FCC Test Report

Application No.:	DNT241264R1758-4855
Applicant:	INTRO UNION ELECTRONICS CO.,LIMITED
Address of Applicant:	Building C, Lilan Industry Park, Huanguan Middle Road, Longhua District, Shenzhen, China, 518000
EUT Description:	CAR FM TRANSMITTER
Model No.:	T33
FCC ID:	2A578-T33
Power Supply:	DC12-24V, 5.65A
Trade Mark:	/
Standards:	47 CFR FCC Part 2, Subpart J 47 CFR Part 15, Subpart C ANSI C63.10: 2013
Date of Receipt:	2024/06/19
Date of Test:	2024/06/21 to 2024/07/19
Date of Issue:	2024/08/05
Test Result:	**PASS**

Prepared By: _____ (Testing Engineer)

Reviewed By: _____ (Project Engineer)

Approved By: _____ (Manager)

Note: If there is any objection to the results in this report, please submit a written inquiry to the company within 15 days from the date of receiving the report. The test report is effective only with both signature and specialized stamp, and is issued by the company in accordance with the requirements of the "Conditions of Issuance of Test Reports" printed in the attached page. Unless otherwise stated, the results presented in this report only apply to the samples tested this time. Partial reproduction of this report is not allowed unless approved by the company in writing.

Dongguan DN Testing Co., Ltd.

Add: No. 1, West Fourth Street, Xingfa South Road, Wusha Community, Chang 'an Town, Dongguan City, Guangdong P.R.China

Web: www.dn-testing.com Tel:+86-769-88087383 E-mail: service@dn-testing.com

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Aug.5, 2024	Valid	Original Report

1 Test Summary

Test Item	Test Requirement	Test Method	Test Result	Result
Antenna Requirement	15.203/247(b)	--	Clause 3.1	PASS
20dB Emission Bandwidth	15.239(a)	ANSI C63.10 (2013)	Clause 3.2	PASS
Radiated Emission	15.239(b)(c)	ANSI C63.10 (2013)	Clause 3.3	PASS
AC Power Line Conducted Emissions	§15.207 (a)	ANSI C63.10 (2013)	Clause 3.4	N/A

Note:
1. “N/A” denotes test is not applicable in this test report.

Contents

2 General Information

2.1 Test Location

Company:	Dongguan DN Testing Co., Ltd
Address:	No. 1, West Fourth Street, South Xinfa Road, Wusha Liwu, Chang ' an Town, Dongguan City, Guangdong P.R.China
Test engineer:	Wayne Lin

2.2 General Description of EUT

Manufacturer:	INTRO UNION ELECTRONICS CO.,LIMITED
Address of Manufacturer:	Building C, Lilan Industry Park, Huanguan Middle Road, Longhua District, Shenzhen, China, 518000
Test EUT Description:	CAR FM TRANSMITTER
Model No.:	T33
Additional Model(s):	/
Chip Type:	QN8027
Serial number:	PR241264R1758
Power Supply:	DC12-24V, 5.65A
Trade Mark:	/
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	88.1-107.9MHz
Modulation Technique:	FM
Sample Type:	☐ Portable Device, ☐ Module,☒ Mobile Device
Antenna Type:	☐ External, ☒ Integrated
Antenna Ports:	☒ Ant 1, ☐ Ant 2, ☐ Ant 3
Antenna Gain*:	☒ Provided by applicant
	0.17dBi
RF Cable*:	☒ Provided by applicant
	0.5dB(0.6~1GHz); 0.8dB(1.4~2GHz); 1.0dB(2.1~2.7GHz); 1.5dB(3~4GHz); 1.8dB(4.4~6GHz);

Remark:

*Since the above data and/or information is provided by the applicant relevant results or conclusions of this report are only made for these data and/or information , DNT is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.

