TEST REPORT

Report Number. : 13171837-E10V1

Applicant	:	Samsung Electronics Co., Ltd. 129 Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 16677, Korea
Model	:	SM-A515U, SM-A515U1, SM-A515W and SM-S515DL
FCC ID	:	A3LSMA515U
EUT Description	:	GSM/CDMA/WCDMA/LTE Phablet with BT/BLE,DTS/UNII a/b/g/n, NFC AND ANT+
Test Standard(s)	:	FCC CFR47 PART 27

Date Of Issue:
FEBRUARY 19, 2020

Prepared by:
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Revision History

NVLAP Lab code: 200065-0

Rev.	Issue Date	Revisions	Revised By
V1	2/19/2020	Initial Review	--

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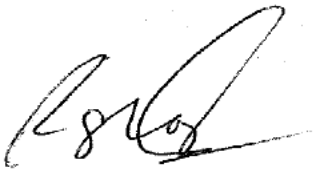
1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	SM-A515U, SM-A515U1, SM-A515W AND SM-S515DL
FCC ID	A3LSMA515U
EUT Description	GSM/CDMA/WCDMA/LTE Phablet with BT/BLE,DTS/UNII a/b/g/n, NFC AND ANT+
Serial Number	CONDUCTED: 353327110230406, 353327110209269 RADIATED: IMEI 353327110220894, 353327110231552, SN R38MC0AMTHP
Date Tested	JANUARY 28, 2020 to FEBRUARY 04, 2020
Applicable Standards	FCC 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. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released By:	Reviewed By:	Prepared By:
		
Dan Coronia Operations Leader UL Verification Services Inc.	Steven Tran Project Engineer UL Verification Services Inc.	Rolly Alegre Test Engineer UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with the following:

- ANSI C63.26:2015
- FCC CFR 47 Part 2, Part 27
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices
- FCC KDB 412172 D01 v01r01. Determining ERP and EIRP

3. FACILITIES AND ACCREDITATION

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

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

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

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

4. 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

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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	3.39 dB
Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Radiated Disturbance,1000 to 18000 MHz	4.24 dB
Radiated Disturbance,18000 to 26000 MHz	4.37 dB
Radiated Disturbance,26000 to 40000 MHz	5.17 dB
Occupied Channel Bandwidth	±0.39 %
Temperature	±0.9 °C
Supply voltages	±0.45 %
Time	±0.02 %

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/CDMA/WCDMA/LTE Phablet with BT/BLE,DTS/UNII a/b/g/n/ac, NFC and ANT+. The model SM-A515U was used for final testing and is representative of the test results in this report.

5.2. MAXIMUM OUTPUT POWER

ERP/EIRP LIMIT

FCC: §2.1046 and §27.50

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015/ TIA-603-E Clause 2.2.17
KDB 971168 D01Section 5.6
KDB 412172 D01 Determining ERP and EIRP v01r01

ERP/EIRP = PMeas + GT − LC
where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);
PMeas = measured transmitter output power or PSD, in dBm or dBW;
GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

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

The transmitter has a maximum average conducted and ERP / EIRP output powers as follows:

OUTPUT POWER FOR LTE BAND 41 (FCC)

Part 27	
EIRP Limit (W)	2.00
Antenna Gain (dBi)	-1.70

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	22.8	21.10	0.129	23380	23M4G7W
	16QAM			20.7	19.00	0.079	25086	25M1D7W
20+5	QPSK	2506.0	2686.7	22.6	20.90	0.123	23357	23M4G7W
	16QAM			20.8	19.10	0.081	23453	23M5D7W
10+20	QPSK	2501.5	2680.0	22.6	20.90	0.123	27962	28M0G7W
	16QAM			20.9	19.20	0.083	28732	28M7D7W
20+10	QPSK	2506.0	2684.5	22.6	20.90	0.123	28016	28M0G7W
	16QAM			20.9	19.20	0.083	28306	28M3D7W
15+15	QPSK	2503.5	2682.5	22.6	20.90	0.123	28590	28M6G7W
	16QAM			21.0	19.30	0.085	28479	28M5D7W
15+20	QPSK	2503.8	2680.0	22.7	21.00	0.126	32736	32M7G7W
	16QAM			20.9	19.20	0.083	32637	32M6D7W
20+15	QPSK	2506.0	2682.2	22.8	21.10	0.129	32602	32M6G7W
	16QAM			21.0	19.30	0.085	32637	32M6D7W
20+20	QPSK	2506.0	2680.0	22.8	21.14	0.130	37426	37M4G7W
	16QAM			20.9	19.20	0.083	37377	37M4D7W

5.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was A515U.001.

5.4. MAXIMUM ANTENNA GAIN

Please see table below:

LTE Bands	Antenna Gain (dBi)
LTE Band 41, 2496 – 2690 MHz (FCC)	-1.7

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT support LTE dual carrier of: Band 41.

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. All testing was performed using QPSK, and 16QAM modulations to represent the worst case. Out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest power for both QPSK and 16QAM.

Highest Power for Each Band				
LTE Band	Compent Carrier	Bandwidth (MHz)	RB Size	RB Offset
41 FCC (Uplink CA)	PCC	20	1	99
	SCC	20	1	0

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, & Z, and it was determined that Y-Axis for 2500MHz with AC/DC Adapter and headset was worst-case orientation.

All radios that can be transmitted simultaneously have been evaluated for radiated for all possible combinations of transmission and found to be in compliance.

Radiated spurious emissions were investigated below 30MHz, 30MHz-1GHz, and above 1GHz. There were no emissions found below 30MHz and 30MHz-1GHz.

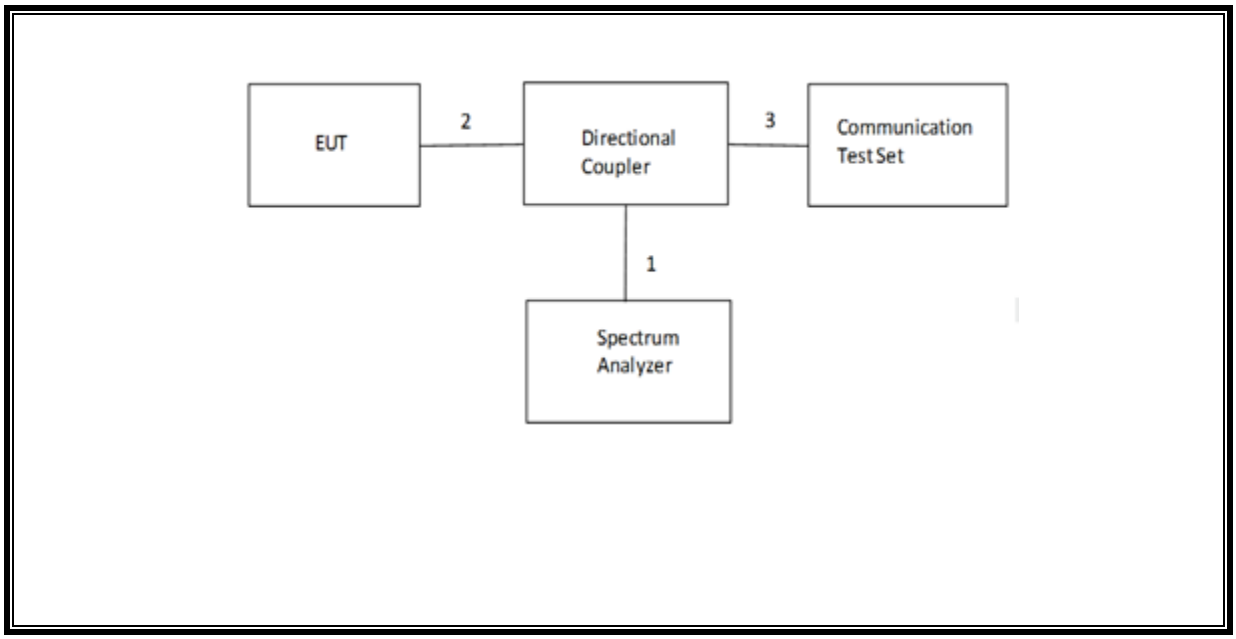
5.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID/ DoC**
AC Adapter	Samsung	EP-TA200	R37KBKLF1W1DK3	N/A
Earphone	Samsung	N/A	N/A	N/A

