Radio Test Report

Report No.:CTA231102010W01

Issued for

Zhejiang Hyxi Technology Co., Ltd.

9-10F, Building 3, Jiuyao Commercial Center, Zhuantang Street, Xihu District, Hangzhou, Zhejiang, China

Product Name:	MICRO INVERTER
Brand Name:	N/A
Model Name:	HYX-M800-S
Series Model(s):	HYX-M600-S,HYX-M700-S, HYX-M800-S,HYX-M900-S, HYX-M1000-S,HYX-M600-S-NA, HYX-M700-S-NA,HYX-M800-S-NA, HYX-M900-S-NA,HYX-M1000-S-NA
FCC ID:	2BDBN-2MSSG1
IC:	31516-2MSSG1
Test Standards:	FCC Part 15.231 RSS-210 Issue 10, Amendment, April 2020 RSS-Gen Issue 5, Amendment 2, February 2021

TEST REPORT

Applicant's Name ..... :	Zhejiang Hyxi Technology Co., Ltd.
Address..... :	9-10F, Building 3, Jiuyao Commercial Center, Zhuantang Street, Xihu District, Hangzhou, Zhejiang, China
Manufacturer's Name ..... :	Zhejiang Hyxi Technology Co., Ltd.
Address..... :	9-10F, Building 3, Jiuyao Commercial Center, Zhuantang Street, Xihu District, Hangzhou, Zhejiang, China

Product Description

Product Name ..... :	MICRO INVERTER
Brand Name..... :	N/A
Model Name..... :	HYX-M800-S
Series Model(s) ..... :	HYX-M600-S,HYX-M700-S,HYX-M800-S,HYX-M900-S, HYX-M1000-S,HYX-M600-S-NA,HYX-M700-S-NA, HYX-M800-S-NA,HYX-M900-S-NA,HYX-M1000-S-NA
Test Standards ..... :	FCC Part 15.231 RSS-210 Issue 10, Amendment, April 2020 RSS-Gen Issue 5, Amendment 2, February 2021
Test Procedure..... :	ANSI C63.10-2013

This device described above has been tested by CTA, the test results show that the equipment under test (EUT) is in compliance with the FCC/IC requirements. And it is applicable only to the tested sample identified in the report.
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Date of Test..... :	
Date of Receipt of Test Item ...:	20 Oct. 2023
Date of performance of tests ..:	20 Oct. 2023 ~ 30 Oct. 2023
Date of Issue..... :	30 Oct. 2023
Test Result ..... :	**Pass**

Testing Engineer : Zoey Cao

(Zoey Cao)

Technical Manager : Amy Wen

(Amy Wen)

Authorized Signatory : Eric Wang

(Eric Wang)

TABLE OF CONTENTS **Page**

TABLE OF CONTENTS **Page**

Revision History

Rev.	Issue Date	Report No.	Effect Page	Contents
00	30 Oct. 2023	CTA231102010W01	ALL	Initial Issue

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part 15.231,Subpart C RSS 210 Issue 10			
Standard Section	Test Item	Judgment	Remark
15.207 RSS-Gen Issue 5	Conducted Emission	PASS	--
15.205(a)/15.209/ 15.231(e) RSS 210 Issue 10 (A.1.4)	Radiated Spurious Emission	PASS	--
15.231(e) RSS 210 Issue 10 (A.1.4)	Transmission requirement	PASS	--
15.231(C) RSS 210 Issue 10 (A.1.3)	20 dB&99% Bandwidth	PASS	--
15.203 RSS-Gen Issue 5	Antenna Requirement	PASS	--

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

(2) All tests are according to ANSI C63.10-2013.

1.1 TEST FACTORY

Shenzhen CTA Testing Technology Co., Ltd.
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community,Fuhai Street, Bao'an District, Shenzhen, China

FCC test Firm Registration Number: 517856

IC test Firm Registration Number: 27890

A2LA Certificate No.: 6534.01

IC CAB ID: CN0127

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** %.

Test	Range	Measurement Uncertainty
Radiated Emission	30~1000MHz	4.06 dB
Radiated Emission	1~18GHz	5.14 dB
Radiated Emission	18-40GHz	5.38 dB
Conducted Disturbance	0.15~30MHz	2.14 dB
Output Peak power	30MHz~18GHz	0.55 dB
Power spectral density	/	0.57 dB
Spectrum bandwidth	/	1.1%
Radiated spurious emission (30MHz-1GHz)	30~1000MHz	4.10 dB
Radiated spurious emission (1GHz-18GHz)	1~18GHz	4.32 dB
Radiated spurious emission (18GHz-40GHz)	18-40GHz	5.54 dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name/PMN	MICRO INVERTER
Trade Name	N/A
Model Name/HVIN	HYX-M800-S
Series Model	HYX-M600-S,HYX-M700-S,HYX-M800-S,HYX-M900-S, HYX-M1000-S,HYX-M600-S-NA,HYX-M700-S-NA, HYX-M800-S-NA,HYX-M900-S-NA,HYX-M1000-S-NA
Model Difference	Motherboard, hardware, software, appearance, etc. are the same, only difference in model name.
Product Description	The EUT is a MICRO INVERTER Operation Frequency: 433.35MHz-434.6 MHz Modulation Type: FSK Number of Channel: 6CH Antenna Designation: Spring Antenna Antenna Gain(Peak) -3 dBi More details of EUT technical specification, please refer to the User Manual.
Power Rating	Input: DC 65V 20A Output: AC 240V 3.64A
Hardware version number	V1.0
Software version number/FVIN	V01.00.02
Sample number	231020005-2
Connecting I/O Port(s)	Please refer to Note 1.

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications orthe User Manual.

2.

Channel List							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequenc y (MHz)
01	433.35	03	433.85	05	434.35		
02	433.6	04	434.1	06	434.6		

3. Table for filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	HYX-M800-S	Spring	N/A	-3	Antenna

2.2 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.

