FCC Test Report

Product Name	MOBILE DATA TERMINAL
Model No.	MT7010
FCC ID	2ABTU-MT7010

Applicant	RuggON Corporation
Address	4F, No. 298, Yang Guang St. Neihu Dist., Taipei City, Taiwan

Date of Receipt	Aug. 29, 2017
Issued Date	Oct. 23, 2017
Report No.	1780508R-RFUSP17V01
Report Version	V1.0

Testing Laboratory
3023

Test Report

Issued Date: Oct. 23, 2017
Report No.: 1780508R-RFUSP17V01

Product Name	MOBILE DATA TERMINAL
Applicant	RuggON Corporation
Address	4F, No. 298, Yang Guang St. Neihu Dist., Taipei City, Taiwan
Manufacturer	RuggON Corporation
Model No.	MT7010
FCC ID.	2ABTU-MT7010
EUT Rated Voltage	DC 9-36V
EUT Test Voltage	DC 12V
Trade Name	RuggON
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2016 ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By : Joanne Lin

(Senior Adm. Specialist / Joanne Lin)

Tested By : Anson Lu

(Engineer / Anson Lu)

Approved By :

(Director / Vincent Lin)

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	MOBILE DATA TERMINAL
Trade Name	RuggON
Model No.	MT7010
FCC ID	2ABTU-MT7010
Frequency Range	13.56MHz
Modulation	ASK
Antenna Type	Loop Antenna

Frequency of Each Channel:

Channel	Frequency
Channel 1:	13.56 MHz

Note:

1. This device is an MOBILE DATA TERMINAL with a built-in 13.56MHz transceiver.
2. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.225
3. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit

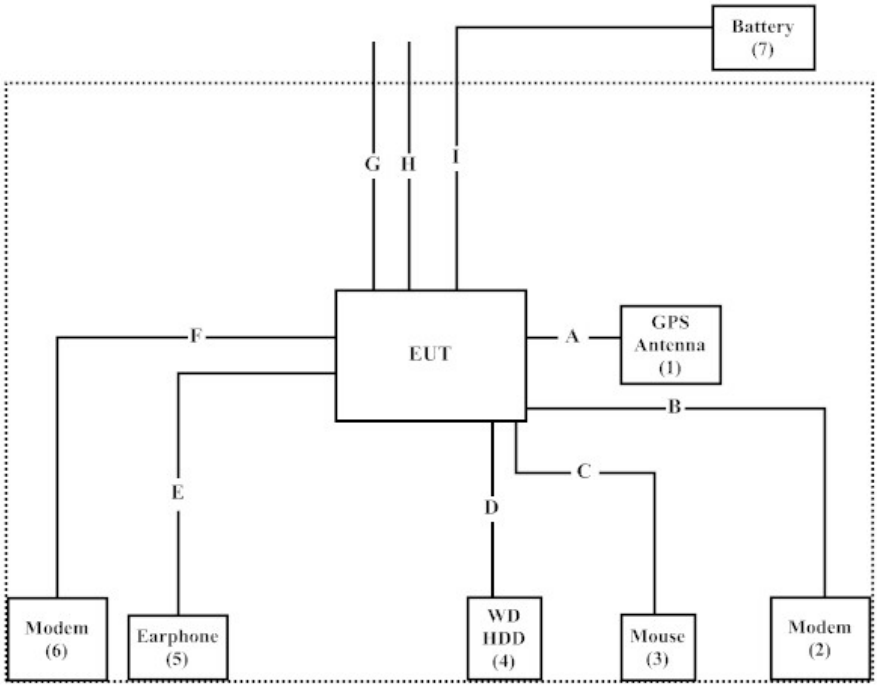
1.3. Tested System Datails

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	GPS Antenna	N/A	N/A	N/A	N/A
2	Modem	ACEEX	DM-1414	0102027550	Non-Shielded, 1.8m
3	Mouse	Logitech	M-SBM96B	810-000439	N/A
4	WD HDD 2.5	Western Digital	WD1200BEVS	WXE108L30036	Non-Shielded, 1.8m With Core*1
5	Earphone	Dr.AV	CD-806B	N/A	N/A
6	Modem	ACEEX	DM-1414	0102027533	Non-Shielded, 1.8m
7	DC 12V Battery	TRANE	12B50PE	N/A	N/A

Signal Cable Type		Signal cable Description
A	Signal Cable	Non-Shielded, 1.3m
B	Signal Cable	Non-Shielded, 1.2m
C	Signal Cable	Non-Shielded, 1.8m
D	USB Cable	Non-Shielded, 0.4m
E	Signal Cable	Non-Shielded, 1.8m
F	Signal Cable	Non-Shielded, 1.2m
G	Signal Cable	Non-Shielded, 0.7m
H	Network Cable	Non-Shielded, 1.8m
I	Signal Cable	Non-Shielded, 1.5m

1.4. Configuration of tested System



1.5. EUT Exercise Software

(1) Setup the EUT as shown in Section 1.4.

(2) Turn on the power of all equipment.

(3) Start the continuous transmitter.

