

FCC Radio Test Report

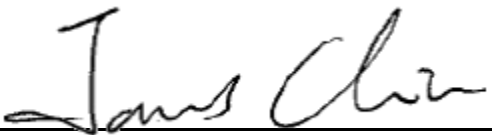
FCC ID: M82-FWA1012VC

This report concerns: Original Grant

Project No. : 1807T071
Equipment : Network Security Platform
Test Model : FWA-1012VC
Series Model : FWA-1012VCXXXXXXXXXXXXXXXXXX (where X may be any alphanumeric character , blank or "-".)
Applicant : Advantech Co., Ltd.
Address : No.1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 11491, Taiwan, R.O.C.

Date of Receipt : Aug. 02, 2018
Date of Test : Aug. 02, 2018 ~ Sep. 14, 2018
Issued Date : Sep. 19, 2018
Tested by : BTL Inc.

Technical Manager :


(James Chiu)

Authorized Signatory :


(Sean Chen)

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BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

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REPORT ISSUED HISTORY

Issue No.	Description	Issued Date
BTL-FCCP-4-1807T071	Original Issue.	Sep. 19, 2018

1 CERTIFICATION

Equipment : Network Security Platform
Brand Name : ADVANTECH
Test Model : FWA-1012VC
Series Model : FWA-1012VCXXXXXXXXXXXXXXXXXX (where X may be any alphanumeric character , blank or "-".)
Applicant : Advantech Co., Ltd.
Manufacturer : Advantech Co., Ltd.
Address : No.1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 11491, Taiwan, R.O.C.
Date of Test : Aug. 02, 2018 ~ Sep. 14, 2018
Test Sample : Production Unit
Standard(s) : 47 CRF FCC Part 2
47 CRF FCC Part 24, Subpart E
KDB 971168 D01 Power Meas License Digital Systems v03r01
ANSI/TIA-603-D-2010

The above equipment has been tested and found in compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCP-4-1807T071) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

Test result included in this report is only for the WCDMA Band II, LTE Band 2 and 25 part.

2 SUMMARY OF TEST RESULTS

Test procedures according to the technical standards.

FCC Clause No	Description	Test Result	Judgement	Tested By
§2.1046 §24.232(c)	RF Power Output	APPENDIX A	Pass	Kay Wu
§24.232(d)	Peak-to-Average Ratio (PAR)	APPENDIX B	Pass	Kay Wu
§2.1049 §24.238(b)	Occupied Bandwidth	APPENDIX C	Pass	Kay Wu
§2.1051 §24.238(a)	Out of Band Emissions	APPENDIX D	Pass	Kay Wu
§2.1051 §24.238(a)	Spurious Emissions at Antenna Terminals	APPENDIX E	Pass	Kay Wu
§2.1053 §24.238(a)	Field strength of spurious radiation	APPENDIX F	Pass	Toby Tian
§2.1055 §24.235	Frequency stability	APPENDIX G	Pass	Kay Wu

NOTE:

(1) "N/A" denotes test is not applicable in this Test Report.

2.1 TEST FACILITY

The test facilities used to collect the test data in this report:

- ☐ **CB08:** (FCC RN:674415; FCC DN:TW0659; IC Assigned Code:20088-1)
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)
- ☐ **CB11:** (FCC RN:674415; FCC DN:TW0659; IC Assigned Code:20088-2)
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)
- ☒ **CB15:** (FCC RN:674415; FCC DN:TW0659; IC Assigned Code:20088-5)
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)
- ☐ **CB16:** (FCC RN:674415; FCC DN:TW0659; IC Assigned Code:20088-6)
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)
- ☒ **TR03:** (FCC RN:674415; FCC DN:TW0659)
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{CISPR} requirement.

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

A. Conducted test:

Applied	Parameter	Uncertainty
☒	RF Power Output	$\pm 0.24 \text{ dB}$
☒	Frequency stability	$\pm 1.2 \times 10^{-7}$
☒	Occupied Bandwidth	$\pm 3.8 \%$
☒	Spurious Emissions at Antenna Terminals	$\pm 2.71 \text{ dB}$
☒	Temperature	$\pm 0.08 \text{ }^{\circ}\text{C}$

B. Radiated emissions below 1 GHz test:

Applied	Test Site	Method	Measurement Frequency Range	Ant. H / V	U (dB)
☐	CB08 (10m)	CISPR	30 MHz ~ 200 MHz	V	3.48
			30 MHz ~ 200 MHz	H	3.08
			200 MHz ~ 1,000 MHz	V	3.94
			200 MHz ~ 1,000 MHz	H	3.46
☐	CB08 (3m)	CISPR	30 MHz ~ 200 MHz	V	3.68
			30 MHz ~ 200 MHz	H	3.28
			200 MHz ~ 1,000 MHz	V	4.26
			200 MHz ~ 1,000 MHz	H	3.92
☐	CB11 (3m)	CISPR	30 MHz ~ 200 MHz	V	4.26
			30 MHz ~ 200 MHz	H	3.76
			200 MHz ~ 1,000 MHz	V	4.46
			200 MHz ~ 1,000 MHz	H	3.84
☒	CB15 (3m)	CISPR	30 MHz ~ 200 MHz	V	4.20
			30 MHz ~ 200 MHz	H	3.64
			200 MHz ~ 1,000 MHz	V	4.56
			200 MHz ~ 1,000 MHz	H	3.90
☐	CB16 (3m)	CISPR	30 MHz ~ 200 MHz	V	4.20
			30 MHz ~ 200 MHz	H	3.64
			200 MHz ~ 1,000 MHz	V	4.56
			200 MHz ~ 1,000 MHz	H	3.90

C. Radiated emissions above 1 GHz test:

Applied	Test Site	Method	Measurement Frequency Range	Ant. H / V	U (dB)
☐	CB08 (3m)	CISPR	1 GHz ~ 6 GHz	V	4.40
			1 GHz ~ 6 GHz	H	3.88
			6 GHz ~18 GHz	V	4.70
			6 GHz ~18 GHz	H	4.08
☐	CB11 (3m)	CISPR	1 GHz ~ 6 GHz	V	4.44
			1 GHz ~ 6 GHz	H	4.40
			6 GHz ~18 GHz	V	4.02
			6 GHz ~18 GHz	H	4.00
☒	CB15 (3m)	CISPR	1 GHz ~ 6 GHz	V	4.46
			1 GHz ~ 6 GHz	H	4.40
			6 GHz ~18 GHz	V	3.88
			6 GHz ~18 GHz	H	4.00
☐	CB16 (3m)	CISPR	1 GHz ~ 6 GHz	V	4.46
			1 GHz ~ 6 GHz	H	4.40
			6 GHz ~18 GHz	V	3.88
			6 GHz ~18 GHz	H	4.00

Applied	Test Site	Method	Measurement Frequency Range	U (dB)
☐	CB08 (1m)	CISPR	18 GHz ~ 26.5 GHz	4.68
			26.5 GHz ~ 40 GHz	5.16
☐	CB11 (1m)	CISPR	18 GHz ~ 26.5 GHz	4.76
			26.5 GHz ~ 40 GHz	5.24
☒	CB15 (1m)	CISPR	18 GHz ~ 26.5 GHz	4.62
			26.5 GHz ~ 40 GHz	5.12
☐	CB16 (1m)	CISPR	18 GHz ~ 26.5 GHz	4.62
			26.5 GHz ~ 40 GHz	5.12

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

Our calculated Measurement Instrumentation Uncertainty is shown in the tables above. These are our U_{lab} values in CISPR 16-4-2 terminology.

Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called U_{CISPR} , as follows:

Conducted Disturbance (mains port) – 150 kHz – 30 MHz : 3.6 dB

Radiated Disturbance (electric field strength on an open area test site or alternative test site) – 30 MHz – 1000 MHz : 5.2 dB

3 GENERAL INFORMATION

3.1 DESCRIPTION OF EUT

Equipment	Network Security Platform						
Brand Name	ADVANTECH						
Test Model	FWA-1012VC						
Series Model	FWA-1012VCXXXXXXXXXXXXXXXXXX (where X may be any alphanumeric character , blank or “-”.)						
Model Difference	Different model distribute to different area.						
Power Source	DC Voltage supplied from AC/DC adapter.						
Power Rating	I/P: 100-240V~, 1.5A, 50-60Hz O/P: 12.0V--- 5.0A MAX						
Products Covered							
AC Adapter Manufacturer	FSP	Model	FSP060-DIBAN2				
WWAN Module Manufacturer	Sierra	Model	EM7455 (FCC ID: N7NEM7455)				
Specification information							
Modulation Type	WCDMA	UL: BPSK DL: QPSK					
	LTE	UL: QPSK,16QAM DL: QPSK,16QAM					
Frequency Range	WCDMA	TX: 1850-1910 MHz, RX: 1930-1990 MHz					
	LTE	Band 2: TX: 1850-1910 MHz, RX: 1930-1990 MHz Band 25: TX: 1850-1915 MHz, RX: 1930-1995 MHz					
Band	Frequency	Channel Bandwidth	Modulation Type	Maximum EIRP RF Power Output		Maximum Frequency Tolerance	Emission Designator
	MHz	MHz	-----	dBm	W	ppm	
WCDMA Band II	1880	-	BPSK	24.67	0.293	0.0004	4M17F9W
LTE Band 2	1880	20	QPSK	25.09	0.323	0.0005	17M9G7D
			16QAM	24.26	0.267		17M9W7D
	1905	10	16QAM	24.35	0.272		
LTE Band 25	1882.5	20	QPSK	24.95	0.313	0.0005	17M9G7D
			16QAM	24.21	0.264		17M9W7D

NOTE:

- (1) For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

Table for Filed Antenna:

Brand	Model	Connector	Type	Antenna Gain(dBi)		
				WCDMA Band II	LTE Band 2	LTE Band 25
Advantech	TE FULL BAND DIPOLE ANTENNA(148)	SMA	DIPOLE	2.04	2.04	2.04

3.2 TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

The EUT system operated these modes were found to be the worst case during the pre-scanning test as following:

WCDMA				
Test Items	Band	Test Channel		
		L	M	H
RF Power Output	II	V	V	V
Peak-to-Average Ratio (PAR)	II	V	V	V
Occupied Bandwidth	II	V	V	V
Out of Band Emissions	II	V		V
Spurious Emissions at Antenna Terminals	II		V	
Field strength of spurious radiation	II		V	
Frequency stability	II		V	

LTE															
Test Items	Band	Bandwidth (MHz)						Modulation		RB Size			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
RF Power Output	2	V	V	V	V	V	V	V	V	V	V	V	V	V	V
	25	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Peak-to-Average Ratio (PAR)	2	V	V	V	V	V	V	V	V	V			V	V	V
	25	V	V	V	V	V	V	V	V	V			V	V	V
Occupied Bandwidth	2	V	V	V	V	V	V	V	V			V	V	V	V
	25	V	V	V	V	V	V	V	V			V	V	V	V
Out of Band Emissions	2	V	V	V	V	V	V	V	V	V		V	V		V
	25	V	V	V	V	V	V	V	V	V		V	V		V
Spurious Emissions at Antenna Terminals	2	V	V	V	V	V	V	V	V	V				V	
	25	V	V	V	V	V	V	V	V	V				V	
Field strength of spurious radiation	2	V	V	V	V	V	V	V		V				V	
	25	V	V	V	V	V	V	V		V				V	
Frequency stability	2	V	V	V	V	V	V	V		V				V	
	25	V	V	V	V	V	V	V		V				V	

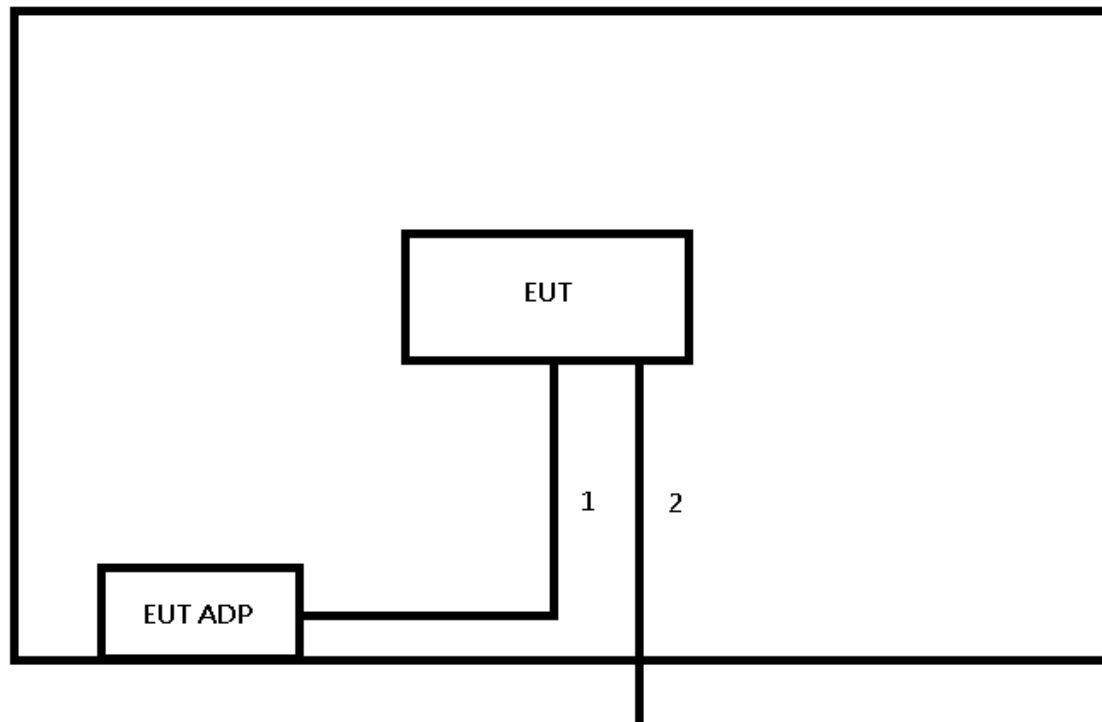
NOTE:

(1) The marker "V" means this configuration is used for testing.