	For Radiated Emission
Final Test Mode	Description
Mode 1	TX Mode(433.35MHz,FSK)
Mode 2	TX Mode(433.85MHz, FSK)
Mode 3	TX Mode(434.6MHz,FSK)

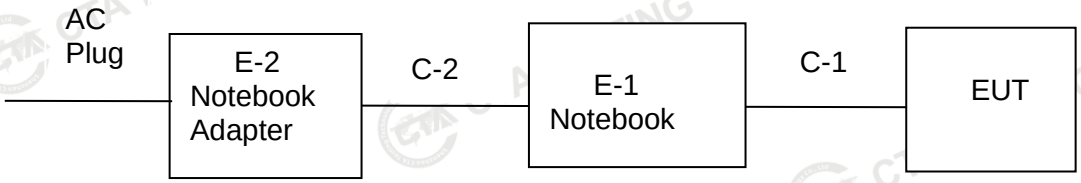
	For conduction Emission
Final Test Mode	Description
Mode 1	TX Mode

Note:

(2)The measurements are performed at all Bit Rate of Transmitter, the worst data was reported

2.3 BLOCK DIAGRAM 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



2.4 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
N/A	N/A	N/A	N/A	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
	Notebook Adapter	LENOVO	ADLX45DLC3A	N/A	N/A
	Notebook	LENOVO	Think Pad E470	N/A	N/A
	USB Cable	N/A	N/A	150cm	NO

Note:

(1)For detachable type I/O cable should be specified the length in cm in『Length』column.

2.5 EQUIPMENTS LIST

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	CTA-308	2023/08/02	2024/08/01
LISN	R&S	ENV216	CTA-314	2023/08/02	2024/08/01
EMI Test Receiver	R&S	ESPI	CTA-307	2023/08/02	2024/08/01
EMI Test Receiver	R&S	ESCI	CTA-306	2023/08/02	2024/08/01
Spectrum Analyzer	Agilent	N9020A	CTA-301	2023/08/02	2024/08/01
Spectrum Analyzer	R&S	FSP	CTA-337	2023/08/02	2024/08/01
Vector Signal generator	Agilent	N5182A	CTA-305	2023/08/02	2024/08/01
Analog Signal Generator	R&S	SML03	CTA-304	2023/08/02	2024/08/01
WIDEBAND RADIO COMMUNICATIO N TESTER	CMW500	R&S	CTA-302	2023/08/02	2024/08/01
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2023/08/02	2024/08/01
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	CTA-310	2023/10/17	2024/10/16
Horn Antenna	Schwarzbeck	BBHA 9120D	CTA-309	2023/10/13	2024/10/12
Loop Antenna	Zhinan	ZN30900C	CTA-311	2023/10/17	2024/10/16
Horn Antenna	Beijing Hangwei Dayang	OBH100400	CTA-336	2021/08/07	2024/08/06
Amplifier	Schwarzbeck	BBV 9745	CTA-312	2023/08/02	2024/08/01
Amplifier	Taiwan chengyi	EMC051845B	CTA-313	2023/08/02	2024/08/01
Directional coupler	NARDA	4226-10	CTA-303	2023/08/02	2024/08/01
High-Pass Filter	XingBo	XBLBQ-GTA18	CTA-402	2023/08/02	2024/08/01
High-Pass Filter	XingBo	XBLBQ-GTA27	CTA-403	2023/08/02	2024/08/01
Automated filter bank	Tonscend	JS0806-F	CTA-404	2023/08/02	2024/08/01
Power Sensor	Agilent	U2021XA	CTA-405	2023/08/02	2024/08/01
Amplifier	Schwarzbeck	BBV9719	CTA-406	2023/08/02	2024/08/01

Test Equipment	Manufacturer	Model No.	Version number	Calibration Date	Calibration Due Date
EMI Test Software	Tonscend	TS®JS32-RE	5.0.0.2	N/A	N/A
EMI Test Software	Tonscend	TS®JS32-CE	5.0.0.1	N/A	N/A
RF Test Software	Tonscend	TS®JS1120-3	3.1.65	N/A	N/A
RF Test Software	Tonscend	TS®JS1120	3.1.46	N/A	N/A

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

FREQUENCY (MHz)	Class B (dBuV)		Standard
	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	CISPR
0.50 -5.0	56.00	46.00	CISPR
5.0 -30.0	60.00	50.00	CISPR

0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.2 TEST PROCEDURE

a. The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

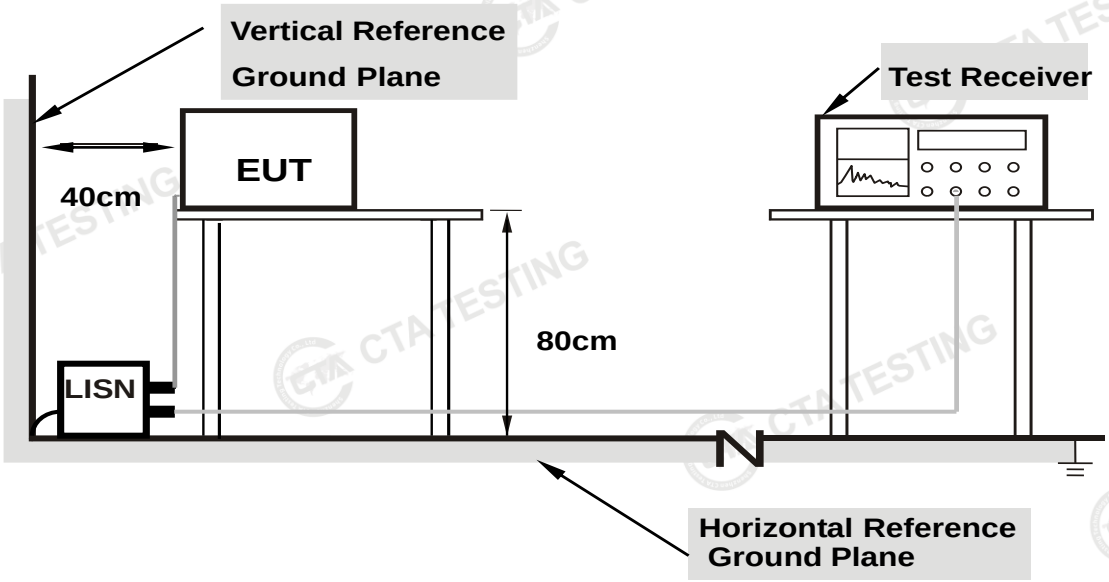
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

d. LISN at least 80 cm from nearest part of EUT chassis.

