

FCC TEST REPORT

FOR

SuZhou MuLan Ele&Tec Co.,Ltd

RFID Reader

Model No.: ML-M2000DX

Prepared for	: SuZhou MuLan Ele&Tec Co.,Ltd
Address	: No. 625, ChuangYe Building, Binhe Road, Suzhou, Jiangsu Province, China
Prepared by	: Shenzhen LCS Compliance Testing Laboratory Ltd
Address	: 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong , China
Date of receipt of test sample	: May 06, 2014
Number of tested samples	: 1
Serial number	: Prototype
Date of Test	: May 06, 2014 - May 13, 2014
Date of Report	: May 13, 2014

FCC TEST REPORT**FCC CFR 47 PART 15 C(15.249): 2013****Report Reference No. : LCS1405060201E**

Date of Issue..... : May 13, 2014

Testing Laboratory Name : Shenzhen LCS Compliance Testing Laboratory Ltd.Address..... : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue,
Bao'an District, Shenzhen, Guangdong, ChinaTesting Location/ Procedure : Full application of Harmonised standards ☒Partial application of Harmonised standards ☐Other standard testing method ☐**Applicant's Name..... : SuZhou MuLan Ele&Tec Co.,Ltd**Address..... : No. 625, ChuangYe Building, Binhe Road, Suzhou, Jiangsu
Province, China**Test Specification**

Standard : FCC CFR 47 PART 15 C(15.249): 2013

Test Report Form No. : LCSEMC-1.0

TRF Originator..... : Shenzhen LCS Compliance Testing Laboratory Ltd.

Master TRF : Dated 2011-03

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Test Item Description..... : RFID Reader

Trade Mark..... :



Model/ Type reference : ML-M2000DX

Ratings : DC 9~12V, 1000mA

Result : Positive**Compiled by:**

Jacky Li/ File administrators

Supervised by:Danny Huang/ Technique
principal**Approved by:**

Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS1405060201EMay 13, 2014

Date of issue

Type / Model..... : ML-M2000DX

EUT..... : RFID Reader

Applicant..... : SuZhou MuLan Ele&Tec Co.,LtdAddress..... : No. 625, ChuangYe Building, Binhe Road, Suzhou, Jiangshu
Province, China

Telephone..... : /

Fax..... : /

Manufacturer..... : SuZhou MuLan Ele&Tec Co.,LtdAddress..... : No. 625, ChuangYe Building, Binhe Road, Suzhou, Jiangshu
Province, China

Telephone..... : /

Fax..... : /

Factory..... : SuZhou MuLan Ele&Tec Co.,LtdAddress..... : No. 625, ChuangYe Building, Binhe Road, Suzhou, Jiangshu
Province, China

Telephone..... : /

Fax..... : /

Test Result**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

TABLE OF CONTENTS

1. GENERAL INFORMATION	5
1.1. Description of Device (EUT)	5
1.2. Host System Configuration List and Details	5
1.3. External I/O	5
1.4. Description of Test Facility	6
1.5. Statement of the measurement uncertainty	6
1.6. Measurement Uncertainty	6
1.7. Description Of Test Modes	7
2. TEST METHODOLOGY	8
2.1. EUT Configuration	8
2.2. EUT Exercise	8
2.3. General Test Procedures	8
3. CONNECTION DIAGRAM OF TEST SYSTEM.....	9
3.1. Justification	9
3.2. EUT Exercise Software	9
3.3. Special Accessories	9
3.4. Block Diagram/Schematics	9
3.5. Equipment Modifications	9
3.6. Test Setup	9
4. SUMMARY OF TEST RESULTS	10
5. POWER LINE CONDUCTED EMISSIONS.....	11
5.1 Standard Applicable	11
5.2 Block Diagram of Test Setup	11
5.3 Test Results	11
6. ANTENNA REQUIREMENT	13
6.1. Standard Applicable	13
6.2. Antenna Connected Construction.....	13
7. RADIATED EMISSION MEASUREMENT	14
7.1. Standard Applicable	14
7.2. Measuring Instruments and Setting	14
7.3. Test Procedure	15
7.4. Test Equipment List and Details	16
7.5. Block Diagram of Test Setup	16
7.6. Test Results	17
8. BANDEDGES MEASUREMENT.....	22
8.1. Standard Applicable	22
8.2. Test Equipment List and Details	22
8.3. Block Diagram of Test Setup	22
8.4. Test Procedure	22
8.5. Test Results	23
9. 20 DB BANDWIDTH MEASUREMENT	24
9.1. Standard Applicable	24
9.2. Test Equipment List and Details	24
9.3. Block Diagram of Test Setup	24
9.4. Test Procedure	24
9.5. Test Results	25
10. MANUFACTURER/ APPROVAL HOLDER DECLARATION	27

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT : RFID Reader

Model Number : ML-M2000DX

Power Supply : DC 9~12V, 1000mA

Frequency Range : 2401.00-2480.00MHz

Channel frequency list (MHz) : 2401-2480MHz(Channel Number: 80,
Channel Frequency=2401+1(K-1), K=1, 2, 380);

Channel number : 80

Modulation Technology : GFSK

Antenna Type and Gain : Integral Antenna, 15.0dBi(Max.)

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
--	AC/DC Adapter	YGY-121000	--	VOC

1.3. External I/O

I/O Port Description	Quantity	Cable
DC Port	1	--

1.4. Description of Test Facility

Site Description

EMC Lab. : Accredited by CNAS, June 04, 2010
 The Certificate Registration Number. is L4595.
 Accredited by FCC, April 22, 2011
 The Certificate Registration Number. is 899208.
 Accredited by Industry Canada, May. 02, 2011
 The Certificate Registration Number. is 9642A-1
 Accredited by VCCI, Japan January 30, 2012
 The Certificate Registration Number. is C-4260 and R-3804
 Accredited by ESMD, April 24, 2012
 The Certificate Registration Number. is ARCB0108.
 Accredited by UL, June 11, 2012
 The Certificate Registration Number. is 100571-492.
 Accredited by TUV, November 21, 2012
 The Certificate Registration Number. is SCN1081
 Accredited by Intertek, December 21, 2012
 The Certificate Registration Number. is 2011-RTL-L1-50.

