



FCC RF Test Report

APPLICANT : Bullitt Group
EQUIPMENT : Rugged Smart Phone
BRAND NAME : CAT
MODEL NAME : S48c
FCC ID : ZL5S48C
STANDARD : FCC 47 CFR Part 2, 22(H), 24(E), 27(L)
CLASSIFICATION : PCS Licensed Transmitter Held to Ear (PCE)

The product was received on Aug. 08, 2018 and completely tested on Aug. 19, 2018. We, Sporton International (Shenzhen) Inc., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.26-2015 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 (Shenzhen) Inc., the test report shall not be reproduced except in full.



Approved by: Eric Shih / Manager

Sporton International (Shenzhen) Inc.

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SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.4	§2.1053 §22.917(a) §24.238(a) §27.53(h)	Field Strength of Spurious Radiation	$< 43 + 10 \log_{10}(P[\text{Watts}])$	PASS	Under limit 40.66 dB at 3465.200 MHz



1 General Description

1.1 Applicant

Bullitt Group

One Valpy, Valpy Street, Reading, Berkshire, England RG1 1AR

1.2 Product Feature of Equipment Under Test

Product Feature	
Equipment	Rugged Smart Phone
Brand Name	CAT
Model Name	S48c
FCC ID	ZL5S48C
EUT supports Radios application	CDMA/EV-DO/GSM/GPRS/EGPRS/WCDMA/HSPA/DC-HSDPA/HSPA+/LTE/NFC WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
IMEI Code	Radiation: 358016090018197
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. This is a variant report for S48c. The product equality declaration could be referred to Appendix D. Based on the similarity between current and previous project, only the worst case of Radiation Spurious Emission from original test report (Sporton Report Number FG850804-03A) were verified for the differences.



1.3 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx Frequency	GSM/GPRS/EDGE: 850: 824.2 MHz ~ 848.8 MHz 1900: 1850.2 MHz ~ 1909.8MHz WCDMA: Band V: 826.4 MHz ~ 846.6 MHz Band II: 1852.4 MHz ~ 1907.6 MHz Band IV: 1712.4 MHz ~ 1752.6 MHz CDMA2000: BC0: 824.70 MHz ~ 848.31 MHz BC1: 1851.25 MHz ~ 1908.75 MHz
Rx Frequency	GSM/GPRS/EDGE: 850: 869.2 MHz ~ 893.8 MHz 1900: 1930.2 MHz ~ 1989.8 MHz WCDMA: Band V: 871.4 MHz ~ 891.6 MHz Band II: 1932.4 MHz ~ 1987.6 MHz Band IV: 2112.4 MHz ~ 2152.6 MHz CDMA2000: BC0: 869.70 MHz ~ 893.31 MHz BC1: 1931.25 MHz ~ 1988.75 MHz
Antenna Type	Fixed Internal Antenna
Antenna Gain	Cellular Band: -1.20 dBi PCS Band: -0.50 dBi AWS Band: -0.50 dBi
Type of Modulation	GSM/GPRS: GMSK EDGE: GMSK / 8PSK HSDPA/DC-HSDPA : QPSK (Uplink) HSUPA: QPSK (Uplink) DC-HSDPA : 64QAM HSPA+ : 16QAM CDMA2000 1xRTT: QPSK CDMA2000 1xEV-DO: QPSK/8PSK



1.4 Modification of EUT

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

1.5 Testing Location

Sporton International (Shenzhen) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600156-0).

Test Site	Sporton International (Shenzhen) Inc.		
Test Site Location	No. 3 Bldg the third floor of south, Shahe River west, Fengzeyuan Warehouse, Nanshan District, Shenzhen City, Guangdong Province 518055, China TEL: +86-755- 3320-2398		
Test Site No.	Sporton Site No.	FCC designation No.	FCC Test Firm Registration No.
	03CH03-SZ	CN5019	577730

1.6 Applicable Standards

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

- 47 CFR Part 2, 22(H), 24(E), 27(L)
- 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.



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 v03r01 with maximum output power.

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

Radiated emissions were investigated as following frequency range:

