

FCC 15.209 Test Report

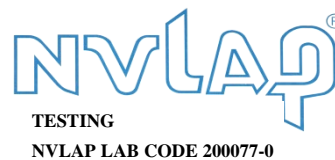
for

FUTABA Corporation

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

Product Name : MODEM
Model Name : FDK32TU
Brand Futaba
FCC ID : AZP-FDK32T

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



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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TEST REPORT

Applicant : FUTABA Corporation
Manufacturer : FUTABA Corporation
EUT Description
(1) Product : MODEM
(2) Model : FDK32TU
(3) Brand : Futaba
(4) Power Supply: DC24V

Applicable Standards:

Title 47 CFR FCC Part 15 Subpart C

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. 02. 29

Reviewed by:

Sabrina Wang

(Sabrina Wang/Administrator)

Approved by:

Johnny Hsueh

(Johnny Hsueh/Section Manager)

1. REVISION RECORD OF TEST REPORT

Edition No	Issued Date	Revision Summary	Report Number
0	2024. 02. 29	Original Report	EM-F240036

2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	N/A, Note 3
15.209	Radiated Spurious Emission	PASS
15.215 (c)	20dB Bandwidth	PASS
15.203	Antenna Requirement	N/A, 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 uses DC power for operation, so it is unnecessary to test.
4. This requirement does not apply to intentional radiators that must be professionally installed. More information can refer instruction manual from manufacture provided.

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	MODEM
Model	FDK32TU
Brand	Futaba

3.2. Description of EUT

Test Model	FDK32TU		
Serial Number	N/A		
Power Rating	DC24V		
RF Features	(1)FSK (151.05-155.95MHz) (2)OFDM (302.20-321.80MHz)		
Transmit Type	1T1R		
Test Sample	Sample No.	Test Item	Firmware
	01	RSE, RF Conducted	N/A
Sample Status	Trial sample		
Date of Receipt	2024. 01. 02		
Date of Test	2024. 01. 22 ~ 02. 27		
Interface Ports of EUT	<ul style="list-style-type: none">• One DC 24V Port• One RS-232C/422 Port• One T1 Port• One T2 Port• One R1 Port• One R2 Port		
Accessories Supplied	<ul style="list-style-type: none">• 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

Antenna Type		Manufacturer	Antenna Part Number	Frequency (MHz)	Max Gain (dBi)
#1	Loop Antenna	Futaba Corporation	FZE32EU	151 - 322	-30
#2	Loop Antenna	Futaba Corporation	FZE32EU	151 - 322	-30

3.5. EUT Specifications Assessed in Current Report

Modulation	Fundamental Range (MHz)	Channel Number	Data Rate (Mbps)
FSK	151.05-155.95	50	100kbps
OFDM	302.20-321.80	50	433kbps

Channel List								
FSK								
Channel Number	Up-link(TX) Frequency (MHz)	Down-link(RX) Frequency (MHz)	Channel Number	Up-link(TX) Frequency (MHz)	Down-link(RX) Frequency (MHz)	Channel Number	Up-link(TX) Frequency (MHz)	Down-link(RX) Frequency (MHz)
1	151.05	230.05	18	152.75	231.75	35	154.45	233.45
2	151.15	230.15	19	152.85	231.85	36	154.55	233.55
3	151.25	230.25	20	152.95	231.95	37	154.65	233.65
4	151.35	230.35	21	153.05	232.05	38	154.75	233.75
5	151.45	230.45	22	153.15	232.15	39	154.85	233.85
6	151.55	230.55	23	153.25	232.25	40	154.95	233.95
7	151.65	230.65	24	153.35	232.35	41	155.05	234.05
8	151.75	230.75	25	153.45	232.45	42	155.15	234.15
9	151.85	230.85	26	153.55	232.55	43	155.25	234.25
10	151.95	230.95	27	153.65	232.65	44	155.35	234.35
11	152.05	231.05	28	153.75	232.75	45	155.45	234.45
12	152.15	231.15	29	153.85	232.85	46	155.55	234.55
13	152.25	231.25	30	153.95	232.95	47	155.65	234.65
14	152.35	231.35	31	154.05	233.05	48	155.75	234.75
15	152.45	231.45	32	154.15	233.15	49	155.85	234.85
16	152.55	231.55	33	154.25	233.25	50	155.95	234.95
17	152.65	231.65	34	154.35	233.35			

Channel List									
OFDM									
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
51	302.2	61	306.2	71	310.2	81	314.2	91	318.2
52	302.6	62	306.6	72	310.6	82	314.6	92	318.6
53	303.0	63	307.0	73	311.0	83	315.0	93	319.0
54	303.4	64	307.4	74	311.4	84	315.4	94	319.4
55	303.8	65	307.8	75	311.8	85	315.8	95	319.8
56	304.2	66	308.2	76	312.2	86	316.2	96	320.2
57	304.6	67	308.6	77	312.6	87	316.6	97	320.6
58	305.0	68	309.0	78	313.0	88	317.0	98	321.0
59	305.4	69	309.4	79	313.4	89	317.4	99	321.4
60	305.8	70	309.8	80	313.8	90	317.8	100	321.8

Note: Test modes are presented at section 3.7.

3.6. Description of Key Components

None

3.7. Test Configuration

Item		Test Mode		
Radiated Test Case	Radiated Spurious Emission	TX1	FSK	151.05MHz
				155.95MHz
			OFDM	302.20MHz
		312.20MHz		
		321.80MHz		
		Conducted Test Case	20dB Bandwidth	TX2
155.95MHz				
OFDM	302.20MHz			
	312.20MHz			
	321.80MHz			
Conducted Test Case	20dB Bandwidth			TX1
		155.95MHz		
		OFDM	302.20MHz	
			312.20MHz	
			321.80MHz	
		Conducted Test Case	20dB Bandwidth	TX2
155.95MHz				
OFDM	302.20MHz			
	312.20MHz			
	321.80MHz			

Note:

Mobile Device

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

3.8. Tested Supporting System List

3.8.1. Support Peripheral Unit

No.	Product	Brand	Model No.	Serial No.	Approval
1.	DC Power Supply	TOP WARD	6303A	N/A	N/A
2.	Notebook PC	hp	TPN-Q189	51144079H	N/A

3.8.2. Cable Lists

No.	Cable Description Of The Above Support Units
1.	DC Power Cable: Unshielded, Detachable, 0.7m
2.	AC Adapter: hp, M/N PPP-012C-S DC Power Cable: Unshielded, Detachable, 1.8m, with one ferrite core AC Power Cord: Unshielded, Detachable, 1.8m RS232 to USB Cable: Shielded, Detachable, 1.0m
3.	SMA Cable x4: Unshielded, Detachable, 1.0m

3.9. Setup Configuration

3.9.1. EUT Configuration for Radiated Emission



3.9.2. EUT Configuration for RF Conducted Test Items



3.10. Operating Condition of EUT

3.10.1. **FSK Mode:** Test program “Futaba Term” is used for enabling EUT RF function under continue transmitting and choosing channel.

3.10.2. **OFDM Mode:** Test program “Futaba Term” is used for enabling EUT RF function under continue transmitting and choosing channel.

3.11. 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

3.12. 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	<input type="checkbox"/>	No. 7 Shielded Room	9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.4dB
	<input type="checkbox"/>	No. 8 Shielded Room	9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.5dB
Radiation Test	<input checked="" type="checkbox"/>	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
	<input type="checkbox"/>	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
	<input type="checkbox"/>	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
	<input type="checkbox"/>	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 = $ku_c(y)$

Test Item	Uncertainty
20dB Bandwidth	±0.2kHz

4. MEASUREMENT EQUIPMENT LIST

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.	Loop antenna	TESEQ	HLA 6121	60478	2023.02.21	1 Year
6.	Bilog Antenna	TESEQ	CBL6112D	33821	2023.09.30	1 Year
7.	Double-Ridged Waveguide Horn	EMCO	3115	9609-4927	2023.07.21	1 Year
8.	Coaxial Cable	HUBER+SUHNER	RG223/U	RE-33	2023.03.02	1 Year
9.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2024.01.05	1 Year
10.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 106	RE-14	2024.01.05	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

