

FCC Test Report

Applicant : Shenzhen Thingsend Communication Technology Co.,Ltd

Address : Room 701,Building 2, Zhuguang Innovation Park,Zhuguang Road,Nanshan District, Shenzhen, China

Product Name : Wireless module

Report Date : Aug. 17, 2023

Shenzhen Anbotek Compliance Laboratory Limited



Contents

1. General Information	5
1.1. Client Information	5
1.2. Description of Device (EUT)	5
1.3. Auxiliary Equipment Used During Test	6
1.4. Description of Test Configuration	6
1.5. Description of Test Setup	7
1.6. Test Equipment List	8
1.7. Measurement Uncertainty	9
1.8. Description of Test Facility	9
2. Summary of Test Results	10
3. Conducted Emission Test	11
3.1. Test Standard and Limit	11
3.2. Test Setup	11
3.3. Test Procedure	11
3.4. Test Data	11
4. Field Strength of Fundamental and Spurious Emission	14
4.1. Test Standard and Limit	14
4.2. Test Setup	15
4.3. Test Procedure	16
4.4. Test Data	16
5. 20dB Occupy Bandwidth Test	21
5.1. Test Standard and Limit	21
5.2. Test Setup	21
5.3. Test Procedure	21
5.4. Test Data	21
6. Dwell Time Test	23
6.1. Test Standard and Limit	23
6.2. Test Setup	23
6.3. Test Procedure	23
6.4. Test Data	23
7. Antenna Requirement	25
7.1. Test Standard and Requirement	25
7.2. Antenna Connected Construction	25
APPENDIX I -- TEST SETUP PHOTOGRAPH	26
APPENDIX II -- EXTERNAL PHOTOGRAPH	26
APPENDIX III -- INTERNAL PHOTOGRAPH	26



TEST REPORT

Applicant : Shenzhen Thingsend Communication Technology Co.,Ltd

Manufacturer : Shenzhen Thingsend Communication Technology Co.,Ltd

Product Name : Wireless module

Test Model No. : XZ-DT

Reference Model No. : XZ

Trade Mark : XZ

Rating(s) : Input: 3.0~5.0V= 40mA

Test Standard(s) : FCC Part15 Subpart C, Section 15.231

Test Method(s) : ANSI C63.10: 2020

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Receipt

Jul. 27, 2023

Date of Test

Jul. 27~Aug. 08, 2023

Prepared by

Tu Tu Hong

(TuTu Hong)

Approved & Authorized Signer

Edward Pan

(Edward Pan)



Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Aug. 17, 2023



1. General Information

1.1. Client Information

Applicant	:	Shenzhen Thingsend Communication Technology Co.,Ltd
Address	:	Room 701,Building 2, Zhuguang Innovation Park,Zhuguang Road,Nanshan District, Shenzhen, China
Manufacturer	:	Shenzhen Thingsend Communication Technology Co.,Ltd
Address	:	Room 701,Building 2, Zhuguang Innovation Park,Zhuguang Road,Nanshan District, Shenzhen, China
Factory	:	Shenzhen Thingsend Communication Technology Co.,Ltd
Address	:	Room 701,Building 2, Zhuguang Innovation Park,Zhuguang Road,Nanshan District, Shenzhen, China

1.2. Description of Device (EUT)

Product Name	:	Wireless module
Test Model No.	:	XZ-DT
Reference Model No.	:	XZ (Note: All samples are the same except the model number, so we prepare "XZ-DT" for test only.)
Trade Mark	:	XZ
Test Power Supply	:	DC 5V
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	N/A
RF Specification		
Operation Frequency	:	424.530MHz
Number of Channel	:	1 Channel
Modulation Type	:	FSK
Antenna Type	:	Monopole antenna
Antenna Gain(Peak)	:	-3.96 dBi
Remark: 1)For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual. 2)The rated voltage of the product is DC 3~5V, only DC5V is selected for testing.		