(4) Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:
http://www.dekra.com.tw/english/about/certificates.aspx?bval=5
The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw/index_en.aspx

Site Description: Accredited by TAF
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd
Site Address: No.5-22, Ruishukeng, Linkou Dist., New Taipei City 24451, Taiwan, R.O.C.
TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : info.tw@dekra.com

FCC Accreditation Number: TW3023

1.7. List of Test Equipment

For Conducted measurements /CB3/SR8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
	Temperature Chamber	WIT GROUP	TH-1S-B	EQ-201-00146	2016/11/28	2017/11/27
X	Spectrum Analyzer	Agilent	N9010A	MY48030495	2017/7/22	2018/7/21
X	Power Meter	Anritsu	ML2495A	6K00003357	2017/6/23	2018/6/22
X	Pulse power sensor	Anritsu	MA2411B	0846193	2017/6/23	2018/6/22
X	EMI Test Receiver	R&S	ESCS 30	100369	2017/10/13	2018/10/12
X	LISN	R&S	ESH3-Z5	836679/017	2017/1/7	2018/1/6
X	LISN	R&S	ENV216	100097	2017/1/7	2018/1/6
X	Coaxial Cable	QTK(Arnist)	RG 400	LC018-RG	2017/6/25	2018/6/24

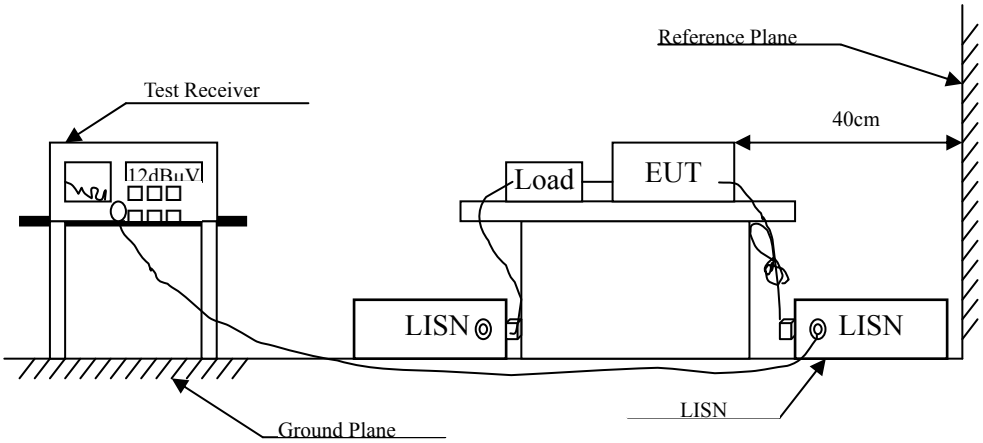
For Radiated measurements / Site3 / CB8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Spectrum Analyzer	R&S	FSP40	100170	2017/1/5	2018/1/4
	Loop Antenna	Teseq	HLA6121	37133	2017/3/18	2018/3/17
X	Bi-Log Antenna	Schaffner Chase	CBL6112B	2707	2017/6/11	2018/6/10
X	Horn Antenna	ETS-Lindgren	3117	00135205	2017/4/6	2018/4/5
X	Horn Antenna	Schwarzbeck	BBHA9170	9170430	2017/1/11	2018/1/10
X	Pre-Amplifier	QTK	AP/0100A	CHM/0901069	2017/6/23	2018/6/22
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2017/1/26	2018/1/24
X	Pre-Amplifier	NARDA WE	DBL-1840N506	013	2017/9/30	2018/9/29
X	Filter	MicroTRON	BRM50701	019	2016/11/2	2017/11/1
X	Filter	Microwave Circuits	N0257881	36681	2016/12/7	2017/12/6
X	EMI Test Receiver	R&S	ESR26	101385	2017/9/29	2018/9/28
X	Coaxial Cable	QTK(Arnist)	SUCOFLEX 106	L1606-015C	2017/6/23	2018/6/22
X	EMI Test Receiver	R&S	ESCS 30	838251/001	2017/7/21	2018/7/20
X	Coaxial Cable	QTK(Arnist)	RG 214	LC003-RG	2017/6/16	2018/6/15
X	Coaxial signal switch	Anritsu	MP59B	6201415889	2017/6/16	2018/6/15

Note:
1. All equipments are calibrated every one year.
2. The test instruments marked with “X” are used to measure the final test results.
3. Test Software version :QuieTek EMI 2.0 V2.1.113.

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBµV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56(注)	56-46(注)
0.50-5.0	56	46
5.0 - 30	60	50

2.3. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)
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.
Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.4. Uncertainty

