

REPORT NUMBER 1985-A

FEBRUARY 2004

RADIO PERFORMANCE MEASUREMENTS

On the TMAB12-D100 Mobile Transceiver

FCC ID: CASTMAD1A

SN: 19005533

In accordance with

FCC 47 CFR Parts 80 and 90 subpart-T

PREPARED BY:

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REPORT ON :

Type Approval Testing of the TMAB12-D100 (Serial No 19005533)
in accordance with:

FCC CFR 47 Parts 80 & 90 subpart-T

Report No 1985-A

FCC ID: CASTMAD1A

PREPARED FOR :

Tait Electronics Ltd
PO Box 1645
558 Wairakei Rd
Christchurch
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APPROVED :

S. A. Crompton

Compliance Laboratory Manager

Date :

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

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permission of the Compliance Laboratory Manager.

Copy No:

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: TMAD1A

Product code: TMAB12-D100

Serial Numbers: 19005533

Quantity: 1

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

FCC CFR 47 Parts 80 & 90 subpart-T

Signature:_____

S. A. Crompton
Compliance Laboratory Manager.

Date:_____

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NAME OF TEST: TRANSMITTER OUTPUT POWER (CONDUCTED)

TEST CONDITIONS: Ambient Temperature 22 °C
Relative Humidity 54 %
Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1046

GUIDE: TIA/EIA-603 2.2.1

MEASUREMENT PROCEDURE:

1. The Equipment Under Test (EUT) was set up as shown in the following diagram.
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: 12.5 kHz Channel Spacing
Switchable: 1 W and 25 W

219.1 MHz	1 W nominal	25 W nominal
POWER (W)	1.1	28.4
Variation from Nominal (%)	+ 10.0	+ 13.6
221.5 MHz	1 W nominal	25 W nominal
POWER (W)	1.1	28.7
Variation from Nominal (%)	+ 10.0	+ 14.8
Measurement Uncertainty (dB)	+0.63 -0.68	

Manufacturer's Rated Output Power: 25.0 kHz Channel Spacing
Switchable: 1 W and 25 W

219.1 MHz	1 W nominal	25 W nominal
POWER (W)	1.1	28.4
Variation from Nominal (%)	+10.0	+13.6
221.5 MHz	1 W nominal	25 W nominal
POWER (W)	1.1	28.7
Variation from Nominal (%)	+10.0	+14.8
Measurement Uncertainty (dB)	+0.63 -0.68	

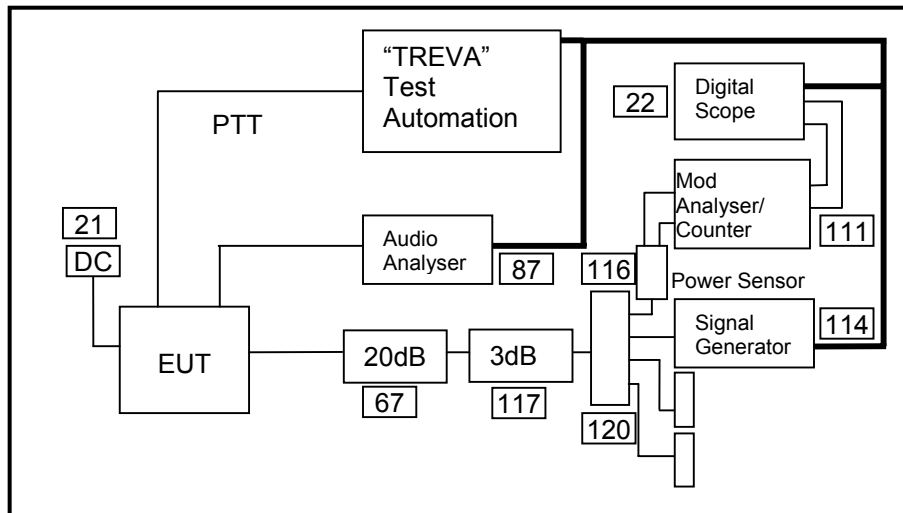
LIMIT CLAUSE: FCC 47 CFR 90.205

Radio Type: Mobile Transceiver

Frequency Band: 216 MHz ~ 222 MHz

(o) The output power shall not exceed by more than 20% the manufacturer's rated output power for the particular transmitter.

TEST SETUP: See page 69 for Test Equipment information.



NAME OF TEST: AUDIO FREQUENCY FILTER RESPONSE

TEST CONDITIONS: Ambient Temperature °C
Relative Humidity %
Standard Voltage V DC

SPECIFICATION: FCC 47 CFR 2.1047

GUIDE: TIA/EIA-603 2.2.15

MEASUREMENT PROCEDURE:

This test was not carried out as the EUT meets the emission limits specified in §90.210.

MEASUREMENT RESULTS:

See Occupied Bandwidth tests on

LIMIT CLAUSE: FCC 47 CFR 90.211 (a)

(a) Transmitters utilizing analog emissions that are equipped with an audio low-pass filter must meet the emission limitations specified in §90.210....

TEST SETUP: See page – Occupied Bandwidth

NAME OF TEST: TRANSMITTER AUDIO FREQUENCY RESPONSE
PRE-EMPHASIS

TEST CONDITIONS: Ambient Temperature 22 °C
Relative Humidity 54 %
Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: TIA/EIA-603 2.2.6

MEASUREMENT PROCEDURE:

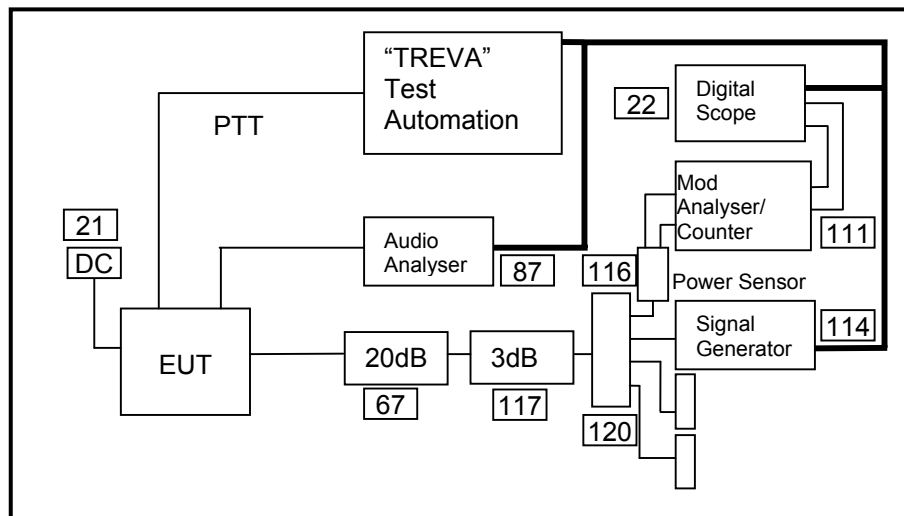
1. The Equipment Under Test (EUT) was set up as shown in the following diagram.
2. An audio input tone of 1000Hz was applied with the level set to obtain 20% of maximum deviation. This was used as the 0dB reference point.
3. The AF was varied while the audio level was held constant.
4. The response in dB relative to 1000Hz was measured.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: TIA/EIA-603 3.2.6

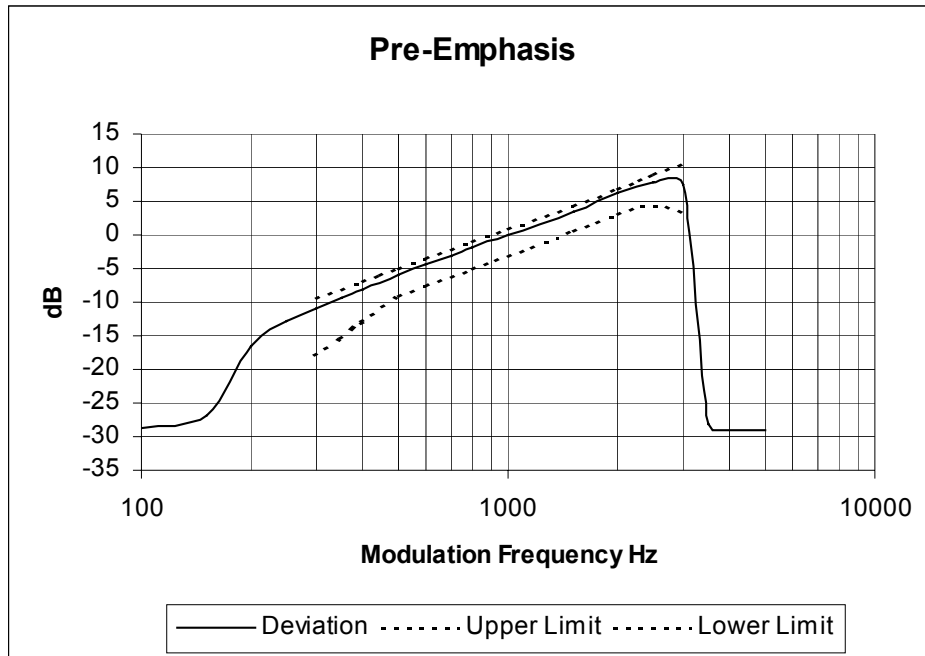
TEST SETUP: See page 69 for Test Equipment information.



NAME OF TEST: TRANSMITTER AUDIO FREQUENCY RESPONSE
PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

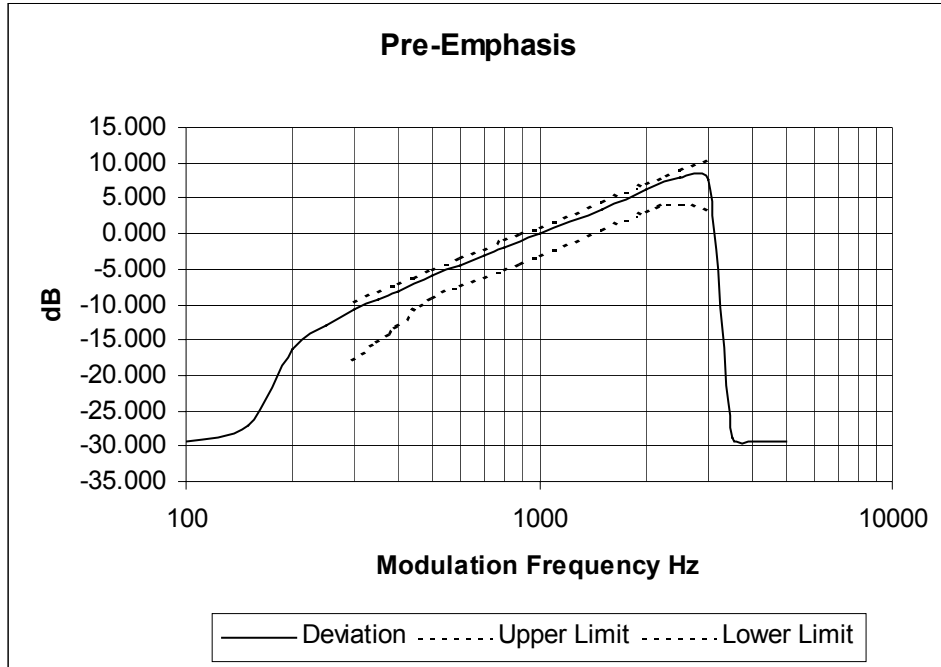
Tx FREQUENCY: 219.1 MHz 12.5 kHz Channel Spacing



NAME OF TEST: TRANSMITTER AUDIO FREQUENCY RESPONSE
PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

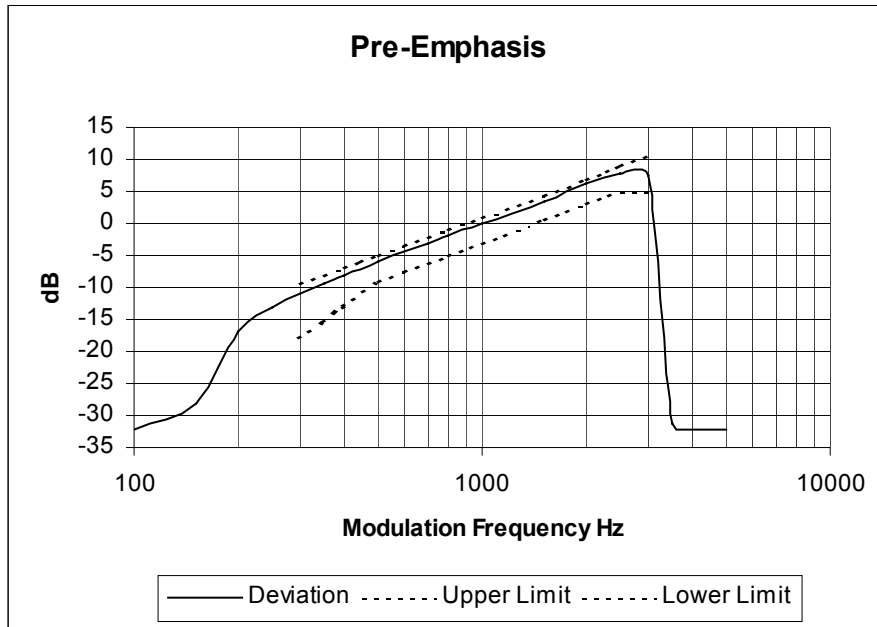
Tx FREQUENCY: 221.5 MHz 12.5 kHz Channel Spacing



NAME OF TEST: TRANSMITTER AUDIO FREQUENCY RESPONSE
PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

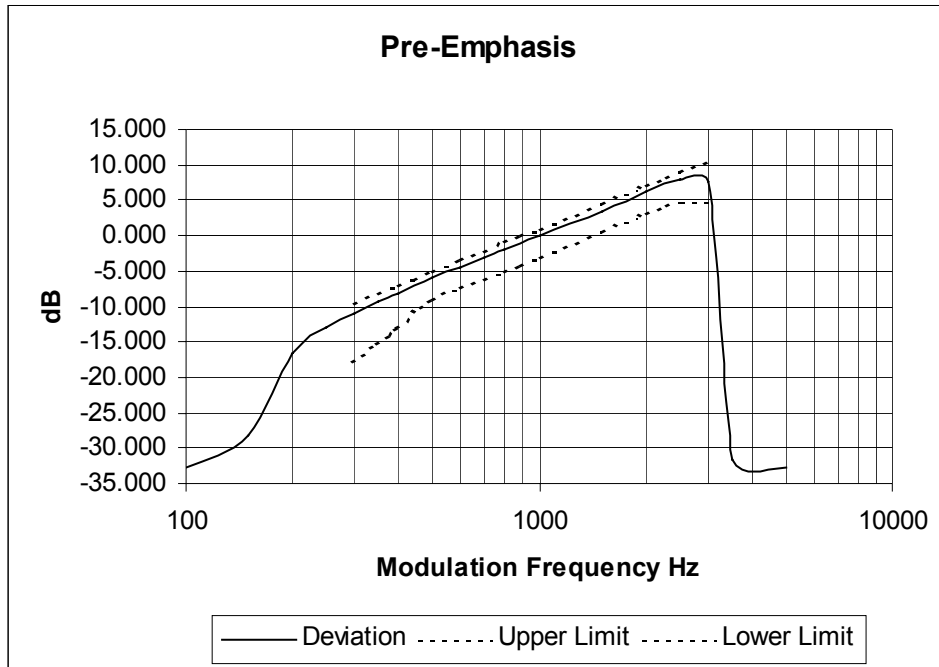
Tx FREQUENCY: 219.1 MHz 25.0 kHz Channel Spacing



NAME OF TEST: TRANSMITTER AUDIO FREQUENCY RESPONSE
PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 221.5 MHz 25.0 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING

TEST CONDITIONS: Ambient Temperature 22 °C
Relative Humidity 54 %
Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: TIA/EIA-603 2.2.3

MEASUREMENT PROCEDURE:

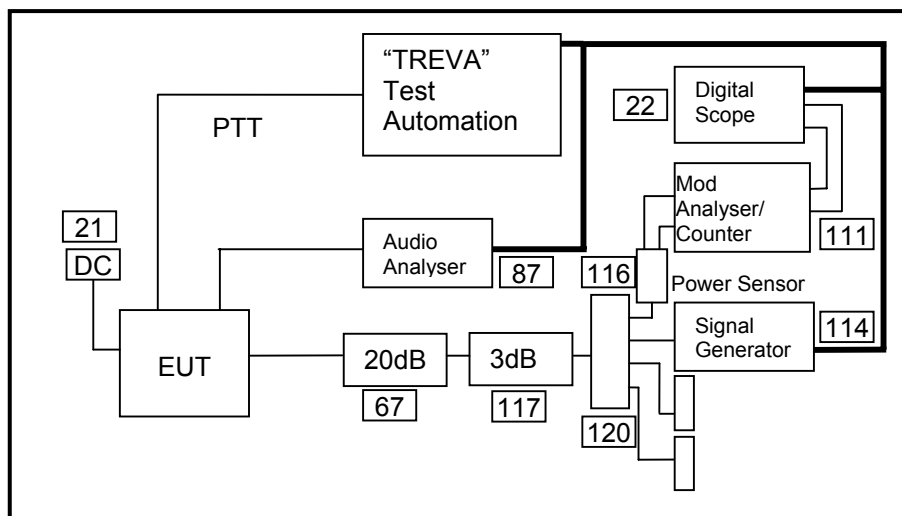
1. The EUT was set up as shown in the following diagram.
2. The modulation response was measured at three audio frequencies while varying the input level.
3. Measurements were made for both Positive and Negative Deviation.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: FCC 47 CFR 90.209

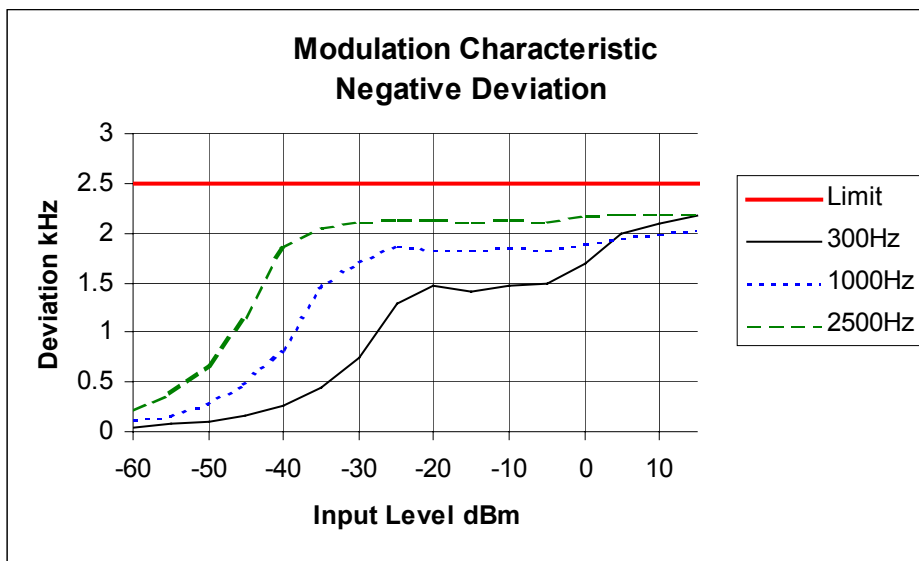
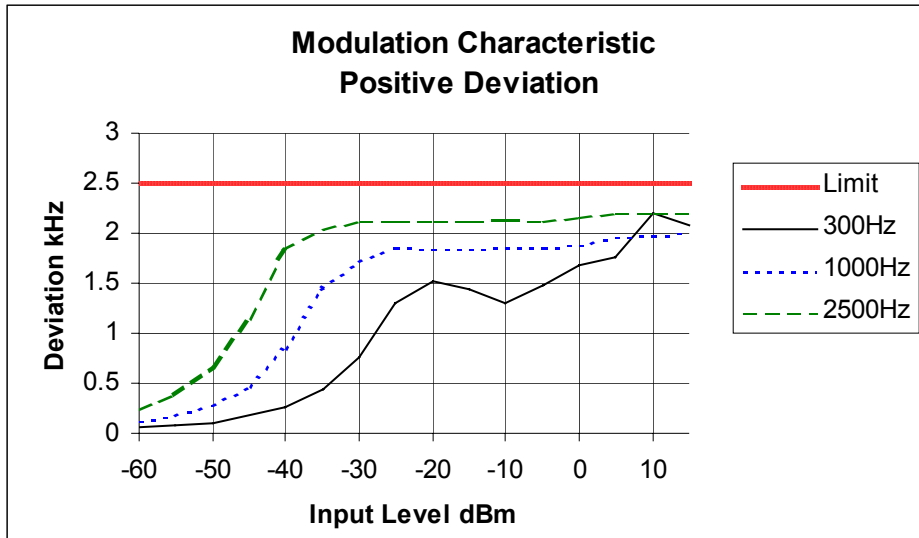
TEST SETUP: See page 69 for Test Equipment information.



NAME OF TEST: TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

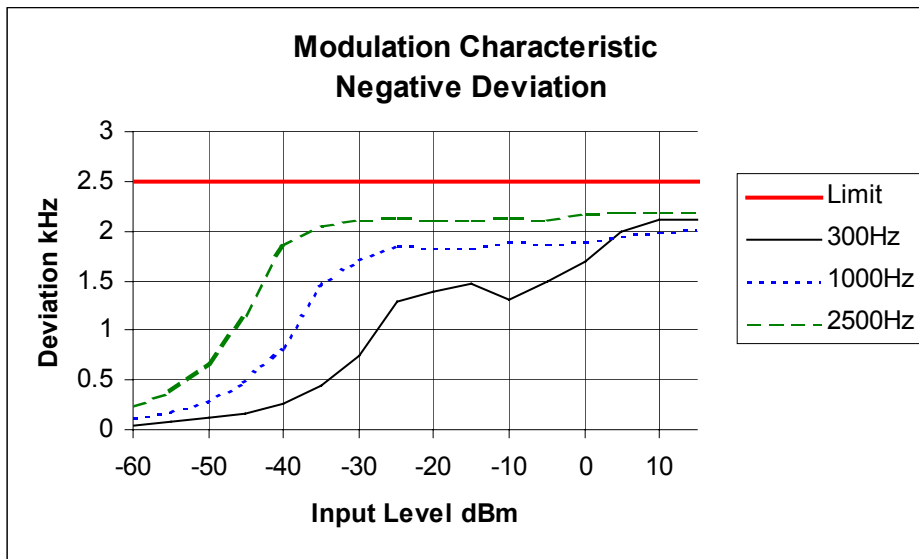
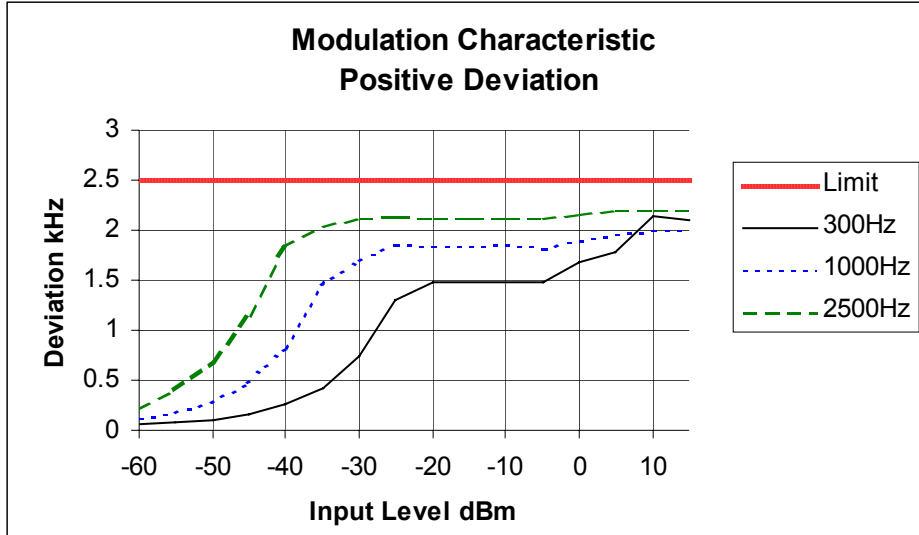
Tx FREQUENCY: 219.1 MHz 12.5 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