EUT TEST CONDITIONS:

Test Item	Environmental Conditions	Test Voltage
RF Power Output	25 °C, 60 % RH	AC 120V/60Hz
Peak-to-Average Ratio (PAR)	25 °C, 60 % RH	AC 120V/60Hz
Occupied Bandwidth	25 °C, 60 % RH	AC 120V/60Hz
Out of Band Emissions	25 °C, 60 % RH	AC 120V/60Hz
Spurious Emissions at Antenna Terminals	25 °C, 60 % RH	AC 120V/60Hz
Field strength of spurious radiation	23 °C, 70 % RH	AC 120V/60Hz
Frequency stability	Normal and Extreme	Normal and Extreme

3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.4 SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Brand	Model/Type No.	FCC ID	Series No.
-	-	-	-	-	-

Item	Shielded Type	Ferrite Core	Length	Note
1	YES	NO	1.5 m	Power Cable
2	NO	NO	3.0 m	LAN Cable

4 RF POWER OUTPUT TEST

4.1 LIMIT

Mobile and portable stations are limited to 2 watts EIRP.

4.2 TEST PROCEDURE

EIRP / ERP Power Measurement:

$EIRP = \text{Conducted Power} + \text{Antenna gain}$.

$ERP \text{ power} = EIPR \text{ power} - 2.15 \text{ dBi}$.

Conducted Power Measurement:

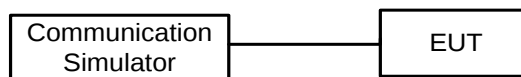
The EUT was set up for the maximum power with WCDMA and LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

4.3 DEVIATION FROM TEST STANDARD

No deviation.

4.4 TEST SETUP

Conducted Power Measurement:



4.5 TEST RESULT

Please refer to the APPENDIX A.

5 PEAK-TO-AVERAGE RATIO (PAR) TEST

5.1 LIMIT

In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

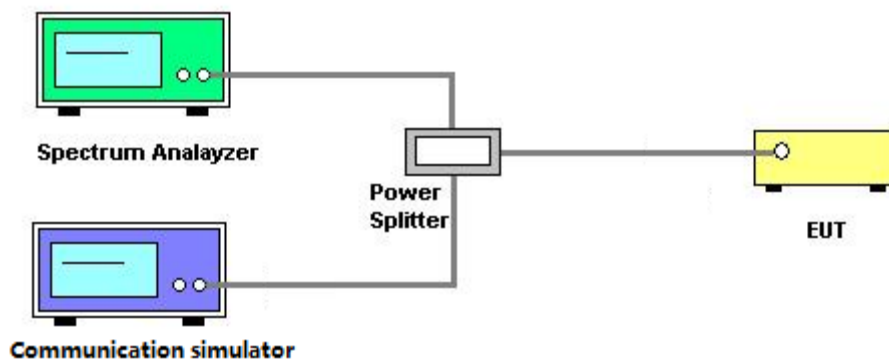
5.2 TEST PROCEDURE

- Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth.
- Set the number of counts to a value that stabilizes the measured CCDF curve.
- Record the maximum PAPR level associated with a probability of 0.1%.

5.3 DEVIATION FROM TEST STANDARD

No deviation.

5.4 TEST SETUP



5.5 TEST RESULT

Please refer to the APPENDIX B.

6 OCCUPIED BANDWIDTH TEST

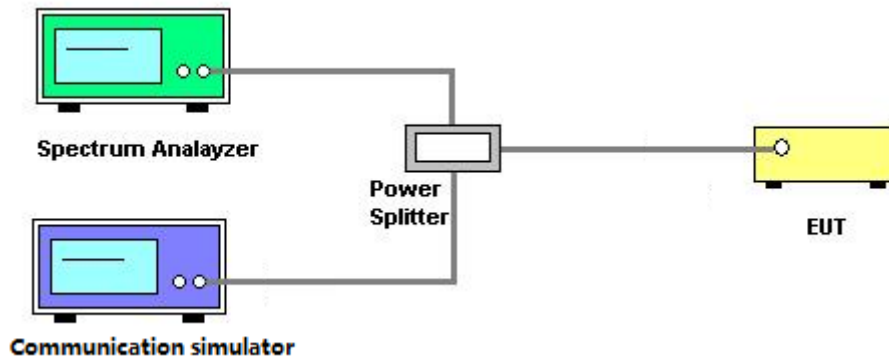
6.1 TEST PROCEDURE

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth and 26 dB bandwidth.

6.2 DEVIATION FROM TEST STANDARD

No deviation.

6.3 TEST SETUP



6.4 TEST RESULT

Please refer to the APPENDIX C.

7 OUT OF BAND EMISSIONS TEST

7.1 LIMIT

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.

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.

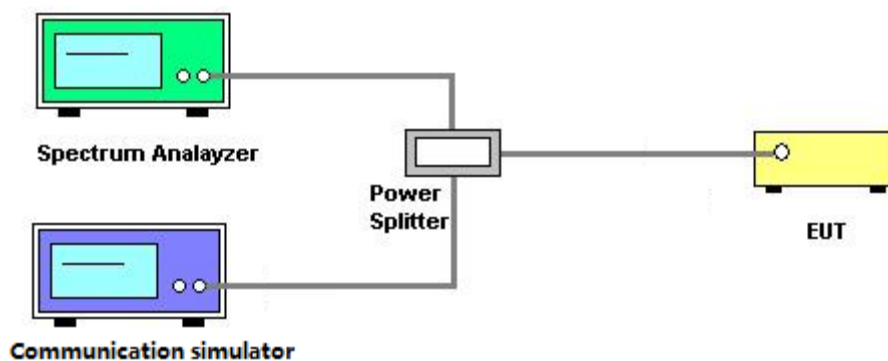
7.2 TEST PROCEDURE

- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 5 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (WCDMA).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 13 kHz and VB of the spectrum is 51 kHz (LTE Bandwidth 1.4MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 30 kHz and VB of the spectrum is 100 kHz (LTE Bandwidth 3MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (LTE Bandwidth 5MHz/10MHz).
- The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 150 kHz and VB of the spectrum is 470 kHz (LTE Bandwidth 15MHz).
- The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 180 kHz and VB of the spectrum is 560 kHz (LTE Bandwidth 20MHz).
- Record the max trace plot into the test report.

7.3 DEVIATION FROM TEST STANDARD

No deviation.

7.4 TEST SETUP



7.5 TEST RESULT

Please refer to the APPENDIX D.

8 SPURIOUS EMISSIONS AT ANTENNA TERMINALS TEST

8.1 LIMIT

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.

The emission limit is equal to -13 dBm.

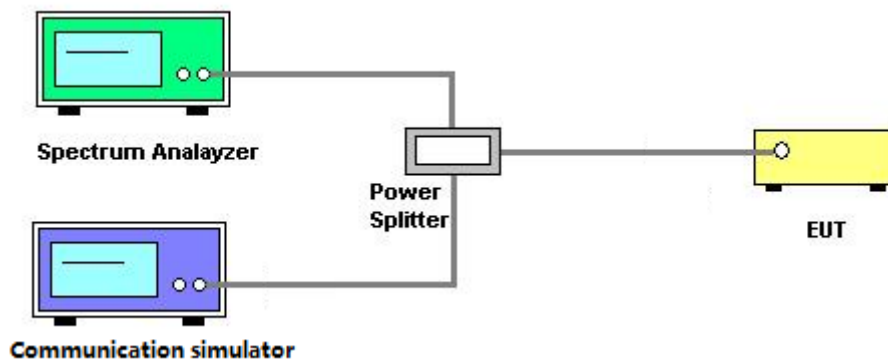
8.2 TEST PROCEDURE

- The testing follows FCC KDB 971168 D01 Power Meas License Digital Systems v03r01.
- The EUT was connected to spectrum analyzer and system simulator via a power divider.
- The band edges of low and high channels for the highest RF powers were measured. Set RBW $\geq 1\%$ EBW in the 1 MHz band immediately outside and adjacent to the band edge.
- Set spectrum analyzer with RMS detector.
- The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
- The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P (Watts)
 $= P(W) - [43 + 10 \log(P)]$ (dB)
 $= [30 + 10 \log(P)]$ (dBm) - $[43 + 10 \log(P)]$ (dB)
 $= -13$ dBm

8.3 DEVIATION FROM TEST STANDARD

No deviation.

8.4 TEST SETUP



8.5 TEST RESULT

Please refer to the APPENDIX E.

9 FIELD STRENGTH OF SPURIOUS RADIATION TEST

9.1 LIMIT

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. The emission limit is equal to -13 dBm.

