

FCC Test Report

Report No.: RF180227C14

FCC ID: TM6DTC-CX24G

Test Model: CC-317

Series Model: RS-210C, S319C, Race, Train (Refer to 3.1 for more detail)

Received Date: Feb. 27, 2018

Test Date: Apr. 26, 2018 ~ May 08, 2018

Issued Date: May 08, 2018

Applicant: Direction Technology Co., Ltd

Address: 1F, No. 88-7, Sec.1, Kwang Fu Rd., Sec.1, San Chung

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
(R.O.C)

Test Location: No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City
33383, Taiwan, R.O.C.

**FCC Registration /
Designation Number:** 788550 / TW0003



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Release Control Record

Issue No.	Description	Date Issued
RF180227C14	Original Release	May 08, 2018

1 Certificate of Conformity

Product: Race computer

Brand: Direction

Test Model: CC-317

Series Model: RS-210C, S319C, Race, Train (Refer to 3.1 for more detail)

Sample Status: Engineering Sample

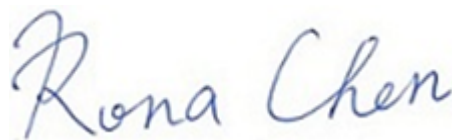
Applicant: Direction Technology Co., Ltd

Test Date: Apr. 26, 2018 ~ May 08, 2018

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.249)
ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan 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 RF characteristics under the conditions specified in this report.

Prepared by :



Date: May 08, 2018

Rona Chen / Specialist

Approved by :



Date: May 08, 2018

Dylan Chiou / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.249)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	N/A	Without AC Power port of the EUT.
15.215 (c)	20dB Bandwidth	PASS	Meet the requirement of limit.
15.209 15.249 15.249 (d)	Radiated Emission Test Band Edge Measurement Limit: 50 dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209	PASS	Meet the requirement of limit. Minimum passing margin is -12.6 dB at 4804 MHz.
15.203	Antenna Requirement	PASS	No antenna connector is used.

N/A: Not Applicable

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	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.44 dB
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Race computer
Brand	Direction
Test Model	CC-317
Series Model	RS-210C, S319C, Race, Train
Status of EUT	Engineering Sample
Power Supply Rating	3.0 Vdc (Battery)
Modulation Type	GFSK
Transfer Rate	2 Mbps
Operating Frequency	2402 MHz
Number of Channel	1 Channel
Antenna Type	Chip antenna with 5 dBi gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. All models are listed as below.

Brand	Model	Description
Direction	RS-210C	All models are electrically identical, different model names are for marketing purpose.
	S319C	
	Race	
	CC-317	
	Train	

2. 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

1 channel is provided to this EUT:

Channel	Freq. (MHz)
1	2402

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE \geq 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where **RE \geq 1G**: Radiated Emission above 1 GHz **RE<1G**: Radiated Emission below 1 GHz
PLC: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.

Radiated Emission Test (Above 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
-	1	1	GFSK

Radiated Emission Test (Below 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Tested Channel	Modulation Technology	Modulation Type
-	1	1	GFSK

Antenna Port Conducted Measurement:

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Tested Channel	Modulation Technology	Modulation Type
-	1	1	GFSK

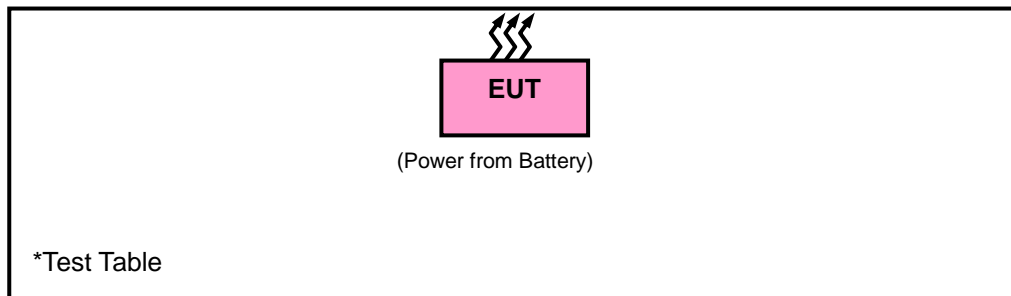
Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE \geq 1G	25 deg. C, 65 % RH	3.0 Vdc	Getaz Yang
RE<1G	25 deg. C, 65 % RH	3.0 Vdc	Getaz Yang
APCM	25 deg. C, 65 % RH	3.0 Vdc	Carlos Chen

