RADIO TEST REPORT FCC ID: 2BK8UCB20RDNAR1

Product: ConBox2020RD

Trade Mark: Lear

Model No.: CB20RDNAR1

Family Model: N/A

Report No.: S24080903001001

Issue Date: Sep. 21, 2024

Prepared for

Lear Corporation Engineering GmbH
Industriestrasse 48, Kronach, Germany, 96317

Prepared by

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Version.1.3 Page 1 of 45



TABLE OF CONTENTS

1		T RESULT CERTIFICATION	
2	SUN	MARY OF TEST RESULTS	4
3	FAC	CILITIES AND ACCREDITATIONS	5
	3.1 3.2 3.3	FACILITIESLABORATORY ACCREDITATIONS AND LISTINGS	5
4	GEN	NERAL DESCRIPTION OF EUT	6
5	DES	SCRIPTION OF TEST MODES	8
6	SET	UP OF EQUIPMENT UNDER TEST	9
	6.1 6.2	BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM	9
	6.3		
7	TES	T REQUIREMENTS	.12
	7.1 7.2 7.3 7.4 7.5 7.6 7.7 7.8	CONDUCTED EMISSIONS TEST RADIATED SPURIOUS EMISSION NUMBER OF HOPPING CHANNEL HOPPING CHANNEL SEPARATION MEASUREMENT AVERAGE TIME OF OCCUPANCY (DWELL TIME) 20DB BANDWIDTH TEST PEAK OUTPUT POWER CONDUCTED BAND EDGE MEASUREMENT	.14 .36 .37 .38 .40
	7.9 7.10	SPURIOUS RF CONDUCTED EMISSIONANTENNA APPLICATION	.44



TEST RESULT CERTIFICATION

1

Applicant's name	Lear Corporation Engineering GmbH	
Address	Industriestrasse 48, Kronach, Germany, 96317	
Manufacturer's Name	Lear Corporation Engineering GmbH	
Address	Industriestrasse 48, Kronach, Germany, 96317	
Product description		
Product name	ConBox2020RD	
Trade Mark	Lear	
Model and/or type reference	CB20RDNAR1	
Family Model	N/A	
Test Sample number	S240809030001	
Date (s) of performance of tests.	Aug. 11, 2024 ~ Sep. 05, 2024	

Measurement Procedure Used:

modelation to the transfer of			
APPLICABLE STANDARDS			
STANDARD/ TEST PROCEDURE	TEST RESULT		
FCC 47 CFR Part 2, Subpart J FCC 47 CFR Part 15, Subpart C ANSI C63.10-2013	Complied		

This device described above has been tested by Shenzhen NTEK Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

This report shall not be reproduced except in full, without the written approval of Shenzhen NTEK Testing Technology Co., Ltd., this document may be altered or revised by Shenzhen NTEK Testing Technology Co., Ltd., personnel only, and shall be noted in the revision of the document. The test results of this report relate only to the tested sample identified in this report.

Prepared By: Mary Hu (Project Engineer)

Reviewed By: Aaron Cheng (Supervisor)

Approved By: Alex Li (Manager)

Version.1.3 Page 3 of 45



SUMMARY OF TEST RESULTS

FCC Part15 (15.247), Subpart C					
Standard Section	Test Item	Verdict	Remark		
15.207	Conducted Emission	N/A			
15.209 (a) 15.205 (a)	Radiated Spurious Emission	PASS			
15.247(a)(1)	Hopping Channel Separation	**PASS			
15.247(b)(1)	Peak Output Power	**PASS			
15.247(a)(iii)	15.247(a)(iii) Number of Hopping Frequency				
15.247(a)(iii)	15.247(a)(iii) Dwell Time				
15.247(a)(1)	Bandwidth	**PASS			
15.247 (d)	Band Edge Emission	**PASS			
15.247 (d)	15.247 (d) Spurious RF Conducted Emission				
15.203	Antenna Requirement	PASS			

Remark:

2

- 1. "N/A" denotes test is not applicable in this Test Report.
- 2. All test items were verified and recorded according to the standards and without any deviation during the test.
- 3. **The maximum conducted power is verified to be the same. The conducted signal test data may be re-used. Please check FCC ID: XPYJODYW374 (Report No.: MDE_UBLOX_2220_FCC_01)

Version.1.3 Page 4 of 45

3 FACILITIES AND ACCREDITATIONS

3.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

1&5/F, Building C, 1&2/F, Building E, Fenda Science Park, Sanwei Community, Hangcheng Street, Baoan District, Shenzhen ,Guangdong, China

The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.10 and CISPR Publication 22.

3.2 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

CNAS-Lab. : The Certificate Registration Number is L5516. IC-Registration
The Certificate Registration Number is 9270A.

CAB identifier: CN0074

FCC- Accredited Test Firm Registration Number: 463705.

Designation Number: CN1184

A2LA-Lab. The Certificate Registration Number is 4298.01

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for

Report No.: S24080903001001

the competence of testing and calibration laboratories.

This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Name of Firm : Shenzhen NTEK Testing Technology Co., Ltd.

Site Location : 1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang

Street, Bao'an District, Shenzhen 518126 P.R. China.

3.3 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

arioortairity	maniphed by a coverage factor of k=2, providing t	a level of commence of approximately co 76.
No.	Item	Uncertainty
1	Conducted Emission Test	±3.1dB
2	RF power, conducted	±0.9dB
3	Spurious emissions, conducted	±2.2dB
4	All emissions, radiated(<1G)	±5.2dB
5	All emissions, radiated(>1G)	±5.1dB
6	Temperature	±0.5°C
7	Humidity	±2%
8	Occupied bandwidth	±3.7%

Version.1.3 Page 5 of 45



4 GENERAL DESCRIPTION OF EUT

Product Feature and Specification				
Equipment	ConBox2020RD			
Trade Mark	Lear			
FCC ID	2BK8UCB20RDNAR1			
Model No.	CB20RDNAR1			
Family Model	N/A			
Model Difference	N/A			
Operating Frequency	2402MHz~2480MHz			
Modulation	GFSK, π/4-DQPSK, 8-DPSK			
Number of Channels	79 Channels			
Antenna Type	External Antenna (4N0.035.500)			
Antenna Gain	0.11dBi			
Adapter	N/A			
Battery	Typical Capacity: DC 3.2V, 1.1Ah, 3.52Wh Rated Capacity: DC 3.6V, 1.05Ah, 3.36Wh			
Power supply	DC 12V			
HW Version	H04			
SW Version	0340			

Note 1: Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.

