



CERTIFICATION TEST REPORT

Report Number. : 12162294-E9V2

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

Model : A1984, A2107, A2108

FCC ID : BCG-E3220A

EUT Description : SMARTPHONE

Test Standard(s) : CFR47 PART 27

Date Of Issue:
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NVLAP LAB CODE 200065-0

Revision History

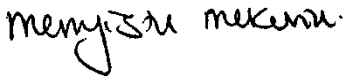
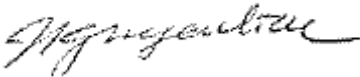
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1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	A1984, A2107, A2108
FCC ID	BCG-E3220A
EUT Description	SMARTPHONE
Serial Number	C7CWN03JK3MN
Date Tested	MARCH 30, 2018 to AUGUST 04, 2018
Applicable Standards	CFR47 PART 27
Test Results	COMPLIES
UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report. Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.	
Approved & Released By: 	Prepared By: 
Mengistu Mekuria Project Engineer UL Verification Services Inc.	Lieu Nguyen Test Engineer UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.26:2015, CFR 47 Part 2, KDB 971168 D01 v03r01/ D02 v02r01, KDB 412172 D01 Determining ERP and EIRP v01r01, Part 27.

3. FACILITIES AND ACCREDITATION

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

47173 Benicia Street	47266 Benicia Street
☐ Chamber A (IC:2324B-1)	☐ Chamber D (IC:22541-1)
☐ Chamber B (IC:2324B-2)	☐ Chamber E (IC:22541-2)
☒ Chamber C (IC:2324B-3)	☐ Chamber F (IC:22541-3)
	☐ Chamber G (IC:22541-4)
	☐ Chamber H (IC:22541-5)

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \\ &\text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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

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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

5.2. DIFFERENCE IN MODEL NUMBER

Model A2107, A2108 is electrically identical to Model A1984. Three model numbers are allocated for marketing and logistic purposes only. A1984 was used to perform all final tests.

5.3. MAXIMUM OUTPUT POWER

ERP/EIRP LIMIT

\$2.1046, \$27.50

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015

KDB 971168 D01 Section 5.6

KDB 412172 D01 Determining ERP and EIRP v01r01

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

where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as P_{Meas} , typically dBW or dBm);

P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

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

OUTPUT POWER FOR LTE BAND 7

Part 27 / RSS 199								
EIRP Limit (W)		2.00						
Antenna Gain (dBi)		-0.90						
Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	99% BW (kHz)	Emission Designator
10+20	QPSK	2505.5	2560.0	25.0	24.10	0.257	28419	28M4G7W
	16QAM			24.2	23.30	0.214	28345	28M3D7W
	64QAM			22.9	22.00	0.158	28352	28M4D7W
20+10	QPSK	2510.0	2564.5	25.0	24.10	0.257	28348	28M3G7W
	16QAM			24.2	23.30	0.214	28318	28M3D7W
	64QAM			23.5	22.60	0.182	28313	28M3D7W
15+15	QPSK	2507.5	2562.5	25.0	24.10	0.257	28897	28M9G7W
	16QAM			22.7	21.80	0.151	28889	28M9D7W
	64QAM			21.5	20.60	0.115	28933	28M9D7W
15+20	QPSK	2507.8	2560.0	25.0	24.10	0.257	33223	33M2G7W
	16QAM			24.2	23.30	0.214	33172	33M2D7W
	64QAM			22.5	21.60	0.145	33158	33M2D7W
20+15	QPSK	2510.0	2562.2	25.0	24.10	0.257	33138	33M1G7W
	16QAM			24.0	23.10	0.204	33121	33M1D7W
	64QAM			22.2	21.30	0.135	33149	33M1D7W
20+20	QPSK	2510.0	2560.0	25.0	24.10	0.257	37978	38M0G7W
	16QAM			24.2	23.30	0.214	37969	38M0D7W
	64QAM			23.0	22.10	0.162	37944	37M9D7W

OUTPUT POWER FOR LTE BAND 41

Part 27								
EIRP Limit (W)		2.00						
Antenna Gain (dBi)		-0.90						
Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	99% BW (kHz)	Emission Designator
5+20	QPSK	2499.3	2680.0	25.0	24.10	0.257	23414	23M4G7W
	16QAM			24.1	23.20	0.209	23434	23M4D7W
	64QAM			23.1	22.20	0.166	23380	23M4D7W
20+5	QPSK	2506.0	2686.7	25.0	24.10	0.257	23381	23M4G7W
	16QAM			24.1	23.20	0.209	23312	23M3D7W
	64QAM			22.8	21.90	0.155	23381	23M4D7W
10+20	QPSK	2501.5	2680.0	25.0	24.10	0.257	28163	28M2G7W
	16QAM			24.1	23.20	0.209	28068	28M1D7W
	64QAM			23.1	22.20	0.166	28087	28M1D7W
20+10	QPSK	2506.0	2684.5	25.0	24.10	0.257	28201	28M2G7W
	16QAM			24.0	23.10	0.204	28147	28M1D7W
	64QAM			23.0	22.10	0.162	28147	28M1D7W
15+15	QPSK	2503.5	2682.5	25.0	24.10	0.257	28570	28M6G7W
	16QAM			24.5	23.60	0.229	28608	28M6D7W
	64QAM			23.2	22.30	0.170	28684	28M7D7W
15+20	QPSK	2503.8	2680.0	25.0	24.10	0.257	32886	32M9G7W
	16QAM			24.0	23.10	0.204	32858	32M9D7W
	64QAM			23.0	22.10	0.162	33022	33M0D7W
20+15	QPSK	2506.0	2682.2	25.0	24.10	0.257	33083	33M1G7W
	16QAM			24.0	23.10	0.204	32831	32M8D7W
	64QAM			23.0	22.10	0.162	32946	32M9D7W
20+20	QPSK	2506.0	2680.0	25.0	24.10	0.257	37994	38M0G7W
	16QAM			24.1	23.20	0.209	37461	37M5D7W
	64QAM			23.1	22.20	0.166	37461	37M5D7W

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 00.28.02.

5.5. MAXIMUM ANTENNA GAIN

Please see table below:

LTE Bands	ANT 1 Antenna Gain (dBi)	ANT 2 Antenna Gain (dBi)
LTE Band 7, 2500 – 2570 MHz	-0.9	-1.6
LTE Band 41, 2496 – 2690 MHz	-0.9	-1.6

5.6. WORST-CASE CONFIGURATION AND MODE

The EUT supports LTE dual carrier Bands of: Band 7, and Band 41.

LTE Band 38 (2570-2620MHz) is covered by LTE Band 41 because it is a subset of LTE band 41. Also, they have the same output power and supported bandwidths on Ant 1.

The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM and 64QAM modulations. It was found that QPSK and 16QAM results were worst case. All testing was performed using QPSK and 16QAM modulations to represent the worst case.

All conducted tests were performed at Ant 1 as worst case since it has higher output powers. Only output power and occupied bandwidth were performed on the 64QAM due to power is lower than QPSK/16QAM

Radiated test was investigated in three orthogonal orientations X/Y/Z on Ant 1/Ant 2, it was determined that X (Flatbed) orientation was the worst-case orientation for all bands on all antenna without AC/DC adapter or headphones.

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

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

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Laptop AC/DC adapter	Apple	MD592LL/A	N/A
Laptop	Apple	A1466	C02PS2H6G08S

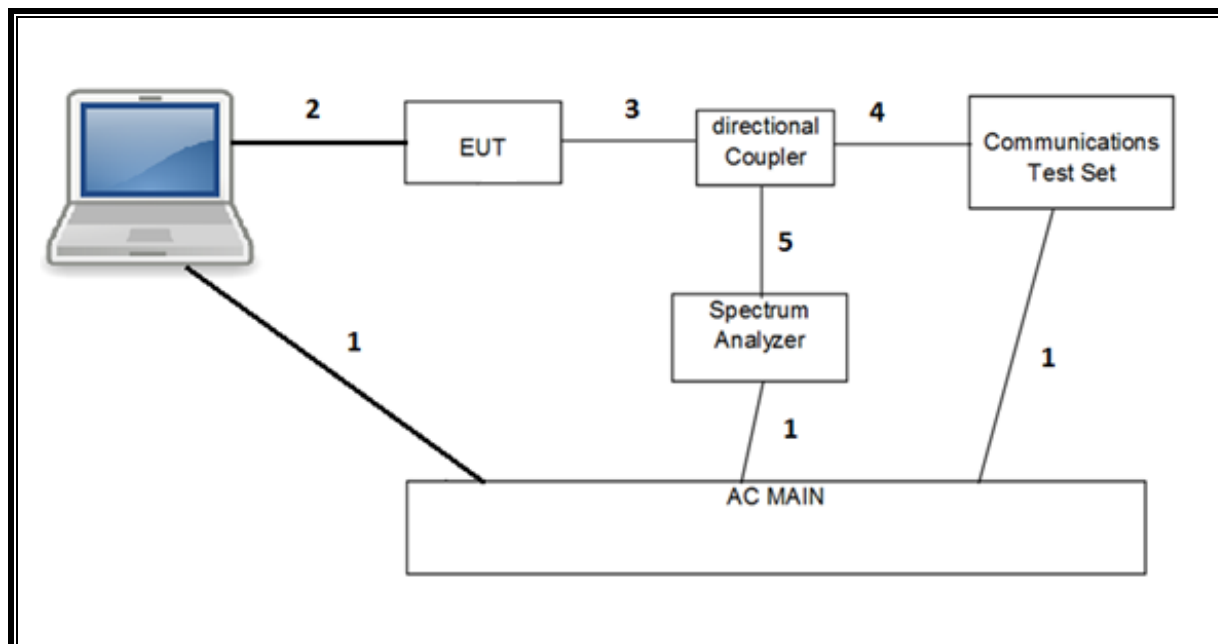
I/O CABLES (RF Conducted Test)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	3	US 115V	Un-shielded	2.0m	N/A
2	USB	1	DC	Un-shielded	1.0m	N/A
3	RF In/Out	1	EUT	Un-shielded	0.6m	N/A
4	RF In/Out	1	Communication Test Set	Un-shielded	1.2m	N/A
5	RF In/Out	1	Barrel	N/A	N/A	N/A