1.3. Auxiliary Equipment Used During Test

Description	Rating(s)
/	/

1.4. Description of Test Configuration

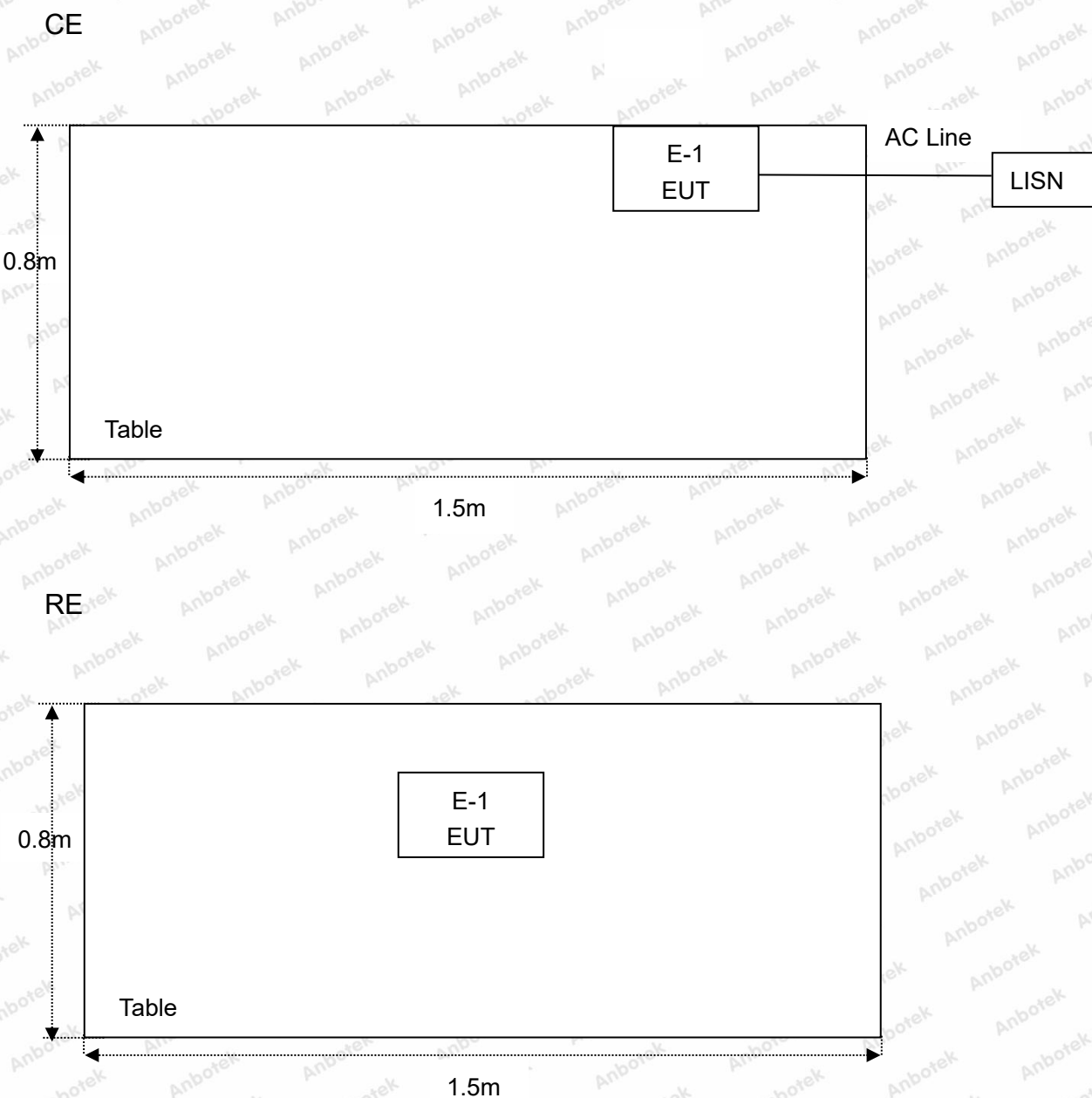
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	424.530								

Note:

1. During the test, the EUT was keeping continuous transmission.



1.5. Description of Test Setup



1.6. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Oct. 23, 2022	1 Year
2.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040DT001	Jul. 05, 2023	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 13, 2022	1 Year
4.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 23, 2022	1 Year
5.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Oct. 22, 2022	1 Year
6.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 13, 2022	1 Year
7.	EMI Preamplifier	SKET Electronic	LNPA-0118G -45	SKET-PA-002	Oct. 13, 2022	1 Year
8.	Double Ridged Horn Antenna	SCHWARZBECK	BBHA 9120D	02555	Oct. 16, 2022	3 Year
9.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	345	Oct. 23, 2022	3 Year
10.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 23, 2022	1 Year
11.	Horn Antenna	A-INFO	LB-180400- KF	J211060628	Oct. 23, 2022	1 Year
12.	Pre-amplifier	SONOMA	310N	186860	Oct. 23, 2022	1 Year
13.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
14.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 13, 2022	1 Year
15.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 13, 2022	1 Year
16.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 13, 2022	1 Year
17.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 22, 2022	1 Year
18.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80 B	N/A	Oct. 19, 2022	1 Year
19.	Power Meter	Agilent	N1914A	MY50001102	Oct.26, 2022	1 Year



1.7. Measurement Uncertainty

Parameter	Uncertainty
Conducted emissions (AMN 150kHz~30MHz)	3.8dB
Occupied Bandwidth	925Hz
Conducted Output Power	0.76dB
Conducted Spurious Emission	1.24dB
Radiated spurious emissions (30MHz~1GHz)	Horizontal: 3.92dB; Vertical: 4.52dB
Radiated spurious emissions (above 1GHz)	1G-6GHz: 4.78dB; 6G-18GHz: 4.88dB
This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

1.8. Description of Test Facility

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

FCC-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111.

