FCC Test Report

Report No: FCS202007065

Issued for

Applicant:	Comark LLC
Address:	440 FORTUNE BLVD MILFORD, MA01757, USA
Product Name:	6” Rugged PDA
Brand Name:	COMARK
Model Name:	COMARK-6
Series Model:	COMARK-6W,COMARK-6A,COMARK-6Q
FCC ID:	2AO8O-COMARK-6

Issued By: Flux Compliance Service Laboratory
Add: Room 105 Floor Bao hao Technology Building 1 NO.15 Gong yeWest Road Hi-Tech Industrial, Song shan lake Dongguan
Tel: 769-27280901 Fax:769-27280901 http://www.FCS-lab.com

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Revision History

Rev.	Issue Date	Effect Page	Contents
01	09 July 2020	All	Initial Issue

TEST RESULT CERTIFICATION

Applicant's Name ..... :	Comark LLC
Address ..... :	440 FORTUNE BLVD MILFORD, MA01757, USA Guancheng District, Dongguan City
Manufacture's Name ..... :	Comark LLC
Address ..... :	440 FORTUNE BLVD MILFORD, MA01757, USA Guancheng District, Dongguan City

Product Description

Product Name ..... :	6" Rugged PDA
Brand Name ..... :	COMARK
Model Name ..... :	COMARK-6
Series Model ..... :	COMARK-6W,COMARK-6A,COMARK-6Q
Test Standards..... :	FCC Rules and Regulations Part 15 Subpart C
Test Procedure ..... :	ANSI C63.10:2013

This device described above has been tested FCS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
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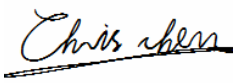
Date of Test.....:

Date (s) of performance of tests .:	15 June 2020 ~ 09 July 2020
Date of Issue .....:	09 July 2020
Test Result .....:	Pass

Prepared By : 

(Chris Chen/Engineer)

Approved By : 

(Brown Lu)

1. Summary of Test Results

Standard Section	Test Item	Judgment	Remark
Antenna Requirement	15.203	Pass	
AC Power Line Conducted Emission	15.207	Pass	
Field Strength of Fundamental Emissions and Mask Measurement	15.225	Pass	--
Radiated Emission	15.209	Pass	
20dB Emission Bandwidth	15.225	Pass	
Frequency Stability Measurement	15.225	Pass	

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

Remark: Test according to ANSI C63.10 2013 and ANSI C63.4: 2014.

NOTE:
(1)" N/A" denotes test is not applicable in this Test Report

1.1 Test Laboratory

Company Name:	Flux Compliance Service Laboratory
Address:	Room 105 Floor Bao hao Technology Building 1 NO.15 Gong yeWest Road Hi-Tech Industrial, Song shan lake Dongguan
Telephone:	+86-769-27280901
Fax:	+86-769-27280901
A2LA Accreditation No. :	

1.2 Measurement Uncertainty

The reported uncertainty of measurement **y** ±**U**,where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**,providing a level of confidence of approximately **95** %.

No.	Items	Uncertainty
1	RF output power, conducted	±0.71dB
2	Unwanted Emissions, conducted	±2.988 dB
3	Conducted Emission (9KHz-150KHz)	±4.13 dB
4	Conducted Emission (150KHz-30MHz)	±4.74 dB
5	All emissions,radiated(<1G) 30MHz-1000MHz	±5.2 dB
6	All emissions,radiated(>1G) 1000MHz -3000MHz	±4.66 dB
7	All emissions,radiated(<1G) 3000MHz -6000MHz	±5.31 dB

1.3 Test Environment Conditions

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

Temperature rang:	20-26℃
Humidity range:	40-65%
Pressure range:	86-106Kpa

2. General Information

2.1 General Description of The EUT

Product Name	6” Rugged PDA
Trade Name	COMARK
Model Name	COMARK-6
Series Model	COMARK-6W,COMARK-6A,COMARK-6Q
Model Difference	Just different in model name
Operation Frequency	13.56MHz
Modulation	ASK
Antenna Type	Integral antenna, maximu PK gain: 1 dBi
Adapter	FJ-SW1260502500UN INPUT: 100-240V~ 50/60Hz 0.4A OUTPUT: DC 5V 2.5A
Battery	DC 3.7V 5000mAh Li Battery
Hardware version number	EM_I62H_MB_PCB_V14R4
Software versionnumber	10.0.17763.1
Connecting I/O Port(s)	Please refer to the User's Manual
Note: For a more detailed features description, please refer to the manufacturer’s specifications or the User's Manual.	

2.2 Channel List

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	13.56	/	/	/	/

2.3 Assistant Equipment Used For Test

Assistant equipment	Manufacturer	Model number
/	/	/
/	/	/

2.4 Description of The Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Worst Mode	Description	Data Rate/Modulation
Mode 1	TX	ASK

2.5 Block Digram Showing The Configuration of System Tested

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS

2.6 Equipments List

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESRP 3	FCS-E001	2020.05.31	2021.05.30
Signal Analyzer	R&S	FSV40-N	FCS-E012	2020.06.05	2021.06.04
Active loop Antenna	ZHINAN	ZN30900C	FCS-E013	2020.03.11	2021.03.10
Bilog Antenna	SCHWARZBECK	VULB 9168	FCS-E002	2020.03.26	2021.03.25
Horn Antenna	SCHWARZBECK	BBHA 9120D	FCS-E003	2020.05.31	2021.05.30
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	FCS-E018	2020.05.31	2021.05.30
Pre-Amplifier(0.1M-3GHz)	EMCI	EM330N	FCS-E004	2020.05.31	2021.05.30
Pre-Amplifier (1G-18GHz)	N/A	TSAMP-0518SE	FCS-E014	2020.03.03	2021.03.02
Temperature & Humidity	HTC-1	victor	FCS-E005	2020.05.31	2021.05.30

