TEST REPORT

APPLICANT	:	NiceRF Wireless Technology LTD.
PRODUCT NAME	:	Wireless Module
MODEL NAME	:	RF4463Pro-433-FCC
BRAND NAME	:	N/A
FCC ID	:	2AD66-RF4463PRO-FCC
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2020-03-25
TEST DATE	:	2020-04-09 to 2020-04-17
ISSUE DATE	:	2020-04-21

Edited by: Peng Mi (Rapporteur)

Approved by: Peng Huarui (Supervisor)

MORLAB

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DIRECTORY

Change History		
Version	**Date**	**Reason for change**
1.0	2020-04-21	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	NiceRF Wireless Technology LTD.
Applicant Address:	309-314, Bldg A,Hongdu business building, Xin'an street, Zone 43, Baoan Dist, Shenzhen 518101, China
Manufacturer:	NiceRF Wireless Technology LTD.
Manufacturer Address:	309-314, Bldg A,Hongdu business building, Xin'an street, Zone 43, Baoan Dist, Shenzhen 518101, China

1.2. Equipment Under Test (EUT) Description

Product Name:	Wireless Module
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	v1.0
Software Version:	v1.0
Modulation Type:	GFSK
Operating Frequency:	433.5MHz
Channel Number:	1
Power Class：	3
Antenna Type:	Spring Antenna
Antenna Gain:	2.15dBi

Note 1: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

No	Identity	Document Title
1	47 CFR Part 15(10-1-15 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Date	Test Engineer	Result	Method determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	15.231(a)(1)	The Max Transmission Time	Apr 14, 2020	Zhou Chuang	PASS	No deviation
3	15.231(c)	20dB Bandwidth	Apr 14, 2020	Zhou Chuang	PASS	No deviation
4	15.207	Conducted Emission	Apr 09, 2020	Huang Zhiye	PASS	No deviation
5	15.231(b) 15.209(a)	Radiated Emission	Apr 17, 2020	Peng Xuewei	PASS	No deviation

Note 1: The tests were performed according to the method of measurements prescribed in ANSIC63.10-2013.

Note 2: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

1.4. Environmental Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15-35
Relative Humidity (%):	30-60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR Part 15C Requirements

2.1. Antenna Requirement

2.1.1. Applicable Standard

According to FCC 15.203, 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 shall be considered sufficient to comply with the provisions of this section.

2.1.2. Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

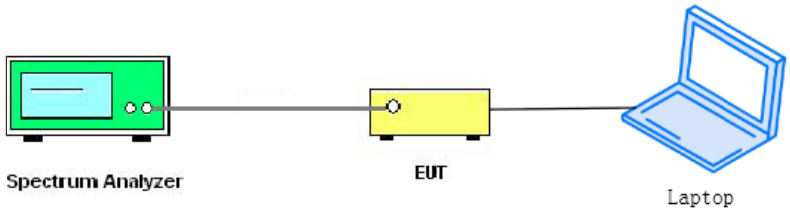
2.2. The Max Transmission Time

2.2.1. Requirement

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

2.2.2. Test Description

Test Setup:



2.2.3. Test Procedure

Set the SPA Center Frequency=Fundamental frequency,
Span=0Hz, change the weep time until get the burst in the screen.
Set EUT as normal operation and press Transmitter button.
Set the SPA View. Delta Mark time.

