

COMPLIANCE WORLDWIDE INC. TEST REPORT 137-25R1

In Accordance with the Requirements of

FCC PART 90:2023 Subpart S
Operation in the 806 to (816) 824 MHz & 851 to (861) 869 MHz
NPSPAC PS / SMR bands
and PART 20:2024

Operation in the 817 to 824 MHz & 862 to 869 MHz CMRS/ESMR bands

Issued to

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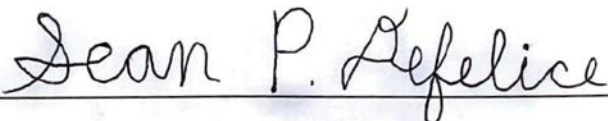
for

ProtectLink BDA 2.5 Watt
Public Safety Bi-Directional Amplifier
Model: CS45-734-834-A0

FCC ID: CH8734834

Original Report Issued on May 1, 2025
Revision Issued on May 15, 2025

Tested by



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Prepared and Reviewed By



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1. Scope

This test report certifies that the Westell ProtectLink BDA 2.5 Watt Public Safety Bi-directional Amplifier Model CS45-734-834-A0, as tested, meets the FCC Part 90 Subpart S and FCC Part 20 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required. Measurement Uncertainty will not be applied to any of the measurement / testing results in this test report to determine pass/fail criteria per the Decision Rule as defined in ISO/IEC Guide 17025-2017 Clause 3.7. Revision R1 converts data in table 6.1.2 from EIRP to ERP, replaced data in section 6.3, two tone measurements with device's internal filtering turned on.

2. Product Details

- 2.1. Manufacturer:** Westell, Inc.
- 2.2. Model Numbers:** CS45-734-834-A0
- 2.3. Serial Number:** 24RF12100001
- 2.4. Description:** The ProtectLink BDA 2.5 Watt Public Safety Bi-directional amplifier was developed for use in enclosed structures where signals from local public safety towers to operate mobile units are poor or unavailable. The downlink and uplink paths support maximum gains of up to 90 dB and 80 dB, respectively. Gain can be adjusted in 1 dB steps, from 60 to 90 dB DL and from 50 to 80 dB UL. The ProtectLink BDA supports uplink bands of 799-805 / 806-824 MHz and downlink bands of 769-775 / 851-869 MHz.
- 2.5. Power Source:** 120 VAC, 60 Hz
- 2.6. Software Version:** 0.1
- 2.7. EMC Modifications:** None

3. Product Configuration

3.1. Support Equipment

Device	Manufacturer	Model	Serial No.	Comment
Power Supply / Battery	Westell	CS45-BBU-004	24B4117659	Power and Battery Backup
Laptop / Notebook PC	Lenovo	P50	PC0MHJ8Y	For configuring the EUT

3.2. Cables

Cable Type	Length	Shield	From	To
RF, 50 Ω , N male – N male	1M	Yes	EUT	Signal Generator
RF, 50 Ω , N male – N male	1M	Yes	EUT	Spectrum Analyzer
Power Supply	2M + 2M	Yes	EUT	120 VAC, 60 Hz
Ethernet	2M	No	EUT	Notebook PC
Ethernet	2M	No	EUT	Remote Annunciator

Notebook PC is connected only during setup and configuration

3.3. Operational Characteristics & Software

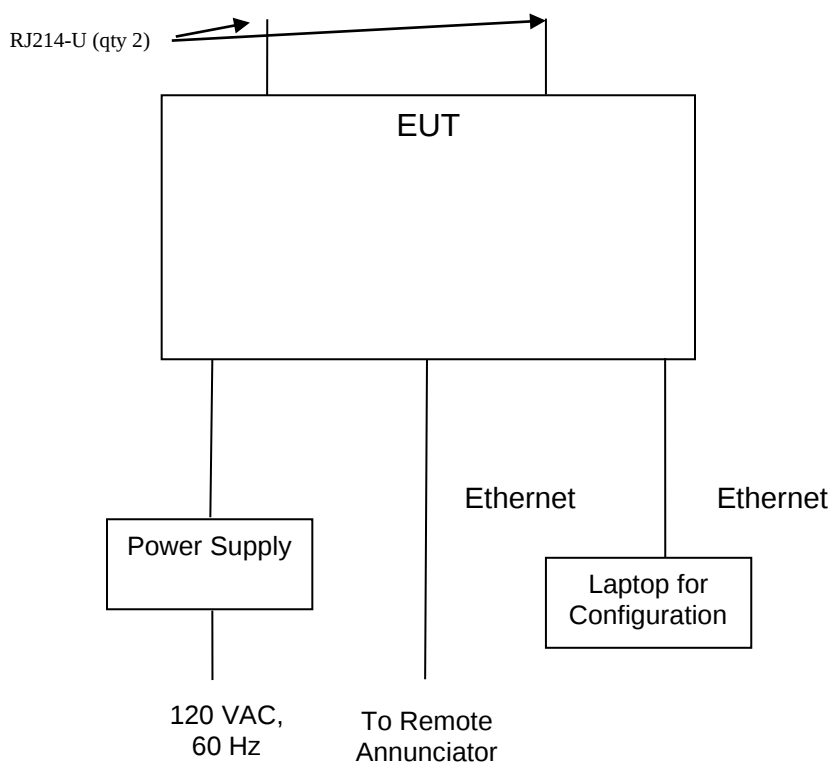
- (1) The unit was allowed to power up normally and go through its configuration cycle.
- (2) Using an RF Signal Generator on the Input and a Spectrum Analyzer on the output Downlink or Uplink frequencies a signal was generated over the intended bandwidth of operation.
- (3) The signal generator was configured to provide CW, 6.25, 12.5 and 25 kHz FM modulated, CPAO P25 Phase 1 and Phase 2 signals to the input of the amplifier across the public safety bands to be used by the product. Additionally, 12 Carriers of a P25 Phase 1 signal was used for the device's 150 kHz BW capability. Also, for the cellular band of operation GSM and AWGN type signals were used.
- (4) The units internal AGC threshold was determined by applying an input signal until a 1 dB increase in input signal did not cause a 1 dB in output signal for each of the Uplink and Downlink frequencies.

3. Product Configuration (continued)

3.3. Operational Characteristics & Software

Emission Designator	Modulation	Occupied Bandwidth	Channel Bandwidth	Audio Frequency
16K0F3E	FM	16.0 kHz	25 kHz	1 kHz
11K3F3E	FM	11.3 kHz	12.5 kHz	1 kHz
4K03F1E	FM	4.03 kHz	6.25 kHz	1 kHz
N/A	CW	N/A	N/A	N/A
8K20F1D	C4FM	8.20 kHz	12.5 kHz	N/A
9K84G1D	$\pi/4$ -DQPSK	9.84 kHz	12.5 kHz	N/A
300KG2W	GSM	265 kHz	300 kHz	N/A
5M00G2W	AWGN	4.14 MHz	5 MHz	N/A

3.4. Block Diagram



4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Test Receiver, 9kHz – 7GHz ¹	Rohde & Schwarz	ESR7	101156	10/16/2025	4 Years
EMI Test Receiver, 10 Hz - 7GHz ¹	Rohde & Schwarz	ESR7	101770	7/23/2025	1 Year
EMI Test Receiver, 9 kHz – 26.5 GHz ¹	Rohde & Schwarz	ESR26	101693	6/26/2025	2 Years
Spectrum Analyzer, 2 Hz to 26.5 GHz ²	Rohde & Schwarz	FSW26	102057	7/19/2026	2 Years
Spectrum Analyzer 20 Hz – 40 GHz ²	Rohde & Schwarz	FSV40	100899	6/27/2025	1 Year
Spectrum Analyzer, 9 kHz to 40 GHz ³	Rohde & Schwarz	FSVR40	100909	9/18/2025	4 Years
Biconilog Antenna, 30 MHz to 2 GHz	Sunol Sciences Corp	JB1	A050913	7/1/2025	4 Years
Dbl Ridged Guide Antenna 1- 18 GHz	ETS-Lindgren	3117	00143292	5/11/2025	3 Years
Dbl Ridged Guide Antenna 1- 18 GHz	ETS-Lindgren	3117	00227631	4/21/2026	4 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A01323	4/9/2026	2 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B H02	3008A00329	4/9/2026	2 Years
RF Signal Generator 5kHz to 6 GHz	Rohde & Schwarz	SMIQ06B	10090	7/23/2025	1 Year
Noise Source 10 MHz to 6 GHz	Micronetics	NS346B	17883	10/15/2025	1 Year
Barometric Pressure/Humidity & Temp Datalogger	Extech Instruments	SD700	Q590483	4/4/2026	2 Years

¹ ESR7/26 Firmware revision: V3.48 SP3, Date installed: 09/30/2020

Previous V3.48 SP2, installed 07/23/2020.

² FSW26 Firmware revision: V4.71 SP1, Date installed: 11/16/2020

Previous V4.61, installed 08/11/2020.

³ FSV40 Firmware revision: V2.30 SP4, Date installed: 05/04/2016

Previous V2.30 SP1, installed 10/22/2014.

⁴ FSVR40 Firmware revision: V2.23 SP1, Date installed: 08/19/2016

Previous V2.23, installed 10/22/2014.

4.2. Measurement & Equipment Setup

Test Dates: 3/11/2025, 3/12/2025, 3/13/2025, 3/28/2025,
3/31/2025, 5/1/2025, 5/15/2025

Test Engineers: Sean Defelice

Normal Site Temperature (15 – 35°C): 24

Relative Humidity (20 -75%RH): 33

4. Measurements Parameters (continued)

4.3. Test Procedure

The test measurements contained in this report are based on the requirements detailed in FCC Part 90 Subpart S and Part 20.

The test methods used to generate the data in this test report are in accordance with ANSI C63.26:2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services, FCC OET KDB 935210 D05 Indus Booster Basic Meas v01r04, dated 4-3-2020, FCC OET KDB 935210 D02 Signal Boosters Certification v04r03 Dated 11-20-2024, Measurements Guidance for Industrial and Non-Consumer Signal Booster, Repeater and Amplifier Devices, FCC OET KDB 971168 D01 Power Meas License Digital Systems v03r01, dated 4-9-2018 and ANSI/TIA-102.CAAA-D-2013, Digital C4FM/CQPSK Transceiver Measurement Methods.

Measurements were also made in accordance with ANSI/TIA-603-D 2010 Land Mobile FM or PM Communications Equipment Measurement and Performance Standard.

5. Measurement Summary

Section Description or Test Requirement	FCC Part 90 Reference	Test Report Section	Result	Comment
Limitations on power and antenna height	90.219(e)(1) 90.635	6.1	Compliant	
Occupied Bandwidth and Emission Mask	90.219(e)(4)(ii) Part 2.1049 90.210	6.2	Compliant	
Spurious Emissions at Antenna Terminals	90.219(e)(3) 90.543	6.3	Compliant	
Field Strength of Spurious Emissions	90.219(e)(3) 90.543	6.4	Compliant	
Frequency Stability	90.213	6.5	N/A	The EUT does not translate the frequency of the input signal
Out of Band Rejection	N/A	6.6	Compliant	
Noise Figure	90.219(e)(2)	6.7	Compliant	
Public Exposure to Radio Frequency Energy Levels	Section 1.1307 (b)(1)	6.8	Compliant	

6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635

Requirement: The transmitter output power of mobile and control transmitters operating in the 806 to 824 MHz, 851 to 869 MHz, 896 to 901 MHz and 935 to 940 MHz bands must not exceed 1 kilowatt (30 dBw) and 304 meters (1,000 ft) above average terrain.

The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

Measurement of AGC Threshold

Test Method: KDB 935210 Section 4.2 & KDB 971168 Section 5.2

6.1.1. Mean Transmitter Output Power, Transmitter Only

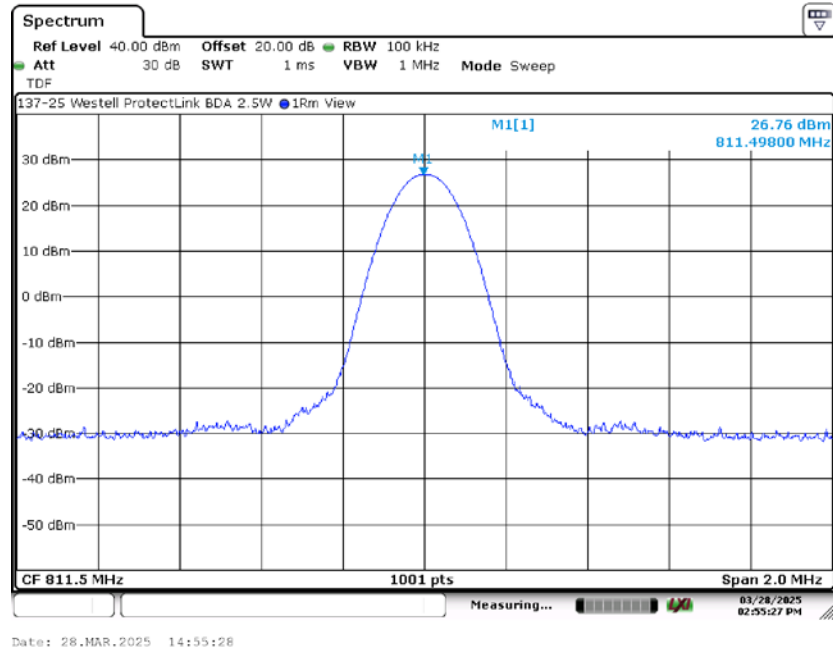
Modulation Type	Center Frequency	Output Power		Input Power (dBm)	Result
	(MHz)	(dBm)	(Watts)		
FM Modulation	811.5	26.76	0.474	-52.55	Compliant
CW	811.5	26.75	0.473	-52.56	Compliant
C4FM Modulation	811.5	26.76	0.474	-52.55	Compliant
$\pi/4$ -DQPSK Modulation	811.5	27.61	0.577	-51.87	Compliant
GSM	820.0	27.14	0.518	-49.27	Compliant
AWGN	820.0	27.25	0.531	-49.09	Compliant
FM Modulation	856.6	34.07	2.553	-57.87	Compliant
CW	856.6	34.04	2.535	-57.86	Compliant
C4FM Modulation	856.6	34.05	2.541	-57.93	Compliant
$\pi/4$ -DQPSK Modulation	856.6	34.00	2.512	-57.99	Compliant
GSM	865.0	33.76	2.377	-55.68	Compliant
AWGN	865.0	33.73	2.360	-57.64	Compliant

Note: Input Power is at the 1 dB AGC threshold Level

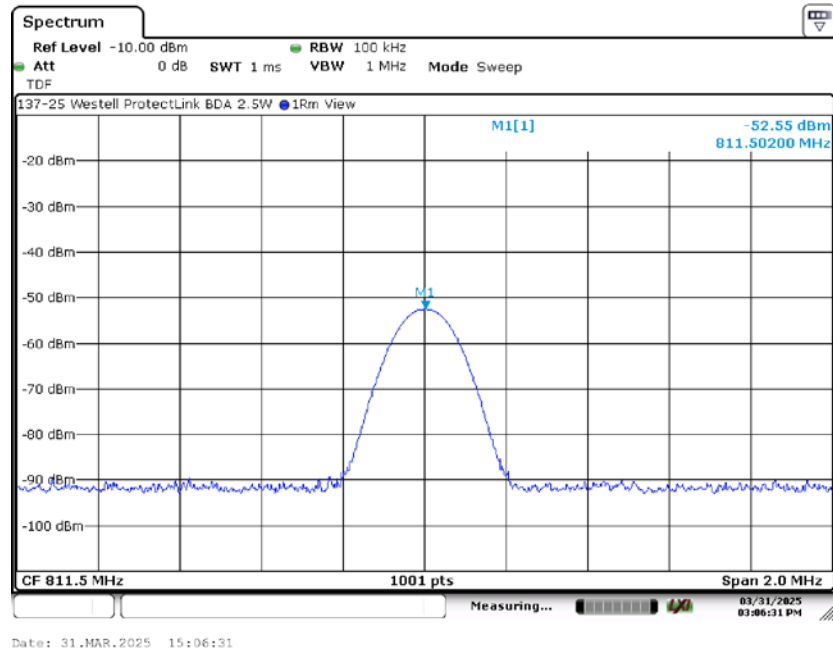
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.2. Mean Transmitter Output Power, 811.5 MHz, FM Modulation



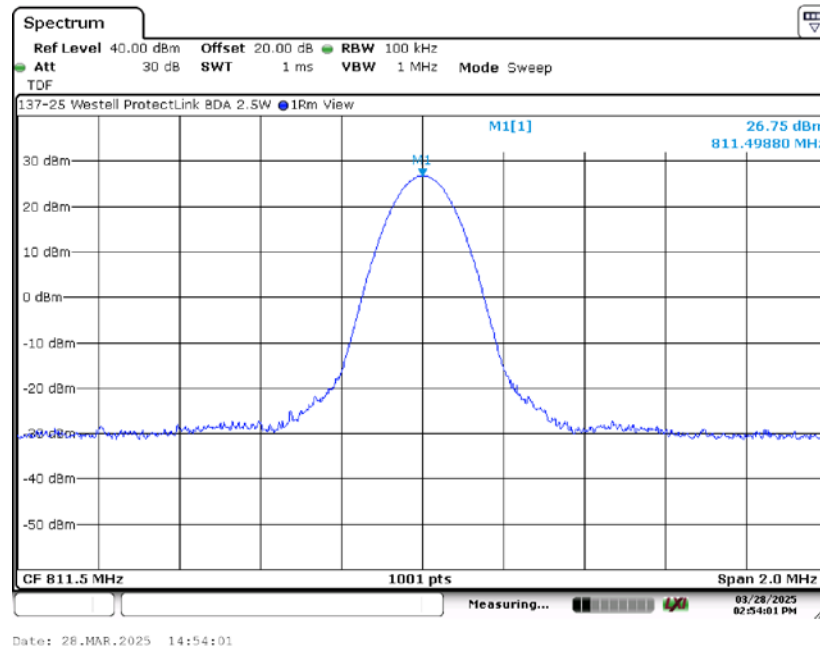
6.1.3. Mean Transmitter Input Power, 811.5 MHz, FM Modulation



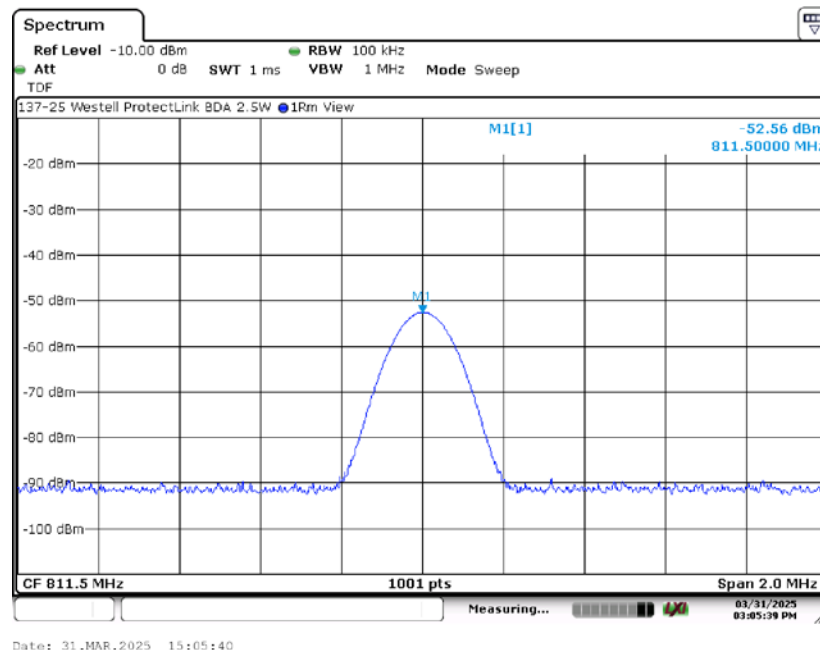
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.4. Mean Transmitter Output Power, 811.5 MHz, CW Signal



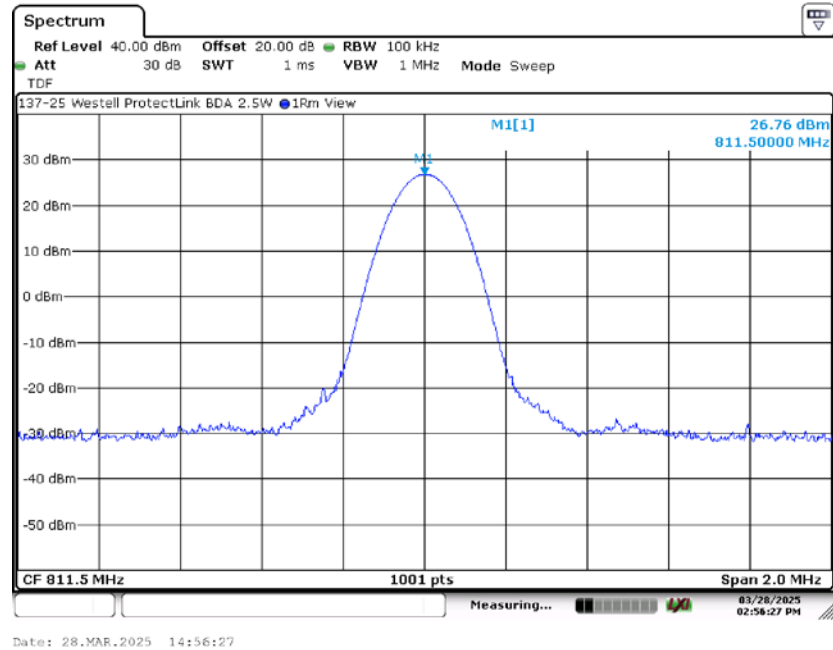
6.1.5. Mean Transmitter Input Power, 811.5 MHz, CW Signal



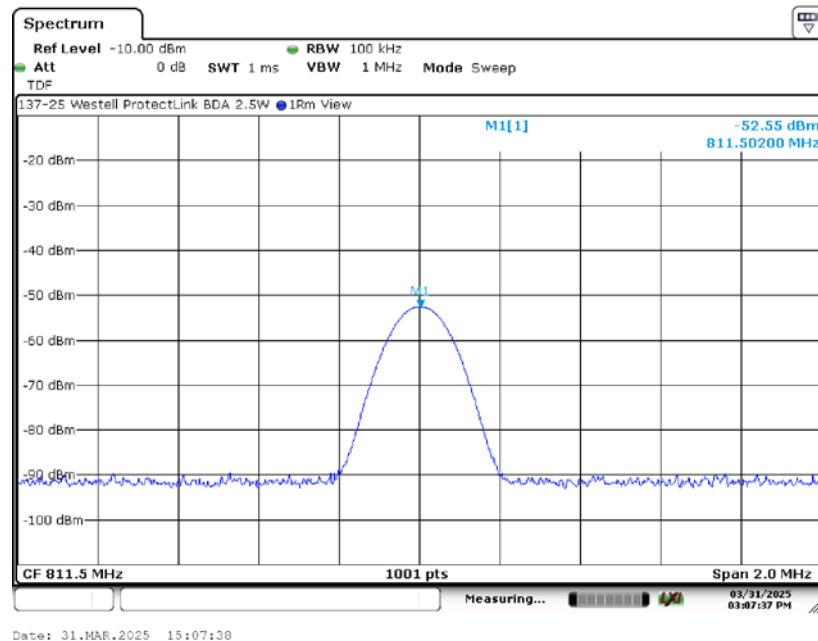
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.6. Mean Transmitter Output Power, 811.5 MHz, C4FM Modulation



