

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBDK4G Base Station Transceiver

Tested in accordance with:

FCC 47 CFR Parts 22 and 90

RSS-119 Issue 12
RSS-Gen Issue 5

Report Revision: 1

Issue Date: 14 October 2022

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Test Technician

CHECKED & APPROVED BY: M. C. James


Laboratory Technical Manager



FCC Registration: 838288
ISED Registration: 737A

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

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FCC ID: CASTBDK4G
IC: 737A-TBDK4G

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REVISION HISTORY

Date	Revision	Comments
14 October 2022	1	Initial test report

INTRODUCTION

Type approval testing of the TBDK4G, 35 Watt, Base Station transceiver in order to demonstrate compliance with FCC 47 Part 90, and RSS-119 Issue 12 & RSS-Gen Issue 5. This radio supports analogue, digital FFSK, Digital Mobile Radio (DMR) and APCO P25 phase-1 modulations.

REPORT PREPARED FOR

Tait International Limited
245 Wooldridge Road
Harewood
Christchurch 8051
New Zealand

DESCRIPTION OF SAMPLE

Manufacturer: Tait International Limited
Equipment: Base Station Transceiver
Type: TBDK4G
Product Code: TB7310-K4B0-0000-0000-10
Serial Number(s): 18355446
Frequency range: 762 → 869 MHz
Transmit Power: 35 Watts

Modulation		Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
Analogue FM		12.5 kHz	1	-	-
		25.0 kHz	1	-	-
FFSK	Fast Frequency Shift Keying	12.5 kHz	-	1200	1200
Digital Mobile Radio (DMR)	4 Level FSK (2 slot TDMA) (ETSI TS102 361-1)	12.5 kHz	2	4800	9600
APCO P25 Phase 1	C4FM (TIA 102)	12.5 kHz	1	4800	9600

HARDWARE & SOFTWARE

Quantity: 1

Module	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01403-NAAA	18354632	p25-3.35.00.0005 & dmr-3.35.00.0005	3
Power Amplifier	T01-01405-NAZZ	18376132	-	0.02
Front Panel	T01-01410-AAAA	4874246	1.10.04.0004	0.01

TEST CONDITIONS

All testing was performed between 23 September → 5 October, and 13 October 2022, and under the following conditions:

Ambient temperature: 15°C → 30°C

Relative Humidity: 20% → 75%

Standard Test Voltage 13.8 V_{DC}

Except OATS testing which was performed at 16°C and 86% humidity, and GNSS Radiated testing which was performed at 13.2°C and 50% humidity.

TEST REQUIREMENTS AND RESULT SUMMARY

ISED Specification	FCC Specification	Test Name	Test Methods	Result
RSS-119 5.4	FCC 47 CFR 2.1046	Transmitter Output Power (Conducted)	RSS-Gen 6.12 ANSI C63.26 5.2.4.2	P
No specification	FCC 47 CFR 2.1047 (a)	Transmitter Audio Frequency Response – Pre-emphasis	ANSI C63.26 5.3.3.2	P
No specification	FCC 47 CFR 2.1047 (b)	Transmitter Modulation Limiting	ANSI C63.26 5.3.2	P
RSS-119 5.5	FCC 47 CFR 2.1049 (c)	Transmitter Occupied (99%) Bandwidth	RSS-Gen 6.7 ANSI C63.26 5.4.4	P
RSS-119 5.5	FCC 47 CFR 90.210	Transmitter Spectrum Masks	RSS-119 4.2.2 TIA-603-E 2.2.11	P
RSS-119 5.8.9	FCC 47 CFR 90.543	Adjacent Channel Power Ratio	RSS-119 4.3 ANSI C63.26 6.5.2.4	P
RSS-119 5.8	FCC 47 CFR 2.1051	Transmitter Spurious Emissions (Conducted)	RSS-Gen 6.13 ANSI C63.26 5.7	P
RSS-119 5.8	FCC 47 CFR 2.1053	Transmitter Spurious Emissions (Radiated)	RSS-Gen 6.13 ANSI C63.26 5.5	P
No specification	FCC CFR 90.543	Transmitter Radiated Emissions in the GNSS Band	ANSI C63.26 6.5.2.7.3	P
RSS-119 5.8.9.2 rad	No specification	Transmitter Conducted Emissions in the GNSS Band	RSS-119 5.8 ANSI C63.26 6.5.2.7.4	P
RSS-119 5.9	FCC 47 CFR 90.214	Transient Frequency Behaviour	RSS-119 5.9 ANSI C63.26 6.5.2.2	N/A 1
RSS-119 5.3	FCC 47 CFR 90.214	Transmitter Frequency Stability - Temperature	RSS-Gen 6.11 ANSI C63.26 5.6.4	P1
RSS-119 5.3	FCC 47 CFR 2.1055 (d) (1)	Transmitter Frequency Stability - Voltage	RSS-Gen 6.11 ANSI C63.26 5.6.5	P1
RSS-Gen 7.4	FCC 47CFR 15.111	Receiver Spurious Emissions (Conducted)	RSS-Gen 7.4 TIA-603-E 2.1.2	P

Test Case Result Definitions	
No test Performed	N
Test does not apply to the test object	N/A
Test object meets requirements	P (Pass)
Test object does not meet requirements	F (Fail)
Test object is not conclusive	I (Inconclusive)

Comments:
N/A 1: Only required where the EUT transmits in the 138-174 or 406.1-512 MHz band
P1: A 10 MHz frequency reference was supplied to the EUT for this test.

STATEMENT OF COMPLIANCE

We, TELTEST LABORATORIES of 558 Wairakei Road, Christchurch, New Zealand, declare under our sole responsibility that the product:

Equipment: Base Station Transceiver
Type: TBDK4G

Module	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01403-NAAA	18354632	p25-3.35.00.0005 & dmr-3.35.00.0005	3
Power Amplifier	T01-01405-NAZZ	18376132	-	0.02
Front Panel	T01-01410-AAAA	4874246	1.10.04.0004	0.01

to which this declaration relates, is in conformity with the following standards:

FCC 47 CFR Part 90

RSS-119 Issue 12 & RSS-Gen Issue 5

Signature: 

Mike James
Technical Manager

Date: 31 October 2022

The results obtained in this test report pertain only to the item(s) tested. Teltest does not make any claims of compliance for samples or variants that were not tested.

LIST OF ANTENNA INTENDED FOR USE WITH THE DEVICE

The equipment tested has a 50 Ω coaxial antenna connection. No antenna was fitted to the EUT during testing the parameters in this report.

Antennas and transmitter power settings are selected with regard to the overall loss of the antenna system, the desired coverage and the EIRP limit of the license.

The radio manufacturer (Tait) does not manufacture specific antennas for this equipment but suggests the following from other suppliers.

Manufacturer	Part Number	Tuning Bandwidth and / or Frequency Range - MHz	Gain - dBd (dBi)
RFI	COL81-806	746-806 MHz	0 (2.1)
RFI	COL81-870	806-870 MHz	0 (2.1)
RFI	COL84-806	746-806 MHz	5 (7.1)
RFI	COL84-870	806-870 MHz	5 (7.1)
RFI	COL85-806	746-806 MHz	7 (9.1)
RFI	COL85-870	806-870 MHz	7 (9.1)
RFI	COL811-806	746-806 MHz	9 (11.1)
RFI	COL811-824	796-824 MHz	9 (11.1)
RFI	COL811-870	806-870 MHz	9 (11.1)
dB Spectra	DS7D03F36U-D or N	746-806 MHz	3 (5.1)
dB Spectra	DS7D06F36U-D or N	746-806 MHz	6 (8.1)
dB Spectra	DS7D09F36U-D or N	746-806 MHz	8 (10.1)
dB Spectra	DS7D10F36U-D or N	746-806 MHz	10 (12.1)
dB Spectra	DS7A06F36U-D or N	746-869 MHz	6 (8.1)
dB Spectra	DS7A08F36U-D or N	746-869 MHz	8 (10.1)
dB Spectra	DS7A06F36D-D or N	746-869 MHz	2 x 6 (8.1)
dB Spectra	DS7C09F36U-D or N	746-869 MHz	9 (11.1)
dB Spectra	DS7C10F36U-D or N	746-869 MHz	10 (12.1)
dB Spectra	DS7B12F36U-D or N	764-806 MHz	12 (14.1)
dB Spectra	DS7E12F36U-D or N	794-824 MHz	12 (14.1)
dB Spectra	DS8A03F36U-D or N	806-869 MHz	3 (5.1)
dB Spectra	DS8A06F36U-D or N	806-869 MHz	6 (8.1)
dB Spectra	DS8A09F36U-D or N	806-869 MHz	9 (11.1)
dB Spectra	DS8A10F36U-D or N	806-869 MHz	10 (12.1)
dB Spectra	DS8A12F36U-D or N	806-869 MHz	12 (14.1)
dB Spectra	DS8A06F36D-D or N	806-869 MHz	2 x 6 (8.1)
dB Spectra	DS8A09F36D-D or N	806-869 MHz	2 x 9 (11.1)
dB Spectra	DS8A03F36T-D or N	806-869 MHz	3 x 3 (5.1)
dB Spectra	DS8A03F36T-D or N	806-869 MHz	3 x 6 (8.1)

CHANNEL TABLE

Channel Number	Transmit Frequency MHz	Receive Frequency MHz	Power Watts	Channel Spacing kHz
1	768.025	794.05	35	12.5
2	768.025	794.05	2	12.5
3	769.075	794.05	35	12.5
4	769.075	794.05	2	12.5
5	774.9	794.05	35	12.5
6	774.9	794.05	2	12.5
7	775.975	800.05	35	12.5
8	775.975	800.05	2	12.5
9	851.025	800.05	35	12.5
10	851.025	800.05	2	12.5
11	860.025	823.95	35	12.5
12	860.025	823.95	2	12.5
13	868.975	823.95	35	12.5
14	868.975	823.95	2	12.5
15	768.025	794.05	35	25.0
16	768.025	794.05	2	25.0
17	769.075	794.05	35	25.0
18	769.075	794.05	2	25.0
19	774.9	794.05	35	25.0
20	774.9	794.05	2	25.0
21	775.975	800.05	35	25.0
22	775.975	800.05	2	25.0
23	851.025	800.05	35	25.0
24	851.025	800.05	2	25.0
25	860.025	823.95	35	25.0
26	860.025	823.95	2	25.0
27	868.975	823.95	35	25.0
28	868.975	823.95	2	25.0

MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

MODULATION TYPES:

F3E	FM Analogue Voice	-	-
F2D	Fast Frequency Shift Keying	1200 symbols/sec	1200 bps
F1E	C4FM	4800 symbols/sec	9600 bps
F1D	C4FM	4800 symbols/sec	9600 bps
FXW	Digital Voice / Data	4800 symbols/sec	9600 bps
FXD	Digital Data	4800 symbols/sec	9600 bps

CHANNEL SPACING: 12.5 kHz & 25.0 kHz

EMISSION DESIGNATORS:

Analogue Voice	11K0F3E & 16K0F3E
FFSK	7K60F2D
P25 Phase 1 Digital Voice	8K10F1E
P25 Phase 1 Digital Data	8K10F1D
DMR Digital Voice / Data	8K00FXW
DMR Digital Data	8K00FXD

Equation: $B_n = 2M + 2Dk$

(M is highest modulating frequency; D is peak allowable deviation; k is a constant of 1 for FM)

Analogue Voice 12.5 kHz Channel Spacing

Necessary bandwidth	Emission Designator
M = 3.0 kHz	11K0F3E
D = 2.5 kHz	F3E represents an FM voice transmission
$B_n = (2 \times 3.0) + (2 \times 2.5) \times 1$ $= 11.0 \text{ kHz}$	

Analogue Voice 25.0 kHz Channel Spacing

Necessary bandwidth	Emission Designator
M = 6.0 kHz	16K0F3E
D = 5 kHz	F3E represents an FM voice transmission
$B_n = (2 \times 6.0) + (2 \times 5) \times 1$ $= 16.0 \text{ kHz}$	

Fast Frequency Shift Keying (FFSK – 1200 bps) 12.5 kHz Channel Spacing

Necessary bandwidth	Emission Designator
M = 1.8 kHz	7K60F2D
D = 2.0 kHz	F2D represents a FM data transmission with the use of a modulating sub carrier
$B_n = (2 \times 1.8) + (2 \times 2.0) \times 1$ $= 7.6 \text{ kHz}$	

APCO P25 Phase 1 (C4FM): Digital Voice, 12.5 kHz Channel Spacing

99% bandwidth
= 8.1 kHz

Emission Designator

8K10F1E

F1E represents a digital FM voice transmission

APCO P25 Phase 1 (C4FM): Digital Data, 12.5 kHz Channel Spacing

99% bandwidth
= 8.1 kHz

Emission Designator

8K10F1D

F1D represents an digital FM data transmission

DMR: Digital Voice, 12.5 kHz Channel Spacing

99% bandwidth
= 8.0 kHz

Emission Designator

8K00FXW

FXW represents a FM Time Division Multiple Access
(TDMA) combination of data and telephony

DMR: Digital Data, 12.5 kHz Channel Spacing

99% bandwidth
= 8.0 kHz

Emission Designator

8K00FXD

FXD represents FM Time Division Multiple Access (TDMA)
data only

TEST RESULTS

TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046
RSS-119 5.4

GUIDE: ANSI C63.26 5.2.4.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up.
2. The coaxial attenuator has an impedance of 50 Ohms.
3. The unmodulated output power was measured with an RF Power meter.

EXAMPLE CALCULATION:

Power in dBm =	Measured power (dBm) + attenuator and cable loss (dB)
Chan 1 power (dBm) =	13.61 dBm + 31.96 dB
	= 45.57dBm
Power in Watts =	$(10^{(45.57\text{dBm}/10)})/1000$
	= 36.1W

MEASUREMENT RESULTS:

Manufacturer's Rated Output Power:

Switchable: 35 W and 2 W

Nominal 35 W	Measured (W)	Variation (%)	Variation (dB)
768.025 MHz	36.1	3.1	0.1
769.075 MHz	36.3	3.7	0.2
774.9 MHz	37.0	5.6	0.2
775.975 MHz	37.1	5.9	0.2
851.025 MHz	38.2	9.2	0.4
860.025 MHz	38.2	9.1	0.4
868.975 MHz	38.1	8.9	0.4
Measurement Uncertainty		± 0.6 dB	

Transmitter Output Power (Conducted) - continued

Nominal 2 W	Measured (W)	Variation (%)	Variation (dB)
768.025 MHz	2.0	1.5	0.1
769.075 MHz	2.0	1.8	0.1
774.9 MHz	2.1	3.4	0.1
775.975 MHz	2.1	3.3	0.1
851.025 MHz	2.2	8.0	0.3
860.025 MHz	2.2	8.6	0.4
868.975 MHz	2.2	7.6	0.3
Measurement Uncertainty		± 0.6 dB	

LIMIT CLAUSES:

FCC 47 CFR 90.205 (s)

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

RSS-119 5.4

The output power shall be within ±1.0 dB of the manufacturer's rated power.

TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: ANSI C63.26 5.3.3.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000 Hz was applied with the level set to obtain 20% of maximum deviation. This was used as the 0 dB reference point.
3. The AF was varied while the audio level was held constant.
4. The response in dB relative to 1000 Hz was measured.

MEASUREMENT RESULTS:

See the plots on the following pages for 12.5 kHz and 25.0 kHz channel spacing tested at 35 W transmit power.

LIMIT CLAUSE: TIA/EIA-603E 3.2.6

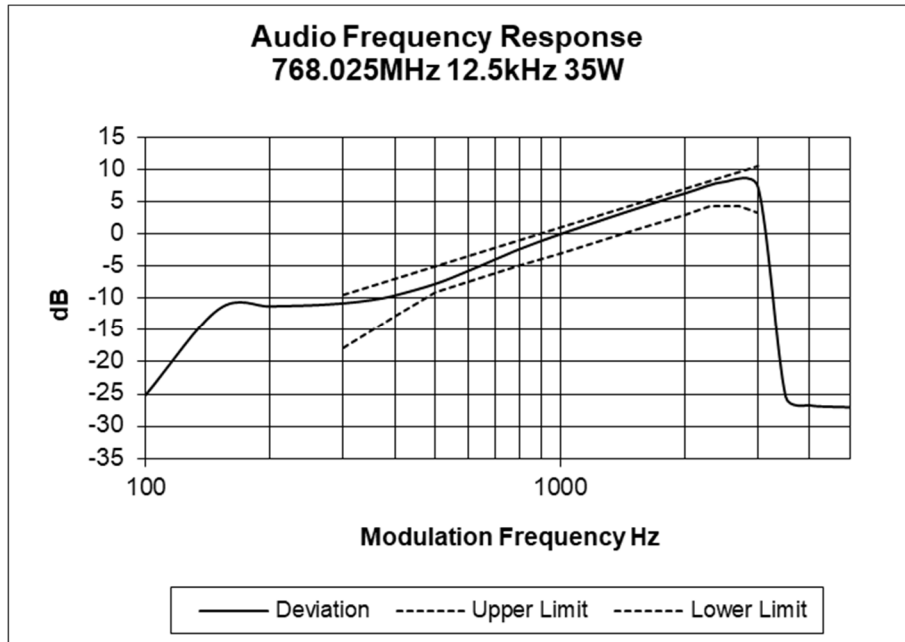
MEASUREMENT UNCERTAINTY: $\pm 1.5 \%$

Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 768.025 MHz

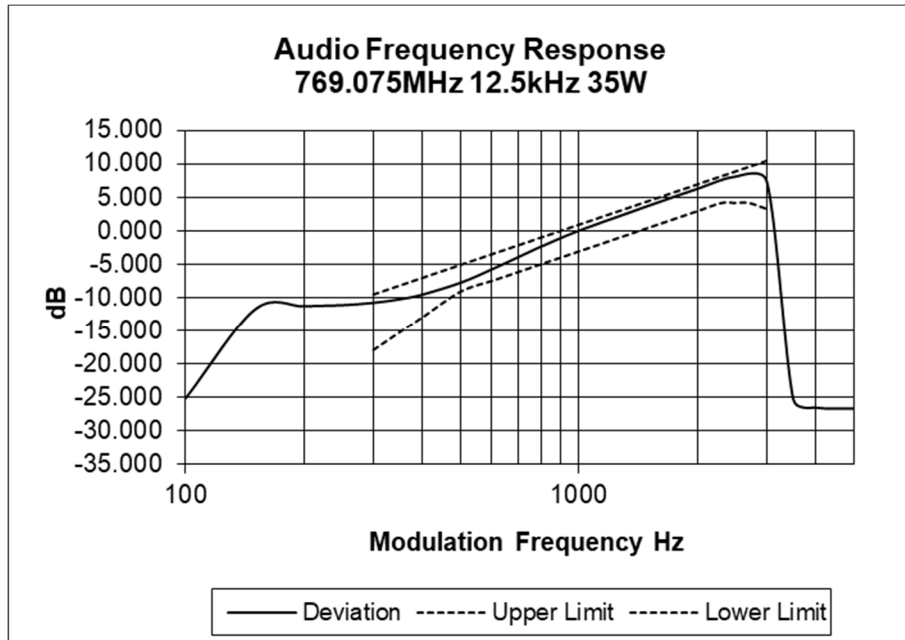
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 769.075 MHz

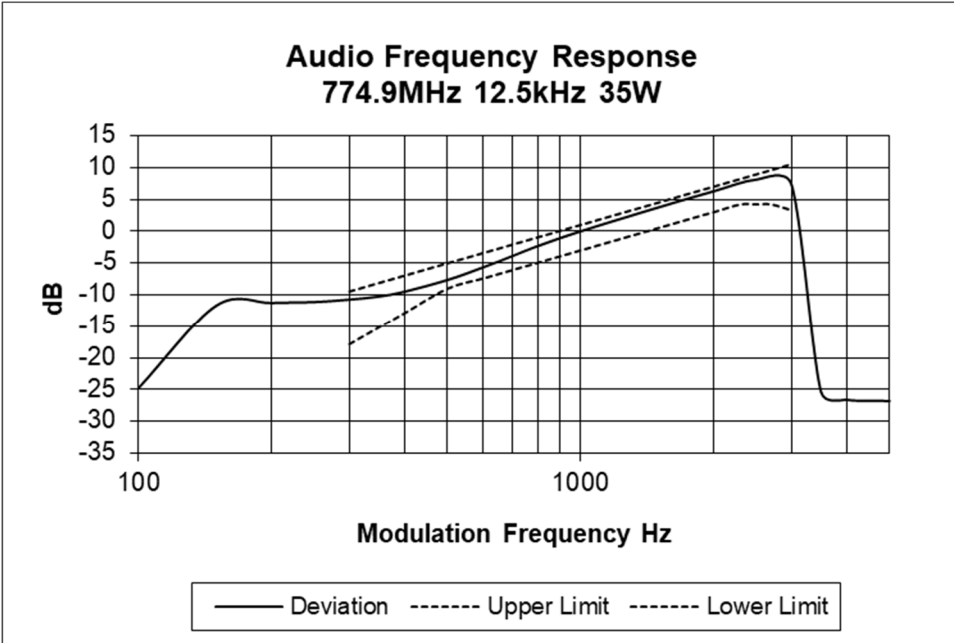
12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

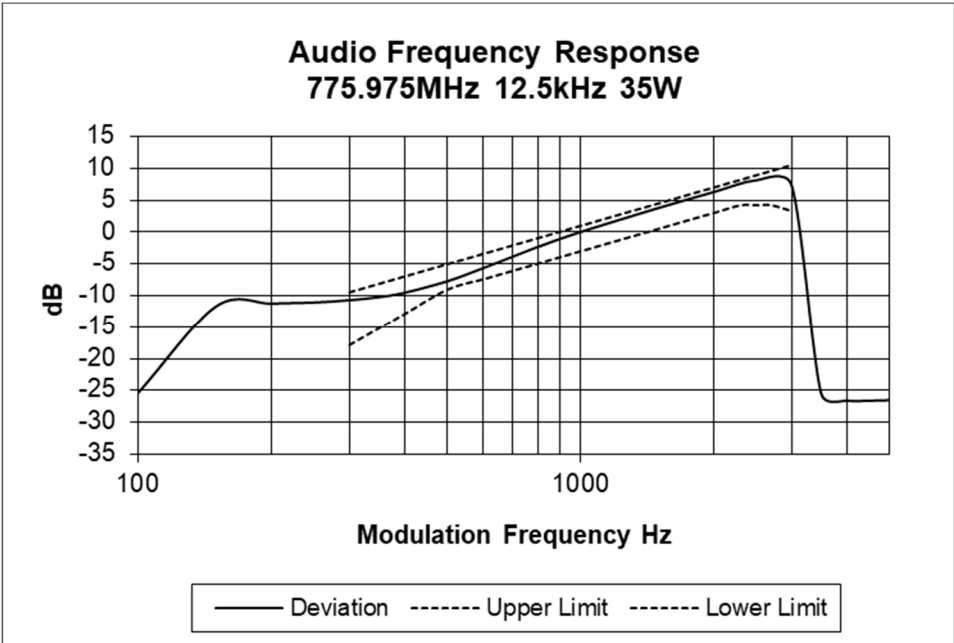
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 774.9 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

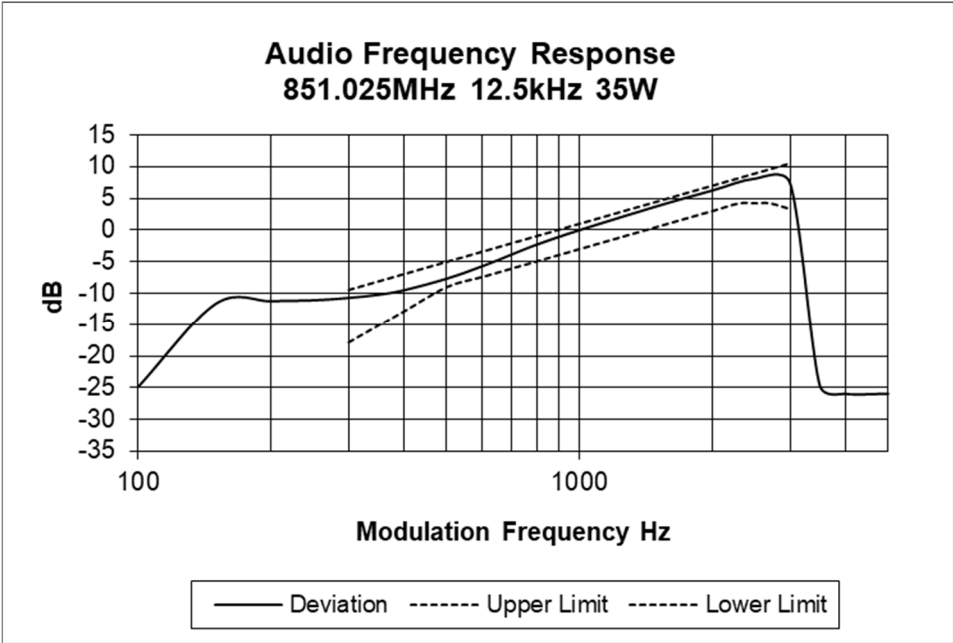
Tx FREQUENCY: 775.975 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