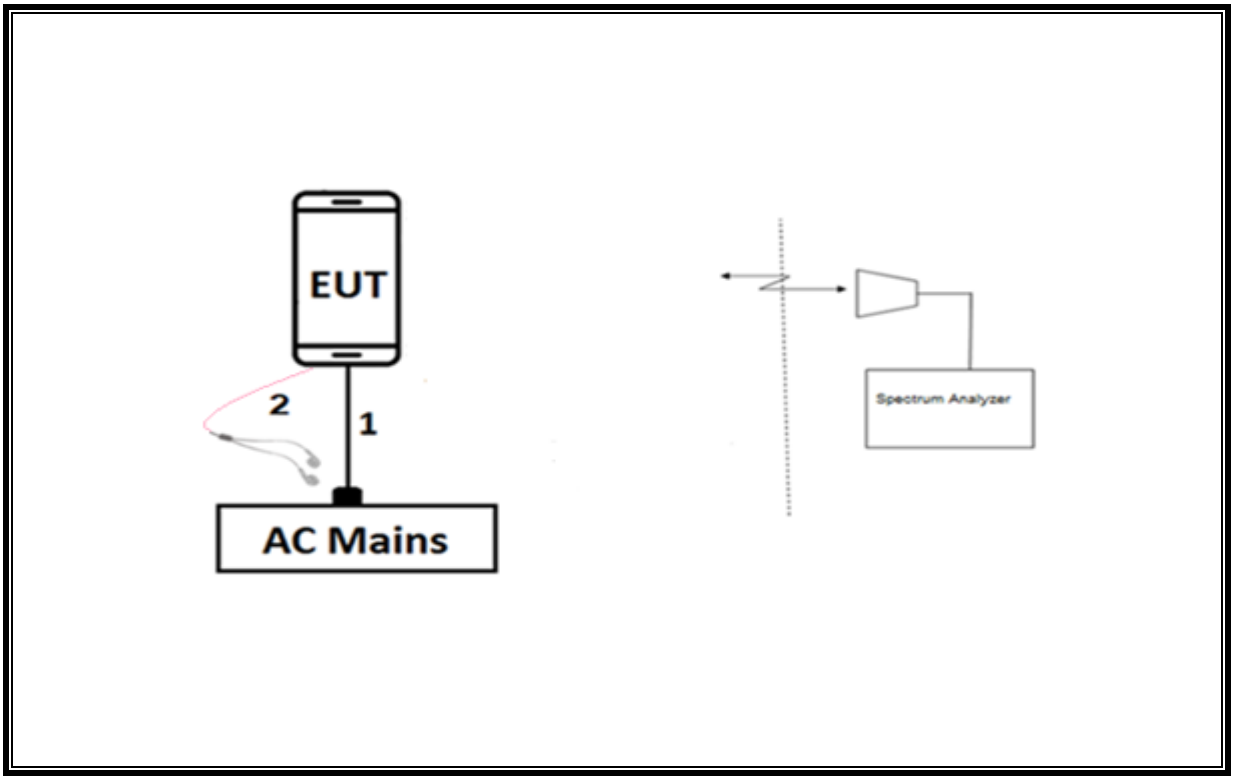
I/O CABLES (RF CONDUCTED TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	RF Out	1	Spectrum Analyzer	Shielded	None	N/A
2	Antenna Port	1	EUT	Shielded	0.1m	N/A
3	RF In/Out	1	Communication Test Set	Shielded	1m	N/A

I/O CABLES (RF RADIATED TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	AC Adapter	Shielded	1	No
2	Earphone	1	USB	Un-shielded	1	No
3	RF In/out	1	Communication Test Set	Un-shielded	2	No

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**	**ID Num**	**Cal Due**	**Last Cal**
Highpass Filter, 4GHz	Micro-Tronics	HPM13351	T1240	05/22/2020	06/22/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T862	06/05/2020	06/05/2019
Ant., Horn 18 - 26.5 GHz	ARA	MWH-1826/B	T448	03/26/2020	03/26/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	05/07/2020	05/07/2019
Hybrid Antenna	SunAR rf motion	JB3	T899	08/23/2020	08/23/2019
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	171460	08/24/2020	08/24/2019
RF Amplifier	AMPLICAL	AMP1G18-35	T1571	05/28/2020	05/28/2019
Pre-Amp 1-26.5 GHz	Agilent	8449B	T404	03/23/2020	03/23/2019
RF Amplifier 9KHz – 1GHz	SONOMA INSTR	310	PRE0180175	05/29/2020	05/29/2019
RF Amplifier 9KHz – 1GHz	SONOMA INSTR	310	PRE0180174	06/01/2020	06/01/2019
Directional Coupler	Mini-Circuits	ZUDC10-183+	PRE0181619	07/21/2020	08/21/2019
Wideband Communication Test Set, Call Box	R&S	CMW500	T375	02/18/2020	02/18/2019
Wideband Communication Test Set, Call Box	R&S	CMW500	T948	02/18/2020	02/18/2019
Wideband Communication Test Set, Call Box	R&S	CMW500	T959	02/16/2020	02/16/2019
Spectrum Analyzer	Agilent (Keysight) Technologies	E4440A	T200	01/28/2020	01/28/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	T917	01/24/2020	01/24/2019
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight	E4446A	T146	01/28/2020	01/28/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	T1450	01/23/2020	01/23/2019
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179376	02/14/2020	02/14/2019
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	05/16/2020	05/16/2019
Spectrum Analyzer	Agilent (Keysight) Technologies	E4440A	T200	01/24/2021	01/24/2020
DC power supply, 8 V @ 3 A or 15 V @ 2 A	Agilent / HP	E3610A	None	CNR	CNR
DC power supply 15V	Sorensen	XT15-4	T465	CNR	CNR
Power Meter	Keysight	N1911A	T1268	01/31/2020	01/31/2019
Power Sensor	Keysight	N1921A	T1226	02/06/2020	02/06/2019
Power Meter	Keysight	N1921A	T229	01/31/2020	01/31/2019
Power Sensor	Keysight	N1921A	T1228	03/01/2020	03/01/2019

UL AUTOMATION SOFTWARE			
CLT Software	UL	UL RF	Ver 7.6, November 11, 2017
Power Measurement Software	UL	UL RF	Ver 2.7, 2019
Radiated test software	UL	UL RF	Ver 9.5 June 15, 2019

NOTES:

*Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

7. RF OUTPUT POWER VERIFICATION

RULE PART(S)

FCC: §2.1046, §27.50

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:

7.1.1. LTE BAND 41 (FCC)

Test Engineer ID:	19480	Test Date:	1/28/2020

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

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB Size	PCC RB Offset	SCC1 RB Size	SCC1 RB Offset	Conducted Average (dBm) QPSK	16QAM	64QAM
5MHz / 20MHz	2499.3	2511.0	1	24	1	0	22.7	20.7	**19.5**
			25	0	100	0	20.6	19.7	17.1
	2583.8	2595.5	1	24	1	0	**22.8**	**20.7**	18.7
			25	0	100	0	20.6	19.7	17.6
	2668.3	2680.0	1	24	1	0	22.6	20.7	18.7
			25	0	100	0	20.7	19.7	17.4

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

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB Size	PCC RB Offset	SCC1 RB Size	SCC1 RB Offset	Conducted Average (dBm) QPSK	16QAM	64QAM
20MHz / 5MHz	2506.0	2517.7	1	99	1	0	**22.6**	**20.8**	19.1
			1	0	1	24	13.5	13.5	13.7
			100	0	25	0	20.8	19.9	**19.8**
	2590.5	2602.2	1	99	1	0	22.5	20.8	19.2
			1	0	1	24	13.8	13.8	13.5
			100	0	25	0	20.7	19.7	19.6
	2675.0	2686.7	1	99	1	0	22.5	20.7	19.4
			1	0	1	24	14.1	13.8	13.5
			100	0	25	0	20.6	19.6	19.6

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

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB Size	PCC RB Offset	SCC1 RB Size	SCC1 RB Offset	Conducted Average (dBm) QPSK	16QAM	64QAM
10MHz / 20MHz	2501.5	2515.9	1	49	1	0	22.6	20.8	19.1
			50	0	100	0	20.8	19.8	19.5
	2583.6	2598.0	1	49	1	0	**22.6**	**20.9**	19.1
			50	0	100	0	20.8	19.8	**19.5**
	2665.6	2680.0	1	49	1	0	22.5	20.8	18.9
			50	0	100	0	20.6	19.6	19.2

