



Certificate #5055.02

TEST REPORT FOR BLE TESTING

Report No.: SRTC2024-9004(F)-24052101(E)

Product Name: i1421-sw

Product ID: i1421-sw

Brand Name: BARROT

Applicant: BARROT TECHNOLOGY CO., LTD.

Manufacturer: BARROT TECHNOLOGY CO., LTD.

Specification: FCC Part 15 Subpart C (2023)

FCC ID: 2AOXV-I1421-SW-A

The State Radio_monitoring_center Testing Center (SRTC) 15th Building, No.30Shixing Street, Shijingshan District, Beijing, P.R.China Tel: 86-10-57996183 Fax: 86-10-57996388



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1. GENERAL INFORMATION

1.1 Notes of the test report

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1.2 Information about the testing laboratory

Company:	The State Radio_monitoring_center Testing Center (SRTC)
Test Site 1:	15th Building, No.30 Shixing Street, Shijingshan District
Test Site 2:	No.80, Zhaojiachang, Beizang, Daxing District
City:	Beijing
Country or Region:	P.R.China
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Registration number:	239125

1.3 Applicant's details

Company:	BARROT TECHNOLOGY CO., LTD.
Address:	A1009, Block A, Jia Hua Building, No.9 Shangdisanjie St, Haidian
Address.	District, Beijing
City:	Beijing
Country or Region:	China
Contacted person:	Kerlwin Qiu
Tel:	18612671878
Email:	bluetooth@barrot.com.cn

1.4 Manufacturer's details

Company:	BARROT TECHNOLOGY CO., LTD.
Address: A1009, Block A, Jia Hua Building, No.9 Shangdisanjie S	
Address.	District, Beijing
City:	Beijing
Country or Region:	China
Contacted person:	Kerlwin Qiu
Tel:	18612671878
Email:	bluetooth@barrot.com.cn

1.5 Test Environment

Date of Receipt of test sample at SRTC:	2024/5/22
Testing Start Date:	2024/5/23
Testing End Date:	2024/6/13

Environmental Data:	Temperature (°C)	Humidity (%)	
Ambient	25	40	
Maximum Extreme	85		
Minimum Extreme	-40		
Normal Supply Voltage (V d.c.):	3.3		
Maximum Extreme Supply Voltage (V d.c.):	3.6		
Minimum Extreme Supply Voltage (V d.c.):	3.0		

2 DESCRIPTION OF THE DEVICE UNDER TEST

2.1Final Equipment Build Status

Frequency Range:	2.402GHz~2.480GHz
Number of Channel:	40
Modulation Type:	GFSK
Equipment Class:	DTS
Channel Spacing:	2MHz
Data Rate:	LE 1Mbps
Power Supply:	DC supply
Software Revision:	1
Hardware Revision:	1
IMEI:	NA
Antenna type:	Refer to Note
Antenna connector:	Refer to Note

Declaration of product difference

The product,

i1421-sw has two versions: i1421-sw single antenna, i1421-sw double antenna



They are all equal to each other and they are all the same of the product design with eachother.

i1421-sw single antenna, i1421-sw double antenna have the same external appearance Peripherals, software, features, function, etc"

Only because of the market purpose, the device needs two versions.

Antenna requirement (FCC Part 15.203)

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.

•The antenna(s) of the EUT is permanently attached.

•There are no provisions for connection to an external antenna.

Note: The antenna provides to the EUT, please refer to the following table:

Brand	Model	Antenna gain	Frequency band	Antenna type	Connecter Type
N/A	N/A	3dBi(max)	2.4GHz~2.4835GHz	Rod antenna	N/A

The antenna gain is provided by the customer and involved in the calculation and influence of the test results. Our laboratory takes the value declared by the customer as the criterion, and the customer is responsible for the antenna gain value. Manufacturers ensure that their designs will not be modified by the user or third party's arbitrary antenna parameters and performance.

2.2Description of Test Modes

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

40 channels are provided to this EUT:

2.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
EUT CONFIGURE MODE	RE ≥ 1G	RE<1G	PLC	APCM	-
GFSK	\checkmark				-

Where

 $RE \ge 1G$: Radiated Emission above 1GHz RE<1G: Radiated Emission below 1GHz



PLC: Power Line Conducted Emission APCM: Antenna Port Conducted Measurement

Radiated Emission Test (Above 1GHz):

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	19	GFSK	1

Radiated Emission Test (Below 1GHz):

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	19	GFSK	1

Power Line Conducted Emission Test:

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	19	GFSK	1

Antenna Port Conducted Measurement:

This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	GFSK	1

2.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor shall be considered.



Modulation Type	Duty Cycle	Correction factor(dB)
GFSK (LE 1Mbps)	97.40%	0.11

2.4 EUT Operating conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

2.5 Support Equipment

The following support equipment was used to exercise the DUT during testing:N/A

3 REFERENCE SPECIFICATION

Specification	Version	Title
FCC Part15 Subpart C	2023	Intentional radiators
ANSI C63.10	2013	Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
KDB 558074D01 v05r02	April 2, 2019	Guidance for compliance measurements on Digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules

4 KEY TO NOTES AND RESULT CODES

Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
N/T	Test case is not tested.



5 RESULT SUMMARY

No.	Test case	Reference	Verdict	Test Site
1	6dB Bandwidth	15.247(a)(2)	Pass	1
2	Transmitter Output Power	15.247(b)(3))	Pass	1
3	Transmitter Power Spectral Density	15.247(e))	Pass	1
4	Conducted Out of band emission measurement	15.247(d)	Pass	1
5	Band-edge	15.247(d)	Pass	1
6	Antenna requirement	15.203	Pass(refer to section 2.1)	1

Test Site 1: 15th Building, No.30 Shixing Street, Shijingshan District

This Test Report Is Approved by:	Review by:
Mr. Peng Zhen 👝	Mr. Li Bin I
彭板	(A 7RK)
Tested and Issued by:	Approved date:
Mr. LiangXisheng	
动力子	20240613



No.	Test case	Reference	Verdict	Test Site
7	Band-edge	15.247(d)	Pass	2
8	Spurious Radiated Emissions	15.205/15.209/15.247(d)	Pass	2
9	AC Power line Conducted Emission	15.207	Pass	2