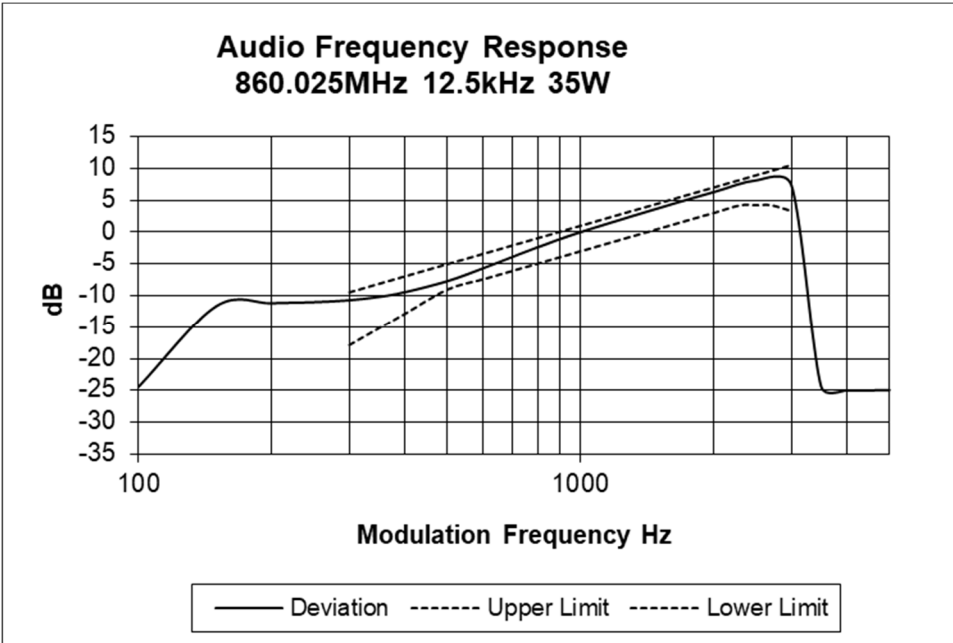
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 851.025 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

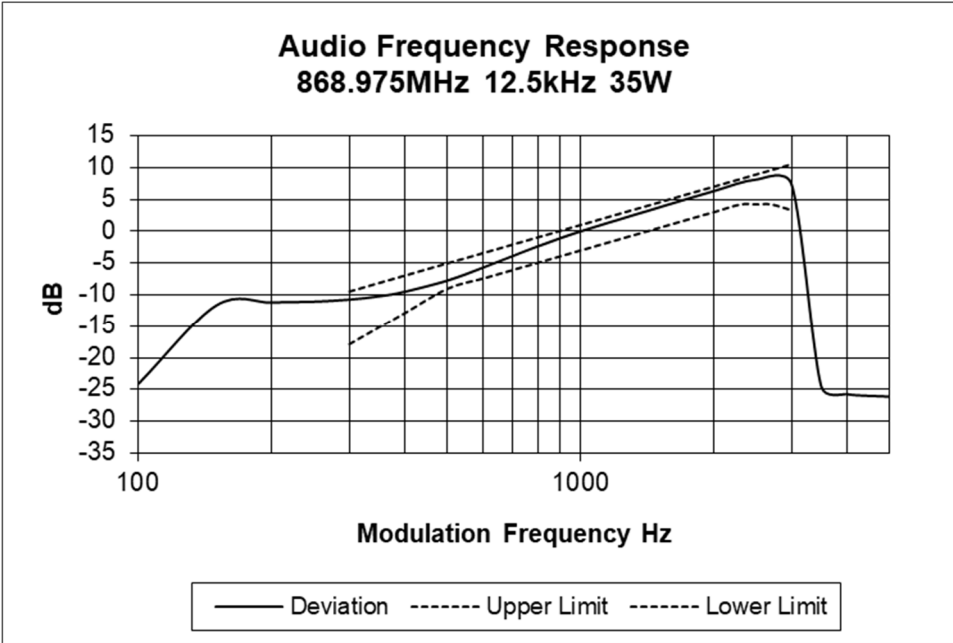
Tx FREQUENCY: 860.025 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

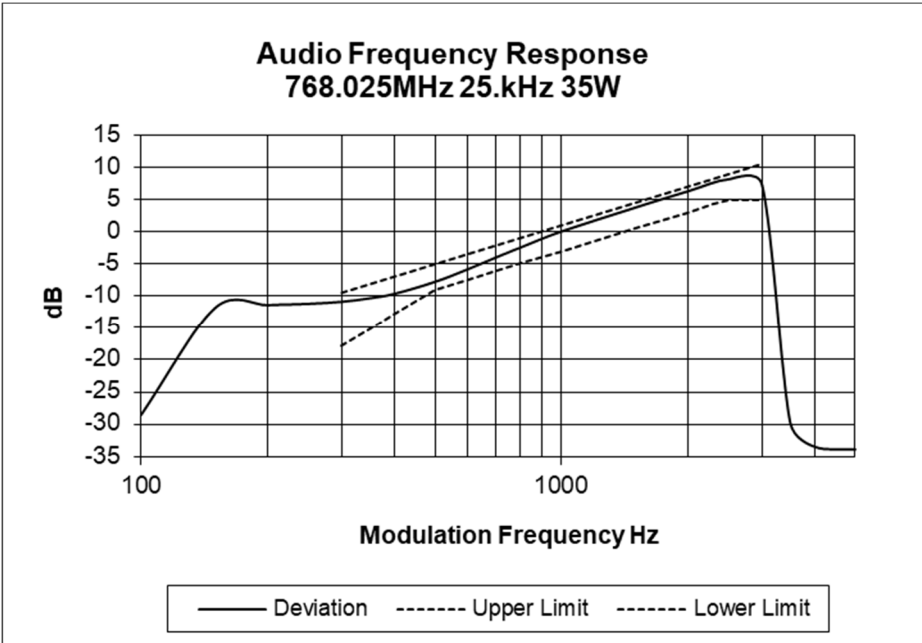
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 868.975 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

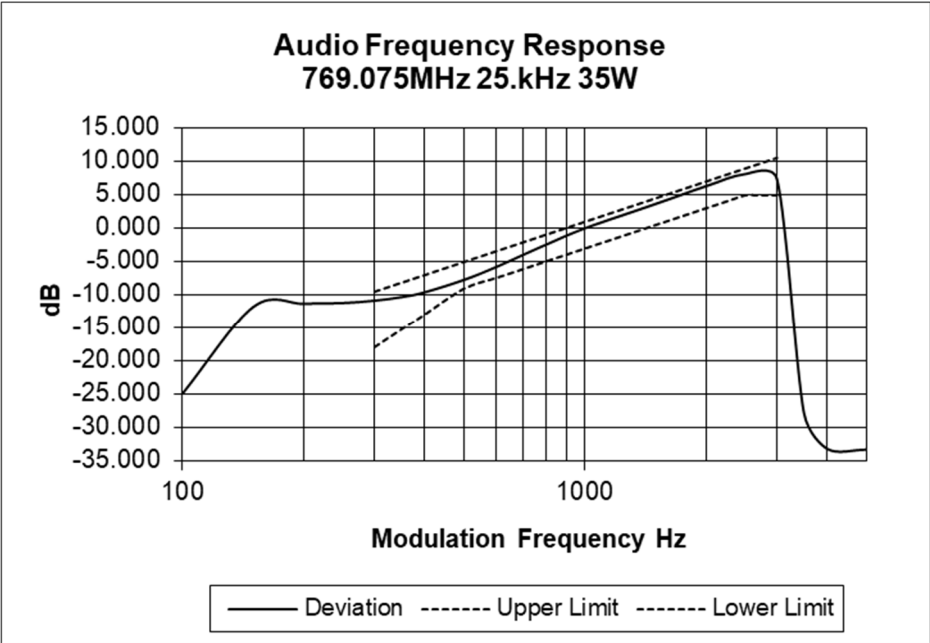
Tx FREQUENCY: 768.025 MHz 25 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

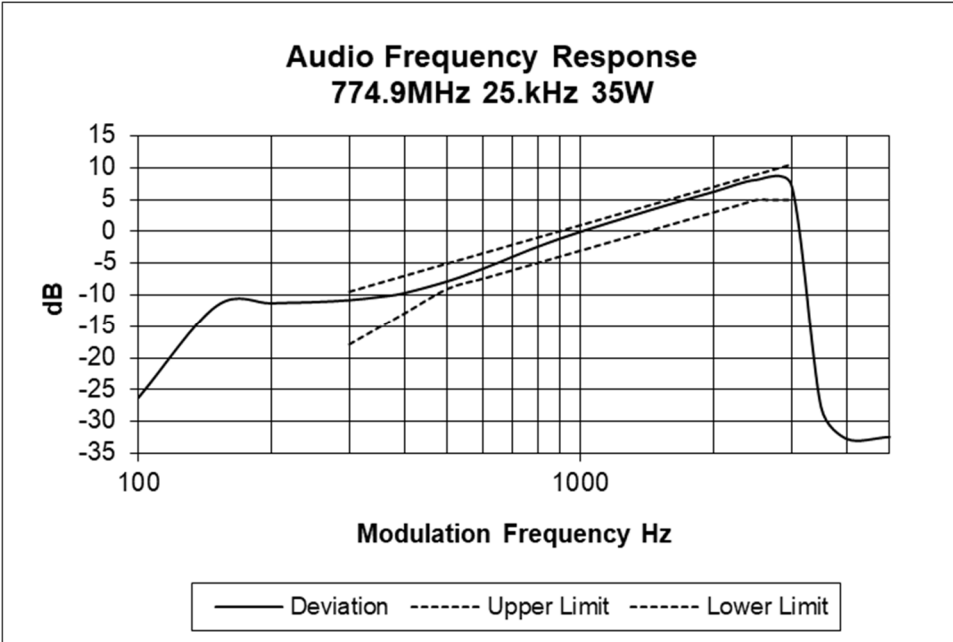
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 769.075 MHz 25 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

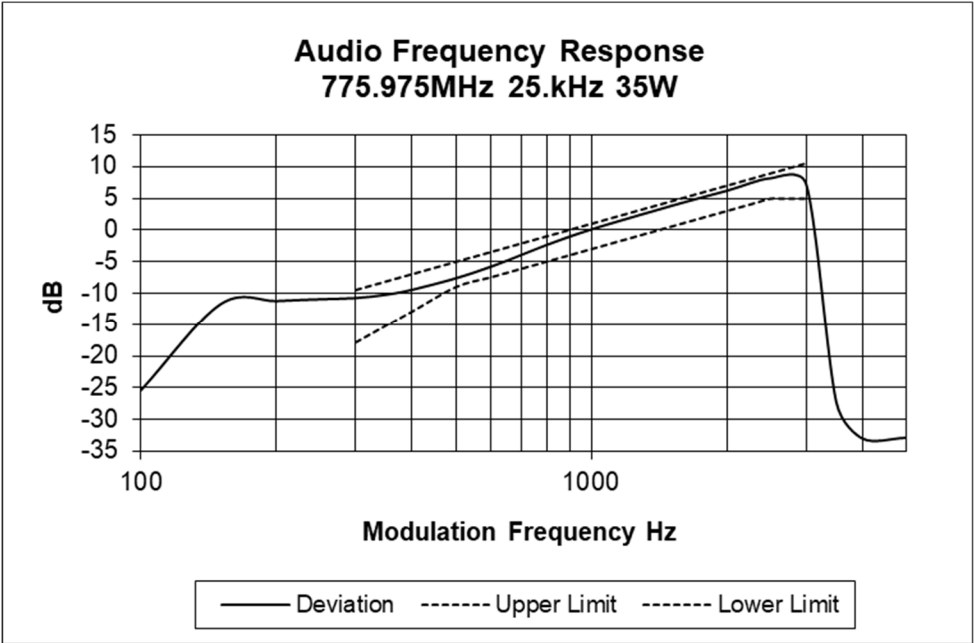
Tx FREQUENCY: 774.9 MHz 25 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

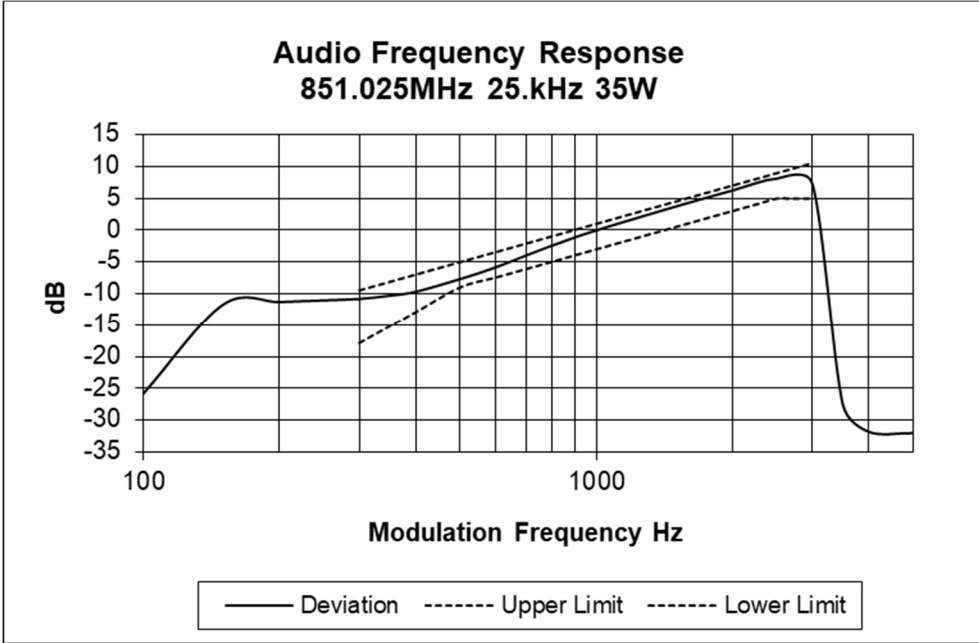
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 775.975 MHz 25 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

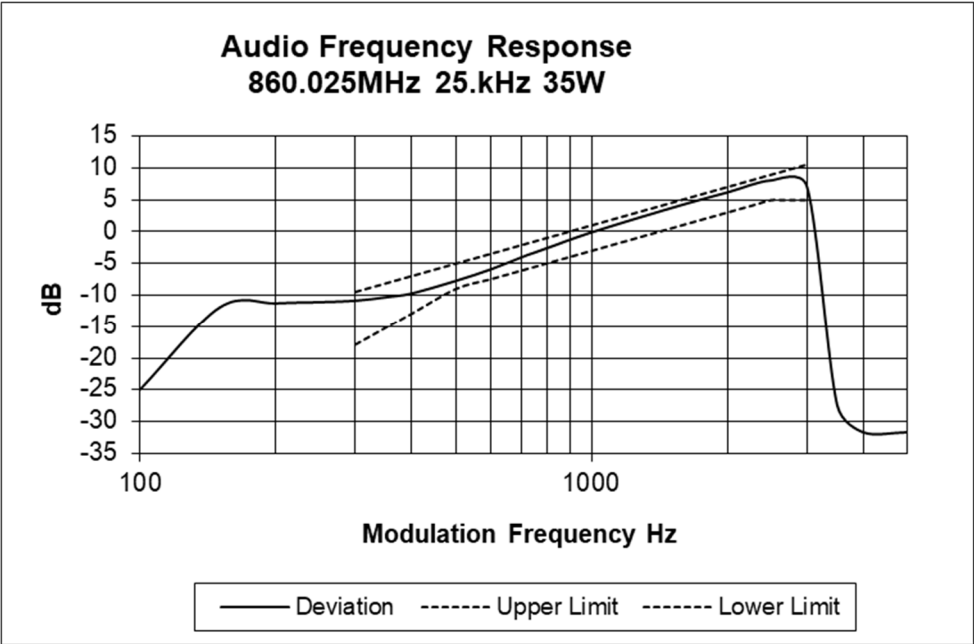
Tx FREQUENCY: 851.025 MHz 25 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

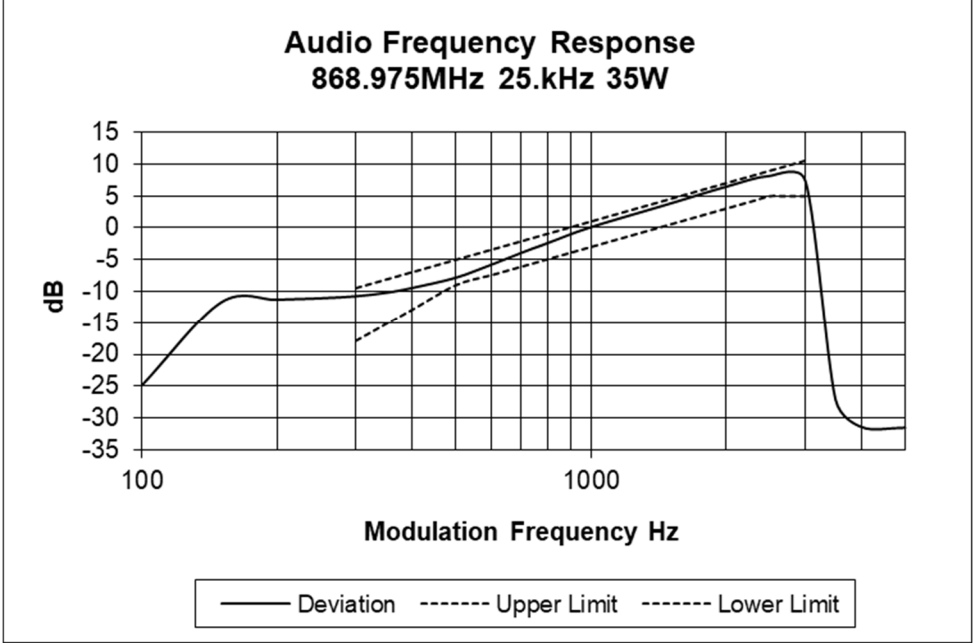
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 860.025 MHz 25 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 868.975 MHz 25 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: ANSI C63.26 5.3.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000 Hz was applied with the level set to obtain 60% of maximum deviation. This was used as the 0 dB reference point.
3. The modulation response was measured at four audio frequencies while increasing the input level in 5dB steps.
4. Additionally the level used to measure sideband spectrum (occupied bandwidth) was included in the level sweep.
5. Measurements were made for both Positive and Negative Deviation.

MEASUREMENT RESULTS:

See the plots on the following pages for 12.5 kHz and 25.0 kHz channel spacing.

LIMIT CLAUSE: TIA/EIA-603E 1.3.4.4

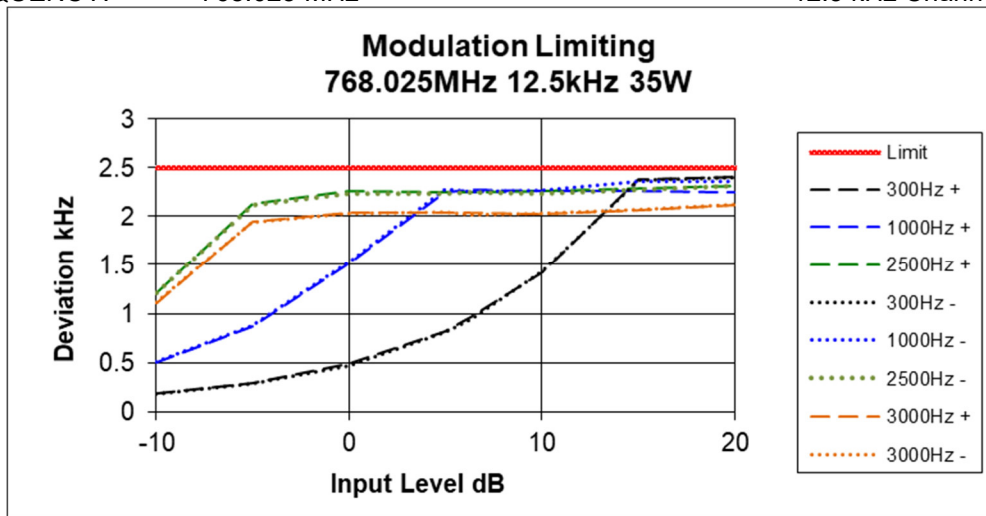
MEASUREMENT UNCERTAINTY: $\pm 1.5 \%$

Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 768.025 MHz

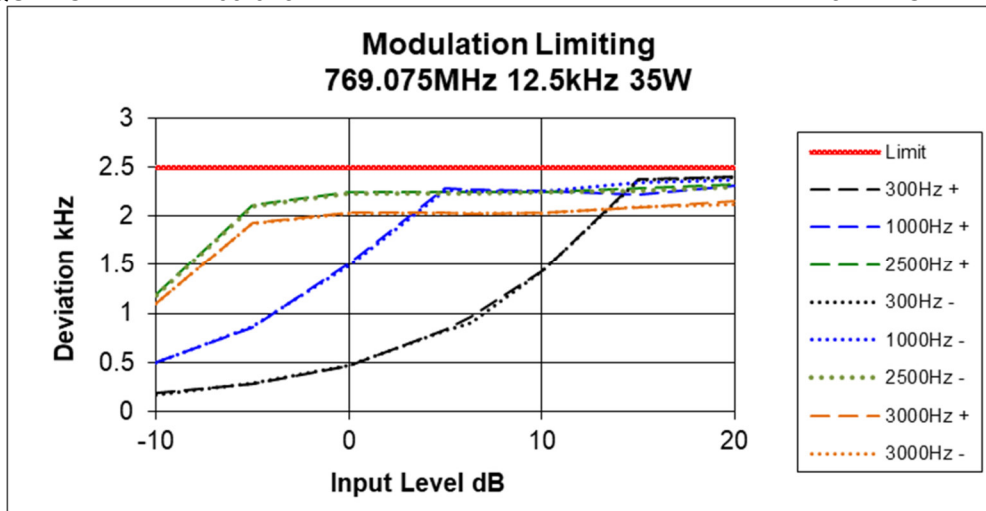
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 769.075 MHz

12.5 kHz Channel Spacing

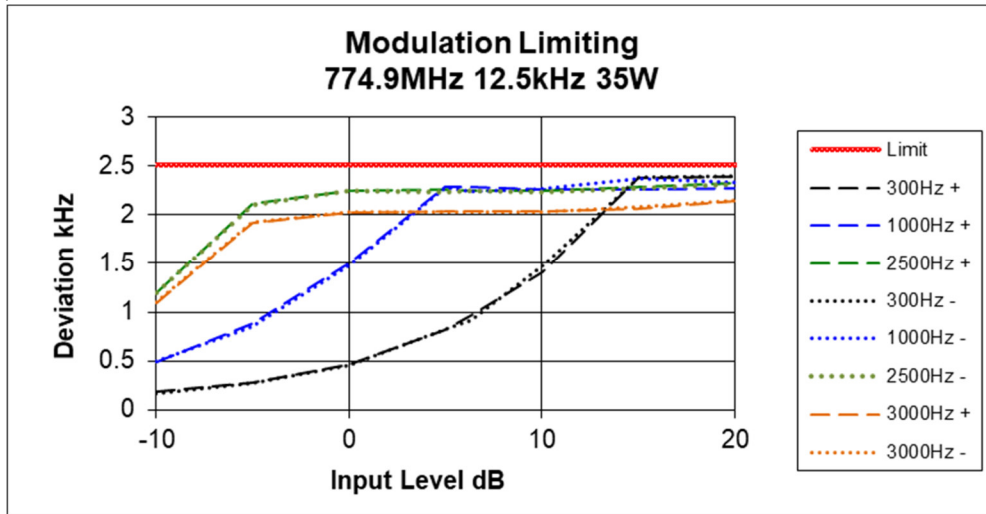


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 774.9 MHz

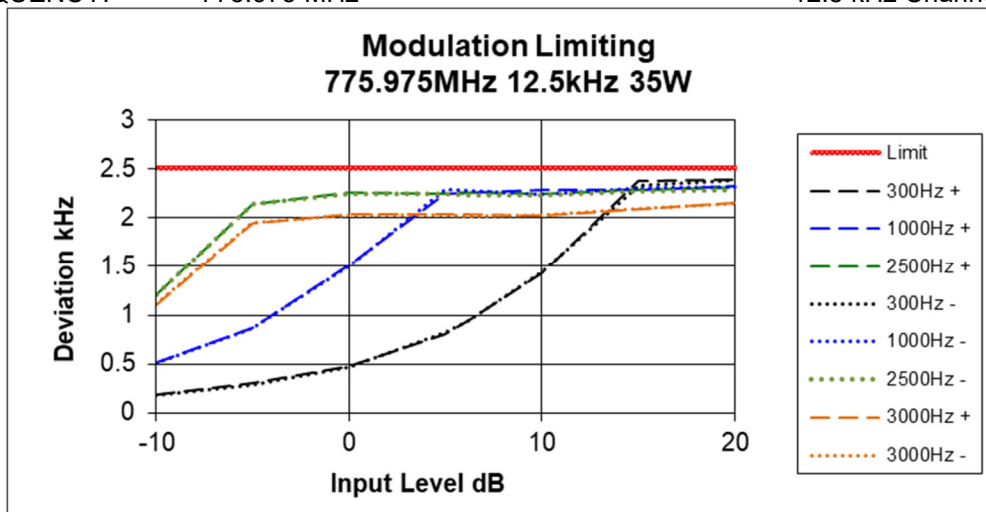
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 775.975 MHz

