

FCC Part 15.225

Measurement And Test Report For

Guangzhou Zhongda Microelectronics, Inc.

Block A, 615, 617 Room 88th Xinhua Street, Tiangui Road, Huadu District, Guangzhou city, Guangdong Province, P.R.China

FCC ID: 2AAJ6ZM2003

June 28, 2013

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: ZM series IC card reader
Report Number:	MTI130617001RF
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Reviewed By:	Jason Zheng <i>Jason Zheng</i>
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Test Date:	Jun 20-28,2013
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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior written consent of Shenzhen Microtest Technology Co.,Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	Guangzhou Zhongda Microelectronics, Inc.
Address of applicant:	Block A, 615, 617 Room 88th Xinhua Street, Tiangui Road, Huadu District, Guangzhou city, Guangdong Province, P.R.China
Manufacturer:	Guangzhou Zhongda Microelectronics, Inc.
Address of manufacturer:	Block A, 615, 617 Room 88th Xinhua Street, Tiangui Road, Huadu District, Guangzhou city, Guangdong Province, P.R.China
Equipment Under Test:	ZM series IC card reader
Tested Model No.:	ZM2003
Trade Name:	
Supplementary Models No:	ZM120UE ZM121UE ZM124UE Remark: supplementary models are only different in exterior with tested Model and with the same circuit construction
Frequency range:	13.56 MHz
Type of Modulation:	ASK
Number of Channels:	1
Antenna Type:	Integral Antenna, Max Gain 0dBi
Power Supply:	DC 5V Form PC with 120V/60Hz

Remark: * The test data gathered are from the production sample provided by the manufacturer.

1.2 Related Submittal(s) / Grant (s)

This submittal(s) is a test report based on the Electromagnetic Interference (EMI) tests performed on the EUT. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4 - 2003.

The tests were performed in order to determine compliance with FCC Part 15, Subpart B, and section 15.205, 15.209 and 15.225rules.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 - 2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Test Facility

All measurement required was performed at laboratory of NTEK Testing Technology Co., Ltd., at 1/F, Building E, Fenda Science Park Sanwei Community, Xixiang Street, Baoan District , Shenzhen,Guangdong

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

FCC – Registration No.: 238937

NTEK Testing Technology 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 our files. Registration 238937.

2. SYSTEM TEST CONFIGURATION

The tests documented in this report were performed in accordance with ANSI C63.4-2003 and FCC CFR 47 Part 15 Subpart C.

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The calibrated antennas used to sample the radiated field strength are mounted on a non-conductive, motorized antenna mast 3 or 10 meters from the leading edge of the turntable.

2.3 General Test Procedures

Conducted Emissions The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 7.1 of ANSI C63.4-2003. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak detector mode.

Radiated Emissions The EUT is placed on a turntable, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4-2003.

