23.5

7.2.3. CDMA BC1

Test Engineer ID:	39004	Test Date:	8/6/2020
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Band	Mode	Radio Configuration (RC)	Service Option (SO)	Ch No.	Freq. (MHz)	Conducted Average Power (dBm)	
						ANT 1	ANT 2
BC1 (1900MHz)	1xRTT	RC1	2 (Loopback)	25	1851.25	25.1	22.5
				600	1880.00	25.2	22.3
				1175	1908.75	25.1	22.4
			55 (Loopback)	25	1851.25	25.1	22.5
				600	1880.00	25.2	22.4
				1175	1908.75	25.2	22.4
		RC2	9 (Loopback)	25	1851.25	25.1	22.5
				600	1880.00	25.2	22.4
				1175	1908.75	25.2	22.4
			55 (Loopback)	25	1851.25	25.1	22.5
				600	1880.00	25.2	22.4
				1175	1908.75	25.2	22.4
		RC3	2 (Loopback)	25	1851.25	25.1	22.6
				600	1880.00	25.2	22.6
				1175	1908.75	25.2	22.7
			55 (Loopback)	25	1851.25	25.1	22.5
				600	1880.00	25.2	22.6
				1175	1908.75	25.2	22.6
			32 (+F-SCH)	25	1851.25	25.3	22.6
				600	1880.00	25.4	22.6
				1175	1908.75	25.4	22.7
			32 (+SCH)	25	1851.25	25.3	22.6
				600	1880.00	25.4	22.6
				1175	1908.75	25.5	22.6
		RC4	2 (Loopback)	25	1851.25	25.1	22.6
				600	1880.00	25.2	22.6
				1175	1908.75	25.2	22.6
			55 (Loopback)	25	1851.25	25.1	22.6
				600	1880.00	25.2	22.6
				1175	1908.75	25.2	22.6
			32 (+F-SCH)	25	1851.25	25.3	22.6
				600	1880.00	25.4	22.6
				1175	1908.75	25.5	22.7
			32 (+SCH)	25	1851.25	25.4	22.6
				600	1880.00	25.4	22.6
				1175	1908.75	25.5	22.7
		RC5	9 (Loopback)	25	1851.25	25.1	22.6
				600	1880.00	25.2	22.6
				1175	1908.75	25.2	22.7
			55 (Loopback)	25	1851.25	25.1	22.6
				600	1880.00	25.2	22.6
				1175	1908.75	25.2	22.6
	1xAdvanced	RC11	2 (Loopback)	25	1851.25	25.4	22.7
				600	1880.00	25.5	22.7
				1175	1908.75	25.6	22.7
			55 (Loopback)	25	1851.25	25.5	22.7
				600	1880.00	25.5	22.7
				1175	1908.75	25.6	22.7
			32 (+F-SCH)	25	1851.25	25.4	22.7
				600	1880.00	25.4	22.7
				1175	1908.75	25.5	22.7
			32 (+SCH)	25	1851.25	25.5	22.7
				600	1880.00	25.4	22.6
				1175	1908.75	25.6	22.7
		1xEVDO Rel. 0	RTAP Rate: 153.6 kbps	25	1851.25	25.4	22.6
				600	1880	25.6	22.2
				1175	1908.75	25.5	22.4
				25	1851.25	25.4	22.7
				600	1880	25.6	22.6
				1175	1908.75	25.6	22.6
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK	RETAP: 4096	25	1851.25	25.4	22.7
				600	1880	25.6	22.6
				1175	1908.75	25.6	22.6

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

Test Engineer ID:	38602	Test Date:	5/28/2020 – 6/4/2020
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Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Conducted Average Power (dBm)	
						ANT 1	ANT 2
W-CDMA Band 5 (850MHz)	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	25.7	23.8
			4183	836.6	N/A	25.7	23.9
			4233	846.6	N/A	25.7	23.8
	HSDPA	Subtest 1	4132	826.4	0	24.7	22.8
			4183	836.6	0	24.7	22.9
			4233	846.6	0	24.7	22.9
		Subtest 2	4132	826.4	0	24.7	22.8
			4183	836.6	0	24.8	22.9
			4233	846.6	0	24.7	22.9
		Subtest 3	4132	826.4	0.5	24.2	22.3
			4183	836.6	0.5	24.2	22.4
			4233	846.6	0.5	24.2	22.4
		Subtest 4	4132	826.4	0.5	24.2	22.3
			4183	836.6	0.5	24.3	22.4
			4233	846.6	0.5	24.2	22.4
	HSPA (HSDPA & HSUPA)	Subtest 1	4132	826.4	0	24.7	22.8
			4183	836.6	0	24.7	22.9
			4233	846.6	0	24.6	22.8
		Subtest 2	4132	826.4	2	22.7	20.9
			4183	836.6	2	22.6	20.9
			4233	846.6	2	22.6	20.8
		Subtest 3	4132	826.4	1	23.7	21.8
			4183	836.6	1	23.6	21.9
			4233	846.6	1	23.5	21.8
		Subtest 4	4132	826.4	2	22.6	20.8
			4183	836.6	2	22.6	20.9
			4233	846.6	2	22.6	20.8
		Subtest 5	4132	826.4	0	24.2	22.4
			4183	836.6	0	24.2	22.4
			4233	846.6	0	24.1	22.4
	DC-HSDPA	Subtest 1	4132	826.4	0	24.6	22.8
			4183	836.6	0	24.6	22.9
			4233	846.6	0	24.6	22.8
		Subtest 2	4132	826.4	0	24.7	22.8
			4183	836.6	0	24.7	22.9
			4233	846.6	0	24.7	22.8
		Subtest 3	4132	826.4	0.5	24.2	22.3
			4183	836.6	0.5	24.2	22.4
			4233	846.6	0.5	24.2	22.4
		Subtest 4	4132	826.4	0.5	24.2	22.3
			4183	836.6	0.5	24.2	22.4
			4233	846.6	0.5	24.2	22.3

7.3.2. WCDMA BAND 2

Test Engineer ID:	38602	Test Date:	5/28/2020 – 6/18/2020
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Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Conducted 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	25.6	23.1	24.5	22.5
			9400	1880.0	N/A	25.6	23.0	24.6	22.6
			9538	1907.6	N/A	25.7	23.1	24.7	22.7
	HSDPA	Subtest 1	9262	1852.4	0	24.7	22.2	23.5	21.6
			9400	1880.0	0	24.7	22.1	23.6	21.6
			9538	1907.6	0	24.8	22.1	23.7	21.7
		Subtest 2	9262	1852.4	0	24.7	22.2	23.5	21.5
			9400	1880.0	0	24.8	22.0	23.6	21.6
			9538	1907.6	0	24.8	22.0	23.7	21.7
		Subtest 3	9262	1852.4	0.5	24.3	21.6	23.0	21.0
			9400	1880.0	0.5	24.3	21.4	23.1	21.1
			9538	1907.6	0.5	24.3	21.6	23.2	21.2
		Subtest 4	9262	1852.4	0.5	24.3	21.6	23.0	21.1
			9400	1880.0	0.5	24.3	21.5	23.1	21.2
			9538	1907.6	0.5	24.4	21.6	23.2	21.2
	HSPA (HSDPA & HSUPA)	Subtest 1	9262	1852.4	0	24.8	22.1	23.5	21.6
			9400	1880.0	0	24.7	22.0	23.6	21.7
			9538	1907.6	0	24.7	22.0	23.7	21.7
		Subtest 2	9262	1852.4	2	22.7	20.1	21.5	19.6
			9400	1880.0	2	22.6	20.0	21.6	19.7
			9538	1907.6	2	22.6	20.0	21.7	19.8
		Subtest 3	9262	1852.4	1	23.6	21.1	22.5	20.6
			9400	1880.0	1	23.6	20.9	22.6	20.7
			9538	1907.6	1	23.6	21.0	22.7	20.8
		Subtest 4	9262	1852.4	2	22.6	20.1	21.5	19.7
			9400	1880.0	2	22.6	19.9	21.6	19.8
			9538	1907.6	2	22.6	19.9	21.7	19.8
		Subtest 5	9262	1852.4	0	24.2	21.6	23.1	21.2
			9400	1880.0	0	24.2	21.5	23.2	21.3
			9538	1907.6	0	24.2	21.5	23.3	21.4
	DC-HSDPA	Subtest 1	9262	1852.4	0	24.7	22.1	23.6	21.7
			9400	1880.0	0	24.7	22.0	23.7	21.8
			9538	1907.6	0	24.8	22.0	23.8	21.8
		Subtest 2	9262	1852.4	0	24.7	22.1	23.6	21.6
			9400	1880.0	0	24.8	22.0	23.7	21.7
			9538	1907.6	0	24.9	22.0	23.8	21.8
		Subtest 3	9262	1852.4	0.5	24.3	21.6	23.1	21.1
			9400	1880.0	0.5	24.3	21.5	23.2	20.9
			9538	1907.6	0.5	24.4	21.6	23.3	21.0
		Subtest 4	9262	1852.4	0.5	24.4	21.7	23.1	20.9
			9400	1880.0	0.5	24.3	21.6	23.2	21.0
			9538	1907.6	0.5	24.4	21.6	23.3	21.1

7.3.3. WCDMA BAND 4

Test Engineer ID:	38602	Test Date:	5/28/2020 – 6/18/2020
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Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Conducted 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	25.5	23.1	24.7	22.7
			1413	1732.6	N/A	25.6	23.1	24.5	22.5
			1513	1752.6	N/A	25.7	23.0	24.5	22.5
	HSDPA	Subtest 1	1312	1712.4	0	24.6	22.1	23.6	21.8
			1413	1732.6	0	24.6	22.1	23.5	21.5
			1513	1752.6	0	24.7	22.0	23.5	21.5
		Subtest 2	1312	1712.4	0	24.5	22.1	23.6	21.7
			1413	1732.6	0	24.6	22.1	23.4	21.5
			1513	1752.6	0	24.7	22.0	23.4	21.5
		Subtest 3	1312	1712.4	0.5	24.1	21.6	23.1	21.3
			1413	1732.6	0.5	24.1	21.6	22.9	21.0
			1513	1752.6	0.5	24.1	21.5	22.9	21.0
		Subtest 4	1312	1712.4	0.5	24.1	21.6	23.1	21.3
			1413	1732.6	0.5	24.0	21.6	22.9	21.0
			1513	1752.6	0.5	24.2	21.5	23.0	21.0
	HSPA (HSDPA & HSUPA)	Subtest 1	1312	1712.4	0	24.6	22.1	23.6	21.8
			1413	1732.6	0	24.4	22.1	23.4	21.6
			1513	1752.6	0	24.5	21.9	23.5	21.6
		Subtest 2	1312	1712.4	2	22.4	20.1	21.6	19.8
			1413	1732.6	2	22.4	20.0	21.4	19.6
			1513	1752.6	2	22.4	19.9	21.5	19.6
		Subtest 3	1312	1712.4	1	23.4	21.1	22.6	20.8
			1413	1732.6	1	23.3	21.0	22.4	20.6
			1513	1752.6	1	23.4	21.0	22.4	20.6
		Subtest 4	1312	1712.4	2	22.4	20.1	21.6	19.8
			1413	1732.6	2	22.4	20.0	21.5	19.6
			1513	1752.6	2	22.4	19.9	21.5	19.6
		Subtest 5	1312	1712.4	0	24.0	21.6	23.2	21.4
			1413	1732.6	0	23.9	21.6	23.1	21.1
			1513	1752.6	0	24.0	21.5	23.1	21.2
	DC-HSDPA	Subtest 1	1312	1712.4	0	24.4	22.0	23.6	21.6
			1413	1732.6	0	24.4	21.9	23.4	21.4
			1513	1752.6	0	24.5	21.8	23.4	21.4
		Subtest 2	1312	1712.4	0	24.5	22.0	23.6	21.6
			1413	1732.6	0	24.5	21.9	23.4	21.4
			1513	1752.6	0	24.6	21.9	23.4	21.4
		Subtest 3	1312	1712.4	0.5	24.1	21.5	23.0	21.1
			1413	1732.6	0.5	24.1	21.5	22.9	20.9
			1513	1752.6	0.5	24.1	21.4	22.9	20.9
		Subtest 4	1312	1712.4	0.5	24.1	21.5	23.0	21.1
			1413	1732.6	0.5	24.1	21.5	22.9	20.9
			1513	1752.6	0.5	24.2	21.4	22.9	20.9

