

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LICENSED TRANSMITTER

Test Report No. : OT-215-RWD-035

Reception No. : 2104001579

Applicant : LG Innotek Co., Ltd.

Address : 26, Hanamsandan 5beon-ro Gwangsan-gu, Gwangju, 506-731, South Korea

Manufacturer : LG Innotek Co., Ltd.

Address : 26, Hanamsandan 5beon-ro Gwangsan-gu, Gwangju, 506-731, South Korea

Type of Equipment : Telematics Modem

FCC ID. : YZP-VL3000

Model Name : LTD-VL3000

Serial number : N/A

Total page of Report : 150 pages (including this page)

Date of Incoming : April 20, 2021

Date of issue : May 18, 2021

SUMMARY

The equipment complies with the regulation; **Part 2, Part 24 Subpart E**

This test report only contains the result of a single test of the sample supplied for the examination.

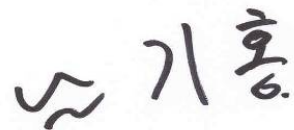
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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-215-RWD-035	May 18, 2021	Class II Permissive Change	All

1. VERIFICATION OF COMPLIANCE

Applicant : LG Innotek Co., Ltd.
 Address : 26, Hanamsandan 5beon-ro Gwangsan-gu, Gwangju, 506-731, South Korea
 Contact Person : Jeong Inchang / Senior Research Engineer
 Telephone No. : 82-2-6327-5661
 FCC ID : YZP-VL3000
 Model Name : LTD-VL3000
 Serial Number : N/A
 Date : May 18, 2021

EQUIPMENT CLASS	PCB-PCS Licensed Transmitter
EQUIPMENT DESCRIPTION	Telematics Modem
THIS REPORT CONCERNS	Class II Permissive Change
MEASUREMENT PROCEDURES	ANSI C63.26:2015, KDB Publication 971168 D01
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC Part 2, Part 24 Subpart E
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
2.1049	Occupied Bandwidth	Met the Limit / PASS
2.1051, 24.238(a)	Band Edge / Spurious and Harmonic Emissions at Antenna Termianl	Met the Limit / PASS
2.1046	Conducted Output Power	Met the Limit / PASS
24.232(d), KDB Publication 971168 D01	Peak-to-Average Ratio	Met the Limit / PASS
2.1055, 24.235	Frequency stability	Met the Limit / PASS
24.232(c)	Equivalent Isotropic Radiated Power	Met the Limit / PASS
2.1053, 24.238(a)	Radiated Spurious and Harmonic Emissions	Met the Limit / PASS

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

-. CLASS II Permissive Change:

The EUT was granted on November 09, 2017 but only following modifications and/or changed items are implemented into the device.

Changed item	Change duplexer of LTE band 2, 13 and CDMA BC1, because of component end of life.
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2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in Part 24 Subpart E.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.26:2015. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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OTC-TRF-RF-001(0)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

3. GENERAL INFORMATION

3.1 Product Description

The LG Innotek Co., Ltd., Model LTD-VL3000 (referred to as the EUT in this report) is a Telematics Modem. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Telematics Modem		
OPERATING FREQUENCY	CDMA BC0	TX	824 MHz ~ 849 MHz
		RX	869 MHz ~ 894 MHz
	CDMA BC1	TX	1 850 MHz ~ 1 910 MHz
		RX	1 930 MHz ~ 1 990 MHz
	LTE Band 2	TX	1 850 MHz ~ 1 910 MHz
		RX	1 930 MHz ~ 1 990 MHz
	LTE Band 4	TX	1 710 MHz ~ 1 755 MHz
		RX	2 110 MHz ~ 2 155 MHz
	LTE Band 5	TX	824 MHz ~ 849 MHz
		RX	869 MHz ~ 894 MHz
	LTE Band 13	TX	777 MHz ~ 787 MHz
		RX	746 MHz ~ 756 MHz
LTE Channel Bandwidth	LTE Band 2	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz	
	LTE Band 4	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz	
	LTE Band 5	1.4 MHz, 3 MHz, 5 MHz, 10 MHz	
	LTE Band 13	5 MHz, 10 MHz	
Modulation Type	QPSK, 16QAM		

Maximum Output Power	CDMA BC0	22.95 dBm
	CDMA BC1	24.11 dBm
	LTE Band 2	23.13 dBm
	LTE Band 4	23.11 dBm
	LTE Band 5	23.07 dBm
	LTE Band 13	22.77 dBm
Rated Power	CDMA BC0	24 dBm
	CDMA BC1	24 dBm
	LTE Band 2	23 dBm
	LTE Band 4	23 dBm
	LTE Band 5	23 dBm
	LTE Band 13	23 dBm
Antenna Type	Dipole Antenna	
Antenna Gain	CDMA BC0	4.5 dBi
	CDMA BC1	2.0 dBi
	LTE Band 2	2.0 dBi
	LTE Band 4	2.0 dBi
	LTE Band 5	4.5 dBi
	LTE Band 13	4.5 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	19.2 MHz	

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	N/A	N/A	N/A
Antenna	N/A	N/A	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
LTD-VL3000	LG Innotek Co., Ltd.	Telematics Modem	-
GP-4303D	LG Precision Co.,Ltd	DC Power Supply	EUT

5.3 Mode of operation during the test

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis, and antenna ports. The worst case was found when positioned as the table below.

Following channel(s) was (were) selected for the final test as listed below:

Band	EIRP	Radiated Emission
LTE Band 2	Y-plane	Y-axis

Test Mode : LTE Band 2

Test Item	Channel Bandwidth	Modulation	Mode	Test Channel
Conducted Output Power	1.4 MHz	QPSK, 16QAM	1 RB / 0 RB Offset	1 850.7 MHz 1 880.0 MHz 1 909.3 MHz
			1 RB / 3 RB Offset	
			1 RB / 5 RB Offset	
			3 RB / 0 RB Offset	
			3 RB / 1 RB Offset	
			3 RB / 3 RB Offset	
			6 RB / 0 RB Offset	
	3 MHz	QPSK, 16QAM	1 RB / 0 RB Offset	1 851.5 MHz 1 880.0 MHz 1 908.5 MHz
			1 RB / 8 RB Offset	
			1 RB / 14 RB Offset	
			8 RB / 0 RB Offset	
			8 RB / 4 RB Offset	
			8 RB / 7 RB Offset	
			15 RB / 0 RB Offset	

Conducted Output Power	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset	1 852.5 MHz 1 880.0 MHz 1 907.5 MHz
			1 RB / 12 RB Offset	
			1 RB / 24 RB Offset	
			12 RB / 0 RB Offset	
			12 RB / 7 RB Offset	
			12 RB / 13 RB Offset	
			25 RB / 0 RB Offset	
	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset	1 855.0 MHz 1 880.0 MHz 1 905.0 MHz
			1 RB / 25 RB Offset	
			1 RB / 49 RB Offset	
			25 RB / 0 RB Offset	
			25 RB / 12 RB Offset	
			25 RB / 25 RB Offset	
			50 RB / 0 RB Offset	
	15 MHz	QPSK, 16QAM	1 RB / 0 RB Offset	1 857.5 MHz 1 880.0 MHz 1 902.5 MHz
			1 RB / 36 RB Offset	
			1 RB / 74 RB Offset	
			36 RB / 0 RB Offset	
			36 RB / 18 RB Offset	
			36 RB / 37 RB Offset	
			75 RB / 0 RB Offset	
	20 MHz	QPSK, 16QAM	1 RB / 0 RB Offset	1 860.0 MHz 1 880.0 MHz 1 900.0 MHz
			1 RB / 49 RB Offset	
			1 RB / 99 RB Offset	
			50 RB / 0 RB Offset	
			50 RB / 24 RB Offset	
			50 RB / 50 RB Offset	
			100 RB / 0 RB Offset	

Equivalent Isotropic Radiated Power	1.4 MHz	QPSK, 16QAM	1 RB / 0 RB Offset	1 850.7 MHz
			1 RB / 3 RB Offset	1 880.0 MHz
			1 RB / 3 RB Offset	1 909.3 MHz
	3 MHz	QPSK, 16QAM	1 RB / 8 RB Offset	1 851.5 MHz
			1 RB / 14 RB Offset	1 880.0 MHz
			1 RB / 8 RB Offset	1 908.5 MHz
	5 MHz	QPSK, 16QAM	1 RB / 12 RB Offset	1 852.5 MHz
			1 RB / 12 RB Offset	1 880.0 MHz
			1 RB / 12 RB Offset	1 907.5 MHz
	10 MHz	QPSK, 16QAM	1 RB / 25 RB Offset	1 855.0 MHz
			1 RB / 25 RB Offset	1 880.0 MHz
			1 RB / 0 RB Offset	1 905.0 MHz
	15 MHz	QPSK, 16QAM	1 RB / 36 RB Offset	1 857.5 MHz
			1 RB / 36 RB Offset	1 880.0 MHz
			1 RB / 74 RB Offset	1 902.5 MHz
	20 MHz	QPSK, 16QAM	1 RB / 49 RB Offset	1 860.0 MHz
			1 RB / 49 RB Offset	1 880.0 MHz
			1 RB / 49 RB Offset	1 900.0 MHz
Frequency stability	1.4 MHz	QPSK	6 RB / 0 RB Offset	1 880.0 MHz

Occupied Bandwidth	1.4 MHz	QPSK, 16QAM	6 RB / 0 RB Offset	1 850.7 MHz
				1 880.0 MHz
				1 909.3 MHz
	3 MHz	QPSK, 16QAM	15 RB / 0 RB Offset	1 851.5 MHz
				1 880.0 MHz
				1 908.5 MHz
	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset	1 852.5 MHz
				1 880.0 MHz
				1 907.5 MHz
	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset	1 855.0 MHz
				1 880.0 MHz
				1 905.0 MHz
	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset	1 857.5 MHz
				1 880.0 MHz
				1 902.5 MHz
	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset	1 860.0 MHz
				1 880.0 MHz
				1 900.0 MHz

Peak-to-Average Ratio	1.4 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 6 RB / 0 RB Offset	1 850.7 MHz
			1 RB / 3 RB Offset 6 RB / 0 RB Offset	1 880.0 MHz
			1 RB / 3 RB Offset 6 RB / 0 RB Offset	1 909.3 MHz
	3 MHz	QPSK, 16QAM	1 RB / 8 RB Offset 15 RB / 0 RB Offset	1 851.5 MHz
			1 RB / 14 RB Offset 15 RB / 0 RB Offset	1 880.0 MHz
			1 RB / 8 RB Offset 15 RB / 0 RB Offset	1 908.5 MHz
	5 MHz	QPSK, 16QAM	1 RB / 12 RB Offset 25 RB / 0 RB Offset	1 852.5 MHz
			1 RB / 12 RB Offset 25 RB / 0 RB Offset	1 880.0 MHz
			1 RB / 12 RB Offset 25 RB / 0 RB Offset	1 907.5 MHz
	10 MHz	QPSK, 16QAM	1 RB / 25 RB Offset 50 RB / 0 RB Offset	1 855.0 MHz
			1 RB / 25 RB Offset 50 RB / 0 RB Offset	1 880.0 MHz
			1 RB / 0 RB Offset 50 RB / 0 RB Offset	1 905.0 MHz
	15 MHz	QPSK, 16QAM	1 RB / 36 RB Offset 75 RB / 0 RB Offset	1 857.5 MHz
			1 RB / 36 RB Offset 75 RB / 0 RB Offset	1 880.0 MHz
			1 RB / 74 RB Offset 75 RB / 0 RB Offset	1 902.5 MHz
	20 MHz	QPSK, 16QAM	1 RB / 49 RB Offset 100 RB / 0 RB Offset	1 860.0 MHz
			1 RB / 49 RB Offset 100 RB / 0 RB Offset	1 880.0 MHz
			1 RB / 49 RB Offset 100 RB / 0 RB Offset	1 900.0 MHz

Band Edge	1.4 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 6 RB / 0 RB Offset	1 850.7 MHz
			1 RB / 5 RB Offset 6 RB / 0 RB Offset	1 909.3 MHz
	3 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 15 RB / 0 RB Offset	1 851.5 MHz
			1 RB / 14 RB Offset 15 RB / 0 RB Offset	1 908.5 MHz
	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 25 RB / 0 RB Offset	1 852.5 MHz
			1 RB / 24 RB Offset 25 RB / 0 RB Offset	1 907.5 MHz
	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 50 RB / 0 RB Offset	1 855.0 MHz
			1 RB / 49 RB Offset 50 RB / 0 RB Offset	1 905.0 MHz
	15 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 75 RB / 0 RB Offset	1 857.5 MHz
			1 RB / 74 RB Offset 75 RB / 0 RB Offset	1 902.5 MHz
	20 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 100 RB / 0 RB Offset	1 860.0 MHz
			1 RB / 99 RB Offset 100 RB / 0 RB Offset	1 900.0 MHz
Spurious and Harmonic Emissions at Antenna Termianl & Radiated Spurious and Harmonic Emissions	1.4 MHz	QPSK (Note 1)	1 RB / 0 RB Offset	1 850.7 MHz
			1 RB / 3 RB Offset	1 880.0 MHz
			1 RB / 3 RB Offset	1 909.3 MHz
	3 MHz	QPSK (Note 1)	1 RB / 8 RB Offset	1 851.5 MHz
			1 RB / 14 RB Offset	1 880.0 MHz
			1 RB / 8 RB Offset	1 908.5 MHz
	5 MHz	QPSK (Note 1)	1 RB / 12 RB Offset	1 852.5 MHz
			1 RB / 12 RB Offset	1 880.0 MHz
			1 RB / 12 RB Offset	1 907.5 MHz
	10 MHz	QPSK (Note 1)	1 RB / 25 RB Offset	1 855.0 MHz
			1 RB / 25 RB Offset	1 880.0 MHz
			1 RB / 0 RB Offset	1 905.0 MHz
	15 MHz	QPSK (Note 1)	1 RB / 36 RB Offset	1 857.5 MHz
			1 RB / 36 RB Offset	1 880.0 MHz
			1 RB / 74 RB Offset	1 902.5 MHz
	20 MHz	QPSK (Note 1)	1 RB / 49 RB Offset	1 860.0 MHz
			1 RB / 49 RB Offset	1 880.0 MHz
			1 RB / 49 RB Offset	1 900.0 MHz

Note 1 : Of all modulation, We have tested modulation of the high Conducted Output Power.

5.4 Frequency List of Low/Middle/High Channels

LTE Band 2 Channel and Frequency List				
Bandwidth	Channel / Frequency	Low	Middle	High
1.4 MHz	Channel	18607	18900	19193
	Frequency	1 850.7 MHz	1 880.0 MHz	1 909.3 MHz
3 MHz	Channel	18615	18900	19185
	Frequency	1 851.5 MHz	1 880.0 MHz	1 908.5 MHz
5 MHz	Channel	18625	18900	19175
	Frequency	1 852.5 MHz	1 880.0 MHz	1 907.5 MHz
10 MHz	Channel	18650	18900	19150
	Frequency	1 855.0 MHz	1 880.0 MHz	1 905.0 MHz
15 MHz	Channel	18675	18900	19125
	Frequency	1 857.5 MHz	1 880.0 MHz	1 902.5 MHz
20 MHz	Channel	18700	18900	19100
	Frequency	1 860.0 MHz	1 880.0 MHz	1 900.0 MHz
CDMA Channel and Frequency List				
Band	Channel / Frequency	Low	Middle	High
BC 1	Channel	25	600	1175
	Frequency	1 851.25 MHz	1 880.00 MHz	1 908.75 MHz

5.5 Configuration of Test System

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.26: 2015 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

6. PRELIMINARY TEST

6.1 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

7. CONDUCTED OUTPUT POWER

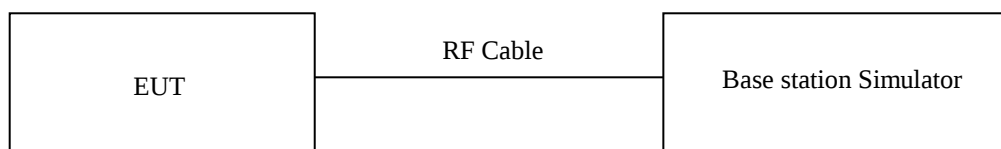
7.1 Operating environment

Temperature : 23 °C
Relative humidity : 47 % R.H.

7.2 Test set-up

Conducted Output Power is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v04, April 9, 2018, Section 5.2.

A base station simulator was used to establish communication with the EUT, and Spectrum analyzer was used for test results. This device was tested under all configurations and the highest power is reported. Conducted Output Powers of EUT are reported below.



