7. 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**	**ID Num**	**Cal Due**	**Last Cal**
Highpass Filter, 2.7 GHz	Micro-Circuits	H2G518G6	T772	07/05/19	07/05/18
Highpass Filter, 1.2 GHz	Micro-Tronics	HPM50108	T1737	04/17/19	04/17/18
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM50114	T1852	07/31/19	07/31/18
Highpass Filter, 4GHz	Micro-Tronics	HPM13351	T1240	08/31/19	08/31/18
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	04/30/19	04/30/18
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T862	05/24/19	05/24/18
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	AT0067	03/26/19	03/26/18
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T345	04/25/19	04/25/18
Ant., Horn 18 - 26.5 GHz	ARA	MWH-1826/B	T477	06/16/2019	06/16/2018
Hybrid Antenna	SunAR rf motion	JB3	PRE0184052	10/24/19	10/24/18
Hybrid Antenna	SunAR rf motion	JB3	PRE0184971	11/13/19	11/13/18
Hybrid Antenna	SunAR rf motion	JB3	PRE0181575	08/01/19	08/01/18
Hybrid Antenna	SunAR rf motion	JB3	PRE0181574	08/01/19	08/01/18
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	174060	08/01/19	08/01/18
RF Amplifier	AMPLICAL	AMP1G18-35	T1571	07/30/19	07/30/18
RF Amplifier	AMPLICAL	AMP1G18-35	T1569	06/03/19	06/03/18
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	T1165	02/20/20	02/20/19
RF Amplifier 9KHz – 1GHz	SONOMA INSTR	310	PRE0180175	07/09/19	07/09/18
RF Amplifier 9KHz – 1GHz	SONOMA INSTR	310	PRE0180174	05/31/19	05/31/18
RF Amplifier 9KHz – 1GHz	SONOMA INSTR	310	175953	12/13/19	12/13/18
Amplifier 100kHz – 1GHz	Agilent	8447D	T15	10/20/19	10/20/18
Directional Coupler	KRYTAR	T922	PRE0078321	06/18/19	06/18/18
Wideband Communication Test Set, Call Box	R&S	CMW500	T375	02/18/20	02/18/19
Wideband Communication Test Set, Call Box	R&S	CMW500	T1871	02/18/20	02/18/19
Wideband Communication Test Set, Call Box	R&S	CMW500	T949	02/21/20	02/21/19
Wideband Communication Test Set, Call Box	R&S	CMW500	T953	02/18/20	02/18/20
Chamber, Environmental	Thermotron	SE-600-10-10	T80	05/01/19	11/01/18
Spectrum Analyzer	Agilent (Keysight) Technologies	E4440A	T200	01/28/20	01/28/19
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179375	05/08/19	05/08/18
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179372	05/04/19	05/04/18
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	04/25/19	04/25/18
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/25/20	01/25/19
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T917	01/24/20	01/24/19
DC power supply, 8 V @ 3 A or 15 V @ 2 A	Agilent / HP	E3610A	None	CNR	CNR
DC power supply 15V	Sprensen	XT15-4	T463	CNR	CNR
Power Meter	Keysight	N1911A	T1265	01/29/20	01/29/19
Power Sensor	Keysight	N1921A	T1227	02/05/20	02/05/19

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

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NOTES:

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

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8. 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

8.1. GSM

Using CMW500 Communication Test Set
Function: Menu select > GSM Mobile Station > GSM 850/900/1800/1900

Press **Connection control** to choose the different menus
Press **RESET** > choose all to reset all settings

Connection	Press **Signal Off** to turn off the signal and change settings Network Support > GSM+GPRS or GSM+EGPRS Main Service > Packet Data Service selection > Test Mode A – Auto Slot Config. off	
MS Signal	Press Slot Config bottom on the right twice to select and change the number of time slots and power setting	
	> Slot configuration	> Uplink/Gamma > 33 dBm for GPRS 850/900 > 27 dBm for EGPRS 850/900 > 30 dBm for GPRS1800/1900 > 26 dBm for EGPRS1800/1900
BS Signal	Enter the same channel number for TCH channel (test channel) and BCCH channel	
	Frequency Offset >	+ 0 Hz
	Mode >	BCCH and TCH
	BCCH Level >	-85 dBm (May need to adjust if link is not stable)
	BCCH Channel >	choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]
	Channel Type >	Off
	P0>	4 dB
	Slot Config >	Unchanged (if already set under MS Signal)
	TCH >	choose desired test channel
	Hopping >	Off
	Main Timeslot >	3 (Default)
Network	Coding Scheme >	CS 4 (GPRS) and MCS5 (EGPRS)
	Bit Stream >	2E9-1PSR Bit Pattern
AF/RF	Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input	
Connection	Press **Signal On** to turn on the signal and change settings	

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RESULT

8.1.1. GSM850

ID:	38206	Date:	2/18/19

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Power			
			1 slot	2 slots	3 slots	4 slots
850.0	128	824.2	33.9	30.7	28.4	27.4
	190	836.6	**34.0**	31.0	28.6	27.6
	251	848.8	33.9	30.6	28.7	26.9

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Power			
			1 slot	2 slots	3 slots	4 slots
850.0	128	824.2	26.9	24.5	23.2	21.4
	190	836.6	**27.0**	24.5	23.2	21.6
	251	848.8	26.9	24.5	23.0	21.4

8.1.2. GSM1900

ID:	38206	Date:	2/18/19

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Power			
			1 slot	2 slots	3 slots	4 slots
1900.0	512	1850.2	29.9	27.9	25.6	24.7
	661	1880.0	**30.3**	28.0	26.0	25.0
	810	1909.8	30.2	28.0	25.9	25.0

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Power			
			1 slot	2 slots	3 slots	4 slots
1900.0	512	1850.2	25.4	23.0	22.3	20.2
	661	1880.0	**25.5**	23.5	22.7	20.8
	810	1909.8	**25.5**	23.4	22.6	20.8

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8.2. CDMA

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

1xRTT

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

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

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

1xEV-DO - Release 0 (REL 0)

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

EVDO Release 0 - RTAP

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

EVDO Release 0 - FTAP

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

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1xEV-DO - Revision A (REV A)

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

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

EVDO Rev. A – RETAP

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

EVDO Rev. A - FETAP

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

RESULT

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8.2.1. CDMA BC0

ID:	39005	Date:	3/7/19

Band	Mode	Radio Configuration (RC)	Service Option (SO)	Ch No.	Freq. (MHz)	Average (dBm)
BC0 (850MHz)	1xRTT	RC1	55 (Loopback)	1013	824.70	**24.3**
				384	836.52	24.1
				777	848.31	23.8
		RC3	55 (Loopback)	1013	824.70	24.3
				384	836.52	24.2
				777	848.31	23.8
			32 (+ F-SCH)	1013	824.70	24.3
				384	836.52	24.1
				777	848.31	23.8
	1xAdvanced	Fwd11/Rvs8	75 (Loopback)	1013	824.70	24.3
				384	836.52	24.1
				777	848.31	23.7
	1xEVDO Rel. 0	FTAP Rate: 307.2 kbps(2 slot, QPSK)	RTAP Rate: 153.6 kbps	1013	824.70	24.3
				384	836.52	24.2
				777	848.31	23.8
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK	RETAP: 4096	1013	824.70	**24.3**
				384	836.52	24.1
				777	848.31	23.7

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8.3. WCDMA

TEST PROCEDURE

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

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

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

REL 99

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

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

HSDPA REL 5

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

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

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HSPA (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 9 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

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

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

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

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

Table E.5.0: Levels for HSDPA connection setup

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

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

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

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

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

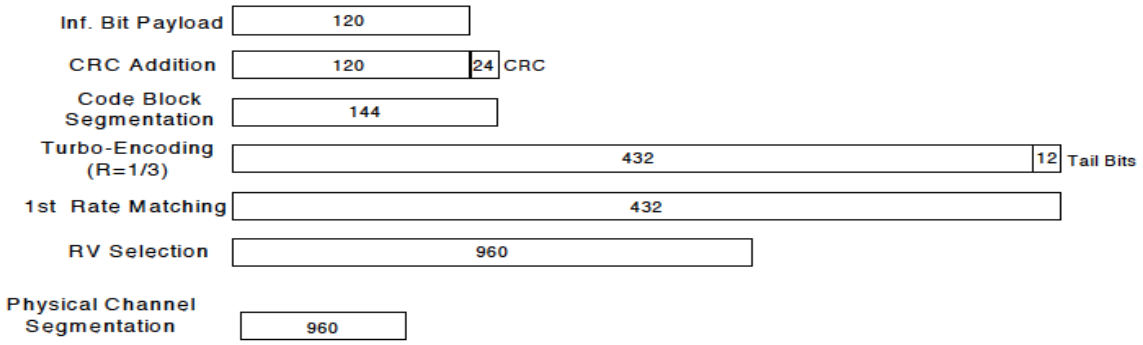

Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm2			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	βd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs = βhs/ βc	30/15			

HSPA+

The following 1 Sub-test was completed according to Release 9 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

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

Sub-test	β_c (Note3)	β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	$\beta_{ed}1$: 30/15 $\beta_{ed}2$: 30/15	$\beta_{ed}3$: 24/15 $\beta_{ed}4$: 24/15	3.5	2.5	14	105	105

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

RESULT

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8.3.1. WCDMA BAND5

ID:	38206	Date:	2/18/19

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Average (dBm)
W-CDMA Band 5 (850MHz)	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	24.7
			4183	836.6	N/A	24.7
			4233	846.6	N/A	24.7
	HSDPA	Subtest 1	4132	826.4	0	23.7
			4183	836.6	0	23.7
			4233	846.6	0	23.7
		Subtest 2	4132	826.4	0.5	23.7
			4183	836.6	0.5	23.7
			4233	846.6	0.5	23.7
		Subtest 3	4132	826.4	0.5	23.2
			4183	836.6	0.5	23.2
			4233	846.6	0.5	23.2
		Subtest 4	4132	826.4	0.5	23.2
			4183	836.6	0.5	23.2
			4233	846.6	0.5	23.2
	HSUPA	Subtest 1	4132	826.4	0.5	23.6
			4183	836.6	0.5	23.7
			4233	846.6	0.5	23.8
		Subtest 2	4132	826.4	1.5	21.6
			4183	836.6	1.5	21.7
			4233	846.6	1.5	21.7
		Subtest 3	4132	826.4	1.5	22.6
			4183	836.6	1.5	22.7
			4233	846.6	1.5	22.7
		Subtest 4	4132	826.4	1.5	21.7
			4183	836.6	1.5	21.6
			4233	846.6	1.5	21.7
		Subtest 5	4132	826.4	0.5	23.7
			4183	836.6	0.5	23.8
			4233	846.6	0.5	23.8
	DC-HSDPA	Subtest 1	4132	826.4	0.5	23.4
			4183	836.6	0.5	23.3
			4233	846.6	0.5	23.1
		Subtest 2	4132	826.4	1.5	23.4
			4183	836.6	1.5	23.3
			4233	846.6	1.5	23.1
		Subtest 3	4132	826.4	1.5	22.9
			4183	836.6	1.5	22.8
			4233	846.6	1.5	22.6
		Subtest 4	4132	826.4	1.5	22.9
			4183	836.6	1.5	22.8
			4233	846.6	1.5	22.6