8. CONDUCTED TEST RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049
ISED: 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)
850	GPRS	190	836.6	244.9125	312.846
	EGPRS			246.0786	302.196
1900	GPRS	661	1880.0	242.6955	308.247
	EGPRS			233.5200	301.599

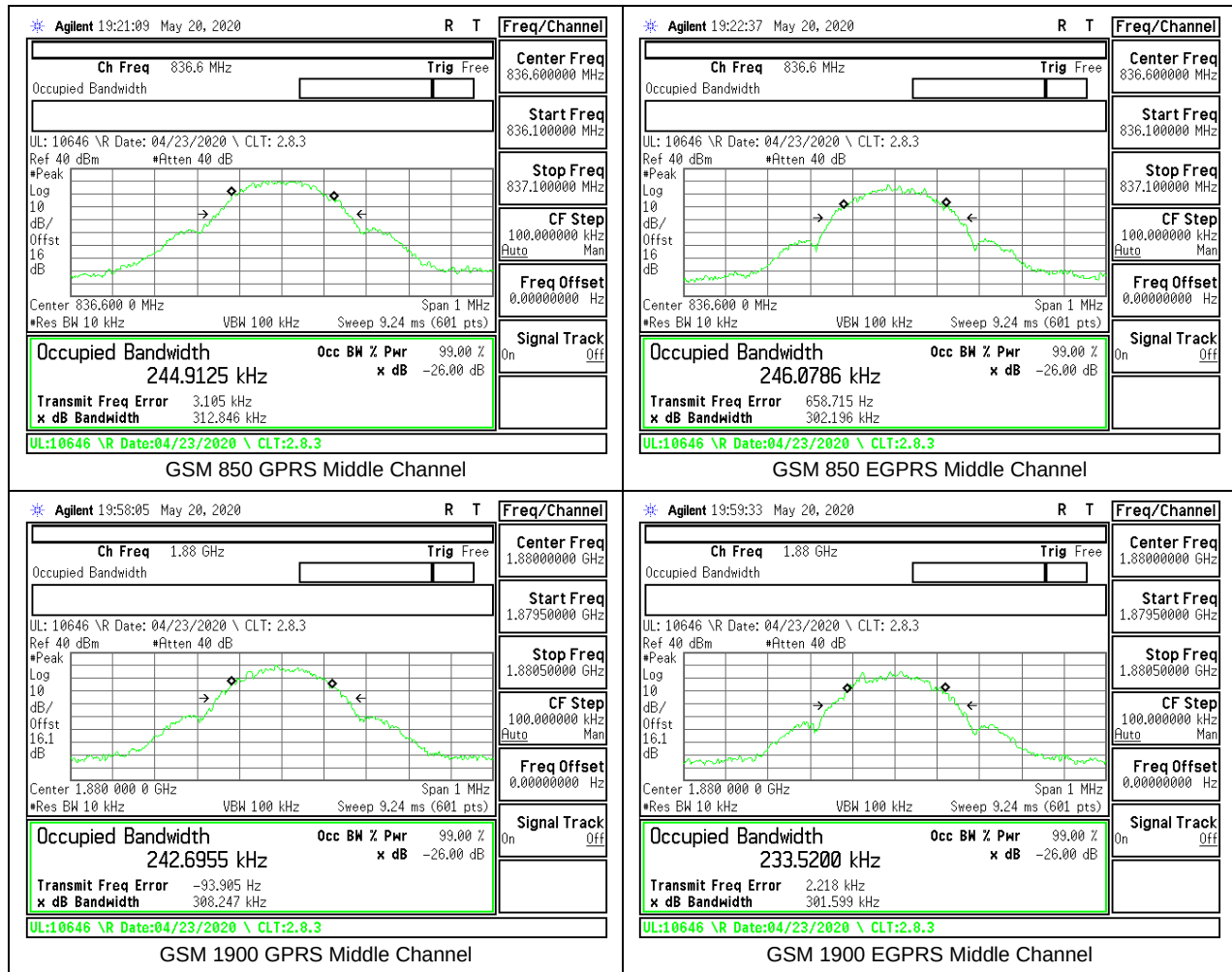
CDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BC10	1xRTT	560	820.0	1.2787	1.437
	1xEV-DO Rev A			1.2818	1.429
BC0	1xRTT	384	836.5	1.2766	1.437
	1xEV-DO Rev A			1.2775	1.436
BC1	1xRTT	600	1880.0	1.2778	1.432
	1xEV-DO Rev A			1.2791	1.433

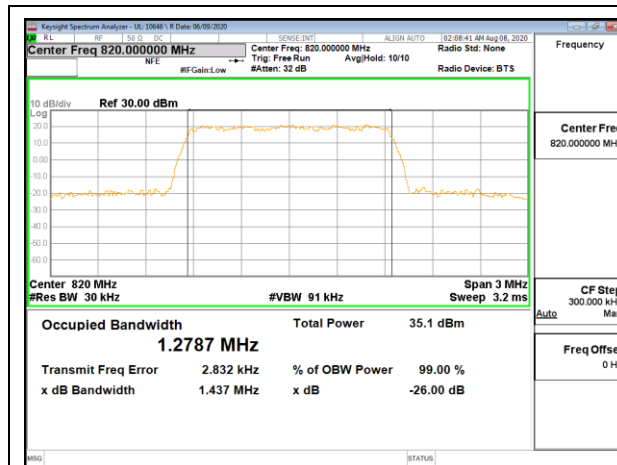
WCDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BAND 5	REL 99	4408	836.6	4.1239	4.708
	HSDPA			4.1267	4.659
BAND 2	REL 99	9800	1880.0	4.1469	4.676
	HSDPA			4.1253	4.682
BAND 4	REL 99	1638	1732.6	4.1346	4.713
	HSDPA			4.1316	4.696

