

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TPDK5A Hand Portable Transceiver

Tested in accordance with:

FCC 47 CFR Part 90

RSS-119 Issue 11

RSS-Gen Issue 3

Report Revision: 2

Issue Date: 25-March-2013

PREPARED BY: Linda White

Test Technician

CHECKED & APPROVED BY: Mike James

Laboratory Engineer



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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
20-February-2013	1	Initial test report
25- March-2014	2	Corrected information in document footers

INTRODUCTION

This report 3425C replaces 3425B. The following tests were added:
Transmitter Conducted Emissions in the GNSS Band
Occupied Bandwidth and Spectrum masks – the addition of Mask H
Adjacent Channel Power Ratio – the addition of 769.06875 MHz tests

Report 3425B was a replacement for 3425. The following test was added:
Occupied Bandwidth and spectrum masks – the addition of P25 Phase 2 modulation.
Two Emission designators were added.

This report demonstrates that the TPDK5A handportable 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	T03-00035-KCDG
Serial number	25383145
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: Handportable Transceiver
Type: TPDK5A
Product Code: T03-00035-KCDG
Serial Number(s): 25383145
Quantity: 1

HARDWARE & SOFTWARE

	DMR	P25 phase 1
Hardware ID	TPDB1X-K500_0004	TPDB1X-K500_0004
Boot Code	QPD1B_S00_3.00.01.0003	QPD1B_S00_3.00.01.0003
DSP	QPD1A_E00_1.00.01.0025	QPD1A_A00_0.08.02.0081
Radio Application	QPD1F_E00_1.00.01.0025	QPD1F_A00_0.08.00.0023
FPGA Image	QPD1G_D07_1.00.00.0001	QPD1G_D07_1.00.00.0001

	P25 phase 2
Hardware ID	TPDB1X-K500_0004
Boot Code	QPD1B_S00_3.00.01.0003
DSP	QPD1A_A00_1.00.01.0021
Radio Application	QPD1F_A00_1.00.01.0021
FPGA Image	QPD1G_S00_1.00.02.0001_P2.a

TEST CONDITIONS

All testing for report 3425 was performed between 26th September → 6th October 2012

Additional tests for report 3425B were performed between 22 → 23 January 2013

Additional tests for report 3425C were performed between 13 → 20 February 2013

All testing was performed under the following conditions:

Ambient temperature: 15°C → 30°C

Relative Humidity: 20% → 75%

Standard Test Voltage 7.5 V_{DC}

DECLARATION OF CONFORMITY

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

Equipment: Handportable Transceiver
Type: TPDK5A
Product Code: T03-00035-KCDG
Serial Number(s): 25383145
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 : _____

M. C. James
Compliance Laboratory Engineer

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	

CHANNEL SPACINGS:	12.5 kHz	25 kHz
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EMISSION DESIGNATORS:

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: $B_n = 2M + 2Dk$

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

Analogue Voice 12.5 kHz Bandwidth

Necessary bandwidth

$M = 3.0 \text{ kHz}$

$D = 2.5 \text{ kHz}$

$B_n = (2 \times 3.0) + (2 \times 2.5) \times 1$
 $= 11.0 \text{ kHz}$

Emission Designator

11K0F3E

F3E represents an FM voice transmission

Analogue Voice 25.0 kHz Bandwidth :

Necessary bandwidth

$M = 3.0 \text{ kHz}$

$D = 5.0 \text{ kHz}$

$B_n = (2 \times 3.0) + (2 \times 5.0) \times 1$
 $= 16.0 \text{ kHz}$

Emission Designator

16K0F3E

F3E represents a FM voice transmission

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

Necessary bandwidth

$M = 1.8 \text{ kHz}$

$D = 1.5 \text{ kHz}$ (60% of peak deviation)

$B_n = (2 \times 1.8) + (2 \times 1.5) \times 1$
 $= 6.6 \text{ kHz}$

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

$M = 1.8 \text{ kHz}$

$D = 3 \text{ kHz}$ (60% of peak deviation)

$B_n = (2 \times 1.8) + (2 \times 3.0) \times 1$
 $= 9.6 \text{ kHz}$

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

$$M = 2.4 \text{ kHz}$$

$$D = 1.5 \text{ kHz (60\% of peak deviation)}$$

$$B_n = (2 \times 2.4) + (2 \times 1.5) \times 1 \\ = 7.8 \text{ kHz}$$

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

$$M = 2.4 \text{ kHz}$$

$$D = 3.0 \text{ kHz (60\% of peak deviation)}$$

$$B_n = (2 \times 2.4) + (2 \times 3.0) \times 1 \\ = 10.8 \text{ kHz}$$

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 in accordance with TIA/EIA 102 CAAB 2.2.5.2

Digital Voice 12.5 kHz Bandwidth P25 phase 1

99% bandwidth

$$= 8.1 \text{ kHz}$$

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

$$= 8.1 \text{ kHz}$$

Emission Designator

8K10F1W

F1W represents a single digital FM telephony channel

Digital Voice 12.5 kHz Bandwidth DMR

99% bandwidth

$$= 7.6 \text{ kHz}$$

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

$$= 8.1 \text{ kHz}$$

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

$$= 8.1 \text{ kHz}$$

Emission Designator

8K10F1W

F1W represents digital FM data transmission

Digital Data 12.5 kHz Bandwidth DMR

99% bandwidth

$$= 7.6 \text{ kHz}$$

Emission Designator

7K60FXD

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

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Report Number 3425C
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: 3 W and 1 W

Nominal 3 W	769.06875MHz	799.06875MHz	807.5125MHz	823.9875MHz	868.9875MHz
Measured	2.81	3.05	2.88	2.74	2.92
Variation (%)	-6.3	1.7	-4.1	-8.5	-2.7
Variation (dB)	-0.3	0.1	-0.2	-0.4	-0.1
Nominal 1 W	769.06875MHz	799.06875MHz	807.5125MHz	823.9875MHz	868.9875MHz
Measured	0.94	1.01	0.96	0.92	0.98
Variation (%)	-5.9	0.9	-4.2	-8.1	-2.1
Variation (dB)	-0.3	0.0	-0.2	-0.4	-0.1
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:

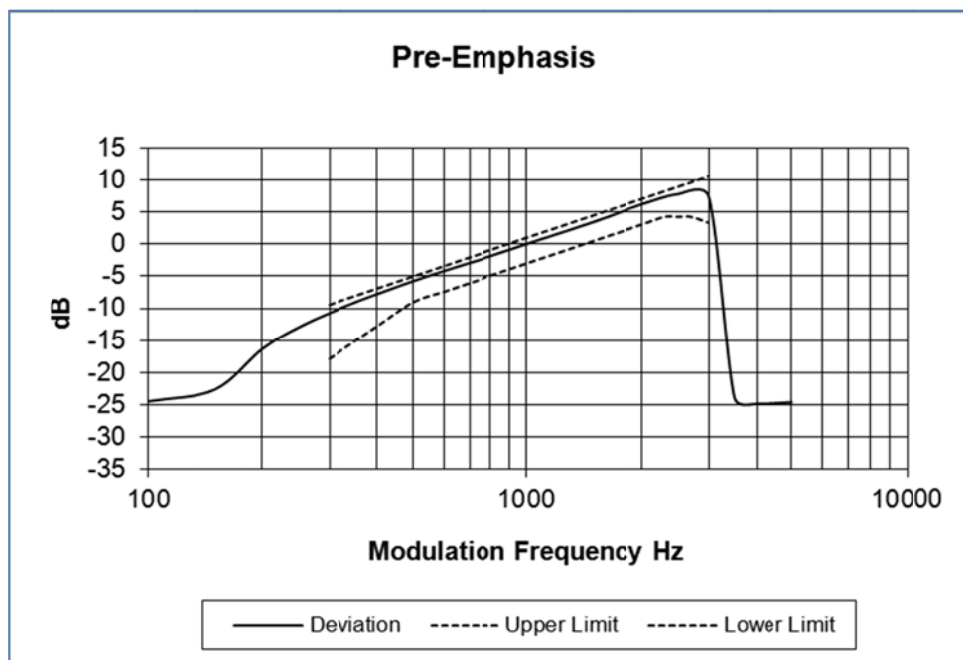
1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000 Hz was applied with the level set to obtain 20% of maximum deviation. This was used as the 0 dB reference point.
3. The AF was varied while the audio level was held constant.
4. The response in dB relative to 1000 Hz was measured.

MEASUREMENT RESULTS:

See the plots on the following pages for 12.5 kHz and 25.0 kHz channel spacings tested at 3 W transmit power.

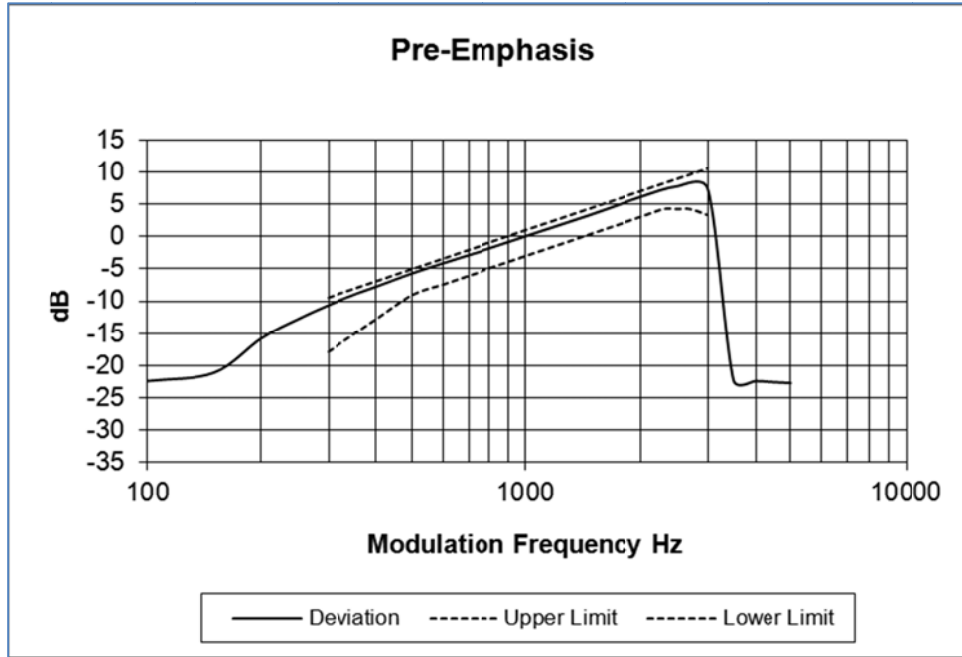
LIMIT CLAUSE: TIA/EIA-603D 3.2.6

Tx FREQUENCY: 807.5125 MHz 12.5 kHz Channel Spacing

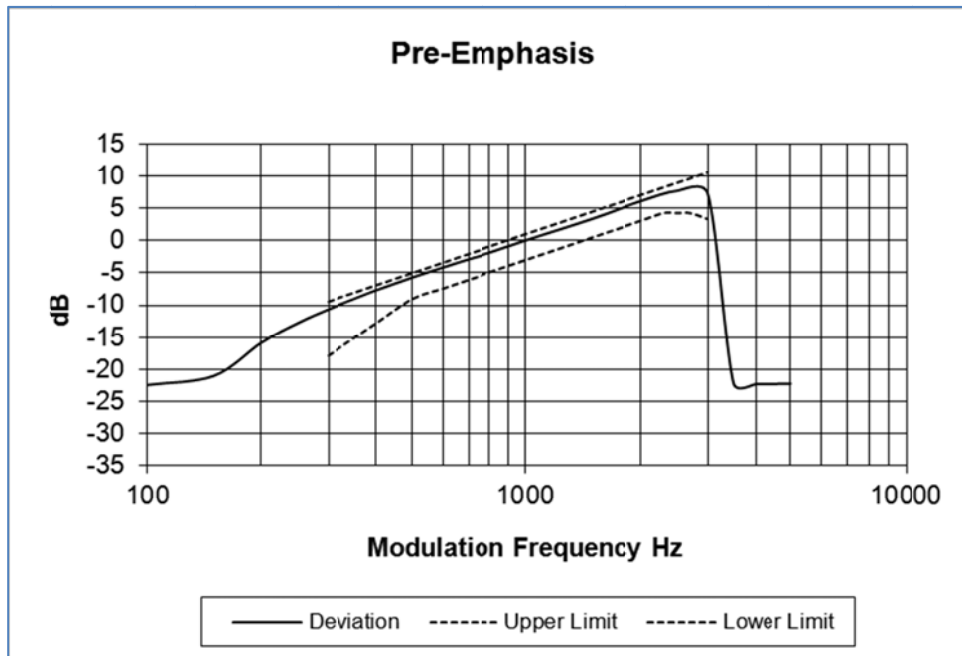


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Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 823.9875 MHz 12.5 kHz Channel Spacing

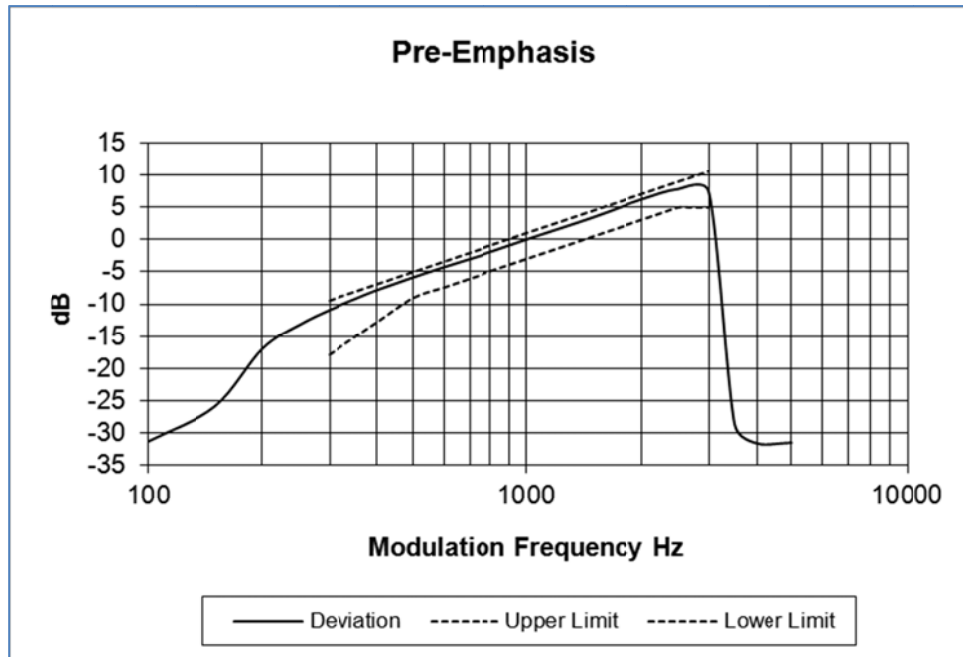


Tx FREQUENCY: 868.9875 MHz 12.5 kHz Channel Spacing

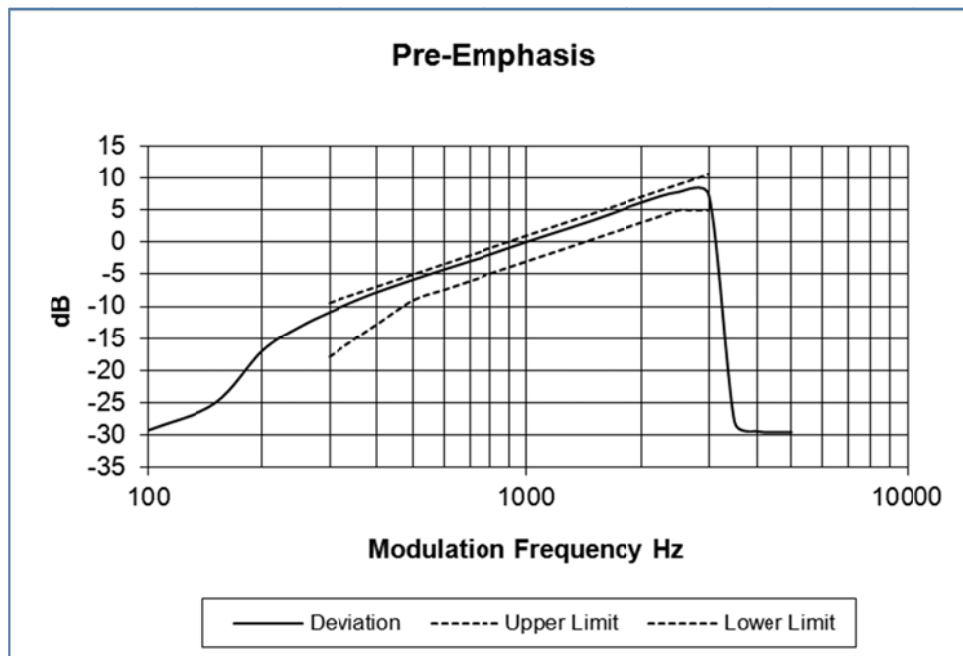


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Tait Communications
Report Number 3425C
Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 807.5125 MHz 25.0 kHz Channel Spacing

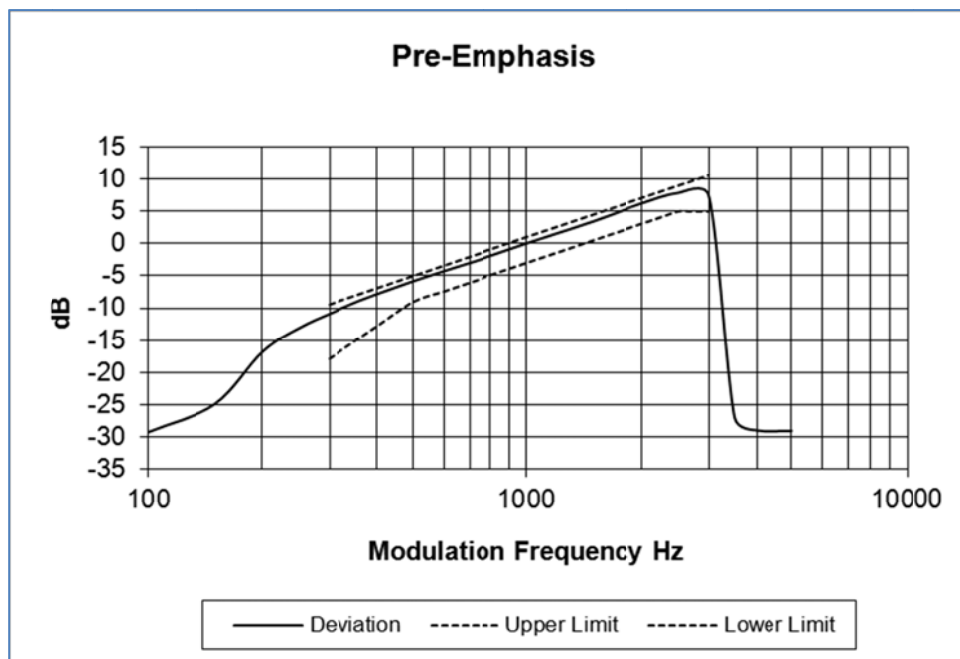


Tx FREQUENCY: 823.9875 MHz 25.0 kHz Channel Spacing



TELTEST Laboratories
Tait Communications
Report Number 3425C
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.

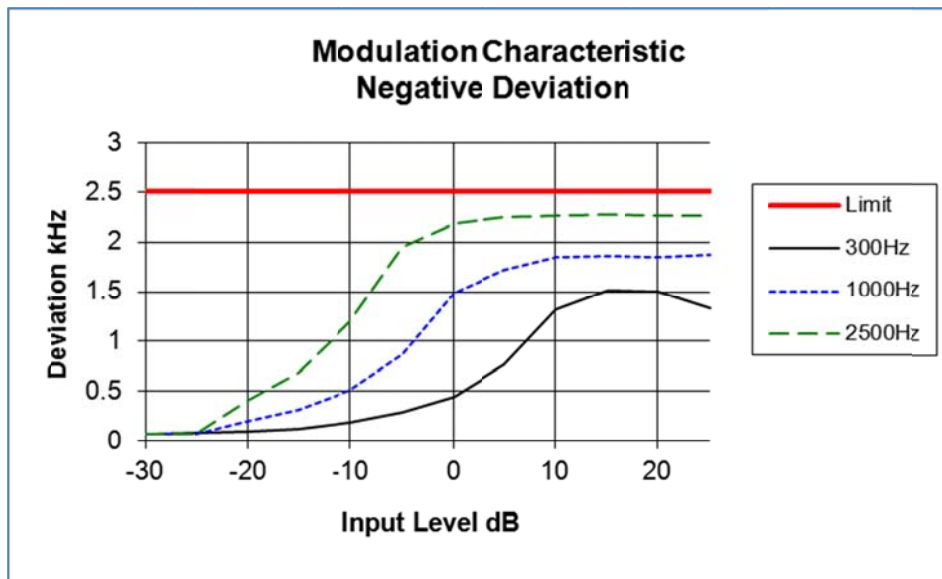
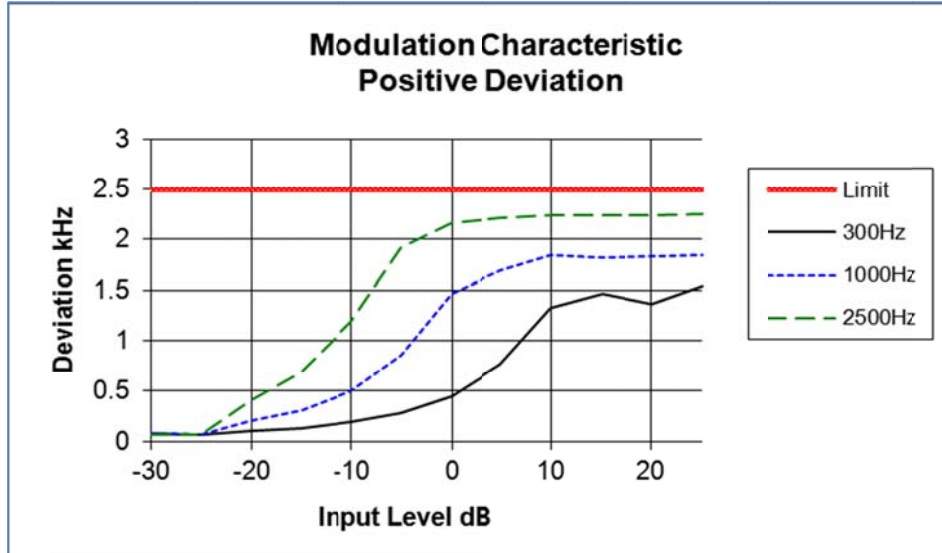
LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 807.5125 MHz

12.5 kHz Channel Spacing

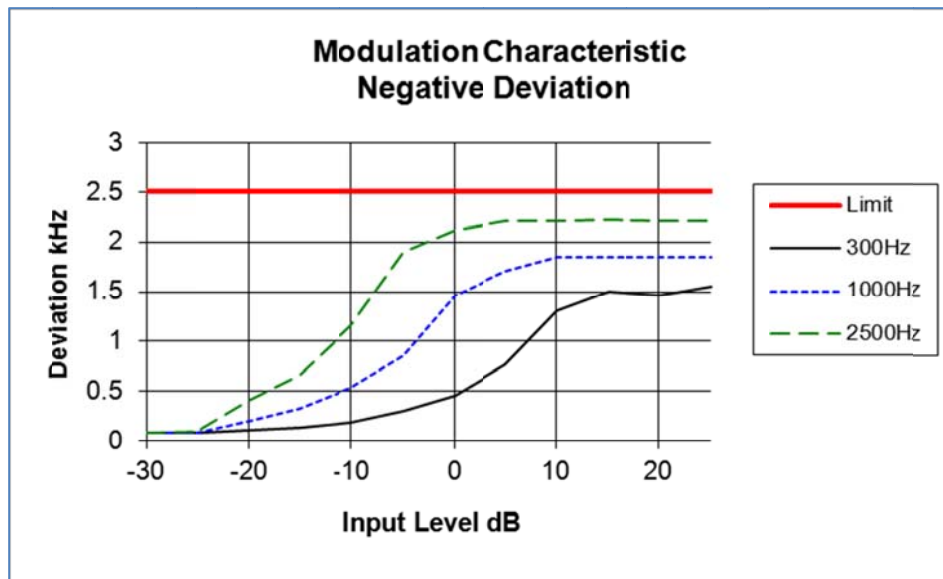
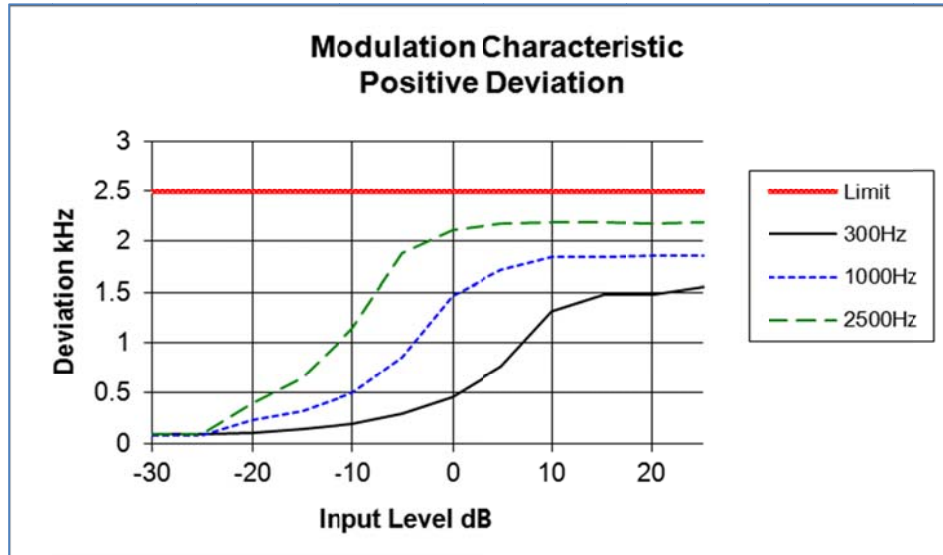


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 823.9875 MHz

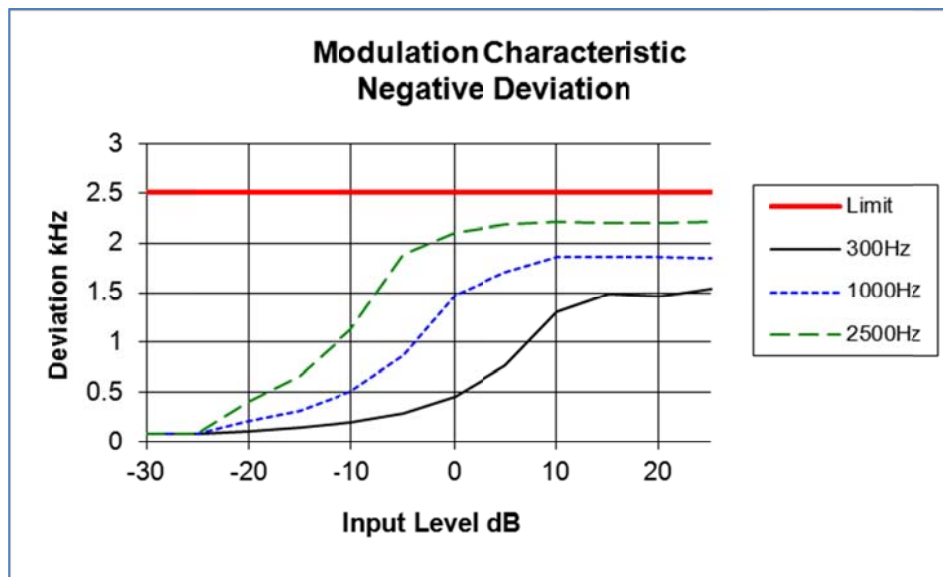
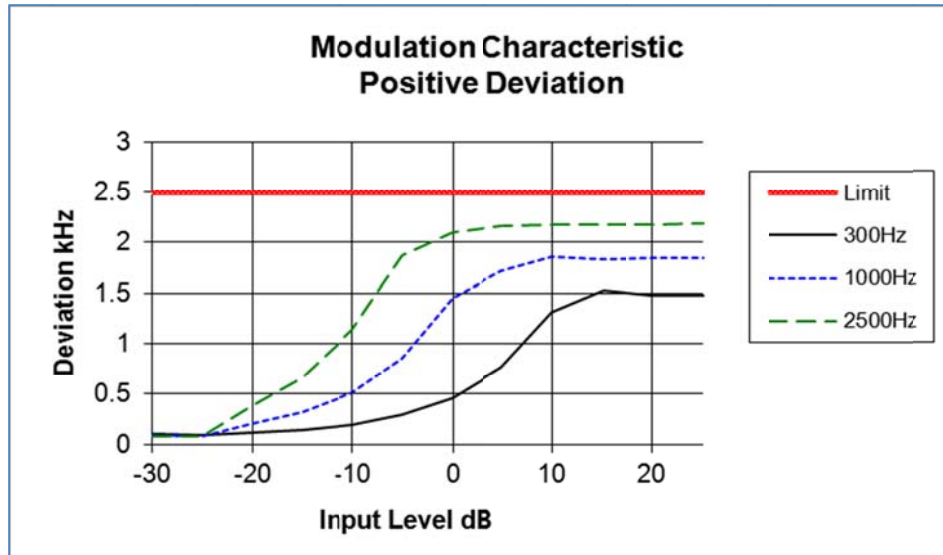
12.5 kHz Channel Spacing



Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

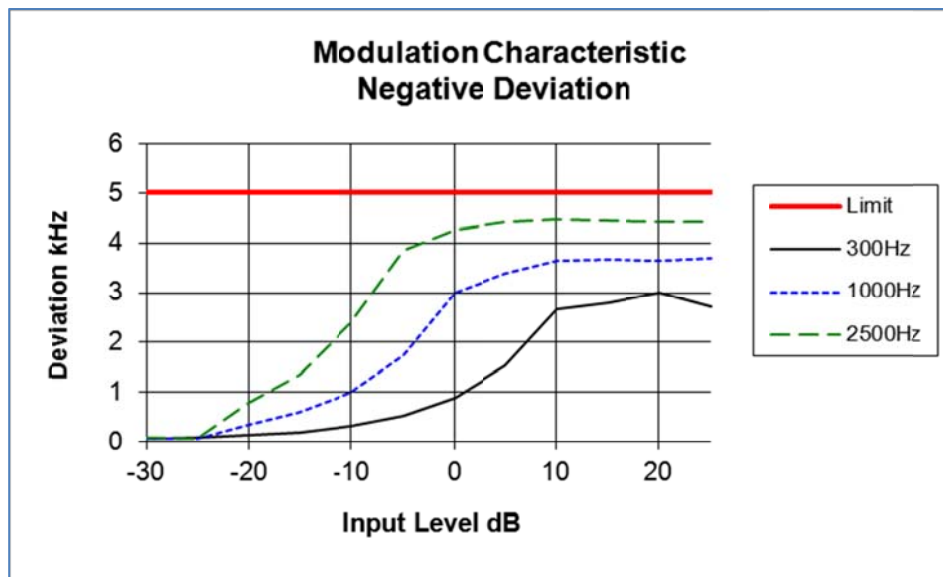
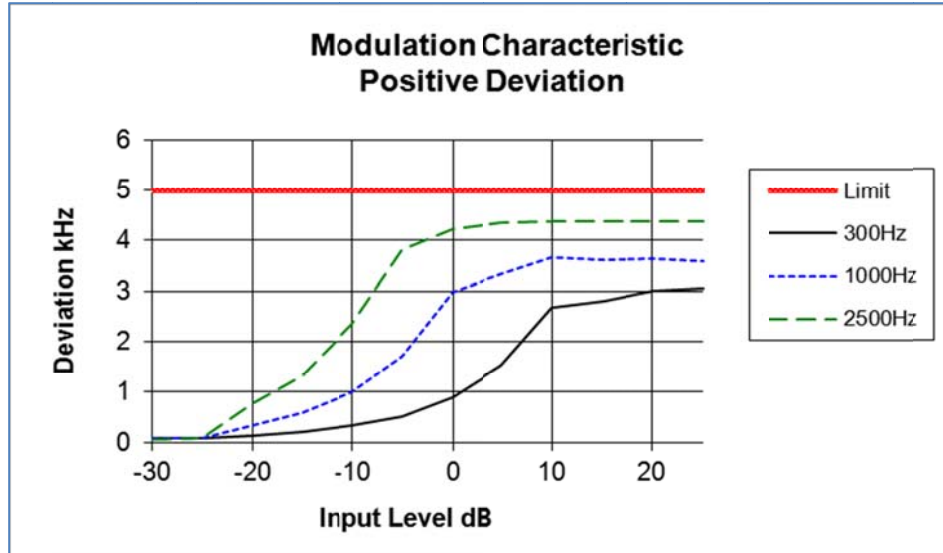
Tx FREQUENCY: 868.9875 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 807.5125 MHz 25.0 kHz Channel Spacing

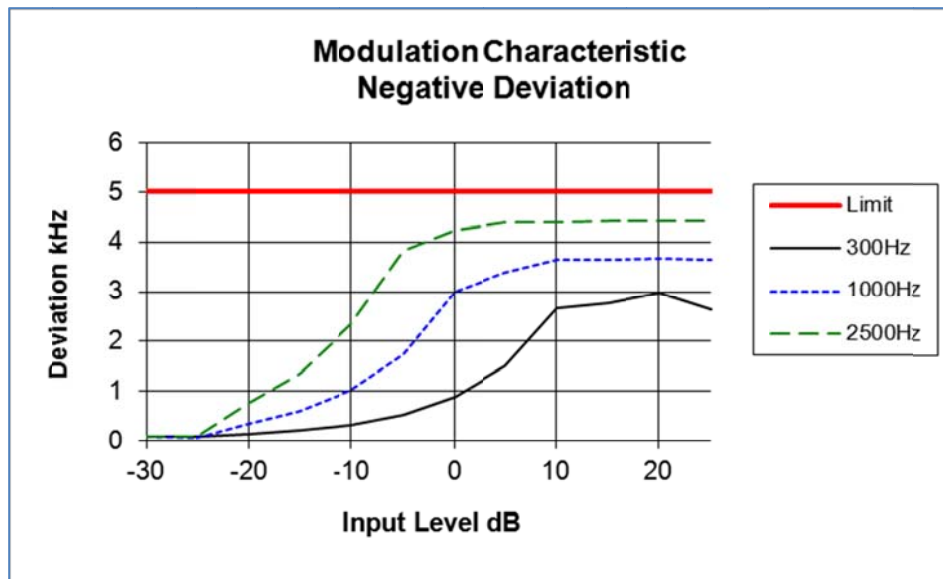
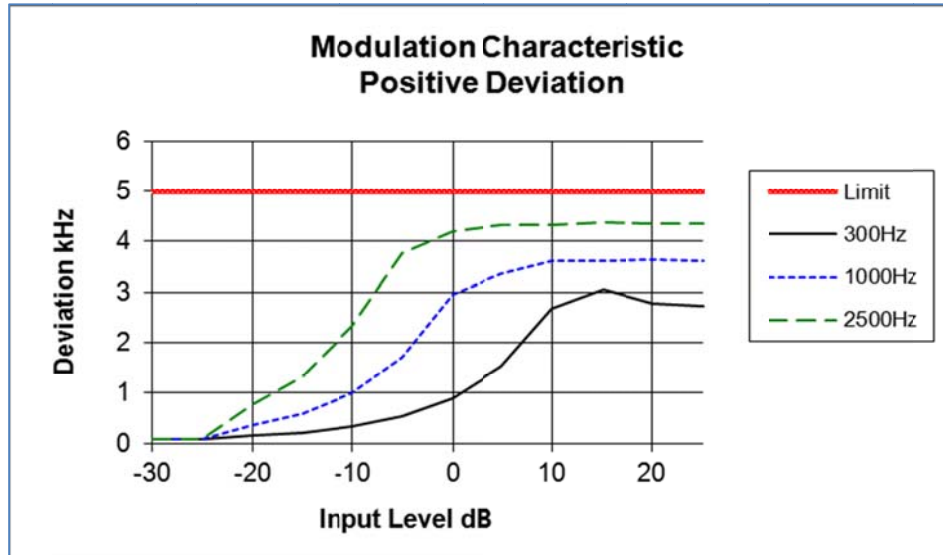


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 823.9875 MHz

25.0 kHz Channel Spacing

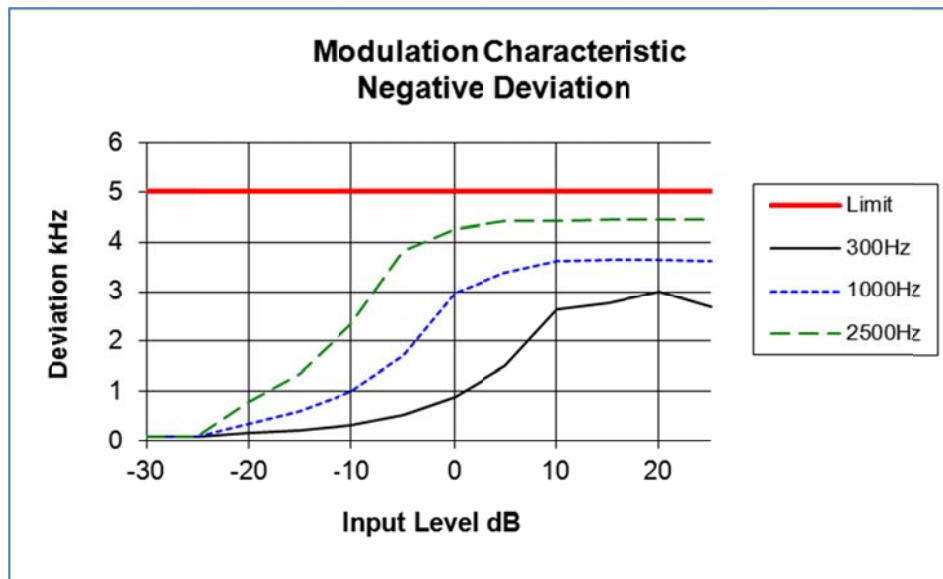
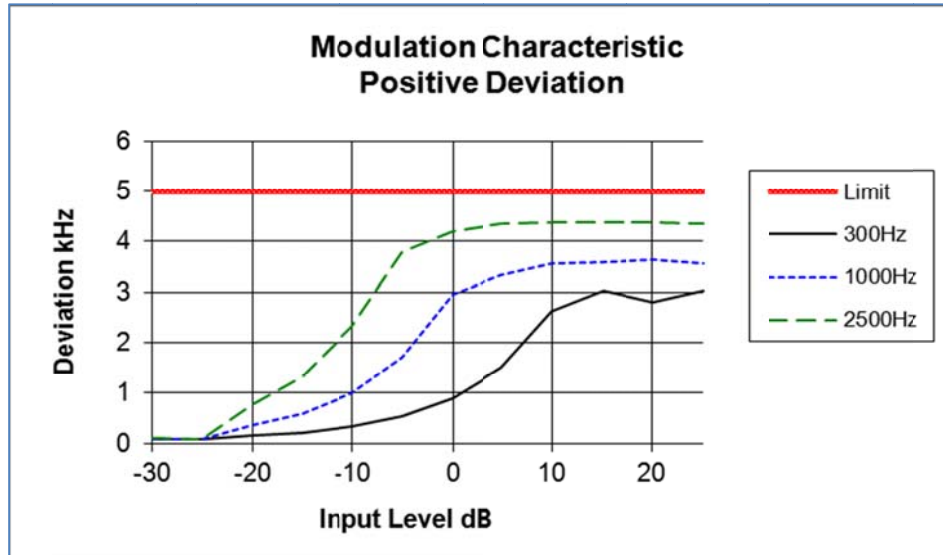


Transmitter Modulation Limiting

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 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

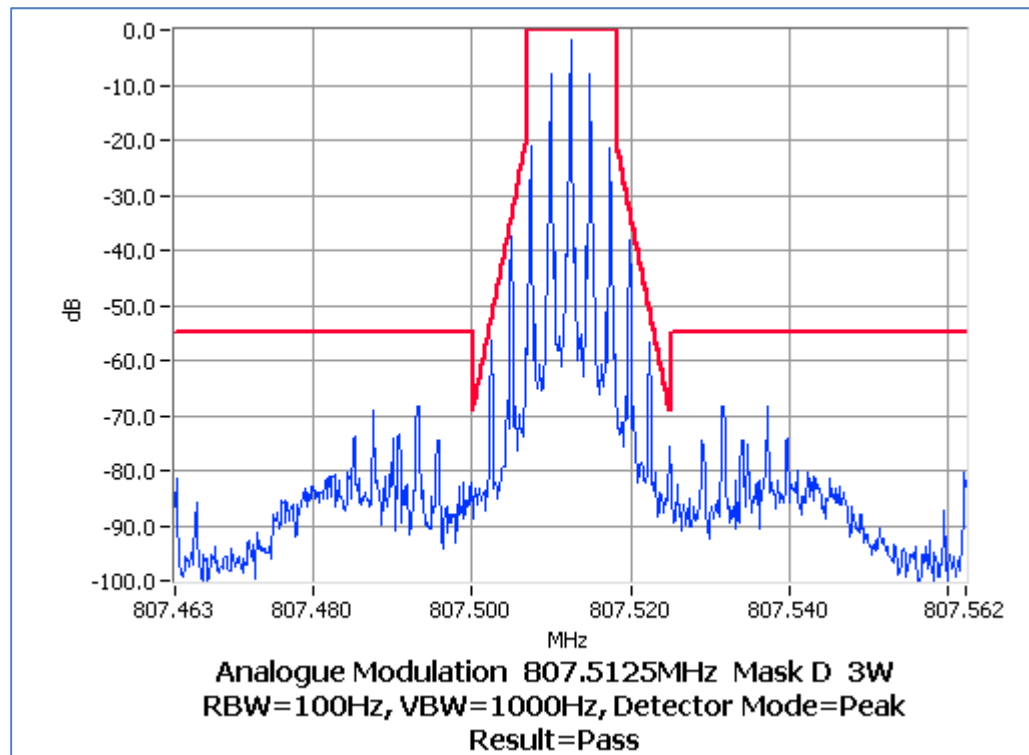
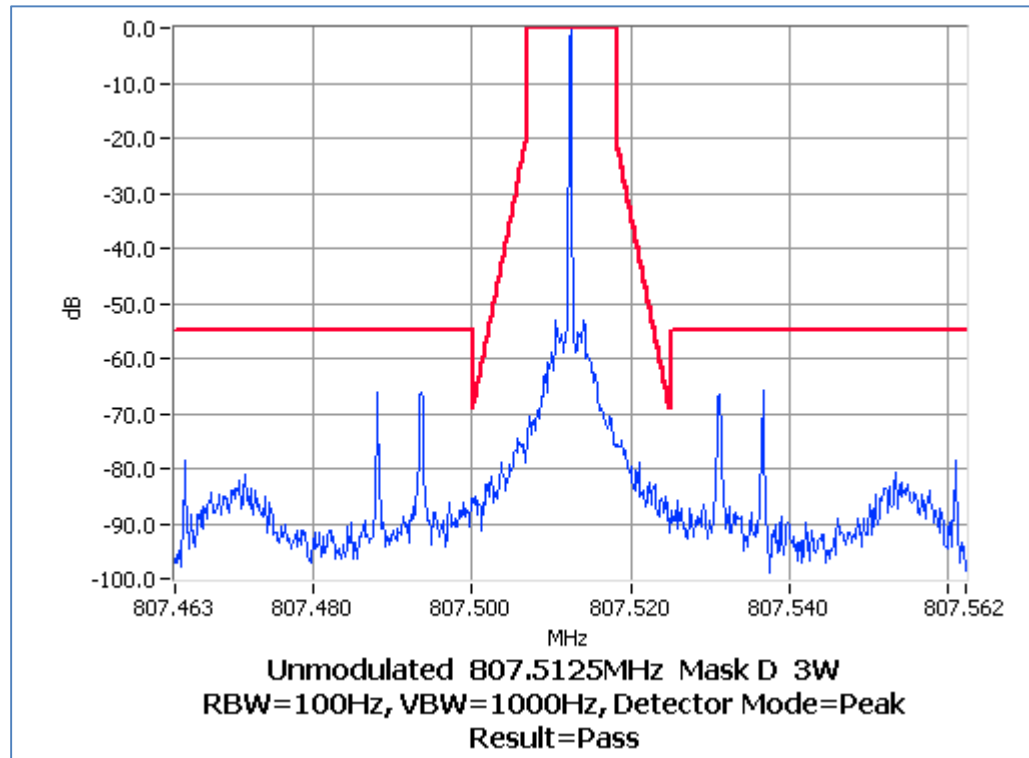
Digital Voice/Data	12.5 kHz Channel Spacing	9600 bps & 12000 bps
FFSK	12.5 kHz Channel Spacing	1200 bps & 2400 bps

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Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 807.5125 MHz 3 W 12.5 kHz Channel Spacing

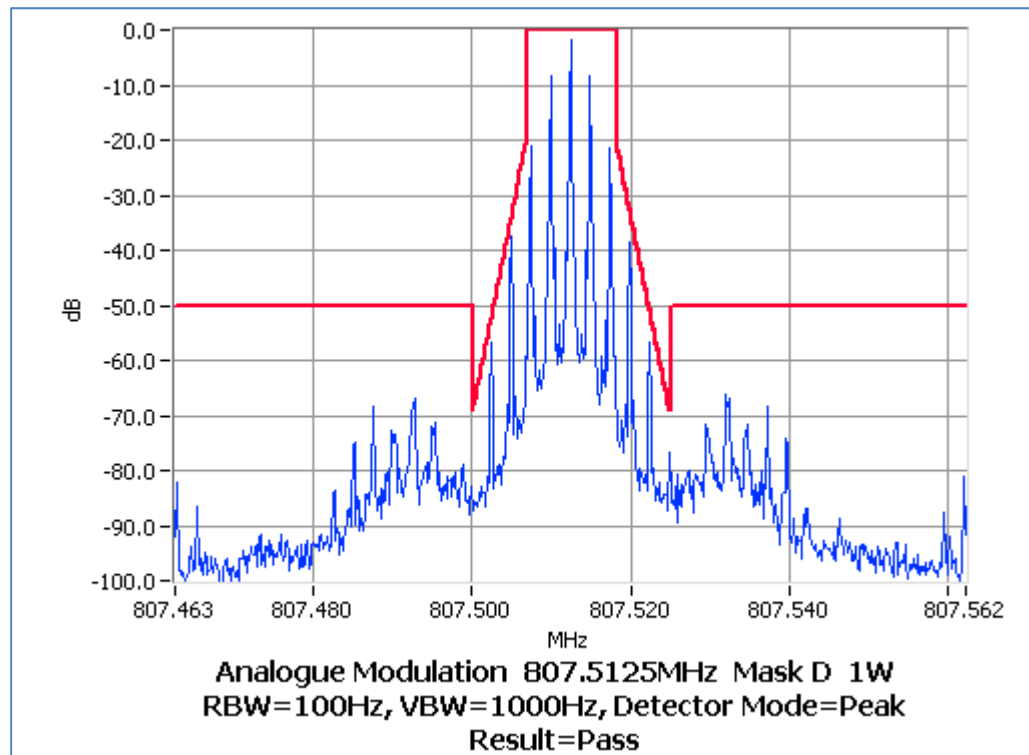
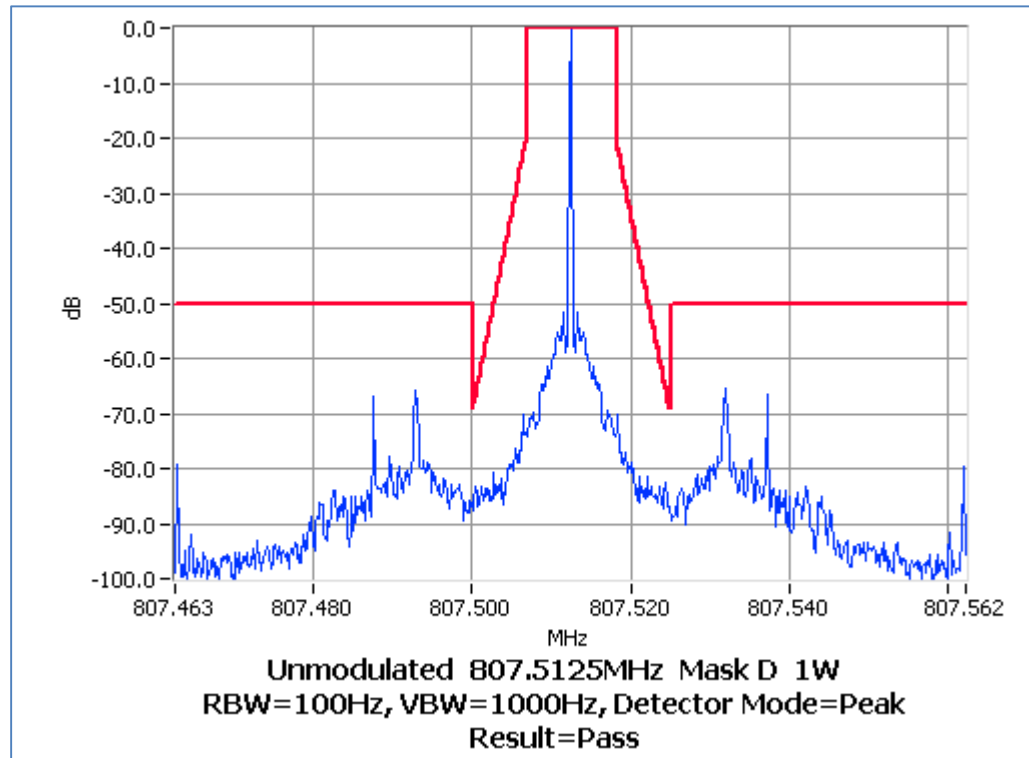


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Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 807.5125 MHz 1 W 12.5 kHz Channel Spacing