Test Site 2: No.80, Zhaojiachang, Beizang, Daxing District

This Test Report Is Approved by: Mr. Liu Wei	Review by: Mr. Guo Yu
Tested and Issued by:	Approved date:
Mr. Dong Qifeng 董奇峰	20240613



6 TEST RESULT

6.1 6dB Bandwidth

6.1.1 Test limit

Part15.247 (a) (2) The minimum permissible 6dB bandwidth is 500 kHz

6.1.2 Test Procedure Used

ANSI C63.10-2013 – Section 11.8.2 Option 2 KDB 558074 D01 v05r02 – Section 8.2

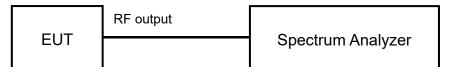
6.1.3 Test Settings

1. The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.

- 2. RBW = 100 kHz
- 3. VBW \geq 3 x RBW
- 4. Detector = Peak
- 5. Trace mode = max hold
- 6. Sweep = auto couple
- 7. The trace was allowed to stabilize

6.1.4 Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



6.1.5 Test result

The test results are shown in Appendix A.



6.2 Transmitter Output Power

6.2.1 Test limit

Part15.247 (b) (3) The maximum permissible conducted output power is 1 Watt.

6.2.2 Test Procedure Used

ANSI C63.10-2013 – Section 11.9.1.3 ANSI C63.10-2013 – Section 11.9.2.2.4 KDB 558074 D01 v05r02 – Section 8.3.1.3

6.2.3Test Settings

Peak Power Measurement

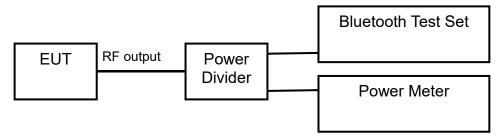
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

Average Power Measurement

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

6.2.4Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



6.2.5Test result

The test results are shown in Appendix A.



6.3 Transmitter Power Spectral Density

6.3.1Test limit

Part15.247 (e) The maximum permissible power spectral density is 8.0dBm in any 3 kHz band.

6.3.2 Test Procedure Used

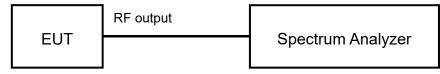
ANSI C63.10-2013 – Section 11.10.2 Method PKPSD KDB 558074 D01 v05r02 – Section 8.4

6.3.3 Test Settings

- 1. Analyzer was set to the center frequency of the DTS channel under investigation
- 2. Span = 1.5 times the DTS channel bandwidth
- 3. $\overrightarrow{RBW} = 3 \text{ kHz}$
- 4. VBW = 10 kHz
- 5. Detector = peak
- 6. Sweep time = auto couple
- 7. Trace mode = max hold
- 8. Trace was allowed to stabilize

6.3.4Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



6.3.5 Test result

The test results are shown in Appendix A.



6.4 Conducted Out of band emission measurement

6.4.1Test limit

Part 15.247(d): The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth.

6.4.2 Test Procedure Used

ANSI C63.10-2013 – Section 11.11.3 KDB 558074 D01 v05r02 – Section 8.5

6.4.3 Reference level measurement Settings

Establish a reference level by using the following procedure:

- a) Set instrument center frequency to DTS channel center frequency.
- b) Set the span to \geq 1.5 MHz
- c) Set the RBW = 100 kHz.
- d) Set the VBW \geq 300 kHz.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum PSD level.

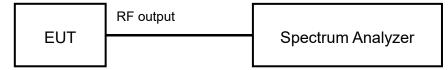
6.4.4Test Settings

a) Set the center frequency and span to encompass frequency range to be measured.

- b) Set the RBW = 100 kHz.
- c) Set the VBW \geq 300 kHz.
- d) Detector = peak.
- e) Set span to encompass the spectrum to be examined
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level.

6.4.5 Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



6.4.6Test result

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement. The test results are shown in Appendix A.



6.5 Band-edge measurement

6.5.1Test limit

Part 15.247(d): The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth.

6.5.2 Test Procedure Used

ANSI C63.10-2013 – Section 11.11.3 KDB 558074 D01 v05r02 – Section 8.7.2

6.5.3 Reference level measurement Settings

Establish a reference level by using the following procedure:

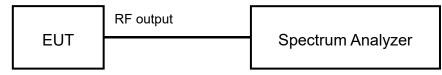
- a) Set instrument center frequency to DTS channel center frequency.
- b) Set the span to ≥ 1.5 MHz
- c) Set the RBW = 100 kHz.
- d) Set the VBW \geq 300 kHz.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum PSD level.

6.5.4Test Settings

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW \geq 300 kHz.
- d) Detector = peak.
- e) Set span to encompass the spectrum to be examined
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level.

6.5.5 Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



6.5.6Test result

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement. The test results are shown in Appendix A.



6.6 Spurious Radiated Emissions

6.6.1 Test Description

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at maximum power and at the appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

6.6.2 Test limit

Part15.205, 15.209, 15.247(d)

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in below Table per Section 15.209. The spectrum shall be investigated from the lowest radio frequency signal generated in the device

	Field strength	Measured Distance		
Frequency [MHz]	[µV/m]	[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		
Radiated Limits				

Part15.35(b):

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit

Used conversion factor: Limit $(dB\mu V/m) = 20 \log (Limit (\mu V/m)/1\mu V/m)$

Frequency [MHz]	Detector	Unit (dBµV/m)
30~88	Quasi-peak	40.0
88~216	Quasi-peak	43.5
216~960	Quasi-peak	46.0
960~1000	Quasi-peak	54.0
1000 \sim 5th harmonic of the highest frequency	Average	54.0
or 40GHz, whichever is lower	Peak	74.0

Conversion Radiated limits



6.6.3 Test Procedure Used

KDB 558074 D01 DTS Meas Guidance v05r02– Section 12.2.7

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Both X and Y axes of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and recorded the reading with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer complied the following setting:

Frequency	RBW
9-150kHz	200-300Hz
0.15-30MHz	9-10kHz

2. Signals below 30MHz are not recorded in the report because they are lower than the limits by more than 20dB.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for $30MHz \sim 1GHz$) / 1.5 meters (for above 1GHz) above the ground in chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and recorded the reading with Maximum Hold Mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detector and recorded the reading with Maximum Hold Mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.