± 2.26 dB

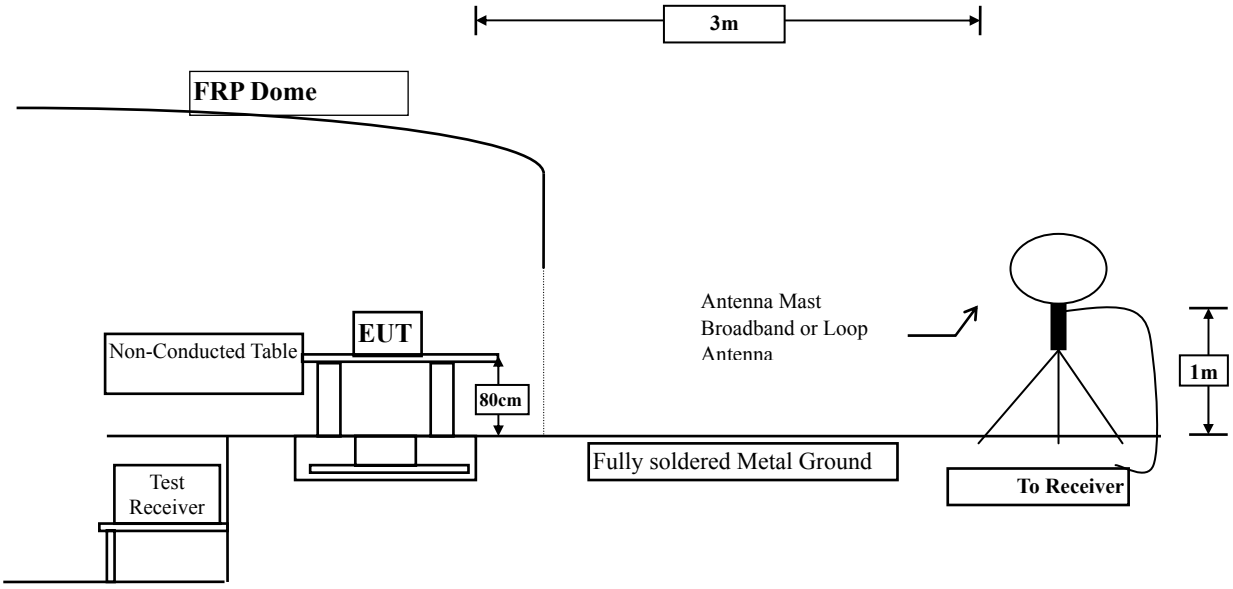
2.5. Test Result of Conducted Emission

Owing to the DC operation of EUT, this test item is not performed.

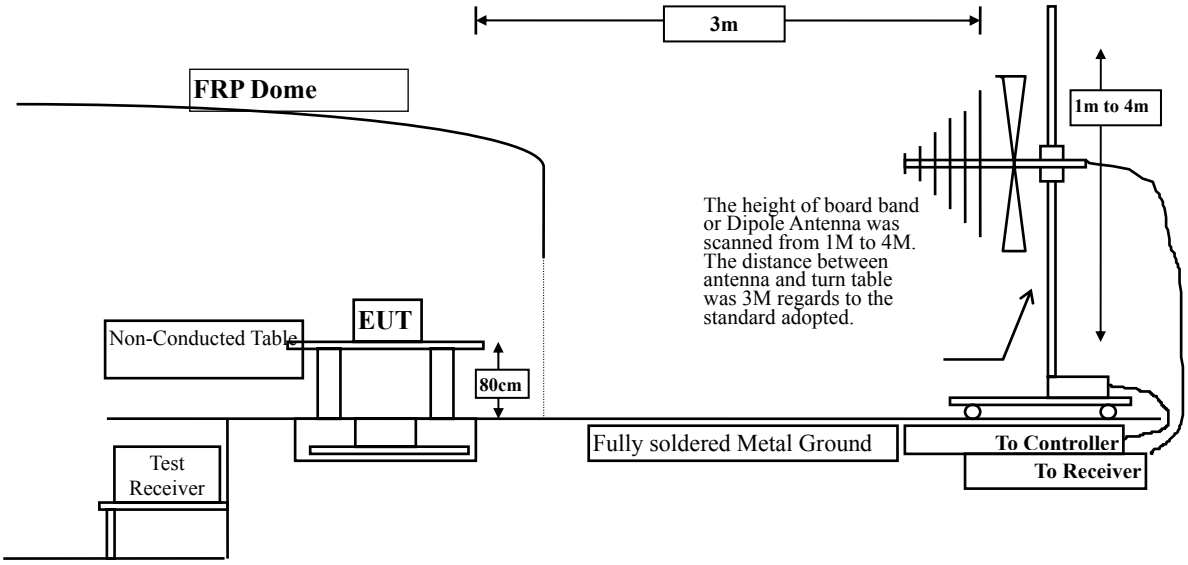
Radiated Emission

2.6. Test Setup

9kHz~30MHz



30MHz~1GHz



2.7. Limits

➢ Fundamental electric field strength Limit

FCC Part 15 Subpart C Paragraph 15.225 Limits				
Fundamental Frequency MHz	Field strength of fundamental			
	uV/m	Distance (meter)	dBμV/m	Distance (meter)
13.553 – 13.567	15848	30	124	3
13.410 – 13.553 and 13.567 – 13.710	334	30	90.47	3
13.110 – 13.410 and 13.710 – 14.010	106	30	80.50	3
Outside of the 13.110 – 14.010	See 15.209 Limits			

Remarks : 1. RF Voltage (dBμV) = 20 log RF Voltage (uV)

2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector.

➢ Spurious electric field strength Limit

FCC Part 15 Subpart C Paragraph 15.209 Limits			
Frequency MHz	uV/m	dBμV/m	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	See Remark[1]	300
0.490-1.705	24000/F(kHz)	See Remark[1]	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Remarks : 1. RF Voltage (dBμV) = 20 log RF Voltage (uV)

2. In the Above Table, the tighter limit applies at the band edges.

3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

2.8. Test Procedure

Fundamental electric field strength:
The EUT and its simulators are placed on a turn table which is 1 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum electric field strength.
The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
The antenna which is 1 meter above ground. All X-axis, Y-axis and Z-axis polarization of the antenna are set on measurement.