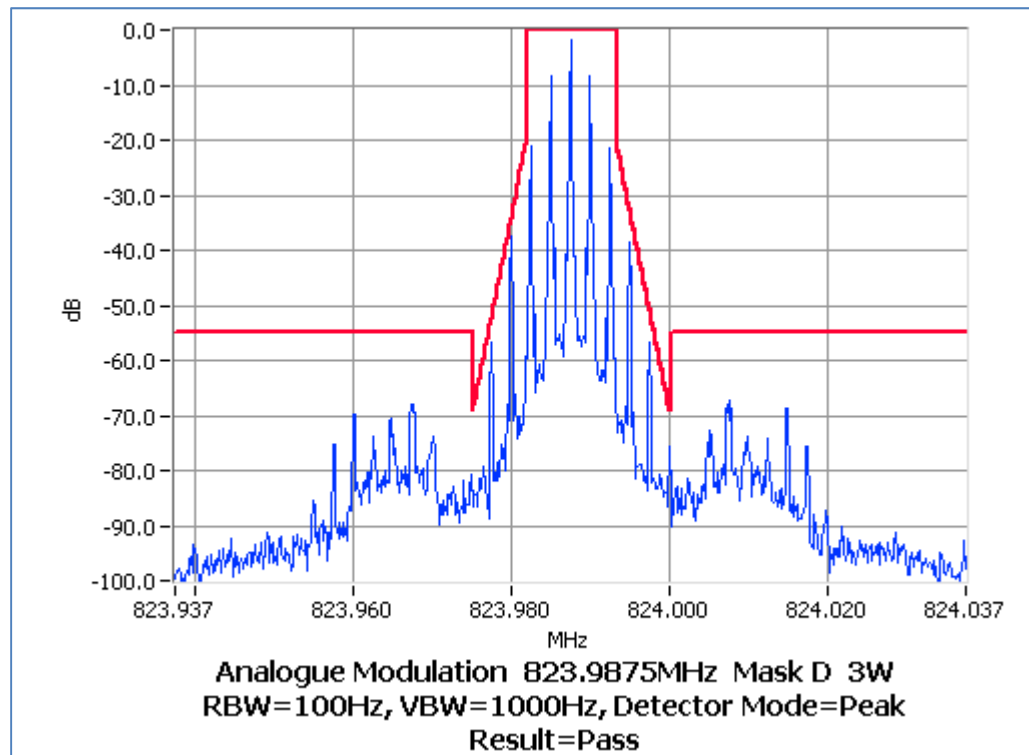
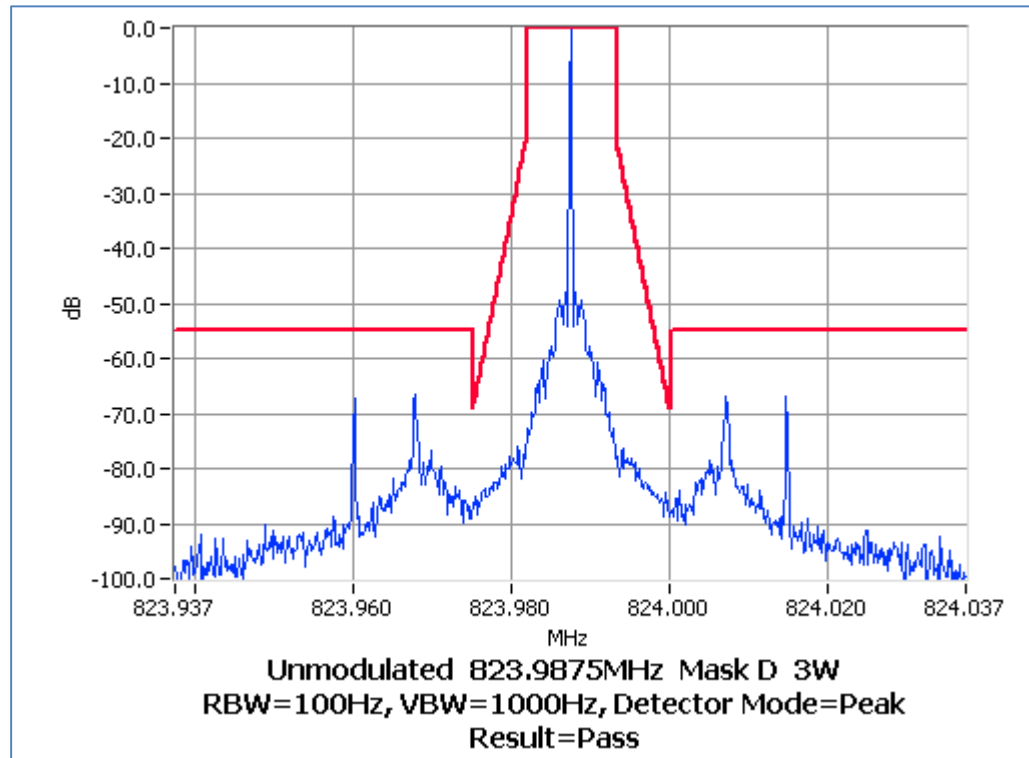


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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 823.9875 MHz 3 W 12.5 kHz Channel Spacing

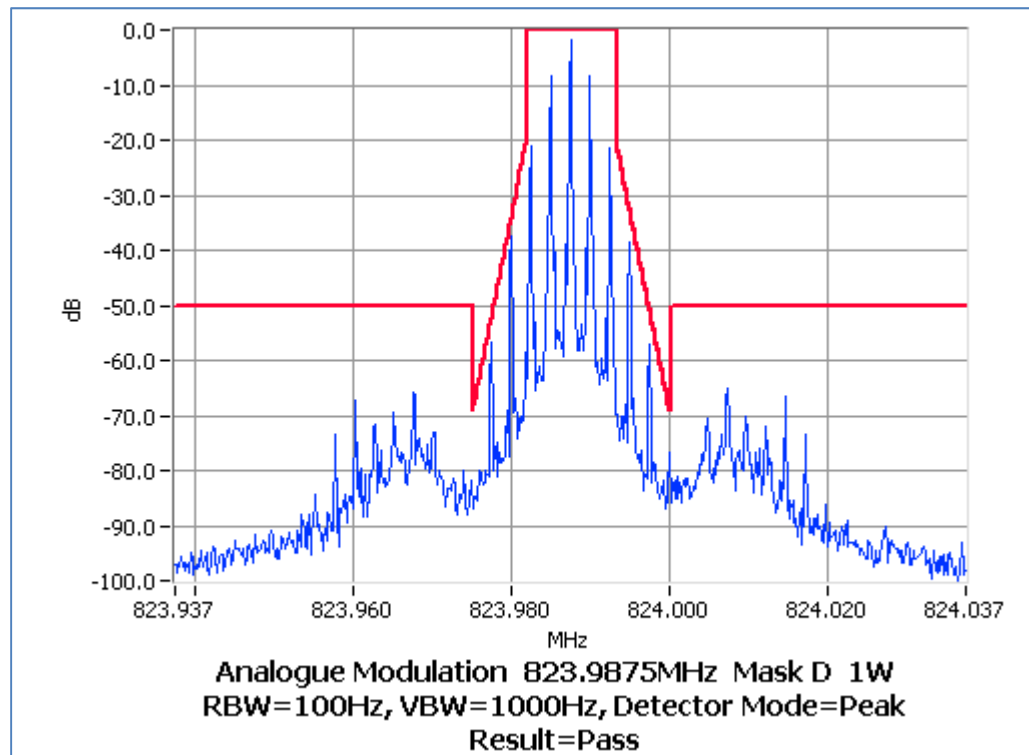
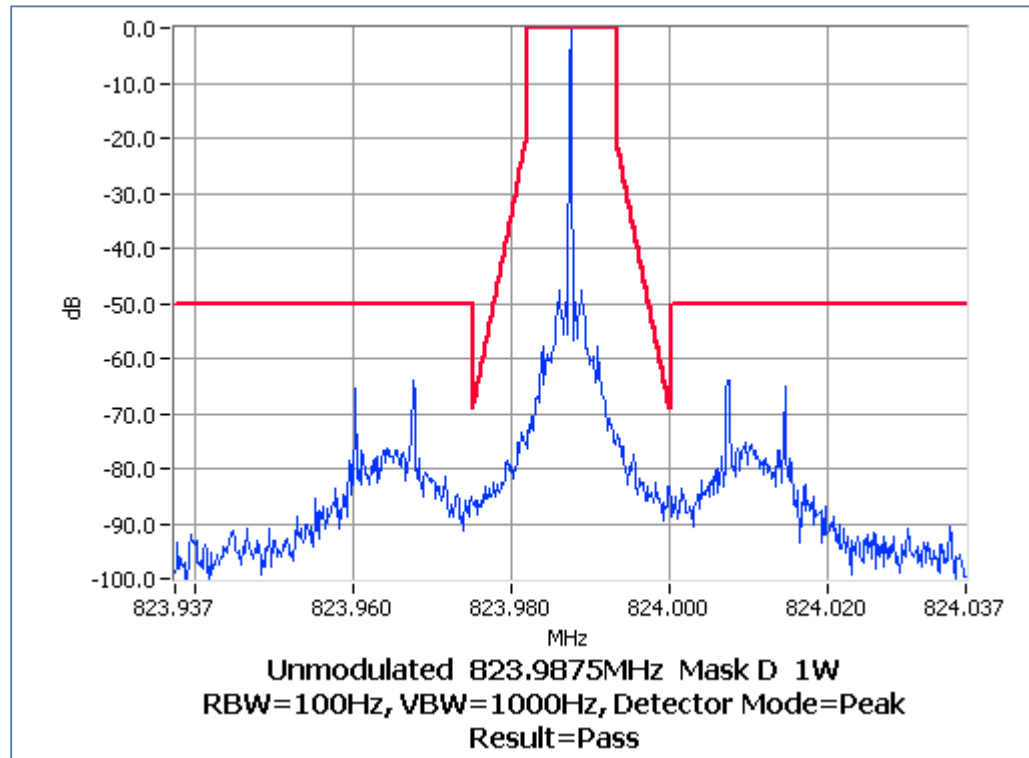


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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 823.9875 MHz 1 W 12.5 kHz Channel Spacing

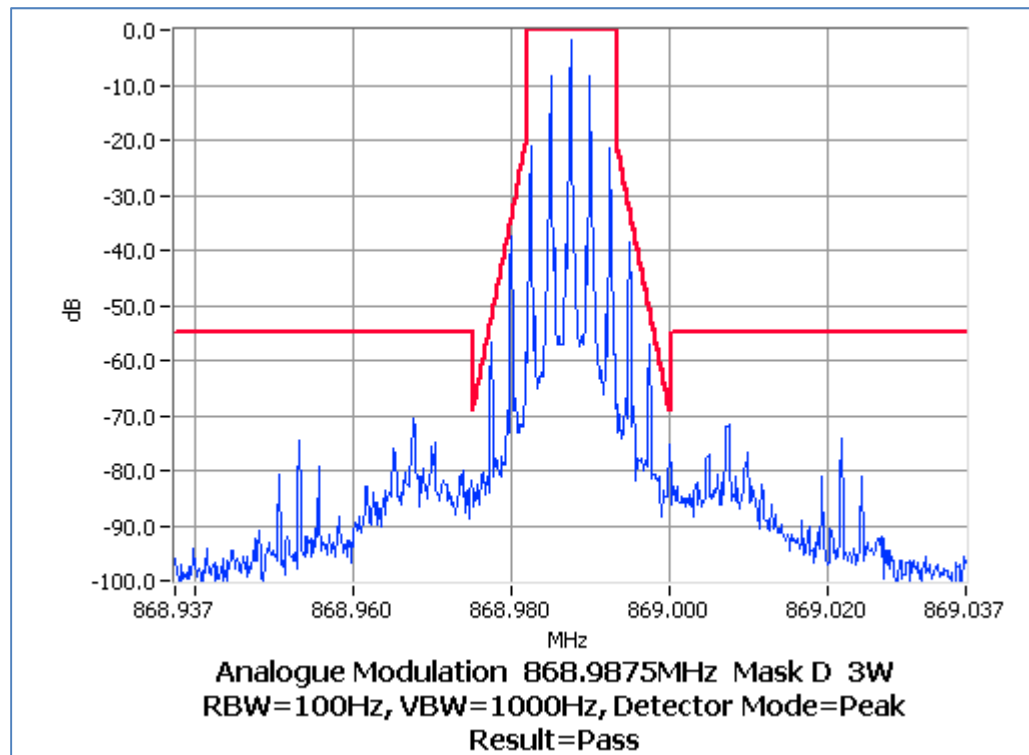
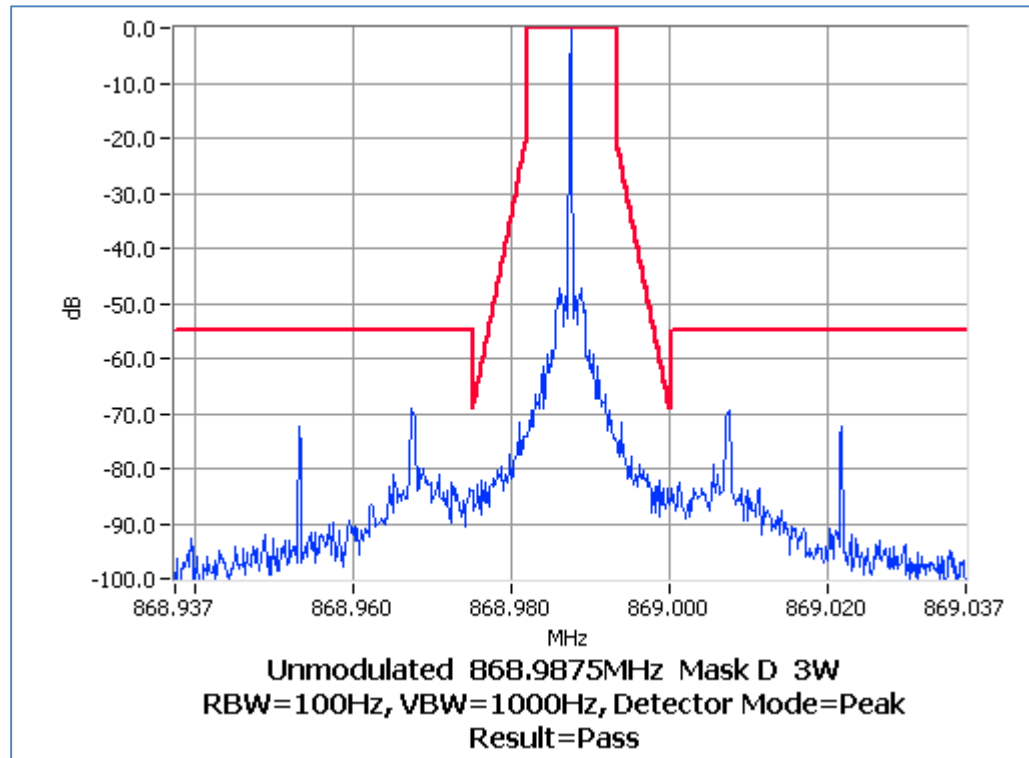


TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 868.9875 MHz 3 W 12.5 kHz Channel Spacing

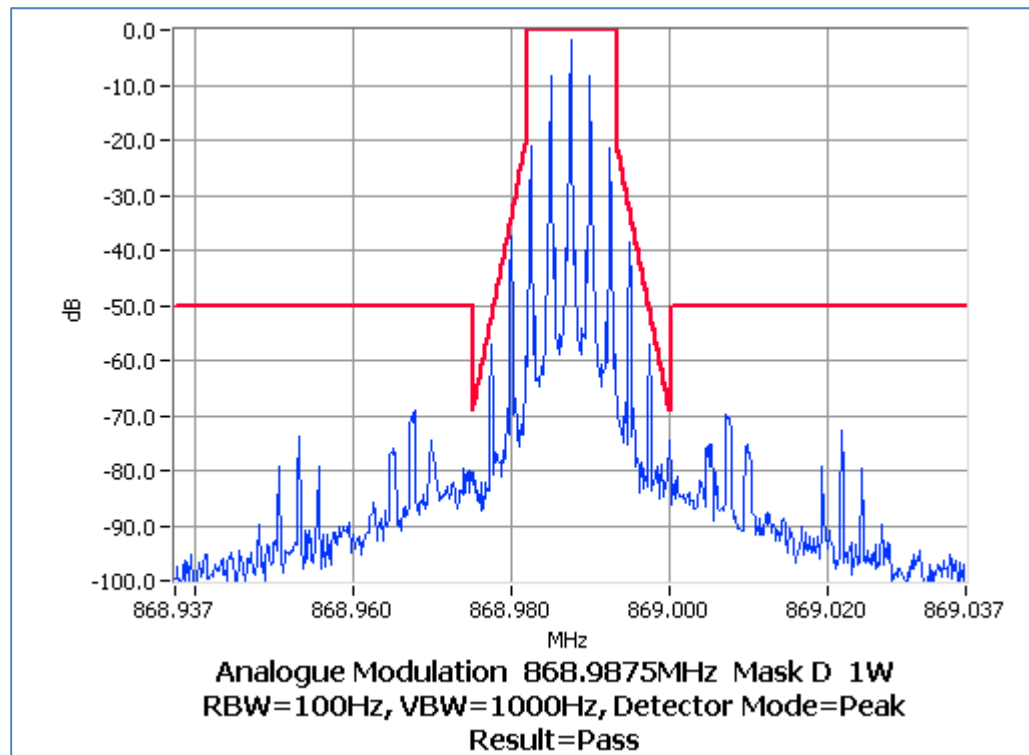
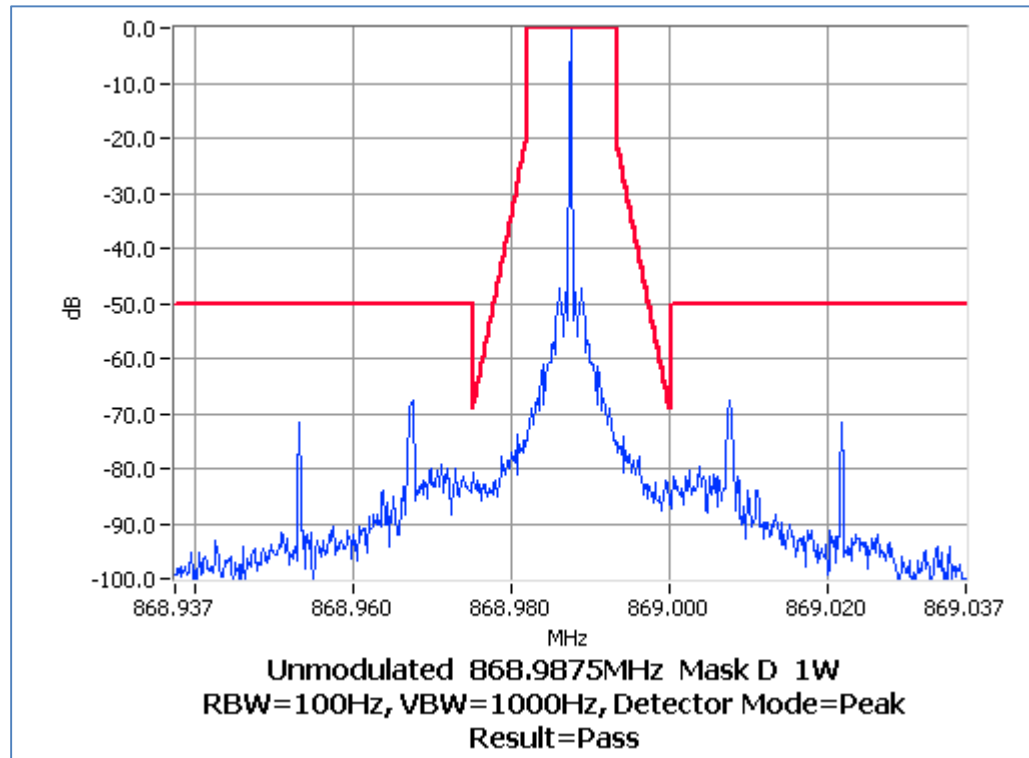


TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 868.9875 MHz 1 W 12.5 kHz Channel Spacing

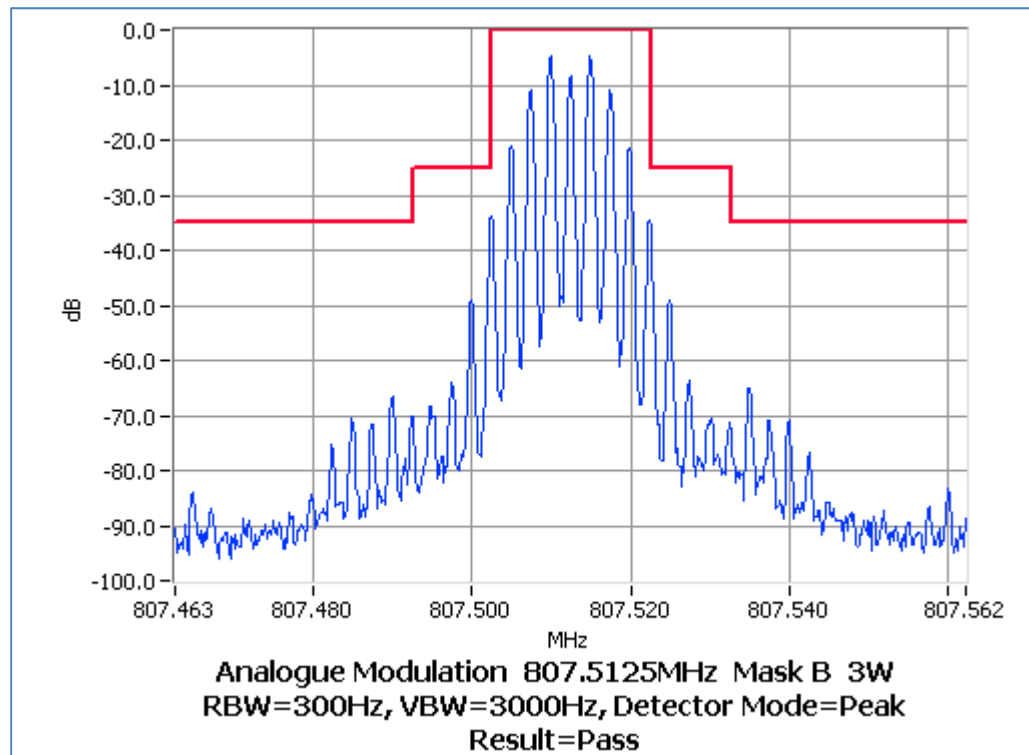
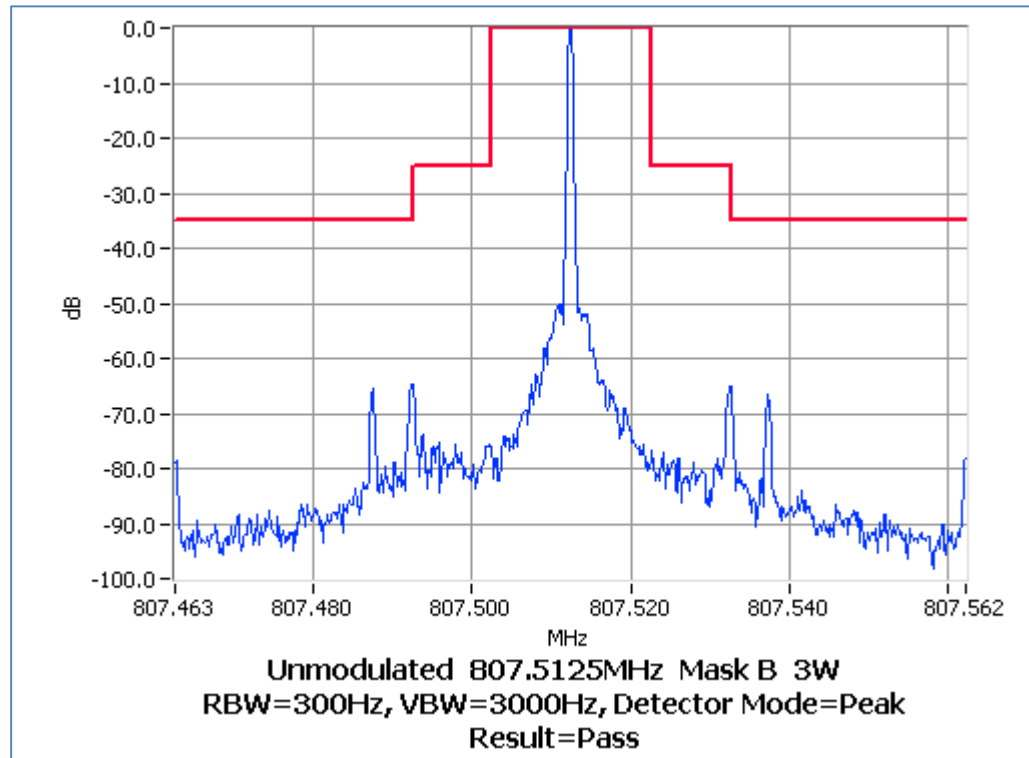


TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 807.5125 MHz 3 W 25.0 kHz Channel Spacing

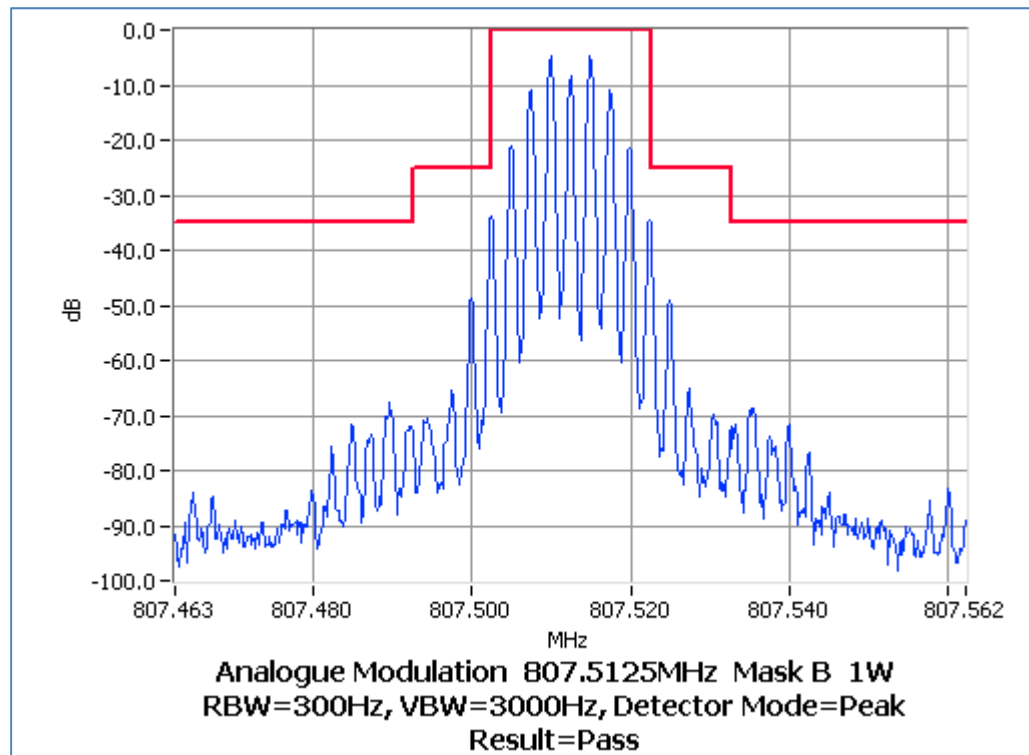
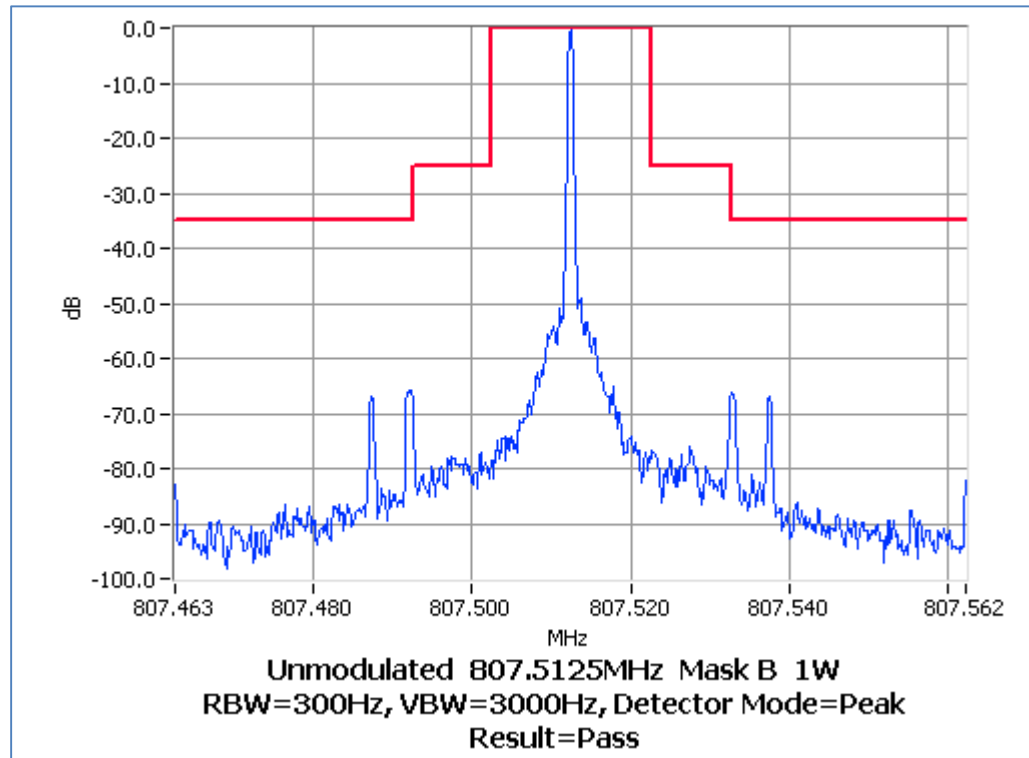


TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 807.5125 MHz 1 W 25.0 kHz Channel Spacing

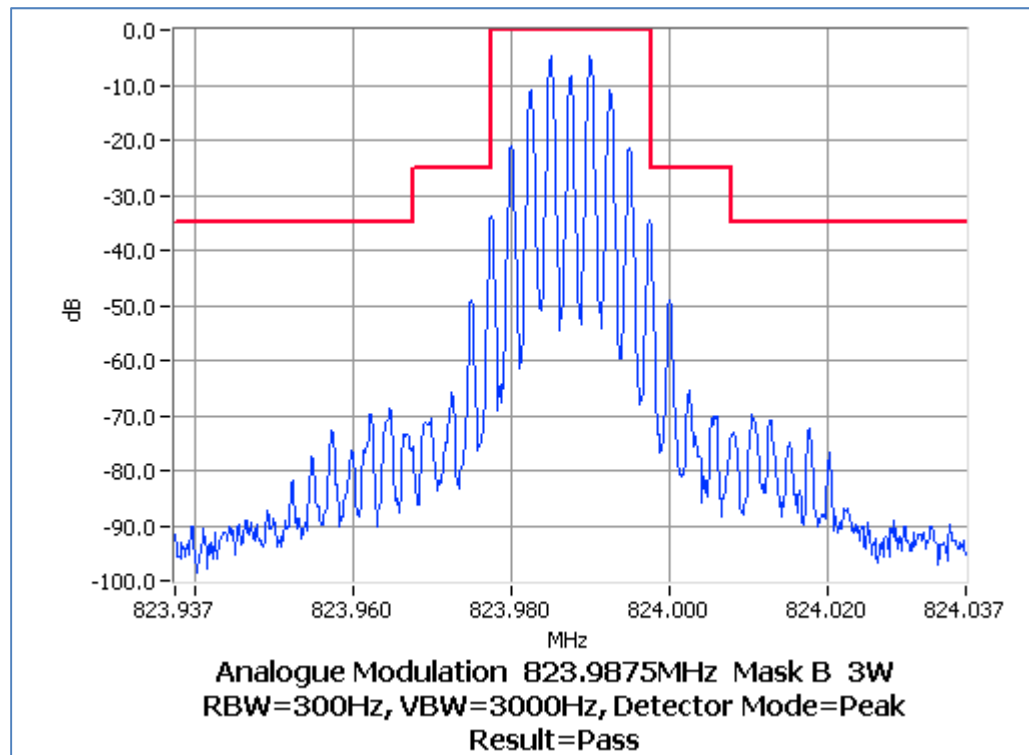
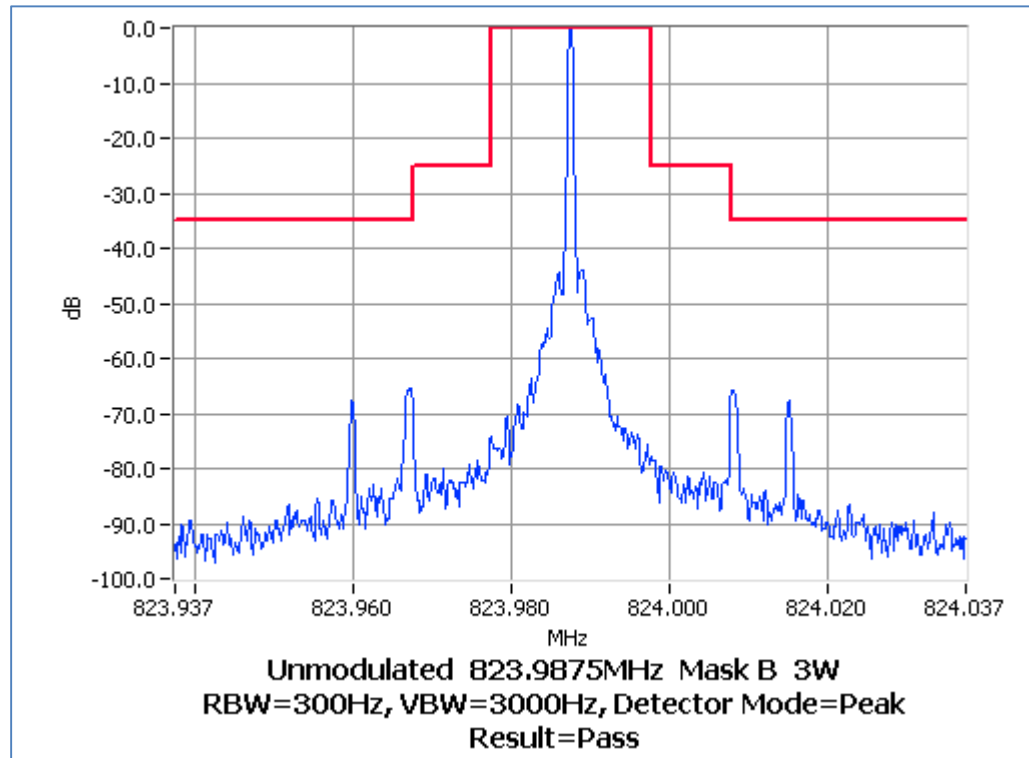


TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 823.9875 MHz 3 W 25.0 kHz Channel Spacing

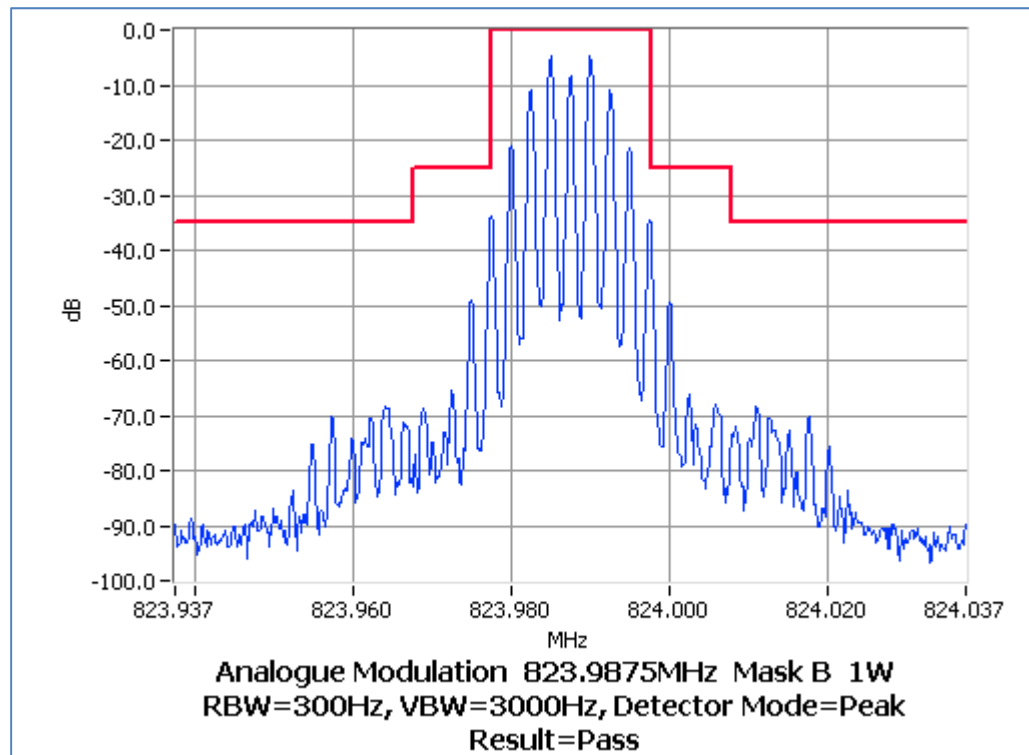
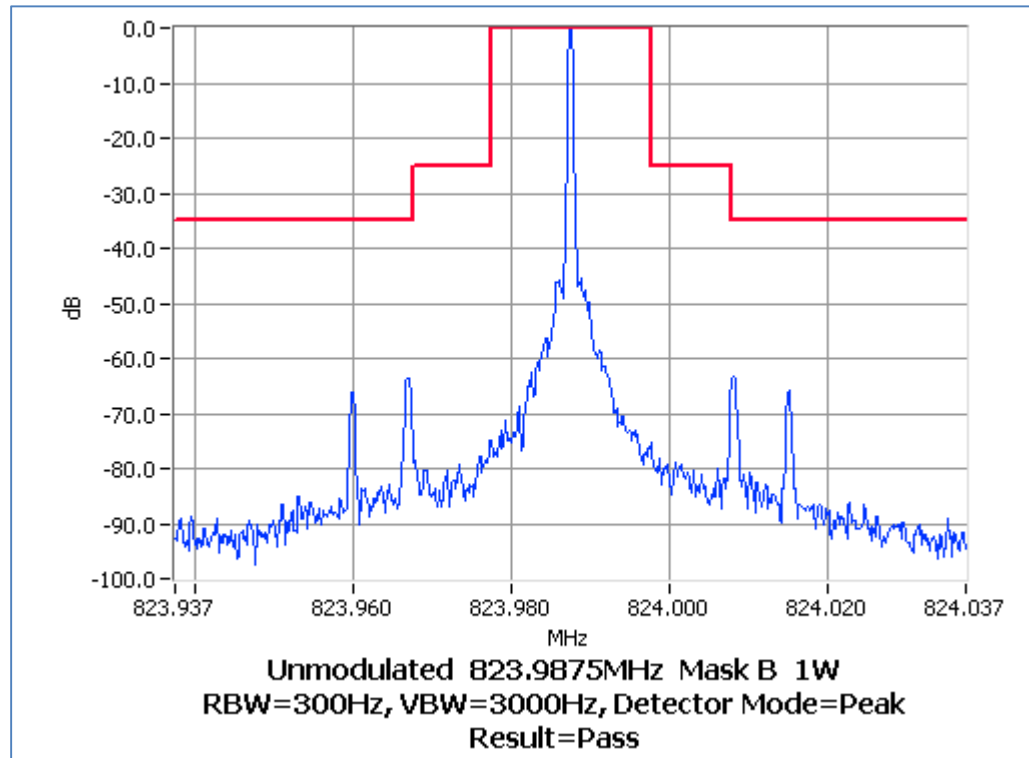


TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 823.9875 MHz 1 W 25.0 kHz Channel Spacing

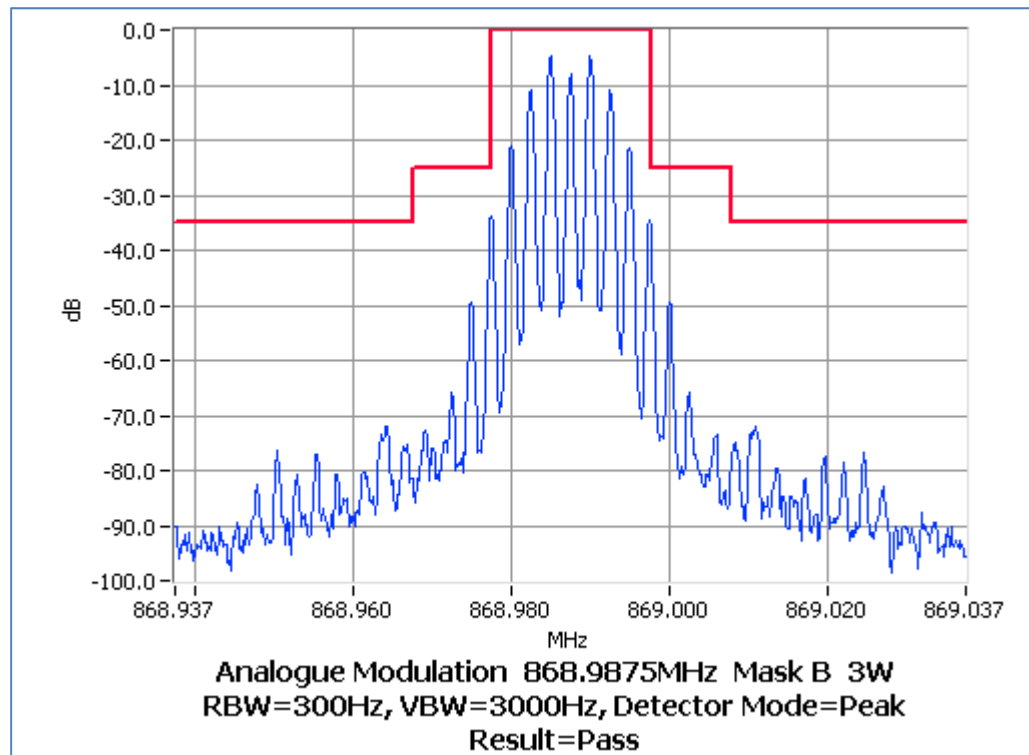
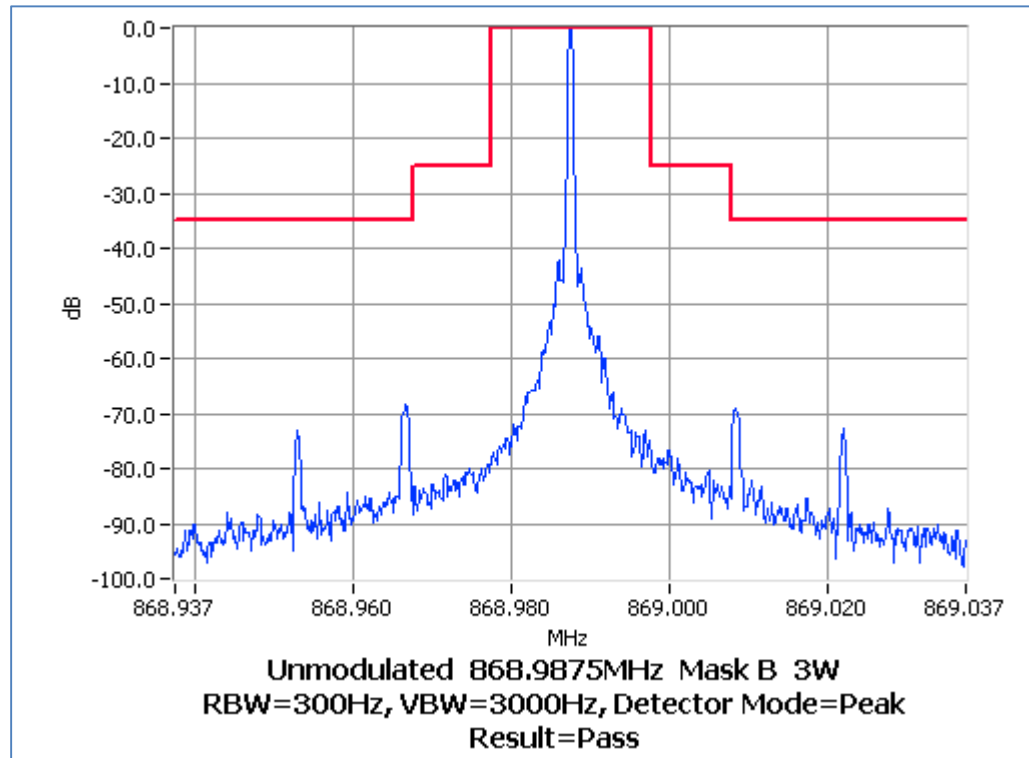


TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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

Tx FREQUENCY: 868.9875 MHz 3 W 25.0 kHz Channel Spacing

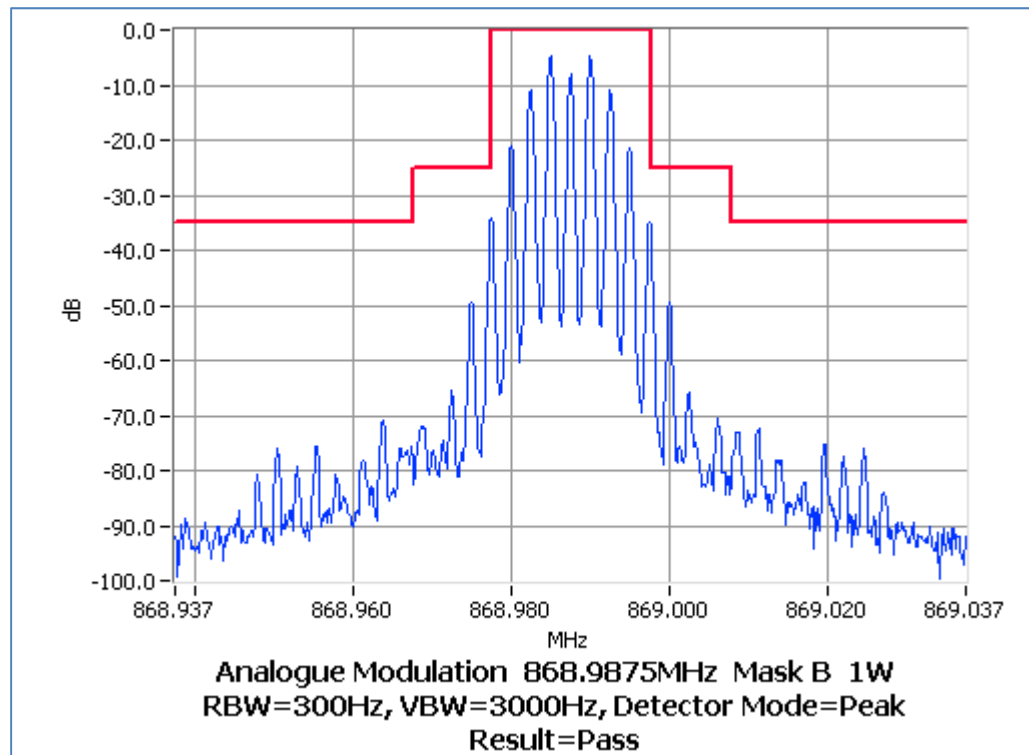
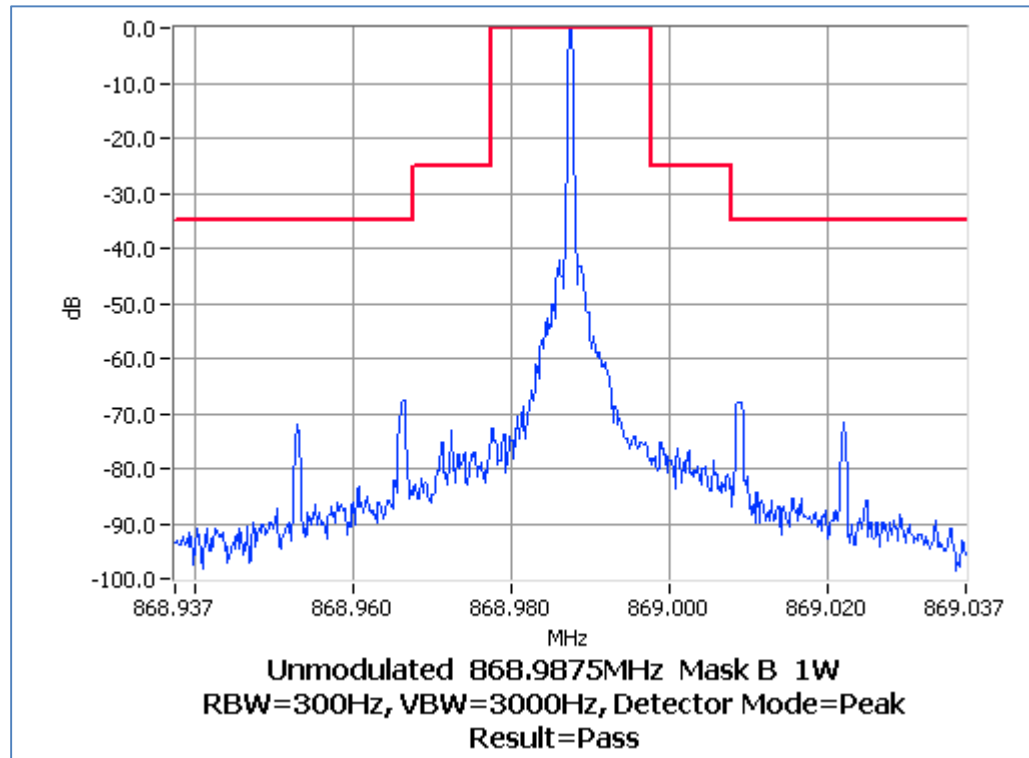


TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

ANALOG VOICE

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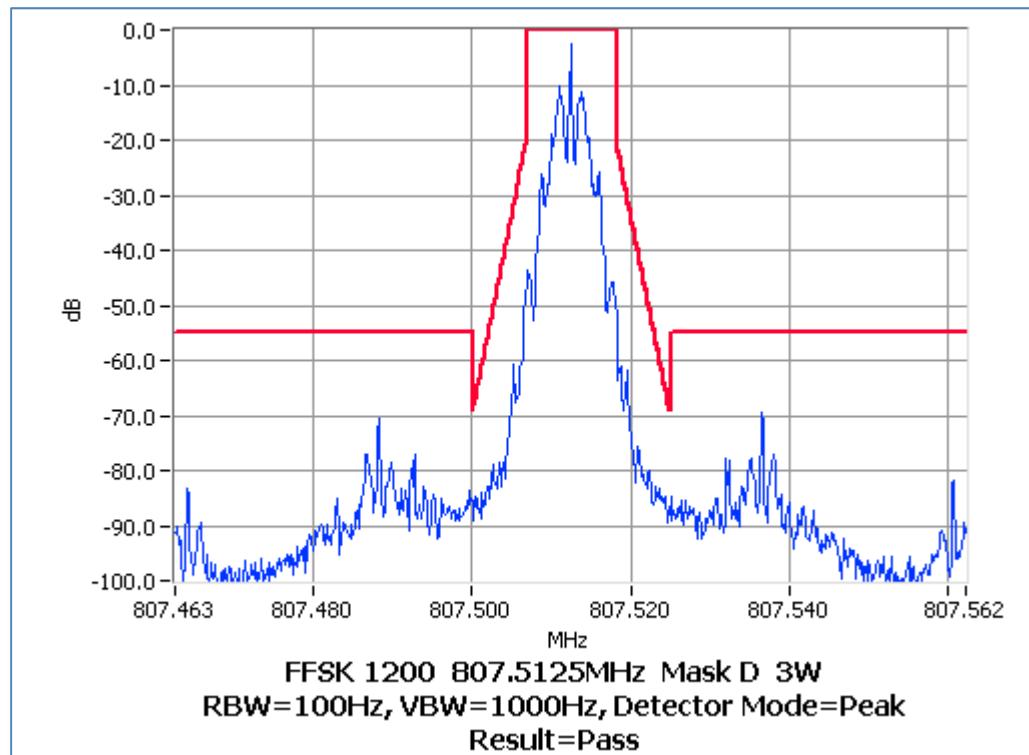
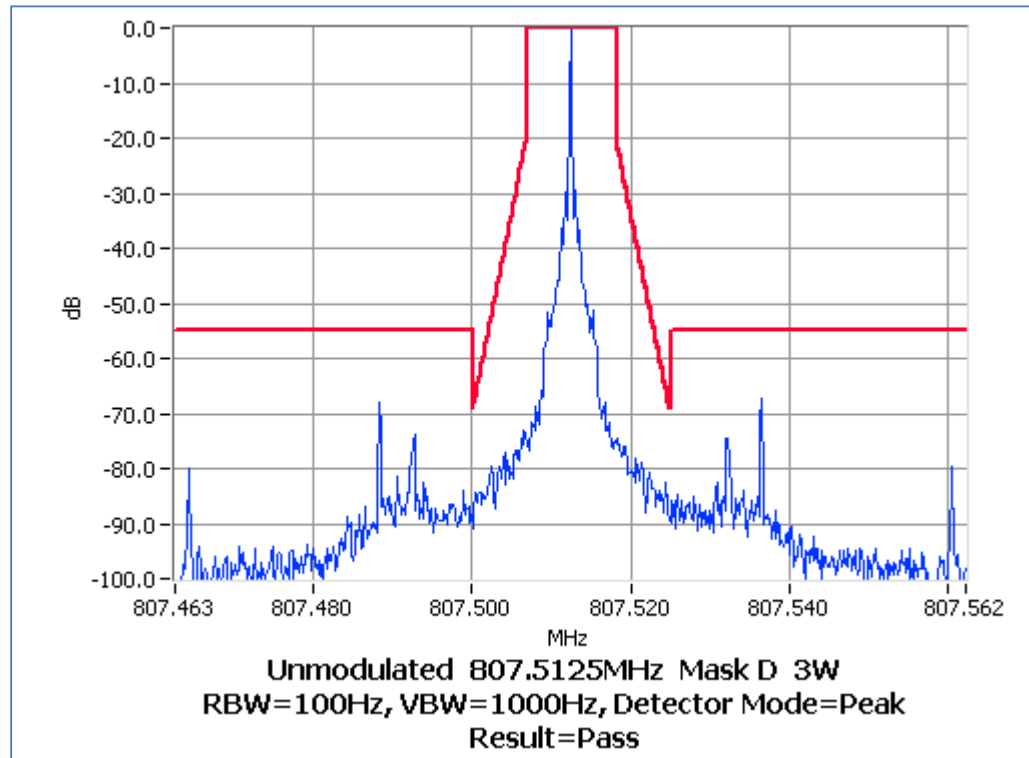
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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

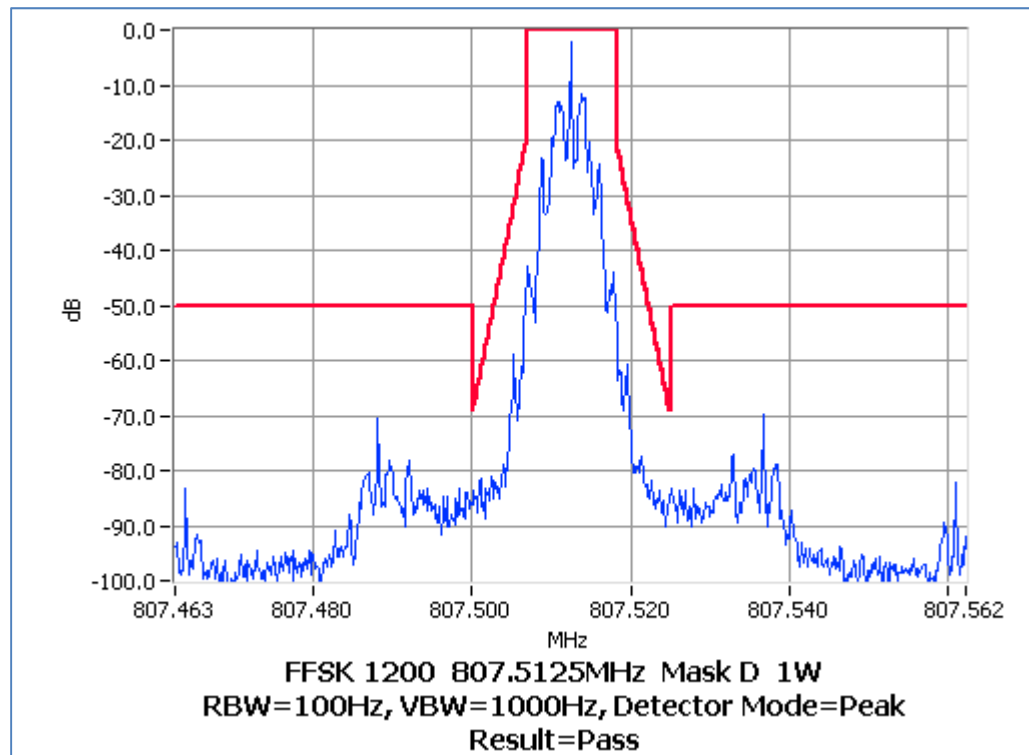
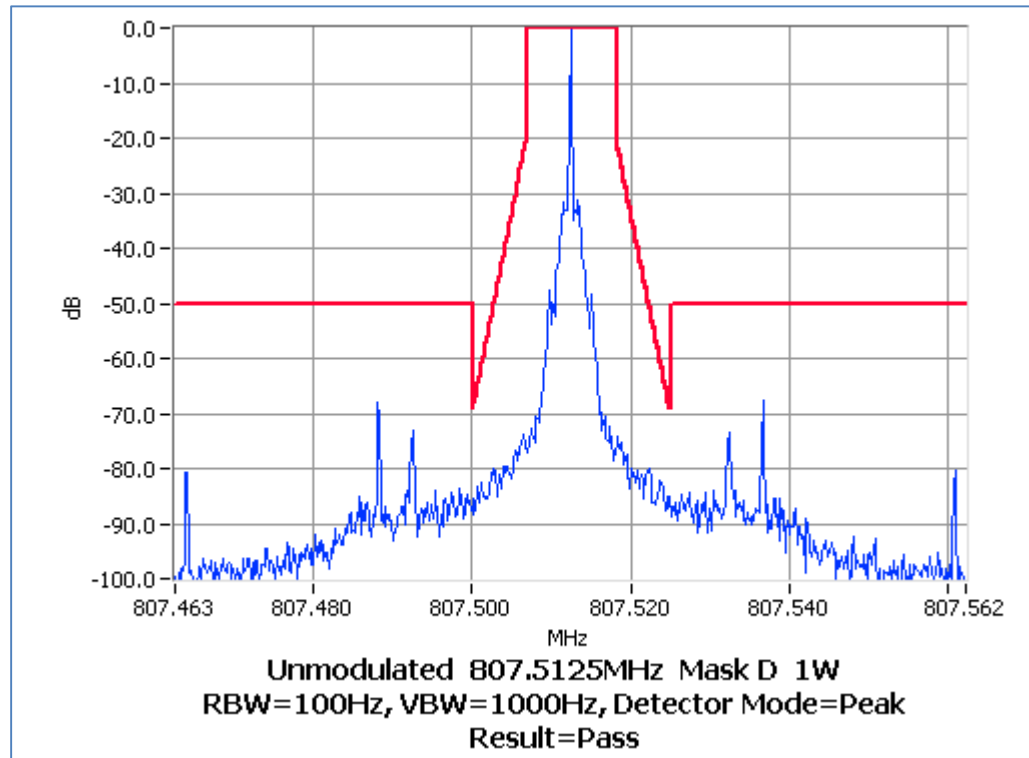
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Tx FREQUENCY: 807.5125 MHz 3 W 12.5 kHz Channel Spacing



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Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

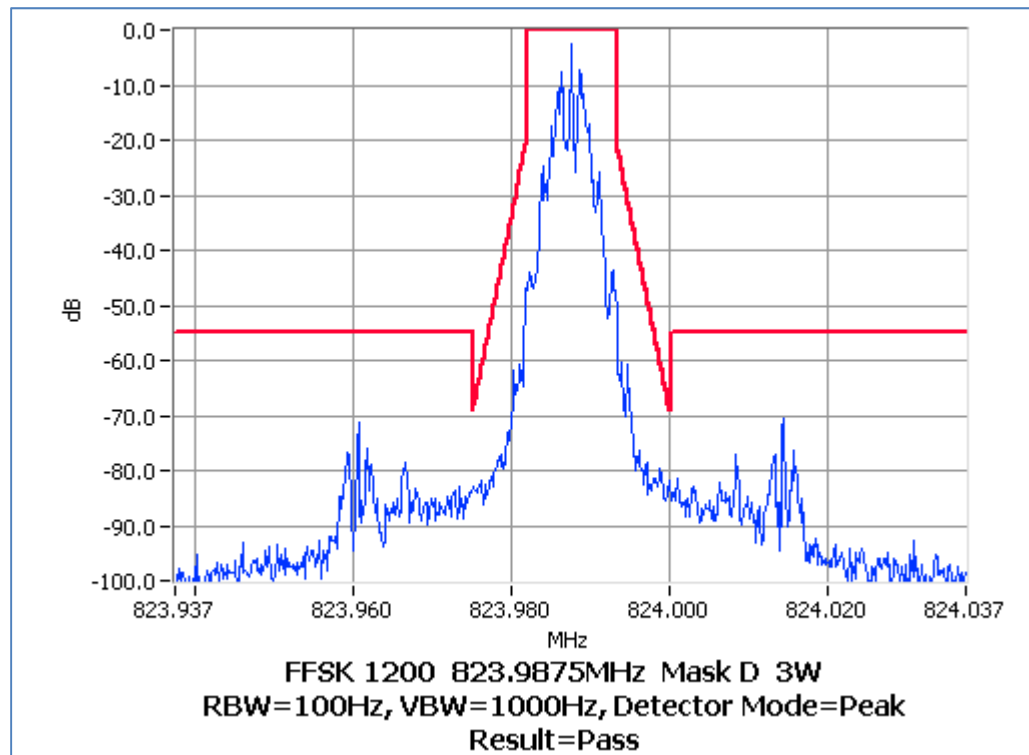
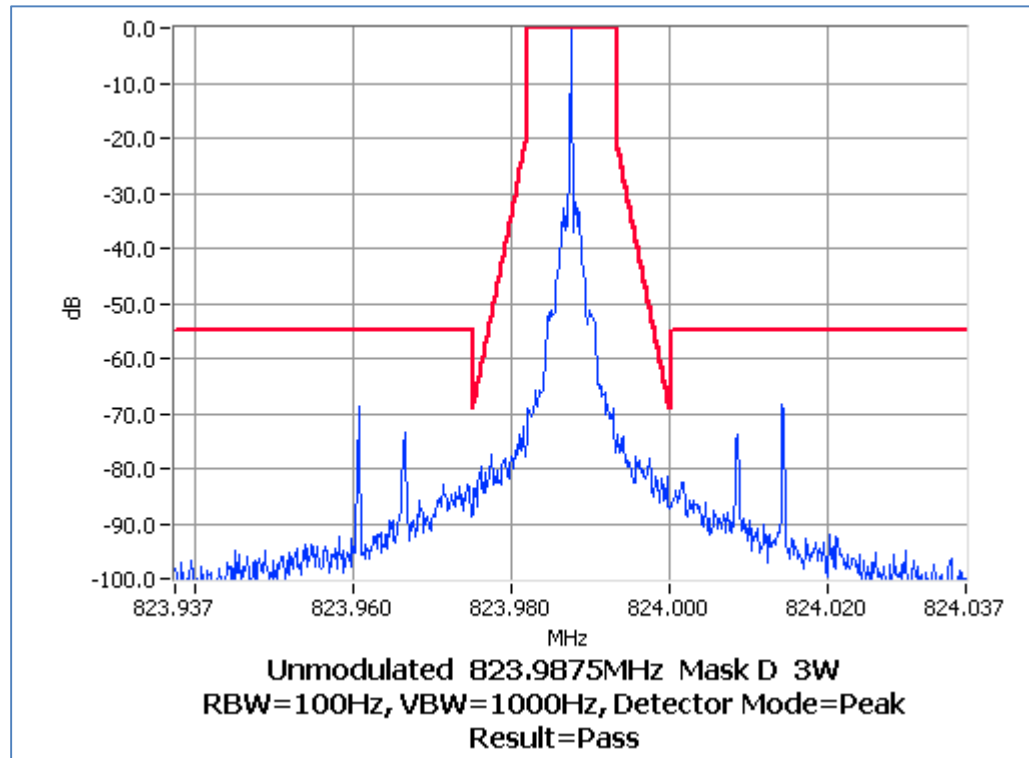
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Tx FREQUENCY: 807.5125 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
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FFSK – 1200 bps

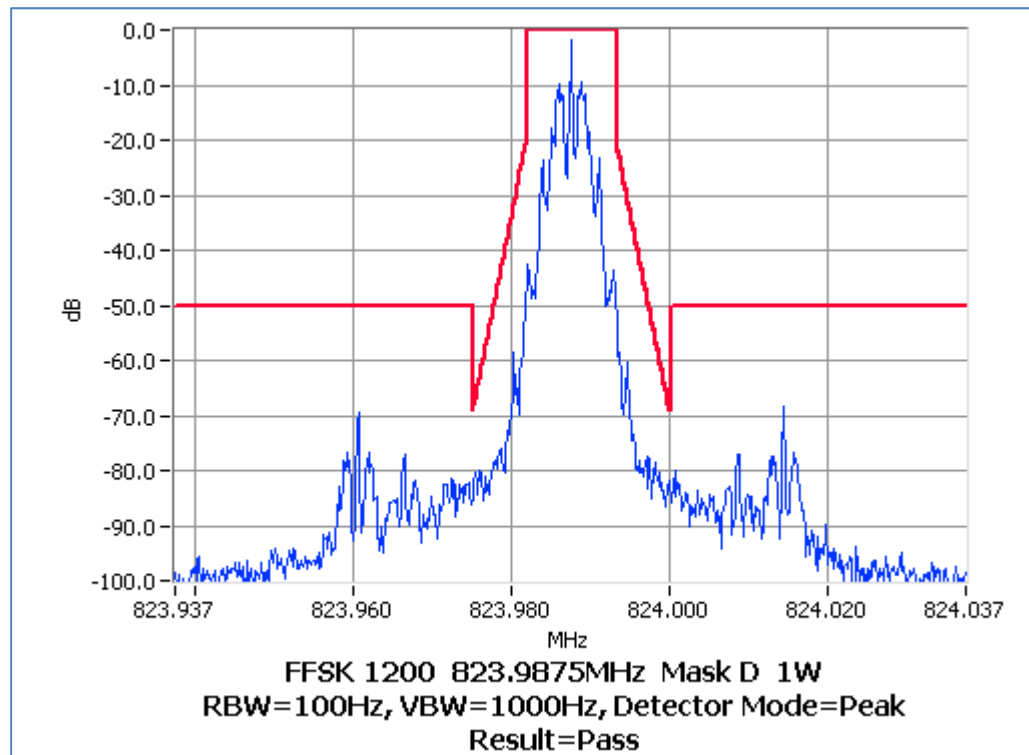
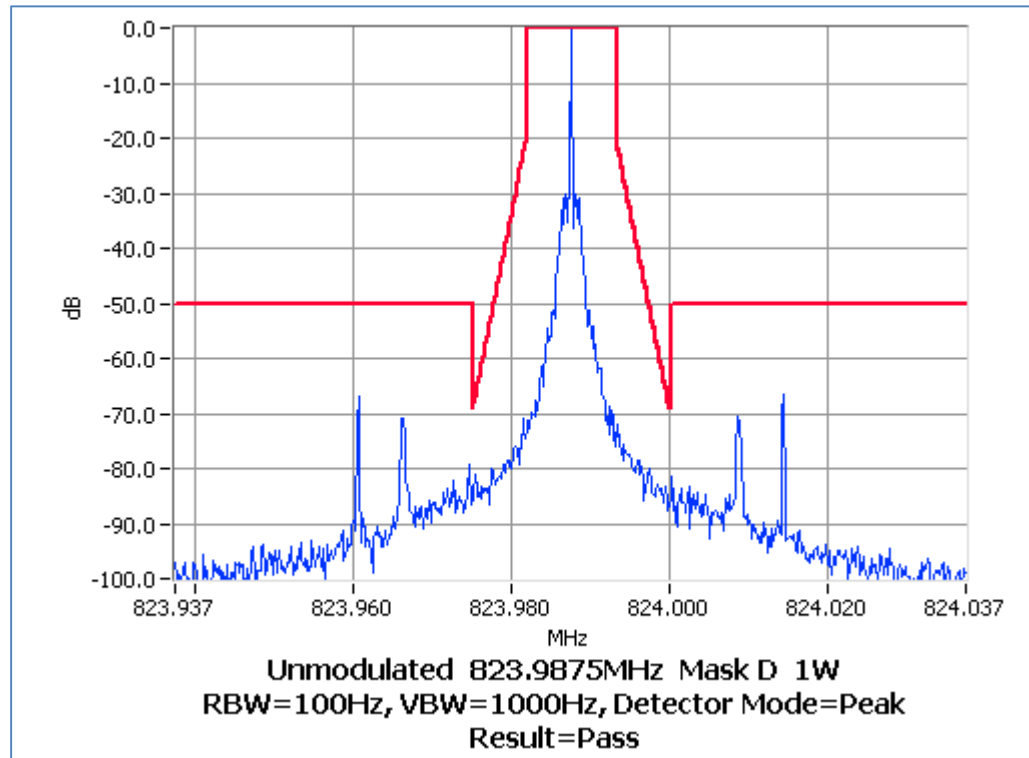
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Tx FREQUENCY:	823.9875 MHz	3 W	12.5 kHz Channel Spacing



TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

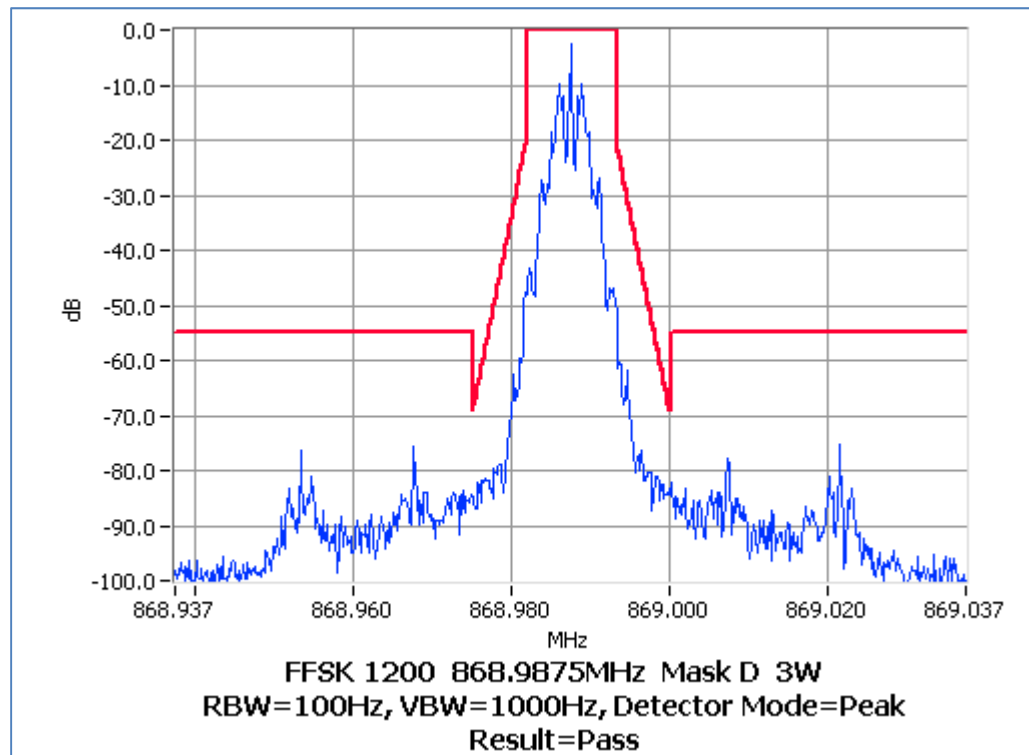
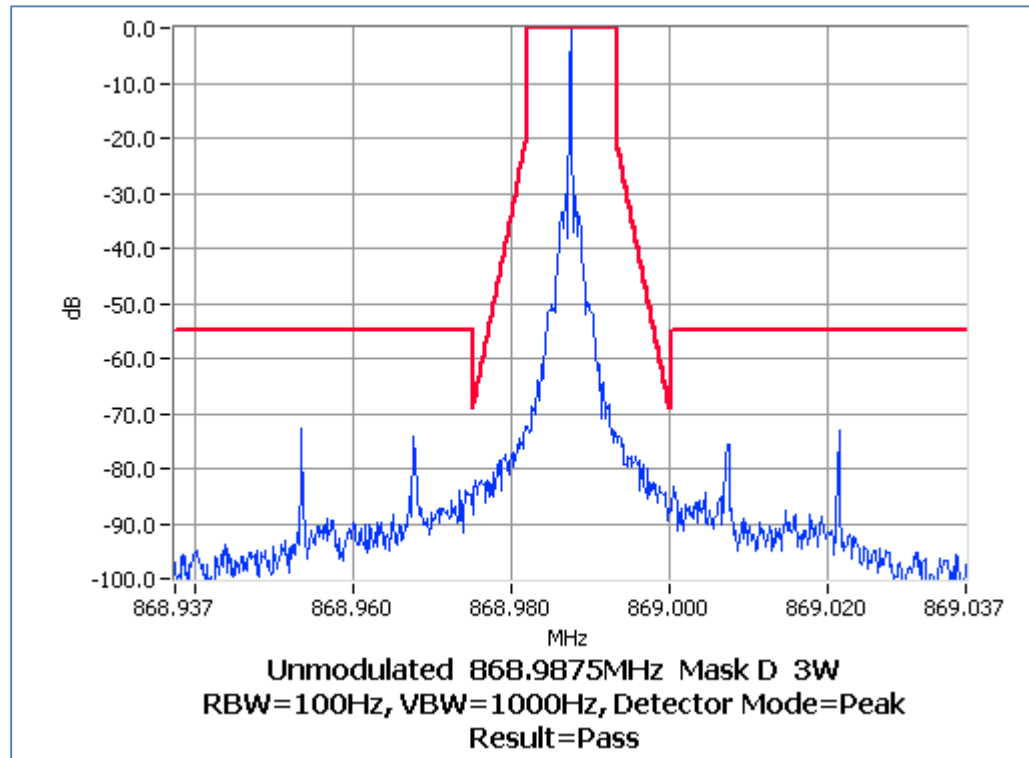
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Tx FREQUENCY: 823.9875 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

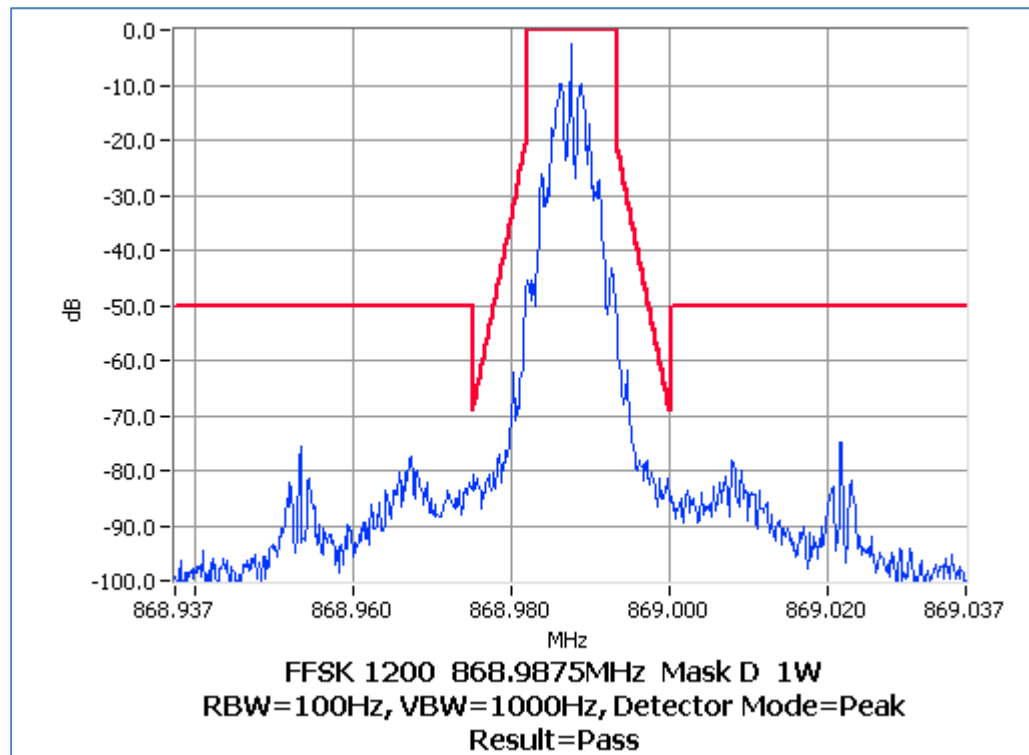
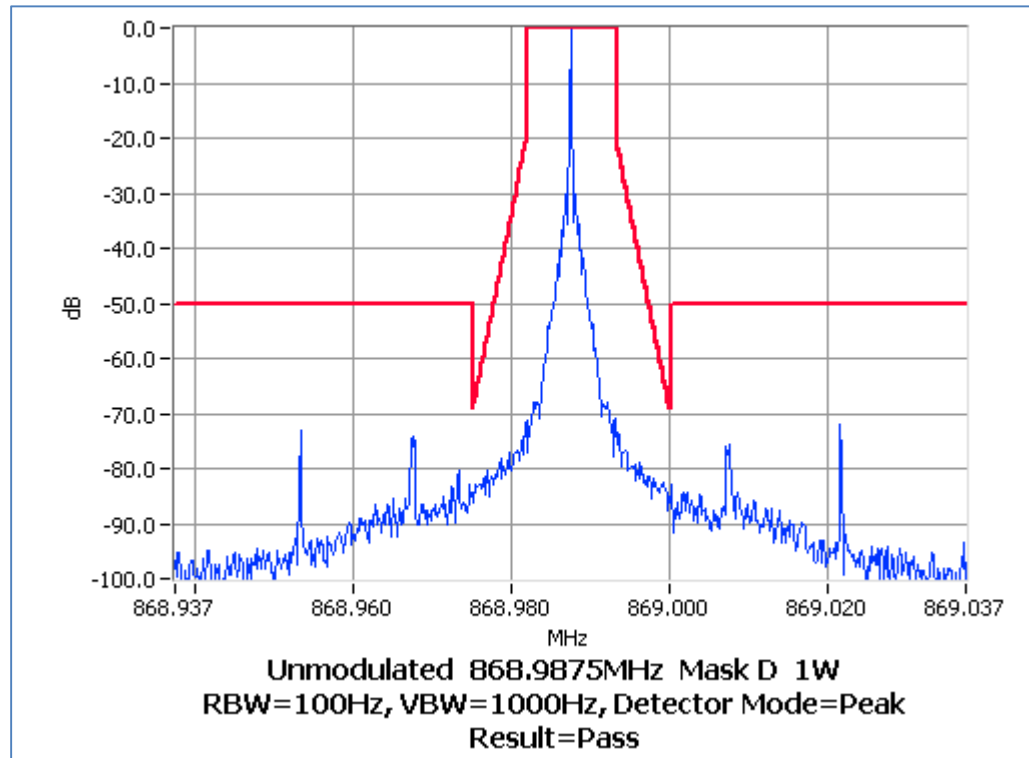
SPECIFICATION:	FCC CFR 2.1049 (c)	RSS-119	5.5
Tx FREQUENCY:	868.9875 MHz	3 W	12.5 kHz Channel Spacing



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Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

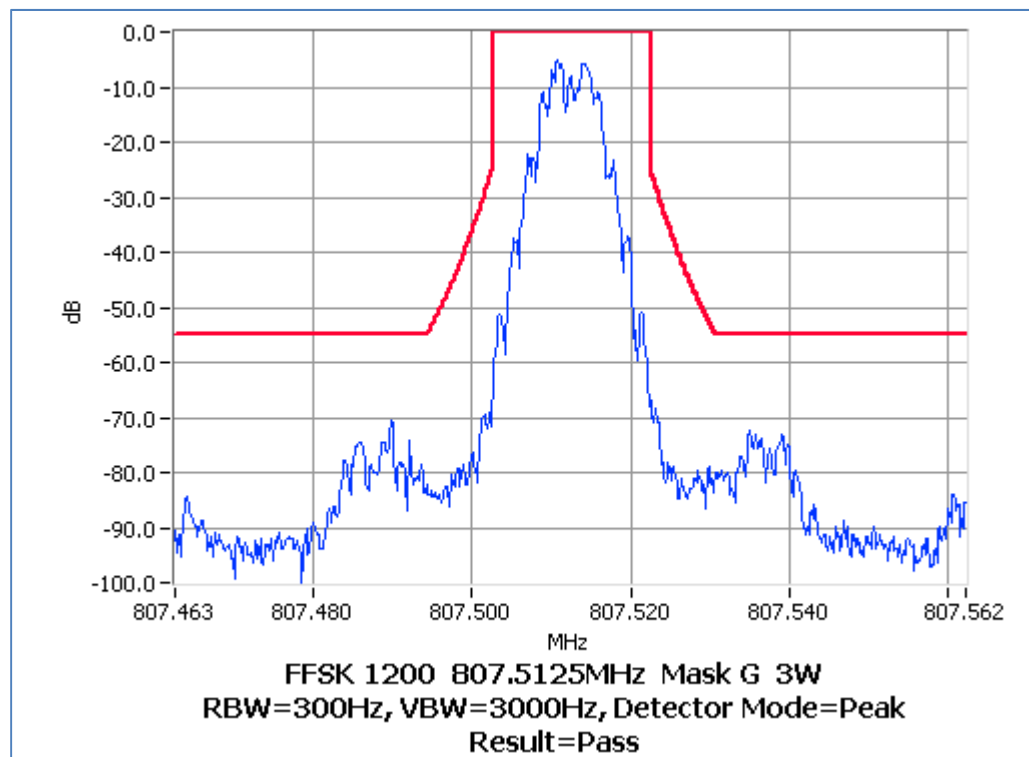
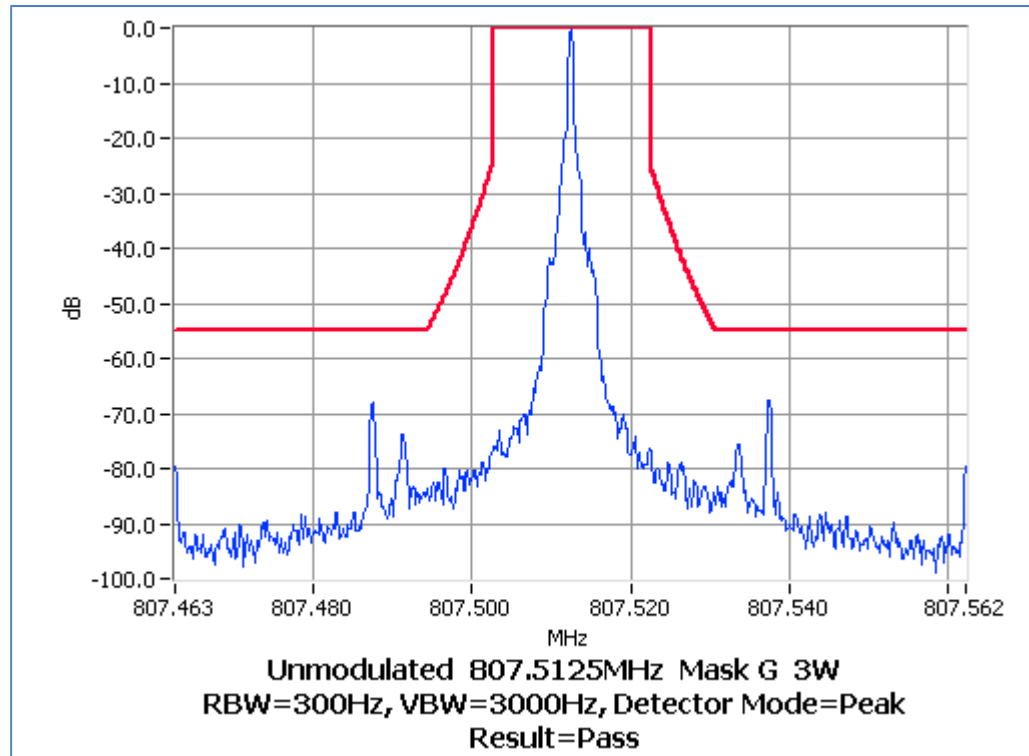
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Tait Communications
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FFSK – 1200 bps

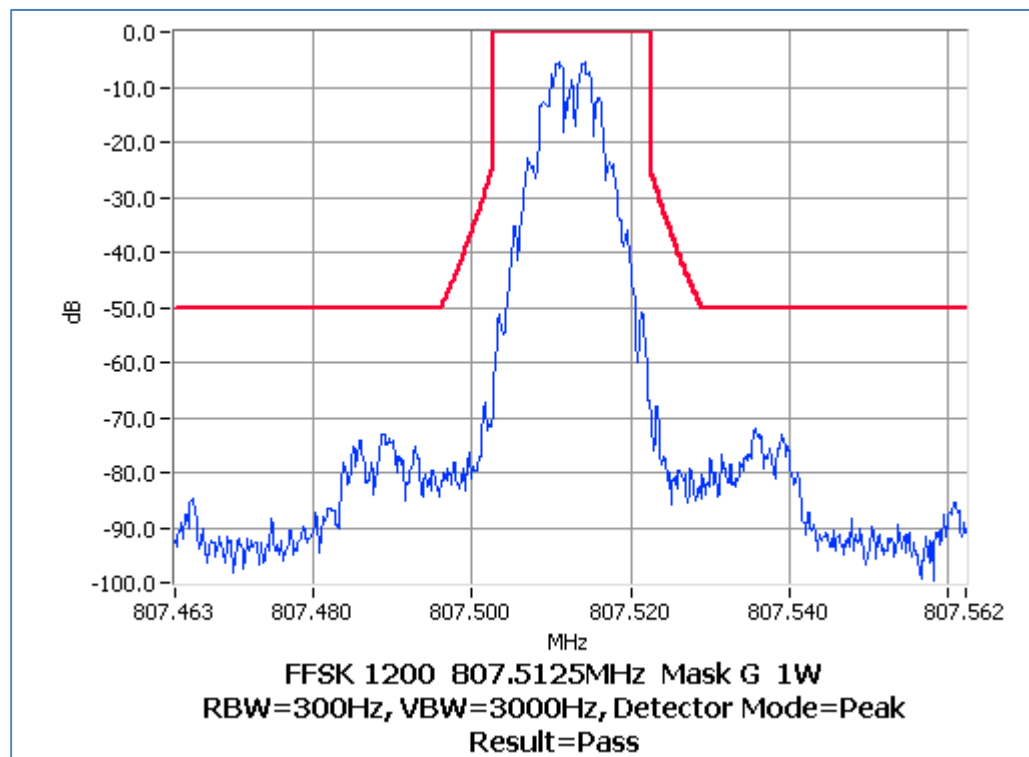
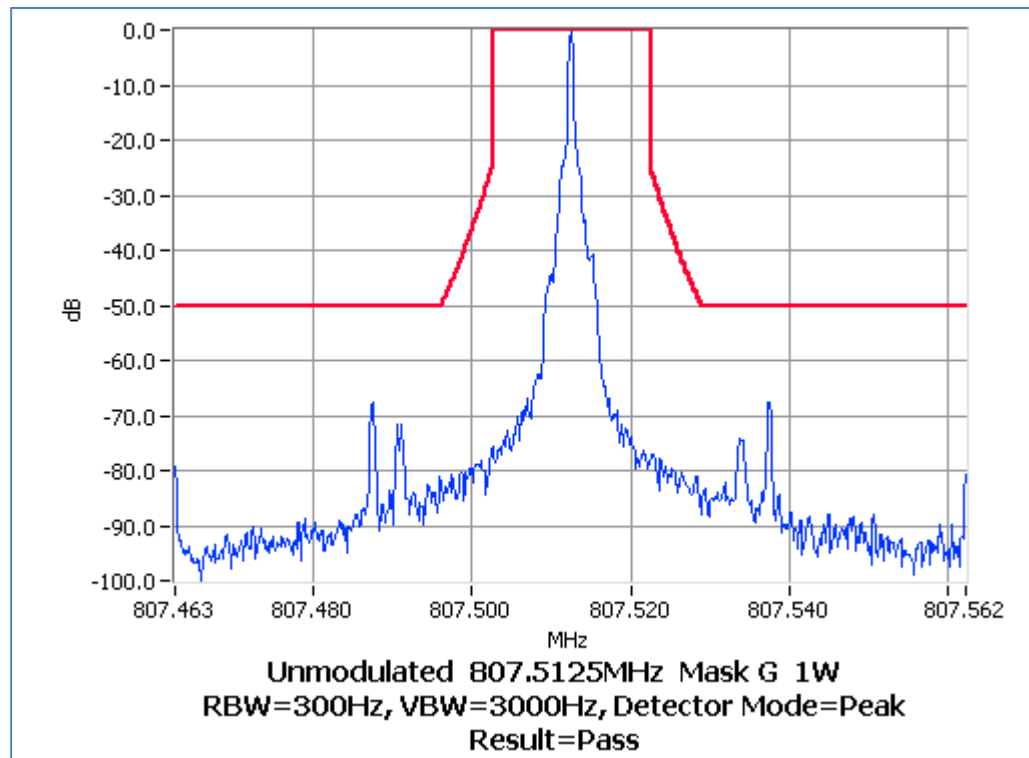
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 3 W 25.0 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

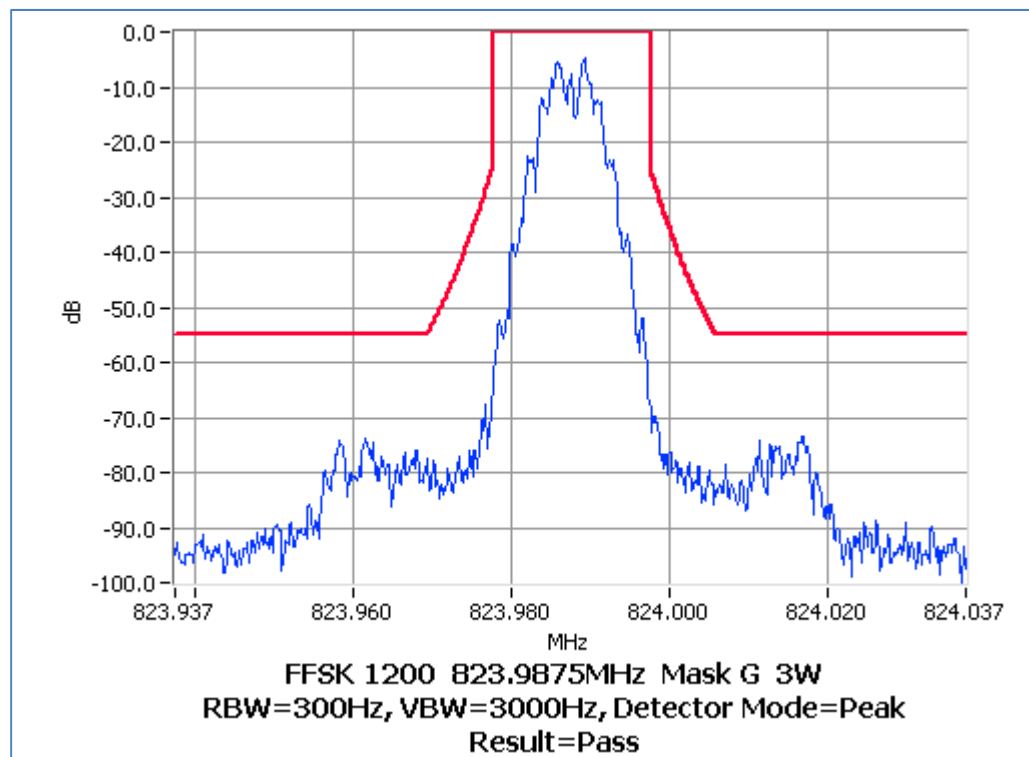
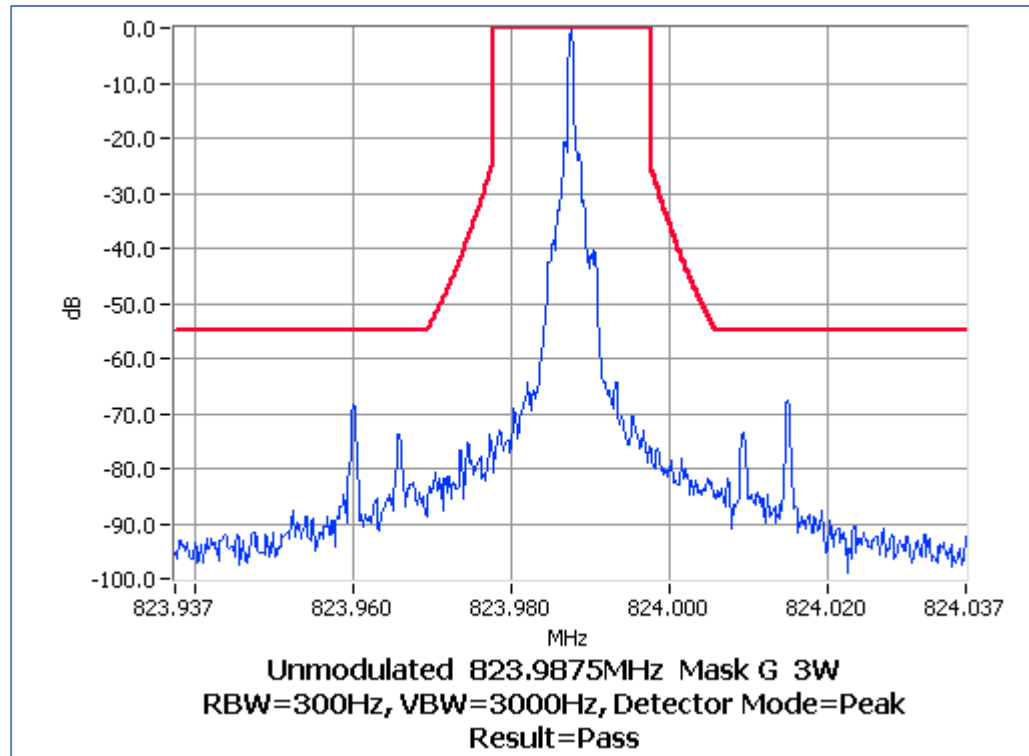
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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

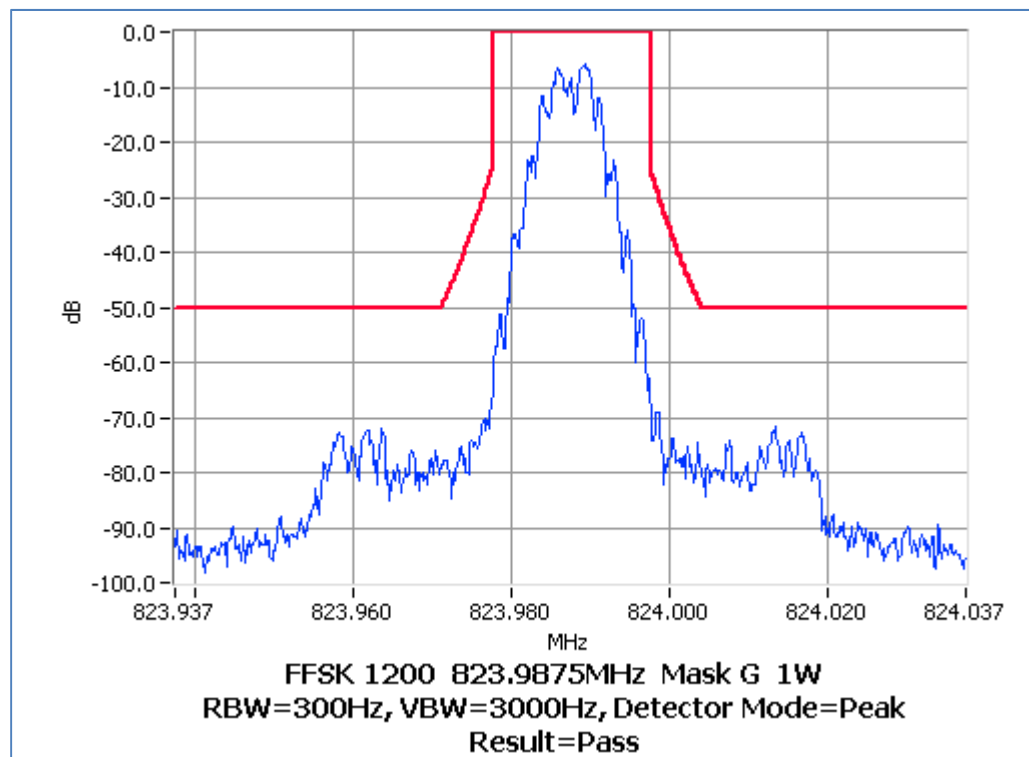
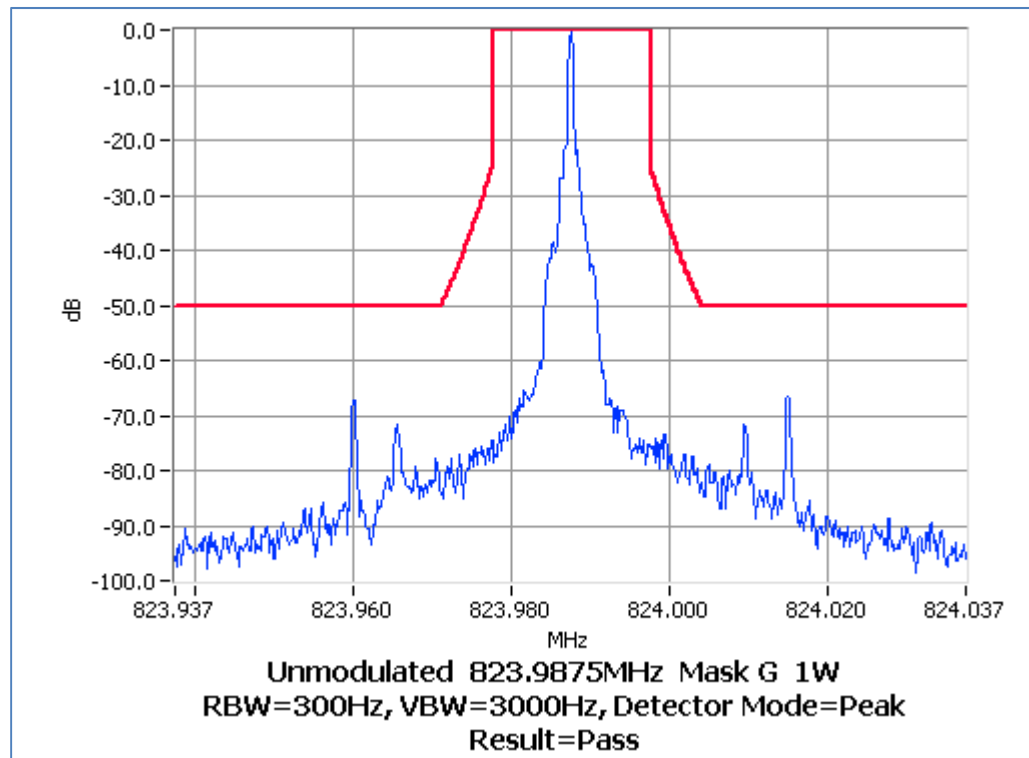
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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