For the radiated emission test above 1GHz:

Place the measurement antenna away from 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 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 measurement antenna elevation shall be that which maximizes the emissions. 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.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1GHz.

2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.

3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Average detection (AV) at frequency above 1GHz. If duty cycle of test signal is < 98%, the duty factor need added to measured value.

4. All modes of operation were investigated and the worst-case emissions are reported.

6.6.4Test Settings

Average Field Strength Measurements per Section 12.2.7 of KDB 558074 (Part 15.35)

Frequency	Detector
<1000MHz	Quasi-peak
>1000MHz	Peak and average

Peak Field Strength Measurements per Section 12.2.7of KDB 558074 (Part 15.35)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. RBW is set depending on measurement frequency, as specified in following table

Frequency	RBW
9-150kHz	200-300Hz
0.15-30MHz	9-10kHz
30-1000MHz	100-120kHz
>1000MHz	1MHz

3. VBW = 3MHz

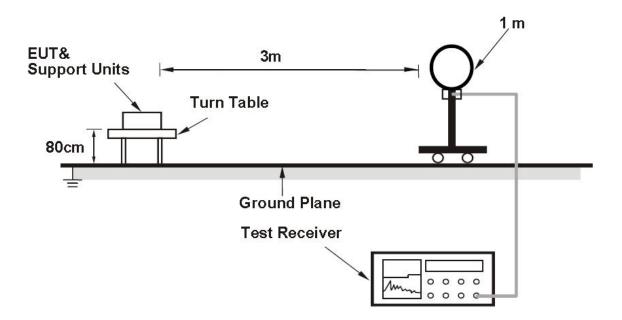
4. Detector = peak

5. Sweep time = auto couple

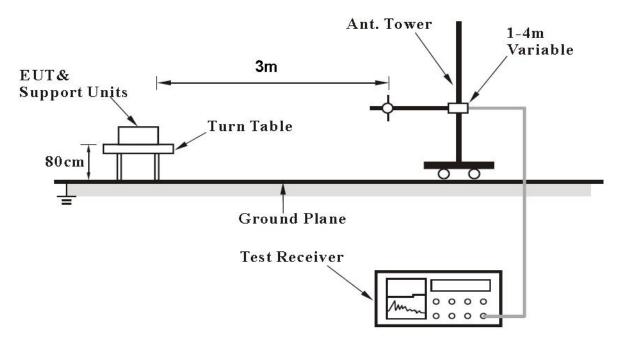
- 6. Trace mode = max hold
- 7. Trace was allowed to stabilize



For Radiated emission below 30MHz

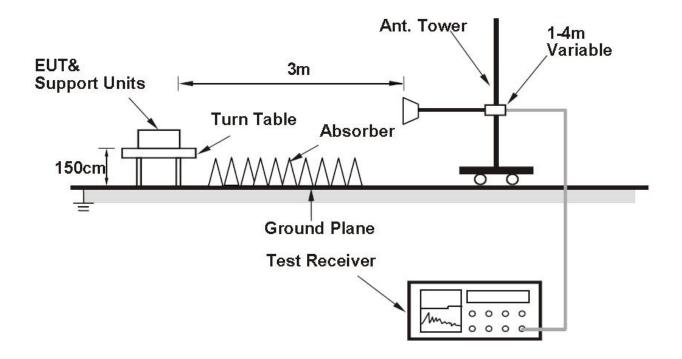


For Radiated emission 30MHz to 1GHz





For Radiated emission above 1GHz



6.6.6 Test result

The test results are shown in Appendix B.



6.7 AC Power line Conducted Emission

6.7.1Test limit

FCC Part15.207

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

The measurement is made according to ANSI C63.10-2013

6.7.2 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

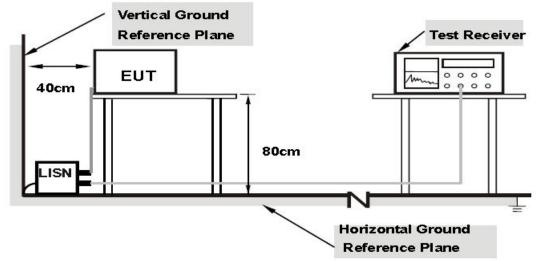
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

The EUT shall test under the power AC120V/60Hz.





For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.7.4 Test result

The test results are shown in AppendixB.



7 MEASUREMENT UNCERTAINTIES

Items	Uncer	tainty
6dB Bandwidth	3kł	Ηz
Peak power output	0.67	′dB
Transmitter Power Spectral Density	0.75	idB
Band edge compliance	1.20	ldB
	30MHz~1GHz	2.83dB
Conducted Out of band emission measurement	1GHz \sim 12.75GHz	2.50dB
medodromont	12.75GHz \sim 25GHz	2.75dB
	30 MHz \sim 200 MHz	4.88dB
Spurious Padiated Emissions	200MHz \sim 1GHz	4.87dB
Spurious Radiated Emissions	1GHz \sim 18GHz	4.58dB
	18GHz~40GHz	4.35dB
AC Power line Conducted Emission	3.92	dB