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】

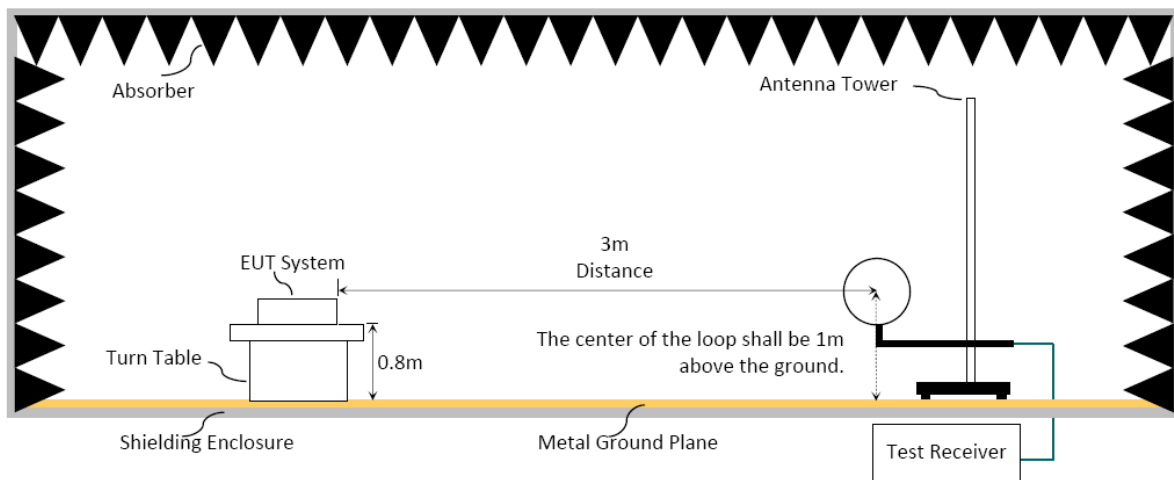
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

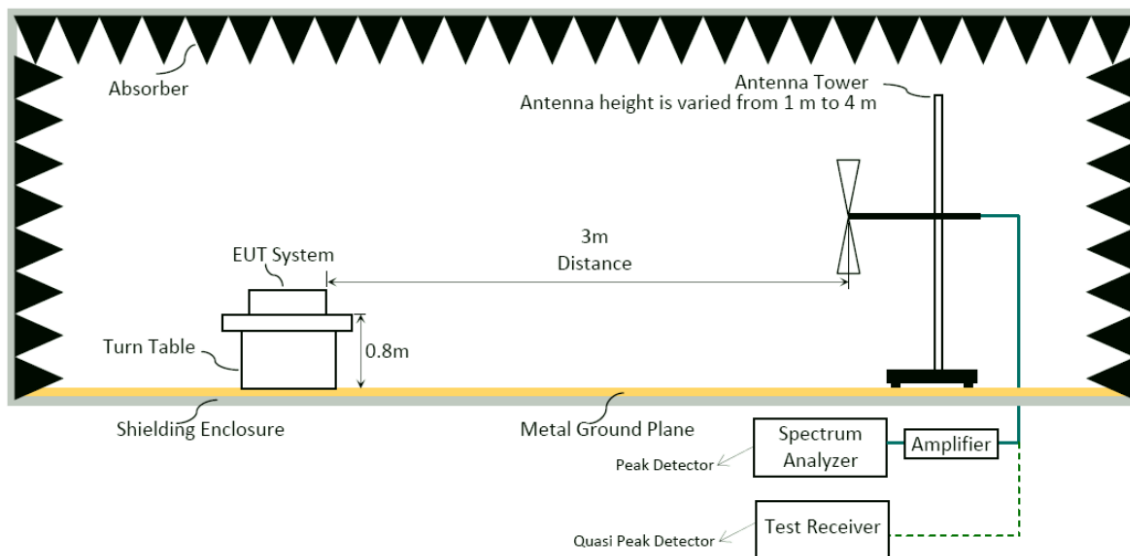
6.1.1. Block Diagram of EUT

Indicated as section 3.9

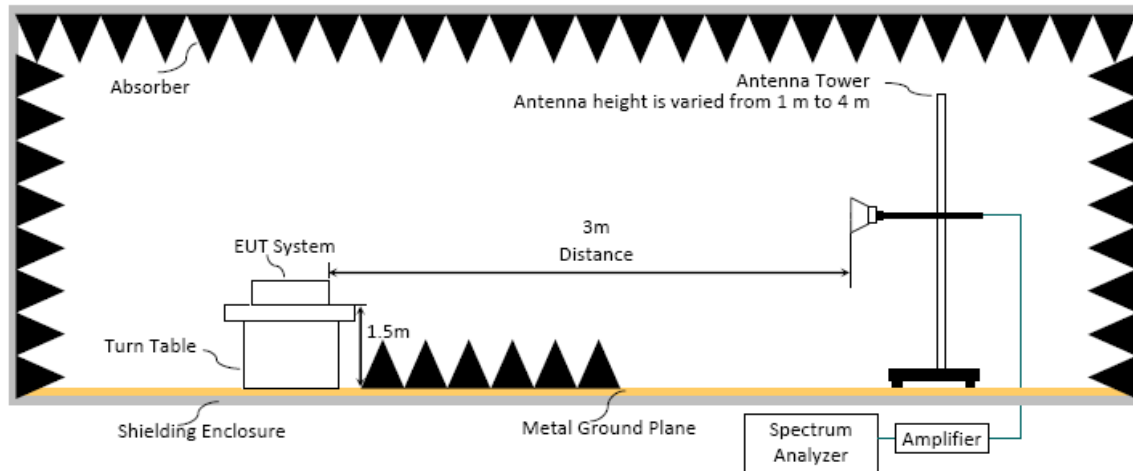
6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000MHz



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	
		dB μ V/m	μ V/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 dB μ V/m (Peak) 54.0 dB μ V/m (Average)	

Remark : (1) dB μ V/m = 20 log (μ V/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.

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 30MHz to 10th harmonic (up to 10 GHz):

The EUT setup on the turntable 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 \geq 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 the Q.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 \geq 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.

Average Detector: **Option 1:**

- (1) RBW = 1MHz
- (2) VBW \geq 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 (dB μ V/m) = Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) + Reading (dB μ V).

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

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

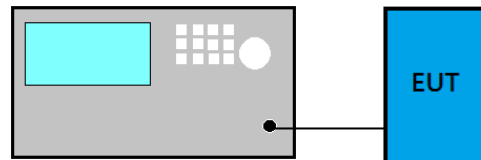
ERP (dBm) = Peak Emission Level (dB μ V/m) - 95.2dB - 2.14dB

6.5. Test Results

Please refer to Appendix A.

7. 20dB BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The bandwidth shall be specified in operating frequency band.

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 to 1% to 5% of OBW.
- (3) Set $VBW \geq 3 \times RBW$.
- (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.

7.4. Test Results

Please refer to Appendix A

8. DEVIATION TO TEST SPECIFICATIONS

【NONE】



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APPENDIX A

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APPENDIX A

TEST DATA AND PLOTS

(Model: FDK32TU)

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A.1 RADIATED EMISSION

Test Date	2024/02/26~27	Temp./Hum.	19°C/66%
Test Voltage	DC 24V (Via DC Power Supply)	Tested By	Harry Huang

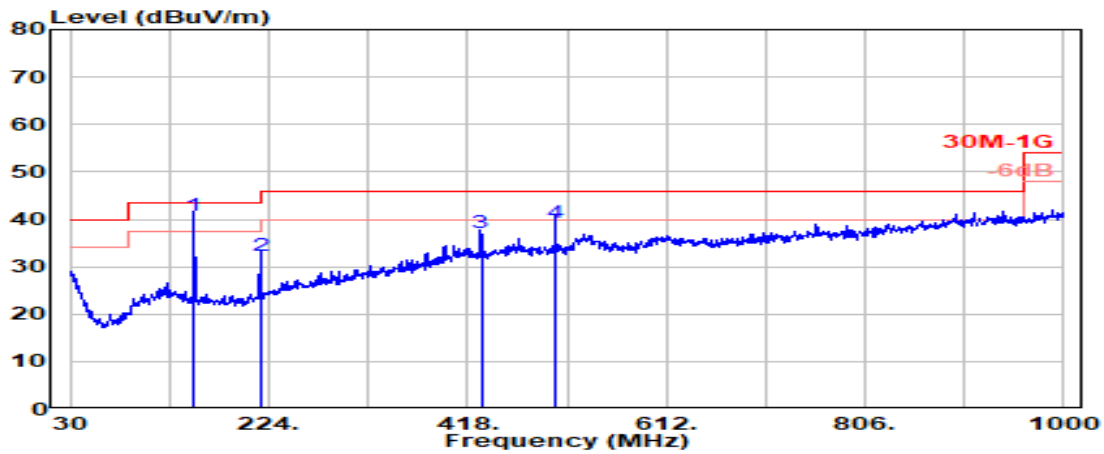
A.1.1 Emissions within Restricted Frequency Bands