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8.3.2. WCDMA BAND2

ID:	38206	Date:	2/18/19

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Average (dBm)
W-CDMA Band 2 (1900MHz)	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	24.5
			9400	1880.0	N/A	24.6
			9538	1907.6	N/A	24.3
	HSDPA	Subtest 1	9262	1852.4	0	23.5
			9400	1880.0	0	23.6
			9538	1907.6	0	23.3
		Subtest 2	9262	1852.4	0	23.6
			9400	1880.0	0	23.6
			9538	1907.6	0	23.3
		Subtest 3	9262	1852.4	0.5	23.0
			9400	1880.0	0.5	23.1
			9538	1907.6	0.5	22.8
		Subtest 4	9262	1852.4	0.5	23.0
			9400	1880.0	0.5	23.1
			9538	1907.6	0.5	22.8
	HSUPA	Subtest 1	9262	1852.4	0	23.5
			9400	1880.0	0	23.6
			9538	1907.6	0	23.3
		Subtest 2	9262	1852.4	2	21.5
			9400	1880.0	2	21.6
			9538	1907.6	2	21.3
		Subtest 3	9262	1852.4	1	22.5
			9400	1880.0	1	22.6
			9538	1907.6	1	22.3
		Subtest 4	9262	1852.4	2	21.5
			9400	1880.0	2	21.6
			9538	1907.6	2	21.3
		Subtest 5	9262	1852.4	1	23.5
			9400	1880.0	1	23.6
			9538	1907.6	1	23.7
	DC-HSDPA	Subtest 1	9262	1852.4	0	22.6
			9400	1880.0	0	22.8
			9538	1907.6	0	22.7
		Subtest 2	9262	1852.4	2	22.6
			9400	1880.0	2	22.8
			9538	1907.6	2	22.7
		Subtest 3	9262	1852.4	1	22.1
			9400	1880.0	1	22.3
			9538	1907.6	1	22.2
		Subtest 4	9262	1852.4	2	22.1
			9400	1880.0	2	22.3
			9538	1907.6	2	22.2

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8.4. LTE

CONDUCTED OUTPUT POWER MEASUREMENT PROCEDURE

All LTE bands conducted average power is obtained from the CMW500 telecommunication test set.
The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.
UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

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

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

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

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

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23[1]	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-
Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.					

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MODES TESTED

- LTE 5
- LTE 41 (FCC)

RESULTS

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

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8.4.1. LTE 5

ID:	38206	Date:	2/18/19

OUTPUT POWER FOR LTE BAND 5 (1.4 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				20407	20525	20643
				824.7 MHz	836.5 MHz	848.3 MHz
1.4	QPSK	1	0	24.2	24.2	24.2
		1	2	24.2	24.3	**24.3**
		1	5	24.2	24.2	24.2
		3	0	24.0	24.2	24.2
		3	1	24.1	24.3	24.2
		3	2	24.1	24.3	24.3
		6	0	23.2	23.3	23.3
	16QAM	1	0	23.2	23.2	23.6
		1	2	23.2	23.3	**23.6**
		1	5	23.2	23.3	23.5
		3	0	23.2	23.4	23.4
		3	1	23.2	23.5	23.4
		3	2	23.2	23.5	23.4
		6	0	22.3	22.5	22.2
	64QAM	1	0	22.3	22.7	22.5
		1	2	22.4	**22.8**	22.5
		1	5	22.3	22.7	22.5
		3	0	22.3	22.6	22.3
		3	1	22.4	22.7	22.3
		3	2	22.4	22.7	22.4
		6	0	21.6	21.3	21.4

OUTPUT POWER FOR LTE BAND 5 (3.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				20415	20525	20635
				825.5 MHz	836.5 MHz	847.5 MHz
3.0	QPSK	1	0	24.2	24.3	**24.4**
		1	7	24.3	24.4	24.4
		1	14	24.2	24.3	24.3
		8	0	23.2	23.3	23.4
		8	4	23.2	23.3	23.4
		8	7	23.2	23.4	23.4
		15	0	23.2	23.3	23.4
	16QAM	1	0	23.6	23.2	23.4
		1	7	**23.6**	23.3	23.4
		1	14	23.5	23.2	23.3
		8	0	22.3	22.5	22.4
		8	4	22.3	22.5	22.5
		8	7	22.3	22.5	22.5
		15	0	22.3	22.4	22.4
	64QAM	1	0	22.4	22.7	22.6
		1	7	22.4	**22.7**	22.6
		1	14	22.3	22.7	22.5
		8	0	21.4	21.4	21.4
		8	4	21.4	21.5	21.4
		8	7	21.4	21.5	21.4
		15	0	21.3	21.4	21.5

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OUTPUT POWER FOR LTE BAND 5 (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				20425	20525	20625
				826.5 MHz	836.5 MHz	846.5 MHz
5.0	QPSK	1	0	24.2	24.5	**24.5**
		1	12	24.2	24.4	24.4
		1	24	24.3	24.4	24.2
		12	0	23.2	23.3	23.3
		12	6	23.3	23.3	23.3
		12	11	23.3	23.3	23.3
		25	0	23.3	23.4	23.3
	16QAM	1	0	23.7	23.5	23.4
		1	12	23.6	23.4	23.3
		1	24	**23.7**	23.5	23.3
		12	0	22.4	22.5	22.4
		12	6	22.5	22.5	22.4
		12	11	22.5	22.5	22.4
		25	0	22.4	22.4	22.3
	64QAM	1	0	22.6	22.3	**22.7**
		1	12	22.5	22.3	22.6
		1	24	22.6	22.3	22.6
		12	0	21.3	21.5	21.5
		12	6	21.4	21.5	21.5
		12	11	21.3	21.5	21.5
		25	0	21.4	21.5	21.5

OUTPUT POWER FOR LTE BAND 5 (10.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				20450	20525	20600
				829.0 MHz	836.5 MHz	844.0 MHz
10.0	QPSK	1	0	24.3	24.3	24.2
		1	24	24.3	24.3	24.2
		1	49	**24.3**	24.3	24.1
		25	0	23.4	23.4	23.3
		25	12	23.3	23.4	23.3
		25	24	23.4	23.3	23.2
		50	0	23.3	23.4	23.2
	16QAM	1	0	23.6	23.1	23.3
		1	24	23.6	23.2	23.2
		1	49	**23.7**	23.2	23.1
		25	0	21.9	22.0	21.9
		25	12	21.9	22.0	22.0
		25	24	21.9	21.9	21.9
		50	0	21.9	21.9	21.8
	64QAM	1	0	22.6	22.4	22.4
		1	24	22.6	22.5	22.4
		1	49	**22.7**	22.4	22.3
		25	0	21.9	22.0	21.8
		25	12	21.9	22.0	21.9
		25	24	22.0	22.0	21.8
		50	0	21.9	21.9	21.8

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8.4.2. LTE 41 (FCC)

ID:	43576	Date:	3/4/19

OUTPUT POWER FOR LTE BAND 41 (FCC) (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				40265	40740	41215
				2557.5 MHz	2605 MHz	2652.5 MHz
5.0	QPSK	1	0	23.7	**23.8**	23.7
		1	12	23.7	23.8	23.7
		1	24	23.7	23.8	23.7
		12	0	22.8	22.9	22.8
		12	7	22.8	22.9	22.8
		12	13	22.8	22.9	22.7
		25	0	22.8	22.9	22.7
	16QAM	1	0	22.7	22.8	22.9
		1	12	22.7	**22.9**	22.9
		1	24	22.7	22.9	22.8
		12	0	21.8	21.9	21.8
		12	7	21.8	21.9	21.9
		12	13	21.9	21.9	21.8
		25	0	21.8	22.0	21.8
	64QAM	1	0	22.0	22.3	21.5
		1	12	22.0	**22.3**	21.5
		1	24	22.0	22.3	21.5
		12	0	20.7	21.1	20.8
		12	7	20.8	21.1	20.8
		12	13	20.8	21.0	20.8
		25	0	20.8	20.9	20.8

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

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				40290	40740	41190
				2560 MHz	2605 MHz	2650 MHz
10.0	QPSK	1	0	23.8	23.7	23.7
		1	25	**23.8**	23.7	23.7
		1	49	23.8	23.7	23.7
		25	0	22.3	22.4	22.2
		25	12	22.3	22.4	22.2
		25	25	22.3	22.4	22.2
		50	0	22.3	22.3	22.2
	16QAM	1	0	22.9	22.8	22.8
		1	25	23.0	22.8	22.7
		1	49	**23.0**	22.8	22.7
		25	0	21.9	21.9	21.8
		25	12	21.9	22.0	21.8
		25	25	21.9	21.9	21.8
		50	0	21.9	21.9	21.8
	64QAM	1	0	22.1	21.5	21.8
		1	25	22.2	21.5	21.8
		1	49	**22.2**	21.5	21.8
		25	0	20.8	21.0	20.7
		25	12	20.9	21.0	20.8
		25	25	20.8	21.0	20.7
		50	0	20.8	20.9	20.8

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

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				40315	40740	41165
				2562.5 MHz	2605 MHz	2647.5 MHz
15.0	QPSK	1	0	23.7	**23.9**	23.8
		1	37	23.7	23.9	23.8
		1	74	23.8	23.8	23.7
		36	0	22.8	22.9	22.7
		36	20	22.8	22.9	22.8
		36	39	22.8	22.9	22.7
		75	0	22.8	22.8	22.7
	16QAM	1	0	22.8	22.9	22.9
		1	37	22.8	**23.0**	22.9
		1	74	22.8	22.9	22.8
		36	0	21.8	21.9	21.8
		36	20	21.9	22.0	21.9
		36	39	21.9	21.9	21.8
		75	0	21.9	21.9	21.8
	64QAM	1	0	22.1	21.5	21.7
		1	37	22.2	21.5	21.7
		1	74	**22.2**	21.4	21.6
		36	0	21.0	21.0	20.8
		36	20	21.0	21.0	20.8
		36	39	20.9	21.0	20.8
		75	0	20.9	20.9	20.8

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

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				40340	40740	41140
				2565 MHz	2605 MHz	2645 MHz
20.0	QPSK	1	0	23.8	23.9	23.8
		1	49	23.8	**23.9**	23.8
		1	99	23.8	23.8	23.6
		50	0	22.8	22.9	22.8
		50	24	22.9	22.9	22.8
		50	50	22.8	22.9	22.8
		100	0	22.8	22.9	22.7
	16QAM	1	0	22.8	22.8	**22.9**
		1	49	22.9	22.8	22.9
		1	99	22.8	22.7	22.8
		50	0	21.8	22.0	21.9
		50	24	21.9	22.0	21.9
		50	50	21.9	22.0	21.8
		100	0	21.9	22.0	21.8
	64QAM	1	0	21.7	22.3	21.9
		1	49	21.9	**22.4**	21.9
		1	99	21.8	22.3	21.7
		50	0	20.9	21.0	20.9
		50	24	21.0	21.0	20.9
		50	50	20.9	21.0	20.8
		100	0	20.9	20.9	20.9

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9. CONDUCTED TEST RESULTS

9.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only.