8 TEST EQUIPMENTS

No.	Name/ Model	Manufacturer	S/N	Cal date	Cal Due date
1.	Spectrum Analyzer / FSV	ROHDE & SCHWARZ	101065	2023.06.21	2024.06.20
2.	Signal Analyzer / N9020A	Agilent	MY48010771	2024.03.06	2025.03.05
3.	Bluetooth Test Set / MT8852B	Anritsu	1329003	2023.06.21	2024.06.20
4.	Power Divider / 11667A	HP	19632	2023.06.21	2024.06.20
5.	Signal Generator / SMBV100A	R&S	260910	2023.06.21	2024.06.20
6.	Power Meter E4416A	Agilent	MY52370013	2024.03.06	2025.03.05
7.	Power Sensor E9323A	Agilent	MY52150008	2024.03.06	2025.03.05
8.	Temperature chamber / SH241	ESPEC	92013758	2023.06.21	2024.06.20
9.	Fully-Anechoic Chamber / 12.65m×8.03m×7.50m	FRANKONIA			
10.	Semi-Anechoic/Chamber / 23.18m×16.88m×9.60m	FRANKONIA			
11.	Turn table Diameter:1m	FRANKONIA			
12.	Turn table Diameter:5m	FRANKONIA			
13.	Antenna master FAC(MA4.0)	MATURO			
14.	Antenna master SAC(MA4.0)	MATURO			
15.	Shielding room / 9.080m×5.255m×3.525m	FRANKONIA			
16.	Double-Ridged Waveguide Horn Antenna / HF 907	R&S	100512	2023.06.21	2024.06.20
17.	Double-Ridged Waveguide Horn Antenna / HF 907	R&S	100513	2023.06.21	2024.06.20
18.	Ultra log antenna / HL562	R&S	100016	2023.06.21	2024.06.20
19.	Receive antenna /3160-09	SCHWARZ-BECK	002058-002	2023.06.21	2024.06.20
20.	EMI test receiver / ESI 40	R&S	100015	2023.06.21	2024.06.20
21.	EMI test receiver / ESCS30	R&S	100029	2023.06.21	2024.06.20
22.	Receive antenna / HL562	R&S	100167	2023.06.21	2024.06.20
23.	AMN / ENV216	R&S	3560.6550.12	2023.06.21	2024.06.20
24.	WLAN AP WIA3300-20 (FCC ID: 2AHKT-WIA3300-20)	SKSpruce	8152017060700339		
25.	Notebook E470c	Lenovo	PF10UZW7		
26.	Loop Antenna	R&S	100340	2023.08.21	2024.08.20
27.	FCC auto test system / RT9200BW-2	Radiosky	V2.05	1	/
28.	EMI test software / EMC32	R&S	V10.20.01	1	/

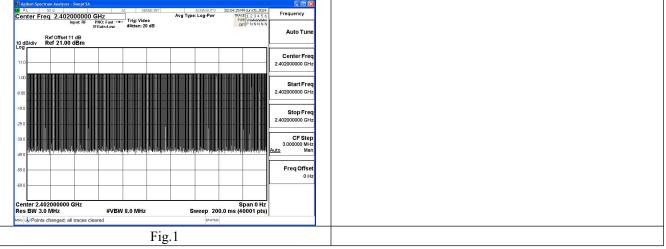


APPENDIX A – TEST DATA OF CONDUCTED EMISSION BLE

1 Duty Cycle and Antenna Gain

Test Mode	Frequency (MHz)	Plot	Duty Cycle	Correction Factor(dB)	Antenna Gain(dBi)
GFSK (LE 1Mbps)	2402	Fig.1	97.40%	0.11	3.00

Note: Correction Factor=10*log(1/Duty Cycle)





Conducted Power

Modulation type	Conducted Peak Power(dBm)		
Modulation type	2402MHz	2440MHz	2480MHz
GFSK (LE 1Mbps)	3.90	3.95	3.33

Modulation type	Conducted Average Power(dBm)		
Modulation type	2402MHz	2440MHz	2480MHz
GFSK (LE 1Mbps)	1.24	1.36	1.97

EIRP

Modulation type	Peak EIRP(dBm)		
Modulation type	2402MHz	2440MHz	2480MHz
GFSK (LE 1Mbps)	6.90	6.95	6.33

Madulation type	Average EIRP(dBm)		
Modulation type	2402MHz	2440MHz	2480MHz
GFSK (LE 1Mbps)	4.24	4.36	4.97

EIRP (dBm)=Conducted Power(dBm)+Antenna Gain(dBi)



3 Occupied Bandwidth

6dB	Bandwidth	
		8

Test Mode	Carrier frequency (MHz)	6dB Bandwidth(KHz)
GFSK (LE 1Mbps)	2402	719.6
GFSK (LE 1Mbps)	2440	752.5
GFSK (LE 1Mbps)	2480	746.3

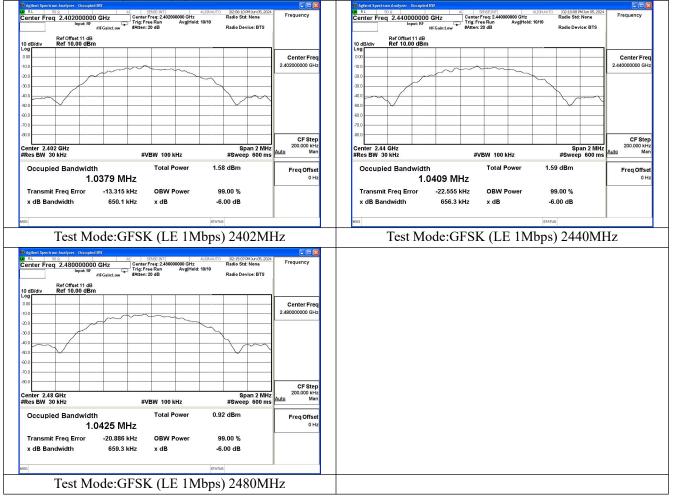
Center Freq 2.402000000 GHz	AC SENSE:INT AUGN Center Freq: 2.402000000 GHz Trig: Free Run Avg Hold: 10/10 #Atten: 20 dB		Prequency ØM #1. 30.9 Ac SREELPTI AUSPLATO Compose Rev Ans, Soci Radio Stati Nene Center Freq 2.4400000 GHz Center Freq 2.4000000 GHz Radio Stati Nene Imple Bit ++ Trig Free Run AugHold: 10/10 Radio Stati Nene Imple Bit #File Static Stati Nene #Radio Stati Nene Radio Device: BTS	Frequency
Ref Offset 11 dB 0 dB/div Ref 10.00 dBm			Ref Offset 11 dB 10 dBldiv Ref 10.00 dBm Log	1
		2.4	Center Freq 40200000 GHz 30.0 30.0	Center Fr 2.440000000 G
				-
enter 2.402 GHz Res BW 100 kHz	#VBW 300 kHz	Span 2 MHz #Sweep 600 ms	CF Step 200.000 Hz Man RRes BW 100 KHz CF Step 200.000 Hz Center 2.44 GHz #VBW 300 KHz #Sweep 600 mr	CF St 200.000 k Auto M
Occupied Bandwidth 1.0699 N	Total Power	1.58 dBm	Freq Offset 0Hz Occupied Bandwidth Total Power 1.59 dBm 1.0644 MHz	Freq Offs 0
Transmit Freq Error -17.391 x dB Bandwidth 719.6		99.00 % -6.00 dB	Transmit Freq Error -26.255 kHz OBW Power 99.00 % x dB Bandwidth 752.5 kHz x dB -6.00 dB	
Test Mode:C	GFSK (LE 1Mb)	VAUTO 02:14:47 PM Jun 05, 2024 Radio Std: None	Test Mode:GFSK (LE 1Mbps) 2440M	Hz
Test Mode:C	GFSK (LE 1Mb)	ps) 2402MHz	Test Mode:GFSK (LE 1Mbps) 2440M	Hz
Test Mode:C	GFSK (LE 1Mb)	NATION 1021447 PM An 105,2024 Radio Stdi None Radio Device: BTS	Center Frequency	Hz
Test Mode:C	GFSK (LE 1Mb)	ps) 2402MHz	Center Freq	Hz
Aller Services and a service of the	GFSK (LE 1Mb)	Auto Badio Stdi None Radio Stdi None Radio Device: BTS Span 2 MHZ #Sweep 600 ms 0.93 dBm	Center Freq	Hz
Addensive Analysis Consultation of the second secon	GFSK (LE 1Mb)	Autor Do 1447 PM An D5, 2004 Radio Std: None Radio Device: BTS	Center Freq 2000000 GHz Center Freq 200000 GHz CF Step 200000 Hz Man FreqOffset	Hz
Adjent Spectrum Analyzer - Occupied DY L 1020 Center Freq 2.46000000 GHz Input B FrGainclow 0 dBidly Ref 10.00 dBm 0 dBid	GFSK (LE 1Mb)	Des) 2402MHz NATIO 20:14-97 PM AN 05-2024 Radio 3x6-None Radio Device: BTS Span 2 MHz #Sweep 600 ms 0.93 dBm 99.00 %	Center Freq 2000000 GHz Center Freq 200000 GHz CF Step 200000 Hz Man FreqOffset	Hz



