REPORT NUMBER 2060 August 2004

RADIO PERFORMANCE MEASUREMENTS

On the TMAB22-D100 Mobile Transceiver

FCC ID: CASTMAD1C

SN: 19015645

In accordance with

FCC 47 CFR Parts 80, 90, and 90 Subpart T

PREPARED BY: Marcus Ludwig _____
Test Technician

CHECKED & APPROVED BY: Hamish Newton _____
Senior Technician

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New Zealand
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REPORT ON :

Type Approval Testing of the TMAB22-D100 (Serial No 19015645)
in accordance with:

FCC CFR 47 Parts 80,90, & 90 Subpart T

FCC ID: CASTMAD1C

PREPARED FOR :

Tait Electronics Ltd
PO Box 1645
558 Wairakei Rd
Christchurch
New Zealand

DISTRIBUTION :

TELTest Laboratory	Mr S Crompton	Copy No 1
Tait Electronics Ltd	Mr. Des Fox	Copy No 2
Tait Electronics Ltd	Mr. Neil Fletcher	Copy No 3

APPROVED :

Hamish Newton

Senior Technician

Date :

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

Copy No:

TABLE OF CONTENTS

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:	TMAD1C
Product code:	TMAB22-D100
Serial Numbers:	19015645
Quantity:	1

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

FCC CFR 47 Parts 80, 90, & 90 subpart T

Signature:_____

S. A. Crompton
Compliance Laboratory Manager.

Date:_____

Test Conditions

All testing was performed at the following conditions.

Ambient Temperature	15°C to 30°C
Relative Humidity	20% to 75%
Standard Test Voltage	13.8Vdc

Necessary Bandwidth and Emission Designators

SPECIFICATION: FCC 47 CFR 2.202

The Necessary Bandwidth is the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed.
This is calculated using the following formula.

Bn = 2M + 2DK Where: Bn = Necessary Bandwidth
M = Maximum modulation frequency
For Data transmission
M = B/2
Where: B = Modulation rate in Baud
D = Peak deviation
K = Constant
For Analogue transmission this is 1
For Data transmission this is typically 1.2

1. Analogue Voice 12.5kHz Bandwidth

Necessary bandwidth

M = 3kHz
D = 2.5kHz

Bn = 6 + 5 x 1
=11kHz

Emission Designator

11k0F3E

F3E represents a FM voice transmission

2. Analogue Voice 25kHz Bandwidth

Necessary bandwidth

M = 3kHz
D = 5kHz

Bn = 6 + 10 x 1
=16kHz

Emission Designator

16k0F3E

F3E represents a FM voice transmission

3. Fast Frequency Shift Keying (FFSK) 12.5kHz Bandwidth

Necessary bandwidth

M = 0.6 (Baud rate = 1200)
D = 1.5kHz (60% of peak deviation)

Bn = 1.2 + 3 x 1.2
=4.8kHz

Emission Designator

4k80F2D

F2D represents a FM data transmission with the use of a modulating sub carrier

4. Fast Frequency Shift Keying (FFSK) 25kHz Bandwidth

Necessary bandwidth	Emission Designator
M = 0.6 (Baud rate = 1200) D = 3kHz (60% of peak deviation)	**8k40F2D** F2D represents a FM data transmission with the use of a modulating sub carrier

Bn = 1.2 + 6 x 1.2
=8.4kHz

5. Tait High Speed Date (THSD)

THSD uses a 4 level gaussian frequency shift keying (CP-4GFSK) modulation scheme. It can be used when transferring data between two radios. Data is transmitted at a rate of 12000bps for narrow band channels, and 19200bps for wide-band channels.
Due to the difficulties in determining the value of k, the necessary bandwidth has been measured using the 99% energy rule.

12.5kHz Bandwidth

99% bandwidth	Emission Designator
7.7 kHz	**7k70F1D** F1D represents a FM data transmission without the use of a modulating sub carrier

25kHz Bandwidth

99% bandwidth	Emission Designator
12.6 kHz	**12k6F1D** F1D represents a FM data transmission without the use of a modulating sub carrier

Test Results

TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046

GUIDE: TIA/EIA-603B 2.2.1

MEASUREMENT PROCEDURE:
1. Refer Appendix 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:

FCC CFR 47 80.215

Manufacturer's Rated Output Power: Switchable: 1 W and 25 W

FCC CFR 47 80.215		
219.1 MHz	1 W nominal	25 W nominal
POWER (W)	1.1	28.4
Variation from Nominal (%)	10.0	13.6
FCC CFR 47 90.729		
221.5 MHz	1 W nominal	25 W nominal
POWER (W)	1.1	28.3
Variation from Nominal (%)	10.0	13.2
Measurement Uncertainty (dB)	+0.63 -0.68	

LIMIT CLAUSE: FCC 47 CFR 90.205

Radio Type: Mobile Transceiver
Frequency Band: 216 MHz ~ 266 MHz

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

TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: TIA/EIA-603B 2.2.6

MEASUREMENT PROCEDURE:
1. Refer Appendix A for Equipment set up.
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 & 25.0 kHz channel spacings.
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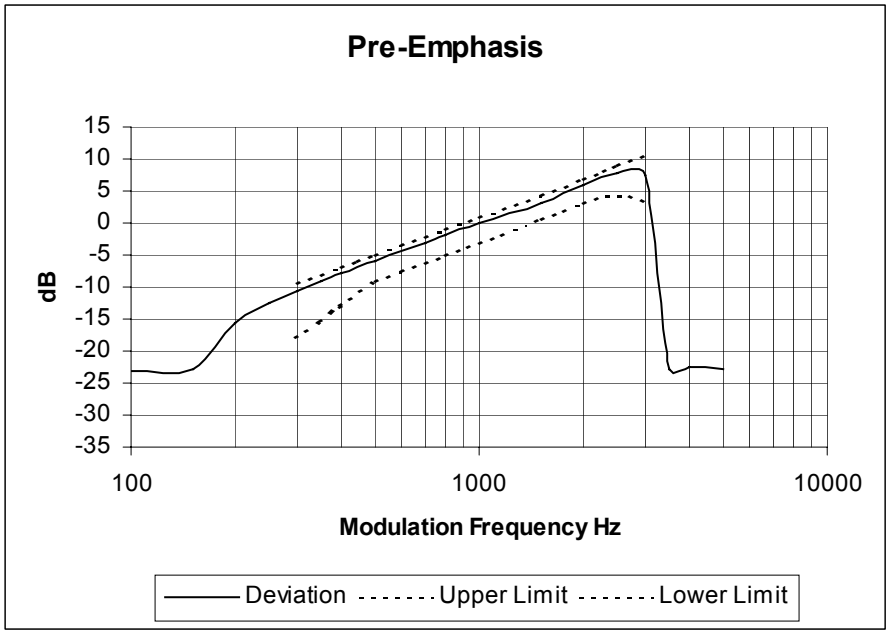
LIMIT CLAUSE: TIA/EIA-603B 3.2.6

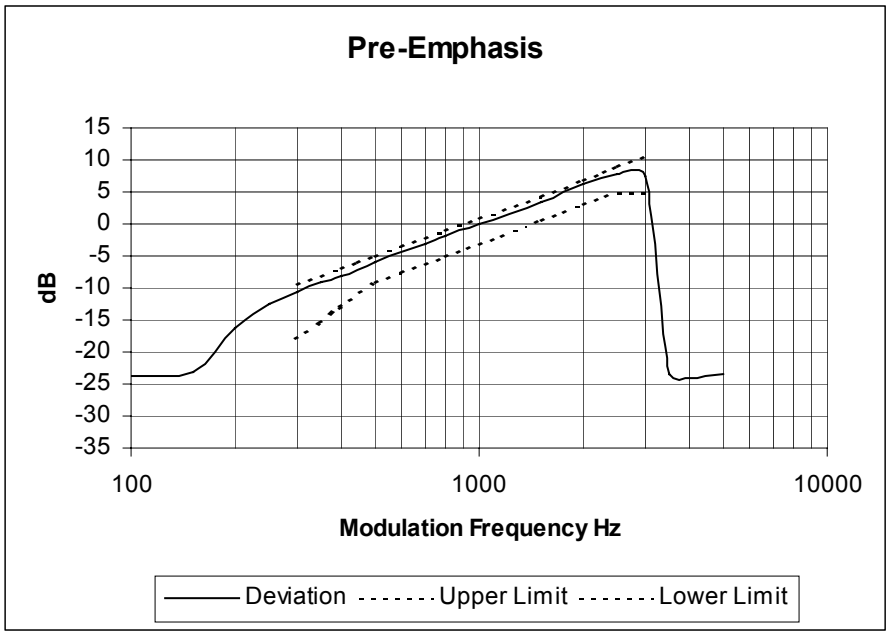
TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 219.1 MHz 12.5 kHz Channel Spacing



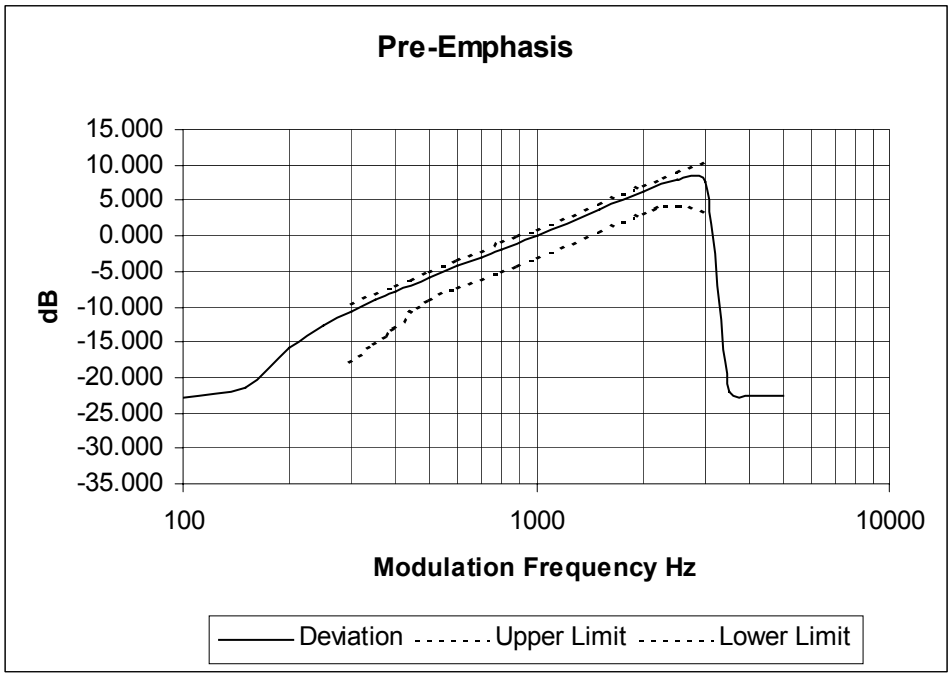
Tx FREQUENCY: 219.1 MHz 25 kHz Channel Spacing



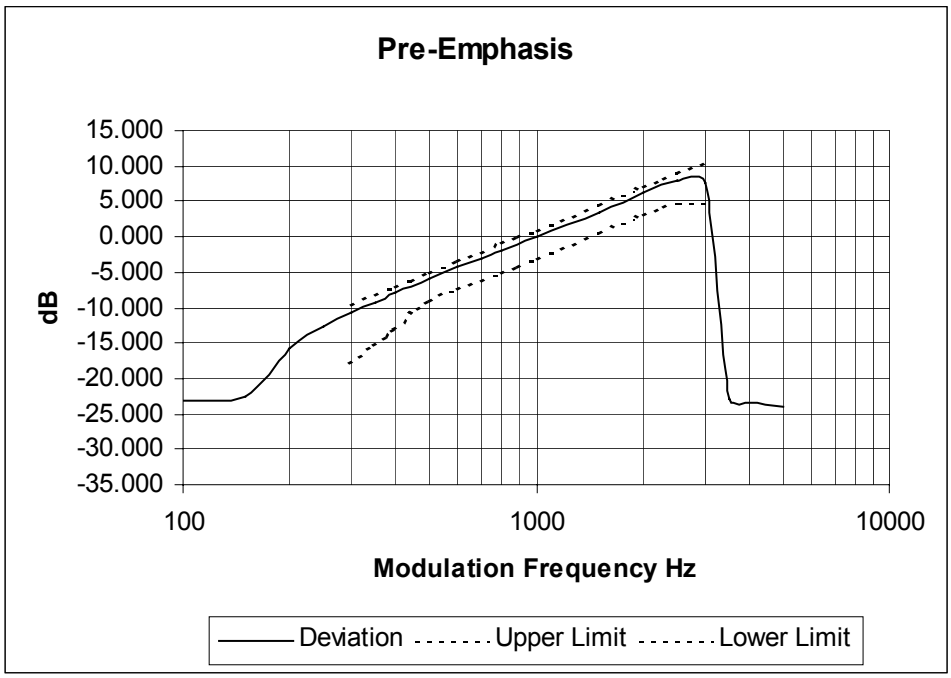
TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 221.5 MHz 12.5 kHz Channel Spacing



Tx FREQUENCY: 221.5 MHz 25 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)
FCC 47 CFR 80.213 (b)

MEASUREMENT PROCEDURE:
1. Refer Appendix 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.

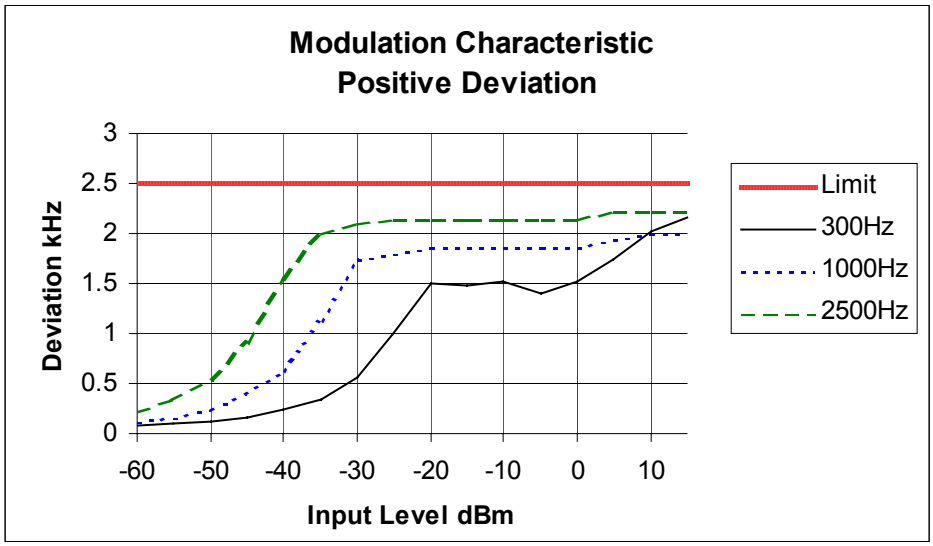
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings.