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the middle channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

MODES TESTED

- GSM 850
- GSM 1900
- CDMA BC0
- WCDMA Band 5
- WCDMA Band 2
- LTE Band 5
- LTE Band 41
-

RESULTS

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

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GSM

Band	Modulation	Channel	f(MHz)	99% BW (KHz)	-26dB BW (KHz)
GSM850	GPRS	190	836.6	241.05	319.80
	EGPRS			229.05	302.60
GSM1900	GPRS	661	1880.0	245.13	319.50
	EGPRS			244.77	316.20

CDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BC0	1xRTT	384	836.5	1.28	1.44
	1xEV-DO Rev A			1.29	1.46

WCDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BAND5	REL 99	4408	836.6	4.12	4.71
	HSDPA			4.15	4.71
BAND2	REL 99	9800	1880.0	4.13	4.71
	HSDPA			4.13	4.70

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LTE5

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 5	1.4 MHz, QPSK	6/0	836.5	1.10	1.25
	1.4 MHz, 16QAM			1.08	1.29
	3 MHz, QPSK	15/0		2.70	3.00
	3 MHz, 16QAM			2.70	3.00
	5 MHz, QPSK	25/0		4.50	4.94
	5 MHz, 16QAM			4.50	4.95
	10 MHz, QPSK	50/0		8.96	9.85
	10 MHz, 16QAM			8.96	9.77

LTE41

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 41	5 MHz, QPSK	25/0	2605.0	4.50	4.91
	5 MHz, 16QAM			4.49	4.94
	10 MHz, QPSK	50/0		8.95	9.79
	10 MHz, 16QAM			8.99	9.72
	15 MHz, QPSK	75/0		13.43	14.59
	15 MHz, 16QAM			13.42	14.51
	20 MHz, QPSK	100/0		17.88	19.23
	20 MHz, 16QAM			17.90	19.24

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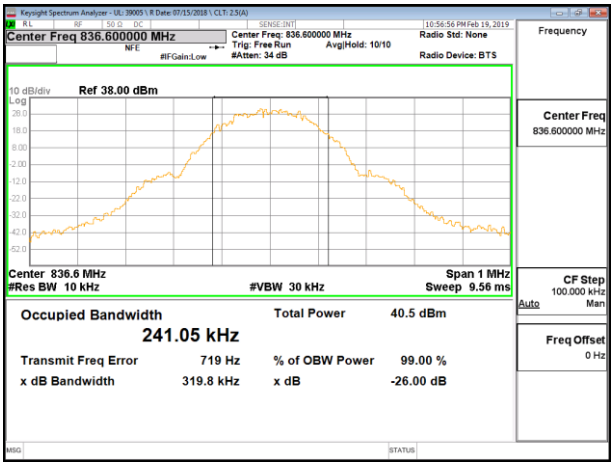
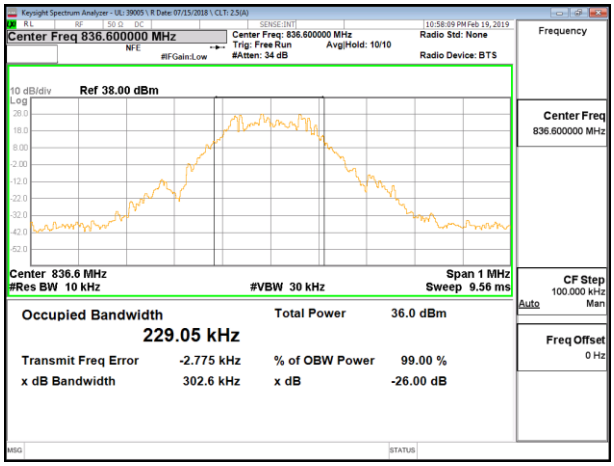
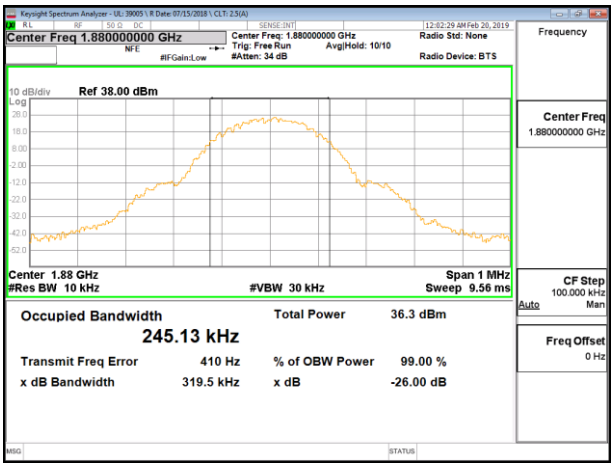
9.1.1. GSM



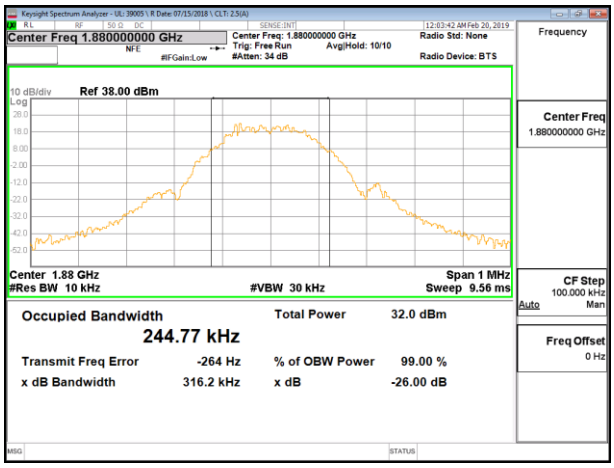
GSM 850MHz GPRS MID Channel



GSM 850MHz EGPRS MID Channel



GSM 1900MHz GPRS MID Channel



GSM 1900MHz EGPRS MID Channel

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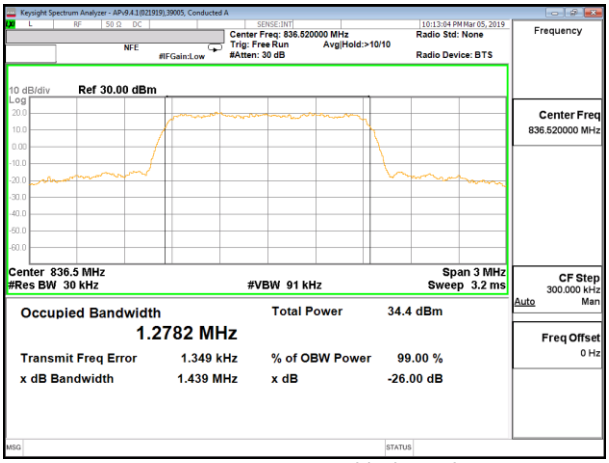
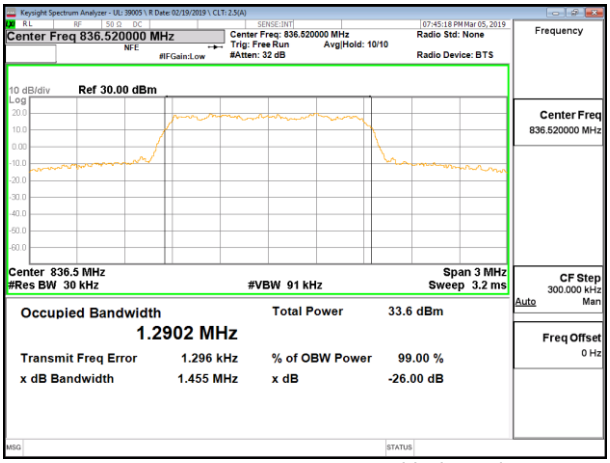
9.1.2. CDMA BC0



CDMA BC0 1xRTT Mid Channel



CDMA BC0 1xEV-DO Rev A Mid Channel

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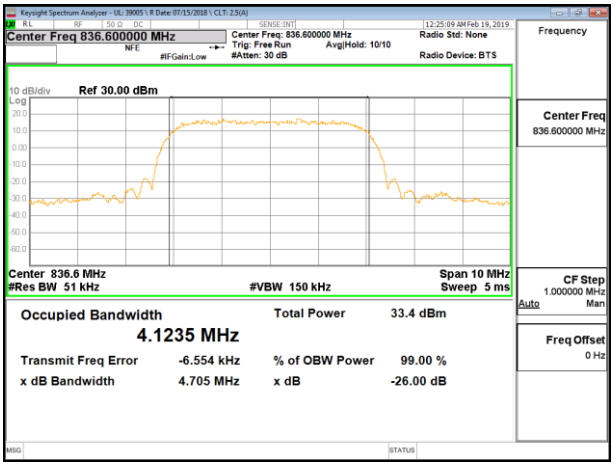
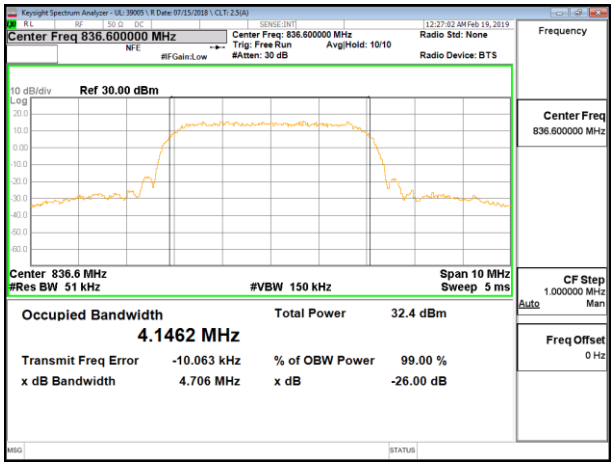
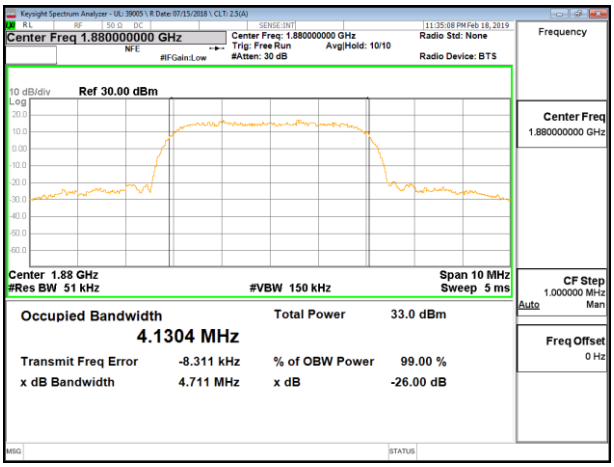
9.1.3. WCDMA



