



FCC Test Report (FM TX)

FCC ID : **2ADAD-F23**

Applicant : Shenzhen YOHE Technology Co., Ltd.
JunWeiXing Industry Park, TongFuYu Industrial Zone, ZhenMei
Village, GuangMing District, Shenzhen, China

Sample Description

Product Name : **FM Transmitter**

Model No. : F23

Trademark : N/A

Receipt Date : 2014-11-19

Test Date : 2014-11-20 to 2014-11-25

Issue Date : 2014-11-26

Test Standard(s) : **FCC CFR Title 47 Part 15 Subpart C Section 15.239**

Conclusions : **PASSED***

*In the configuration tested, the EUT complied with the standards specified above.

Test/Witness Engineer : *Jason Deng*

Approved & Authorized : *Frank Zhang*

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.



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1. General Information

1.1. Client Information

Applicant	:	Shenzhen YOHE Technology Co., Ltd.
Address	:	JunWeiXing Industry Park, TongFuYu Industrial Zone, ZhenMei Village, GuangMing District, Shenzhen, China
Manufacturer	:	Shenzhen YOHE Technology Co., Ltd.
Address	:	JunWeiXing Industry Park, TongFuYu Industrial Zone, ZhenMei Village, GuangMing District, Shenzhen, China

1.2. General Description of EUT (Equipment Under Test)

Product Name	:	FM Transmitter	
Models No.	:	F23	
Trademark	:	N/A	
Product Description	:	Operation Frequency:	88.1MHz~107.9MHz
		Channel Separation:	100kHz
		Number of Channel:	199 Channels
		Modulation Type:	FM
		Antenna Type:	Integral PCB Antenna
		Antenna Gain:	0 dBi
Power Supply	:	Input DC 12V-24VDC	

Note:

- (1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
- (2) The device doesn't any tune outside of the 88.1MHz~107.9MHz band and the tuning controls were manually adjusted to verify maximum tuning range.
- (3) Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	88.1	48	92.8	98	97.8	148	102.8
02	88.2	49	92.9	99	97.9	149	102.9
03	88.3	50	93.0	100	98.0	150	103.0



04	88.4	51	93.1	101	98.1	151	103.1
05	88.5	52	93.2	102	98.2	152	103.2
06	88.6	53	93.3	103	98.3	153	103.3
07	88.7	54	93.4	104	98.4	154	103.4
08	88.8	55	93.5	105	98.5	155	103.5
09	88.9	56	93.6	106	98.6	156	103.6
10	89.0	57	93.7	107	98.7	157	103.7
11	89.1	58	93.8	108	98.8	158	103.8
12	89.2	59	93.9	119	98.9	159	103.9
.....
46	92.6	96	97.6	146	102.6	199	107.9
Remark: 88.1MHz, 98.1MHz & 107.9MHz select for test.							

1.3. Block Diagram Showing The Configuration of System Tested

Line-in mode



Built-in microphone mode:



Bluetooth mode:



1.4. Description of Support Units

Name	Model	Serial Number	Manufacturer
Valve Regulated rechargeable battery	PH7-12	B26-0007021-09	Powerchannel Electronic Tech.
Notebook	D430	RDC2-0330	Dell



IPod	iPodnano	DCYHHY6FDCMN	APPLE
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1.5. External I/O Cable

2*80cm unshielded Power cable.

1.2m unshielded audio cable.

1.6. Description of Test Mode

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 follow was evaluated respectively.

Test Mode	Description
Transmitting mode	Keep the EUT in Transmitting mode with worst case data rate
Audio Input Signal	A typical audio with maximum audio input

In section 15.31(m), regards to the operating frequency range over 10MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel as below:

Lowest Channel	CH01:88.1MHz
Middle Channel	CH101:98.1MHz
Highest Channel	CH199:107.9MHz

Remark: The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.



1.7. Test Instruments List

Item	Test Equipment	Manufacturer	Model No.	Cal. Date	Cal. Due date
1	Bilog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	Mar. 28, 2014	Mar. 27, 2015
2	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	Mar. 28, 2014	Mar. 27, 2015
3	Coaxial Cable	N/A	N/A	Mar. 28, 2014	Mar. 27, 2015
4	Coaxial Cable	N/A	N/A	Mar. 28, 2014	Mar. 27, 2015
5	Coaxial cable	N/A	N/A	Mar. 28, 2014	Mar. 27, 2015
6	Coaxial Cable	N/A	N/A	Mar. 28, 2014	Mar. 27, 2015
7	Coaxial Cable	N/A	N/A	Mar. 28, 2014	Mar. 27, 2015
8	Amplifier (10kHz-1.3GHz)	HP	8447D	Mar. 28, 2014	Mar. 27, 2015
9	Amplifier (1GHz-18GHz)	Compliance Direction Systems Inc.	PAP-1G18	Mar. 28, 2014	Mar. 27, 2015
10	Pre-amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	Mar. 28, 2014	Mar. 27, 2015
11	Horn Antenna	ETS-LINDGREN	3160	Mar. 28, 2014	Mar. 27, 2015
12	Positioning Controller	UC	UC3000	N/A	N/A
13	Spectrum analyzer 9kHz-30GHz	Rohde & Schwarz	FSP	Mar. 28, 2014	Mar. 27, 2015
14	EMI Test Receiver	Rohde & Schwarz	ESPI	Mar. 28, 2014	Mar. 27, 2015
15	Loop antenna	Laplace instrument	RF300	Mar. 28, 2014	Mar. 27, 2015
16	Universal radio communication tester	Rhode & Schwarz	CMU200	Mar. 28, 2014	Mar. 27, 2015
17	Signal Analyzer	Rohde & Schwarz	FSIQ3	Mar. 28, 2014	Mar. 27, 2015
18	EMI Test Receiver	Rohde & Schwarz ESCI	ESCI	Mar. 28, 2014	Mar. 27, 2015
19	LISN	CHASE	MN2050D	Mar. 28, 2014	Mar. 27, 2015



