

FCC REPORT

(BLE)


Applicant: Shenzhen TQL Technology Co., Ltd

Address of Applicant: Room 1202C, Block D, CFG Building, Baoyuan Road, Xixiang, Bao'an District, Shenzhen City, China

Equipment Under Test (EUT)

Product Name: T-ONE Smartpen

Model No.: TQL-101, TQL-101S, TQL-101W, TQL-101B, TQL-101G, TQL-101RG

Trade mark: 

FCC ID: 2ANZFTQL-101

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

Date of sample receipt: 18 Oct., 2017

Date of Test: 18 Oct., to 23 Oct., 2017

Date of report issued: 24 Oct., 2017

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 CCIS 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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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(3)	Pass
6dB Emission Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247(d)	Pass
Conducted and radiated Spurious Emission	15.205/15.209	Pass

Pass: The EUT complies with the essential requirements in the standard.

5 General Information

5.1 Client Information

Applicant:	Shenzhen TQL Technology Co., Ltd
Address of Applicant:	Room 1202C, Block D, CFG Building, Baoyuan Road, Xixiang, Bao'an District, Shenzhen City, China
Manufacturer	Shenzhen TQL Technology Co., Ltd
Address of Manufacturer:	Room 1202C, Block D, CFG Building, Baoyuan Road, Xixiang, Bao'an District, Shenzhen City, China

5.2 General Description of E.U.T.

Product Name:	T-ONE Smartpen
Model No.:	TQL-101, TQL-101S, TQL-101W, TQL-101B, TQL-101G, TQL-101RG
Operation Frequency:	2402-2480 MHz
Channel numbers:	40
Channel separation:	2 MHz
Modulation technology:	GFSK
Data speed :	1Mbps
Antenna Type:	Internal Antenna
Antenna gain:	5.5 dBi
Power supply:	Rechargeable Li-ion Battery DC3.7V-250mAh
Remark:	Model No.: TQL-101, TQL-101S, TQL-101W, TQL-101B, TQL-101G, TQL-101RG were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being different model name correspond different color.

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

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2442MHz
The Highest channel	2480MHz

5.3 Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test mode:	
Operation mode	Keep the EUT in continuous transmitting with modulation
<p>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. Duty cycle setting during the transmission is 100% with maximum power setting for all modulations.</p>	

5.4 Measurement Uncertainty

Items	Expanded Uncertainty (Confidence of 95%)
Conducted Emission (9kHz ~ 30MHz)	2.14 dB (k=2)
Radiated Emission (9kHz ~ 30MHz)	4.24 dB (k=2)
Radiated Emission (30MHz ~ 1000MHz)	4.35 dB (k=2)
Radiated Emission (1GHz ~ 18GHz)	4.44 dB (k=2)
Radiated Emission (18GHz ~ 26.5GHz)	4.56 dB (k=2)

5.5 Laboratory Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> FCC - Registration No.: 817957 Shenzhen Zhongjian Nanfang Testing Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in out files. Registration 817957, February 27, 2012. IC - Registration No.: 10106A-1 The 3m Semi-anechoic chamber of Shenzhen Zhongjian Nanfang Testing 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 L6048 Shenzhen Zhongjian Nanfang Testing Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6048.

5.6 Laboratory Location

<p>Shenzhen Zhongjian Nanfang Testing Co., Ltd. Address: No. B-C, 1/F., Building 2, Laodong No.2 Industrial Park, Xixiang Road, Bao'an District, Shenzhen, Guangdong, China Website: http://www.ccis-cb.com Tel: +86-755-23118282 Fax: +86-755-23116366 Email: info@ccis-cb.com</p>

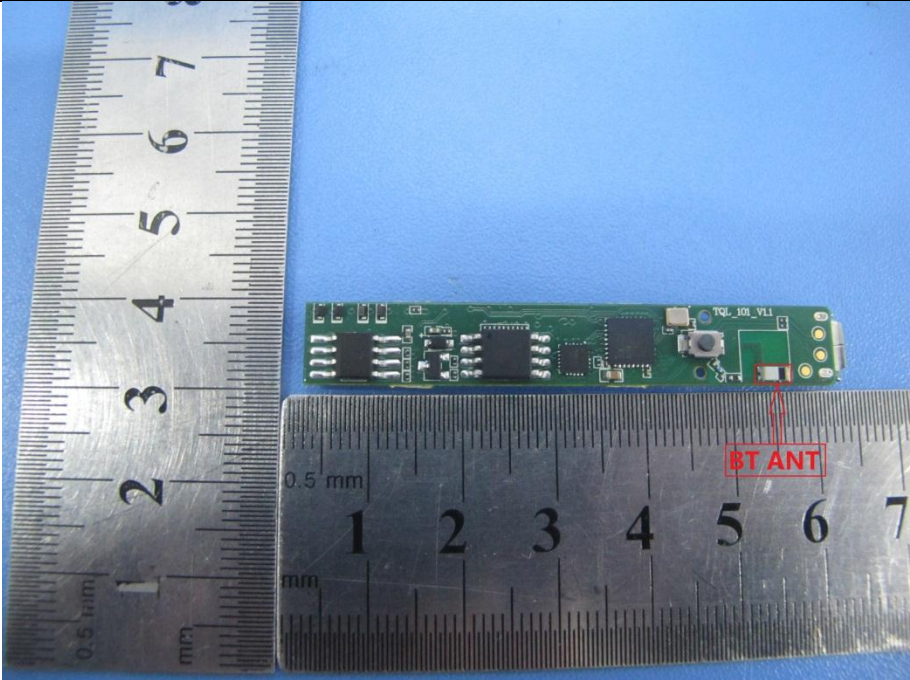
5.7 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
1	3m SAC	SAEMC	9(L)*6(W)* 6(H)	CCIS0001	07-22-2017	07-21-2020
2	BiConiLog Antenna	SCHWARZBECK	VULB9163	CCIS0005	02-25-2017	02-24-2018
3	Horn Antenna	SCHWARZBECK	BBHA9120D	CCIS0006	02-25-2017	02-24-2018
4	Pre-amplifier (10kHz-1.3GHz)	HP	8447D	CCIS0003	02-25-2017	02-24-2018
5	Pre-amplifier (1GHz-18GHz)	Compliance Direction Systems Inc.	PAP-1G18	CCIS0011	02-25-2017	02-24-2018
6	Pre-amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	02-25-2017	02-24-2018
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	02-25-2017	02-24-2018
8	Spectrum analyzer 9k-30GHz	Rohde & Schwarz	FSP30	CCIS0023	02-25-2017	02-24-2018
9	EMI Test Receiver	Rohde & Schwarz	ESRP7	CCIS0167	02-25-2017	02-24-2018
10	Loop antenna	Laplace instrument	RF300	EMC0701	02-25-2017	02-24-2018
11	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
12	Coaxial Cable	N/A	N/A	CCIS0018	02-25-2017	02-24-2018
13	Coaxial Cable	N/A	N/A	CCIS0020	02-25-2017	02-24-2018

Conducted Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
1	Shielding Room	ZhongShuo Electron	11.0(L)x4.0(W)x3.0(H)	CCIS0061	07-22-2017	07-21-2020
2	EMI Test Receiver	Rohde & Schwarz	ESCI	CCIS0002	02-25-2017	02-24-2018
3	LISN	CHASE	MN2050D	CCIS0074	02-25-2017	02-24-2018
4	Coaxial Cable	CCIS	N/A	CCIS0086	02-25-2017	02-24-2018
5	EMI Test Software	AUDIX	E3	N/A	N/A	N/A

