



FCC Test Report (FM TX)

FCC ID : 2ACYW-MT-096

Applicant : SHENZHEN UNICHAIN TECHNOLOGY CO.,LTD
5/F, Block 17, Lishan Industrial Park, Nanshan District, Shenzhen,
Guangdong, China

Sample Description

Product Name : FM TRANSMITTER

Model No. : MT-096

Serial No. : N/A

Trademark : N/A

Receipt Date : 2014-08-11

Test Date : 2014-08-11 to 2014-08-15

Issue Date : 2014-08-16

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 UNICHAIN TECHNOLOGY CO.,LTD
Address	:	5/F, Block17, Lishan Industrial Park, Nanshan District, Shenzhen,China.
Manufacturer	:	SHENZHEN UNICHAIN TECHNOLOGY CO.,LTD
Address	:	5/F, Block17, Lishan Industrial Park, Nanshan District, Shenzhen,China.

1.2. General Description of EUT (Equipment Under Test)

Product Name	:	FM TRANSMITTER	
Models No.	:	MT-096	
Serial No.	:	N/A	
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 5V from DC power system of car.	

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



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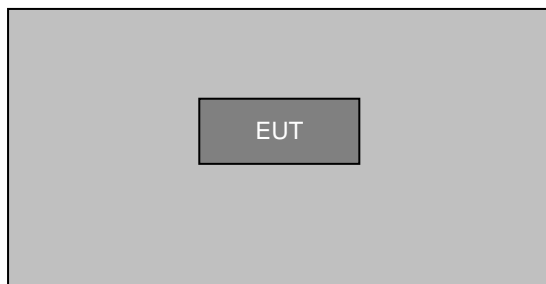
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06	88.6	53	93.3	103	98.3	153	103.3
07	88.7	54	93.4	104	98.4	154	103.4
08	88.8	55	93.5	105	98.5	155	103.5
09	88.9	56	93.6	106	98.6	156	103.6
10	89.0	57	93.7	107	98.7	157	103.7
11	89.1	58	93.8	108	98.8	158	103.8
12	89.2	59	93.9	119	98.9	159	103.9
.....
46	92.6	96	97.6	146	102.6	199	107.9

Remark: 88.1MHz, 98.1MHz & 107.9MHz were selected for test.

1.3. Block Diagram Showing The Configuration of System Tested



1.4. Description of Support Units

Name	Model	Serial Number	Manufacturer
Printer	HP1020	CNCJ410726	HP
LCD Monitor	G205HV	10306738385	ACER
PC	ASPIREM1830	PTSF90C00305005CAC3000	ACER
Keyboard	SK-9625	KBUSB1580500037E0100	ACER
Mouse	MS.11200.014	M-UAY-ACR2	ACER
Smart Phone	iPhone 5	----	APPLE

1.5. External I/O Cable

N/A



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



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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

Shenzhen Certification Technology Service Co., Ltd.

Address: 2F, Building B, East Area of Nanchang Second Industrial Zone, Gushu 2nd Road, Bao'an District, Shenzhen 518126, P.R. 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 197647.

Tel:86-755-86375552 Fax: 86-755-26736857



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

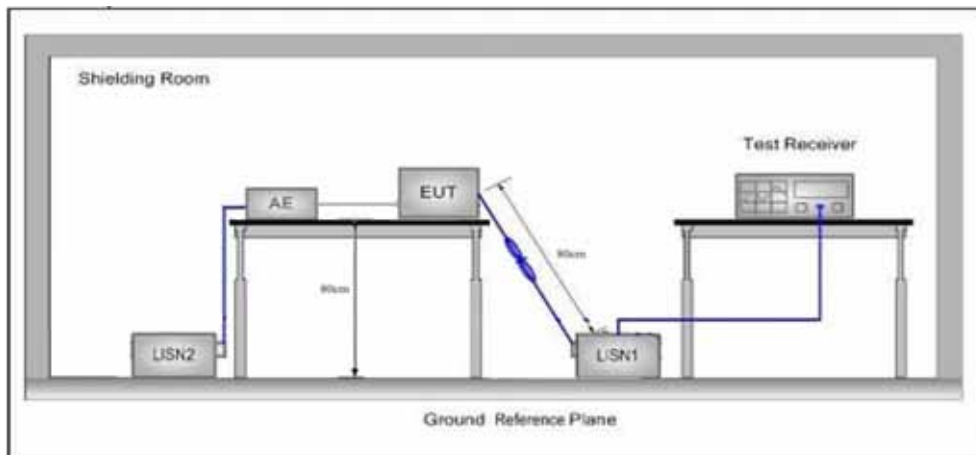
4.1.2 Test Limit

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 Ω /50 μ H + 5 Ω 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 5V, from a car battery.