12.5 kHz Channel Spacing

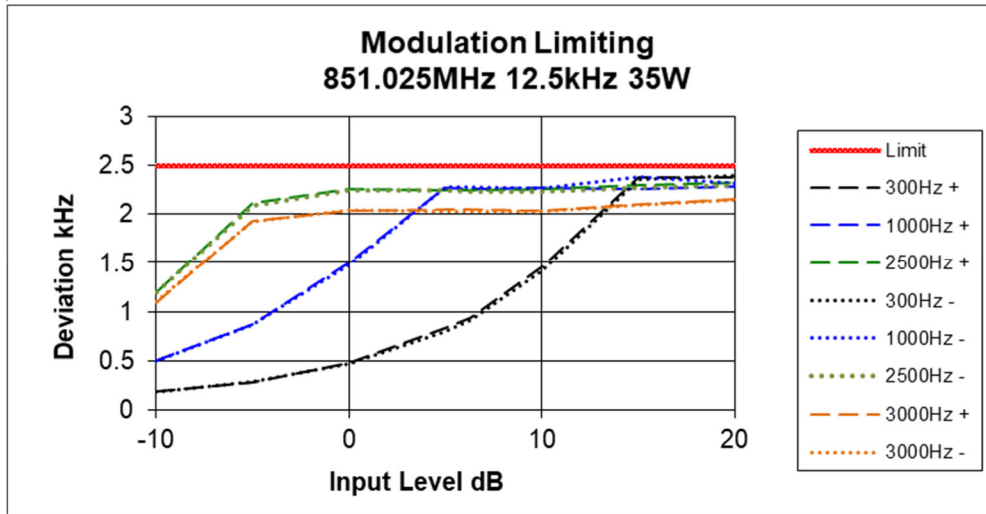


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 851.025 MHz

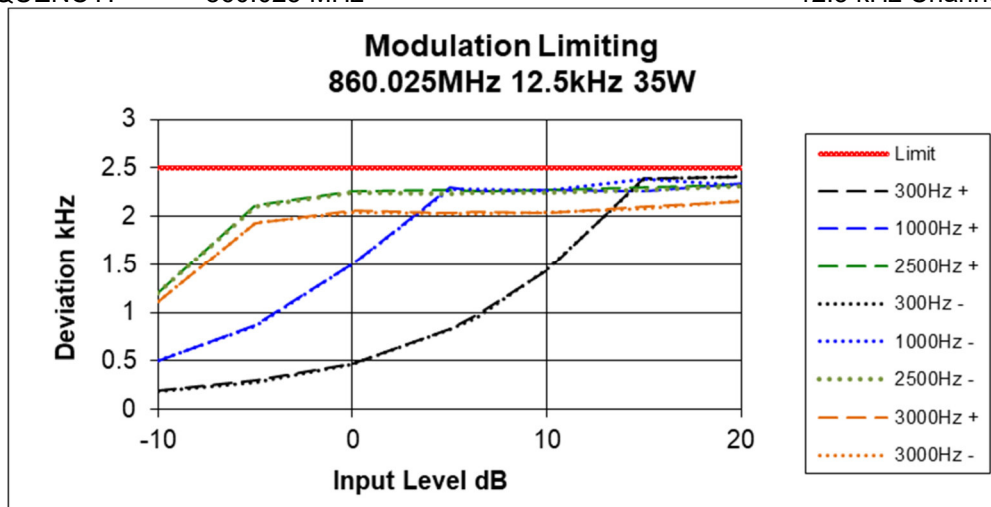
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 860.025 MHz

12.5 kHz Channel Spacing

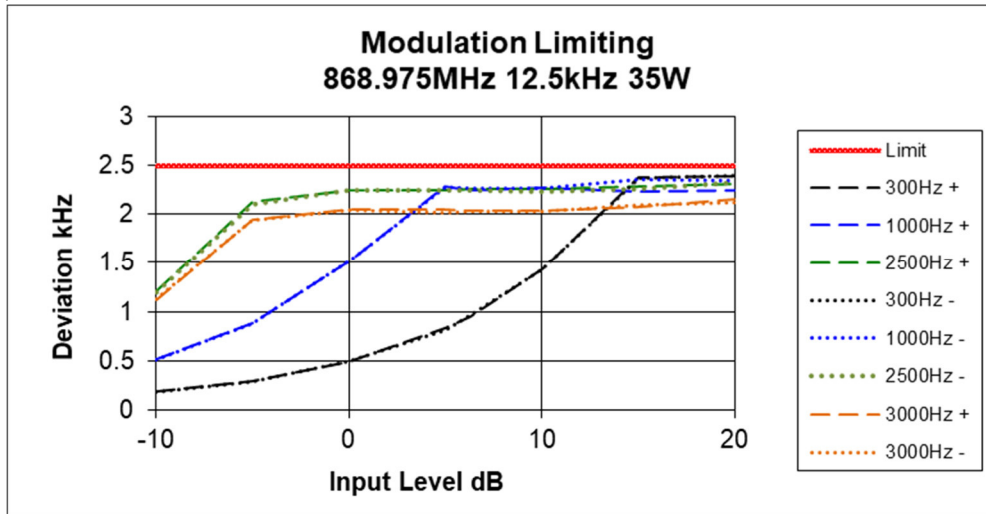


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 868.975 MHz

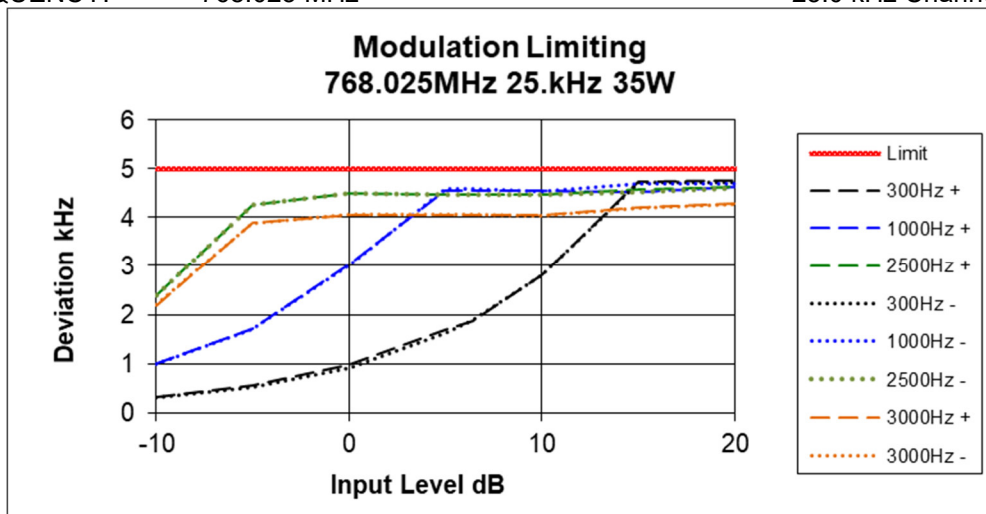
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 768.025 MHz

25.0 kHz Channel Spacing

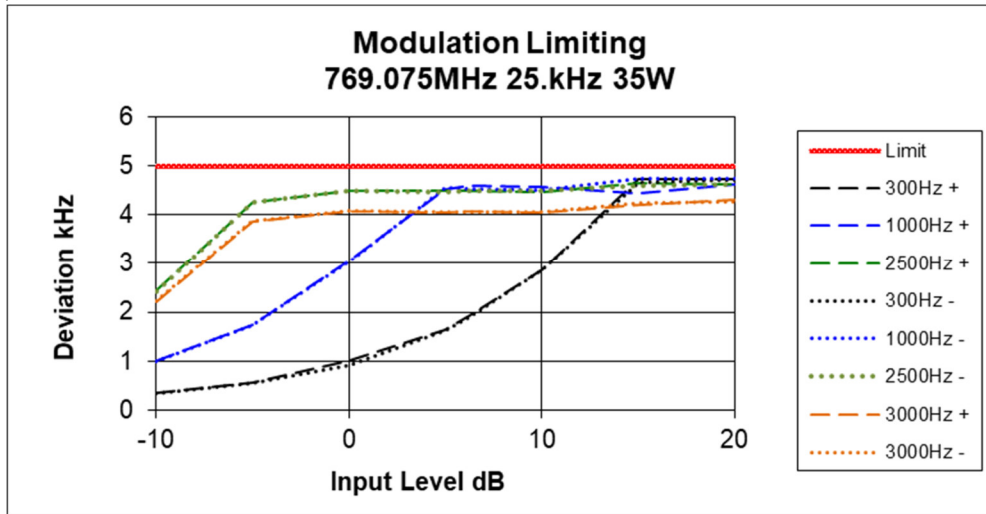


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 769.075 MHz

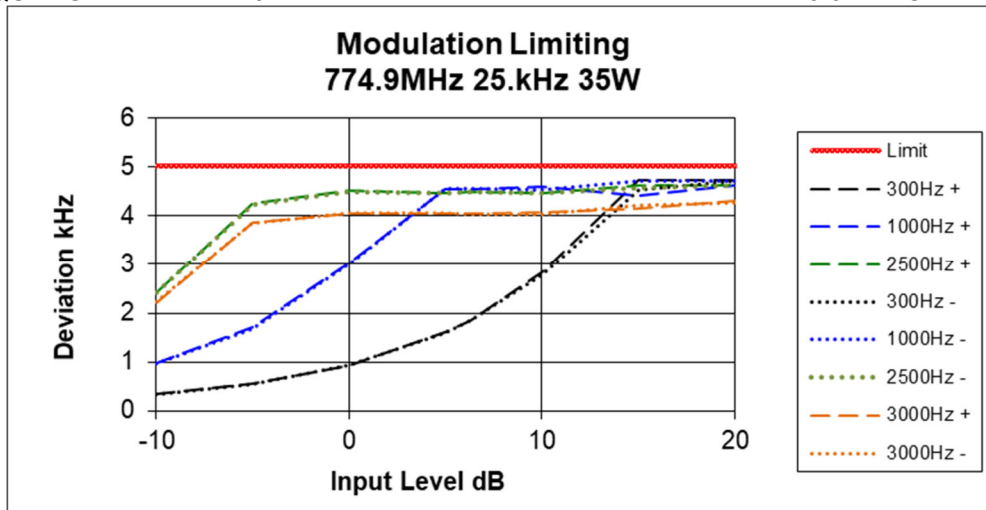
25.0 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 774.9 MHz

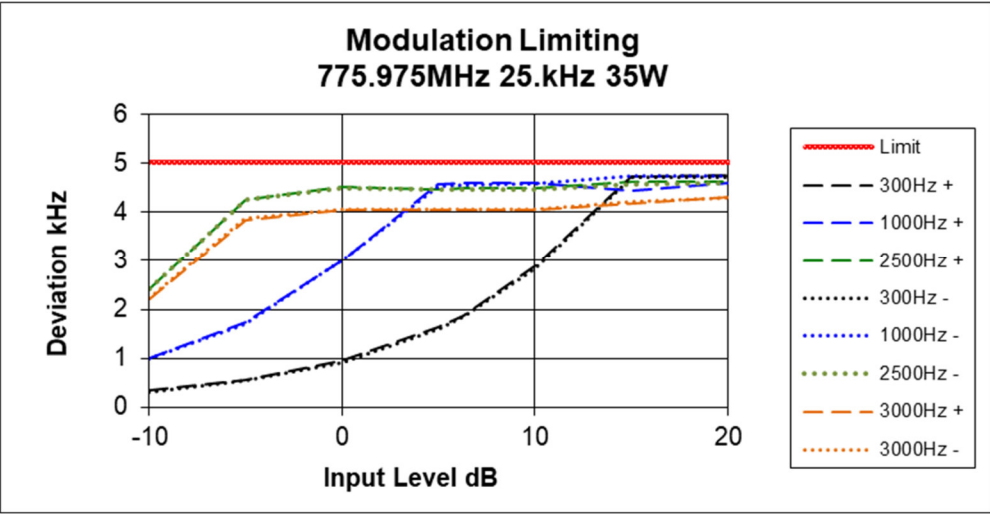
25.0 kHz Channel Spacing



Transmitter Modulation Limiting

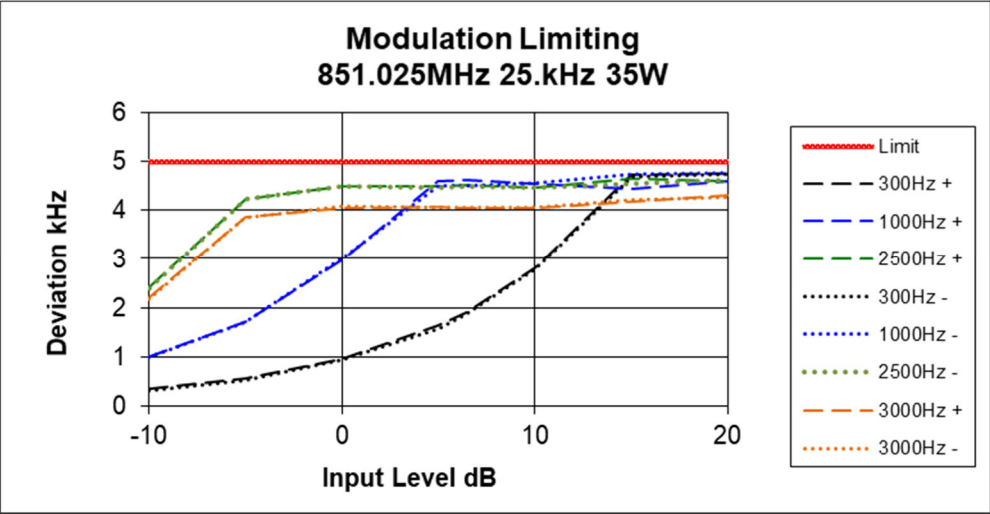
SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 775.975 MHz 25.0 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 851.025 MHz 25.0 kHz Channel Spacing

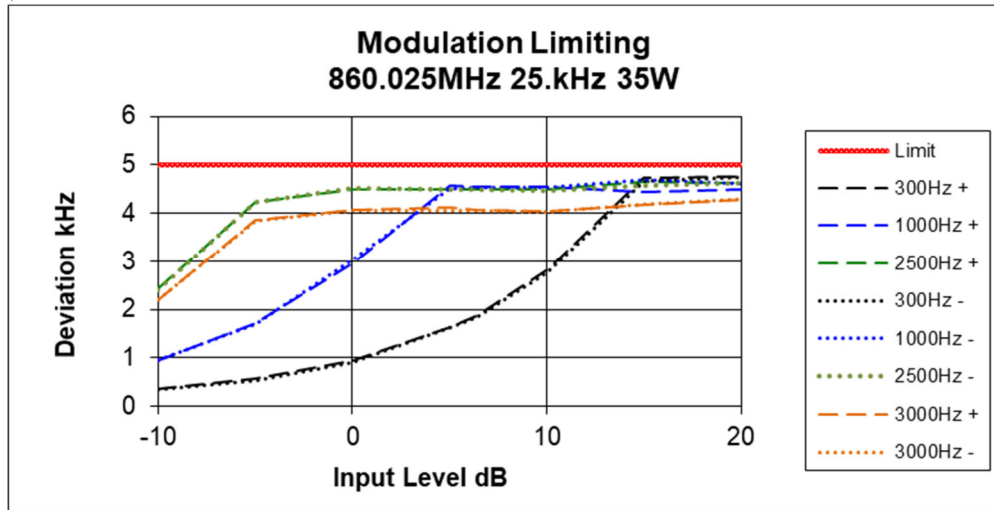


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 860.025 MHz

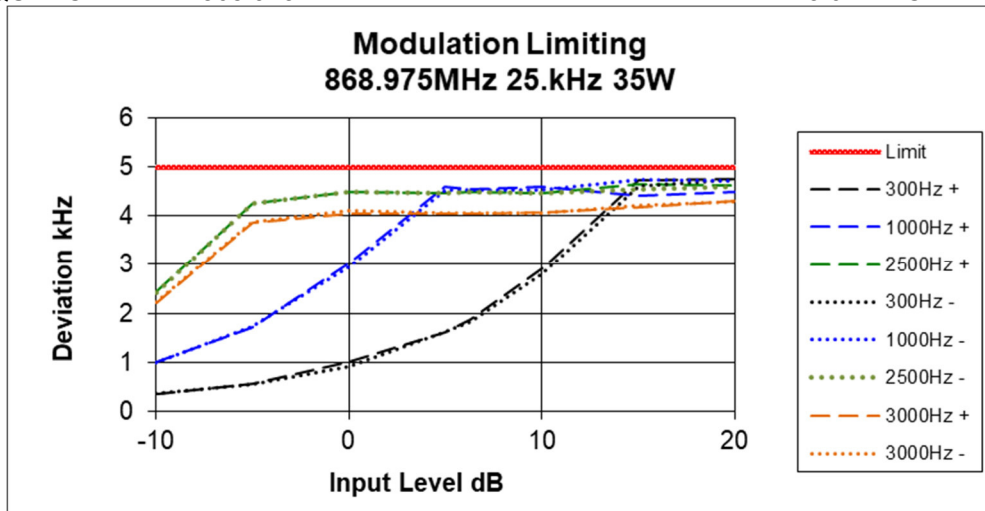
25.0 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 868.975 MHz

25.0 kHz Channel Spacing



TRANSMITTER OCCUPIED (99%) BANDWIDTH

SPECIFICATION: RSS-119 5.5

GUIDE: RSS-Gen 6.7

MEASUREMENT PROCEDURE:

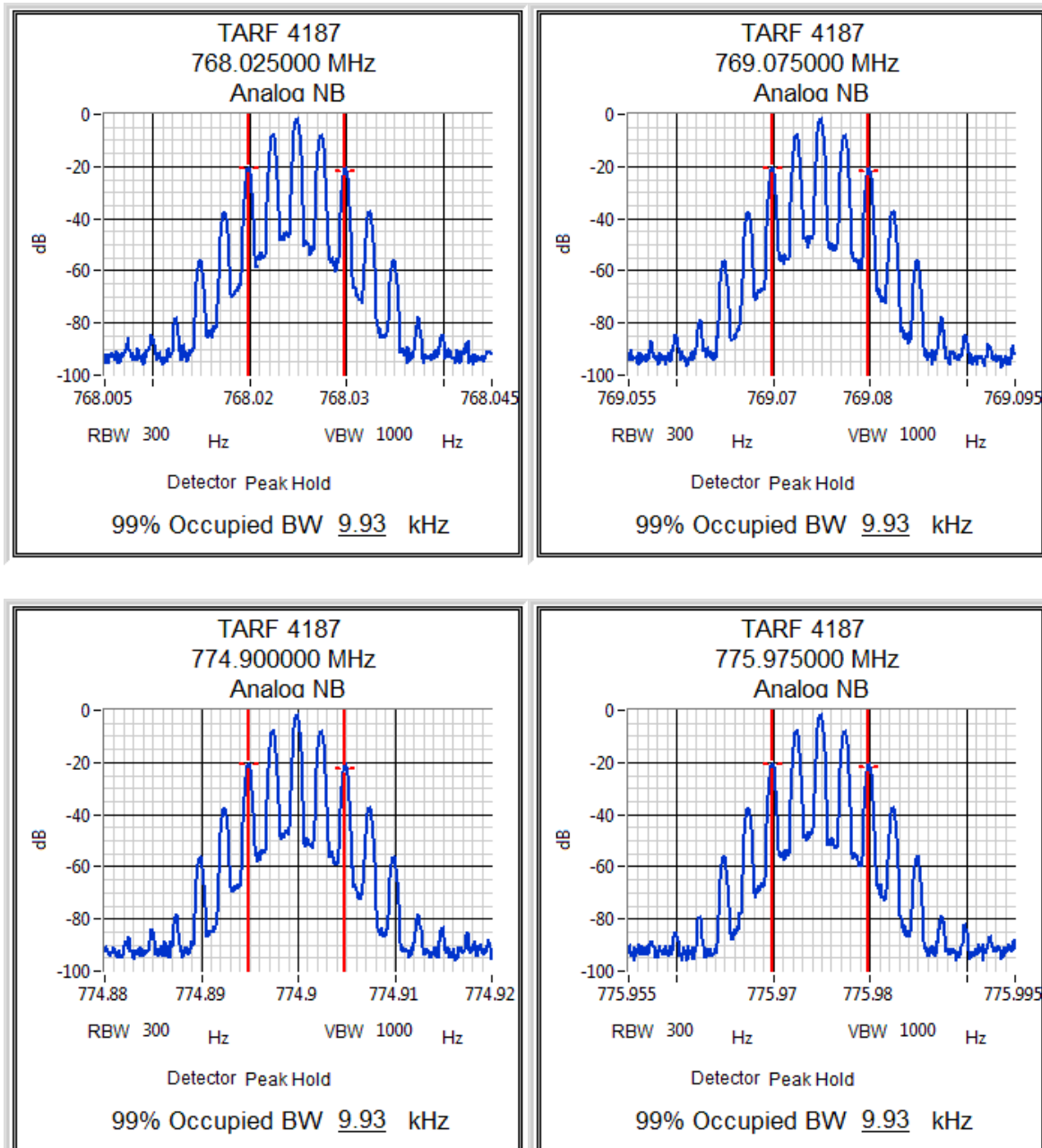
1. Refer Annex A for Equipment Set up.
2. For analogue measurements: The EUT was modulated by a 2500 Hz tone at an input level 16 dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.
For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as follows.
Resolution Bandwidth = 300 Hz, Video Bandwidth = 1000 Hz

MEASUREMENT RESULTS:

Channel Frequency (MHz)	Bandwidths (kHz)				
	Analogue 12.5 kHz chan spac.	Analogue 25.0 kHz chan spac.	FFSK 1200 bps 12.5 kHz chan spac.	DMR 12.5 kHz chan spac.	APCO P25 phase I C4FM 12.5 kHz chan spac.
768.025 MHz	9.93	15.0	6.93	7.8	8.07
769.075 MHz	9.93	15.0	7.0	7.8	8.0
774.9 MHz	9.93	15.0	7.0	7.8	8.07
775.975 MHz	9.93	15.0	7.0	7.8	8.07
851.025 MHz	9.93	15.0	6.93	7.93	8.0
860.025 MHz	9.93	15.0	6.93	7.8	8.07
868.975 MHz	9.93	15.0	7.0	7.8	8.07
<u>Limit</u> Authorized Bandwidth 47 CFR 90.209 RSS 119 5.5	11.25	20.0	11.25	11.25	11.25
Necessary BW used in emission designator	11.0	16.0	7.6	8.0	8.1
Result	Pass	Pass	Pass	Pass	Pass

