

FCC Test Report

Report No.: RWAQ202400227A

Applicant: Kirisun Communication Co.,Ltd.

Address: 3rd Floor, Building A, Tongfang Information Harbour, No.11 Langshan Road Nanshan District, Shenzhen 518057 China

Product Name: DMR Digital Repeater

Product Model: TB2210-B1

Multiple Models: N/A

Trade Mark: Tait

FCC ID: Q5ETB2210B1

Standards: FCC CFR Title 47 Part 90

Test Date: 2024-03-13 to 2024-03-27

Test Result: Complied

Issue Date: 2024-04-07

Reviewed by:

Frank Yin

Approved by:

Jacob Kong

Frank Yin
Project Engineer

Jacob Kong
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Prepared by:

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Revision History

Version No.	Issued Date	Description
00	2024-04-07	Original

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1 General Information

1.1 Client Information

Applicant:	Kirisun Communication Co.,Ltd.
Address:	3rd Floor, Building A, Tongfang Information Harbour, No.11 Langshan Road Nanshan District, Shenzhen 518057 China
Manufacturer:	Kirisun Communication Co.,Ltd.
Address:	3rd Floor, Building A, Tongfang Information Harbour, No.11 Langshan Road Nanshan District, Shenzhen 518057 China

1.2 Product Description of EUT

Sample Serial number	6M-1 for CE&RE test, 6M-1 for RF conducted test (assigned by WATC)
Sample Received Date	2024-03-08
Sample Status	Good Condition
Operating Frequency Range	136-174MHz
Rated Output Power [#]	45Watts, 40Watts, 35Watts, 30Watts, 25Watts, 20Watts, 15Watts, 10Watts, 5Watts
Modulation Technology	FM, 4FSK
Channel Spacing	12.5kHz
Antenna Type	External antenna
Antenna Gain [#]	10dBi
Power Supply	AC 100-240V 50/60 Hz or DC 10.8-15.6V, 15A
Operating temperature [#]	-30 deg.C to +60 deg.C
Adapter Information	N/A
Modification	Sample No Modification by the test lab

1.3 Measurement Uncertainty

Parameter		Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Emissions, Radiated	Below 30MHz	±2.78dB
	Below 1GHz	±4.84dB
	Above 1GHz	±5.44dB
Emissions, Conducted		1.75dB
Conducted Power		0.74dB
Frequency Error		150Hz
Bandwidth		0.34%
Modulation Limiting		1.32%
Note 1: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.		
Note 2: The Decision Rule is based on simple acceptance with ISO Guide 98-4:2012 Clause 8.2 (Measurement		

uncertainty is not taken into account when stating conformity with a specified requirement.)

1.4 Laboratory Location

World Alliance Testing and Certification (Shenzhen) Co., Ltd

No. 1002, East Block, Laobing Building, Xingye Road 3012, Xixiang street, Bao'an District, Shenzhen, Guangdong, People's Republic of China

Tel: +86-755-29691511, Email: ga@watc.com.cn

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 463912, the FCC Designation No. : CN5040.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0160.

1.5 Test Methodology

FCC CFR Title 47 Part 2, 90

ANSI C63.26-2015

ANSI TIA-603-E-2016

2 Description of Measurement

2.1 Test Configuration

Operating frequency range:		136-174MHz		
According to Per C63.26-2015, section 5.1, below frequencies was tested				
Modulation	Channel spacing [kHz]	Lowest Channel [MHz]	Middle Channel [MHz]	High channel [MHz]
FM	12.5	136.0125	155.7600	173.9700
4FSK	12.5	136.0125	155.7600	173.9700

Test Mode:	
Transmitting mode:	Keep the EUT in continuous transmitting with modulation

Worst-Case Configuration:
The device support AC power supply mode and DC power supply mode, for AC power supply mode, the AC power was first convert to DC Power, than share same circuit with the DC power supply mode, so the AC power supply mode was selected to test, the DC power supply mode was additional test for frequency stability
For antenna-conducted emission and radiated emission was investigated from 30MHz to 10 times of fundamental with the EUT transmits at the highest output power as worst-case scenario.

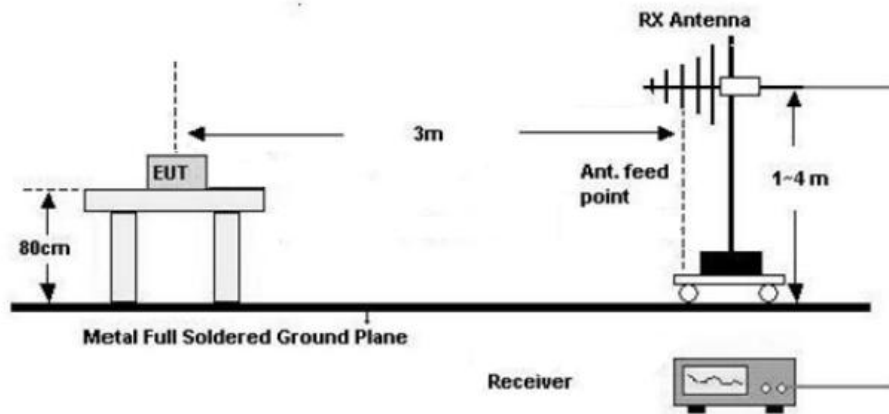
2.2 Test Auxiliary Equipment

Manufacturer	Description	Model	Serial Number
Unknown	50Ω Load	ADL96	Unknown

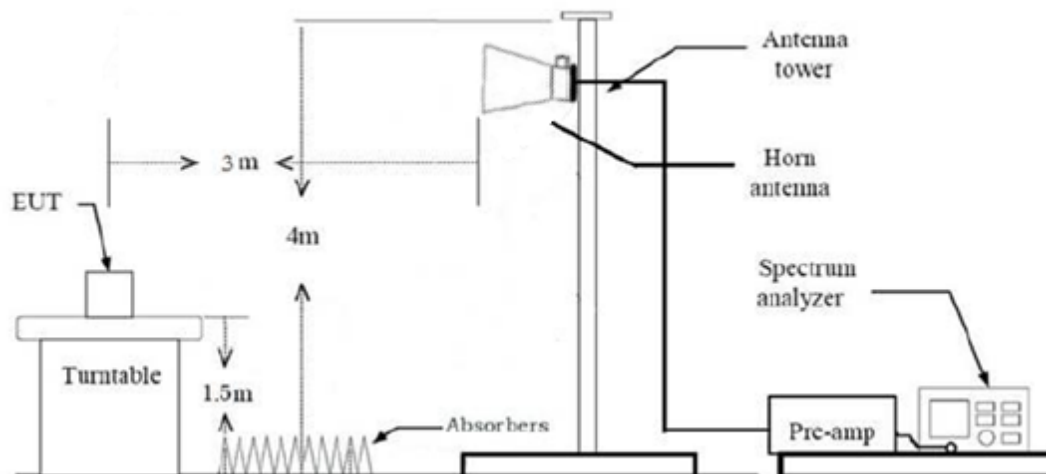
2.3 Test Setup

1) Radiated emission measurement:

30MHz-1GHz (3m SAC)

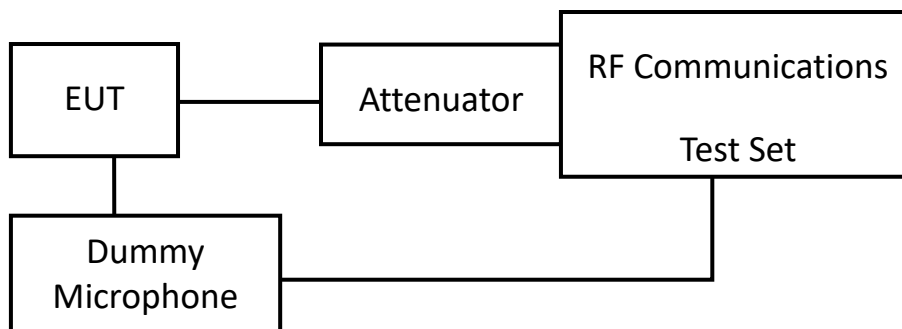


Above 1GHz(3m FAC)

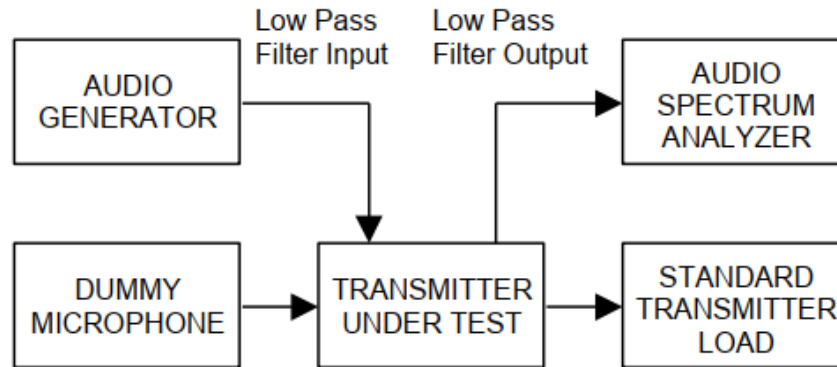


2) RF Conducted Test

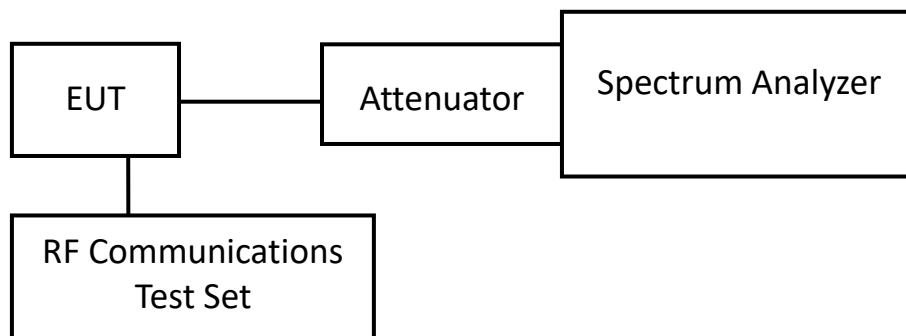
For Modulation Limiting/Audio Frequency Response test



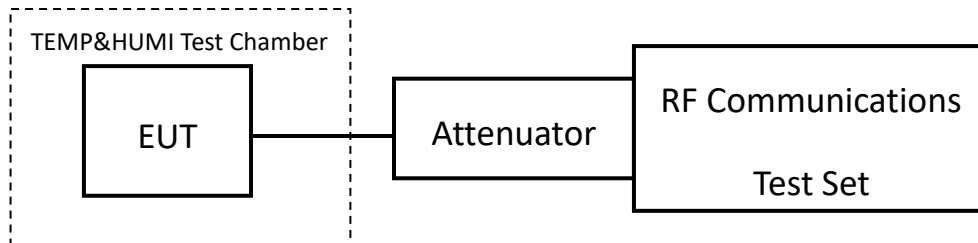
For Audio frequency filter test



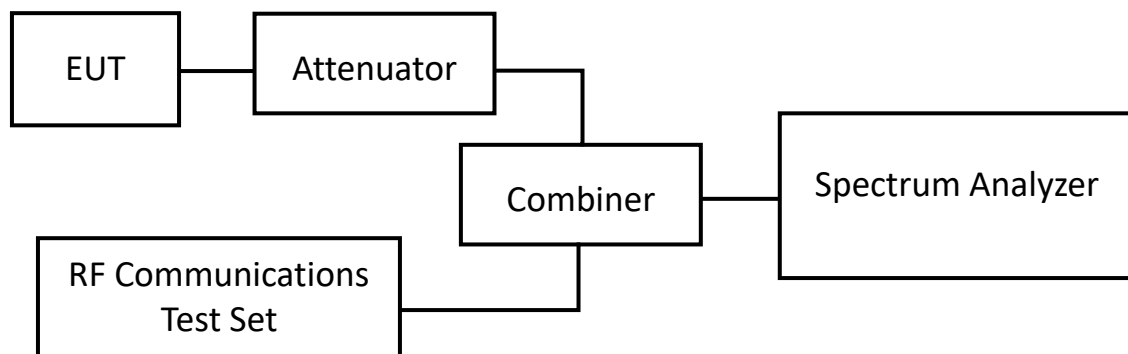
For RF Output Power/OBW/Emission Mask/Conducted Emission test



For Frequency Stability test



For Transient Frequency Behavior test



2.4 Test Procedure

Radiated Emission Procedure:

a) For 30MHz-1GHz:

1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m.
2. EUT works in each mode of operation that needs to be tested. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.

b) For above 1GHz:

1. The EUT was placed on the tabletop of a rotating table 1.5 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 m.
2. EUT works in each mode of operation that needs to be tested, and having the EUT continuously working. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.
3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.

RF Conducted Test:

1. The antenna port of EUT was connected to the RF port of the test equipment (RF Communications Test Set or Spectrum analyzer) through Attenuator and RF cable.
2. The cable assembly insertion loss of 30.6dB (including 30dB Attenuator and 0.6dB cable) was entered as an offset in the spectrum analyzer. Note: Actual cable loss was unavailable at the time of testing, therefore a loss of 0.6dB was assumed as worst case. This was later verified to be true by laboratory. (if the RF cable provided by client, the cable loss declared by client)
3. The EUT is keeping in continuous transmission mode with modulation signals required.

2.5 Measurement Method

Description of Test	Measurement Method
Modulation Limiting	ANSI C63.26-2015 section 5.3.2
Audio Frequency Response	ANSI C63.26-2015 section 5.3.3.2
Audio frequency filter	ANSI TIA-603-E-2016 section 2.2.15
Occupied Bandwidth	ANSI C63.26-2015 section 5.4.4
RF Output Power	ANSI C63.26-2015 section 5.2.3.3
Emission Mask	ANSI C63.26-2015 section 5.7.3
Spurious Emission at Antenna Terminal	ANSI C63.26-2015 section 5.7.4
Frequency Stability	ANSI C63.26-2015 section 5.6
Spurious Radiated Emissions	ANSI C63.26-2015 section 5.5.4
Transient Frequency Behavior	ANSI C63.26-2015 section 6.5.2.2

2.6 Measurement Equipment

Manufacturer	Description	Model	Management No.	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI test receiver	ESR3	102758	2023/7/3	2024/7/2
ROHDE& SCHWARZ	SPECTRUM ANALYZER	FSV40-N	101608	2023/7/3	2024/7/2
SONOMA INSTRUMENT	Low frequency amplifier	310	186014	2023/7/12	2024/7/11
COM-POWER	preamplifier	PAM-118A	18040152	2023/8/21	2024/8/20
SCHWARZBECK	Log - periodic wideband antenna	VULB 9163	9163-872	2023/7/7	2024/7/6
Astro Antenna Ltd	Horn antenna	AHA-118S	3015	2023/7/6	2024/7/5
N/A	Coaxial Cable	N/A	NO.9	2023/8/8	2024/8/7
N/A	Coaxial Cable	N/A	NO.10	2023/8/8	2024/8/7
N/A	Coaxial Cable	N/A	NO.11	2023/8/8	2024/8/7
Audix	Test Software	E3	191218 V9	/	/
RF Conducted Test					
ROHDE& SCHWARZ	SPECTRUM ANALYZER	FSV40	101419	2023/9/12	2024/9/11
ROHDE& SCHWARZ	SPECTRUM ANALYZER	FSU-26	200680/026	2023/7/12	2024/7/11
BIRD	30dB attenuator	300-WA-FFN-30	1207	2023/7/26	2024/7/25
BACL	TEMP&HUMI Test Chamber	BTH-150	30022	2023/7/12	2024/7/11
FLUKE	Digital Multimeter	15B+	N/A	2023/7/12	2024/7/11
HP	RF communication test set	HP8920A	N/A	2023/7/12	2024/7/11
N/A	Coaxial Cable	NO.9	N/A	2023/8/8	2024/8/7
N/A	Coaxial Cable	NO.10	N/A	2023/8/8	2024/8/7

Note: All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or International standards.