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.3.1 Configuration of System under Test



3.4 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:

FCC Part 15, Subpart C (15.249)

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 and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 ~ 928 MHz	50	500
2400 ~ 2483.5 MHz	50	500
5725 ~ 5875 MHz	50	500
24 ~ 24.25 GHz	250	2500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits as below table, whichever is the lesser attenuation

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 1000 MHz, 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
Test Receiver Agilent	N9038A	MY51210203	Mar. 16, 2018	Mar. 15, 2019
Spectrum Analyzer Agilent	N9010A	MY52220314	Nov. 24, 2017	Nov. 23, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Jan. 11, 2018	Jan. 10, 2019
Double Ridge Guide Horn Antenna EMCO	3115	5619	Nov. 30, 2017	Nov. 29, 2018
BILOG Antenna SCHWARZBECK	VULB 9168	9168-153	Dec. 06, 2017	Dec. 05, 2018
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(R FC-SMS-100-SM S-120+RFC-SMS -100-SMS-400)	Jun. 23, 2017	Jun. 22, 2018
Fixed Attenuator	BW-N4W5+	1301	Aug. 14, 2017	Aug. 13, 2018
Preamplifier EMCI	EMC 012645	980115	Oct. 20, 2017	Oct. 19, 2018
Preamplifier EMCI	EMC 184045	980116	Oct. 20, 2017	Oct. 19, 2018
Preamplifier EMCI	EMC 330H	980112	Oct. 13, 2017	Oct. 12, 2018
Power Meter Anritsu	ML2495A	1012010	Aug. 15, 2017	Aug. 14, 2018
Power Sensor Anritsu	MA2411B	1315050	Aug. 15, 2017	Aug. 14, 2018
RF Coaxial Cable HUBER+SUHNNER	EMC104-SM-SM-8 000&3000	140811+170717	Oct. 20, 2017	Oct. 19, 2018
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM- 1000(140807)	Oct. 20, 2017	Oct. 19, 2018
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA
Loop Antenna	EM-6879	269	Aug. 11, 2017	Aug. 10, 2018

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 10.
3. The horn antenna and preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1GHz if tested.
4. The IC Site Registration No. is IC7450F-10.

4.1.3 Test Procedures

For Radiated emission below 30 MHz

- 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. Both 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 9 kHz at frequency below 30 MHz.

For Radiated emission above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) 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 detected 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:

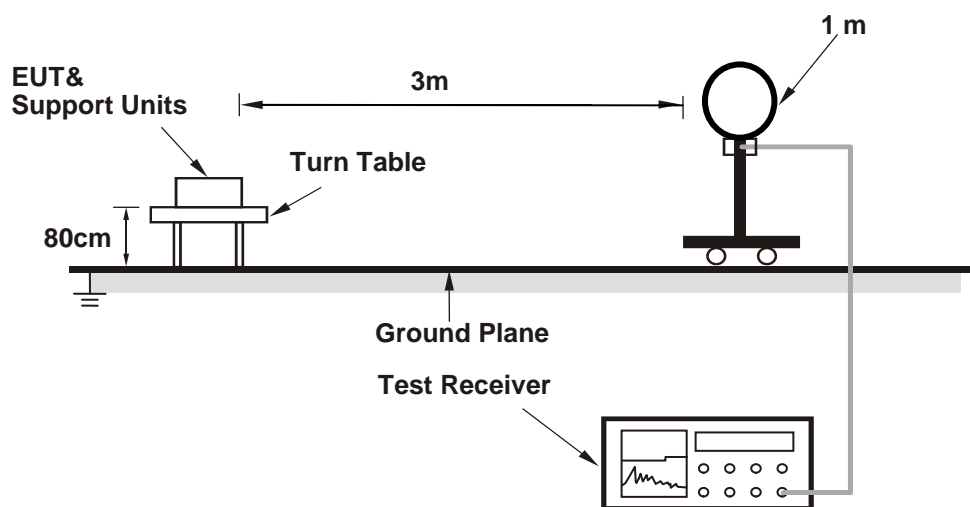
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.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