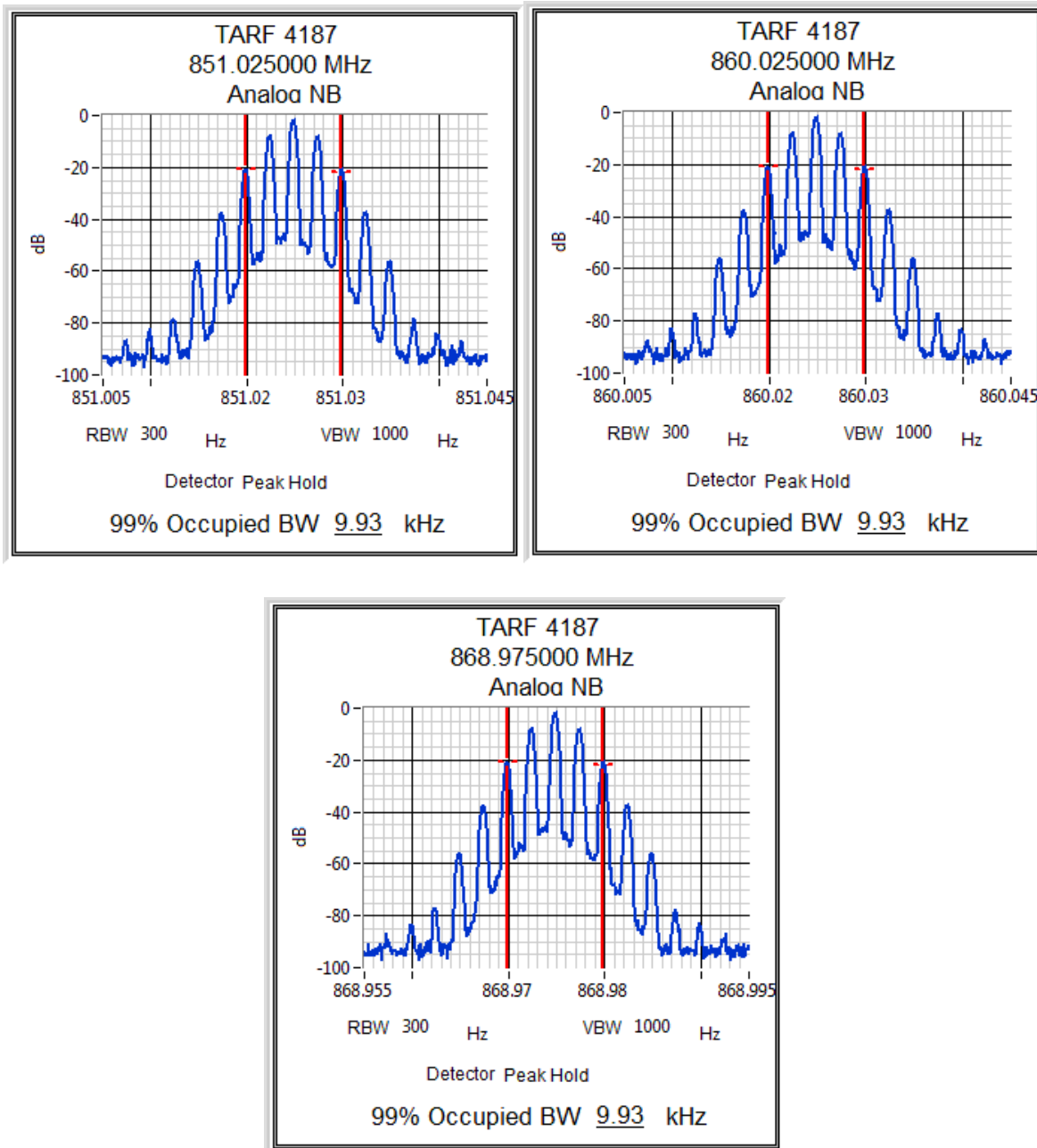
Transmitter Occupied (99%) Bandwidth

Channel 1-4 35 watts 12.5 kHz ch spacing Analogue Modulation



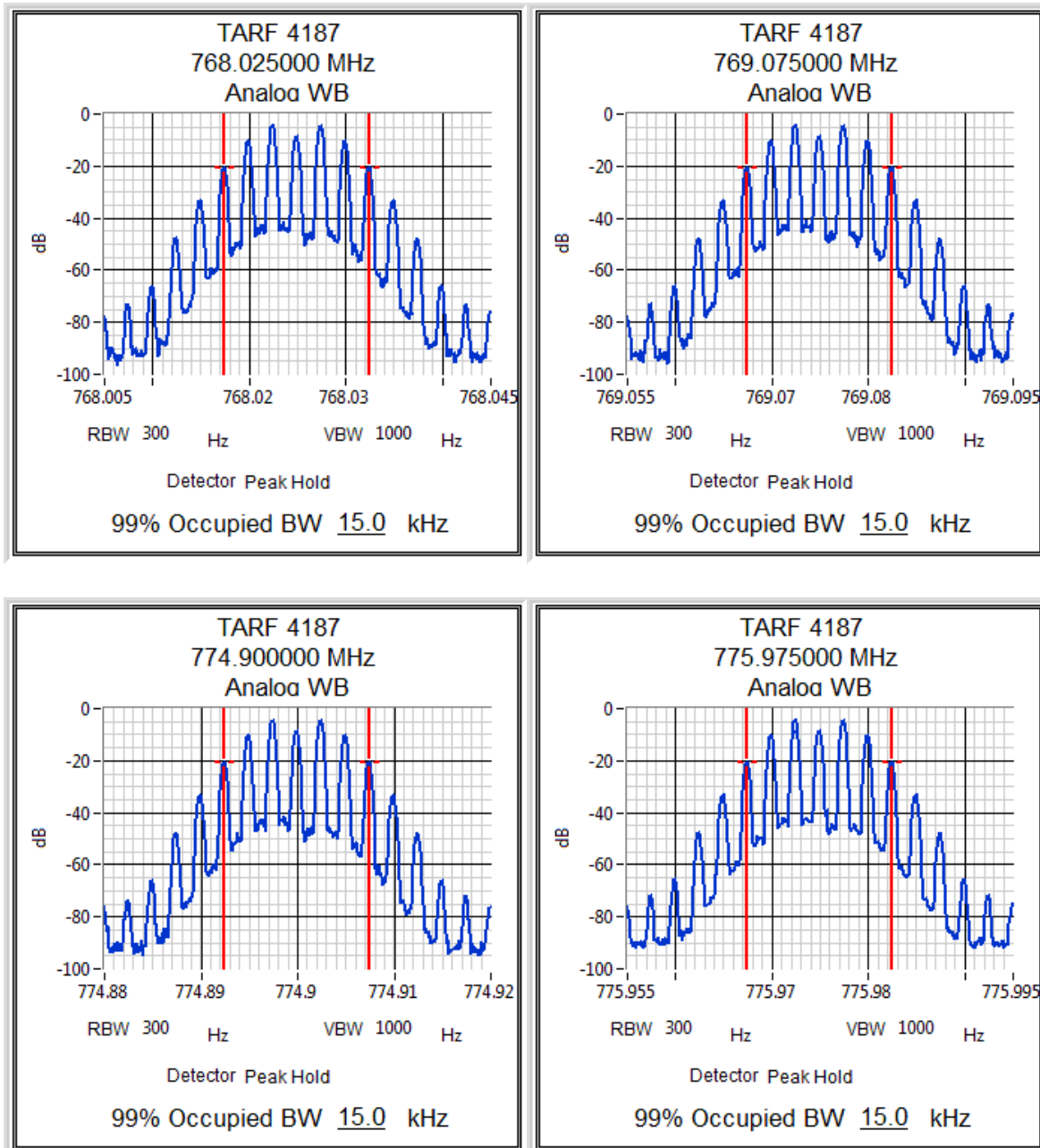
Transmitter Occupied (99%) Bandwidth

Channel 5-7 35 watts 12.5 kHz ch spacing Analogue Modulation



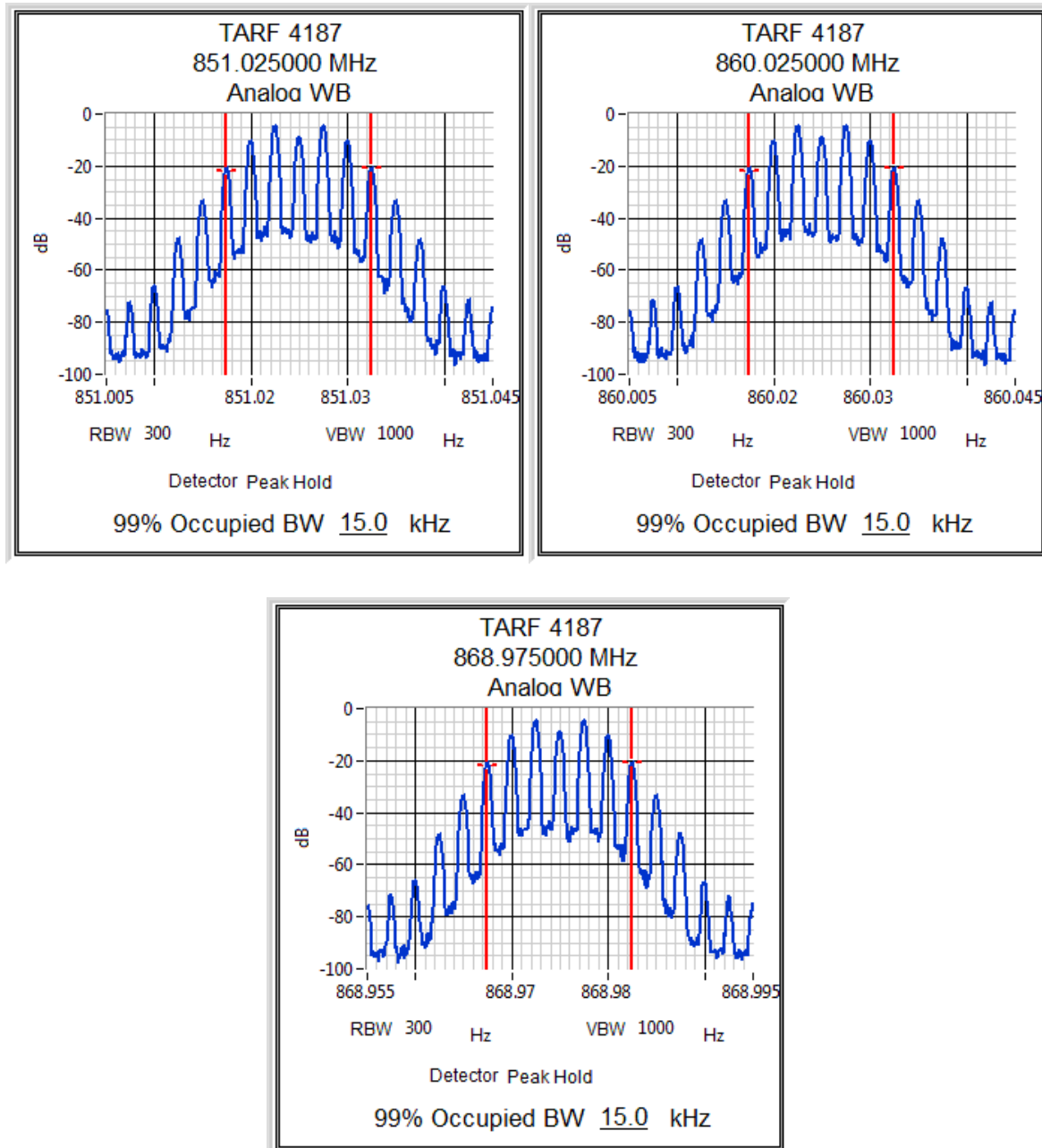
Transmitter Occupied (99%) Bandwidth

Channel 1-4 35 watts 25.0 kHz ch spacing Analogue Modulation



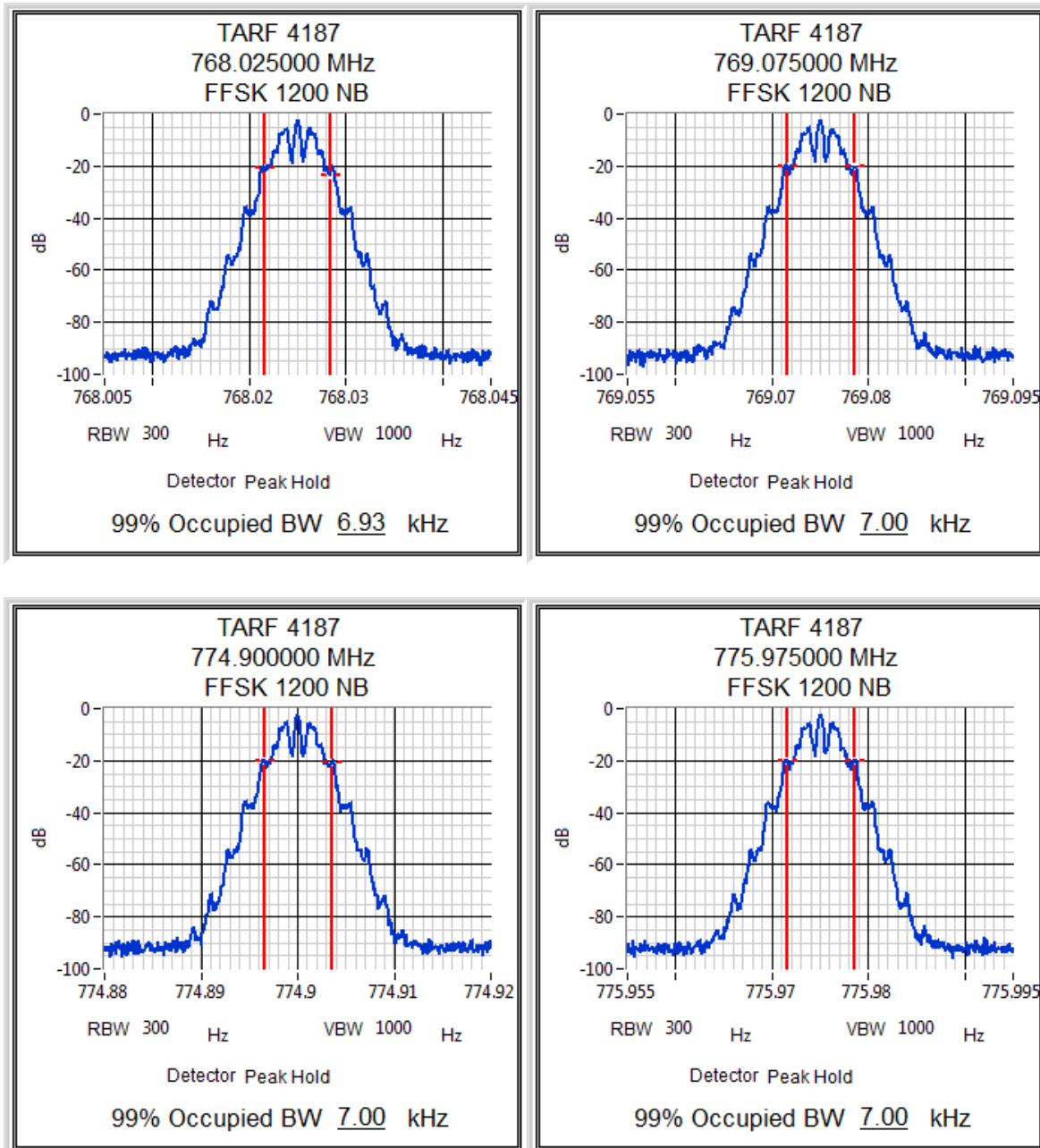
Transmitter Occupied (99%) Bandwidth

Channel 5-7 35 watts 25.0 kHz ch spacing Analogue Modulation



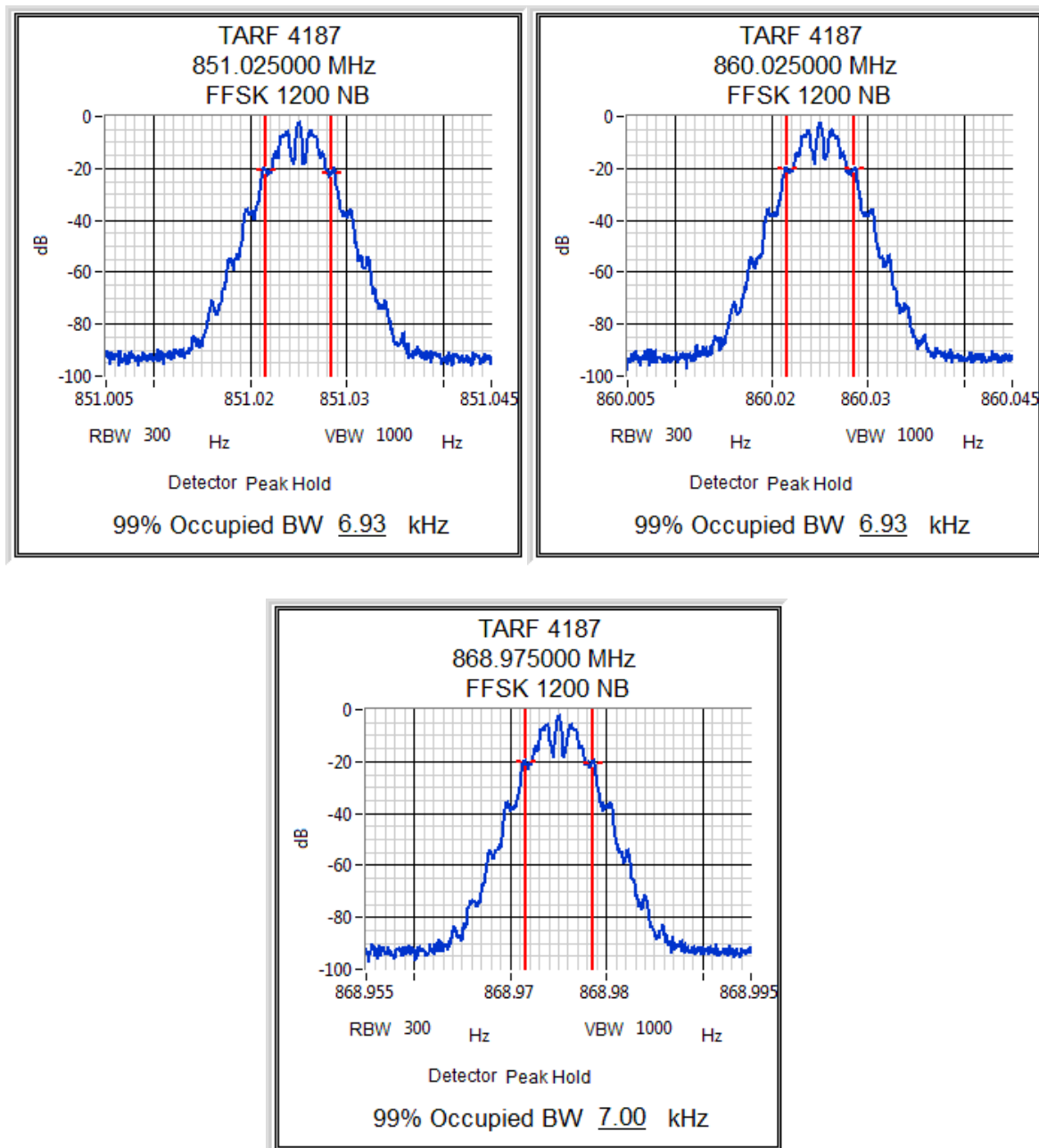
Transmitter Occupied (99%) Bandwidth

Channel 1-4 35 watts 12.5 kHz ch spacing FFSK (1200bps) Modulation



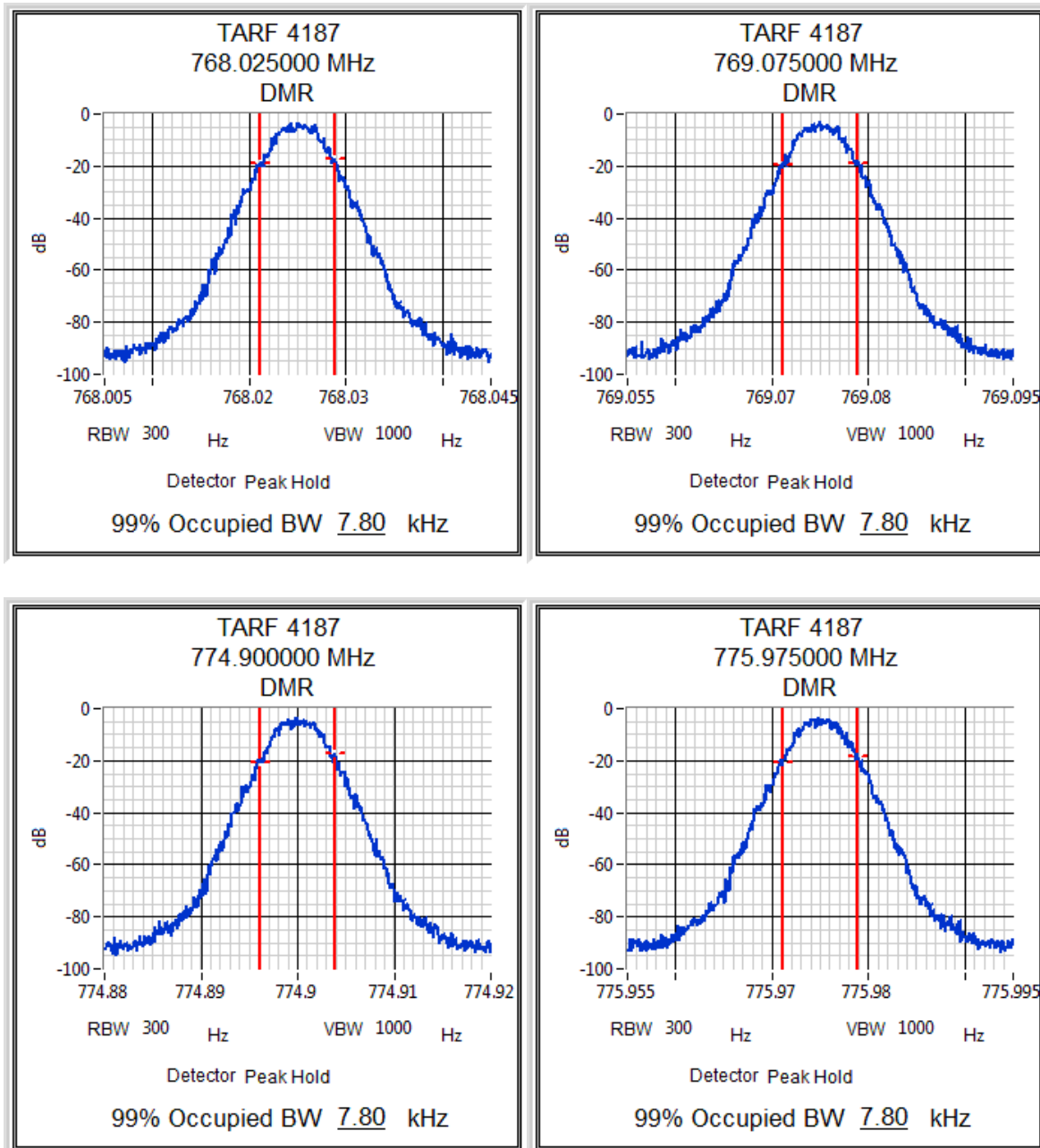
Transmitter Occupied (99%) Bandwidth

Channel 5-7 35 watts 12.5 kHz ch spacing FFSK (1200bps) Modulation



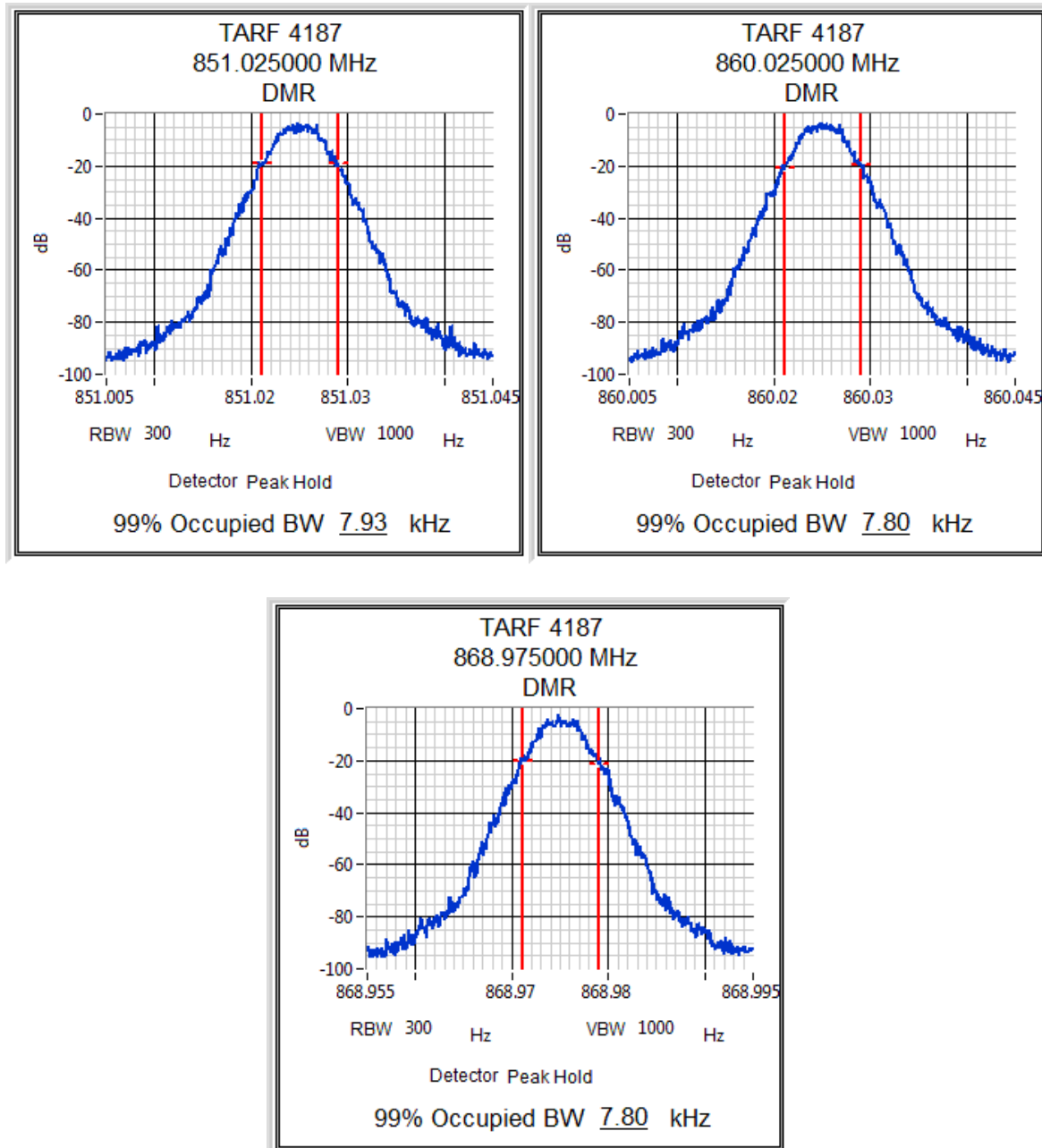
Transmitter Occupied (99%) Bandwidth

Channel 1-4 35 watts 12.5 kHz ch spacing DMR Modulation



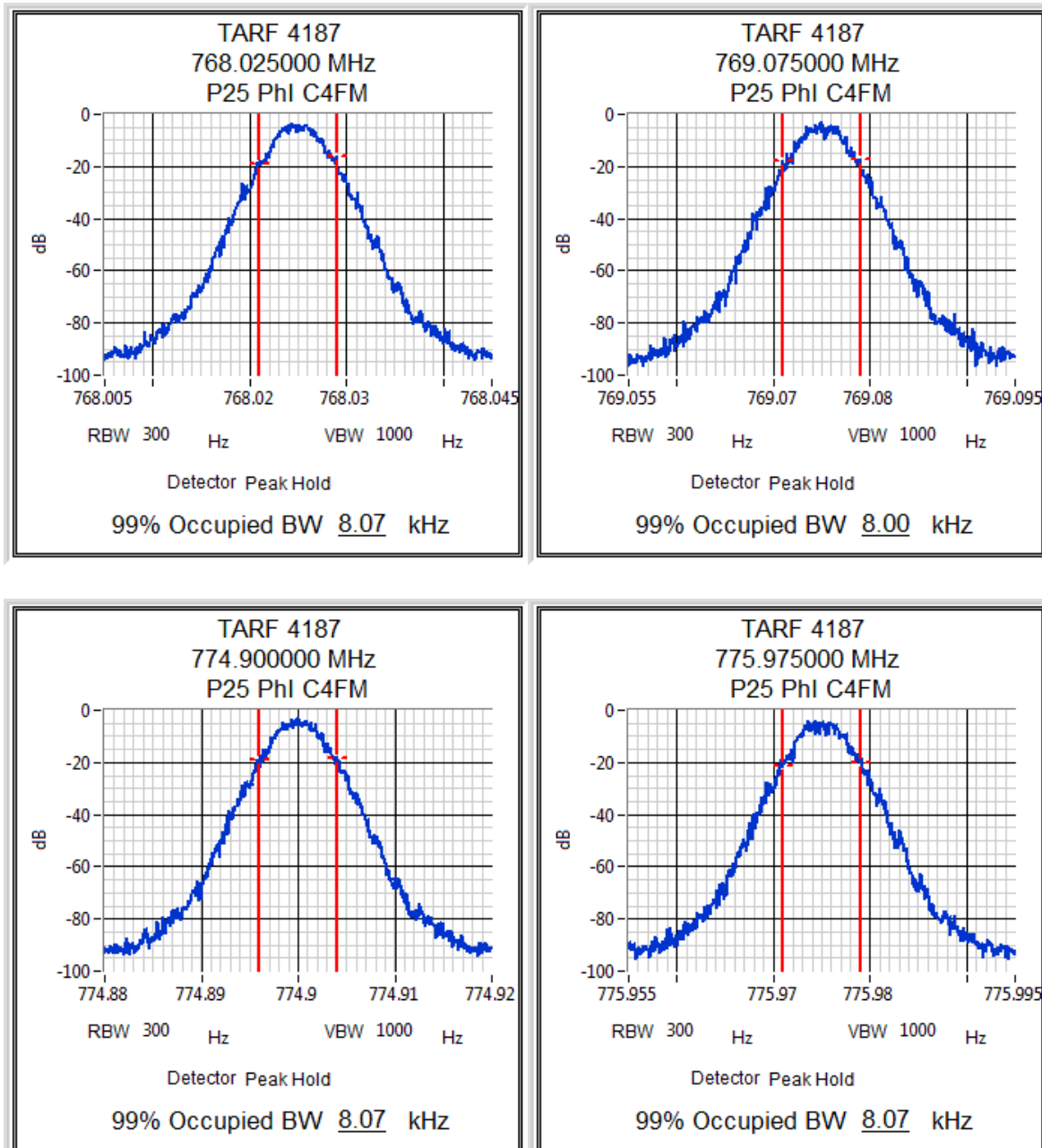
Transmitter Occupied (99%) Bandwidth

Channel 5-7 35 watts 12.5 kHz ch spacing DMR Modulation



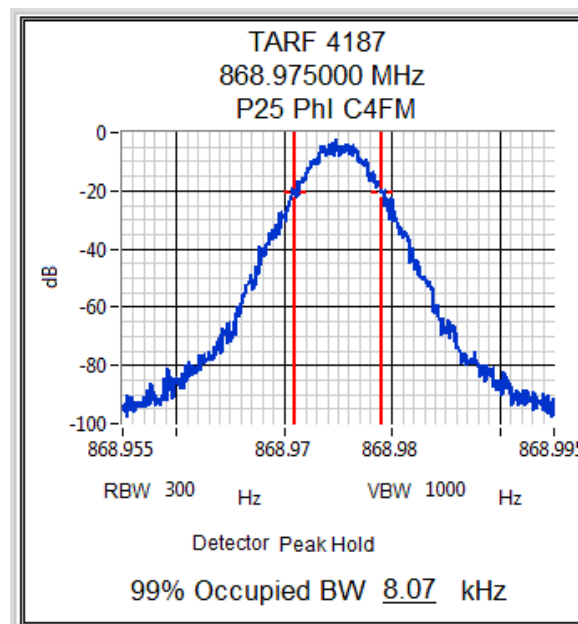
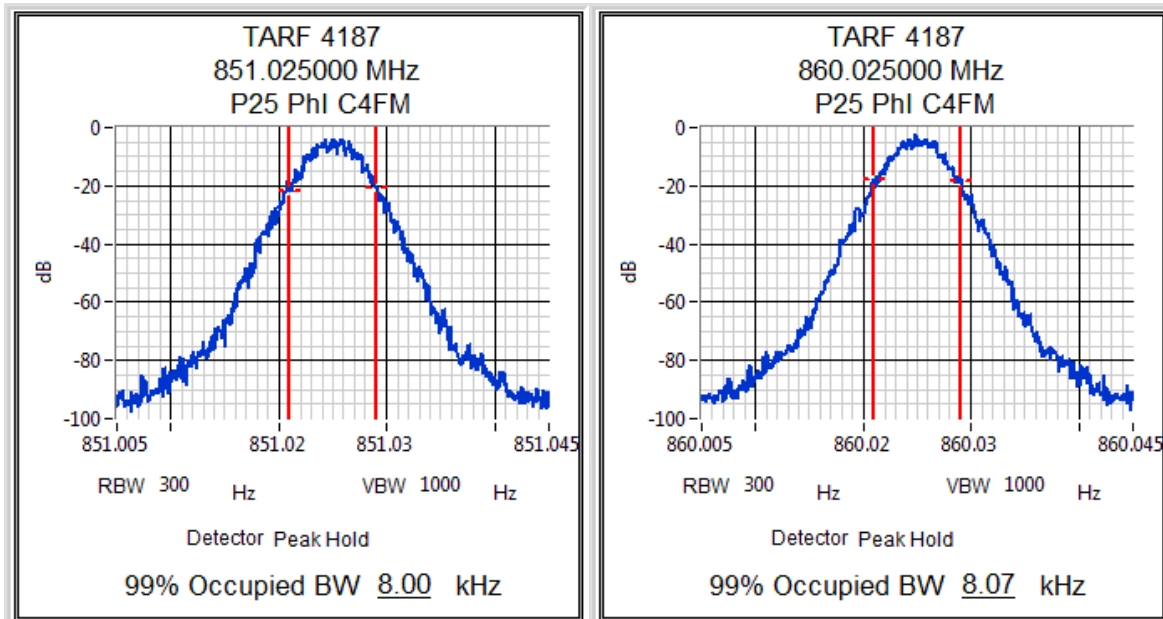
Transmitter Occupied (99%) Bandwidth