2.3 Channel List

TESTED CHANNEL	TESTED FREQUENCY	TEST MODES
Low	88.1 MHz	Transmitting
Middle	98.0 MHz	Transmitting
High	107.9 MHz	Transmitting

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

2.4 5Test Environment and Mode

Operating Environment:	
Temperature:	20~25.0 ˚C
Humidity:	45~56 % RH
Atmospheric Pressure:	101.0~101.30 KPa
Test mode:	
Transmitting mode:	Keep the EUT in transmitting mode with all kind of modulation and all kind of data rate.

2.5 Description of Support Units

The EUT has been tested independent unit.

2.6 Test Facility

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

Lab A:

• FCC, USA

Designation Number: CN1348

• A2LA (Certificate No. 7050.01)

DONGGUAN DN TESTING CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 7050.01.

• Innovation, Science and Economic Development Canada

DONGGUAN DN TESTING CO., LTD. EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

IC#: 31026.

2.7 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	20dB Emission Bandwidth	±0.0196%
2	Carrier Frequency Separation	±1.9%
3	Number of Hopping Channel	±1.9%
4	Time of Occupancy	±0.028%
5	Max Peak Conducted Output Power	±0.743 dB
6	Band-edge Spurious Emission	±1.328 dB
7	Conducted RF Spurious Emission	9KHz-1GHz:±0.746dB 1GHz-26GHz:±1.328dB

No.	Item	Measurement Uncertainty
1	Conduction Emission	± 3.0dB (150kHz to 30MHz)
2	Radiated Emission	± 4.8dB (Below 1GHz)
		± 4.8dB (1GHz to 6GHz)
		± 4.5dB (6GHz to 18GHz)
		± 5.02dB (Above 18GHz)

2.8 Equipment List

For Connect EUT Antenna Terminal Test					
Description	Manufacturer	Model	Serial Number	Cal date	Due date
Signal Generator	Keysight	N5181A-6G	MY48180415	2023-10-25	2024-10-24
Signal Generator	Keysight	N5182B	MY57300617	2023-10-25	2024-10-24
Power supply	Keysight	E3640A	ZB2022656	2023-10-25	2024-10-24
Radio Communication Tester	R&S	CMW500	105082	2023-10-25	2024-10-24
Spectrum Analyzer	Aglient	N9010A	MY52221458	2023-10-25	2024-10-24
BT/WIFI Test Software	Tonscend	JS1120 V3.1.83	NA	NA	NA
RF Control Unit	Tonscend	JS0806-2	22F8060581	NA	NA
Power Sensor	Anritsu	ML2495A	2129005	2023-10-25	2024-10-24
Pulse Power Sensor	Anritsu	MA2411B	1911397	2023-10-25	2024-10-24
temperature and humidity box	SCOTEK	SCD-C40-80PRO	6866682020008	2023-10-25	2024-10-24

Test Equipment for Conducted Emission					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Receiver	R&S	ESCI3	101152	2023-10-24	2024-10-23
LISN	R&S	ENV216	102874	2023-10-24	2024-10-23
ISN	R&S	ENY81-CA6	1309.8590.03	2023-10-24	2024-10-23

Test Equipment for Radiated Emission(30MHz-1000MHz)					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Receiver	R&S	ESR7	102497	2023-10-24	2024-10-23
Test Software	ETS-LINDGREN	TiLE-FULL	NA	NA	NA
RF Cable	ETS-LINDGREN	RFC-NMS-100-NMS-350-IN	NA	2023-10-24	2024-10-23
Log periodic antenna	ETS-LINDGREN	VULB 9168	01475	2023-10-24	2024-10-23
Pre-amplifier	Schwarzbeck	BBV9743B	00423	2023-10-24	2024-10-23

Test Equipment for Radiated Emission(Above 1000MHz)					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Frequency analyser	Keysight	N9010A	MY52221458	2023-10-24	2024-10-23
RF Cable	ETS-LINDGREN	RFC-NMS-100-NMS-350-IN	NA	2023-10-24	2024-10-23
Horn Antenna	ETS-LINDGREN	3117	00252567	2023-10-24	2024-10-23
Double ridged waveguide antenna	ETS-LINDGREN	3116C	00251780	2023-10-24	2024-10-23
Test Software	ETS-LINDGREN	TiLE-FULL	NA	NA	NA
Pre-amplifier	ETS-LINDGREN	3117-PA	252567	2023-10-24	2024-10-23
Pre-amplifier	ETS-LINDGREN	3116C-PA	251780	2023-10-24	2024-10-23