Conduction Test equipment

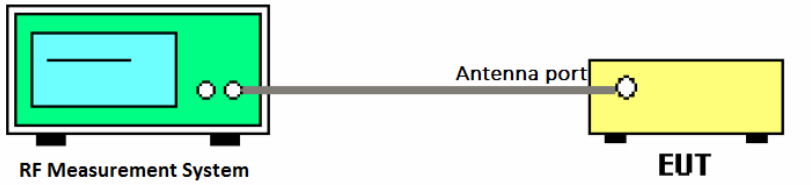
Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESPI	FCS-E020	2020.05.31	2021.05.30
LISN	R&S	ENV216	FCS-E007	2020.05.15	2021.05.14
LISN	ETS	3810/2NM	FCS-E009	2020.03.15	2021.03.14
Temperature & Humidity	HTC-1	victor	FCS-E008	2020.05.31	2021.05.30

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
MXA SIGNAL Analyzer	Keysight	N9020A	FCS-E015	2020.03.02	2021.03.01

3. 20dB Bandwidth

3.1 Block Diagram of Test Setup



3.2 Limit

N/A

3.3 Test Procedure

(1)Connect EUT's antenna output to spectrum analyzer by RF cable

(2) Set the spectrum analyzer as follows:

RBW	1KHz
VBW	3KHz
Detector Mode	Peak
Sweep time	Auto
Trace mode	Max hold

(3) Allow the trace to stabilize, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

3.4 Test Result

Occupied Bandwidth – Test Results

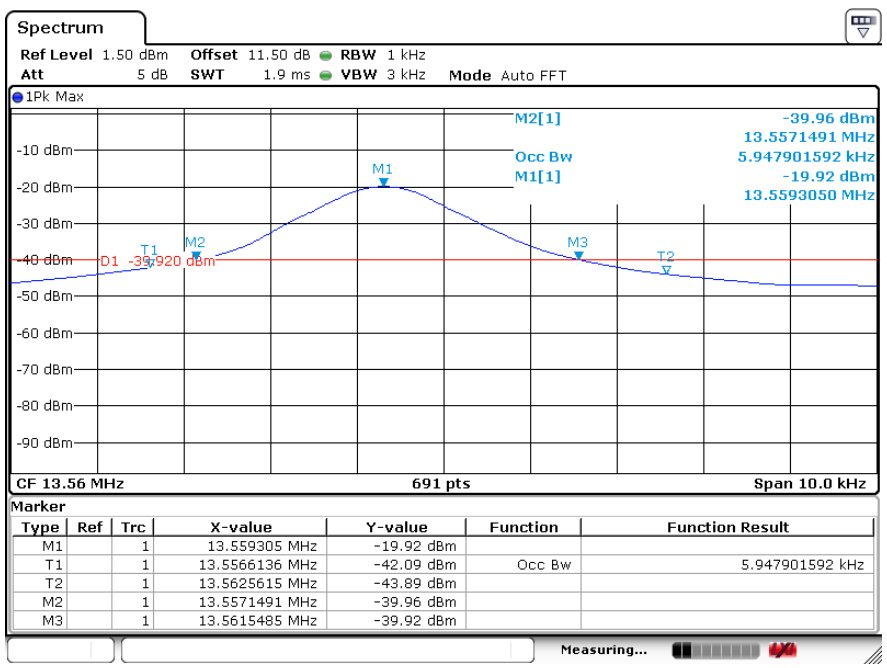
Occupied Bandwidth for 13.56 MHz			
Mode	Limit (kHz)	99% BW (kHz)	20 dB BW (kHz)
ASK Modulation	Na	5.9479	4.3994
Note: All lower and upper markers of 99% Bandwidth and 20 dB Bandwidth are within the allowable band;			

20 dB Bandwidth Frequency – Test Results

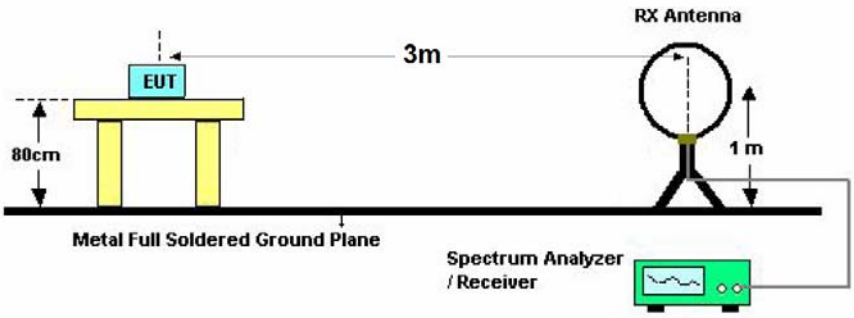
20 dB Bandwidth Frequencies for 13.56 MHz				
Mode	Occupied Band Limit (MHz)	Lower Freq. (MHz)	Upper Freq. (MHz)	Results
ASK Modulation	13.553 < X < 13.567	13.5571491	13.5615485	Pas
Note: All lower and upper markers of 20 dB Bandwidth are within the allowable band; 13.553 MHz to 13.567				