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

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB Size	PCC RB Offset	SCC1 RB Size	SCC1 RB Offset	Conducted Average (dBm) QPSK	16QAM	64QAM
20MHz / 10MHz	2506.0	2520.4	1	99	1	0	**22.6**	**20.9**	18.8
			100	0	50	0	20.9	19.9	**19.5**
	2588.1	2602.5	1	99	1	0	22.6	20.6	18.8
			100	0	50	0	20.8	19.8	19.4
	2670.1	2684.5	1	99	1	0	22.5	20.8	19.0
			100	0	50	0	20.6	19.7	19.2

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

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB Size	PCC RB Offset	SCC1 RB Size	SCC1 RB Offset	Conducted Average (dBm)		
							QPSK	16QAM	64QAM
15MHz / 15MHz	2503.5	2518.5	1	74	1	0	**22.6**	20.7	19.1
			75	0	75	0	20.8	19.8	19.5
	2585.5	2600.5	1	74	1	0	22.4	**21.0**	19.0
			75	0	75	0	20.7	19.7	**19.5**
	2667.5	2682.5	1	74	1	0	22.3	20.7	18.9
			75	0	75	0	20.6	19.5	19.2

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

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB Size	PCC RB Offset	SCC1 RB Size	SCC1 RB Offset	Conducted Average (dBm)		
							QPSK	16QAM	64QAM
15MHz / 20MHz	2503.8	2520.9	1	74	1	0	22.6	20.7	18.8
			75	0	100	0	20.7	19.7	**20.3**
	2583.3	2600.4	1	74	1	0	**22.7**	**20.9**	18.9
			75	0	100	0	20.8	19.7	20.0
	2662.9	2680.0	1	74	1	0	22.3	20.7	18.9
			75	0	100	0	20.5	19.5	19.6

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

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB Size	PCC RB Offset	SCC1 RB Size	SCC1 RB Offset	Conducted Average (dBm)		
							QPSK	16QAM	64QAM
20MHz / 15MHz	2506.0	2523.1	1	99	1	0	**22.8**	**21.0**	18.6
			100	0	75	0	20.8	20.0	**20.0**
	2585.6	2602.7	1	99	1	0	22.6	20.9	19.0
			100	0	75	0	20.8	19.9	19.9
	2665.1	2682.2	1	99	1	0	22.5	20.7	18.6
			100	0	75	0	20.6	19.6	19.3

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

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	PCC RB Size	PCC RB Offset	SCC1 RB Size	SCC1 RB Offset	Conducted Average (dBm)		
							QPSK	16QAM	64QAM
20MHz/ 20MHz	2506.0	2525.8	1	99	1	0	**22.8**	**20.9**	18.6
			1	0	1	99	13.7	13.6	13.6
			100	0	100	0	20.8	20.0	**20.0**
	2583.1	2602.9	1	99	1	0	22.5	20.7	19.1
			1	0	1	99	14.1	13.9	13.3
			100	0	100	0	20.8	19.9	20.0
	2660.2	2680.0	1	99	1	0	22.4	20.6	18.6
			1	0	1	99	14.2	13.9	13.3
			100	0	100	0	20.6	19.6	19.6

8. CONDUCTED TEST RESULTS

8.1. 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.

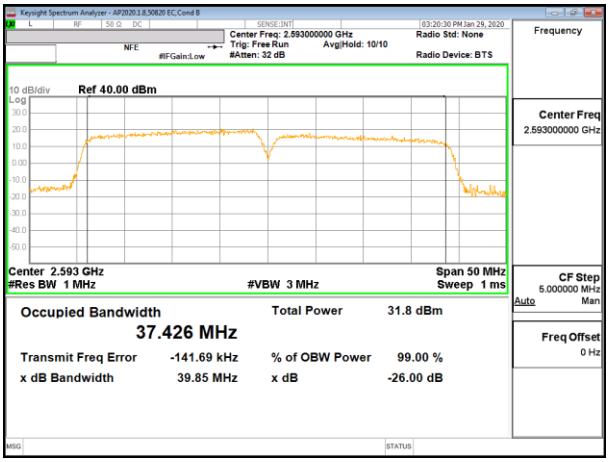
RESULTS

There is no limit required and power is the same for low, middle and high channel; therefore, only middle channel was tested. Worst-case plots (QPSK/16QAM modes and highest bandwidth) are reported only.

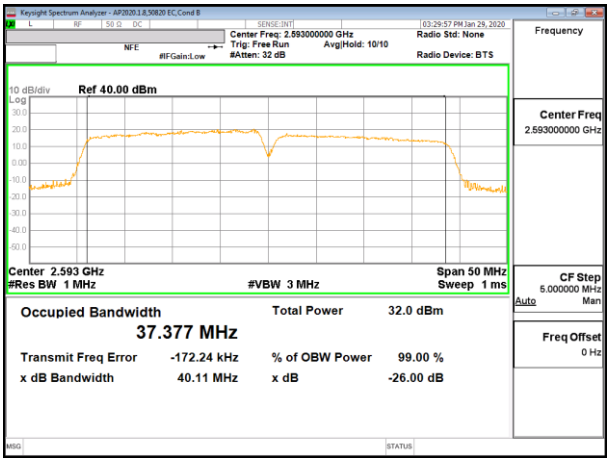
LTE BAND 41 (FCC)

Band	Mode	RB Allocation/RB Offset	f (MHz)	99% BW (MHz)	- 26dB BW (MHz)
LTE BAND 41 (FCC)	5MHz + 20MHz BAND QPSK	25/0 + 100/0	2593	23.380	26.50
	5MHz + 20MHz BAND 16QAM			25.086	39.00
	20MHz + 5MHz BAND QPSK	100/0 + 25/0		23.357	26.49
	20MHz + 5MHz BAND 16QAM			23.453	28.50
	10MHz + 20MHz BAND QPSK	50/0 + 100/0		27.962	31.28
	10MHz + 20MHz BAND 16QAM			28.732	44.00
	20MHz + 10MHz BAND QPSK	100/0 + 50/0		28.016	30.78
	20MHz + 10MHz BAND 16QAM			28.306	37.00
	15MHz + 15MHz BAND QPSK	75/0 + 75/0		28.590	32.33
	15MHz + 15MHz BAND 16QAM			28.479	31.39
	15MHz + 20MHz BAND QPSK	75/0 + 100/0		32.736	35.56
	15MHz + 20MHz BAND 16QAM			32.637	35.33
	20MHz + 15MHz BAND QPSK	100/0 + 75/0		32.602	35.28
	20MHz + 15MHz BAND 16QAM			32.637	35.61
	20MHz + 20MHz BAND QPSK	100/0 + 100/0		37.426	39.85
	20MHz + 20MHz BAND 16QAM			37.377	40.11

8.1.1. LTE BAND 41 (FCC)



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



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

8.2. BAND EDGE AND EMISSION MASK

LIMITS

FCC: §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 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 R&S CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each band edge measurement:

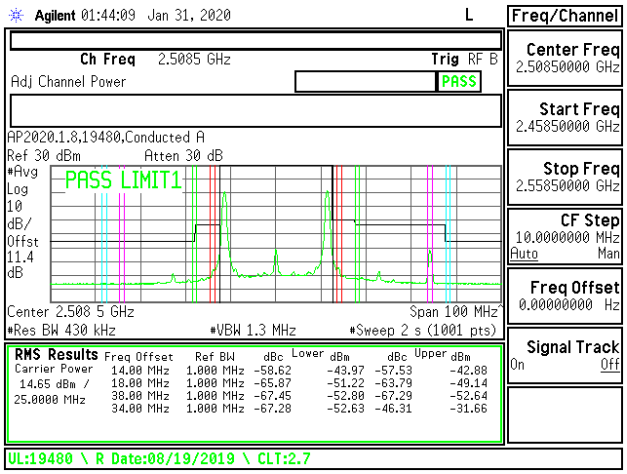
- Set the spectrum analyzer span to include the block edge frequency.
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

TEST PROCEDURE FOR FCC PART 27

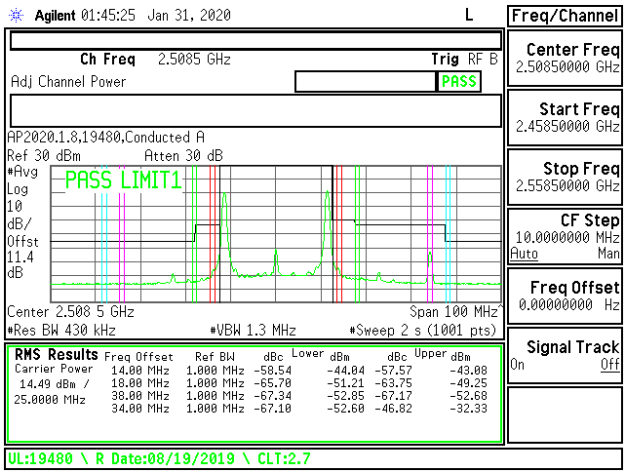
(m)(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of 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.