Spurious electric field strength:
The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.
The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.
On any frequency the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurement are included emission measurement below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
The bandwidth below 30MHz setting on the field strength meter is 9kHz and above 30MHz is 120kHz.
The frequency range from 9kHz to 10th harmonics is checked.

2.9. Uncertainty

± 4.08 dB above 1GHz
± 4.22 dB below 1GHz

2.10. Test Result of Radiated Emission

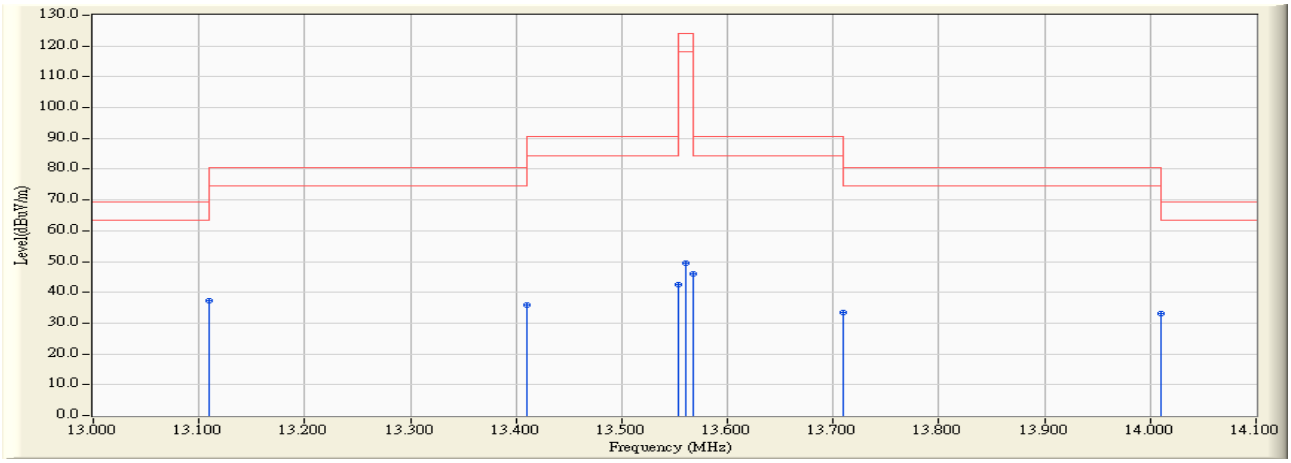
Product : MOBILE DATA TERMINAL
Test Item : Fundamental Radiated Emission
Test Site : No.3 OATS
Test date : 2017/10/17
Test Mode : Mode 1: Transmit

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBμV	dBμV/m	dB	dBμV/m
X-axis					
Quasi-Peak					
Horizontal					
13.110	20.020	17.230	37.250	-32.250	69.500
13.410	20.020	15.970	35.990	-44.510	80.500
13.553	20.020	22.430	42.450	-48.050	90.500
13.560	20.020	29.430	49.450	-74.550	124.000
13.567	20.020	26.030	46.050	-44.450	90.500
13.710	20.020	13.580	33.600	-46.900	80.500
14.010	20.020	13.260	33.280	-36.220	69.500
Vertical					
13.110	20.020	26.680	46.700	-22.800	69.500
13.410	20.020	26.370	46.390	-34.110	80.500
13.553	20.020	28.650	48.670	-41.830	90.500
13.560	20.020	34.280	54.300	-69.700	124.000
13.567	20.020	31.850	51.870	-38.630	90.500
13.710	20.020	29.870	49.890	-30.610	80.500
14.010	20.020	23.430	43.450	-26.050	69.500

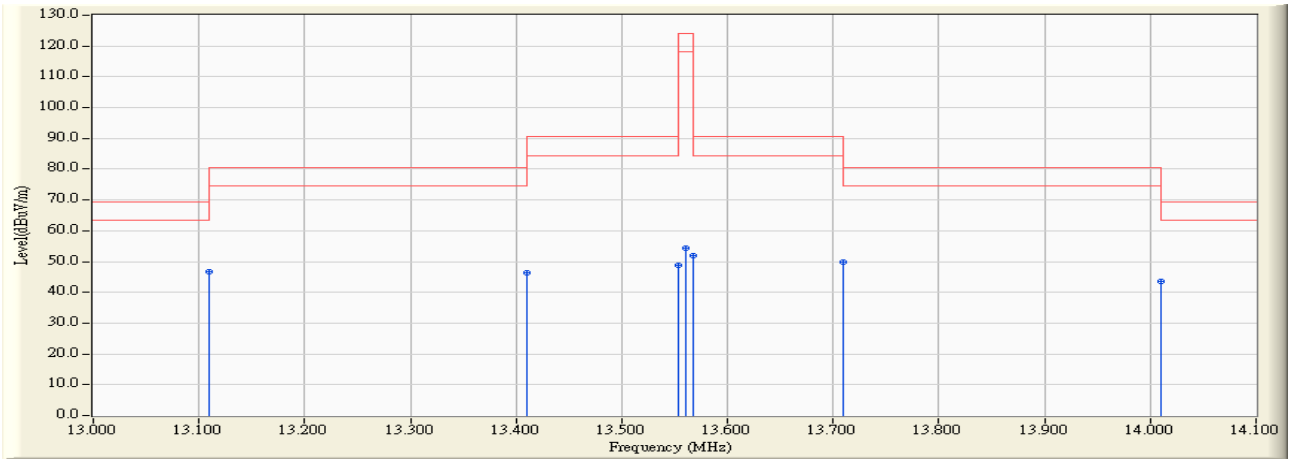
Note:

1. Fundamental Limit=84dB μ V/m + 40*Log (30(m)/3(m))=124dB μ V/m
2. All Readings below 1GHz are Quasi-Peak, above are average value.
3. " " means the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.