3.5 Original Test data

CH1

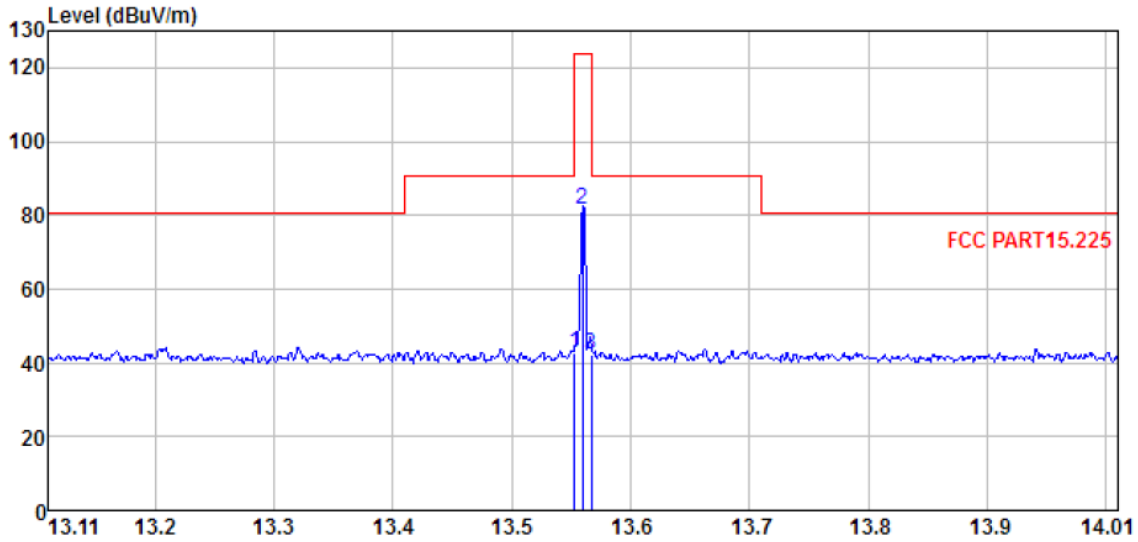


4. Field Strength of Fundamental Emissions and Mask Measurement

<table>
<tr><td>Test Requirement:</td><td colspan="3">FCC Part15 C Section 15.225 and 15.209</td></tr>
<tr><td>Test Method:</td><td colspan="3">ANSI C63.10:2013</td></tr>
<tr><td>Test site:</td><td colspan="3">Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td colspan="3">RBW=9KHz, VBW=30KHz, Sweep time=Auto</td></tr>
<tr><td>Limit:</td><td colspan="3"><table>
<tr><th>Frequency (MHz)</th><th>Field Strength (microvolts/meter) at 30m</th><th>Field Strength (dBuV/m) at 3m</th></tr>
<tr><td>13.553~13.567</td><td>15848</td><td>124 (QP)</td></tr>
</table></td></tr>
<tr><td>Mark limit:</td><td colspan="3"><table>
<tr><th>Frequency (MHz)</th><th>Field Strength (microvolts/meter) at 30m</th><th>Field Strength (dBuV/m) at 3m</th></tr>
<tr><td>1.705~13.110</td><td>30</td><td>69.5</td></tr>
<tr><td>13.110~13.410</td><td>106</td><td>80.5</td></tr>
<tr><td>13.410~13.553</td><td>334</td><td>90.5</td></tr>
<tr><td>13.553~13.567</td><td>15848</td><td>124.0</td></tr>
<tr><td>13.567~13.710</td><td>334</td><td>90.5</td></tr>
<tr><td>13.710~14.010</td><td>106</td><td>80.5</td></tr>
<tr><td>14.010~30.000</td><td>30</td><td>69.5</td></tr>
</table></td></tr>
<tr><td>Test setup:</td><td colspan="3"> 
</td></tr>
<tr><td>Test Procedure:</td><td colspan="3">1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT, the turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the receiving antenna was fixed at one meter above ground to find the maximum emissions field strength.</td></tr>
</table>

	4. For Fundamental emissions, use the receiver to measure QP reading. 5. 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. 6. Compliance with the spectrum mask is tested using a spectrum analyzer with RB set to a 1KHz for the band 13.553~13.567MHz.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Measurement data:

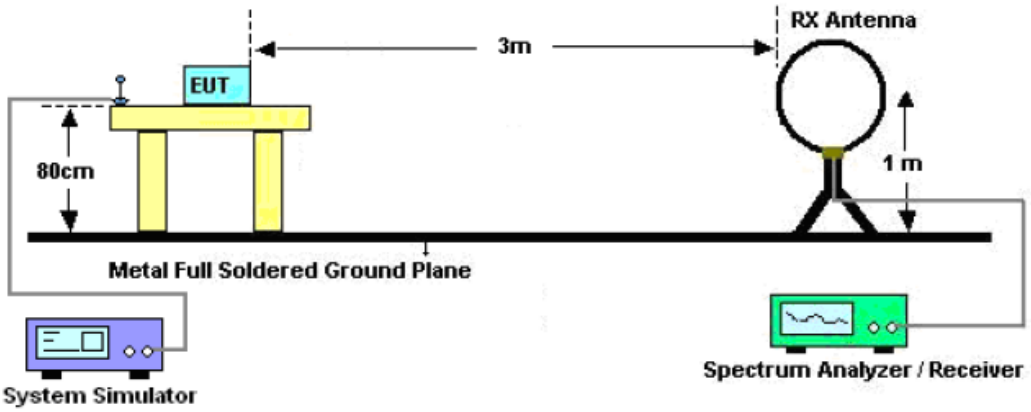


Freq	Rd_level	Factor	Level	Limit	Over	detector
13.56	67.78	13.58	81.36	124	-42.64	QP
13.553	29.05	13.58	42.63	90.47	-47.84	QP
13.567	28.79	13.58	42.37	90.47	-48.1	QP