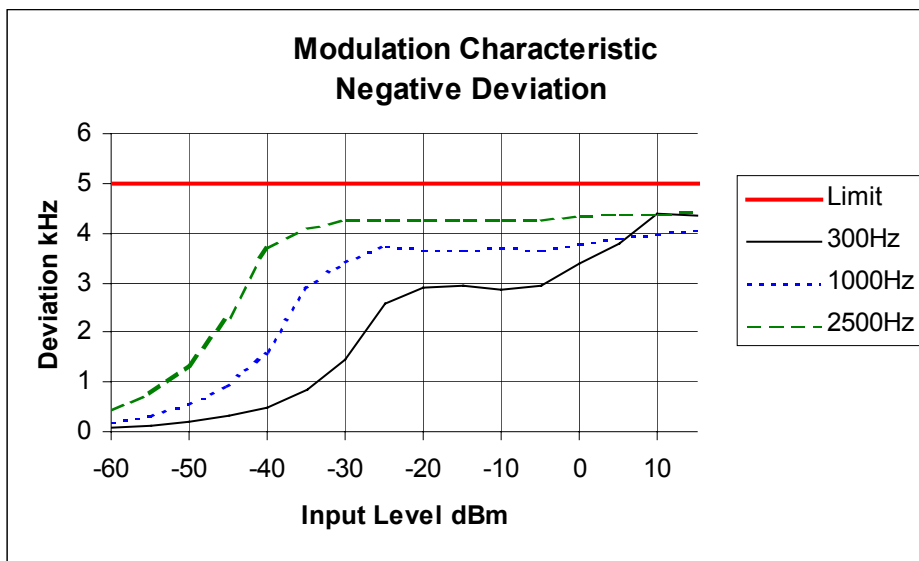
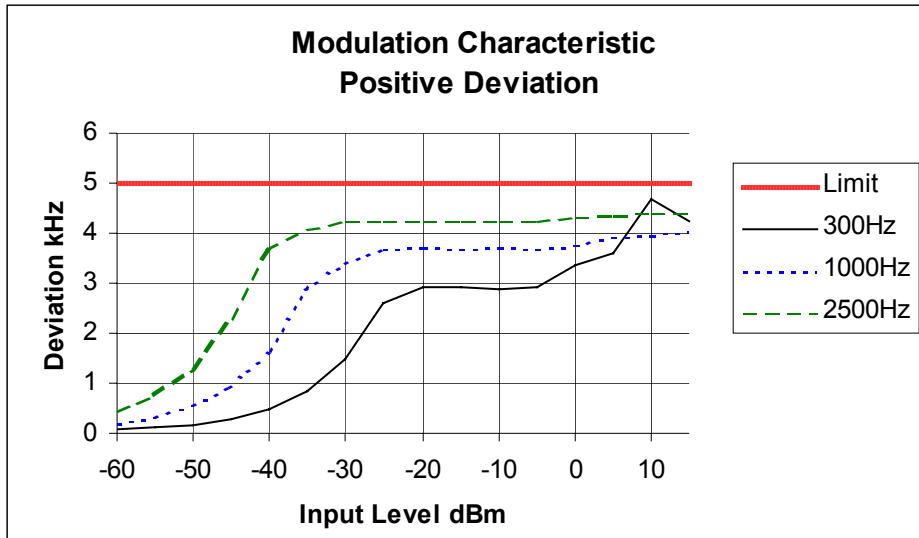
Tx FREQUENCY: 221.5 MHz 12.5 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

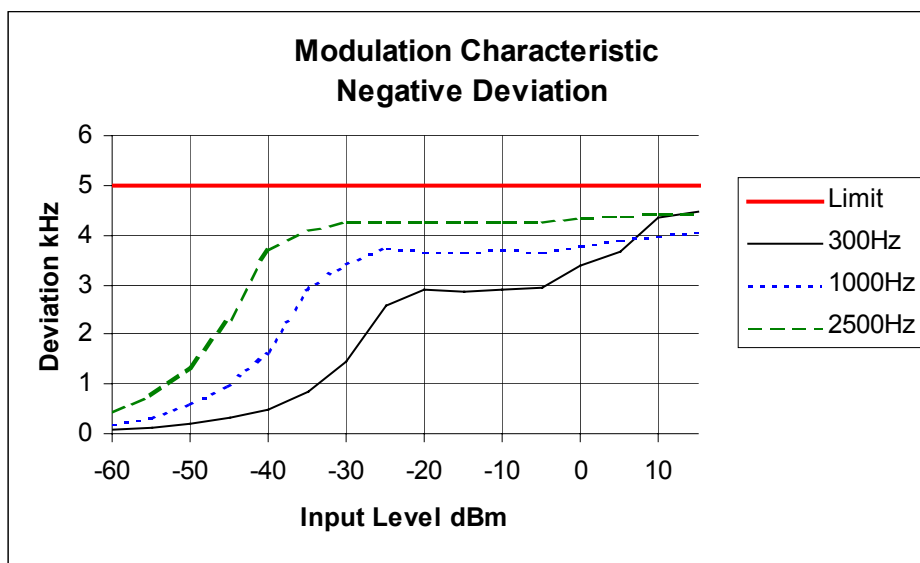
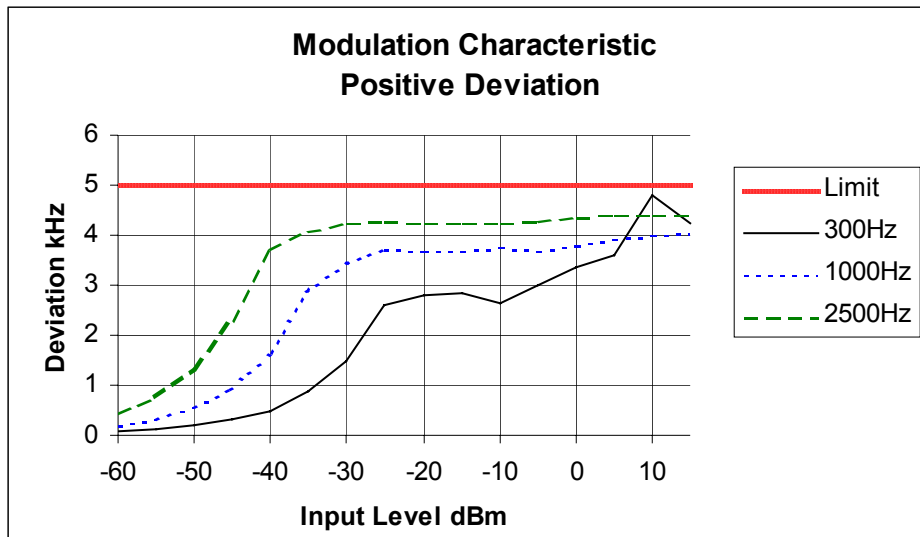
Tx FREQUENCY: 219.1 MHz 25.0 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 221.5 MHz 25.0 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING
STEADY STATE

TEST CONDITIONS: Ambient Temperature 22 °C
Relative Humidity 54 %
Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: TIA/EIA-603 2.2.3

MEASUREMENT PROCEDURE:

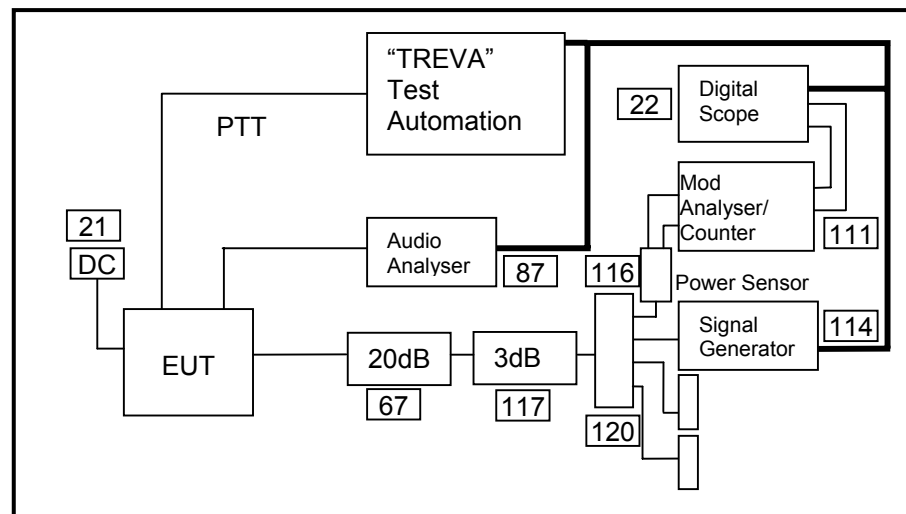
1. The Equipment Under Test was set up as shown in the following diagram.
2. The modulation response was measured with a level stepped 20 dB above the level required to obtain 60% deviation at 1000Hz AF.
3. Measurements were made for both Positive and Negative deviation.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: FCC 47 CFR 90.209

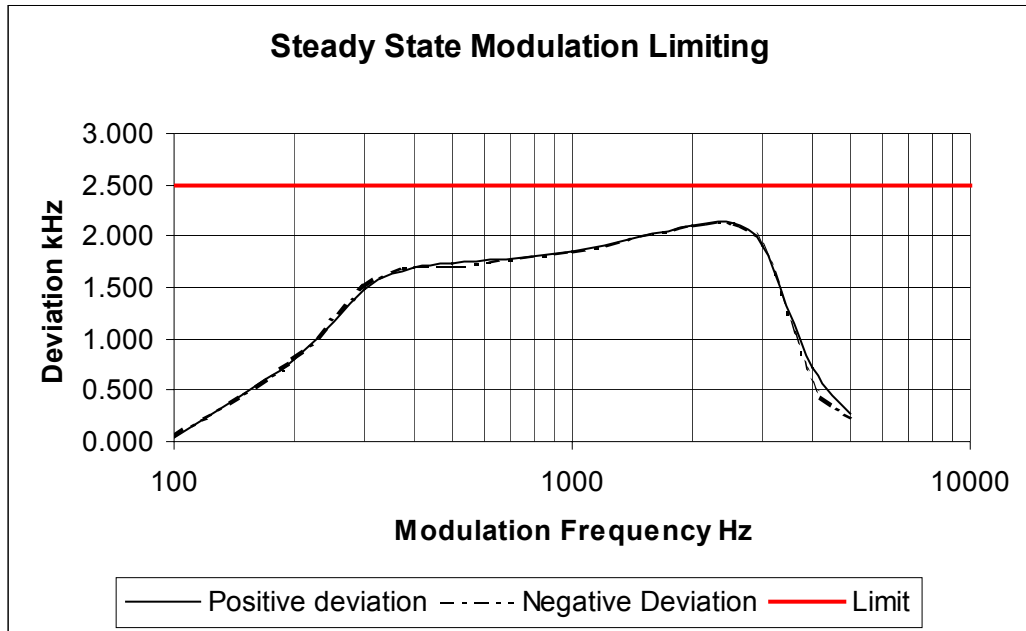
TEST SETUP: See page 69 for Test Equipment information.



NAME OF TEST: TRANSMITTER MODULATION LIMITING
STEADY STATE

SPECIFICATION: FCC CFR 2.1047 (b)

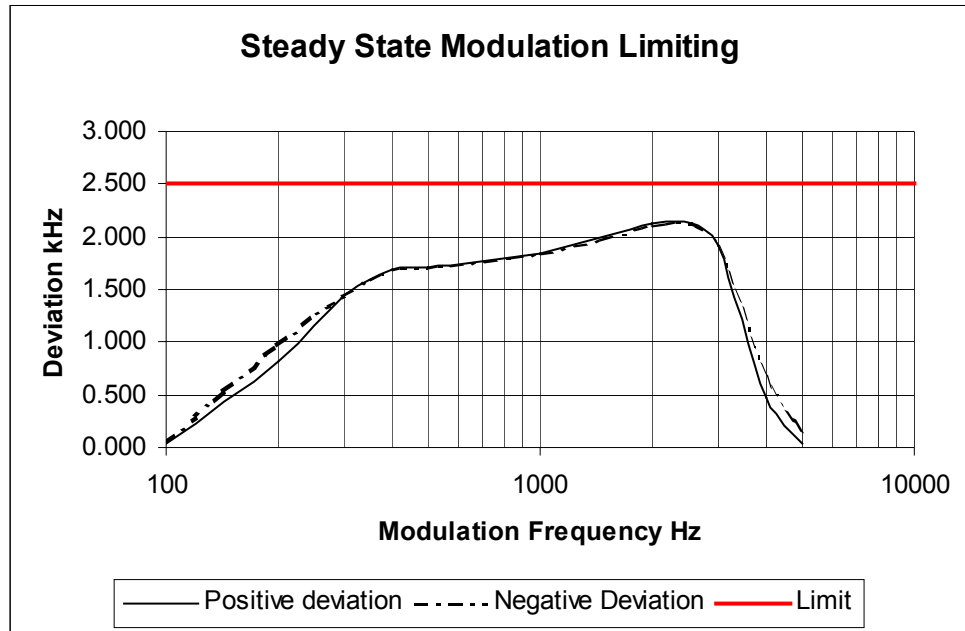
Tx FREQUENCY: 219.1 MHz 12.5 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING
STEADY STATE

SPECIFICATION: FCC CFR 2.1047 (b)

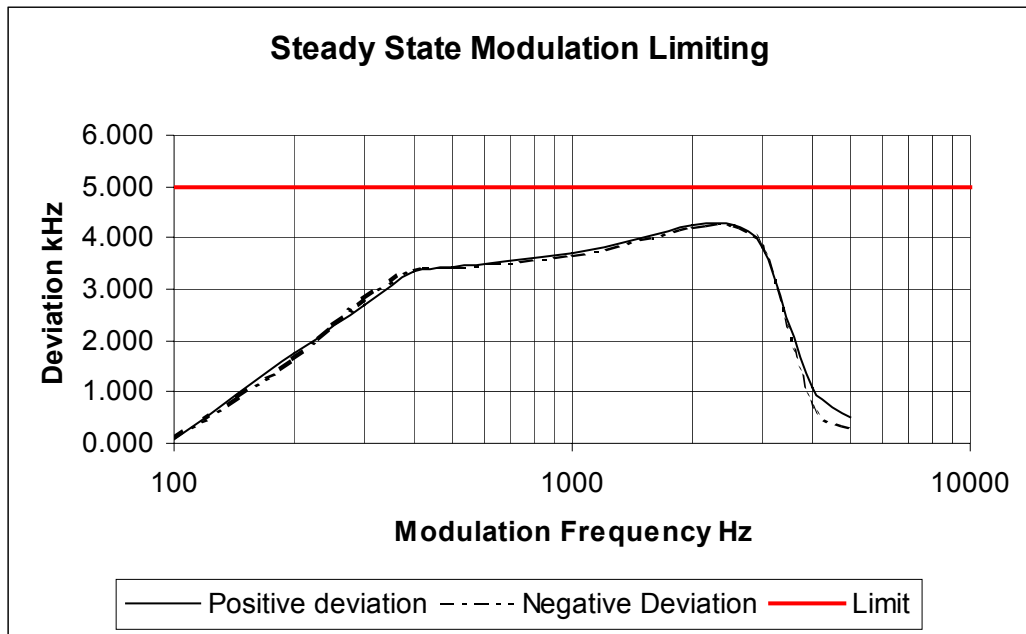
Tx FREQUENCY: 221.5 MHz 12.5 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING
STEADY STATE

SPECIFICATION: FCC CFR 2.1047 (b)

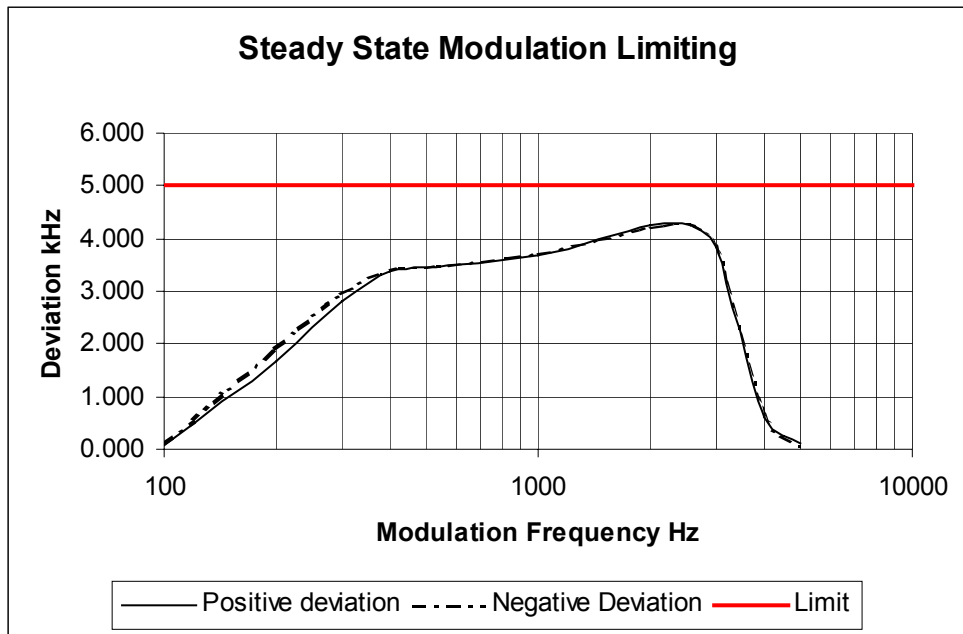
Tx FREQUENCY: 219.1 MHz 25.0 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING
STEADY STATE

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 221.5 MHz 25.0 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING
INSTANTANEOUS

TEST CONDITIONS: Ambient Temperature 22 °C
Relative Humidity 54 %
Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: TIA/EIA-603 2.2.3

MEASUREMENT PROCEDURE:

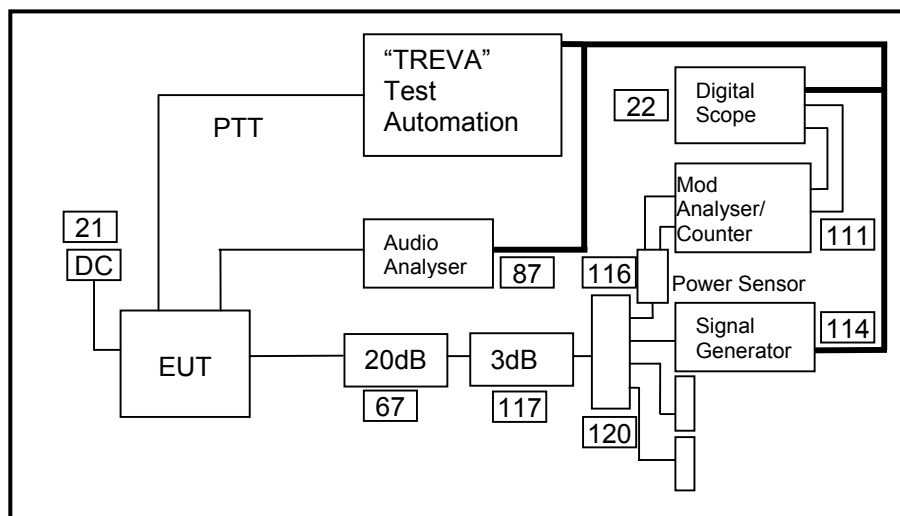
1. The Equipment Under Test was set up as shown in the following diagram.
2. The modulation response was measured with a level stepped 20 dB above the level required to obtain 60% deviation at 1000Hz AF.
3. Measurements were made for both Positive and Negative deviation.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: FCC 47 CFR 90.209

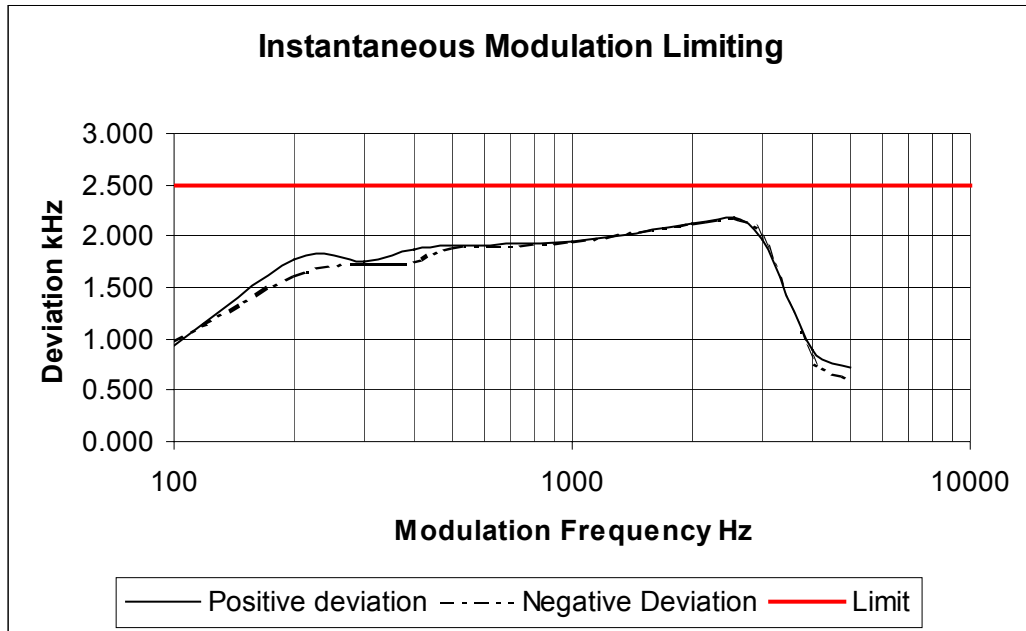
TEST SETUP: See page 69 for Test Equipment information.



