SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.

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1 Cover Page

RF Test Report

Application No.:	SHEM1705002814CR
Applicant:	Beijing Smartmi Electronic Technology Co., Ltd
FCC ID:	2AMKNAC-M3-CA
Equipment Under Test (EUT): **NOTE:** The following sample(s) was/were submitted and identified by the client as	
Product Name:	Mi Air Purifier Pro
Model No.(EUT):	AC-M3-CA
Standards:	FCC PART 15 Subpart C: 2016
Date of Receipt:	2017-05-16
Date of Test:	2017-05-16 to 2017-06-23
Date of Issue:	2017-06-28
Test Result:	**Pass***

*In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Parlam Zhan
E&E Section Manager
SGS-CSTC (Shanghai) Co., Ltd.

2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00	/	2017-06-28	/	Original

Authorized for issue by:				
Engineer		Eddy Zong **Print Name**		Eddy Zong
Clerk		Susie Liu **Print Name**		Susie Liu
Reviewer		Parlam Zhan **Print Name**		Parlam Zhan

3 Test Summary

Test Item	Test Requirement	Test Method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203	/	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10 (2013) Section 6.2	PASS
Emission Mask	47 CFR Part 15, Subpart C Section 15.225(a)/(b)/(c)	ANSI C63.10 (2013) Section 6.9.2	PASS*
Radiated Emissions	47 CFR Part 15, Subpart C Section 15.225(d)/15.209	ANSI C63.10 (2013) Section 6.4	PASS
Frequency tolerance	47 CFR Part 15, Subpart C Section 15.225(e)	ANSI C63.10 (2013) Section 6.4&6.5	PASS
20dB Bandwidth	47 CFR Part 15, Subpart C Section 15.215	ANSI C63.10 (2013) Section 6.8	PASS

Remark: * The test level of the fundamental signal is below the limit of general spurious emission, so the test no performs.

4 Contents

5 General Information

5.1 Client Information

Applicant:	Beijing Smartmi Electronic Technology Co., Ltd
Address of Applicant:	The Rainbow City office Building, No.68 Qinghe Middle Street, Haidian District,Beijing.100085 China
Manufacturer:	Beijing Smartmi Electronic Technology Co., Ltd
Address of Manufacturer:	Building A,Room6,Shunshijiaye Pioneer Park, No.66 Zhufang Road, Haidian District, Beijing 100085 China
Factory:	Beijing Smartmi Electronic Technology Co., Ltd
Address of Factory:	Building A,Room6,Shunshijiaye Pioneer Park, No.66 Zhufang Road, Haidian District, Beijing 100085 China

5.2 General Description of E.U.T.

Product Description:	Fixed product with 13.56Mhz RFID & WiFi function
Rated Input:	AC 120V 60Hz

5.3 Technical Specifications

Operation Frequency:	13.56MHz
Modulation Type:	ASK
Antenna Type:	Integral Loop Antenna

5.4 E.U.T Operation Mode

Test Mode	Description of Test Mode
Engineering mode:	Keep EUT working in continuous transmitting mode

5.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. E&E Lab

No.588 West Jindu Road, Songjiang District, Shanghai, China. 201612.

Tel: +86 21 6191 5666

Fax: +86 21 6191 5678

No tests were sub-contracted.

5.6 Test Facility

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

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **FCC – Registration No.: 402683**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered and fully described in a report filed with the Federal Communications Commission (FCC). The acceptance letter from the FCC is maintained in our files. Registration No.: 402683,

- **Industry Canada (IC) – IC Assigned Code: 8617A**

The 3m Semi-anechoic chamber of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 8617A-1.

- **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-3868, C-4336, T-2221, G-830 respectively..