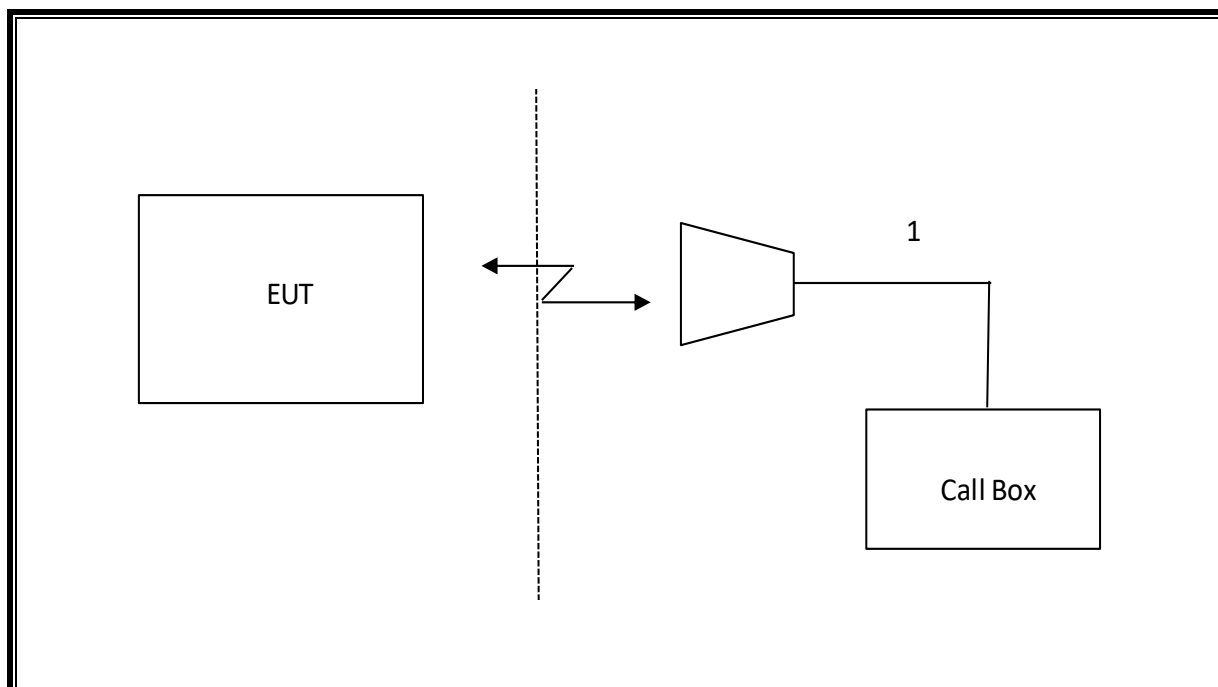
I/O CABLES (RF Radiated Test)

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

CONDUCTED SETUP



RADIATED SETUP



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T119	04/03/2019
*Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T900	05/31/2018
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T1131	12/30/2018
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T285	06/24/2018
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T1113	12/21/2018
Spectrum Analyzer, PXA, 3Hz to 50GHz w/Ext. Mixer	Keysight	N9030A	T342	02/22/2019
Spectrum Analyzer, PSA 3Hz to 44GHz	Keysight	E4446A	T123	10/28/2018
Directional Coupler	KRYTAR	152610	T1536	04/27/2019
Directional Coupler	KRYTAR	152610	T1537	04/27/2019
Power Meter, P-series single channel	Keysight	N1912A	T1265	12/15/2018
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight	N1921A	T750	10/27/2018
Filter, HPF 3.0GHz	MICROTRONICS	HPM17543	T487	12/04/2018
Filter, HPF 1.2GHz	Micro-Tronics	WHKX1.2/15G-6ST	T1182	05/19/2019
*Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	T1210	07/17/2018
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T959	02/17/2019
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	T978	08/31/2018
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T971	02/19/2019
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T754	09/05/2018
Amplifier, 26.5GHz to 40GHz	Miteq	TTA2640-35-HG	T1864	03/09/2019
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Keysight	8449B	T404	03/09/2019
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	06/16/2019
Antenna, Horn 26.5GHz to 40GHz	ARA	MWH-2640	T90	08/25/2018
Antenna, Active Loop 9KHz to 30MHz	EMCO	6502	T1616	09/14/2018
UL AUTOMATION SOFTWARE				
CLT Software	UL	UL RF	Ver 1.7, November 2015	
Power Measurement Software	UL	UL RF	Ver 2.2, June 2017	

Note: *Testing is completed before equipment expiration date.

7. RF OUTPUT POWER VERIFICATION

RULE PART(S)

§2.1046, §27.50

MODES TESTED

- LTE Band 7
- LTE Band 41

RESULT

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

7.1. ANT1 and ANT2

7.1.1. LTE BAND 7

ID:	39004	Date:	6/11/18
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OUTPUT POWER FOR LTE BAND 7 (10.0MHz + 20.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
10MHz / 20MHz	2505.5	2519.9	1	49	1	0	25.0	24.2	22.9	21.2	20.0	18.8
			50	0	100	0	23.3	22.5	19.8	17.5	16.5	16.5
	2525.6	2540.0	1	49	1	0	24.4	23.8	22.7	21.5	20.6	19.6
			50	0	100	0	22.9	22.2	19.4	17.0	16.0	16.0
	2545.6	2560.0	1	49	1	0	24.4	23.5	22.4	21.4	20.5	19.4
			50	0	100	0	23.0	22.2	19.6	17.5	16.5	16.5

OUTPUT POWER FOR LTE BAND 7 (20.0MHz + 10.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
20MHz / 10MHz	2510.0	2524.4	1	99	1	0	24.9	24.2	23.5	21.5	20.4	19.6
			1	0	1	49	16.9	17.0	17.0	12.9	12.9	13.0
			100	0	50	0	23.3	22.5	22.5	19.5	18.5	18.5
	2530.1	2544.5	1	99	1	0	24.6	23.7	23.1	21.3	20.3	19.4
			1	0	1	49	16.6	16.6	16.7	12.7	12.7	12.9
			100	0	50	0	22.9	22.0	22.0	19.2	18.2	18.2
	2550.1	2564.5	1	99	1	0	25.0	23.8	23.0	21.3	20.3	19.4
			1	0	1	49	16.7	16.8	16.7	12.9	12.9	12.9
			100	0	50	0	23.0	22.1	22.1	19.3	18.3	18.3

OUTPUT POWER FOR LTE BAND 7 (15.0MHz + 15.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
15MHz / 15MHz	2507.5	2522.5	1	74	1	0	23.7	22.7	21.5	21.5	20.6	19.5
			75	0	75	0	21.9	21.2	19.2	16.9	16.0	15.9
	2527.5	2542.5	1	74	1	0	23.4	22.4	21.2	19.9	19.0	18.0
			75	0	75	0	21.6	20.8	18.8	16.5	15.4	15.4
	2547.5	2562.5	1	74	1	0	25.0	22.2	21.2	19.8	18.9	17.8
			75	0	75	0	21.6	20.9	19.0	16.7	15.7	15.6

OUTPUT POWER FOR LTE BAND 7 (15.0MHz + 20.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
15MHz / 20MHz	2507.8	2524.9	1	74	1	0	24.9	24.2	22.5	21.5	20.5	19.5
			75	0	100	0	21.7	20.9	19.8	17.9	17.0	16.9
	2525.3	2542.4	1	74	1	0	25.0	24.0	22.1	21.3	20.3	19.3
			75	0	100	0	21.4	20.5	19.4	17.4	16.4	16.4
	2542.9	2560.0	1	74	1	0	24.9	23.7	22.0	21.2	20.2	19.2
			75	0	100	0	21.6	20.7	19.6	17.8	16.7	16.8

OUTPUT POWER FOR LTE BAND 7 (20.0MHz + 15.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
20MHz / 15MHz	2510.0	2527.1	1	99	1	0	25.0	24.0	22.2	21.5	20.4	19.4
			100	0	75	0	22.6	21.7	20.7	18.8	17.8	17.8
	2527.6	2544.7	1	99	1	0	24.6	23.7	22.1	21.3	20.3	19.1
			100	0	75	0	22.2	21.3	20.3	18.6	17.6	17.4
	2545.1	2562.2	1	99	1	0	24.8	23.6	22.0	21.3	20.2	19.3
			100	0	75	0	22.3	21.4	20.4	18.6	17.6	17.6

OUTPUT POWER FOR LTE BAND 7 (20.0MHz + 20.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
20MHz/ 20MHz	2510.0	2529.8	1	99	1	0	25.0	24.2	23.0	21.5	20.5	19.4
			1	0	1	99	16.9	16.9	13.0	9.0	9.0	9.2
			100	0	100	0	23.4	22.7	20.8	18.2	17.2	17.1
	2525.1	2544.9	1	99	1	0	25.0	23.9	22.8	21.3	20.3	19.1
			1	0	1	99	16.7	16.7	12.7	9.5	9.5	9.2
			100	0	100	0	23.1	22.3	20.4	17.9	16.9	16.8
	2540.2	2560.0	1	99	1	0	23.9	23.0	22.5	21.1	20.1	19.2
			1	0	1	99	15.9	15.9	13.1	9.3	9.3	9.2
			100	0	100	0	22.4	21.6	20.6	18.1	17.1	17.1

7.1.2. LTE BAND 41

ID:	39004	Date:	6/11/18
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OUTPUT POWER FOR LTE BAND 41 (5.0MHz + 20.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
5MHz / 20MHz	2499.3	2511.0	1	24	1	0	25.0	24.1	23.1	22.4	21.2	20.2
			25	0	100	0	22.8	21.8	21.8	20.1	19.1	19.1
	2583.8	2595.5	1	24	1	0	24.8	23.8	22.8	22.5	21.4	20.6
			25	0	100	0	22.8	21.8	21.8	20.3	19.4	19.3
	2668.3	2680.0	1	24	1	0	24.6	21.9	21.4	21.9	21.0	19.9
			25	0	100	0	22.4	21.4	21.4	19.7	18.7	18.7