NAME OF TEST: TRANSMITTER MODULATION LIMITING
INSTANTANEOUS

SPECIFICATION: FCC CFR 2.1047 (b)

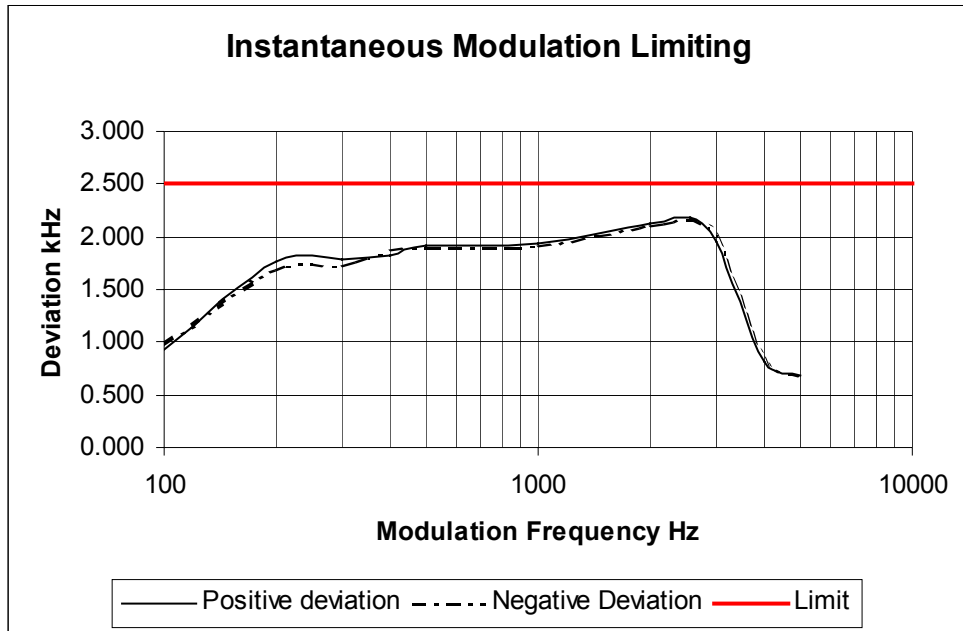
Tx FREQUENCY: 219.1 MHz 12.5 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING
INSTANTANEOUS

SPECIFICATION: FCC CFR 2.1047 (b)

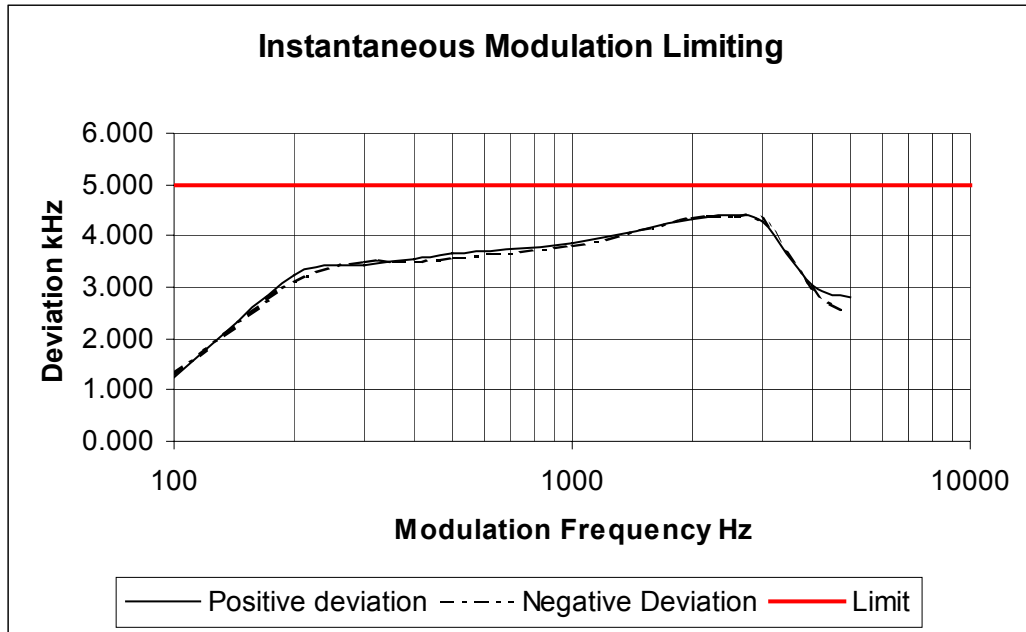
Tx FREQUENCY: 221.5 MHz 12.5 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING
INSTANTANEOUS

SPECIFICATION: FCC CFR 2.1047 (b)

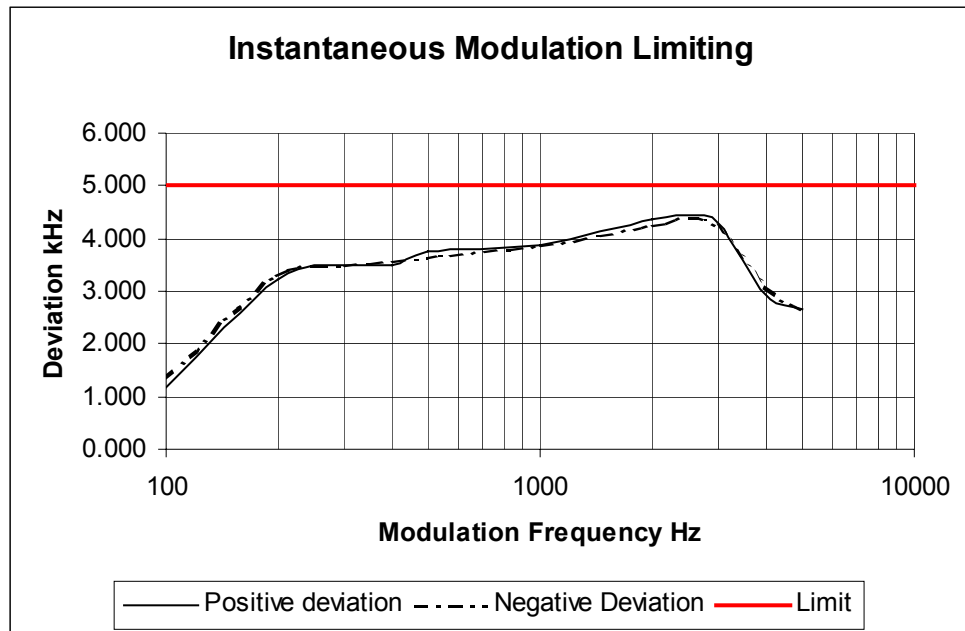
Tx FREQUENCY: 219.1 MHz 25.0 kHz Channel Spacing



NAME OF TEST: TRANSMITTER MODULATION LIMITING
INSTANTANEOUS

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 221.5 MHz 25.0 kHz Channel Spacing



NAME OF TEST: OCCUPIED BANDWIDTH

TEST CONDITIONS: Ambient Temperature 22 °C
 Relative Humidity 48 %
 Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1049 (c)

GUIDE: TIA/EIA-603 2.2.11

MEASUREMENT PROCEDURE:

1. The Equipment Under Test was set up as shown in the following diagram.
2. For analogue measurements: The EUT was modulated by a 2500Hz tone at an input level 16dB 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 pseudorandom bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser with the controls set as shown on the following plots.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: FCC 47 CFR 90.210

EMISSION MASKS

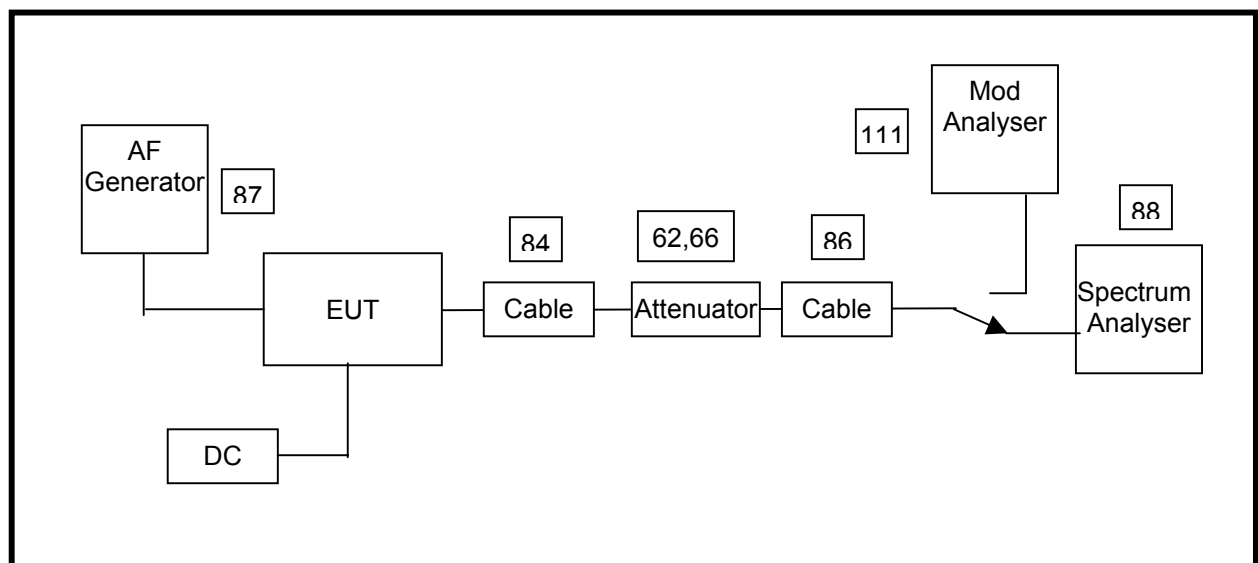
Emission Mask D 12.5 kHz Channel Spacing Analog; FFSK; THSD
 Emission Mask B 25.0 kHz Channel Spacing Analog; FFSK; THSD

DATA SPEED

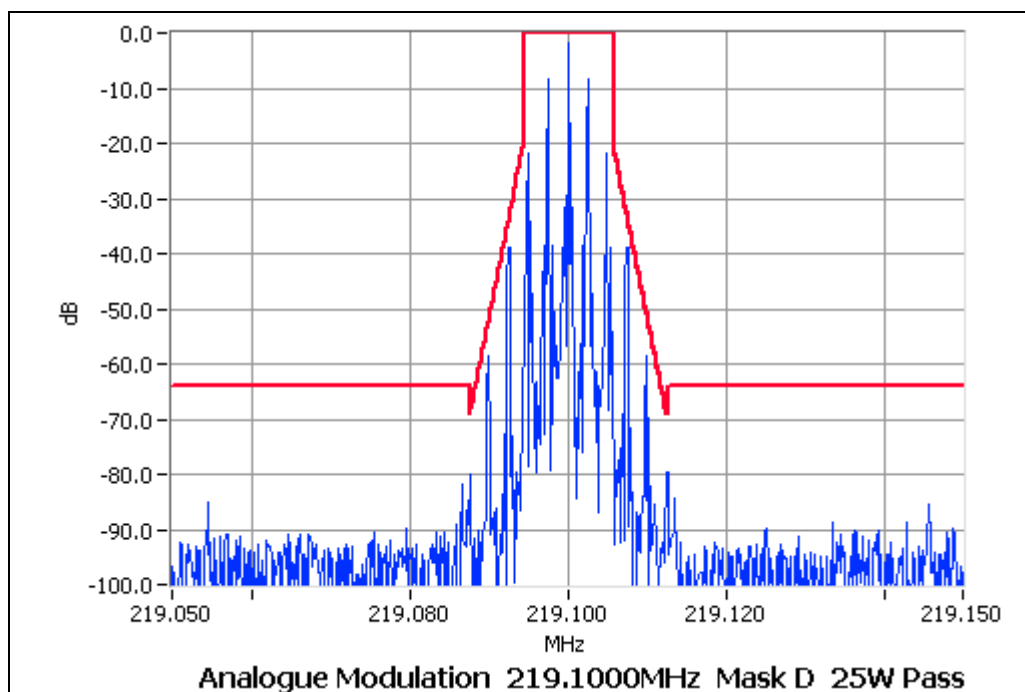
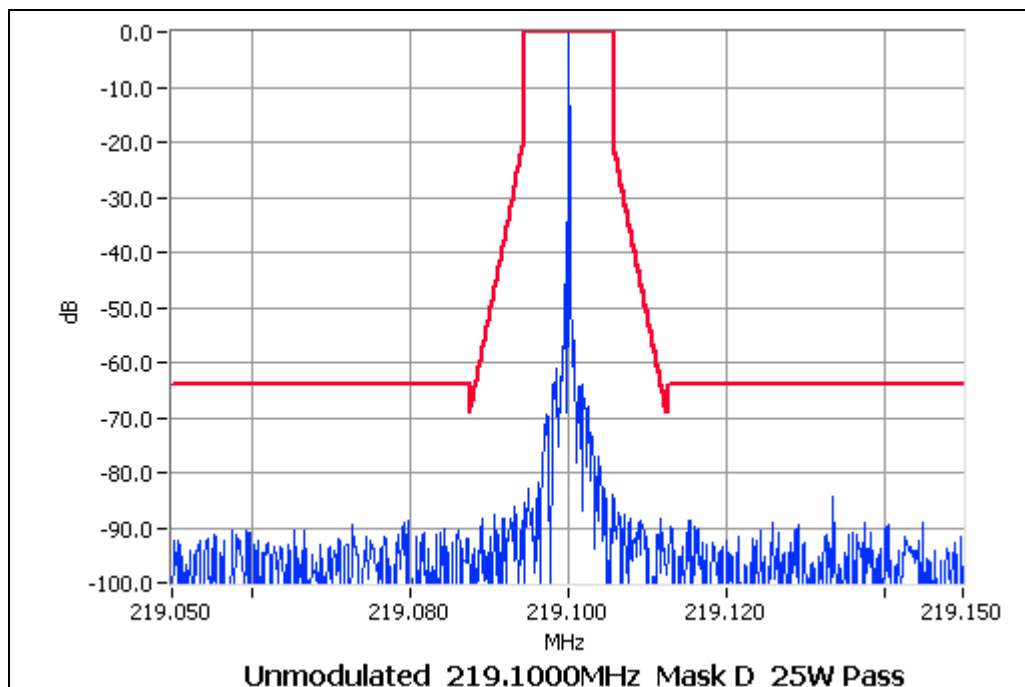
FFSK 1200 bps 12.5 kHz Channel Spacing
 THSD 12000 bps 12.5 kHz Channel Spacing
 THSD 19200 bps 25.0 kHz Channel Spacing
 (FFSK is Fast Frequency Shift Keying; THSD is Tait High Speed Data – CP4GFSK)

TEST SETUP: For analogue modulation

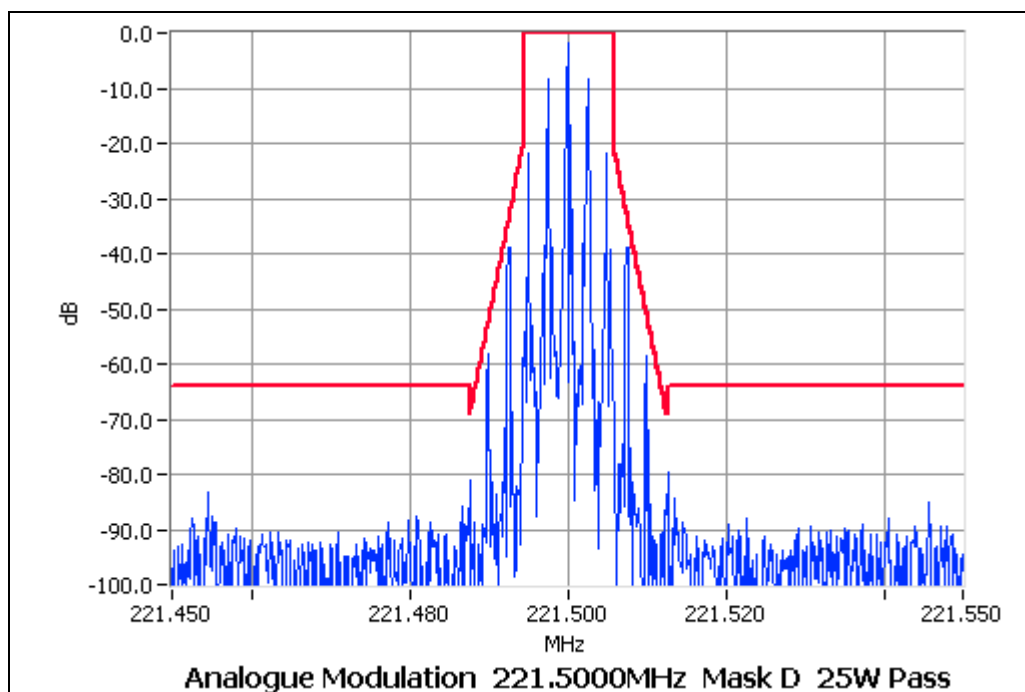
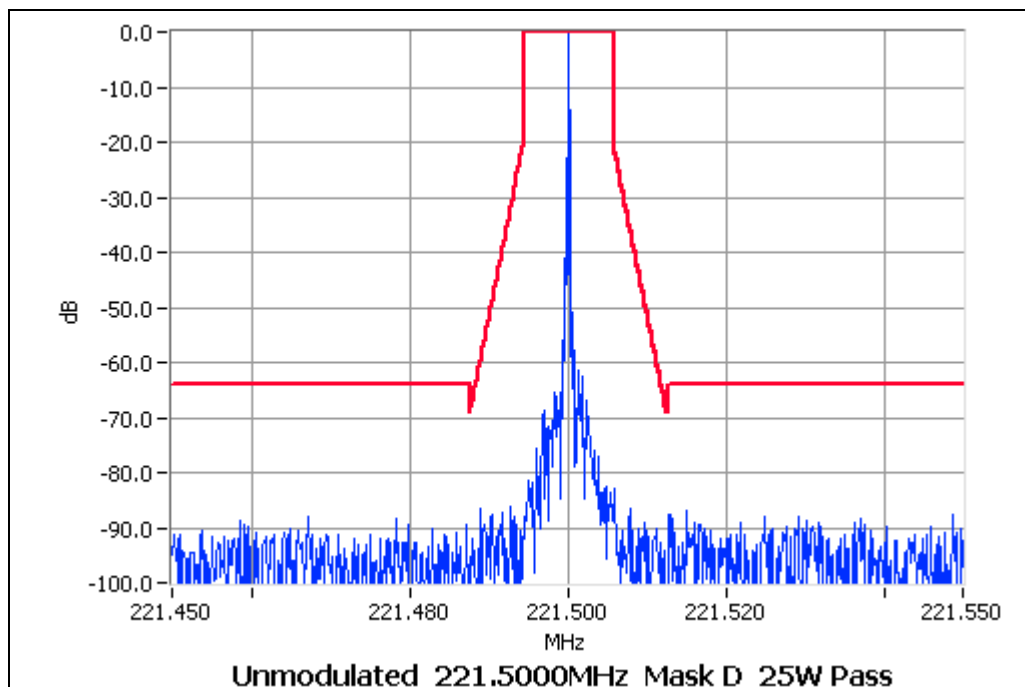
See page 69 for Test Equipment information



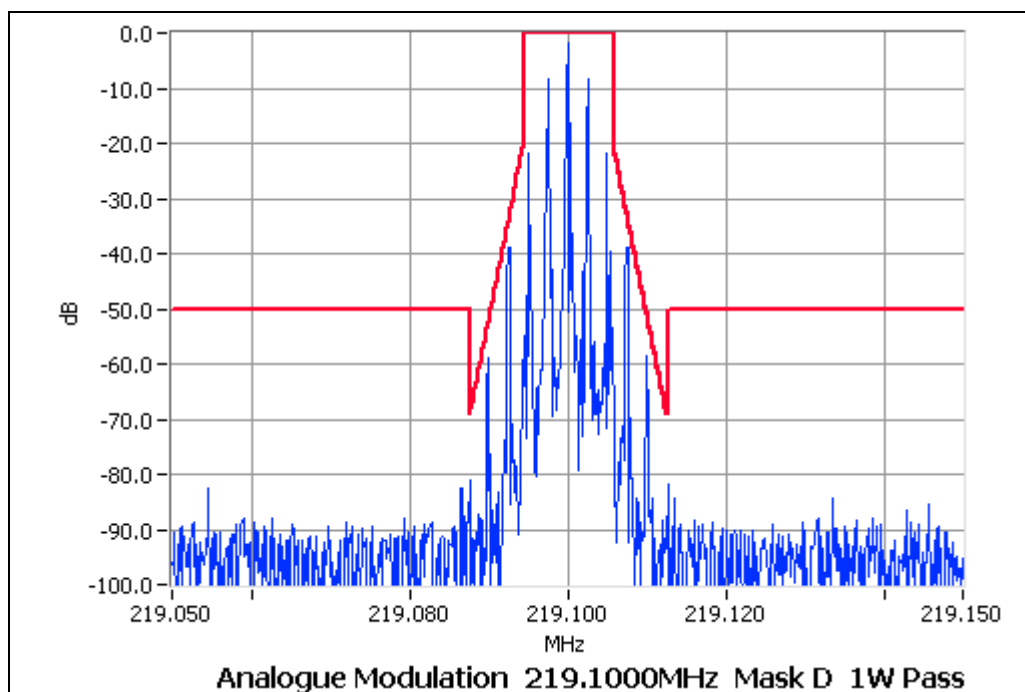
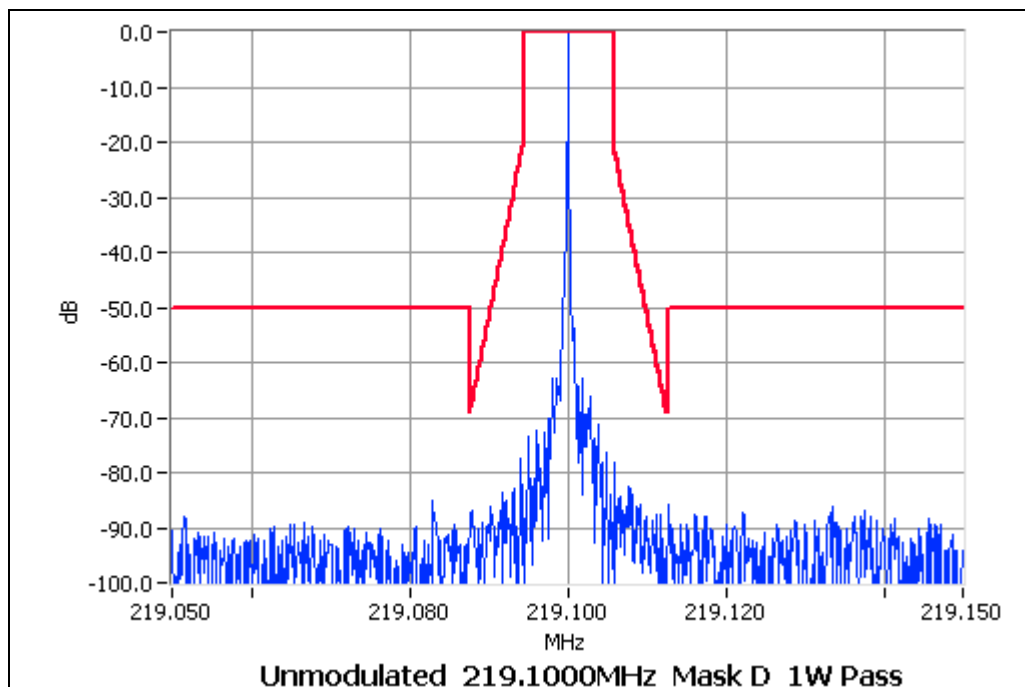
NAME OF TEST:	OCCUPIED BANDWIDTH	VOICE
SPECIFICATION:	FCC CFR 2.1049 (c)	
Tx FREQUENCY:	219.1 MHz	25W
		12.5 kHz Channel Spacing



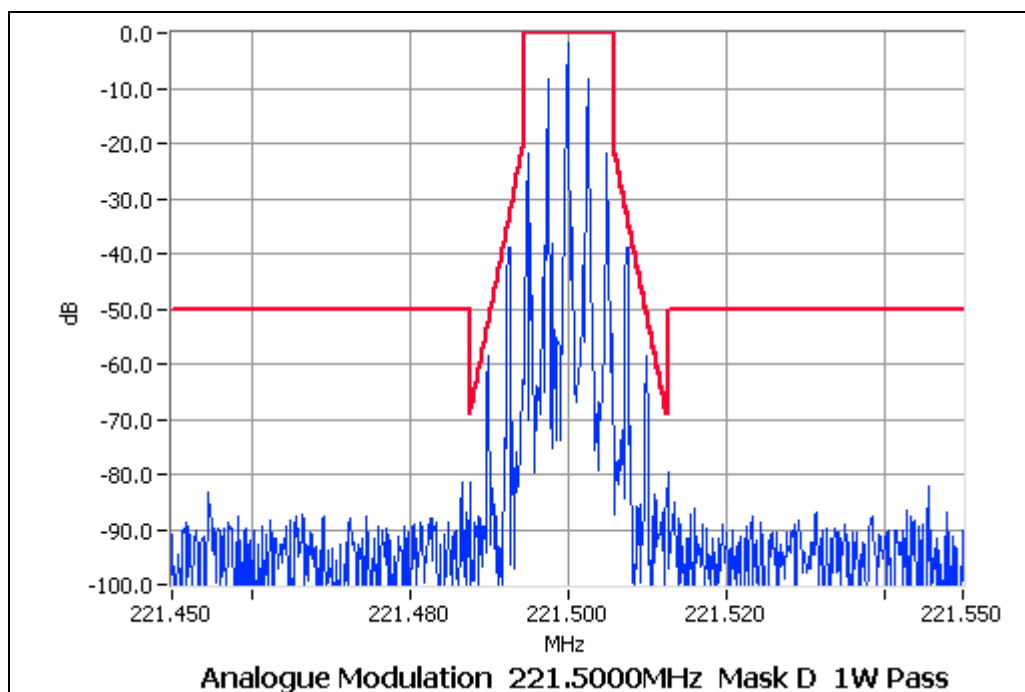
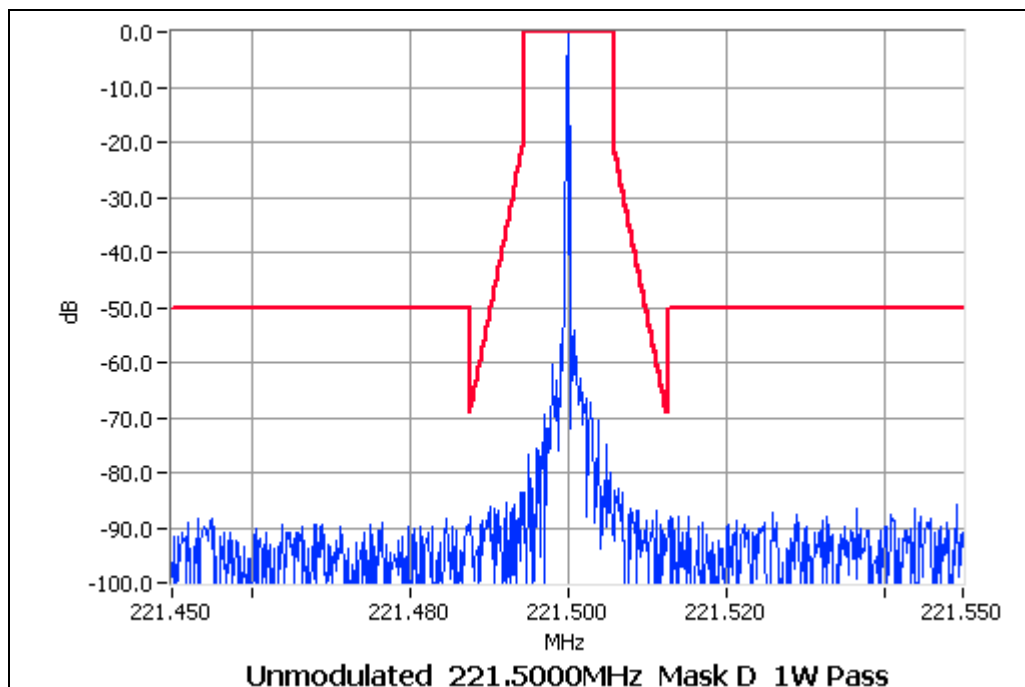
NAME OF TEST:	OCCUPIED BANDWIDTH	VOICE
SPECIFICATION:	FCC CFR 2.1049 (c)	
Tx FREQUENCY:	221.5 MHz	25W
		12.5 kHz Channel Spacing



