

FCC IC Test Report

Report No.: FCC_IC_SL19121803-TRB-030_Co-location Rev_1.0

FCC ID: JUP-8311891

IC: 1756A-8311891

Test Model: CBMRX-010B (SPS855)

Series Model: N/A

Received Date: 02/04/2020

Test Date: 02/04/2020

Issued Date: 02/26/2020

Applicant: Trimble Inc.

Address: 935 Stewart Drive, Sunnyvale, CA 94085, USA

Issued By: Bureau Veritas Consumer Products Services, Inc.

Lab Address: 775 Montague Expressway, Milpitas, CA 95035, USA

**FCC Registration /
Designation Number:** 540430 / 4842D



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Release Control Record

Issue No.	Description	Date Issued
FCC_IC_SL19121803-TRB-030_Co-location	Original release	02/05/2020
FCC_IC_SL19121803-TRB-030_Co-location Rev_1.0	Update Per Customer Review	02/26/2020

1 Certificate of Conformity

Product: GNSS Receiver with integrated 900MHz FHSS radio and optional BT modem

Brand: Trimble Inc.

Test Model: CBMRX-010B (SPS855)

Series Model: N/A

Sample Status: Engineering Sample

Applicant: Trimble Inc.

Test Date: 02/04/2020

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc. Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :  , **Date:** 02/26/2020
Deon Dai / Test Engineer

Approved by :  , **Date:** 02/26/2020
Chen Ge / Engineer Reviewer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247) RSS 247 Issue2, RSS Gen Issue5			
FCC / IC Clause	Test Item	Result	Remarks
15.207 RSS Gen 8.8	AC Power Conducted Emission	N/A	N/A
15.205 &15.209 & 15.247(d) RSS 247 5.5C	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2) RSS 247 5.2.1 RSS Gen 6.7	6dB bandwidth & 99% bandwidth	N/A	N/A
15.247(b) RSS 247 5.4.4	Conducted power	N/A	N/A
15.247(e) RSS 247 5.2.2	Power Spectral Density	N/A	N/A
15.203	Antenna Requirement	PASS	Antenna connector is TNC not a standard connector. (The device is professionally installed) BT antenna is permanently attached

Note: N/A: For details please see

900MHz

original report No.: R1504291-247 (FCC ID: JUP-8311891/ IC: 1756A-8311891)

BT module

FR3D0402AE (FCC ID: Z64-2564N, IC: 451I-2564N)

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	GNSS Receiver with integrated 900MHz FHSS radio and optional BT modem
Brand	Trimble Inc.
Test Model	CBMRX-010B (SPS855)
Identification No. of EUT	N/A
Series Model	N/A
Model Difference	N/A
Status of EUT	Engineering Sample
Operating Frequency	902.6 ~ 927.6 MHz 2.402 ~ 2.48 GHz
Number of Channel	FHSS: 50 BT_LE:40
Antenna Type	Dipole Antenna Chip Antenna
Antenna Connector	TNC Connector
Antenna Gain	900MHz Band: 2.5 dBi 2.4G Band: 2 dBi

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

50 channels are provided for 902.6 ~ 927.6 MHz

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.6	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	50	927.6
25	915.4		

40 channels are for BLE:

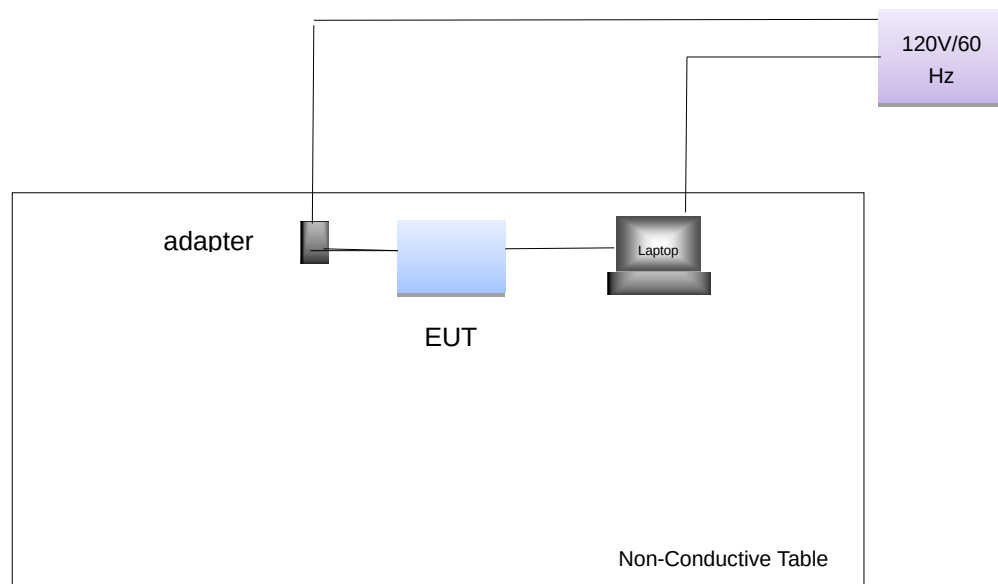
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