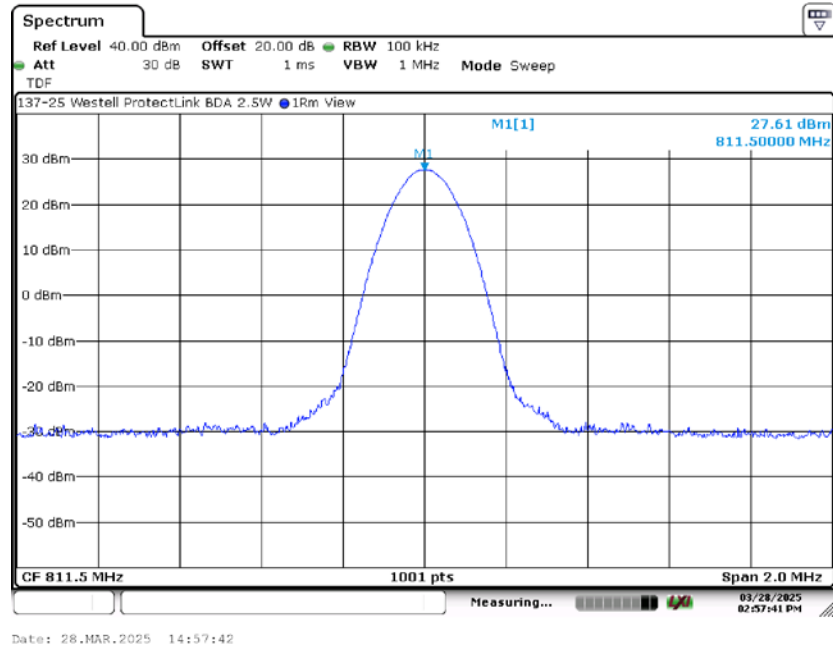
6.1.7. Mean Transmitter Input Power, 811.5 MHz, C4FM Modulation



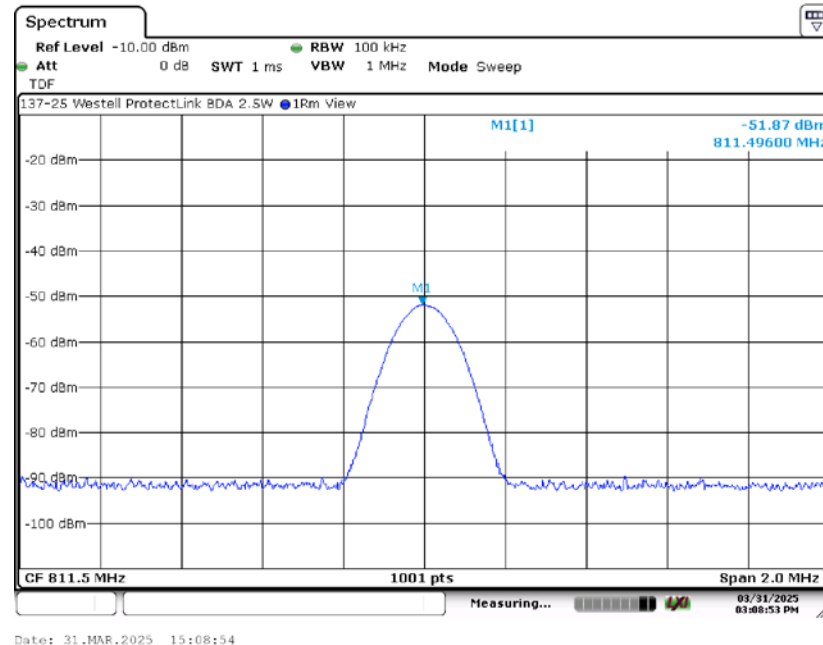
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.8. Mean Transmitter Output Power, 811.5 MHz, $\pi/4$ -DQPSK Modulation



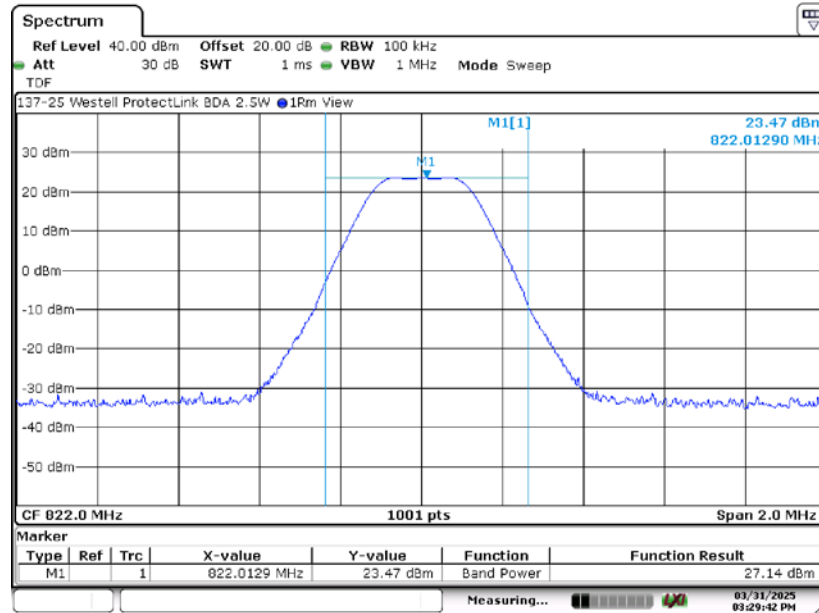
6.1.9. Mean Transmitter Input Power, 811.5 MHz, $\pi/4$ -DQPSK Modulation



6. Measurement Data

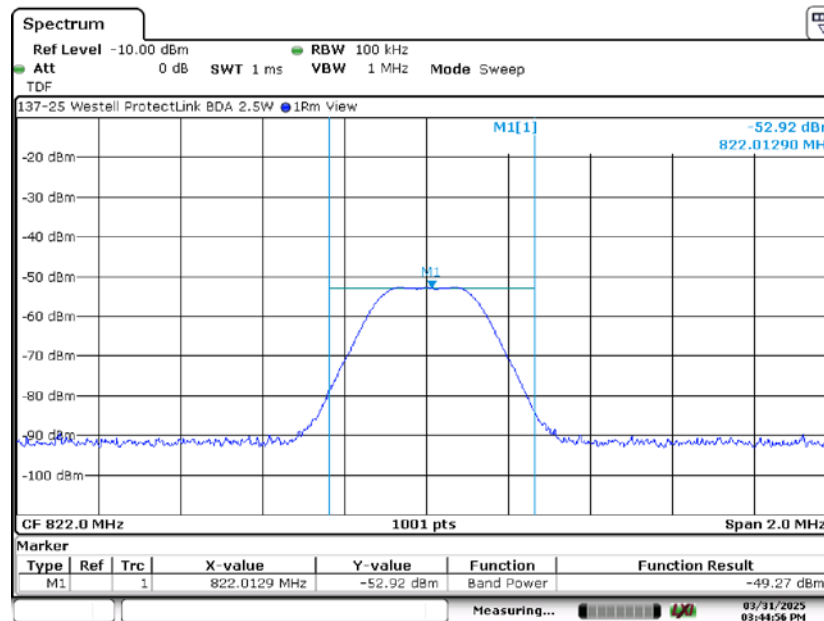
6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.10. Mean Transmitter Output Power, 820.0 MHz, GSM Modulation



Date: 31.MAR.2025 15:29:43

6.1.11. Mean Transmitter Input Power, 820.0 MHz, GSM Modulation

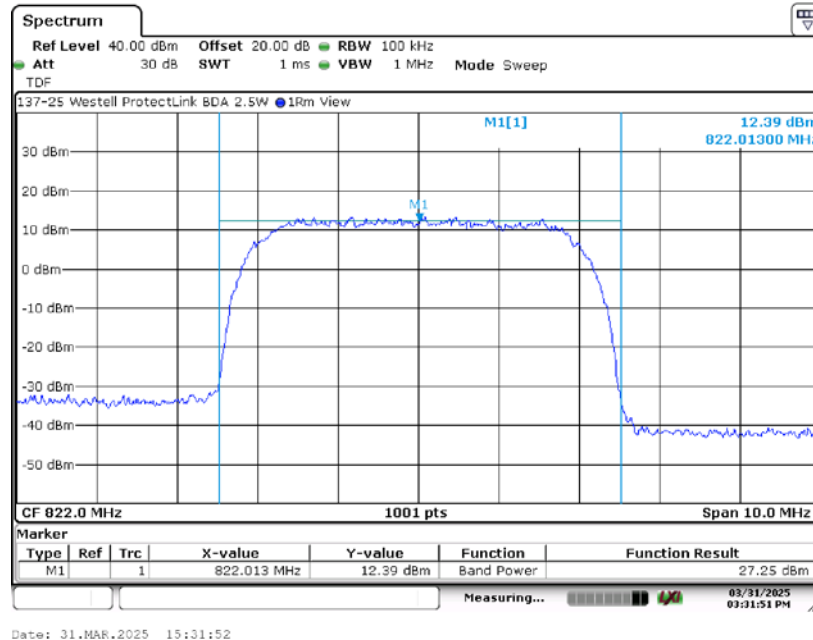


Date: 31.MAR.2025 15:44:57

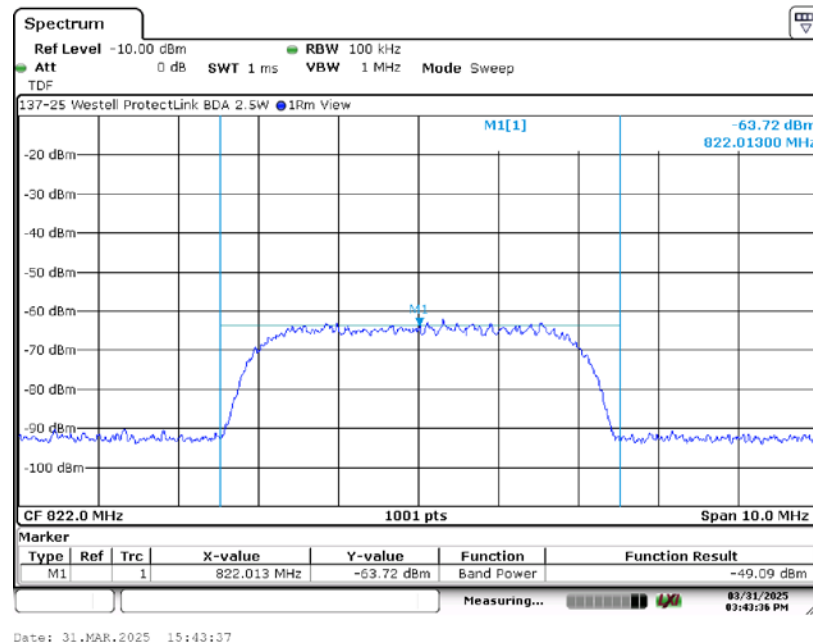
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.12. Mean Transmitter Output Power, 820.0 MHz, AWGN Modulation



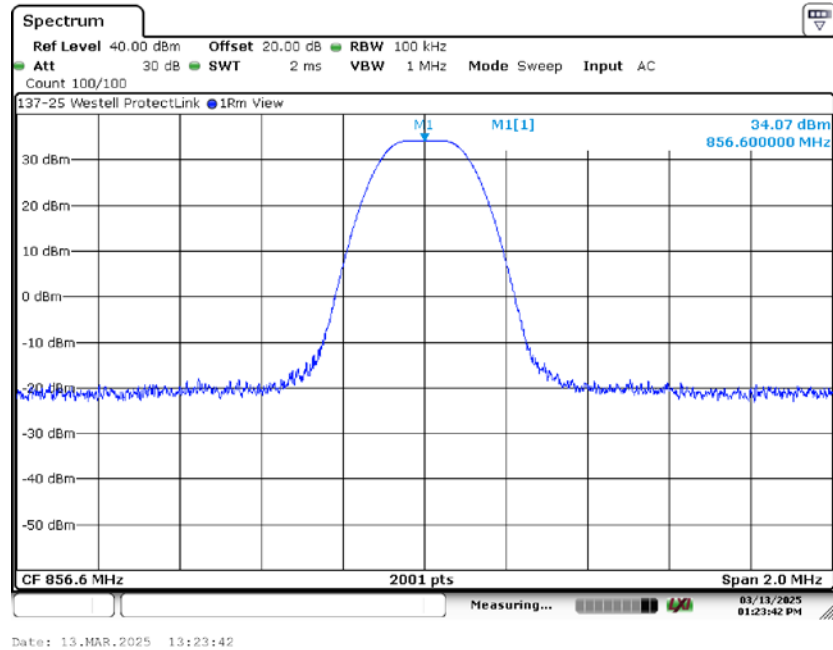
6.1.13. Mean Transmitter Input Power, 820.0 MHz, AWGN Modulation



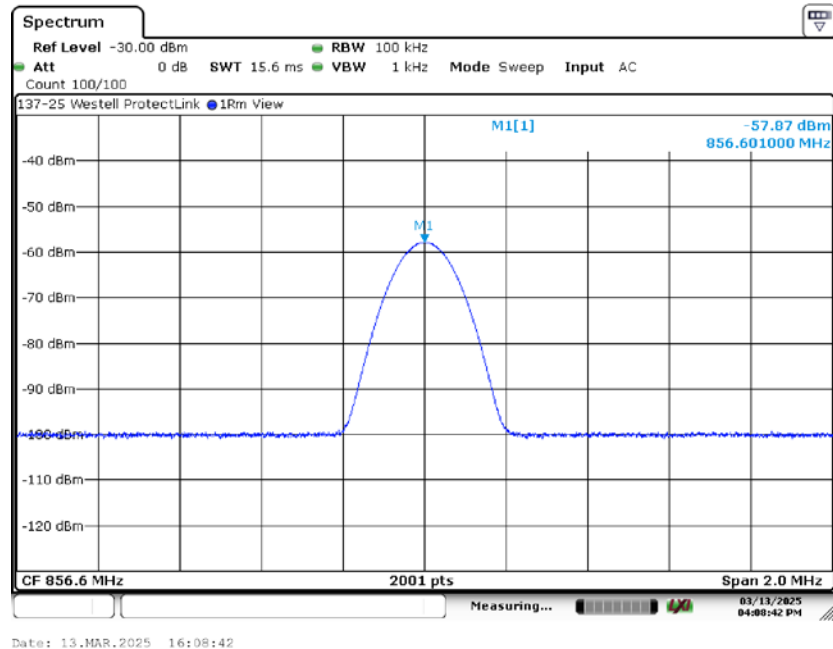
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.14. Mean Transmitter Output Power, 856.6 MHz, FM Modulation



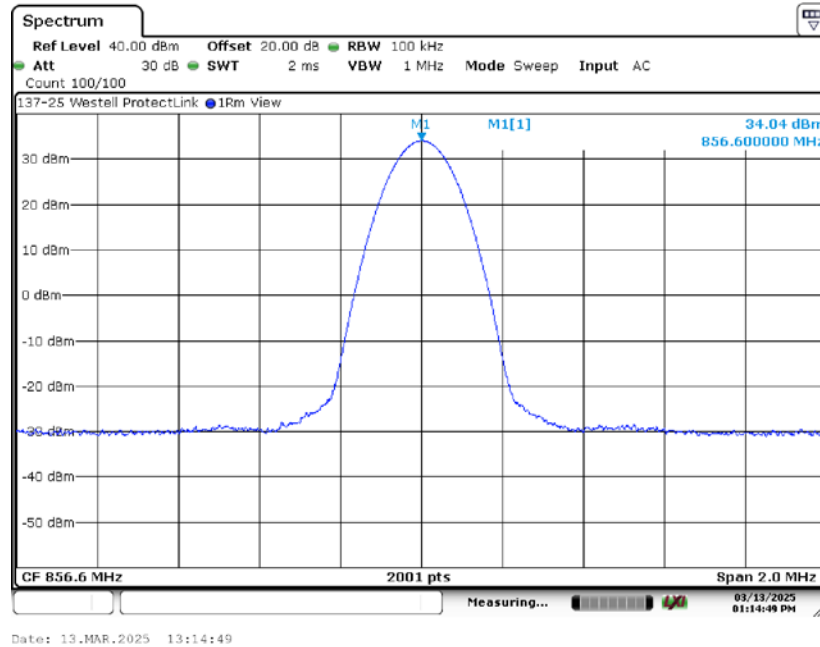
6.1.15. Mean Transmitter Input Power, 856.6 MHz, FM Modulation



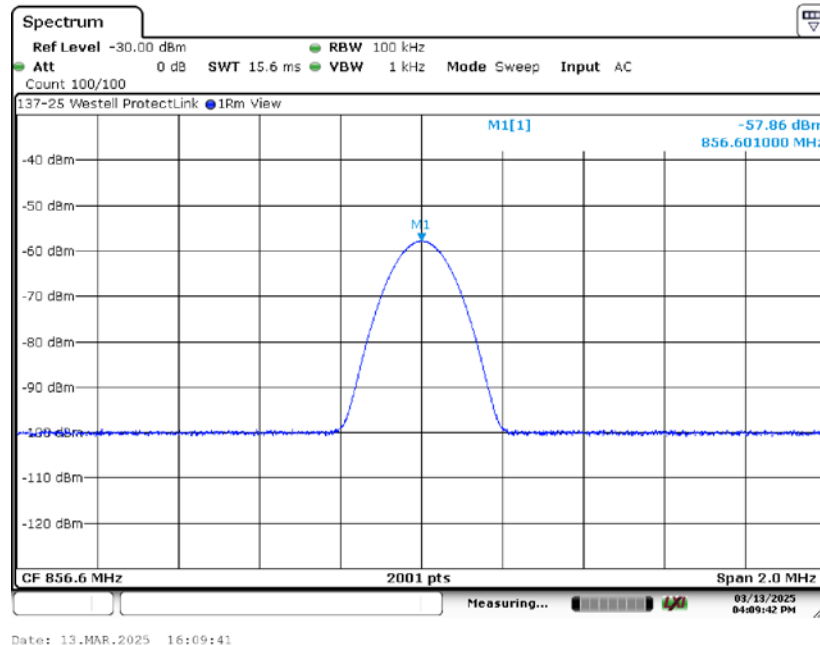
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.16. Mean Transmitter Output Power, 856.6 MHz, CW Signal



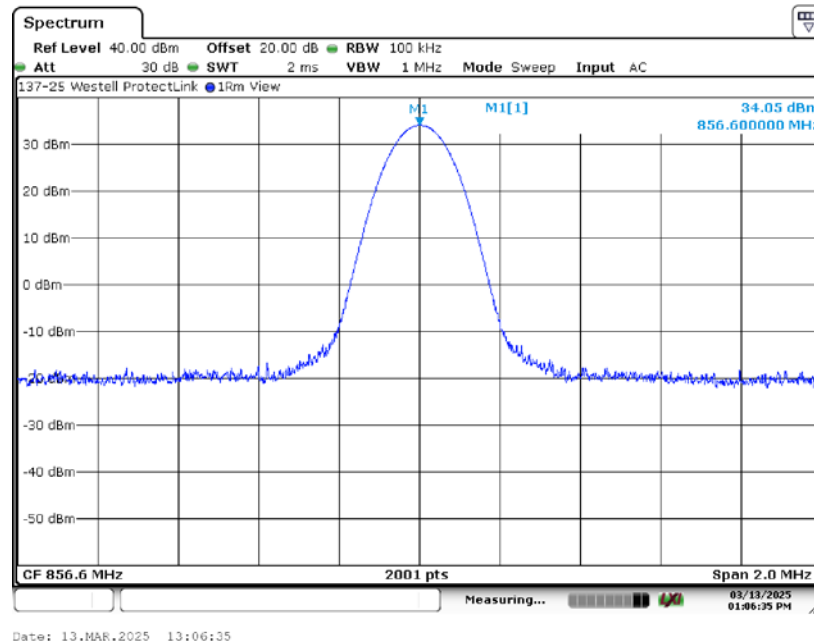
6.1.17. Mean Transmitter Input Power, 856.6 MHz, CW Signal



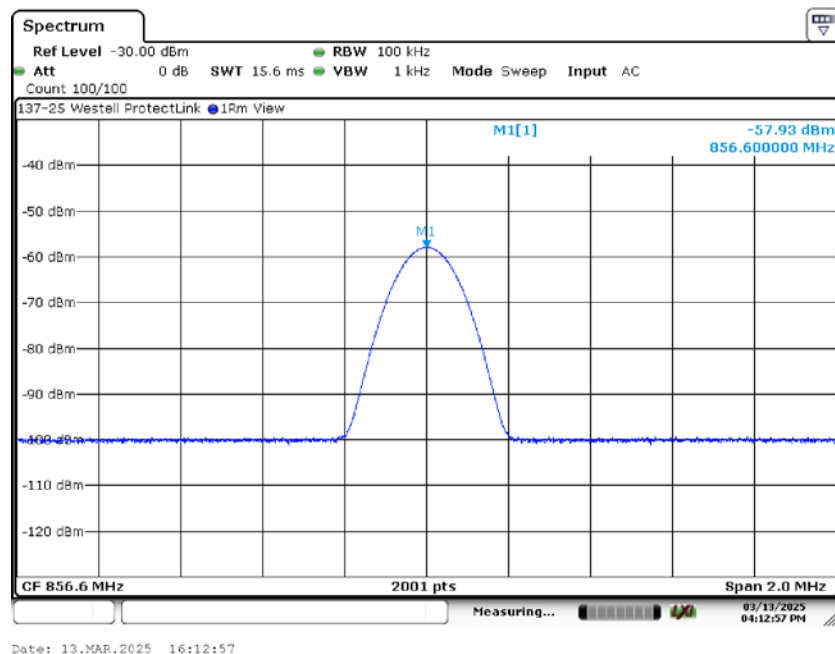
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.18. Mean Transmitter Output Power, 856.6 MHz, C4FM Modulation



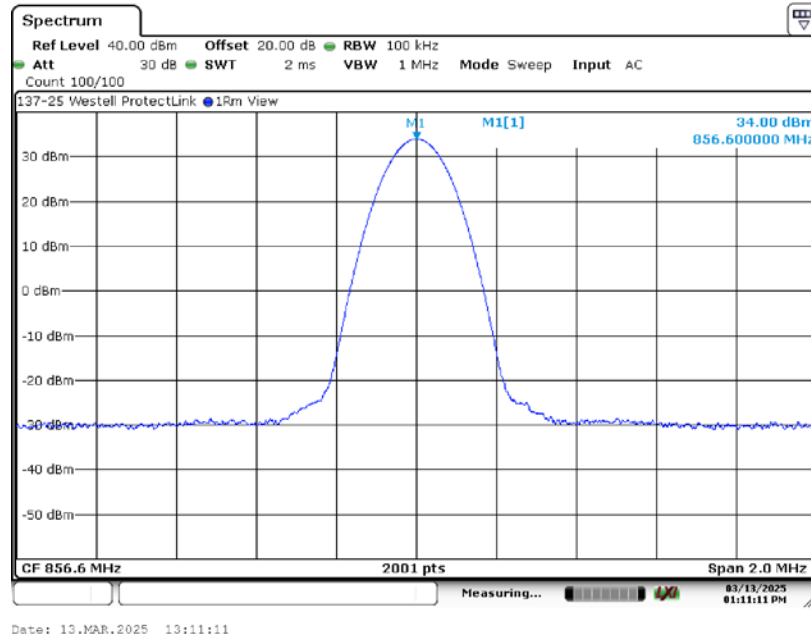
6.1.19. Mean Transmitter Input Power, 856.6 MHz, C4FM Modulation