ISED-Registration No.: 8058A

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

Test Location

Shenzhen Anbotek Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102



2. Summary of Test Results

Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.205/15.209/15.231(b)	Radiated emission, Spurious Emission and Field Strength of Fundamental	PASS
15.231(c)	20dB Occupied Bandwidth	PASS
15.231(a)	Dwell time	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		



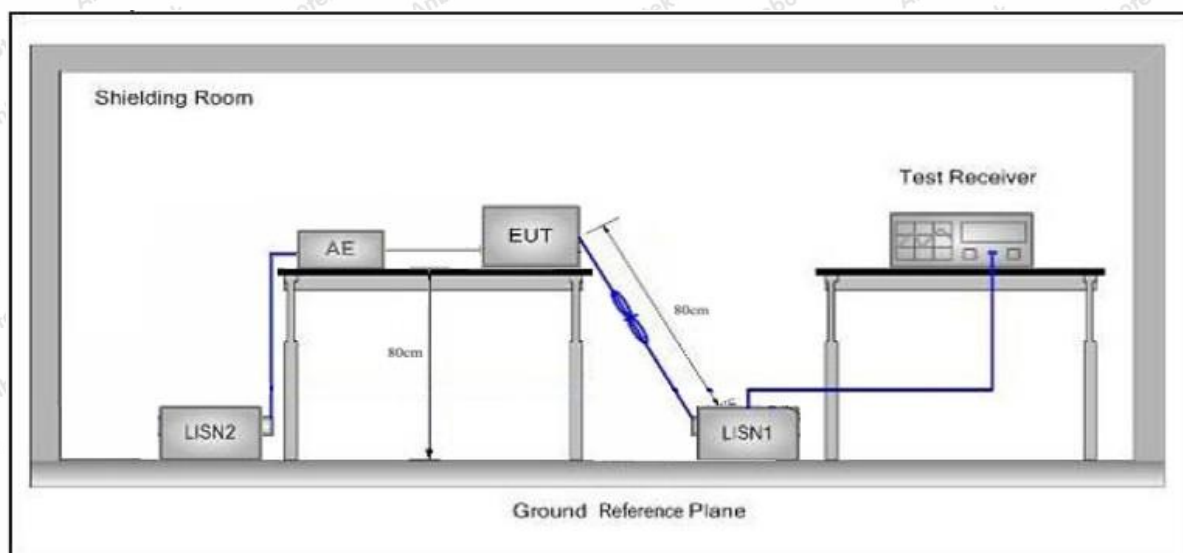
3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50

Remark: (1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequency.

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10: 2020 on Conducted Emission Measurement.

The bandwidth of test CAR REMOTE (ESCI) set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

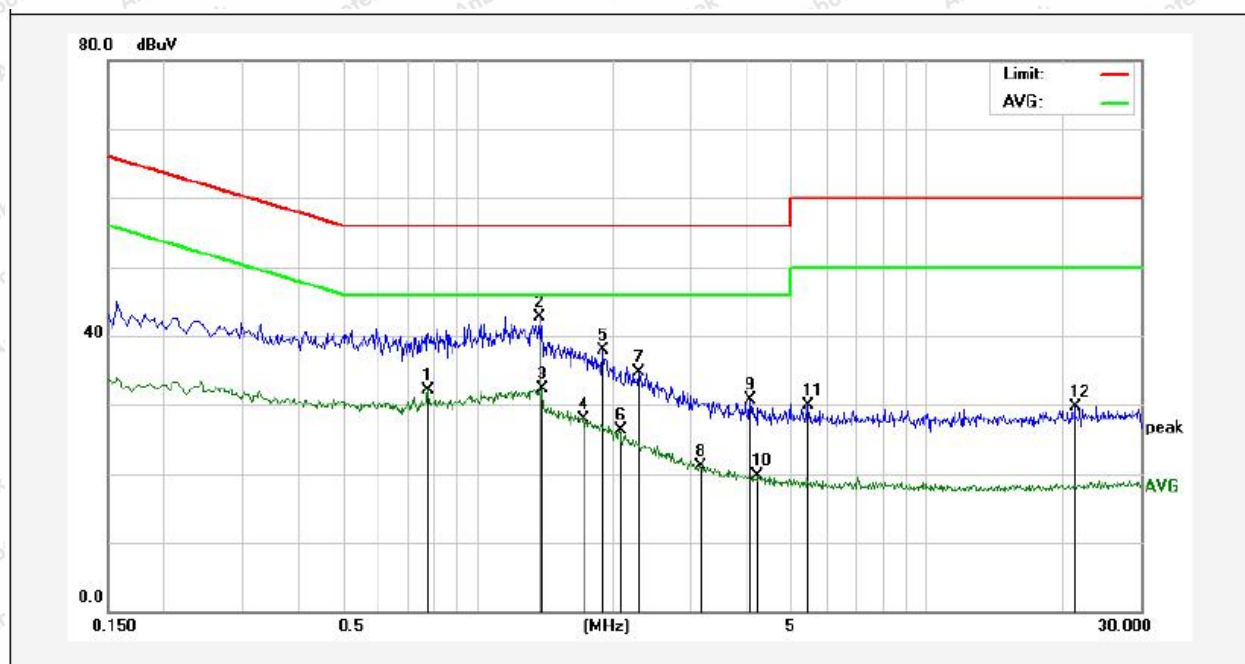
AC conducted emission pre-test at both at AC 120V/60Hz and AC 240V/60Hz modes, recorded worst case AC 120V/60Hz.