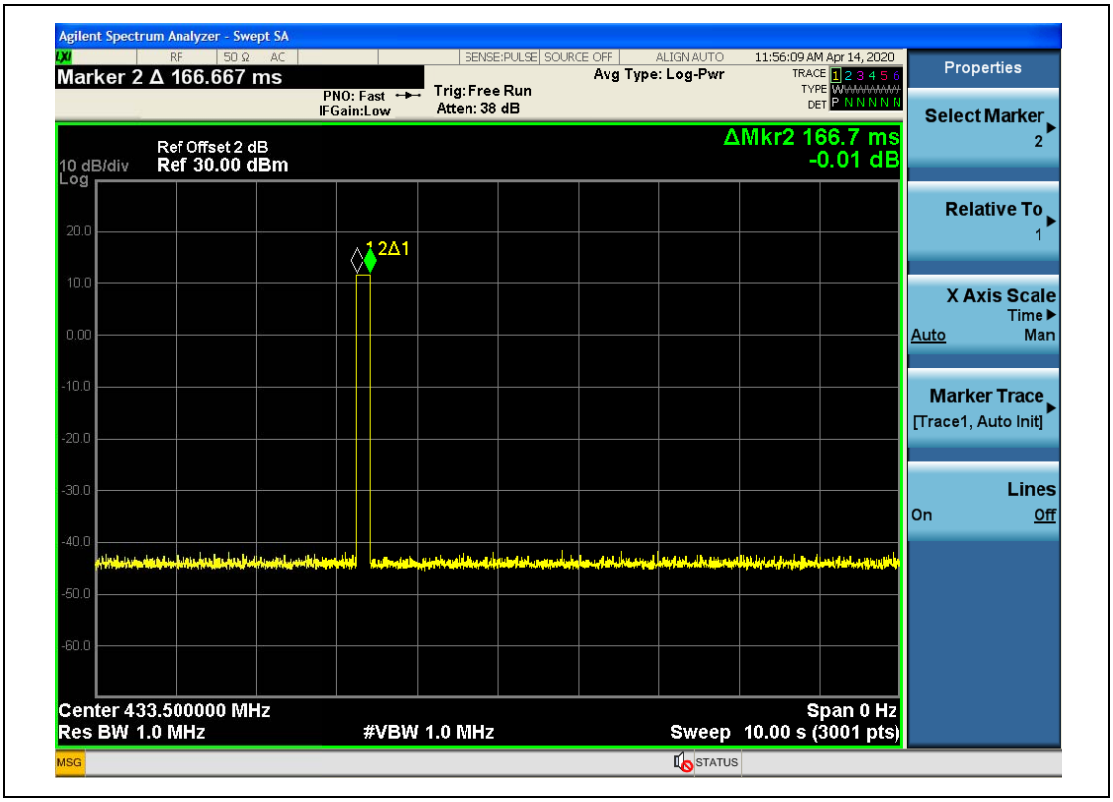
2.2.4. Test Result

The frequency(433.5MHz) is selected to perform testing to verify the max transmission time of the EUT.

A. Test Verdict:

Frequency (MHz)	The max transmission time	Limit	Verdict
433.5	0.17 s	≤5s	PASS

B. Test Plots:



(The max transmission time _433.5MHz)

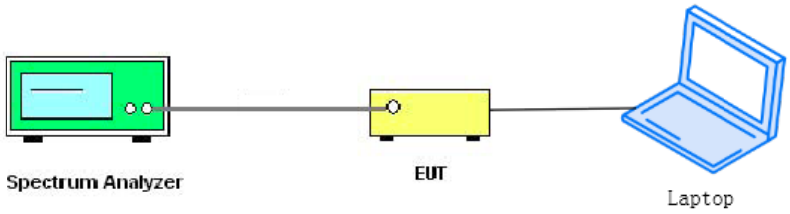
2.3. 20dB Bandwidth

2.3.1. Requirement

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.
As the center frequency for the device operating is 433.5MHz, thus, the 20dB bandwidth limit is 1085 kHz.

2.3.2. Test Description

Test Setup:



2.3.3. Test Procedure

Set spectrum analyzer's Center Frequency =Fundamental frequency, RBW,VBW and span to applicable value with Peak in Max Hold, A PEAK output reading and 20db Bandwidth function in spectrum analyzer were taken.

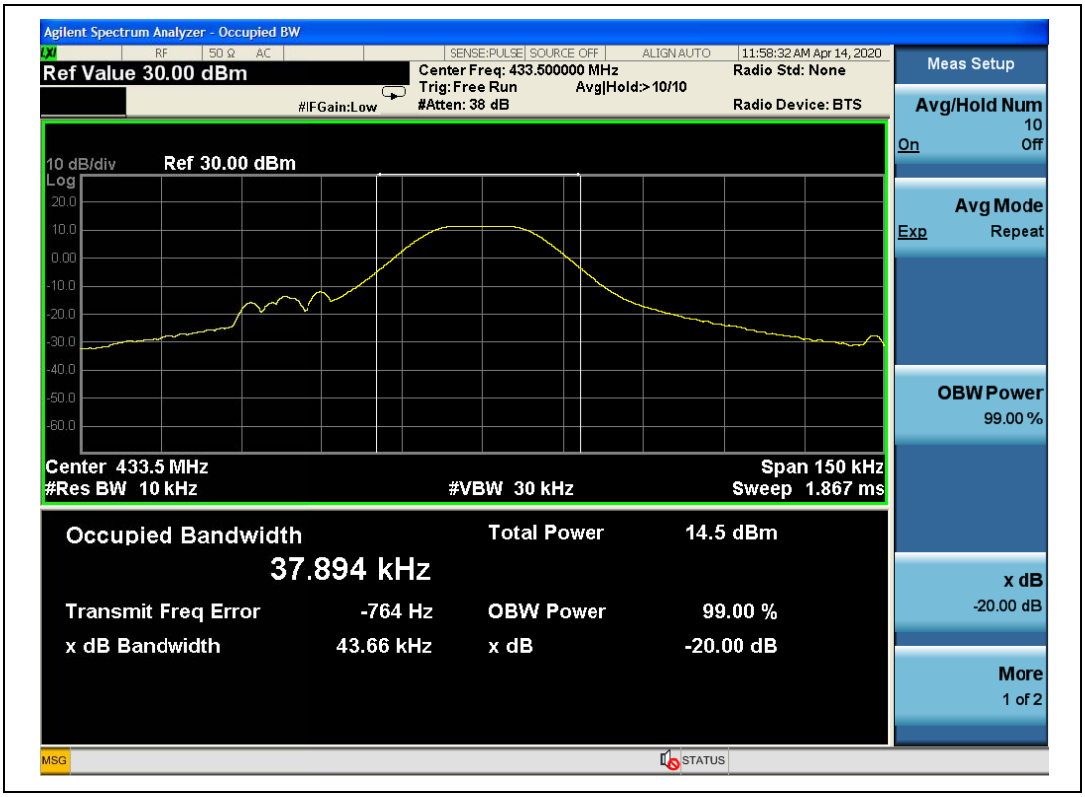
2.3.4. Test Result

The frequency (433.5MHz) is selected to perform testing to verify the 20dB bandwidth of the EUT.