OUTPUT POWER FOR LTE BAND 41 (20.0MHz + 5.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
20MHz / 5MHz	2506.0	2517.7	1	99	1	0	24.7	23.6	22.7	22.5	21.4	20.5
			1	0	1	24	15.9	15.9	16.0	13.6	13.5	13.6
			100	0	25	0	22.5	21.5	21.5	20.4	19.4	19.4
	2590.5	2602.2	1	99	1	0	25.0	24.1	22.8	22.5	21.6	20.6
			1	0	1	24	24.9	24.1	16.0	13.8	13.8	13.8
			100	0	25	0	23.8	22.9	21.5	20.3	19.3	19.4
	2675.0	2686.7	1	99	1	0	24.4	23.4	22.4	25.9	20.9	20.0
			1	0	1	24	15.6	15.6	15.6	13.2	13.1	13.2
			100	0	25	0	22.1	21.2	21.2	19.7	18.8	18.7

OUTPUT POWER FOR LTE BAND 41 (10.0MHz + 20.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
10MHz / 20MHz	2501.5	2515.9	1	49	1	0	24.9	24.1	23.1	22.5	21.5	20.5
			50	0	100	0	22.9	21.9	21.9	20.2	19.2	19.2
	2583.6	2598.0	1	49	1	0	25.0	24.0	23.0	22.5	21.5	20.6
			50	0	100	0	22.8	21.8	21.8	20.3	19.3	19.3
	2665.6	2680.0	1	49	1	0	24.8	23.8	22.7	22.0	21.0	19.9
			50	0	100	0	22.7	21.5	21.5	19.7	18.7	18.7

OUTPUT POWER FOR LTE BAND 41 (20.0MHz + 10.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
20MHz / 10MHz	2506.0	2520.4	1	99	1	0	24.9	23.9	23.0	22.4	21.5	20.5
			100	0	50	0	22.8	21.8	21.8	20.2	19.2	19.2
	2588.1	2602.5	1	99	1	0	25.0	24.0	23.0	22.5	21.4	20.5
			100	0	50	0	22.8	21.7	21.7	20.2	19.2	19.2
	2670.1	2684.5	1	99	1	0	24.7	23.7	22.7	21.9	20.9	19.9
			100	0	50	0	22.4	21.4	21.4	19.6	18.6	18.6

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

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
15MHz / 15MHz	2503.5	2518.5	1	74	1	0	24.8	24.5	23.2	22.4	21.5	20.5
			75	0	75	0	23.1	22.0	22.1	20.2	19.2	19.2
	2585.5	2600.5	1	74	1	0	25.0	24.3	23.2	22.5	21.6	20.4
			75	0	75	0	22.4	22.0	22.0	20.2	19.3	19.3
	2667.5	2682.5	1	74	1	0	24.9	24.0	22.8	21.9	21.0	19.8
			75	0	75	0	22.7	21.7	21.7	19.7	18.7	18.7

OUTPUT POWER FOR LTE BAND 41 (15.0MHz + 20.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
15MHz / 20MHz	2503.8	2520.9	1	74	1	0	25.0	24.0	23.0	22.4	21.3	20.4
			75	0	100	0	22.8	21.8	21.8	21.5	19.2	19.2
	2583.3	2600.4	1	74	1	0	25.0	24.0	22.9	22.5	21.5	20.5
			75	0	100	0	22.8	21.8	21.8	20.2	19.2	19.2
	2662.9	2680.0	1	74	1	0	24.7	23.8	22.7	21.9	21.0	19.9
			75	0	100	0	22.4	21.4	21.4	19.7	18.7	18.6

OUTPUT POWER FOR LTE BAND 41 (20.0MHz + 15.0MHz)

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
20MHz / 15MHz	2506.0	2523.1	1	99	1	0	25.0	23.9	23.0	22.5	21.5	20.5
			100	0	75	0	22.7	21.8	21.8	20.3	19.4	19.4
	2585.6	2602.7	1	99	1	0	25.0	24.0	23.0	22.5	21.5	20.6
			100	0	75	0	22.5	21.7	21.7	20.4	19.4	19.4
	2665.1	2682.2	1	99	1	0	24.6	23.6	22.6	22.0	21.0	20.1
			100	0	75	0	22.3	21.3	21.4	19.7	18.8	18.8

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

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB	PCC RB	SCC1 RB	SCC1 RB	Conducted Average (dBm)					
			Size	Offset	Size	Offset	Ant 1			Ant 2		
							QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
20MHz/ 20MHz	2506.0	2525.8	1	99	1	0	25.0	24.1	23.1	22.5	21.6	20.6
			1	0	1	99	16.2	16.3	16.1	13.5	13.5	13.4
			100	0	100	0	22.9	21.9	21.9	20.3	19.3	19.3
	2583.1	2602.9	1	99	1	0	25.0	23.9	23.0	22.5	21.5	20.5
			1	0	1	99	16.0	16.0	16.0	13.7	13.6	13.6
			100	0	100	0	22.8	21.7	21.8	20.3	19.3	19.3
	2660.2	2680.0	1	99	1	0	24.7	23.5	22.6	22.0	20.9	20.0
			1	0	1	99	15.6	15.6	23.1	13.0	12.9	13.0
			100	0	100	0	22.4	21.4	21.4	19.8	18.7	18.8

8. CONDUCTED TEST RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

§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

- LTE Band 7
- 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

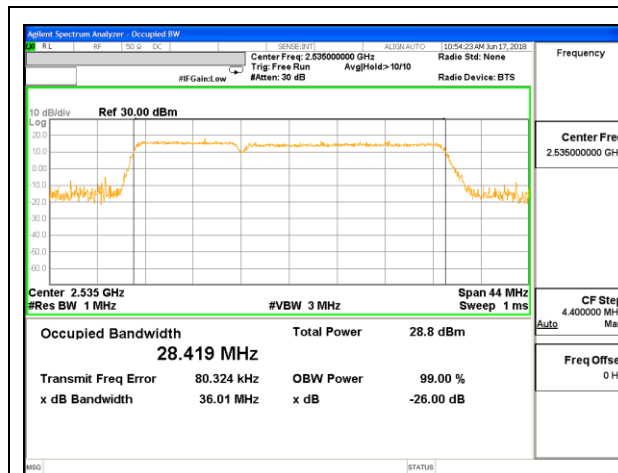
LTE BAND 7

Band	Mode	RB Allocation/RB Offset	f (MHz)	99% BW (MHz)	- 26dB BW (MHz)
LTE BAND 7	10MHz + 20MHz BAND QPSK	50/0 + 100/0	2535	28.419	36.01
	10MHz + 20MHz BAND 16QAM			28.345	38.51
	10MHz + 20MHz BAND 64QAM			28.352	31.43
	20MHz + 10MHz BAND QPSK	100/0 + 50/0		28.348	33.40
	20MHz + 10MHz BAND 16QAM			28.318	31.10
	20MHz + 10MHz BAND 64QAM			28.313	37.34
	15MHz + 15MHz BAND QPSK	75/0 + 75/0		28.897	36.12
	15MHz + 15MHz BAND 16QAM			28.889	34.68
	15MHz + 15MHz BAND 64QAM			28.933	33.91
	15MHz + 20MHz BAND QPSK	75/0 + 100/0		33.223	37.78
	15MHz + 20MHz BAND 16QAM			33.172	42.40
	15MHz + 20MHz BAND 64QAM			33.158	39.02
	20MHz + 15MHz BAND QPSK	100/0 + 75/0		33.138	42.18
	20MHz + 15MHz BAND 16QAM			33.121	42.24
	20MHz + 15MHz BAND 64QAM			33.149	43.44
	20MHz + 20MHz BAND QPSK	100/0 + 100/0		37.978	41.87
	20MHz + 20MHz BAND 16QAM			37.969	41.61
	20MHz + 20MHz BAND 64QAM			37.944	42.34

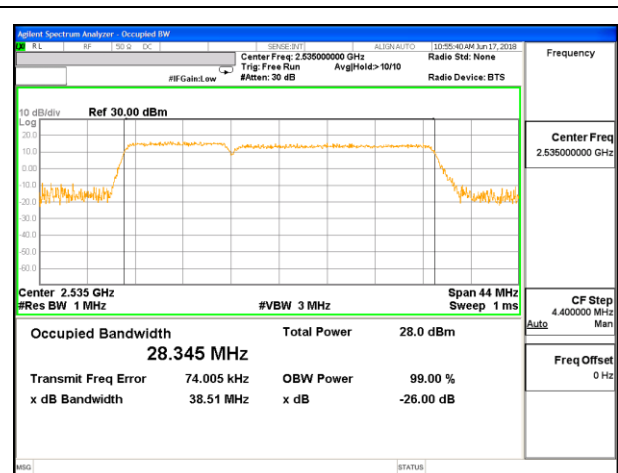
LTE BAND 41

Band	Mode	RB Allocation/RB Offset	f (MHz)	99% BW (MHz)	- 26dB BW (MHz)
LTE BAND 41	5MHz + 20MHz BAND QPSK	25/0 + 100/0	2593	23.414	24.82
	5MHz + 20MHz BAND 16QAM			23.434	24.90
	5MHz + 20MHz BAND 64QAM			23.380	24.70
	20MHz + 5MHz BAND QPSK	100/0 + 25/0		23.381	24.82
	20MHz + 5MHz BAND 16QAM			23.312	25.15
	20MHz + 5MHz BAND 64QAM			23.381	24.82
	10MHz + 20MHz BAND QPSK	50/0 + 100/0		28.163	29.95
	10MHz + 20MHz BAND 16QAM			28.068	29.91
	10MHz + 20MHz BAND 64QAM			28.087	30.42
	20MHz + 10MHz BAND QPSK	100/0 + 50/0		28.201	30.00
	20MHz + 10MHz BAND 16QAM			28.147	29.71
	20MHz + 10MHz BAND 64QAM			28.147	29.71
	15MHz + 15MHz BAND QPSK	75/0 + 75/0		28.570	30.63
	15MHz + 15MHz BAND 16QAM			28.608	31.04
	15MHz + 15MHz BAND 64QAM			28.684	30.48
	15MHz + 20MHz BAND QPSK	75/0 + 100/0		32.886	35.26
	15MHz + 20MHz BAND 16QAM			32.858	38.29
	15MHz + 20MHz BAND 64QAM			33.022	35.21
	20MHz + 15MHz BAND QPSK	100/0 + 75/0		33.083	34.88
	20MHz + 15MHz BAND 16QAM			32.831	34.77
	20MHz + 15MHz BAND 64QAM			32.946	35.37
	20MHz + 20MHz BAND QPSK	100/0 + 100/0		37.994	41.85
	20MHz + 20MHz BAND 16QAM			37.461	44.92
	20MHz + 20MHz BAND 64QAM			37.461	44.92