Please to see the following pages.



Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: 424.530MHz
Test Specification: DC 5V
Comment: Live Line
Temp.(°C)/Hum.(%RH): 22.1°C/52%RH

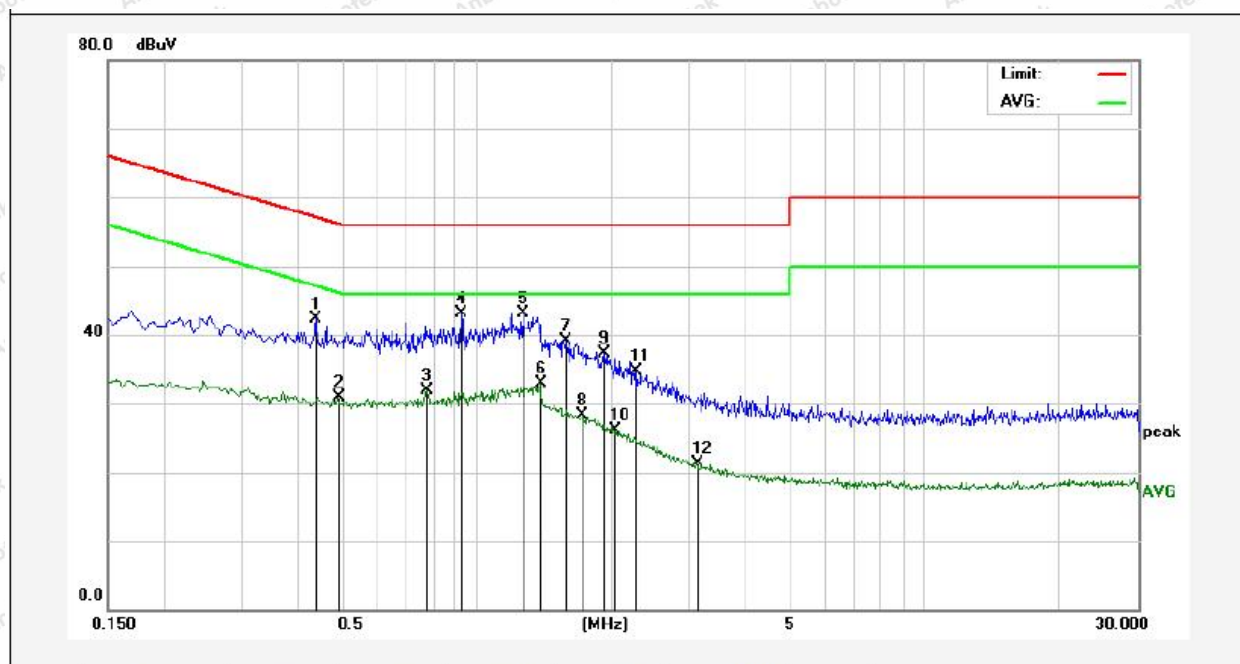


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.7780	12.14	19.87	32.01	46.00	-13.99	AVG	
2	1.3740	22.85	19.86	42.71	56.00	-13.29	QP	
3	1.3940	12.53	19.86	32.39	46.00	-13.61	AVG	
4	1.7300	8.08	19.85	27.93	46.00	-18.07	AVG	
5	1.9060	18.09	19.85	37.94	56.00	-18.06	QP	
6	2.0740	6.41	19.85	26.26	46.00	-19.74	AVG	
7	2.2940	14.84	19.85	34.69	56.00	-21.31	QP	
8	3.1380	1.18	19.85	21.03	46.00	-24.97	AVG	
9	4.0620	10.89	19.85	30.74	56.00	-25.26	QP	
10	4.2060	-0.21	19.85	19.64	46.00	-26.36	AVG	
11	5.4660	9.95	19.87	29.82	60.00	-30.18	QP	
12	21.3779	9.36	20.34	29.70	60.00	-30.30	QP	



Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: 424.530MHz
Test Specification: DC 5V
Comment: Neutral Line
Temp.(°C)/Hum.(%RH): 22.1°C/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.4380	22.47	19.83	42.30	57.10	-14.80	QP	
2	0.4900	11.11	19.86	30.97	46.17	-15.20	AVG	
3	0.7780	12.03	19.87	31.90	46.00	-14.10	AVG	
4	0.9260	23.33	19.86	43.19	56.00	-12.81	QP	
5	1.2700	23.16	19.86	43.02	56.00	-12.98	QP	
6	1.3940	13.03	19.86	32.89	46.00	-13.11	AVG	
7	1.5859	19.16	19.85	39.01	56.00	-16.99	QP	
8	1.7260	8.41	19.85	28.26	46.00	-17.74	AVG	
9	1.9300	17.38	19.85	37.23	56.00	-18.77	QP	
10	2.0380	6.27	19.85	26.12	46.00	-19.88	AVG	
11	2.2820	14.91	19.85	34.76	56.00	-21.24	QP	
12	3.0940	1.44	19.85	21.29	46.00	-24.71	AVG	



4. Field Strength of Fundamental and Spurious Emission

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209, 15.205 and 15.231(b)				
Test Limit	Frequency (MHz)	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~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3
Remark: (1)The lower limit shall apply at the transition frequency. (2) 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.					

the formulas for calculating the maximum permitted fundamental field strengths are as follows:

for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$.

