

FCC REPORT

(Bluetooth)

Applicant: Aratek Biometrics Co., Ltd.

Address of Applicant: 2F, T2-A Building, ShenZhen Software Park South Area, Hi-Tech Park

Equipment Under Test (EUT)

Product Name: Automated Election Device

Model No.: VC33, BD1300

Trade mark: Aratek

FCC ID: 2AGUJ-VC331

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Date of sample receipt: 12 Jan., 2022

Date of Test: 13 Jan., to 13 Feb., 2022

Date of report issued: 22 Feb., 2022

Test Result: PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the JYT product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	14 Feb., 2022	Original
01	22 Feb., 2022	add model

Tested by:

Mike.ou

Test Engineer

Date:

22 Feb., 2022

Reviewed by:

Winner Zhang

Project Engineer

Date:

22 Feb., 2022

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4 Test Summary

Test Items	Section in CFR 47	Test Data	Result
Antenna Requirement	15.203 & 15.247 (b)	See Section 6.1	Pass
AC Power Line Conducted Emission	15.207	See Section 6.2	Pass
Conducted Peak Output Power	15.247 (b)(1)	Appendix A – BT	Pass
20dB Occupied Bandwidth	15.247 (a)(1)	Appendix A – BT	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Appendix A – BT	Pass
Hopping Channel Number	15.247 (a)(1)	Appendix A – BT	Pass
Dwell Time	15.247 (a)(1)	Appendix A – BT	Pass
Conducted Band Edge	15.205 & 15.209	Appendix A – BT	Pass
Radiated Band Edge		See Section 6.9.2	Pass
Conducted Spurious Emission	15.247(d)	Appendix A – BT	Pass
Radiated Spurious Emission		See Section 6.10.2	Pass
Remark: 1. Pass: The EUT complies with the essential requirements in the standard. 2. The cable insertion loss used by “RF Output Power” and other conduction measurement items is 0.5dB (provided by the customer).			
Test Method:	ANSI C63.10-2013 KDB 558074 D01 15.247 Meas Guidance v05r02		

5 General Information

5.1 Client Information

Applicant:	Aratek Biometrics Co., Ltd.
Address:	2F, T2-A Building, ShenZhen Software Park South Area, Hi-Tech Park
Manufacturer:	Aratek Biometrics Co., Ltd.
Address:	2F, T2-A Building, ShenZhen Software Park South Area, Hi-Tech Park
Factory:	Aratek Biometrics Co., Ltd.
Address:	Block 4, 1st Industrial Park of Nan Gang, 1029# Song Bai Road of Bai Mang, Nan Shan District, Shenzhen 518055, China.

5.2 General Description of E.U.T.

Product Name:	Automated Election Device
Model No.:	VC33, BD1300
Operation Frequency:	2402MHz~2480MHz
Transfer rate:	1/2/3 Mbits/s
Number of channel:	79
Modulation type:	GFSK, $\pi/4$ -DQPSK, 8DPSK
Modulation technology:	FHSS
Antenna Type:	Internal Antenna
Antenna gain:	1.3 dBi
Power supply:	Rechargeable Li-ion Battery DC11.1V, 13Ah
AC adapter:	Model: AK120WG-2400500W2 Input: AC100-240V, 50/60Hz, 2.0A Output: DC 24.0V, 5.0A
Remark:	Model No.: VC331, BD1300 were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being model name.
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

Operation Frequency each of channel for GFSK, $\pi/4$ -DQPSK, 8DPSK							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz
...	...	...	...	...	...	...	...
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz
16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz
17	2419MHz	37	2439MHz	57	2459MHz	77	2479MHz
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz		
Remark: Channel 0, 39 & 78 selected for GFSK, $\pi/4$ -DQPSK and 8DPSK.							

5.3 Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test Modes:	
Non-hopping mode:	Keep the EUT in continuous transmitting mode with worst case data rate.
Hopping mode:	Keep the EUT in hopping mode.
Remark	GFSK (1 Mbps) is the worst case mode.

Radiated Emission: The sample was placed 0.8m (below 1GHz)/1.5m (above 1GHz) above the ground plane of 3m chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

5.4 Description of Support Units

The EUT has been tested as an independent unit.

5.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Conducted Emission (9kHz ~ 150KHz) for V-AMN	3.11 dB
Conducted Emission (150kHz ~ 30MHz) for V-AMN	2.62 dB
Radiated Emission (9kHz ~ 30MHz electric field) for 3m SAC	3.13 dB
Radiated Emission (9kHz ~ 30MHz magnetic field) for 3m SAC	3.13 dB
Radiated Emission (30MHz ~ 1GHz) for 3m SAC	4.45 dB
Radiated Emission (1GHz ~ 18GHz) for 3m SAC	5.34 dB
Radiated Emission (18GHz ~ 40GHz) for 3m SAC	5.34 dB
Radiated Emission (30MHz ~ 1GHz) for 10m SAC	4.32 dB

5.6 Additions to, deviations, or exclusions from the method

No

5.7 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

● **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

● **CNAS - Registration No.: CNAS L15527**

JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527.

● **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: <https://portal.a2la.org/scopepdf/4346-01.pdf>

5.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.

Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.

Tel: +86-755-23118282, Fax: +86-755-23116366

Email: info-JYTee@lets.com, Website: <http://jyt.lets.com>

5.9 Test Instruments list

Radiated Emission(Above 1GHz):					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
3m SAC	ETS	RFD-100	Q1984	04-14-2021	04-13-2024
BiConiLog Antenna	SCHWARZBECK	VULB9163	9163-1246	03-07-2021	03-06-2022
Biconical Antenna	SCHWARZBECK	VUBA 9117	9117#359	06-17-2021	06-17-2022
Horn Antenna	SCHWARZBECK	BBHA9120D	912D-916	03-07-2021	03-06-2022
Broad-Band Horn Antenna	SCHWARZBECK	BBHA9170	1067	04-02-2021	04-01-2022
Broad-Band Horn Antenna	SCHWARZBECK	BBHA9170	1068	04-02-2021	04-01-2022
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-03-2021	03-02-2022
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-03-2021	03-02-2022
Spectrum analyzer	Keysight	N9010B	MY60240202	10-27-2021	10-26-2022
Low Pre-amplifier	SCHWARZBECK	BBV9743B	00305	03-07-2021	03-06-2022
High Pre-amplifier	SKET	LNPA_0118G-50	MF280208233	03-07-2021	03-06-2022
Cable	Qualwave	JYT3M-1G-NN-8M	JYT3M-1	03-07-2021	03-06-2022
Cable	Qualwave	JYT3M-18G-NN-8M	JYT3M-2	03-07-2021	03-06-2022
Cable	Qualwave	JYT3M-1G-BB-5M	JYT3M-3	03-07-2021	03-06-2022
Cable	Bost	JYT3M-40G-SS-8M	JYT3M-4	04-02-2021	04-01-2022
EMI Test Software	Tonscend	TS+	Version:3.0.0.1		

Radiated Emission(Below 1GHz):					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
10m SAC	ETS	RFSD-100-F/A	Q2005	04-28-2021	04-27-2024
BiConiLog Antenna	SCHWARZBECK	VULB 9168	1249	04-02-2021	04-01-2022
BiConiLog Antenna	SCHWARZBECK	VULB 9168	1250	04-02-2021	04-01-2022
EMI Test Receiver	R&S	ESR 3	102800	04-08-2021	04-07-2022
EMI Test Receiver	R&S	ESR 3	102802	04-08-2021	04-07-2022
Low Pre-amplifier	Bost	LNA 0920N	2016	04-06-2021	04-05-2022
Low Pre-amplifier	Bost	LNA 0920N	2019	04-06-2021	04-05-2022
Cable	Bost	JYT10M-1G-NN-10M	JYT10M-1	04-02-2021	04-01-2022
Cable	Bost	JYT10M-1G-NN-10M	JYT10M-2	04-02-2021	04-01-2022
Test Software	R&S	EMC32	Version: 10.50.40		

Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESCI 3	101189	03-03-2021	03-02-2022
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	03-18-2021	03-17-2022
LISN	Rohde & Schwarz	ESH3-Z5	843862/010	06-18-2020	06-17-2022
RF Switch	TOP PRECISION	RSU0301	N/A	03-03-2021	03-02-2022
Cable	Bost	JYTCE-1G-NN-2M	JYTCE-1	03-03-2021	03-02-2022
Cable	Bost	JYTCE-1G-BN-3M	JYTCE-2	03-03-2021	03-02-2022
EMI Test Software	AUDIX	E3	Version: 6.110919b		