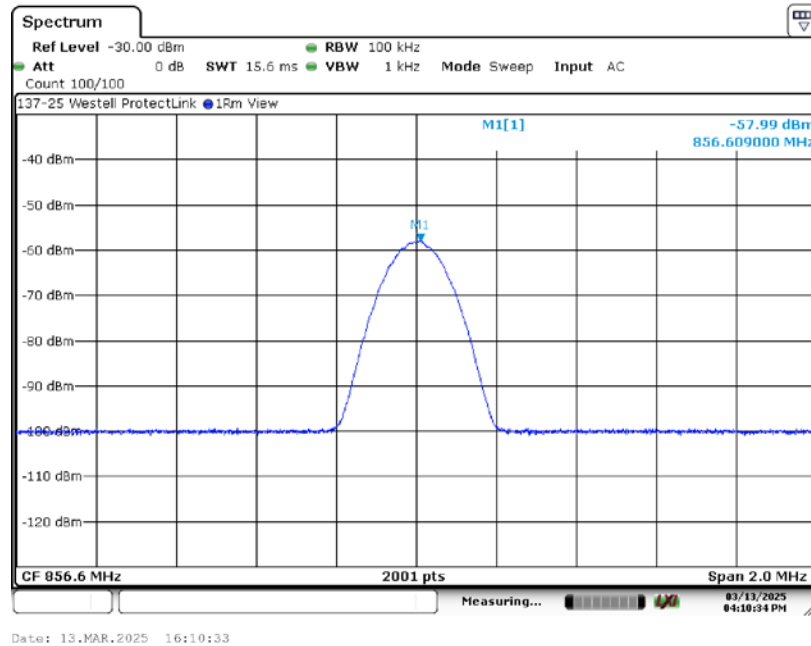
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.20. Mean Transmitter Output Power, 856.6 MHz, $\pi/4$ -DQPSK Modulation



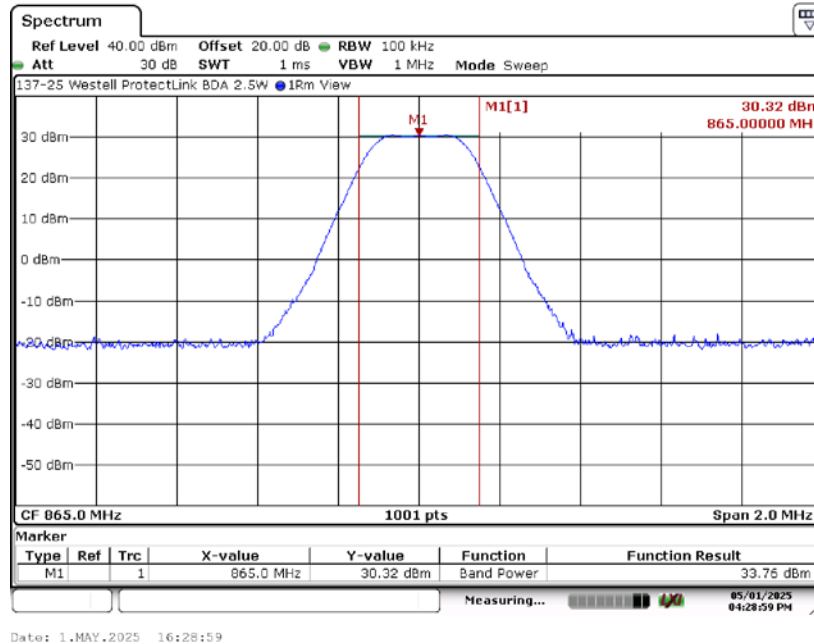
6.1.21. Mean Transmitter Input Power, 856.6 MHz, $\pi/4$ -DQPSK Modulation



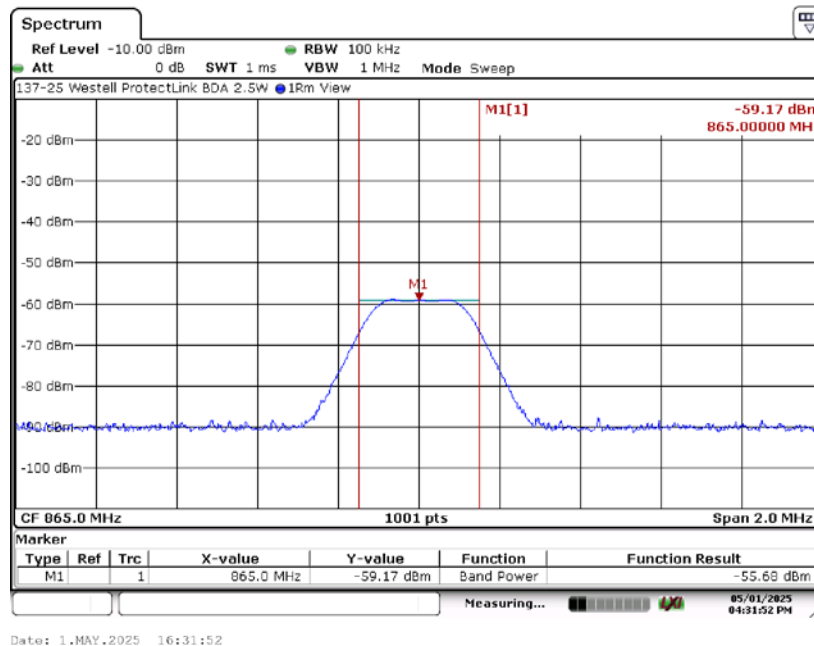
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.22. Mean Transmitter Output Power, 865.0 MHz, GSM Modulation



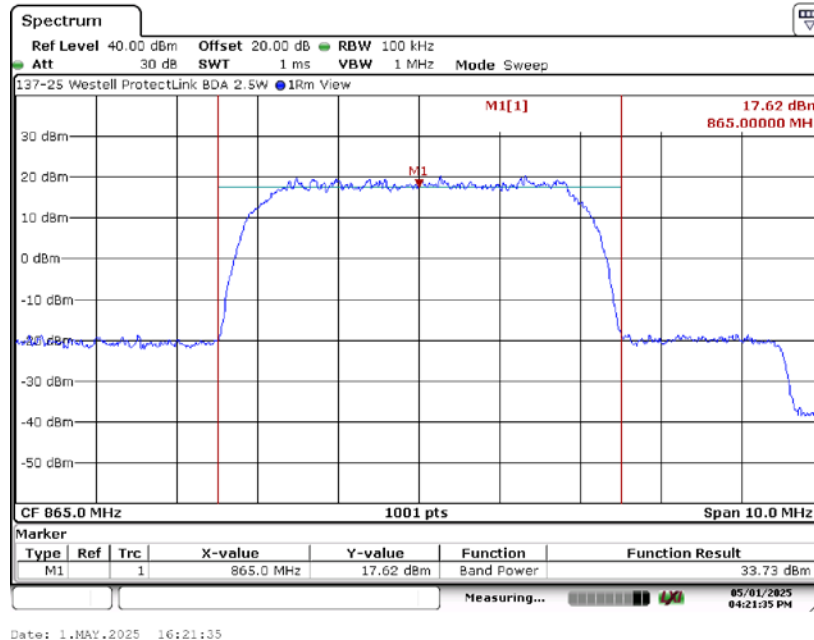
6.1.23. Mean Transmitter Input Power, 865.0 MHz, GSM Modulation



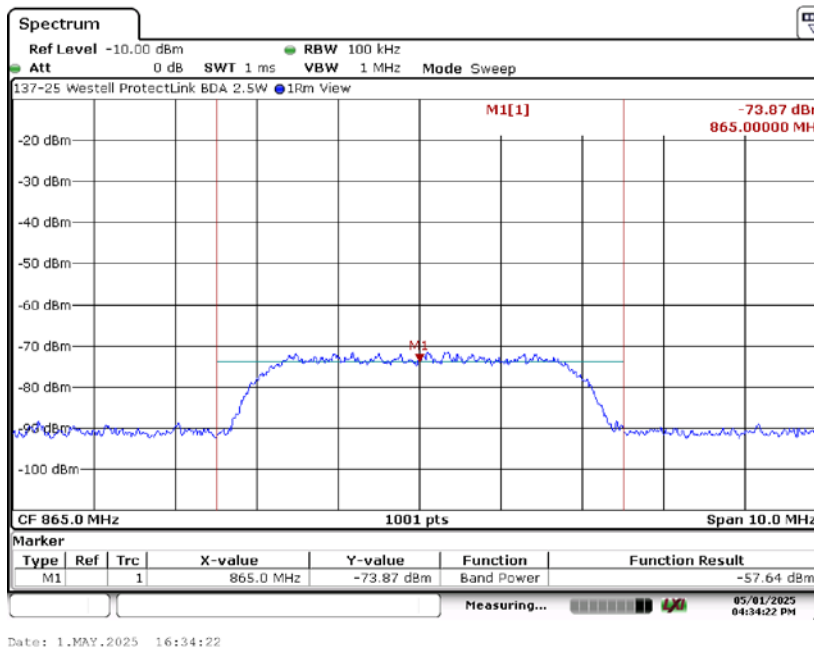
6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (cont)

6.1.24. Mean Transmitter Output Power, 865.0 MHz, AWGN Modulation



6.1.25. Mean Transmitter Input Power, 865.0 MHz, AWGN Modulation



6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (continued)

6.1.2. Maximum ERP

ERP is defined in FCC Title 47, Chapter I, Part 2, Subpart A, Section 2.1 as "Effective Radiated Power. The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction."

$$\text{ERP} = \text{Transmitter Power (dBm)} - \text{Cable Loss (dB)} + \text{Antenna Gain (dBi)} - 2.15$$

The manufacturer of the device under test recommends one antenna and cable combination for use with their product. The following table provides the worst case effective radiated power based on the measured transmitter output power and the antenna gain:

Modulation Type	Center Frequency	Transmitter Power ¹	Cable Insertion Loss ²	Antenna Gain ²	EIRP to ERP conversion ³	Total Output Power (ERP)	
	MHz	dBm	dB	dBi	dB	dBm	Watts
FM Modulation	811.5	26.76	0.10	3.00	-2.15	27.51	0.56
CW	811.5	26.75	0.10	3.00	-2.15	27.50	0.56
C4FM Modulation	811.5	26.76	0.10	3.00	-2.15	27.51	0.56
$\pi/4$ -DQPSK Modulation	811.5	27.61	0.10	3.00	-2.15	28.36	0.69
GSM	820.0	27.14	0.10	3.00	-2.15	27.89	0.62
AWGN	820.0	27.25	0.10	3.00	-2.15	28.00	0.63
FM Modulation	856.6	34.07	0.10	3.00	-2.15	34.82	3.03
CW	856.6	34.04	0.10	3.00	-2.15	34.79	3.01
C4FM Modulation	856.6	34.05	0.10	3.00	-2.15	34.80	3.02
$\pi/4$ -DQPSK Modulation	856.6	34.00	0.10	3.00	-2.15	34.75	2.99
GSM	865.0	33.76	0.10	3.00	-2.15	34.51	2.82
AWGN	865.0	33.73	0.10	3.00	-2.15	34.48	2.81

¹ Measured. See section 6.1.1.

² Customer supplied 3 dBi antenna gain, minimum cable loss.

³ FCC KDB 412172 D01 Determining ERP and EIRP v01r01, dated 8-7-2015.

6. Measurement Data

6.1. Limitations on power and antenna height 90.219(e)(1), 90.635 (continued)

6.1.3. Booster gain – UL 80 dB, DL 90 dB Nominal

Modulation Type	Frequency	Output Power	Input Power	Gain (dB)
	(MHz)	(dBm)	(dBm)	
FM Modulation	811.5	26.76	-52.55	79.31
CW	811.5	26.75	-52.56	79.31
C4FM Modulation	811.5	26.76	-52.55	79.31
$\pi/4$ -DQPSK Modulation	811.5	27.61	-51.87	79.48
GSM	820.0	27.14	-49.27	76.41
AWGN	820.0	27.25	-49.09	76.34
FM Modulation	856.6	34.07	-57.87	91.94
CW	856.6	34.04	-57.86	91.90
C4FM Modulation	856.6	34.05	-57.93	91.98
$\pi/4$ -DQPSK Modulation	856.6	34.00	-57.99	91.99
GSM	865.0	33.76	-55.68	89.44
AWGN	865.0	33.73	-57.64	91.37

6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 and Emission Mask 90.210

Requirement: Each authorization issued to a station licensed under this part will show an emission designator representing the class of emission authorized. The designator will be prefixed by a specified necessary bandwidth. This number does not necessarily indicate the bandwidth occupied by the emission at any instant.

There is no significant change in the occupied bandwidth of the retransmitted signal.

Emission Mask shall also be met for each modulation type. Emission Mask H is used for the 806 to 809 MHz and 851 to 854 MHz bands and Emission Mask G is used for the 809 to 824 MHz and 854 to 869 MHz Bands per the table in section 90.210.

FM modulation at 16 kHz was used as worst case against emission Mask G at AGC threshold and 3 dB above AGC threshold as the other modulations are narrower.

C4FM Modulation was used against Emissions Mask H at AGC threshold and 3 dB above AGC threshold.

Test Method: KDB 935210 Section 4.4

6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 and Emission Mask 90.210

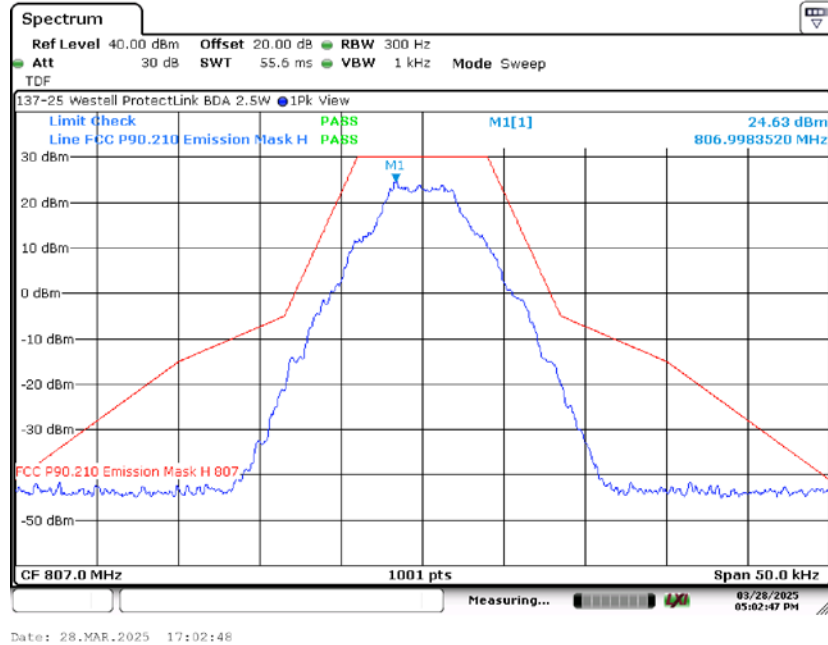
6.2.1. Occupied (99% Power) Bandwidth

Modulation Type	Frequency	Output Occupied Bandwidth	Input Occupied Bandwidth	Difference	Result
	MHz	kHz	kHz	kHz	
FM 16K0F3E	811.5	16.034	16.034	0.000	Compliant
FM 11K3F3E	811.5	11.329	11.329	0.000	Compliant
FM 4K03F1E	811.5	4.031	4.031	0.000	Compliant
C4FM	811.5	8.212	8.122	0.090	Compliant
$\pi/4$ -DQPSK	811.5	9.800	9.710	0.090	Compliant
C4FM - 12 Carrier	811.5	144.655	144.456	0.199	Compliant
GSM	820.0	245.754	245.754	0.000	Compliant
AWGN	820.0	4135.864	4205.794	-69.930	Compliant
FM 16K0F3E	856.6	16.017	16.017	0.000	Compliant
FM 11K3F3E	856.6	11.319	11.319	0.000	Compliant
FM 4K03F1E	856.6	4.033	4.033	0.000	Compliant
C4FM	856.6	8.096	8.036	0.060	Compliant
$\pi/4$ -DQPSK	856.6	9.835	9.790	0.045	Compliant
C4FM - 12 Carrier	856.6	144.456	144.655	-0.199	Compliant
GSM	865.0	247.752	250.749	-2.997	Compliant
AWGN	865.0	4175.824	4195.804	-19.980	Compliant

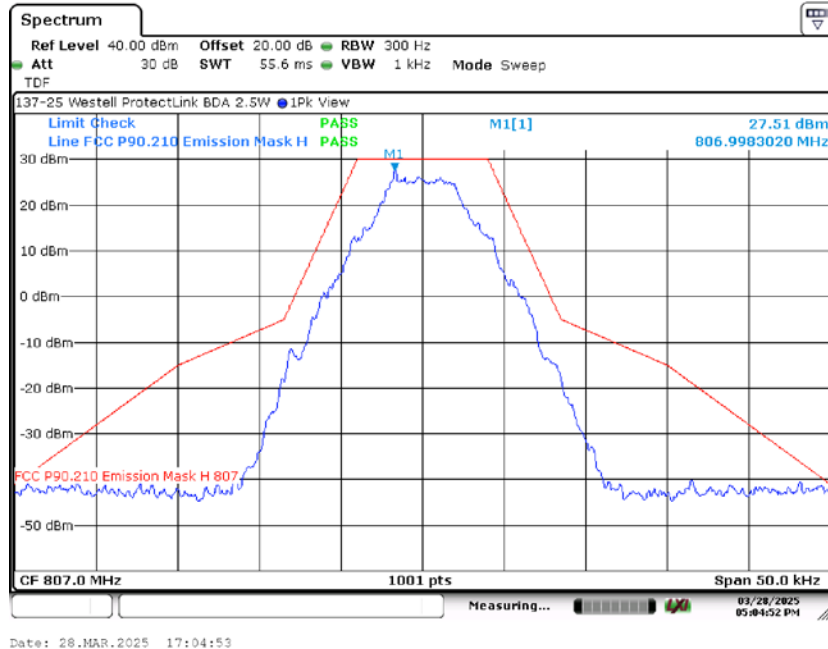
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.1. Occupied (99% Power) Emissions Mask H, 807.0 MHz, C4FM



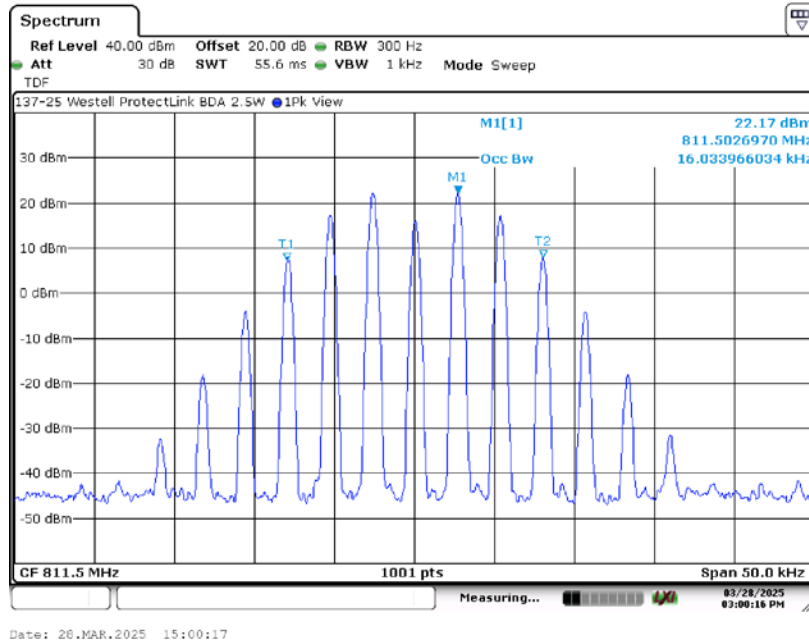
6.2.1.2. Occupied (99% Power) Emissions Mask H plus 3dB, 807.0 MHz, C4FM



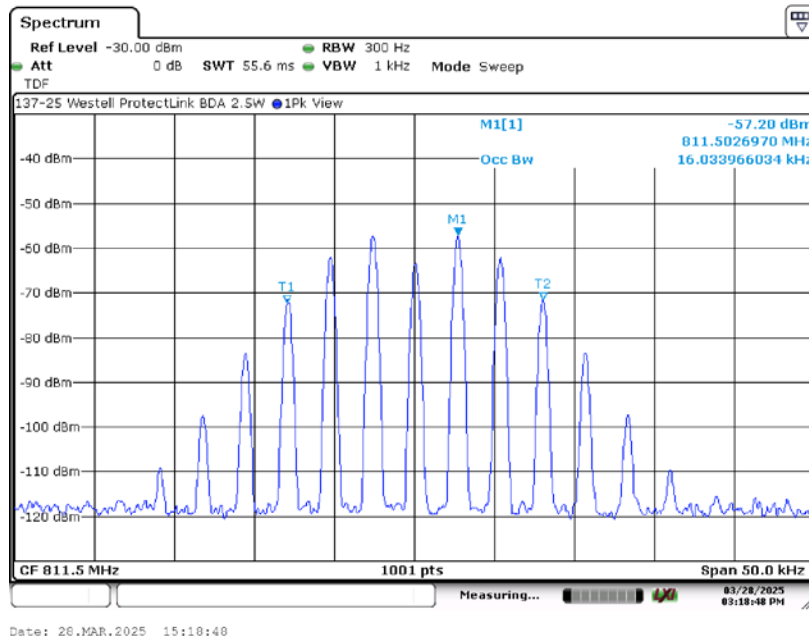
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.3. Occupied (99% Power) Bandwidth Measurement, 811.5 MHz, 16k FM



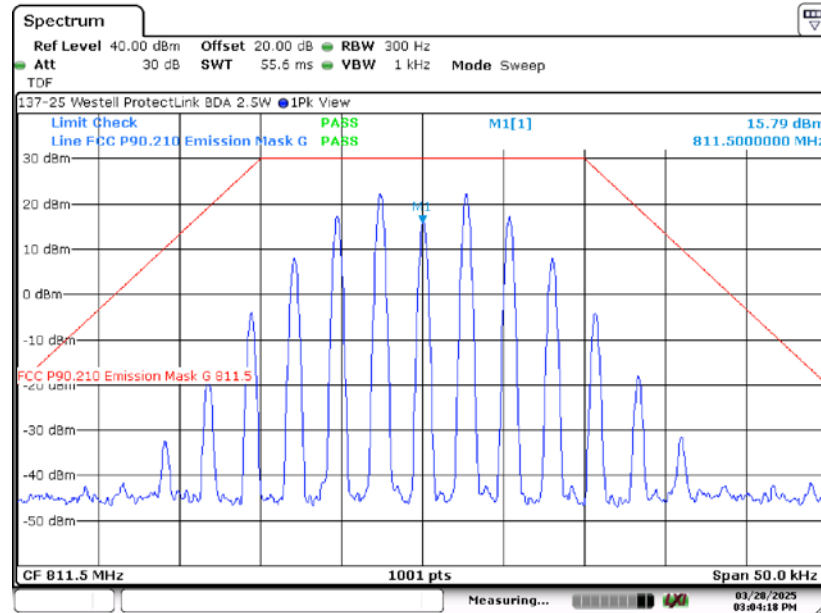
6.2.1.4. Occupied (99% Power) Bandwidth Input, 811.5 MHz, 16k FM



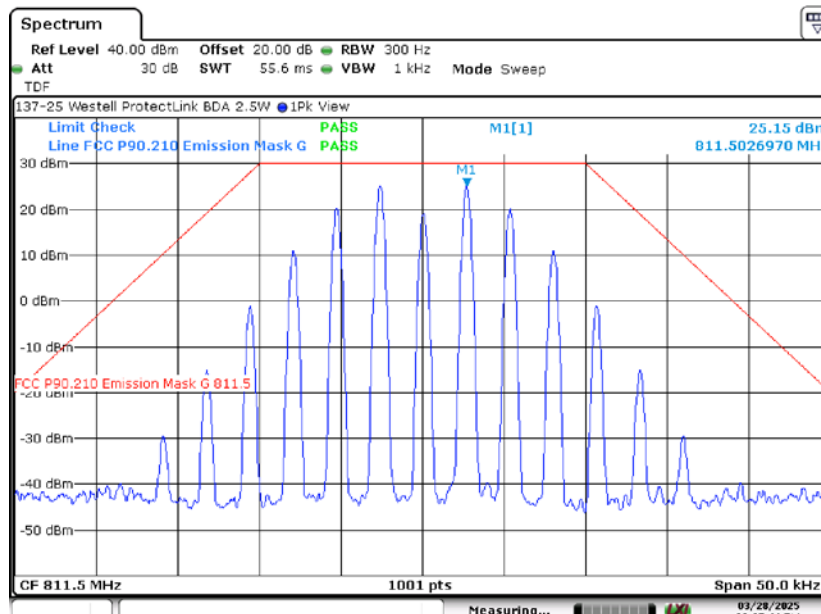
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.5. Occupied (99% Power) Emissions Mask G, 811.5 MHz, 16k FM