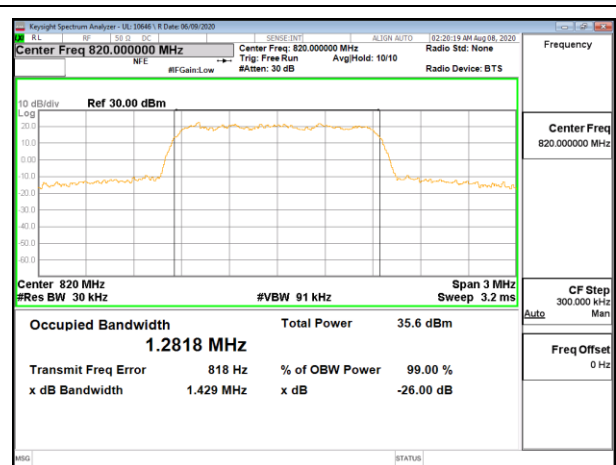
8.1.1. GSM



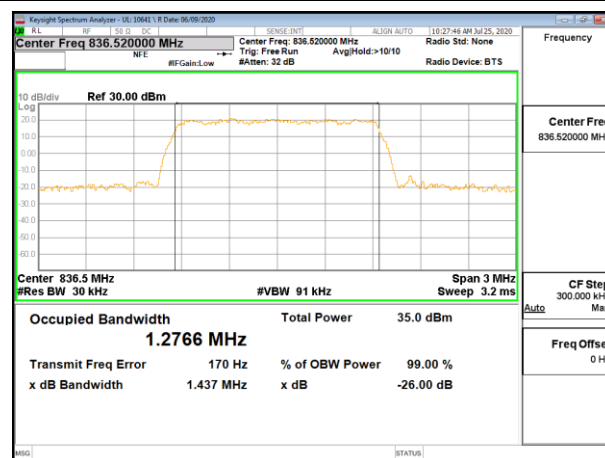
8.1.2. CDMA



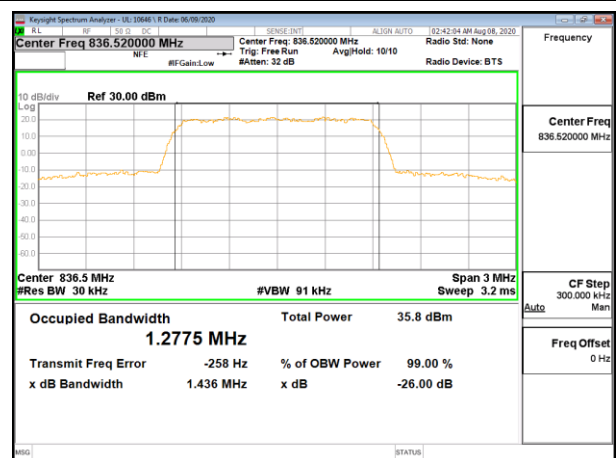
CDMA BC10 1xRTT Middle Channel



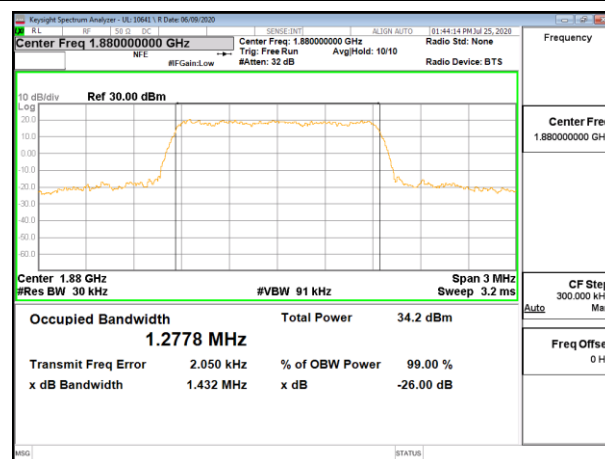
CDMA BC10 1xEV-DO Rev A Middle Channel



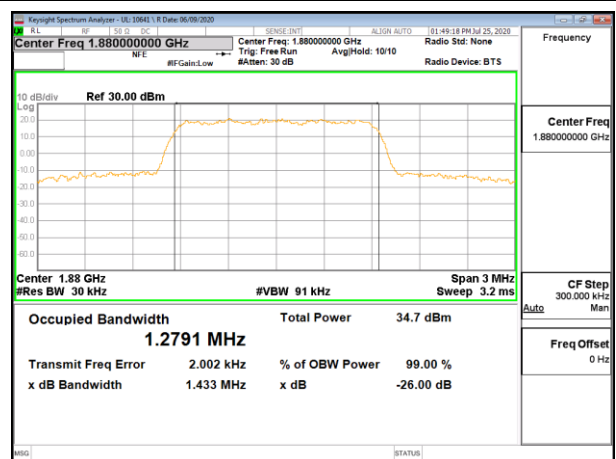
CDMA BC0 1xRTT Middle Channel



CDMA BC0 1xEV-DO Rev A Middle Channel

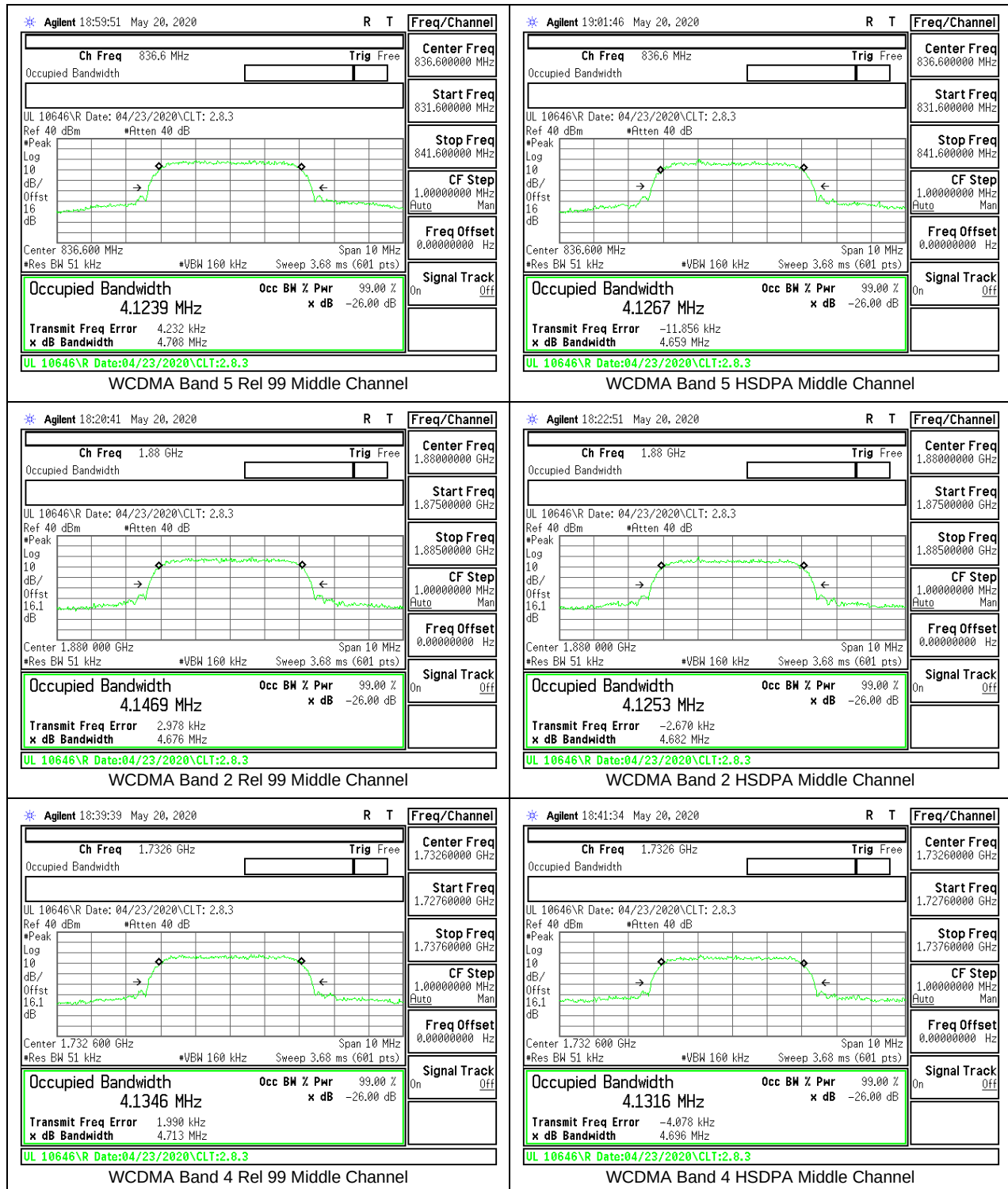


CDMA BC1 1xRTT Middle Channel



CDMA BC1 1xEV-DO Rev A Middle Channel

8.1.3. WCDMA



8.2. BAND EDGE AND EMISSION MASK

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

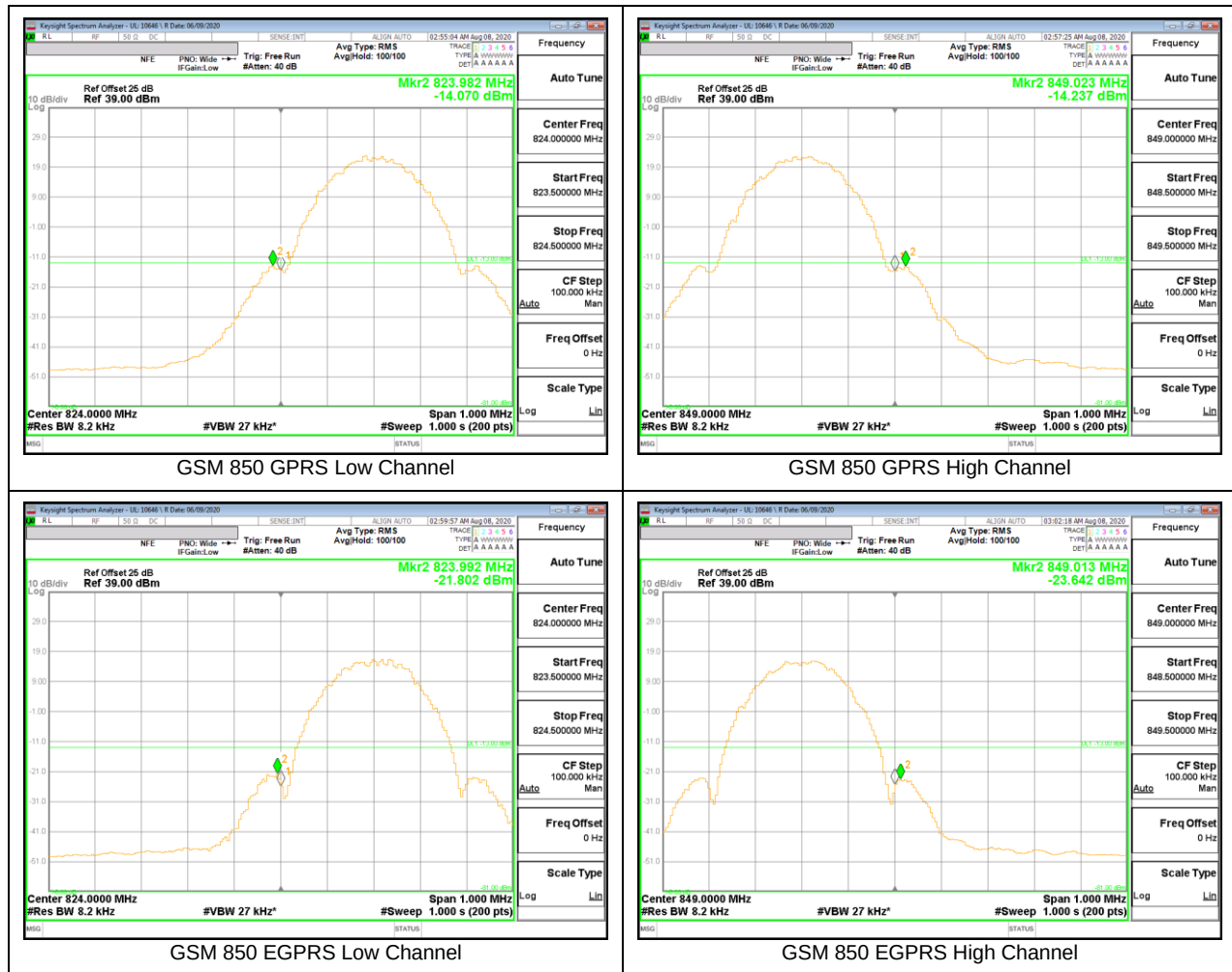
The transmitter output was connected to a R&S CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each band edge measurement:

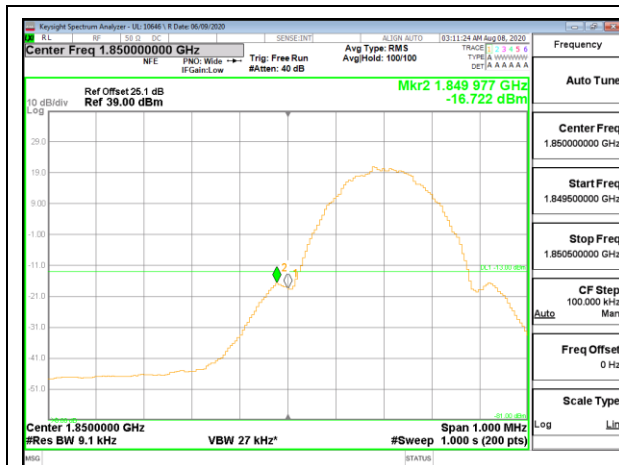
- Set the spectrum analyzer span to include the block edge frequency.
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