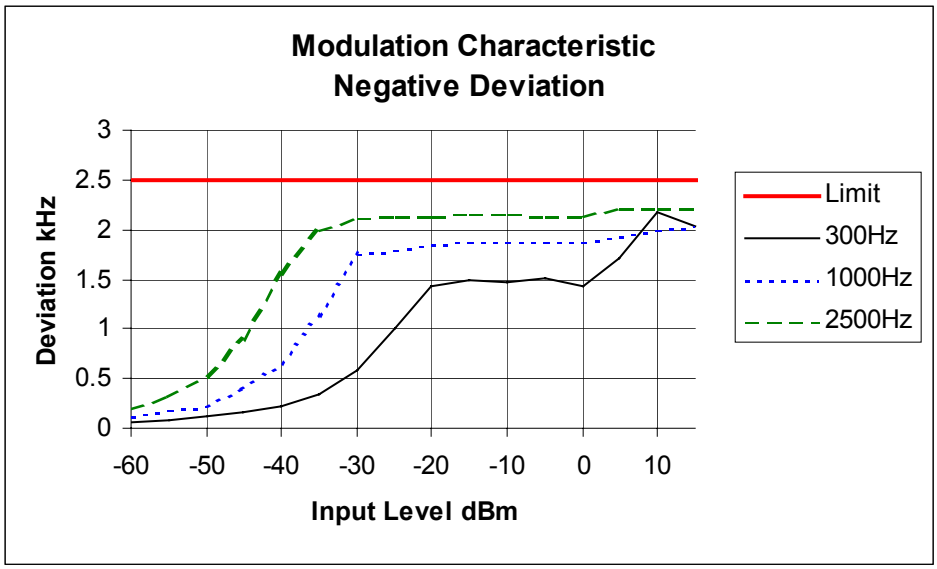
LIMIT CLAUSE: TIA/EIA-603B 1.3.4.4

TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 219.1MHz 12.5 kHz Channel Spacing

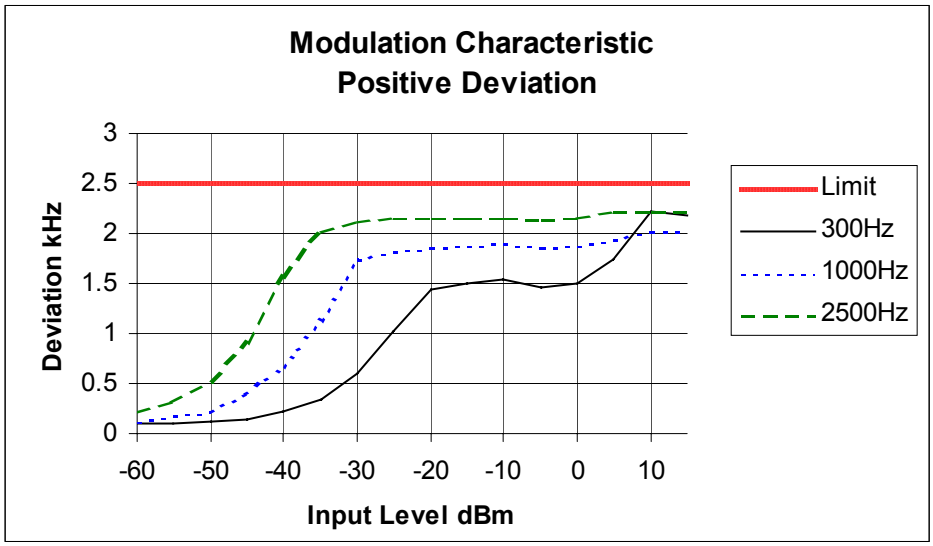


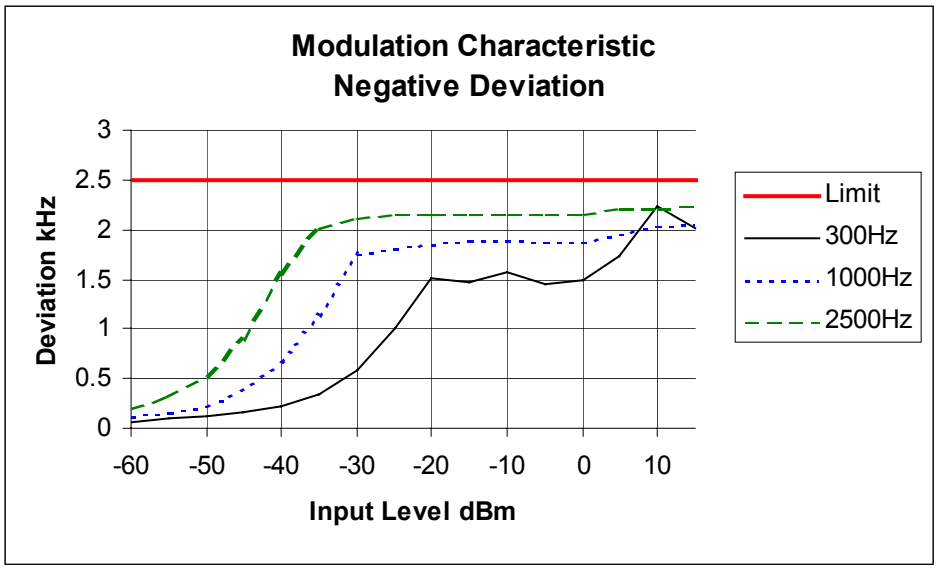


TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 221.5 MHz 12.5 kHz Channel Spacing

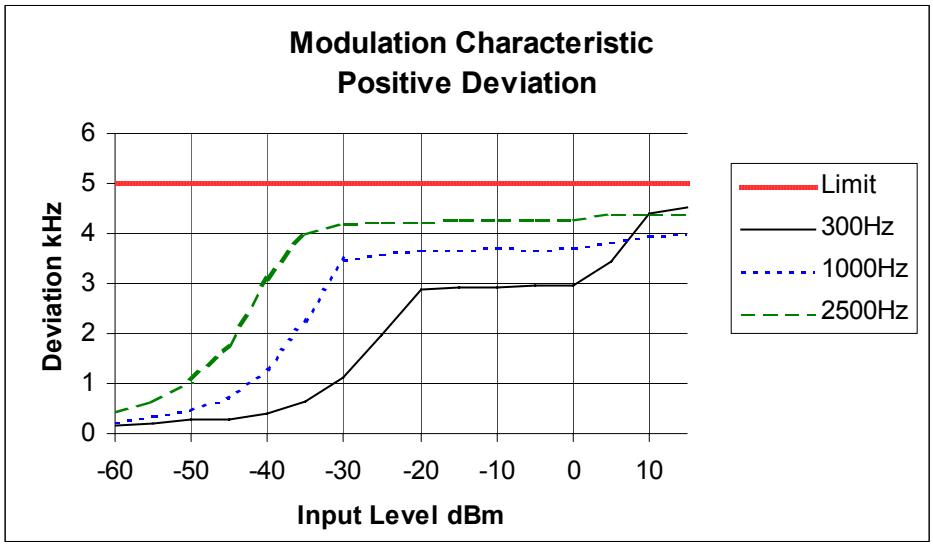


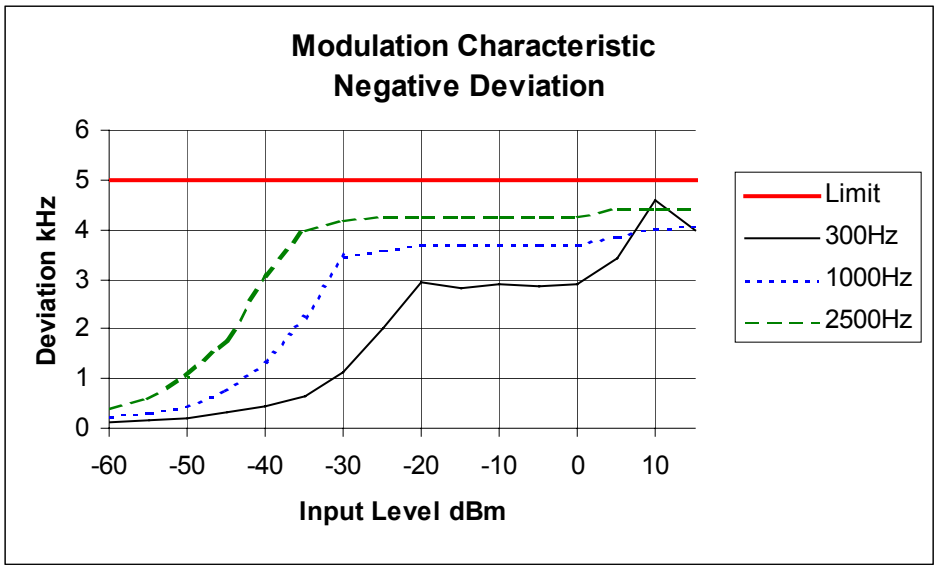


TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 219.1MHz 25 kHz Channel Spacing

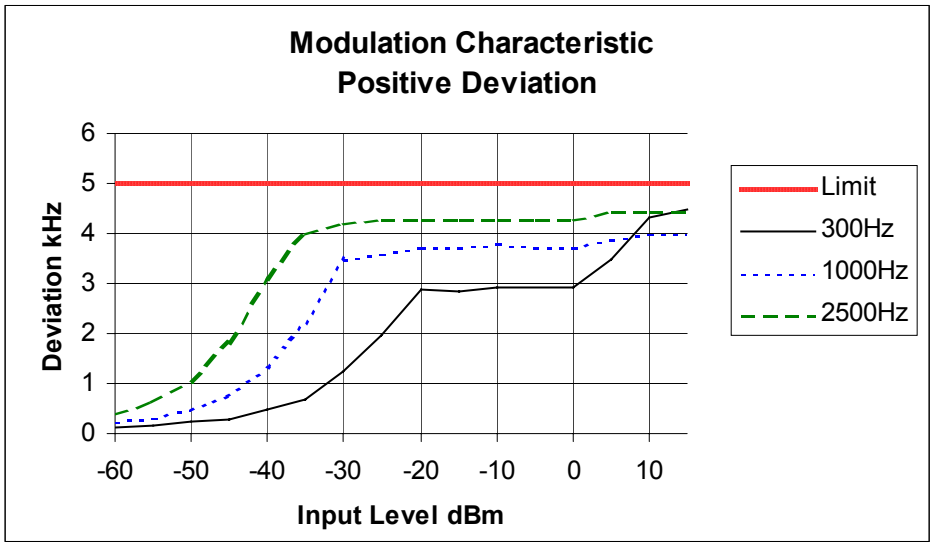


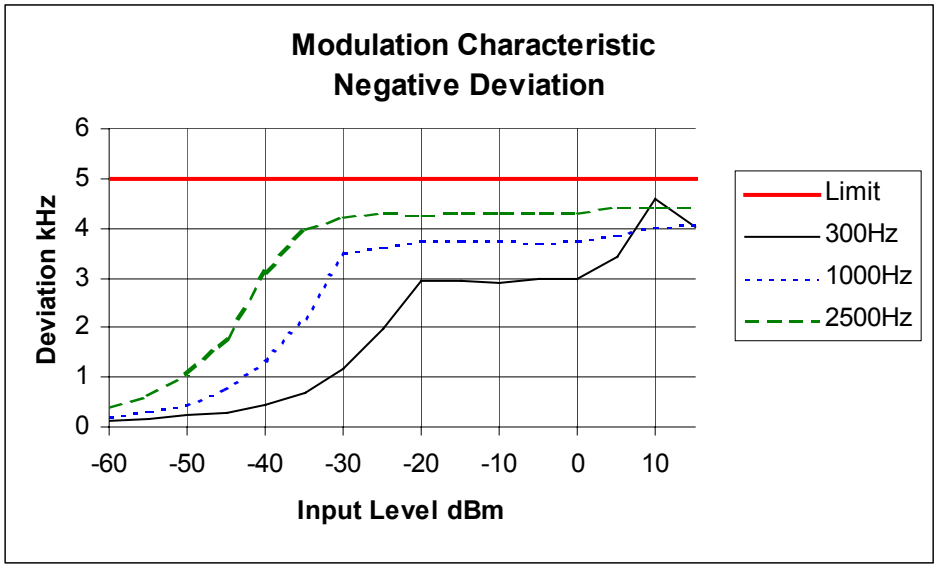


TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 221.5 MHz 25 kHz Channel Spacing





OCCUPIED BANDWIDTH

SPECIFICATION: FCC 47 CFR 2.1049 (c)
FCC 47 CFR 90.733 (d), (e)

GUIDE: TIA/EIA-603B 2.2.11

MEASUREMENT PROCEDURE:
1. Refer Appendix A for Equipment Set up.
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 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 = 100Hz, Video Bandwidth = 1 kHz
   Emission Mask B, and C – Resolution bandwidth = 300Hz, Video Bandwidth = 3 kHz

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

LIMIT CLAUSE: FCC 47 CFR 90.210

EMISSION MASKS

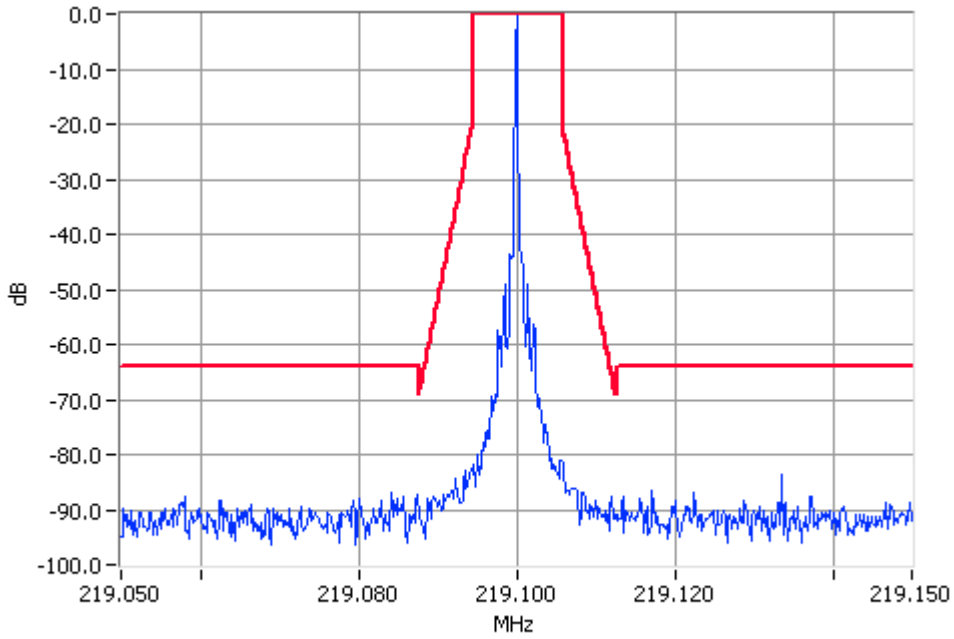
216 – 220 MHz		
Emission Mask D	12.5 kHz Channel Spacing	Analog; FFSK; THSD
FCC 47 CFR 80.211(f)		
Emission Mask B	25.0 kHz Channel Spacing	Analog; FFSK; THSD
220 – 222 MHz		
FCC 47 CFR 90.210(f)		
Emission Mask F (modified)	12.5 kHz Channel Spacing	Analog; FFSK; THSD

DATA SPEED
FFSK 1200 bps 12.5 kHz Channel Spacing
FFSK 1200 bps 25.0 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)