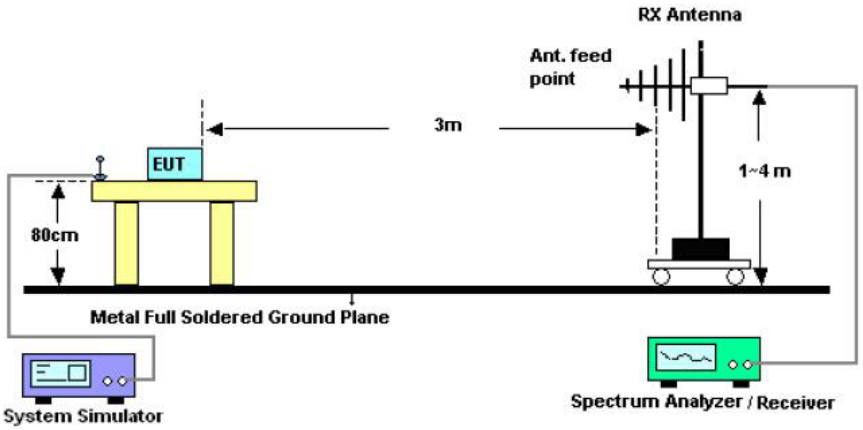
5. Radiated Emissions

5.1 Block Diagram of Test Setup

Radiated Emission Test-Setup Frequency Below 30MHz



Radiated Emission Test-Setup Frequency 30MHz-1000MHz



5.2 FCC 15.209 Limit

Frequency(MHz)	Distance Meters	Field Strengths Limit	
		μV/m	dB(μV)/m
0.009~0.490	300	2400/F(KHz)	67.6-20log(F)
0.490~1.705	30	24000/F(KHz)	87.6-20log(F)
1.705~30.0	30	30	29.54
30~88	3	100	40.0
88~216	3	150	43.5
216~960	3	200	46.0
960~1000	3	500	54.0
Above 1000	3	74.0dBμV/m—Peak 54.0 dBμV/m--Average	

Remark:
(1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz, radiated emissions limits in these three bands are based on measurements employing an average detector.

(2) At frequencies below 30MHz, measurement may be performed at a distance closer than that specified, and the limit at closer measurement distance can be extrapolated by below formula:

All restriction band should comply with 15.209, other emission should be at least 20dB below the fundamental.

$Limit_{3m}$ (dBuV/m)= $Limit_{30m}$(dBuV/m) + 40Log(30m/3m)

(3) Limit for this EUT

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions or comply with 15.209 limits

5.3 Test Procedure

(1)EUT was place on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber for below 1G and 150 cm above the ground plane inside a semi-anechoic chamber for above 1G.
(2) Test antenna was located 3m from the EUT on an adjustable mast, and the antenna used asbelow table.

Test frequency range	Test antenna used	Test antenna distance
9kHz-30MHz	Active Loop antenna	3m
30MHz-1GHz	Trilog Broadband Antenna	3m
1GHz-18GHz	Double Ridged Horn Antenna(1GHz-18GHz)	3m
18GHz-40GHz	Horn Antenna(18GHz-40GHz)	3m

According ANSI C63.10:2013 clause 6.4.4.2 and 6,5.3, for measurements below 30 MHz, the loop antenna was positioned with its plane vertical from the EUT and rotated about its vertical axis for maximum response at each azimuth position around the EUT. And the loop antenna alsobe positioned with its plane horizontal at the specified distance from the EUT. The center of the loop is 1 m above the ground. for measurement above 30MHz, the trilog Broadband Antenna or Horn Antenna was located 3m from EUT, Measurements were made with the antenna positioned in both the horizontal and vertical planes of Polarization, and the measurement antenna was varied from 1 m to 4 m. in height above the reference ground plane to obtain the maximum signal strength.

(3) Below pre-scan procedure was first performed in order to find prominent frequency spectrum radiated emissions from 9 kHz to 1 GHz:
(a) Scanning the peak frequency spectrum with the antenna specified in step (3), and the EUT was rotated 360 degree, the antenna height was varied from 1m to 4m (Except loop antenna, it's fixed 1m above ground.)
(b) Change work frequency or channel of device if practicable.
(c) Change modulation type of device if practicable.
(d) Change power supply range from 85% to 115% of the rated supply voltage
(e) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions.
Spectrum frequency from 9 kHz to 1 GHz (tenth harmonic of fundamental frequency) was investigated, and no any obvious emission were detected.
(4) For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipment and all of the interface cables were changed according to ANSI C63.10:2013 on Radiated Emission test.
(5) The emissions from 9 kHz to 1GHz were measured based on CISPR QP detector except for the frequency bands 9-90 kHz, 110-490 kHz, for emissions from 9 kHz-90 kHz,110 kHz-490 kHz and above 1 GHz were measured based on average detector, for emissions above 1 GHz, peak emissions also be measured and need comply with Peak limit.
(6) The emissions from 9 kHz to 1 GHz, QP or average values were measured with EMI receiver with below RBW

Frequency band	RBW
9 kHz-150 kHz	200 Hz
150 kHz-30 MHz	9 kHz
30 MHz-1 GHz	120 kHz

(7) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1 MHz, VBW is set at 3 MHz for Peak measure; RBW 1 MHz VBW 10 Hz for Average measure (according ANSI C63.10:2013 clause 4.1.4.2.2 procedure for average measure).