5.7 Measurement Uncertainty

No.	Parameter	Measurement Uncertainty
1	Radio Frequency	$< \pm 1 \times 10^{-5}$
2	Total RF power, conducted	< ±1.5 dB
3	RF power density, conducted	< ±3 dB
4	Spurious emissions, conducted	< ±3 dB
5	All emissions, radiated	< ±6 dB (Below 1GHz) < ±6 dB (Above 1GHz)
6	Temperature	< ±1°C
7	Humidity	< ±5 %
8	DC and low frequency voltages	< ±3 %

6 Equipments List

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due date
1	Power meter	Rohde & Schwarz	NRP	101641	2017-01-14	2018-01-13
2	Power Sensor	Rohde & Schwarz	NRP-Z22	101096	2016-08-06	2017-08-05
3	Spectrum Analyzer	Rohde & Schwarz	FSP-30	2705121009	2017-01-14	2018-01-13
4	EMI test receiver	Rohde & Schwarz	ESU40	100109	2017-02-13	2018-01-15
5	Active Loop Antenna (9kHz to 30MHz)	Rohde & Schwarz	FMZB1519	1519-034	2017-02-13	2018-01-15
6	Broadband UHF-VHF ANTENNA (25MHz to 2GHz)	SCHWARZBECK	VULB9168	9168-313	2017-02-13	2018-01-15
7	Ultra broadband antenna (25MHz to3GHz)	Rohde & Schwarz	HL562	100227	2016-08-30	2017-08-29
8	Horn Antenna (1GHz to 18GHz)	Rohde & Schwarz	HF906	100284	2017-02-13	2018-01-15
9	Horn Antenna (1GHz to 18GHz)	SCHWARZBECK	BBHA9120D	9120D-679	2017-02-13	2018-01-15
10	Horn Antenna(14GHz to 40GHz)	SCHWARZBECK	BBHA 9170	BBHA917-0373	2017-02-13	2018-01-15
11	Pre-amplifier (9KHz – 2GHz)	LNA6900	TESEQ	71033	/	/
12	Pre-amplifier (1GHz – 26.5GHz)	SCHWARZBECK	SCU-F0118-G40-BZ4-CSS(F)	10001	2017-01-14	2018-01-13
13	Pre-amplifie (14GHz – 40GHz)	SCHWARZBECK	SCU-F1840-G35-BZ3-CSS(F)	10001	2017-01-14	2018-01-13
14	Tunable Notch Filter	Wainwright instruments Gmbh	WRCT800.0/880.0-0.2/40-5SSK	170397 169777 169780 192507	/	/
15	High pass Filter	FSCW	HP 12/2800-5AA2	19A45-02	/	/
16	High-low temperature cabinet	Suzhou Zhihe	TL-40	50110050	2016-09-11	2017-09-10
17	AC power stabilizer	WOCEN	6100	51122	2017-01-14	2018-01-13
18	DC power	QJE	QJ30003SII	3573/4/3	2017-01-14	2018-01-13
19	Signal Generator (Interferer)	Rohde & Schwarz	SMR40	100555	2016-08-13	2017-08-12
20	Signal Generator (Blocker)	Rohde & Schwarz	SMJ100A	101394	2017-01-14	2018-01-13
21	Splitter	Anritsu	MA1612A	M12265	/	/
22	Coupler	e-meca	803-S-1	900-M01	/	/

7 Test results and Measurement Data

7.1 Antenna Requirement

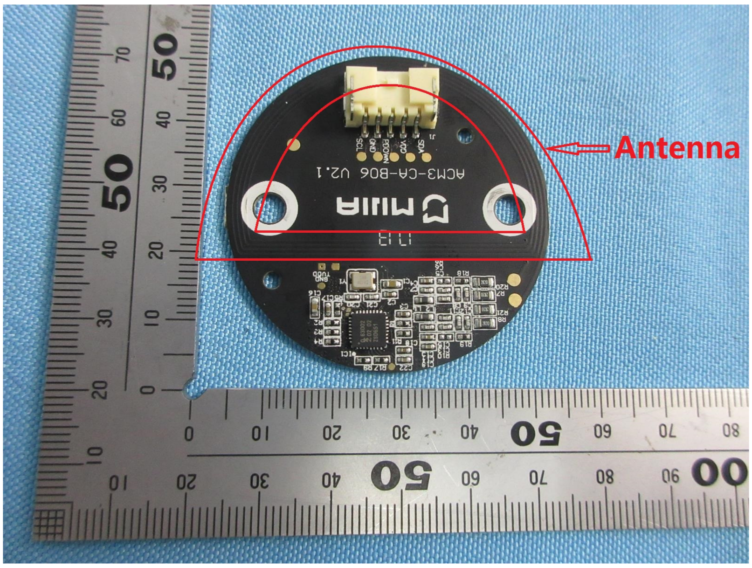
Standard requirement: 47 CFR Part 15C Section 15.203

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.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement.