No.: SRTC2024-9004(F)-24052101(E) FCC ID: 2AOXV-I1421-SW-A

99% Bandwidth

Test Mode	Carrier frequency (MHz)	99% Bandwidth(kHz)
GFSK (LE 1Mbps)	2402	1037.9
GFSK (LE 1Mbps)	2440	1040.9
GFSK (LE 1Mbps)	2480	1042.5





No.: SRTC2024-9004(F)-24052101(E) FCC ID: 2AOXV-11421-SW-A

4 Transmitter Power Spectral Density

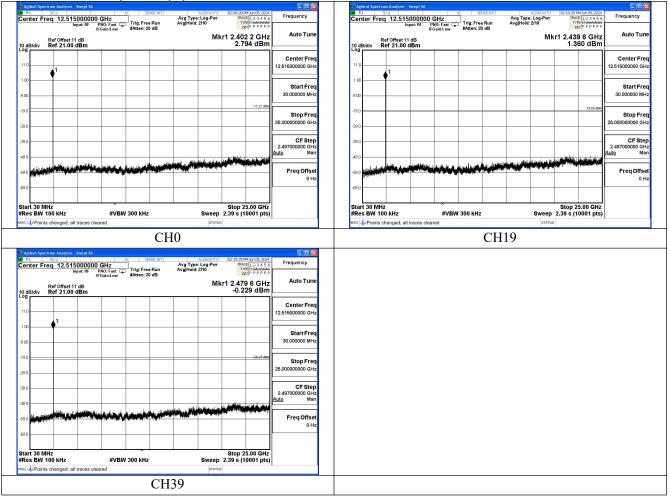
Test Mode	Carrier frequency (MHz)	Channel No.	Power Density (dBm/3kHz)
GFSK (LE 1Mbps)	2402	0	-11.4
GFSK (LE 1Mbps)	2440	19	-11.6
GFSK (LE 1Mbps)	2480	39	-12.6