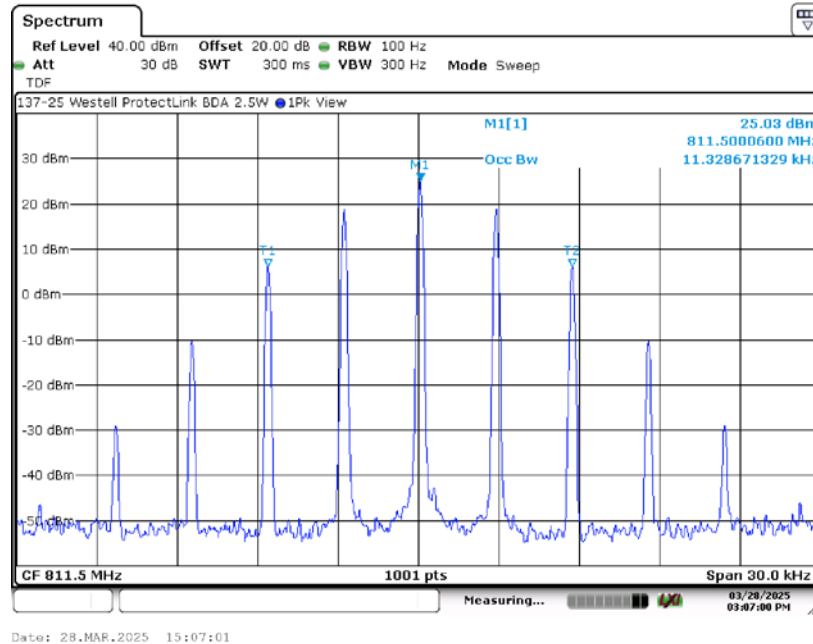
6.2.1.6. Occupied (99% Power) Emissions Mask G plus 3 dB, 811.5 MHz, 16k FM



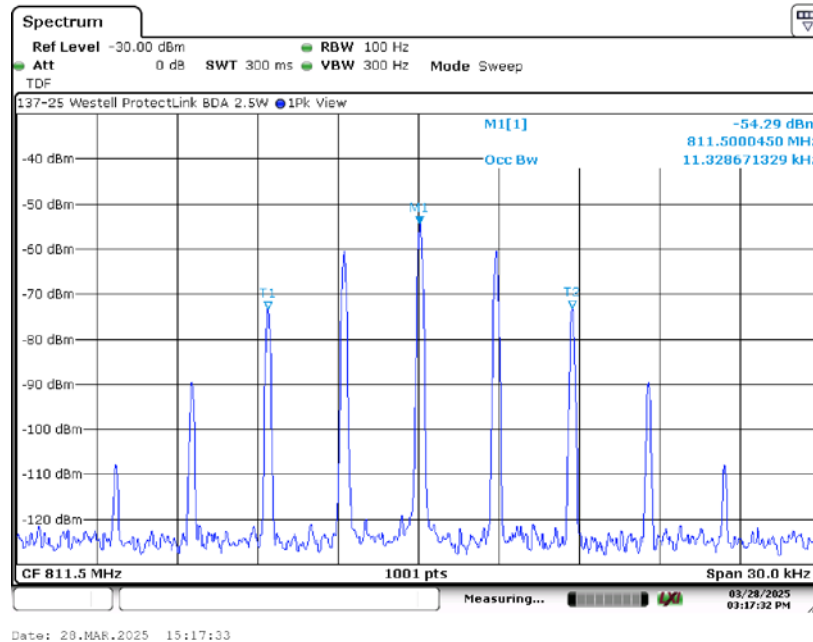
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.7. Occupied (99% Power) Bandwidth Measurement, 811.5 MHz, 11k FM



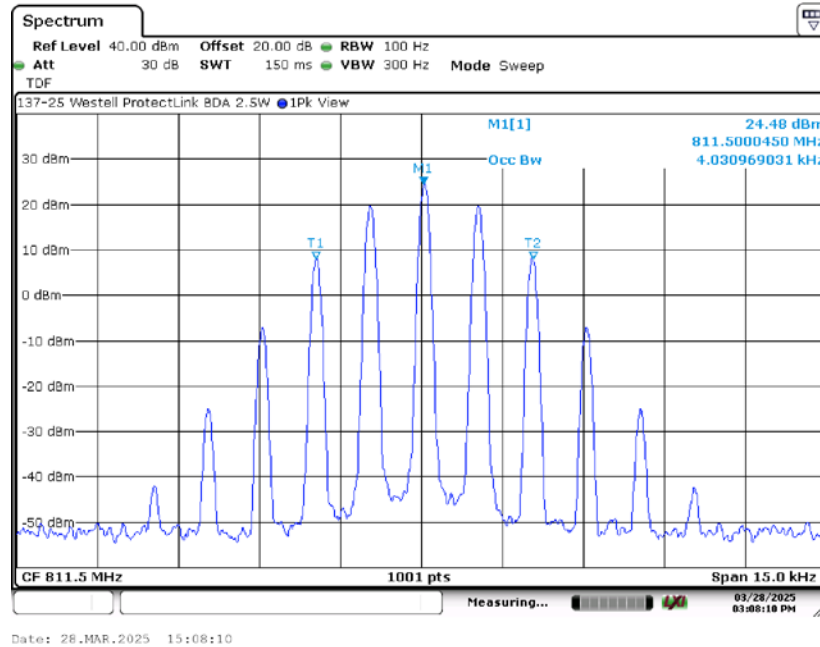
6.2.1.8. Occupied (99% Power) Bandwidth Input, 811.5 MHz, 11k FM



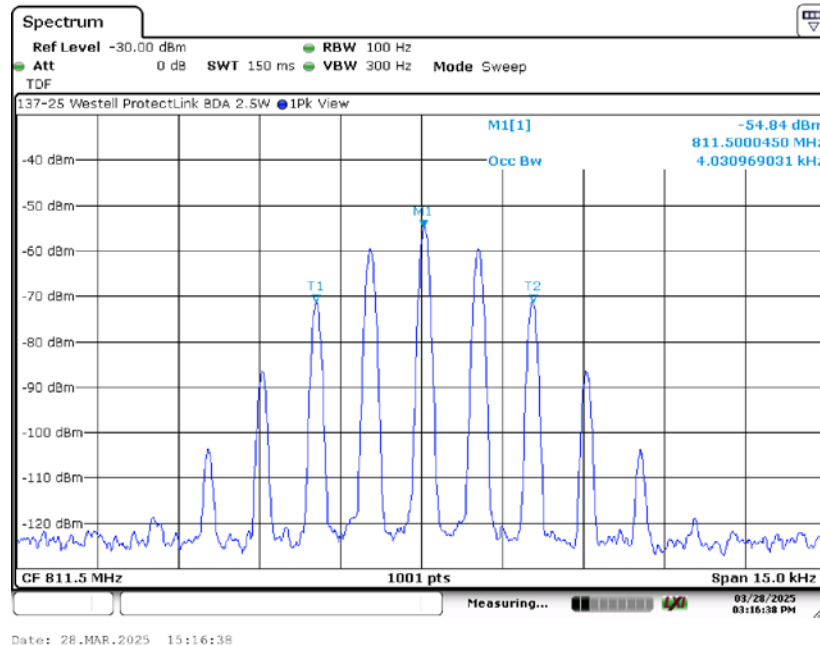
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.9. Occupied (99% Power) Bandwidth Measurement, 811.5 MHz, 4k FM



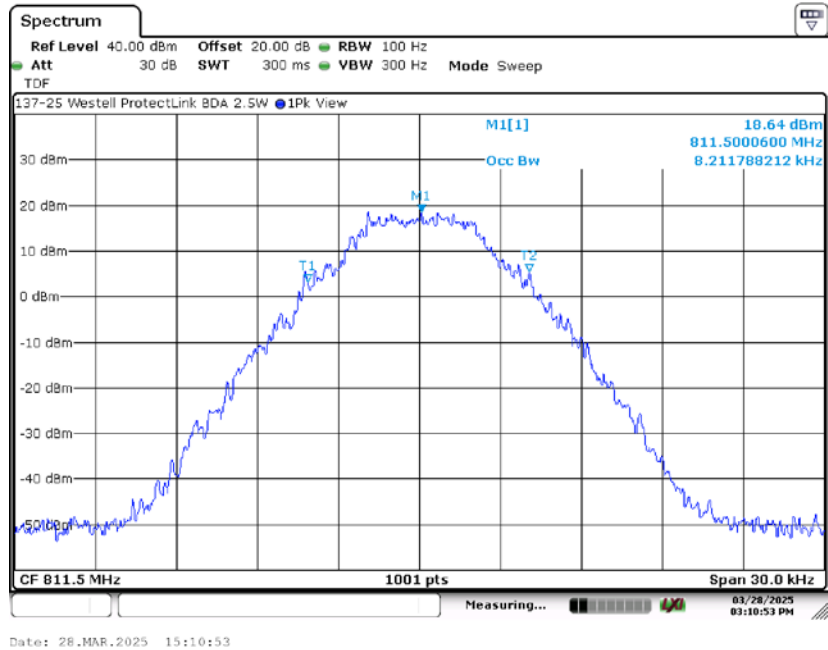
6.2.1.10. Occupied (99% Power) Bandwidth Input, 811.5 MHz, 4k FM



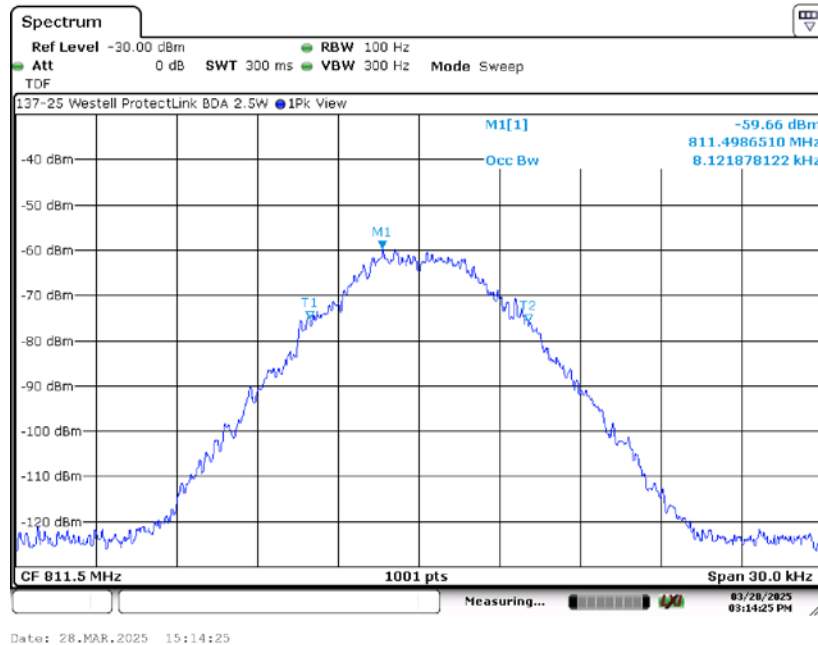
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.11. Occupied (99% Power) Bandwidth Measurement, 811.5 MHz, C4FM



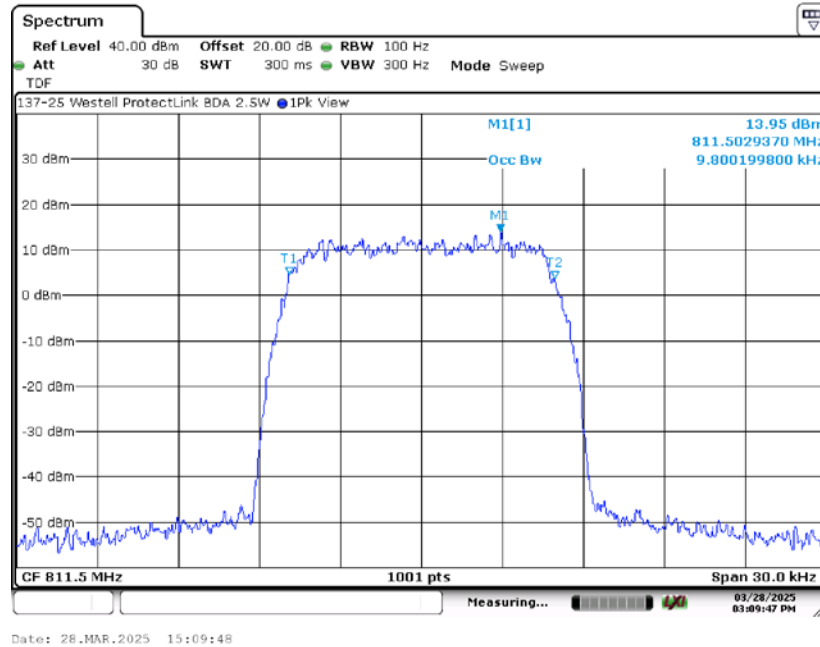
6.2.1.12. Occupied (99% Power) Bandwidth Input, 811.5 MHz, C4FM



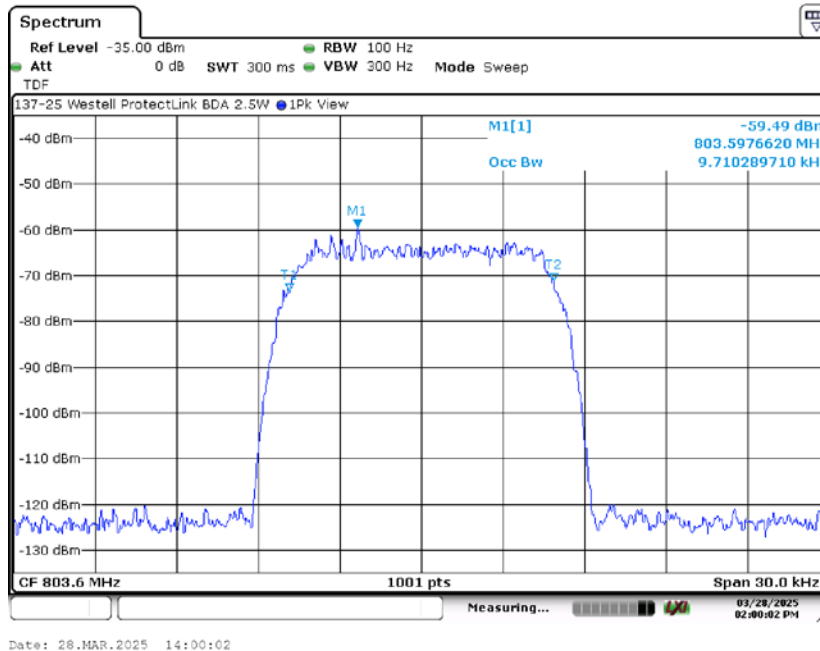
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.13. Occupied (99% Power) Bandwidth Measurement, 811.5 MHz, $\pi/4$ -DQPSK



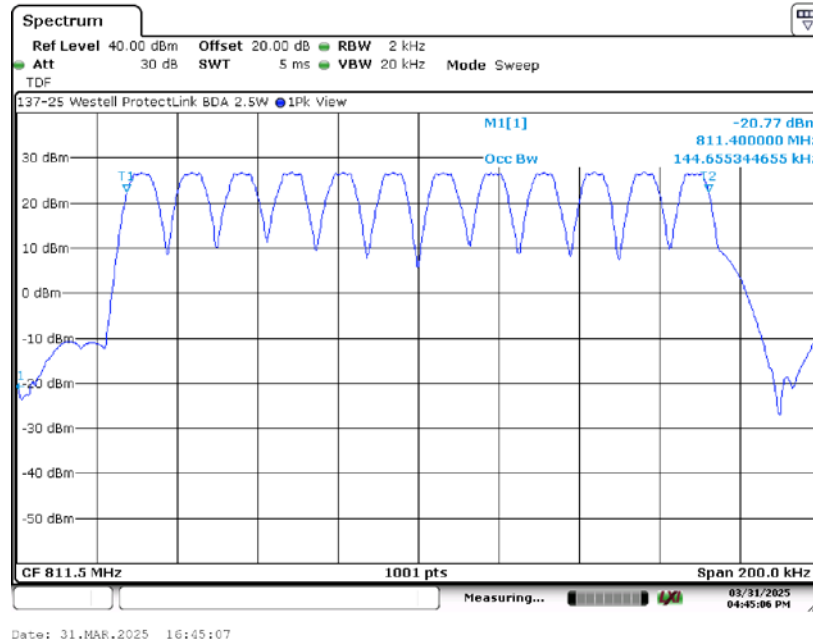
6.2.1.14. Occupied (99% Power) Bandwidth Input, 811.5 MHz, $\pi/4$ -DQPSK



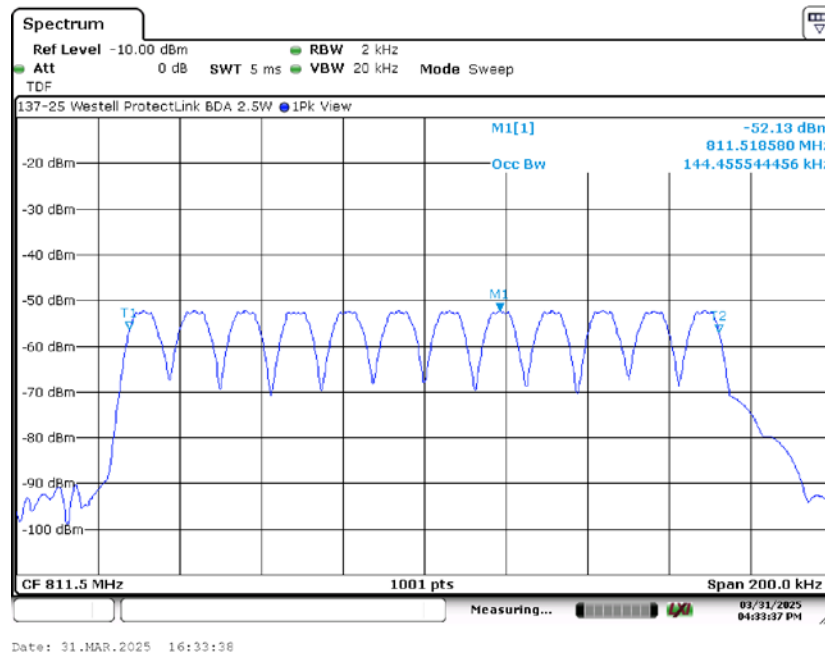
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.15. Occupied (99% Power) Bandwidth Measurement, 811.5 MHz, C4FM- 12C



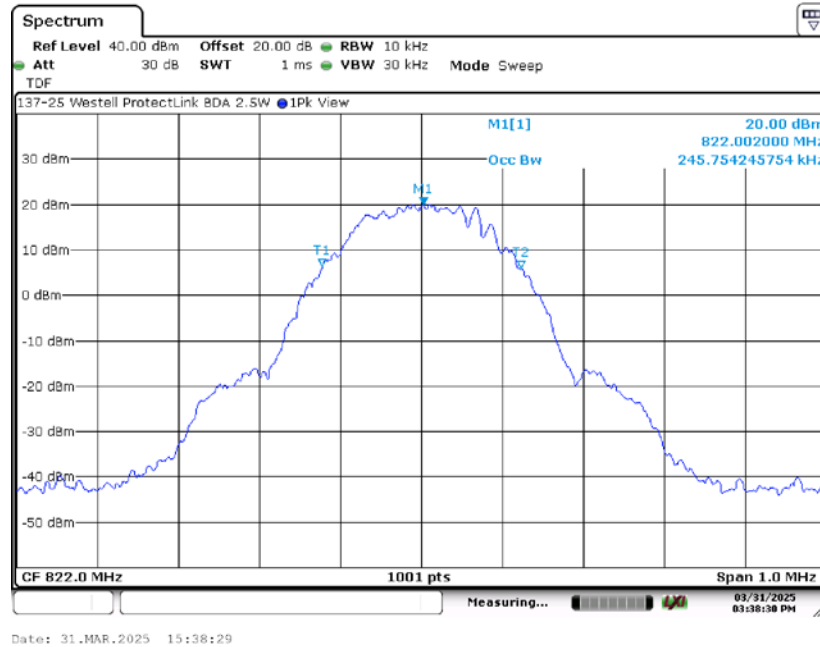
6.2.1.16. Occupied (99% Power) Bandwidth Input, 811.5 MHz, C4FM – 12C



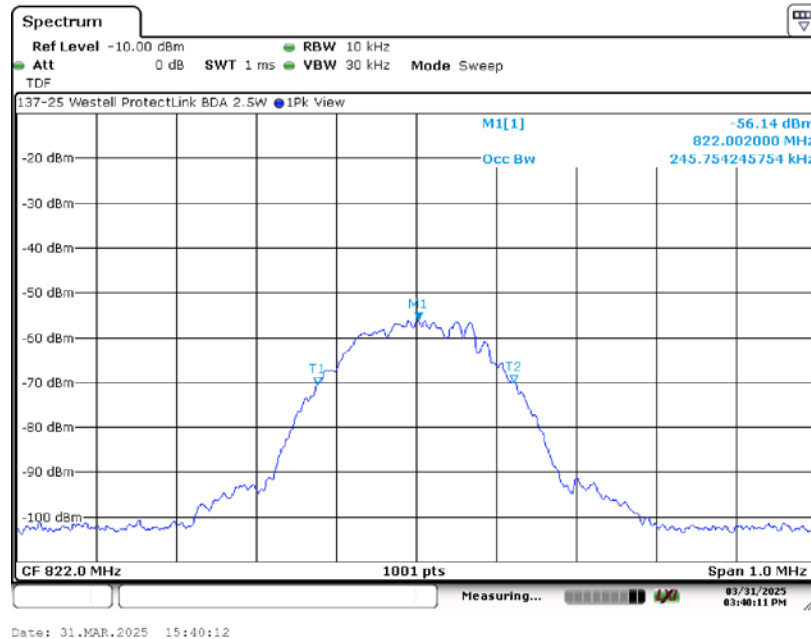
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.17. Occupied (99% Power) Bandwidth Measurement, 820.0 MHz, GSM



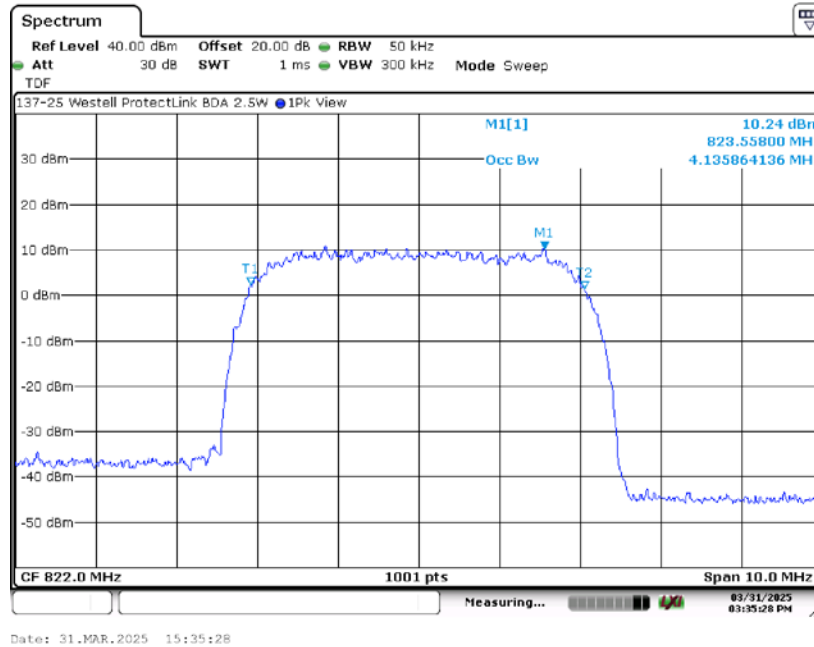
6.2.1.18. Occupied (99% Power) Bandwidth Input, 820.0 MHz, GSM