2.9 Assistant equipment used for test

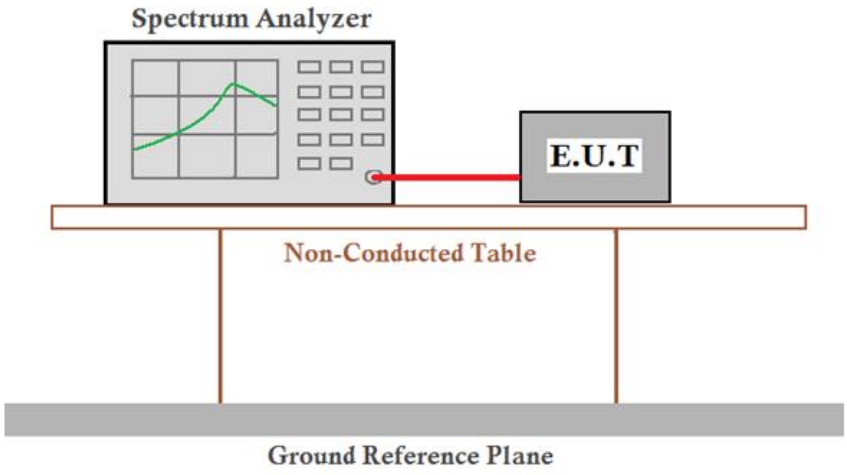
Code	Equipment	Manufacturer	Model No.	Equipment No.
1	Computer	acer	N22C8	EMC notebook01
2	Adapter	HUAWEI	HW-100225C00	NA

3 Test results and Measurement Data

3.1 Antenna Requirement

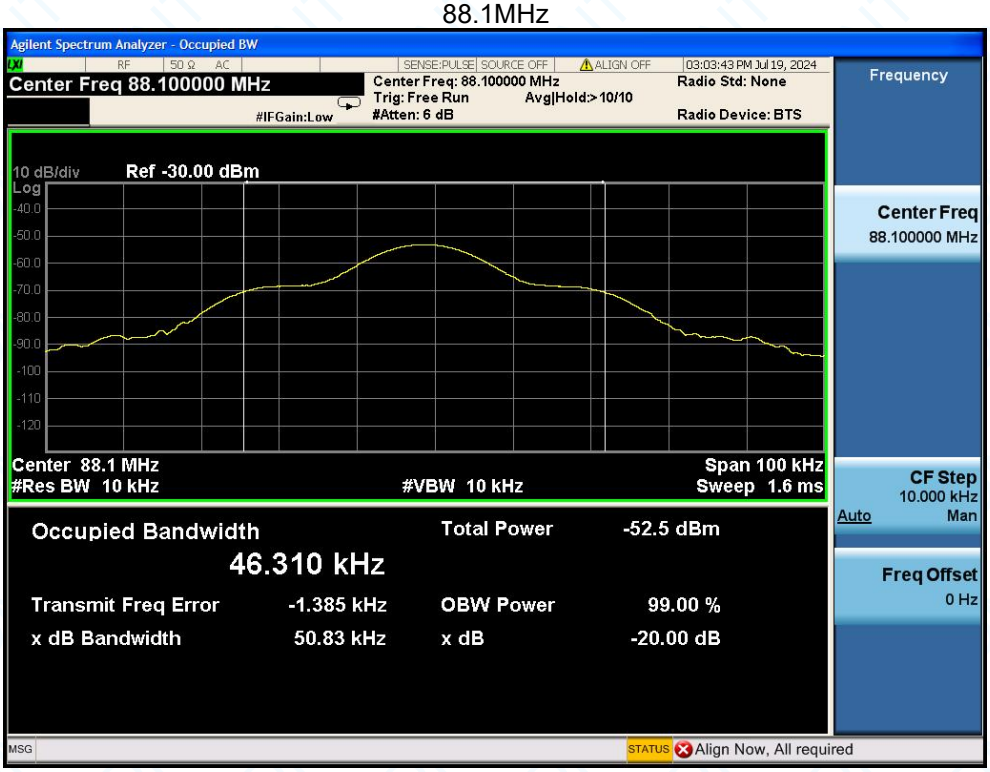
Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a 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. 15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0.17dBi.	