RESULTS

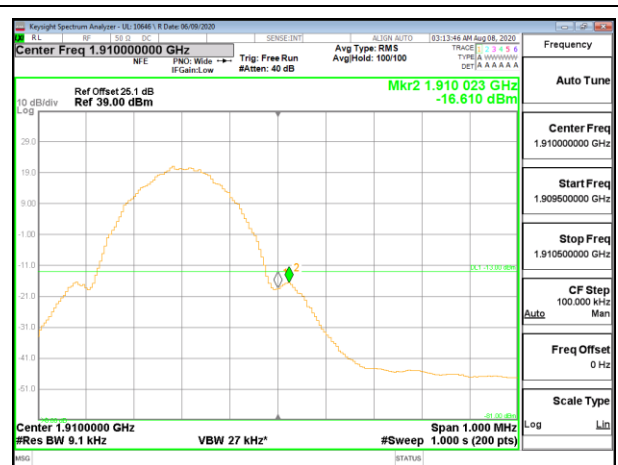
8.2.1. GSM 850



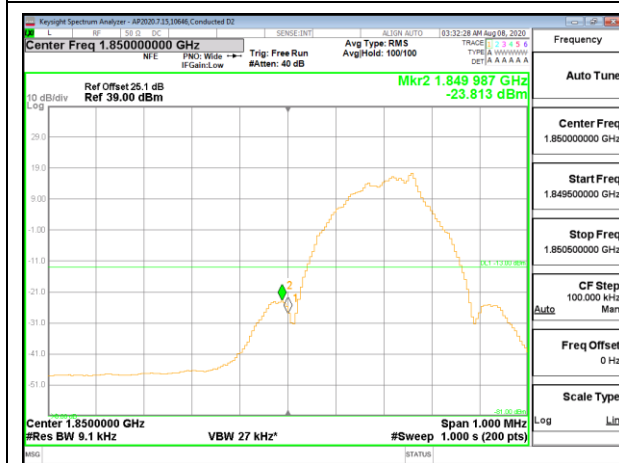
8.2.2. GSM 1900



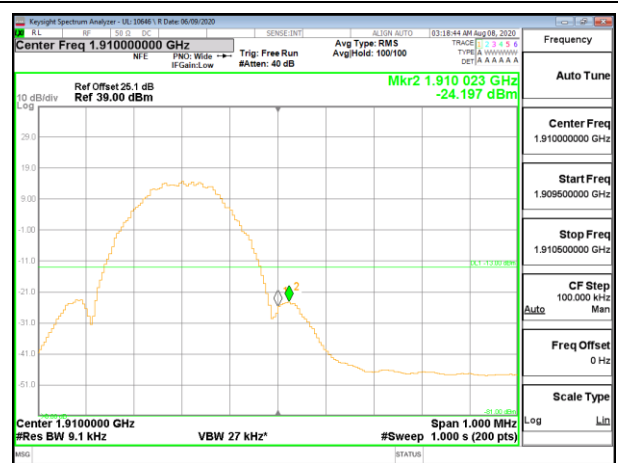
GSM 1900 GPRS Low Channel



GSM 1900 GPRS High Channel



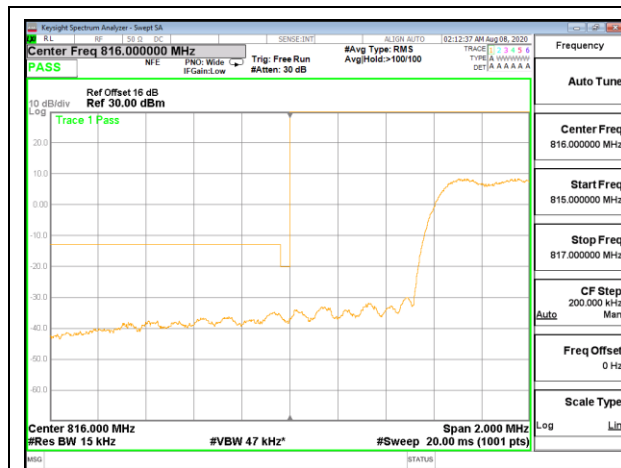
GSM 1900 EGPRS Low Channel



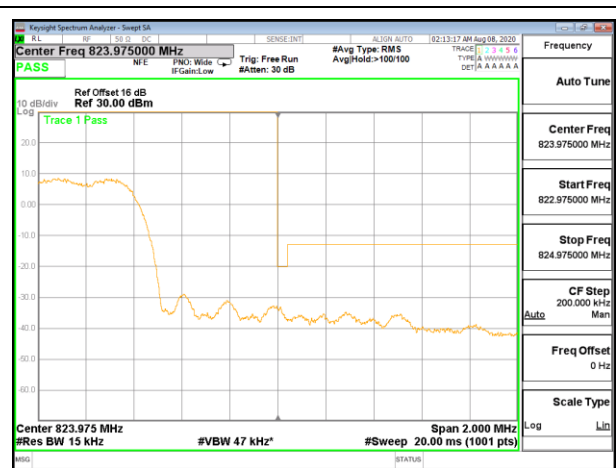
GSM 1900 EGPRS High Channel

8.2.3. CDMA BC10

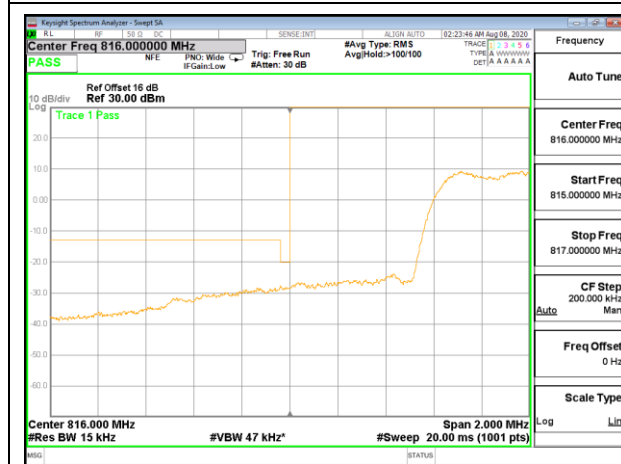
Test Engineer ID:	10646	Test Date:	8/8/2020
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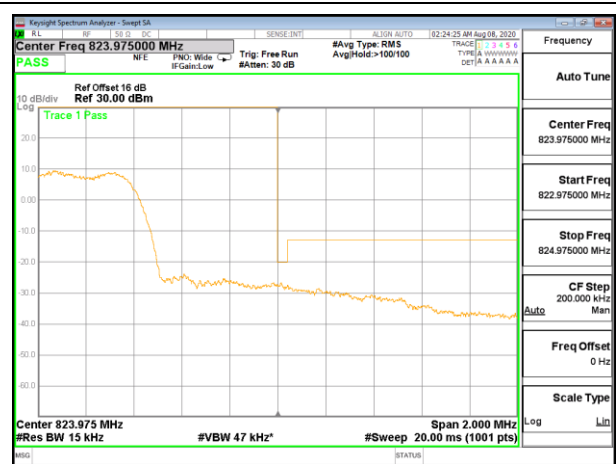
CDMA BC10 1xRTT Low Channel, RBW=1% of EBW



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



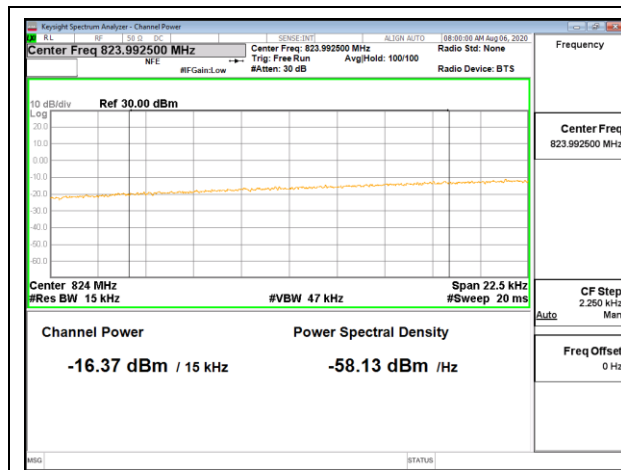
CDMA BC10 1xEV-DO Rev A Low Channel, RBW=1% of EBW



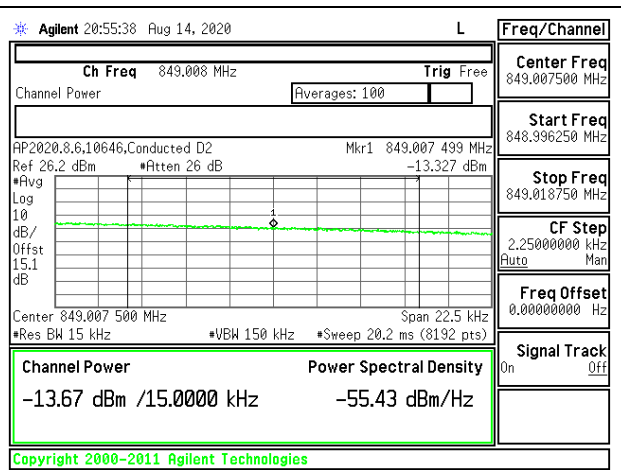
CDMA BC10 1xEV-DO Rev A High Channel, RBW=1% of EBW

8.2.4. CDMA BC0

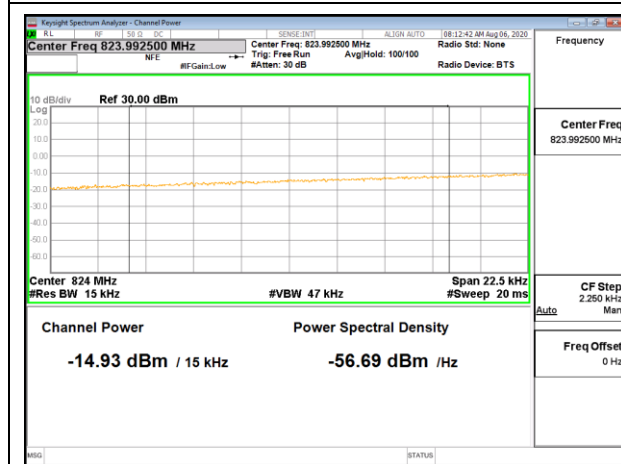
Test Engineer ID:	10646	Test Date:	8/6/2020 & 8/14/2020
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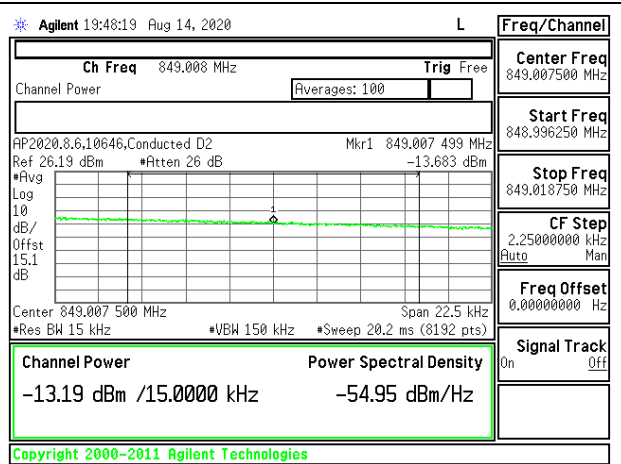
CDMA BC0 1xRTT Low Channel