7.3 Test Date

April 20, 2021 ~ April 30, 2021

7.4 Test data for Band 2_Bandwidth 1.4 MHz

-. Test Result : Pass

Conducted Average Output Power (dBm)

RB Size	RB Offset	QPSK			16QAM		
		LOW	MIDDLE	HIGH	LOW	MIDDLE	HIGH
		1 850.7 MHz	1 880.0 MHz	1 909.3 MHz	1 850.7 MHz	1 880.0 MHz	1 909.3 MHz
1	0	22.95	22.94	23.00	21.97	21.85	21.98
1	3	22.93	23.07	23.10	22.09	21.93	21.88
1	5	22.74	22.90	22.90	21.94	21.89	22.07
3	0	22.83	22.95	22.94	21.95	21.86	21.90
3	1	22.80	22.99	22.91	21.75	21.91	21.79
3	3	22.91	22.93	22.85	21.72	21.92	21.83
6	0	21.87	21.94	21.81	21.00	20.79	20.96

7.5 Test data for Band 2_Bandwidth 3 MHz

-. Test Result : Pass

Conducted Average Output Power (dBm)

RB Size	RB Offset	QPSK			16QAM		
		LOW	MIDDLE	HIGH	LOW	MIDDLE	HIGH
		1 851.5 MHz	1 880.0 MHz	1 908.5 MHz	1 851.5 MHz	1 880.0 MHz	1 908.5 MHz
1	0	22.61	22.66	22.53	21.95	21.52	21.92
1	8	22.64	22.72	22.71	21.89	21.68	21.54
1	14	22.62	22.77	22.64	21.88	21.68	21.62
8	0	21.76	21.82	21.87	20.85	20.99	20.90
8	4	21.62	21.72	21.83	21.02	20.95	20.89
8	7	21.59	21.85	21.78	20.93	20.94	20.86
15	0	21.73	21.82	21.79	20.92	21.05	20.83

7.6 Test data for Band 2_Bandwidth 5 MHz

-. Test Result : Pass

Conducted Average Output Power (dBm)

RB Size	RB Offset	QPSK			16QAM		
		LOW	MIDDLE	HIGH	LOW	MIDDLE	HIGH
		1 852.5 MHz	1 880.0 MHz	1 907.5 MHz	1 852.5 MHz	1 880.0 MHz	1 907.5 MHz
1	0	22.63	22.29	22.61	21.74	21.57	21.83
1	12	22.70	22.42	22.93	21.84	21.52	21.71
1	24	22.60	22.29	22.75	21.88	21.48	21.64
12	0	21.49	21.46	21.62	20.73	20.76	20.63
12	7	21.65	21.46	21.71	20.72	20.71	20.73
12	13	21.56	21.37	21.59	20.70	20.73	20.72
25	0	21.59	21.43	21.81	20.75	20.76	20.77

7.7 Test data for Band 2_Bandwidth 10 MHz

-. Test Result : Pass

Conducted Average Output Power (dBm)

RB Size	RB Offset	QPSK			16QAM		
		LOW	MIDDLE	HIGH	LOW	MIDDLE	HIGH
		1 855.0 MHz	1 880.0 MHz	1 905.0 MHz	1 855.0 MHz	1 880.0 MHz	1 905.0 MHz
1	0	22.55	22.39	22.70	21.45	21.53	21.82
1	25	22.76	22.75	22.62	21.80	21.90	22.03
1	49	22.45	22.35	22.68	21.65	21.57	21.84
25	0	21.58	21.44	21.47	20.71	20.87	20.89
25	12	21.53	21.39	21.49	20.82	20.88	20.93
25	25	21.53	21.38	21.61	20.72	20.70	20.81
50	0	21.58	21.30	21.50	20.73	20.75	20.63

7.8 Test data for Band 2_Bandwidth 15 MHz

-. Test Result : Pass

Conducted Average Output Power (dBm)

RB Size	RB Offset	QPSK			16QAM		
		LOW	MIDDLE	HIGH	LOW	MIDDLE	HIGH
		1 857.5 MHz	1 880.0 MHz	1 902.5 MHz	1 857.5 MHz	1 880.0 MHz	1 902.5 MHz
1	0	22.43	22.39	22.39	21.48	21.44	21.63
1	36	22.50	22.55	22.48	21.49	21.84	21.48
1	74	22.34	22.47	22.61	21.46	21.53	21.57
36	0	21.61	21.43	21.61	20.60	20.34	20.63
36	18	21.62	21.51	21.66	20.61	20.45	20.70
36	37	21.46	21.36	21.55	20.45	20.30	20.59
75	0	21.46	21.37	21.47	20.55	20.38	20.60

7.9 Test data for Band 2_Bandwidth 20 MHz

-. Test Result : Pass

Conducted Average Output Power (dBm)

RB Size	RB Offset	QPSK			16QAM		
		LOW	MIDDLE	HIGH	LOW	MIDDLE	HIGH
		1 860.0 MHz	1 880.0 MHz	1 900.0 MHz	1 860.0 MHz	1 880.0 MHz	1 900.0 MHz
1	0	22.83	22.40	22.57	21.79	21.91	21.64
1	49	23.05	22.76	23.13	22.04	22.00	22.03
1	99	22.45	22.52	22.65	21.67	21.79	21.78
50	0	21.69	21.55	21.61	20.66	21.54	20.72
50	24	21.66	21.53	21.65	20.74	20.63	20.77
50	50	21.45	21.44	21.63	20.65	20.68	20.42
100	0	21.53	21.57	21.51	20.59	20.65	20.60

7.10 Test data for CDMA_1xRTT

-. Test Result : Pass

Conducted Average Output Power (dBm)

Radio Configuration	Service Option	BC 1		
		LOW	MIDDLE	HIGH
		1 851.25 MHz	1 880.00 MHz	1 908.75 MHz
RC1 (Fwd1, Rvs1)	2 (Loopback)	23.95	23.94	24.00
	55 (Loopback)	23.96	23.89	23.96
RC2 (Fwd2, Rvs2)	2 (Loopback)	23.91	23.84	23.91
	55 (Loopback)	23.93	23.89	23.94
RC3 (Fwd3, Rvs3)	2 (Loopback)	23.92	23.86	23.93
	55 (Loopback)	23.94	23.99	23.96
	32 (+F-SCH)	23.97	23.87	23.92
	32 (+SCH)	23.94	23.88	23.92
RC4 (Fwd4, Rvs3)	2 (Loopback)	23.98	23.92	23.95
	55 (Loopback)	23.98	23.88	23.91
	32 (+F-SCH)	23.96	23.89	23.93
	32 (+SCH)	23.94	23.88	23.92
RC5 (Fwd5, Rvs4)	9 (Loopback)	23.90	23.84	23.89
	55 (Loopback)	23.87	23.81	23.87

7.11 Test data for CDMA_EV-DO

-. Test Result : Pass

Conducted Average Output Power (dBm)

Radio Configuration	Service Option	BC 1		
		LOW	MIDDLE	HIGH
		1 851.25 MHz	1 880.00 MHz	1 908.75 MHz
Rel. 0	FTAP (307.2 kbps, QPSK)	24.01	24.11	24.11
	RTAP (153.6 kbps)	23.98	24.10	24.09
Rel. A	FETAP (307.2 kbps, QPSK)	24.00	24.07	24.00
	RETAP (153.6 kbps)	23.99	24.05	24.02

8. EQUIVALENT ISOTROPIC RADIATED POWER

8.1 Operating environment

Temperature : 23 °C
Relative humidity : 47 % R.H.

8.2 Methods of Measurement

1. The testing follows ANSI C63.26 (2015) Section 5.5.3.
2. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber,
EUT placed on the 0.8 m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) 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.
3. The substitution 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 2. Record the power level of S.G.
4. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution antenna power can be
Calculated. E.R.P power = E.I.P.R power - 2.15 dBi.

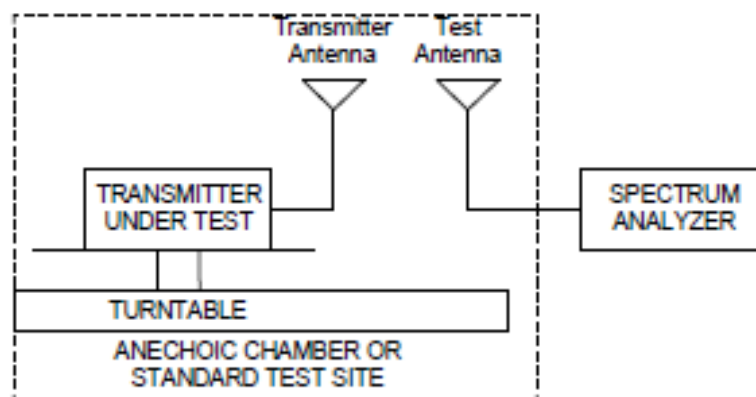
8.3 Limits

Rule Part 24.232(c) Mobile and portable stations are limited to 2 watts EIRP.

Limit	2 W (33 dBm)
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8.4 Test set-up

The EUT and measurement equipment were set up as shown in the diagram below.



8.5 Test Date

April 20, 2021 ~ April 30, 2021

8.6 Test data for Band 2_Bandwidth 1.4 MHz

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	EIRP (dBm)	Limits (dBm)	Margin (dB)
Test Data for QPSK							
1 850.7	14.02	H	1.00	10.10	23.12	33.00	9.88
1 850.7	14.34	V	1.00	10.10	23.44	33.00	9.56
1 880.0	14.29	H	1.00	10.10	23.39	33.00	9.61
1 880.0	15.46	V	1.00	10.10	24.56	33.00	8.44
1 909.3	14.32	H	1.00	10.10	23.42	33.00	9.58
1 909.3	13.99	V	1.00	10.10	23.09	33.00	9.91
Test Data for 16QAM							
1 850.7	13.67	H	1.00	10.10	22.77	33.00	10.23
1 850.7	13.79	V	1.00	10.10	22.89	33.00	10.11
1 880.0	13.29	H	1.00	10.10	22.39	33.00	10.61
1 880.0	14.46	V	1.00	10.10	23.56	33.00	9.44
1 909.3	13.59	H	1.00	10.10	22.69	33.00	10.31
1 909.3	13.52	V	1.00	10.10	22.62	33.00	10.38

Remark: "H": Horizontal, "V": Vertical

8.7 Test data for Band 2_Bandwidth 3 MHz

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	EIRP (dBm)	Limits (dBm)	Margin (dB)
Test Data for QPSK							
1 851.5	14.40	H	1.00	10.10	23.50	33.00	9.50
1 851.5	14.75	V	1.00	10.10	23.85	33.00	9.15
1 880.0	14.57	H	1.00	10.10	23.67	33.00	9.33
1 880.0	14.76	V	1.00	10.10	23.86	33.00	9.14
1 908.5	13.37	H	1.00	10.10	22.47	33.00	10.53
1 908.5	13.86	V	1.00	10.10	22.96	33.00	10.04
Test Data for 16QAM							
1 851.5	13.24	H	1.00	10.10	22.34	33.00	10.66
1 851.5	13.29	V	1.00	10.10	22.39	33.00	10.61
1 880.0	13.24	H	1.00	10.10	22.34	33.00	10.66
1 880.0	13.29	V	1.00	10.10	22.39	33.00	10.61
1 908.5	12.59	H	1.00	10.10	21.69	33.00	11.31
1 908.5	13.51	V	1.00	10.10	22.61	33.00	10.39

Remark: "H": Horizontal, "V": Vertical

8.8 Test data for Band 2_Bandwidth 5 MHz

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	EIRP (dBm)	Limits (dBm)	Margin (dB)
Test Data for QPSK							
1 852.5	14.35	H	1.00	10.10	23.45	33.00	9.55
1 852.5	14.58	V	1.00	10.10	23.68	33.00	9.32
1 880.0	14.67	H	1.00	10.10	23.77	33.00	9.23
1 880.0	14.79	V	1.00	10.10	23.89	33.00	9.11
1 907.5	12.65	H	1.00	10.10	21.75	33.00	11.25
1 907.5	13.26	V	1.00	10.10	22.36	33.00	10.64
Test Data for 16QAM							
1 852.5	13.02	H	1.00	10.10	22.12	33.00	10.88
1 852.5	13.39	V	1.00	10.10	22.49	33.00	10.51
1 880.0	13.71	H	1.00	10.10	22.81	33.00	10.19
1 880.0	14.07	V	1.00	10.10	23.17	33.00	9.83
1 907.5	11.61	H	1.00	10.10	20.71	33.00	12.29
1 907.5	12.13	V	1.00	10.10	21.23	33.00	11.77

Remark: "H": Horizontal, "V": Vertical

8.9 Test data for Band 2_Bandwidth 10 MHz

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	EIRP (dBm)	Limits (dBm)	Margin (dB)
Test Data for QPSK							
1 855.0	15.37	H	1.00	10.10	24.47	33.00	8.53
1 855.0	14.88	V	1.00	10.10	23.98	33.00	9.02
1 880.0	15.55	H	1.00	10.10	24.65	33.00	8.35
1 880.0	14.65	V	1.00	10.10	23.75	33.00	9.25
1 905.0	14.16	H	1.00	10.10	23.26	33.00	9.74
1 905.0	13.17	V	1.00	10.10	22.27	33.00	10.73
Test Data for 16QAM							
1 855.0	14.37	H	1.00	10.10	23.47	33.00	9.53
1 855.0	13.98	V	1.00	10.10	23.08	33.00	9.92
1 880.0	14.93	H	1.00	10.10	24.03	33.00	8.97
1 880.0	13.95	V	1.00	10.10	23.05	33.00	9.95
1 905.0	13.33	H	1.00	10.10	22.43	33.00	10.57
1 905.0	11.97	V	1.00	10.10	21.07	33.00	11.93

Remark: "H": Horizontal, "V": Vertical

8.10 Test data for Band 2_Bandwidth 15 MHz

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	EIRP (dBm)	Limits (dBm)	Margin (dB)
Test Data for QPSK							
1 857.5	14.60	H	1.00	10.10	23.70	33.00	9.30
1 857.5	14.69	V	1.00	10.10	23.79	33.00	9.21
1 880.0	14.43	H	1.00	10.10	23.53	33.00	9.47
1 880.0	14.66	V	1.00	10.10	23.76	33.00	9.24
1 902.5	12.56	H	1.00	10.10	21.66	33.00	11.34
1 902.5	12.72	V	1.00	10.10	21.82	33.00	11.18
Test Data for 16QAM							
1 857.5	13.58	H	1.00	10.10	22.68	33.00	10.32
1 857.5	13.60	V	1.00	10.10	22.70	33.00	10.30
1 880.0	13.62	H	1.00	10.10	22.72	33.00	10.28
1 880.0	14.20	V	1.00	10.10	23.30	33.00	9.70
1 902.5	11.73	H	1.00	10.10	20.83	33.00	12.17
1 902.5	11.73	V	1.00	10.10	20.83	33.00	12.17

Remark: "H": Horizontal, "V": Vertical

8.11 Test data for Band 2_Bandwidth 20 MHz

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	EIRP (dBm)	Limits (dBm)	Margin (dB)
Test Data for QPSK							
1 860.0	14.62	H	1.00	10.10	23.72	33.00	9.28
1 860.0	14.70	V	1.00	10.10	23.80	33.00	9.20
1 880.0	14.45	H	1.00	10.10	23.55	33.00	9.45
1 880.0	14.72	V	1.00	10.10	23.82	33.00	9.18
1 900.0	13.74	H	1.00	10.10	22.84	33.00	10.16
1 900.0	14.53	V	1.00	10.10	23.63	33.00	9.37
Test Data for 16QAM							
1 860.0	13.58	H	1.00	10.10	22.68	33.00	10.32
1 860.0	13.47	V	1.00	10.10	22.57	33.00	10.43
1 880.0	13.97	H	1.00	10.10	23.07	33.00	9.93
1 880.0	14.10	V	1.00	10.10	23.20	33.00	9.80
1 900.0	13.41	H	1.00	10.10	22.51	33.00	10.49
1 900.0	13.66	V	1.00	10.10	22.76	33.00	10.24

Remark: "H": Horizontal, "V": Vertical

8.12 Test data for CDMA_1xRTT

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	EIRP (dBm)	Limits (dBm)	Margin (dB)
1851.25	15.11	H	1.00	10.10	24.21	33.00	8.79
1851.25	15.76	V	1.00	10.10	24.86	33.00	8.14
1880.00	14.97	H	1.00	10.10	24.07	33.00	8.93
1880.00	15.43	V	1.00	10.10	24.53	33.00	8.47
1908.75	14.89	H	1.00	10.10	23.99	33.00	9.01
1908.75	15.37	V	1.00	10.10	24.47	33.00	8.53

Remark: "H": Horizontal, "V": Vertical

8.13 Test data for CDMA_EV-DO

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	EIRP (dBm)	Limits (dBm)	Margin (dB)
1851.25	14.77	H	1.00	10.10	23.87	33.00	9.13
1851.25	15.48	V	1.00	10.10	24.58	33.00	8.42
1880.00	14.83	H	1.00	10.10	23.93	33.00	9.07
1880.00	15.12	V	1.00	10.10	24.22	33.00	8.78
1908.75	14.65	H	1.00	10.10	23.75	33.00	9.25
1908.75	15.29	V	1.00	10.10	24.39	33.00	8.61

Remark: "H": Horizontal, "V": Vertical

9. RADIATED SPURIOUS EMISSIONS

9.1 Operating environment

Temperature : 23 °C
Relative humidity : 47 % R.H.