3.2 20dB Emission Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.239(a)
Test Method:	ANSI C63.10:2013 Section 7.8.7
Test Setup:	
Instruments Used:	Refer to section 2.9 for details
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the worst case of all modulation type.
Limit:	NA
Test Results:	Pass

TEST CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (KHz)	Limit (KHz)
Low	88.1	50.83	200
Middle	98.0	50.69	200
High	107.9	51.05	200

88.1MHz



98MHz

107.9MHz


Agilent Spectrum Analyzer - Occupied BW
RF 50 Ω AC
SENSE:PULSE SOURCE OFF ALIGN OFF 03:02:27 PM Jul 19, 2024
x dB -20.00 dB
Center Freq: 107.900000 MHz
Trig: Free Run Avg|Hold:>10/10
#IFGain:Low #Atten: 6 dB
Radio Std: None
Radio Device: BTS
Meas Setup
Avg/Hold Num
10
On Off
Avg Mode
Exp Repeat
OBW Power
99.00 %
x dB
-20.00 dB
More
1 of 2
10 dB/div Ref -30.00 dBm
Log
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100
-110
-120
Center 107.9 MHz
#Res BW 10 kHz
#VBW 10 kHz
Span 100 kHz
Sweep 1.6 ms
Occupied Bandwidth
46.735 kHz
Total Power -48.8 dBm
Transmit Freq Error -1.998 kHz
OBW Power 99.00 %
x dB Bandwidth 51.05 kHz
x dB -20.00 dB
MSG
STATUS Align Now, All required

3.3 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205 and 15.239(b)(c)				
Test Method:	ANSI C63.10: 2013 Section 11.12				
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz (DC⩾0.98) ⩾1/T (DC<0.98)	Average

Limit:

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

Remark: 15.35(b),Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

According to §15.239(b), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

requency Range of Fundamental [MHz]	**Field Strength of Fundamental Emission [Peak] [μV/m]**	**Field Strength of Fundamental Emission [Average] [μV/m]**
88 – 108	2500 (68 dBμV/m)	250 (48 dBμV/m)

Test Setup:	