e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.3 TEST SETUP

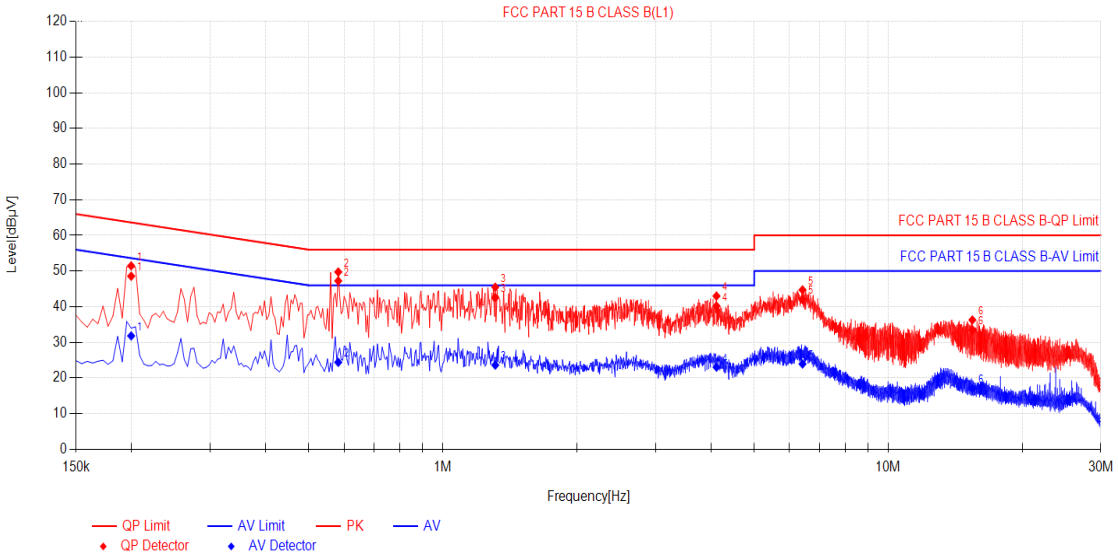


Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.

3.4 TEST RESULTS

Temperature:	26.2(C)	Relative Humidity:	54%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 1		



Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBµV]	QP Value [dBuV]	QP Limit [dBuV]	QP Margin [dB]	AV Reading [dBuV]	AV Value [dBuV]	AV Limit [dBuV]	AV Margin [dB]	Verdict
1	0.1995	10.50	38.06	48.56	63.63	15.07	21.31	31.81	53.63	21.82	PASS
2	0.582	10.50	36.74	47.24	56.00	8.76	13.90	24.40	46.00	21.60	PASS
3	1.311	10.50	32.07	42.57	56.00	13.43	13.12	23.62	46.00	22.38	PASS
4	4.1145	10.50	29.69	40.19	56.00	15.81	12.55	23.05	46.00	22.95	PASS
5	6.4185	10.50	31.52	42.02	60.00	17.98	13.44	23.94	50.00	26.06	PASS
6	15.45	10.50	22.96	33.46	60.00	26.54	6.59	17.09	50.00	32.91	PASS

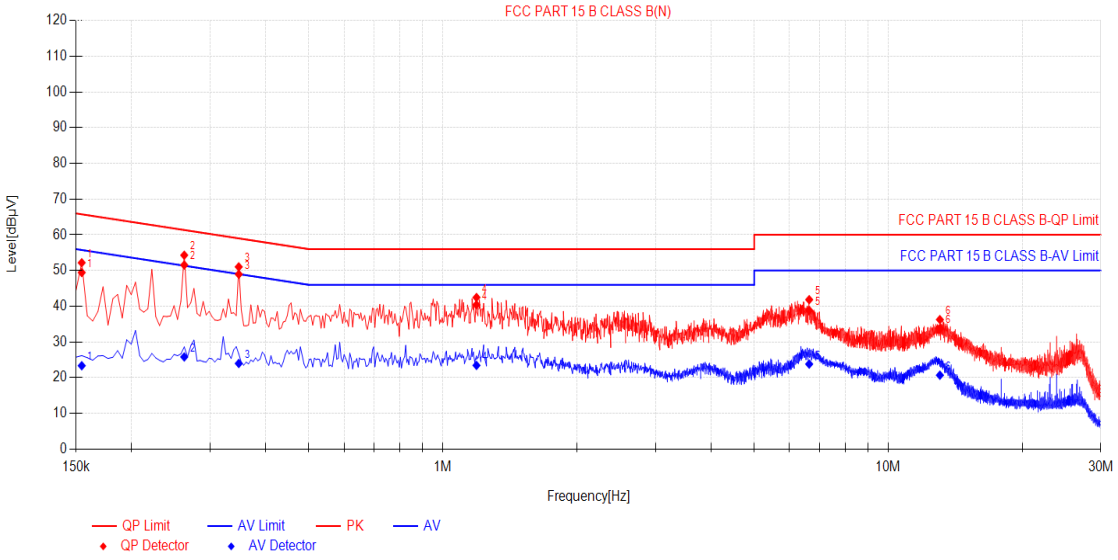
Note:1).QP Value (dBµV)= QP Reading (dBµV)+ Factor (dB)

2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin(dB) = QP Limit (dBµV) - QP Value (dBµV)

4). AVMargin(dB) = AV Limit (dBµV) - AV Value (dBµV)

Temperature:	26.2(C)	Relative Humidity:	54%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 1		



Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBµV]	QP Value [dBuV]	QP Limit [dBuV]	QP Margin [dB]	AV Reading [dBuV]	AV Value [dBuV]	AV Limit [dBuV]	AV Margin [dB]	Verdict
1	0.1545	10.50	38.94	49.44	65.75	16.31	12.85	23.35	55.75	32.40	PASS
2	0.2625	10.50	41.05	51.55	61.35	9.80	15.30	25.80	51.35	25.55	PASS
3	0.348	10.50	38.47	48.97	59.01	10.04	13.49	23.99	49.01	25.02	PASS
4	1.1895	10.50	29.90	40.40	56.00	15.60	12.94	23.44	46.00	22.56	PASS
5	6.6435	10.50	28.38	38.88	60.00	21.12	13.31	23.81	50.00	26.19	PASS
6	13.0605	10.50	23.29	33.79	60.00	26.21	10.19	20.69	50.00	29.31	PASS

Note:1).QP Value (dBµV)= QP Reading (dBµV)+ Factor (dB)

2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin(dB) = QP Limit (dBµV) - QP Value (dBµV)

4). AVMargin(dB) = AV Limit (dBµV) - AV Value (dBµV)

4. RADIATED EMISSION MEASUREMENT

4.1 RADIATED EMISSION LIMITS

In case the emission fall within the restricted band specified on Part 15.205(a), then the Part 15.209(a), Part 15.231(e), RSS-Gen Issue 5 and RSS 210 Issue 10 (A.1.4) limit in the table below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100**	3
88~216	150**	3
216~960	200**	3
Above 960	500	3

Fundamental Frequency (MHz)	Field Strength of fundamental (microvolts/meter)	Field Strength of Unwanted Emissions (microvolts/meter)
40.66 - 40.70	1,000	100
70 - 130	500	50
130 - 174	500 to 1,500 **	50 to 1,50 **
174 - 260	1,500	1,50
260 - 470	1,500 to 5,000 **	1,50 to 5,00 **
Above 470	5,000	5,00

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

NOTE:** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental
field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 22.72727(F) - 2454.545; for the band 260-470 MHz, uV/m at 3 meters = 16.6667(F) - 2833.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

The limits on the field strength of the spurious emissions in the above table are based on thefundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to theaverage (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in93 Section 15.209, whichever limit permits a higher field strength.