1.8. Laboratory Location

Test location:

Shenzhen TOBY technology Co.,Ltd

Address: 1 A/F., Bldg.6, Yusheng Industrial Zone The National Road No.107 Xixiang Section 467,
Xixiang, Bao' an, Shenzhen, Guangdong, 518057, China

At the time of testing, the Laboratory is accredited. It is listed in the United States of American Federal Communications Commission (FCC), and the registration number is 811562.

Tel:0086-755-26509301 Fax: 0086-755-26509195



2. Test Summary

Standard Section	Test Item	Judgment
15.203	Antenna Requirement	PASSED
15.207	Conducted Emission	N/A
15.239(a)	20dB Occupied Bandwidth	PASSED
15.239(b)	Radiated Emission of the Fundamental Signal	PASSED
15.239(c)/15.209	Spurious Emission	PASSED
Remark: "N/A" is an abbreviation for Not Applicable.		



3. Antenna Requirement

3.1. Standard Requirement

3.1.1 Test standard

FCC Part15 Section 15.203

3.1.2 Requirement

1) 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.

3.2. Antenna Connected Construction

The FM antenna is an integral antenna which permanently attached, and the best case gain of the antenna is 0 dBi. It complies with the standard requirement.



4. Conducted Emission Test

4.1. Test Standard and Limit

4.1.1 Test Standard

FCC Part15 Section 15.207

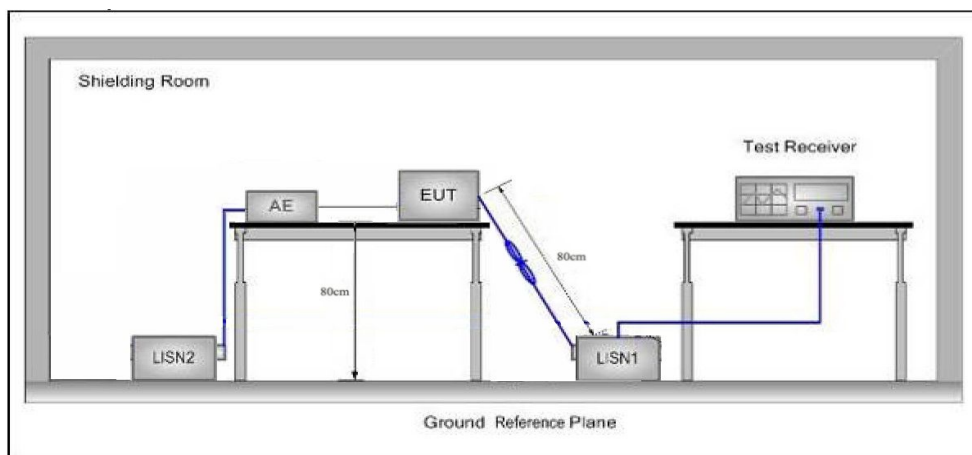
4.1.2 Test Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dB μ V)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

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

4.2. Test Setup



4.3. Test Procedure

- 1) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50 \Omega / 50 \mu\text{H} + 5 \Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 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.



- 2) 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.

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 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

The Test Receiver setup: RBW=9kHz, VBW=30kHz, Sweep time= auto

4.4. Test Data

N/A.

Remark: The EUT's power supply is DC 12V, from a car battery.



5. 20dB Occupy Bandwidth Test

5.1. Test Standard and Limit

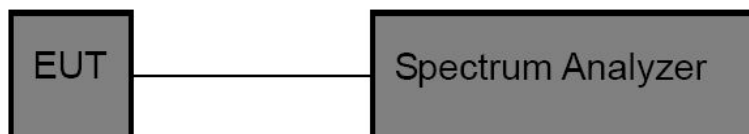
5.1.1 Test Standard

FCC Part15 C Section 15.239 (a)

5.1.2 Test Limit

FCC Part 15 Subpart C(15.239)		
Test Item	Limit	Frequency Range (MHz)
Bandwidth	200KHz	88~108

5.2. Test Setup



5.3. Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting:
Bandwidth: RBW=10 kHz, VBW=30 kHz, detector= Peak
- (3) A continuously playing MP3 audio source was connected during the test. The volume of the audio source was set to maximum to represent the worst case. The transmitter was transmitting continuously. For all test modes, The volume of the audio source was set to maximum.