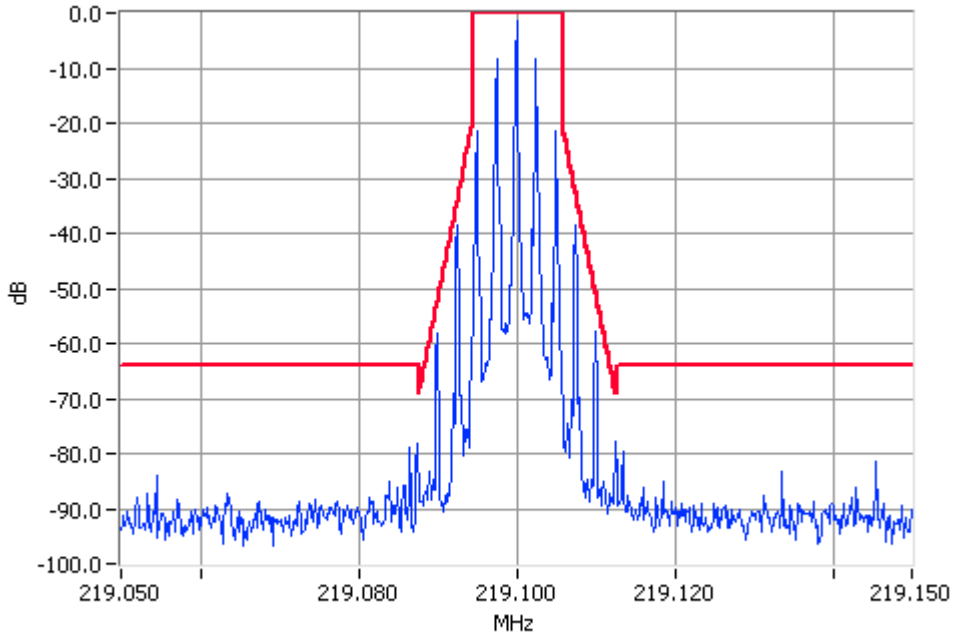
NAME OF TEST: OCCUPIED BANDWIDTH VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 219.1 MHz 25W 12.5 kHz Channel Spacing



Unmodulated 219.1000MHz Mask D 25W Pass
RBW=100Hz VBW=1000Hz

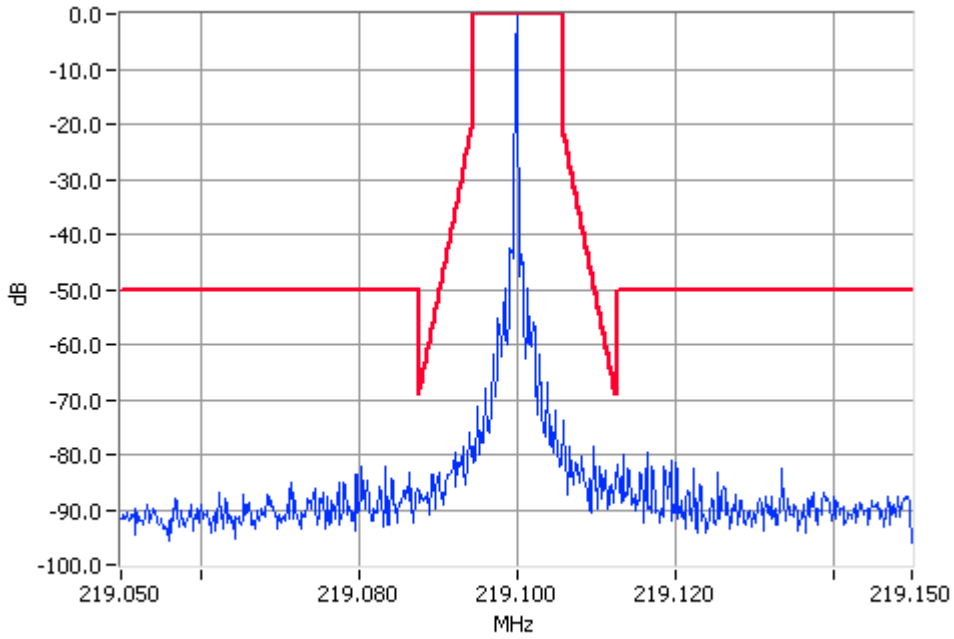


Analogue Modulation 219.1000MHz Mask D 25W
Pass

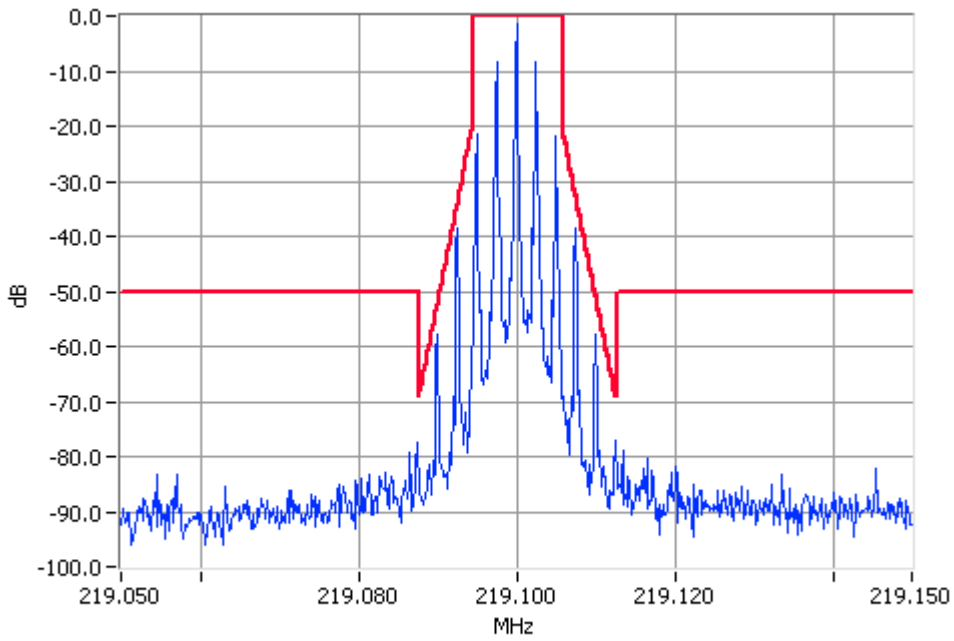
NAME OF TEST: OCCUPIED BANDWIDTH VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 219.1 MHz 1W 12.5 kHz Channel Spacing



Unmodulated 219.1000MHz Mask D 1W Pass
RBW=100Hz VBW=1000Hz

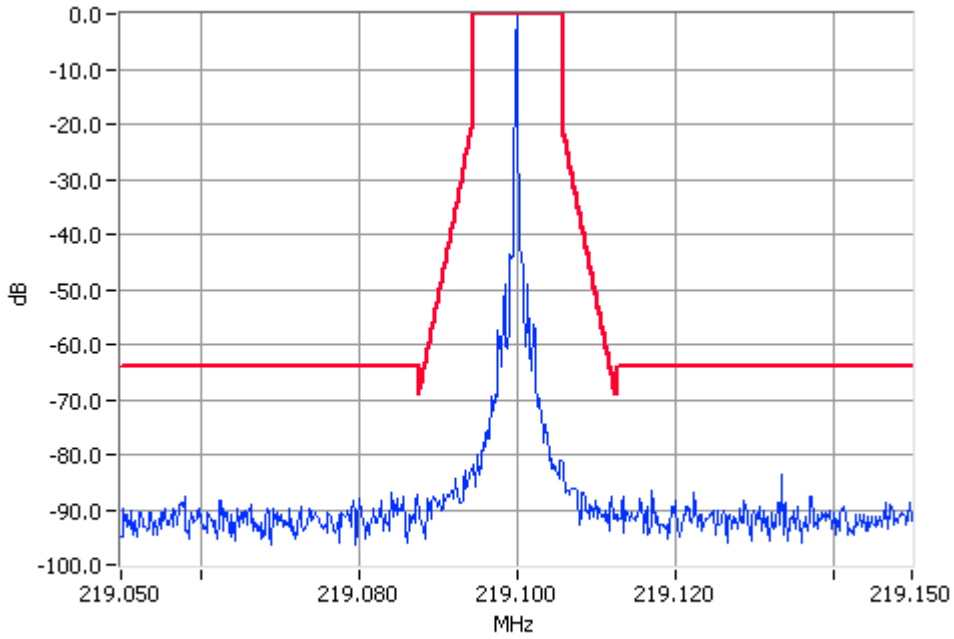


Analogue Modulation 219.1000MHz Mask D 1W Pass
RBW=100Hz VBW=1000Hz

NAME OF TEST: OCCUPIED BANDWIDTH FFSK

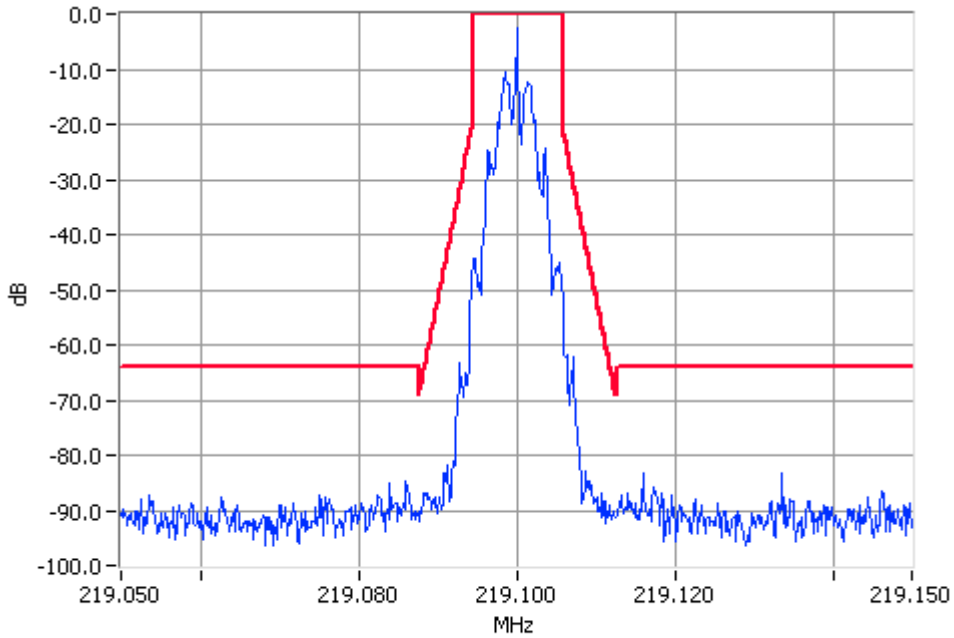
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 219.1 MHz 25W 12.5 kHz Channel Spacing



Unmodulated 219.1000MHz Mask D 25W Pass
RBW=100Hz VBW=1000Hz

Tx FREQUENCY: 219.1 MHz 25W 12.5 kHz Channel Spacing

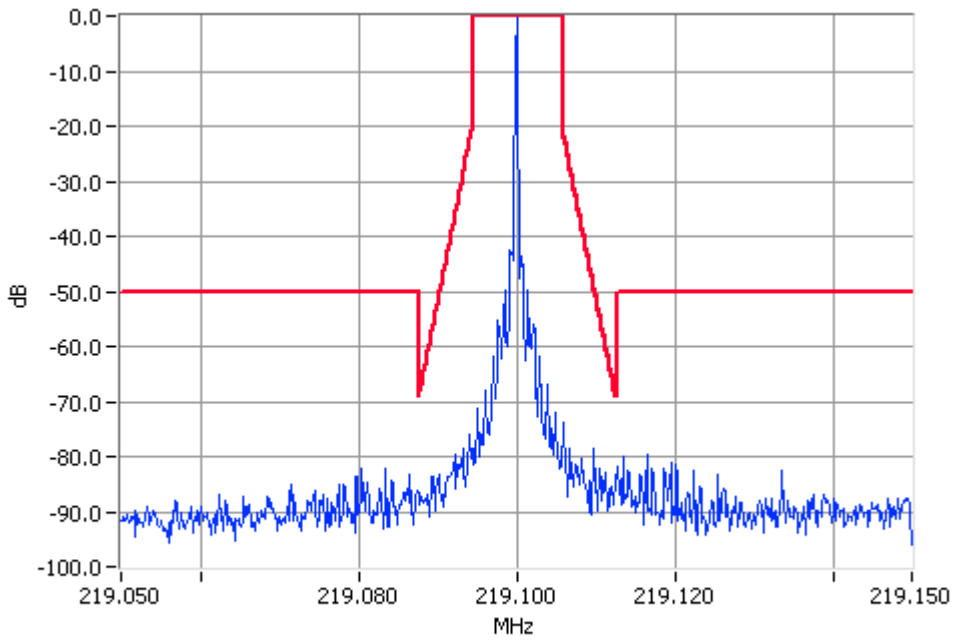


Digital Modulation 219.1000MHz Mask D 25W Pass
RBW=100Hz VBW=1000Hz

NAME OF TEST: OCCUPIED BANDWIDTH FFSK

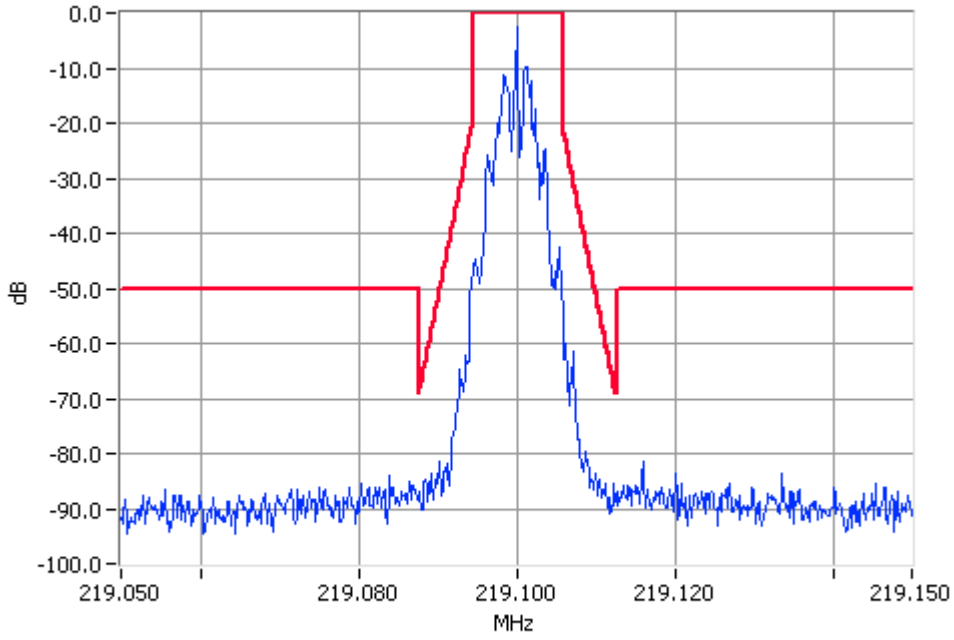
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 219.1 MHz 1W 12.5 kHz Channel Spacing



