



REPORT No. : SZ17070027W02

FCC RF TEST REPORT

APPLICANT : dormakaba EAD GmbH
PRODUCT NAME : data collection terminal
MODEL NAME : 9600-K6 MRD
TRADE NAME : Terminal 96 00
BRAND NAME : dormakaba
FCC ID : NVI-KT9600K6L
STANDARD(S) : 47 CFR Part 15 Subpart C
ISSUE DATE : 2017-09-05

SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.

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DIRECTORY

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Change History		
Issue	Date	Reason for change
1.0	2017-09-05	First edition



Test Report Declaration

Applicant	dormakaba EAD GmbH
Applicant Address	Albertistr. 3, 78056 Villingen-Schwenningen, Germany
Manufacturer	In-Tech Electronics Ltd
Manufacturer Address	Unit A,13/F, Wing Tai Centre,12 Hing Yip Street, Kwun Tong Kowloon, Hong Kong
Product Name	data collection terminal
Model Name	9600-K6 MRD
Brand Name	dormakaba
HW Version	02
SW Version	V5
Test Standards	47 CFR Part 15 Subpart C
Test Date	2017-08-01 to 2017-08-21
Test Result	PASS

Tested by : Wang Dalong
Wang Dalong (Test engineer)

Approved by : Andy Yeh
Andy Yeh (Technical Director)



1. Technical Information

Note: Provided by applicant.

1.1. Applicant Information

Company:	dormakaba EAD GmbH
Address:	Albertistr. 3, 78056 Villingen-Schwenningen, Germany

1.2. Equipment under Test (EUT) Description

Product Name:	data collection terminal
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	02
Software Version:	V5
Frequency Range:	13.553MHz~13.567MHz
Frequency:	13.56MHz
Channel Number:	1
Modulation Type:	ASK
Antenna Type:	PCB Antenna

NOTE:

1. The EUT is a data collection terminal which supports 13.56 MHz band. For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



2. Test Results

2.1. Applied Reference Documents

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C:

No.	Identity	Document Title
1	47 CFR Part 15	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Result
1	15.203	Antenna requirement	PASS
2	15.207	Conducted Emission	PASS
3	15.209 15.225(a)(b)(c)(d)	Radiated Emission	PASS
4	15.225(e)	Frequency Tolerance	PASS
5	15.215(c)	20dB Bandwidth	PASS

Note: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013. The EUT has been tested under continuous operating condition.



3. 47 CFR Part 15c Requirements

3.1. Antenna requirement

3.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.1.2. Result:

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

Result: Compliant

3.2. Conducted Emission

3.2.1. Test Requirement

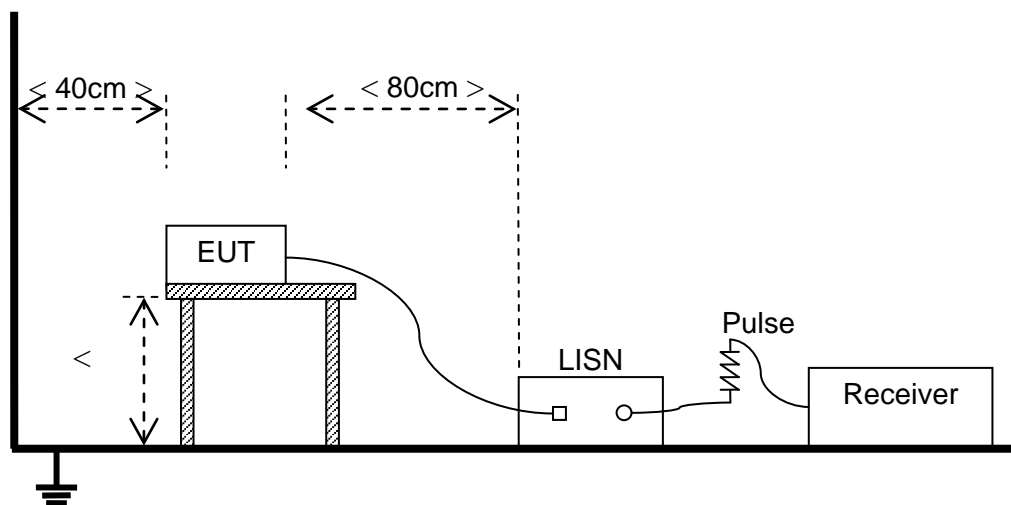
According to FCC section 15.207, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