5.4. Test Data

Result for Line-in mode:

Channel Number	Channel Frequency	20dB Bandwidth (kHz)	Limit(kHz)	Result
CH 01	88.0(MHz)	101.0	200	PASSED
CH 101	98.1(MHz)	98.03	200	PASSED
CH 199	107.9(MHz)	97.66	200	PASSED
Remark: Test plot as follows				

Result for built-in microphone mode:

Channel Number	Channel Frequency	20dB Bandwidth (kHz)	Limit(kHz)	Result
CH 01	88.0(MHz)	82.25	200	PASSED
CH 101	98.1(MHz)	104.9	200	PASSED
CH 199	107.9(MHz)	88.4	200	PASSED
Remark: Test plot as follows				

Result for Bluetooth mode:

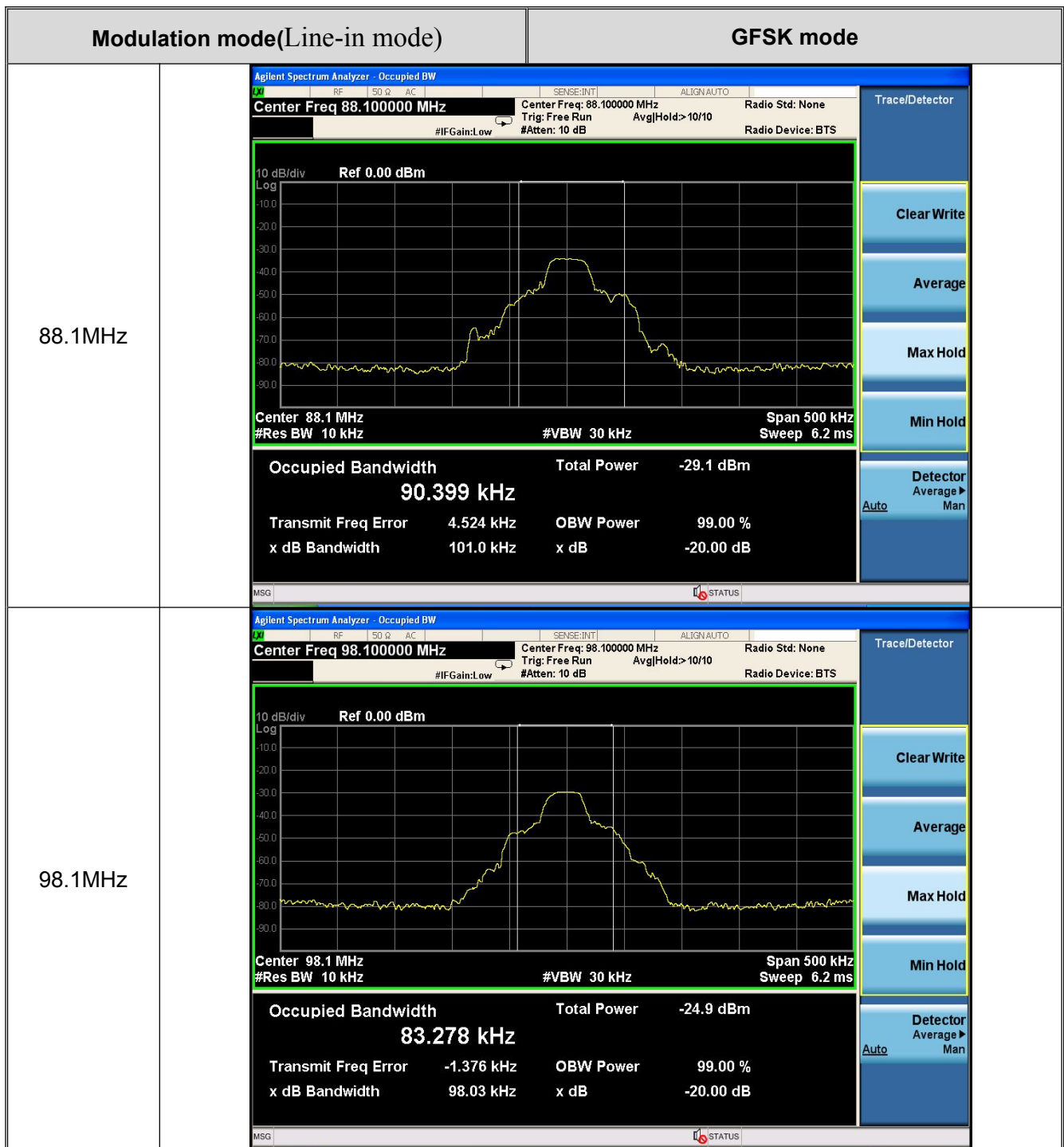
Channel Number	Channel Frequency	20dB Bandwidth (kHz)	Limit(kHz)	Result
CH 01	88.0(MHz)	109.8	200	PASSED
CH 101	98.1(MHz)	92.76	200	PASSED
CH 199	107.9(MHz)	89.8	200	PASSED
Remark: Test plot as follows				