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

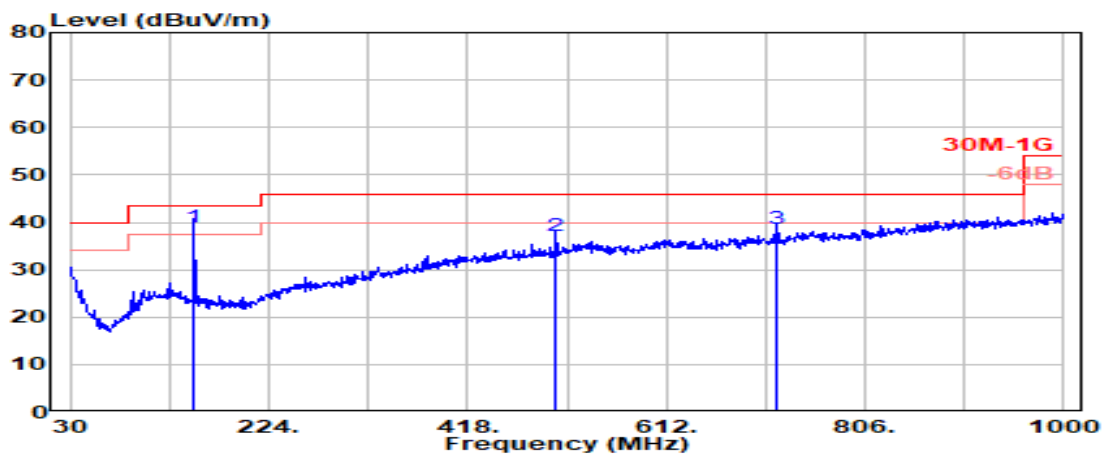
Mode	FSK	Frequency	TX1: 151.05MHz
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Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	151.250	16.48	2.89	0.00	21.40	40.77	43.50	2.73	QP
	215.917	16.26	3.56	0.00	12.37	32.19	43.50	11.31	QP
	431.170	22.14	5.84	0.00	9.14	37.12	46.00	8.88	QP
	503.683	23.17	6.41	0.00	9.56	39.15	46.00	6.85	QP

Remark: The “@” means fundamental frequency.

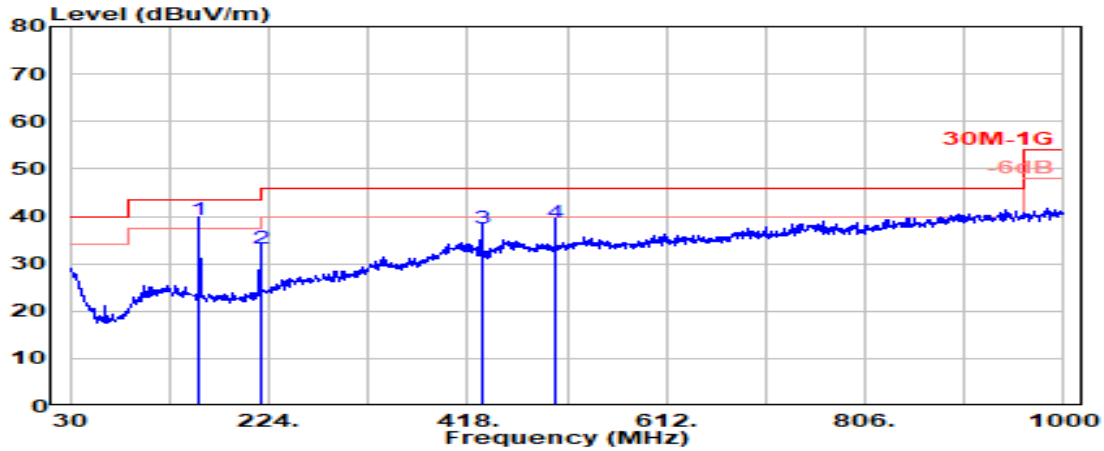


Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	151.250	16.48	2.89	0.00	19.70	39.07	43.50	4.43	QP
	504.492	23.18	6.42	0.00	7.44	37.04	46.00	8.96	QP
	720.317	24.75	7.44	0.00	6.36	38.55	46.00	7.45	QP

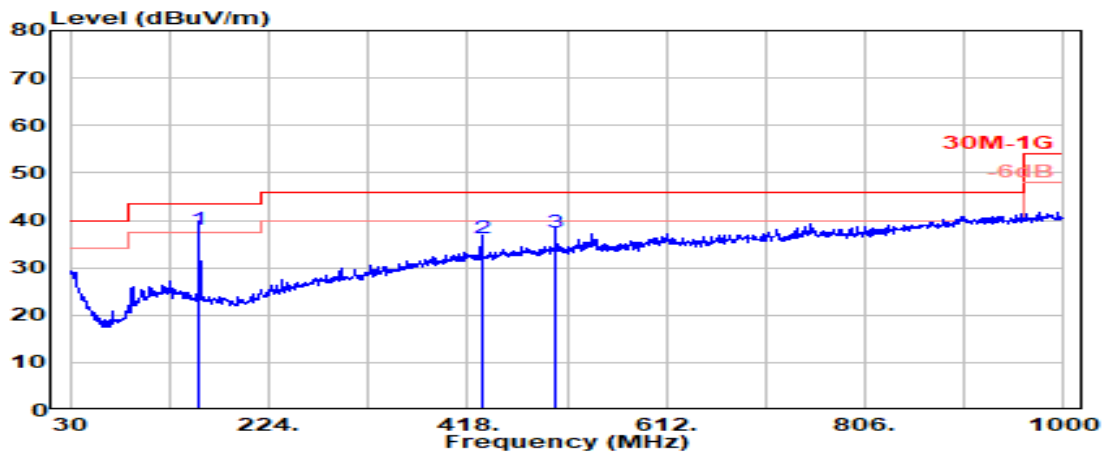
Remark: The “@” means fundamental frequency.

Mode	FSK	Frequency	TX1: 155.95MHz
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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
@	156.100	16.22	2.94	0.00	20.20	39.36	43.50	4.14	QP
	215.917	16.26	3.56	0.00	13.46	33.28	43.50	10.22	QP
	431.742	22.09	5.81	0.00	9.41	37.32	46.00	8.68	QP
	503.683	23.17	6.41	0.00	8.91	38.49	46.00	7.51	QP

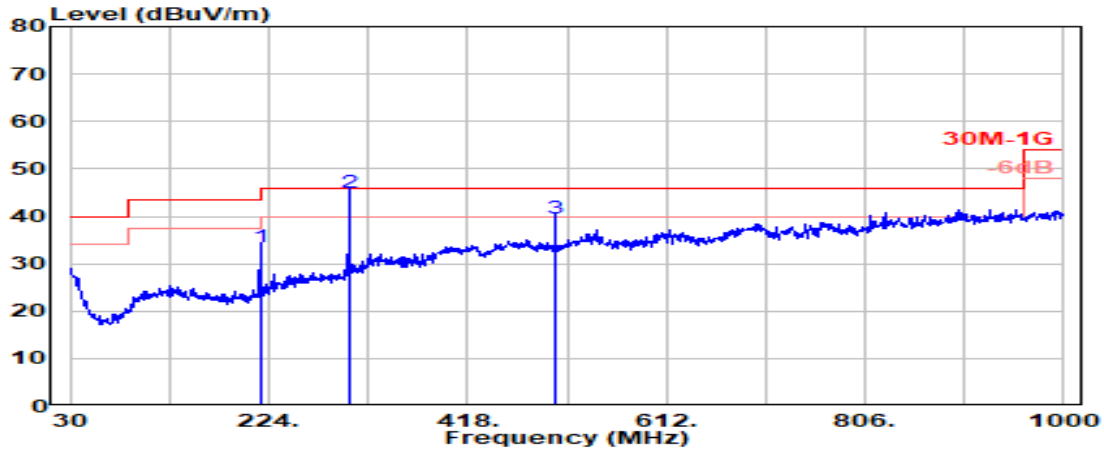


Antenna at Vertical Polarization

	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
@	156.100	16.22	2.94	0.00	18.80	37.96	43.50	5.54	QP
	431.742	22.09	5.81	0.00	8.32	36.23	46.00	9.77	QP
	503.683	23.17	6.41	0.00	7.82	37.41	46.00	8.59	QP