RESULTS

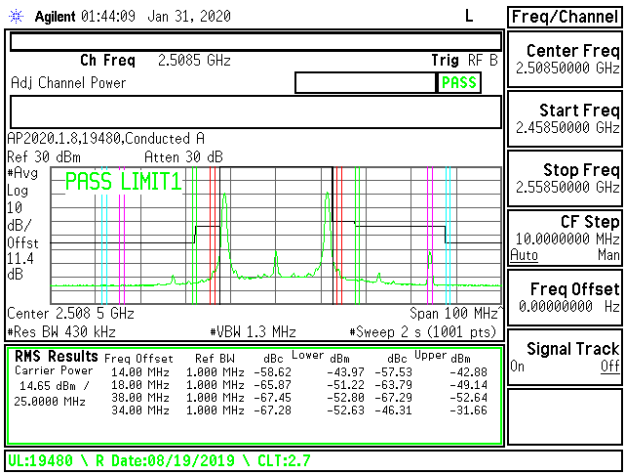
8.2.1. LTE BAND 41 (FCC)



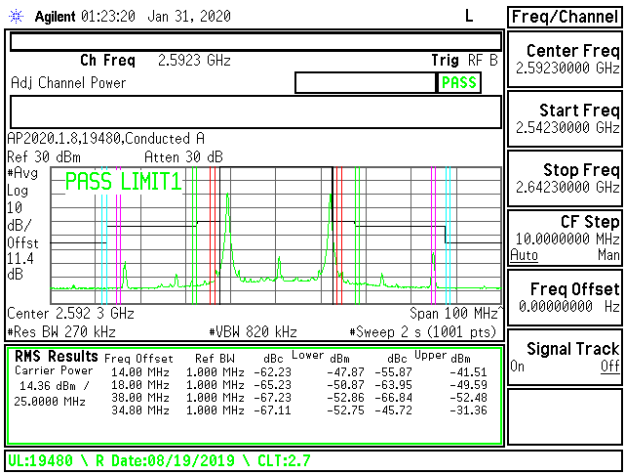
LTE B41 20MHz + 5MHz QPSK Low Ch RB1-0 + RB1-24



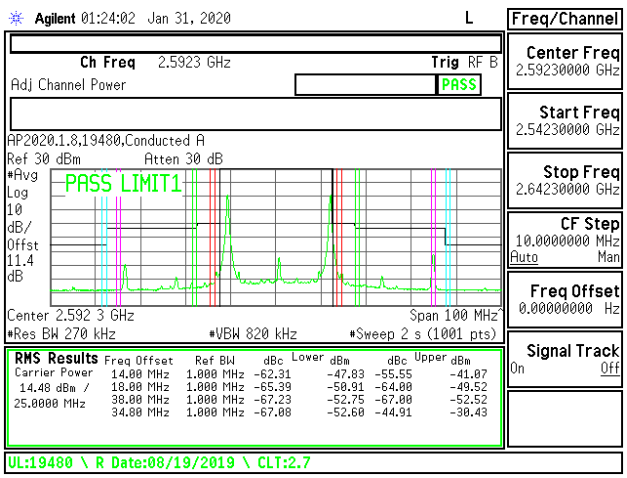
LTE B41 20MHz + 5MHz 16QAM Low Ch RB1-0 + RB1-24



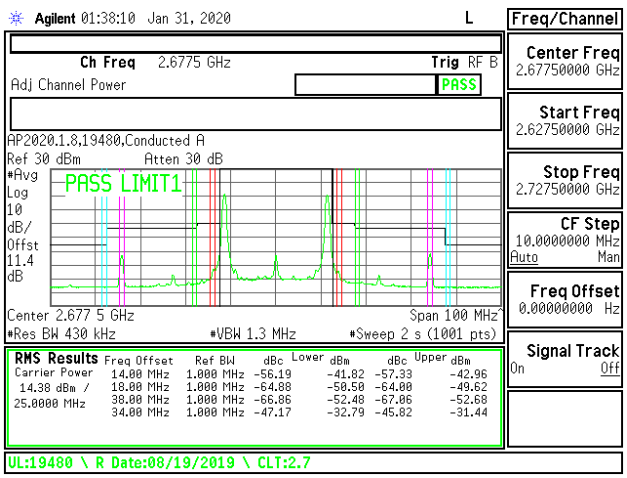
LTE B41 20MHz + 5MHz QPSK Mid Ch RB1-0 + RB1-24



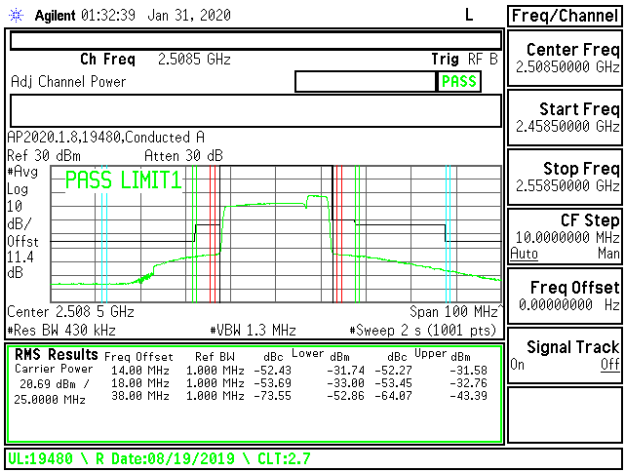
LTE B41 20MHz + 5MHz 16QAM Mid Ch RB1-0 + RB1-24



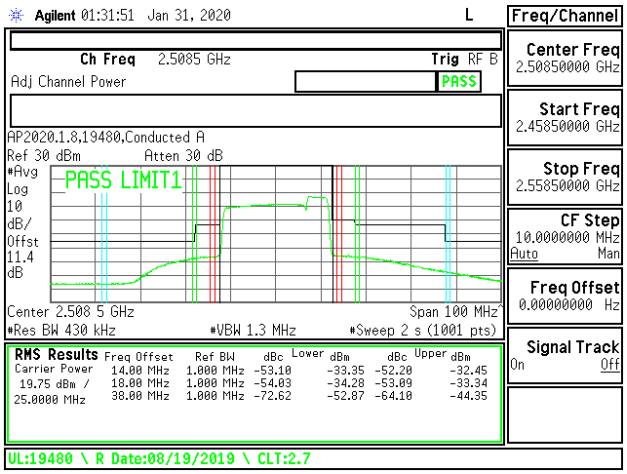
LTE B41 20MHz + 5MHz QPSK High Ch RB1-0 + RB1-24



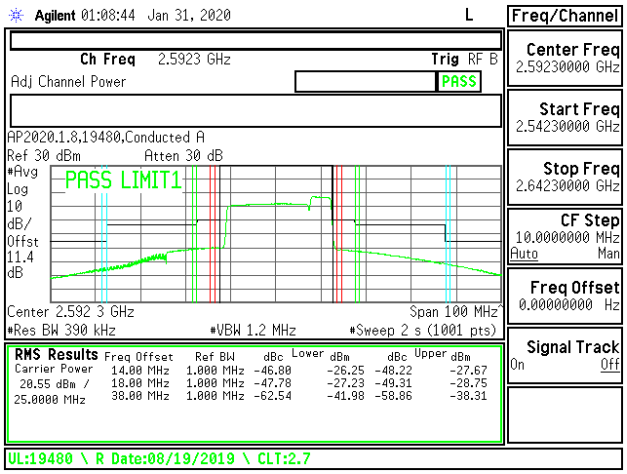
LTE B41 20MHz + 5MHz 16QAM High Ch RB1-0 + RB1-24