1.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	$\pm 3.10\text{dB}$	(1)
		30MHz~200MHz	$\pm 2.96\text{dB}$	(1)
		200MHz~1000MHz	$\pm 3.10\text{dB}$	(1)
		1GHz~26.5GHz	$\pm 4.00\text{dB}$	(1)
Conduction Uncertainty	:	150kHz~30MHz	$\pm 1.63\text{dB}$	(1)
Power disturbance	:	30MHz~300MHz	$\pm 1.60\text{dB}$	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

1.7. Description Of Test Modes

The EUT operates in the unlicensed ISM band at 2.4GHz. The following operating modes were applied for the related test items. And the new battery is used during the measurement.

The EUT received DC 12.0V power from a AC/DC Adapter which are new and full power.

All test modes were tested, only the result of the worst case was recorded in the report.

The EUT is considered a portable unit; it was pre-tested on the positioned of each 3 axis. The worst case was found positioned on X-plane. Therefore only the test data of this X-plane was used for radiated emission measurement test.

Mode of Operations	Transmitting Frequency (MHz)
GFSK	2401
	2441
	2480
For Conducted Emission	
Test Mode	TX Mode
For Radiated Emission	
Test Mode	TX Mode

2. TEST METHODOLOGY

All measurements contained in this report were conducted with 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.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd..

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 EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.249 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, 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

3. CONNECTION DIAGRAM OF TEST SYSTEM

3.1. Justification

The system was configured for testing in a continuous transmit condition.

3.2. EUT Exercise Software

N/A

3.3. Special Accessories

N/A

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207(a)	Conduction Emissions	Compliant
§15.205(a), §15.209(a), §15.249(a), §15.249(c)	Radiated Emissions Measurement	Compliant
§15.249	Band Edges Measurement	Compliant
§15.249, §15.215	20 dB Bandwidth	Compliant

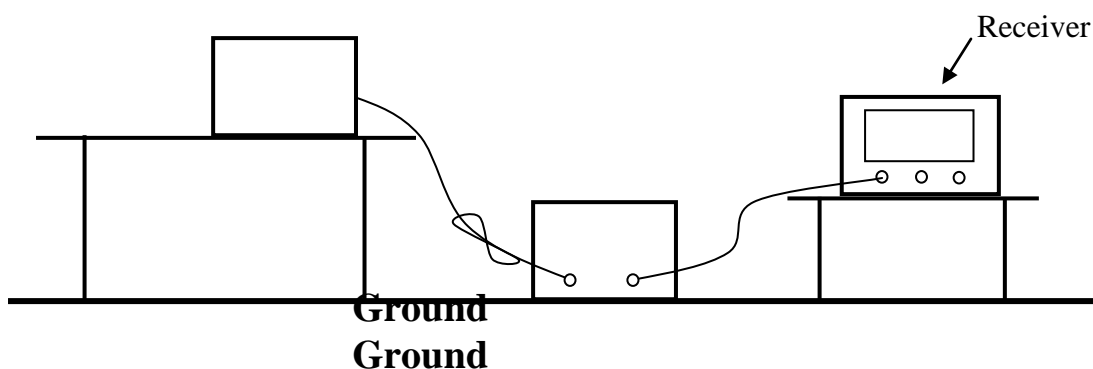
5. POWER LINE CONDUCTED EMISSIONS

5.1 Standard Applicable

According to RSS-Gen: For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

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

5.2 Block Diagram of Test Setup

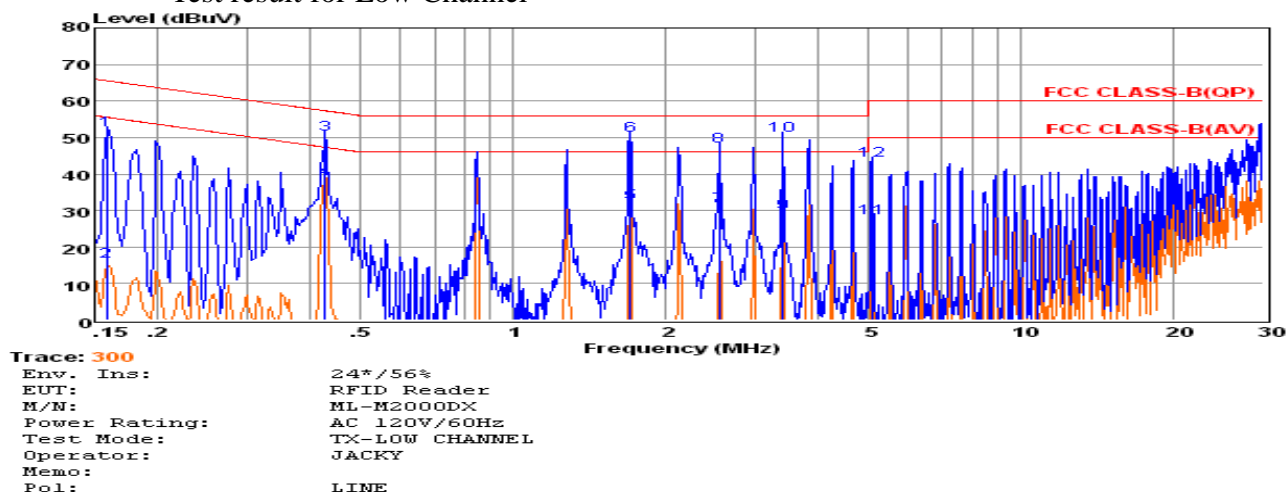


5.3 Test Results

PASS.

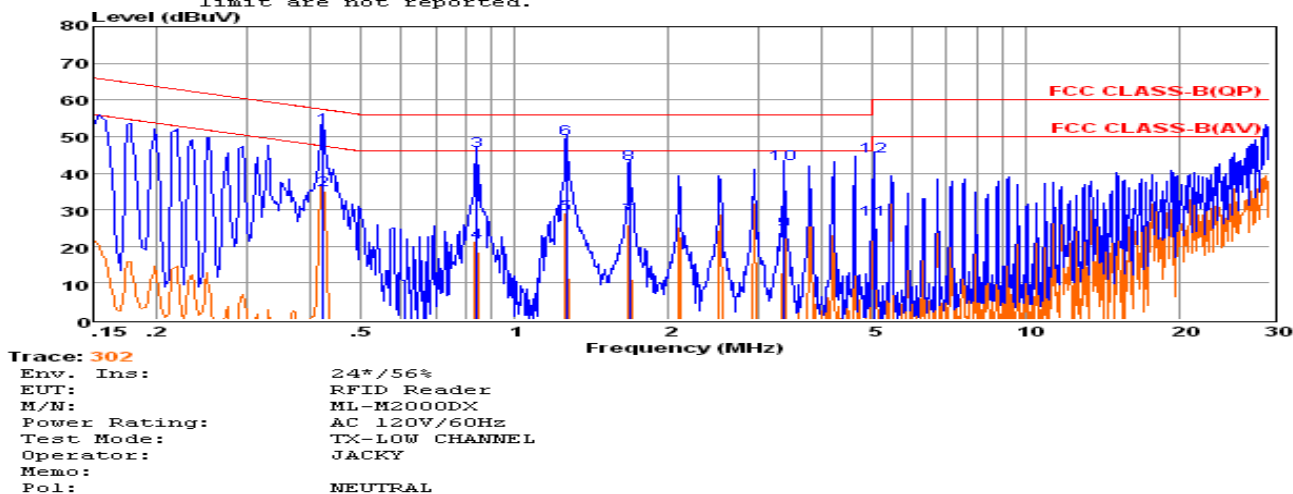
The test data please refer to following page.