CDMA BC0 1xRTT High Channel

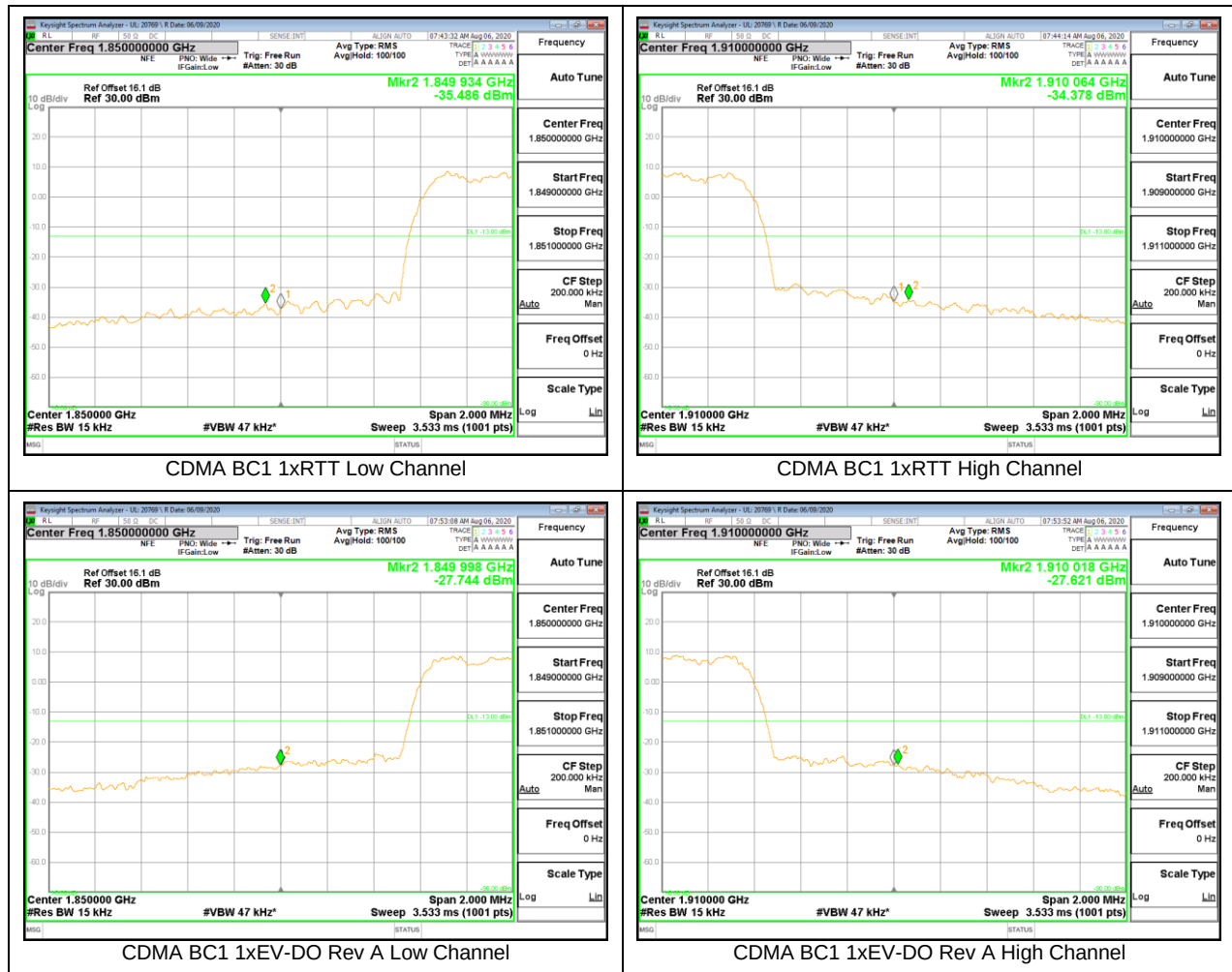


CDMA BC0 1xEV-DO Rev A Low Channel

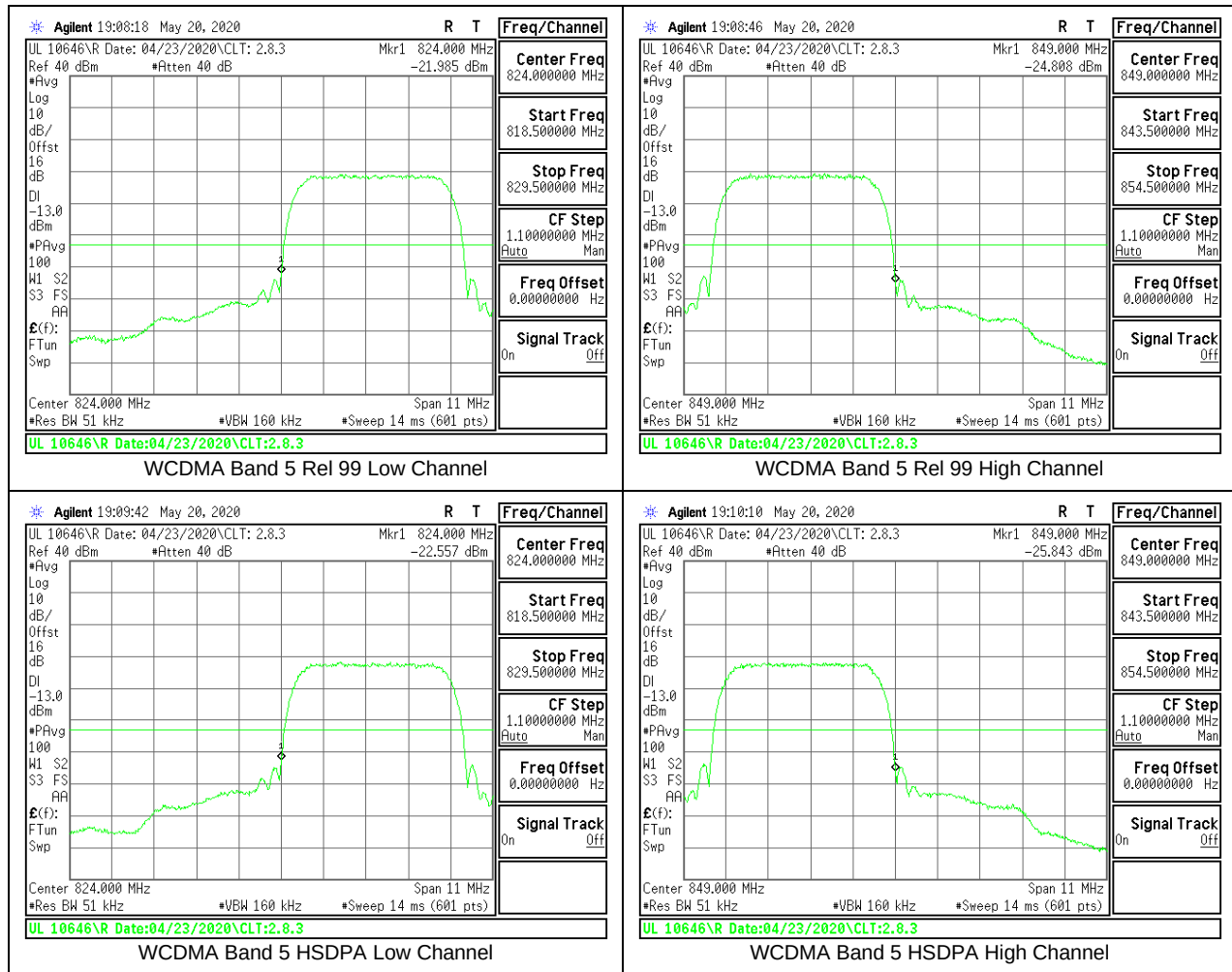


CDMA BC0 1xEV-DO Rev A High Channel

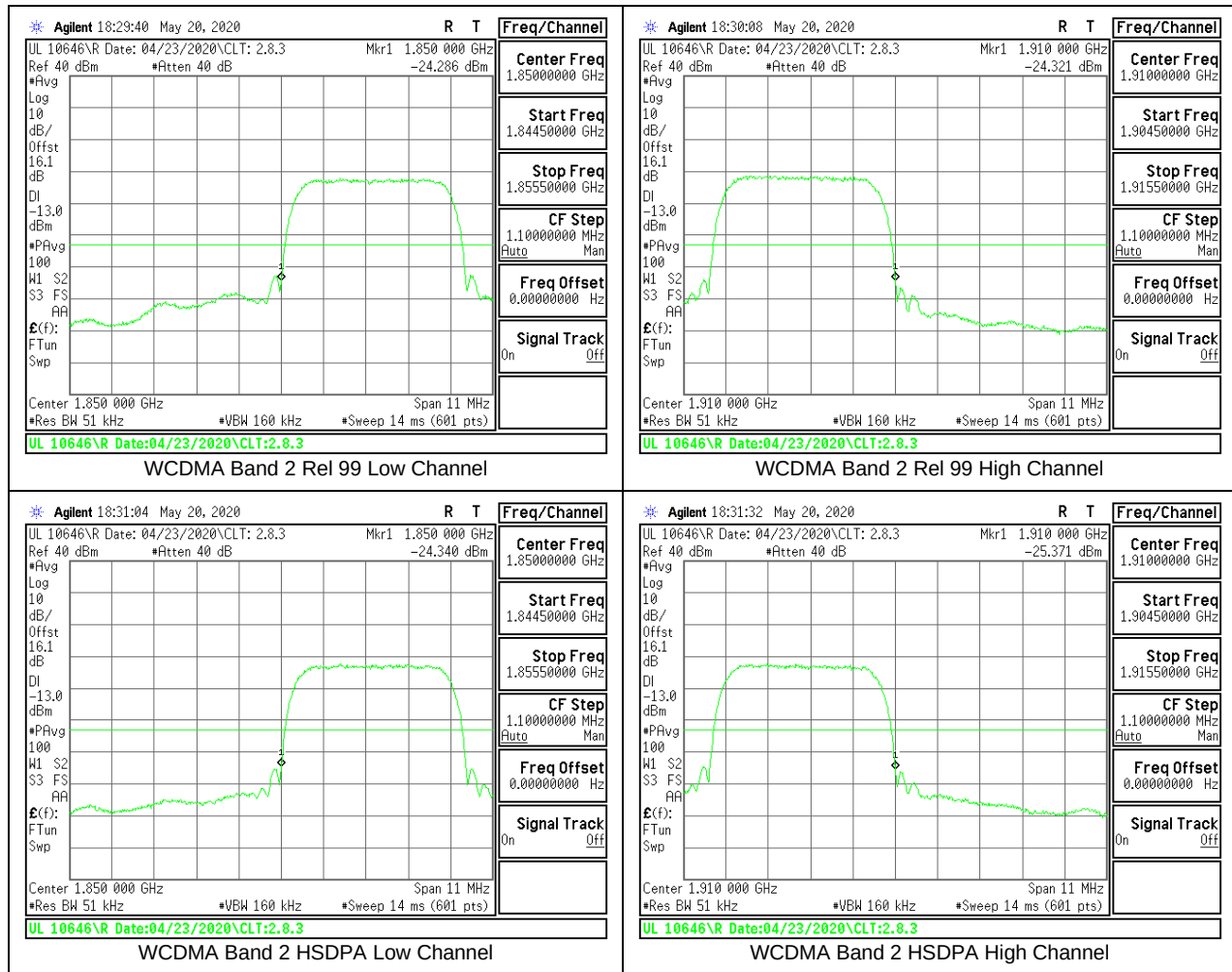
8.2.5. CDMA BC1



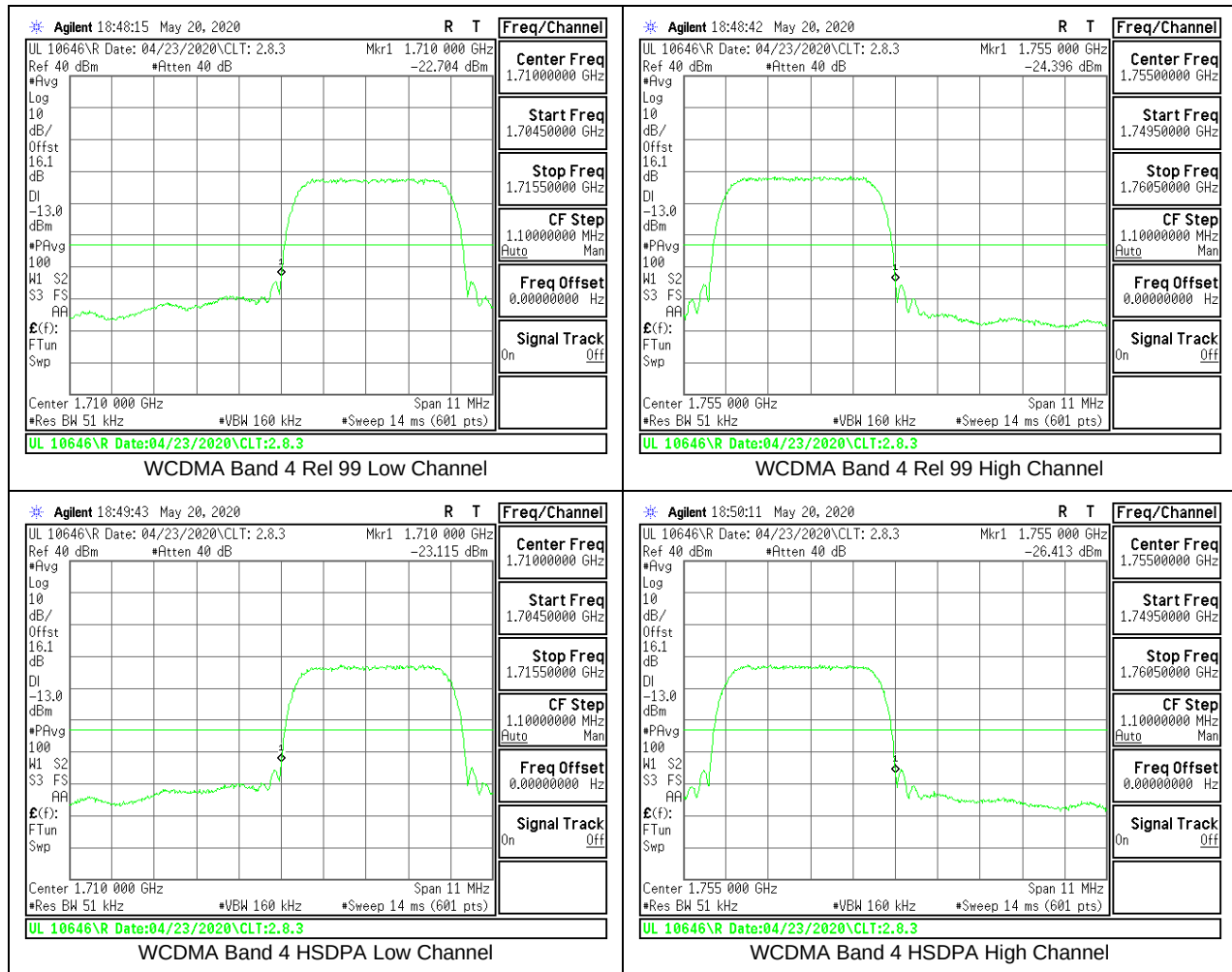
8.2.6. WCDMA BAND 5



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
ISED: 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