Center Freq 2.402000000 GHz	SENSE:INT ALIGNAUTO 02:00 Avg Type: Log-Pwr Free Run Avg[Hold: 10/10	5:29 PM Jun 05, 2024 TRACE 1 2 3 4 5 6 TYPE MULLINUE	Center Freq 2.44000000	0 GHz PNO: Far - Ban Trig: Free Run	ALIGNAUTO 02:09:25 PM Jun 05, 2024 Avg Type: Log-Pwr TRACE 1 2 3 4 5 6 Avg Hold: 10/10 Type	Frequency
Input: RF PNO: Far ++++ Trig: I IFGain:Low #Atter	n: 20 dB		Input: RF	PNO: Far +++ Trig: Free Run IFGain:Low #Atten: 20 dB	DET P N N N N N	Auto Tur
Ref Offset 11 dB 0 dB/div Ref 10.00 dBm	Mkr1 2.401 -1	952 0 GHz Auto Tulle 1.422 dBm	Ref Offset 11 dB 10 dB/div Ref 10.00 dBm		Mkr1 2.439 947 5 GHz -11.580 dBm	Auto Tu
°g		Center Freq	Log			Center Fre
0.00		2.402000000 GHz	0.00			2.440000000 GH
00	1		-10.0	∳ ¹		
no han	Manaparana	2.401250000 GHz	-20.0	the sub all which a sub-	144/144 Autor	Start Fre 2.439250000 Gi
	a harden of the all when when the		-30.0	up an all when all the party	. J. I. Marthall	
AMV.	h. M	2.402750000 GHz	What		THE REAL PROPERTY OF	Stop Fre 2.440750000 Gi
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200 pM		CF Step 150.000 kHz Auto Man	-50.0			CF Ste 150.000 ki
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0.0		0 Hz	-80.0			01
			3449			
enter 2.4020000 GHz Res BW 3.0 kHz #VBW 10 kH		an 1.500 MHz ms (1001 pts)	Center 2.4400000 GHz #Res BW 3.0 kHz	#VBW 10 kHz	Span 1.500 MHz #Sweep 600 ms (1001 pts)	
	status	ina (1001 pra)		#VOV IV NIZ	status	
Agilent Spectrum Analyzer - Swept SA RL 50 Ω AC enter Freq 2.480000000 GHz	K (LE 1Mbps) 24	4:26 PM Jun 05, 2024	Test M	ode:GFSK (L	E 1Mbps) 2440MH	łz
Argient Spectrum Analyzer - Swept SA RL 50 0. AC enter Freq 2.48000000 GHz Input: RF PR0: Far. Trig: IFGain:Low AC	SENSE:INT ALIGNAUTO 02:1- Avg Type: Log-Pwr Free Run Avg Hold: 10/10 r: 20 dB Avg Avg	4:26 PM Jun (5, 2024 TRACE [1 2 3 4 5 6 TYPE [M Jun N N N N TYPE [M Jun N N N N TYPE [M Jun N N N N N TYPE [M Jun N N N N N N N N N N N N N N N N N N N		ode:GFSK (L	E 1Mbps) 2440MH	Iz
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Addited Spectram Analyzer Swept SA	SPREENT AUGUARTO R2-10 Avg Type: Log Pwr Avg Type: Log Pwr Avg Type: Log Pwr 20 dB Mkr1 2.479 -1:	Image: Start Frequency Auto Tune 2.575 dBm Center Freq 2.40000000 GHz 2.479250000 GHz		ode:GFSK (L	E 1Mbps) 2440MF	Iz
Applient Spectrum Analyzer - Swept SA. 0.0 0.0 It 0.0 0.0 0.0 Input RF PI00-Ear Trg. Input RF PI00-Ear Trg. OdSIdV Ref Offset11 dB 0.0	SPREENT AUGUARTO R2-10 Avg Type: Log Pwr Avg Type: Log Pwr Avg Type: Log Pwr 20 dB Mkr1 2.479 -1:	Center Frequency 2.575 dBm Center Frequency 2.49000000 GHz 2.49000000 GHz Start Freq 2.49000000 GHz Start Freq Center Freq 2.49000000 GHz Start Freq Center Freq 2.4900000 GHz Start Freq CF Step		ode:GFSK (L	E 1Mbps) 2440MF	Iz
Applied Spectram Analyzer - Swept SA. R.L. 900 enter Freq 2.430000000 GHz Imput RP PI00 Far Trg. Ref Offset11 dB G G G G G G G G G G G G G G G G G G G	SPREENT AUGUARTO R2-10 Avg Type: Log Pwr Avg Type: Log Pwr Avg Type: Log Pwr 20 dB Mkr1 2.479 -1:	Center Freq Center Freq Center Freq Catorean Control Center Freq Center Freq Catorean Control Center Freq Cen		ode:GFSK (L	E 1Mbps) 2440MF	Ηz
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Reflection Analyser Swept SA In L 00 - 00 - 00 - 00 - 00 - 00 - 00 - 0	SPREENT AUGUARTO R2-10 Avg Type: Log Pwr Avg Type: Log Pwr Avg Type: Log Pwr 20 dB Mkr1 2.479 -1:	2.800 A0102 0000 replication Frequency 7680 GHz Auto Tune 2.675 dBm Center Freq 2.48000000 GHz 2.49050000 GHz 2.49050000 GHz Stop Freq 2.49050000 GHz Stop Freq 2.48075000 GHz		ode:GFSK (L	E 1Mbps) 2440MF	Ηz
Addrest Spectram Analyzer - Swept SA Table	SPREENT AUGUARTO R2-10 Avg Type: Log Pwr Avg Type: Log Pwr Avg Type: Log Pwr 20 dB Mkr1 2.479 -1:	2.800 A0102 0000 ref Frequency 7680 G HLz Auto Tune 2.675 dBm Center Freq 2.40050000 GHz 2.40050000 GHz 2.40050000 GHz 2.40050000 GHz VM Center Freq VM Center Freq VM Center Freq Conter Freq 2.40050000 GHz Center Freq 150.000 Hz Man Freq Offset		ode:GFSK (L	E 1Mbps) 2440MF	Ηz
Agained Spectram Analyzer - Swept SA. 00 0.0		Center Frequency 769 0 GHz 769 0 GHz 2.575 dBm Center Freq 2.40750000 GHz Start Freq 2.40750000 GHz VM VM VM Frequency Center Freq 2.49050000 GHz Start Freq 2.490750000 GHz Stop Freq Auto Man FreqUency Mato NW NW		ode:GFSK (L	E 1Mbps) 2440MF	Iz
Reflection Analyser Swept SA In L 00 - 00 - 00 - 00 - 00 - 00 - 00 - 0		Center Frequency 769 0 GHz 769 0 GHz 2.575 dBm Center Freq 2.40750000 GHz Start Freq 2.40750000 GHz VM VM VM Frequency Center Freq 2.49050000 GHz Start Freq 2.490750000 GHz Stop Freq Auto Man FreqUency Mato NW NW		ode:GFSK (L	E 1Mbps) 2440MF	Iz



No.: SRTC2024-9004(F)-24052101(E) FCC ID: 2AOXV-I1421-SW-A

5 Conducted Out of band emission measurement Test Mode: GFSK (LE 1Mbps)



6 Band Edge measurement Test Mode: GFSK (LE 1Mbps)

RL 50 g Center Freq 2.400000000 GHz	AC SENSE:INT AUGNAUTO Avg Type: Log-Pwr Trig: Free Run Avg Hold: 100/100	02:06:35 PM Jun 05, 2024 TRACE 1 2 3 4 5 6 TYPE MONANCHI DET P N N N N	requency	Byte Byte <th< th=""><th>Jency</th></th<>	Jency
Ref Offset 11 dB 10 dB/div Ref 21.00 dBm	#Atten: 20 dB		Auto Tune	Ref Offset 11 dB Mkr2 2.483 50 GHz Au 10 dB/div Ref 21.00 dBm -55.552 dBm	uto Tune
-09 110 100 9.00			Center Freq 0000000 GHz		nter Fred 0000 GH:
19.0 29.0 39.0			Start Freq 5000000 GHz	220 2.47850	tart Free 0000 GH
49.0 99.0		2.40	Stop Freq 5000000 GHz		top Fred 0000 GH;
Center 2.400000 GHz Res BW 100 kHz #V	/BW 300 kHz Sweep 1		CF Step 1.000000 MHz Man	International and the second s	CF Step 0000 MH: Mar
2 3 3 4 5 6 7			Freq Offset 0 Hz	2 N 1 f 2.483 50 GHz -55.552 dBm	e q Offse 0 Ha
8 9 9 10 10 11 12 12 12 12 12 12 12 12 12 12 12 12					
86	CH0			eso status CH39	