Horizontal



Vertical



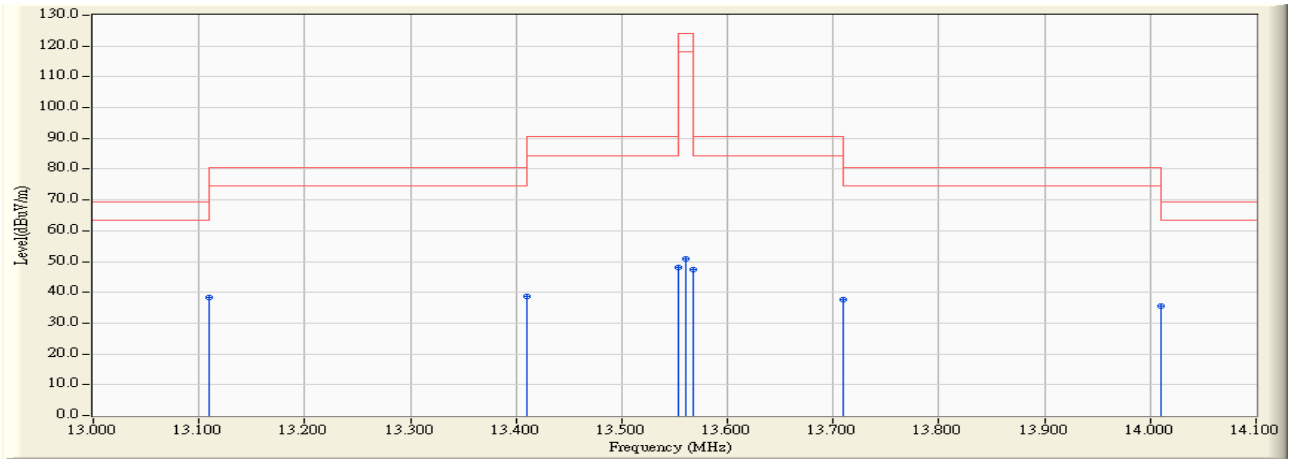
Product : MOBILE DATA TERMINAL
Test Item : Fundamental Radiated Emission
Test Site : No.3 OATS
Test date : 2017/10/17
Test Mode : Mode 1: Transmit

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBμV	dBμV/m	dB	dBμV/m
Y-axis					
Quasi-Peak					
Horizontal					
13.110	20.020	18.210	38.230	-31.270	69.500
13.410	20.020	18.780	38.800	-41.700	80.500
13.553	20.020	28.210	48.230	-42.270	90.500
13.560	20.020	30.780	50.800	-73.200	124.000
13.567	20.020	27.430	47.450	-43.050	90.500
13.710	20.020	17.640	37.660	-42.840	80.500
14.010	20.020	15.660	35.680	-33.820	69.500
Vertical					
13.110	20.020	26.040	46.060	-23.440	69.500
13.410	20.020	42.070	62.090	-18.410	80.500
13.553	20.020	43.290	63.310	-27.190	90.500
13.560	20.020	45.020	65.040	-58.960	124.000
13.567	20.020	42.810	62.830	-27.670	90.500
13.710	20.020	42.350	62.370	-18.130	80.500
14.010	20.020	19.110	39.130	-30.370	69.500

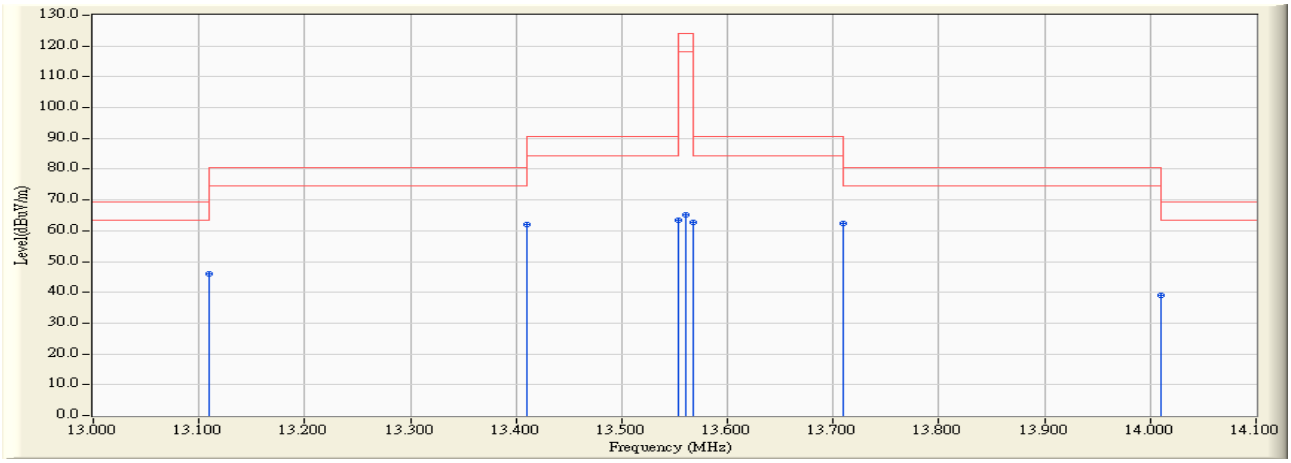
Note:

1. Fundamental Limit=84dB μ V/m + 40*Log (30(m)/3(m))=124dB μ V/m
2. All Readings below 1GHz are Quasi-Peak, above are average value.
3. " " means the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.

Horizontal



Vertical



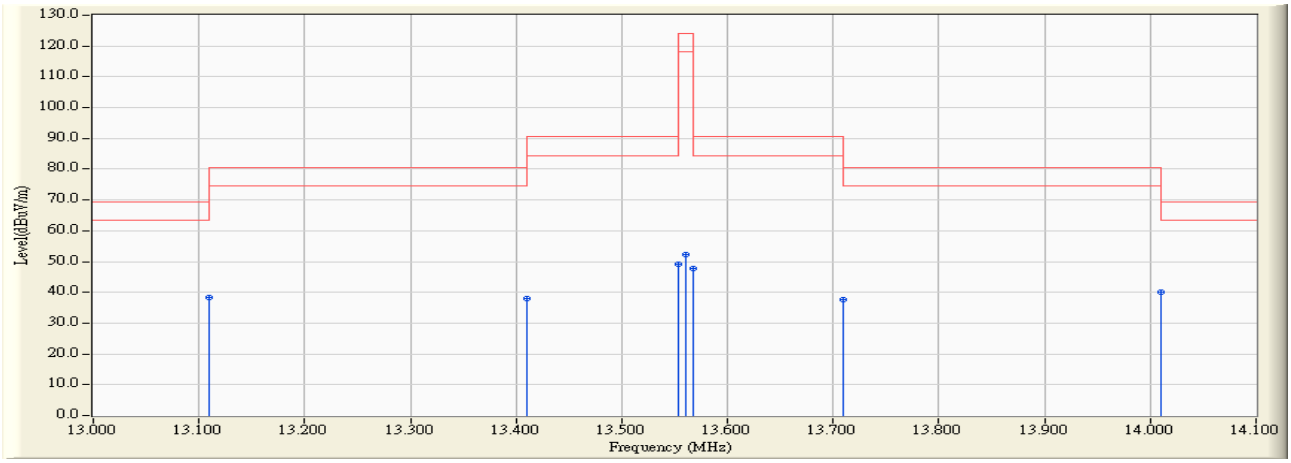
Product : MOBILE DATA TERMINAL
Test Item : Fundamental Radiated Emission
Test Site : No.3 OATS
Test date : 2017/10/17
Test Mode : Mode 1: Transmit

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBμV	dBμV/m	dB	dBμV/m
Z-axis					
Quasi-Peak					
Horizontal					
13.110	20.020	18.310	38.330	-31.170	69.500
13.410	20.020	17.880	37.900	-42.600	80.500
13.553	20.020	29.270	49.290	-41.210	90.500
13.560	20.020	32.370	52.390	-71.610	124.000
13.567	20.020	27.790	47.810	-42.690	90.500
13.710	20.020	17.680	37.700	-42.800	80.500
14.010	20.020	20.050	40.070	-29.430	69.500
Vertical					
13.110	20.020	27.210	47.230	-22.270	69.500
13.410	20.020	41.740	61.760	-18.740	80.500
13.553	20.020	43.540	63.560	-26.940	90.500
13.560	20.020	45.365	65.385	-58.615	124.000
13.567	20.020	43.280	63.300	-27.200	90.500
13.710	20.020	40.900	60.920	-19.580	80.500
14.010	20.020	28.310	48.330	-21.170	69.500

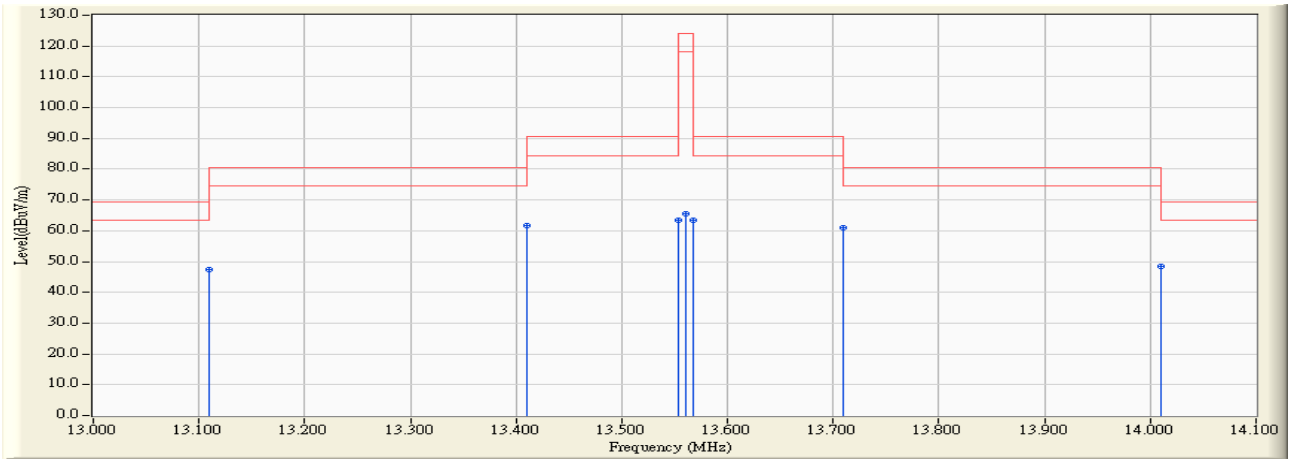
Note:

1. Fundamental Limit=84dB μ V/m + 40*Log (30(m)/3(m))=124dB μ V/m
2. All Readings below 1GHz are Quasi-Peak, above are average value.
3. " " means the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.

Horizontal



Vertical



Product	:	MOBILE DATA TERMINAL
Test Item	:	General Radiated Emission Data (below 30MHz)
Test Site	:	No.3 OATS
Test date	:	2017/10/17
Test Mode	:	Mode 1: Transmit

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBμV	dBμV/m	dB	dBμV/m
Horizontal					
27.120	20.200	11.580	31.780	-37.760	69.540
Vertical					
27.120	20.200	21.360	41.560	-27.980	69.540

Note:

1. Limit=29.54dB μ V/m + 40*Log (30(m)/3(m))=69.54dB μ V/m
2. All Readings below 1GHz are Quasi-Peak, above are average value.
3. " " means the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.

Product : MOBILE DATA TERMINAL
Test Item : General Radiated Emission Data (above 30MHz)
Test Site : No.3 OATS
Test date : 2017/10/17
Test Mode : Mode 1: Transmit

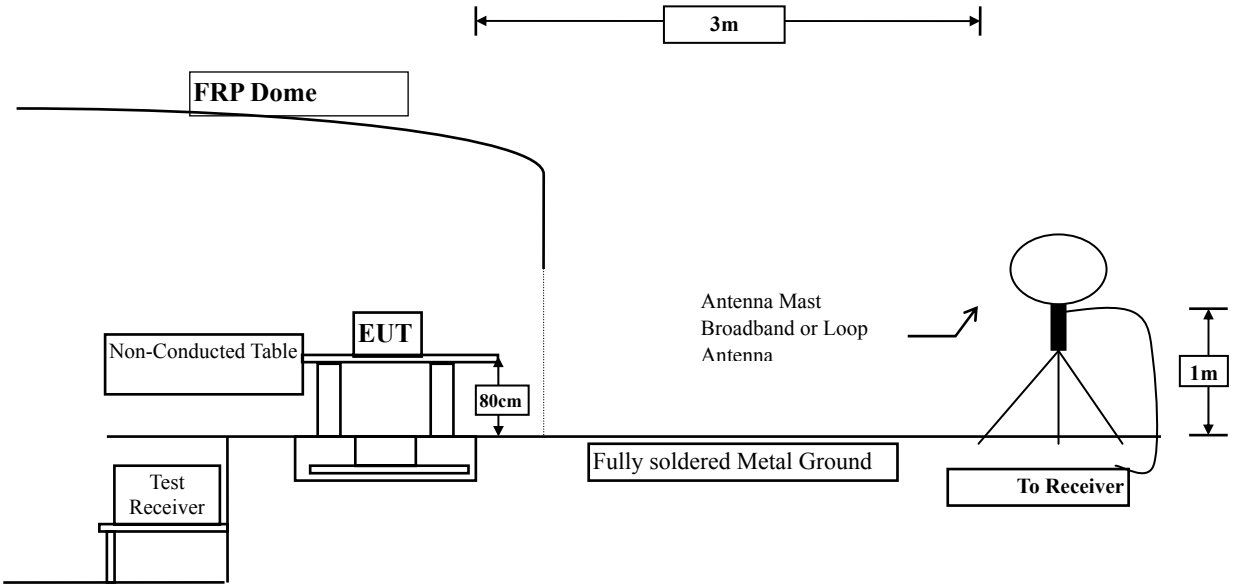
Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBμV	dBμV/m	dB	dBμV/m
Horizontal					
QP Detector					
122.150	-7.303	35.788	28.485	-15.015	43.500
307.420	-4.120	44.296	40.176	-5.824	46.000
512.090	3.184	38.676	41.860	-4.140	46.000
716.760	3.809	40.642	44.451	-1.549	46.000
819.580	6.961	31.891	38.852	-7.148	46.000
921.430	6.730	33.250	39.980	-6.020	46.000
Vertical					
QP Detector					
122.150	-3.593	36.611	33.018	-10.482	43.500
153.190	-5.284	38.540	33.256	-10.244	43.500
307.420	-4.030	39.340	35.310	-10.690	46.000
512.090	0.604	40.663	41.267	-4.733	46.000
600.360	1.302	32.584	33.886	-12.114	46.000
819.580	3.001	30.695	33.696	-12.304	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

3. Band Edge

3.1. Test Setup



3.2. Limits

In any 9 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 50 dB below that in the 9 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

3.3. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.
The bandwidth below 30MHz setting on the field strength meter is 9kHz and above 30MHz is 120kHz.

