TELTEST Laboratories
Tait Communications
Report Number 3432

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TMBK5B Mobile Transceiver

Tested in accordance with:

FCC 47 CFR Part 90

RSS-119 Issue 11
RSS-Gen Issue 3

Report Revision:	1	
Issue Date:	17-January-2013	
PREPARED BY:	Garry Pringle	_____ Test Technician
	Linda White	_____ Test Technician
CHECKED & APPROVED BY:	Steve Crompton	_____ Laboratory Manager

TELTEST Laboratories (A Division of Tait Communications)
PO Box 1645, 558 Wairakei Road, Christchurch, New Zealand.
Telephone: 64 3 358 3399
FAX: 64 3 359 4632

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REVISION

Date	Revision	Comments
17-January-2013	1	Initial test report

INTRODUCTION

This report demonstrates that the TMBK5B mobile transceiver complies with FCC 47 Part 90, and RSS-119 Issue 11 & RSS-Gen Issue 3. This radio supports analog, digital FFSK, P25 phase-1, P25 phase-2 and Digital Mobile Radio modulations.

Modulation		Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
Analogue FM		12.5 kHz	1	-	-
FFSK	Fast Frequency Shift Keying	12.5 kHz	-	1200	1200
		12.5 kHz	-	2400	2400
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
APCO P25 Phase 2	H-CPM (2 slot TDMA) (TIA 102)	12.5 kHz	2	6000	12000

Type Approval Testing of the T02-00014-XPAA
Serial number 20041219
Frequency range 762 → 870 MHz

in accordance with:
FCC 47 CFR Part 90
RSS-119 Issue 11 & RSS-Gen Issue 3

REPORT PREPARED FOR
Tait Communications
PO Box 1645
558 Wairakei Road
Christchurch
New Zealand

DESCRIPTION OF SAMPLE
Manufacturer Tait Limited
Equipment: Mobile Transceiver
Type: TMBK5B
Product Code: T02-00014-XPAA
Serial Number(s): 20041219
Quantity: 1

HARDWARE & SOFTWARE

DMR
Hardware ID TMBB14-K500_0006
Boot Code QMB1B_S00_3.00.03.0001
DSP QMB1A_E00_1.00.01.0025
Radio Application QMB1F_E00_1.00.01.0025
FPGA Image QMB1G_S00_1.00.02.0001

P25 phase 1
Hardware ID TMBB14-K500_0006
Boot Code QMB1B_S00_3.00.03.0001
DSP QMB1A_A00_1.00.01.0021
Radio Application QMB1F_A00_1.00.01.0021
FPGA Image QMB1G_S00_1.00.02.0001

	P25 phase 2
Hardware ID	TMBB14-K500_0006
Boot Code	QMB1B_S00_3.00.03.0001
DSP	QMB1A_A00_1.00.01.0021
Radio Application	QMB1F_A00_1.00.01.0021
FPGA Image	QMB1G_S00_1.00.02.0001_P2.a

TEST CONDITIONS

All testing was performed between 28th November → 17th January 2013, and under the following conditions:

Ambient temperature:	15°C → 30°C
Relative Humidity:	20% → 75%
Standard Test Voltage	13.8 V_{DC}

DECLARATION OF CONFORMITY

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

Equipment:	Mobile Transceiver
Type:	TMBK5B
Product Code:	T02-00014-XPAA
Serial Number(s):	20041219
Quantity:	1

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

FCC 47 CFR Part 90

RSS-119 Issue 11 & RSS-Gen Issue 3

Signature: _____

S.A. Crompton
Compliance Laboratory Manager

Date: _____

MODULATION TYPES, NECESSARY BANDWIDTH, and EMISSION DESIGNATORS

MODULATION TYPES:

F3E	Analog FM		
F2D	FFSK	1200 bps	2400 bps
FXD	Digital	9600 bps	
FXW	Digital Voice / Data	9600 bps	
F1W	Digital Voice / Data	12000 bps	

EMISSION DESIGNATORS:

CHANNEL SPACINGS:	12.5 kHz	25.0 kHz
Analog FM	11K0F3E	16K0F3E
FFSK Data 1200bps	6K60F2D	9K60F2D
FFSK Data 2400bps	7K80F2D	10K8F2D
Digital Voice / Data	8K10F1E	
	8K10F7E	
	8K10F7D	
	8K10F1D	
	8K10F1W	
Digital Voice / Data	7K60FXW	
	7K60FXD	

CALCULATIONS:

Equation: Bn = 2M + 2Dk
(M is highest modulating frequency; D is peak allowable deviation; k is a constant of 1 for FM)

Analogue FM Voice 12.5 kHz Bandwidth:

Necessary bandwidth
M = 3.0 kHz
D = 2.5 kHz
Bn = (2x3.0) + (2x2.5) x 1
= 11.0 kHz

Emission Designator
11K0F3E
F3E represents an FM voice transmission

Analogue FM Voice 25.0 kHz Bandwidth :

Necessary bandwidth
M = 3.0 kHz
D = 5.0 kHz
Bn = (2x3.0) + (2x5.0) x 1
= 16.0 kHz

Emission Designator
16K0F3E
F3E represents a FM voice transmission

Fast Frequency Shift Keying (FFSK – 1200 bps) 12.5 kHz Bandwidth:

Necessary bandwidth
M = 1.8 kHz
D = 1.5 kHz (60% of peak deviation)
Bn = (2 x 1.8) + (2 x 1.5) x 1
= 6.6 kHz

Emission Designator
6K60F2D
F2D represents a FM data transmission with the use of a modulating sub carrier

Fast Frequency Shift Keying (FFSK – 1200 bps) 25.0 kHz Bandwidth

Necessary bandwidth
M = 1.8 kHz
D = 3 kHz (60% of peak deviation)
Bn = (2 x 1.8) + (2 x 3.0) x 1
= 9.6 kHz

Emission Designator
9K60F2D
F2D represents a FM data transmission with the use of a modulating sub carrier

Emission Designators – Continued

Fast Frequency Shift Keying (FFSK – 2400 bps) 12.5 kHz Bandwidth

Necessary bandwidth
M = 2.4 kHz
D = 1.5 kHz (60% of peak deviation)
Bn = (2 x 2.4) + (2 x 1.5) x 1
= 7.8 kHz

Emission Designator
7K80F2D
F2D represents a FM data transmission with the use of a modulating sub carrier

Fast Frequency Shift Keying (FFSK - 2400 bps) 25.0 kHz Bandwidth

Necessary bandwidth
M = 2.4 kHz
D = 3.0 kHz (60% of peak deviation)
Bn = (2 x 2.4) + (2 x 3.0) x 1
= 10.8 kHz

Emission Designator
10K8F2D
F2D represents a FM data transmission with the use of a modulating sub carrier

MEASURED BANDWIDTHS:

Digital Voice/data transmissions use a 4 level frequency shift keying modulation scheme.
The necessary bandwidth has been measured using the 99% energy rule, and in accordance with TIA/EIA 102 CAAB 2.2.5.2.

Digital Voice 12.5 kHz Bandwidth P25 phase 1

99% bandwidth
= 8.1 kHz

Emission Designator
8K10F1E
F1E represents a digital FM voice transmission
8K10F7E
F7E represents two or more channels containing quantized or digital voice information

Digital Voice 12.5 kHz Bandwidth P25 phase 2

99% bandwidth
= 8.1 kHz

Emission Designator
8K10F1W
F1W represents a single FM telephony channel

Digital Voice 12.5 kHz Bandwidth DMR

99% bandwidth
= 7.6 kHz

Emission Designator
7K60FXW
FXW represents a FM Time Division Multiple Access (TDMA) combination of data and telephony

Digital Data 12.5 kHz Bandwidth P25 phase 1

99% bandwidth
= 8.1 kHz

Emission Designator
8K10F1D
F1D represents an digital FM data transmission
8K10F7D
F7D represents two or more channels containing quantized or digital information

Digital Data 12.5 kHz Bandwidth P25 phase 2

99% bandwidth
= 8.1 kHz

Emission Designator
8K10F1W
F1W represents digital FM data transmission

Digital Data 12.5 kHz Bandwidth DMR

99% bandwidth
= 7.6 kHz

Emission Designator
7K60FXD
FXW 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: TIA/EIA-603D 2.2.1

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.

MEASUREMENT RESULTS:

Manufacturer's Rated Output Power: Switchable: (30 W for 700 MHz) 35 W and 2 W

Note: 700MHz channels are 30 W

Nominal 30 & 35 W	769.06875MHz	799.06875MHz	807.5125MHz	823.9875MHz	868.9875MHz
Measured	25.14	26.60	32.11	31.13	30.51
Variation (%)	-16.19	-11.34	-8.26	-11.05	-12.82
Variation (dB)	-0.8	-0.5	-0.4	-0.5	-0.6
Nominal 2 W	769.06875MHz	799.06875MHz	807.5125MHz	823.9875MHz	868.9875MHz
Measured	1.90	1.84	1.81	1.73	1.76
Variation (%)	-5.09	-8.04	-9.72	-13.30	-11.95
Variation (dB)	-0.2	-0.4	-0.4	-0.6	-0.6
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)

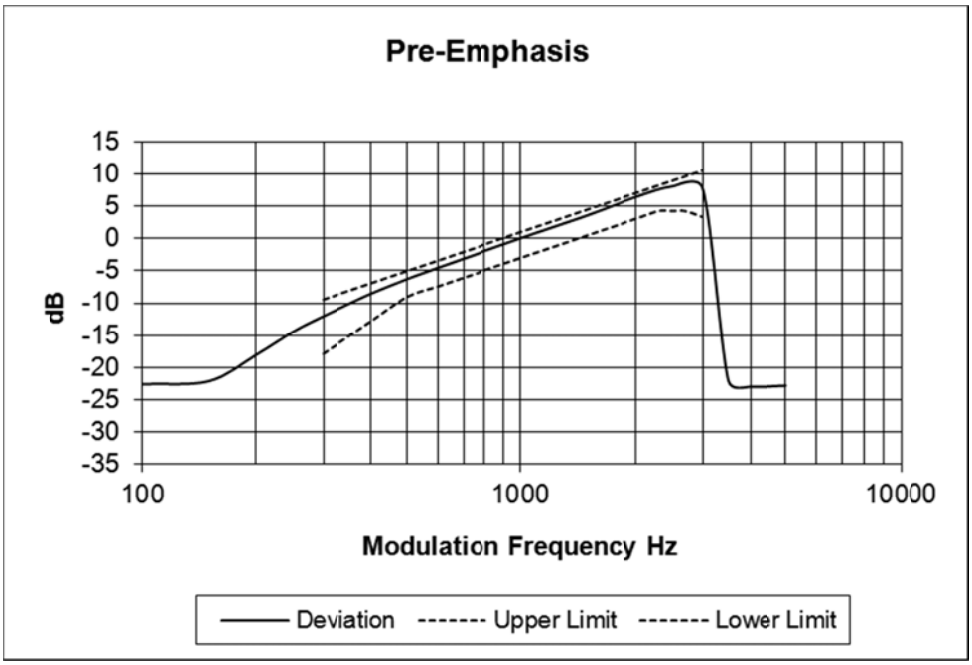
GUIDE: TIA/EIA-603D 2.2.6

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 0dB 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 spacings tested at 35 W transmit power.

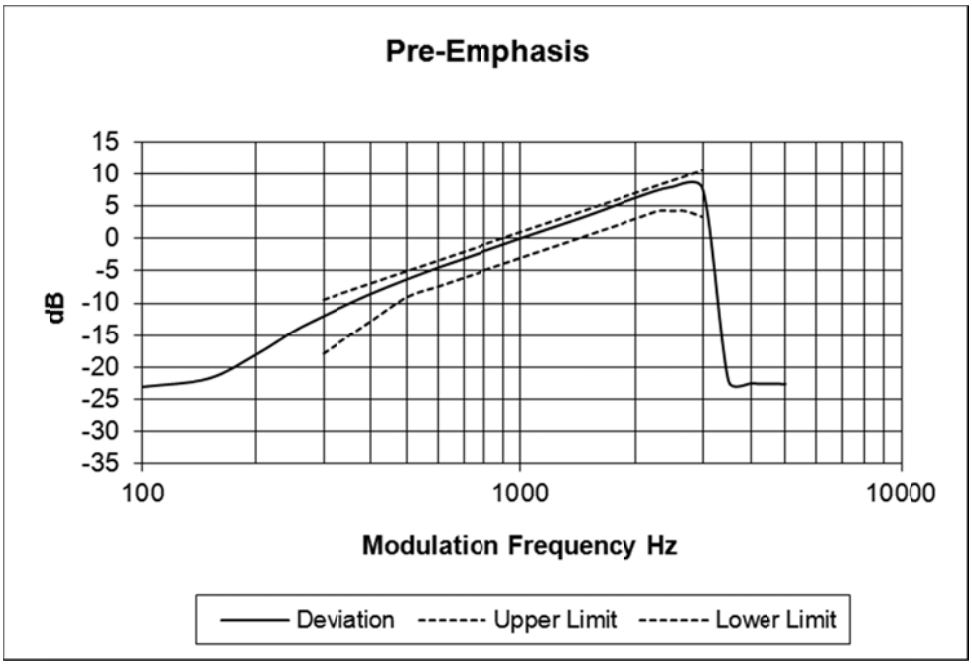
LIMIT CLAUSE: TIA/EIA-603D 3.2.6

Tx FREQUENCY: 807.5125 MHz 12.5 kHz Channel Spacing

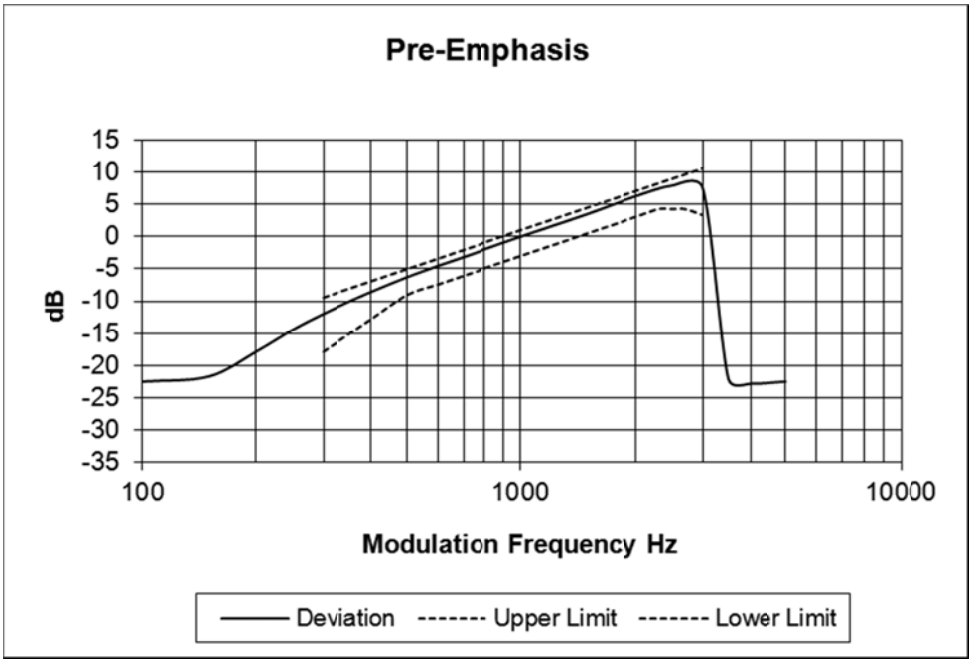


Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 823.9875 MHz 12.5 kHz Channel Spacing

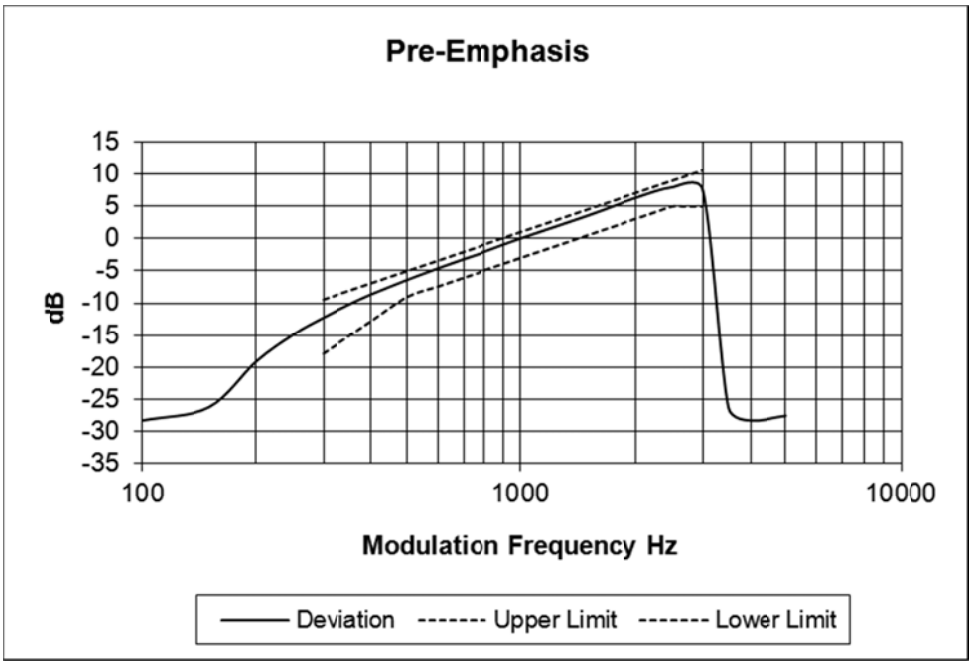


Tx FREQUENCY: 868.9875 MHz 12.5 kHz Channel Spacing

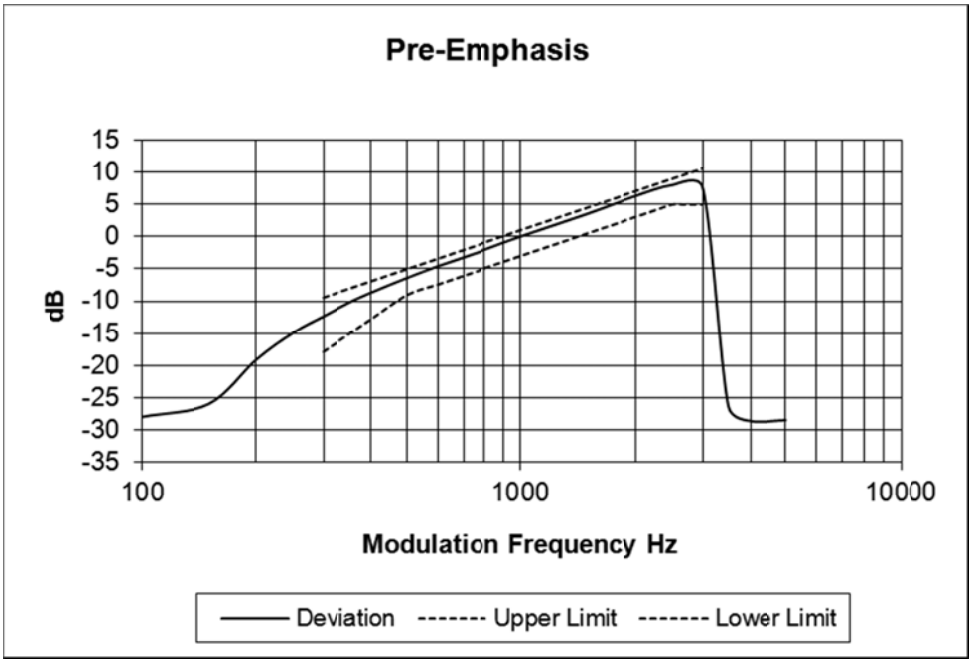


Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 807.5125 MHz 25.0 kHz Channel Spacing

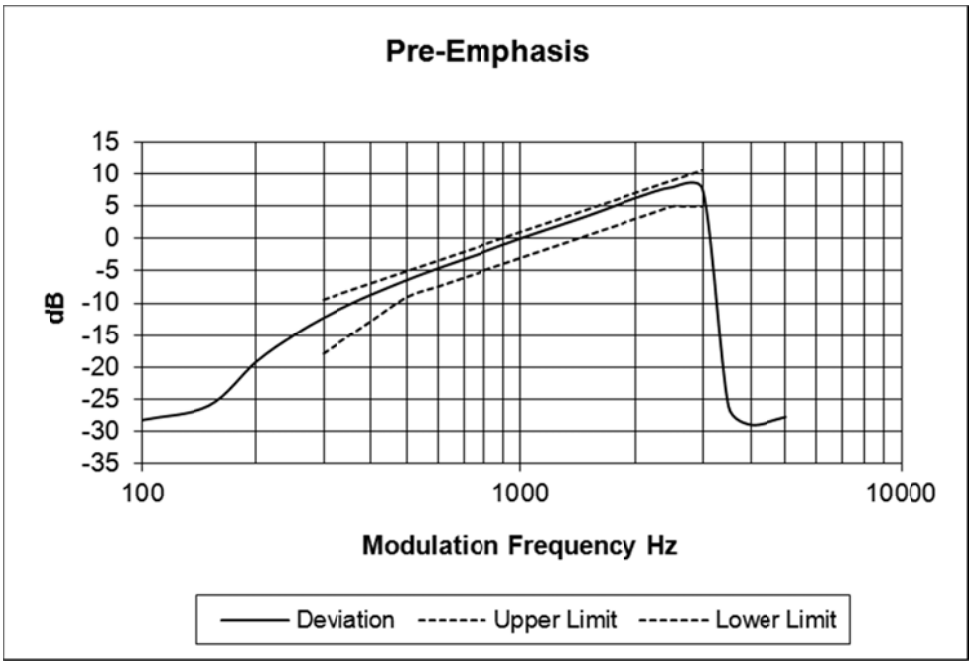


Tx FREQUENCY: 823.9875 MHz 25.0 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 868.9875 MHz 25.0 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: TIA/EIA-603D 2.2.3

MEASUREMENT PROCEDURE:
1. Refer Annex A for Equipment set up.
2. The modulation response was measured at three audio frequencies while varying the input level.
3. Measurements were made for both Positive and Negative Deviation.

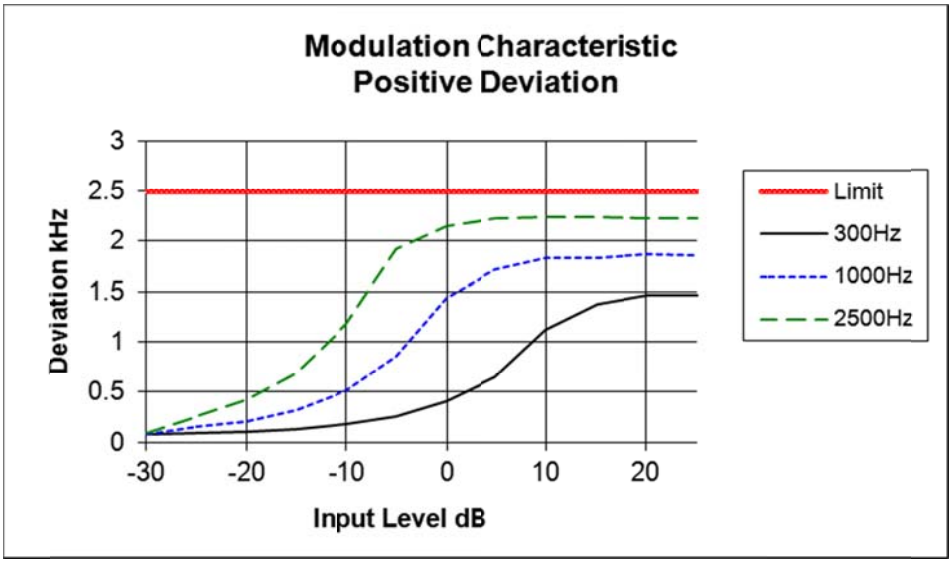
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz and 25.0 kHz channel spacings.

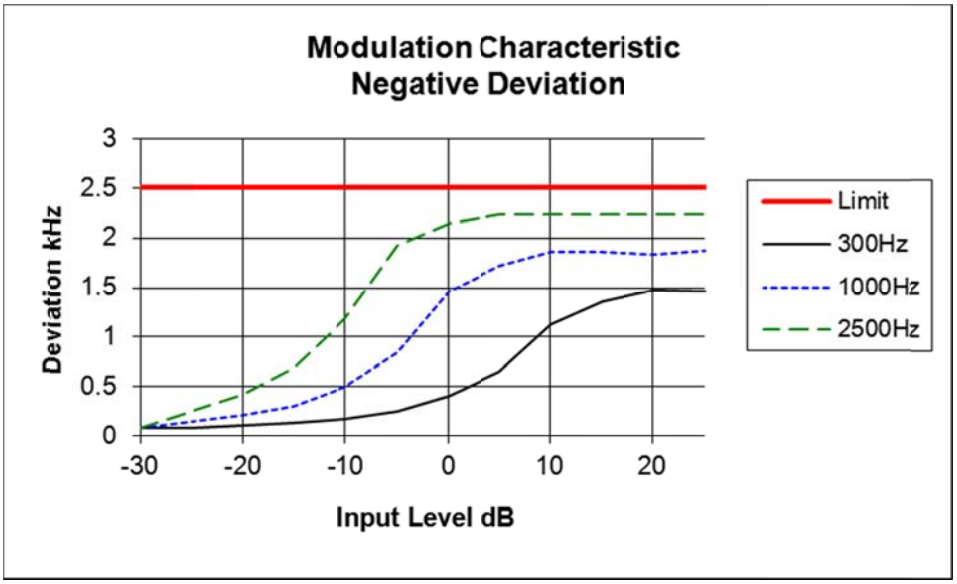
LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 807.5125 MHz 12.5 kHz Channel Spacing

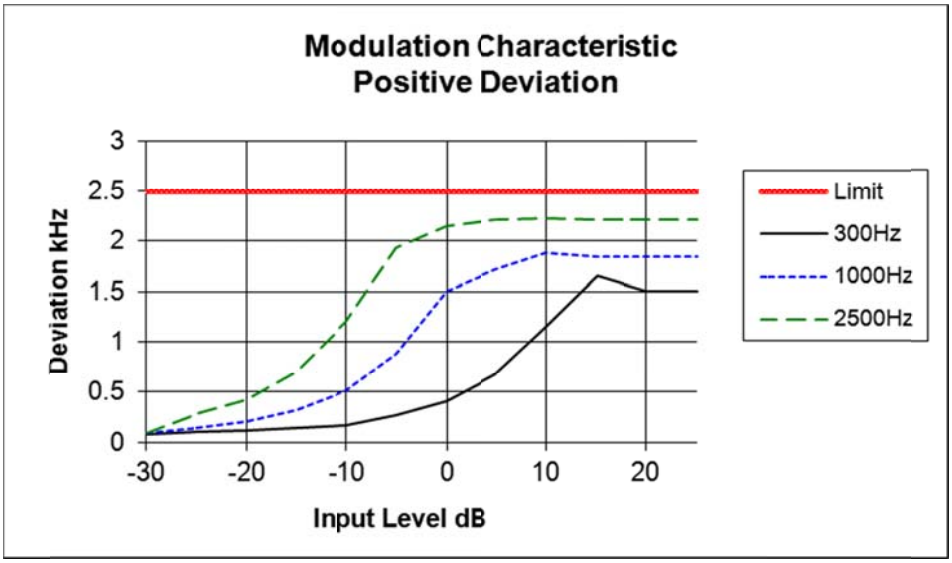


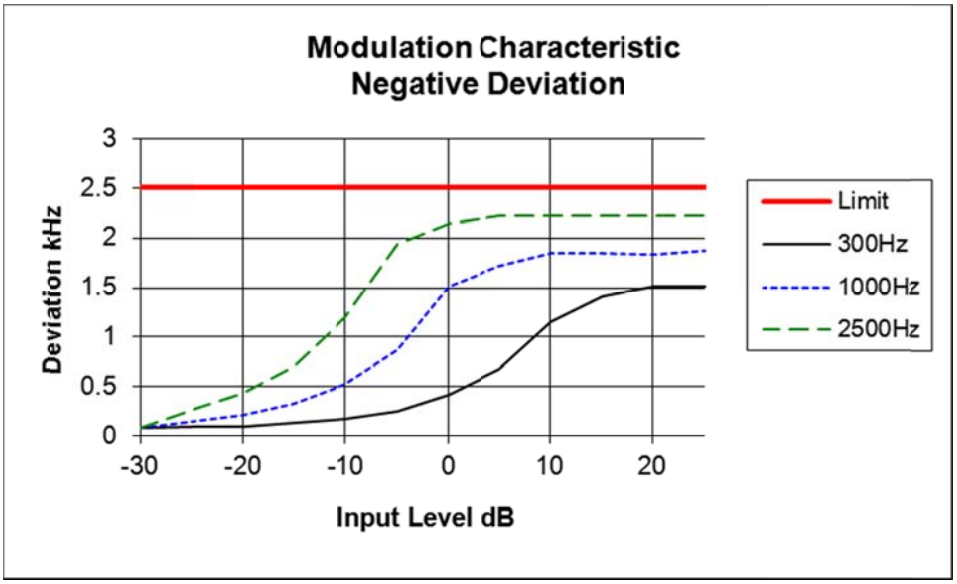


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 823.9875 MHz 12.5 kHz Channel Spacing

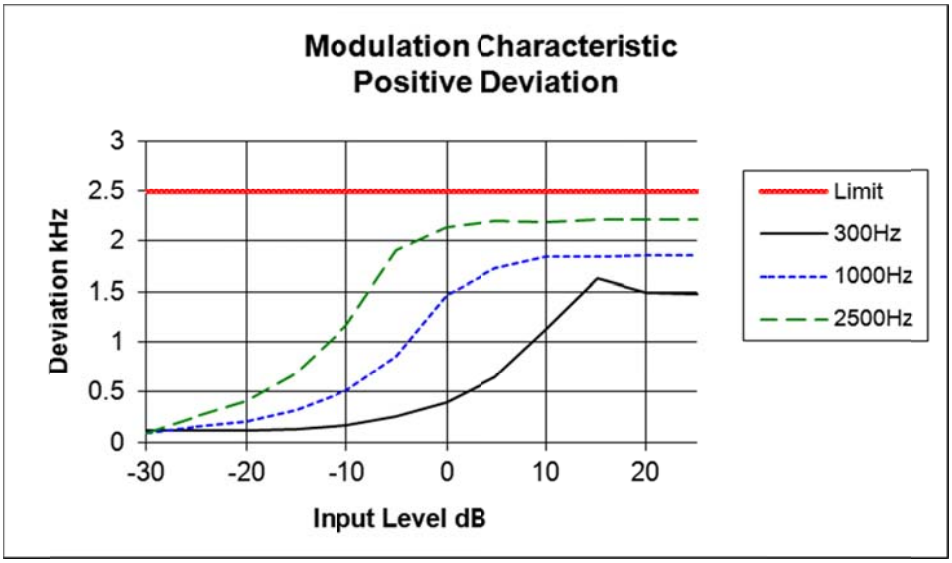


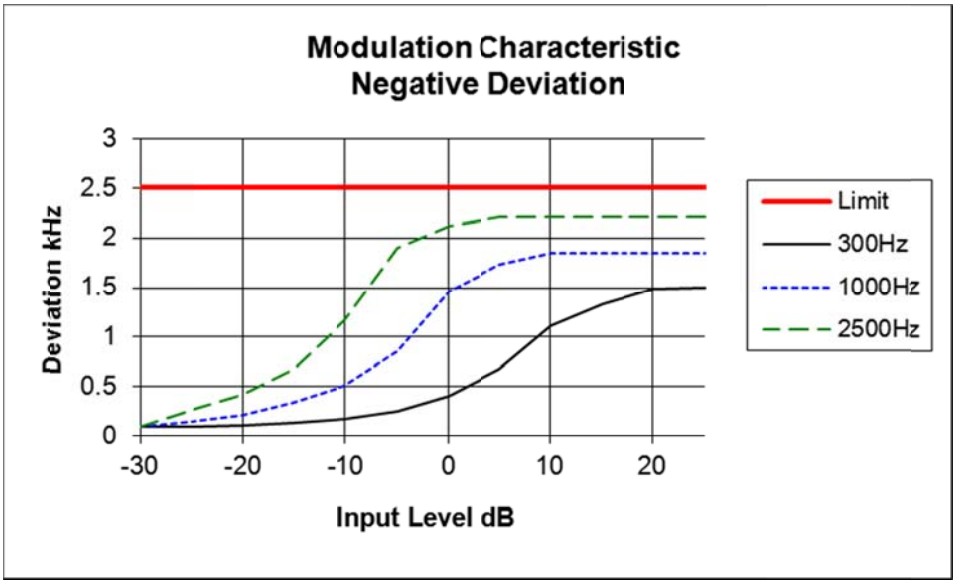


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 868.9875 MHz 12.5 kHz Channel Spacing

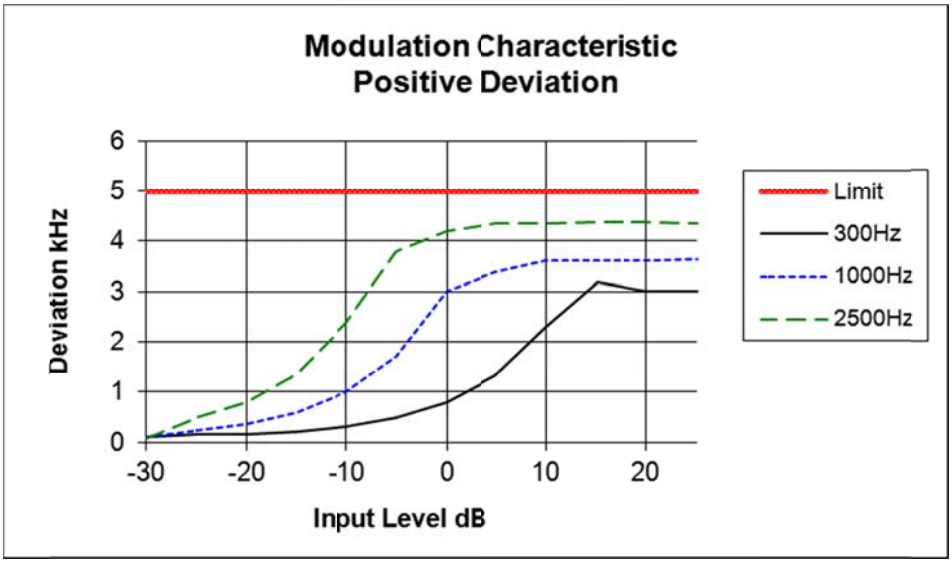


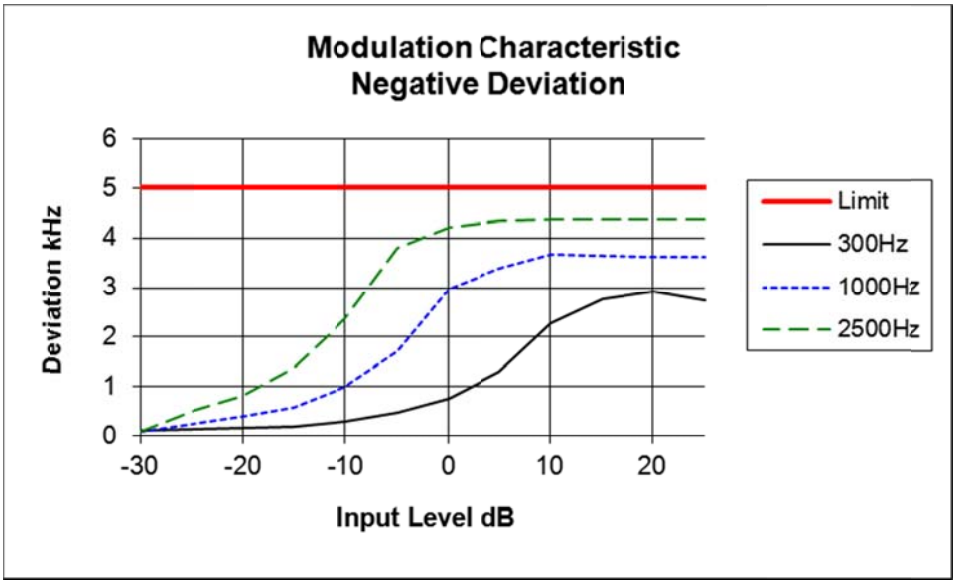


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 807.5125 MHz 25.0 kHz Channel Spacing

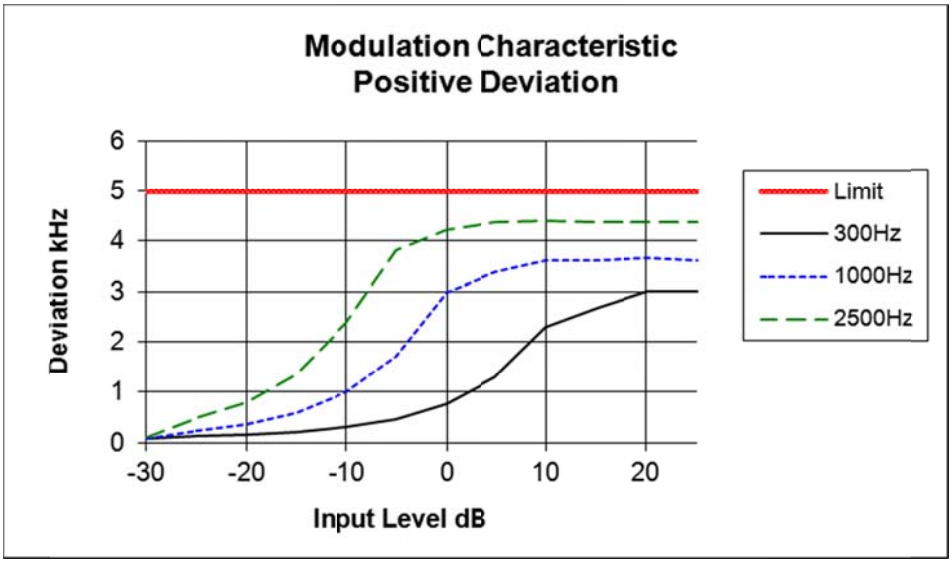


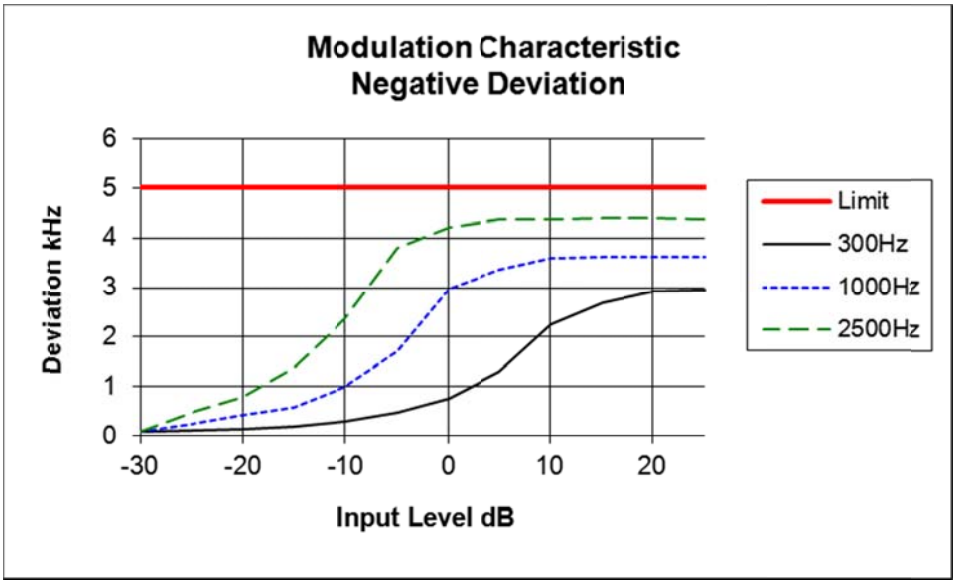


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 823.9875 MHz 25.0 kHz Channel Spacing

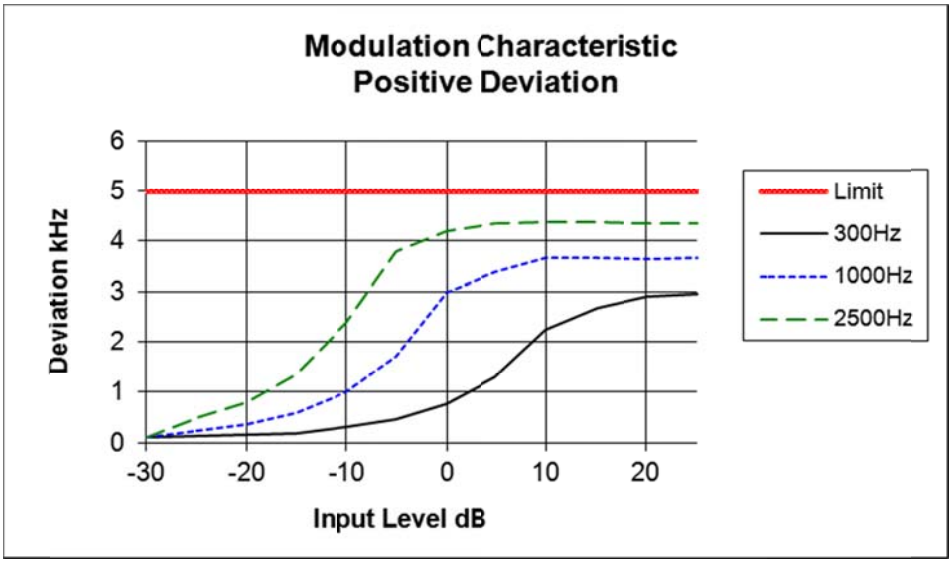


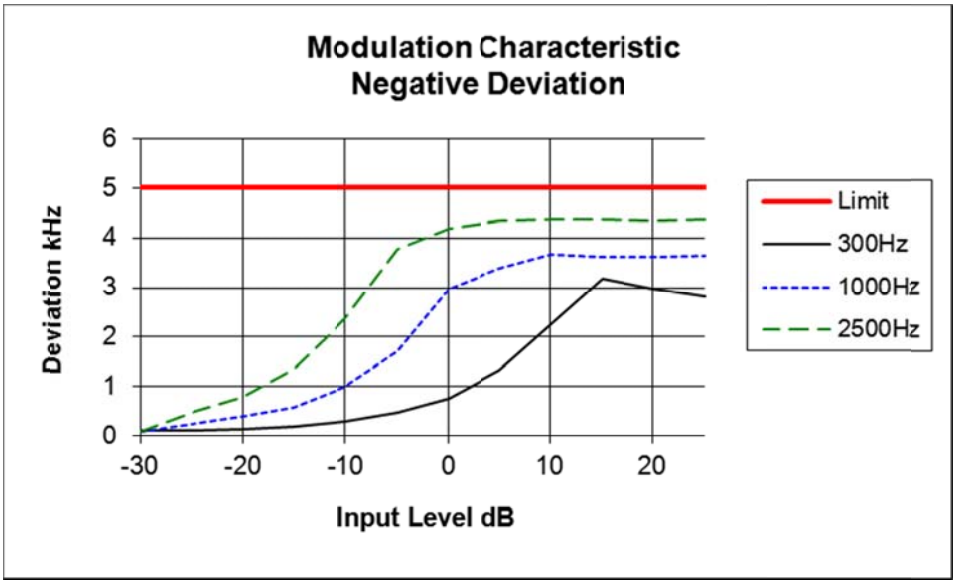


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 868.9875 MHz 25.0 kHz Channel Spacing





OCCUPIED BANDWIDTH AND SPECTRUM MASKS

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

GUIDE: TIA/EIA-603D 2.2.11

MEASUREMENT PROCEDURE:
1. Refer Annex A for Equipment Set up.
2. For analog 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.

