# **FCC RF Test Report**

APPLICANT : Essential Products Inc.

**EQUIPMENT**: Smartphone

BRAND NAME : Essential Products

MODEL NAME : A11

FCC ID : 2ALBB-A11

STANDARD : FCC 47 CFR Part 2, and 90(S)

**CLASSIFICATION**: PCS Licensed Transmitter Held to Ear (PCE)

The product was received on Apr. 08, 2017 and testing was completed on Jun. 12, 2017. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI / TIA / EIA-603-D-2010 and shown compliance with the applicable technical standards.

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

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

#### SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1<sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.

SPORTON INTERNATIONAL INC.

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Report Issued Date : Jun. 16, 2017

Testing Laboratory 1190

Report No.: FW740822A

Report Version : Rev. 01

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## **REVISION HISTORY**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FW740822A	Rev. 01	Initial issue of report	Jun. 16, 2017

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## **SUMMARY OF TEST RESULT**

Report Section	FCC Rule Description		Limit	Result	Remark
3.1	§2.1046 §90.635	Conducted Output Power	< 100 Watts	PASS	-
3.2	§2.1049 §90.209	Bandwidth limitations	N/A (Reporting only)	PASS	-
3.3	§2.1051 §90.691	Emission masks – In-band emissions	< 50+10log <sub>10</sub> (P[Watts])	PASS	-
3.4	§2.1051 §90.691	Emission masks – Out of band emissions	< 43+10log <sub>10</sub> (P[Watts])	PASS	-
3.5	§2.1053 §90.691	Field Strength of Spurious Radiation	< 43+10log <sub>10</sub> (P[Watts])	PASS	Under limit 30.35 dB at 1648.000 MHz
\$2.1055 Frequency Stability for \$90.213 Temperature & Voltage		< 2.5 ppm	PASS	-	

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### 1 General Description

### 1.1 Applicant

**Essential Products Inc.** 

380 Portage Ave., Palo Alto, CA 94306

#### 1.2 Manufacturer

**FIH Mobile Limited** 

No. 4, Mingsheng St., Tu-Cheng Dist., New Taipei City 23679, Taiwan

### 1.3 Feature of Equipment Under Test

GSM/WCDMA/CDMA2000/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n/ac, NFC, and GPS.

Product Specification subjective to this standard				
	WWAN: PIFA Antenna			
	WLAN: Monopole Antenna			
Antenna Type	Bluetooth: Monopole Antenna			
	GPS/Glonass/Galileo/Beidou: Monopole Antenna			
	NFC: Loop Antenna			

#### 1.4 Modification of EUT

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

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# 1.5 Maximum Conducted Power, Frequency Tolerance, and Emission Designator

FCC Rule	System	Type of Modulation	Emission Designator	Frequency Tolerance (ppm)
Part 90(S)	CDMA2000 BC10 1xRTT	QPSK	1M28F9W	0.0268 ppm

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### 1.6 Testing Site

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190) and the FCC designation No. TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.
	No. 52, Hwa Ya 1 <sup>st</sup> Rd., Hwa Ya Technology Park,
Took Cita Location	Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.
Test Site Location	TEL: +886-3-327-3456
	FAX: +886-3-328-4978
Toot Site No.	Sporton Site No.
Test Site No.	TH03-HY

Test Site	SPORTON INTERNATIONAL INC.	
	No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd. Guishan Dist,	
Test Site Location	Taoyuan City, Taiwan (R.O.C.)	
rest Site Location	TEL: +886-3-327-0868	
	FAX: +886-3-327-0855	
Test Site No.	Sporton Site No.	
rest Site No.	03CH11-HY	

## 1.7 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 / EIA-603-D-2010
- FCC KDB 971168 D01 Power Meas. License Digital Systems v02r02
- FCC KDB 412172 D01 Determining ERP and EIRP v01r01

#### 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.

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## 2 Test Configuration of Equipment Under Test

#### 2.1 Test Mode

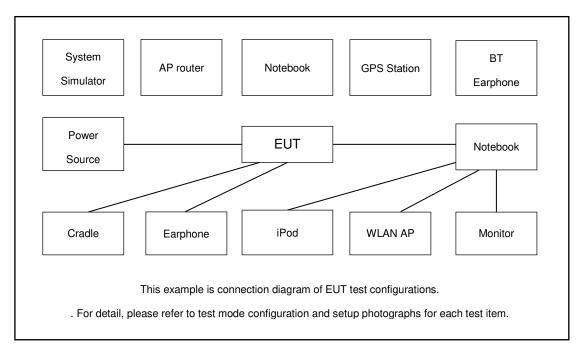
Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas. License Digital Systems v02r02 with maximum output power.

Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission.

Frequency range investigated for radiated emission is 30 MHz to 9000 MHz for CDMA2000 BC10.

Test Modes						
Band	Conducted TCs					
CDMA2000 BC10	■ 1xRTT Link	■ 1xRTT Link				

### 2.2 Connection Diagram of Test System



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### 2.3 Support Unit used in test configuration

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m

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### 2.4 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:

 $Offset(dB) = RF \ cable \ loss(dB) + attenuator \ factor(dB).$ = 4.2 + 10 = 14.2 (dB)

### 2.5 Frequency List of Low/Middle/High Channels

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

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#### 3 Test Result

### 3.1 Conducted Output Power Measurement

#### 3.1.1 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.

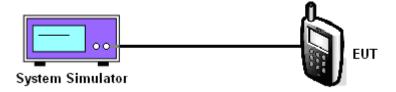
#### 3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.1.3 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.
- Measure the maximum burst average power for GSM and maximum average power for other modulation signal.

#### 3.1.4 Test Setup



#### 3.1.5 Test Result of Conducted Output Power

Please refer to Appendix A.

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#### 3.2 Bandwidth Limitations Measurement

#### 3.2.1 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.

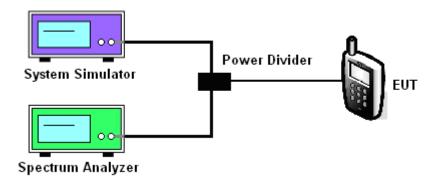
#### 3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.2.3 Test Procedures

- The EUT was connected to the spectrum analyzer and system simulator via a power divider.
- 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.
- The 99% occupied bandwidth were measured, set RBW= 1% of span, VBW≥ 3\*RBW, sample detector, trace maximum hold.
- 4. The 26dB bandwidth were measured, set RBW= 1% of EBW, VBW≥ 3\*RBW, peak detector, trace maximum hold.

#### 3.2.4 Test Setup



#### 3.2.5 Test Result of Occupied Bandwidth and 26dB Bandwidth

Please refer to Appendix A.

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#### 3.3 Emissions Mask Measurement

#### 3.3.1 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 Log10(f/6.1) decibels or 50 + 10 Log10(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.

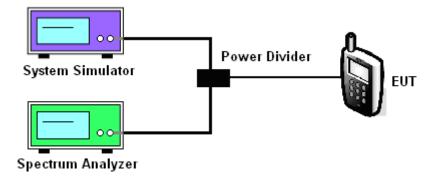
#### 3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.3.3 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.
- The measured RBW and the VBW set 3 times of RBW are then set in spectrum analyzer, and the RBW correction factor 10log (1% of OBW/measured RBW)(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.

#### 3.3.4 Test Setup



#### 3.3.5 Test Result (Plots) of Conducted Emissions Mask

Please refer to Appendix A.

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#### 3.4 Emissions Mask - Out Of Band Emissions Measurement

# 3.4.1 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.

#### 3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.4.3 Test Procedures

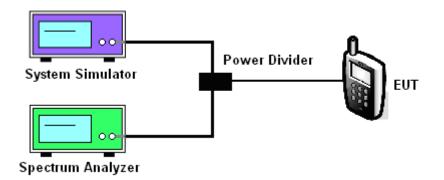
- 1. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
- 2. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. The middle channel for the highest RF power 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 + 10log(P) dB below the transmitter power P(Watts)

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#### 3.4.4 Test Setup



### 3.4.5 Test Result (Plots) of Conducted Spurious Emission

Please refer to Appendix A.

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### 3.5 Field Strength of Spurious Radiation Measurement

#### 3.5.1 Description of Field Strength of Spurious Radiated Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA / EIA-603-D-2010. The power of any emission FCC Part 90.691 on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth at least 43 + 10 log (P) dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 43+10log<sub>10</sub>(P[Watts]) dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

#### 3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

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#### 3.5.3 Test Procedures

- 1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
- 3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
- 4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
- 5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, Sweep = 500ms, Taking the record of maximum spurious emission.
- 6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
- 7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
- 8. Taking the record of output power at antenna port.
- 9. Repeat step 7 to step 8 for another polarization.
- 10. EIRP (dBm) = S.G. Power Tx Cable Loss + Tx Antenna Gain
- 11. ERP (dBm) = EIRP 2.15
- 12. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
- 13. The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts)

