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 GHz	Micro-Tronics	HPM18129	T889	02/21/19	02/21/18
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM50114	T1852	07/16/19	07/16/18
Highpass Filter, 4GHz	Micro-Tronics	HPM13351	T1241	07/19/19	07/19/18
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	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	T863	06/21/19	06/21/18
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	AT0067	03/26/19	03/26/18
Antenna, Horn 18 - 26.5 GHz	ARA	MWH-1826/B	T477	06/16/2019	06/16/2018
Hybrid Antenna	Sunol Sciences Corp.	JB3	T407	05/10/19	05/10/18
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
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	174060	08/01/19	08/01/18
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	T493	10/13/19	10/13/18
RF Amplifier	AMPLICAL	AMP1G18-35	T1571	07/30/19	07/30/18
RF Amplifier	AMPLICAL	AMP1G18-35	T1569	06/03/19	06/03/18
Directional Coupler	Mini-Circuits	ZUDC10-183+	T1136	06/18/19	06/18/18
Wideband Communication Test Set, Call Box	R&S	CMW500	T972	05/29/19	05/29/18
Wideband Communication Test Set, Call Box	R&S	CMW500	T1872	02/15/19	02/15/18
Wideband Communication Test Set, Call Box	R&S	CMW500	T949	02/21/19	02/21/18
Chamber, Environmental	Thermotron	SE-600-10-10	T80	02/22/19	02/22/18
Spectrum Analyzer	Agilent (Keysight) Technologies	E4446A	T146	07/18/19	07/18/18
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	T1466	04/16/19	04/16/18
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	T1268	06/25/2019	06/25/2018
Power Sensor	Keysight	N1921A	T1228	07/10/2019	07/10/2018

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

NOTES:

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:	52280	Date:	1/14/19

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Power			
			1 slot	2 slots	3 slots	4 slots
850.0	128	824.2	32.6	30.1	28.6	27.2
	190	836.6	32.6	29.9	28.7	27.3
	251	848.8	**32.7**	30.1	28.8	27.3

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Power			
			1 slot	2 slots	3 slots	4 slots
850.0	128	824.2	**26.5**	24.7	23.3	21.9
	190	836.6	26.5	24.5	23.2	21.7
	251	848.8	26.3	24.4	23.1	21.7

8.1.2. GSM1900

ID:	52280	Date:	1/14/19

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Power			
			1 slot	2 slots	3 slots	4 slots
1900.0	512	1850.2	29.8	26.6	25.2	23.5
	661	1880.0	**29.9**	26.6	25.1	23.6
	810	1909.8	29.6	26.6	25.1	23.6

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Power			
			1 slot	2 slots	3 slots	4 slots
1900.0	512	1850.2	26.3	23.8	22.3	21.1
	661	1880.0	**26.3**	23.8	22.3	21.2
	810	1909.8	26.3	23.8	22.3	21.2

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8.2. WCDMA

TEST PROCEDURE

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

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

- Set the spectrum analyzer span wide enough or greater than the modulated signal BW.
- Set a spectrum analyzer at peak detection mode with VBW ≥ 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.		

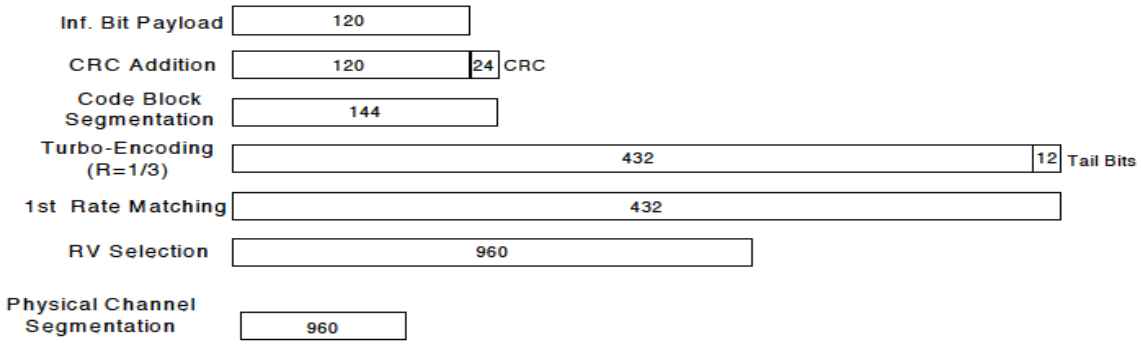

Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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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 β_{hs} = 30/15 * β_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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8.2.1. WCDMA BAND5

ID:	52280	Date:	1/14/19

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	24.5
			4233	846.6	N/A	24.3
	HSDPA	Subtest 1	4132	826.4	0	**23.4**
			4183	836.6	0	23.2
			4233	846.6	0	22.9
		Subtest 2	4132	826.4	0.5	22.6
			4183	836.6	0.5	22.3
			4233	846.6	0.5	22.0
		Subtest 3	4132	826.4	0.5	21.4
			4183	836.6	0.5	21.4
			4233	846.6	0.5	21.6
		Subtest 4	4132	826.4	0.5	21.5
			4183	836.6	0.5	21.1
			4233	846.6	0.5	21.1
	HSPA (HSDPA & HSUPA)	Subtest 1	4132	826.4	0.5	19.9
			4183	836.6	0.5	19.7
			4233	846.6	0.5	19.3
		Subtest 2	4132	826.4	1.5	18.9
			4183	836.6	1.5	18.7
			4233	846.6	1.5	18.3
		Subtest 3	4132	826.4	1.5	19.9
			4183	836.6	1.5	19.7
			4233	846.6	1.5	19.4
		Subtest 4	4132	826.4	1.5	18.9
			4183	836.6	1.5	18.6
			4233	846.6	1.5	18.3
		Subtest 5	4132	826.4	0.5	22.8
			4183	836.6	0.5	22.4
			4233	846.6	0.5	22.0

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8.2.2. WCDMA BAND2

ID:	52280	Date:	1/14/19

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	25.0
			9400	1880.0	N/A	**25.2**
			9538	1907.6	N/A	**25.2**
	HSDPA	Subtest 1	9262	1852.4	0	24.7
			9400	1880.0	0	24.5
			9538	1907.6	0	24.4
		Subtest 2	9262	1852.4	0	24.7
			9400	1880.0	0	24.6
			9538	1907.6	0	24.4
		Subtest 3	9262	1852.4	0.5	23.7
			9400	1880.0	0.5	23.6
			9538	1907.6	0.5	23.4
		Subtest 4	9262	1852.4	0.5	25.1
			9400	1880.0	0.5	25.2
			9538	1907.6	0.5	**25.3**
	HSPA (HSDPA & HSUPA)	Subtest 1	9262	1852.4	0	23.0
			9400	1880.0	0	21.5
			9538	1907.6	0	21.4
		Subtest 2	9262	1852.4	2	21.1
			9400	1880.0	2	20.5
			9538	1907.6	2	20.4
		Subtest 3	9262	1852.4	1	23.0
			9400	1880.0	1	21.6
			9538	1907.6	1	21.4
		Subtest 4	9262	1852.4	2	21.7
			9400	1880.0	2	20.6
			9538	1907.6	2	20.4
		Subtest 5	9262	1852.4	1	25.0
			9400	1880.0	1	23.4
			9538	1907.6	1	23.3

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8.3. LTE

CONDUCTED OUTPUT POWER MEASUREMENT PROCEDURE

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

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

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

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

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

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

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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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8.3.1. LTE 5

ID:	38866	Date:	1/15/19

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	23.5	**23.8**	23.5
		1	2	23.4	23.8	23.4
		1	5	23.4	23.8	23.4
		3	0	23.5	23.7	23.5
		3	1	23.5	23.7	23.5
		3	2	23.5	23.7	23.5
		6	0	22.0	22.2	22.0
	16QAM	1	0	22.4	22.6	22.4
		1	2	22.4	22.6	22.4
		1	5	22.4	22.6	22.4
		3	0	22.4	**22.6**	22.4
		3	1	22.4	22.6	22.4
		3	2	22.4	22.6	22.4
		6	0	21.3	21.7	21.3

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	23.8	**23.9**	23.7
		1	7	23.8	23.8	23.6
		1	14	23.7	23.9	23.5
		8	0	22.2	22.3	22.0
		8	4	22.1	22.3	22.0
		8	7	22.2	22.3	22.0
		15	0	22.2	22.3	22.0
	16QAM	1	0	22.9	22.6	22.4
		1	7	**23.0**	22.5	22.3
		1	14	22.9	22.6	22.5
		8	0	21.7	21.7	21.5
		8	4	21.7	21.8	21.4
		8	7	21.7	21.8	21.4
		15	0	21.6	21.7	21.4

OUTPUT POWER FOR LTE BAND 5 (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				20425	20525	20625
				826.5 MHz	836.5 MHz	846.5 MHz
5.0	QPSK	1	0	23.7	**23.8**	23.6
		1	12	23.7	23.8	23.5
		1	24	23.7	23.8	23.5
		12	0	22.2	22.2	22.0
		12	6	22.2	22.2	22.0
		12	11	22.1	22.3	22.0
		25	0	22.2	22.2	22.0
	16QAM	1	0	22.7	**22.8**	22.5
		1	12	22.6	22.7	22.4
		1	24	22.6	22.7	22.4
		12	0	21.6	21.6	21.5
		12	6	21.6	21.7	21.4
		12	11	21.6	21.6	21.4
		25	0	21.7	21.7	21.4

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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	24.4	**24.5**	24.4
		1	24	24.5	**24.5**	24.5
		1	49	24.5	**24.5**	24.5
		25	0	23.1	23.1	23.0
		25	12	23.1	23.1	23.1
		25	24	23.0	23.1	23.1
		50	0	23.1	23.1	23.1
	16QAM	1	0	23.4	**23.5**	23.5
		1	24	23.5	**23.5**	23.5
		1	49	23.5	**23.5**	23.5
		25	0	22.5	22.5	22.5
		25	12	22.5	22.5	22.5
		25	24	22.5	22.5	22.5
		50	0	22.5	22.5	22.5

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8.3.2. LTE 41 (FCC)

ID:	38866	Date:	1/15/19

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

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				39675	40620	41565
				2498.5 MHz	2593.0 MHz	2687.5 MHz
5.0	QPSK	1	0	23.4	23.4	**23.4**
		1	12	23.4	23.4	**23.4**
		1	24	**23.4**	**23.5**	**23.4**
		12	0	22.7	22.7	22.7
		12	6	22.7	22.7	22.7
		12	11	22.7	22.8	22.7
		25	0	22.7	22.7	22.7
	16QAM	1	0	22.7	22.7	22.7
		1	12	22.7	22.7	**22.7**
		1	24	**22.7**	**22.8**	**22.7**
		12	0	21.8	21.8	21.8
		12	6	21.8	21.8	21.9
		12	11	21.8	21.8	21.8
		25	0	21.7	21.8	21.9

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

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				39700	40620	41540
				2501.0 MHz	2593.0 MHz	2685.0 MHz
10.0	QPSK	1	0	**23.3**	23.5	23.3
		1	24	23.3	23.5	**23.3**
		1	49	23.2	**23.5**	23.1
		25	0	22.5	22.7	22.7
		25	12	22.5	22.8	22.5
		25	24	22.5	22.8	22.5
		50	0	22.5	22.7	22.6
	16QAM	1	0	**22.3**	22.6	**22.6**
		1	24	22.2	22.6	**22.6**
		1	49	22.2	**22.6**	**22.6**
		25	0	21.5	21.8	21.7
		25	12	21.5	21.8	21.7
		25	24	21.5	21.8	21.7
		50	0	21.6	21.8	21.6

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

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power Conducted Average (dBm)		
				39725	40620	41515
				2503.5 MHz	2593.0 MHz	2682.5 MHz
15.0	QPSK	1	0	**23.3**	23.3	23.2
		1	37	23.2	**23.5**	**23.3**
		1	74	23.2	23.5	23.1
		36	0	22.6	22.7	22.6
		36	16	22.5	22.8	22.5
		36	35	22.6	22.8	22.5
		75	0	22.5	22.8	22.6
	16QAM	1	0	22.3	**22.7**	**22.6**
		1	37	**22.4**	22.6	**22.6**
		1	74	22.4	22.5	**22.6**
		36	0	21.5	21.7	21.7
		36	16	21.6	21.8	21.7
		36	35	21.5	21.8	21.7
		75	0	21.5	21.8	21.6

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

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Power		
				Conducted Average (dBm)		
				39750	40620	41490
				2506.0 MHz	2593.0 MHz	2680.0 MHz
20.0	QPSK	1	0	23.4	23.3	23.4
		1	49	23.3	23.5	23.4
		1	99	23.3	**23.5**	23.4
		50	0	22.6	22.7	22.6
		50	24	22.6	22.7	22.6
		50	49	22.5	22.8	22.6
		100	0	22.6	22.7	22.6
	16QAM	1	0	22.7	22.5	22.9
		1	49	22.7	22.7	**22.9**
		1	99	22.4	22.6	22.9
		50	0	21.6	21.8	21.7
		50	24	21.6	21.8	21.7
		50	49	21.6	21.8	21.6
		100	0	21.6	21.8	21.6

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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
- 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	237.05	303.00
	EGPRS			238.78	309.84
GSM1900	GPRS	661	1880.0	238.44	309.62
	EGPRS			242.01	310.99

WCDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BAND5	REL 99	4408	836.6	4.17	4.71
	HSDPA			4.14	4.73
BAND2	REL 99	9800	1880.0	4.14	4.72
	HSDPA			4.14	4.68

LTE5

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 5	1.4 MHz, QPSK	6/0	836.5	1.09	1.28
	1.4 MHz, 16QAM			1.08	1.32
	3 MHz, QPSK	15/0		2.69	3.02
	3 MHz, 16QAM			2.70	3.04
	5 MHz, QPSK	25/0		4.51	5.25
	5 MHz, 16QAM			4.51	5.11
	10 MHz, QPSK	50/0		8.96	10.03
	10 MHz, 16QAM			8.97	10.06

LTE41

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 41	5 MHz, QPSK	25/0	2593.0	4.53	5.19
	5 MHz, 16QAM			4.49	5.34
	10 MHz, QPSK	50/0		8.97	9.98
	10 MHz, 16QAM			8.96	10.67
	15 MHz, QPSK	75/0		13.44	14.98
	15 MHz, 16QAM			13.44	15.18
	20 MHz, QPSK	100/0		17.82	19.38
	20 MHz, 16QAM			17.85	19.54

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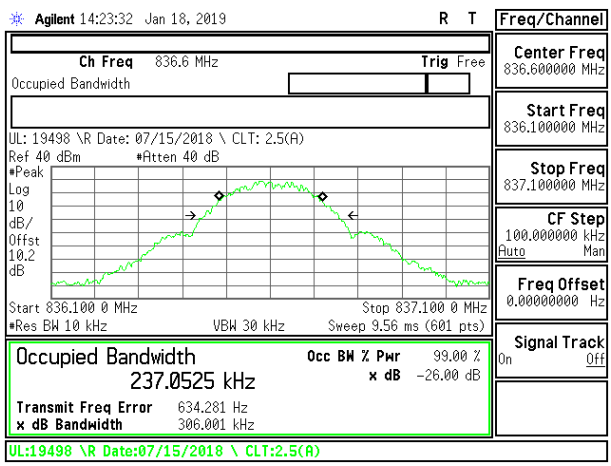
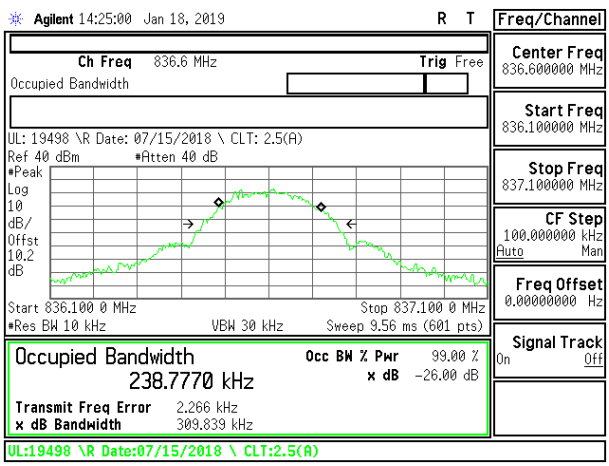
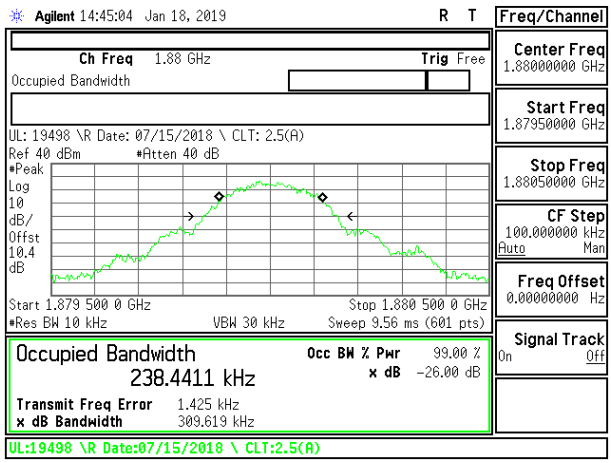
9.1.1. GSM



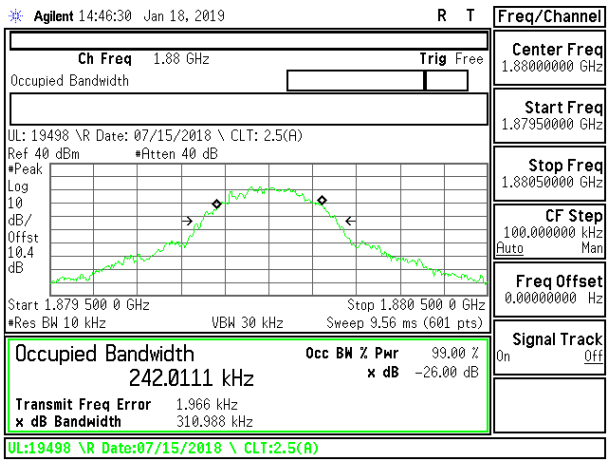
GSM 850MHz GPRS MID Channel



GSM 850MHz EGPRS MID Channel



GSM 1900MHz GPRS MID Channel



GSM 1900MHz EGPRS MID Channel

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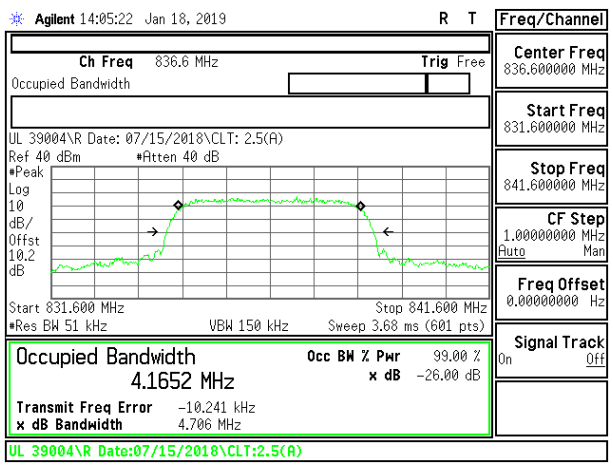
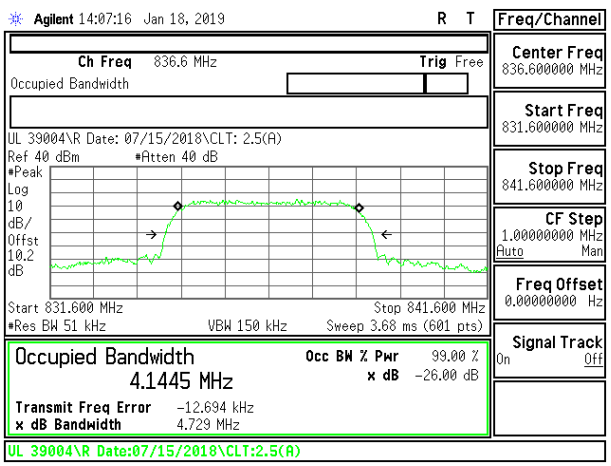
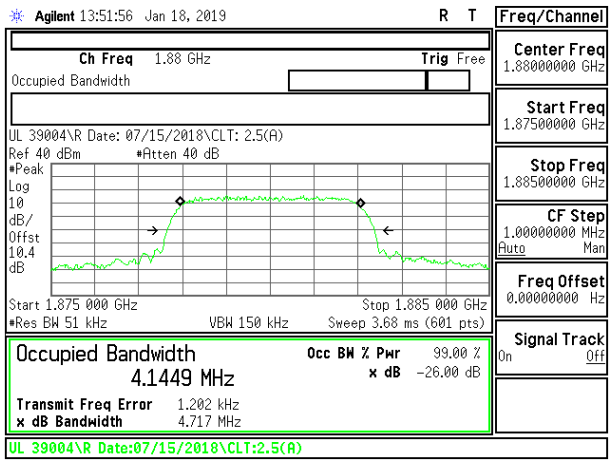
9.1.2. WCDMA



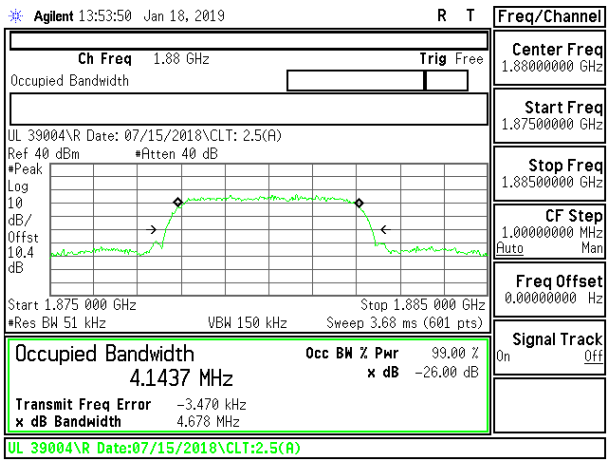
WCDMA BAND5 Rel99 MID Channel



WCDMA BAND5 HSDPA MID Channel



WCDMA BAND2 Rel99 MID Channel



WCDMA BAND2 HSDPA MID Channel

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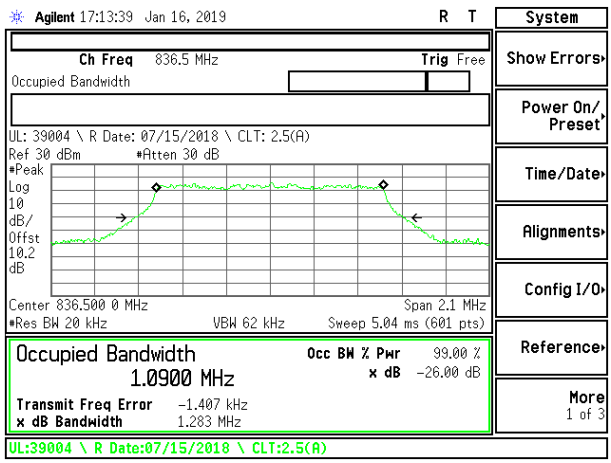
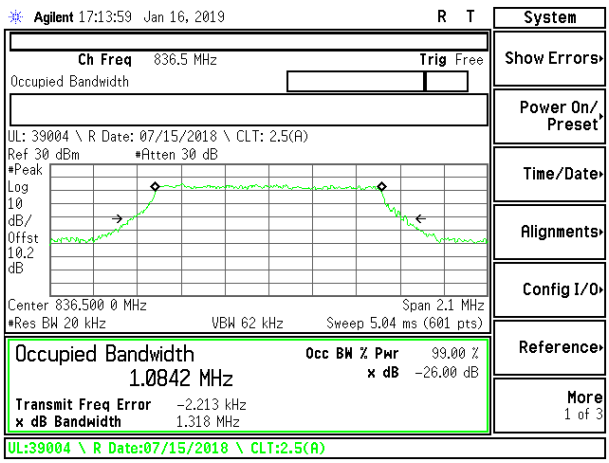
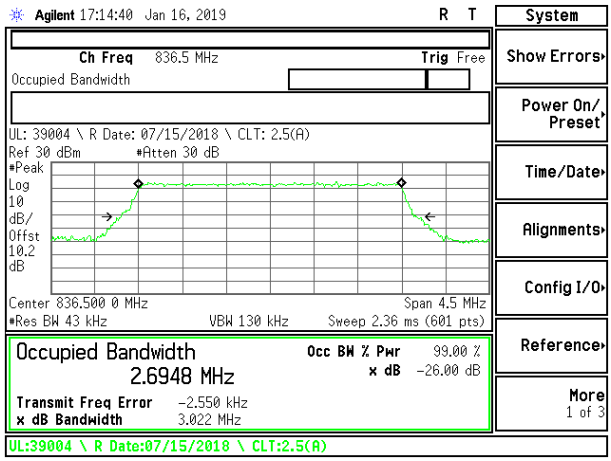
9.1.3. LTE BAND 5



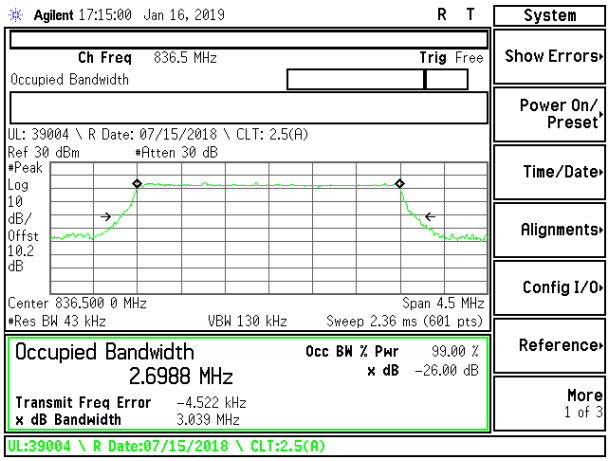
LTE B5 1.4MHz QPSK Mid Channel RB6-0



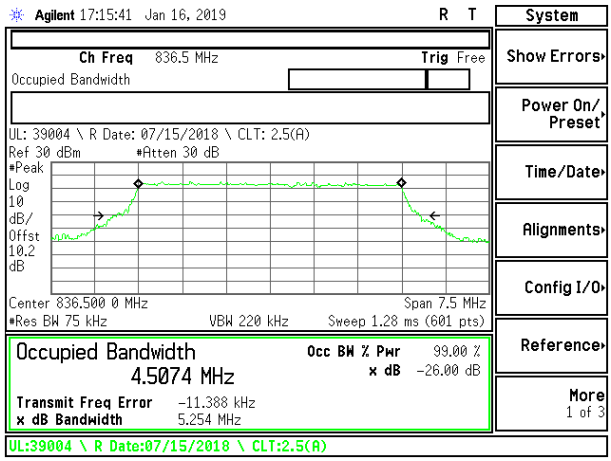
LTE B5 1.4MHz 16QAM Mid Channel RB6-0



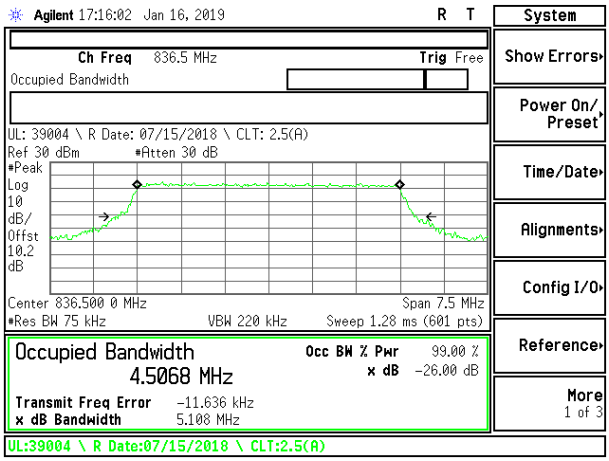
LTE B5 3MHz QPSK Mid Channel RB15-0



LTE B5 3MHz 16QAM Mid Channel RB15-0



LTE B5 5MHz QPSK Mid Channel RB25-0



LTE B5 5MHz 16QAM Mid Channel RB25-0

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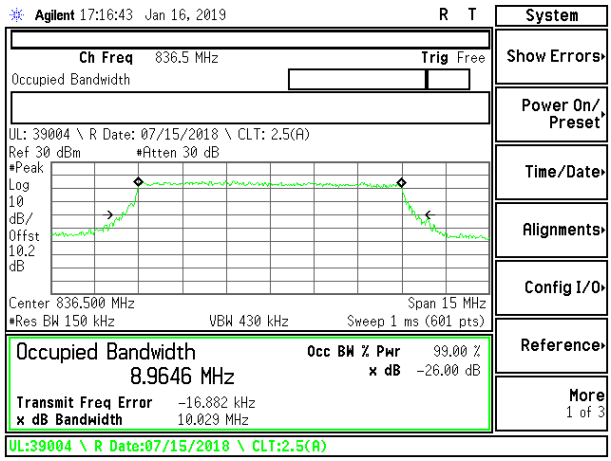
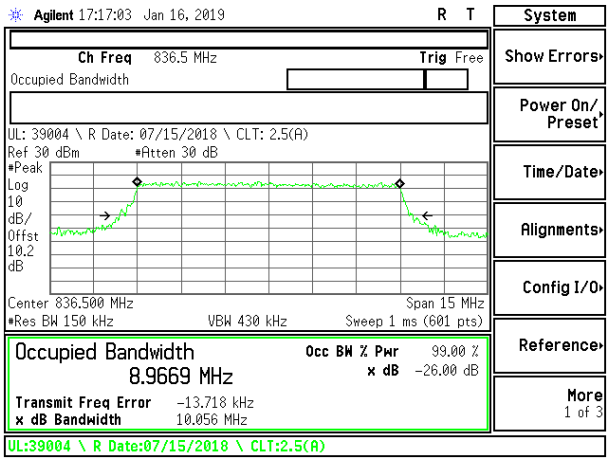


LTE B5 10MHz QPSK Mid Channel RB50-0



LTE B5 10MHz 16QAM Mid Channel RB50-0

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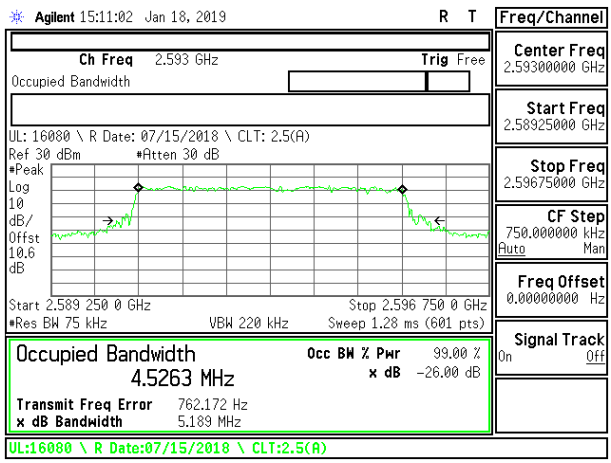
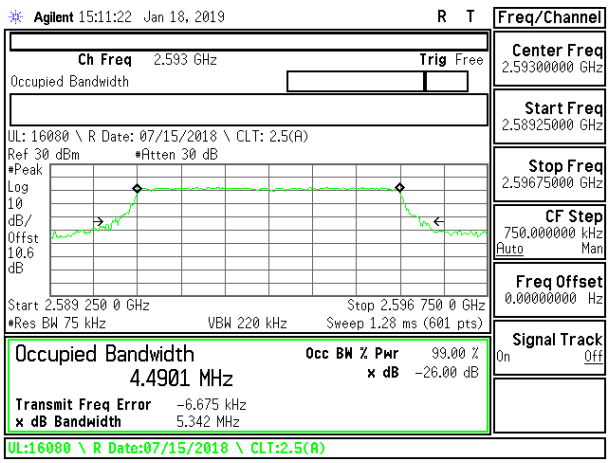
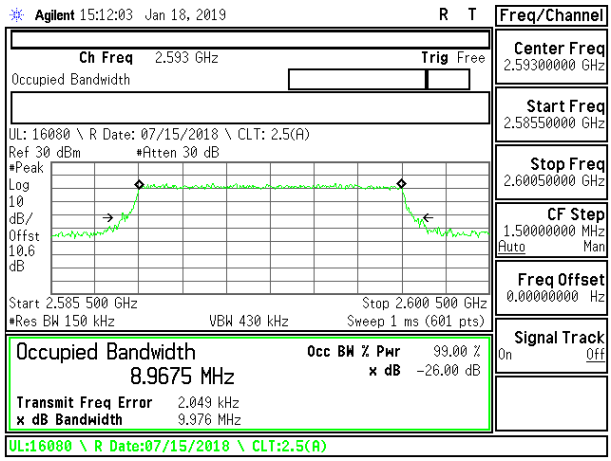
9.1.4. LTE BAND 41