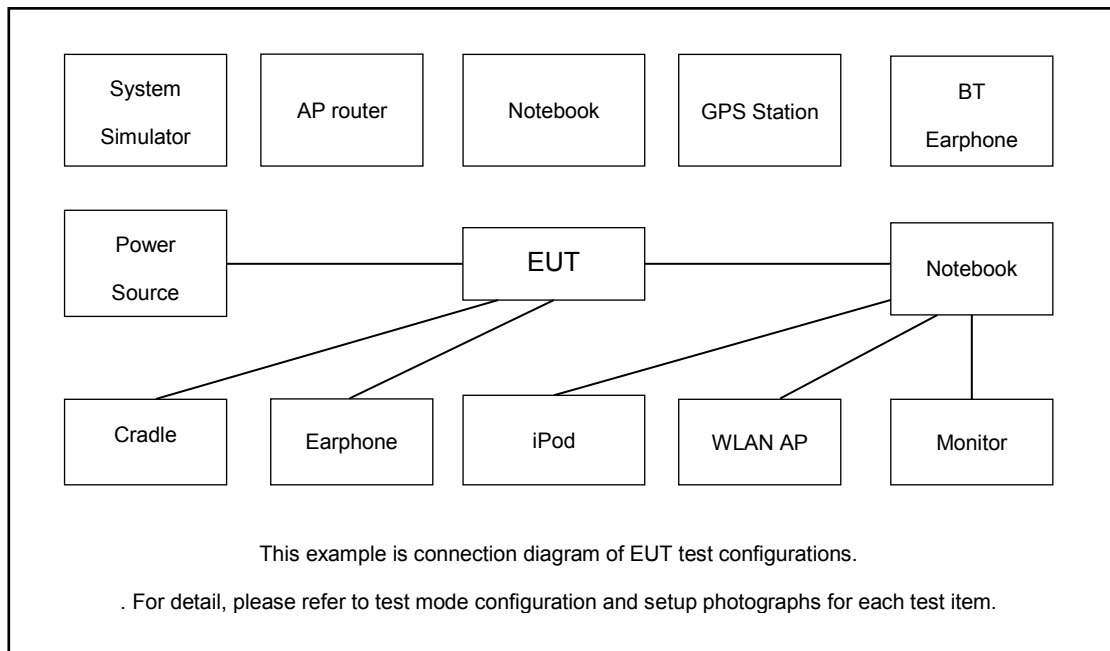
1. 30 MHz to 10th harmonic for WCDMA Band IV.

All modes and data rates and positions were investigated.

Test modes are chosen to be reported as the worst case configuration below:

Test Modes	
Band	Radiated TCs
WCDMA Band IV	■ RMC 12.2Kbps Link

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	Earphone	Apple	MC690ZP/A	N/A	Shielded, 1.0m	N/A

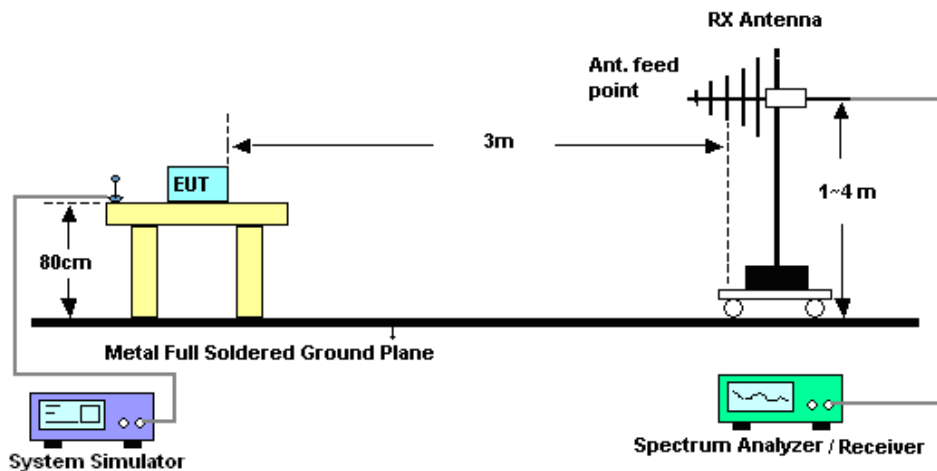
3 Radiated Test Items

3.1 Measuring Instruments

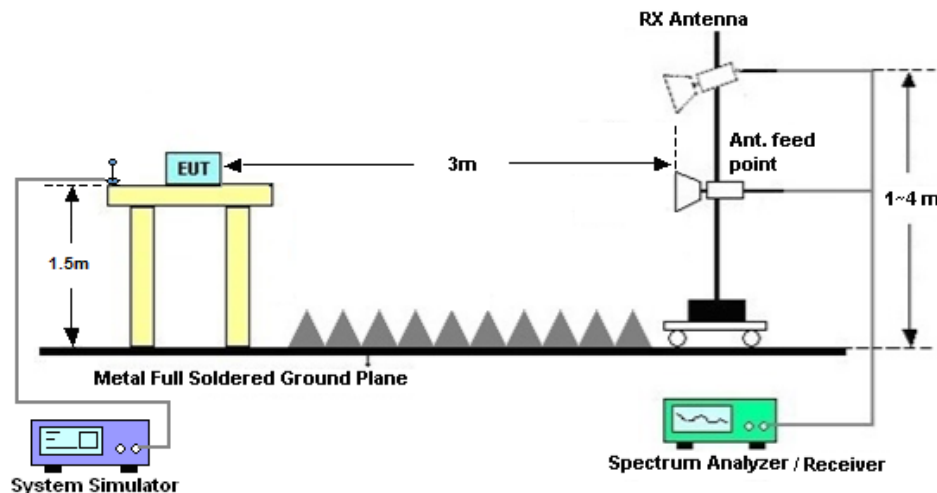
See list of measuring instruments of this test report.