9.2 Test set-up

Radiated emission measurements are performed in the Semi-Anechoic chamber. The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI C63.26 (2015) Section 5.5.3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the level of the maximized emission. The level and position of the maximized emission is recorded with the spectrum analyzer using RMS detector.

A vertically polarized half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The power is calculated by the following formula;

$$P_d(\text{dBm}) = P_g(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.

The maximum EIRP is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration

Limits

Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.”

$$\begin{aligned} &= P(W) - [43 + 10\log(P)](\text{dB}) \\ &= [30+10\text{Log}(P)] (\text{dBm}) - [43 + 10\log(P)](\text{dB}) \\ &= -13 \text{ dBm} \end{aligned}$$

Limit	-13 dBm
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Radiated spurious emissions

1. Frequency Range : 9 kHz ~ 10th Harmonics of highest channel fundamental frequency.
2. The EUT was setup to maximum output power. The 100 kHz RBW was used to scan from 30 MHz to 1 GHz. Also, the 1 MHz RBW was used to scan from 1 GHz to 20 GHz. The high, low and a middle channel were tested for out of band measurements.

9.3 Test Date

April 20, 2021 ~ April 30, 2021

9.4 Test data for Band 2_Bandwidth 1.4 MHz

-. Detector : RMS

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
3 701.40	-74.30	V	1.40	12.30	-63.40	-13.00	50.40
5 552.10	-71.82	V	1.70	13.20	-60.32	-13.00	47.32
7 402.80	-67.44	V	1.90	11.00	-58.34	-13.00	45.34
9 253.50	-63.36	H	2.10	10.70	-54.76	-13.00	41.76
11 104.20	-63.85	H	2.30	11.10	-55.05	-13.00	42.05
Test Data for Middle Channel							
3 760.00	-75.75	V	1.40	12.30	-64.85	-13.00	51.85
5 640.00	-72.13	V	1.70	13.50	-60.33	-13.00	47.33
7 520.00	-67.71	V	1.90	11.10	-58.51	-13.00	45.51
9 400.00	-63.66	H	2.10	10.80	-54.96	-13.00	41.96
11 280.00	-64.40	H	2.30	11.40	-55.30	-13.00	42.30
Test Data for High Channel							
3 818.60	-75.52	V	1.40	12.30	-64.62	-13.00	51.62
5 727.90	-72.06	V	1.70	13.50	-60.26	-13.00	47.26
7 637.20	-68.21	H	1.90	11.50	-58.61	-13.00	45.61
9 546.50	-64.06	H	2.10	11.20	-54.96	-13.00	41.96
11 455.80	-64.47	H	2.30	11.30	-55.47	-13.00	42.47

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst case was found in QPSK modulation

3. Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit : $33.00 - [43 + 10 \log_{10}(2.00)] = -13$ dBm

“H”: Horizontal, “V”: Vertical

9.5 Test data for Band 2_Bandwidth 3 MHz

-. Detector : RMS

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
3 703.00	-74.43	V	1.40	12.30	-63.53	-13.00	50.53
5 554.50	-71.28	V	1.70	13.20	-59.78	-13.00	46.78
7 406.00	-66.85	V	1.90	11.00	-57.75	-13.00	44.75
9 257.50	-62.78	H	2.10	10.70	-54.18	-13.00	41.18
11 109.00	-64.73	H	2.30	11.10	-55.93	-13.00	42.93
Test Data for Middle Channel							
3 760.00	-75.63	V	1.40	12.30	-64.73	-13.00	51.73
5 640.00	-71.48	V	1.70	13.50	-59.68	-13.00	46.68
7 520.00	-67.07	V	1.90	11.10	-57.87	-13.00	44.87
9 400.00	-63.46	H	2.10	10.80	-54.76	-13.00	41.76
11 280.00	-64.85	H	2.30	11.40	-55.75	-13.00	42.75
Test Data for High Channel							
3 817.00	-75.10	V	1.40	12.30	-64.20	-13.00	51.20
5 725.50	-70.47	H	1.70	13.50	-58.67	-13.00	45.67
7 634.00	-67.97	H	1.90	11.50	-58.37	-13.00	45.37
9 542.50	-64.00	H	2.10	11.20	-54.90	-13.00	41.90
11 451.00	-63.86	V	2.30	11.30	-54.86	-13.00	41.86

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst case was found in QPSK modulation

3. Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit : $33.00 - [43 + 10 \log_{10}(2.00)] = -13$ dBm

“H”: Horizontal, “V”: Vertical

9.6 Test data for Band 2_Bandwidth 5 MHz

-. Detector : RMS

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
3 705.00	-68.34	H	1.40	12.30	-57.44	-13.00	44.44
5 557.50	-64.82	H	1.70	13.20	-53.32	-13.00	40.32
7 410.00	-64.71	H	1.90	11.00	-55.61	-13.00	42.61
9 262.50	-61.60	H	2.10	10.70	-53.00	-13.00	40.00
11 115.00	-62.56	H	2.30	11.10	-53.76	-13.00	40.76
Test Data for Middle Channel							
3 760.00	-74.96	V	1.40	12.30	-64.06	-13.00	51.06
5 640.00	-74.69	V	1.70	13.50	-62.89	-13.00	49.89
7 520.00	-67.10	H	1.90	11.10	-57.90	-13.00	44.90
9 400.00	-63.70	H	2.10	10.80	-55.00	-13.00	42.00
11 280.00	-64.46	H	2.30	11.40	-55.36	-13.00	42.36
Test Data for High Channel							
3 815.00	-75.10	V	1.40	12.30	-64.20	-13.00	51.20
5 722.50	-70.47	H	1.70	13.50	-58.67	-13.00	45.67
7 630.00	-67.97	H	1.90	11.50	-58.37	-13.00	45.37
9 537.50	-64.00	H	2.10	11.20	-54.90	-13.00	41.90
11 445.00	-63.86	V	2.30	11.30	-54.86	-13.00	41.86

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst case was found in QPSK modulation

3. Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit : $33.00 - [43 + 10 \log_{10}(2.00)] = -13$ dBm

“H”: Horizontal, “V”: Vertical

9.7 Test data for Band 2_Bandwidth 10 MHz

-. Detector : RMS

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
3 710.00	-75.17	V	1.40	12.30	-64.27	-13.00	51.27
5 565.00	-70.32	V	1.70	13.20	-58.82	-13.00	45.82
7 420.00	-67.14	H	1.90	11.00	-58.04	-13.00	45.04
9 275.00	-62.90	H	2.10	10.70	-54.30	-13.00	41.30
11 130.00	-63.37	H	2.30	11.10	-54.57	-13.00	41.57
Test Data for Middle Channel							
3 760.00	-74.55	V	1.40	12.30	-63.65	-13.00	50.65
5 640.00	-69.49	V	1.70	13.50	-57.69	-13.00	44.69
7 520.00	-67.12	H	1.90	11.10	-57.92	-13.00	44.92
9 400.00	-63.16	H	2.10	10.80	-54.46	-13.00	41.46
11 280.00	-64.70	H	2.30	11.40	-55.60	-13.00	42.60
Test Data for High Channel							
3 810.00	-75.68	V	1.40	12.30	-64.78	-13.00	51.78
5 715.00	-67.84	V	1.70	13.50	-56.04	-13.00	43.04
7 620.00	-67.72	H	1.90	11.50	-58.12	-13.00	45.12
9 525.00	-63.39	H	2.10	11.20	-54.29	-13.00	41.29
11 430.00	-63.97	V	2.30	11.30	-54.97	-13.00	41.97

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst case was found in QPSK modulation

3. Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit : $33.00 - [43 + 10 \log_{10}(2.00)] = -13$ dBm

“H”: Horizontal, “V”: Vertical

9.8 Test data for Band 2_Bandwidth 15 MHz

-. Detector : RMS

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
3 715.00	-76.11	H	1.40	12.30	-65.21	-13.00	52.21
5 572.50	-73.45	V	1.70	13.20	-61.95	-13.00	48.95
7 430.00	-67.08	H	1.90	11.00	-57.98	-13.00	44.98
9 287.50	-62.70	H	2.10	10.70	-54.10	-13.00	41.10
11 145.00	-63.73	H	2.30	11.10	-54.93	-13.00	41.93
Test Data for Middle Channel							
3 760.00	-74.59	V	1.40	12.30	-63.69	-13.00	50.69
5 640.00	-69.69	V	1.70	13.50	-57.89	-13.00	44.89
7 520.00	-67.00	H	1.90	11.10	-57.80	-13.00	44.80
9 400.00	-63.88	H	2.10	10.80	-55.18	-13.00	42.18
11 280.00	-64.64	H	2.30	11.40	-55.54	-13.00	42.54
Test Data for High Channel							
3 805.00	-75.99	V	1.40	12.30	-65.09	-13.00	52.09
5 707.50	-67.55	V	1.70	13.50	-55.75	-13.00	42.75
7 610.00	-68.39	H	1.90	11.50	-58.79	-13.00	45.79
9 512.50	-63.40	H	2.10	11.20	-54.30	-13.00	41.30
11 415.00	-64.26	V	2.30	11.30	-55.26	-13.00	42.26

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst case was found in QPSK modulation

3. Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit : $33.00 - [43 + 10 \log_{10}(2.00)] = -13$ dBm

“H”: Horizontal, “V”: Vertical

9.9 Test data for Band 2_Bandwidth 20 MHz

-. Detector : RMS

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
3 720.00	-76.96	V	1.40	12.30	-66.06	-13.00	53.06
5 580.00	-71.22	V	1.70	13.20	-59.72	-13.00	46.72
7 440.00	-67.12	V	1.90	11.00	-58.02	-13.00	45.02
9 300.00	-62.78	H	2.10	10.70	-54.18	-13.00	41.18
11 160.00	-63.53	H	2.30	11.10	-54.73	-13.00	41.73
Test Data for Middle Channel							
3 760.00	-75.74	V	1.40	12.30	-64.84	-13.00	51.84
5 640.00	-70.32	V	1.70	13.50	-58.52	-13.00	45.52
7 520.00	-67.00	H	1.90	11.10	-57.80	-13.00	44.80
9 400.00	-63.94	H	2.10	10.80	-55.24	-13.00	42.24
11 280.00	-64.35	H	2.30	11.40	-55.25	-13.00	42.25
Test Data for High Channel							
3 800.00	-76.47	V	1.40	12.30	-65.57	-13.00	52.57
5 700.00	-69.32	V	1.70	13.50	-57.52	-13.00	44.52
7 600.00	-67.17	H	1.90	11.50	-57.57	-13.00	44.57
9 500.00	-63.66	H	2.10	11.20	-54.56	-13.00	41.56
11 400.00	-64.64	H	2.30	11.30	-55.64	-13.00	42.64

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst case was found in QPSK modulation

3. Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10} (P)$ dB.”

Limit : $33.00 - [43 + 10 \log_{10}(2.00)] = -13$ dBm

“H”: Horizontal, “V”: Vertical

9.10 Test data for CDMA_1xRTT

-. Detector : RMS

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
3 702.50	-74.51	V	1.40	12.30	-63.61	-13.00	50.61
5 553.75	-70.91	V	1.70	13.30	-59.31	-13.00	46.31
7 405.00	-67.08	V	1.90	11.00	-57.98	-13.00	44.98
9 256.25	-63.00	H	2.10	10.70	-54.40	-13.00	41.40
11 107.50	-63.36	H	2.30	11.10	-54.56	-13.00	41.56
Test Data for Middle Channel							
3 760.00	-73.27	H	1.40	12.30	-62.37	-13.00	49.37
5 640.00	-68.55	V	1.70	13.50	-56.75	-13.00	43.75
7 520.00	-67.11	V	1.90	11.10	-57.91	-13.00	44.91
9 400.00	-63.87	H	2.10	10.80	-55.17	-13.00	42.17
11 280.00	-63.13	H	2.30	11.40	-54.03	-13.00	41.03
Test Data for High Channel							
3 817.50	-75.21	V	1.40	12.30	-64.31	-13.00	51.31
5 726.25	-67.83	V	1.70	13.50	-56.03	-13.00	43.03
7 635.00	-68.15	V	1.90	11.50	-58.55	-13.00	45.55
9 543.75	-64.10	H	2.10	11.20	-55.00	-13.00	42.00
11 452.50	-63.90	V	2.30	11.20	-55.00	-13.00	42.00

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

- Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.”

Limit : $33.00 - [43 + 10 \log_{10}(2.00)] = -13$ dBm

“H”: Horizontal, “V”: Vertical

9.11 Test data for CDMA_EV-DO

-. Detector : RMS

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
3 702.50	-74.49	V	1.40	12.30	-63.59	-13.00	50.59
5 553.75	-70.88	V	1.70	13.30	-59.28	-13.00	46.28
7 405.00	-67.04	V	1.90	11.00	-57.94	-13.00	44.94
9 256.25	-62.93	H	2.10	10.70	-54.33	-13.00	41.33
11 107.50	-63.05	H	2.30	11.10	-54.25	-13.00	41.25
Test Data for Middle Channel							
3 760.00	-73.32	H	1.40	12.30	-62.42	-13.00	49.42
5 640.00	-68.46	V	1.70	13.50	-56.66	-13.00	43.66
7 520.00	-67.03	V	1.90	11.10	-57.83	-13.00	44.83
9 400.00	-63.81	H	2.10	10.80	-55.11	-13.00	42.11
11 280.00	-63.04	H	2.30	11.40	-53.94	-13.00	40.94
Test Data for High Channel							
3 817.50	-75.19	V	1.40	12.30	-64.29	-13.00	51.29
5 726.25	-67.80	V	1.70	13.50	-56.00	-13.00	43.00
7 635.00	-68.10	V	1.90	11.50	-58.50	-13.00	45.50
9 543.75	-64.03	H	2.10	11.20	-54.93	-13.00	41.93
11 452.50	-63.86	V	2.30	11.20	-54.96	-13.00	41.96

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

- Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.”

Limit : $33.00 - [43 + 10 \log_{10}(2.00)] = -13$ dBm

“H”: Horizontal, “V”: Vertical

10. PEAK-TO-AVERAGE RATIO

10.1 Operating environment

Temperature : 23 °C
Relative humidity : 47 % R.H.

10.2 Test set-up

Peak to Average Power Ratio is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v04, April 9, 2018, Section 5.7.

- Section 5.7.2 Measurement of peak power in a broadband noise-like signal using CCDF

- a) Set resolution/measurement bandwidth $\geq$ OBW or specified reference bandwidth.
- b) Set the number of counts to a value that stabilizes the measured CCDF curve.
- c) Set the measurement interval as follows:
 - 1) For continuous transmissions, set to the greater of $[10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ or 1 ms.
 - 2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.
 - 3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
- d) Record the maximum PAPR level associated with a probability of 0.1%.
- e) The peak power level is calculated from the sum of the PAPR value from step d) to the measured average power.