3 Test Results

3.1 Test Summary

FCC Rules	Description of Test	Result
§2.1055; §90.213	Frequency Stability	Compliance
§2.1046; §90.205	RF Output Power	Compliance
§2.1049; §90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliance
§2.1051; §90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053; §90.210	Spurious Radiated Emissions	Compliance
§90.214	Transient Frequency Behavior	Compliance
§2.1047	Modulation Characteristic	Compliance

3.2 Limit

Test items	Limit																																		
Frequency Stability	Table 1 to § 90.213(a)—Minimum Frequency Stability [Parts per million (ppm)] <table><tr><th rowspan="2">Frequency range (MHz)</th><th rowspan="2">Fixed and base stations</th><th colspan="2">Mobile stations</th></tr><tr><th>Over 2 watts output power</th><th>2 watts or less output power</th></tr><tr><td>Below 25</td><td>^{1 2 3} 100</td><td>100</td><td>200</td></tr><tr><td>25-50</td><td>20</td><td>20</td><td>50</td></tr><tr><td>72-76</td><td>5</td><td></td><td>50</td></tr><tr><td>150-174</td><td>^{5 11} 5</td><td>⁶ 5</td><td>^{4 6} 50</td></tr><tr><td>216-220</td><td>1.0</td><td></td><td>1.0</td></tr><tr><td>220-222¹²</td><td>0.1</td><td>1.5</td><td>1.5</td></tr><tr><td>421-512</td><td>^{7 11 14} 2.5</td><td>⁸ 5</td><td>⁸ 5</td></tr></table> ⁵In the 150-174 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm. ⁶In the 150-174 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth or designed to operate on a frequency specifically designated for itinerant use or designed for low-power operation of two watts or less, must have a frequency stability of 5.0 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 2.0 ppm. ⁷In the 421-512 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 1.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 0.5 ppm. ⁸In the 421-512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.	Frequency range (MHz)	Fixed and base stations	Mobile stations		Over 2 watts output power	2 watts or less output power	Below 25	^{1 2 3} 100	100	200	25-50	20	20	50	72-76	5		50	150-174	^{5 11} 5	⁶ 5	^{4 6} 50	216-220	1.0		1.0	220-222 ¹²	0.1	1.5	1.5	421-512	^{7 11 14} 2.5	⁸ 5	⁸ 5
Frequency range (MHz)	Fixed and base stations			Mobile stations																															
		Over 2 watts output power	2 watts or less output power																																
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220-222 ¹²	0.1	1.5	1.5																																
421-512	^{7 11 14} 2.5	⁸ 5	⁸ 5																																
Occupied Bandwidth	Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth. All stations must operate on channels with a bandwidth of 12.5 kHz or less beginning January 1, 2013, unless the operations meet the efficiency standard of § 90.203(i)(3).																																		

RF Output Power	§90.205(d): 150-174 MHz The maximum allowable station ERP is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 1. Applicants requesting an ERP in excess of that listed in table 1 must submit an engineering analysis based upon generally accepted engineering practices and standards that includes coverage contours to demonstrate that the requested station parameters will not produce coverage in excess of that which the applicant requires. §90.205(h): 450-470 MHz The maximum allowable station effective radiated power (ERP) is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 2. Applicants requesting an ERP in excess of that listed in table 2 must submit an engineering analysis based upon generally accepted engineering practices and standards that includes coverage contours to demonstrate that the requested station parameters will not produce coverage in excess of that which the applicant requires. §90.205(s): The output power shall not exceed by more than 20 percent either the output power shown in the Radio Equipment List [available in accordance with § 90.203(a)(1)] for transmitters included in this list or when not so listed, the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.
Emission Mask Spurious Emission at Antenna Terminal Spurious Radiated Emissions	Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows: (1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0: Zero dB. (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB. (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation. (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

Transient Frequency Behavior	Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:						
	<table><tr><th rowspan="2">Time intervals^{1 2}</th><th rowspan="2">Maximum frequency difference³</th><th colspan="2">All equipment</th></tr><tr><th>150 to 174 MHz</th><th>421 to 512 MHz</th></tr></table>	Time intervals ^{1 2}	Maximum frequency difference ³	All equipment		150 to 174 MHz	421 to 512 MHz
	Time intervals ^{1 2}			Maximum frequency difference ³	All equipment		
		150 to 174 MHz	421 to 512 MHz				
	Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels						
	t ₁ ⁴	±25.0 kHz	5.0 ms	10.0 ms			
	t ₂	±12.5 kHz	20.0 ms	25.0 ms			
	t ₃ ⁴	±25.0 kHz	5.0 ms	10.0 ms			
	Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels						
	t ₁ ⁴	±12.5 kHz	5.0 ms	10.0 ms			
	t ₂	±6.25 kHz	20.0 ms	25.0 ms			
	t ₃ ⁴	±12.5 kHz	5.0 ms	10.0 ms			
	Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels						
	t ₁ ⁴	±6.25 kHz	5.0 ms	10.0 ms			
	t ₂	±3.125 kHz	20.0 ms	25.0 ms			
t ₃ ⁴	±6.25 kHz	5.0 ms	10.0 ms				
	¹_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing. t₁ is the time period immediately following t_{on}. t₂ is the time period immediately following t₁. t₃ is the time period from the instant when the transmitter is turned off until t_{off}. t_{off} is the instant when the 1 kHz test signal starts to rise. ² During the time from the end of t₂ to the beginning of t₃, the frequency difference must not exceed the limits specified in § 90.213. ³ Difference between the actual transmitter frequency and the assigned transmitter frequency. ⁴ If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.						
Modulation Characteristic	(a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.						
	(b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.						
	(c) Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power. A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of §2.1049 for the occupied bandwidth tests.						
	(d) Other types of equipment. A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.						

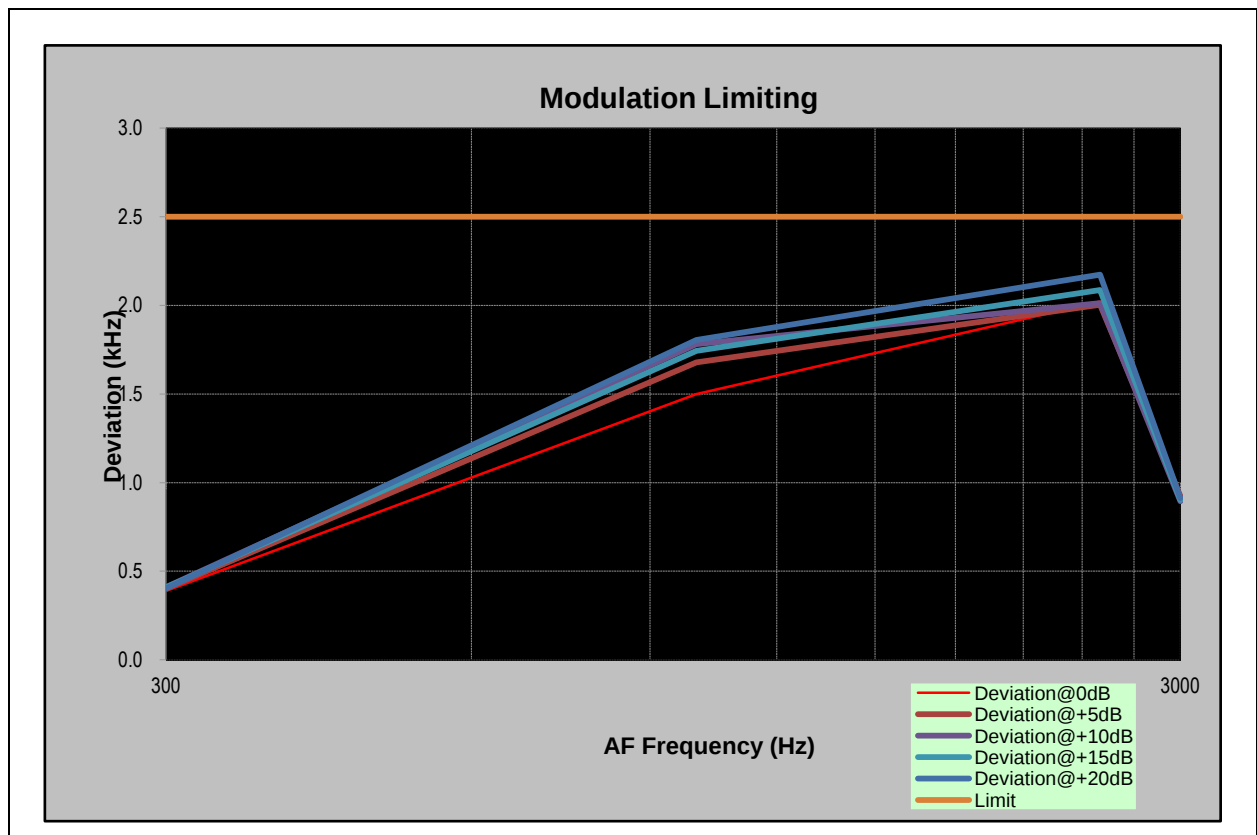
3.3 RF Conducted Test Data

Test Date:	2024-03-13~2024-03-27	Test By:	Baylor Li
Environment condition:	Temperature: 22.3~26.4°C; Relative Humidity:47~76%; ATM Pressure: 101.0~101.8kPa		

3.3.1 Modulation Characteristic

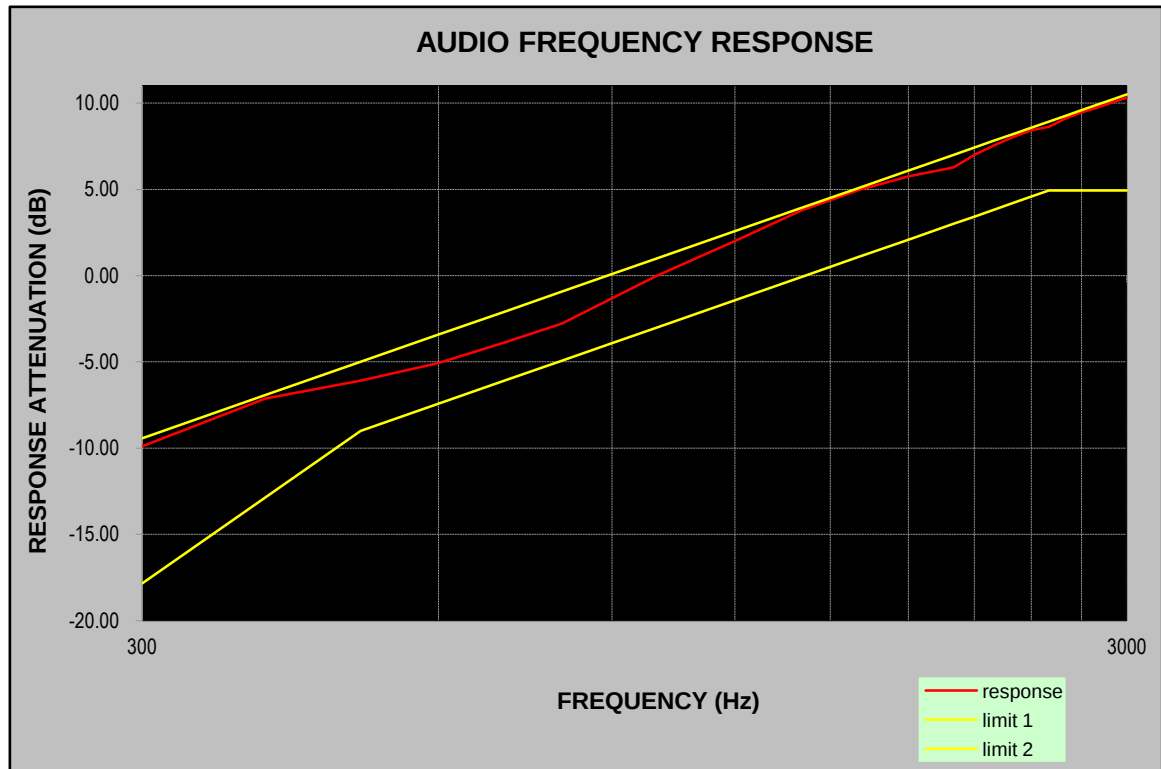
Modulation Limiting

Test Frequency: 155.76 MHz, Channel Spacing: 12.5kHz						
Audio Frequency (Hz)	Deviation (@+0dB) [kHz]	Deviation (@+5dB) [kHz]	Deviation (@+10dB) [kHz]	Deviation (@+15dB) [kHz]	Deviation (@+20dB) [kHz]	Limit [kHz]
300	0.389	0.402	0.411	0.408	0.404	2.500
1000	1.500	1.678	1.782	1.743	1.804	2.500
2500	2.021	2.004	2.013	2.087	2.174	2.500
3000	0.908	0.924	0.894	0.902	0.912	2.500



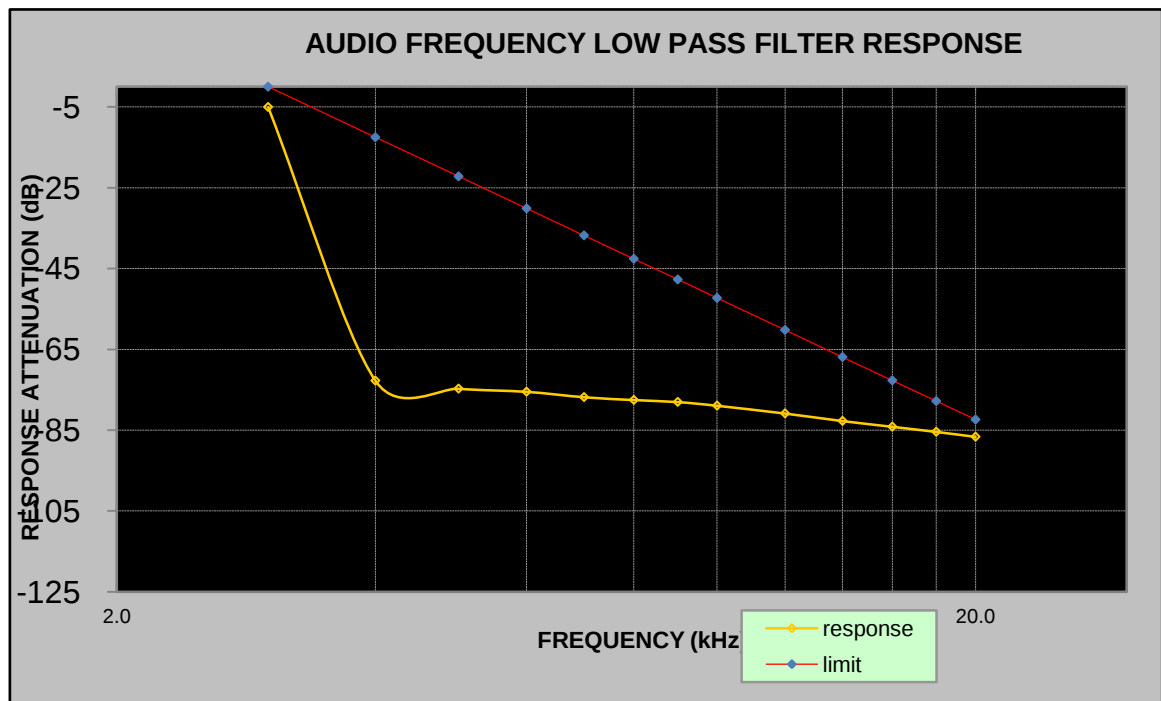
Audio Frequency Response

Test Frequency: 155.76MHz, Channel Spacing: 12.5kHz			
Audio Frequency (Hz)	Response Attenuation (dB)	High Limit (dB)	Low Limit (dB)
300	-9.90	-9.4	-17.8
400	-7.13	-6.9	-12.9
500	-6.09	-5.0	-9.0
600	-5.07	-3.4	-7.4
700	-3.88	-2.1	-6.1
800	-2.78	-0.9	-4.9
900	-1.31	0.1	-3.9
1000	0.00	1.0	-3.0
1200	2.01	2.6	-1.4
1400	3.76	3.9	-0.1
1600	4.95	5.1	1.1
1800	5.76	6.1	2.1
2000	6.28	7.0	3.0
2100	7.00	7.4	3.4
2200	7.56	7.8	3.8
2300	8.04	8.2	4.2
2400	8.43	8.6	4.6
2500	8.63	8.9	4.9
2600	9.11	9.3	4.9
2700	9.47	9.6	4.9
2800	9.75	9.9	4.9
2900	10.04	10.2	4.9
3000	10.32	10.5	4.9