LIMITS OF RESTRICTED FREQUENCY BANDS

FCC:

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

IC:

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	

16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

Spectrum Parameter	Setting
Detector	Peak
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1MHz / 3MHz

Receiver Parameter	**Setting**
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

4.2 TEST PROCEDURE

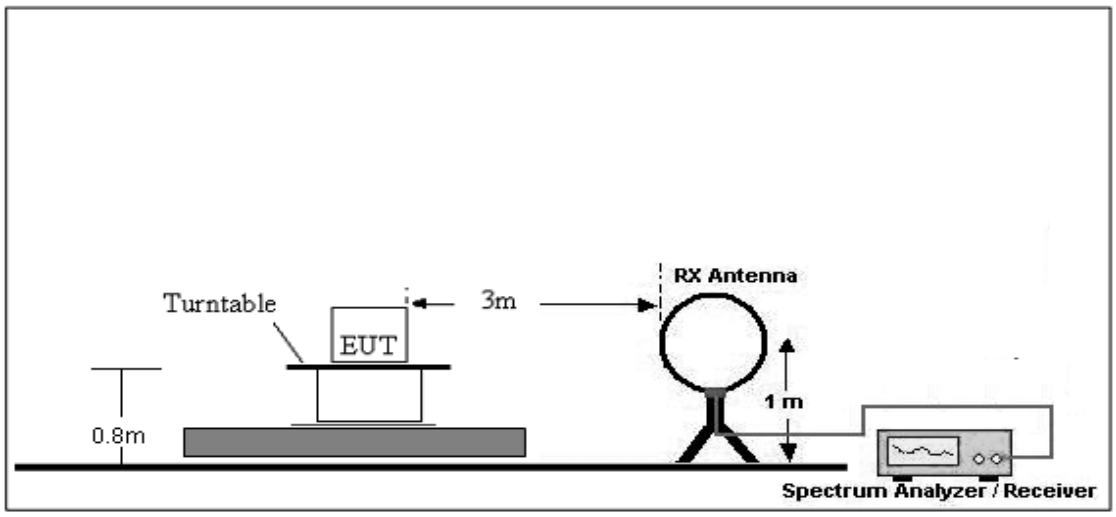
a. The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading.The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from theTest Antenna, which is mounted on avariable-height antenna master tower.
   During test, the table was rotated 360 degrees to determine the position of the highest radiation.
b. In the frequency range of 9KHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 3m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
c. In the frequency range 30MHz-1GHz, Bi-Log Test Antenna used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.
d. In the frequency above1GHz, place the measurement antenna 3m away from the EUT for each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
f. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
g. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
h. For the actual test configuration, please refer to the related Item –EUT Test Photos.
   Note: Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

4.3 DEVIATION FROM TEST STANDARD

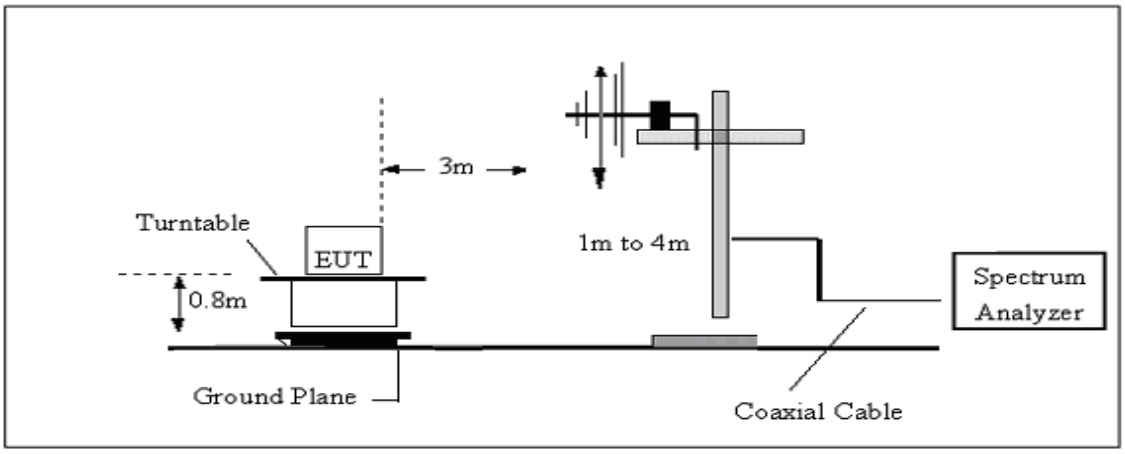
No deviation

4.4 TEST SETUP

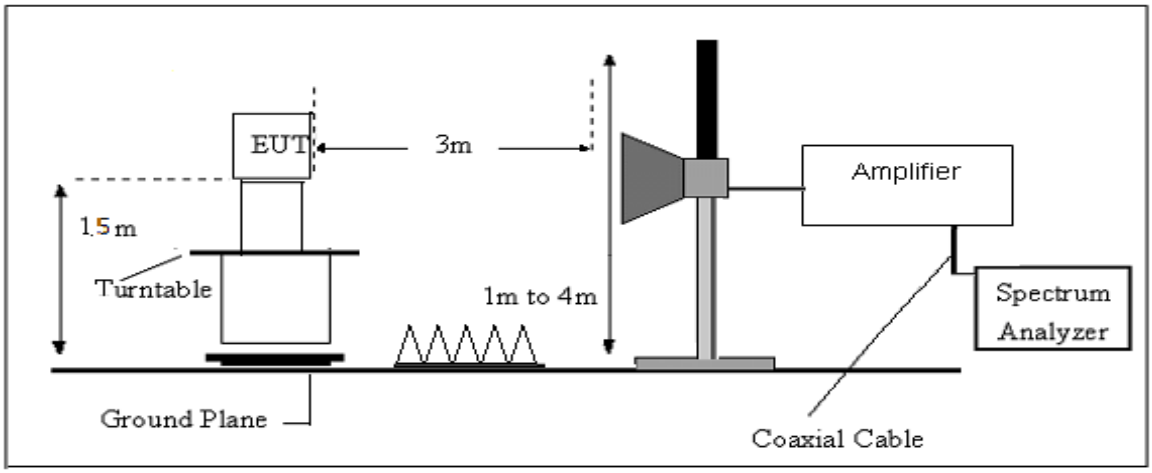
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