- Section 5.7.3 Alternate Procedure for PAPR

Some regulatory requirements specify a PAPR limit when the output power limits are specified in terms of average power. If it becomes necessary to provide measurement data to demonstrate compliance to a PAPR limit, then the appropriate procedure from those provided in 5.2.3 shall be utilized to determine the peak power (or peak PSD) and the appropriate procedure from those provided in 5.2.4 shall be used to determine the average power (or average PSD). The data from these measurements is then used in Equation (2) to determine the PAPR of a narrowband CW-like signal. See 5.2.3.4 for guidance on determining the PAPR of a broadband noise-like signal.

$$\text{PAPR (dB)} = P_{\text{Pk}} (\text{dBm or dBW}) - P_{\text{Avg}} (\text{dBm or dBW})$$

where

PAPR peak-to-average power ratio, in dB

P_{Pk} measured peak power or peak PSD level, in dBm or dBW

P_{Avg} measured average power or average PSD level, in dBm or dBW

10.3 Test Date

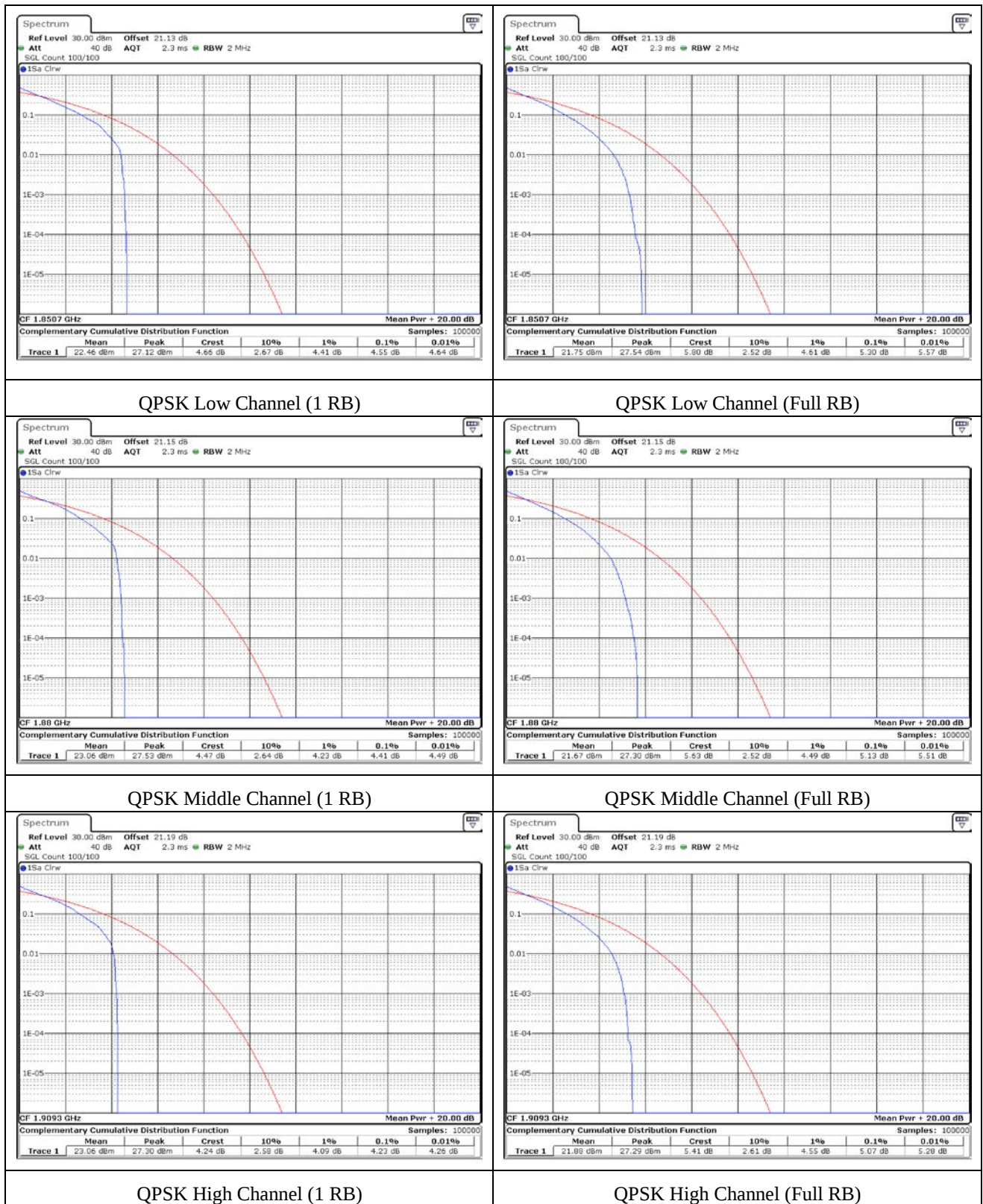
April 20, 2021 ~ April 30, 2021

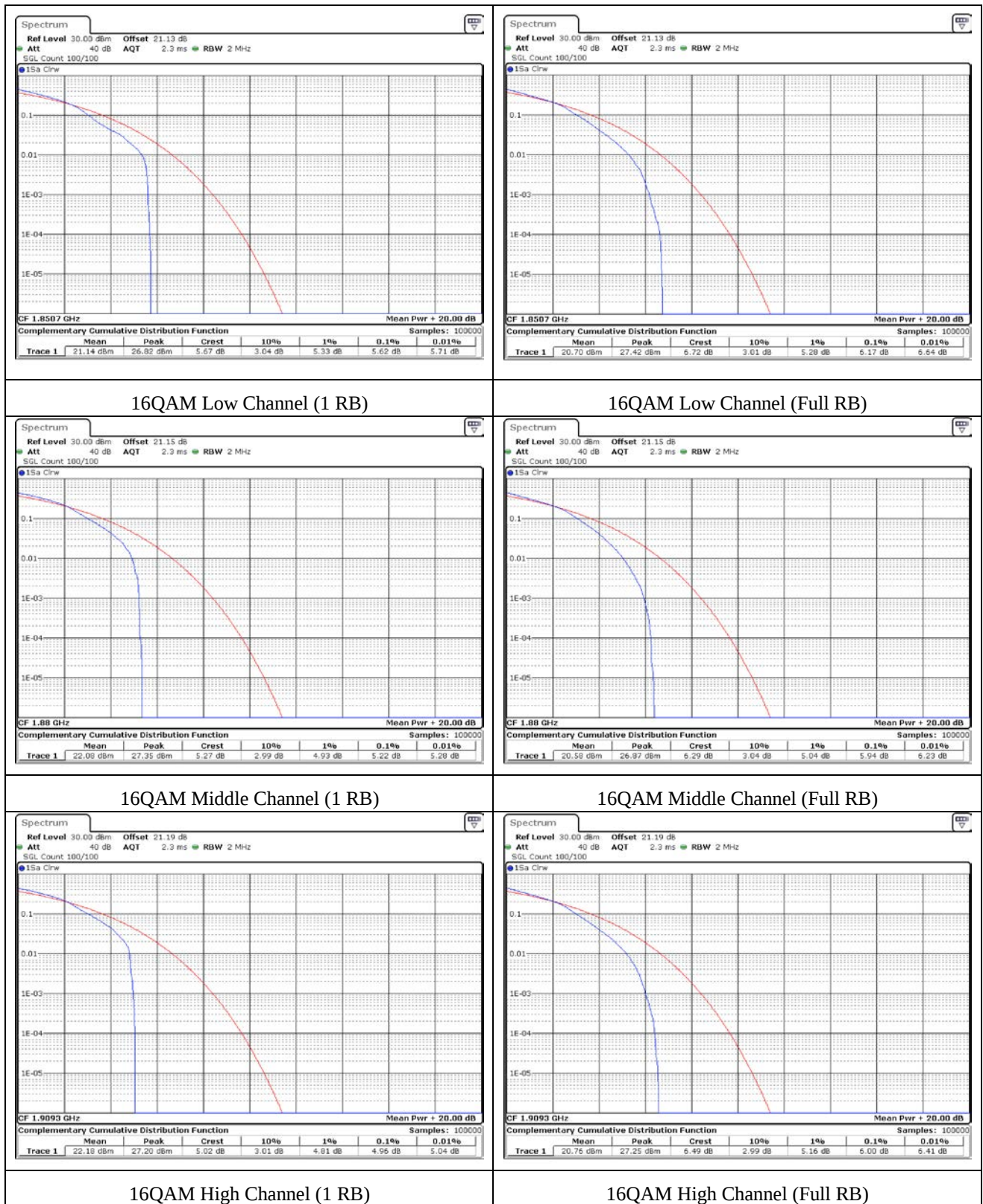
10.4 Test data for Band 2_Bandwidth 1.4 MHz

-. Test Result : Pass

Test Mode	Channel	Peak-Average Ratio(PAR) CCDF 0.1 %	Limit (dB)	Result
LTE Band 2 QPSK				
1 RB	18607	4.55	13.00	Pass
	18900	4.41	13.00	Pass
	19193	4.23	13.00	Pass
Full RB	18607	5.30	13.00	Pass
	18900	5.13	13.00	Pass
	19193	5.07	13.00	Pass
LTE Band 2 16QAM				
1 RB	18607	5.62	13.00	Pass
	18900	5.22	13.00	Pass
	19193	4.96	13.00	Pass
Full RB	18607	6.17	13.00	Pass
	18900	5.94	13.00	Pass
	19193	6.00	13.00	Pass

Remark: Measured the using CCDFof spectrum analyzer.



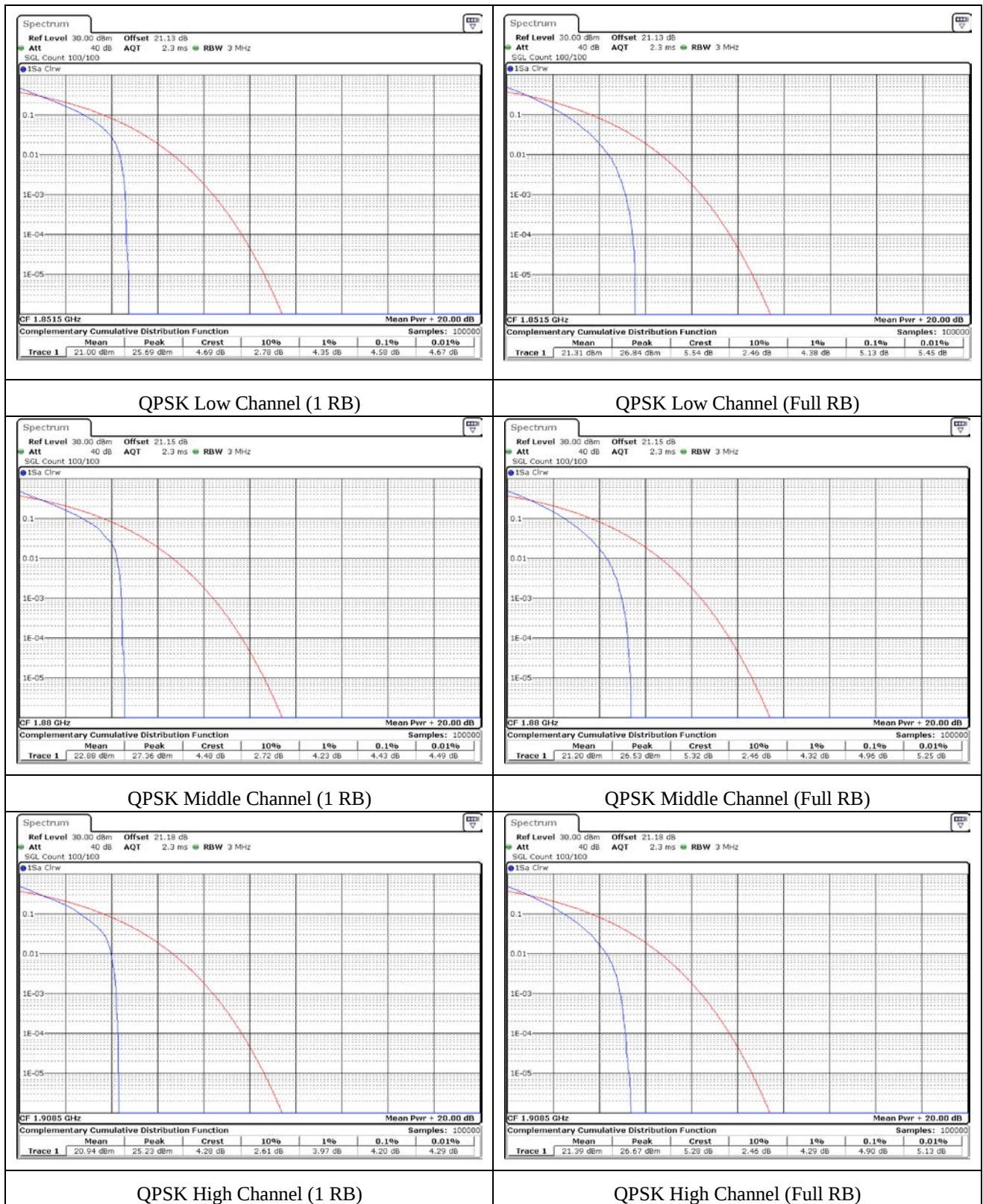


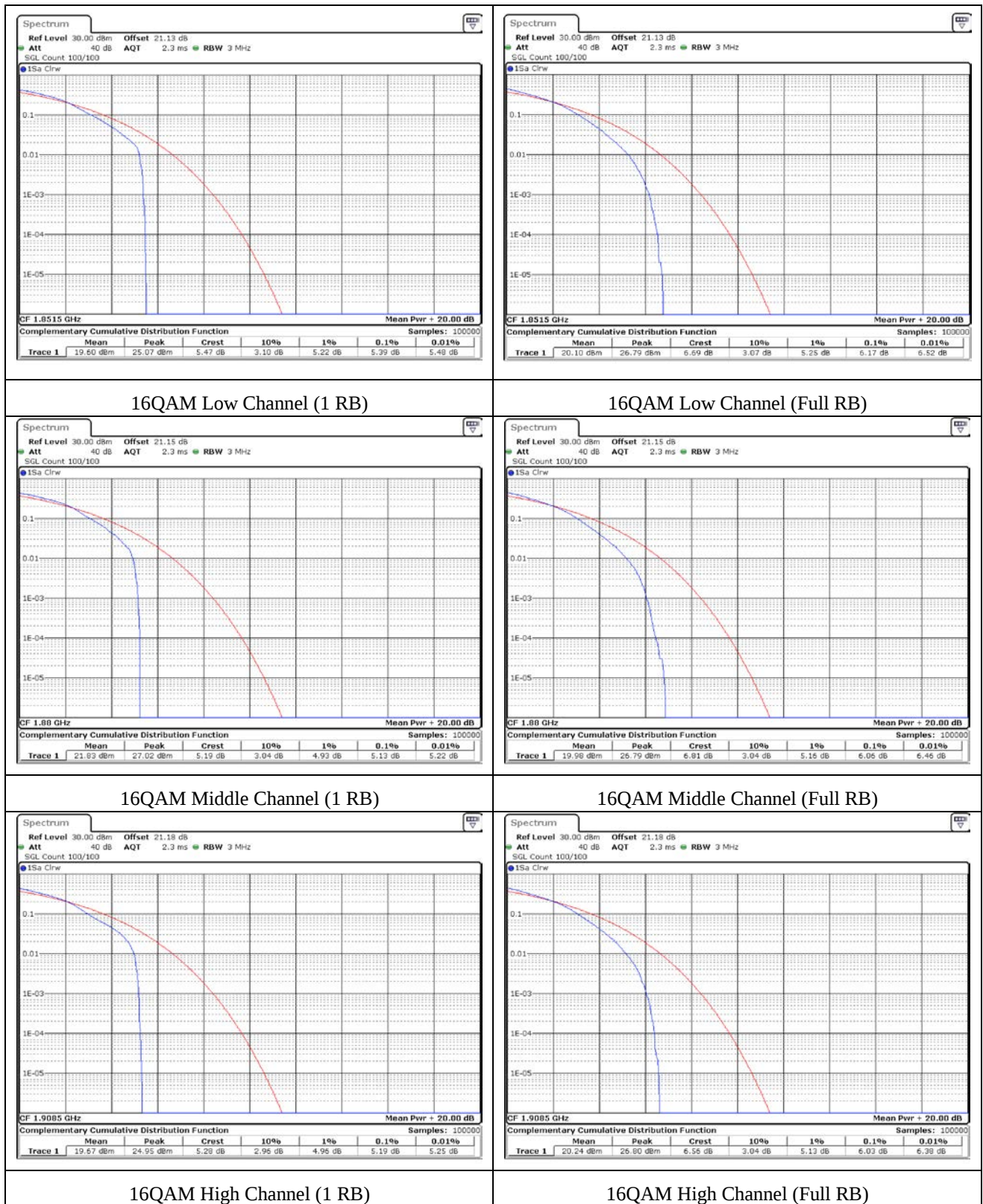
10.5 Test data for Band 2_Bandwidth 3 MHz

-. Test Result : Pass

Test Mode	Channel	Peak-Average Ratio(PAR) CCDF 0.1 %	Limit (dB)	Result
LTE Band 2 QPSK				
1 RB	18615	4.58	13.00	Pass
	18900	4.43	13.00	Pass
	19185	4.20	13.00	Pass
Full RB	18615	5.13	13.00	Pass
	18900	4.96	13.00	Pass
	19185	4.90	13.00	Pass
LTE Band 2 16QAM				
1 RB	18615	5.39	13.00	Pass
	18900	5.13	13.00	Pass
	19185	5.19	13.00	Pass
Full RB	18615	6.17	13.00	Pass
	18900	6.06	13.00	Pass
	19185	6.03	13.00	Pass

Remark: Measured the using CCDFof spectrum analyzer.