   Emission Mask D – Resolution bandwidth = 100 Hz, Video bandwidth = 1 kHz
   Emission Mask B, G – Resolution bandwidth = 300 Hz, Video bandwidth = 3 kHz

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

LIMIT CLAUSE: FCC 47 CFR 90.210 RSS-119 5.5

EMISSION MASKS

Emission Mask D	12.5 kHz Channel Spacing	Analog; FFSK; Digital Voice/Data
Emission Mask B	25.0 kHz Channel Spacing	Analog;
Emission Mask G	25.0 kHz Channel Spacing	FFSK;

DATA SPEED

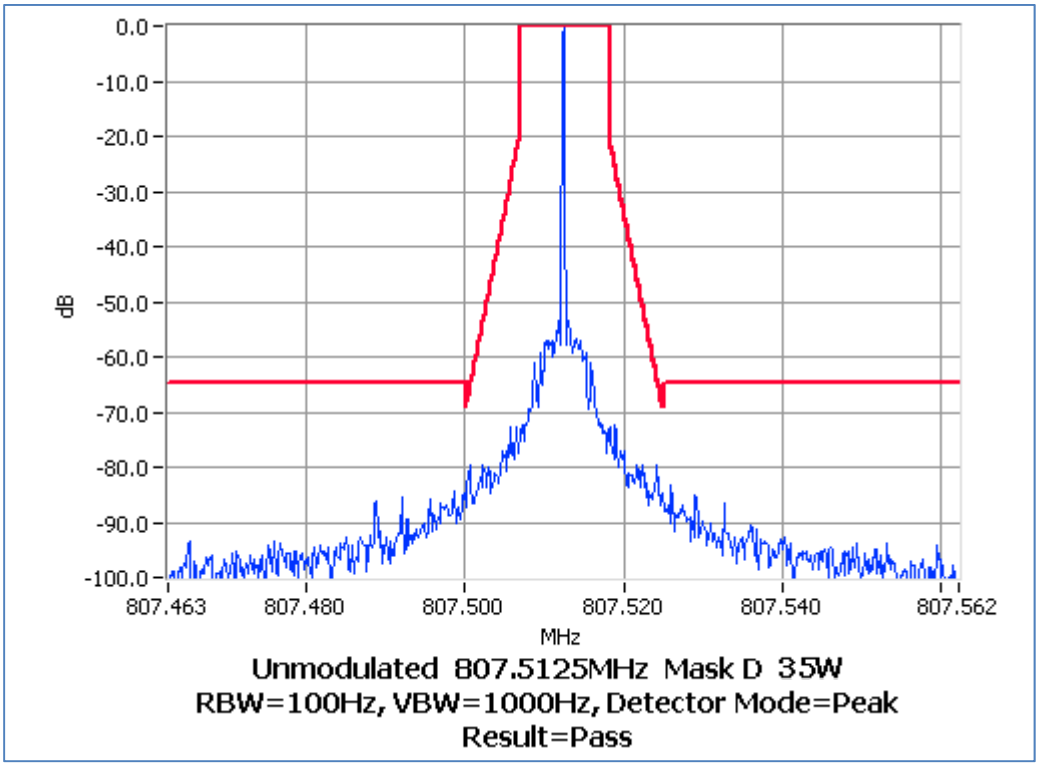
Digital Voice/Data	12.5 kHz Channel Spacing	9600 bps & 12000 bps
FFSK	12.5 kHz Channel Spacing	1200 bps & 2400 bps

Occupied Bandwidth and Spectrum Masks

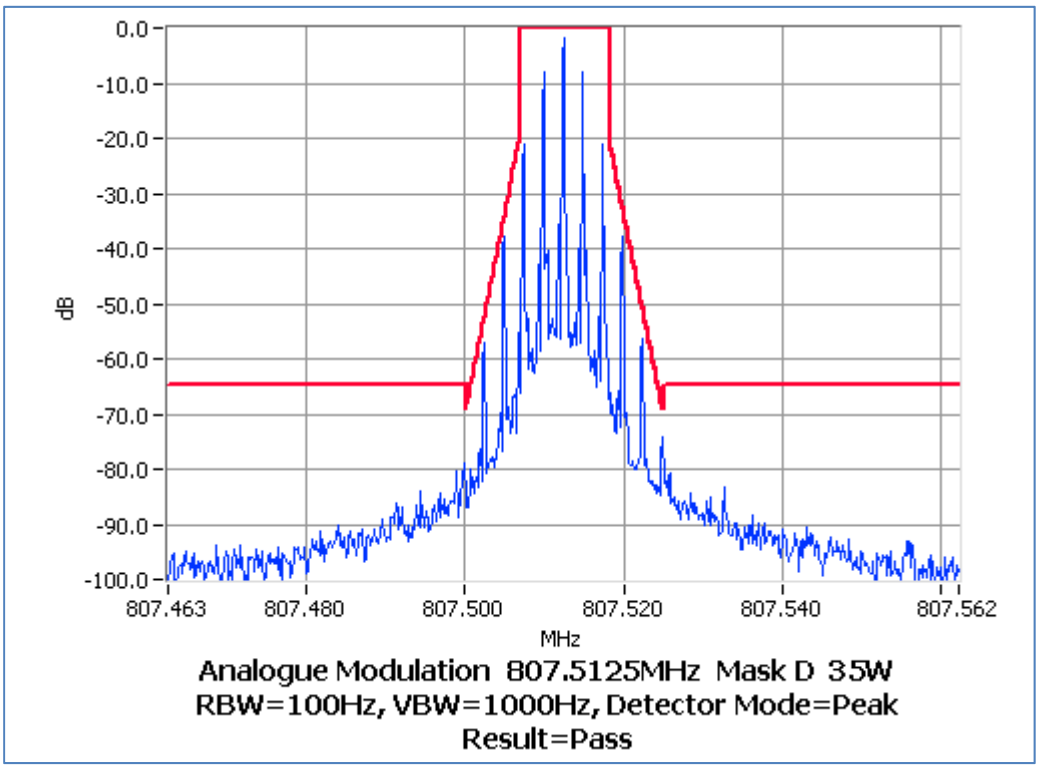
ANALOG VOICE

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

Tx FREQUENCY: 807.5125 MHz 35 W 12.5 kHz Channel Spacing



Unmodulated 807.5125MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



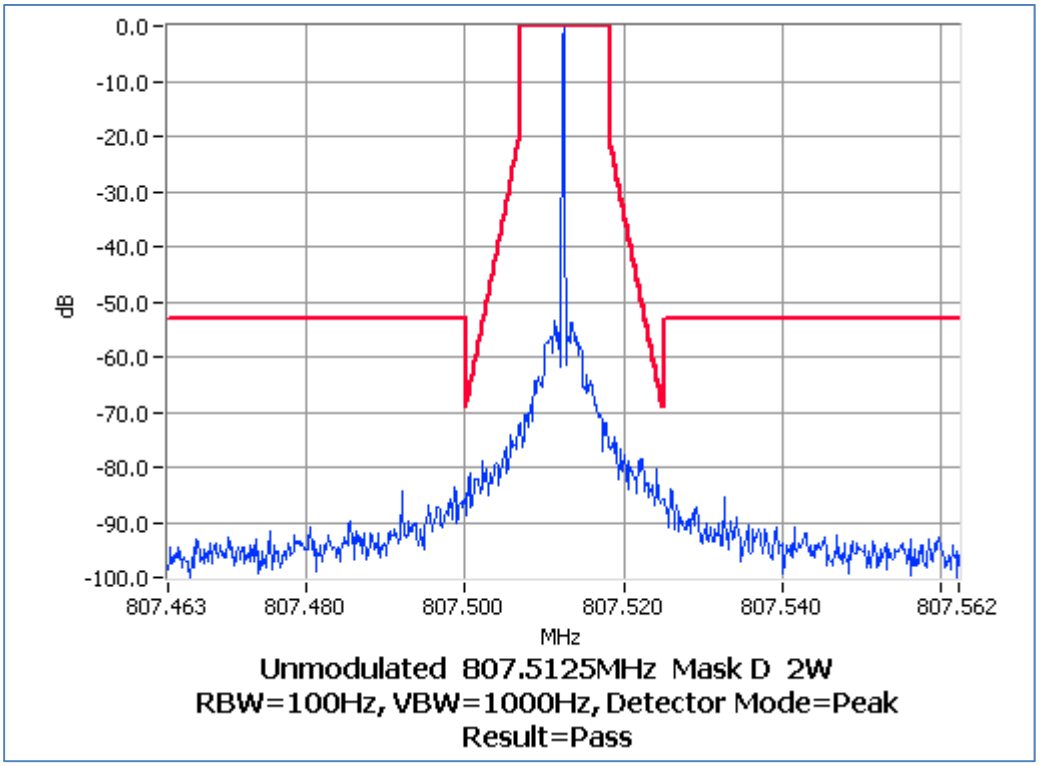
Analogue Modulation 807.5125MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

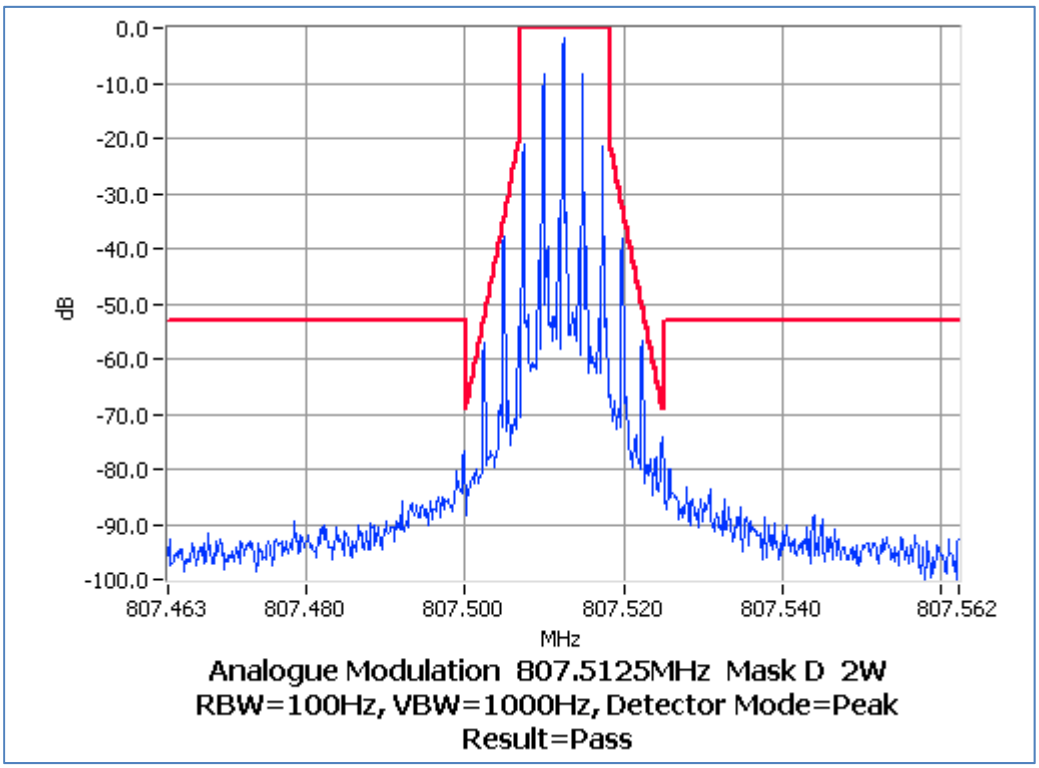
ANALOG VOICE

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

Tx FREQUENCY: 807.5125 MHz 2 W 12.5 kHz Channel Spacing



Unmodulated 807.5125MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



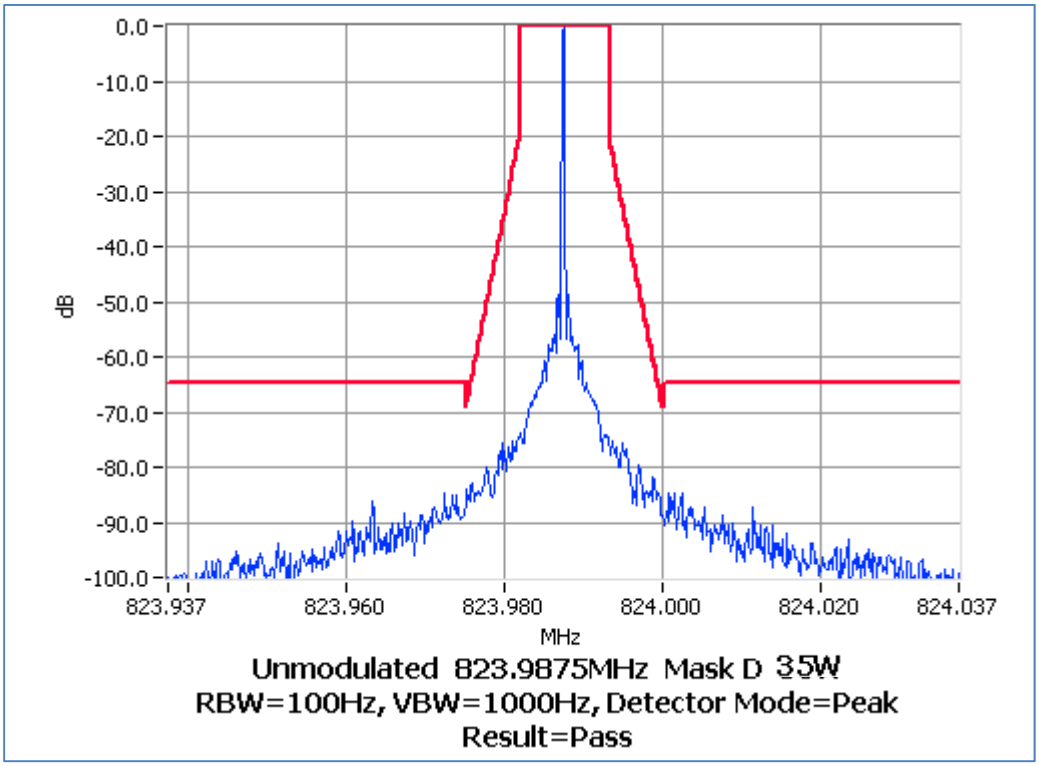
Analogue Modulation 807.5125MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

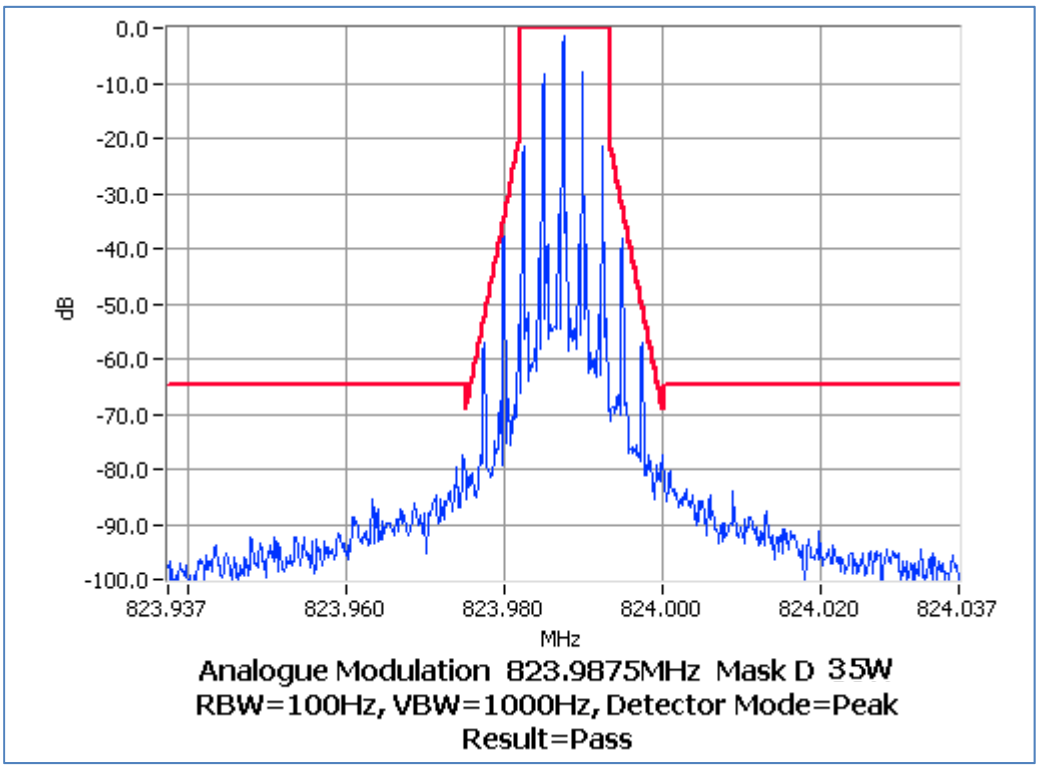
ANALOG VOICE

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

Tx FREQUENCY: 823.9875 MHz 35 W 12.5 kHz Channel Spacing



Unmodulated 823.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



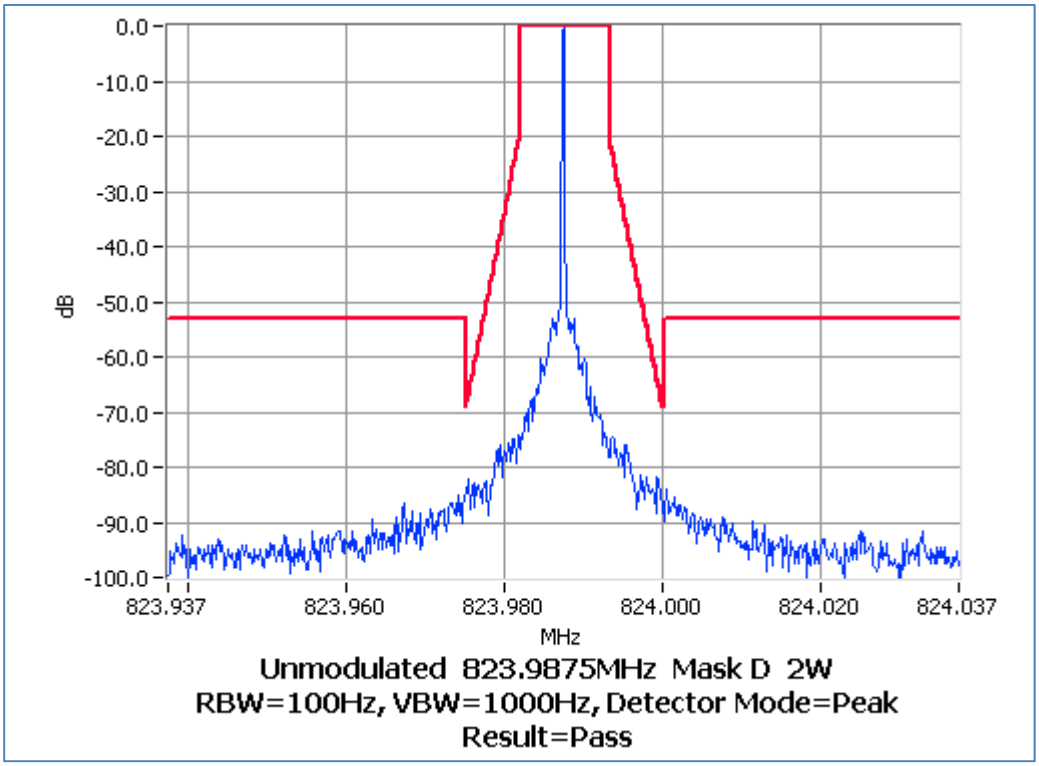
Analogue Modulation 823.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

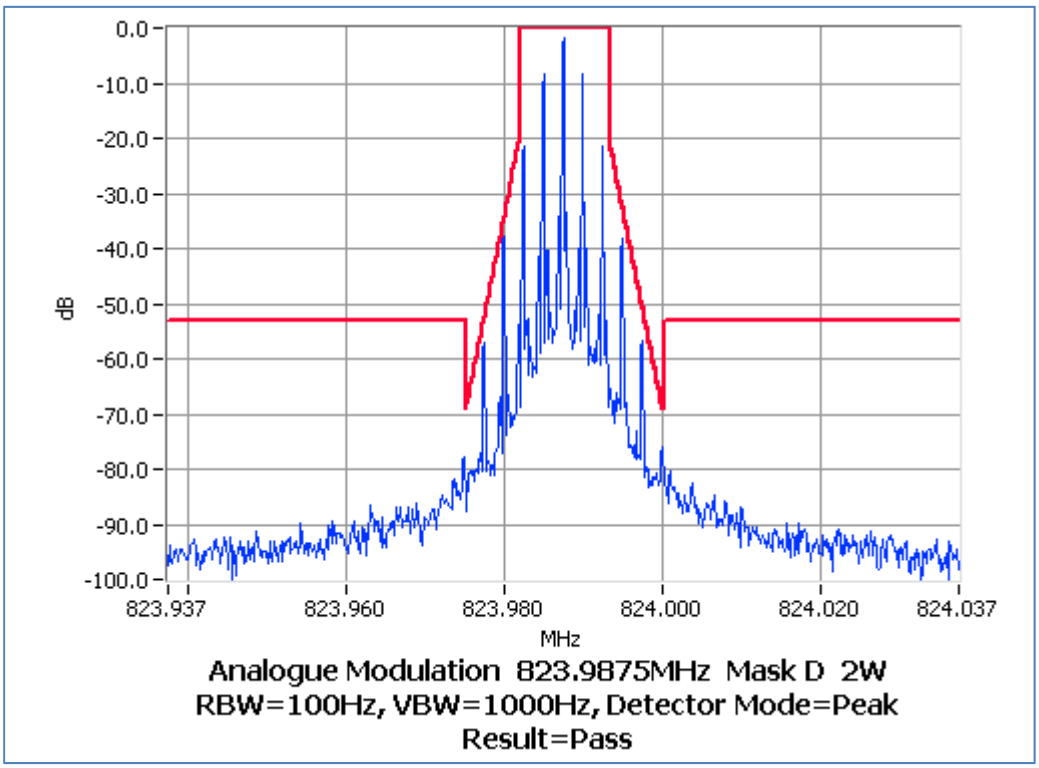
ANALOG VOICE

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

Tx FREQUENCY: 823.9875 MHz 2 W 12.5 kHz Channel Spacing



Unmodulated 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



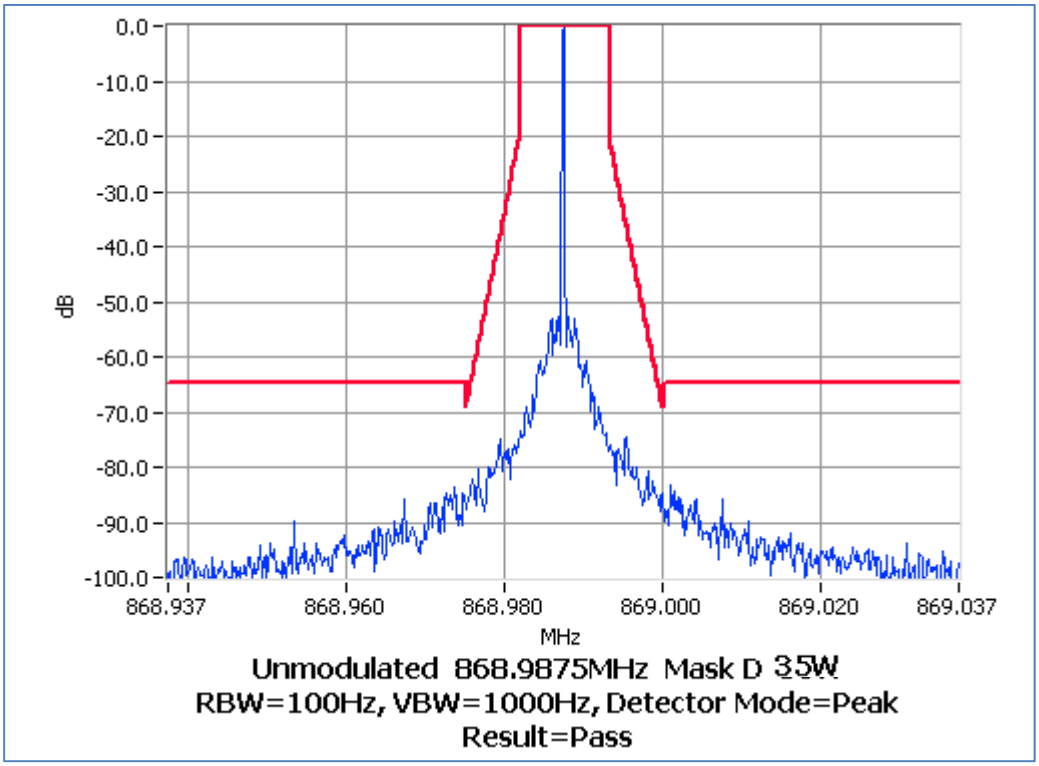
Analogue Modulation 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

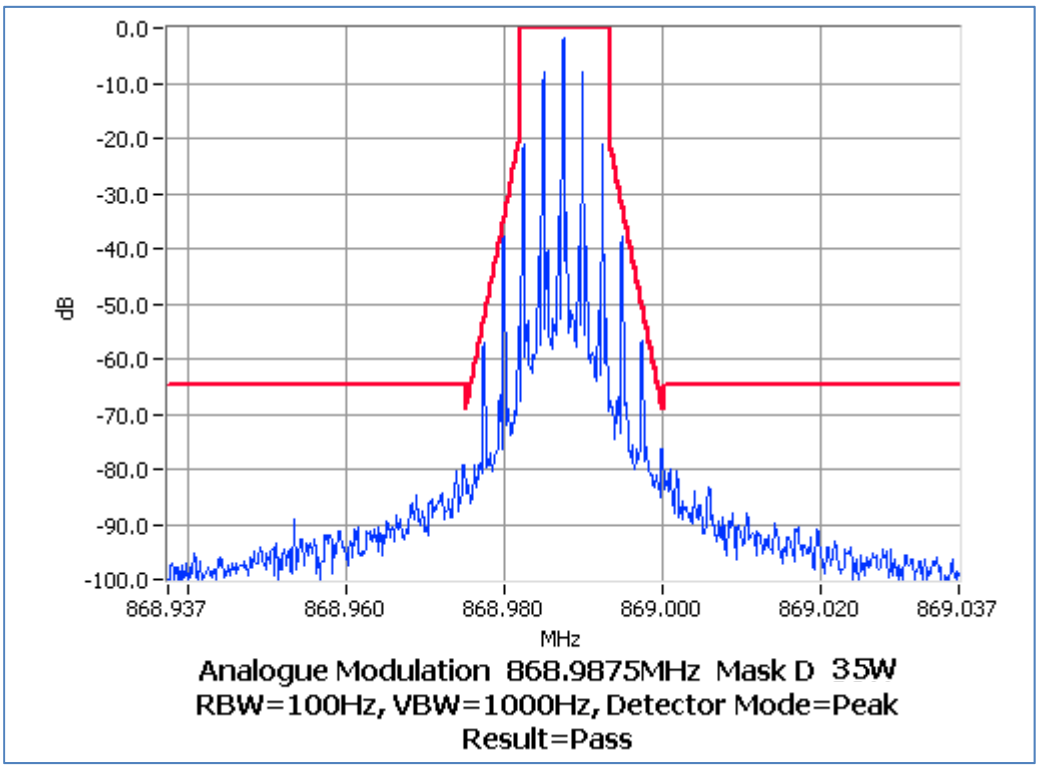
ANALOG VOICE

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

Tx FREQUENCY: 868.9875 MHz 35 W 12.5 kHz Channel Spacing



Unmodulated 868.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



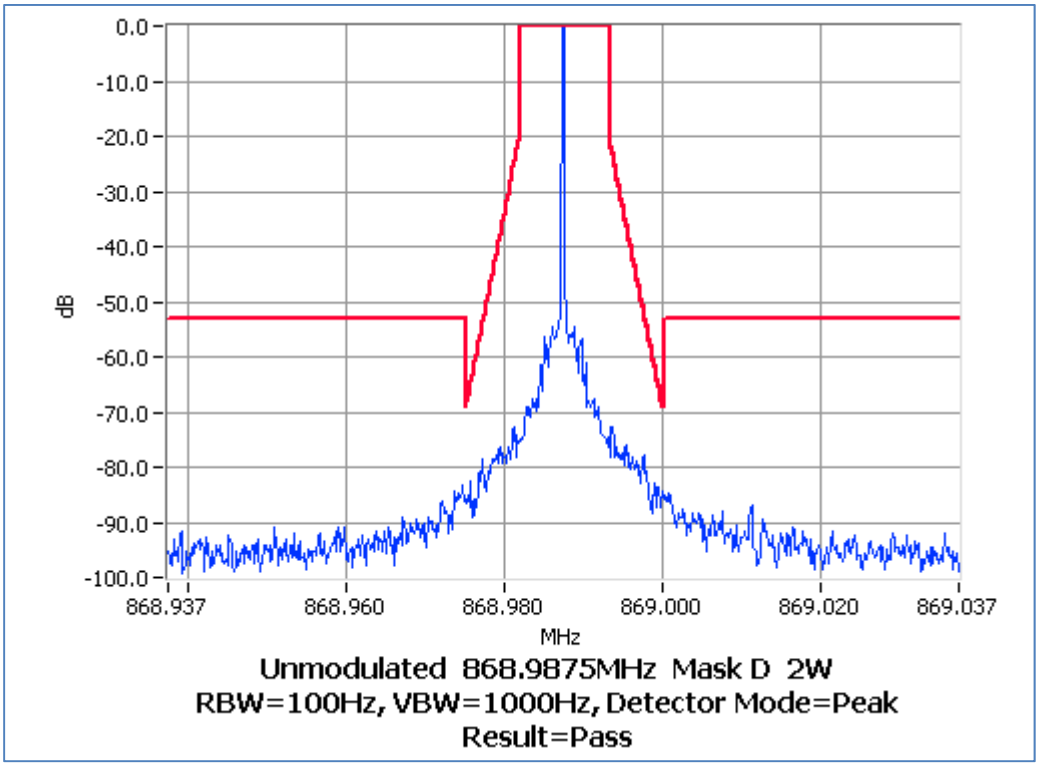
Analogue Modulation 868.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

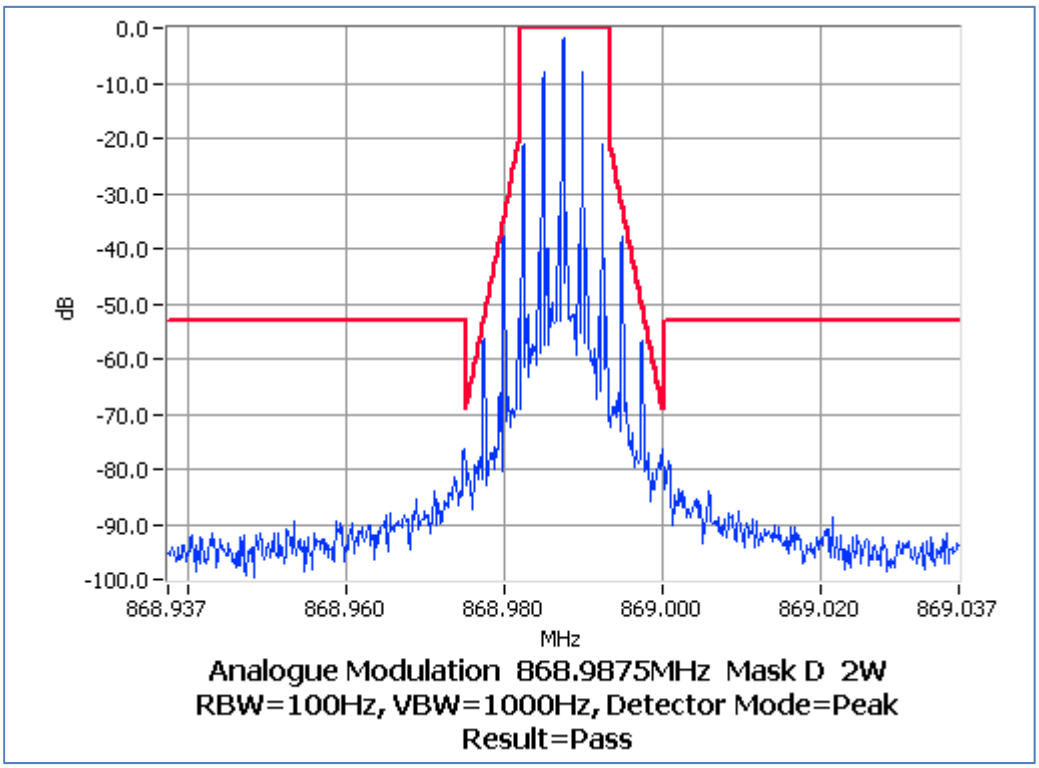
ANALOG VOICE

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

Tx FREQUENCY: 868.9875 MHz 2 W 12.5 kHz Channel Spacing



Unmodulated 868.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



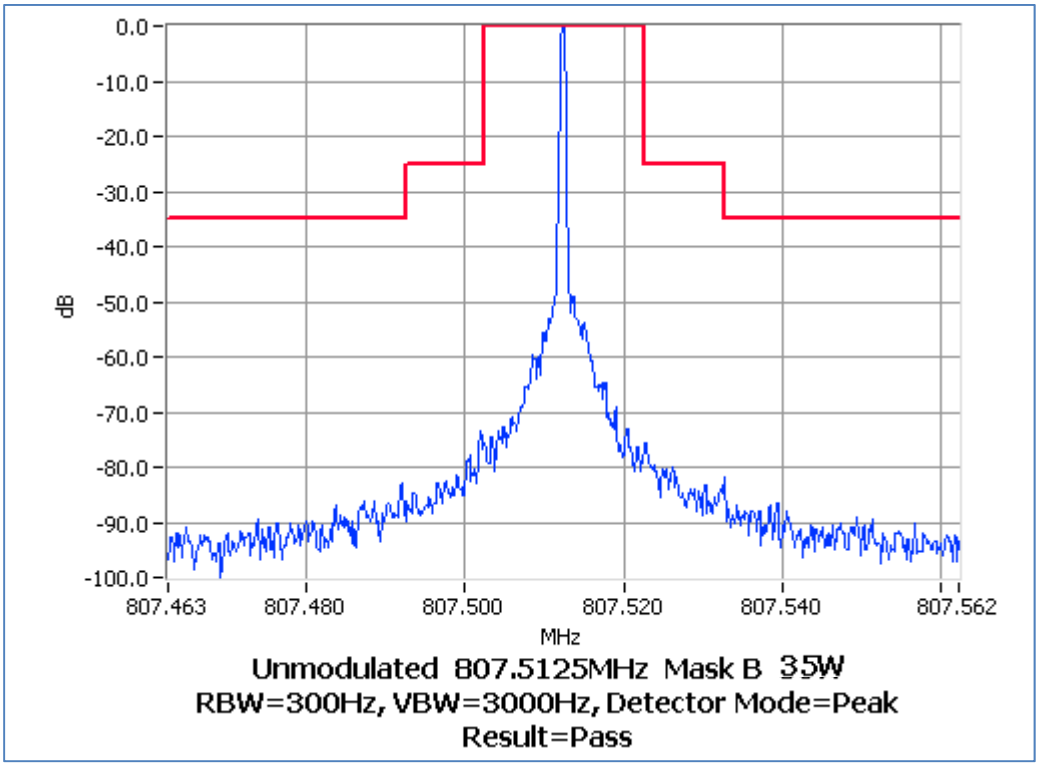
Analogue Modulation 868.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

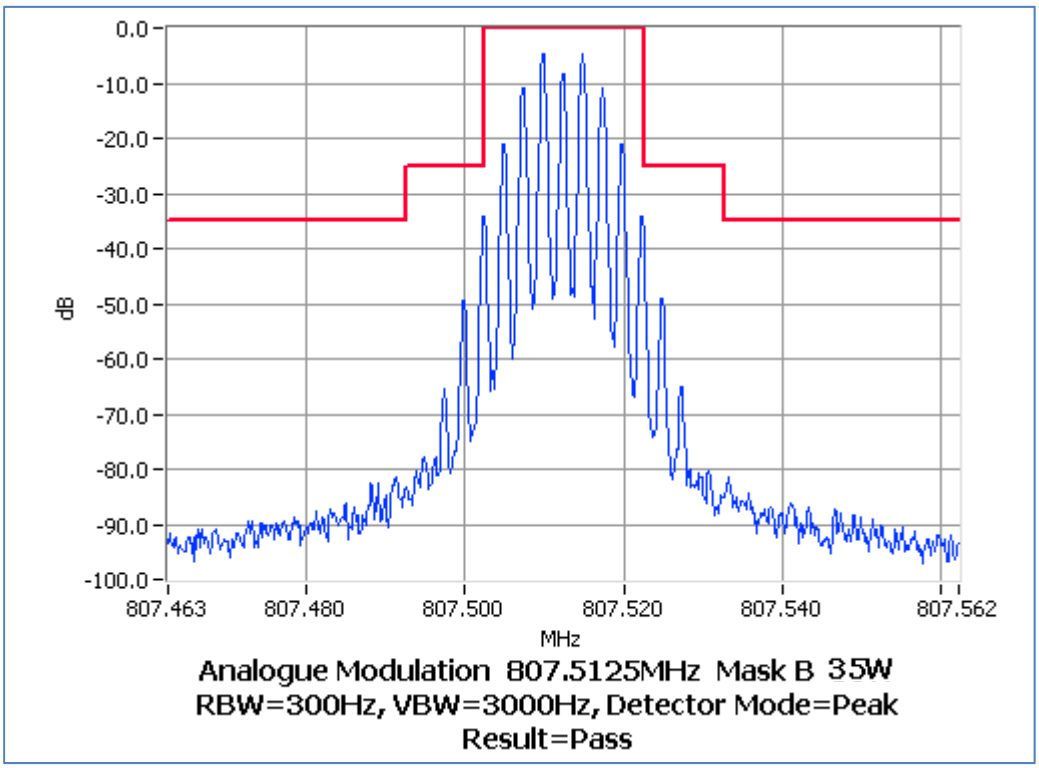
ANALOG VOICE

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

Tx FREQUENCY: 807.5125 MHz 35 W 25.0 kHz Channel Spacing



Unmodulated 807.5125MHz Mask B 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass



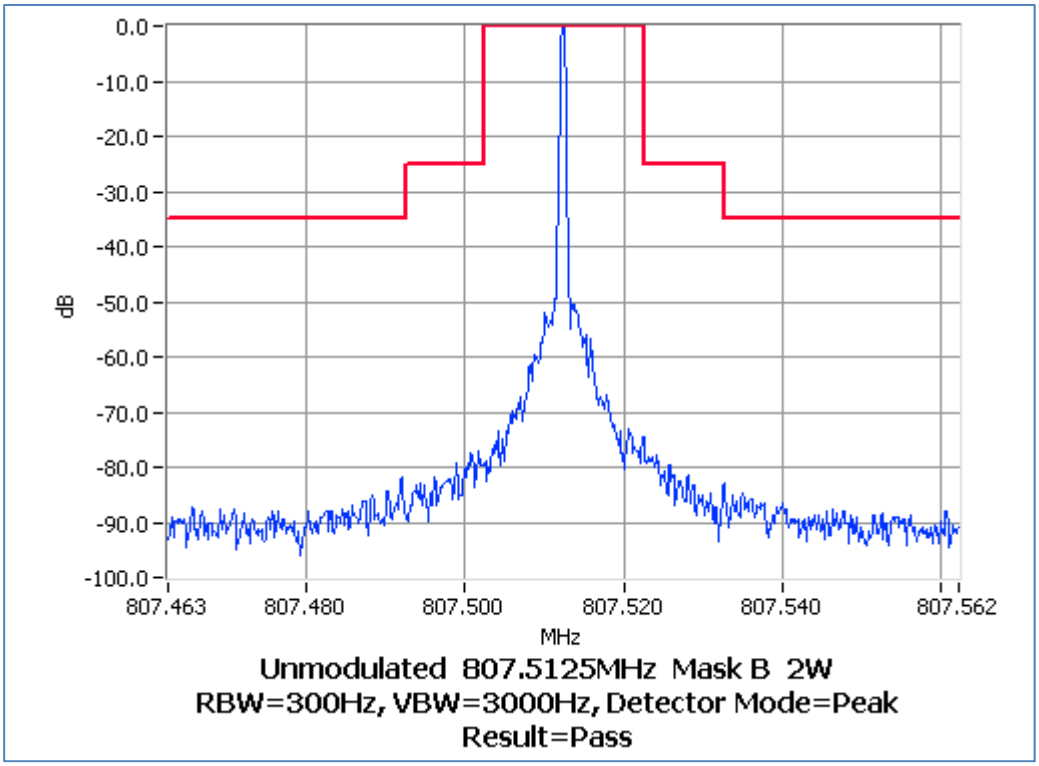
Analogue Modulation 807.5125MHz Mask B 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

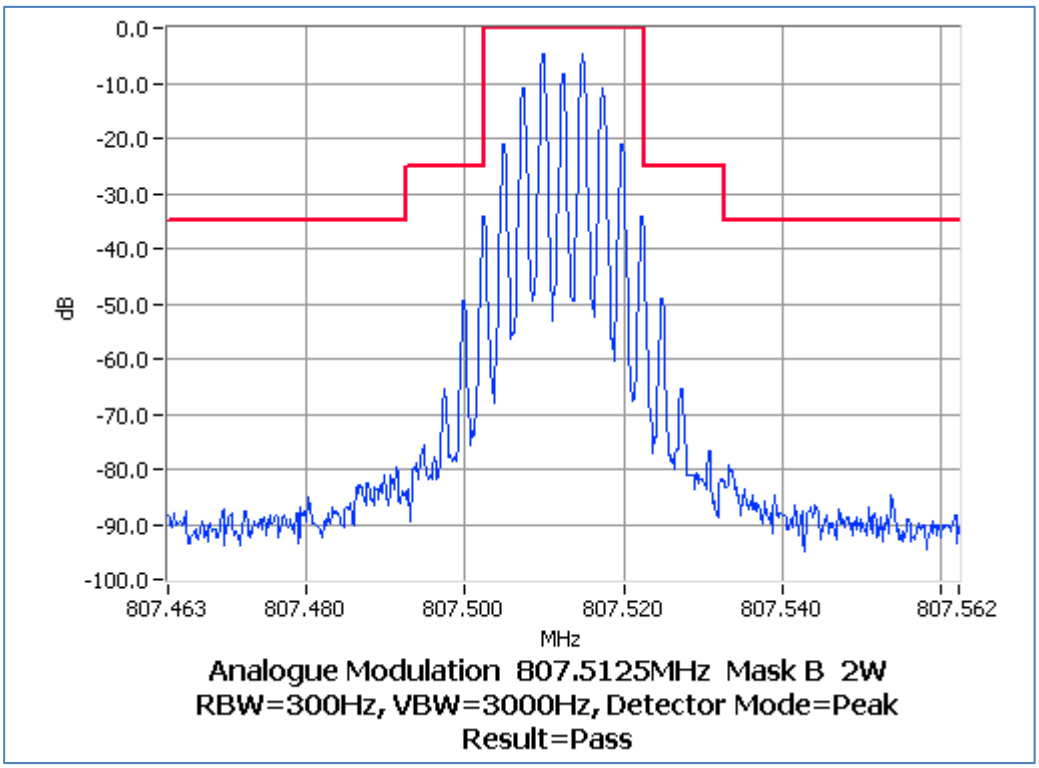
ANALOG VOICE

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

Tx FREQUENCY: 807.5125 MHz 2 W 25.0 kHz Channel Spacing



Unmodulated 807.5125MHz Mask B 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass



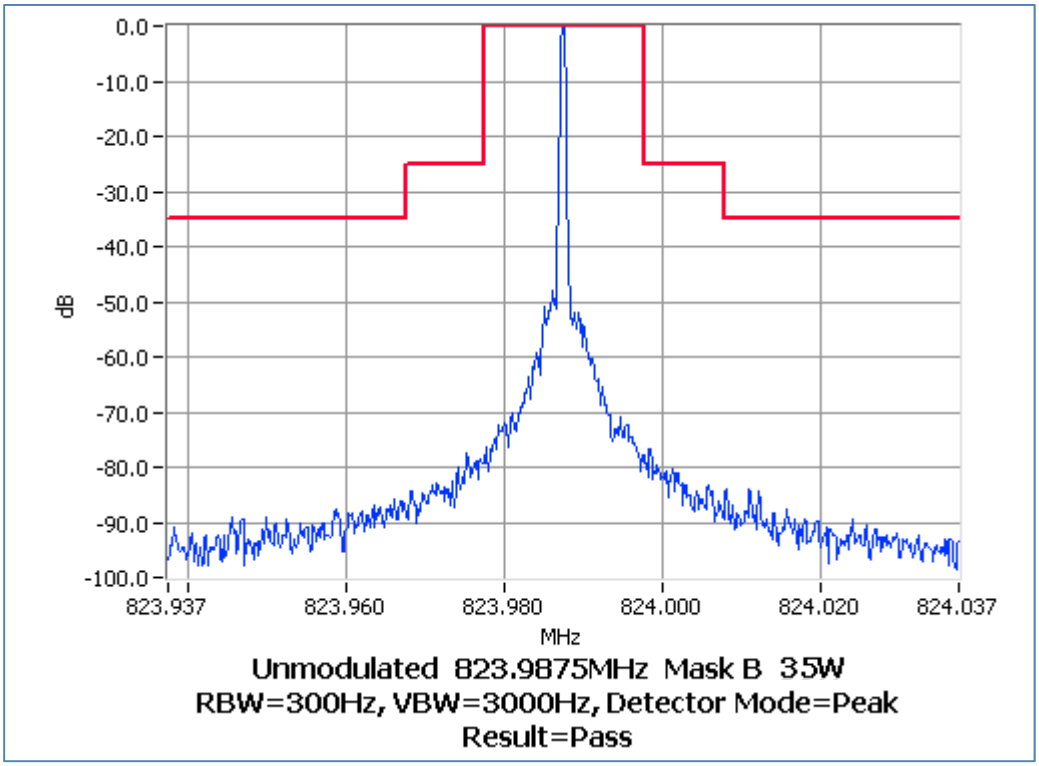
Analogue Modulation 807.5125MHz Mask B 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

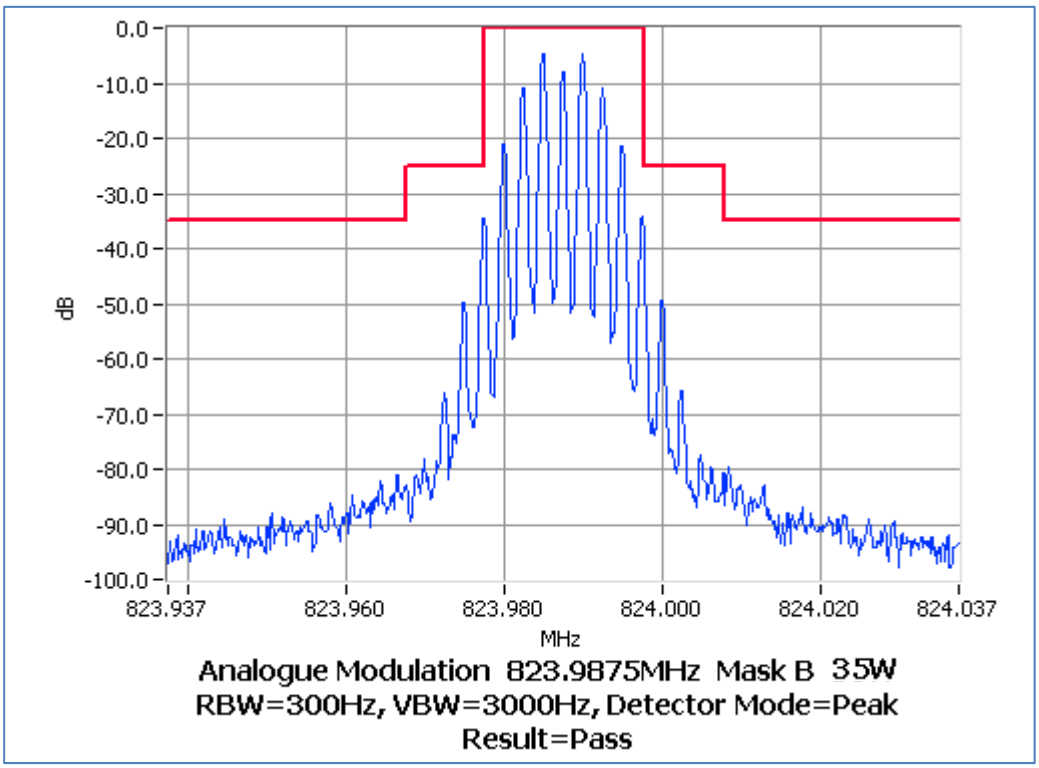
ANALOG VOICE

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

Tx FREQUENCY: 823.9875 MHz 35 W 25.0 kHz Channel Spacing



Unmodulated 823.9875MHz Mask B 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass



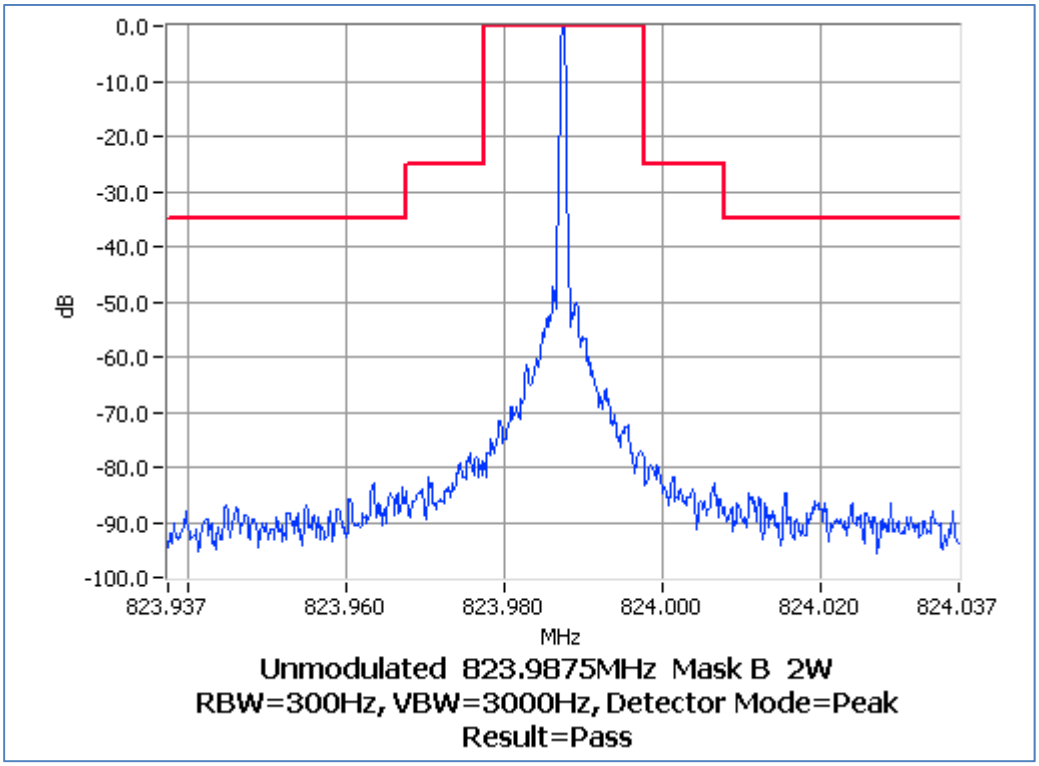
Analogue Modulation 823.9875MHz Mask B 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