2.4 List of Measuring Equipments Used

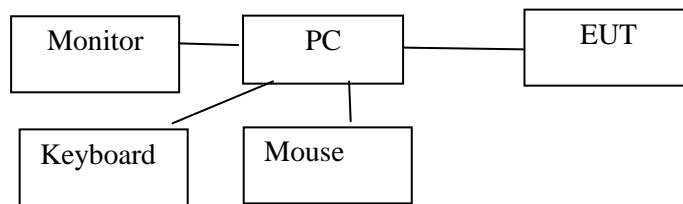
Items	Equipment	Manufacturer	Model No.	Serial No.	Last Cal	Calibration Period
1	EMI Test Receiver	ROHDE & SCHWARZ	ESI 26	100079	2012/11/18	1 year
2	Horn Antenna	TESEQ	BHA 9118	9118698	2013/02/11	1 year
3	Loop Antenna	COM Power	AL-130	UBTL0031	2013/02/11	1 year
4	3m Semi- Anechoic Chamber	ETS	N/A	N/A	2012/09/05	1 year
5	EMI Test Receiver	ROHDE & SCHWARZ	ESCS30	100038	2012/11/18	1 year
6	EMI Test Receiver	ROHDE & SCHWARZ	ESI 26	100009	2012/11/18	1 year
7	Receiver/ Spectrum Analyzer	ROHDE & SCHWARZ	ESCI	100106	2013/02/07	1 year
8	Spectrum Analyzer	Agilent	E7405A	US41160415	2012/11/18	1 year
9	Artificial Mains	ROHDE & SCHWARZ	ESH2-Z5	100028	2012/11/18	1 year
10	Pulse Limiter	ROHDE & SCHWARZ	ESHSZ2	100044	2012/11/18	1 year
11	LISN	COM Power	LI-200	12212	2012/11/18	1 year
12	LISN	COM Power	LI-200	12019	2012/11/18	1 year
13	3m/5m Semi- Anechoic Chamber	ETS	N/A	N/A	2012/09/05	1 year
14	Ultra-Broadband Antenna	R/S	HL562	100015	2013/02/11	1 year
15	Horn Antenna	OCEAN MICROWAVE	OBH2026 5	OC134039	2013/02/11	1 year
16	RF Test Panel	R/S	TS / RSP	335015/ 0017	N/A	N/A
17	Turntable	ETS	2088	2149	N/A	N/A
18	Antenna Mast	ETS	2075	2346	N/A	N/A

2.5 Test conduction

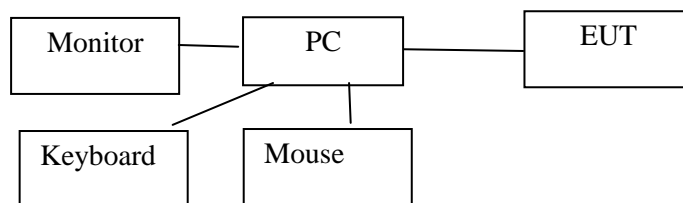
For Radiated with Below 30MHz:



For Radiated with Above 30MHz:



For Conducted:



2.6 Test Peripheral Information

Items	Equipment	Manufacturer	Model No.
1	PC	DELL	M18X
2	Monitor	DELL	U2312HM
3	Mouse	DELL	WM311
4	Keyboard	DELL	YK-325
5	Notebook	DELL	WE-21
6			

3. SUMMARY OF TEST RESULTS

3.1 Test Peripheral Information

FCC Rules	Description of Test	Result
15.207	Conducted Emission	Pass
15.209	Radiated Emission	Pass
15.225	Spectrum Mask	Pass
15.225	Frequency stability	Pass
15.215	Bandwidth Test	Pass
15.203	Antenna Requirement	Pass

Note: The EUT has been tested as an independent unit. And Continual, Transmitting in maximum power (The PC be used during Test)

3.2 Test Peripheral Information

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (MHz)
1	CH1	13.56
Note: According exploratory test, EUT will have maximum output power in those data rate. so those data rate were used for all test.		

4. RADIATED EMISSION

4.1 Limits of Radiated Emission Measurement

According to § 15.205 15.209(a) & 15.35 (b), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Section 15.209:

0.009–0.490 2400/F (kHz) uV/m @300m

0.490–1.705 24000/F (kHz) uV/m @30m

1.705–30.0 30 uV/m @30m

30 - 88 MHz 40 dBuV/m @3M

88 -216 MHz 43.5 dBuV/m @3M

216 -960 MHz 46 dBuV/m @3M

Above 960 MHz 54dBuV/m @3M

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

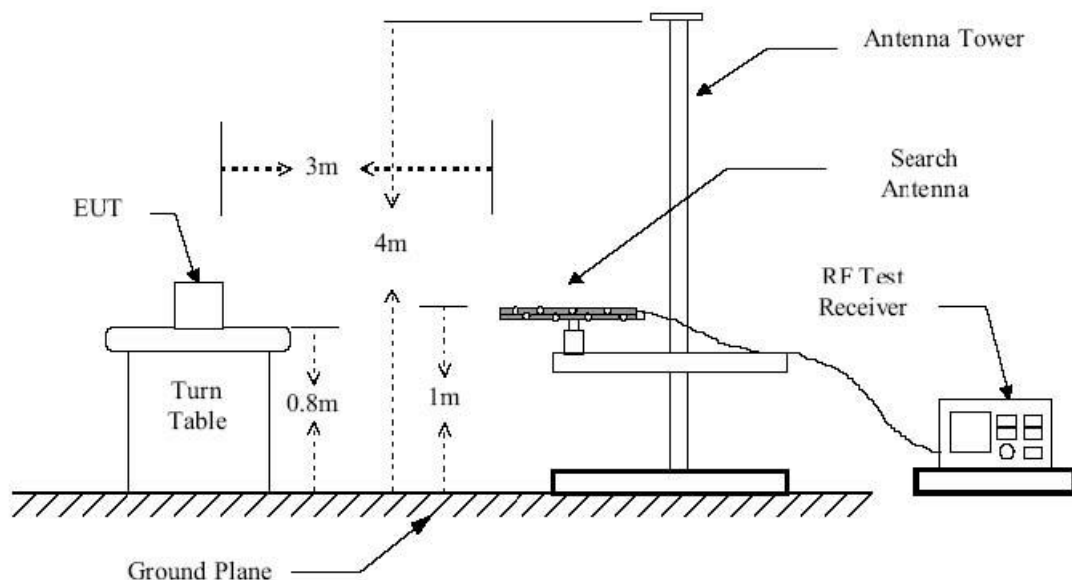
Emissions that fall in the restricted bands (15.205) must be less than 54dBuV/m otherwise the spurious and harmonics must be attenuated by at least 20dB.

Note: 30m to 3m correction factor calculation:

$$40 * \text{Log}(30\text{m}/3\text{m}) = 40$$

4.2 EUT Setup

Radiated Measurement Setup



4.3 Test Equipment List and Details

See section 2.4.

4.4 Test Procedure

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. 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 is a broadband antenna, and its 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 rotatable 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 the quasi-peak method or average method as specified and then reported in Data sheet peak mode and QP mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.

4.5 Test Result

According to the data below, the FCC Part 15.205, 15.209 and 15.225 standards, and had the worst margin of:

-2.68 dB μ V at 288.99MHz in the Horizontal polarization, with 9KHz to 25 GHz, 3Meters

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

From 9KHz to 30MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Radiated Emissions Result of Inside band (27MHZ)

Channel (13.56MHZ)									
Fre. MHz	Plority H/V	Reading dBuV	Antenna Factor dB	Cable Loss dB	Amplifier Gain dB	Correct Factor dB	Measure Result dBuV/m	Limit dBuV/m	Margin dB
13.56	H	115.48(PK)	8.68	0.26	26.93	-17.99	97.49	124	-26.51
13.56	H	106.74 (AV)	8.68	0.26	26.93	-17.99	88.75	104	-15.25
--	H	--	--	--	--	--	--	--	--
13.56	V	120.52(PK)	8.68	0.26	26.93	-17.99	102.53	124	-21.47
13.56	V	112.87(AV)	8.68	0.26	26.93	-17.99	94.88	104	-9.12
--	V	--	--	--	--	--	--	--	--

Notes: --Means other frequency and mode comply with standard requirements and at least have 20dB margin.

