

TEST REPORT



DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1701-0003

2. Customer

- Name : Code Corporation
- Address : 12393 South Gateway Park Place Suite 600 Draper Utah United States 84020

3. Use of Report : FCC & IC Original Grant

4. Product Name / Model Name : Mobile Computer / CR4900

FCC ID / IC : QQ6-WBT11 / 9966A-WBT11

5. Test Method Used : ANSI C63.10-2013

Test Specification : FCC Part 15.225

RSS-210 Issue 9 (2016-04), RSS-GEN Issue 4 (2014-11)

6. Date of Test : 2016-11-11 ~ 2016-11-25

7. Testing Environment : See appended Test Report.

8. Test Result : Refer to the attached Test Result.

Affirmation	Tested by Name : JungWoo Kim 	Technical Manager Name : WonJung Lee 
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The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2017 . 01 . 05 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1701-0003	Jan. 05, 2017	Initial issue

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1. General Information

1.1. Testing Laboratory

DT&C Co., Ltd.			
Standard		Site number	Address
FCC	<input checked="" type="checkbox"/>	165783	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/>	804488	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/>	596748	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/>	678747	683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080
IC	<input checked="" type="checkbox"/>	5740A-3	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/>	5740A-2	683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080
www.dtnc.net			
Telephone		:	+ 82-31-321-2664
FAX		:	+ 82-31-321-1664

1.2. Testing Environment

Ambient Condition	
▪ Temperature	+21 °C ~ +25 °C
▪ Relative Humidity	34 % ~ 42 %

1.3. Measurement Uncertainty

Test items	Measurement uncertainty
AC conducted emission	2.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, k = 2)

1.4. Details of Applicant

Applicant : Code Corporation
Address : 12393 South Gateway Park Place Suite 600 Draper Utah United States
84020
Contact person : Ryan Hoobler

1.5. Description of EUT

FCC Equipment Class	Low Power Communications Device Transmitter(DXX)
EUT	Mobile Computer
Model Name	CR4900
Serial Number	Identical prototype
Hardware version	MP
Software version	89.xx
Power Supply	DC 3.7 V
Frequency Band	13.56 MHz
Modulation Type	ASK
Channel(s)	1
Antenna type	Loop Antenna

2. Information about test items

2.1 Test mode

Test mode1	Continuous transmitting mode
Test mode2	-

Note: For this test mode, a test program was supported by manufacturer.

2.2 Support equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-

2.3 Tested frequency

Channel	TX Frequency(MHz)	RX Frequency(MHz)
Lowest	13.56	13.56
Middle	-	-
Highest	-	-

2.4 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. Antenna requirements

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

**The antenna is attached to the battery cover, and it is coupled use the special tension.(Refer to Internal photo file)
Therefore this E.U.T Complies with the requirement of §15.203**

4. Test report

4.1 Summary of tests

FCC part section(s)	RSS section(s)	Parameter	Limit	Test condition	Status Note 1
2.1049	-	20 dB Bandwidth	-	Radiated	C
-	RSS-Gen [6.6]	Occupied Bandwidth	-		C
15.225 (a)	RSS-210 [B6(a)]	In-Band Emissions	15,848 μ N/m @ 30 m 13.553 – 13.567 MHz		C
15.225 (b)	RSS-210 [B6(b)]	In-Band Emissions	334 μ N/m @ 30 m 13.410 – 13.553 MHz 13.567 – 13.710 MHz		C
15.225 (c)	RSS-210 [B6(c)]	In-Band Emissions	106 μ N/m @ 30 m 13.110 – 13.410 MHz 13.710 – 14.010 MHz		C
15.225 (d) 15.209	RSS-210 [B6(d)] RSS-GEN [8.9]	Out-of Band Emissions	Emissions outside of the specified band (13.110-14.010 MHz) must meet the radiated limits detailed in 15.209		C
15.225 (e)	RSS-210 [B6]	Frequency Stability	\pm 0.01 % of operating frequency	Temp & Humid Test Chamber	C
15.207	RSS-Gen [8.8]	AC Conducted Emissions	FCC Part 15.207	AC Line Conducted	C
15.203	RSS-Gen [8.3]	Antenna Requirements	FCC Part 15.203	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

The sample was tested according to the following specification:
ANSI C-63.10-2013

4.2 Transmitter requirements

4.2.1 20dB bandwidth

- Procedure:

The 20 dB Bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

- Measurement Data: Comply



- Minimum Standard: NA

4.2.2 Occupied bandwidth

- Procedure:

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3 x RBW.