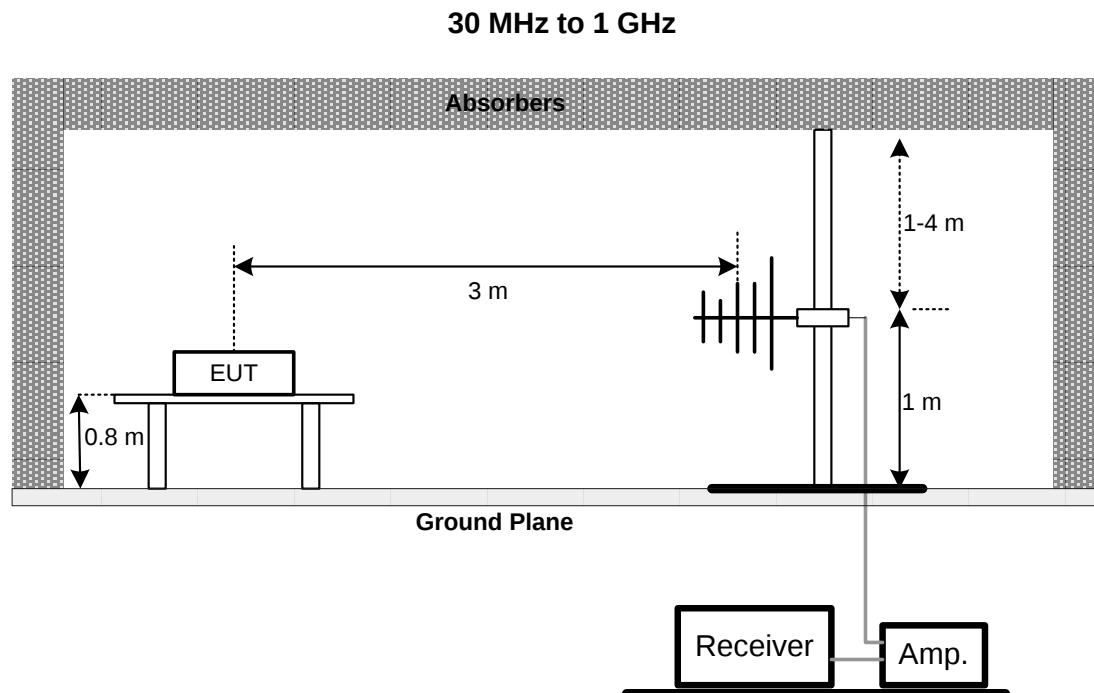
9.2 TEST PROCEDURE

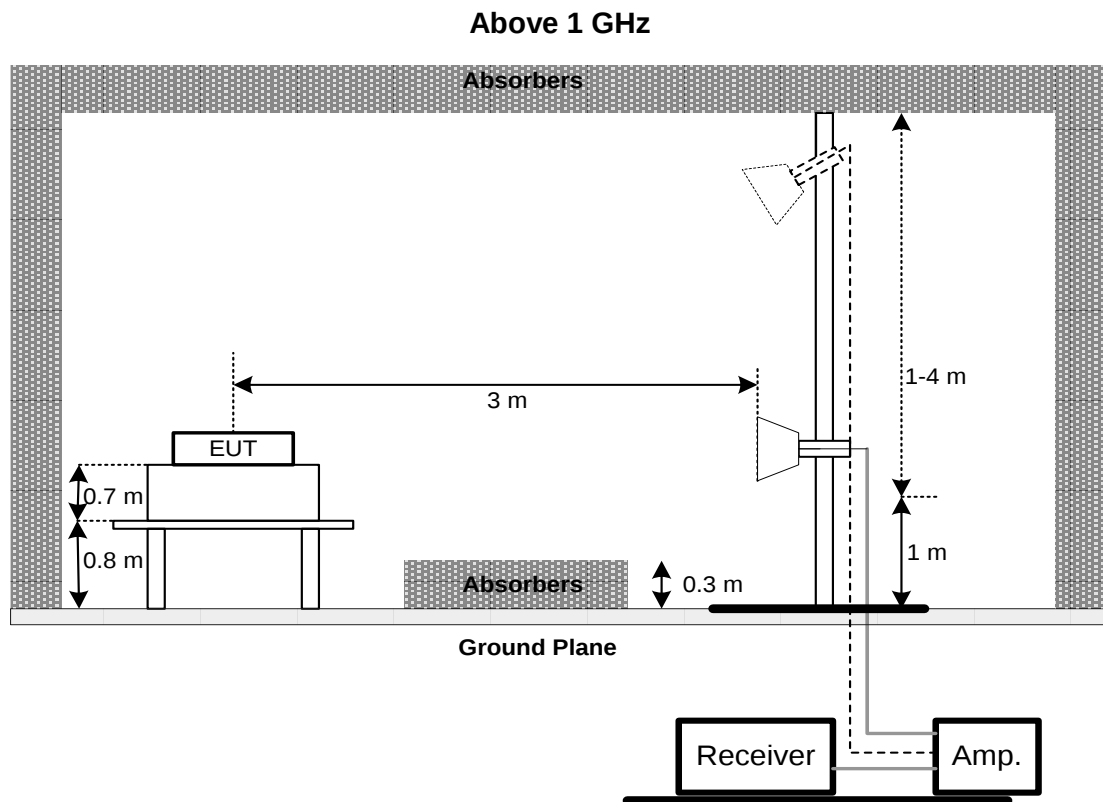
- In the semi-anechoic chamber, EUT placed on the 0.8 m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step a. Record the power level of S.G.
- $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$
- ERP power can be calculated form EIRP power by subtracting the gain of dipole,
 $ERP \text{ power} = EIRP \text{ power} - 2.15 \text{ dBi}.$
- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz / 3 MHz.

9.3 DEVIATION FROM TEST STANDARD

No deviation.

9.4 TEST SETUP





9.5 TEST RESULT

Please refer to the APPENDIX F.

10 FREQUENCY STABILITY TEST

10.1 LIMIT

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

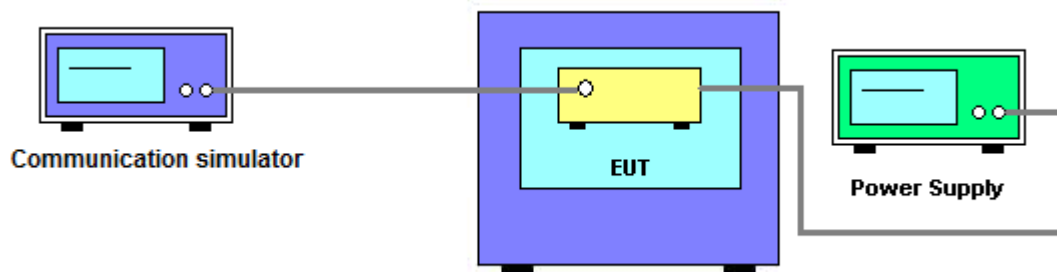
10.2 TEST PROCEDURE

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.
- The frequency error was recorded frequency error from the communication simulator.

10.3 DEVIATION FROM TEST STANDARD

No deviation.

10.4 TEST SETUP



10.5 TEST RESULT

Please refer to the APPENDIX G.

11 LIST OF MEASURING EQUIPMENTS

RF Power Output and Frequency stability					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Wireless Communications Test Set (WCDMA)	Agilent	8960	US38080149	Oct. 16, 2018
2	Radio Communication Analyzer (LTE)	Anritsu	MT8820C	6201525878	Nov. 04, 2018

Peak-to-Average Ratio (PAR), Occupied Bandwidth, Out of Band Emissions and Spurious Emissions at Antenna Terminals					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EXA Signal Analyzer	Agilent	N9010A	MY54200240	Oct. 01, 2018
2	Wireless Communications Test Set (WCDMA)	Agilent	8960	US38080149	Oct. 16, 2018
3	Radio Communication Analyzer (LTE)	Anritsu	MT8820C	6201525878	Nov. 04, 2018

Field strength of spurious radiation					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Preamplifier	EMCI	012645B	980267	Feb. 27, 2019
2	Preamplifier	EMCI	EMC02325	980217	Dec. 27, 2018
3	Preamplifier	EMCI	EMC2654045	980030	Feb. 13, 2019
4	Test Cable	EMCI	EMC104-SM-SM-8000	8m	Jan. 03, 2019
5	Test Cable	EMCI	EMC104-SM-SM-800	150207	Jan. 03, 2019
6	Test Cable	EMCI	EEMC104-SM-SM-3000	151205	Jan. 03, 2019
7	MXE EMI Receiver	Agilent	N9038A	MY55420127	Jan. 08, 2019
8	Signal Analyzer	Agilent	N9010A	MY52220990	Feb. 21, 2019
9	Loop Ant	EMCI	LPA600	274	May 03, 2019
10	Horn Ant	SCHWARZBECK	BBHA 9120D	9120D-1342	Feb. 27, 2019
11	Horn Ant	Schwarzbeck	BBHA 9170	187	Dec. 05, 2018
12	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	9168-548	Jan. 15, 2019
13	5dB Attenuator	EMCI	EMCI-N-6-05	AT-N0623	Jan. 15, 2019
14	Wireless Communications Test Set (WCDMA)	Agilent	8960	US38080149	Oct. 16, 2018
15	Radio Communication Analyzer (LTE)	Anritsu	MT8820C	6201525878	Nov. 04, 2018

Remark: "N/A" denotes no model name, no serial no. or no calibration specified.
All calibration period of equipment list is one year.

APPENDIX A RF POWER OUTPUT

CONTINUE ON NEXT PAGE

Band		WCDMA Band II					
Antenna Gain (dBi)	2.04	Conducted Power (dBm)			EIRP Power (dBm)		
Tx Channel		9262	9400	9538	9262	9400	9538
Rx Channel		9662	9800	9938	9662	9800	9938
Frequency (MHz)		1852.4	1880	1907.6	1852.4	1880	1907.6
RMC 12.2K		22.38	22.63	22.41	24.42	24.67	24.45
HSDPA Subtest-1		21.38	21.17	21.24	23.42	23.21	23.28
HSDPA Subtest-2		21.42	21.21	21.32	23.46	23.25	23.36
HSDPA Subtest-3		20.88	20.68	20.81	22.92	22.72	22.85
HSDPA Subtest-4		20.92	20.71	20.80	22.96	22.75	22.84
HSUPA Subtest-1		20.67	20.54	20.62	22.71	22.58	22.66
HSUPA Subtest-2		20.38	20.21	20.33	22.42	22.25	22.37
HSUPA Subtest-3		19.63	19.91	19.62	21.67	21.95	21.66
HSUPA Subtest-4		20.82	20.67	20.76	22.86	22.71	22.80
HSUPA Subtest-5		21.37	21.20	21.32	23.41	23.24	23.36

Remark: EIRP power = Conducted Power + Antenna gain.

Band			LTE Band 2					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			18607	18900	19193	18607	18900	19193
			1850.7 MHz	1880 MHz	1909.3 MHz	1850.7 MHz	1880 MHz	1909.3 MHz
1.4	QPSK	1/0	22.84	22.93	20.80	24.88	24.97	22.84
		1/2	22.64	22.76	22.83	24.68	24.80	24.87
		1/5	22.70	22.86	22.85	24.74	24.90	24.89
		3/0	22.62	22.55	22.57	24.66	24.59	24.61
		3/1	22.76	22.67	22.70	24.80	24.71	24.74
		3/3	22.61	22.45	22.63	24.65	24.49	24.67
	16QAM	6/0	21.65	21.52	21.68	23.69	23.56	23.72
		1/0	21.83	22.11	21.80	23.87	24.15	23.84
		1/2	22.16	21.41	21.89	24.20	23.45	23.93
		1/5	22.14	21.47	21.90	24.18	23.51	23.94
		3/0	21.85	21.63	21.50	23.89	23.67	23.54
		3/1	21.74	21.61	21.72	23.78	23.65	23.76
		3/3	21.88	21.64	21.77	23.92	23.68	23.81
		6/0	20.74	20.55	20.79	22.78	22.59	22.83

Band			LTE Band 2					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			18615	18900	19185	18615	18900	19185
			1851.5 MHz	1880 MHz	1908.5 MHz	1851.5 MHz	1880 MHz	1908.5 MHz
3	QPSK	1/0	22.74	22.98	22.69	24.78	25.02	24.73
		1/7	22.83	22.55	22.57	24.87	24.59	24.61
		1/14	22.75	22.69	22.82	24.79	24.73	24.86
		8/0	21.78	21.70	21.77	23.82	23.74	23.81
		8/3	21.80	21.75	21.74	23.84	23.79	23.78
		8/7	21.81	21.68	21.90	23.85	23.72	23.94
		15/0	21.79	21.64	21.74	23.83	23.68	23.78
	16QAM	1/0	22.15	21.88	21.72	24.19	23.92	23.76
		1/7	21.92	21.94	22.12	23.96	23.98	24.16
		1/14	21.78	21.86	22.11	23.82	23.90	24.15
		8/0	20.87	20.69	20.89	22.91	22.73	22.93
		8/3	20.86	20.75	20.75	22.90	22.79	22.79
		8/7	20.85	20.77	20.84	22.89	22.81	22.88
		15/0	20.87	20.73	20.75	22.91	22.77	22.79

Remark: EIRP power = Conducted Power + Antenna gain.