Correct Factor=Cable Loss+Antenna Factor-Amplifier Gain

Measurement Result=Reading + Correct Factor

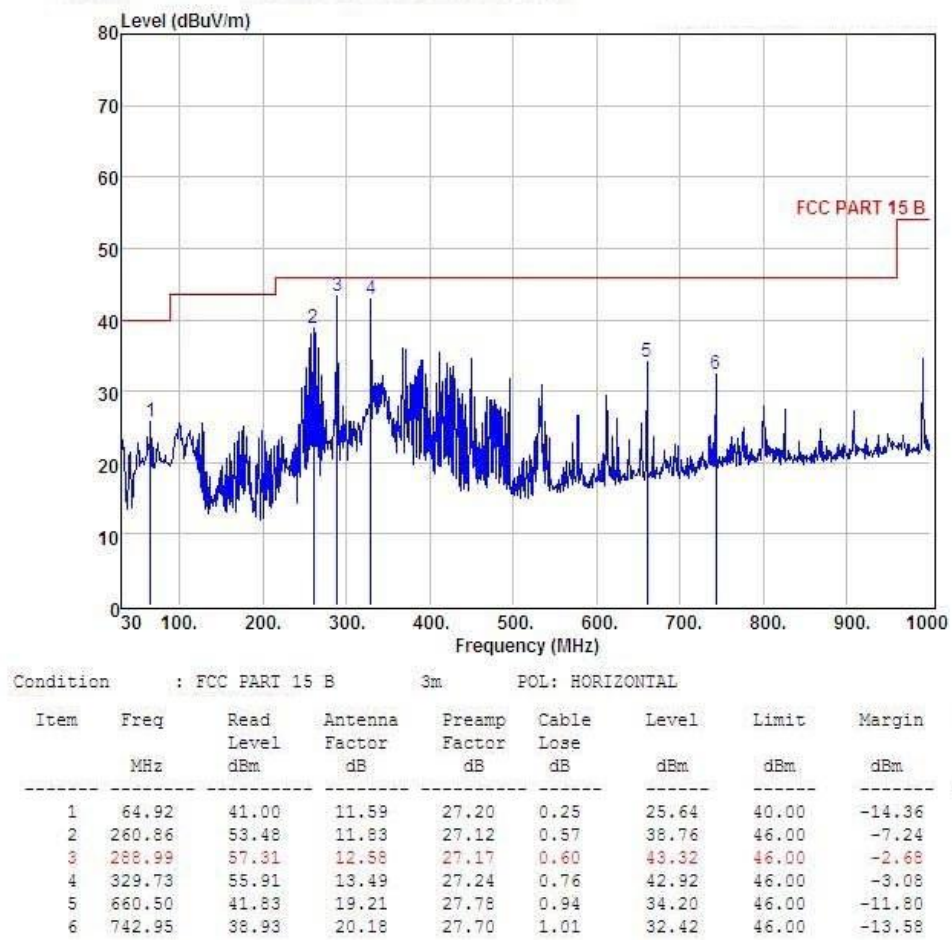
Margin=Measurement Result-Limit

--Spectrum setting:

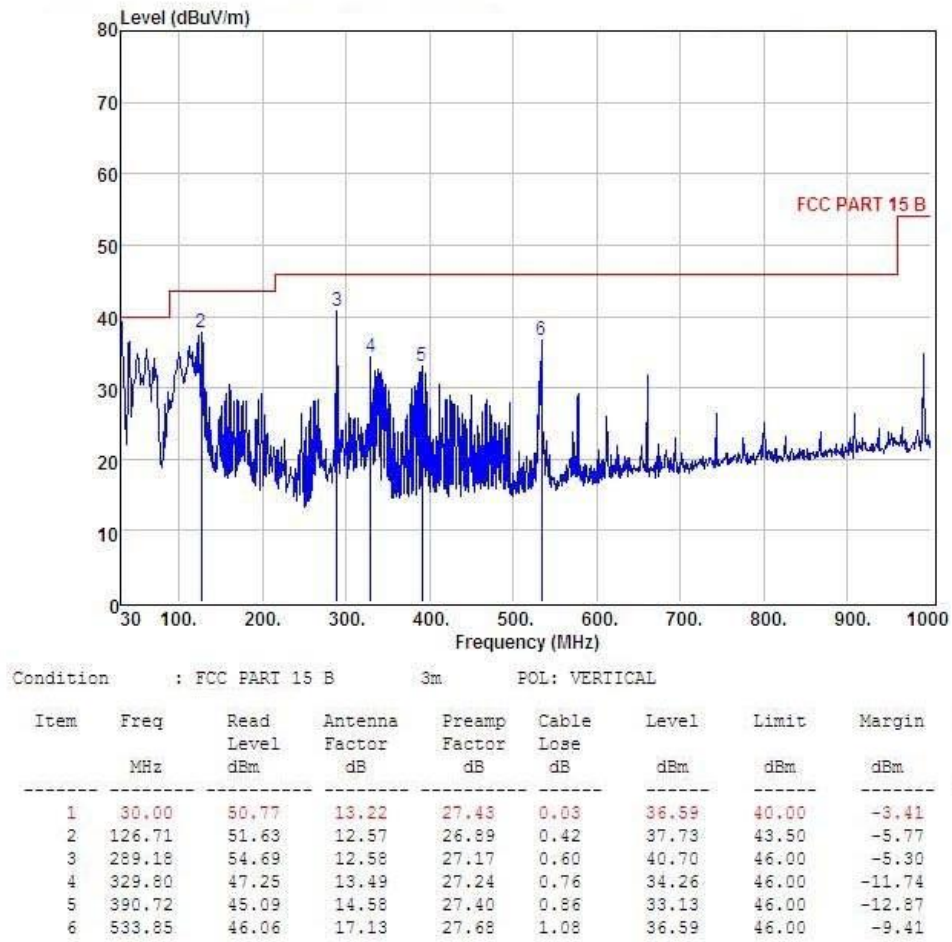
a. Peak setting RBW=120KHz, VBW=300KHz.

