



FCC RADIO TEST REPORT

FCC ID : 2ABZ2-EF136
Equipment : Smart Phone
Brand Name : ONEPLUS
Model Name : LE2117
Applicant : OnePlus Technology (Shenzhen) Co., Ltd.
18C02, 18C03, 18C04 and 18C05, Shum Yip
Terra Building, Binhe Avenue North, Futian
District, Shenzhen
Manufacturer : OnePlus Technology (Shenzhen) Co., Ltd.
18C02, 18C03, 18C04 and 18C05, Shum Yip
Terra Building, Binhe Avenue North, Futian
District, Shenzhen
Standard : FCC 47 CFR Part 2, and 90(S)

The product was received on Dec. 15, 2020 and testing was started from Dec. 18, 2020 and completed on Dec. 18, 2020. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The test results in this partial report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Louis Wu

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



Table of Contents

History of this test report.....	3
Summary of Test Result.....	4
1 General Description	5
1.1 Feature of Equipment Under Test.....	5
1.2 Modification of EUT	5
1.3 Testing Site.....	6
1.4 Applied Standards	6
2 Test Configuration of Equipment Under Test	7
2.1 Test Mode.....	7
2.2 Connection Diagram of Test System	7
2.3 Measurement Results Explanation Example	8
2.4 Frequency List of Low/Middle/High Channels.....	8
3 Conducted Test Items.....	9
3.1 Measuring Instruments.....	9
3.2 Conducted Output Power Measurement.....	10
3.3 Peak-to-Average Ratio	11
3.4 Bandwidth Limitations Measurement	12
3.5 Emissions Mask Measurement	13
3.6 Emissions Mask – Out Of Band Emissions Measurement.....	14
3.7 Frequency Stability Measurement.....	15
4 List of Measuring Equipment.....	16

Appendix A. Test Results of Conducted Test



History of this test report



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046 §90.635	Conducted Output Power	Pass	-
3.3	-	Peak-to-Average Ratio	Reporting only	-
3.4	§2.1049 §90.209	Bandwidth Limitations	Reporting only	-
3.5	§2.1051 §90.691	Emission masks – In-band emissions	Pass	-
3.6	§2.1051 §90.691	Emission masks – Out of band emissions	Pass	-
3.7	§2.1055 §90.213	Frequency Stability for Temperature & Voltage	Pass	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Vivian Hsu



1 General Description

1.1 Feature of Equipment Under Test

GSM/CDMA/WCDMA/LTE/5G NR, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax, Wi-Fi 5GHz 802.11a/n/ac/ax, NFC, GNSS, ANT+, and WPC/WPT

Product Specification subjective to this standard	
Antenna Type	WWAN: <Down Antenna>: Coupling type (LDS) Antenna <Upper Antenna>: Coupling type (LDS) Antenna Bluetooth: PIFA Antenna WLAN: <Ant. 4>: PIFA Antenna <Ant. 6>: PIFA Antenna NFC: Loop Antenna BDS/Galileo/GLONASS/GPS/SBAS: PIFA Antenna ANT+: PIFA Antenna WPC/WPT: Loop Antenna
Antenna Gain	<Upper Antenna>: -4 dBi <Down Antenna>: -4.5 dBi

1.2 Modification of EUT

No modifications are made to the EUT during all test items.



1.3 Testing Site

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sportun Site No. TH03-HY
Test Engineer	Oscar Chi
Temperature	21~24°C
Relative Humidity	51~55%

FCC Designation No.: TW1190

1.4 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC 47 CFR Part 2, 90
- ANSI / TIA-603-E
- ANSI C63.26-2015
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.
3. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168

