Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

FCC 15.247 & RSS-247
900 MHz Test Report

for

FUTABA Corporation

1080 YabutsukaChosei-son Chosei-gun, Chiba-ken, 299-4395 Japan.

Product Name	**:**	**Radio Control**
Model Name	**:**	**TM-18**
Brand		**Futaba**
FCC ID	**:**	**AZPTM18**
IC	**:**	**2914D-TM18**

Prepared by: **:** **AUDIX Technology Corporation, EMC Department**

Testing Laboratory
1724

TESTING
NVLAP LAB CODE 200077-0

The test report is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
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Fax: +886 2 26099303

TABLE OF CONTENTS

Audix Technology Corp.
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New Taipei City244,Taiwan
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Fax: +886 2 26099303

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No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

TEST REPORT

Applicant	:	FUTABA Corporation
Manufacturer	:	FUTABA Corporation
EUT Description		
(1) Product	:	Radio Control
(2) Model	:	TM-18
(3) Brand	:	Futaba
(4) Power Supply	:	DC 4.0V-8.4V

Applicable Standards:

Title 47 CFR FCC Part 15 Subpart C
RSS-Gen (Issue 5), Amendment 2, February 2021
RSS-247 (Issue 3), August 2023

Audix Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.
Audix Technology Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Report: 2024. 01. 17

Reviewed by:  (Annie Yu/Administrator)

Approved by:  (Johnny Hsueh/Section Manager)

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Tel: +886 2 26099301
Fax: +886 2 26099303

1. REVISION RECORD OF TEST REPORT

Edition No	Issued Date	Revision Summary	Report Number
0	2024. 01. 17	Original Report	EM-F230631

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2. SUMMARY OF TEST RESULTS

Rule		Description	Results
FCC	IC		
15.207	RSS-Gen §8.8	Conducted Emission	**N/A, Note 3**
15.247(d)/15.205	RSS-Gen §8.9 RSS-247 §5.5	Radiated Band Edge and Radiated Spurious Emission	**PASS**
15.247(a)(1)(i)	RSS-247 §5.1(C)	20dB Bandwidth	**PASS**
15.247(a)(1)(i)	RSS-247 §5.1(C)	Carrier Frequency Separation	**PASS**
15.247(a)(1)(i)	RSS-247 §5.1(C)	Time of Occupancy	**PASS**
15.247(a)(1)(i)	RSS-247 §5.1(C)	Number of Hopping Channels	**PASS**
15.247(b)(2)	RSS-247 §5.4(a)	Maximum Peak Output Power	**PASS**
15.247(d)	RSS-247 §5.5	Conducted Band Edges and Conducted Spurious Emission	**PASS**
15.203	---	Antenna Requirement	**Compliance, Note 4**

Note: 1. Decision rule according to the limit of the test standard chapter, the test value is lower than the limit specified in the test chapter, and it is judged as Pass.
2. The uncertainties value is not used in determining the result.
3. The EUT only employs battery power for operation, so it is unnecessary to test.
4. It's RP-SMA connector.

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New Taipei City244,Taiwan
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3. GENERAL INFORMATION

3.1. Description of Application

Applicant	FUTABA Corporation 1080 Yabutsuka Chosei-mura Chosei-gun Chiba-ken, 299-4395 Japan.
Manufacturer	FUTABA Corporation 1080 Yabutsuka Chosei-mura Chosei-gun Chiba-ken, 299-4395 Japan.
Product	Radio Control
Model	TM-18
Brand	Futaba

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3.2. Description of EUT

Test Model	TM-18
Serial Number	N/A
Power Rating	DC 4.0V-8.4V
Software Version	N/A
RF Features	2GFSK (FHSS)
Transmit Type	1T1R
Test Sample	Sample No. / Test Item / Firmware: 01 / RSE, RF Conducted / N/A
Sample Status	Trial sample
Date of Receipt	2023. 10. 16
Date of Test	2023. 11. 29 ~ 2024. 01. 17
Interface Ports of EUT	None
Accessories Supplied	None

Pursuant ISO 17025:2017 section 7.8.2, ***Audix Technology Corp.*** does not assume responsibility for all EUT's information including RF features, transmit type, antenna information…etc are provided by customer.

3.3. Reference Test Guidance

ANSI C63.10:2013

3.4. Antenna Information

No.	Antenna Type	Manufacture	Antenna Part Number	Frequency (MHz)	Max Gain (dBi)
1.	1/2λ di-pole type	SHENZHENFEDCOMMUNICATIONSEQUIPMENT.CO.,LTD	9M99Z11701	880-960	3.83

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3.5. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (kbps)
FHSS	904.6-925.4	53	2GFSK	140

Channel List							
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
1	904.6	16	910.6	31	916.6	46	922.6
2	905.0	17	911.0	32	917.0	47	923.0
3	905.4	18	911.4	33	917.4	48	923.4
4	905.8	19	911.8	34	917.8	49	923.8
5	906.2	20	912.2	35	918.2	50	924.2
6	906.6	21	912.6	36	918.6	51	924.6
7	907.0	22	913.0	37	919.0	52	925.0
8	907.4	23	913.4	38	919.4	53	925.4
9	907.8	24	913.8	39	919.8		
10	908.2	25	914.2	40	920.2		
11	908.6	26	914.6	41	920.6		
12	909.0	27	915.0	42	921.0		
13	909.4	28	915.4	43	921.4		
14	909.8	29	915.8	44	921.8		
15	910.2	30	916.2	45	922.2		

3.6. Description of Key Components

None

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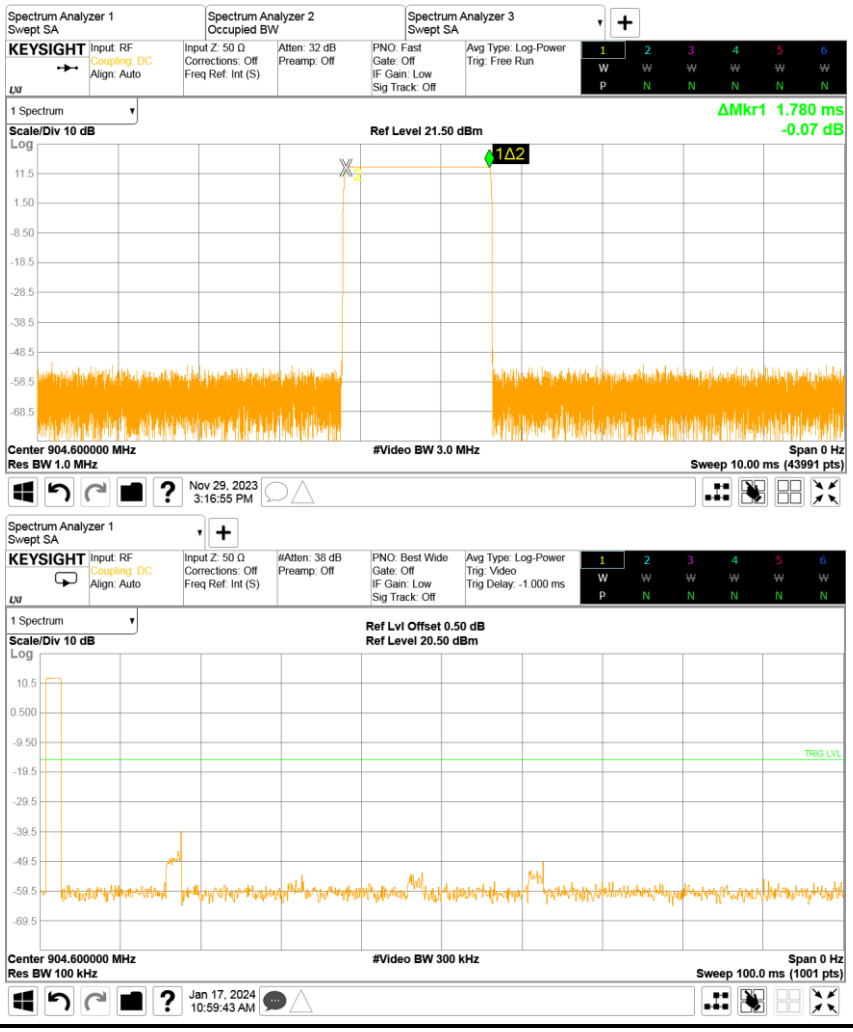
3.7. Test Configuration

Mode	Frequency (MHz)	TX_{on} (ms)	TX_{on+off} (ms)	Duty Cycle Correction Factor (dB)
FHSS	904.6	1.780	100	-34.99

Note: Duty Cycle Correction Factor (DCCF)= 20log (TXon/TX on+off)。
"TX on + off" means the period of the pulse train or 100ms if the pulse train length is greater than 100ms.