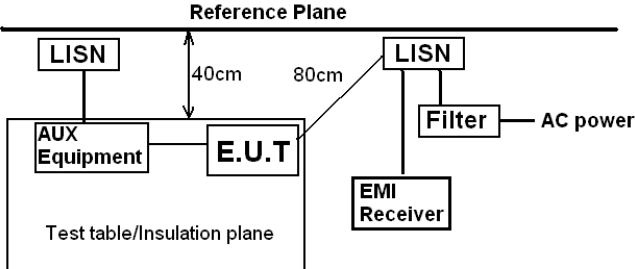
Conducted method:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Spectrum Analyzer	Keysight	N9010B	MY60240202	10-27-2021	10-26-2022
Vector Signal Generator	Keysight	N5182B	MY59101009	10-27-2021	10-26-2022
Analog Signal Generator	Keysight	N5173B	MY59100765	10-27-2021	10-26-2022
Power Detector Box	MWRF-test	MW100-PSB	MW201020JYT	11-19-2021	11-18-2022
Simulated Station	Rohde & Schwarz	CMW270	102335	10-27-2021	10-26-2022
RF Control Box	MWRF-test	MW100-RFCB	MW200927JYT	N/A	N/A
PDU	MWRF-test	XY-G10	N/A	N/A	N/A
DC Power Supply	Keysight	E3642A	MY60296194	11-27-2020	11-26-2023
Temperature Humidity Chamber	Deli	8840	N/A	03-08-2021	03-07-2022
Test Software	MWRF-tes	MTS 8310	Version: 2.0.0.0		

6 Test results and measurement data

6.1 Antenna Requirement

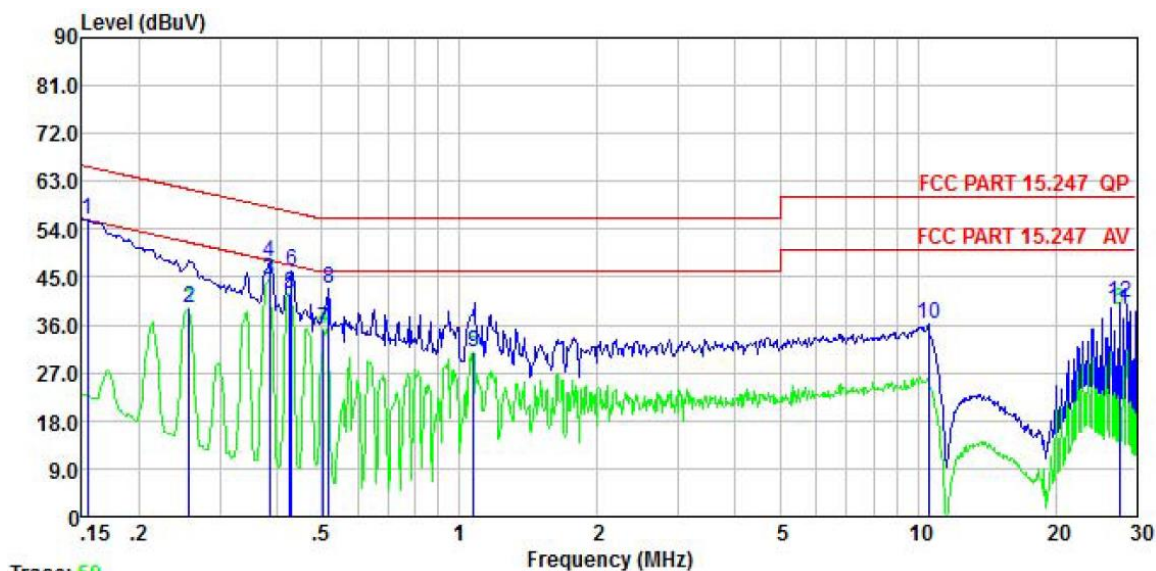
Standard requirement:	FCC Part 15 C Section 15.203 & 247(b)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(b) (4) requirement: (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
E.U.T Antenna:	
The Bluetooth antenna is an Internal antenna which permanently attached, and the best case gain of the antenna is 1.3 dBi.	

6.2 Conducted Emissions

Test Requirement:	FCC Part 15 C Section 15.207		
Test Frequency Range:	150 kHz to 30 MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto		
Limit:	Frequency range (MHz)	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.			
Test setup:	 Remark E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m		
Test procedure:	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10(latest version) on conducted measurement.		
Test Instruments:	Refer to section 5.9 for details		
Test mode:	Hopping mode		
Test results:	Pass		

Measurement Data:

Product name:	Automated Election Device	Product model:	VC331
Test by:	Mike	Test mode:	BT Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5°C Humi: 55%

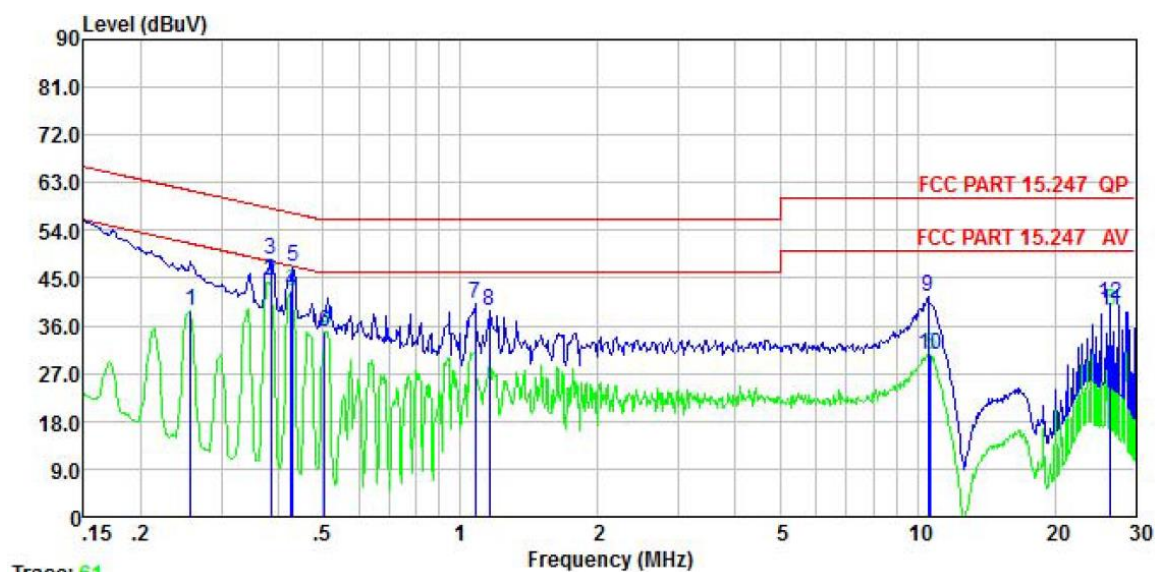


	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.154	55.81	0.04	0.01	55.86	65.78	-9.92	QP
2	0.258	39.29	0.04	0.01	39.34	51.51	-12.17	Average
3	0.385	44.47	0.04	0.03	44.54	48.17	-3.63	Average
4	0.385	47.62	0.04	0.03	47.69	58.17	-10.48	QP
5	0.426	41.78	0.04	0.03	41.85	47.33	-5.48	Average
6	0.431	46.16	0.04	0.03	46.23	57.24	-11.01	QP
7	0.505	35.18	0.04	0.03	35.25	46.00	-10.75	Average
8	0.518	42.68	0.04	0.03	42.75	56.00	-13.25	QP
9	1.071	30.81	0.05	0.07	30.93	46.00	-15.07	Average
10	10.564	35.71	0.22	0.12	36.05	60.00	-23.95	QP
11	27.562	38.29	0.38	0.19	38.86	50.00	-11.14	Average
12	27.562	39.52	0.38	0.19	40.09	60.00	-19.91	QP

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

Product name:	Automated Election Device	Product model:	VC331
Test by:	Mike	Test mode:	BT Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5℃ Humi: 55%



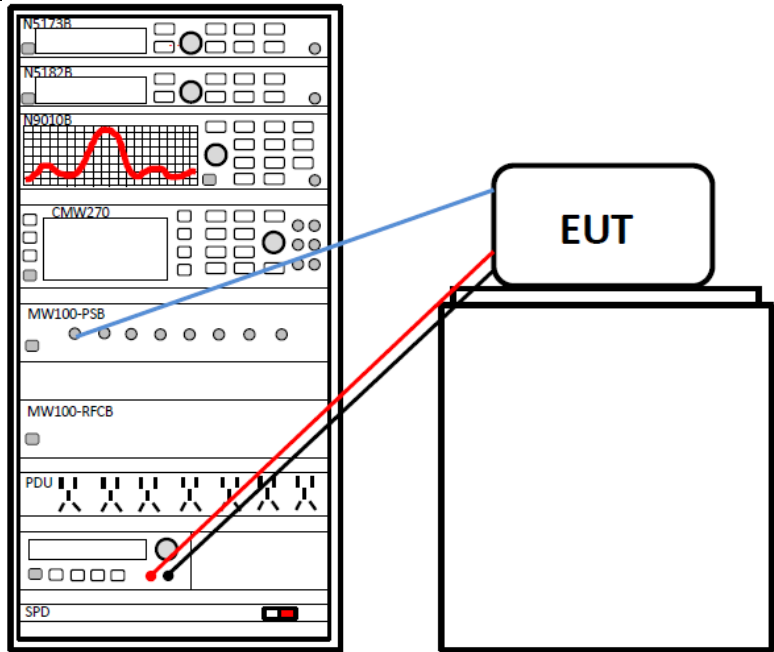
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	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.258	38.70	0.04	0.01	38.75	51.51	-12.76	Average
2	0.385	44.42	0.04	0.03	44.49	48.17	-3.68	Average
3	0.385	48.44	0.04	0.03	48.51	58.17	-9.66	QP
4	0.426	42.59	0.04	0.03	42.66	47.33	-4.67	Average
5	0.431	47.15	0.04	0.03	47.22	57.24	-10.02	QP
6	0.505	34.96	0.04	0.03	35.03	46.00	-10.97	Average
7	1.077	40.12	0.05	0.07	40.24	56.00	-15.76	QP
8	1.160	38.81	0.05	0.08	38.94	56.00	-17.06	QP
9	10.564	41.09	0.20	0.12	41.41	60.00	-18.59	QP
10	10.676	30.24	0.20	0.12	30.56	50.00	-19.44	Average
11	26.418	38.13	0.37	0.21	38.71	50.00	-11.29	Average
12	26.418	39.61	0.37	0.21	40.19	60.00	-19.81	QP