A. Test Verdict:

Frequency (MHz)	20 dB Bandwidth (kHz)	Limits(MHz)	Verdict
433.5	43.66	≤1.085	PASS

B. Test Plots:



(Bandwidth_433.5MHz)

2.4. Conducted Emission

2.4.1. Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

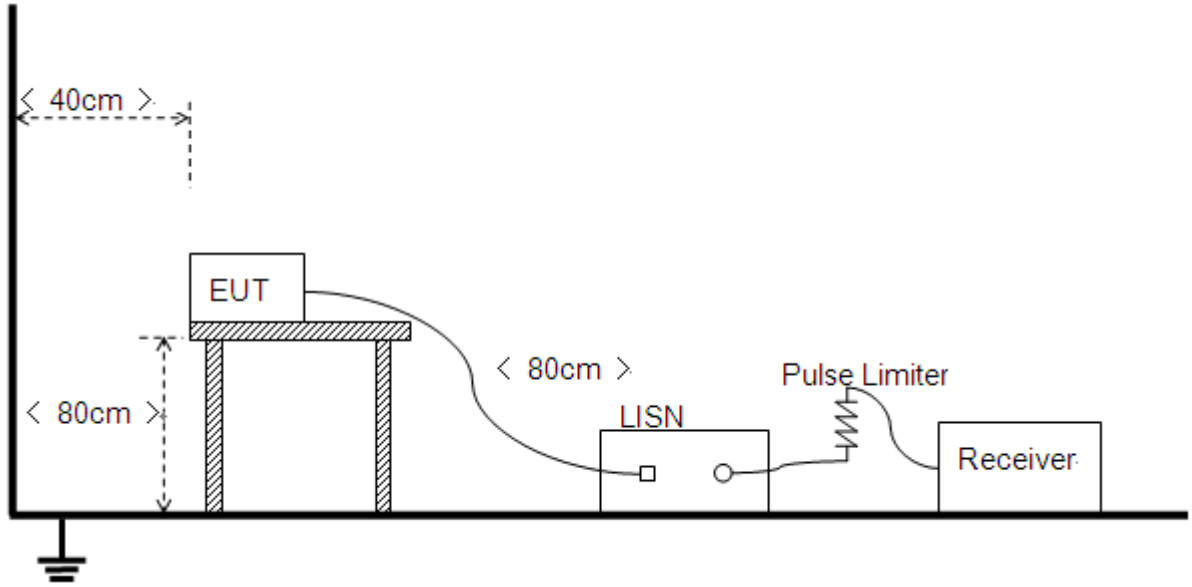
NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.4.2. Test Description

Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

2.4.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

A. Test Setup:

Test Mode: EUT+ADAPTER+433 TX

Test voltage: AC 120V/60Hz

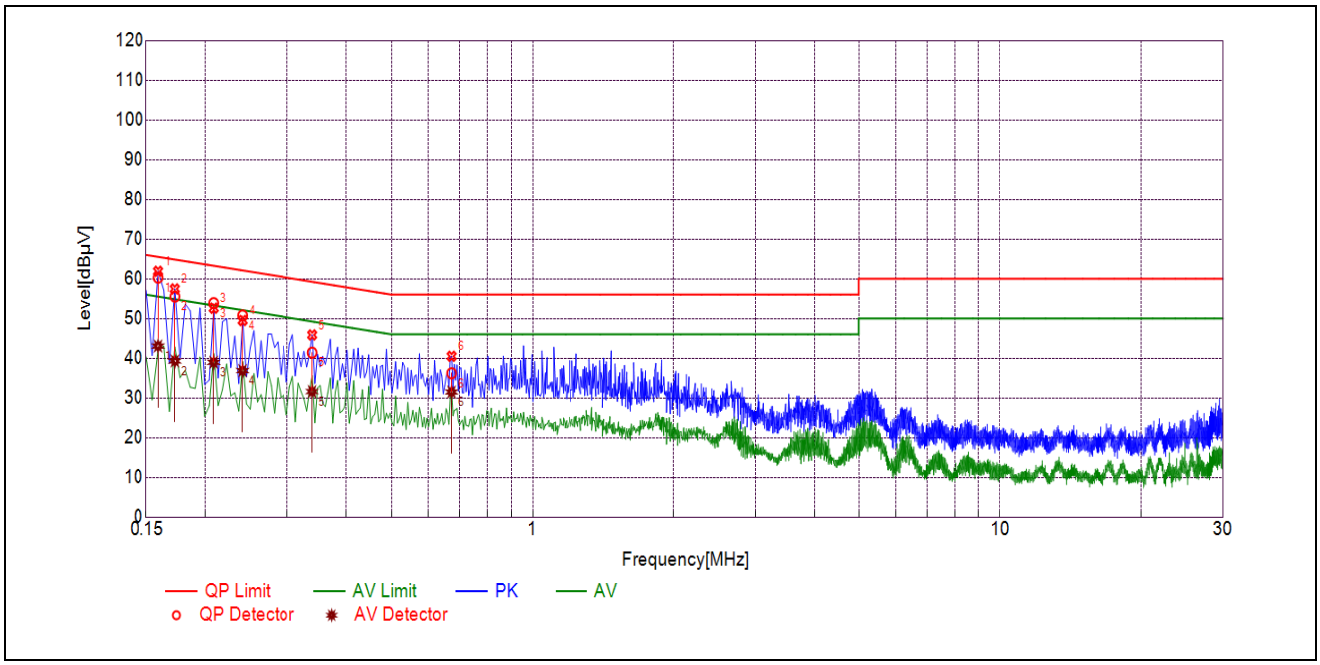
The measurement results are obtained as below:

$E\ [dB\mu V] = U_R + L_{Cable\ loss}\ [dB] + A_{Factor}$

U_R: Receiver Reading

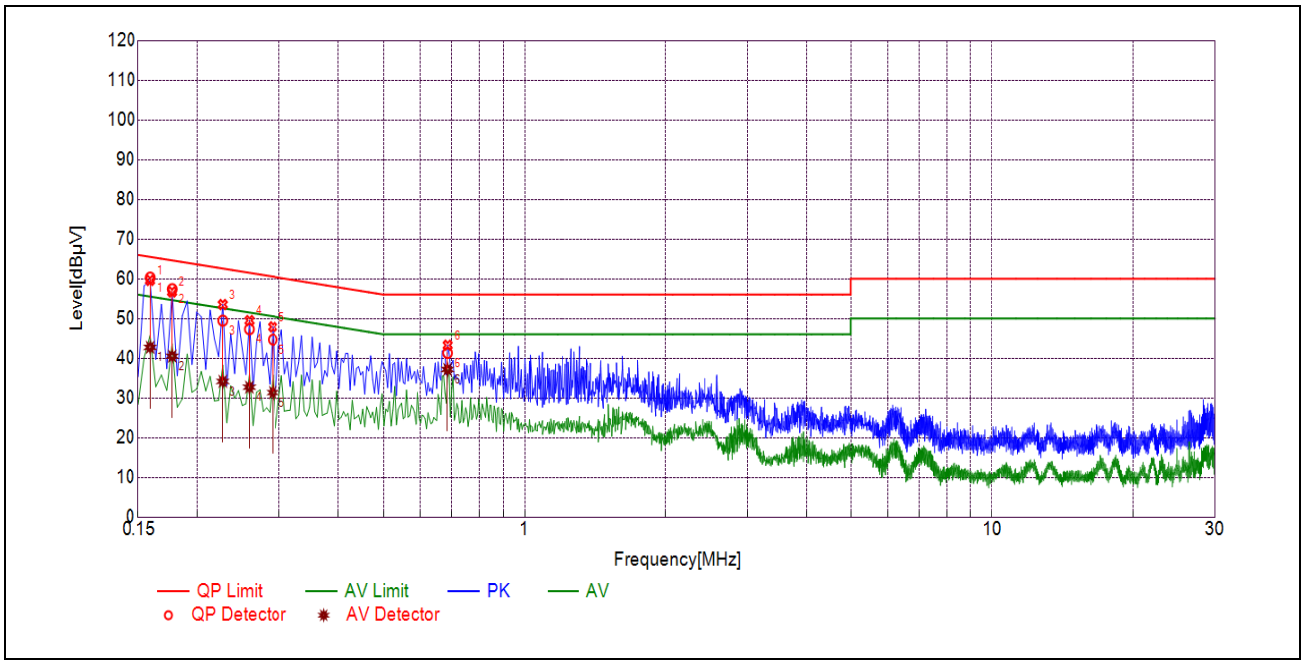
A_{Factor}: Voltage division factor of LISN

B. Test Plots:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1590	60.29	43.05	65.51	55.51	Line	PASS
2	0.1726	55.51	39.30	64.83	54.83		PASS
3	0.2084	53.87	38.96	63.27	53.27		PASS
4	0.2399	50.77	36.87	62.10	52.10		PASS
5	0.3388	41.40	31.60	59.23	49.23		PASS
6	0.6718	36.21	31.49	56.00	46.00		PASS



(N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1591	60.31	42.73	65.51	55.51	Neutral	PASS
2	0.1771	57.38	40.51	64.62	54.62		PASS
3	0.2265	49.45	34.16	62.58	52.58		PASS
4	0.2578	47.30	32.70	61.50	51.50		PASS
5	0.2897	44.68	31.35	60.53	50.53		PASS
6	0.6849	41.31	37.16	56.00	46.00		PASS

2.5. Radiated Emission

2.5.1. Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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

FCC Part 15.231(b)

Fundamental frequency(MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission(microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750	125 to 375
174-260	3750	375
260-47	3750 to 12500	375 to 1250
Above 470	12500	1250

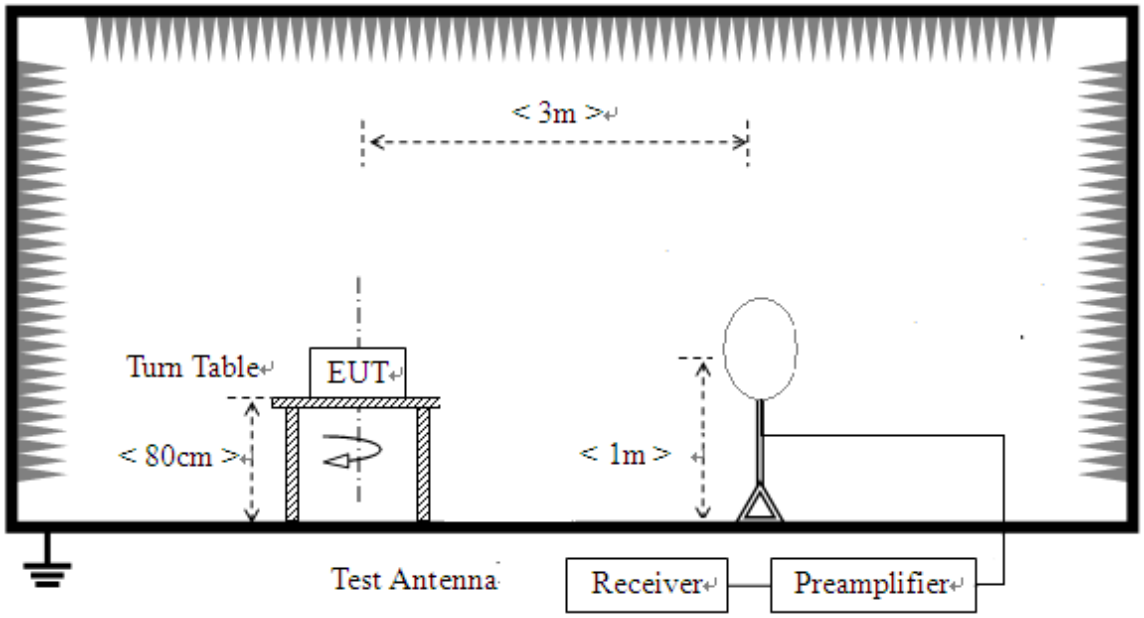
Note 1: For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
Note 2: For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