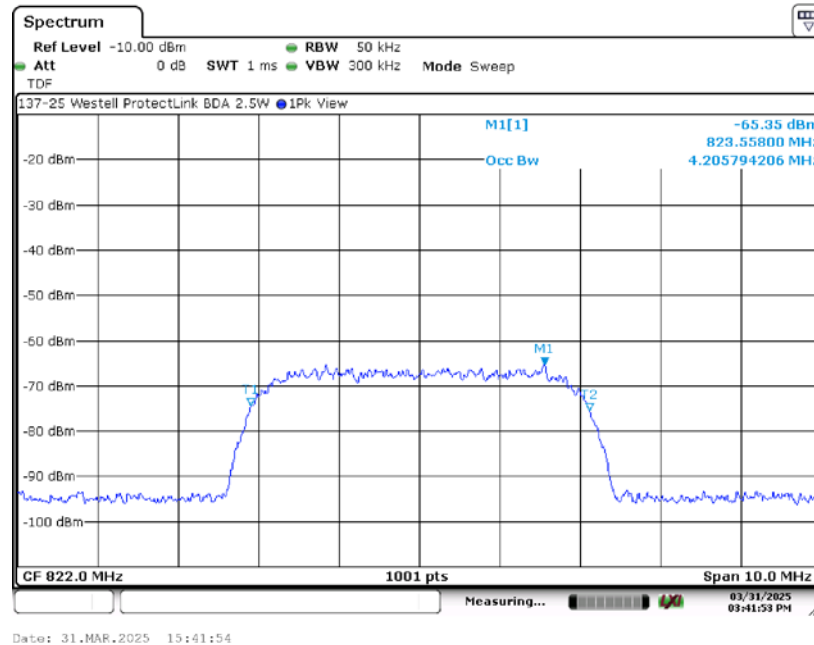
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.19. Occupied (99% Power) Bandwidth Measurement, 820.0 MHz, AWGN



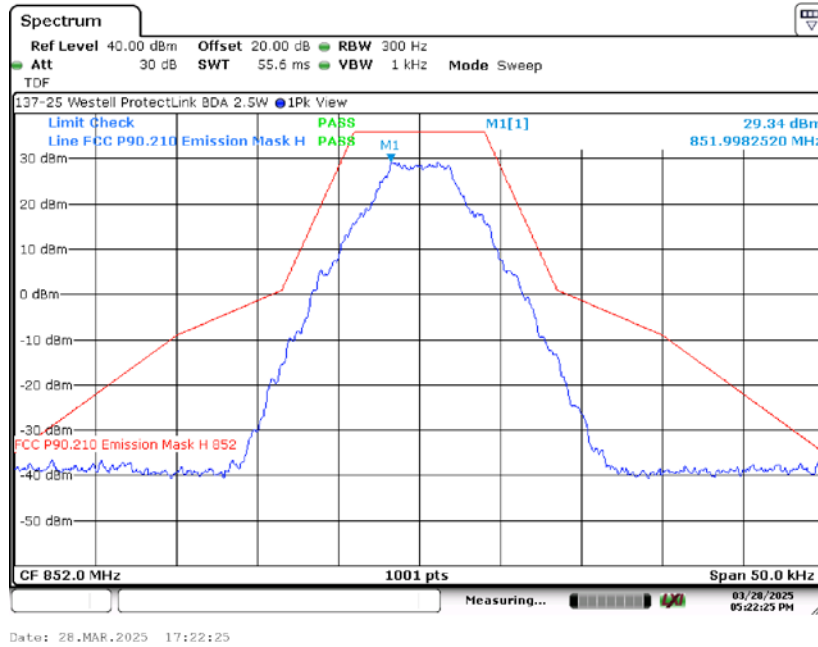
6.2.1.20. Occupied (99% Power) Bandwidth Input, 820.0 MHz, AWGN



6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.21. Occupied (99% Power) Emissions Mask H, 852.0 MHz, C4FM



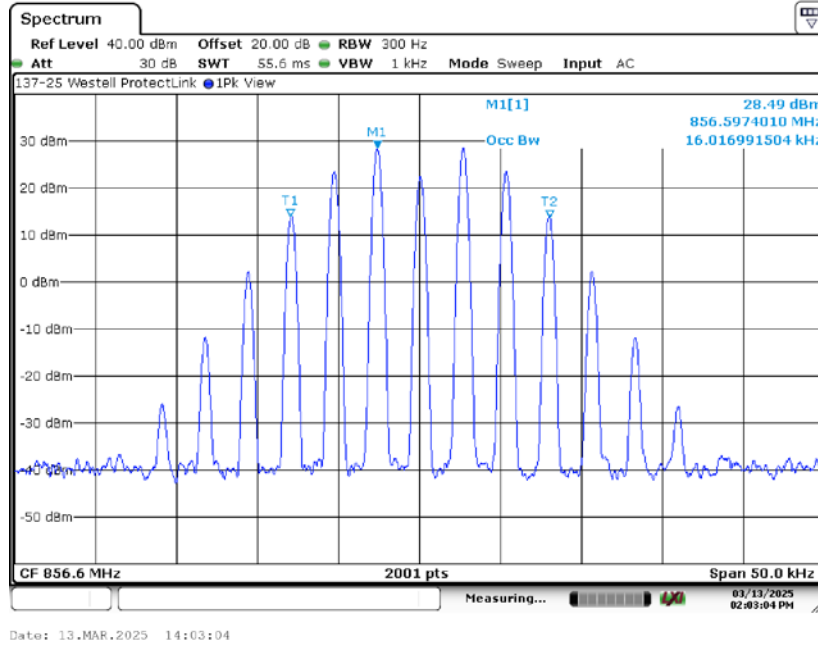
6.2.1.22. Occupied (99% Power) Emissions Mask H plus 3dB, 852.0 MHz, C4FM



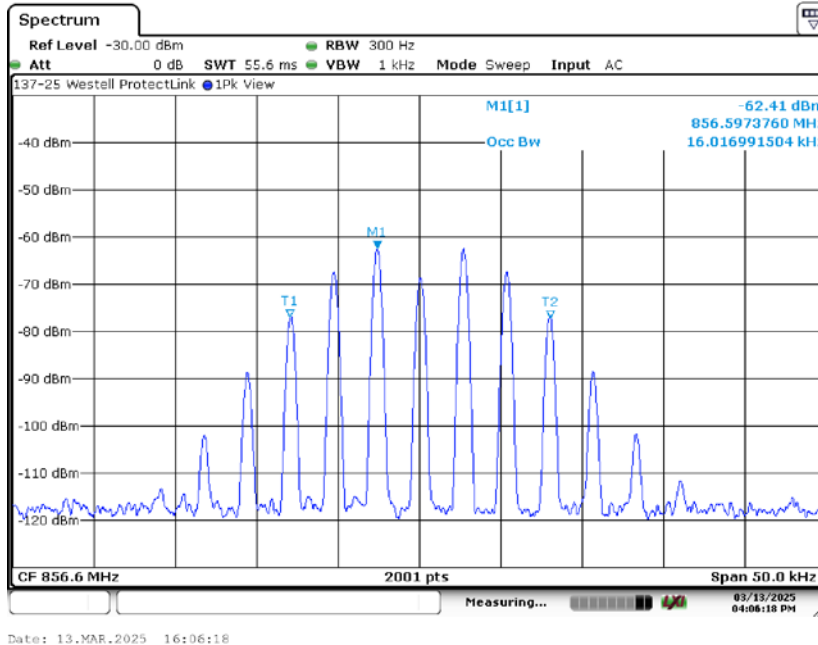
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.23. Occupied (99% Power) Bandwidth Measurement, 856.6 MHz, 16k FM



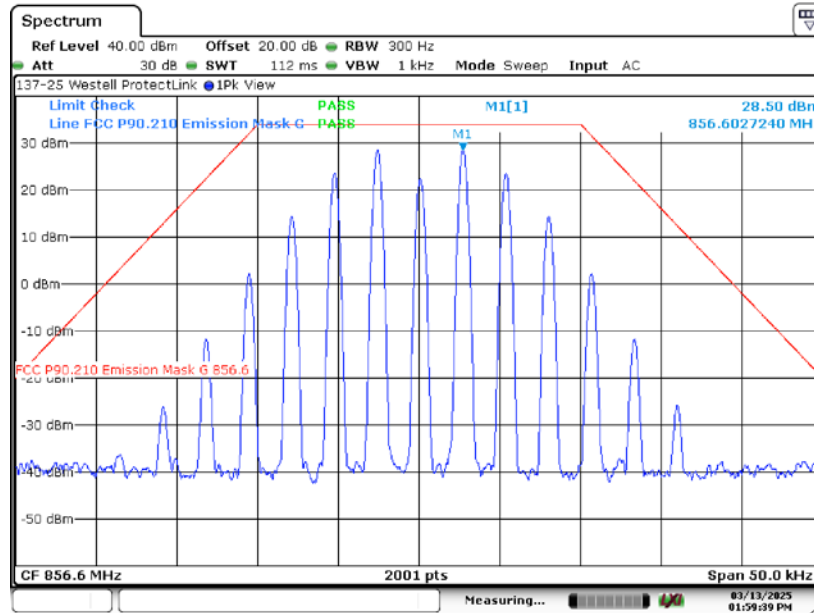
6.2.1.24. Occupied (99% Power) Bandwidth Input, 856.6 MHz, 16k FM



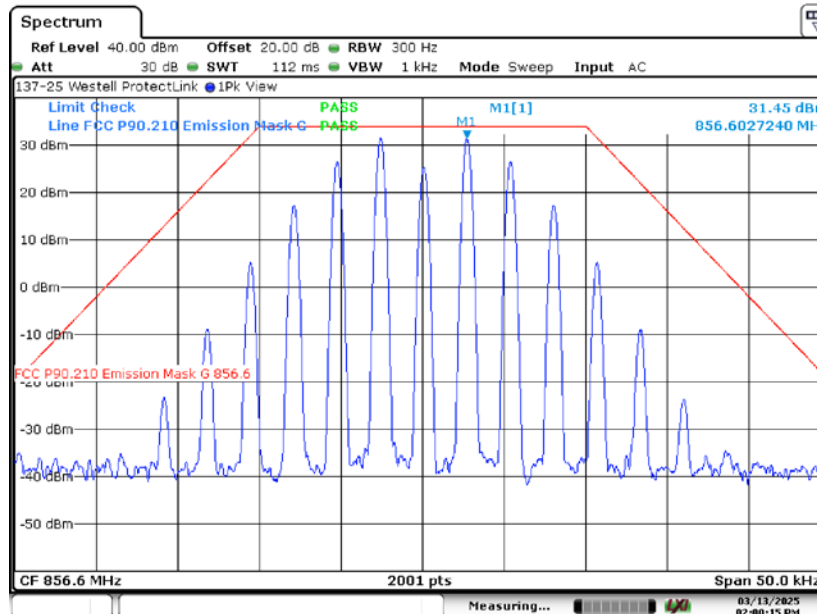
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.25. Occupied (99% Power) Emissions Mask G, 856.6 MHz, 16k FM



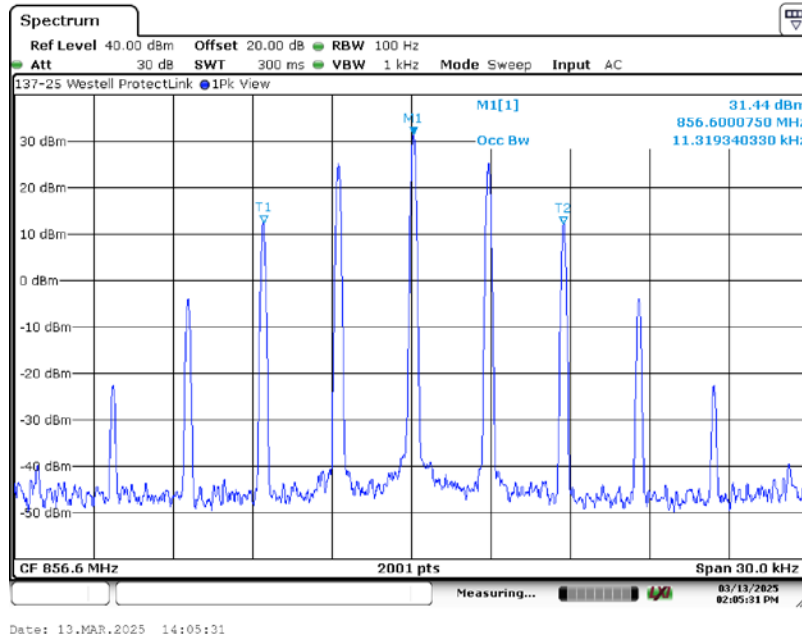
6.2.1.26. Occupied (99% Power) Emissions Mask G plus 3 dB, 856.6 MHz, 16k FM



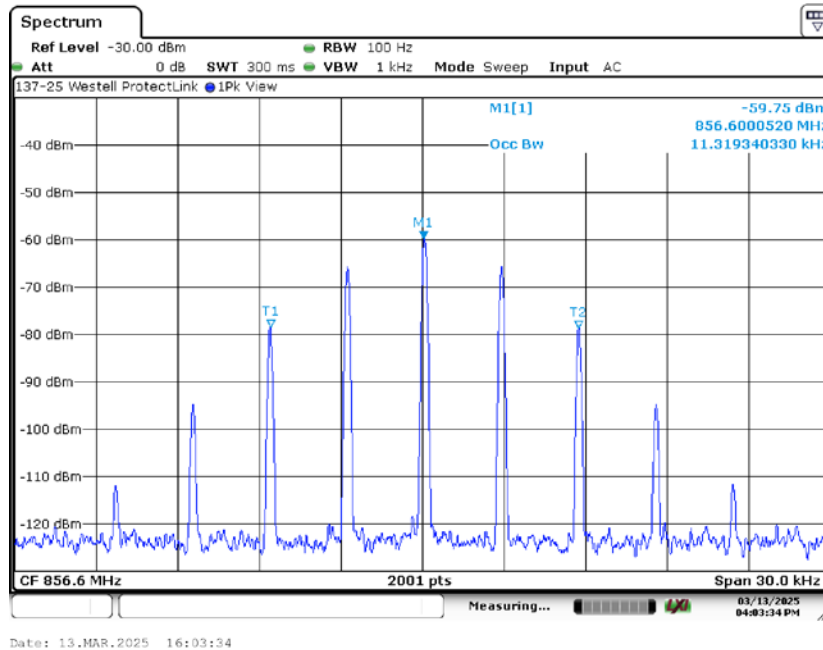
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.27. Occupied (99% Power) Bandwidth Measurement, 856.6 MHz, 11k FM



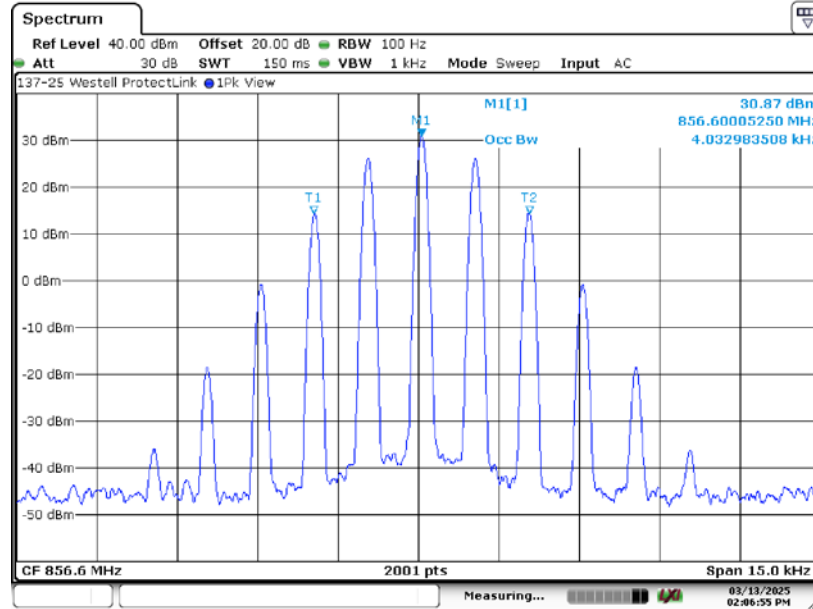
6.2.1.28. Occupied (99% Power) Bandwidth Input, 856.6 MHz, 11k FM



6. Measurement Data (continued)

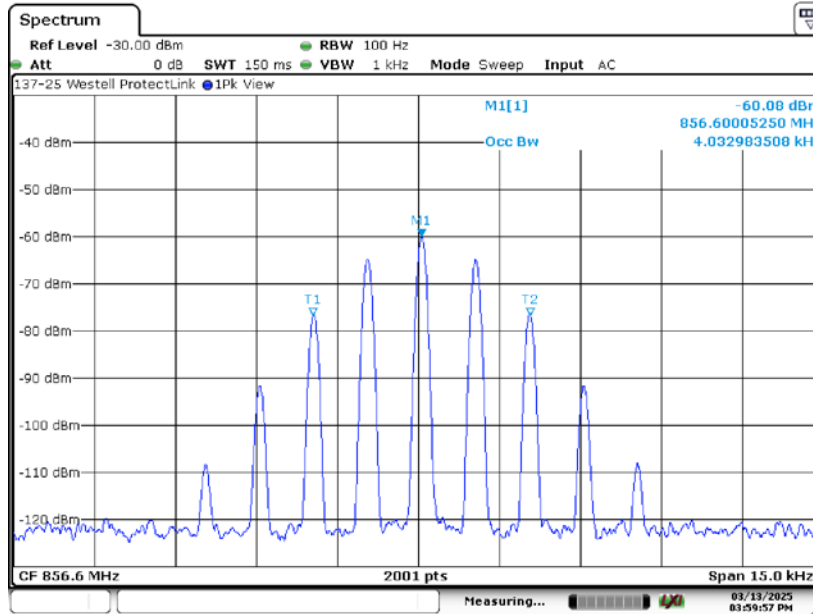
6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.29. Occupied (99% Power) Bandwidth Measurement, 856.6 MHz, 4k FM



Date: 13.MAR.2025 14:06:55

6.2.1.30. Occupied (99% Power) Bandwidth Input, 856.6 MHz, 4k FM

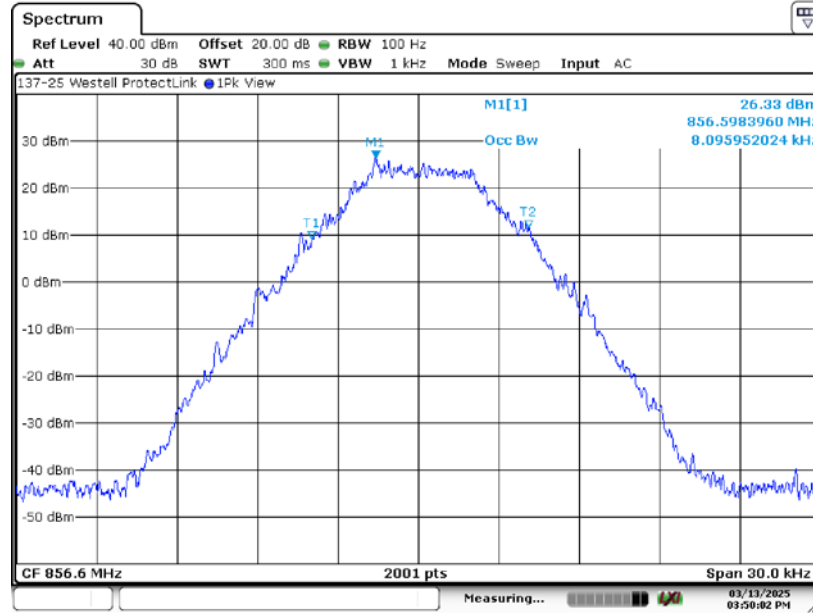


Date: 13.MAR.2025 15:59:57

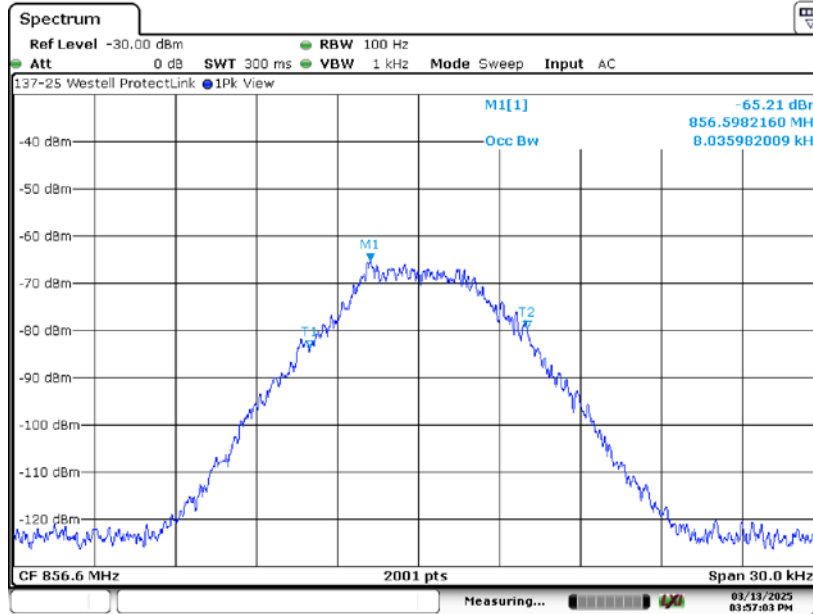
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.31. Occupied (99% Power) Bandwidth Measurement, 856.6 MHz, C4FM



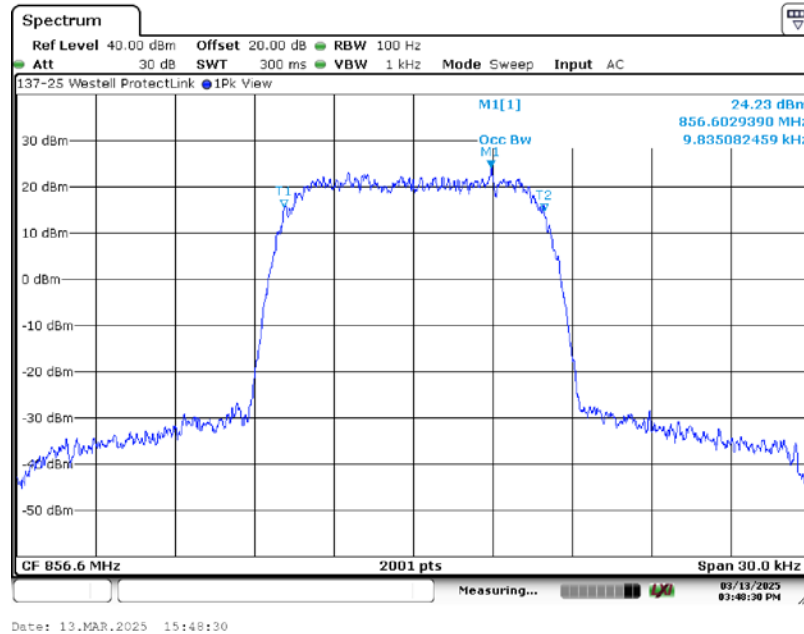
6.2.1.32. Occupied (99% Power) Bandwidth Input, 856.6 MHz, C4FM