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level Emission Level (dBuV/m)=20log Emission Level($\mu\text{V/m}$)

The field strength of emission limits have been calculated in below table:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBuV/m)@3m
424.530	80.82 (AVG)
424.530	100.82 (Peak)



4.2. Test Setup

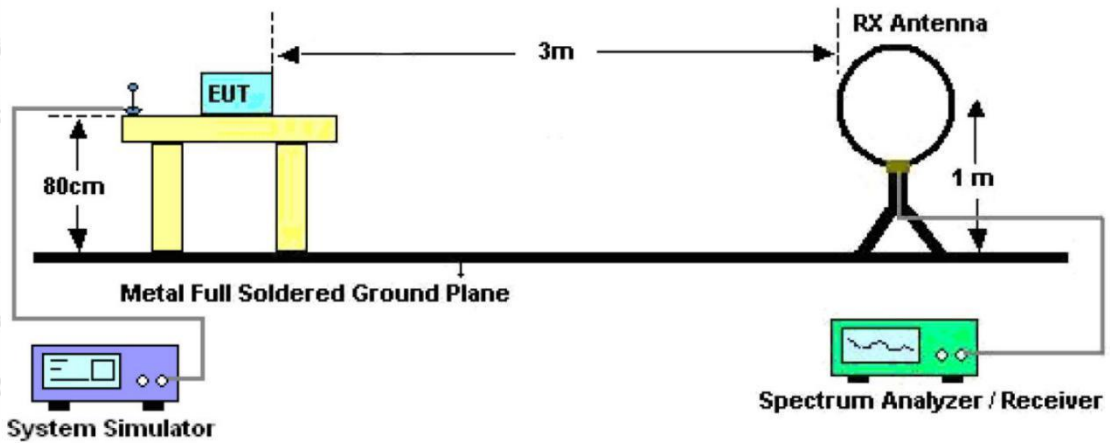


Figure 1. Below 30MHz

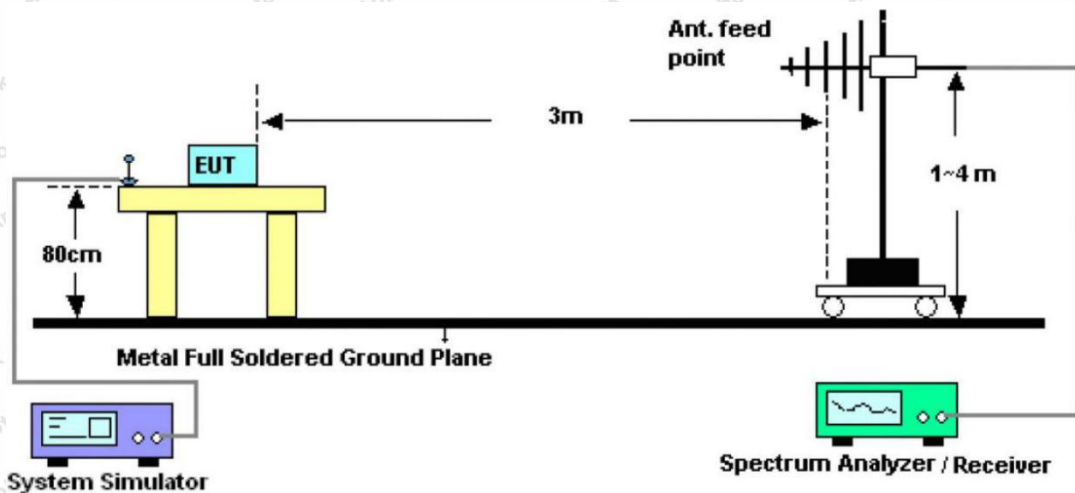


Figure 2. 30MHz to 1GHz

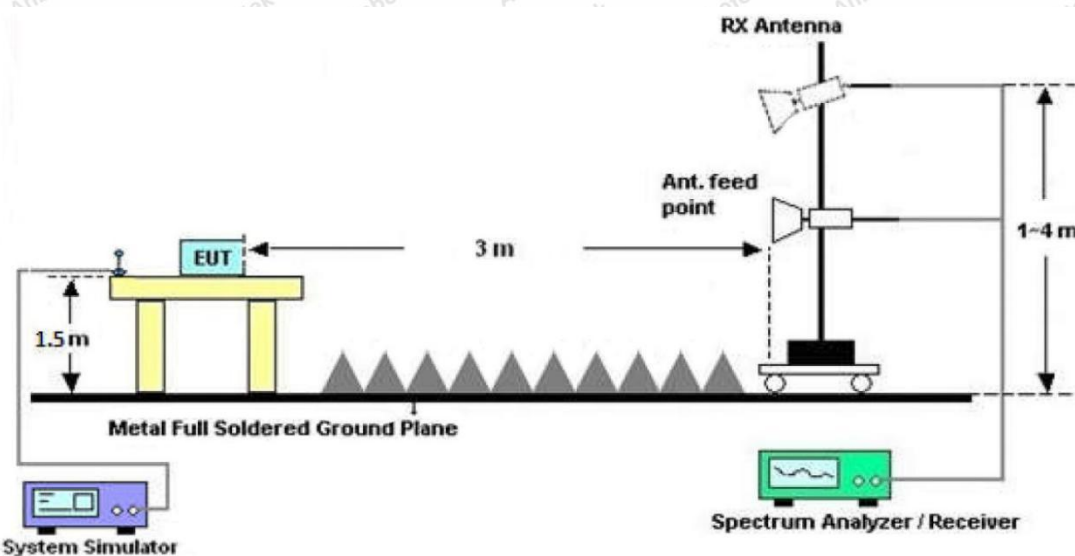


Figure 3. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9KHz, VBW =30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:

RBW = 100kHz, VBW =300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz, Set the spectrum analyzer as:

RBW =1MHz, VBW =1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

RBW =1MHz, VBW =10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

4.4. Test Data

PASS

During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

The test results of 9kHz-30MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.



Test Results (30~1000MHz)

Test Mode: 424.530MHz
Power Source: DC 5V
Polarization: Horizontal
Temp.(°C)/Hum.(%RH): 24.4°C/47%RH
Fundamental



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	43.8119	40.83	-15.40	25.43	40.00	-14.57	QP			
2	63.7588	51.19	-18.87	32.32	40.00	-7.68	QP			
3	98.4865	50.01	-21.40	28.61	43.50	-14.89	QP			
4	121.9754	54.67	-23.66	31.01	43.50	-12.49	QP			
5	226.8935	49.44	-21.88	27.56	46.00	-18.44	QP			
6	425.0280	91.33	-15.81	75.52	/	/	peak			



Test Results (30~1000MHz)

Test Mode: 424.530MHz
Power Source: DC 5V