Channel 1-4 35 watts 12.5 kHz ch spacing P25 PhI C4FM Modulation



Transmitter Occupied (99%) Bandwidth

Channel 5-7 35 watts 12.5 kHz ch spacing P25 Phl C4FM Modulation



TRANSMITTER SPECTRUM MASKS

SPECIFICATION: FCC 47 CFR 2.1049 (c) RSS-119 5.5

GUIDE: TIA/EIA-603E 2.2.11 (Analogue)
TIA-102.CAAA-C 2.2.5 (Digital)

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
2. For Analogue measurements: The EUT was modulated by a 2500 Hz tone at an input level 16 dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.
For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as noted on the recorded plots.

MEASUREMENT RESULTS:

See the plots on the following pages for 12.5 kHz and 25.0 kHz channel spacing.

MEASUREMENT UNCERTAINTY 95% $\pm 0.65\text{dB}$

LIMIT CLAUSE: FCC 47 CFR 90.210 RSS-119 5.5

EMISSION MASKS

Emission Mask B	12.5 & 25.0 kHz Channel Spacing	Analogue
Emission Mask D	12.5 kHz Channel Spacing	Analogue, Digital Voice/Data
Emission Mask H	12.5 kHz	FFSK, Digital Voice/Data

DATA SPEED

FFSK	12.5 kHz Channel Spacing	1200 bps
Digital Voice/Data	12.5 kHz Channel Spacing	9600 bps (DMR, P25 Phase I)

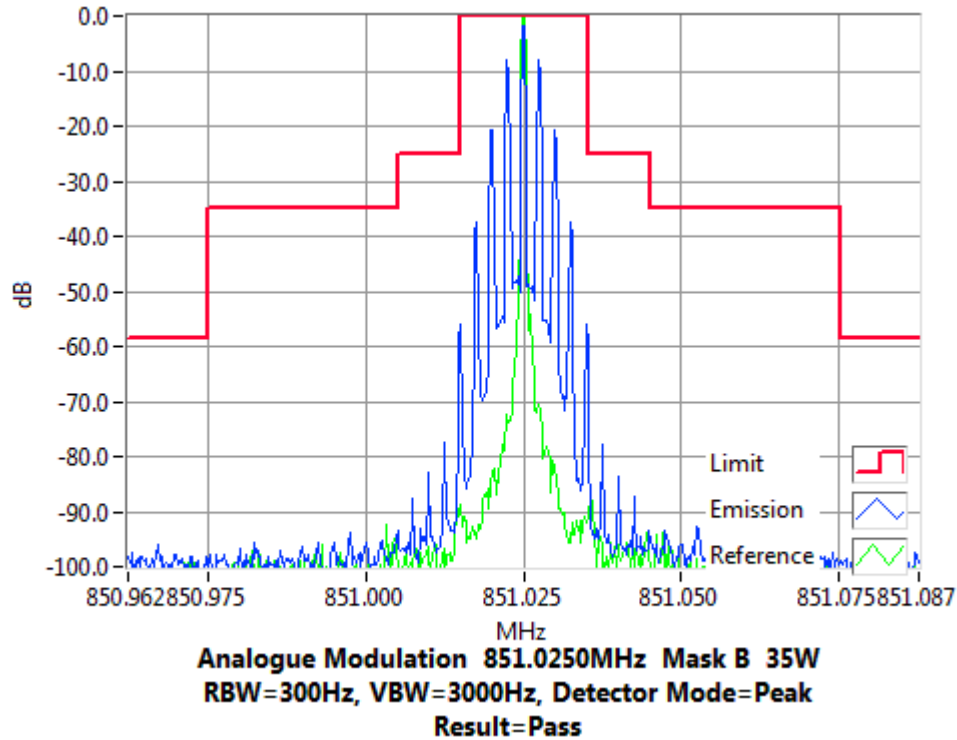
Transmitter Spectrum Masks

ANALOGUE VOICE

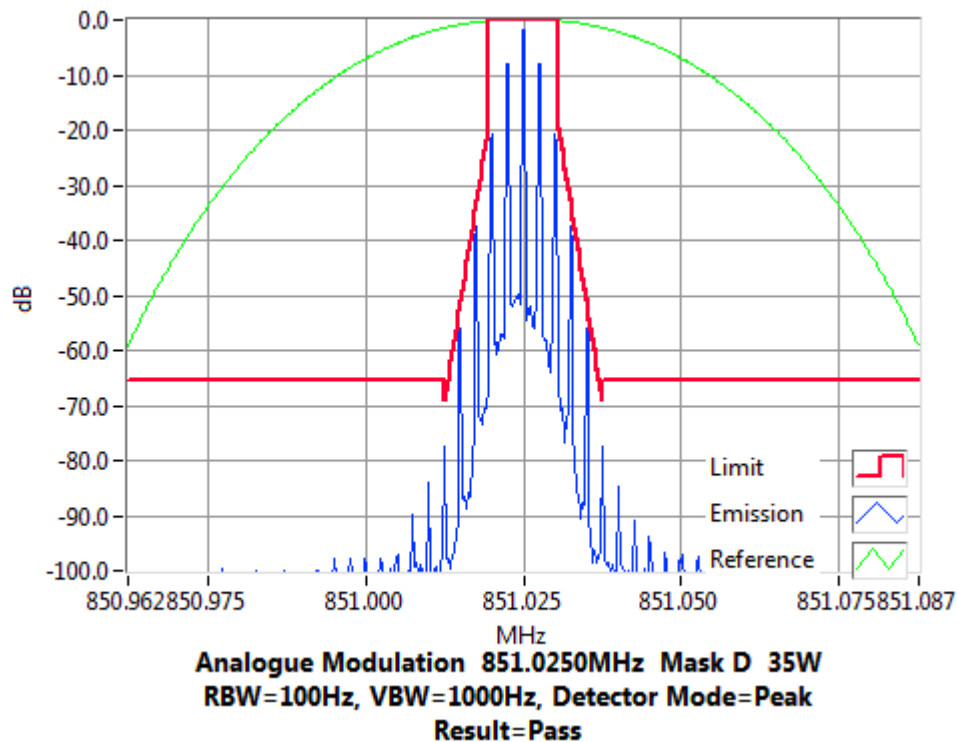
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 851.025 MHz 35 W 12.5 kHz Channel Spacing



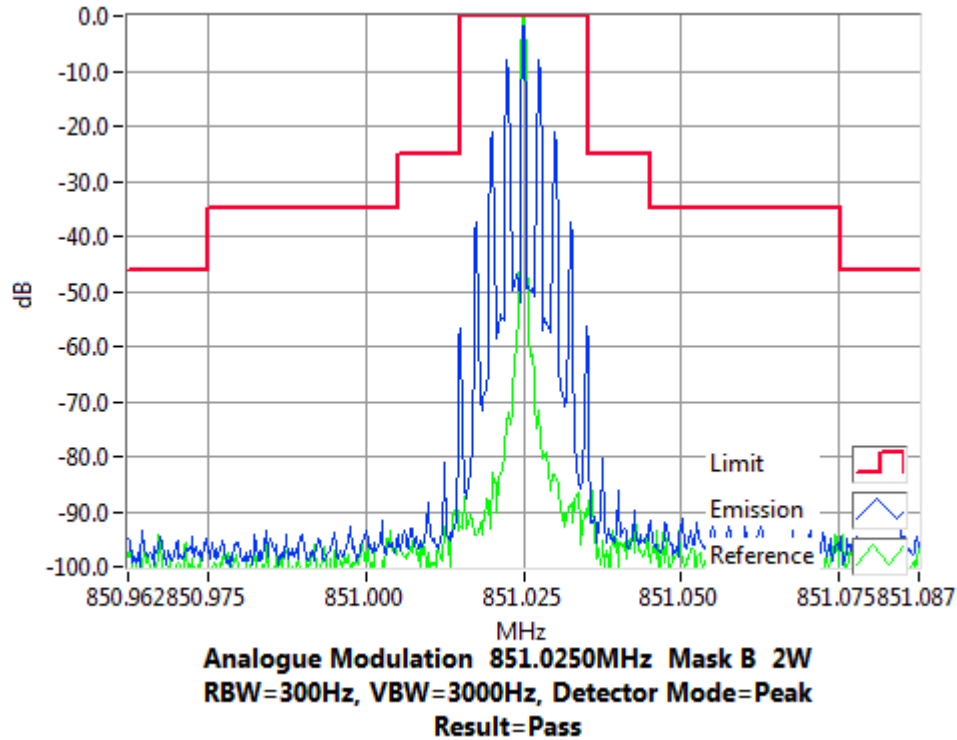
Transmitter Spectrum Masks

ANALOGUE VOICE

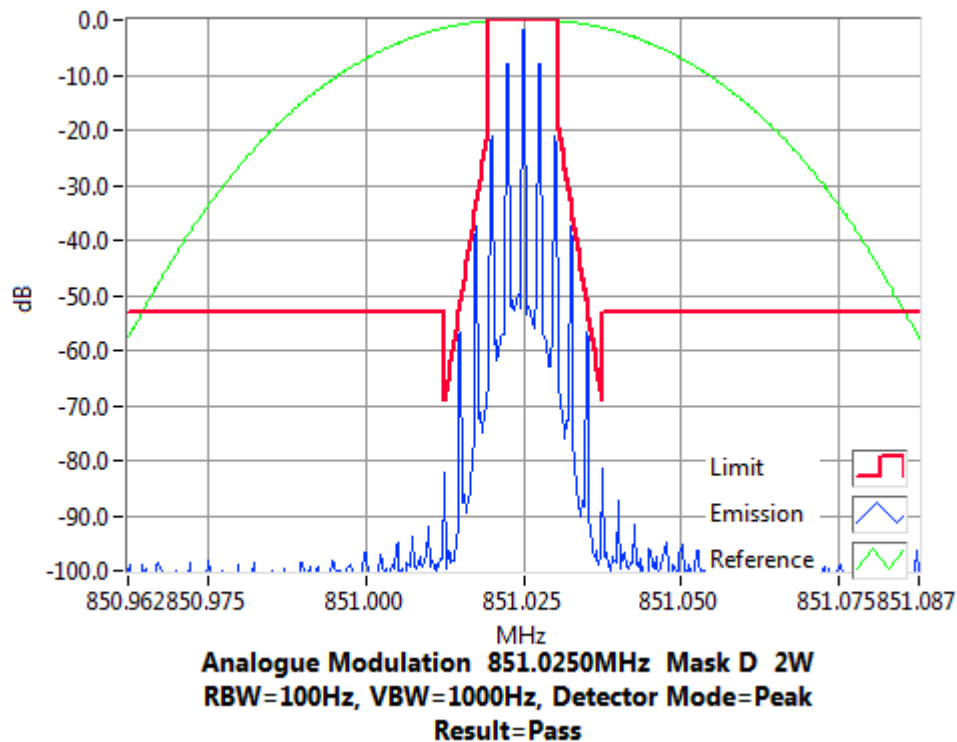
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



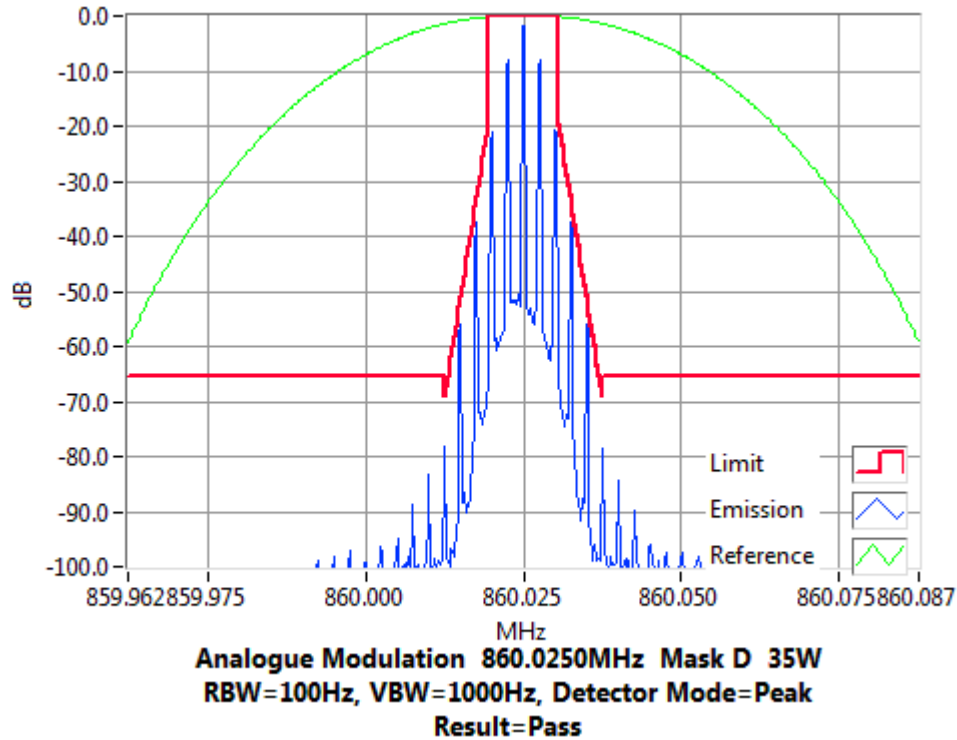
Transmitter Spectrum Masks

ANALOGUE VOICE

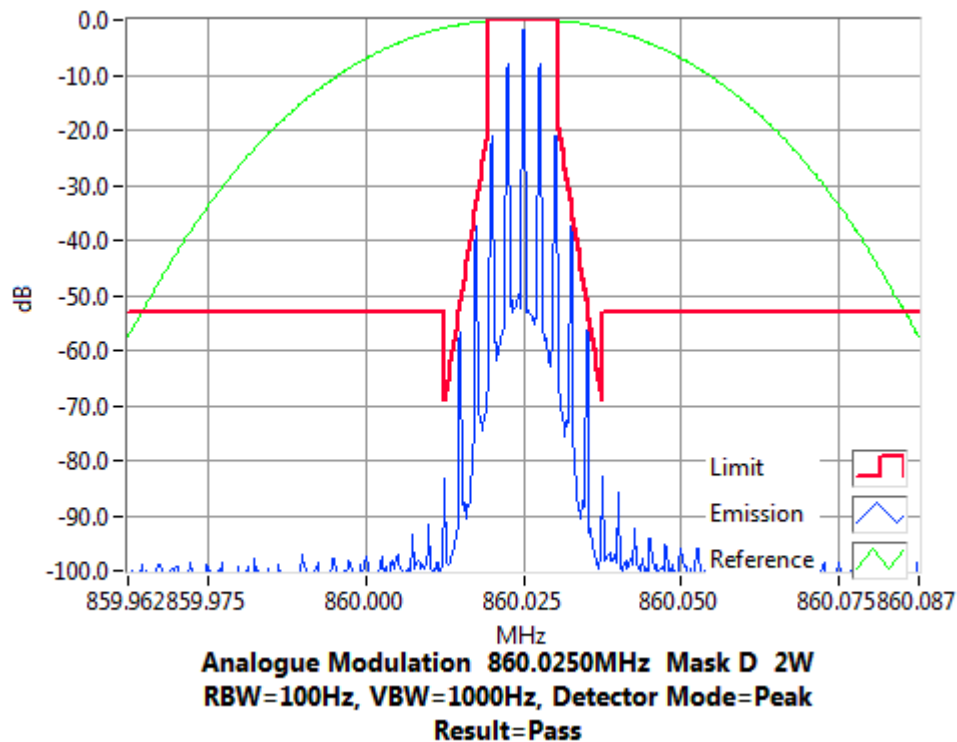
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 860.025 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 860.025 MHz 2 W 12.5 kHz Channel Spacing



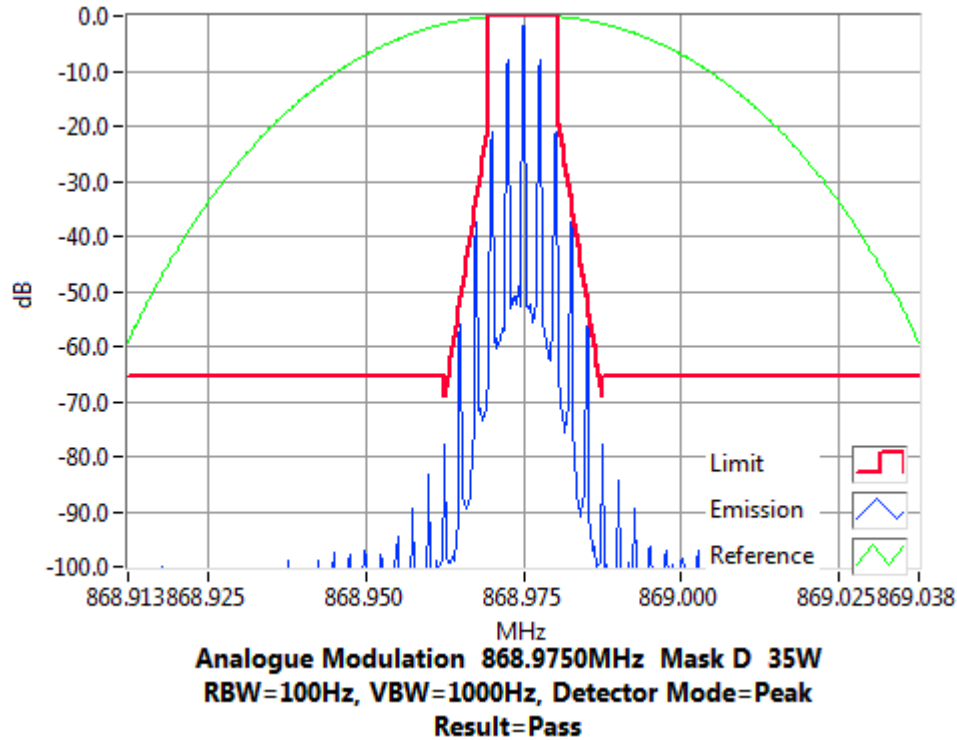
Transmitter Spectrum Masks

ANALOGUE VOICE

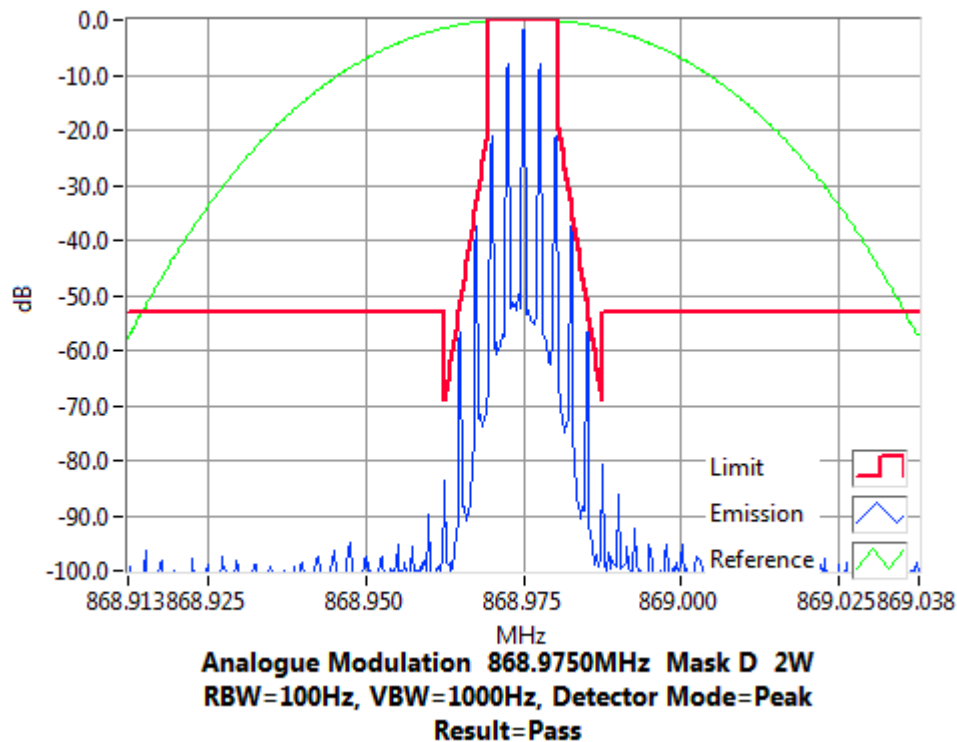
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 868.975 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 868.975 MHz 2 W 12.5 kHz Channel Spacing