6 Test results and Measurement Data

6.1 Antenna requirement:

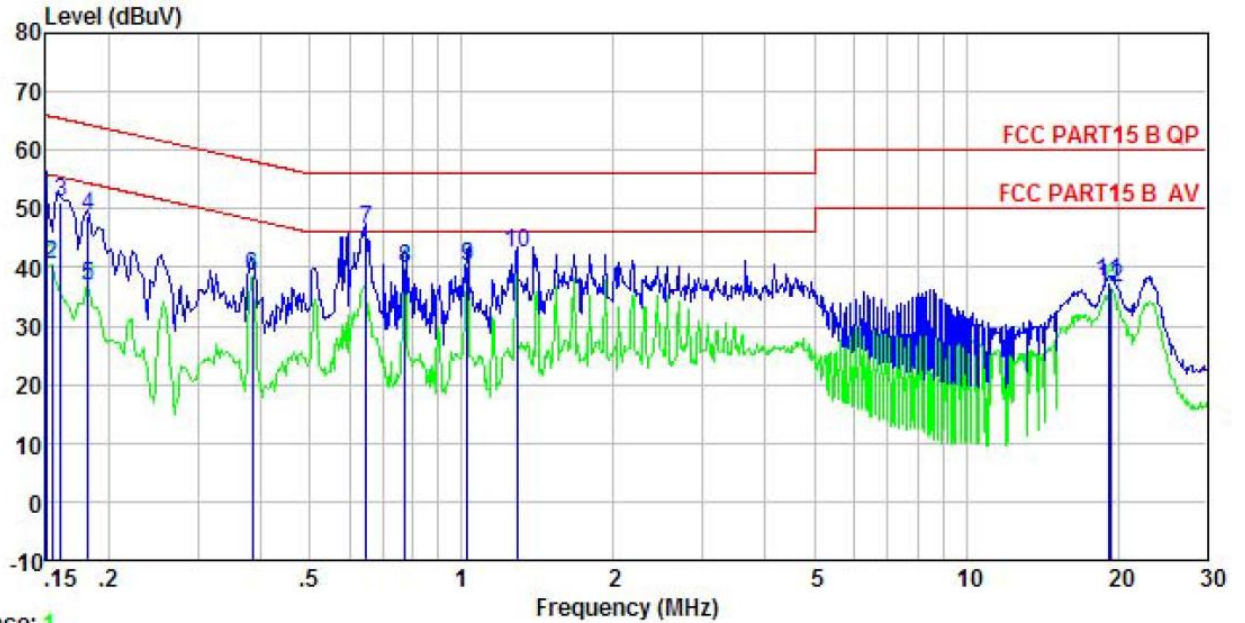
<p>Standard requirement: FCC Part 15 C Section 15.203 /247(c)</p>	
<p><i>15.203 requirement:</i> <i>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an 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.</i></p> <p><i>15.247(c) (1)(i) requirement:</i> <i>(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.</i></p>	
<p>E.U.T Antenna:</p>	
<p><i>The BLE antenna is an internal antenna which cannot replace by end-user, the best case gain of the antenna is 5.5 dBi.</i></p>	
	

6.2 Conducted Emission

Test Requirement:	FCC Part 15 C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150 kHz to 30 MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9kHz, VBW=30kHz		
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 procedure	<ol style="list-style-type: none"> 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.), which 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 C63.4: 2014 on conducted measurement. 		
Test setup:	<p><i>Remark</i> <i>E.U.T: Equipment Under Test</i> <i>LISN: Line Impedance Stabilization Network</i> <i>Test table height=0.8m</i></p>		
Test Instruments:	Refer to section 5.7 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Passed		

Measurement Data:

Test Polarization: Neutral



Trace: 1

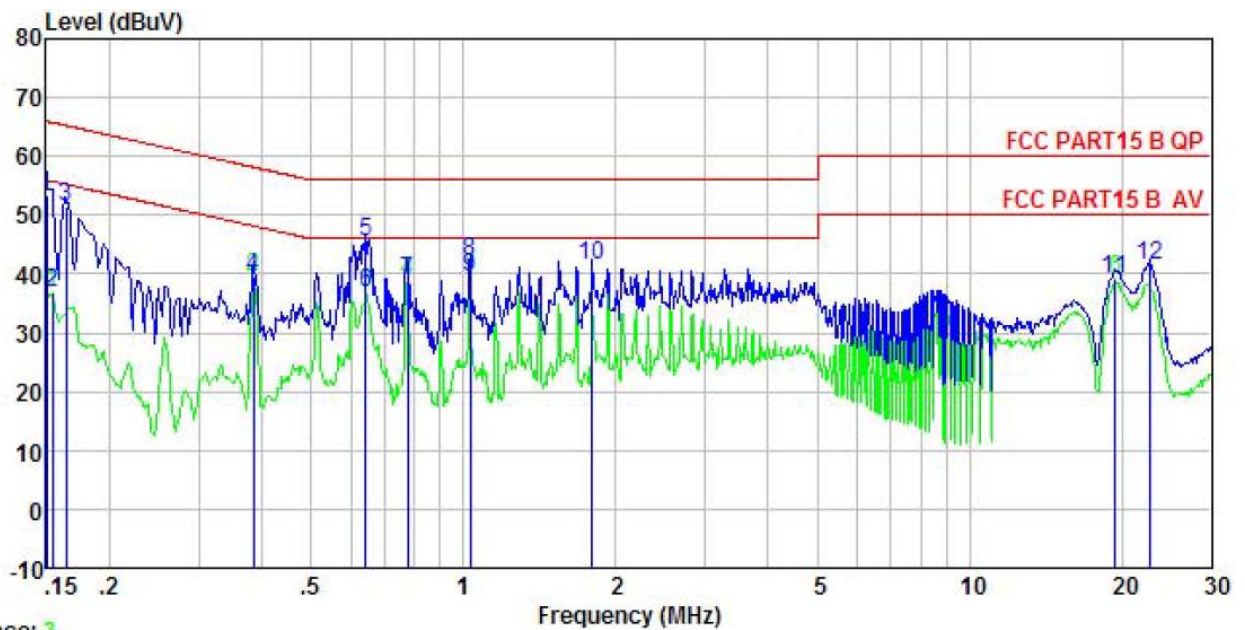
Site : CCIS Shielding Room
 Condition : FCC PART15 B QP LISN NEUTRAL
 EUT : T-ONE Smartpen
 Model : TQL-101
 Test Mode : BLE Mode
 Power Rating : AC 120/60Hz
 Environment : Temp: 23 °C Humi:56% Atmos:101KPa
 Test Engineer: Carey
 Remark :