Polarization: Vertical
Temp.(°C)/Hum.(%RH): 24.4°C/47%RH
Fundamental



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	45.0583	47.41	-15.06	32.35	40.00	-7.65	QP			
2	62.2128	50.67	-18.30	32.37	40.00	-7.63	QP			
3	90.5374	49.64	-17.54	32.10	43.50	-11.40	QP			
4	104.1701	44.66	-17.24	27.42	43.50	-16.08	QP			
5	150.0107	46.01	-22.09	23.92	43.50	-19.58	QP			
6	425.0280	81.25	-14.06	67.19	/	/	peak			



Test Results (Fundamental)

Mode	Freq. (MHz)	Antenna Pol.	Reading (dBuV/m)	Factor (dB)	Duty cycle Factor (dB)	Results (dBuV/m)	Limits (dBuV/m)	Det. Mode
TX Mode	424.53	H	91.33	-15.7	--	75.63	100.82	PK
	424.53	H	91.33	-15.7	-5.03	70.60	80.82	AV
	424.53	V	81.25	-13.93	--	67.32	100.82	PK
	424.53	V	81.25	-13.93	-5.03	62.29	80.82	AV

Remark:

1. Results = Reading + Factor + Duty cycle Factor

Test Results (Harmonics Emissions+Radiated Emissions from 1G-4G)

Test Mode: 424.530MHz

Frequency (MHz)	Antenna Pol.	Reading (dBuV/m)	Factor (dB)	Duty cycle Factor (dB)	Results (dBuV/m)	Limits (dBuV/m)	Det. Mode
849.06	H	64.28	-7.00	--	57.28	80.82	PK
849.06	H	64.28	-7.00	-5.03	52.25	60.82	AV
849.06	V	62.38	-7.00	--	55.38	80.82	PK
849.06	V	62.38	-7.00	-5.03	50.35	60.82	AV
1273.59	H	55.28	1.36	--	56.64	74.00	PK
1273.59	H	55.28	1.36	-5.03	51.61	54.00	AV
1273.59	V	54.26	1.36	--	55.62	74.00	PK
1273.59	V	54.26	1.36	-5.03	50.59	54.00	AV

Remark:

1. Result = Reading + Factor + Duty cycle Factor



Pulse Desensitization Correction Factor

Mode	Freq. (MHz)	Pulse Width (ms)	2/Pulse Width (kHz)
TX Mode	424.53	15.300	0.131

Remark:

RBW(1000kHz)>2/Pulse Width, Therefore PDCF is not needed.

