TEST REPORT

APPLICANT	:	Shenzhen lingchengxin Electronics Co., Ltd
PRODUCT NAME	:	Wireless Module
MODEL NAME	:	Ling-T3A
BRAND NAME	:	fengniaorf
FCC ID	:	2A3VI-LING-T3A
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2021-11-19
TEST DATE	:	2021-11-25 to 2021-12-03
ISSUE DATE	:	2021-12-16

Edited by: Zeng Xiaoying (Rapporteur)

Approved by: Shen Junsheng (Supervisor)

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Change History		
Version	Date	Reason for change
1.0	2021-12-16	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Shenzhen lingchengxin Electronics Co., Ltd
Applicant Address:	515, block D, Huayuan science and Technology Innovation Park, Xixiang street, Bao'an District, Shenzhen, Guangdong
Manufacturer:	Shenzhen lingchengxin Electronics Co., Ltd
ManufacturerAddress:	515, block D, Huayuan science and Technology Innovation Park, Xixiang street, Bao'an District, Shenzhen, Guangdong

1.2. Equipment Under Test (EUT) Description

Product Name:	Wireless Module
Sample No.:	1#, 2#
Hardware Version:	v1.0
Software Version:	v1.0
Operating Frequency:	433.92MHz
Channel Number:	1
Antenna Type:	PCB Antenna
Antenna Gain:	-2.0dBi

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	Nov 26, 2021	Meng Shurui	PASS	No deviation
3	15.231(c)	20dB Bandwidth	Nov 26, 2021	Meng Shurui	PASS	No deviation
4	15.207	Conducted Emission	Nov 25, 2021	Yang Lian	PASS	No deviation
5	15.231(b) 15.209(a)	Radiated Emission	Dec 02&03, 2021	Yin Xiaogang	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.

Note 3: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

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.

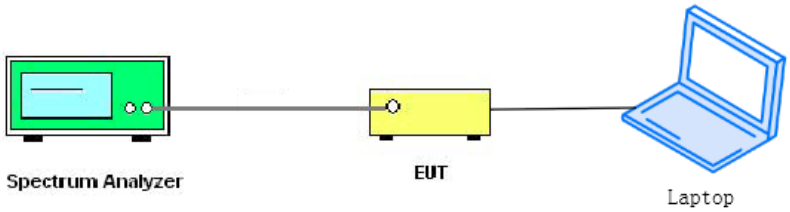
2.2. The Max Transmission Time

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.

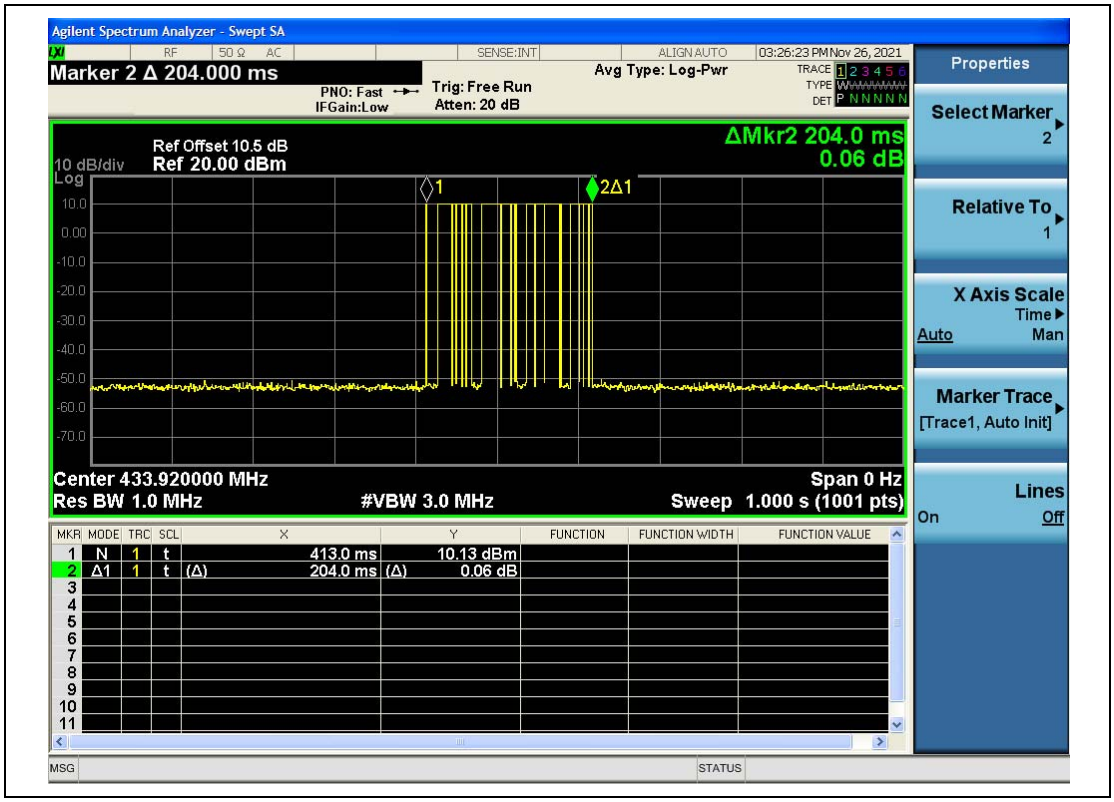
2.2.4. Test Result

The frequency(433.92MHz) 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
433.92	0.204s	≤5s	PASS