3.3 Description of Support Units

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

ID	Product	Brand	Model No.	Serial No.	Remarks
A.	Laptop	Lenovo	E430	N/A	Provide by customer
B.	Zephyr3 Rover GNSS antenna	Trimble	105000-10	1312118144	Provide by customer
C.	900MHz Antenna	Laird Tech	MAF94384 /Gain: 2.5dB	N/A	Provide by customer
D.	RJ45 Ethernet Cable	N/A	N/A	N/A	Provide by customer
E.	DB26-DB9 Ethernet and Power Adapter	ENHANCE, INC	TNL-57168	N/A	Provide by customer
F.	DB9-DB9 Null Modem cable	Cable Connection	59043	N/A	Provide by customer
G.	DB9(F) Y to OS/PM to power jack cable	SINBON ELECTRONICS	59044	N/A	Provide by customer
H.	AC-DC Adapter	Adaptech Tech Inc.	ATS065T-A190_65W (TPN107000)	N/A	Provide by customer

3.3.1 Configuration of System under Test



GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

47 CFR FCC Part 15, Subpart C (Section 15.247)
RSS 247 Issue 2, February 2017
RSS Gen Issue 5, March 2019
ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Emission Measurement

4.1.1 Limits of Radiated Emission Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB (power peak measurement) or 30dB (power Ave.measurement) below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
50GHz Spectrum Analyzer	N9030B (PXA)	MY57140597	06/05/2019	06/05/2020
Biconilog Antenna Sunol	JB1	A030702	03/09/2018	03/09/2020
Pre-Amplifier RF Bay, Inc.	LPA-6-30	11170601	04/27/2019	04/27/2020
Horn Antenna ETS-Lindgren	3117	218554	11/06/2019	11/06/2020
Pre-Amplifier RF-Lambda	RAMP00M50GA	17032300048	06/18/2019	06/18/2020
Micro-Tronics	800-1000MHz Notch filter	BRM50706	10/23/2019	10/23/2020

4.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

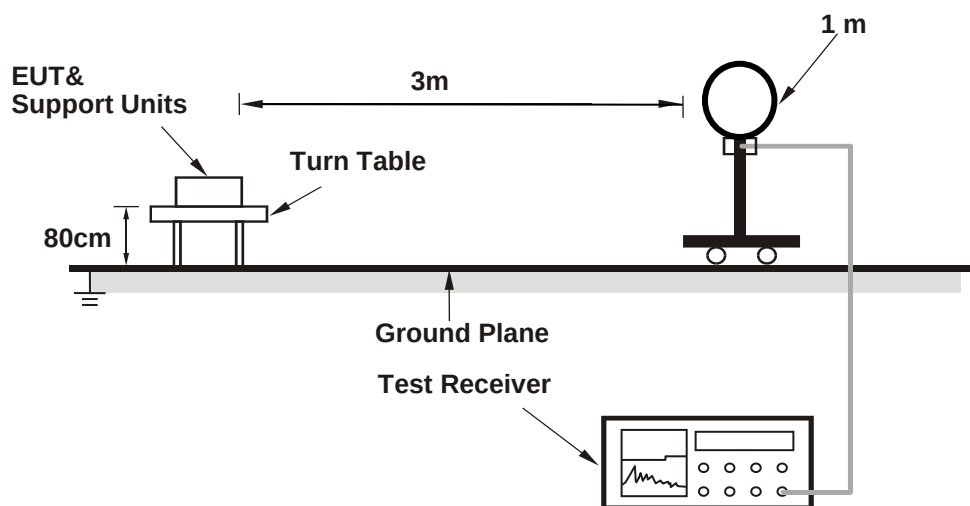
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