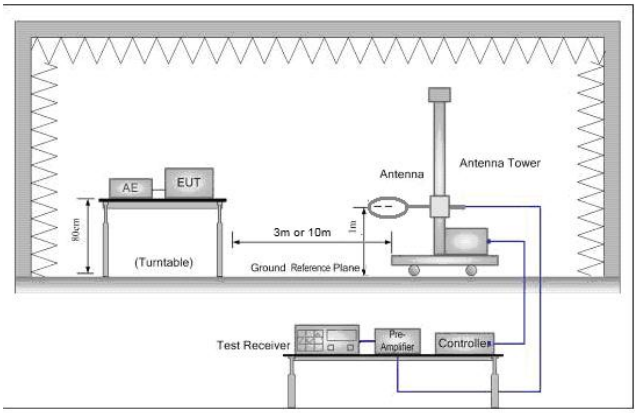


Figure 1. Below 30MHz

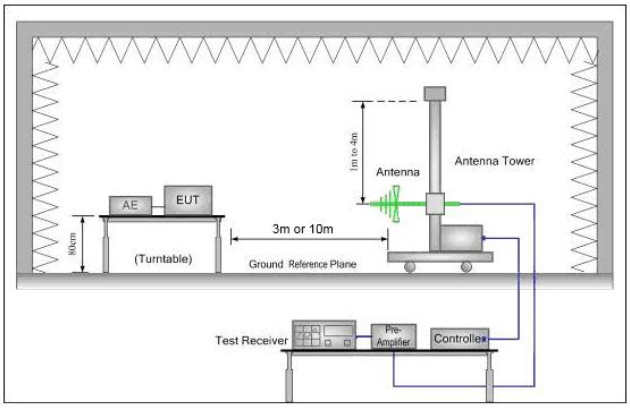


Figure 2. 30MHz to 1GHz

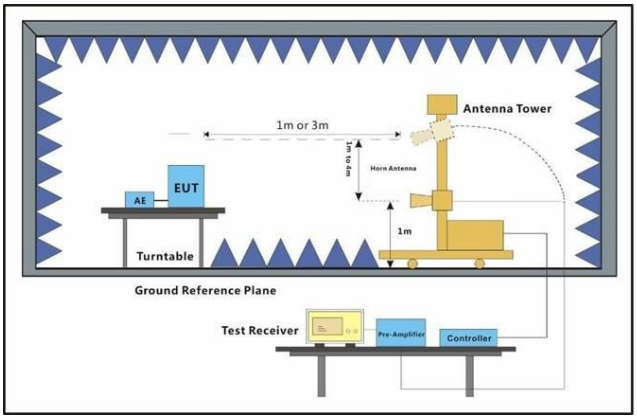


Figure 3. Above 1 GHz

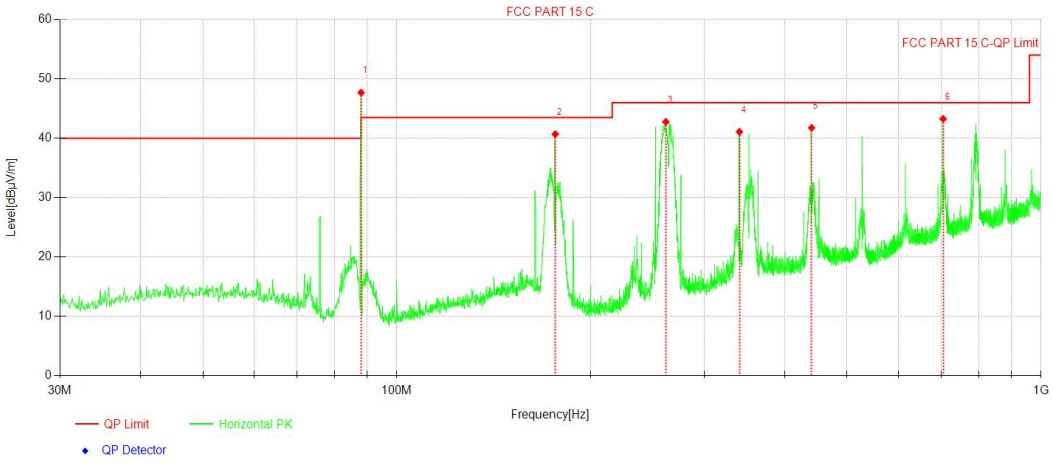
Test Procedure:	a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 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 c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. 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. e. 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. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. 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. h. Test the EUT in the lowest channel, the middle channel ,the Highest channel. i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case. j. Repeat above procedures until all frequencies measured was complete.

Test Configuration:	Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW ⩾ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Charge+Transmitting mode.
Final Test Mode:	Pretest the EUT at Transmitting mode. Through Pre-scan, find the 3DH5 of data type is the worst case of All modulation type.
Instruments Used:	Refer to section 2.9 for details
Test Results:	Pass