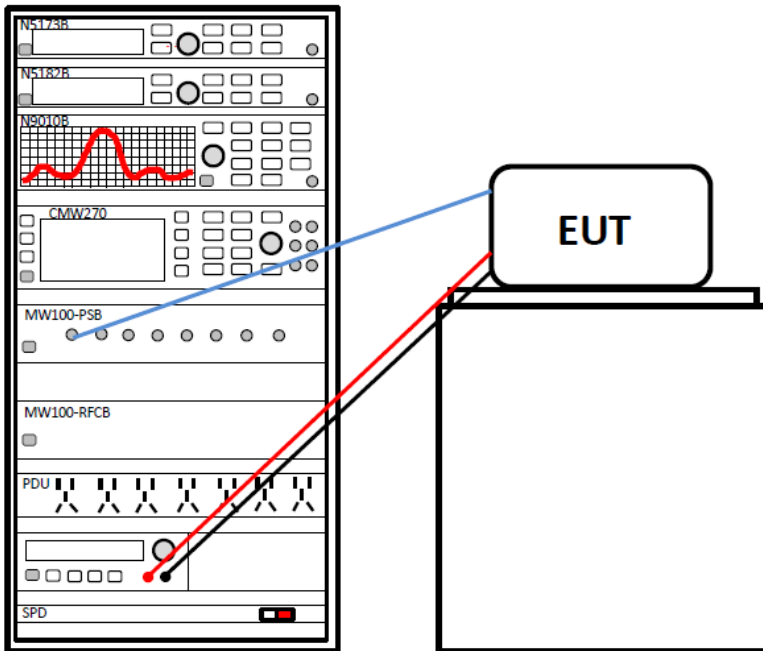
Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

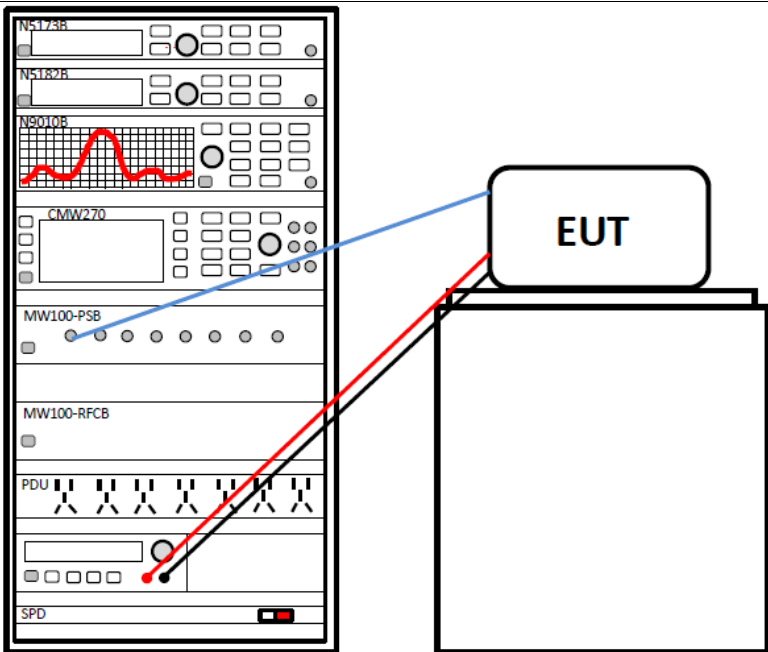
6.3 Conducted Output Power

Test Requirement:	FCC Part 15 C Section 15.247 (b)(1)
Receiver setup:	RBW=1MHz, VBW=3MHz, Detector=Peak (If 20dB BW ≤1 MHz) RBW=2MHz, VBW=6MHz, Detector=Peak (If 20dB BW > 1 MHz and < 3MHz)
Limit:	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Non-hopping mode
Test results:	Pass
Measurement Data:	Refer to Appendix A - BT

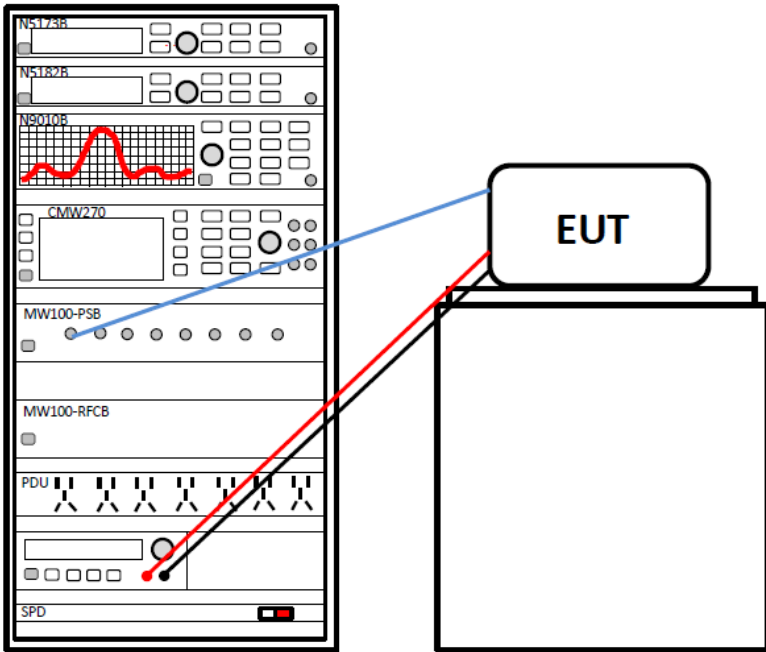
6.4 20dB Occupy Bandwidth

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Receiver setup:	DH1: RBW=15 kHz, VBW=47 kHz, detector=Peak 2DH1&3DH: RBW=20 kHz, VBW=62 kHz, detector=Peak
Limit:	Within authorization band
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Non-hopping mode
Test results:	Pass
Measurement Data:	Refer to Appendix A - BT

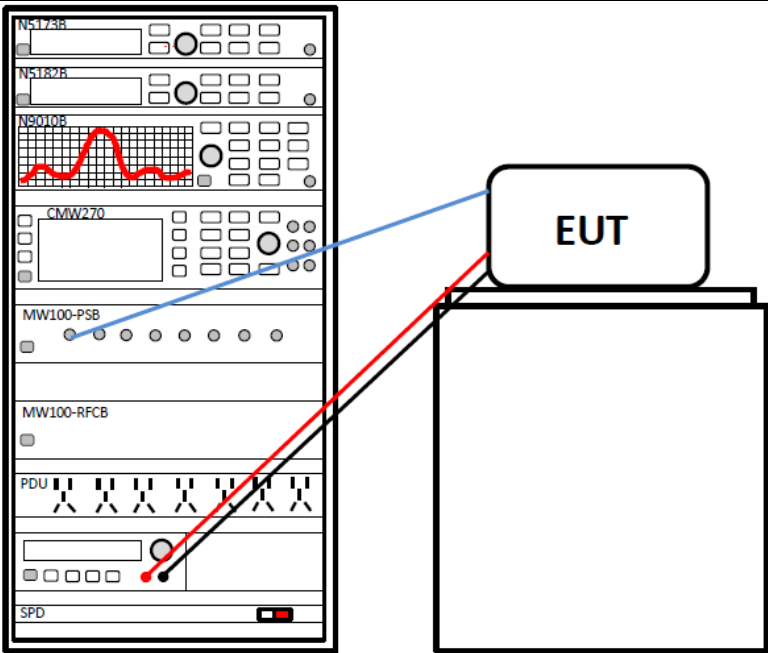
6.5 Carrier Frequencies Separation

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Receiver setup:	RBW=300 kHz, VBW=1 MHz, detector=Peak
Limit:	a) 0.025MHz or the 20dB bandwidth (whichever is greater) b) 0.025MHz or two-thirds of the 20dB bandwidth (whichever is greater)
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Hopping mode
Test results:	Pass
Measurement Data:	Refer to Appendix A - BT