4.1.4 Deviation from Test Standard

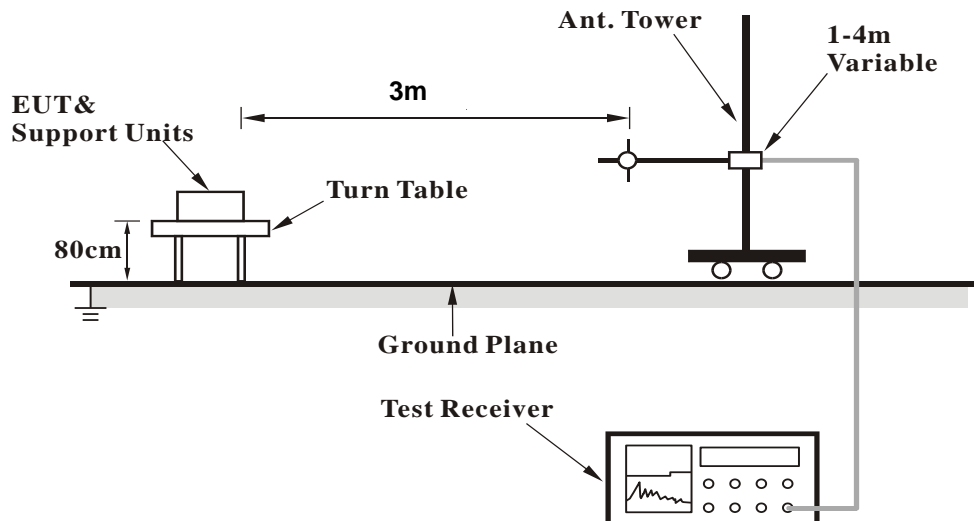
No deviation.

4.1.5 Test Set Up

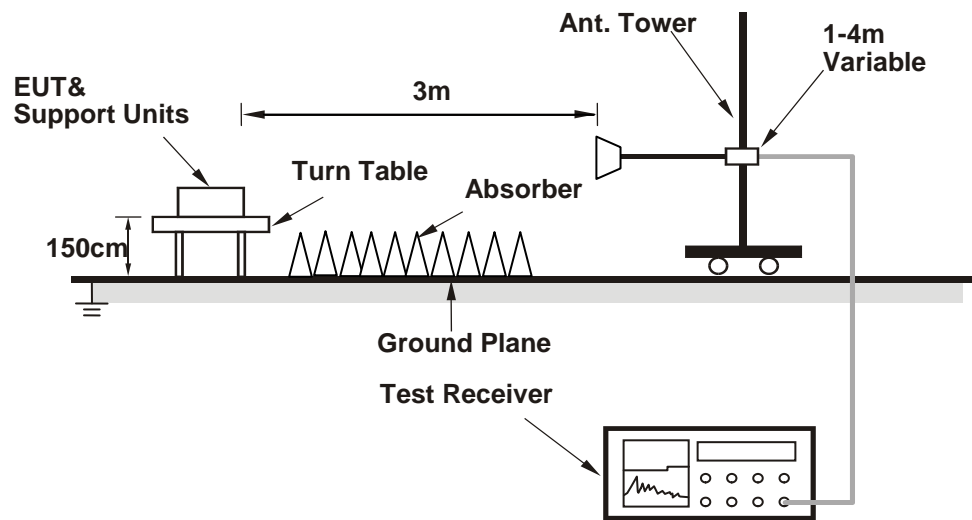
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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

4.1.6 EUT Operating Conditions

Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1 GHz WORST-CASE DATA:

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antenna Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2386.58	41.3	47.28	54	-12.7	27.16	4.36	37.5	213	360	Average
2386.58	53.72	59.7	74	-20.28	27.16	4.36	37.5	213	360	Peak
2402	75.92	81.91	94	-18.08	27.16	4.37	37.52	213	360	Average
2402	88.34	94.33	114	-25.66	27.16	4.37	37.52	213	360	Peak
4804	41.4	56.37	54	-12.6	31.14	6.79	52.9	157	154	Average
4804	53.82	68.79	74	-20.18	31.14	6.79	52.9	157	154	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2389.94	40.72	46.72	54	-13.28	27.16	4.36	37.52	129	92	Average
2389.94	53.14	59.14	74	-20.86	27.16	4.36	37.52	129	92	Peak
2402	75.78	82.02	94	-18.22	26.91	4.37	37.52	129	92	Average
2402	88.2	94.44	114	-25.8	26.91	4.37	37.52	129	92	Peak
4804	41.04	56.21	54	-12.96	31.14	6.79	53.1	144	79	Average
4804	53.46	68.63	74	-20.54	31.14	6.79	53.1	144	79	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:

$$20 \log (\text{Duty cycle}) = 20 \log (0.92 \text{ ms} / 0.26 \text{ ms}) = -12.42 \text{ dB}$$
Please refer to the plotted duty

Below 1 GHz WORST-CASE DATA:

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

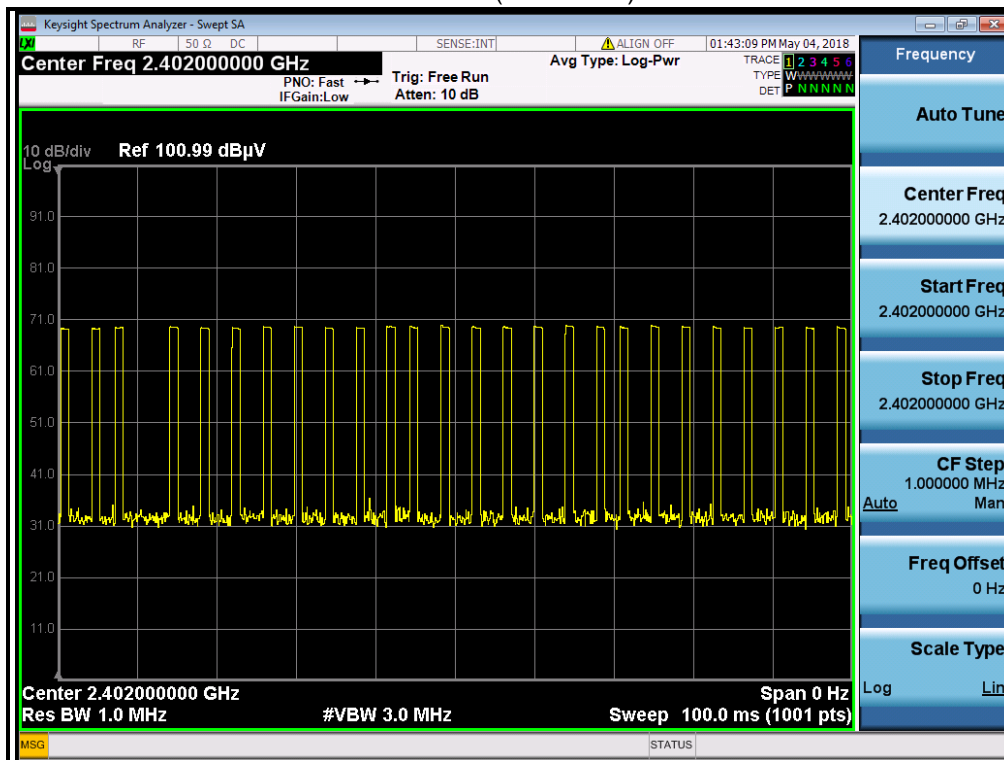
Antenna Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
36.79	16.81	34.27	40	-23.19	13.09	0.48	31.03	102	231	Peak
116.33	15.6	36.01	43.5	-27.9	10.65	0.82	31.88	111	165	Peak
189.08	15.9	36.3	43.5	-27.6	10.12	1.17	31.69	152	236	Peak
642.07	25.32	34.2	46	-20.68	20.12	3.08	32.08	111	321	Peak
860.32	28.38	33.39	46	-17.62	23	3.89	31.9	185	265	Peak
966.05	29.6	33.31	54	-24.4	23.88	4.3	31.89	145	251	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
43.58	25.04	42.06	40	-14.96	13.59	0.5	31.11	165	253	Peak
113.42	18.08	38.76	43.5	-25.42	10.37	0.81	31.86	111	147	Peak
503.36	21.17	32.85	46	-24.83	17.4	2.53	31.61	251	256	Peak
585.81	23.52	33.53	46	-22.48	19.28	2.84	32.13	123	256	Peak
867.11	28.99	33.96	46	-17.01	23.09	3.92	31.98	111	165	Peak
946.65	29.28	33.15	46	-16.72	23.77	4.21	31.85	102	236	Peak