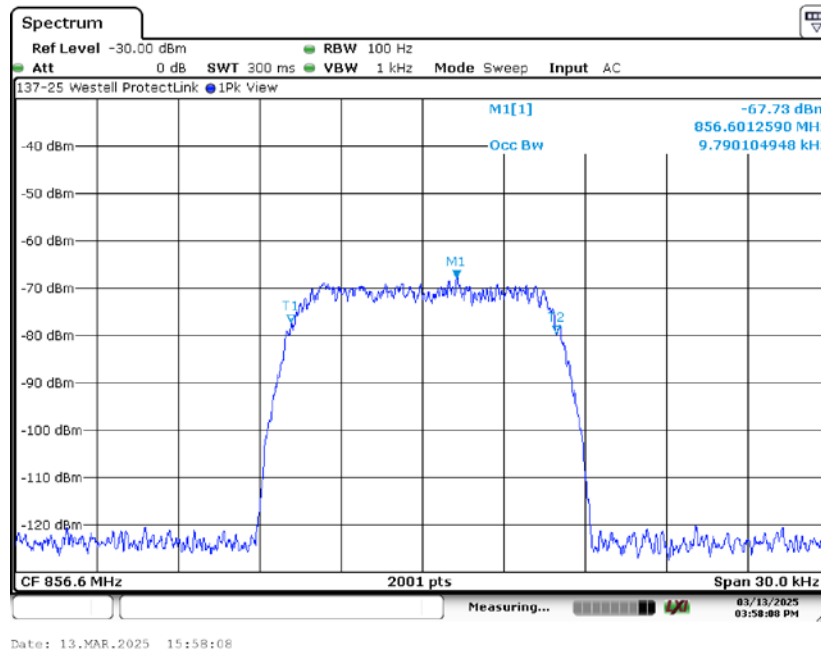
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.33. Occupied (99% Power) Bandwidth Measurement, 856.6 MHz, $\pi/4$ -DQPSK



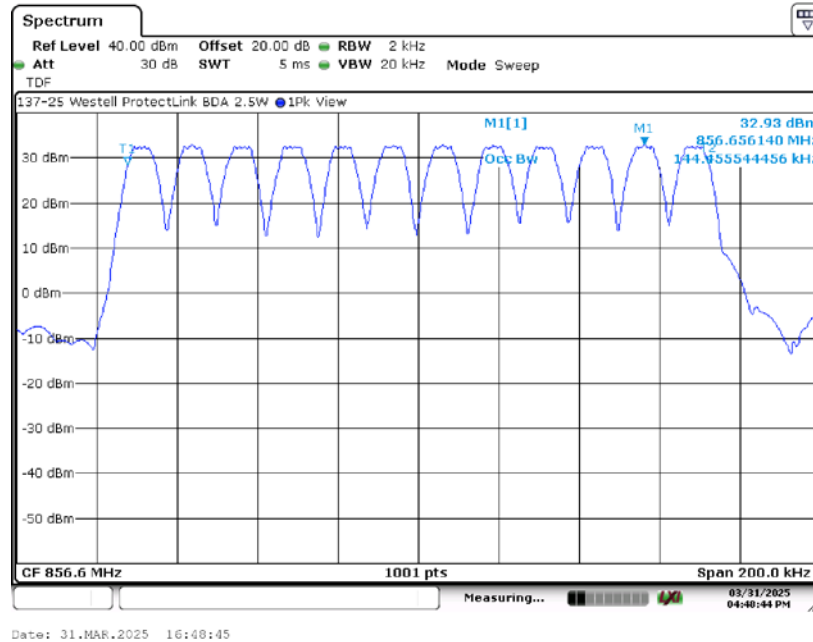
6.2.1.34. Occupied (99% Power) Bandwidth Input, 856.6 MHz, $\pi/4$ -DQPSK



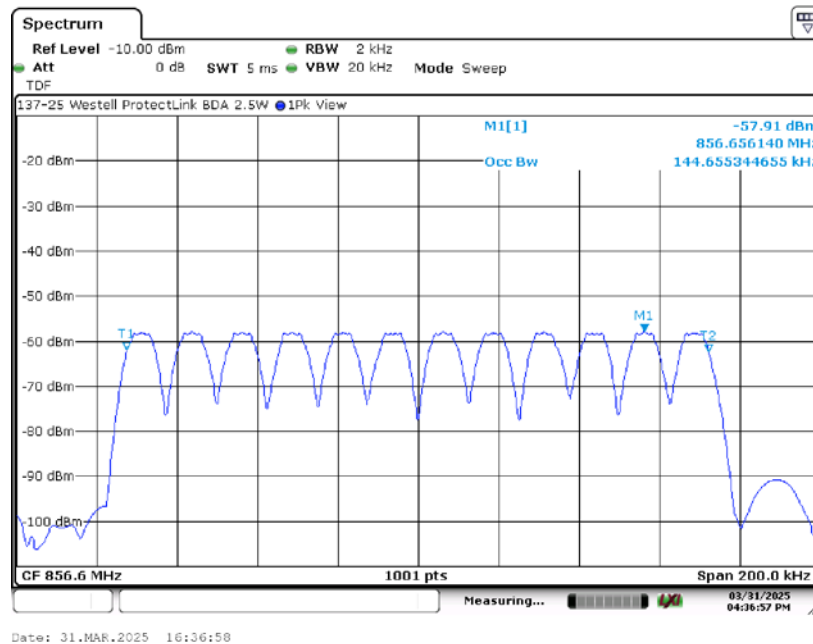
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.35. Occupied (99% Power) Bandwidth Measurement, 856.6 MHz, C4FM-12C



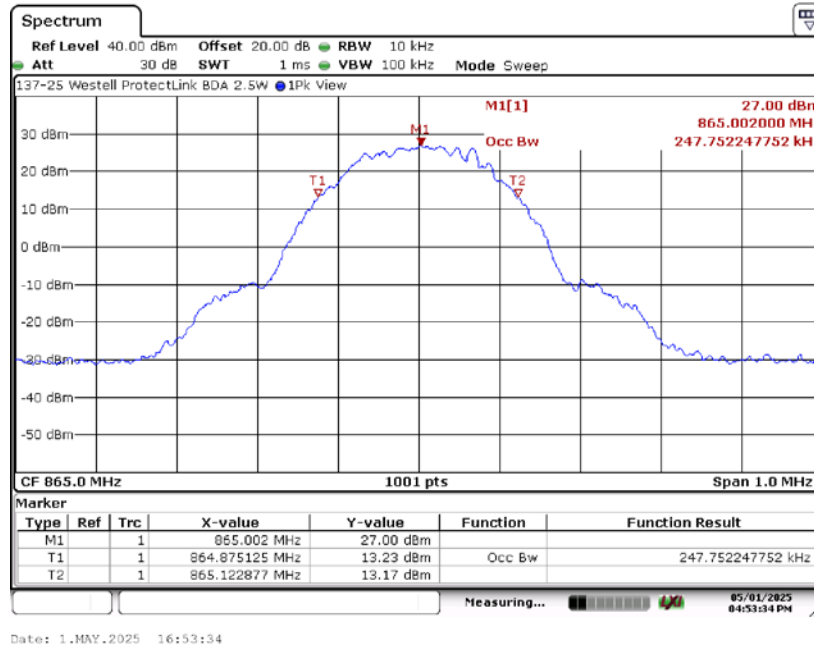
6.2.1.36. Occupied (99% Power) Bandwidth Input, 856.6 MHz, C4FM-12C



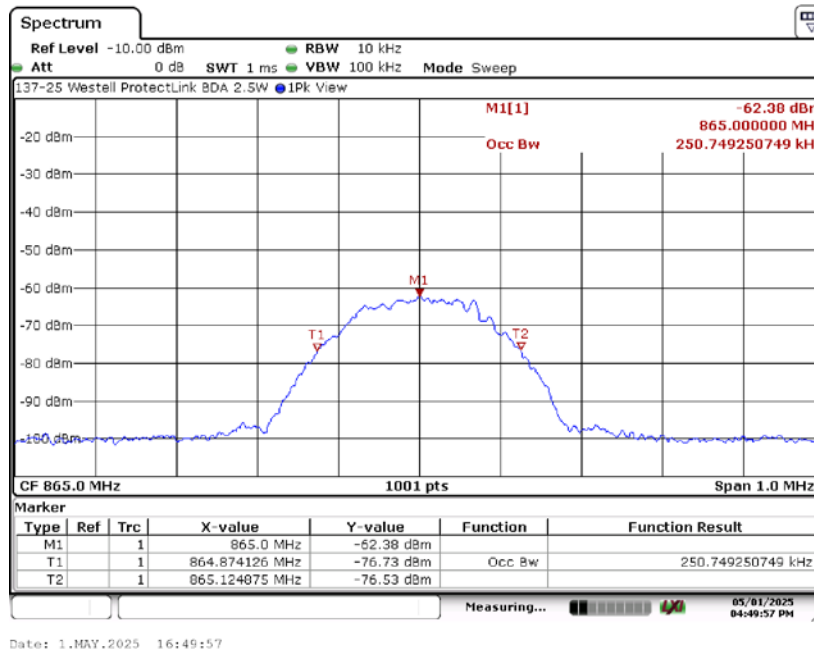
6. Measurement Data (continued)

6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.37. Occupied (99% Power) Bandwidth Measurement, 865.0 MHz, GSM



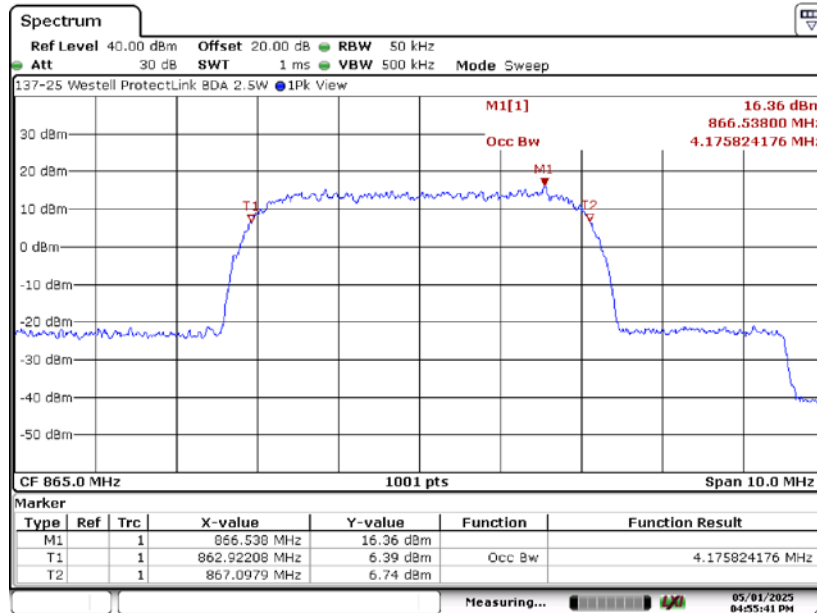
6.2.1.38. Occupied (99% Power) Bandwidth Input, 865.0 MHz, GSM



6. Measurement Data (continued)

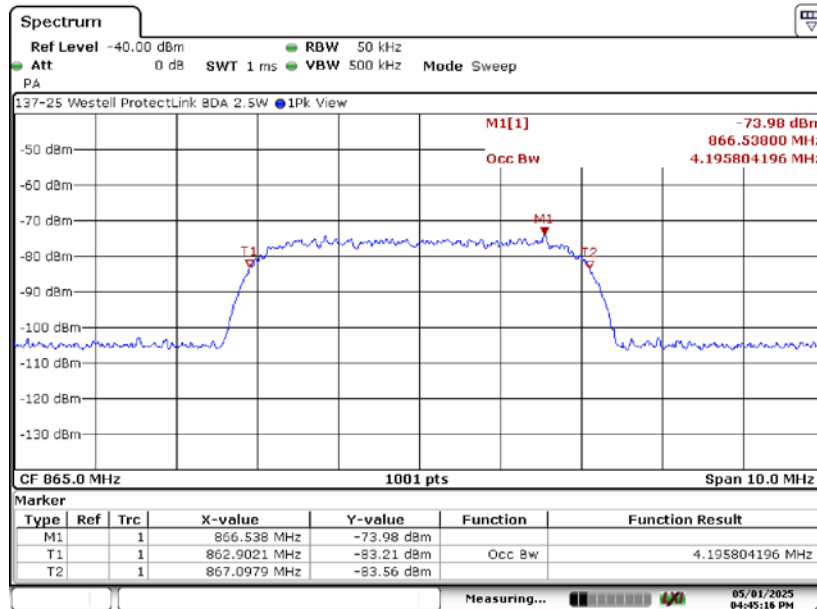
6.2. Bandwidth Limitations 90.219(e)(4)(ii), FCC Part 2.1049 (continued)

6.2.1.39. Occupied (99% Power) Bandwidth Measurement, 865.0 MHz, AWGN



Date: 1.MAY.2025 16:55:41

6.2.1.40. Occupied (99% Power) Bandwidth Input, 865.0 MHz, AWGN



Date: 1.MAY.2025 16:45:16

6. Measurement Data (continued)

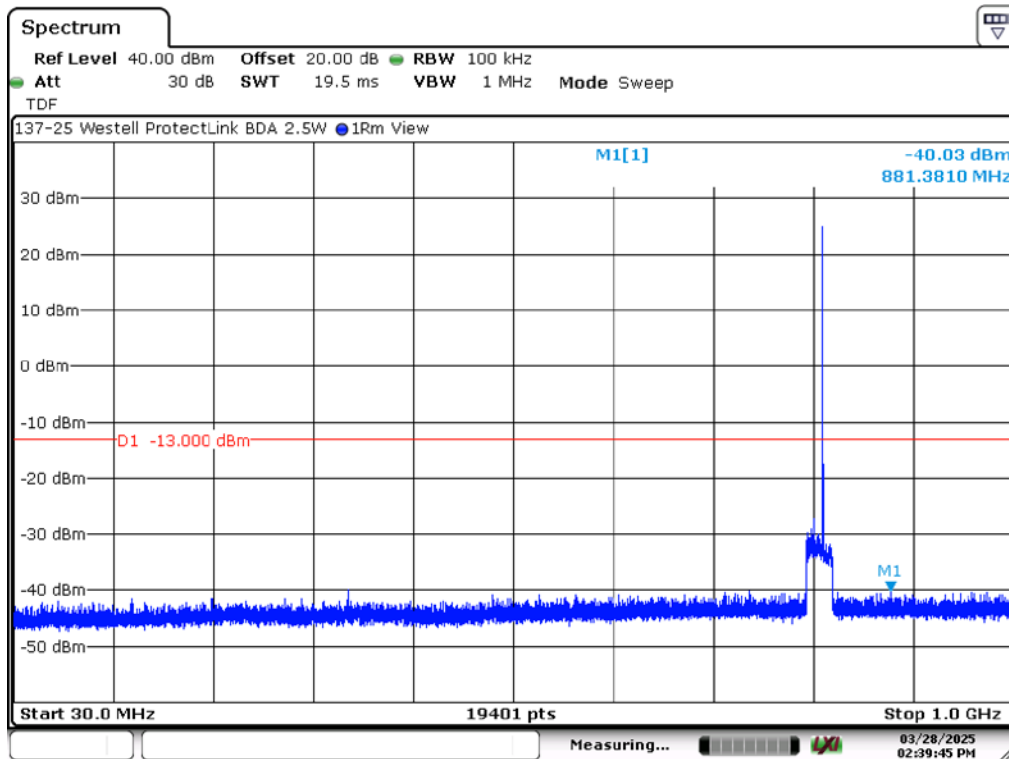
6.3. Spurious Emissions at the Antenna Terminals 90.219(e)(3), 90.669

Requirement: Transmitters designed to operate in the 806 to 824 MHz, 851 to 869 MHz, 896 to 901 MHz and 935 to 940 MHz bands, any emission outside of the MTA licensee's spectrum shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB or 80 decibels, whichever is the lesser attenuation.

Compliance with this provision is based upon the use of measurement instrumentation employing a resolution bandwidth of 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

Test Method: KDB 935210 Section 4.73

6.3.1. 811.5 MHz, 30 MHz to 1 GHz

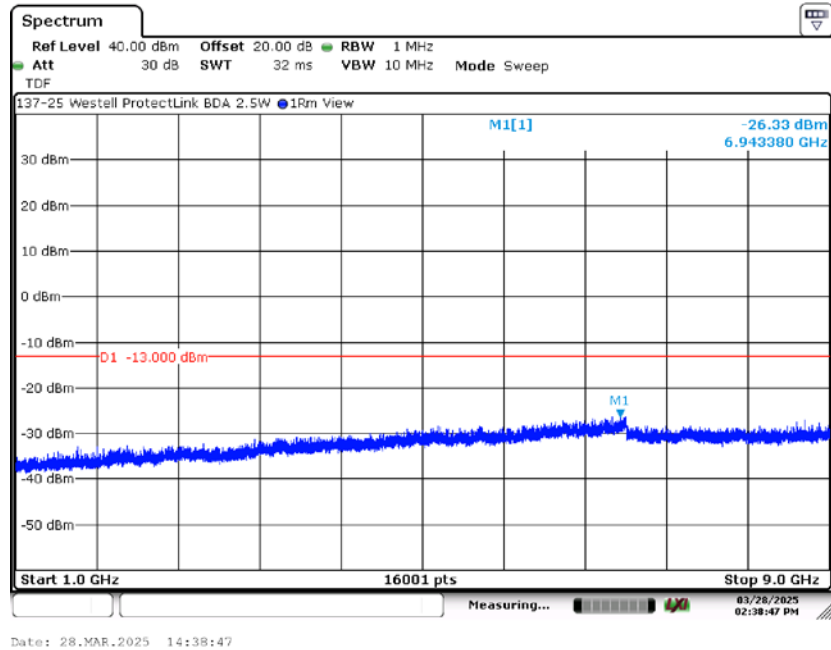


Date: 28.MAR.2025 14:39:45

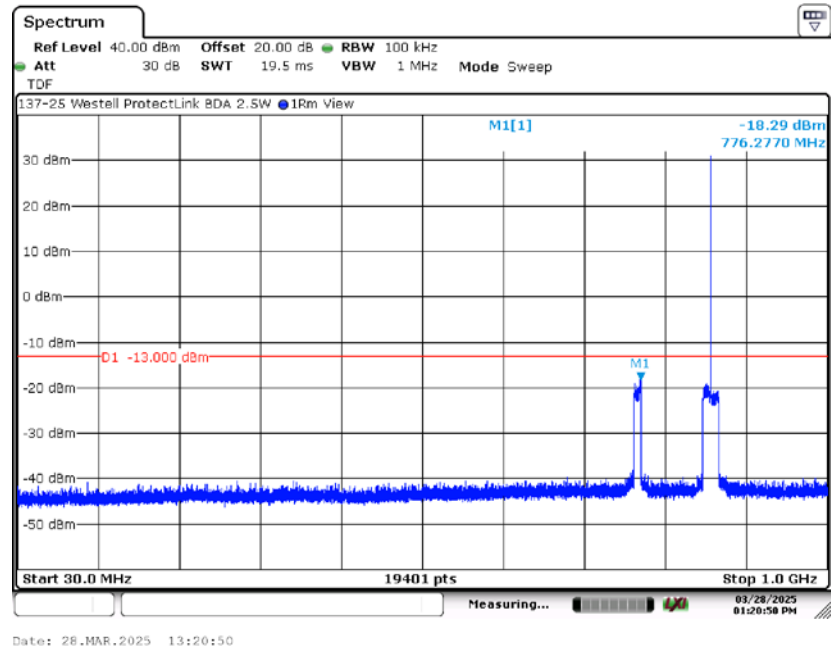
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 90.219(e)(3), 90.669 (continued)

6.3.2. 811.5 MHz, 1 to 9 GHz



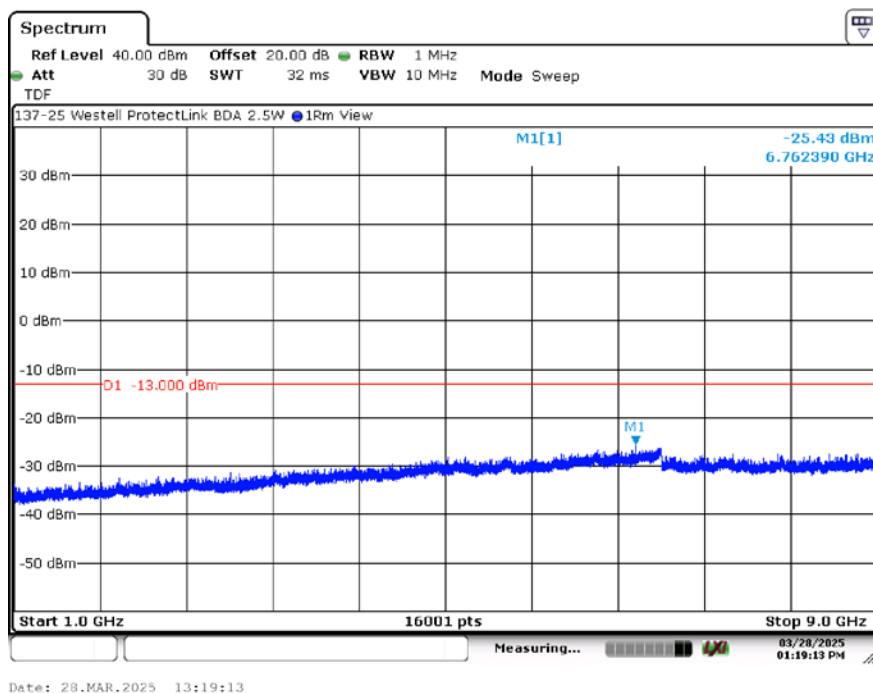
6.3.3. 856.6 MHz, 30 MHz to 1 GHz



6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 90.219(e)(3), 90.669 (continued)

6.3.4. 856.6 MHz, 1 to 9 GHz



Out of Band / Out of Block Inter-modulation

Requirement: The mean power Inter-modulation products shall be measured using two CW signals with each of the available channel spacings of 6.25 kHz, 12.5 kHz and 25 kHz on a center frequency of each applicable band over a 100 kHz span when measured in a 300 Hz RBW. This shall be verified at AGC threshold and 3 dB above AGC threshold. See next pages for plots.

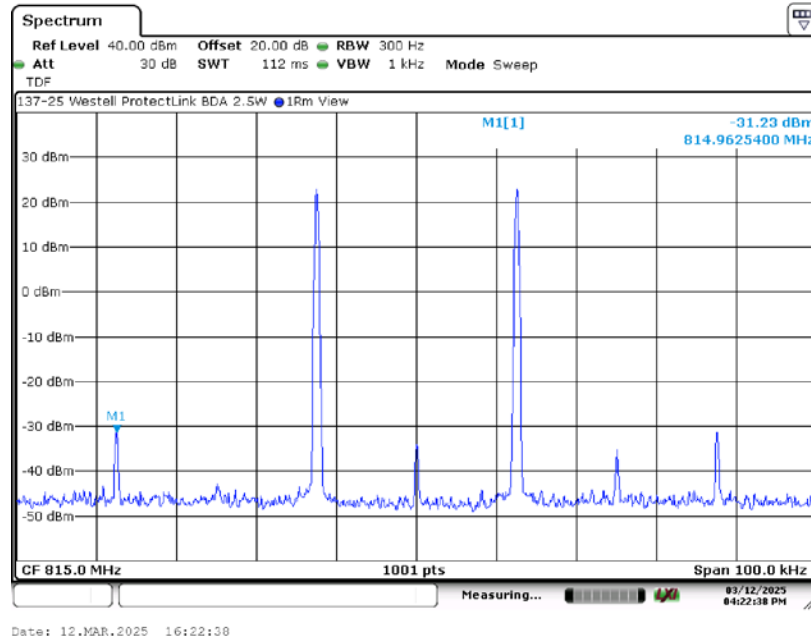
Test Method: KDB 935210 Section 4.7.1, 4.7.2

Note: Turned on 50 kHz filter for 25 kHz measurements, and 12.5 kHz filter for 12.5 kHz and 6.25 kHz measurements at 860 MHz.