Test result for Low Channel



	Freq	Reading	LisnFac	CabLos	AttFac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.15816	32.33	9.58	0.02	10.00	51.93	65.56	-13.63	QP
2	0.15826	-3.68	9.58	0.02	10.00	15.92	55.55	-39.63	Average
3	0.42598	31.19	9.62	0.04	10.00	50.85	57.33	-6.48	QP
4	0.42599	19.05	9.62	0.04	10.00	38.71	47.33	-8.62	Average
5	1.69820	12.35	9.64	0.05	10.00	32.04	46.00	-13.96	Average
6	1.69810	30.73	9.64	0.05	10.00	50.42	56.00	-5.58	QP
7	2.54014	11.57	9.64	0.05	10.00	31.26	46.00	-14.74	Average
8	2.54004	27.85	9.64	0.05	10.00	47.54	56.00	-8.46	QP
9	3.39947	9.65	9.65	0.06	10.00	29.36	46.00	-16.64	Average
10	3.39937	30.83	9.65	0.06	10.00	50.54	56.00	-5.46	QP
11	5.08493	8.39	9.65	0.06	10.00	28.10	50.00	-21.90	Average
12	5.08483	23.87	9.65	0.06	10.00	43.58	60.00	-16.42	QP

Remarks: 1. Measured = Reading + Lisn Factor + Cable Loss + AttFac.
2. The emission levels that are 20dB below the official limit are not reported.



	Freq	Reading	LisnFac	CabLos	AttFac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.42149	33.13	9.61	0.04	10.00	52.78	57.42	-4.64	QP
2	0.42159	15.61	9.61	0.04	10.00	35.26	47.42	-12.16	Average
3	0.84378	26.34	9.63	0.04	10.00	46.01	56.00	-9.99	QP
4	0.84388	1.35	9.63	0.04	10.00	21.02	46.00	-24.98	Average
5	1.26223	9.27	9.63	0.05	10.00	28.95	46.00	-17.05	Average
6	1.26213	29.68	9.63	0.05	10.00	49.36	56.00	-6.64	QP
7	1.68030	8.17	9.63	0.05	10.00	27.85	46.00	-18.15	Average
8	1.68020	22.98	9.63	0.05	10.00	42.66	56.00	-13.34	QP
9	3.36363	4.69	9.65	0.06	10.00	24.40	46.00	-21.60	Average
10	3.36353	22.67	9.65	0.06	10.00	42.38	56.00	-13.62	QP
11	5.03133	7.54	9.66	0.06	10.00	27.26	50.00	-22.74	Average
12	5.03123	25.00	9.66	0.06	10.00	44.72	60.00	-15.28	QP

Remarks: 1. Measured = Reading + Lisn Factor + Cable Loss + AttFac.
2. The emission levels that are 20dB below the official limit are not reported.

***Note: Pre-scan all mode and recorded the worst case results in this report (Low Channel).

6. ANTENNA REQUIREMENT

6.1. Standard Applicable

According to §15.203, Antenna 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 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 re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

6.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is 15.0dBi(Max.), and EUT is equipped with an integral antenna and no consideration of replacement. Please see EUT photo for details.

Result: Compliance.

7. RADIATED EMISSION MEASUREMENT

7.1. Standard Applicable

1. Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.
2. 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) and 15.249 limit in the table below has to be followed.

Fundamental Frequency	Field Strength of fundamental (millivolts/meter)	Field Strength of harmonics (microvolts/meter)
902-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

7.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (Emission in non-restricted band)	1000KHz / 1000KHz for peak

7.3. Test Procedure

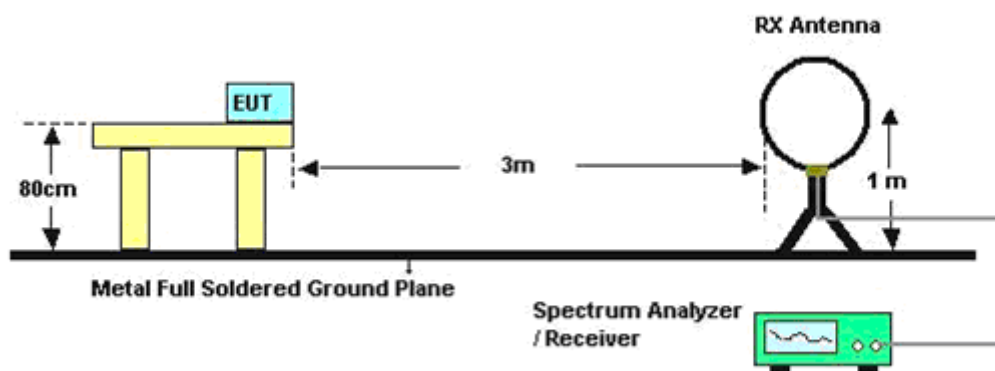
1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 m to 4 m) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