Mode	Frequency (MHz)	TX_{on} (ms)
FHSS	904.6	

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Item		Test Channel
Radiated Test Case	Radiated Spurious Emission (30MHz~1GHz)	1

Item		Test Channel
Radiated Test Case	Radiated Band Edge Note	1/53
	Radiated Spurious Emission Note	1/27/53
Conducted Test Case	20dB Bandwidth	1/27/53
	Carrier Frequency Separation	1/27/53
	Time of Occupancy	1/27/53
	Number of Hopping Channels	27
	Maximum Peak Output Power	1/27/53
	Band Edges	1/53
	Spurious Emission	1/27/53

Note 1: □Mobile Device ■Portable Device
and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ■Lie □Side □Stand

Note 2: Low, mid, and high channels were measured, only the worst channel of each modulation was presented in this report.

3.8. Output Power Setting

Mode	Centre Frequency (MHz)	Power Setting
2GFSK	904.6	Default
	915.0	Default
	925.4	Default

3.9. Tested Supporting System List

3.9.1. Support Peripheral Unit

No.	Product	Brand	Model No.	Serial No.	Approval
1.	Battery (DC 6.0V)	Futaba	HT5F1800B	N/A	N/A
2.	Test Jig	Futaba	CIU-3	N/A	N/A
3.	Notebook PC	Dynabook	CS40L-HB	51144079H	N/A

3.9.2. Cable Lists

No.	Cable Description Of The Above Support Units
1.	Power Wire: Unshielded, Detachable, 0.1m*2
2.	Signal Cable: Unshielded, Detachable, 0.2m
3.	Adapter: BSY, M/N BSY065T1902103 D, DC Cord：Shielded, Undetachable, 1.8m, Bonded a ferrite core AC Power Cord：Unshielded, Detachable, 1.5m

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3.10.Setup Configuration

3.10.1. EUT Configuration for Radiated Emission

3.10.2. EUT Configuration for RF Conducted Test Items

3.11.Operating Condition of EUT

Test program "Futaba Term" is used for enabling EUT RF function under continue transmitting and choosing channel.

3.12.Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 491, Zhongfu Rd., Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2017 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724
Test Facilities	FCC OET Designation Number under APEC MRA by NCC is : TW1724 ISED CAB Identifier Number under APEC TEL MRA by NCC is TW1724 (1) No.1 3m Semi Anechoic Chamber

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3.13.Measurement Uncertainty

The measurement uncertainty levels have been estimated as specified in ETSI TR 100 028-2001

Test Items/Facilities			Frequency Range	Uncertainty
Conduction Test	☐	No. 7 Shielded Room	9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.4dB
	☐	No. 8 Shielded Room	9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.5dB
Radiation Test	☒	No.1 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.6dB
			200MHz-1000MHz, 3m, Horizontal	±4.3dB
			30MHz-200MHz, 3m, Vertical	±4.4dB
			200MHz-1000MHz, 3m, Vertical	±4.8dB
			1GHz-6GHz, 3m	±4.8dB
			6GHz-18GHz, 3m	±4.5dB
	☐	No.3 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.0dB
			200MHz-1000MHz, 3m, Horizontal	±4.4dB
			30MHz-200MHz, 3m, Vertical	±4.7dB
			200MHz-1000MHz, 3m, Vertical	±4.5dB
			1GHz-6GHz, 3m	±4.8dB
			6GHz-18GHz, 3m	±4.5dB
	☐	No.4 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.3dB
			200MHz-1000MHz, 3m, Horizontal	±4.2dB
			30MHz-200MHz, 3m, Vertical	±4.8dB
			200MHz-1000MHz, 3m, Vertical	±4.7dB
			1GHz-6GHz, 3m	±4.6dB
			6GHz-18GHz, 3m	±4.4dB
	☐	No.5 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.6dB
			200MHz-1000MHz, 3m, Horizontal	±4.4dB
			30MHz-200MHz, 3m, Vertical	±4.5dB
			200MHz-1000MHz, 3m, Vertical	±4.9dB
			1GHz-6GHz, 3m	±4.9dB
			6GHz-18GHz, 3m	±4.6dB
	Radiated emissions (18GHz-40GHz)		18GHz-40GHz, 3m	±3.4dB

Remark：Uncertainty = $ku_c(y)$

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Test Item	Uncertainty
20dB Bandwidth	±0.2kHz
99% Occupied Bandwidth	±0.38%
Carrier Frequency Separation	±0.2kHz
Time of Occupancy	±0.03sec
Maximum peak Output power	± 0.52dB
Conducted Emission Limitations	± 0.13dB

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4. MEASUREMENT EQUIPMENTLIST

4.1. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2023.08.16	1 Year
2.	Test Receiver	R&S	ESCS30	100338	2023.06.20	1 Year
3.	Amplifier	HP	8447D	2944A06305	2022.12.29	1 Year
4.	Microwave Preamplifier	HP	8449B	3008A01284	2023.06.06	1 Year
5.	Bilog Antenna	TESEQ	CBL6112D	33821	2023.09.30	1 Year
6.	Double-Ridged Waveguide Horn	EMCO	3115	9112-3775	2023.05.04	1 Year
7.	High-Pass Filter	Woken	WFIL-H1200-12000F	WRG19WC2B4	2023.05.03	1 Year
8.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2023.01.07	1 Year
9.	Coaxial Cable	HUBER+ SUHNER	SUCOFLEX 106	RE-14	2023.01.07	1 Year
10.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.1 3m A/C	2023.04.13	1 Year
11.	Test Software	Audix	e3	V9 18621a	N.C.R.	N.C.R.

4.2. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9020B	MY57120357	2023.02.22	1 Year
2.	Digital Thermo-Hygro Meter	iMax	HTC-1	RF-03	2023.04.13	1 Year

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5. CONDUCTED EMISSION

【The EUT only employs uses DC power for operation, no conductive emission limits are required according to FCC Part 15 Section §15.207 and RSS-Gen §8.8】

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New Taipei City244,Taiwan
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Fax: +886 2 26099303

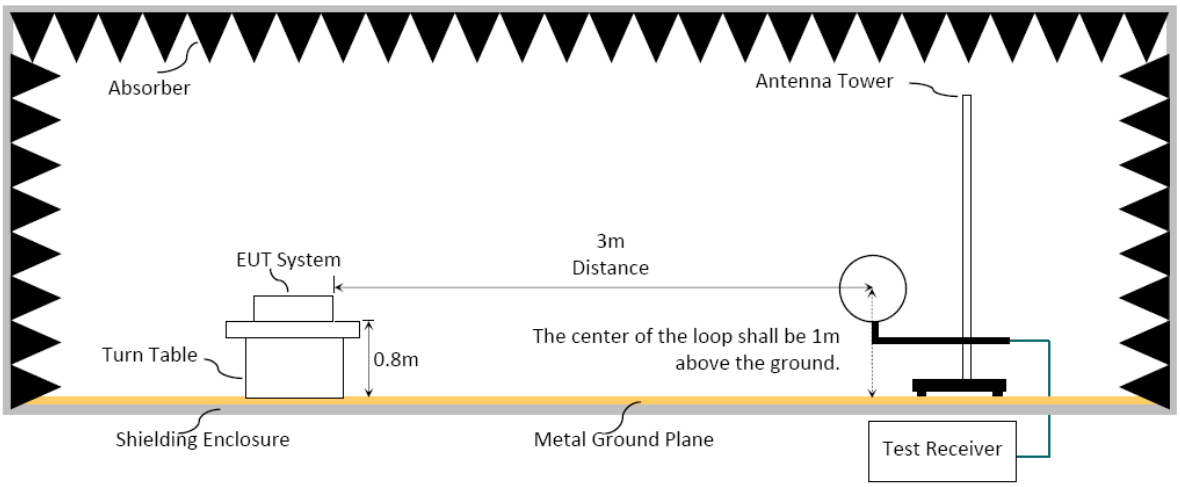
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