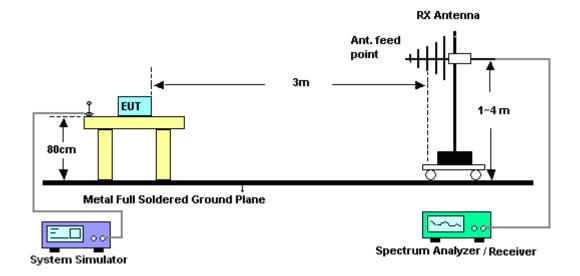
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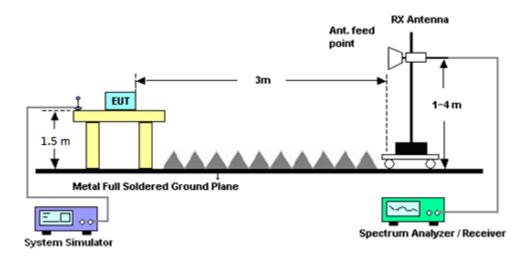
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#### 3.5.4 Test Setup

#### For radiated emissions from 30MHz to 1GHz



#### For radiated emissions above 1GHz



### 3.5.5 Test Result of Field Strength of Spurious Radiated

Please refer to Appendix B.

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### 3.6 Frequency Stability Measurement

#### 3.6.1 Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency according to FCC Part 90.213.

#### 3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.6.3 Test Procedures for Temperature Variation

- 1. The EUT was set up in the thermal chamber and connected with the base station.
- 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.

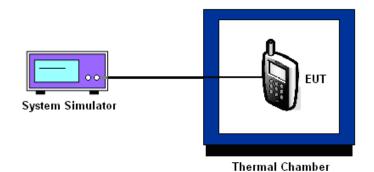
#### 3.6.4 Test Procedures for Voltage Variation

- 1. The EUT was placed in a temperature chamber at 20±5° 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.

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#### 3.6.5 Test Setup



### 3.6.6 Test Result of Temperature Variation

Please refer to Appendix A.

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## 4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	Rohde & Schwarz	FSP30	101329	9kHz~30GHz	Jun. 27, 2016	Apr. 24, 2017 ~ Apr. 27, 2017	Jun. 26, 2017	Conducted (TH03-HY)
Temperature Chamber	ESPEC	SU-641	92013721	-30℃ ~70℃	Nov. 16, 2016	Apr. 24, 2017 ~ Apr. 27, 2017	Nov. 15, 2017	Conducted (TH03-HY)
Programmable Power Supply	GW Instek	PSS-2005	EL883644	Voltage:0~20V;Cur rent:0~5A	Nov. 22, 2016	Apr. 24, 2017 ~ Apr. 27, 2017	Nov. 21, 2017	Conducted (TH03-HY)
Base Station (Measure)	Rohde & Schwarz	CMU200	117997	GSM / GPRS / WCDMA / CDMA	Aug. 05, 2016	Apr. 24, 2017 ~ Apr. 27, 2017	Aug. 04, 2017	Conducted (TH03-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 10, 2016	Apr. 22, 2017 ~ Jun. 12, 2017	Nov. 09, 2017	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-	35414&AT-N0 602	30MHz~1GHz	Oct. 15, 2016	Apr. 22, 2017 ~ Jun. 12, 2017	Oct. 14, 2017	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 07, 2016	Apr. 22, 2017 ~ Jun. 12, 2017	Oct. 06, 2017	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 10, 2016	Apr. 22, 2017 ~ Jun. 12, 2017	Nov. 09, 2017	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 12, 2016	Apr. 22, 2017 ~ Jun. 12, 2017	Oct. 11, 2017	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Apr. 22, 2017 ~ Jun. 12, 2017	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-450 0-B	N/A	1~4m	N/A	Apr. 22, 2017 ~ Jun. 12, 2017	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Apr. 22, 2017 ~ Jun. 12, 2017	N/A	Radiation (03CH11-HY)
Preamplifier	MITEQ	TTA 1840-35-HG	1887435	18GHz ~ 40GHz	Oct. 13, 2016	Apr. 22, 2017 ~ Jun. 12, 2017	Oct. 12, 2017	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA917058 4	18GHz- 40GHz	Nov. 08, 2016	Apr. 22, 2017 ~ Jun. 12, 2017	Nov. 07, 2017	Radiation (03CH11-HY)