7.4. Test Equipment List and Details

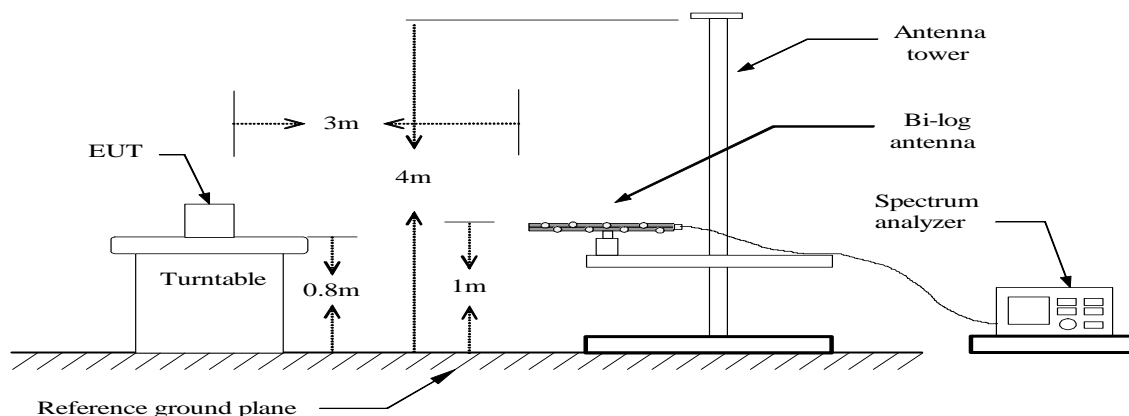
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4407B	MY41440754	2013-07-16	2014-07-15
Test Receiver	Rohde & Schwarz	ESCI	101142	2013-06-18	2014-06-17
Loop antenna	EMCO	6502	0042963	2013-06-18	2014-06-17
Log per Antenna	Schwarzbeck	VULB9163	9163-470	2013-06-10	2014-06-09
Horn-antenna	ETS.LINDGREN	3115	00034771	2013-06-10	2014-06-09
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	2013-06-10	2014-06-09
Amplifier	SCHAFFNER	COA9231A	18667	2013-06-18	2014-06-17
Amplifier	Agilent	8449B	3008A02120	2013-07-16	2014-07-15

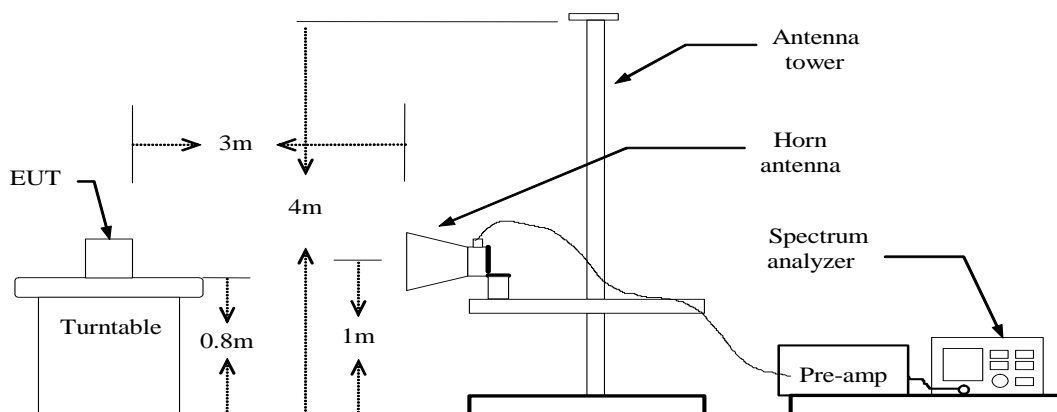
7.5. Block Diagram of Test Setup

For radiated emissions below 30MHz



For radiated emissions above 30MHz





Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1.5m.

Distance extrapolation factor = $20 \log (\text{specific distance } [3\text{m}] / \text{test distance } [1.5\text{m}])$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

7.6. Test Results

Results of Radiated Emissions (9kHz~30MHz)

Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
				See Note

Note:

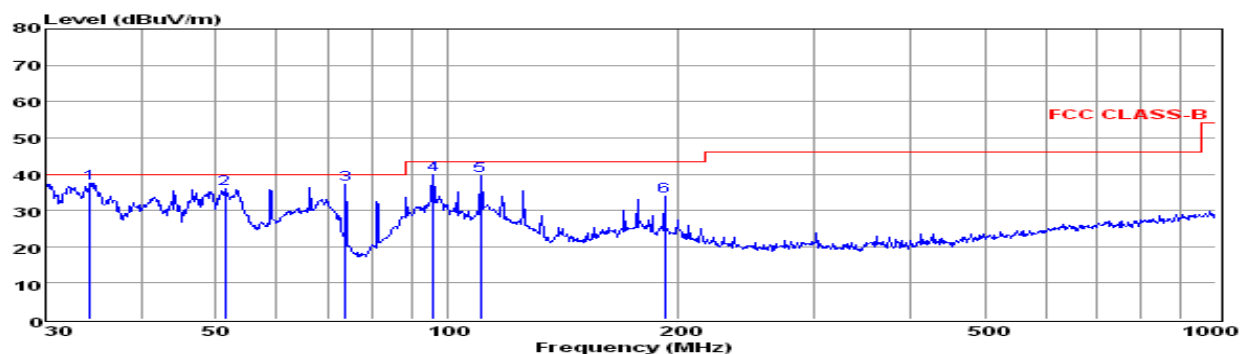
The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

Results of Radiated Emissions (30MHz~1000MHz)

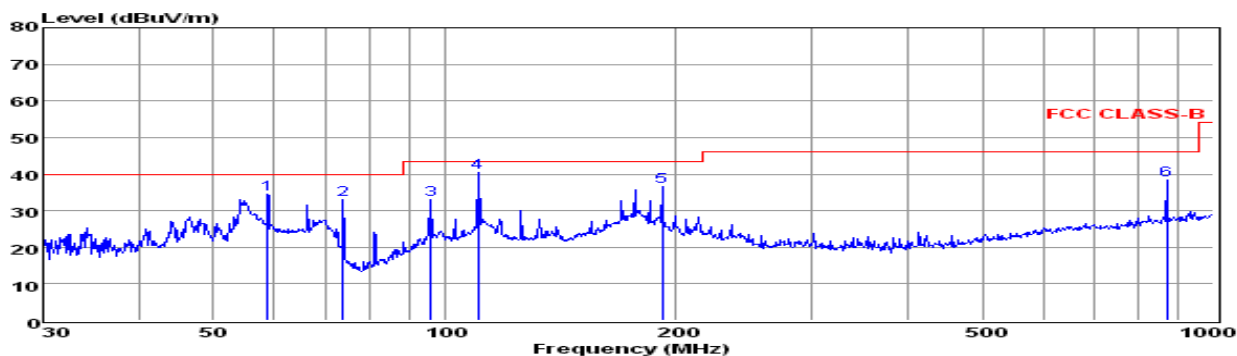
Test Mode (Low channel: 2401MHz)