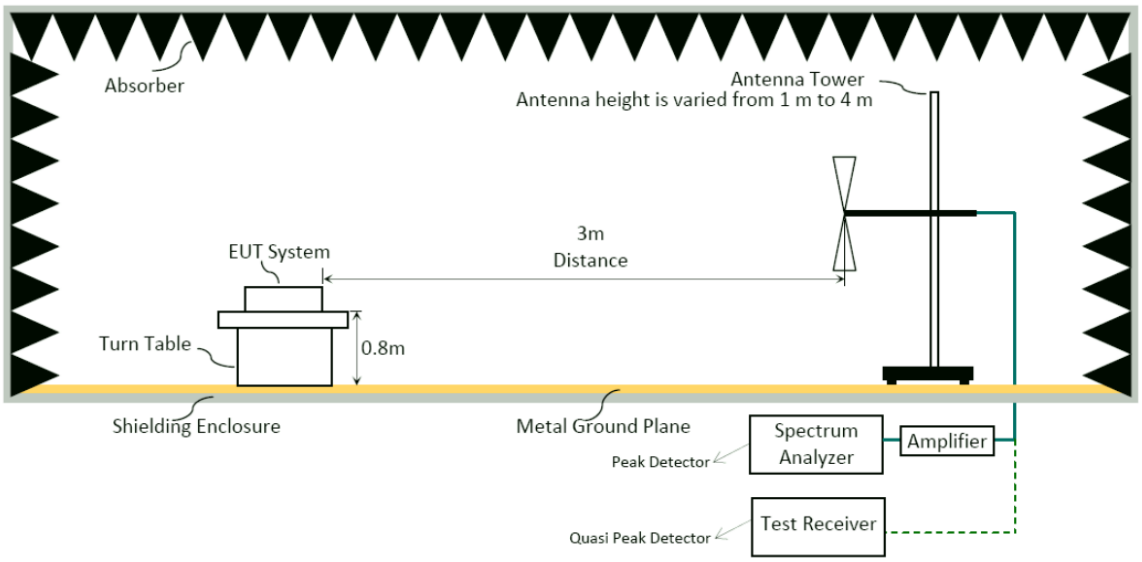
6.1.1. Block Diagram of EUT

Indicated as section 3.10

6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000MHz



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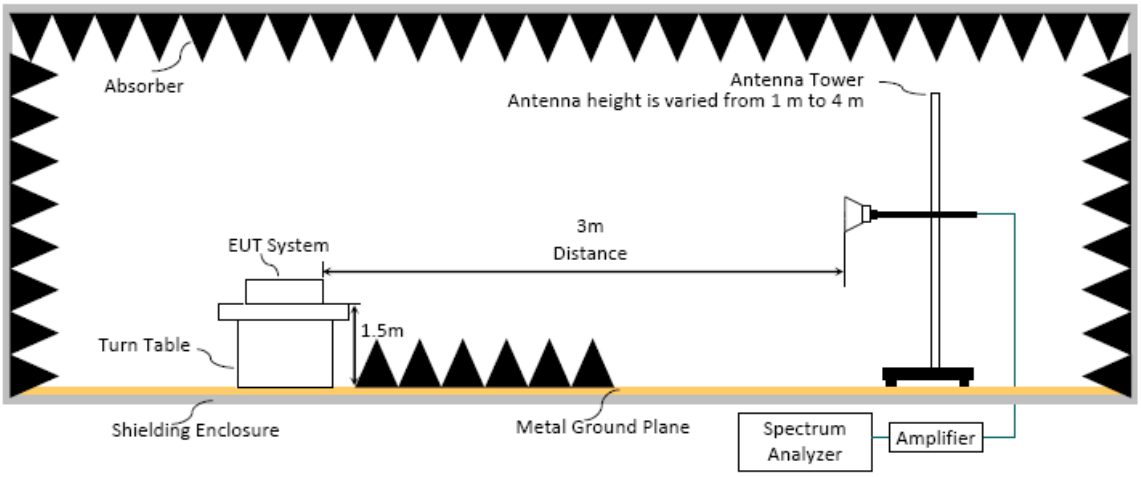
6.1.4. Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205/ RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance(m)	Limits	
		dBμV/m	μV/m
0.009 - 0.490	300	67.6-20 log f(kHz)	2400/f kHz
0.490 - 1.705	30	87.6-20 log f(kHz)	24000/f kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dBμV/m (Peak) 54.0 dBμV/m (Average)	

Remark：(1) dBμV/m = 20 log (μV/m)
(2) The tighter limit applies to the edge between two frequency bands.
(3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
(4) Fundamental and emission fall within operation band are exempted from this section.
(5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

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No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

6.3. Test Procedure

Frequency Range 9kHz~30MHz:
The EUT setup on the turntable which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level.
In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

(1) RBW = 9kHz with peak and average detector.

(2) Detector: average and peak (9kHz-490kHz)
Q.P. (490kHz-30MHz)

Frequency Range 30MHzto 10th harmonic (up to 10 GHz):
The EUT setup on the turn table which has 80cm (for 30-1000MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1GHz:
Spectrum Analyzer is used for pre-testing with following setting:

(1)RBW = 120KHz

(2)VBW ≥ 3 x RBW.

(3)Detector = Peak.

(4)Sweep time = auto.

(5)Trace mode = max hold.

(6)Allow sweeps to continue until the trace stabilizes.

Note 1: When peak-detected value is lower than limit that the measurement using theQ.P. detector is not required, otherwise using Q.P. for final measurement.

Note 2: When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Frequency above 1GHz to 10th harmonic (up to 10 GHz):
Peak Detector:

(1)RBW = 1MHz

(2)VBW ≥ 3 x RBW.

(3)Detector = Peak.

(4)Sweep time = auto.

(5)Trace mode = max hold.

(6)Allow sweeps to continue until the trace stabilizes.

Note: When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.

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Average Detector:

☐**Option 1:**

(1)RBW = 1MHz
(2)VBW ≥ 1/ T
(3)Detector = Peak.
(4)Sweep time = auto.
(5)Trace mode = max hold.
(6)Allow sweeps to continue until the trace stabilizes.

■**Option 2:**

Average Emission Level= Peak Emission Level+ D.C.C.F.

6.4. Measurement Result Explanation

■Peak Emission Level(dBμV/m)=Antenna Factor(dB/m) + Cable Loss (dB)– Preamp Gain (dB)+ Reading(dBμV).

☐Average Emission Level(dBμV/m)= Antenna Factor(dB/m) + Cable Loss (dB)– Preamp Gain (dB)+ Reading(dBμV).

■Average Emission Level(dBμV/m)= Peak Emission Level(dBμV/m)+ DCCF(dB)
Duty Cycle Correction Factor (DCCF)(dB)= 20log(TX_{on}/TX_{on+off}) presented in section 3.7.

☐ERP(dBm)= Peak Emission Level(dBμV/m) -95.2dB-2.14dB

6.5. Test Results

Please refer to Appendix A.

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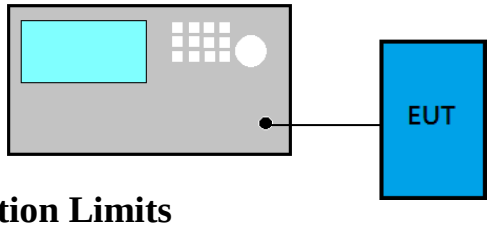
7. 20dB/OCCUPIED BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

7.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

For 20dB Bandwidth

(1) Set Span range 2~5 times the OBW
(2) Set RBW close to1% to 5% of OBW.
(3) Set VBW≥3xRBW.
(4) Detector = Peak.
(5) Trace mode = Max hold.
(6) Sweep = Auto couple.
(7) Allow the trace to stabilize.
(8) Setting channel bandwidth function x dB to -20 dB to record the final bandwidth.

For 99% Occupied Bandwidth

(9) Set Span range 1.5~5 times the OBW
(10) Set RBW = 1% to 5% of OBW.
(11) Set VBW≥3xRBW.
(12) Detector = Peak.
(13) Trace mode = Max hold
(14) Sweep = Auto couple.
(15) Allow the trace to stabilize.