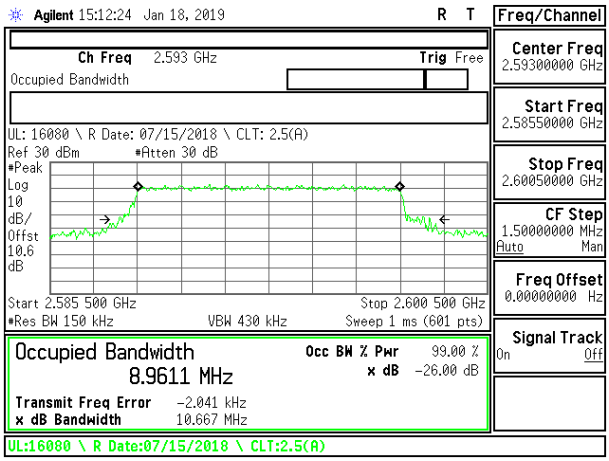
LTE B41 5MHz QPSK Mid Channel RB25-0



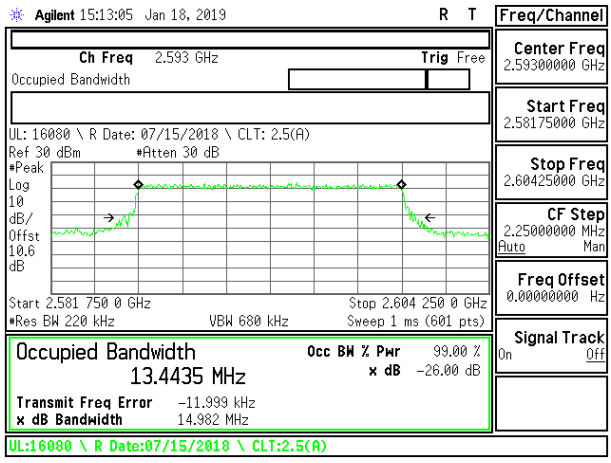
LTE B41 5MHz 16QAM Mid Channel RB25-0



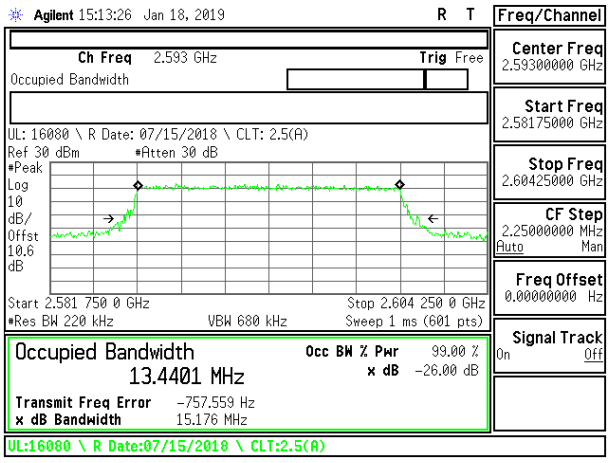
LTE B41 10MHz QPSK Mid Channel RB50-0



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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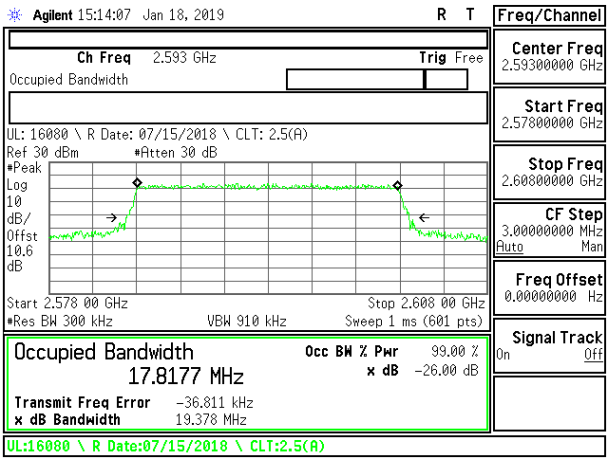
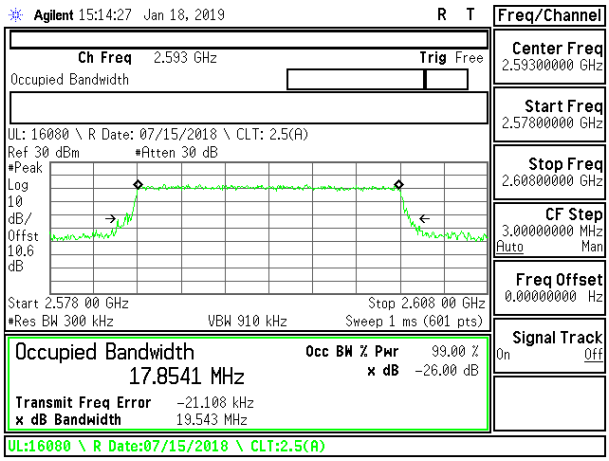


LTE B41 20MHz QPSK Mid Channel RB100-0



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 (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
- WCDMA Band 5
- WCDMA Band 2
- LTE Band 5
- LTE Band 41

RESULTS

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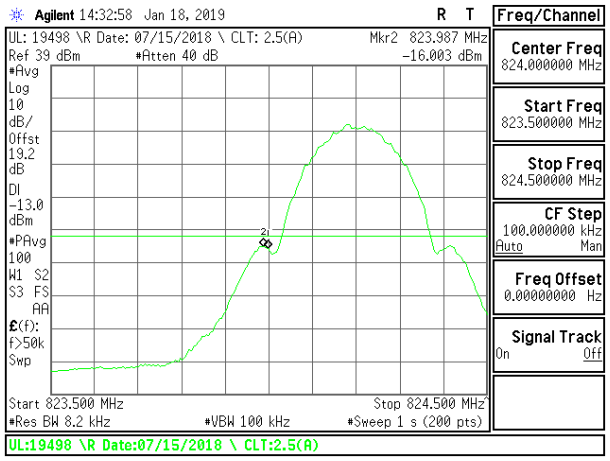
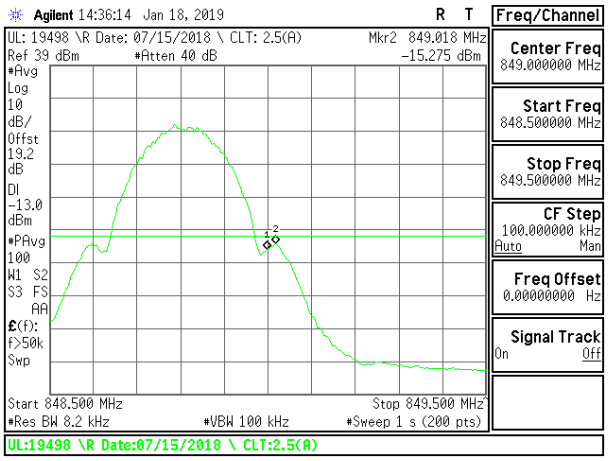
9.2.1. GSM850

GPRS

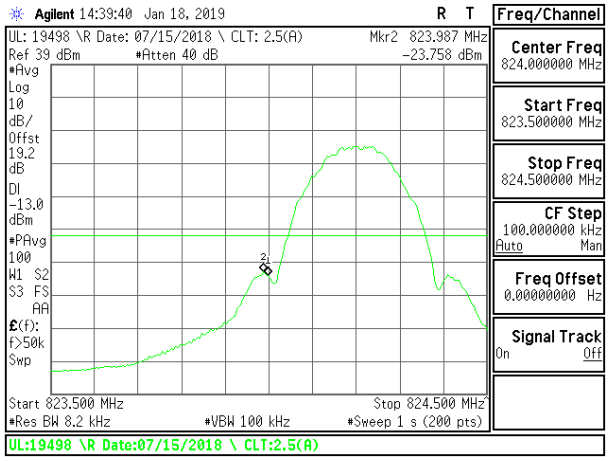


GSM850 GPRS LOW Channel



GSM850 GPRS HIGH Channel

EGPRS



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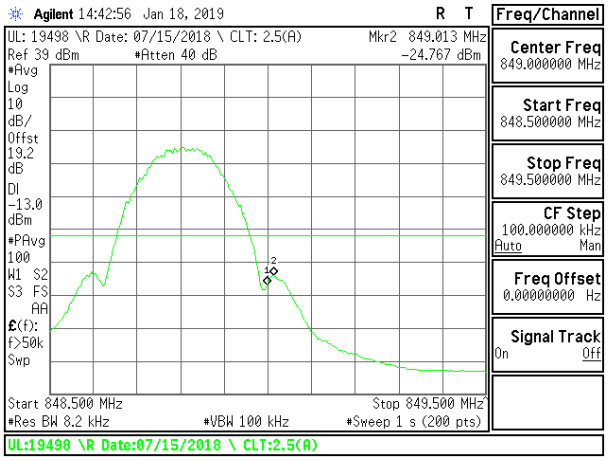

GSM850 EGPRS HIGH Channel

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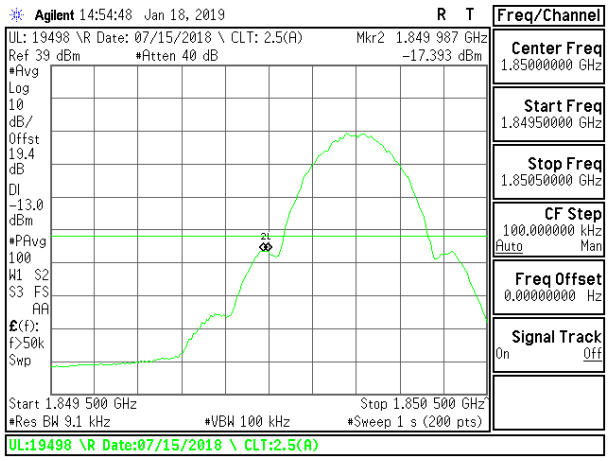
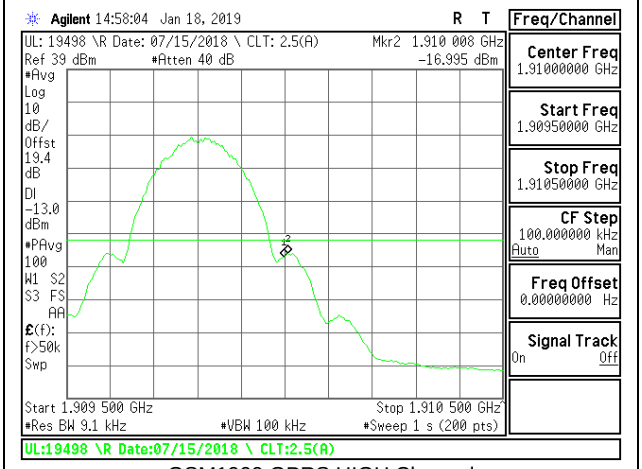
9.2.2. GSM1900

GPRS

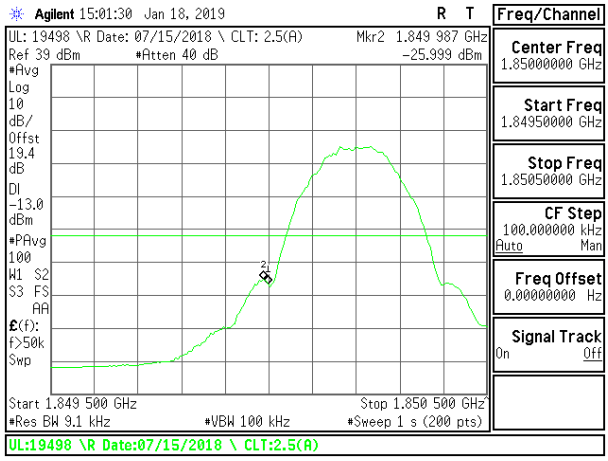


GSM1900 GPRS LOW Channel

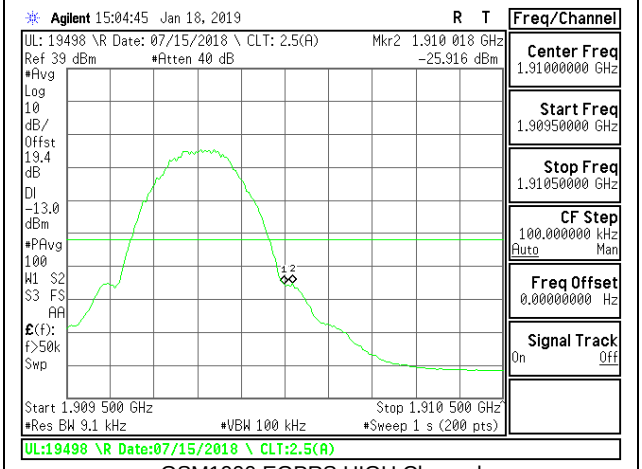


GSM1900 GPRS HIGH Channel

EGPRS



GSM1900 EGPRS LOW Channel



GSM1900 EGPRS HIGH Channel

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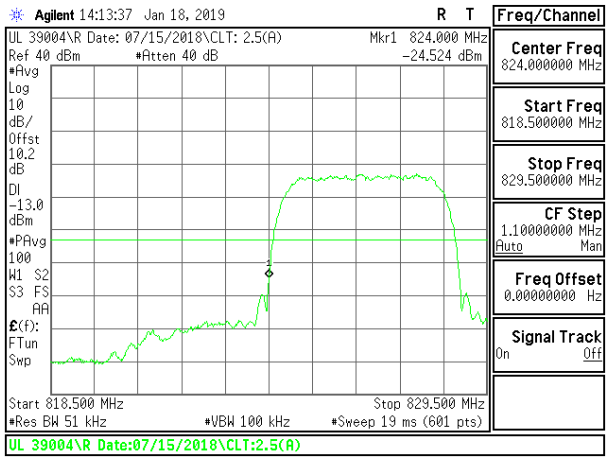
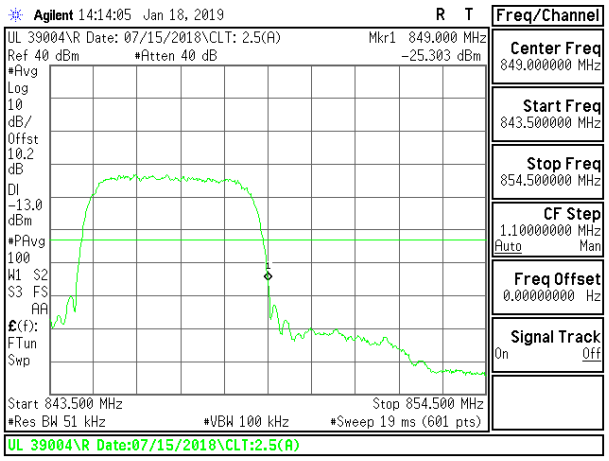
9.2.3. WCDMA BAND5

Rel99

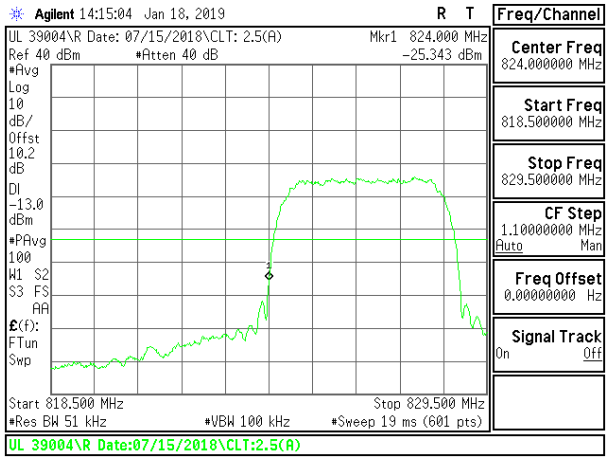


BAND5 Rel99 LOW Channel

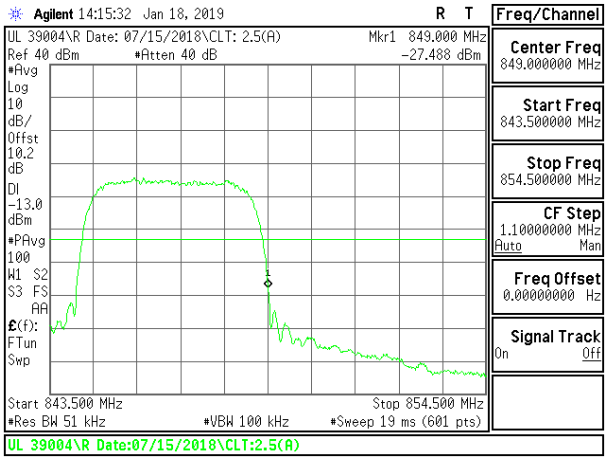


BAND5 Rel99 HIGH Channel

HSDPA



BAND5 HSDPA LOW Channel



BAND5 HSDPA HIGH Channel

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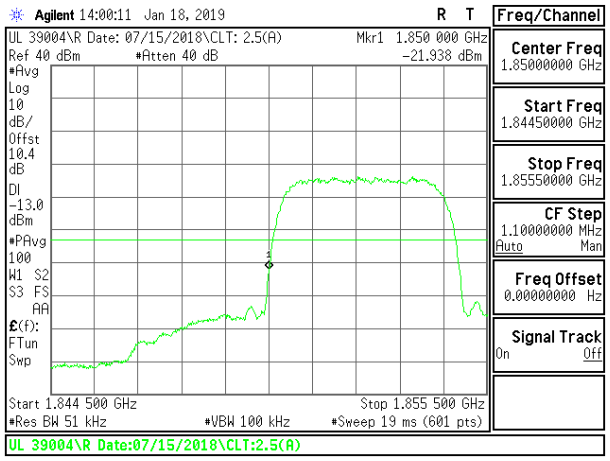
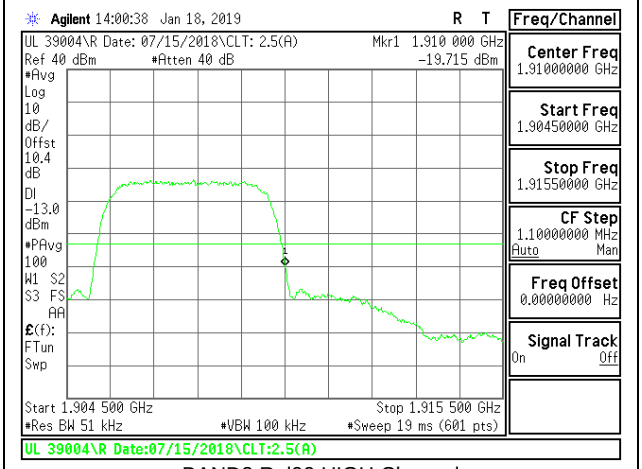
9.2.4. WCDMA BAND2

Rel99

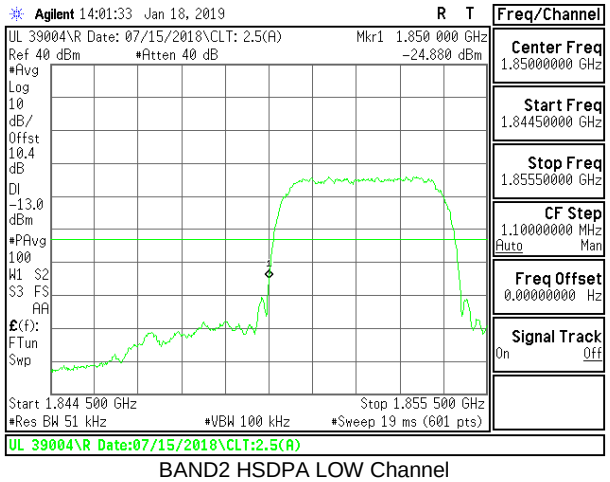


BAND2 Rel99 LOW Channel



BAND2 Rel99 HIGH Channel

HSDPA



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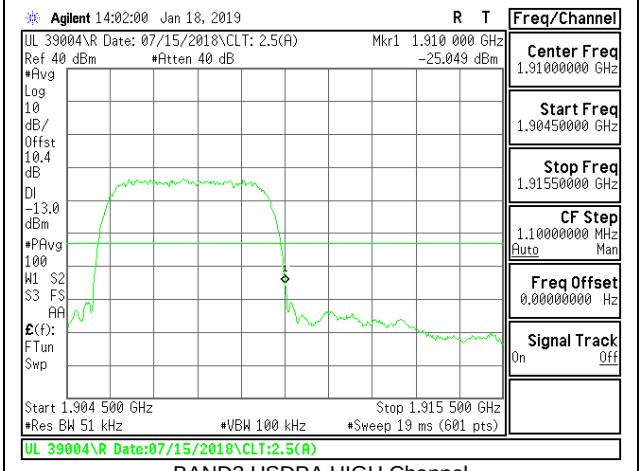

BAND2 HSDPA HIGH Channel

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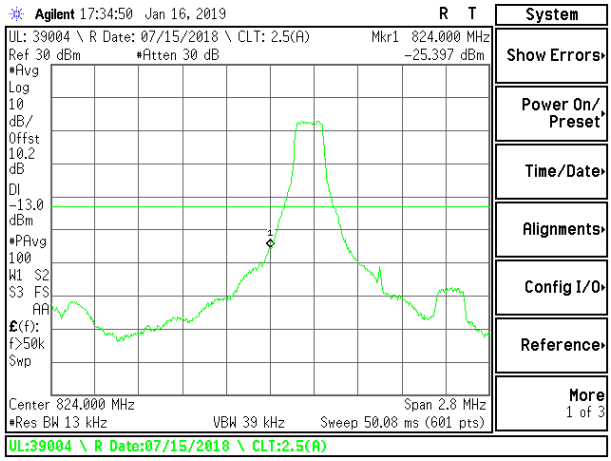
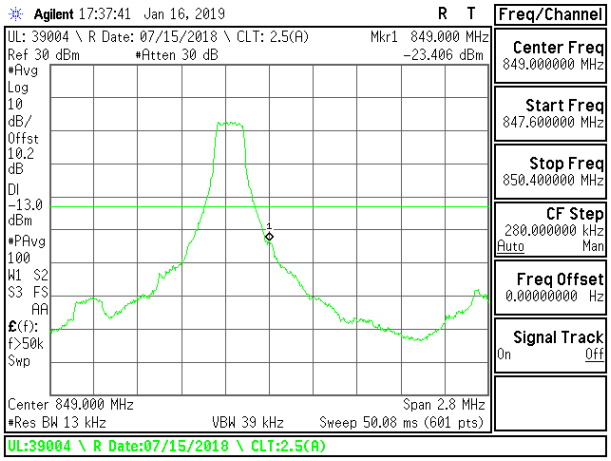
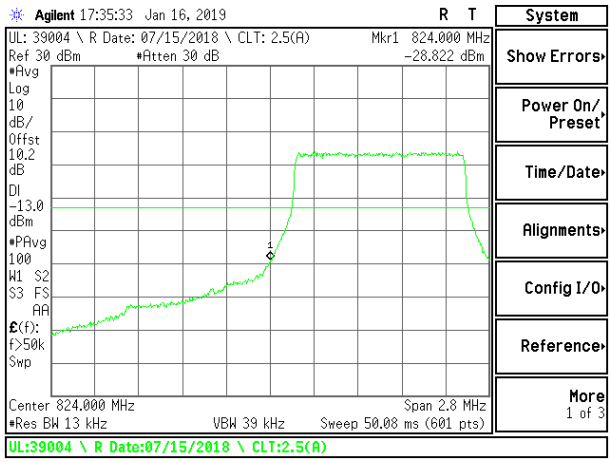
9.2.5. LTE BAND 5 BANDEDGE



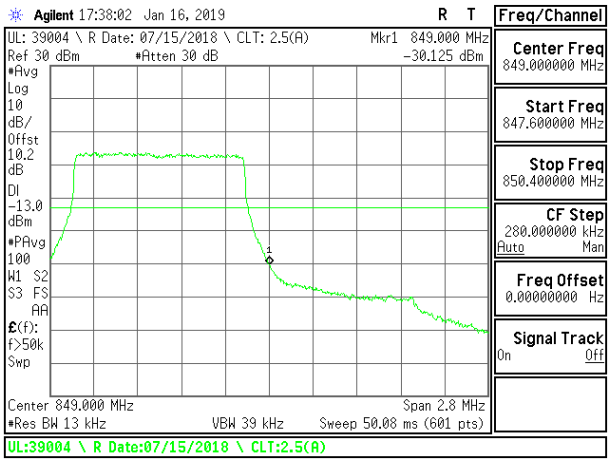
LTE B5 1.4MHz QPSK Low Channel RB1-0



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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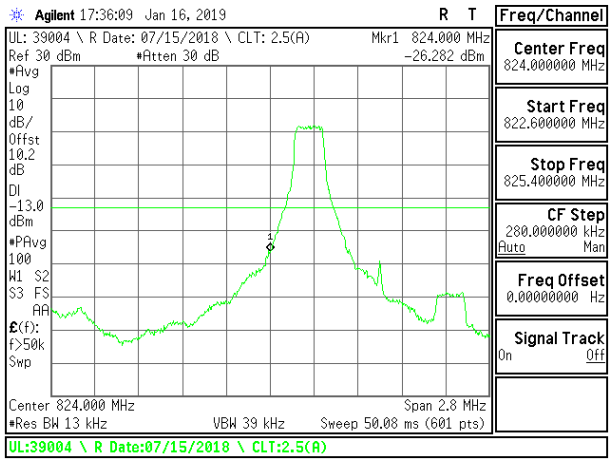
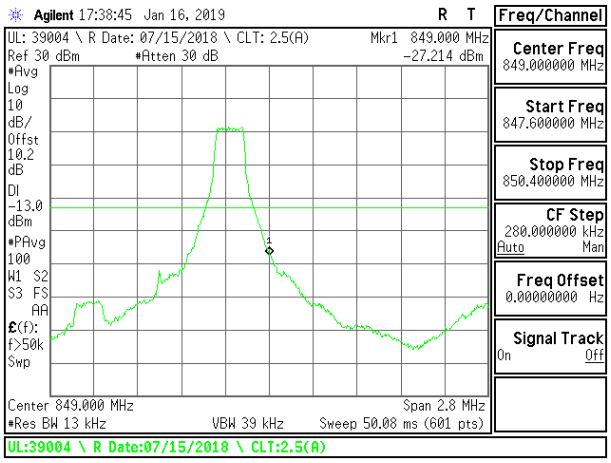
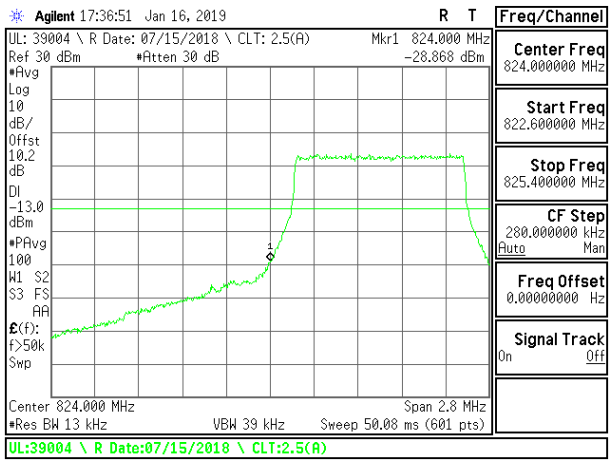


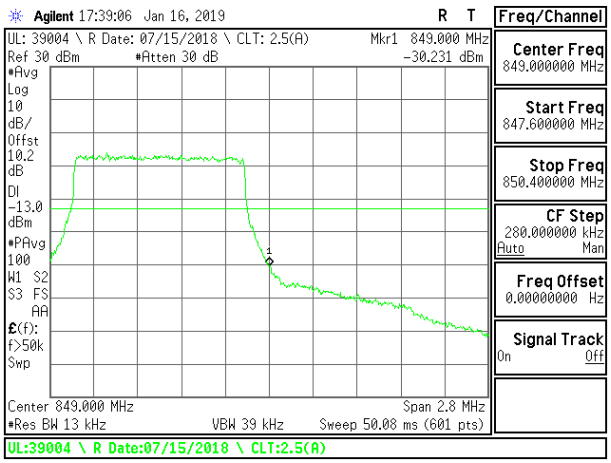
LTE B5 1.4MHz 16QAM Low Channel RB1-0



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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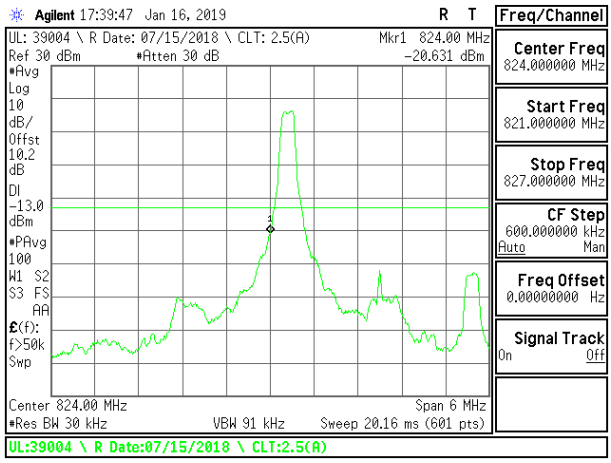
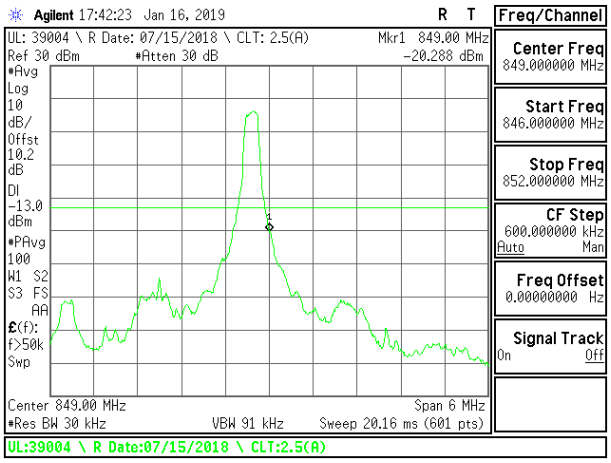
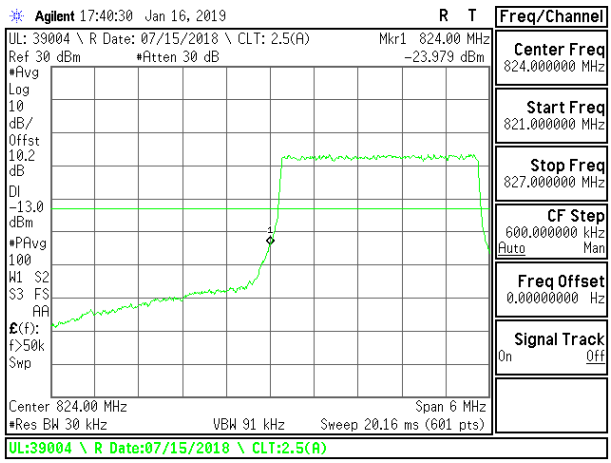


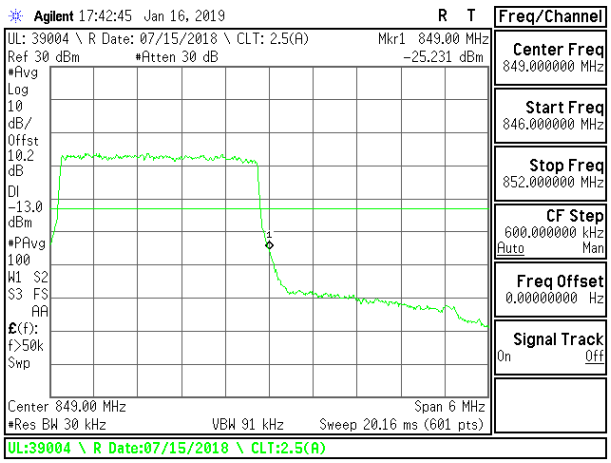
LTE B5 3MHz QPSK Low Channel RB1-0



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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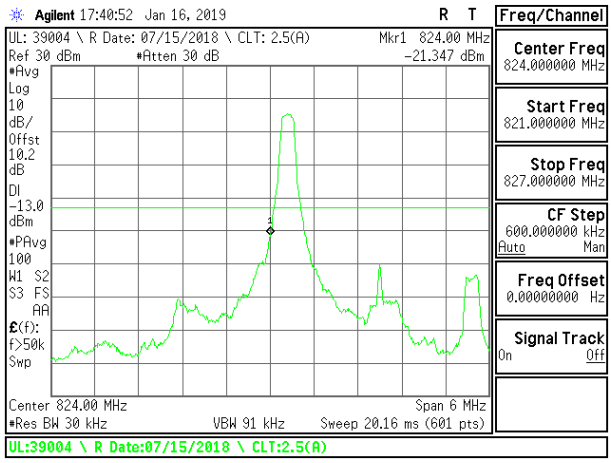
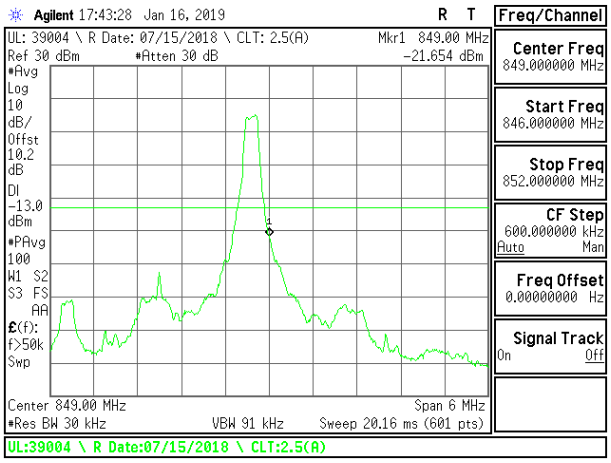
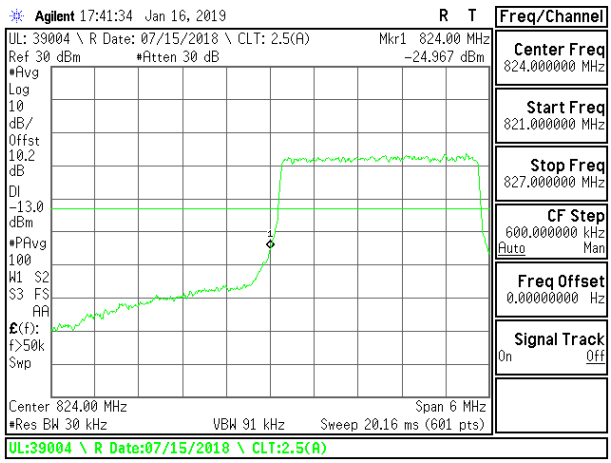