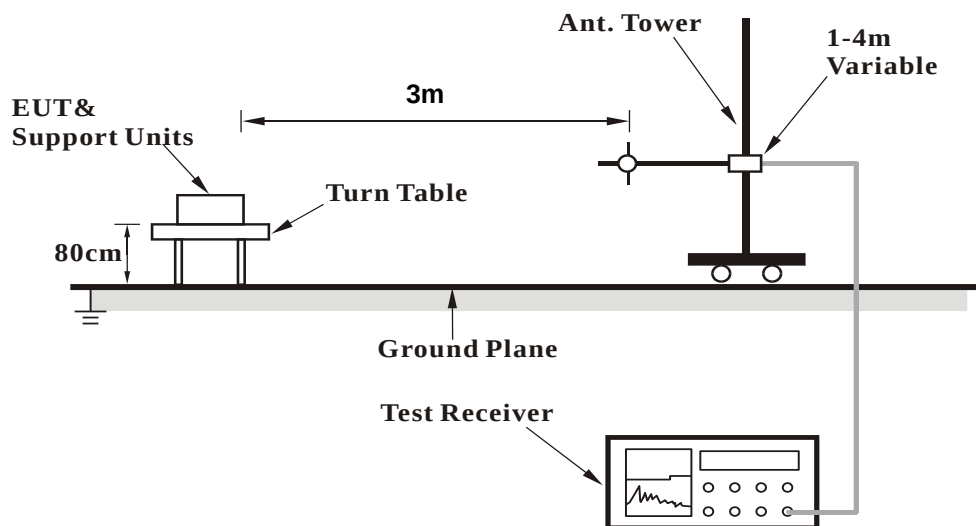
No deviation.

4.1.5 Test Setup

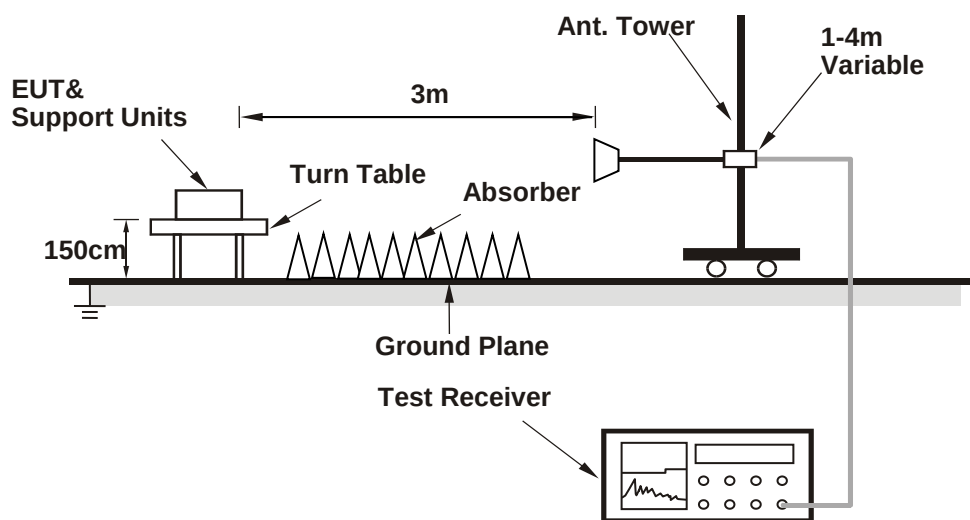
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

- a. Placed the EUT on the testing table.
- b. Prepared notebooks to act as communication partner and placed it outside of testing area.
- c. The communication partner connected with EUT via a USB cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- d. The necessary accessories enable the system in full functions.