6.6 Hopping Channel Number

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Receiver setup:	RBW=100 kHz, VBW=300 kHz, Center Frequency=2441MHz, Frequency Range: 2400MHz~2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Hopping mode
Test results:	Pass
Measurement Data:	Refer to Appendix A - BT

6.7 Dwell Time

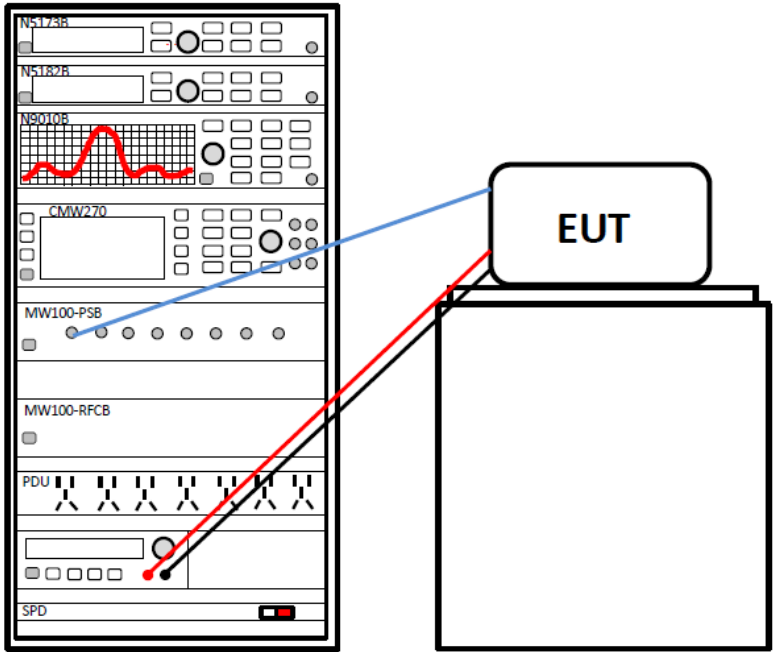
Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Receiver setup:	RBW=1 MHz, VBW=1 MHz, Span=0 Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Hopping mode
Test results:	Pass
Measurement Data:	Refer to Appendix A - BT

6.8 Pseudorandom Frequency Hopping Sequence

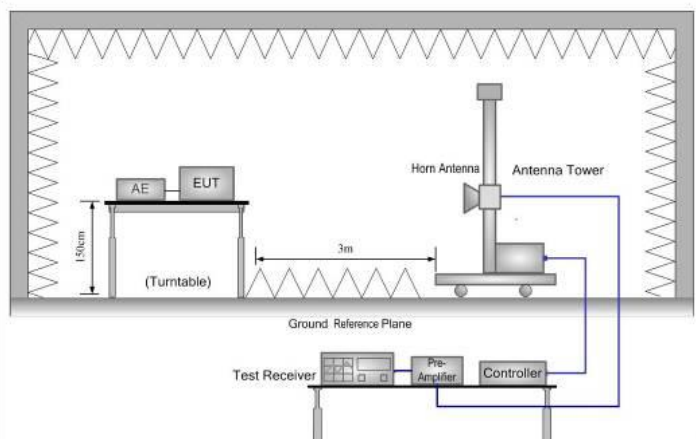
Test Requirement:	FCC Part 15 C Section 15.247 (a)(1) requirement:
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.	
EUT Pseudorandom Frequency Hopping Sequence	
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones. • Number of shift register stages: 9 • Length of pseudo-random sequence: $2^9 - 1 = 511$ bits • Longest sequence of zeros: 8 (non-inverted signal) <i>Linear Feedback Shift Register for Generation of the PRBS sequence</i> An example of Pseudorandom Frequency Hopping Sequence as follow: Each frequency used equally on the average by each transmitter. The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.	

6.9 Band Edge

6.9.1 Conducted Emission Method

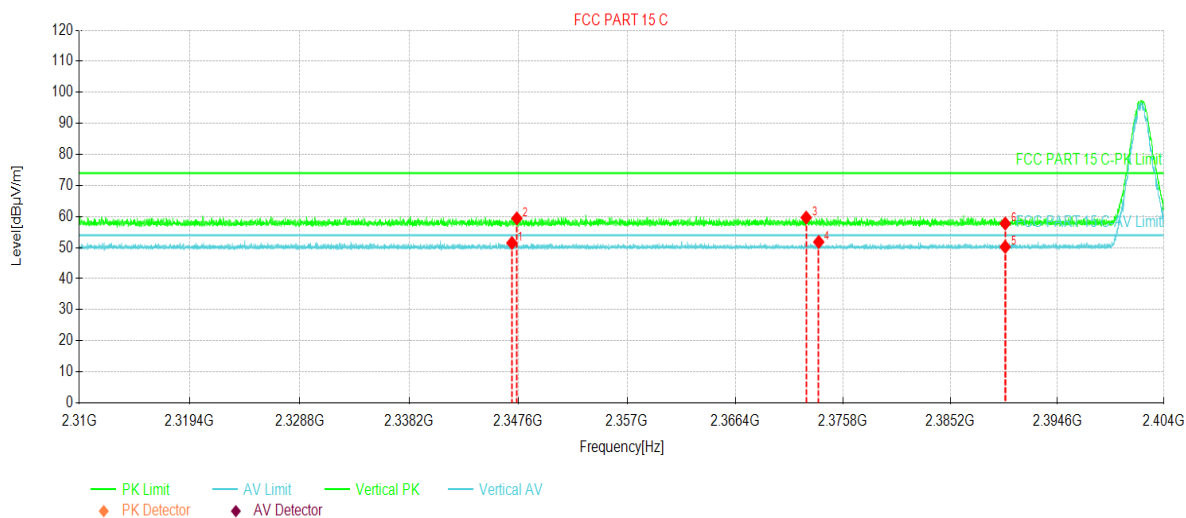
Test Requirement:	FCC Part 15 C Section 15.247 (d)
Receiver setup:	RBW=100 kHz, VBW=300 kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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.
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Non-hopping mode and hopping mode
Test results:	Pass
Measurement Data:	Refer to Appendix A - BT

6.9.2 Radiated Emission Method

Test Requirement:	FCC Part 15 C Section 15.209 and 15.205				
Test Frequency Range:	2310 MHz to 2390 MHz and 2483.5 MHz to 2500 MHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	Above 1GHz		54.00		Average Value
			74.00		Peak Value
Test setup:					
Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height 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. 4. 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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.				
Test Instruments:	Refer to section 5.9 for details				
Test mode:	Non-hopping mode				
Test results:	Passed				

GFSK Mode:

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%

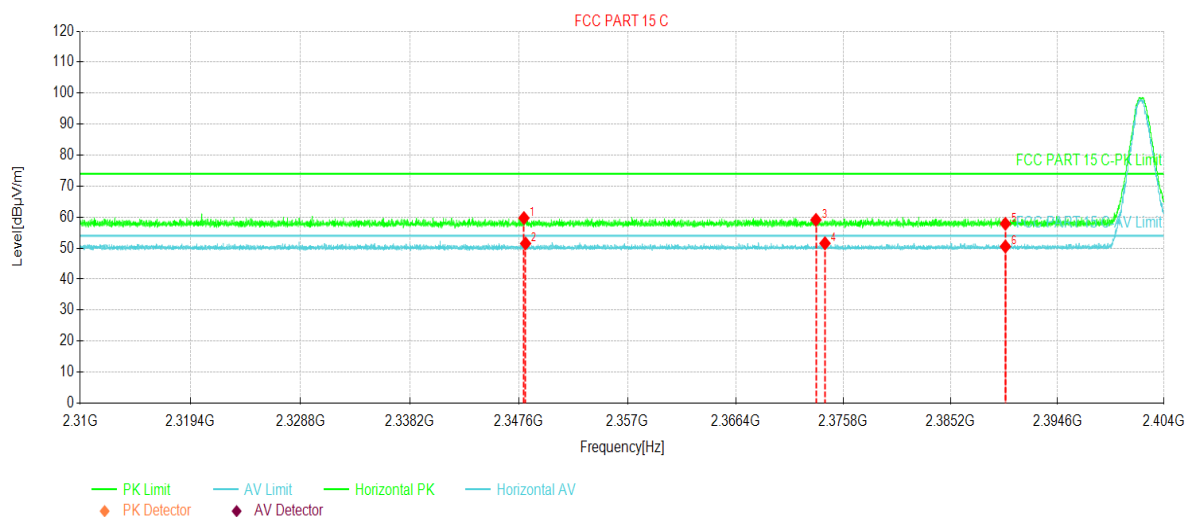


NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2347.04	15.96	51.49	35.53	54.00	2.51	AV	Vertical
2	2347.47	23.88	59.42	35.54	74.00	14.58	PK	Vertical
3	2372.58	23.95	59.67	35.72	74.00	14.33	PK	Vertical
4	2373.67	16.10	51.82	35.72	54.00	2.18	AV	Vertical
5	2390.00	14.39	50.23	35.84	54.00	3.77	AV	Vertical
6	2390.00	21.93	57.77	35.84	74.00	16.23	PK	Vertical