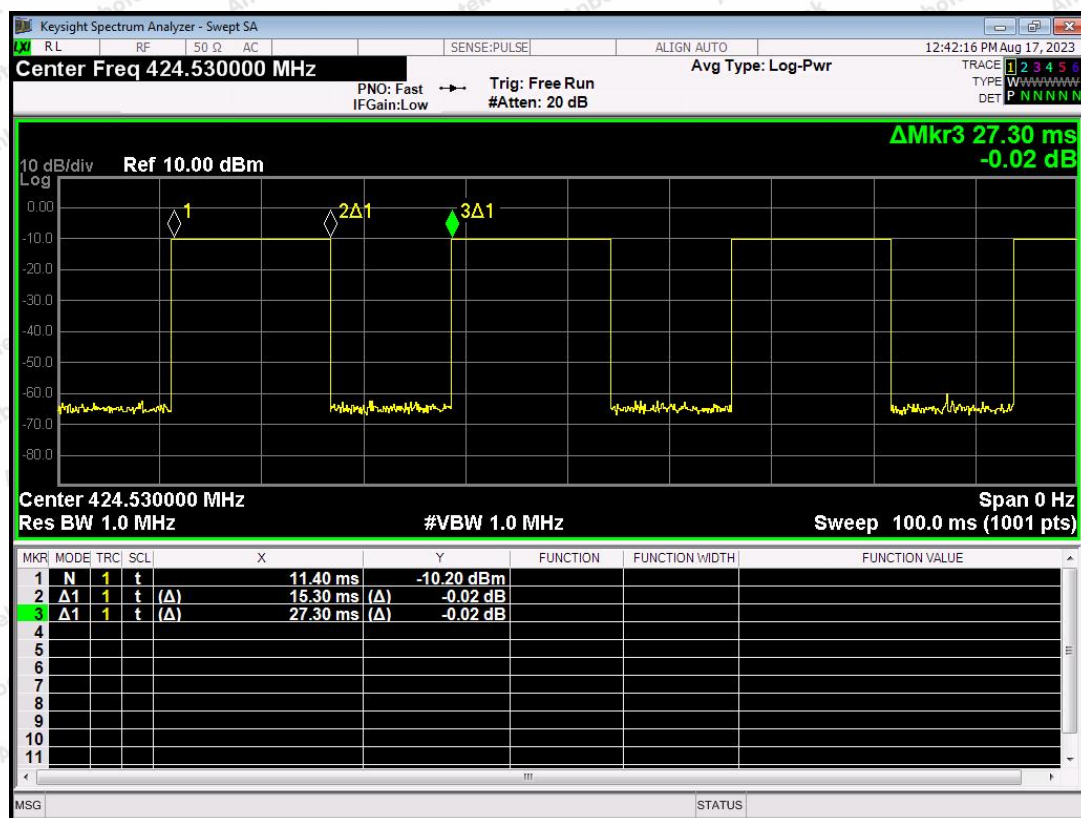
Duty Cycle Factor

Mode	Freq. (MHz)	T on (ms)	T period(ms)	Duty Cycle	Duty Cycle Factor
TX Mode	424.530	15.30	27.30	56.04%	-5.03

Remark:

1. Duty Cycle=T on/T period
2. Duty Cycle Factor =20*Ig(Duty Cycle)

T period

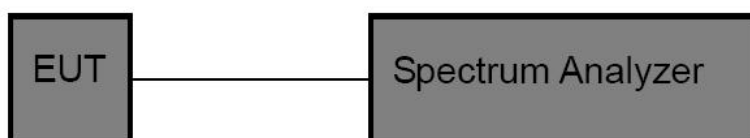


5. 20dB Occupy Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.231 (c)
Test Limit	According to FCC Part 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

5.2. Test Setup



5.3. Test Procedure

1. Place the EUT on the table and set it in the continuously transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:
RBW = 1% to 5% of the OBW, $VBW \geq 3 \times RBW$,
Span= $2 \times OBW \sim 5 \times OBW$
Detector= Peak
Trace mode= Max hold.
Sweep- auto couple.
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

5.4. Test Data

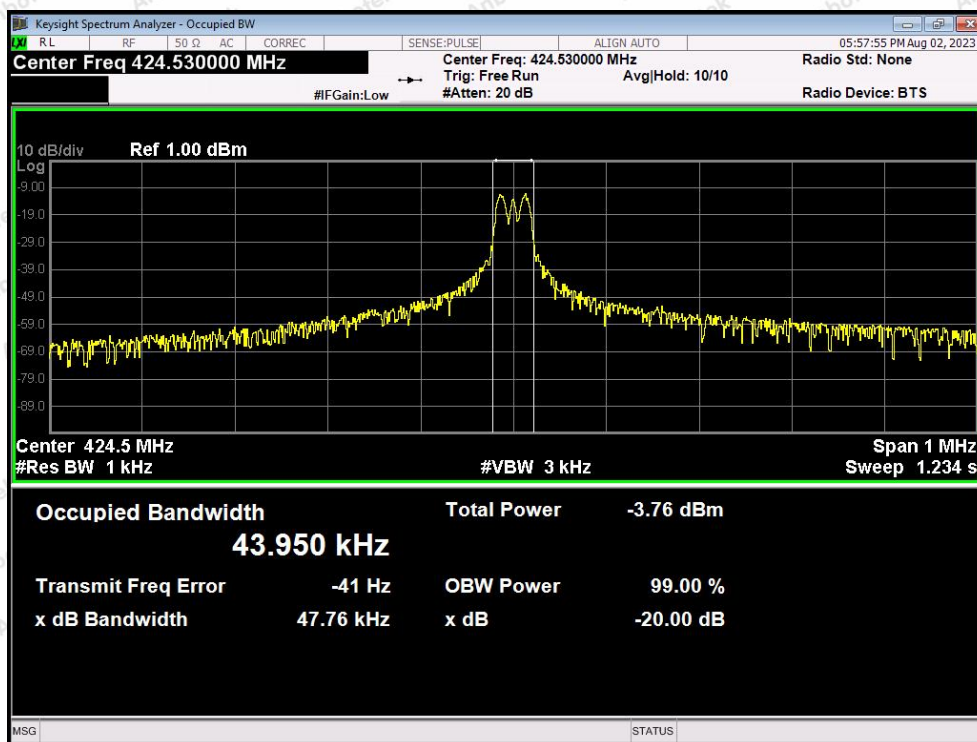
Test Item	: 20dB Bandwidth	Test Mode	: Continuously transmitting
Test Voltage	: DC 5V	Temperature	: 22.7℃
Test Result	: PASS	Humidity	: 55%RH