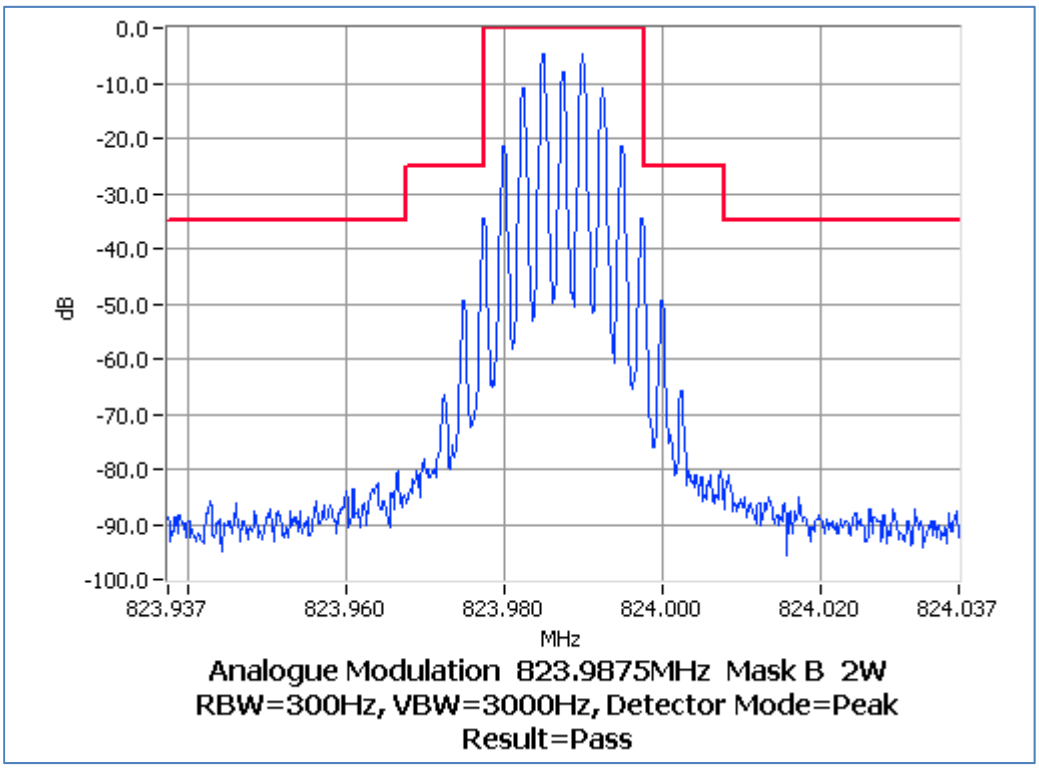
ANALOG VOICE

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

Tx FREQUENCY: 823.9875 MHz 2 W 25.0 kHz Channel Spacing



Unmodulated 823.9875MHz Mask B 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass



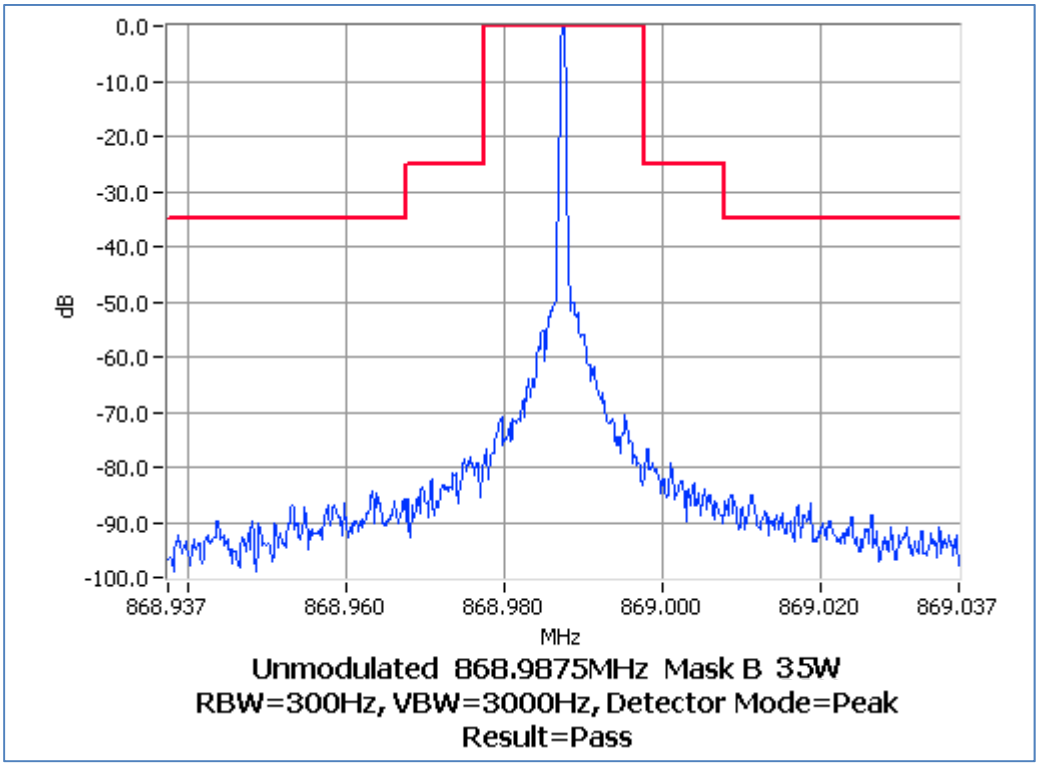
Analogue Modulation 823.9875MHz Mask B 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

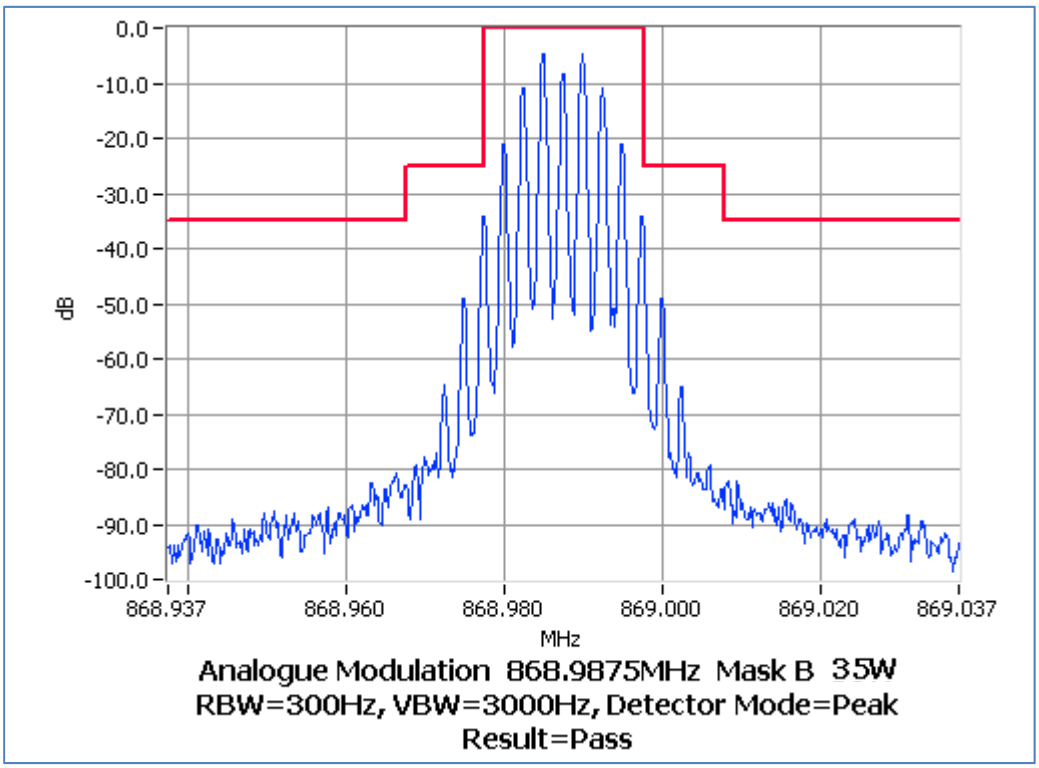
ANALOG VOICE

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

Tx FREQUENCY: 868.9875 MHz 35 W 25.0 kHz Channel Spacing



Unmodulated 868.9875MHz Mask B 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass



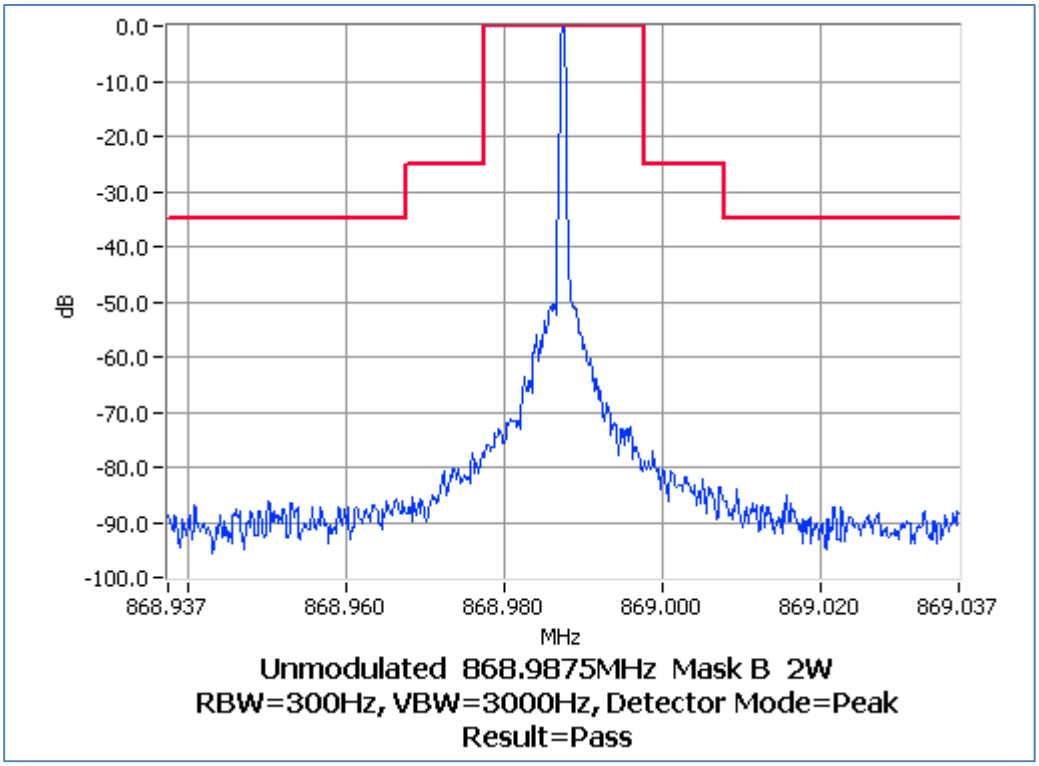
Analogue Modulation 868.9875MHz Mask B 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

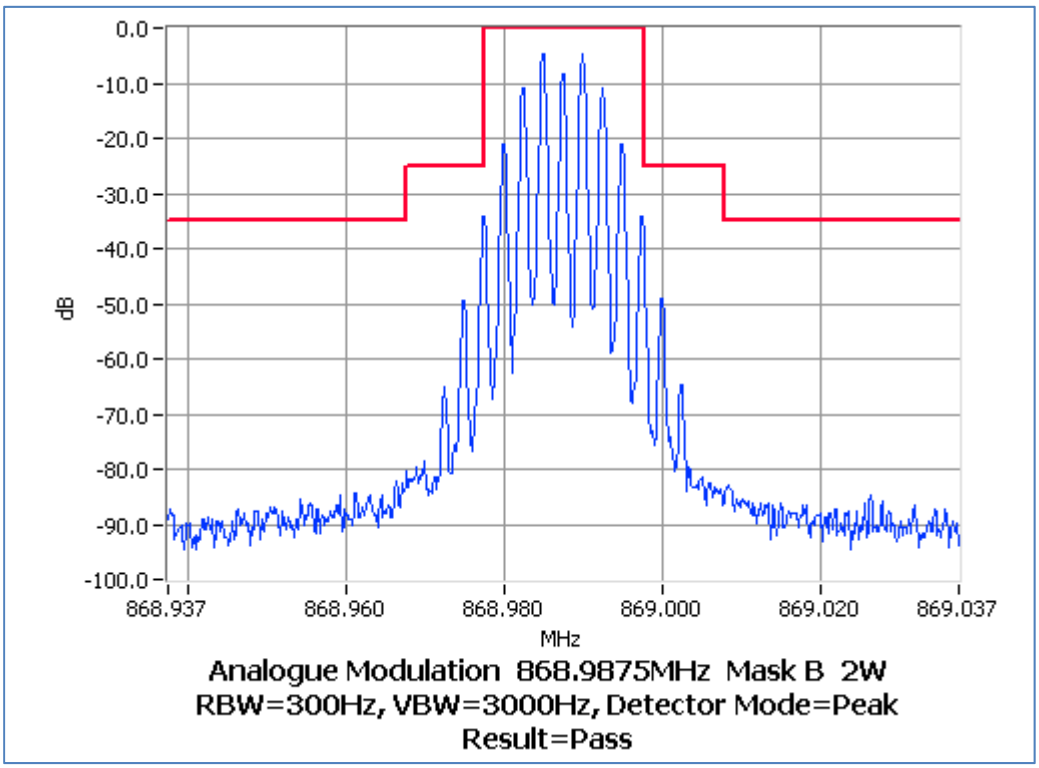
ANALOG VOICE

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

Tx FREQUENCY: 868.9875 MHz 2 W 25.0 kHz Channel Spacing



Unmodulated 868.9875MHz Mask B 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

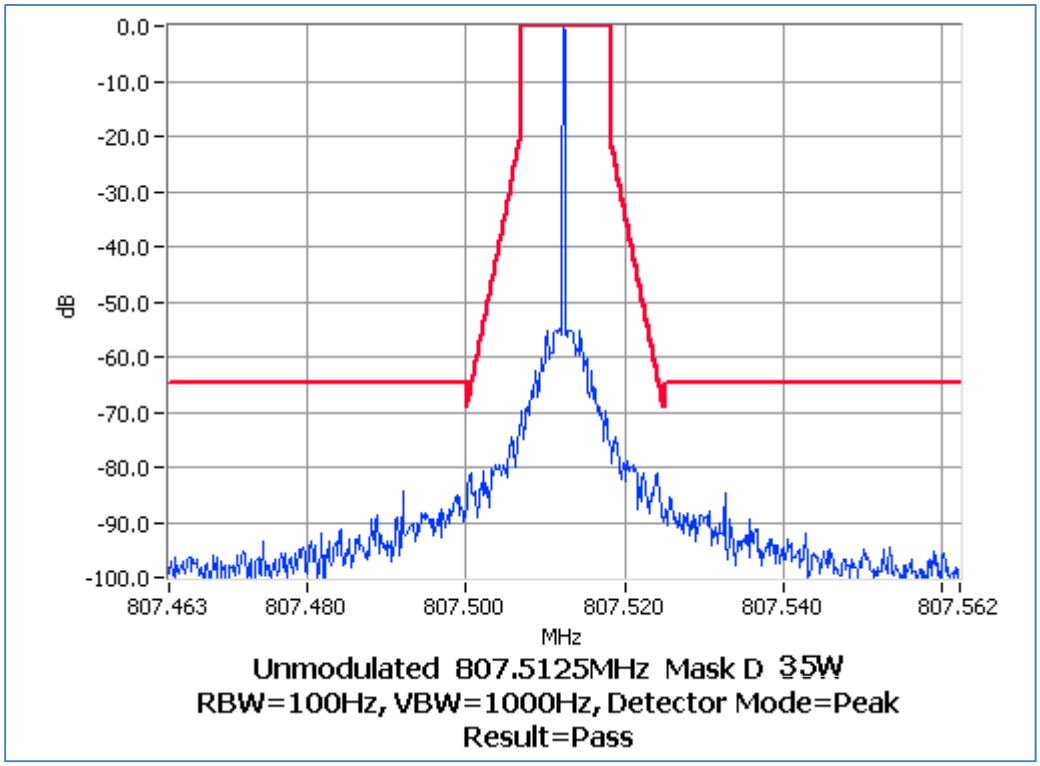


Analogue Modulation 868.9875MHz Mask B 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

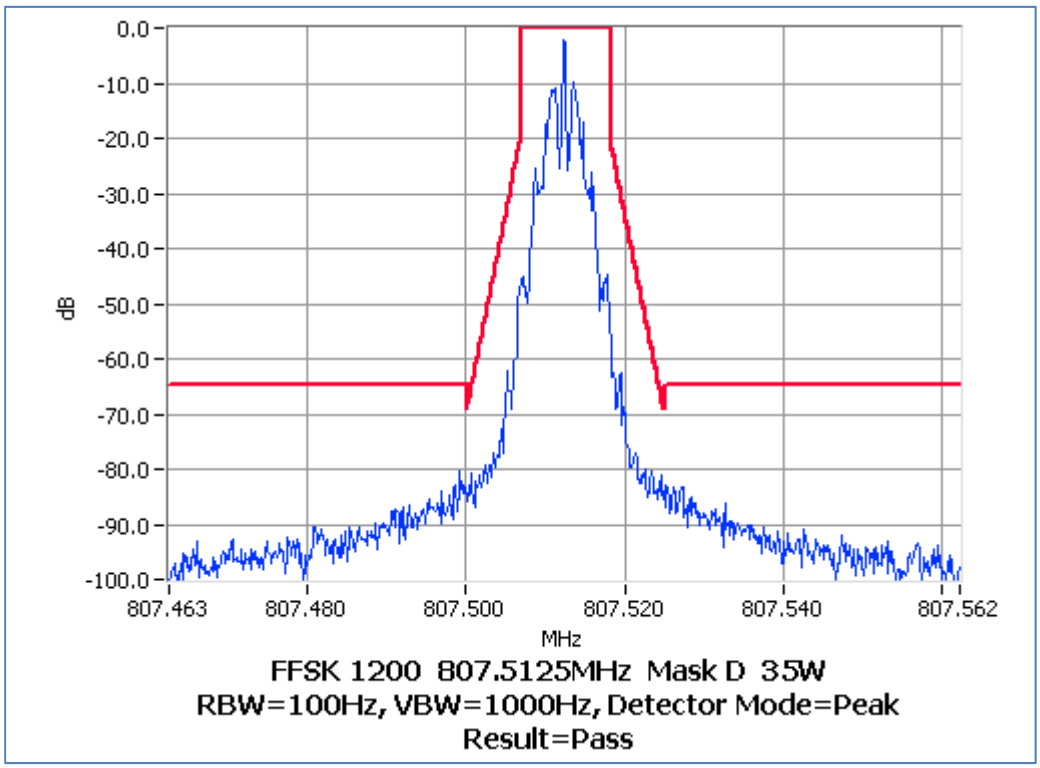
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	807.5125 MHz	35 W	12.5 kHz Channel Spacing



Unmodulated 807.5125MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

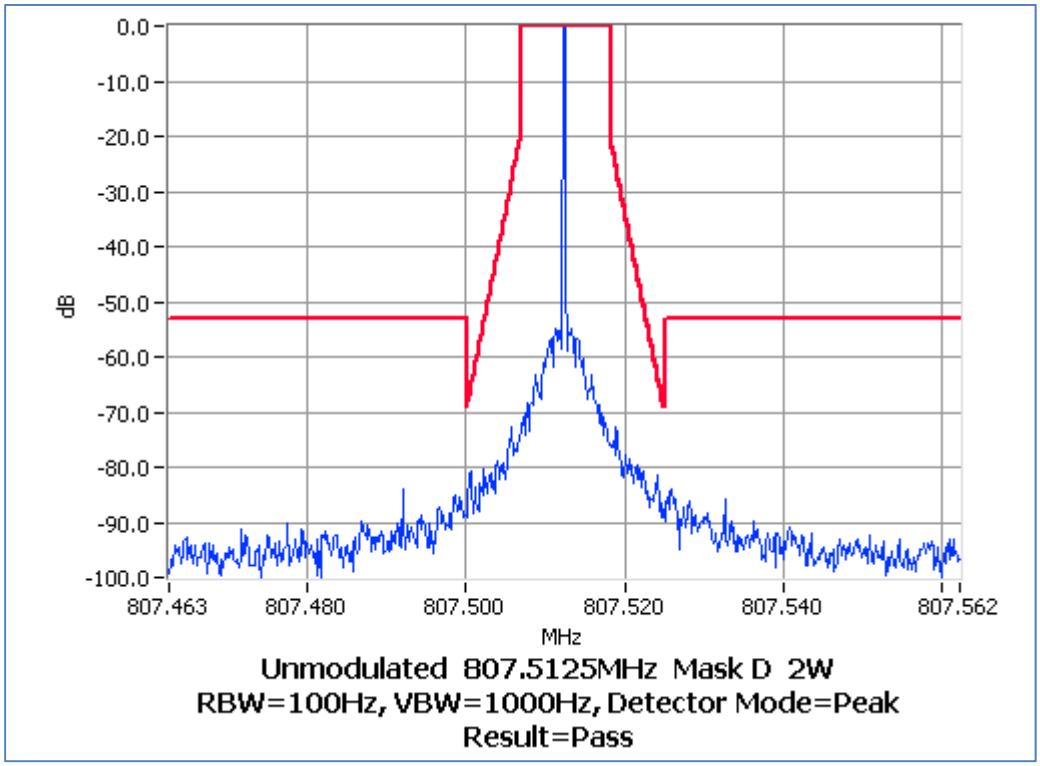


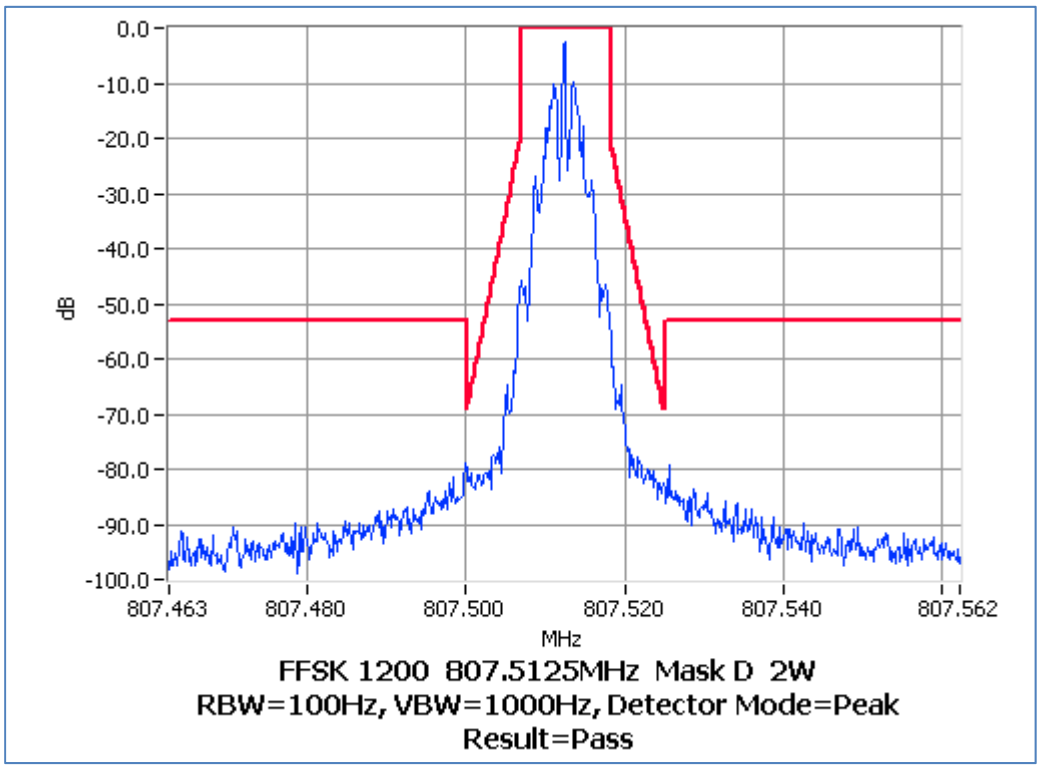
FFSK 1200 807.5125MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	807.5125 MHz	2 W	12.5 kHz Channel Spacing

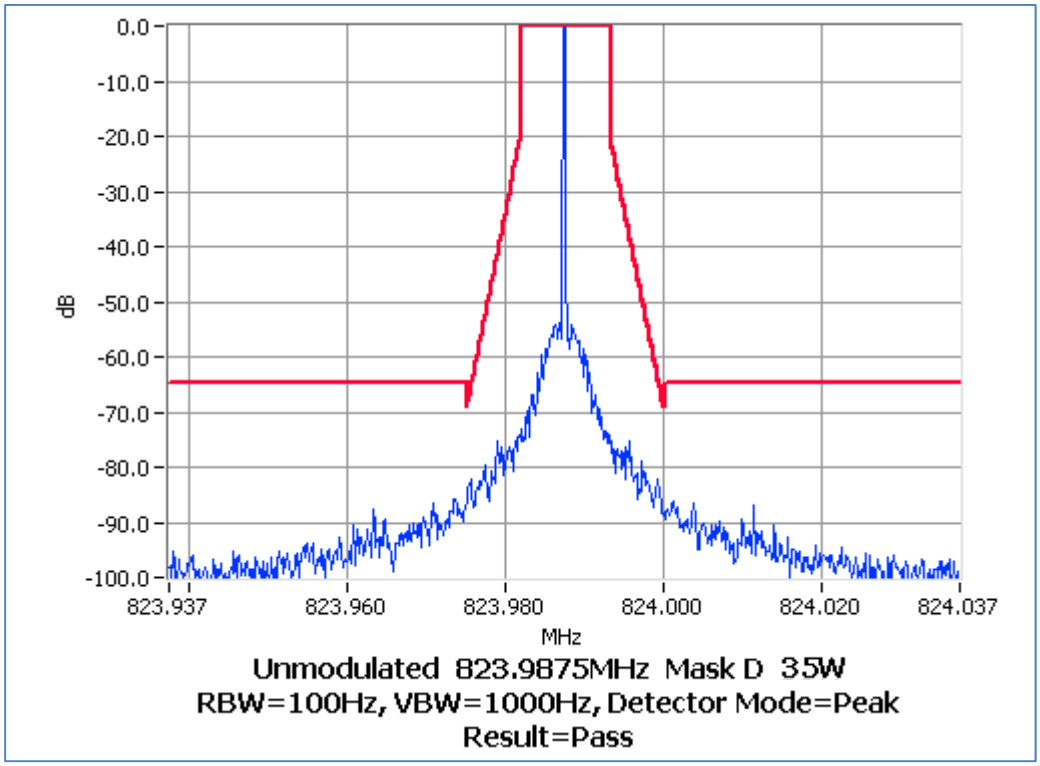




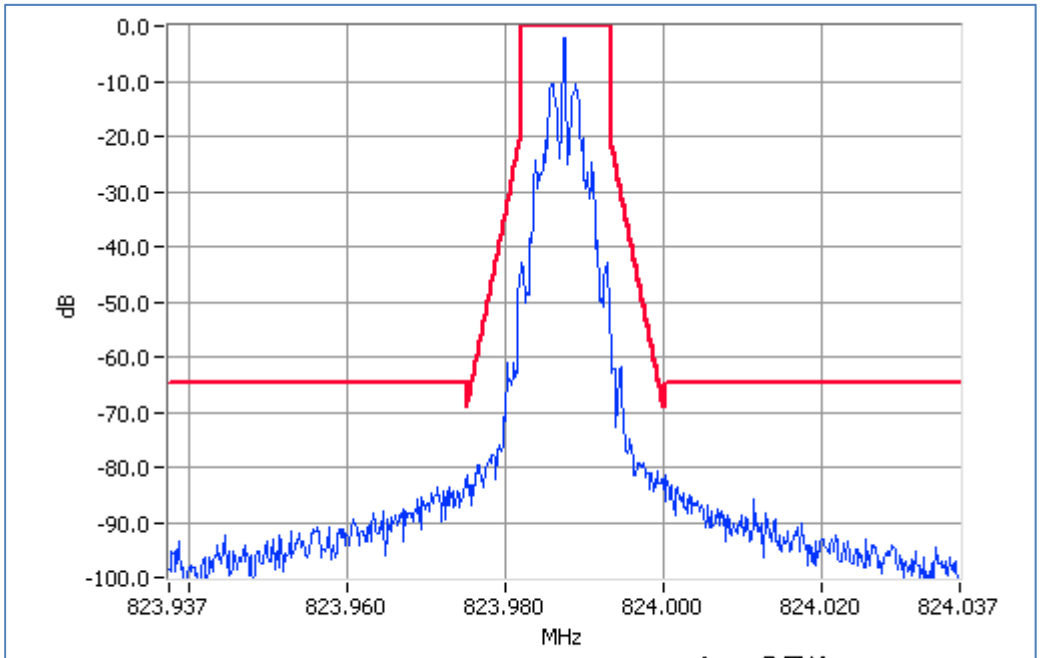
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	823.9875 MHz	35 W	12.5 kHz Channel Spacing



Unmodulated 823.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

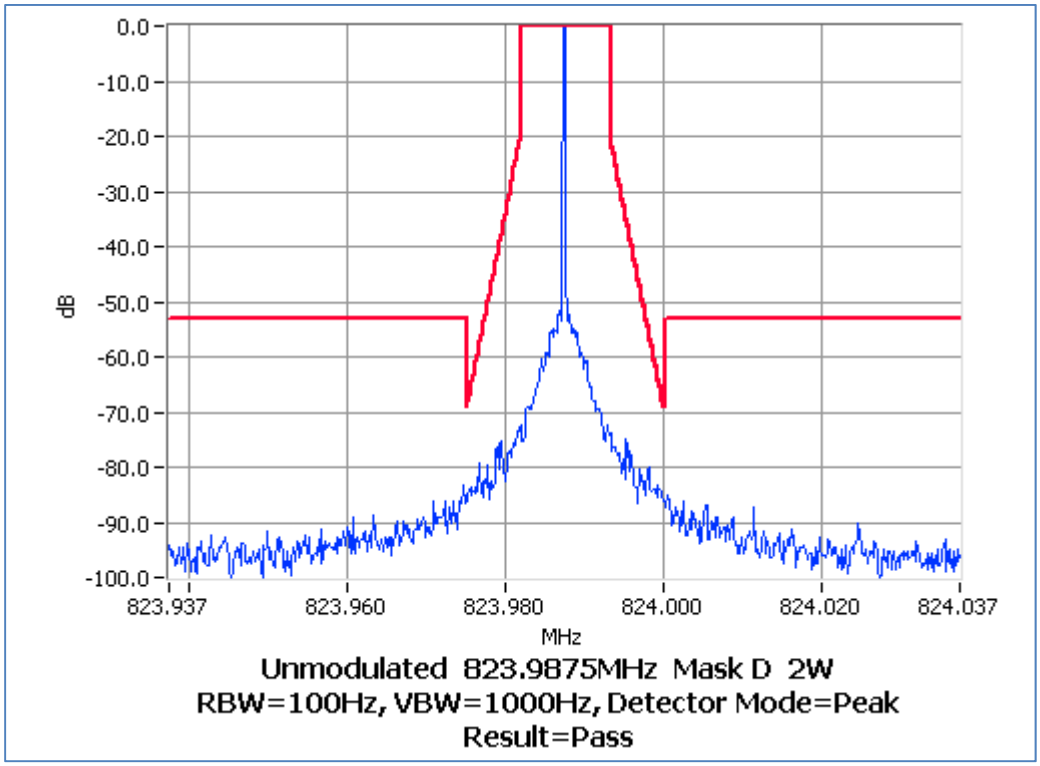


FFSK 1200 823.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

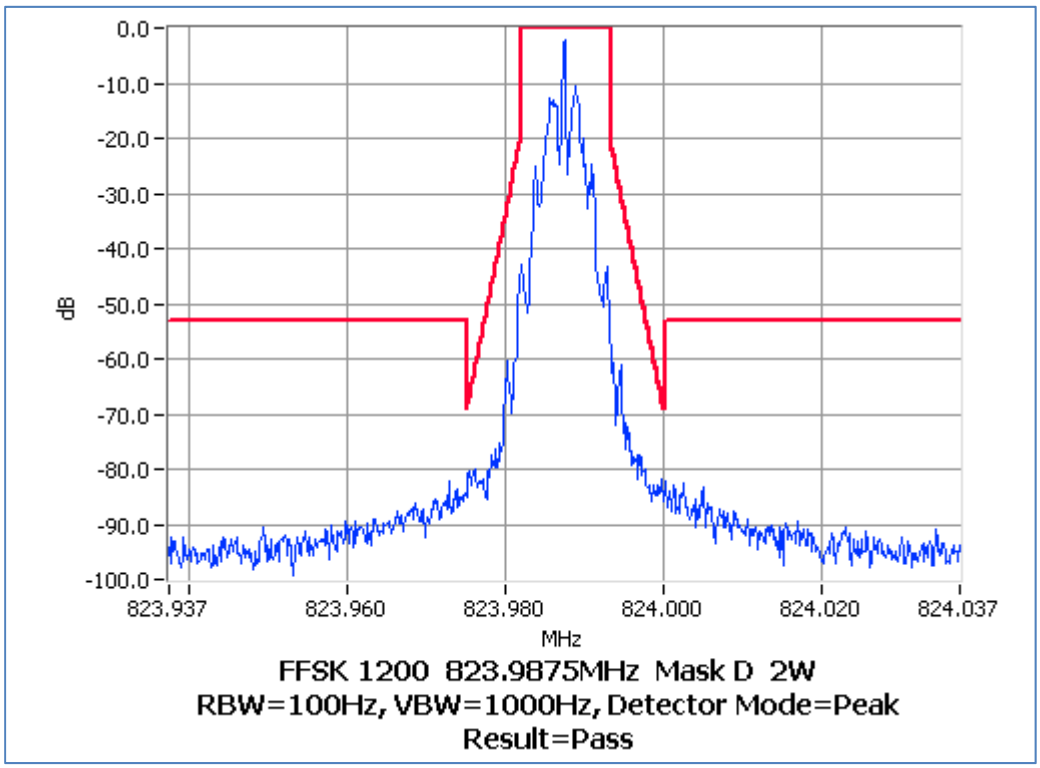
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	823.9875 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

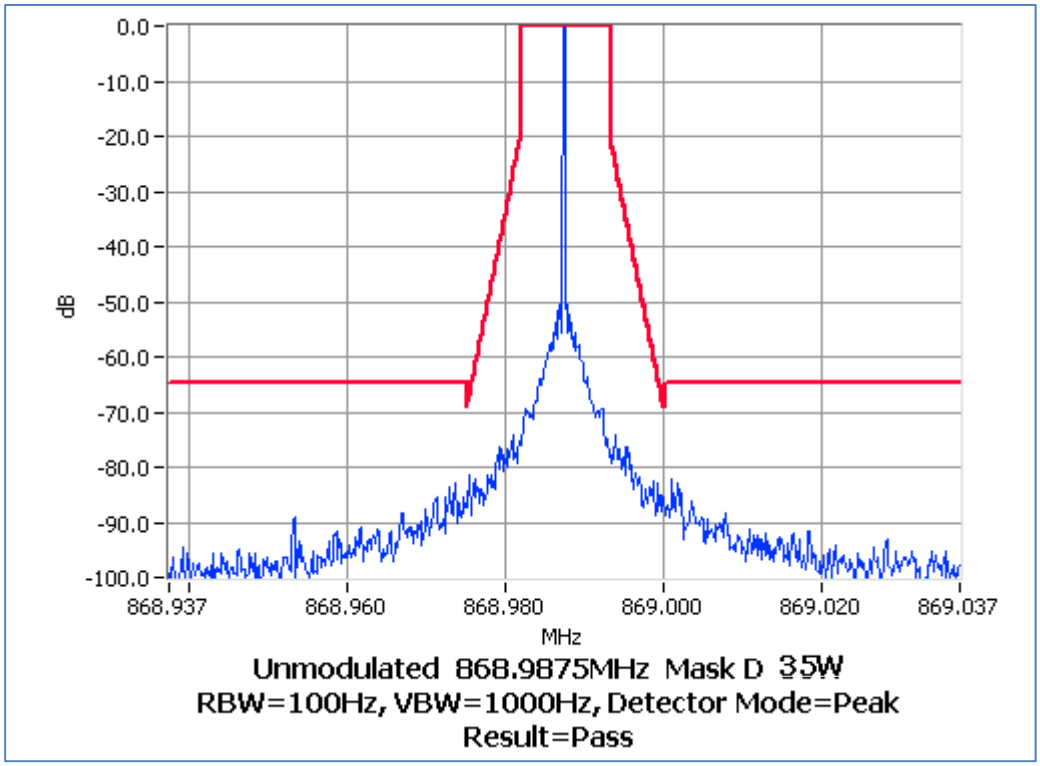


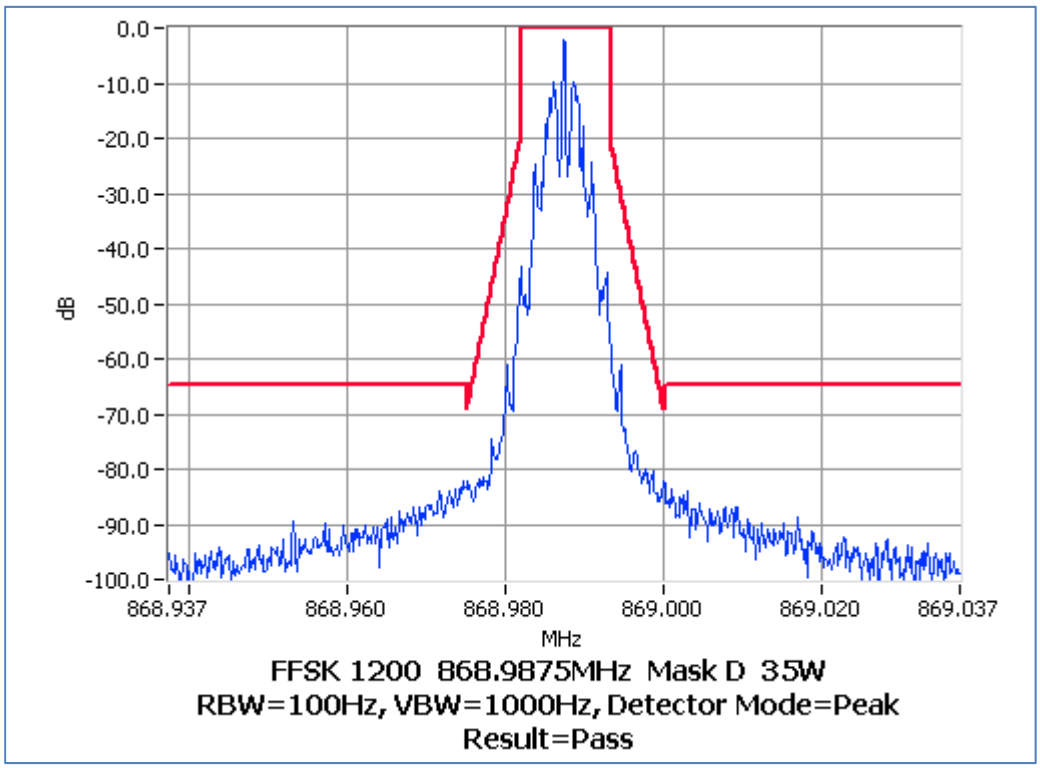
FFSK 1200 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	868.9875 MHz	35 W	12.5 kHz Channel Spacing

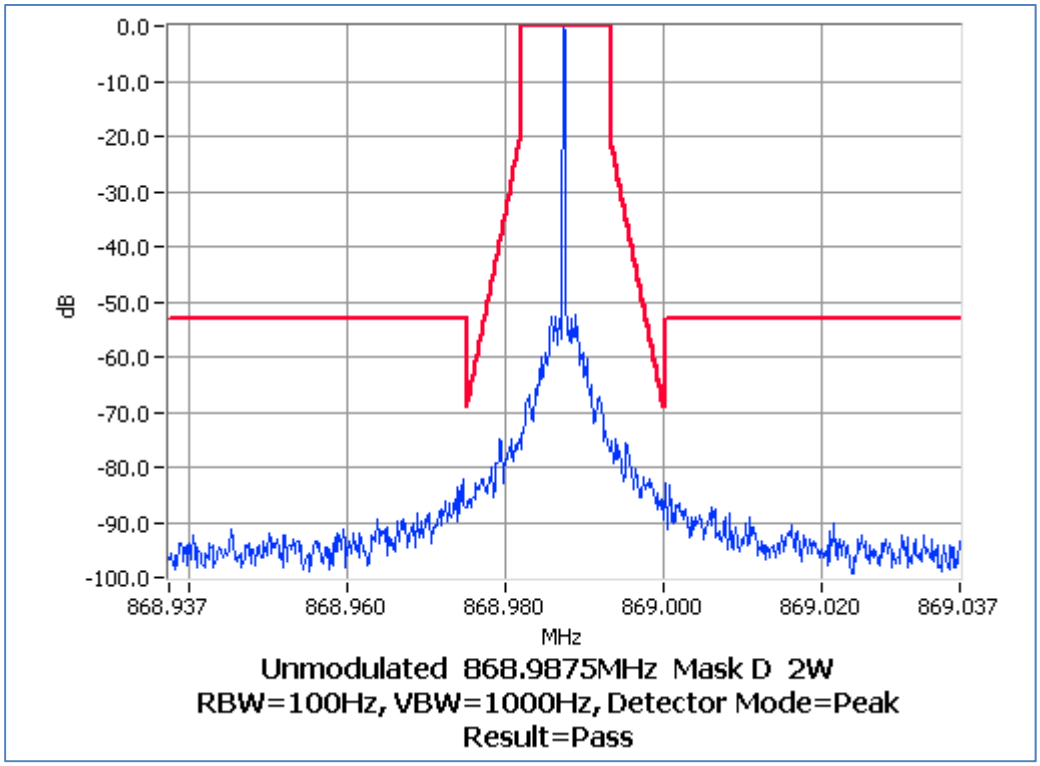




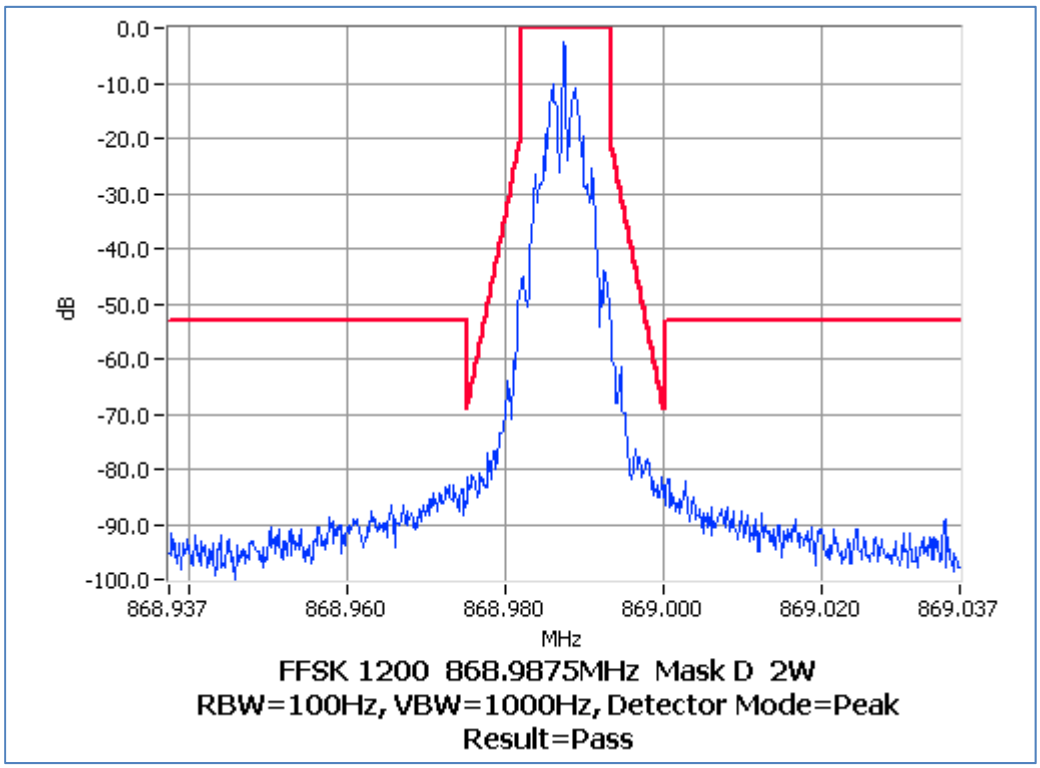
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	868.9875 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 868.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