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## 5 Uncertainty of Evaluation

#### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of	2.27
Confidence of 95% (U = 2Uc(y))	3.37

#### **Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)**

Measuring Uncertainty for a Level of	3.67
Confidence of 95% (U = 2Uc(y))	

#### <u>Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)</u>

Measuring Uncertainty for a Level of	4.03
Confidence of 95% (U = 2Uc(y))	4.03

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## **Appendix A. Test Results of Conducted Test**

## Conducted Output Power(Average power)

Conducted Power (*Unit: dBm)							
Band	CDMA 2000 BC10						
Channel	476 580 684						
Frequency	817.9	820.5	823.1				
1xRTT RC1 SO55	24.19	24.48	24.54				
1xRTT RC3 SO55	24.27	24.57	24.63				
1xRTT RC3	24.28	24.57	24.62				
SO32 (+ F-SCH)		_	_				
1xRTT RC3	24.27	24.56	24.62				
SO32 (+SCH)	,		2 02				
1xEVDO RTAP	24.37	24.56	24.62				
153.6Kbps	2 :.07	2 ::00	2-7.02				
1xEVDO RETAP	24.21	24.38	24.45				
4096Bits	<del></del> -						

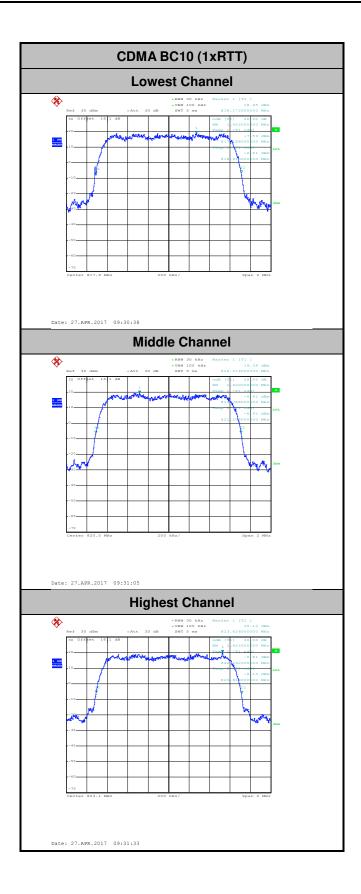
## A2. CDMA

## 26dB Bandwidth

Report No.: FW740822A

Mode	CDMA BC10			
Mod.	1xRTT			
Lowest CH	1.42			
Middle CH	1.42			
Highest CH	1.42			

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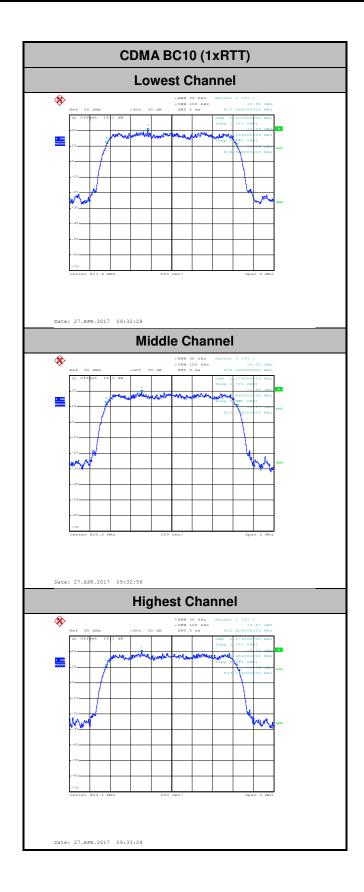
TEL: 886-3-327-3456 FAX: 886-3-328-4978