Env./Ins: 24°C/56%
 EUT: RFID Reader
 M/N: ML-M2000DX
 Power Rating: AC 120V/60Hz
 Test Mode: TX-Low channel
 Operator: JACKY
 Memo:
 pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	34.28	24.73	0.37	12.30	37.40	40.00	-2.60	QP
2	51.30	22.11	0.54	13.19	35.84	40.00	-4.16	QP
3	73.62	28.71	0.54	8.04	37.29	40.00	-2.71	QP
4	95.76	26.35	0.58	12.89	39.82	43.50	-3.68	QP
5	110.57	26.80	0.61	12.15	39.56	43.50	-3.94	QP
6	191.75	22.56	0.86	10.56	33.98	43.50	-9.52	QP

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that ate 20db blow the official limit are not reported

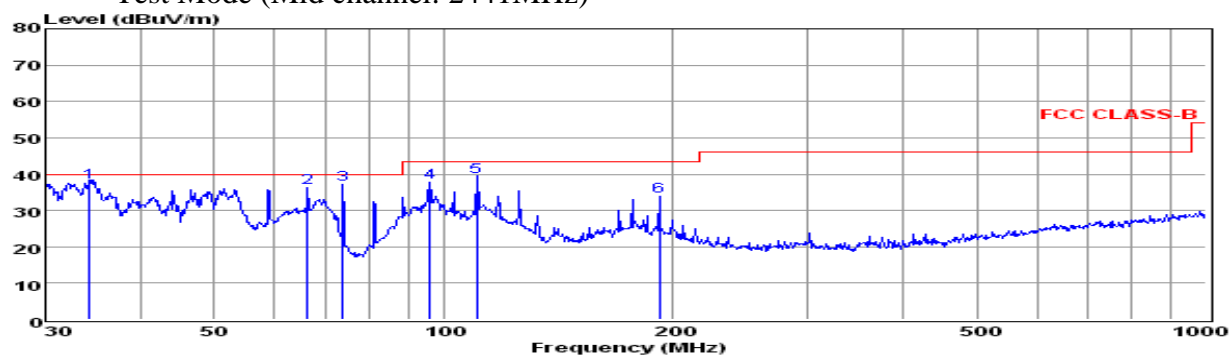


Env./Ins: 24°C/56%
 EUT: RFID Reader
 M/N: ML-M2000DX
 Power Rating: AC 120V/60Hz
 Test Mode: TX-Low channel
 Operator: JACKY
 Memo:
 pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	58.82	21.24	0.49	12.77	34.50	40.00	-5.50	QP
2	73.62	24.42	0.54	8.04	33.00	40.00	-7.00	QP
3	95.76	19.51	0.58	12.89	32.98	43.50	-10.52	QP
4	110.57	27.58	0.61	12.15	40.34	43.50	-3.16	QP
5	191.75	25.07	0.86	10.56	36.49	43.50	-7.01	QP
6	869.13	15.58	1.87	20.77	38.22	46.00	-7.78	QP

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that ate 20db blow the official limit are not reported

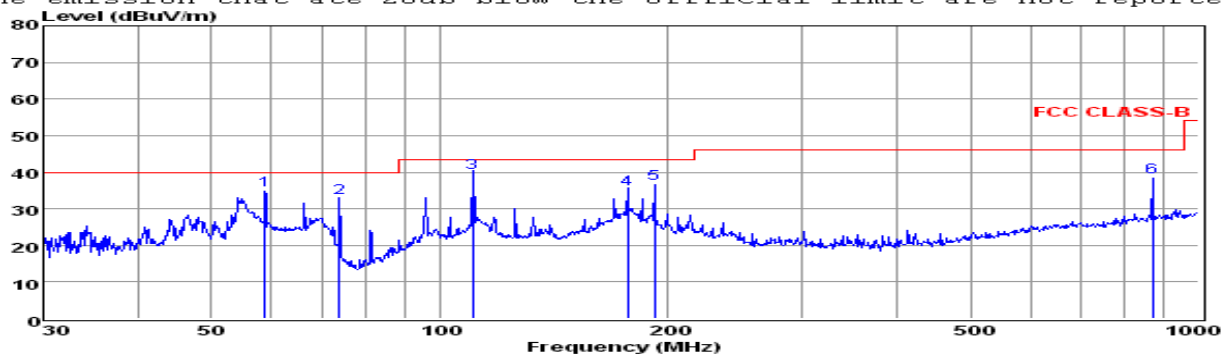
Test Mode (Mid channel: 2441MHz)



Env./Ins: 24°C/56%
 EUT: RFID Reader
 M/N: ML-M2000DX
 Power Rating: AC 120V/60Hz
 Test Mode: TX-Middle channel
 Operator: JACKY
 Memo:
 pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	34.28	25.21	0.37	12.30	37.88	40.00	-2.12	QP
2	66.27	25.57	0.52	10.19	36.28	40.00	-3.72	QP
3	73.62	28.63	0.54	8.04	37.21	40.00	-2.79	QP
4	95.76	24.28	0.58	12.89	37.75	43.50	-5.75	QP
5	110.57	26.62	0.61	12.15	39.38	43.50	-4.12	QP
6	191.75	22.45	0.86	10.56	33.87	43.50	-9.63	QP

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that ate 20db blow the official limit are not reported

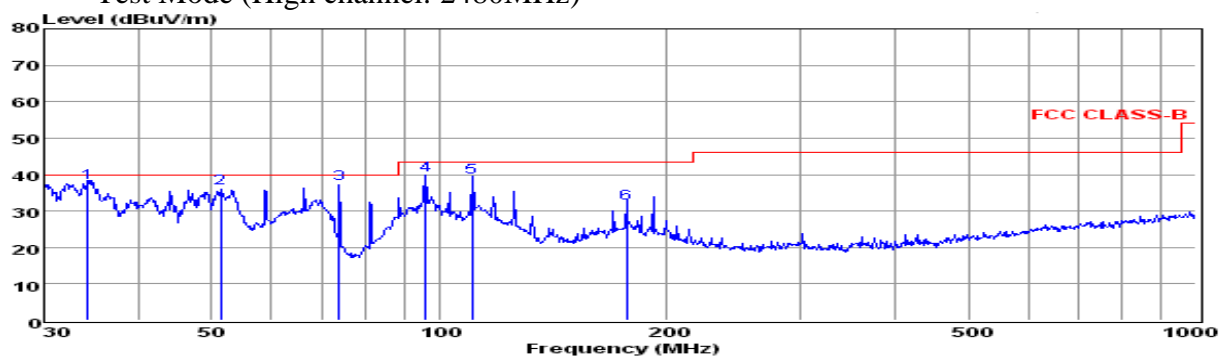


Env./Ins: 24°C/56%
 EUT: RFID Reader
 M/N: ML-M2000DX
 Power Rating: AC 120V/60Hz
 Test Mode: TX-Middle channel
 Operator: JACKY
 Memo:
 pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	58.82	21.85	0.49	12.77	35.11	40.00	-4.89	QP
2	73.62	24.37	0.54	8.04	32.95	40.00	-7.05	QP
3	110.57	27.16	0.61	12.15	39.92	43.50	-3.58	QP
4	176.89	25.14	0.73	9.46	35.33	43.50	-8.17	QP
5	191.75	25.45	0.86	10.56	36.87	43.50	-6.63	QP
6	869.13	15.96	1.87	20.77	38.60	46.00	-7.40	QP