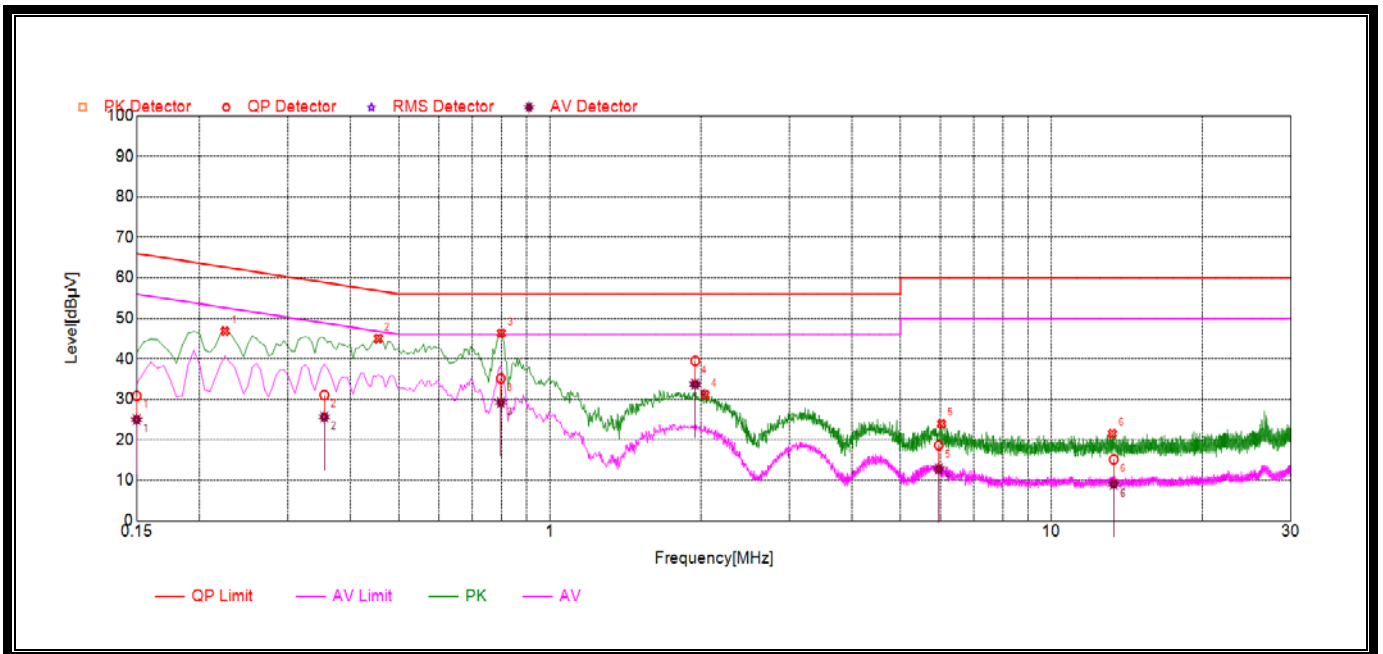
- The limit subjects to the Class B digital device.
- The lower limit shall apply at the band edges.
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

3.2.2. Test Setup



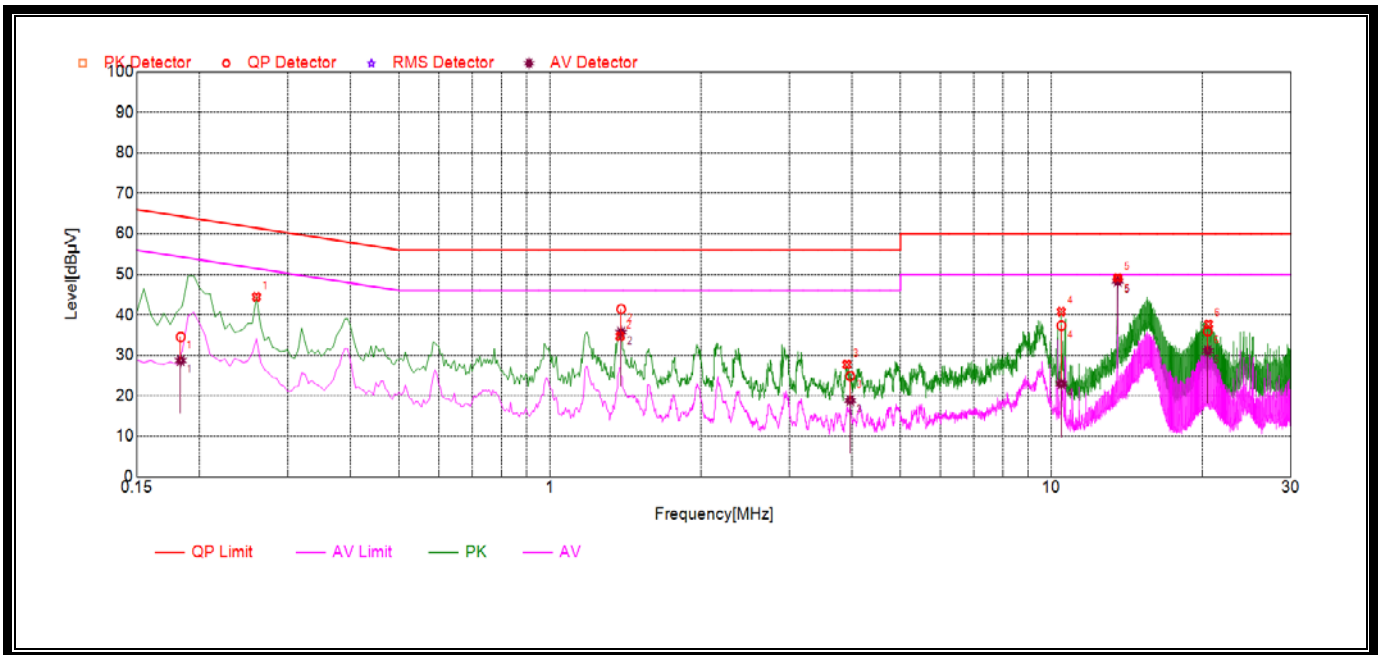
The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides 50 Ω /50 μ H of coupling impedance for the measuring instrument. The RF Card is used for the call between with the EUT, and the EUT was measured by transmitter mode continuously. A Pulse Limiter is used to protect the measuring instrument. The factors of the whole test system are calibrated to correct the reading.