Band			LTE Band 2					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			18625	18900	19175	18625	18900	19175
			1852.5 MHz	1880 MHz	1907.5 MHz	1852.5 MHz	1880 MHz	1907.5 MHz
5	QPSK	1/0	22.76	22.99	22.89	24.80	25.03	24.93
		1/12	22.59	22.23	22.77	24.63	24.27	24.81
		1/24	22.79	22.63	22.75	24.83	24.67	24.79
		12/0	21.81	21.73	21.82	23.85	23.77	23.86
		12/6	21.86	21.79	21.78	23.90	23.83	23.82
		12/13	21.79	21.63	21.74	23.83	23.67	23.78
		25/0	21.84	21.73	21.78	23.88	23.77	23.82
	16QAM	1/0	21.70	21.68	22.17	23.74	23.72	24.21
		1/12	21.97	21.85	22.12	24.01	23.89	24.16
		1/24	22.27	21.84	21.93	24.31	23.88	23.97
		12/0	20.83	20.65	20.91	22.87	22.69	22.95
		12/6	20.82	20.74	20.87	22.86	22.78	22.91
		12/13	20.78	20.51	20.80	22.82	22.55	22.84
		25/0	20.89	20.73	20.87	22.93	22.77	22.91

Band			LTE Band 2					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			18650	18900	19150	18650	18900	19150
			1855 MHz	1880 MHz	1905 MHz	1855 MHz	1880 MHz	1905 MHz
10	QPSK	1/0	22.88	23.00	22.70	24.92	25.04	24.74
		1/24	22.77	22.58	22.85	24.81	24.62	24.89
		1/49	22.61	22.53	22.96	24.65	24.57	25.00
		25/0	21.75	21.66	21.83	23.79	23.70	23.87
		25/12	21.84	21.67	21.75	23.88	23.71	23.79
		25/25	21.70	21.68	21.76	23.74	23.72	23.80
		50/0	21.72	21.55	21.80	23.76	23.59	23.84
	16QAM	1/0	22.15	22.08	22.22	24.19	24.12	24.26
		1/24	21.97	21.85	22.31	24.01	23.89	24.35
		1/49	21.76	22.05	21.89	23.80	24.09	23.93
		25/0	20.80	20.62	20.89	22.84	22.66	22.93
		25/12	20.73	20.67	20.79	22.77	22.71	22.83
		25/25	20.74	20.60	20.81	22.78	22.64	22.85
		50/0	20.81	20.71	20.86	22.85	22.75	22.90

Remark: EIRP power = Conducted Power + Antenna gain.

Band			LTE Band 2					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			18675	18900	19125	18675	18900	19125
			1857.5 MHz	1880 MHz	1902.5 MHz	1857.5 MHz	1880 MHz	1902.5 MHz
15	QPSK	1/0	22.99	23.01	22.97	25.03	25.05	25.01
		1/37	22.88	22.92	22.59	24.92	24.96	24.63
		1/74	22.58	22.64	22.78	24.62	24.68	24.82
		36/0	21.80	21.83	21.79	23.84	23.87	23.83
		36/19	21.68	21.77	22.02	23.72	23.81	24.06
		36/39	21.61	21.71	21.89	23.65	23.75	23.93
		75/0	21.68	21.76	21.88	23.72	23.80	23.92
	16QAM	1/0	22.02	22.07	22.01	24.06	24.11	24.05
		1/37	22.16	22.04	22.20	24.20	23.99	24.24
		1/74	21.73	22.20	21.78	23.77	24.24	23.82
		36/0	20.72	20.71	20.84	22.76	22.75	22.88
		36/19	20.68	20.87	20.97	22.72	22.91	23.01
		36/39	20.61	20.81	20.87	22.65	22.85	22.91
		75/0	20.72	20.83	20.85	22.76	22.87	22.89

Band			LTE Band 2					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			18700	18900	19100	18700	18900	19100
			1860 MHz	1880 MHz	1900 MHz	1860 MHz	1880 MHz	1900 MHz
20	QPSK	1/0	22.76	23.05	22.64	24.80	25.09	24.68
		1/50	22.56	22.69	22.77	24.60	24.73	24.81
		1/99	22.25	22.31	22.56	24.29	24.35	24.60
		50/0	21.75	21.70	21.63	23.79	23.74	23.67
		50/25	21.69	21.71	21.78	23.73	23.75	23.82
		50/50	21.65	21.59	21.68	23.69	23.63	23.72
		100/0	21.61	21.74	21.76	23.65	23.78	23.80
	16QAM	1/0	21.90	22.01	21.93	23.94	24.05	23.97
		1/50	21.97	22.22	21.67	24.01	24.26	23.71
		1/99	21.72	21.85	21.81	23.76	23.89	23.85
		50/0	20.64	20.75	20.66	22.68	22.79	22.70
		50/25	20.52	20.64	20.76	22.56	22.68	22.80
		50/50	20.46	20.57	20.72	22.50	22.61	22.76
		100/0	20.57	20.59	20.80	22.61	22.63	22.84

Remark: EIRP power = Conducted Power + Antenna gain.

Band			LTE Band 25					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			26047	26365	26683	26047	26365	26683
			1850.7 MHz	1882.5 MHz	1914.3 MHz	1850.7 MHz	1882.5 MHz	1914.3 MHz
1.4	QPSK	1/0	22.04	22.23	21.91	24.08	24.27	23.95
		1/2	22.09	21.91	21.80	24.13	23.95	23.84
		1/5	21.52	21.46	21.80	23.56	23.50	23.84
		3/0	20.94	20.82	20.88	22.98	22.86	22.92
		3/1	20.91	20.83	20.98	22.95	22.87	23.02
		3/3	20.68	20.73	20.90	22.72	22.77	22.94
	16QAM	6/0	20.85	20.79	20.99	22.89	22.83	23.03
		1/0	21.30	21.23	21.16	23.34	23.27	23.20
		1/2	21.31	21.40	21.46	23.35	23.44	23.50
		1/5	21.24	21.01	21.38	23.28	23.05	23.42
		3/0	19.95	19.93	20.03	21.99	21.97	22.07
		3/1	20.12	19.98	20.15	22.16	22.02	22.19
		3/3	19.81	19.79	20.01	21.85	21.83	22.05
		6/0	19.87	19.85	20.06	21.91	21.89	22.10

Band			LTE Band 25					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			26055	26365	26675	26055	26365	26675
			1851.5 MHz	1882.5 MHz	1913.5 MHz	1851.5 MHz	1882.5 MHz	1913.5 MHz
3	QPSK	1/0	22.15	22.34	22.02	24.19	24.38	24.06
		1/7	22.20	22.02	21.91	24.24	24.06	23.95
		1/14	21.63	21.57	21.91	23.67	23.61	23.95
		8/0	21.05	20.93	20.99	23.09	22.97	23.03
		8/3	21.02	20.94	21.09	23.06	22.98	23.13
		8/7	20.82	20.87	21.04	22.86	22.91	23.08
		15/0	20.98	20.92	21.12	23.02	22.96	23.16
	16QAM	1/0	21.43	21.36	21.29	23.47	23.40	23.33
		1/7	21.44	21.53	21.59	23.48	23.57	23.63
		1/14	21.37	21.14	21.51	23.41	23.18	23.55
		8/0	20.05	20.03	20.13	22.09	22.07	22.17
		8/3	20.22	20.08	20.25	22.26	22.12	22.29
		8/7	19.91	19.89	20.11	21.95	21.93	22.15
		15/0	19.97	19.95	20.16	22.01	21.99	22.20

Remark: EIRP power = Conducted Power + Antenna gain.

Band			LTE Band 25					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			26065	26365	26665	26065	26365	26665
			1852.5 MHz	1882.5 MHz	1912.5 MHz	1852.5 MHz	1882.5 MHz	1912.5 MHz
5	QPSK	1/0	22.28	22.47	22.15	24.32	24.51	24.19
		1/12	22.33	22.15	22.04	24.37	24.19	24.08
		1/24	21.76	21.70	22.04	23.80	23.74	24.08
		12/0	21.13	21.19	21.25	23.17	23.23	23.29
		12/6	21.10	21.02	21.17	23.14	23.06	23.21
		12/13	20.90	20.95	21.12	22.94	22.99	23.16
		25/0	21.07	21.01	21.21	23.11	23.05	23.25
	16QAM	1/0	21.54	21.47	21.40	23.58	23.51	23.44
		1/12	21.55	21.64	21.70	23.59	23.68	23.74
		1/24	21.48	21.25	21.62	23.52	23.29	23.66
		12/0	20.17	20.15	20.25	22.21	22.19	22.29
		12/6	20.30	20.16	20.33	22.34	22.20	22.37
		12/13	19.99	19.97	20.19	22.03	22.01	22.23
		25/0	20.05	20.03	20.24	22.09	22.07	22.28

Band			LTE Band 25					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			26090	26365	26640	26090	26365	26640
			1855 MHz	1882.5 MHz	1910 MHz	1855 MHz	1882.5 MHz	1910 MHz
10	QPSK	1/0	22.41	22.60	22.28	24.45	24.64	24.32
		1/24	22.46	22.28	22.17	24.50	24.32	24.21
		1/49	21.89	21.83	22.17	23.93	23.87	24.21
		25/0	21.31	21.19	21.25	23.35	23.23	23.29
		25/12	21.21	21.13	21.28	23.25	23.17	23.32
		25/25	21.01	21.06	21.23	23.05	23.10	23.27
		50/0	21.18	21.12	21.32	23.22	23.16	23.36
	16QAM	1/0	21.67	21.60	21.53	23.71	23.64	23.57
		1/24	21.68	21.77	21.83	23.72	23.81	23.87
		1/49	21.61	21.38	21.75	23.65	23.42	23.79
		25/0	20.25	20.23	20.33	22.29	22.27	22.37
		25/12	20.42	20.28	20.45	22.46	22.32	22.49
		25/25	20.11	20.09	20.31	22.15	22.13	22.35
		50/0	20.17	20.15	20.36	22.21	22.19	22.40

Remark: EIRP power = Conducted Power + Antenna gain.

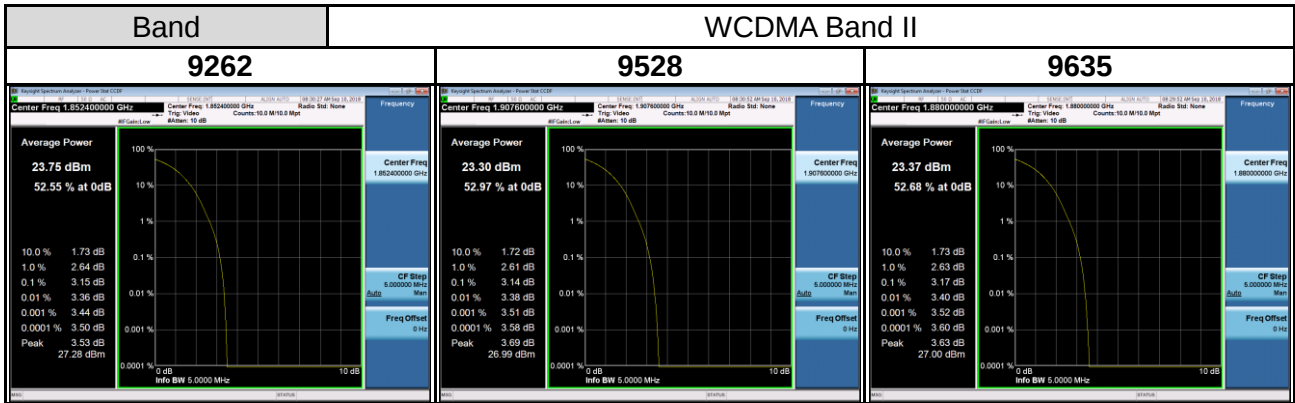
Band			LTE Band 25					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			26115	26365	26615	26115	26365	26615
			1857.5 MHz	1882.5 MHz	1907.5 MHz	1857.5 MHz	1882.5 MHz	1907.5 MHz
15	QPSK	1/0	22.55	22.74	22.42	24.59	24.78	24.46
		1/37	22.60	22.42	22.31	24.64	24.46	24.35
		1/74	22.03	21.97	22.31	24.07	24.01	24.35
		36/0	21.45	21.33	21.39	23.49	23.37	23.43
		36/19	21.42	21.34	21.49	23.46	23.38	23.53
		36/39	21.22	21.27	21.44	23.26	23.31	23.48
		75/0	21.39	21.33	21.53	23.43	23.37	23.57
	16QAM	1/0	21.84	21.77	21.70	23.88	23.81	23.74
		1/37	21.85	21.94	22.00	23.89	23.98	24.04
		1/74	21.78	21.55	21.92	23.82	23.59	23.96
		36/0	20.47	20.45	20.55	22.51	22.49	22.59
		36/19	20.64	20.50	20.67	22.68	22.54	22.71
		36/39	20.33	20.31	20.53	22.37	22.35	22.57
		75/0	20.39	20.37	20.58	22.43	22.41	22.62