Note 2: The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.

Version.1.3 Page 6 of 45



Revision History

Report No.	Version	Description	Issued Date
S24080903001001	Rev.01	Initial issue of report	Sep. 21, 2024

Version.1.3 Page 7 of 45



5 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (1Mbps for GFSK modulation; 2Mbps for $\pi/4$ -DQPSK modulation; 3Mbps for 8-DPSK modulation) were used for all test.

The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement –X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.

Carrier Frequency and Channel list:

Channel	Frequency(MHz)
0	2402
1	2403
39	2441
40	2442
	•••
77	2479
78	2480

Note: fc=2402MHz+k×1MHz k=0 to 78

The following summary table is showing all test modes to demonstrate in compliance with the standard.

	For AC Conducted Emission
Final Test Mode	Description
N/A	N/A

Note: AC power line Conducted Emission was tested under maximum output power.

For Radiated Test Cases			
Final Test Mode	Description		
Mode 1	normal link mode		
Mode 2	CH00(2402MHz)		
Mode 3	CH39(2441MHz)		
Mode 4	CH78(2480MHz)		

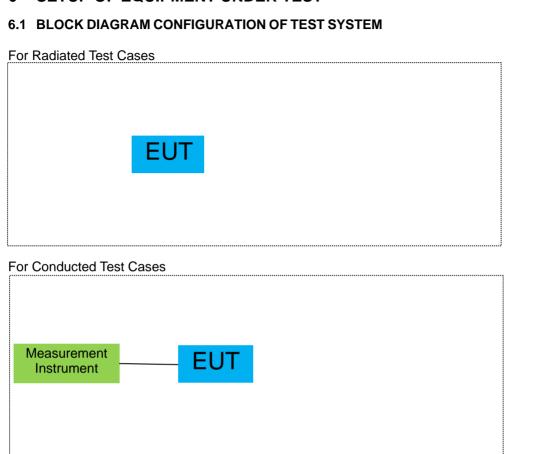
Note: For radiated test cases, the worst mode data rate 1Mbps was reported only, because this data rate has the highest RF output power at preliminary tests, and no other significantly frequencies found in conducted spurious emission.

For Conducted Test Cases				
Final Test Mode	Description			
Mode 2	CH00(2402MHz)			

Note: The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode. Max. power in BT Device Under Test Mode.

Version.1.3 Page 8 of 45

6 SETUP OF EQUIPMENT UNDER TEST



Version.1.3 Page 9 of 45





6.2 SUPPORT EQUIPMENT

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.

Item	Equipment	Model/Type No.	Series No.	Note
-	-	-	-	ı
-	-	-	-	-
-	=	-	-	-
-	-	-	-	-

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	RF Cable***	Yes	NO	54cm
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Notes:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in <code>[Length]</code> column.
- (3) "YES" is means "shielded" "with core"; "NO" is means "unshielded" "without core".
- (4) "***" RF Cable is between the module and the antenna, that's part of the EUT. Provided by the applicant.

Version.1.3 Page 10 of 45





6.3 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation& Conducted Test equipment

Radialic	adiation& Conducted Test equipment							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibrati on period	
1	Spectrum Analyzer	Agilent	N9020A	MY53280244	2024.04.26	2025.04.25	1 year	
2	Spectrum Analyzer	R&S	FSV40	101417	2024.04.26	2025.04.25	1 year	
3	Test Receiver	R&S	ESPI7	101318	2024.03.12	2025.03.11	1 year	
4	Active Loop Antenna	SCHWARZBE CK	FMZB 1519 B	055	2024.05.17	2027.05.16	3 year	
5	Log-Periodic Antenna	SCHWARZBE CK	VULB 9162	586	2024.05.12	2025.05.11	1 year	
6	Broadband Horn Antenna	SCHWARZBE CK	BBHA 9120 D	2816	2024.05.18	2027.05.17	3 year	
7	Broadband Horn Antenna	SCHWARZBE CK	BBHA 9170	803	2024.05.12	2027.05.11	3 year	
8	50Ω Coaxial Switch	Anritsu	MP59B	6200983705	2024.04.26	2027.04.25	3 year	
9	Pre-Amplifier	EMC	EMC051835 SE	980246	2024.01.23	2025.01.22	1 year	
10	Low Noise Amplifier	B&Z	BZ-P540-550 850-452727	16476-11729	2024.02.03	2025.02.02	1 year	
11	Pre-Amplifier	Sonoma	310N	186604	2024.04.25	2025.04.24	1 year	
12	Power sensor	MWRFtest	MW100-PD	MW2021043	2023.12.19	2024.12.18	1 year	
13	Filter	TRILTHIC	2400MHz	29	2024.04.26	2027.04.25	3 year	
14	RF Control Unit	MWRFtest	MW100-RFC B	MW230608N TEK-43	N/A	N/A	N/A	

Note: Each piece of equipment is scheduled for calibration once a year except the Aux Equipment & Test Cable which is scheduled for calibration every 2 or 3 years.

Measurement Software

Item	Manufacturer	Software Name	Software Version	Description
1	MWRFtest	MTS 8310 2.4GHz/5GHz	2.0	RF Conducted Test
2	Farad	EZ-EMC_RE	AIT-03A	Radiated Test
3	raditeq	RadiMation	2023.1.3	Radiated Test

Version.1.3 Page 11 of 45





7 TEST REQUIREMENTS

7.1 CONDUCTED EMISSIONS TEST

7.1.1 Applicable Standard

According to FCC Part 15.207(a)

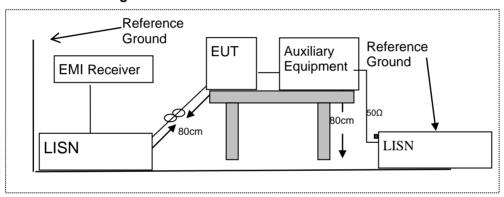
7.1.2 Conformance Limit

Frequency(MHz)	Conducted Emission Limit		
	Quasi-peak	Average	
0.15-0.5	66-56*	56-46*	
0.5-5.0	56	46	
5.0-30.0	60	50	

Note: 1. *Decreases with the logarithm of the frequency

- 2. The lower limit shall apply at the transition frequencies
- 3. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