3.2.3. Test Result



(Plot A: L Phase)

NO.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.15	31.00	25.21	66.00	56.00	Line	PASS
2	2.1858	31.36	25.46	56	46		PASS
3	3.1678	33.71	24.32	56	46		PASS
4	10.3218	34.92	33.23	60	50		PASS
5	13.5596	47.19	47.10	60	50		PASS
6	21.3488	38.59	33.12	60	50		PASS



(Plot B: N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1836	34.57	28.73	65.04	55.04	Line	PASS
2	1.3872	41.40	35.71	56	46		PASS
3	3.9716	24.86	18.87	56	46		PASS
4	10.4678	37.35	22.99	60	50		PASS
5	13.56	48.75	48.32	60	50		PASS
6	20.5016	35.93	31.16	60	50		PASS

Result: PASS



3.3. Radiated Emission

3.3.1. Test Requirement

A. Radiated Emission <30MHz (9KHz-30MHz, E-field)

According to FCC section 15.225, for <30MHz, Radiated emissions were measured according to ANSIC63.4. The EUT was set to transmit at the highest output power. The EUT was set 30 meter away from the measuring antenna. The loop antenna was positioned 1 meter above the ground from the center of the loop. The measuring bandwidth was set to 10KHz. (Note: During testing the receive antenna was rotated about its axis to maximize the emission from the EUT)

There was no detected Restricted bands and Radiated Spurious emission below 30MHz. The 30m limit was converted to 3m Limit using square factor(x) as it was found by measurements as follows;
 $3\text{ m Limit(dBuV/m)} = 20\log(X) + 40\log(30/3) = 20\log(15848) + 40\log(30/3) = 124\text{dBuV}$

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency range (MHz)	Field Strength@30m		Field Strength@3m
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
Below 13.110	30	29.5	69.5
13.110 ~ 13.410	106	40.5	80.5
13.410 ~ 13.553	334	50.5	90.5
13.553 ~13.567	15.848	84	124
13.567 ~ 13.710	334	50.5	90.5
13.710 ~14.010	106	40.5	80.5
Above 14.010	30	29.5	69.5

NOTE:

- Field Strength ($\text{dB}\mu\text{V/m}$) = $20 \cdot \log[\text{Field Strength } (\mu\text{V/m})]$.
- In the emission tables above, the tighter limit applies at the band edges.

B. Radiated Emission >30MHz (30MHz-1GHz, E-field)

According to FCC section 15.205, the field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

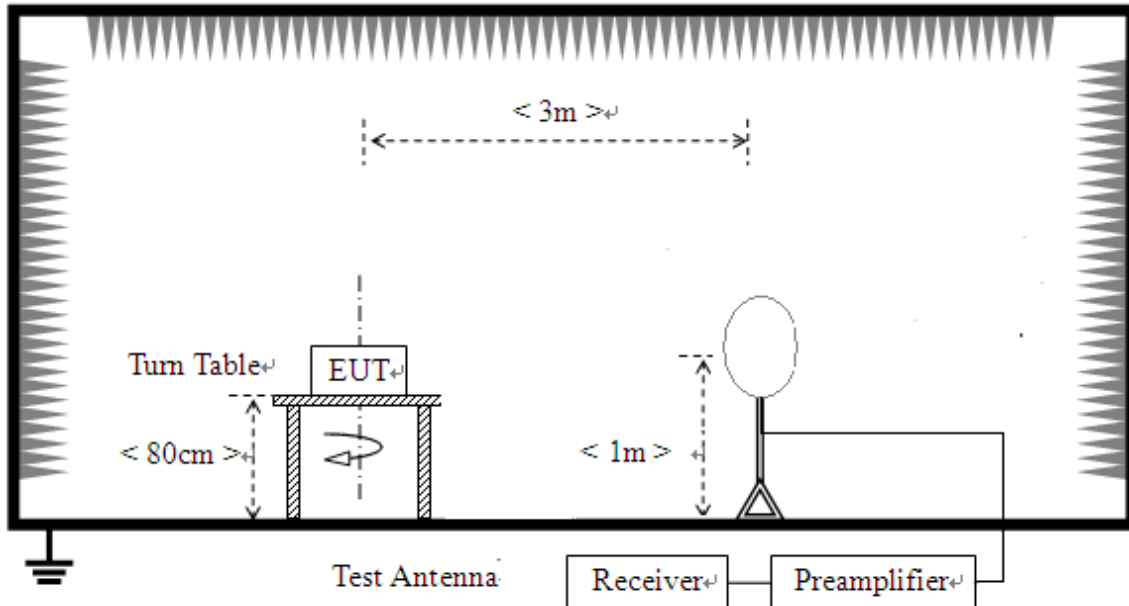
Frequency range (MHz)	Field Strength	
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