B. Test Plot:



(The max transmission time _433.92MHz)

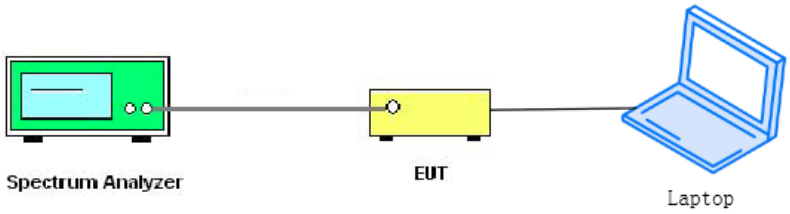
2.3. 20 dB Bandwidth

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 433.92MHz, 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.

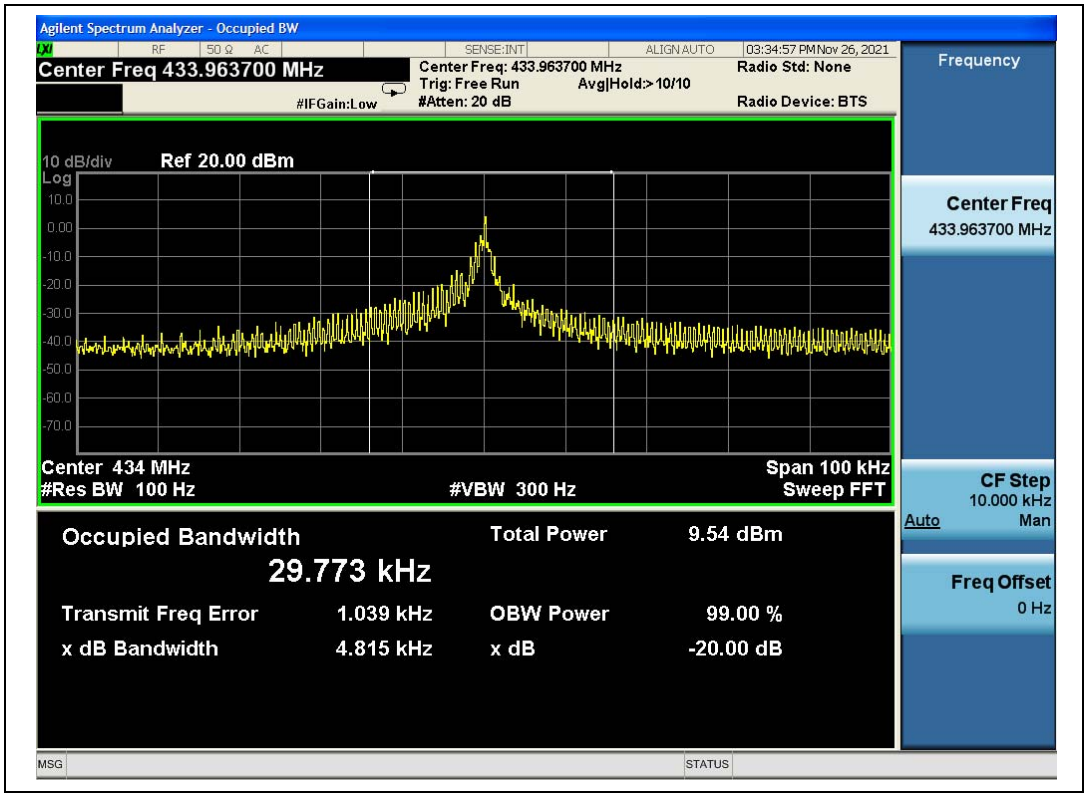
2.3.4. Test Result

The frequency (433.92MHz) 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
433.92	4.815	≤1.085	PASS

B. Test Plot:



(Bandwidth_433.92MHz)