7.1.3 Test Configuration



7.1.4 Test Procedure

According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room.
- 2. The EUT was placed on a table which is 0.8m above ground plane.
- 3. Connect EUT to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- 4. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40cm long.
- 5. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- 6. LISN at least 80 cm from nearest part of EUT chassis.
- 7. The frequency range from 150KHz to 30MHz was searched.
- 8. Set the test-receiver system to Peak Detect Function and specified bandwidth(IF bandwidth=9KHz) with Maximum Hold Mode
- 9. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Version.1.3 Page 12 of 45





7.1.5 Test Results

EUT:	ConBox2020RD	Model Name:	CB20RDNAR1
Temperature:	N/A	Relative Humidity:	N/A
Pressure:	N/A	Phase :	L
Test Voltage:	N/A	Test Mode:	N/A

Not Applicable

EUT:	ConBox2020RD	Model Name:	CB20RDNAR1
Temperature:	N/A	Relative Humidity:	N/A
Pressure:	N/A	Phase :	N
Test Voltage:	DC 12V	Test Mode:	N/A

Not Applicable

Version.1.3 Page 13 of 45

31.2-31.8

36.43-36.5 (2)







7.2 RADIATED SPURIOUS EMISSION

7.2.1 Applicable Standard

According to FCC Part 15.247(d) and 15.209 and ANSI C63.10-2013

7.2.2 Conformance Limit

12.51975-12.52025

12.57675-12.57725

According to FCC Part 15.247(d): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). According to FCC Part15.205, Restricted bands

MHz MHz MHz GHz 0.090-0.110 13.36-13.41 322-335.4 3.6-4.4 0.495-0.505 16.42-16.423 399.9-410 4.5-5.15 2.1735-2.1905 16.69475-16.69525 608-614 5.35-5.46 4.125-4.128 16.80425-16.80475 960-1240 7.25-7.75 4.17725-4.17775 25.5-25.67 1300-1427 8.025-8.5 4.20725-4.20775 37.5-38.25 1435-1626.5 9.0-9.2 73-74.6 6.215-6.218 1645.5-1646.5 9.3-9.5 6.26775-6.26825 74.8-75.2 1660-1710 10.6-12.7 6.31175-6.31225 108-121.94 1718.8-1722.2 13.25-13.4 14.47-14.5 8.291-8.294 123-138 2200-2300 2310-2390 8.362-8.366 149.9-150.05 15.35-16.2 156.52475-156.52525 8.37625-8.38675 2483.5-2500 17.7-21.4 2690-2900 22.01-23.12 8.41425-8.41475 156.7-156.9 23.6-24.0 12.29-12.293 162.0125-167.17 3260-3267

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

3332-3339

3345.8-3358

167.72-173.2

240-285

Restricted Frequency(MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance	
0.009~0.490	2400/F(KHz)	20 log (uV/m)	300	
0.490~1.705	24000/F(KHz)	20 log (uV/m)	30	
1.705~30.0	30	29.5	30	
30-88	100	40	3	
88-216	150	43.5	3	
216-960	200	46	3	
Above 960	500	54	3	

Limits of Radiated Emission Measurement(Above 1000MHz)

Frequency(MHz)	Class B (dBuV/m) (at 3M)		
	PEAK	AVERAGE	
Above 1000	74	54	

Remark :1. Emission level in dBuV/m=20 log (uV/m)

- 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
- 3. For Frequency 9kHz~30MHz:

Distance extrapolation factor =40log(Specific distance/ test distance)(dB);

Limit line=Specific limits(dBuV) + distance extrapolation factor.

For Frequency above 30MHz:

Distance extrapolation factor =20log(Specific distance/ test distance)(dB);

Limit line=Specific limits(dBuV) + distance extrapolation factor.

Version.1.3 Page 14 of 45



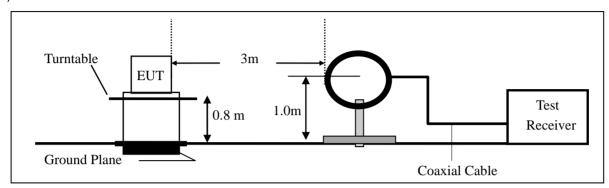


7.2.3 Measuring Instruments

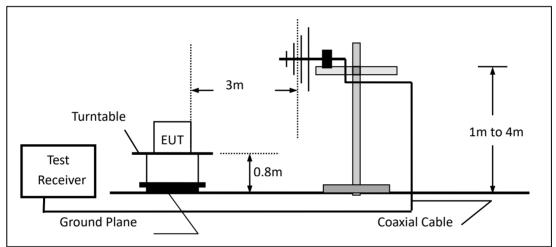
The Measuring equipment is listed in the section 6.3 of this test report.

7.2.4 Test Configuration

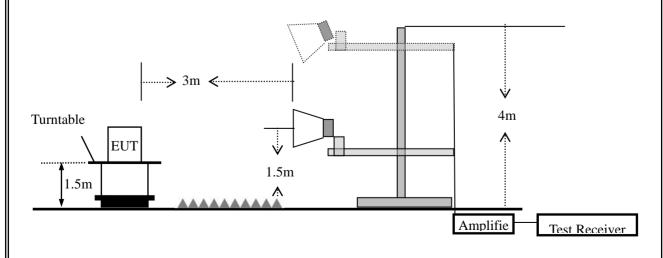
(a) For radiated emissions below 30MHz



(b) For radiated emissions from 30MHz to 1000MHz



(c) For radiated emissions above 1000MHz



Version.1.3 Page 15 of 45





7.2.5 Test Procedure

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10-2013. The test distance is 3m.The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

<u></u>	to the terror and the second and the			
Spectrum Parameter	Setting			
Attenuation	Auto			
Start Frequency	1000 MHz			
Stop Frequency	10th carrier harmonic			
RB / VB (emission in restricted band)	1 MHz / 3 MHz for Peak, 1 MHz / 3 MHz for Average			

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

- a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- b. The EUT was placed on the top of a rotating table 0.8 m for below 1GHz and 1.5m for above 1GHz the ground at a 3 meter. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8 m for below 1GHz and 1.5m for above 1GHz; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For the radiated emission test above 1GHz:
 - Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- e. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- f. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- g. For the actual test configuration, please refer to the related Item -EUT Test Photos.

Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

Version.1.3 Page 16 of 45

Report No.: S24080903001001

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 4000	Peak	1 MHz	3 MHz
Above 1000	Average	1 MHz	3 MHz

Note: for the frequency ranges below 30 MHz, a narrower RBW is used for these ranges but the measured value should add a RBW correction factor (RBWCF) where RBWCF [dB] =10*lg(100 [kHz]/narrower RBW [kHz]). , the narrower RBW is 1 kHz and RBWCF is 20 dB for the frequency 9 kHz to 150 kHz, and the narrower RBW is 10 kHz and RBWCF is 10 dB for the frequency 150 kHz to 30 MHz.

7.2.6 Test Results

■ Spurious Emission below 30MHz (9KHz to 30MHz)

EUT:	ConBox2020RD	Model No.:	CB20RDNAR1
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode2/Mode3/Mode4	Test By:	Mary Hu

Freq.	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	(dB) AV

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Version.1.3 Page 17 of 45





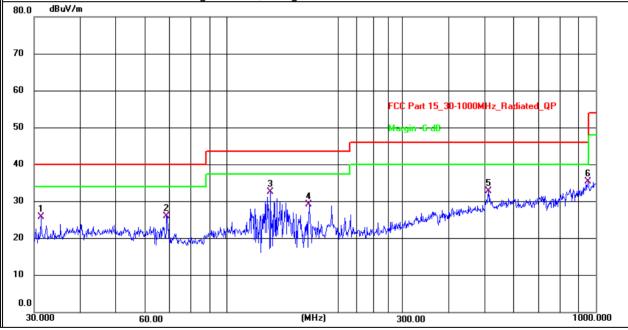
■ Spurious Emission below 1GHz (30MHz to 1GHz)
All the modulation modes have been tested, and the worst result was report as below:

7 111 1110 1110 010101011	, ,	7 III III O TTO GALLACTO TO T					
EUT:	ConBox2020RD	Model Name:	CB20RDNAR1				
Temperature:	25℃	Relative Humidity:	55%				
Pressure:	1010hPa	Test Mode:	Mode 2				
Test Voltage:	DC 12V						

Polar	Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Remark
(H/V)	(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Ttomark
V	31.2892	9.16	16.61	25.77	40.00	-14.23	QP
V	68.6310	9.75	16.30	26.05	40.00	-13.95	QP
V	131.2965	18.06	14.48	32.54	43.50	-10.96	QP
V	167.2366	14.02	15.14	29.16	43.50	-14.34	QP
V	511.8351	8.52	24.31	32.83	46.00	-13.17	QP
V	952.0937	4.73	30.66	35.39	46.00	-10.61	QP

Remark:

Emission Level= Meter Reading+ Factor, Margin= Emission Level - Limit



Version.1.3 Page 18 of 45

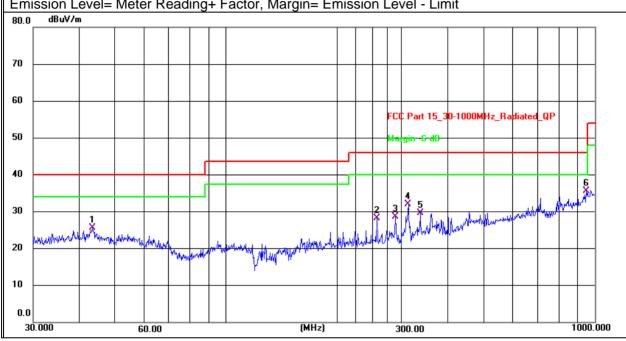




Meter **Emission** Frequency **Factor** Limits Margin Polar Reading Level Remark (H/V) (MHz) (dBuV) (dB) (dBuV/m) (dBuV/m) (dB) 43.3534 49.80 25.54 40.00 -14.46 QP Н -24.26256.5210 9.58 18.71 28.29 46.00 -17.71 QΡ Н Н 287.9904 8.67 19.94 28.61 46.00 -17.39 QP Н -14.05 QP 312.1792 11.49 20.46 31.95 46.00 Н 336.0350 8.40 21.18 46.00 -16.42 QP 29.58 Н 30.63 QP 948.7608 5.06 35.69 46.00 -10.31

Remark:





Version.1.3 Page 19 of 45



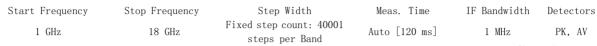


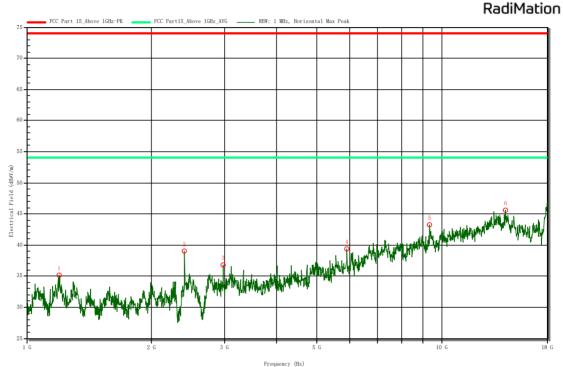
Spurious Emission Above 1GHz (1GHz to 26.5GHz)

EUT:	ConBox2020RD	Model No.:	CB20RDNAR1
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode2/Mode3/Mode4	Test By:	Mary Hu

All the modulation modes have been tested, and the worst result was report as below:

[1 GHz-18 GHz]/Horizontal RSE BT GFSK 1-DH1 2402MHz





Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
1199.325	35.1	74	-38.9	Pass
2402.075	39.1	74	-34.9	Pass
2972.85	36.8	74	-37.2	Pass
5908.325	39.4	74	-34.6	Pass
9352.95	43.2	74	-30.8	Pass
14237.475	45.6	74	-28.4	Pass

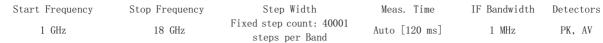
Version.1.3 Page 20 of 45

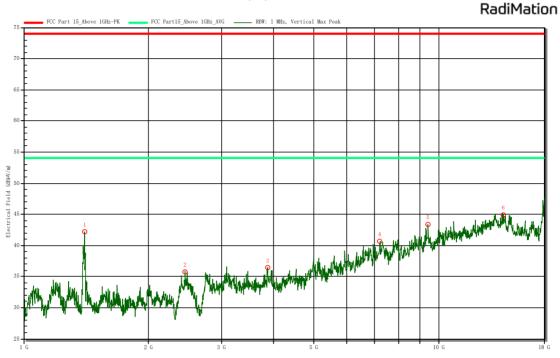






[1 GHz-18 GHz]/Vertical RSE BT GFSK 1-DH1 2402MHz





Frequency (Hz)