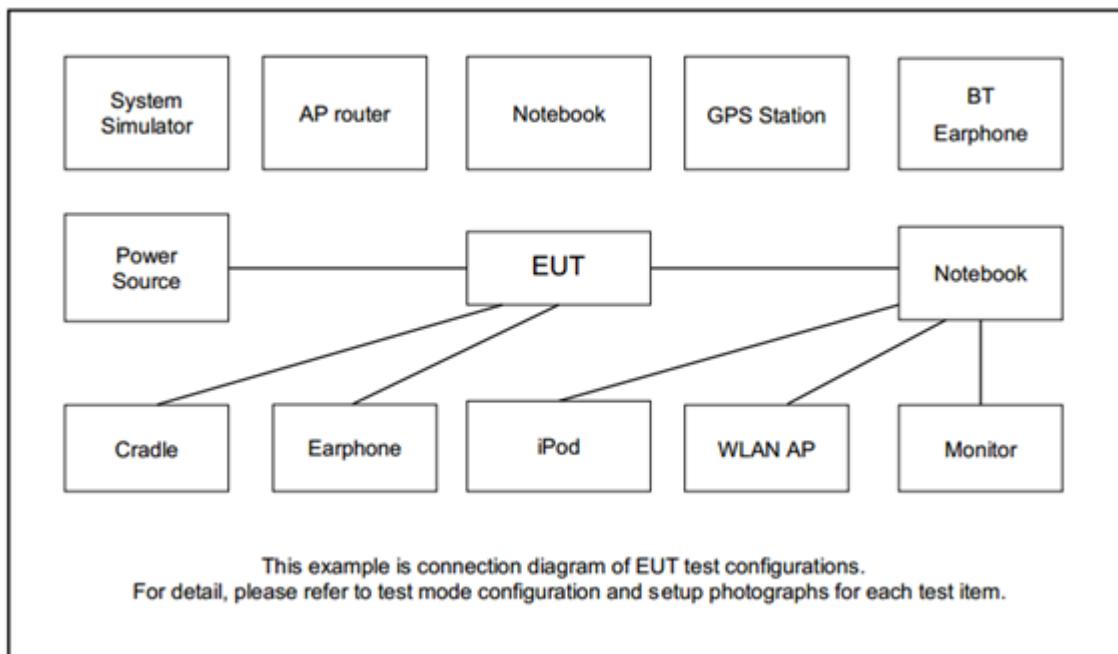
D01 Power Meas. License Digital Systems v03r01 with maximum output power.

1. 30 MHz to 9000 MHz for CDMA BC10.

Test Modes	
Band	Conducted TCs
CDMA2000 BC10	■ 1xRTT Link

Remark: All test items were performed with Down Antenna.

2.2 Connection Diagram of Test System





2.3 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between RF conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level will be exactly the RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

The following shows an offset computation example with RF cable loss 4.2 dB and a 10dB attenuator.

Example :

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$

2.4 Frequency List of Low/Middle/High Channels

Frequency List				
Band	Channel/Frequency(MHz)	Lowest	Middle	Highest
CDMA2000 BC10	Channel	476	580	684
	Frequency	817.9	820.5	823.1

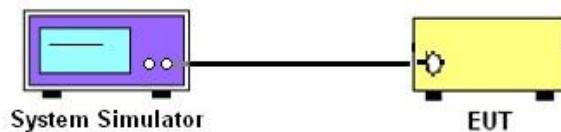
3 Conducted Test Items

3.1 Measuring Instruments

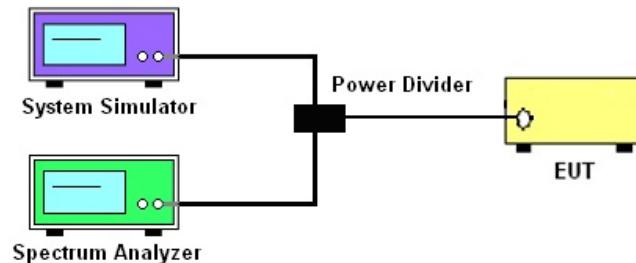
See list of measuring instruments of this test report.