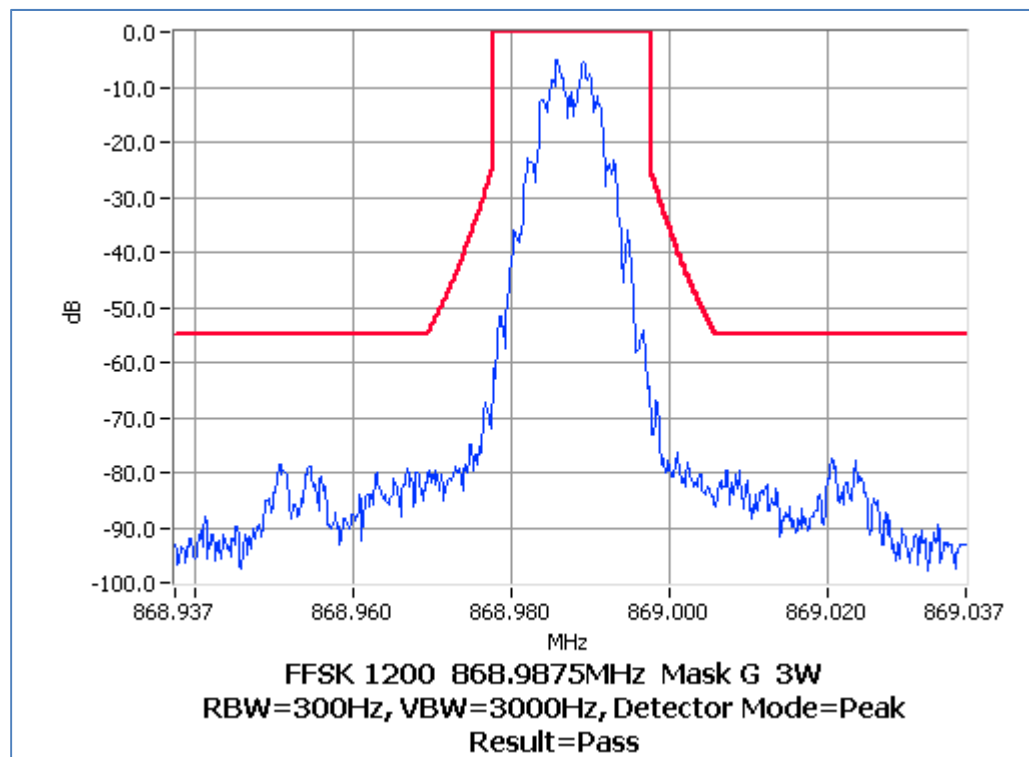
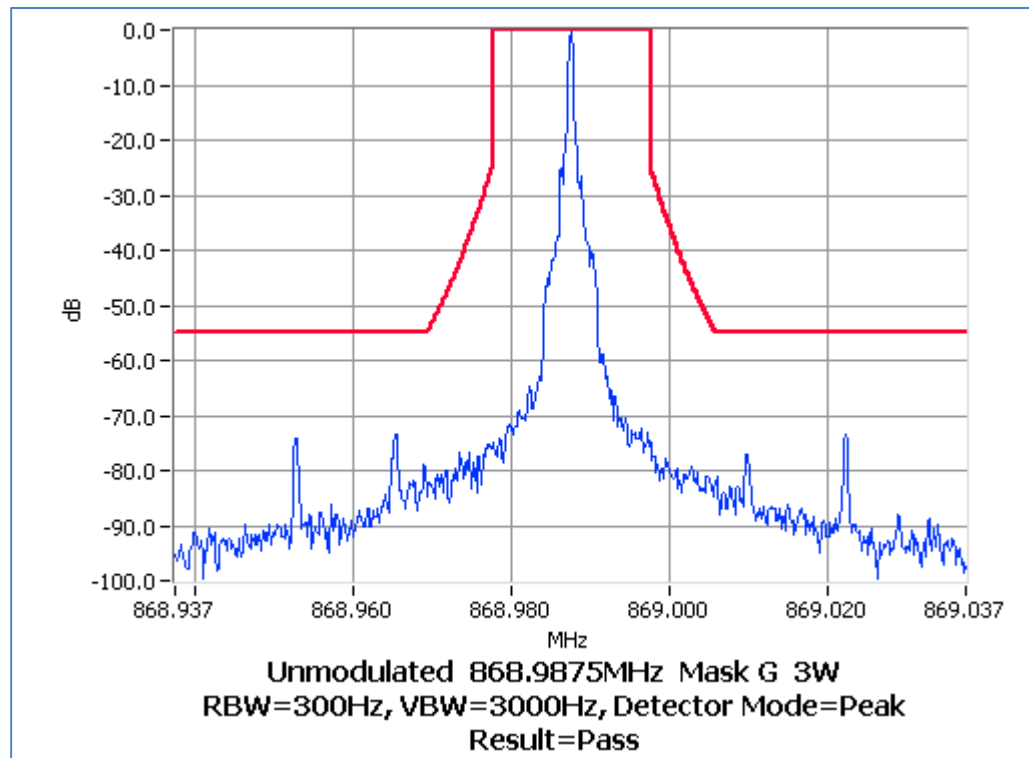
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FFSK – 1200 bps

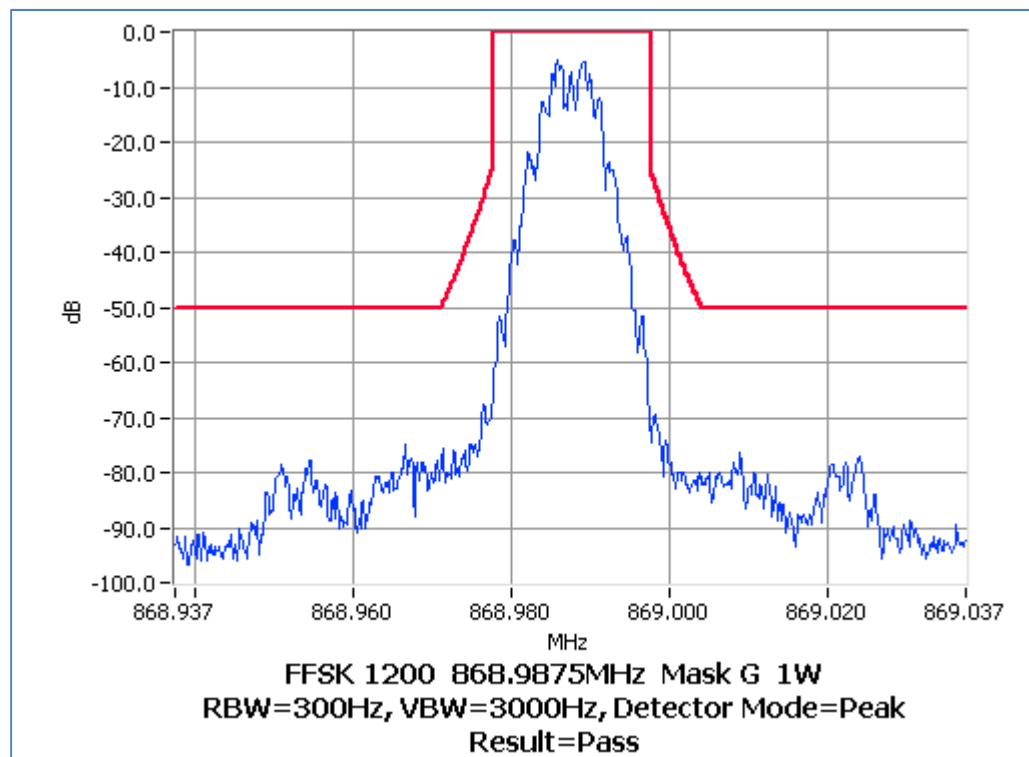
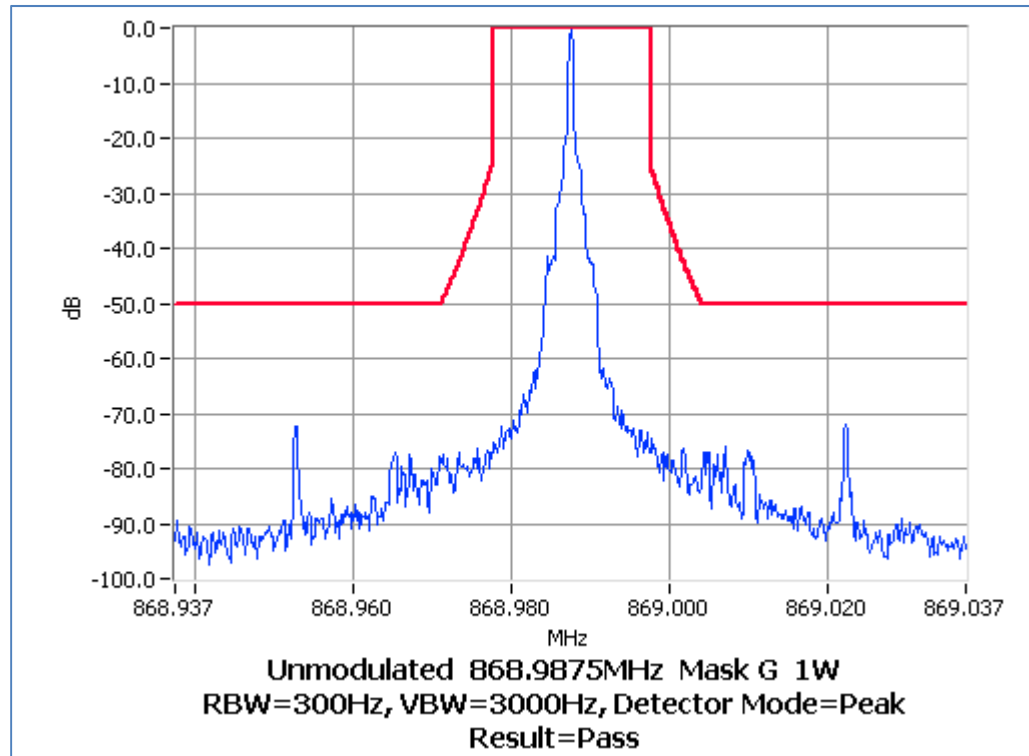
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Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

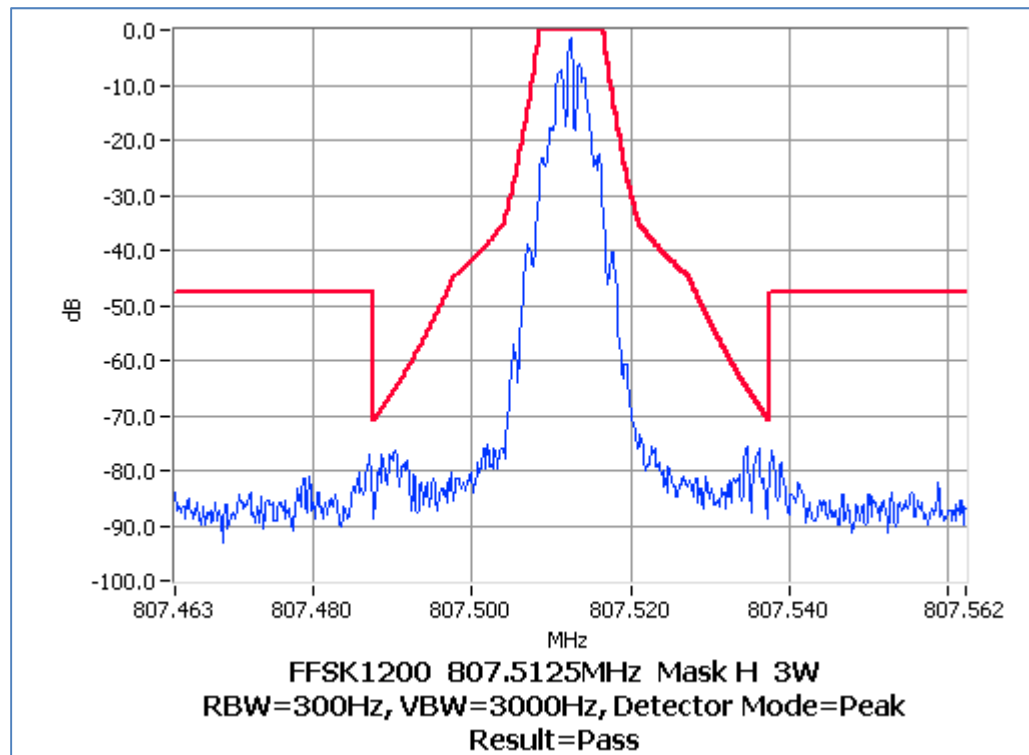
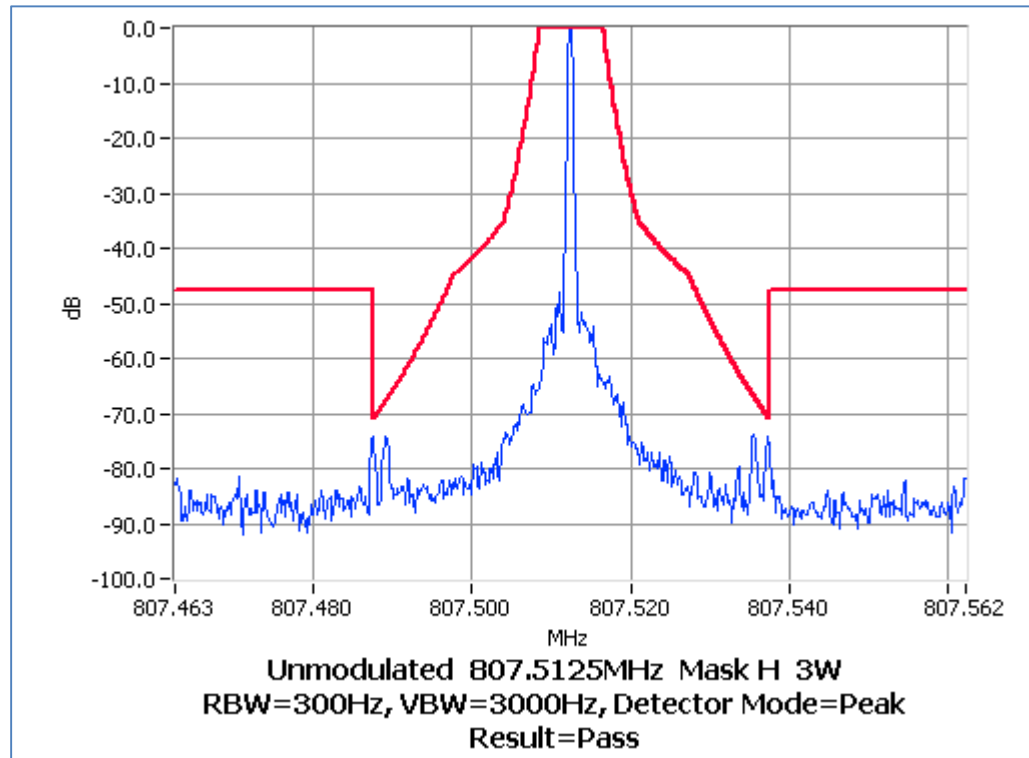
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FFSK – 1200 bps

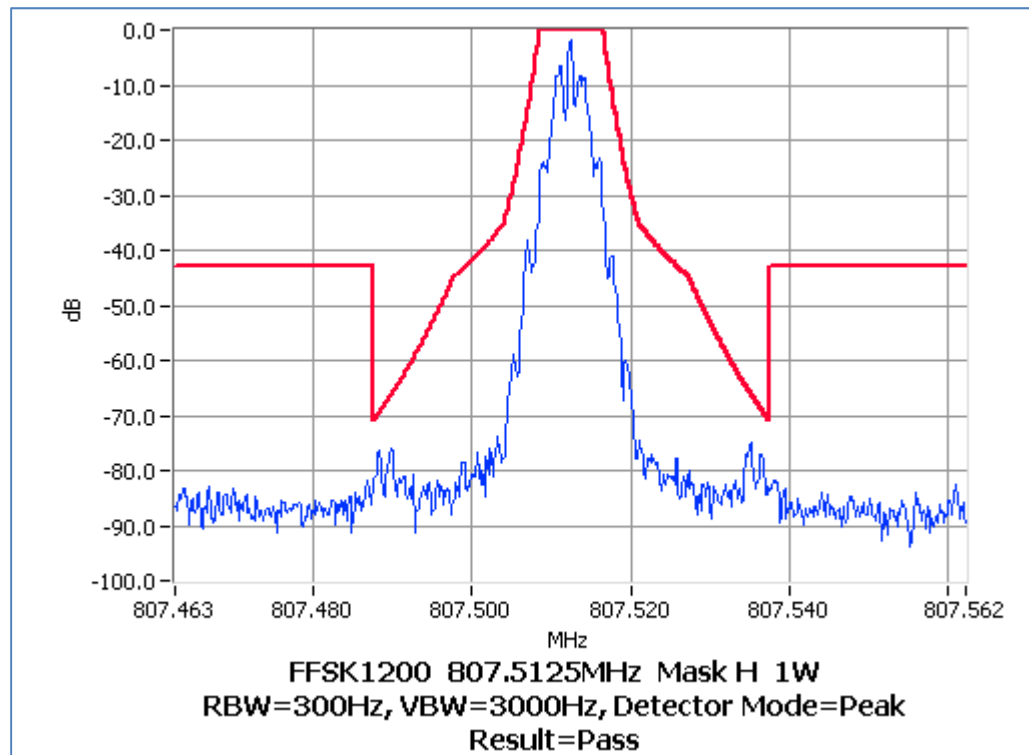
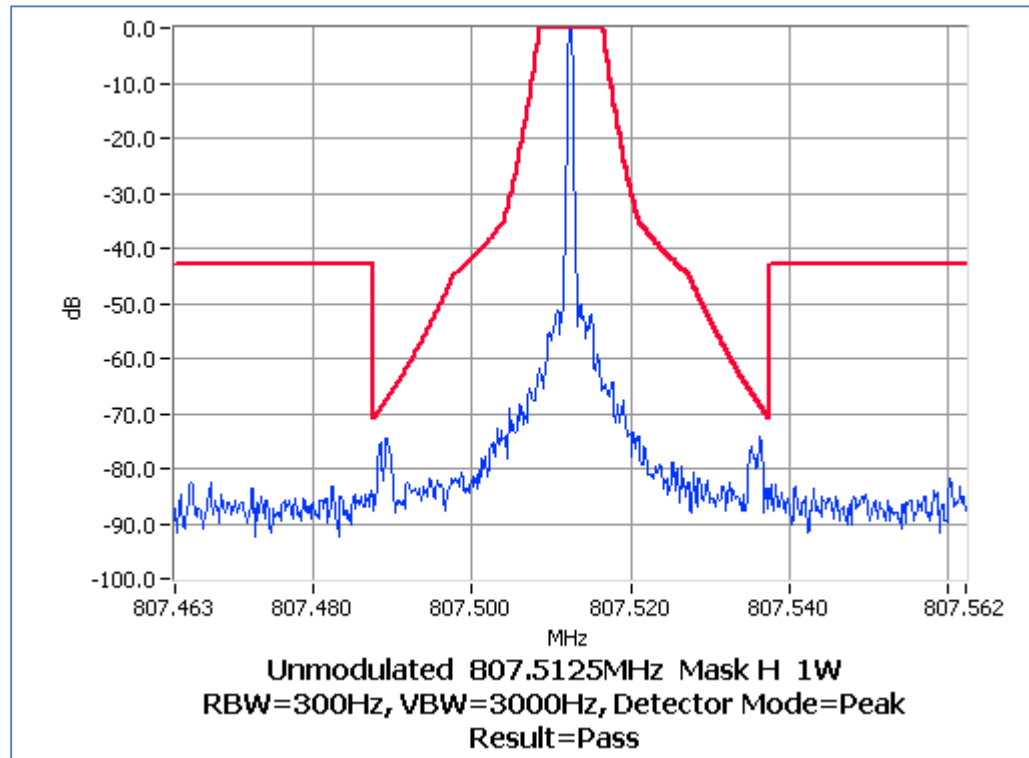
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 3 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 1200 bps

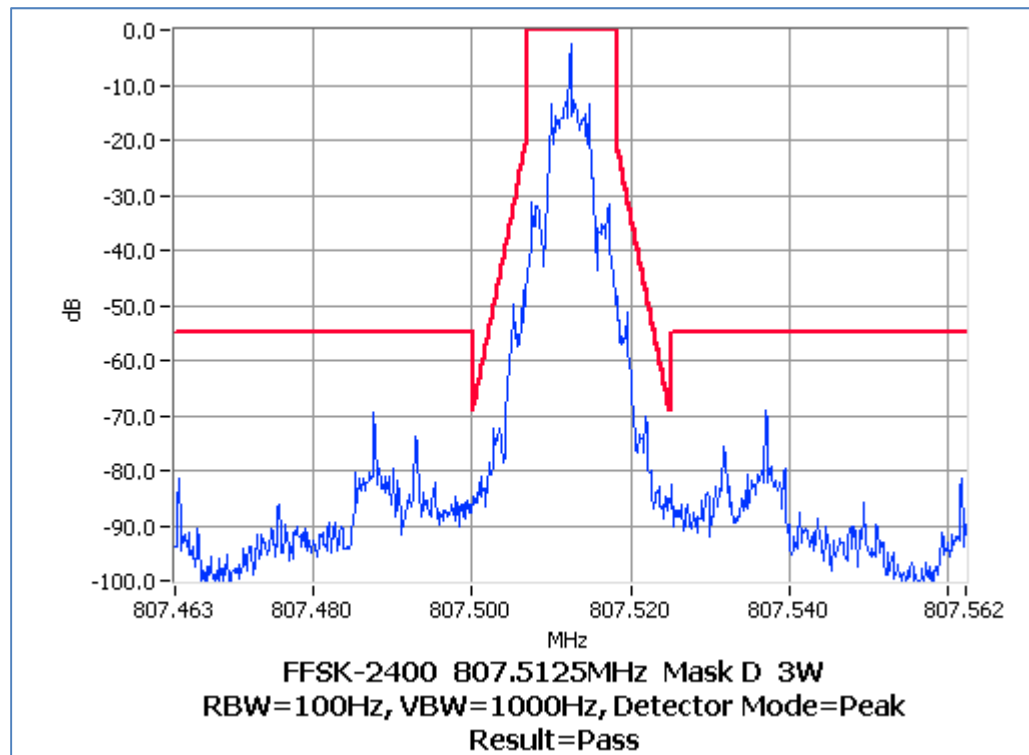
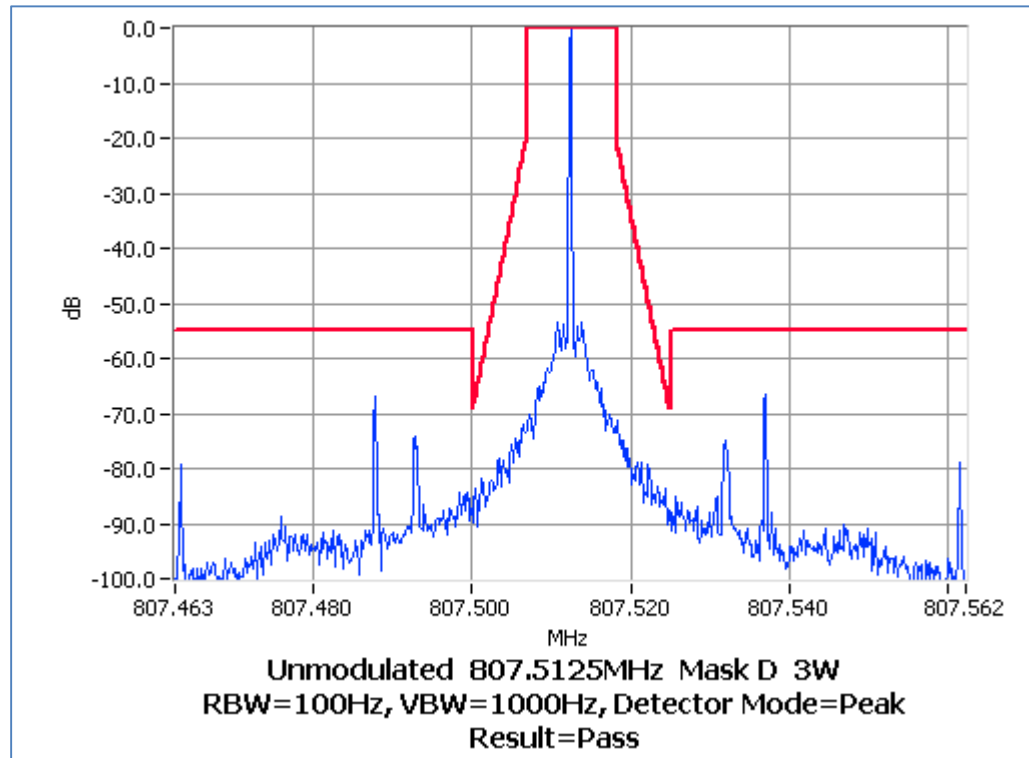
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Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

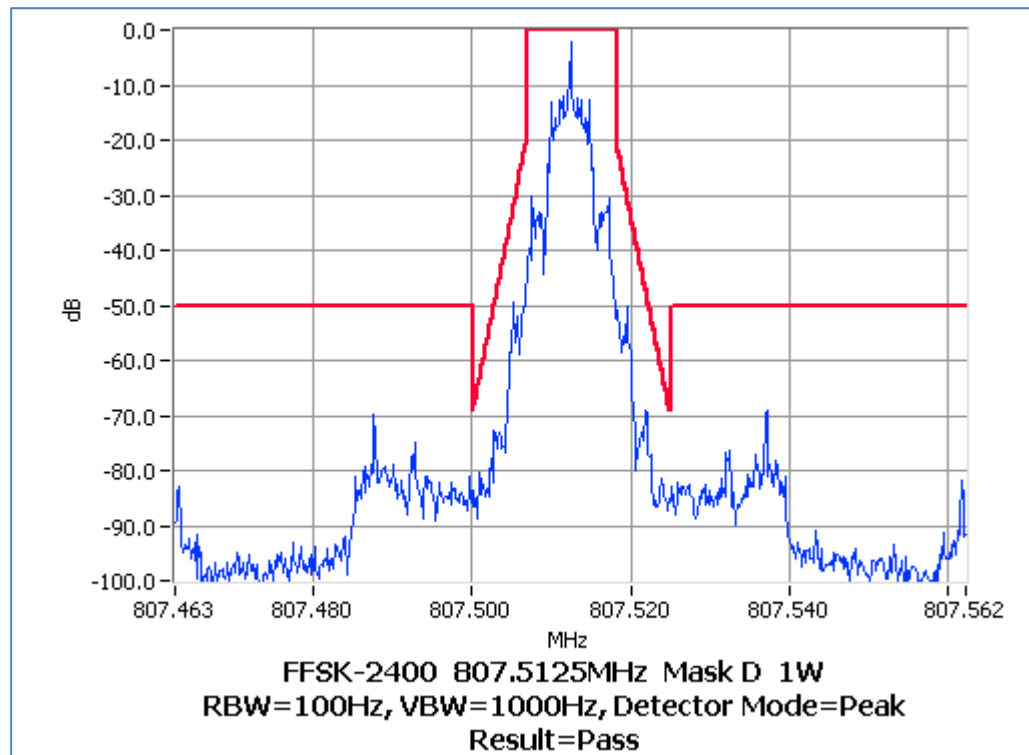
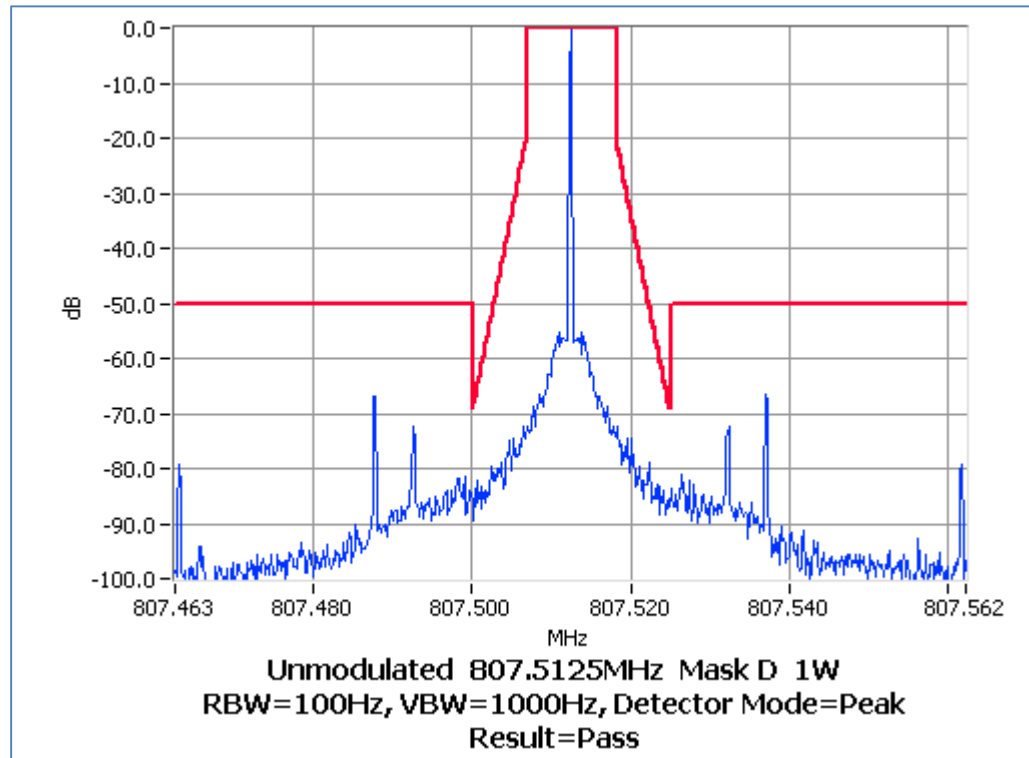
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Tx FREQUENCY: 807.5125 MHz 3 W 12.5 kHz Channel Spacing



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Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

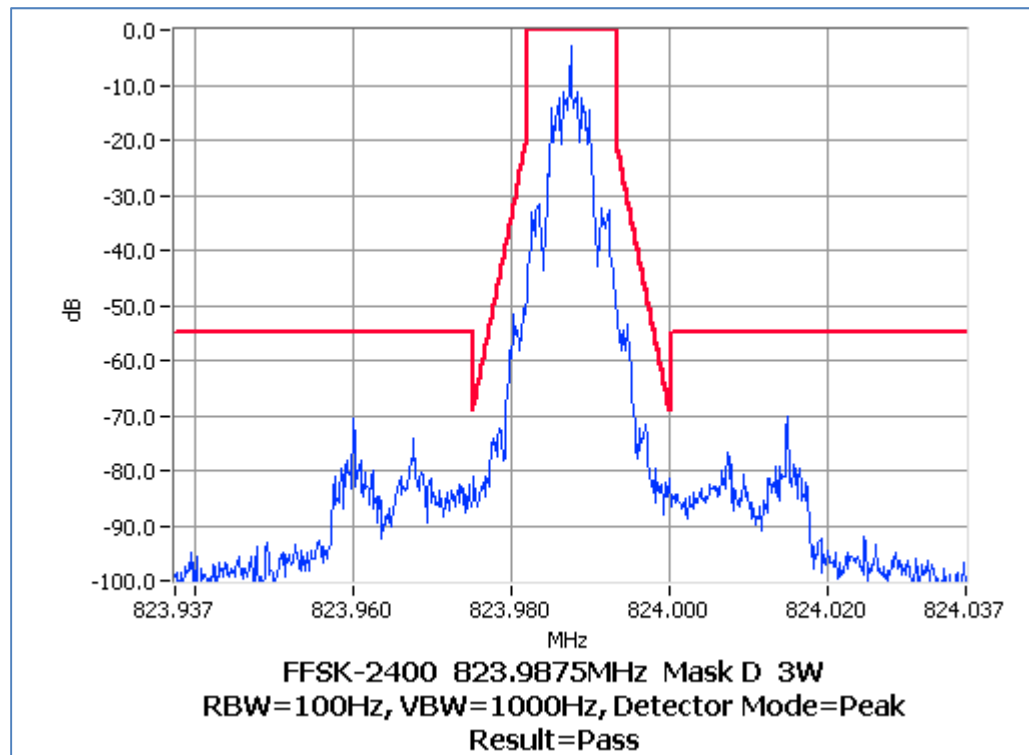
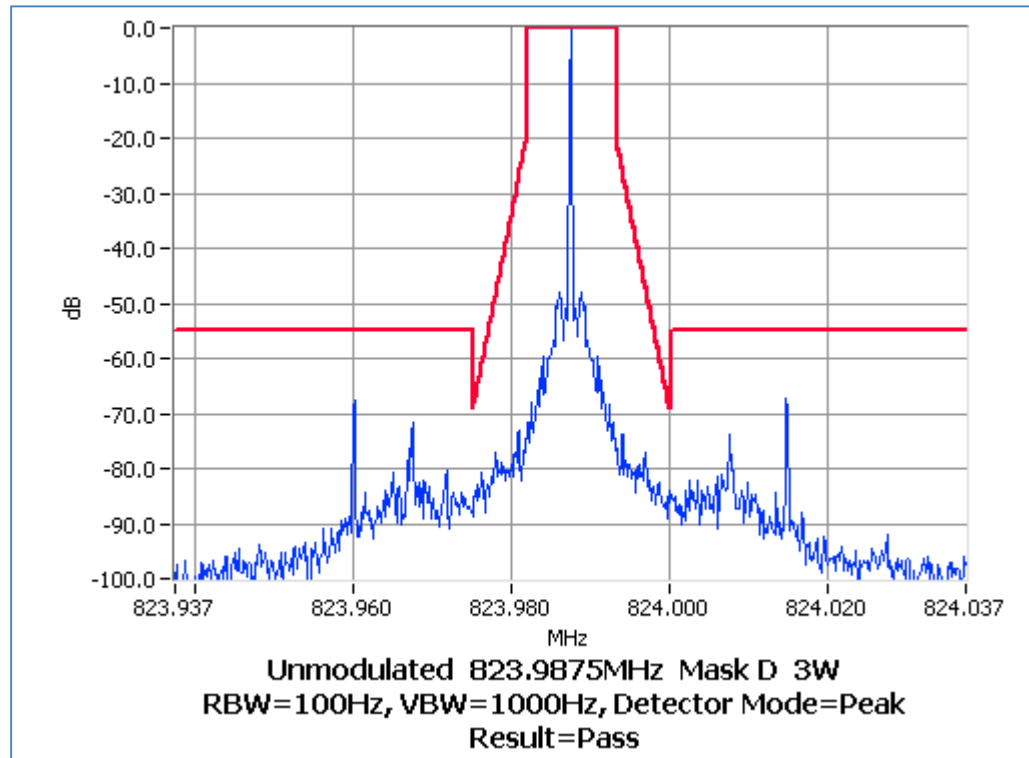
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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

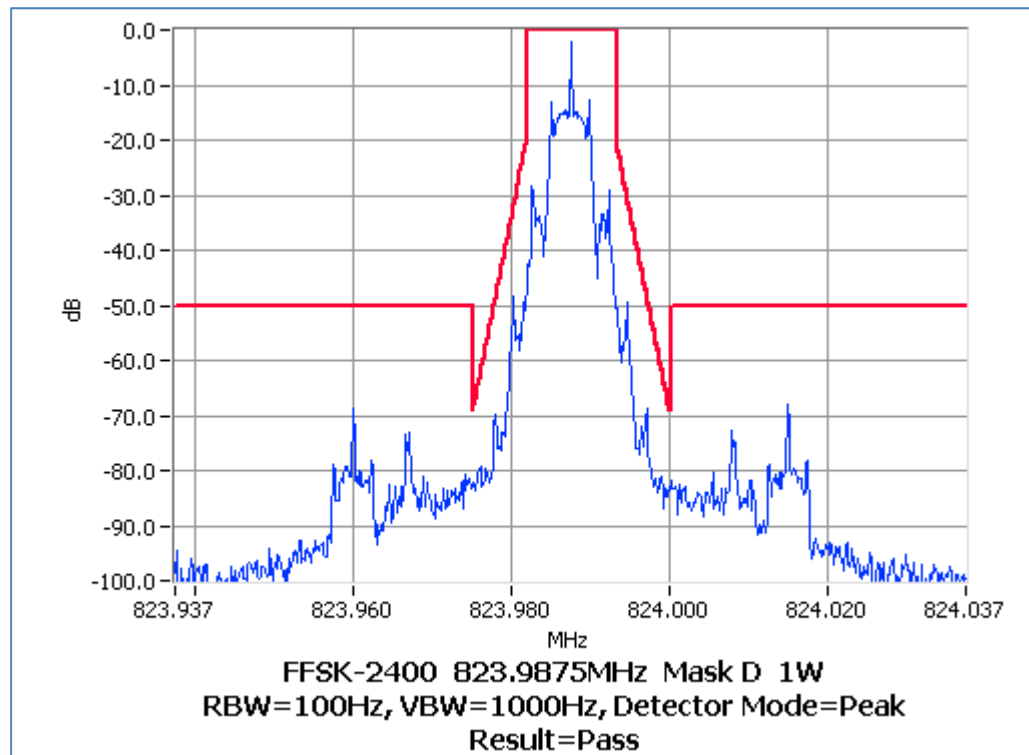
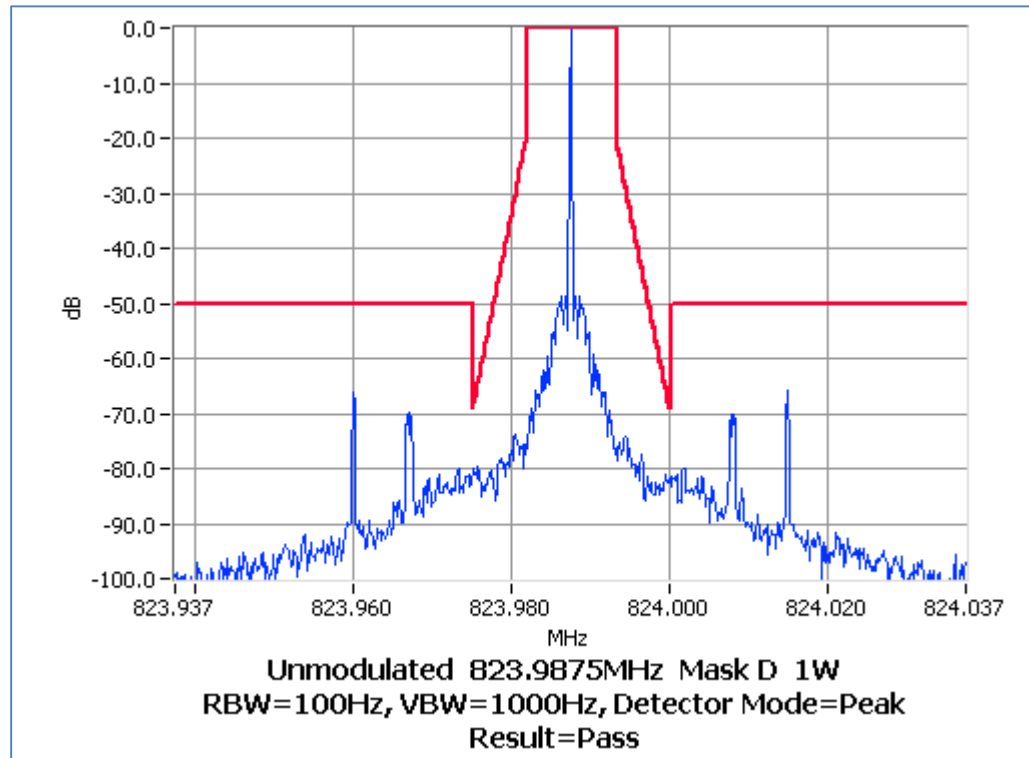
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Tx FREQUENCY: 823.9875 MHz 3 W 12.5 kHz Channel Spacing



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Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

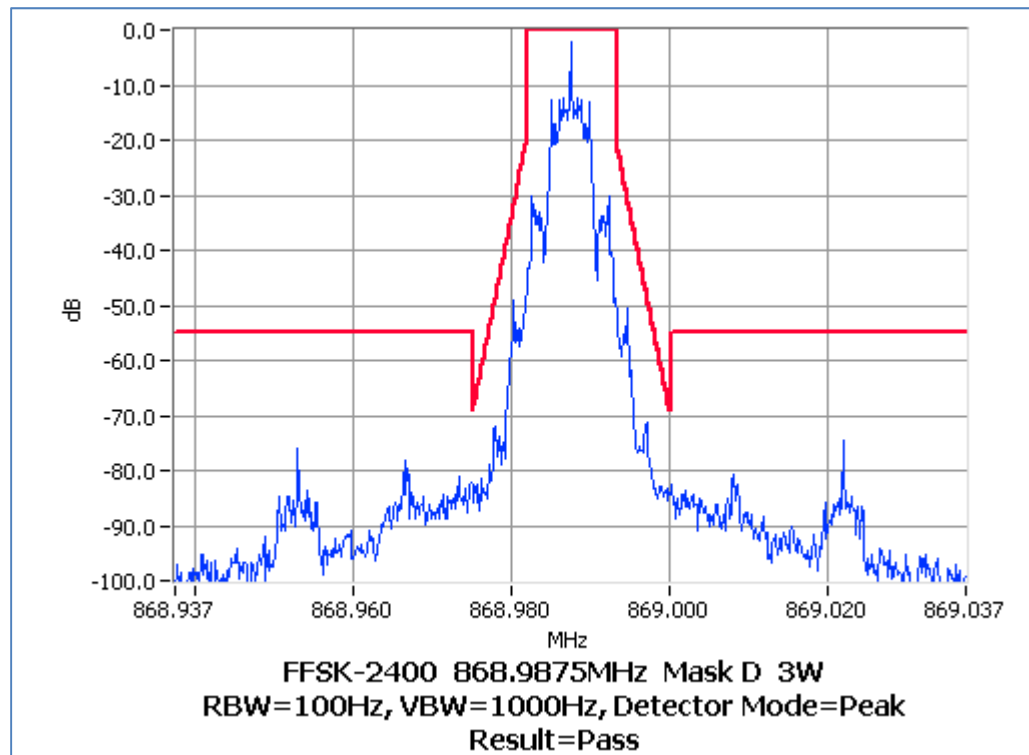
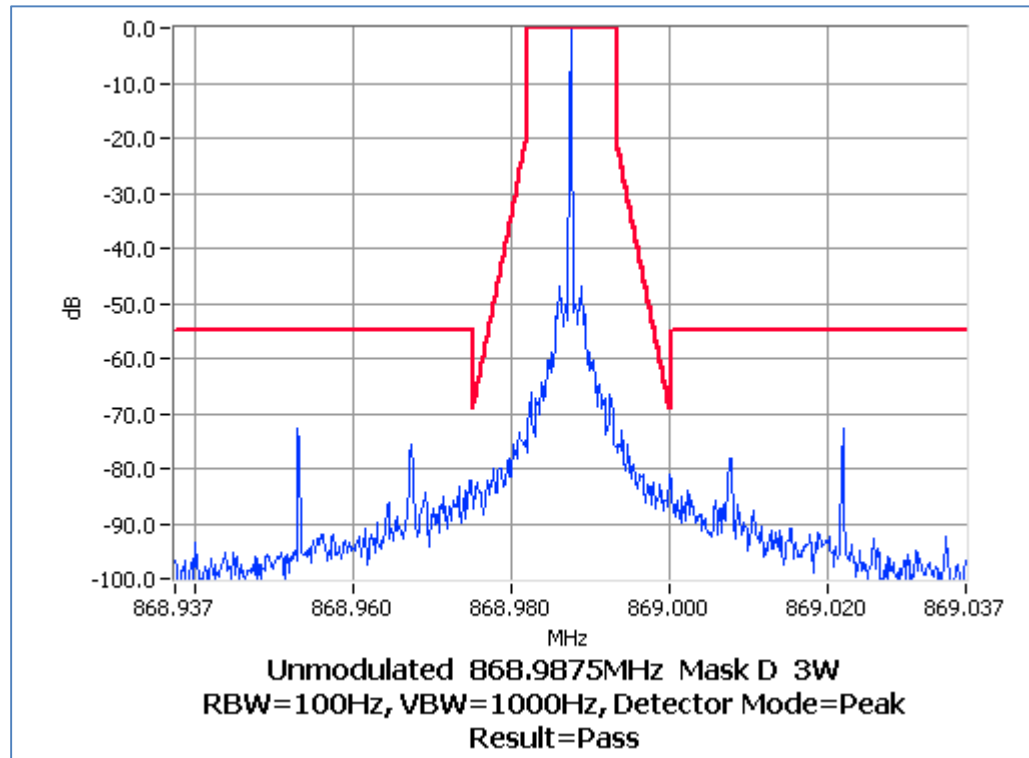
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Tx FREQUENCY: 823.9875 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

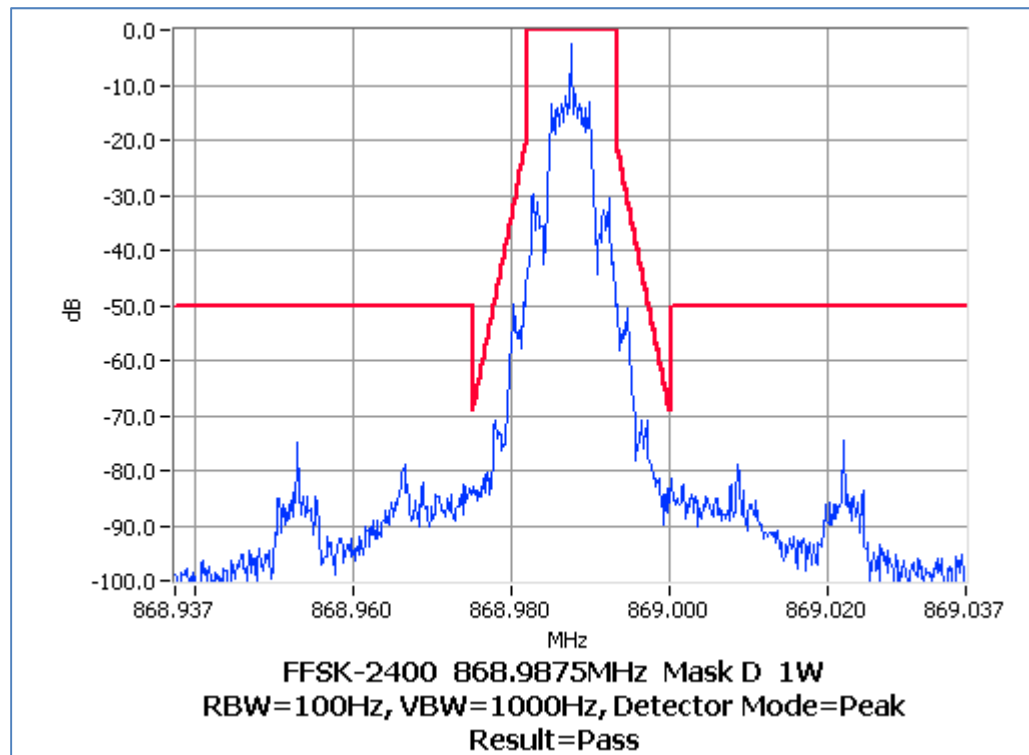
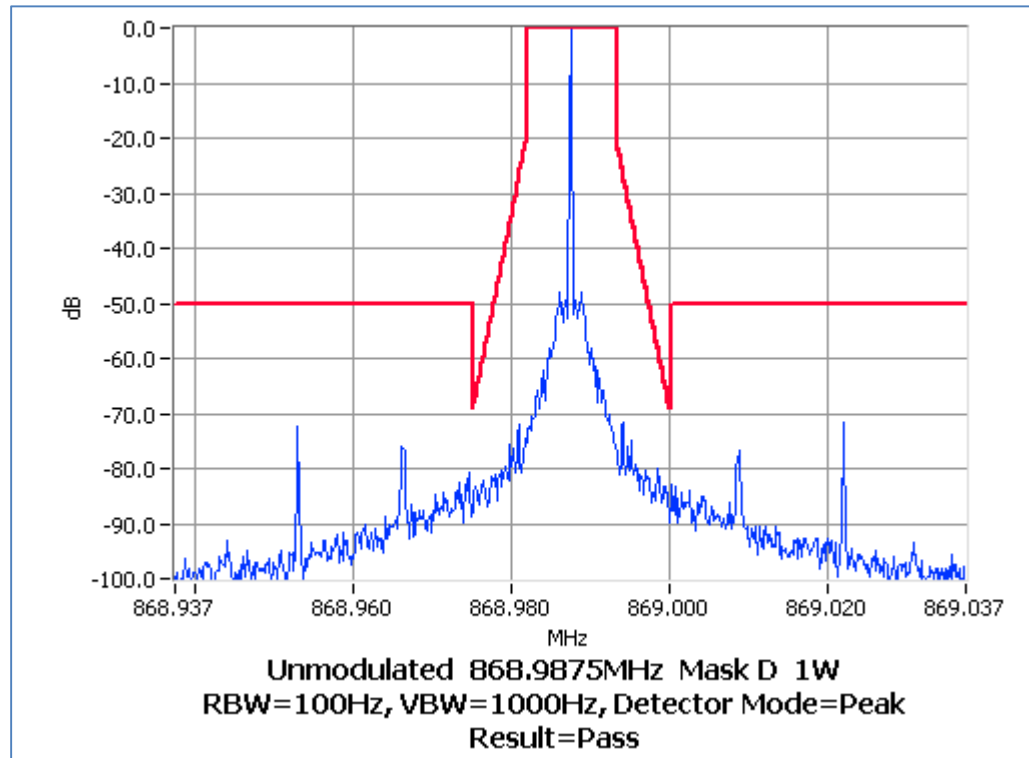
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Tx FREQUENCY: 868.9875 MHz 3 W 12.5 kHz Channel Spacing