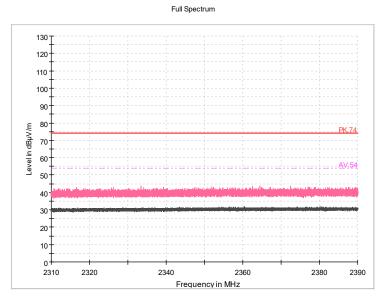


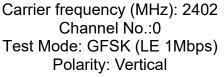
APPENDIX B – TEST DATA OF RADIATED EMISSION

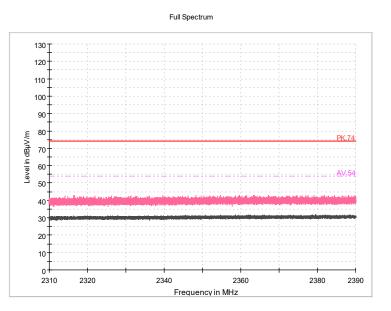
Note: The worst channel results are reflected in the report.

Note: The scanned graph represents the maximum of both horizontal and vertical polarizations and is not a single horizontal or vertical polarization scan.

Radiated Emission Band Edge



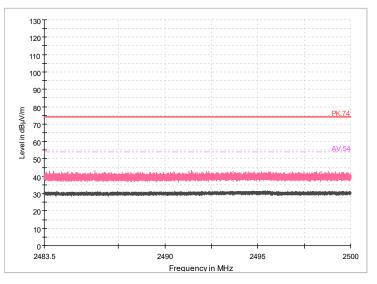


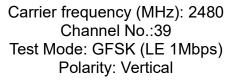


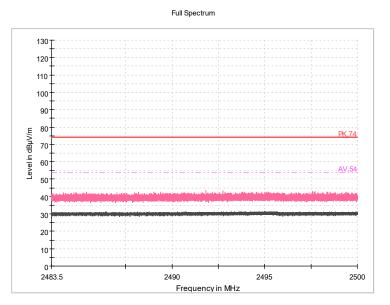
Carrier frequency (MHz): 2402 Channel No.:0

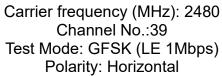














Sample Calculations

After comparison, the worst case attitude is EUT lay down.

Determining Spurious Emissions Levels

A "reference path loss" is established and the A_{Rpl} is the attenuation of "reference path loss", and including the gain of receive antenna, the gain of the preamplifier, the cable loss. The measurement results are obtained as described below: Result= P_{mea} + A_{Rpl} Sample calculation: (50.43dBµV/m) = (23.43dBµV) - (-27dB),

For GFSK (LE 1Mbps)

Channel No.:0

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)	Margin (dB)
120.651667	23.43	-27	50.43	Vertical	33.50	10.07
124.995333	27.17	-27	54.17	Vertical	33.50	6.33
249.996000	26.78	-22	48.78	Vertical	36.00	9.22
374.996667	30.93	-18	48.93	Vertical	36.00	5.07
499.997333	33.36	-15	48.36	Horizontal	36.00	2.64
918.172000	21.64	-8	29.64	Horizontal	36.00	14.36

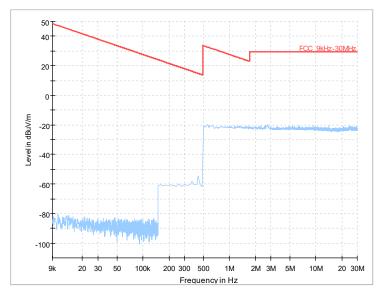
Channel No.:19

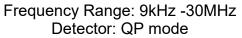
Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)	Margin (dB)
120.935667	23.80	-27	50.80	Vertical	33.50	9.70
120.952000	23.76	-27	50.76	Vertical	33.50	9.74
123.691000	22.70	-27	49.70	Vertical	33.50	10.80
124.995333	27.09	-27	54.09	Vertical	33.50	6.41
374.996667	30.86	-18	48.86	Vertical	36.00	5.14
499.997333	32.86	-15	47.86	Horizontal	36.00	3.14

Channel No.:39

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)	Margin (dB)
118.607000	22.85	-26	48.85	Vertical	33.50	10.65
120.745333	23.60	-27	50.60	Vertical	33.50	9.90
121.550000	23.04	-27	50.04	Vertical	33.50	10.46
124.995333	27.14	-27	54.14	Vertical	33.50	6.36
374.996667	30.86	-18	48.86	Vertical	36.00	5.14
499.997333	33.08	-15	48.08	Horizontal	36.00	2.92

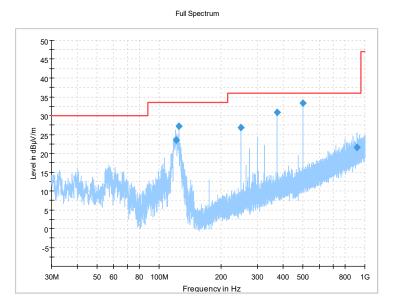






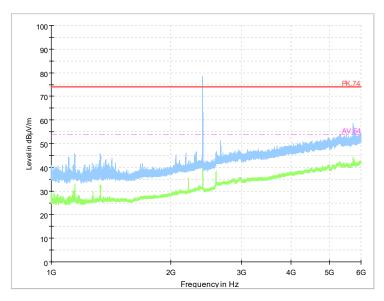
Note: The relevant tests have been performed in order to verify in which mode would have the worstfeatures, the result show above is the worst case.