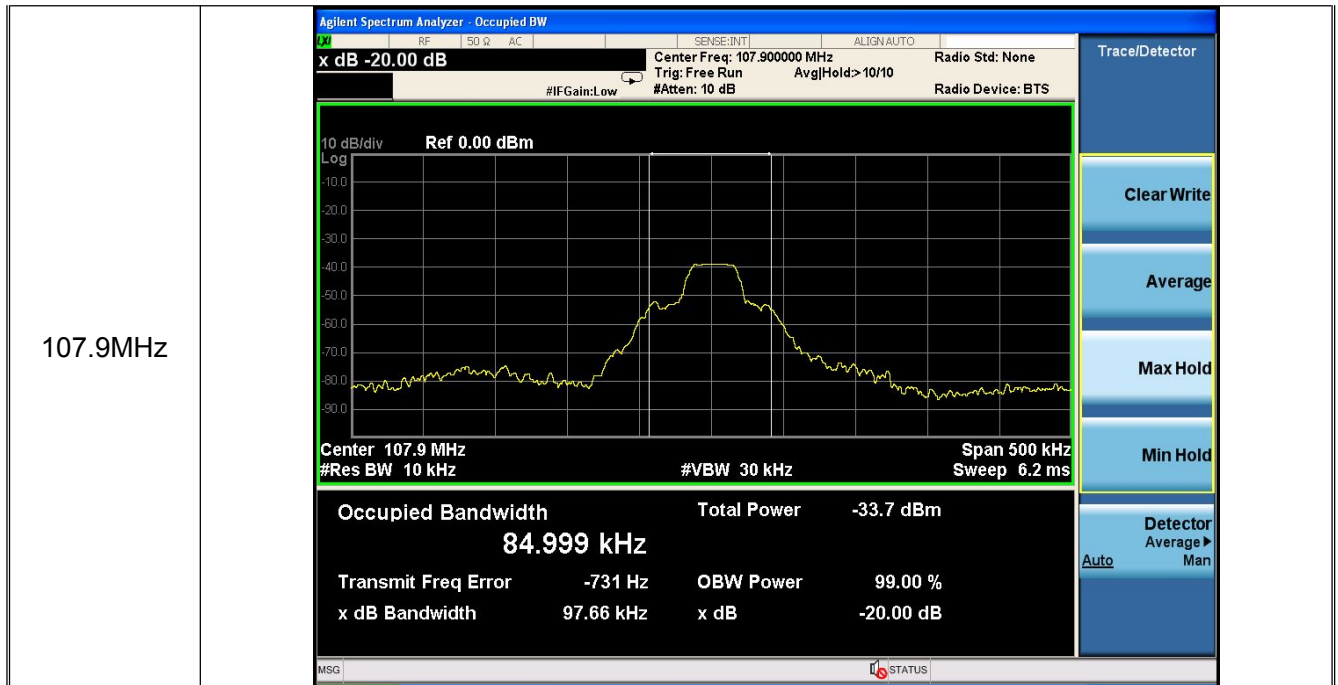


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