b. AV setting RBW=1MHz, VBW=10Hz.

From 30 MHz to 1 GHz
Test mode: Link mode
Horizontal



Vertical



5 Spectrum Mask

5.1 Limit

Please see the section 15.225(b) and 15.225(c)

15.225(b): Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter (50.5dBuV/m) at 30 meters

15.225(c): Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter (40.5dBuV/m) at 30 meters

Note: 30m to 3m correction factor calculation:

$$40 * \log(30\text{m}/3\text{m}) = 40$$

5.2 Test Result:

EUT	ZM series IC card reader	Model Name	ZM2003
Temperature	26oC	Relative Humidity	56%
Pressure	960hPa	Test voltage	DC 5V supply by PC
Test Mode	TX	Distance	3m

Freq. (MHz)	Position	Detector Mode (PK/OP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limits 3m (dBuV/m)	Margin (dBuV/m)
13.274	H	Peak	62.87	-17.92	44.95	80.50	-35.55
13.468	H	Peak	61.54	-17.92	43.62	90.50	-46.88
13.513	H	Peak	63.29	-17.92	45.37	90.50	-45.13
13.569	H	Peak	62.83	-17.91	44.92	90.50	-45.58
13.728	H	Peak	61.47	-17.91	43.56	80.50	-36.94
13.896	H	Peak	60.93	-17.91	43.02	80.50	-37.48

Freq. (MHz)	Position X/Y/Z	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limits 3m (dBuV/m)	Margin (dBuV/m)
13.186	V	Peak	59.76	-17.92	41.84	80.50	-38.66
13.394	V	Peak	60.24	-17.92	42.32	80.50	-38.18
13.452	V	Peak	59.82	-17.92	41.90	90.50	-48.60
13.517	V	Peak	57.43	-17.92	39.51	90.50	-50.99
13.642	V	Peak	58.84	-17.91	40.93	90.50	-49.57
13.785	V	Peak	57.16	-17.91	39.25	80.50	-41.25

6. CONDUCTED DISTURBANCES

6.1. Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is +2.4 dB.

6.2. Limit of Conducted Disturbances (Class B)

Frequency Range (MHz)	Limits (dBuV)	
	Quasi-Peak	Average
0.150~0.500	66~56	56~46
0.500~5.000	56	46
5.000~30.00	60	50

Note: (1) The tighter limit shall apply at the edge between two frequency bands.

6.3. EUT Setup

The setup of EUT is according with CISPR 16-1: 2002, CISPR16-2: 2002 measurement procedure.

The EUT was placed center and the back edge of the test table.

The cables were draped along the test table and bundled to 30-40cm in the middle.

The spacing between the peripherals was 10 cm.