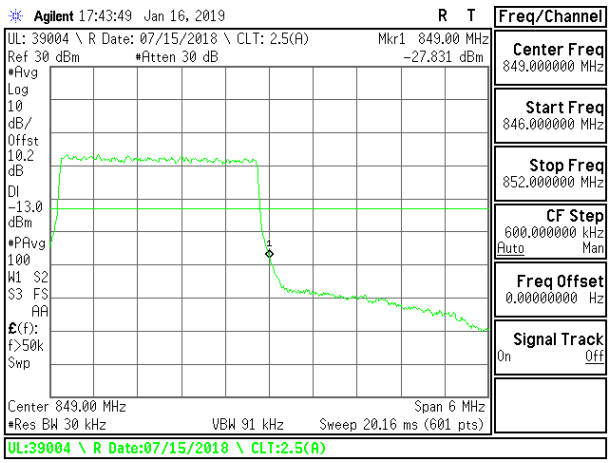
LTE B5 3MHz 16QAM Low Channel RB1-0



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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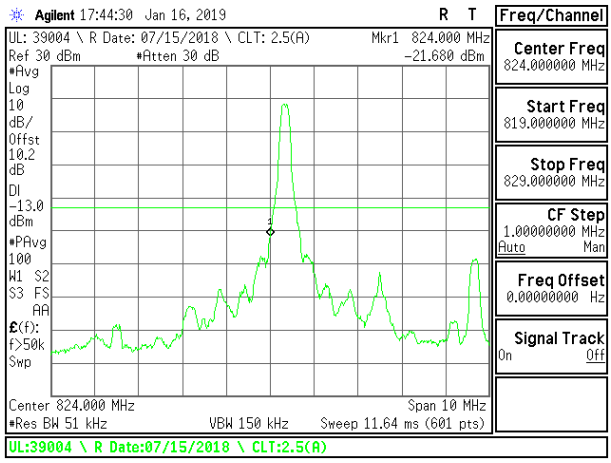
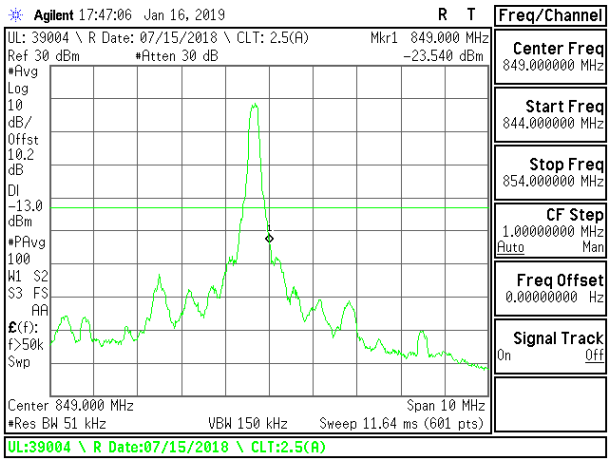
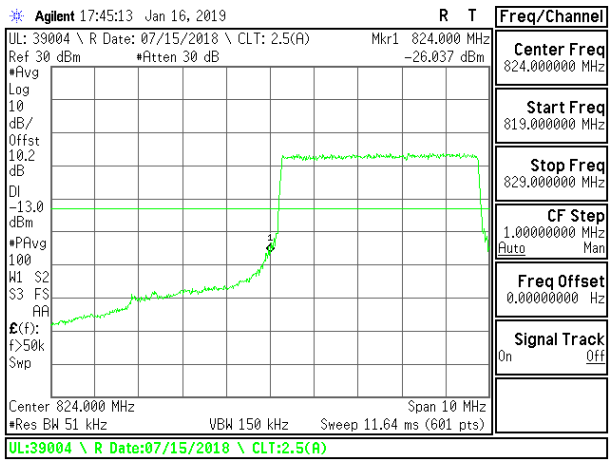


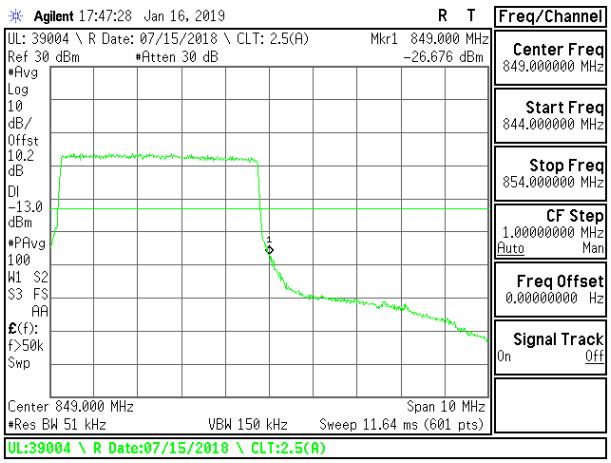
LTE B5 5MHz QPSK Low Channel RB1-0



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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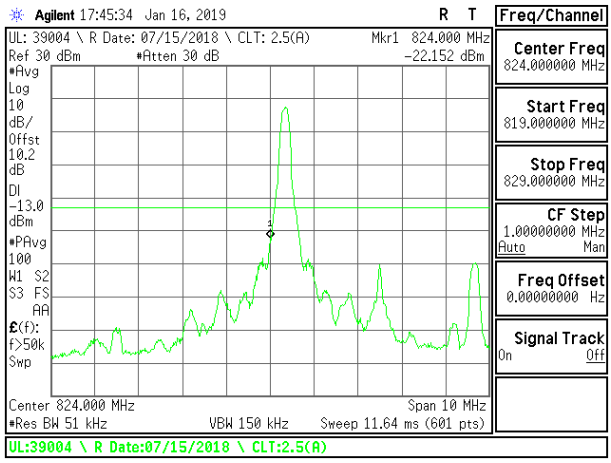
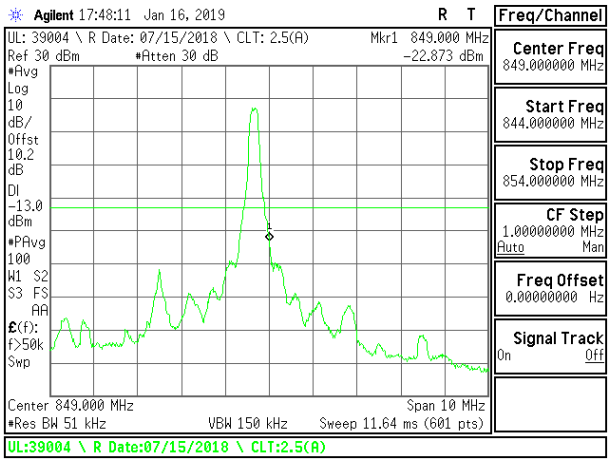
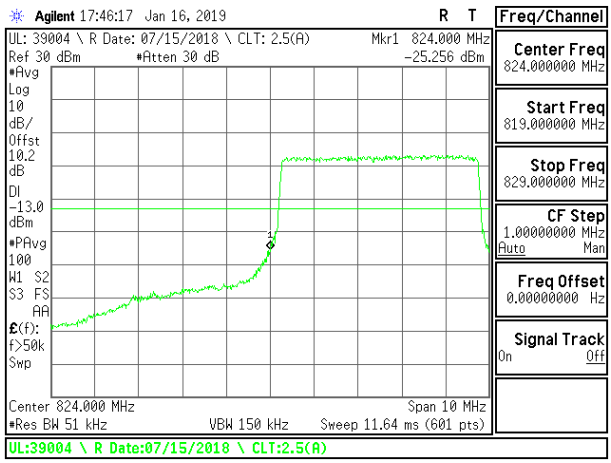


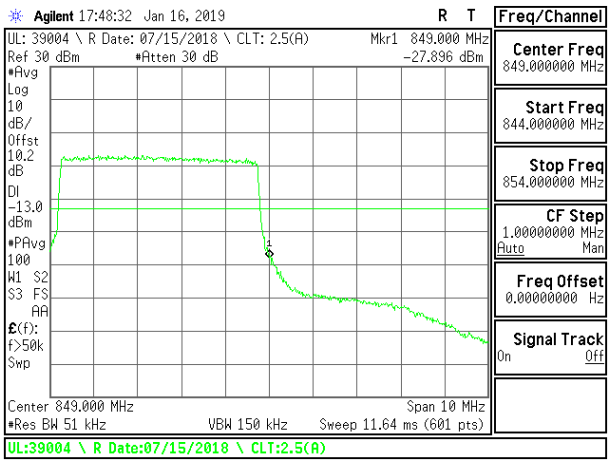
LTE B5 5MHz 16QAM Low Channel RB1-0



LTE B5 5MHz 16QAM High Channel RB1-24



LTE B5 5MHz 16QAM Low Channel RB25-0



LTE B5 5MHz 16QAM High Channel RB25-0

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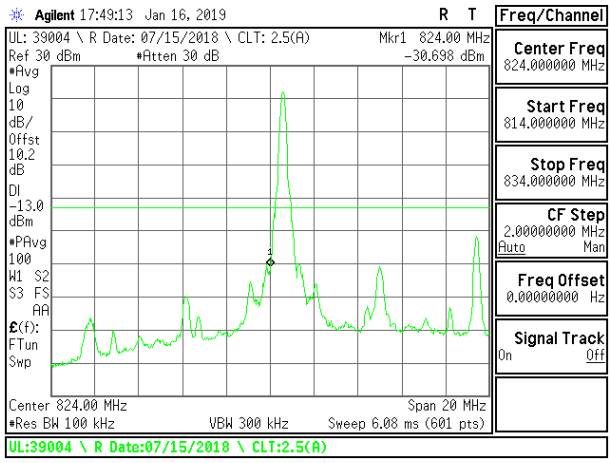
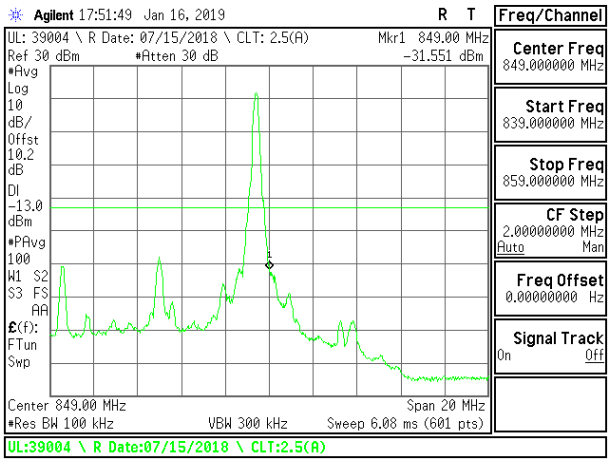


LTE B5 10MHz QPSK Low Channel RB1-0



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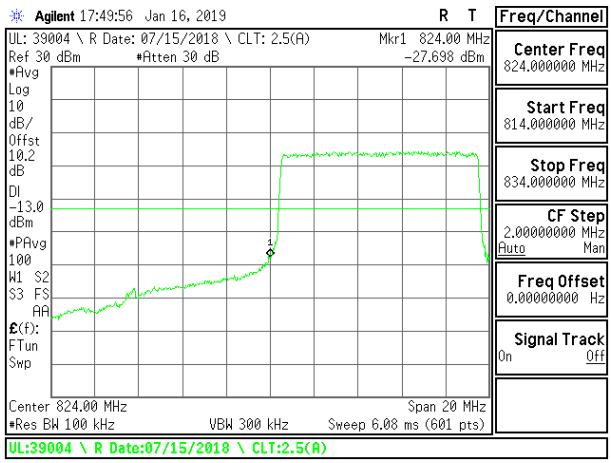

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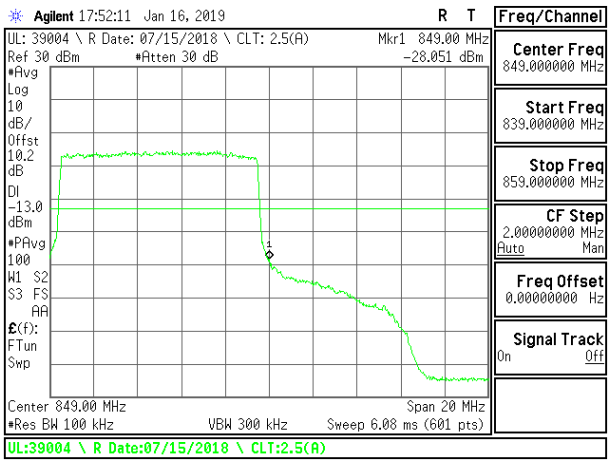

LTE B5 10MHz QPSK High Channel RB50-0

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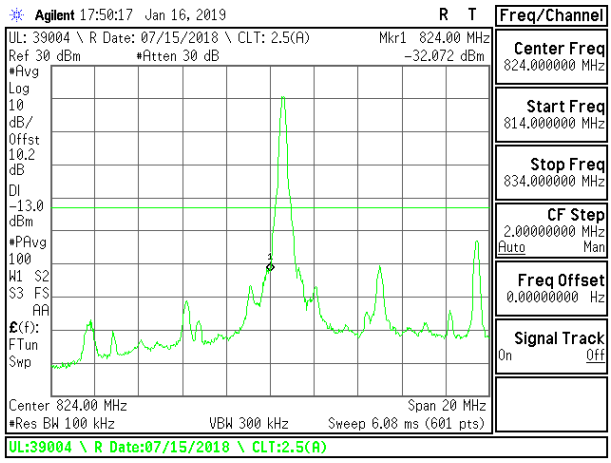
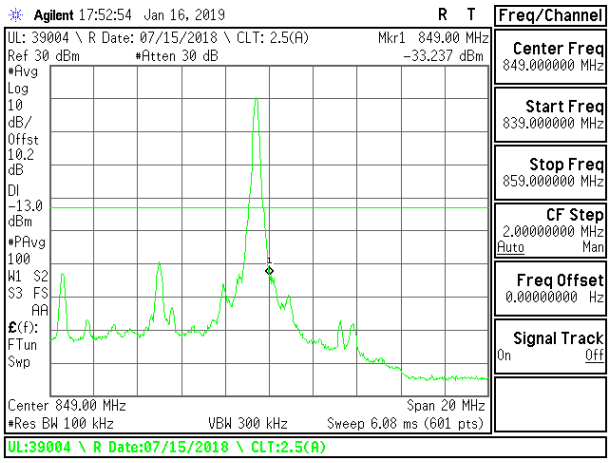
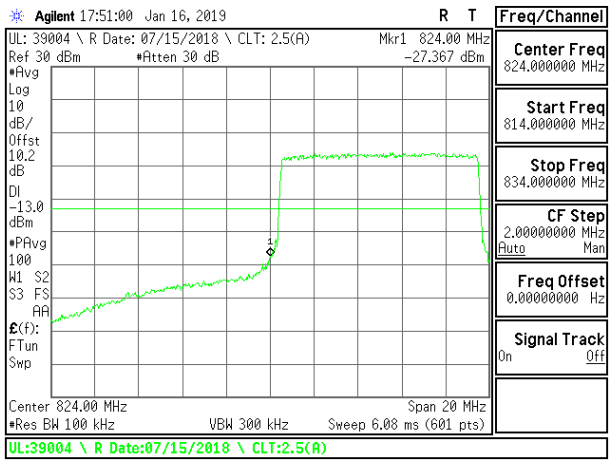


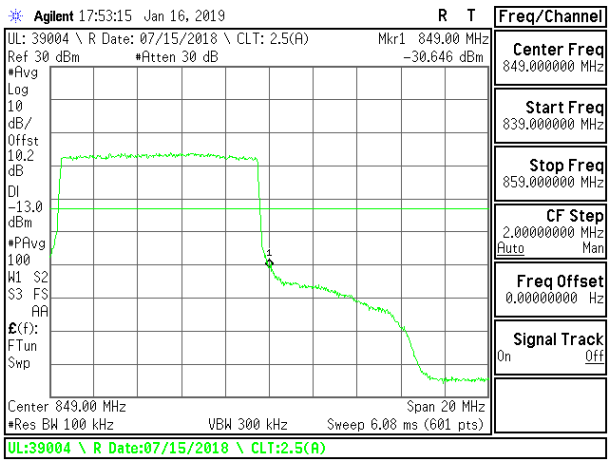
LTE B5 10MHz 16QAM Low Channel RB1-0



LTE B5 10MHz 16QAM High Channel RB1-49



LTE B5 10MHz 16QAM Low Channel RB50-0



LTE B5 10MHz 16QAM High Channel RB50-0

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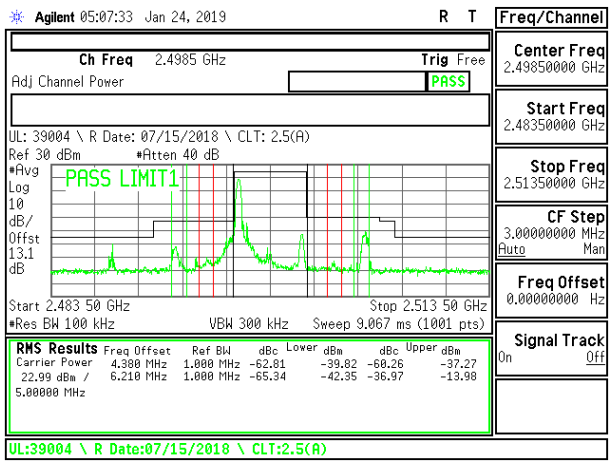
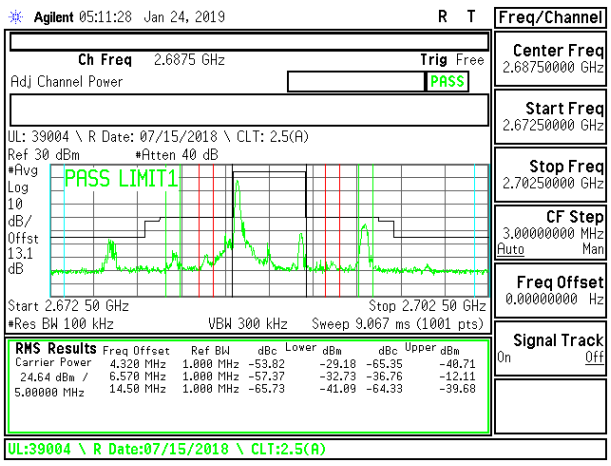
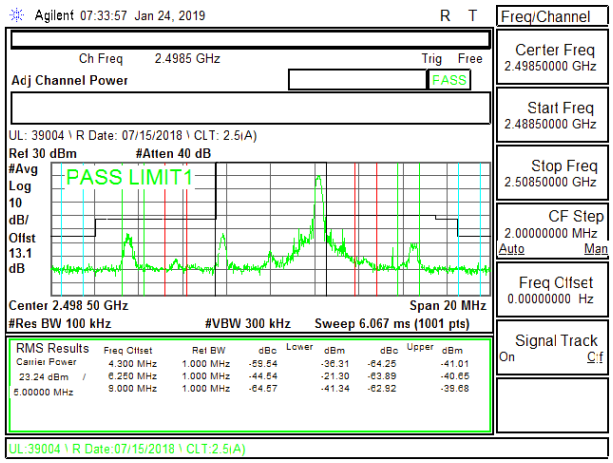
9.2.6. LTE BAND 41 ADJACENT CHANNEL POWER



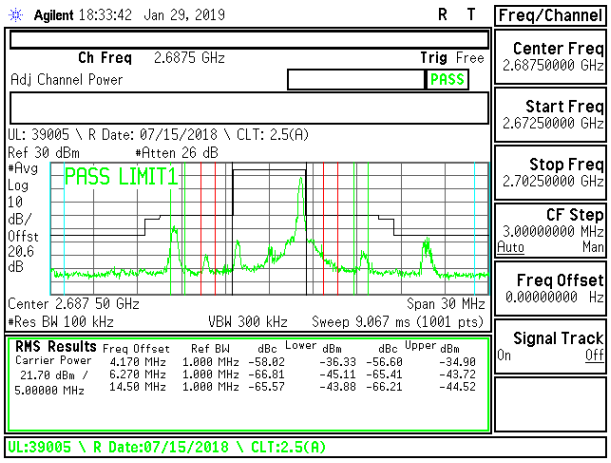
LTE B41 5MHz QPSK Low Channel RB1-0



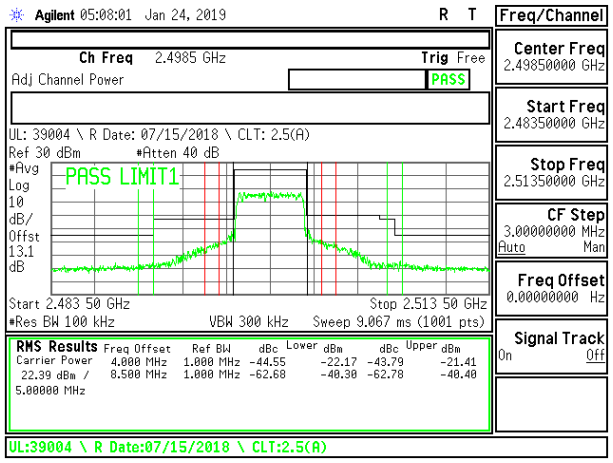
LTE B41 5MHz QPSK High Channel RB1-0



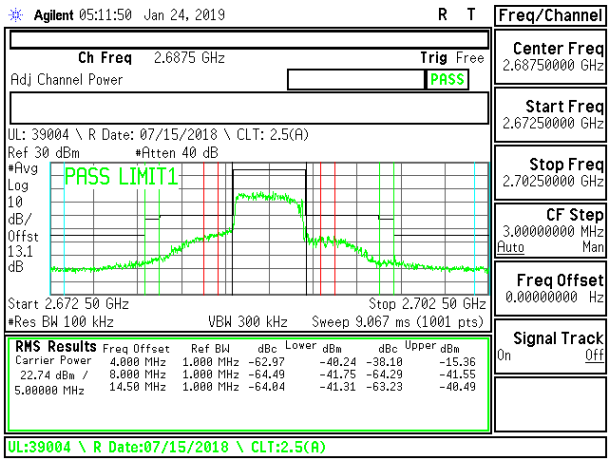
LTE B41 5MHz QPSK Low Channel RB1-24



LTE B41 5MHz QPSK High Channel RB1-24



LTE B41 5MHz QPSK Low Channel RB25-0



LTE B41 5MHz QPSK High Channel RB25-0

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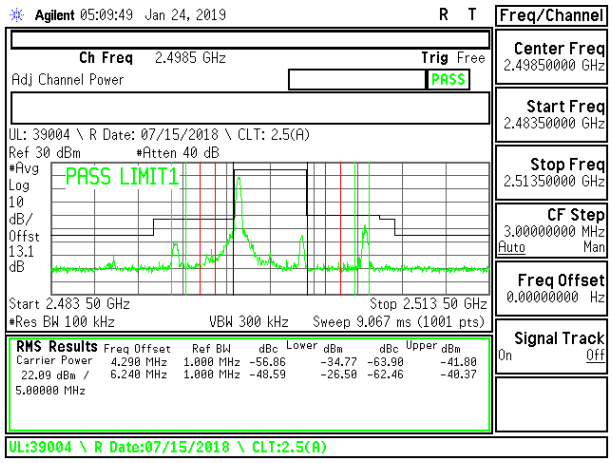
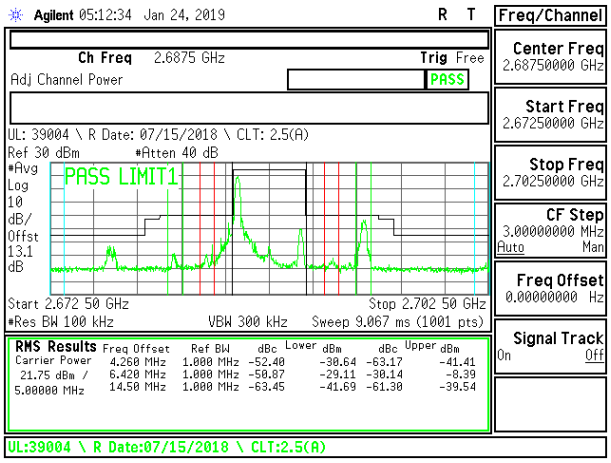
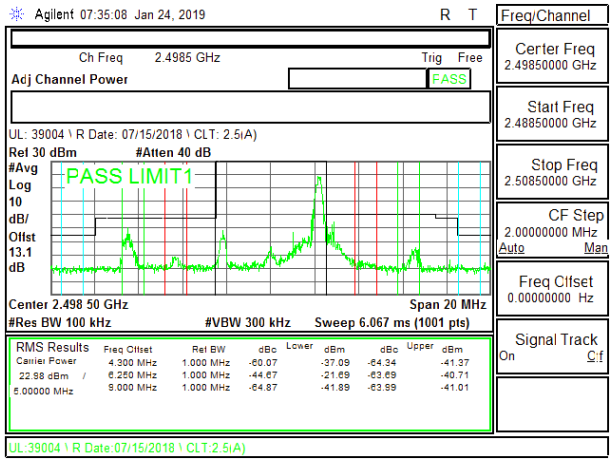


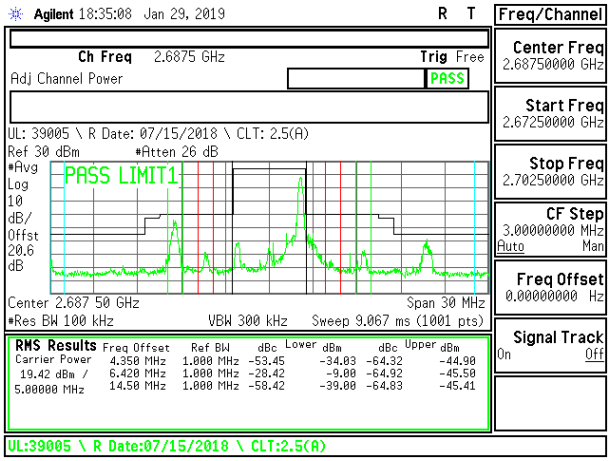
LTE B41 5MHz 16QAM Low Channel RB1-0



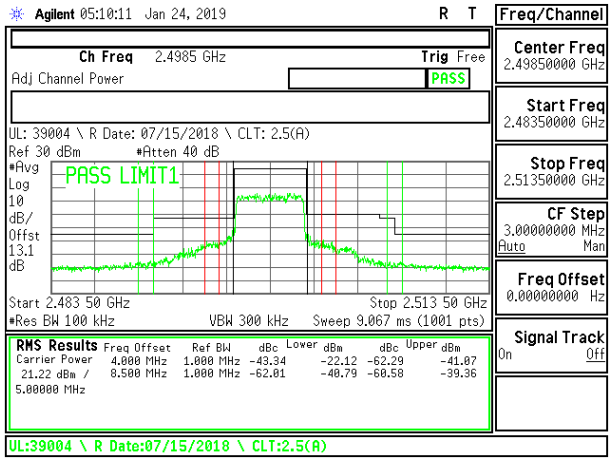
LTE B41 5MHz 16QAM High Channel RB1-0



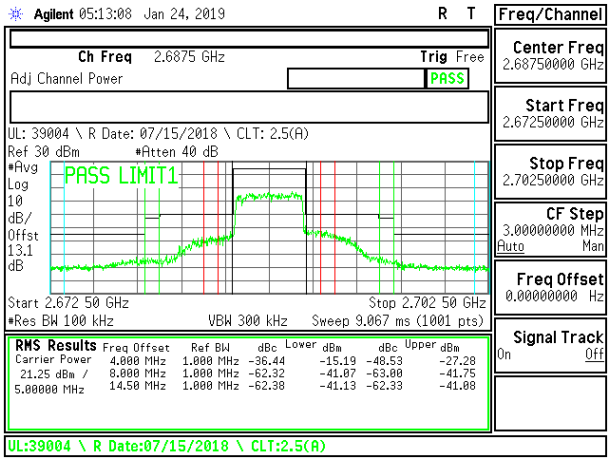
LTE B41 5MHz 16QAM Low Channel RB1-24



LTE B41 5MHz 16QAM High Channel RB1-24



LTE B41 5MHz 16QAM Low Channel RB25-0



LTE B41 5MHz 16QAM High Channel RB25-0

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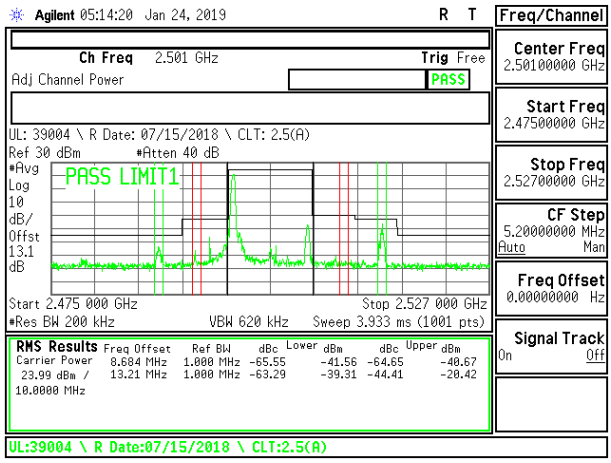
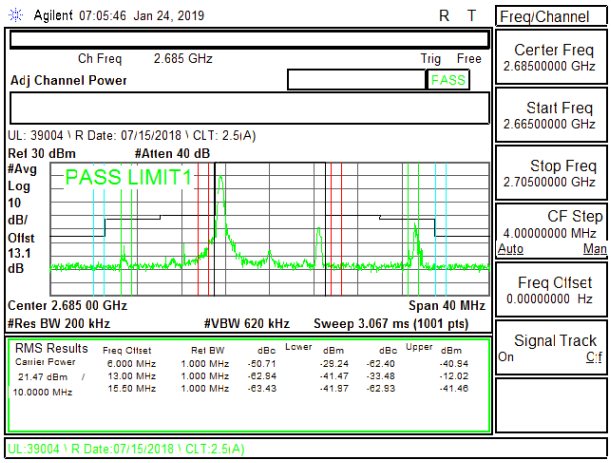
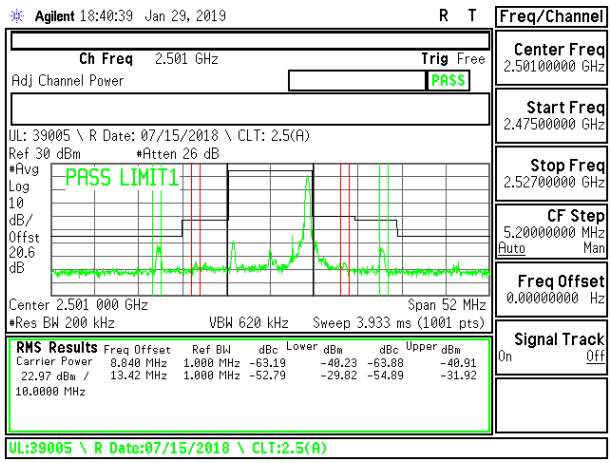


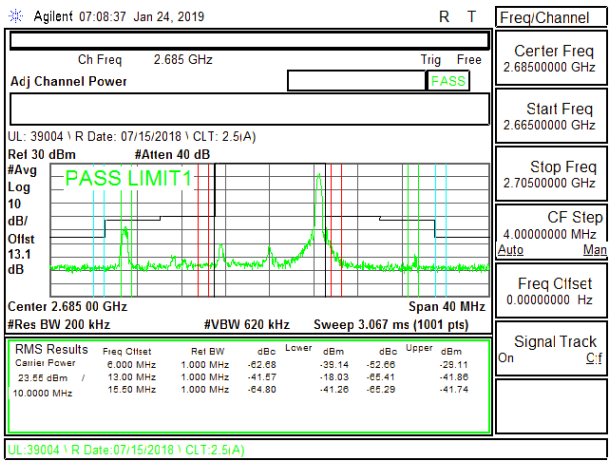
LTE B41 10MHz QPSK Low Channel RB1-0



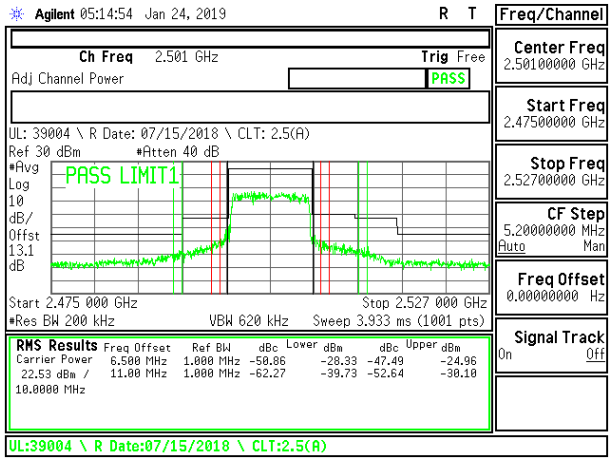
LTE B41 10MHz QPSK High Channel RB1-0



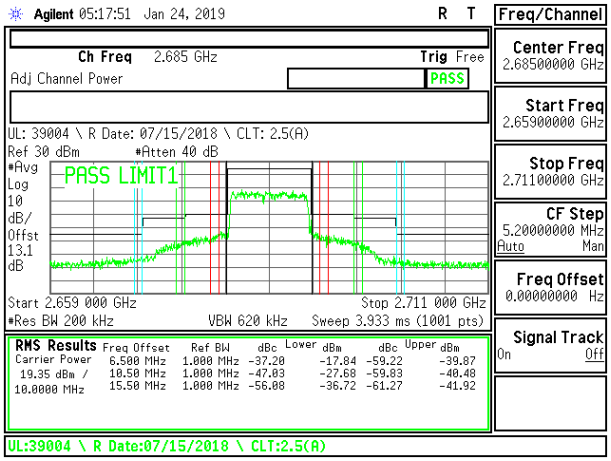
LTE B41 10MHz QPSK Low Channel RB1-49



LTE B41 10MHz QPSK High Channel RB1-49



LTE B41 10MHz QPSK Low Channel RB50-0



LTE B41 10MHz QPSK High Channel RB50-0

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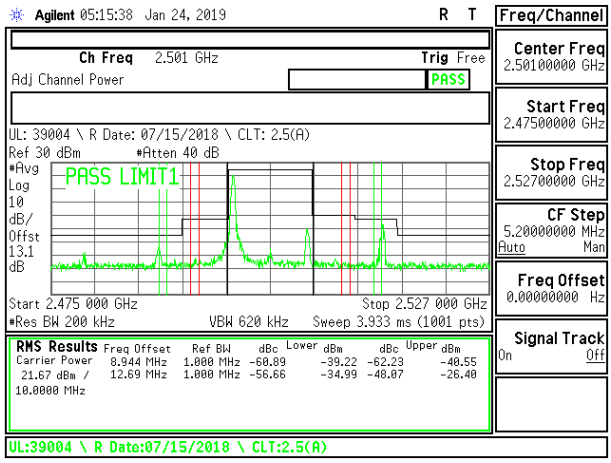
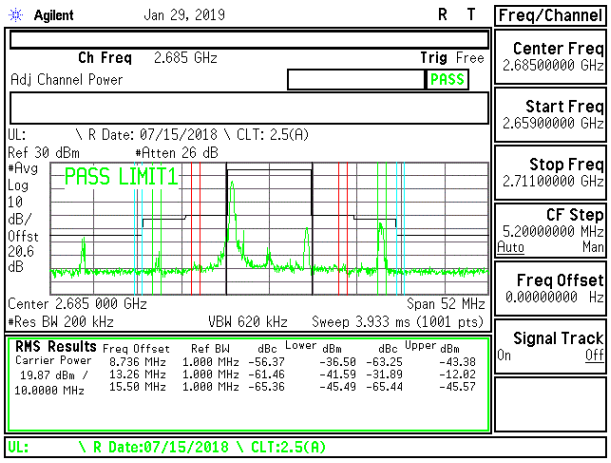
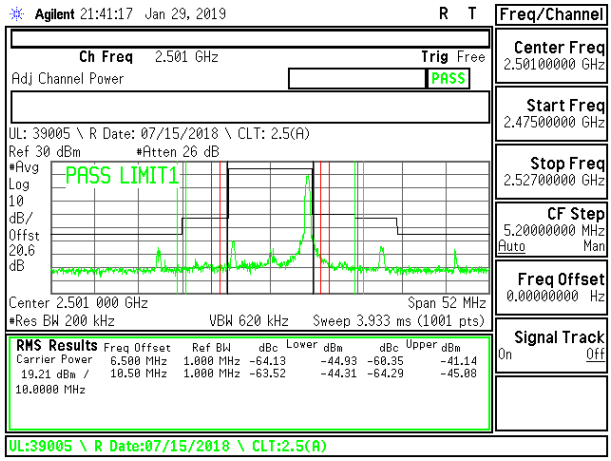