4.1.7 Test Results

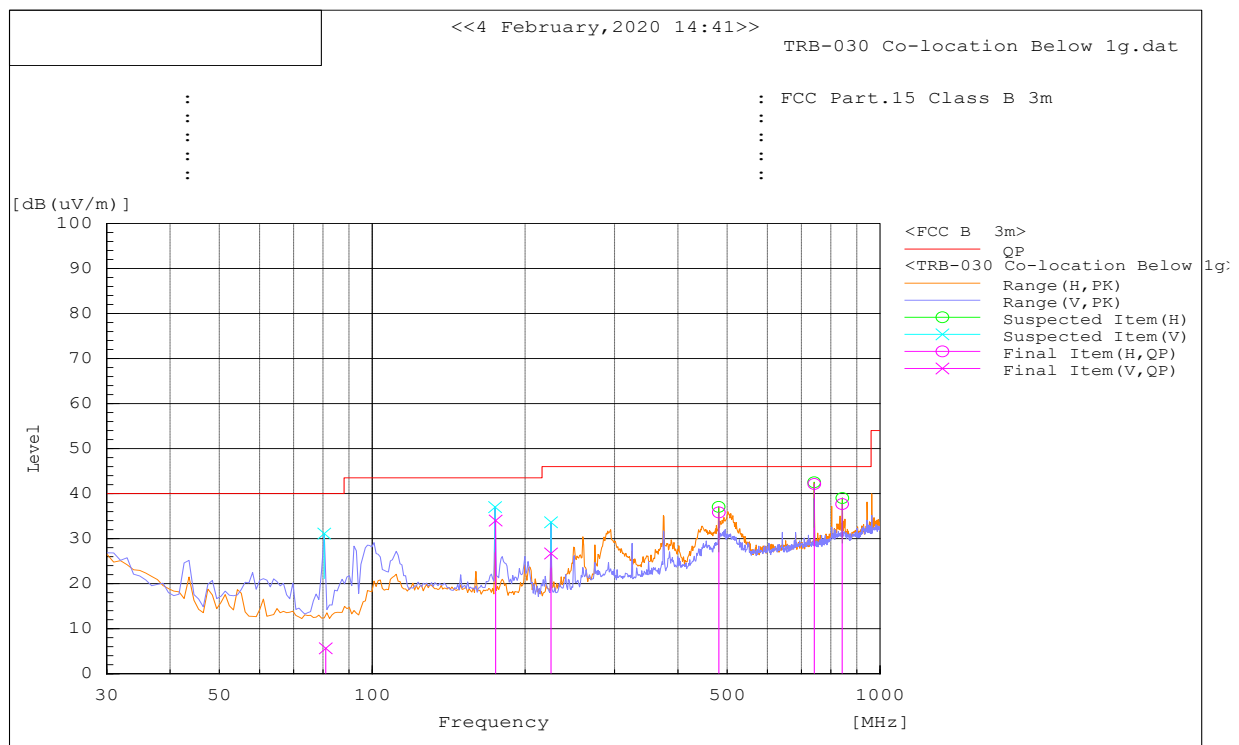
BELOW 1GHz WORST-CASE DATA:

CHANNEL	900MHz/BLE transmit simultaneous mode	DETECTOR FUNCTION	Quasi Peak
FREQUENCY RANGE	30MHz – 1GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading QP [dB(uV)]	Factor [dB/m]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	81.009	V	-7.2	12.9	5.7	40	34.3	131	356	Pass
2	174.992	V	15.8	18.2	34	43.5	9.5	141	149	Pass
3	224.988	V	9.4	17.3	26.7	46	19.3	99.9	76.7	Pass
4	481.48	H	10.9	24.9	35.8	46	10.2	195	306	Pass
5	742.119	H	13.8	28.3	42.1	46	3.9	112	177	Pass
6	842.243	H	8	29.7	37.7	46	8.3	99.8	170	Pass

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB/m).
2. Factor (dB (1/m)) = Antenna Factor (AF) (dB/m) + Cable Loss (dB)
3. Margin = Limit value (dBuV/m) - Level (dBuV/m)



Above 1GHz Test Data:

Above 1GHz-26.5GHz – Co-location

ANTENNA POLARITY & test distance: HORIZONTAL& Vertical at 3 m									
Frequency [MHz]	Pol	Reading AV [dB(uV)]	Factor [dB/m]	Measurement Type	Level [dB(uV/m)]	Limit [dB(uV/m)]	Margin [dB]	Height [cm]	Angle [deg]
1798.108	H	44.5	-10.9	Average	33.6	54	20.4	290.1	290.4
2700.988	H	42.1	-9	Average	33.1	54	20.9	217.7	169.6
4504.097	V	39.9	-4	Average	35.9	54	18.1	191.3	42.9
1798.108	H	53.9	-10.9	Peak	43	74	31	290.1	290.4
2700.988	H	51.1	-9	Peak	42.1	74	31.9	217.7	169.6
4504.097	V	49.3	-4	Peak	45.3	74	28.7	191.3	42.9

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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