## Occupied Bandwidth

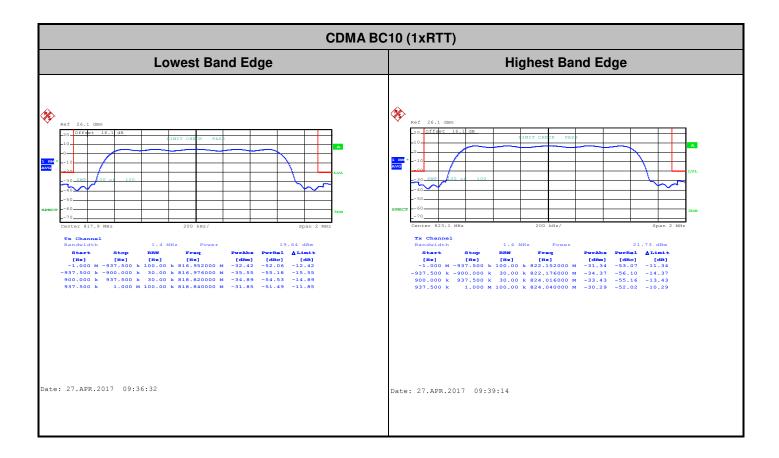
Report No.: FW740822A

Mode	CDMA BC10		
Mod.	1xRTT		
Lowest CH	1.27		
Middle CH	1.28		
Highest CH	1.27		

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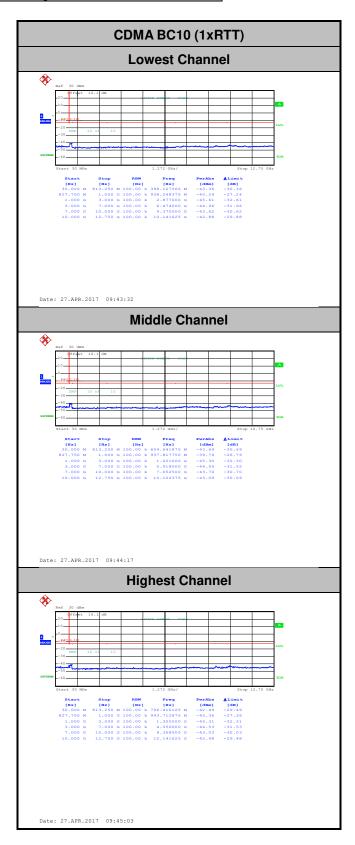


## **Power Mask**



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## **Conducted Spurious Emission**



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## Frequency Stability

Test Conditions	Conditions Middle Channel CDMA BC10 (1xRTT)			
Temperature (°C)	Voltage (Volt)	Deviation (ppm)	Result	
50	Normal Voltage	0.0037		
40	Normal Voltage	0.0268		
30	Normal Voltage	0.0244		
20(Ref.)	Normal Voltage	0.0000		
10	Normal Voltage	0.0232		
0	Normal Voltage	0.0207		
-10	Normal Voltage	0.0024	PASS	
-20	Normal Voltage	0.0219		
-30	Normal Voltage	0.0195		
20	Maximum Voltage	0.0232		
20	Normal Voltage	0.0000		
20	Battery End Point	0.0024		

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#### Note:

- 1. Normal Voltage = 3.8V. ; Battery End Point (BEP) = 3.5 V.; Maximum Voltage =4.2 V
- 2. The frequency fundamental emissions stay within the authorized frequency block based on the frequency deviation measured is small.

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## **Appendix B. Test Results of ERP/EIRP and Radiated Test**

Report No.: FW740822A

## **ERP/EIRP**

Channel	Mode	Cond	lucted	ERP		
Chamilei	Wode	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)	
Lowest	CDMA BC10	24.27	0.2673	17.20	0.0525	
Middle	1xRTT	24.57	0.2864	17.50	0.0562	
Highest	GT - LC = -4.92 dB	24.63	0.2904	17.56	0.0570	
Lowest	CDMA BC10	24.37	0.2735	17.30	0.0537	
Middle	1xEV-DO	24.56	0.2858	17.49	0.0561	
Highest	GT - LC = -4.92 dB	24.62	0.2897	17.55	0.0569	
Limit	ERP < 100W	Re	sult	PASS		

## **Radiated Spurious Emission**

## Part90S CDMA BC10 1xRTT

Mode 1_CDMA BC10 1xRTT									
Channel	Frequency ( MHz )	ERP (dBm)	Limit ( dBm )	Over Limit ( dB )	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss ( dB )	TX Antenna Gain (dBi)	Polarization (H/V)
	1648	-47.35	-13	-34.35	-57.12	-54.3	0.53	9.63	Н
	2470	-62.12	-13	-49.12	-75.21	-70.1	0.65	10.78	Н
	3293	-50.93	-13	-37.93	-76.13	-60	0.76	11.98	Н
									Н
									Н
									Н
Llighoot									Н
Highest	1648	-43.35	-13	-30.35	-52.79	-50.3	0.53	9.63	V
	2472	-60.82	-13	-47.82	-74.35	-68.8	0.65	10.78	V
	3293	-60.23	-13	-47.23	-76.04	-69.3	0.76	11.98	V
									V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

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