7.4. Test Results

Please refer to Appendix A

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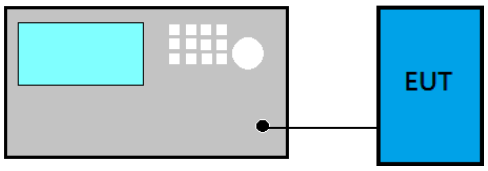
8. CARRIER FREQUENCY SEPARATION

8.1. Block Diagram of Test Setup



8.2. Specification Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

8.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Span = Wide enough to capture the peaks of two adjacent channels
(2) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
(3) VBW≥ RBW
(4) Sweep = Auto
(5) Detector function = Peak
(6) Trace = Max hold
(7) Allow the trace to stabilize.

8.4. Test Results

Please refer to Appendix A

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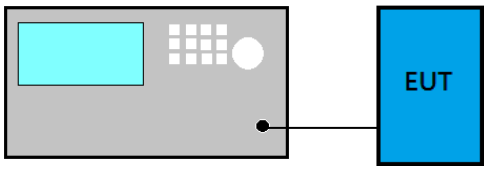
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

9. TIME OF OCCUPANCY

9.1. Block Diagram of Test Setup



9.2. Specification Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

9.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Span: Zero span, centered on a hopping channel.
(2) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1/T, where T is the expected dwell time per channel.
(3) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
(4) Detector function = Peak
(5) Trace = Max hold

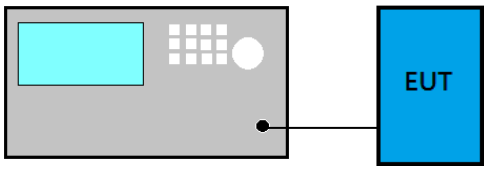
9.4. Test Results

Please refer to Appendix A

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

10. NUMBER OF HOPPING CHANNELS

10.1. Block Diagram of Test Setup



10.2. Specification Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

10.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
(2) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
(3) VBW ≥ RBW
(4) Sweep = Auto
(5) Detector function = Peak
(6) Trace = m=Max hold
(7) Allow the trace to stabilize.

10.4. Test Results

Please refer to Appendix A

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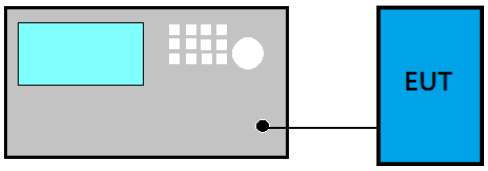
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

11. MAXIMUM PEAK OUTPUT POWER

11.1. Block Diagram of Test Setup



11.2. Specification Limits

The Limits of maximum Peak Output Power for frequency hopping systems in 902–928 MHz is: 1 watt for systems employing at least 50 hopping channels; and 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i)of 15.247.

11.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(a) Use the following spectrum analyzer settings

(1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
(2) RBW > 20 dB bandwidth of the emission being measured.
(3) VBW ≥ RBW
(4) Sweep: Auto
(5) Detector function: Peak
(6) Trace: Max hold

(b) Allow trace to stabilize.

(c) Use the marker-to-peak function to set the marker to the peak of the emission.

11.4. Test Results

Please refer to Appendix A

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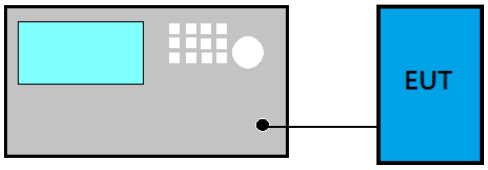
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

12. EMISSION LIMITATIONS

12.1. Block Diagram of Test Setup



12.2. Specification Limits

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, that the required attenuation shall be 30 dB instead of 20 dB.
Attenuation below the general limits specified in Section 15.209(a)/ RSS-Gen Section 8.9 table 4 is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a)/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4. (See Section 15.205(c)).

12.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Set span wide enough to capture the peak level of the in-band emission and all spurious emissions; up to 10^{th} harmonic.
(2) RBW = 100 kHz
(3) VBW ≥ RBW
(4) Sweep = Auto
(5) Detector function = Peak
(6) Trace = Max hold

12.4. Test Results

Please refer to Appendix A

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

13. DEVIATION TO TEST SPECIFICATIONS

【NONE】

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

APPENDIX A

TEST DATA AND PLOTS

(Model:TM-18)

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

TABLE OF CONTENTS

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

A.1 RADIATED EMISSION

Test Date	2023/12/02	Temp./Hum.	22℃/54%
Test Voltage	DC 6.0V (Via Battery)	Tested By	Hua Wu

A.1.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

The emissions (9kHz~30MHz) not reported for there is no emission be found.

A.2.1.2 Frequency Below 1 GHz

Mode	FHSS	Frequency	TX 904.6MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
33.233	22.77	1.27	26.52	31.58	29.09	40.00	10.91	Peak
101.942	16.84	2.32	26.30	33.92	26.78	43.50	16.72	Peak
254.717	18.17	3.92	25.72	32.28	28.64	46.00	17.36	Peak
368.692	20.80	5.18	26.27	32.40	32.12	46.00	13.88	Peak
465.692	22.64	6.12	26.95	32.58	34.38	46.00	11.62	Peak
549.758	23.77	6.59	27.29	33.00	36.07	46.00	9.93	Peak

Antenna at Vertical Polarization

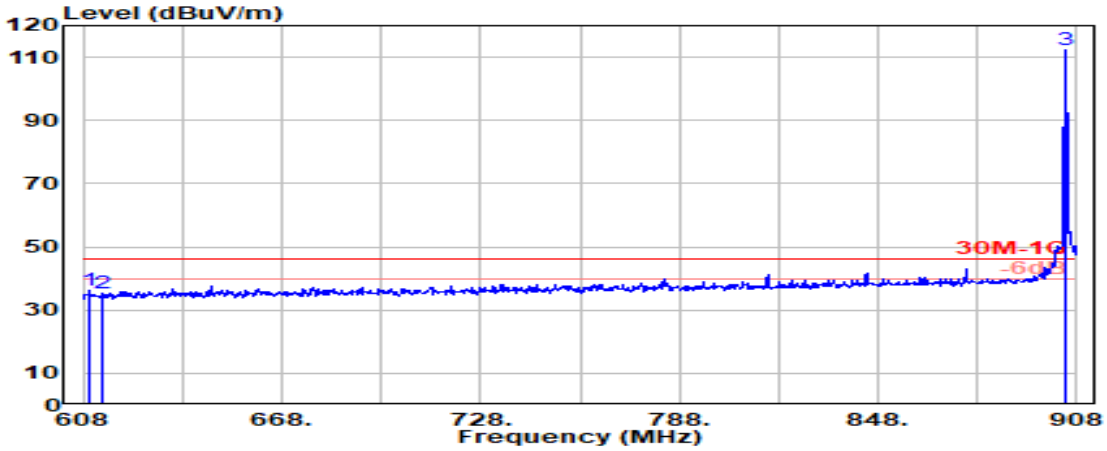
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
34.850	22.21	1.30	26.51	33.46	30.45	40.00	9.55	Peak
101.942	16.84	2.32	26.30	33.85	26.71	43.50	16.79	Peak
313.725	19.33	4.54	25.79	30.69	28.76	46.00	17.24	Peak
397.792	21.51	5.49	26.49	31.87	32.37	46.00	13.63	Peak
451.142	22.40	5.99	26.86	32.87	34.40	46.00	11.60	Peak
573.200	24.03	6.67	27.35	31.68	35.04	46.00	10.96	Peak

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

A.2.1.3 Frequency Above 1 GHz to 10th harmonics

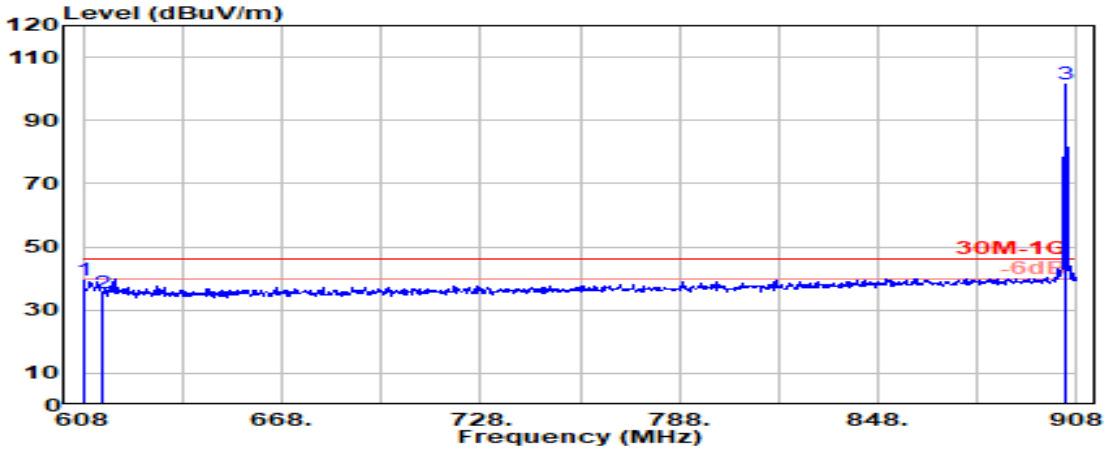
Band Edge:

Mode	FHSS	Frequency	TX 904.6MHz



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	610.100	24.37	6.82	27.41	32.36	36.14	46.00	9.86	Peak
	614.000	24.39	6.84	27.41	31.68	35.50	46.00	10.50	Peak
@	904.700	26.28	8.75	27.03	104.11	112.11	---	---	Peak



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	608.000	24.36	6.81	27.41	35.60	39.36	46.00	6.64	Peak
	614.000	24.39	6.84	27.41	31.36	35.18	46.00	10.82	Peak
@	904.700	26.28	8.75	27.03	93.26	101.25	---	---	Peak

Remark: The "@" means fundamental frequency, it is ignored in this section.

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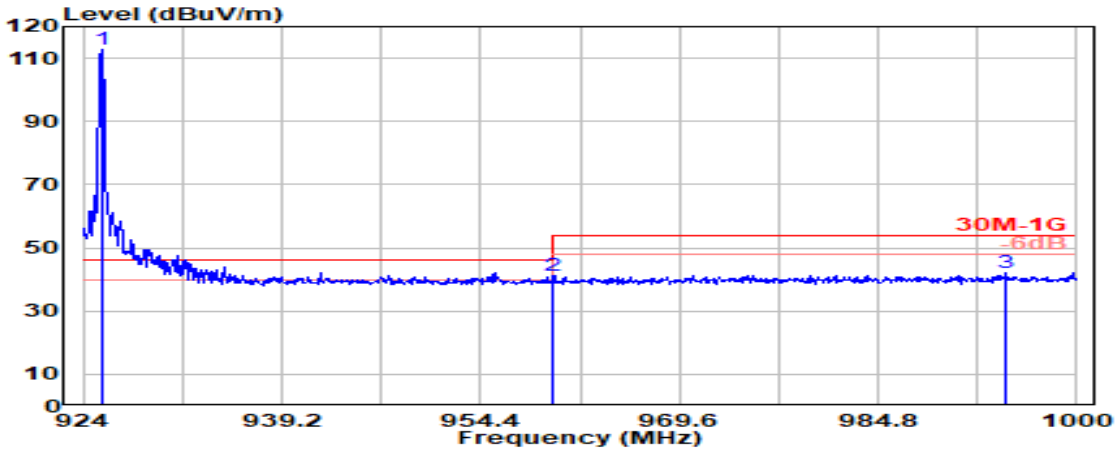
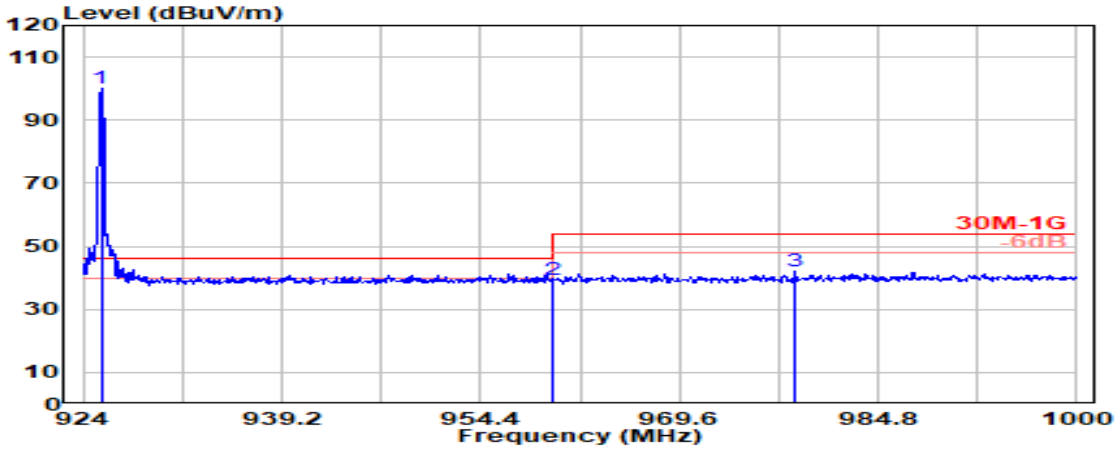
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

Mode	FHSS	Frequency	TX 925.4MHz



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	925.444	26.42	8.87	26.97	104.64	112.96	---	---	Peak
	960.000	26.66	9.06	26.87	32.23	41.08	46.00	4.92	Peak
	994.604	26.93	9.24	26.77	32.65	42.05	46.00	3.95	Peak



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	925.368	26.42	8.87	26.97	91.84	100.16	---	---	Peak
	960.000	26.66	9.06	26.87	30.44	39.29	46.00	6.71	Peak
	978.492	26.80	9.16	26.82	33.16	42.30	46.00	3.70	Peak

Remark: The "@" means fundamental frequency, it is ignored in this section.

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

A.1.2 Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

Mode	FHSS	Frequency	TX 904.6MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1809.200	26.54	4.77	40.03	69.59	60.87	74.00	13.13	Peak
2713.800	28.88	6.38	39.98	62.94	58.22	74.00	15.78	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1809.200	60.87	-34.99	25.88	54.00	28.12	Average
2713.800	58.22	-34.99	23.23	54.00	30.77	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1809.200	26.54	4.77	40.03	64.77	56.05	74.00	17.95	Peak
2713.800	28.88	6.38	39.98	63.24	58.52	74.00	15.48	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1809.200	56.05	-34.99	21.06	54.00	32.94	Average
2713.800	58.52	-34.99	23.53	54.00	30.47	Average

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

Mode	FHSS	Frequency	TX 915.0MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1830.000	26.79	4.80	40.03	70.31	61.88	74.00	12.12	Peak
2745.000	28.81	6.46	39.99	65.58	60.86	74.00	13.14	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1830.000	61.88	-34.99	26.89	54.00	27.11	Average
2745.000	60.86	-34.99	25.87	54.00	28.13	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1830.000	26.79	4.80	40.03	66.76	58.32	74.00	15.68	Peak
2745.000	28.81	6.46	39.99	63.55	58.83	74.00	15.17	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1830.000	58.32	-34.99	23.33	54.00	30.67	Average
2745.000	58.83	-34.99	23.84	54.00	30.16	Average

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

Mode	FHSS	Frequency	TX 925.4MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1850.800	27.10	4.84	40.02	71.93	63.86	74.00	10.14	Peak
2776.200	28.89	6.52	40.00	62.25	57.66	74.00	16.34	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1850.800	63.86	-34.99	28.87	54.00	25.13	Average
2776.200	57.66	-34.99	22.67	54.00	31.33	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1850.800	27.10	4.84	40.02	66.09	58.01	74.00	15.99	Peak
2776.200	28.89	6.52	40.00	65.93	61.34	74.00	12.66	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1850.800	58.01	-34.99	23.02	54.00	30.98	Average
2776.200	61.34	-34.99	26.35	54.00	27.65	Average

A.1.3 Emissions in Non-restricted Frequency Bands:

All emission levels below the FCC 15.209(a)/RSS-Gen Section 8.9 table 4 general radiated emissions limits is not required.