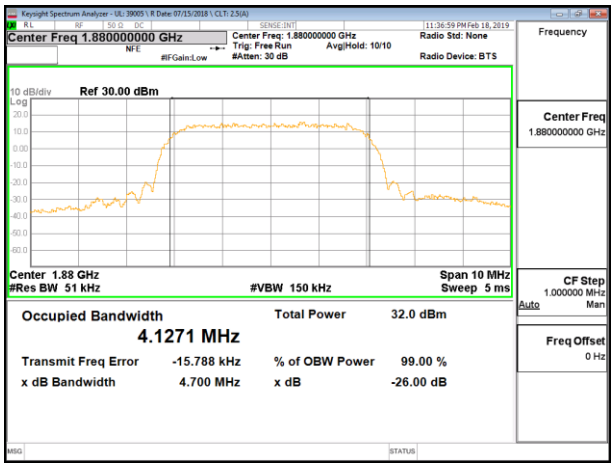
WCDMA BAND5 Rel99 MID Channel



WCDMA BAND5 HSDPA MID Channel



WCDMA BAND2 Rel99 MID Channel



WCDMA BAND2 HSDPA MID Channel

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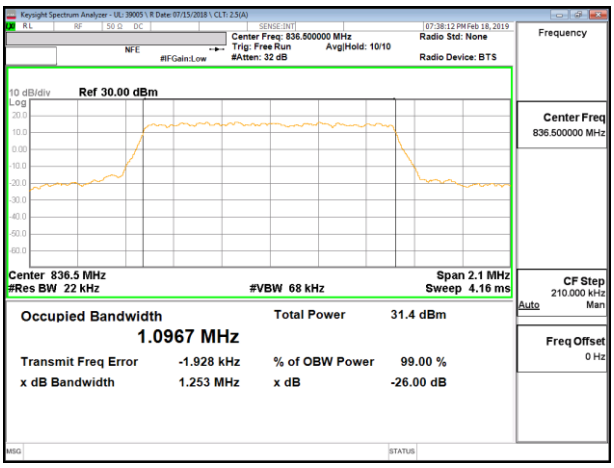
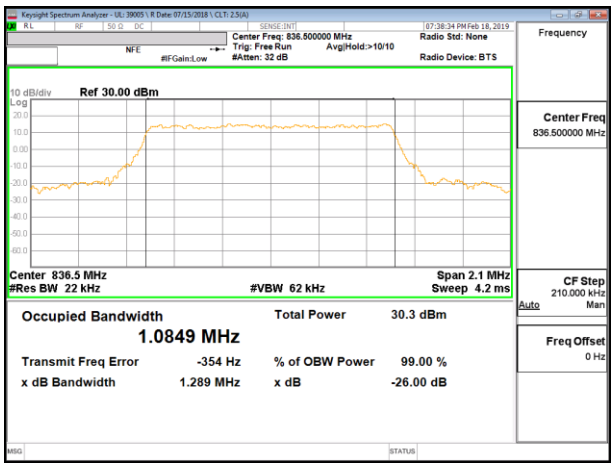
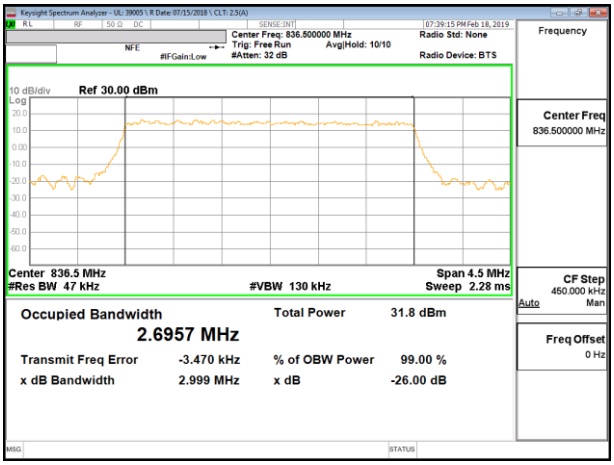
9.1.4. LTE BAND 5



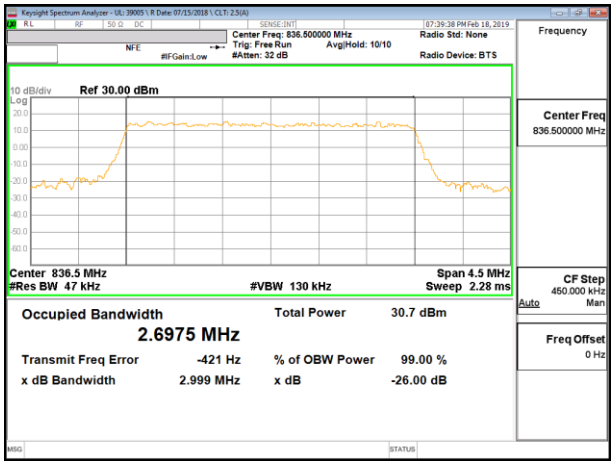
LTE B5 1.4MHz QPSK Mid Channel RB6-0



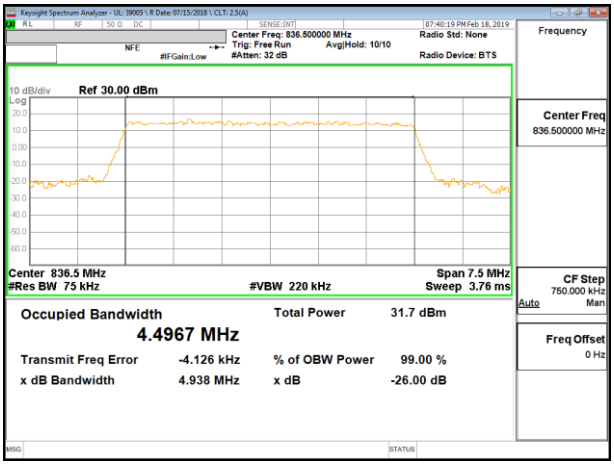
LTE B5 1.4MHz 16QAM Mid Channel RB6-0



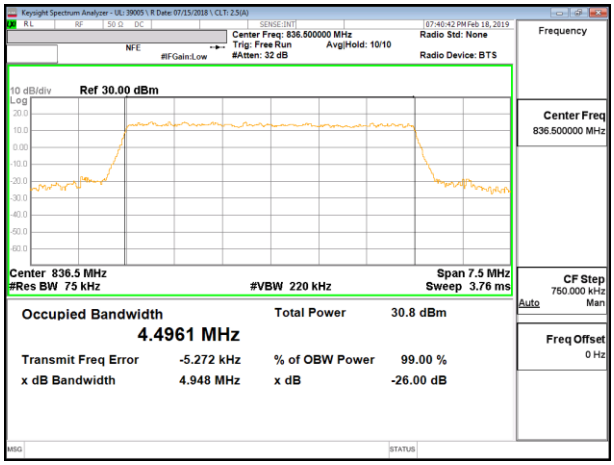
LTE B5 3MHz QPSK Mid Channel RB15-0



LTE B5 3MHz 16QAM Mid Channel RB15-0



LTE B5 5MHz QPSK Mid Channel RB25-0



LTE B5 5MHz 16QAM Mid Channel RB25-0

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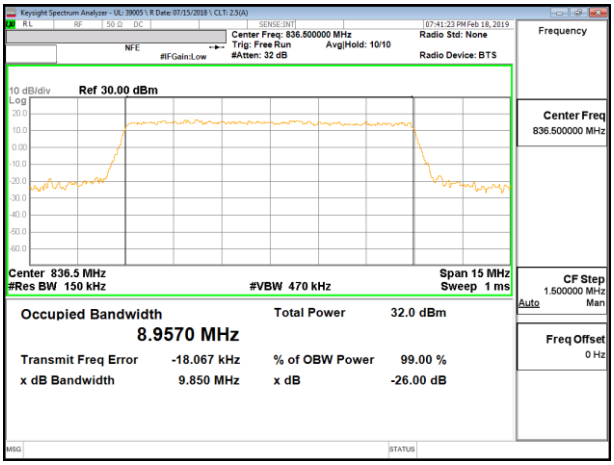
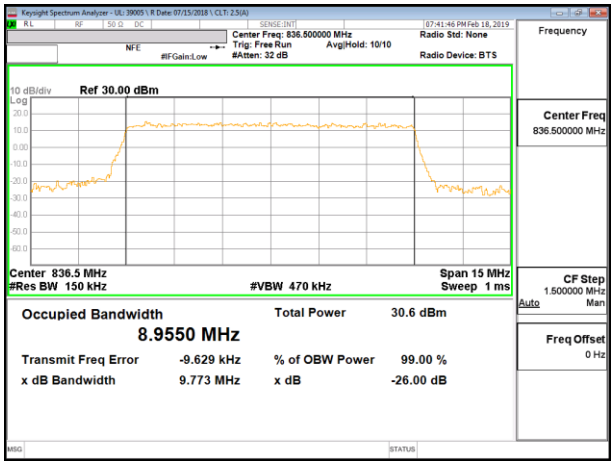


LTE B5 10MHz QPSK Mid Channel RB50-0



LTE B5 10MHz 16QAM Mid Channel RB50-0

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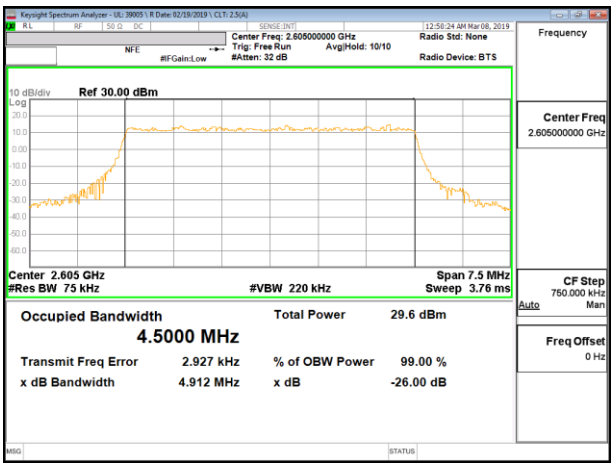
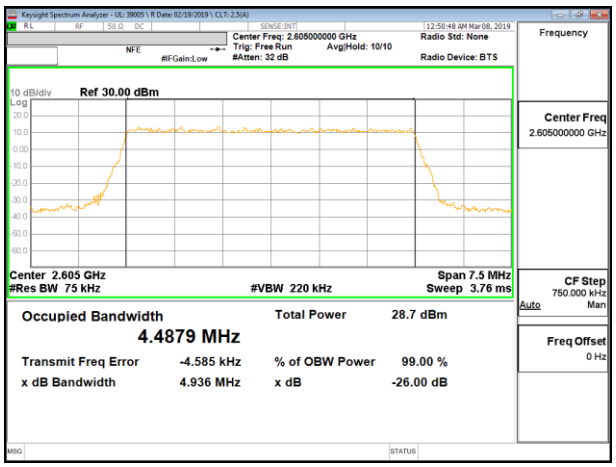
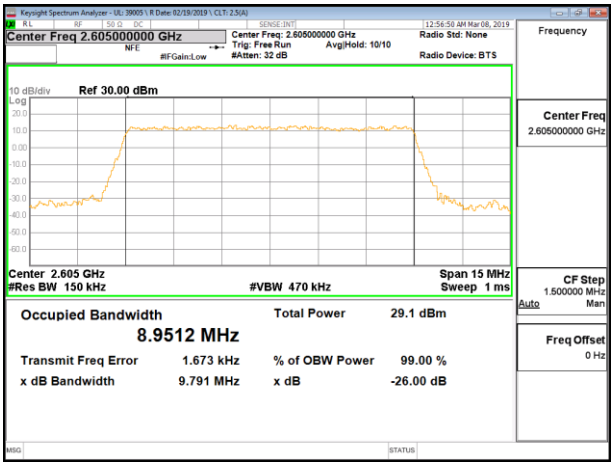
9.1.5. LTE BAND 41