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FFSK – 2400 bps

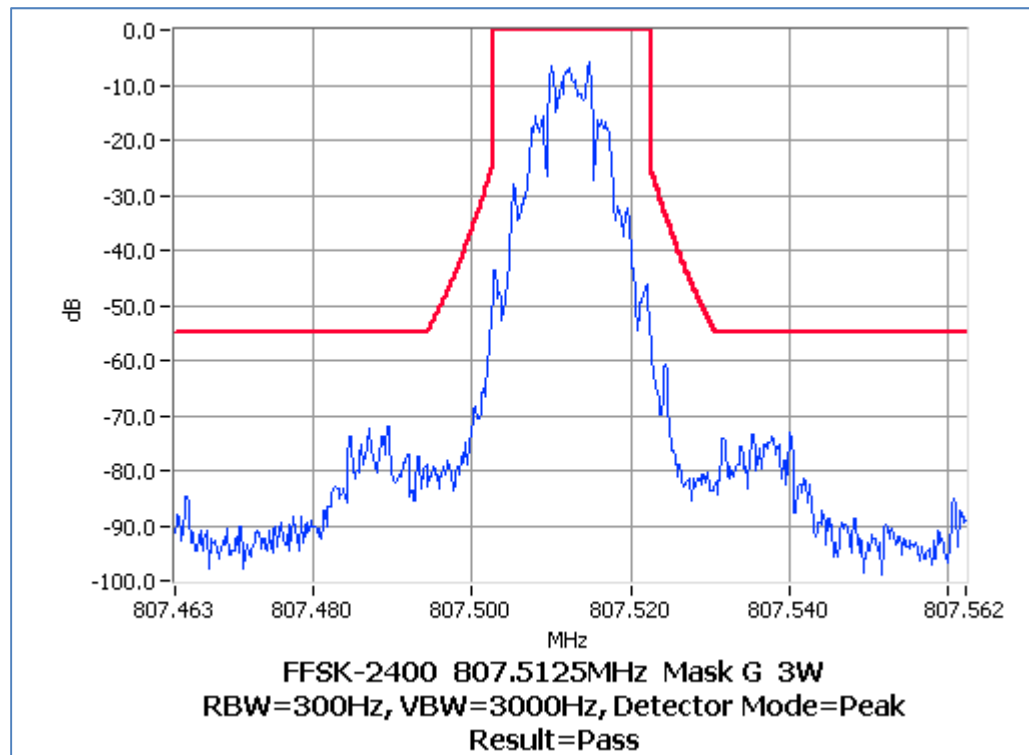
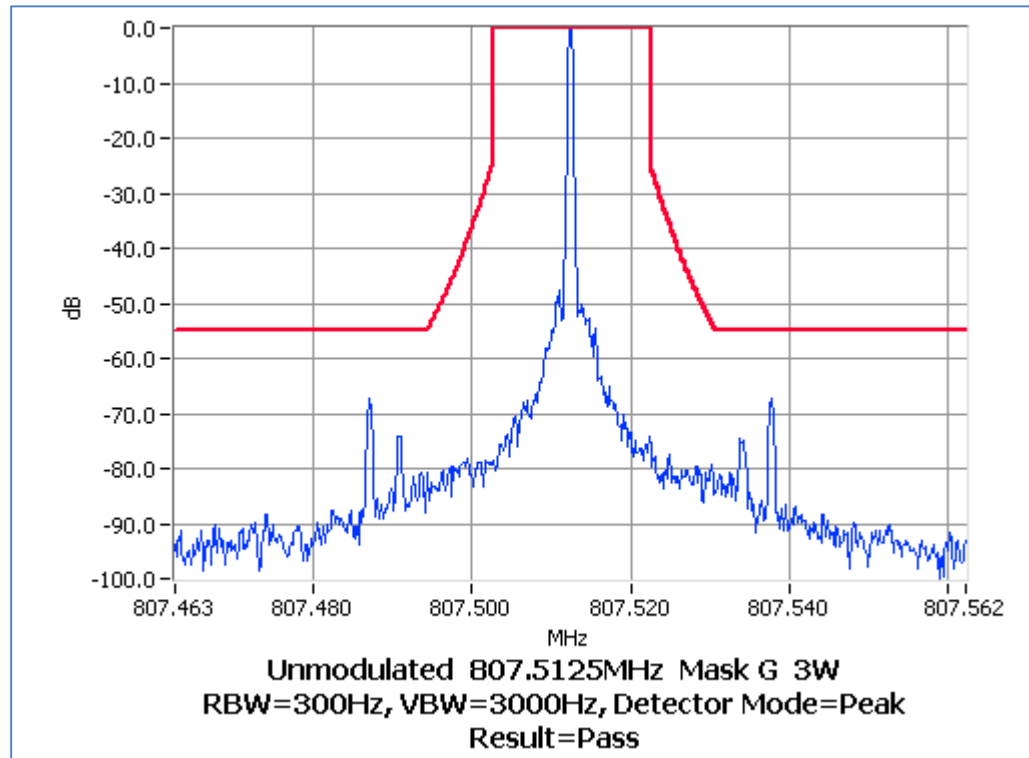
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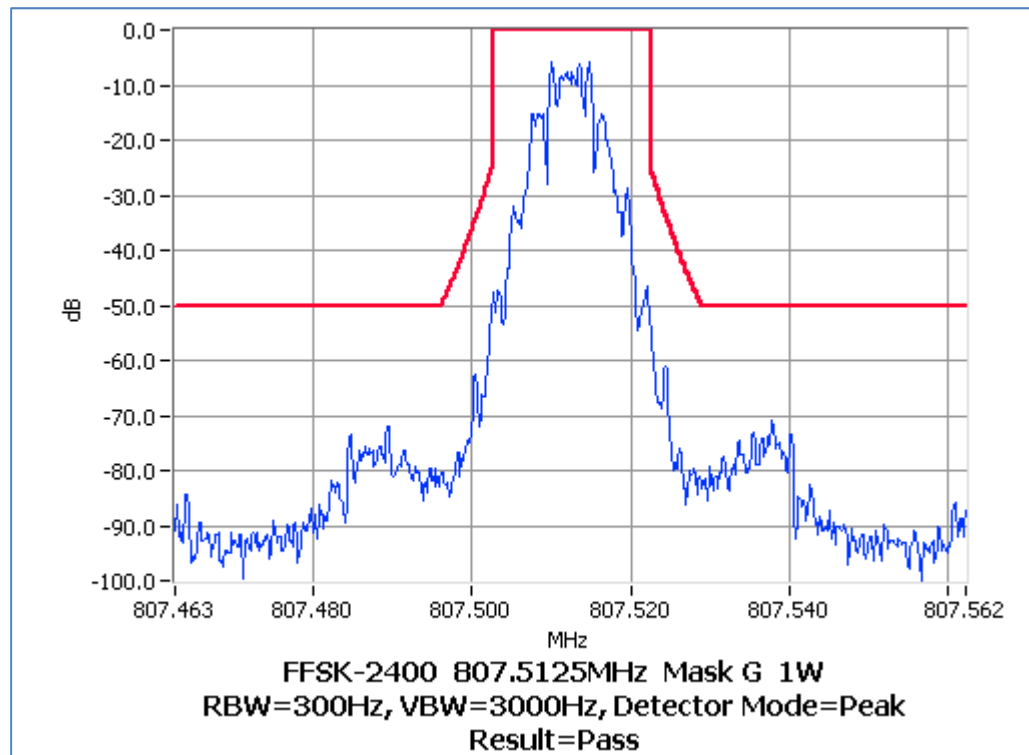
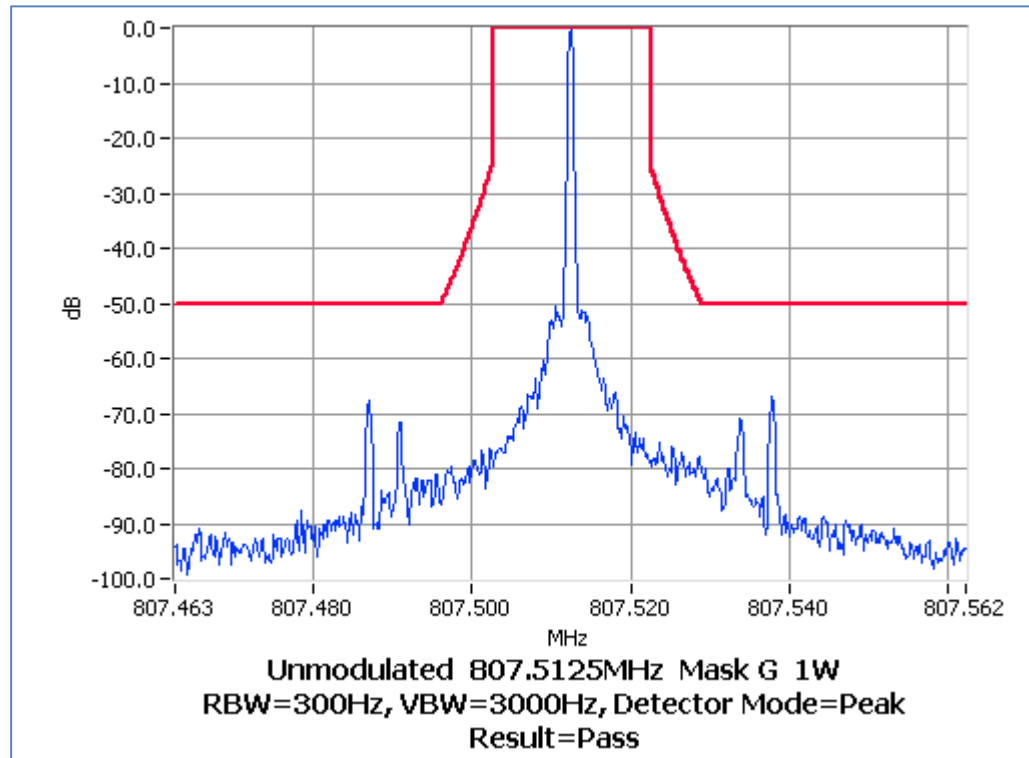
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 3 W 25.0 kHz Channel Spacing



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FFSK – 2400 bps

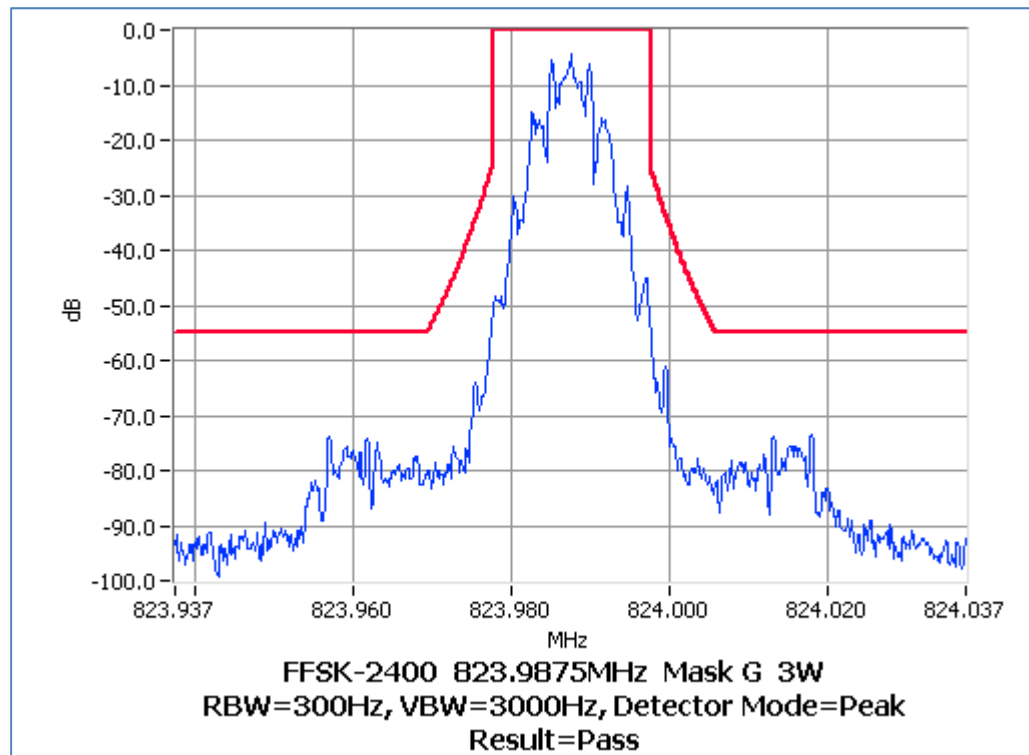
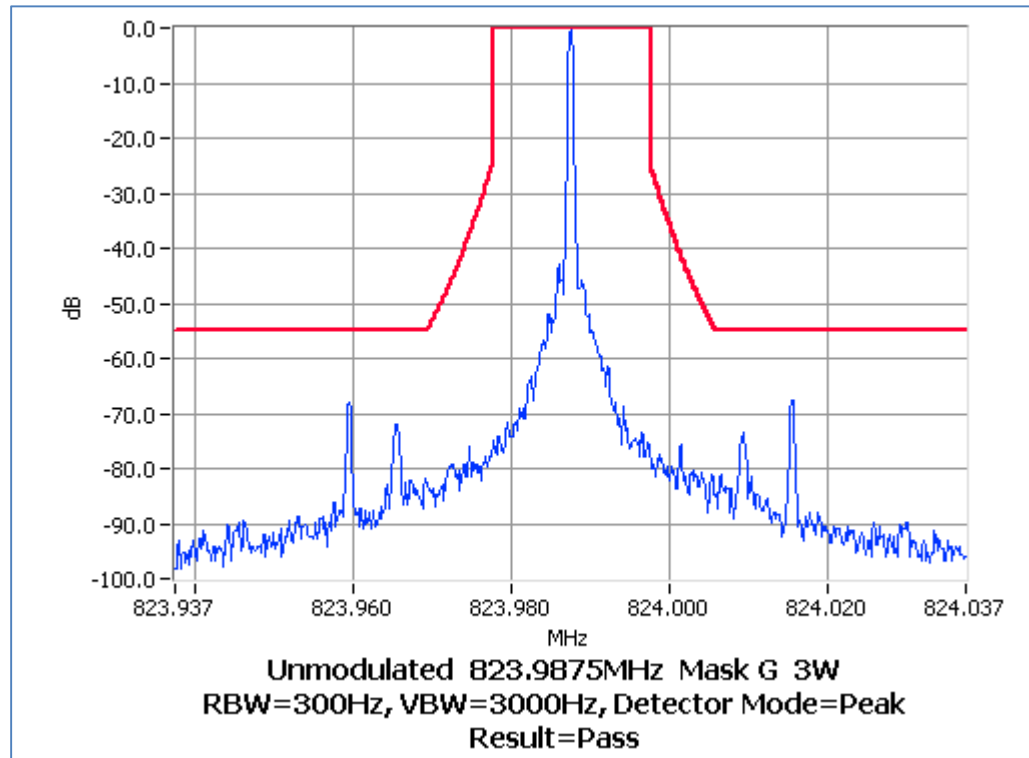
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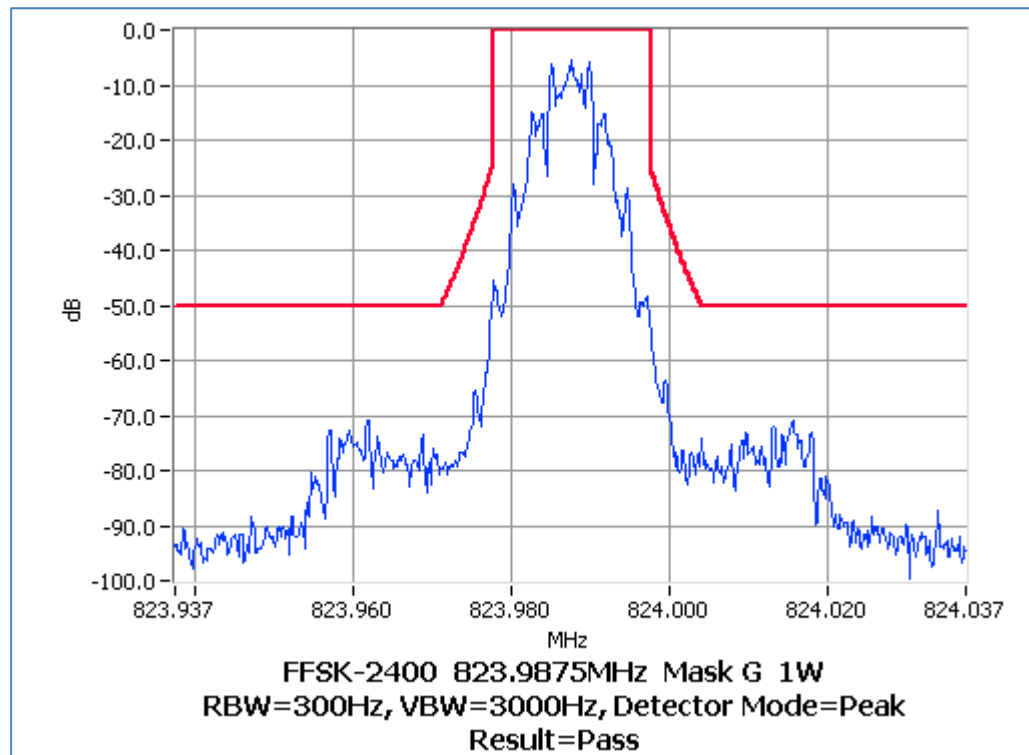
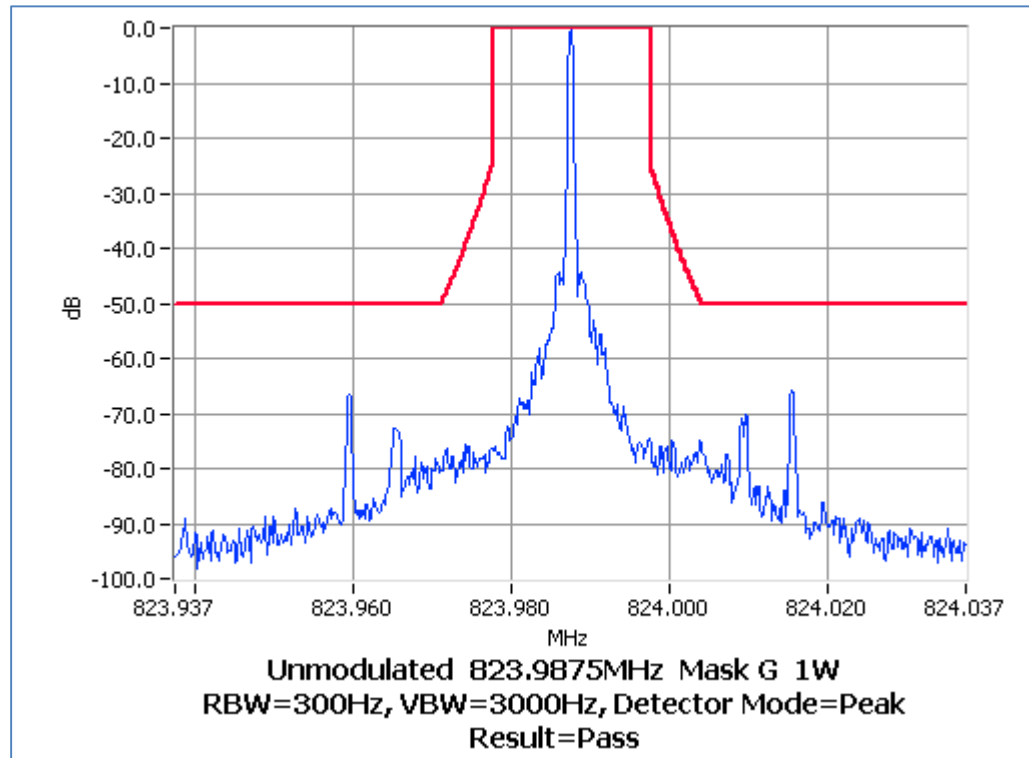
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Tx FREQUENCY: 823.9875 MHz 3 W 25.0 kHz Channel Spacing



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FFSK – 2400 bps

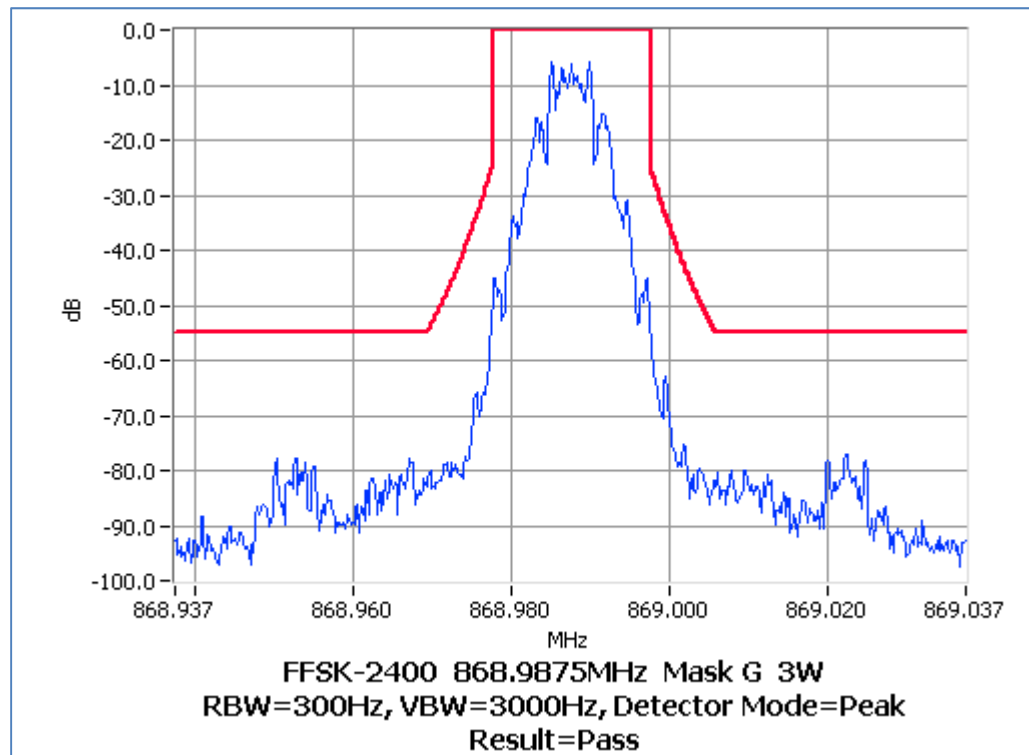
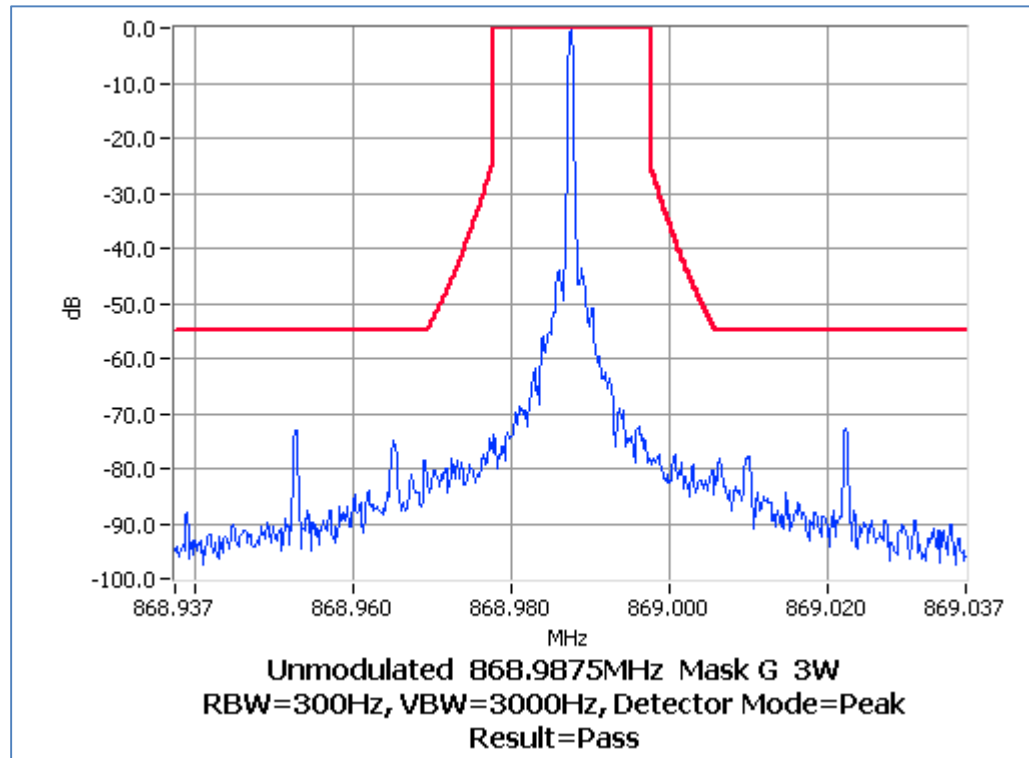
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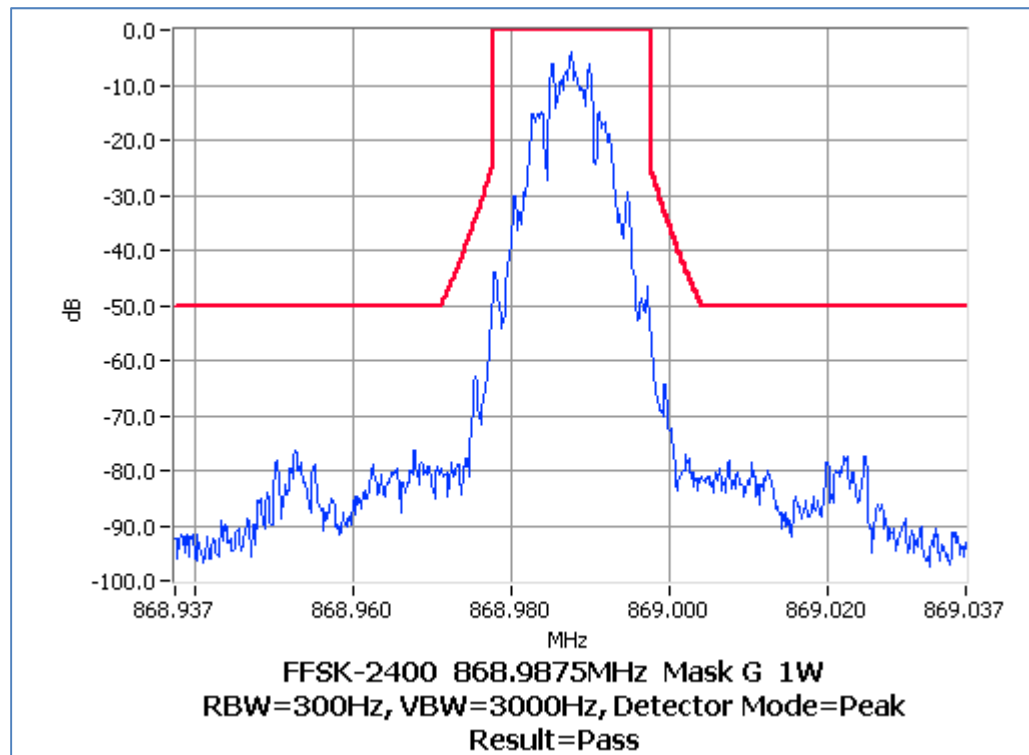
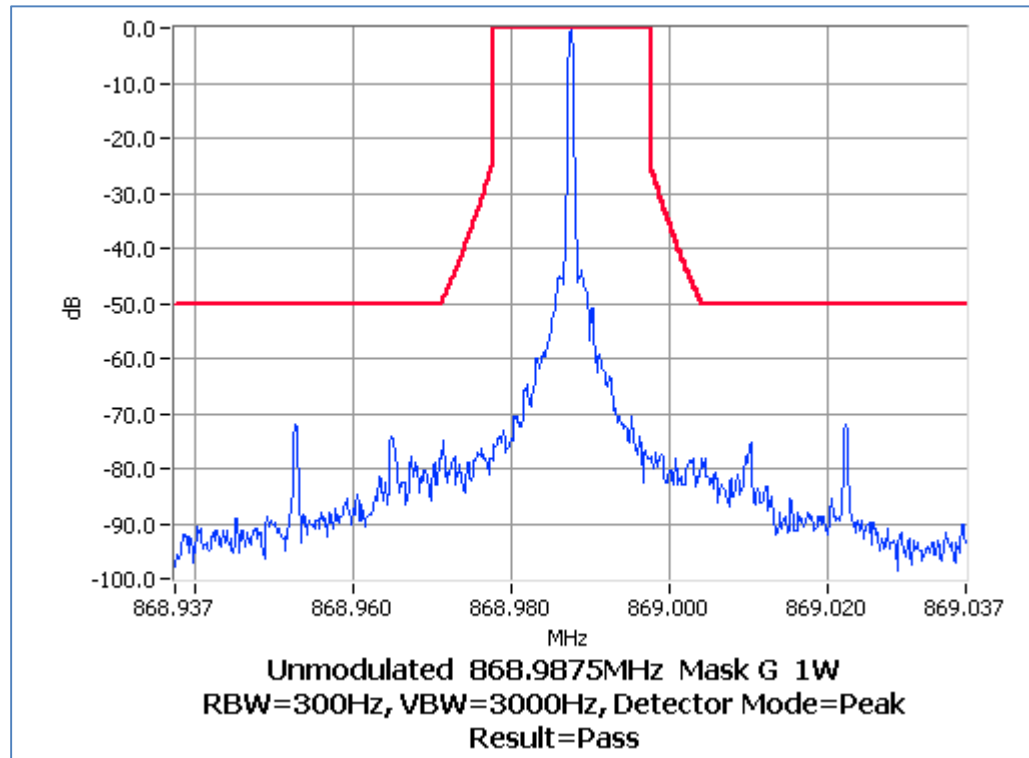
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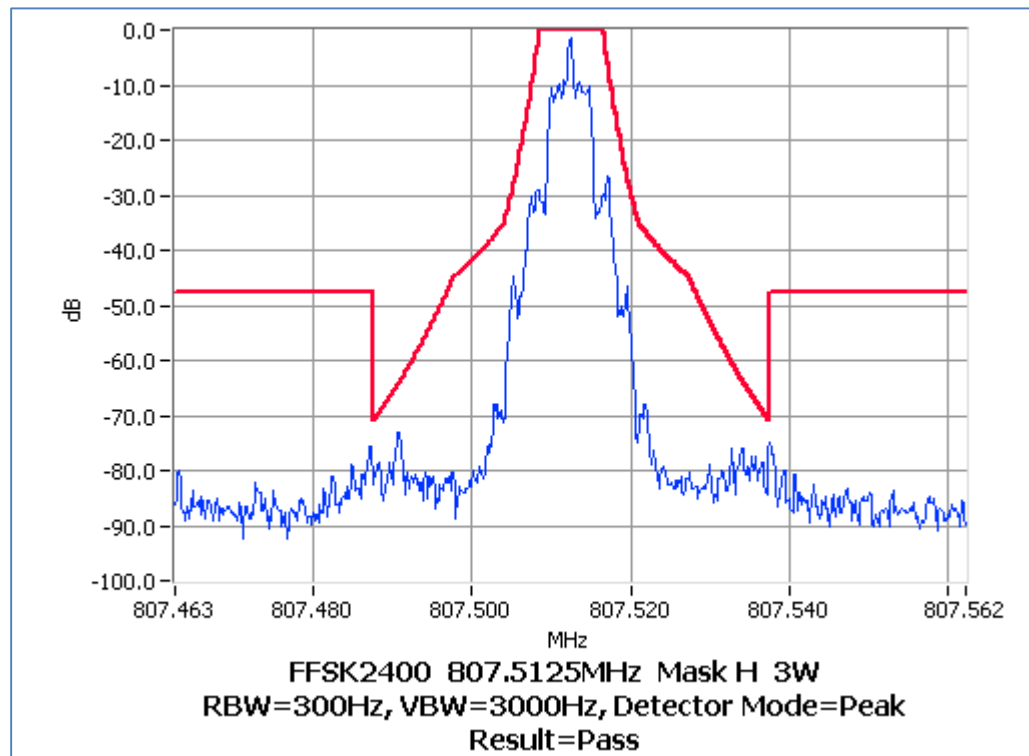
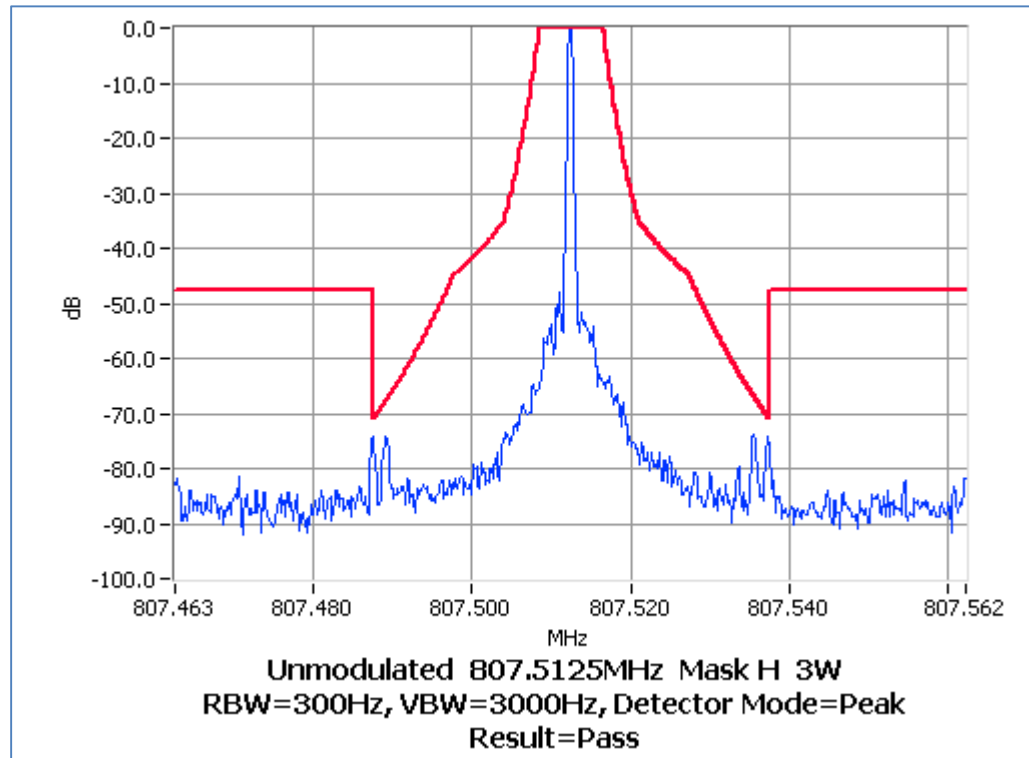
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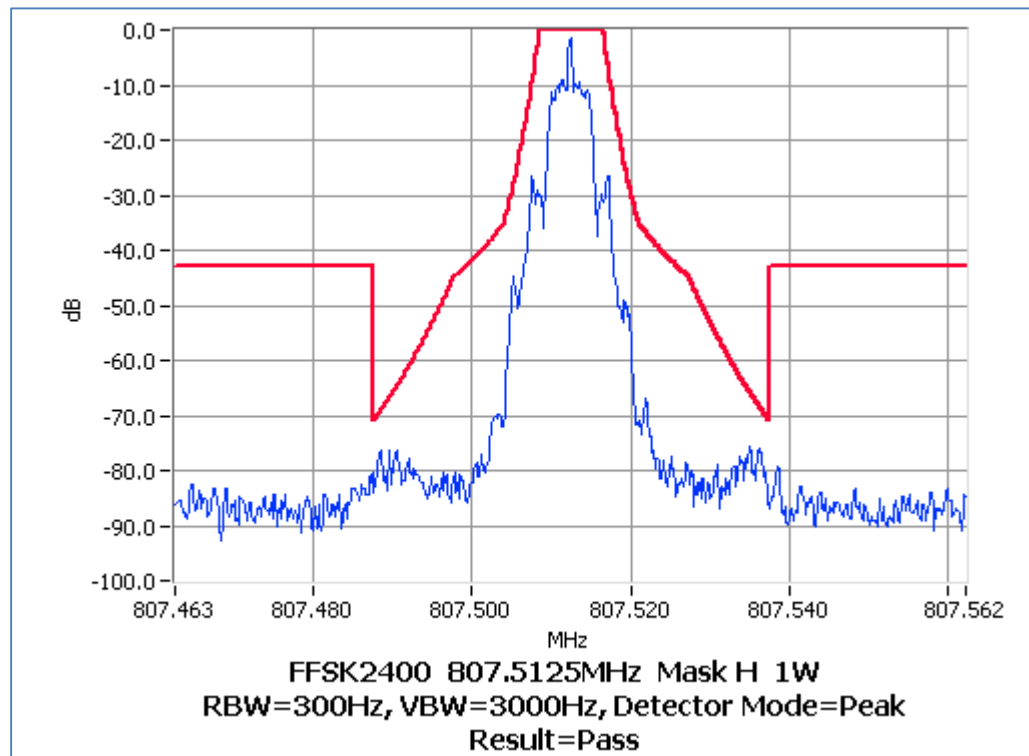
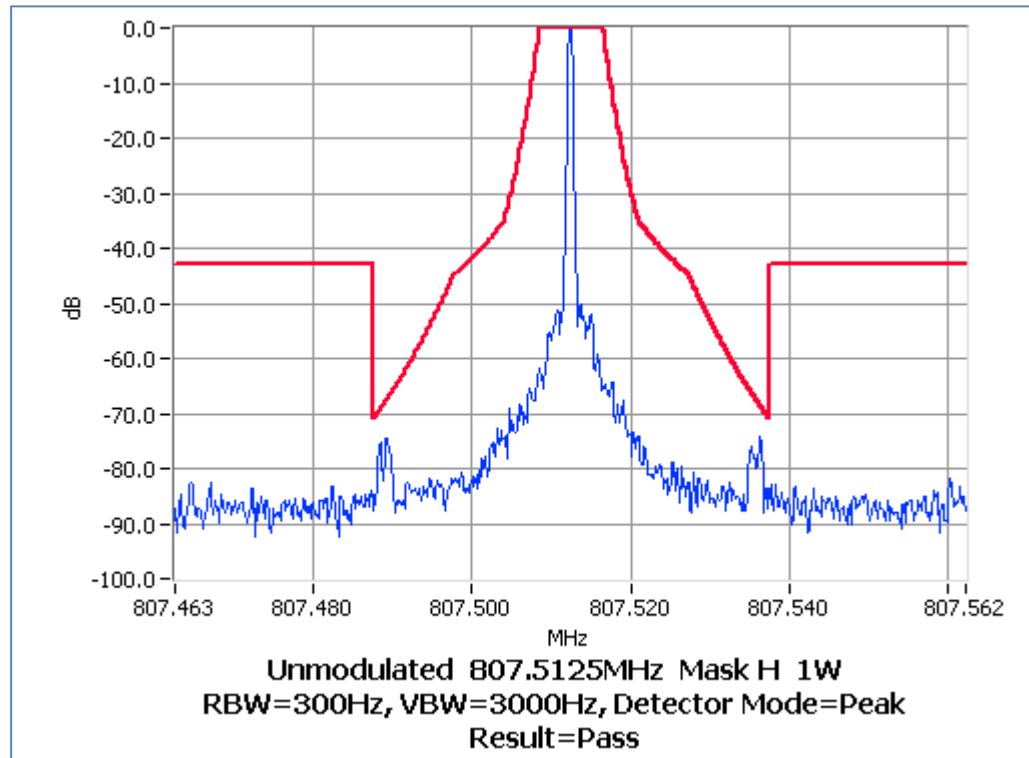
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Occupied Bandwidth and Spectrum Masks

FFSK – 2400 bps

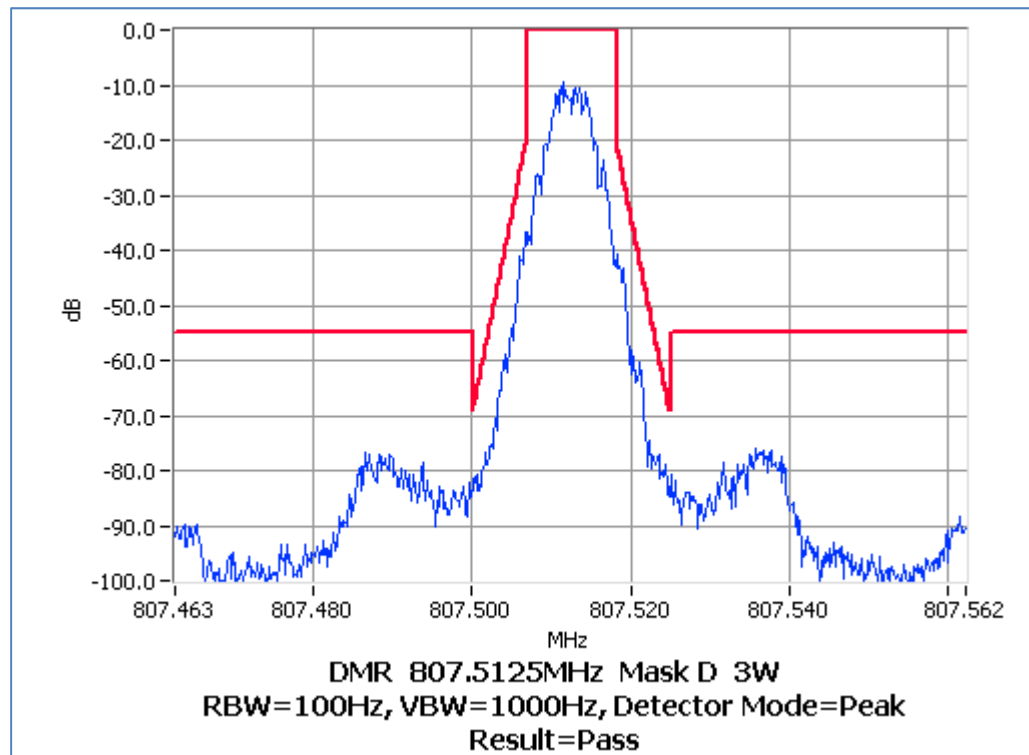
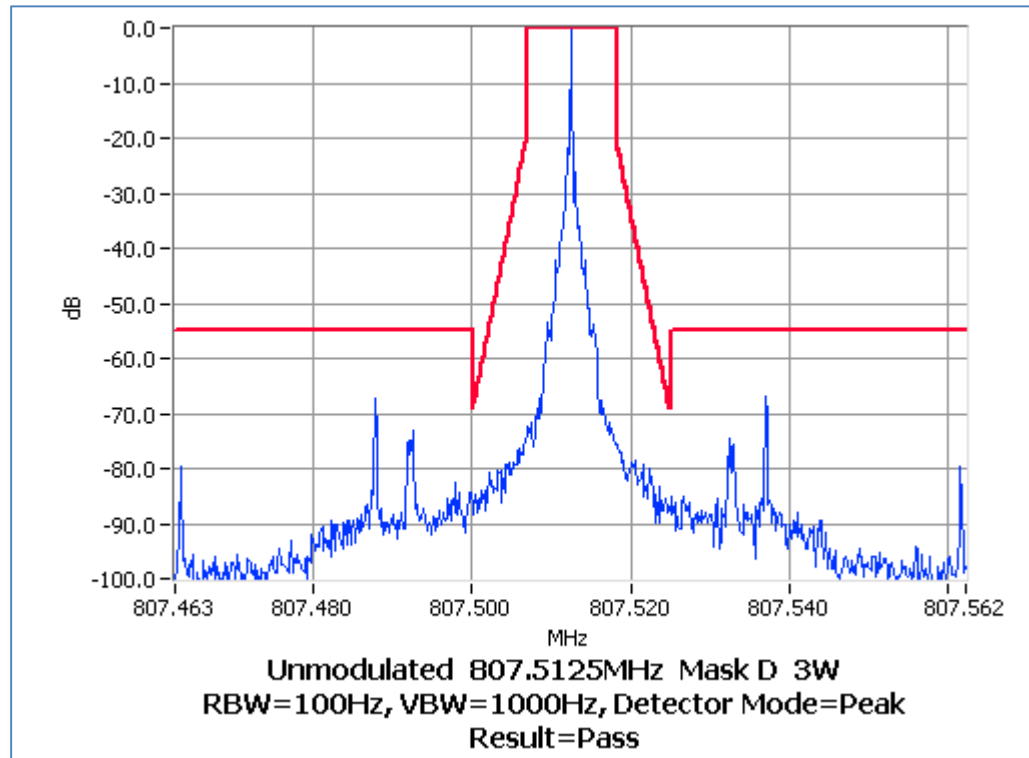
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

DMR

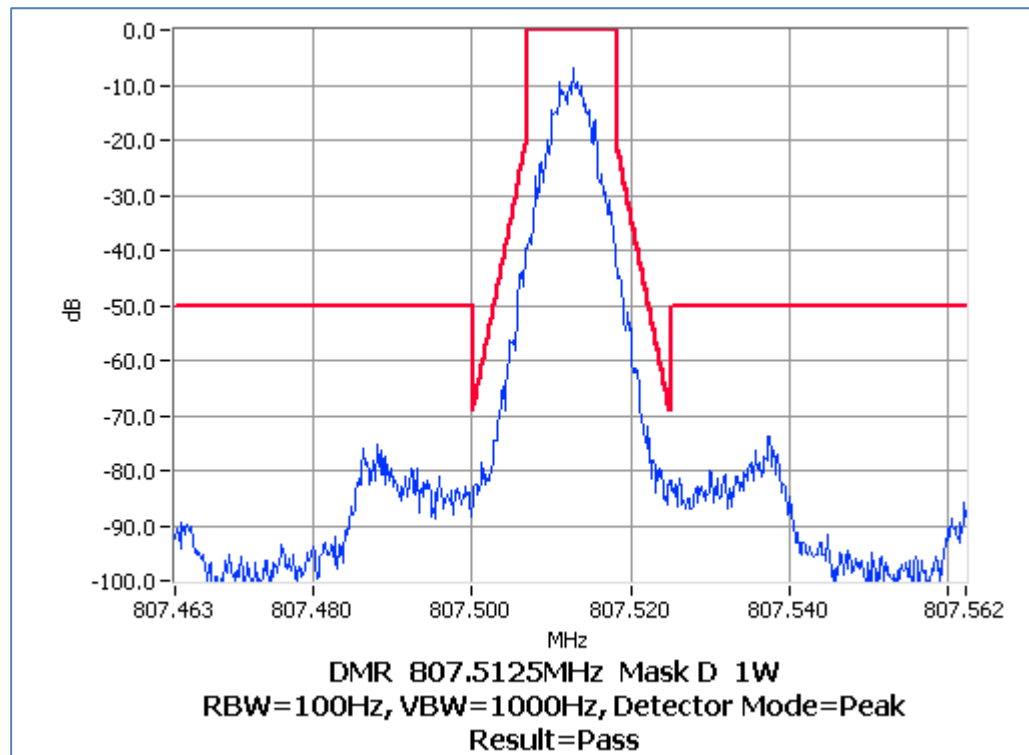
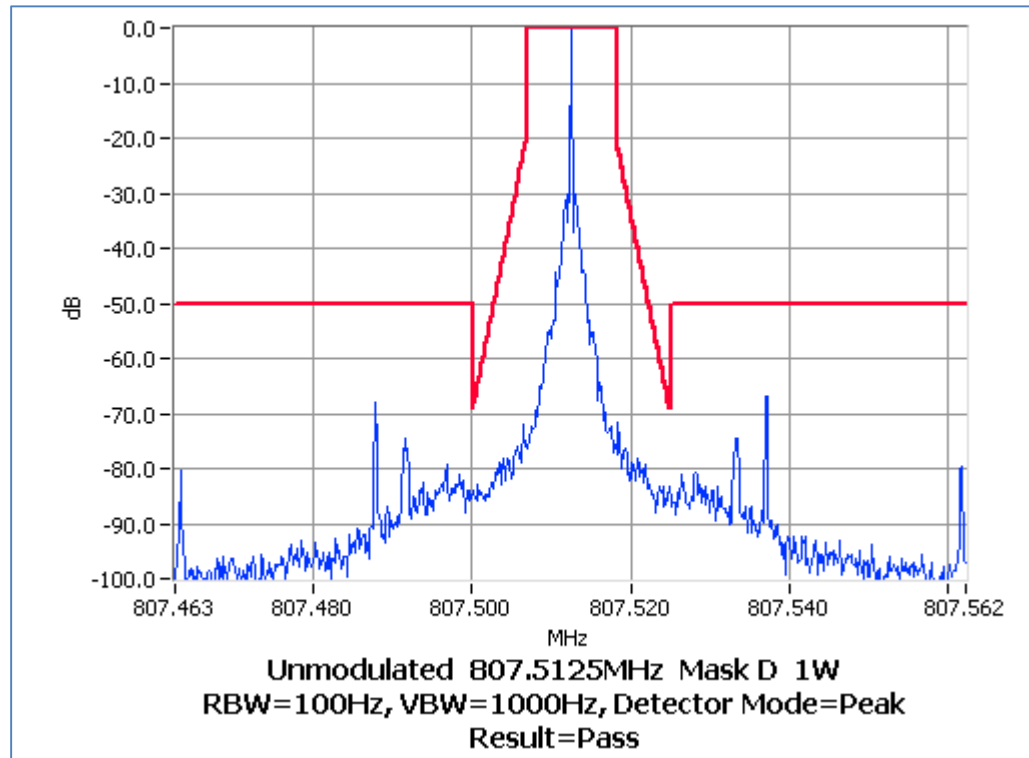
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Tx FREQUENCY: 807.5125 MHz 3 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

DMR

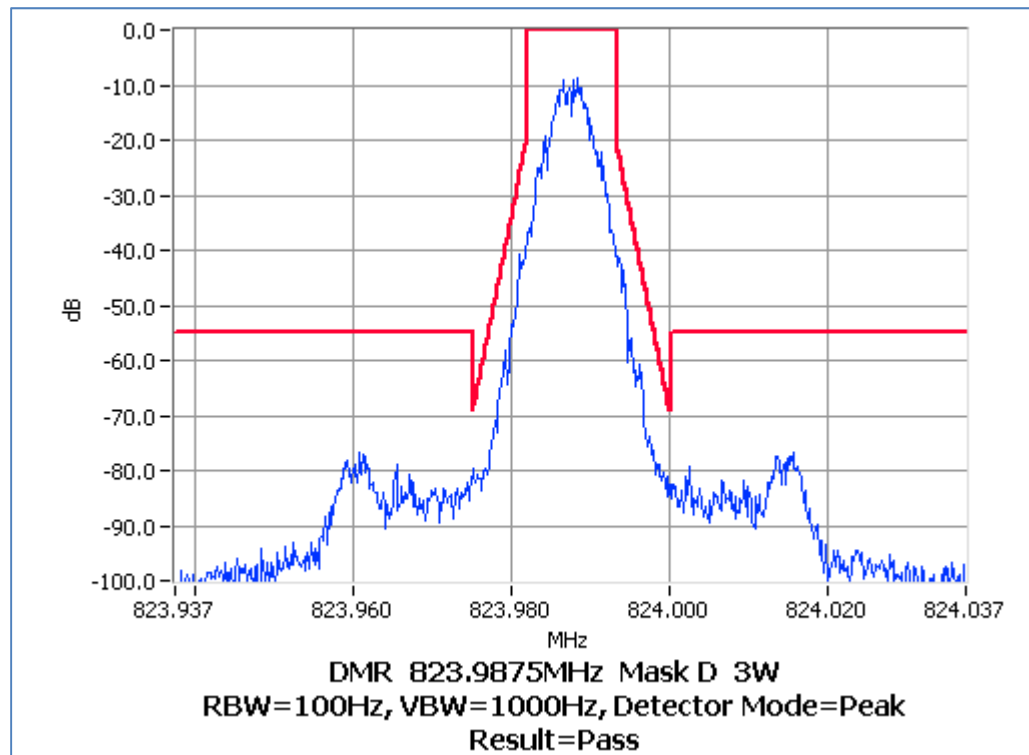
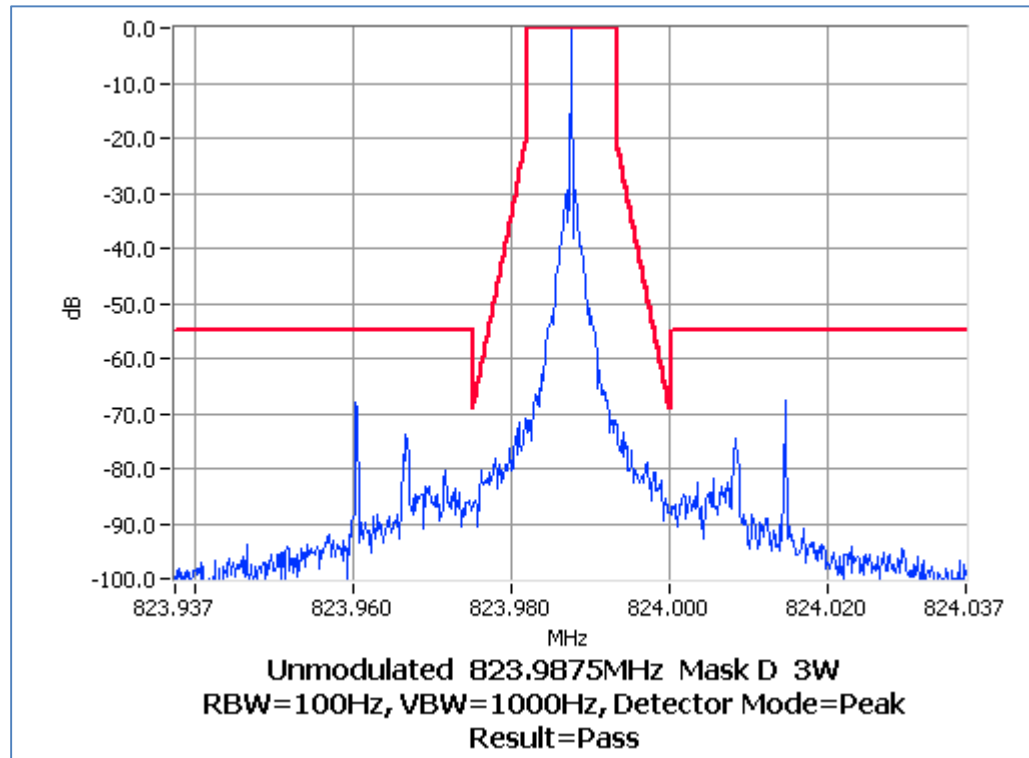
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Tx FREQUENCY: 807.5125 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