5. 20dB Occupy Bandwidth Test

5.1. Test Standard and Limit

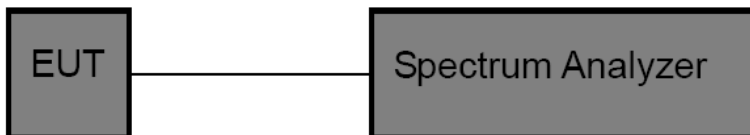
5.1.1 Test Standard

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=3 kHz, VBW=10 kHz, detector= Peak

5.4. Test Data

Channel Number	Channel Frequency	20dB Bandwidth (kHz)	Limit(kHz)	Result
CH 01	88.1(MHz)	146.00	200	PASSED
CH 101	98.1(MHz)	144.00	200	PASSED
CH 199	107.9(MHz)	146.00	200	PASSED

Remark: Test plot as follows



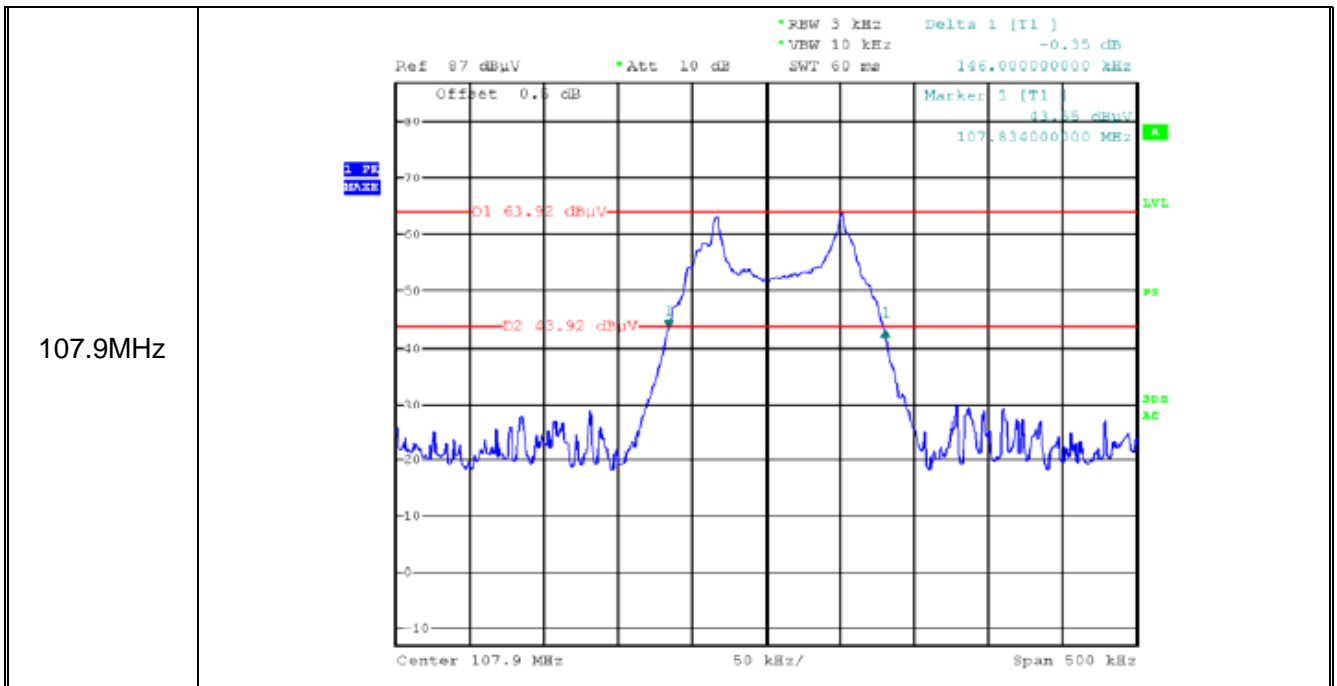
Modulation mode	GFSK mode
88.1MHz	<p>Ref 97 dBuV Att 10 dB SWT 60 ms RBW 3 kHz VBW 10 kHz Delta 1 [T1] -0.86 dB</p> <p>Offset 0.0 dB Marker 1 [T1] 36.03 dBuV 88.031000000 MHz</p> <p>D1 56.03 dBuV D2 36.03 dBuV</p> <p>Center 88.1 MHz 50 kHz/ Span 500 kHz</p>
98.1MHz	<p>Ref 97 dBuV Att 10 dB SWT 60 ms RBW 3 kHz VBW 10 kHz Delta 1 [T1] -0.51 dB</p> <p>Offset 0.0 dB Marker 1 [T1] 37.37 dBuV 98.034000000 MHz</p> <p>D1 58.2 dBuV D2 38.2 dBuV</p> <p>Center 98.1 MHz 50 kHz/ Span 500 kHz</p>