Unmodulated 219.1000MHz Mask D 1W Pass
RBW=100Hz VBW=1000Hz

Tx FREQUENCY: 219.1 MHz 1W 12.5 kHz Channel Spacing

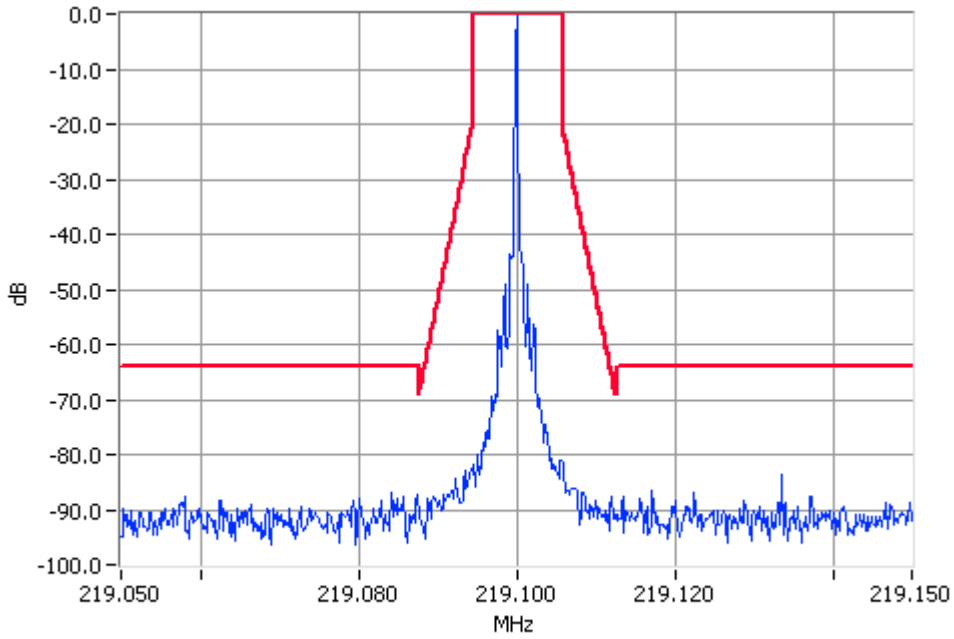


Digital Modulation 219.1000MHz Mask D 1W Pass
RBW=100Hz VBW=1000Hz

NAME OF TEST: OCCUPIED BANDWIDTH THSD

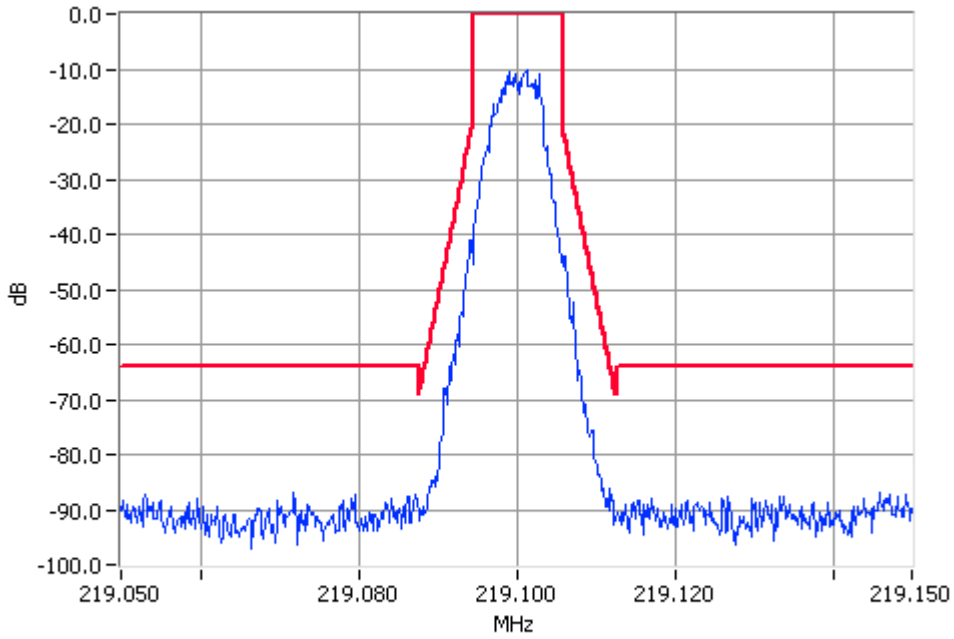
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 219.1 MHz 25W 12.5 kHz Channel Spacing



Unmodulated 219.1000MHz Mask D 25W Pass
RBW=100Hz VBW=1000Hz

Tx FREQUENCY: 219.1 MHz 25W 12.5 kHz Channel Spacing

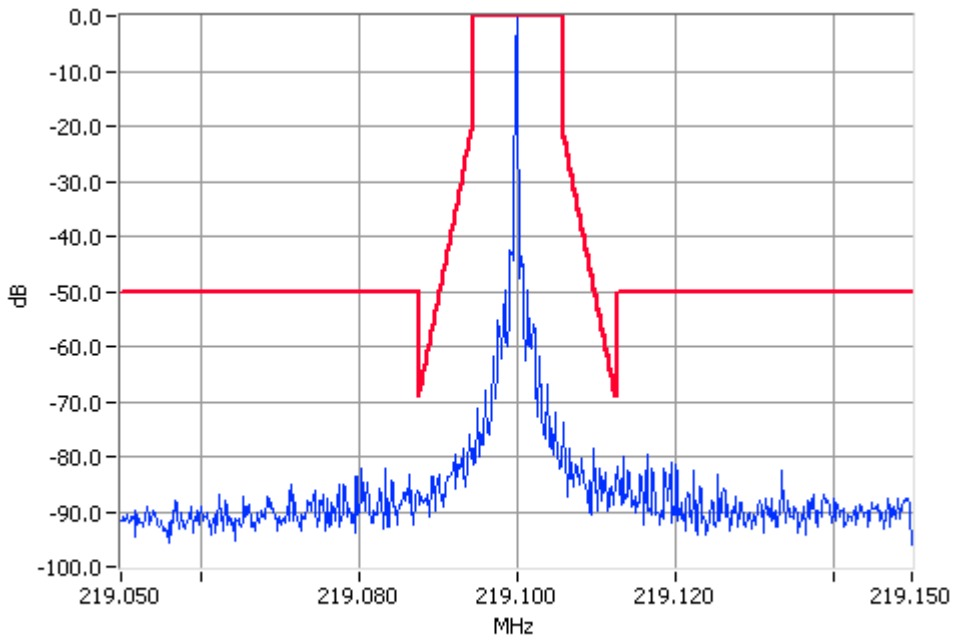


Digital Modulation 219.1000MHz Mask D 25W Pass
RBW=100Hz VBW=1000Hz

NAME OF TEST: OCCUPIED BANDWIDTH THSD

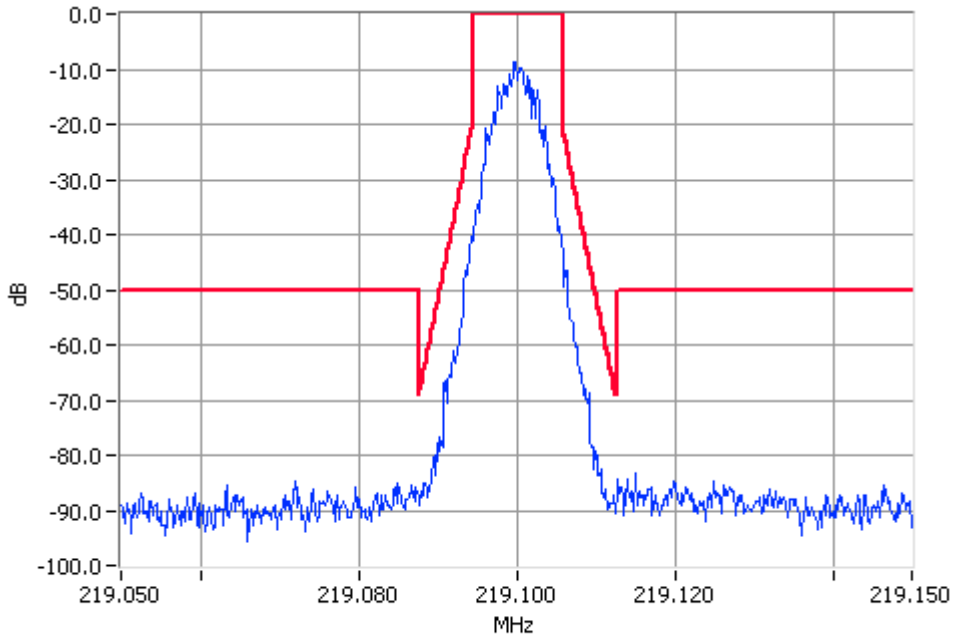
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 219.1 MHz 1W 12.5 kHz Channel Spacing



Unmodulated 219.1000MHz Mask D 1W Pass
RBW=100Hz VBW=1000Hz

Tx FREQUENCY: 219.1 MHz 1W 12.5 kHz Channel Spacing

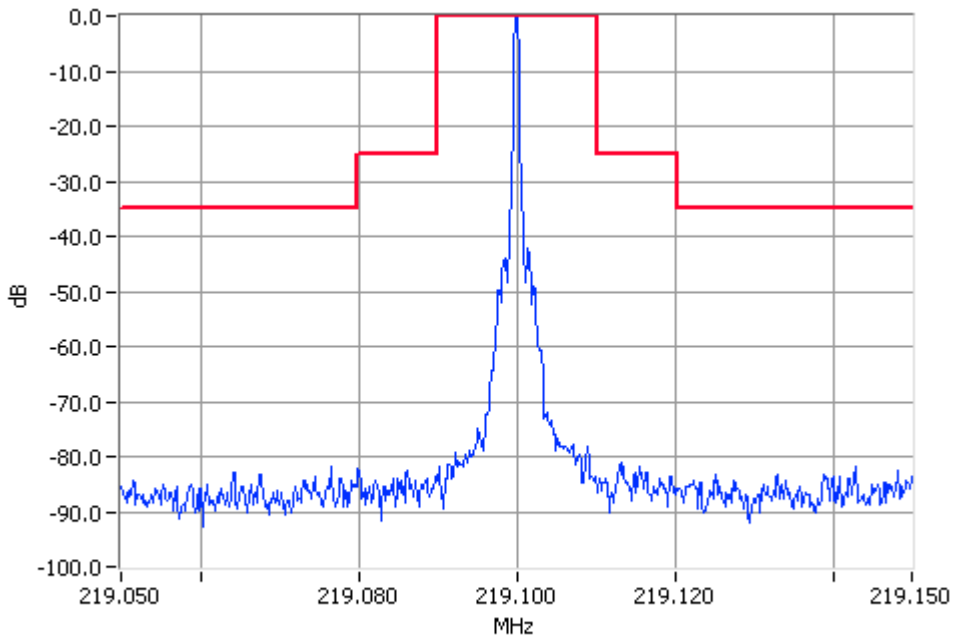


Digital Modulation 219.1000MHz Mask D 1W Pass
RBW=100Hz VBW=1000Hz

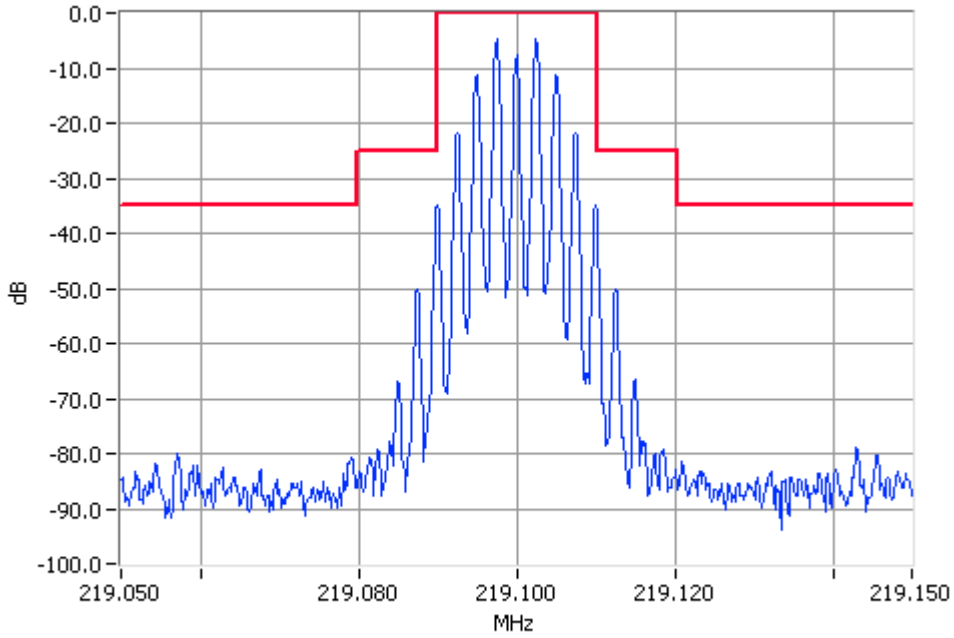
NAME OF TEST: OCCUPIED BANDWIDTH VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 219.1 MHz 25W 25 kHz Channel Spacing



Unmodulated 219.1000MHz Mask B 25W Pass
RBW=300Hz VBW=3000Hz

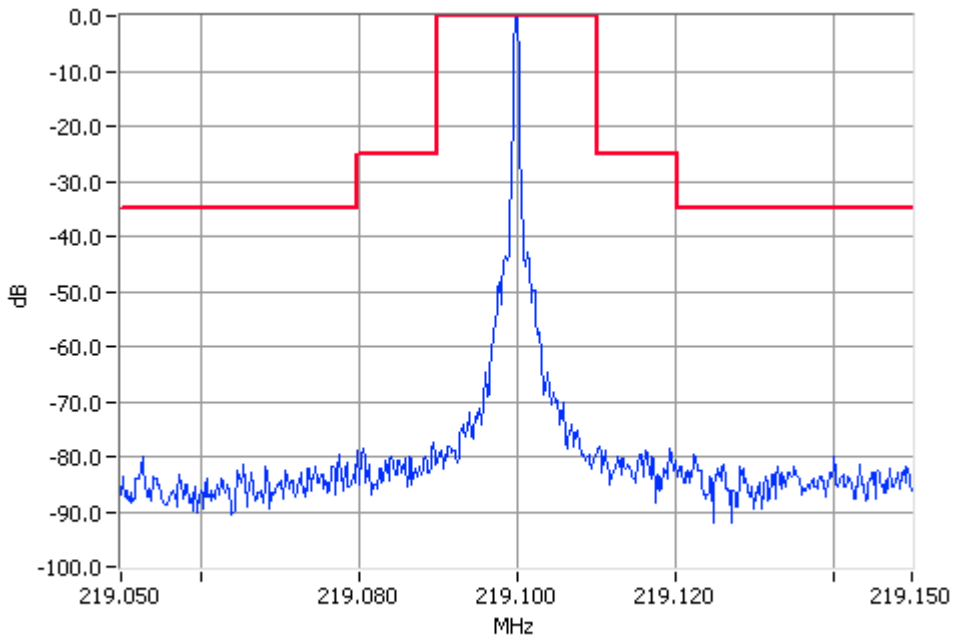


Analogue Modulation 219.1000MHz Mask B 25W
Pass

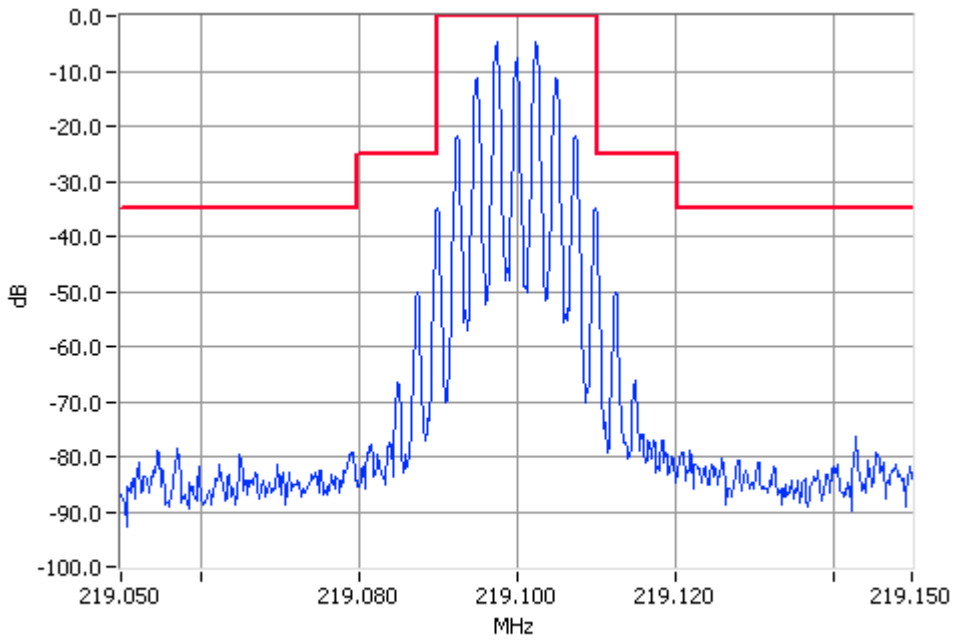
NAME OF TEST: OCCUPIED BANDWIDTH VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 219.1 MHz 1W 25 kHz Channel Spacing