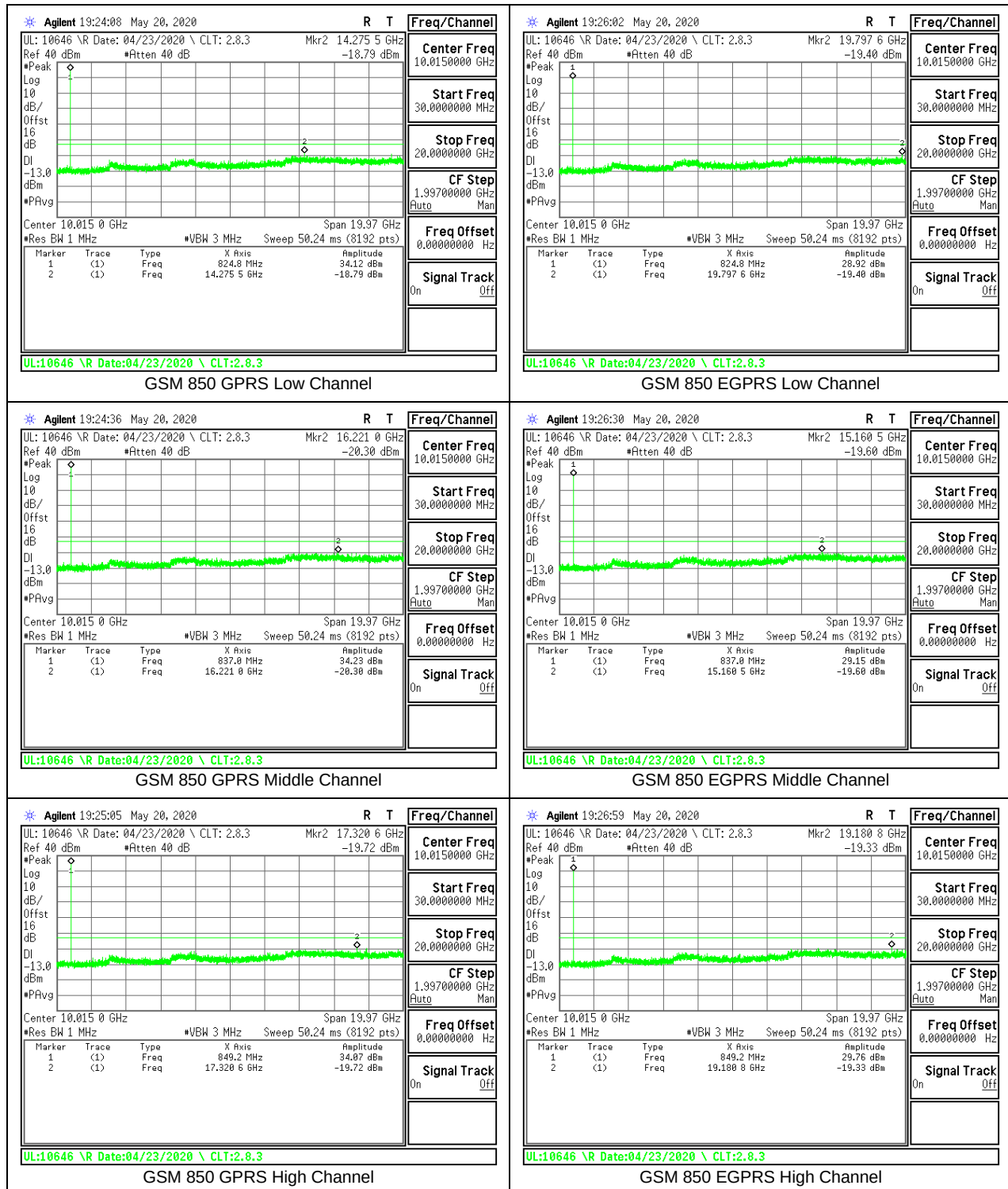
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case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

For each out of band emissions measurement:

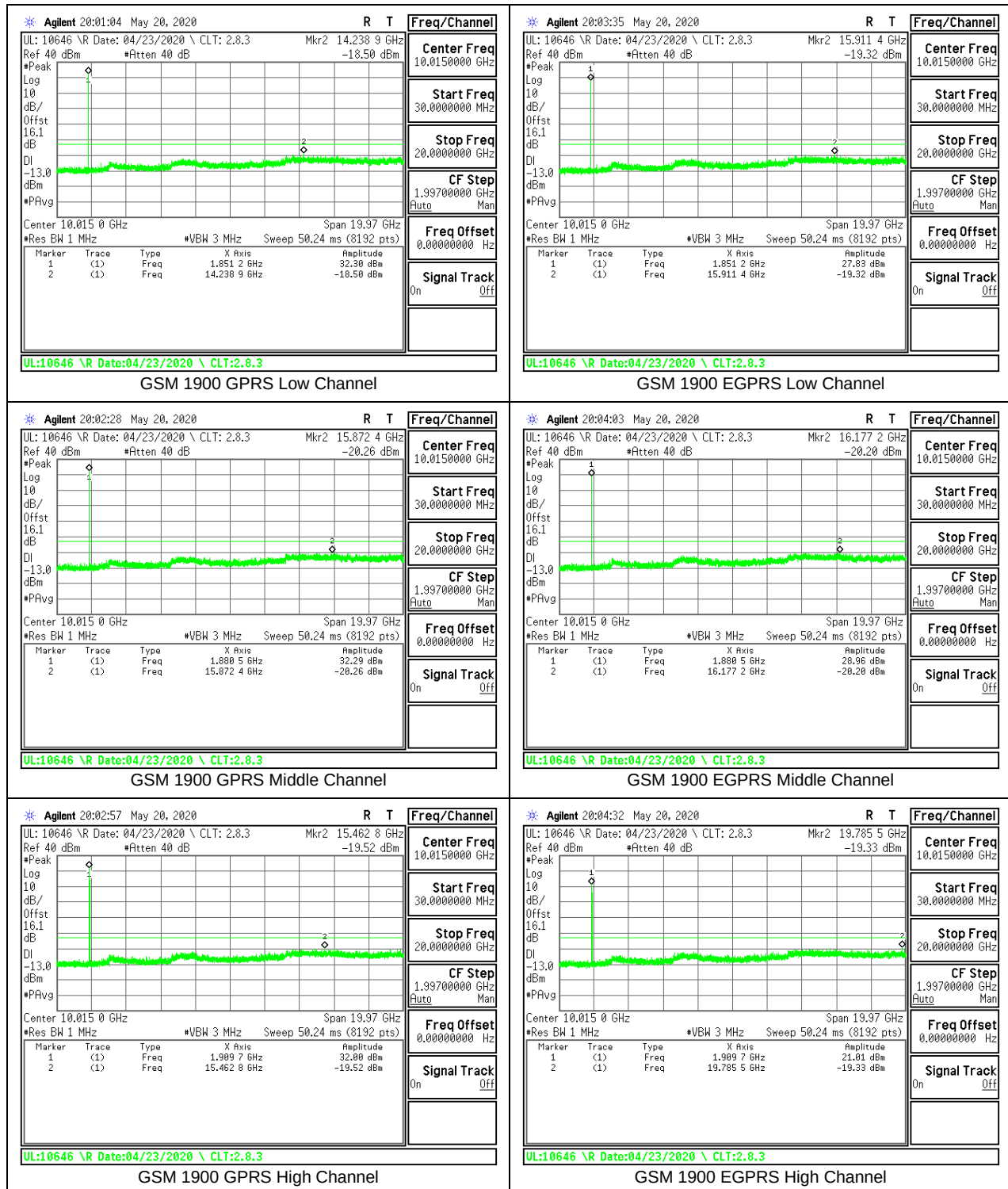
- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.
(NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