Maximum emission emitted from EUT was determined by manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation and the levels in the final result of the test were recorded with the EUT running in the operating mode that maximum emission was emitted.

6.4. Instrument Setup

The test receiver was set with the following configurations:

Test Receiver Setting:

Frequency Range.....150 KHz to 30 MHz

Detector.....Peak & Quasi-Peak & Average

Sweep Speed.....Auto

IF Band Width.....9 KHz

6.5. Test Procedure

During the conducted emission test, the EUT power cord was connected to the auxiliary outlet of the first Artificial Mains.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance using all installation combination.

All data was recorded in the peak detection mode. Quasi-peak and Average readings were only performed when an emission was found to be marginal (within -10 dB μ V of specification limits). Quasi-peak readings are distinguished with a "**QP**". Average readings are distinguished with a "**AV**".

6.6. Summary of Test Results

According to the data in section 3.6, the worst margin reading of:

EUT Configuration on Test

ZM series IC card reader

Model Number : ZM2003

Serial Number : N/A

Applicant : Guangzhou Zhongda Microelectronics, Inc.

6.7. Test Result

Pass.

Detailed information please refers to the following page.

Plot of Conducted Emissions Test Data

Conducted Disturbance

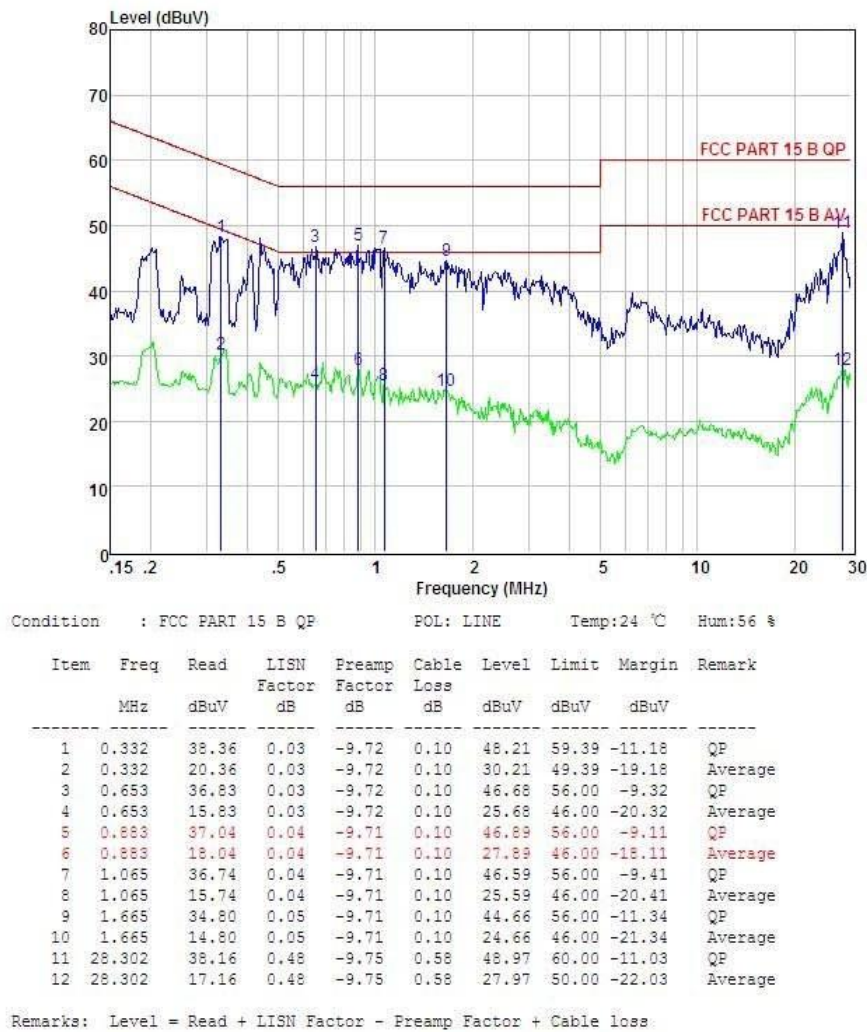
EUT: ZM series IC card reader

M/N: ZM2003

Operating Condition: Link mode

Test Specification: L

Comment: DC 5V From PC with AC 120V/50Hz



Plot of Conducted Emissions Test Data

Conducted Disturbance

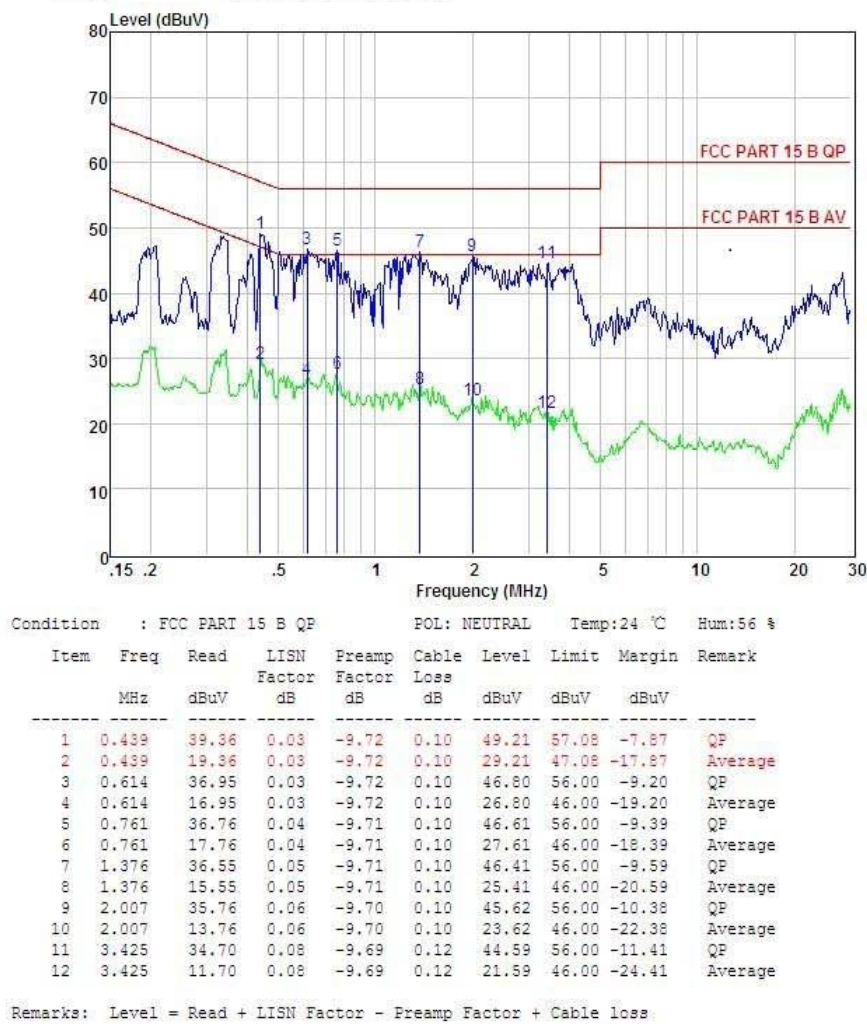
EUT: ZM series IC card reader

M/N: ZM2003

Operating Condition: Link mode

Test Specification: N

Comment: DC 5V From PC with AC 120V/50Hz



7. Frequency stability

7.1 Test limit

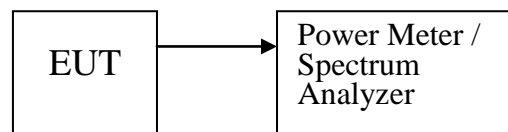
Please refer section 15.225e.

Regulation 15.225(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ (± 100 ppm) of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

7.2 Test Procedure

The following equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

7.3 Test Setup



7.4 Test Equipment List and Details

See section 2.4.

7.5 Test Results

PASS

Detailed information please see the following page.