Antenna Configuration:



7.2 Conducted Emissions

Frequency Range: 150 KHz to 30 MHz

Class/Severity: Class B

Limit:

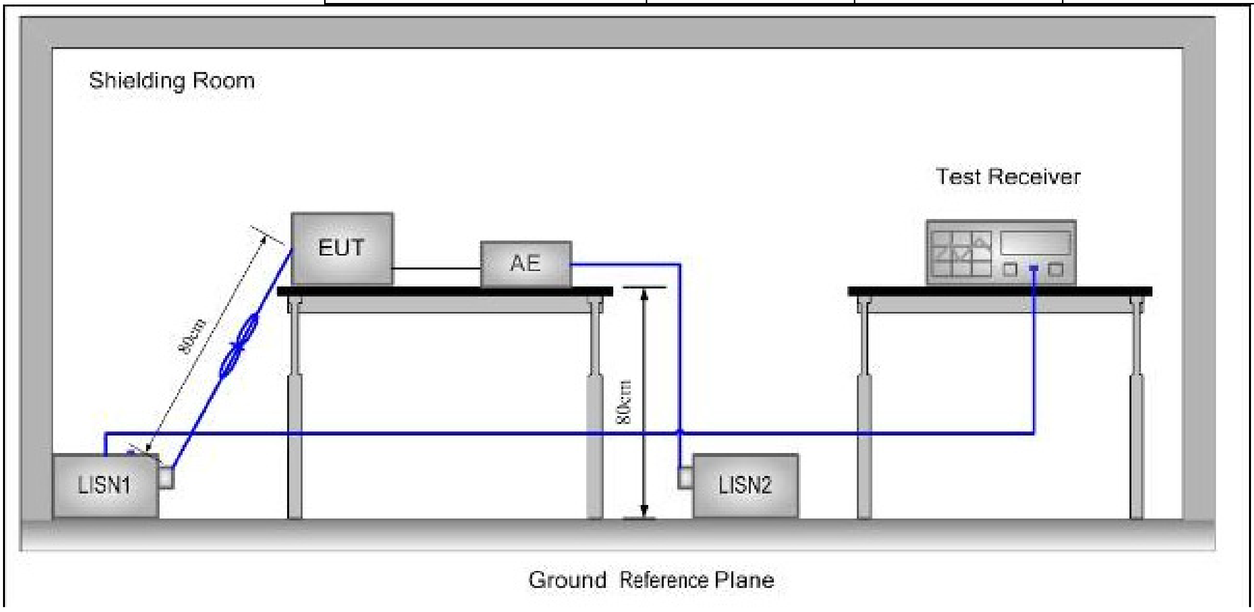
Frequency range MHz	Class B Limits: dB (μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note1: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50MHz.

Note2: The lower limit is applicable at the transition frequency.

Test site/setup: Test instrumentation set-up:

Frequency Range	Detector	RBW	VBW
9KHz to 150Hz	Quasi-peak	200Hz	500Hz
150KHz to 30MHz	Quasi-peak	9kHz	30kHz



Test Procedure:

1. The mains terminal disturbance voltage was measured with the EUT in a shielded room.
2. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN, which was bonded to the ground reference plane in the same way as the LISN for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded
3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference

plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

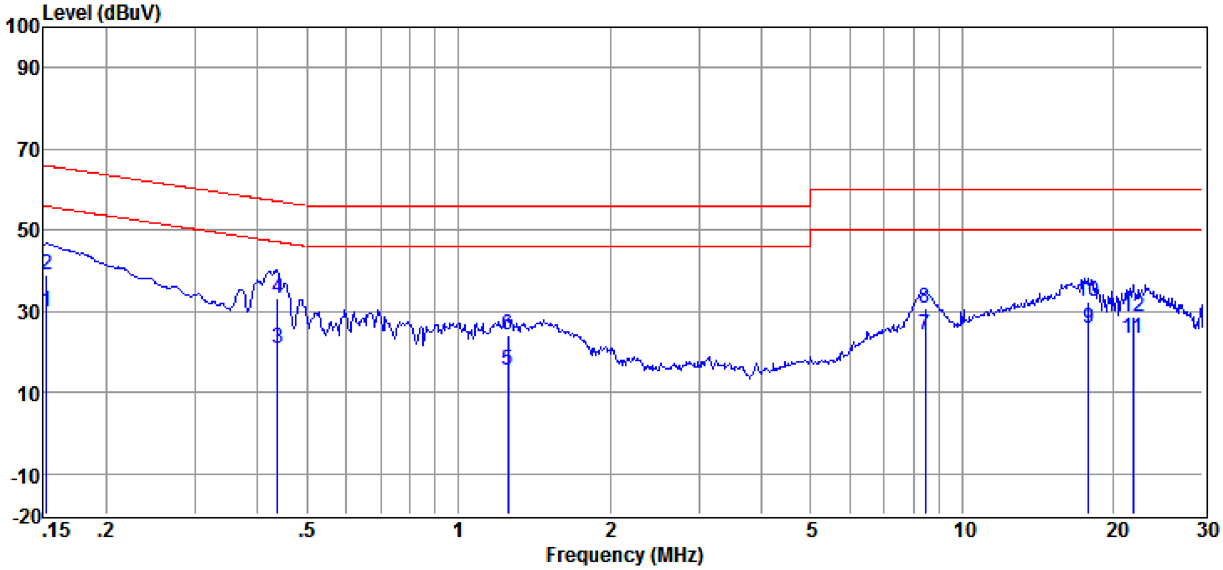
4. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance was between the closest points of the LISN and the EUT. The mains lead of EUT excess 0.8m was folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0.3m and 0.4m. All other units of the EUT and associated equipment were at least 0.8 m from the LISN.

Remark: Pre-scan was performed with peak detected on all ports, Quasi-peak & average measurements were performed at the frequencies at which maximum peak emission level were detected. Please see the attached Quasi-peak and Average test results.

Test Result: Pass

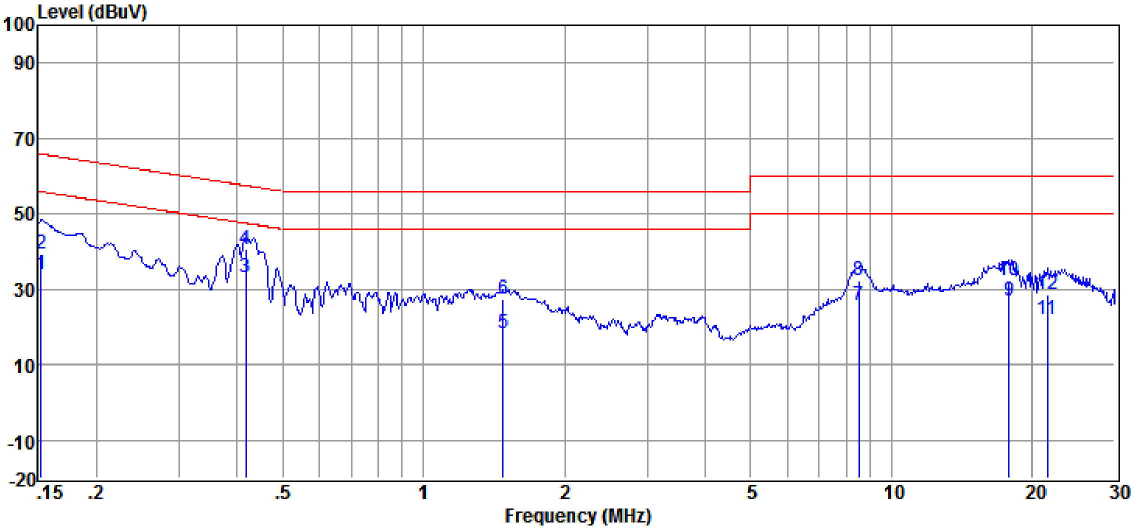
Test data:

Live Line:



Item	Freq.	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBμV)	(dB)	(dB)	(dBμV)	(dBμV)	(dB)	
1	0.152	20.19	0.05	9.81	30.05	55.87	-25.82	Average
2	0.152	29.28	0.05	9.81	39.14	65.87	-26.73	QP
3	0.437	11.01	0.10	9.82	20.93	47.11	-26.18	Average
4	0.437	23.33	0.10	9.82	33.25	57.11	-23.86	QP
5	1.255	5.43	0.08	9.84	15.35	46.00	-30.65	Average
6	1.255	14.19	0.08	9.84	24.11	56.00	-31.89	QP
7	8.456	14.16	0.18	9.87	24.21	50.00	-25.79	Average
8	8.456	20.77	0.18	9.87	30.82	60.00	-29.18	QP
9	17.849	15.53	0.24	10.03	25.80	50.00	-24.20	Average
10	17.849	22.08	0.24	10.03	32.35	60.00	-27.65	QP
11	21.830	12.98	0.31	10.04	23.33	50.00	-26.67	Average
12	21.830	18.47	0.31	10.04	28.82	60.00	-31.18	QP

Neutral Line:



Item	Freq.	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBµV)	(dB)	(dB)	(dBµV)	(dBµV)	(dB)	
1	0.152	23.98	0.05	9.81	33.84	55.87	-22.03	Average
2	0.152	29.49	0.05	9.81	39.35	65.87	-26.52	QP
3	0.417	23.51	0.04	9.82	33.37	47.51	-14.14	Average
4	0.417	30.92	0.04	9.82	40.78	57.51	-16.73	QP
5	1.480	8.45	0.06	9.84	18.35	46.00	-27.65	Average
6	1.480	17.64	0.06	9.84	27.54	56.00	-28.46	QP
7	8.501	15.54	0.20	9.87	25.61	50.00	-24.39	Average
8	8.501	22.32	0.20	9.87	32.39	60.00	-27.61	QP
9	17.849	16.56	0.29	10.03	26.88	50.00	-23.12	Average
10	17.849	21.86	0.29	10.03	32.18	60.00	-27.82	QP
11	21.486	11.70	0.33	10.04	22.07	50.00	-27.93	Average
12	21.486	18.14	0.33	10.04	28.51	60.00	-31.49	QP

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

7.3 Radiated Emissions

Test frequency range: 9KHz – 1GHz

Test Site: Measurement Distance: 3m (Semi-Anechoic Chamber)

Receiver Setup:

Frequency (MHz)	RBW	VBW	Detector
0.009-0.015	200Hz	1KHz	Quasi-peak
0.015-30	9kHz	30KHz	Quasi-peak
30-1000	120 kHz	300KHz	Quasi-peak

Note: The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector. For the frequency bands 9~90 kHz, 110~490 kHz and above 1000 MHz, the radiated emission limits are based on measurements employing an average detector.

Limit:

Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)	Limit @3m (dBμV/m)
0.009-0.490	2400/F(kHz)	300	128.5 ~ 93.8
0.490-1.705	24000/F(kHz)	30	73.8 ~63.0
1.705-30	30	30	69.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
960-1000	500	3	54.0

NOTE:

(1) For test distance other than what is specified, but fulfilling the requirements of section 15.31(f) (2) the field strength is calculated by adding additionally an extrapolation factor of 40dB/decade (inverse linear distance for field strength measurements).
So the Distance Extrapolation Factor in dB is 40*log (D_{TEST} / D_{SPEC})
where D_{TEST} = Test Distance and D_{SPEC} = Specified Distance.
Field strength limit (dBμV/m)@test distance= Field strength limit (dBμV/m)@specified distance -Distance Extrapolation Factor

(2) The lower limit shall apply at the transition frequencies.

Limit: (Fundamental signal)

Frequency	Limit (dBuV/m @3m)	Remark
13.56MHz	124	Quasi-peak Value

Test Procedure:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna 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.
d. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10dB 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 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
g. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.