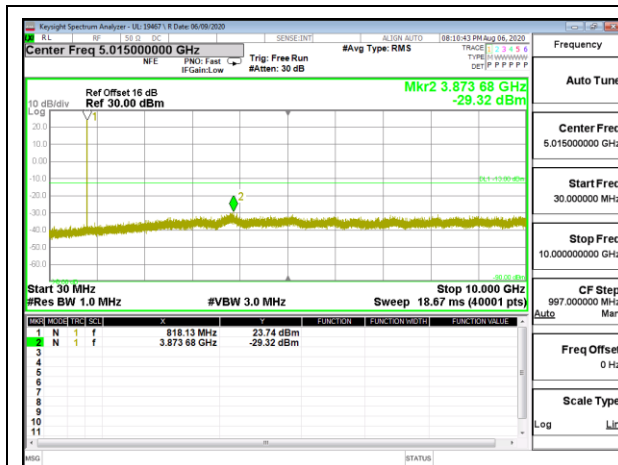
8.3.1. GSM 850



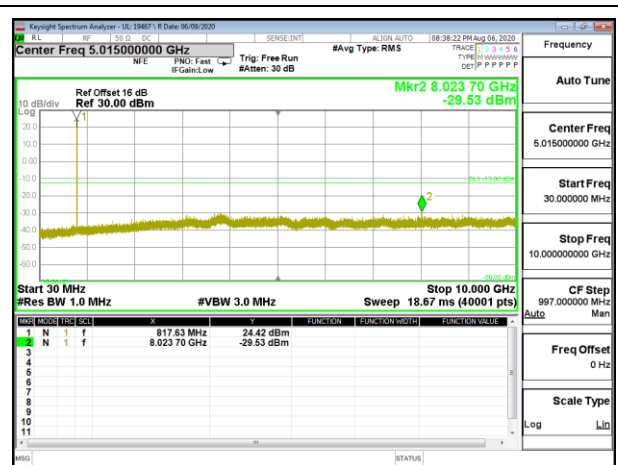
8.3.2. GSM 1900



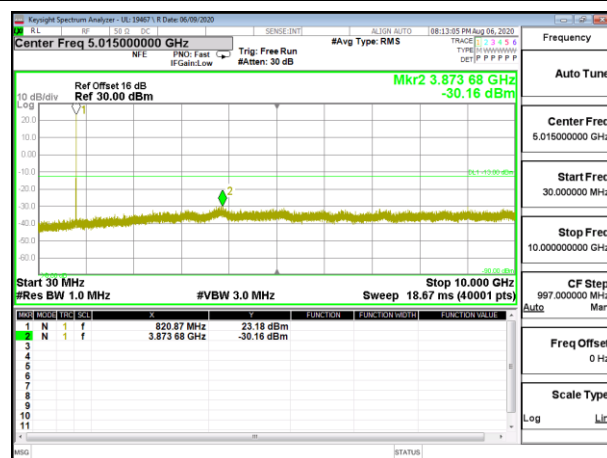
8.3.3. CDMA BC10



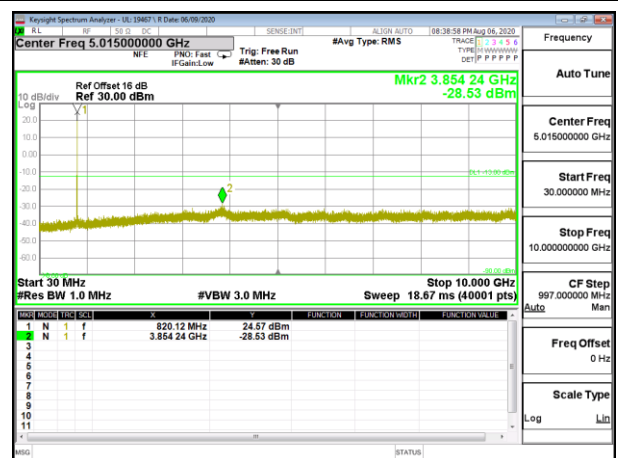
CDMA BC10 1xRTT Low Channel



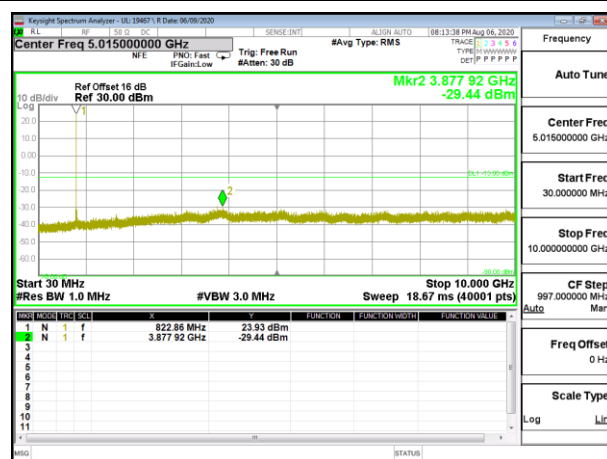
CDMA BC10 1xEV-DO Rev A Low Channel



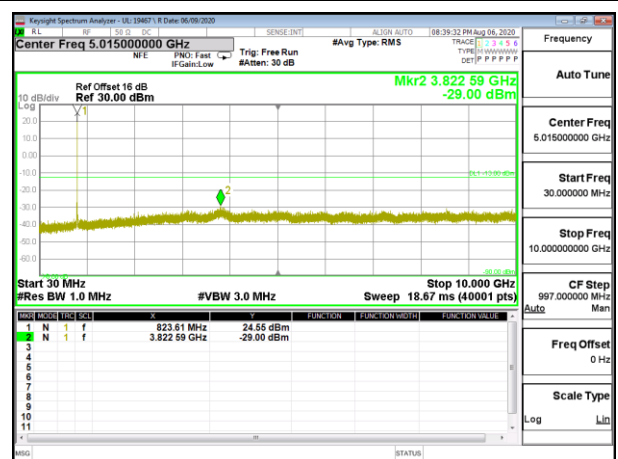
CDMA BC10 1xRTT Middle Channel



CDMA BC10 1xEV-DO Rev A Middle Channel

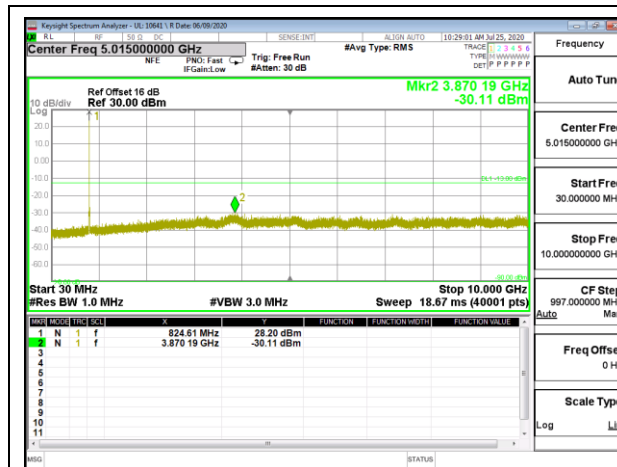


CDMA BC10 1xRTT High Channel

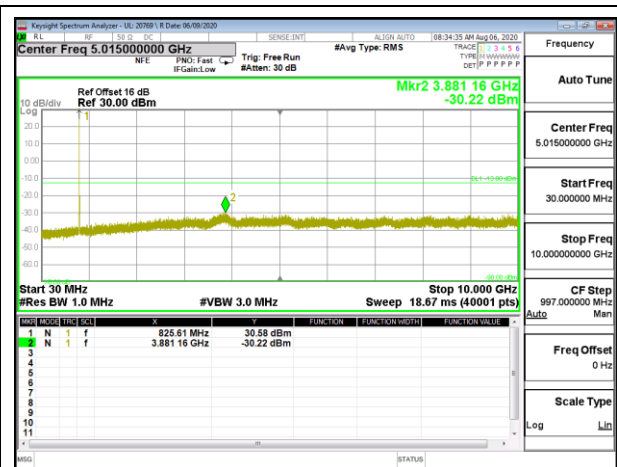


CDMA BC10 1xEV-DO Rev A High Channel

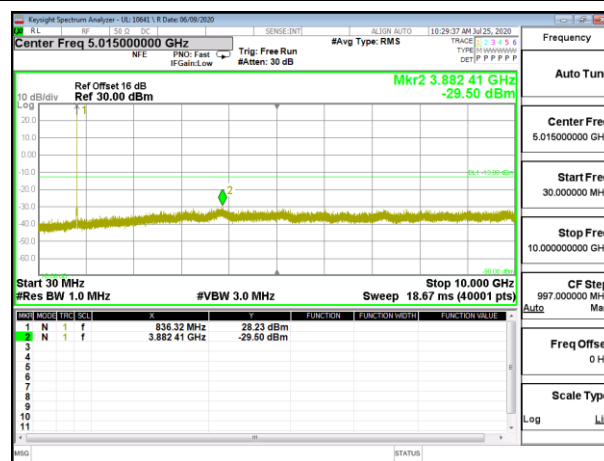
8.3.4. CDMA BC0



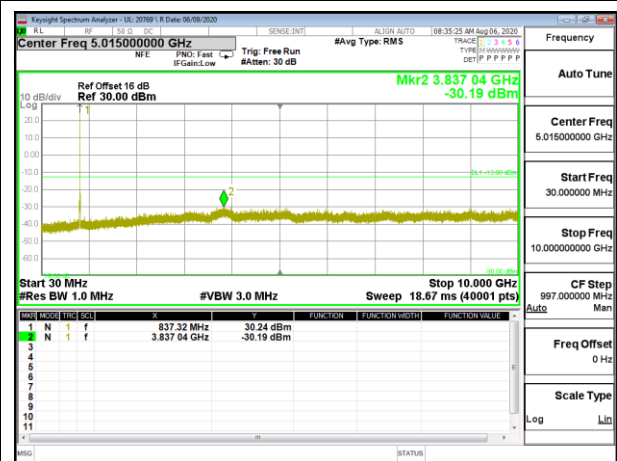
CDMA BC0 1xRTT Low Channel



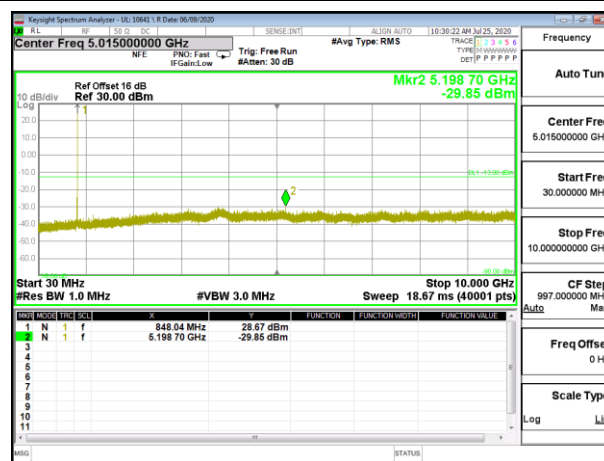
CDMA BC0 1xEV-DO Rev A Low Channel