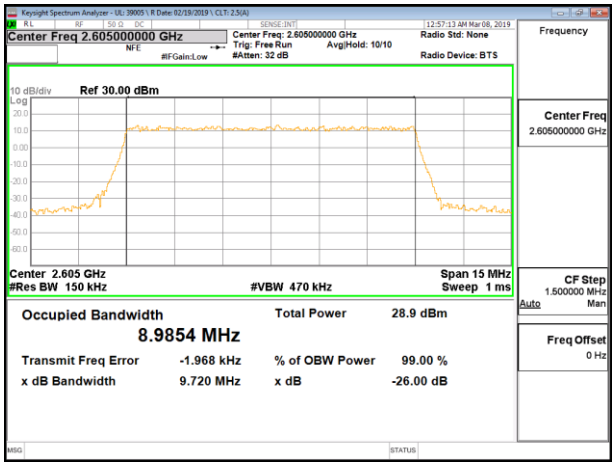
LTE B41 5MHz QPSK Mid Channel RB25-0



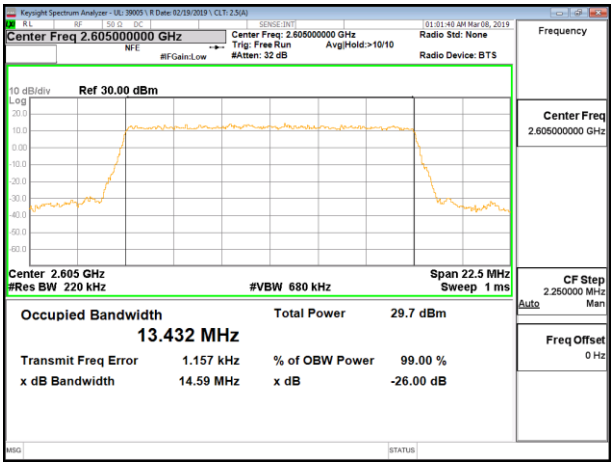
LTE B41 5MHz 16QAM Mid Channel RB25-0



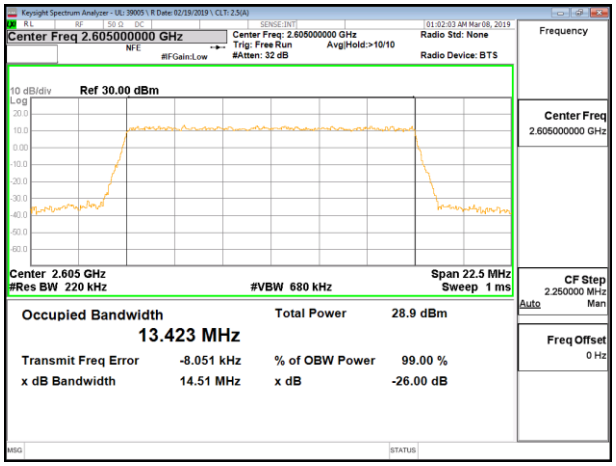
LTE B41 10MHz QPSK Mid Channel RB50-0



LTE B41 10MHz 16QAM Mid Channel RB50-0



LTE B41 15MHz QPSK Mid Channel RB75-0



LTE B41 15MHz 16QAM Mid Channel RB75-0

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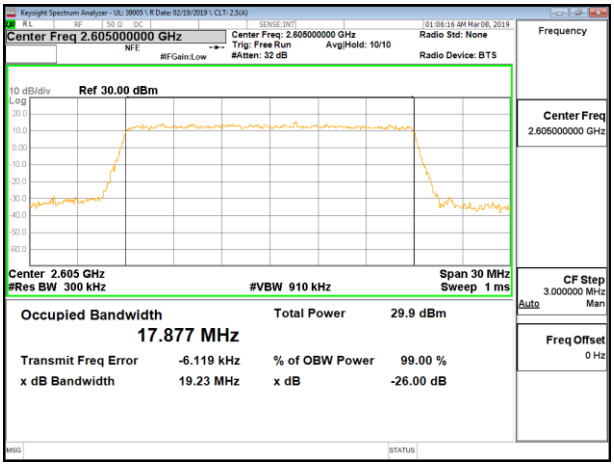
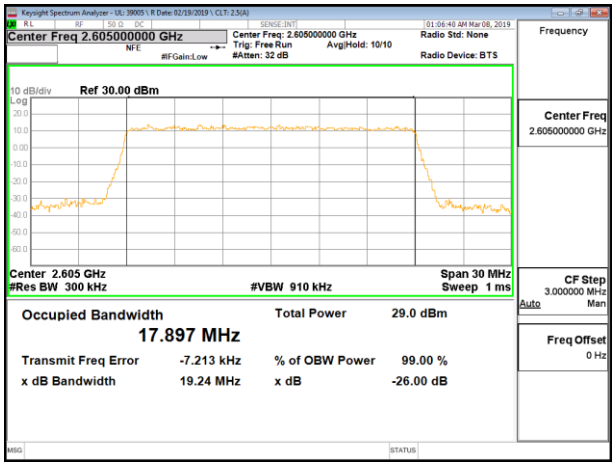


LTE B41 20MHz QPSK Mid Channel RB100-0



LTE B41 20MHz 16QAM Mid Channel RB100-0

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9.2. BAND EDGE AND EMISSION MASK

RULE PART(S)
FCC: §2.1051, §22.917, §24.238, and §27.53

LIMITS
FCC: §22.917, §24.238, §27.53
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: §27.53 (Band 41)
(m)(4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

TEST PROCEDURE
The transmitter output was connected to a CMW500Test 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.

MODES TESTED

- GSM 850
- GSM 1900
- CDMA BC0
- WCDMA Band 5
- WCDMA Band 2
- LTE Band 5
- LTE Band 41

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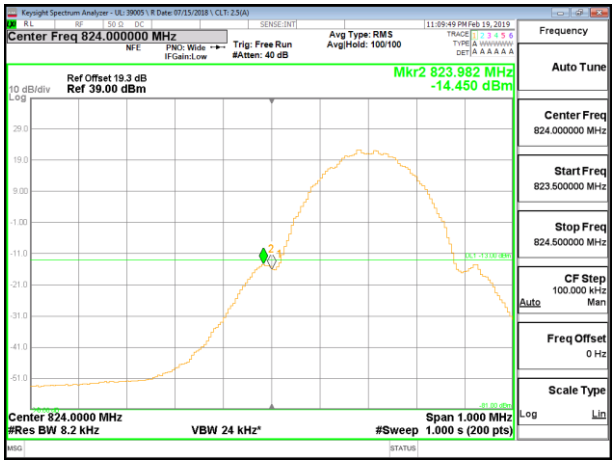
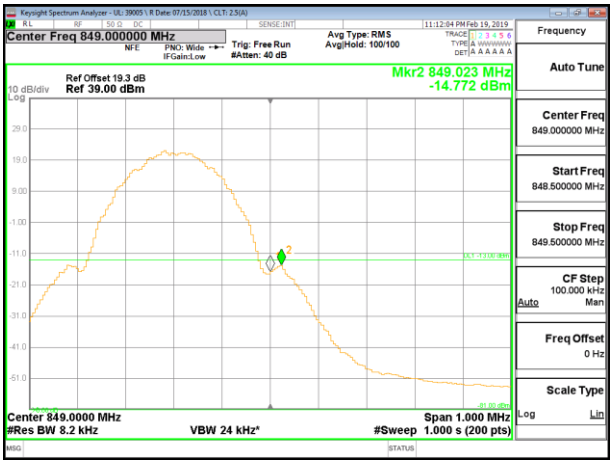
RESULTS

9.2.1. GSM850

GPRS

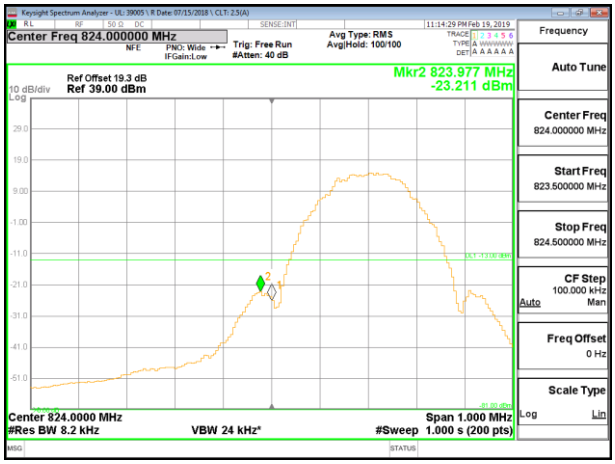


GSM850 GPRS LOW Channel

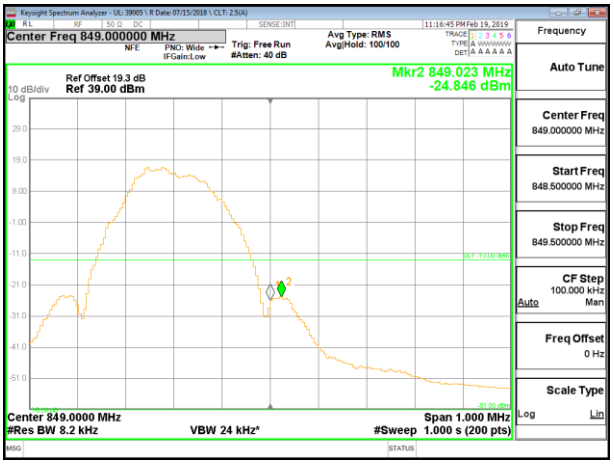


GSM850 GPRS HIGH Channel

EGPRS



GSM850 EGPRS LOW Channel



GSM850 EGPRS HIGH Channel

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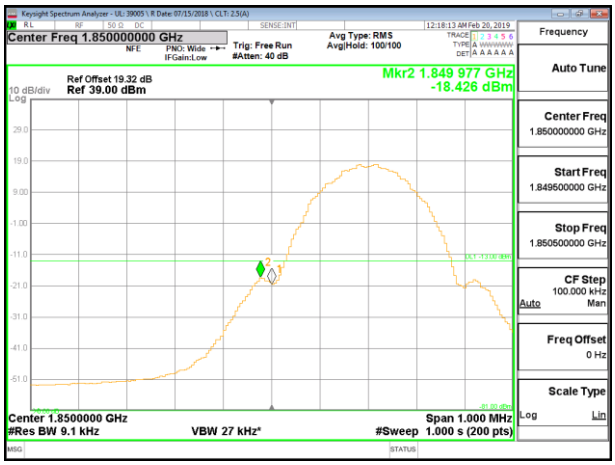
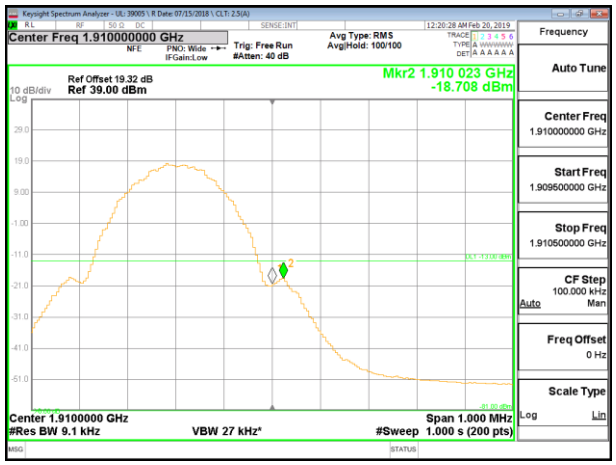
9.2.2. GSM1900