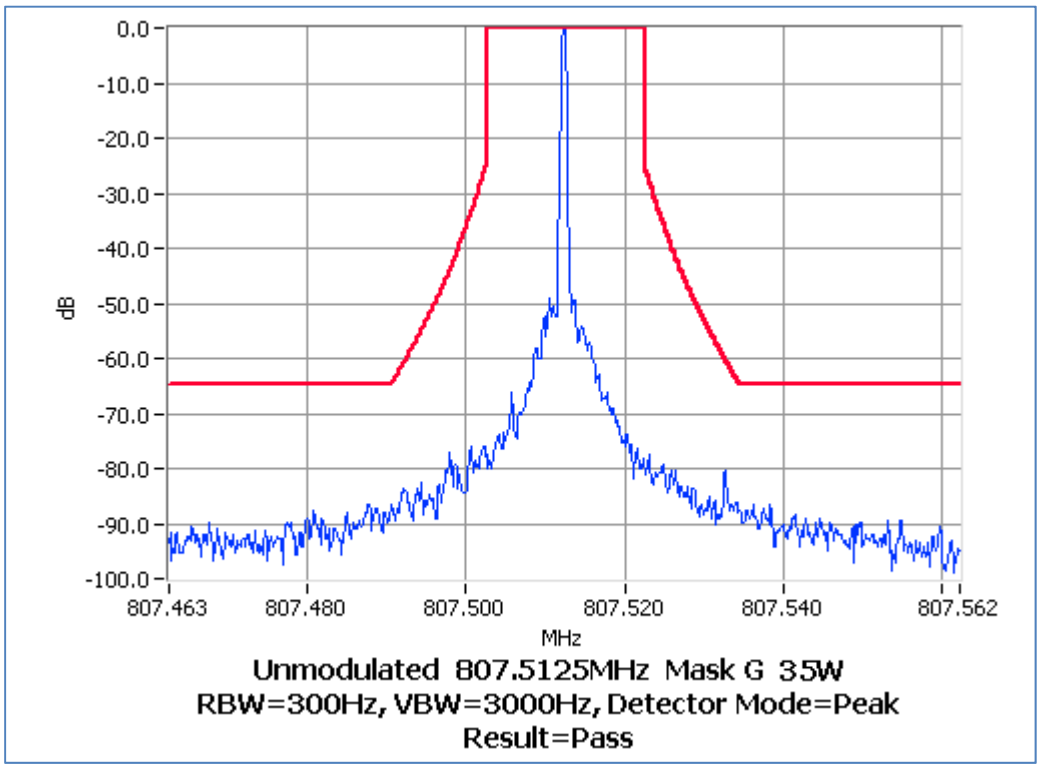


FFSK 1200 868.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

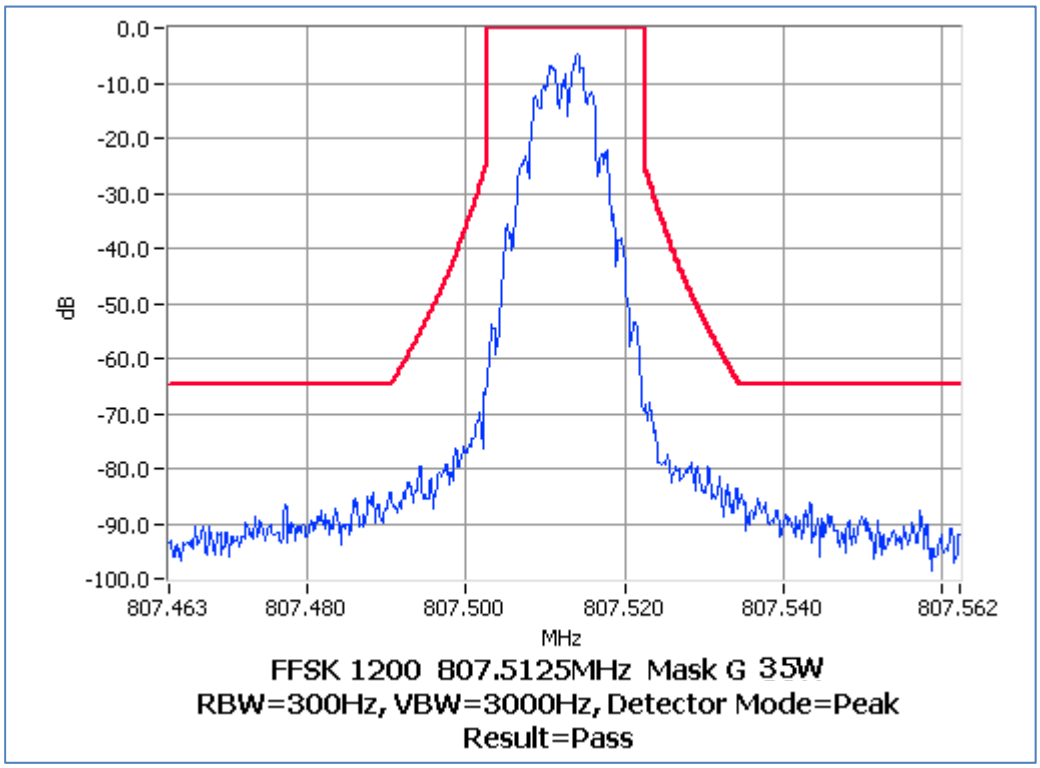
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	807.5125 MHz	35 W	25.0 kHz Channel Spacing



Unmodulated 807.5125MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

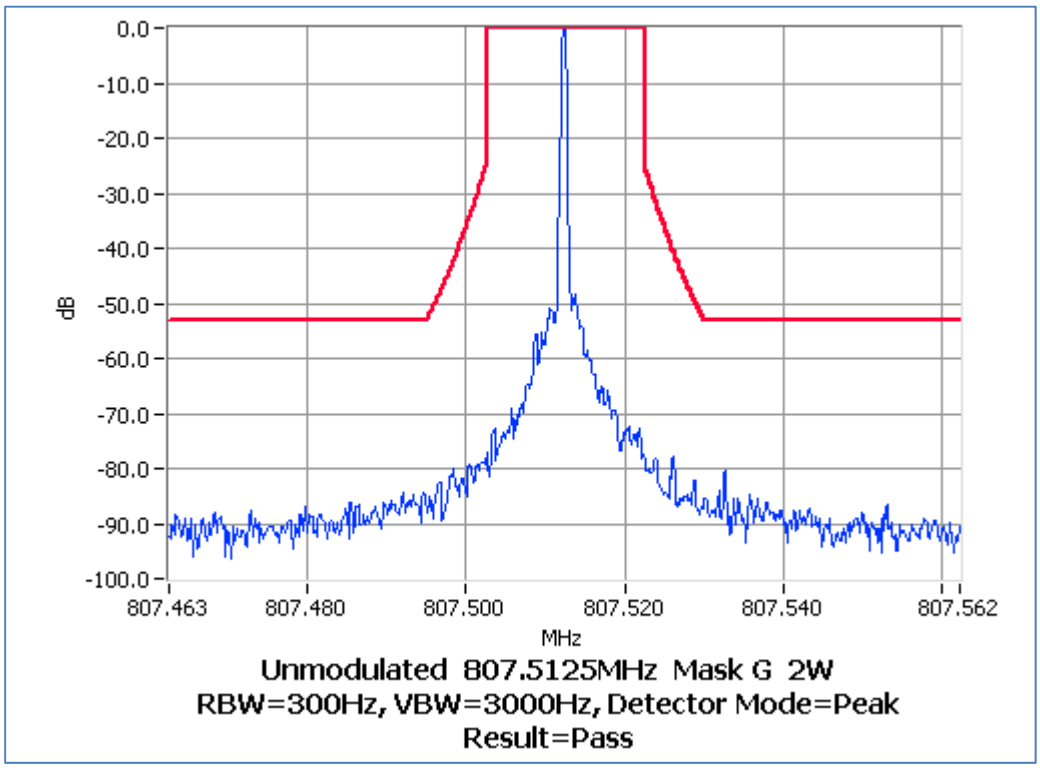


FFSK 1200 807.5125MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

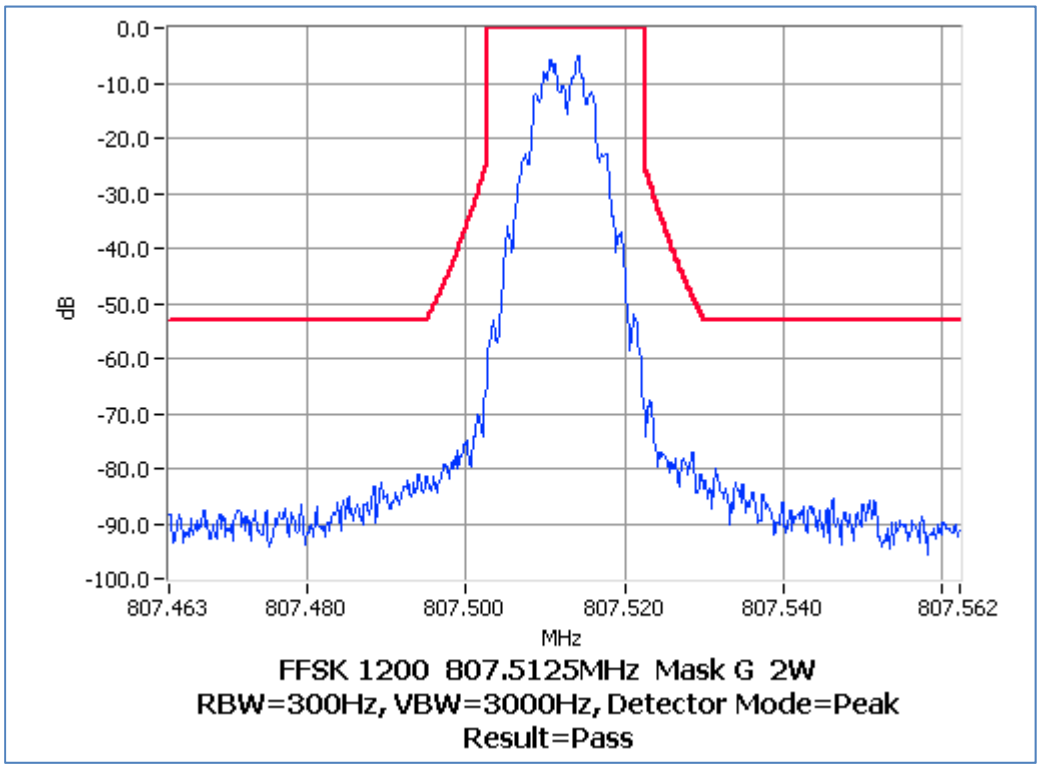
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	807.5125 MHz	2 W	25.0 kHz Channel Spacing



Unmodulated 807.5125MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

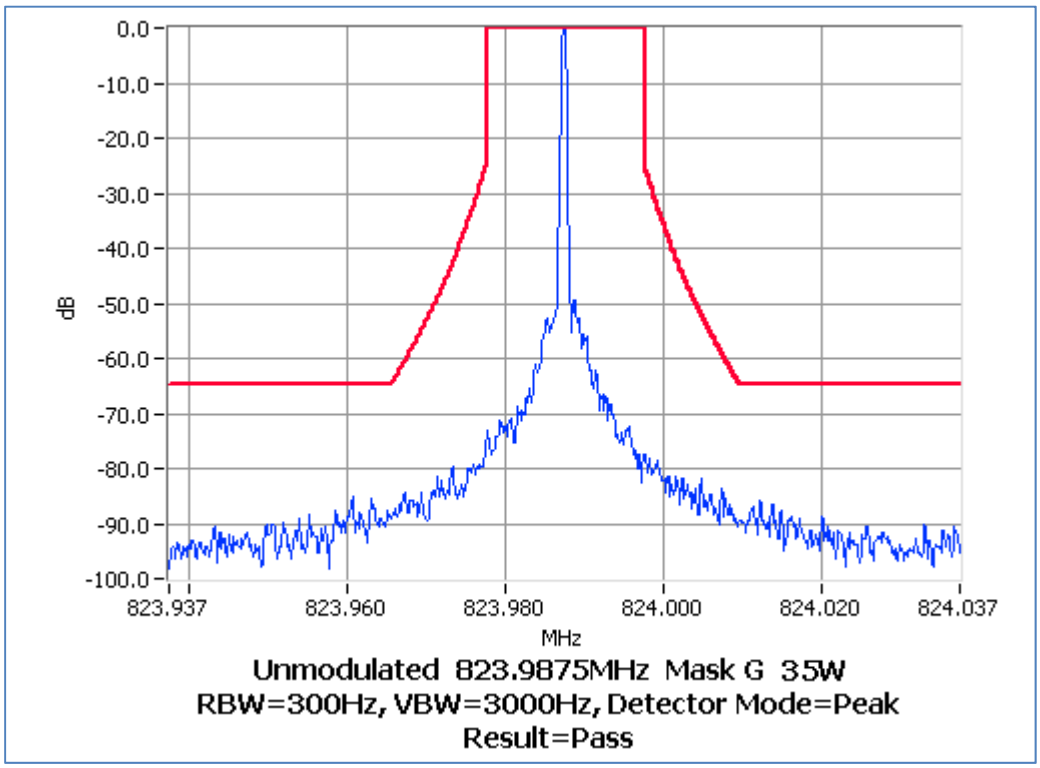


FFSK 1200 807.5125MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

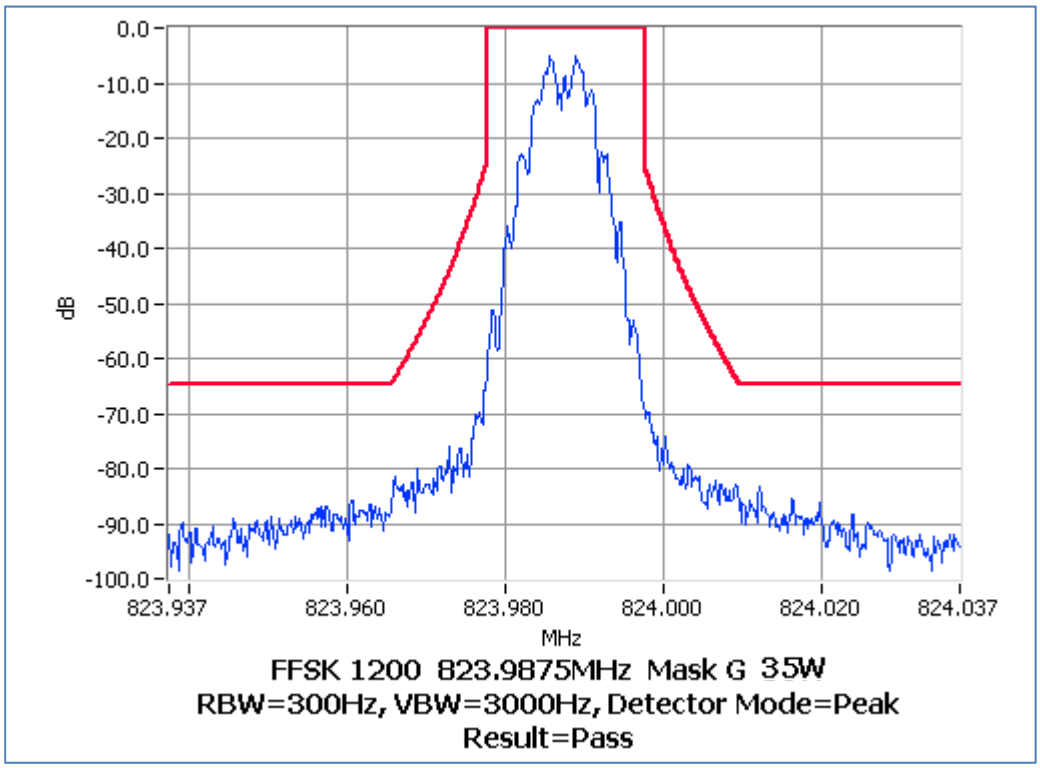
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	823.9875 MHz	35 W	25.0 kHz Channel Spacing



Unmodulated 823.9875MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

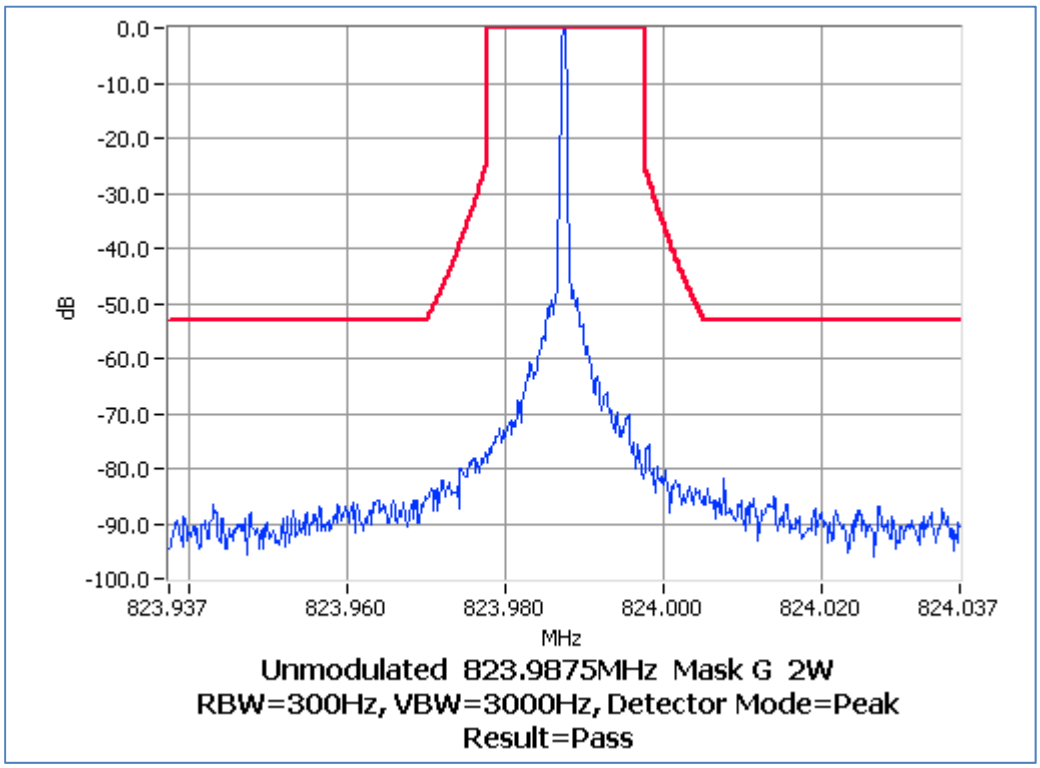


FFSK 1200 823.9875MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

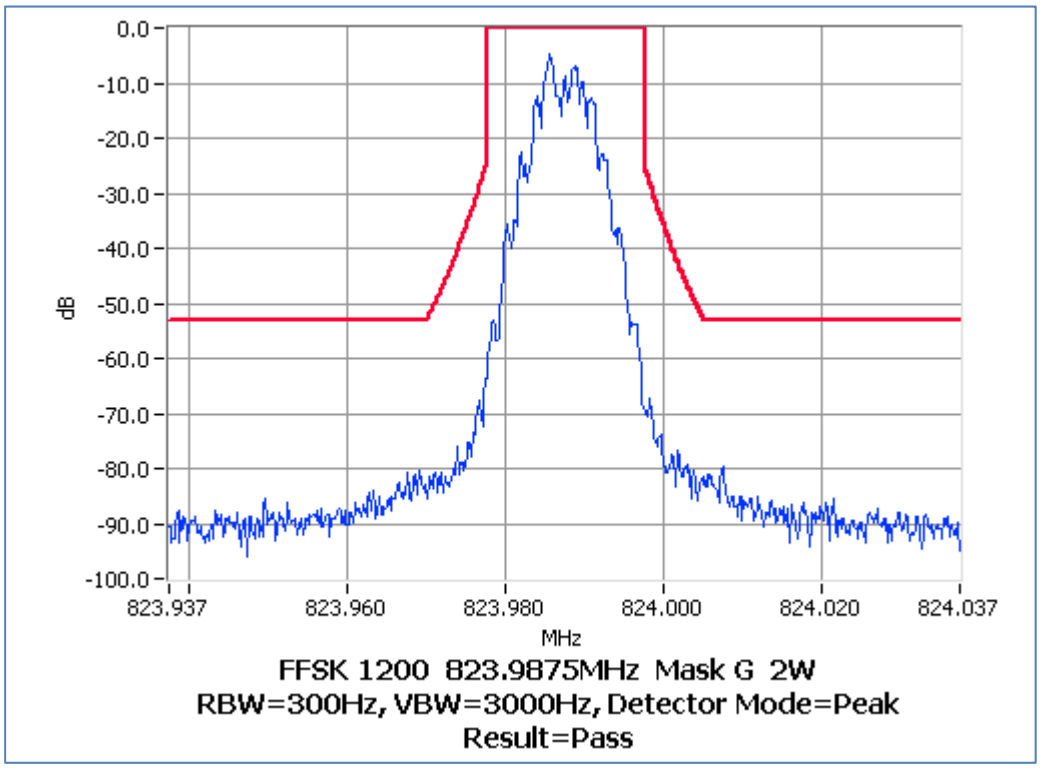
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	823.9875 MHz	2 W	25.0 kHz Channel Spacing



Unmodulated 823.9875MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

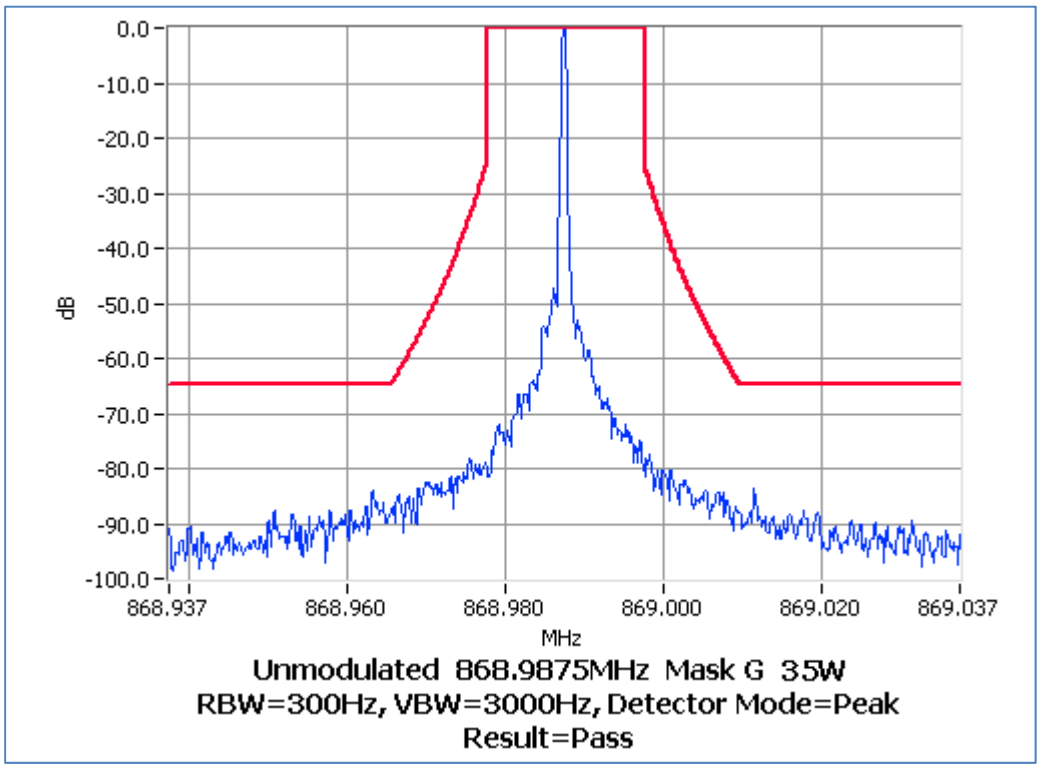


FFSK 1200 823.9875MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

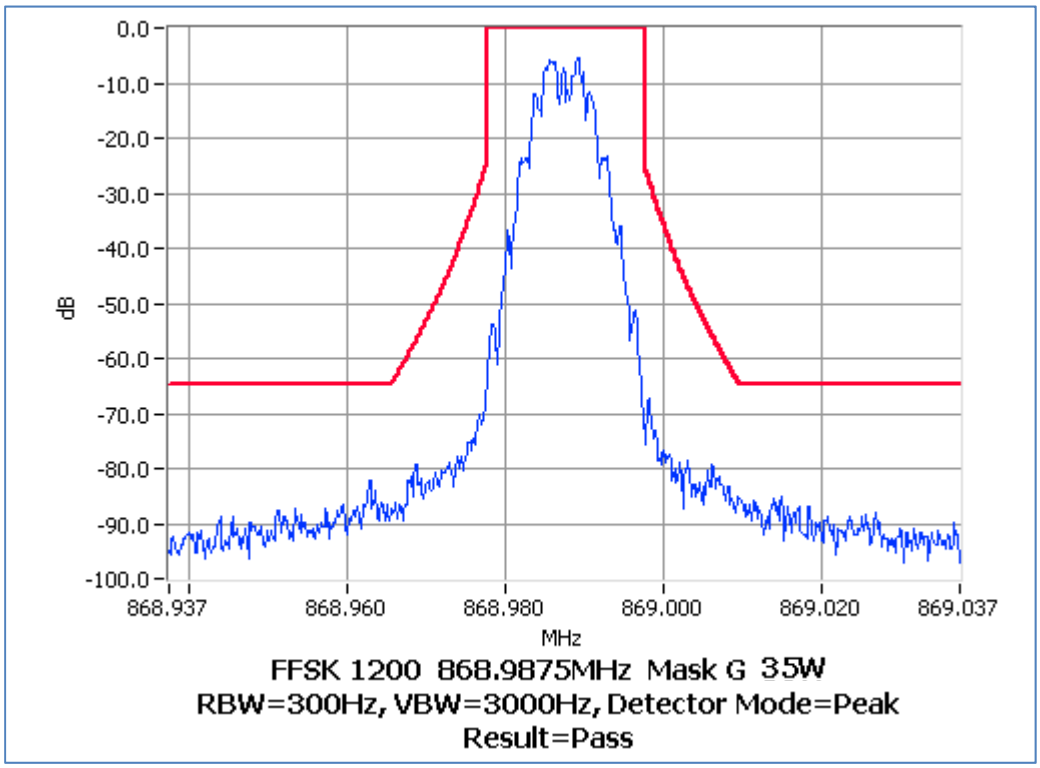
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	868.9875 MHz	35 W	25.0 kHz Channel Spacing



Unmodulated 868.9875MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

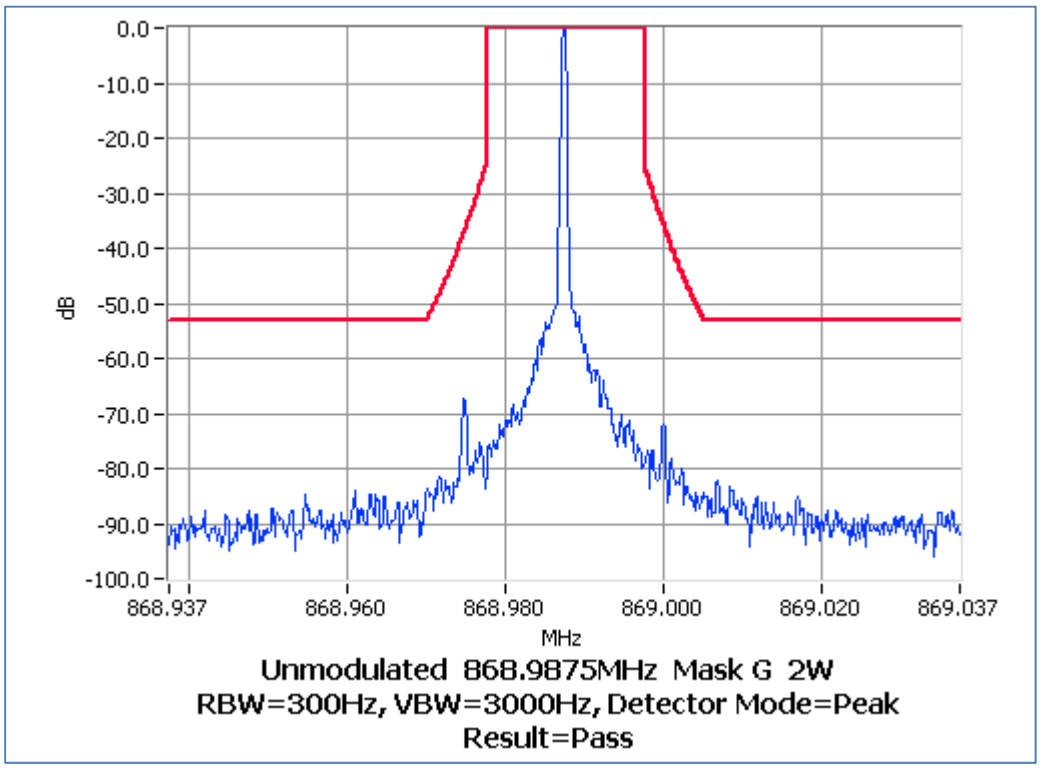


FFSK 1200 868.9875MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

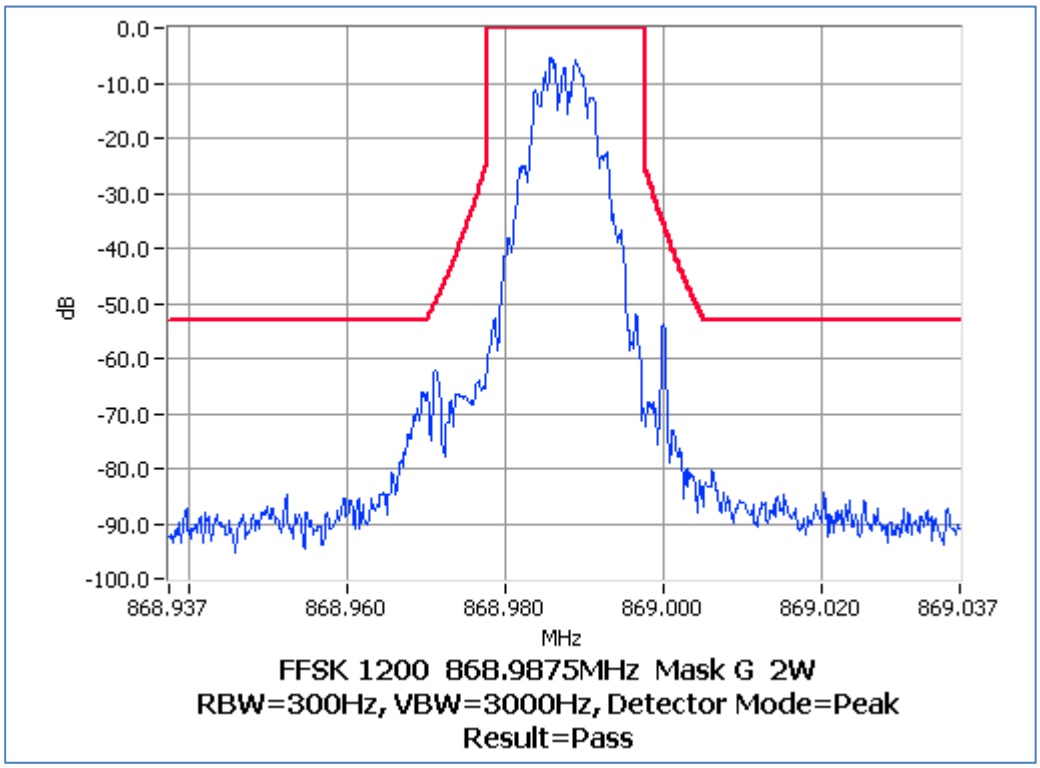
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	868.9875 MHz	2 W	25.0 kHz Channel Spacing



Unmodulated 868.9875MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

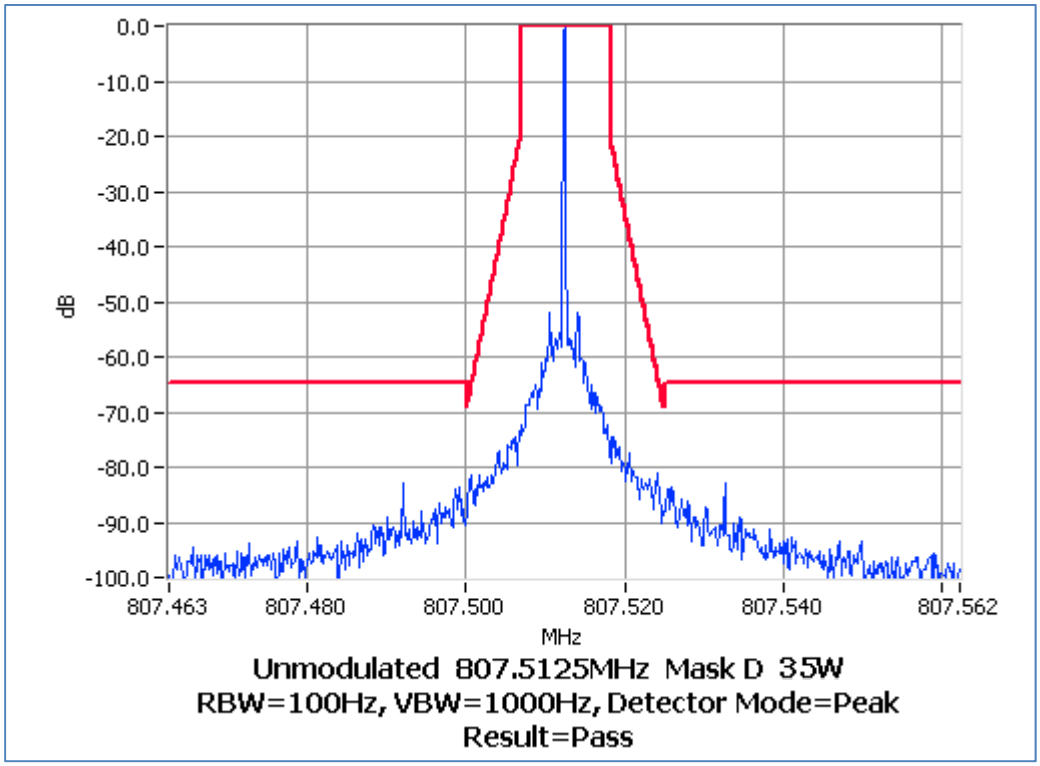


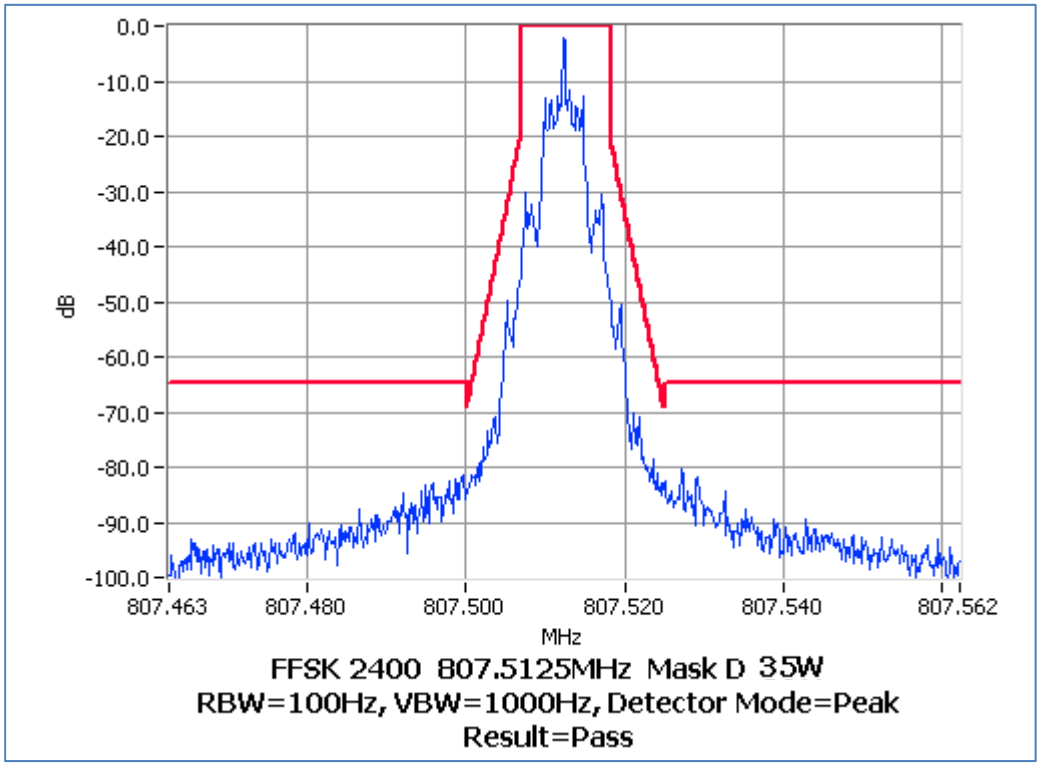
FFSK 1200 868.9875MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	807.5125 MHz	35 W	12.5 kHz Channel Spacing

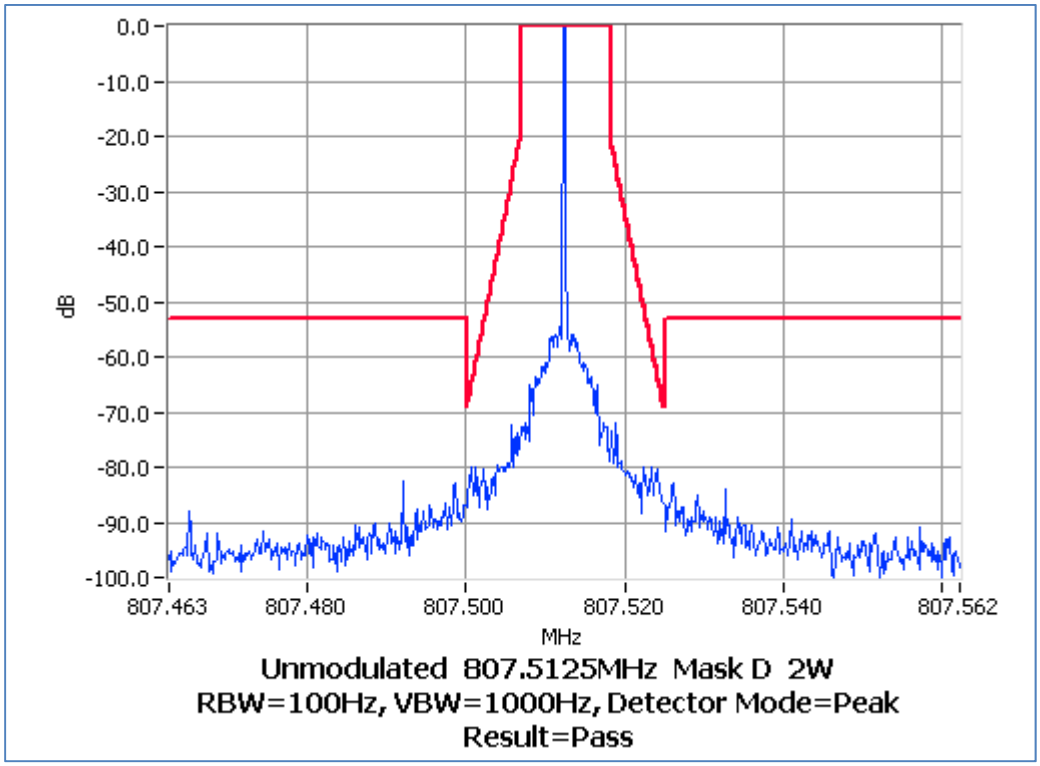




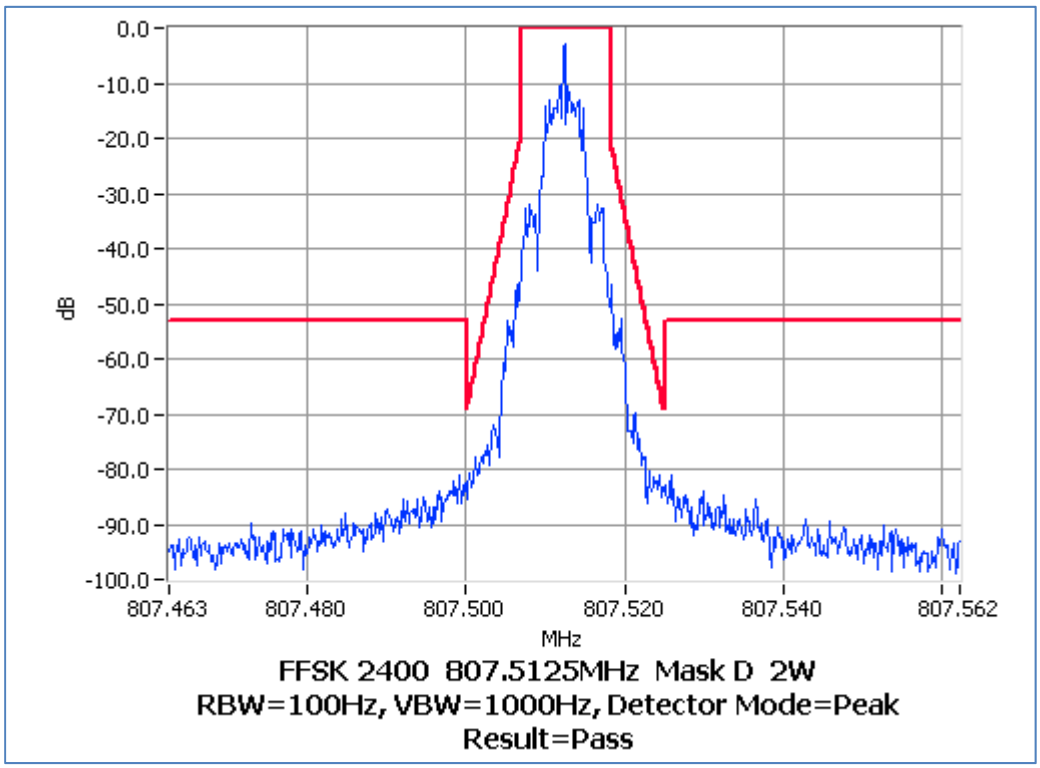
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	807.5125 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 807.5125MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

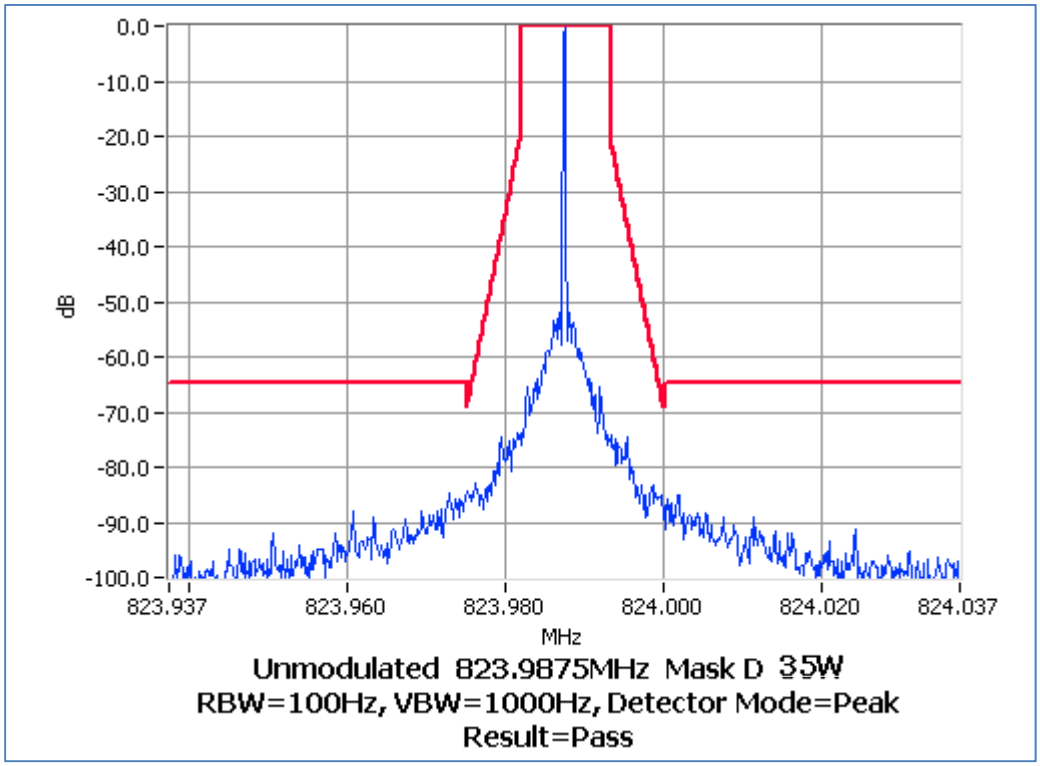


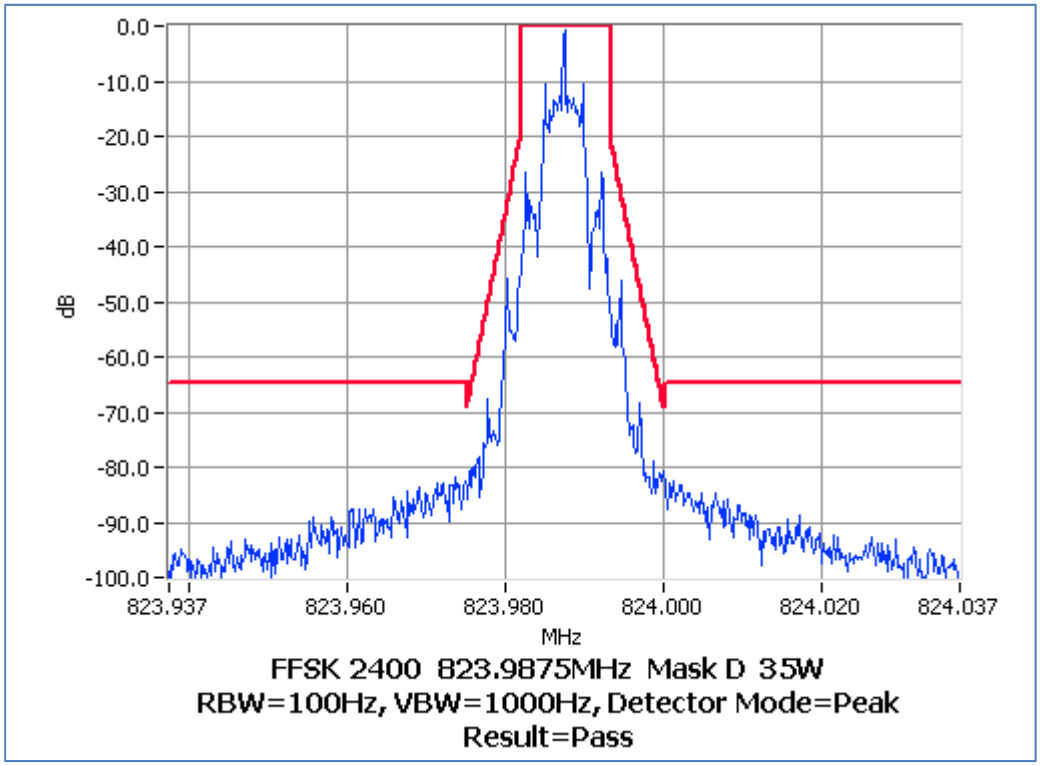
FFSK 2400 807.5125MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	823.9875 MHz	35 W	12.5 kHz Channel Spacing