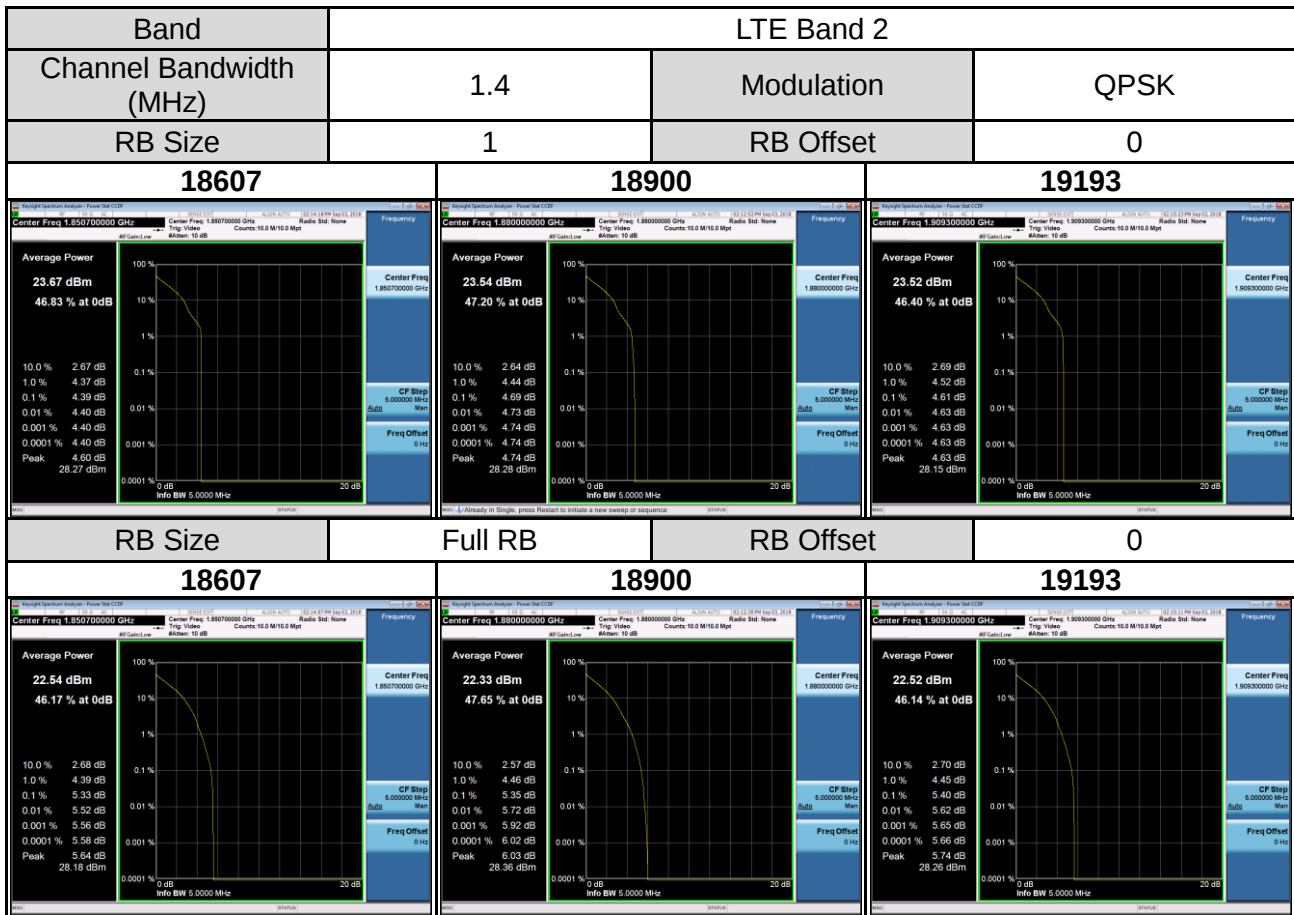
Band			LTE Band 25					
Antenna Gain (dBi)	2.04		Conducted Power (dBm)			EIRP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			26140	26365	26590	26140	26365	26590
			1860 MHz	1882.5 MHz	1905 MHz	1860 MHz	1882.5 MHz	1905 MHz
20	QPSK	1/0	22.72	22.91	22.59	24.76	24.95	24.63
		1/50	22.77	22.59	22.48	24.81	24.63	24.52
		1/99	22.20	22.14	22.48	24.24	24.18	24.52
		50/0	21.62	21.50	21.56	23.66	23.54	23.60
		50/25	21.59	21.51	21.66	23.63	23.55	23.70
		50/50	21.39	21.44	21.61	23.43	23.48	23.65
		100/0	21.56	21.50	21.70	23.60	23.54	23.74
	16QAM	1/0	22.01	21.94	21.87	24.05	23.98	23.91
		1/50	22.02	22.11	22.17	24.06	24.15	24.21
		1/99	21.95	21.72	22.09	23.99	23.76	24.13
		50/0	20.64	20.62	20.72	22.68	22.66	22.76
		50/25	20.81	20.67	20.84	22.85	22.71	22.88
		50/50	20.50	20.48	20.70	22.54	22.52	22.74
		100/0	20.56	20.54	20.75	22.60	22.58	22.79

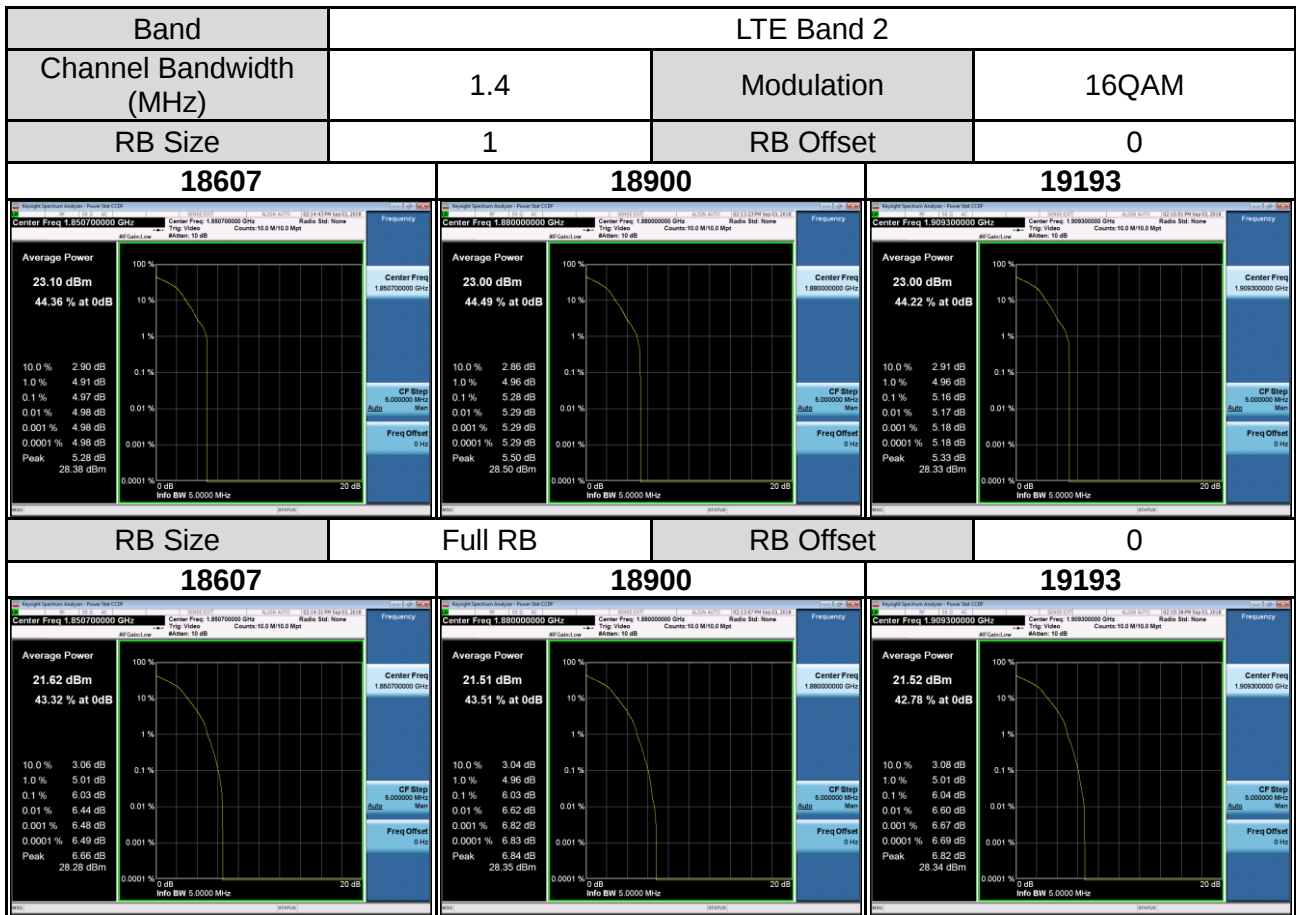
Remark: EIRP power = Conducted Power + Antenna gain.

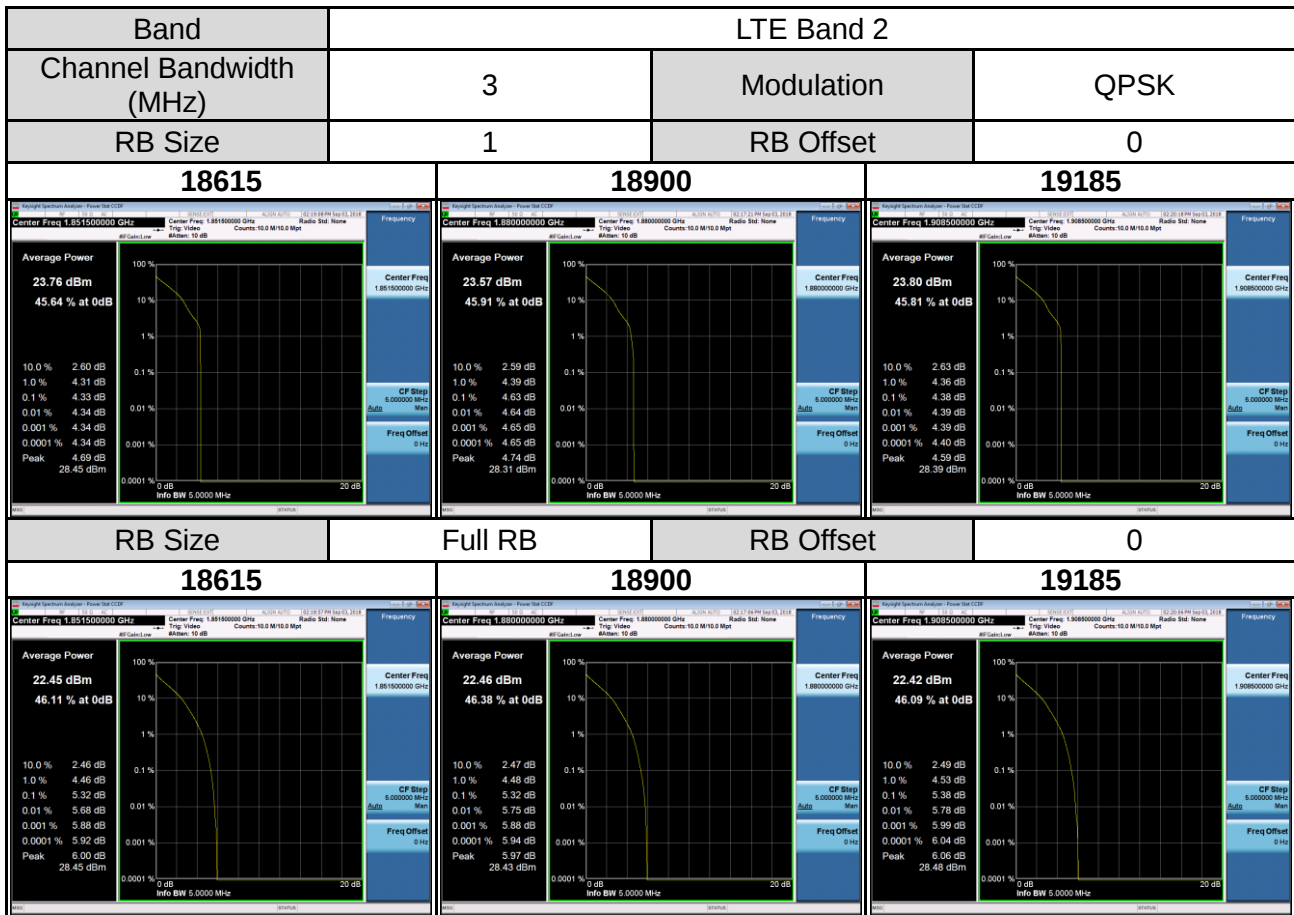
APPENDIX B PEAK-TO-AVERAGE RATIO (PAR)