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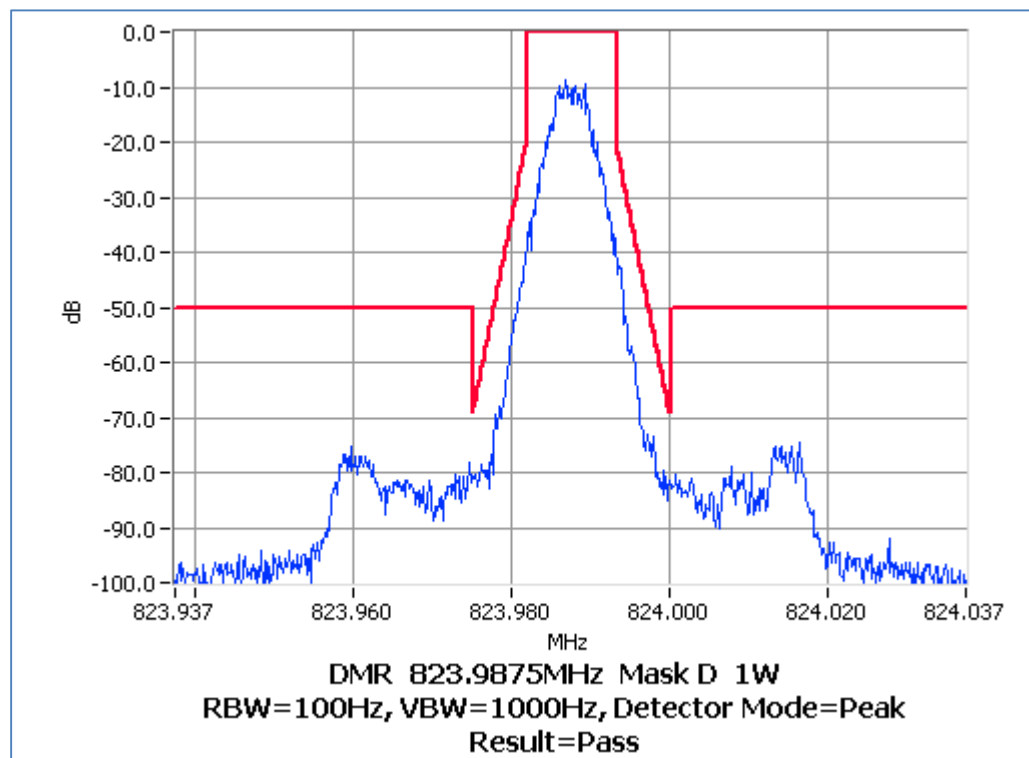
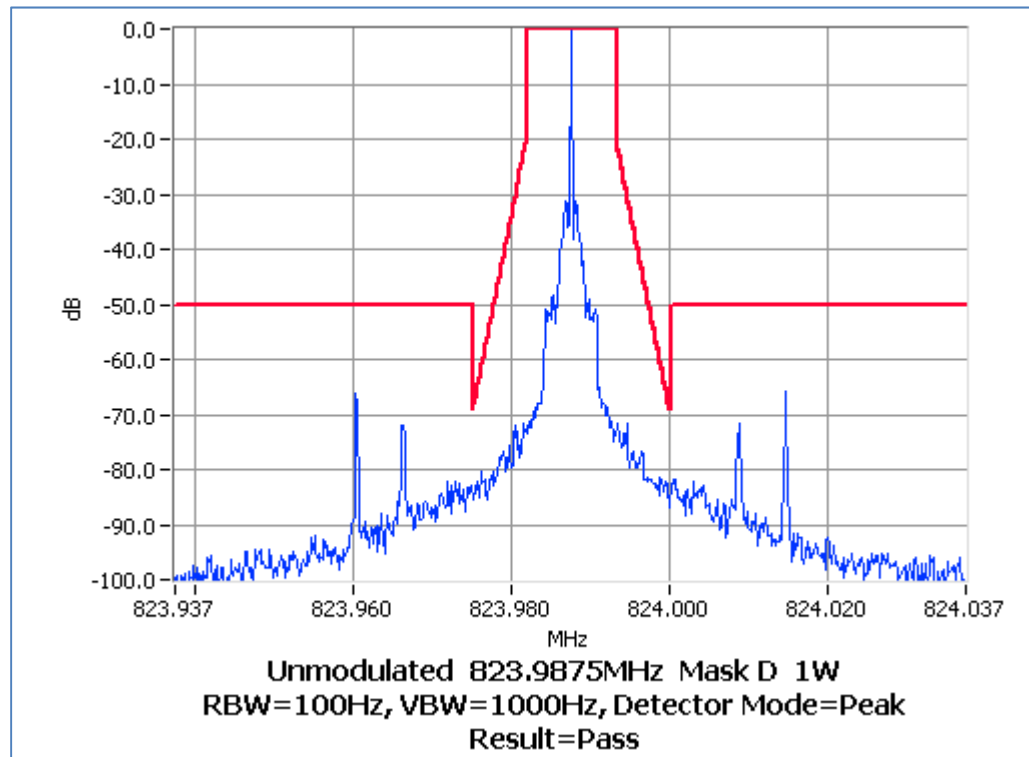
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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

DMR

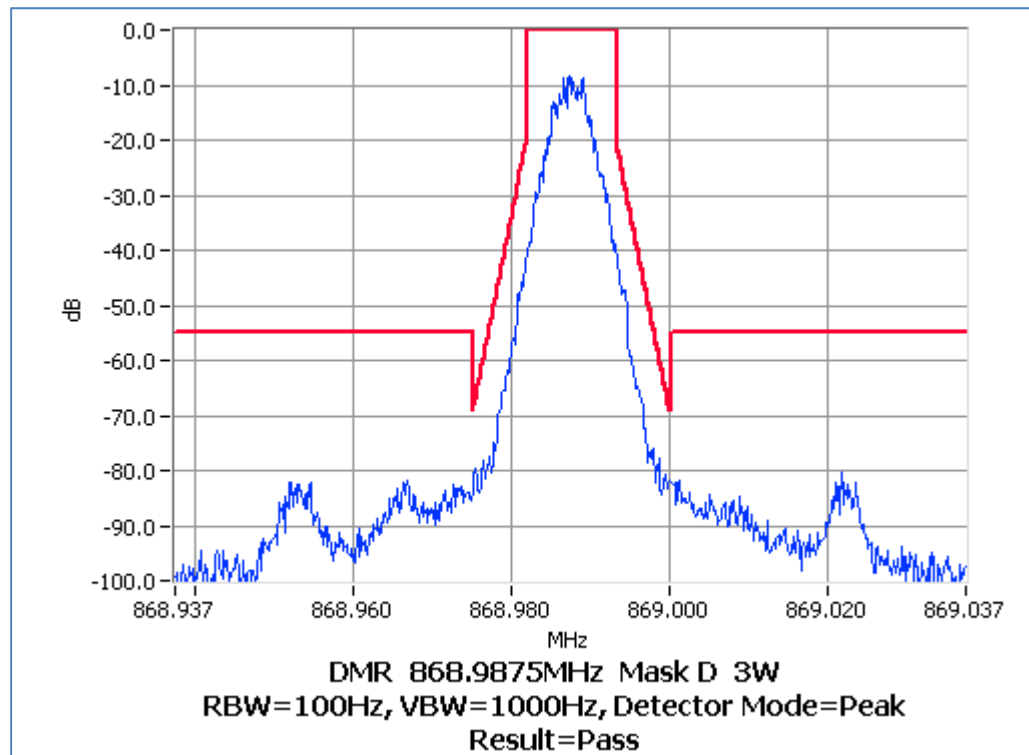
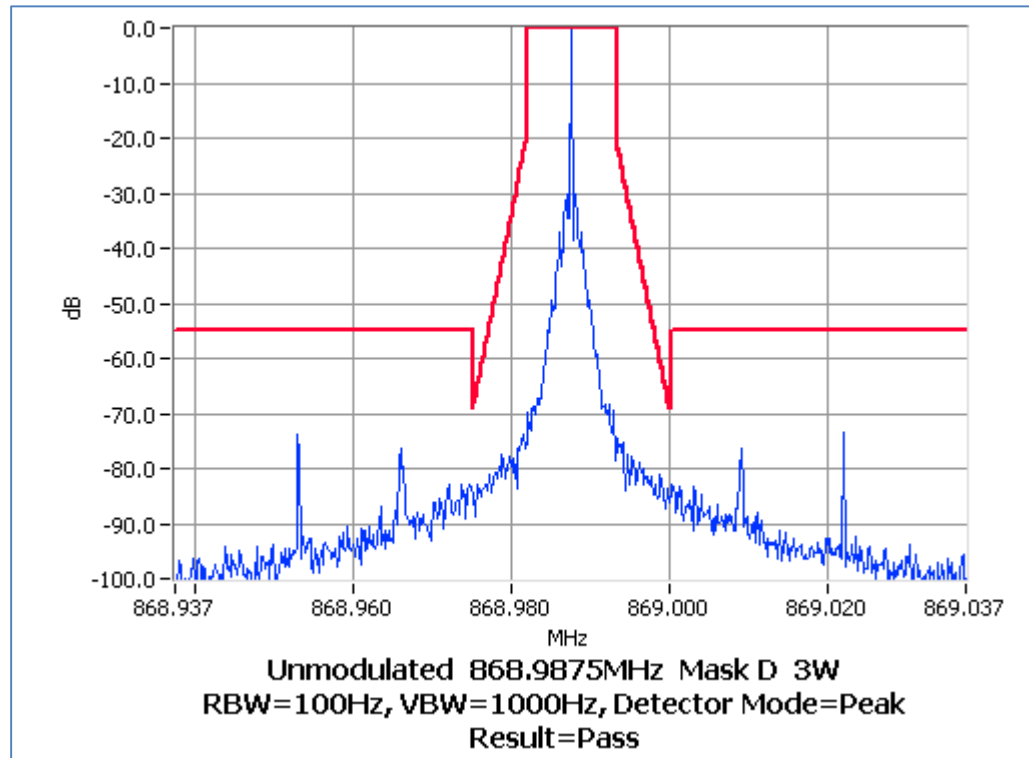
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Tx FREQUENCY: 823.9875 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

DMR

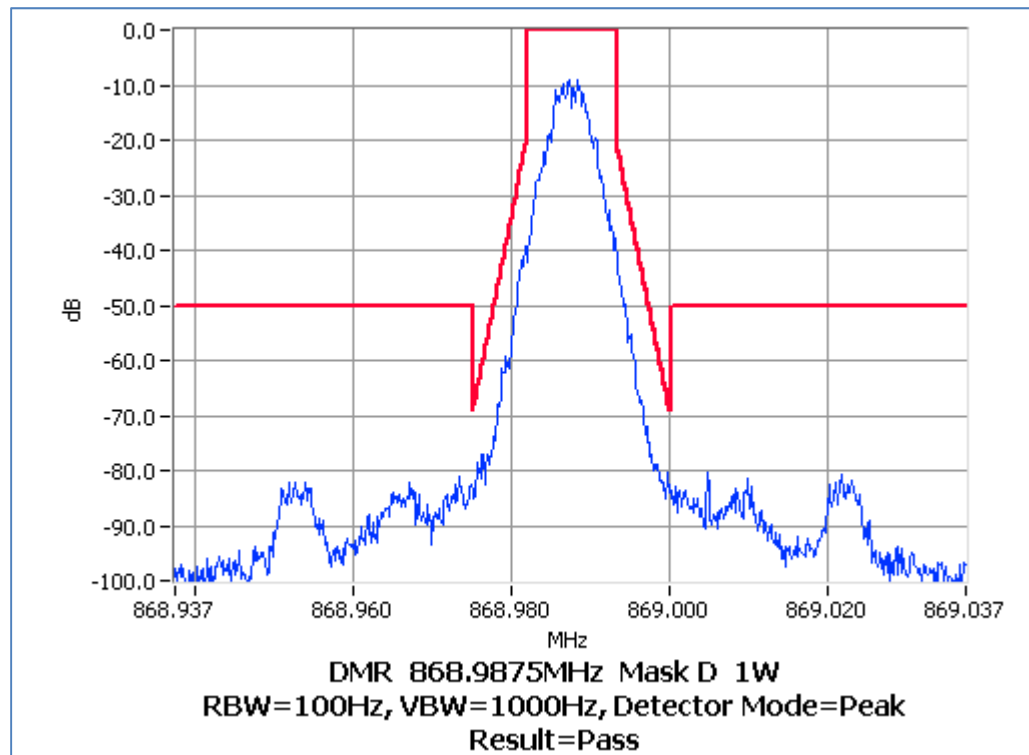
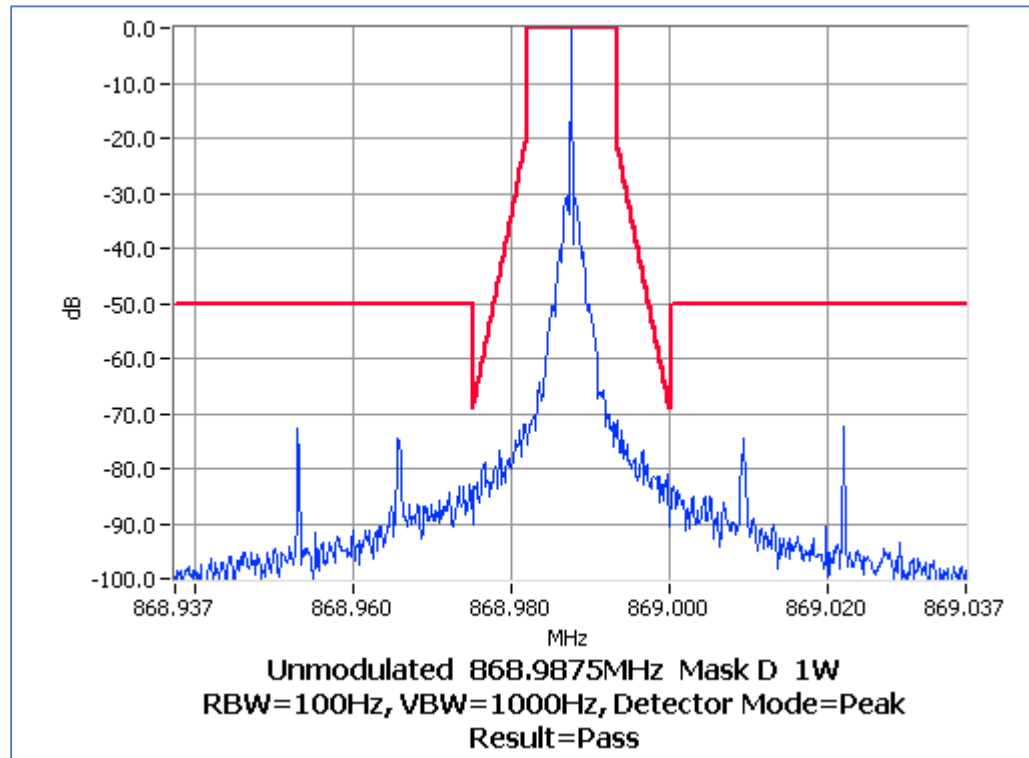
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 868.9875 MHz 3 W 12.5 kHz Channel Spacing



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Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

DMR

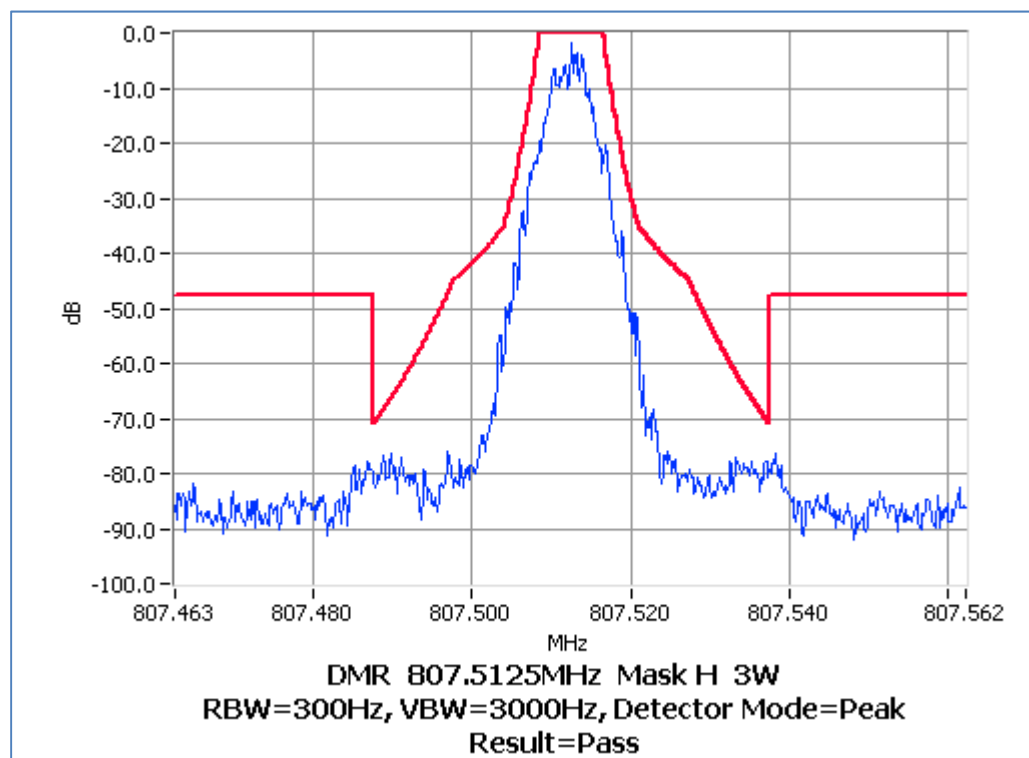
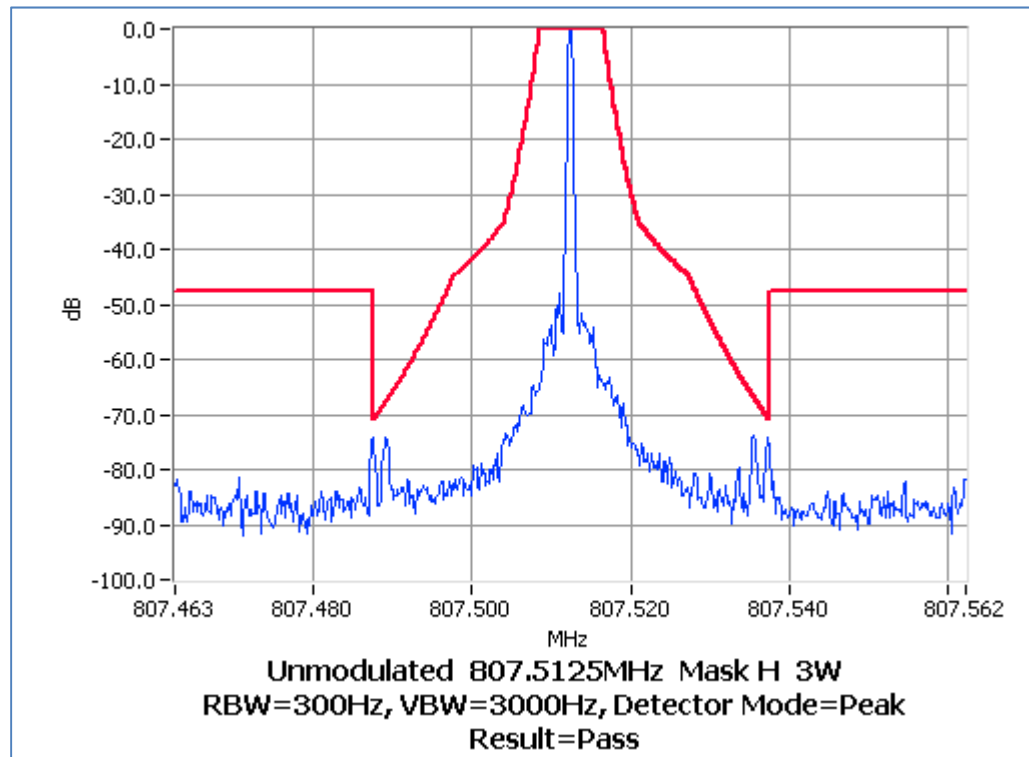
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Tx FREQUENCY: 868.9875 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

DMR

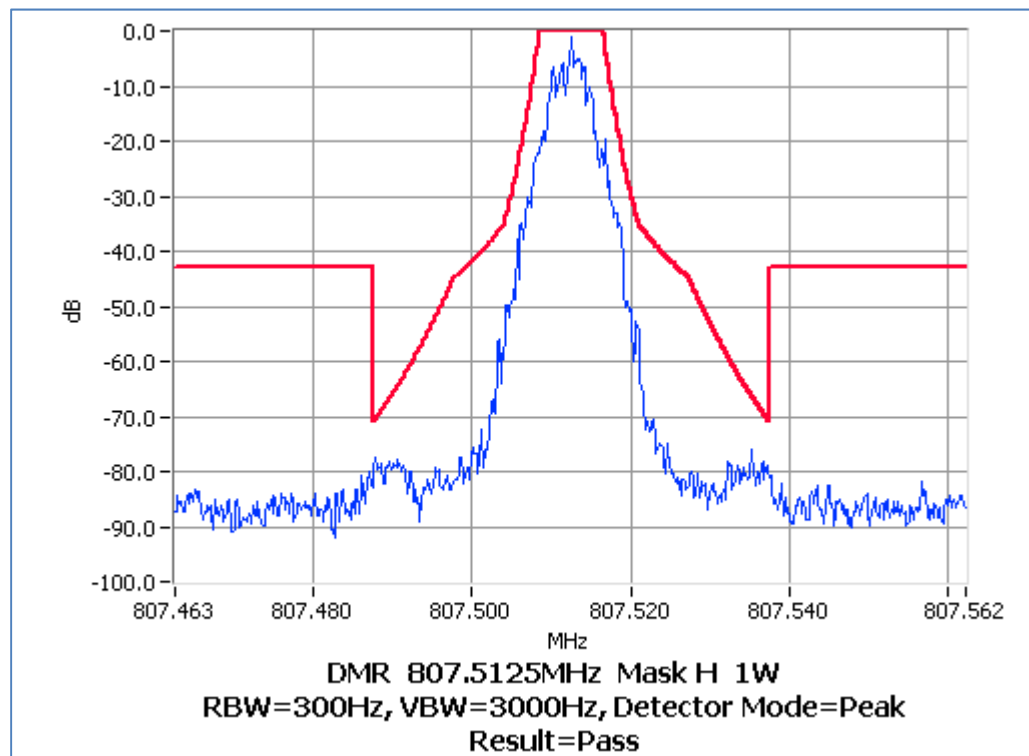
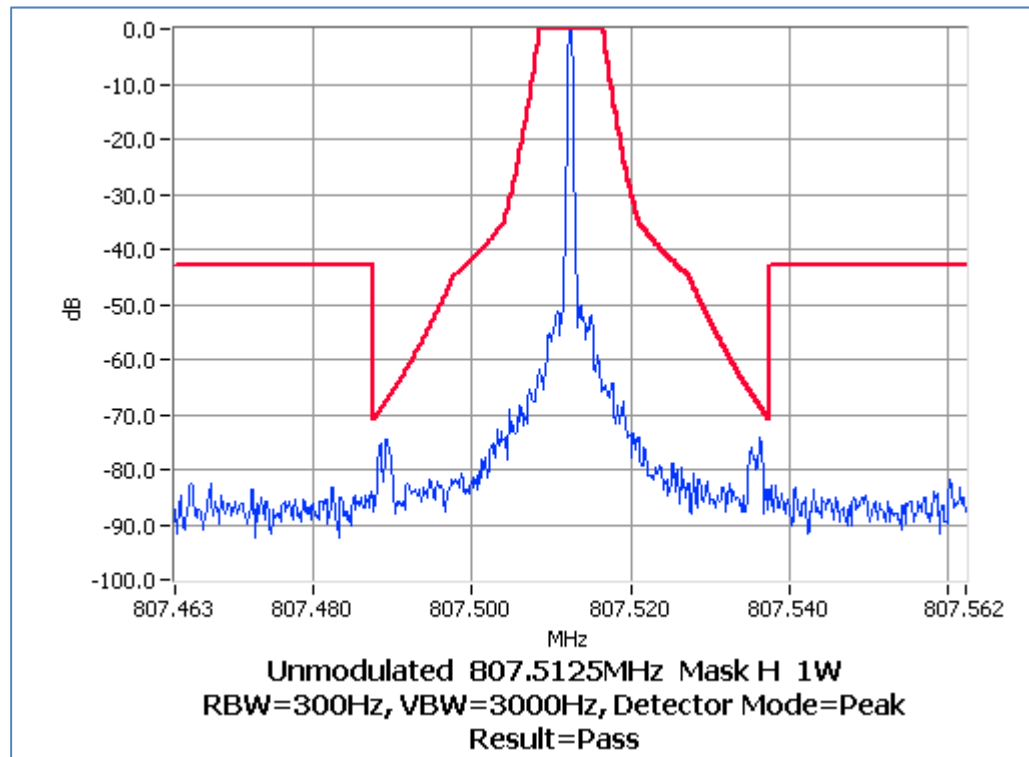
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 3 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

DMR

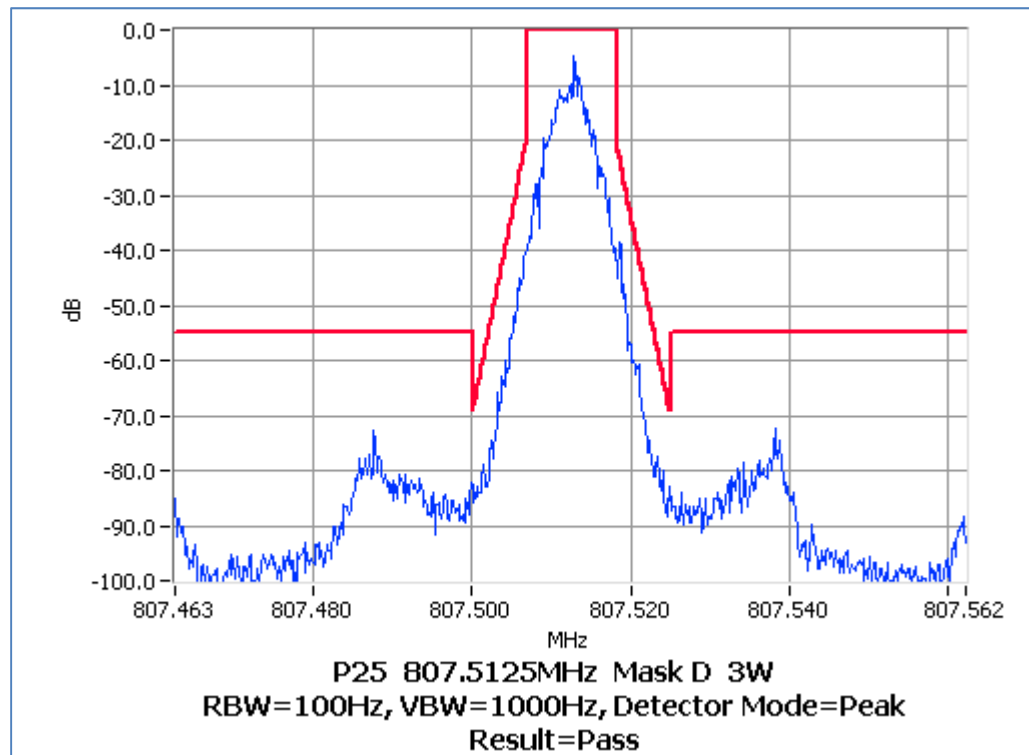
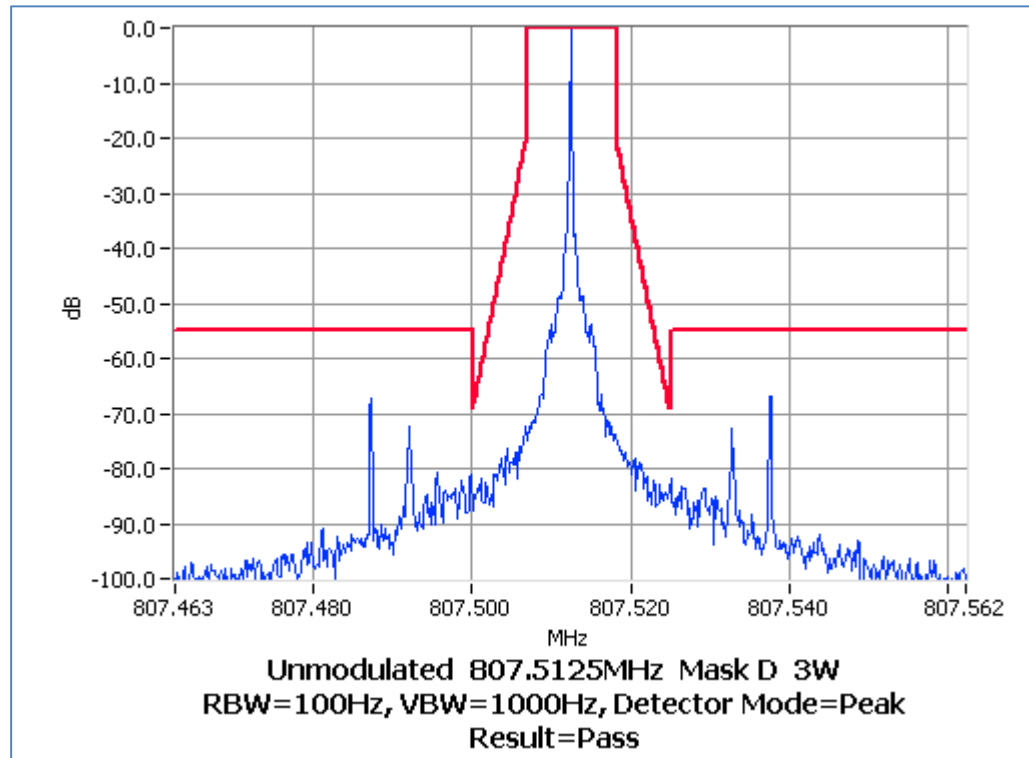
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 1 W 12.5 kHz Channel Spacing



TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

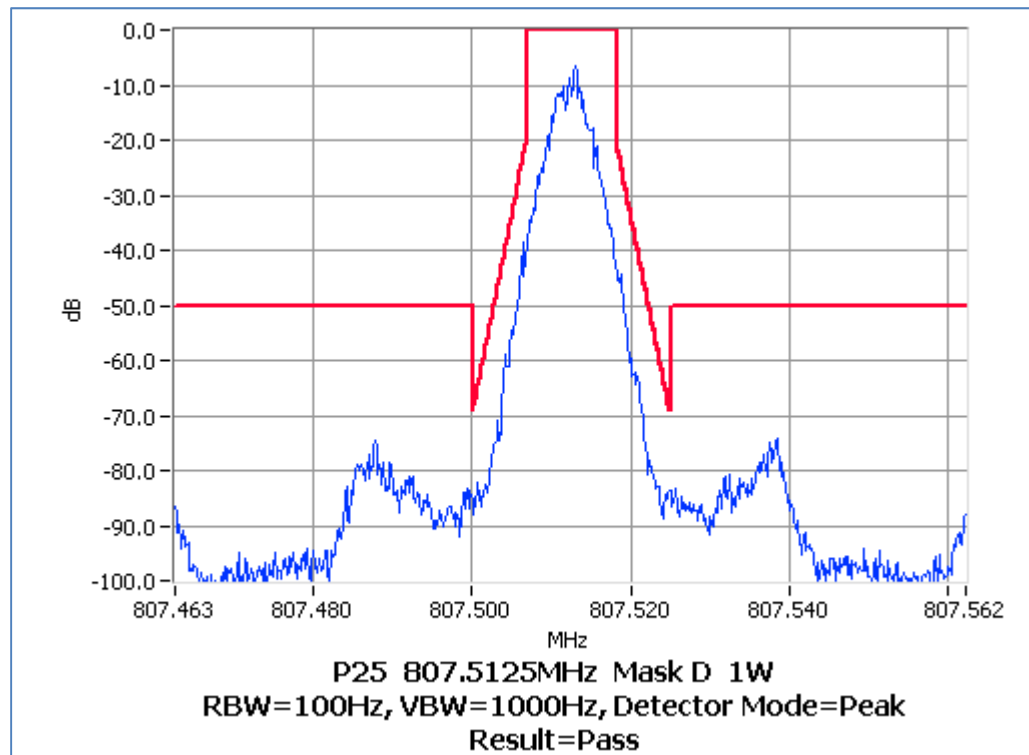
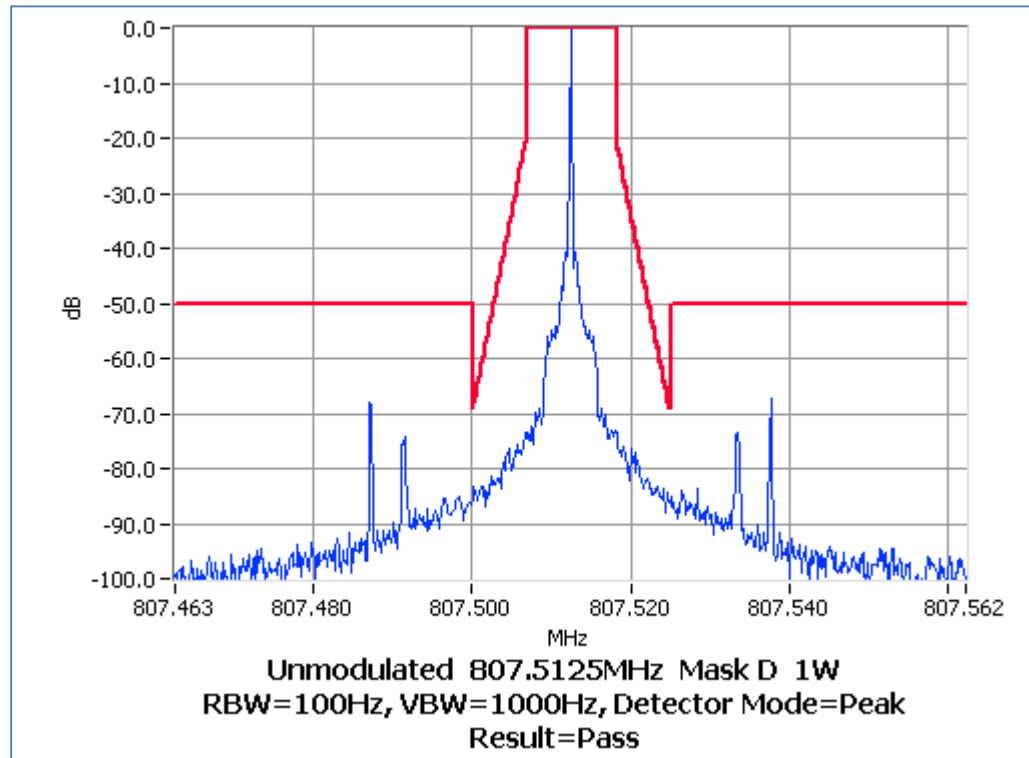
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Tx FREQUENCY: 807.5125 MHz 3 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

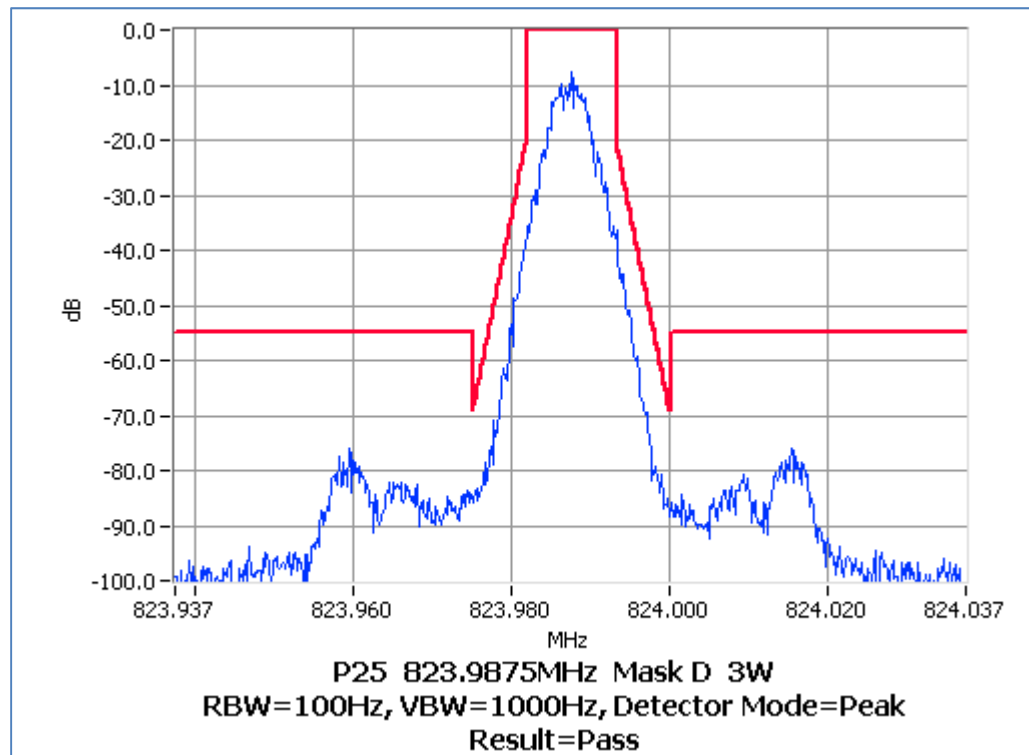
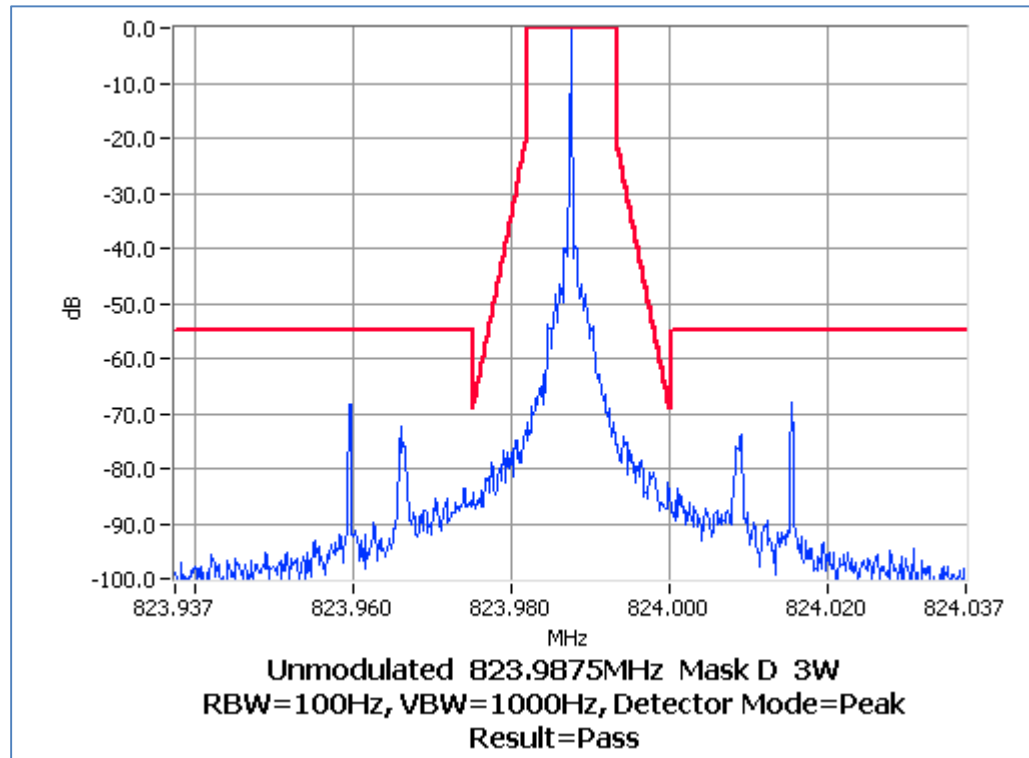
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Tx FREQUENCY: 807.5125 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

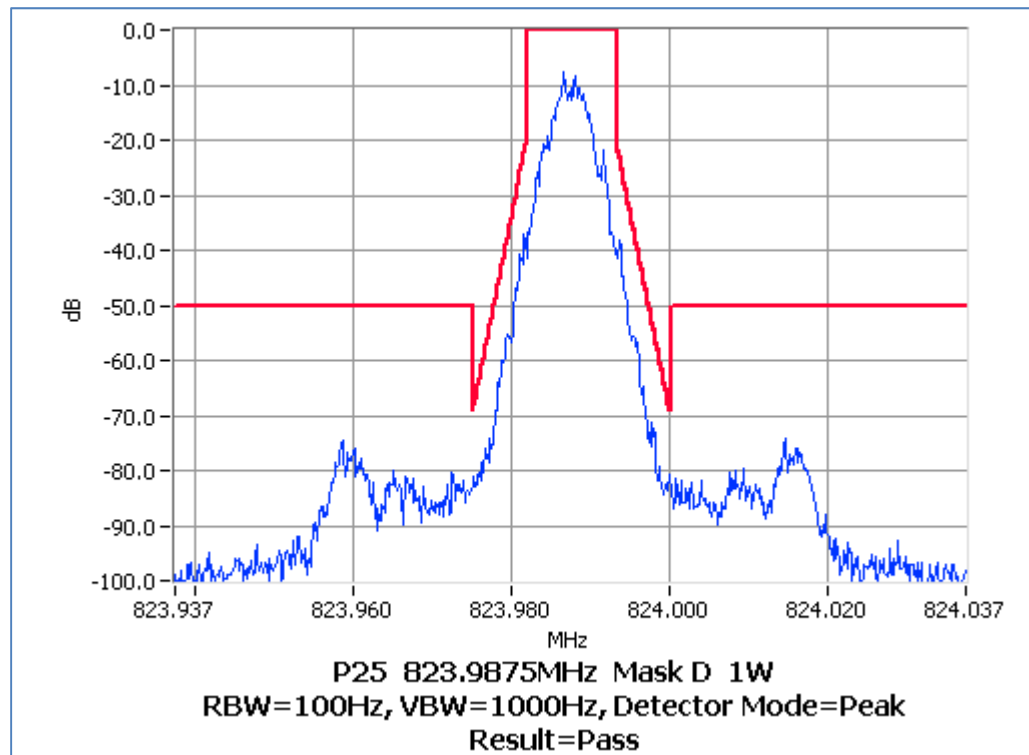
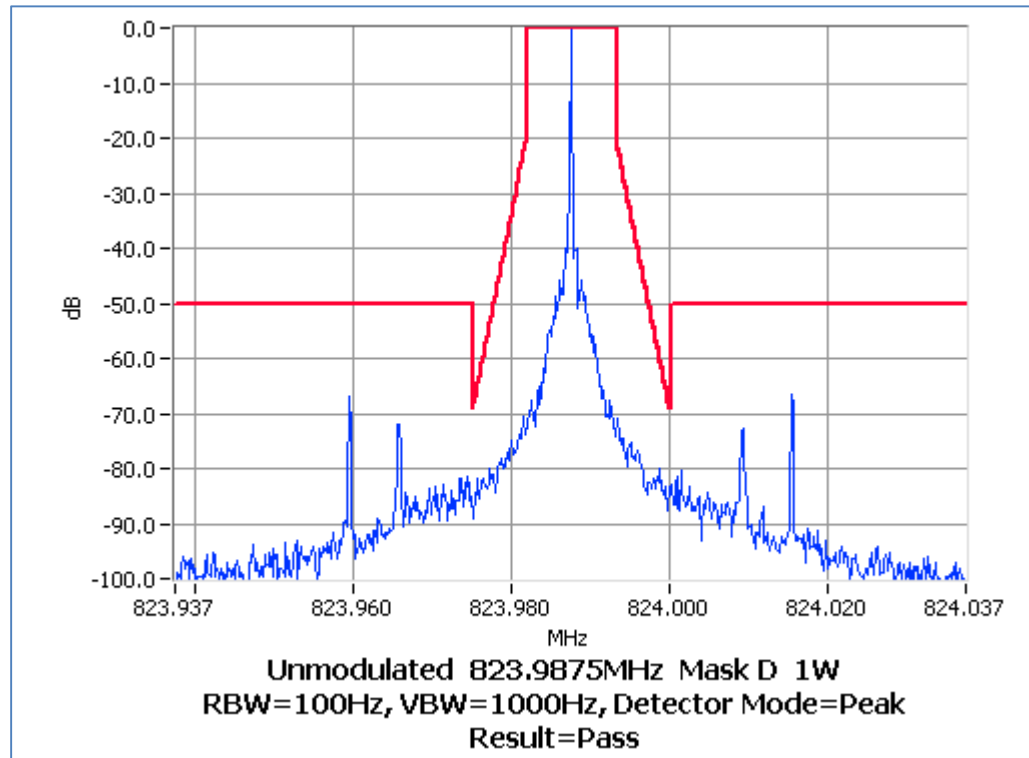
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 823.9875 MHz 3 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

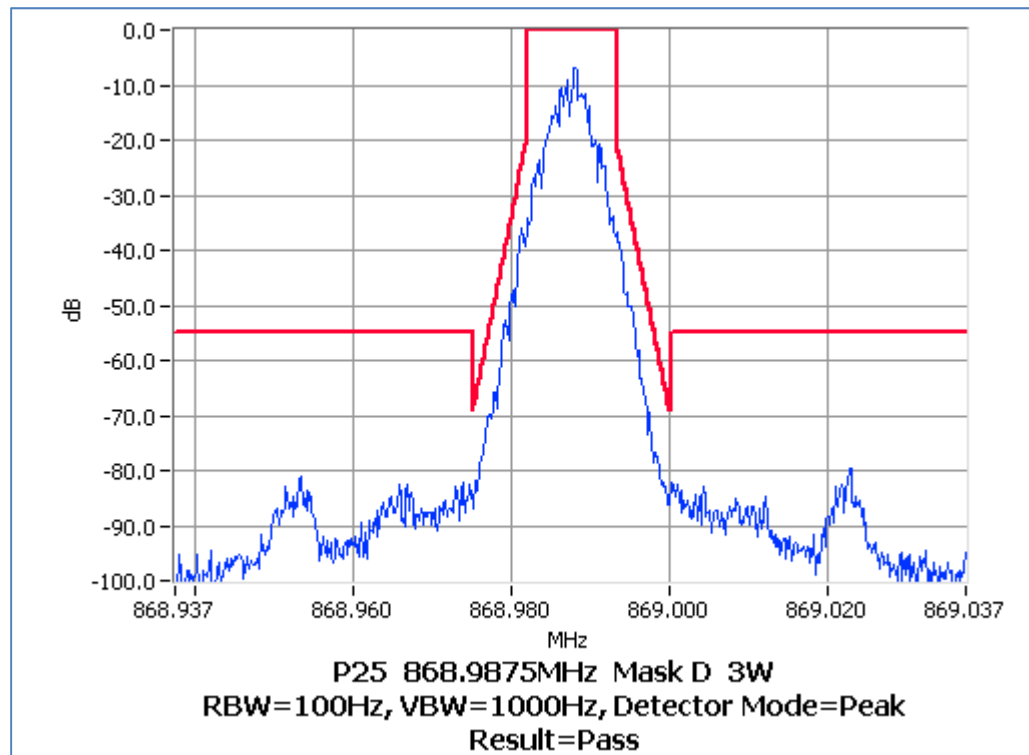
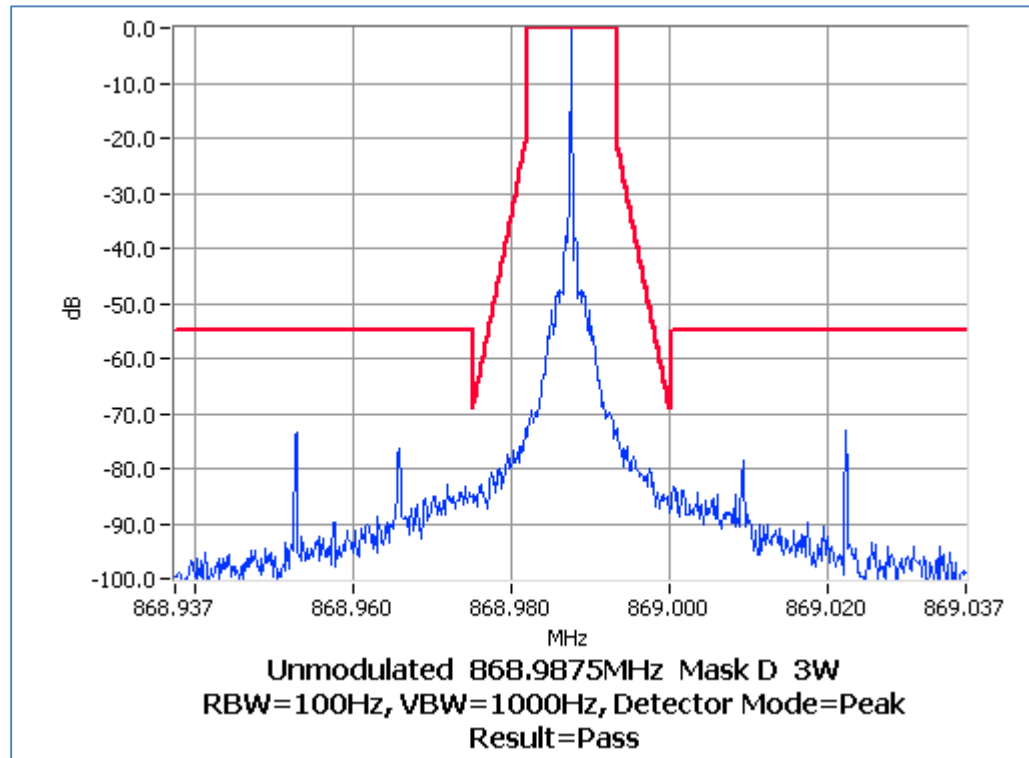
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 823.9875 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