Audio Low Pass Filter Response

Test Frequency: 155.76 MHz, Channel Spacing: 12.5kHz		
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.00	/
3.0	-5.01	0.0
4.0	-72.74	-12.5
5.0	-74.72	-22.2
6.0	-75.48	-30.1
7.0	-76.82	-36.8
8.0	-77.52	-42.6
9.0	-78.02	-47.7
10.0	-78.93	-52.3
12.0	-80.86	-60.2
14.0	-82.72	-66.9
16.0	-84.14	-72.7
18.0	-85.40	-77.8
20.0	-86.63	-82.4

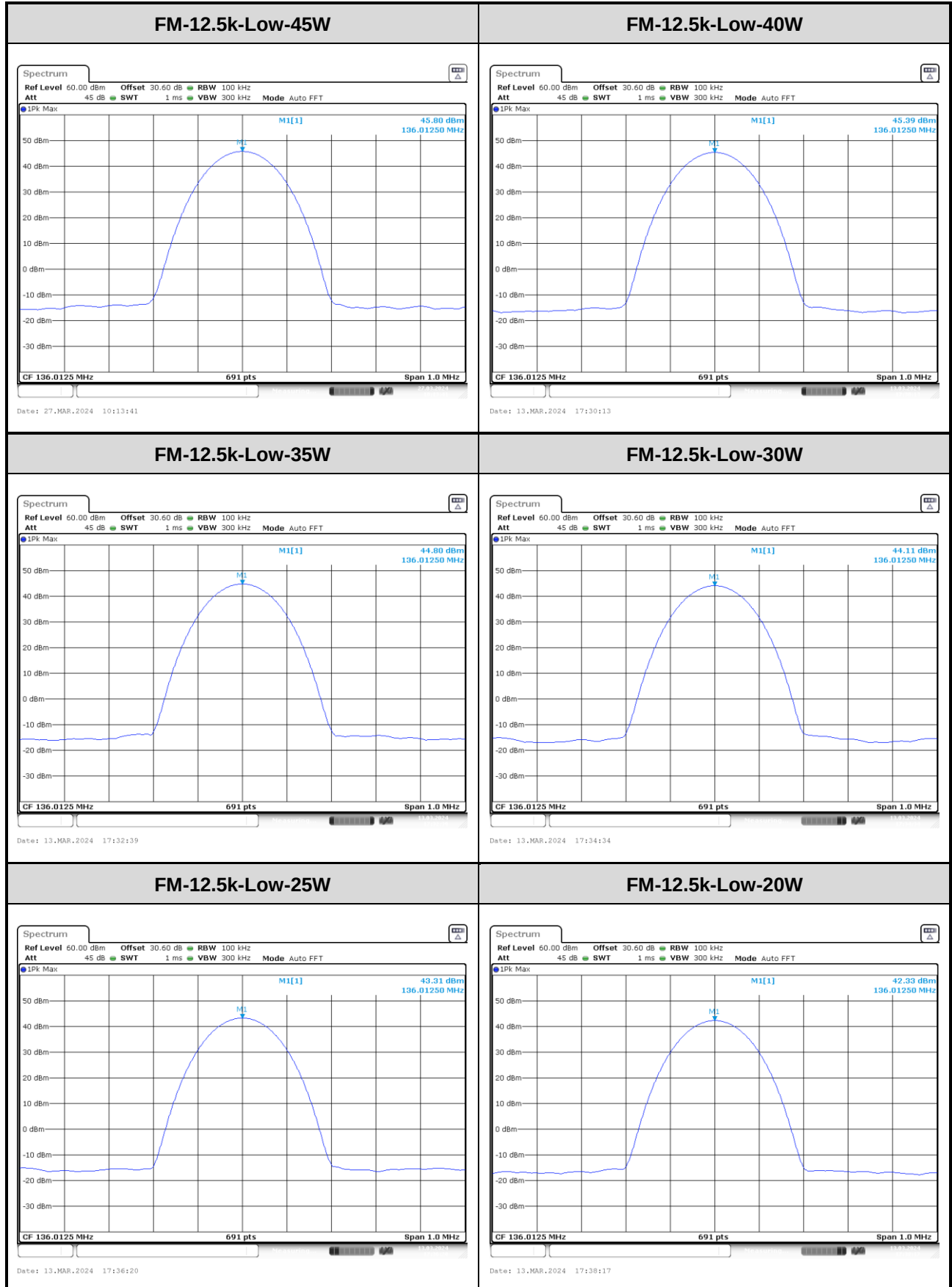


3.3.2 RF Output Power

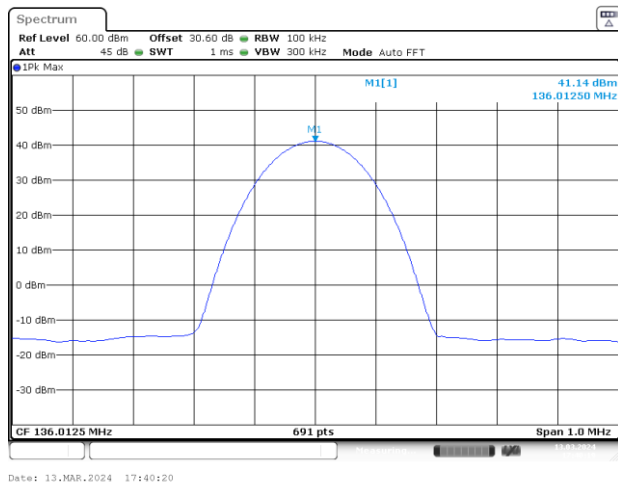
Modulation	Channel Spacing (kHz)	Rated Power (W)	Conducted Output power						Limit (W)	Verdict
			Low Channel		Middle Channel		High Channel			
			(dBm)	(W)	(dBm)	(W)	(dBm)	(W)		
FM	12.5	45	45.80	38.02	45.86	38.55	45.98	39.63	≤54	Pass
		40	45.39	34.59	45.39	34.59	45.49	35.40	≤48	Pass
		35	44.80	30.20	44.84	30.48	44.94	31.19	≤42	Pass
		30	44.11	25.76	44.18	26.18	44.27	26.73	≤36	Pass
		25	43.31	21.43	43.39	21.83	43.48	22.28	≤30	Pass
		20	42.33	17.10	42.45	17.58	42.58	18.11	≤24	Pass
		15	41.14	13.00	41.29	13.46	41.45	13.96	≤18	Pass
		10	39.45	8.81	39.66	9.25	39.89	9.75	≤12	Pass
		5	36.73	4.71	36.87	4.86	37.26	5.32	≤6	Pass
4FSK	12.5	45	45.81	38.11	45.73	37.41	45.86	38.55	≤54	Pass
		40	45.30	33.88	45.29	33.81	45.39	34.59	≤48	Pass
		35	44.68	29.38	44.74	29.79	44.85	30.55	≤42	Pass
		30	44.05	25.41	44.07	25.53	44.14	25.94	≤36	Pass
		25	43.16	20.70	43.28	21.28	43.38	21.78	≤30	Pass
		20	42.23	16.71	42.37	17.26	42.52	17.86	≤24	Pass
		15	41.08	12.82	41.22	13.24	41.39	13.77	≤18	Pass
		10	39.36	8.63	39.58	9.08	39.84	9.64	≤12	Pass
		5	36.43	4.40	36.80	4.79	37.20	5.25	≤6	Pass

Note: The output power shall not exceed by more than 20 percent the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

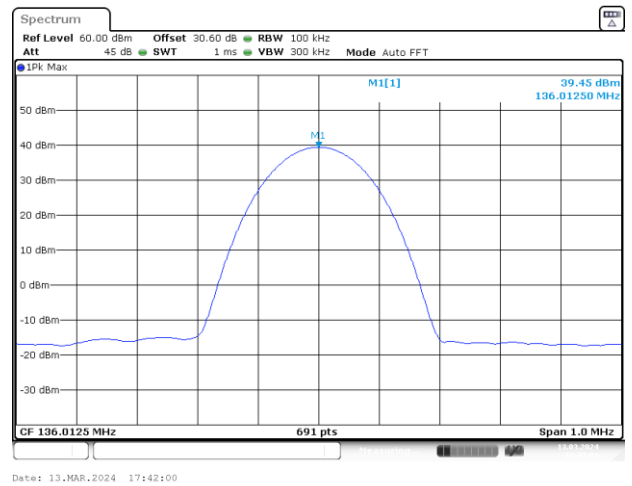
Test Plots:



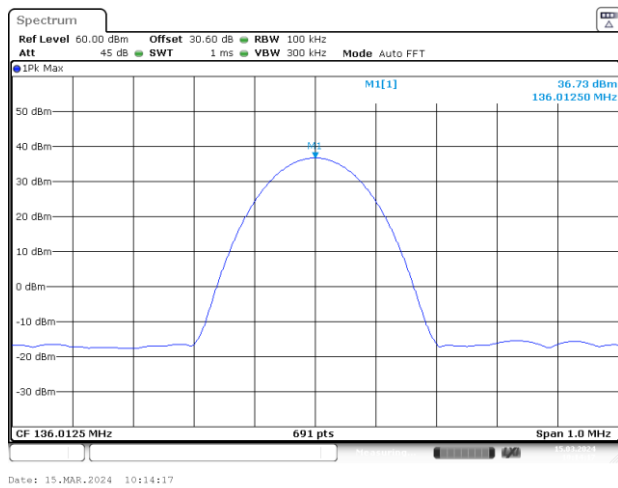
FM-12.5k-Low-15W



FM-12.5k-Low-10W



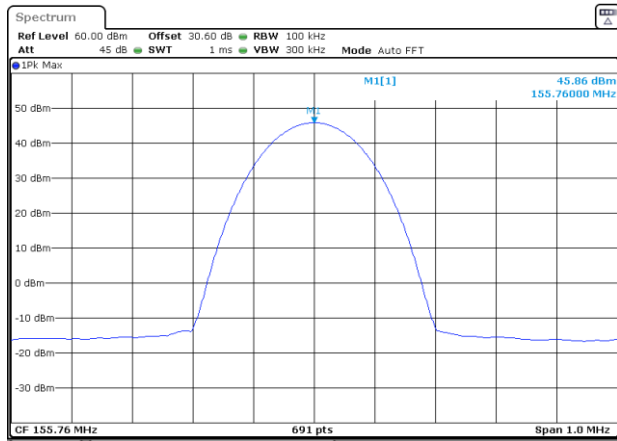
FM-12.5k-Low-5W



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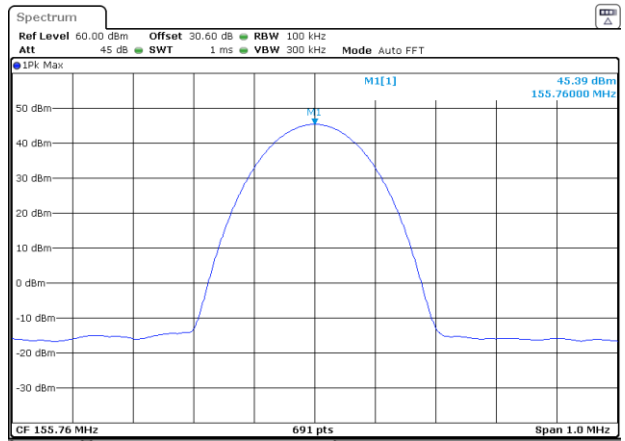
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FM-12.5k-Middle-45W