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.150	41.91	-0.38	10.78	52.31	66.00	-13.69	QP
2	0.154	30.06	-0.38	10.78	40.46	55.78	-15.32	Average
3	0.161	40.75	-0.37	10.77	51.15	65.43	-14.28	QP
4	0.182	38.27	-0.35	10.77	48.69	64.42	-15.73	QP
5	0.182	26.48	-0.35	10.77	36.90	54.42	-17.52	Average
6	0.385	28.13	-0.32	10.72	38.53	48.17	-9.64	Average
7	0.647	36.07	-0.30	10.77	46.54	56.00	-9.46	QP
8	0.771	29.24	-0.30	10.80	39.74	46.00	-6.26	Average
9	1.027	29.63	-0.29	10.87	40.21	46.00	-5.79	Average
10	1.289	31.95	-0.28	10.90	42.57	56.00	-13.43	QP
11	19.224	27.13	-0.46	10.93	37.60	60.00	-22.40	QP
12	19.428	25.99	-0.47	10.93	36.45	50.00	-13.55	Average

Notes:

1. An initial pre-scan was performed on the live 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.

Test Polarization: Line



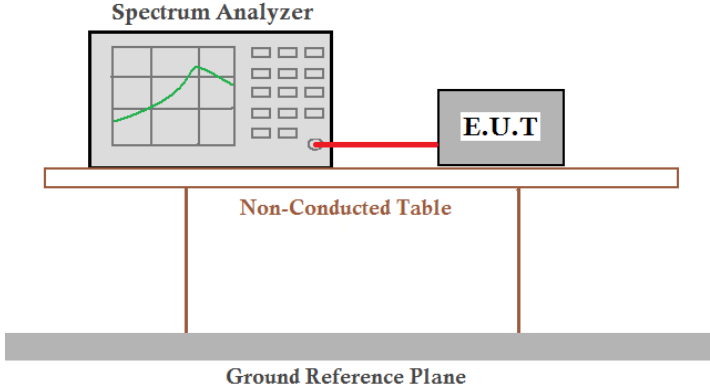
Trace: 3
 Site : CCIS Shielding Room
 Condition : FCC PART15 B QP LISN LINE
 EUT : T-ONE Smartpen
 Model : TQL-101
 Test Mode : BLE Mode
 Power Rating : AC 120/60Hz
 Environment : Temp: 23 °C Humi:56% Atmos:101KPa
 Test Engineer: Carey
 Remark :

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.150	43.12	-0.56	10.78	53.34	66.00	-12.66	QP
2	0.154	26.54	-0.56	10.78	36.76	55.78	-19.02	Average
3	0.164	41.38	-0.55	10.77	51.60	65.25	-13.65	QP
4	0.385	29.37	-0.50	10.72	39.59	48.17	-8.58	Average
5	0.641	35.25	-0.48	10.77	45.54	56.00	-10.46	QP
6	0.641	26.46	-0.48	10.77	36.75	46.00	-9.25	Average
7	0.775	28.54	-0.48	10.80	38.86	46.00	-7.14	Average
8	1.032	31.61	-0.49	10.87	41.99	56.00	-14.01	QP
9	1.032	29.04	-0.49	10.87	39.42	46.00	-6.58	Average
10	1.800	30.84	-0.44	10.95	41.35	56.00	-14.65	QP
11	19.428	28.59	-0.50	10.93	39.02	50.00	-10.98	Average
12	22.775	31.02	-0.60	10.90	41.32	60.00	-18.68	QP

Notes:

1. An initial pre-scan was performed on the live 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.

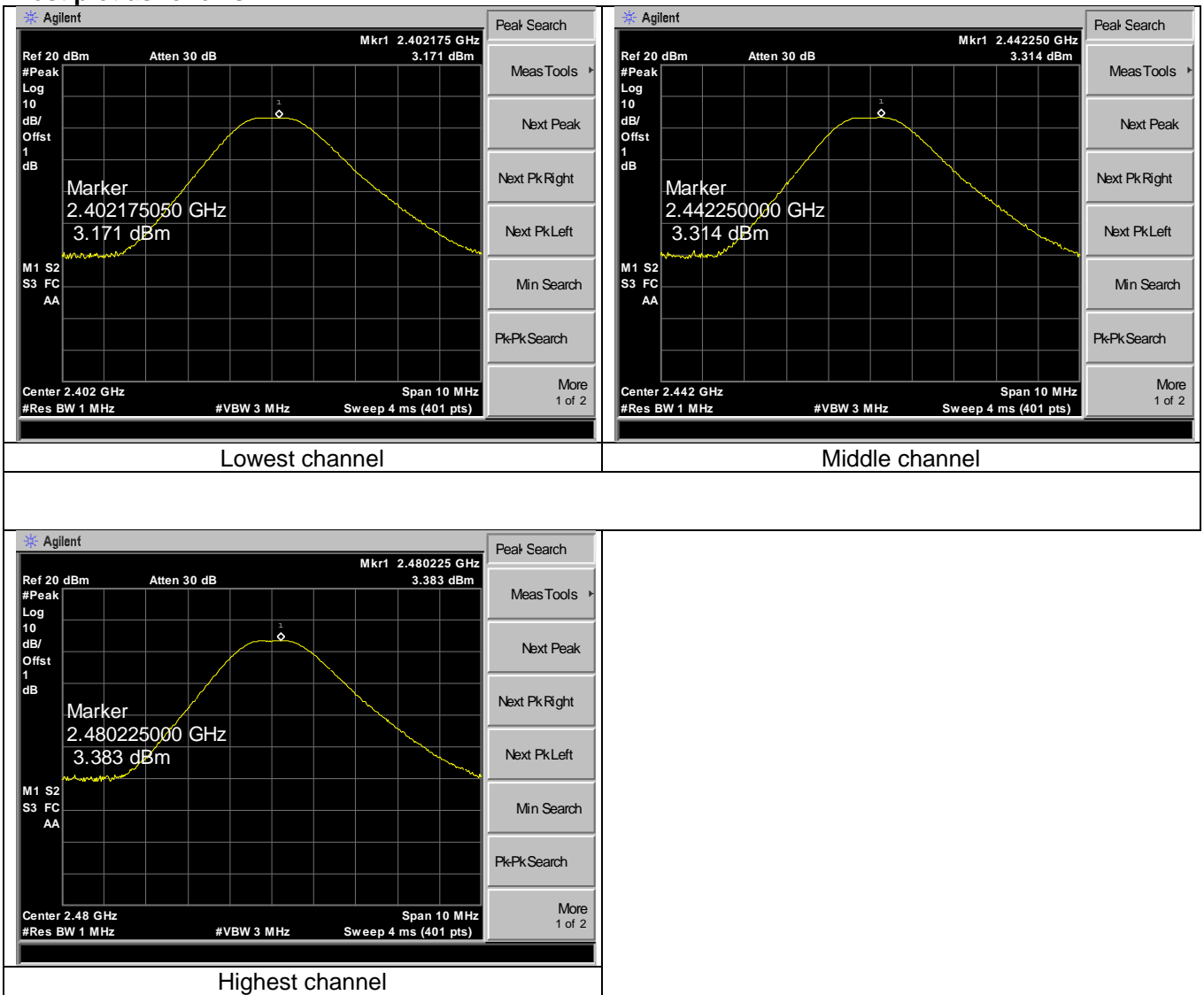
6.3 Conducted Output Power

Test Requirement:	FCC Part 15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance v04 section 9.1.1
Limit:	30dBm
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