NOTE:

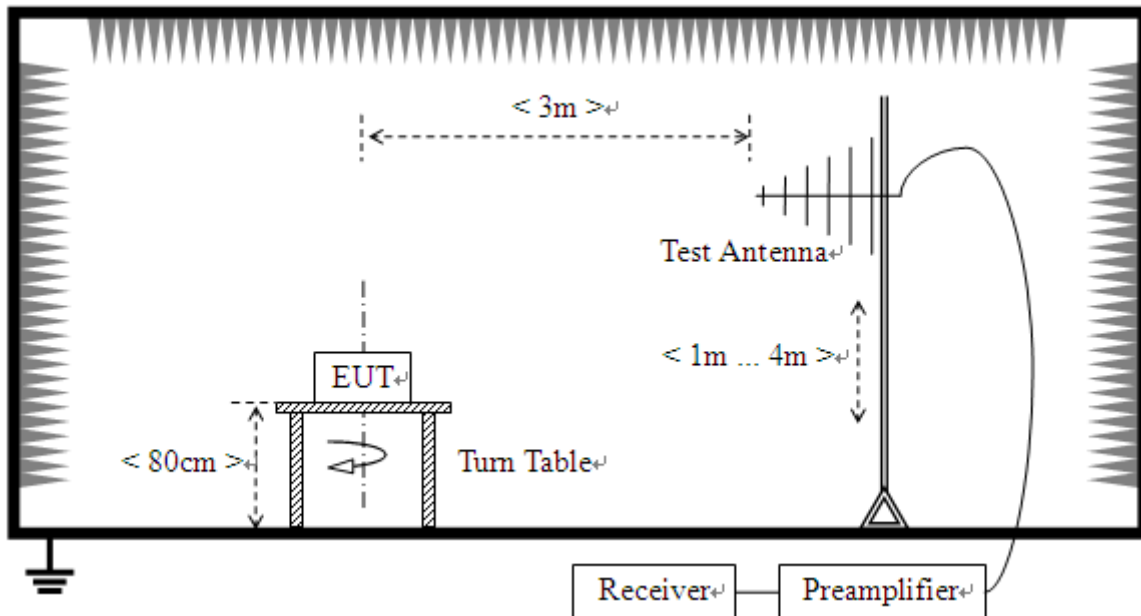
- Field Strength ($\text{dB}\mu\text{V/m}$) = $20 \cdot \log[\text{Field Strength } (\mu\text{V/m})]$.
- In the emission tables above, the tighter limit applies at the band edges.

3.3.2. Test Setup

- 1) For radiated emissions from 9kHz to 30MHz



- 2) For radiated emissions from 30MHz to 1GHz



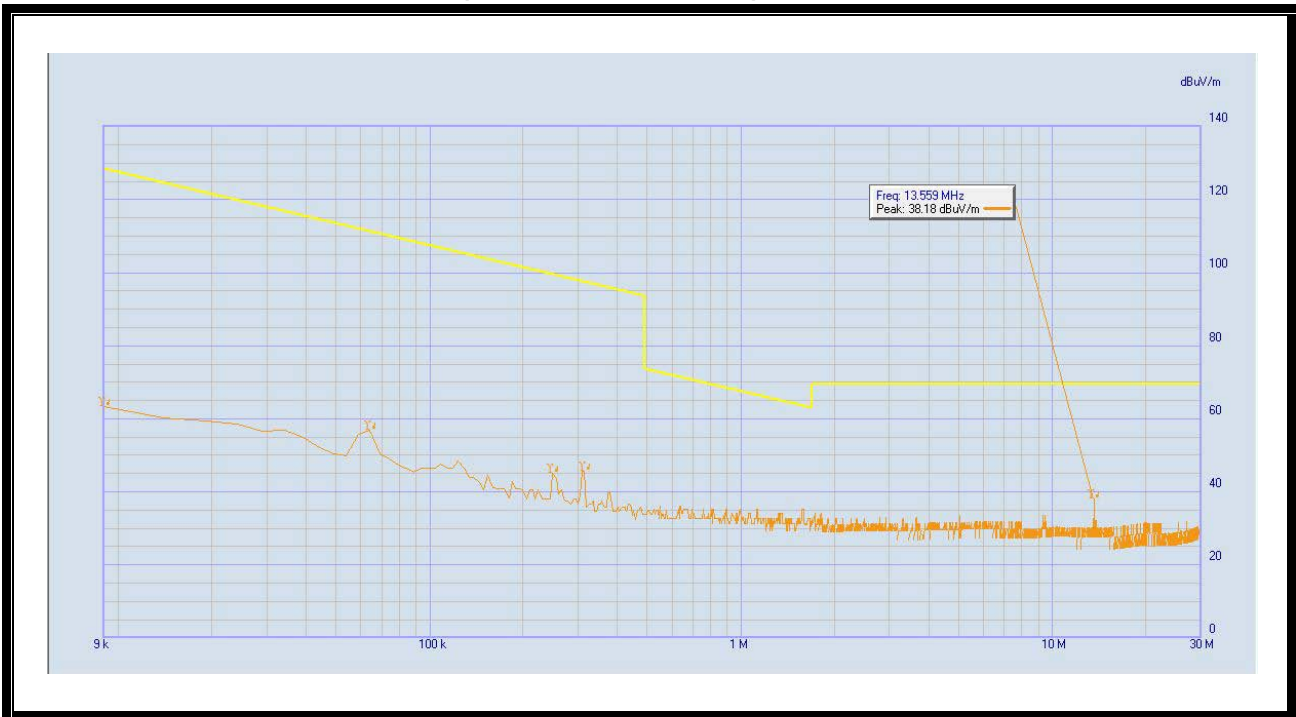
The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a variable-height antenna master tower.