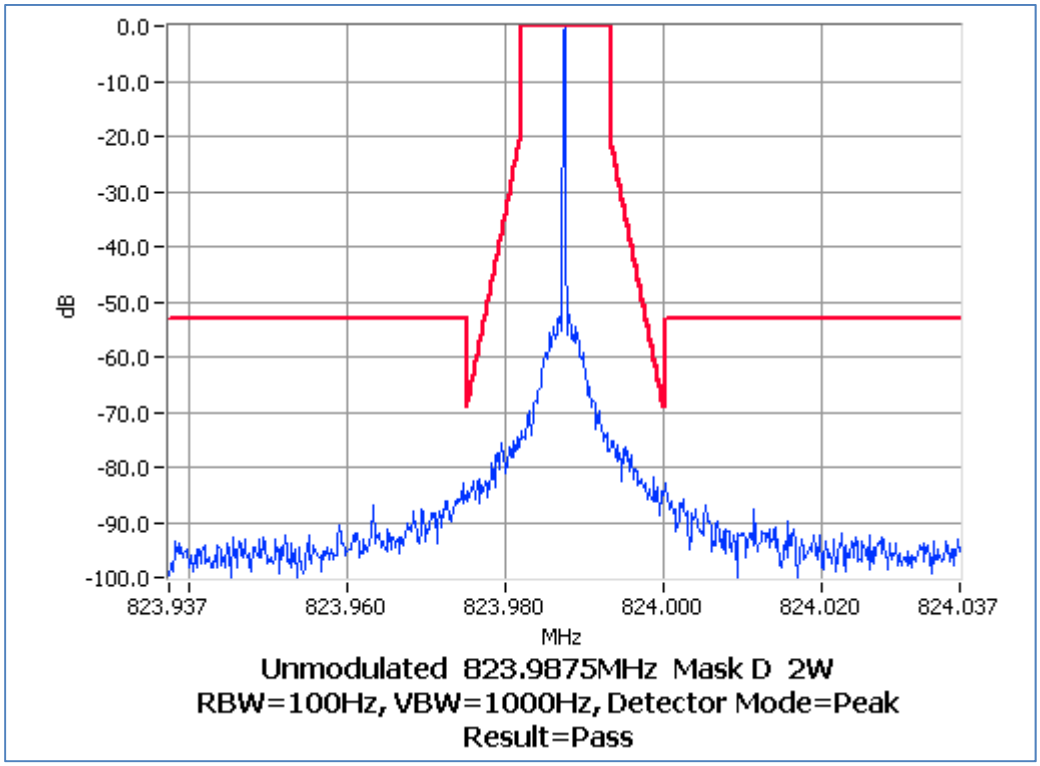




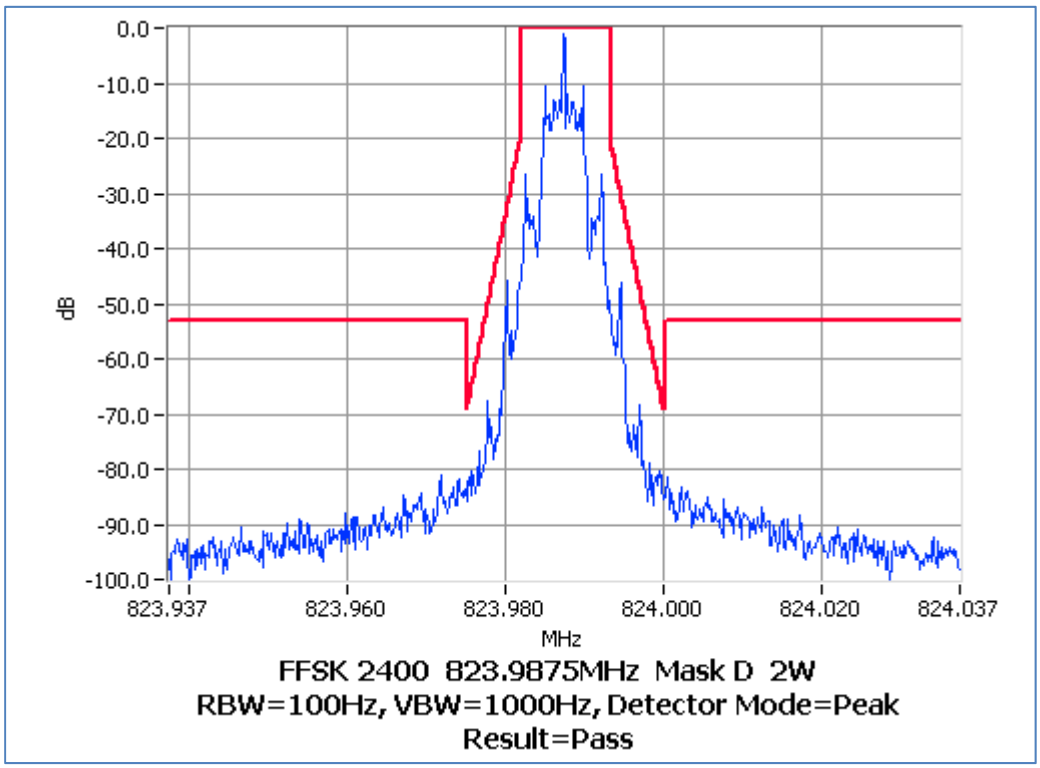
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	823.9875 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

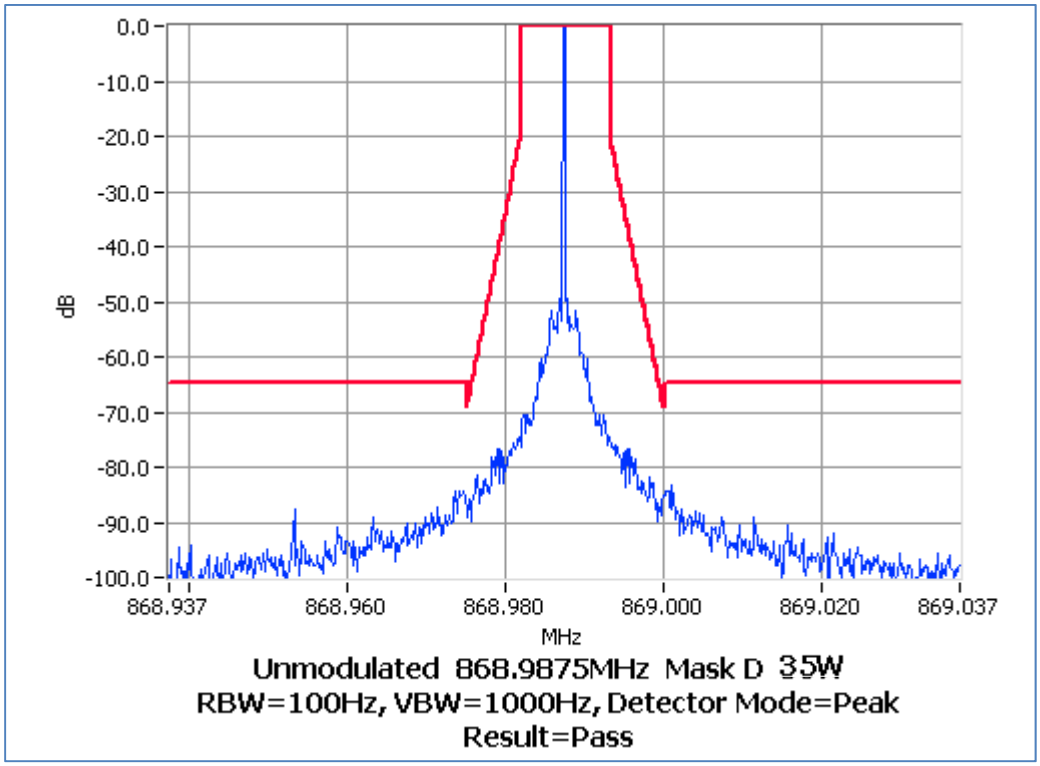


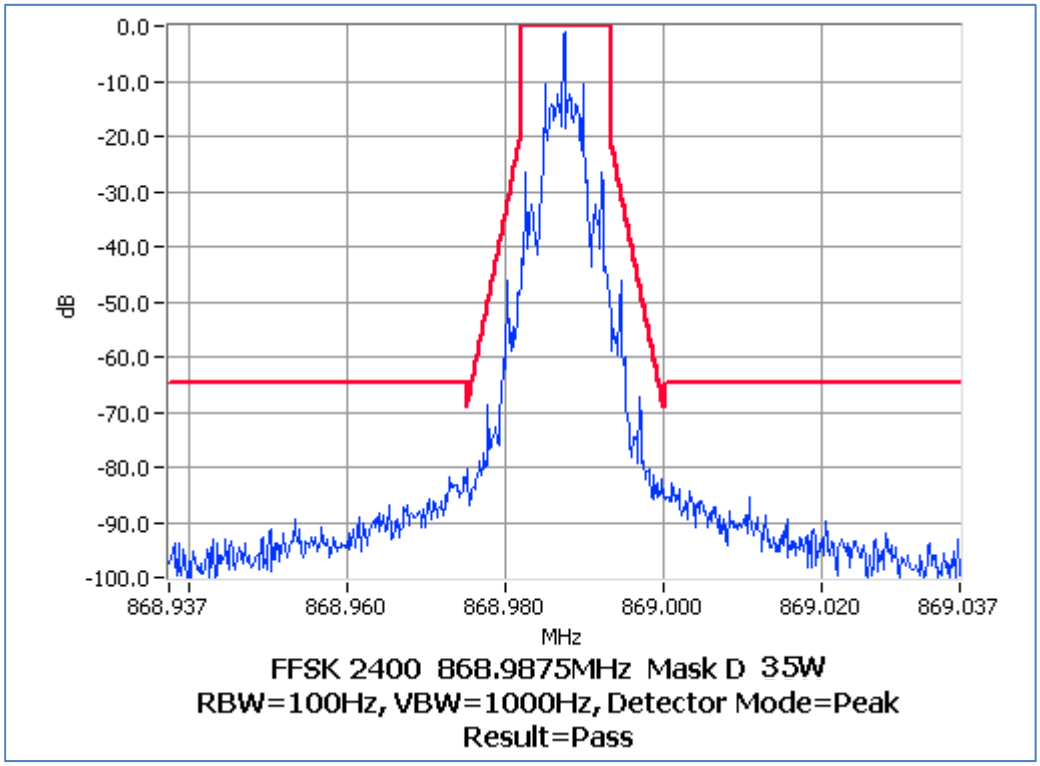
FFSK 2400 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	868.9875 MHz	35 W	12.5 kHz Channel Spacing

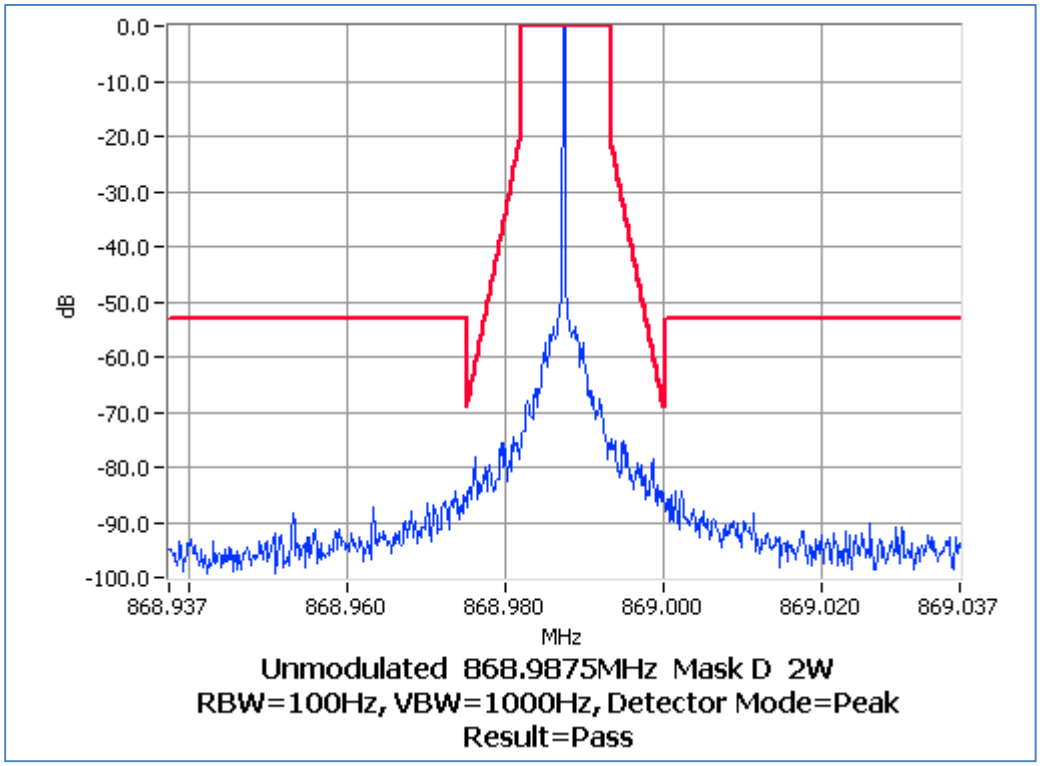




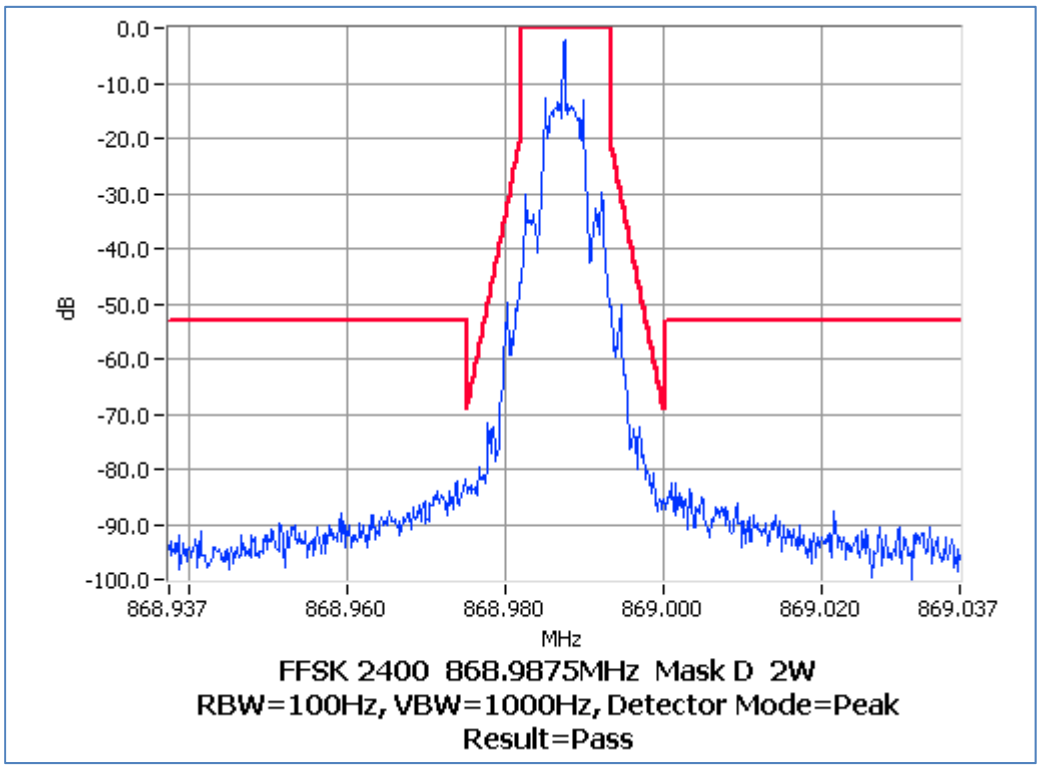
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	868.9875 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 868.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

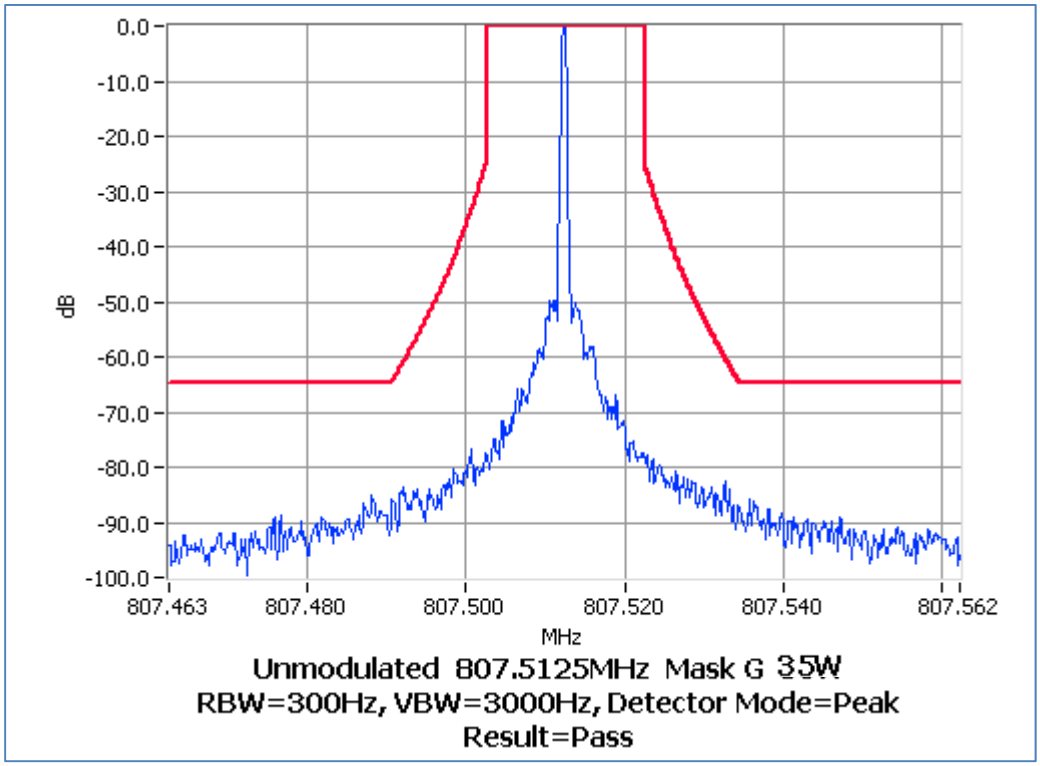


FFSK 2400 868.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

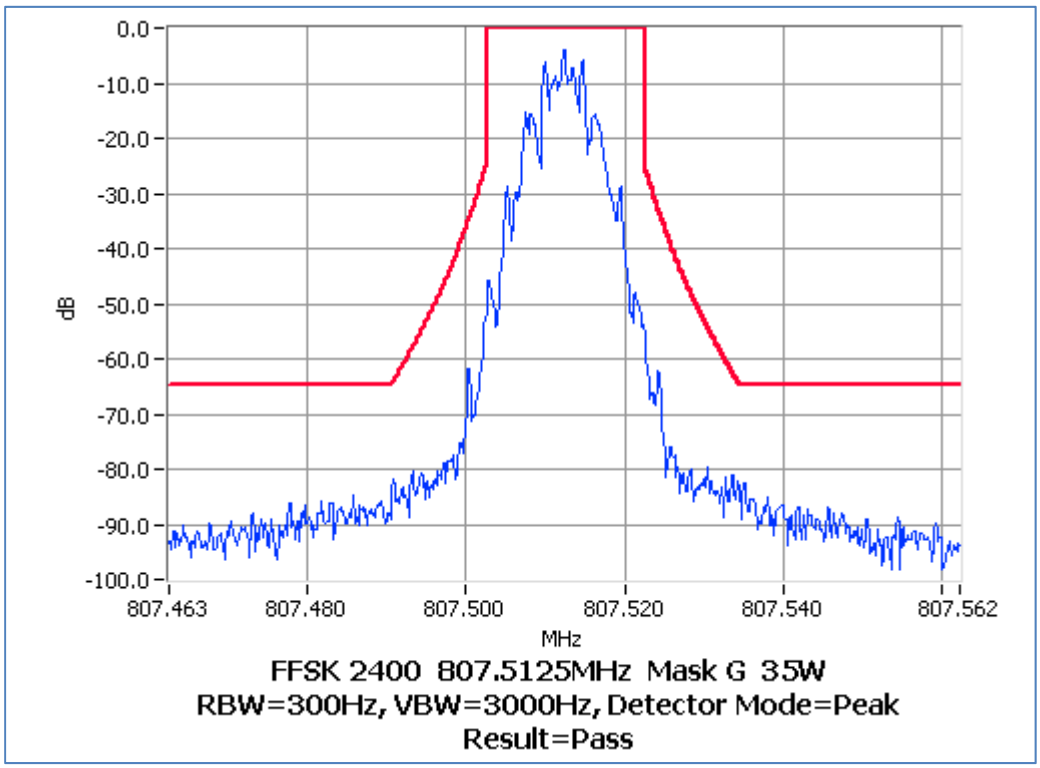
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	807.5125 MHz 35 W	25.0 kHz Channel Spacing	



Unmodulated 807.5125MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

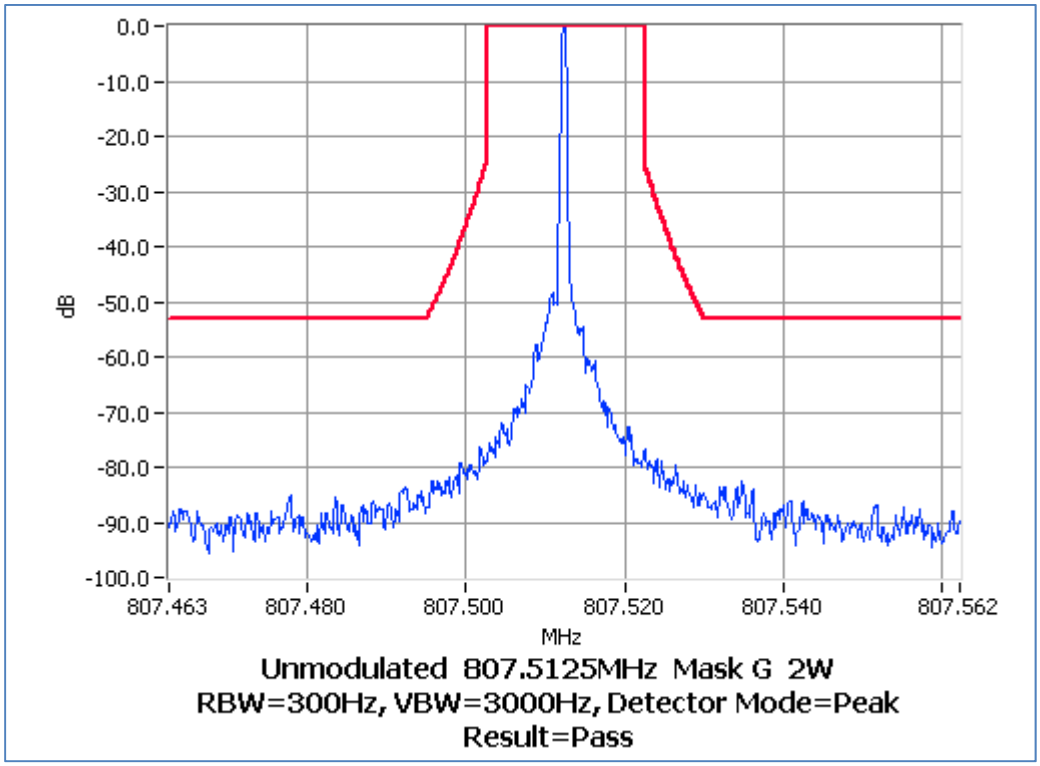


FFSK 2400 807.5125MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

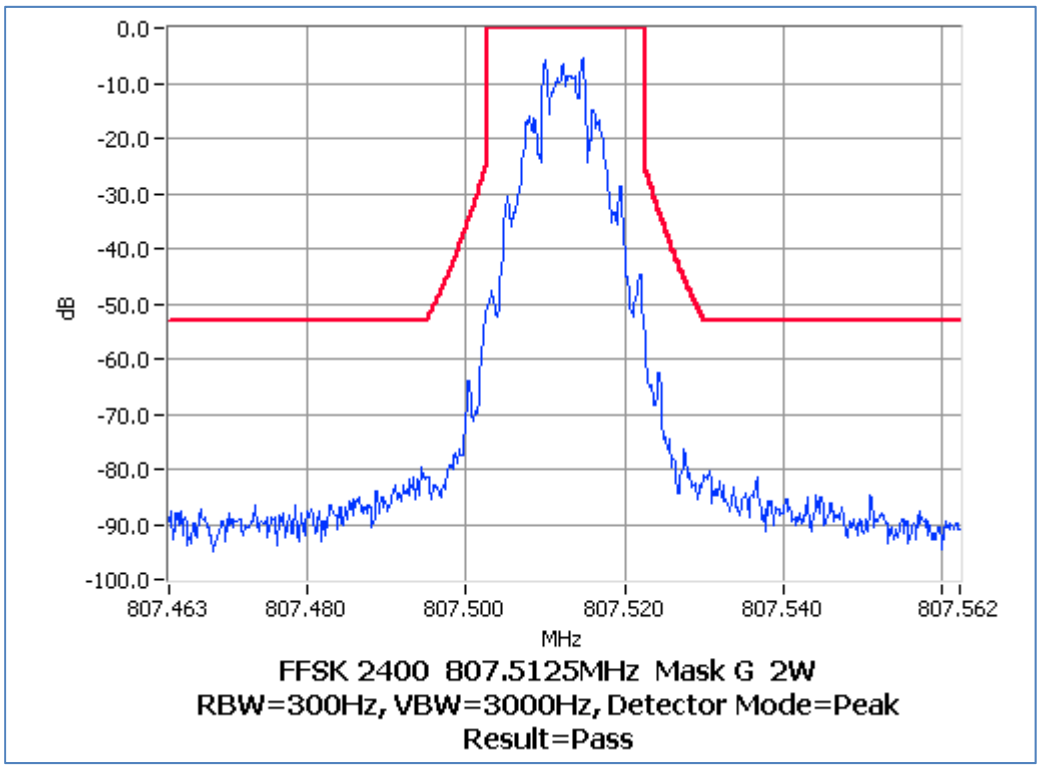
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	807.5125 MHz	2 W	25.0 kHz Channel Spacing



Unmodulated 807.5125MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

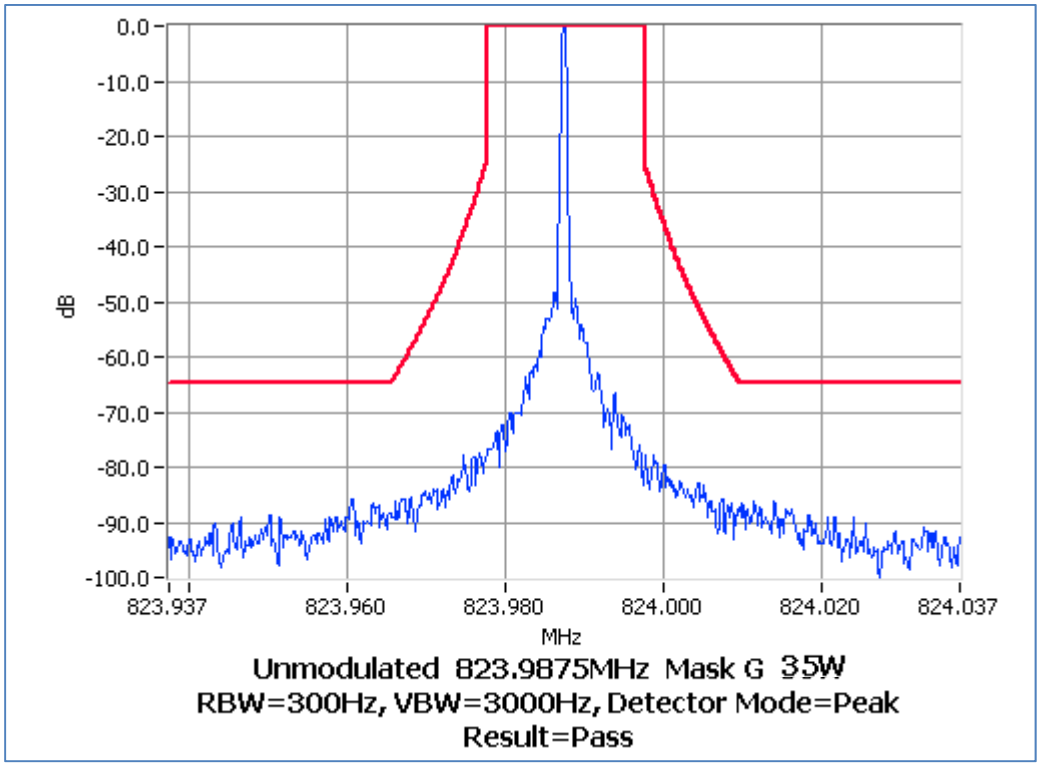


FFSK 2400 807.5125MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

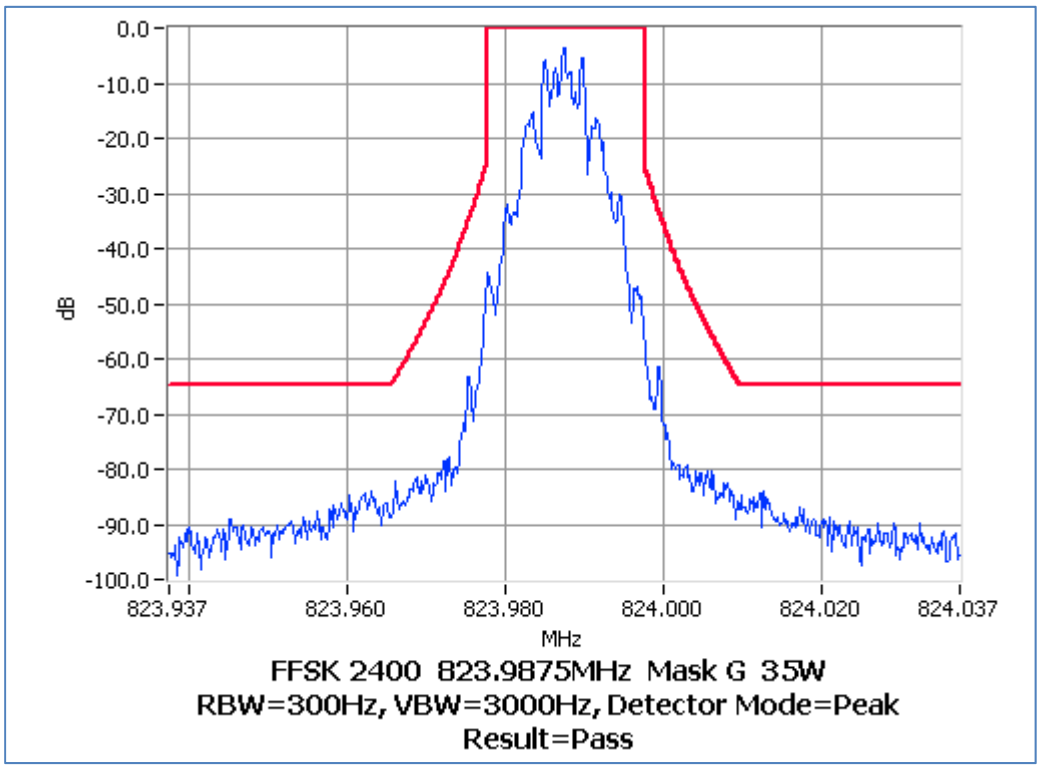
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	823.9875 MHz	35 W	25.0 kHz Channel Spacing



Unmodulated 823.9875MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

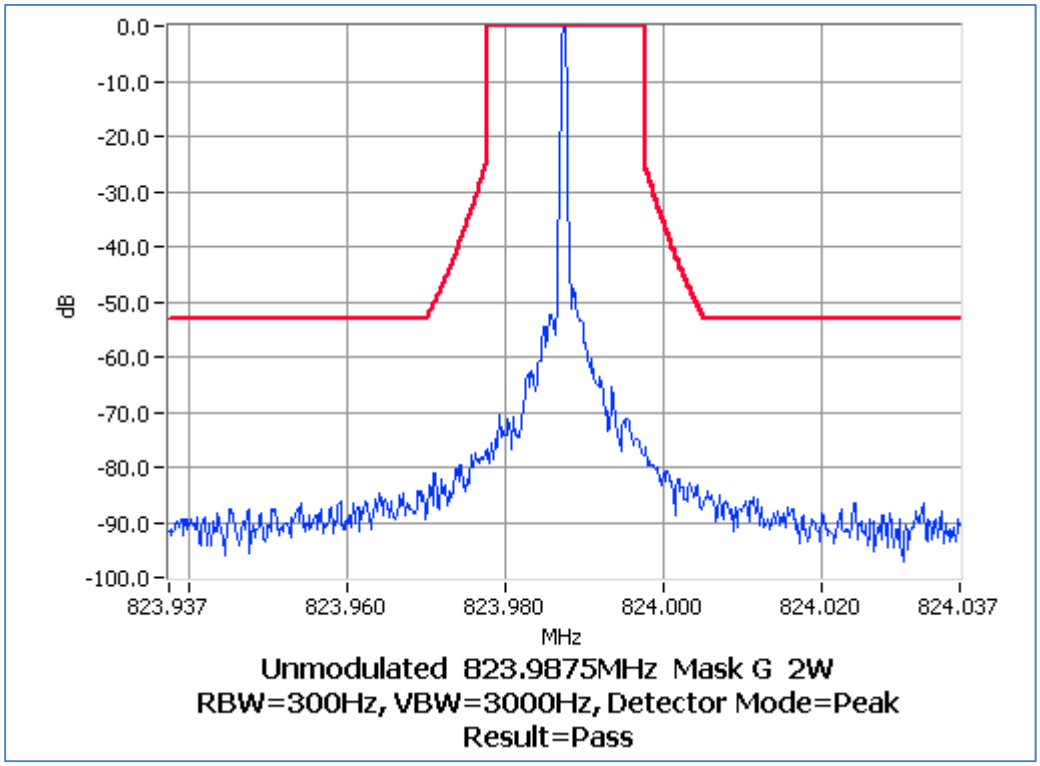


FFSK 2400 823.9875MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

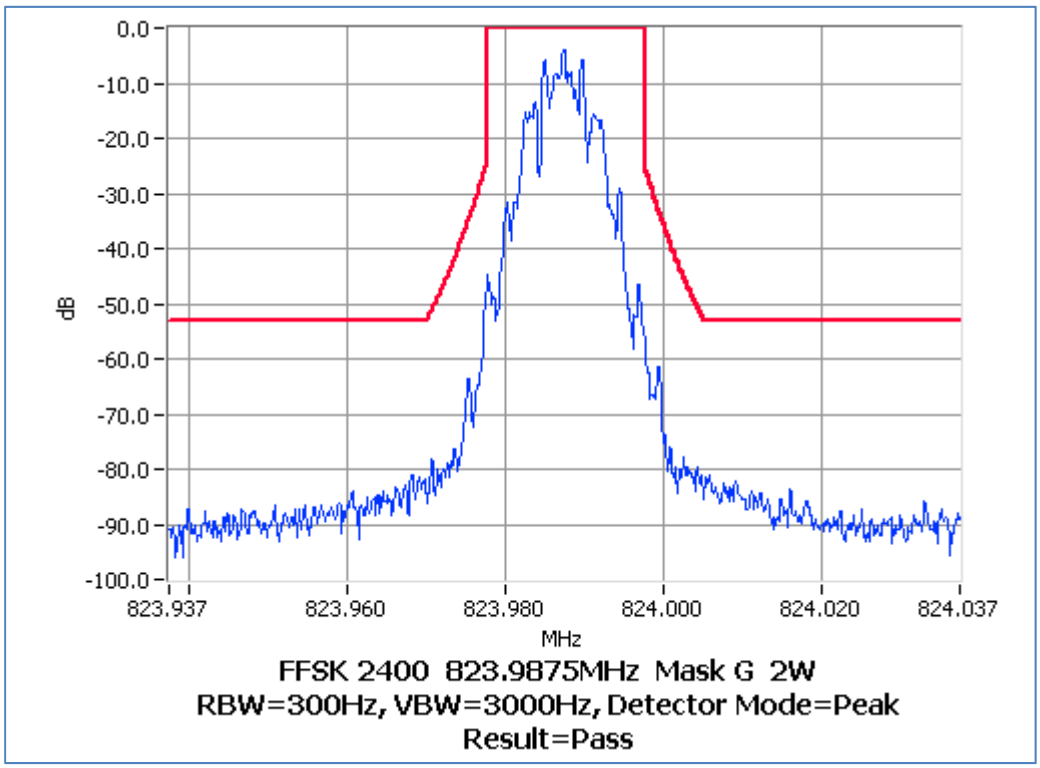
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	823.9875 MHz	2 W	25.0 kHz Channel Spacing



Unmodulated 823.9875MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

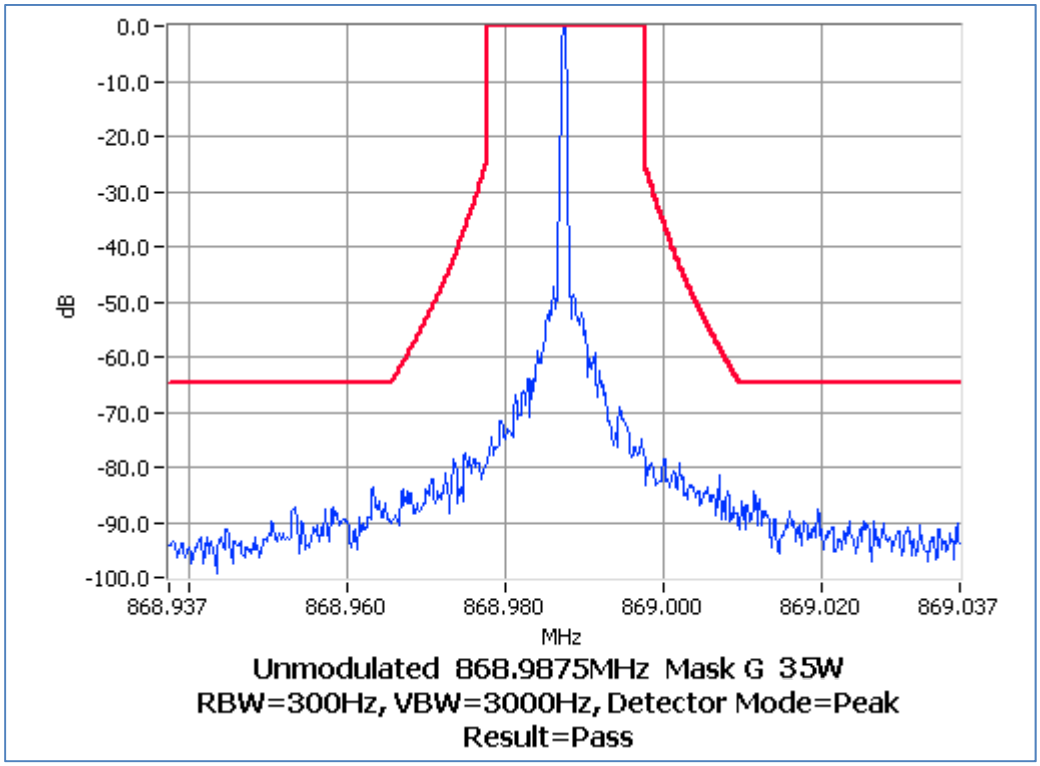


FFSK 2400 823.9875MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

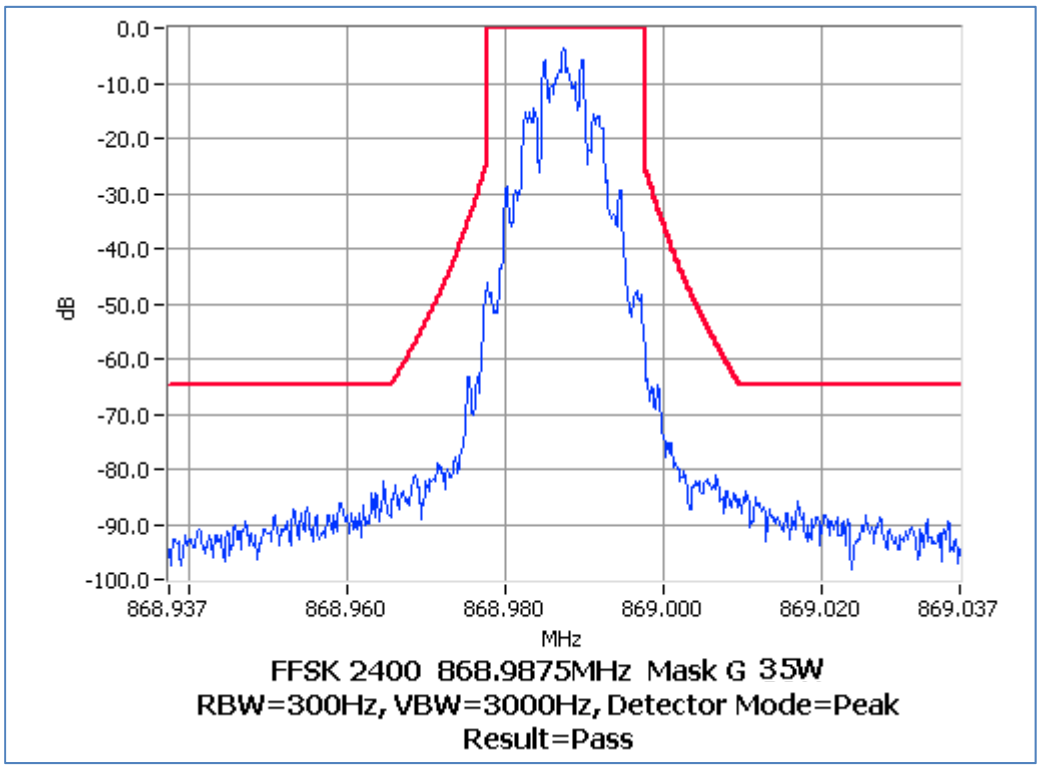
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	868.9875 MHz	35 W	25.0 kHz Channel Spacing



Unmodulated 868.9875MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

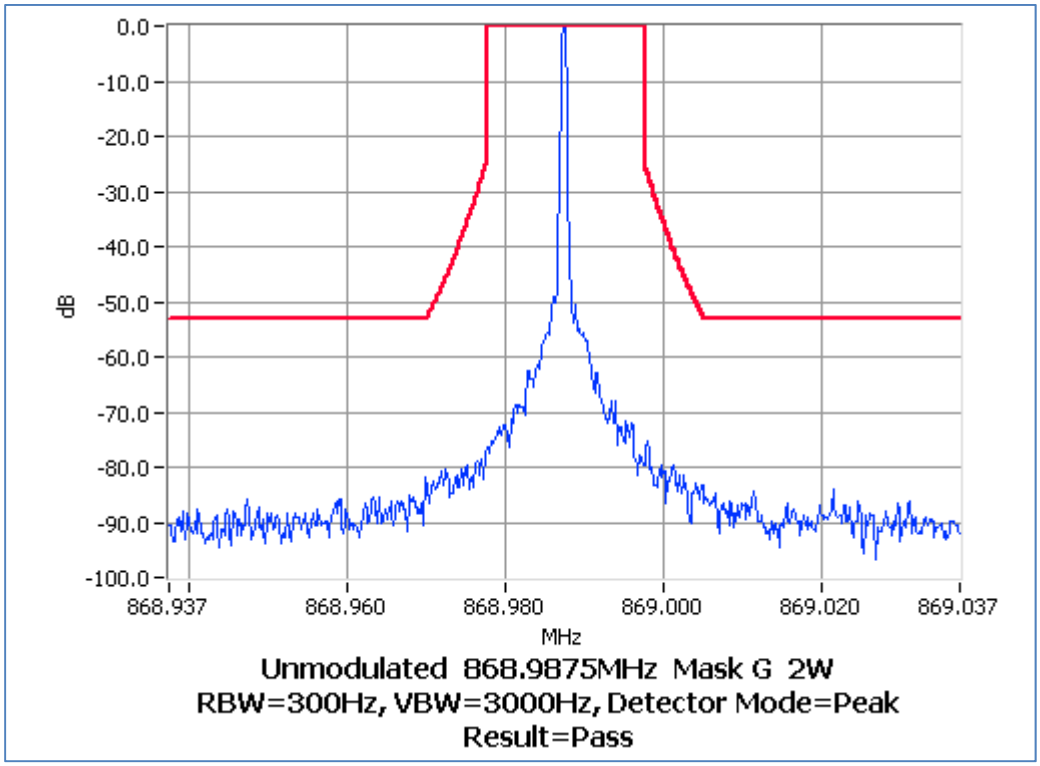


FFSK 2400 868.9875MHz Mask G 35W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

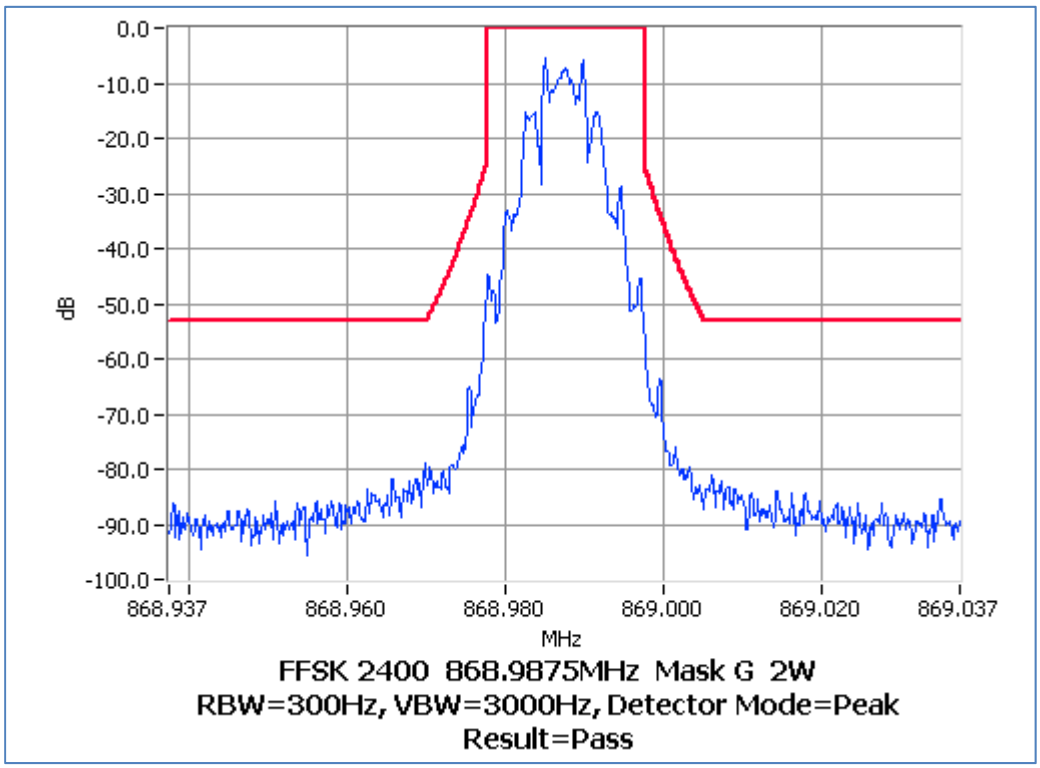
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	868.9875 MHz	2 W	25.0 kHz Channel Spacing