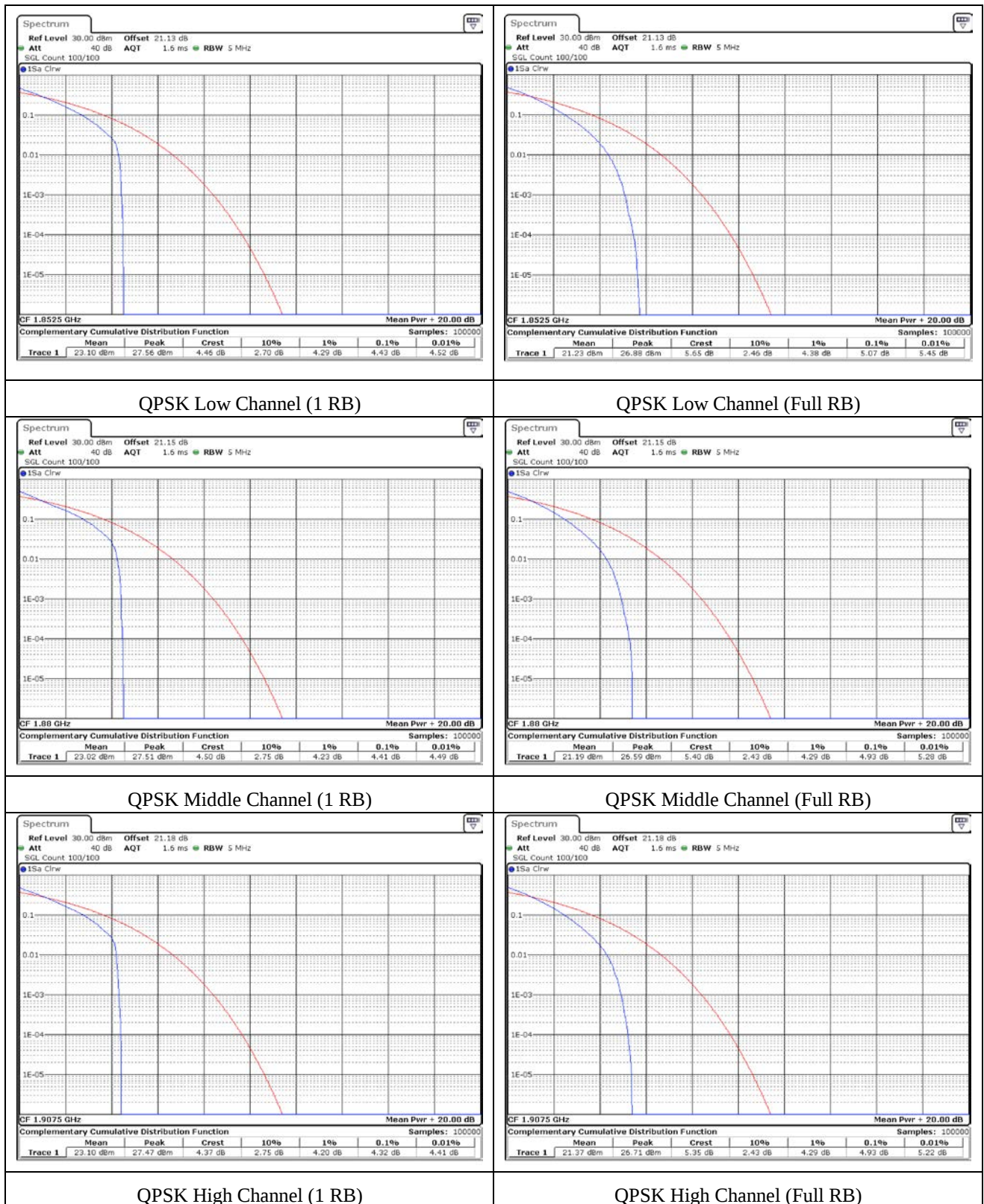


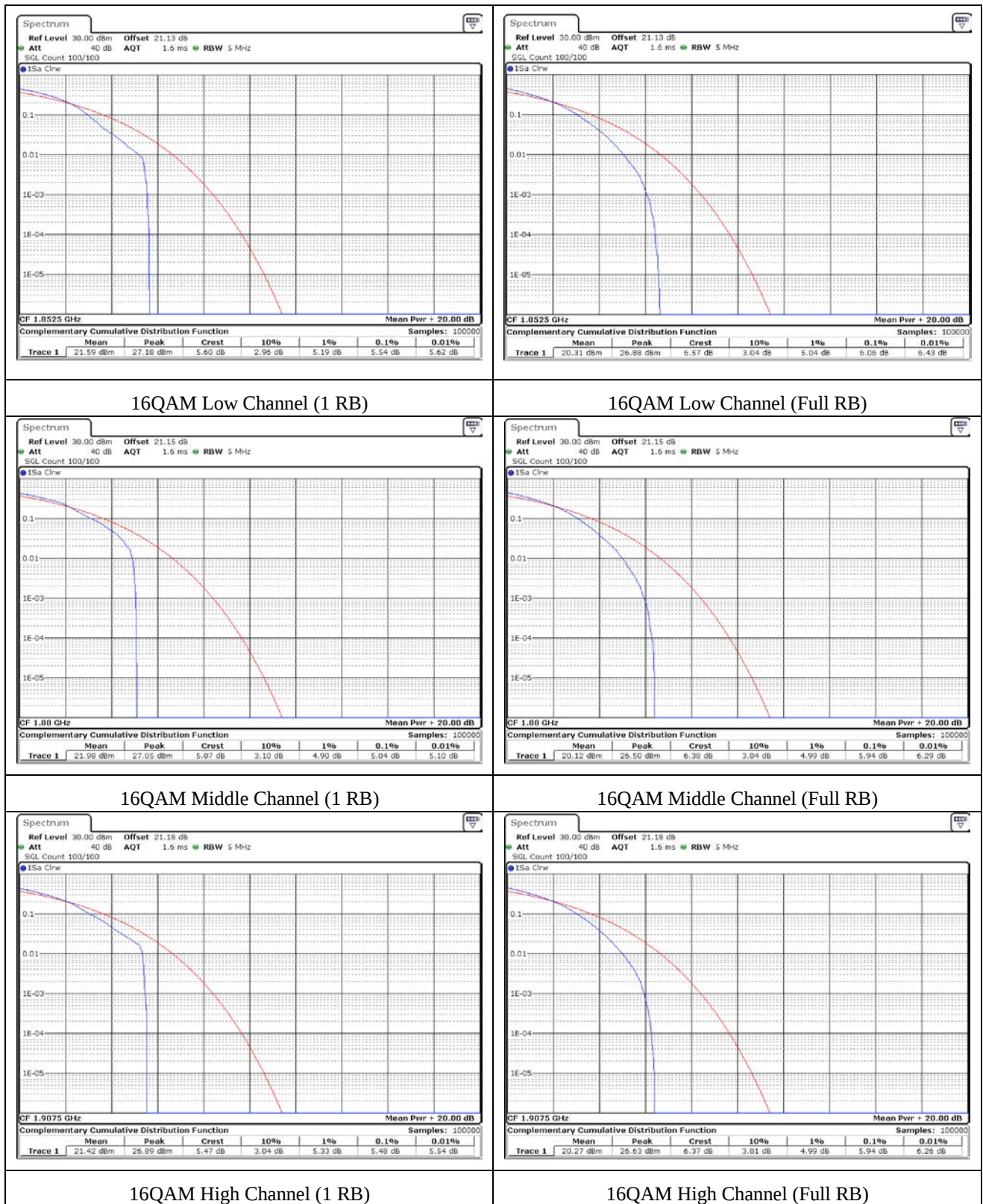
10.6 Test data for Band 2_Bandwidth 5 MHz

-. Test Result : Pass

Test Mode	Channel	Peak-Average Ratio(PAR) CCDF 0.1 %	Limit (dB)	Result
LTE Band 2 QPSK				
1 RB	18625	4.43	13.00	Pass
	18900	4.41	13.00	Pass
	19175	4.32	13.00	Pass
Full RB	18625	5.07	13.00	Pass
	18900	4.93	13.00	Pass
	19175	4.93	13.00	Pass
LTE Band 2 16QAM				
1 RB	18625	5.54	13.00	Pass
	18900	5.04	13.00	Pass
	19175	5.48	13.00	Pass
Full RB	18625	6.06	13.00	Pass
	18900	5.94	13.00	Pass
	19175	5.94	13.00	Pass

Remark: Measured the using CCDFof spectrum analyzer.



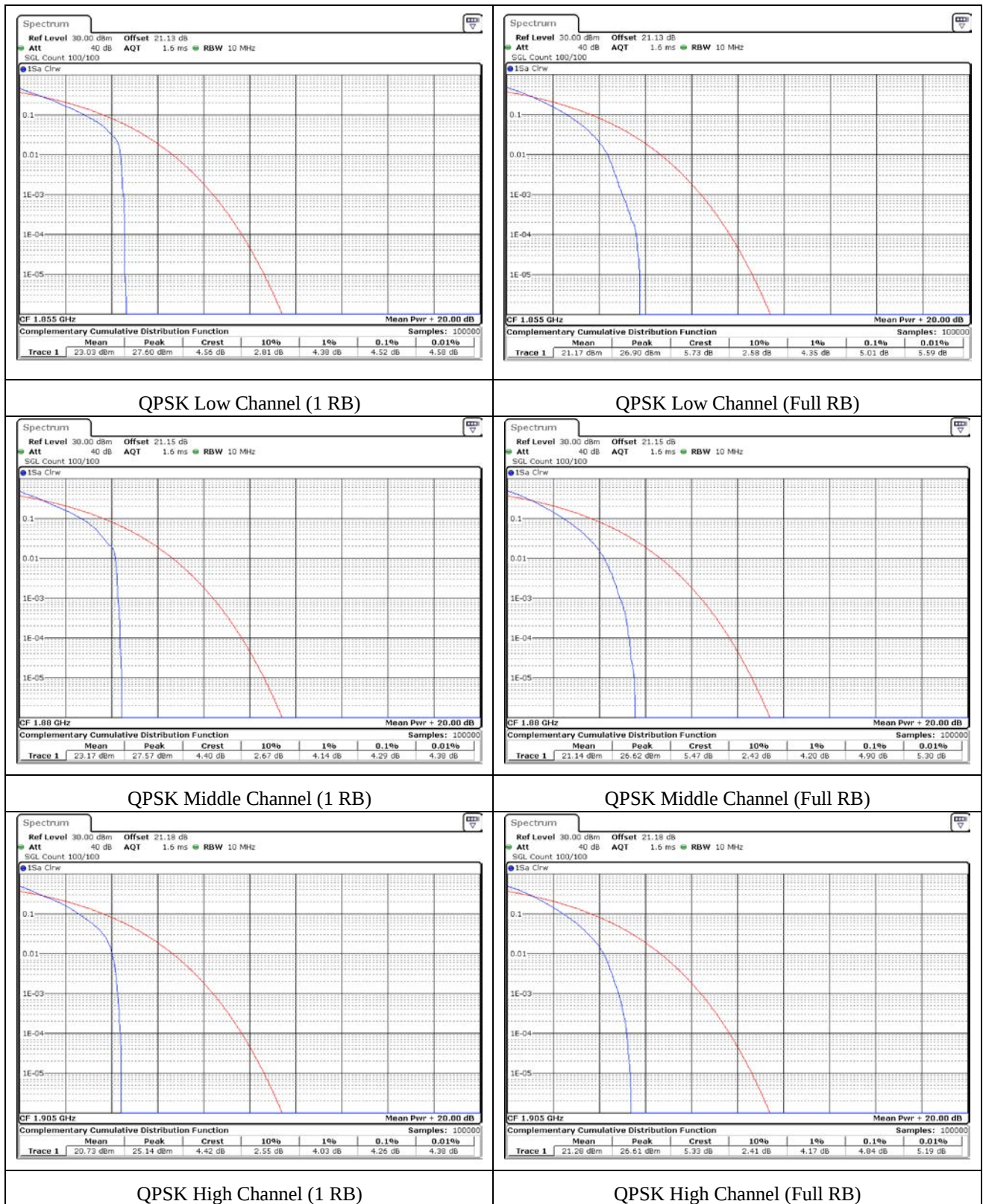


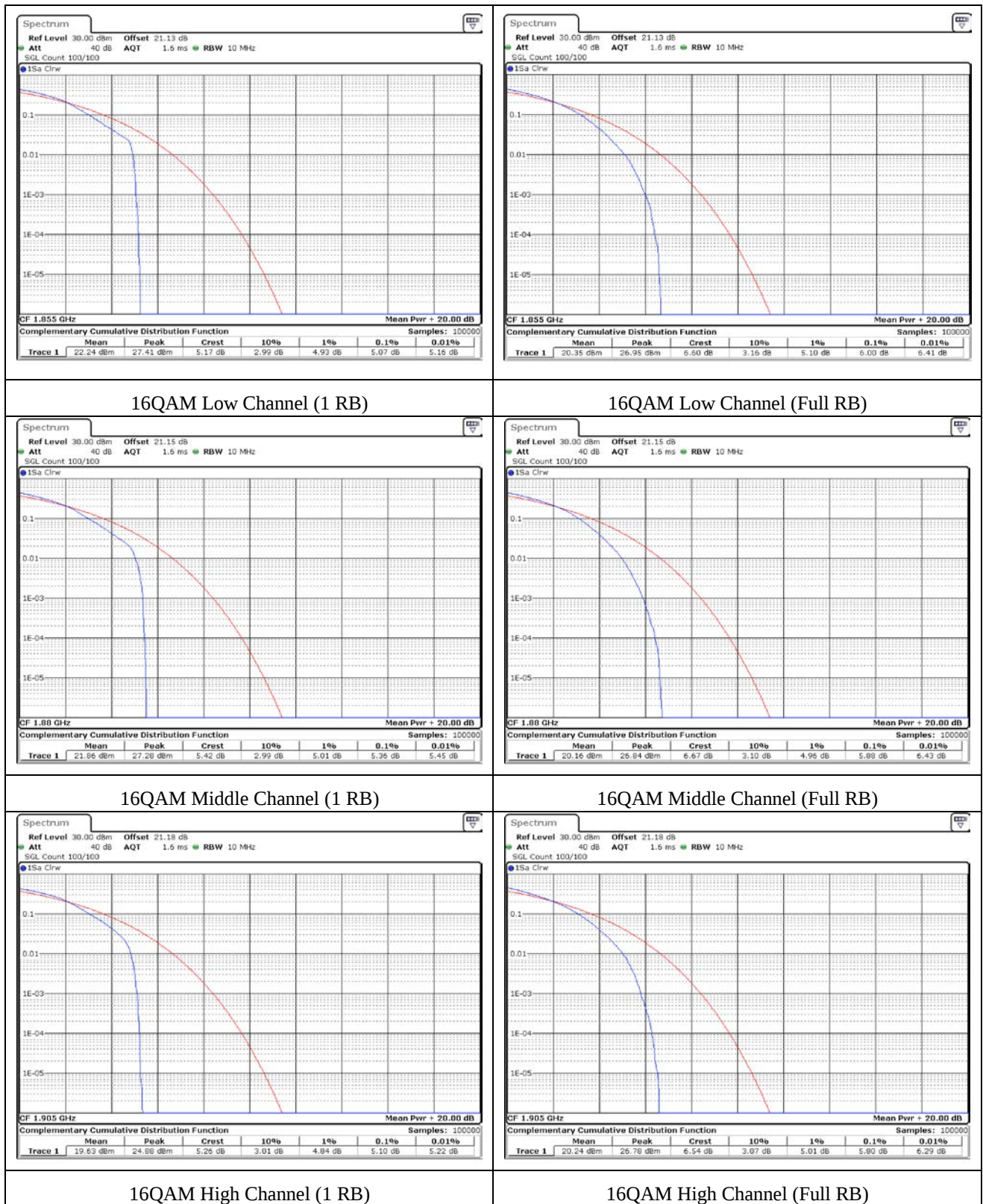
10.7 Test data for Band 2_Bandwidth 10 MHz

-. Test Result : Pass

Test Mode	Channel	Peak-Average Ratio(PAR) CCDF 0.1 %	Limit (dB)	Result
LTE Band 2 QPSK				
1 RB	18650	4.52	13.00	Pass
	18900	4.29	13.00	Pass
	19150	4.26	13.00	Pass
Full RB	18650	5.01	13.00	Pass
	18900	4.90	13.00	Pass
	19150	4.84	13.00	Pass
LTE Band 2 16QAM				
1 RB	18650	5.07	13.00	Pass
	18900	5.36	13.00	Pass
	19150	5.10	13.00	Pass
Full RB	18650	6.00	13.00	Pass
	18900	5.88	13.00	Pass
	19150	5.80	13.00	Pass

Remark: Measured the using CCDFof spectrum analyzer.