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

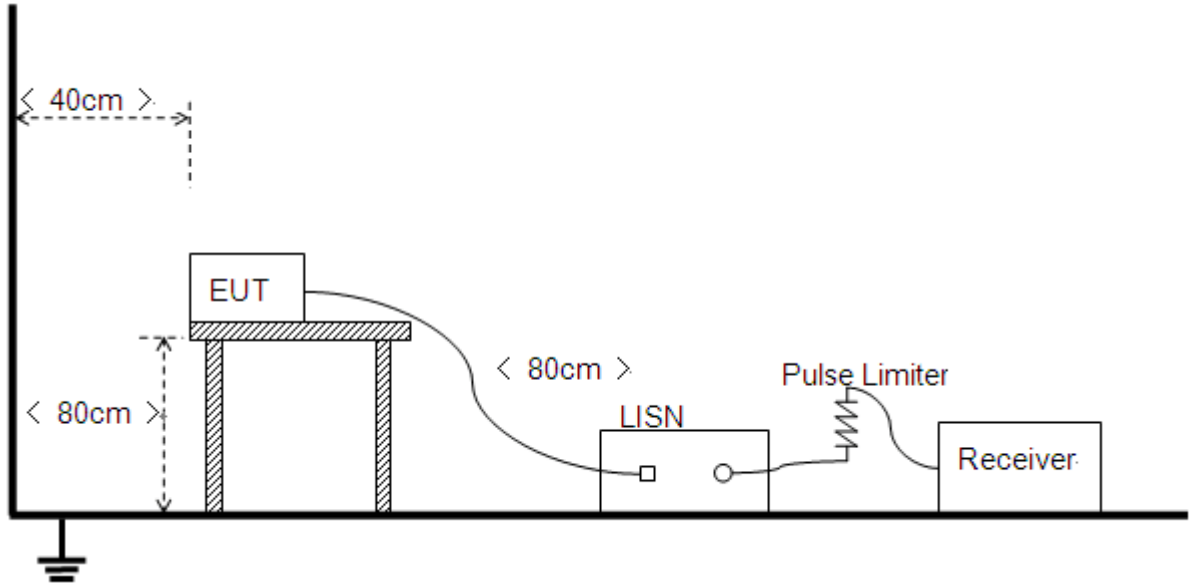
Note:

(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. Set RBW=9kHz, VBW=30kHz. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hzwere 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+DC power supply+433.92MHz TX

Test voltage: AC 120V/60Hz

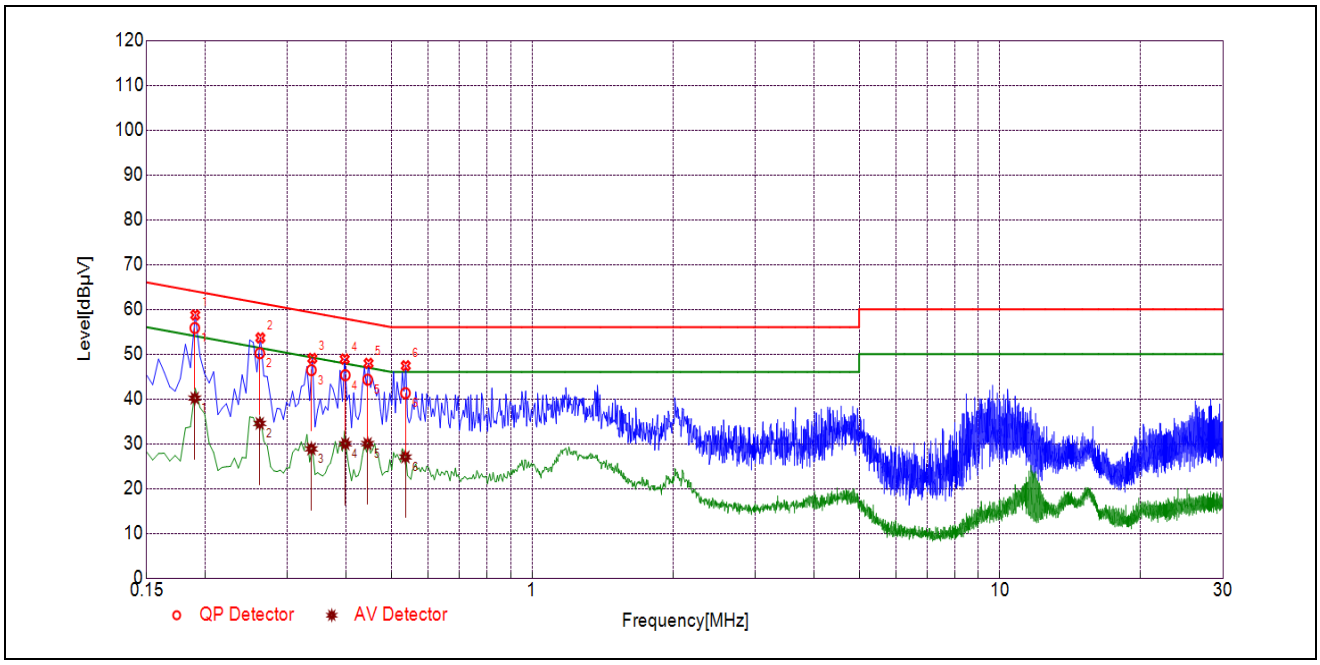
The measurement results are obtained as below:

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

U_R: Receiver Reading

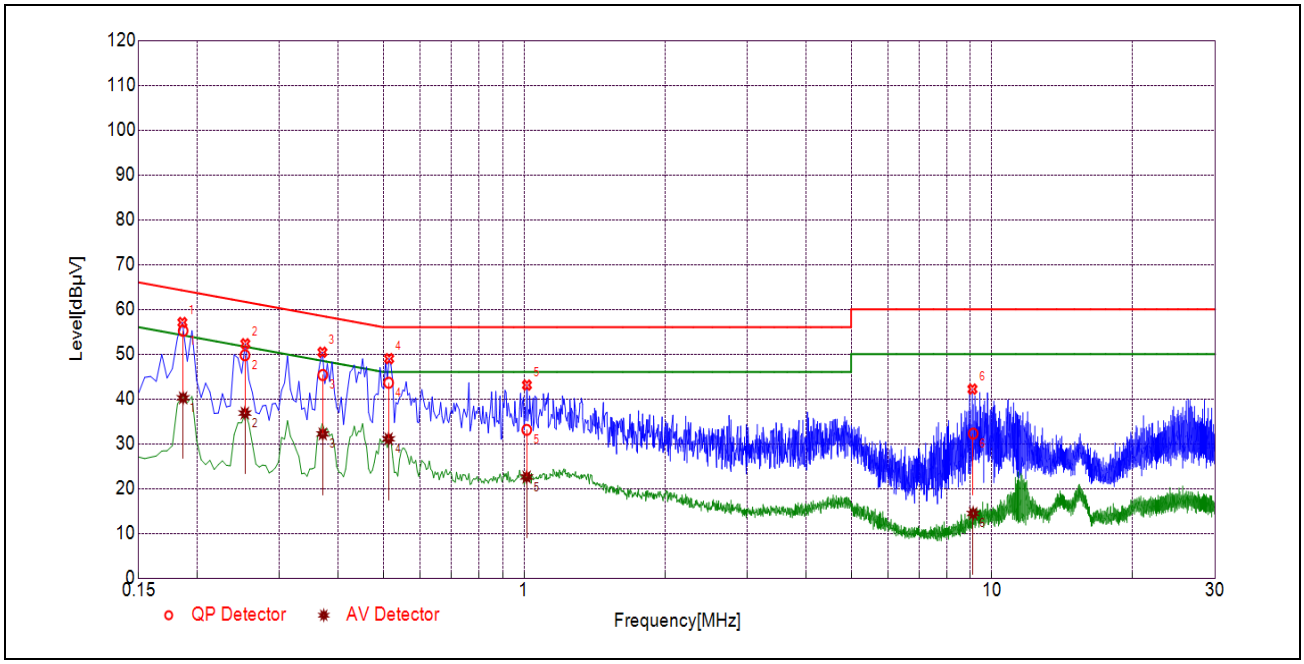
A_{Factor}: Voltage division factor of LISN

B.Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1900	55.82	40.16	64.03	54.03	Line	PASS
2	0.2617	50.18	34.52	61.38	51.38		PASS
3	0.3374	46.40	28.84	59.27	49.27		PASS
4	0.3987	45.28	29.97	57.88	47.88		PASS
5	0.4450	44.29	30.00	56.97	46.97		PASS
6	0.5360	41.28	27.03	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	0.1866	55.20	40.22	64.19	54.19	Neutral	PASS
2	0.2530	49.75	36.82	61.66	51.66		PASS
3	0.3711	45.32	32.17	58.48	48.48		PASS
4	0.5132	43.60	31.07	56.00	46.00		PASS
5	1.0126	33.08	22.56	56.00	46.00		PASS
6	9.1188	32.24	14.42	60.00	50.00		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