4.5 EUT OPERATING CONDITIONS

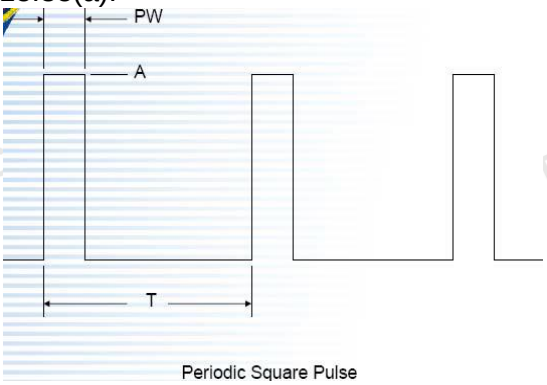
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

4.6 TEST RESULTS

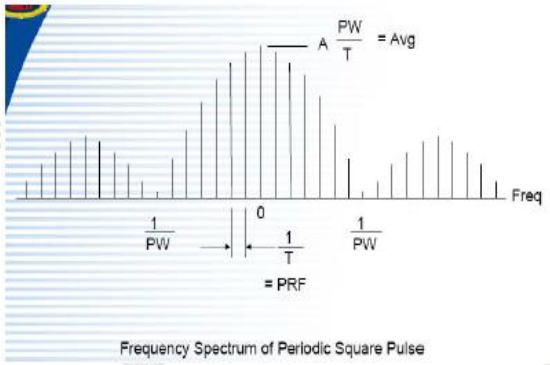
INTRODUCTION TO PDCF

Reference: (§15.35 Measurement detector functions and bandwidths.)

a. Part 15 of the FCC Rules provides for the operation of low power communication devices without an individual license (e.g., intrusion detectors, pulsed water tank level gauges, etc.), subject to certain requirements. Some of these devices use extremely narrow pulses to generate wideband emissions, which are measured to determine compliance with the rules. These measurements are typically performed with a receiver or spectrum analyzer. Depending on a number of factors (e.g., resolution bandwidth, pulsewidth, etc.), the spectrum analyzer may not always display the true peak value of the measured emission. This effect, called “pulse desensitization,” relates to the capabilities of the measuring instrument. For the measurement and reporting of the true peak of pulsed emissions, it may be necessary to apply a “pulse desensitization correction factor” (PDCF) to the measured value, pursuant to 47 CFR 15.35(a).



Periodic Square Pulse



Frequency Spectrum of Periodic Square Pulse

If using spectrum analyzer to measure pulse signal, it have to make sure the RBW use is at least 2/PW.

•When RBW is less than 2/PW, you are able to measure the true peak level of the pulse signal. If this is the case, PDCF is required to compensate to determine true peak value.

Pulse desensitization:

315MHz, ASK

PW =28800usec,Period=100000usec, Level=A

RBW>2/PW=0.069K , PRF=1/T=0.01K ,

315MHz, FSK

PW =29600usec,Period=100000usec, Level=A

RBW>2/PW=0.068K , PRF=1/T=0.01K ,

433.92MHz, ASK

PW =16730usec,Period=100000usec, Level=A

RBW>2/PW=0.1K , PRF=1/T=0.01K ,

433.92MHz, FSK

PW =17600usec,Period=100000usec, Level=A

RBW>2/PW=0.1K , PRF=1/T=0.01K

NOTE: 2 / PW < RBW, first don't need

b. For the actual test, please refer to the ANSI C63.10,Annex C refer to section 7 for more detail

4.7 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting theAmplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dBμV/m)	(dBμV/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

Factor=AF+CL-AG

4.8 TEST RESULTS (EMISSION)

(Radiated Emission<30MHz (9KHz-30MHz, H-field))

Temperature:	20 ℃	Relative Humidtity:	48%
Test Mode:	Mode 1	Polarization:	--

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

Limit line = specific limits (dBuv) + distance extrapolation factor.

Between 30MHz – 5000 MHz

Temperature:	23.1 ℃	Relative Humidity:	60%
Test Voltage:	AC 120V/60HZ	Phase:	Horizontal
Test Mode:	Mode 1		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	156.1000	55.81	-18.66	37.15	43.50	-6.35	peak
2	257.9500	54.18	-15.02	39.16	46.00	-6.84	peak
4	600.3600	43.64	-5.84	37.80	46.00	-8.20	peak
5	706.0900	41.64	-3.98	37.66	46.00	-8.34	peak

Fundamental Frequency

No.	Frequency	Reading	Correct	Duty cycle	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
3	433.3500	83.50	-10.13	-	73.37	92.85	-19.48	peak
3	433.3500	83.50	-10.13	10.14	63.23	72.85	-9.62	AVG
6	867.1100	49.57	-0.50	-	49.07	72.85	-23.78	peak
6	867.1100	49.57	-0.50	10.14	38.93	52.85	-13.92	AVG

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Temperature:	23.1 ℃	Relative Humidity:	60%
Test Voltage:	AC 120V/60HZ	Phase:	Vertical
Test Mode:	Mode 1		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	198.7800	57.11	-21.12	35.99	43.50	-7.51	peak
2	257.9500	50.96	-15.02	35.94	46.00	-10.06	peak
4	597.4500	42.95	-5.85	37.10	46.00	-8.90	peak
5	799.2100	39.89	-2.04	37.85	46.00	-8.15	peak
6	867.1100	44.47	-0.50	43.97	46.00	-2.03	peak

Fundamental Frequency

No.	Frequency	Reading	Correct	Duty cycle	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
3	433.3500	75.93	-10.13	-	65.80	92.85	-27.05	peak
3	433.3500	75.93	-10.13	10.14	55.66	72.85	-17.19	AVG

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Temperature:	23.1 ℃	Relative Humidity:	60%
Test Voltage:	AC 120V/60HZ	Phase:	Horizontal
Test Mode:	Mode 2		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	167.7400	57.03	-19.58	37.45	43.50	-6.05	peak
2	256.9800	54.30	-15.13	39.17	46.00	-6.83	peak
3	399.5700	50.05	-11.16	38.89	46.00	-7.11	peak
5	797.2700	40.98	-2.03	38.95	46.00	-7.05	peak

Fundamental Frequency

No.	Frequency	Reading	Correct	Duty cycle	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
4	433.8500	83.23	-10.12	-	73.11	92.87	-19.76	peak
4	433.8500	83.23	-10.12	10.14	62.97	72.87	-9.9	AVG
6	868.0800	49.62	-0.51	-	49.11	72.87	-19.76	peak
6	868.0800	49.62	-0.51	10.14	38.97	52.87	-13.9	AVG