3.1.1 Test Setup

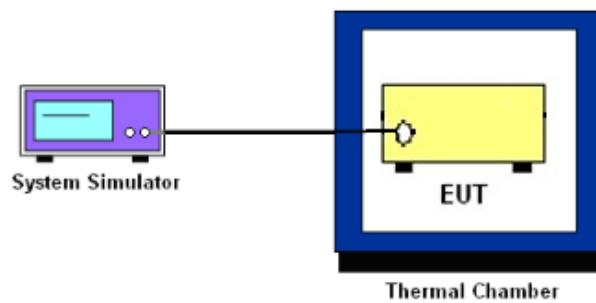
3.1.2 Conducted Output Power



3.1.3 Peak-to-Average Ratio, Occupied Bandwidth, Conducted Band-Edge, and Conducted Spurious Emission



3.1.4 Frequency Stability



3.1.5 Test Result of Conducted Test

Please refer to Appendix A.



3.2 Conducted Output Power Measurement

3.2.1 Description of the Conducted Output Power Measurement

A system simulator was used to establish communication with the EUT. Its parameters were set to enforce EUT transmitting at the maximum power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

3.2.2 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.



3.3 Peak-to-Average Ratio

3.3.1 Description of the PAR Measurement

Reporting only

3.3.2 Test Procedures

1. The EUT was connected to spectrum and system simulator via a power divider.
2. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
3. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
4. Record the deviation as Peak to Average Ratio.



3.4 Bandwidth Limitations Measurement

3.4.1 Description of (Occupied) Bandwidth Limitations Measurement

The 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The emission bandwidth is defined as the width of the signal between two points, located at the 2 sides of the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

3.4.2 Test Procedures

1. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
2. The RF output of the EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
3. The 99% occupied bandwidth were measured, set RBW= 1% of span, VBW \geq 3*RBW, sample detector, trace maximum hold.
4. The 26dB bandwidth were measured, set RBW= 1% of EBW, VBW \geq 3*RBW, peak detector, trace maximum hold.



3.5 Emissions Mask Measurement

3.5.1 Description of Emissions Mask Measurement

Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of FCC

Part 90.691.(a)(1)

(a). Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

- (1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

3.5.2 Test Procedures

1. The EUT was connected to spectrum analyzer and system simulator via power divider.
2. The emissions mask of low and high channels for the highest RF powers were measured.
3. The measured RBW and the VBW set 3 times of RBW are then set in spectrum analyzer, and the RBW correction factor $10\log(1\% \text{ of OBW}/\text{measured RBW})(\text{dB})$ was compensated, if required.
4. The test results were shown below plots with a correction offset factor including cable loss, insertion loss of power divider.



3.6 Emissions Mask – Out Of Band Emissions Measurement

3.6.1 Description of Conducted Spurious Emissions Out of band emissions measurement

The power of any emission FCC Part 90.691 (a)(2) on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth at least $43 + 10 \log(P)$ dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

3.6.2 Test Procedures

1. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
2. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
6. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)



3.7 Frequency Stability Measurement

3.7.1 Description of Frequency Stability Measurement

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

3.7.2 Test Procedures for Temperature Variation

1. The EUT was set up in the thermal chamber and connected with the base station.
2. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency was recorded within one minute.
3. With power OFF, the temperature was raised in 10°C step up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

3.7.3 Test Procedures for Voltage Variation

1. The EUT was placed in a temperature chamber at $20\pm5^\circ\text{C}$ and connected with the base station.
2. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 02, 2020	Dec. 18, 2020	Mar. 01, 2021	Conducted (TH03-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101329	9kHz~30GHz	Sep. 03, 2020	Dec. 18, 2020	Sep. 02, 2021	Conducted (TH03-HY)
Temperature Chamber	ESPEC	SH-641	92013720	-40°C ~90°C	Sep. 14, 2020	Dec. 18, 2020	Sep. 13, 2021	Conducted (TH03-HY)
Programmable Power Supply	GW Instek	PSS-2005	EL890001	1V~20V 0.5A~4A	Oct. 05, 2020	Dec. 18, 2020	Oct. 04, 2021	Conducted (TH03-HY)
Base Station (Measure)	Rohde & Schwarz	CMU200	117995	GSM / GPRS / WCDMA / CDMA	Sep. 07, 2020	Dec. 18, 2020	Sep. 06, 2021	Conducted (TH03-HY)
Power Divider	Warison	WCOU-0.4-26.5S-20	#A	N/A	Nov. 03, 2020	Dec. 18, 2020	Nov. 02, 2021	Conducted (TH03-HY)



Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power)

<Down Antenna>

Conducted Power (*Unit: dBm)			
Band	CDMA 2000 BC10		
Channel	476	580	684
Frequency	817.9	820.5	823.1
1xRTT RC1 SO55	24.61	24.75	24.74
1xRTT RC3 SO55	24.64	24.62	24.56
1xRTT RC3 SO32 (+ F-SCH)	24.40	24.32	24.73
1xRTT RC3 SO32 (+SCH)	24.58	24.67	24.71
1xEVDO RTAP 153.6Kbps	24.57	24.65	24.59
1xEVDO RETAP 4096Bits	24.71	24.66	24.69



<Upper Antenna>

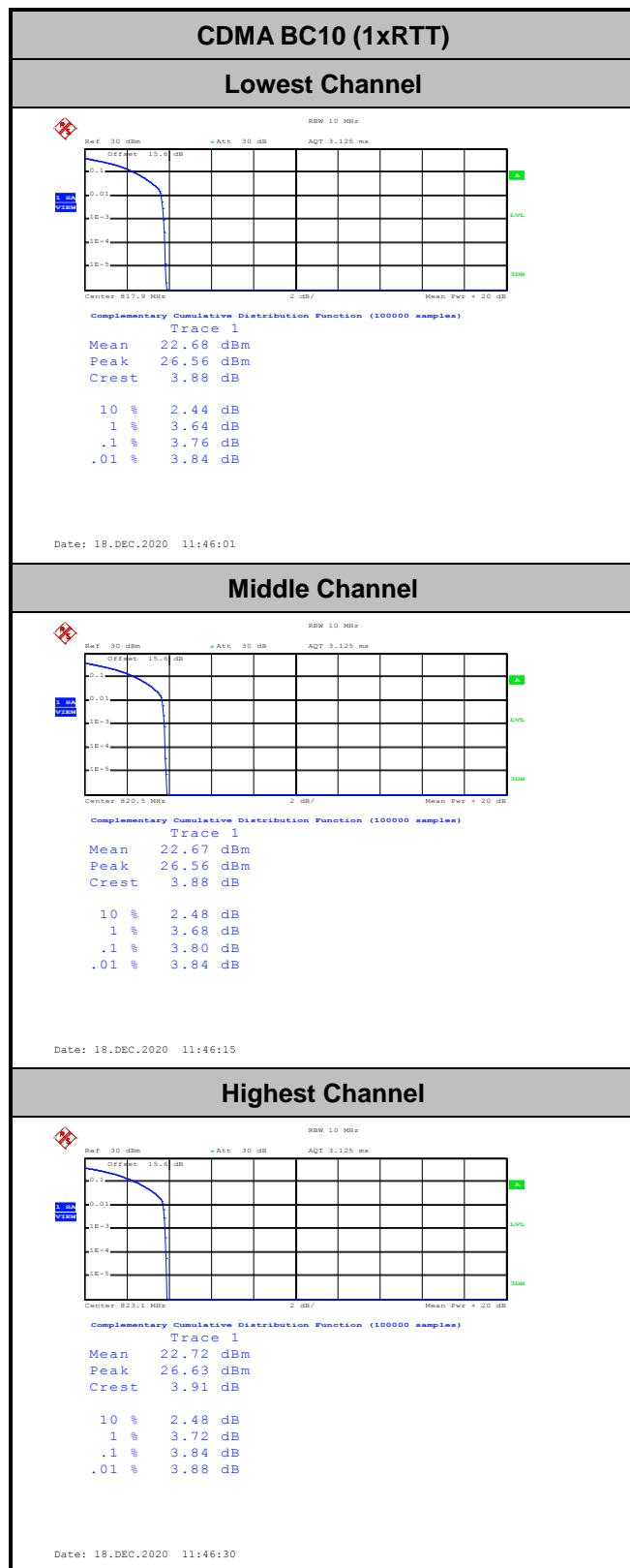
Conducted Power (*Unit: dBm)			
Band	CDMA 2000 BC10		
Channel	476	580	684
Frequency	817.9	820.5	823.1
1xRTT RC1 SO55	23.29	23.56	23.22
1xRTT RC3 SO55	23.44	23.47	23.42
1xRTT RC3 SO32 (+ F-SCH)	23.43	23.43	23.50
1xRTT RC3 SO32 (+SCH)	23.31	23.42	23.45
1xEVDO RTAP 153.6Kbps	23.42	23.39	23.29
1xEVDO RETAP 4096Bits	23.43	23.36	23.37