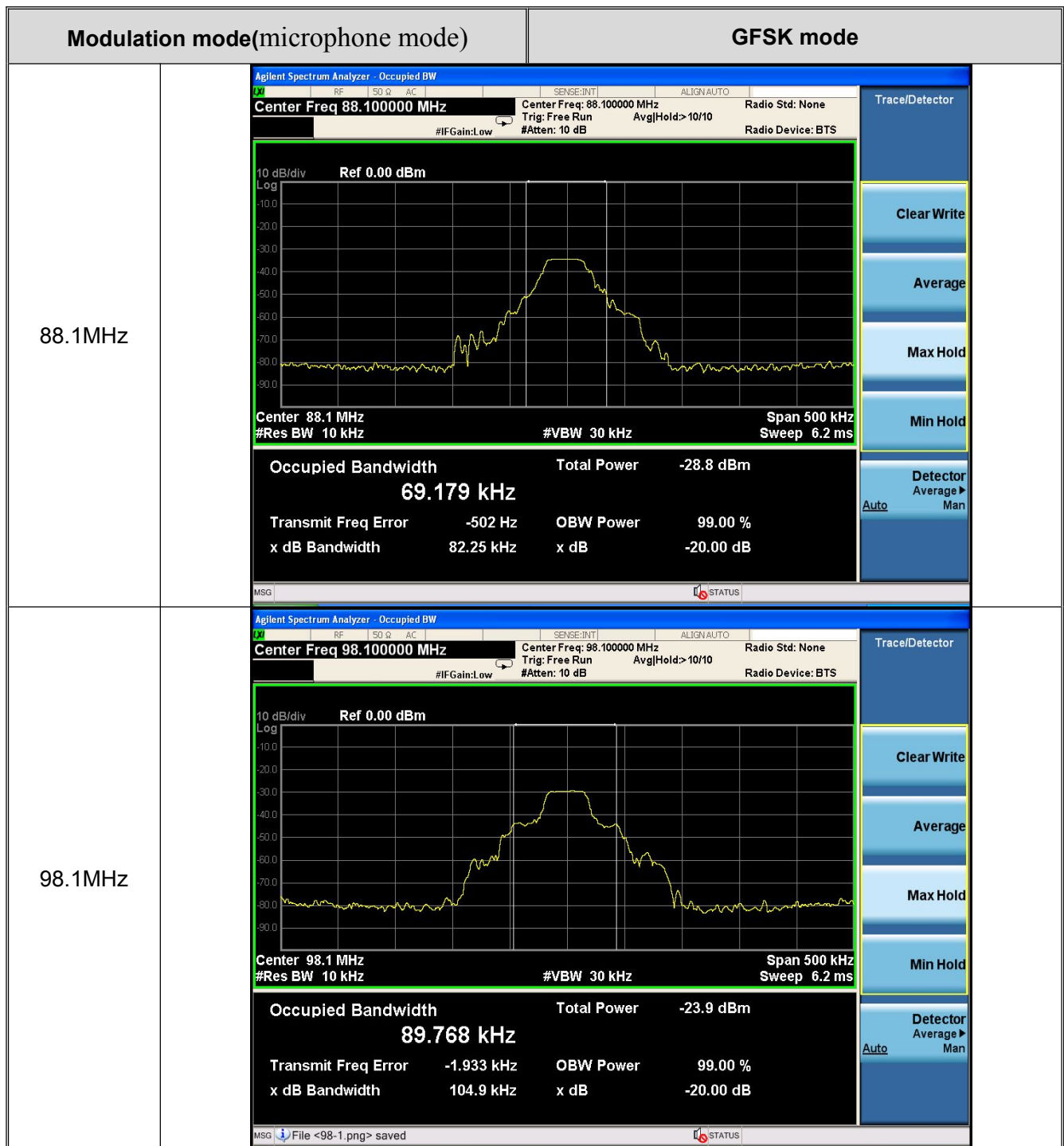