(8) X axis, Y axis, Z axis are tested, and worse setup X axis is reported

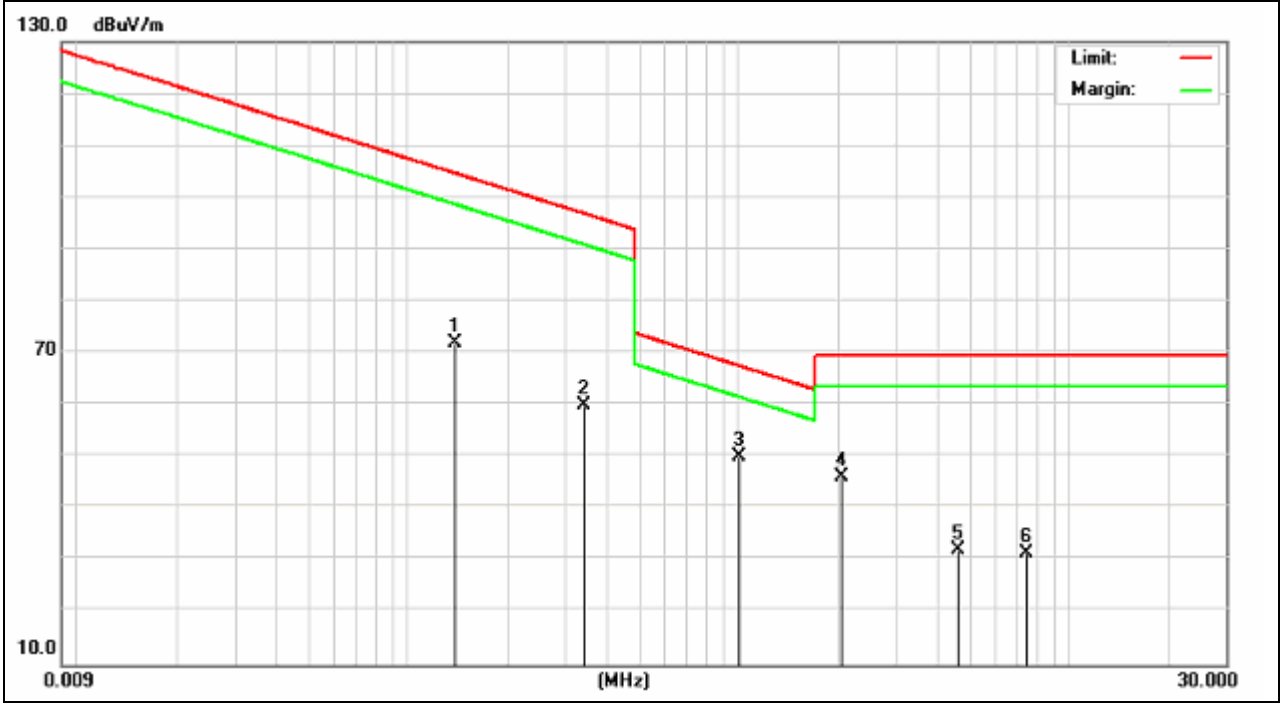
5.4 Test Result

Pass

5.5 Test Result and Data

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
0.1396	31.3	40.61	71.91	104.6 4	-32.73	Quasi-Peak
0.3436	26.68	33.22	59.9	96.86	-36.96	Quasi-Peak
1.0023	24	26.01	50.01	67.6	-17.59	Quasi-Peak
2.0632	24.29	21.85	46.14	69.5	-23.36	Quasi-Peak
4.6436	16.53	15.63	32.16	69.5	-37.34	Quasi-Peak
7.4333	17	14.48	31.48	69.5	-38.02	Quasi-Peak

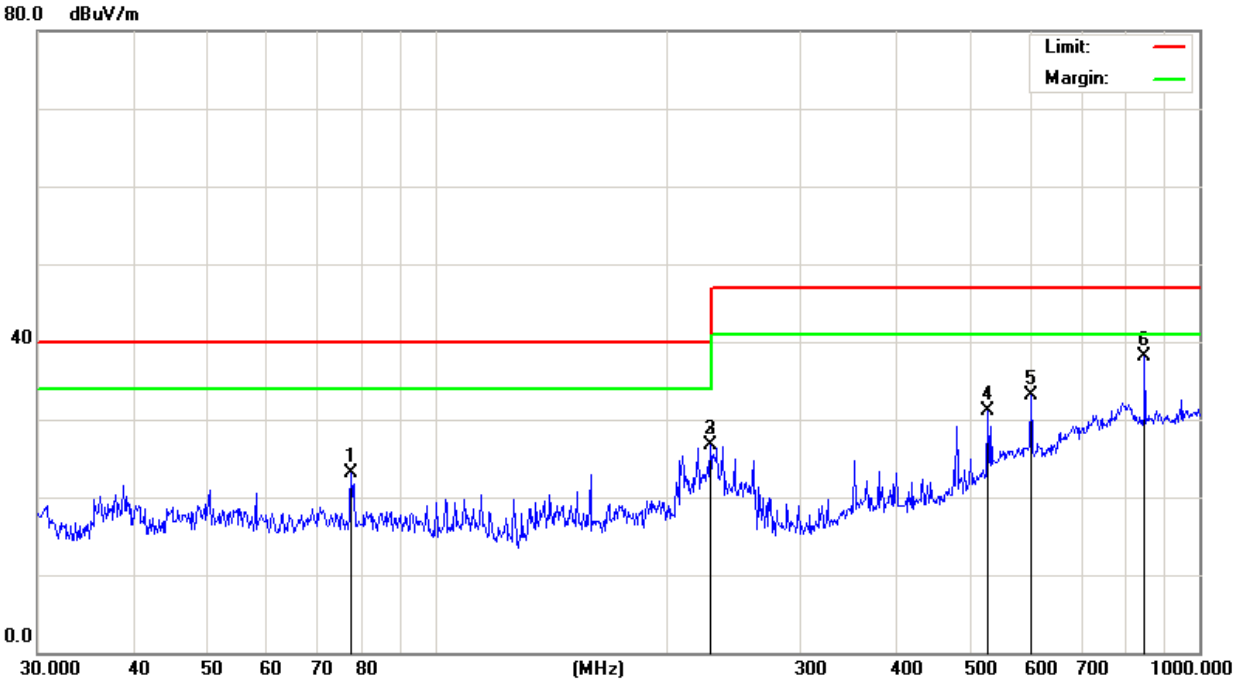
Remark:
1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