Assigned Frequency(MHz): 13.56MHz Voltage: DC 5V				
Voltage	Temperature	Measured Frequency (MHz)	Frequency stability	Limit
Low 4.25V	+20°C	13.56081	0.00081	±100 ppm ±0.001356MHz
Normal 5V	-20°C	13.56084	0.00083	
	-10°C	13.55913	-0.00087	
	0°C	13.56076	0.00076	
	+10°C	13.55938	-0.00038	
	+20°C	13.56072	-0.00072	
	+30°C	13.56083	0.00083	
	+40°C	13.55944	-0.00056	
	+50°C	13.55939	-0.00061	
High 5.75V	+20°C	13.56086	0.00086	

8 Bandwidth Test

8.1 Limit for Bandwidth

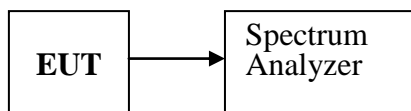
Please see the section 15.215.

8.2 Method of measurement

a) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

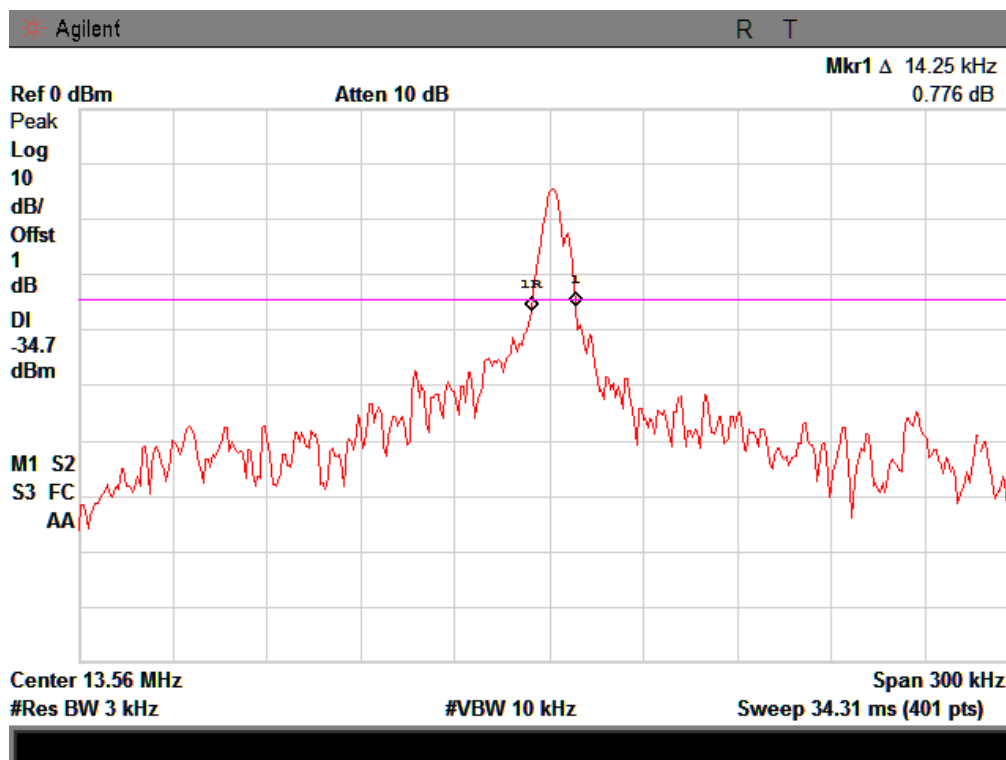
b) The test receiver RBW set 3KHZ, VBW set 10KHZ

8.3 Test Setup



8.4 Test Results

PASS.



13.56MHz bandwidth test plot

9. ANTENNA REQUIREMENT

9.1 Standard Applicable

Section 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. 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.

Section 15.247(b)/(c):

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

If the intentional radiator is used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

9.2 Antenna Connected Construction

This product has a integral antenna, The maximum Gain of the antenna is 0dBi.
fulfill the requirement of this section.