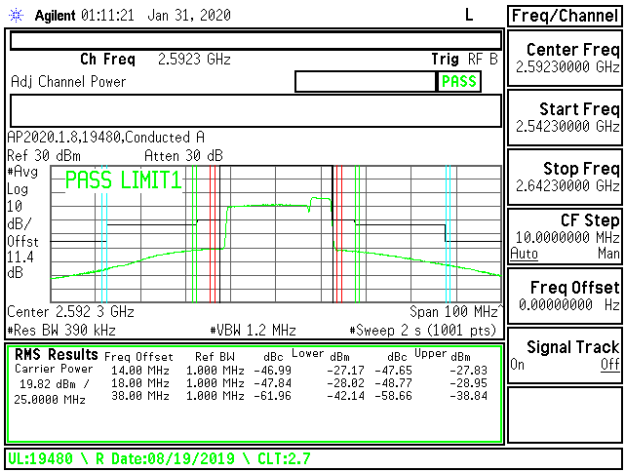
LTE B41 20MHz + 5MHz QPSK Low Ch RB100-0 + RB25-0



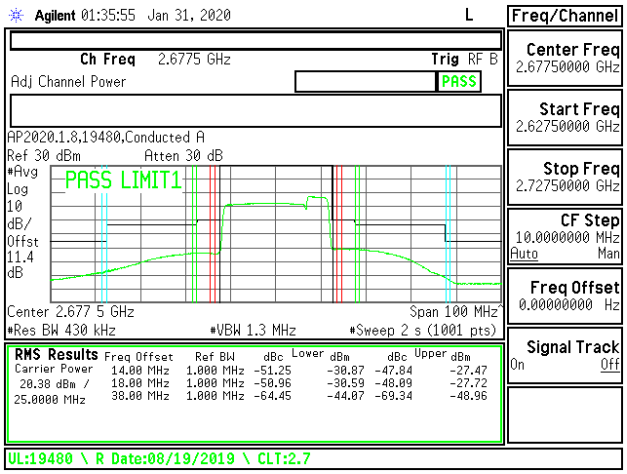
LTE B41 20MHz + 5MHz 16QAM Low Ch RB100-0 + RB25-0



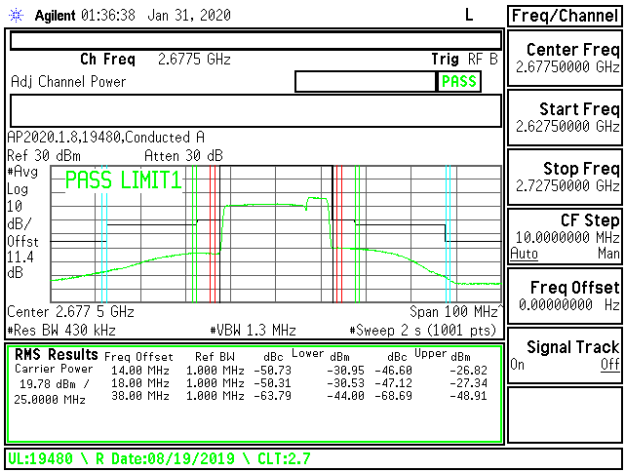
LTE B41 20MHz + 5MHz QPSK Mid Ch RB100-0 + RB25-0



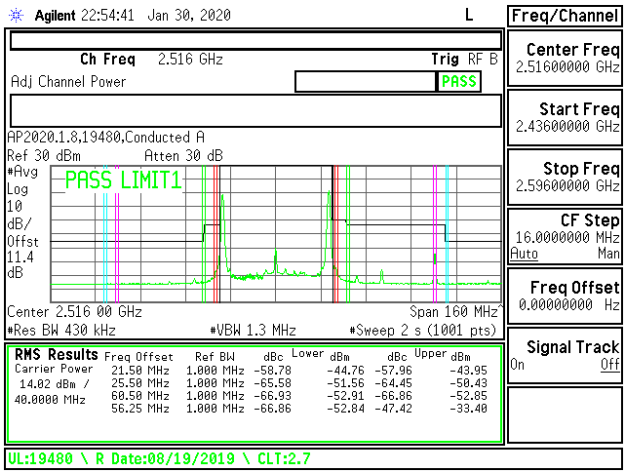
LTE B41 20MHz + 5MHz 16QAM Mid Ch RB100-0 + RB25-0



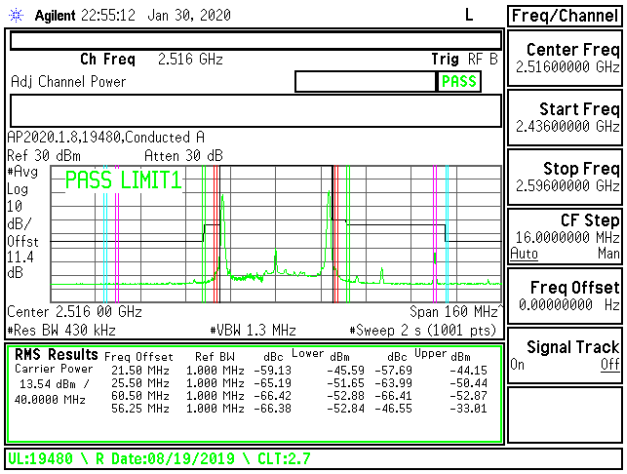
LTE B41 20MHz + 5MHz QPSK High Ch RB100-0 + RB25-0



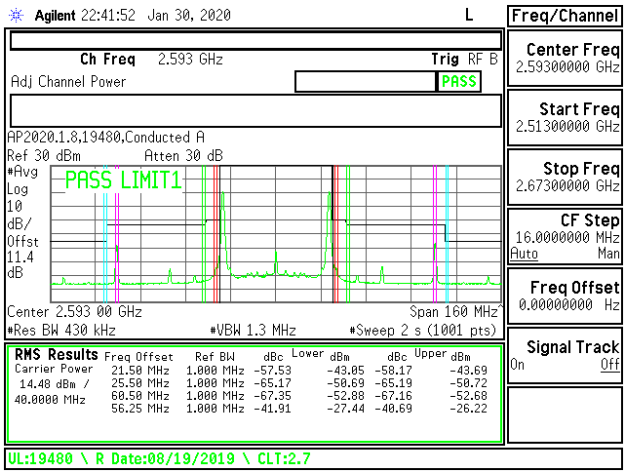
LTE B41 20MHz + 5MHz 16QAM High Ch RB100-0 + RB25-0



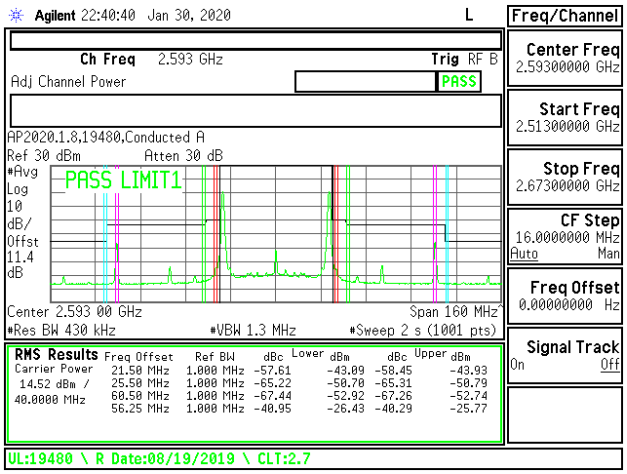
LTE B41 20MHz + 20MHz QPSK Low Ch RB1-0 + RB1-99



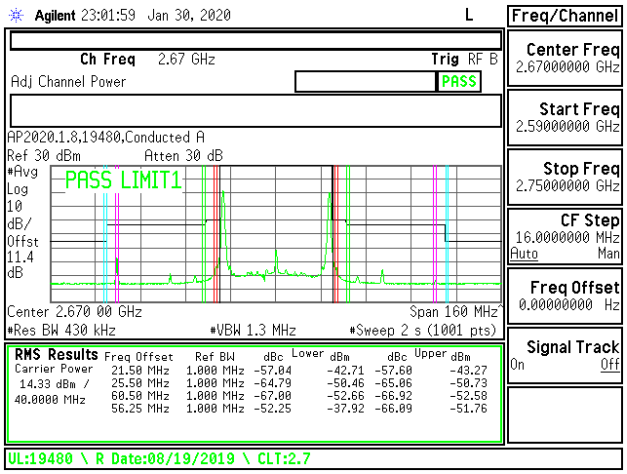
LTE B41 20MHz + 20MHz 16QAM Low Ch RB1-0 + RB1-99