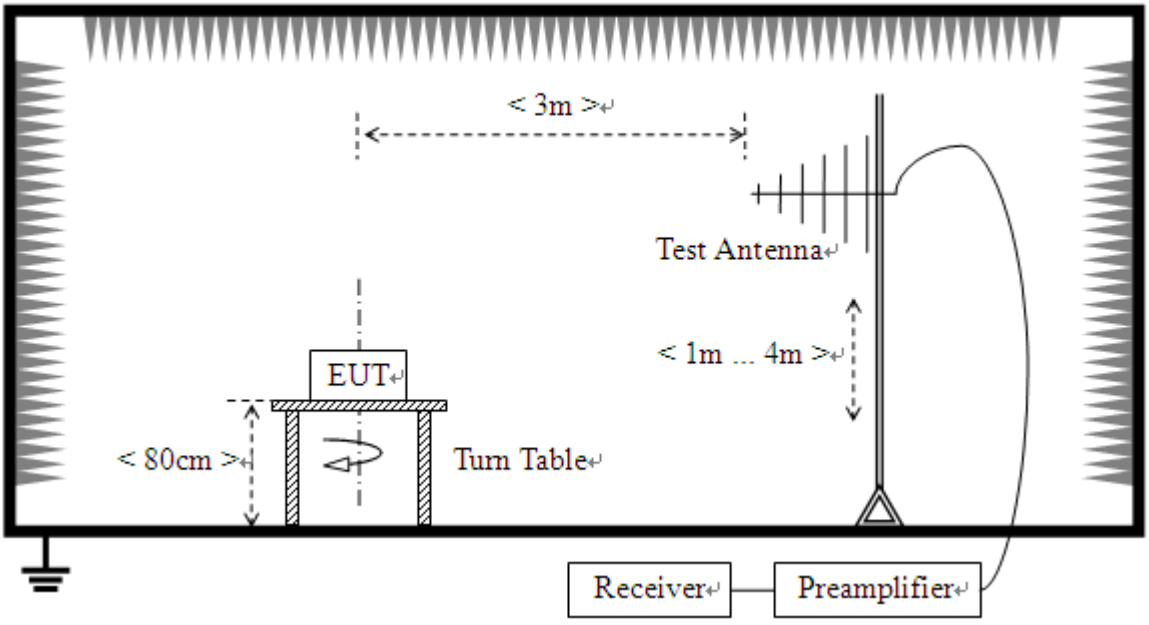
2.5.2. Test Description

Test Setup:

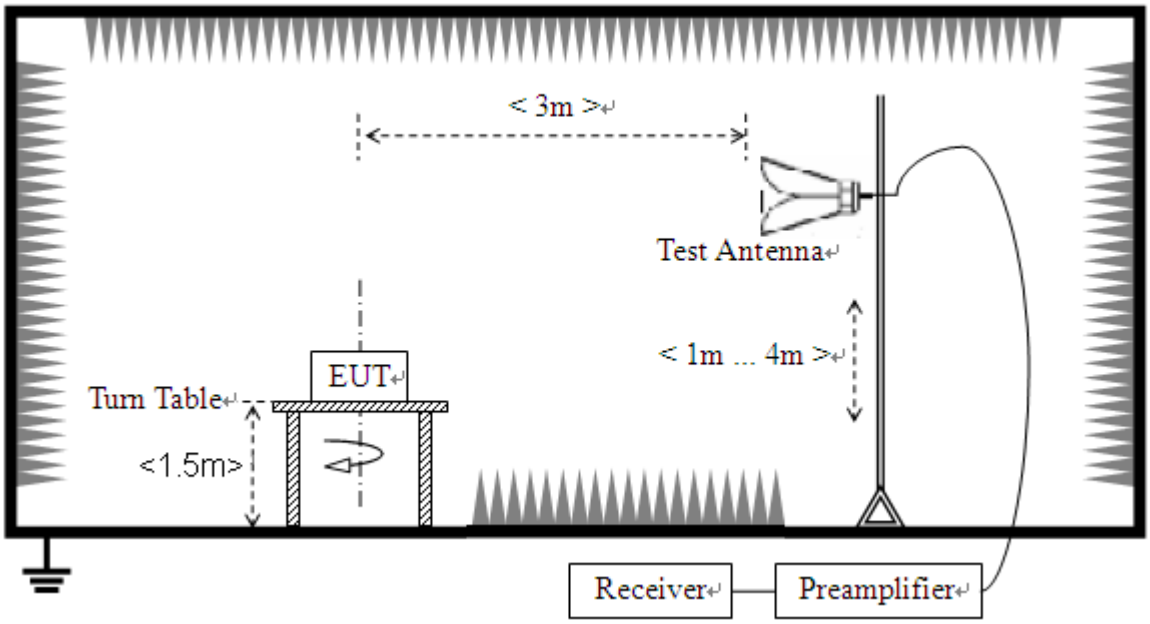
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz. Test site have a minimum area of the ground plane covered with RF absorbing material as specified in Figure 6 of ANSI C63.4: 2014.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10:2013. For radiated emissions below or equal to 1GHz,The EUT was set-up on insulator 80cm above the Ground Plane,for radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10:2013.