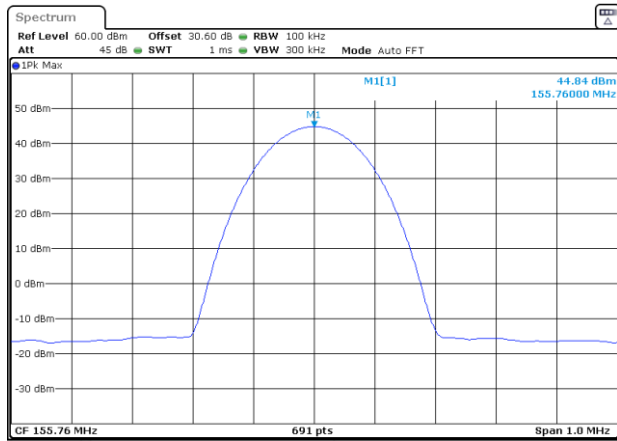
Date: 13.MAR.2024 17:28:52

FM-12.5k-Middle-40W



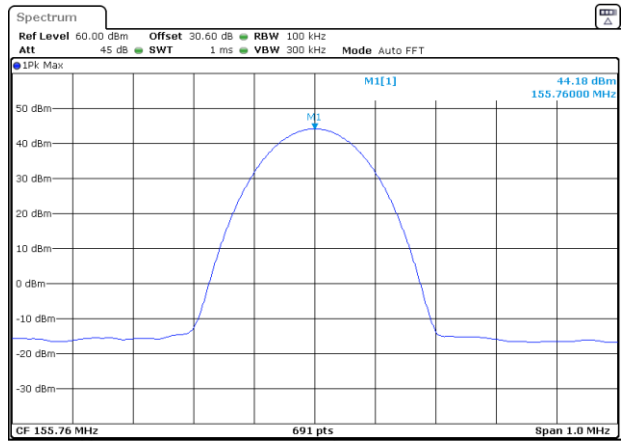
Date: 13.MAR.2024 17:30:53

FM-12.5k-Middle-35W



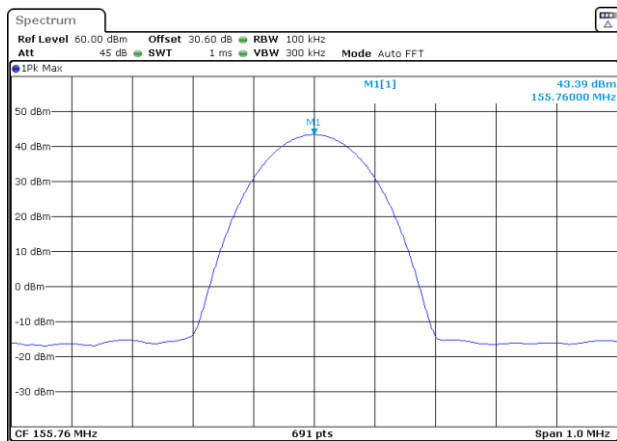
Date: 13.MAR.2024 17:33:00

FM-12.5k-Middle-30W



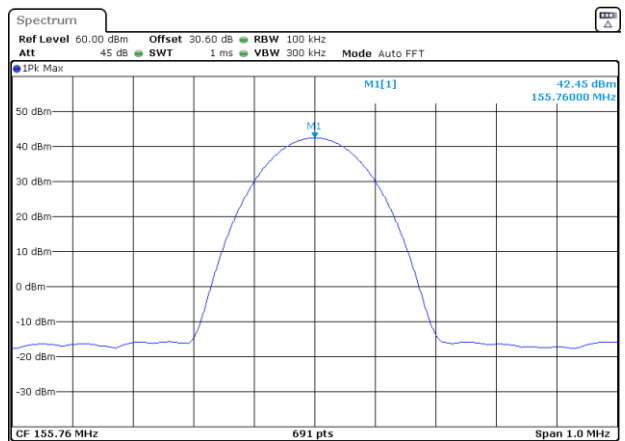
Date: 13.MAR.2024 17:35:10

FM-12.5k-Middle-25W



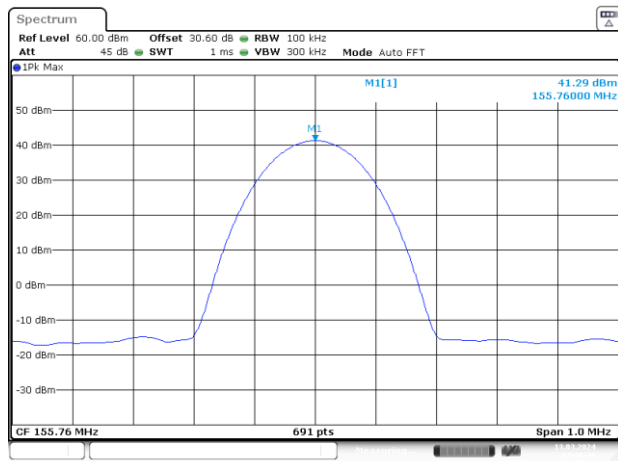
Date: 13.MAR.2024 17:36:57

FM-12.5k-Middle-20W



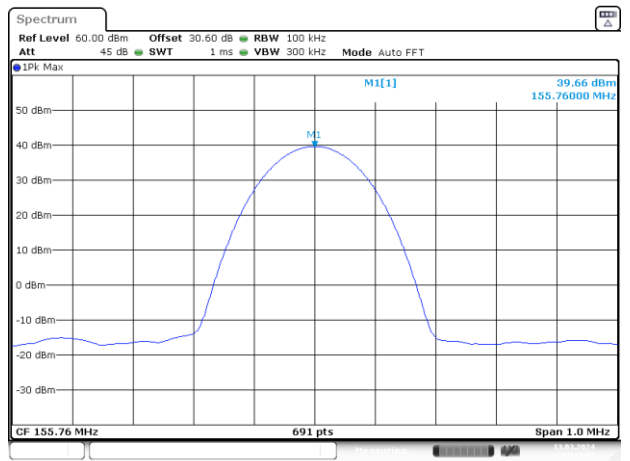
Date: 13.MAR.2024 17:38:43

FM-12.5k-Middle-15W



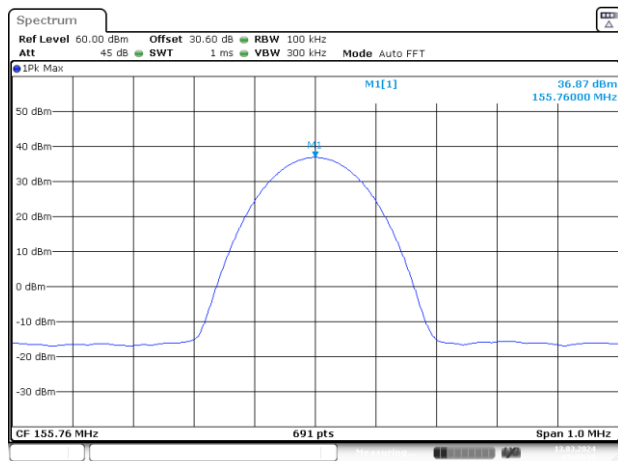
Date: 13.MAR.2024 17:40:49

FM-12.5k-Middle-10W



Date: 13.MAR.2024 17:42:28

FM-12.5k-Middle-5W

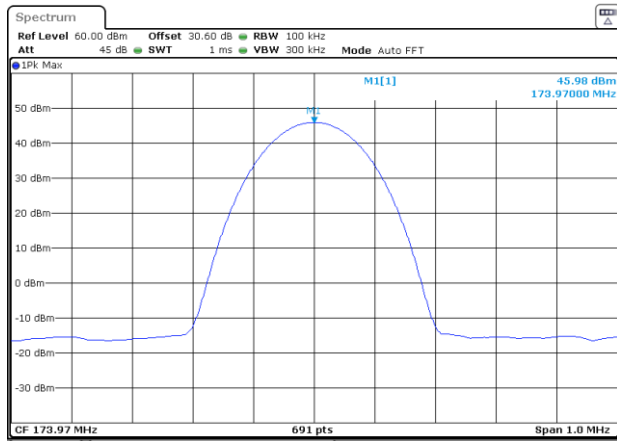


Date: 13.MAR.2024 17:44:13

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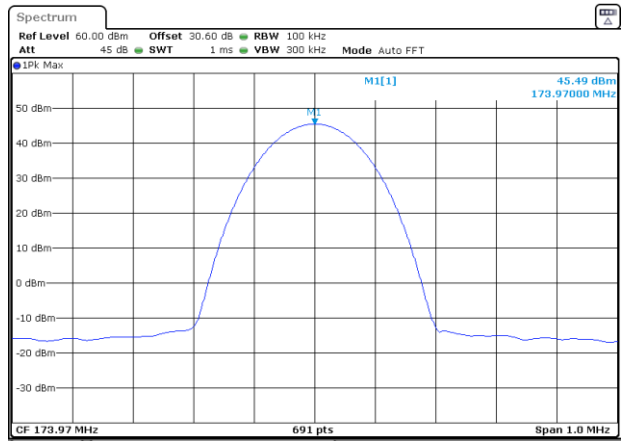
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FM-12.5k-High-45W



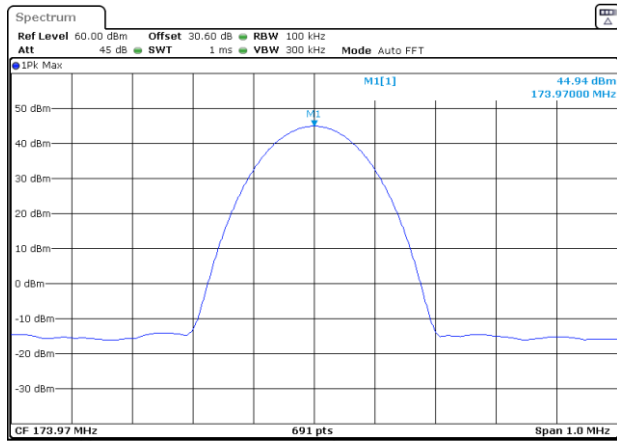
Date: 13.MAR.2024 17:29:25

FM-12.5k- High-40W



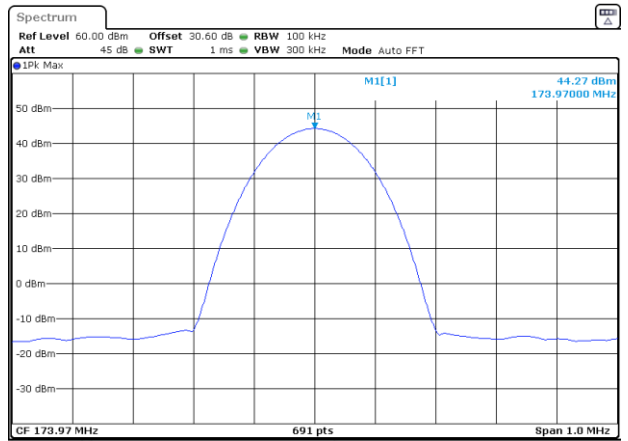
Date: 13.MAR.2024 17:31:23

FM-12.5k- High-35W



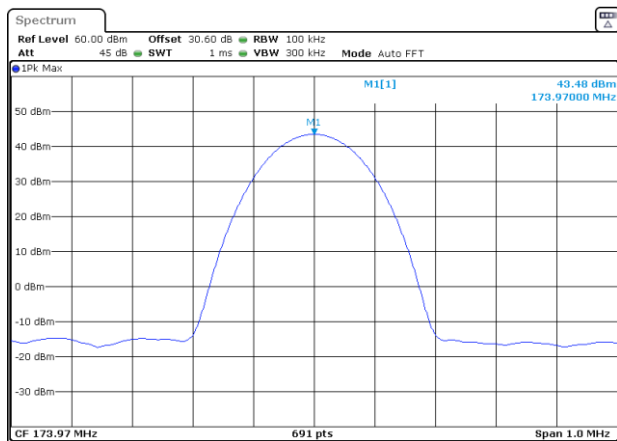
Date: 13.MAR.2024 17:33:40

FM-12.5k- High-30W



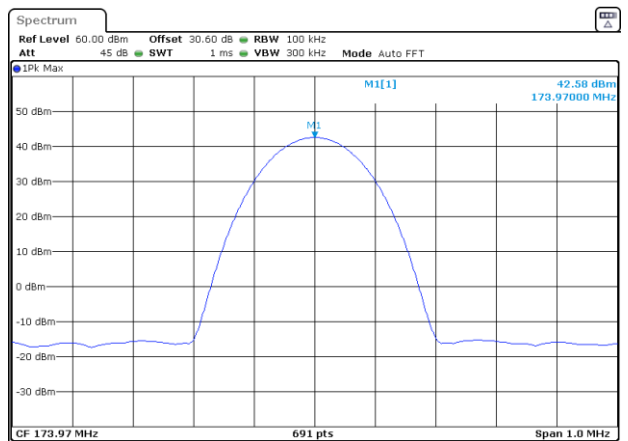
Date: 13.MAR.2024 17:35:39

FM-12.5k- High-25W



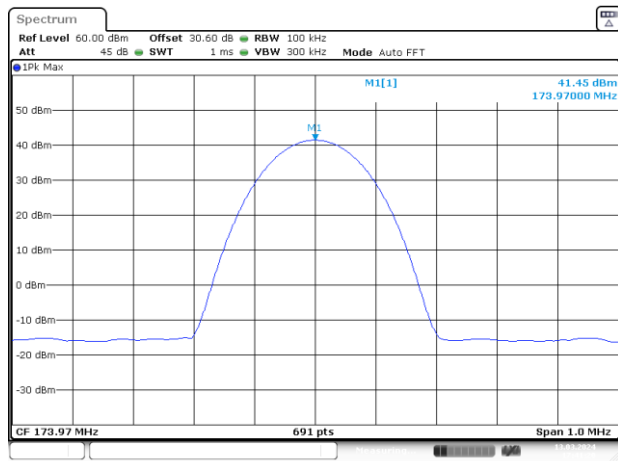
Date: 13.MAR.2024 17:37:28

FM-12.5k- High-20W



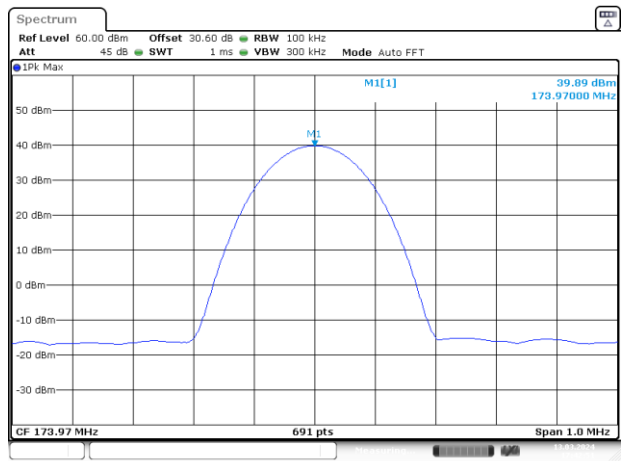
Date: 13.MAR.2024 17:39:04

FM-12.5k- High-15W



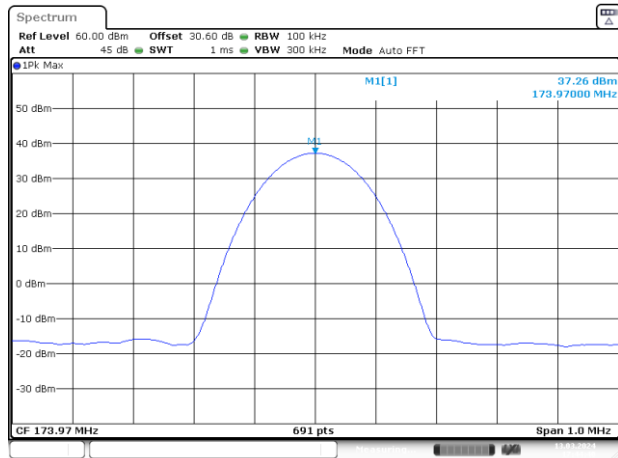
Date: 13.MAR.2024 17:41:20

FM-12.5k- High-10W



Date: 13.MAR.2024 17:42:51

FM-12.5k- High-5W

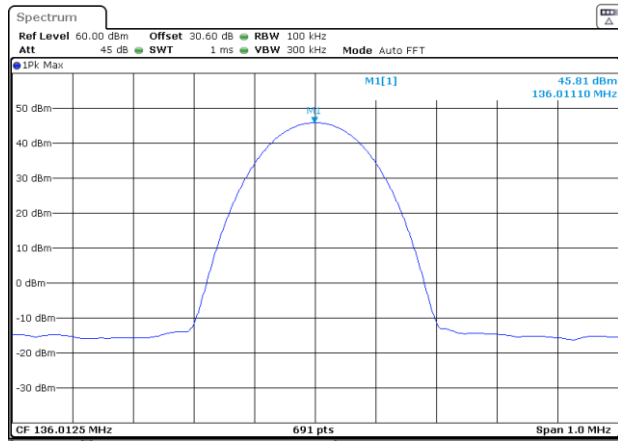


Date: 13.MAR.2024 17:44:40

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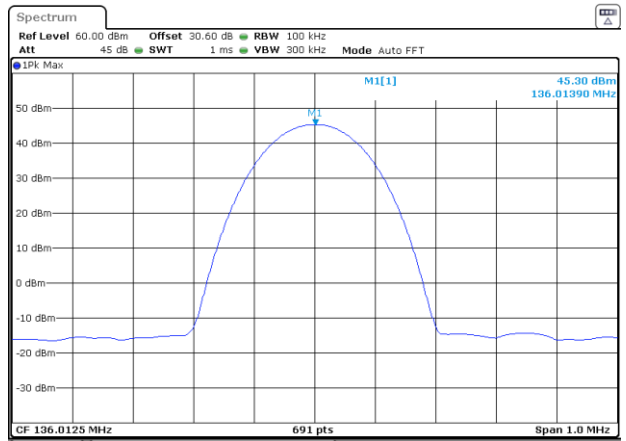
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4FSK-12.5k-Low-45W