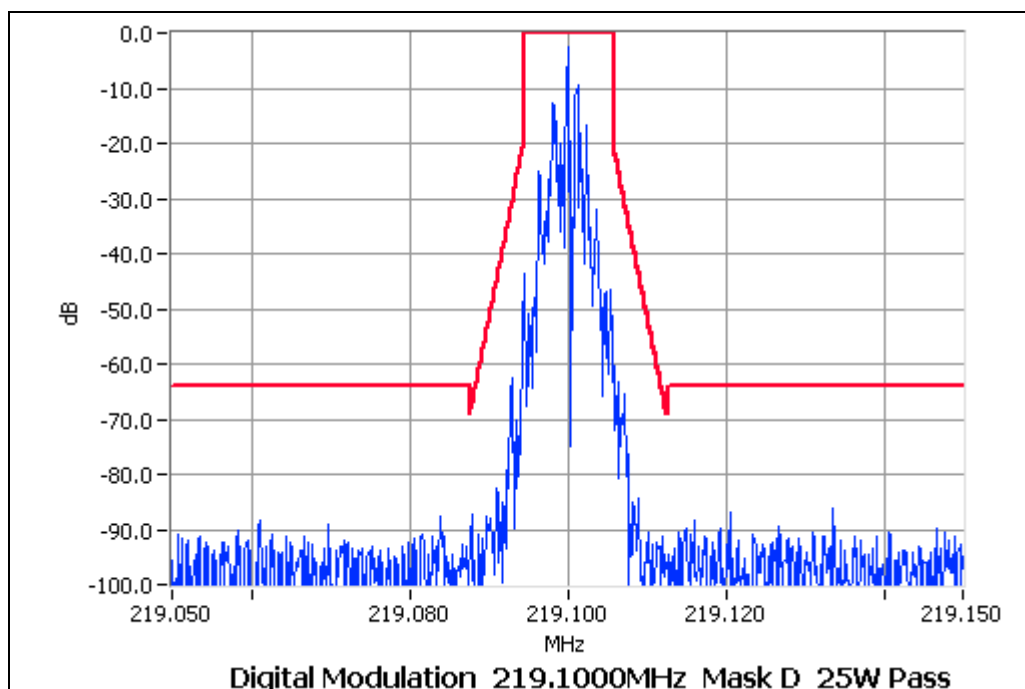
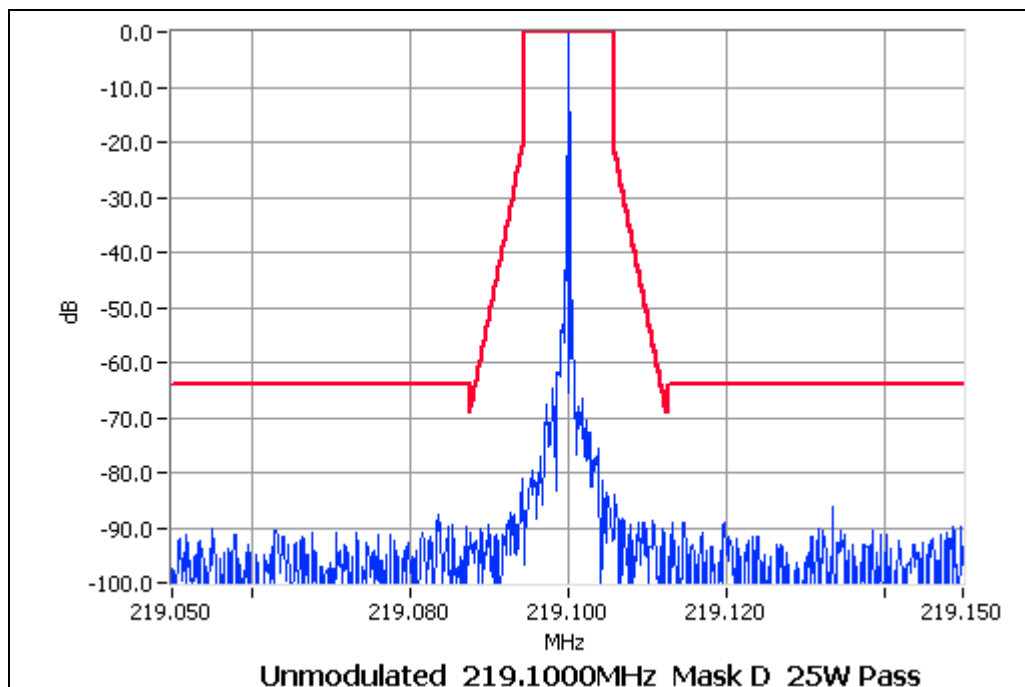
NAME OF TEST: OCCUPIED BANDWIDTH VOICE
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 219.1 MHz 1W 12.5 kHz Channel Spacing



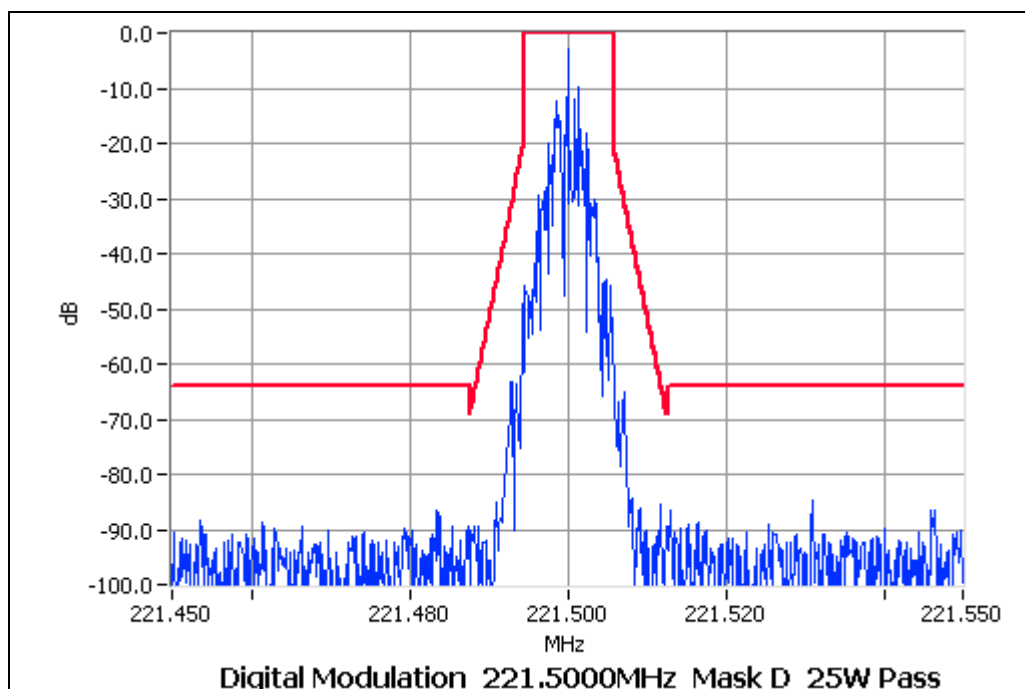
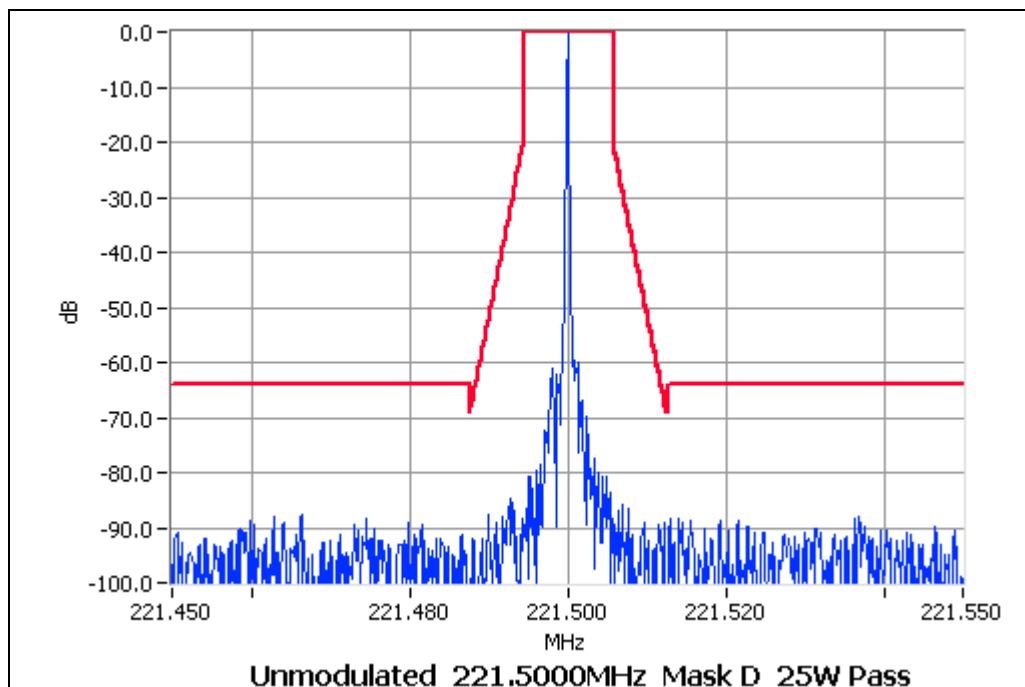
NAME OF TEST:	OCCUPIED BANDWIDTH	VOICE
SPECIFICATION:	FCC CFR 2.1049 (c)	
Tx FREQUENCY:	221.5 MHz	1W
		12.5 kHz Channel Spacing



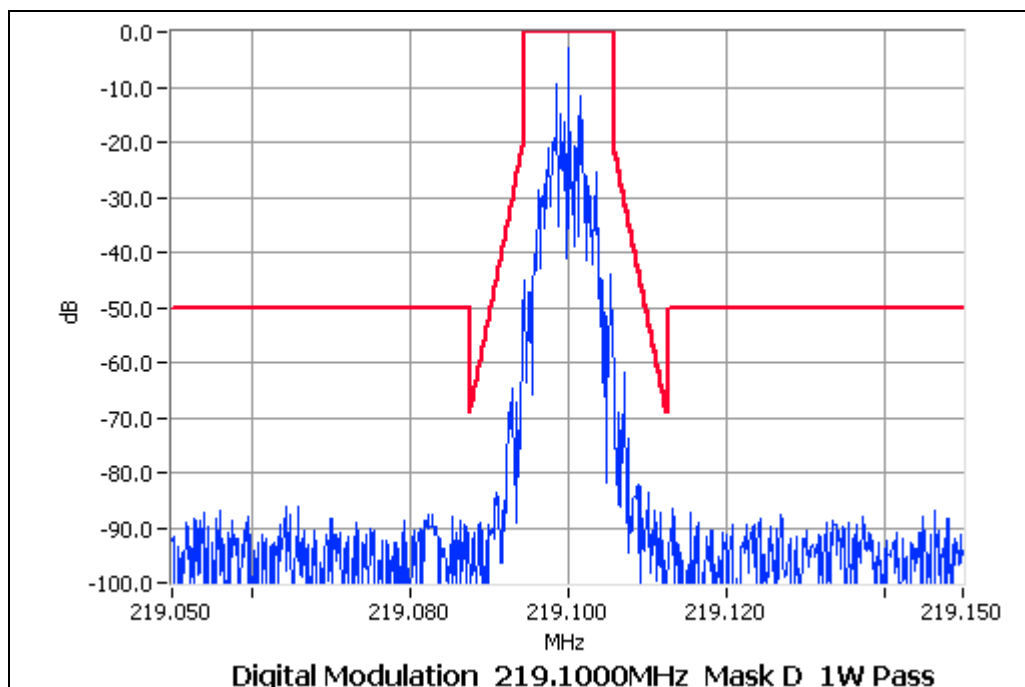
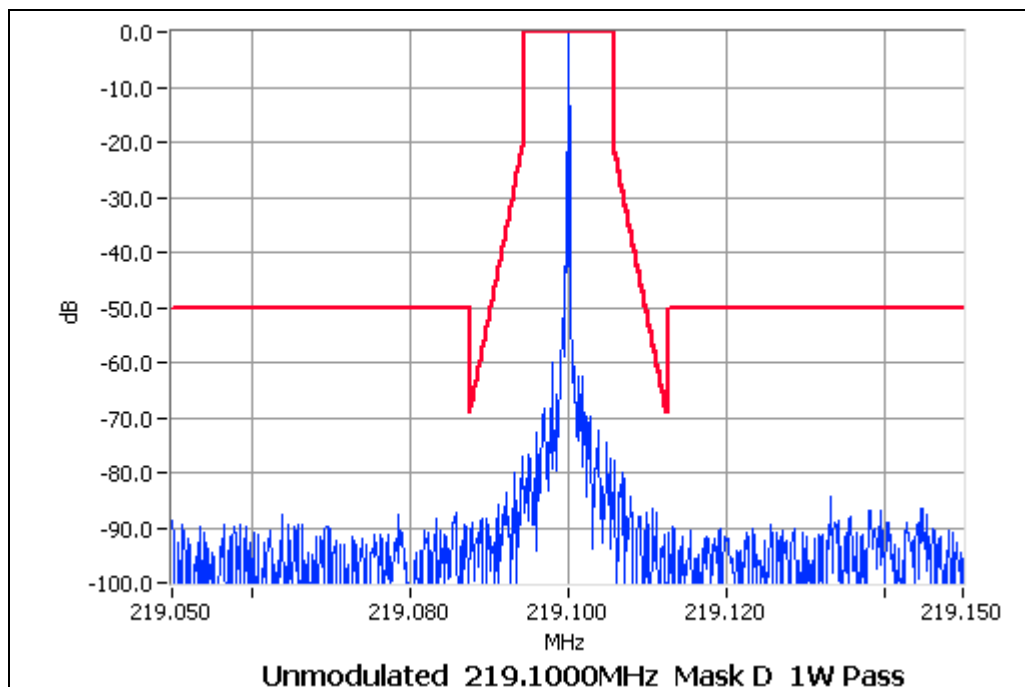
NAME OF TEST:	OCCUPIED BANDWIDTH	DATA	FFSK
SPECIFICATION:	FCC CFR 2.1049 (c)		
Tx FREQUENCY:	219.1 MHz	25W	12.5 kHz Channel Spacing



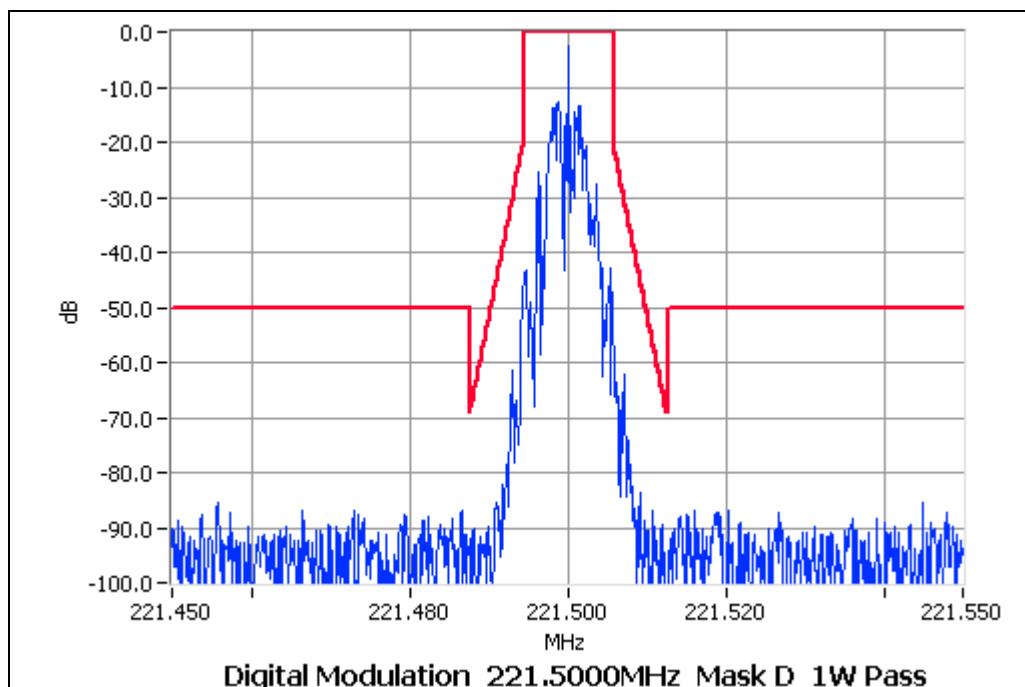
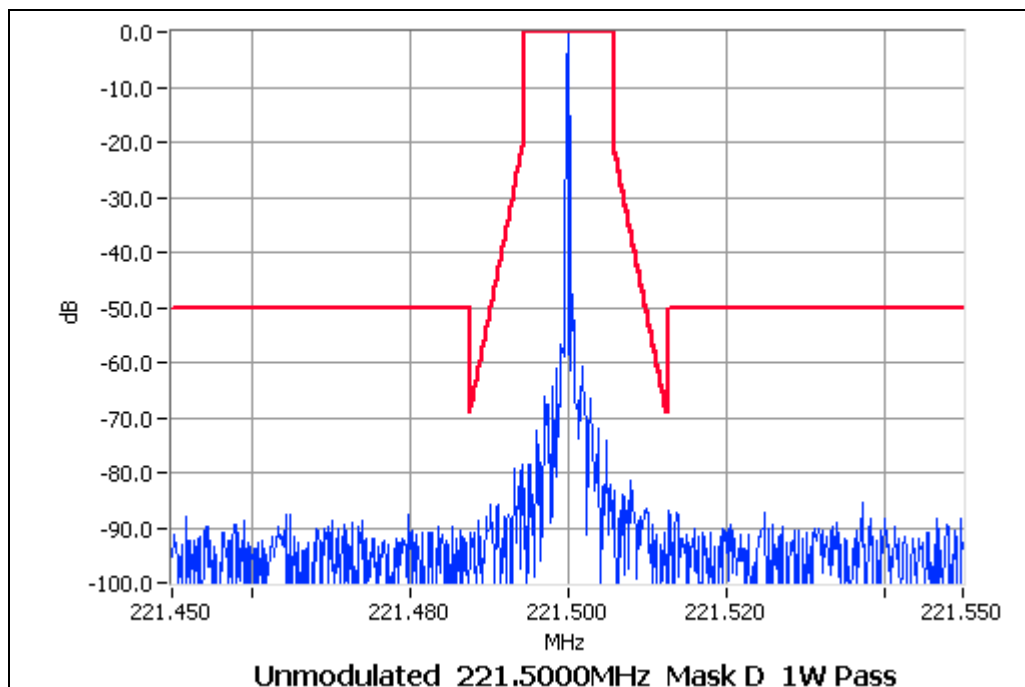
NAME OF TEST: OCCUPIED BANDWIDTH DATA FFSK
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 221.5 MHz 25W 12.5 kHz Channel Spacing



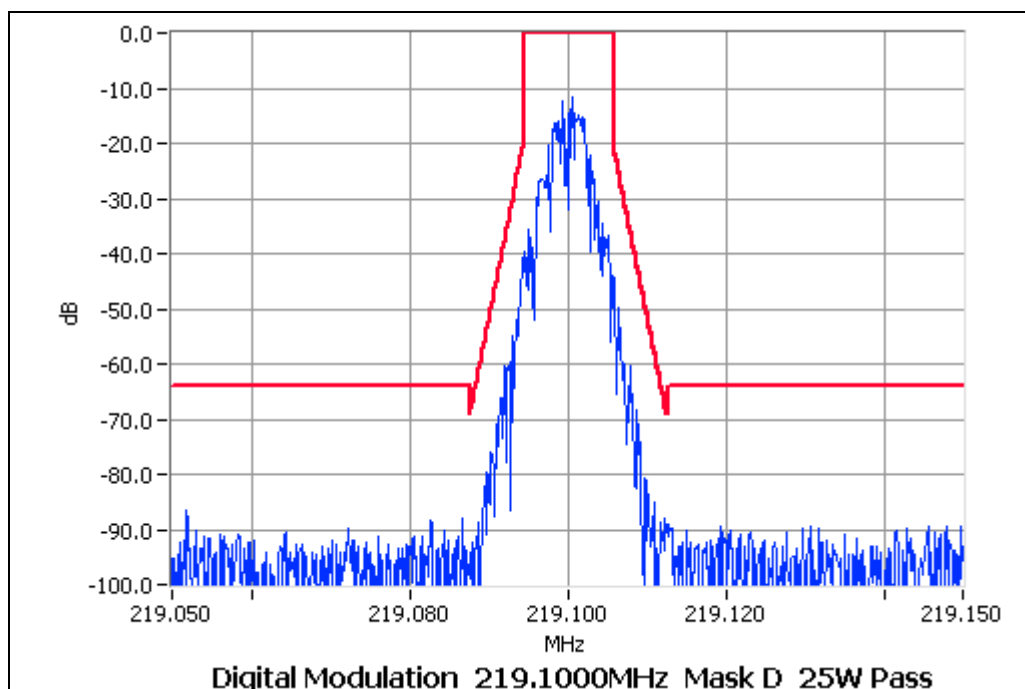
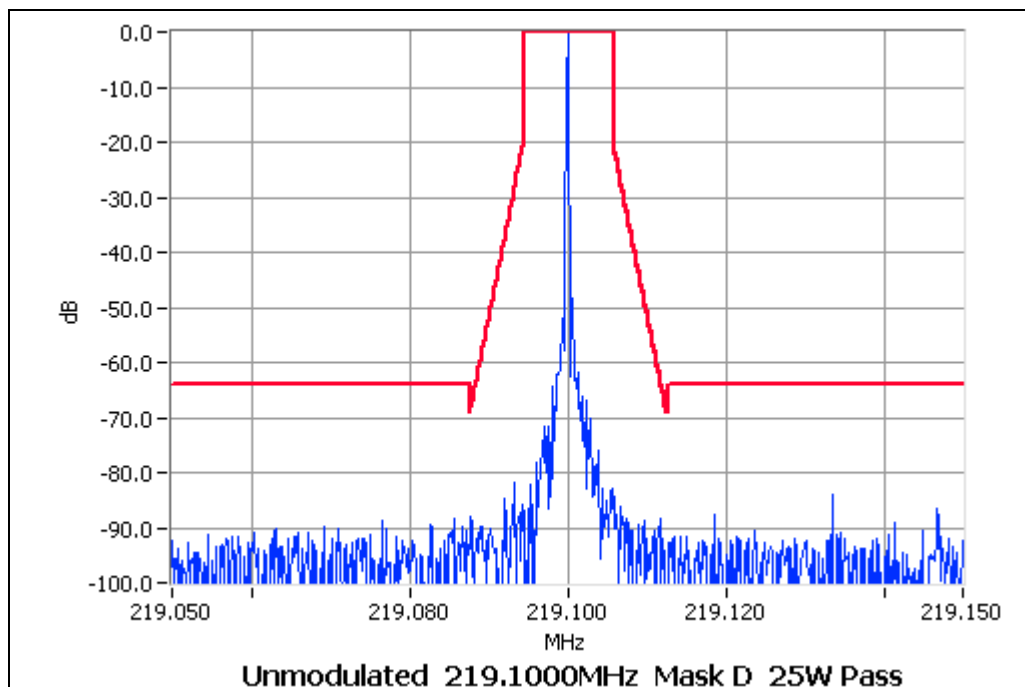
NAME OF TEST: OCCUPIED BANDWIDTH DATA FFSK
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 219.1 MHz 1W 12.5 kHz Channel Spacing