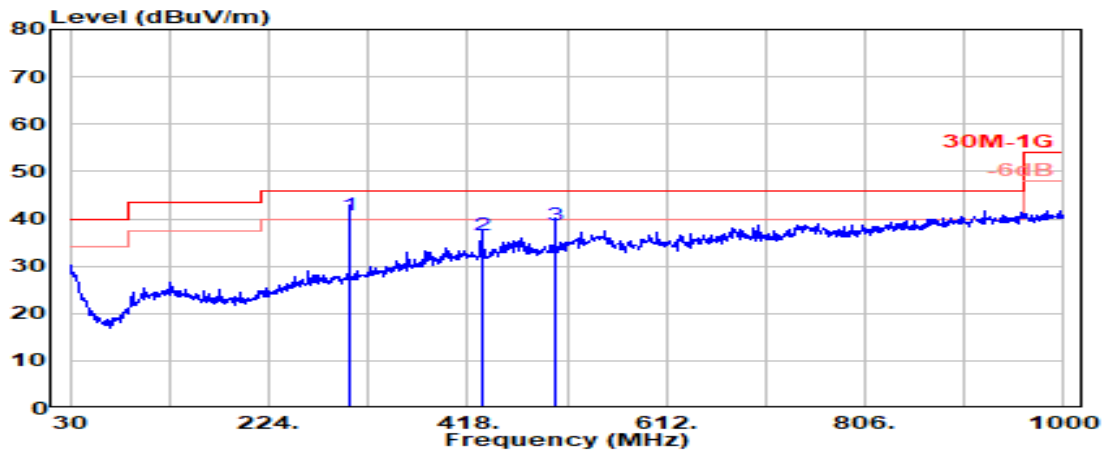
Remark: The “@” means fundamental frequency.

Mode	OFDM	Frequency	TX1: 302.20MH
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Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	215.917	16.26	3.56	0.00	13.55	33.37	43.50	10.13	QP
@	302.408	18.98	4.39	0.00	21.70	45.07	46.00	0.93	QP
	503.683	23.17	6.41	0.00	10.03	39.62	46.00	6.38	QP

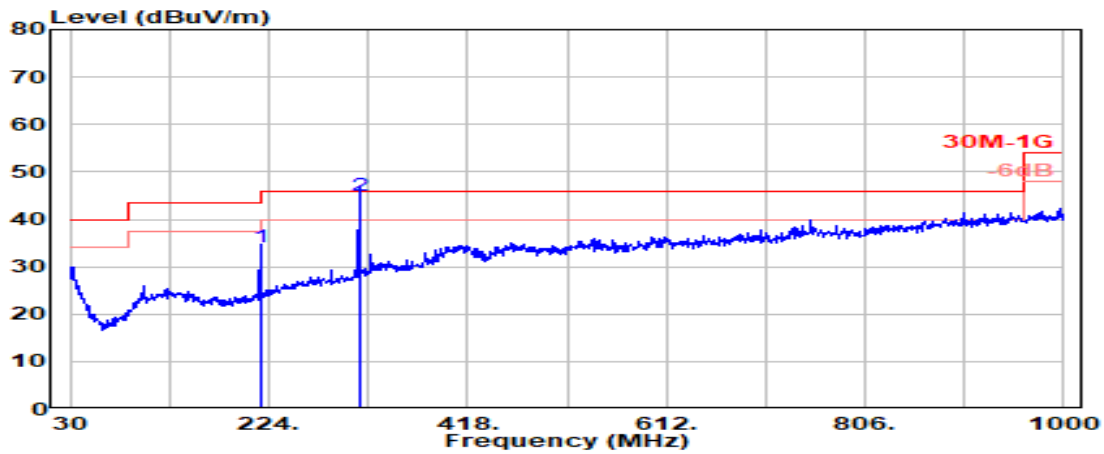


Antenna at Vertical Polarization

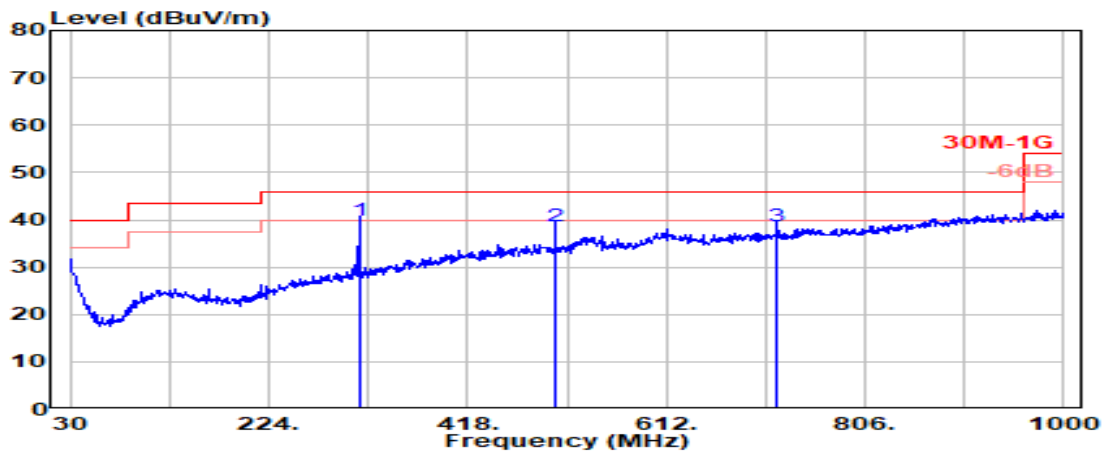
	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	302.408	18.98	4.39	0.00	17.38	40.76	46.00	5.24	QP
	431.742	22.09	5.81	0.00	8.76	36.67	46.00	9.33	QP
	503.683	23.17	6.41	0.00	9.20	38.79	46.00	7.21	QP

Remark: The “@” means fundamental frequency.

Mode	OFDM	Frequency	TX1: 312.20MHz
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Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
215.917	16.26	3.56	0.00	14.28	34.10	43.50	9.40	QP
@ 312.108	19.28	4.52	0.00	21.30	45.10	46.00	0.90	QP

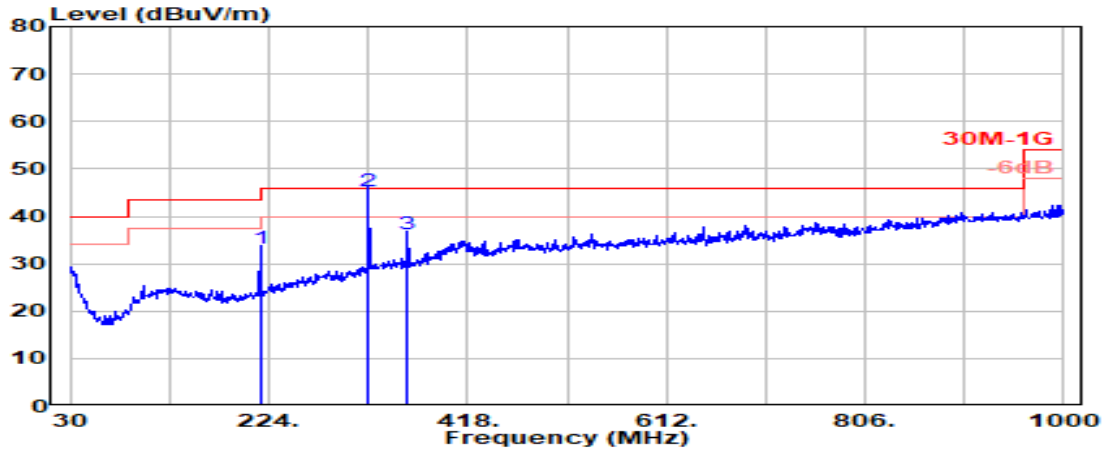


Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@ 312.108	19.28	4.52	0.00	15.99	39.79	46.00	6.21	QP
503.683	23.17	6.41	0.00	8.98	38.57	46.00	7.43	QP
720.317	24.75	7.44	0.00	6.49	38.68	46.00	7.32	QP