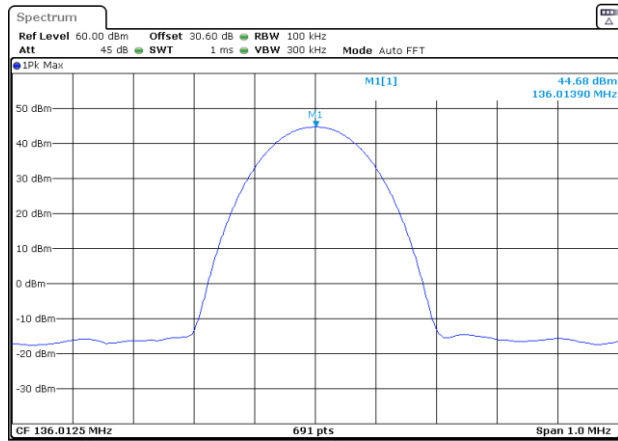
Date: 15.MAR.2024 11:22:39

4FSK-12.5k-Low-40W



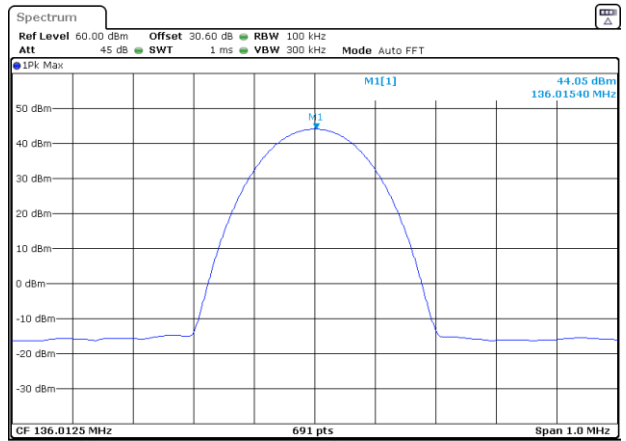
Date: 15.MAR.2024 11:27:06

4FSK-12.5k-Low-35W



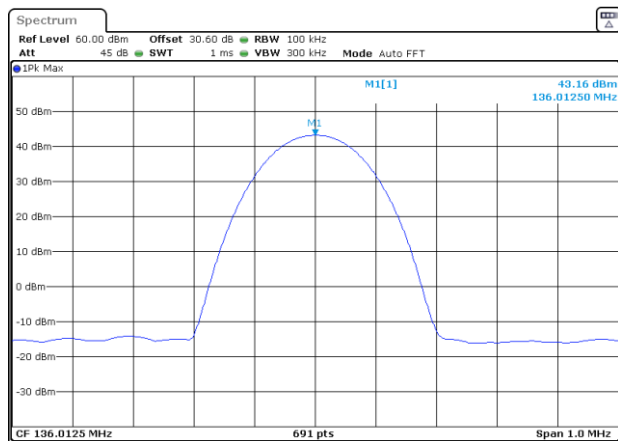
Date: 15.MAR.2024 11:30:02

4FSK-12.5k-Low-30W



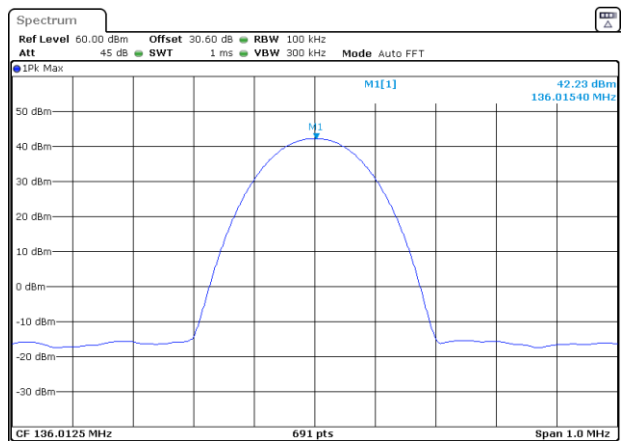
Date: 15.MAR.2024 11:32:14

4FSK-12.5k-Low-25W



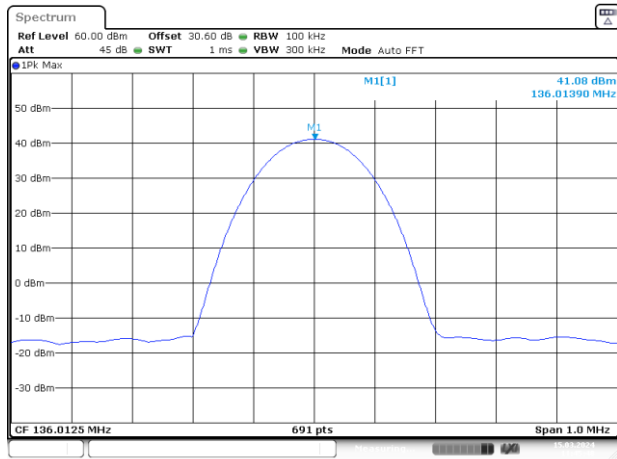
Date: 15.MAR.2024 11:39:58

4FSK-12.5k-Low-20W



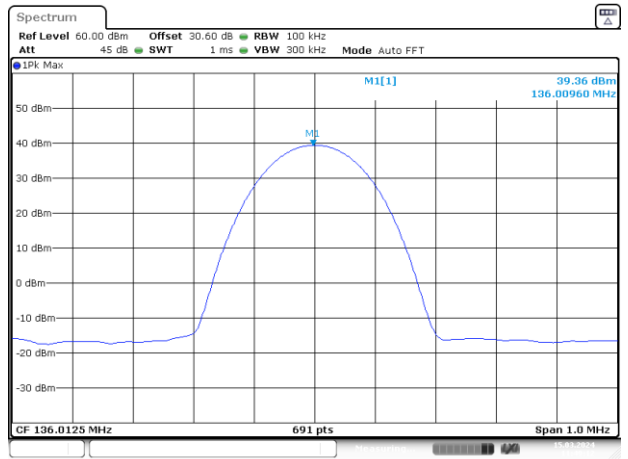
Date: 15.MAR.2024 11:42:58

4FSK-12.5k-Low-15W



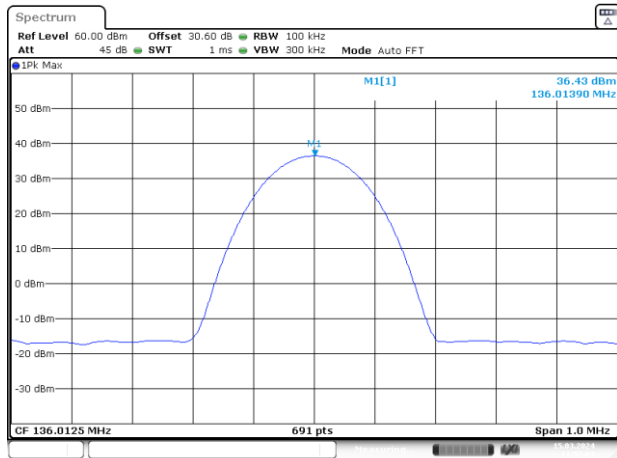
Date: 15.MAR.2024 11:45:47

4FSK-12.5k-Low-10W



Date: 15.MAR.2024 11:49:12

4FSK-12.5k-Low-5W

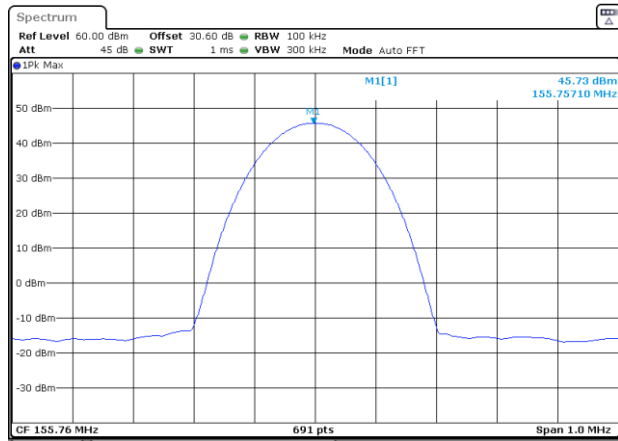


Date: 15.MAR.2024 11:52:03

/

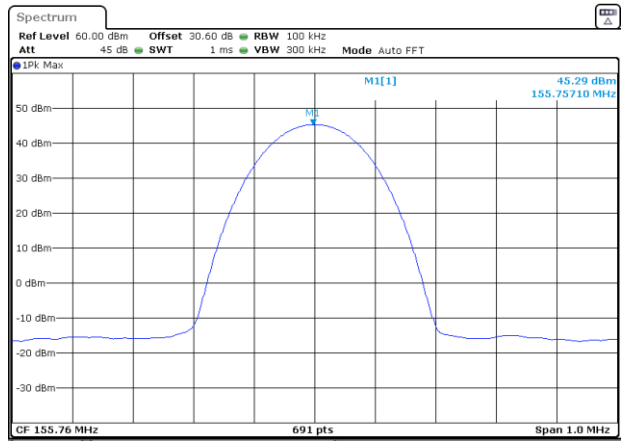
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4FSK-12.5k-Middle-45W