For the test Antenna:

- 1) In the frequency range of 9KHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

3.3.3. Test Result

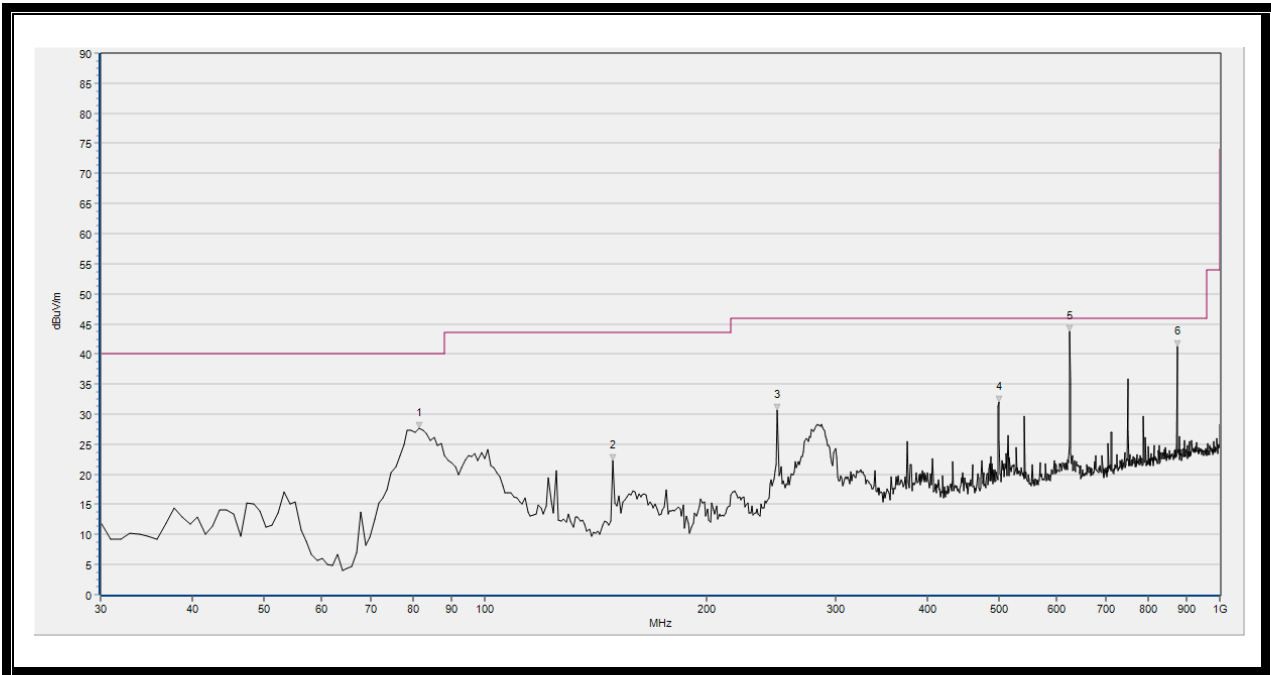
A. Radiated Emission <30MHz (9KHz-30MHz, E-field)



(Plot A: 9KHz – 30MHz)