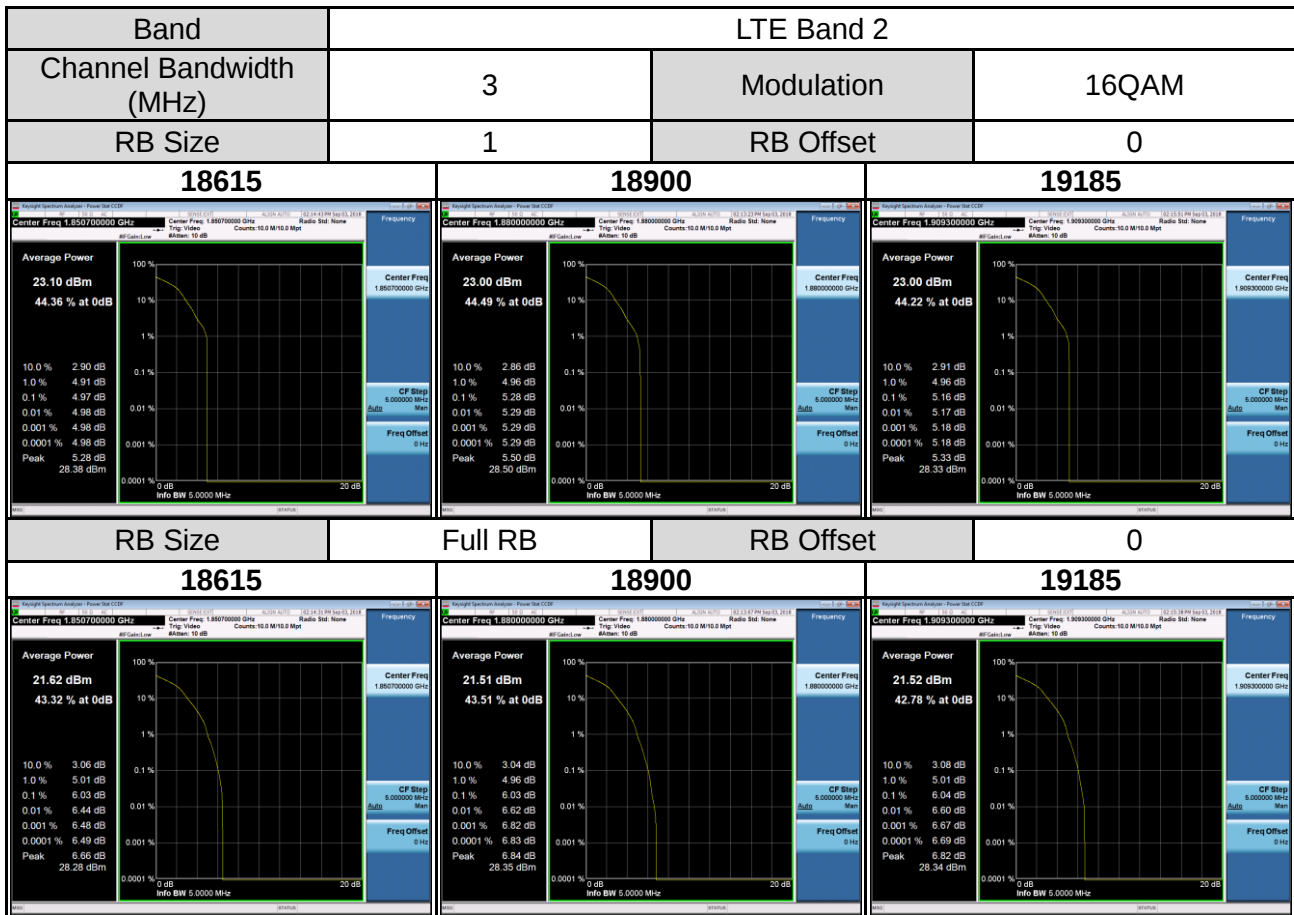
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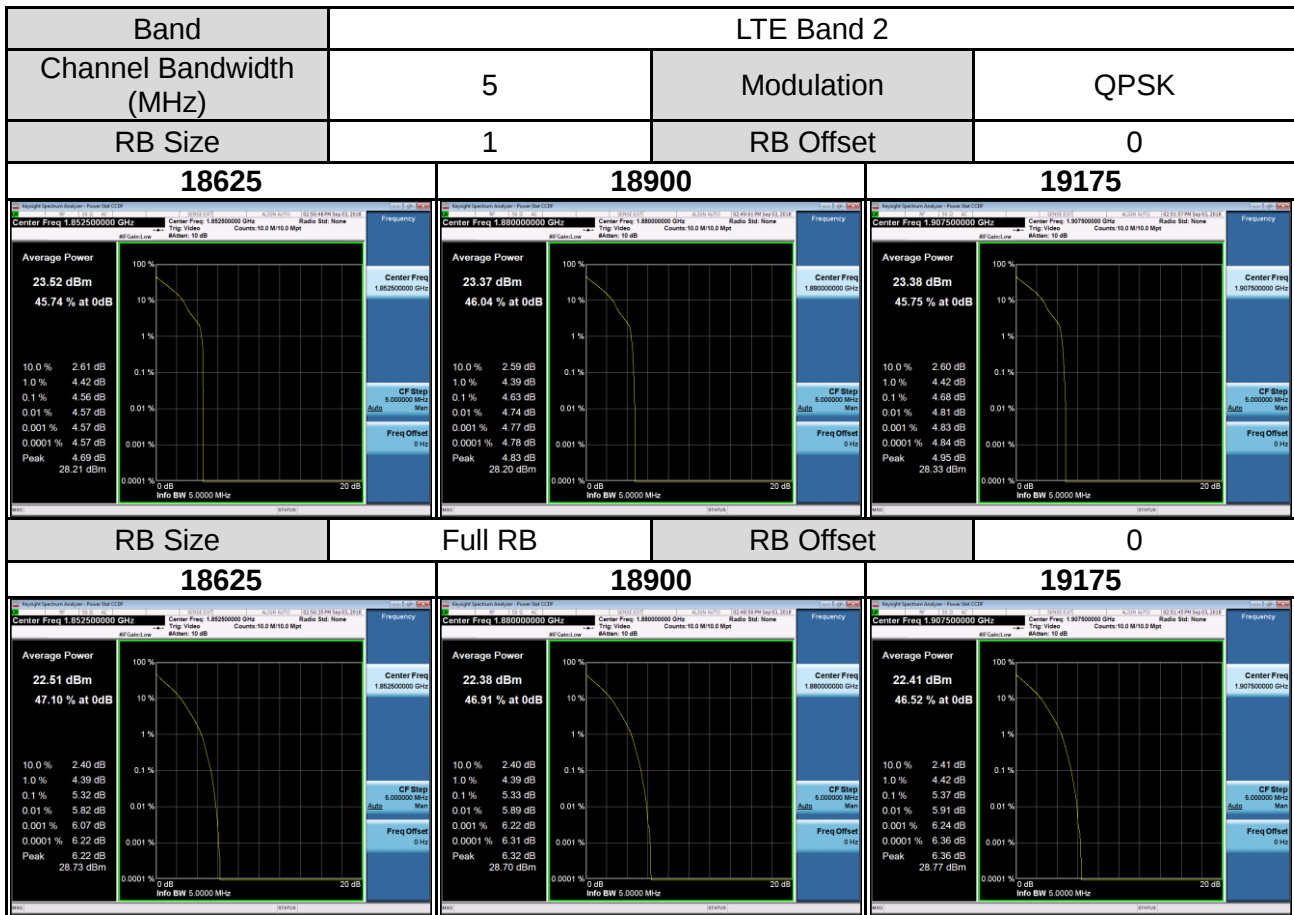