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

A.2 20dB/OCCUPIED BANDWIDTH

Test Date	2023/11/29	Temp./Hum.	25℃/55%
Cable Loss	0.50dB	Tested By	Hua Wu
Test Voltage	DC 6.0V (Via Battery)		

A.2.1 Emission Bandwidth Result

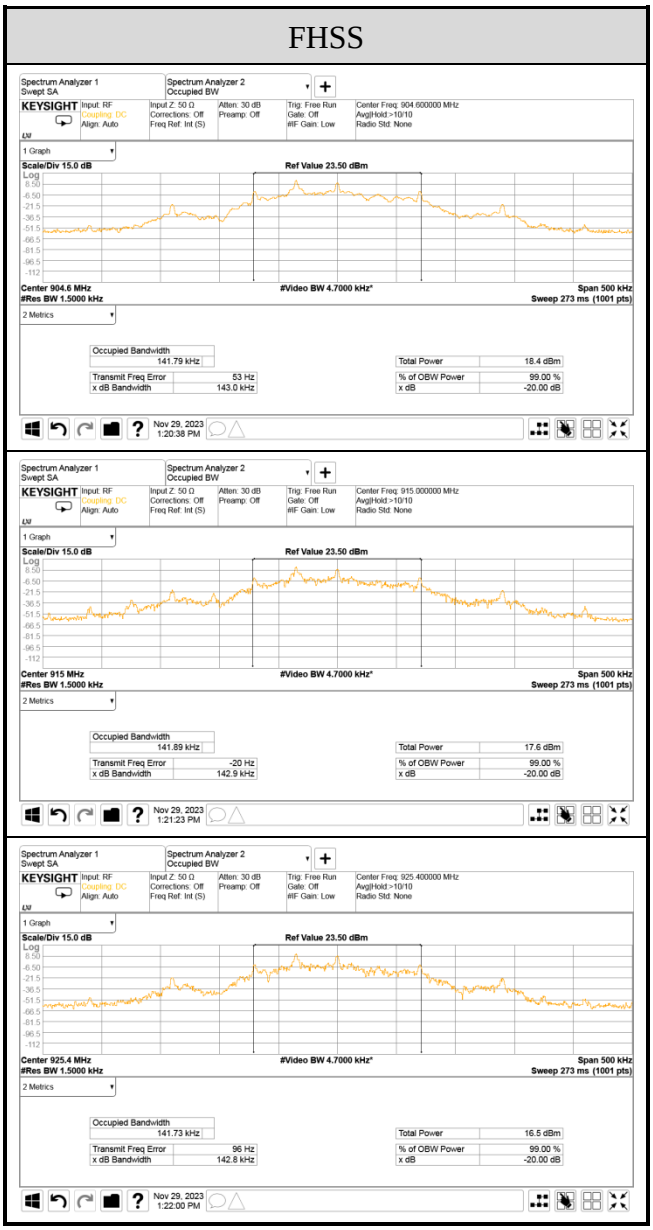
Mode	Centre Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
FHSS	904.6	0.1430	0.14179
	915.0	0.1429	0.14189
	925.4	0.1428	0.14173

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

A.2.2 Measurement Plots

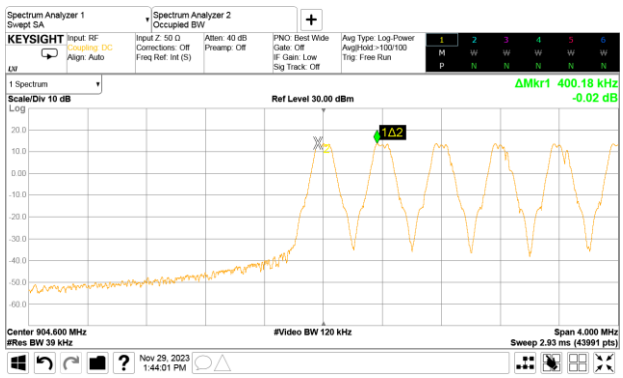
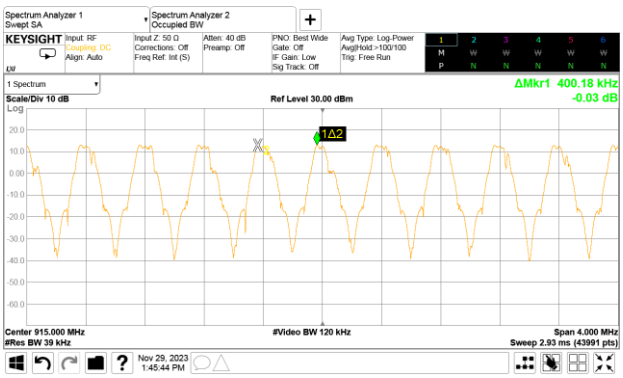
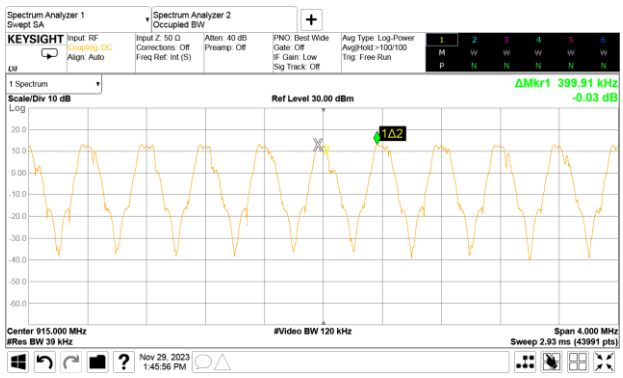
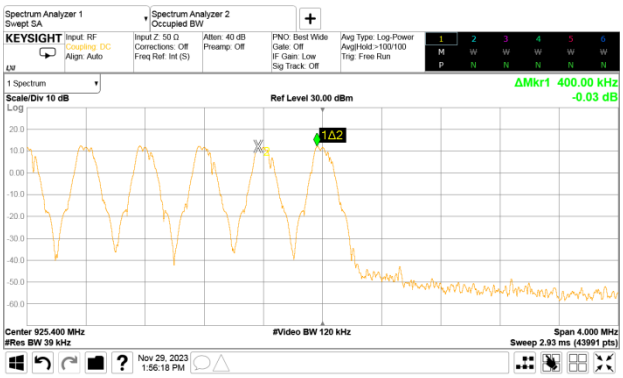
FHSS



Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

A.3 CARRIER FREQUENCY SEPARATION

Test Date	2023/11/29	Temp./Hum.	25℃/55%
Cable Loss	0.50dB	Tested By	Hua Wu
Test Voltage	DC 6.0V (Via Battery)		

FHSS	
904.6MHz	915.0MHz adjacent channel of left carrier frequency
	
915.0MHz adjacent channel of right carrier frequency	925.4MHz
	

Limit: The max 20 dB Bandwidth: 0.1430MHz

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

A.4 TIME OF OCCUPANCY

Test Date	2023/11/29	Temp./Hum.	25℃/55%
Cable Loss	0.50dB	Tested By	Hua Wu
Test Voltage	DC 6.0V (Via Battery)		