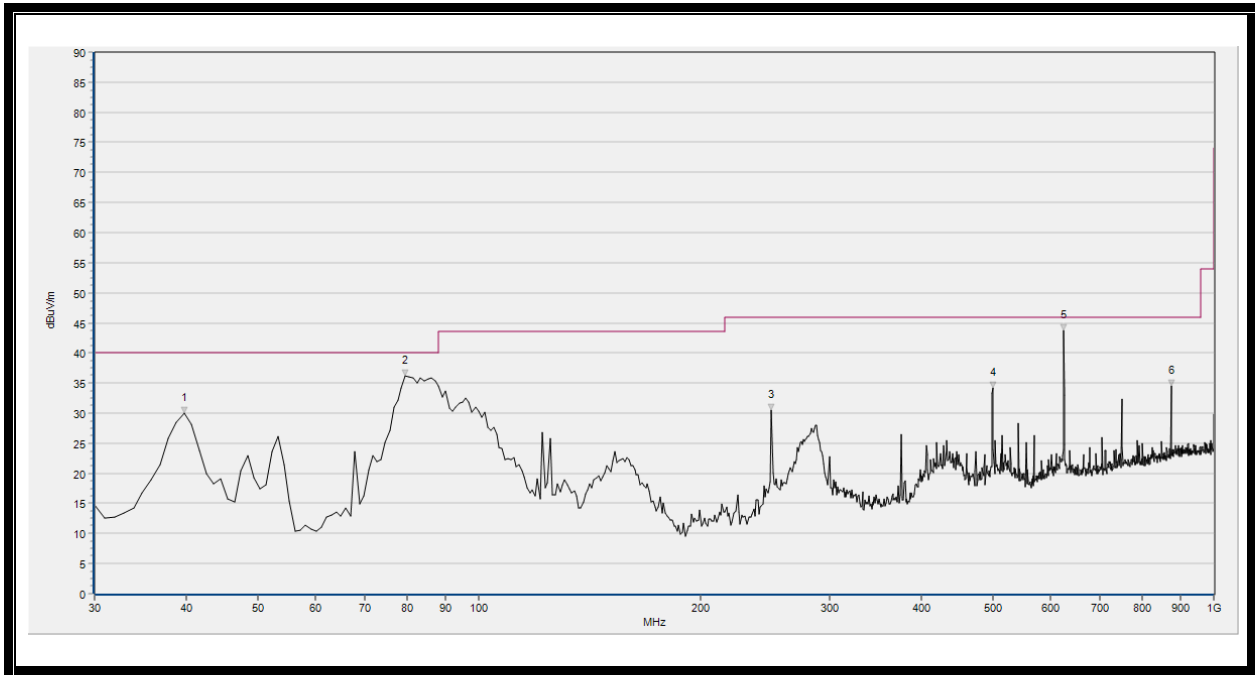
NO.	Frequency (MHz)	Detector Type	Level at 3m (dBµV/m)	Limit at 3m (dBµV/m)
1	13.56	Quasi Peak	38.18	124

B. Radiated Emission >30MHz (30MHz-1GHz, E-field)



(Plot B: 30MHz – 1GHz, Test Antenna Horizontal)

No.	Fre. MHz	Pk dBµV/m	QP dBµV/m	AV dBµV/m	Limit-PK dBµV/m	Limit-QP dBµV/m	Limit-AV dBµV/m	ANT	Verdict
1	81.410	27.63	N/A	N/A	N/A	40.00	N/A	H	Pass
2	149.310	22.22	N/A	N/A	N/A	43.50	N/A	H	Pass
3	250.190	30.72	N/A	N/A	N/A	46.00	N/A	H	Pass
4	500.450	32.01	N/A	N/A	N/A	46.00	N/A	H	Pass
5	624.610	43.75	N/A	N/A	N/A	46.00	N/A	H	Pass
6	874.870	41.26	N/A	N/A	N/A	46.00	N/A	H	Pass



(Plot C: 30MHz – 1GHz, Test Antenna Vertical)

No.	Fre. MHz	Pk dBµV/m	QP dBµV/m	AV dBµV/m	Limit-PK dBµV/m	Limit-QP dBµV/m	Limit-AV dBµV/m	ANT	Verdict
1	39.700	30.02	N/A	N/A	N/A	40.00	N/A	V	Pass
2	79.470	36.16	N/A	N/A	N/A	40.00	N/A	V	Pass
3	250.190	30.42	N/A	N/A	N/A	46.00	N/A	V	Pass
4	500.450	34.22	N/A	N/A	N/A	46.00	N/A	V	Pass
5	625.000	44.63	43.79	40.20	N/A	46.00	N/A	V	Pass
6	874.870	34.57	N/A	N/A	N/A	46.00	N/A	V	Pass

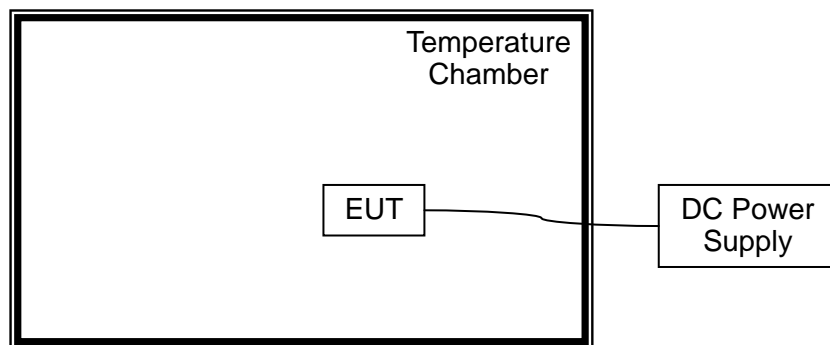
Result: PASS

3.4. Frequency Tolerance

3.4.1. Test Requirement

According to FCC section 15.225, the devices operating in the 13.553~13.567 MHz shall maintain the carrier frequency within 0.01% of the operating frequency over the temperature variation of -20°C to +50°C using an environmental chamber. The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

3.4.2. Test Setup



The EUT, which is powered by the DC Power Supply directly, is located in the Temperature Chamber. The EUT was measured by transmitter mode continuously.