GPRS

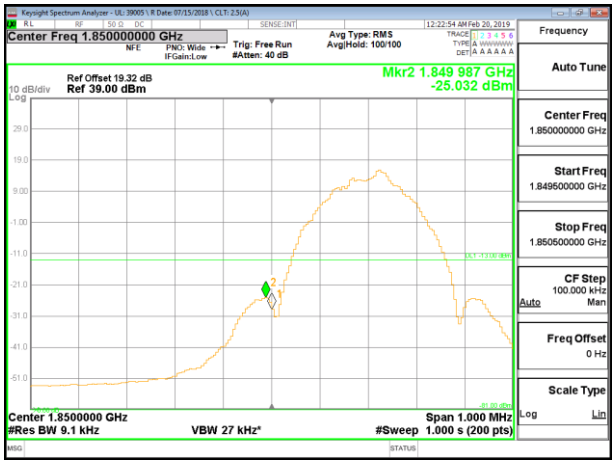


GSM1900 GPRS LOW Channel

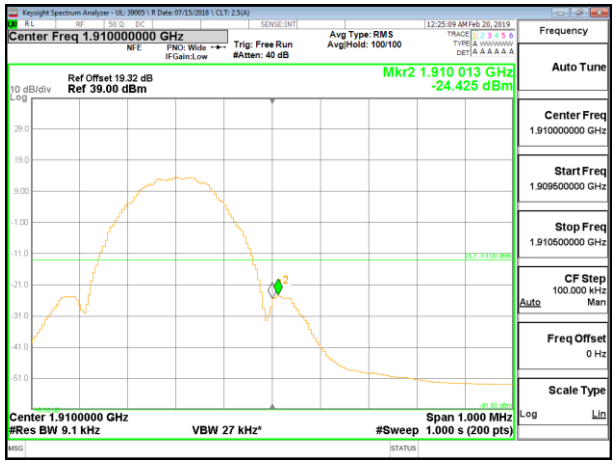


GSM1900 GPRS HIGH Channel

EGPRS



GSM1900 EGPRS LOW Channel



GSM1900 EGPRS HIGH Channel

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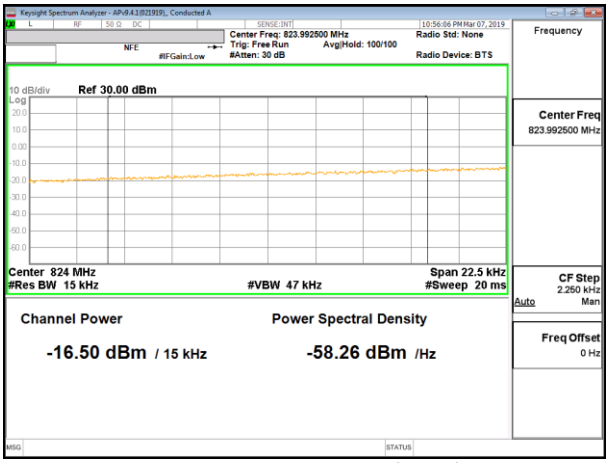
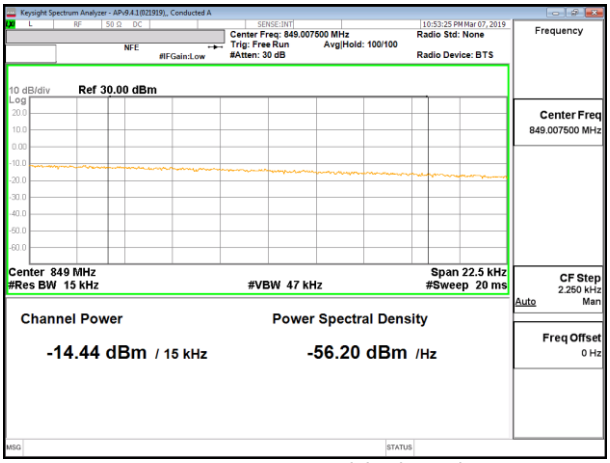
9.2.3. CDMA BC0



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

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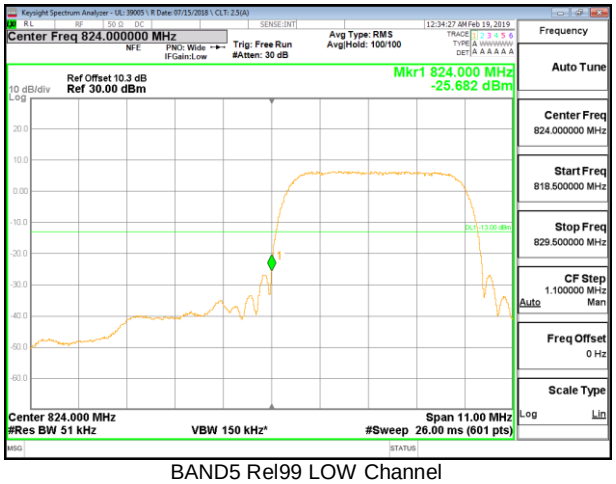
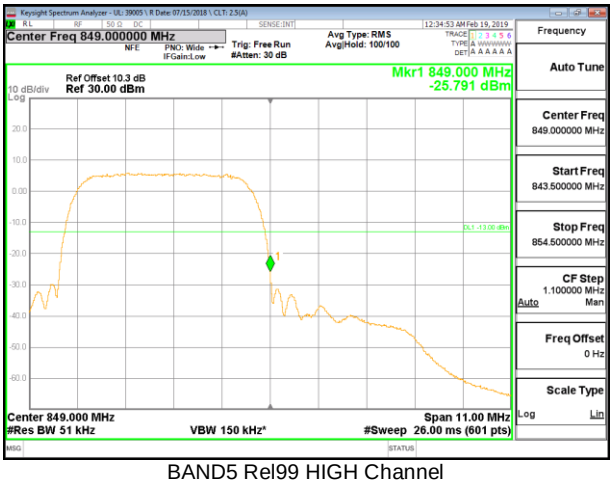
9.2.4. WCDMA BAND5

Rel99

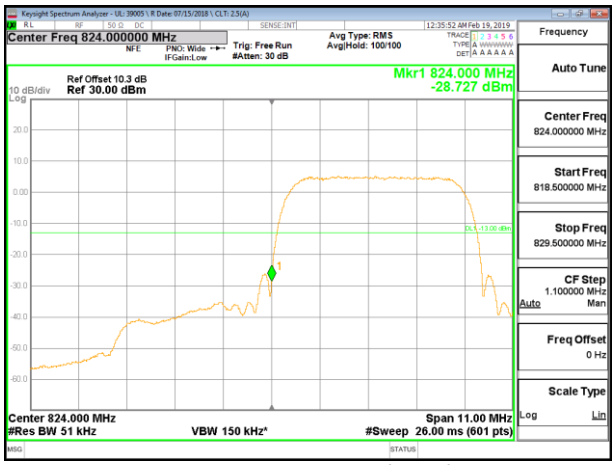


BAND5 Rel99 LOW Channel

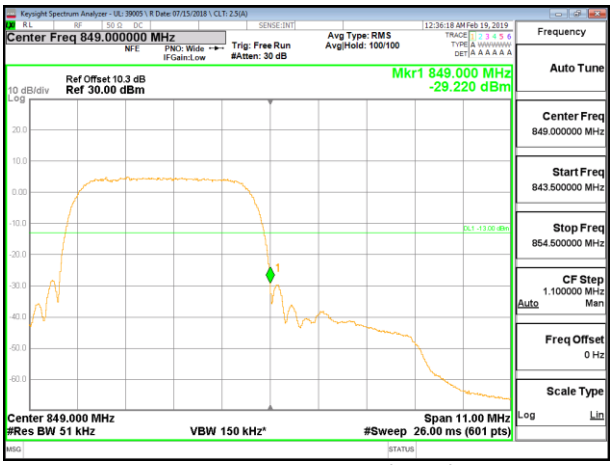


BAND5 Rel99 HIGH Channel

HSDPA



BAND5 HSDPA LOW Channel



BAND5 HSDPA HIGH Channel

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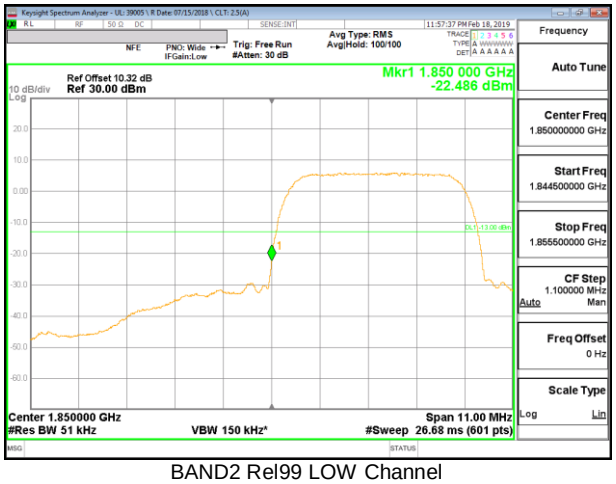
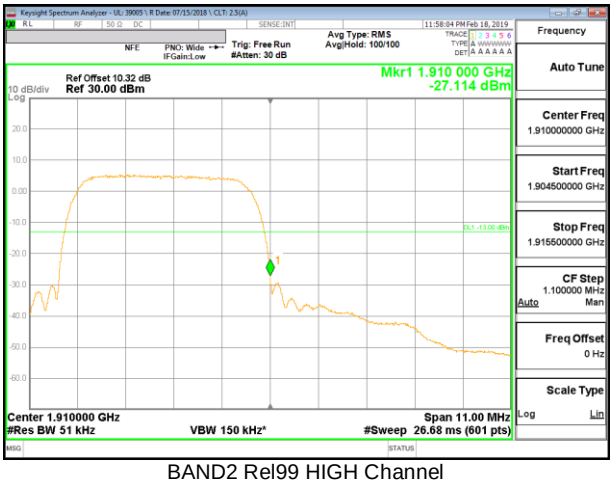
9.2.5. WCDMA BAND2