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Temperature:	23.1 ℃	Relative Humidity:	60%
Test Voltage:	AC 120V/60HZ	Phase:	Vertical
Test Mode:	Mode 2		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	143.4900	54.22	-18.23	35.99	43.50	-7.51	peak
2	199.7500	57.82	-21.11	36.71	43.50	-6.79	peak
3	399.5700	49.92	-11.16	38.76	46.00	-7.24	peak
5	803.0900	39.83	-2.03	37.80	46.00	-8.20	peak
6	868.0800	39.36	-0.51	38.85	46.00	-7.15	peak

Fundamental Frequency

No.	Frequency	Reading	Correct	Duty cycle	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
4	433.8500	77.36	-10.12	-	67.24	92.87	-25.63	peak
4	433.8500	77.36	-10.12	10.14	57.1	72.87	-15.77	AVG

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Temperature:	23.1 ℃	Relative Humidity:	60%
Test Voltage:	AC 120V/60HZ	Phase:	Horizontal
Test Mode:	Mode 3		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	156.1000	55.37	-18.66	36.71	43.50	-6.79	peak
2	256.9800	53.47	-15.13	38.34	46.00	-7.66	peak
3	399.5700	49.67	-11.16	38.51	46.00	-7.49	peak
5	706.0900	42.65	-3.98	38.67	46.00	-7.33	peak

Fundamental Frequency

No.	Frequency	Reading	Correct	Duty cycle	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
4	434.6000	83.23	-10.12	-	73.11	92.89	-19.78	peak
4	434.6000	83.23	-10.12	10.14	62.97	72.89	-9.92	AVG
6	870.0200	51.03	-0.53	-	50.50	72.89	-22.39	peak
6	870.0200	51.03	-0.53	10.14	40.36	52.89	-12.53	AVG

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Temperature:	23.1 ℃	Relative Humidity:	60%
Test Voltage:	AC 120V/60HZ	Phase:	Vertical
Test Mode:	Mode 3		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	143.4900	54.45	-18.23	36.22	43.50	-7.28	peak
2	258.9200	52.42	-14.90	37.52	46.00	-8.48	peak
3	399.5700	49.56	-11.16	38.40	46.00	-7.60	peak
5	598.4200	42.96	-5.85	37.11	46.00	-8.89	peak
6	870.0200	41.03	-0.53	40.50	46.00	-5.50	peak

Fundamental Frequency

No.	Frequency	Reading	Correct	Duty cycle	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
4	434.6000	75.69	-10.12	-	65.57	92.89	-27.32	peak
4	434.6000	75.69	-10.12	10.14	55.43	72.89	-17.46	AVG

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

PEAK TEST RESULTS:

Mode 1

Frequency	Reading	Detector	Amplifier	Loss	Antenna Factor	Corrected Factor	Corrected Amplitude	FCC Part 15.231/15.209/205		RX Antenna
								Limit	Margin	Polar
(MHz)	(dBμV/m)	(PK/QP/AV)	（dB）	（dB）	（dB）	（dB）	(dBμV/m)	(dBμV/m)	(dB)	(H/V)
1299.9031	65.17	PK	45.1	4.0	25.1	-16.00	49.17	74	-24.83	H
1299.9031	65.86	PK	45.1	4.0	25.1	-16.00	49.86	74	-24.14	V
1733.4024	63.02	PK	44.1	5.3	25	-13.80	49.22	74	-24.78	H
1733.4024	64.16	PK	44.1	5.3	25	-13.80	50.36	74	-23.64	V
2166.7352	61.42	PK	43.8	5.4	25.9	-12.47	48.95	74	-25.05	H
2166.7352	62.30	PK	43.8	5.4	25.9	-12.47	49.83	74	-24.17	V

Mode 2

Frequency	Reading	Detector	Amplifier	Loss	Antenna Factor	Corrected Factor	Corrected Amplitude	FCC Part 15.231/15.209/205		RX Antenna
								Limit	Margin	Polar
(MHz)	(dBμV/m)	(PK/QP/AV)	（dB）	（dB）	（dB）	（dB）	(dBμV/m)	(dBμV/m)	(dB)	(H/V)
1301.58	63.74	PK	45.1	4.0	25.1	-16.00	47.74	74	-26.26	H
1301.58	64.43	PK	45.1	4.0	25.1	-16.00	48.43	74	-25.57	V
1735.58	61.82	PK	44.1	5.3	25	-13.80	48.02	74	-25.98	H
1735.58	63.23	PK	44.1	5.3	25	-13.80	49.43	74	-24.57	V
2169.20	60.40	PK	43.8	5.4	25.9	-12.47	47.93	74	-26.07	H
2169.20	60.53	PK	43.8	5.4	25.9	-12.47	48.06	74	-25.94	V

Mode 3

Frequency	Reading	Detector	Amplifier	Loss	Antenna Factor	Corrected Factor	Corrected Amplitude	FCC Part 15.231/15.209/205		RX Antenna
								Limit	Margin	Polar
(MHz)	(dBμV/m)	(PK/QP/AV)	（dB）	（dB）	（dB）	（dB）	(dBμV/m)	(dBμV/m)	(dB)	(H/V)
1304.03	63.85	PK	45.1	4.0	25.1	-16.00	47.85	74	-26.15	H
1304.03	64.21	PK	45.1	4.0	25.1	-16.00	48.21	74	-25.79	V
1738.49	61.90	PK	44.1	5.3	25	-13.80	48.10	74	-25.90	H
1738.49	63.19	PK	44.1	5.3	25	-13.80	49.39	74	-24.61	V
2172.98	60.19	PK	43.8	5.4	25.9	-12.47	47.73	74	-26.27	H
2172.98	60.85	PK	43.8	5.4	25.9	-12.47	48.39	74	-25.61	V

5. BANDWIDTH TEST

5.1 LIMIT

FCC Part15.231,Subpart C RSS 210 Issue 10			
Section	Test Item	Limit	Result
15.231(C) RSS 210 A.1.3	20 Bandwidth& 99% Bandwidth	The20dB bandwidth&99% Bandwidth of the emissions shall not exceed 0.25% of the center frequency	PASS

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth
RB	1% to 5% of the OBW
VB	≥3RB
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.2 TEST REQUIREMENTS

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.3 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. Spectrum Setting: 1% to 5% of the OBW, VBW≥3RBW, Sweep time = Auto.