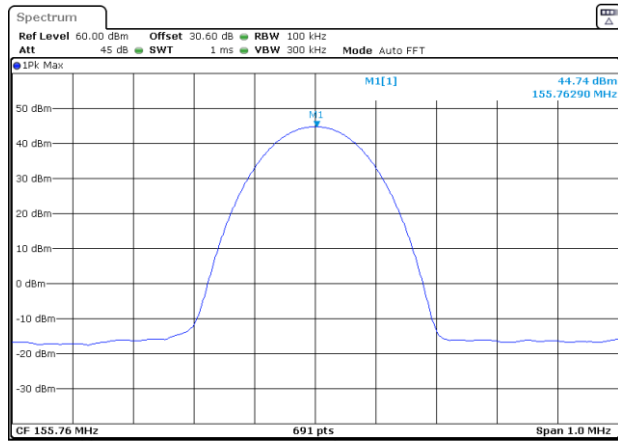
Date: 15.MAR.2024 11:24:27

4FSK-12.5k-Middle-40W



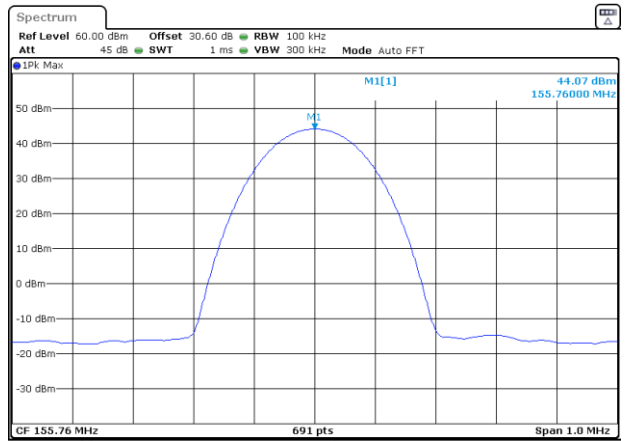
Date: 15.MAR.2024 11:28:08

4FSK-12.5k-Middle-35W



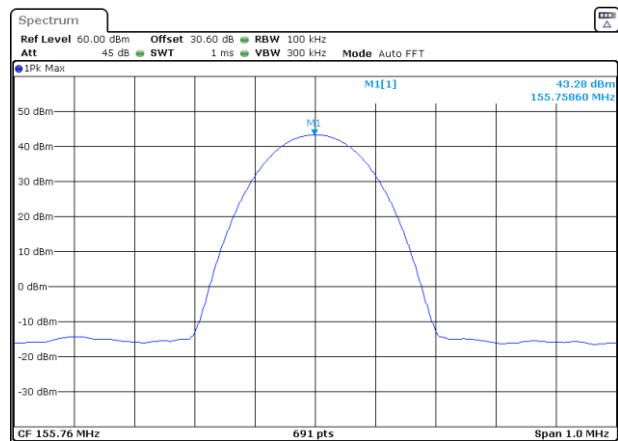
Date: 15.MAR.2024 11:31:08

4FSK-12.5k-Middle-30W



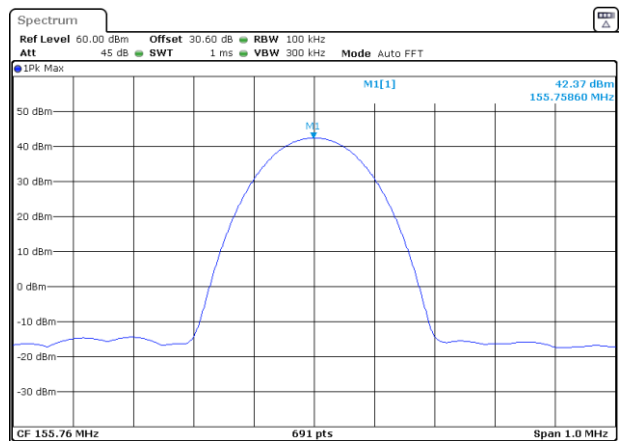
Date: 15.MAR.2024 11:33:32

4FSK-12.5k-Middle-25W



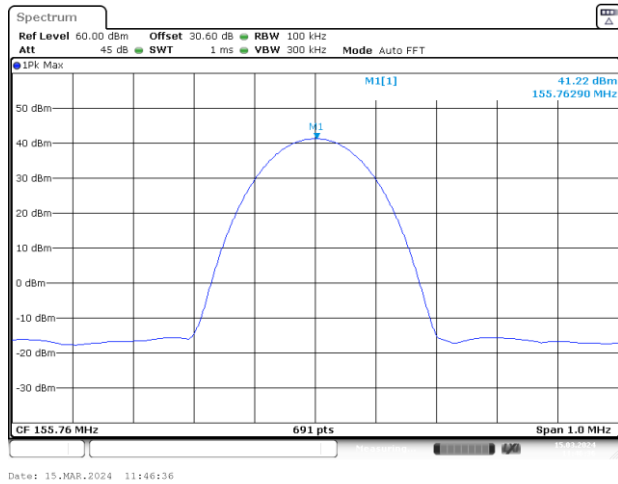
Date: 15.MAR.2024 11:41:22

4FSK-12.5k-Middle-20W

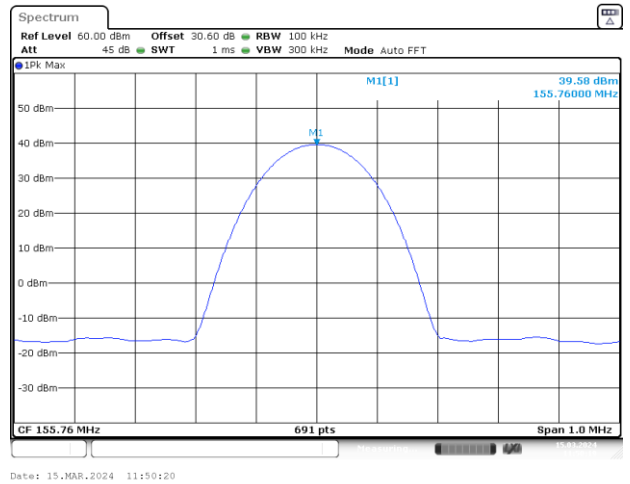


Date: 15.MAR.2024 11:44:03

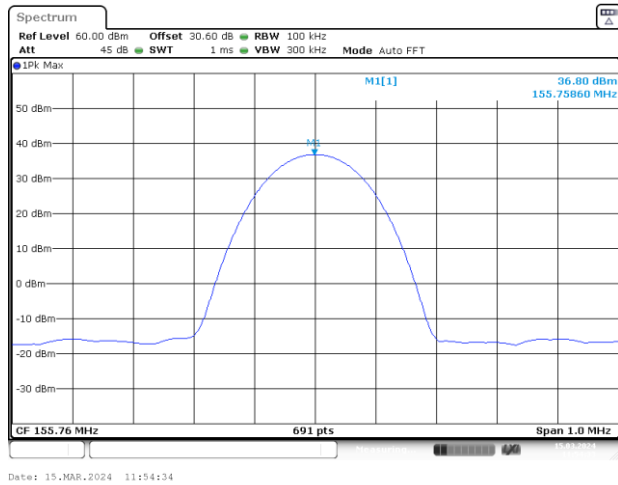
4FSK-12.5k-Middle-15W



4FSK-12.5k-Middle-10W



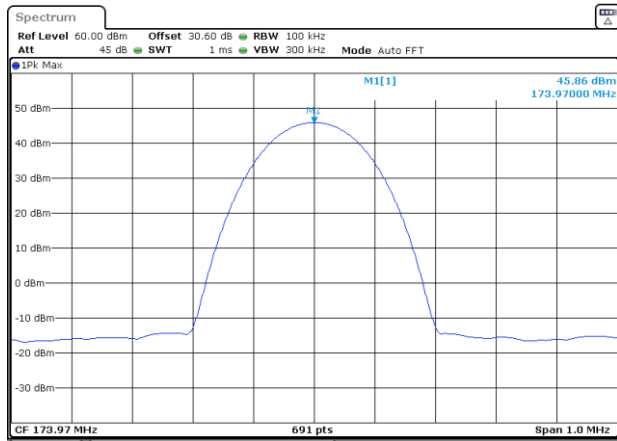
4FSK-12.5k-Middle-5W



/

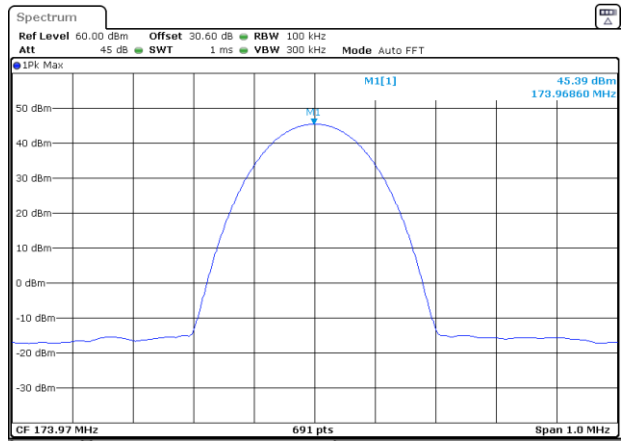
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4FSK-12.5k-High-45W



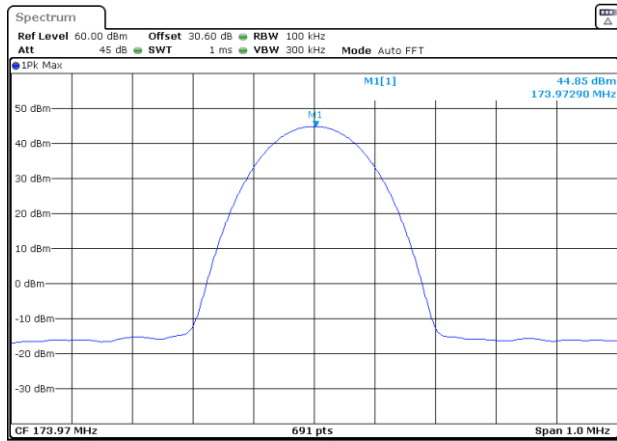
Date: 15.MAR.2024 11:25:13

4FSK-12.5k- High-40W



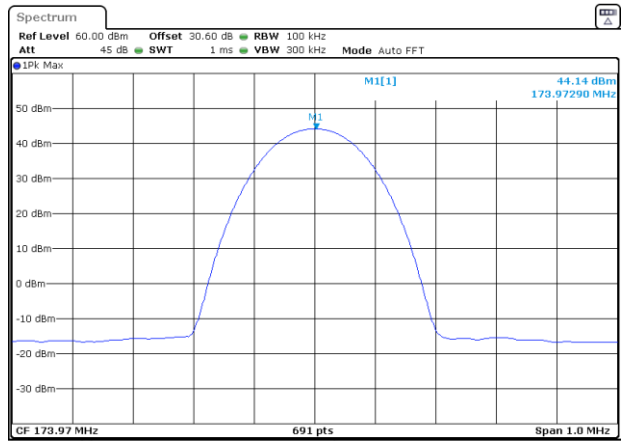
Date: 15.MAR.2024 11:28:40

4FSK-12.5k- High-35W



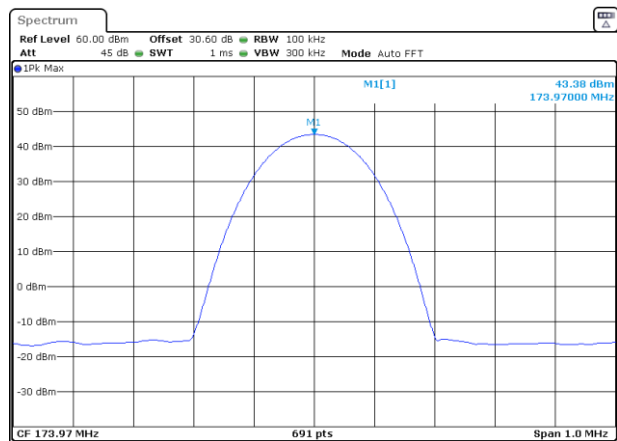
Date: 15.MAR.2024 11:31:28

4FSK-12.5k- High-30W



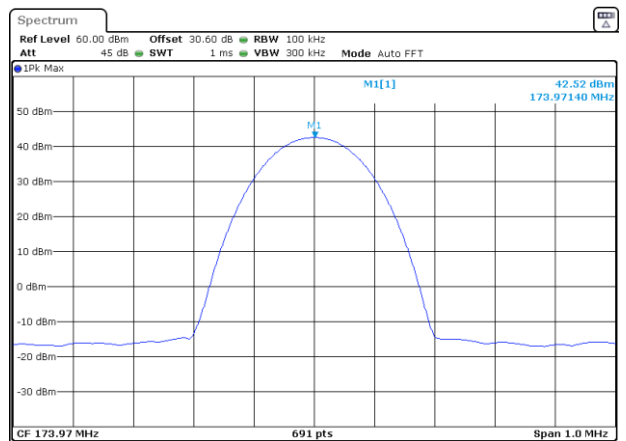
Date: 15.MAR.2024 11:35:59

4FSK-12.5k- High-25W



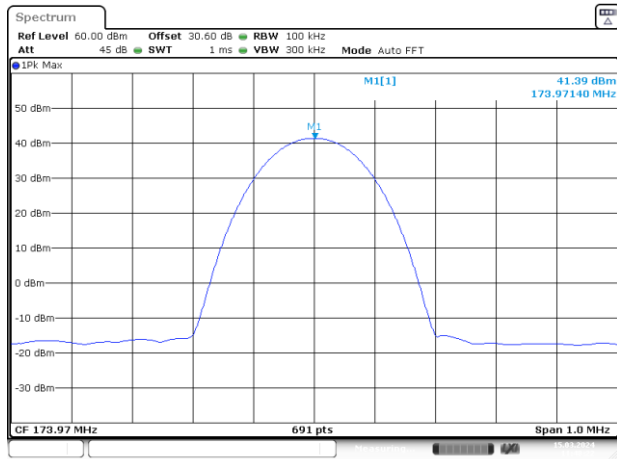
Date: 15.MAR.2024 11:41:45

4FSK-12.5k- High-20W



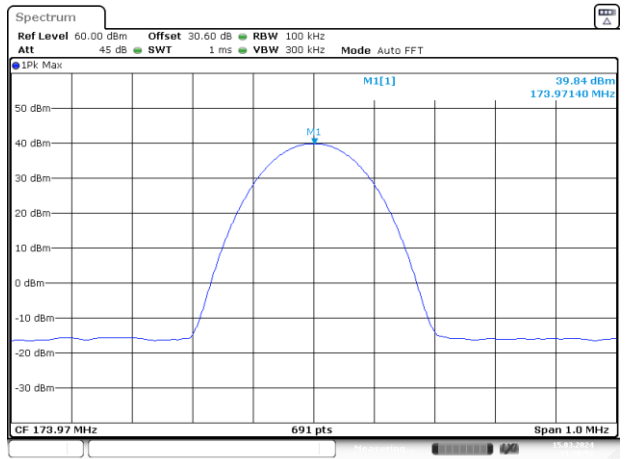
Date: 15.MAR.2024 11:44:36

4FSK-12.5k- High-15W



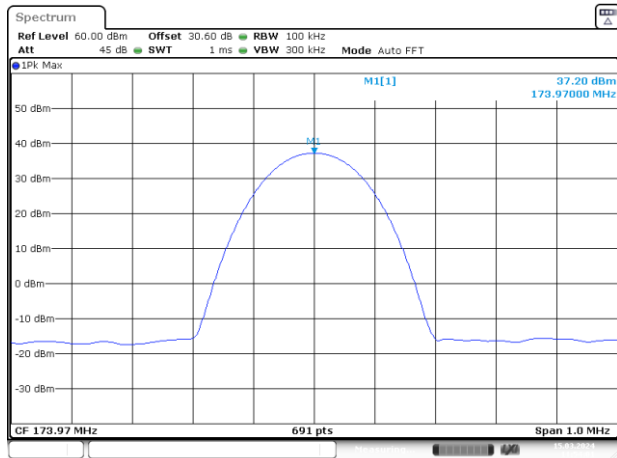
Date: 15.MAR.2024 11:48:22

4FSK-12.5k- High-10W



Date: 15.MAR.2024 11:50:52

4FSK-12.5k- High-5W



Date: 15.MAR.2024 11:54:01

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3.3.3 Occupied Bandwidth and Emission Mask

Modulation	Channel Spacing (kHz)	Rated Power (W)	Bandwidth(kHz)						Limit (kHz)	Verdict
			Low Channel		Middle Channel		High Channel			
			26dB	99%	26dB	99%	26dB	99%		
FM	12.5	45	10.203	7.525	10.203	7.525	10.203	9.841	≤11.25	Pass
		40	10.130	7.525	10.203	7.525	10.203	9.841	≤11.25	Pass
		35	10.130	7.525	10.203	7.525	10.203	9.841	≤11.25	Pass
		30	10.130	7.525	10.203	7.525	10.203	9.913	≤11.25	Pass
		25	10.130	7.525	10.203	7.525	10.203	9.841	≤11.25	Pass
		20	10.130	7.525	10.203	7.525	10.203	9.841	≤11.25	Pass
		15	10.130	7.525	10.203	7.525	10.203	9.841	≤11.25	Pass
		10	10.203	7.525	10.203	7.525	10.203	9.841	≤11.25	Pass
		5	10.203	7.525	10.203	7.525	10.203	9.841	≤11.25	Pass
4FSK	12.5	45	9.986	8.104	9.913	7.742	9.841	7.453	≤11.25	Pass
		40	9.986	8.104	9.913	7.742	9.841	7.453	≤11.25	Pass
		35	9.986	8.104	9.913	7.742	9.841	7.453	≤11.25	Pass
		30	9.986	8.104	9.913	7.742	9.841	7.453	≤11.25	Pass
		25	9.986	8.104	9.913	7.742	9.841	7.453	≤11.25	Pass
		20	9.986	8.104	9.913	7.742	9.841	7.453	≤11.25	Pass
		15	9.986	8.104	9.913	7.742	9.841	7.453	≤11.25	Pass
		10	9.986	8.104	9.913	7.742	9.841	7.453	≤11.25	Pass
		5	9.986	8.104	9.913	7.598	9.841	7.308	≤11.25	Pass

Note:

Emission bandwidth was based on calculation method instead of measurement.

Emission Designator: Per CFR 47 §2.201& §2.202, BW = 2M + 2D

For FM Mode (Channel Spacing: 12.5 kHz)

Emission Designator: 11K0F3E

In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.

$$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 2.5 \text{ kHz}) = 11 \text{ kHz} = 11K0$$

F3E portion of the designator represents an FM voice transmission

Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

For Digital Mode (Channel Spacing: 12.5 kHz)

Emission Designator: 7K60F1D and 7K60F1E

The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz. The emission mask was obtained from 47CFR 90.210(d).

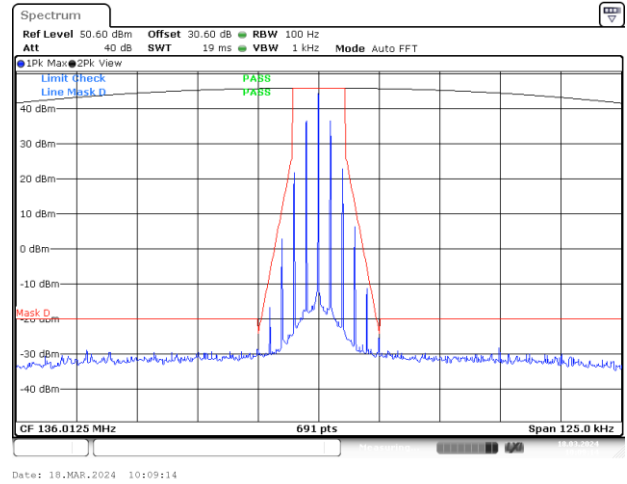
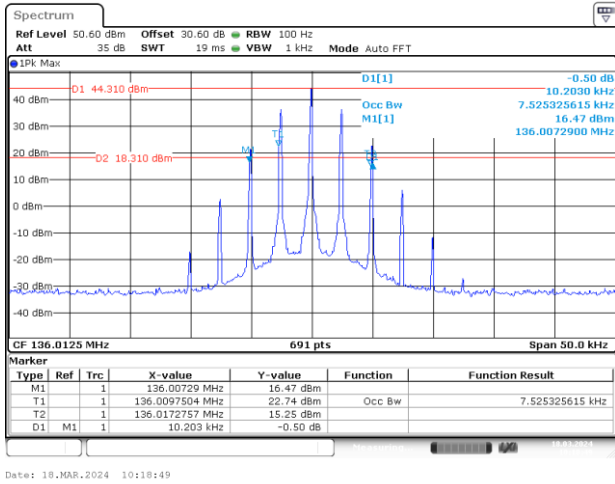
F1D and F1E portion of the designator indicates digital information.

Therefore, the entire designator for 12.5 kHz channel spacing digital mode is 7K60F1D and 7K60F1E.