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

(a) 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 1m 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.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant

emissions, with polarization oriented for maximum response. The test antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final test antenna elevation shall be that which maximizes the emissions. The test 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. The emission levels at both horizontal and vertical polarizations should be tested.

2.5.3. Test Result

According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:
$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m

During the test, the total correction Factor A_T and A_{Factor} were built in test software.

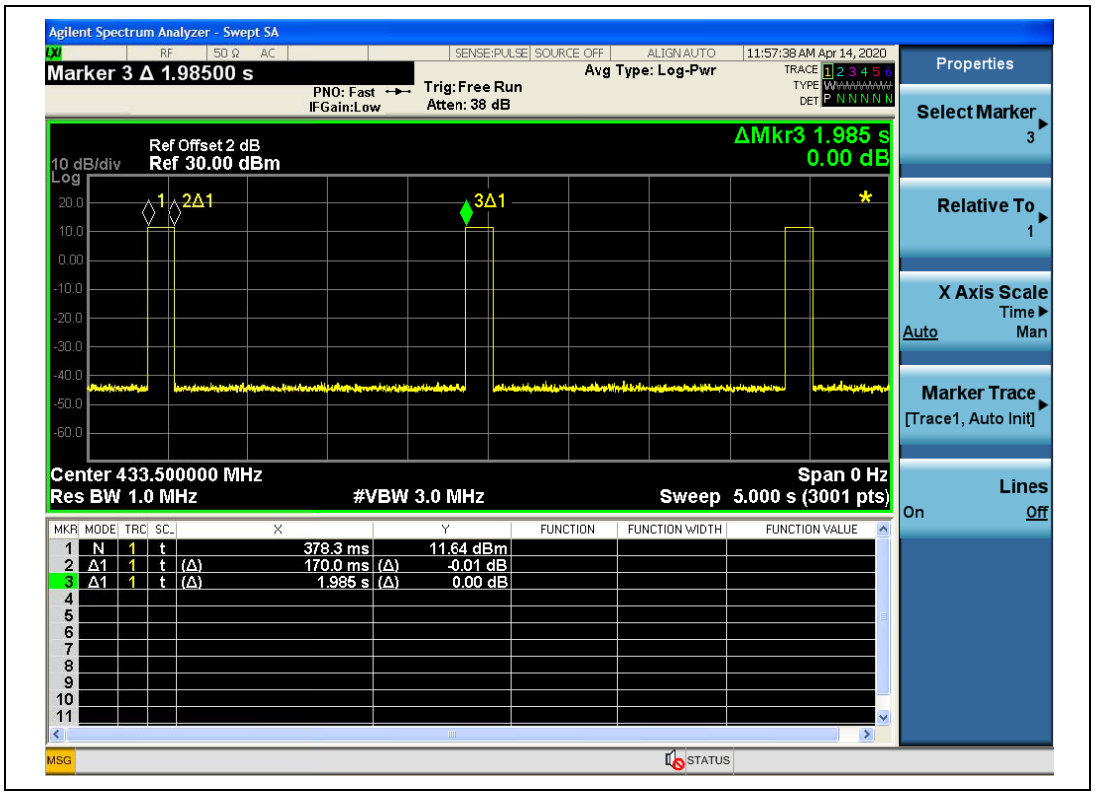
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Note2: For the frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Note3: The duty cycle is simply the on-time divided by the period:

The duration of one cycle:	1985ms
Effective period of the cycle:	170ms
Duty cycle (%):	8.56