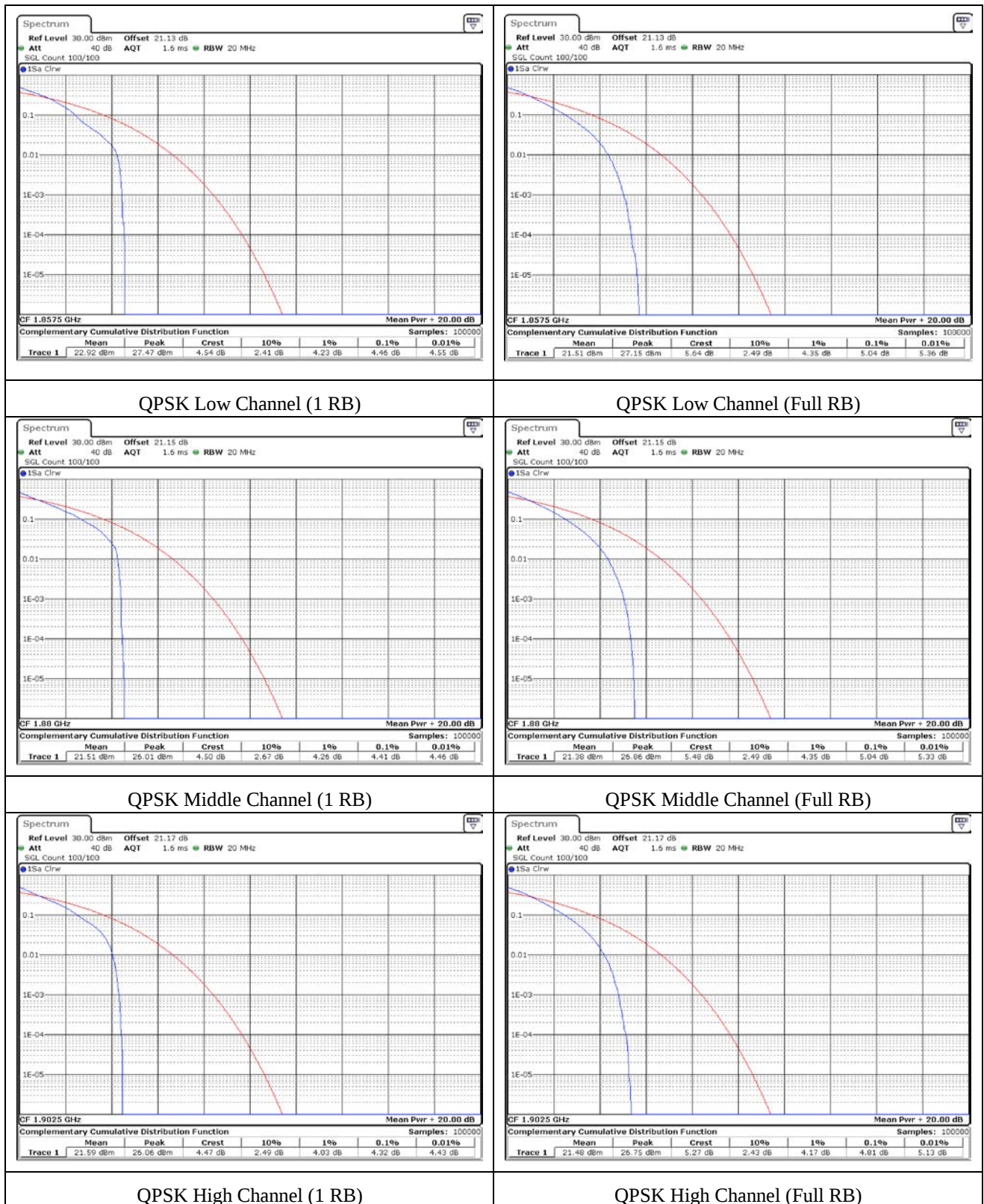


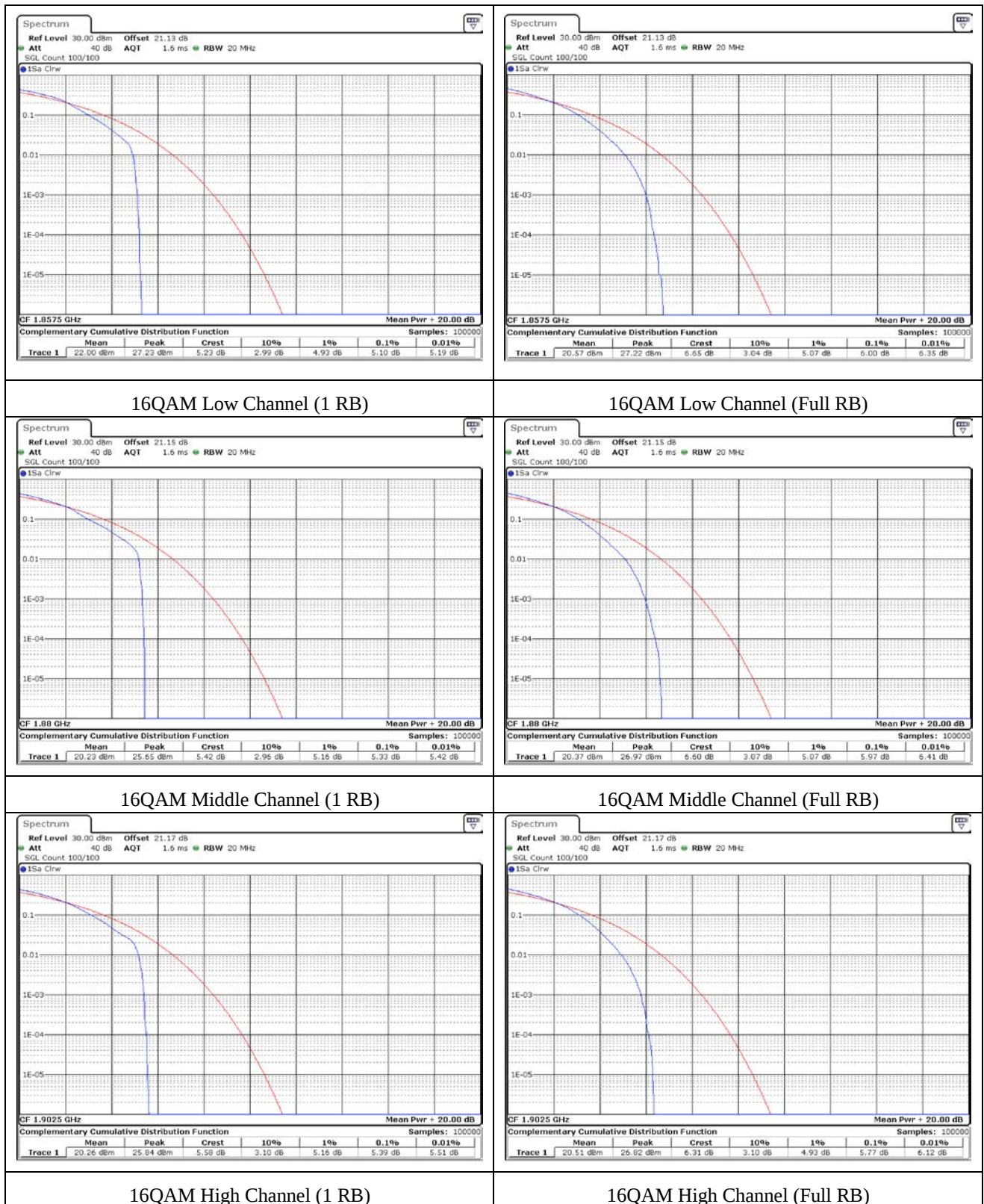
10.8 Test data for Band 2_Bandwidth 15 MHz

-. Test Result : Pass

Test Mode	Channel	Peak-Average Ratio(PAR) CCDF 0.1 %	Limit (dB)	Result
LTE Band 2 QPSK				
1 RB	18675	4.46	13.00	Pass
	18900	4.41	13.00	Pass
	19125	4.32	13.00	Pass
Full RB	18675	5.04	13.00	Pass
	18900	5.04	13.00	Pass
	19125	4.81	13.00	Pass
LTE Band 2 16QAM				
1 RB	18675	5.10	13.00	Pass
	18900	5.33	13.00	Pass
	19125	5.39	13.00	Pass
Full RB	18675	6.00	13.00	Pass
	18900	5.97	13.00	Pass
	19125	5.77	13.00	Pass

Remark: Measured the using CCDFof spectrum analyzer.



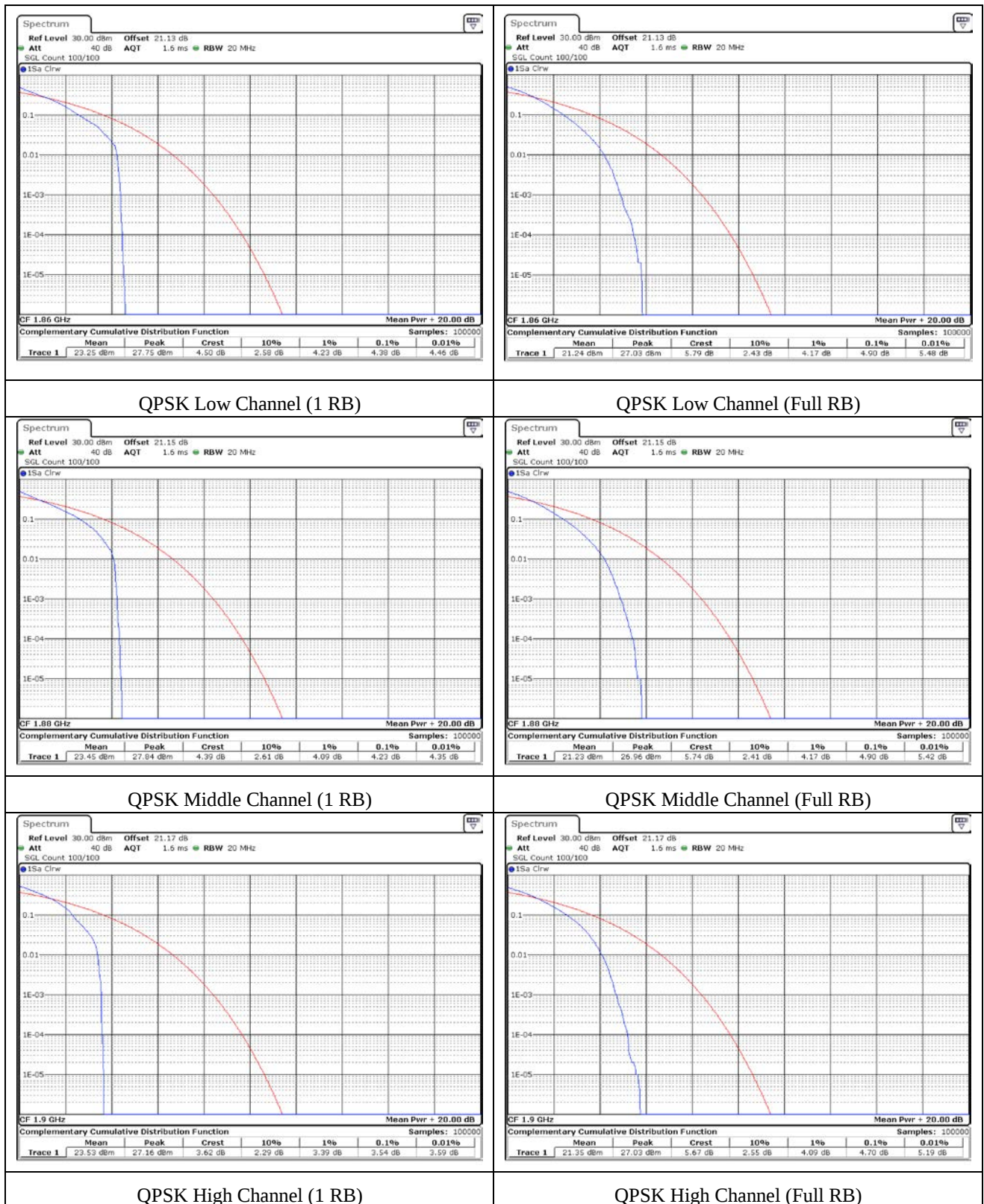


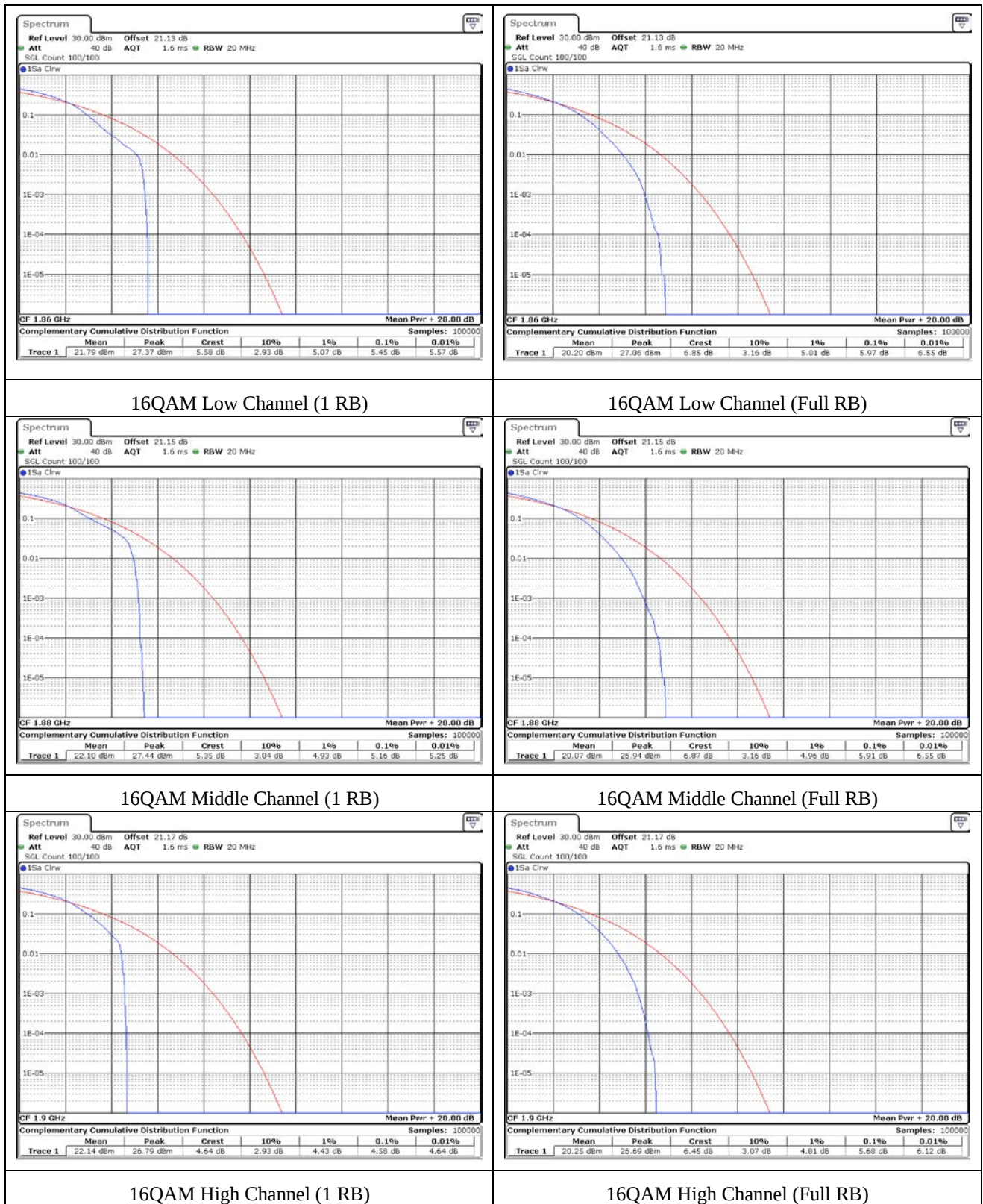
10.9 Test data for Band 2_Bandwidth 20 MHz

-. Test Result : Pass

Test Mode	Channel	Peak-Average Ratio(PAR) CCDF 0.1 %	Limit (dB)	Result
LTE Band 2 QPSK				
1 RB	18700	4.38	13.00	Pass
	18900	4.23	13.00	Pass
	19100	3.54	13.00	Pass
Full RB	18700	4.90	13.00	Pass
	18900	4.90	13.00	Pass
	19100	4.70	13.00	Pass
LTE Band 2 16QAM				
1 RB	18700	5.45	13.00	Pass
	18900	5.16	13.00	Pass
	19100	4.58	13.00	Pass
Full RB	18700	5.97	13.00	Pass
	18900	5.91	13.00	Pass
	19100	5.68	13.00	Pass

Remark: Measured the using CCDFof spectrum analyzer.