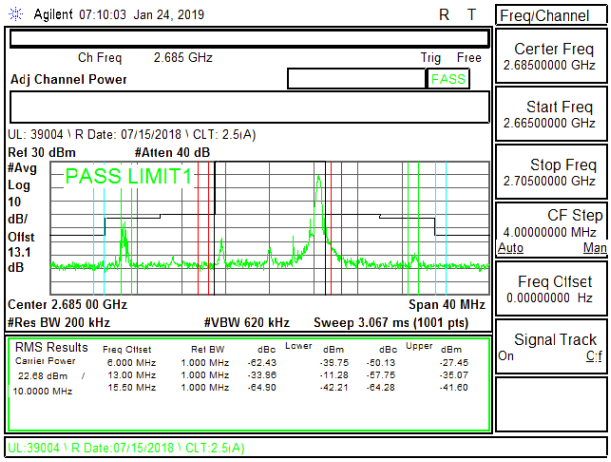
LTE B41 10MHz 16QAM Low Channel RB1-0



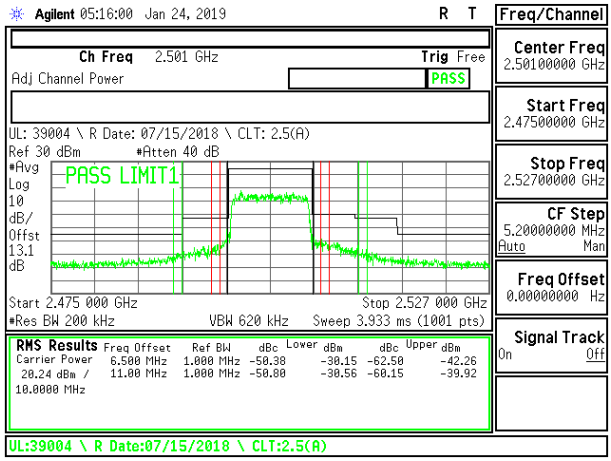
LTE B41 10MHz 16QAM High Channel RB1-0



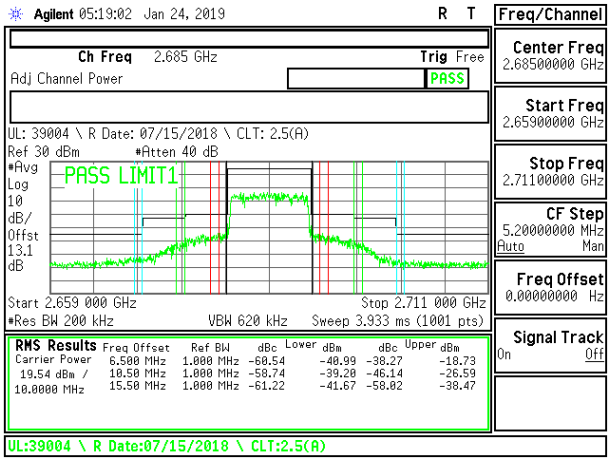
LTE B41 10MHz 16QAM Low Channel RB1-49



LTE B41 10MHz 16QAM High Channel RB1-49



LTE B41 10MHz 16QAM Low Channel RB50-0



LTE B41 10MHz 16QAM High Channel RB50-0

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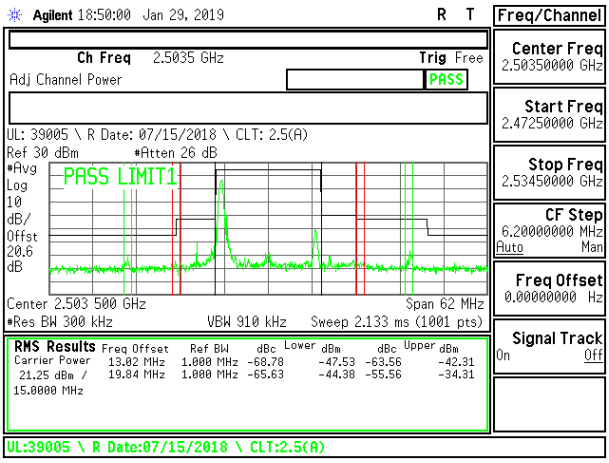
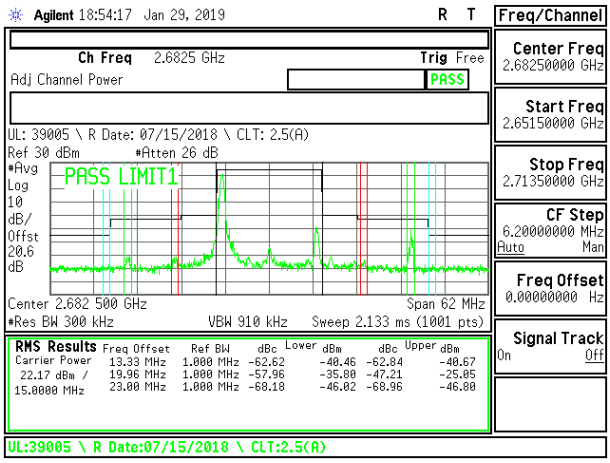
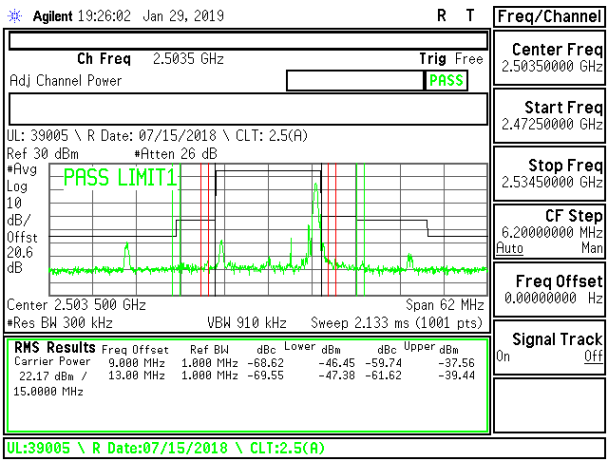


LTE B41 15MHz QPSK Low Channel RB1-0



LTE B41 15MHz QPSK High Channel RB1-0



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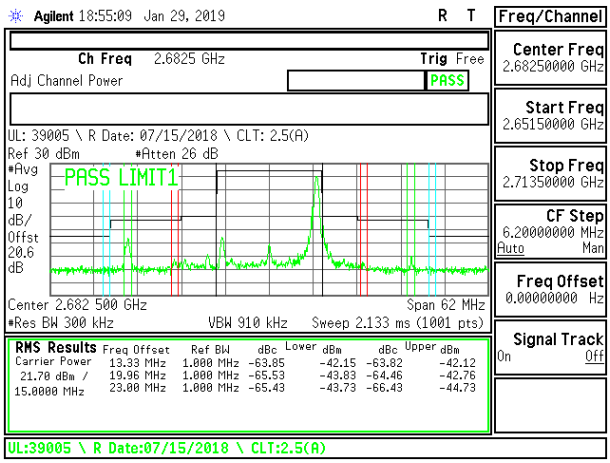
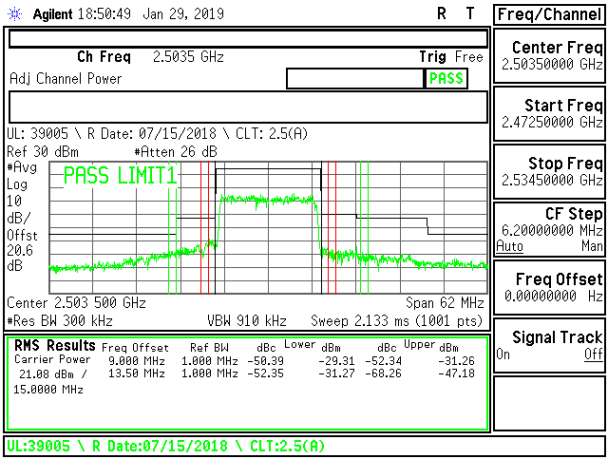
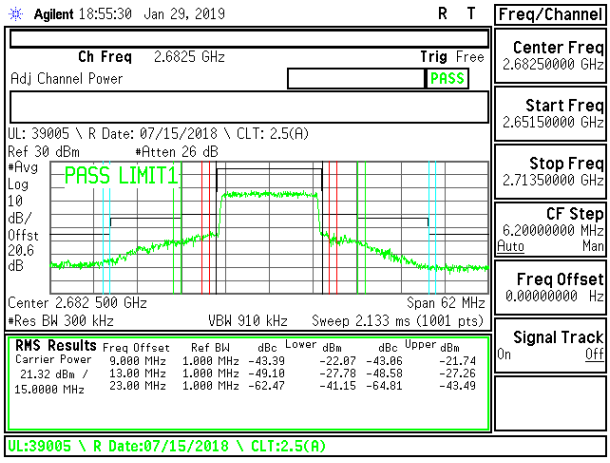


LTE B41 15MHz QPSK High Channel RB1-74



LTE B41 15MHz QPSK Low Channel RB75-0



LTE B41 15MHz QPSK High Channel RB75-0

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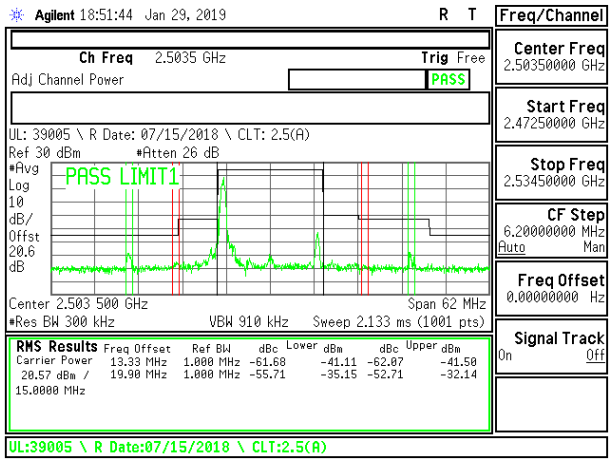
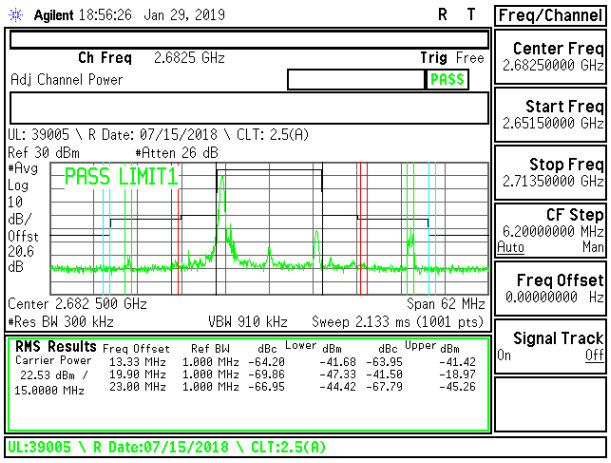
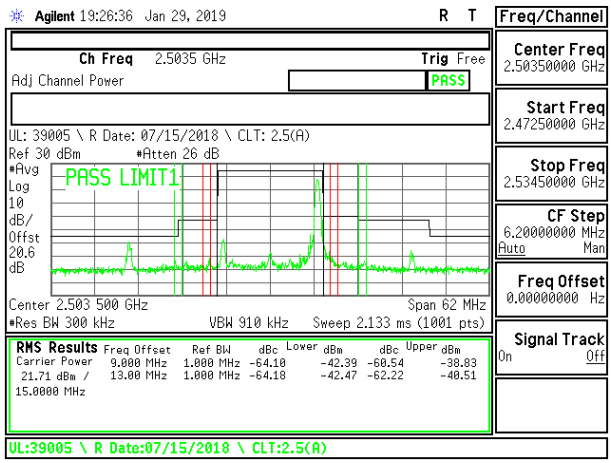


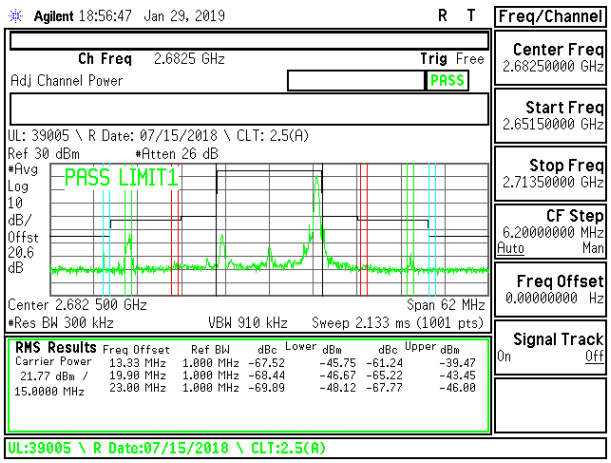
LTE B41 15MHz 16QAM Low Channel RB1-0



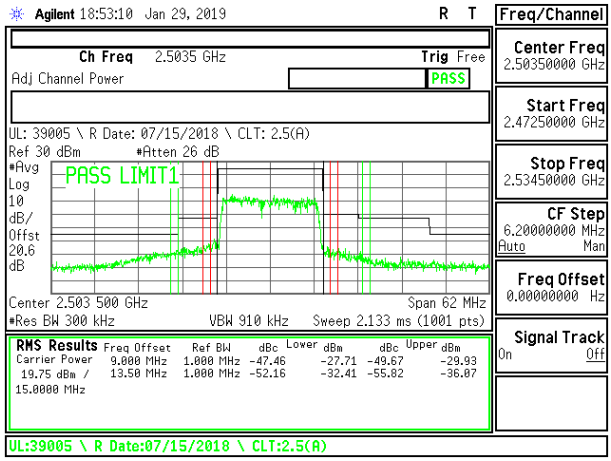
LTE B41 15MHz 16QAM High Channel RB1-0



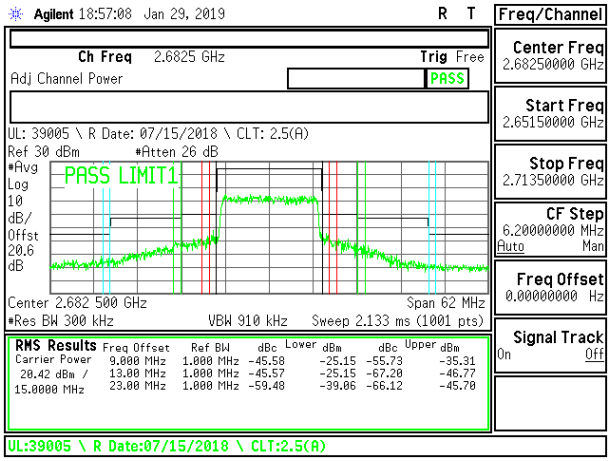
LTE B41 15MHz 16QAM Low Channel RB1-74



LTE B41 15MHz 16QAM High Channel RB1-74



LTE B41 15MHz 16QAM Low Channel RB75-0



LTE B41 15MHz 16QAM High Channel RB75-0

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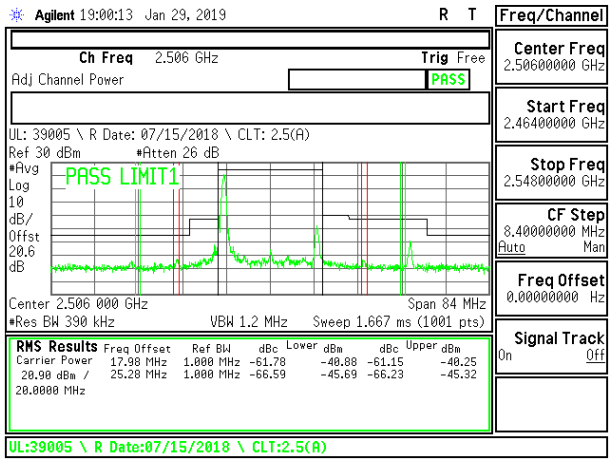
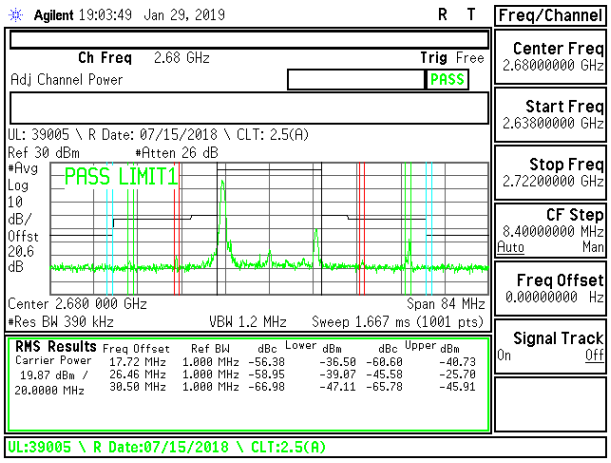
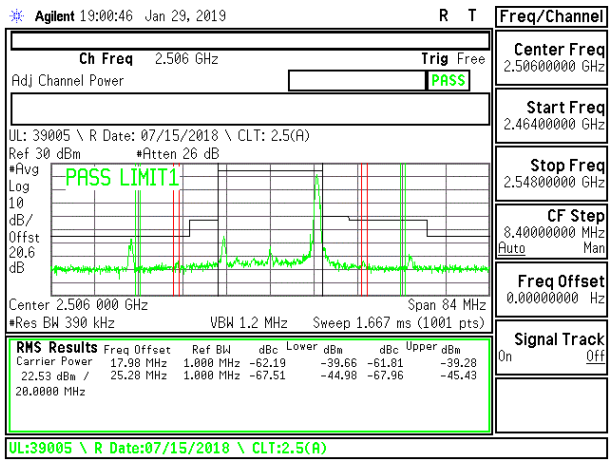


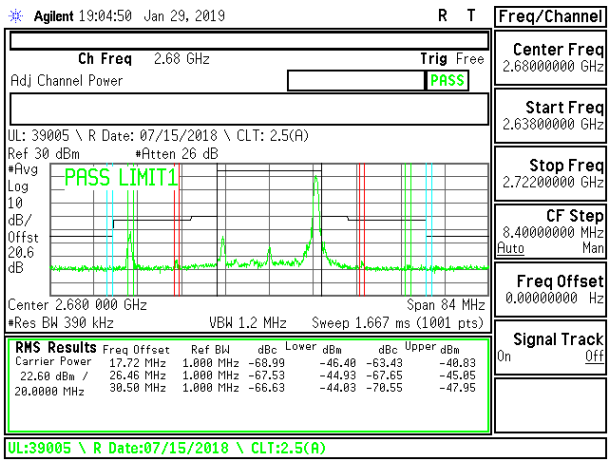
LTE B41 20MHz QPSK Low Channel RB1-0



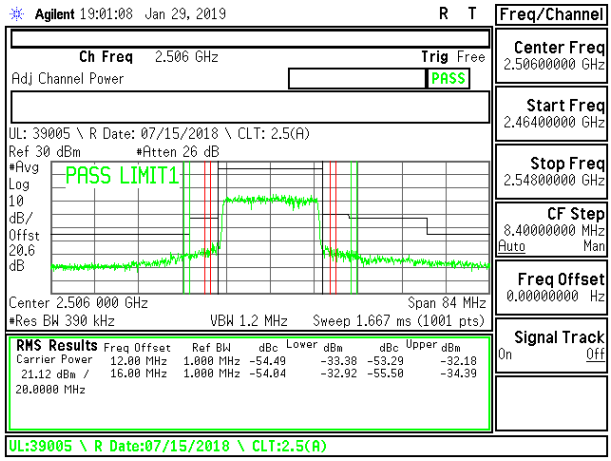
LTE B41 20MHz QPSK High Channel RB1-0



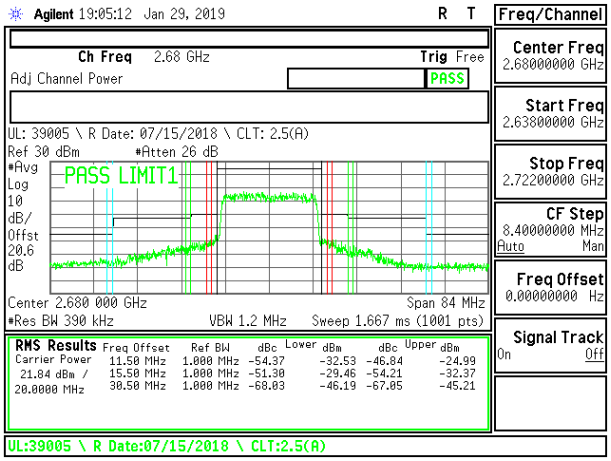
LTE B41 20MHz QPSK Low Channel RB1-99



LTE B41 20MHz QPSK High Channel RB1-99



LTE B41 20MHz QPSK Low Channel RB100-0



LTE B41 20MHz QPSK High Channel RB100-0

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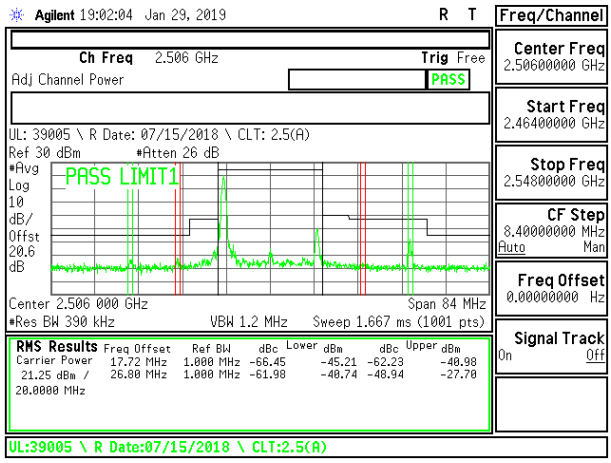
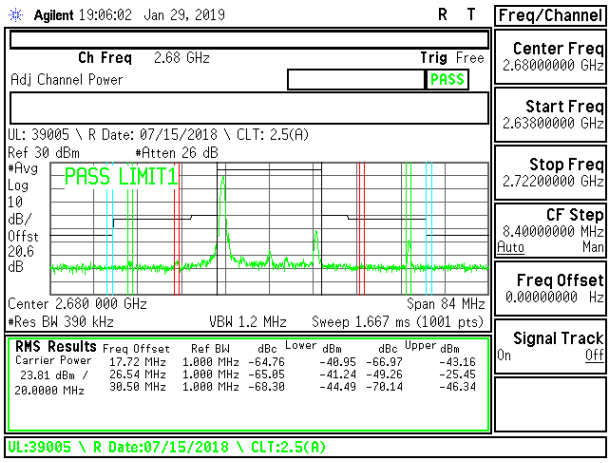
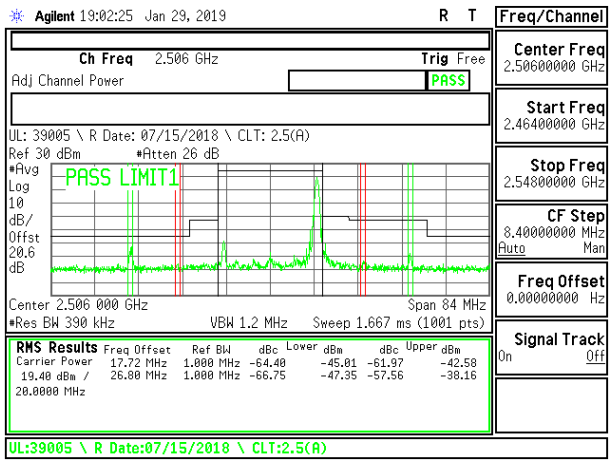


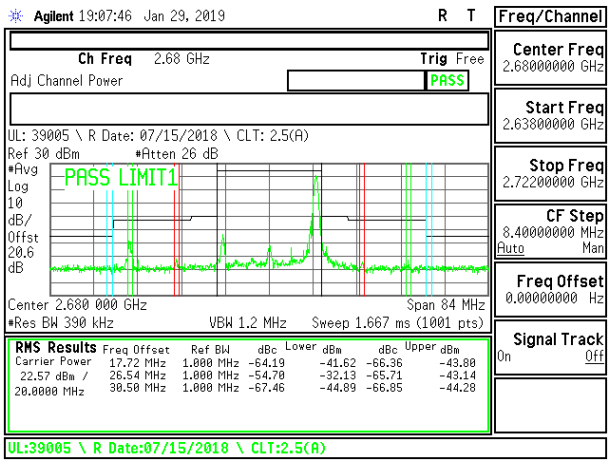
LTE B41 20MHz 16QAM Low Channel RB1-0



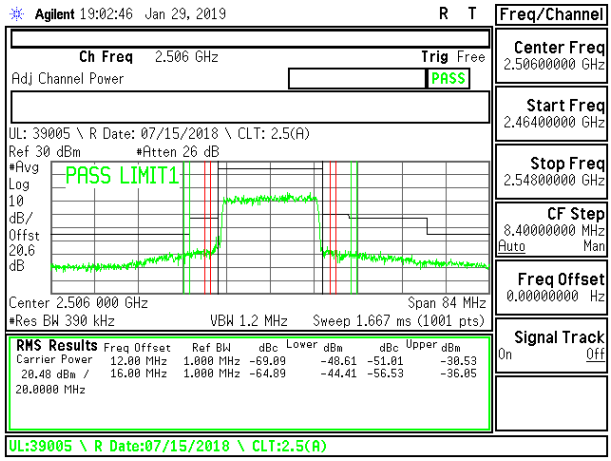
LTE B41 20MHz 16QAM High Channel RB1-0



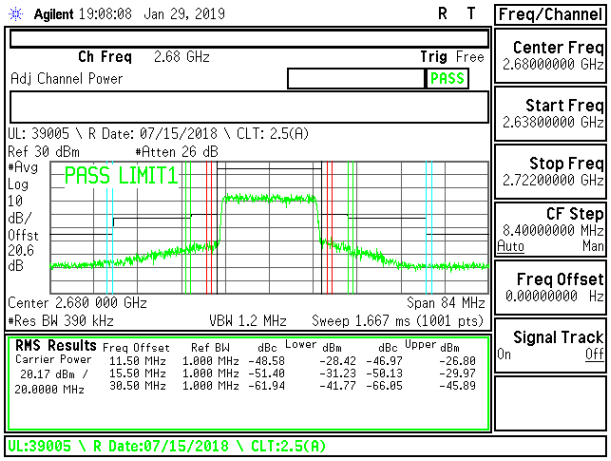
LTE B41 20MHz 16QAM Low Channel RB1-99



LTE B41 20MHz 16QAM High Channel RB1-99



LTE B41 20MHz 16QAM Low Channel RB100-0



LTE B41 20MHz 16QAM High Channel RB100-0

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9.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238, §27.53

LIMITS

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

FCC: §27.53 (m) (Band 41)
The minimum permissible attenuation level of any spurious emissions is 55 + 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, -25dBm and -40dBm according to the band Limit
- 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)

MODES TESTED

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

RESULTS

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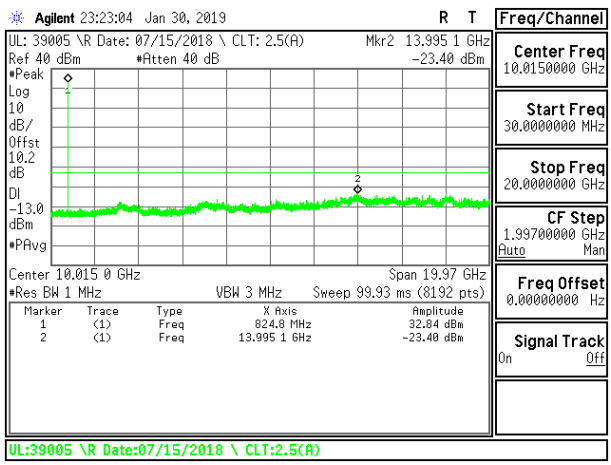
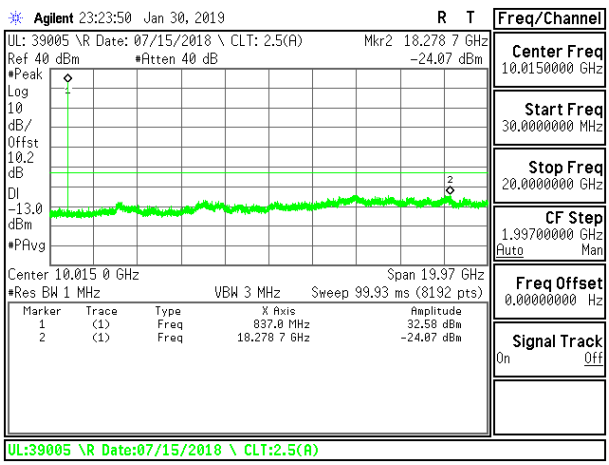
9.3.1. GSM850

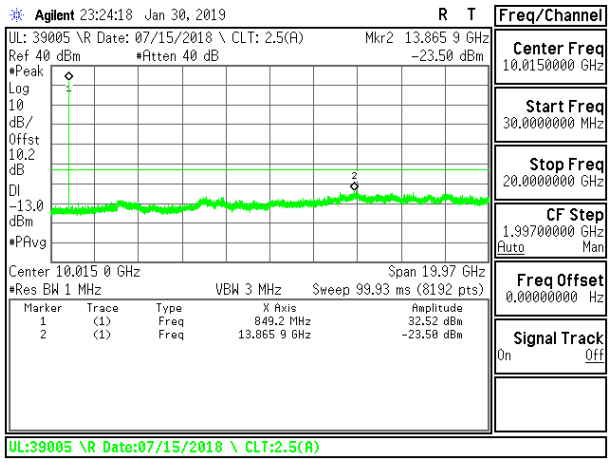
GPRS



GSM850 GPRS LOW Channel



GSM850 GPRS MID Channel



GSM850 GPRS HIGH Channel

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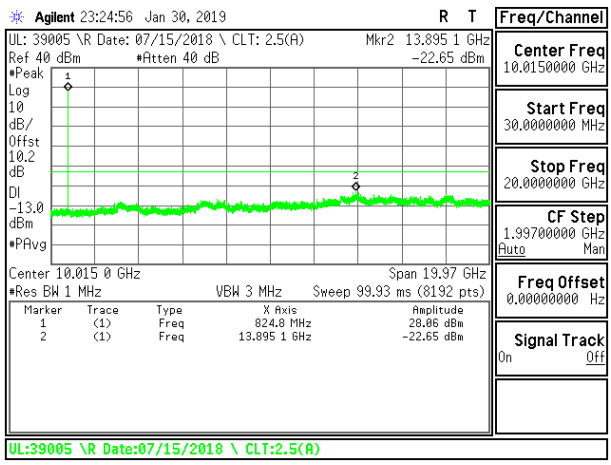
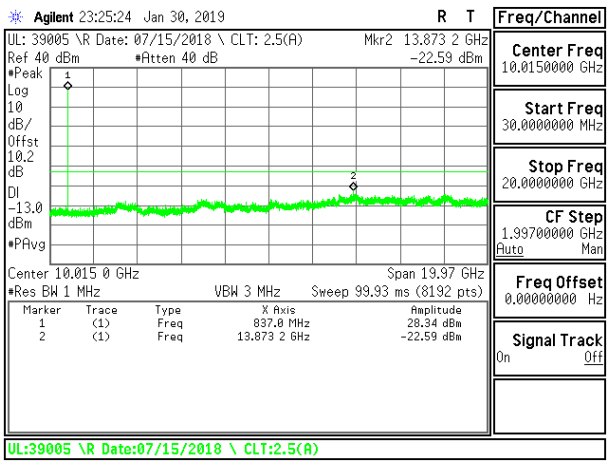
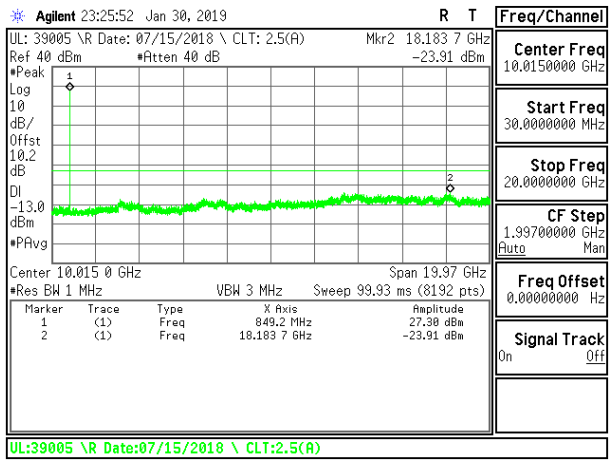
EGPRS