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that ate 20db blow the official limit are not reported

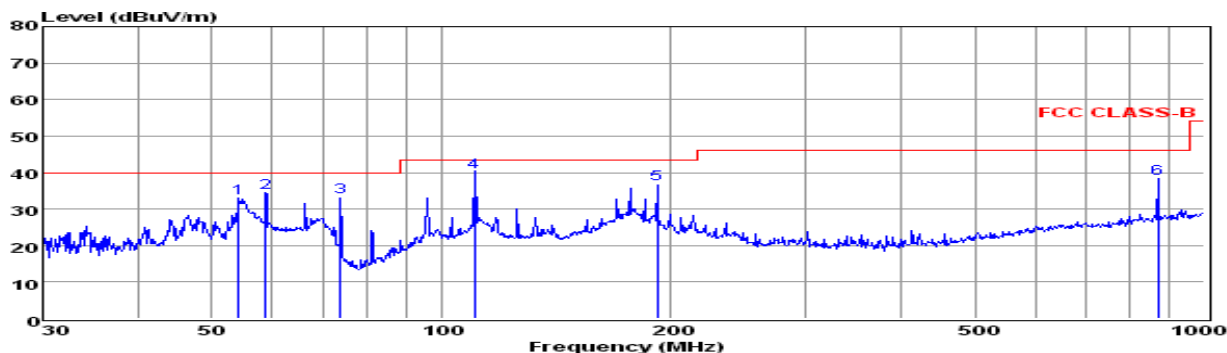
Test Mode (High channel: 2480MHz)



Env./Ins: 24°C/56%
 EUT: RFID Reader
 M/N: ML-M2000DX
 Power Rating: AC 120V/60Hz
 Test Mode: TX-High channel
 Operator: JACKY
 Memo:
 pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	34.28	25.20	0.37	12.30	37.87	40.00	-2.13	QP
2	51.30	22.59	0.54	13.19	36.32	40.00	-3.68	QP
3	73.62	28.88	0.54	8.04	37.46	40.00	-2.54	QP
4	95.76	26.53	0.58	12.89	40.00	43.50	-3.50	QP
5	110.57	26.59	0.61	12.15	39.35	43.50	-4.15	QP
6	176.89	22.04	0.73	9.46	32.23	43.50	-11.27	QP

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported



Env./Ins: 24°C/56%
 EUT: RFID Reader
 M/N: ML-M2000DX
 Power Rating: AC 120V/60Hz
 Test Mode: TX-High channel
 Operator: JACKY
 Memo:
 pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	54.26	19.63	0.46	13.05	33.14	40.00	-6.86	QP
2	58.82	21.24	0.49	12.77	34.50	40.00	-5.50	QP
3	73.62	24.77	0.54	8.04	33.35	40.00	-6.65	QP
4	110.57	27.38	0.61	12.15	40.14	43.50	-3.36	QP
5	191.75	25.41	0.86	10.56	36.83	43.50	-6.67	QP
6	869.13	15.72	1.87	20.77	38.36	46.00	-7.64	QP

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported

Above 1GHz

Field Strength Of Fundamental-Low channel						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2401	H	90.36	88.65	114	94	Pass
2401	V	89.10	88.02	114	94	Pass

Field Strength Of Fundamental-Middle channel						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2441	H	90.24	88.47	114	94	Pass
2441	V	89.01	87.86	114	94	Pass

Field Strength Of Fundamental-High channel						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2480	H	90.11	88.34	114	94	Pass
2480	V	88.92	87.75	114	94	Pass

The worst test result for Tx-Low Channel:

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4802.00	57.70	33.06	35.04	3.94	59.66	74	-14.34	Peak	Horizontal
4802.00	44.91	33.06	35.04	3.94	46.87	54	-7.13	Average	Horizontal
4802.00	57.14	33.06	35.04	3.94	59.10	74	-14.9	Peak	Vertical
4802.00	44.28	33.06	35.04	3.94	46.24	54	-7.76	Average	Vertical

The worst test result for Tx-Middle Channel:

Freq. MHz	Reading Dbuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4882.00	57.46	33.16	35.15	3.96	59.43	74	-14.57	Peak	Horizontal
4882.00	44.72	33.16	35.15	3.96	46.69	54	-7.31	Average	Horizontal
4882.00	57.04	33.16	35.15	3.96	59.01	74	-14.99	Peak	Vertical
4882.00	44.16	33.16	35.15	3.96	46.13	54	-7.87	Average	Vertical

The worst test result for Tx-High Channel:

Freq. MHz	Reading DBuv	Ant. Fac dB/m	Pre. Fac dB	Cab. Los dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4960.00	57.27	33.26	35.14	3.98	59.37	74	-14.63	Peak	Horizontal
4960.00	44.30	33.26	35.14	3.98	46.40	54	-7.60	Average	Horizontal
4960.00	56.77	33.26	35.14	3.98	58.87	74	-15.13	Peak	Vertical
4960.00	43.95	33.26	35.14	3.98	46.05	54	-7.95	Average	Vertical

Notes:

1. Measuring frequencies from 9k~10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30 MHz.
2. Radiated emissions measured in frequency range from 9k~10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.
3. 18~25GHz at least have 20dB margin. No recording in the test report.