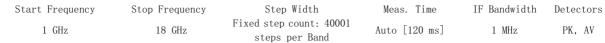
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
1401.2	42.1	74	-31.9	Pass
2443.725	35.8	74	-38.2	Pass
3872.15	36.5	74	-37.5	Pass
7220.725	40.6	74	-33.4	Pass
9427.325	43.4	74	-30.6	Pass
14311	44.9	74	-29.1	Pass

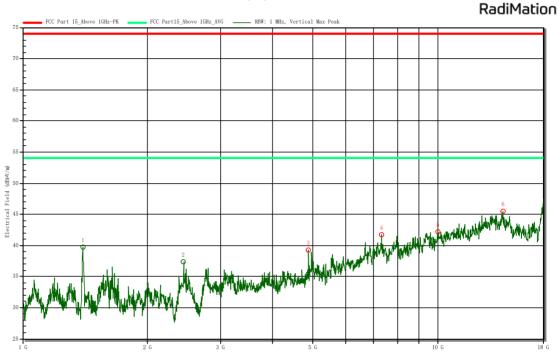
Version.1.3 Page 21 of 45





[1 GHz-18 GHz]/Vertical RSE BT GFSK 1-DH1 2441MHz





Frequency (Hz)

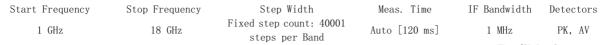
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
1396.1	39.7	74	-34.3	Pass
2440.75	37.4	74	-36.6	Pass
4881.525	39.2	74	-34.8	Pass
7323.575	41.7	74	-32.3	Pass
10001.925	42.2	74	-31.8	Pass
14351.8	45.5	74	-28.5	Pass

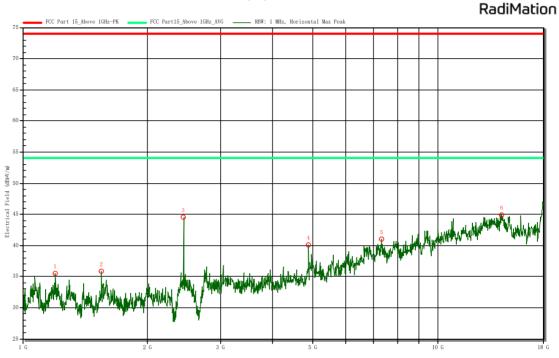
Version.1.3 Page 22 of 45











Frequency (Hz)

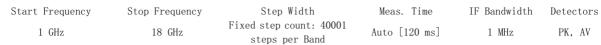
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
1199.75	35.4	74	-38.6	Pass
1548.675	35.8	74	-38.2	Pass
2440.75	44.5	74	-29.5	Pass
4881.95	40.1	74	-33.9	Pass
7324	41	74	-33.0	Pass
14271.475	44.9	74	-29.1	Pass

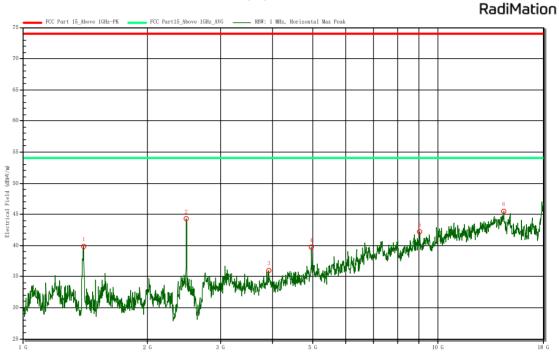
Version.1.3 Page 23 of 45





[1 GHz-18 GHz]/Horizontal RSE BT GFSK 1-DH1 2480MHz





Frequency (Hz)

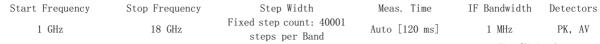
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
1402.475	39.8	74	-34.2	Pass
2479.85	44.3	74	-29.7	Pass
3912.95	36	74	-38.0	Pass
4959.725	39.7	74	-34.3	Pass
9050.775	42.2	74	-31.8	Pass
14415.125	45.5	74	-28.5	Pass

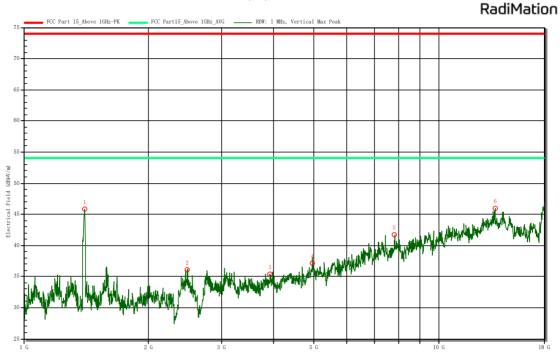
Version.1.3 Page 24 of 45











Frequency (Hz)

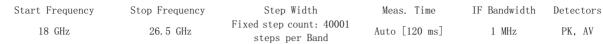
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
1405.025	45.9	74	-28.1	Pass
2479.85	36.1	74	-37.9	Pass
3923.15	35.4	74	-38.6	Pass
4960.15	37.2	74	-36.8	Pass
7829.75	41.7	74	-32.3	Pass
13663.3	45.9	74	-28.1	Pass

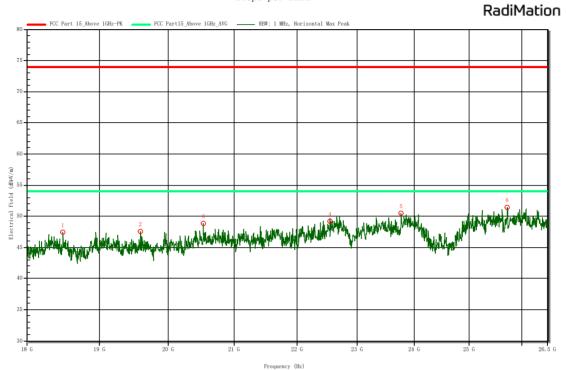
Version.1.3 Page 25 of 45





[18 GHz-26.5 GHz]/Horizontal RSE BT GFSK 1-DH1 2402MHz





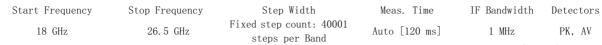
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
18489.813	47.4	74	-26.6	Pass
19586.95	47.6	74	-26.4	Pass
20522.375	48.8	74	-25.2	Pass
22550.688	49.2	74	-24.8	Pass
23764.063	50.5	74	-23.5	Pass
25715.875	51.4	74	-22.6	Pass