Remarks:

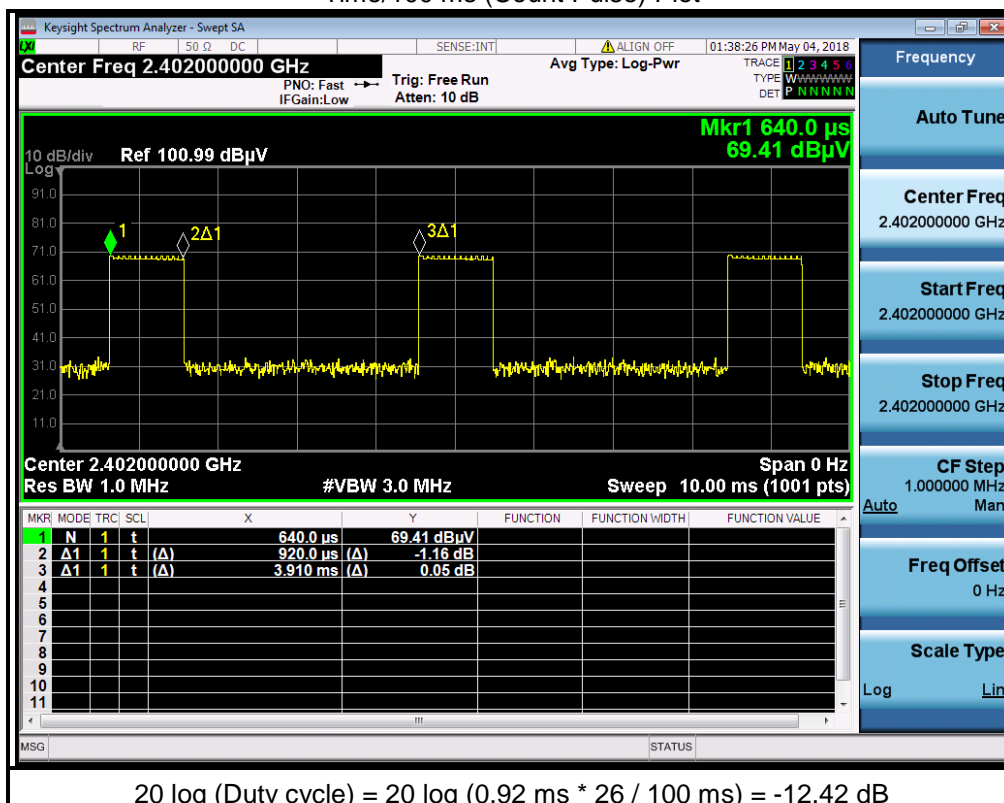
- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log (0.92 \text{ ms} / 0.26 \text{ ms}) = -12.42 \text{ dB}$
Please refer to the plotted duty

<Duty Cycle Correction Factor>

Time/100 ms (One Pulse) Plot



Time/100 ms (Count Pulse) Plot



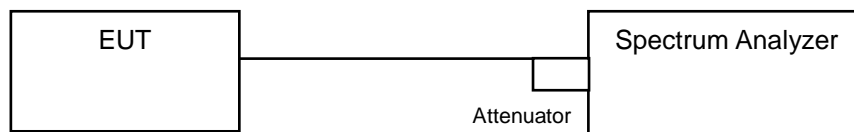
$$20 \log (\text{Duty cycle}) = 20 \log (0.92 \text{ ms} * 26 / 100 \text{ ms}) = -12.42 \text{ dB}$$