5.4 TEST SETUP

5.5 EUT OPERATION CONDITIONS

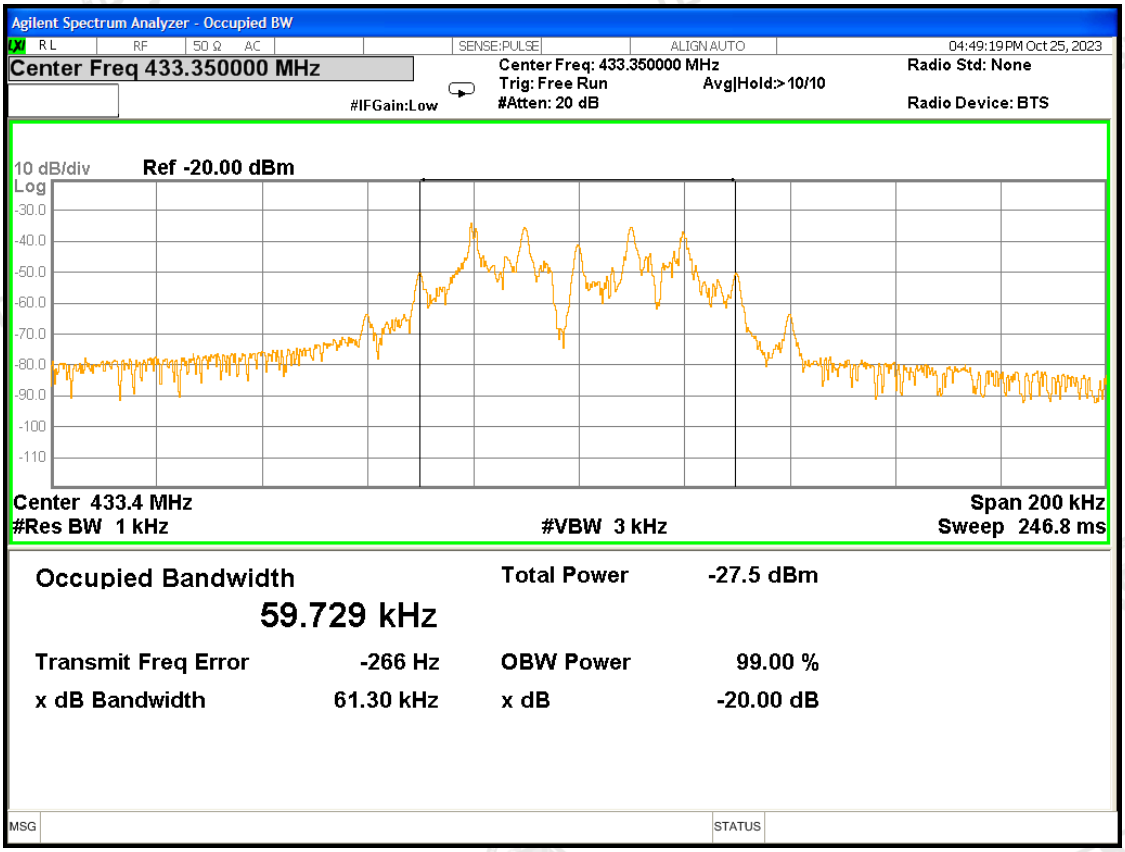
TX mode.

5.6 TEST RESULTS

Temperature:	25 ℃	Relative Humidity:	60%
Test Mode:	Mode 1		

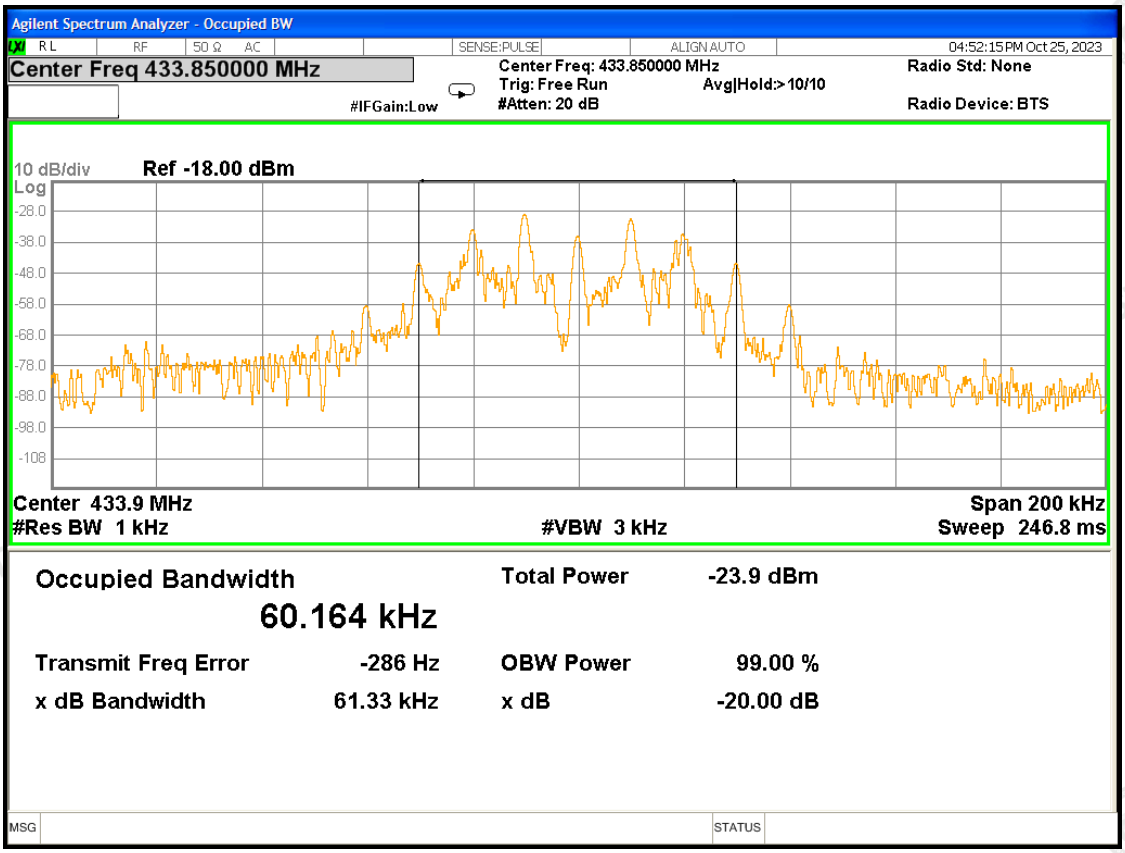
Centre Frequency	Measurement			
	20dB Bandwidth (KHz)	99% Bandwidth (KHz)	Limit(kHz)	Frequency Range (MHz)
433.35	61.3	59.729	1083.375	PASS