3.4. Uncertainty

± 4.08 dB above 1GHz
± 4.22 dB below 1GHz

3.5. Test Result of Band Edge

Product : MOBILE DATA TERMINAL
Test Item : Band Edge Data
Test Site : No.3 OATS
Test date : 2017/10/17
Test Mode : Mode 1: Transmit

RF Radiated Measurement

(Horizontal)

Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	QP Limit (dBμV/m)	Result
13.110	20.020	18.310	38.330	69.540	Pass
13.360	20.020	17.750	37.770	69.540	Pass
13.410	20.020	17.880	37.900	69.540	Pass
14.010	20.020	20.050	40.070	69.540	Pass

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

(Vertical)

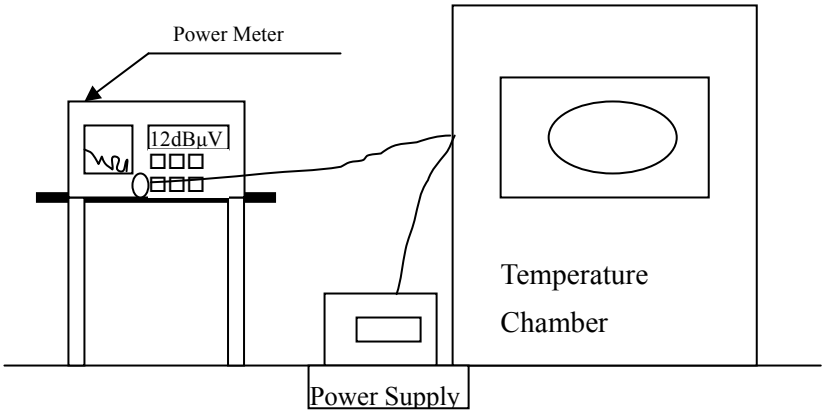
Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	QP Limit (dBμV/m)	Result
13.110	20.020	27.210	47.230	69.540	Pass
13.360	20.020	26.590	46.610	69.540	Pass
13.410	20.020	41.740	61.760	69.540	Pass
14.010	20.020	28.310	48.330	69.540	Pass

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

4. Frequency Tolerance

4.1. Test Setup



4.2. Limits

The frequency tolerance of the carrier signal shall be maintained within ±0.01％ of the operating frequency.

4.3. Test Procedure

The over 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.

4.4. Uncertainty

± 283 Hz

4.5. Test Result of Frequency Stability

Product : MOBILE DATA TERMINAL
Test Item : Frequency Tolerance
Test Site : Temperature Chamber
Test date : 2017/10/03
Test Mode : Mode 1: Transmit

Temperature (℃)	Voltage (V)	Observe Time	Declared Frequency (MHz)	Read Frequency (MHz)	Tolerance (%)	Limit (%)
20	12	start	13.56	13.55936	-0.004720	± 0.01 %
		2mins	13.56	13.55936	-0.004720	
		5mins	13.56	13.55936	-0.004720	
		10mins	13.56	13.55936	-0.004720	
20	13.2	start	13.56	13.55936	-0.004720	± 0.01 %
		2mins	13.56	13.55936	-0.004720	
		5mins	13.56	13.55936	-0.004720	
		10mins	13.56	13.55936	-0.004720	
20	10.8	start	13.56	13.55936	-0.004720	± 0.01 %
		2mins	13.56	13.55936	-0.004720	
		5mins	13.56	13.55936	-0.004720	
		10mins	13.56	13.55936	-0.004720	
50	5	start	13.56	13.55936	-0.004720	± 0.01 %
		2mins	13.56	13.55936	-0.004720	
		5mins	13.56	13.55936	-0.004720	
		10mins	13.56	13.55936	-0.004720	
40	5	start	13.56	13.55936	-0.004720	± 0.01 %
		2mins	13.56	13.55936	-0.004720	
		5mins	13.56	13.55936	-0.004720	
		10mins	13.56	13.55936	-0.004720	
30	5	start	13.56	13.55936	-0.004720	± 0.01 %
		2mins	13.56	13.55936	-0.004720	
		5mins	13.56	13.55936	-0.004720	
		10mins	13.56	13.55936	-0.004720	

10	5	start	13.56	13.55936	-0.004720	±	0.01	%
		2mins	13.56	13.55936	-0.004720			
		5mins	13.56	13.55936	-0.004720			
		10mins	13.56	13.55936	-0.004720			
0	5	start	13.56	13.55936	-0.004720	±	0.01	%
		2mins	13.56	13.55936	-0.004720			
		5mins	13.56	13.55936	-0.004720			
		10mins	13.56	13.55936	-0.004720			
-10	5	start	13.56	13.55936	-0.004720	±	0.01	%
		2mins	13.56	13.55936	-0.004720			
		5mins	13.56	13.55936	-0.004720			
		10mins	13.56	13.55936	-0.004720			
-20	5	start	13.56	13.55936	-0.004720	±	0.01	%
		2mins	13.56	13.55936	-0.004720			
		5mins	13.56	13.55936	-0.004720			
		10mins	13.56	13.55936	-0.004720			

5. EMI Reduction Method During Compliance Testing

No modification was made during testing.