Unmodulated 219.1000MHz Mask B 1W Pass
RBW=300Hz VBW=3000Hz

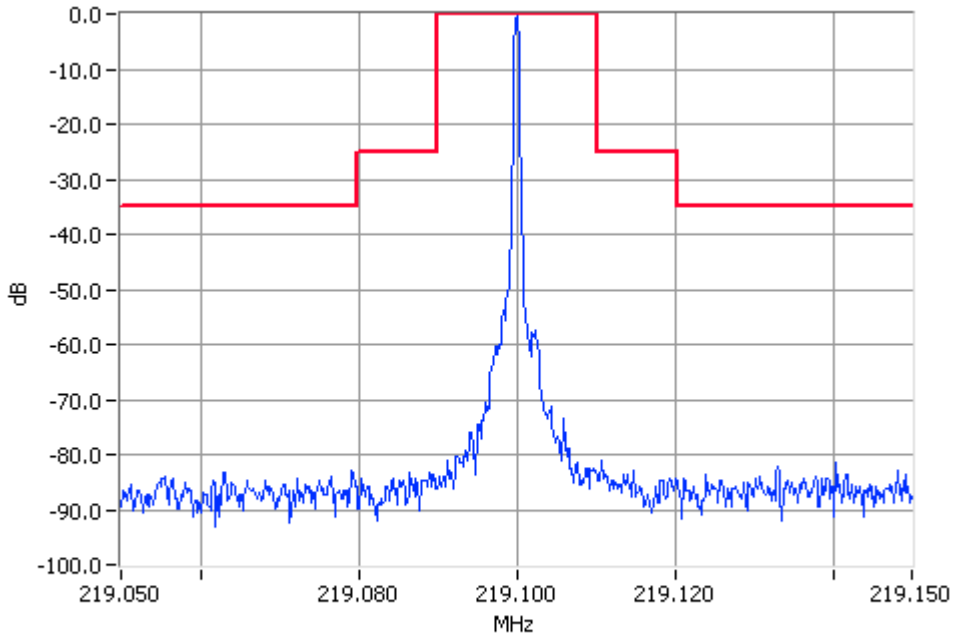


Analogue Modulation 219.1000MHz Mask B 1W Pass
RBW=300Hz VBW=3000Hz

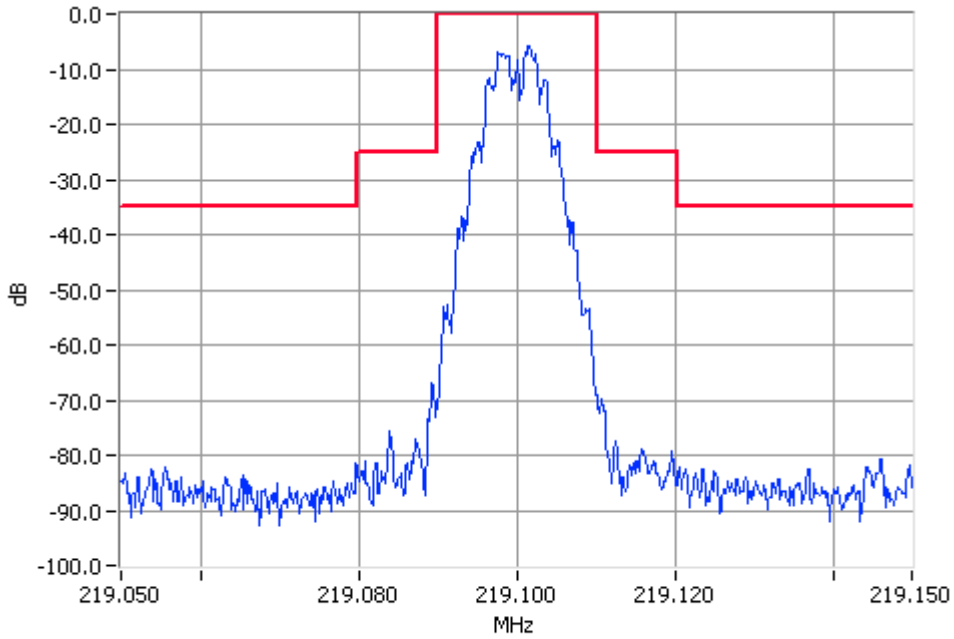
NAME OF TEST: OCCUPIED BANDWIDTH FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 219.1 MHz 25W 25 kHz Channel Spacing

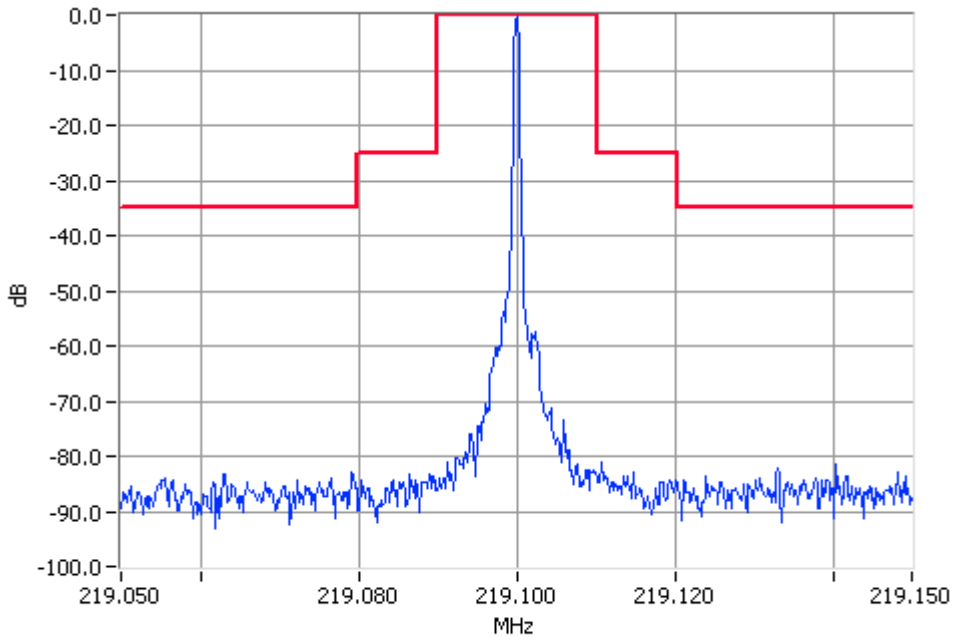


Unmodulated 219.1000MHz Mask B 25W Pass
RBW=300Hz VBW=3000Hz

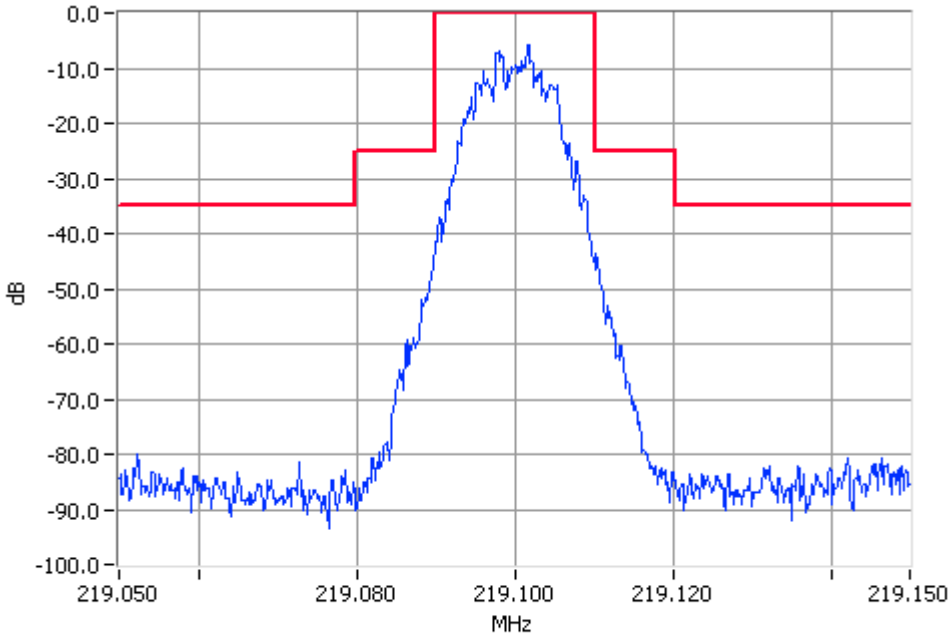


Digital Modulation 219.1000MHz Mask B 25W Pass
RBW=300Hz VBW=3000Hz

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

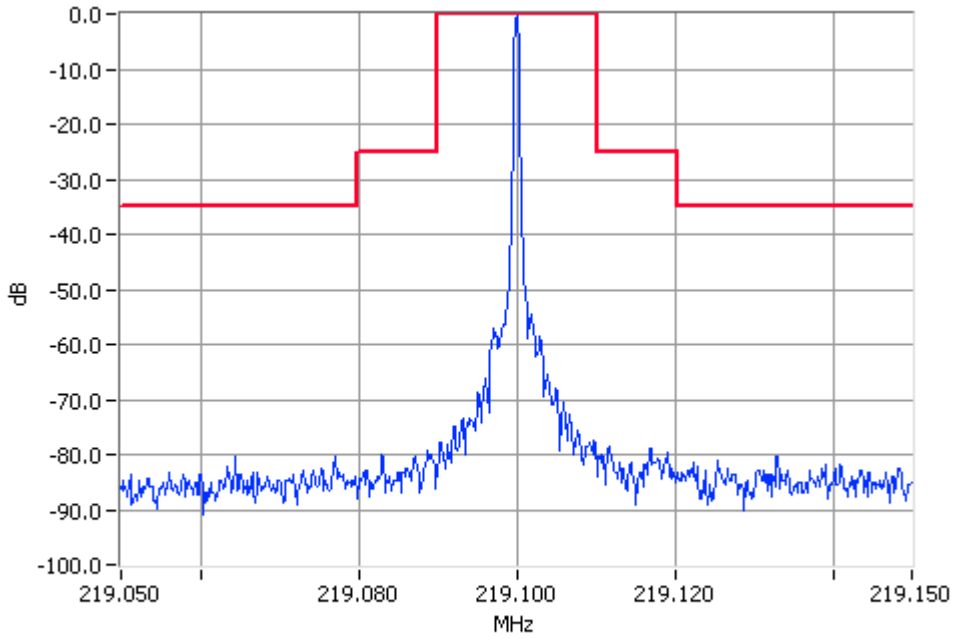


Unmodulated 219.1000MHz Mask B 25W Pass
RBW=300Hz VBW=3000Hz

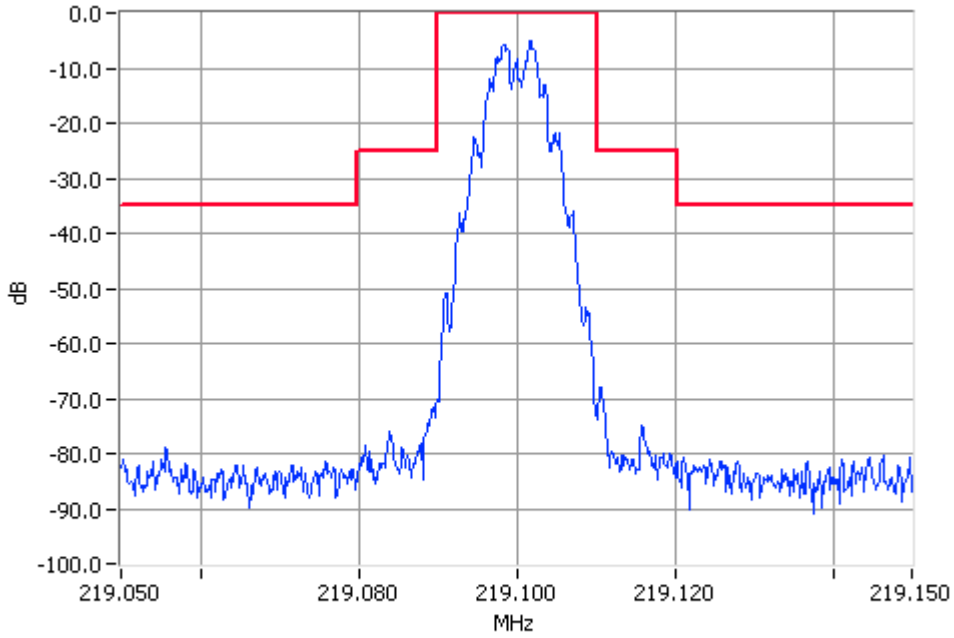


Digital Modulation 219.1000MHz Mask B 25W Pass
RBW=300Hz VBW=3000Hz

NAME OF TEST:	OCCUPIED BANDWIDTH		FFSK
SPECIFICATION:	FCC CFR 2.1049 (c)		
Tx FREQUENCY:	219.1 MHz	1W	25 kHz Channel Spacing