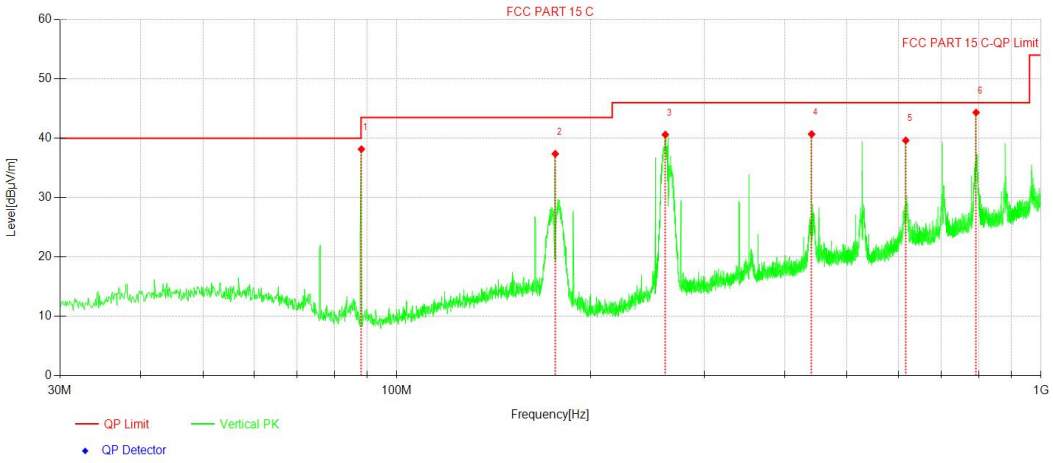
Test data

For 30-1000MHz

88.1MHz

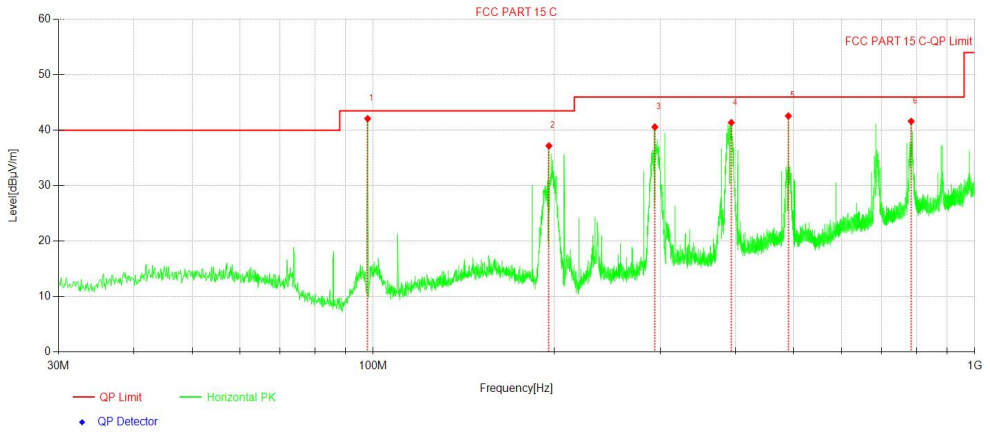


NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	88.01	61.54	-13.85	47.69	48.00	0.31	200	11	PK	H
2	176.19	49.57	-8.88	40.69	43.50	2.81	200	15	PK	H
3	261.56	51.32	-8.55	42.77	46.00	3.23	100	55	PK	H
4	340.33	46.99	-5.90	41.09	46.00	4.91	100	146	PK	H
5	440.44	44.80	-3.04	41.76	46.00	4.24	200	318	PK	H
6	704.79	40.81	2.46	43.27	46.00	2.73	100	175	PK	H