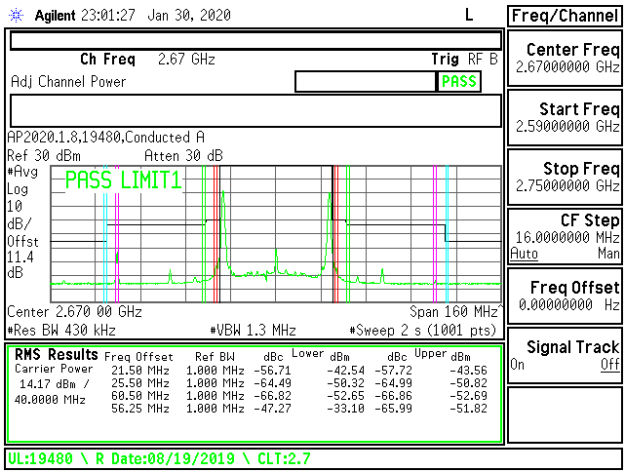
LTE B41 20MHz + 20MHz QPSK Mid Ch RB1-0 + RB1-99



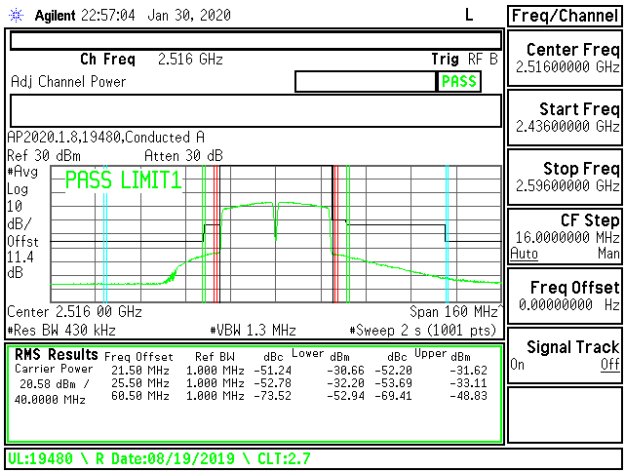
LTE B41 20MHz + 20MHz 16QAM Mid Ch RB1-0 + RB1-99



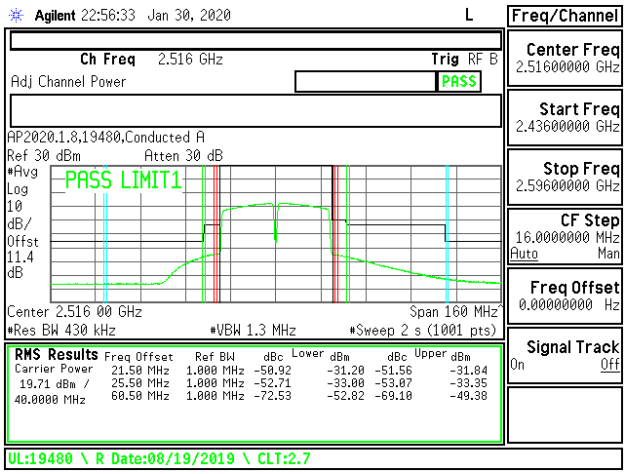
LTE B41 20MHz + 20MHz QPSK High Ch RB1-0 + RB1-99



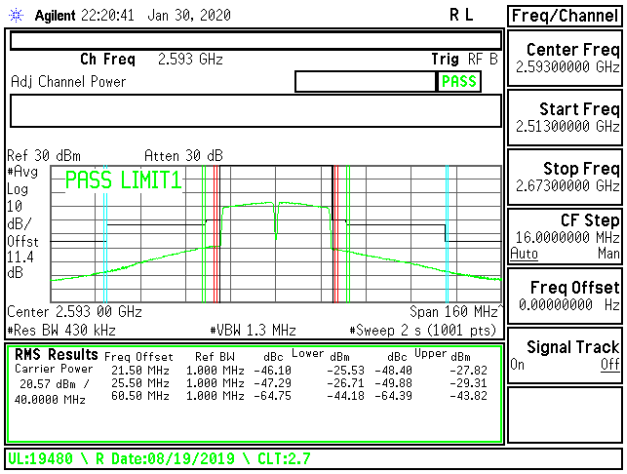
LTE B41 20MHz + 20MHz 16QAM High Ch RB1-0 + RB1-99



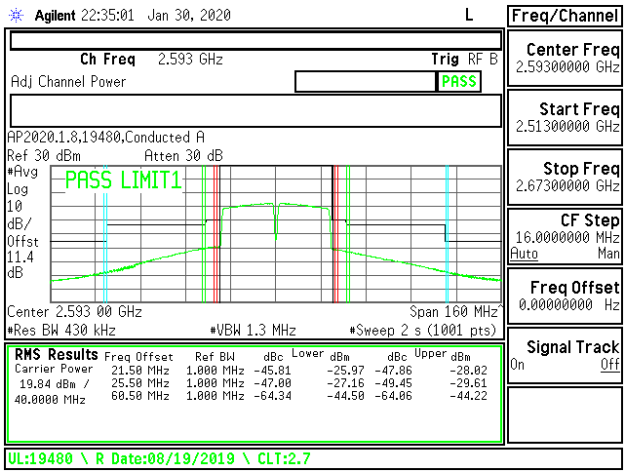
LTE B41 20MHz + 20MHz QPSK Low Ch RB100-0 + RB100-0



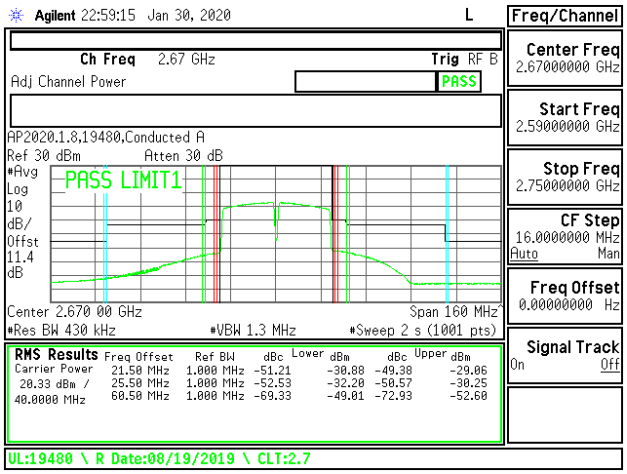
LTE B41 20MHz + 20MHz 16QAM Low Ch RB100-0 + RB100-0



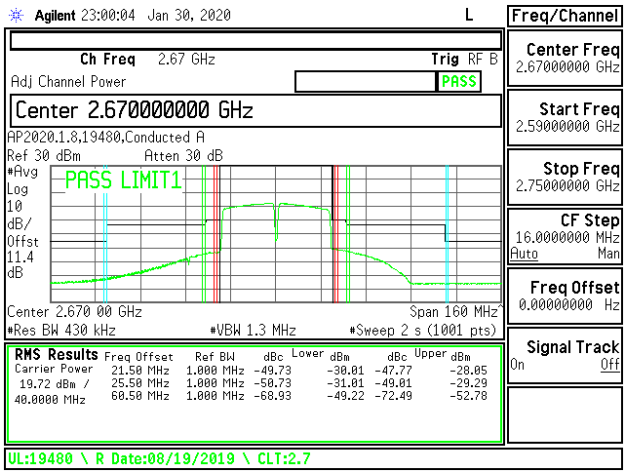
LTE B41 20MHz + 20MHz QPSK Mid Ch RB100-0 + RB100-0



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



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



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

8.3. OUT OF BAND EMISSIONS

LIMITS

FCC: §27.53 (m)
The minimum permissible attenuation level of any spurious emissions is 55 + 10 log (P) dB where transmitting power (P) in Watts.