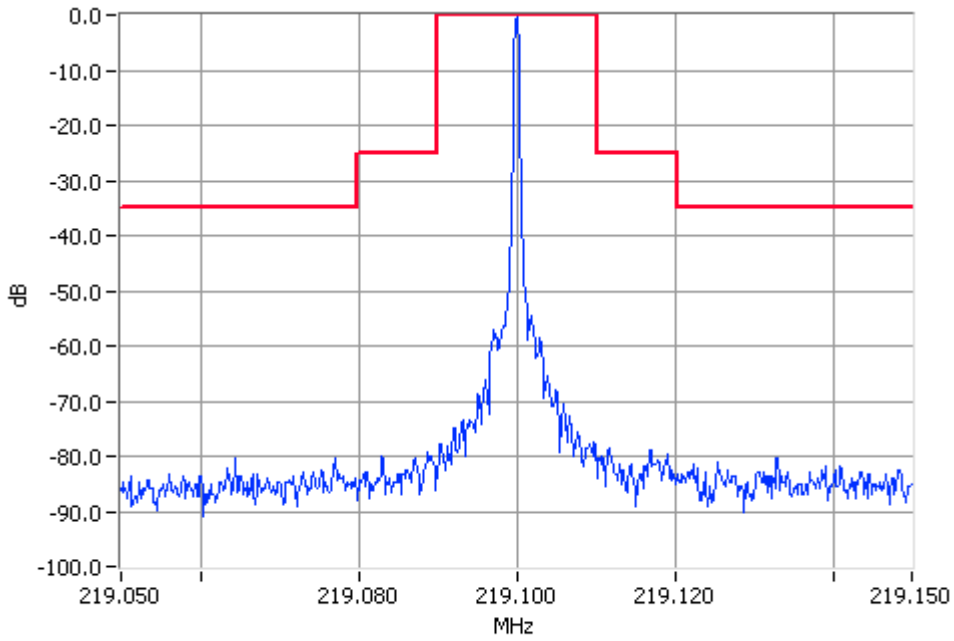


Unmodulated 219.1000MHz Mask B 1W Pass
RBW=300Hz VBW=3000Hz

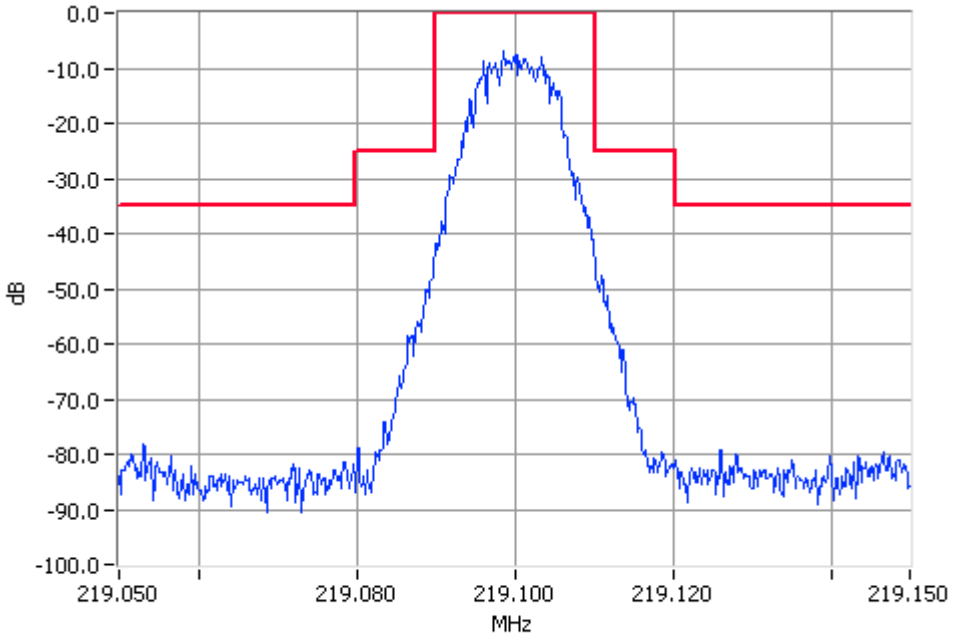


Digital Modulation 219.1000MHz Mask B 1W Pass
RBW=300Hz VBW=3000Hz

NAME OF TEST:	OCCUPIED BANDWIDTH		THSD
SPECIFICATION:	FCC CFR 2.1049 (c)		
Tx FREQUENCY:	219.1 MHz	1W	25 kHz Channel Spacing



Unmodulated 219.1000MHz Mask B 1W Pass
RBW=300Hz VBW=3000Hz

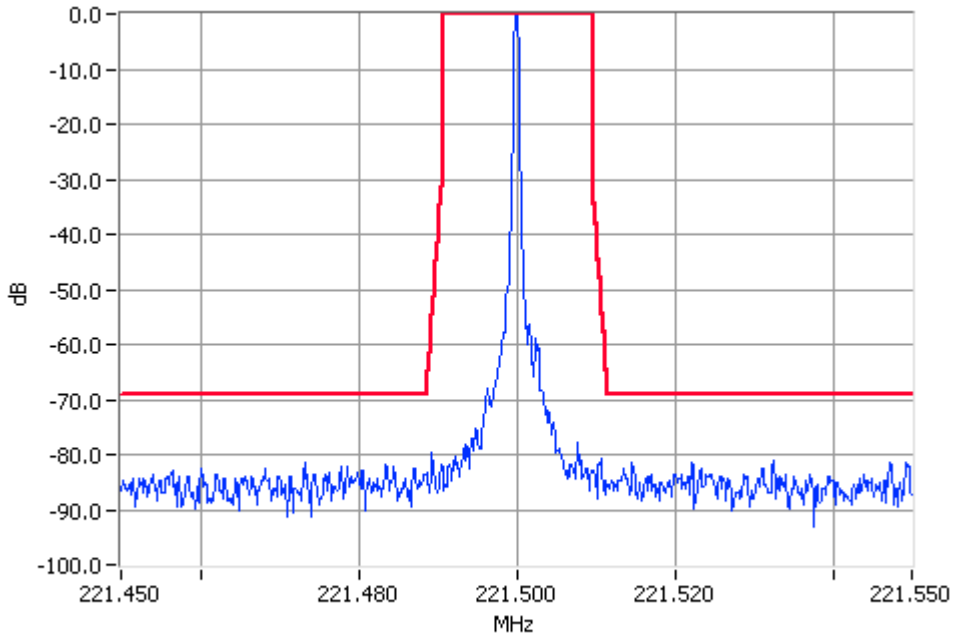


Digital Modulation 219.1000MHz Mask B 1W Pass
RBW=300Hz VBW=3000Hz

NAME OF TEST: OCCUPIED BANDWIDTH VOICE

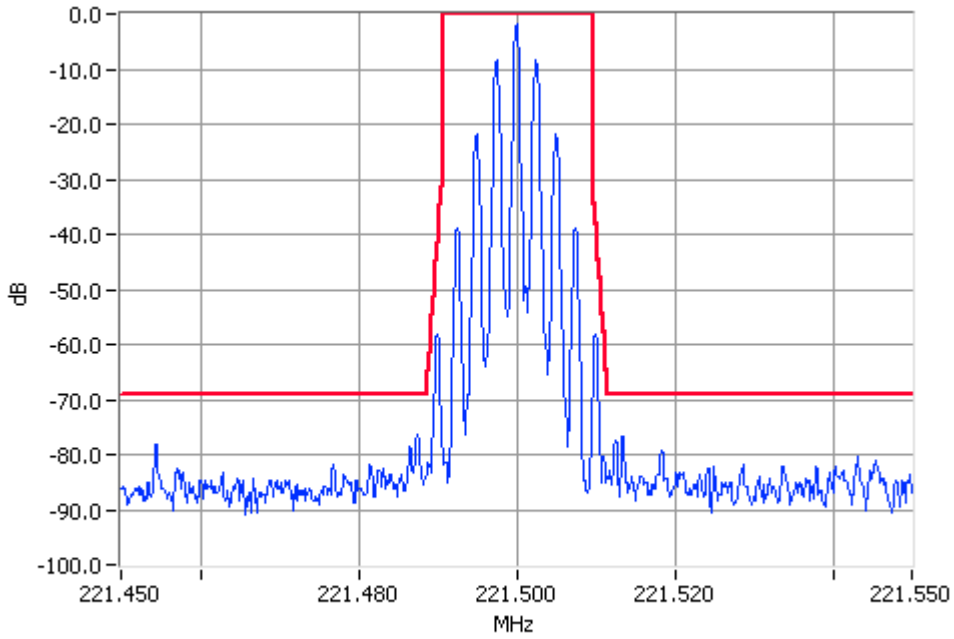
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 221.5 MHz 25W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx4 25W Pass
RBW=300Hz VBW=3000Hz

Tx FREQUENCY: 221.5 MHz 25W 12.5 kHz Channel Spacing

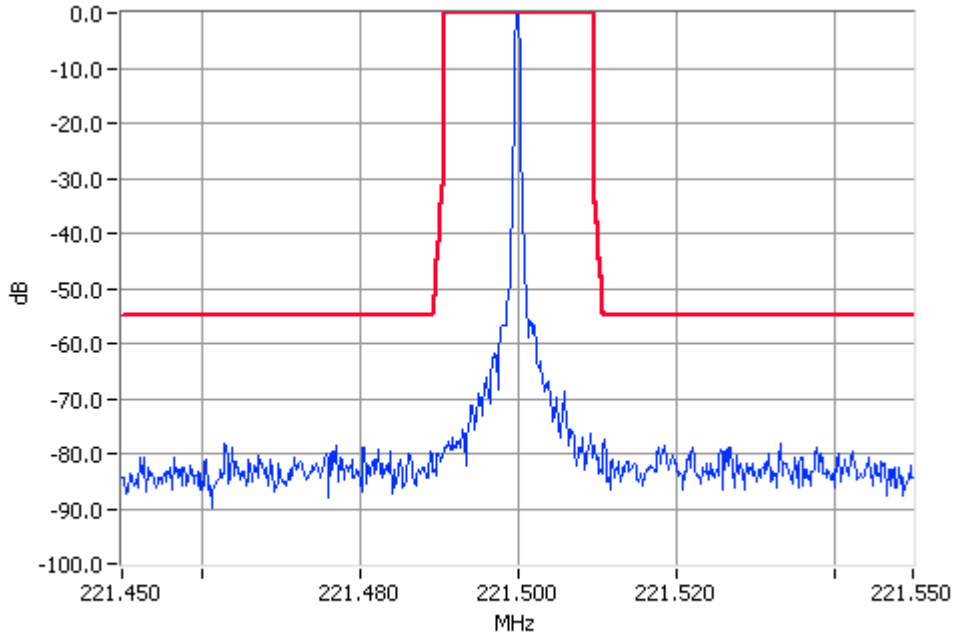


Analogue Modulation 221.5000MHz Mask Fx4 25W
Pass

NAME OF TEST: OCCUPIED BANDWIDTH VOICE

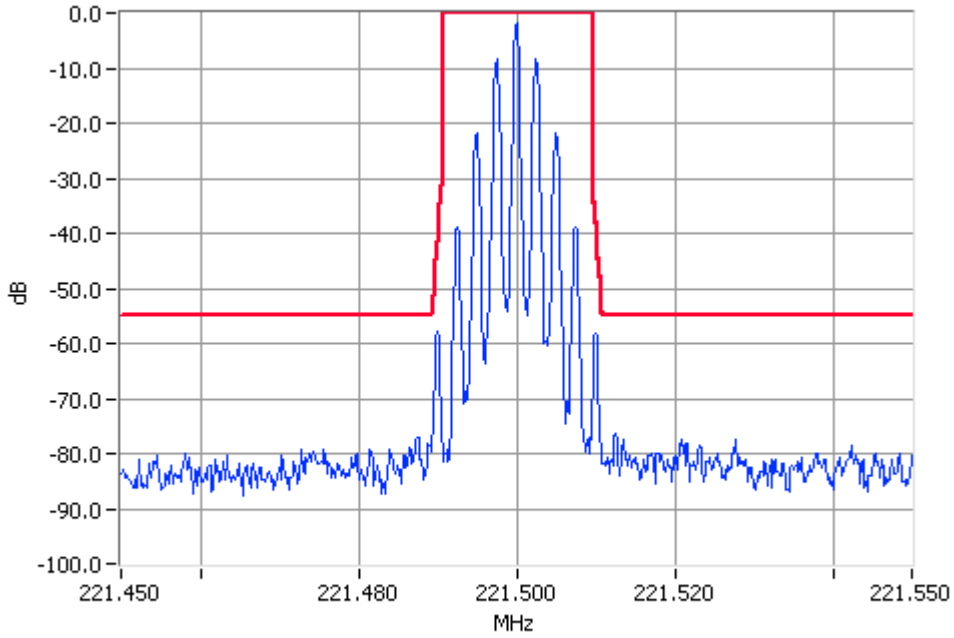
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 221.5 MHz 1W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx4 1W Pass
RBW=300Hz VBW=3000Hz

Tx FREQUENCY: 221.5 MHz 1W 12.5 kHz Channel Spacing

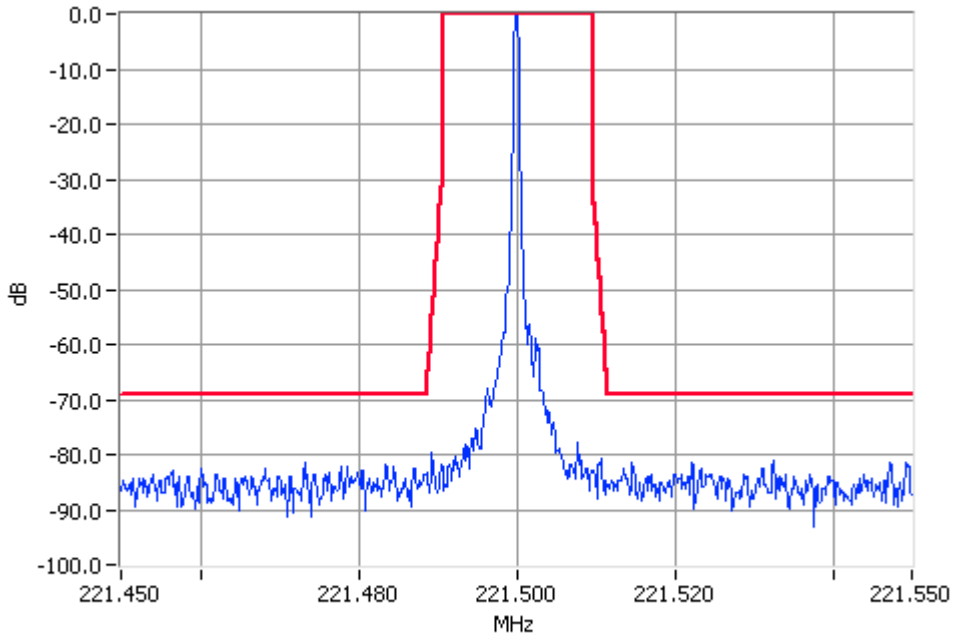


Analogue Modulation 221.5000MHz Mask Fx4 1W
Pass

NAME OF TEST: OCCUPIED BANDWIDTH FFSK

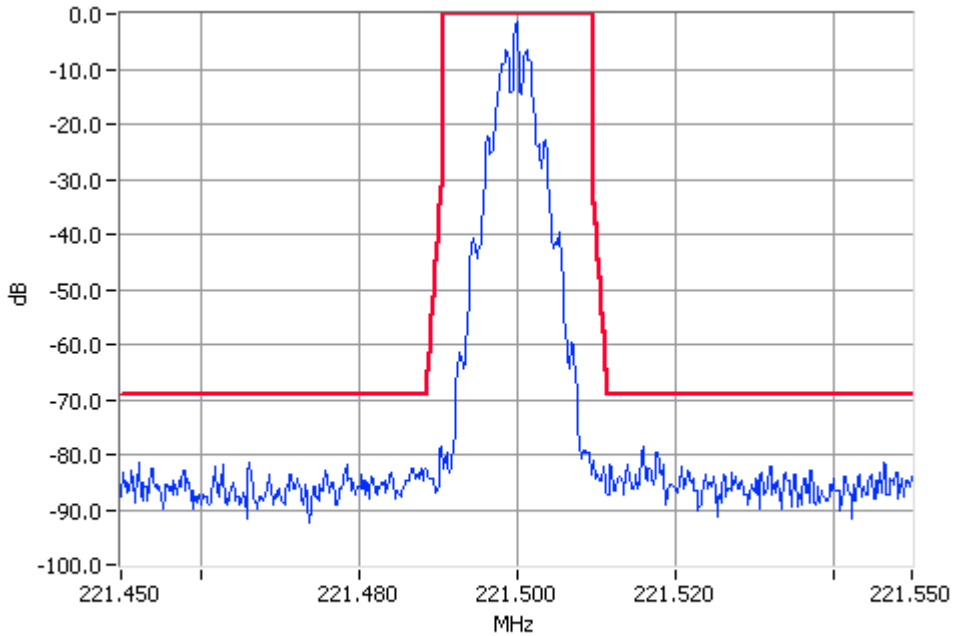
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 221.5 MHz 25W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx4 25W Pass
RBW=300Hz VBW=3000Hz