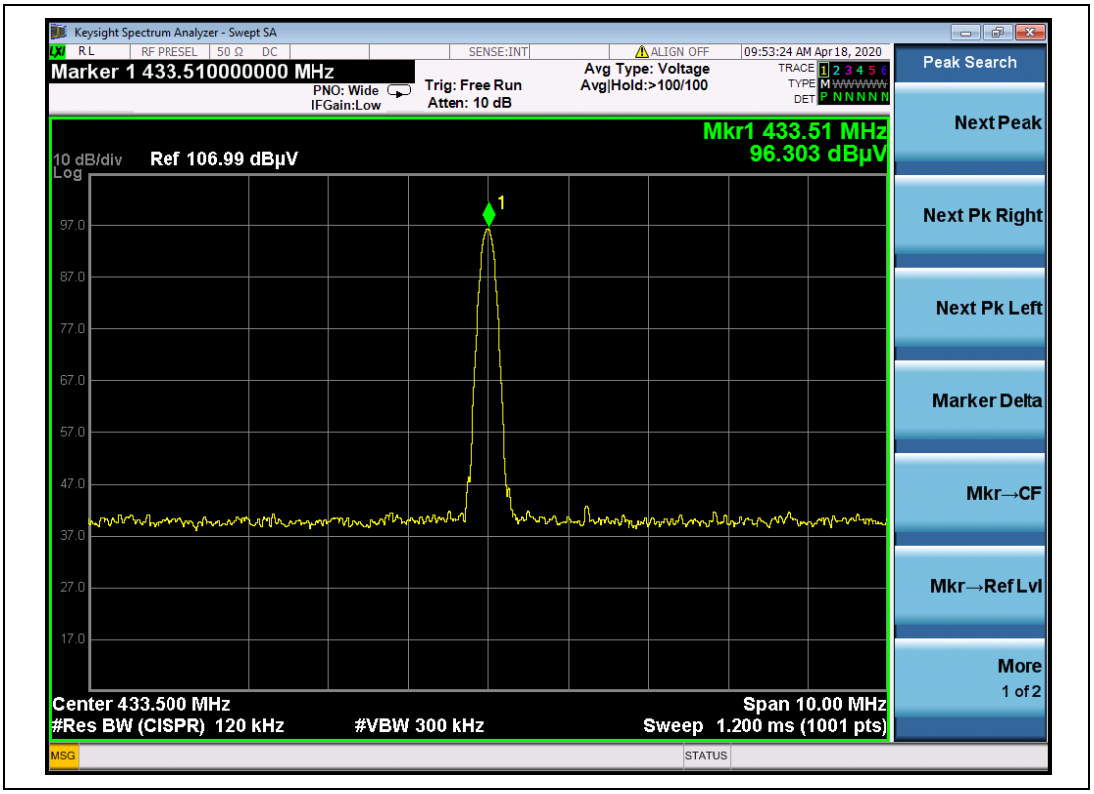
Therefore, the average factor is found by 20log (Duty cycle) =-21.35


Agilent Spectrum Analyzer - Swept SA
Marker 3 Δ 1.98500 s
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 38 dB
Avg Type: Log-Pwr
11:57:38 AM Apr 14, 2020
Ref Offset 2 dB
10 dB/div
Log
Ref 30.00 dBm
ΔMkr3 1.985 s
0.00 dB
Center 433.500000 MHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 5.000 s (3001 pts)
MKR MODE TRC SC X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 t 378.3 ms 11.64 dBm
2 Δ1 1 t (Δ) 170.0 ms (Δ) -0.01 dB
3 Δ1 1 t (Δ) 1.985 s (Δ) 0.00 dB
Properties
Select Marker 3
Relative To 1
X Axis Scale Time
Auto Man
Marker Trace [Trace1, Auto Init]
Lines
On Off
MSG
STATUS

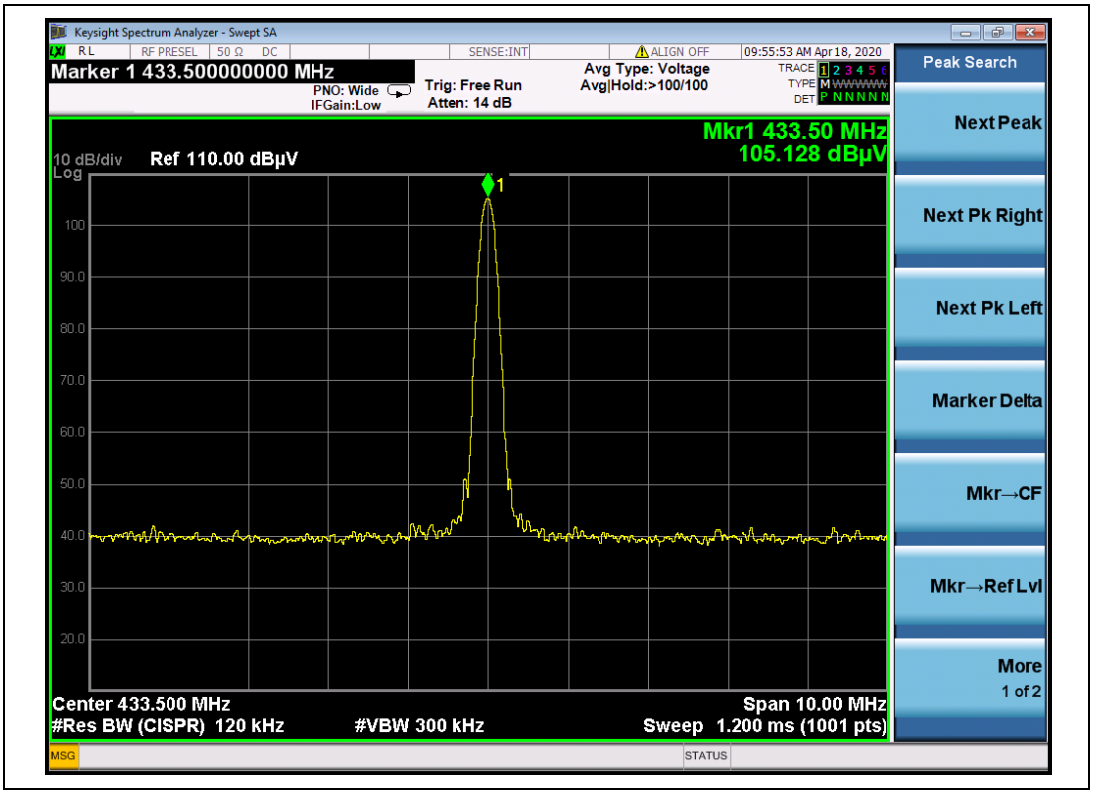
(Duty cycle)