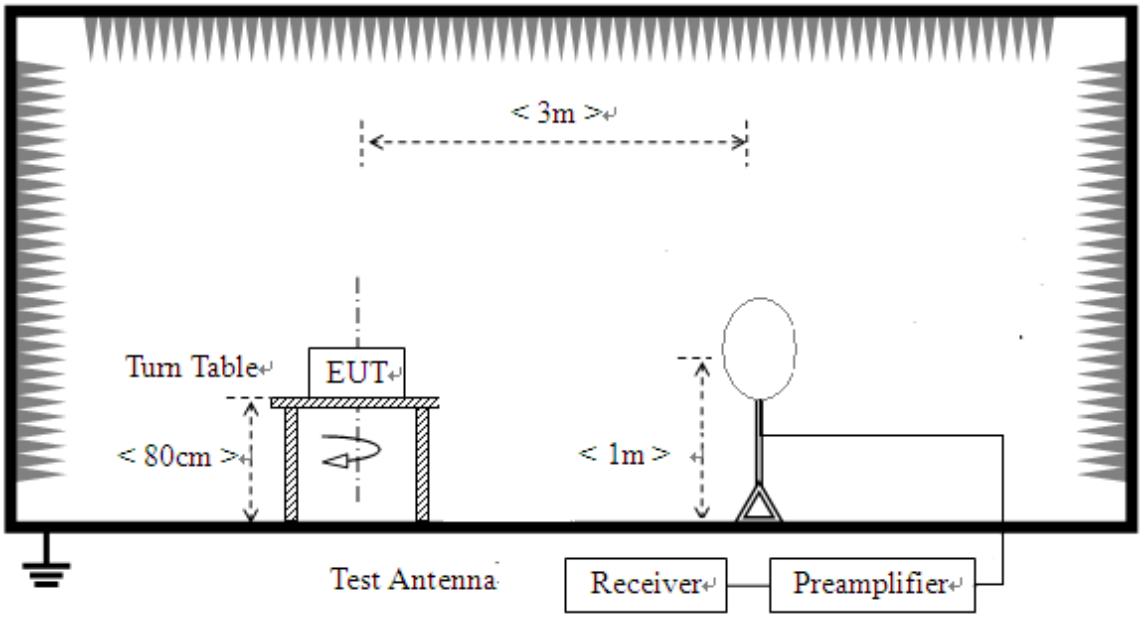
Note 1: For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
Note 2: For above 1000MHz, limit field 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).

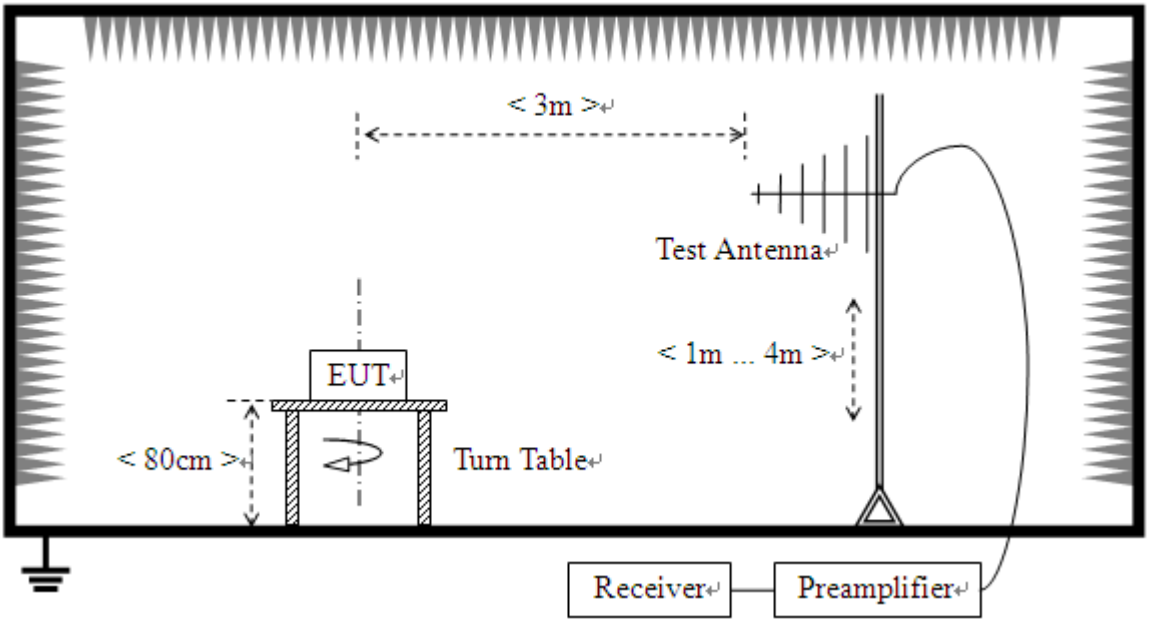
2.5.2. Test Description

Test Setup:

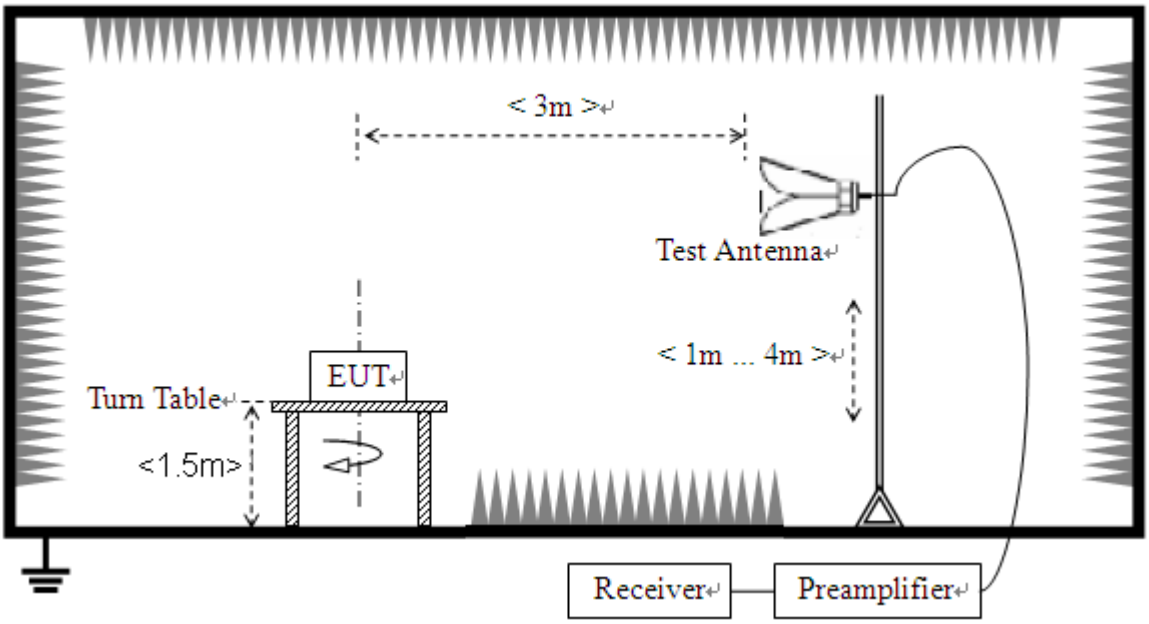
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz.The antenna to EUT distance is 3meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 30MHz, the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9kHz-90 kHz, 110kHz-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

For measurements below 1GHz the resolution bandwidth is set to 100kHz for peak detection measurements or 120kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1GHz the resolution bandwidth is set to 1MHz, the video band width is set to 3MHz for peak measurements and as applicable for average measurements.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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 (or average) limit, it is unnecessary to perform an quasi-peak measurement (or average).

The measurement results are obtained as below:

E [dBμV/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.

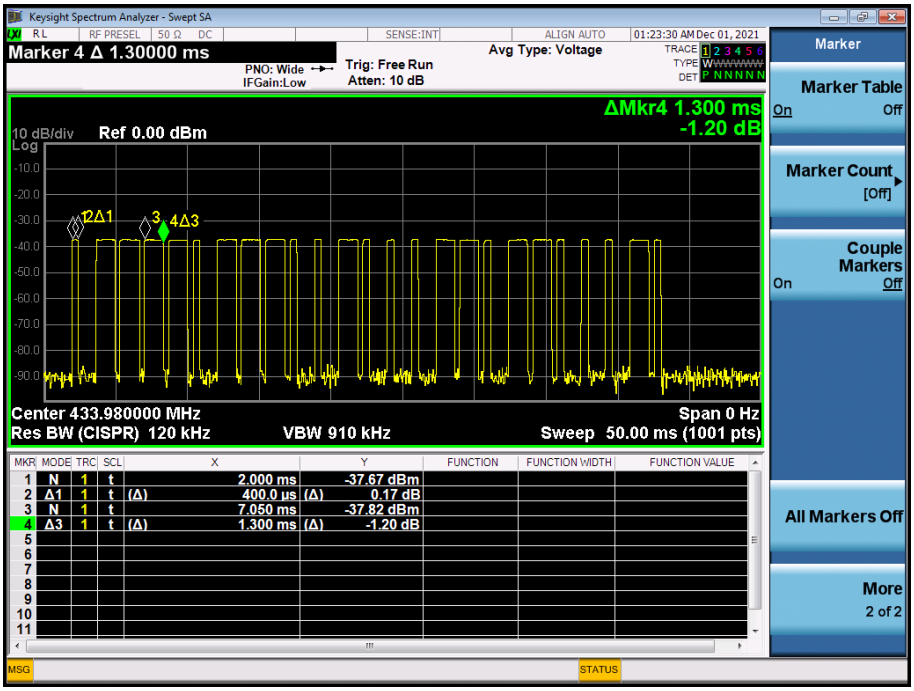
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