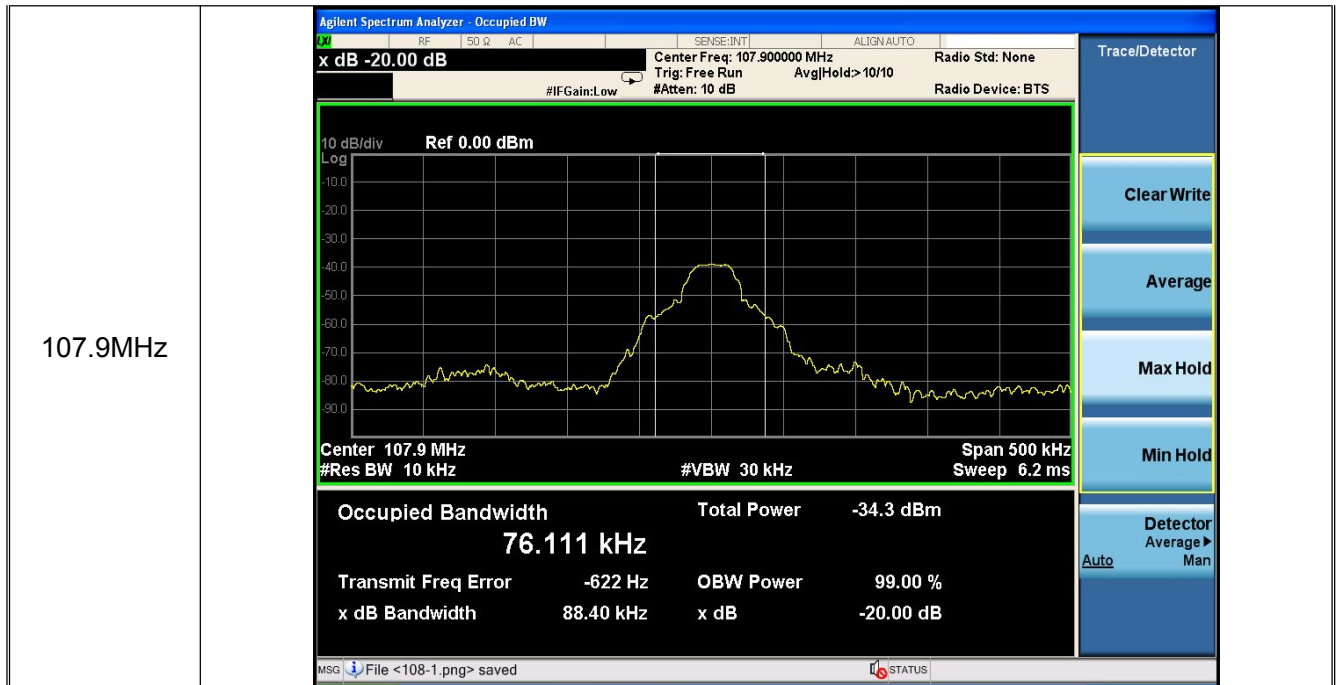


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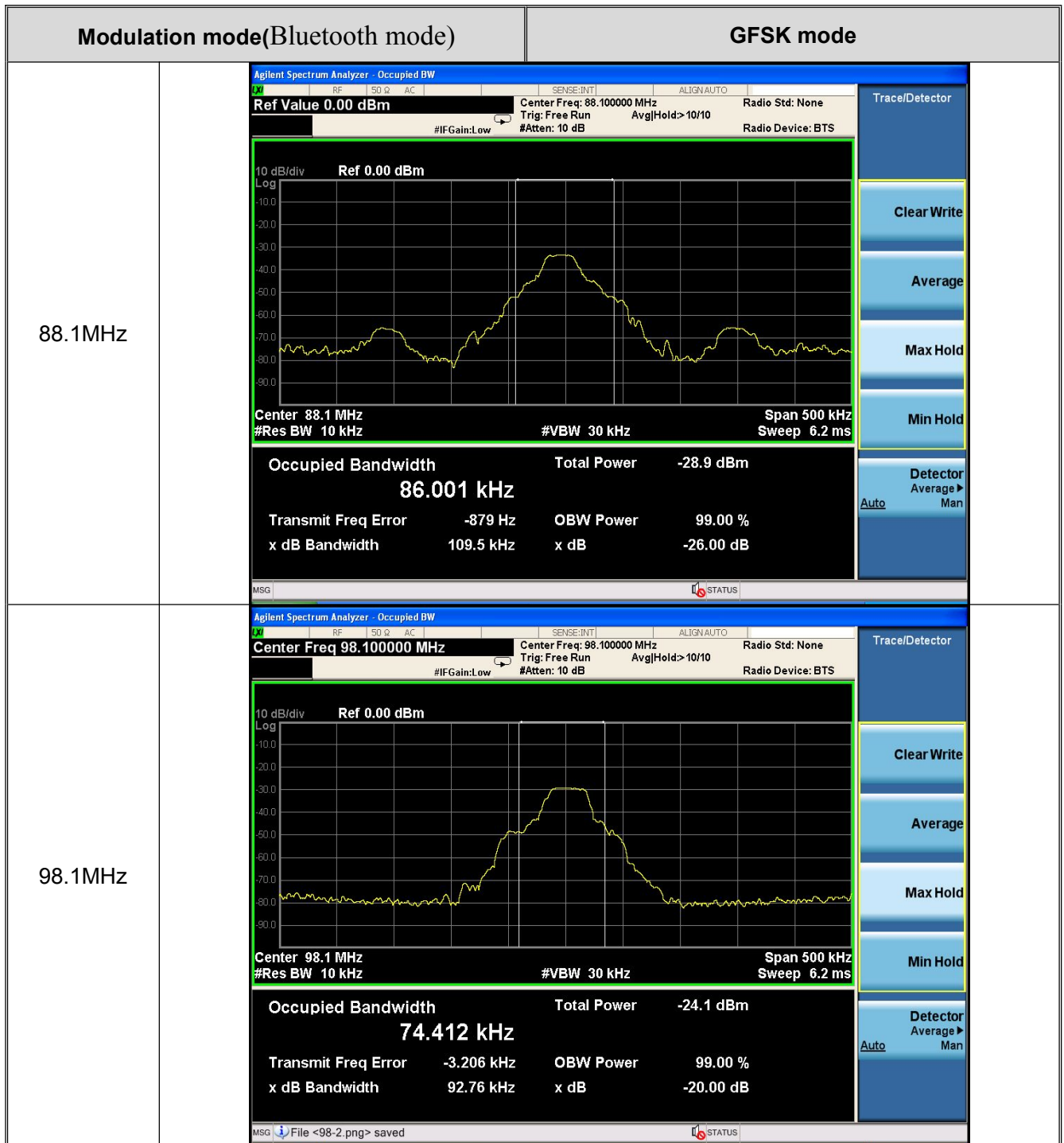