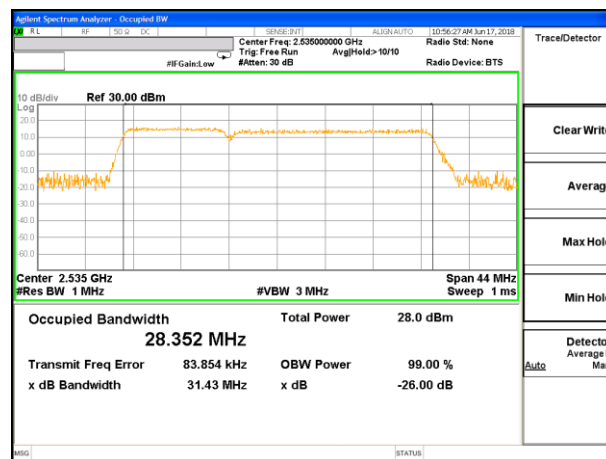
8.1.1. LTE BAND 7



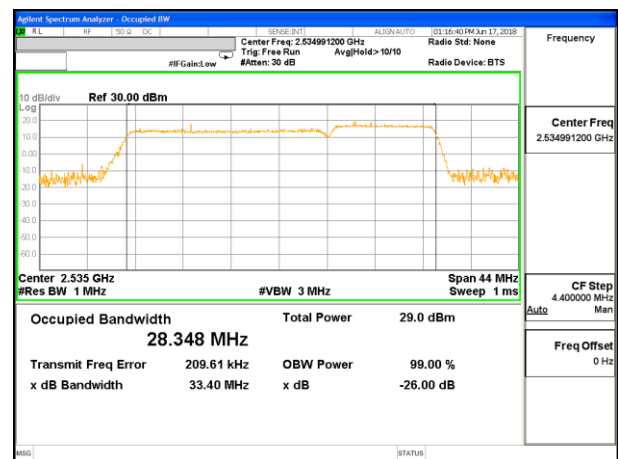
LTE B7 10MHz + 20MHz QPSK RB50-0 + RB100-0 ID:19406



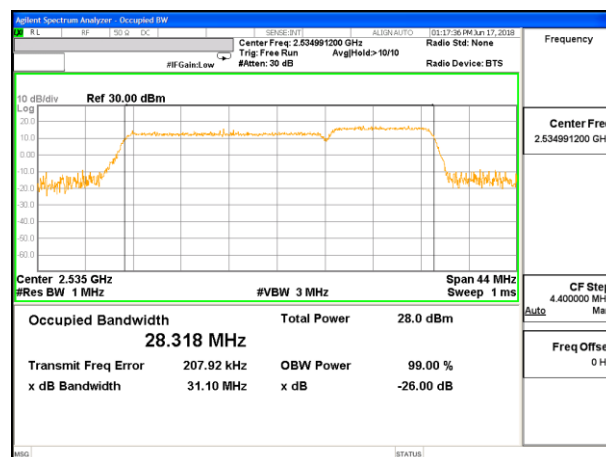
LTE B7 10MHz + 20MHz 16QAM RB50-0 + RB100-0 ID:19406



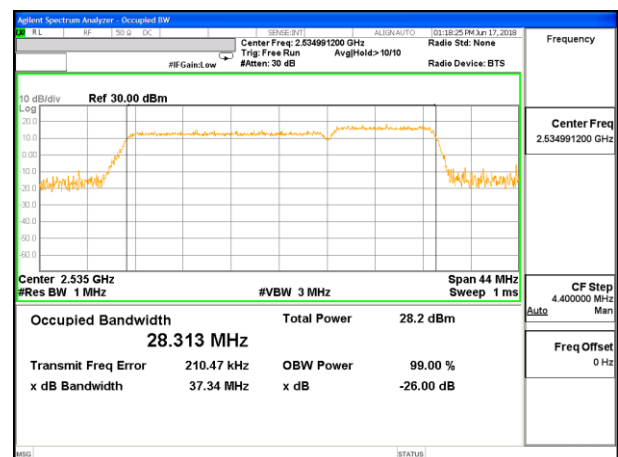
LTE B7 10MHz + 20MHz 64QAM RB50-0 + RB100-0 ID:19406



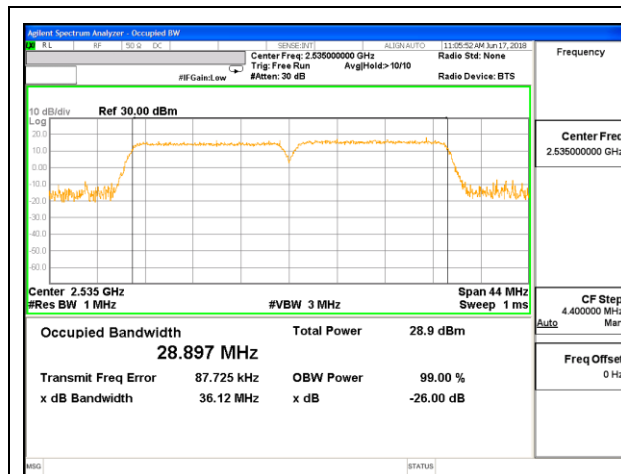
LTE B7 20MHz + 10MHz QPSK RB100-0 + RB50-0 ID:19406



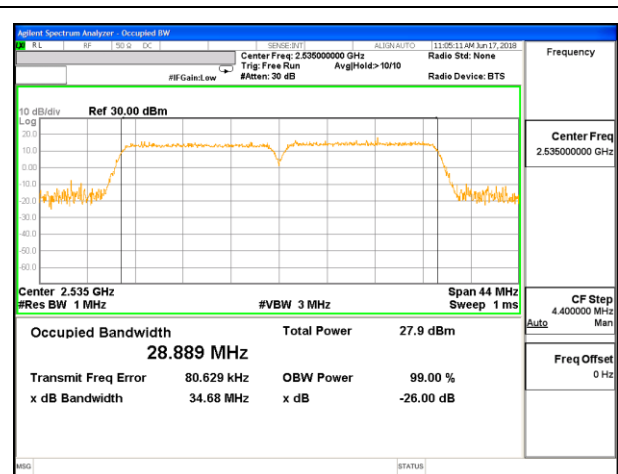
LTE B7 20MHz + 10MHz 16QAM RB100-0 + RB50-0 ID:19406



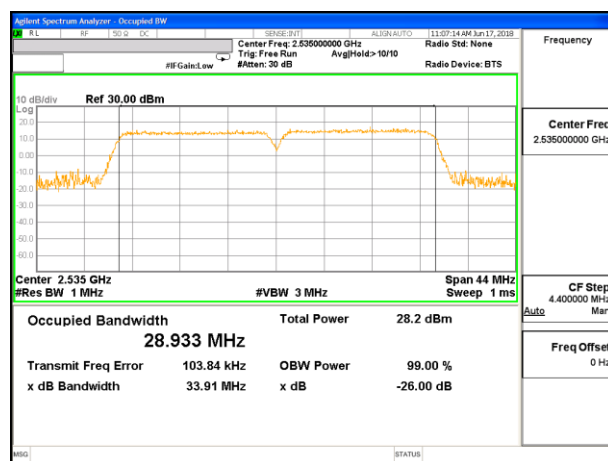
LTE B7 20MHz + 10MHz 64QAM RB100-0 + RB50-0 ID:19406



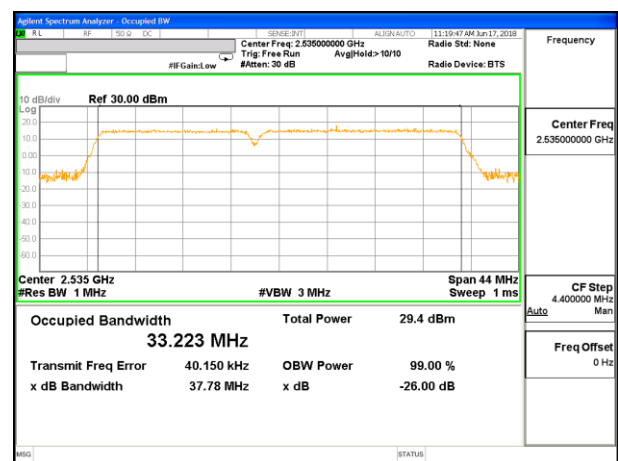
LTE B7 15MHz + 15MHz QPSK RB75-0 + RB75-0 ID:19406



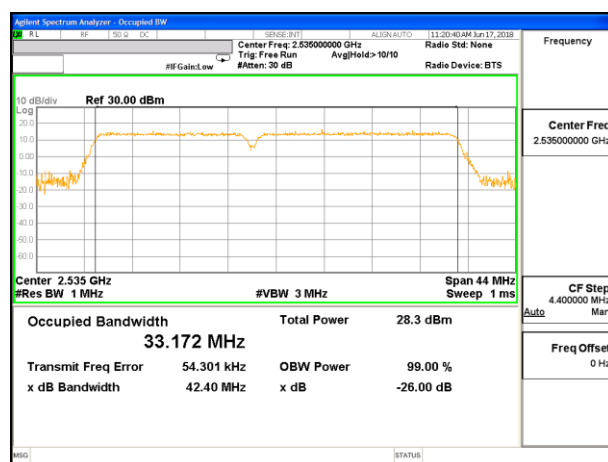
LTE B7 15MHz + 15MHz 16QAM RB75-0 + RB75-0 ID:19406