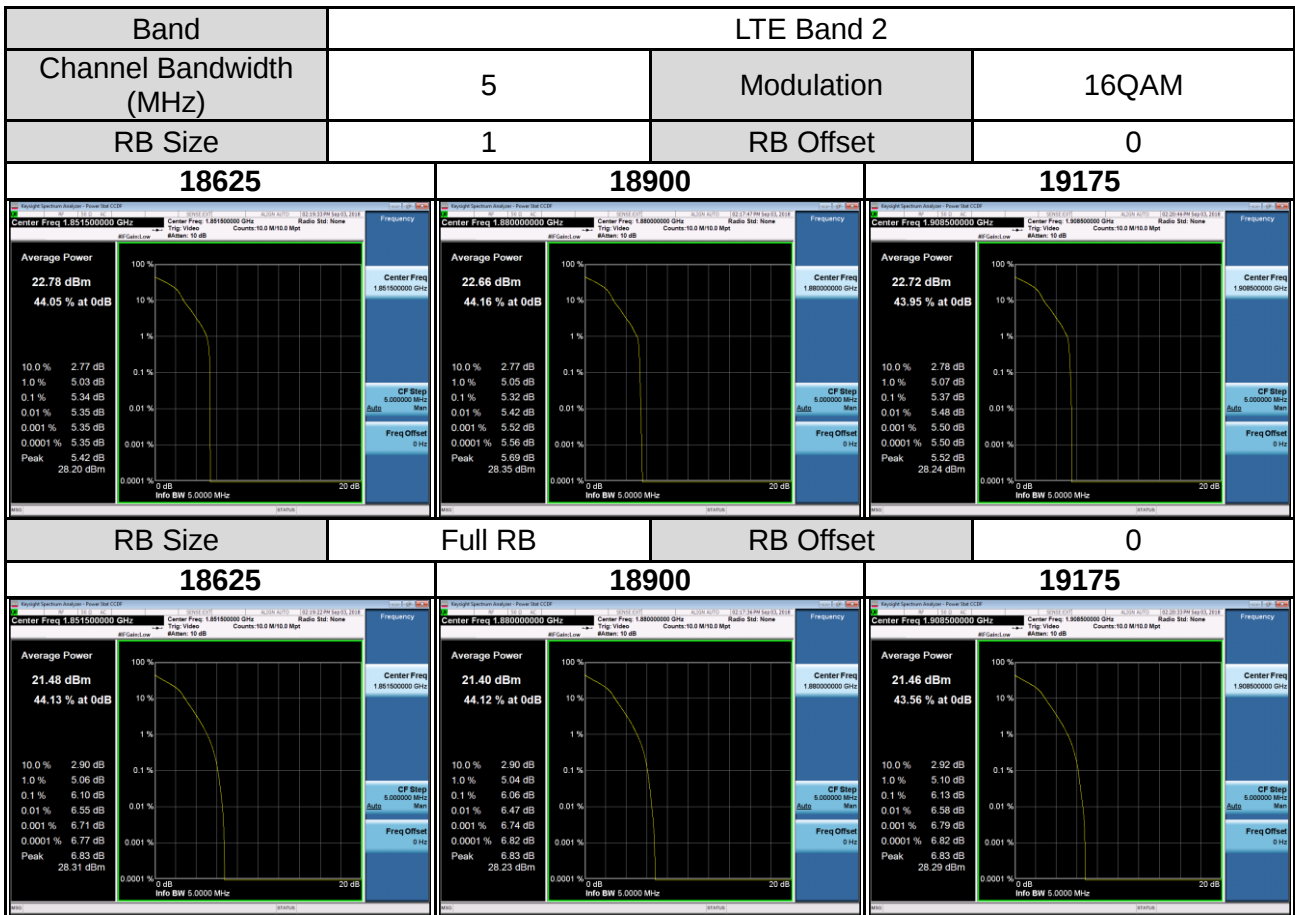


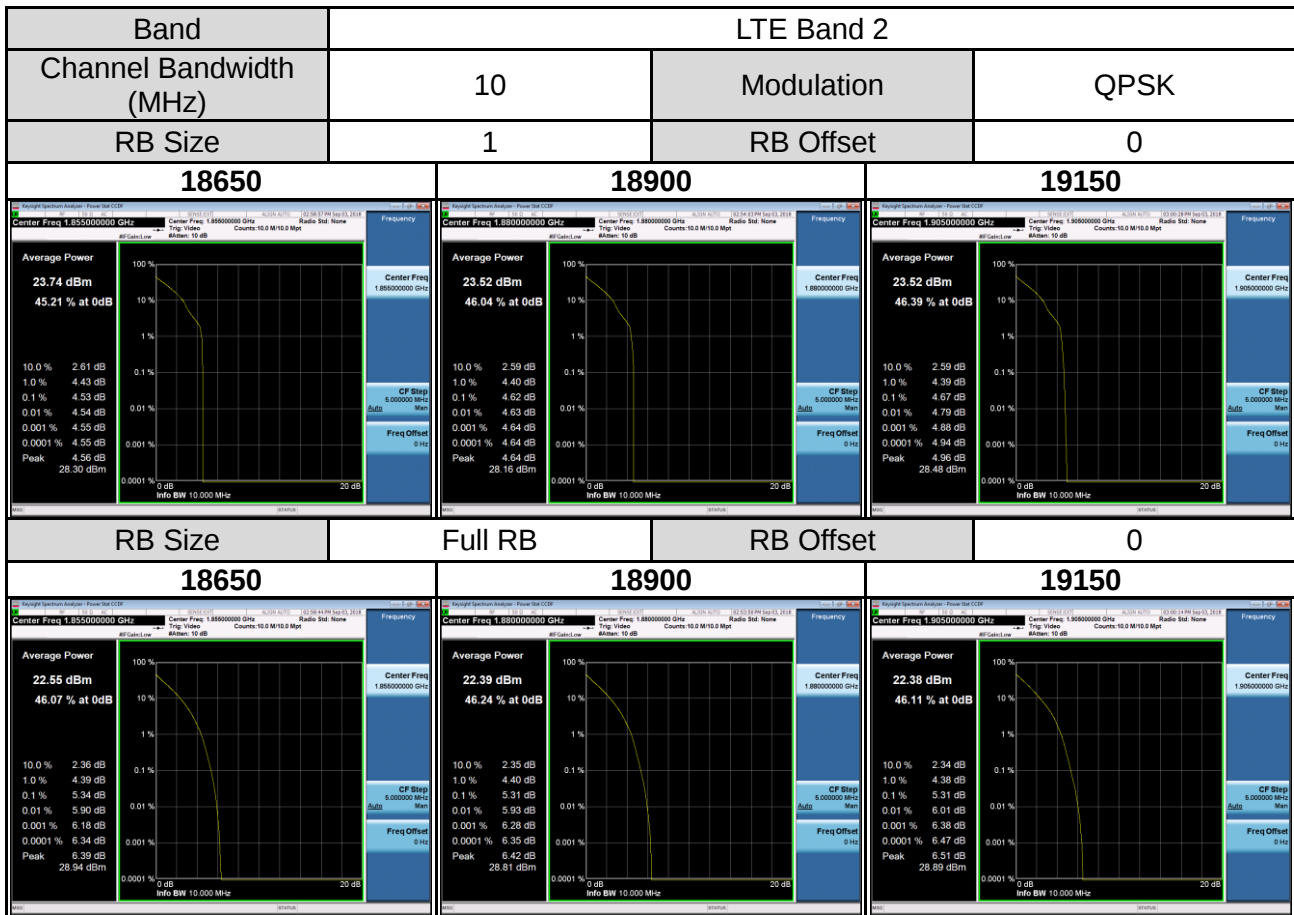


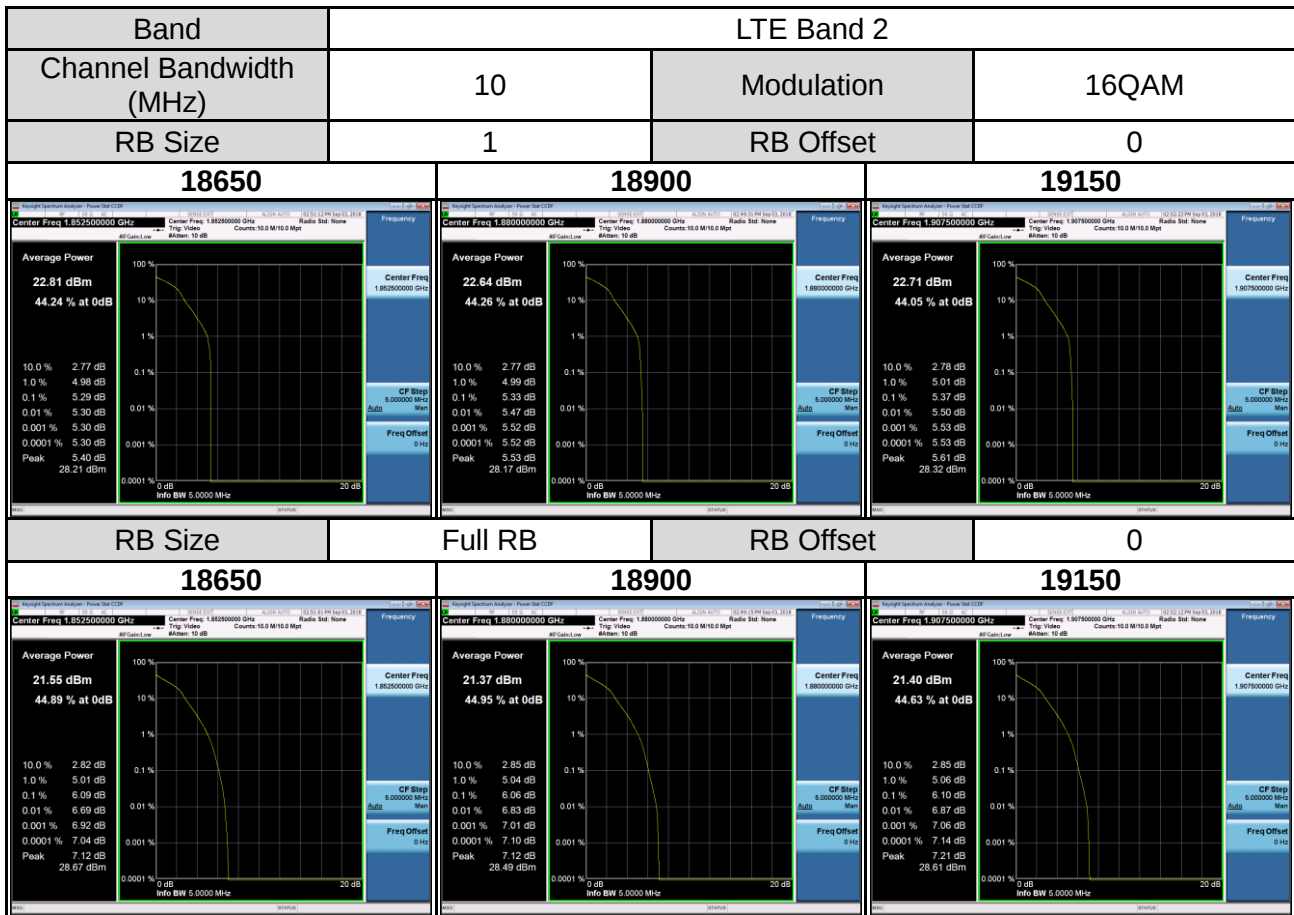




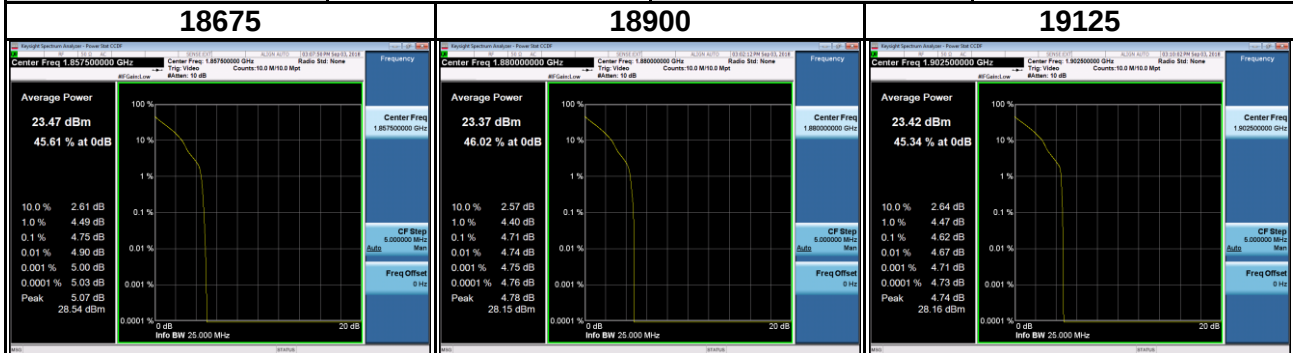




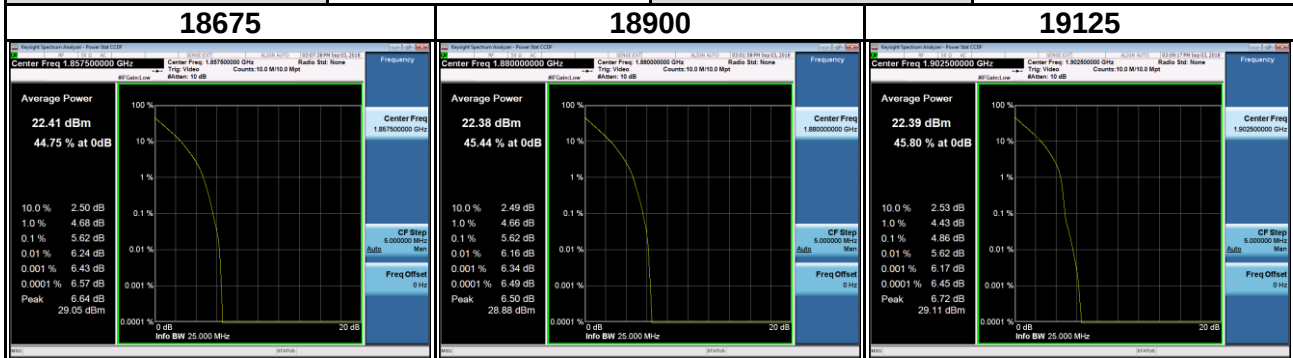


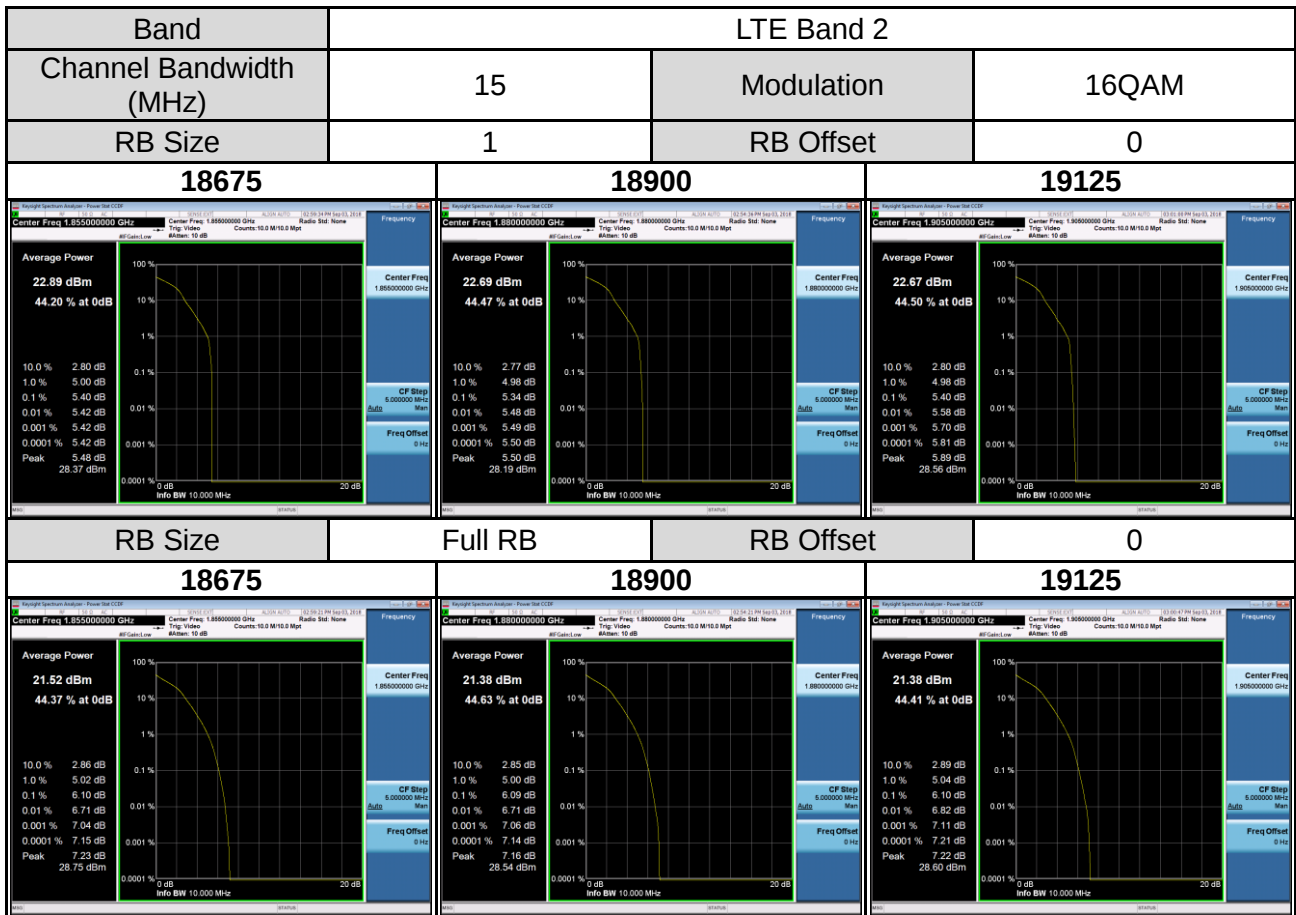


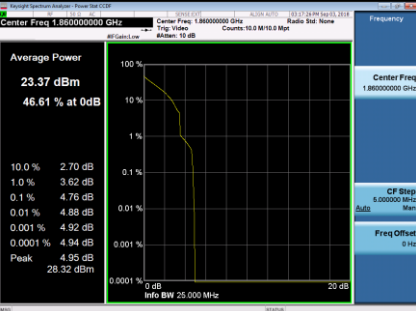
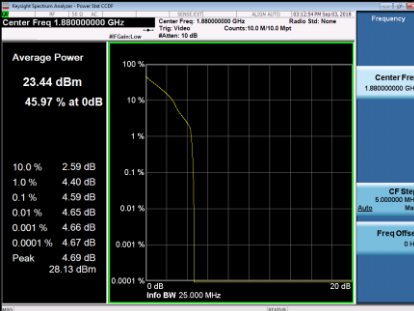
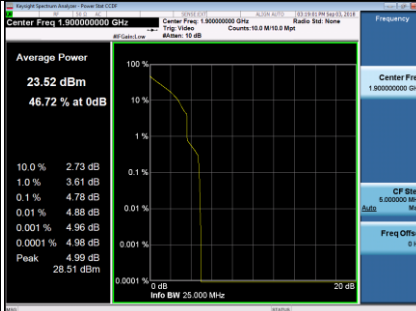
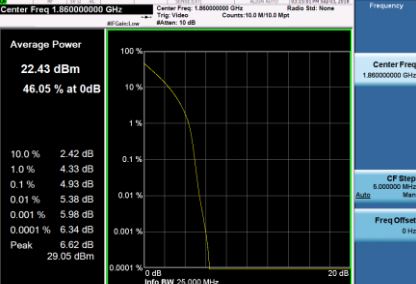
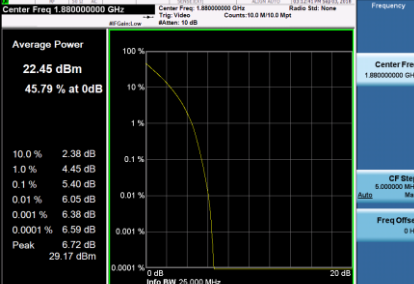
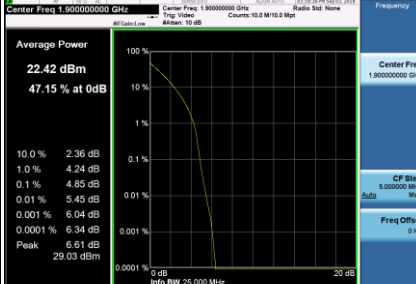
Band	LTE Band 2		