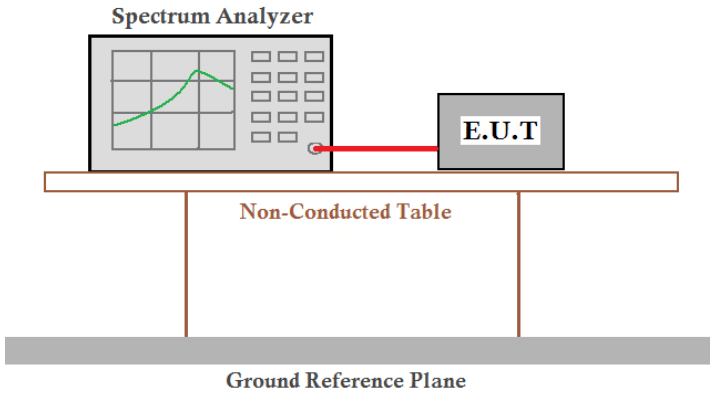
Measurement Data:

Test CH	PEAK Conducted Output Power (dBm)	Limit(dBm)	Result
Lowest	3.171	30.00	Pass
Middle	3.314		
Highest	3.383		

Test plot as follows:



6.4 Occupy Bandwidth

Test Requirement:	FCC Part 15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance v04 section 8.1
Limit:	>500kHz
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

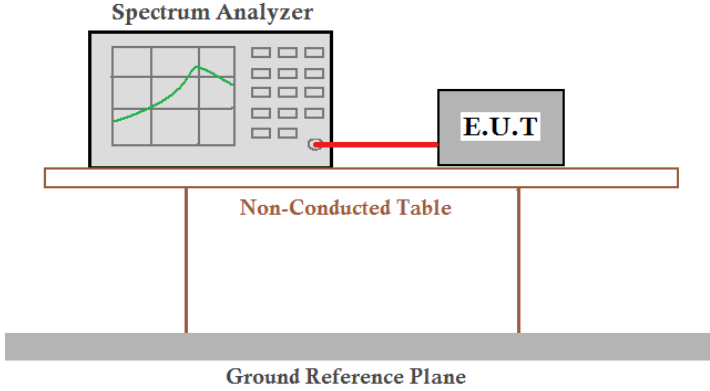
Measurement Data:

Test CH	6dB Emission Bandwidth (MHz)	Limit(kHz)	Result
Lowest	0.822	>500	Pass
Middle	0.815		
Highest	0.816		
Test CH	99% Occupy Bandwidth (MHz)	Limit(kHz)	Result
Lowest	1.1598	N/A	N/A
Middle	1.1546		
Highest	1.1369		

Test plot as follows:



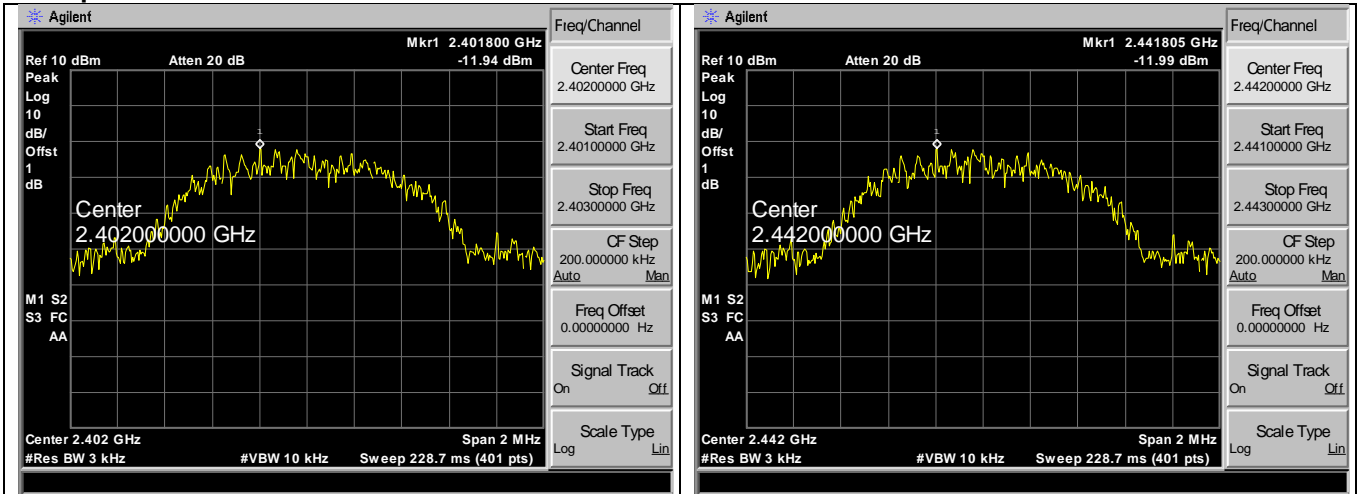
6.5 Power Spectral Density

Test Requirement:	FCC Part 15 C Section 15.247 (e)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance v04 section 10.2
Limit:	8 dBm
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

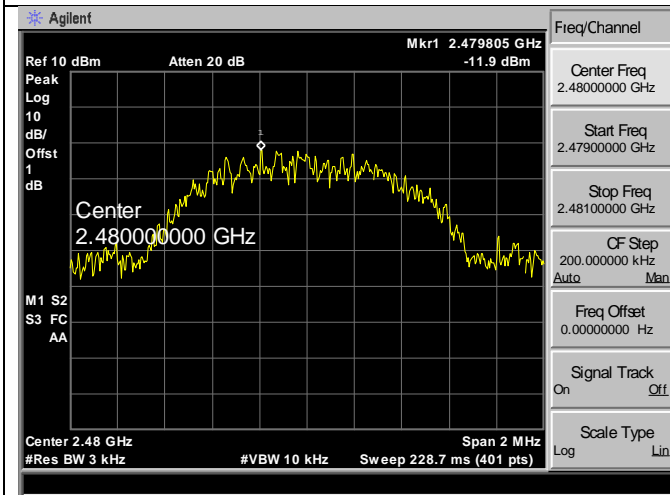
Test CH	Power Spectral Density (dBm)	Limit(dBm)	Result
Lowest	-11.94	8.00	Pass
Middle	-11.99		
Highest	-11.90		

Test plots as follow:



Lowest channel

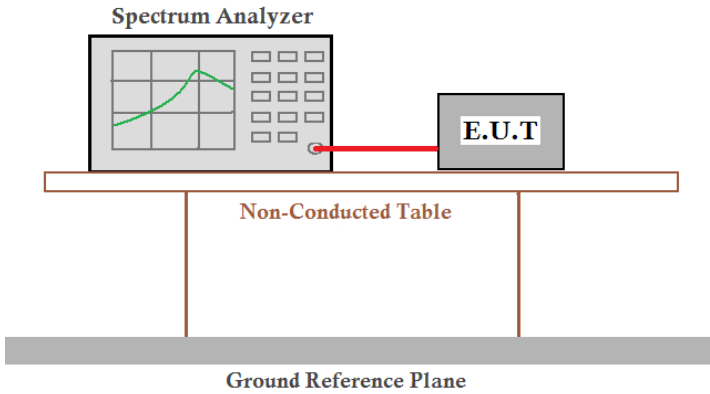
Middle channel



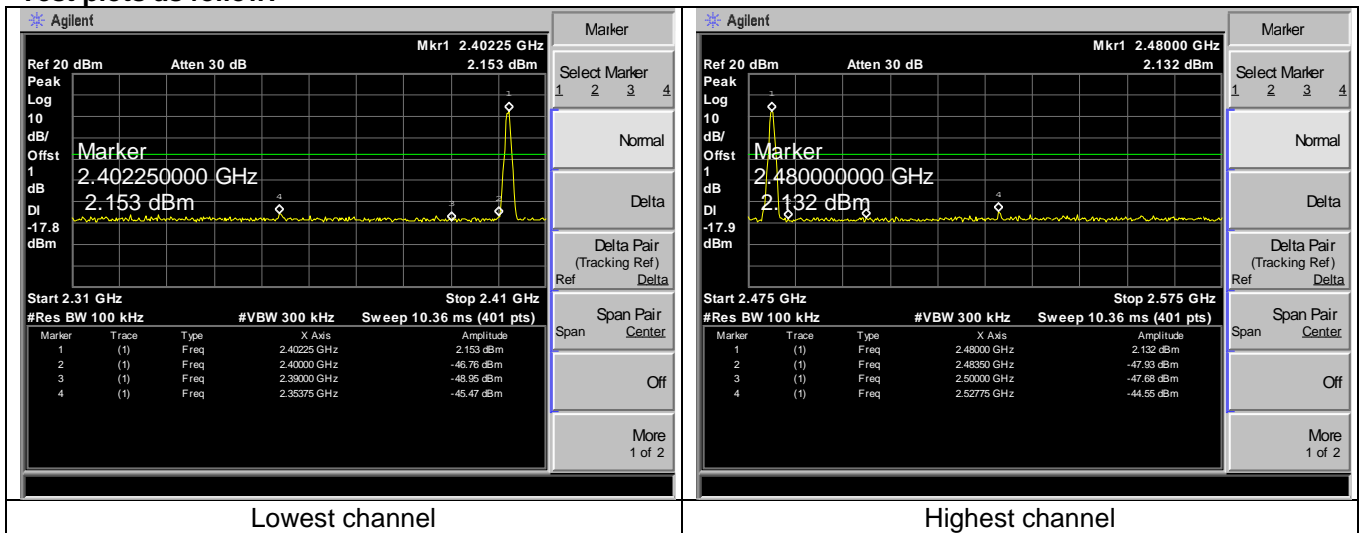
Highest channel

6.6 Band Edge

6.6.1 Conducted Emission Method

Test Requirement:	FCC Part 15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance v04 section 13
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:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

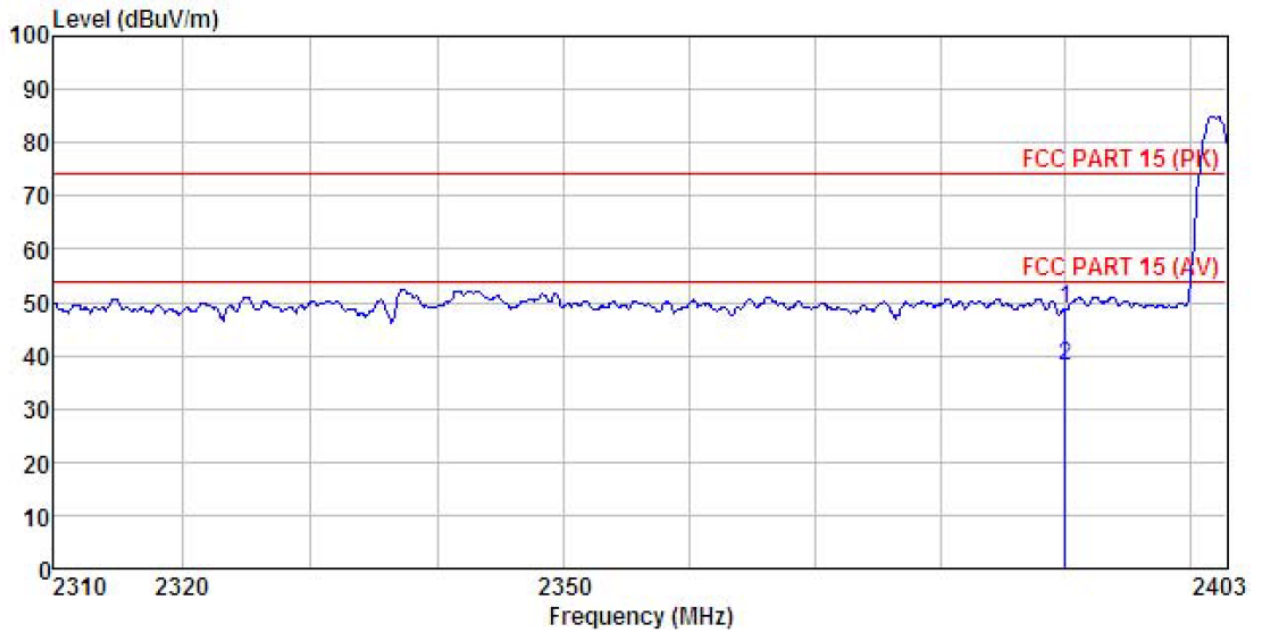
Test plots as follow:



6.6.2 Radiated Emission Method

Test Requirement:	FCC Part 15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10: 2013 and KDB558074 D01 DTS Meas Guidance v04 section 12.1				
Test Frequency Range:	2.3GHz to 2.5GHz				
Test site:	Measurement 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 Procedure:	<ol style="list-style-type: none"> 1. The EUT was placed on the top of a rotating table 1.5 meters 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 10 dB 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 10 dB 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 setup:					
Test Instruments:	Refer to section 5.7 for details				
Test mode:	Refer to section 5.3 for details				
Test results:	Passed				

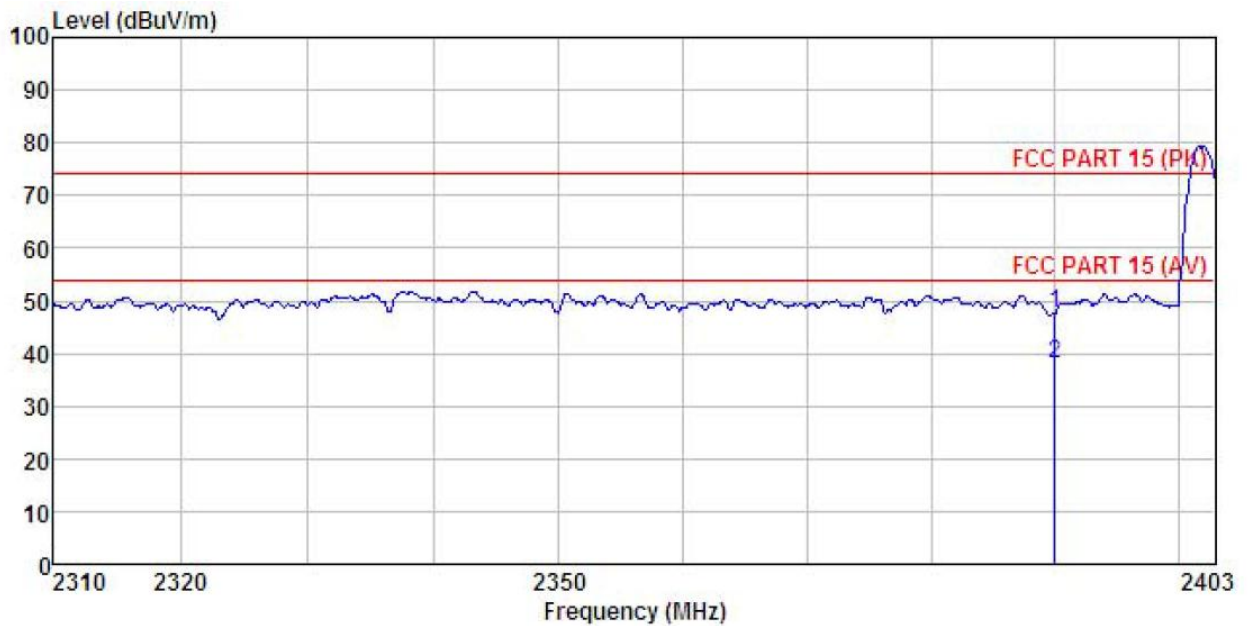
Test channel: Lowest channel
 Test Polarization: Horizontal



Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18G) HORIZONTAL
 EUT : T-ONE Smartpen
 Model : TQL-101
 Test mode : BLE - L Mode
 Power Rating : AC 120V/60Hz
 Environment : Temp:25.5°C Humi:55%
 Test Engineer:
 REMARK :

	Read	Antenna	Cable	Preamp	Limit	Over		
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2390.000	18.51	25.45	4.69	0.00	48.65	74.00	-25.35 Peak
2	2390.000	7.84	25.45	4.69	0.00	37.98	54.00	-16.02 Average

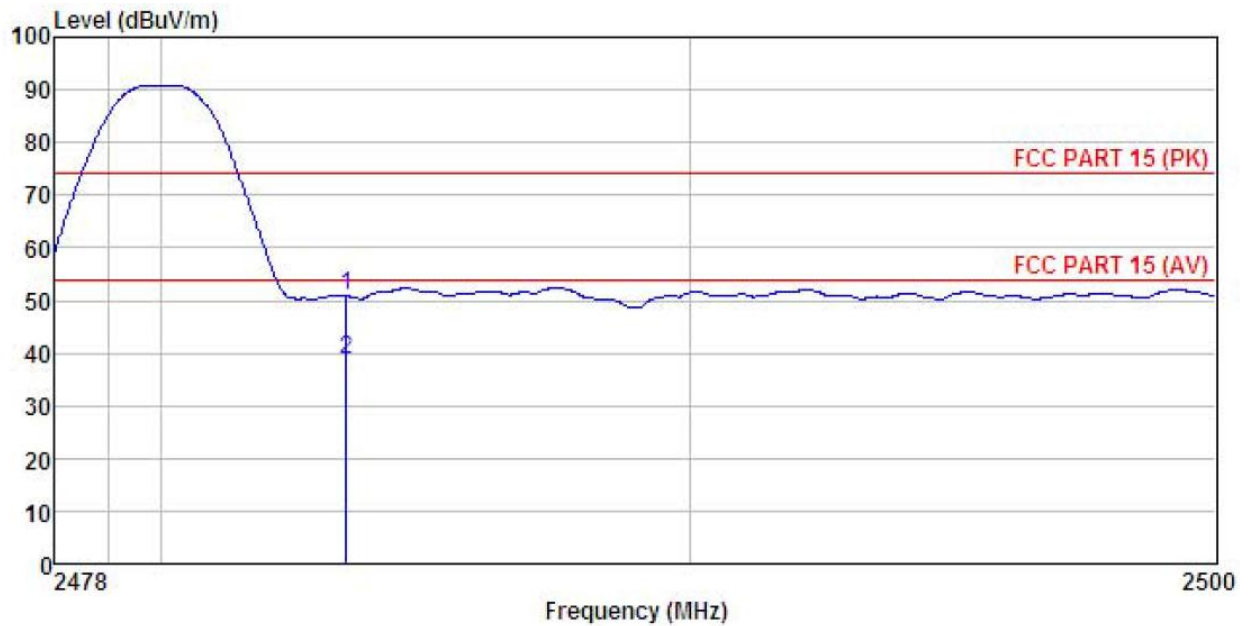
Test Polarization: Vertical



Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18G) VERTICAL
 EUT : T-ONE Smartpen
 Model : TQL-101
 Test mode : BLE - L Mode
 Power Rating : AC 120V/60Hz
 Environment : Temp:25.5°C Humi:55%
 Test Engineer:
 REMARK :

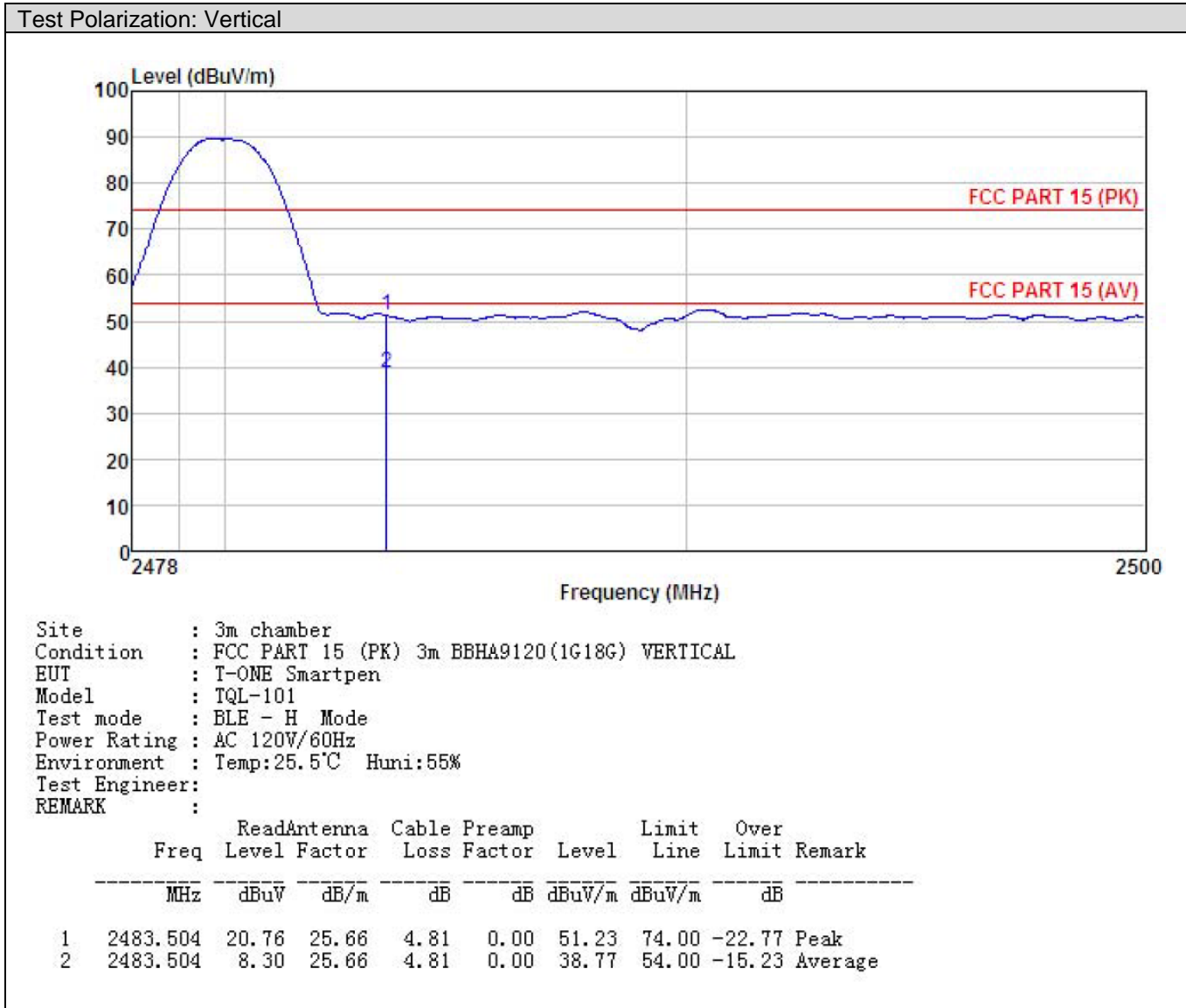
	Freq	ReadAntenna	Cable	Preamp	Limit	Over		
	MHz	Level	Factor	Loss	Line	Limit	Remark	
		dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	2390.000	17.42	25.45	4.69	0.00	47.56	74.00	-26.44 Peak
2	2390.000	7.93	25.45	4.69	0.00	38.07	54.00	-15.93 Average