GSM850 EGPRS LOW Channel



GSM850 EGPRS MID Channel



GSM850 EGPRS HIGH Channel

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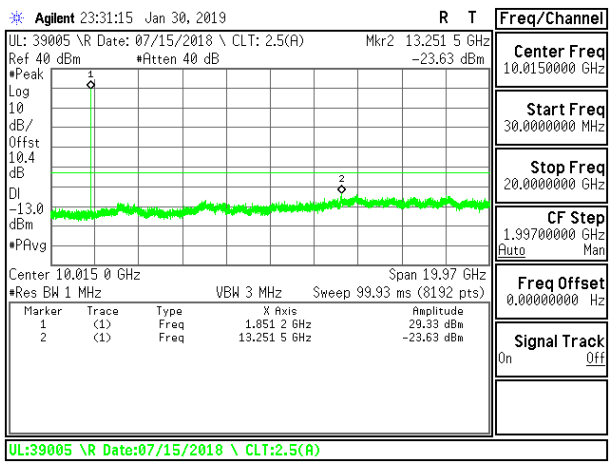
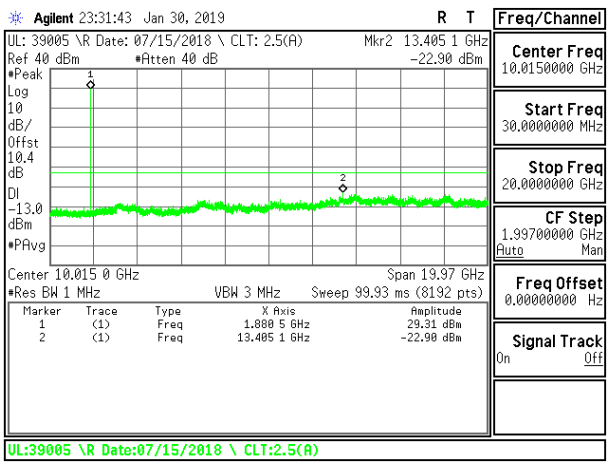
9.3.2. GSM1900

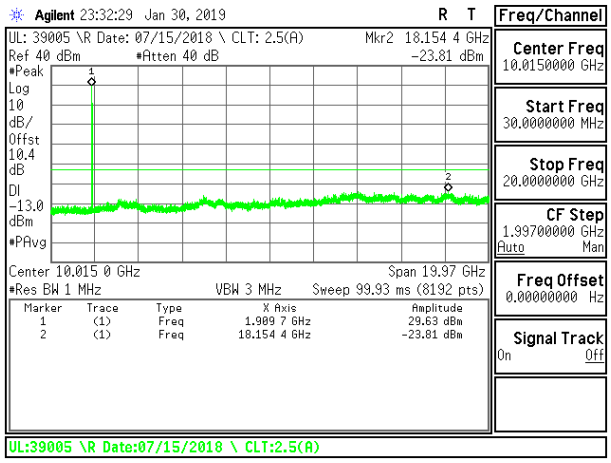
GPRS



GSM1900 GPRS LOW Channel



GSM1900 GPRS MID Channel



GSM1900 GPRS HIGH Channel

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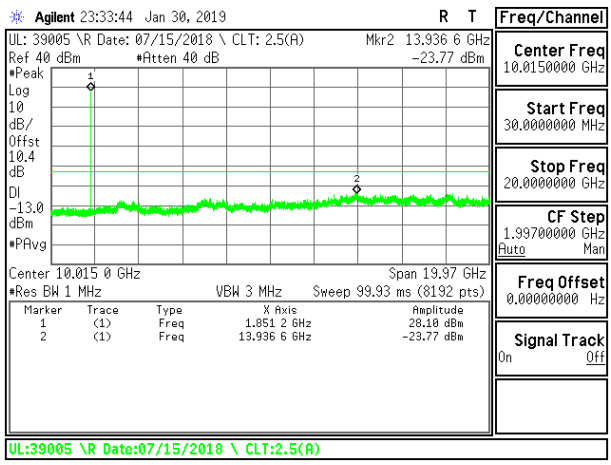
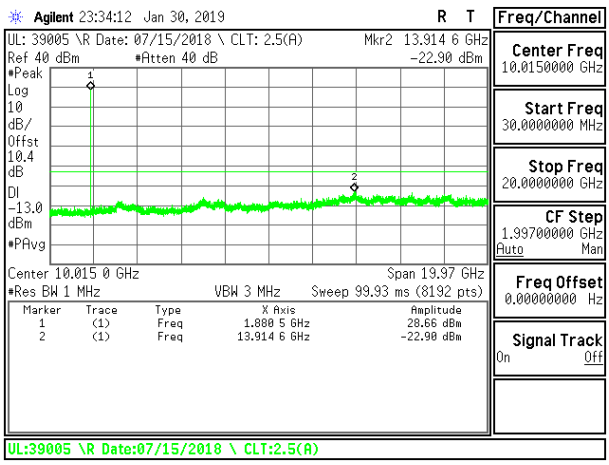
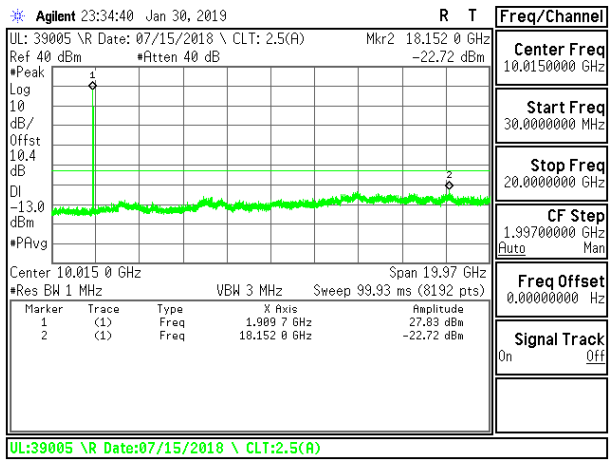
EGPRS



GSM1900 EGPRS LOW Channel



GSM1900 EGPRS MID Channel



GSM1900 EGPRS HIGH Channel

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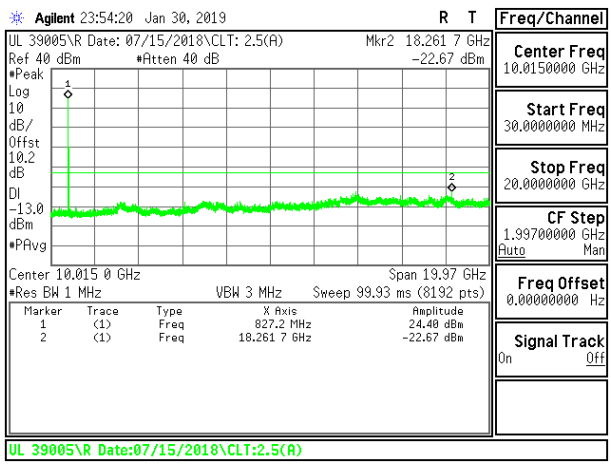
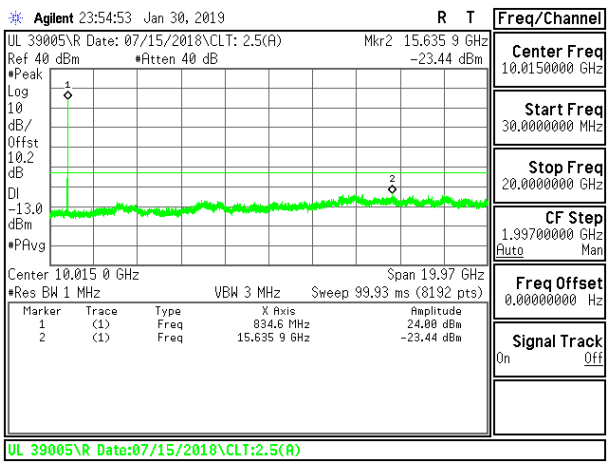
9.3.3. WCDMA BAND5

Rel99



BAND5 Rel99 LOW Channel



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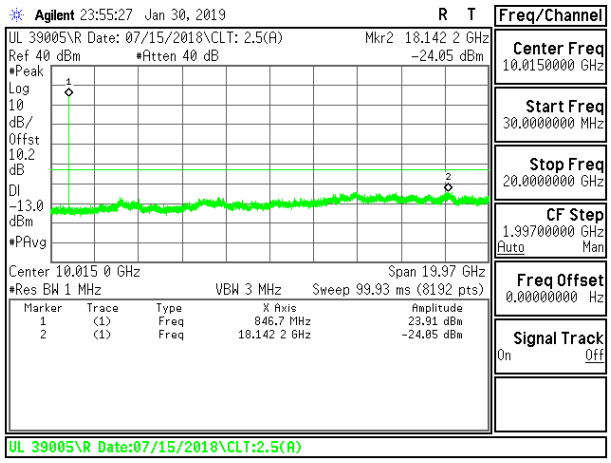

BAND5 Rel99 HIGH Channel

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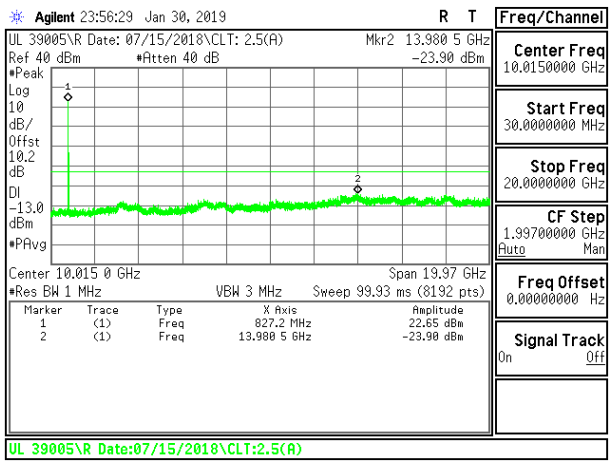
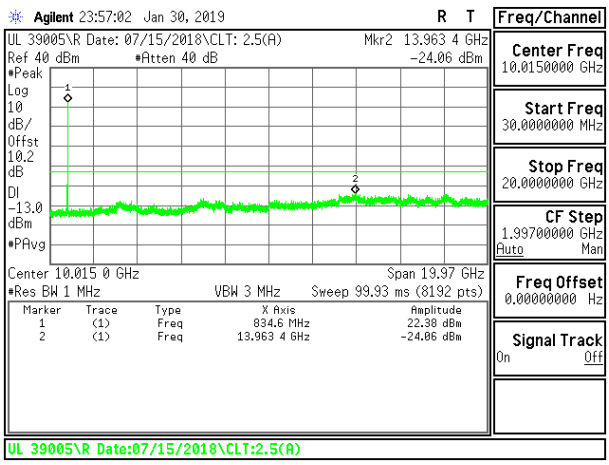
HSDPA



BAND5 HSDPA LOW Channel



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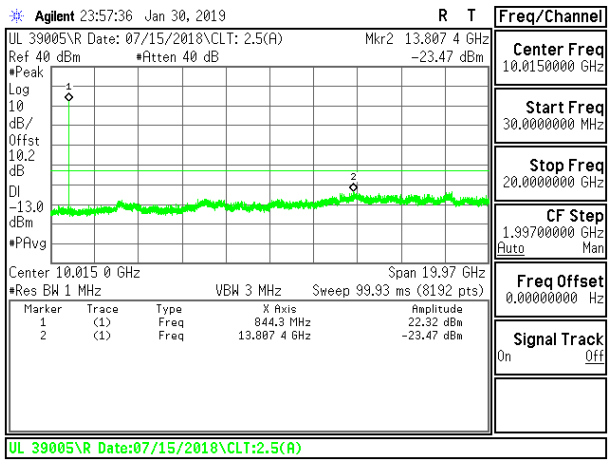

BAND5 HSDPA HIGH Channel

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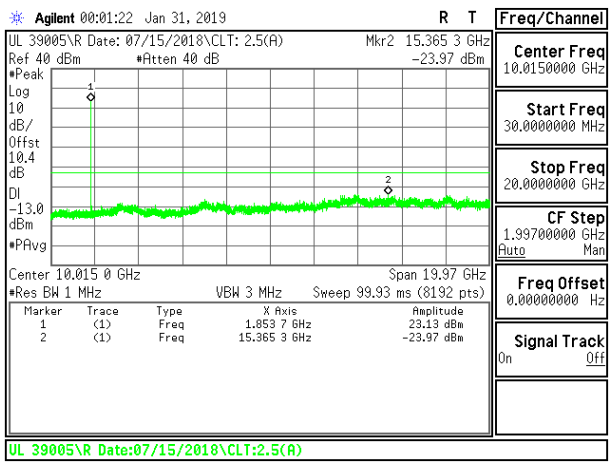
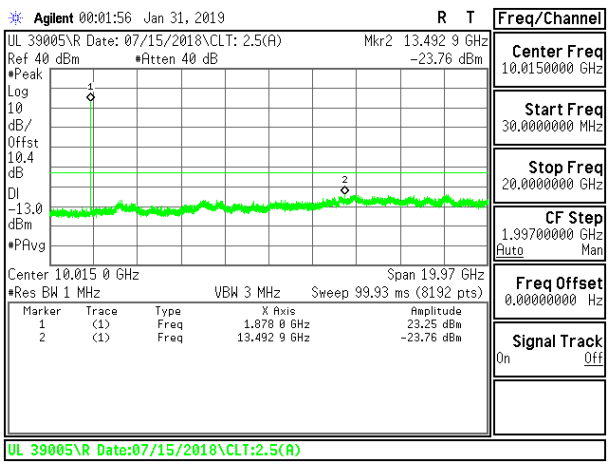
9.3.4. WCDMA BAND2

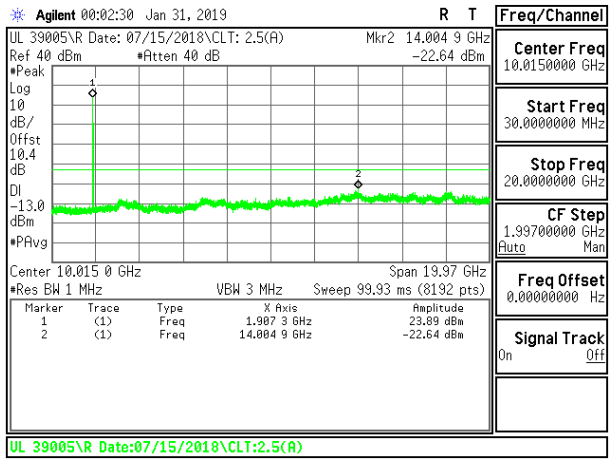
Rel99



BAND2 Rel99 LOW Channel



BAND2 Rel99 MID Channel



BAND2 Rel99 HIGH Channel

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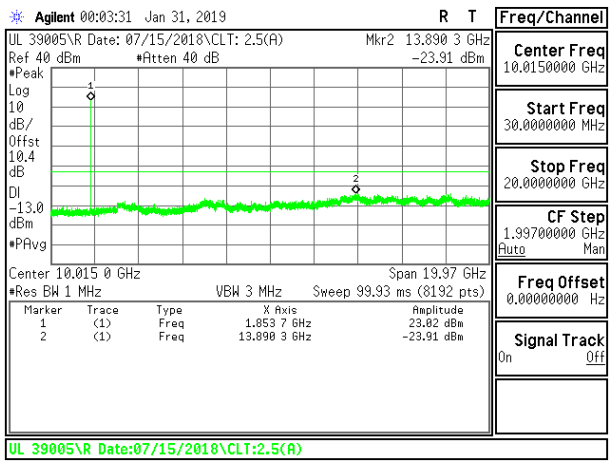
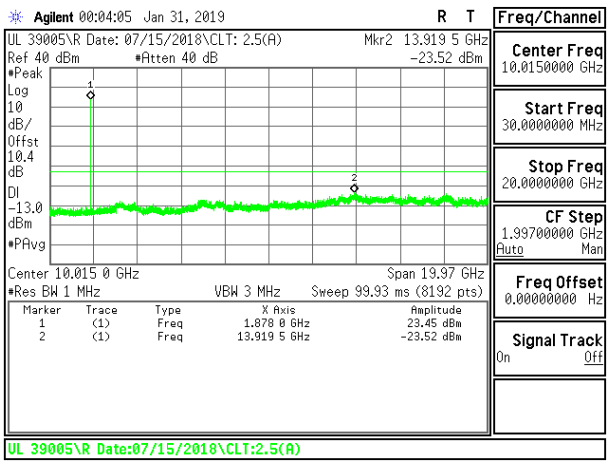
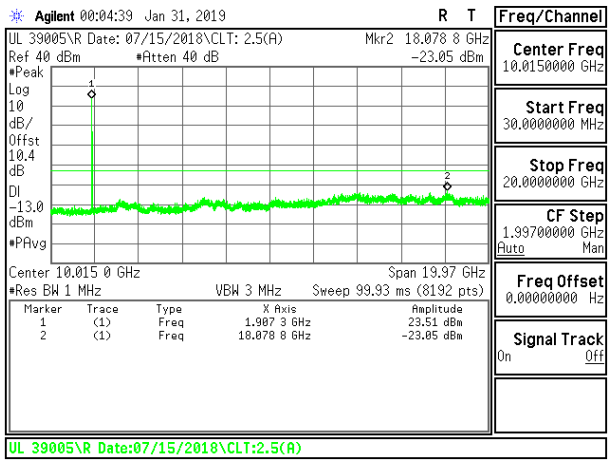
HSDPA



BAND2 HSDPA LOW Channel



BAND2 HSDPA MID Channel



BAND2 HSDPA HIGH Channel

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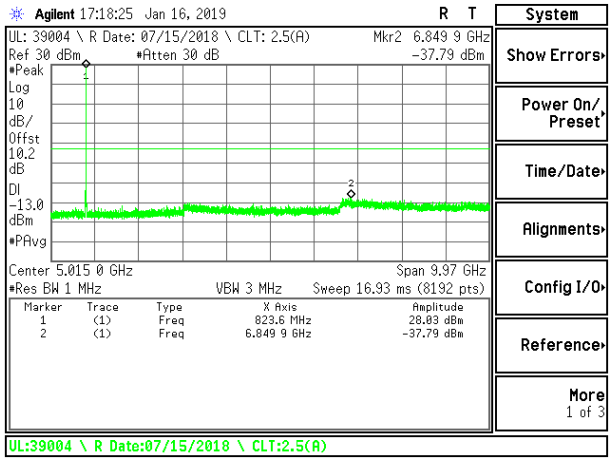
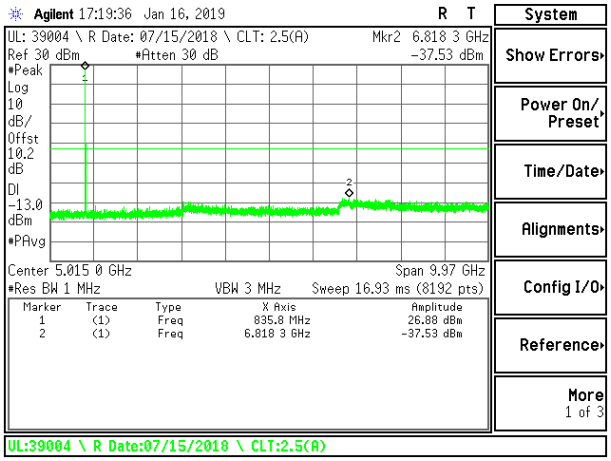
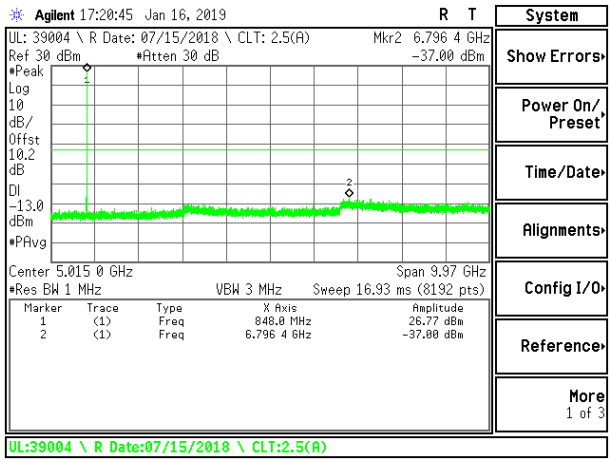
9.3.5. LTE BAND 5



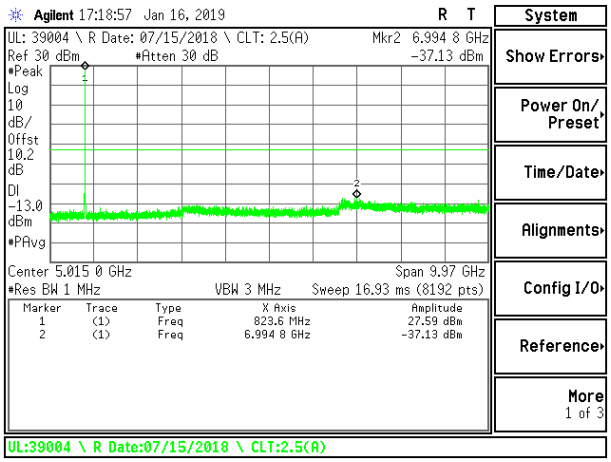
LTE B5 1.4MHz QPSK Low Channel RB1-0



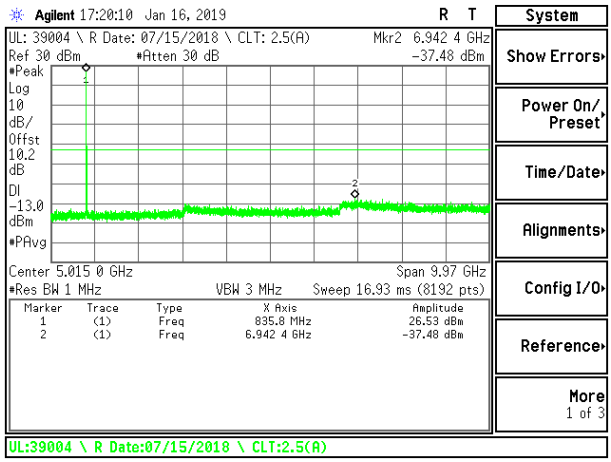
LTE B5 1.4MHz QPSK Mid Channel RB1-0



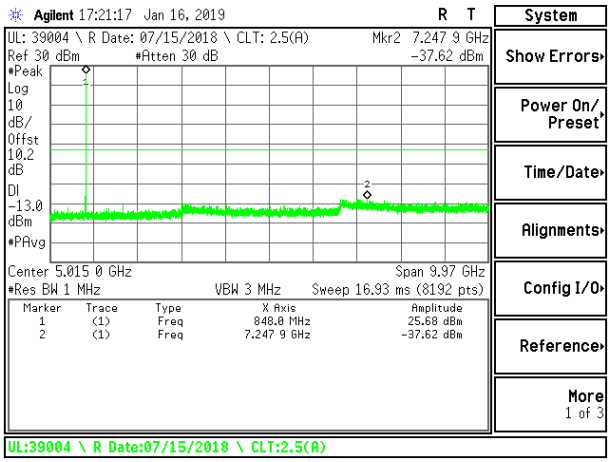
LTE B5 1.4MHz QPSK High Channel RB1-0



LTE B5 1.4MHz 16QAM Low Channel RB1-0



LTE B5 1.4MHz 16QAM Mid Channel RB1-0



LTE B5 1.4MHz 16QAM High Channel RB1-0

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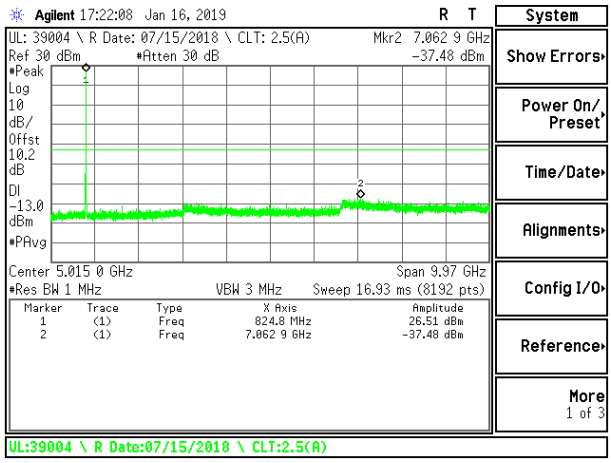
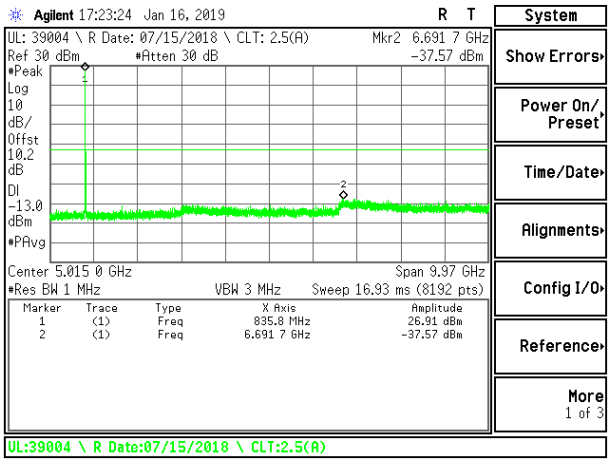
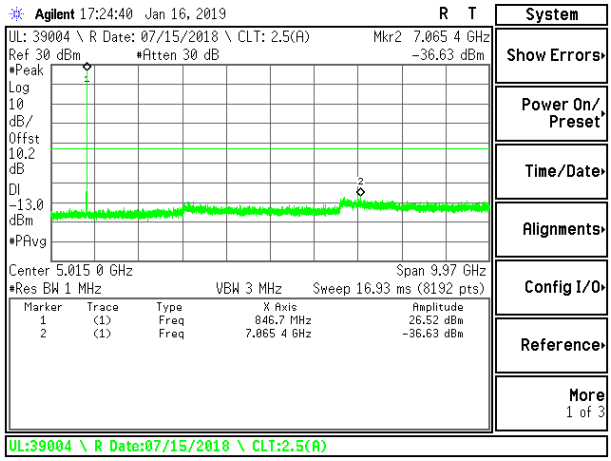


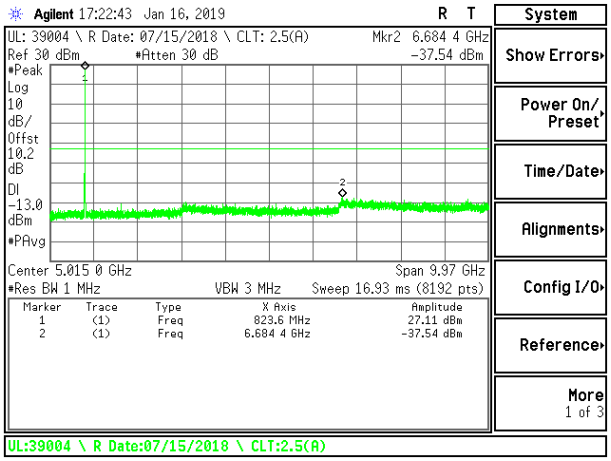
LTE B5 3MHz QPSK Low Channel RB1-0



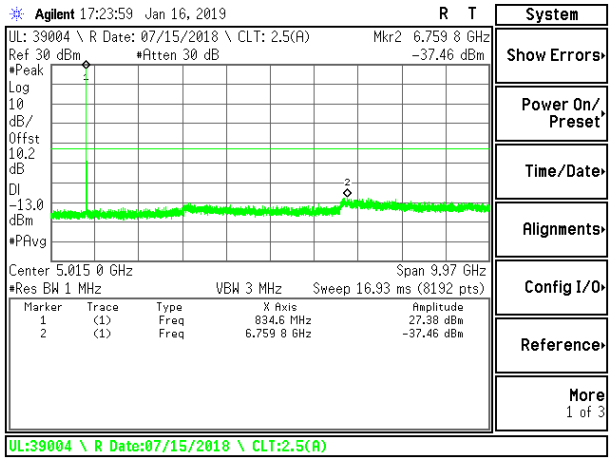
LTE B5 3MHz QPSK Mid Channel RB1-0



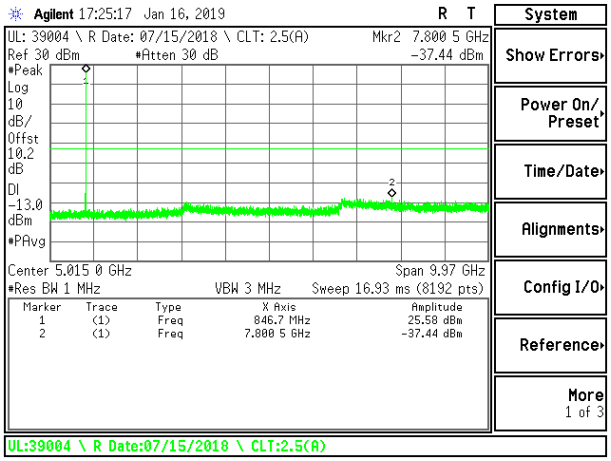
LTE B5 3MHz QPSK High Channel RB1-0



LTE B5 3MHz 16QAM Low Channel RB1-0



LTE B5 3MHz 16QAM Mid Channel RB1-0



LTE B5 3MHz 16QAM High Channel RB1-0

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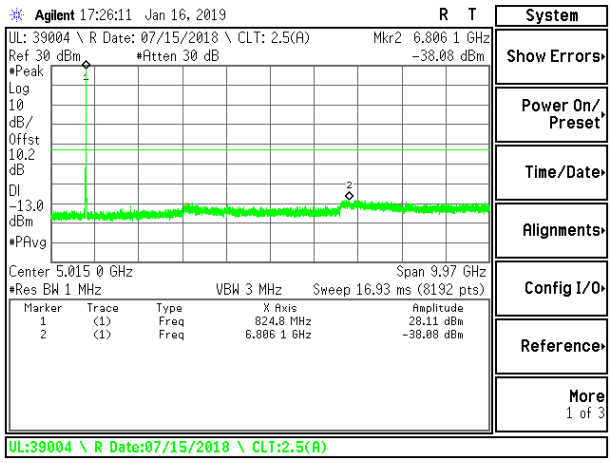
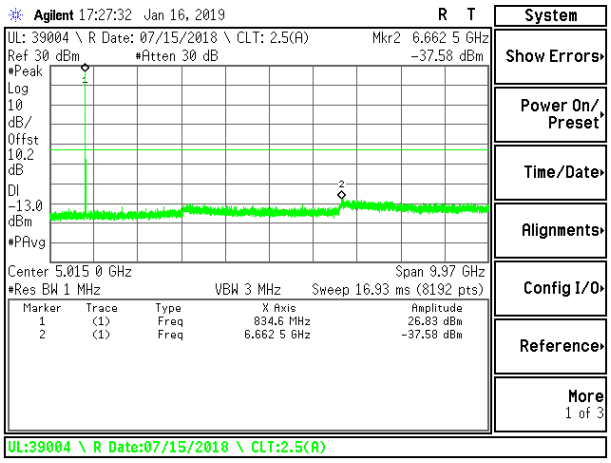
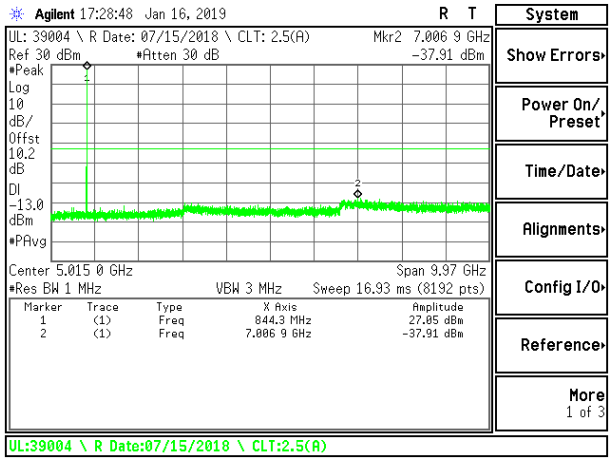


LTE B5 5MHz QPSK Low Channel RB1-0



LTE B5 5MHz QPSK Mid Channel RB1-0



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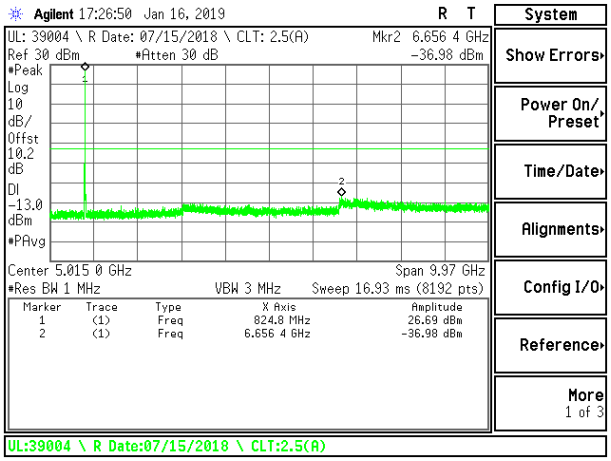
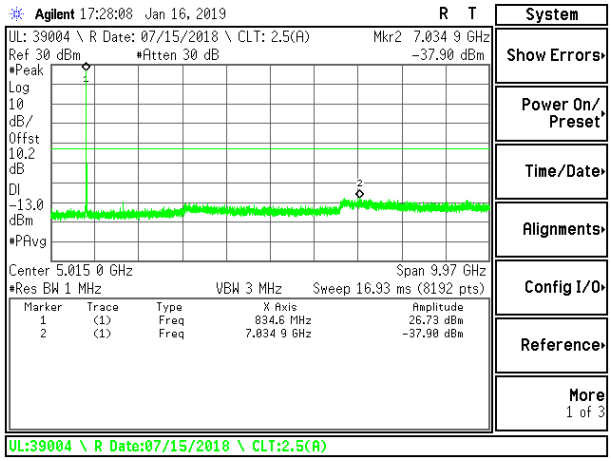
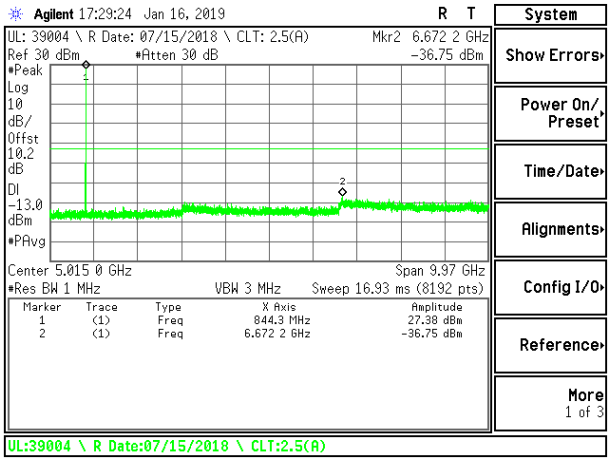