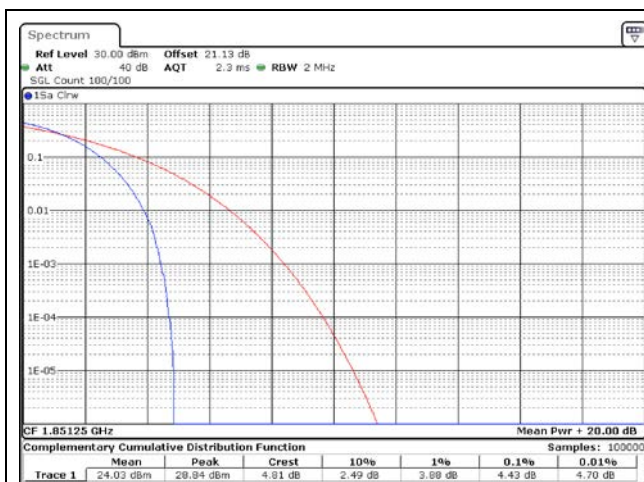


10.10 Test data for CDMA_1xRTT

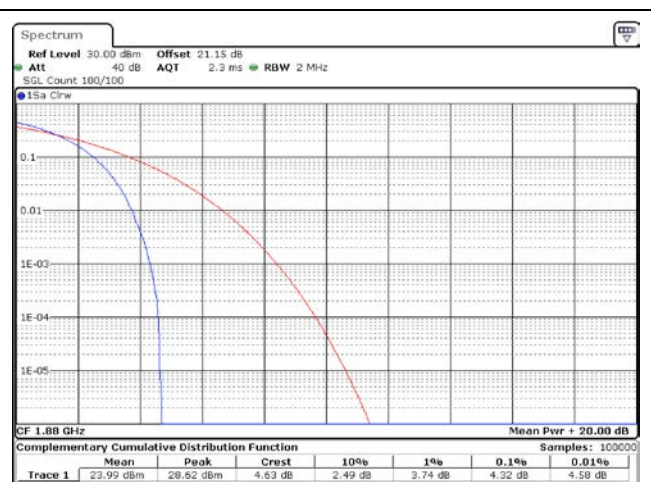
-. Test Result : Pass

Test Mode	Channel	Peak-Average Ratio(PAR) CCDF 0.1 %	Limit (dB)	Result
1xRTT	25	4.43	13.00	Pass
	600	4.32	13.00	Pass
	1175	4.23	13.00	Pass

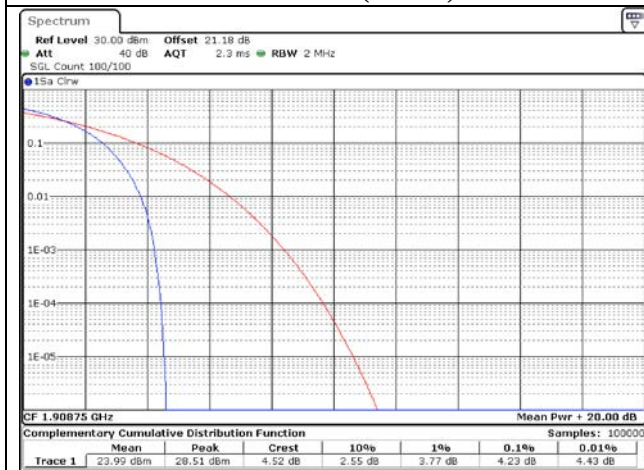
Remark: Measured the using CCDF of spectrum analyzer.



Low Channel (1xRTT)



Middle Channel (1xRTT)



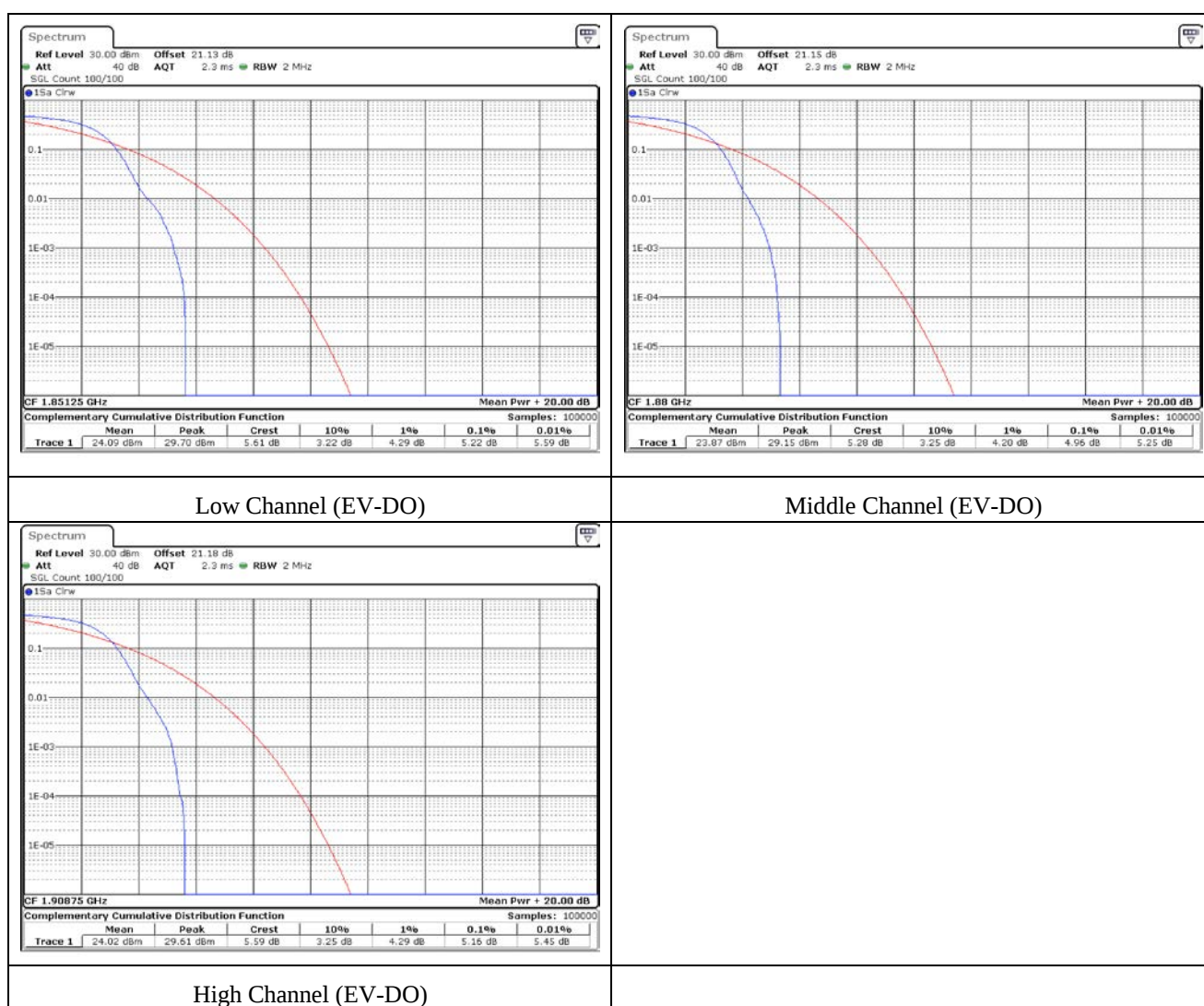
High Channel (1xRTT)

10.11 Test data for CDMA_EV-DO

-. Test Result : Pass

Test Mode	Channel	Peak-Average Ratio(PAR) CCDF 0.1 %	Limit (dB)	Result
EV-DO	25	5.22	13.00	Pass
	600	4.96	13.00	Pass
	1175	5.16	13.00	Pass

Remark: Measured the using CCDF of spectrum analyzer.



11. OCCUPIED BANDWIDTH

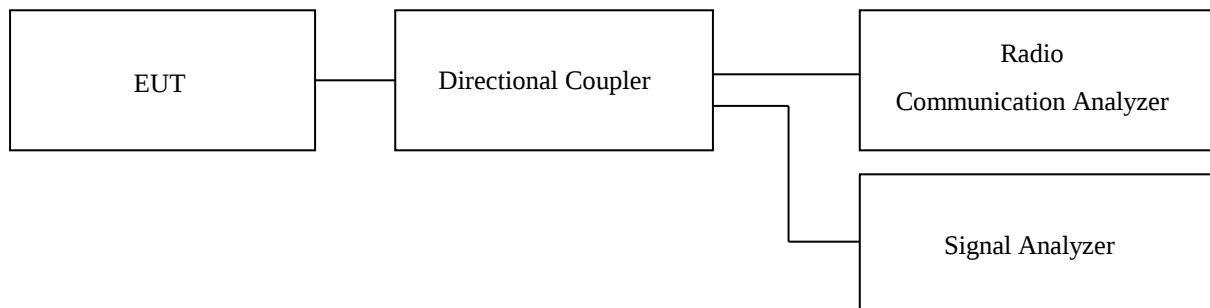
11.1 Operating environment

Temperature : 23 °C
Relative humidity : 47 % R.H.

11.2 Test set-up

The emission bandwidth (×dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated × dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3× the resolution bandwidth. When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3×RBW.



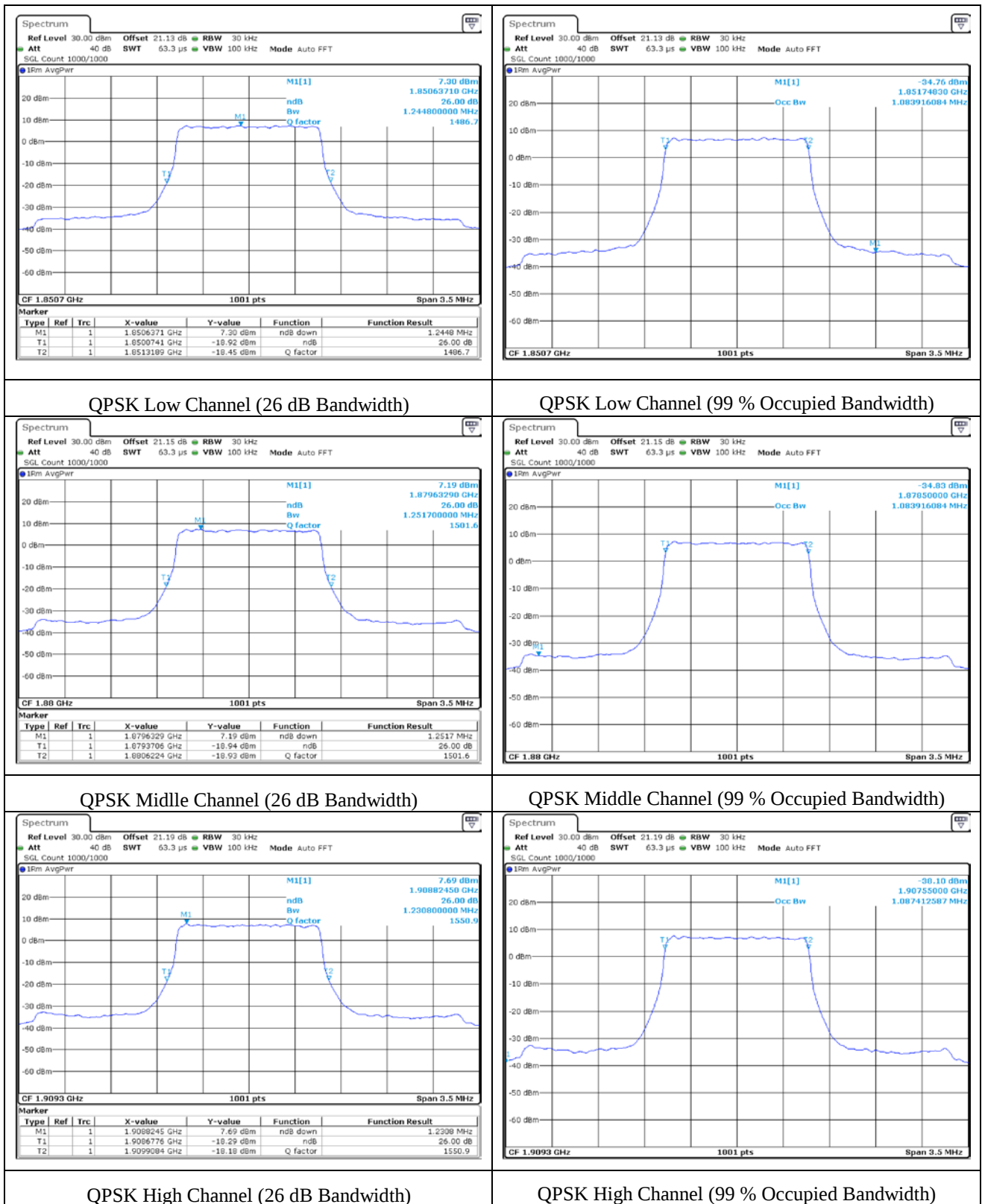
11.3 Test Date

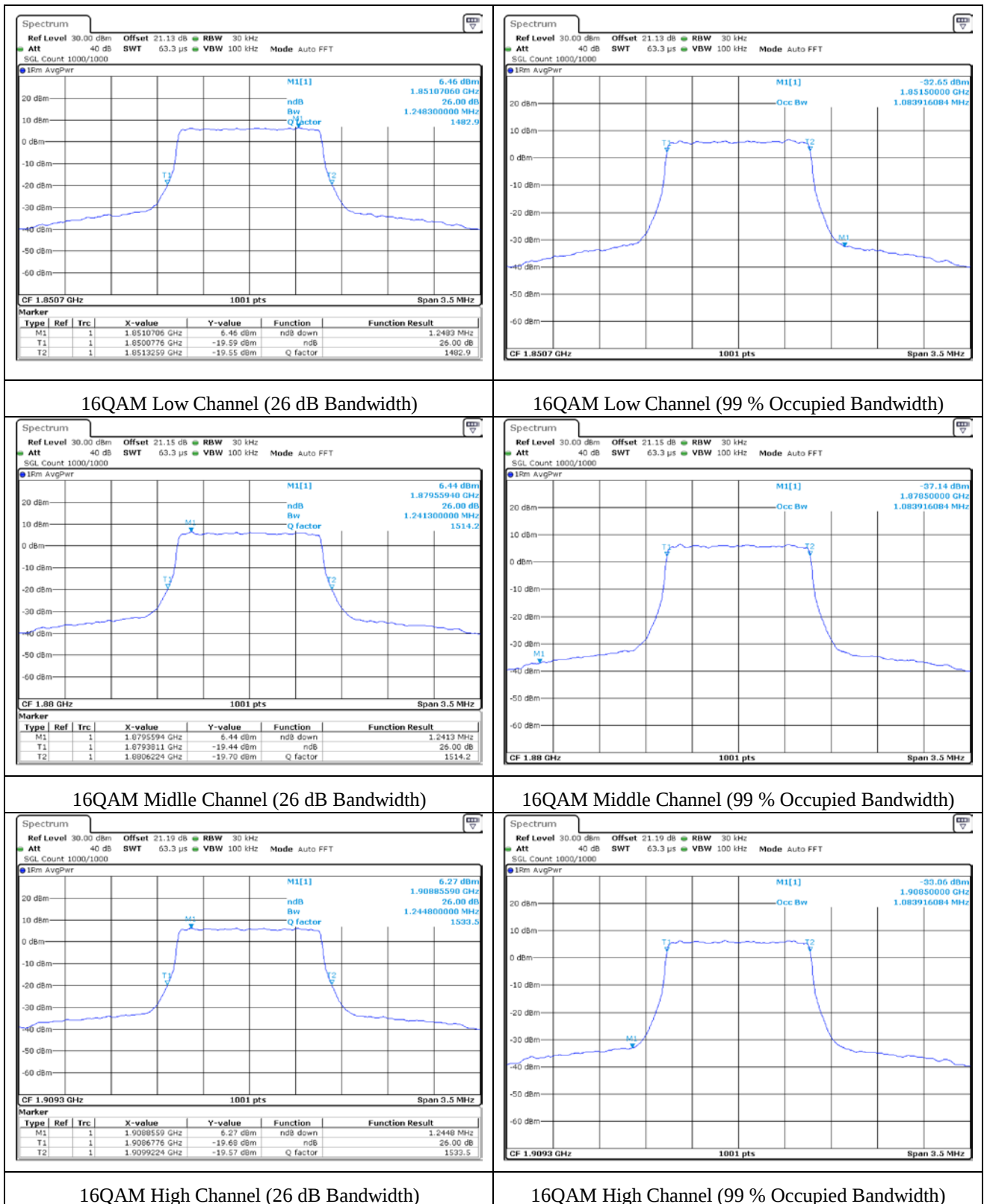
April 20, 2021 ~ April 30, 2021

11.4 Test data for Band 2_Bandwidth 1.4 MHz

-. Test Result : Pass

Test Mode	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
QPSK	18607	1.24	1.08	PASS
	18900	1.25	1.08	PASS
	19193	1.23	1.09	PASS
16QAM	18607	1.25	1.08	PASS
	18900	1.24	1.08	PASS
	19193	1.24	1.08	PASS