A.4.1 Time of Occupancy

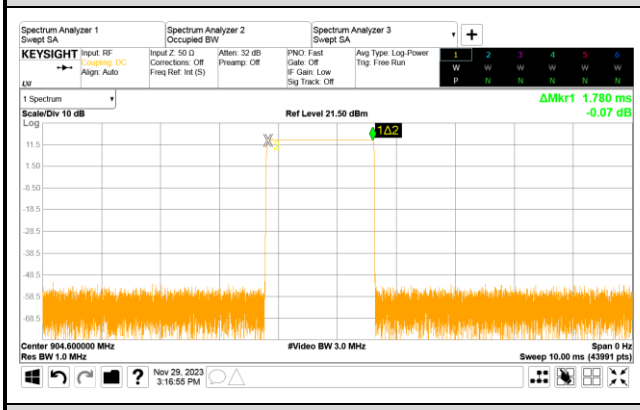
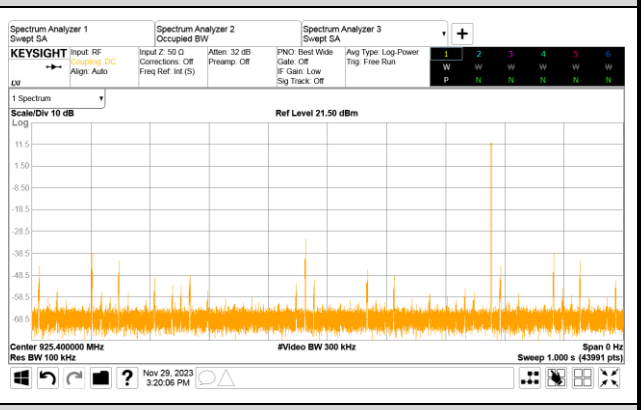
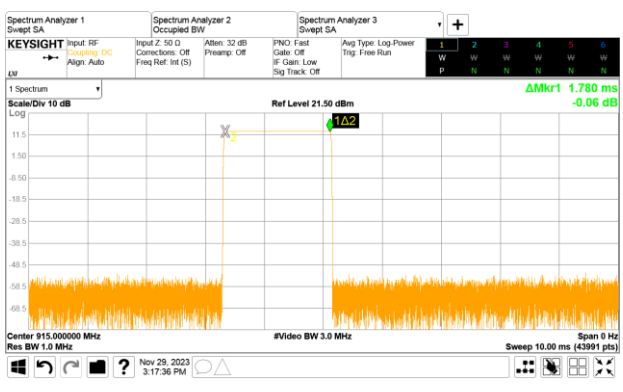
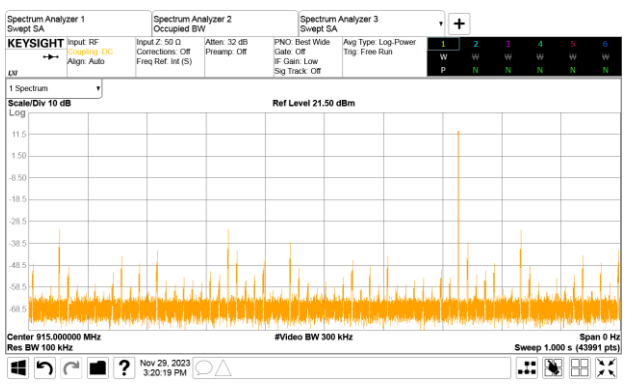
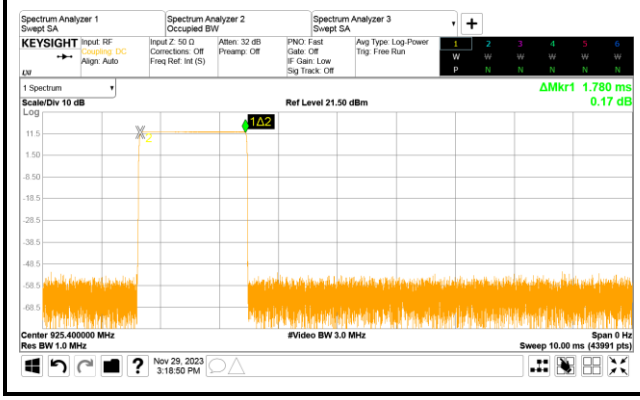
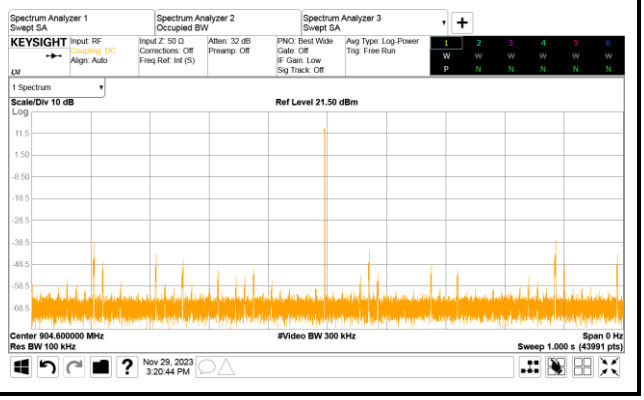
Mode	Centre Frequency (MHz)	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
2GFSK	904.60	1	1.780	35.600	<400
	915.00	1	1.780	35.600	<400
	925.40	1	1.780	35.600	<400

Observation Period: 20

Centre Frequency: 2403.25MHz
For each second of **1** transmission appearance,the longest time of occupancy is
1 channels* **20** * **1.780** ms= **35.600** ms (<400ms)
Centre Frequency: 2425.00MHz
For each second of **1** transmission appearance,the longest time of occupancy is
1 channels* **20** * **1.780** ms= **35.600** ms (<400ms)
Centre Frequency: 2447.50MHz
For each second of **1** transmission appearance,the longest time of occupancy is
1 channels* **20** * **1.780** ms= **35.600** ms (<400ms)

Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

A.4.2 Measurement Plots

FHSS	
904.6MHz	
	
915.0MHz	
	
925.4MHz	
	

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New Taipei City244, Taiwan
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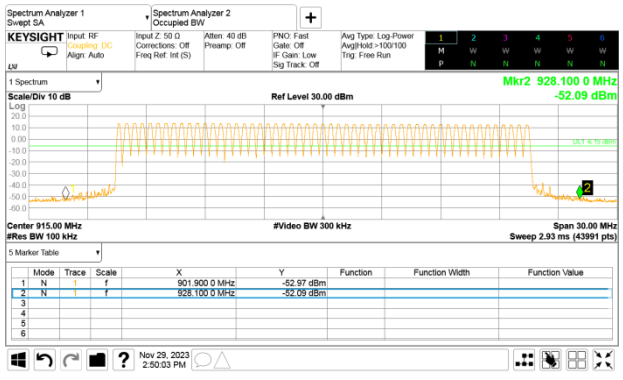
Fax: +886 2 26099303

A.5 NUMBER OF HOPPING CHANNELS

Test Date	2023/11/29	Temp./Hum.	25℃/55%
Cable Loss	0.50dB	Tested By	Hua Wu
Test Voltage	DC 6.0V (Via Battery)		

FHSS

The number hopping channel is 53.

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A.6 MAXIMUM PEAK OUTPUT POWER

Test Date	2023/11/29	Temp./Hum.	25℃/55%
Cable Loss	0.50dB	Tested By	Hua Wu
Test Voltage	DC 6.0V (Via Battery)		

A.6.1 Maximum Peak Output Power

Mode	Centre Frequency (MHz)	Peak Output Power		Limit
		dBm	W	
FHSS	904.6	13.79	0.023933	30dBm (1.0W)
	915.0	13.08	0.020324	
	925.4	12.30	0.016982	

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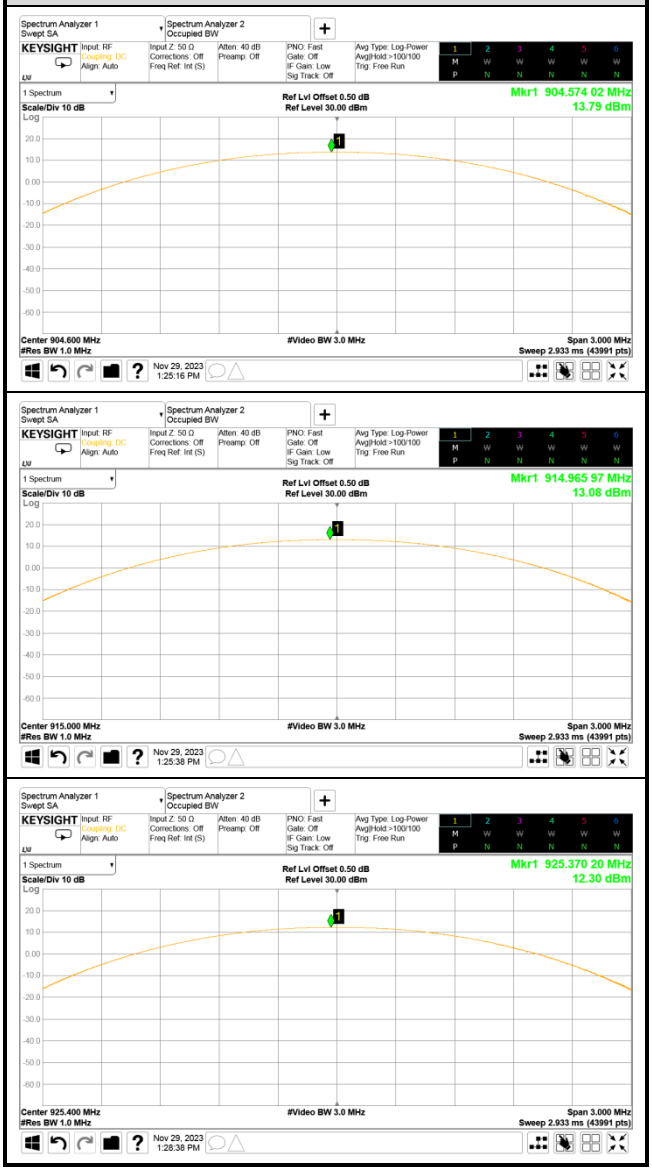
A.6.2 Measurement Plots