Channel No.:0

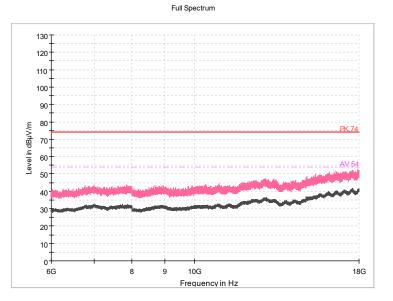


Frequency Range: 30MHz-1GHz Detector: QP mode Modulation type: GFSK (LE 1Mbps)





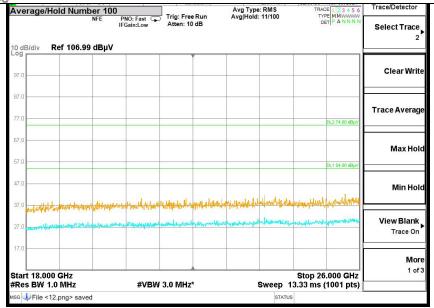
Frequency Range: 1GHz-6GHz Detector: Av mode and PK mode Modulation type: GFSK (LE 1Mbps)



Frequency Range: 6GHz-18GHz Detector: Av mode and PK mode Modulation type: GFSK (LE 1Mbps)

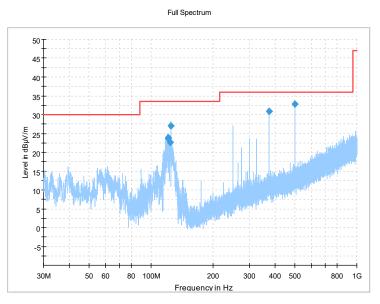


No.: SRTC2024-9004(F)-24052101(E) FCC ID: 2AOXV-I1421-SW-A



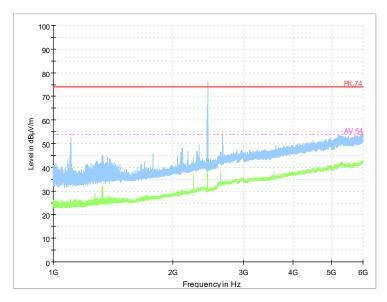
Frequency Range: 18GHz-26GHz Detector: Av mode and PK mode Modulation type: GFSK (LE 1Mbps)



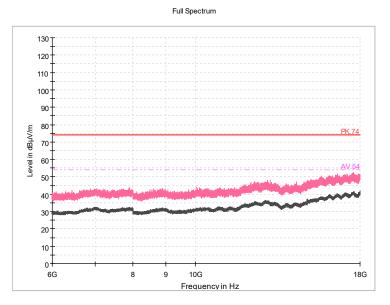


Frequency Range: 30MHz-1GHz Detector: QP mode Modulation type: GFSK (LE 1Mbps)





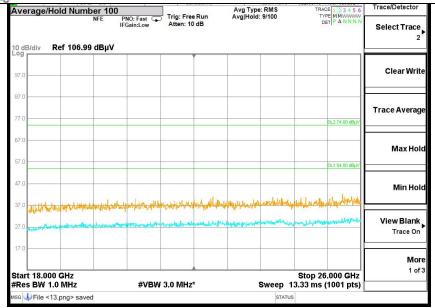
Frequency Range: 1GHz-6GHz Detector: Av mode and PK mode Modulation type: GFSK (LE 1Mbps)



Frequency Range: 6GHz-18GHz Detector: Av mode and PK mode Modulation type: GFSK (LE 1Mbps)

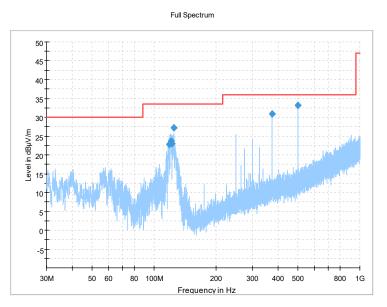


No.: SRTC2024-9004(F)-24052101(E) FCC ID: 2AOXV-I1421-SW-A



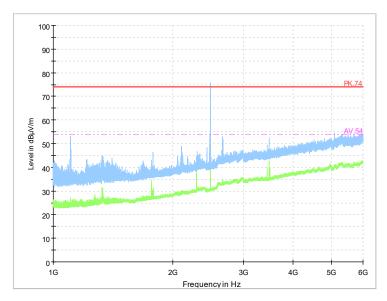
Frequency Range: 18GHz-26GHz Detector: Av mode and PK mode Modulation type: GFSK (LE 1Mbps)

Channel No.:39

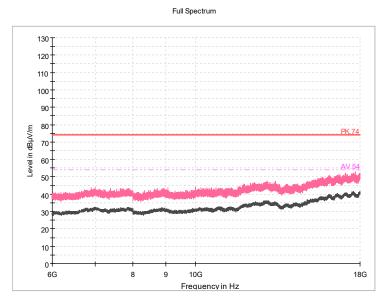


Frequency Range: 30MHz-1GHz Detector: QP mode Modulation type: GFSK (LE 1Mbps)





Frequency Range: 1GHz-6GHz Detector: Av mode and PK mode Modulation type: GFSK (LE 1Mbps)



Frequency Range: 6GHz-18GHz Detector: Av mode and PK mode Modulation type: GFSK (LE 1Mbps)



No.: SRTC2024-9004(F)-24052101(E) FCC ID: 2AOXV-11421-SW-A

Average/Hold Num	ber 100			Avg Type: RMS	TRACE 1 2 3 4 5 6	Trace/Detector
10 dB/div Ref 106.9	NFE	PNO: Fast 😱 FGain:Low	Trig: Free Run Atten: 10 dB	Avg Hold: 9/100	DET PANNN	Select Trace 2
97.0						Clear Writ
77.0					DL2 74.00 dBµV	Trace Averag
67.0					DL1 54.00 dBuV	Max Hol
47.0	1	. Jula	1	Maijan John Holes	a set usel have some	Min Ho
37.0 Moratekipatilitativi	An tokal and	a loss united at	and an		anterpresent of the second second	View Blank Trace On
17.0 Start 18.000 GHz #Res BW 1.0 MHz		#\/D\\\/	3.0 MHz*		Stop 26.000 GHz 3.33 ms (1001 pts)	Mor 1 of

Frequency Range: 18GHz-26GHz Detector: Av mode and PK mode Modulation type: GFSK (LE 1Mbps)

---End of Test Report---