A2. CDMA

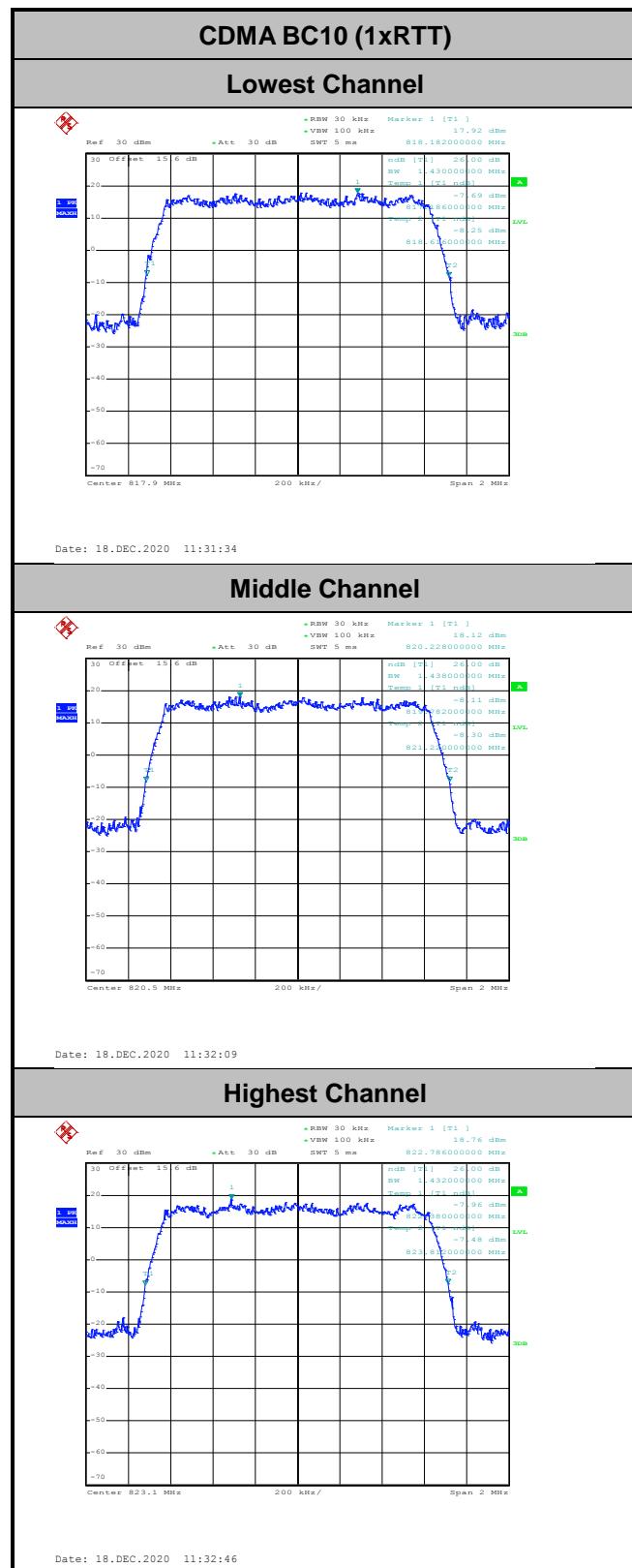
Peak-to-Average Ratio

Mode	CDMA BC10	Limit: 13dB
Mod.	1xRTT	Result
Lowest CH	3.76	PASS
Middle CH	3.80	
Highest CH	3.84	