Unmodulated 868.9875MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

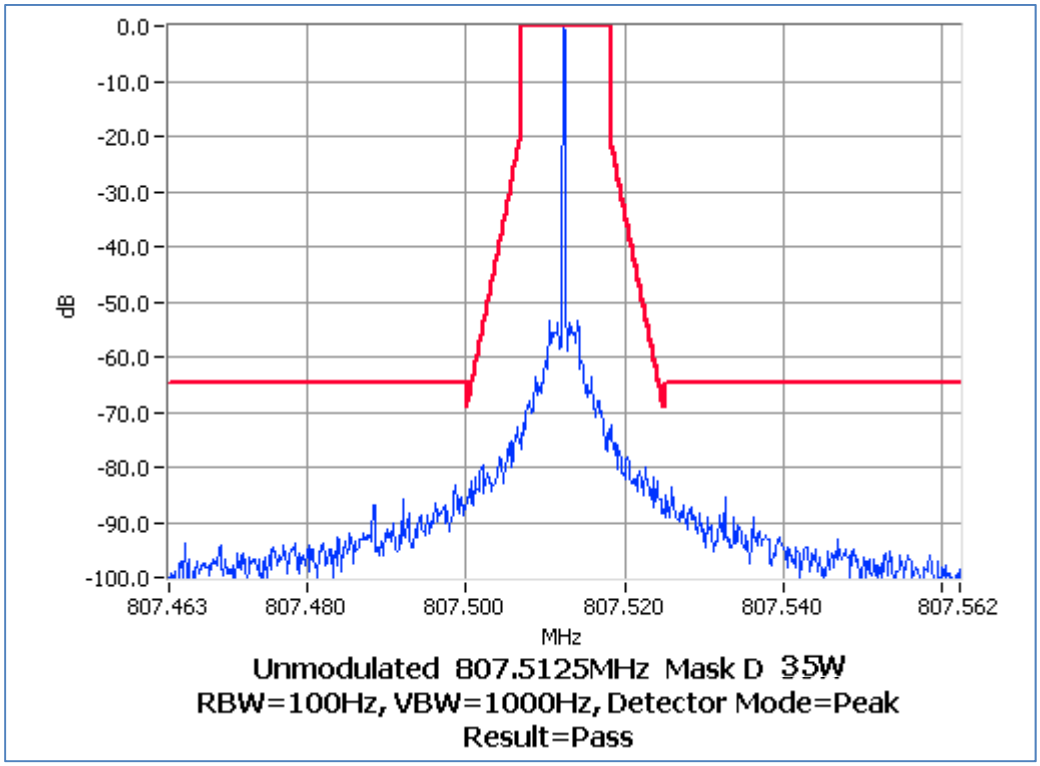


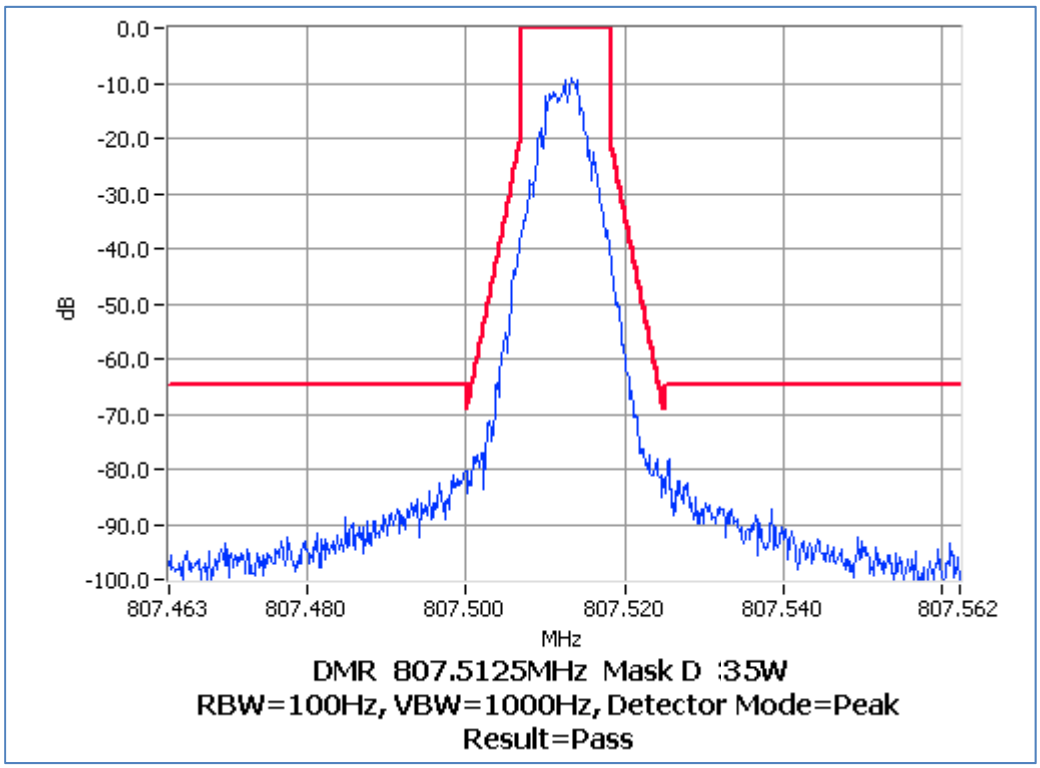
FFSK 2400 868.9875MHz Mask G 2W
RBW=300Hz, VBW=3000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

DMR

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	807.5125 MHz	35 W	12.5 kHz Channel Spacing

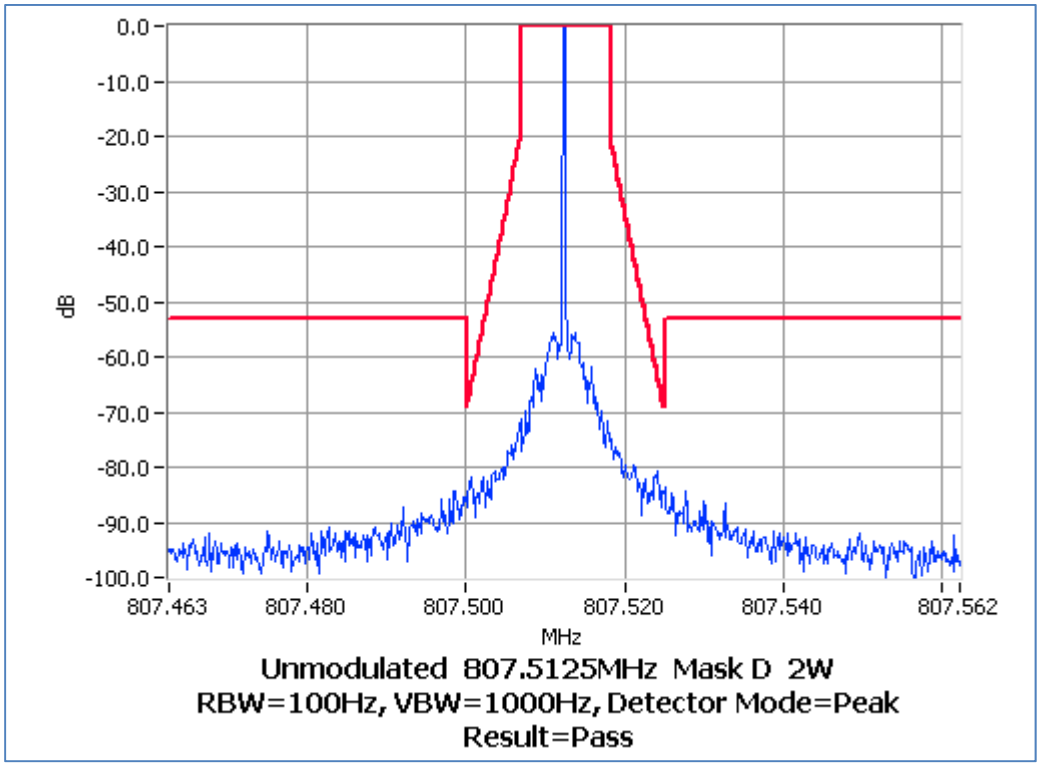


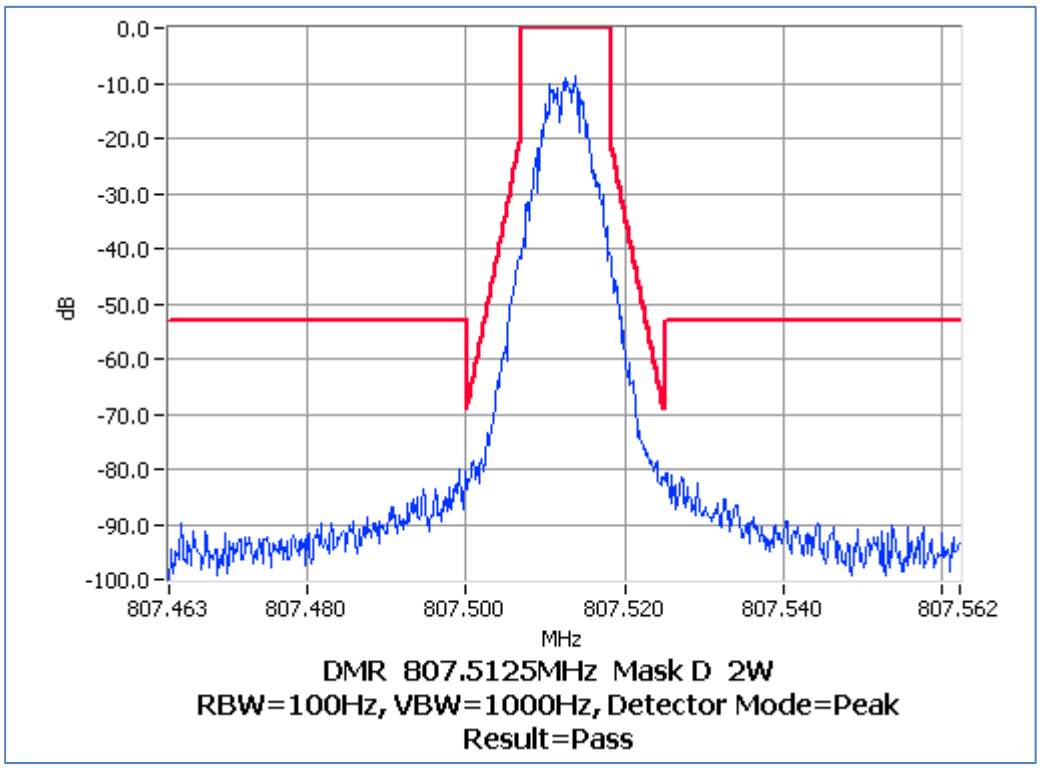


Occupied Bandwidth and Spectrum Masks

DMR

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	807.5125 MHz	2 W	12.5 kHz Channel Spacing

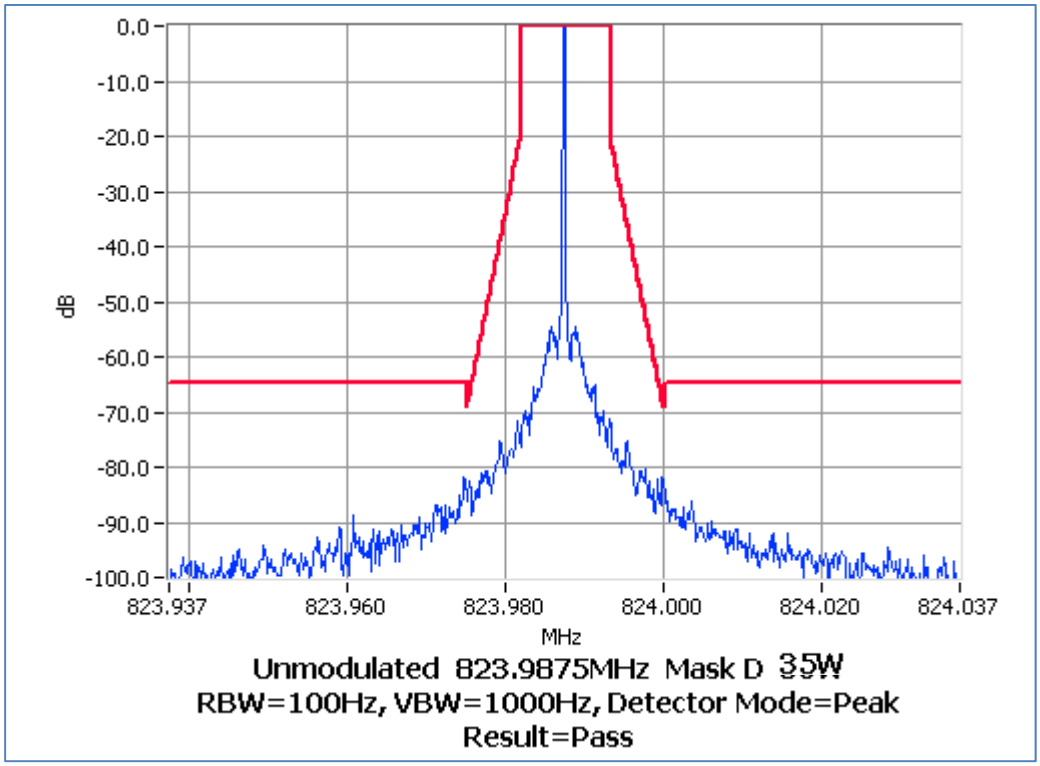


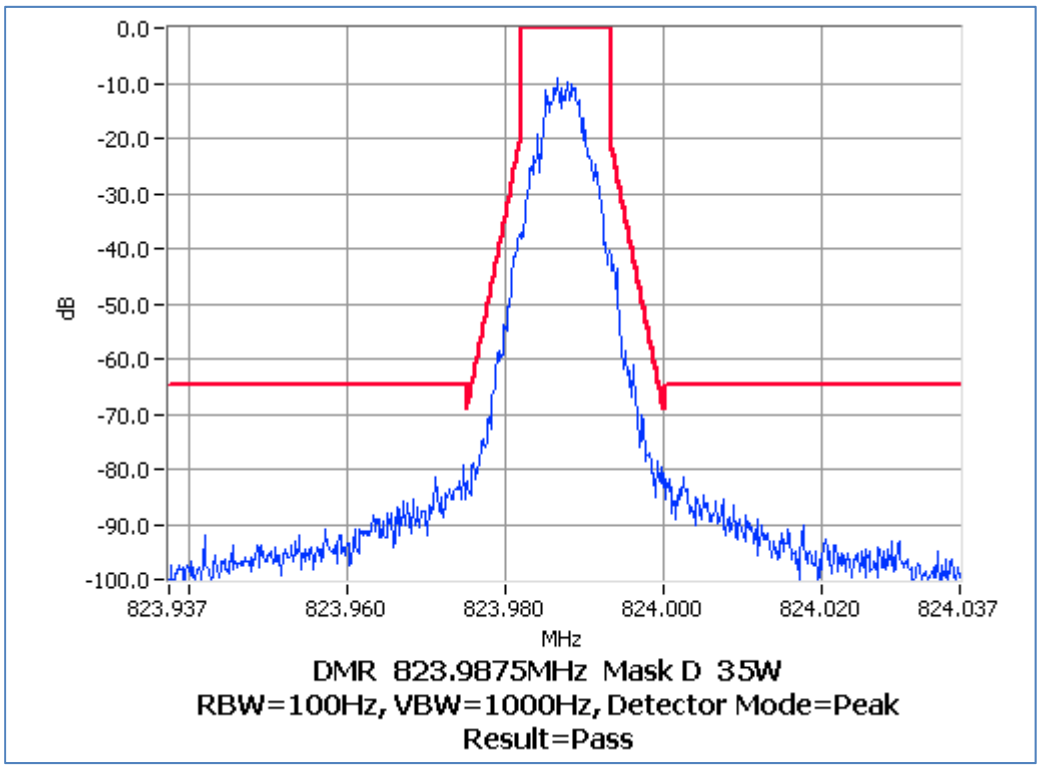


Occupied Bandwidth and Spectrum Masks

DMR

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	823.9875 MHz	35 W	12.5 kHz Channel Spacing

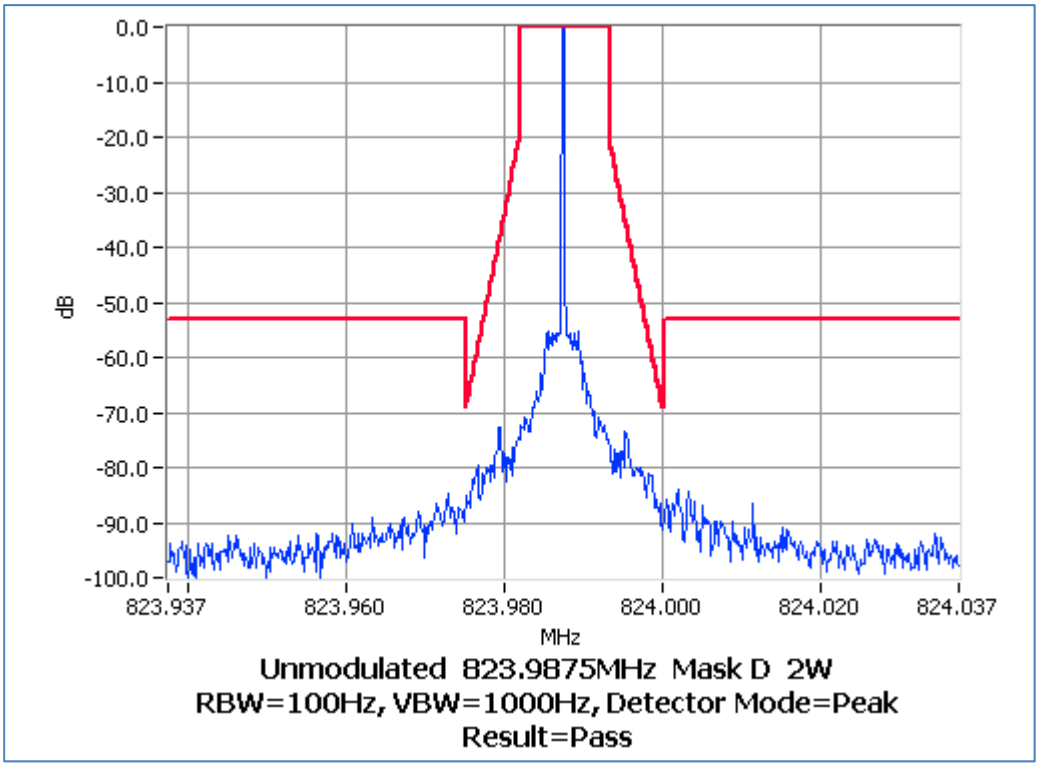




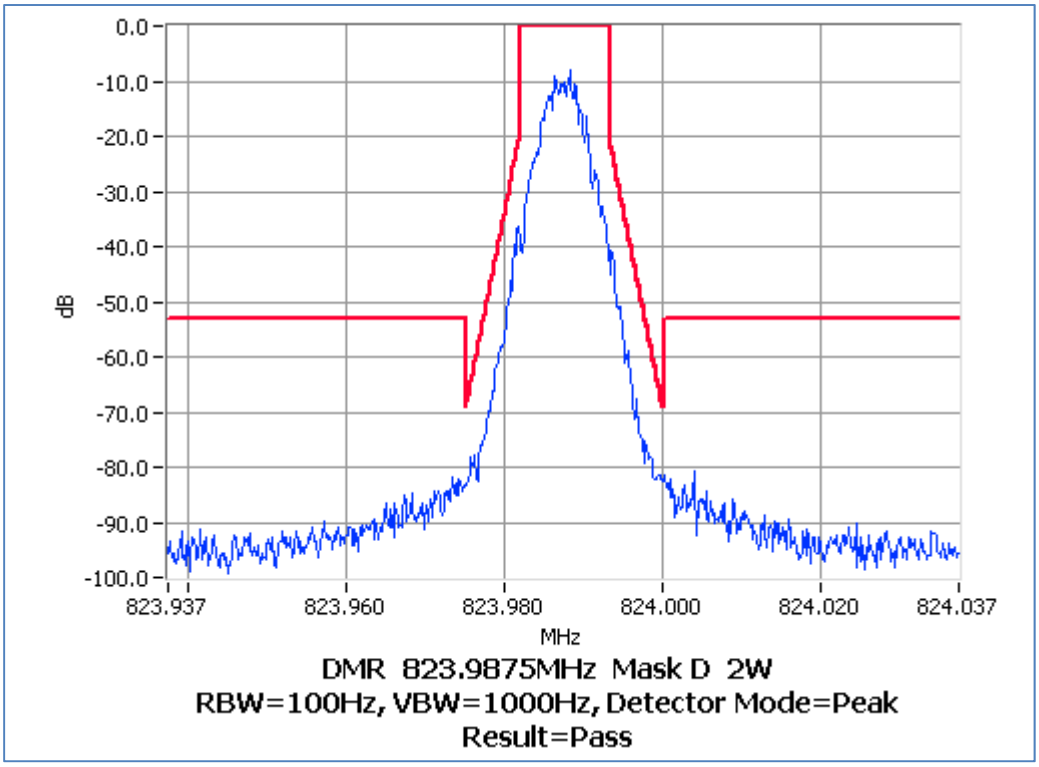
Occupied Bandwidth and Spectrum Masks

DMR

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	823.9875 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

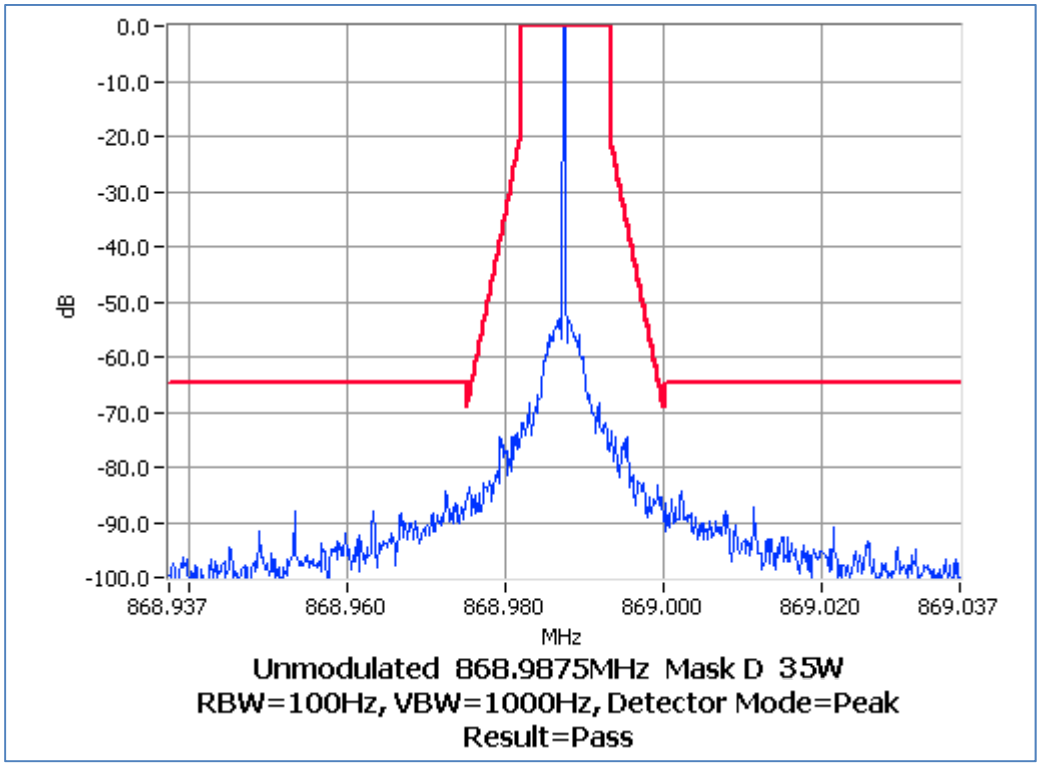


DMR 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

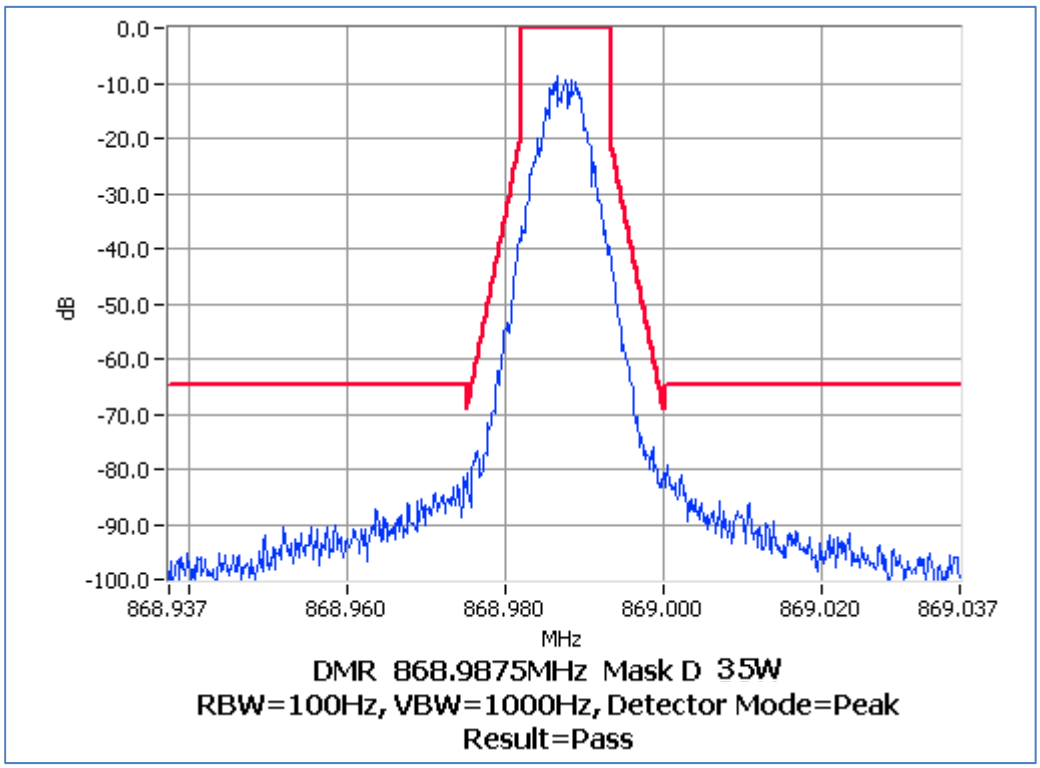
Occupied Bandwidth and Spectrum Masks

DMR

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	868.9875 MHz	35 W	12.5 kHz Channel Spacing



Unmodulated 868.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

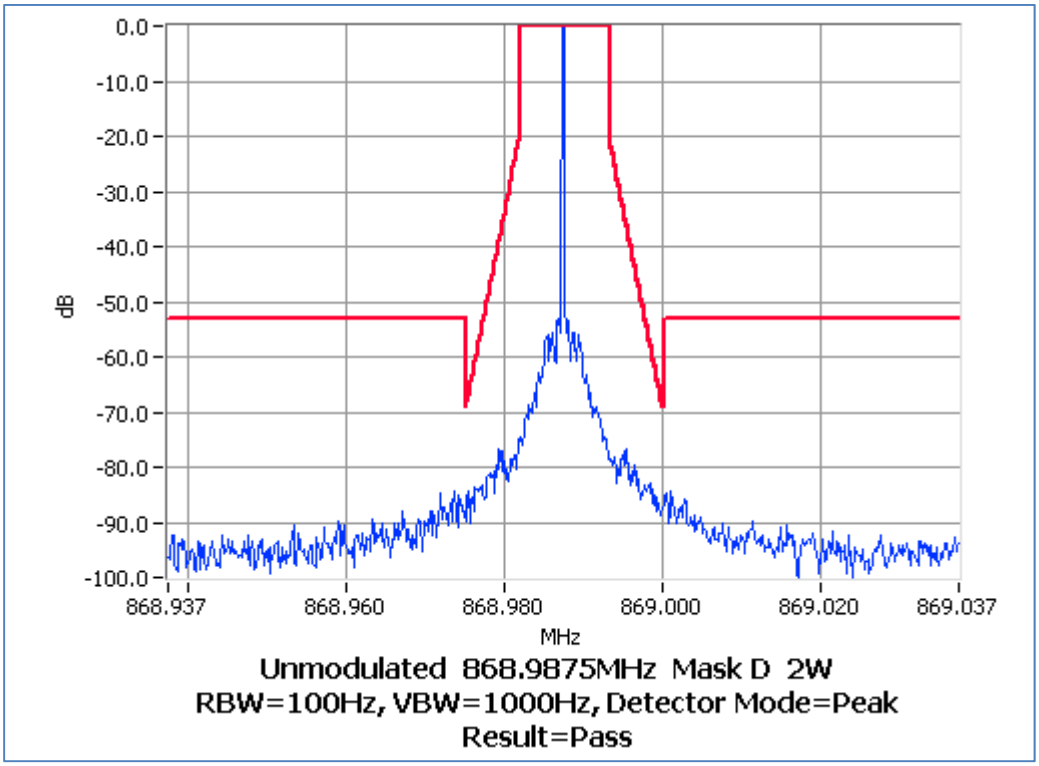


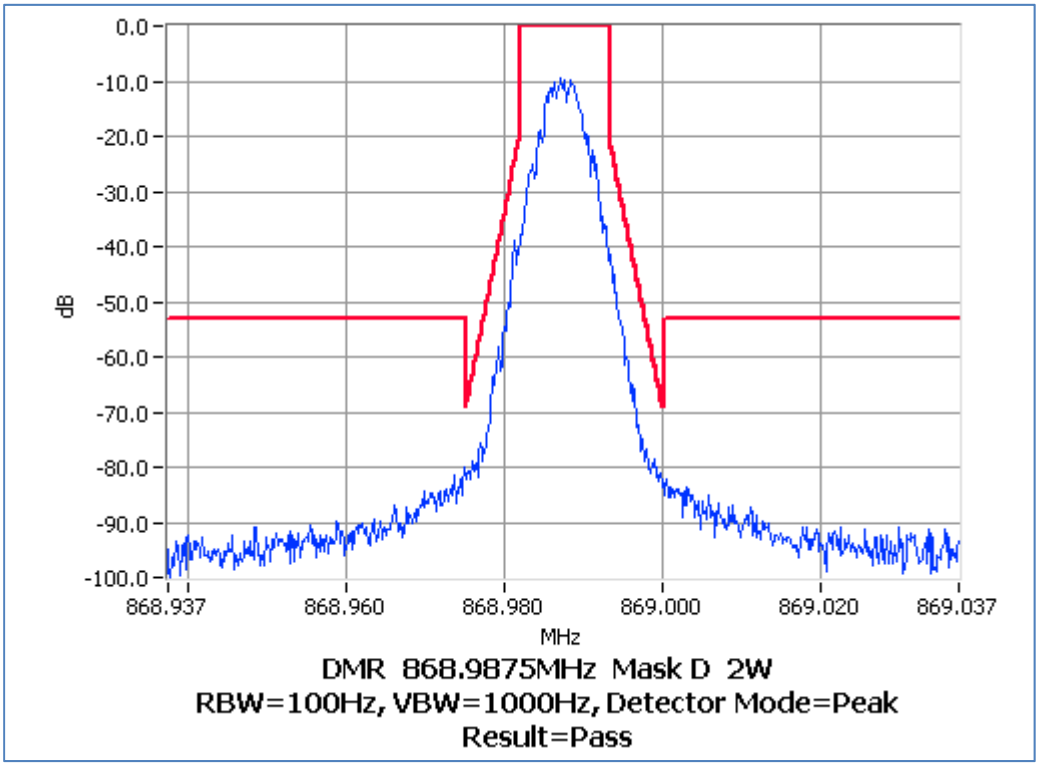
DMR 868.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

DMR

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	868.9875 MHz	2 W	12.5 kHz Channel Spacing

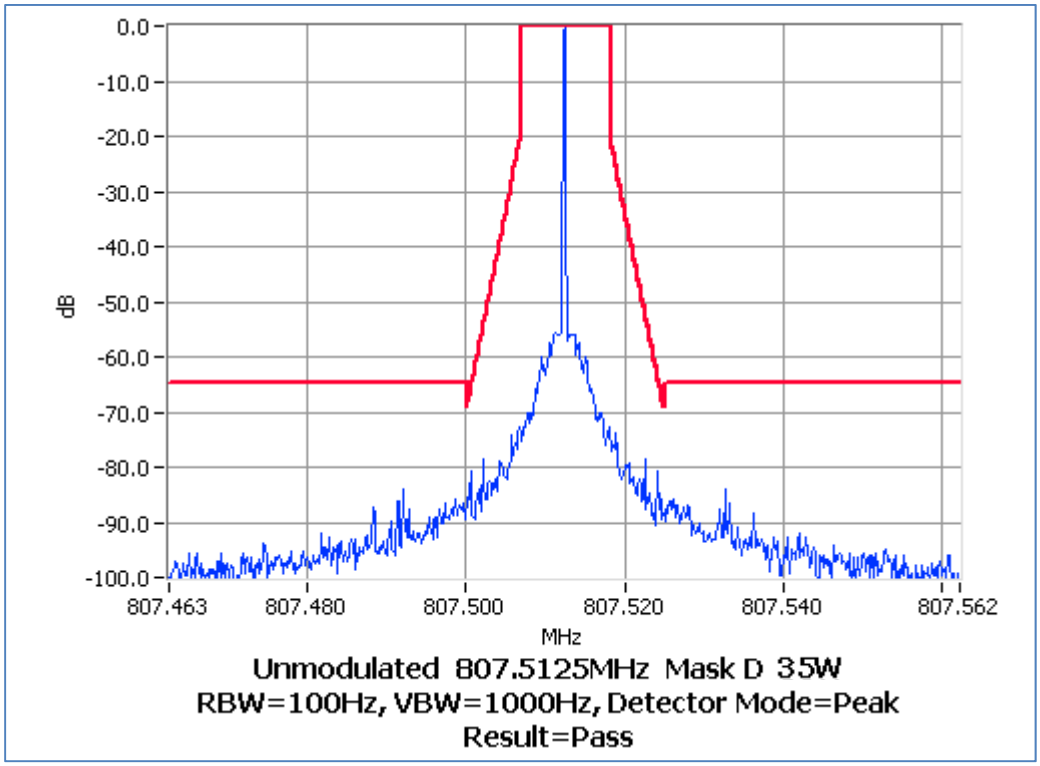


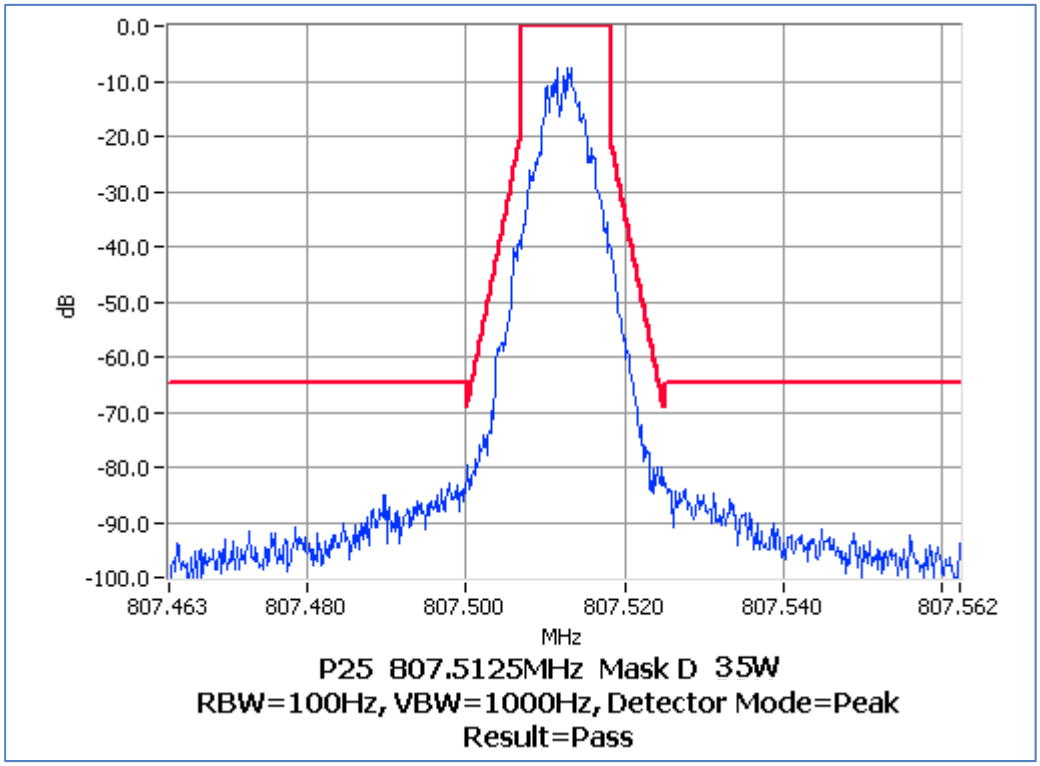


Occupied Bandwidth and Spectrum Masks

P25 Phase 1

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	807.5125 MHz	35 W	12.5 kHz Channel Spacing

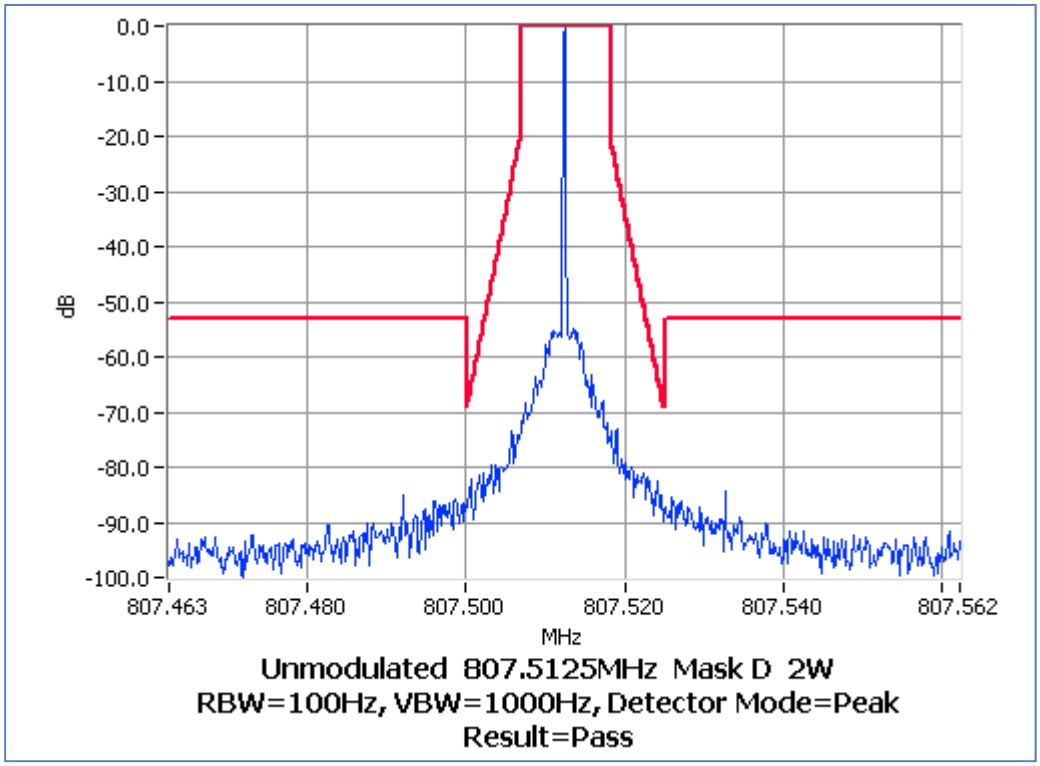


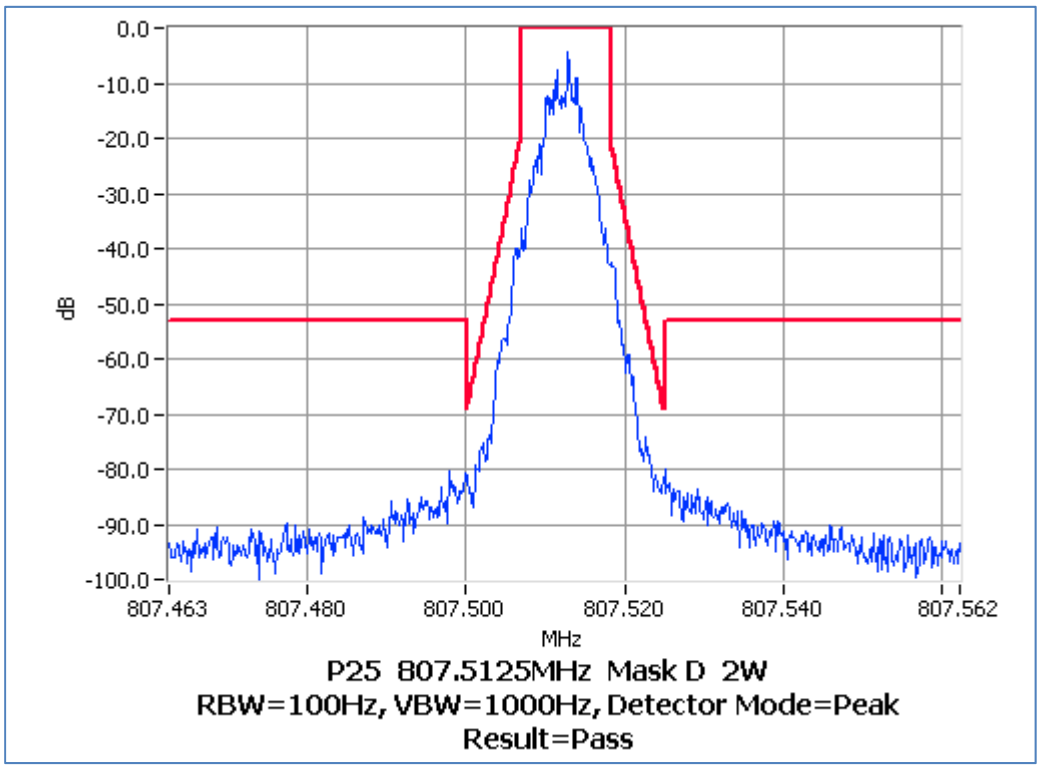


Occupied Bandwidth and Spectrum Masks

P25 Phase 1

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	807.5125 MHz	2 W	12.5 kHz Channel Spacing

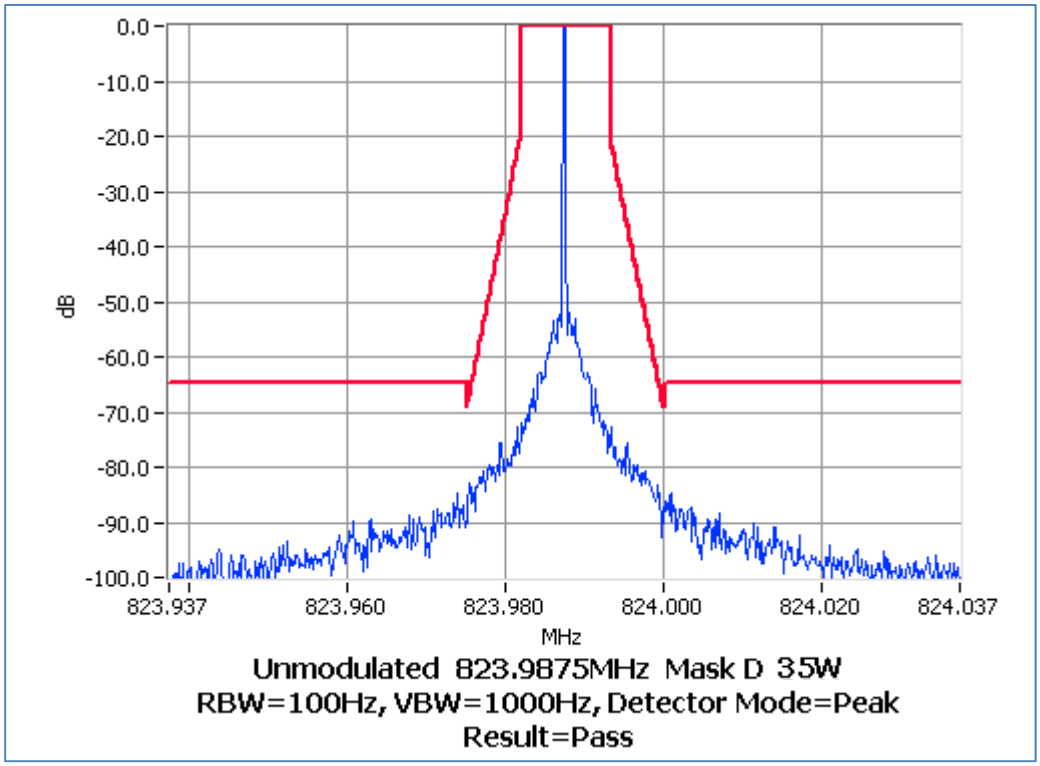




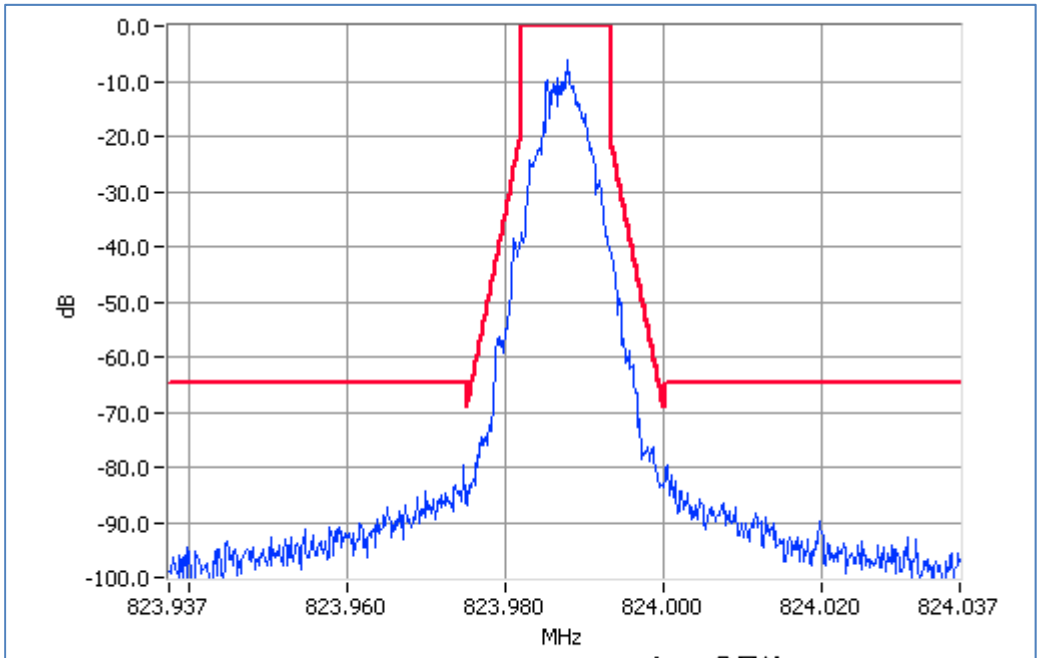
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	823.9875 MHz	35 W	12.5 kHz Channel Spacing