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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

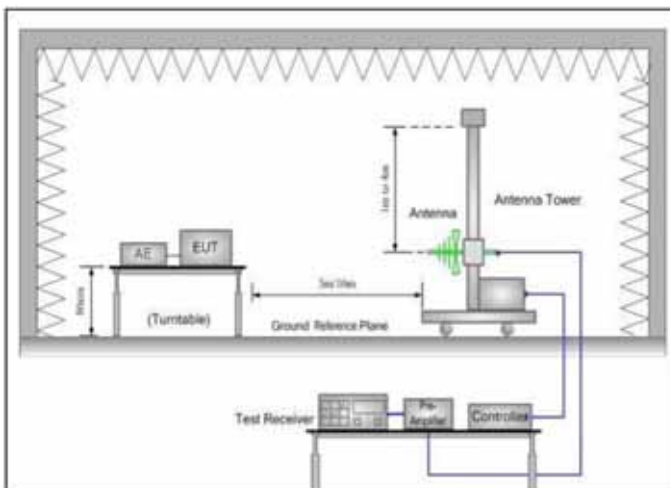
Remark: 1. The lower limit shall apply at the transition frequency.

Radiated Emission of the Fundamental Signal Limit

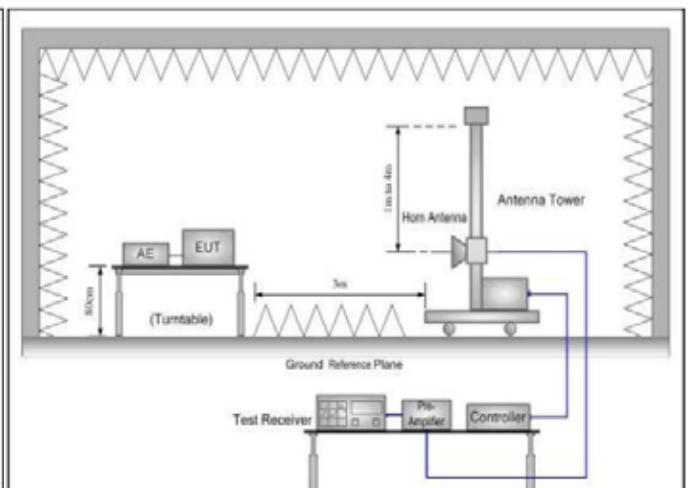
Frequency (MHz)	Limit (dB μ V/m)	
	At 3m Distance	
88MHz~108MHz	48.0	Average
	68.0	Peak

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.