Remark:

- Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%

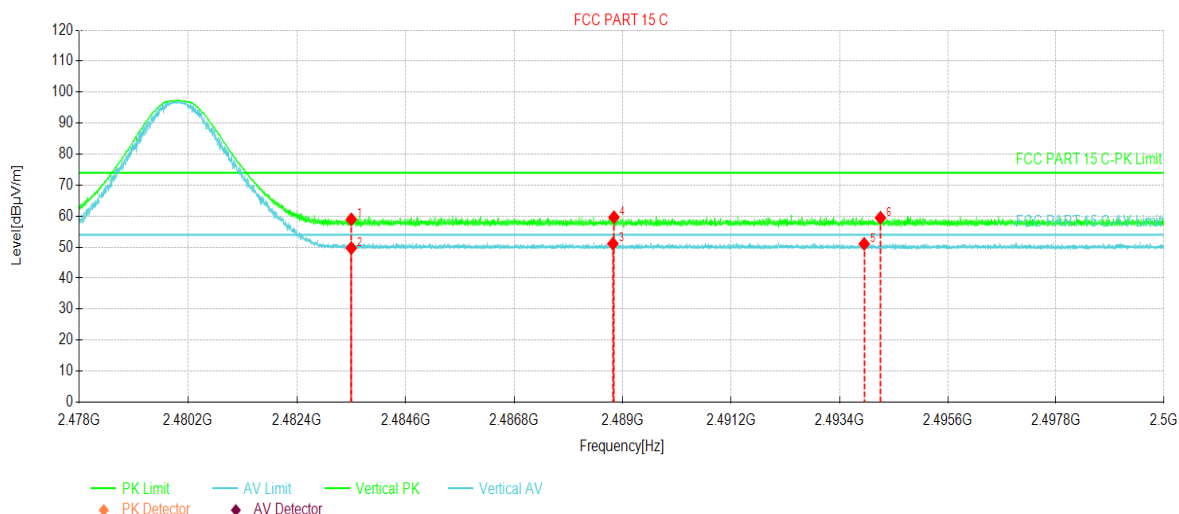


NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Factor [dB]	Limit [dBuV/m]	Margin [dB]	Trace	Polarity
1	2348.03	24.18	59.72	35.54	74.00	14.28	PK	Horizontal
2	2348.17	15.96	51.50	35.54	54.00	2.50	AV	Horizontal
3	2373.40	23.41	59.13	35.72	74.00	14.87	PK	Horizontal
4	2374.19	15.83	51.56	35.73	54.00	2.44	AV	Horizontal
5	2390.00	22.02	57.86	35.84	74.00	16.14	PK	Horizontal
6	2390.00	14.69	50.53	35.84	54.00	3.47	AV	Horizontal

Remark:

1. Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%

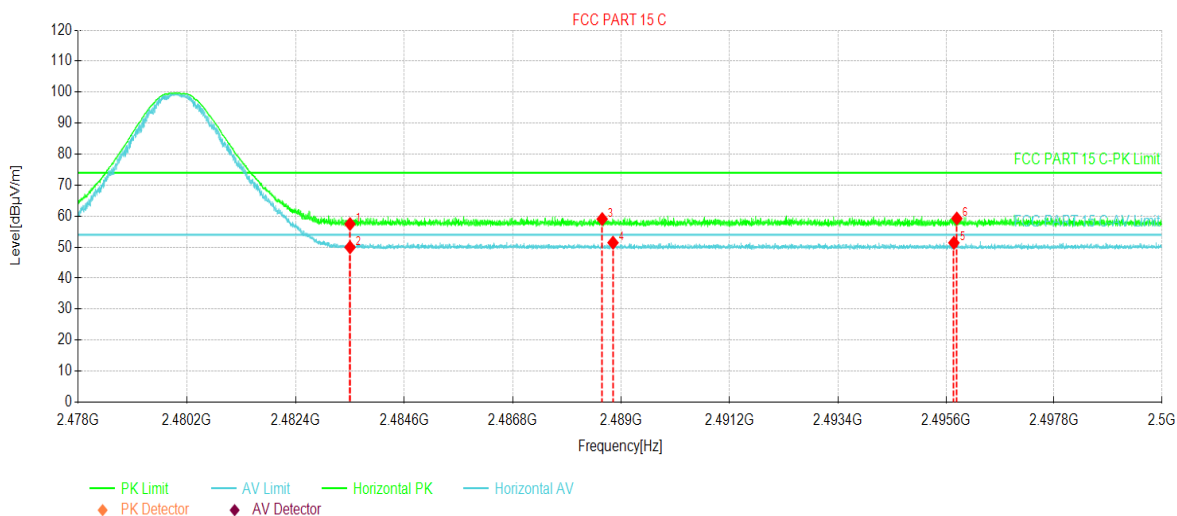


NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2483.50	23.23	58.95	35.72	74.00	15.05	PK	Vertical
2	2483.50	13.98	49.70	35.72	54.00	4.30	AV	Vertical
3	2488.79	15.40	51.11	35.71	54.00	2.89	AV	Vertical
4	2488.82	23.93	59.64	35.71	74.00	14.36	PK	Vertical
5	2493.90	15.36	51.05	35.69	54.00	2.95	AV	Vertical
6	2494.23	23.76	59.45	35.69	74.00	14.55	PK	Vertical

Remark:

- Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%



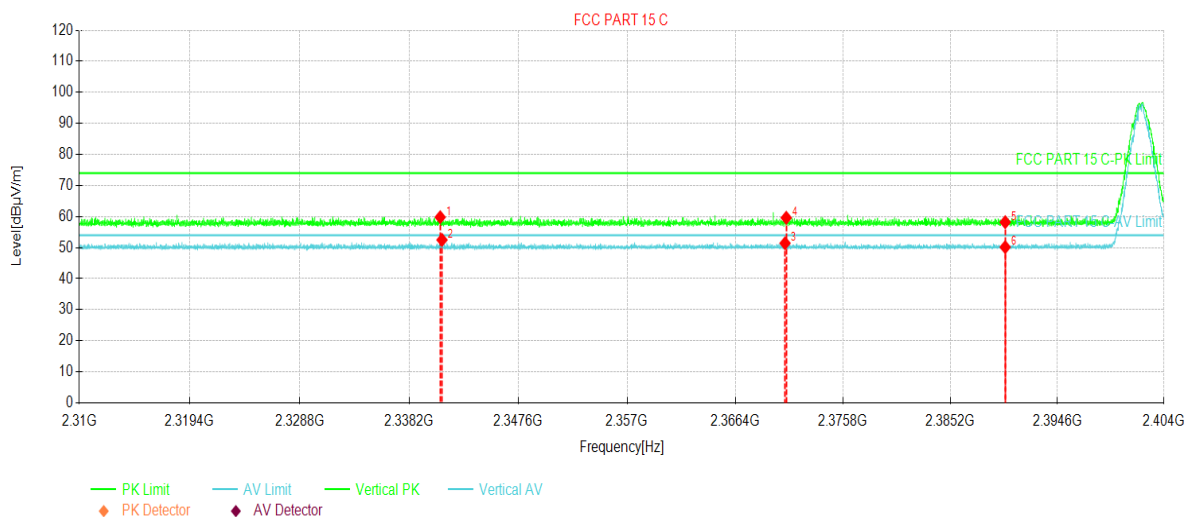
NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Factor [dB]	Limit [dBuV/m]	Margin [dB]	Trace	Polarity
1	2483.50	21.74	57.46	35.72	74.00	16.54	PK	Horizontal
2	2483.50	14.23	49.95	35.72	54.00	4.05	AV	Horizontal
3	2488.61	23.35	59.06	35.71	74.00	14.94	PK	Horizontal
4	2488.83	15.72	51.43	35.71	54.00	2.57	AV	Horizontal
5	2495.75	15.71	51.40	35.69	54.00	2.60	AV	Horizontal
6	2495.82	23.56	59.25	35.69	74.00	14.75	PK	Horizontal

Remark:

- Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

$\pi/4$ -DQPSK mode

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	2DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%