Unmodulated 823.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

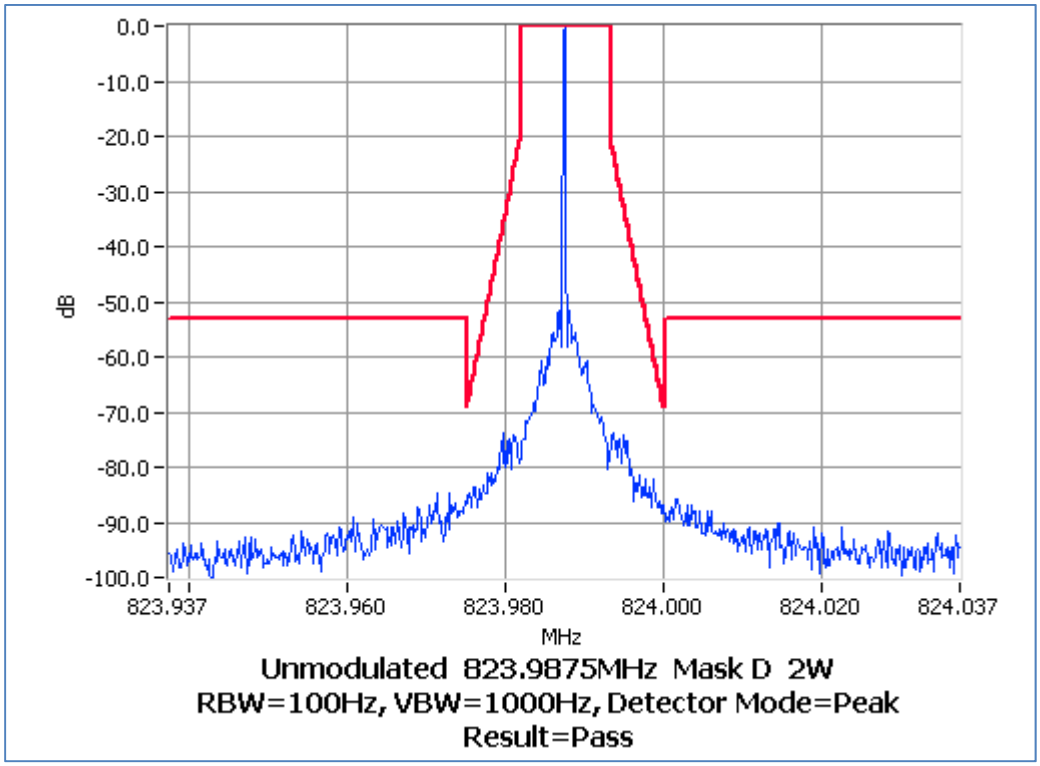


P25 823.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

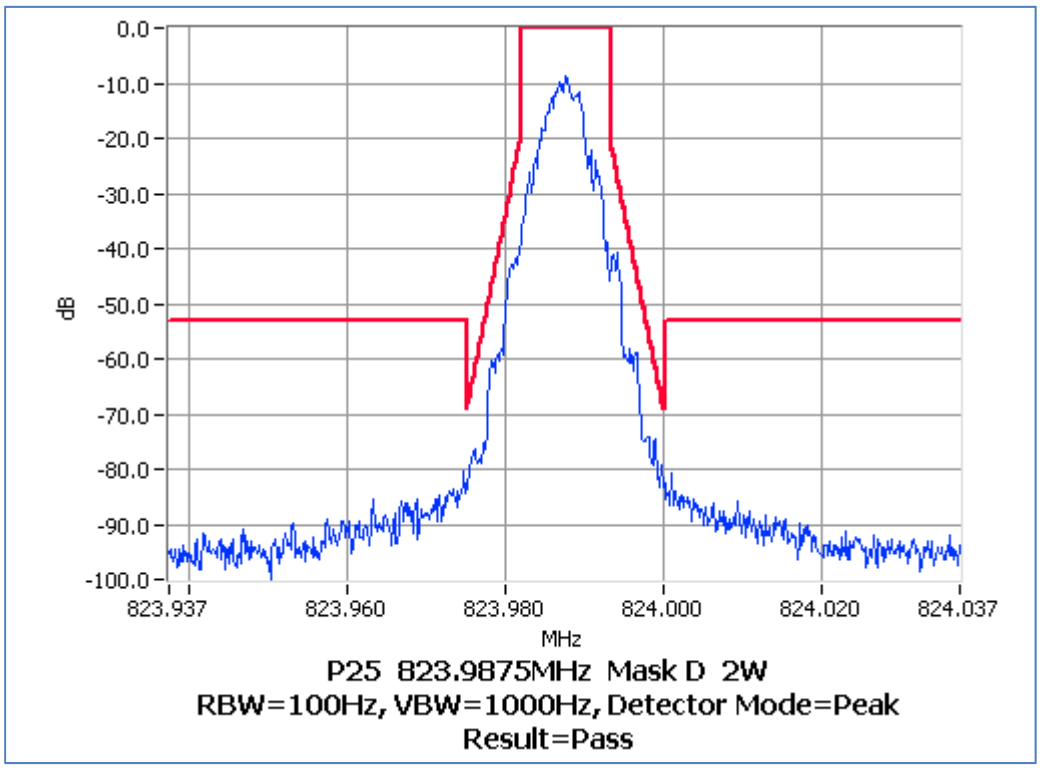
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	823.9875 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

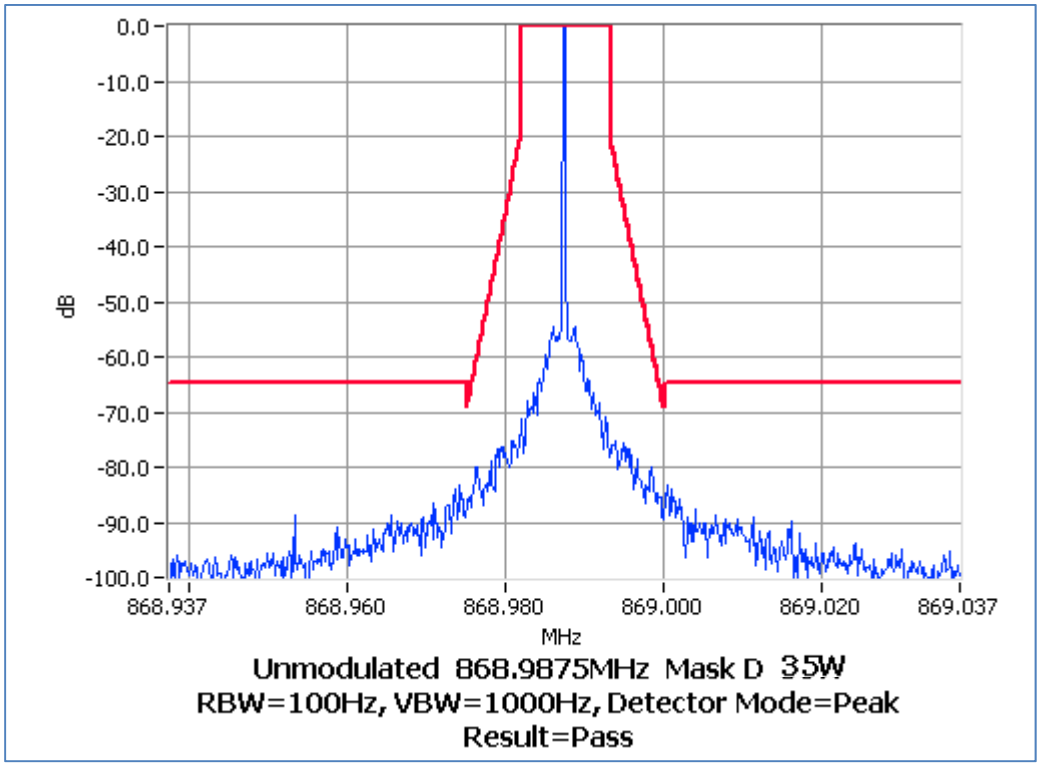


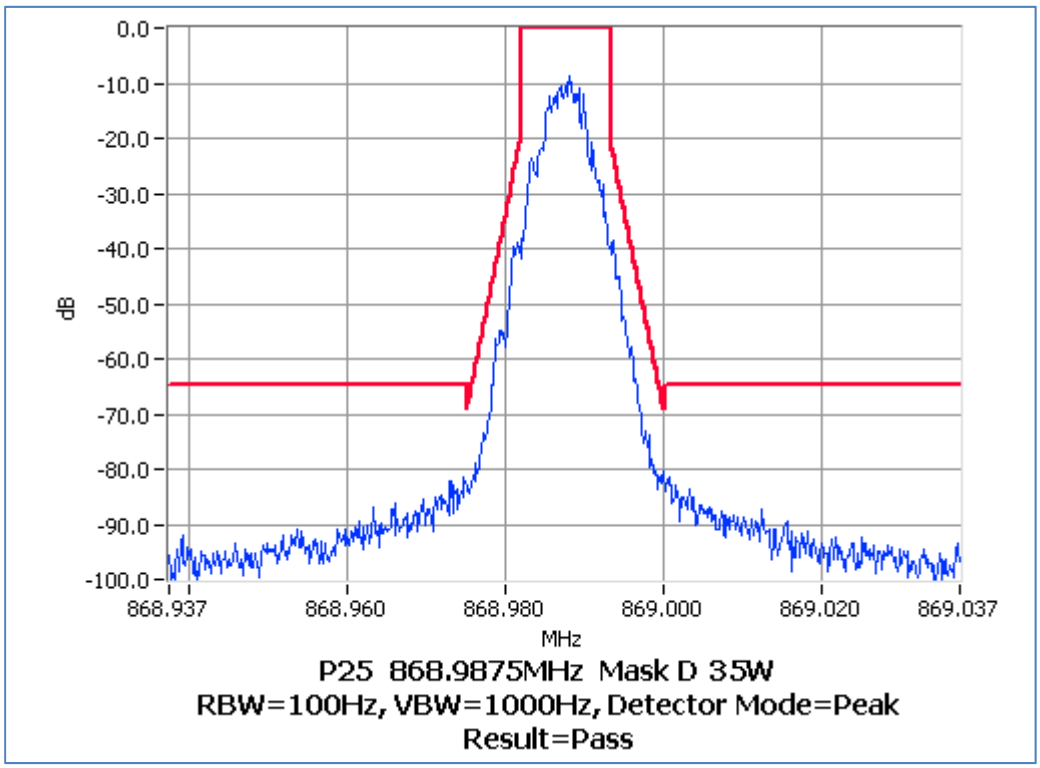
P25 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

P25 Phase 1

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	868.9875 MHz 35 W	12.5 kHz Channel Spacing	

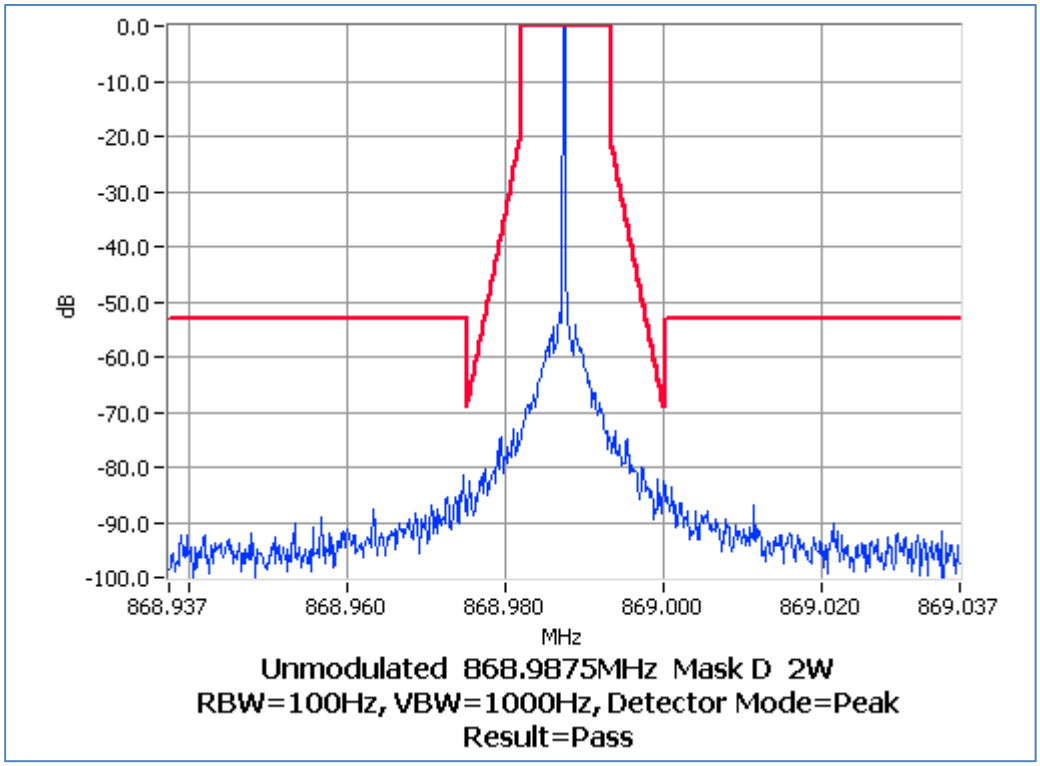




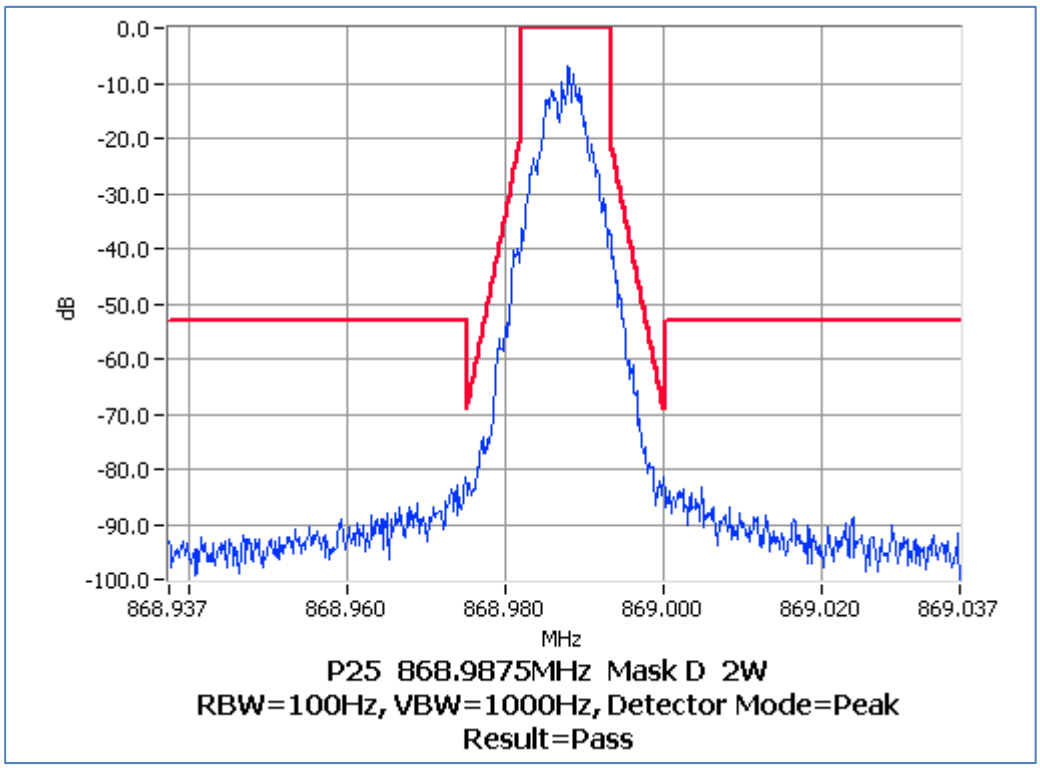
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	868.9875 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 868.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

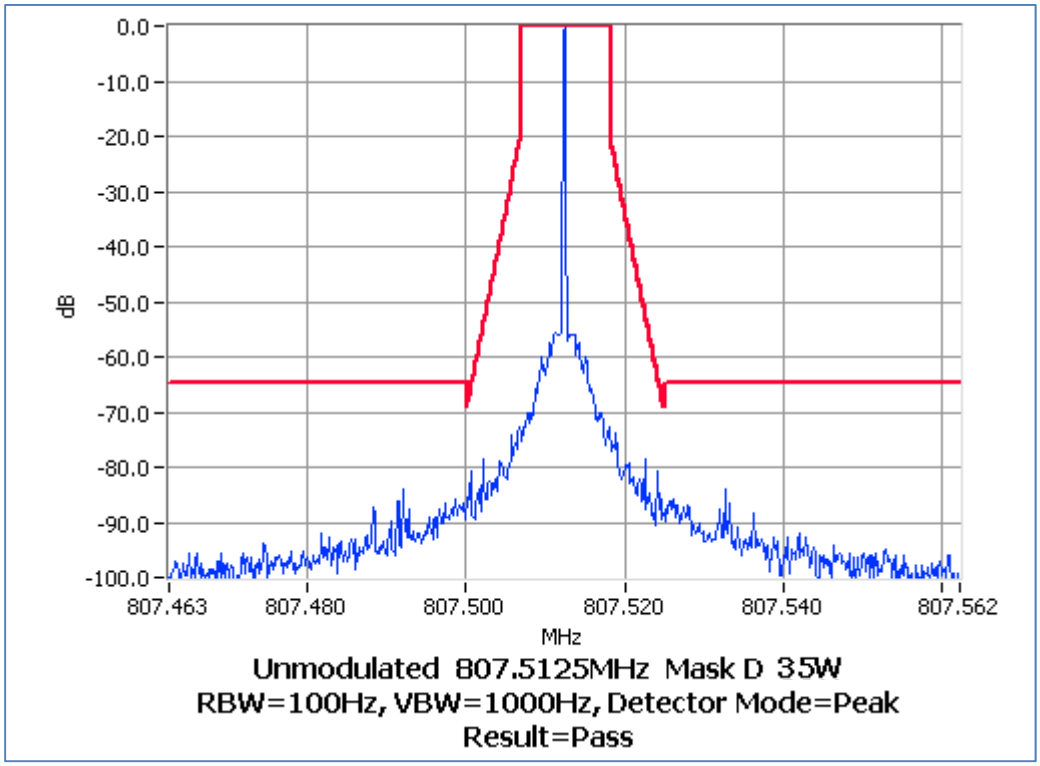


P25 868.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

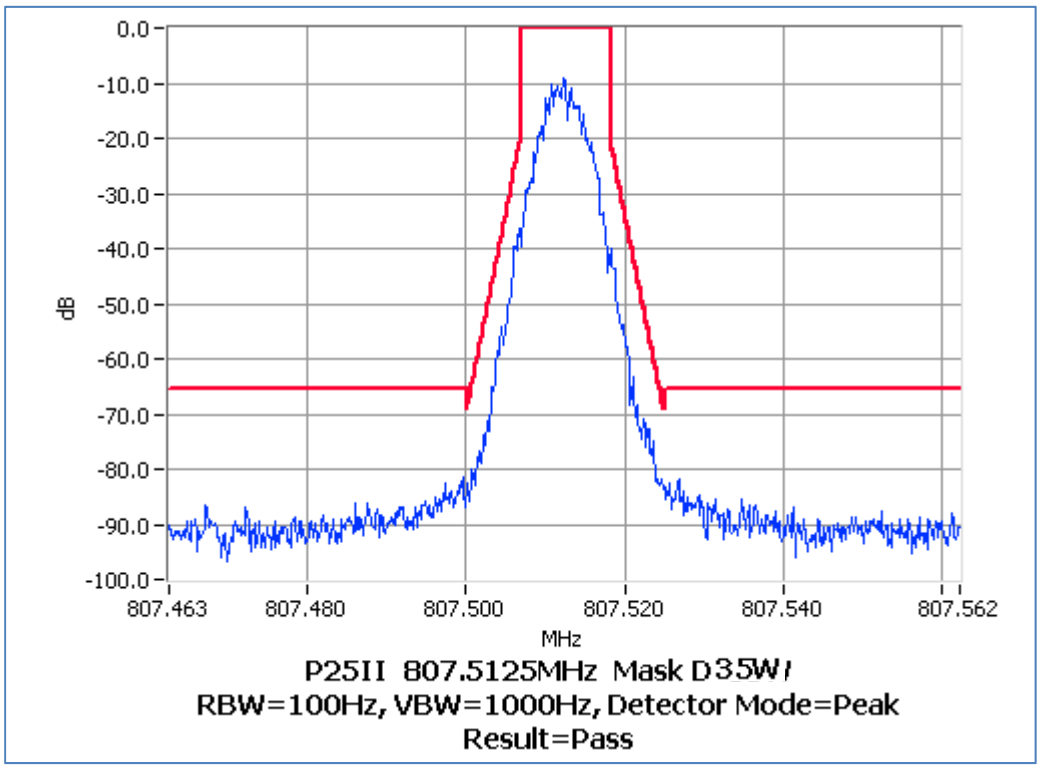
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	807.5125 MHz	35 W	12.5 kHz Channel Spacing



Unmodulated 807.5125MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

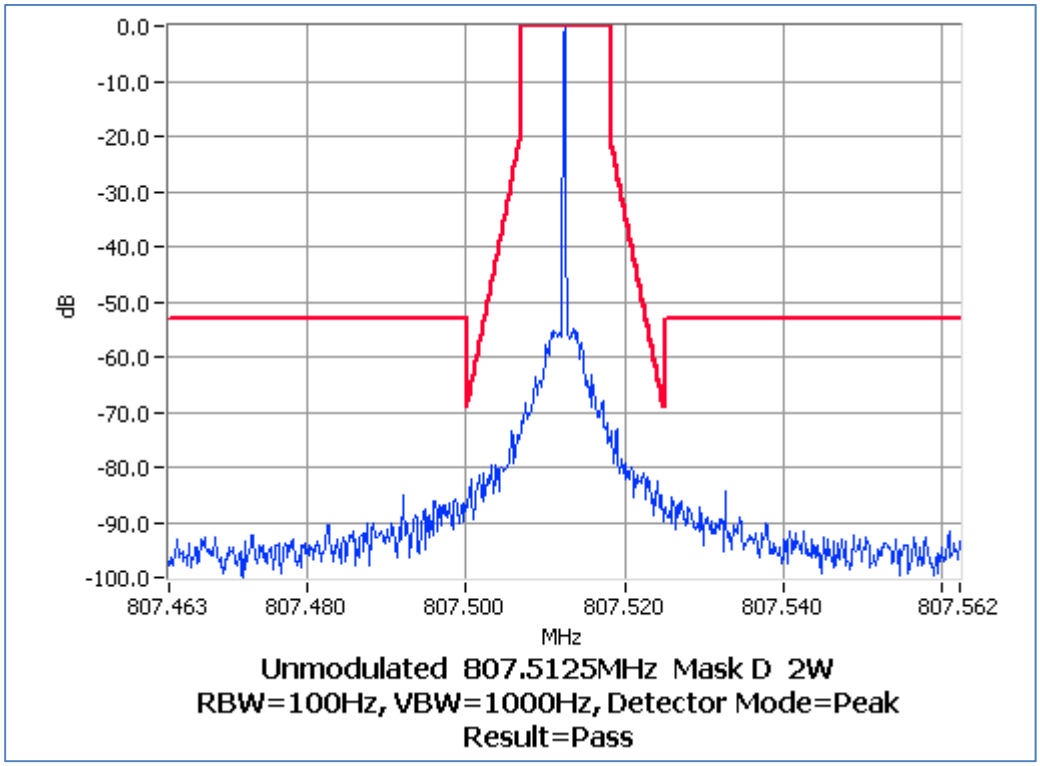


P25II 807.5125MHz Mask D35W/
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

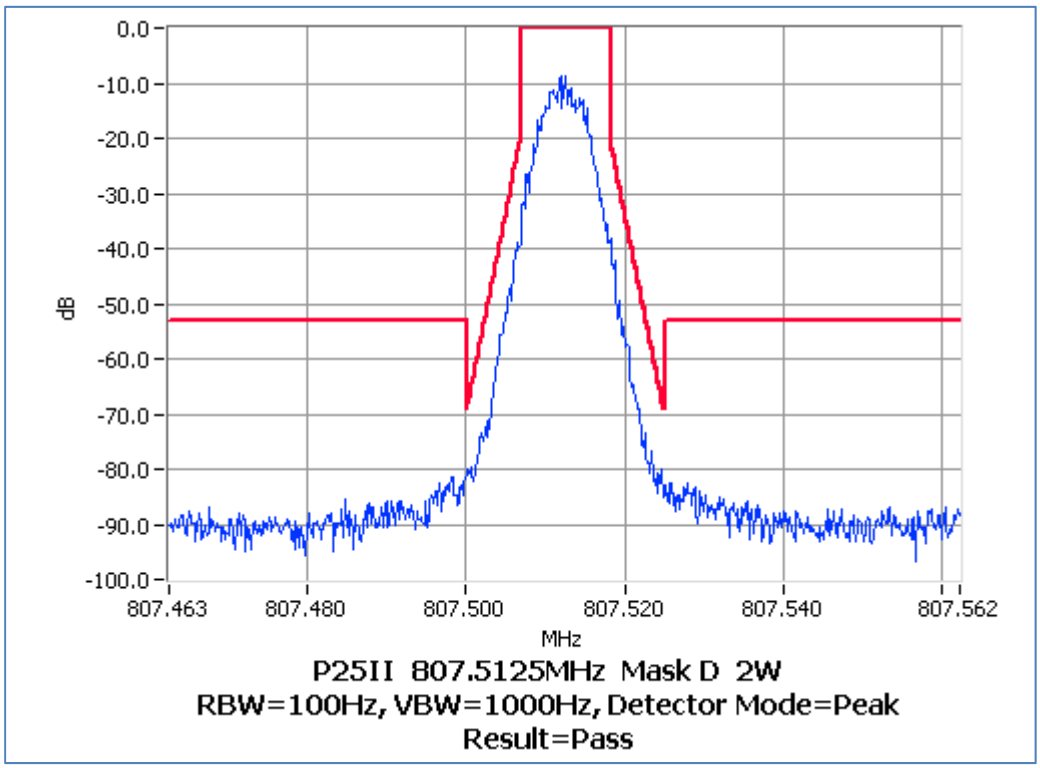
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	807.5125 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 807.5125MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

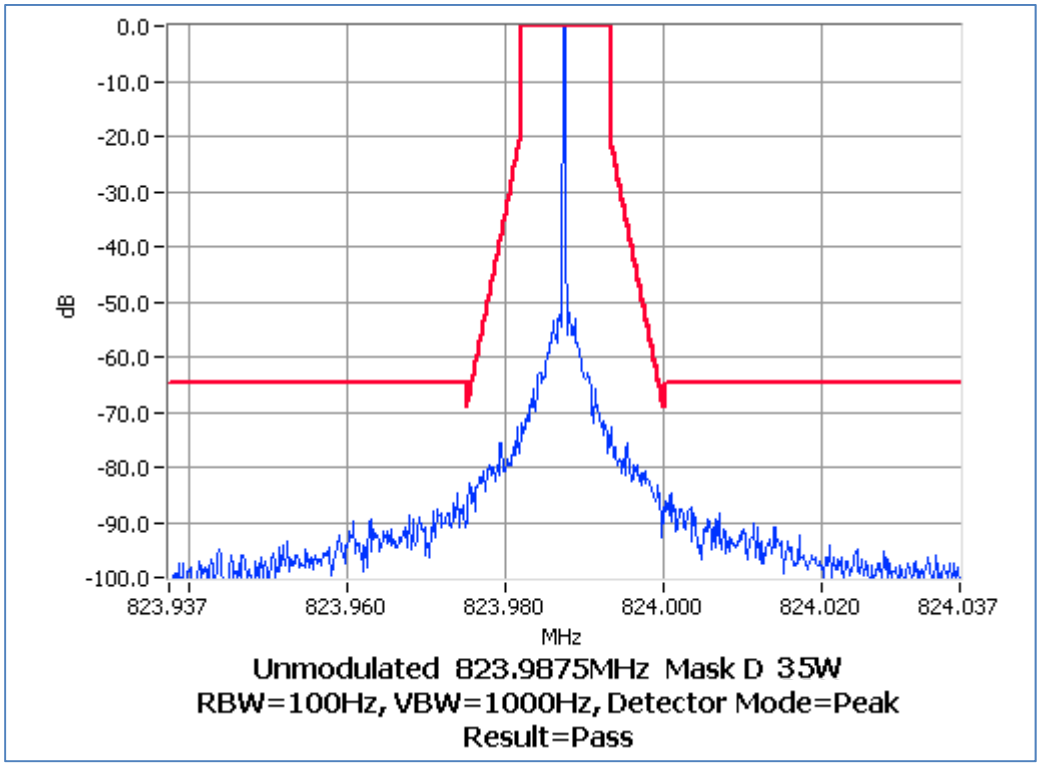


P25II 807.5125MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

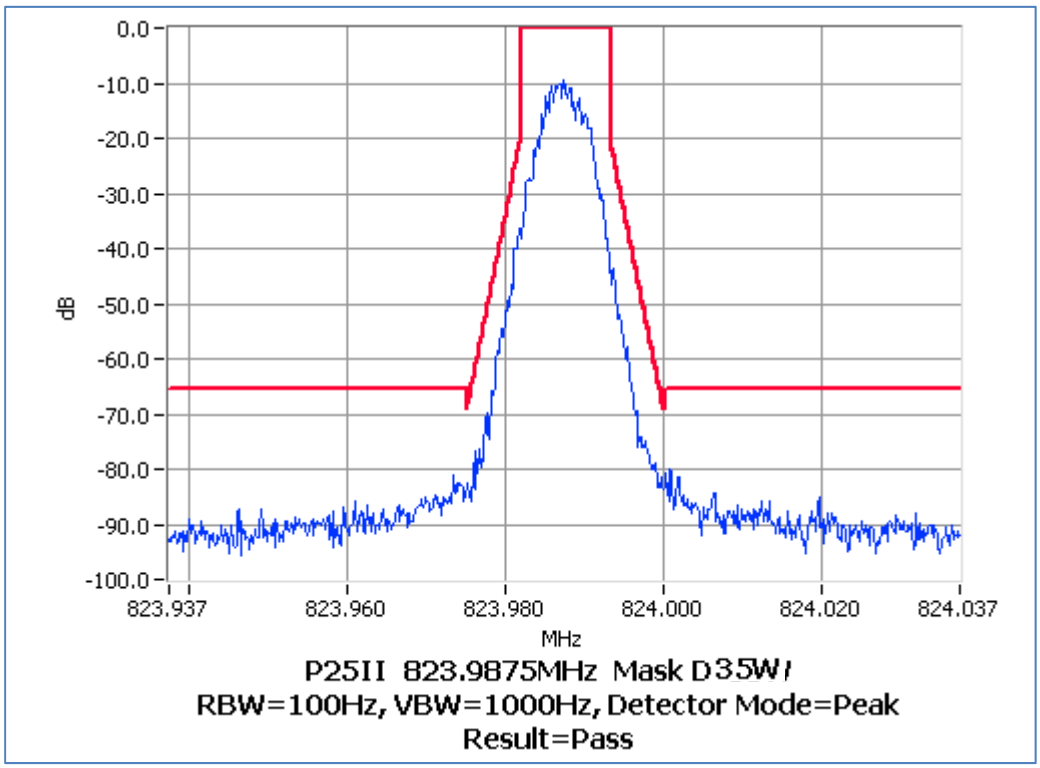
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	823.9875 MHz	35 W	12.5 kHz Channel Spacing



Unmodulated 823.9875MHz Mask D 35W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

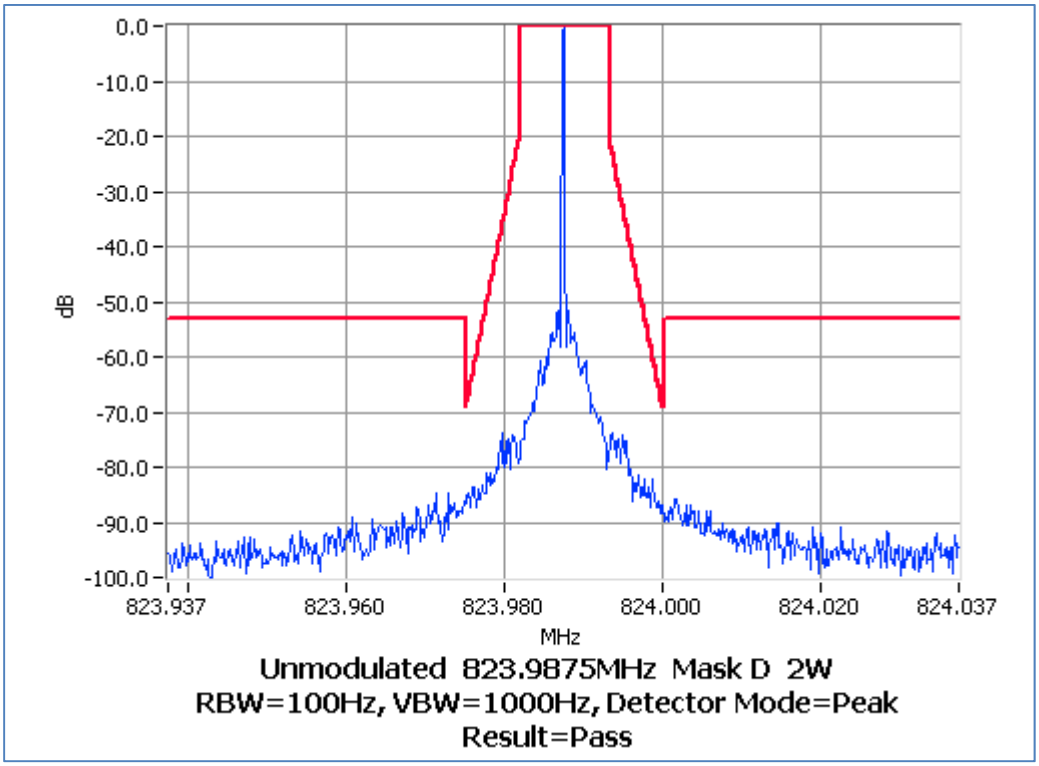


P25II 823.9875MHz Mask D35W/
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

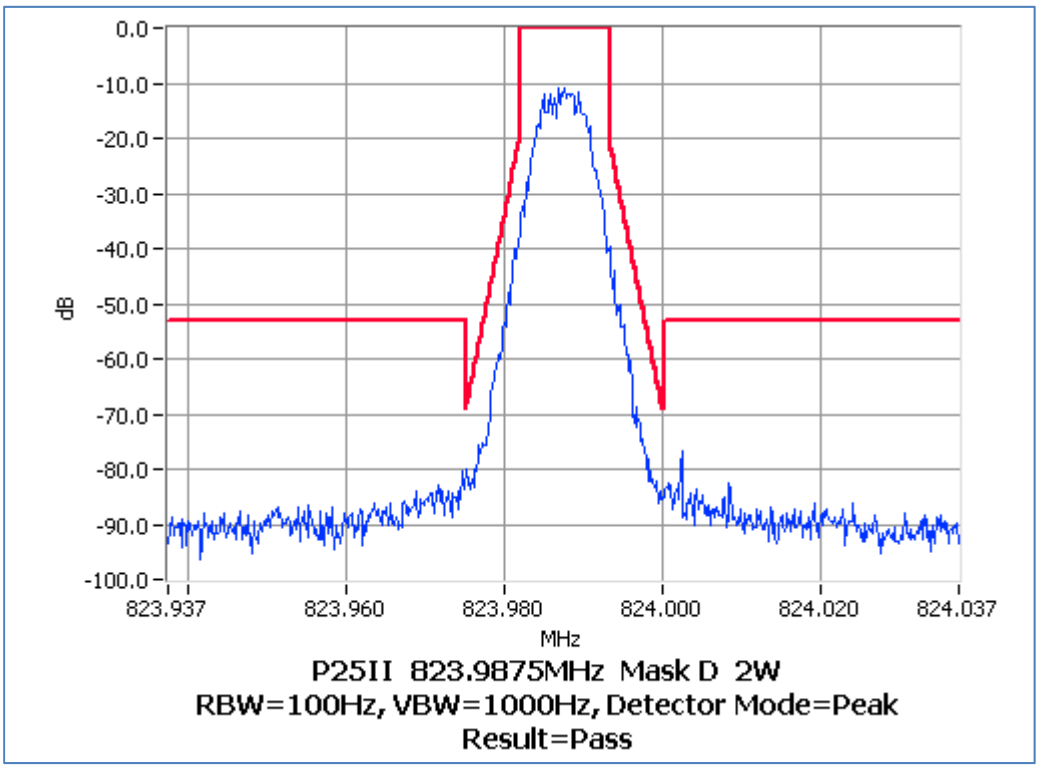
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	823.9875 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

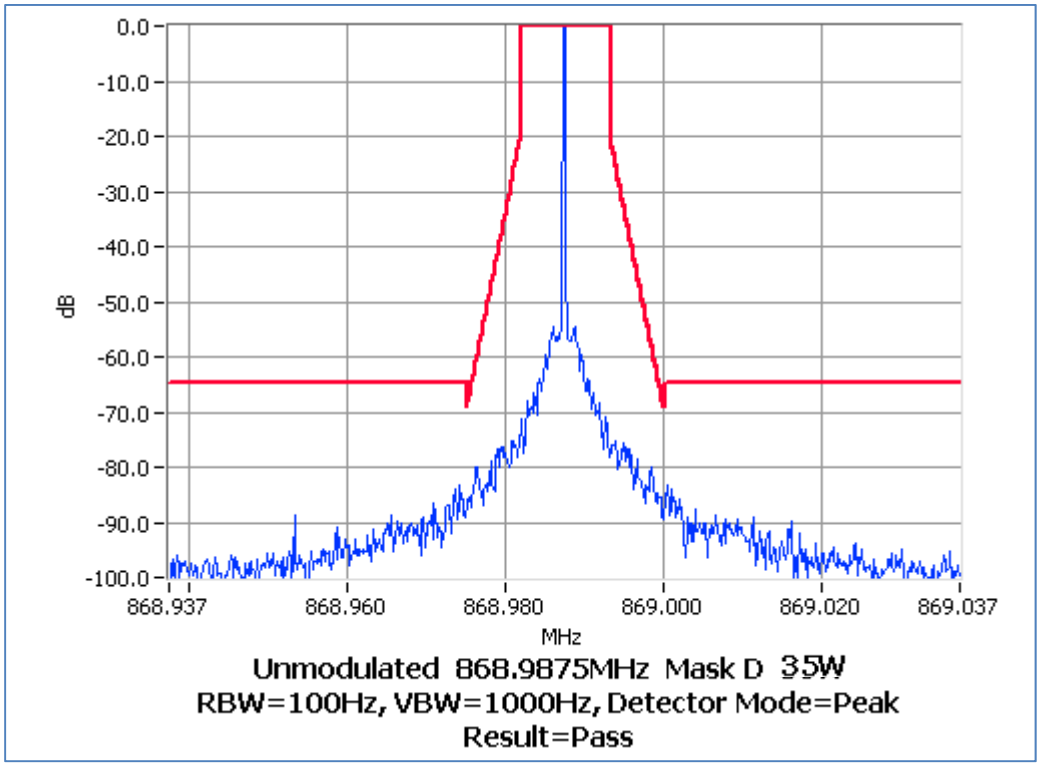


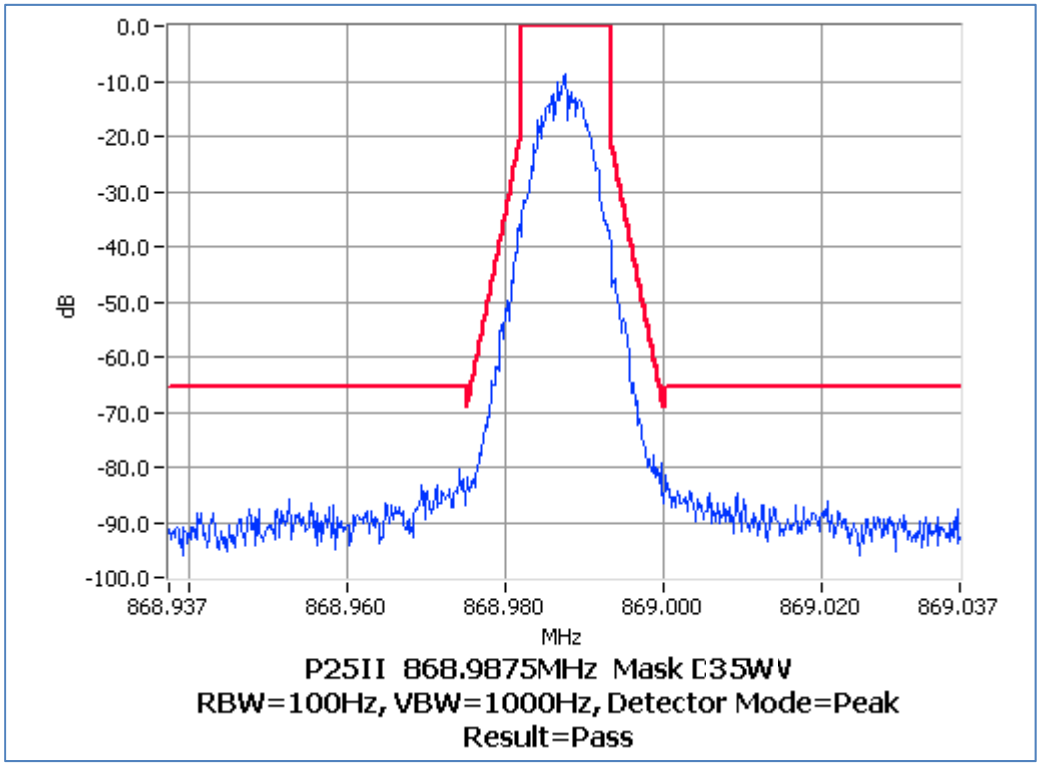
P25II 823.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

P25 Phase 2

SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	868.9875 MHz 35 W	12.5 kHz Channel Spacing	

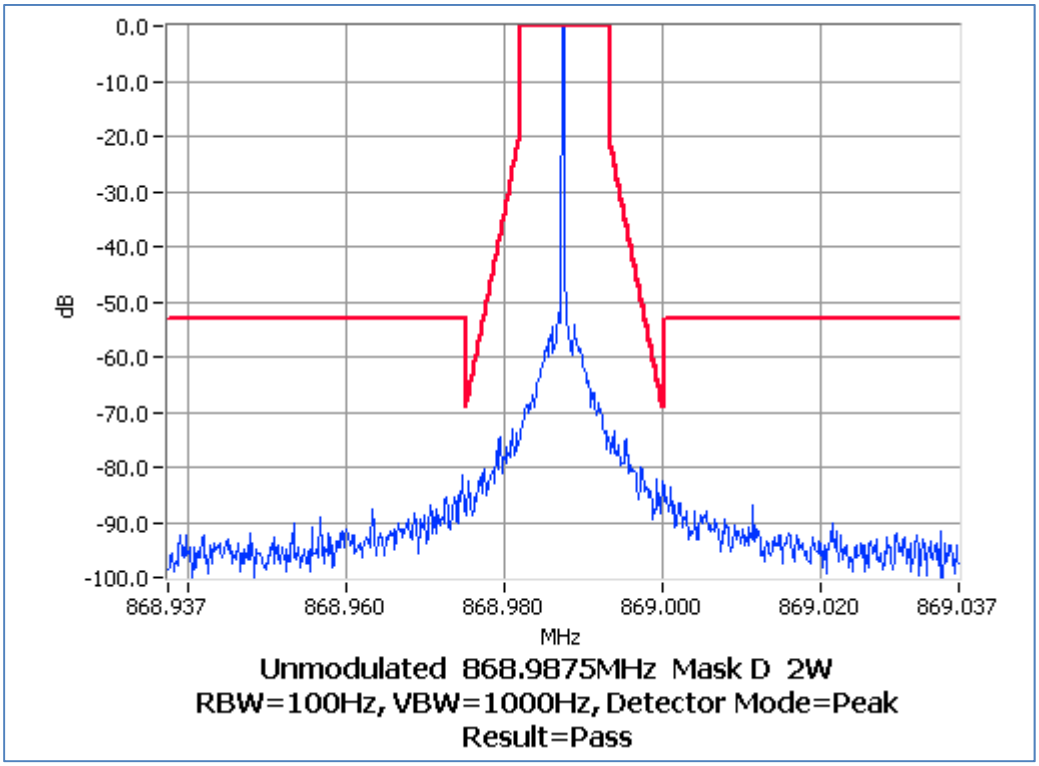




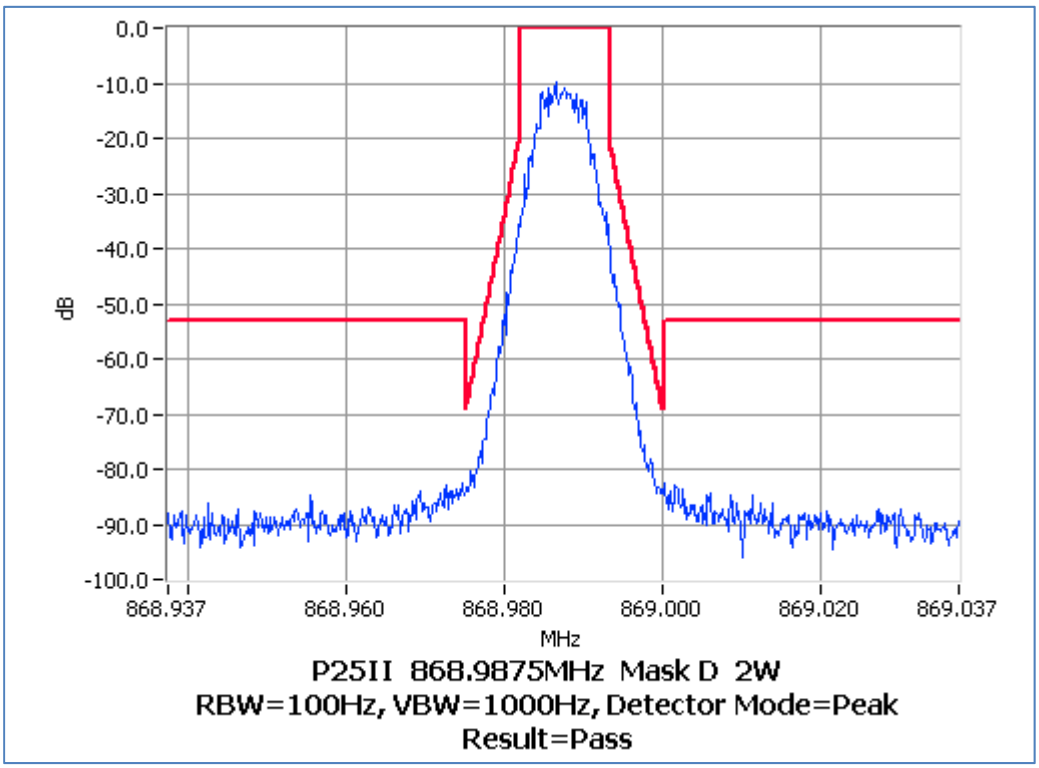
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

SPECIFICATION:	FCC CFR 2.1049 (c)		RSS-119 5.5
Tx FREQUENCY:	868.9875 MHz	2 W	12.5 kHz Channel Spacing



Unmodulated 868.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



P25II 868.9875MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

ADJACENT CHANNEL POWER RATIO

SPECIFICATION: FCC 47 CFR 90.543

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

MEASUREMENT RESULTS:

DMR

Tx FREQUENCY: 799.06875 MHz 30 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	-42.26	-43.70	-40
15.625 kHz	6.25 kHz	-72.40	-72.37	-60
21.875 kHz	6.25 kHz	-77.14	-77.24	-60
37.5 kHz	25 kHz	-76.30	-76.36	-60
62.5 kHz	25 kHz	-80.53	-80.53	-65
87.5 kHz	25 kHz	-82.15	-82.19	-65
150 kHz	100 kHz	-76.19	-76.20	-65
250 kHz	100 kHz	-79.20	-79.12	-65
350 kHz	100 kHz	-81.67	-81.46	-65
>400 kHz to 12 MHz	30 kHz (swept)	-89.31		-75
12 MHz to paired receive band	30 kHz (swept)	-87.62		-75
In the paired receive band	30 kHz (swept)	-106.56		-100

P25 Phase 1

Tx FREQUENCY: 799.06875 MHz 30 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	-40.39	-41.22	-40
15.625 kHz	6.25 kHz	-73.26	-73.26	-60
21.875 kHz	6.25 kHz	-77.14	-77.36	-60
37.5 kHz	25 kHz	-76.17	-76.15	-60
62.5 kHz	25 kHz	-80.45	-80.47	-65
87.5 kHz	25 kHz	-82.08	-82.13	-65
150 kHz	100 kHz	-76.68	-76.67	-65
250 kHz	100 kHz	-79.32	-79.29	-65
350 kHz	100 kHz	-82.21	-82.05	-65
>400 kHz to 12 MHz	30 kHz (swept)	-88.93		-75
12 MHz to paired receive band	30 kHz (swept)	-105.03		-75
In the paired receive band	30 kHz (swept)	-102.75		-100

P25 Phase 2

Tx FREQUENCY: 799.06875 MHz 30 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	-41.36	-42.41	-40
15.625 kHz	6.25 kHz	-73.42	-73.36	-60
21.875 kHz	6.25 kHz	-77.61	-77.70	-60
37.5 kHz	25 kHz	-76.38	-76.48	-60
62.5 kHz	25 kHz	-80.84	-80.95	-65
87.5 kHz	25 kHz	-82.65	-82.70	-65
150 kHz	100 kHz	-76.59	-76.57	-65
250 kHz	100 kHz	-79.69	-79.58	-65
350 kHz	100 kHz	-81.84	-81.72	-65
>400 kHz to 12 MHz	30 kHz (swept)	-88.771		-75
12 MHz to paired receive band	30 kHz (swept)	-92.410		-75
In the paired receive band	30 kHz (swept)	-109.856		-100

SPURIOUS EMISSIONS (Tx CONDUCTED)

SPECIFICATIONS: FCC 47 CFR 2.1051 RSS-119 5.8

GUIDE: TIA/EIA-603D 2.2.13

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The frequency range examined was from the lowest frequency generated within the EUT, to a frequency higher than the 10th Harmonic: 100 kHz to Fc-BW
   Fc+BW to 10Fc GHz
3. A Pre-scan is performed with a resolution bandwidth of 1 kHz, and a video bandwidth of 3 kHz. If any emissions are found to be within 20 dB of the limit a second measurement is made with the carrier modulated, and a resolution bandwidth of 10 kHz, and a video bandwidth of 30 kHz.