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Radiated Emission Test Data of Fundamental Signal

EUT: FM TRANSMITTER M/N: MT-096
Operating Condition: FM TX mode
Test Site: 3m chamber
Operator: Jason
Test Specification: DC 5V
Polarization: Horizontal & Vertical
Note Tem:23 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	71.22	14.60	1.09	30.73	59.16	68.00	-8.84	V	PEAK
88.10	68.27	14.60	1.09	30.73	53.23	68.00	-14.77	H	PEAK
98.10	73.42	16.10	1.18	30.75	59.95	68.00	-8.05	V	PEAK
98.10	67.25	16.10	1.18	30.75	53.78	68.00	-14.22	H	PEAK
107.90	78.45	14.95	1.26	30.80	63.86	68.00	-4.14	V	PEAK
107.90	66.90	14.95	1.26	30.80	52.31	68.00	-15.69	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	59.54	14.60	1.09	30.73	44.50	48.00	-3.50	V	AVG.
88.10	57.27	14.60	1.09	30.73	42.23	48.00	-5.77	H	AVG.
98.10	59.26	16.10	1.18	30.75	45.79	48.00	-2.21	V	AVG.
98.10	51.25	16.10	1.18	30.75	37.78	48.00	-10.22	H	AVG.
107.90	60.45	14.95	1.26	30.80	45.86	48.00	-2.14	V	AVG.
107.90	50.90	14.95	1.26	30.80	36.31	48.00	-11.69	H	AVG.

Remark:

1. Final Level = Read Level + Antenna Factor + Cable Loss – Preamplifier Factor



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Radiated Emission Test Data (Below 1GHz)

EUT: FM TRANSMITTER M/N: MT-096
Operating Condition: FM TX mode 88.1MHz
Test Site: 3m chamber
Operator: Jason
Test Specification: DC 5V
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)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Level
65.32	47.36	12.04	0.87	30.82	29.45	40.00	-10.55	V	QP
170.41	46.67	12.55	1.69	31.07	29.84	43.50	-13.66	V	QP
260.72	44.89	15.26	2.15	31.17	31.13	46.00	-14.87	V	QP
394.68	42.57	16.97	2.84	30.91	31.47	46.00	-14.53	V	QP
62.77	39.77	12.04	0.87	30.93	21.75	40.00	-18.25	H	QP
170.56	41.89	12.55	1.69	31.07	25.06	43.50	-18.44	H	QP
284.53	42.15	15.75	2.31	31.17	29.04	46.00	-16.96	H	QP
582.74	39.76	20.14	3.66	30.12	33.44	46.00	-12.56	H	QP

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: MT-096
Operating Condition: FM TX mode 98.1MHz
Test Site: 3m chamber
Operator: Jason
Test Specification: DC 5V
Polarization: Horizontal & Vertical
Note Tem:23 Hum:50%

Test mode: 98.1MHz					Test channel: Lowest				
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
65.33	39.59	12.04	0.87	30.82	21.68	40	-18.32	V	QP
170.41	45.67	12.55	1.69	31.07	28.84	43.5	-14.66	V	QP
260.75	43.29	15.26	2.15	31.17	29.53	46	-16.47	V	QP
394.68	42.58	16.97	2.84	30.91	31.48	46	-14.52	V	QP
62.76	39.45	12.04	0.87	30.93	21.43	40	-18.57	H	QP
170.51	40.82	12.55	1.69	31.07	23.99	43.5	-19.51	H	QP
284.52	43.29	15.75	2.31	31.17	30.18	46	-15.82	H	QP
582.74	40.75	20.14	3.66	30.12	34.43	46	-11.57	H	QP

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: MT-096
Operating Condition: FM TX mode 107.9MHz
Test Site: 3m chamber
Operator: Jason
Test Specification: DC 5V
Polarization: Horizontal & Vertical
Note Tem:23 Hum:50%

Test mode: 107.9MHz					Test channel: Lowest				
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
65.32	38.25	12.04	0.87	30.82	20.34	40	-19.66	V	QP
170.41	42.14	12.55	1.69	31.07	25.31	43.5	-18.19	V	QP
260.72	38.9	15.26	2.15	31.17	25.14	46	-20.86	V	QP
394.68	41.54	16.97	2.84	30.91	30.44	46	-15.56	V	QP
62.77	44.23	12.04	0.87	30.93	26.21	40	-13.79	H	QP
170.56	44.26	12.55	1.69	31.07	27.43	43.5	-16.07	H	QP
284.53	44.72	15.75	2.31	31.17	31.61	46	-14.39	H	QP
582.74	38.69	20.14	3.66	30.12	32.37	46	-13.63	H	QP

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.