- Measurement Data: Comply



- Minimum Standard: NA

4.2.3 In-band emissions

- Procedure:

The EUT was placed on a 0.8 m high non-conductive table inside a 3 m semi anechoic chamber. An antenna was placed at 3 m distance from the EUT. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions. A loop antenna was used for this test item. And the loop antenna was rotated about vertical axis.

- Measurement Data: **Comply**

Tested Frequency : 13.56 MHz
Measurement Distance : 3 Meters

Test Frequency Band [MHz]	Freq. [MHz]	EUT Posi.	Reading Level [dBuV]	T.F	Field Strength @3 m [dBuV/m]	Field Strength @30 m [dBuV/m]	Limit [dBuV/m]	Margin [dB]
13.110 ~ 13.410	13.348	Y	13.70	20.20	33.90	-6.10	40.51	46.61
13.410 ~ 13.553	13.552	Y	23.60	20.20	43.80	3.80	50.47	46.67
13.553 ~ 13.567	13.559	Y	29.80	20.20	50.00	10.00	84.00	74.00
13.567 ~ 13.710	13.568	Y	20.80	20.20	41.00	1.00	50.47	49.47
13.710 ~ 14.010	13.772	Y	12.00	20.20	32.20	-7.80	40.51	48.31

Note 1. This test item was performed using a loop antenna.

Note 2. This test item was performed at 3 m and the data were extrapolated to the specified measurement distance of 30 m using the square of an inverse linear distance extrapolation factor (40 dB/decade) as specified in §15.31(f)2.

▪ Extrapolation Factor = $20 \log_{10}(30/3)^2 = 40$ dB

Note 3. All data were recorded using a spectrum analyzer employing a peak detector.

If PK results were meet Quasi-peak limit, Quasi-peak measurements were omitted.

Note 4. Sample Calculation.

Margin = Limit – Field Strength @ 30 m / Field Strength @ 30 m = Field Strength @ 3 m – 40 dB

Field Strength @ 3 m = Reading + T.F / T.F = AF + CL – AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

- Minimum Standard: Part 15.225(a), (b), (c)& RSS-210 [B6(a), (b), (c)]

Frequency Band [MHz]	Limit	
	[uV/m]	[dBuV/m]
13.553-13.567	15,848	84.00
13.410-13.553	334	50.47
13.567-13.710		
13.110-13.410	106	40.51
13.710-14.010		

4.2.4 Out-of-band emissions

- Procedure:

The EUT was tested from 9 kHz up to the 1 GHz excluding the band 13.110-14.010 MHz. All measurements were recorded with spectrum analyzer employing a peak detector for emissions below 30 MHz. Above 30 MHz a Quasi-peak detector was used. All out-of-band emissions must not exceed the limits §15.209. A loop antenna was used for searching for emissions below 30 MHz.

- Measurement Data: Comply

Tested Frequency : 13.56 MHz
Measurement Distance : 3 Meters

Frequency [MHz]	EUT Posi.	ANT Pol	Reading [dBuV]	T.F [dB/m]	Distance factor [dB]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
1.469	Y	H	14.7	19.8	40	-5.5	24.3	29.8
40.670	Z	V	40.1	-15.6	N/A	24.5	40.0	15.5
67.709	Z	V	39.5	-22.1	N/A	17.4	40.0	22.6
176.224	X	H	35.2	-19.0	N/A	16.2	43.5	27.3
657.124	Y	V	39.5	-6.9	N/A	32.6	46.0	13.4
711.820	Y	V	36.6	-6.4	N/A	30.2	46.0	15.8

Note 1. All measurements were recorded using a spectrum analyzer employing a peak detector for below 30 MHz and a Quasi-peak detector for above 30 MHz.

Note 2. Both Vertical and Horizontal polarities of the receiver antenna were evaluated with the worst case emissions being reported. For 30 MHz below the loop antenna was rotated about vertical axis.

Note 3. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 4. Sample calculation

$$\text{Margin} = \text{Limit} - \text{Field Strength}$$

$$\text{Field Strength} = \text{Reading} + \text{T.F} - \text{Distance factor}$$

$$\text{T.F} = \text{AF} + \text{CL} - \text{AG}$$

$$\text{Distance factor} = 20\log(\text{Measurement distance} / \text{The measured distance})^2$$

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

- Minimum Standard: Part 15.209, 225(d) & RSS-210[B6(d)], RSS-GEN[8.9]

- FCC Part 15.209(a):

Frequency [MHz]	Field Strength [uV/m]	Measurement Distance [Meters]
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	200	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

- FCC Part 15.209(b):

In the emission table above, the tighter limit applies at the band edges.