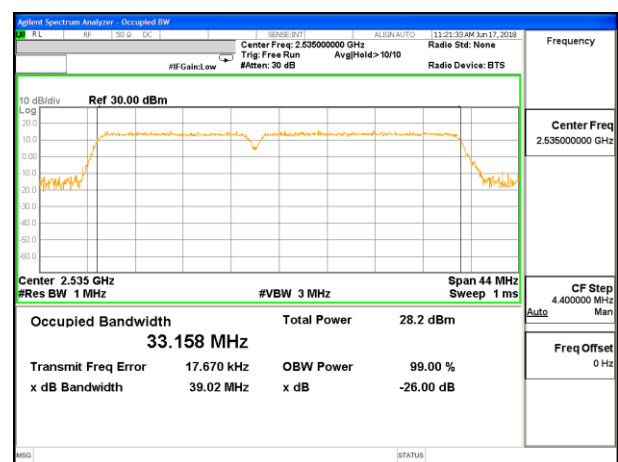
LTE B7 15MHz + 15MHz 64QAM RB75-0 + RB75-0 ID:19406



LTE B7 15MHz + 20MHz QPSK RB75-0 + RB100-0 ID:19406



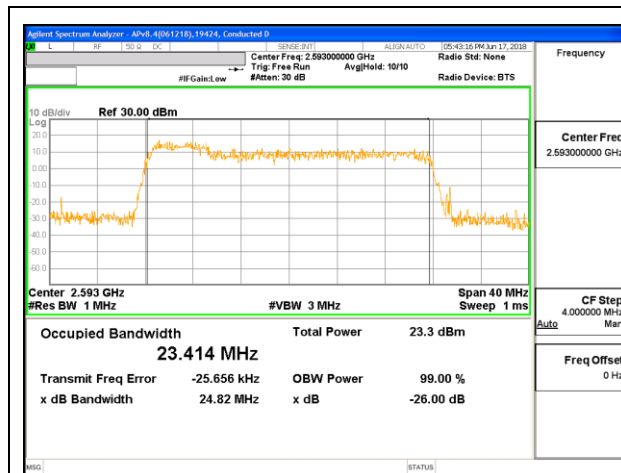
LTE B7 15MHz + 20MHz 16QAM RB75-0 + RB100-0 ID:19406



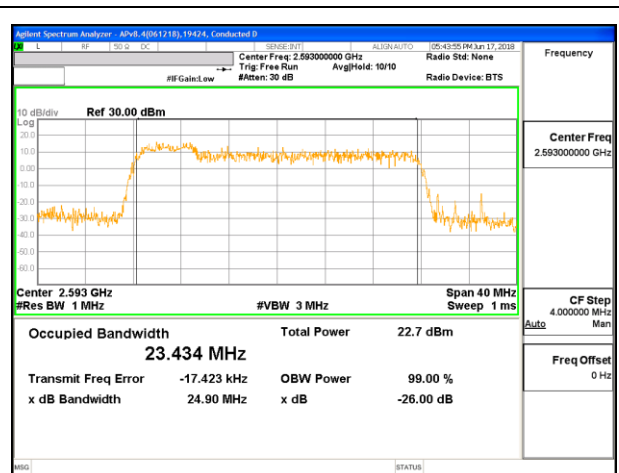
LTE B7 15MHz + 20MHz 64QAM RB75-0 + RB100-0 ID:19406



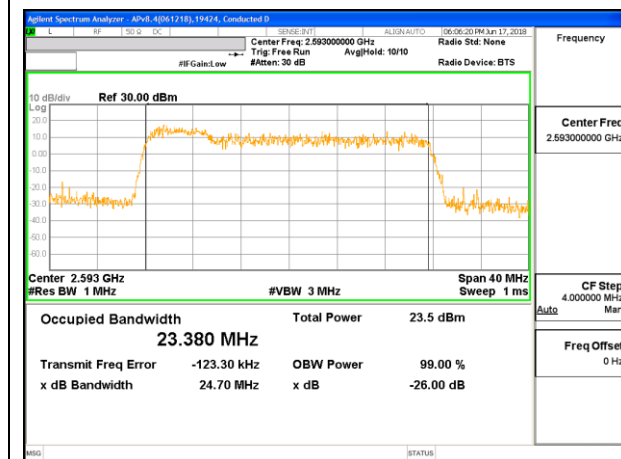
8.1.2. LTE BAND 41



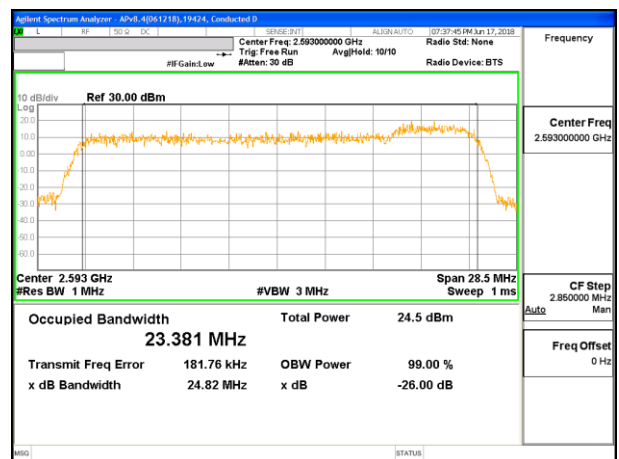
LTE B41 5MHz + 20MHz QPSK RB25-0 + RB100-0



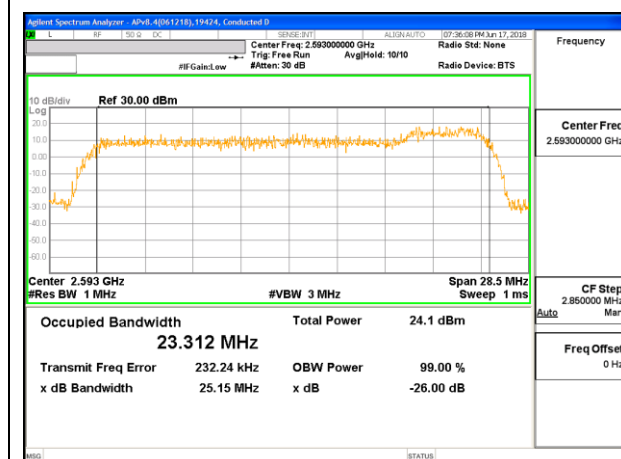
LTE B41 5MHz + 20MHz 16QAM RB25-0 + RB100-0



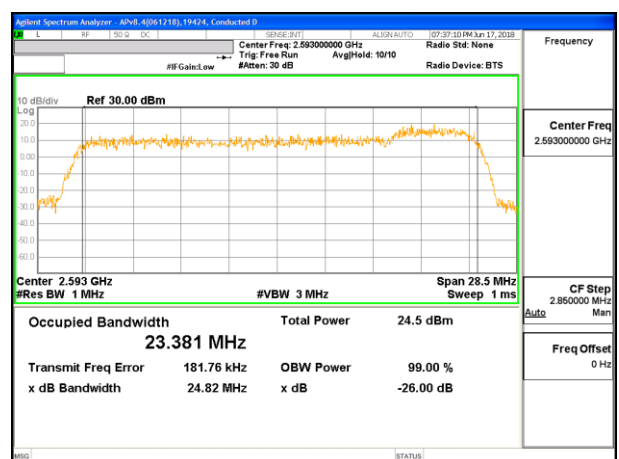
LTE B41 5MHz + 20MHz 64QAM RB25-0 + RB100-0



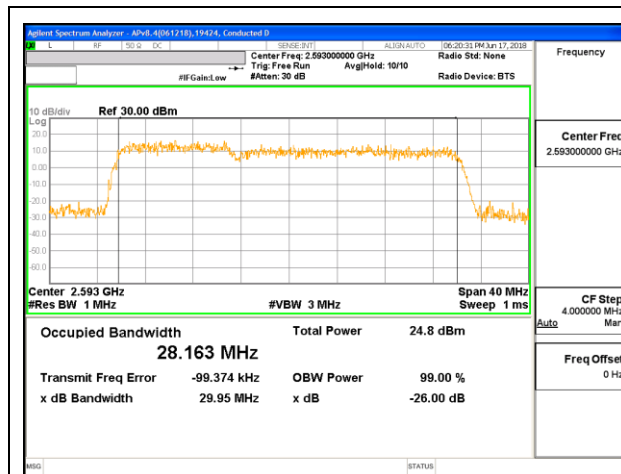
LTE B41 20MHz + 5MHz QPSK RB100-0 + RB25-0



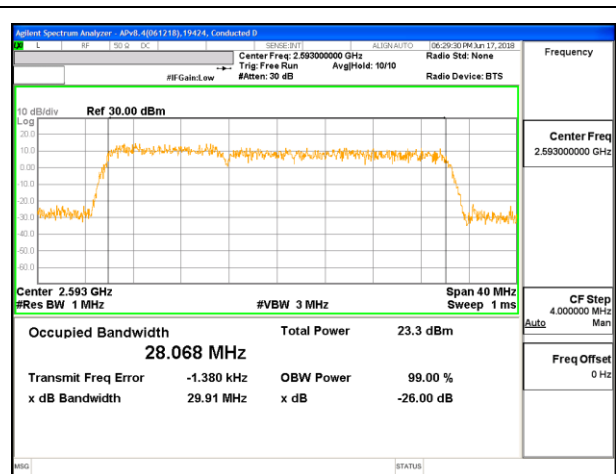
LTE B41 20MHz + 5MHz 16QAM RB100-0 + RB25-0



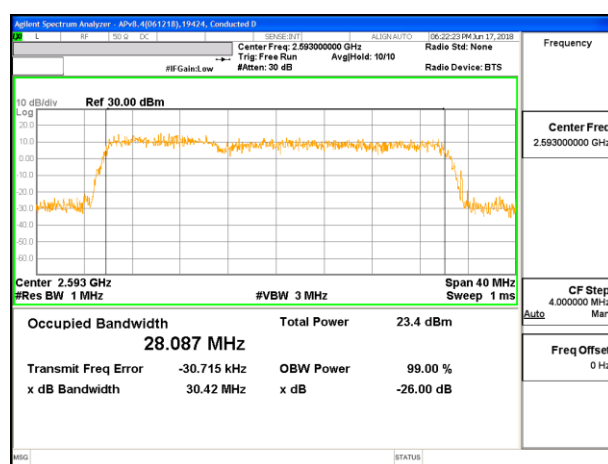
LTE B41 20MHz + 5MHz 64QAM RB100-0 + RB25-0