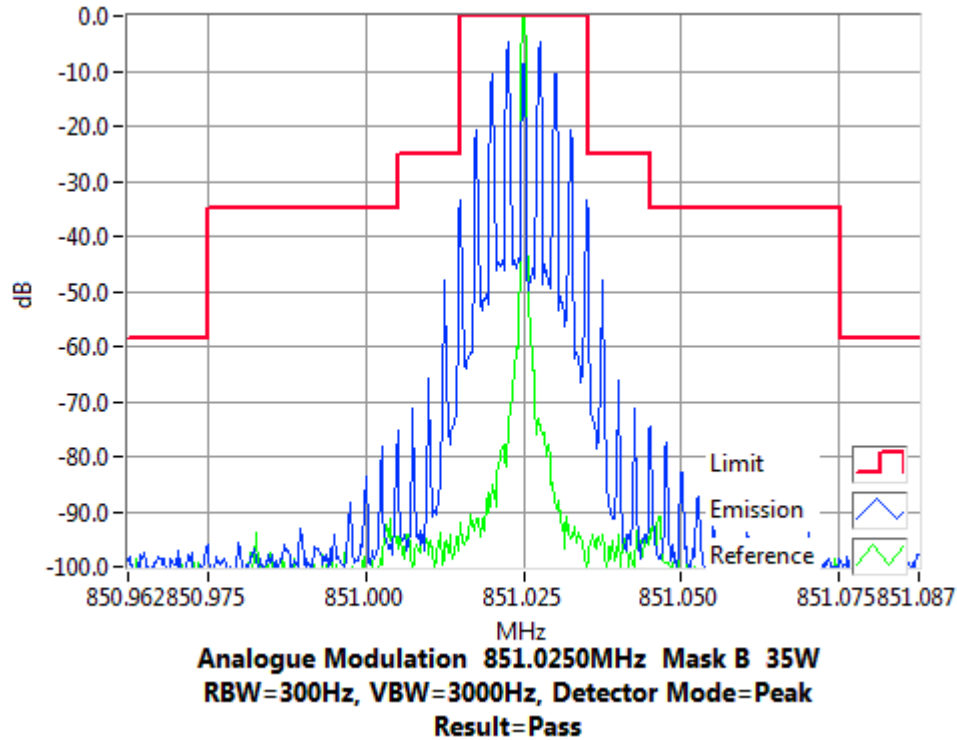
Transmitter Spectrum Masks

ANALOGUE VOICE

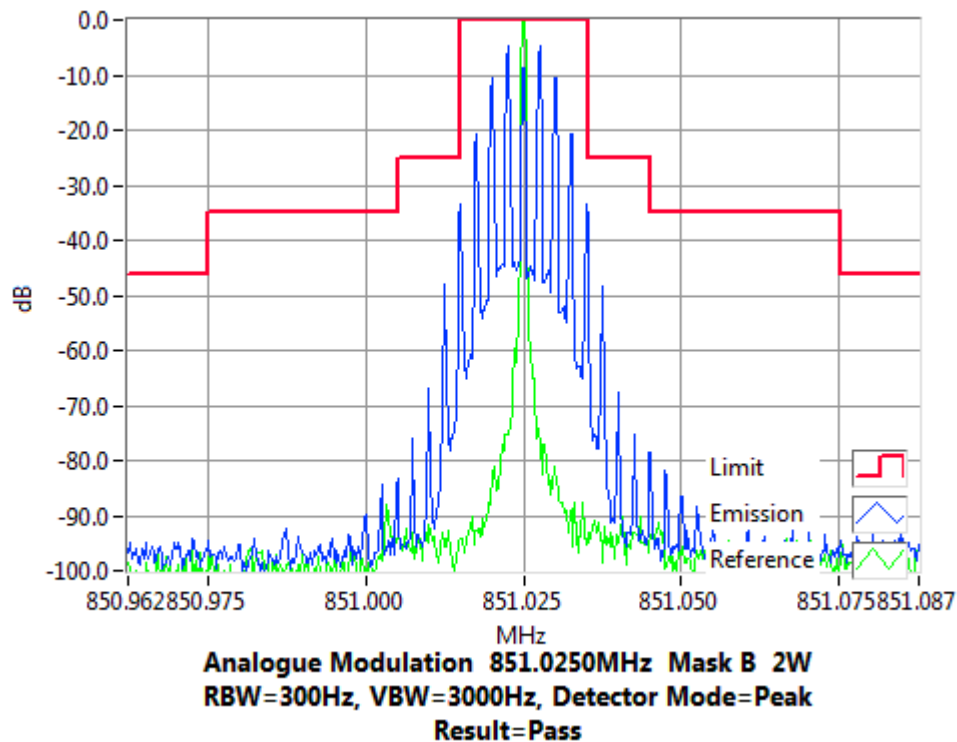
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 35 W 25.0 kHz Channel Spacing



Tx FREQUENCY: 851.025 MHz 2 W 25.0 kHz Channel Spacing



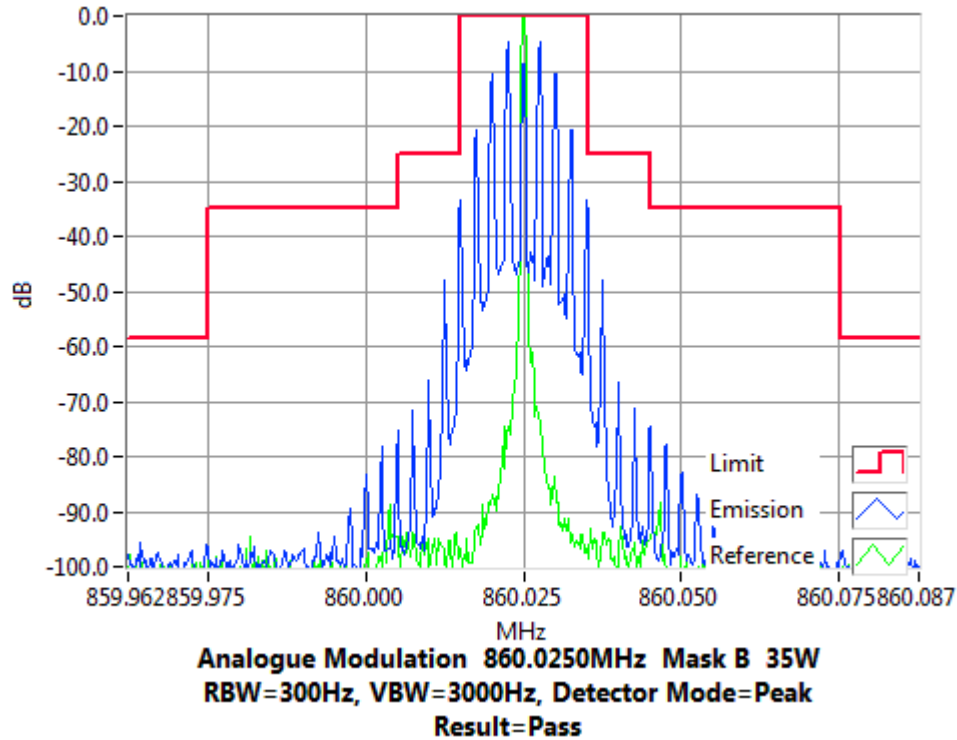
Transmitter Spectrum Masks

ANALOGUE VOICE

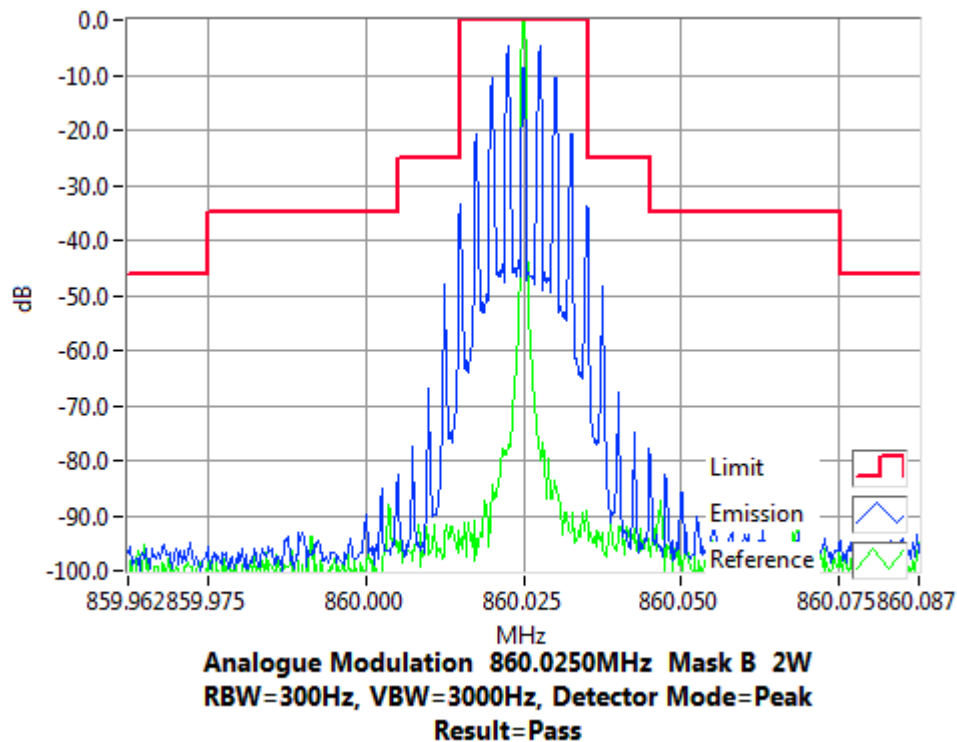
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 860.025 MHz 35 W 25.0 kHz Channel Spacing



Tx FREQUENCY: 860.025 MHz 2 W 25.0 kHz Channel Spacing



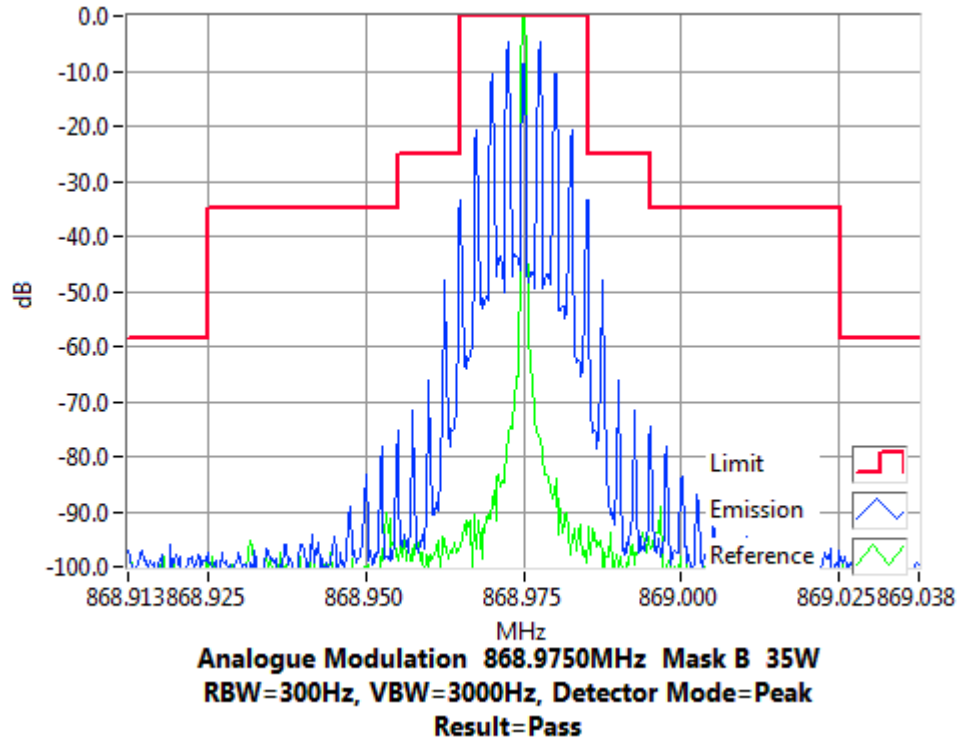
Transmitter Spectrum Masks

ANALOGUE VOICE

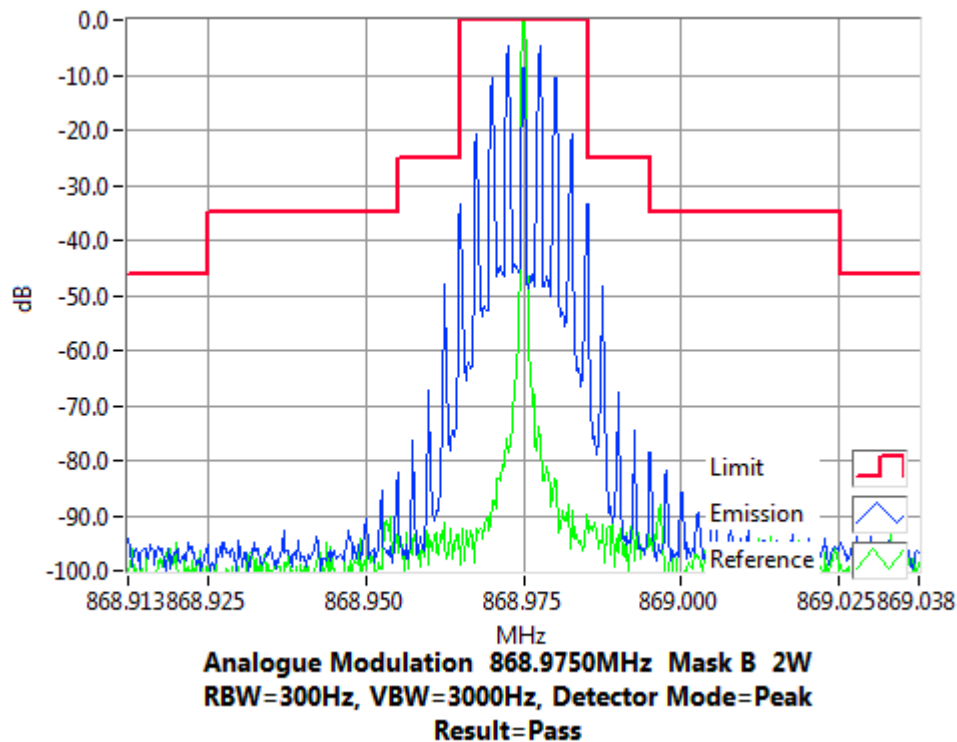
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 868.975 MHz 35 W 25.0 kHz Channel Spacing



Tx FREQUENCY: 868.975 MHz 2 W 25.0 kHz Channel Spacing



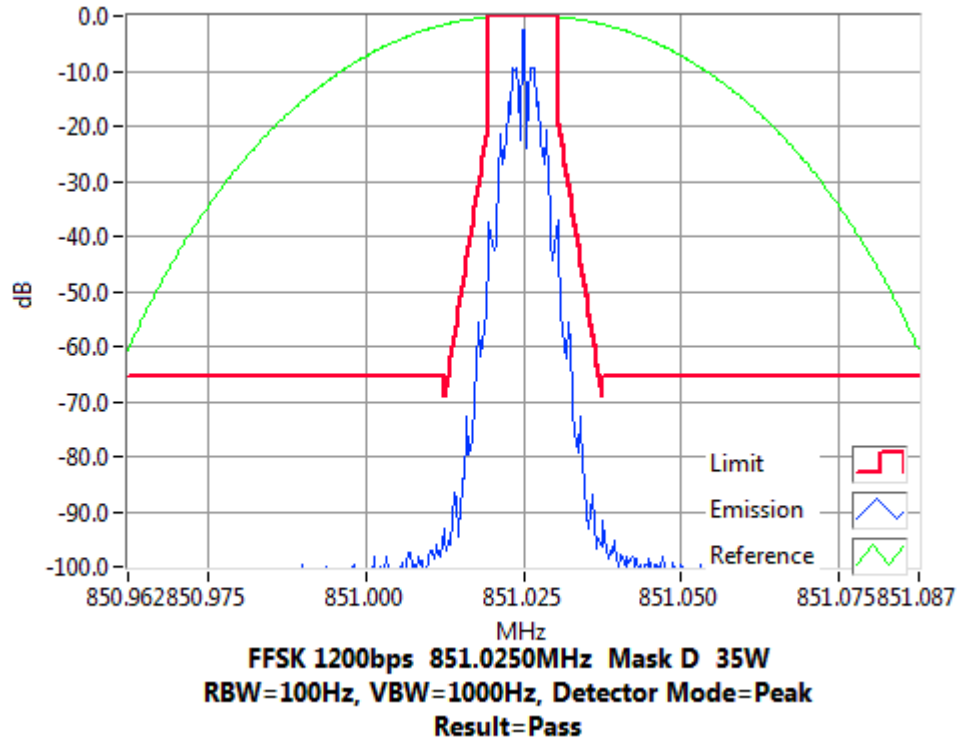
Transmitter Spectrum Masks

FFSK, 1200 bps

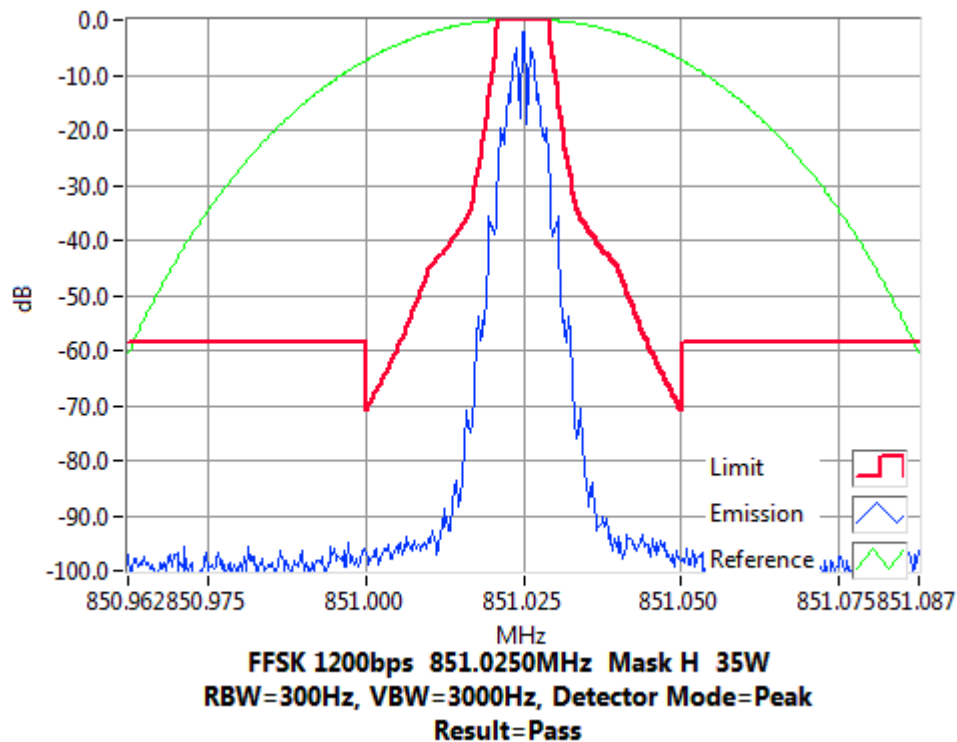
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 851.025 MHz 35 W 12.5 kHz Channel Spacing



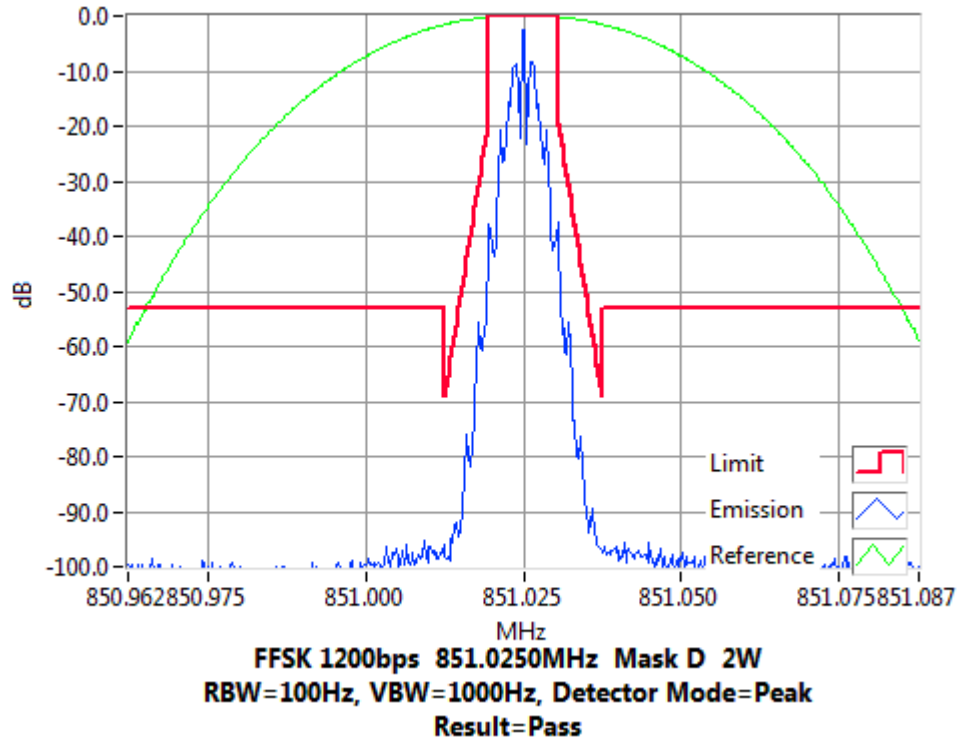
Transmitter Spectrum Masks

FSK, 1200 bps

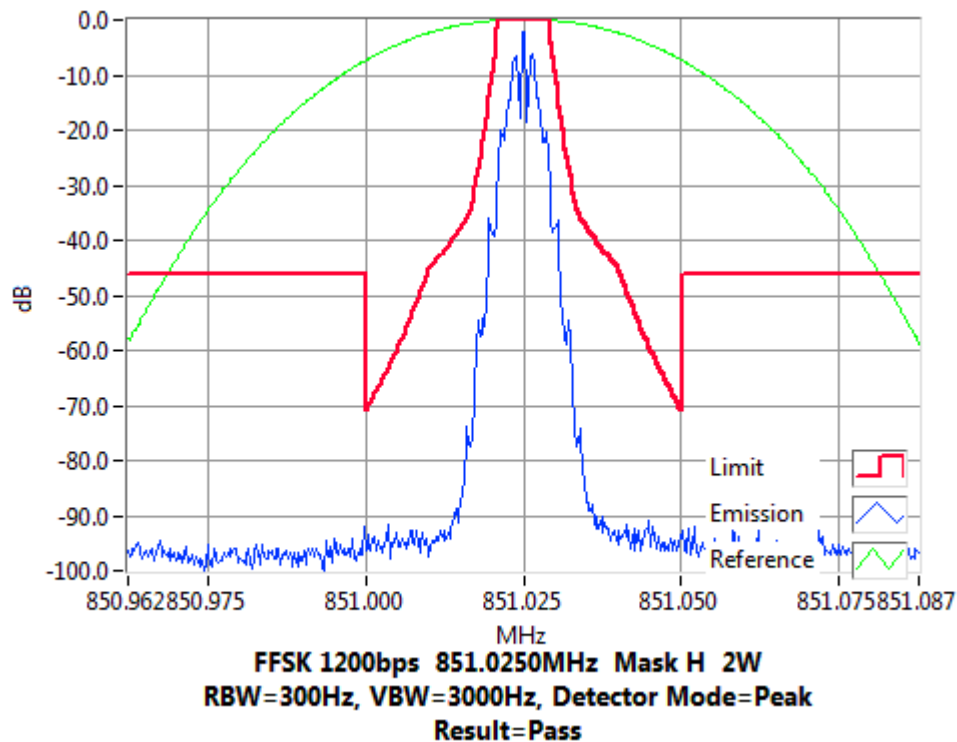
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



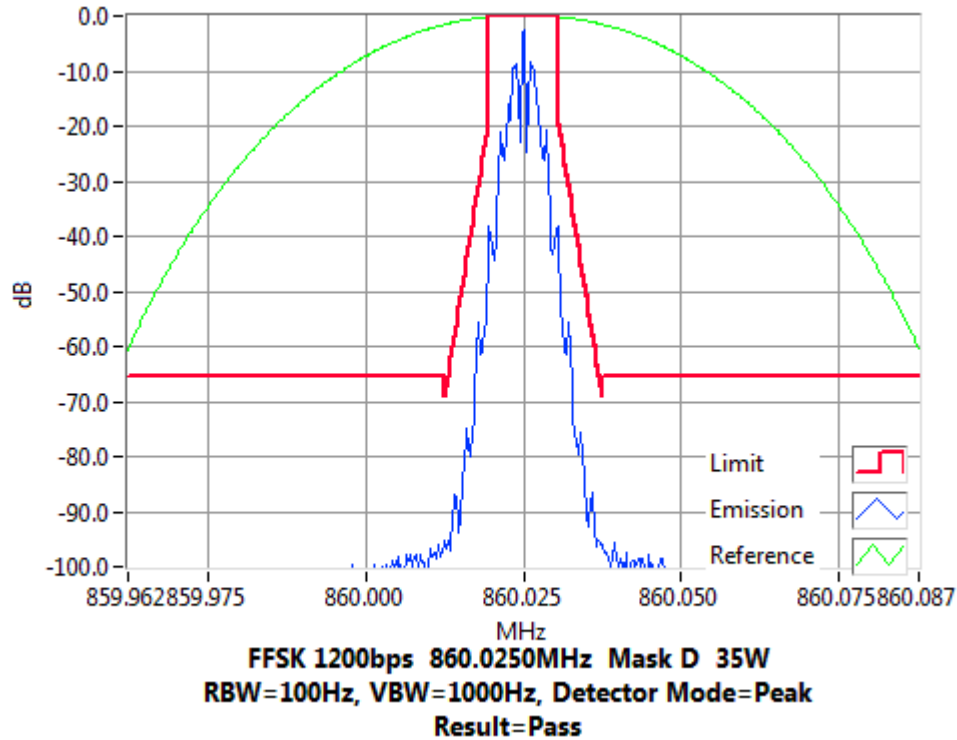
Transmitter Spectrum Masks

FSK, 1200 bps

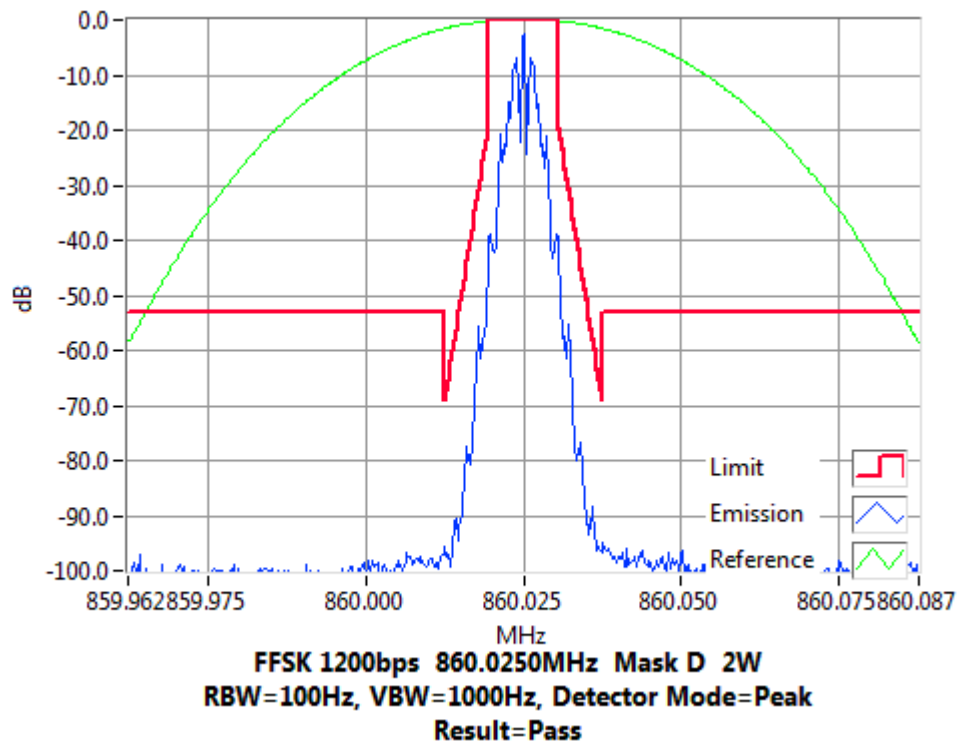
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 860.025 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 860.025 MHz 2 W 12.5 kHz Channel Spacing