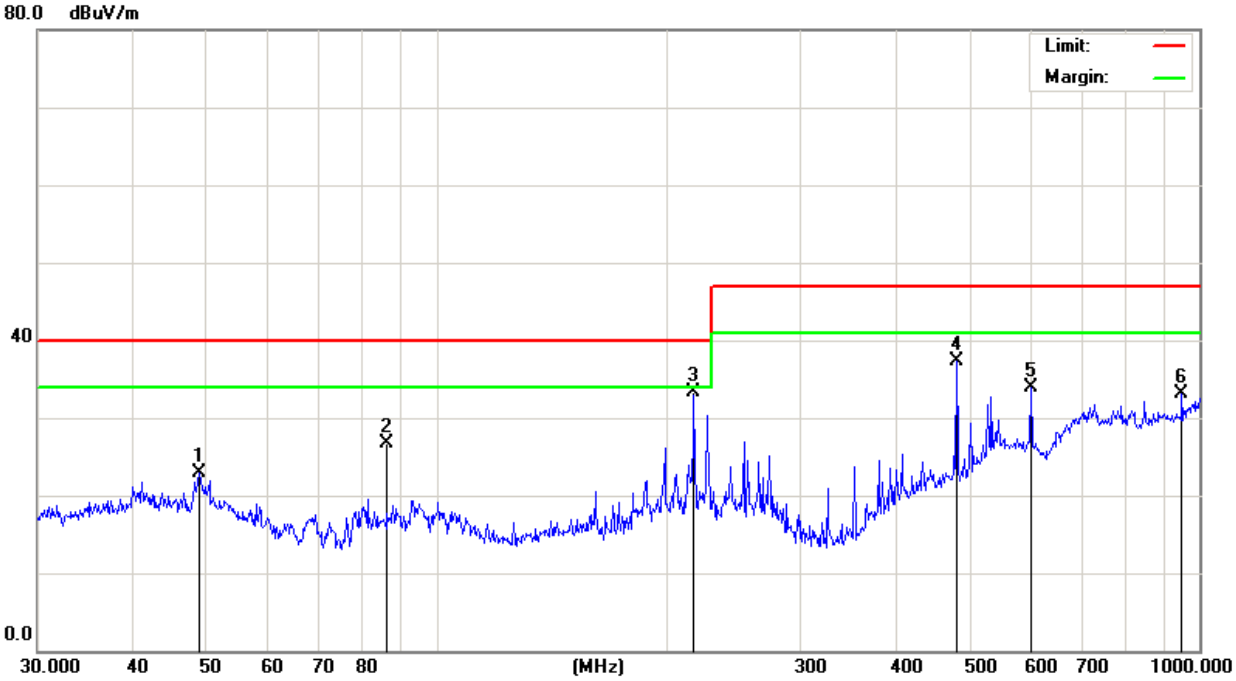
Note:

Pre-scan in the all of mode and antenna was aligned along the site axis, orthogonal to the axis, the worst case in of was recorded.

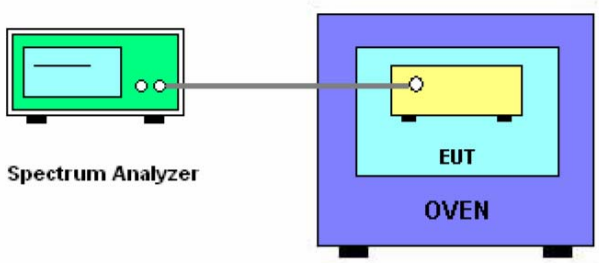
Vertical



Horizontal



6. Frequency Stability Measurement

Test Requirement:	FCC Part15 C Section 15.225
Test Method:	ANSI C63.10: 2013
Receiver setup:	RBW=1KHz, VBW=1KHz, Sweep time=Auto
Limit:	The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, 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.
Test setup:	
Test Procedure:	1. The transmitter output (antenna port) was connected to the spectrum analyzer. 2. EUT have transmitted absence of modulation signal and fixed channelize 3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth. 4. Set RBW=1KHz, VBW=1KHz with peak detector and maxhold settings. 5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc x10^6 ppm and the limit is less than ±100ppm. 6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value 7. Extreme temperature rule is -20℃ ~50℃
Test results:	Pass