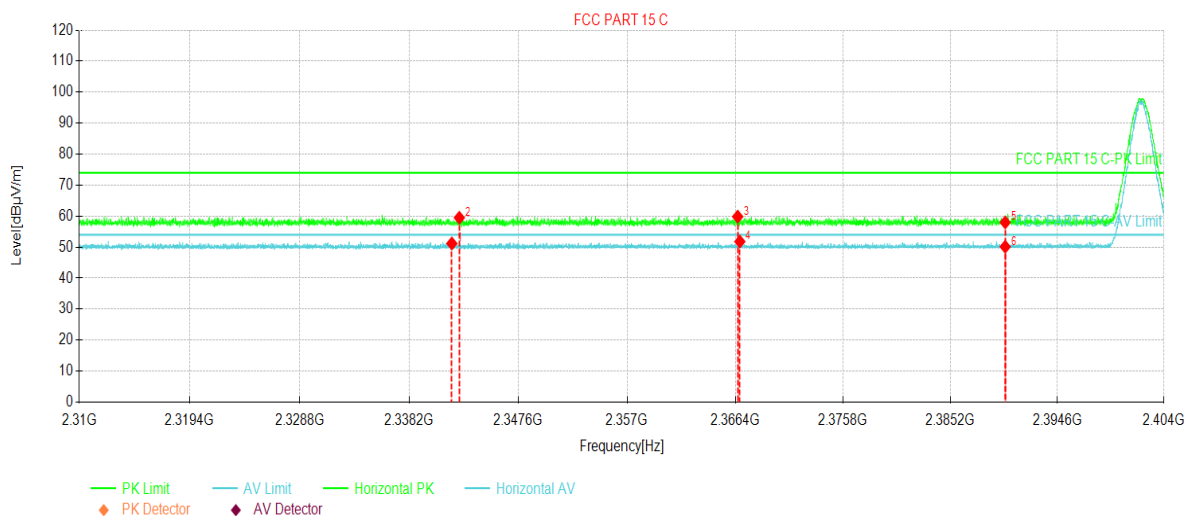


NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Factor [dB]	Limit [dBuV/m]	Margin [dB]	Trace	Polarity
1	2340.86	24.32	59.81	35.49	74.00	14.19	PK	Vertical
2	2341.02	16.99	52.48	35.49	54.00	1.52	AV	Vertical
3	2370.73	15.72	51.42	35.70	54.00	2.58	AV	Vertical
4	2370.84	23.90	59.60	35.70	74.00	14.40	PK	Vertical
5	2390.00	22.36	58.20	35.84	74.00	15.80	PK	Vertical
6	2390.00	14.31	50.15	35.84	54.00	3.85	AV	Vertical

Remark:

1. Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	2DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%

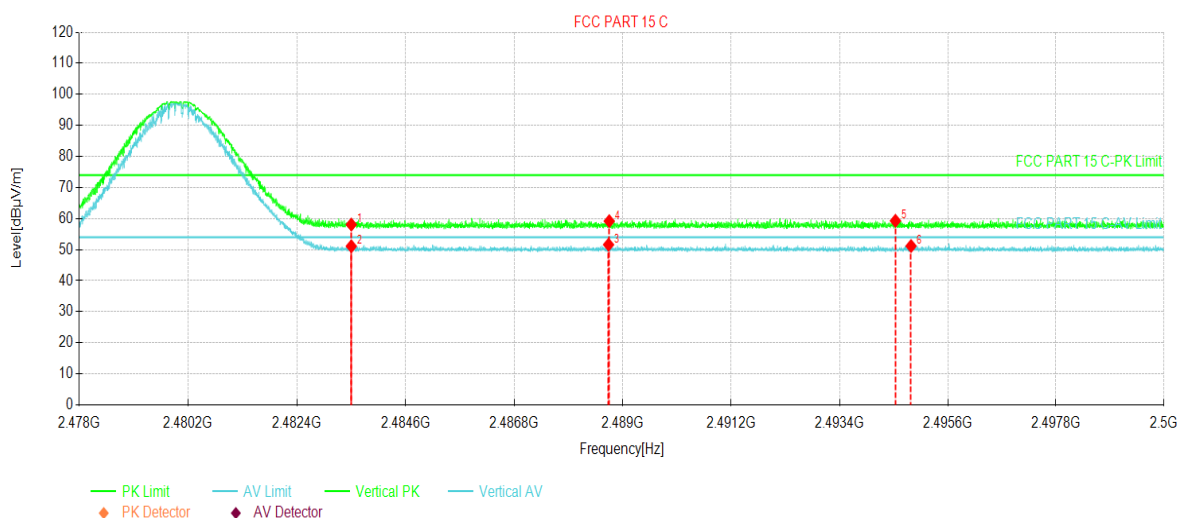


NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Factor [dB]	Limit [dBuV/m]	Margin [dB]	Trace	Polarity
1	2341.86	15.68	51.18	35.50	54.00	2.82	AV	Horizontal
2	2342.51	23.99	59.49	35.50	74.00	14.51	PK	Horizontal
3	2366.61	24.17	59.84	35.67	74.00	14.16	PK	Horizontal
4	2366.79	16.13	51.80	35.67	54.00	2.20	AV	Horizontal
5	2390.00	22.14	57.98	35.84	74.00	16.02	PK	Horizontal
6	2390.00	14.29	50.13	35.84	54.00	3.87	AV	Horizontal

Remark:

1. Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	2DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%

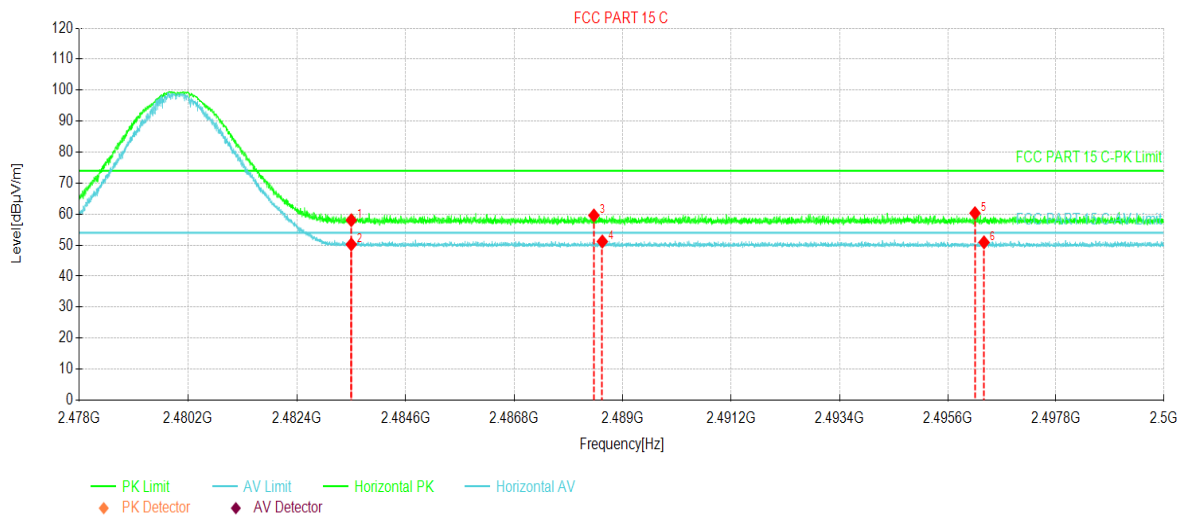


NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Factor [dB]	Limit [dBuV/m]	Margin [dB]	Trace	Polarity
1	2483.50	22.34	58.06	35.72	74.00	15.94	PK	Vertical
2	2483.50	15.36	51.08	35.72	54.00	2.92	AV	Vertical
3	2488.71	15.88	51.59	35.71	54.00	2.41	AV	Vertical
4	2488.72	23.47	59.18	35.71	74.00	14.82	PK	Vertical
5	2494.53	23.58	59.27	35.69	74.00	14.73	PK	Vertical
6	2494.85	15.46	51.15	35.69	54.00	2.85	AV	Vertical

Remark:

- Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	2DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%



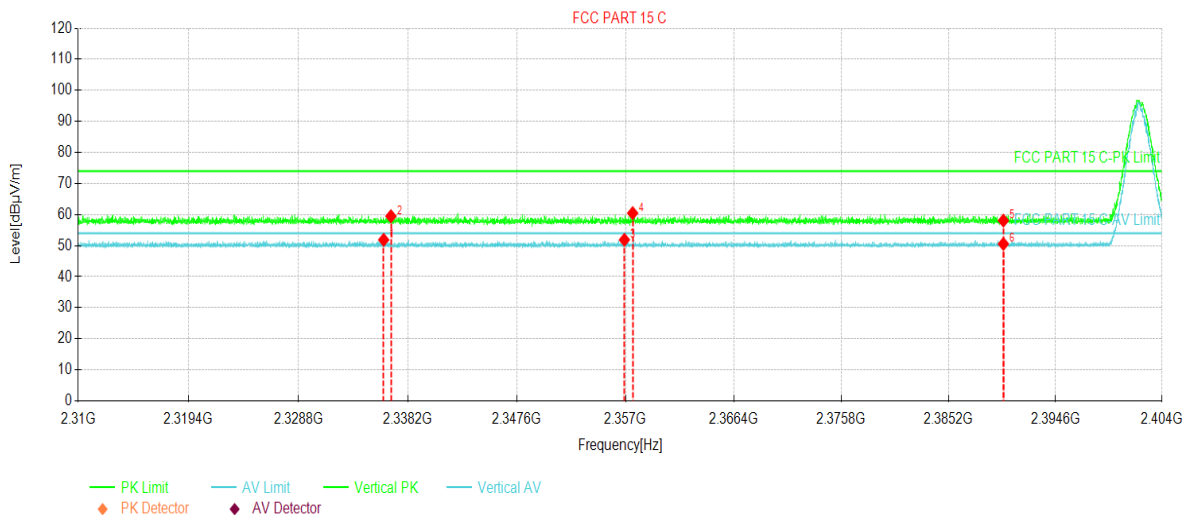
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2483.50	22.33	58.05	35.72	74.00	15.95	PK	Horizontal
2	2483.50	14.52	50.24	35.72	54.00	3.76	AV	Horizontal
3	2488.41	23.88	59.59	35.71	74.00	14.41	PK	Horizontal
4	2488.58	15.47	51.18	35.71	54.00	2.82	AV	Horizontal
5	2496.15	24.63	60.32	35.69	74.00	13.68	PK	Horizontal
6	2496.33	15.21	50.90	35.69	54.00	3.10	AV	Horizontal