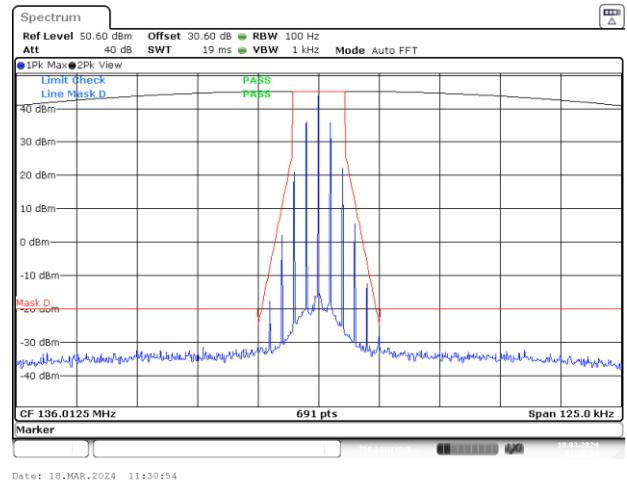
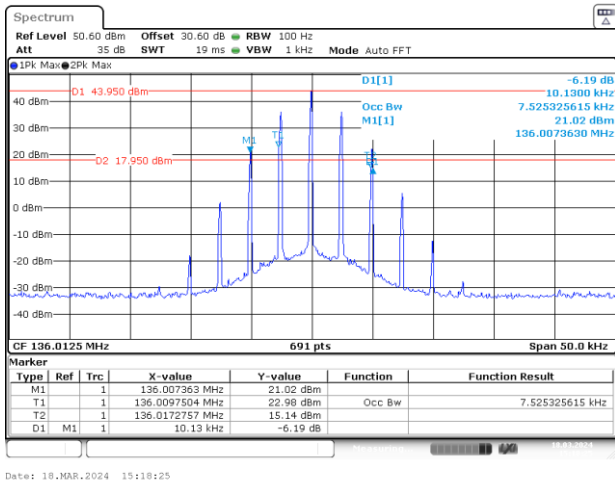
Modulation	Channel Spacing (kHz)	Rated Power (W)	Emission Mask Result			Limit	Verdict
			Low Channel	Middle Channel	High Channel		
FM	12.5	45	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		40	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		35	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		30	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		25	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		20	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		15	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		10	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		5	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
4FSK	12.5	45	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		40	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		35	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		30	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		25	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		20	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		15	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		10	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass
		5	Refer test plot	Refer test plot	Refer test plot	Refer test plot	Pass

Test Plots:

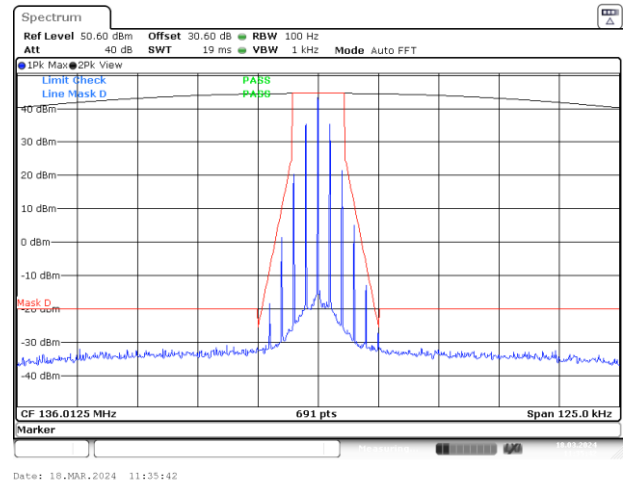
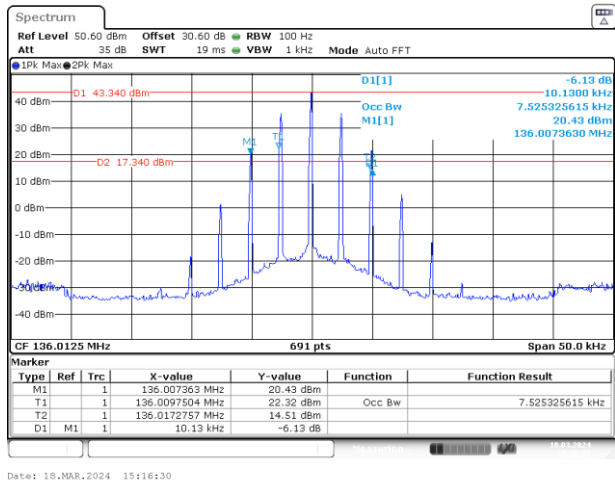
FM-12.5k-Low-45W



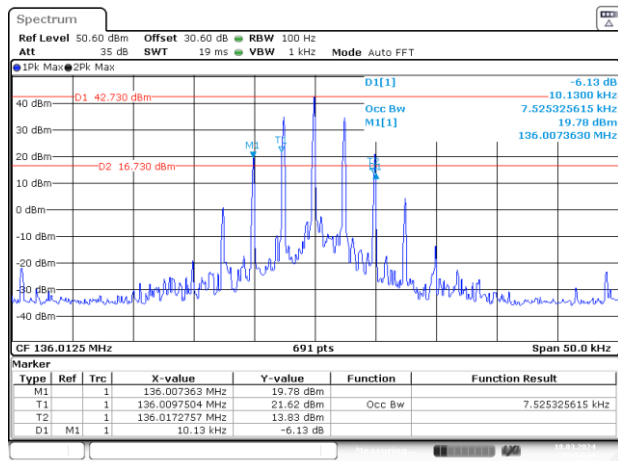
FM-12.5k-Low-40W



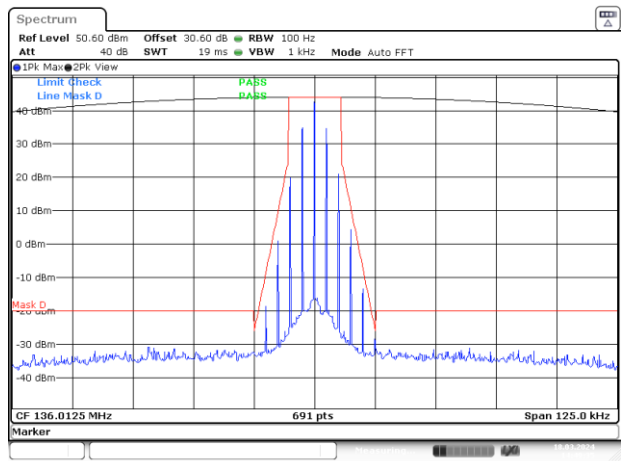
FM-12.5k-Low-35W



FM-12.5k-Low-30W

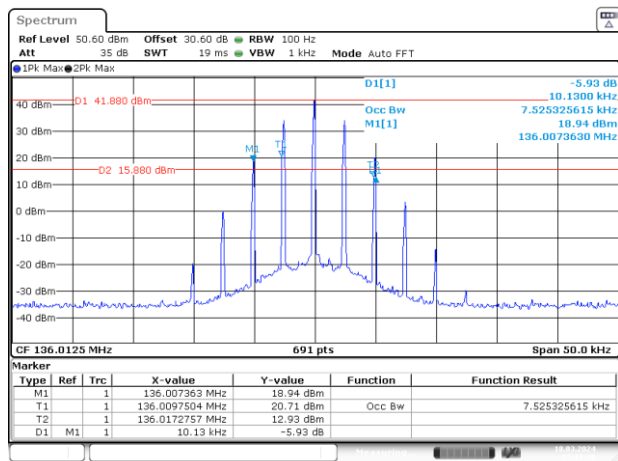


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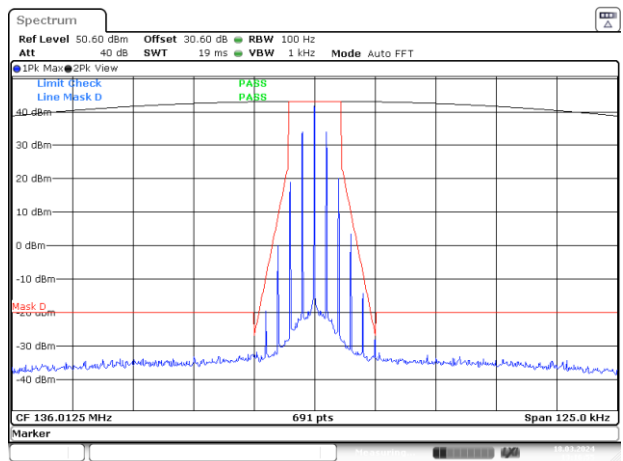


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FM-12.5k-Low-25W

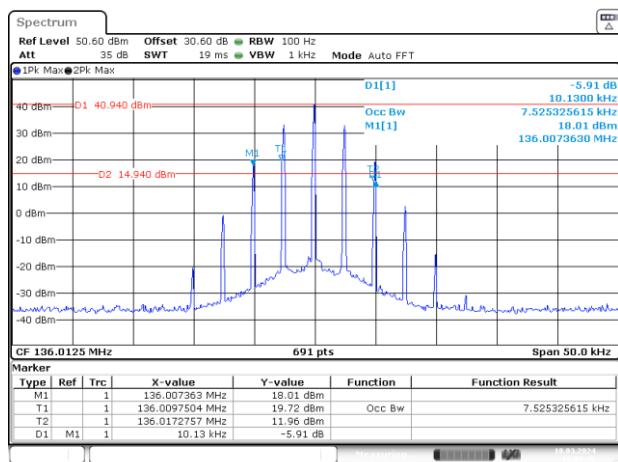


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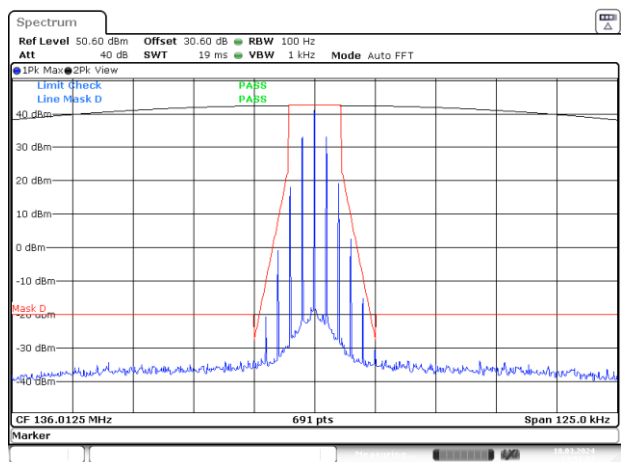


Date: 18.MAR.2024 13:16:55

FM-12.5k-Low-20W

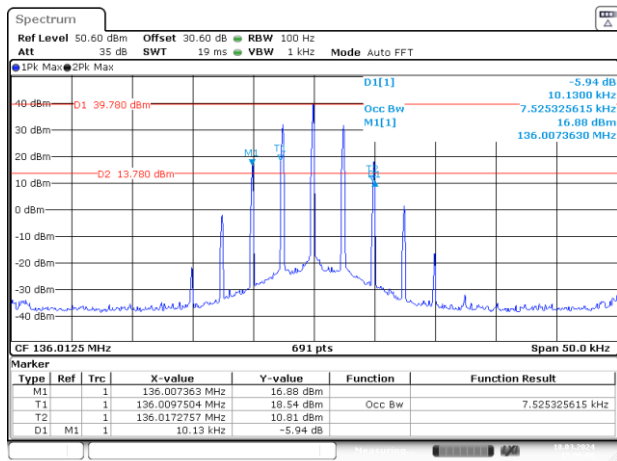


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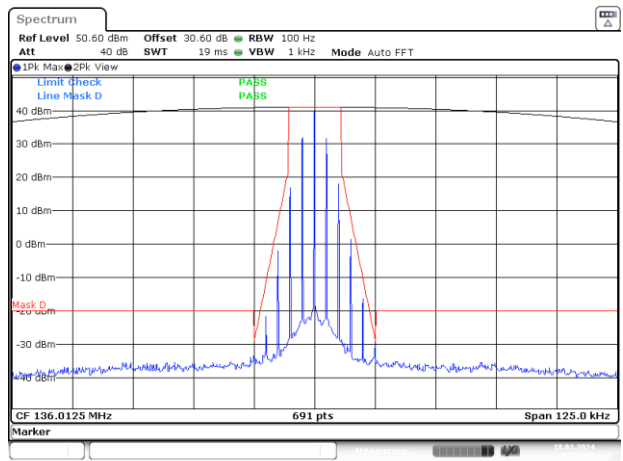


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FM-12.5k-Low-15W

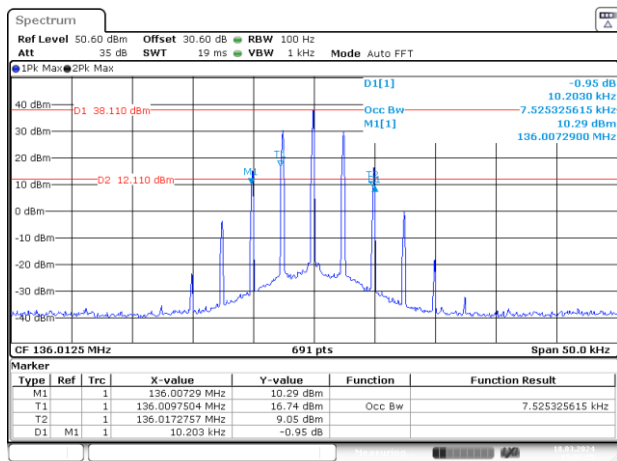


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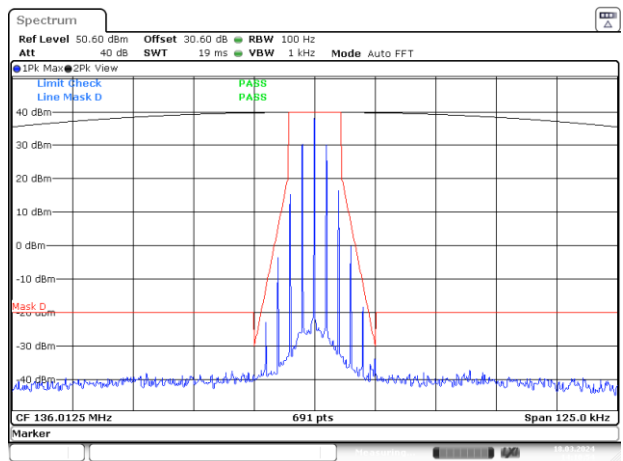


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FM-12.5k-Low-10W

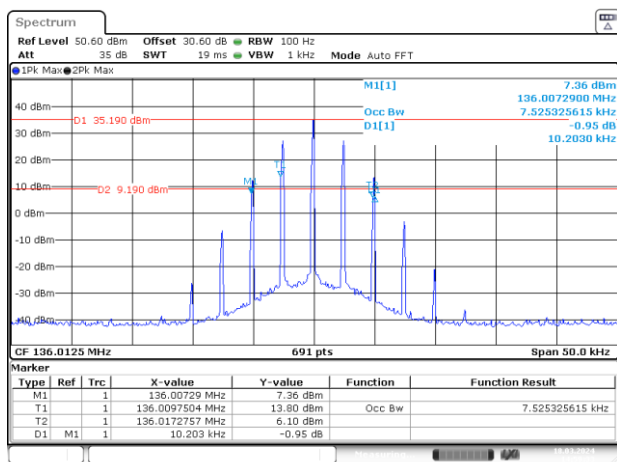


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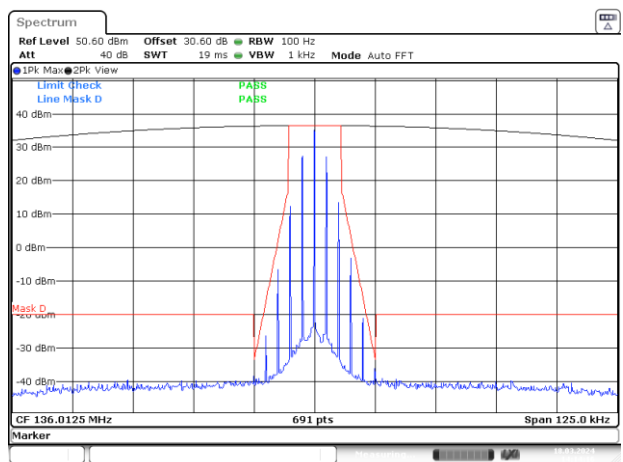