Tx FREQUENCY: 221.5 MHz 25W 12.5 kHz Channel Spacing

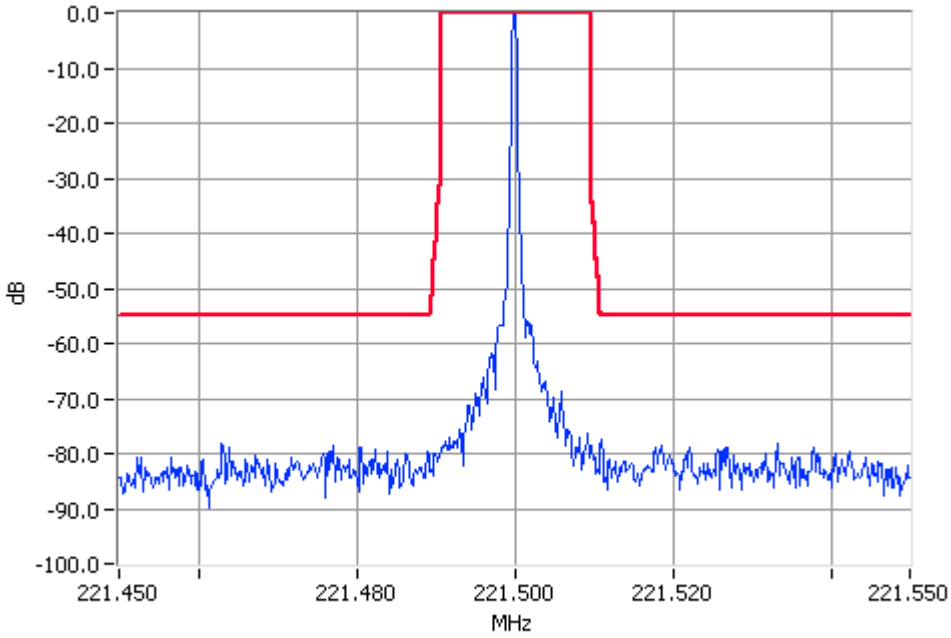


Digital Modulation 221.5000MHz Mask Fx4 25W Pass
RBW=300Hz VBW=3000Hz

NAME OF TEST: OCCUPIED BANDWIDTH FFSK

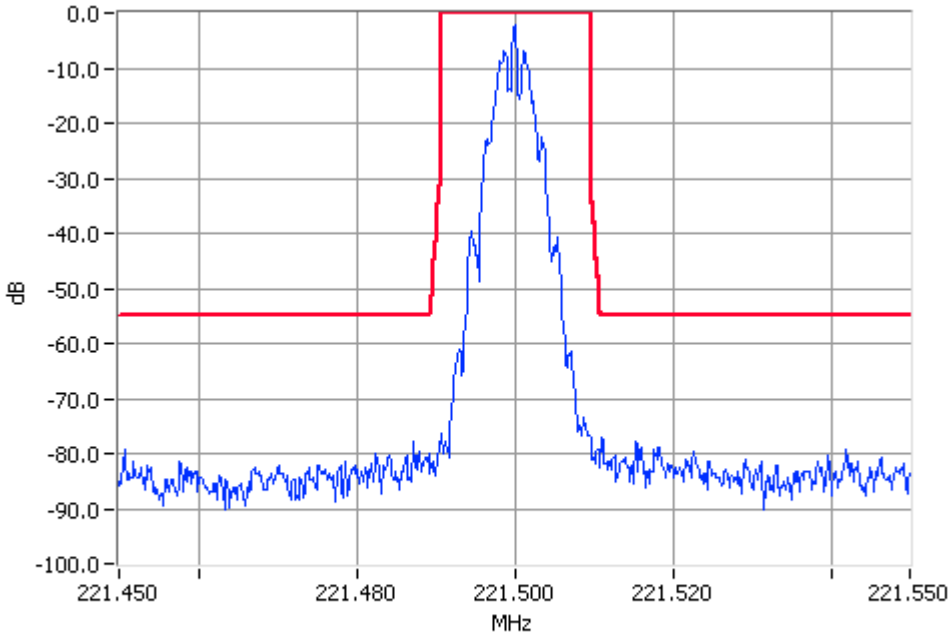
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 221.5 MHz 1W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx4 1W Pass
RBW=300Hz VBW=3000Hz

Tx FREQUENCY: 221.5 MHz 1W 12.5 kHz Channel Spacing

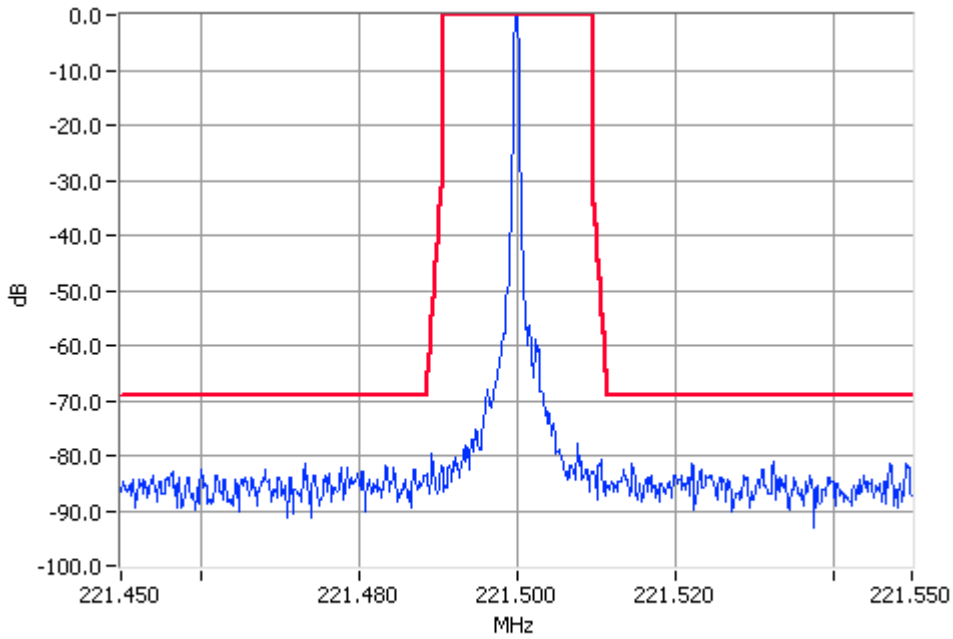


Digital Modulation 221.5000MHz Mask Fx4 1W Pass
RBW=300Hz VBW=3000Hz

NAME OF TEST: OCCUPIED BANDWIDTH THSD

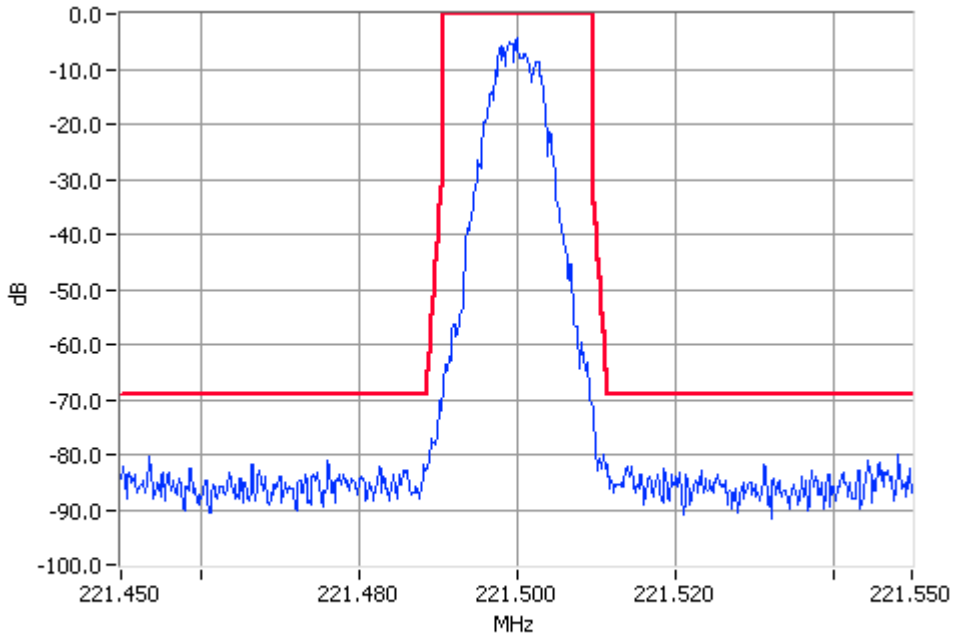
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 221.5 MHz 25W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx4 25W Pass
RBW=300Hz VBW=3000Hz

Tx FREQUENCY: 221.5 MHz 25W 12.5 kHz Channel Spacing

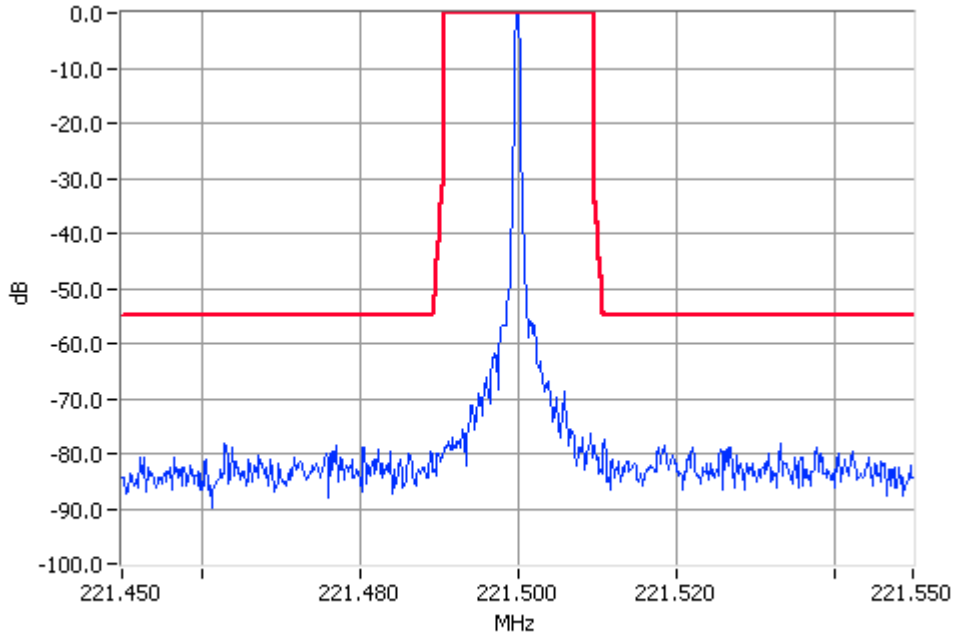


Digital Modulation 221.5000MHz Mask Fx4 25W Pass
RBW=300Hz VBW=3000Hz

NAME OF TEST: OCCUPIED BANDWIDTH THSD

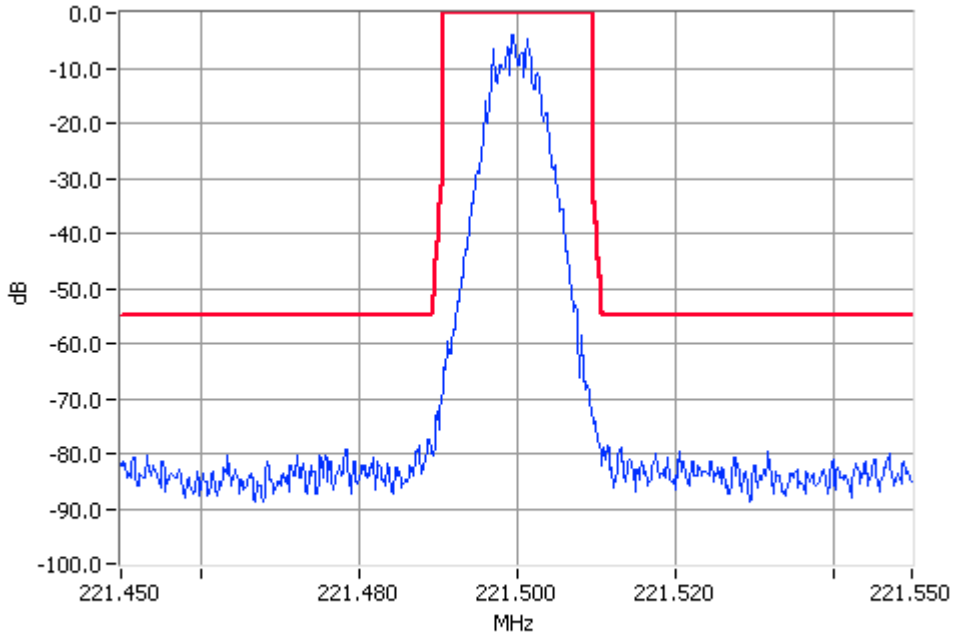
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 221.5 MHz 1W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx4 1W Pass
RBW=300Hz VBW=3000Hz

Tx FREQUENCY: 221.5 MHz 1W 12.5 kHz Channel Spacing



Digital Modulation 221.5000MHz Mask Fx4 1W Pass
RBW=300Hz VBW=3000Hz

SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1051

GUIDE: TIA/EIA-603B 2.2.13

MEASUREMENT PROCEDURE:

1. Refer Appendix 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 4.7 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 30kHz.
4. 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 & 25.0 kHz channel spacings.