3.2 Test Setup

3.2.1 For radiated test from 30MHz to 1GHz



3.2.2 For radiated test above 1GHz



3.3 Test Result of Radiated Test

Please refer to Appendix B.



3.4 Field Strength of Spurious Radiation Measurement

3.4.1 Description of Field Strength of Spurious Radiated Measurement

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 $43 + 10 \log (P)$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

3.4.2 Test Procedures

1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.8 and ANSI/TIA-603-E Section 2.2.12.
2. The EUT was placed on a rotatable wooden table 0.8 meters for frequency below 1GHz and 1.5 meter for frequency above 1GHz above the ground.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical polarizations.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
9. Taking the record of output power at antenna port.
10. Repeat step 7 to step 8 for another polarization.
11. $EIRP \text{ (dBm)} = S.G. \text{ Power} - Tx \text{ Cable Loss} + Tx \text{ Antenna Gain}$
12. $ERP \text{ (dBm)} = EIRP - 2.15$
13. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
14. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$
 $= -13\text{dBm}.$



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150246	10Hz~44GHz;	Apr. 19, 2018	Aug. 19, 2018	Apr. 18, 2019	Radiation (03CH03-SZ)
Bilog Antenna	TeseQ	CBL6112D	35408	30MHz-2GHz	Apr. 19, 2018	Aug. 19, 2018	Apr. 18, 2019	Radiation (03CH03-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1355	1GHz~18GHz	Mar. 29, 2018	Aug. 19, 2018	Mar. 28, 2019	Radiation (03CH03-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz-40GHz	Mar. 30, 2018	Aug. 19, 2018	Mar. 29, 2019	Radiation (03CH03-SZ)
Amplifier	Burgeon	BPA-530	102210	0.01Hz ~3000MHz	Oct. 19, 2017	Aug. 19, 2018	Oct. 18, 2018	Radiation (03CH03-SZ)
Amplifier	Agilent Technologies	83017A	MY39501302	500MHz~26.5GHz	Dec. 27, 2017	Aug. 19, 2018	Dec. 26, 2018	Radiation (03CH03-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 17, 2018	Aug. 19, 2018	Jul. 16, 2019	Radiation (03CH03-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	Aug. 19, 2018	NCR	Radiation (03CH03-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Aug. 19, 2018	NCR	Radiation (03CH03-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Aug. 19, 2018	NCR	Radiation (03CH03-SZ)

NCR: No Calibration Required



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.0 dB
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.6 dB
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Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.8 dB
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Appendix A. Test Results of Conducted Test

Radiated Spurious Emission

WCDMA Band IV(RMC 12.2Kbps)									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	3465.2	-53.66	-13	-40.66	-67.36	-61.63	4.63	12.60	H
	5197.8	-60.96	-13	-47.96	-78.89	-67.41	6.25	12.70	H
	6930.4	-59.81	-13	-46.81	-79.43	-64.58	8.23	13.00	H
	3465.2	-59.63	-13	-46.63	-71.04	-67.60	4.63	12.60	V
	5197.8	-65.39	-13	-52.39	-79	-71.84	6.25	12.70	V
	6930.4	-60.02	-13	-47.02	-79.14	-64.79	8.23	13.00	V

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



Appendix C. Product Equality Declaration

Bullitt Group

One Valpy, Valpy Street, Reading, Berkshire, England RG1 1AR, United Kingdom

Tel: +44 118 9580449

Date: September 27, 2018

Product Equality Declaration

We, Bullitt Group, declare on our sole responsibility for the product of Smartphone as below:

The differences between S48c (VzW Sku) and previous model, S48c (Sprint Sku) are as below:

1. L3613&C3637&L3247&C3232&L3232&C3215&C3018&C3001&U3002 Changed from NC to 0201 8.2nH & 0201 4.7pF & 0201 15nH & 0201 39pF & 0201 22nH & 0201 39pF & 0201 33pF & 0201 33pF & FILTER,SAW FOR GPS 1109
2. R3319&L3238&U3213&L3240&R3005&R3001 Changed from 0201 10nH&0201 15nH&Duplexer, Band 13,1814& 0201 15nH &0201 0Ω&0201 0Ω to 0201 5.6nH & NC& Duplexer, Band 13(NB07), 1814&0201 18Nh&NC&NC
3. S48c (VzW Sku) Based on S48c (Sprint Sku), add the following manufacturers and models of 4+64G memory:
1st_ Samsung, 2nd_Hynix

Software change:

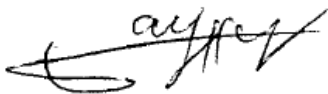
In addition, S48c (VzW Sku) vs. S48c (Sprint Sku), the UL CA was cancelled, and the DL CA was changed to the following combination.

CA_4A-13A, CA_13A-66A, CA_2A-13A, CA_2A-5A, CA_4A-5A, CA_5A-66A, CA_2A-2A, CA_5B, CA_5A-5A, CA_4A-4A

Except listings above, the others are all the same as previous version.

Should you have any questions or comments regarding this matter, please have my best attention.

Sincerely yours,



Wayne Huang

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