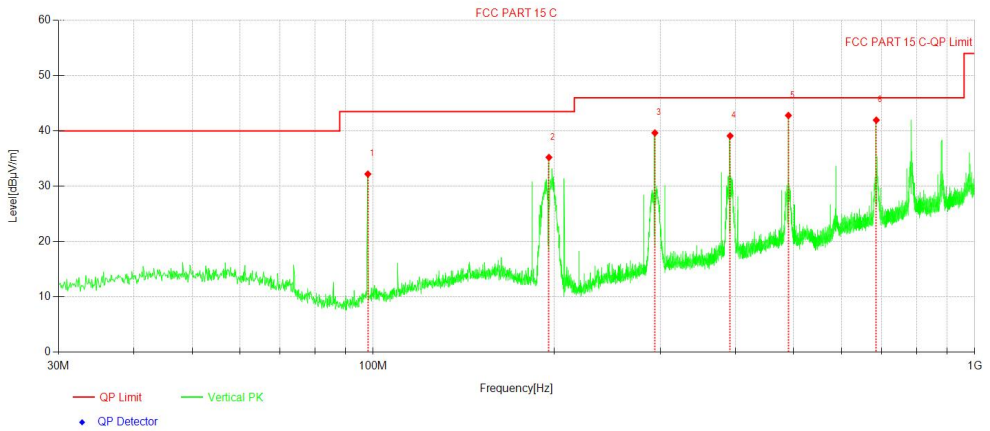


NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	88.1088	52.01	-13.85	38.16	48.00	9.84	200	310	PK	V
2	176.1936	46.26	-8.88	37.38	43.50	6.12	100	223	PK	V
3	261.0771	49.17	-8.56	40.61	46.00	5.39	200	98	PK	V
4	440.448	43.73	-3.04	40.69	46.00	5.31	100	255	PK	V
5	616.7147	38.66	0.98	39.64	46.00	6.36	100	102	PK	V
6	792.8843	40.28	4.06	44.34	46.00	1.66	200	75	PK	V

98MHz

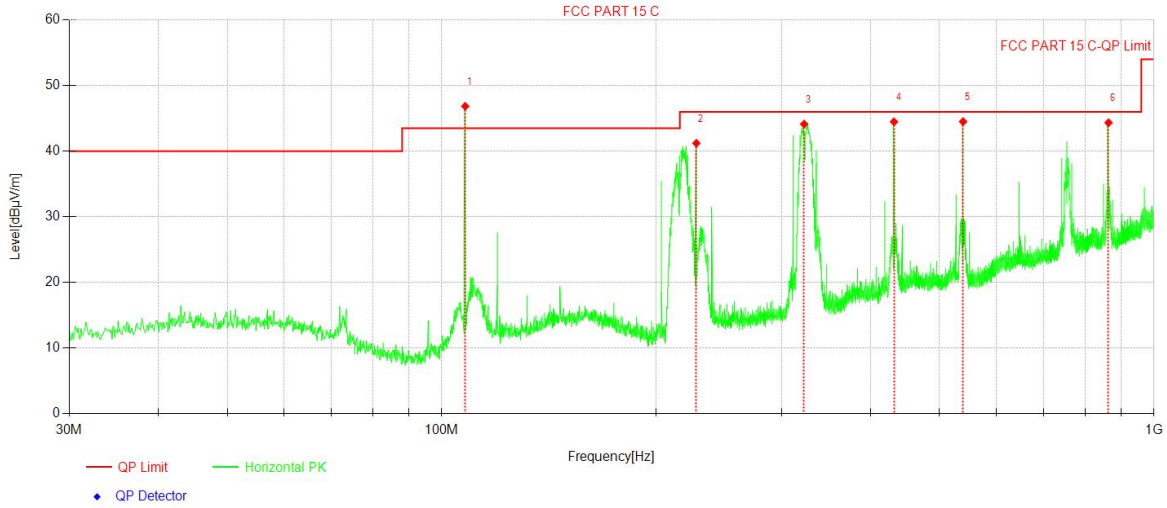


NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	97.90	55.02	-12.93	42.09	48.00	5.91	200	252	PK	H
2	195.98	48.17	-10.99	37.18	43.50	6.32	100	320	PK	H
3	293.96	47.74	-7.15	40.59	46.00	5.41	100	123	PK	H
4	393.78	45.80	-4.42	41.38	46.00	4.62	100	170	PK	H
5	490.02	44.76	-2.18	42.58	46.00	3.42	200	146	PK	H
6	783.95	37.59	4.03	41.62	46.00	4.38	100	137	PK	H