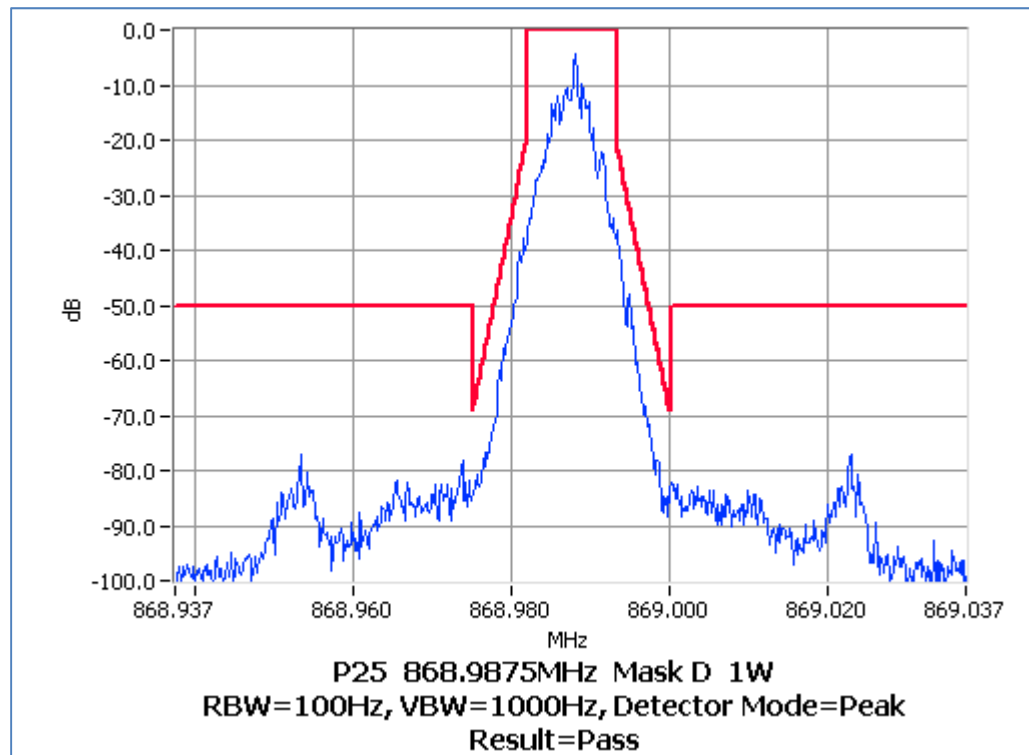
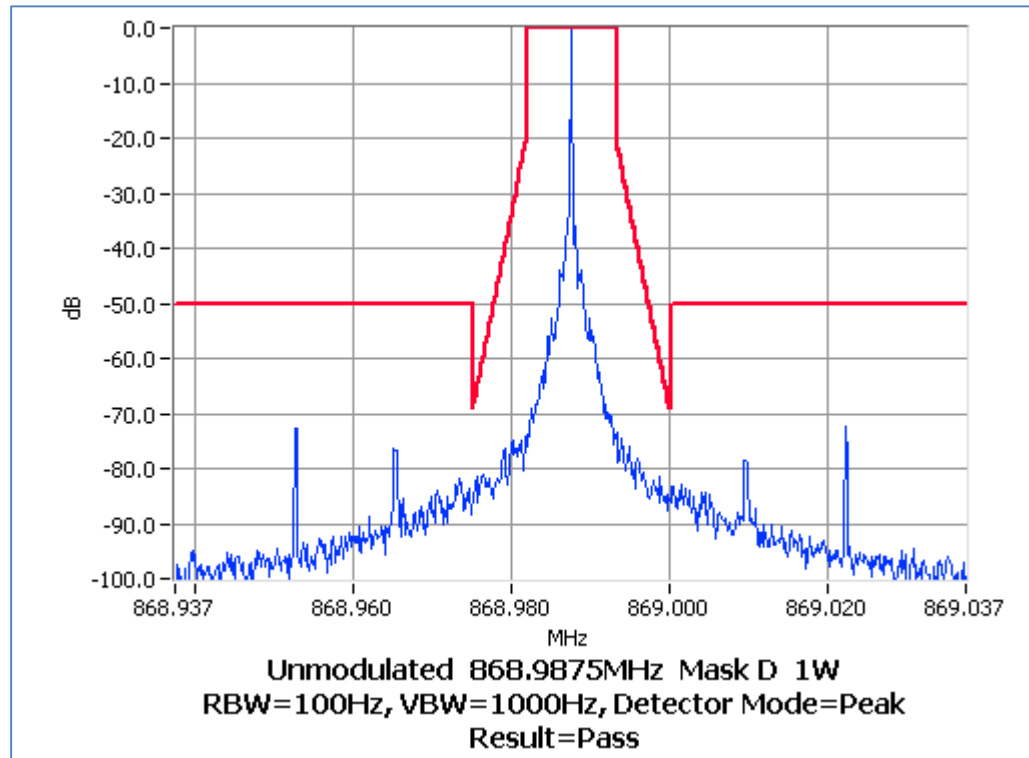
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 868.9875 MHz 3 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

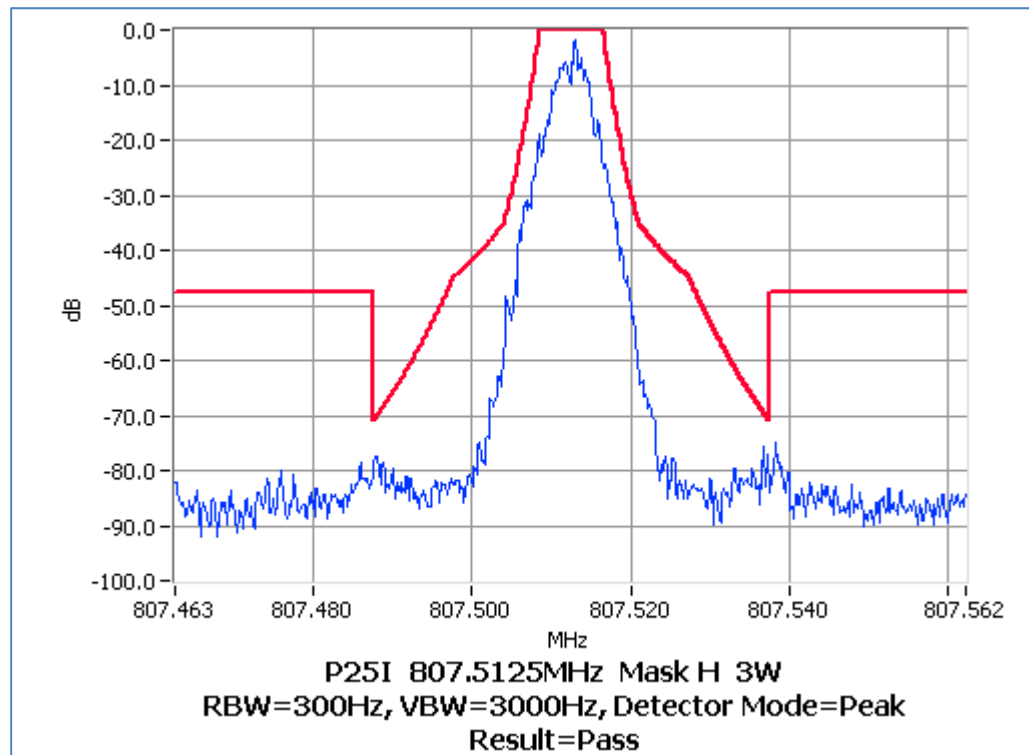
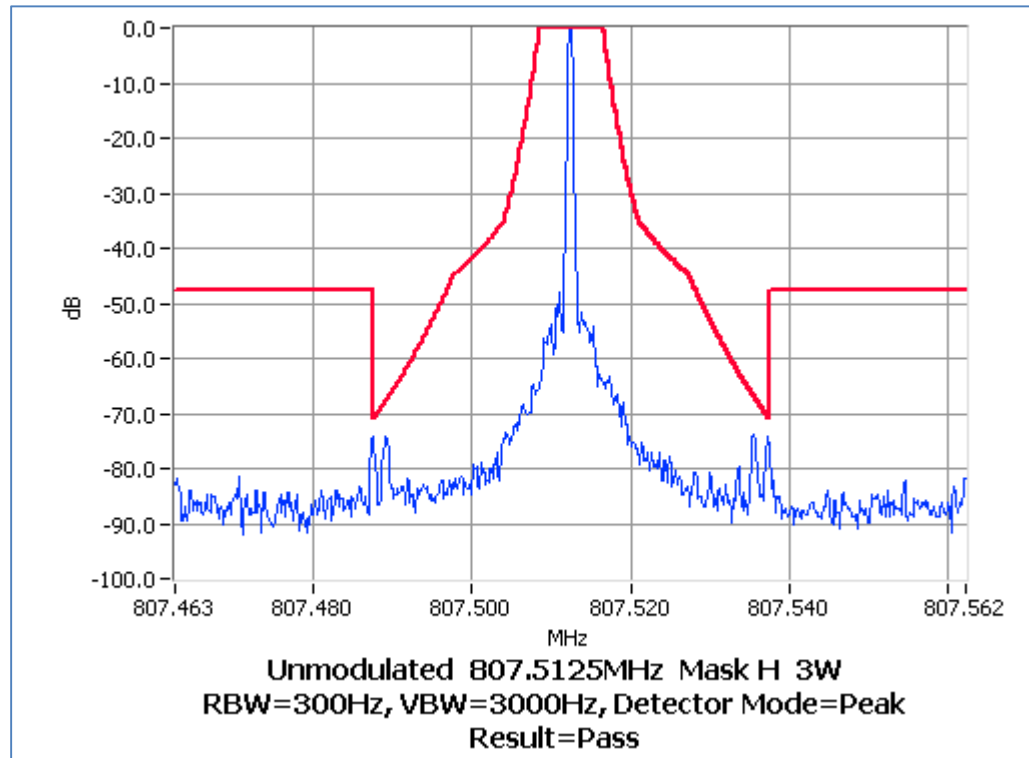
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Tx FREQUENCY: 868.9875 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

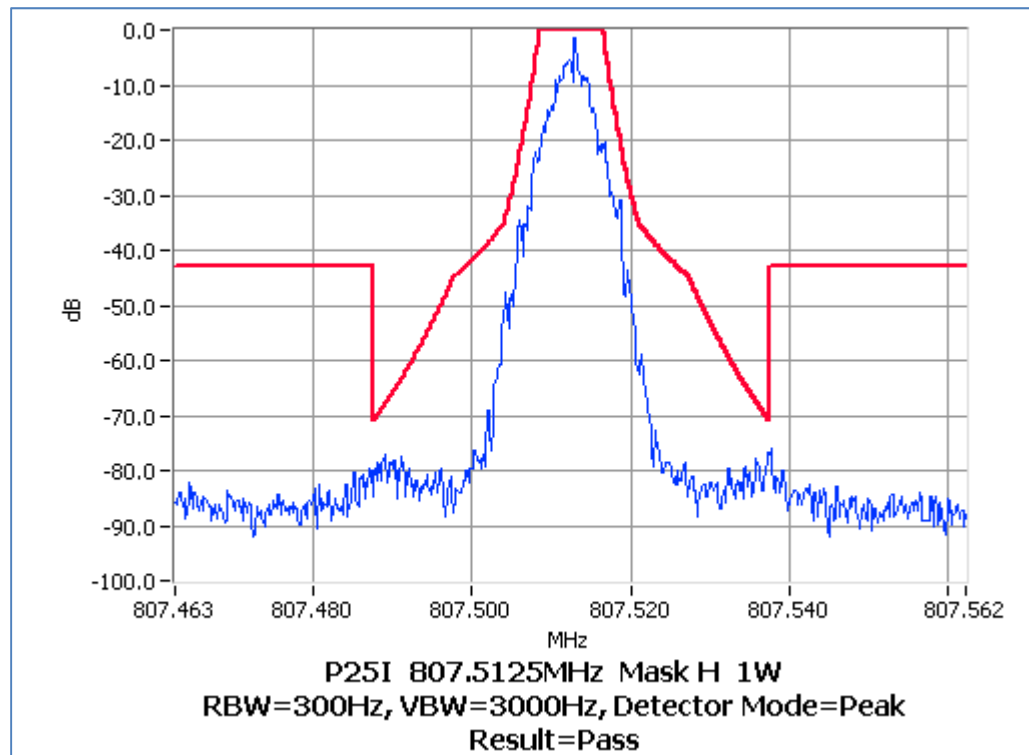
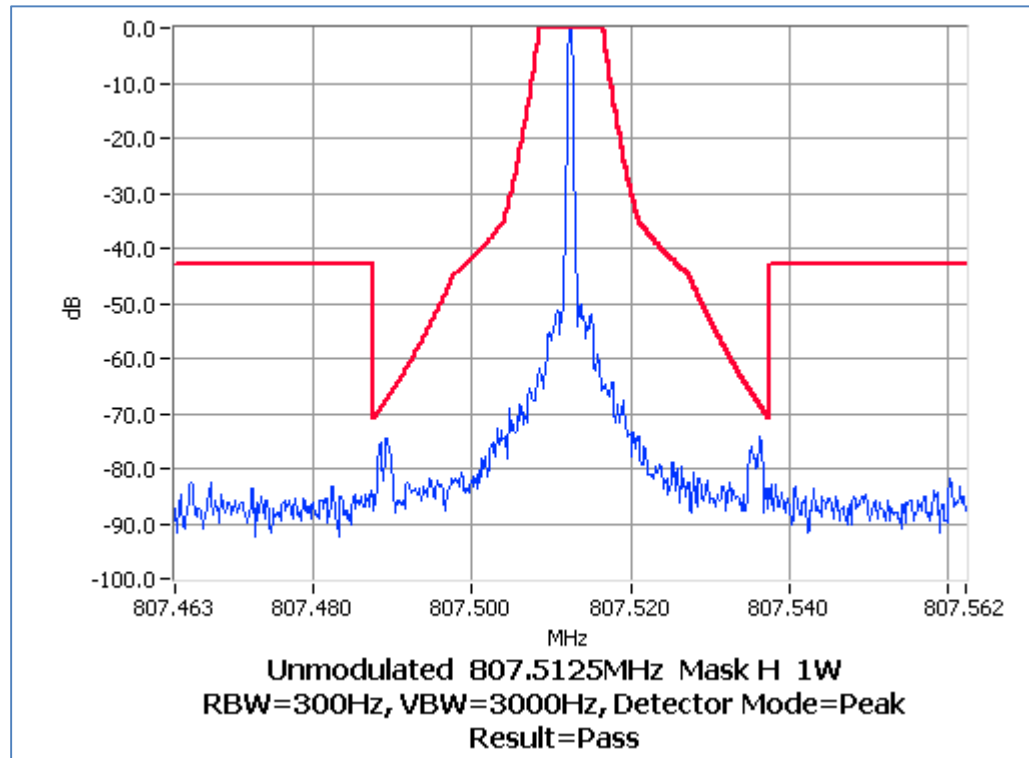
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 3 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 1

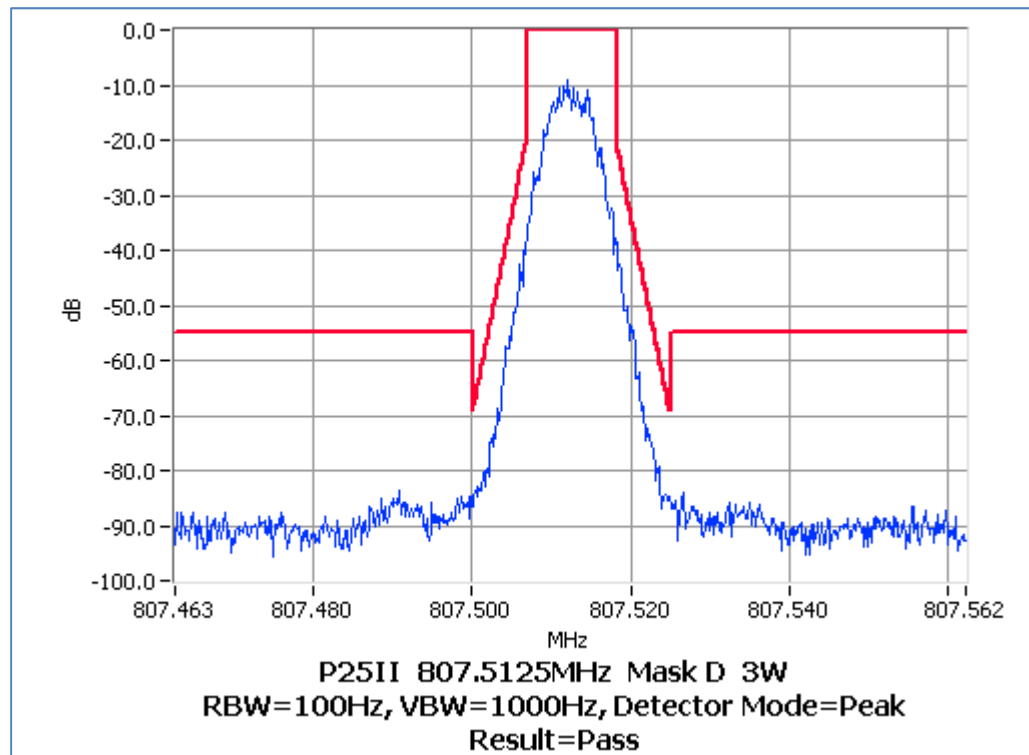
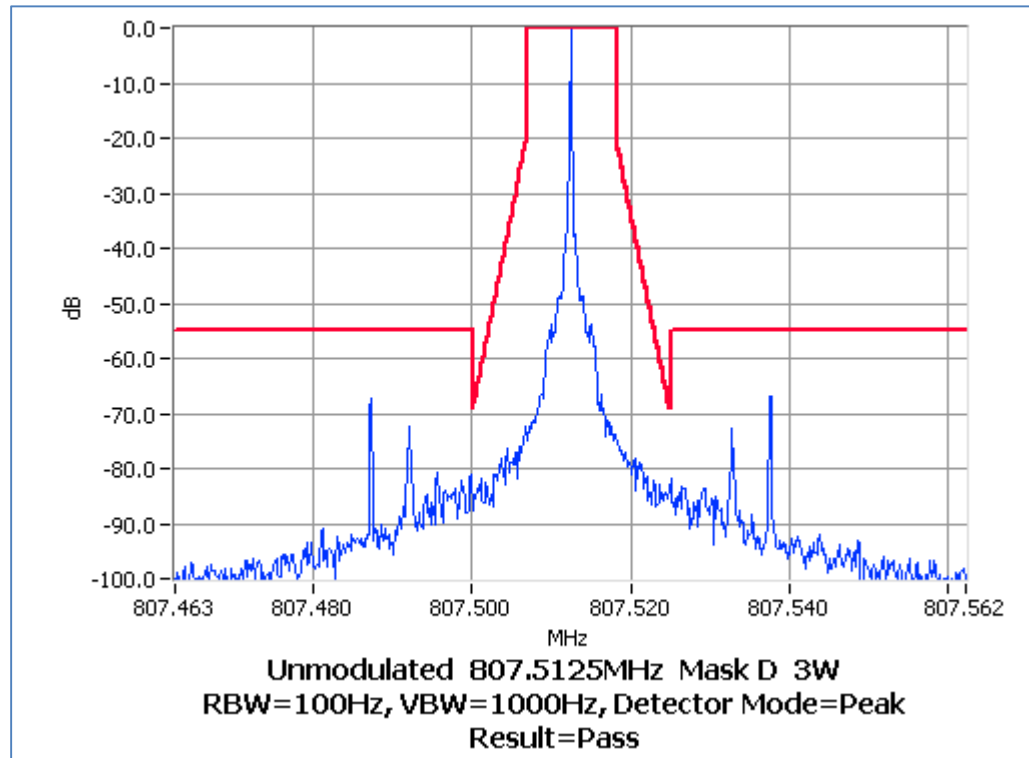
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

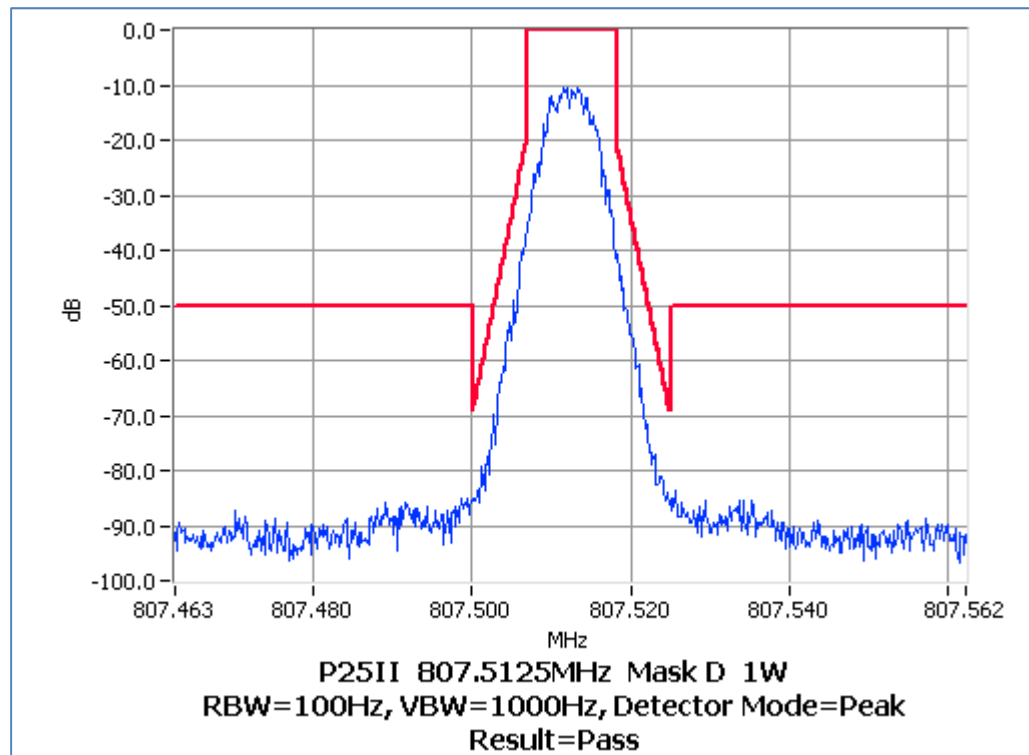
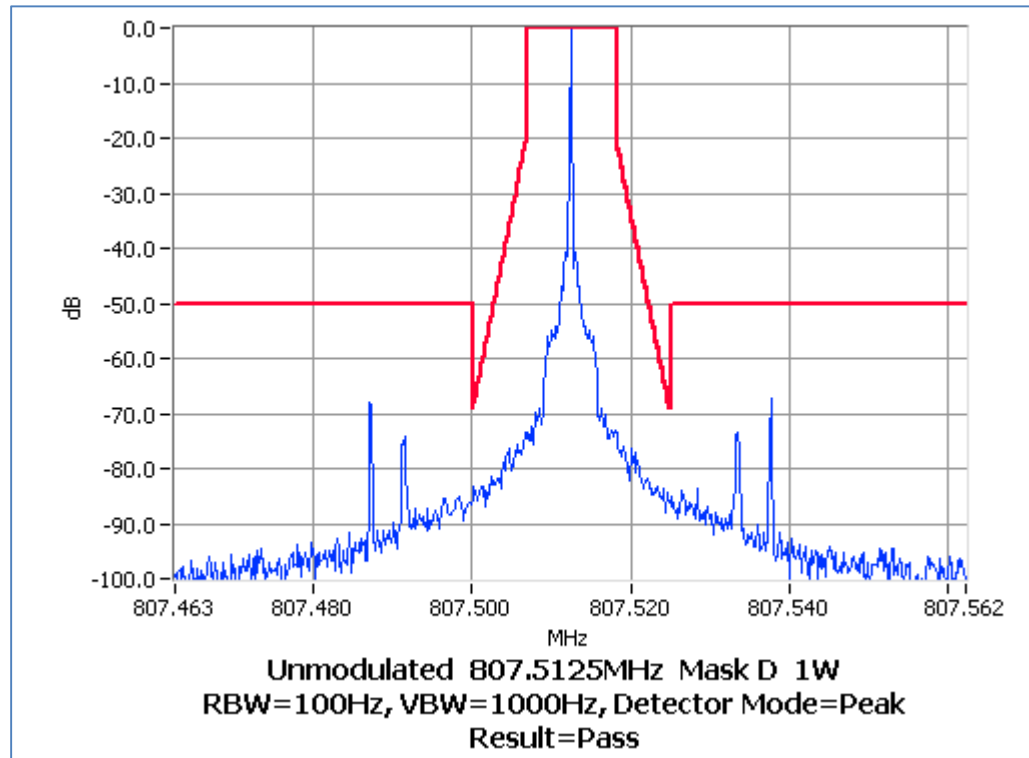
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 3 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

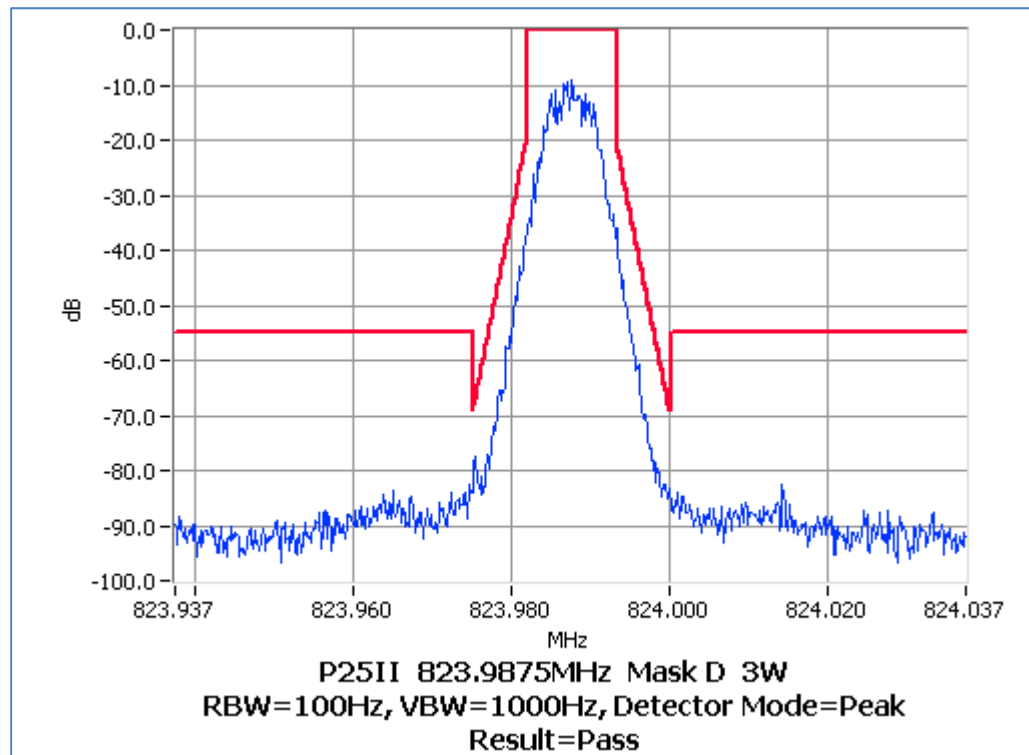
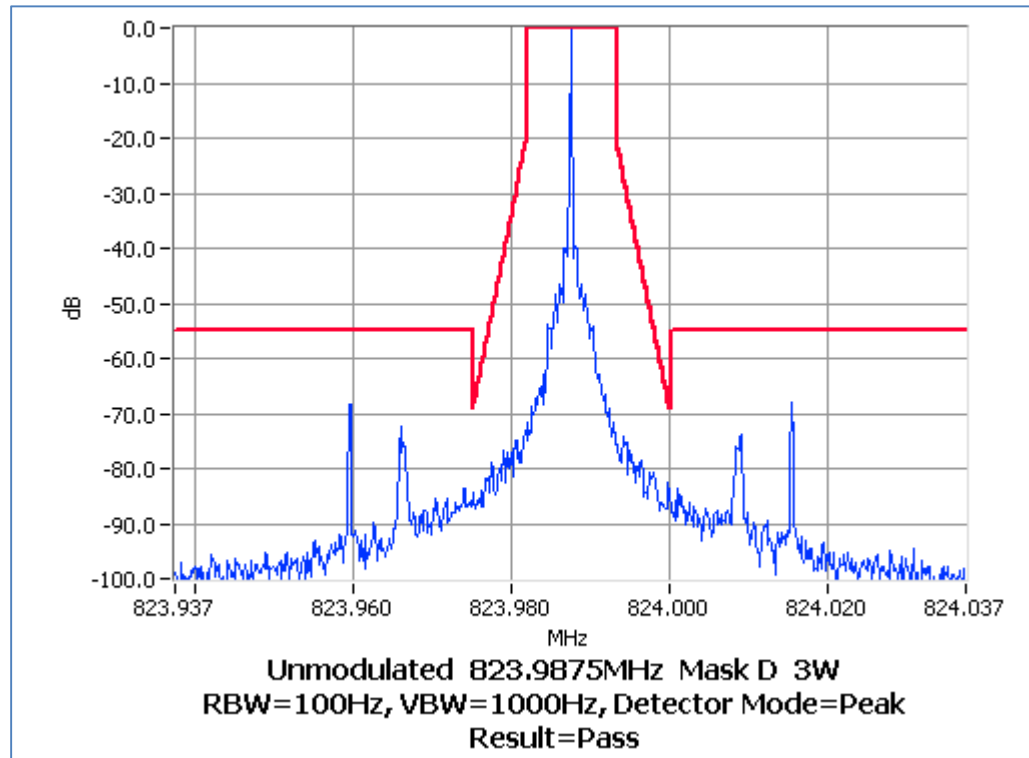
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

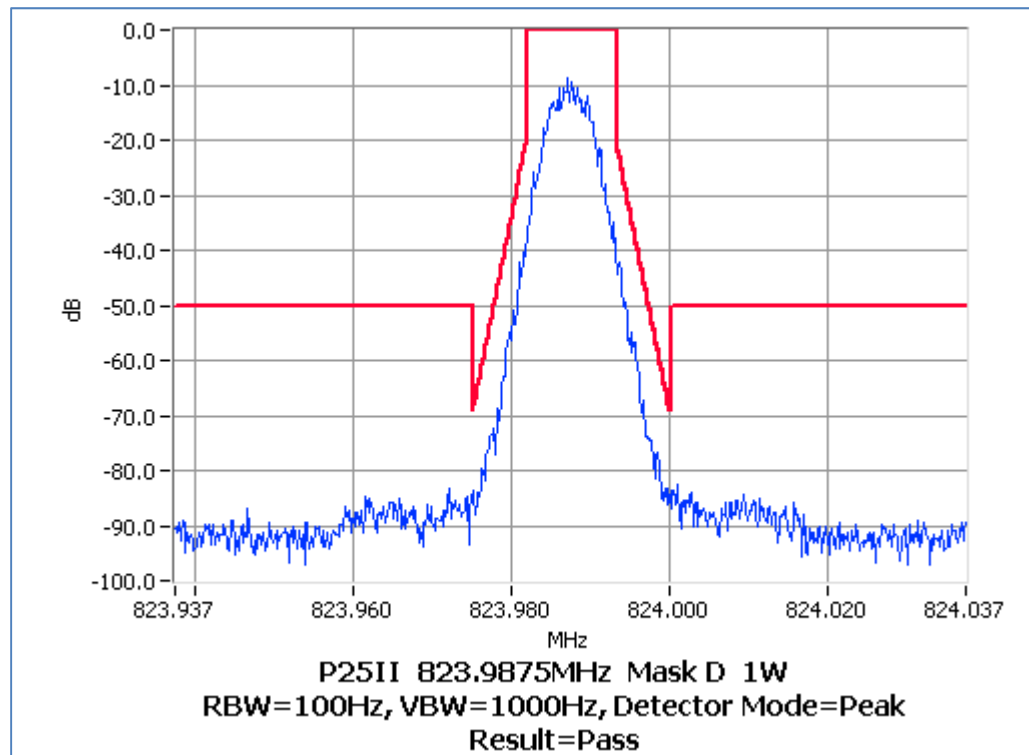
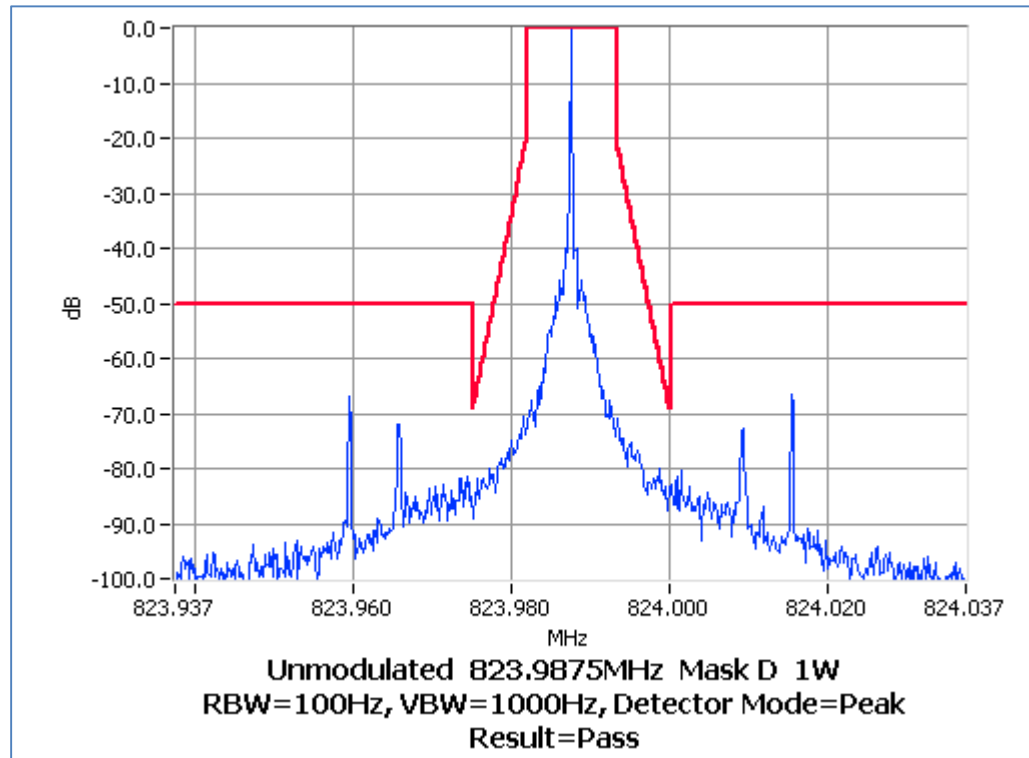
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 823.9875 MHz 3 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

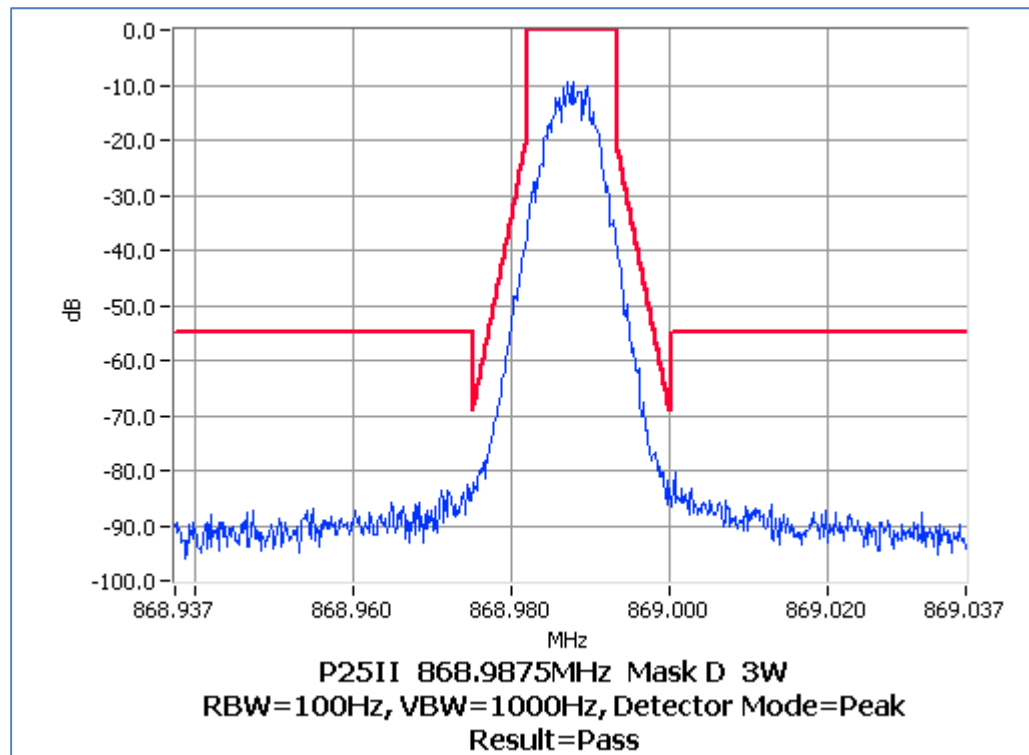
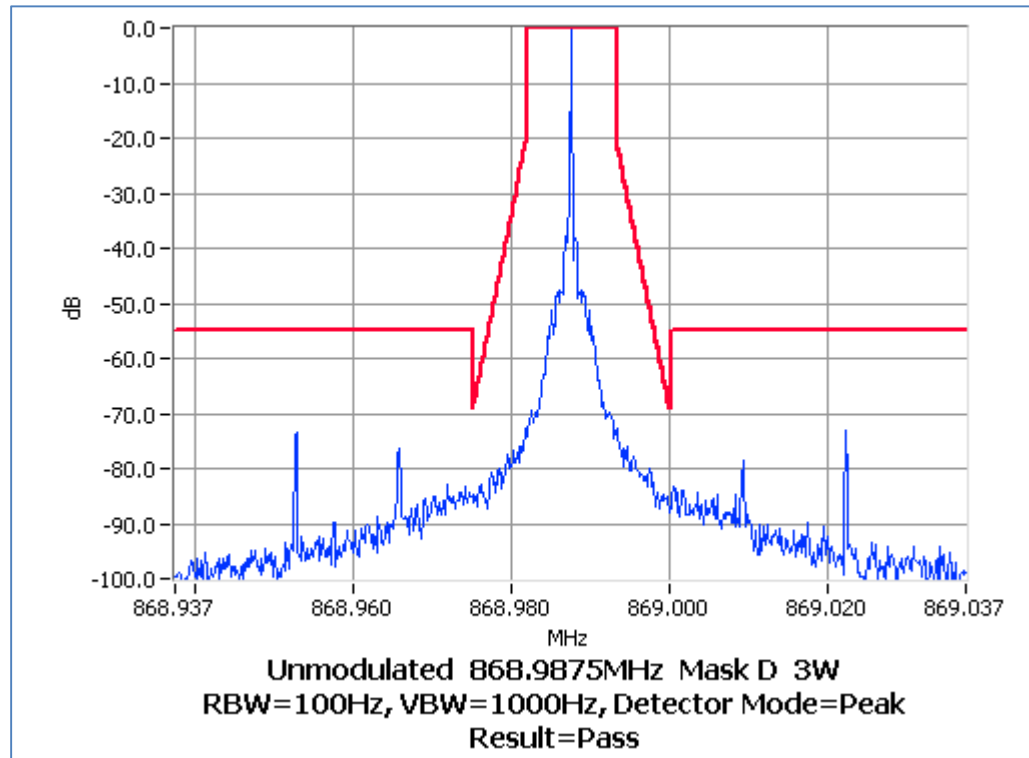
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 823.9875 MHz 1 W 12.5 kHz Channel Spacing



TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

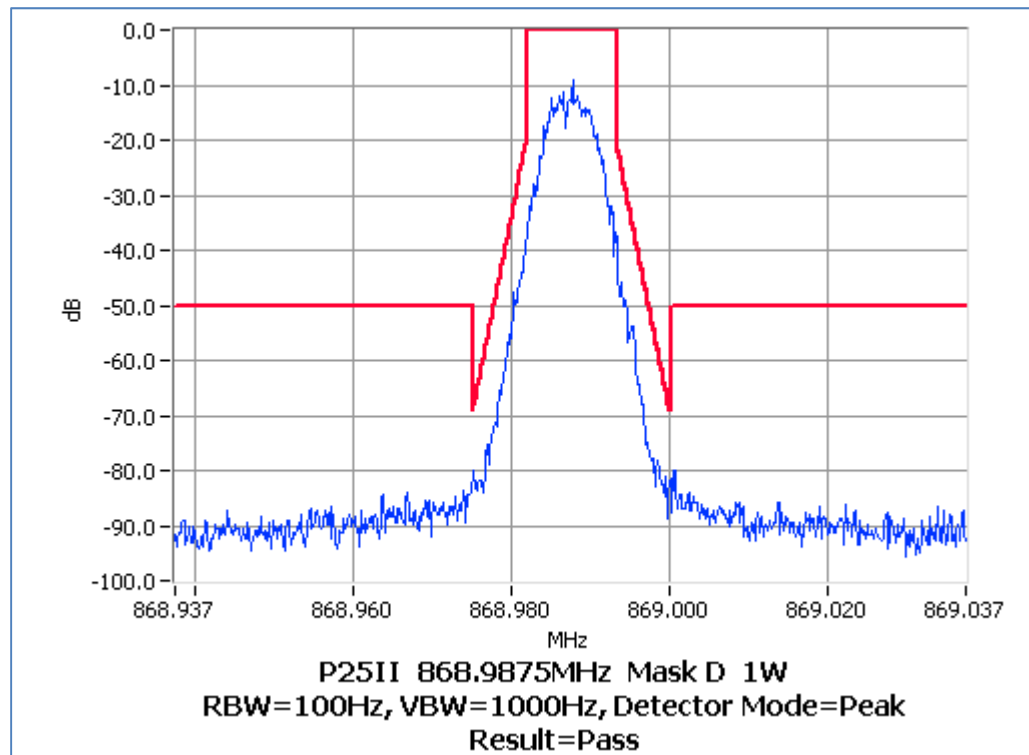
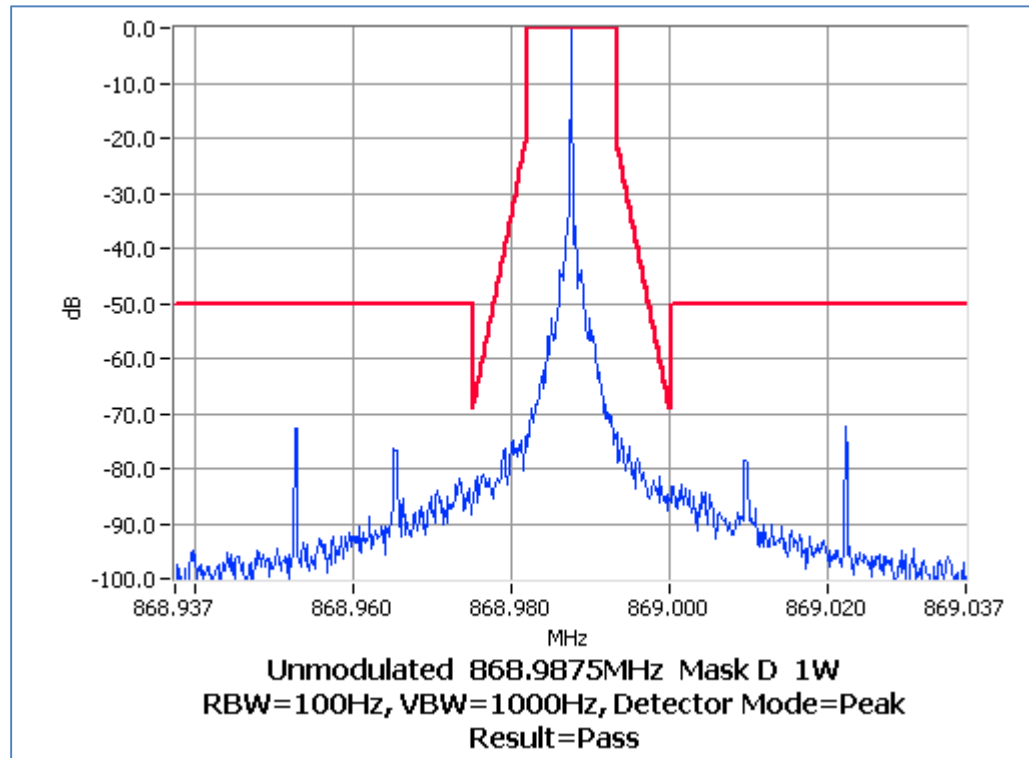
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 868.9875 MHz 3 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

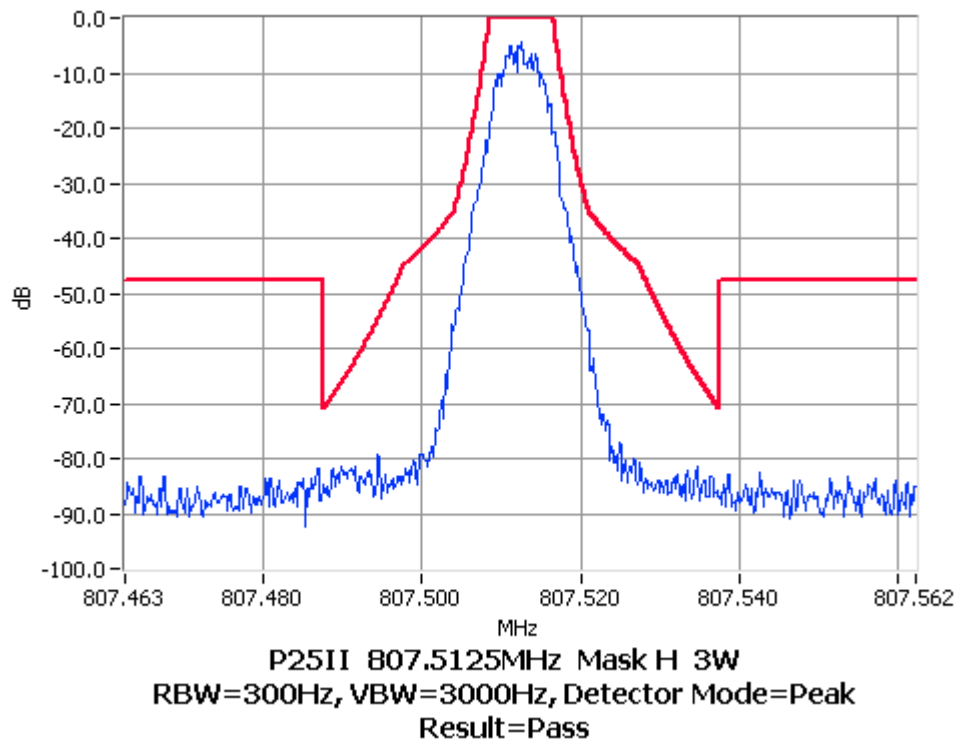
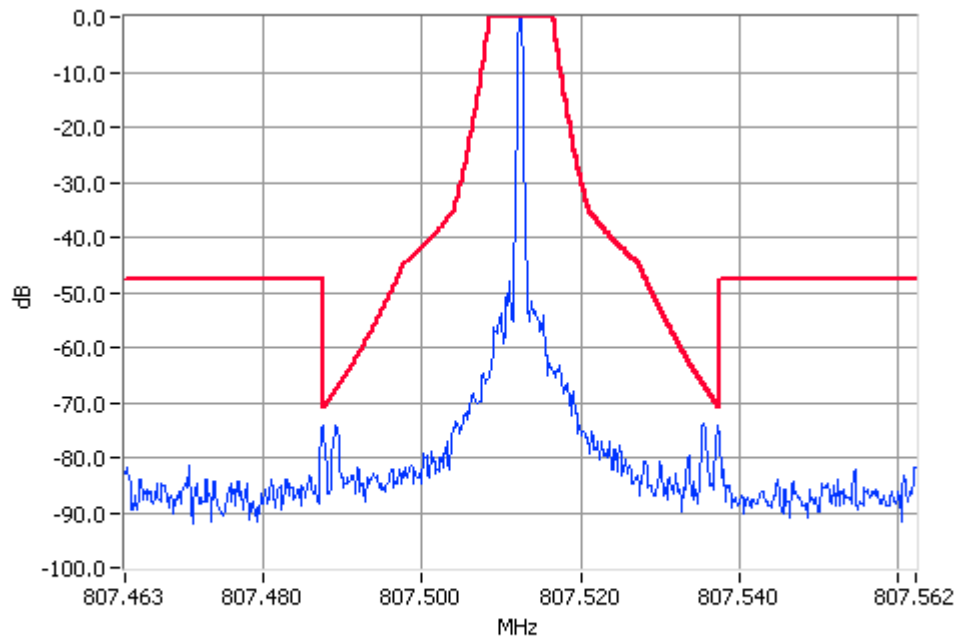
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Tx FREQUENCY: 868.9875 MHz 1 W 12.5 kHz Channel Spacing



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Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