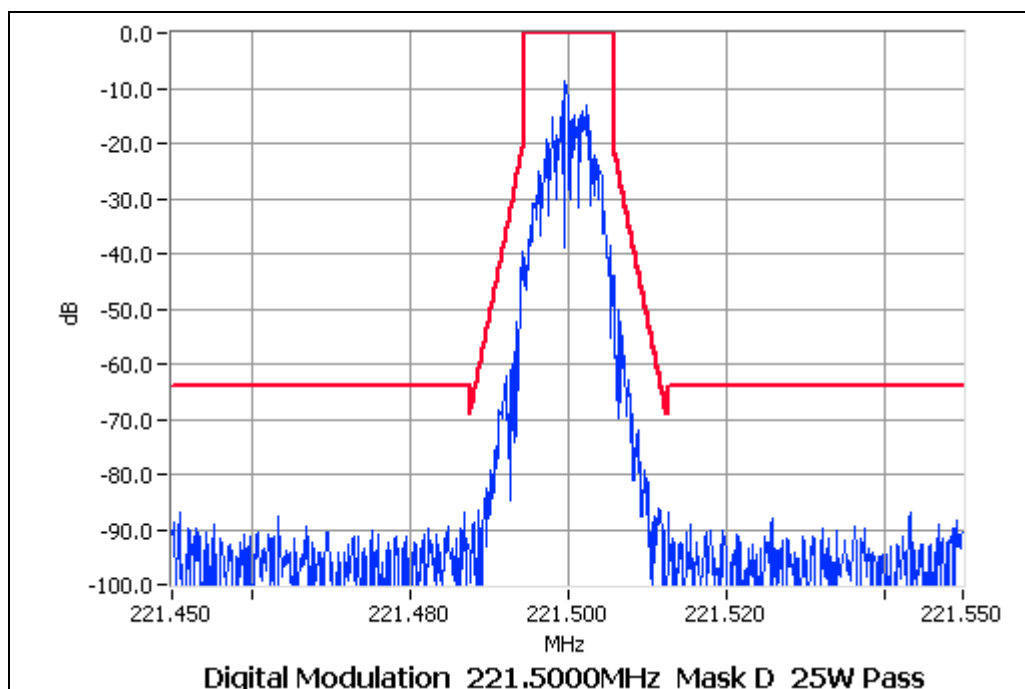
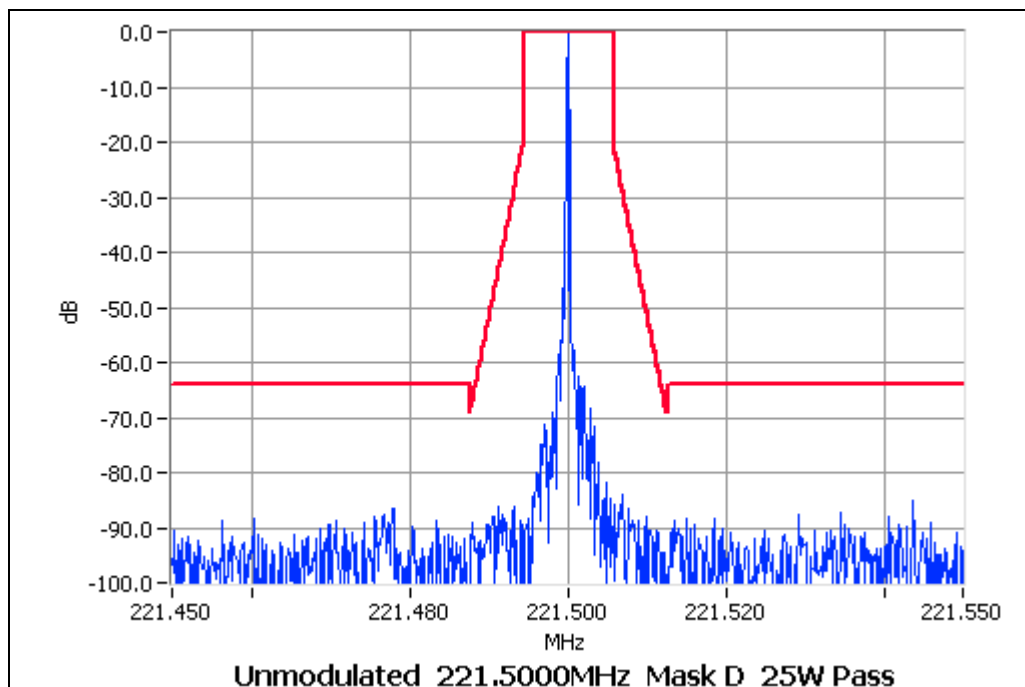
NAME OF TEST: OCCUPIED BANDWIDTH DATA FFSK
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 221.5 MHz 1W 12.5 kHz Channel Spacing



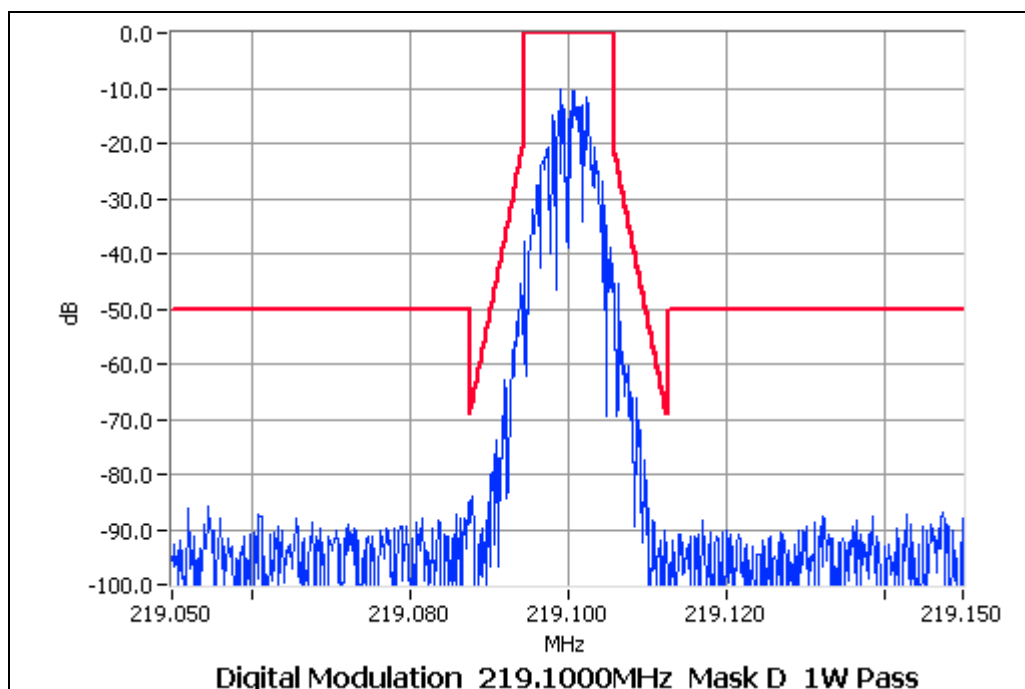
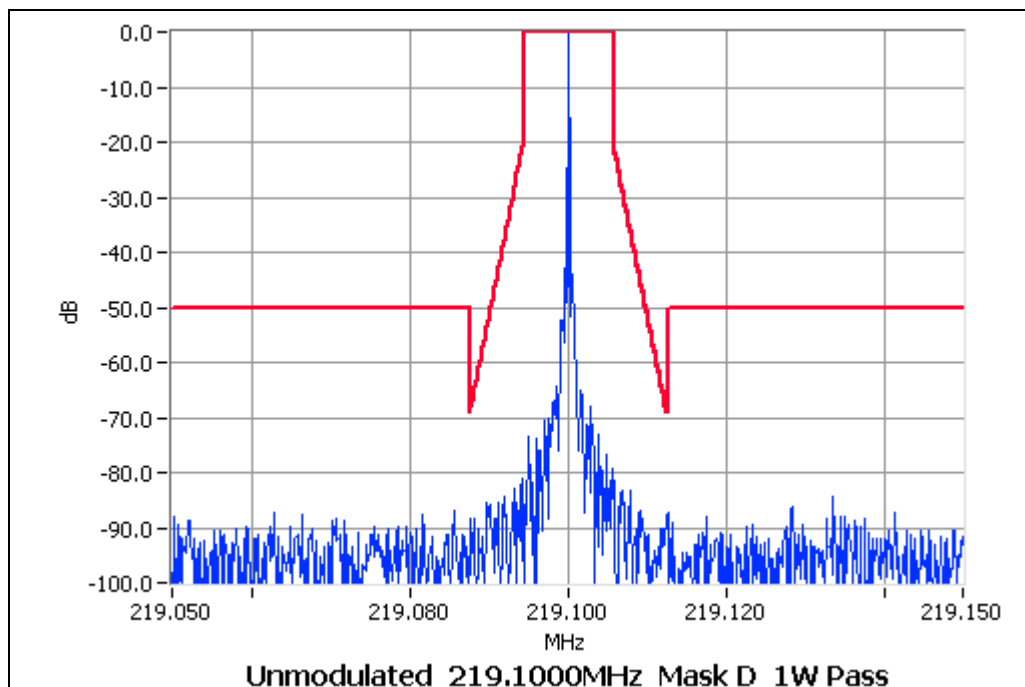
NAME OF TEST:	OCCUPIED BANDWIDTH	DATA	THSD
SPECIFICATION:	FCC CFR 2.1049 (c)		
Tx FREQUENCY:	219.1 MHz	25W	12.5 kHz Channel Spacing



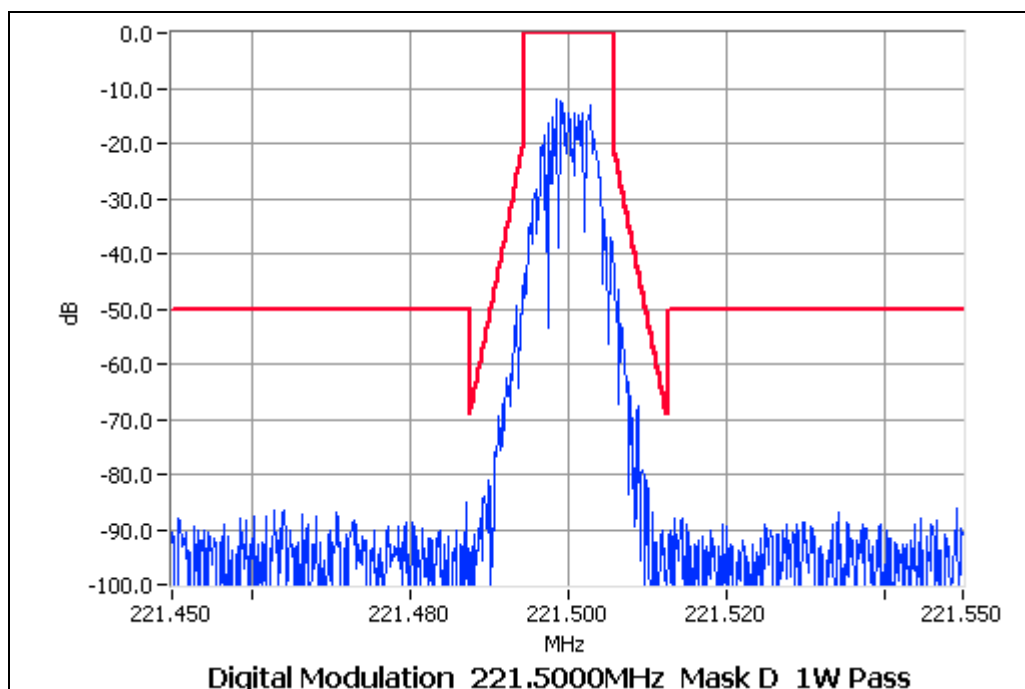
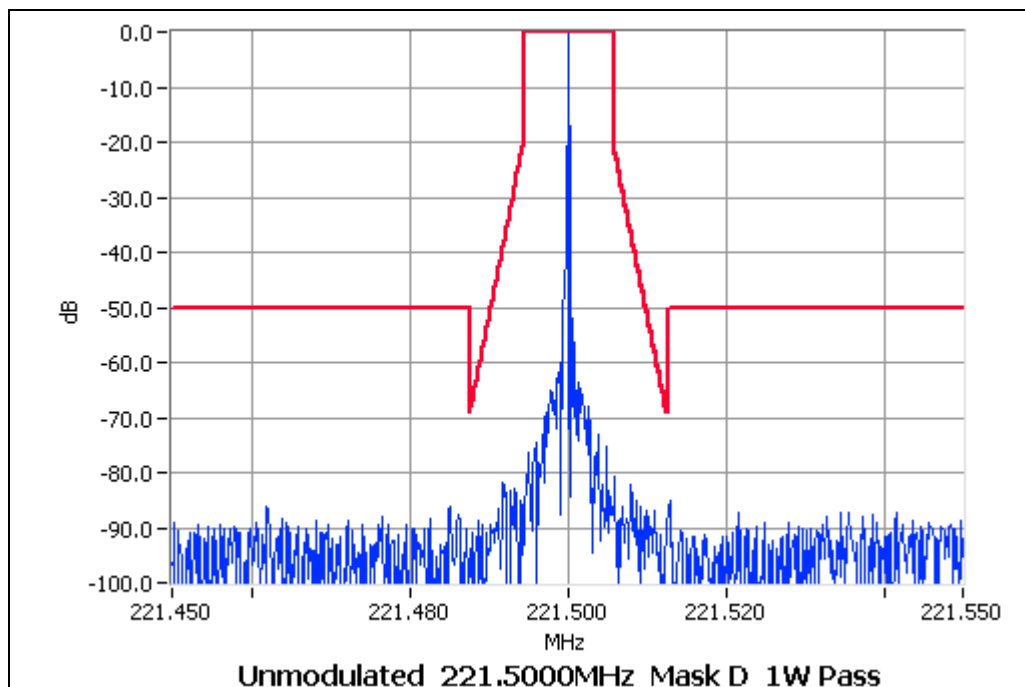
NAME OF TEST:	OCCUPIED BANDWIDTH	DATA	THSD
SPECIFICATION:	FCC CFR 2.1049 (c)		
Tx FREQUENCY:	221.5 MHz	25W	12.5 kHz Channel Spacing



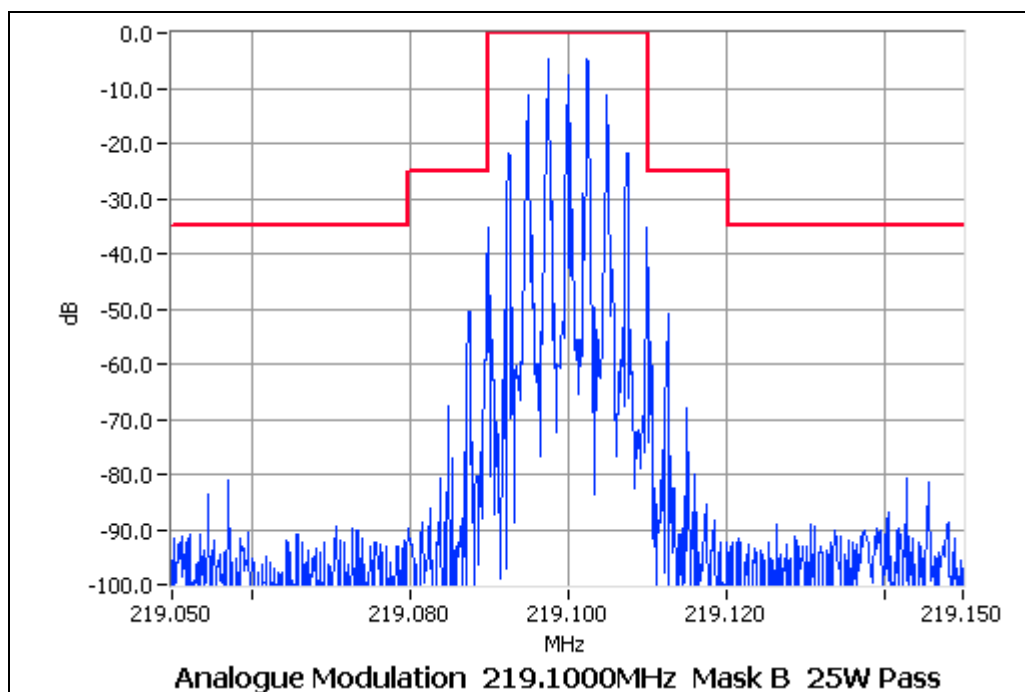
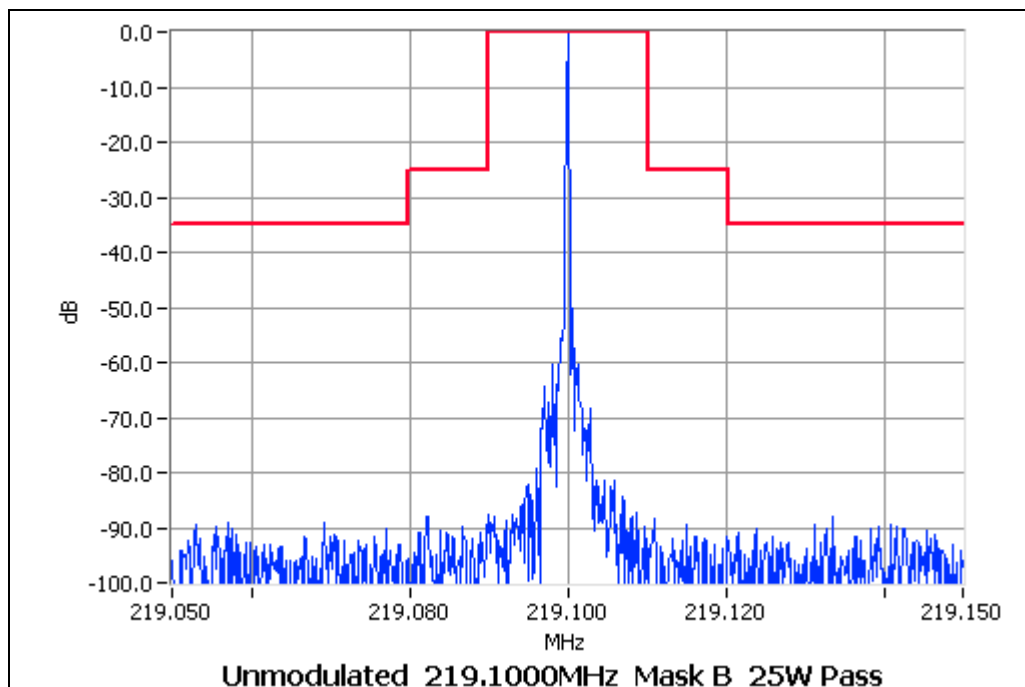
NAME OF TEST:	OCCUPIED BANDWIDTH	DATA	THSD
SPECIFICATION:	FCC CFR 2.1049 (c)		
Tx FREQUENCY:	219.1 MHz	1W	12.5 kHz Channel Spacing



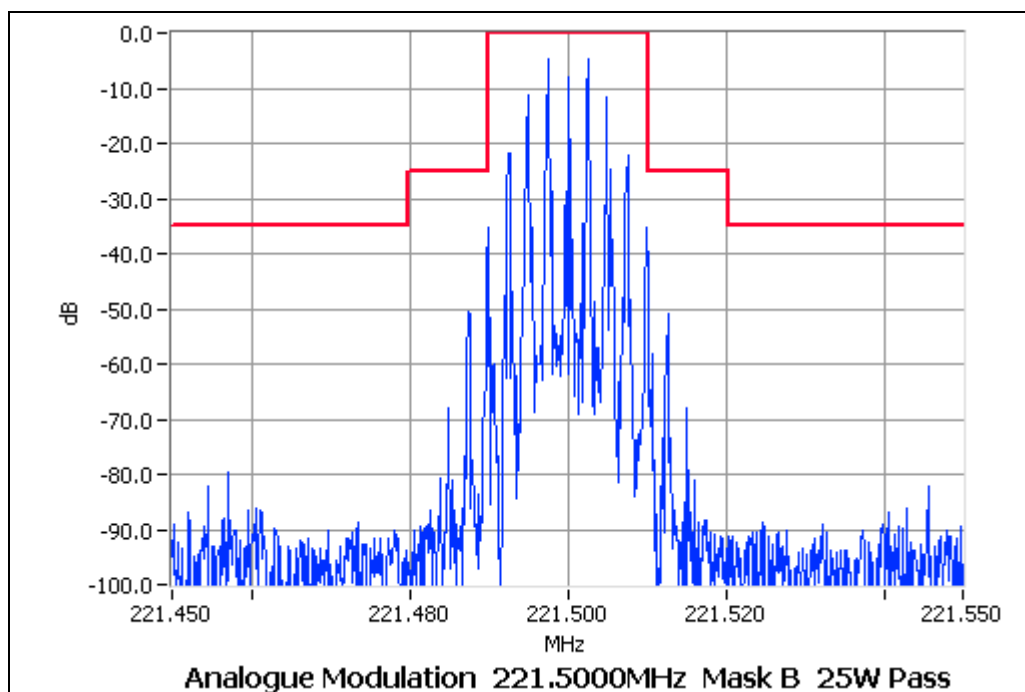
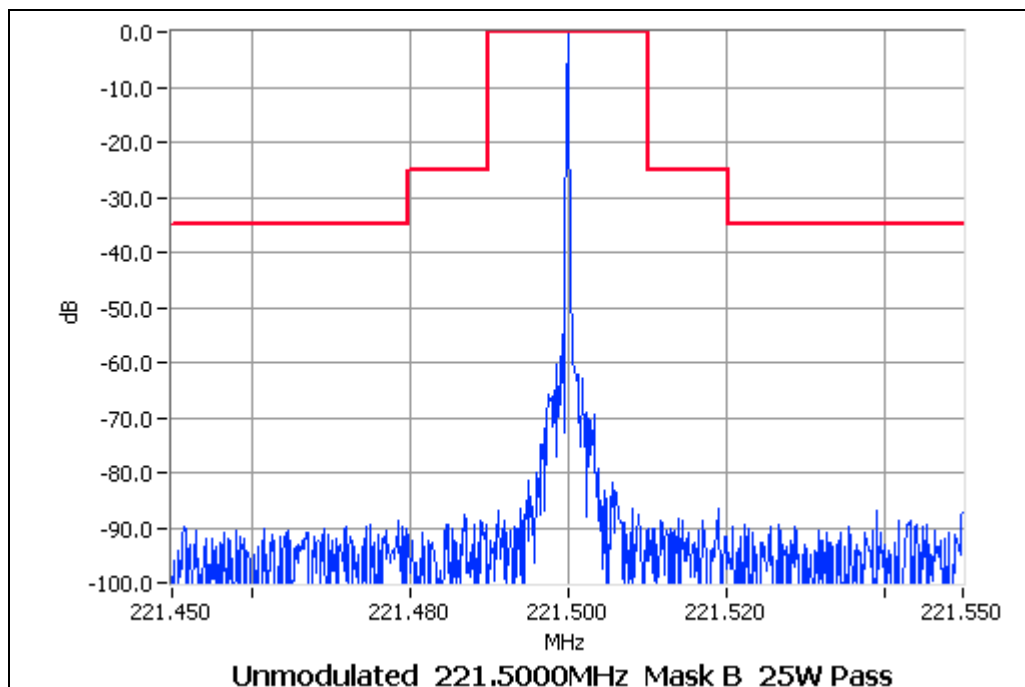
NAME OF TEST:	OCCUPIED BANDWIDTH	DATA	THSD
SPECIFICATION:	FCC CFR 2.1049 (c)		
Tx FREQUENCY:	221.5 MHz	1W	12.5 kHz Channel Spacing