Remark:

- Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

8DPSK mode

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	3DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%

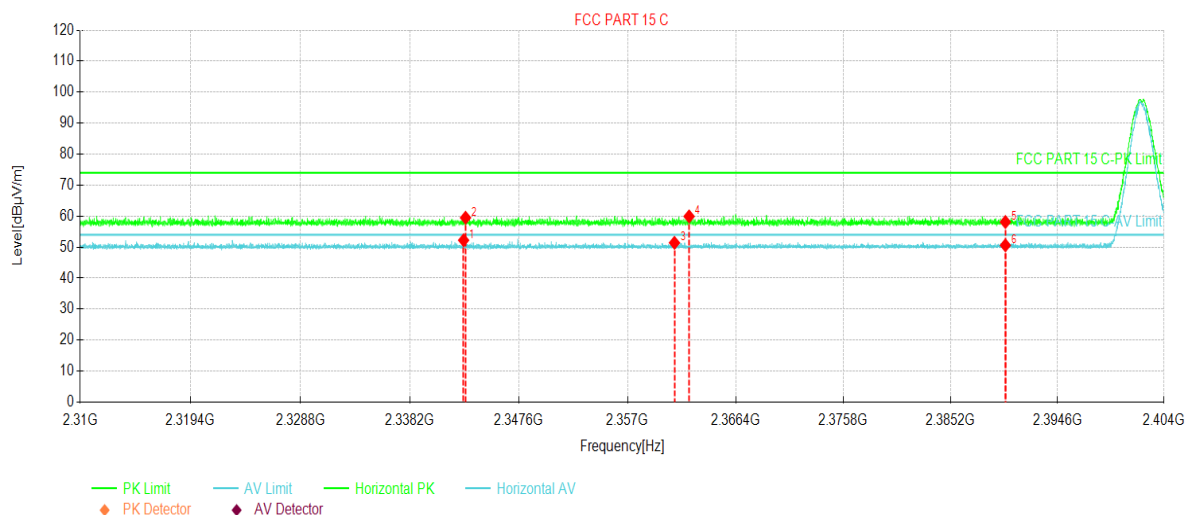


NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Factor [dB]	Limit [dBuV/m]	Margin [dB]	Trace	Polarity
1	2336.12	16.40	51.86	35.46	54.00	2.14	AV	Vertical
2	2336.74	24.00	59.46	35.46	74.00	14.54	PK	Vertical
3	2356.90	16.27	51.87	35.60	54.00	2.13	AV	Vertical
4	2357.62	24.85	60.46	35.61	74.00	13.54	PK	Vertical
5	2390.00	22.22	58.06	35.84	74.00	15.94	PK	Vertical
6	2390.00	14.70	50.54	35.84	54.00	3.46	AV	Vertical

Remark:

- Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	3DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%

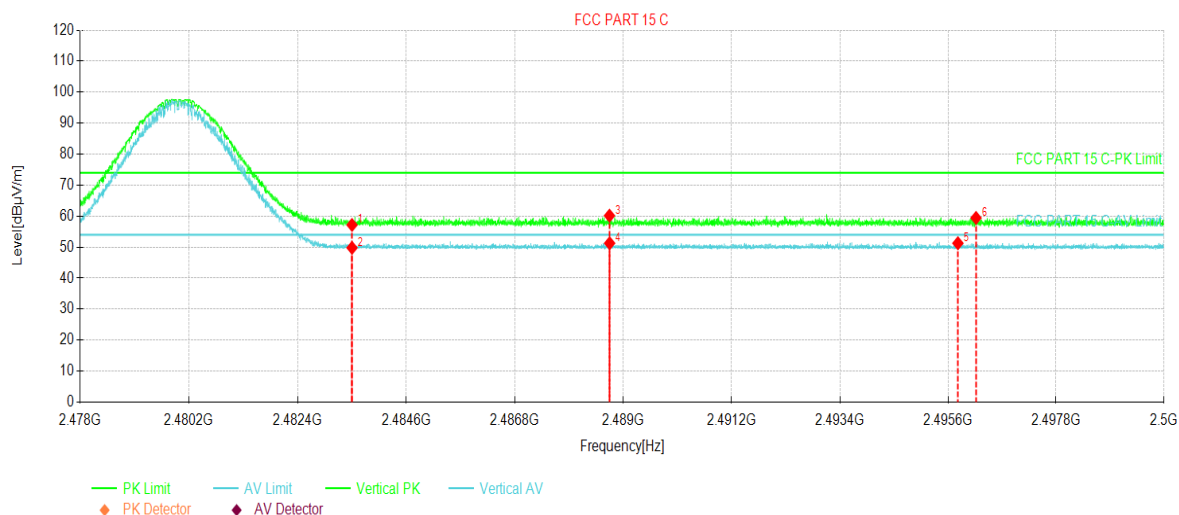


NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2342.82	16.73	52.23	35.50	54.00	1.77	AV	Horizontal
2	2342.99	23.98	59.49	35.51	74.00	14.51	PK	Horizontal
3	2361.07	15.76	51.39	35.63	54.00	2.61	AV	Horizontal
4	2362.34	24.28	59.92	35.64	74.00	14.08	PK	Horizontal
5	2390.00	22.28	58.12	35.84	74.00	15.88	PK	Horizontal
6	2390.00	14.76	50.60	35.84	54.00	3.40	AV	Horizontal

Remark:

- Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	3DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%

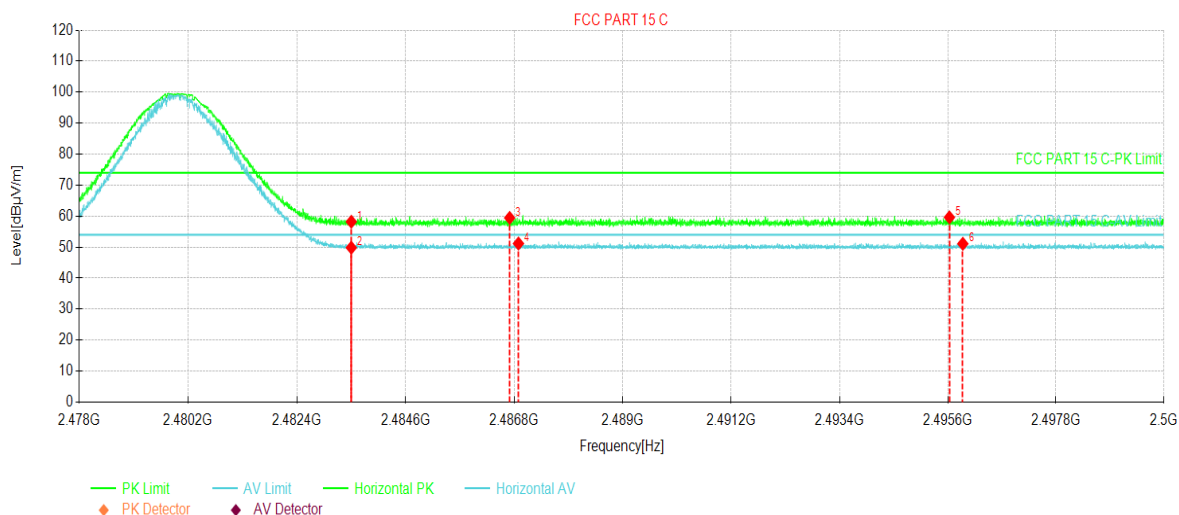


NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2483.50	21.45	57.17	35.72	74.00	16.83	PK	Vertical
2	2483.50	14.07	49.79	35.72	54.00	4.21	AV	Vertical
3	2488.71	24.45	60.16	35.71	74.00	13.84	PK	Vertical
4	2488.72	15.56	51.27	35.71	54.00	2.73	AV	Vertical
5	2495.80	15.58	51.27	35.69	54.00	2.73	AV	Vertical
6	2496.16	23.73	59.42	35.69	74.00	14.58	PK	Vertical