434.35MHz



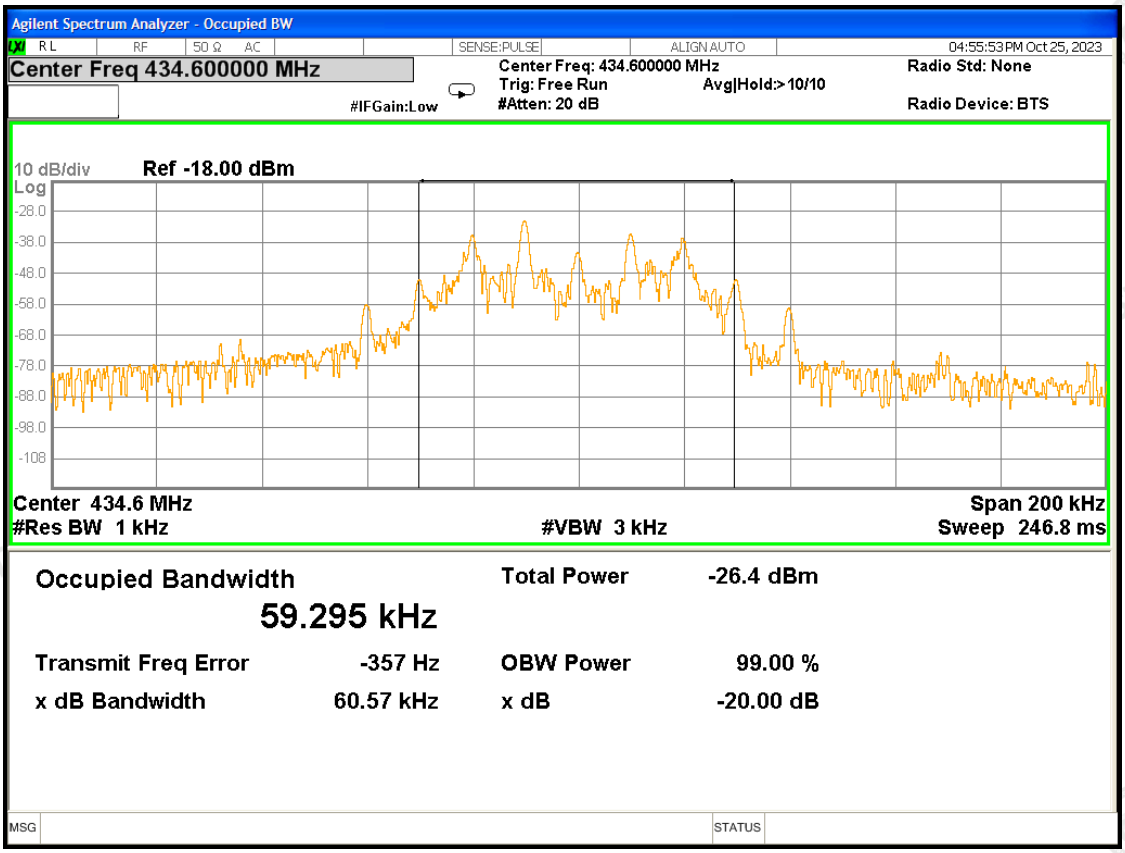
Centre Frequency	Measurement			
	20dB Bandwidth (KHz)	99% Bandwidth (KHz)	Limit(kHz)	Frequency Range (MHz)
433.85	61.33	60.164	1084.625	PASS

434.85MHz



Centre Frequency	Measurement			
	20dB Bandwidth (KHz)	99% Bandwidth (KHz)	Limit(kHz)	Frequency Range (MHz)
434.6	60.57	59.295	1086.5	PASS

434.6MHz



6. TRANSMITTER TIMEOUT

6.1 LIMIT

In addition, devices operated under the provisions of this paragraph shall be provided with a meansFor automatically limiting operation so that the duration of each transmission shall not be greater thanone second and the silent period between transmissions shall be at least 30 times the duration of thebut in no case less than 10 seconds.

6.2 TEST PROCEDURE

(1) Put the EUT on the support in its standard position with associated equipment and switched on.
(2) Set center frequency of spectrum analyzer = operating frequency.
(3) Set the spectrum analyzer as RBW=100kHz, VBW=100kHz, Span=0Hz, Adjust Sweep=Auto.
(4) record the duration time

6.3 TEST SETUP

6.4 TEST RESULTS

Temperature:	26 ℃	Relative Humidity:	53%
Test Mode:	Mode TX		

Frequency(MHz)	Each transmission time(s)	silent period between transmissions(s)
433.35	0.035	11.86
Limit	<1s	>10s and > 30*(duration of transmission)
Result	Pass	

7. PERIODIC OPERATION

7.1 TEST PROCEDURE

The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
The Duty Cycle Was Determined By The Following Equation: To Calculate The Actual Field Intensity,The Duty Cycle Correction Factor In Decibel Is Needed For Later Use And Can Be Obtained From Following Conversion
Duty Cycle(%)=Total On Interval In A Complete Pulse Train/ Length Of A Complete Pulse Train * %
Duty Cycle Correction Factor(dB)=20 * Log10(Duty Cycle(%)

7.2 TEST SETUP

7.3 EUT OPERATION CONDITIONS

TX mode.

7.4 TEST RESULTS

FCC Part15.231(e) RSS 210 Issue 10	
Total On interval in a complete pulse train(ms)	31.1
Length of a complete pulse train(ms)	100
Duty Cycle(%)	31.10%
Duty Cycle Correction Factor(dB)	10.14

Refer to the duty cycle plot (as below), This device meets the FCC requirement. Length of a complete pulse train

Remark:FCC part15.35(c) and RSS 210 required that a complete pulse train is more than 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.

Note: Number of pulse train 1 = 1, Time of single pulse train 1 = 0.62ms;

Number of pulse train 2 = 1, Time of single pulse train 2 = 30.48ms;

Total on interval in a complete pulse train= Number of pulse train 1x Time of single pulse train 1+ Number of pluse train 2x Time of single pulse train 2=1x0.62+1 x30.48=31.1ms

8. ANTENNA REQUIREMENT

8.1 STANDARD REQUIREMENT

According to the FCC Part 15 Paragraph 15.203 and RSS Gen, 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 to the intentional radiator shall be considered sufficient to comply with the provisions of this section. This product use a permanent ceramic printed antenna, fulfill the requirement of this section

8.2 EUT ANTENNA

The EUT antenna is Spring antenna.It conforms to the standard requirements.

APPENDIX 1-PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※