Rel99

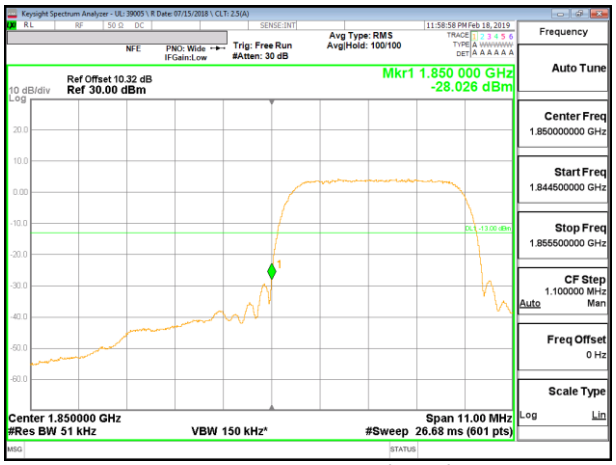


BAND2 Rel99 LOW Channel

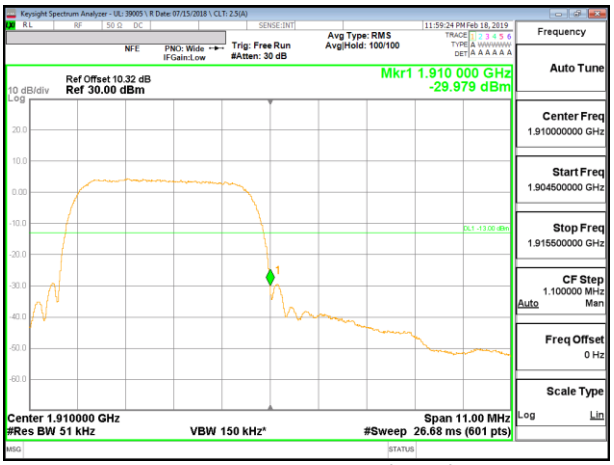


BAND2 Rel99 HIGH Channel

HSDPA



BAND2 HSDPA LOW Channel



BAND2 HSDPA HIGH Channel

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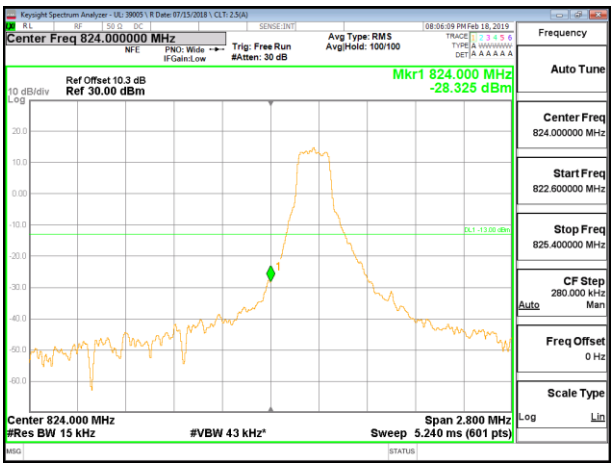
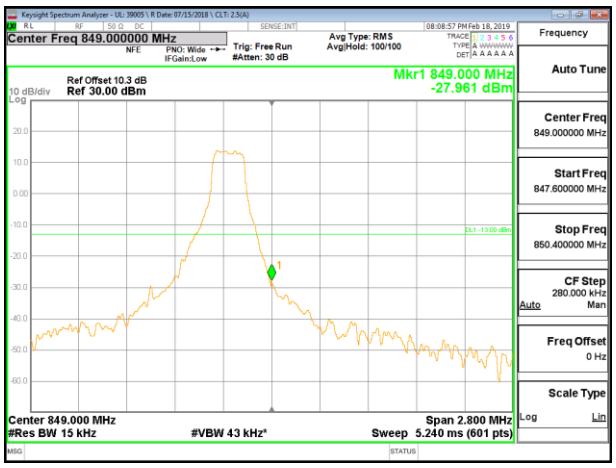
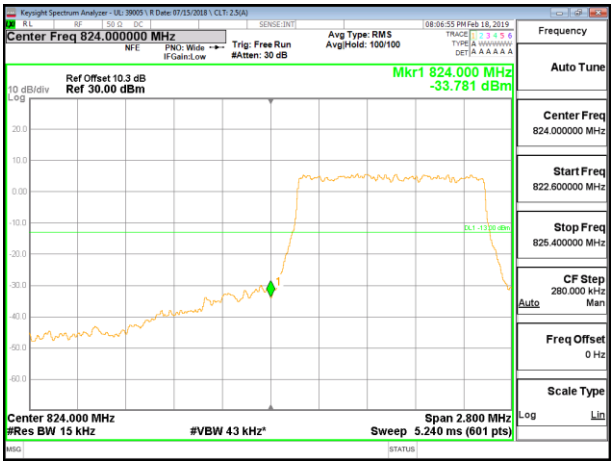
9.2.6. LTE BAND 5 BANDEDGE



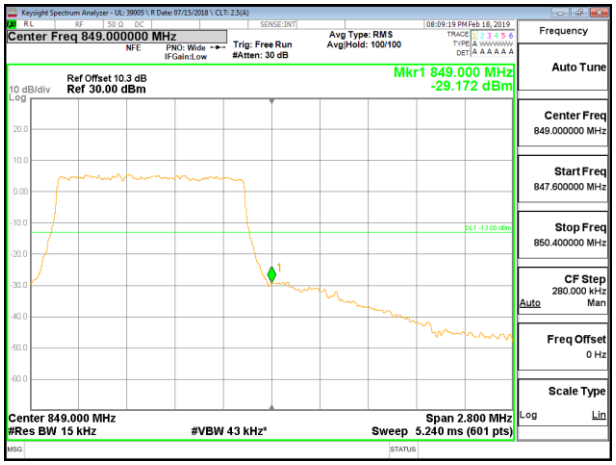
LTE B5 1.4MHz QPSK Low Channel RB1-0



LTE B5 1.4MHz QPSK High Channel RB1-5



LTE B5 1.4MHz QPSK Low Channel RB6-0



LTE B5 1.4MHz QPSK High Channel RB6-0

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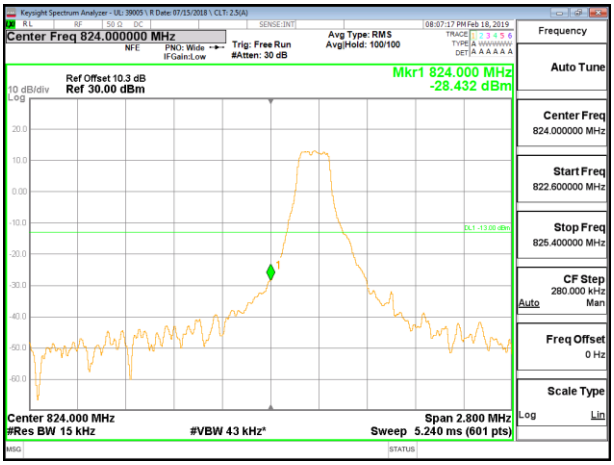
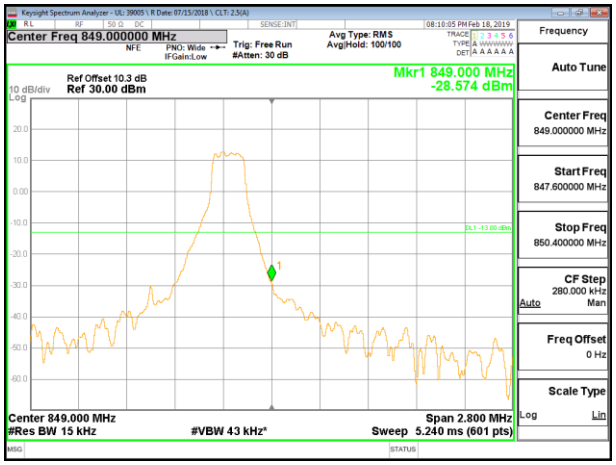
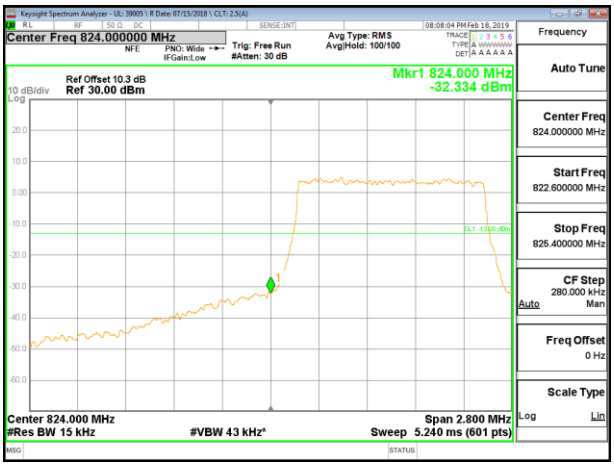