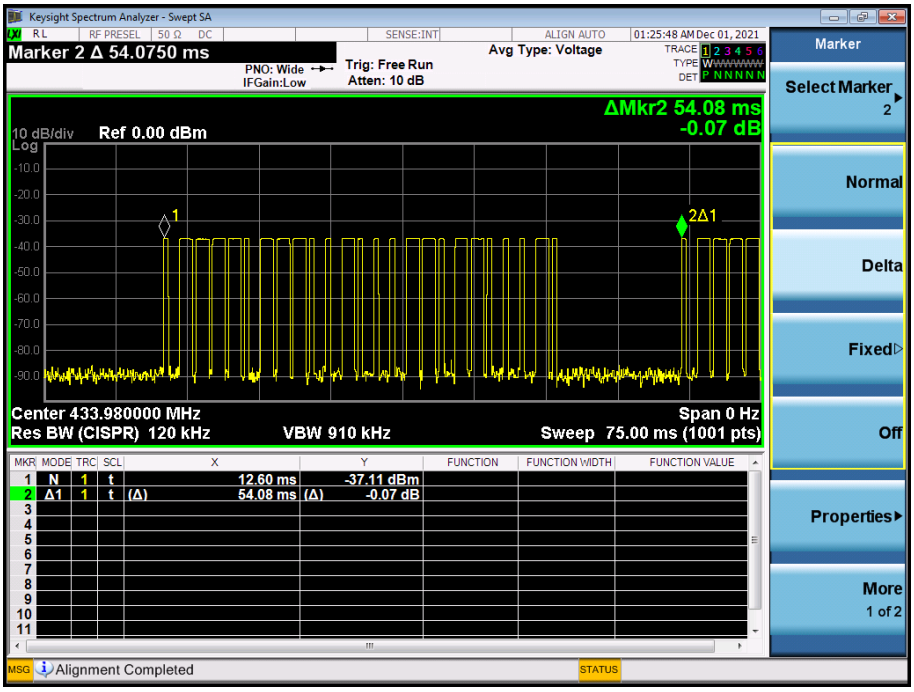
Note2: For the frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

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

The duration of one cycle:	21.70ms
Effective period of the cycle:	54.08ms
Duty cycle (%):	40.13

Therefore, the average factor is found by 20log(Duty cycle)=-7.93



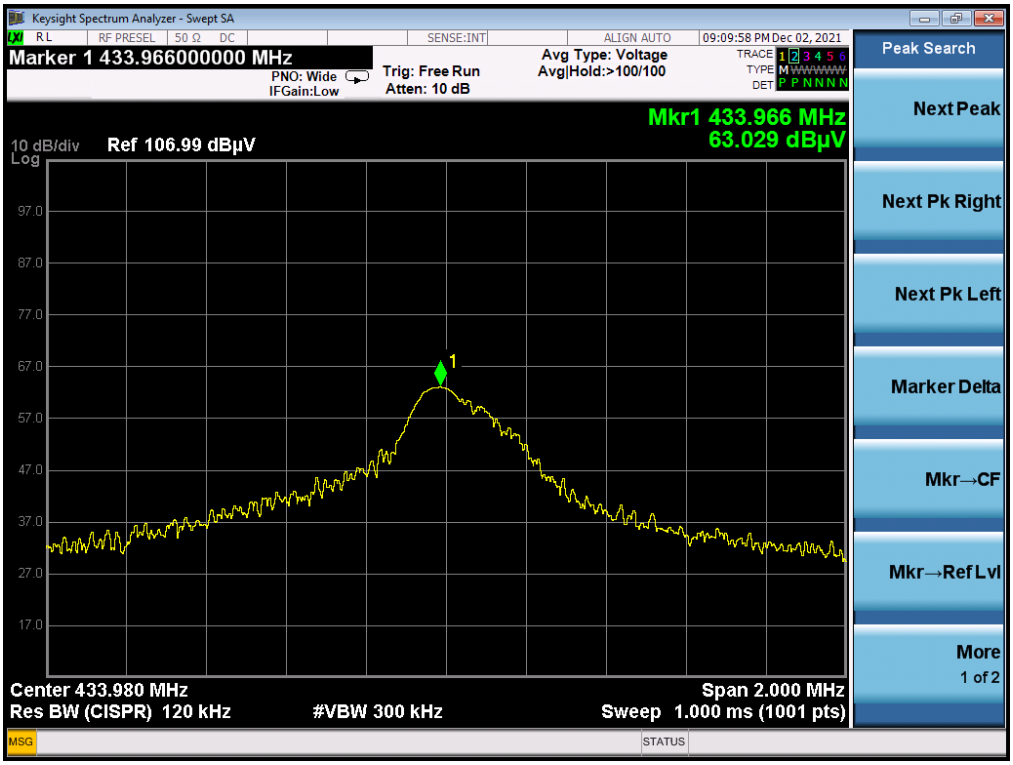


(Duty cycle)

A. 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
433.92	H	63.03	6.42	15.6	85.05	100.83	-7.93	77.12	80.83	PASS
433.92	V	63.01	6.42	15.6	85.03	100.83	-7.93	77.10	80.83	PASS