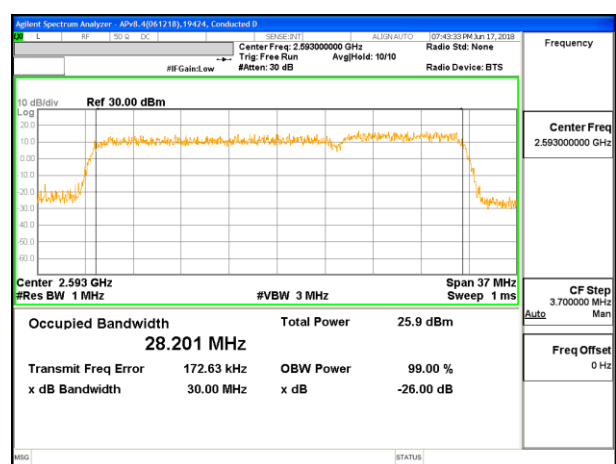
LTE B41 10MHz + 20MHz QPSK RB50-0 + RB100-0



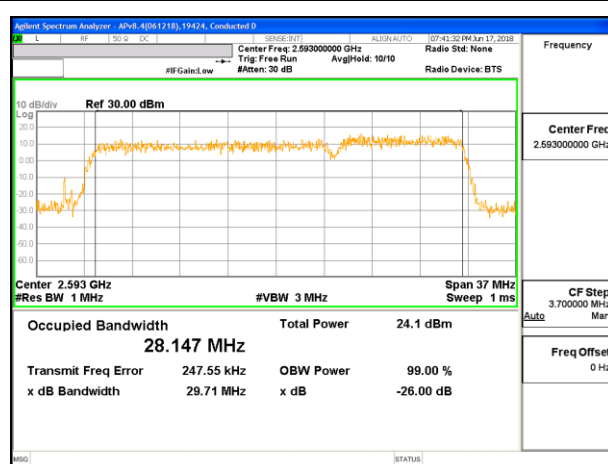
LTE B41 10MHz + 20MHz 16QAM RB50-0 + RB100-0



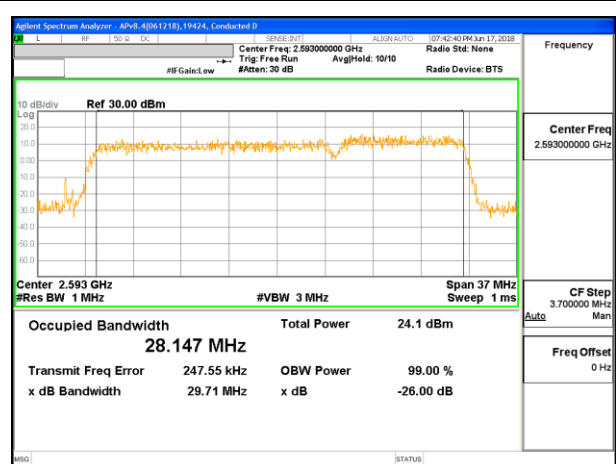
LTE B41 10MHz + 20MHz 64QAM RB50-0 + RB100-0



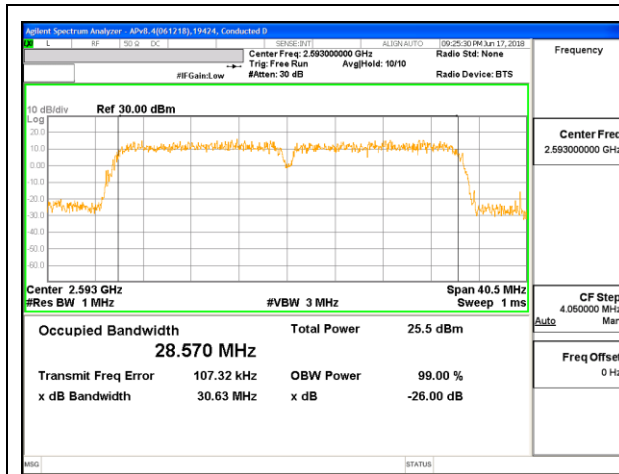
LTE B41 20MHz + 10MHz QPSK RB100-0 + RB50-0



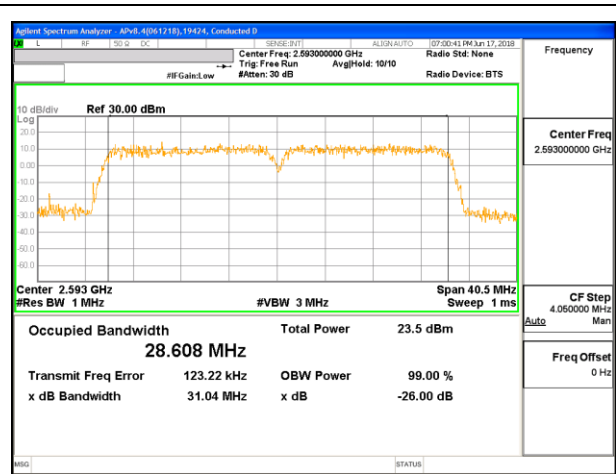
LTE B41 20MHz + 10MHz 16QAM RB100-0 + RB50-0



LTE B41 20MHz + 10MHz 64QAM RB100-0 + RB50-0



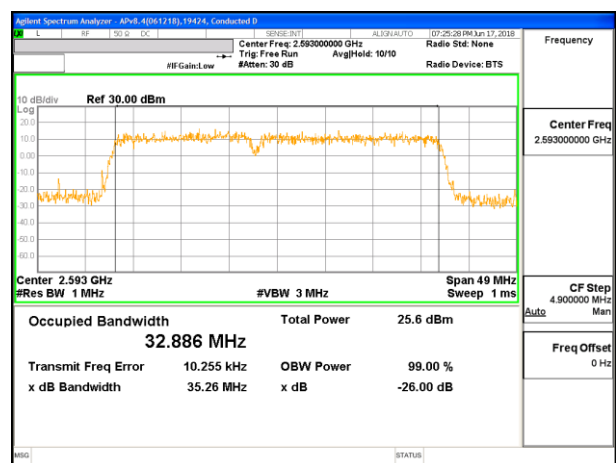
LTE B41 15MHz + 15MHz QPSK RB75-0 + RB75-0



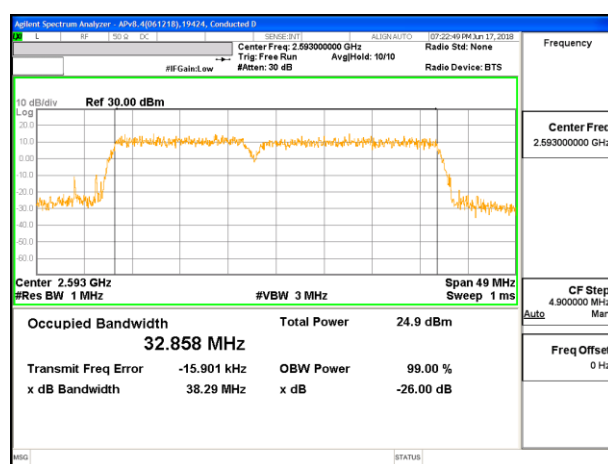
LTE B41 15MHz + 15MHz 16QAM RB75-0 + RB75-0



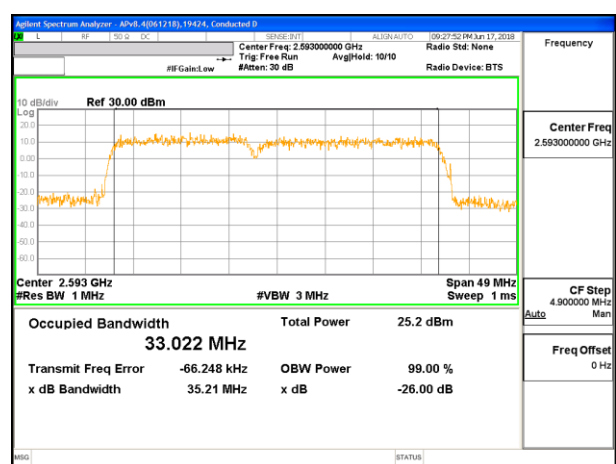
LTE B41 15MHz + 15MHz 64QAM RB75-0 + RB75-0



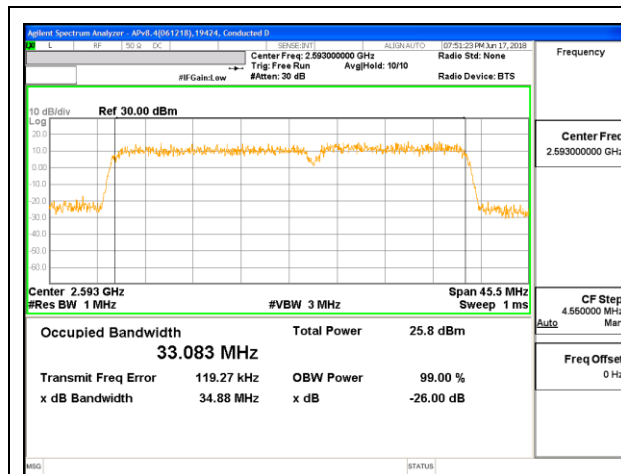
LTE B41 15MHz + 20MHz QPSK RB75-0 + RB100-0



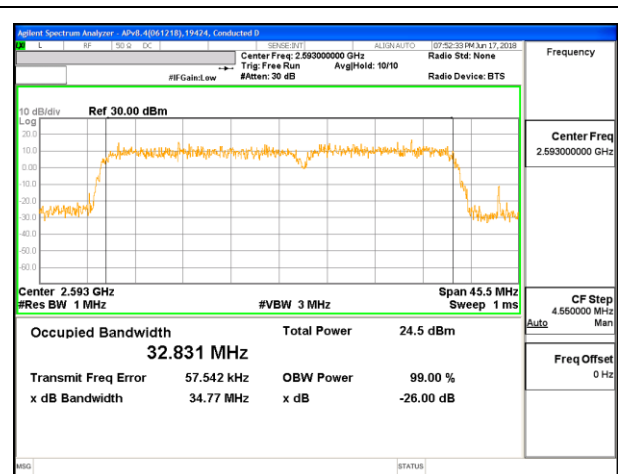
LTE B41 15MHz + 20MHz 16QAM RB75-0 + RB100-0