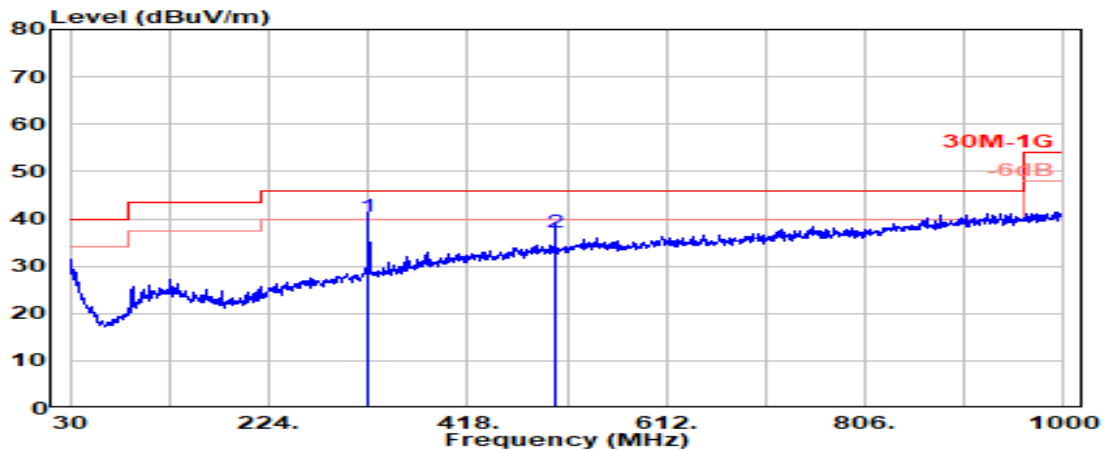
Remark: The "@" means fundamental frequency.

Mode	OFDM	Frequency	TX1: 321.80MHz
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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
	215.917	16.26	3.56	0.00	13.38	33.20	43.50	10.30	QP
@	321.808	19.55	4.64	0.00	21.19	45.37	46.00	0.63	QP
	359.800	20.59	5.09	0.00	10.63	36.31	46.00	9.69	QP

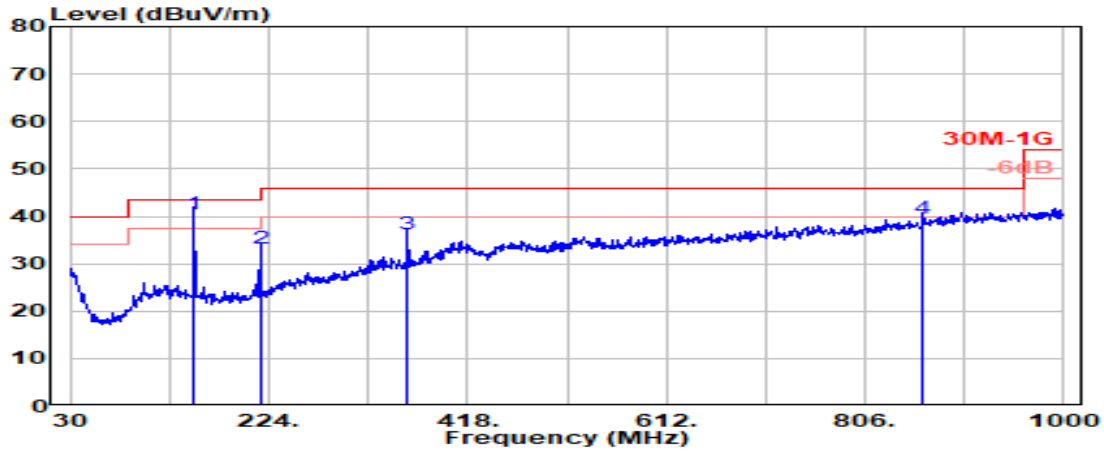


Antenna at Vertical Polarization

	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
@	321.808	19.55	4.64	0.00	16.23	40.41	46.00	5.59	QP
	503.683	23.17	6.41	0.00	7.42	37.01	46.00	8.99	QP

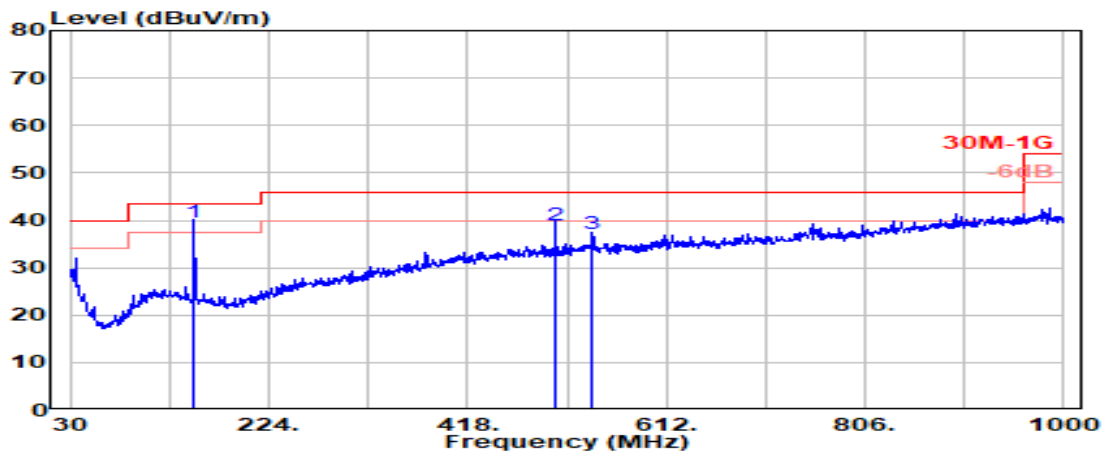
Remark: The “@” means fundamental frequency.

Mode	FSK	Frequency	TX2: 151.05MHz
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Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	151.250	16.48	2.89	0.00	21.00	40.37	43.50	3.13	QP
	215.917	16.26	3.56	0.00	13.32	33.14	43.50	10.36	QP
	359.800	20.59	5.09	0.00	10.58	36.26	46.00	9.74	QP
	862.583	25.80	8.44	0.00	5.45	39.69	46.00	6.31	QP

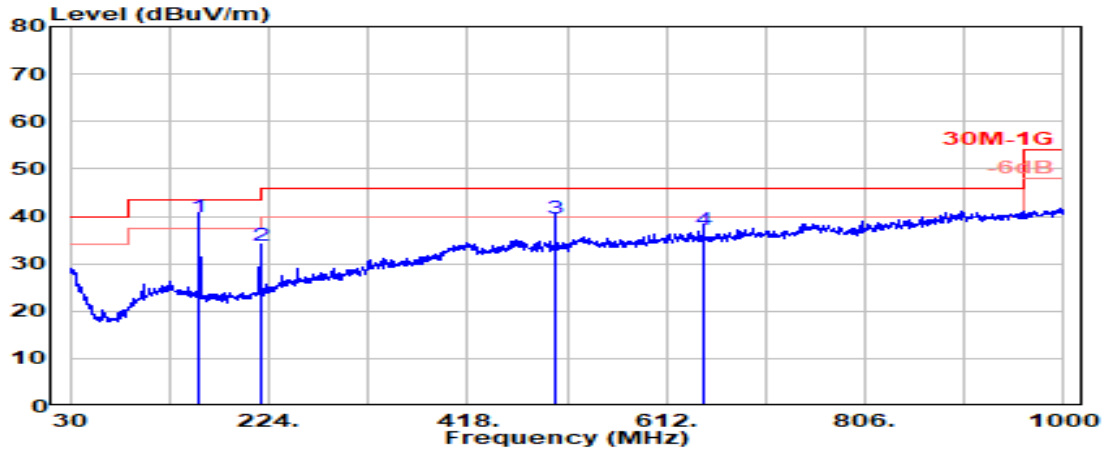


Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	151.250	16.48	2.89	0.00	20.13	39.50	43.50	4.00	QP
	503.683	23.17	6.41	0.00	9.32	38.91	46.00	7.09	QP
	540.058	23.63	6.55	0.00	6.87	37.06	46.00	8.94	QP