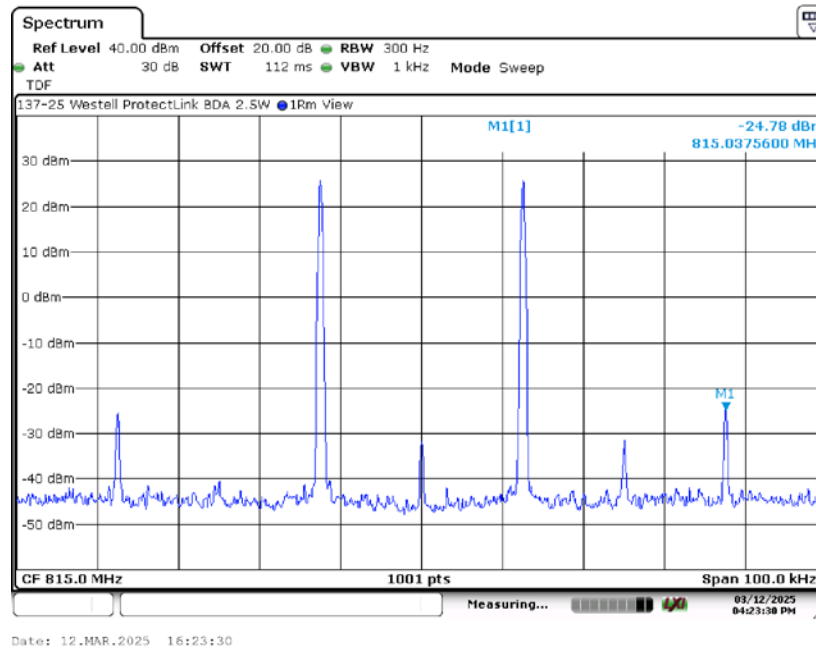
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 90.219(e)(3), 90.669 (continued)

6.3.5. 815.0 MHz Two Tone Modulation, 25 kHz Spacing



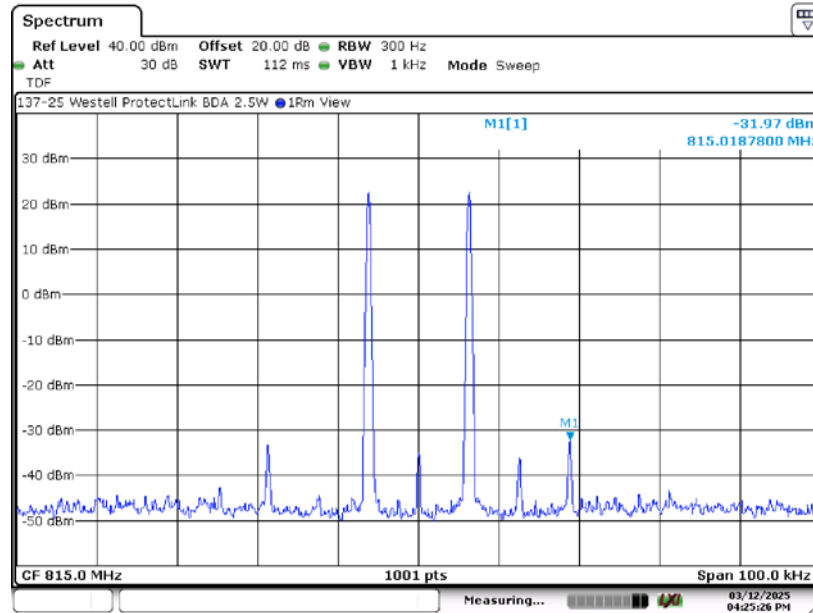
6.3.6. 815.0 MHz Two Tone Modulation plus 3 dB, 25 kHz Spacing



6. Measurement Data (continued)

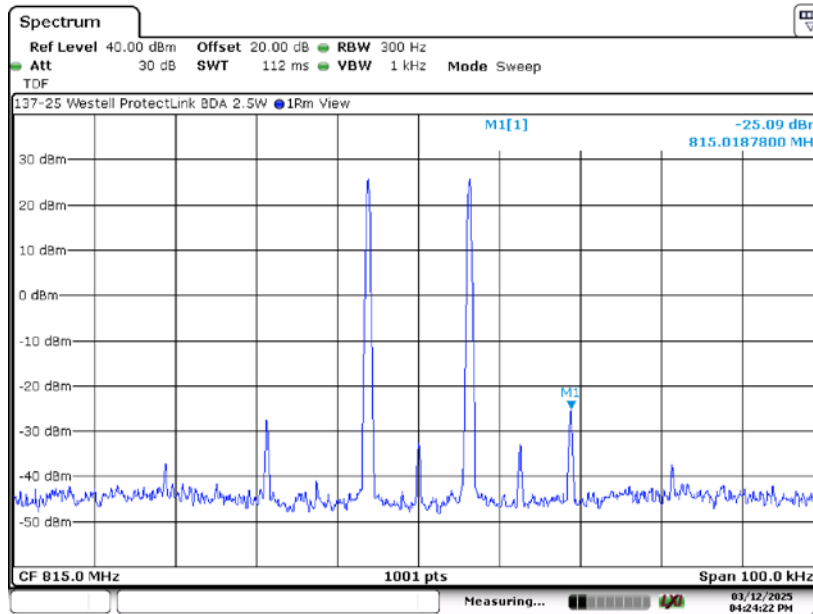
6.3. Spurious Emissions at the Antenna Terminals 90.219(e)(3), 90.669 (continued)

6.3.7. 815.0 MHz Two Tone Modulation, 12.5 kHz Spacing



Date: 12.MAR.2025 16:25:26

6.3.8. 815.0 MHz Two Tone Modulation plus 3 dB, 12.5 kHz Spacing

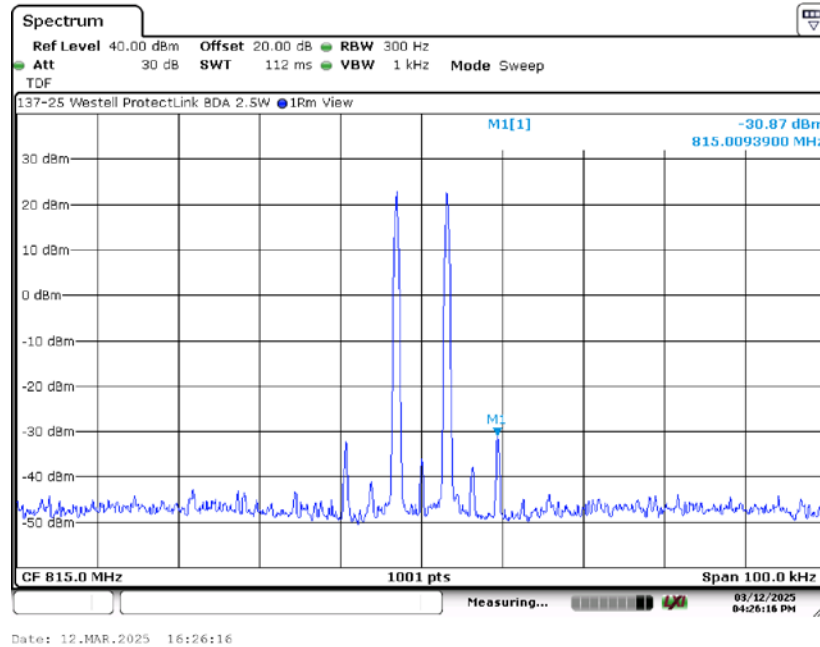


Date: 12.MAR.2025 16:24:22

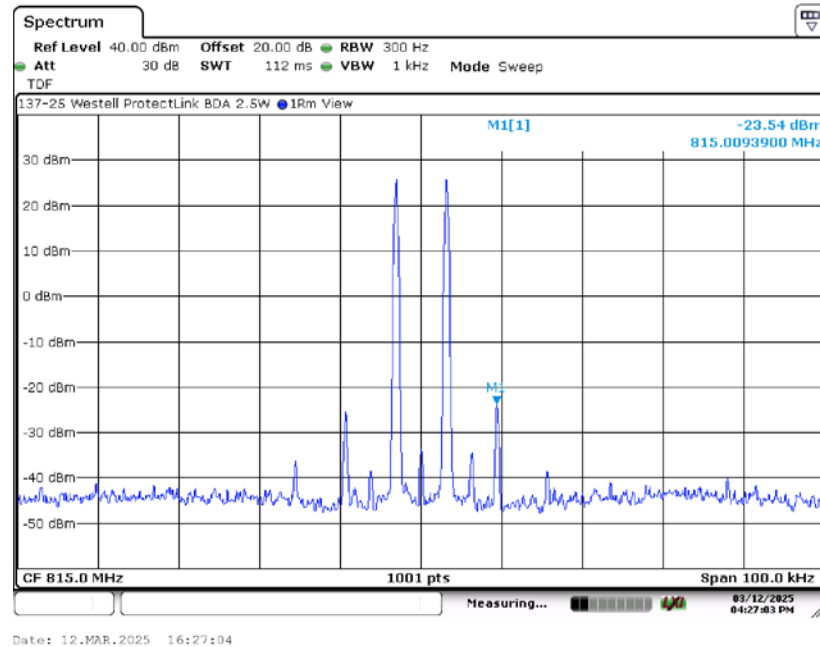
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 90.219(e)(3), 90.669 (continued)

6.3.9. 815.0 MHz Two Tone Modulation, 6.25 kHz Spacing



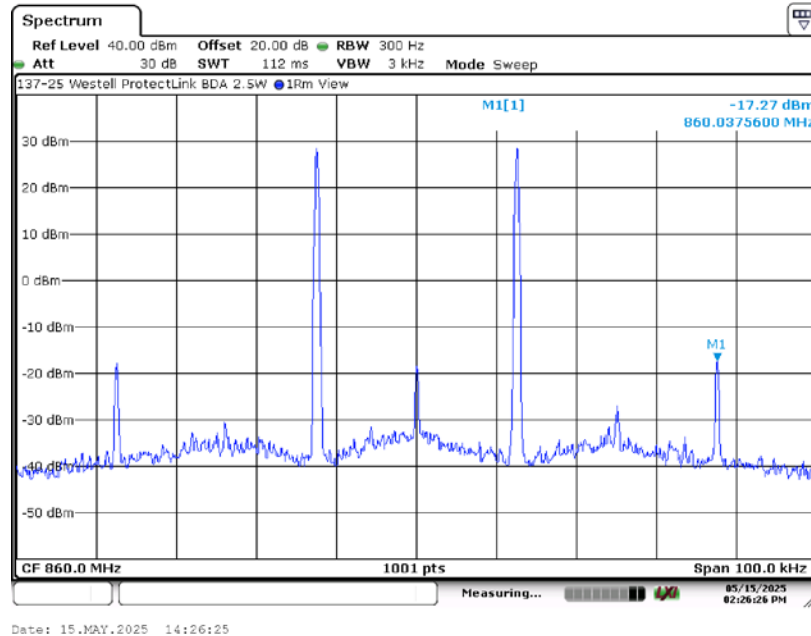
6.3.10. 815.0 MHz Two Tone Modulation plus 3 dB, 6.25 kHz Spacing



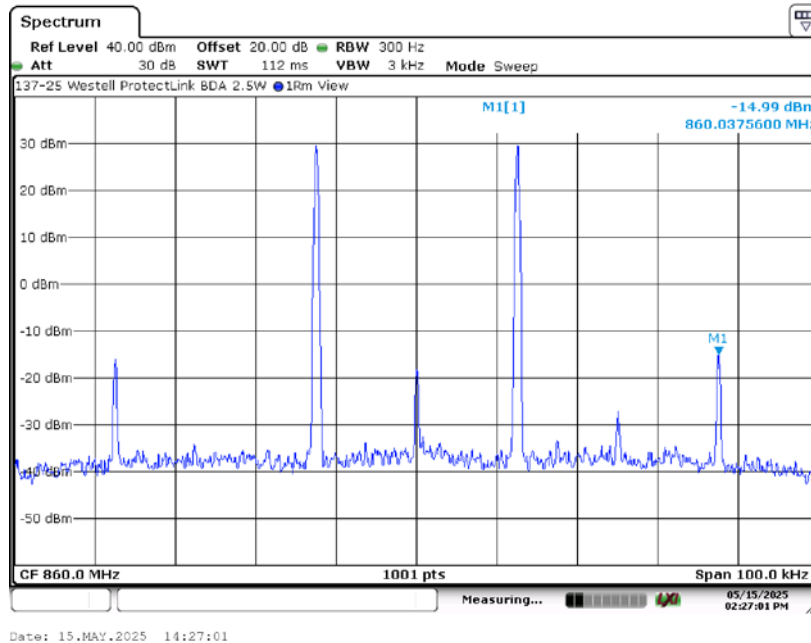
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 90.219(e)(3), 90.669 (continued)

6.3.11. 860.0 MHz 2 Tone Modulation, 25 kHz Spacing



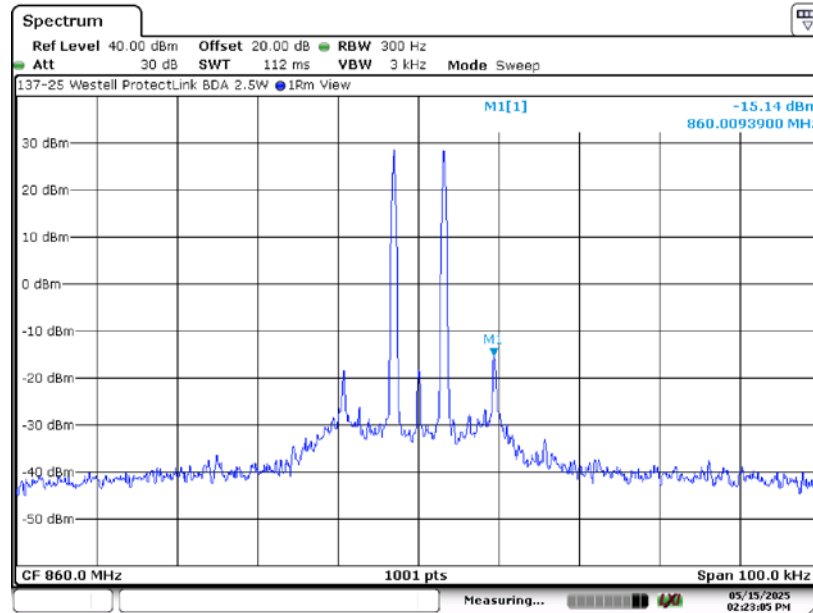
6.3.12. 860.0 MHz 2 Tone Modulation plus 3 dB, 25 kHz Spacing



6. Measurement Data (continued)

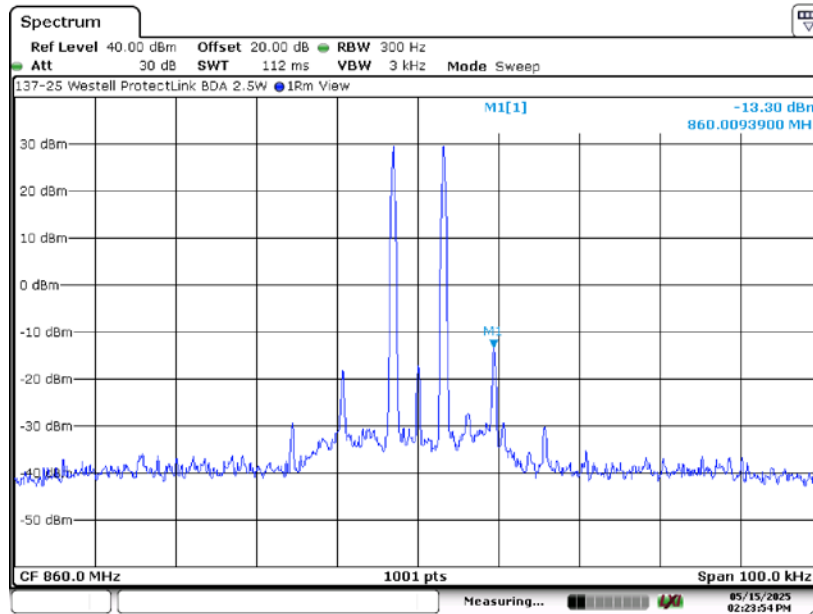
6.3. Spurious Emissions at the Antenna Terminals 90.219(e)(3), 90.669 (continued)

6.3.15. 860.0 MHz 2 Tone Modulation, 6.25 kHz Spacing



Date: 15.MAY.2025 14:23:06

6.3.16. 860.0 MHz 2 Tone Modulation plus 3 dB, 6.25 kHz Spacing



Date: 15.MAY.2025 14:23:55

6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 90.219(e)(3), 90.669

Requirement: Transmitters designed to operate in the 806 to 824 MHz, 851 to 869 MHz, 896 to 901 MHz and 935 to 940 MHz bands, any emission outside of the MTA licensee's spectrum shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB.

Compliance with this provision is based upon the use of measurement instrumentation employing a resolution bandwidth of 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

Test Method: KDB 935210 Section 4.9

6.4.1. Measurement and Equipment Setup

Test Date:	3/28/2025, 3/31/2025
Test Engineer:	Sean Defelice
Site Temperature (°C):	21
Relative Humidity (%RH):	32
Frequency Range:	30 MHz to 1 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	100 kHz
EMI Receiver Avg Bandwidth:	$\geq 3 * IF (BW)$ or RBW
Detector Functions:	Peak and Quasi-Peak.
Antenna Height:	1 to 4 meters

6.4.2 Test Procedure

Test measurements were made in accordance with ANSI/TIA-603-D 2010 Land Mobile FM or PM Communications Equipment Measurement and Performance Standards and ANSI C63.26 2015 American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services, Substitution Methodology.

6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 90.219(e)(3), 90.669 (continued)

6.4.3. Horizontal Polarity

Frequency (MHz)	Antenna Height (cm)	Turntable Position (deg)	EIRP (dBm)	Limit (dBm)	Margin (dB)
38.96	400	354	-73.88	-13.00	-60.88
50.00	400	354	-78.99	-13.00	-65.99
69.02	400	354	-79.62	-13.00	-66.62
111.59	344	20	-79.45	-13.00	-66.45
116.81	306	64	-76.32	-13.00	-63.32
125.00	122	178	-73.42	-13.00	-60.42
150.00	400	124	-65.13	-13.00	-52.13
175.00	298	274	-78.86	-13.00	-65.86
250.00	400	244	-71.15	-13.00	-58.15
336.00	314	268	-75.67	-13.00	-62.67
350.00	223	314	-74.78	-13.00	-61.78
432.00	211	178	-73.73	-13.00	-60.73
450.00	239	244	-59.80	-13.00	-46.80
549.99	121	354	-78.61	-13.00	-65.61
575.96	137	144	-68.36	-13.00	-55.36
599.99	100	354	-82.60	-13.00	-69.60
649.99	143	28	-74.82	-13.00	-61.82
824.75	100	280	-67.59	-13.00	-54.59

6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 90.219(e)(3), 90.669 (continued)

6.4.4. Vertical Polarity

Frequency (MHz)	Antenna Height (cm)	Turntable Position (deg)	EIRP (dBm)	Limit (dBm)	Margin (dB)
38.8400	100	354	-68.93	-13.00	-55.93
69.0500	100	50	-68.87	-13.00	-55.87
111.5900	192	334	-69.05	-13.00	-56.05
117.0800	206	4	-67.07	-13.00	-54.07
125.0000	100	24	-70.41	-13.00	-57.41
150.0000	353	200	-64.69	-13.00	-51.69
168.8000	100	234	-75.94	-13.00	-62.94
250.0000	100	254	-74.63	-13.00	-61.63
336.0000	100	40	-76.72	-13.00	-63.72
350.0000	100	60	-73.05	-13.00	-60.05
432.0000	129	148	-78.09	-13.00	-65.09
450.0000	253	254	-63.24	-13.00	-50.24
549.9941	100	330	-80.46	-13.00	-67.46
575.9600	100	314	-70.91	-13.00	-57.91
649.9930	100	300	-78.07	-13.00	-65.07
824.5400	100	354	-68.08	-13.00	-55.08

6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 90.219(e)(3), 90.669 (continued)

6.4.5. Measurement and Equipment Setup

Test Date:	4/11/2025
Test Engineer:	Sean Defelice
Site Temperature (°C):	24
Relative Humidity (%RH):	33
Frequency Range:	Above 1 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	1 MHz
EMI Receiver Avg Bandwidth:	$\geq 3 * \text{IF(BW)}$ or RBW
Detector Functions:	Peak and Average
Antenna Height:	1 to 4 meters

6.4.6. Radiated Emissions above 1 GHz

There were no measureable emissions above 1 GHz

6. Measurement Data (continued)

6.5. Frequency Stability 90.213

Requirement: Fixed and base stations designed to operating in the 806 to 809 MHz, 809 to 824 MHz, 851 to 854 MHz and 854 to 869 MHz frequency bands must meet the frequency stability requirements of this section which is either 1.0 or 1.5 ppm respectively.

Test Method: KDB 935210 Section 4.8

Note: The EUT does not translate the input frequency and therefore this testing was not performed.

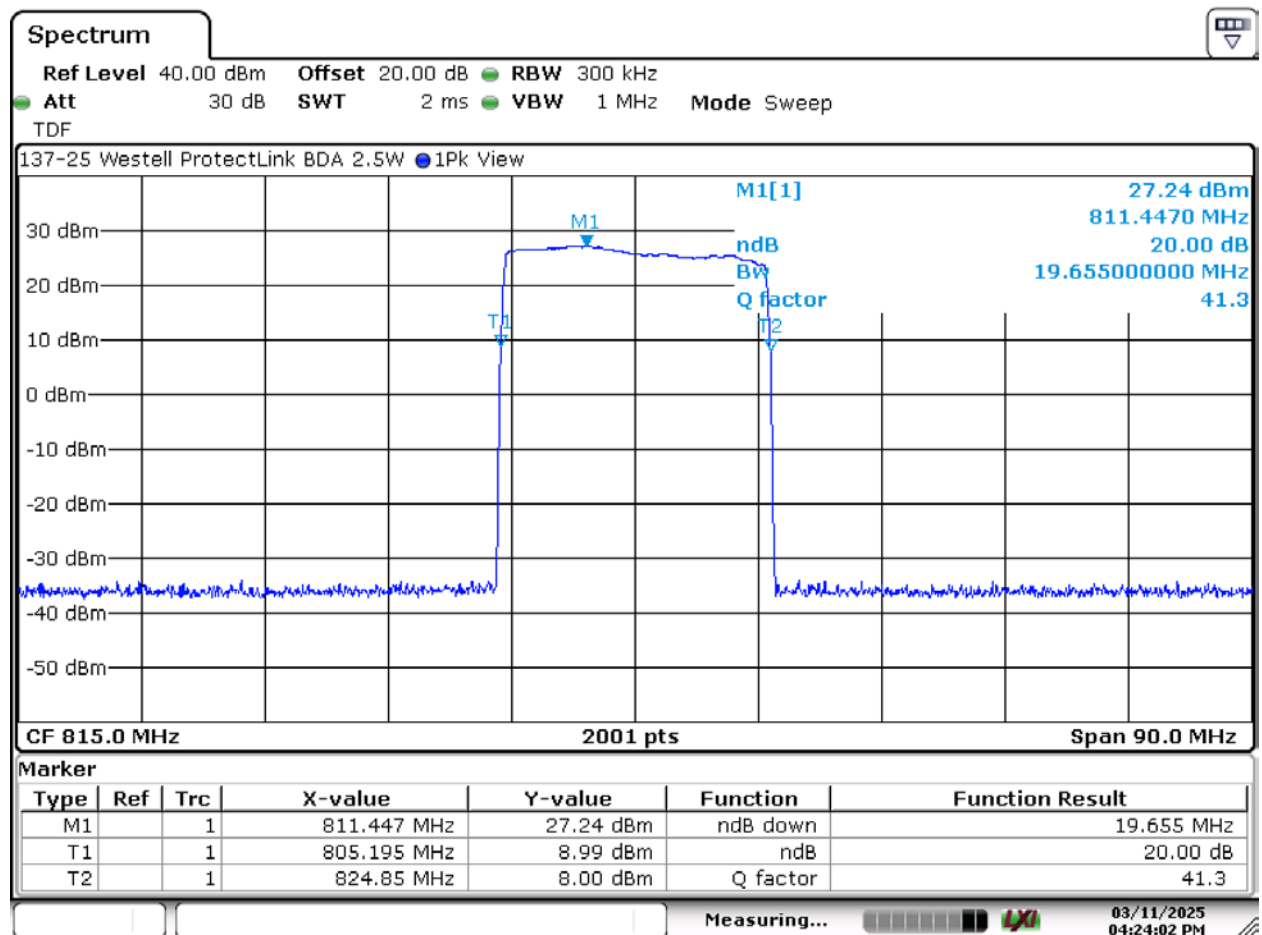
6. Measurement Data (continued)

6.6. Out of Band Rejection

Requirement: Over a +/- 250 % span of the passband of the EUT measure the 20 dB bandwidth of the pass band of the EUT.