Test channel: Highest channel
 Test Polarization: Horizontal



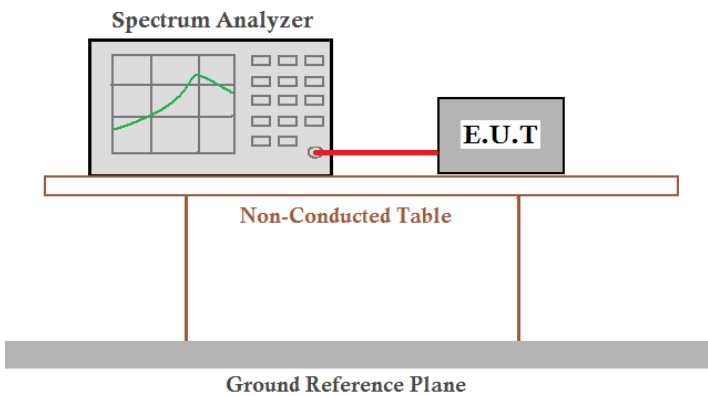
Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18G) HORIZONTAL
 EUT : T-ONE Smartpen
 Model : TQL-101
 Test mode : BLE - H Mode
 Power Rating : AC 120V/60Hz
 Environment : Temp:25.5°C Humi:55%
 Test Engineer:
 REMARK :

	Read	Antenna	Cable	Preamp	Level	Limit	Over	
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.504	20.36	25.66	4.81	0.00	50.83	74.00	-23.17 Peak
2	2483.504	8.26	25.66	4.81	0.00	38.73	54.00	-15.27 Average



6.7 Spurious Emission

6.7.1 Conducted Emission Method

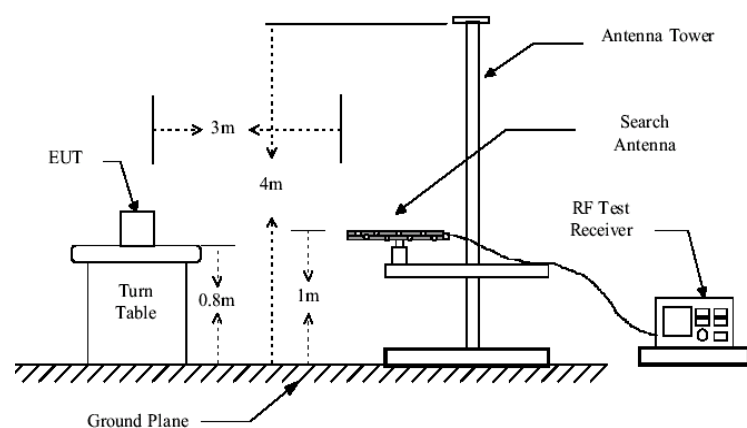
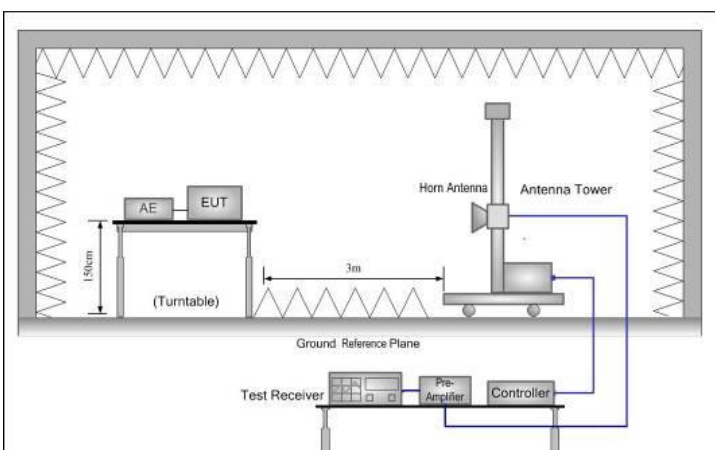
Test Requirement:	FCC Part 15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance v04 section 11
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by 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:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by two legs. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plot as follows:



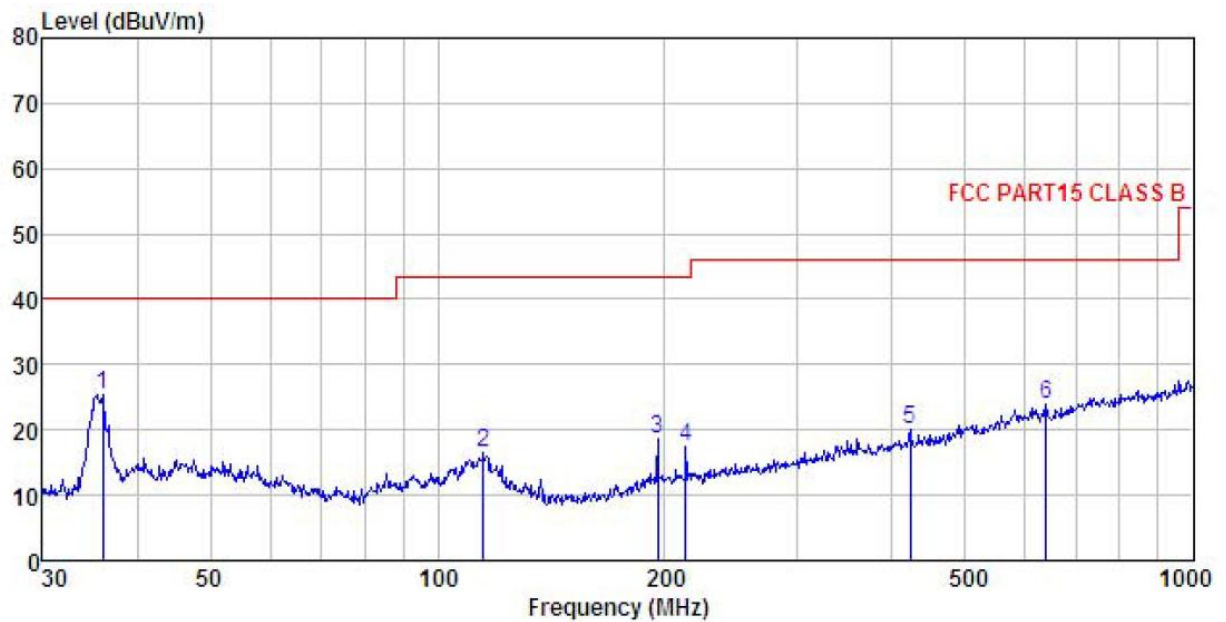
6.7.2 Radiated Emission Method

Test Requirement:	FCC Part 15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9KHz to 25GHz				
Test site:	Measurement Distance: 3m				
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 @3m)		Remark	
	30MHz-88MHz	40.0		Quasi-peak Value	
	88MHz-216MHz	43.5		Quasi-peak Value	
	216MHz-960MHz	46.0		Quasi-peak Value	
	960MHz-1GHz	54.0		Quasi-peak Value	
	Above 1GHz	54.0		Average Value	
74.0		Peak Value			
Test Procedure:	<ol style="list-style-type: none"> 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 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 10 dB 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 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. 				