**3.4.3. Test Result**

Operating Frequency: 13,560,000 Hz

Deference Voltage: 48V

Deviant Limit: $\pm 0.01\%$

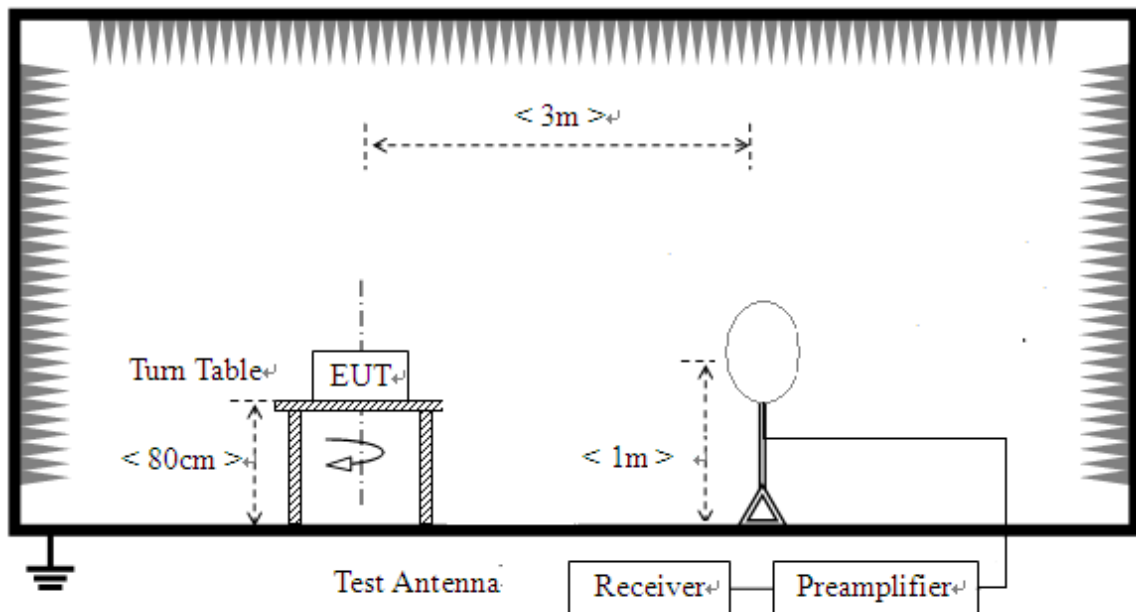
VOLTAGE(%)	Test Conditions		Frequency(Hz)	Deviation(%)	Verdict
	Power (VDC)	Temperature (°C)			
100	48	-20	13,560,015	0.0001106	PASS
100		-10	13,560,047	0.0003466	
100		0	13,560,082	0.0006047	
100		+10	13,559,764	0.0017404	
100		+20	13,559,592	0.0030088	
100		+25	13,559,593	0.0030015	
100		+30	13,559,584	0.0030678	
100		+40	13,560,071	0.0005236	
100		+50	13,560,019	0.0001401	
Battery End Point		44	+20	13,560,032	
115	57	+20	13,559,635	0.0026917	

3.5. 20dB Bandwidth

3.5.1. Test Requirement

According to FCC section 15.215(c), the 20dB bandwidth should be contained within the frequency band designated in the rule section under which the EUT is operated, it was measured with a spectrum analyzer connected the EUT while the EUT is operating in transmission mode.