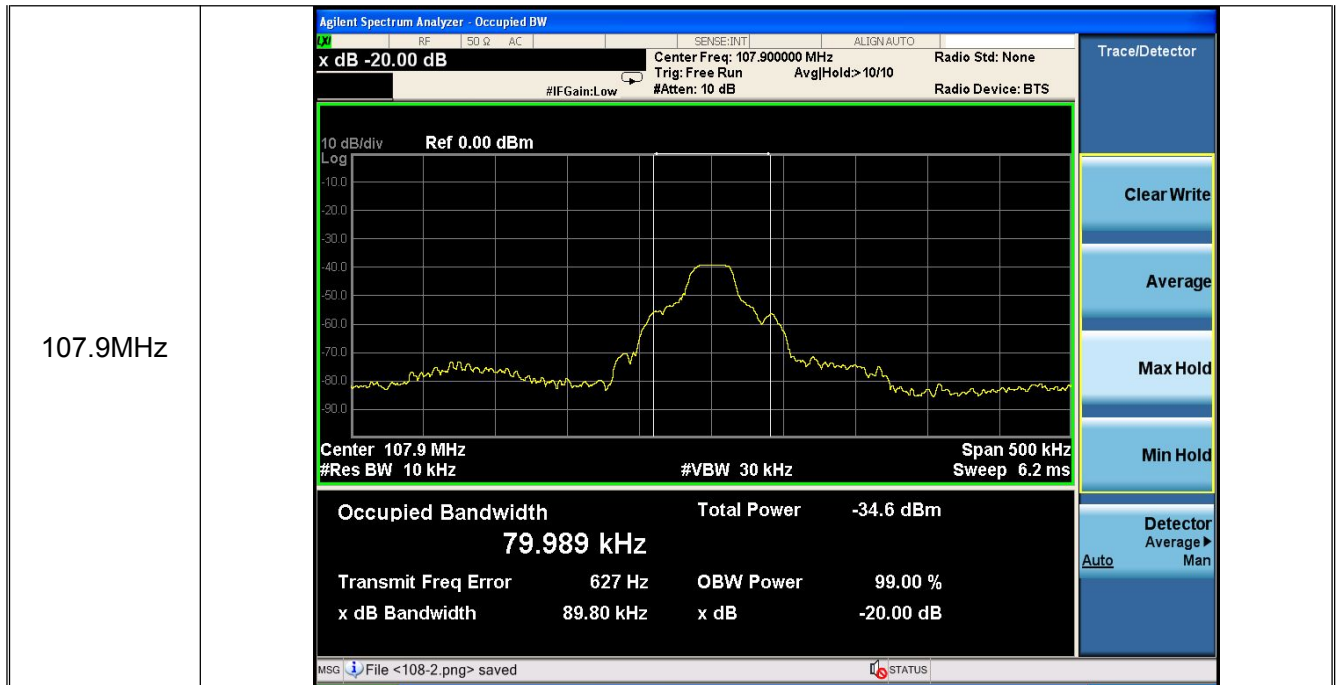


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6. Spurious Emission

6.1. Test Standard and Limit

6.1.1 Test Standard

FCC Part15 C Section 15.239(b), 15.239(c), 15.209

6.1.2 Test Limit

Frequency (MHz)	Limit (dB μ V/m)	
	At 3m Distance	
30MHz~88MHz	40	Quasi-peak
88MHz~216MHz	43.5	Quasi-peak
216MHz~960MHz	46	Quasi-peak
960MHz~1000MHz	54	Quasi-peak
Above 1000MHz	54	Average
	74	Peak

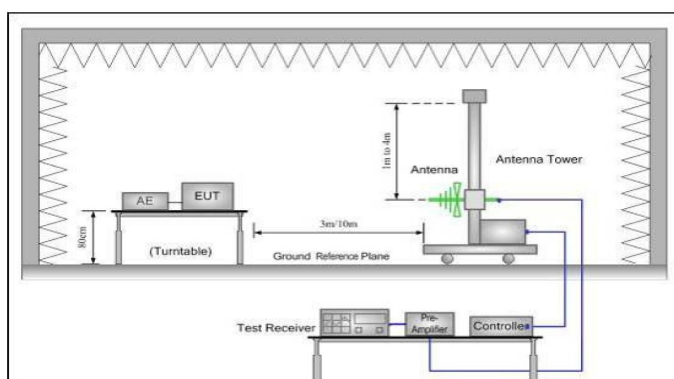
Remark: 1. The lower limit shall apply at the transition frequency.

Radiated Emission of the Fundamental Signal Limit

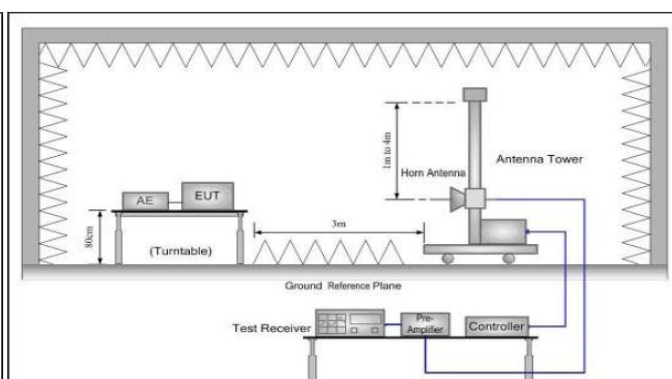
Frequency (MHz)	Limit (dB μ V/m)	
	At 3m Distance	
88MHz~108MHz	48.0	Average
	68.0	Peak

6.2. Test Setup

Below 1GHz



Above 1GHz





6.3. Test Procedure

- 1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
Peak value: RBW=1MHz, VBW=3MHz;
Average value: RBW=1MHz, VBW=10Hz;
QP Value: RBW=100kHz, VBW=300kHz
- 6) 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.

6.4. Test Data

Remark:

1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case.
2. 9 kHz to 30 MHz is noise floor, so only shows the data of above 30MHz in this report.