8. BANDEDGES MEASUREMENT

8.1. Standard Applicable

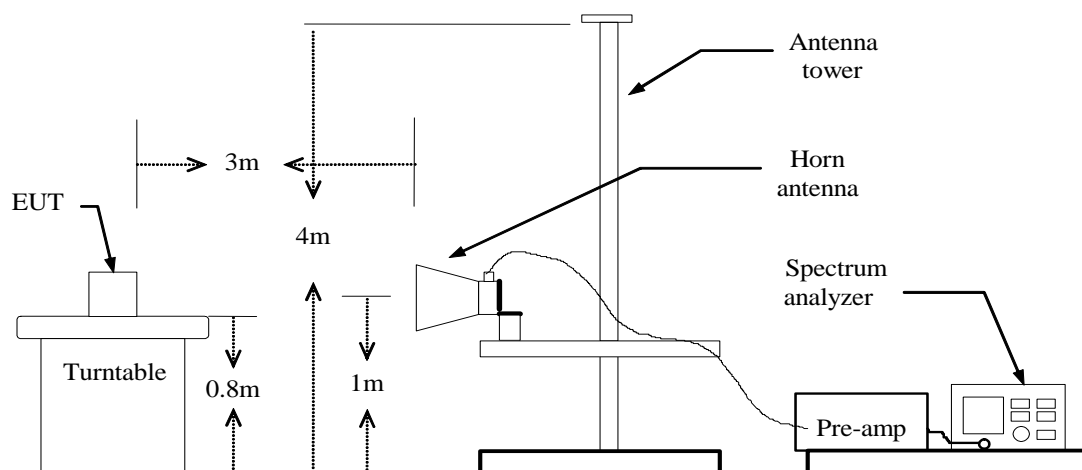
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

8.2. Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4407B	MY41440754	2013-07-16	2014-07-15
Test Receiver	Rohde & Schwarz	ESCI	101142	2013-06-18	2014-06-17
Test Receiver	Rohde & Schwarz	ESPI	101840	2013-06-18	2014-06-17
Loop antenna	EMCO	6502	0042963	2013-06-18	2014-06-17
Log per Antenna	Schwarzbeck	VULB9163	9163-470	2013-06-10	2014-06-09
Horn-antenna	ETS.LINDGREN	3115	00034771	2013-06-10	2014-06-09
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA917015 4	2013-06-10	2014-06-09

8

8.3. Block Diagram of Test Setup



8.4. Test Procedure

The EUT is placed on a turntable, which is 0.8m above the ground plane. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:

Peak: RBW=VBW=1MHz / Sweep=AUTO

Repeat the procedures until the peak versus polarization are measured.

8.5. Test Results

Only record the worst test case as following:

Tx-2401

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2390.00	50.05	32.89	35.16	3.51	51.29	74	-22.71	Peak	Horizontal
2390.00	38.21	32.89	35.16	3.51	39.45	54	-14.55	Average	Horizontal
2400.00	51.59	32.92	35.16	3.54	52.89	74	-21.11	Peak	Horizontal
2400.00	39.09	32.92	35.16	3.54	40.39	54	-13.61	Average	Horizontal
2390.00	49.87	32.89	35.16	3.51	51.11	74	-22.89	Peak	Vertical
2390.00	38	32.89	35.16	3.51	39.24	54	-14.76	Average	Vertical
2400.00	51.55	32.92	35.16	3.54	52.85	74	-21.15	Peak	Vertical
2400.00	39	32.92	35.16	3.54	40.30	54	-13.7	Average	Vertical

Tx-2480

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2483.50	51.39	33.06	35.18	3.60	52.87	74	-21.13	Peak	Horizontal
2483.50	39.47	33.06	35.18	3.60	40.95	54	-13.05	Average	Horizontal
2483.50	50.24	33.06	35.18	3.60	51.72	74	-22.28	Peak	Vertical
2483.50	39.14	33.06	35.18	3.60	40.62	54	-13.38	Average	Vertical

9. 20 DB BANDWIDTH MEASUREMENT

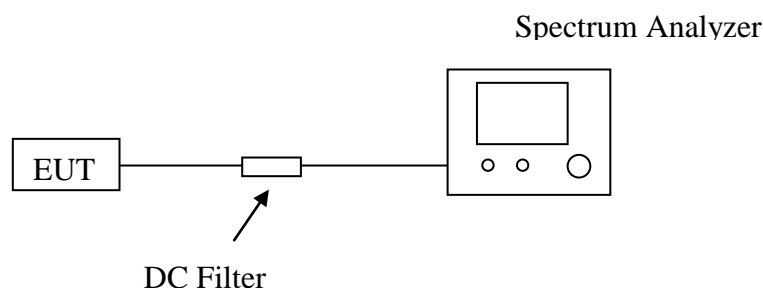
9.1. Standard Applicable

According to §15.215 & RSS-210.

9.2. Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4407B	MY41440754	2013-07-16	2014-07-15
DC Filter	MPE	23872C	N/A	2013-06-10	2014-06-09

9.3. Block Diagram of Test Setup



9.4. Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW \geq 1% of the 20 dB bandwidth