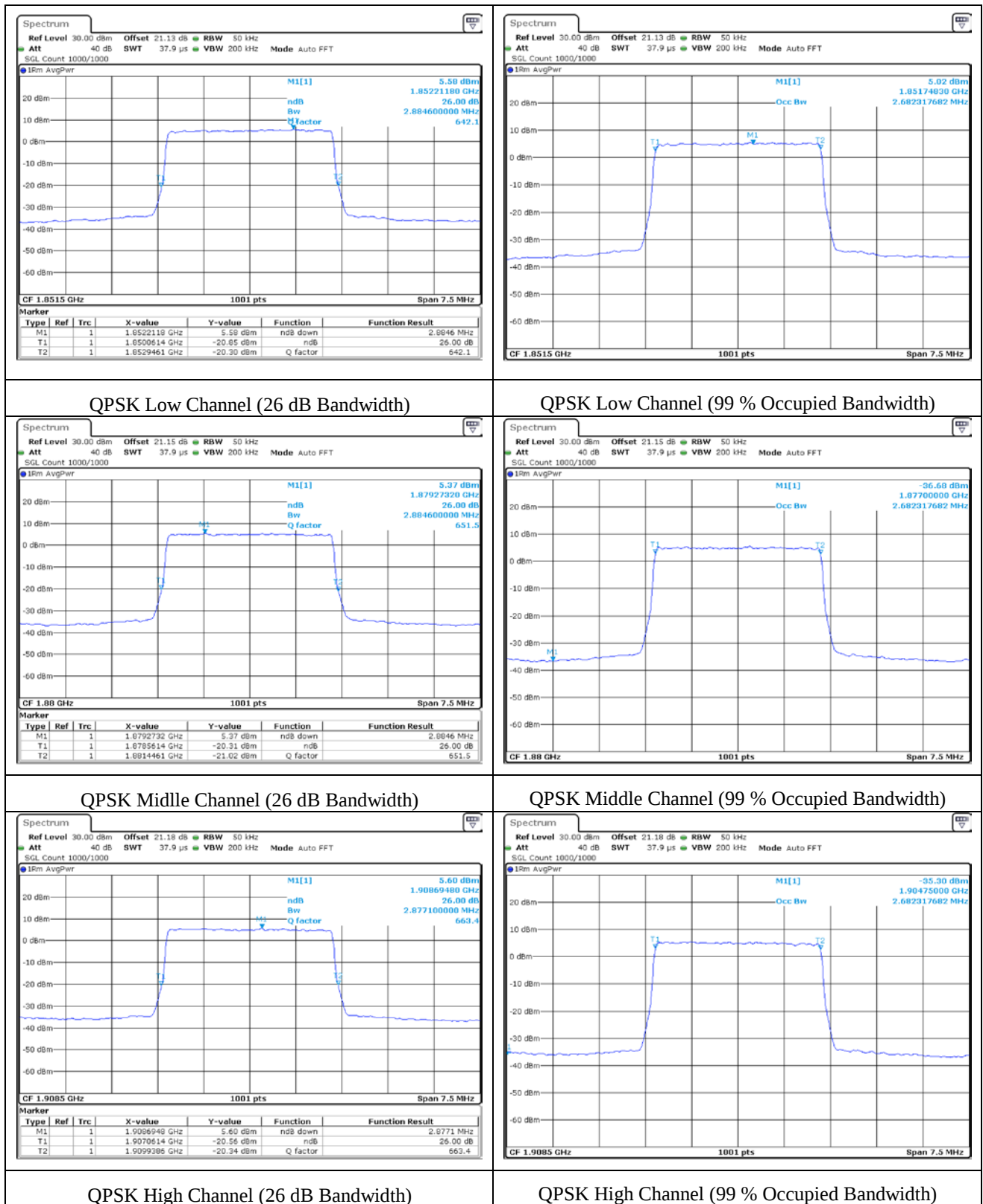


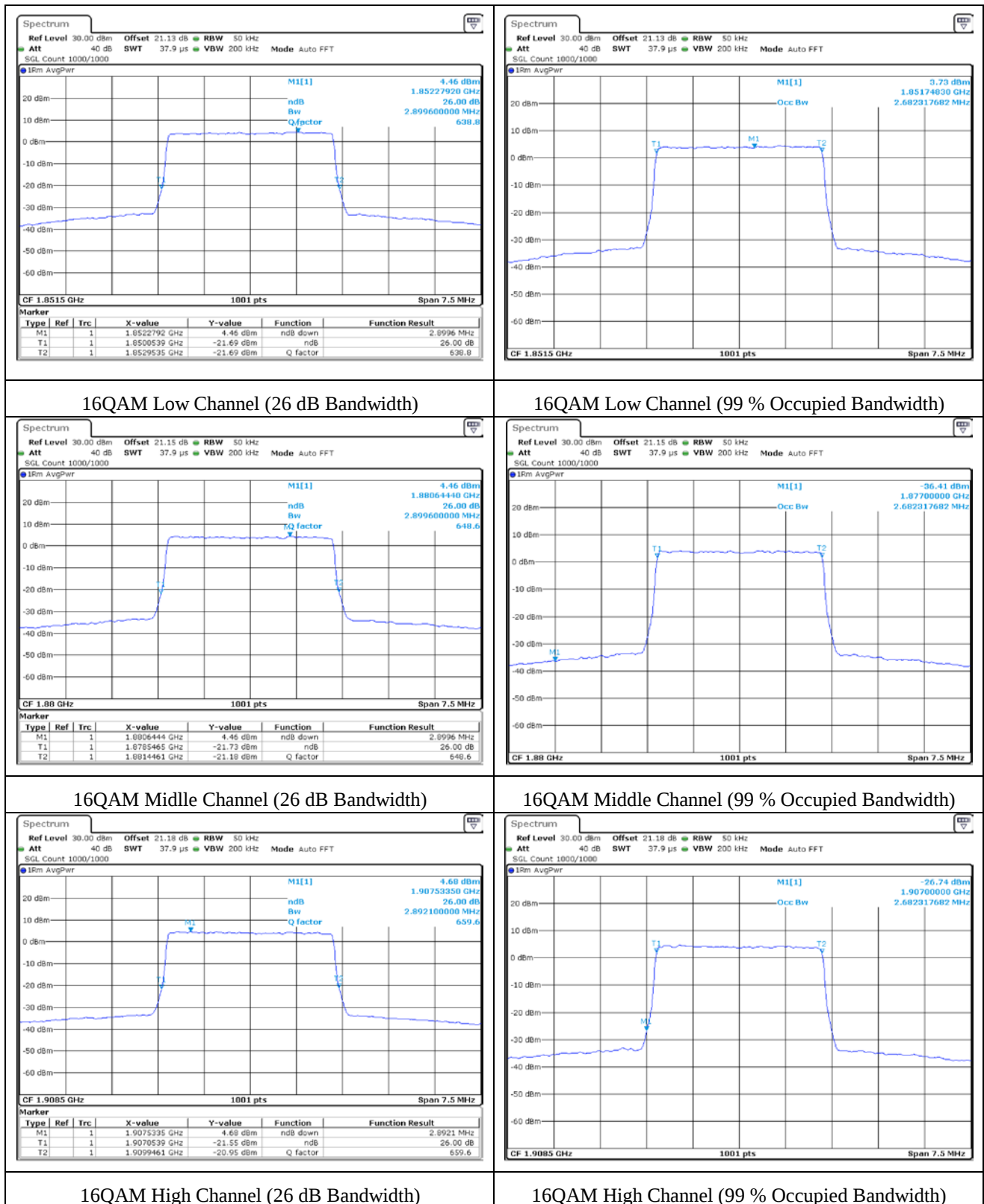


11.5 Test data for Band 2_Bandwidth 3 MHz

-. Test Result : Pass

Test Mode	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
QPSK	18615	2.88	2.68	PASS
	18900	2.88	2.68	PASS
	19185	2.88	2.68	PASS
16QAM	18615	2.90	2.68	PASS
	18900	2.90	2.68	PASS
	19185	2.89	2.68	PASS

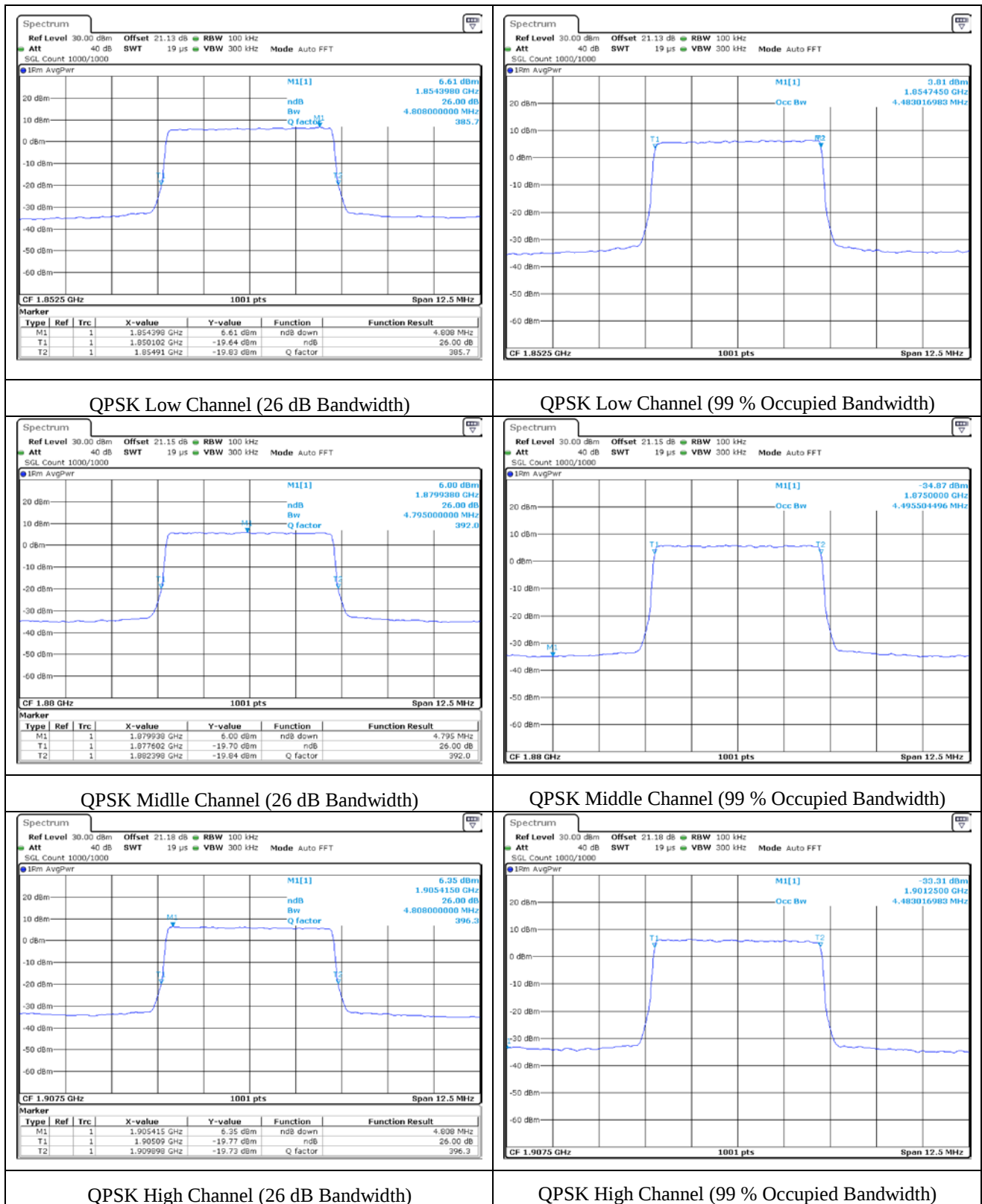


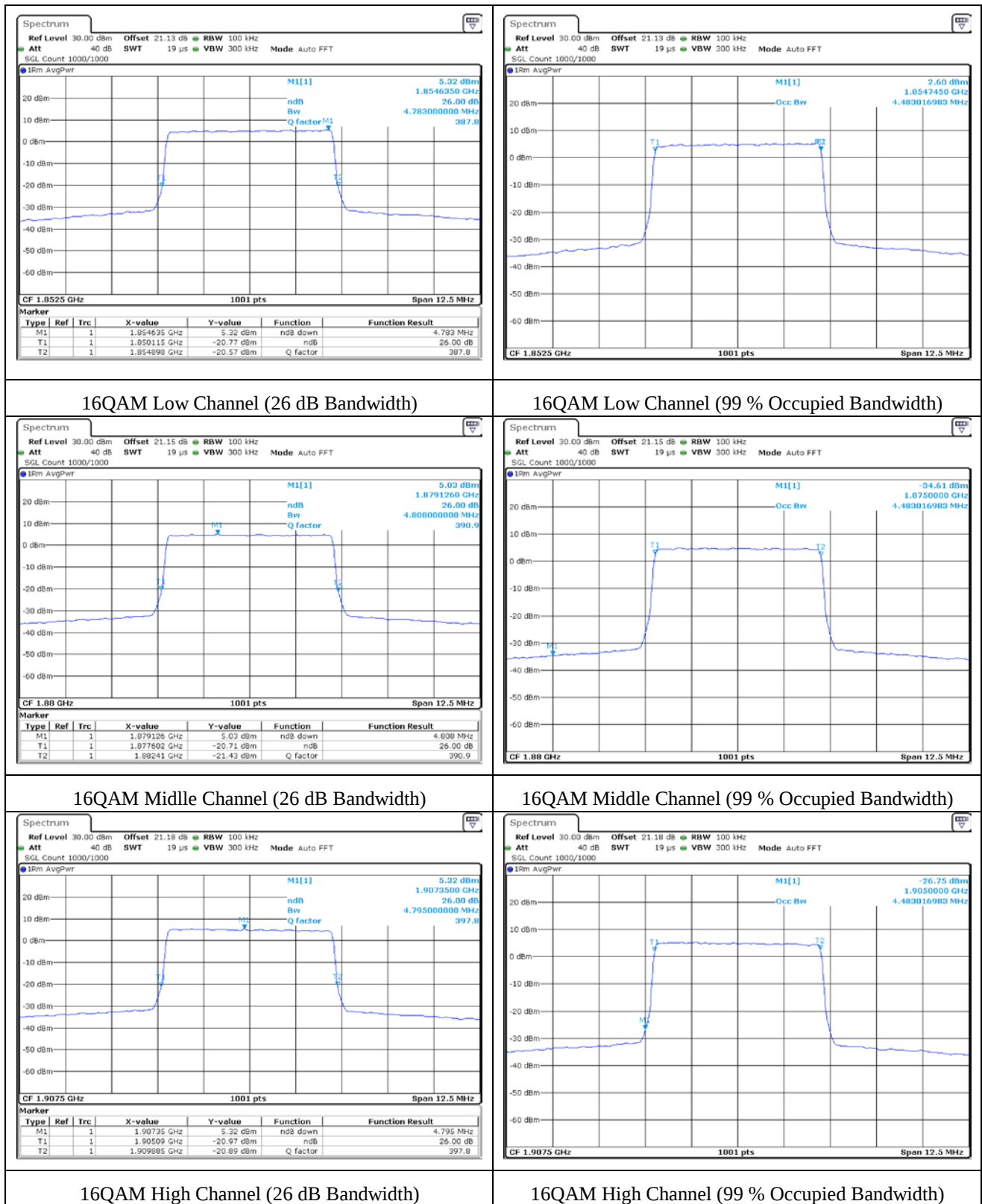


11.6 Test data for Band 2_Bandwidth 5 MHz

-. Test Result : Pass

Test Mode	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
QPSK	18625	4.81	4.48	PASS
	18900	4.80	4.50	PASS
	19175	4.81	4.48	PASS
16QAM	18625	4.78	4.48	PASS
	18900	4.81	4.48	PASS
	19175	4.80	4.48	PASS





11.7 Test data for Band 2_Bandwidth 10 MHz

-. Test Result : Pass

Test Mode	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
QPSK	18650	9.47	8.92	PASS
	18900	9.49	8.94	PASS
	19150	9.49	8.92	PASS
16QAM	18650	9.52	8.92	PASS
	18900	9.49	8.94	PASS
	19150	9.49	8.92	PASS