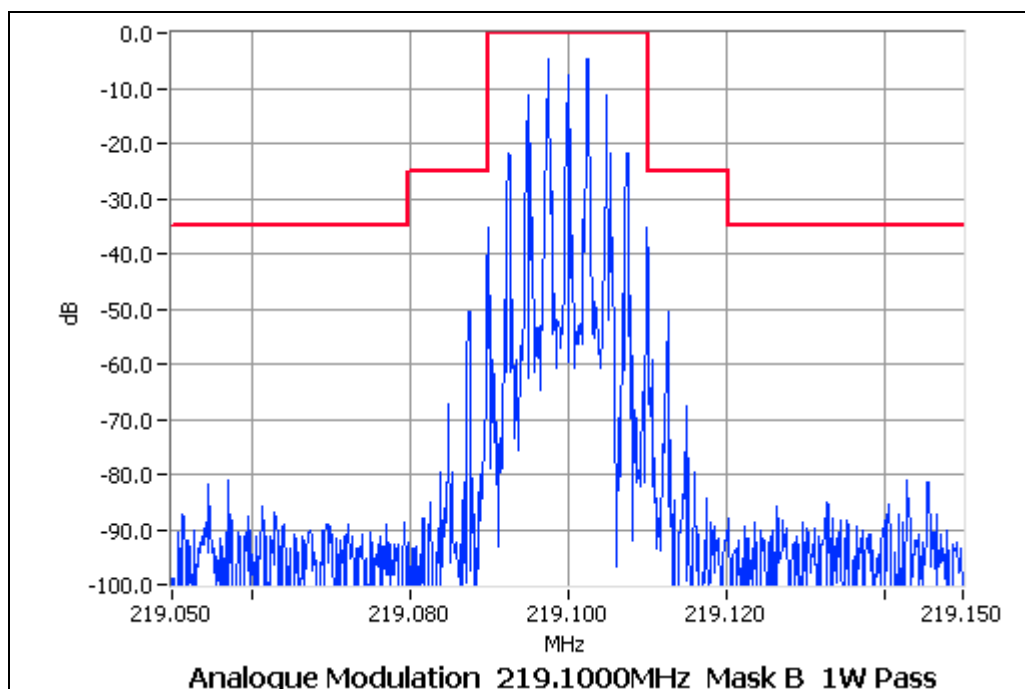
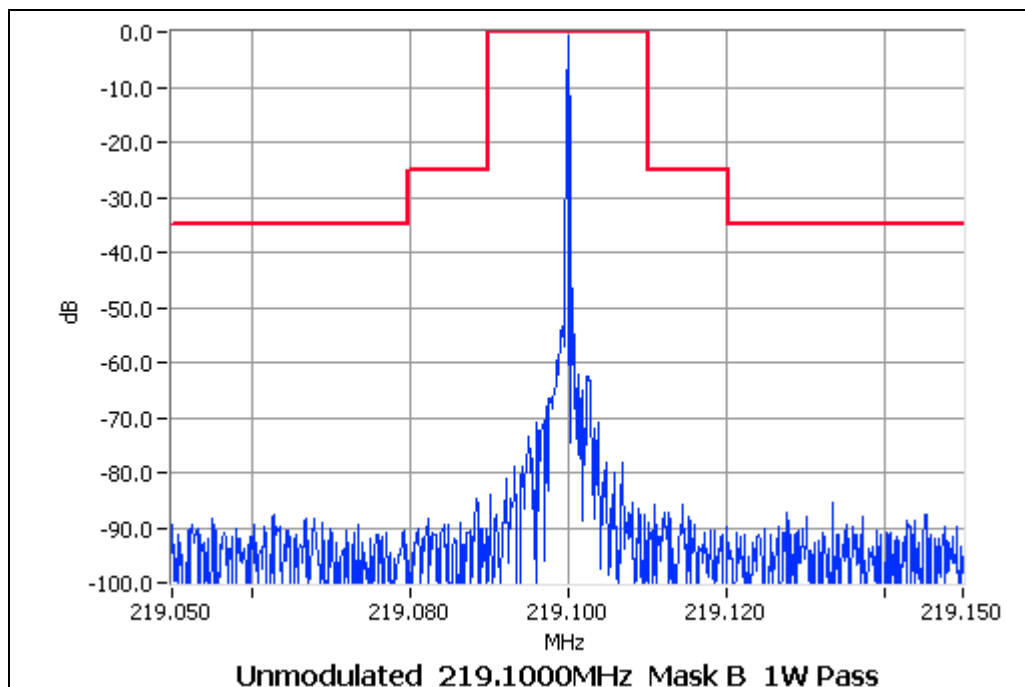
NAME OF TEST: OCCUPIED BANDWIDTH VOICE
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 219.1 MHz 25W 25.0 kHz Channel Spacing



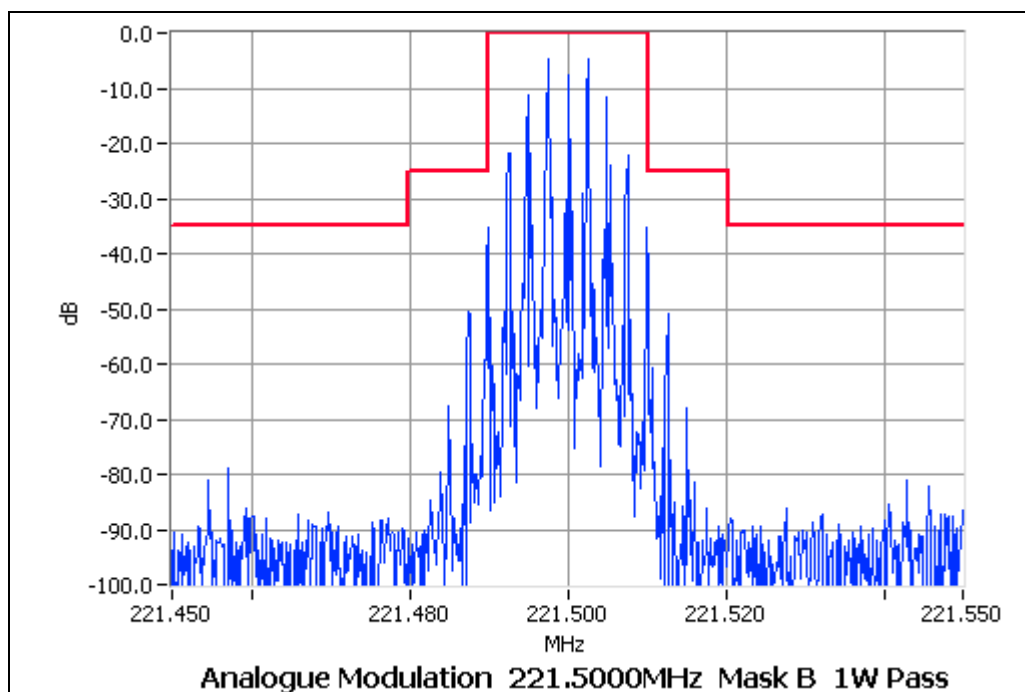
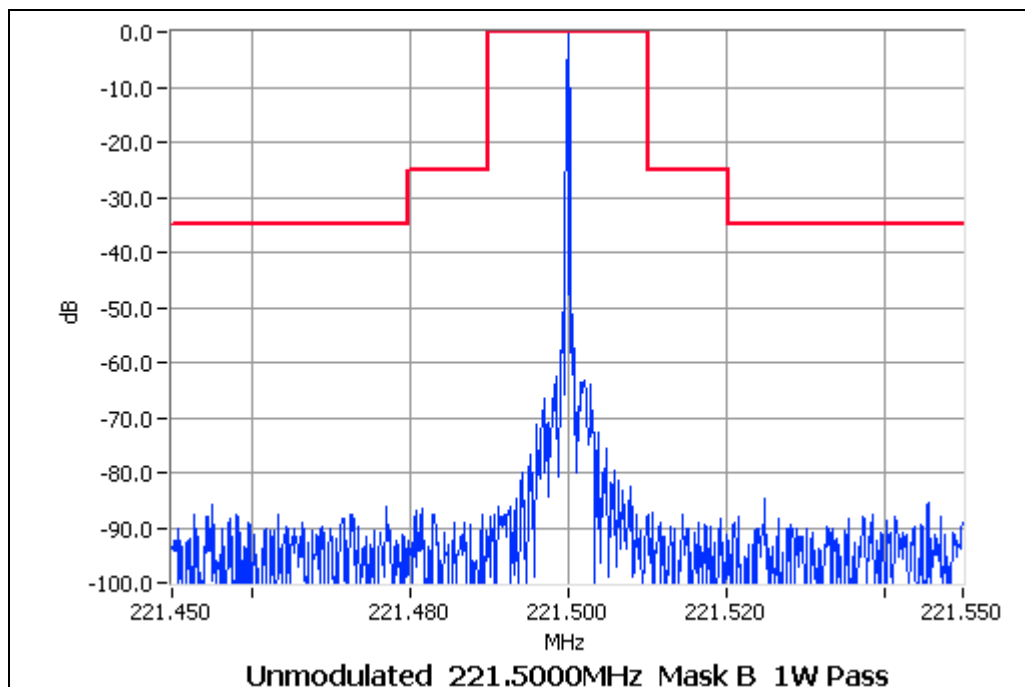
NAME OF TEST: OCCUPIED BANDWIDTH VOICE
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 221.5 MHz 25W 25.0 kHz Channel Spacing



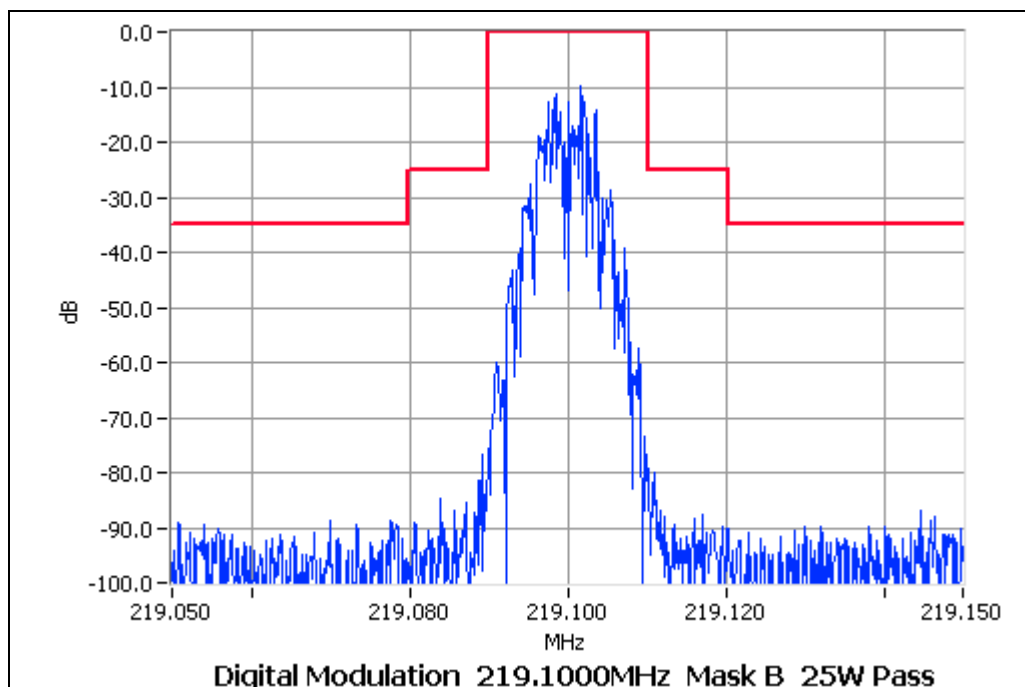
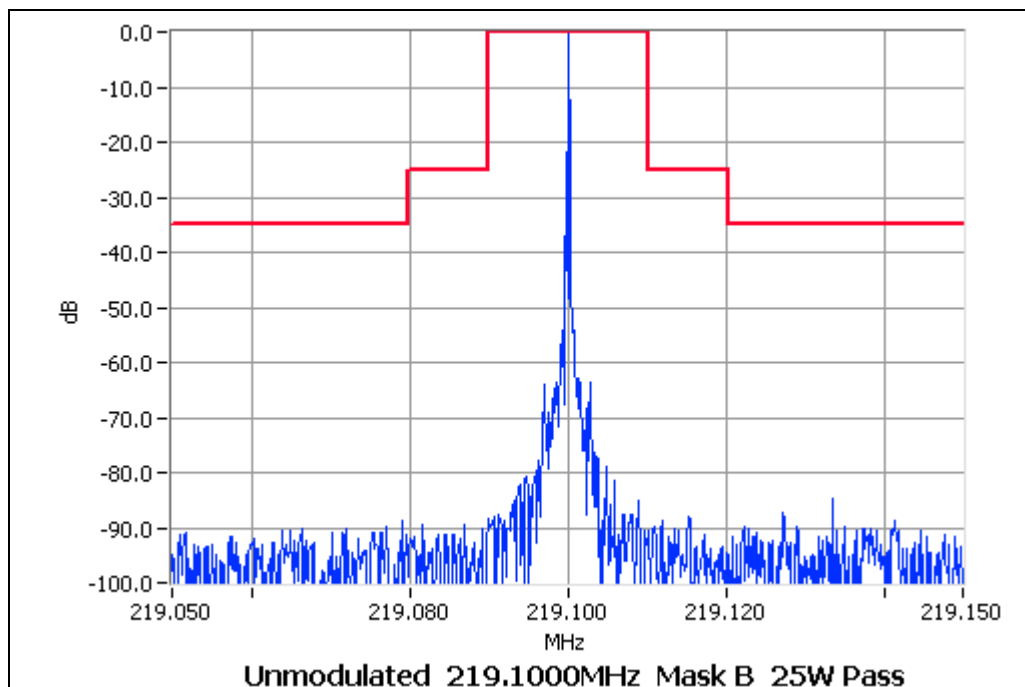
NAME OF TEST: OCCUPIED BANDWIDTH VOICE
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 219.1 MHz 1W 25.0 kHz Channel Spacing



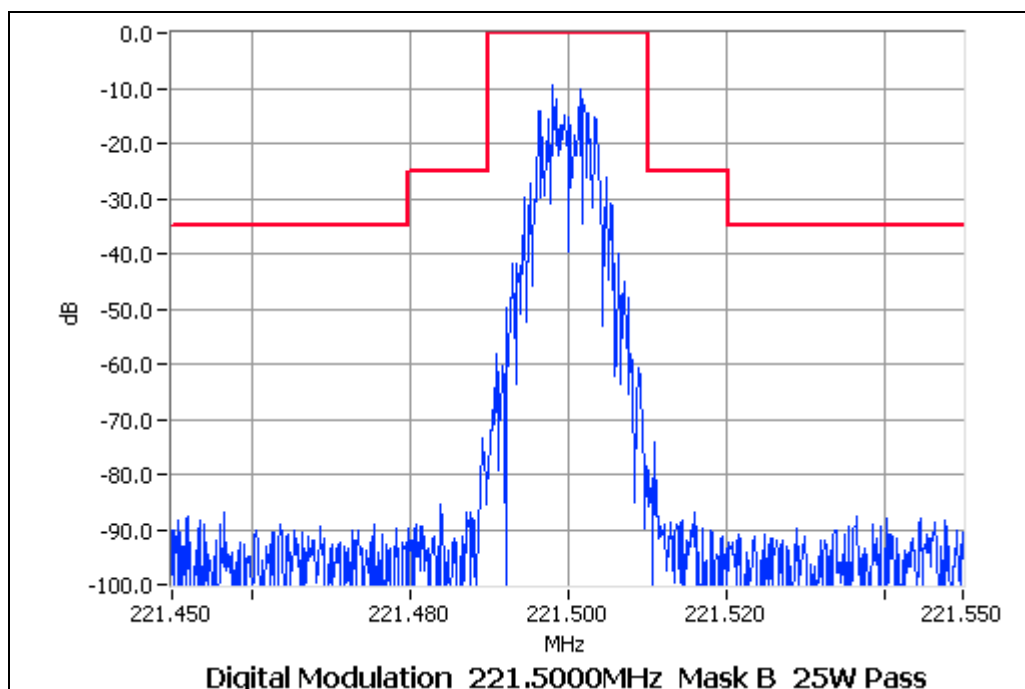
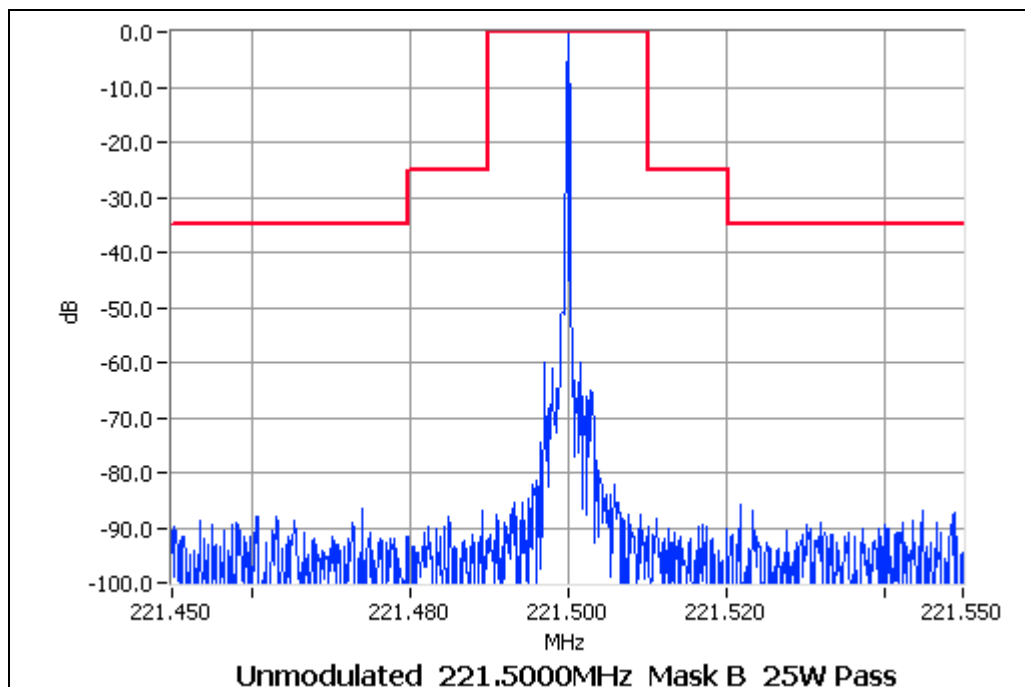
NAME OF TEST: OCCUPIED BANDWIDTH VOICE
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 221.5 MHz 1W 25.0 kHz Channel Spacing



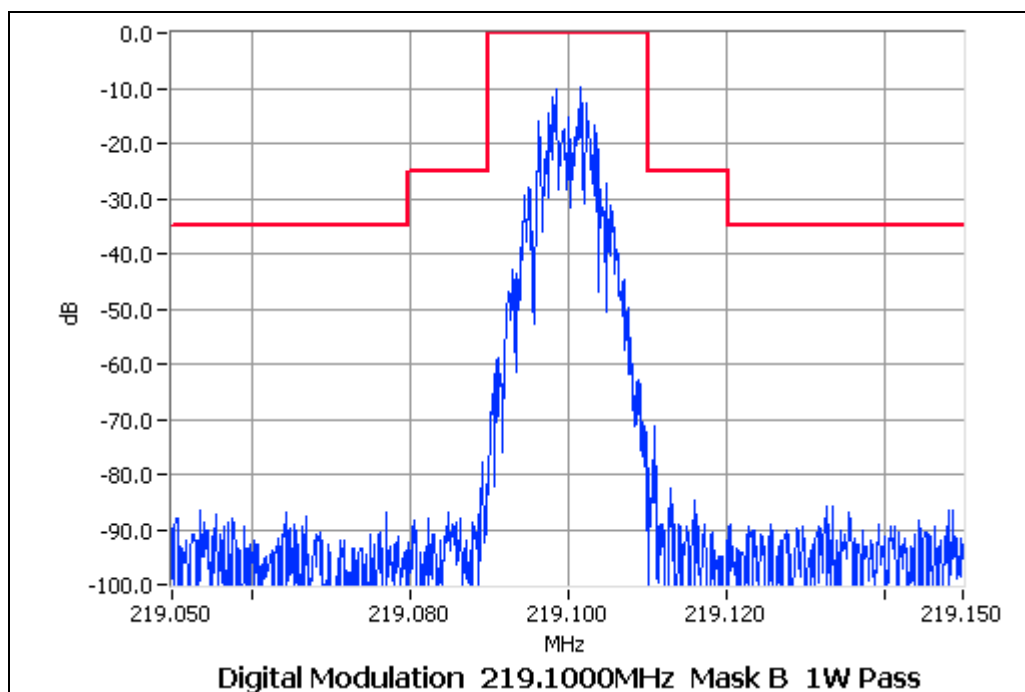
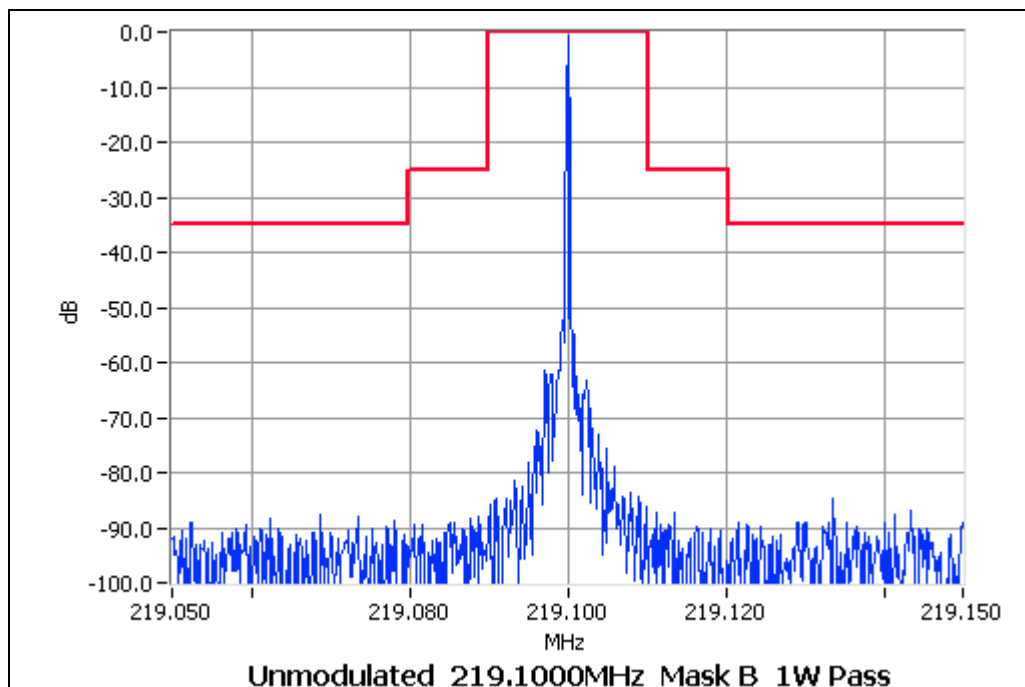
NAME OF TEST: OCCUPIED BANDWIDTH FFSK
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 219.1 MHz 25W 25.0 kHz Channel Spacing



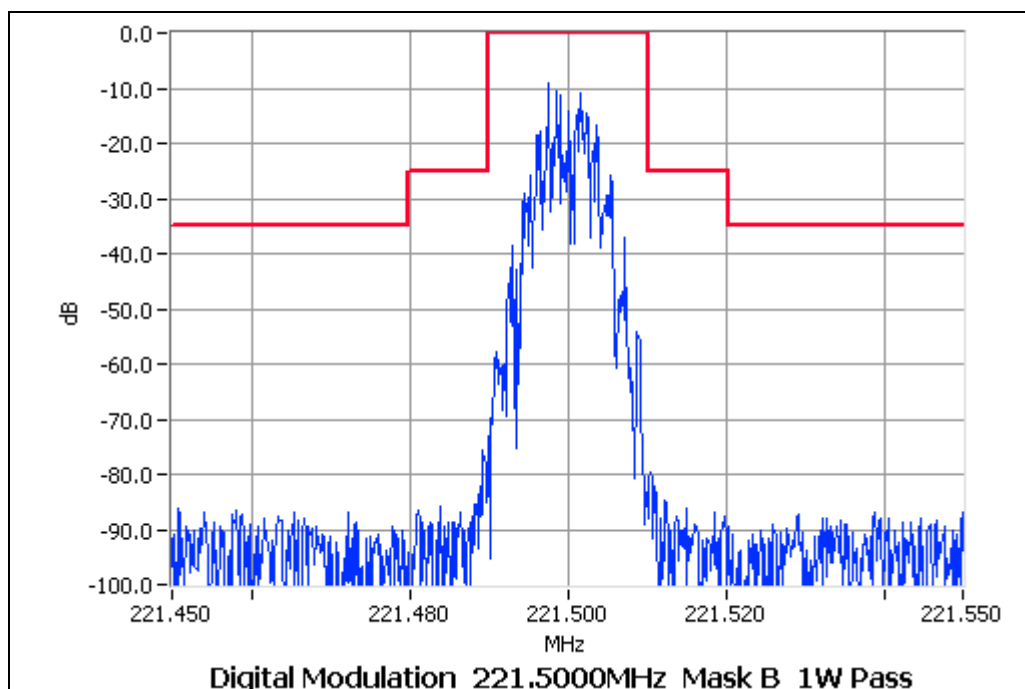
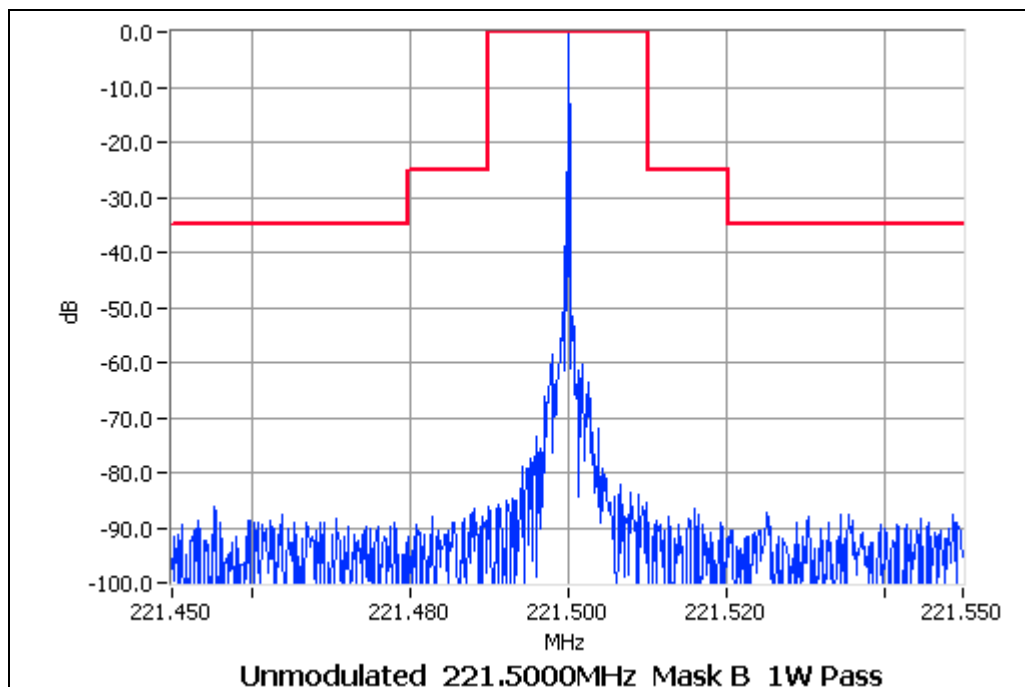
NAME OF TEST: OCCUPIED BANDWIDTH FFSK
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 221.5 MHz 25W 25.0 kHz Channel Spacing