4.2.5 Frequency Stability

- Procedure:

Part 15.225 requires that devices operating in the 13.553 – 13.567 MHz shall maintain the carrier frequency within 0.01 % of the operating frequency over the temperature variation of -20 degrees to + 50 degrees C at normal supply voltage.

- Measurement Data: Comply

Operating Frequency : **13,560,000 Hz**

VOLTAGE (%)	POWER (V _{DC})	TEMP (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	3.700	+20(ref)	13,559,667	-333	0.002456
100%		-20	13,559,034	-966	0.007124
100%		-10	13,559,406	-594	0.004381
100%		0	13,559,567	-433	0.003193
100%		+10	13,559,607	-393	0.002898
100%		+20	13,559,667	-333	0.002456
100%		+30	13,559,756	-244	0.001799
100%		+40	13,559,807	-193	0.001423
100%		+50	13,559,910	-90	0.000664
115%	4.255	+20	13,559,965	-35	0.000258
BATT.ENDPOINT	3.400	+20	13,559,843	-157	0.001158

- Minimum Standard: Part 15. 225(e) & RSS-210 [B6]

The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency.

4.2.6 AC Line Conducted Emissions

- Test Requirements and limit

For an intentional radiator that is designed to be connected to the public utility (AC)power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

- Measurement Data: **Comply** (refer to the next page)

Measurement Data

Results of Conducted Emission

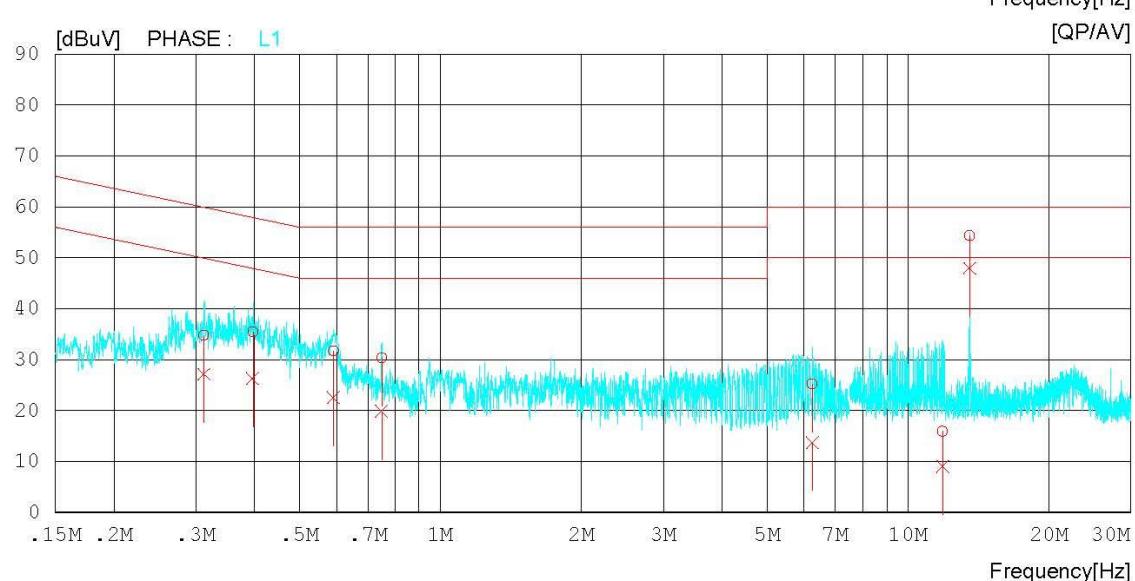
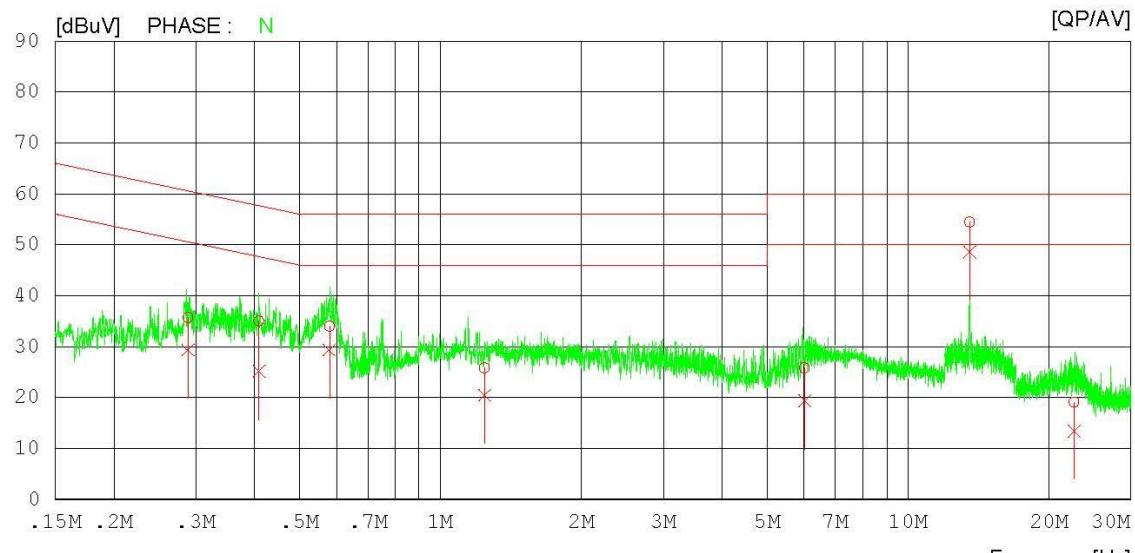
DTNC