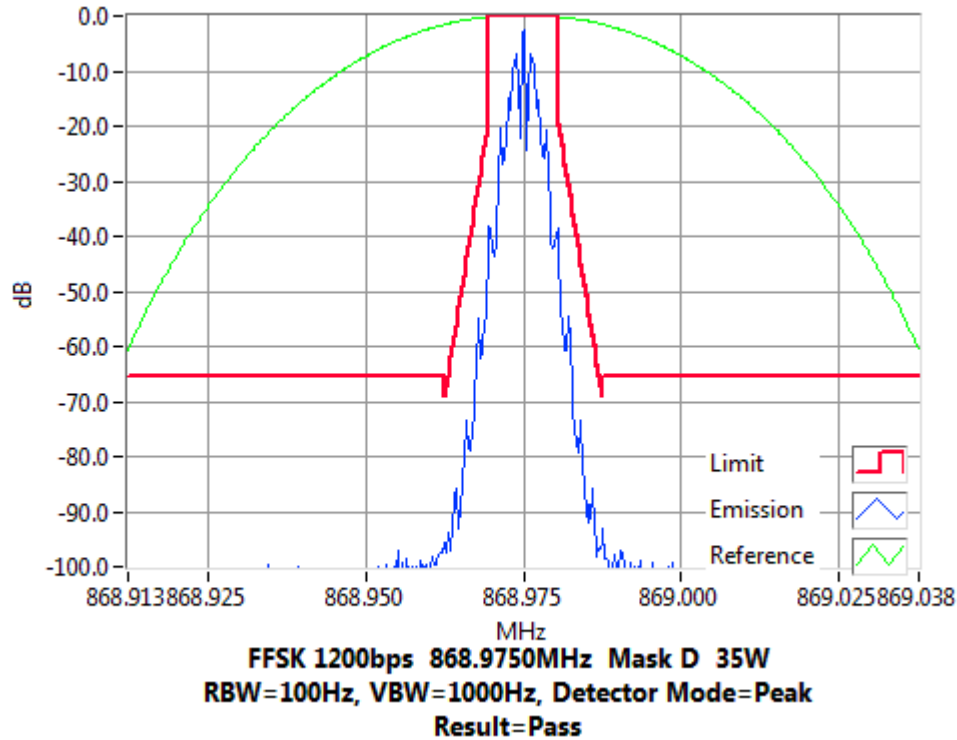
Transmitter Spectrum Masks

FSK, 1200 bps

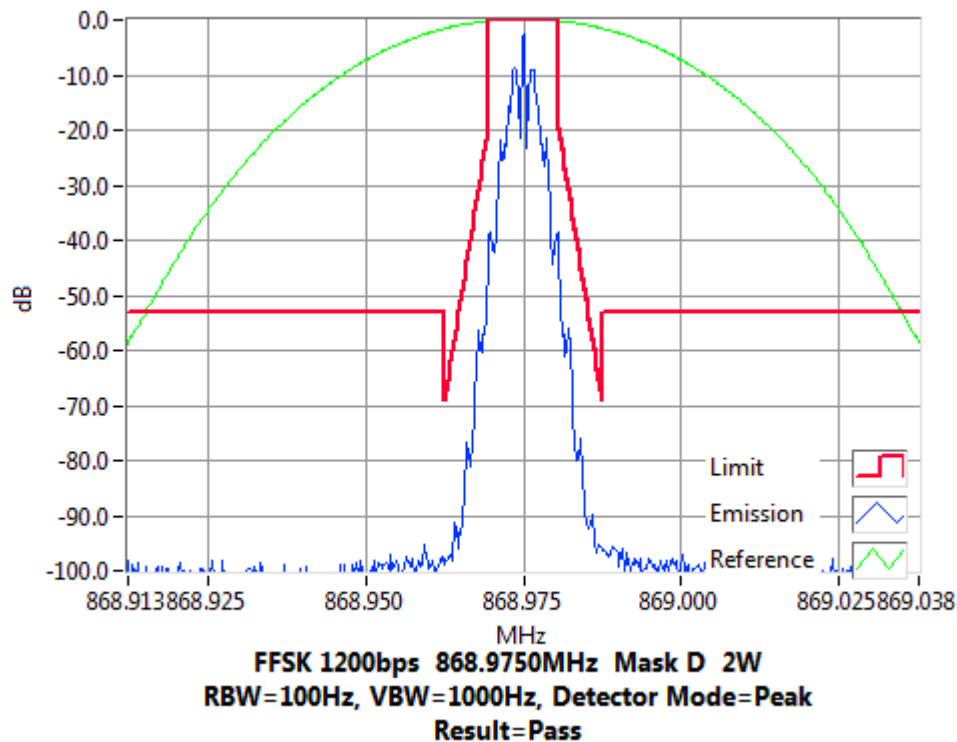
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 868.975 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 868.975 MHz 2 W 12.5 kHz Channel Spacing



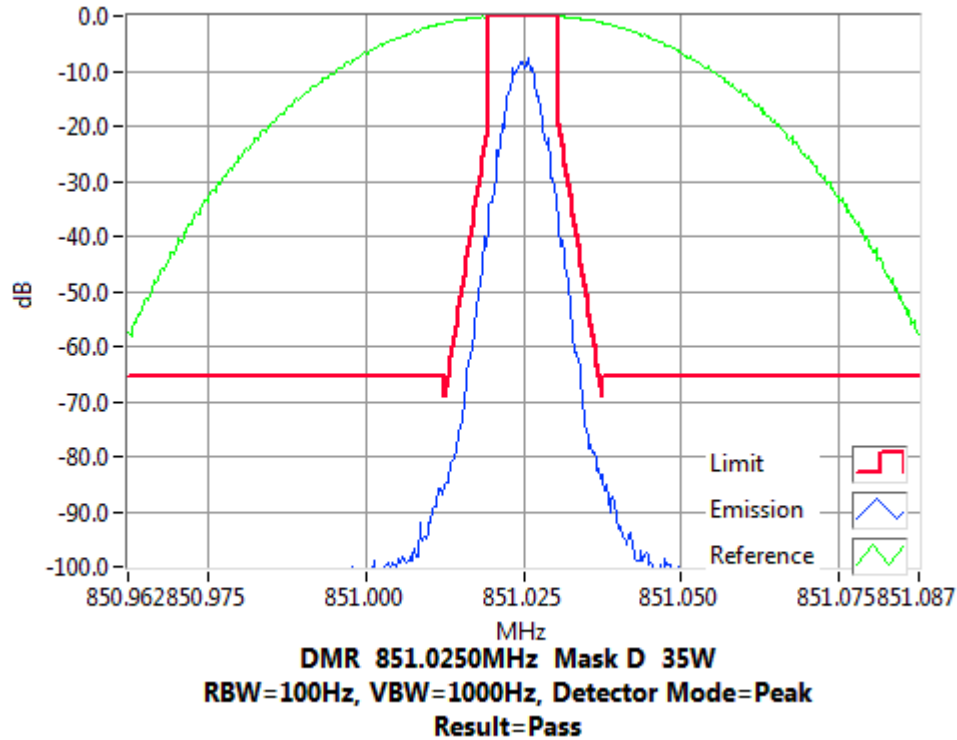
Transmitter Spectrum Masks

DMR

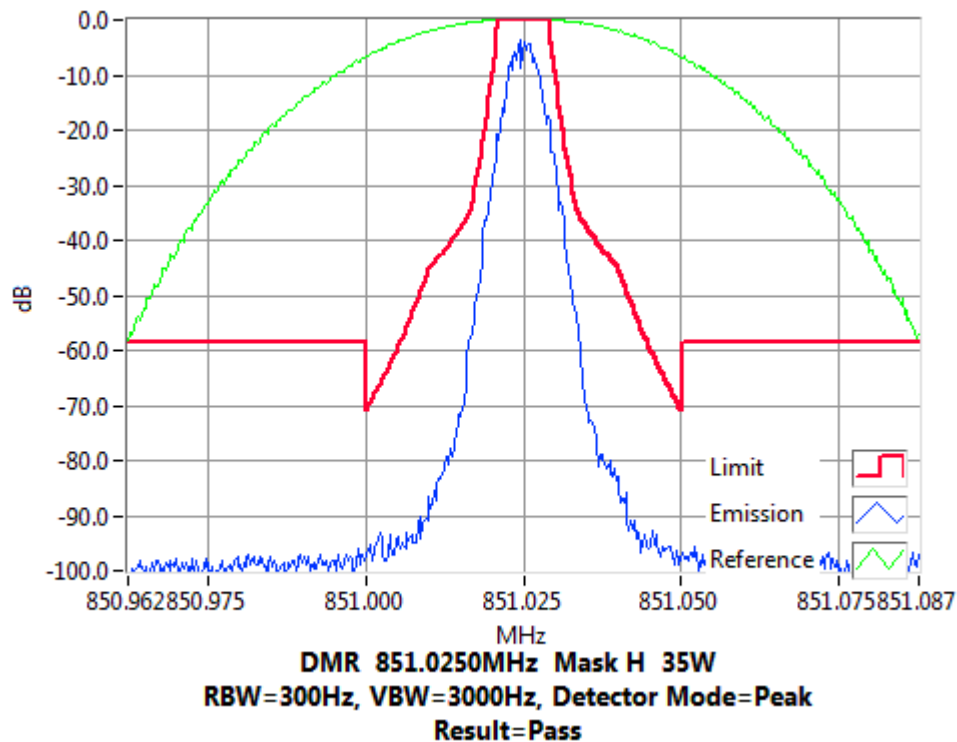
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 851.025 MHz 35 W 12.5 kHz Channel Spacing



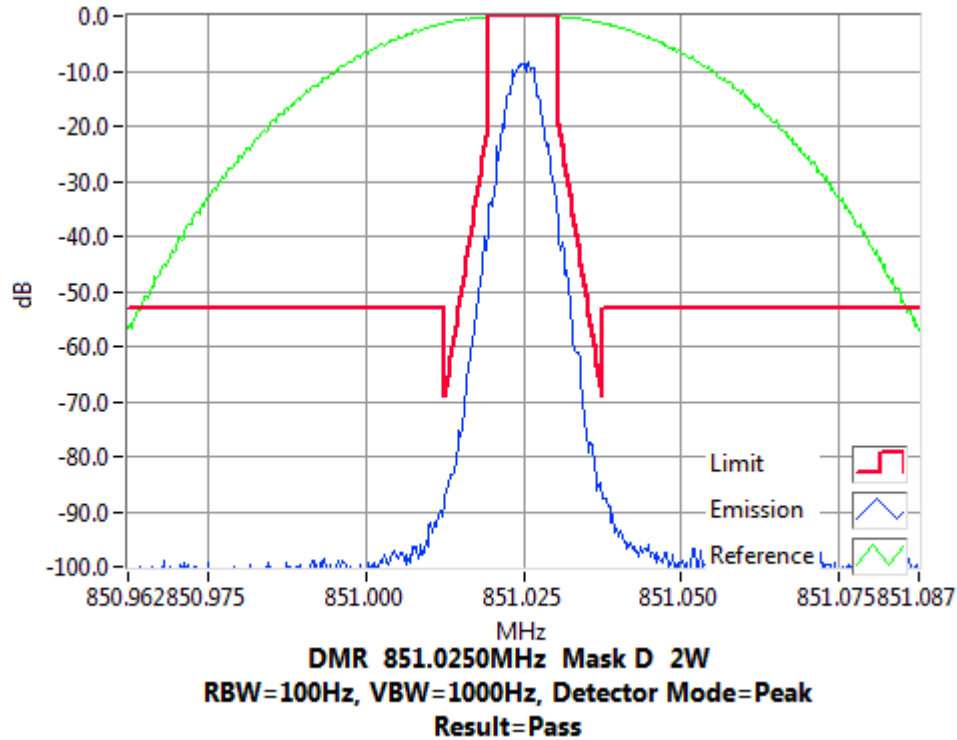
Transmitter Spectrum Masks

DMR

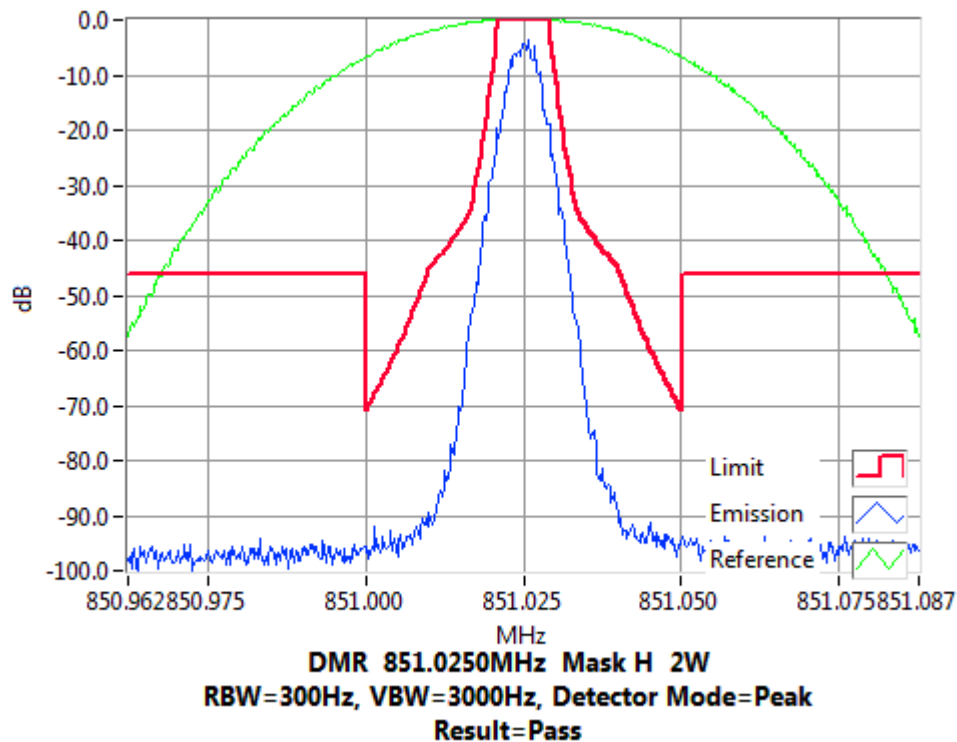
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



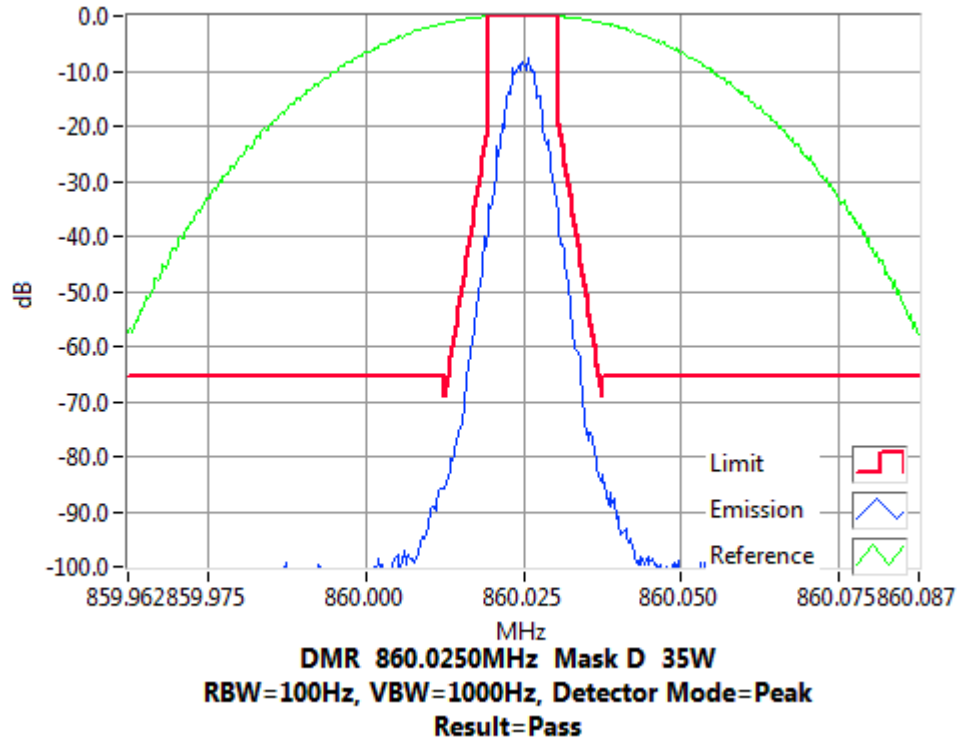
Transmitter Spectrum Masks

DMR

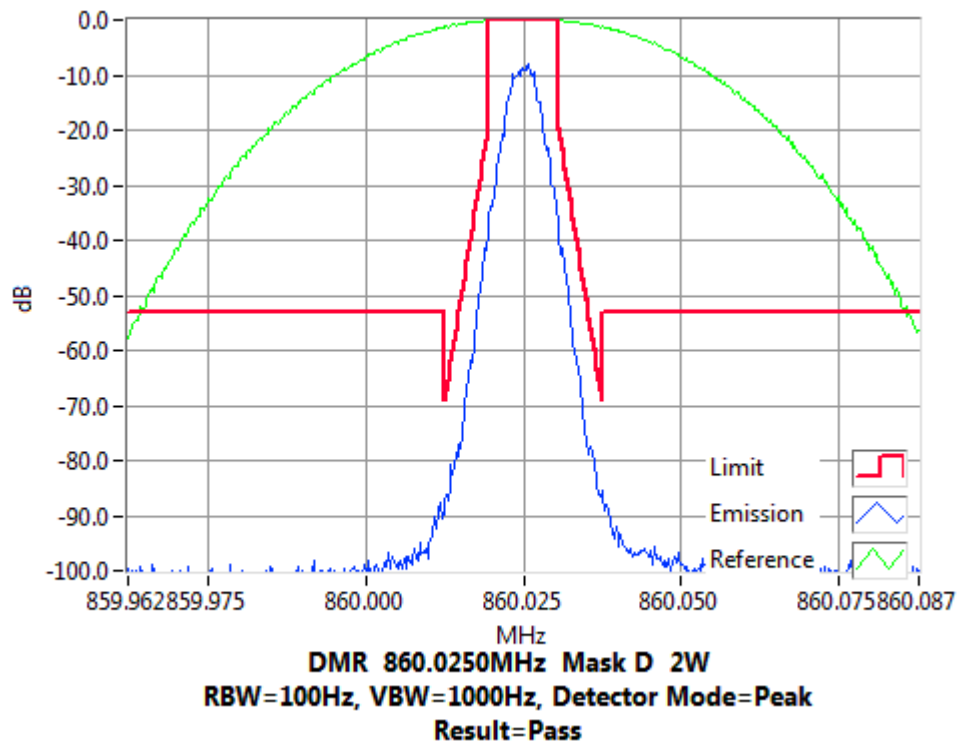
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 860.025 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 860.025 MHz 2 W 12.5 kHz Channel Spacing



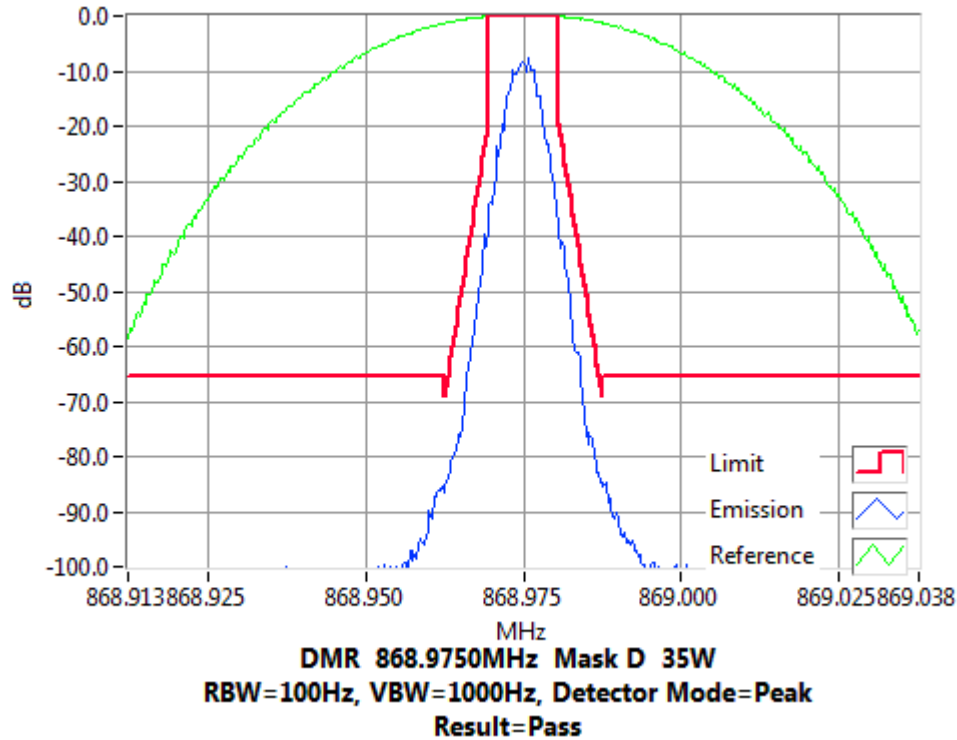
Transmitter Spectrum Masks

DMR

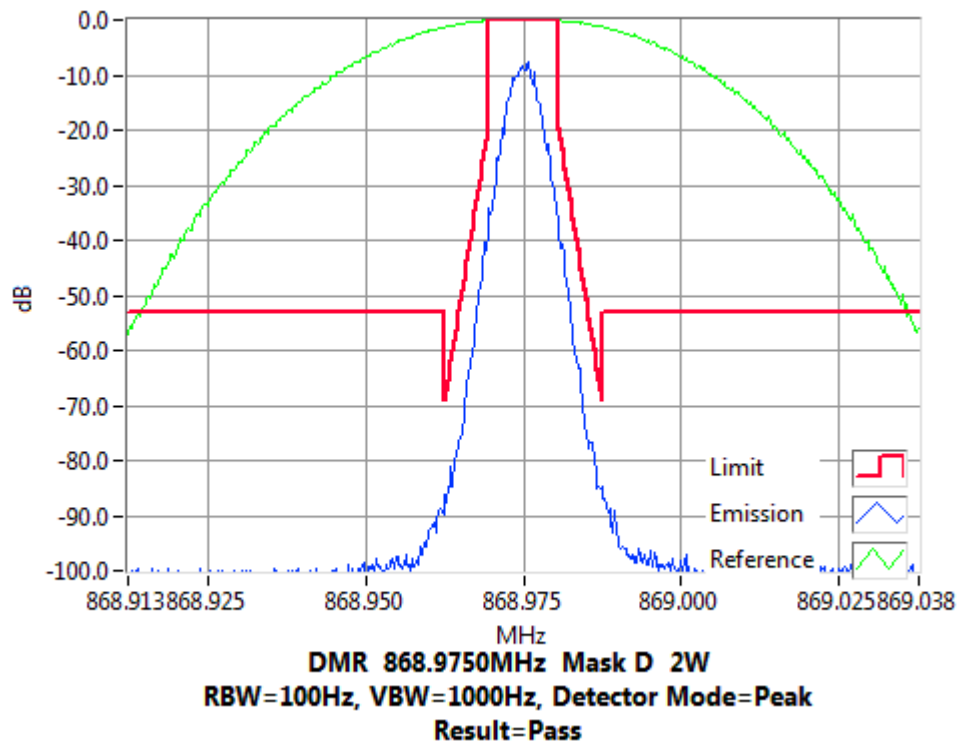
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 868.975 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 868.975 MHz 2 W 12.5 kHz Channel Spacing