LIMIT CLAUSE: FCC 47 CFR 90.210

SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 219.1MHz

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 $50 + 10 \text{ Log}_{10} (P_{Watts})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 219.1MHz

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 $50 + 10 \text{ Log}_{10} (P_{Watts})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

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 F
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 F 12.5 kHz Channel Spacing 55 + 10 Log_{10} (P_{Watts})	
1 W	-25 dBm	55 dBc
25 W	-25 dBm	69 dBc

SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 221.5MHz

12.5 kHz Channel Spacing	221.5 MHz @ 1 W	Emission Mask F
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 F 12.5 kHz Channel Spacing 55 + 10 Log_{10} (P_{Watts})	
1 W	-25 dBm	55 dBc
25 W	-25 dBm	69 dBc

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA/EIA-603B 2.2.12

MEASUREMENT PROCEDURE:
1. Refer Appendix A for equipment set up.
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^{o} 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

LIMIT CLAUSE: FCC 47 CFR 90.210

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 219.1MHz

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 $50 + 10 \text{ Log}_{10} (P_{Watts})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 219.1MHz

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 $50 + 10 \text{ Log}_{10} (P_{Watts})$	
1 W	-20 dBm	50 dBc
25 W	-20 dBm	64 dBc

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 F
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 F 12.5 kHz Channel Spacing 55 + 10 Log_{10} (P_{Watts})	
1 W	-25 dBm	55 dBc
25 W	-25 dBm	69 dBc

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 F
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 F 12.5 kHz Channel Spacing 55 + 10 Log_{10} (P_{Watts})	
1 W	-25 dBm	55 dBc
25 W	-25 dBm	69 dBc

TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

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

GUIDE: TIA/EIA-603B 2.2.2

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

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

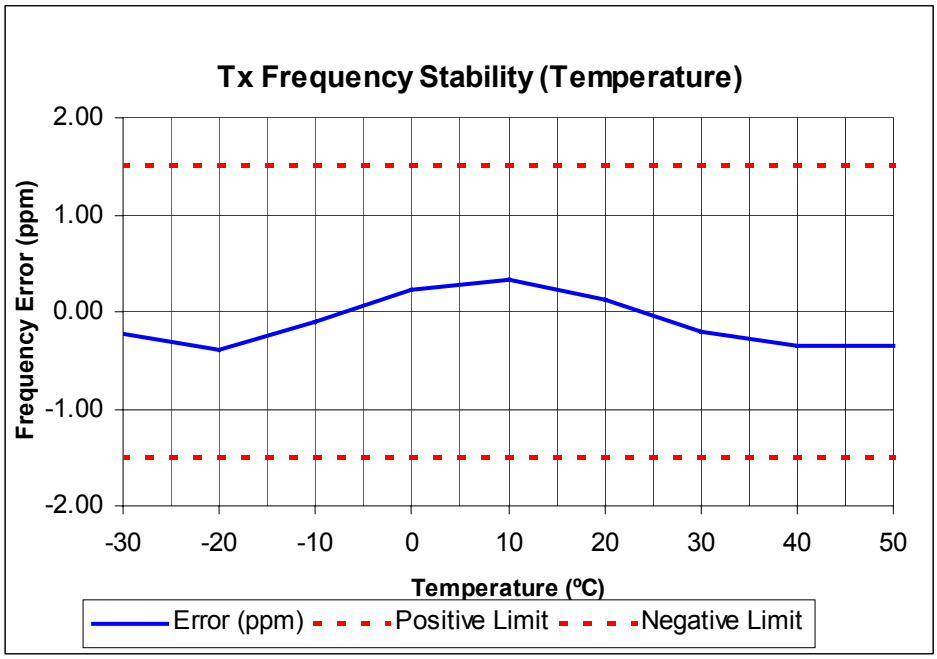
Frequency Range: 216 - 220 MHz	
LIMIT CLAUSE: FCC 47 CFR 80.209	
Channel Spacing (kHz)	Frequency Error (ppm)
12.5	5.0
25.0	5.0

Frequency Range: 220 - 222 MHz	
LIMIT CLAUSE: FCC 47 CFR 90.213	
Channel Spacing (kHz)	Frequency Error (ppm)
12.5	1.5

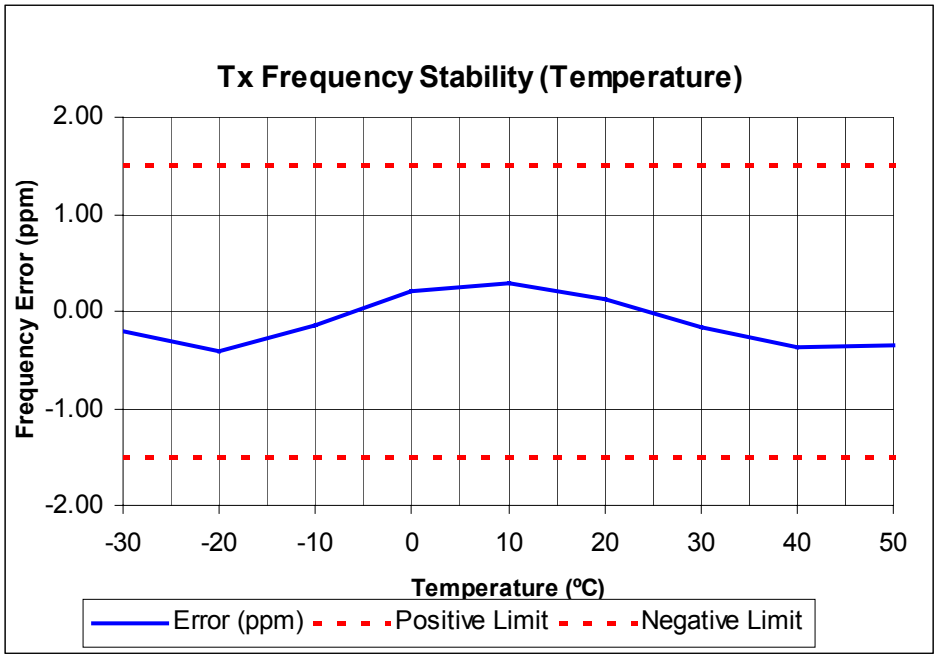
TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

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

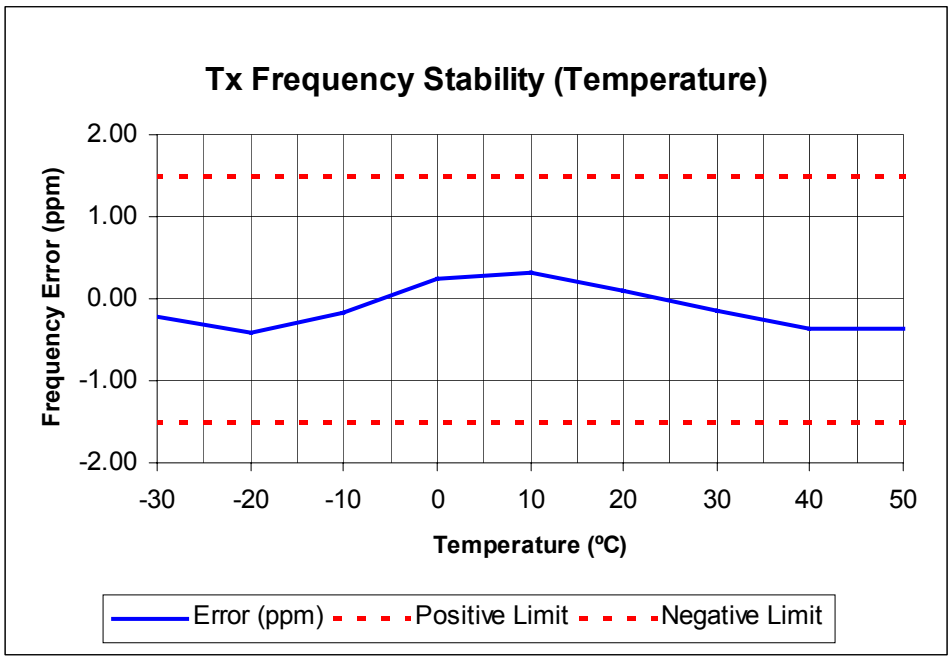
Tx FREQUENCY: 219.1 MHz 25W 12.5 kHz channel Spacing



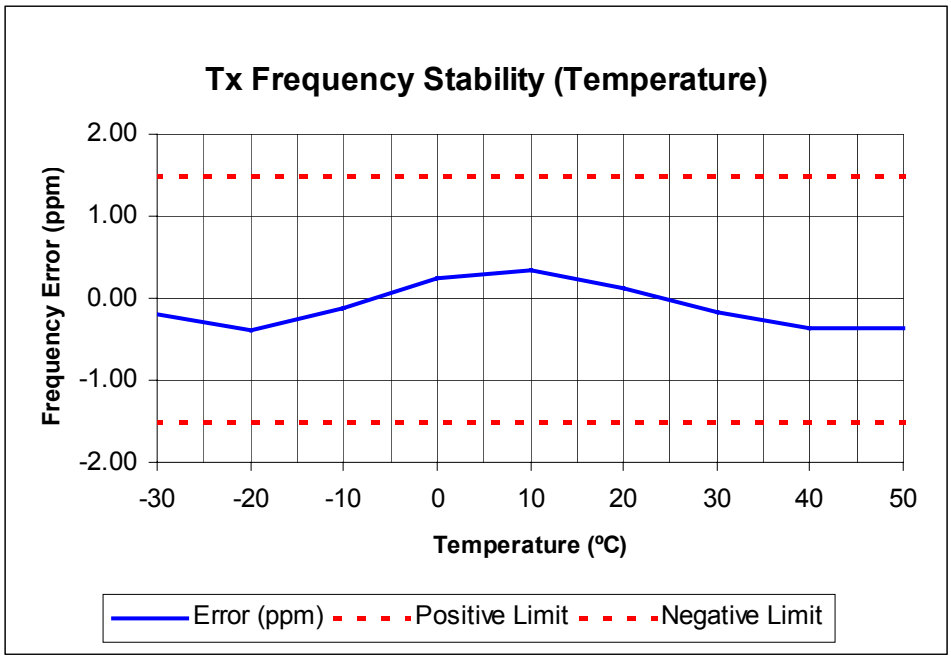
Tx FREQUENCY: 219.1 MHz 25W 25.0 kHz channel Spacing



Tx FREQUENCY: 221.5 MHz 25W 12.5 kHz channel Spacing



Tx FREQUENCY: 221.5 MHz 25W 25.0 kHz channel Spacing



TRANSMITTER FREQUENCY STABILITY (VOLTAGE)

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

GUIDE: TIA/EIA-603B 2.2.2

MEASUREMENT PROCEDURE:
1. Refer Appendix A for equipment set up.
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 ~ 266 MHz

Channel Spacing (kHz)	FREQUENCY ERROR (ppm) @ 219.1 MHz		
	11.7 V DC	13.8 V DC	15.9 V DC
12.5	-0.05	-0.07	-0.09
25.0	0.06	0.05	0.04

Channel Spacing (kHz)	FREQUENCY ERROR (ppm) @ 221.5 MHz		
	11.7 V DC	13.8 V DC	15.9 V DC
12.5	-0.10	-0.09	-0.16
25.0	-0.05	-0.04	-0.06

LIMITS

Frequency Range: 216 - 220 MHz	
LIMIT CLAUSE: FCC 47 CFR 80.209	
Channel Spacing (kHz)	Frequency Error (ppm)
12.5	5.0
25.0	5.0

Frequency Range: 220 - 222 MHz	
LIMIT CLAUSE: FCC 47 CFR 90.213	
Channel Spacing (kHz)	Frequency Error (ppm)
12.5	1.5

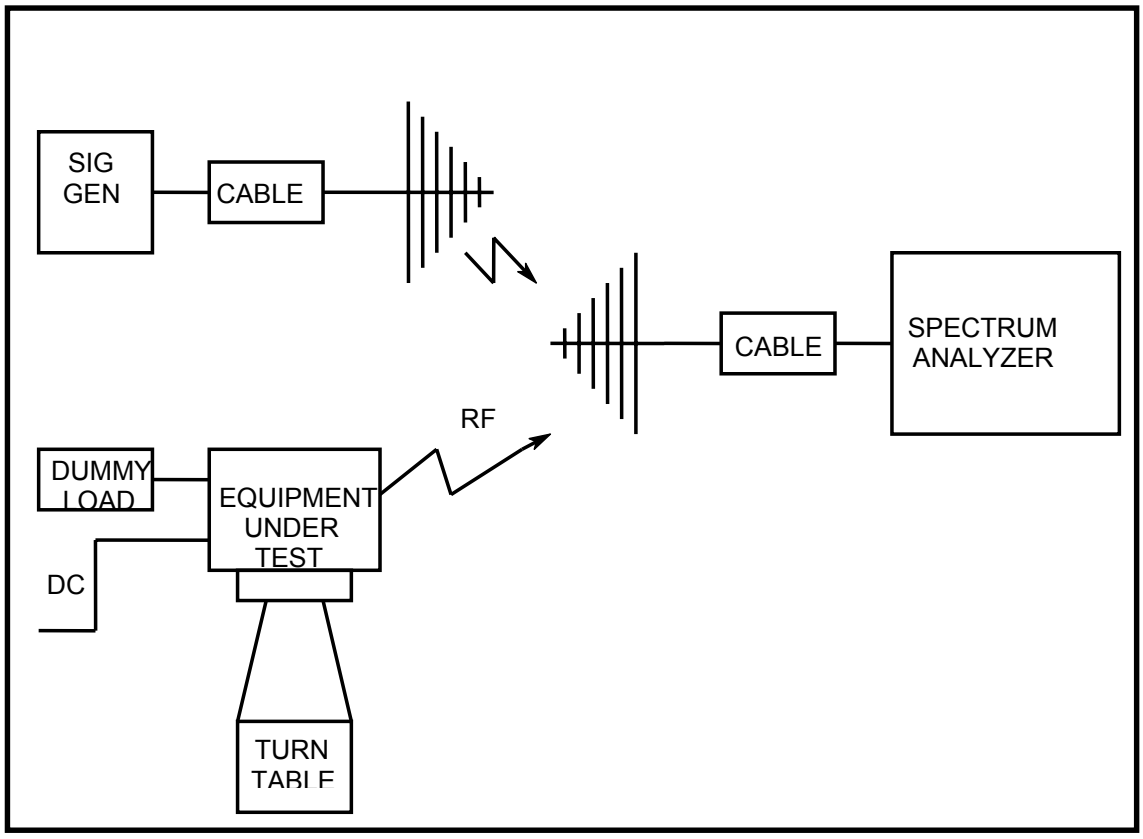
TEST EQUIPMENT USED

No#	Equipment	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
1	Signal Generator	Hewlett Packard	HP8642B (Opt 001)	2512A00176	E3064	18-Feb-05
2	Signal Generator	Hewlett Packard	HP8648A	3430U00344	E3579	15-Oct-04
3	Signal Generator	Agilent	E4422B	GB40050320	E3788	22-Oct-04
4	Signal Generator	Hewlett Packard	HP8648C	3443U00543	E3558	11-Sep-05
5	Signal Generator	Rohde & Schwarz	SMY01 1062.5502.11	841736/019	E3553	29-Oct-04
13	Audio Analyser	Hewlett Packard	HP8903A	2308A02597	E3074	15-Oct-04
16	Power Sensor	Rohde & Schwarz	URV5- Z4 395.1619. 55	841.498/003	E3557	11-Mar-05
20	Power Supply	Hewlett Packard	HP6032A	2441A-0041Z	E3075	15-Oct-04
21	Power Supply	Rohde & Schwarz	NGS M32/10 192.0810.31	Fnr 434	E3556	14-Jun-05
22	Oscilloscope	Tektronics	TDS340	B013611	E3585	25-Nov-04
24	Environ. Chamber	Contherm	Temp Control	E3397	E3397	04-Mar-05
43	Horn Antenna	Emco	DRG3115		E3076	27-Sep-06
52	Amplifier +21.7 dB	Tait	ZFL-1000LN	E3660	E3360	
53	RF Filter 21.4M (CAST)	Tait	NDK21G-6DT	E3069	E3069	28-May-05
62	RF Attenuator 150W	Weinschel	57-10-34	LB590	E3674	20-Jul-05
65	RF Attenuator 50W	Weinschel	24-20-44	AW1266	E3562	28-Jun-05
82	3m Coax Cable BLUE)	Suhner	Sucoflex 104A	25033/4A	E3694	30-Oct-04
84	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25005/4A	E3692	15-Jul-05
87	Audio Analyser	Hewlett Packard	HP8903B	2818A04275	E3710	25-Nov-04
88	Spectrum Analyser	Hewlett Packard	HP8562E	3821A00779	E3715	06-Jan-05
90	Power Supply	Hewlett Packard	HP6012B	2524A00616	E3712	21-Jul-05
91	20m Coax Cable		RG214/U-50 (Ext Cal)	CBL01	E3404	08-Sep-04
100	Oscilloscope	Tektronics	TDS380	B017095	E3782	16-Oct-04
111	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	15-Oct-04
114	Signal Generator	Rohde & Schwarz	SML03 1090.3000.13		E4050	28-Nov-04
115	Environ. Chamber	Contherm	5400 RHSLT.M		E4051	04-Mar-05
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	23-Apr-05

APPENDIX A

TEST SETUP DETAILS

Test set up for Spurious Emissions (Radiated)



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