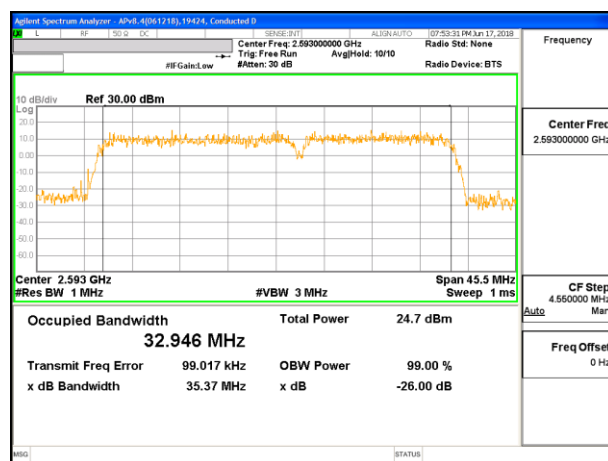
LTE B41 15MHz + 20MHz 64QAM RB75-0 + RB100-0



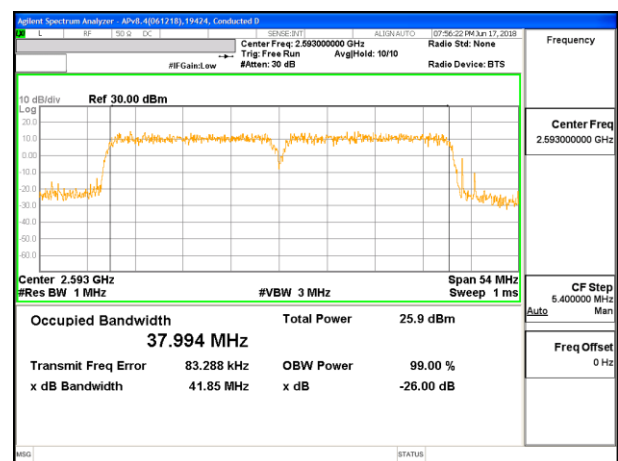
LTE B41 20MHz + 15MHz QPSK RB100-0 + RB75-0



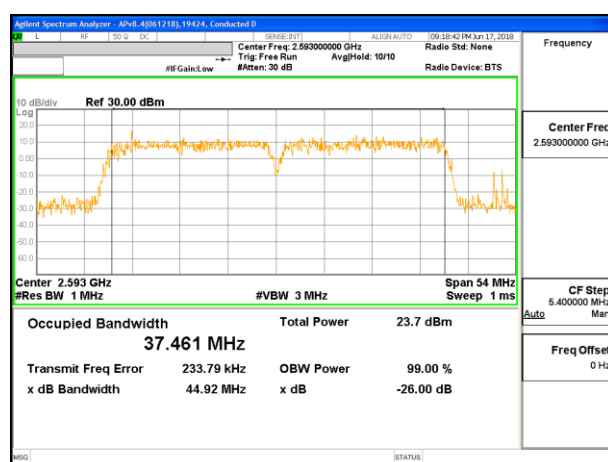
LTE B41 20MHz + 15MHz 16QAM RB100-0 + RB75-0



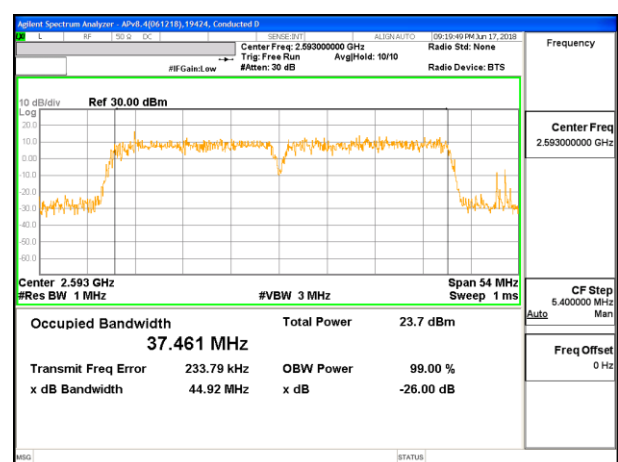
LTE B41 20MHz + 15MHz 64QAM RB100-0 + RB75-0



LTE B41 20MHz + 20MHz QPSK RB100-0 + RB100-0



LTE B41 20MHz + 20MHz 16QAM RB100-0 + RB100-0



LTE B41 20MHz + 20MHz 64QAM RB100-0 + RB100-0

8.2. EMISSION MASK

RULE PART(S)

§2.1051, §27.53

LIMITS

§27.53(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 than $43 + 10 \log (P)$ 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 FOR PART 27

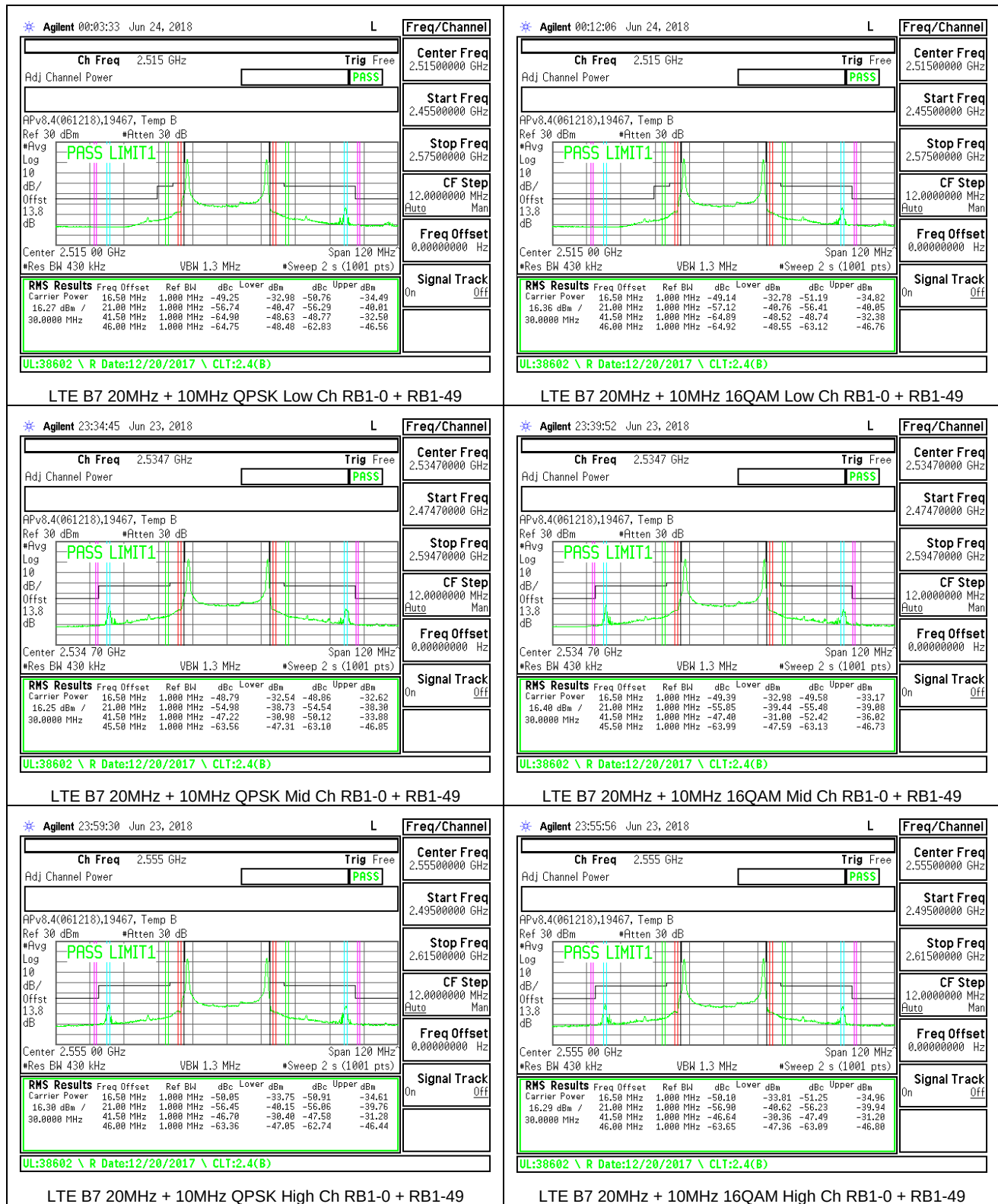
(m)(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed; for mobile digital stations, in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed, except when the 1 megahertz band is 2495-2496 MHz, in which case a resolution bandwidth of at least one percent may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 megahertz or 1 percent of emission bandwidth, as specified; or 1 megahertz or 2 percent for mobile digital stations, except in the band 2495-2496 MHz). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