VBW \geq RBW

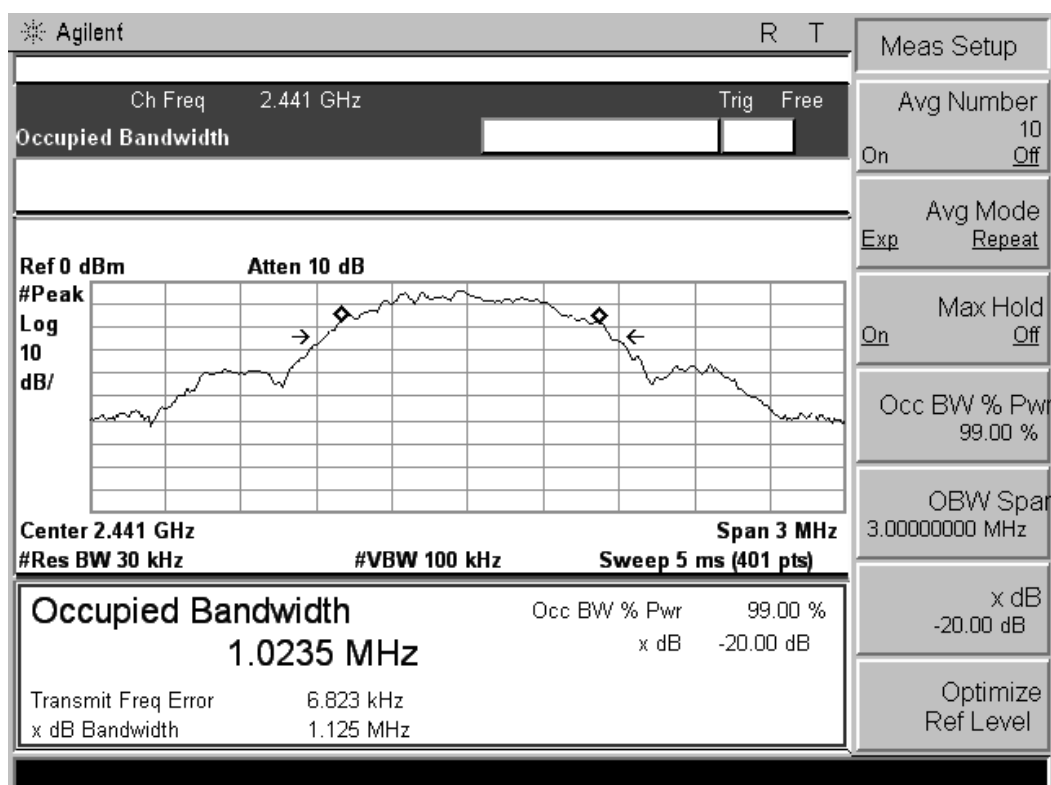
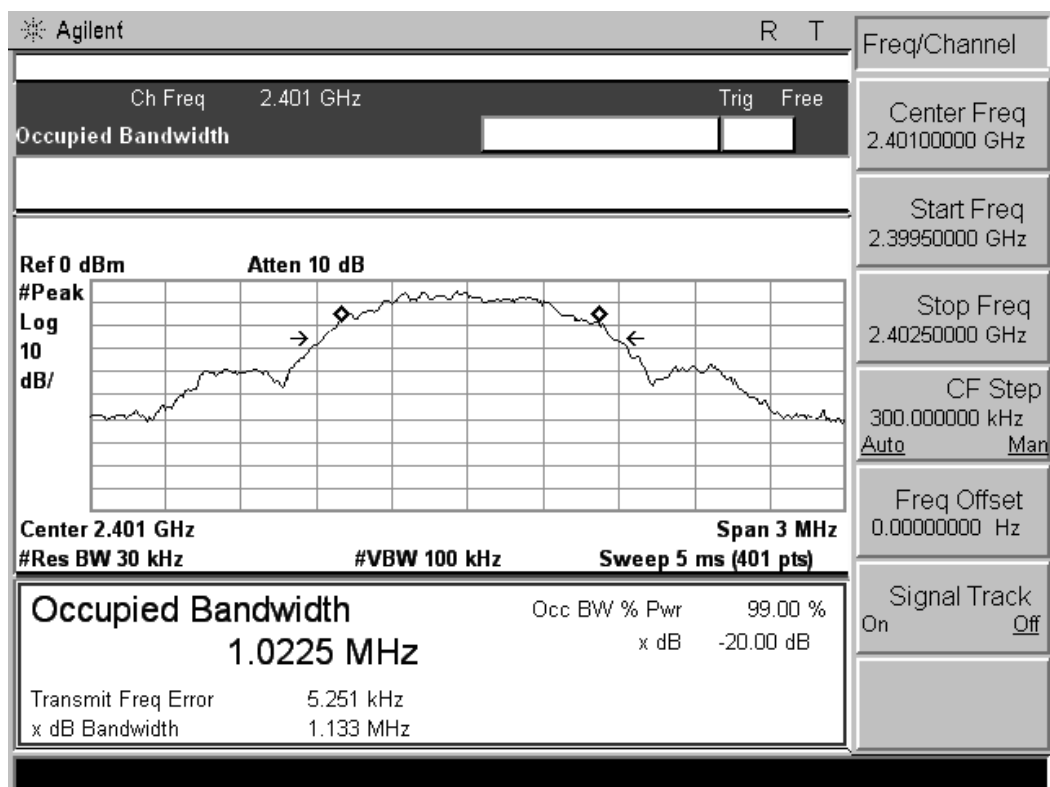
Sweep = auto

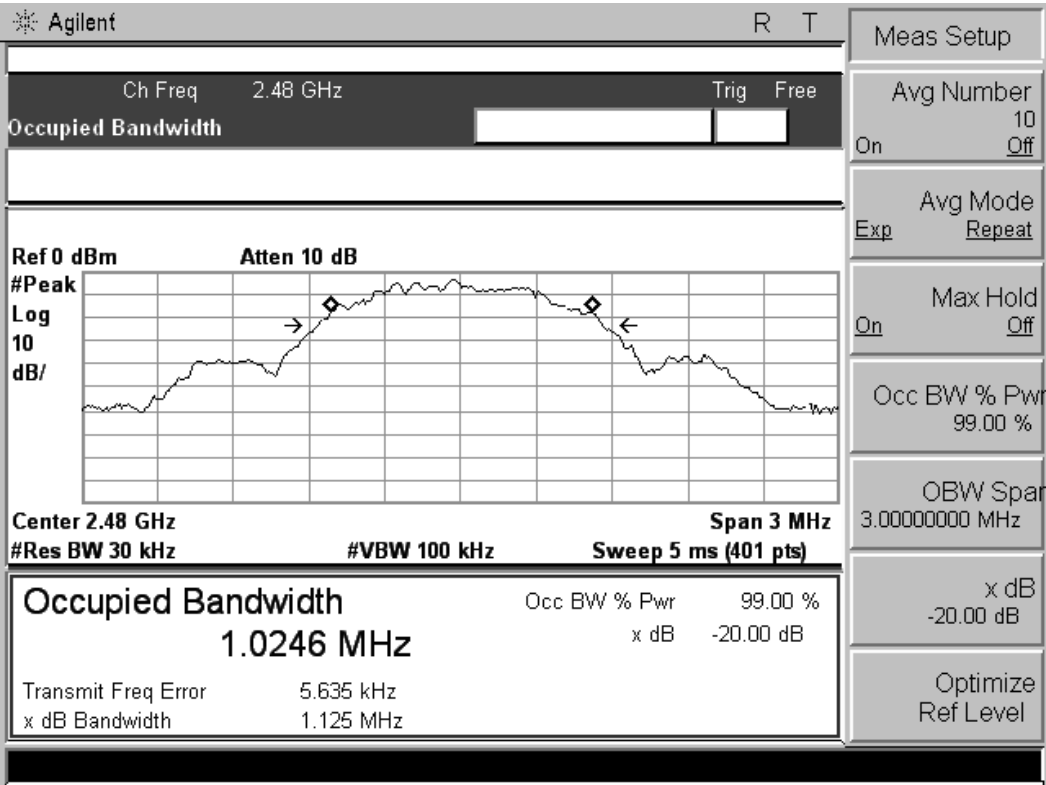
Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

9.5. Test Results





10. MANUFACTURER/ APPROVAL HOLDER DECLARATION

The following identical model(s):

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Belong to the tested device:

Product description : RFID Reader

Model name : ML-M2000DX

Remark: No additional models were tested.

-----THE END OF REPORT-----