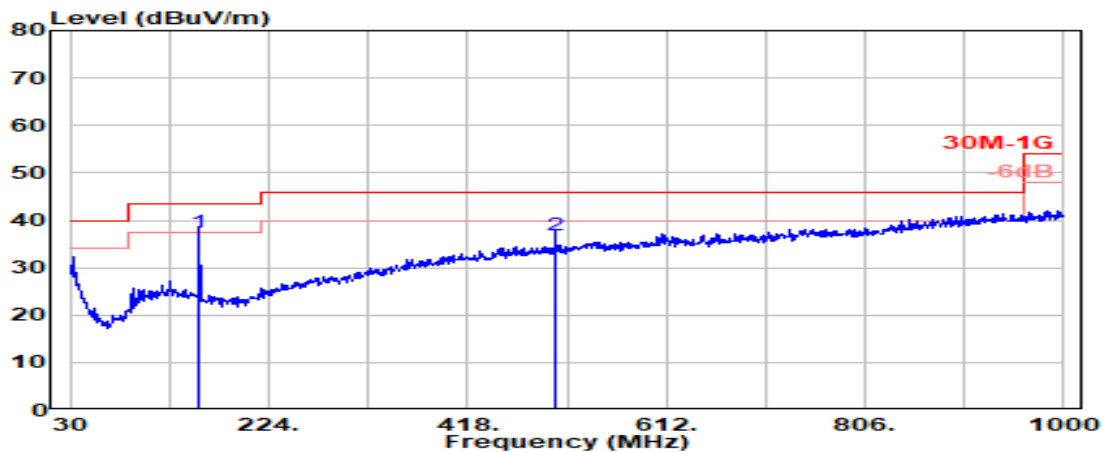
Remark: The “@” means fundamental frequency.

Mode	FSK	Frequency	TX2: 155.95MHz
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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
@	156.100	16.22	2.94	0.00	20.80	39.96	43.50	3.54	QP
	215.917	16.26	3.56	0.00	13.86	33.68	43.50	9.82	QP
	503.683	23.17	6.41	0.00	9.90	39.49	46.00	6.51	QP
	648.375	24.51	7.03	0.00	5.65	37.20	46.00	8.80	QP

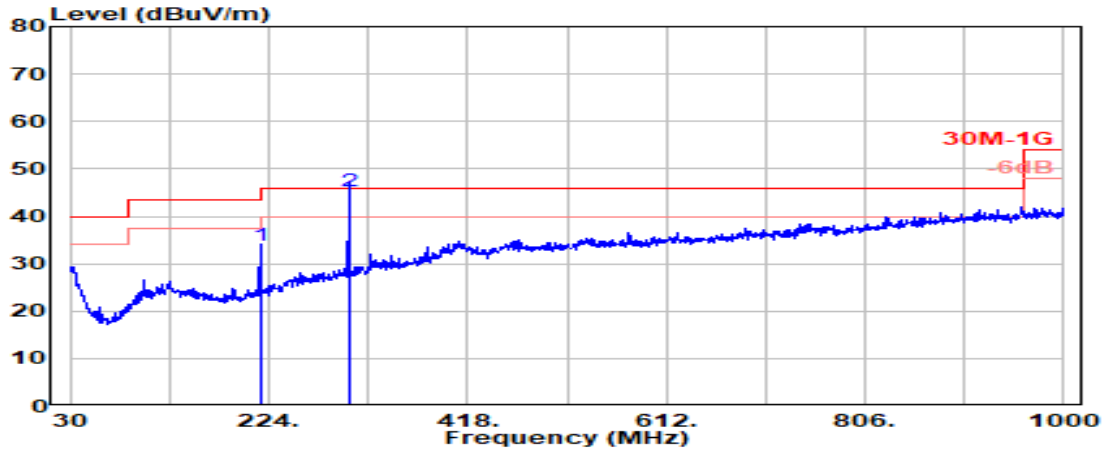


Antenna at Vertical Polarization

	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
@	156.100	16.22	2.94	0.00	18.42	37.58	43.50	5.92	QP
	503.683	23.17	6.41	0.00	7.18	36.77	46.00	9.23	QP

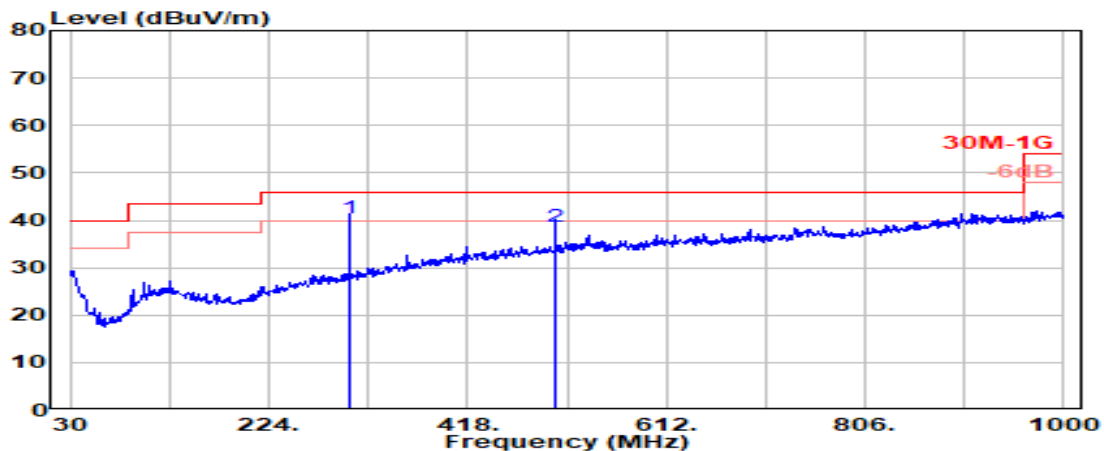
Remark: The “@” means fundamental frequency.

Mode	OFDM	Frequency	TX2: 302.20MH
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
215.917	16.26	3.56	0.00	13.97	33.79	43.50	9.71	QP
@ 302.408	18.98	4.39	0.00	22.00	45.37	46.00	0.63	QP

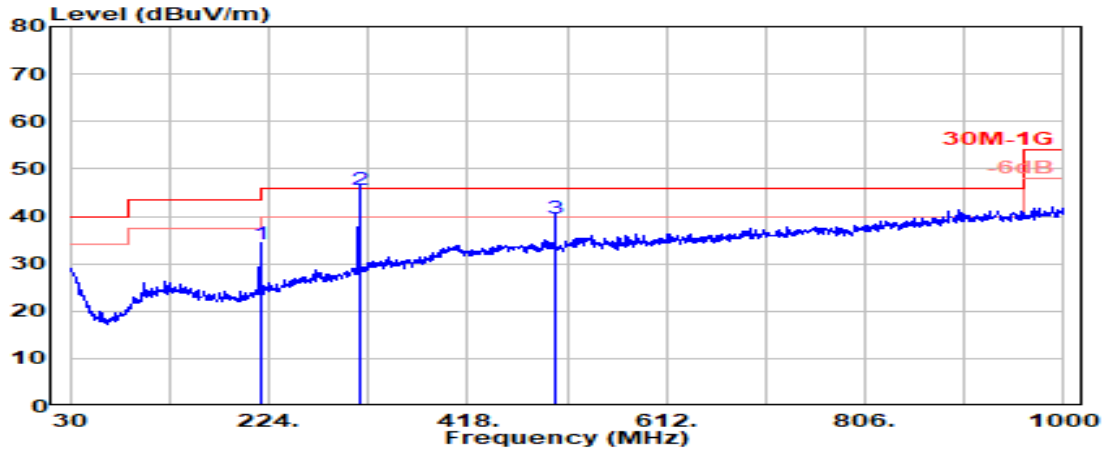


Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@ 302.408	18.98	4.39	0.00	17.20	40.57	46.00	5.43	QP
503.683	23.17	6.41	0.00	9.00	38.58	46.00	7.42	QP

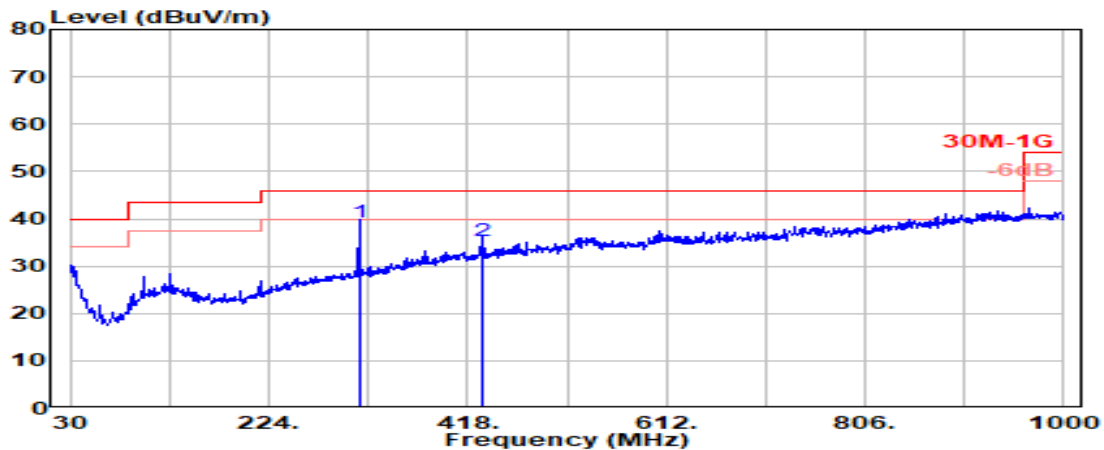
Remark: The “@” means fundamental frequency.