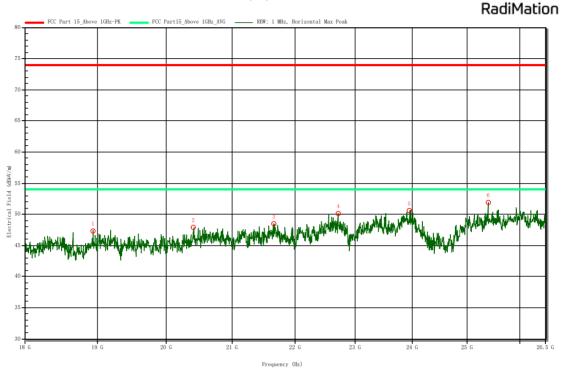
Version.1.3 Page 26 of 45





[18 GHz-26.5 GHz]/Horizontal RSE BT GFSK 1-DH1 2441MHz





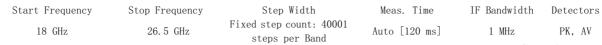
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
18937.763	47.3	74	-26.7	Pass
20405.925	47.9	74	-26.1	Pass
21657.55	48.5	74	-25.5	Pass
22711.763	50.2	74	-23.8	Pass
23952.55	50.6	74	-23.4	Pass
25389.263	51.9	74	-22.1	Pass

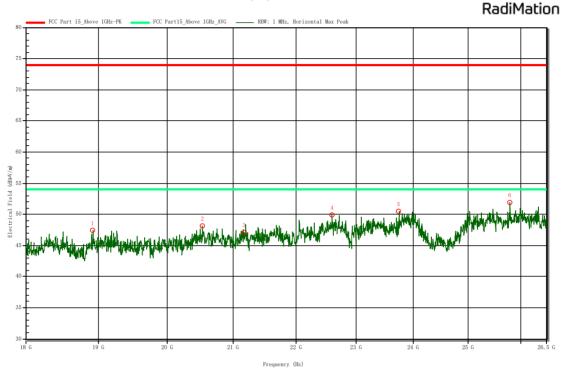
Version.1.3 Page 27 of 45





[18 GHz-26.5 GHz]/Horizontal RSE BT GFSK 1-DH1 2480MHz





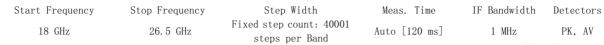
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
18922.25	47.5	74	-26.5	Pass
20526.2	48.2	74	-25.8	Pass
21167.525	47.1	74	-26.9	Pass
22595.1	49.9	74	-24.1	Pass
23745.363	50.5	74	-23.5	Pass
25785.788	51.9	74	-22.1	Pass

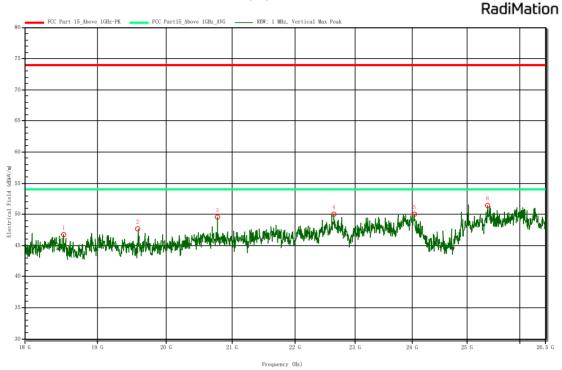
Version.1.3 Page 28 of 45





[18 GHz-26.5 GHz]/Vertical RSE BT GFSK 1-DH1 2402MHz





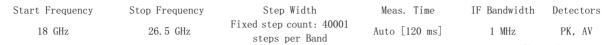
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
18528.913	46.7	74	-27.3	Pass
19579.938	47.7	74	-26.3	Pass
20766.538	49.5	74	-24.5	Pass
22642.913	50	74	-24.0	Pass
24032.025	50.1	74	-23.9	Pass
25385.65	51.4	74	-22.6	Pass

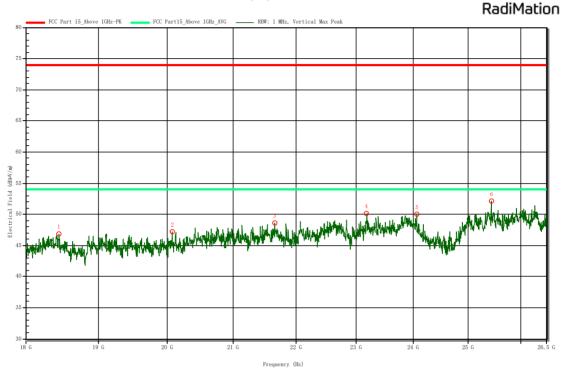
Version.1.3 Page 29 of 45





[18 GHz-26.5 GHz]/Vertical RSE BT GFSK 1-DH1 2441MHz





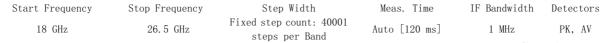
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
18449.863	46.9	74	-27.1	Pass
20068.9	47.2	74	-26.8	Pass
21653.725	48.6	74	-25.4	Pass
23183.088	50.1	74	-23.9	Pass
24058.375	50	74	-24.0	Pass
25431.975	52.1	74	-21.9	Pass

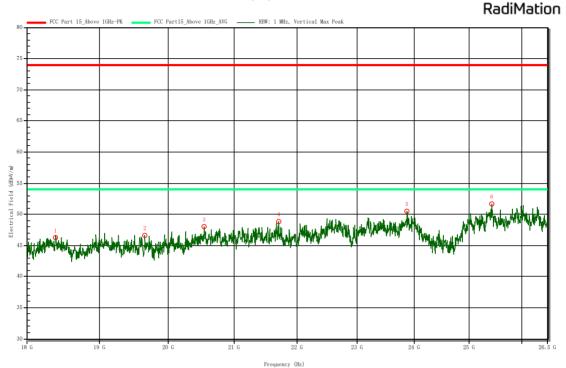
Version.1.3 Page 30 of 45





[18 GHz-26.5 GHz]/Vertical RSE BT GFSK 1-DH1 2480MHz





Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
18393.55	46.3	74	-27.7	Pass
19646.025	46.6	74	-27.4	Pass
20533.425	48	74	-26.0	Pass
21701.325	48.8	74	-25.2	Pass
23870.738	50.5	74	-23.5	Pass
25420.288	51.7	74	-22.3	Pass