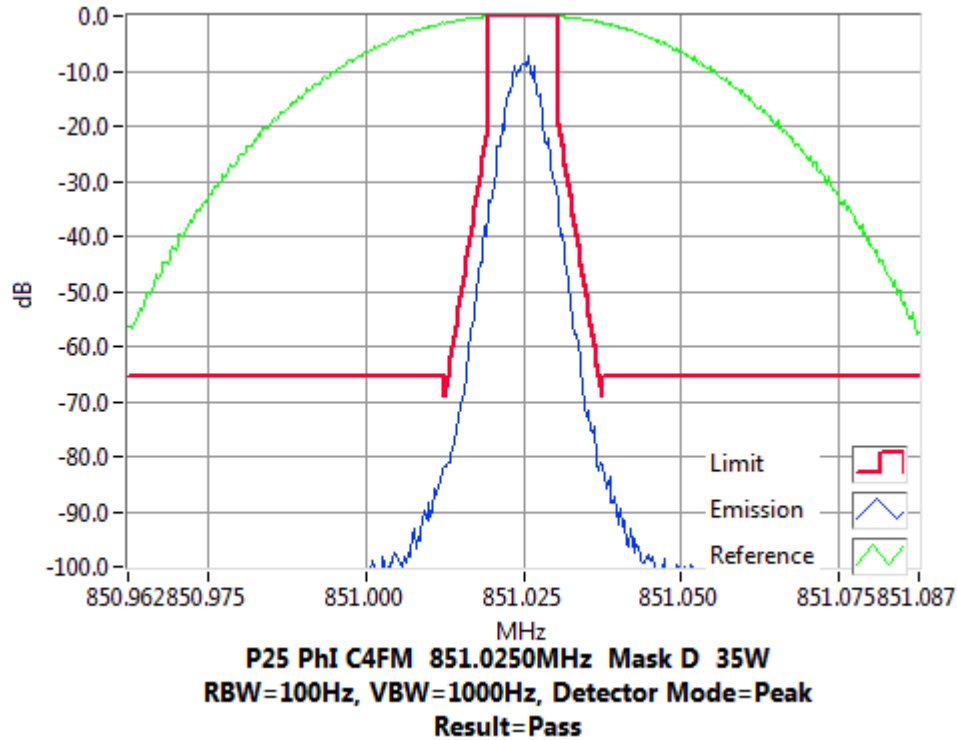
Transmitter Spectrum Masks

P25 PHASE I, C4FM

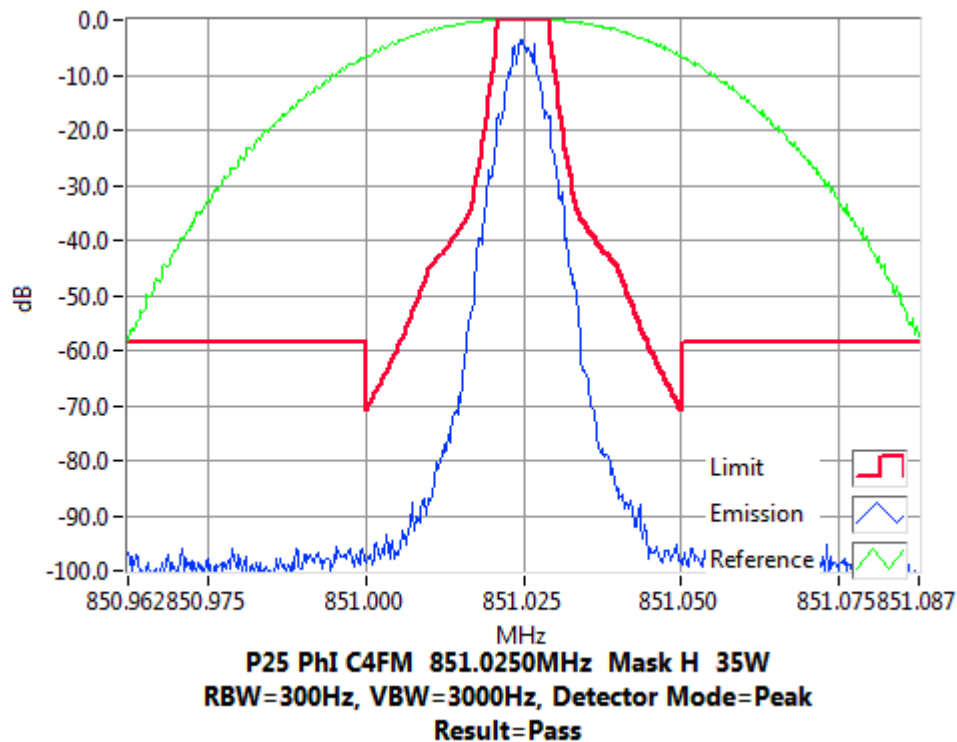
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 851.025 MHz 35 W 12.5 kHz Channel Spacing



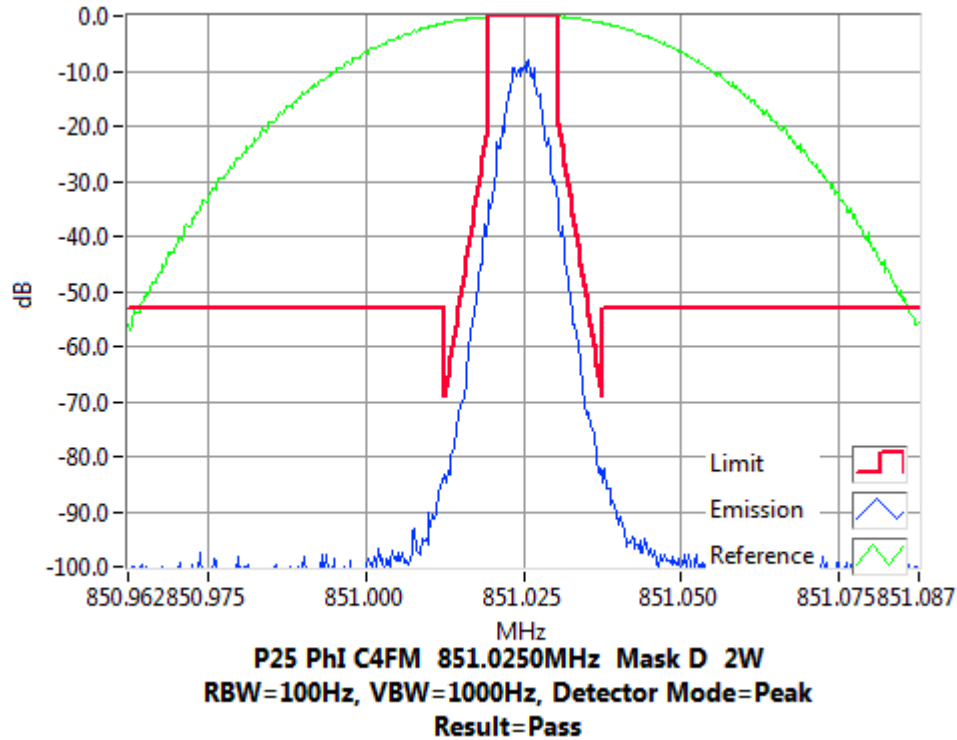
Transmitter Spectrum Masks

P25 PHASE I, C4FM

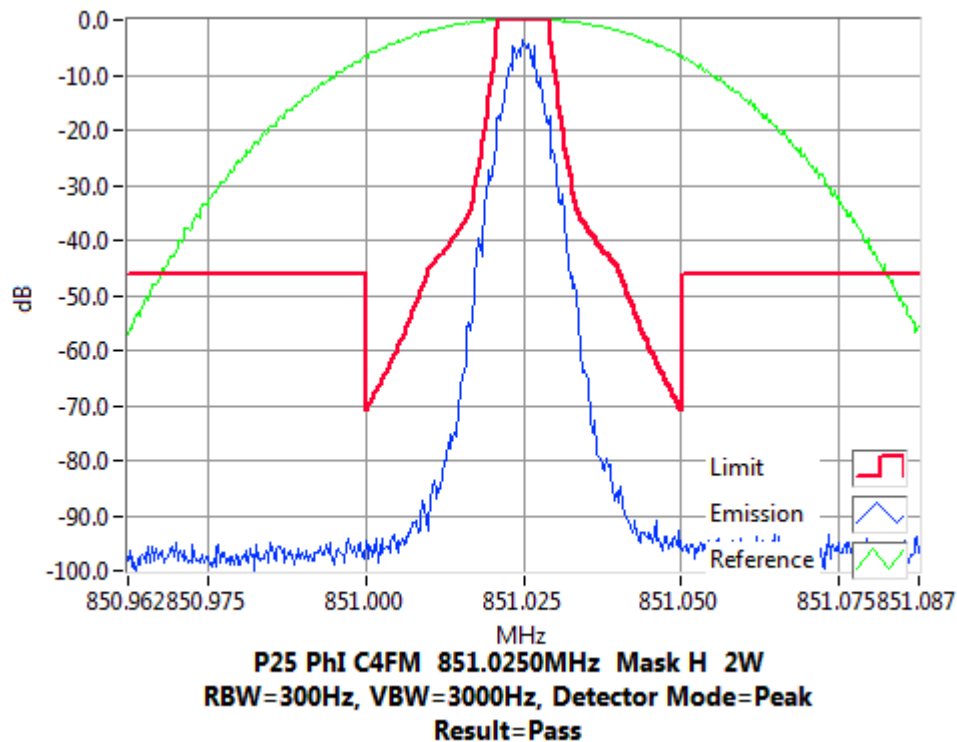
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 851.025 MHz 2 W 12.5 kHz Channel Spacing



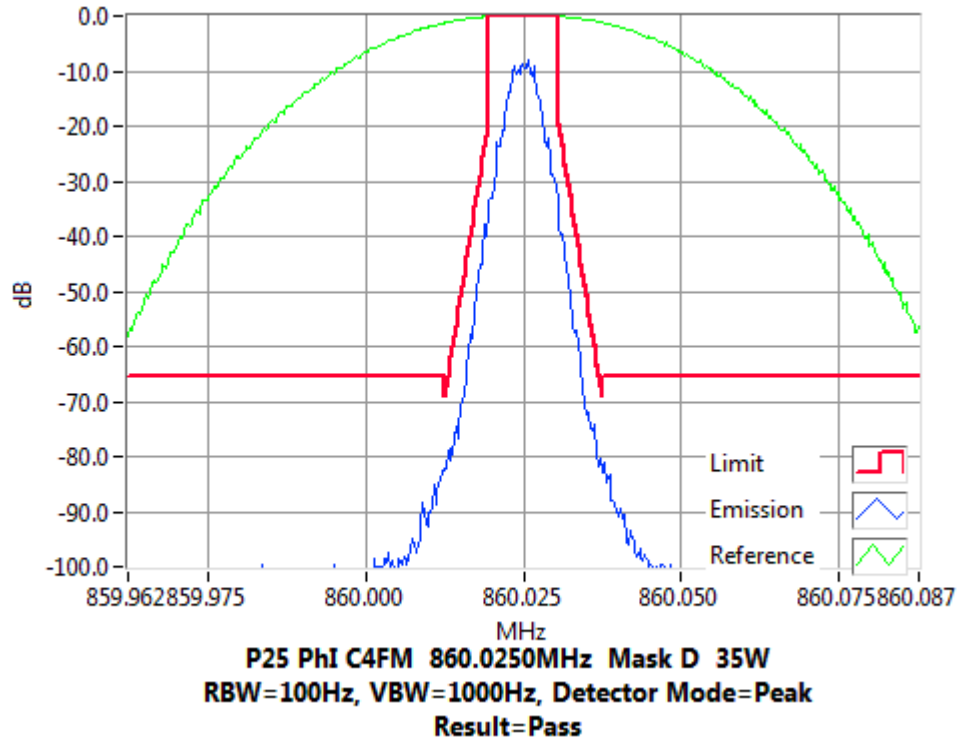
Transmitter Spectrum Masks

P25 PHASE I, C4FM

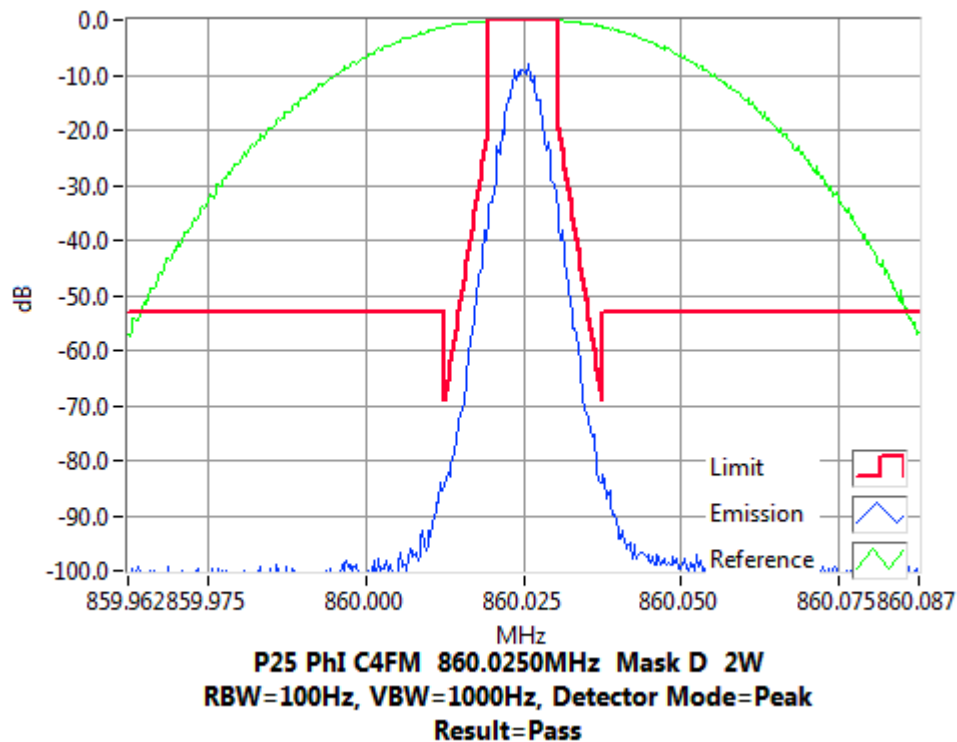
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 860.025 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 860.025 MHz 2 W 12.5 kHz Channel Spacing



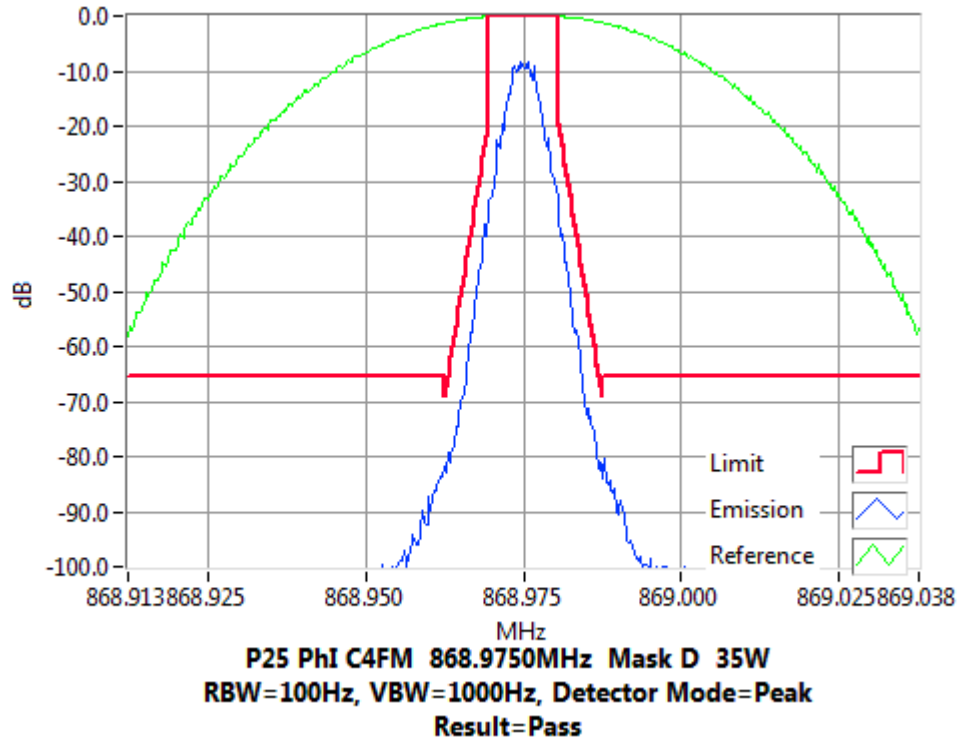
Transmitter Spectrum Masks

P25 PHASE I, C4FM

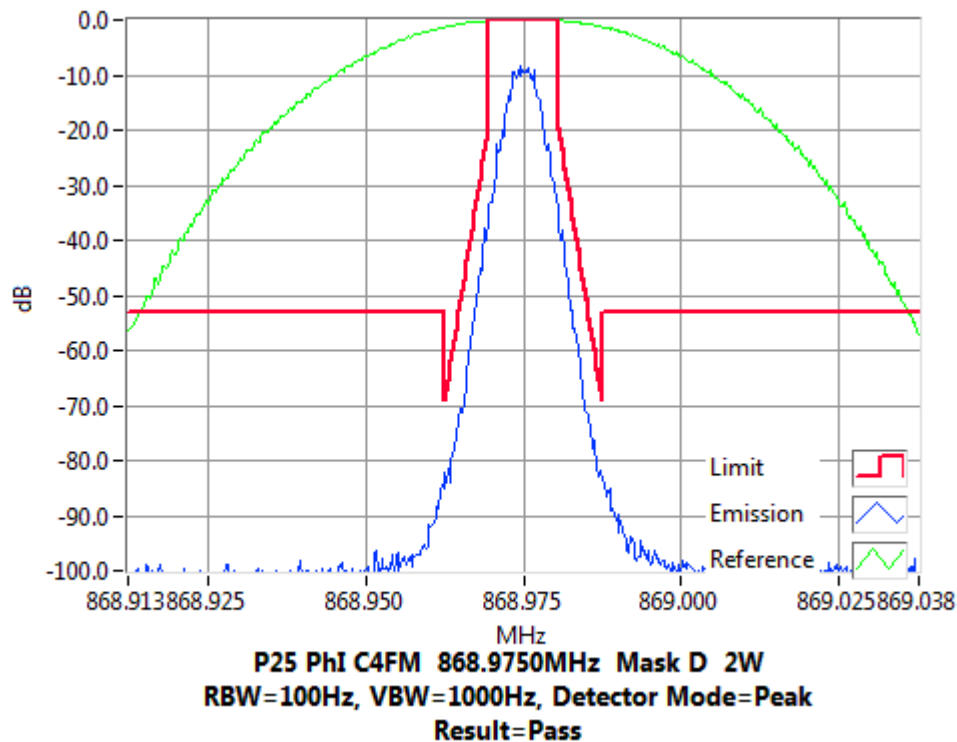
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 868.975 MHz 35 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 868.975 MHz 2 W 12.5 kHz Channel Spacing



ADJACENT CHANNEL POWER RATIO

SPECIFICATION: FCC 47 CFR 90.543

RSS-119 5.8.9

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The transmitter is modulated with the standard test pattern for digital modulation.
3. The test is performed in accordance with 47 CFR 90.543

LIMIT CLAUSE: FCC 47 CFR 90.543

RSS-119 5.8.9

MEASUREMENT UNCERTAINTY: ≤ 12.75 GHz ± 3.0 dB

MEASUREMENT RESULTS:

Analogue

Tx FREQUENCY: 769.075 MHz 35 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP(dBc)
9.375 kHz	6.25 kHz	-44.91	-47.15	-40
15.625 kHz	6.25 kHz	-75.78	-77.1	-60
21.875 kHz	6.25 kHz	-90.3	-90.13	-60
37.5 kHz	25 kHz	-86.33	-86.05	-60
62.5 kHz	25 kHz	-86.9	-86.66	-65
87.5 kHz	25 kHz	-86.58	-86.46	-65
150 kHz	100 kHz	-79.34	-79.37	-65
250 kHz	100 kHz	-84.37	-84.39	-65
350 kHz	100 kHz	-87.49	-87.43	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.6		-80
12 MHz to paired receive band	30 kHz (swept)	-112.8		-80
In the paired receive band	30 kHz (swept)	-112.6		-85

Analogue

Tx FREQUENCY: 774.9 MHz 35 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
9.375 kHz	6.25 kHz	-44.72	-47.2	-40
15.625 kHz	6.25 kHz	-75.24	-77.42	-60
21.875 kHz	6.25 kHz	-88.49	-88.33	-60
37.5 kHz	25 kHz	-84.86	-84.61	-60
62.5 kHz	25 kHz	-85.14	-84.97	-65
87.5 kHz	25 kHz	-84.87	-84.82	-65
150 kHz	100 kHz	-79.25	-79.27	-65
250 kHz	100 kHz	-84.14	-84.14	-65
350 kHz	100 kHz	-87.01	-87.01	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.4		-80
12 MHz to paired receive band	30 kHz (swept)	-112.9		-80
In the paired receive band	30 kHz (swept)	-112.4		-85

Adjacent Channel Power Ratio

Analogue

Tx FREQUENCY: 769.075 MHz 35 W 25.0 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP(dBc)
15.625 kHz	6.25 kHz	-56.76	-61.95	-40
21.875 kHz	6.25 kHz	-76.77	-78.02	-60
37.5 kHz	25 kHz	-85.23	-85.46	-60
62.5 kHz	25 kHz	-86.98	-86.72	-65
87.5 kHz	25 kHz	-86.66	-86.59	-65
150 kHz	100 kHz	-79.27	-79.3	-65
250 kHz	100 kHz	-84.34	-84.37	-65
350 kHz	100 kHz	-87.43	-87.47	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.8		-80
12 MHz to paired receive band	30 kHz (swept)	-112.9		-80
In the paired receive band	30 kHz (swept)	-113		-85

Analogue

Tx FREQUENCY: 774.9 MHz 35 W 25.0 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
15.625 kHz	6.25 kHz	-56.71	-62.42	-40
21.875 kHz	6.25 kHz	-76.05	-77.1	-60
37.5 kHz	25 kHz	-83.9	-84.09	-60
62.5 kHz	25 kHz	-85.23	-85.1	-65
87.5 kHz	25 kHz	-84.92	-84.88	-65
150 kHz	100 kHz	-79.13	-79.16	-65
250 kHz	100 kHz	-84.12	-84.04	-65
350 kHz	100 kHz	-87.04	-86.93	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.2		-80
12 MHz to paired receive band	30 kHz (swept)	-112.4		-80
In the paired receive band	30 kHz (swept)	-112.7		-85

Adjacent Channel Power Ratio

FFSK, 1200 bps

Tx FREQUENCY: 769.075 MHz 35 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP(dBc)
9.375 kHz	6.25 kHz	-55.28	-54.8	-40
15.625 kHz	6.25 kHz	-88.63	-88.52	-60
21.875 kHz	6.25 kHz	-90.19	-90.15	-60
37.5 kHz	25 kHz	-86.37	-86.03	-60
62.5 kHz	25 kHz	-86.63	-86.34	-65
87.5 kHz	25 kHz	-86.86	-86.74	-65
150 kHz	100 kHz	-79.37	-79.38	-65
250 kHz	100 kHz	-84.39	-84.38	-65
350 kHz	100 kHz	-87.38	-87.46	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.9		-80
12 MHz to paired receive band	30 kHz (swept)	-112.7		-80
In the paired receive band	30 kHz (swept)	-112.8		-85

FFSK, 1200 bps

Tx FREQUENCY: 774.9 MHz 35 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
9.375 kHz	6.25 kHz	-55.36	-54.98	-40
15.625 kHz	6.25 kHz	-87.19	-87.08	-60
21.875 kHz	6.25 kHz	-88.53	-88.38	-60
37.5 kHz	25 kHz	-84.87	-84.63	-60
62.5 kHz	25 kHz	-85.06	-84.84	-65
87.5 kHz	25 kHz	-84.98	-84.91	-65
150 kHz	100 kHz	-79.3	-79.24	-65
250 kHz	100 kHz	-84.21	-84.16	-65
350 kHz	100 kHz	-86.97	-86.97	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.5		-80
12 MHz to paired receive band	30 kHz (swept)	-112.7		-80
In the paired receive band	30 kHz (swept)	-112.3		-85

Adjacent Channel Power Ratio

DMR

Tx FREQUENCY: 769.075 MHz 35 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP(dBc)
9.375 kHz	6.25 kHz	-43.76	-42.91	-40
15.625 kHz	6.25 kHz	-82.24	-81.62	-60
21.875 kHz	6.25 kHz	-89.94	-89.77	-60
37.5 kHz	25 kHz	-86.31	-86.0	-60
62.5 kHz	25 kHz	-87.04	-86.79	-65
87.5 kHz	25 kHz	-86.6	-86.55	-65
150 kHz	100 kHz	-79.24	-79.27	-65
250 kHz	100 kHz	-84.31	-84.35	-65
350 kHz	100 kHz	-87.42	-87.3	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.5		-80
12 MHz to paired receive band	30 kHz (swept)	-112.4		-80
In the paired receive band	30 kHz (swept)	-112.7		-85

DMR

Tx FREQUENCY: 774.9 MHz 35 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
9.375 kHz	6.25 kHz	-44.25	-43.24	-40
15.625 kHz	6.25 kHz	-81.92	-81.28	-60
21.875 kHz	6.25 kHz	-88.17	-88.07	-60
37.5 kHz	25 kHz	-84.79	-84.55	-60
62.5 kHz	25 kHz	-85.22	-85.09	-65
87.5 kHz	25 kHz	-84.89	-84.78	-65
150 kHz	100 kHz	-79.25	-79.31	-65
250 kHz	100 kHz	-84.18	-84.15	-65
350 kHz	100 kHz	-87.01	-86.97	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.2		-80
12 MHz to paired receive band	30 kHz (swept)	-113.1		-80
In the paired receive band	30 kHz (swept)	-112.9		-85

Adjacent Channel Power Ratio

P25 Phase I C4FM

Tx FREQUENCY: 769.075 MHz 35 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP(dBc)
9.375 kHz	6.25 kHz	-42.03	-41.07	-40
15.625 kHz	6.25 kHz	-79.84	-79.25	-60
21.875 kHz	6.25 kHz	-89.86	-89.64	-60
37.5 kHz	25 kHz	-86.24	-85.95	-60
62.5 kHz	25 kHz	-86.93	-86.67	-65
87.5 kHz	25 kHz	-86.61	-86.53	-65
150 kHz	100 kHz	-79.39	-79.35	-65
250 kHz	100 kHz	-84.39	-84.43	-65
350 kHz	100 kHz	-87.4	-87.46	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.8		-80
12 MHz to paired receive band	30 kHz (swept)	-112.8		-80
In the paired receive band	30 kHz (swept)	-112.6		-85

P25 Phase I C4FM

Tx FREQUENCY: 774.9 MHz 35 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
9.375 kHz	6.25 kHz	-41.9	-40.91	-40
15.625 kHz	6.25 kHz	-79.3	-78.72	-60
21.875 kHz	6.25 kHz	-88.31	-88.09	-60
37.5 kHz	25 kHz	-84.79	-84.57	-60
62.5 kHz	25 kHz	-85.22	-85.0	-65
87.5 kHz	25 kHz	-84.89	-84.82	-65
150 kHz	100 kHz	-79.21	-79.17	-65
250 kHz	100 kHz	-84.09	-84.08	-65
350 kHz	100 kHz	-86.99	-86.96	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.7		-80
12 MHz to paired receive band	30 kHz (swept)	-112.5		-80
In the paired receive band	30 kHz (swept)	-113		-85