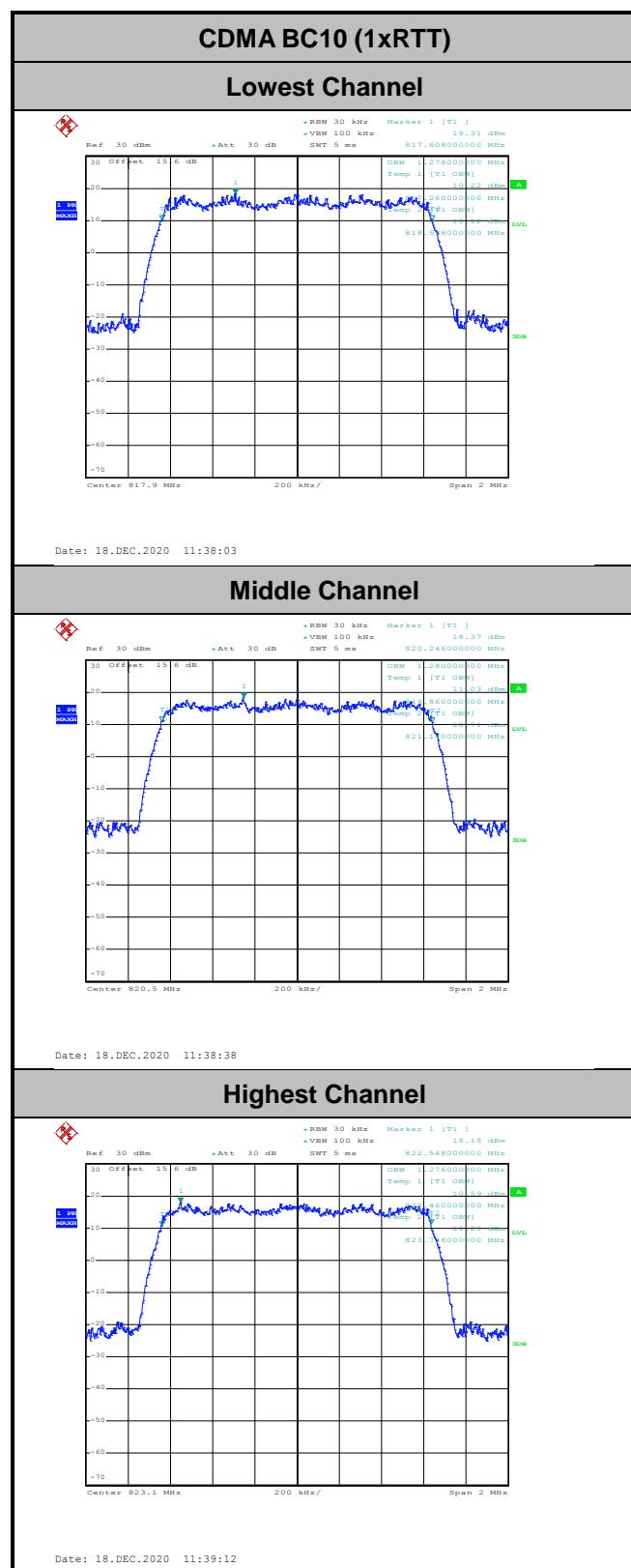
**26dB Bandwidth**

Mode	CDMA BC10: 26dB BW(MHz)
Mod.	1xRTT
Lowest CH	1.43
Middle CH	1.44
Highest CH	1.43