Date : 2016-11-16

Order No. : CR4900
Model No. : CR4900
Serial No. : Identical prototype
Test Condition : NFC

Reference No.
Power Supply : 120V 60Hz
Temp/Humi. : 21°C 34% R.H
Operator : J.W.Kim

Memo :

LIMIT : FCC P15.207 QP
FCC P15.207 AV

Measurement Data**Results of Conducted Emission**

DTNC

Date : 2016-11-16

Order No.	:		Referrence No.	:	
Model No.	:	CR4900	Power Supply	:	120V 60Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	21'C 34% R.H
Test Condition	:	NFC	Operator	:	J.W.Kim

Memo :

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN [dBuV]	PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]		
1	0.28827	25.6	19.2	10.1	35.7	29.3	60.6	50.6	24.9	N
2	0.40911	25.0	15.1	10.1	35.1	25.2	57.7	47.7	22.6	N
3	0.57866	23.9	19.2	10.1	34.0	29.3	56.0	46.0	22.0	N
4	1.24240	15.5	10.3	10.2	25.7	20.5	56.0	46.0	30.3	N
5	6.00920	15.3	8.9	10.5	25.8	19.4	60.0	50.0	34.2	N
6	13.55880	43.4	37.5	11.0	54.4	48.5	60.0	50.0	5.6	N
7	22.68540	7.5	1.8	11.6	19.1	13.4	60.0	50.0	40.9	N
8	0.31178	24.6	17.0	10.1	34.7	27.1	59.9	49.9	25.2	L1
9	0.39683	25.4	16.1	10.1	35.5	26.2	57.9	47.9	22.4	L1
10	0.59029	21.6	12.4	10.1	31.7	22.5	56.0	46.0	24.3	L1
11	0.74785	20.1	9.6	10.2	30.3	19.8	56.0	46.0	25.7	L1
12	6.23760	14.7	3.2	10.5	25.2	13.7	60.0	50.0	34.8	L1
13	11.86220	5.1	-1.8	10.8	15.9	9.0	60.0	50.0	44.1	L1
14	13.55960	43.3	36.9	11.0	54.3	47.9	60.0	50.0	5.7	L1

APPENDIX

TEST EQUIPMENT FOR TESTS

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent	N9020A	16/09/09	17/09/09	MY50200834
Dynamic Measurement DC Source	Agilent	66332A	16/09/08	17/09/08	US37473305
Vector Signal Generator	Rohde Schwarz	SMBV100A	16/01/05	17/01/05	255571
DIGITAL MULTIMETER	Agilent	34401A	16/01/05	17/01/05	US36099541
Temp & Humi Test Chamber	SJ Science	SJ-TH-S50	16/09/09	17/09/09	U5542113
Thermohygrometer	BODYCOM	BJ5478	16/04/22	17/04/22	120612-2
Low Noise Pre Amplifier	tsj	MLA-010K01-B01-27	16/03/10	17/03/10	1844539
Loop Antenna	Schwarzbeck	FMZB1513	16/04/22	18/04/22	1513-128
BILOG Antenna	SCHAFFNER	CBL6112B	14/12/10	16/12/10	2737
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESR7	16/02/25	17/02/25	101061
EMI TEST RECEIVER	R&S	ESCI	16/02/25	17/02/25	100364
ARTIFICIAL MAINS NETWORK	Narda S.T.S. / PMM	PMM L2-16B	16/06/22	17/06/22	000WX20305
SINGLE-PHASE MASTER	NF	4420	16/09/08	17/09/08	3049354420023