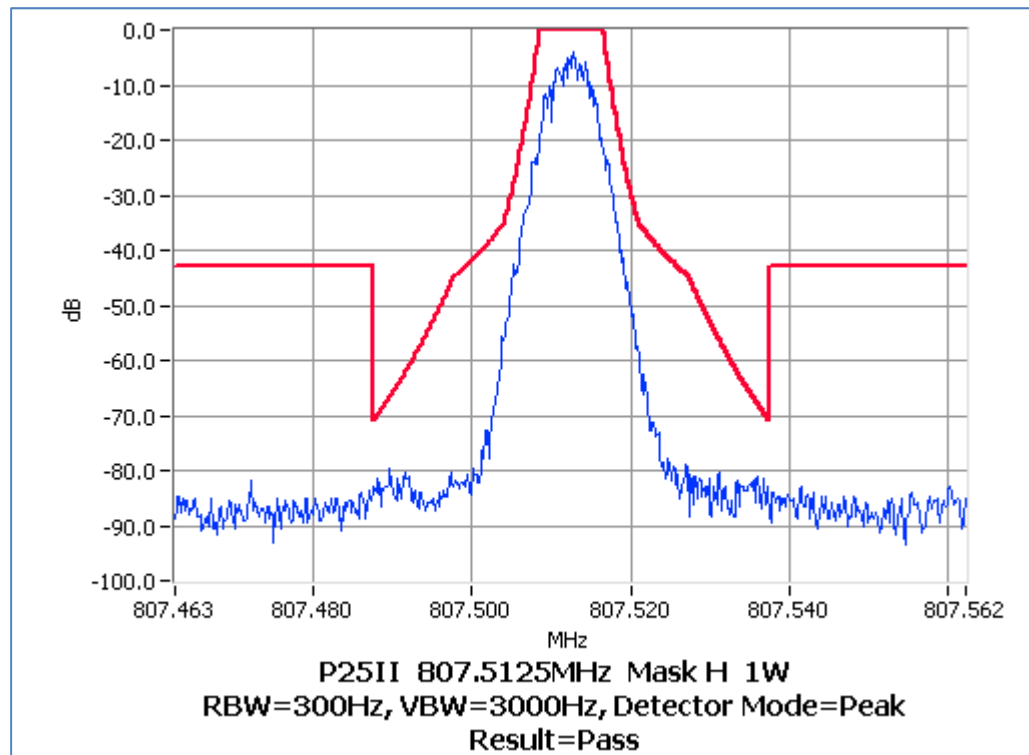
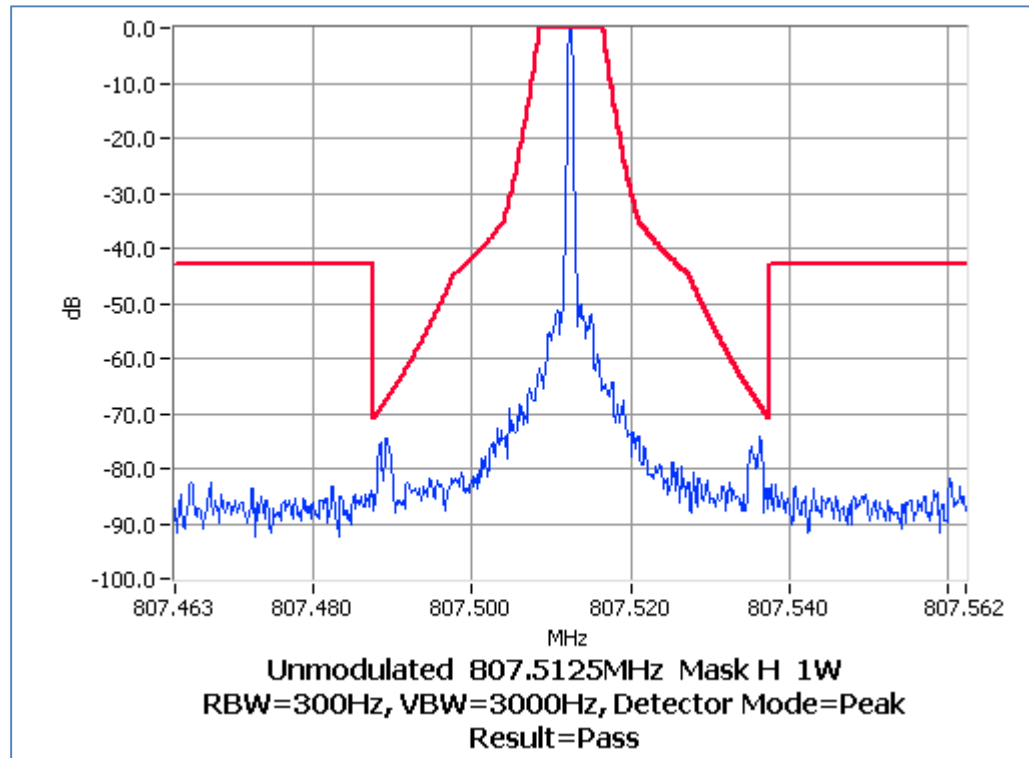
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 3 W 12.5 kHz Channel Spacing



TELTEST Laboratories
Tait Communications
Report Number 3425C
Occupied Bandwidth and Spectrum Masks

P25 Phase 2

SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5
Tx FREQUENCY: 807.5125 MHz 1 W 12.5 kHz Channel Spacing



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: 769.06875 MHz 3 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	-42.10	-41.23	-40
15.625 kHz	6.25 kHz	-76.76	-76.44	-60
21.875 kHz	6.25 kHz	-78.49	-79.08	-60
37.5 kHz	25 kHz	-78.86	-78.87	-60
62.5 kHz	25 kHz	-82.85	-82.81	-65
87.5 kHz	25 kHz	-84.41	-84.42	-65
150 kHz	100 kHz	-77.72	-77.66	-65
250 kHz	100 kHz	-80.89	-80.87	-65
350 kHz	100 kHz	-83.37	-83.32	-65
>400 kHz to 12 MHz	30 kHz (swept)	-89.11		-75
12 MHz to paired receive band	30 kHz (swept)	-94.75		-75
In the paired receive band	30 kHz (swept)	-104.85		-100

DMR

Tx FREQUENCY: 799.06875 MHz 3 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	-42.96	-42.53	-40
15.625 kHz	6.25 kHz	-73.13	-73.29	-60
21.875 kHz	6.25 kHz	-66.81	-66.68	-60
37.5 kHz	25 kHz	-71.33	-70.90	-60
62.5 kHz	25 kHz	-79.48	-79.32	-65
87.5 kHz	25 kHz	-81.44	-81.33	-65
150 kHz	100 kHz	-76.84	-76.84	-65
250 kHz	100 kHz	-80.71	-80.75	-65
350 kHz	100 kHz	-83.35	-83.34	-65
>400 kHz to 12 MHz	30 kHz (swept)	-77.79		-75
12 MHz to paired receive band	30 kHz (swept)	-87.07		-75
In the paired receive band	30 kHz (swept)	-101.04		-100

TELTEST Laboratories
Tait Communications
Report Number 3425C
Adjacent Channel Power Ratio - Continued

P25 Phase 1

Tx FREQUENCY: 769.06875 MHz 3 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	-40.13	-40
15.625 kHz	6.25 kHz	-76.44	-76.33	-60
21.875 kHz	6.25 kHz	-79.98	-79.71	-60
37.5 kHz	25 kHz	-78.51	-78.56	-60
62.5 kHz	25 kHz	-82.33	-82.26	-65
87.5 kHz	25 kHz	-84.24	-84.19	-65
150 kHz	100 kHz	-77.75	-77.70	-65
250 kHz	100 kHz	-80.81	-80.75	-65
350 kHz	100 kHz	-83.19	-83.15	-65
>400 kHz to 12 MHz	30 kHz (swept)	-89.23		-75
12 MHz to paired receive band	30 kHz (swept)	-94.05		-75
In the paired receive band	30 kHz (swept)	-104.40		-100

P25 Phase 1

Tx FREQUENCY: 799.06875 MHz 3 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	-41.46	-41.03	-40
15.625 kHz	6.25 kHz	-74.09	-74.43	-60
21.875 kHz	6.25 kHz	-67.51	-67.54	-60
37.5 kHz	25 kHz	-71.12	-70.38	-60
62.5 kHz	25 kHz	-79.44	-79.23	-65
87.5 kHz	25 kHz	-81.40	-81.29	-65
150 kHz	100 kHz	-77.09	-77.01	-65
250 kHz	100 kHz	-81.01	-81.00	-65
350 kHz	100 kHz	-83.64	-83.58	-65
>400 kHz to 12 MHz	30 kHz (swept)	-78.36		-75
12 MHz to paired receive band	30 kHz (swept)	-86.53		-75
In the paired receive band	30 kHz (swept)	-102.75		-100

TELTEST Laboratories
Tait Communications
Report Number 3425C
Adjacent Channel Power Ratio - Continued

P25 Phase 2

Tx FREQUENCY: 769.06875 MHz 3 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	-41.66	-41.48	-40
15.625 kHz	6.25 kHz	-76.77	-76.71	-60
21.875 kHz	6.25 kHz	-78.97	-79.28	-60
37.5 kHz	25 kHz	-78.16	-78.13	-60
62.5 kHz	25 kHz	-83.08	-83.05	-65
87.5 kHz	25 kHz	-84.47	-84.42	-65
150 kHz	100 kHz	-77.76	-77.73	-65
250 kHz	100 kHz	-80.87	-80.85	-65
350 kHz	100 kHz	-83.37	-83.34	-65
>400 kHz to 12 MHz	30 kHz (swept)	-89.44		-75
12 MHz to paired receive band	30 kHz (swept)	-94.19		-75
In the paired receive band	30 kHz (swept)	-105.16		-100

P25 Phase 2

Tx FREQUENCY: 799.06875 MHz 3 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	-41.88	-41.78	-40
15.625 kHz	6.25 kHz	-76.03	-76.22	-60
21.875 kHz	6.25 kHz	-73.07	-73.43	-60
37.5 kHz	25 kHz	-74.74	-74.32	-60
62.5 kHz	25 kHz	-81.12	-80.78	-65
87.5 kHz	25 kHz	-83.25	-83.16	-65
150 kHz	100 kHz	-77.67	-77.65	-65
250 kHz	100 kHz	-81.12	-81.11	-65
350 kHz	100 kHz	-83.68	-83.67	-65
>400 kHz to 12 MHz	30 kHz (swept)	-89.83		-75
12 MHz to paired receive band	30 kHz (swept)	-97.82		-75
In the paired receive band	30 kHz (swept)	-105.9		-100

TELTEST Laboratories
Tait Communications
Report Number 3425C
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: 100kHz 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 20dB 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.

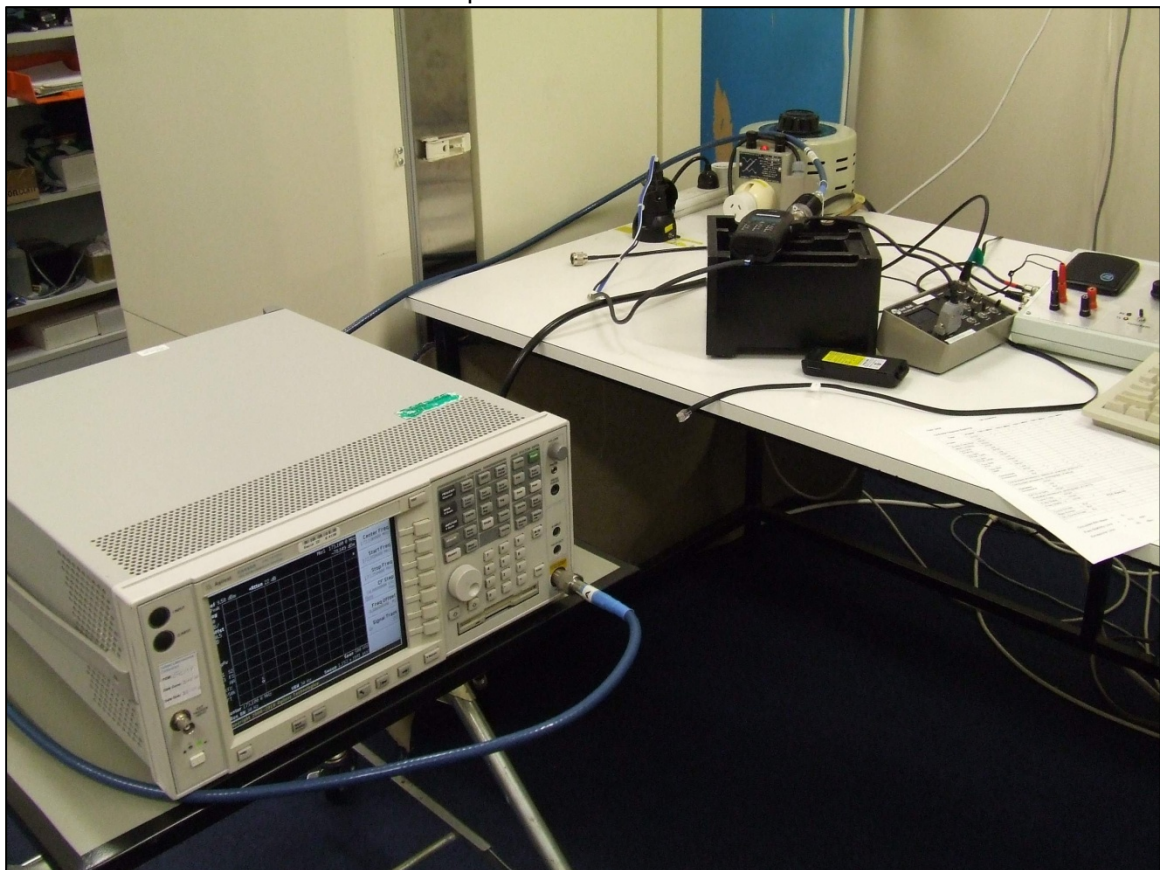
MEASUREMENT RESULTS:

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



TELTEST Laboratories
Tait Communications
Report Number 3425C
Tx Conducted Emissions - Continued

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing		769.06875MHz @ 3 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
769.0484	-34.9		-69.7
~	~		~
12.5 kHz Channel Spacing		769.06875MHz @ 1 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.			

769.06875MHz @ 3 W



TELTEST Laboratories
Tait Communications
Report Number 3425C
Tx Conducted Emissions - Continued

12.5 kHz Channel Spacing		799.06875MHz @ 3 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
799.0442	-33.3		-68.1
~	~		~
12.5 kHz Channel Spacing		799.06875MHz @ 1 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
799.0442	-39.7		-69.7
~	~		~
No other emissions were detected at a level greater than 20 dB below the limit.			

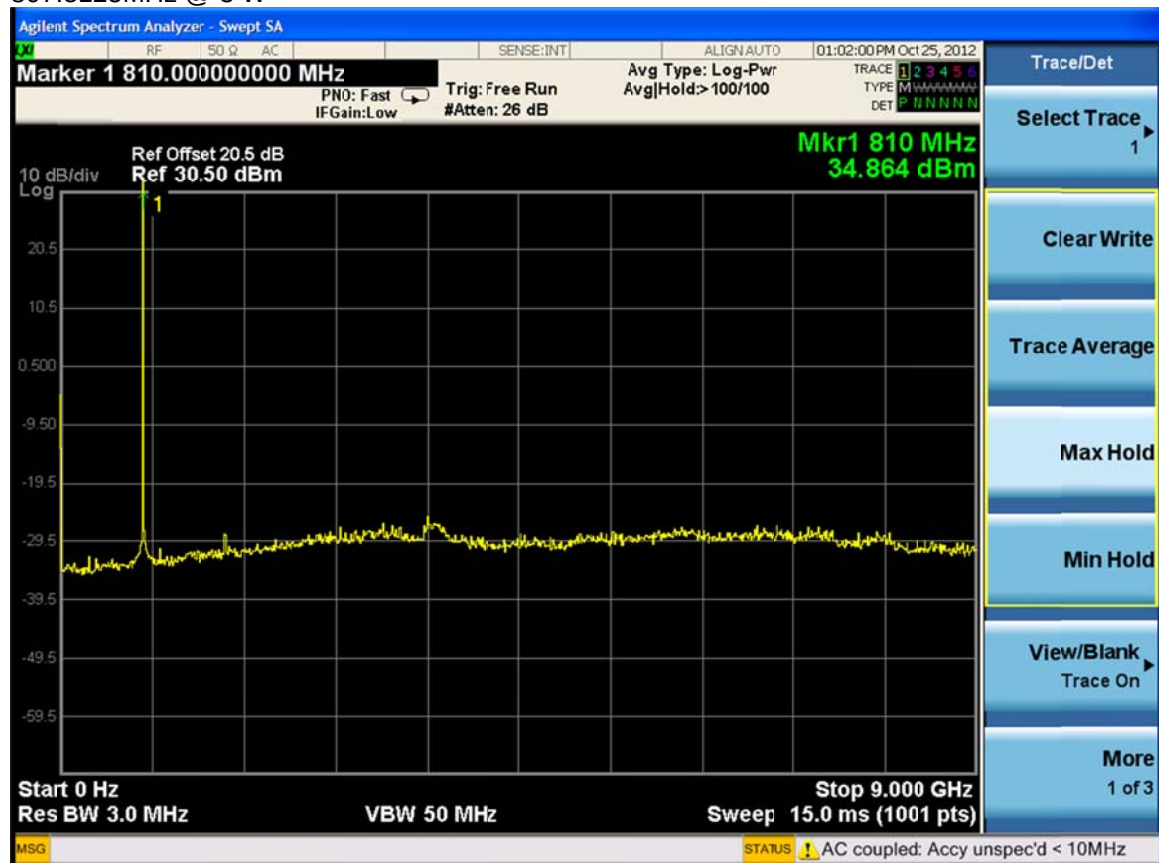
799.06875MHz @ 3 W



TELTEST Laboratories
Tait Communications
Report Number 3425C
Tx Conducted Emissions - Continued

12.5 kHz Channel Spacing		807.5125MHz @ 3 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
807.4863	-33.2		-68.0
807.5379	-32.9		-67.7
~	~		~
12.5 kHz Channel Spacing		807.5125MHz @ 1 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
807.4863	-38.4		-68.4
807.5379	-37.7		-67.7
~	~		~
No other emissions were detected at a level greater than 20 dB below the limit.			

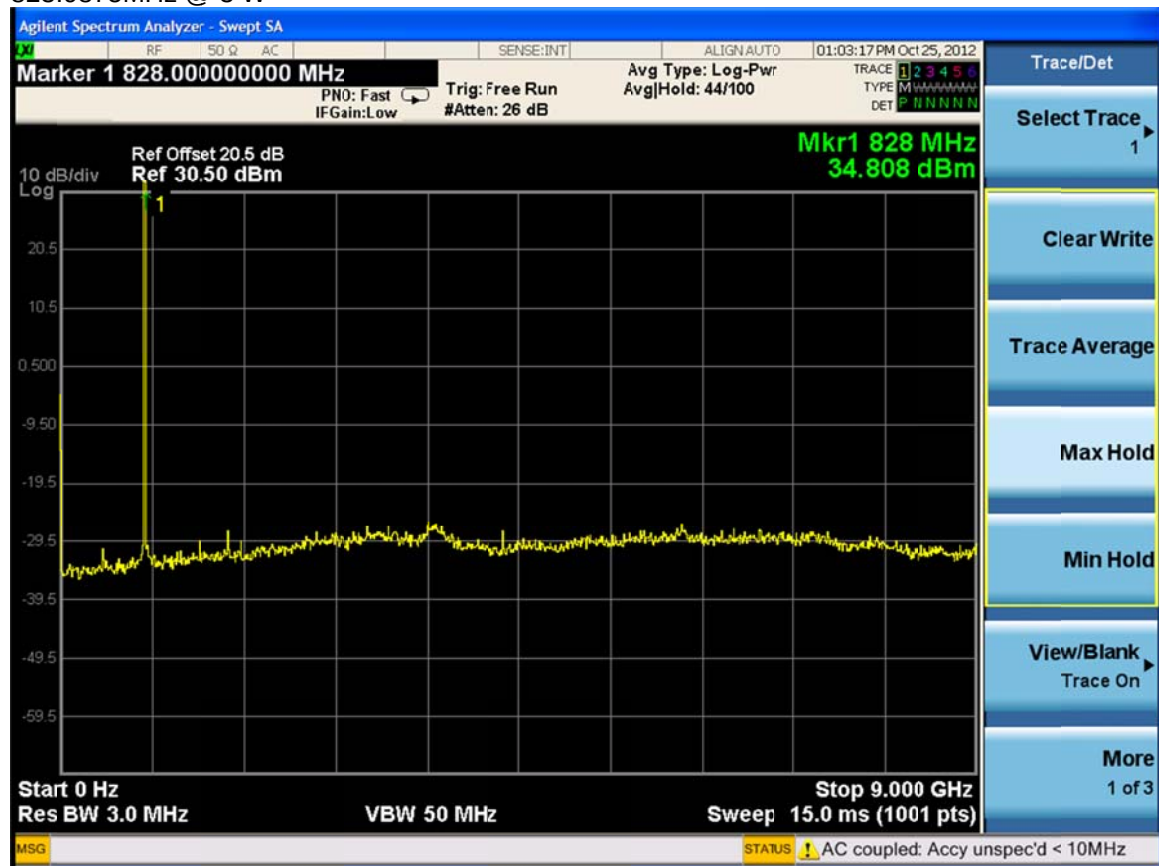
807.5125MHz @ 3 W



TELTEST Laboratories
Tait Communications
Report Number 3425C
Tx Conducted Emissions - Continued

12.5 kHz Channel Spacing		823.9875MHz @ 3 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
823.9596	-33.2		-68.0
824.0145	-32.9		-67.7
~	~		~
12.5 kHz Channel Spacing		823.9875MHz @ 1 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
823.9588	-36.4		-66.4
824.0154	-36.1		-66.1
~	~		~
No other emissions were detected at a level greater than 20 dB below the limit.			

823.9875MHz @ 3 W



TELTEST Laboratories
Tait Communications
Report Number 3425C
Tx Conducted Emissions - Continued

12.5 kHz Channel Spacing		868.9875MHz @ 3 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
868.9521	-38.6		-73.4
869.0220	-38.2		-73.0
~	~		~
12.5 kHz Channel Spacing		868.9875MHz @ 1 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 @ 3 W



TELTEST Laboratories
Tait Communications
Report Number 3425C
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 $50 + 10 \log_{10} (P_{\text{Watts}})$		
3 W	-20 dBm	-54.7 dBc	
1 W	-20 dBm	-50.0 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 10th 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 6th 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 1 m to 4 m to obtain a maximum reading; the turntable is then rotated through 360° 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

TELTEST Laboratories
Tait Communications
Report Number 3425C
Tx Radiated Emissions - Continued

12.5 kHz Channel Spacing		769.06875MHz @ 3 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
~	~		~
12.5 kHz Channel Spacing		769.06875MHz @ 1 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 @ 3 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
~	~		~
12.5 kHz Channel Spacing		799.06875MHz @ 1 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 @ 3 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
~	~		~
12.5 kHz Channel Spacing		807.5125MHz @ 1 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.			

TELTEST Laboratories
Tait Communications
Report Number 3425C
Tx Radiated Emissions - Continued

12.5 kHz Channel Spacing		823.9875MHz @ 3 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
~	~		~
12.5 kHz Channel Spacing		823.9875MHz @ 1 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 @ 3 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
~	~		~
12.5 kHz Channel Spacing		868.9875MHz @ 1 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 $50 + 10 \log_{10} (P_{\text{Watts}})$	
3 W	-20 dBm	-54.7 dBc
1 W	-20 dBm	-50.0 dBc

TELTEST Laboratories
Tait Communications
Report Number 3425C
Tx Radiated Emissions - Continued

Open Area Test Site Results for the First Six Harmonics		
12.5 kHz Channel Spacing	823.9875MHz @ 3 W	Emission Mask D
Harmonics Emission Frequency (MHz)	Level (dBm)	Level (dBc)
1647.9750	-49.0	-83.7
2471.9625	-58.8	-93.5
3295.9500	-64.8	-99.5
4119.9375	< -60.0	< -94.7
4943.9250	< -60.0	< -94.7
5767.9125	< -60.0	< -94.7

Photo: OATS Setup



TRANSMITTER 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° 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 3W

Frequency	Antenna Polarity	Level dBW / MHz EIRP
1598.1375 MHz	Horizontal	-79.4
	Vertical	-72.7

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 CONDUCTED EMISSIONS IN THE GNSS BAND

SPECIFICATION: RSS-119 5.8

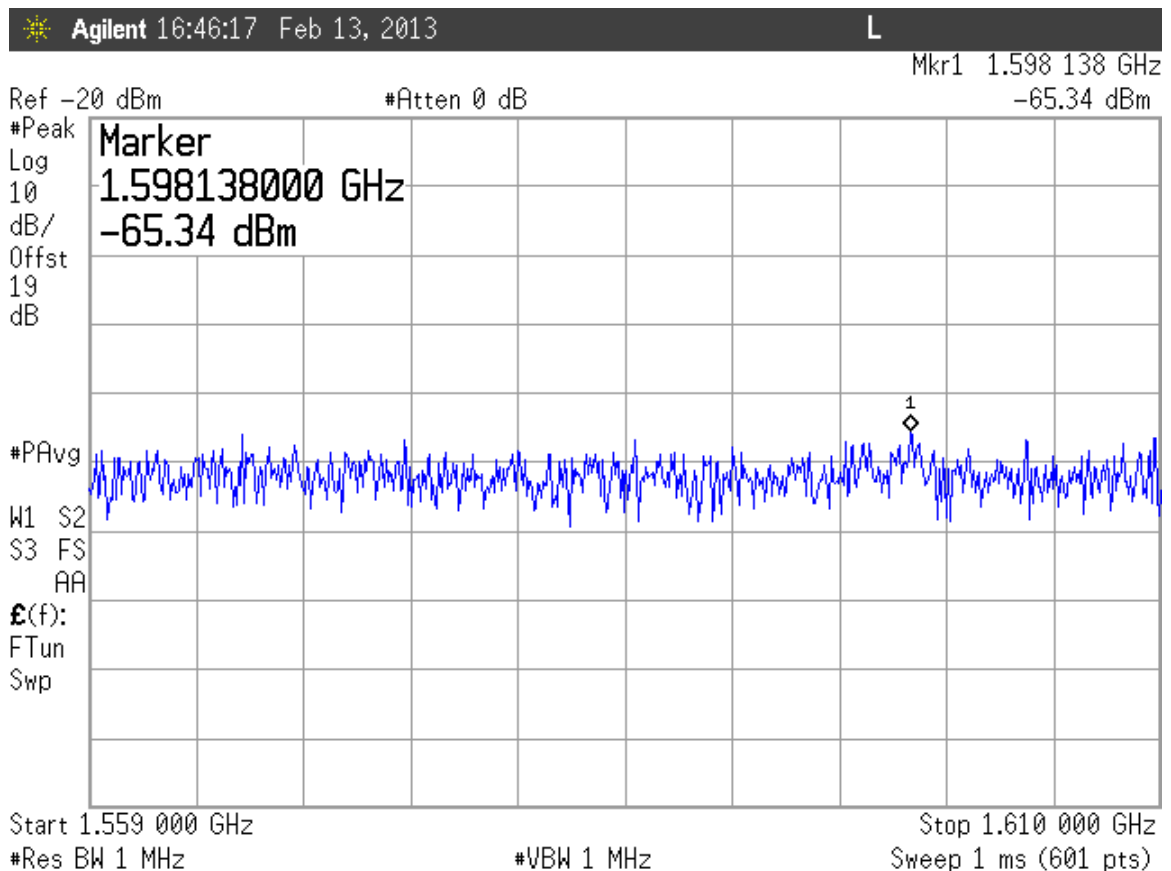
MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. Spurious emissions were measured in the GNSS band. (1559 – 1610 MHz)
3. The EUT was connected via an attenuator to a spectrum analyser.
4. Allowance was made for a theoretical dipole with a gain of 2.15dBm isotropic.
5. The emission at the frequency of the second harmonic was measured.

799.06875 MHz 3W

Frequency	Level dBm / MHz EIRP	Level dBW / MHz EIRP
1598.1375 MHz	-65.34	-95.34

LIMIT CLAUSE RSS-119 5.8.9.2	-70 dBW / MHz EIRP
---------------------------------	--------------------



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:

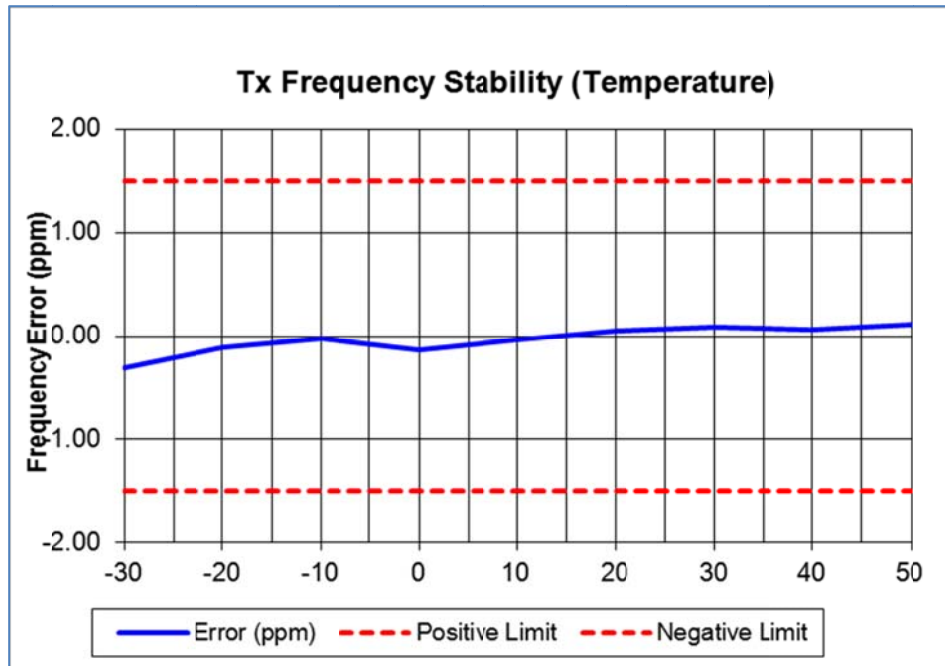
1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error from -30°C to $+50^{\circ}\text{C}$ in 10°C increments
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

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

769.06875 MHz

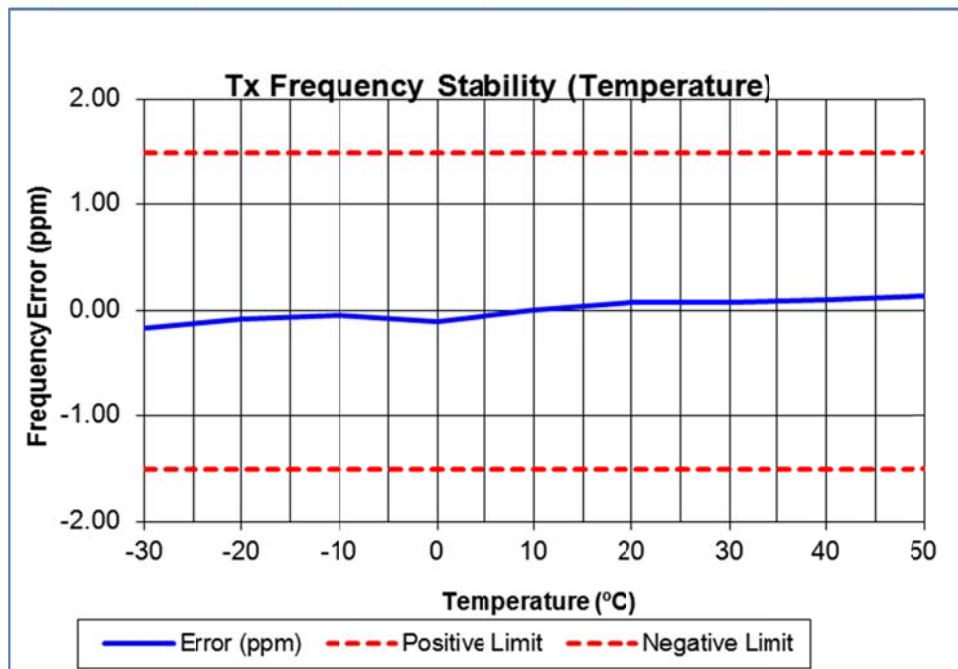
Temperature ($^{\circ}\text{C}$)	Frequency (MHz)	Error (ppm)
50	769.068837	0.11
40	769.068801	0.07
30	769.068819	0.09
20	769.068792	0.05
10	769.068720	-0.04
0	769.068650	-0.13
-10	769.068729	-0.03
-20	769.068661	-0.12
-30	769.068516	-0.30



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Report Number 3425C
Transmitter Frequency Stability - Temperature

799.06875 MHz

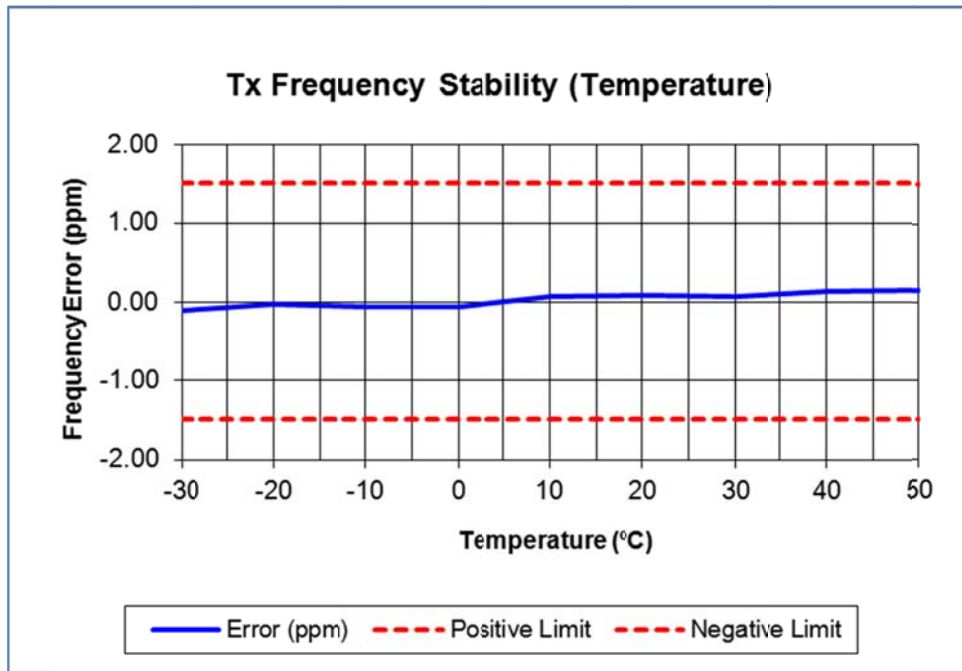
Temperature (°C)	Frequency (MHz)	Error (ppm)
50	799.068866	0.14
40	799.068825	0.09
30	799.068812	0.08
20	799.068809	0.07
10	799.068753	0.00
0	799.068669	-0.10
-10	799.068716	-0.04
-20	799.068688	-0.08
-30	799.068614	-0.17



TELTEST Laboratories
Tait Communications
Report Number 3425C
Transmitter Frequency Stability - Temperature

807.5125 MHz

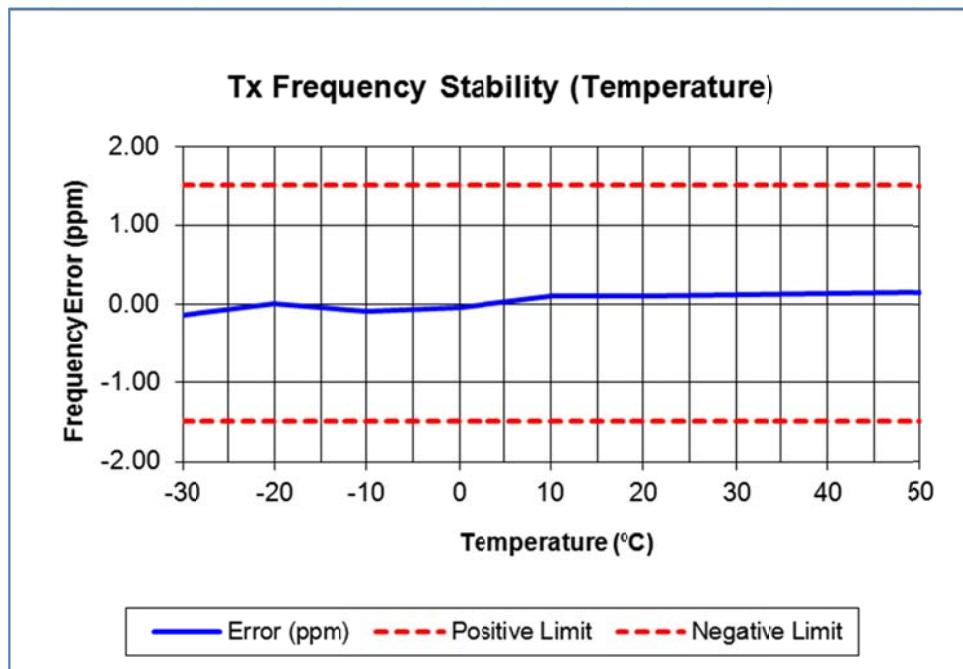
Temperature (°C)	Frequency (MHz)	Error (ppm)
50	807.512629	0.16
40	807.512608	0.13
30	807.512563	0.08
20	807.512577	0.10
10	807.512554	0.07
0	807.512448	-0.06
-10	807.512452	-0.06
-20	807.512477	-0.03
-30	807.512414	-0.11



TELTEST Laboratories
Tait Communications
Report Number 3425C
Transmitter Frequency Stability - Temperature

823.9875 MHz

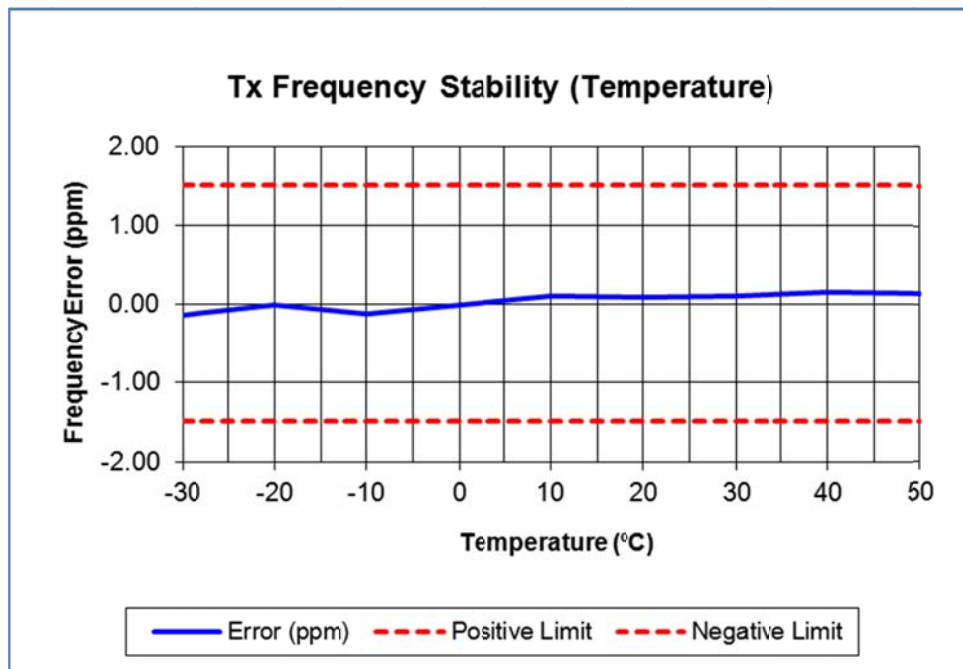
Temperature (°C)	Frequency (MHz)	Error (ppm)
50	823.987627	0.15
40	823.987619	0.14
30	823.987594	0.11
20	823.987589	0.11
10	823.987584	0.10
0	823.987470	-0.04
-10	823.987424	-0.09
-20	823.987507	0.01
-30	823.987392	-0.13



TELTEST Laboratories
Tait Communications
Report Number 3425C
Transmitter Frequency Stability - Temperature

868.9875 MHz

Temperature (°C)	Frequency (MHz)	Error (ppm)
50	868.98762	0.14
40	868.987641	0.16
30	868.987595	0.11
20	868.987580	0.09
10	868.987593	0.11
0	868.987492	-0.01
-10	868.987393	-0.12
-20	868.987497	0.00
-30	868.987373	-0.15



LIMIT: FCC 47 CFR 90.213

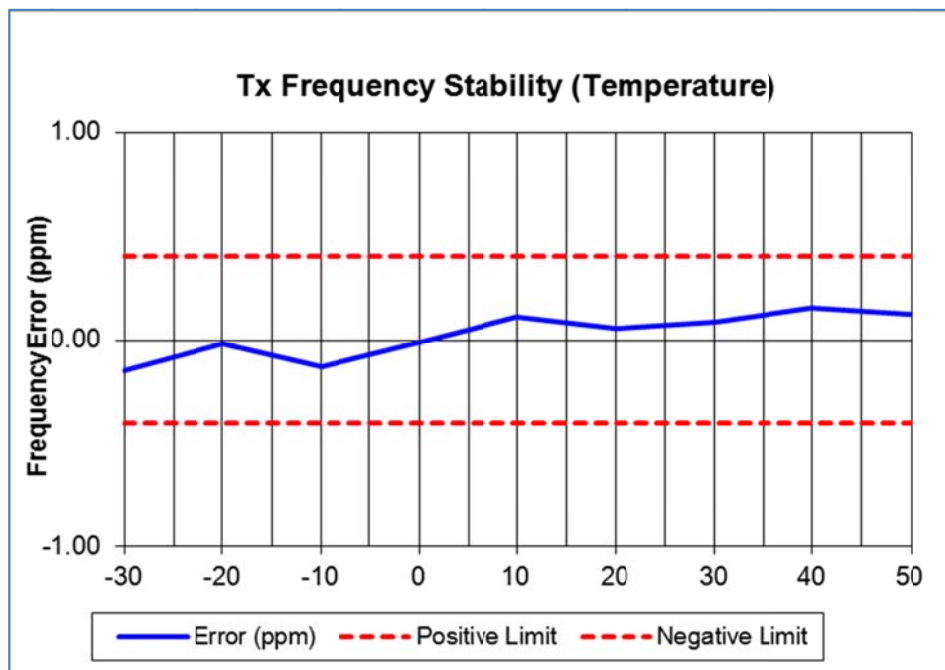
RSS-119 5.3

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

TELTEST Laboratories
Tait Communications
Report Number 3425C
Transmitter Frequency Stability - Temperature

769.06875 MHz With AFC On

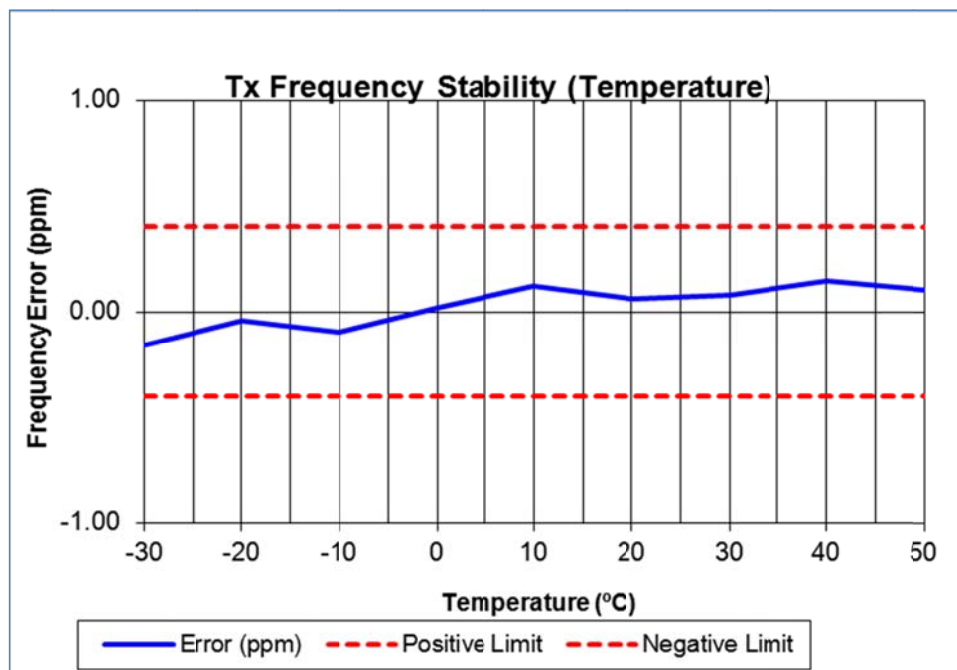
Temperature (°C)	Frequency (MHz)	Error (ppm)
50	769.068847	0.13
40	769.068870	0.16
30	769.068817	0.09
20	769.068792	0.05
10	769.068837	0.11
0	769.068739	-0.01
-10	769.068649	-0.13
-20	769.068734	-0.02
-30	769.068635	-0.15



TELTEST Laboratories
Tait Communications
Report Number 3425C
Transmitter Frequency Stability - Temperature

799.06875 MHz With AFC On

Temperature (°C)	Frequency (MHz)	Error (ppm)
50	799.068832	0.10
40	799.068865	0.14
30	799.068814	0.08
20	799.068801	0.06
10	799.068855	0.13
0	799.068766	0.02
-10	799.068675	-0.09
-20	799.068717	-0.04
-30	799.068623	-0.16



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 battery endpoint.
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
7.5 V _{DC}	-0.04	-0.10	0.03	0.04	0.01
6.375 V _{DC}	-0.02	-0.07	-0.12	0.03	0.02

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.		

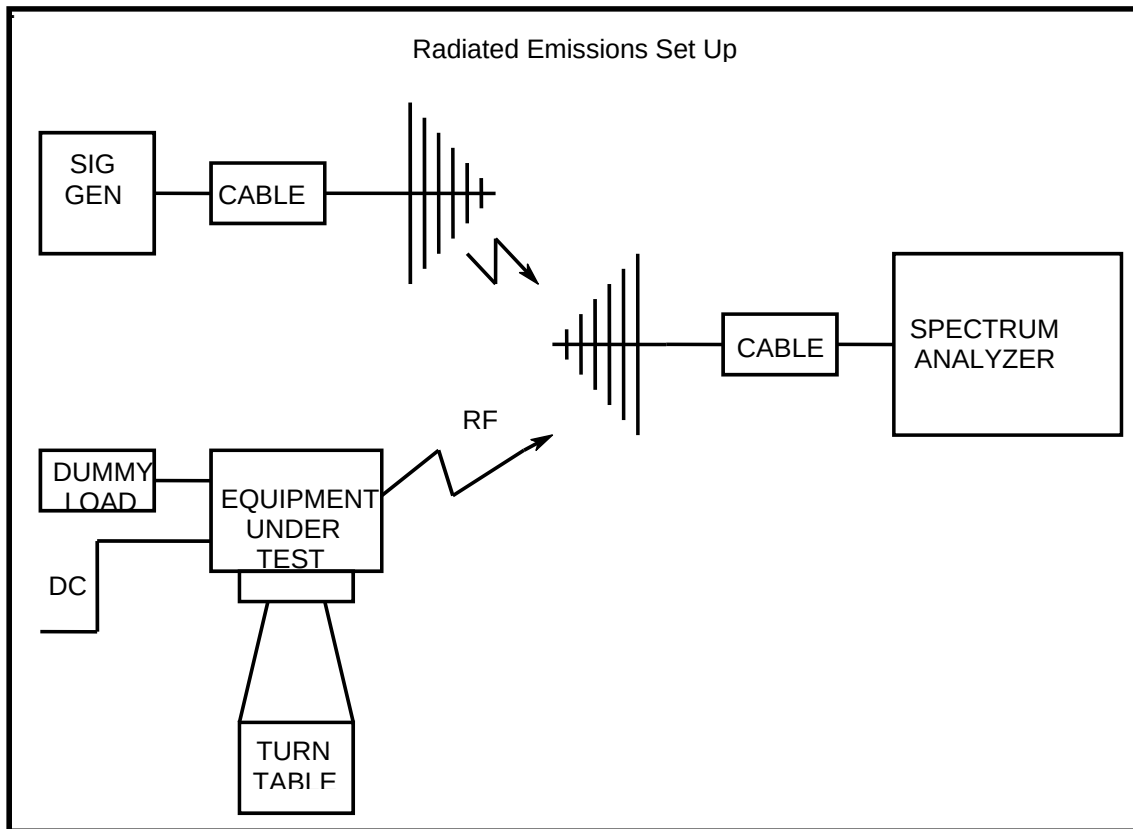
LIMIT CLAUSE: RSS-Gen 6(b)

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

TEST EQUIPMENT LIST

Equipment	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
1m Coax Cable (Blue)	Suhner	Sucoflex 104A	44610/4A	E4619	12-Oct-13
2m Coax (Black2)	Suhner	RG214HF/Nm/Nm/2000	Black2	E4623	12-Oct-13
2m Coax (Black3)	Suhner	RG214HF/Nm/Nm/2000	Black3	E4624	13-Oct-13
2m Coax (Black4)	Suhner	RG214HF/Nm/Nm/2000	Black4	E4653	13-Oct-13
3m Coax Cable (Blue)	Suhner	Sucoflex 104A	44611/4A	E4620	13-Oct-13
Amplifier +21.7 dB	Tait	ZFL-1000LN	E3660	E3360	18-Dec-13
Antenna Tower	Electrometrics	EM-4720-2	112	E4447	On use
Audio Analyser	Hewlett Packard	HP8903A	2308A02597	E3074	10-Oct-13
Environ. Chamber	Contherm	5400 RHSLT.M	1416	E4051	2-Aug-15
Horn Antenna	Emco	DRG3115	2084	E3076	5-Apr-13
Log Periodic Antenna	Schwarzbeck	VUSLP	9111-219	E4617	On use
Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073	18-Oct-13
OATS NSA	Tait				31-Aug-13
OATS Tower Cable	Intelcom	RG214	OATS1	E4621	15-Oct-13
OATS Tower Controller	Electrometrics	EM-4700	119	E4445	On use
OATS Turntable	Electrometrics	EM-4704A	105	E4446	On use
OATS Turntable Cable	Intelcom	RG215	OATS2	E4622	15-Oct-13
Oscilloscope	Tektronics	TDS340	B013611	E3585	10-Oct-13
Power Supply	Hewlett Packard	HP6032A	2441A00412	E3075	17-Oct-13
Reference Dipoles	Emco	3121C DB1	9510-1164	E3559	9-Dec-12
RF Attenuator 150W	Weinschel	40-20-33	CJ405	E3733	12-Oct-13
RF Attenuator 25W	Weinschel	33-20-33	BD5871	E3673	13-Oct-13
RF Attenuator 50W	Weinschel	24-10-34	AZ0401	E3388	13-Oct-13
RF Attenuator 50W	Weinschel	24-20-44	AW1266	E3562	13-Oct-13
RF Load 50W	Weinschel	F1426	AE2490	E3624	13-Oct-13
RF Splitter Combiner	Minicircuits	ZFSC-4-1	-	E4083	On use
Signal Generator	Agilent	E4422B	GB40050320	E3788	15-Oct-13
S-Line TEM Cell	Rohde & Schwarz	1089.9296.02	338232/003	E3636	31-Aug-15
Spectrum Analyser	Agilent	PXA N9030A	MY49432161	E4907	30-Mar-14
Spectrum Analyser	Hewlett Packard	HP8562E	3821A00779	E3715	17-Oct-13
Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	21-Nov-14

ANNEX A – TEST SETUP DETAILS



All other testing is performed using the Teltest Radio **EVAL**uation 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.