Test Setup:

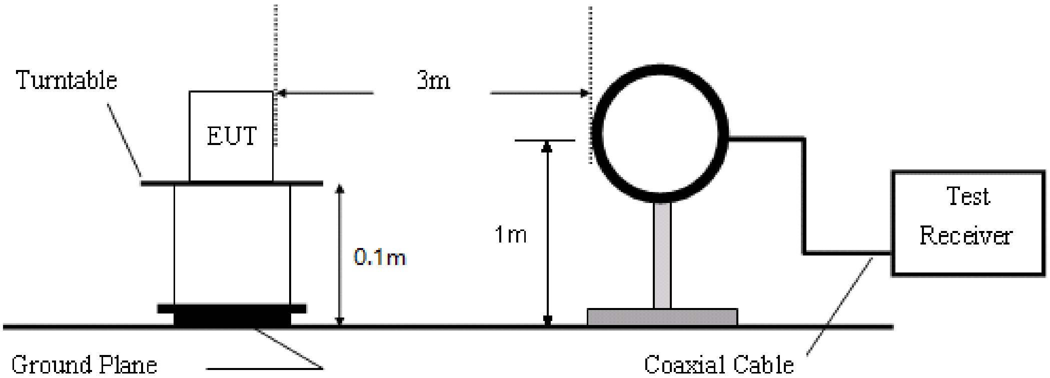


Figure 1. Below 30MHz

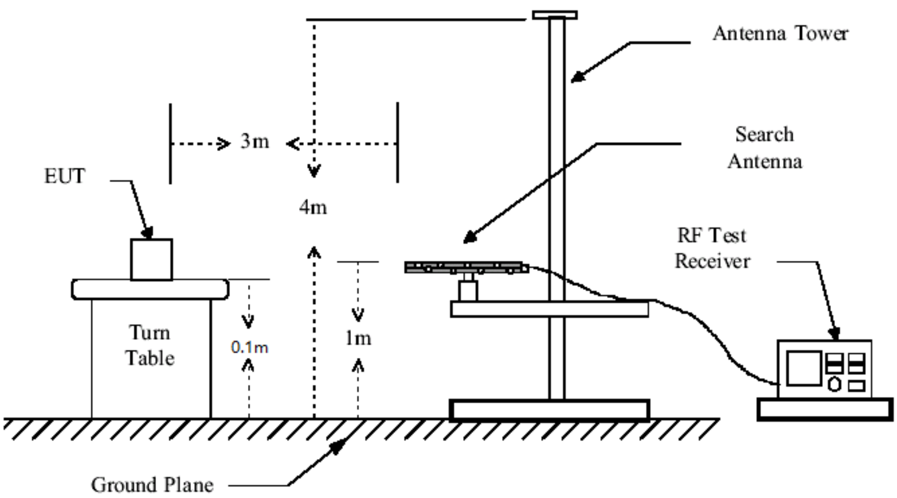


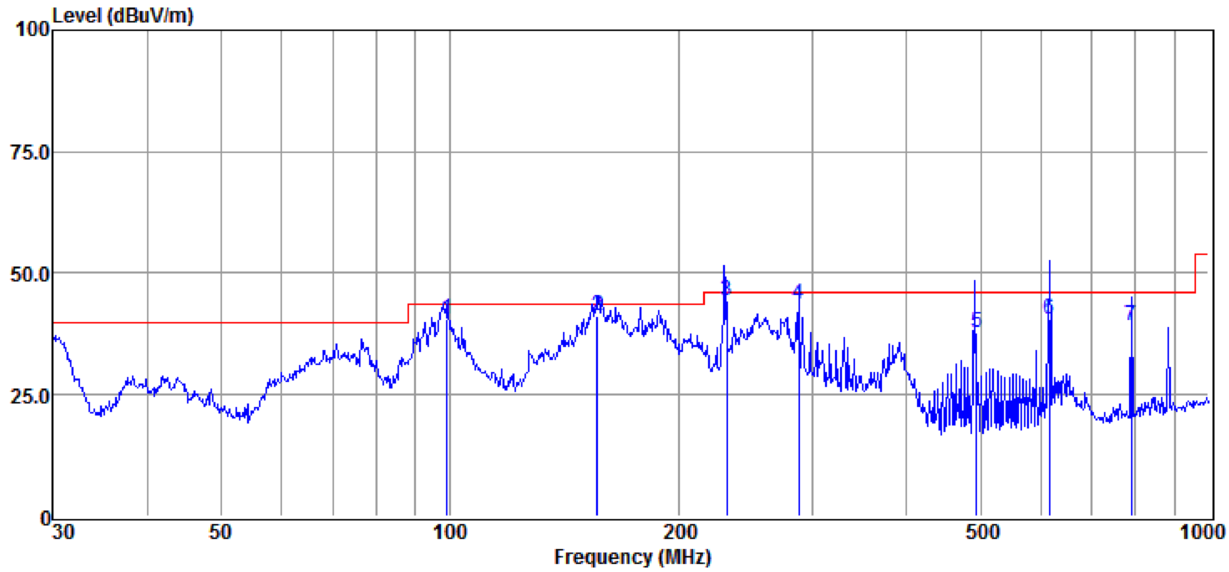
Figure 2. 30MHz to 1GHz

Test Results: Pass

Item	Freq.	Read Level	Antenna Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBµV)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	0.02	43.02	20.52	0.03	63.57	122.02	-58.45	QP
2	0.06	36.40	19.96	0.04	56.40	112.44	-56.04	QP
3	0.16	30.59	19.99	0.05	50.63	103.78	-53.15	QP
4	0.40	30.48	19.80	0.06	50.34	95.47	-45.13	QP
5	0.81	25.04	19.44	0.07	44.55	69.43	-24.88	QP
6	1.22	19.76	19.33	0.08	39.17	65.91	-26.74	QP
7	13.56	10.33	19.20	0.13	66.48	124	-57.52	QP

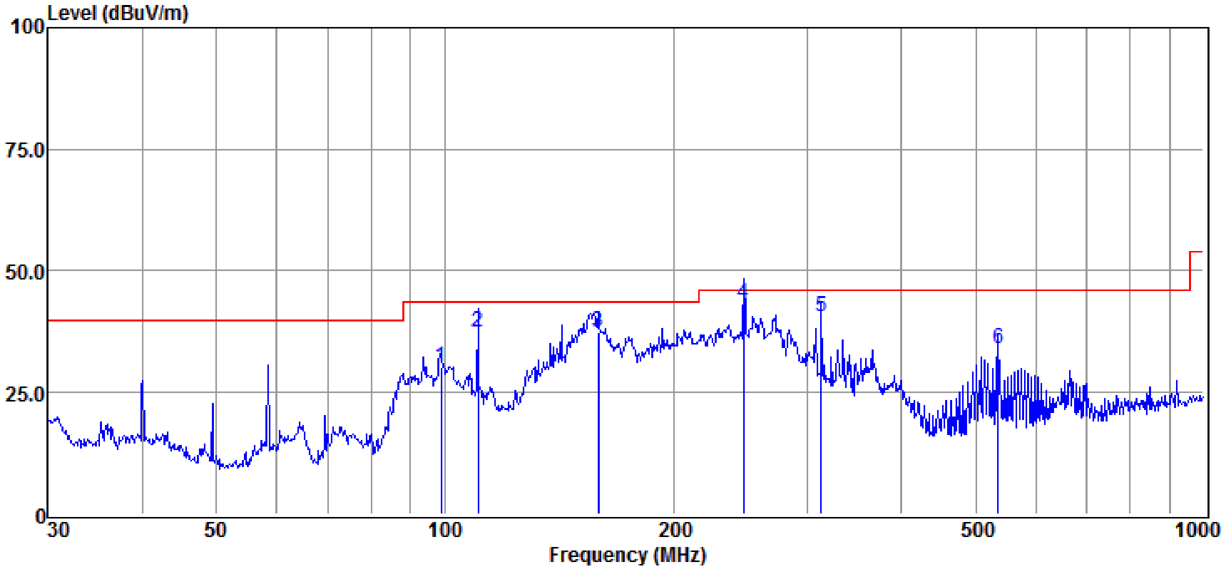
30MHz-1GHz:

Vertical



Item	Freq.	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	
1	99.18	73.51	9.41	42.70	0.45	40.67	43.50	-2.83	QP
2	156.46	70.33	12.70	42.56	0.63	41.10	43.50	-2.40	QP
3	231.85	75.20	10.78	42.45	0.74	44.27	46.00	-1.73	QP
4	287.99	72.31	12.81	42.36	0.83	43.59	46.00	-2.41	QP
5	494.13	61.49	17.10	42.12	1.17	37.64	46.00	-8.36	QP
6	615.40	61.90	19.55	42.20	1.40	40.65	46.00	-5.35	QP

Horizontal



Item	Freq.	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1	98.83	63.00	9.36	42.70	0.45	30.11	43.50	-13.39	QP
2	110.57	70.01	9.62	42.70	0.50	37.43	43.50	-6.07	QP
3	159.23	66.38	13.03	42.56	0.63	37.48	43.50	-6.02	QP
4	247.68	73.69	11.40	42.43	0.77	43.43	46.00	-2.57	QP
5	313.28	68.57	13.48	42.31	0.86	40.60	46.00	-5.40	QP
6	535.71	56.73	18.05	42.15	1.25	33.88	46.00	-12.12	QP

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
2) Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

7.4 Frequency tolerance

Requirements: 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, 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.