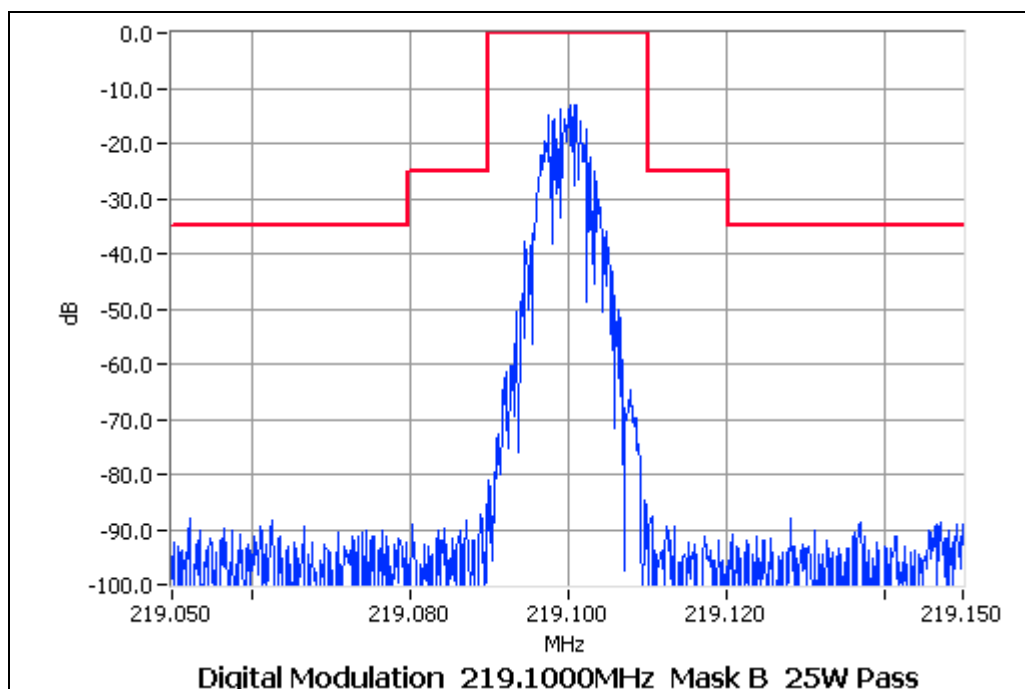
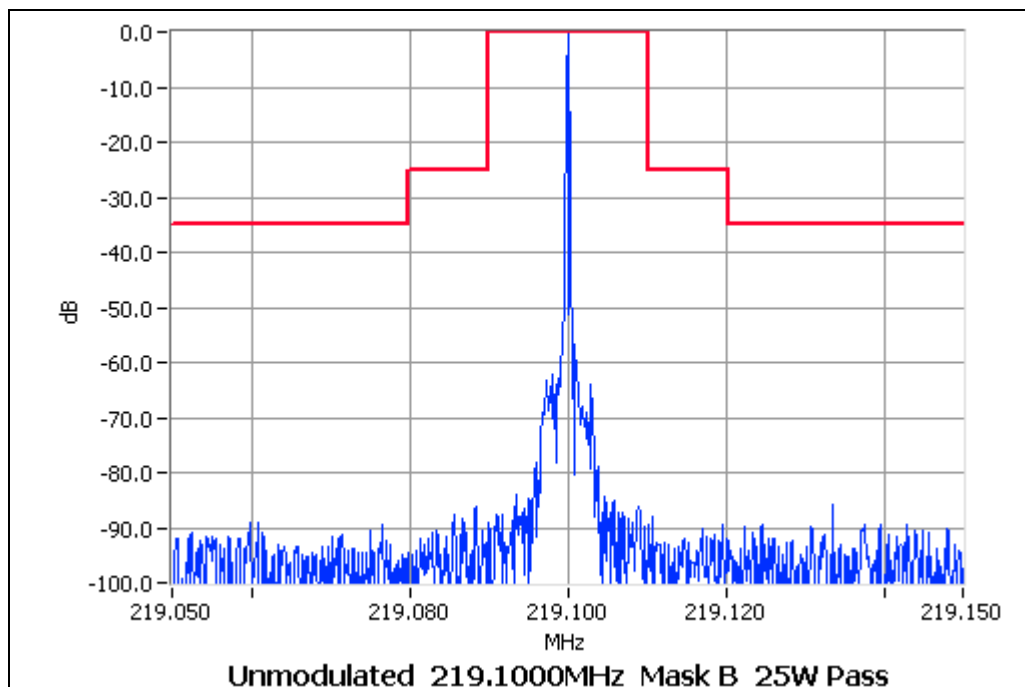
NAME OF TEST: OCCUPIED BANDWIDTH FFSK
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 219.1 MHz 1W 25.0 kHz Channel Spacing



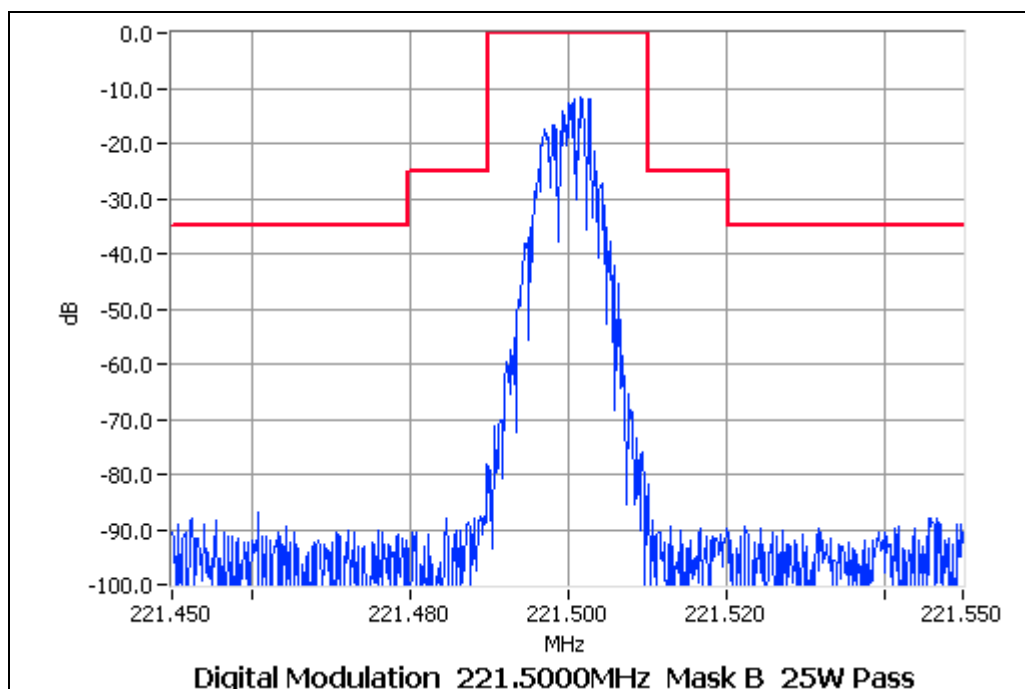
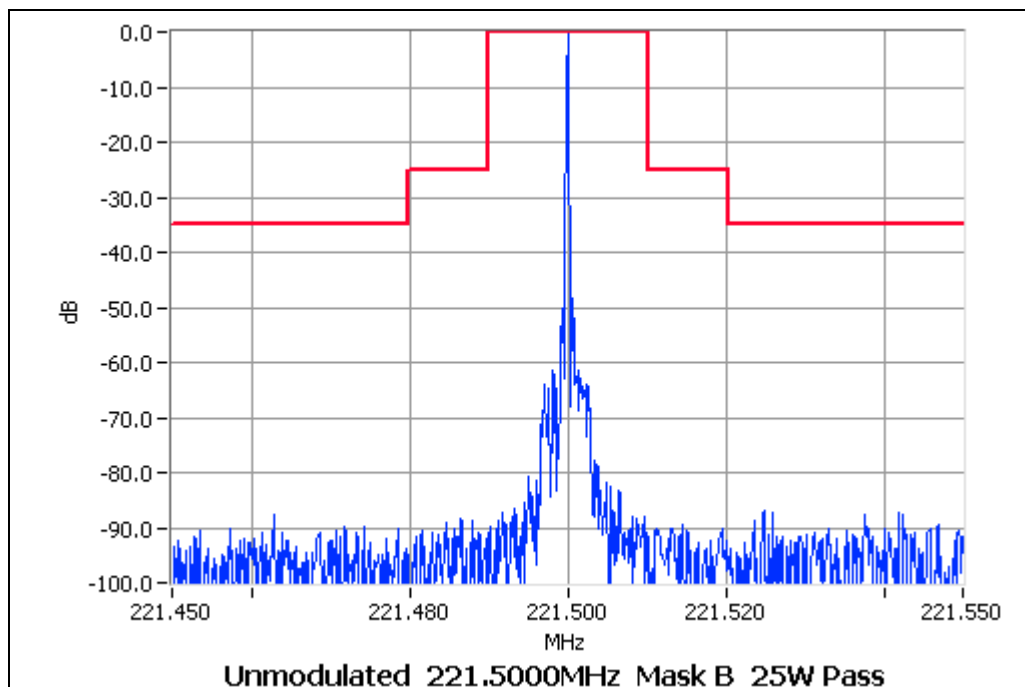
NAME OF TEST: OCCUPIED BANDWIDTH FFSK
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 221.5 MHz 1W 25.0 kHz Channel Spacing



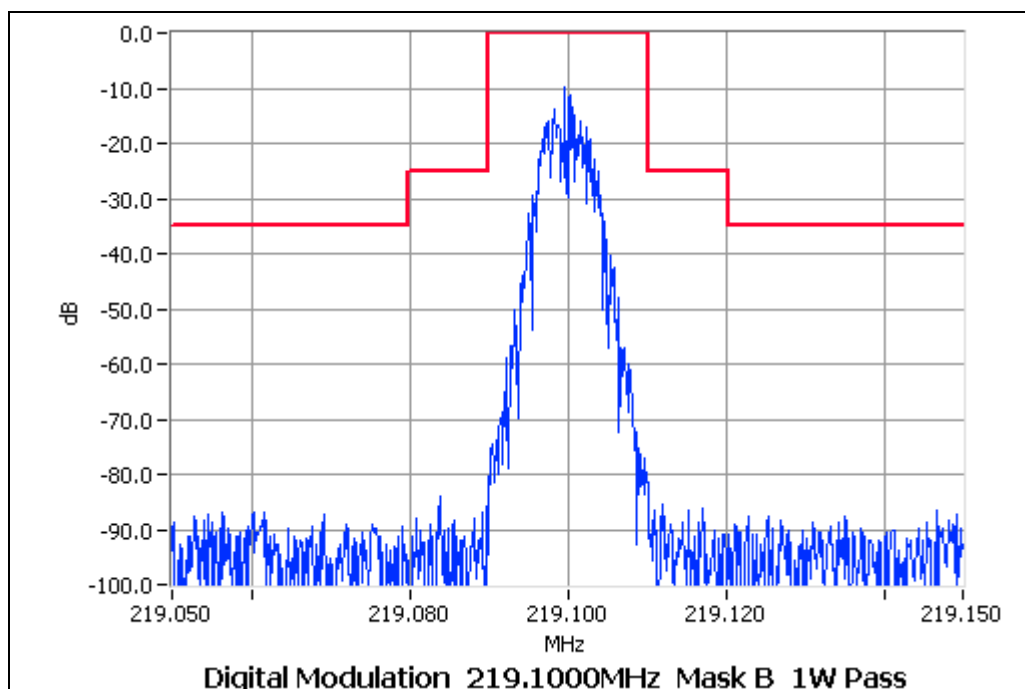
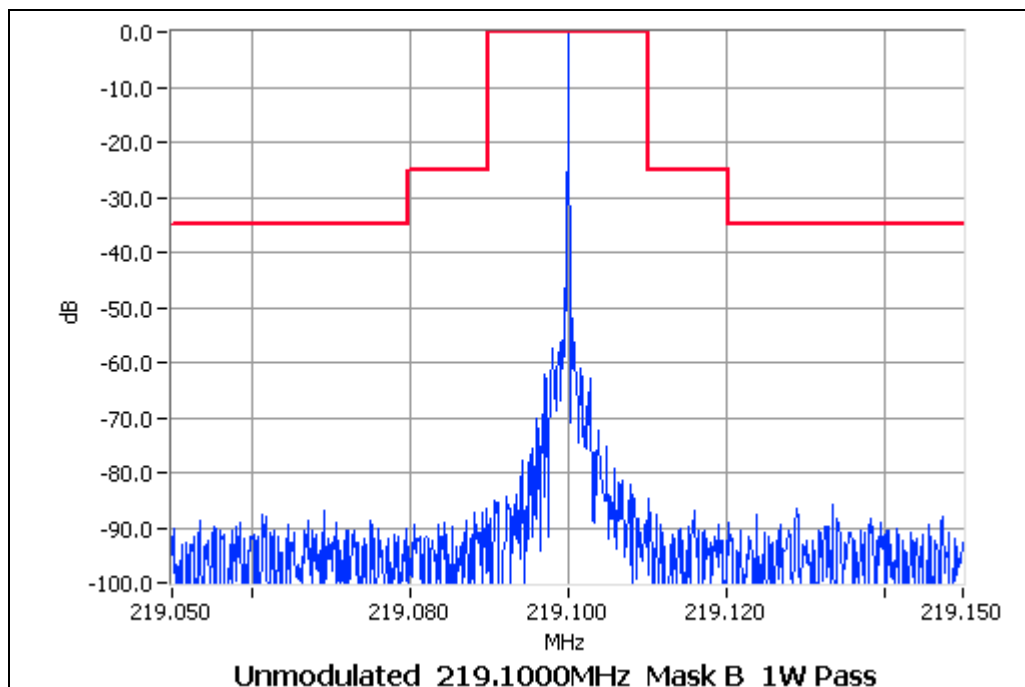
NAME OF TEST:	OCCUPIED BANDWIDTH	THSD
SPECIFICATION:	FCC CFR 2.1049 (c)	
Tx FREQUENCY:	219.1 MHz	25W
		25.0 kHz Channel Spacing



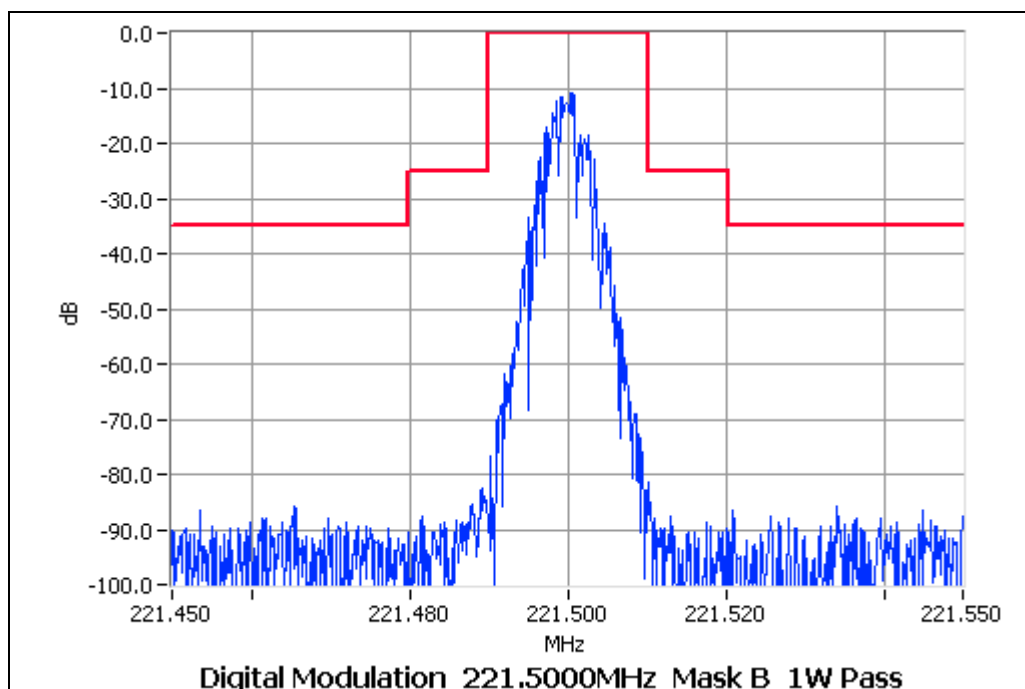
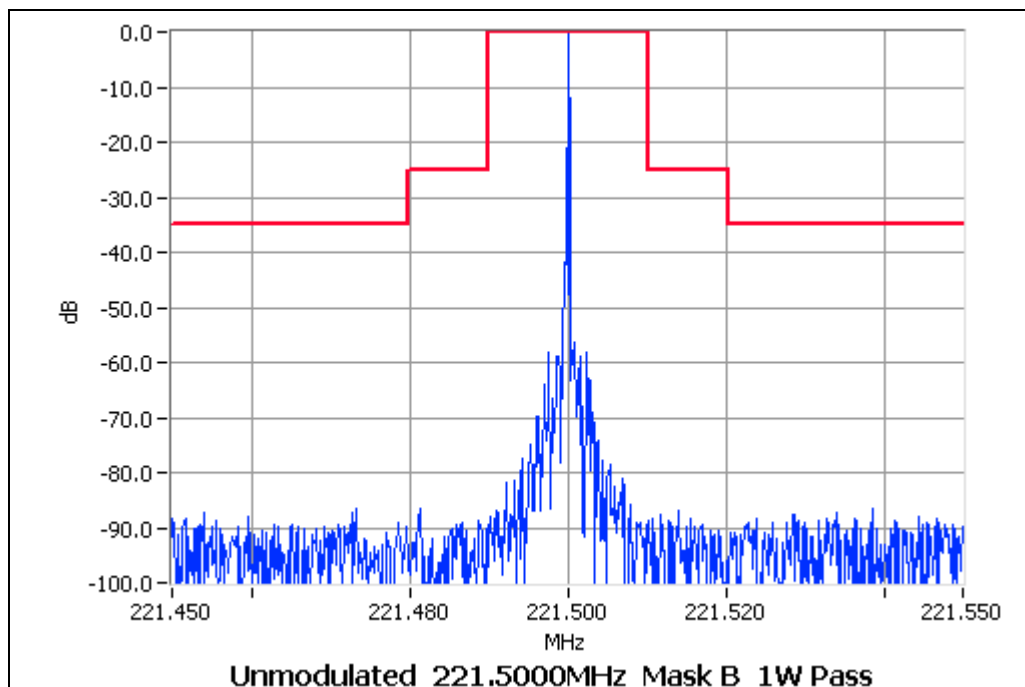
NAME OF TEST:	OCCUPIED BANDWIDTH	THSD
SPECIFICATION:	FCC CFR 2.1049 (c)	
Tx FREQUENCY:	221.5 MHz	25W
		25.0 kHz Channel Spacing



NAME OF TEST:	OCCUPIED BANDWIDTH	THSD
SPECIFICATION:	FCC CFR 2.1049 (c)	
Tx FREQUENCY:	219.1 MHz	1W
		25.0 kHz Channel Spacing



NAME OF TEST: OCCUPIED BANDWIDTH THSD
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 221.5 MHz 1W 25.0 kHz Channel Spacing



NAME OF TEST: SPURIOUS EMISSIONS (CONDUCTED)

TEST CONDITIONS: Ambient Temperature 22 °C
Relative Humidity 54 %
Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1051

GUIDE: TIA/EIA-603 2.2.13

MEASUREMENT PROCEDURE:

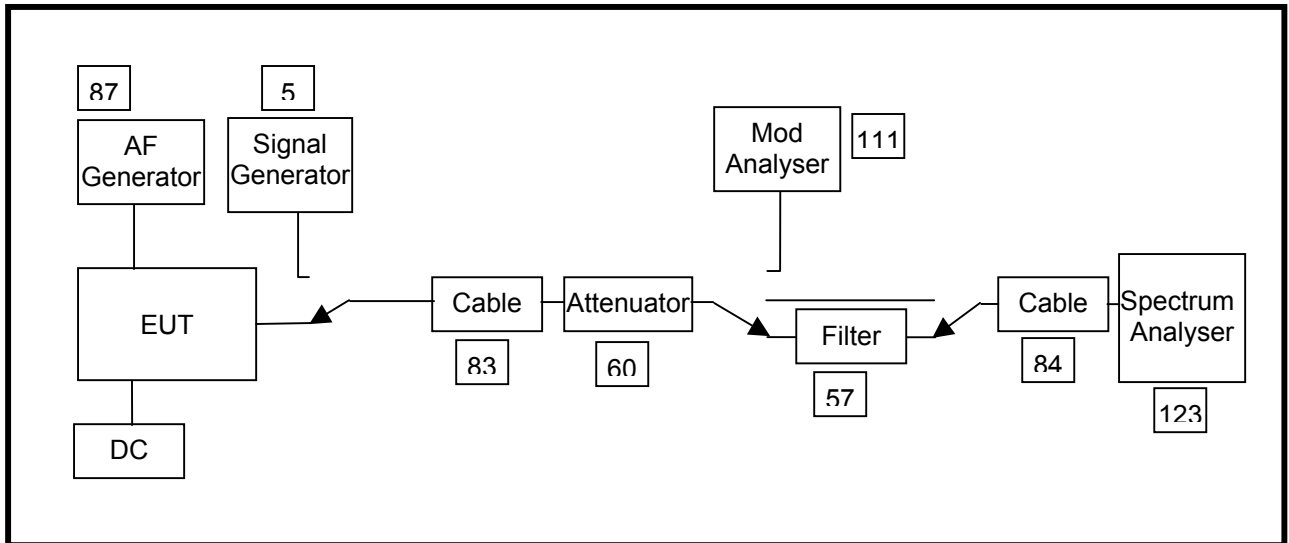
1. The Equipment Under Test was set up as shown in the following diagram.
2. The frequency range examined was from the lowest frequency generated within the EUT, to a frequency higher than the 10th Harmonic: 100kHz to Fc-BW
Fc+BW to 2.7 GHz
3. Spurious emissions which were attenuated more than 20dB below the limit were not recorded.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: FCC 47 CFR 90.210

TEST SETUP: See page 69 for Test Equipment information.



NAME OF TEST: SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 219.1 MHz

12.5 kHz Channel Spacing	219.1 MHz @ 1 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.		

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

NAME OF TEST: SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 219.1 MHz

12.5 kHz Channel Spacing	219.1 MHz @ 25 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.		

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

NAME OF TEST: SPURIOUS EMISSIONS (CONDUCTED)
 SPECIFICATION: FCC CFR 2.1051
 Tx FREQUENCY: 221.5 MHz

12.5 kHz Channel Spacing	221.5 MHz @ 1 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.		