FHSS



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A.7 EMISSION LIMITATIONS MEASUREMENT

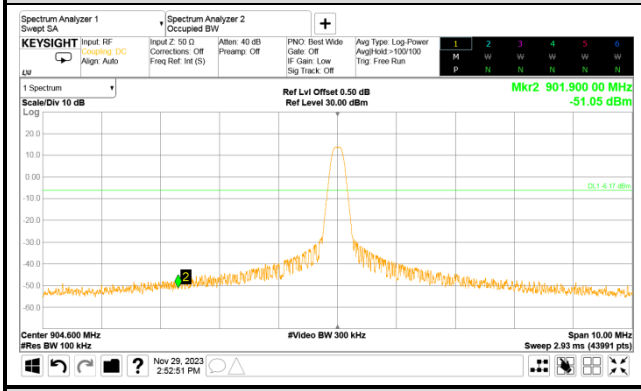
A.7.1 Band Edge

Test Date	2023/11/29	Temp./Hum.	25℃/55%
Cable Loss	0.50dB	Tested By	Hua Wu
Test Voltage	DC 6.0V (Via Battery)		

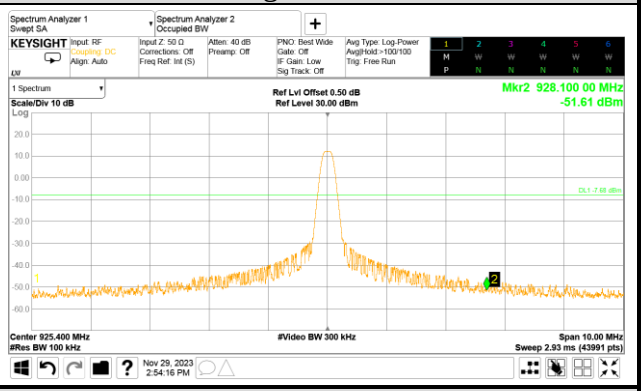
FHSS

Single Channel

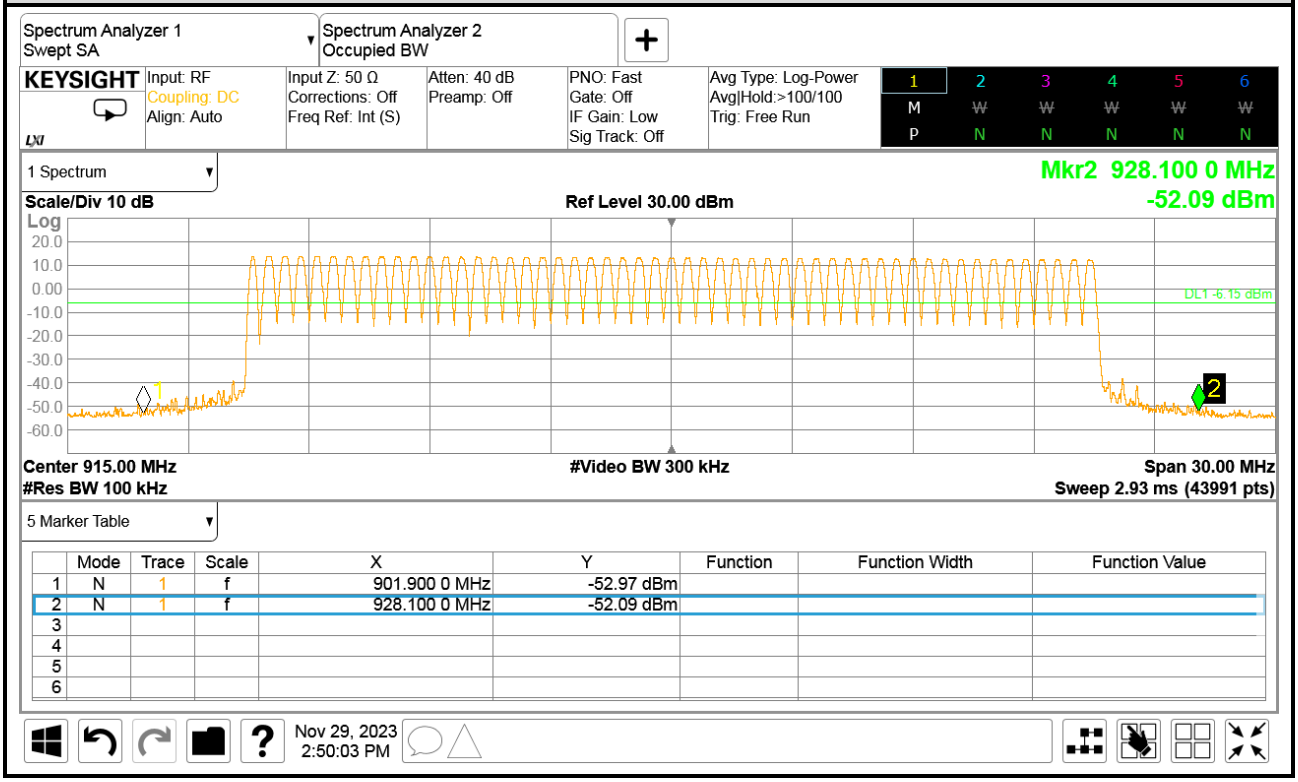
Low channel



High channel



Hopping Mode



	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	901.900 0 MHz	-52.97 dBm			
2	N	1	f	928.100 0 MHz	-52.09 dBm			
3								
4								
5								
6								

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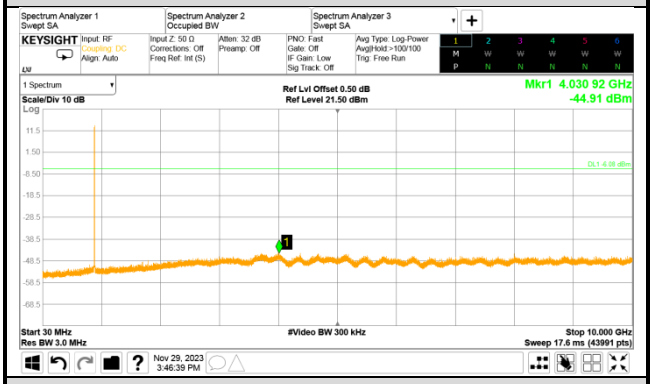
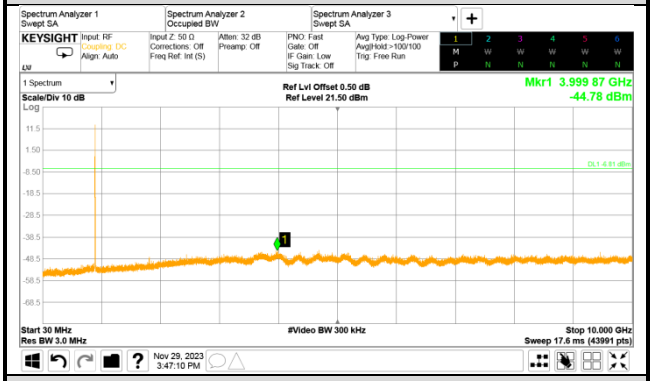
A.7.2 Spurious Emission

Test Date	2022/12/21	Temp./Hum.	18℃/68%
Cable Loss	0.40dB	Tested By	Hua Wu
Test Voltage	DC 6.0V (Via Battery)		

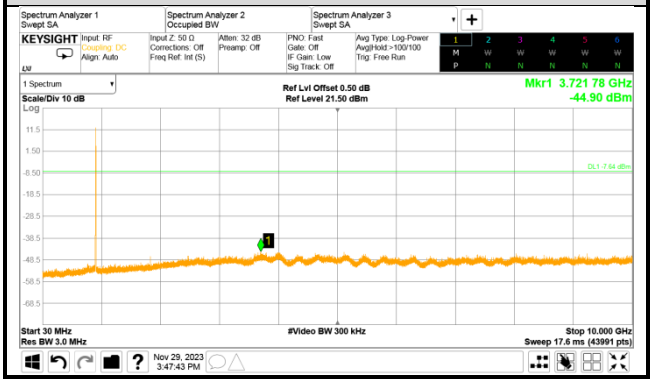
FHSS
904.6MHz
30MHz –25GHz



915.0MHz
30MHz –25GHz



925.4MHz
30MHz –25GHz



Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

APPENDIX B

TEST PHOTOGRAPHS

(Model: TM-18)