TEST PROCEDURE

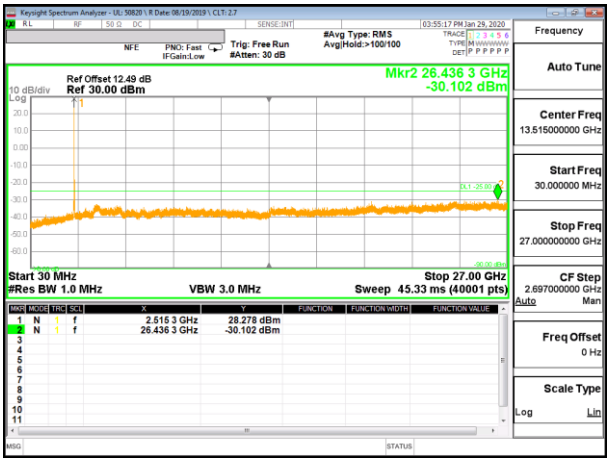
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case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

For each out of band emissions measurement:

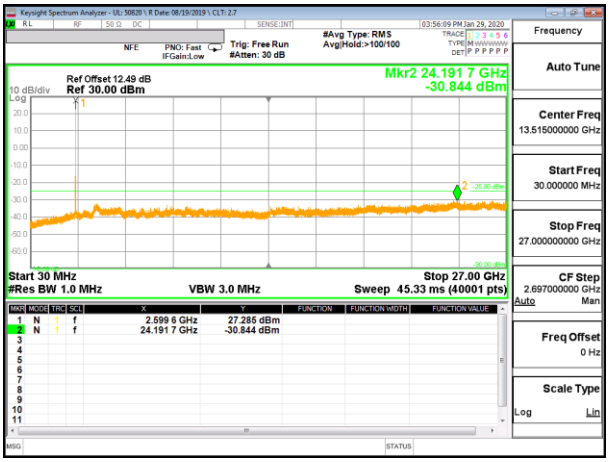
- Set display line at -25 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

8.3.1. LTE BAND 41 (FCC)

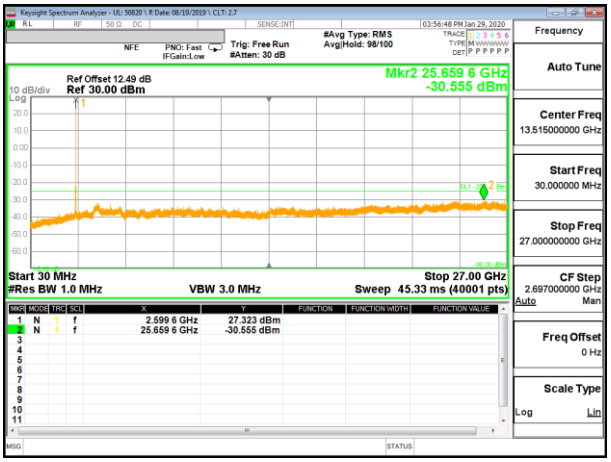
LTE B41 20MHz + 5MHz QPSK Low Ch RB1-99 + RB1-0



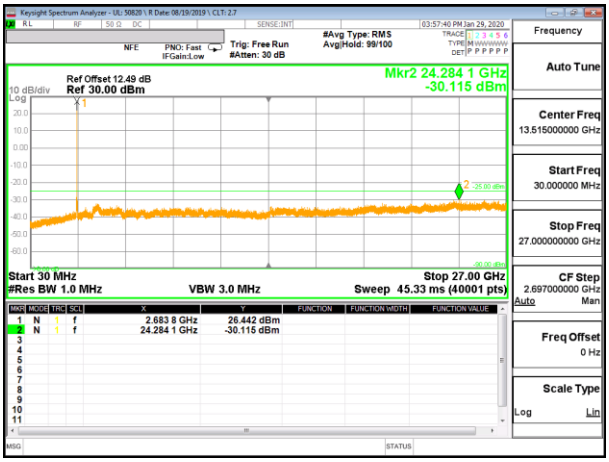
LTE B41 20MHz + 5MHz 16QAM Low Ch RB1-99 + RB1-0



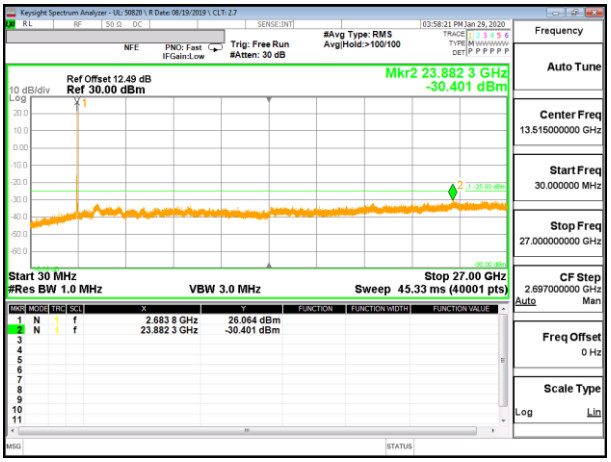
LTE B41 20MHz + 5MHz QPSK Middle Ch RB1-99 + RB1-0



LTE B41 20MHz + 5MHz 16QAM Middle Ch RB1-99 + RB1-0

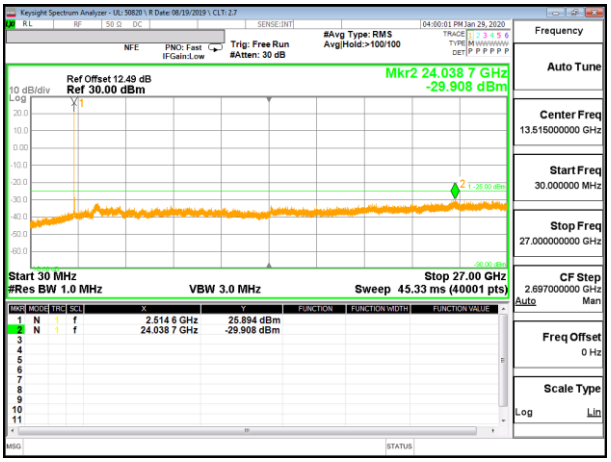


LTE B41 20MHz + 5MHz QPSK High Ch RB1-99 + RB1-0



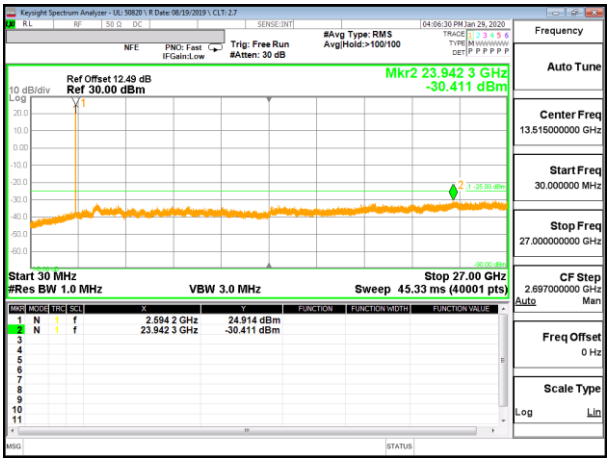
LTE B41 20MHz + 5MHz 16QAM High Ch RB1-99 + RB1-0

LTE B41 20MHz + 20MHz QPSK Low Ch RB1-99 + RB1-0

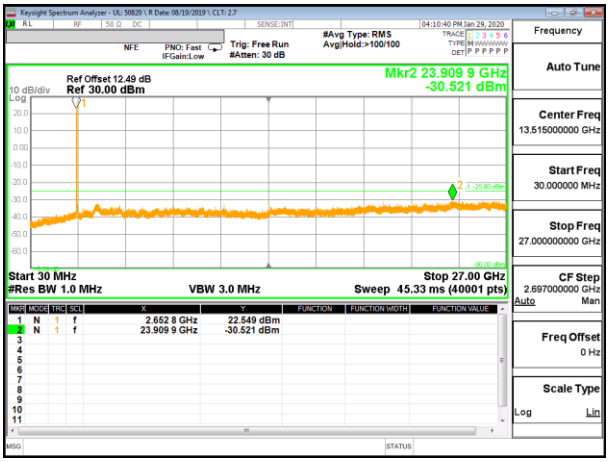


LTE B41 20MHz + 20MHz 16QAM Low Ch RB1-99 + RB1-0

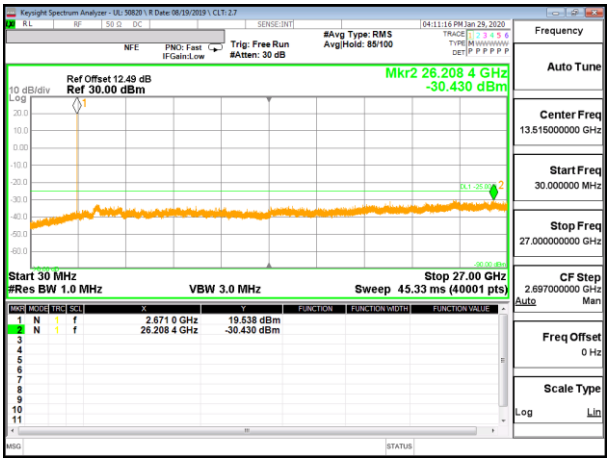
LTE B41 20MHz + 20MHz QPSK Middle Ch RB1-99 + RB1-0



LTE B41 20MHz + 20MHz 16QAM Middle Ch RB1-99 + RB1-0-



LTE B41 20MHz + 20MHz QPSK High Ch RB1-99 + RB1-0



LTE B41 20MHz + 20MHz 16QAM High Ch RB1-99 + RB1-0-

8.4. PEAK-TO-AVERAGE POWER RATIO

LIMIT

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

Test was performed on full resource block (FRB) for each bandwidth was used to measure as the worst case. The results from all CCDF measurements are passed with 13dB peak-to-average ratio criteria.