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

NAME OF TEST: SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 221.5 MHz

12.5 kHz Channel Spacing	221.5 MHz @ 25 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.		

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

NAME OF TEST: SPURIOUS EMISSIONS (RADIATED)

TEST CONDITIONS: Ambient Temperature 23 °C
Relative Humidity 49 %
Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA/EIA-603 2.2.12

MEASUREMENT PROCEDURE:

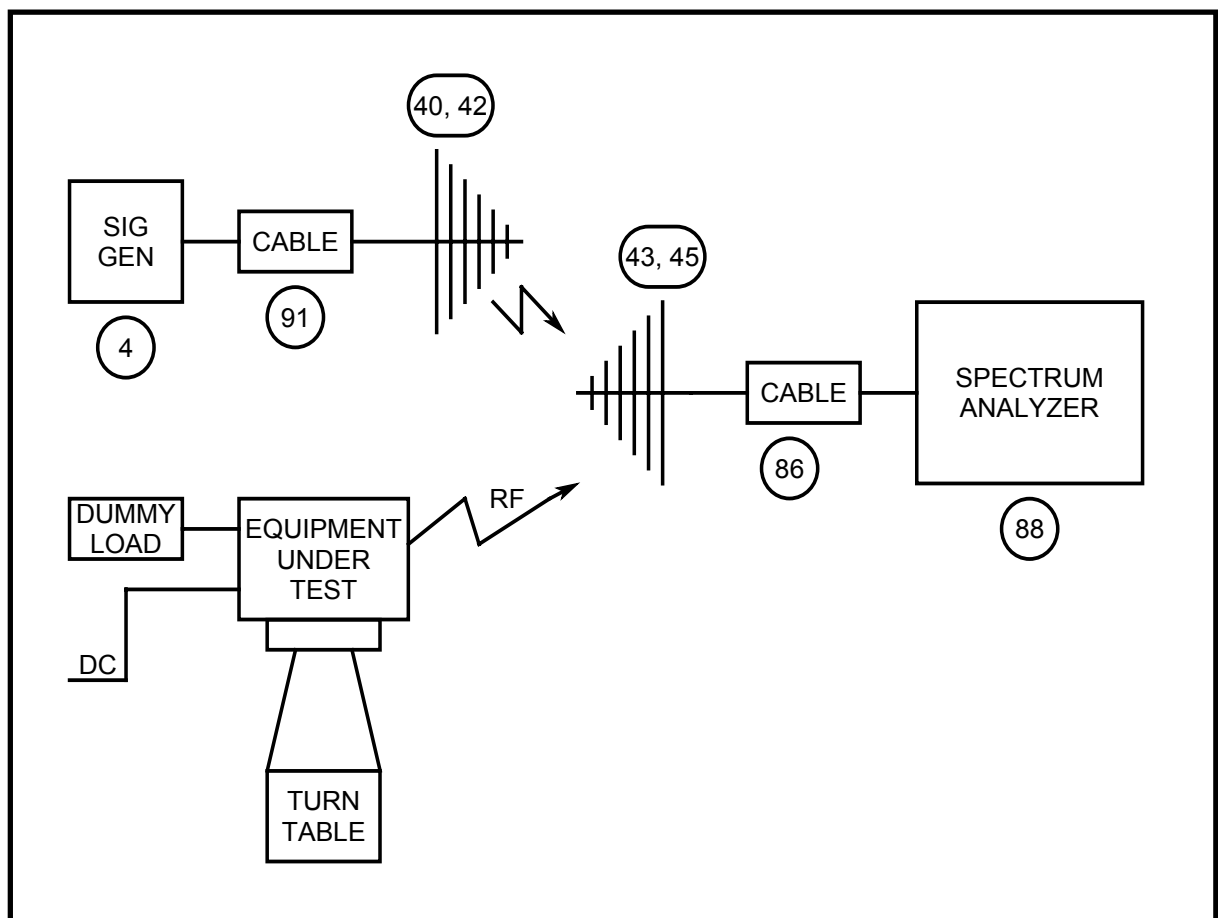
1. The Equipment Under Test was set up as shown in the following diagram.
2. The EUT was placed on a wooden turntable at a distance of three metres from the test antenna. The output terminal was connected to an RF dummy load.
3. The turntable was rotated through 360° to obtain the maximum response of each spurious emission. Valid emissions were determined by switching the EUT on and off.
4. The EUT was replaced by a signal generator and substitution antenna to make measurements by the substitution method.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: FCC 47 CFR 90.210

TEST SETUP: See page 69 for Test Equipment information.



NAME OF TEST: SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 219.1 MHz

12.5 kHz Channel Spacing	219.1 MHz @ 1 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.		

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

NAME OF TEST: SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 219.1 MHz

12.5 kHz Channel Spacing	219.1 MHz @ 25 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.		

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

NAME OF TEST: SPURIOUS EMISSIONS (RADIATED)
 SPECIFICATION: FCC CFR 2.1051
 Tx FREQUENCY: 221.5 MHz

12.5 kHz Channel Spacing	221.5 MHz @ 1 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.		

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

NAME OF TEST: SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 221.5 MHz

12.5 kHz Channel Spacing	221.5 MHz @ 25 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.		

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

NAME OF TEST: TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

TEST CONDITIONS: Ambient Temperature 22 °C
Relative Humidity 54 %
Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1055 (a) (1)

GUIDE: TIA/EIA-603 2.2.2

MEASUREMENT PROCEDURE:

1. The Equipment Under Test was set up as shown in the following diagram.
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:

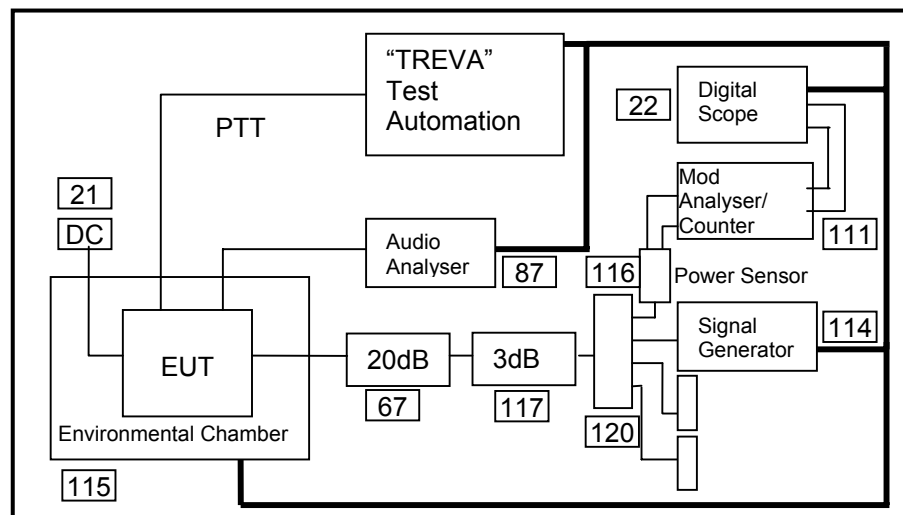
See the plots on the following pages for 12.5 kHz and 25.0 kHz channel spacings.

LIMIT CLAUSE: FCC 47 CFR 80.209 & 90.213

Frequency Range: 216 MHz ~ 222 MHz

Channel Spacing (kHz)	Frequency Error (ppm)	
12.5	5.0 (219.1 MHz)	1.5 (221.5 MHz)
25.0	5.0 (219.1 MHz)	1.5 (221.5 MHz)

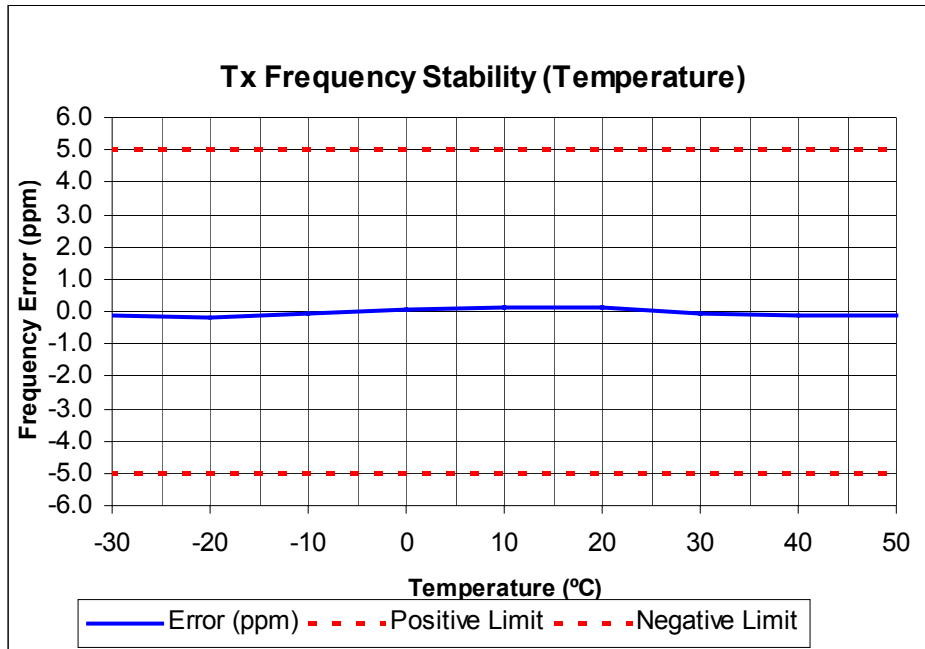
TEST SETUP: See page 69 for Test Equipment information.



NAME OF TEST: TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

SPECIFICATION: FCC 47 CFR 2.1055 (a) (1)

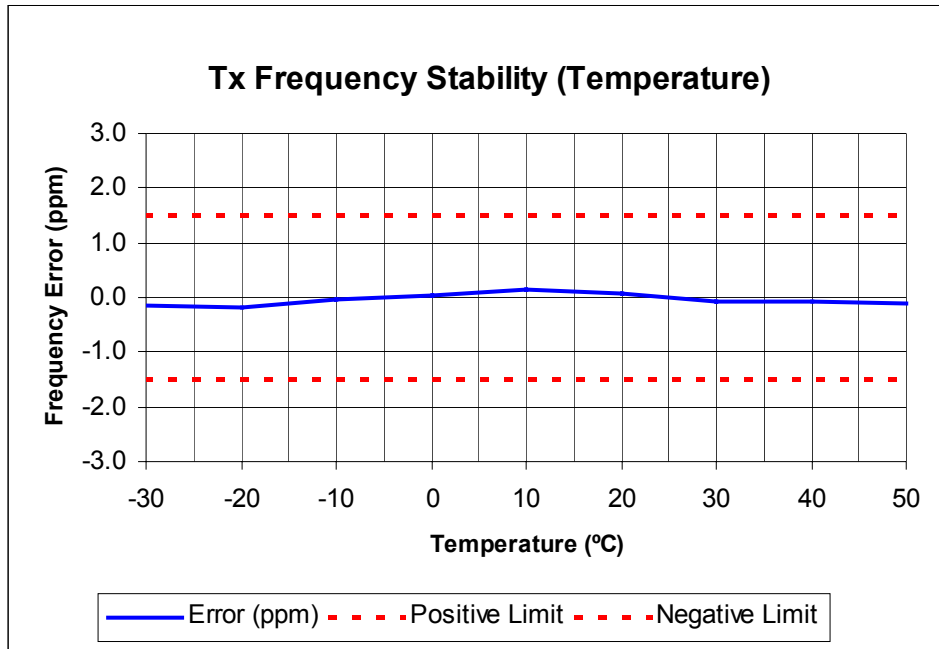
Tx FREQUENCY: 219.1 MHz 25W 12.5 kHz channel Spacing



NAME OF TEST: TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

SPECIFICATION: FCC 47 CFR 2.1055 (a) (1)

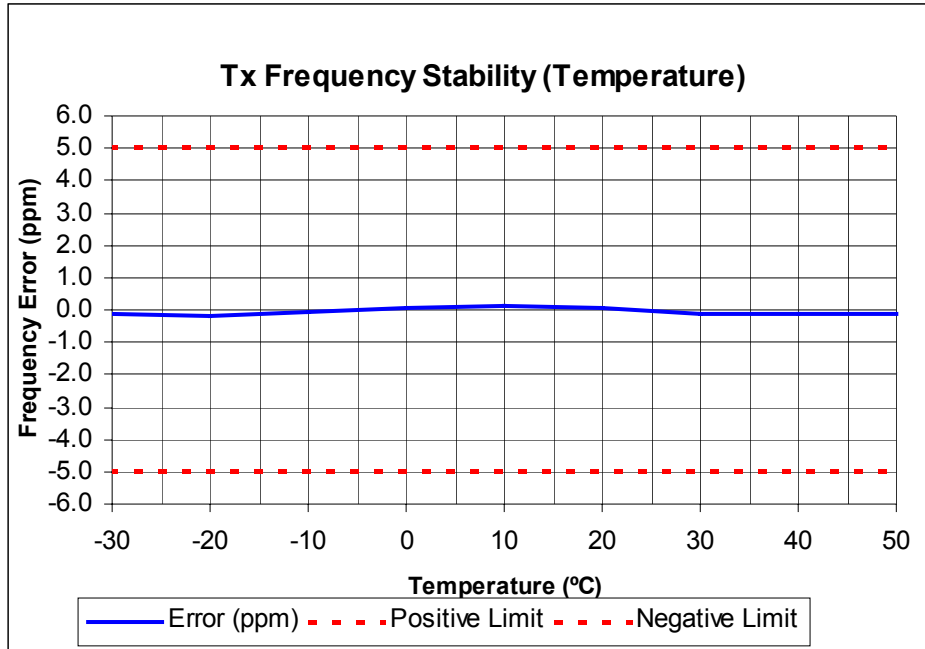
Tx FREQUENCY: 221.5 MHz 25W 12.5 kHz channel Spacing



NAME OF TEST: TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

SPECIFICATION: FCC 47 CFR 2.1055 (a) (1)

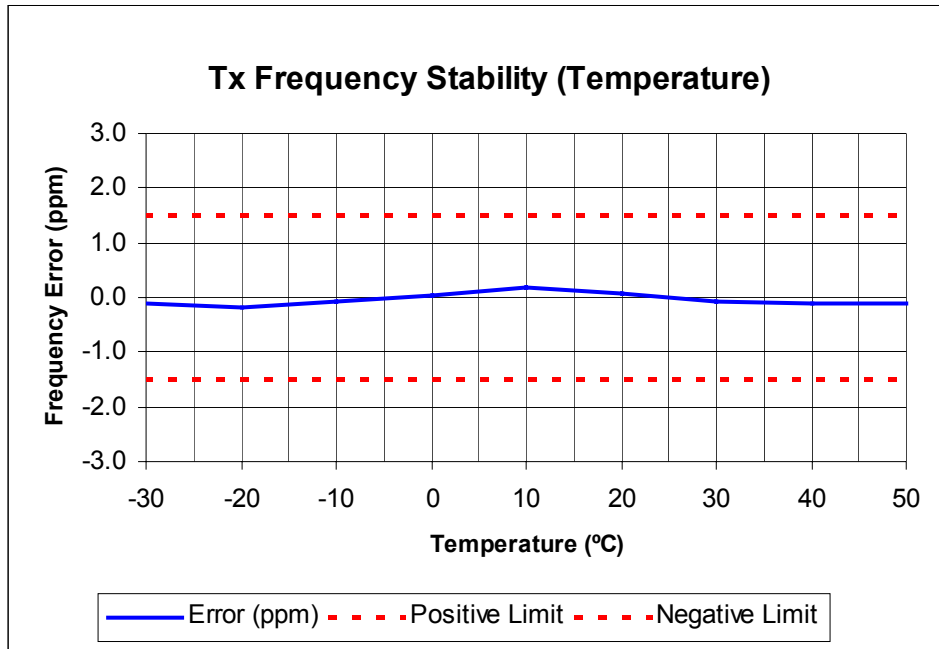
Tx FREQUENCY: 219.1 MHz 25W 25.0 kHz channel Spacing



NAME OF TEST: TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

SPECIFICATION: FCC 47 CFR 2.1055 (a) (1)

Tx FREQUENCY: 221.5 MHz 25W 25.0 kHz channel Spacing



NAME OF TEST: TRANSMITTER FREQUENCY STABILITY (VOLTAGE)

TEST CONDITIONS: Ambient Temperature 22 °C
Relative Humidity 54 %
Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1055 (d) (1)

GUIDE: TIA/EIA-603 2.2.2

MEASUREMENT PROCEDURE:

1. The Equipment Under Test was set up as shown in the following diagram.
2. The EUT was tested for frequency error at an input voltage to the radio of 85% to 115%.
3. The frequency error was recorded in parts per million (ppm).

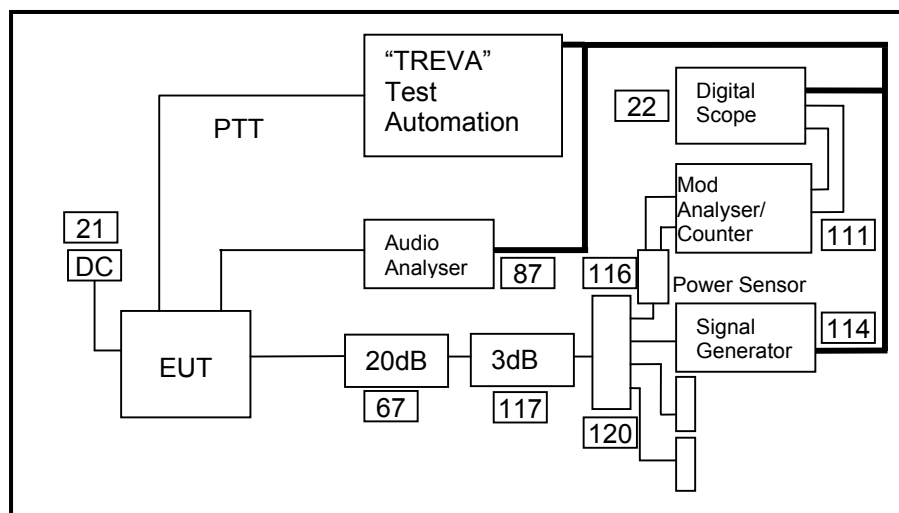
MEASUREMENT RESULTS: Frequency Range: 216 MHz ~ 222 MHz

Channel Spacing (kHz)	FREQUENCY ERROR (ppm) @ 219.1 MHz		
	11.73 V DC	13.8 V DC	15.87 V DC
12.5	-0.04	-0.05	-0.03
25.0	-0.08	-0.11	-0.05
	FREQUENCY ERROR (ppm) @ 221.5 MHz		
12.5	-0.07	-0.06	-0.07
25.0	-0.05	-0.06	-0.02

LIMIT CLAUSE: FCC 47 CFR 80.209 & 90.213

Channel Spacing (kHz)	Frequency Error (ppm)	
12.5	5.0 (219.1 MHz)	1.5 (221.5 MHz)
25.0	5.0 (219.1 MHz)	1.5 (221.5 MHz)

TEST SETUP: See page 69 for Test Equipment information.



TELTEST LABORATORIES Test Equipment List

To facilitate inclusion on each page, the test equipment used is numbered and listed against the related test in the report.

No	Equipment Type	Manufacturer	Model Number	Serial No	Tait ID	Cal Due (yr-mth- day)
1	Signal Generator	Hewlett Packard	HP8642B (Opt 001)	2512A00176	E3064	2005-02-18
2	Signal Generator	Hewlett Packard	HP8648A	3430U00344	E3579	2004-10-15
3	Signal Generator	Agilent	E4422B	GB40050320	E3788	2004-10-22
4	Signal Generator	Hewlett Packard	HP8648C	3443U00543	E3558	2005-09-11
5	Signal Generator	Rohde & Schwarz	SMY01 1062.5502.11	841736/019	E3553	2004-10-29
10						
11	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073	2004-08-05
12	Modulation Analyser	Rohde & Schwarz	FMA0852.8500.52	842541/001	E3554	2004-07-18
13	Audio Analyser	Hewlett Packard	HP8903A	2308A02597	E3074	2004-10-15
14	Power Head	Hewlett Packard	HP11722A	2320A00688	E3307	2004-10-15
15						
16						
20	Power Supply	Hewlett Packard	HP6032A	2441A-0041Z	E3075	2004-10-15
21	Power Supply	Rohde & Schwarz	NGS M32/10 192.0810.31	Fnr 434	E3556	2005-06-14
22	Oscilloscope	Tektronics	TDS340	B013611	E3585	2004-11-25
23						
24						
24						
25	Whirling Hygrometer	Casella	3156/82	TA004	TA004	2010-03-16
30	Directional Coupler	Hewlett Packard	HP778D-012	1144 07392	E3292	2004-08-11
31						
32	4 Port Combiner	Rohde & Schwarz	DVU4, 3W 201.4018. 03	300.971/28	E3572	2004-08-28
33	3 Port Combiner	Weinschel	1506A, 1W	LD858	E3672	2004-08-28
34						
35						
36						
37						
38						
40	Reference Dipoles	Emco	3121C DB1	9510-1164	E3559	2006-10-17
41						
42	Reference Horn Antenna	Emco	DRG3115	9512-4638	E3560	2006-09-27
43	Horn Antenna	Emco	DRG3115	2084	E3076	2006-09-27
44						
45						
46						
50						
51						
52						
53						
54						
55						
56						
57						
60	RF Attenuator 250W	Weinschel	45-30-34	JW663	E3386	2004-07-09
61	RF Attenuator 150W	Weinschel	40-20-33	CJ404	E3387	2004-08-11
62	RF Attenuator 150W	Weinschel	57-10-34	LB590	E3674	2004-07-09
63	RF Attenuator 150W	Weinschel	40-06-34	KV457	E3561	2004-08-11
64	RF Attenuator 50W	Weinschel	24-10-34	AZ0401	E3388	2004-08-11
65	RF Attenuator 50W	Weinschel	24-20-44	AW1266	E3562	2004-05-26
66	RF Attenuator 25W	Weinschel	33-20-33	BD5871	E3673	2004-07-09
67	RF Attenuator 150W Treva	Weinschel	40-20-33	CJ405	E3733	2004-05-29
70	RF Load 150W	Bird	8166	524	E3625	2004-10-30
71	RF Load 50W	Weinschel	F1426	BF0487	E3675	2004-08-11
72	RF Load 50W	Weinschel	F1426	AE2490	E3624	2004-07-09
73						

74	RF Termination 2W	MCL	NTRM-50	951215	E3574	2004-06-01
75	RF Termination 2W	MCL	NTRM-50	954214	E3575	2004-06-02
76	RF Termination 2W	MCL	NTRM-50	954214	E3576	2004-06-03
80	20m Coax Cable	Intelcom	RG214/U-50(Ext Cal)	CBL03	E3659	2004-09-08
81	2m Coax Cable	Intelcom	RG213/U-50 (Ext Cal)	CBL02	E3658	2004-08-11
82	3m Coax Cable BLUE)	Suhner	Sucoflex 104A	25033/4A	E3694	2004-08-11
83	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25006/4A	E3693	2004-08-11
84	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25005/4A	E3692	2004-07-09
85	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25004/4A	E3691	2004-07-09
86	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25003/4A	E3690	2004-08-11
87	Audio Analyser	Hewlett Packard	HP8903B	2818A04275	E3710	2004-11-25
88	Spectrum Analyser	Hewlett Packard	HP8562E	3821A00779	E3715	2005-01-06
89	Field Strength Meter	Holaday	HI-422	95661	E3630	2005-05-28
90	Power Supply	Hewlett Packard	HP6012B	2524A00616	E3712	2004-05-16
91	20m Coax Cable		RG214/U-50 (Ext Cal)	CBL01	E3404	2004-09-08
92						
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100	Oscilloscope	Tektronics	TDS380	B017095	E3782	2004-10-16
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111	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	2004-10-15
112	Signal Generator	Agilent	E4433B	US384440446	E4147	2005-05-30
113						
114	Signal Generator	Rohde & Schwarz	SML03 1090.3000.13	100597	E4050	2004-11-28
115						
116	Power Head	Hewlett Packard	HP11722A	2716A02037	1575	2004-08-08
117						
118						
119	RF Attenuator 150W Treva	Weinschel	40-20-23	MF817	E4082	2004-07-09
120						
121						
122						
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	2004-03-28
124						
125						
126						
127	RF Attenuator	Minicircuits	BW-N10W5	1		2004-08-28
128	RF Attenuator	Minicircuits	BW-N10W5	2		2004-08-28
129						
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131						