Remark:

- Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	3DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC 11.1V	Environment:	Temp:21.8℃ Huni: 57%



NO.	Freq. [MHz]	Reading [dBuV/m]	Level [dBuV/m]	Factor [dB]	Limit [dBuV/m]	Margin [dB]	Trace	Polarity
1	2483.50	22.49	58.21	35.72	74.00	15.79	PK	Horizontal
2	2483.50	14.11	49.83	35.72	54.00	4.17	AV	Horizontal
3	2486.70	23.74	59.45	35.71	74.00	14.55	PK	Horizontal
4	2486.88	15.46	51.17	35.71	54.00	2.83	AV	Horizontal
5	2495.63	23.93	59.62	35.69	74.00	14.38	PK	Horizontal
6	2495.90	15.41	51.10	35.69	54.00	2.90	AV	Horizontal

Remark:

- Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

6.10.1 Conducted Emission Method

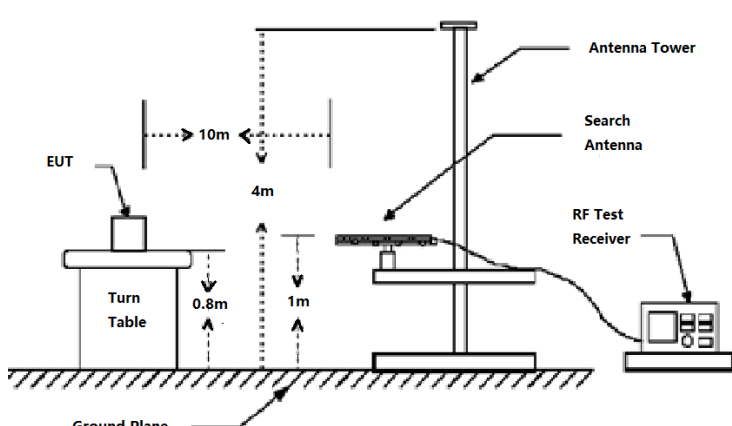
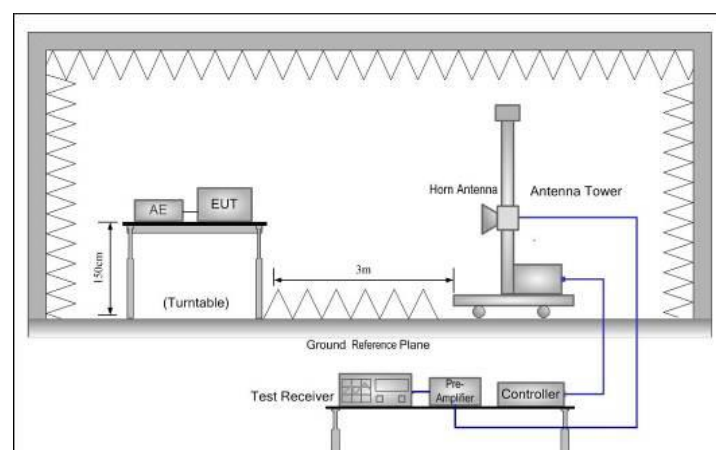
The diagram shows a rack of network equipment on the left and a server rack on the right. The server rack is labeled 'EUT'. The network equipment rack contains the following units from top to bottom:

- N5173B
- N5182B
- N9010B (displaying a red waveform graph)
- CMW270
- MW100-PSB
- MW100-RFCB
- PDU (Power Distribution Unit)
- SPD (Surge Protection Device)

Connections are shown as follows:

- A blue line connects the N9010B unit to the EUT rack.
- A red line connects the MW100-PSB unit to the EUT rack.
- A black line connects the SPD unit to the EUT rack.

6.10.2 Radiated Emission Method

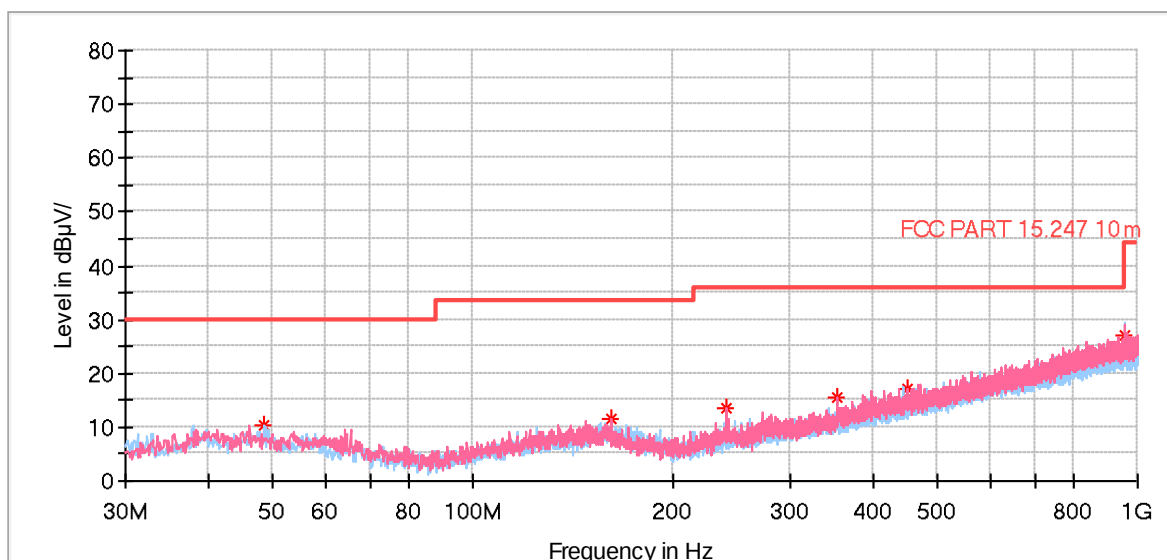
Test Requirement:	FCC Part 15 C Section 15.209				
Test Frequency Range:	9 kHz to 25 GHz				
Test Distance:	3m or 10m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value
Limit:	Frequency		Limit (dBuV/m @10m)		Remark
	30MHz-88MHz		30.0		Quasi-peak Value
	88MHz-216MHz		33.5		Quasi-peak Value
	216MHz-960MHz		36.0		Quasi-peak Value
	960MHz-1GHz		44.0		Quasi-peak Value
	Frequency		Limit (dBuV/m @3m)		Remark
	Above 1GHz		54.0		Average Value
	Above 1GHz		74.0		Peak Value
Test setup:	Below 1GHz				
					
	Above 1GHz				
					
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8m(below 1GHz)/1.5m(above 1GHz) above the ground at a 10 meter chamber (below 1GHz)or 3 meter chamber(above 1GHz). The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 10 meters(below 1GHz) or 3 meters(above 1GHz)				

	away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. - The antenna height 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. - 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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading. - The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. - If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 5.9 for details
Test mode:	Non-hopping mode
Test results:	Pass
Remark:	- Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case. 9 kHz to 30 MHz is noise floor and lower than the limit 20dB, so only shows the data of above 30MHz in this report.

Measurement Data (worst case):
Below 1GHz:

Product Name:	Automated Election Device	Product Model:	VC331
Test By:	Mike	Test mode:	BT Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical & Horizontal
Test Voltage:	DC 11.1V	Environment:	Temp: 20.9℃ Humi: 59%

Full Spectrum



Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
48.624000	10.50	30.00	19.50	100.0	H	138.0	-15.8
161.144000	11.35	33.50	22.15	100.0	V	84.0	-15.5
240.005000	13.43	36.00	22.57	100.0	V	115.0	-15.7
353.689000	15.62	36.00	20.38	100.0	V	296.0	-12.7
450.980000	17.12	36.00	18.88	100.0	V	220.0	-9.8
959.939000	26.96	36.00	9.04	100.0	V	70.0	0.0

Remark:

- Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Above 1GHz:

Test channel: Lowest channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization
4804.00	60.63	-9.60	51.03	74.00	22.97	Vertical
4804.00	63.06	-9.60	53.46	74.00	20.54	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization
4804.00	53.61	-9.60	44.01	54.00	9.99	Vertical
4804.00	58.31	-9.60	48.71	54.00	5.29	Horizontal
Test channel: Middle channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization
4882.00	60.97	-9.05	51.92	74.00	22.08	Vertical
4882.00	63.52	-9.05	54.47	74.00	19.53	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization
4882.00	53.74	-9.05	44.69	54.00	9.31	Vertical
4882.00	58.28	-9.05	49.23	54.00	4.77	Horizontal
Test channel: Highest channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization
4960.00	60.46	-8.45	52.01	74.00	21.99	Vertical
4960.00	63.53	-8.45	55.08	74.00	18.92	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization
4960.00	53.77	-8.45	45.32	54.00	8.68	Vertical
4960.00	58.52	-8.45	50.07	54.00	3.93	Horizontal
Remark: 1. Final Level =Receiver Read level + Factor. 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.						