8.4.1. LTE BAND 41 (FCC)

Test Engineer ID:	39005	**Test Date:**	2/4/2020

Band	Bandwidth (MHz)	PCC f (MHz)	SCC1 f (MHz)	Modulation	Conducted Power (dBm)		Peak-to-Average Power Ratio (dB)
					Peak	Average	
Band 41 (FCC)	5MHz / 20MHz	2583.8	2595.5	QPSK	31.09	21.50	7.36
				16QAM	30.61	20.50	7.88
	10MHz / 20MHz	2583.6	2598.0	QPSK	30.77	21.36	7.18
				16QAM	30.48	20.46	7.79
	15MHz / 15MHz	2585.5	2600.5	QPSK	30.86	21.35	7.28
				16QAM	30.35	20.38	7.74
	15MHz / 20MHz	2583.3	2600.4	QPSK	30.76	21.35	7.18
				16QAM	30.31	20.36	7.72
	20MHz / 5MHz	2590.5	2602.2	QPSK	31.21	21.8	7.18
				16QAM	30.41	20.86	7.32
	20MHz / 10MHz	2588.1	2602.5	QPSK	31.39	21.86	7.30
				16QAM	30.98	20.9	7.85
	20MHz / 15MHz	2585.6	2602.7	QPSK	31.08	21.82	7.03
				16QAM	30.74	20.91	7.60
	20MHz / 20MHz	2583.1	2602.9	QPSK	31.40	21.92	7.25
				16QAM	30.90	20.92	7.75
Duty Cycle Correction Factor (dB) =			2.23				
Peak-to-Average Power Ratio= Peak Reading - Average Reading - Duty Cycle Correction Factor							

9. RADIATED TEST RESULTS

9.1. FIELD STRENGTH OF SPURIOUS RADIATION, ABOVE 1GHz

LIMIT

FCC: §27.53 (m)
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/D02 v02r01

RESULTS

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

9.1.1. LTE BAND 41 (FCC)

QPSK LTE BAND 41 (20.0MHZ + 20.0MHZ BANDWIDTH)

Company:	Samsung
Project #:	13171837
Date:	1/28/20
Test Engineer:	19480
Configuration:	EUT + Support Equipment
Mode	LTE 41 QPSK 20 MHz + 20 MHz
Chamber #:	Chamber I

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	WWAN Harmonics Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	2506 + 2525.8 MHz											
1	5.02953	-75.62	Pk	34.3	-27	12.3	-56.02	-25	-31.02	0-360	149	H
2	7.53225	-77.03	Pk	35.6	-23.9	11.5	-53.83	-25	-28.83	0-360	149	H
3	10.06366	-77.27	Pk	37.1	-20.9	11.9	-49.17	-25	-24.17	0-360	149	H
4	5.02369	-77.24	Pk	34.2	-27	12.6	-57.44	-25	-32.44	0-360	149	V
5	7.53703	-77.9	Pk	35.5	-23.9	11.7	-54.6	-25	-29.6	0-360	149	V
6	10.05994	-73.66	Pk	37.1	-21	11.9	-45.66	-25	-20.66	0-360	149	V
	2583.1 + 2602.9 MHz											
1	5.18519	-76.12	Pk	34.4	-27	11.9	-56.82	-25	-31.82	0-360	149	H
2	7.78034	-77	Pk	35.6	-23.7	12.1	-53	-25	-28	0-360	149	H
3	10.36806	-75.81	Pk	37.4	-20.1	12.3	-46.21	-25	-21.21	0-360	149	H
4	5.19156	-76.85	Pk	34.4	-27	12.3	-57.15	-25	-32.15	0-360	149	V
5	7.77822	-77.05	Pk	35.7	-23.7	12.1	-52.95	-25	-27.95	0-360	149	V
6	10.36806	-75.27	Pk	37.4	-20.1	12.2	-45.77	-25	-20.77	0-360	149	V
	2660.2 + 2680 MHz											
1	5.34031	-75.56	Pk	34.6	-26.7	11.7	-55.96	-25	-30.96	0-360	149	H
2	8.00719	-73.34	Pk	35.7	-23.4	11.8	-49.24	-25	-24.24	0-360	149	H
3	10.67672	-68.68	Pk	37.9	-20.2	11.6	-39.38	-25	-14.38	0-360	149	H
4	5.34031	-76.16	Pk	34.6	-26.7	12	-56.26	-25	-31.26	0-360	149	V
5	8.01144	-70.66	Pk	35.7	-23.4	11.9	-46.46	-25	-21.46	0-360	149	V
6	10.67619	-64.96	Pk	37.9	-20.2	11.7	-35.56	-25	-10.56	0-360	149	V

16QAM LTE BAND 41 (20.0MHZ + 20.0MHZ BANDWIDTH)

Company:	Samsung
Project #:	13171837
Date:	1/28/20
Test Engineer:	19480
Configuration:	EUT + Support Equipment
Mode	LTE 41 16QAM 20 MHz + 20 MHz
Chamber #:	Chamber I

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	WWAN Harmonics Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	2506 + 2525.8 MHz											
1	5.03006	-76.36	Pk	34.3	-26.9	12.3	-56.66	-25	-31.66	0-360	149	H
2	7.5535	-78.27	Pk	35.6	-23.8	12	-54.47	-25	-29.47	0-360	149	H
3	10.04931	-78.54	Pk	37.1	-21.1	11.8	-50.74	-25	-25.74	0-360	149	H
4	5.02847	-75.64	Pk	34.3	-27	12.5	-55.84	-25	-30.84	0-360	149	V
5	7.54181	-78.09	Pk	35.5	-23.8	11.9	-54.49	-25	-29.49	0-360	149	V
6	10.06366	-77.82	Pk	37.1	-20.9	11.9	-49.72	-25	-24.72	0-360	149	V
	2583.1 + 2602.9 MHz											
1	5.18041	-75.75	Pk	34.4	-27	11.7	-56.65	-25	-31.65	0-360	149	H
2	7.77822	-77.23	Pk	35.7	-23.7	12.1	-53.13	-25	-28.13	0-360	149	H
3	10.36806	-72.72	Pk	37.4	-20.1	12.3	-43.12	-25	-18.12	0-360	149	H
4	5.18359	-76.58	Pk	34.4	-27	12.1	-57.08	-25	-32.08	0-360	149	V
5	7.77344	-76.8	Pk	35.8	-23.8	12	-52.8	-25	-27.8	0-360	149	V
6	10.36753	-75.46	Pk	37.4	-20	12.2	-45.86	-25	-20.86	0-360	149	V
	2660.2 + 2680 MHz											
1	5.33978	-76.6	Pk	34.6	-26.7	11.7	-57	-25	-32	0-360	149	H
2	8.00719	-75.05	Pk	35.7	-23.4	11.8	-50.95	-25	-25.95	0-360	149	H
3	10.67619	-72.36	Pk	37.9	-20.2	11.6	-43.06	-25	-18.06	0-360	149	H
4	5.34084	-77.16	Pk	34.6	-26.7	11.9	-57.36	-25	-32.36	0-360	149	V
5	8.00719	-71.72	Pk	35.7	-23.4	11.9	-47.52	-25	-22.52	0-360	149	V
6	10.67619	-72.51	Pk	37.9	-20.2	11.7	-43.11	-25	-18.11	0-360	149	V