Version.1.3 Page 31 of 45



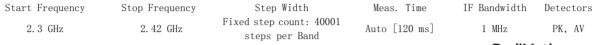


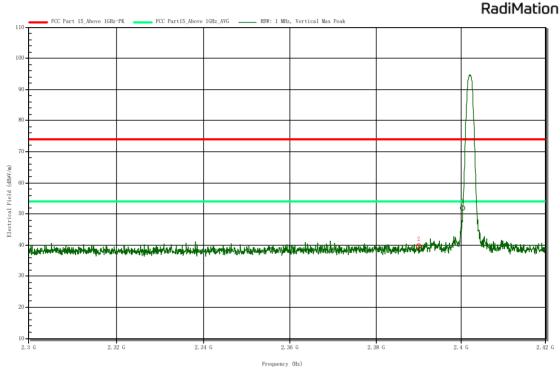
Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

- opanoac.	- Opariodo Erricolori in reconicea Baria 2010 2000 in 12 aria 2 10010 2000 in 12			
EUT:	ConBox2020RD	Model No.:	CB20RDNAR1	
Temperature :	20 ℃	Relative Humidity:	48%	
Test Mode:	Mode2/ Mode4	Test By:	Mary Hu	

All the modulation modes have been tested, and the worst result was report as below:

[2.3 GHz-2.42 GHz]/Vertical RSE BT GFSK 1-DH1 2402MHz





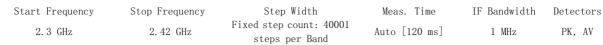
Frequency (MHz)Peak (dBμV/m)Peak Limit (dBμV/m)Peak Difference (dB)Status2390.00939.874-34.2Pass

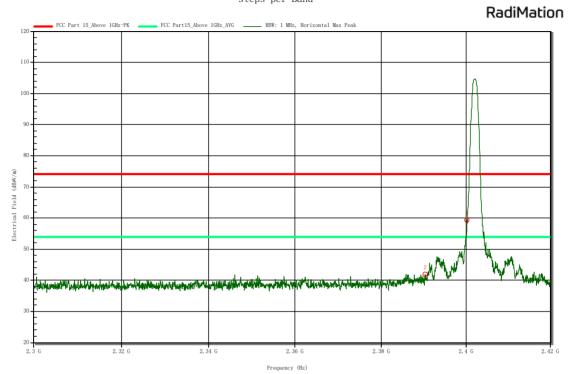
Version.1.3 Page 32 of 45





[2.3 GHz-2.42 GHz]/Horizontal RSE BT GFSK 1-DH1 2402MHz





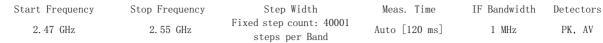
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
2390.243	42	74	-32.0	Pass

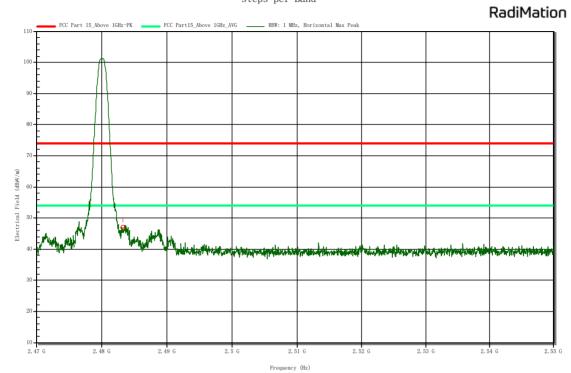
Version.1.3 Page 33 of 45





[2.47 GHz-2.55 GHz]/Horizontal RSE BT GFSK 1-DH1 2480MHz





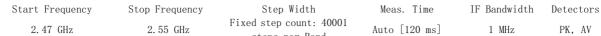
Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
2483.178	46.9	74	-27.1	Pass

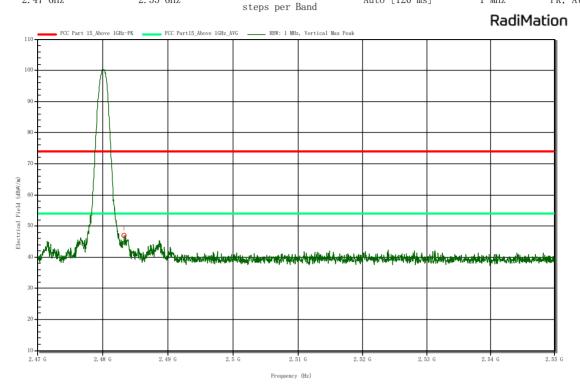
Version.1.3 Page 34 of 45





[2.47 GHz-2.55 GHz]/Vertical RSE BT GFSK 1-DH1 2480MHz





Frequency (MHz)	Peak (dBμV/m)	Peak Limit (dBμV/m)	Peak Difference (dB)	Status
2483.218	47	74	-27.0	Pass

Version.1.3 Page 35 of 45



7.3 NUMBER OF HOPPING CHANNEL

7.3.1 Applicable Standard

According to FCC Part 15.247(a)(1) (iii)and ANSI C63.10-2013

7.3.2 Conformance Limit

Frequency hopping systems in the 2400-2483.5MHz band shall use at least 15 channels.

7.3.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.3.4 Test Setup

Please refer to Section 6.1 of this test report.

7.3.5 Test Procedure

The testing follows ANSI C63.10-2013 clause 7.8.3

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

7.3.6 Test Results

EUT:	ConBox2020RD	Model No.:	CB20RDNAR1
Temperature:	N/A	Relative Humidity:	N/A
Test Mode:	N/A	Test By:	N/A

Please check FCC ID: XPYJODYW374 (Report No.: MDE_UBLOX_2220_FCC_01)

Version.1.3 Page 36 of 45





7.4 HOPPING CHANNEL SEPARATION MEASUREMENT

7.4.1 **Applicable Standard**

According to FCC Part 15.247(a)(1) and ANSI C63.10-2013

Conformance Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band shall have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

7.4.3 **Measuring Instruments**

The Measuring equipment is listed in the section 6.3 of this test report.

Test Setup 7.4.4

Please refer to Section 6.1 of this test report.