Mode	OFDM	Frequency	TX2: 312.20MHz
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Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	215.917	16.26	3.56	0.00	14.23	34.04	43.50	9.46	QP
@	312.108	19.28	4.52	0.00	21.67	45.46	46.00	0.54	QP
	503.683	23.17	6.41	0.00	9.89	39.47	46.00	6.53	QP

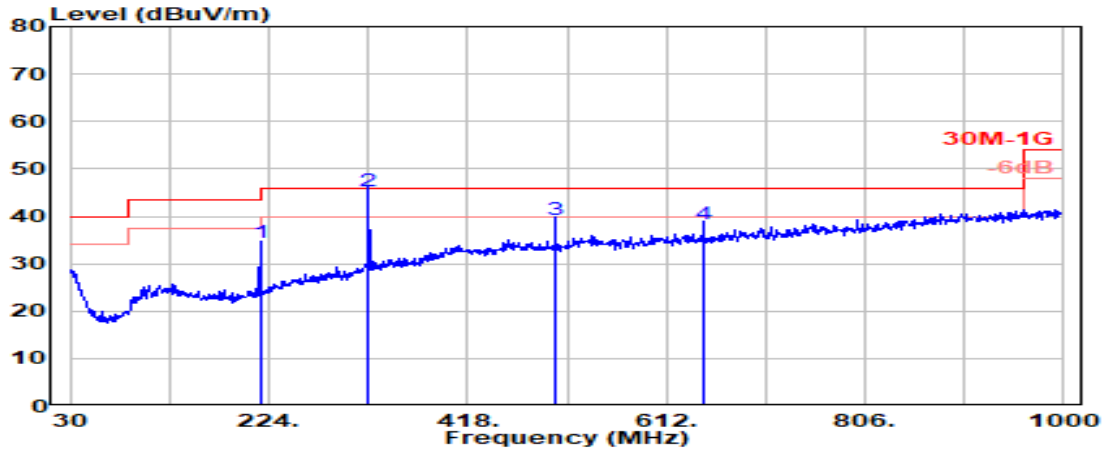


Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	312.108	19.28	4.52	0.00	15.50	39.30	46.00	6.70	QP
	431.742	22.09	5.81	0.00	7.32	35.23	46.00	10.77	QP

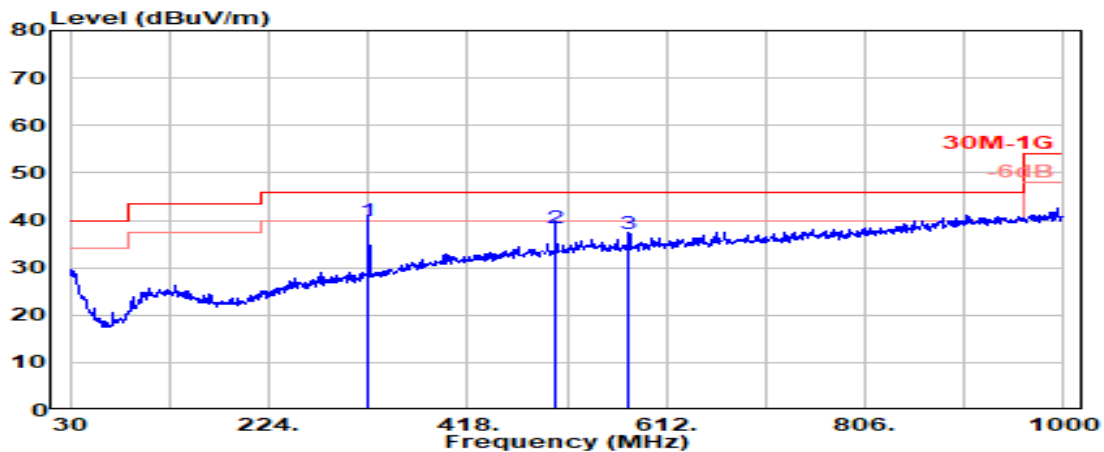
Remark: The “@” means fundamental frequency

Mode	OFDM	Frequency	TX2: 321.80MHz
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Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	215.917	16.26	3.56	0.00	14.48	34.30	43.50	9.20	QP
@	321.808	19.55	4.64	0.00	21.14	45.32	46.00	0.68	QP
	503.683	23.17	6.41	0.00	9.59	39.18	46.00	6.82	QP
	648.375	24.51	7.03	0.00	6.81	38.36	46.00	7.64	QP



Antenna at Vertical Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	321.808	19.55	4.64	0.00	15.72	39.91	46.00	6.09	QP
	503.683	23.17	6.41	0.00	8.69	38.28	46.00	7.72	QP
	575.625	24.06	6.68	0.00	6.29	37.03	46.00	8.97	QP

Remark: The “@” means fundamental frequency

A.1.2 Emissions outside the frequency band:

The emissions (up to 4GHz) not reported for there is no emission be found.

Mode	FSK	Frequency	TX1: 151.05MHz
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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
1510.500	25.80	3.96	40.23	45.68	35.20	54.00	18.80	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
1510.500	25.80	3.95	40.23	46.25	35.77	54.00	18.23	Peak

Mode	FSK	Frequency	TX1: 155.95MHz
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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
1560.000	25.72	4.12	40.20	46.16	35.81	54.00	18.19	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
1560.000	25.72	4.12	40.20	45.34	34.98	54.00	19.02	Peak

Mode	OFDM				Frequency	TX1: 302.20MH		
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1511.000	25.80	3.96	40.23	45.63	35.16	54.00	18.84	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1511.000	25.80	3.96	40.23	45.53	35.06	54.00	18.94	Peak

Mode	OFDM				Frequency	TX1: 312.20MHz		
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1561.000	25.71	4.13	40.20	44.56	34.20	54.00	19.80	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1561.000	25.71	4.13	40.20	46.99	36.63	54.00	17.37	Peak

Mode	OFDM				Frequency	TX1: 321.80MHz		
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1609.000	25.38	4.29	40.17	47.24	36.74	54.00	17.26	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1609.000	25.38	4.29	40.17	46.97	36.46	54.00	17.54	Peak

Mode	FSK	Frequency	TX2: 151.05MHz
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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
1510.000	25.80	3.95	40.23	46.40	35.92	54.00	18.08	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
1510.000	25.80	3.95	40.23	45.43	34.95	54.00	19.05	Peak

Mode	FSK	Frequency	TX2: 155.95MHz
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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
1560.000	25.72	4.12	40.20	45.62	35.26	54.00	18.74	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
1560.000	25.72	4.12	40.20	47.12	36.76	54.00	17.24	Peak

Mode	OFDM	Frequency	TX2: 302.20MH
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1511.000	25.80	3.96	40.23	45.97	35.49	54.00	18.51	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1511.000	25.80	3.96	40.23	46.35	35.87	54.00	18.13	Peak

Mode	OFDM	Frequency	TX2: 312.20MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1561.000	25.71	4.13	40.20	45.50	35.13	54.00	18.87	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1561.000	25.71	4.13	40.20	45.96	35.60	54.00	18.40	Peak

Mode	OFDM	Frequency	TX2: 321.80MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1609.000	25.38	4.29	40.17	46.05	35.55	54.00	18.45	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1609.000	25.38	4.29	40.17	46.69	36.18	54.00	17.82	Peak

A.1.3 Emissions in Non-restricted Frequency Bands:

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

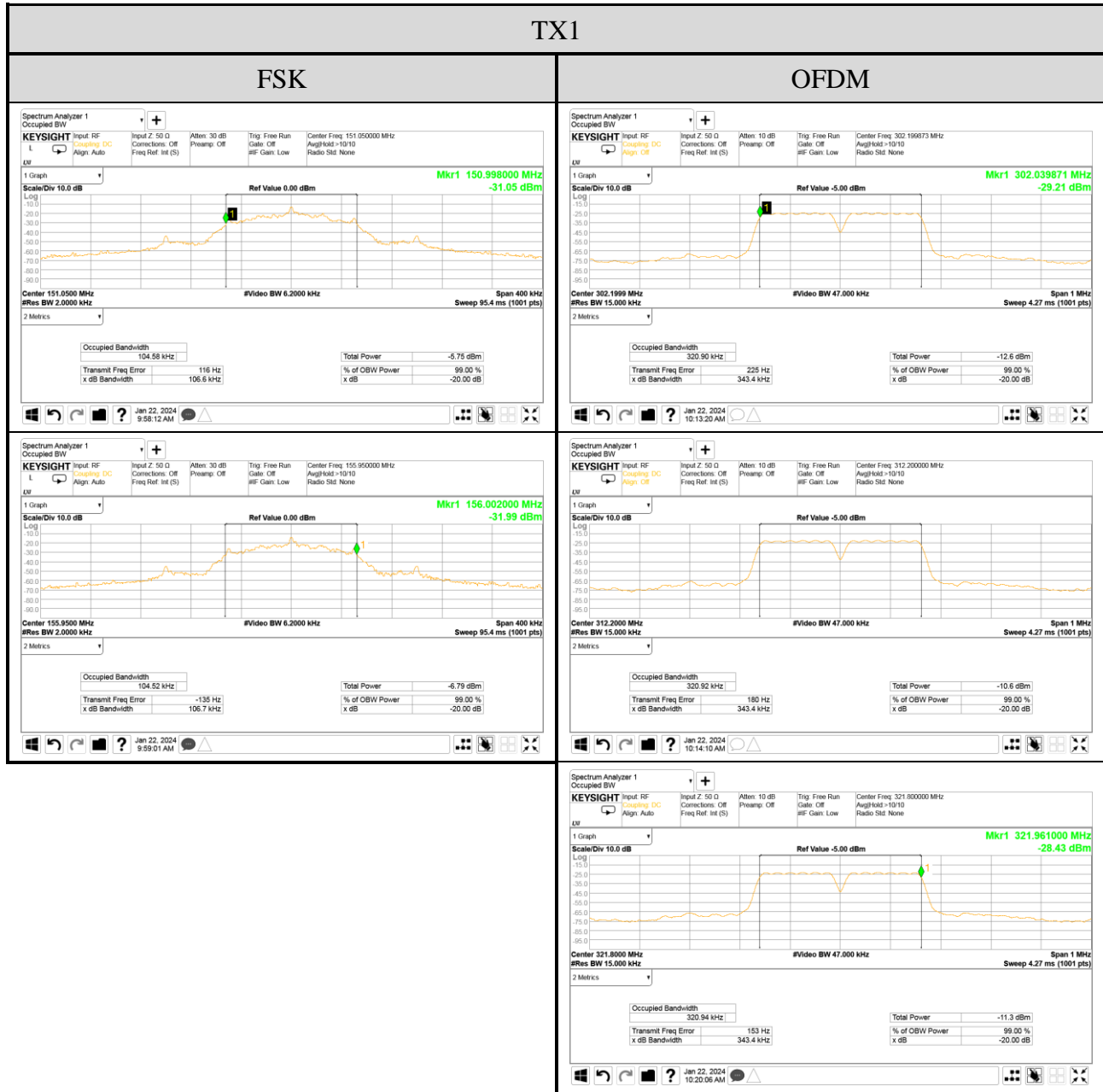
A.2 20dB BANDWIDTH

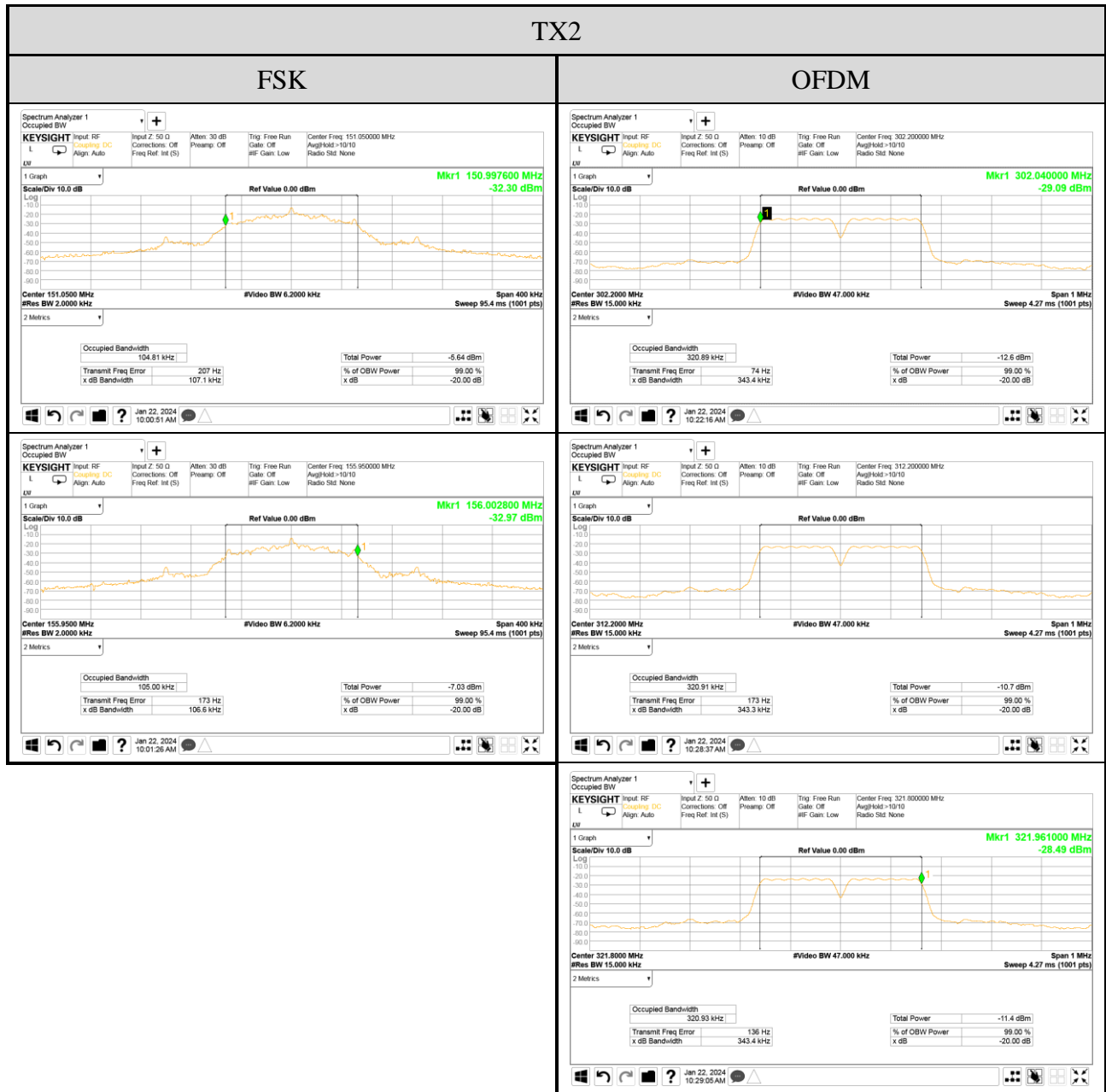
Test Date	2024/01/22	Temp./Hum.	20°C/58%
Cable Loss	0dB	Tested By	Harry Huang
Test Voltage	DC 24V (Via DC Power Supply)		

A.2.1 Emission Bandwidth Result

Mode		Centre Frequency (MHz)	20 dB Bandwidth (MHz)
TX1	FSK	151.05	0.1066
		155.95	0.1067
	OFDM	302.20	0.3434
		312.20	0.3434
		321.80	0.3434
TX2	FSK	151.05	0.1071
		155.95	0.1066
	OFDM	302.20	0.3434
		312.20	0.3433
		321.80	0.3434

A.2.2 Measurement Plots







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APPENDIX B

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TEST PHOTOGRAPHS

(Model: FDK32TU)