4.2 20 dB Bandwidth Measurement

4.2.1 Limits of 20 dB Bandwidth Measurement

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedure

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

4.2.5 Deviation from Test Standard

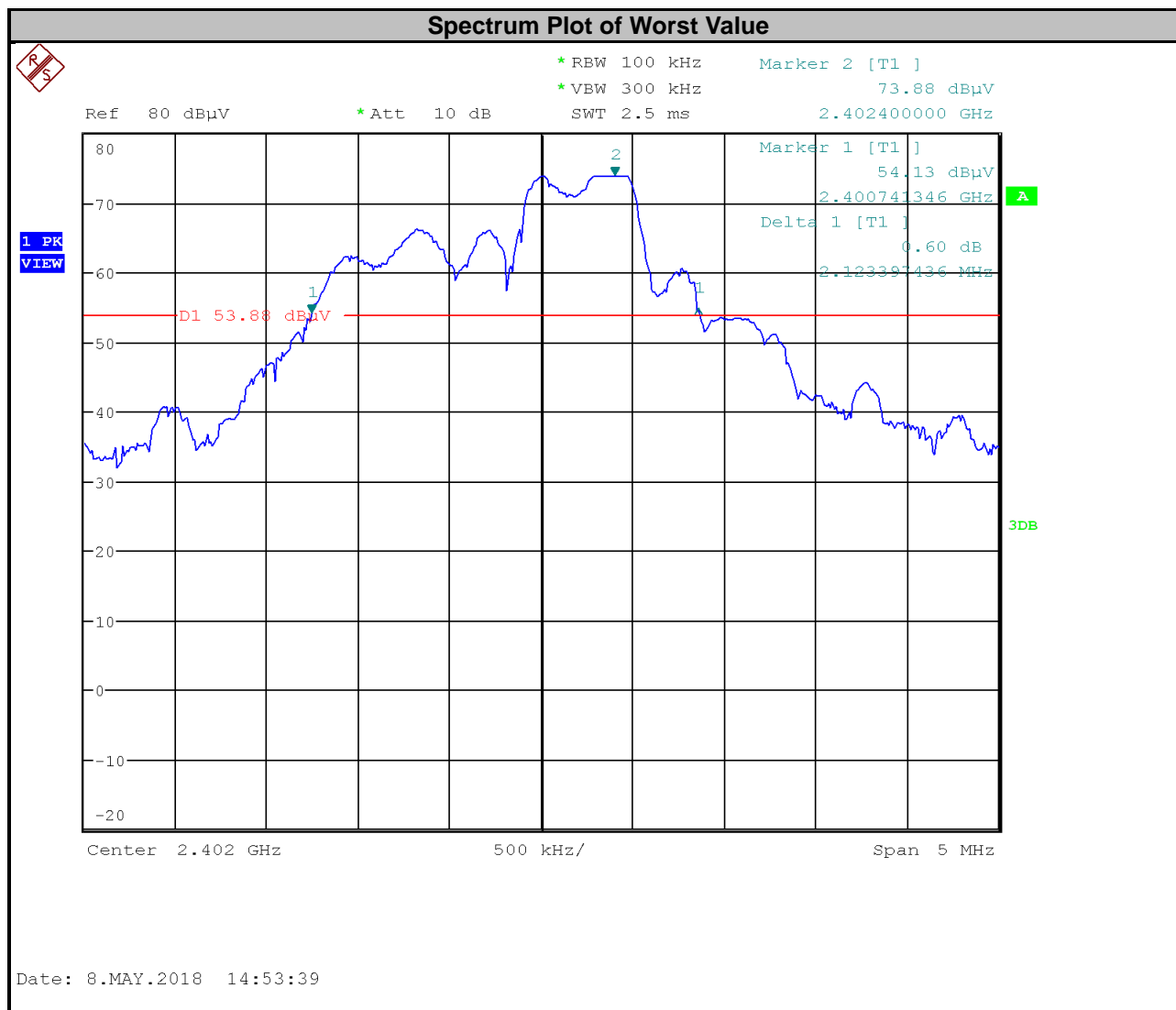
No deviation.

4.2.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at channel frequencies individually.

4.2.7 Test Result

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	Pass / Fail
1	2402	2.123397436	Pass



5 Pictures of Test Arrangements

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

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

--- END ---