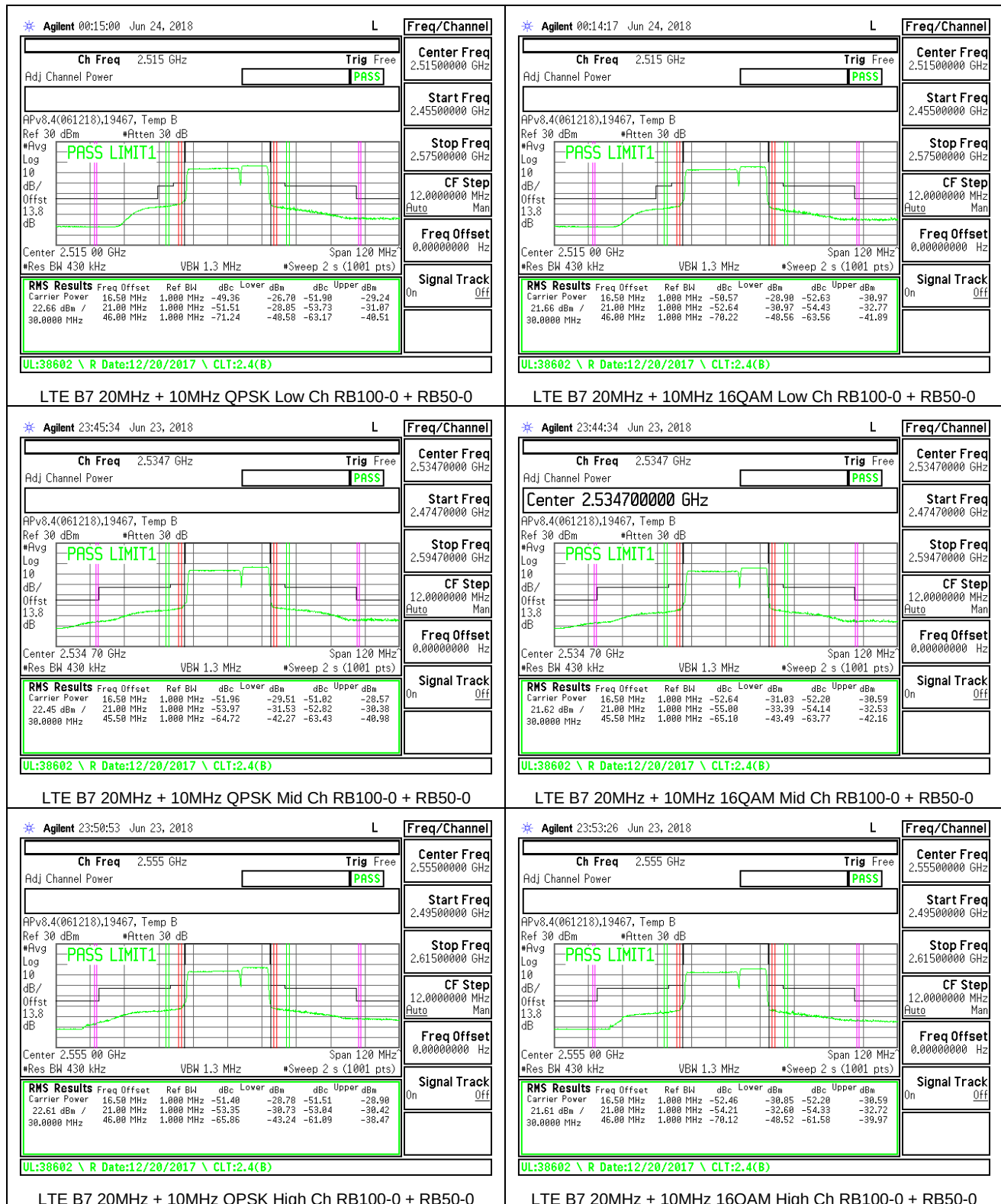
MODES TESTED

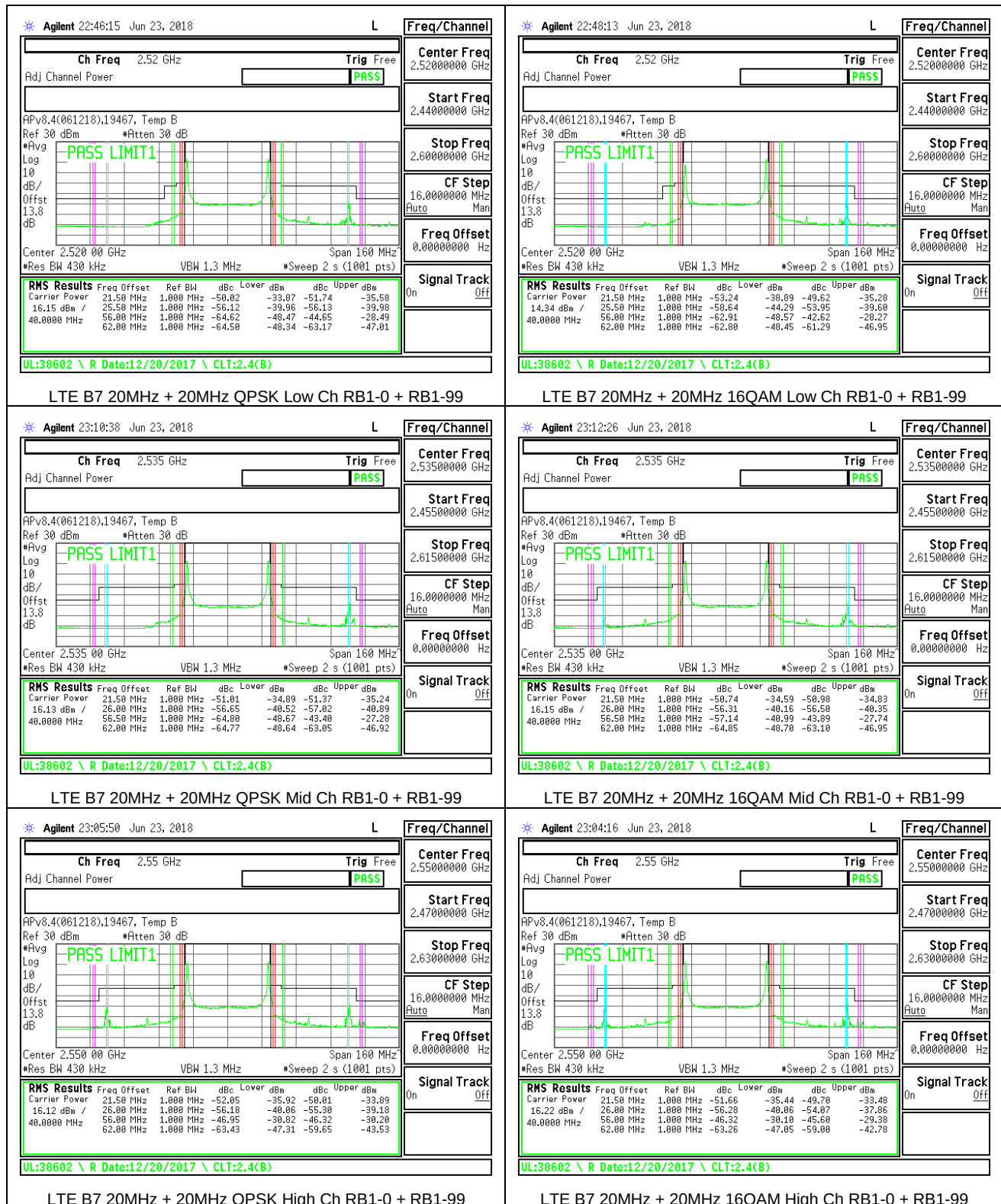
- LTE Band 7
- LTE Band 41

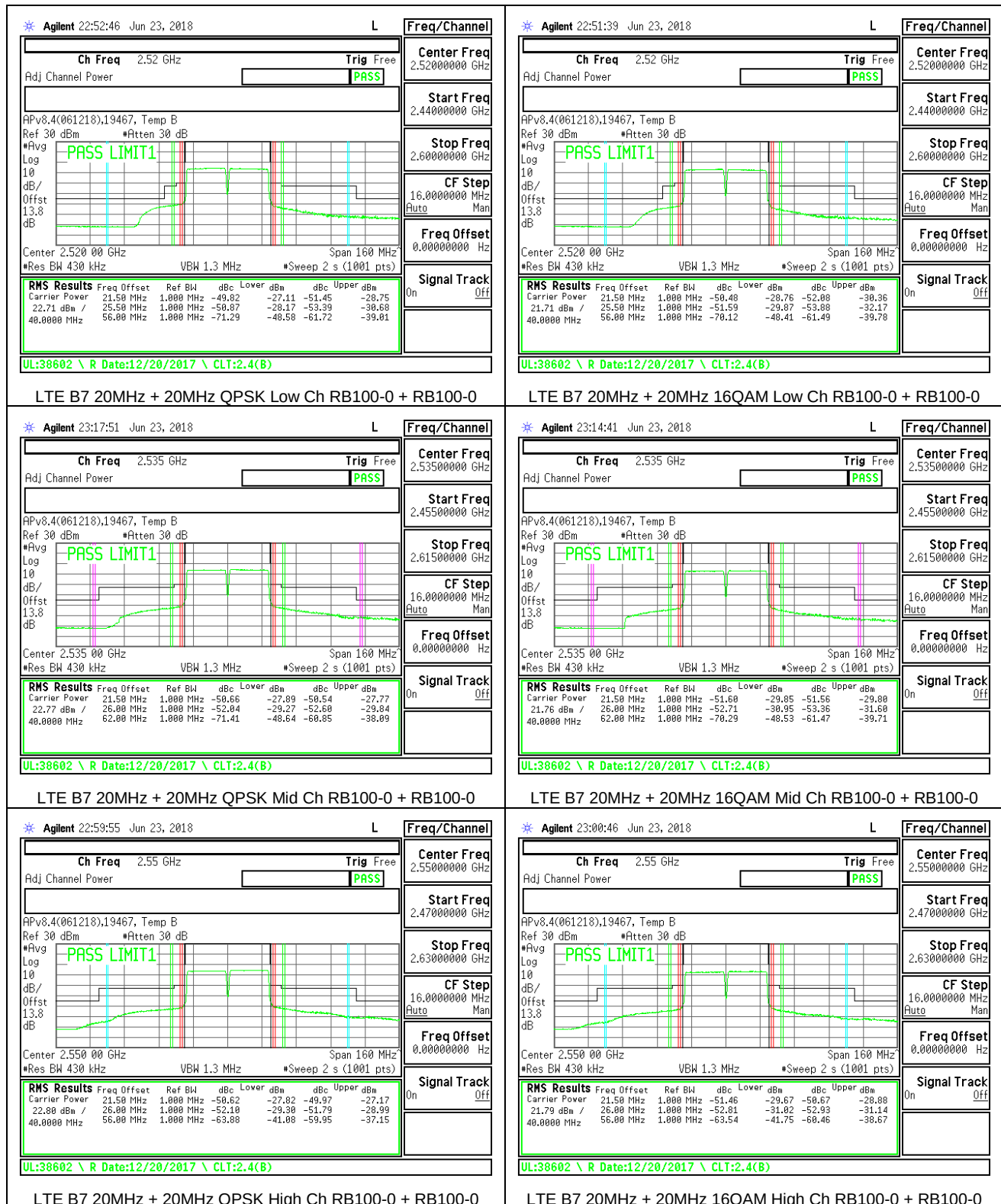
RESULTS

8.2.1. LTE BAND 7









8.2.2. LTE BAND 41