LTE B5 5MHz 16QAM Low Channel RB1-0



LTE B5 5MHz 16QAM Mid Channel RB1-0



LTE B5 5MHz 16QAM High Channel RB1-0

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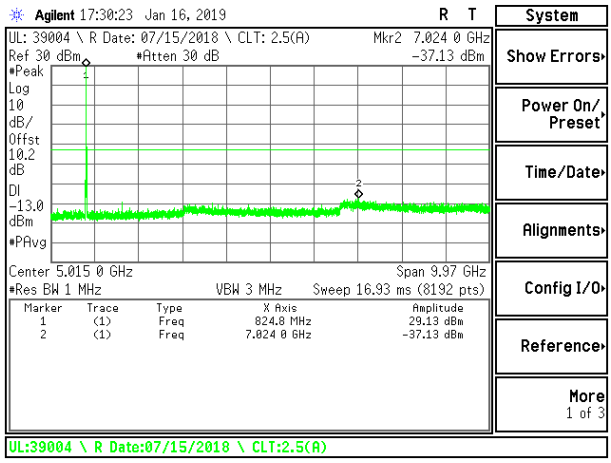
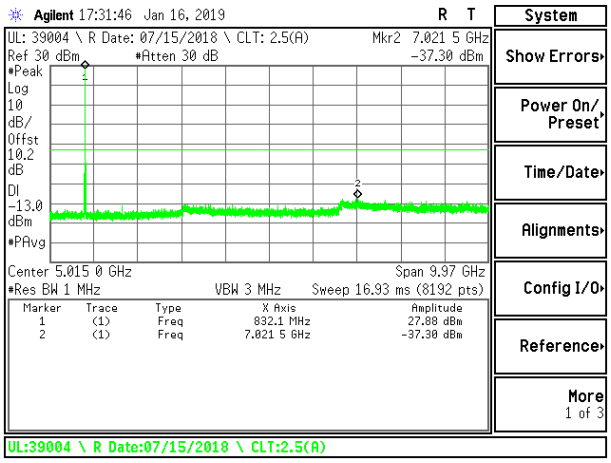
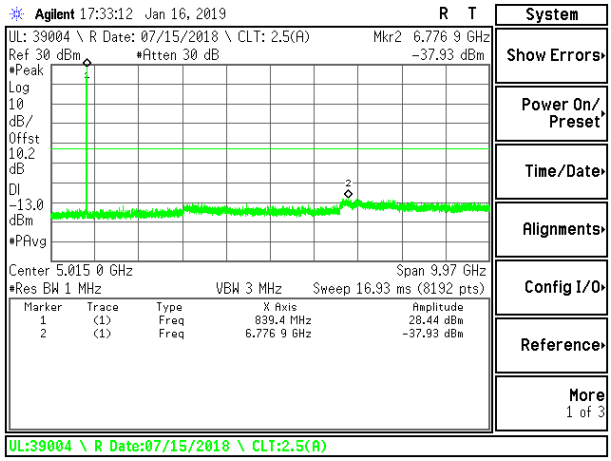


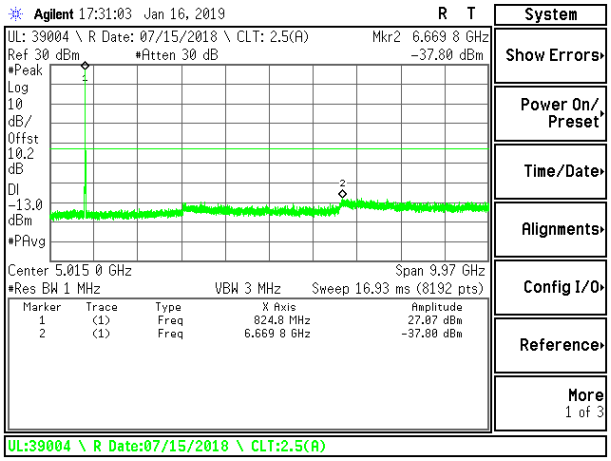
LTE B5 10MHz QPSK Low Channel RB1-0



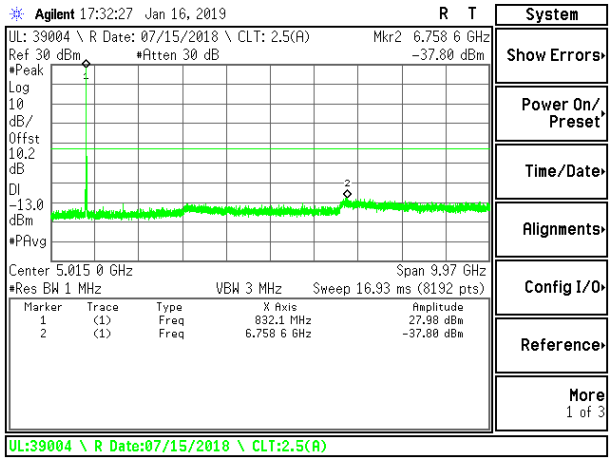
LTE B5 10MHz QPSK Mid Channel RB1-0



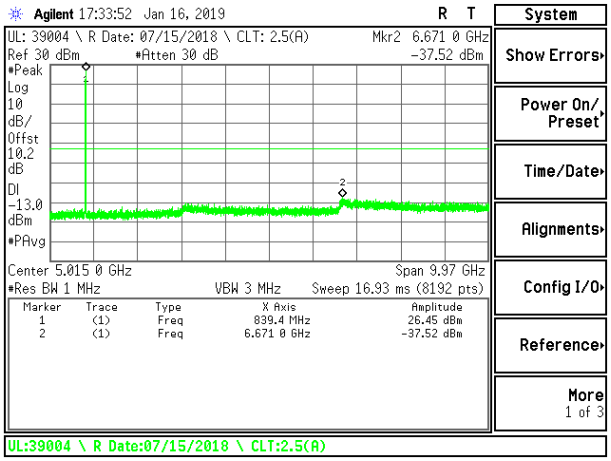
LTE B5 10MHz QPSK High Channel RB1-0



LTE B5 10MHz 16QAM Low Channel RB1-0



LTE B5 10MHz 16QAM Mid Channel RB1-0



LTE B5 10MHz 16QAM High Channel RB1-0

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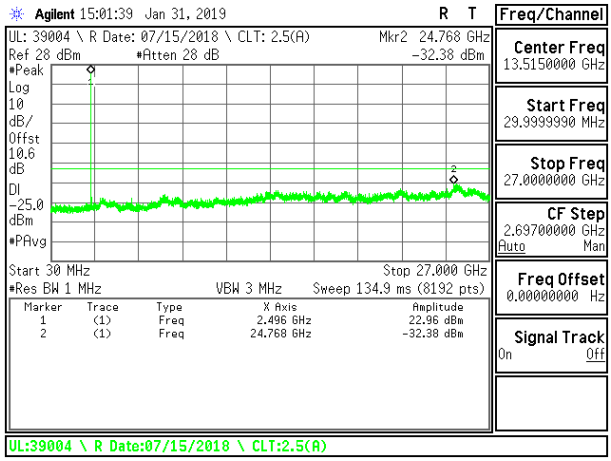
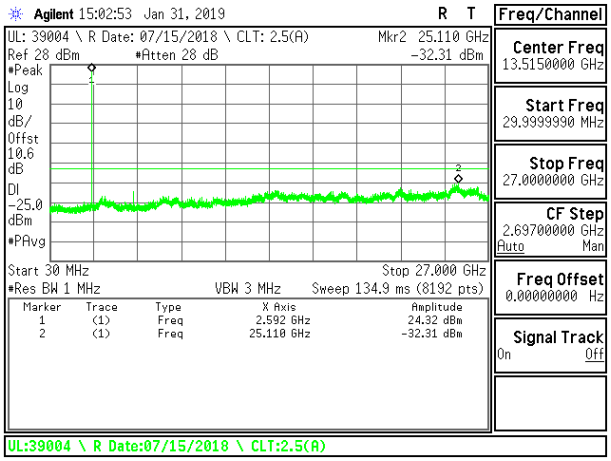
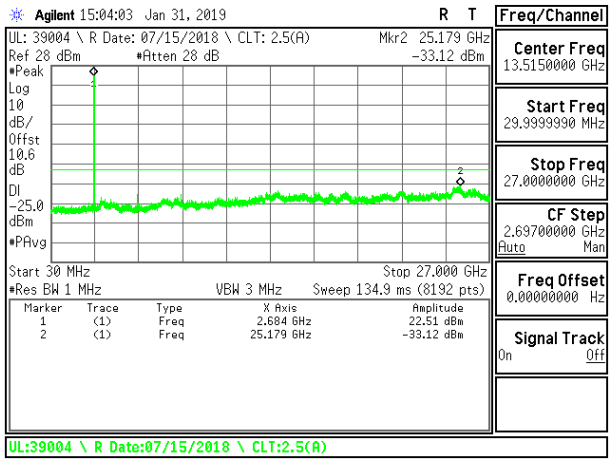
9.3.6. LTE BAND 41



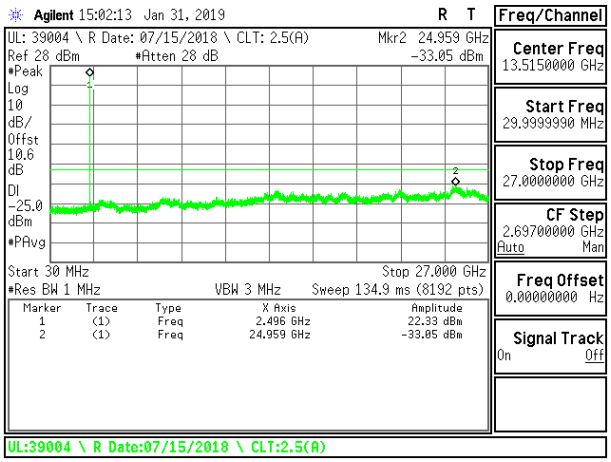
LTE B41 5MHz QPSK Low Channel RB1-0



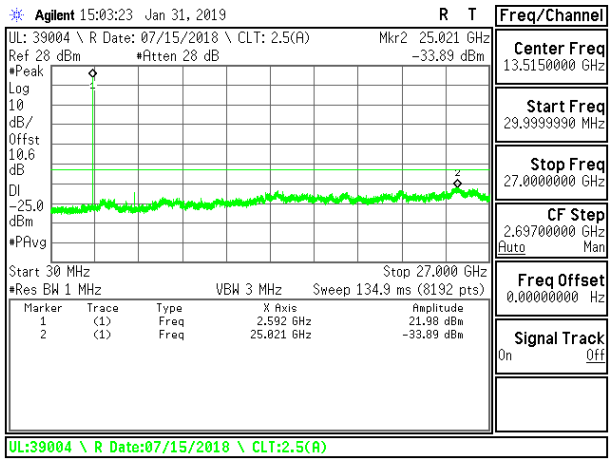
LTE B41 5MHz QPSK Mid Channel RB1-0



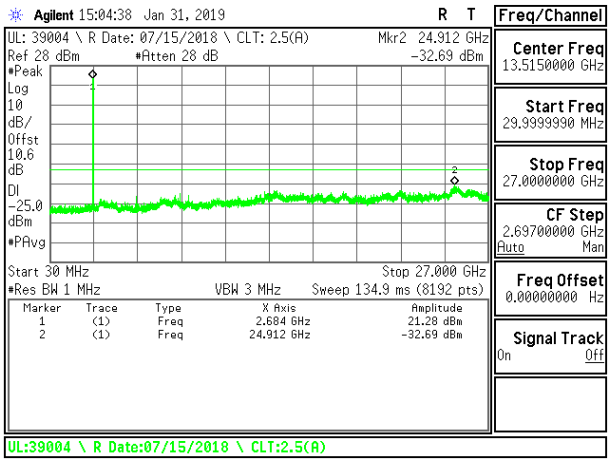
LTE B41 5MHz QPSK High Channel RB1-0



LTE B41 5MHz 16QAM Low Channel RB1-0



LTE B41 5MHz 16QAM Mid Channel RB1-0



LTE B41 5MHz 16QAM High Channel RB1-0

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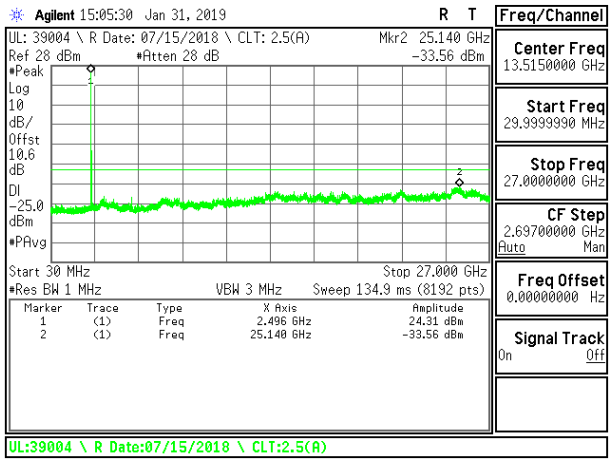
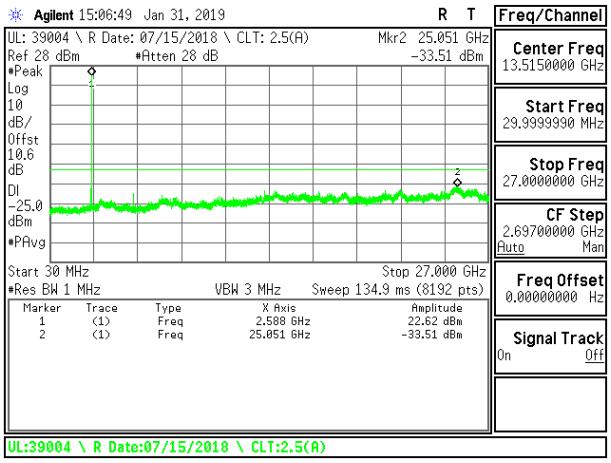
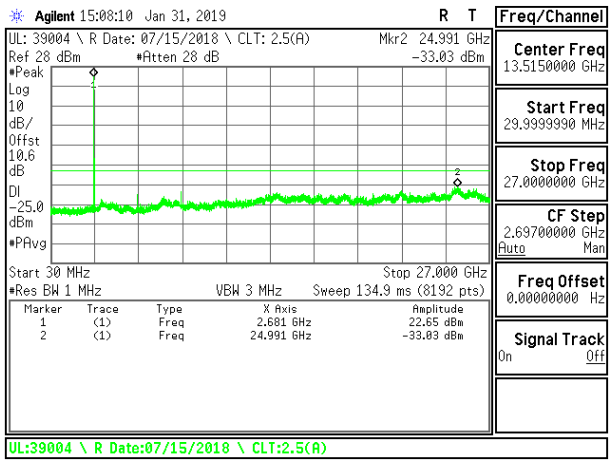


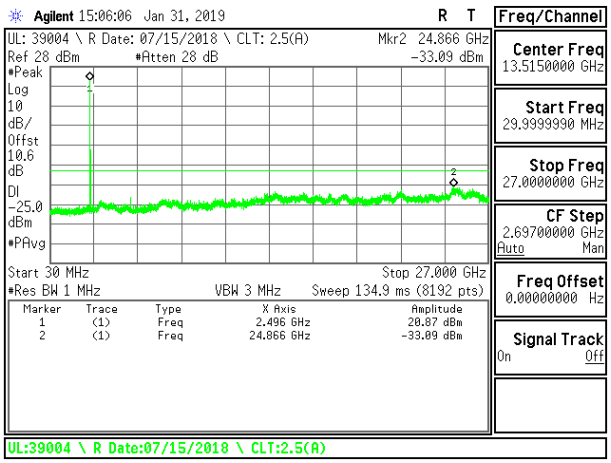
LTE B41 10MHz QPSK Low Channel RB1-0



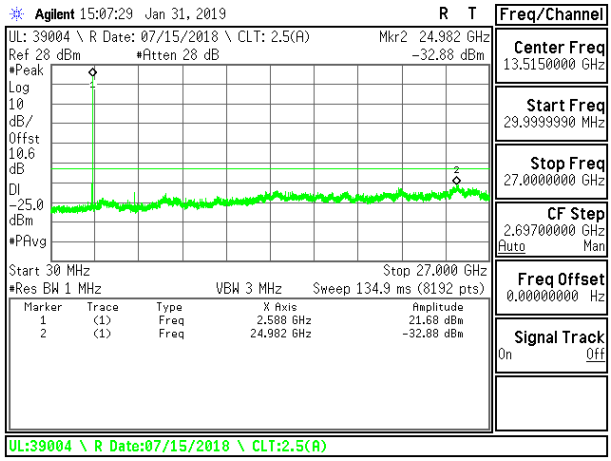
LTE B41 10MHz QPSK Mid Channel RB1-0



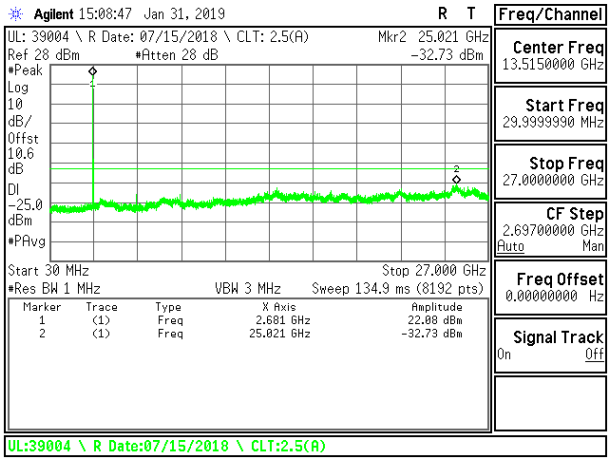
LTE B41 10MHz QPSK High Channel RB1-0



LTE B41 10MHz 16QAM Low Channel RB1-0



LTE B41 10MHz 16QAM Mid Channel RB1-0



LTE B41 10MHz 16QAM High Channel RB1-0

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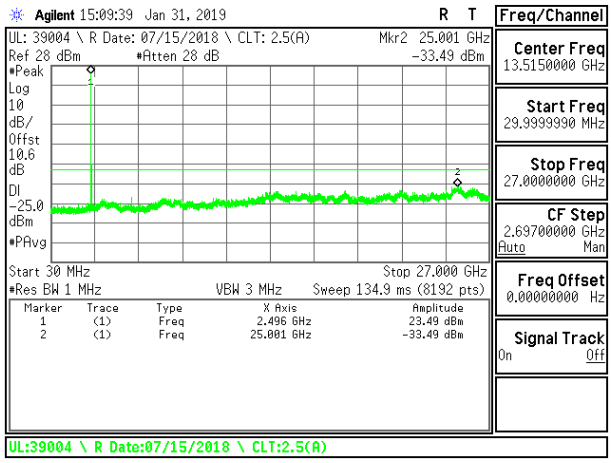
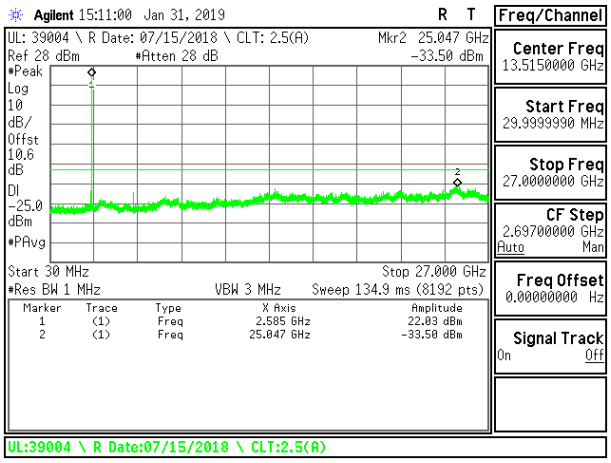
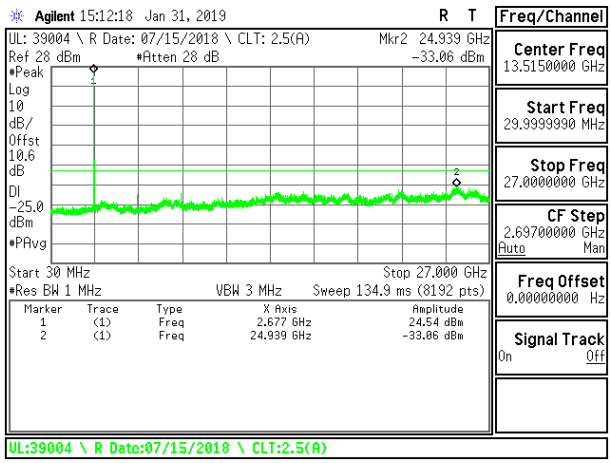


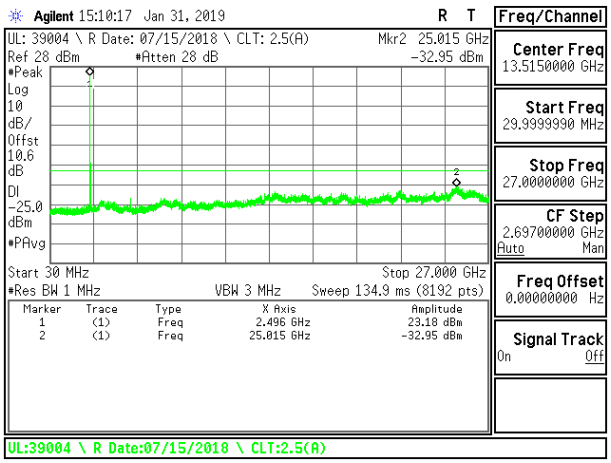
LTE B41 15MHz QPSK Low Channel RB1-0



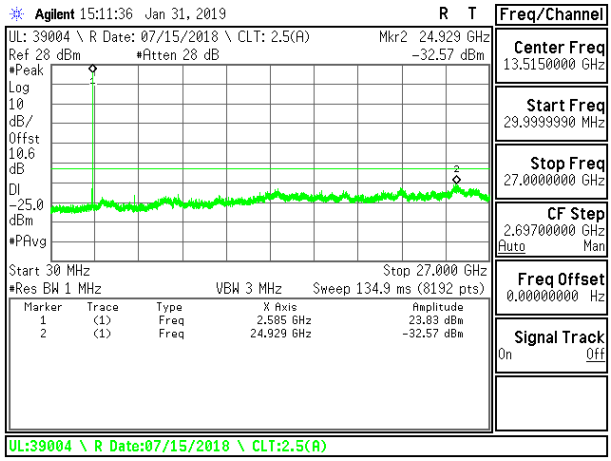
LTE B41 15MHz QPSK Mid Channel RB1-0



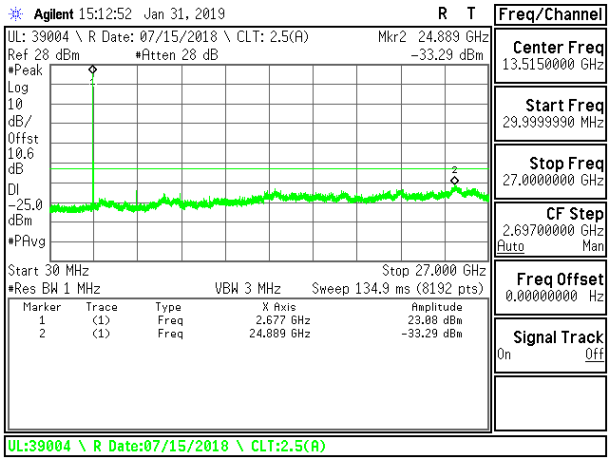
LTE B41 15MHz QPSK High Channel RB1-0



LTE B41 15MHz 16QAM Low Channel RB1-0



LTE B41 15MHz 16QAM Mid Channel RB1-0



LTE B41 15MHz 16QAM High Channel RB1-0

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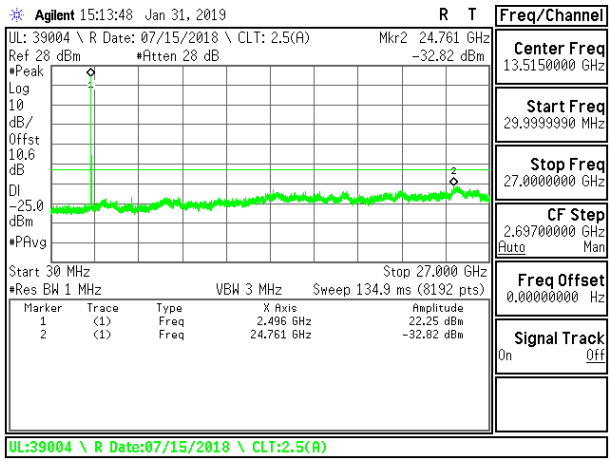
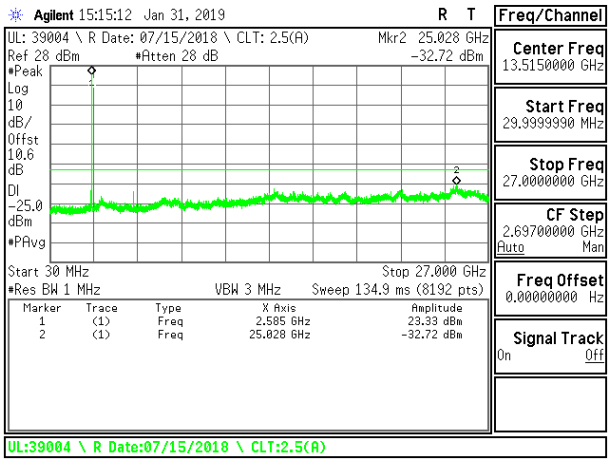
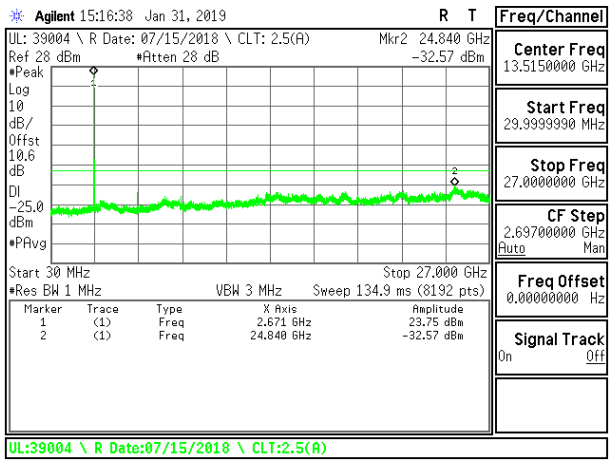


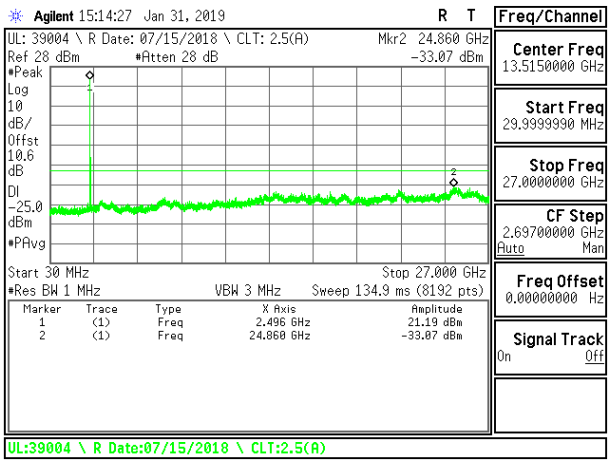
LTE B41 20MHz QPSK Low Channel RB1-0



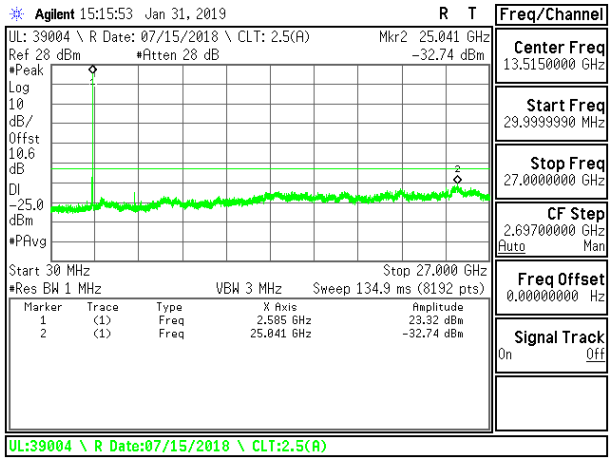
LTE B41 20MHz QPSK Mid Channel RB1-0



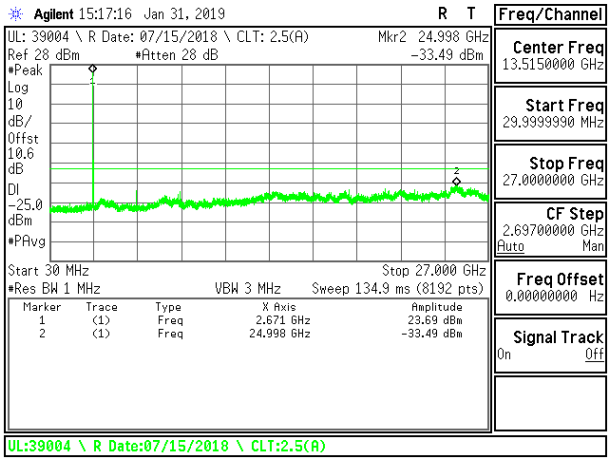
LTE B41 20MHz QPSK High Channel RB1-0



LTE B41 20MHz 16QAM Low Channel RB1-0



LTE B41 20MHz 16QAM Mid Channel RB1-0



LTE B41 20MHz 16QAM High Channel RB1-0

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9.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235, and §27.54

LIMITS

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

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

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

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

  Low voltage, 3.3VDC, Normal, 3.85VDC and High voltage, 4.43VDC.
  End Voltage, 3.2VDC.

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

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

MODES TESTED

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

RESULTS

See the following pages.

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9.4.1. GSM

ID:	19497	Date:	1/24/19

GPRS 850MHz

Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	824.0337	848.9628		
Extreme (50C)		824.0337	848.9628	5.2	0.006
Extreme (40C)		824.0337	848.9628	4.4	0.005
Extreme (30C)		824.0337	848.9628	4.8	0.006
Extreme (10C)		824.0337	848.9628	3.1	0.004
Extreme (0C)		824.0337	848.9628	6.4	0.008
Extreme (-10C)		824.0337	848.9628	5.6	0.007
Extreme (-20C)		824.0337	848.9628	6.1	0.007
Extreme (-30C)		824.0337	848.9628	4.7	0.006
20C	15%	824.0337	848.9628	5.5	0.007
	-15%	824.0337	848.9628	5.6	0.007
	End Point	824.0337	848.9628	5.2	0.006

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GPRS 1900MHz

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	1850.0623	1909.9357		
Extreme (50C)		1850.0623	1909.9357	-2.3	-0.001
Extreme (40C)		1850.0623	1909.9357	-3.4	-0.002
Extreme (30C)		1850.0623	1909.9357	-2.7	-0.001
Extreme (10C)		1850.0623	1909.9357	-4.8	-0.003
Extreme (0C)		1850.0623	1909.9357	-3.3	-0.002
Extreme (-10C)		1850.0623	1909.9357	-4.1	-0.002
Extreme (-20C)		1850.0623	1909.9357	-4.8	-0.003
Extreme (-30C)		1850.0623	1909.9357	-3.3	-0.002
20C	15%	1850.0623	1909.9357	-5.1	-0.003
	-15%	1850.0623	1909.9357	-5.2	-0.003
	End Point	1850.0623	1909.9357	-4.9	-0.003

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9.4.2. WCDMA

ID:	19497	Date:	1/25/19

UMTS REL99 BAND 5

Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	824.1670	848.8170		
Extreme (50C)		824.1670	848.8170	-6.9	-0.0082
Extreme (40C)		824.1670	848.8170	-6.2	-0.0075
Extreme (30C)		824.1670	848.8170	-8.1	-0.0097
Extreme (10C)		824.1670	848.8170	-5.7	-0.0068
Extreme (0C)		824.1670	848.8170	-7.2	-0.0085
Extreme (-10C)		824.1670	848.8170	-4.4	-0.0053
Extreme (-20C)		824.1670	848.8170	-5.9	-0.0070
Extreme (-30C)		824.1670	848.8170	-4.8	-0.0057
20C	15%	824.1670	848.8170	-7.1	-0.0085
	-15%	824.1670	848.8170	-6.6	-0.0078
	End Point	824.1670	848.8170	-6.9	-0.0083

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UMTS REL99 BAND 2

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	1850.1500	1909.8670		
Extreme (50C)		1850.1500	1909.8670	-10.2	-0.0054
Extreme (40C)		1850.1500	1909.8670	-11.3	-0.0060
Extreme (30C)		1850.1500	1909.8670	-10.7	-0.0057
Extreme (10C)		1850.1500	1909.8670	-9.5	-0.0050
Extreme (0C)		1850.1500	1909.8670	-12.6	-0.0067
Extreme (-10C)		1850.1500	1909.8670	-9.8	-0.0052
Extreme (-20C)		1850.1500	1909.8670	-11.3	-0.0060
Extreme (-30C)		1850.1500	1909.8670	-12.5	-0.0066
20C	15%	1850.1500	1909.8670	-10.3	-0.0055
	-15%	1850.1500	1909.8670	-11.1	-0.0059
	End Point	1850.1500	1909.8670	-9.5	-0.0051

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9.4.3. LTE BAND 5

ID:	19497	Date:	1/28/19

QPSK, (10MHz BANDWIDTH)

Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	824.1970	848.7380		
Extreme (50C)		824.1970	848.7380	-16.9	-0.020
Extreme (40C)		824.1970	848.7380	-18.2	-0.022
Extreme (30C)		824.1970	848.7380	-17.4	-0.021
Extreme (10C)		824.1970	848.7380	-16.3	-0.019
Extreme (0C)		824.1970	848.7380	-16.7	-0.020
Extreme (-10C)		824.1970	848.7380	-18.6	-0.022
Extreme (-20C)		824.1970	848.7380	-17.1	-0.020
Extreme (-30C)		824.1970	848.7380	-19.4	-0.023
20C	15%	824.1970	848.7380	-18.2	-0.022
	-15%	824.1970	848.7380	-18.4	-0.022
	End Point	824.1970	848.7380	-17.9	-0.021

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9.4.4. LTE BAND 41

ID:	19497	Date:	1/28/19

QPSK, (20MHz BANDWIDTH)

Limit		2496	2690	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	2496.7900	2689.2810		
Extreme (50C)		2496.7900	2689.2810	-19.6	-0.008
Extreme (40C)		2496.7900	2689.2810	-18.7	-0.007
Extreme (30C)		2496.7900	2689.2810	-19.1	-0.007
Extreme (10C)		2496.7900	2689.2810	-15.3	-0.006
Extreme (0C)		2496.7900	2689.2810	-17.6	-0.007
Extreme (-10C)		2496.7900	2689.2810	-20.0	-0.008
Extreme (-20C)		2496.7900	2689.2810	-18.6	-0.007
Extreme (-30C)		2496.7900	2689.2810	-16.4	-0.006
20C	15%	2496.7900	2689.2810	-19.7	-0.008
	-15%	2496.7900	2689.2810	-20.1	-0.008
	End Point	2496.7900	2689.2810	-18.9	-0.007

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9.5. PEAK TO AVERAGE RATIO

LIMITS

In addition, the peak to average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

RESULT

LAT 1 Antenna was used to measure as the worst case. The results from all CCDF plots are passed with 13dB peak-to-average power ratio criteria.