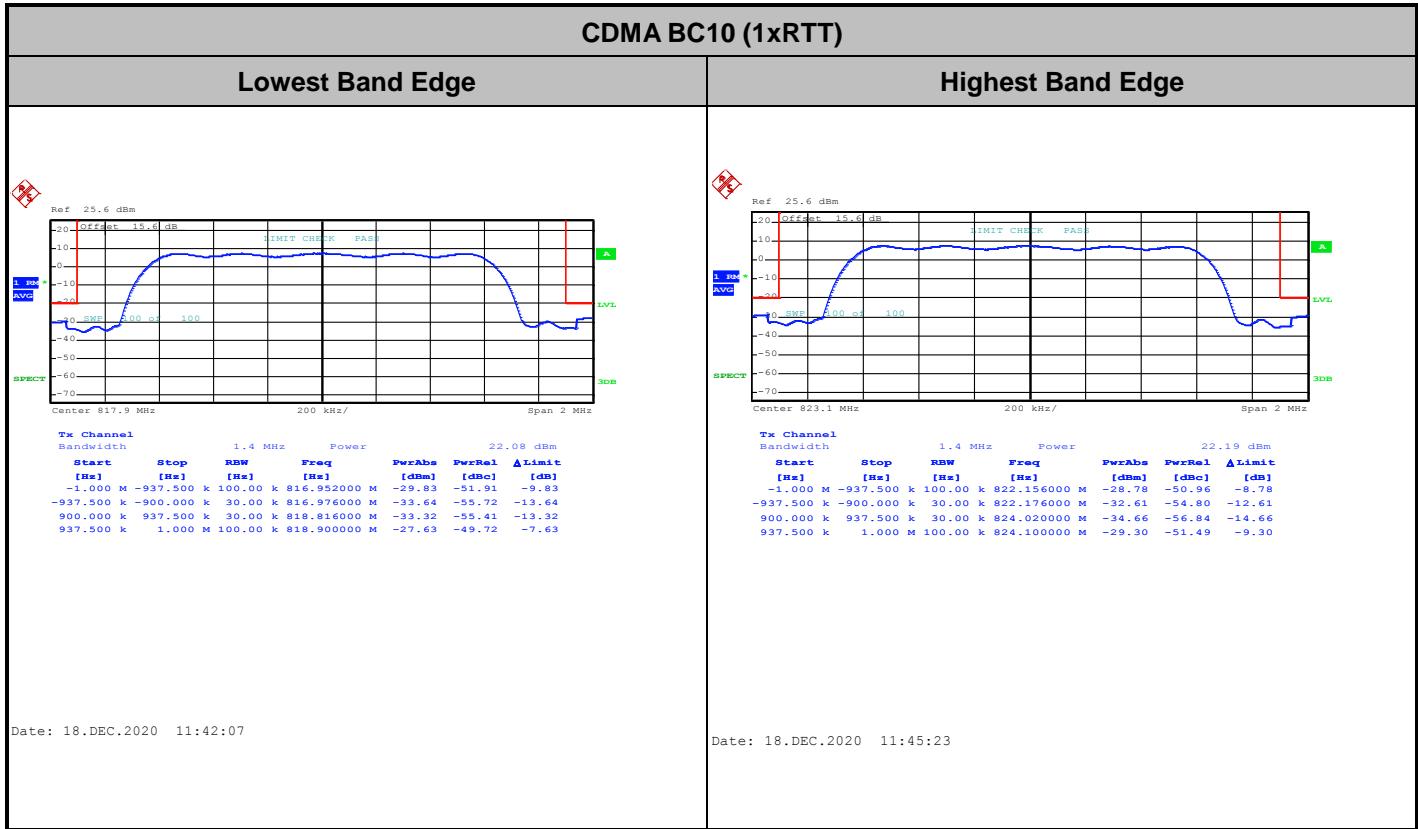
**Occupied Bandwidth**

Mode	CDMA BC10: 99% OBW (MHz)
Mod.	1xRTT
Lowest CH	1.28
Middle CH	1.28
Highest CH	1.28