A. Test Results for Field strength of fundamental

Fre. (MHz)	ANT	Receiver Reading U_R (PK) (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Final Emission_PK (dBuV/m)	Limit-PK (dBμV/m)	AV factor (dB)	Final Emission_AV (dBuV/m)	Limit-AV (dBμV/m)	Verdict
433.5	H	96.30	-32.20	16.11	80.21	100.83	-21.35	58.86	80.83	PASS
433.5	V	105.13	-32.20	16.11	89.04	100.83	-21.35	67.69	80.83	PASS

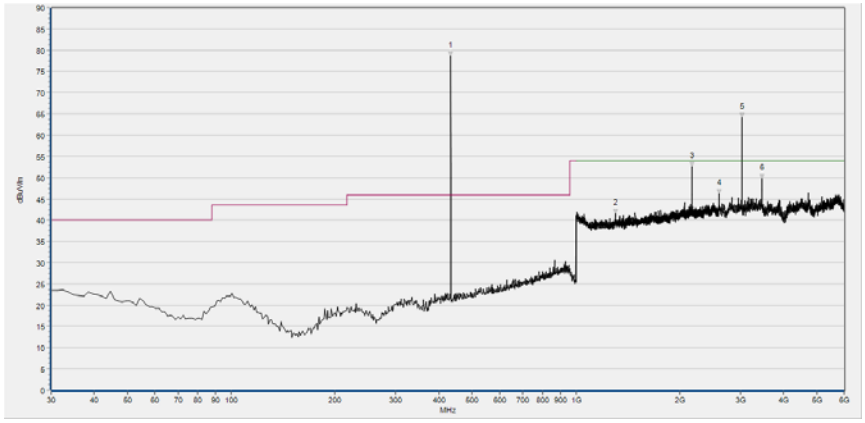


(433.5MHz, Antenna Horizontal)



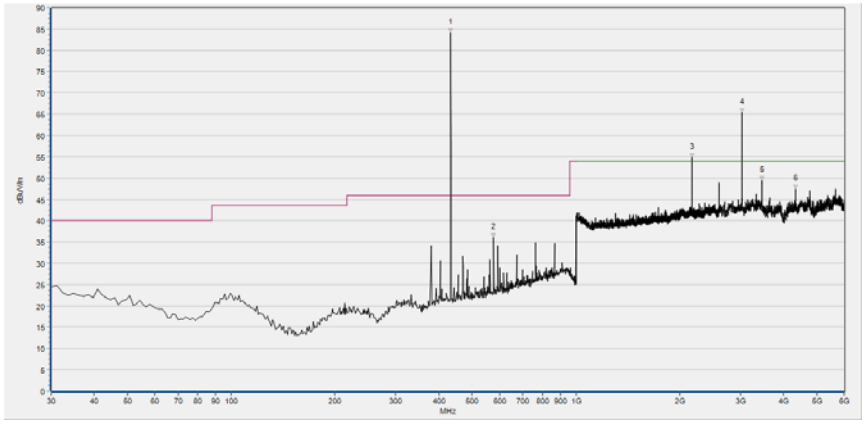
(433.5MHz, Antenna Vertical)

B. Test Results for Radiated emission



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
433.054	78.62	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1300.280	41.63	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2170.900	54.62	N/A	42.33	74.00	N/A	54.00	Horizontal	PASS
2600.000	43.46	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3034.500	64.27	N/A	48.80	74.00	N/A	54.00	Horizontal	PASS
3468.158	49.78	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(433.5MHz, Antenna Horizontal, 30MHz to 5GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
433.054	84.09	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
576.308	36.06	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2172.300	54.90	N/A	42.43	74.00	N/A	54.00	Vertical	PASS
3034.500	65.33	N/A	48.75	74.00	N/A	54.00	Vertical	PASS
3465.357	49.39	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4336.316	47.47	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(433.5MHz, Antenna Vertical, 30MHz to 5GHz)

Annex A Test Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Test items	Uncertainty
20dB Bandwidth	±5%
Transmission time	±5%
Radiated Emission	±2.95dB

This uncertainty represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.

4. Test Equipments Utilized

4.1 Conducted Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2020.04.01	2021.03.31
RF cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
Coaxial cable	CB02	RF02	Morlab	N/A	N/A
SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A
USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2020.04.01	2021.03.31
Computer	T430i	Think Pad	Lenovo	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2019.04.09	2020.04.08
LISN	812744	NSLK 8127	Schwarzbeck	2019.03.27	2020.03.26
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2019.03.27	2020.03.26
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A
Adapter	KX1749000012	FC22	KUNXIN	N/A	N/A

4.3 List of Software Used

Description	Manufacturer	Software Version
Test system	Tonscend	V2.6
Power Panel	Agilent	V3.8
MORLAB EMCR V1.2	MORLAB	V1.0

4.4 Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal.Due
Receiver	MY54130016	N9038A	Agilent	2019.07.29	2020.07.28
Test Antenna - Bi-Log	9163-520	VULB 9163	Schwarzbeck	2019.05.24	2022.05.23
Test Antenna - Loop	1520-022	FMZB1520	Schwarzbeck	2019.02.14	2022.02.13
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2019.05.24	2022.05.23
Test Antenna – Horn	BBHA9170 #774	BBHA9170	Schwarzbeck	2019.05.24	2022.05.23
Coaxial cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
Coaxial cable(N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
Anechoic Chamber	N/A	9m*6m*6m	CRT	2020.01.06	2023.01.05

END OF REPORT