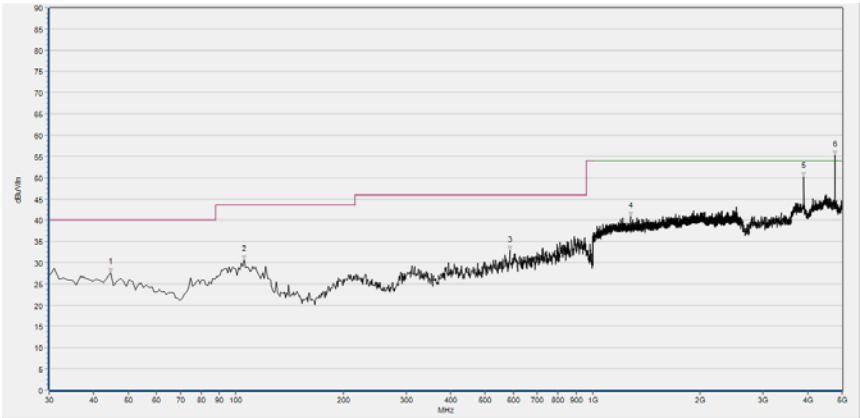
Test Plot:



(433.92MHz, Antenna Horizontal)

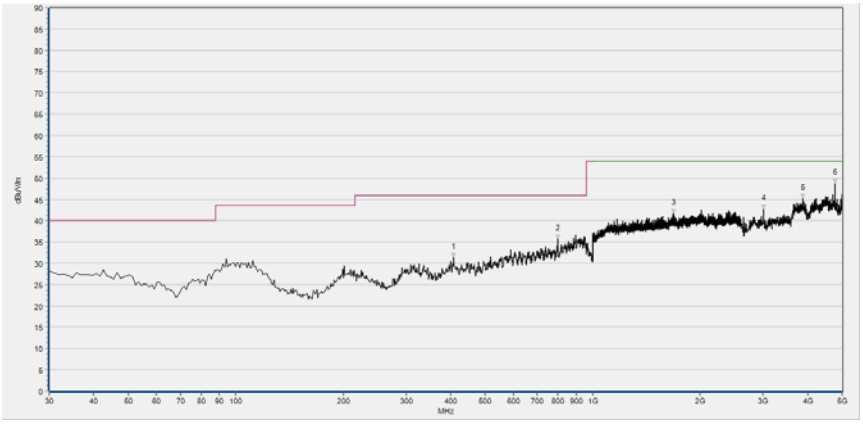
(433.92MHz, Antenna Vertical)

B. 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
44.550	27.63	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
105.660	30.63	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
585.810	32.80	N/A	N/A	N/A	46.00	54.00	Horizontal	PASS
1275.200	40.85	N/A	N/A	N/A	N/A	54.00	Horizontal	PASS
3905.920	50.30	N/A	41.34	N/A	N/A	54.00	Horizontal	PASS
4774.480	55.39	N/A	46.47	N/A	N/A	54.00	Horizontal	PASS

(433.92MHz, 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
408.300	31.36	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
799.210	35.71	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1681.600	41.71	N/A	N/A	N/A	N/A	54.00	Vertical	PASS
3012.720	42.72	N/A	N/A	N/A	N/A	54.00	Vertical	PASS
3881.280	45.22	N/A	N/A	N/A	N/A	54.00	Vertical	PASS
4774.480	48.83	N/A	N/A	N/A	N/A	54.00	Vertical	PASS

(433.92MHz, 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
20 dB 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.
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.
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	Due Date
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2021.03.25	2022.03.24
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	MY54180008	U2021XA	Agilent	2021.10.21	2022.10.20

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY56400093	N9038A	KEYSIGHT	2021.03.09	2022.03.08
LISN	812744	NSLK 8127	Schwarzbeck	2021.03.09	2022.03.08
Pulse Limiter (10dB)	VTSD 9561 F-B #206	VTSD 9561-F	Schwarzbeck	2021.07.21	2022.07.20
Coaxial Cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A
DC POWER SUPPLY	098977302	3005A	VICTOR	N/A	N/A

4.3 List of Software Used

Description	Manufacturer	Software Version
Test System	Townsend	V2.5.77.0418
MORLAB EMCR V1.2	MORLAB	V1.0
TS+ -[JS32-CE]	Tonscend	V2.5.0.0

4.4Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY54130016	N9038A	Agilent	2021.07.16	2022.07.15
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2019.05.24	2022.05.23
Test Antenna - Loop	1519-022	FMZB 1519	Schwarzbeck	2019.02.14	2022.02.13
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2019.07.26	2022.07.25
Test Antenna – Horn	BBHA9170 #774	BBHA9170	Schwarzbeck	2019.07.26	2022.07.25
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	61171/61172	S020180L3203	Tonscend	2021.07.16	2022.07.15
Anechoic Chamber	N/A	9m*6m*6m	CRT	2020.01.06	2023.01.05

END OF REPORT