<p>Test setup:</p>	<p>Below 1GHz</p>  <p>Above 1GHz</p> 
<p>Test Instruments:</p>	<p>Refer to section 5.7 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.3 for details</p>
<p>Test results:</p>	<p>Passed</p>
<p>Remark:</p>	<ol style="list-style-type: none"> 1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case. 2. 9 kHz to 30MHz is too low, so only shows the data of above 30MHz in this report.

Below 1GHz:

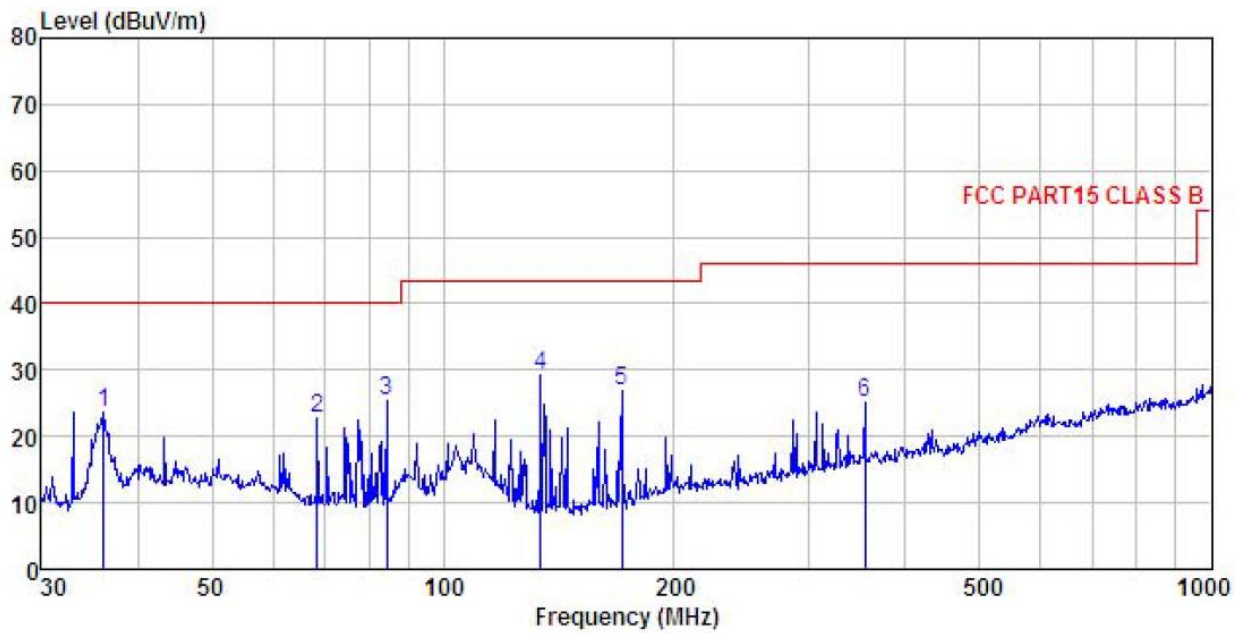
Test Polarization: Horizontal



Site : 3m chamber
 Condition : FCC PART15 CLASS B 3m VULB9163(30M2G) HORIZONTAL
 EUT : T-ONE Smartpen
 Model : TQL-101
 Test mode : BLE Mode
 Power Rating : AC 120V/60Hz
 Environment : Temp:25.5°C Humi:55%
 Test Engineer:
 REMARK :

Freq	ReadAntenna	Cable	Preamp	Limit	Over	Remark			
MHz	Level	Factor	Loss	Line	Limit				
	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m			
1	36.001	42.42	11.90	1.07	29.94	25.45	40.00	-14.55	QP
2	114.917	32.42	11.32	2.11	29.42	16.43	43.50	-27.07	QP
3	195.822	33.63	10.94	2.84	28.86	18.55	43.50	-24.95	QP
4	213.015	32.06	11.30	2.85	28.75	17.46	43.50	-26.04	QP
5	422.058	30.34	15.48	3.13	28.82	20.13	46.00	-25.87	QP
6	638.369	30.17	18.55	3.88	28.81	23.79	46.00	-22.21	QP

Test Polarization: Vertical



Site : 3m chamber
 Condition : FCC PART15 CLASS B 3m VULB9163(30M2G) VERTICAL
 EUT : T-ONE Smartpen
 Model : TQL-101
 Test mode : BLE Mode
 Power Rating : AC 120V/60Hz
 Environment : Temp:25.5°C Humi:55%
 Test Engineer:
 REMARK :

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	36.127	40.72	11.90	1.07	29.94	23.75	40.00	-16.25	QP
2	68.631	40.88	10.20	1.49	29.73	22.84	40.00	-17.16	QP
3	84.405	43.26	9.76	1.83	29.60	25.25	40.00	-14.75	QP
4	134.088	47.68	8.48	2.33	29.31	29.18	43.50	-14.32	QP
5	170.793	44.23	9.00	2.66	29.04	26.85	43.50	-16.65	QP
6	354.183	35.75	14.72	3.10	28.58	24.99	46.00	-21.01	QP

Above 1GHz

Test channel: Lowest channel								
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	46.11	35.99	6.80	41.81	47.09	74.00	-26.91	Vertical
4804.00	47.66	35.99	6.80	41.81	48.64	74.00	-25.36	Horizontal
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	38.54	35.99	6.80	41.81	39.52	54.00	-14.48	Vertical
4804.00	39.13	35.99	6.80	41.81	40.11	54.00	-13.89	Horizontal
Test channel: Middle channel								
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4884.00	46.44	36.38	6.86	41.84	47.84	74.00	-26.16	Vertical
4884.00	47.45	36.38	6.86	41.84	48.85	74.00	-25.15	Horizontal
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4884.00	38.25	36.38	6.86	41.84	39.65	54.00	-14.35	Vertical
4884.00	38.98	36.38	6.86	41.84	40.38	54.00	-13.62	Horizontal
Test channel: Highest channel								
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	46.01	36.71	6.91	41.87	47.76	74.00	-26.24	Vertical
4960.00	48.20	36.71	6.91	41.87	49.95	74.00	-24.05	Horizontal
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	38.16	36.71	6.91	41.87	39.91	54.00	-14.09	Vertical
4960.00	39.45	36.71	6.91	41.87	41.20	54.00	-12.80	Horizontal

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Pre-amplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*