Radiated Emission Test Data of Fundamental Signal

EUT: FM Transmitter M/N: F23
Operating Condition: FM TX mode
Test Site: 3m chamber
Operator: Jason
Test Specification: DC 12V
Polarization: Horizontal & Vertical
Note Tem:23°C Hum:50%

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Level
88.10	73.16	14.60	1.09	30.73	58.12	68.00	-9.88	V	PEAK
88.10	72.15	14.60	1.09	30.73	57.11	68.00	-10.89	H	PEAK
98.10	75.12	16.10	1.18	30.75	61.65	68.00	-6.35	V	PEAK
98.10	71.96	16.10	1.18	30.75	58.49	68.00	-9.51	H	PEAK
107.90	76.66	14.95	1.26	30.80	62.07	68.00	-5.93	V	PEAK
107.90	74.80	14.95	1.26	30.80	60.21	68.00	-7.79	H	PEAK
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Level
88.10	55.79	14.60	1.09	30.73	40.75	48	-7.25	V	AVG.
88.10	57.32	14.60	1.09	30.73	42.28	48	-5.72	H	AVG.
98.10	57.82	16.10	1.18	30.75	44.35	48	-3.65	V	AVG.
98.10	54.73	16.10	1.18	30.75	41.26	48	-6.74	H	AVG.
107.90	55.78	14.95	1.26	30.80	41.19	48	-6.81	V	AVG.
107.90	56.36	14.95	1.26	30.80	41.77	48	-6.23	H	AVG.

Remark:

1. Final Level = Read Level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.



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Radiated Emission Test Data (Below 1GHz)

EUT: FM Transmitter M/N: F23
Operating Condition: FM TX mode 88.1MHz
Test Site: 3m chamber
Operator: Jason
Test Specification: DC 12V
Polarization: Horizontal & Vertical
Note Tem:23℃ Hum:50%

Test mode: 88.1MHz					Test channel: Lowest				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Level
75.45	45.47	12.04	0.99	30.82	27.68	40	-12.32	V	PEAK
176.27	49.48	12.55	1.72	31.07	32.68	43.5	-10.82	V	PEAK
264.75	44.15	15.26	2.19	31.17	30.43	46	-15.57	V	PEAK
393.47	39.73	16.97	2.82	30.91	28.61	46	-17.39	V	PEAK
750.11	38.61	22.43	4.28	30.26	35.06	46	-10.94	V	PEAK
60.92	38.91	15.61	0.87	30.93	24.46	40	-15.54	H	PEAK
176.27	41.07	12.55	1.72	31.07	24.27	43.5	-19.23	H	PEAK
282.99	39.7	15.75	2.28	31.17	26.56	46	-19.44	H	PEAK
582.74	38.5	20.14	3.66	30.12	32.18	46	-13.82	H	PEAK
776.88	38.11	22.77	4.37	30.29	34.96	46	-11.04	H	PEAK

Remark:

1. Final Level = Read Level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.



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Radiated Emission Test Data (Below 1GHz)

EUT: FM Transmitter M/N: F23
Operating Condition: FM TX mode 98.1MHz
Test Site: 3m chamber
Operator: Jason
Test Specification: DC 12V
Polarization: Horizontal & Vertical
Note Tem:23℃ Hum:50%

Test mode: 98.1MHz					Test channel: Middle				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Level
40.85	38.58	16.58	0.67	31.05	24.78	40	-15.22	V	PEAK
83.23	49.58	12.46	1.06	30.75	32.35	43.5	-11.15	V	PEAK
196.51	49.47	13.57	1.82	31.13	33.73	46	-12.27	V	PEAK
294.11	51.9	15.98	2.33	31.18	39.03	46	-6.97	V	PEAK
869.13	38.23	23.78	4.74	30.22	36.53	46	-9.47	V	PEAK
56.00	38.55	16.04	0.83	30.95	24.47	40	-15.53	H	PEAK
196.51	50.7	13.57	1.82	31.13	34.96	43.5	-8.54	H	PEAK
294.11	40.35	15.98	2.33	31.18	27.48	46	-18.52	H	PEAK
407.52	38.87	17.24	2.89	30.86	28.14	46	-17.86	H	PEAK
903.31	37.67	24.07	4.87	30.18	36.43	46	-9.57	H	PEAK

Remark:

1. Final Level = Read Level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.



Radiated Emission Test Data (Below 1GHz)

EUT: FM Transmitter M/N: F23
Operating Condition: FM TX mode 107.9MHz
Test Site: 3m chamber
Operator: Jason
Test Specification: DC 12V
Polarization: Horizontal & Vertical
Note Tem:23°C Hum:50%

Test mode: 107.9MHz					Test channel: Highest				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Level
79.24	47.01	11.74	1.02	30.77	29.0	40	-11.0	V	PEAK
215.75	53.05	14.12	1.93	31.15	37.95	43.5	-5.55	V	PEAK
323.32	48.68	16.31	2.49	31.11	36.37	46	-9.63	V	PEAK
539.48	39.64	19.39	3.48	30.35	32.16	46	-13.84	V	PEAK
798.98	38.56	23.06	4.45	30.32	35.75	46	-10.25	V	PEAK
79.24	43.86	11.74	1.02	30.77	25.85	40	-14.15	H	PEAK
216.02	49.57	14.12	1.93	31.15	34.47	43.5	-9.03	H	PEAK
323.32	44.35	16.31	2.49	31.11	32.04	46	-13.96	H	PEAK
530.10	38.58	19.23	3.44	30.4	30.85	46	-15.15	H	PEAK
845.09	39.29	23.55	4.63	30.25	37.22	46	-8.78	H	PEAK

Remark:

1. Final Level = Read Level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.