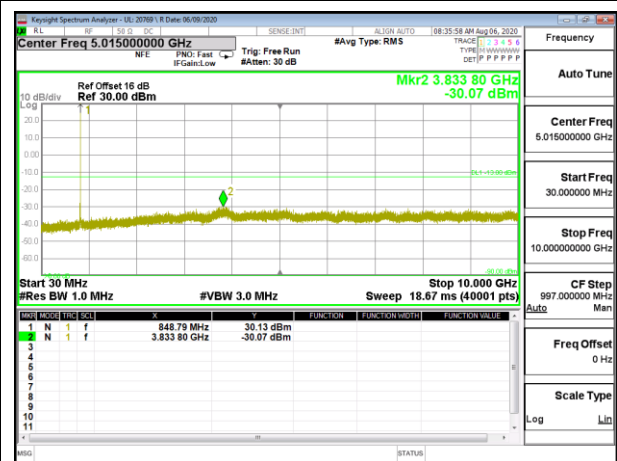
CDMA BC0 1xRTT Middle Channel



CDMA BC0 1xEV-DO Rev A Middle Channel

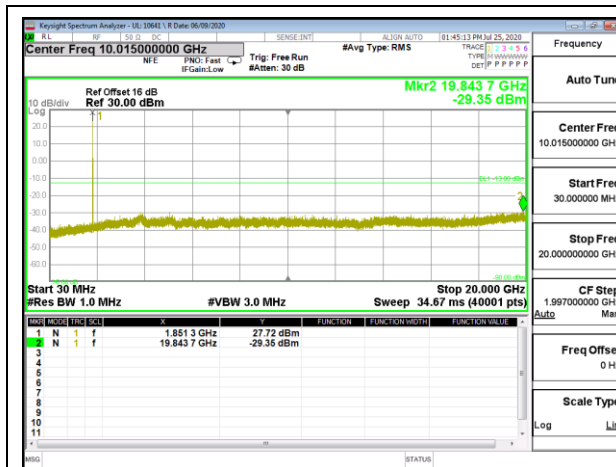


CDMA BC0 1xRTT High Channel

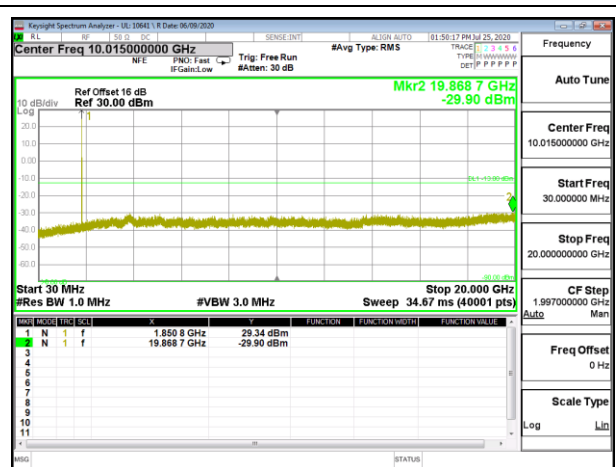


CDMA BC0 1xEV-DO Rev A High Channel

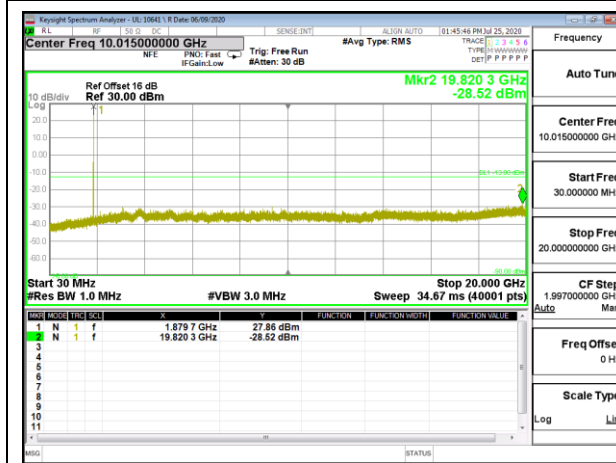
8.3.5. CDMA BC1



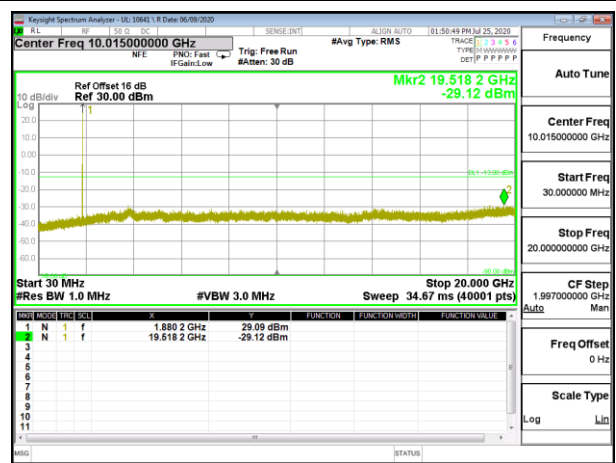
CDMA BC1 1xRTT Low Channel



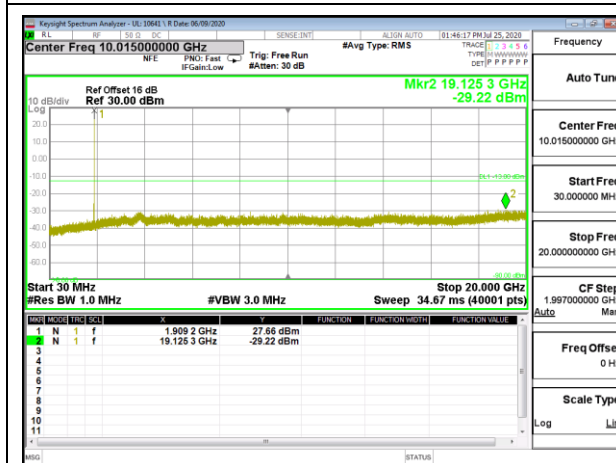
CDMA BC1 1xEV-DO Rev A Low Channel



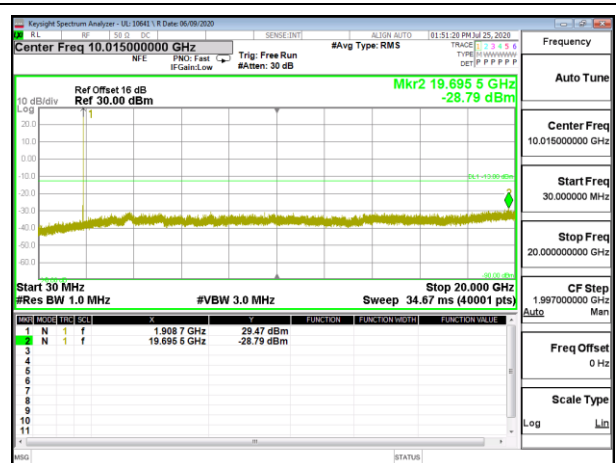
CDMA BC1 1xRTT Middle Channel



CDMA BC1 1xEV-DO Rev A Middle Channel

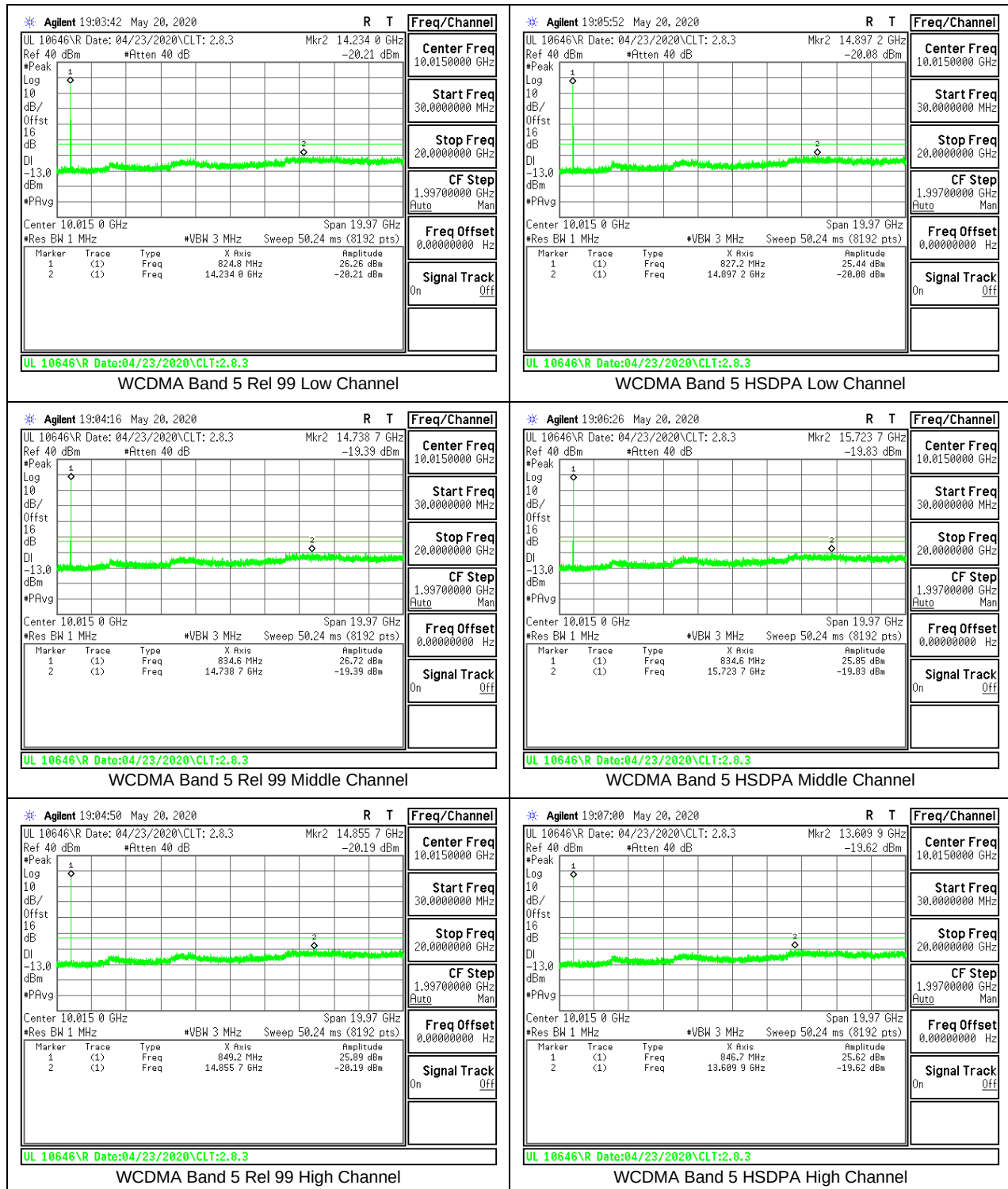


CDMA BC1 1xRTT High Channel

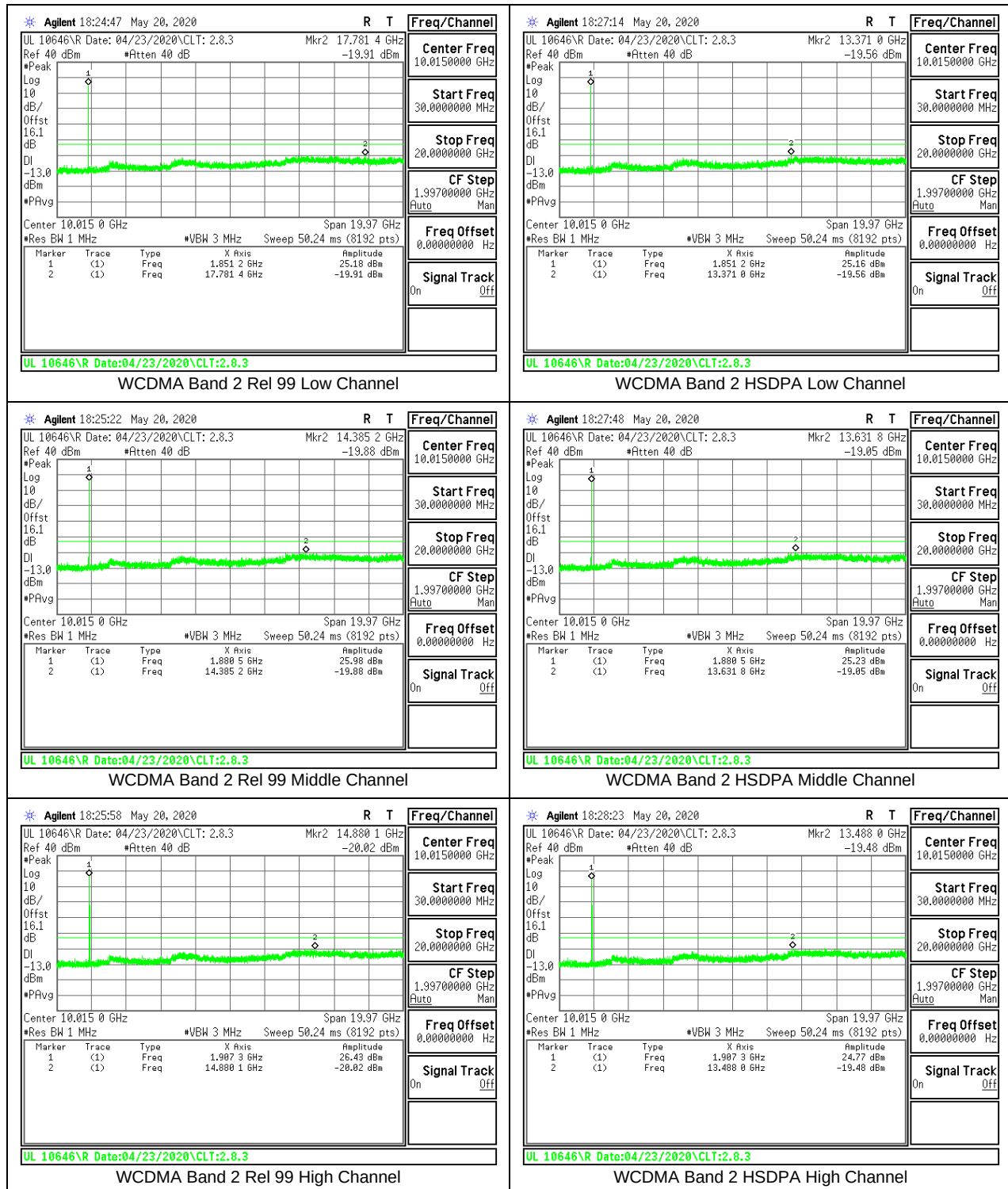


CDMA BC1 1xEV-DO Rev A High Channel

8.3.6. WCDMA BAND 5



8.3.7. WCDMA BAND 2



8.3.8. WCDMA BAND 4