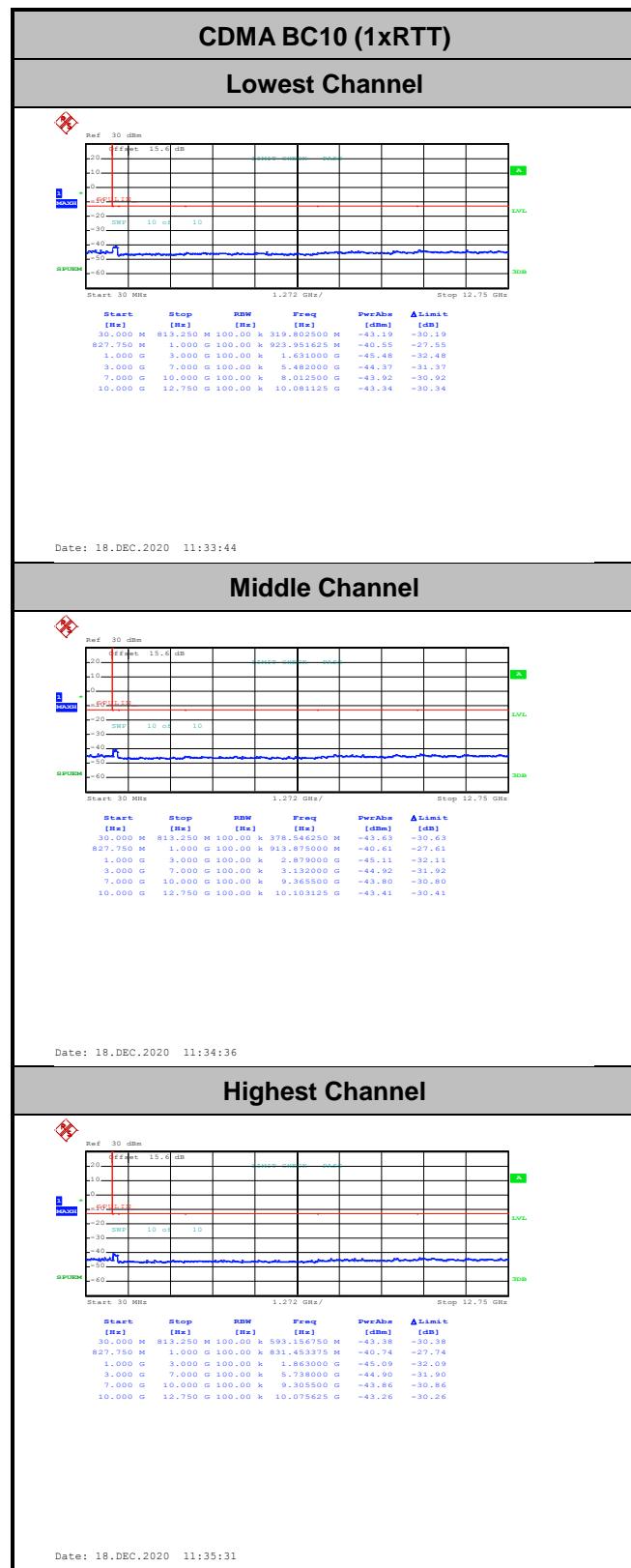


Conducted Band Edge





Conducted Spurious Emission





Frequency Stability

Test Conditions	Middle Channel	CDMA BC10 (1xRTT)	Limit Note 2.
Temperature (°C)	Voltage (Volt)	Deviation (ppm)	Result
50	Normal Voltage	0.0646	PASS
40	Normal Voltage	0.0622	
30	Normal Voltage	0.0597	
20(Ref.)	Normal Voltage	0.0000	
10	Normal Voltage	0.0024	
0	Normal Voltage	0.0098	
-10	Normal Voltage	0.0098	
-20	Normal Voltage	0.0122	
-30	Normal Voltage	0.0122	
20	Maximum Voltage	0.0012	
20	Normal Voltage	0.0000	
20	Battery End Point	0.0024	

Note:

1. Normal Voltage = 7.74V. ; Battery End Point (BEP) = 7.2 V. ; Maximum Voltage = 8.9 V
2. The frequency fundamental emissions stay within the authorized frequency block.

—————THE END—————