Test Method: KDB 935210 Section 4.3

6.6.1. 815 MHz Center Frequency, $f_0 = 811.447$ MHz

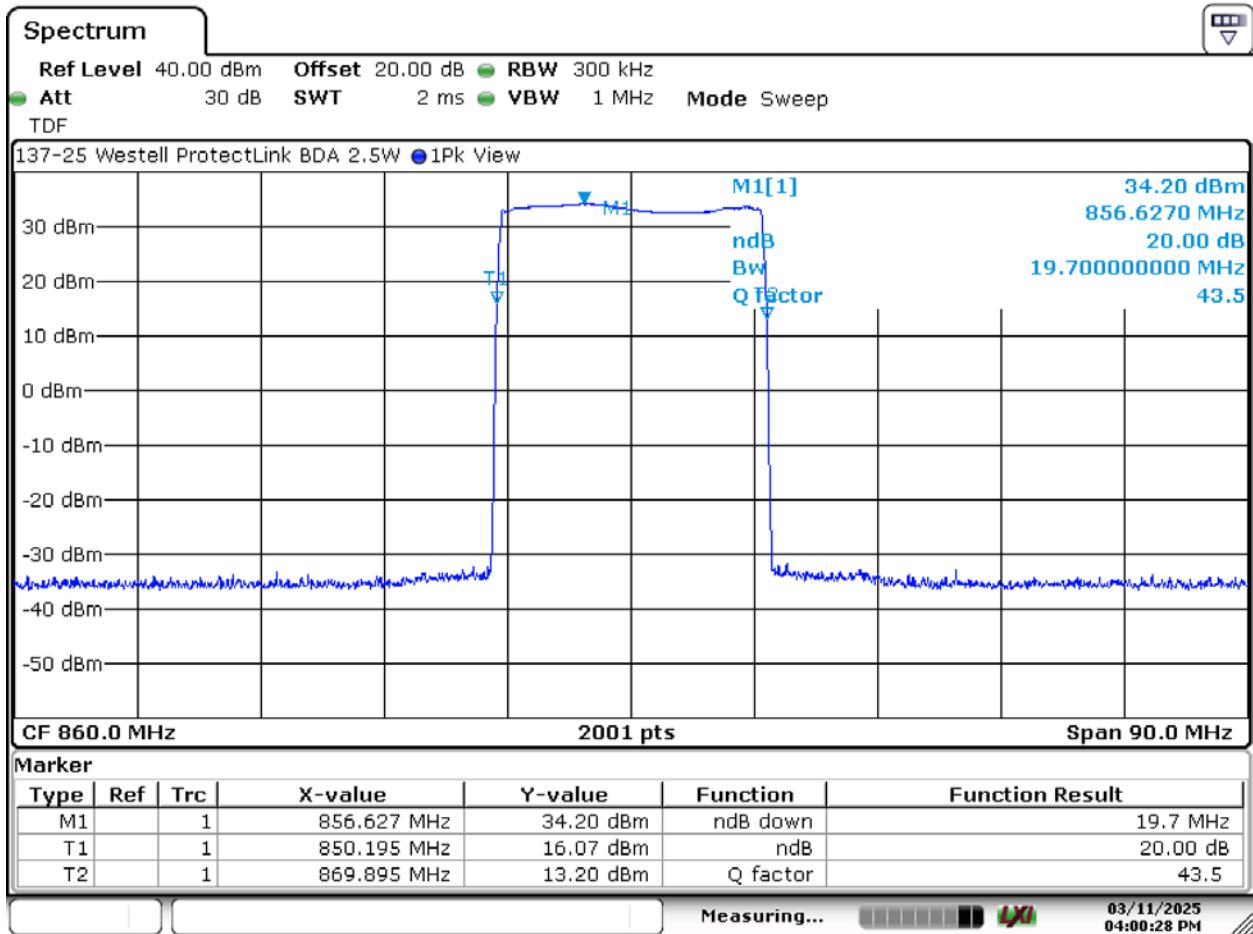


Date: 11.MAR.2025 16:24:02

6. Measurement Data (continued)

6.6. Out of Band Rejection (continued)

6.6.2. 860 MHz, Center Frequency, $f_0 = 856.627$ MHz



Date: 11.MAR.2025 16:00:28

6. Measurement Data (continued)

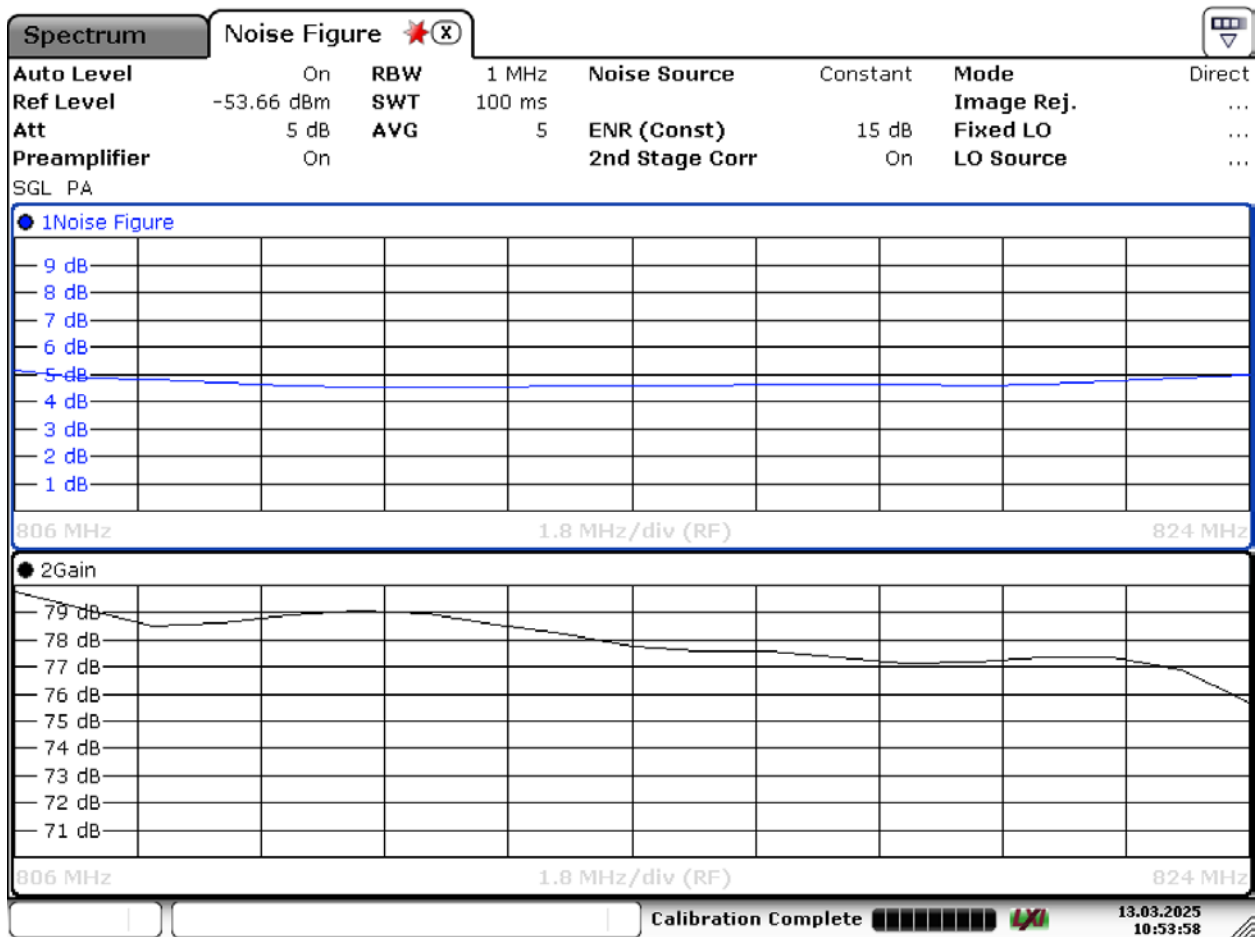
6.7. Noise Figure

Requirement: The noise figure of a signal booster must not exceed 9 dB in either direction.

Test Method: KDB 935210 Section 4.6

Result: Compliant, < 5.1 dB

6.7.1. 806 to 824 MHz band



Date: 13.MAR.2025 10:53:58

6. Measurement Data (continued)

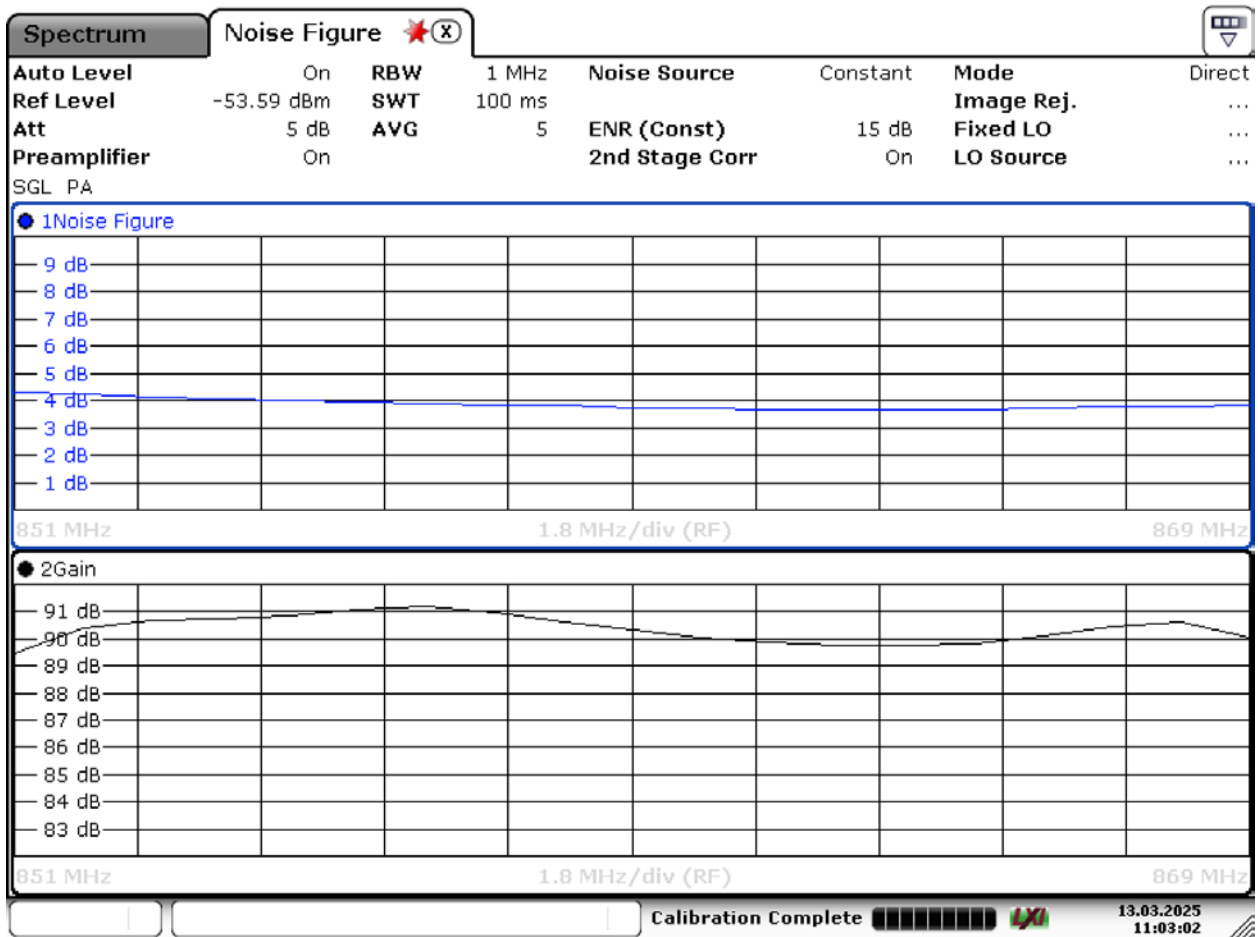
6.7. Noise Figure (continued)

Requirement: The noise figure of a signal booster must not exceed 9 dB in either direction.

Test Method: KDB 935210 Section 4.6

Result: Compliant, < 4.5 dB

6.7.2. 851 to 869 MHz band



Date: 13.MAR.2025 11:03:02

7. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with the Federal Communications Commission (FCC) and Industry Canada standards. Through our American Association for Laboratory Accreditation (A2LA) ISO Guide 17025 Accreditation our test sites are designated with the FCC (designation number **US1091**) and Industry Canada (file number **IC 3023A-1**)

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 11, AS/NZS CISPR 14-1, AS/NZS CISPR 15, AS/NZS CISPR 32, Chinese-Taipei (Taiwan) BSMI CNS 15936 and Korea (RRA) KS C 9811, KS C 9814-1, KS C 9815, KS C 9832, KS C 9610-6-3 & KS C 9610-6-4.

The radiated emissions test site is a 3- and 10-meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

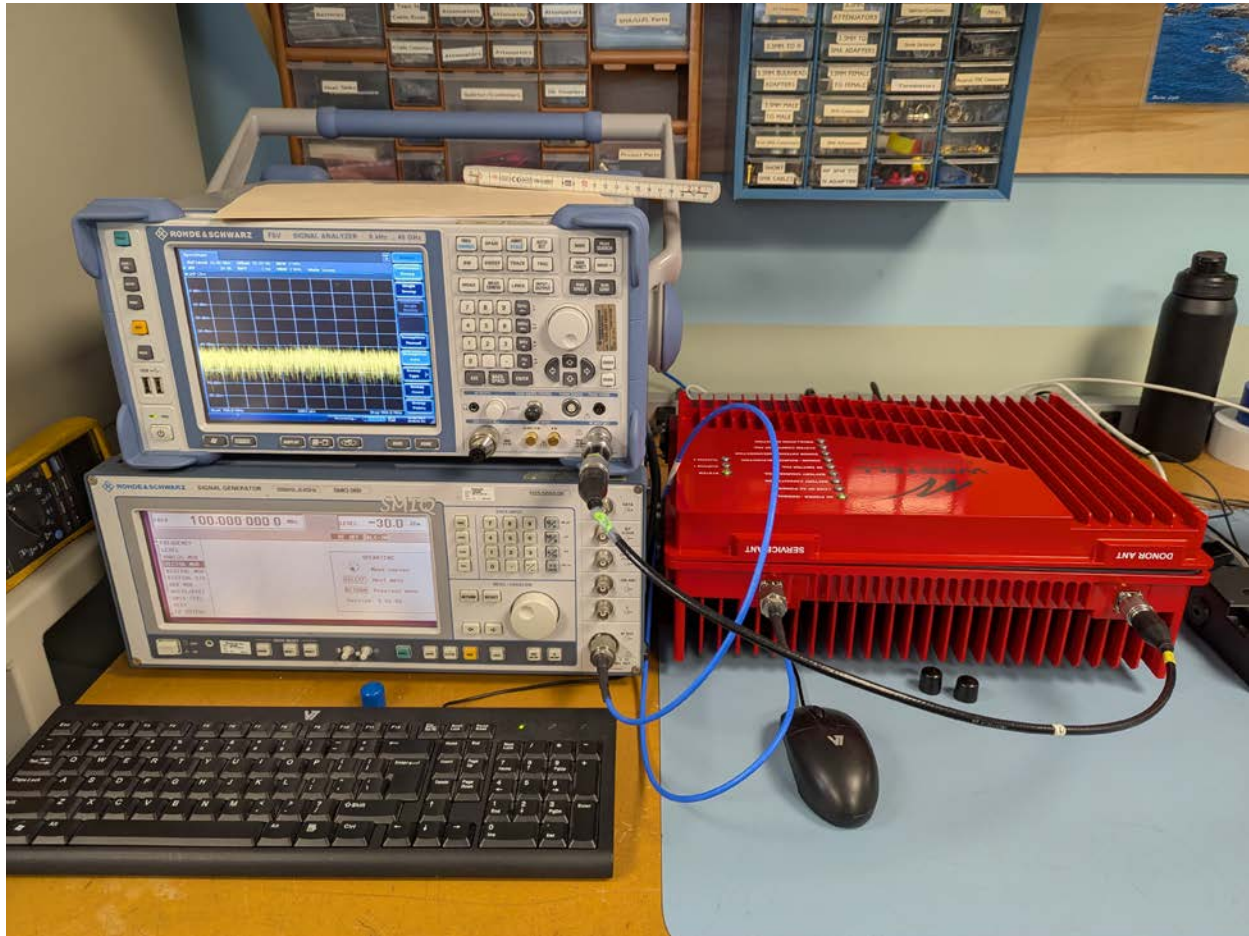
The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane. A second conducted emissions site is also located in the basement of the OATS site with a 2.3 x 2.5-meter ground plane and a 2.4 x 2.4-meter vertical wall.

The radiated emissions test site for measurements above 1GHz is a 3 Meter open area test site (OATS) with a 3.6 by 3.6-meter anechoic absorber floor patch to achieve a quasi-free space measurement environment per ANSI C63.4/C63.10 and CISPR 16-1-4 standards.

The sites are designed to test products or systems 1.5 meters W x 1.5 meters L x 2.0 meters H, floor standing or tabletop.

8. Test Setup Photographs

8.1 Antenna Port Conducted Emissions



8. Test Setup Photographs (cont)

8.2 Radiated Emissions (Front)



8. Test Setup Photographs (cont)

8.3 Radiated Emissions (Rear)



8. Test Setup Photographs (cont)

8.4 Radiated Emissions Above 1 GHz (Front)



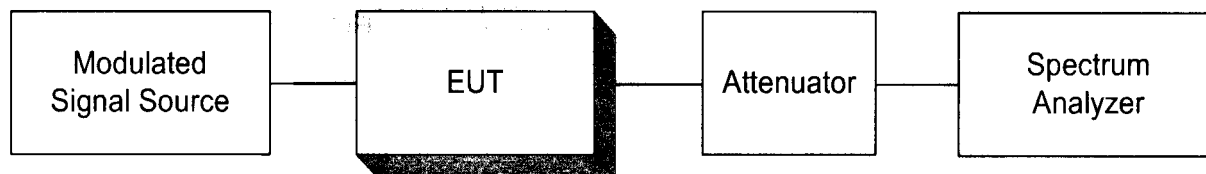
8. Test Setup Photographs (cont)

8.5 Radiated Emissions Above 1 GHz (Rear)

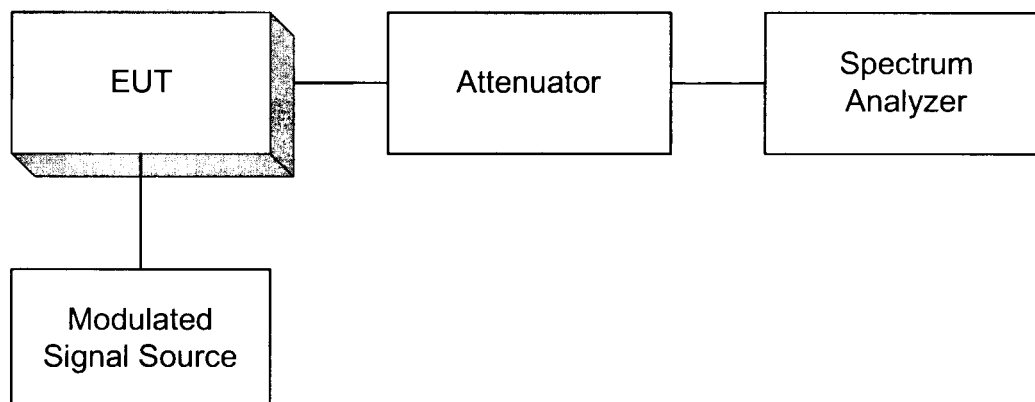


Appendix A

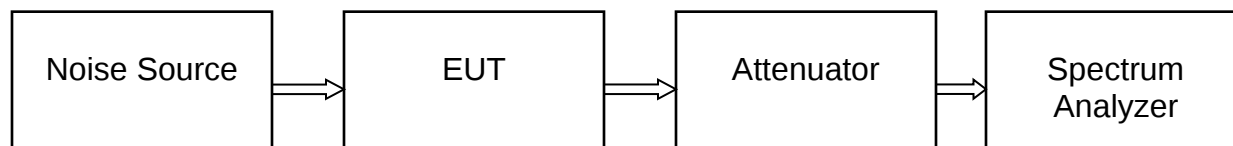
RF Output Power



Occupied Bandwidth

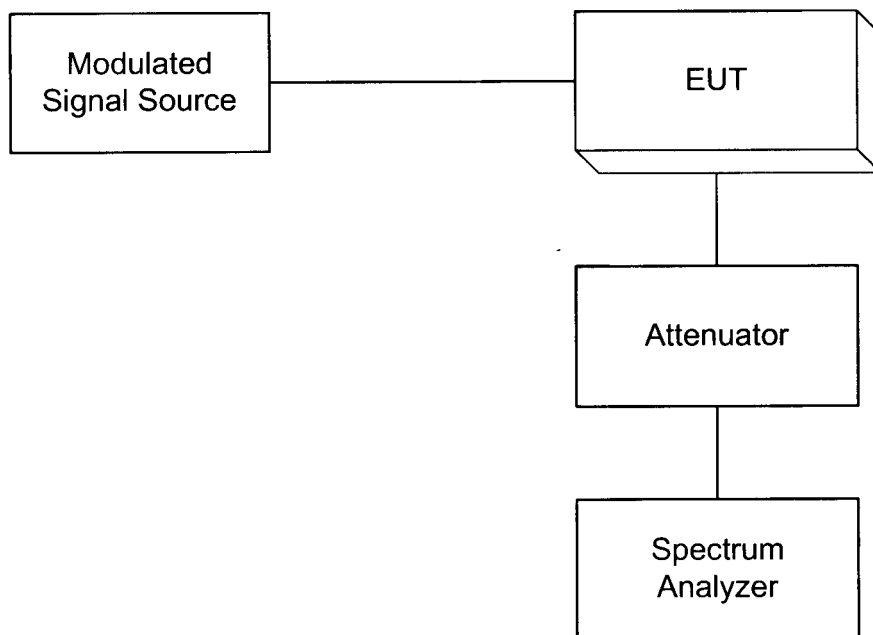


Noise Figure



Appendix A

Spurious Emissions at the Antenna Terminals



Field Strength of Spurious Radiation