Channel Bandwidth (MHz)	15	Modulation	QPSK
RB Size	1	RB Offset	0

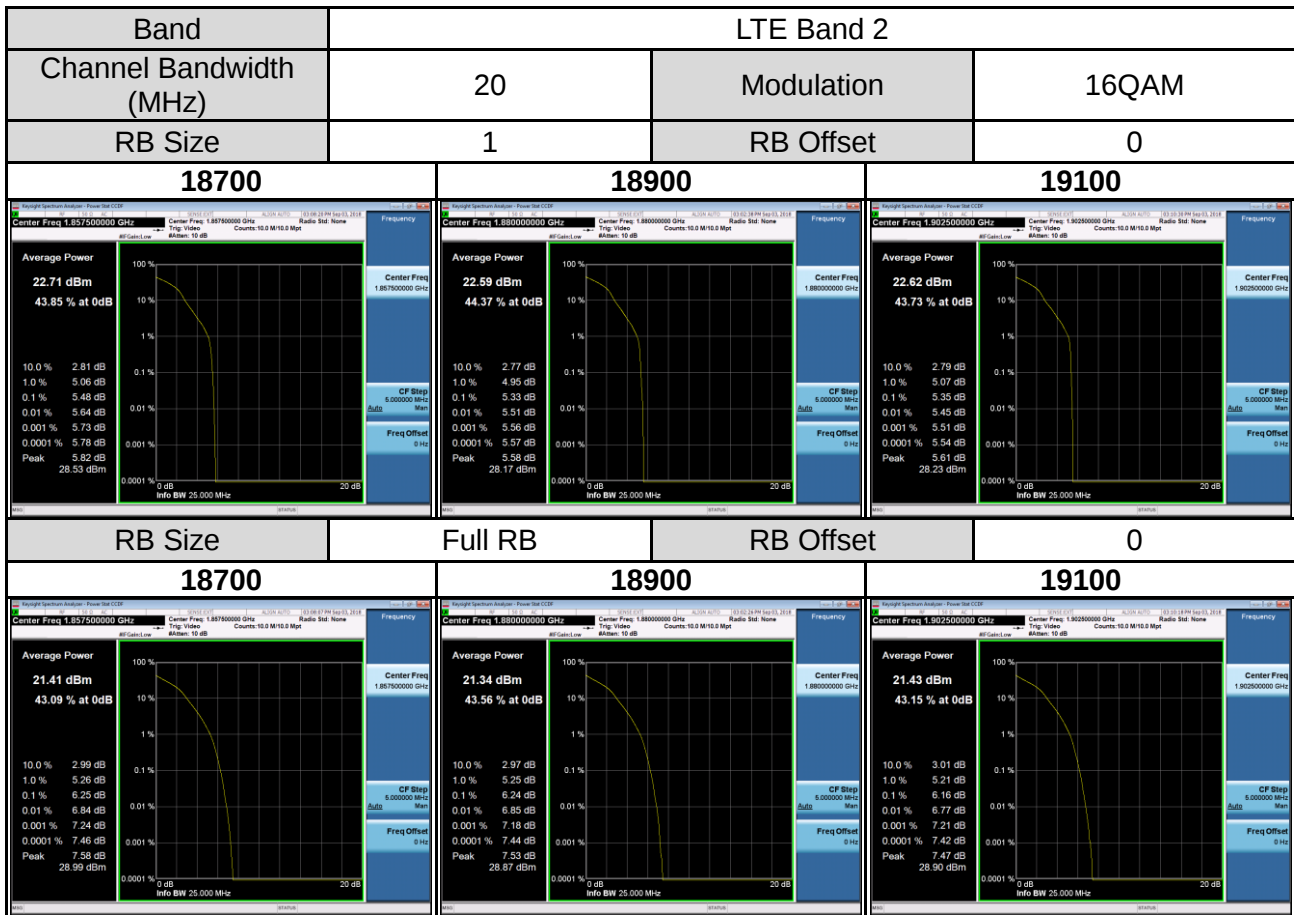


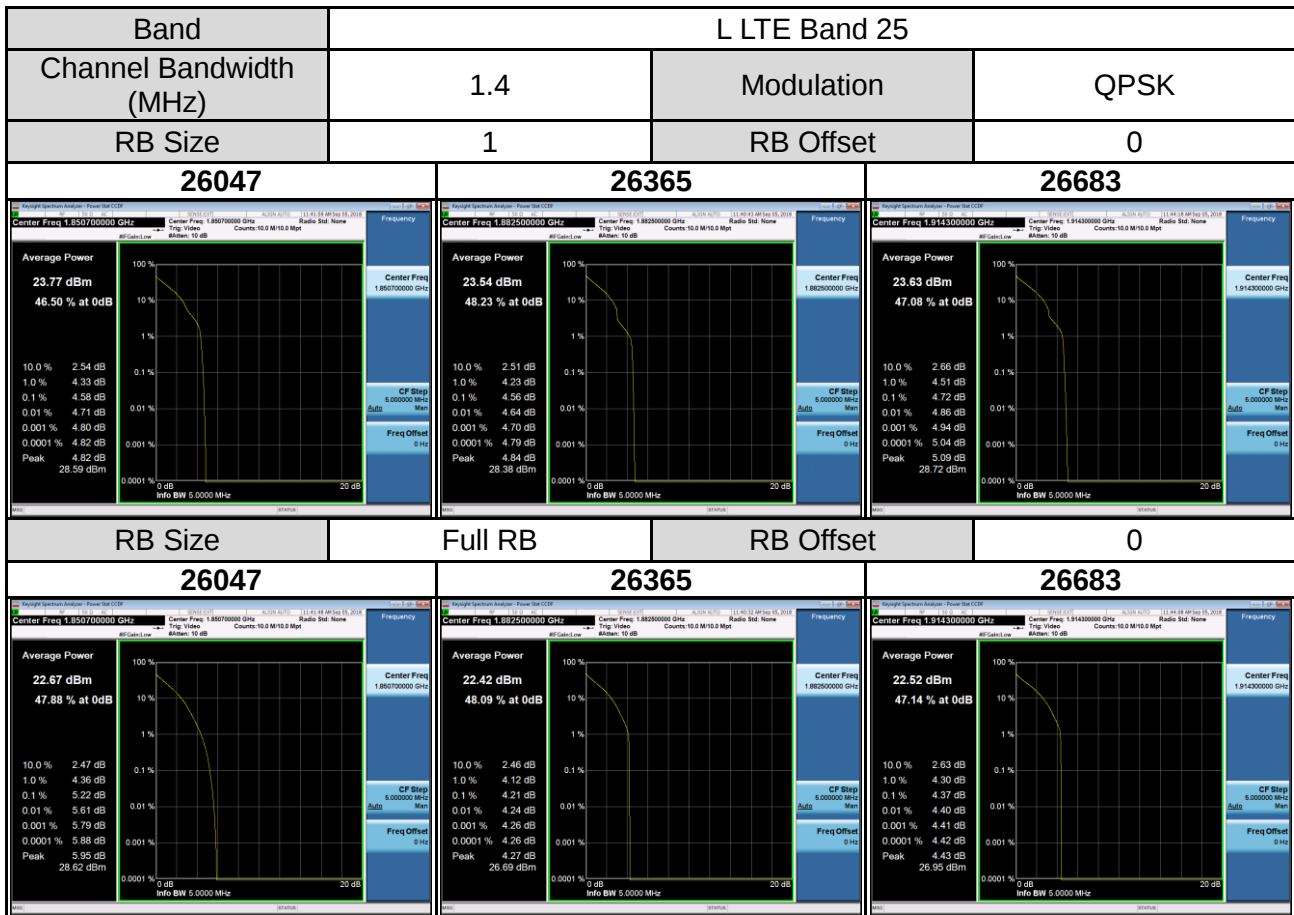
RB Size	Full RB	RB Offset	0
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Band		LTE Band 2			
Channel Bandwidth (MHz)		20	Modulation	QPSK	
RB Size		1	RB Offset	0	
18700		18900		19100	
					
RB Size		Full RB		RB Offset	0
18700		18900		19100	
					





Band	LTE Band 2		
Channel Bandwidth (MHz)	1.4	Modulation	16QAM
RB Size	1	RB Offset	0
26047	26365	26683	
RB Size	Full RB	RB Offset	0
26047	26365	26683	