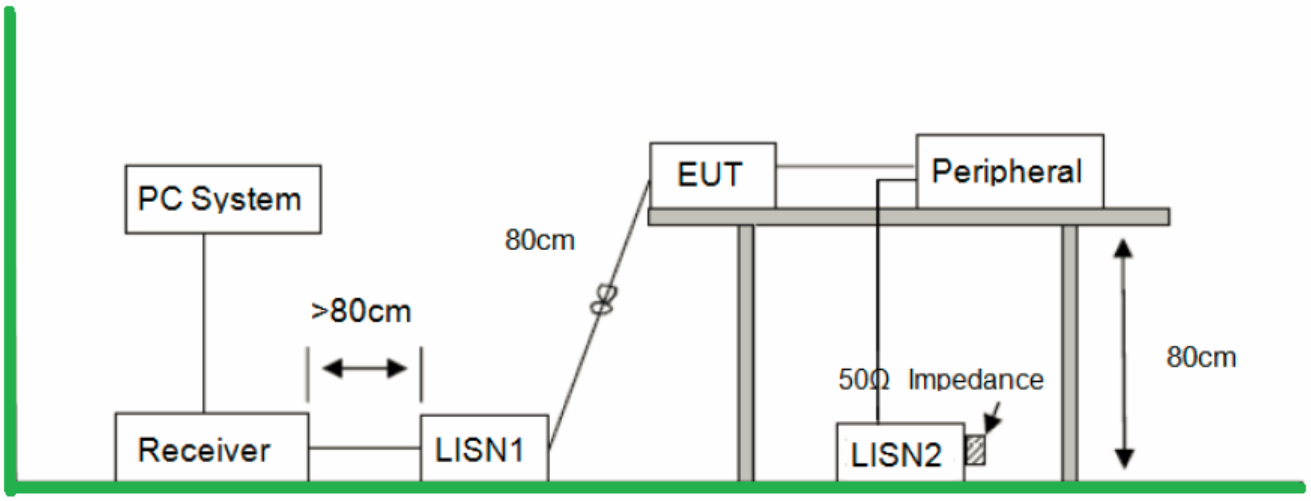
Measurement data:

Reference Frequency: 13.56MHz					
Power supplied (Vdc)	Temperature (℃)	Frequency error		Limit	Result
		Hz	%		
3.70	-20	31	0.00023%	+/- 0.01%	Pass
	-10	43	0.00032%		
	0	48	0.00036%		
	10	23	0.00017%		
	20	34	0.00025%		
	30	38	0.00028%		
	40	55	0.00041%		
	50	52	0.00038%		

Reference Frequency: 13.56MHz					
Temperature (℃)	Power supplied (Vdc)	Frequency error		Limit	Result
		Hz	ppm		
20	3.60	35	0.00026%	+/- 0.01%	Pass
	3.70	28	0.00021%		
	4.07	32	0.00024%		

7. Power Line Conducted Emission

7.1 Block Diagram of Test Setup



7.2 Limit

Frequency	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150KHz-500KHz	66 ~ 56*	56 ~ 46*
500KHz-5MHz	56	46
5MHz-30MHz	60	50

Note 1: * Decreasing linearly with logarithm of frequency.
Note 2: The lower limit shall apply at the transition frequencies

7.3 Test Procedure

The EUT and Support equipment, if needed, were put placed on a non-metallic table, 80cm above the ground plane.

Configuration EUT to simulate typical usage as described in clause 2.4 and test equipment as described in clause 10.2 of this report.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.

All support equipment power received from a second LISN.

Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.

The Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.

During the above scans, the emissions were maximized by cable manipulation.

The test mode(s) described in clause 2.4 were scanned during the preliminary test.

After the preliminary scan, we found the test mode producing the highest emission level.

The EUT configuration and worse cable configuration of the above highest emission levels were recorded for reference of the final test.

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

A scan was taken on both power lines, Neutral and Line, recording at least the six highest emissions.

Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.

The test data of the worst-case condition(s) was recorded.

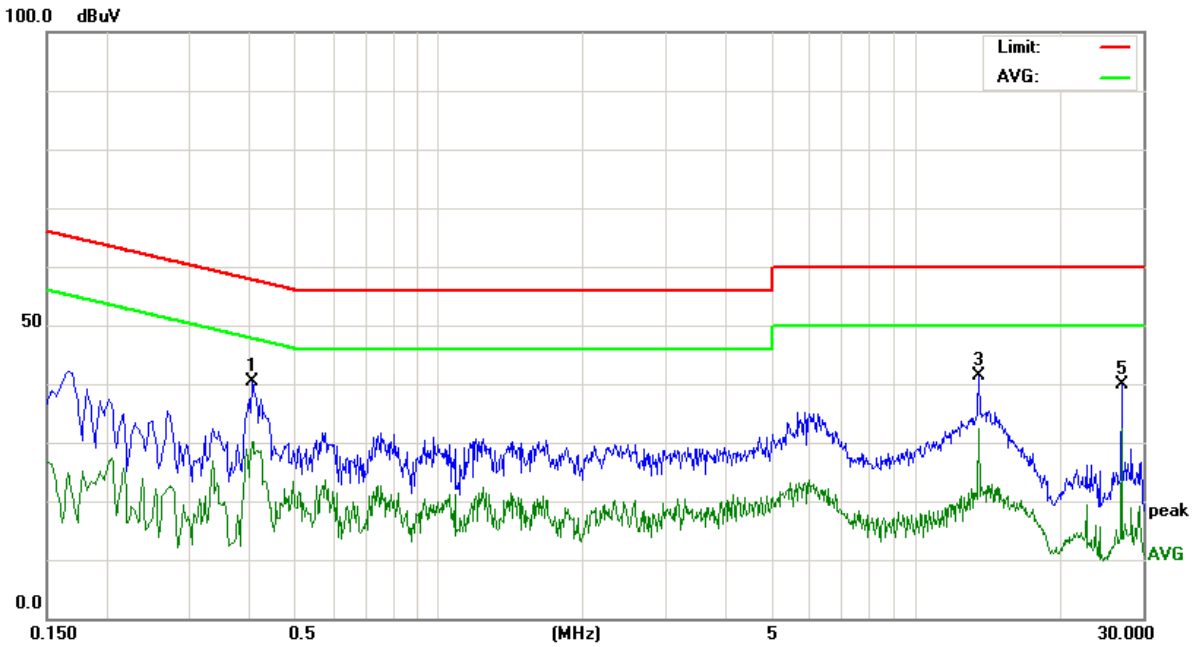
The bandwidth of test receiver is set at 9 kHz.