3.5.2. Test Setup

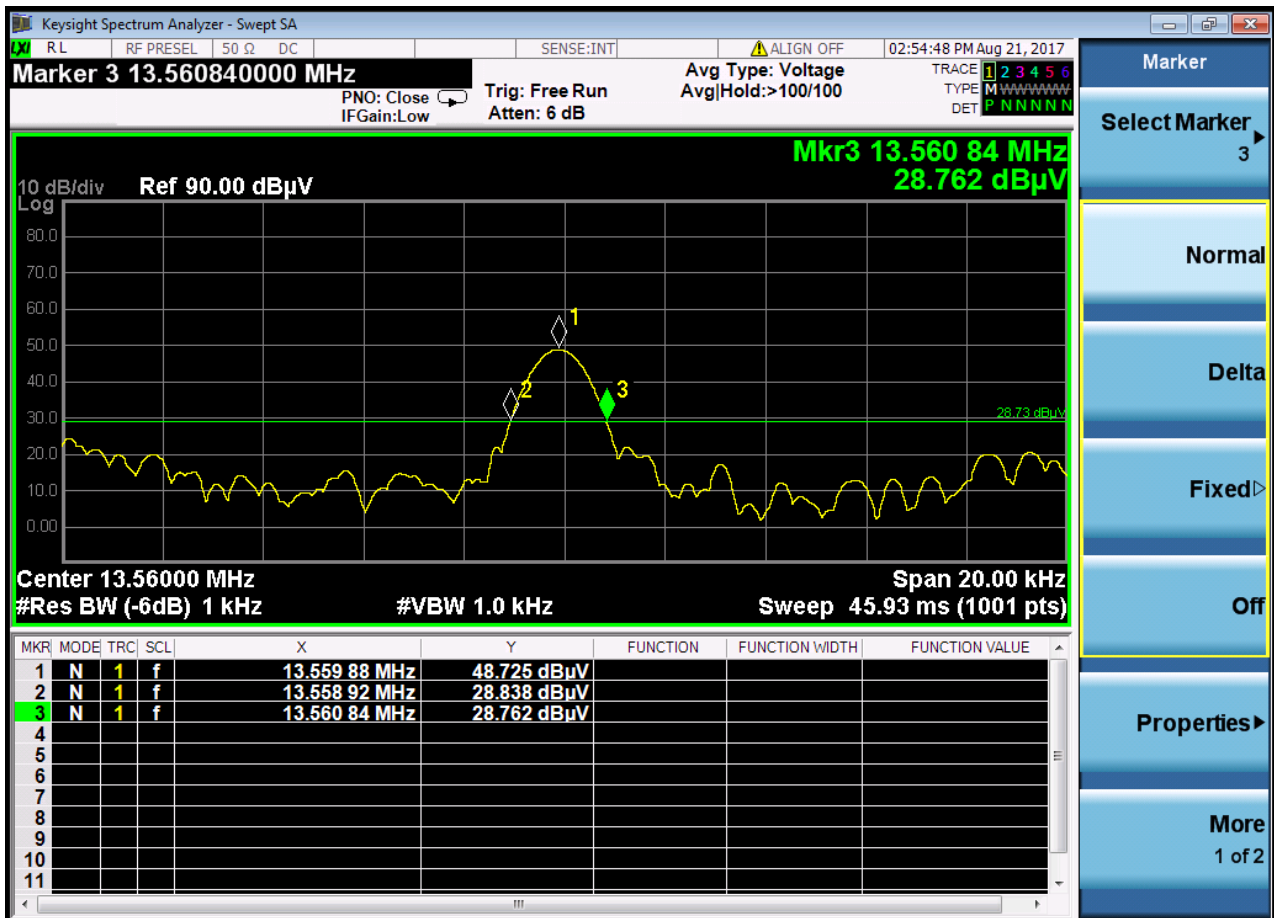




3.5.3. Test Result

Centre Frequency	Measurement		Limit		Verdict
	20dB Bandwidth (KHz)	Frequency Range (MHz)	20dB Bandwidth (KHz)	Frequency Range(MHz)	
13.56MHz	1.92	13.55892~13.56084	14	13.553~13.567	Pass

Please refer to the following plot:





ANXXE A Test Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission:	±1.8dB
Uncertainty of Radiated Emission:	±3.1dB

ANNEX B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Company Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Department:	Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, Guangdong Province, P. R. China
Responsible Test Lab Manager:	Mr. Su Feng
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, Guangdong Province, P. R. China

3. Accreditation Certificate

Accredited Testing Laboratory:	The FCC designation number is CN1192 (Shenzhen Morlab Communications Technology Co., Ltd.)
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4. Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	20 - 75
Atmospheric Pressure (kPa):	86 - 106



5. Test Equipments Utilized

5.1 Test Equipment

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	N9038A	MY54130016	2017.05.17	2018.05.16
LISN	Schwarzbeck	NSLK 8127	812744	2017.05.17	2018.05.16
Pulse Limiter (20dB)	Schwarzbeck	VTSD 9561-D	9537	2017.05.24	2018.05.23
Coaxial Cable	Morlab	EMC01	CB05	(n.a.)	(n.a.)
Coaxial Cable	Morlab	EMC02	CB06	(n.a.)	(n.a.)
MXE EMI Receiver	Agilent	N9038A	MY54130016	2017.05.17	2018.05.16
Anechoic Chamber	Changning	9m*6m*6m	N/A	2017.01.11	2018.01.10
Test Antenna – Bi-Log	Schwarzbeck	VULB 9163	9163-274	2016.12.09	2017.12.08
Test Antenna -Loop	Schwarzbeck	FMZB 1519	1519-022	2017.03.07	2018.03.06
Spectrum Analyzer	Agilent	E7405A	US44210471	2017.05.17	2018.05.16
DC Power Supply	Good Will	GPS-3030DD	EF920938	2017.05.24	2018.05.23
Temperature Chamber	YinHe Experimental Equip.	HL4003T	(n.a.)	2017.01.11	2018.01.10
RF cable	Morlab	RF03	CB03	(n.a.)	(n.a.)

5.2 Test Software Utilized

Model	Version Number	Producer
TS+ -[JS32-CE]	Version 2.5.0.0	Tonscend
MORLAB EMCR V1.2	Version 1.0	MORLAB

***** END OF REPORT *****