Test Procedure: The EUT was placed in an environmental test chamber and powered such that control element received normal voltage and the transmitter provided maximum RF output.

Frequency Range: Operation within the band 13.110-14.010 MHz

Test Result: Pass

Test Data:

Nominal Operation Frequency: 13.56MHz

Test Conditions		Test Result (MHz)	Deviation (KHz)	Limit (KHz)	Result
Temp (℃)	Volt (V AC)				
T_{nom} (20)	V_{nom} (120)	13.55992	-0.08	±0.01% (1.3560KHz)	Pass
T_{nom} (20)	V_{min} (102)	13.56015	0.15		Pass
	V_{max} (138)	13. 55982	-0.18		Pass
T_{min} (-10)	V_{nom} (120)	13.56007	0.07		Pass
T_{max} (+60)		13.56011	0.11		Pass

Note: Deviation (KHz) = (Test Result-13.56MHz)*1000

7.5 20dB Bandwidth

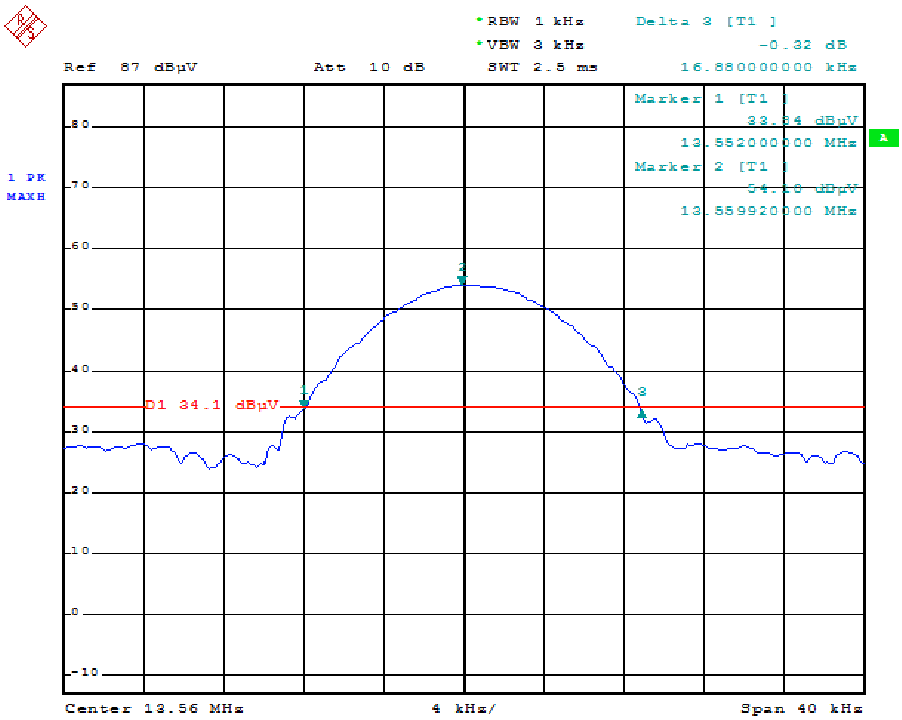
Frequency Range: Operation within the band 13.110 – 14.010 MHz

Requirements: Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §15.217 through §15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Data:

20dB bandwidth (kHz)	F_L (MHz)	F_H (MHz)	Limit(MHz)	Result
16.88	13.55200	13.56888	13.110 – 14.010	Pass

Test plot as follows:



8 Test Setup Photographs

Refer to the < Test Setup Photos-FCC >

9 EUT Constructional Details

Refer to the < External Photos-FCC> & < Internal Photos-FCC>.

--End of the Report--