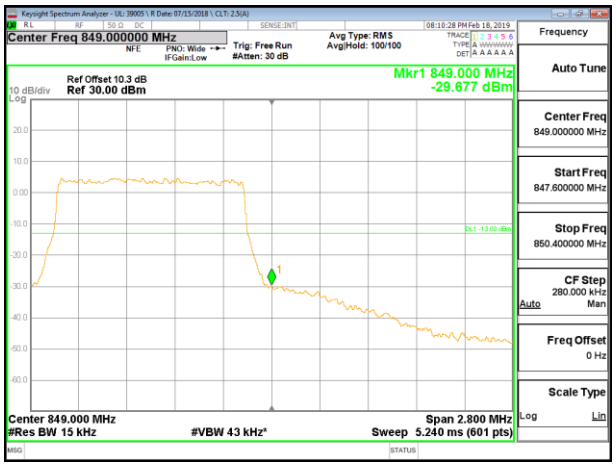
LTE B5 1.4MHz 16QAM Low Channel RB1-0



LTE B5 1.4MHz 16QAM High Channel RB1-5



LTE B5 1.4MHz 16QAM Low Channel RB6-0



LTE B5 1.4MHz 16QAM High Channel RB6-0

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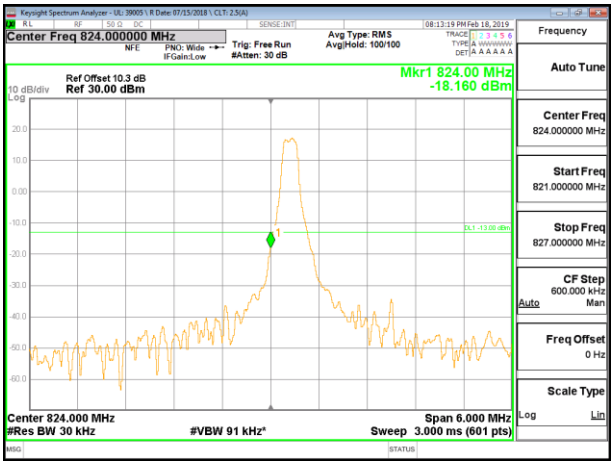
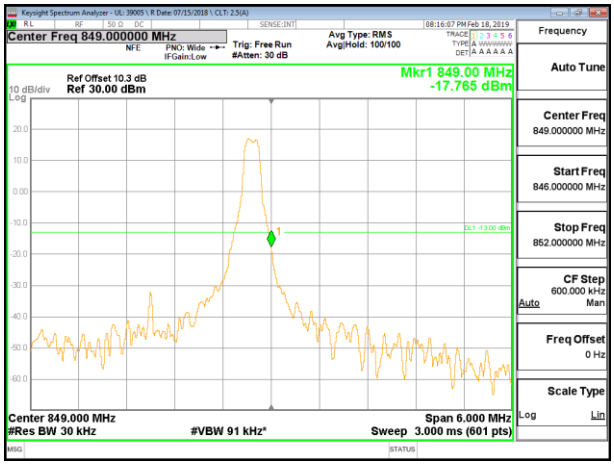
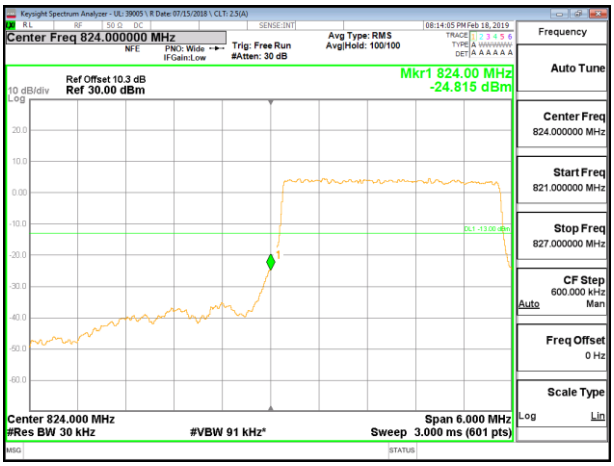


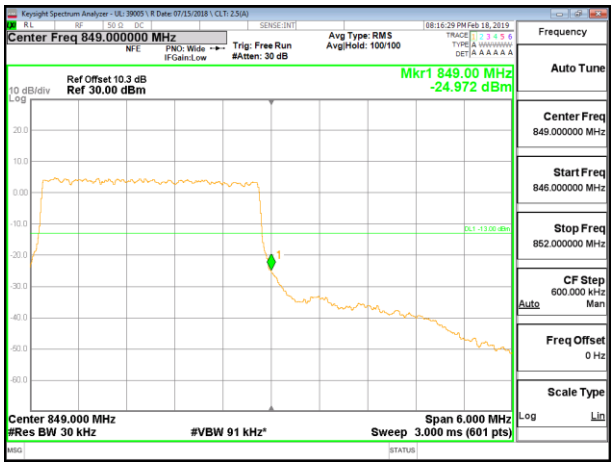
LTE B5 3MHz QPSK Low Channel RB1-0



LTE B5 3MHz QPSK High Channel RB1-14



LTE B5 3MHz QPSK Low Channel RB15-0



LTE B5 3MHz QPSK High Channel RB15-0

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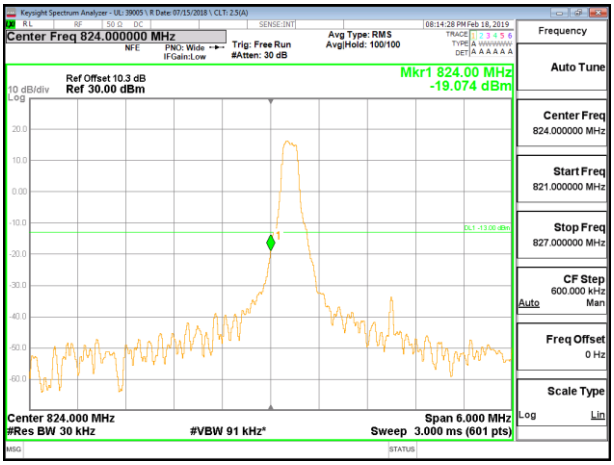
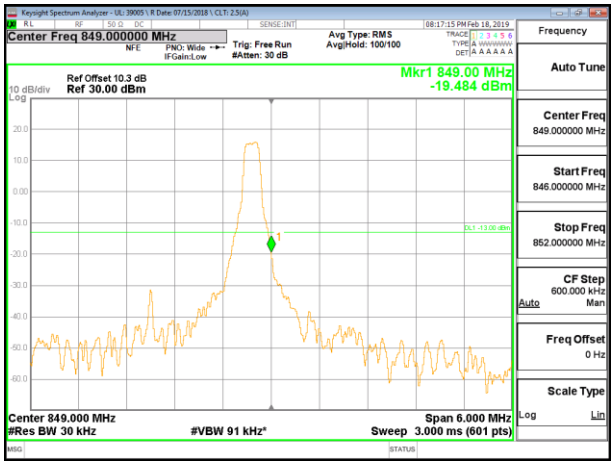
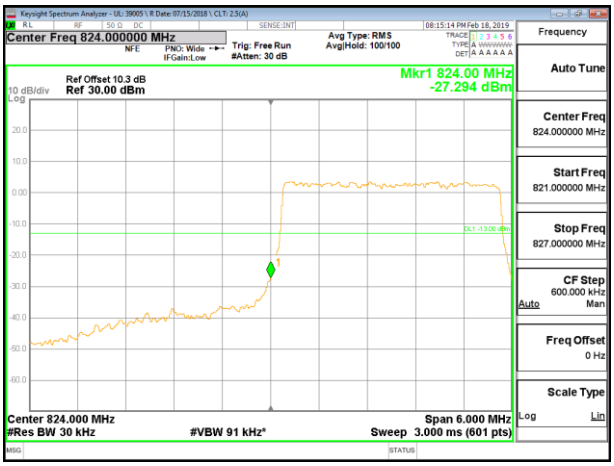


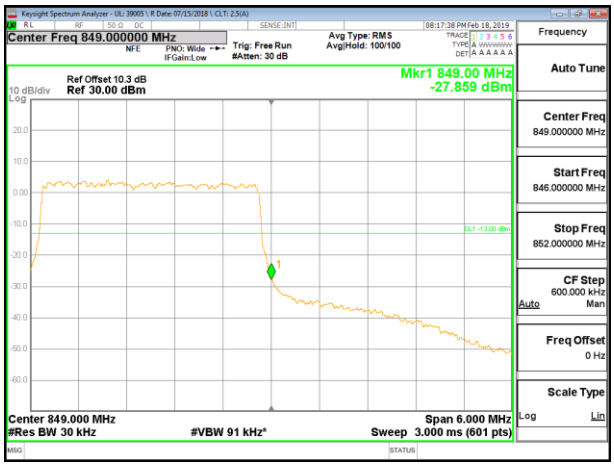
LTE B5 3MHz 16QAM Low Channel RB1-0



LTE B5 3MHz 16QAM High Channel RB1-14



LTE B5 3MHz 16QAM Low Channel RB15-0



LTE B5 3MHz 16QAM High Channel RB15-0

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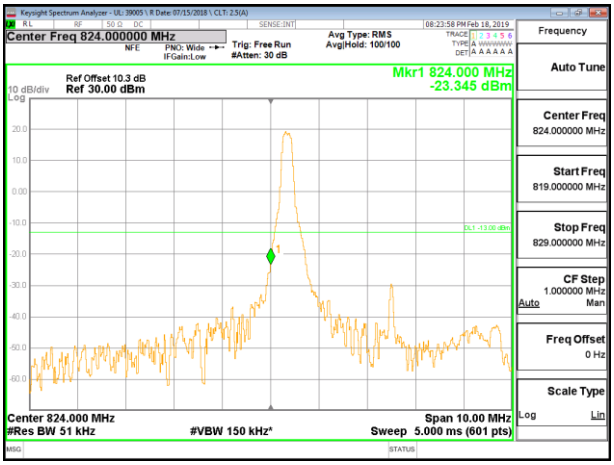
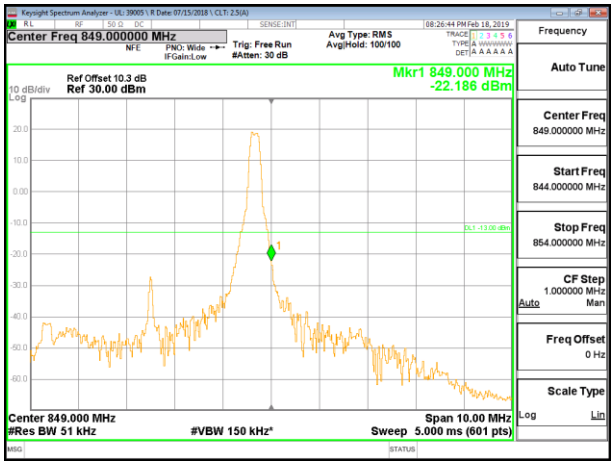
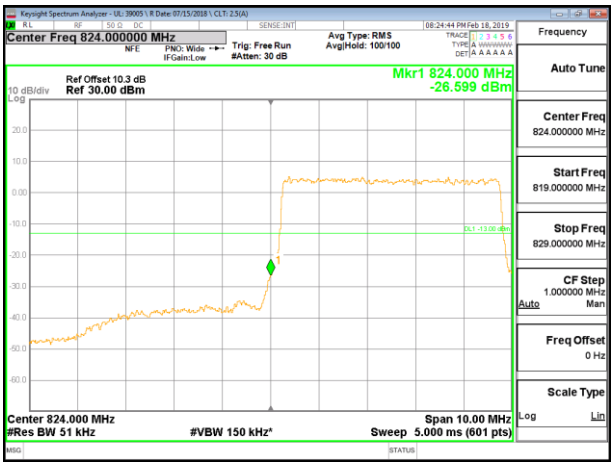


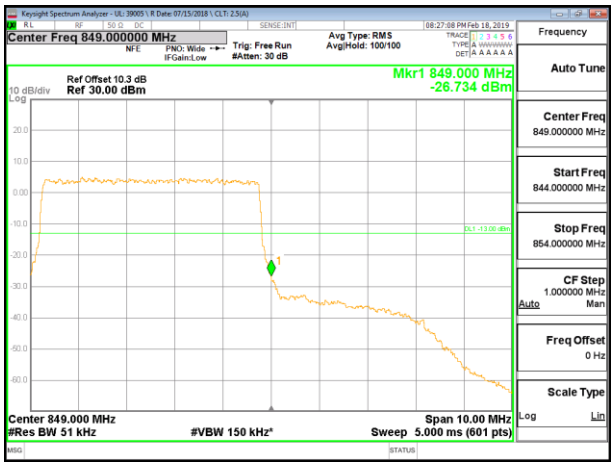
LTE B5 5MHz QPSK Low Channel RB1-0



LTE B5 5MHz QPSK High Channel RB1-24



LTE B5 5MHz QPSK Low Channel RB25-0



LTE B5 5MHz QPSK High Channel RB25-0

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