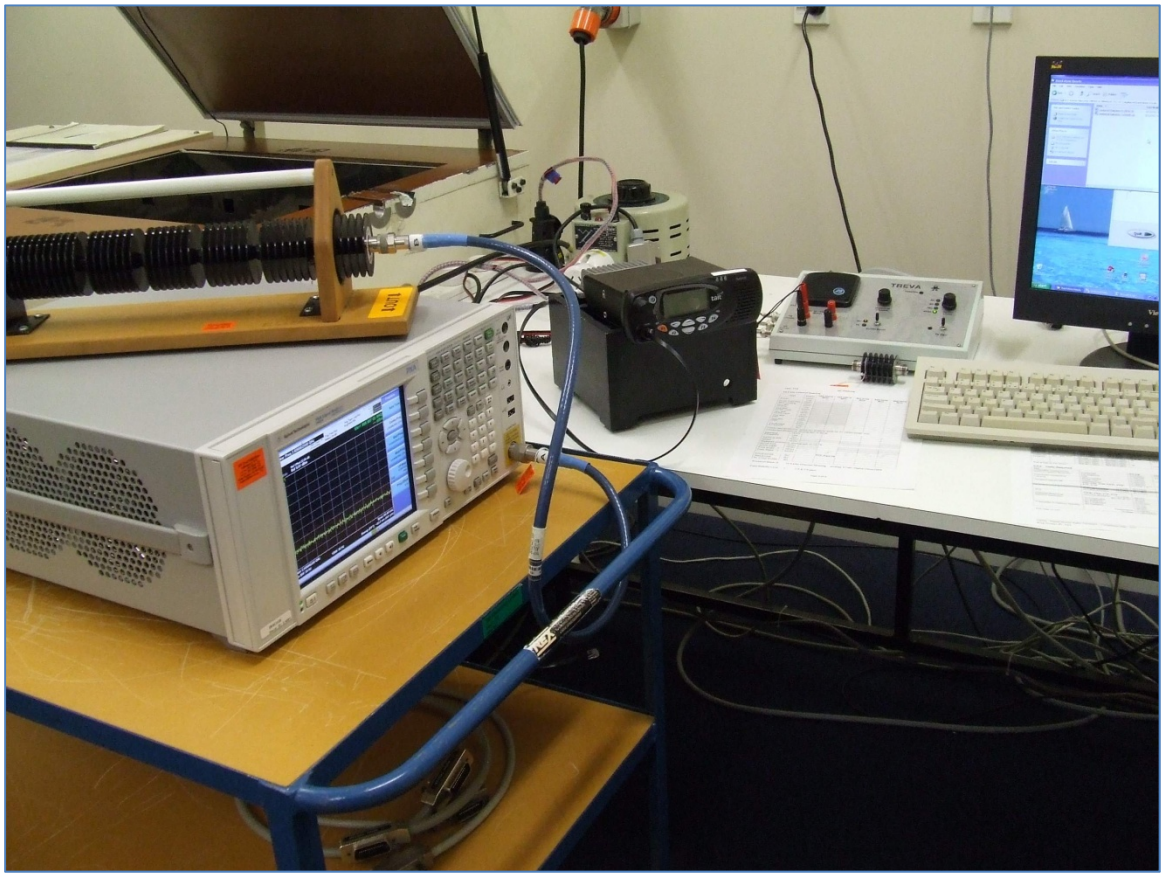
Spurious emissions which were attenuated by more than 20 dB below the limit were not recorded.

MEASUREMENT RESULTS:
See the tables and plots on the following pages for 12.5 kHz channel spacing.

A photograph of the test set-up is included below.

LIMIT CLAUSES: FCC 47 CFR 90.210 RSS-119 5.8

Photo: Conducted Emissions Test Setup



Tx Conducted Emissions - Continued

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

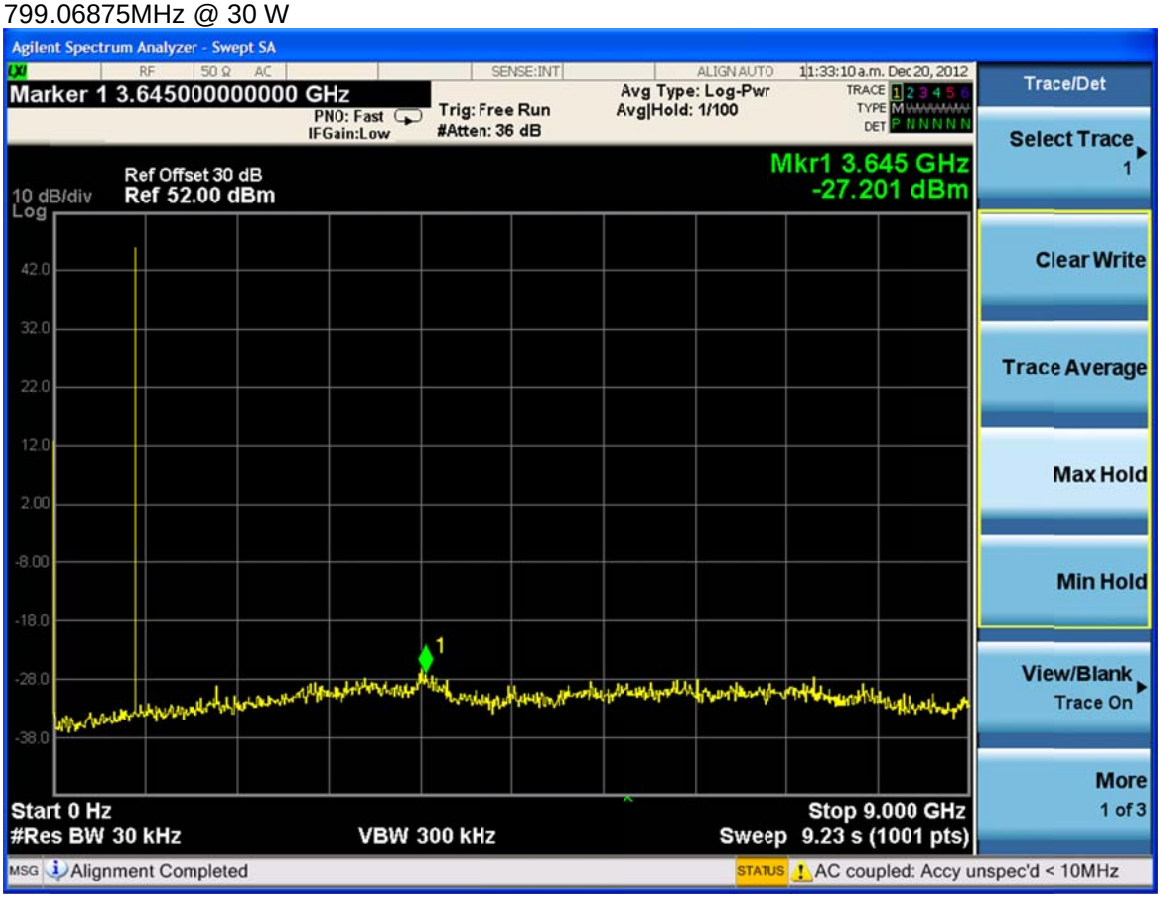
12.5 kHz Channel Spacing	769.06875MHz @ 30 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	769.06875MHz @ 2 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

769.06875MHz @ 30 W

Tx Conducted Emissions - Continued

12.5 kHz Channel Spacing	799.06875MHz @ 30 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	799.06875MHz @ 2 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

799.06875MHz @ 30 W



Tx Conducted Emissions - Continued

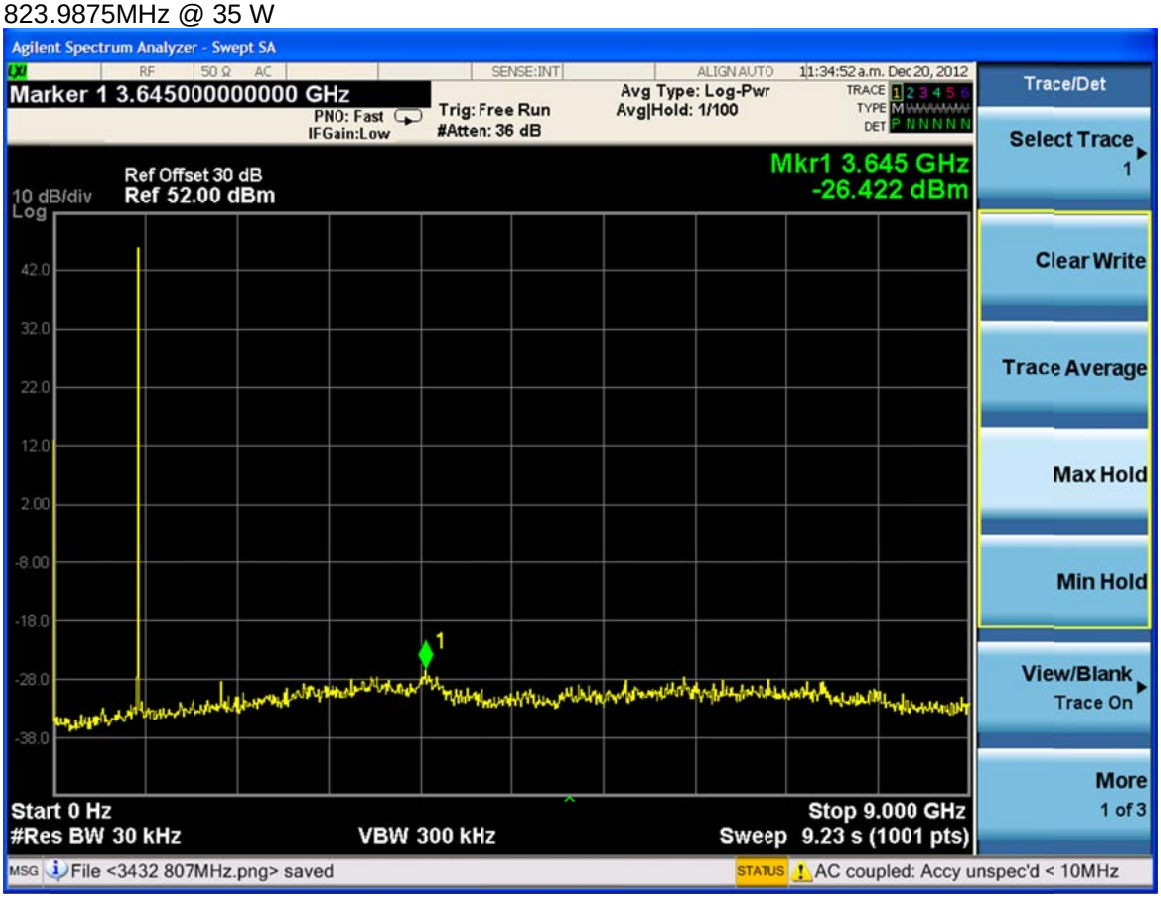
12.5 kHz Channel Spacing	807.5125MHz @ 35 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
807.3898	-36.7	-81.8
807.6344	-36.7	-81.8
~	~	~
12.5 kHz Channel Spacing	807.5125MHz @ 2 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No other emissions were detected at a level greater than 20 dB below the limit.		

807.5125MHz @ 35 W

Tx Conducted Emissions - Continued

12.5 kHz Channel Spacing	823.9875MHz @ 35 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
~	~	~
12.5 kHz Channel Spacing	823.9875MHz @ 2 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

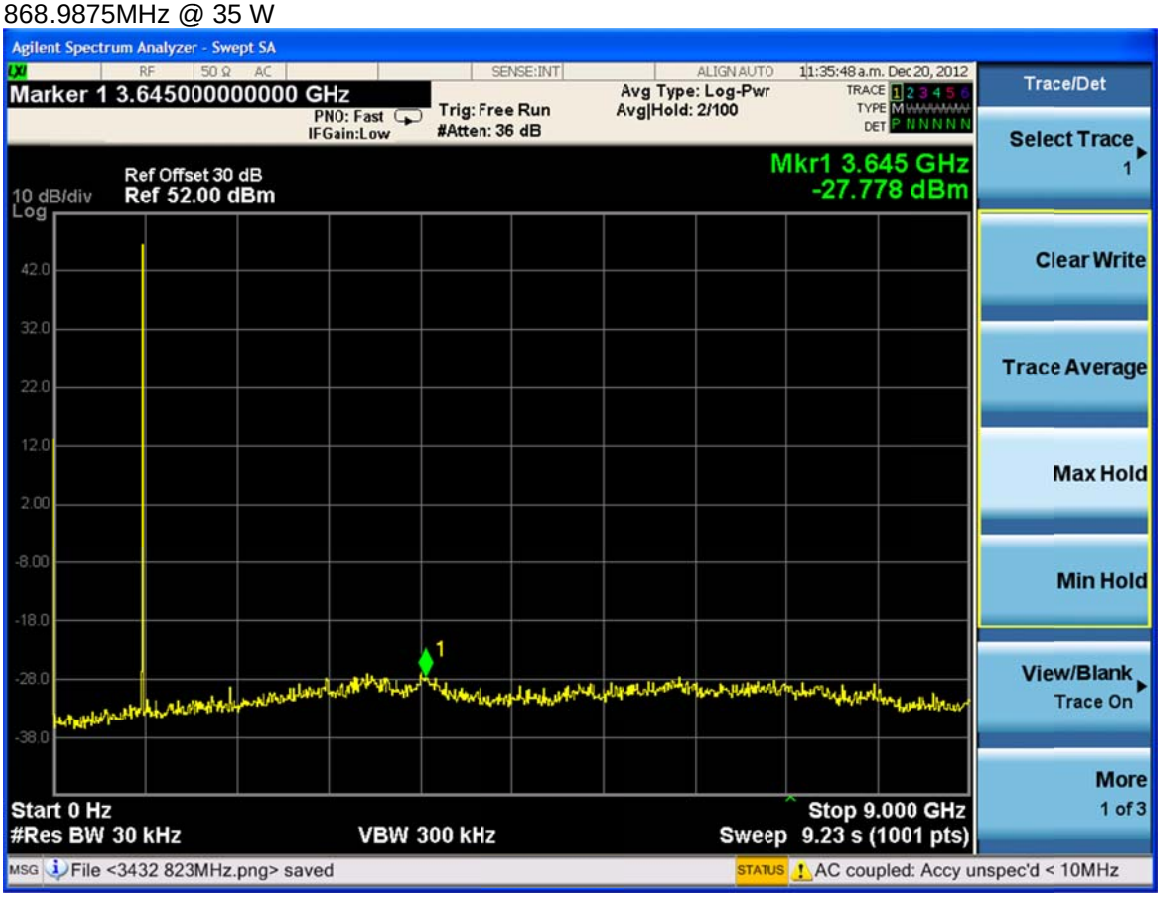
823.9875MHz @ 35 W



Tx Conducted Emissions - Continued

12.5 kHz Channel Spacing	868.9875MHz @ 35 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
868.7043	-36.5	-81.9
869.2705	-35.6	-81.0
~	~	~
12.5 kHz Channel Spacing	868.9875MHz @ 2 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No other emissions were detected at a level greater than 20 dB below the limit.		

868.9875MHz @ 35 W



Tx Conducted Emissions – Continued

LIMITS: FCC 47 CFR 90.210 RSS-119 5.8

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{Watts})$	
35 W	-20 dBm	-65.4 dBc
30 W	-20 dBm	-64.7 dBc
2 W	-20 dBm	-53.0 dBc

SPURIOUS EMISSIONS (Tx RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA/EIA-603D 2.2.12

MEASUREMENT PROCEDURE:
Initial Scan:

1. The EUT is placed in the S-Line TEM cell and emissions are measured from 30 MHz to 1000 MHz. Any emission within 10 dB of the limit is then re-tested on the OATS along with measurements from 1000 MHz to the 10^{th} harmonic of the fundamental frequency.
2. The EUT is then placed on a wooden turntable at a distance of 0.5 metres from the test antenna and emissions are measured from 1000 MHz to the upper frequency required. Any emission within 10 dB of the limit is then re-tested on the OATS.
3. The harmonics emissions up to the 6^{th} harmonic of the fundamental frequency are measured on the OATS

OATS Measurement:

1. The EUT is placed on a wooden turntable at a distance of three meters from the test antenna. The output terminal is connected to an RF dummy load.
2. The test antenna is raised from 1m to 4m to obtain a maximum reading; the turntable is then rotated through 360^{o} to obtain the maximum response of each spurious emission. Valid emissions are determined by switching the EUT on and off.
3. The EUT is then replaced by a signal generator and substitution antenna to make measurements by the substitution method.

MEASUREMENT RESULTS:
See the tables on the following pages.

LIMIT CLAUSE: FCC 47 CFR 90.210

Tx Radiated Emissions - Continued

12.5 kHz Channel Spacing	769.06875MHz @ 30 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	769.06875MHz @ 2 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 10 dB below the limit.		

12.5 kHz Channel Spacing	799.06875MHz @ 30 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	799.06875MHz @ 2 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 10 dB below the limit.		

12.5 kHz Channel Spacing	807.5125MHz @ 35 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	807.5125MHz @ 2 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 10 dB below the limit.		

Tx Radiated Emissions - Continued

12.5 kHz Channel Spacing	823.9875MHz @ 35 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	823.9875MHz @ 2 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 10 dB below the limit.		

12.5 kHz Channel Spacing	868.9875MHz @ 35 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	868.9875MHz @ 2 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 10 dB below the limit.		

LIMITS: FCC CFR 2.1053

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{Watts})$	
35 W	-20 dBm	-65.4 dBc
30 W	-20 dBm	-64.7 dBc
2 W	-20 dBm	-53.0 dBc

Tx Radiated Emissions - Continued

Open Area Test Site Results for the First Six Harmonics		
12.5 kHz Channel Spacing	823.9875MHz @ 35 W	Emission Mask D
Harmonics Emission Frequency (MHz)	Level (dBm)	Level (dBc)
1647.9750	-52.1	-97.5
2471.9625	-43.5	-88.9
3295.9500	-54.3	-99.7
4119.9375	< -50.0	< -95.4
4943.9250	< -50.0	< -95.4
5767.9125	< -50.0	< -95.4

Photo: OATS Setup

TX RADIATED EMISSIONS IN THE GNSS BAND

SPECIFICATION: FCC CFR 90.543

GUIDE: TIA/EIA-603D 2.2.12

MEASUREMENT PROCEDURE:
1. Refer Annex A for equipment set up.
2. Spurious emissions were measured in the GNSS band. (1559 – 1610 MHz)
3. The EUT was placed on a wooden turntable at a distance of three metres from the test antenna.
4. The test antenna was raised from 1m to 4m to obtain a maximum reading; the turntable was then rotated through 360^{o} to obtain the maximum response of each spurious emission.
5. Valid emissions were determined by switching the EUT on and off.
6. The EUT was replaced by a signal generator and substitution antenna to make measurements by the substitution method.
7. The test was performed with a representative antenna connected to the EUT

799.06875 MHz 30W

Frequency	Antenna Polarity	Level dBW / MHz EIRP
1598.1375 MHz	Horizontal	-78.5
	Vertical	-74.8

LIMIT CLAUSE FCC 47 CFR 90.543 (f)	-70 dBW / MHz EIRP

(f) For operations in the 763-775 MHz and 793-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

TRANSMITTER FREQUENCY STABILITY - TEMPERATURE

SPECIFICATION: FCC 47 CFR 2.1055 (a) (1) RSS-119 5.3

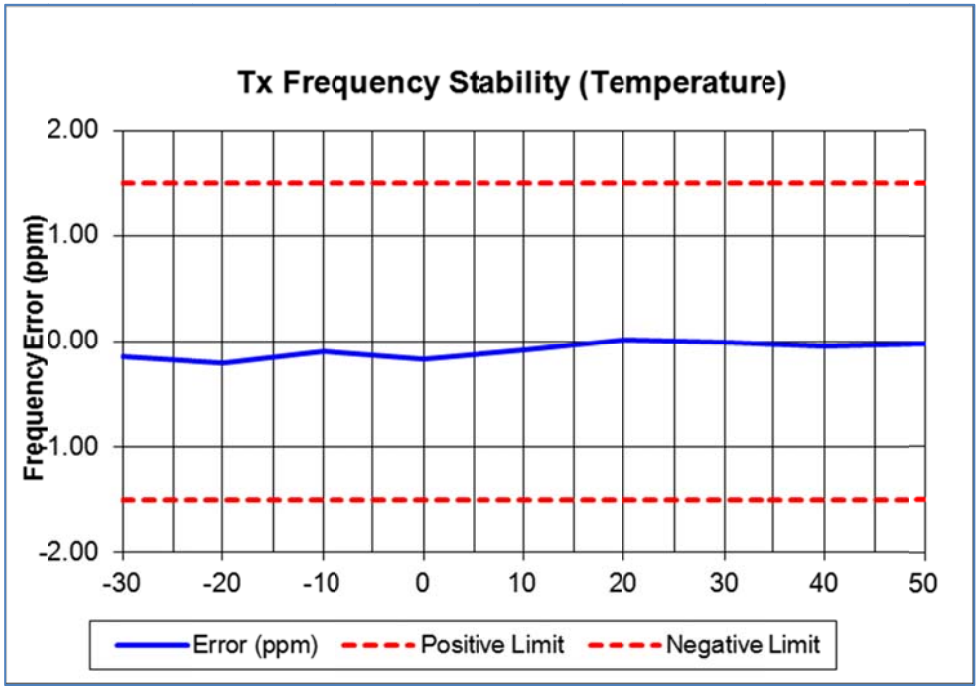
GUIDE: TIA/EIA-603D 2.2.2

MEASUREMENT PROCEDURE:
1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error from –30 °C to +50°C in 10 °C increments
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing.

769.06875 MHz

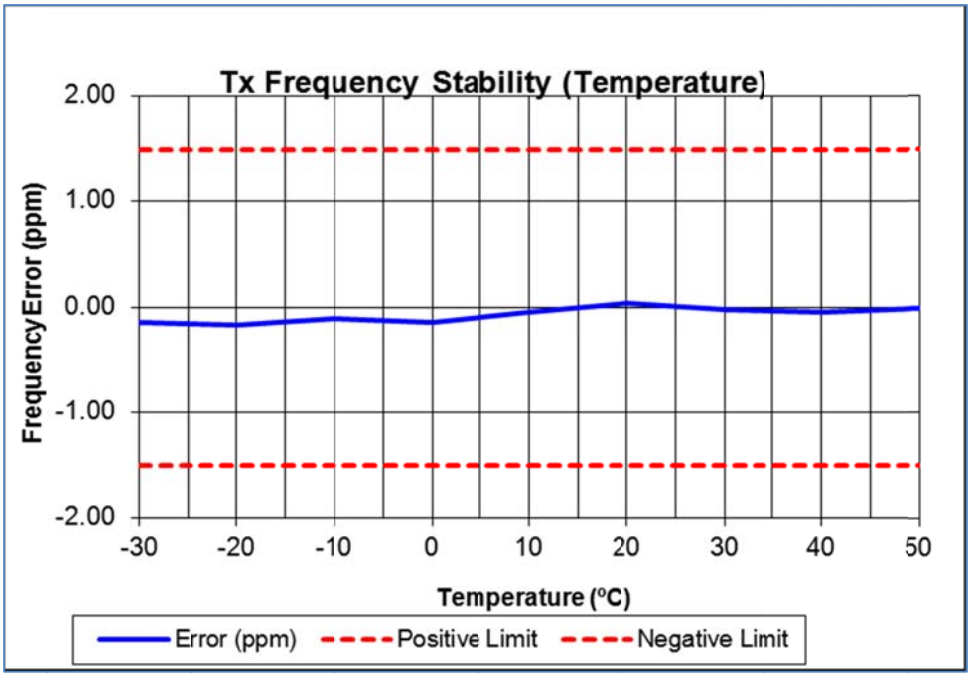
Temperature (ºC)	Frequency (MHz)	Error (ppm)
50	769.068727	-0.03
40	769.068708	-0.05
30	769.068744	-0.01
20	769.068760	0.01
10	769.068682	-0.09
0	769.068619	-0.17
-10	769.068677	-0.09
-20	769.068586	-0.21
-30	769.068633	-0.15



Transmitter Frequency Stability - Temperature

799.06875 MHz

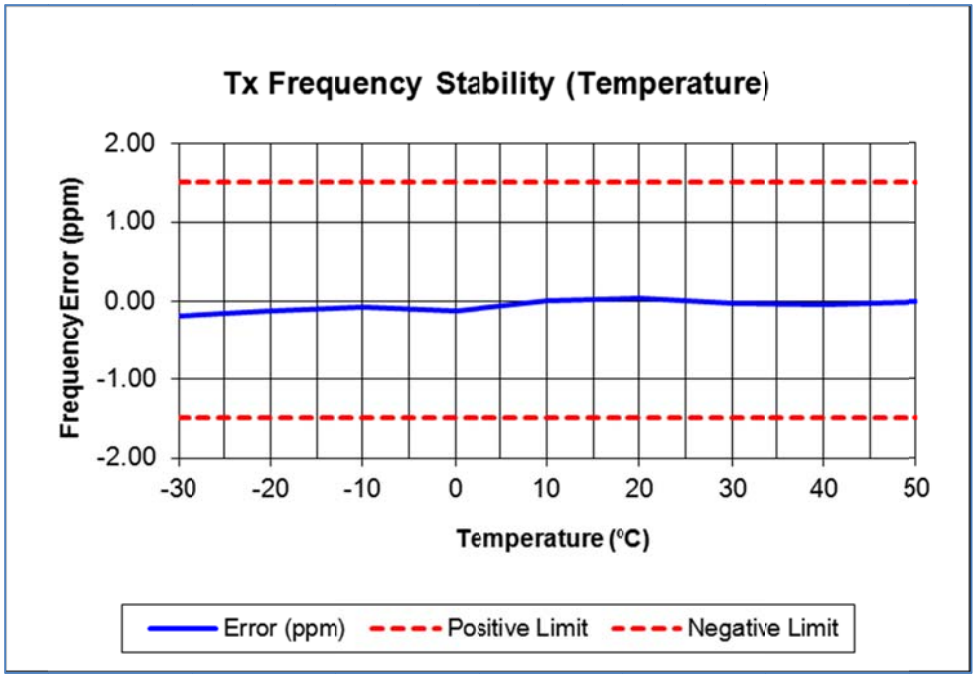
Temperature (ºC)	Frequency (MHz)	Error (ppm)
50	799.068743	-0.01
40	799.068715	-0.04
30	799.068734	-0.02
20	799.068782	0.04
10	799.068713	-0.05
0	799.068632	-0.15
-10	799.068666	-0.11
-20	799.068611	-0.17
-30	799.068639	-0.14



Transmitter Frequency Stability - Temperature

807.5125 MHz

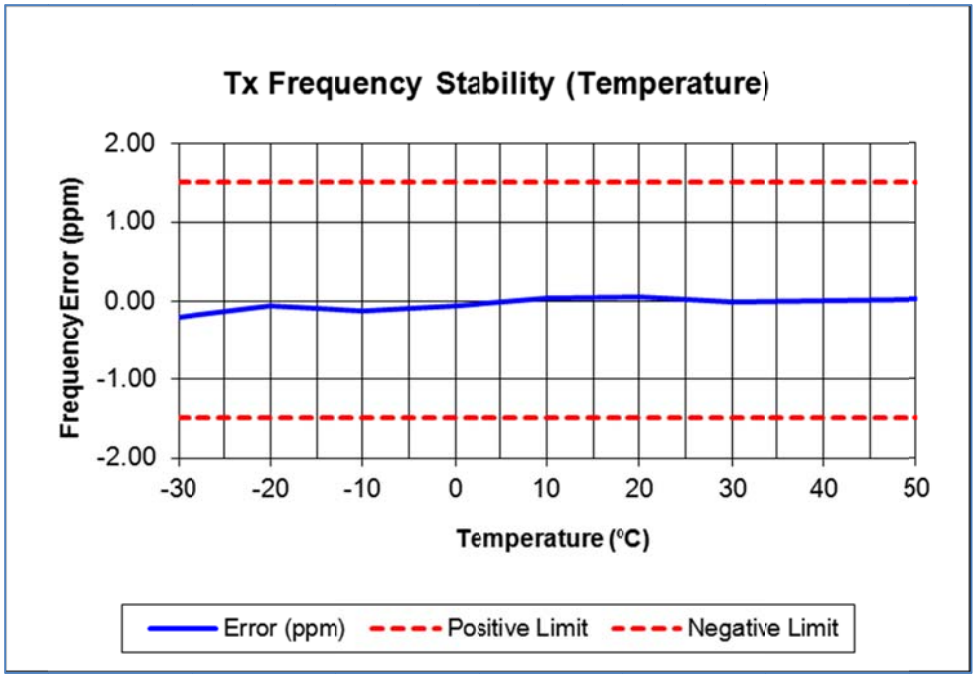
Temperature (ºC)	Frequency (MHz)	Error (ppm)
50	807.512497	0.00
40	807.512468	-0.04
30	807.512484	-0.02
20	807.512527	0.03
10	807.512503	0.00
0	807.512399	-0.13
-10	807.512434	-0.08
-20	807.512398	-0.13
-30	807.512349	-0.19



Transmitter Frequency Stability - Temperature

823.9875 MHz

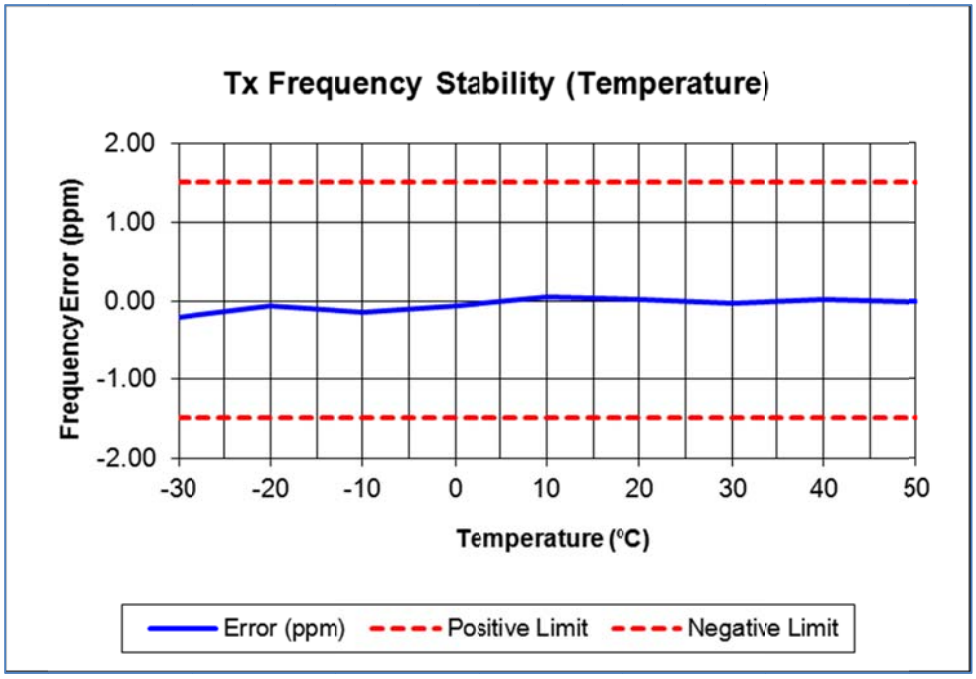
Temperature (ºC)	Frequency (MHz)	Error (ppm)
50	823.987514	0.02
40	823.987506	0.01
30	823.987497	0.00
20	823.987545	0.05
10	823.987535	0.04
0	823.987447	-0.06
-10	823.987397	-0.13
-20	823.987451	-0.06
-30	823.987331	-0.21



Transmitter Frequency Stability - Temperature

868.9875 MHz

Temperature (ºC)	Frequency (MHz)	Error (ppm)
50	868.987492	-0.01
40	868.987516	0.02
30	868.987480	-0.02
20	868.987526	0.03
10	868.987549	0.06
0	868.987457	-0.05
-10	868.987374	-0.14
-20	868.987446	-0.06
-30	868.987319	-0.21



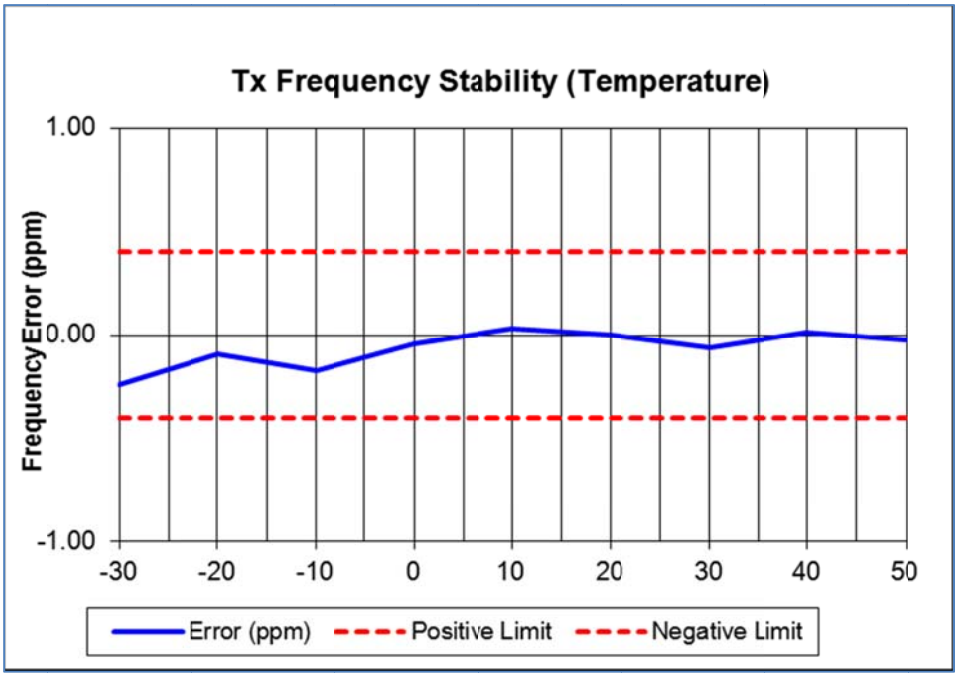
LIMIT: FCC 47 CFR 90.213 RSS-119 5.3

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	1.5

Transmitter Frequency Stability - Temperature

769.06875 MHz With AFC On

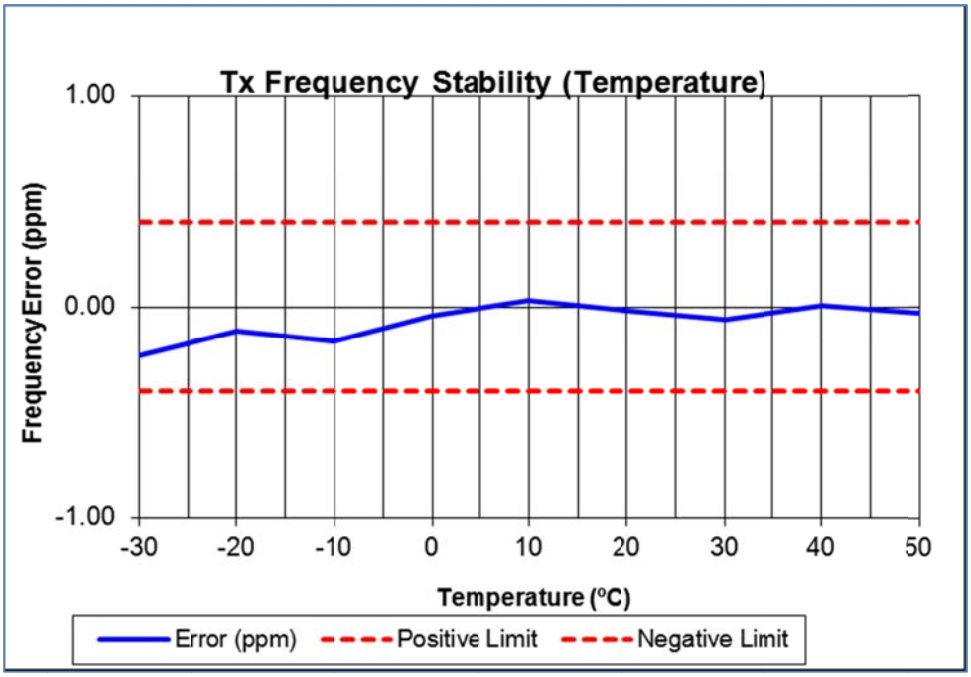
Temperature (ºC)	Frequency (MHz)	Error (ppm)
50	769.068731	-0.02
40	769.068762	0.02
30	769.068704	-0.06
20	769.068752	0.00
10	769.068775	0.03
0	769.068715	-0.05
-10	769.068615	-0.18
-20	769.068679	-0.09
-30	769.068565	-0.24



Transmitter Frequency Stability - Temperature

799.06875 MHz With AFC On

Temperature (ºC)	Frequency (MHz)	Error (ppm)
50	799.068727	-0.03
40	799.068757	0.01
30	799.068703	-0.06
20	799.068737	-0.02
10	799.068776	0.03
0	799.068719	-0.04
-10	799.068622	-0.16
-20	799.068661	-0.11
-30	799.068567	-0.23



LIMIT: With AFC On

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	0.4

TRANSMITTER FREQUENCY STABILITY - VOLTAGE

SPECIFICATION: FCC 47 CFR 2.1055 (d) (1) RSS-119 5.3

GUIDE: TIA/EIA-603D 2.2.2

MEASUREMENT PROCEDURE:
1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error at an input voltage to the radio of nominal and extreme voltages.
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

Voltage	FREQUENCY ERROR (ppm) for 12.5 kHz				
	769.06875 MHz	799.06875 MHz	807.5125 MHz	823.9875 MHz	868.9875 MHz
13.80 V_{DC}	-0.11	-0.09	-0.09	-0.07	-0.09
11.73 V_{DC}	-0.09	-0.09	-0.08	-0.08	-0.10
15.87 V_{DC}	-0.08	-0.09	-0.09	-0.09	-0.10

LIMIT CLAUSES: FCC 47 CFR 90.213 RSS-119 5.3

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	1.5

SPURIOUS EMISSIONS – Rx CONDUCTED

SPECIFICATION: RSS-119 5.11

GUIDE: TIA/EIA-603D 2.1.2

MEASUREMENT PROCEDURE:
1. Refer Annex A for Equipment set up diagram.
2. The frequency range examined was from 30 MHz to 3 times highest tunable frequency.
3. Spurious emissions which were attenuated more than 20dB below the limit were not recorded.

769.06875MHz Receive		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

852.5125MHz Receive		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

868.9875MHz Receive		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

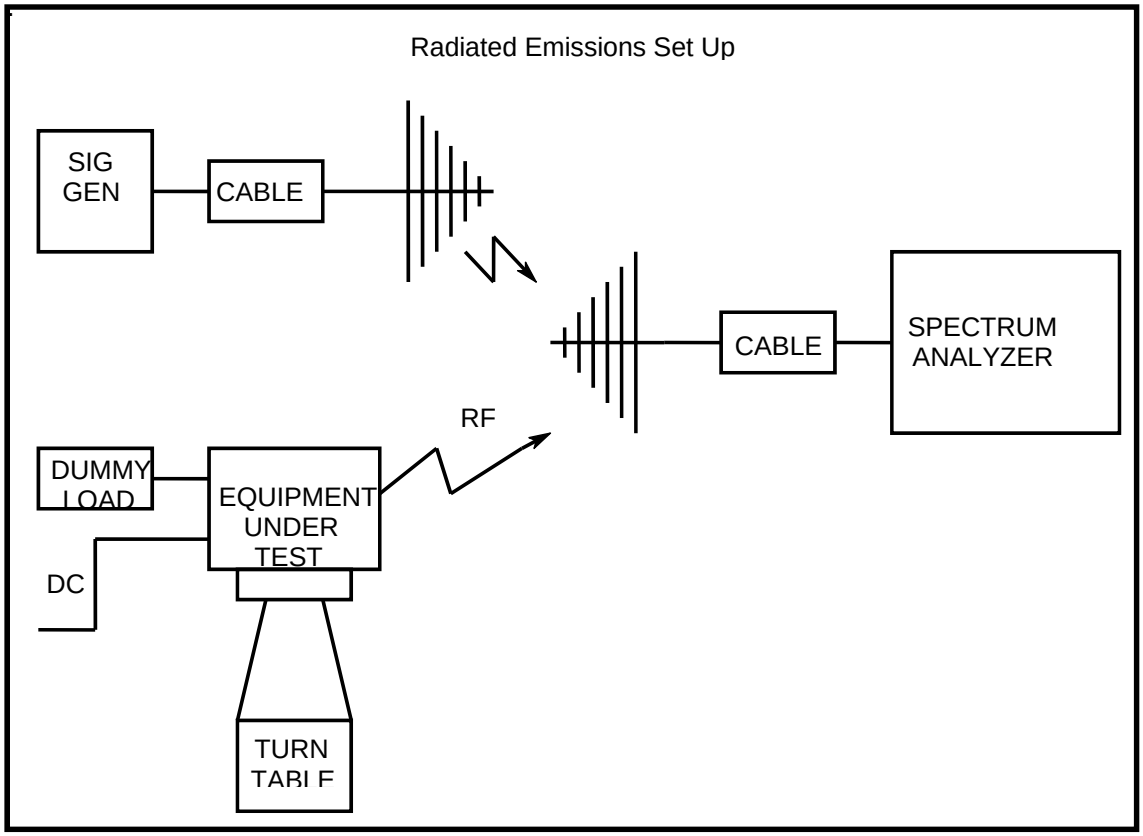
LIMIT CLAUSE: RSS-Gen 6(b)

LIMIT	30 → 1000 MHz	2 nW	- 57 dBm
	> 1000 MHz	5 nW	- 53 dBm

TEST EQUIPMENT LIST

Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
AC Voltmeter		Tait		2		3-Sep-13
Antenna	18GHz DRG	Emco	DRG3115	9512-4638	E3560	on use
Antenna	18GHz DRG	Emco	DRG3115	2084	E3076	on use
Audio Analyser	TREVA2	Hewlett Packard	HP8903B	2818A04275	E3710	12-Oct-13
Coax Cable	1m Blue	Suhner	Sucoflex 104A	44610/4A	E4619	12-Oct-13
Coax Cable	2m Black	Suhner	RG214HF/Nm/2000	Black2	E4623	12-Oct-13
Coax Cable	2m Black	Suhner	RG214HF/Nm/2000	Black3	E4624	13-Oct-13
Coax Cable	3m Blue	Suhner	Sucoflex 104A	44611/4A	E4620	13-Oct-13
Coax Cable	OATS Tower Cable	Intelcom	RG214	OATS1	E4621	15-Oct-13
Coax Cable	OATS Turntable Cable	Intelcom	RG215	OATS2	E4622	15-Oct-13
Environ. Chamber	Chest	Contherm	Chest	E3397	E3397	2-Aug-15
Modulation Analyser	TREVA2	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	12-Oct-13
OATS	Antenna Tower	Electrometrics	EM-4720-2	112	E4447	on use
OATS	Controller	Electrometrics	EM-4700	119	E4445	on use
OATS	Turntable	Electrometrics	EM-4704A	105	E4446	on use
Power Meter	Power Head for HP8901	Hewlett Packard	HP11722A	2716A02037	E1575	15-Oct-13
Power Supply	TREVA2 60V/25A	Agilent	N5767A	US09F4901H	E4656	8-Oct-13
Power Supply	TREVA2	Hewlett Packard	HP6012B	2524A00616	E3712	16-Oct-13
RF Attenuator	20dB 25W	Weinschel	33-20-33	BD5871	E3673	13-Oct-13
RF Attenuator	TREVA2 20dB 150W	Weinschel	40-20-33	CJ405	E3733	12-Oct-13
RF Attenuator	30dB 350W	Weinschel	67-30-33	BR0531	E4280	13-Oct-13
RF Chamber	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	31-Aug-15
RF Load	50W	Weinschel	F1426	BF0487	E3675	13-Oct-13
Signal Generator	Analog 1GHz	Hewlett Packard	HP8648A	3430U00344	E3579	18-Oct-13
Signal Generator	Analog 4GHz	Agilent	E4422B	GB40050320	E3788	15-Oct-13
Signal Generator	Digital 4GHz	Agilent	E4433B	US38440446	E4147	18-Oct-13
Spectrum Analyser	26.5GHz	Agilent	PXA N9030A	MY49432161	E4907	30-Mar-14
Spectrum Analyser	13.2GHz	Hewlett Packard	HP8562E	3821A00779	E3715	17-Oct-13
Spectrum Analyser	13.2GHz	Agilent	E4445A	MY42510072	E4139	21-Nov-14

ANNEX A – TEST SETUP DETAILS



All other testing is performed using the **T**eltest **R**adio **EVA**luation system (TREVA), which is configured as shown below. The Spectrum Analyser is connected to the EUT via the attenuator network for Conducted Emissions testing, and Occupied Bandwidth.