7.4.5 Test Procedure

The testing follows ANSI C63.10-2013 clause 7.8.2

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Measurement Bandwidth or Channel Separation

RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

 $VBW \ge RBW$ Sweep = auto Detector function = peak

Trace = max hold

7.4.6 **Test Results**

EUT:	ConBox2020RD	Model No.:	CB20RDNAR1
Temperature:	N/A	Relative Humidity:	N/A
Test Mode:	N/A	Test By:	N/A

Please check FCC ID: XPYJODYW374 (Report No.: MDE_UBLOX_2220_FCC_01)

Version.1.3 Page 37 of 45



7.5 AVERAGE TIME OF OCCUPANCY (DWELL TIME)

7.5.1 Applicable Standard

According to FCC Part 15.247(a)(1)(iii) and ANSI C63.10-2013

7.5.2 Conformance Limit

The average time of occupancy on any channel shall not be greater than 0.4s within a period of 0.4s multiplied by the number of hopping channels employed.

7.5.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.5.4 Test Setup

Please refer to Section 6.1 of this test report.

7.5.5 Test Procedure

The testing follows ANSI C63.10-2013 clause 7.8.4

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW ≥ 1MHz

 $VBW \ge RBW$

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

Measure the maximum time duration of one single pulse.

Set the EUT for DH5, DH3 and DH1 packet transmitting.

Measure the maximum time duration of one single pulse.

Version.1.3 Page 38 of 45



7.5.6 Test Results

EUT:	ConBox2020RD	Model No.:	CB20RDNAR1
Temperature:	N/A	Relative Humidity:	N/A
Test Mode:	N/A	Test By:	N/A

Please check FCC ID: XPYJODYW374 (Report No.: MDE_UBLOX_2220_FCC_01)

Version.1.3 Page 39 of 45





7.6 20DB BANDWIDTH TEST

7.6.1 Applicable Standard

According to FCC Part 15.247(a)(1) and ANSI C63.10-2013

7.6.2 Conformance Limit

No limit requirement.

7.6.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.6.4 Test Setup

Please refer to Section 6.1 of this test report.

7.6.5 Test Procedure

The testing follows ANSI C63.10-2013 clause 6.9.2

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW ≥ 1% of the 20 dB bandwidth

 $\mathsf{VBW} \geq \mathsf{RBW}$

Sweep = auto

Detector function = peak

Trace = max hold

7.6.6 Test Results

EUT:	ConBox2020RD	Model No.:	CB20RDNAR1
Temperature:	N/A	Relative Humidity:	N/A
Test Mode:	N/A	Test By:	N/A

Please check FCC ID: XPYJODYW374 (Report No.: MDE_UBLOX_2220_FCC_01)

Version.1.3 Page 40 of 45





7.7 PEAK OUTPUT POWER

7.7.1 Applicable Standard

According to FCC Part 15.247(b)(1) and ANSI C63.10-2013

7.7.2 Conformance Limit

The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

7.7.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.7.4 Test Setup

Please refer to Section 6.1 of this test report.

7.7.5 Test Procedure

The testing follows ANSI C63.10-2013 clause 7.8.5.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW ≥ the 20 dB bandwidth of the emission being measured

 $VBW \geq RBW$

Sweep = auto

Detector function = peak

Trace = max hold

Version.1.3 Page 41 of 45



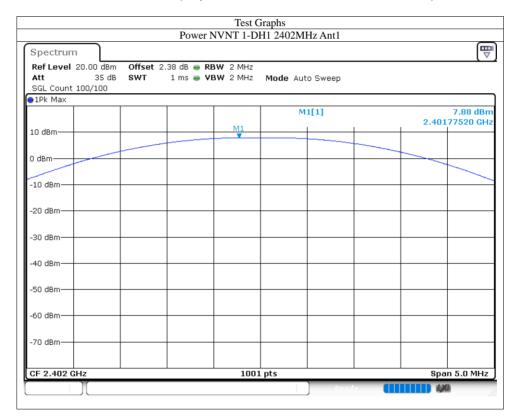


7.7.6 Test Results

EUT:	ConBox2020RD	Model No.:	CB20RDNAR1
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode2	Test By:	Mary Hu

Condition	Mode	Frequency (MHz)	Verified Host Conducted Power (dBm)	Original Module Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	1-DH1	2402	7.88	11.5	30	Pass

The maximum conducted power is verified to be the same. The conducted signal test data may be re-used. Please check FCC ID: XPYJODYW374 (Report No.: MDE_UBLOX_2220_FCC_01)



Version.1.3 Page 42 of 45





7.8 CONDUCTED BAND EDGE MEASUREMENT

7.8.1 Applicable Standard

According to FCC Part 15.247(d) and ANSI C63.10-2013

7.8.2 Conformance Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

7.8.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.8.4 Test Setup

Please refer to Section 6.1 of this test report.

7.8.5 Test Procedure

The testing follows ANSI C63.10-2013 clause 7.8.6.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW = 100KHz

VBW = 300KHz

Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.

Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

Repeat above procedures until all measured frequencies were complete.

7.8.6 Test Results

EUT:	ConBox2020RD	Model No.:	CB20RDNAR1
Temperature:	N/A	Relative Humidity:	N/A
Test Mode:	N/A	Test By:	N/A

Please check FCC ID: XPYJODYW374 (Report No.: MDE_UBLOX_2220_FCC_01)

Version.1.3 Page 43 of 45





7.9 SPURIOUS RF CONDUCTED EMISSION

7.9.1 Applicable Standard

According to FCC Part 15.247(d) and ANSI C63.10-2013.

7.9.2 Conformance Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

7.9.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.9.4 Test Setup

Please refer to Section 6.1 of this test report.

7.9.5 Test Procedure

Establish an emission level by using the following procedure:

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW ≥ [3 × RBW].
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

Then the limit shall be attenuated by at least 20 dB relative to the maximum amplitude level in 100 kHz.

7.9.6 Test Results

Remark: The measurement frequency range is from 30MHzHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

Please check FCC ID: XPYJODYW374 (Report No.: MDE UBLOX 2220 FCC 01)

Version.1.3 Page 44 of 45

Report No.: S24080903001001

7.10 ANTENNA APPLICATION

7.10.1 Antenna Requirement

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

7.10.2 Result

The EUT antenna is permanent attached External Antenna (Gain: 0.11dBi). It comply with the standard requirement.

END OF REPORT

Version.1.3 Page 45 of 45