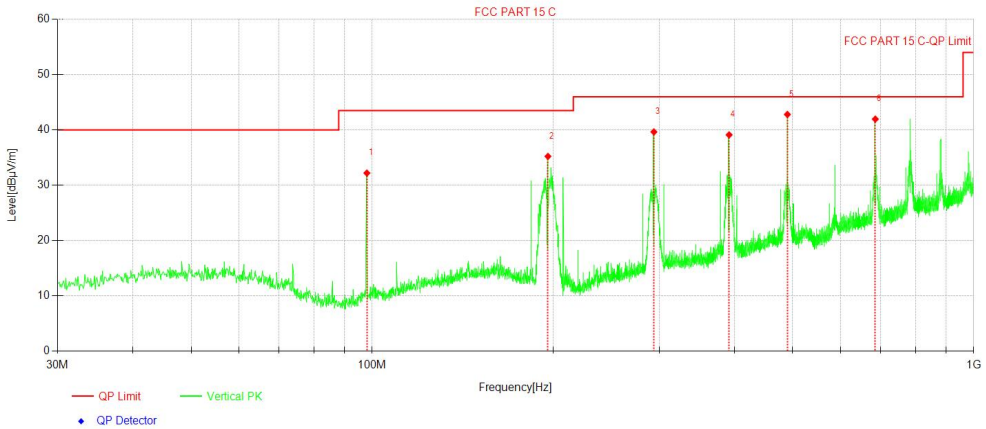


NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	98.00	45.12	-12.92	32.20	48.00	15.8	100	279	PK	V
2	195.98	46.21	-10.99	35.22	43.50	8.28	100	87	PK	V
3	293.96	46.80	-7.15	39.65	46.00	6.35	100	70	PK	V
4	392.04	43.58	-4.47	39.11	46.00	6.89	100	70	PK	V
5	490.02	44.98	-2.18	42.80	46.00	3.20	100	87	PK	V
6	685.97	39.83	2.13	41.96	46.00	4.04	200	93	PK	V

107.9 MHz



NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	107.89	58.32	-11.47	46.85	68.00	21.15	200	343	PK	H
2	227.80	51.90	-10.68	41.22	46.00	4.78	100	326	PK	H
3	322.67	50.34	-6.20	44.14	46.00	1.86	100	344	PK	H
4	431.52	47.79	-3.30	44.49	46.00	1.51	200	331	PK	H
5	539.49	45.90	-1.39	44.51	46.00	1.49	200	154	PK	H
6	863.21	39.78	4.57	44.35	46.00	1.65	100	136	PK	H



NO.	Freq. [MHz]	Reading Level [dBµV]	Correct Factor [dB/m]	Result Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Remark	Polarity
1	107.89	49.82	-11.47	38.35	48.00	9.65	100	119	PK	V
2	227.80	48.48	-10.68	37.80	46.00	8.20	100	278	PK	V
3	323.74	45.15	-6.17	38.98	46.00	7.02	100	244	PK	V
4	431.52	41.88	-3.30	38.58	46.00	7.42	100	265	PK	V
5	539.49	41.12	-1.39	39.73	46.00	6.27	100	272	PK	V
6	755.34	38.83	3.51	42.34	46.00	3.66	200	70	PK	V

Note:

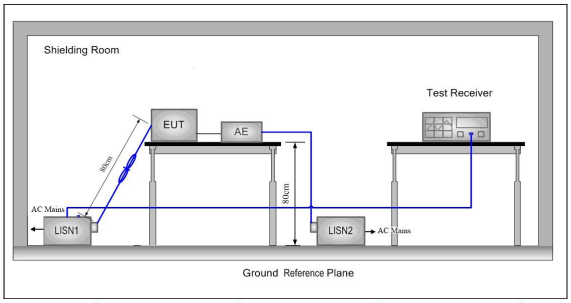
1. The Measurement (Result Level) is calculated by Reading Level adding the Correct Factor(maybe including Ant.Factor and the Cable Factor etc.), The basic equation is as follows:

Result Level= Reading Level + Correct Factor(including Ant.Factor, Cable Factor etc.)

2. The amplitude of 9KHz to 30MHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

3.The Peak value is below the AV limit, so we think the AV value also meets the requirements, so it does not reflect the AV value.

3.4 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150kHz to 30MHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test Procedure:	1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω 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. 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, 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 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. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 2013 on conducted measurement.		
Test Setup:			
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.		
Final Test Mode:	Through Pre-scan, find the the worst case.		
Instruments Used:	Refer to section 2.9 for details		
Test Results:	NA		

---END OF REPORT---