Mode	Freq. (MHz)	20DB Bandwidth (kHz)	Limit (kHz)	Results
TX Mode	424.530	47.76	≤1061.25	PASS

Note: Limit=0.0025*Freq.

20dB Bandwidth

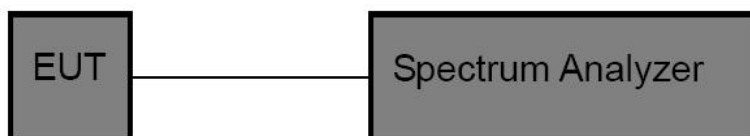


6. Dwell Time Test

6.1. Test Standard and Limit

Test Standard	FCC Part 15.231(a)
Test Limit	According to FCC Part 15.231(a)(1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

6.2. Test Setup



6.3. Test Procedure

1. Place the EUT on the table and set it in continuously transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

2. Set the spectrum analyzer as

RBW= 1MHz

VBW= 1MHz

Span= 0Hz

Sweep Time= 30 Seconds.

3. Record the Delta mark time.

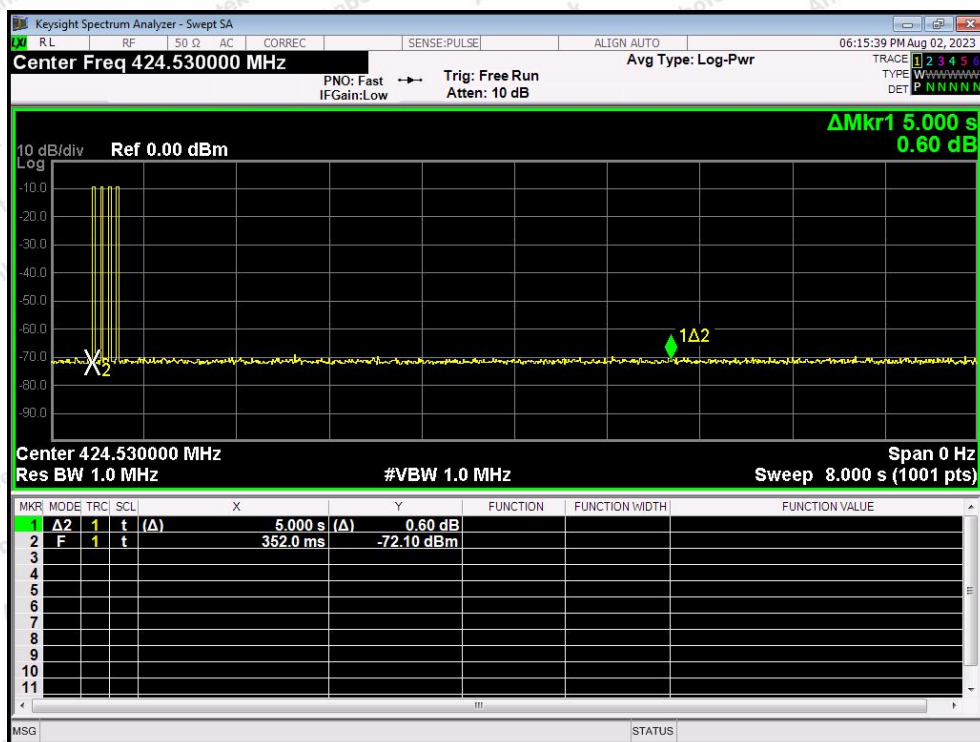
6.4. Test Data

Test Item	:	Dwell Time	Test Mode	:	Continuously transmitting
Test Voltage	:	DC 5V	Temperature	:	22.7℃
Test Result	:	PASS	Humidity	:	55%RH

Mode	Freq. (MHz)	Transmitting time(s)	Limit(s)	Results
TX Mode	424.530	5.0	≤5	PASS



424.530 MHz



7. Antenna Requirement

7.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203
Requirement	1) 15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

7.2. Antenna Connected Construction

The antenna is a Monopole antenna which permanently attached, and the best case gain of the antenna is -3.96dBi. It complies with the standard requirement.



APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to separated files Appendix I -- Test Setup Photograph

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to separated files Appendix II -- External Photograph

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to separated files Appendix III -- Internal Photograph

----- End of Report -----