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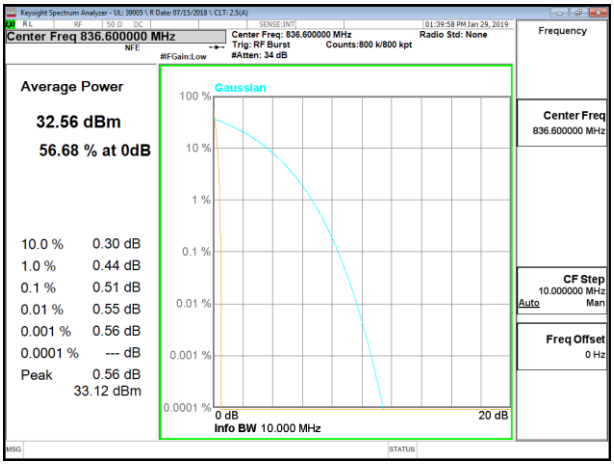
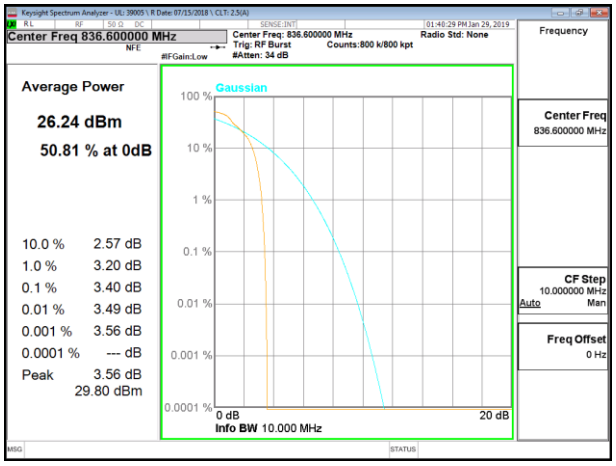
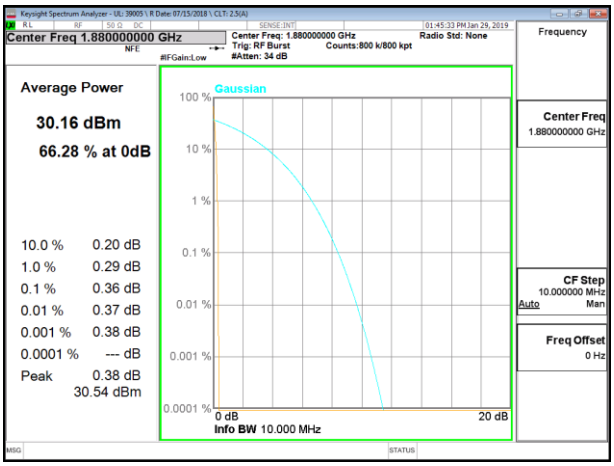
9.5.1. GSM



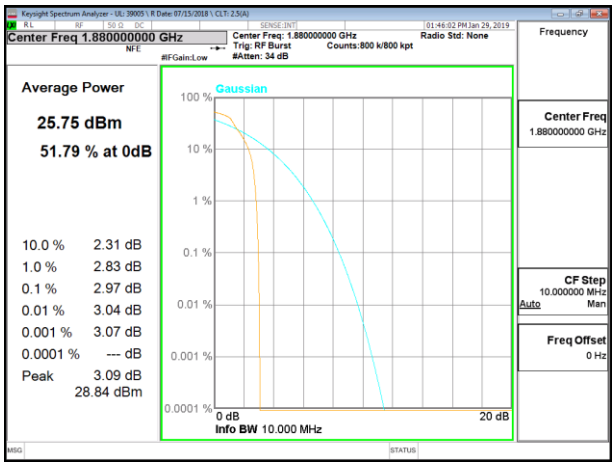
GSM 850MHz GPRS MID Channel



GSM 850MHz EGPRS MID Channel



GSM 1900MHz GPRS MID Channel



GSM 1900MHz EGPRS MID Channel

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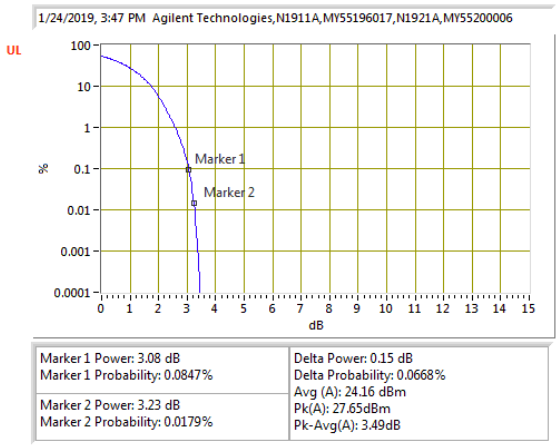
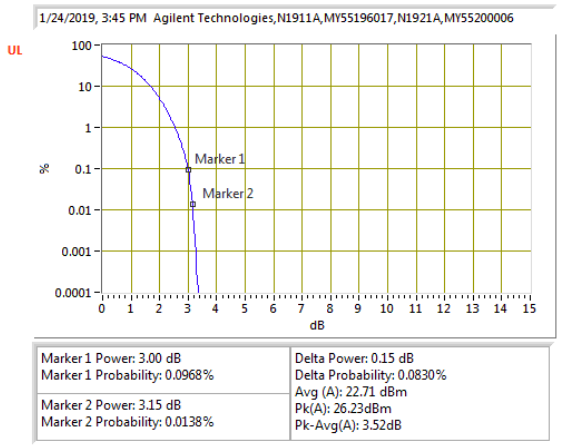
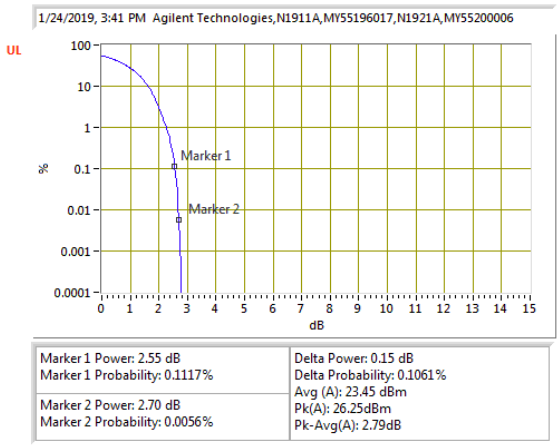
9.5.2. WCDMA



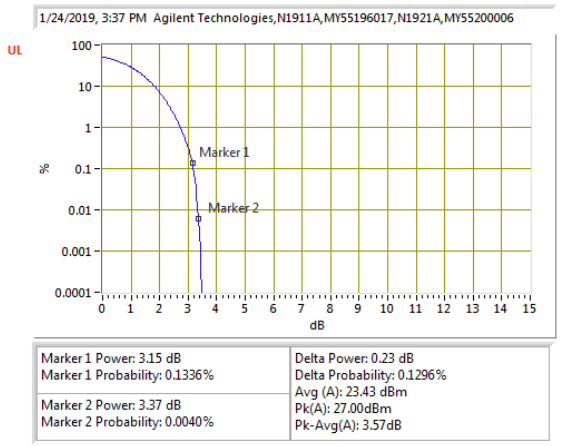
WCDMA BAND5 Rel99 MID Channel



WCDMA BAND5 HSDPA MID Channel



WCDMA BAND2 Rel99 MID Channel



WCDMA BAND2 HSDPA MID Channel

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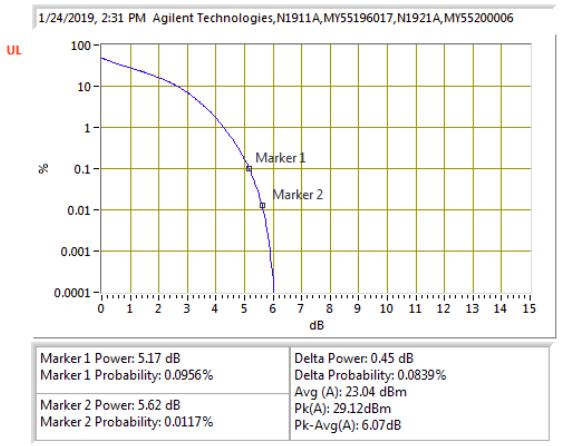
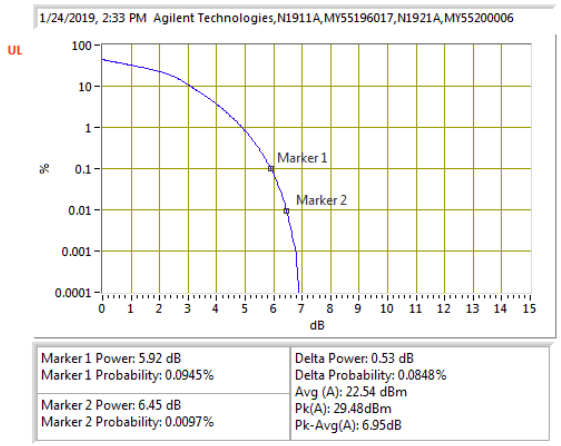
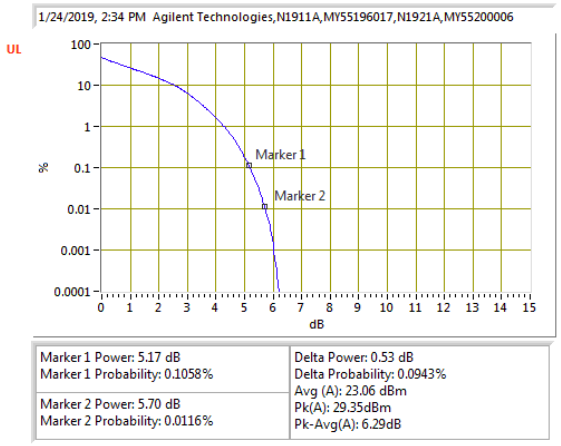
9.5.3. LTE BAND 5



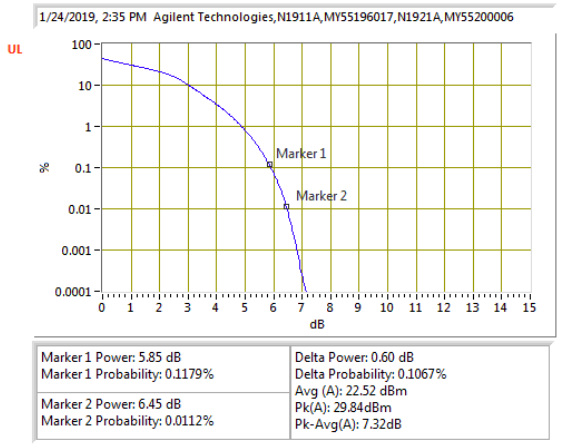
LTE B5 1.4MHz QPSK Mid Channel



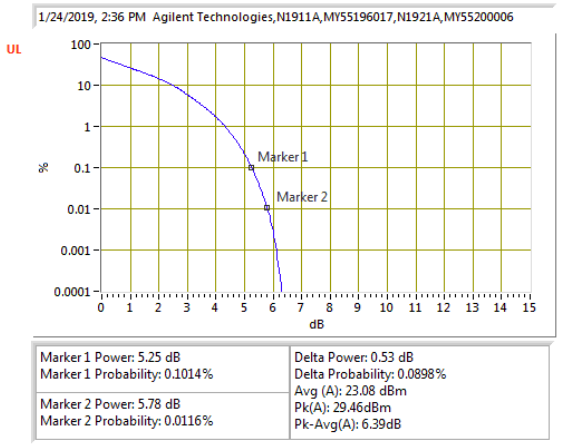
LTE B5 1.4MHz 16QAM Mid Channel



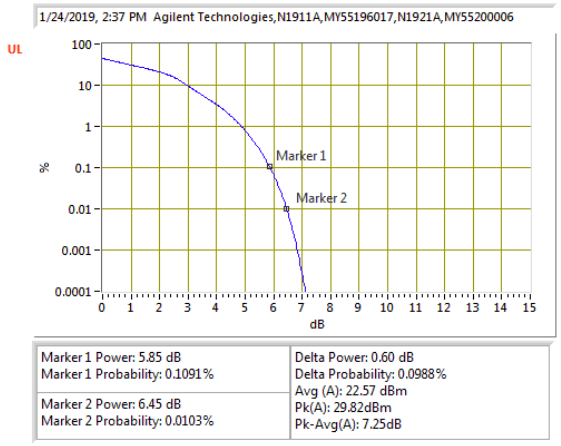
LTE B5 3MHz QPSK Mid Channel



LTE B5 3MHz 16QAM Mid Channel



LTE B5 5MHz QPSK Mid Channel



LTE B5 5MHz 16QAM Mid Channel

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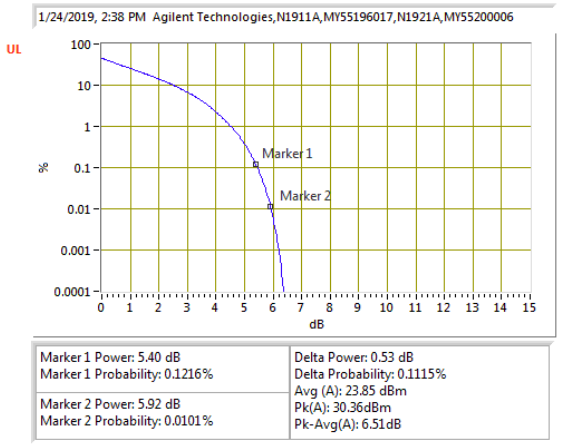
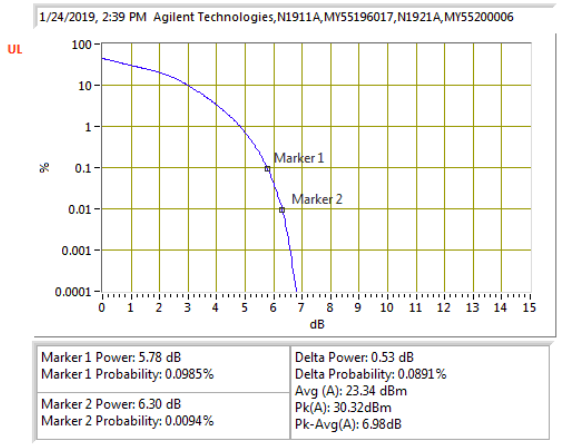


LTE B5 10MHz QPSK Mid Channel



LTE B5 10MHz 16QAM Mid Channel

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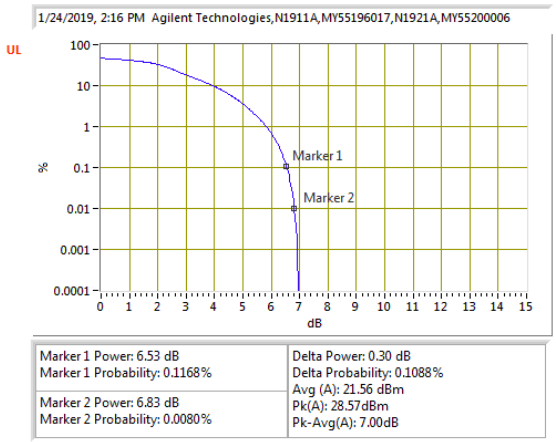
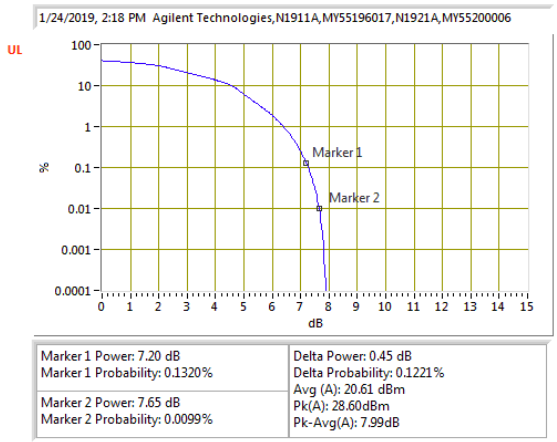
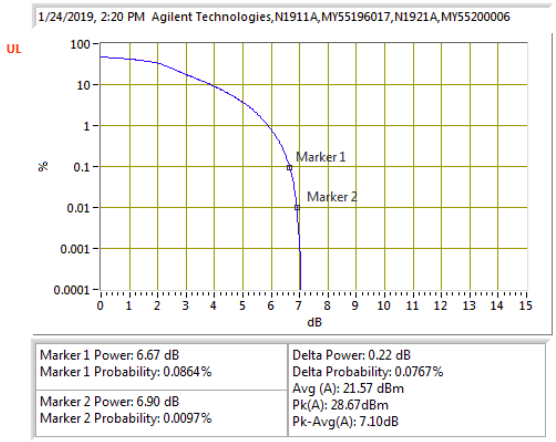
9.5.4. LTE BAND 41



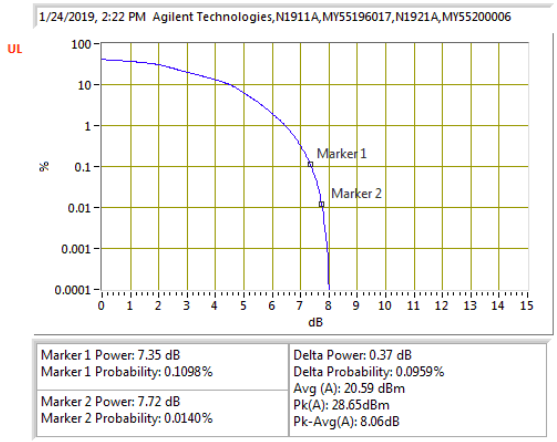
LTE B41 5MHz QPSK Middle Channel



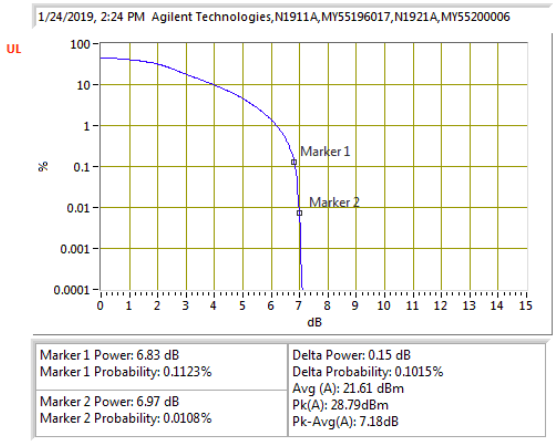
LTE B41 5MHz 16QAM Middle Channel



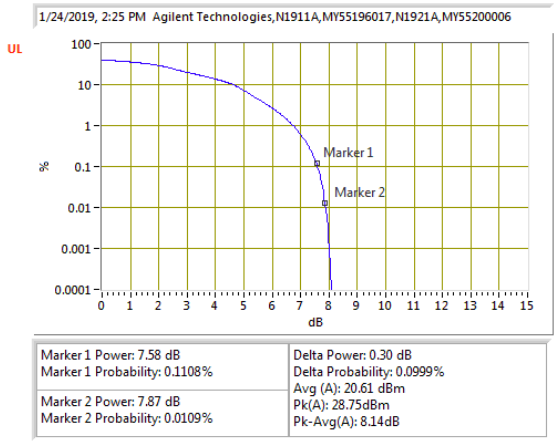
LTE B41 10MHz QPSK Middle Channel



LTE B41 10MHz 16QAM Middle Channel



LTE B41 15MHz QPSK Middle Channel



LTE B41 15MHz 16QAM Middle Channel

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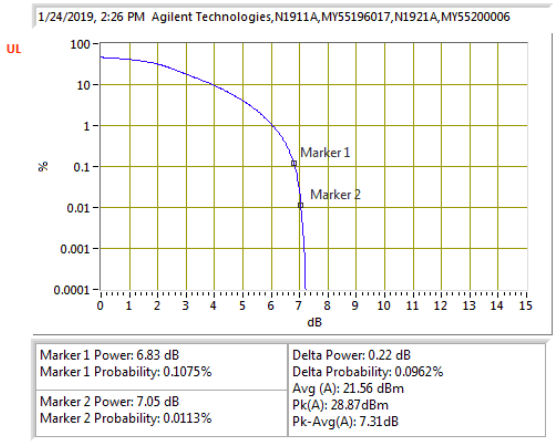
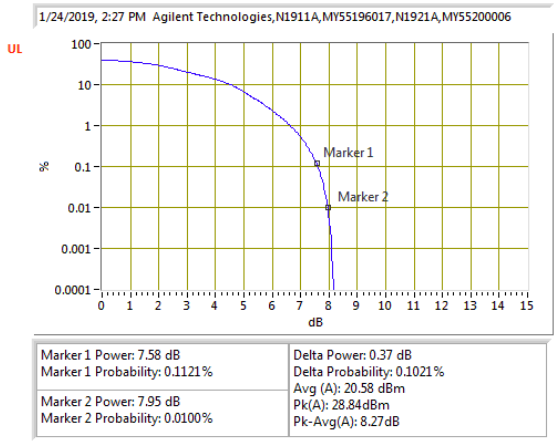


LTE B41 20MHz QPSK Middle Channel



LTE B41 20MHz 16QAM Middle Channel

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10. RADIATED TEST RESULTS

10.1. EFFECTIVE RADIATED POWER ERP/EIRP

RULE PART(S)

FCC: §2.1053, §22.917, §24.238, and §27.53

LIMITS

22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

24.232(c) - Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13dB.

TEST PROCEDURE

ANSI / TIA / EIA 603-E (2016), Clause 2.2.17; PSA setting reference to 971168 D01 v03r01

For peak power measurement with a PSA:

a) Set the RBW ≥ OBW; b) Set VBW ≥ 3 × RBW; c) Set span ≥ 2 x RBW; d) Sweep time = auto couple; e) Detector = peak; f) Ensure that the number of measurement points ≥ span/RBW; g) Trace mode = max hold;

For average power measurement with a PSA:

a) Set span to at least 1.5 times the OBW; b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz; c) Set VBW ≥ 3 x RBW; d) Set number of points in sweep ≥ 2 × span / RBW; e) Sweep time = auto-couple; f) Detector = RMS (power averaging); g) Use free run trigger If burst duty cycle ≥ 98; h) Use trigger to capture bursts If burst duty cycle < 98; i) Trace average at least 100 traces in power averaging (*i.e.*, RMS) mode. j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function.

MODES TESTED

GSM, WCMDA, and LTE

Note: This testing was performed to confirm that the measured radiated powers were consistent with the calculated ERP/EIRP test data given device-to-device variations in output power and the measurement uncertainties associated with the radiated tests. Measured ERP/EIRP test results are for reference only. Please refer to Section 5.2 for the final ERP/EIRP results.

TEST RESULTS

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GSM

Band	Mode	Channel	f(MHz)	ERP/EIRP	
				dBm	mW
GSM 850	GPRS	128	824.2	29.11	814.70
		190	836.6	28.45	699.84
		251	848.8	28.50	707.95
	EGPRS	128	824.2	26.46	442.59
		190	836.6	26.43	439.54
		251	848.8	26.49	445.66
GSM 1900	GPRS	512	1850.2	30.75	1188.50
		661	1880.0	31.01	1261.83
		810	1909.8	31.91	1552.39
	EGPRS	512	1850.2	29.26	843.33
		661	1880.0	29.65	922.57
		810	1909.8	30.43	1104.08

WCDMA

Band	Mode	Channel	f(MHz)	ERP/EIRP	
				dBm	mW
Band 2	REL99	9262	1852.4	26.54	450.82
		9400	1880	26.63	460.26
		9538	1907.6	27.04	505.82
	HSDPA	9262	1852.4	26.83	481.95
		9400	1880.0	26.96	496.59
		9538	1907.6	27.64	580.76
Band 5	REL99	4132	826.4	22.02	159.22
		4183	836.6	21.90	154.88
		4233	846.6	22.25	167.88
	HSDPA	4132	826.4	20.85	121.62
		4183	836.6	20.47	111.43
		4233	846.6	20.36	108.64

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LTE Band 5

BW (MHz)	Mode	RB/RB Size	f(MHz)	ERP	
				dBm	mW
10	QPSK	1/0	829	22.11	162.55
		1/0	836.5	21.12	129.42
		1/0	844	22.45	175.79
	16QAM	1/0	829	21.84	152.76
		1/0	836.5	20.51	112.46
		1/0	844	22.05	160.32
3	QPSK	1/0	825.5	22.45	175.79
		1/0	836.5	22.18	165.20
		1/0	847.5	22.13	163.31
	16QAM	1/0	825.5	21.84	152.76
		1/0	836.5	21.49	140.93
		1/0	847.5	21.69	147.57

LTE Band 41

BW (MHz)	Mode	RB/RB Size	f(MHz)	EIRP	
				dBm	mW
20	QPSK	1/0	2506	22.04	159.96
		1/0	2593	22.50	177.83
		1/0	2680	20.62	115.35
	16QAM	1/0	2506	21.78	150.66
		1/0	2593	22.22	166.72
		1/0	2680	20.45	110.92
15	QPSK	1/0	2503.5	21.38	137.40
		1/0	2593	20.76	119.12
		1/0	2682.5	20.46	111.17
	16QAM	1/0	2503.5	21.26	133.66
		1/0	2593	20.43	110.41
		1/0	2682.5	20.29	106.91

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10.1.1. GSM

GPRS 850

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 1/31/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: GPRS 850 MHz Fundamentals

Test Equpment:
Receiving: Hybrid PRE0181575, and Chamber J SMA Cables
Substitution: Dipole T416, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
824.20	22.60	V	3.1	0.1	19.61	38.5	-18.9	
824.20	32.01	H	3.1	0.2	29.11	38.5	-9.4	
Mid Ch								
836.60	21.87	V	3.1	0.1	18.80	38.5	-19.7	
836.60	31.42	H	3.1	0.2	28.45	38.5	-10.1	
High Ch								
848.80	22.00	V	3.2	0.0	18.85	38.5	-19.6	
848.80	31.55	H	3.2	0.1	28.50	38.5	-10.0	

EGPRS 850

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 1/31/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: EGPRS 850 MHz Fundamentals

Test Equpment:
Receiving: Hybrid PRE0181575, and Chamber J SMA Cables
Substitution: Dipole T416, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
824.20	19.85	V	3.1	0.1	16.86	38.5	-21.6	
824.20	29.36	H	3.1	0.2	26.46	38.5	-12.0	
Mid Ch								
836.60	19.85	V	3.1	0.1	16.78	38.5	-21.7	
836.60	29.40	H	3.1	0.2	26.43	38.5	-12.1	
High Ch								
848.80	19.91	V	3.2	0.0	16.76	38.5	-21.7	
848.80	29.54	H	3.2	0.1	26.49	38.5	-12.0	

GPRS 1900

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 1/31/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: GPRS 1900 MHz Fundamentals

Test Equpment:
Receiving: Horn PRE0101793, and Chamber J SMA Cables
Substitution: Horn PRE0181258, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1850.20	12.19	V	5.0	9.8	16.96	33.0	-16.0	
1850.20	25.97	H	5.0	9.8	30.75	33.0	-2.3	
Mid Ch								
1880.00	12.78	V	5.1	10.0	17.66	33.0	-15.3	
1880.00	26.13	H	5.1	10.0	31.01	33.0	-2.0	
High Ch								
1909.80	12.82	V	5.2	10.1	17.77	33.0	-15.2	
1909.80	26.96	H	5.2	10.1	31.91	33.0	-1.1	

EGPRS 1900

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 1/31/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: EGPRS 1900 MHz Fundamentals

Test Equpment:
Receiving: Horn PRE0101793, and Chamber J SMA Cables
Substitution: Horn PRE0181258, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1850.20	10.24	V	5.0	9.8	15.01	33.0	-18.0	
1850.20	24.49	H	5.0	9.8	29.26	33.0	-3.7	
Mid Ch								
1880.00	11.13	V	5.1	10.0	16.01	33.0	-17.0	
1880.00	24.77	H	5.1	10.0	29.65	33.0	-3.4	
High Ch								
1909.80	12.42	V	5.2	10.1	17.37	33.0	-15.6	
1909.80	25.48	H	5.2	10.1	30.43	33.0	-2.6	

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10.1.2. WCDMA

B2 REL99

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 1/31/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: Rel99 Band 2 Fundamentals

Test Equpment:
Receiving: Horn PRE0101793, and Chamber J SMA Cables
Substitution: Horn PRE0181258, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1852.40	11.39	V	5.0	9.8	16.17	33.0	-16.8	
1852.40	21.76	H	5.0	9.8	26.54	33.0	-6.5	
Mid Ch								
1880.00	8.63	V	5.1	10.0	13.51	33.0	-19.5	
1880.00	21.75	H	5.1	10.0	26.63	33.0	-6.4	
High Ch								
1907.60	7.39	V	5.2	10.1	12.34	33.0	-20.7	
1907.60	22.09	H	5.2	10.1	27.04	33.0	-6.0	

B2 HSDPA

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 1/31/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: HSDPA Band 2 Fundamentals

Test Equpment:
Receiving: Horn PRE0101793, and Chamber J SMA Cables
Substitution: Horn PRE0181258, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1852.40	11.67	V	5.0	9.8	16.45	33.0	-16.6	
1852.40	22.05	H	5.0	9.8	26.83	33.0	-6.2	
Mid Ch								
1880.00	8.95	V	5.1	10.0	13.83	33.0	-19.2	
1880.00	22.08	H	5.1	10.0	26.96	33.0	-6.0	
High Ch								
1907.60	7.97	V	5.2	10.1	12.92	33.0	-20.1	
1907.60	22.69	H	5.2	10.1	27.64	33.0	-5.4	

B5 REL99

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 1/31/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: Rel99 Band 5 Fundamentals

Test Equpment:
Receiving: Hybrid PRE0181575, and Chamber J SMA Cables
Substitution: Dipole T416, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.40	15.01	V	3.1	0.1	12.00	38.5	-26.5	
826.40	24.93	H	3.1	0.2	22.02	38.5	-16.5	
Mid Ch								
836.60	14.94	V	3.1	0.1	11.87	38.5	-26.6	
836.60	24.87	H	3.1	0.2	21.90	38.5	-16.6	
High Ch								
846.60	15.72	V	3.1	0.0	12.59	38.5	-25.9	
846.60	25.28	H	3.1	0.1	22.25	38.5	-16.3	

B5 HSDPA

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 1/31/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: HSDPA Band 5 Fundamentals

Test Equpment:
Receiving: Hybrid PRE0181575, and Chamber J SMA Cables
Substitution: Dipole T416, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.40	13.76	V	3.1	0.1	10.75	38.5	-27.7	
826.40	23.76	H	3.1	0.2	20.85	38.5	-17.6	
Mid Ch								
836.60	13.54	V	3.1	0.1	10.47	38.5	-28.0	
836.60	23.44	H	3.1	0.2	20.47	38.5	-18.0	
High Ch								
846.60	14.01	V	3.1	0.0	10.88	38.5	-27.6	
846.60	23.39	H	3.1	0.1	20.36	38.5	-18.1	

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10.1.3. LTE Band 5

10MHz QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 2/1/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: LTE_QPSK Band 5 Fundamentals, 10MHz Bandwidth

Test Equipment:
Receiving: Hybrid PRE0181575, and Chamber J SMA Cables
Substitution: Dipole T416, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
829.00	17.11	V	3.1	0.1	14.09	38.5	-24.4	
829.00	25.03	H	3.1	0.2	22.11	38.5	-16.4	
Mid Ch								
836.50	17.03	V	3.1	0.1	13.96	38.5	-24.5	
836.50	24.09	H	3.1	0.2	21.12	38.5	-17.4	
High Ch								
844.00	16.96	V	3.1	0.0	13.84	38.5	-24.7	
844.00	25.47	H	3.1	0.1	22.45	38.5	-16.0	

10MHz 16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 2/1/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: LTE_16QAM Band 5 Fundamentals, 10MHz Bandwidth

Test Equipment:
Receiving: Hybrid PRE0181575, and Chamber J SMA Cables
Substitution: Dipole T416, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
829.00	16.44	V	3.1	0.1	13.42	38.5	-25.1	
829.00	24.76	H	3.1	0.2	21.84	38.5	-16.7	
Mid Ch								
836.50	16.86	V	3.1	0.1	13.79	38.5	-24.7	
836.50	23.48	H	3.1	0.2	20.51	38.5	-18.0	
High Ch								
844.00	16.93	V	3.1	0.0	13.81	38.5	-24.7	
844.00	25.07	H	3.1	0.1	22.05	38.5	-16.4	

3MHz QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 2/1/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: LTE_QPSK Band 5 Fundamentals, 3MHz Bandwidth

Test Equipment:
Receiving: Hybrid PRE0181575, and Chamber J SMA Cables
Substitution: Dipole T416, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
825.50	16.50	V	3.1	0.1	13.50	38.5	-25.0	
825.50	25.35	H	3.1	0.2	22.45	38.5	-16.1	
Mid Ch								
836.50	15.12	V	3.1	0.1	12.05	38.5	-26.4	
836.50	25.15	H	3.1	0.2	22.18	38.5	-16.3	
High Ch								
847.50	15.45	V	3.1	0.0	12.31	38.5	-26.2	
847.50	25.17	H	3.1	0.1	22.13	38.5	-16.4	

3MHz 16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 2/1/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: LTE_16QAM Band 5 Fundamentals, 3MHz Bandwidth

Test Equipment:
Receiving: Hybrid PRE0181575, and Chamber J SMA Cables
Substitution: Dipole T416, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
825.50	16.07	V	3.1	0.1	13.07	38.5	-25.4	
825.50	24.74	H	3.1	0.2	21.84	38.5	-16.7	
Mid Ch								
836.50	14.82	V	3.1	0.1	11.75	38.5	-26.7	
836.50	24.46	H	3.1	0.2	21.49	38.5	-17.0	
High Ch								
847.50	15.05	V	3.1	0.0	11.91	38.5	-26.6	
847.50	24.73	H	3.1	0.1	21.69	38.5	-16.8	

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10.1.4. LTE Band 41

20MHz QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 2/1/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: LTE_QPSK Band 41(FCC) Fundamentals, 20MHz Bandwidth

Test Equipment:
Receiving: Horn PRE0101793, and Chamber J SMA Cables
Substitution: Horn PRE0181258, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2506.00	18.33	V	5.9	9.6	22.04	33.0	-11.0	
2506.00	16.08	H	5.9	9.6	19.79	33.0	-13.2	
Mid Ch								
2593.00	18.71	V	6.1	9.9	22.50	33.0	-10.5	
2593.00	17.30	H	6.1	9.9	21.09	33.0	-11.9	
High Ch								
2680.00	17.09	V	6.3	9.9	20.62	33.0	-12.4	
2680.00	16.73	H	6.3	9.9	20.26	33.0	-12.7	

20MHz 16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 2/1/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: LTE_16QAM Band 41(FCC) Fundamentals, 20MHz Bandwidth

Test Equipment:
Receiving: Horn PRE0101793, and Chamber J SMA Cables
Substitution: Horn PRE0181258, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2506.00	18.07	V	5.9	9.6	21.78	33.0	-11.2	
2506.00	15.98	H	5.9	9.6	19.69	33.0	-13.3	
Mid Ch								
2593.00	18.43	V	6.1	9.9	22.22	33.0	-10.8	
2593.00	16.91	H	6.1	9.9	20.70	33.0	-12.3	
High Ch								
2680.00	16.92	V	6.3	9.9	20.45	33.0	-12.6	
2680.00	16.42	H	6.3	9.9	19.95	33.0	-13.1	

15MHz QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 2/1/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: LTE_QPSK Band 41(FCC) Fundamentals, 15MHz Bandwidth

Test Equipment:
Receiving: Horn PRE0101793, and Chamber J SMA Cables
Substitution: Horn PRE0181258, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2503.50	17.68	V	5.9	9.6	21.38	33.0	-11.6	
2503.50	15.48	H	5.9	9.6	19.18	33.0	-13.8	
Mid Ch								
2593.00	16.97	V	6.1	9.9	20.76	33.0	-12.2	
2593.00	15.23	H	6.1	9.9	19.02	33.0	-14.0	
High Ch								
2682.50	16.48	V	6.3	9.9	20.00	33.0	-13.0	
2682.50	16.94	H	6.3	9.9	20.46	33.0	-12.5	

15MHz 16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Lions
Project #: 12678282
Date: 2/1/2019
Test Engineer: 19480 BS
Configuration: EUT Only
Location: Chamber J
Mode: LTE_16QAM Band 41(FCC) Fundamentals, 15MHz Bandwidth

Test Equipment:
Receiving: Horn PRE0101793, and Chamber J SMA Cables
Substitution: Horn PRE0181258, Chamber J Passthrough Cables

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2503.50	17.56	V	5.9	9.6	21.26	33.0	-11.7	
2503.50	15.25	H	5.9	9.6	18.95	33.0	-14.0	
Mid Ch								
2593.00	16.64	V	6.1	9.9	20.43	33.0	-12.6	
2593.00	15.01	H	6.1	9.9	18.80	33.0	-14.2	
High Ch								
2682.50	16.19	V	6.3	9.9	19.71	33.0	-13.3	
2682.50	16.77	H	6.3	9.9	20.29	33.0	-12.7	

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10.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §22.917, §24.238, and §27.53

LIMITS

FCC: §22.917(a), §24.238(a), §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 (m) (41)
At least 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.