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FM-12.5k-Low-5W

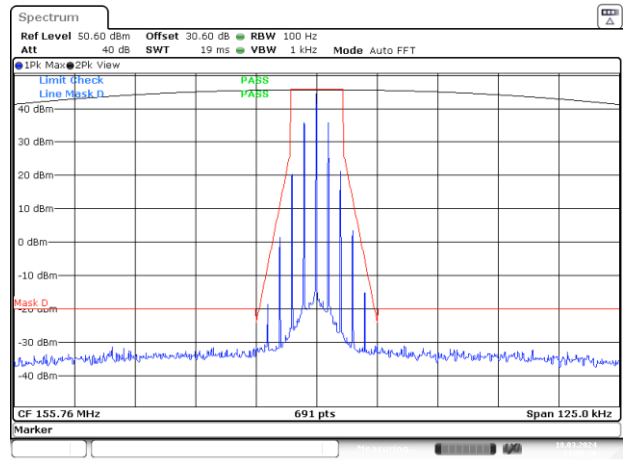
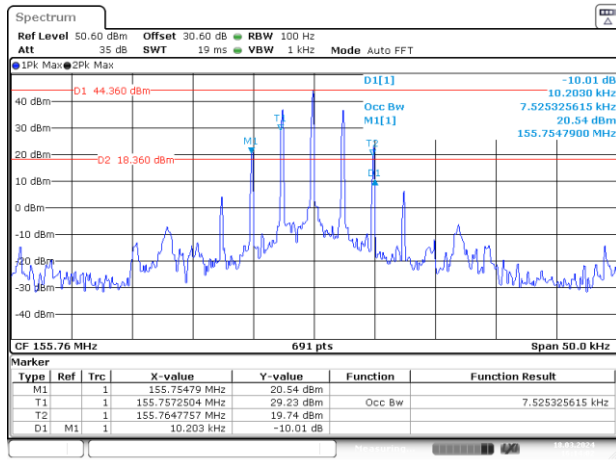


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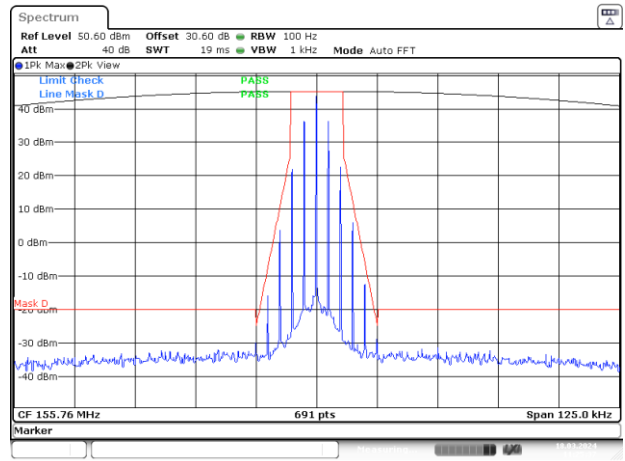
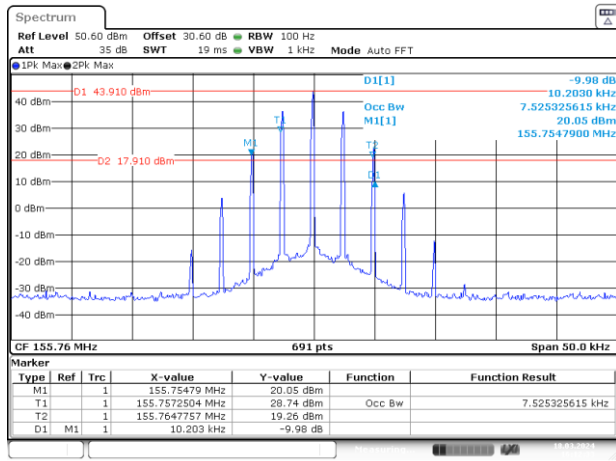


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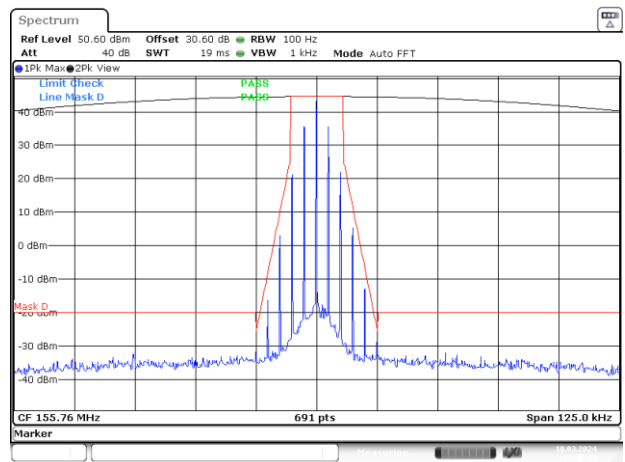
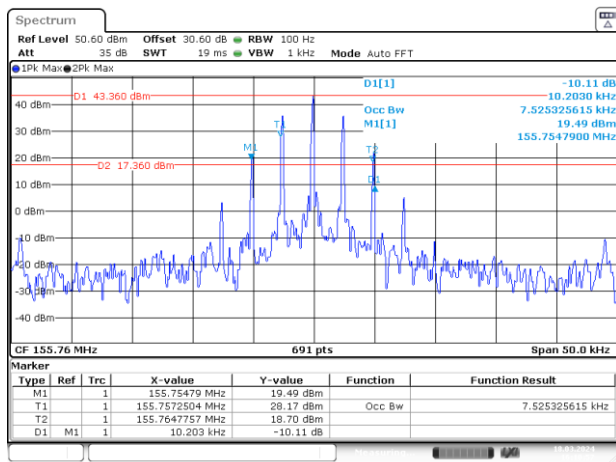
FM-12.5k-Middle-45W



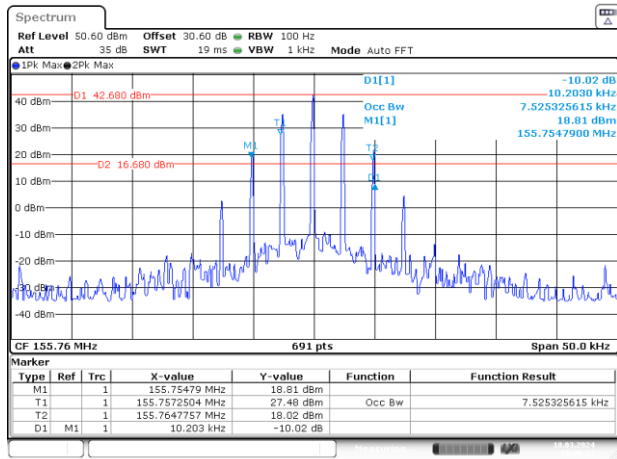
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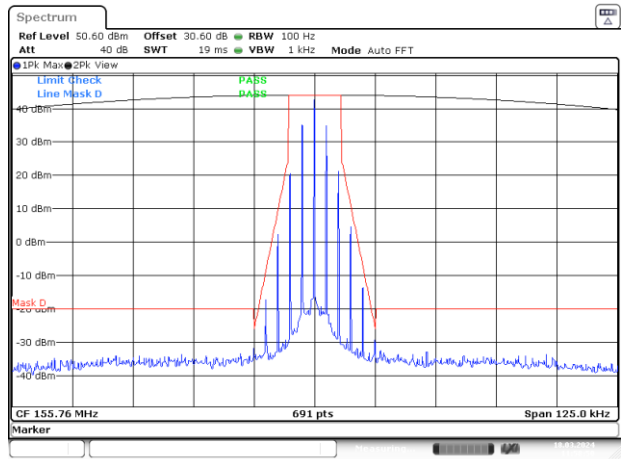
FM-12.5k-Middle-35W



FM-12.5k-Middle-30W

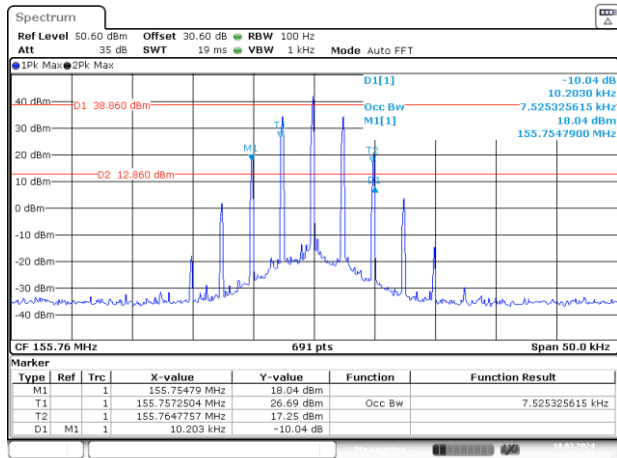


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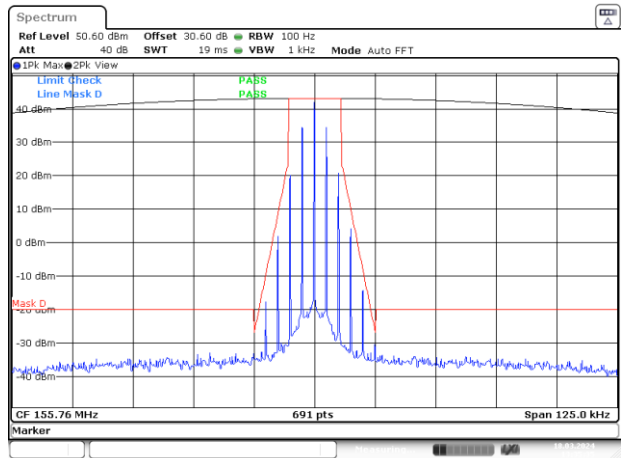


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FM-12.5k-Middle-25W

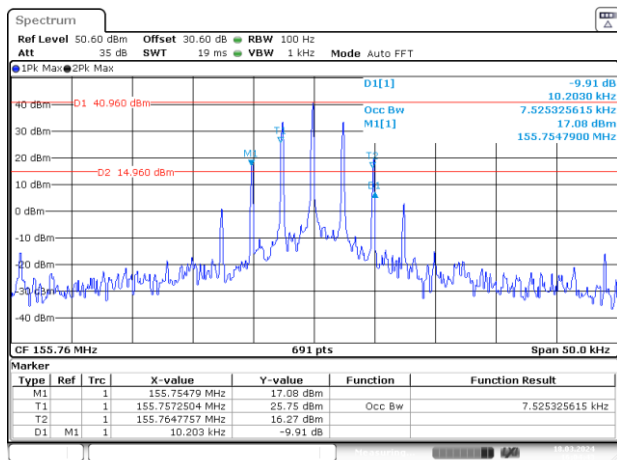


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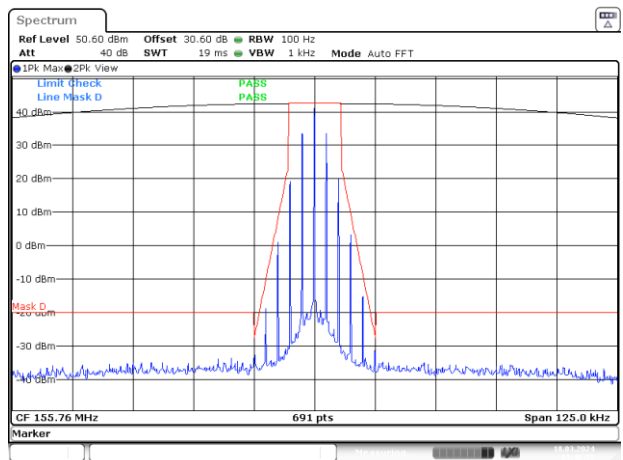


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FM-12.5k-Middle-20W

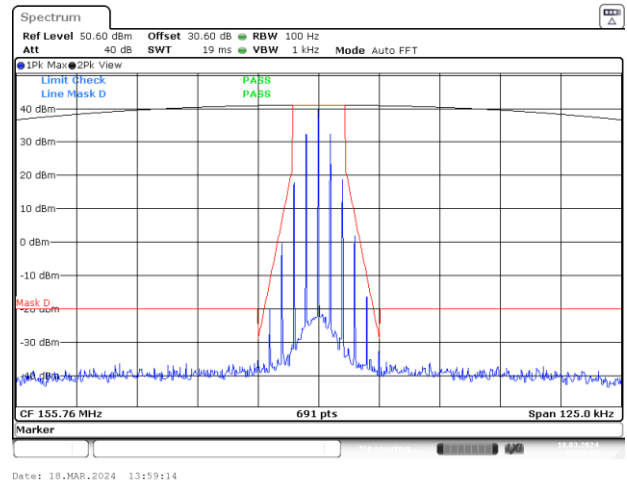
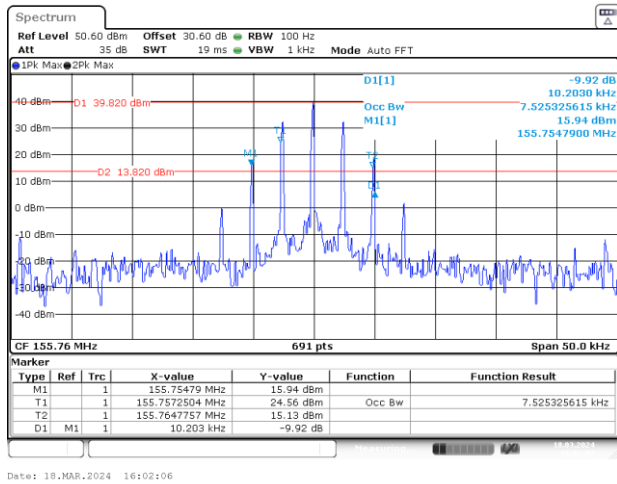


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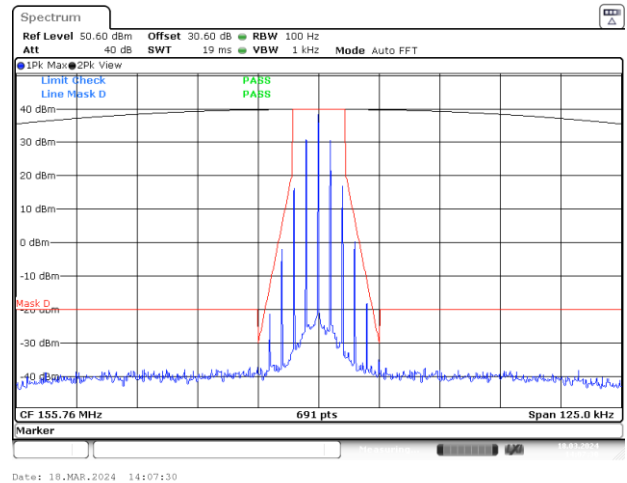
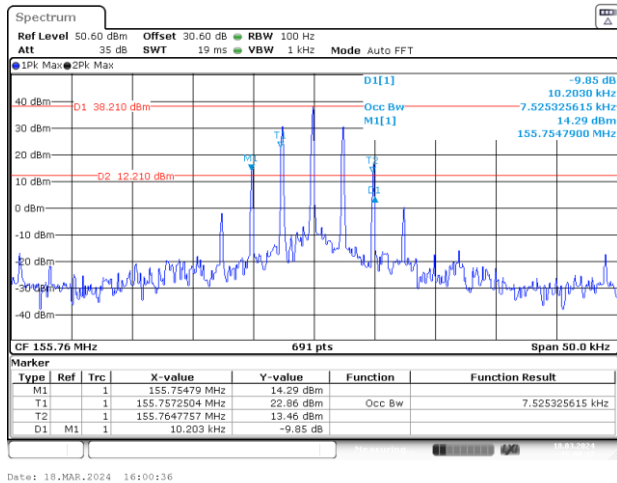


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FM-12.5k-Middle-15W



FM-12.5k-Middle-10W



FM-12.5k-Middle-5W