7.4 Test Result

PASS. (See below detailed test result)

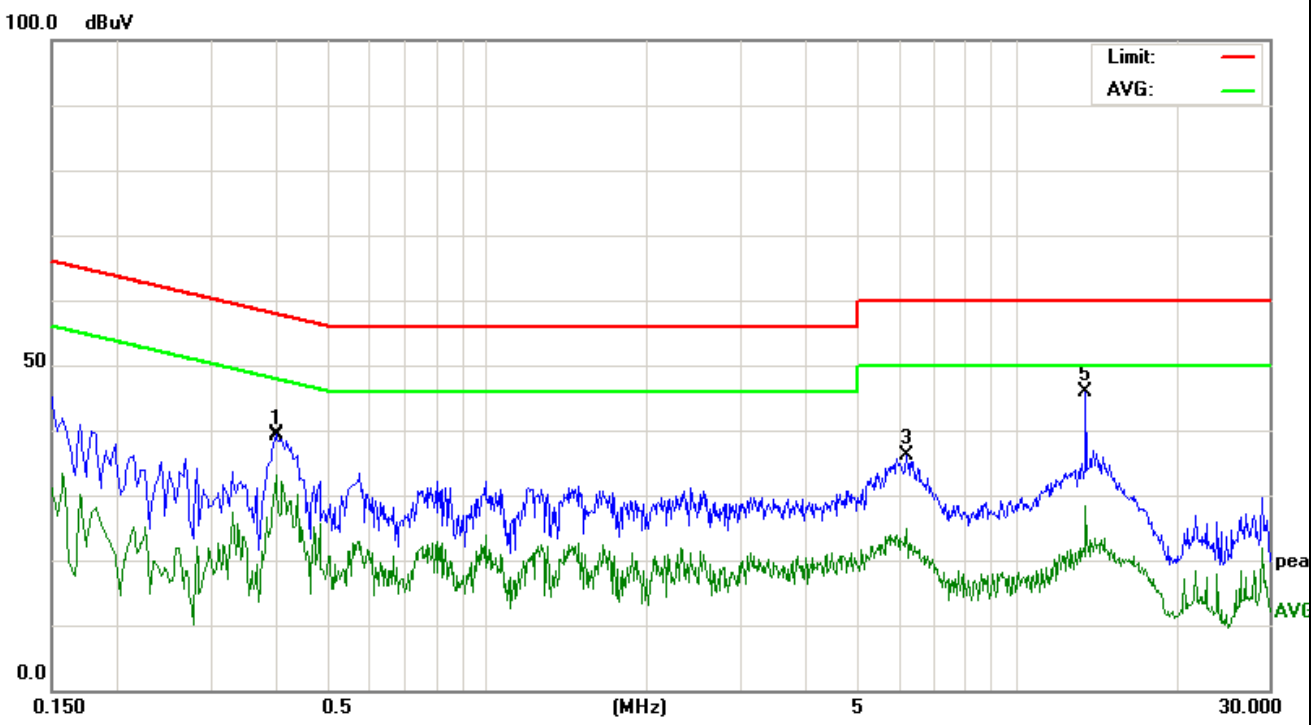
7.5 Original Test data

L



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	0.4060	30.37	10.08	40.45	57.73	-17.28	peak
2		0.4060	20.07	10.08	30.15	47.73	-17.58	AVG
3		13.5860	31.11	10.25	41.36	60.00	-18.64	peak
4		13.5860	22.11	10.25	32.36	50.00	-17.64	AVG
5		27.1180	28.40	11.40	39.80	60.00	-20.20	peak
6		27.1180	20.95	11.40	32.35	50.00	-17.65	AVG

N



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.3980	29.16	10.09	39.25	57.89	-18.64	peak
2		0.3980	23.14	10.09	33.23	47.89	-14.66	AVG
3		6.2060	26.14	10.07	36.21	60.00	-23.79	peak
4		6.2060	14.84	10.07	24.91	50.00	-25.09	AVG
5	*	13.5340	35.62	10.25	45.87	60.00	-14.13	peak
6		13.5340	18.05	10.25	28.30	50.00	-21.70	AVG

8. Antenna Requirements

8.1 Limit

15.203 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, 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..

8.2 Result

The antenna is integral antenna, the best case gain of the antenna is 1dBi.

※※※※※**END OF REPORT**※※※※※