TEST PROCEDURE

KDB 971168 D01 v03r01/D02 v02/r01
TIA-603-E, Section 2.2.12.

MODES TESTED

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

RESULTS

No spurious emissions were detected above system noise floor from 18-26GHz.

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10.2.1. GSM

Company:	Samsung
Project #:	12678282
Date:	1/30/2019
Test Engineer:	19480
Configuration:	EUT+ Support Equipment
Mode:	GPRS 850
Chamber #:	Chamber B

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T863 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	824.2MHz											
1	1.649	-68.39	Pk	28.6	-33.4	10.9	-62.29	-13	-49.29	0-360	149	H
2	1.649	-68.16	Pk	28.6	-33.4	10.2	-62.76	-13	-49.76	0-360	149	V
4	2.472	-68.62	Pk	32.6	-32.4	9	-59.42	-13	-46.42	0-360	149	V
3	2.474	-68.88	Pk	32.6	-32.4	8.9	-59.78	-13	-46.78	0-360	149	H
6	3.296	-72.21	Pk	32.9	-31.1	9.7	-60.71	-13	-47.71	0-360	149	V
5	3.297	-70.67	Pk	32.9	-31.1	9.7	-59.17	-13	-46.17	0-360	149	H
	836.6MHz											
1	1.673	-69.71	Pk	29	-33.2	10.6	-63.31	-13	-50.31	0-360	149	H
2	1.673	-68.36	Pk	29	-33.2	9	-63.56	-13	-50.56	0-360	149	V
3	2.509	-69.58	Pk	32.7	-32.2	9.1	-59.98	-13	-46.98	0-360	149	H
4	2.51	-69.6	Pk	32.7	-32.2	9.3	-59.8	-13	-46.8	0-360	149	V
5	3.345	-70.71	Pk	32.9	-31	9.1	-59.71	-13	-46.71	0-360	149	H
6	3.345	-71.96	Pk	32.9	-31	9.3	-60.76	-13	-47.76	0-360	149	V
	848.8MHz											
1	1.698	-67.68	Pk	29.5	-33.3	10	-61.48	-13	-48.48	0-360	149	H
2	1.698	-68.58	Pk	29.5	-33.3	9.3	-63.08	-13	-50.08	0-360	149	V
3	2.546	-69	Pk	32.7	-32	9.2	-59.1	-13	-46.1	0-360	149	H
4	2.546	-70.64	Pk	32.7	-32	8.9	-61.04	-13	-48.04	0-360	149	V
5	3.396	-69.28	Pk	32.8	-31.3	8.7	-59.08	-13	-46.08	0-360	149	H
6	3.396	-70.96	Pk	32.8	-31.3	8.9	-60.56	-13	-47.56	0-360	149	V

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Company:	Samsung
Project #:	12678282
Date:	1/30/2019
Test Engineer:	19480
Configuration:	EUT+ Support Equipment
Mode:	EGPRS 850
Chamber #:	Chamber B

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T863 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	824.2MHz											
2	1.648	-68.01	Pk	28.6	-33.4	10.4	-62.41	-13	-49.41	0-360	149	V
1	1.649	-69.27	Pk	28.6	-33.4	10.9	-63.17	-13	-50.17	0-360	149	H
4	2.473	-69.68	Pk	32.6	-32.4	9	-60.48	-13	-47.48	0-360	149	V
3	2.474	-68.74	Pk	32.6	-32.4	8.9	-59.64	-13	-46.64	0-360	149	H
5	3.297	-69.98	Pk	32.9	-31.1	9.7	-58.48	-13	-45.48	0-360	149	H
6	3.297	-69.57	Pk	32.9	-31.1	9.8	-57.97	-13	-44.97	0-360	149	V
	836.6MHz											
1	1.674	-68.29	Pk	29.1	-33.2	10.5	-61.89	-13	-48.89	0-360	149	H
2	1.674	-68.21	Pk	29.1	-33.2	9	-63.31	-13	-50.31	0-360	149	V
3	2.51	-69.9	Pk	32.7	-32.2	9.1	-60.3	-13	-47.3	0-360	149	H
4	2.51	-69.4	Pk	32.7	-32.2	9.3	-59.6	-13	-46.6	0-360	149	V
6	3.344	-69.69	Pk	32.9	-31	9.3	-58.49	-13	-45.49	0-360	149	V
5	3.347	-69.47	Pk	32.9	-31	9.1	-58.47	-13	-45.47	0-360	149	H
	848.8MHz											
1	1.696	-67.9	Pk	29.5	-33.3	10.2	-61.5	-13	-48.5	0-360	149	H
2	1.698	-67.62	Pk	29.5	-33.3	9.3	-62.12	-13	-49.12	0-360	149	V
3	2.547	-69.65	Pk	32.7	-31.9	9.2	-59.65	-13	-46.65	0-360	149	H
4	2.548	-69.41	Pk	32.7	-31.9	9	-59.61	-13	-46.61	0-360	149	V
6	3.394	-70.26	Pk	32.8	-31.3	8.8	-59.96	-13	-46.96	0-360	149	V
5	3.395	-69.31	Pk	32.8	-31.3	8.7	-59.11	-13	-46.11	0-360	149	H

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Company:	Samsung
Project #:	12678282
Date:	1/24/2019
Test Engineer:	10649
Configuration:	EUT+ Support Equipment
Mode:	GPRS 1900
Chamber #:	Chamber K

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	1852.2MHz											
1	3.7	-66.77	Pk	33.2	-32.5	10.8	-55.27	-13	-42.27	0-360	150	H
2	5.552	-70.55	Pk	34.6	-29.9	10.7	-55.15	-13	-42.15	0-360	150	H
3	7.399	-74.19	Pk	35.6	-26.9	10.5	-54.99	-13	-41.99	0-360	150	H
5	5.557	-71.06	Pk	34.6	-29.9	10.9	-55.46	-13	-42.46	0-360	150	V
6	7.4	-73.83	Pk	35.6	-26.9	10.6	-54.53	-13	-41.53	0-360	150	V
4	3.7	-68.81	Pk	33.2	-32.5	11.1	-57.01	-13	-44.01	0-360	150	V
	1880MHz											
1	3.759	-68.5	Pk	33.3	-32.5	10.4	-57.3	-13	-44.3	0-360	150	H
2	5.638	-71.09	Pk	34.6	-29.5	10.4	-55.59	-13	-42.59	0-360	150	H
3	7.515	-73.38	Pk	35.6	-26.8	10.5	-54.08	-13	-41.08	0-360	150	H
4	3.737	-69.76	Pk	33.3	-32.5	10.7	-58.26	-13	-45.26	0-360	150	V
5	5.618	-71.47	Pk	34.6	-29.6	10.8	-55.67	-13	-42.67	0-360	150	V
6	7.515	-73.82	Pk	35.6	-26.8	10.8	-54.22	-13	-41.22	0-360	150	V
	1909.8MHz											
1	3.819	-65.97	Pk	33.4	-32.2	10	-54.77	-13	-41.77	0-360	150	H
2	5.73	-71.66	Pk	34.9	-29.4	10.4	-55.76	-13	-42.76	0-360	150	H
3	7.638	-73.34	Pk	35.6	-26.6	10.3	-54.04	-13	-41.04	0-360	150	H
4	3.819	-67.87	Pk	33.4	-32.2	10.3	-56.37	-13	-43.37	0-360	150	V
5	5.713	-71.44	Pk	34.9	-29.3	10.4	-55.44	-13	-42.44	0-360	150	V
6	7.612	-73.39	Pk	35.6	-26.6	10.6	-53.79	-13	-40.79	0-360	150	V

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Company:	Samsung
Project #:	12678282
Date:	1/24/2019
Test Engineer:	10649
Configuration:	EUT+ Support Equipment
Mode:	EGPRS 1900
Chamber #:	Chamber K

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	1852.2MHz											
1	3.702	-68.93	Pk	33.2	-32.5	10.7	-57.53	-13	-44.53	0-360	150	H
2	5.555	-70.76	Pk	34.6	-29.9	10.8	-55.26	-13	-42.26	0-360	150	H
3	7.396	-73.31	Pk	35.6	-27	10.6	-54.11	-13	-41.11	0-360	150	H
4	3.717	-68.64	Pk	33.2	-32.6	10.7	-57.34	-13	-44.34	0-360	150	V
5	5.55	-65.27	Pk	34.6	-29.9	10.9	-49.67	-13	-36.67	0-360	150	V
6	7.386	-74	Pk	35.5	-26.9	10.7	-54.7	-13	-41.7	0-360	150	V
	1880MHz											
1	3.761	-67.79	Pk	33.3	-32.5	10.3	-56.69	-13	-43.69	0-360	150	H
2	5.638	-70.98	Pk	34.6	-29.5	10.3	-55.58	-13	-42.58	0-360	150	H
3	7.521	-73.76	Pk	35.6	-26.8	10.5	-54.46	-13	-41.46	0-360	150	H
4	3.758	-68.89	Pk	33.3	-32.5	10.7	-57.39	-13	-44.39	0-360	150	V
5	5.634	-71.13	Pk	34.6	-29.5	10.7	-55.33	-13	-42.33	0-360	150	V
6	7.511	-73.74	Pk	35.6	-26.8	10.8	-54.14	-13	-41.14	0-360	150	V
	1909.8MHz											
1	3.819	-65.36	Pk	33.4	-32.2	10	-54.16	-13	-41.16	0-360	150	H
2	5.726	-71.69	Pk	34.9	-29.3	10.5	-55.59	-13	-42.59	0-360	150	H
3	7.639	-73.33	Pk	35.6	-26.6	10.3	-54.03	-13	-41.03	0-360	150	H
4	3.819	-67.69	Pk	33.4	-32.2	10.3	-56.19	-13	-43.19	0-360	150	V
5	5.725	-71.21	Pk	34.9	-29.3	10.5	-55.11	-13	-42.11	0-360	150	V
6	7.64	-73.07	Pk	35.6	-26.6	10.5	-53.57	-13	-40.57	0-360	150	V

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10.2.2. WCDMA

Company:	Samsung
Project #:	12678282
Date:	1/24/2019
Test Engineer:	10649
Configuration:	EUT+ Support Equipment
Mode:	REL99 B5
Chamber #:	Chamber K

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	826.4MHz											
1	1.651	-57.46	Pk	28.5	-35.5	10.1	-54.36	-13	-41.36	0-360	150	H
2	2.474	-64.73	Pk	32.3	-35.3	10.9	-56.83	-13	-43.83	0-360	150	H
3	3.312	-66.7	Pk	32.8	-33.4	10.8	-56.5	-13	-43.5	0-360	150	H
4	1.651	-62.38	Pk	28.5	-35.5	11	-58.38	-13	-45.38	0-360	150	V
5	2.471	-64.4	Pk	32.2	-35.4	11.1	-56.5	-13	-43.5	0-360	150	V
6	3.309	-67.52	Pk	32.8	-33.4	11.2	-56.92	-13	-43.92	0-360	150	V
	836.6MHz											
1	1.674	-59.8	Pk	28.6	-35.5	9.8	-56.9	-13	-43.9	0-360	150	H
2	2.477	-64.61	Pk	32.3	-35.3	10.8	-56.81	-13	-43.81	0-360	150	H
3	3.382	-66.38	Pk	32.7	-33.4	11	-56.08	-13	-43.08	0-360	150	H
4	1.675	-64.44	Pk	28.6	-35.5	11.3	-60.04	-13	-47.04	0-360	150	V
5	2.517	-65.15	Pk	32.3	-35.4	11.2	-57.05	-13	-44.05	0-360	150	V
6	3.263	-66.06	Pk	32.9	-33.4	11.1	-55.46	-13	-42.46	0-360	150	V
	846.6MHz											
1	1.791	-64.37	Pk	30	-35.4	12.1	-57.67	-13	-44.67	0-360	150	H
2	2.537	-65.4	Pk	32.3	-35.3	9.7	-58.7	-13	-45.7	0-360	150	H
3	3.391	-68.57	Pk	32.6	-33.3	11.1	-58.17	-13	-45.17	0-360	150	H
4	1.865	-63.86	Pk	30.4	-35.4	11.3	-57.56	-13	-44.56	0-360	150	V
5	2.539	-65.03	Pk	32.3	-35.3	10.4	-57.63	-13	-44.63	0-360	150	V
6	3.383	-68.06	Pk	32.7	-33.4	11.1	-57.66	-13	-44.66	0-360	150	V

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Company:	Samsung
Project #:	12678282
Date:	1/24/2019
Test Engineer:	10649
Configuration:	EUT+ Support Equipment
Mode:	HSDPA B5
Chamber #:	Chamber K

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	826.4MHz											
1	1.651	-59.29	Pk	28.5	-35.5	10.1	-56.19	-13	-43.19	0-360	150	H
2	2.473	-66.3	Pk	32.3	-35.3	10.9	-58.4	-13	-45.4	0-360	150	H
3	3.306	-67.93	Pk	32.8	-33.5	10.8	-57.83	-13	-44.83	0-360	150	H
4	1.651	-63.43	Pk	28.5	-35.5	11	-59.43	-13	-46.43	0-360	150	V
5	2.478	-66.16	Pk	32.3	-35.3	10.7	-58.46	-13	-45.46	0-360	150	V
6	3.306	-67.72	Pk	32.8	-33.5	11.3	-57.12	-13	-44.12	0-360	150	V
	836.6MHz											
1	1.675	-62.99	Pk	28.6	-35.5	9.8	-60.09	-13	-47.09	0-360	150	H
2	2.51	-65.22	Pk	32.3	-35.3	10.1	-58.12	-13	-45.12	0-360	150	H
3	3.348	-67.77	Pk	32.8	-33.5	10.5	-57.97	-13	-44.97	0-360	150	H
4	1.737	-64.68	Pk	29.4	-35.5	12.6	-58.18	-13	-45.18	0-360	150	V
5	2.514	-65.71	Pk	32.3	-35.3	11.3	-57.41	-13	-44.41	0-360	150	V
6	3.389	-66.83	Pk	32.6	-33.4	11.1	-56.53	-13	-43.53	0-360	150	V
	846.6MHz											
1	1.763	-65.41	Pk	29.7	-35.5	13	-58.21	-13	-45.21	0-360	150	H
2	2.537	-63.4	Pk	32.3	-35.3	9.7	-56.7	-13	-43.7	0-360	150	H
3	3.39	-67.03	Pk	32.6	-33.3	11.1	-56.63	-13	-43.63	0-360	150	H
4	1.69	-65.08	Pk	28.7	-35.4	11.8	-59.98	-13	-46.98	0-360	150	V
5	2.506	-64.37	Pk	32.3	-35.2	11.2	-56.07	-13	-43.07	0-360	150	V
6	3.387	-68.3	Pk	32.6	-33.4	11.1	-58	-13	-45	0-360	150	V

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Company:	Samsung
Project #:	12678282
Date:	1/24/2019
Test Engineer:	10649
Configuration:	EUT+ Support Equipment
Mode:	REL99 B2
Chamber #:	Chamber K

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	1852.4MHz											
1	3.701	-68.95	Pk	33.2	-32.5	10.7	-57.55	-13	-44.55	0-360	151	H
4	5.561	-70.1	Pk	34.6	-30	10.8	-54.7	-13	-41.7	0-360	151	H
5	7.404	-73.59	Pk	35.6	-26.9	10.4	-54.49	-13	-41.49	0-360	151	H
2	3.705	-68.14	Pk	33.2	-32.6	11	-56.54	-13	-43.54	0-360	151	V
3	5.562	-69.51	Pk	34.6	-30	11	-53.91	-13	-40.91	0-360	151	V
6	7.404	-74.15	Pk	35.6	-26.9	10.6	-54.85	-13	-41.85	0-360	151	V
	1880MHz											
1	3.761	-67.28	Pk	33.3	-32.5	10.3	-56.18	-13	-43.18	0-360	150	H
3	5.637	-70.86	Pk	34.6	-29.5	10.4	-55.36	-13	-42.36	0-360	150	H
5	7.511	-73.4	Pk	35.6	-26.8	10.5	-54.1	-13	-41.1	0-360	150	H
2	3.761	-68.76	Pk	33.3	-32.5	10.6	-57.36	-13	-44.36	0-360	150	V
4	5.637	-70.49	Pk	34.6	-29.5	10.6	-54.79	-13	-41.79	0-360	150	V
6	7.51	-73.12	Pk	35.6	-26.8	10.8	-53.52	-13	-40.52	0-360	150	V
	1907.6MHz											
1	3.812	-67.93	Pk	33.4	-32.3	10.2	-56.63	-13	-43.63	0-360	150	H
4	5.725	-71.49	Pk	34.9	-29.3	10.4	-55.49	-13	-42.49	0-360	150	H
5	7.635	-72.99	Pk	35.6	-26.6	10.4	-53.59	-13	-40.59	0-360	150	H
2	3.814	-68.68	Pk	33.4	-32.3	10.3	-57.28	-13	-44.28	0-360	150	V
3	5.724	-71.6	Pk	34.9	-29.3	10.5	-55.5	-13	-42.5	0-360	150	V
6	7.633	-73.9	Pk	35.6	-26.6	10.7	-54.2	-13	-41.2	0-360	150	V

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Company:	Samsung
Project #:	12678282
Date:	1/24/2019
Test Engineer:	10649
Configuration:	EUT+ Support Equipment
Mode:	HSDPA B2
Chamber #:	Chamber K

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	1852.4MHz											
1	3.702	-66.76	Pk	33.2	-32.5	10.7	-55.36	-13	-42.36	0-360	150	H
3	5.555	-70.6	Pk	34.6	-29.9	10.8	-55.1	-13	-42.1	0-360	150	H
5	7.407	-73.78	Pk	35.6	-26.9	10.4	-54.68	-13	-41.68	0-360	150	H
2	3.698	-68.13	Pk	33.2	-32.5	11.1	-56.33	-13	-43.33	0-360	150	V
4	5.554	-70.92	Pk	34.6	-29.9	10.9	-55.32	-13	-42.32	0-360	150	V
6	7.404	-73.45	Pk	35.6	-26.9	10.6	-54.15	-13	-41.15	0-360	150	V
	1880MHz											
1	3.757	-66.19	Pk	33.3	-32.5	10.4	-54.99	-13	-41.99	0-360	150	H
4	5.64	-72.13	Pk	34.6	-29.4	10.2	-56.73	-13	-43.73	0-360	150	H
5	7.515	-73.52	Pk	35.6	-26.8	10.5	-54.22	-13	-41.22	0-360	150	H
2	3.758	-68.46	Pk	33.3	-32.5	10.7	-56.96	-13	-43.96	0-360	150	V
3	5.642	-70.09	Pk	34.6	-29.4	10.4	-54.49	-13	-41.49	0-360	150	V
6	7.513	-74.04	Pk	35.6	-26.8	10.8	-54.44	-13	-41.44	0-360	150	V
	1907.6MHz											
1	3.813	-67.67	Pk	33.4	-32.3	10.2	-56.37	-13	-43.37	0-360	150	H
3	5.728	-72.43	Pk	34.9	-29.4	10.5	-56.43	-13	-43.43	0-360	150	H
5	7.632	-74.03	Pk	35.6	-26.6	10.5	-54.53	-13	-41.53	0-360	150	H
2	3.815	-67.79	Pk	33.4	-32.2	10.3	-56.29	-13	-43.29	0-360	150	V
4	5.723	-71.57	Pk	34.9	-29.3	10.4	-55.57	-13	-42.57	0-360	150	V
6	7.631	-72.56	Pk	35.6	-26.6	10.6	-52.96	-13	-39.96	0-360	150	V

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10.2.3. LTE BAND 5

Company:	Samsung
Project #:	12678282
Date:	1/15/2019
Test Engineer:	10649
Configuration:	EUT+ Support Equipment
Mode:	LTE 5 QPSK 10MHz
Chamber #:	Chamber K

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	829MHz											
1	1.649	-55.39	Pk	28.5	-35.5	10.1	-52.29	-13	-39.29	0-360	150	H
2	2.474	-55.38	Pk	32.3	-35.3	10.9	-47.48	-13	-34.48	0-360	150	H
3	3.314	-67.8	Pk	32.8	-33.4	10.9	-57.5	-13	-44.5	0-360	150	H
4	1.649	-58.05	Pk	28.5	-35.5	10.9	-54.15	-13	-41.15	0-360	150	V
5	2.474	-58.18	Pk	32.3	-35.3	11	-50.18	-13	-37.18	0-360	150	V
6	3.311	-68.38	Pk	32.8	-33.4	11.2	-57.78	-13	-44.78	0-360	150	V
	836.5MHz											
1	1.664	-53.5	Pk	28.9	-33.1	10.2	-47.5	-13	-34.5	0-360	149	H
2	1.664	-52.35	Pk	28.9	-33.1	8.5	-48.05	-13	-35.05	0-360	149	V
4	2.496	-64.23	Pk	32.7	-32	9	-54.53	-13	-41.53	0-360	149	V
3	2.497	-62.7	Pk	32.7	-32	8.6	-53.4	-13	-40.4	0-360	149	H
6	3.328	-69.85	Pk	32.9	-30.9	9.2	-58.65	-13	-45.65	0-360	149	V
5	3.33	-70.11	Pk	32.9	-31	8.9	-59.31	-13	-46.31	0-360	149	H
	844MHz											
1	1.679	-53.85	Pk	28.6	-35.5	10	-50.75	-13	-37.75	0-360	150	H
2	2.519	-62.42	Pk	32.3	-35.4	10.5	-55.02	-13	-42.02	0-360	150	H
3	3.372	-67.66	Pk	32.7	-33.4	10.8	-57.56	-13	-44.56	0-360	150	H
4	1.679	-57.73	Pk	28.6	-35.5	11.2	-53.43	-13	-40.43	0-360	150	V
5	2.532	-66.42	Pk	32.3	-35.3	10.8	-58.62	-13	-45.62	0-360	150	V
6	3.376	-68.86	Pk	32.7	-33.4	11.1	-58.46	-13	-45.46	0-360	150	V

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Company:	Samsung
Project #:	12678282
Date:	1/15/2019
Test Engineer:	10649
Configuration:	EUT+ Support Equipment
Mode:	LTE 5 16QAM 10MHz
Chamber #:	Chamber K

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	829MHz											
1	1.649	-53.73	Pk	28.5	-35.5	10.1	-50.63	-13	-37.63	0-360	150	H
2	2.474	-54.13	Pk	32.3	-35.3	10.9	-46.23	-13	-33.23	0-360	150	H
3	3.314	-67.29	Pk	32.8	-33.4	10.9	-56.99	-13	-43.99	0-360	150	H
4	1.649	-56.93	Pk	28.5	-35.5	10.9	-53.03	-13	-40.03	0-360	150	V
5	2.474	-58.87	Pk	32.3	-35.3	11	-50.87	-13	-37.87	0-360	150	V
6	3.309	-68.34	Pk	32.8	-33.4	11.2	-57.74	-13	-44.74	0-360	150	V
	836.5MHz											
1	1.664	-53.48	Pk	28.6	-35.5	10.3	-50.08	-13	-37.08	0-360	150	H
2	2.497	-59.93	Pk	32.3	-35.3	9.8	-53.13	-13	-40.13	0-360	150	H
3	3.351	-67.87	Pk	32.8	-33.5	10.5	-58.07	-13	-45.07	0-360	150	H
4	1.664	-57.76	Pk	28.6	-35.5	11	-53.66	-13	-40.66	0-360	150	V
5	2.497	-59.67	Pk	32.3	-35.3	10.9	-51.77	-13	-38.77	0-360	150	V
6	3.344	-67.67	Pk	32.8	-33.4	10.8	-57.47	-13	-44.47	0-360	150	V
	844MHz											
1	1.679	-59.42	Pk	28.6	-35.5	10	-56.32	-13	-43.32	0-360	150	H
2	2.519	-61.14	Pk	32.3	-35.4	10.5	-53.74	-13	-40.74	0-360	150	H
3	3.381	-67.76	Pk	32.7	-33.4	11	-57.46	-13	-44.46	0-360	150	H
4	1.679	-56.22	Pk	28.6	-35.5	11.2	-51.92	-13	-38.92	0-360	150	V
5	2.534	-66.87	Pk	32.3	-35.3	10.7	-59.17	-13	-46.17	0-360	150	V
6	3.378	-68.61	Pk	32.7	-33.4	11.2	-58.11	-13	-45.11	0-360	150	V

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10.2.4. LTE BAND 41

Company:	Samsung
Project #:	12678282
Date:	1/31/2019
Test Engineer:	39339
Configuration:	EUT+ Support Equipment
Mode:	LTE 41 QPSK 20MHz
Chamber #:	Chamber K

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	2506MHz											
1	4.994	-64.47	Pk	34.3	-30.8	10.4	-50.57	-25	-25.57	0-360	150	H
2	7.491	-62.65	Pk	35.6	-26.8	10.4	-43.45	-25	-18.45	0-360	150	H
3	9.989	-73.06	Pk	37	-24	10.3	-49.76	-25	-24.76	0-360	150	H
4	4.994	-66.33	Pk	34.3	-30.8	10.7	-52.13	-25	-27.13	0-360	150	V
5	7.491	-62.89	Pk	35.6	-26.8	10.6	-43.49	-25	-18.49	0-360	150	V
6	9.988	-73.91	Pk	37	-24	10.7	-50.21	-25	-25.21	0-360	150	V
	2593MHz											
1	5.168	-59.71	Pk	34.4	-30.5	10.5	-45.31	-25	-20.31	0-360	150	H
2	7.752	-62.27	Pk	35.7	-26.4	10.4	-42.57	-25	-17.57	0-360	150	H
3	10.335	-74.48	Pk	37.4	-23.6	10.6	-50.08	-25	-25.08	0-360	150	H
4	5.168	-63.27	Pk	34.4	-30.5	10.7	-48.67	-25	-23.67	0-360	150	V
5	7.752	-60.16	Pk	35.7	-26.4	10.6	-40.26	-25	-15.26	0-360	150	V
6	10.336	-73.27	Pk	37.4	-23.6	10.8	-48.67	-25	-23.67	0-360	150	V
	2680MHz											
1	5.342	-59.68	Pk	34.5	-30.3	11	-44.48	-25	-19.48	0-360	150	H
2	8.013	-65.28	Pk	35.7	-26.1	10.2	-45.48	-25	-20.48	0-360	150	H
3	10.721	-75.29	Pk	37.9	-23.1	9.9	-50.59	-25	-25.59	0-360	150	H
4	5.342	-60.88	Pk	34.5	-30.3	10.9	-45.78	-25	-20.78	0-360	150	V
5	8.013	-67.69	Pk	35.7	-26.1	10.5	-47.59	-25	-22.59	0-360	150	V
6	10.713	-75.33	Pk	37.9	-23.1	10.1	-50.43	-25	-25.43	0-360	150	V

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Company:	Samsung
Project #:	12678282
Date:	1/31/2019
Test Engineer:	39339
Configuration:	EUT+ Support Equipment
Mode:	LTE 41 16QAM 20MHz
Chamber #:	Chamber K

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	2506MHz											
1	4.994	-62.07	Pk	34.3	-30.8	10.4	-48.17	-25	-23.17	0-360	150	H
2	7.491	-63.37	Pk	35.6	-26.8	10.4	-44.17	-25	-19.17	0-360	150	H
3	9.972	-74	Pk	37	-24.1	10.3	-50.8	-25	-25.8	0-360	150	H
4	4.994	-64.81	Pk	34.3	-30.8	10.7	-50.61	-25	-25.61	0-360	150	V
5	7.491	-69.25	Pk	35.6	-26.8	10.6	-49.85	-25	-24.85	0-360	150	V
6	9.988	-71.4	Pk	37	-24	10.7	-47.7	-25	-22.7	0-360	150	V
	2593MHz											
1	5.168	-61.96	Pk	34.4	-30.5	10.5	-47.56	-25	-22.56	0-360	150	H
2	7.752	-64.82	Pk	35.7	-26.4	10.4	-45.12	-25	-20.12	0-360	150	H
3	10.331	-73.81	Pk	37.4	-23.7	10.6	-49.51	-25	-24.51	0-360	150	H
4	5.168	-64.2	Pk	34.4	-30.5	10.7	-49.6	-25	-24.6	0-360	150	V
5	7.752	-65.68	Pk	35.7	-26.4	10.6	-45.78	-25	-20.78	0-360	150	V
6	10.343	-73.28	Pk	37.4	-23.6	10.7	-48.78	-25	-23.78	0-360	150	V
	2680MHz											
1	5.342	-61.07	Pk	34.5	-30.3	10.9	-45.97	-25	-20.97	0-360	150	H
2	8.013	-68.25	Pk	35.7	-26.1	10.2	-48.45	-25	-23.45	0-360	150	H
3	10.689	-75.17	Pk	37.8	-23	9.9	-50.47	-25	-25.47	0-360	150	H
4	5.342	-61.39	Pk	34.5	-30.3	10.9	-46.29	-25	-21.29	0-360	150	V
5	8.013	-68.3	Pk	35.7	-26.1	10.5	-48.2	-25	-23.2	0-360	150	V
6	10.227	-72.3	Pk	37.3	-23.6	10.5	-48.1	-25	-23.1	0-360	150	V

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