

Laboratory Test Report

For the
TBAC0 Base Station Transceiver

Tested In accordance with
FCC 47 CFR Part 80 and 90T

Report Revision: 1
Issue Date: 17-Oct-2006
FCC ID: CASTBA7C0

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		Laboratory Manager



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

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Revision History

Date	Revision	Comments
17-Oct-2005	1	Initial test report

Introduction

Type Approval Testing of the TBAC0, FCC ID: CASTBA7C0 Base Station
Transceiver in accordance with:

FCC CFR 47 Part 80 and 90T

Report Prepared For

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

Description of Sample

Equipment: Base Station Transceiver
Type: TBAC0

The TBAC0 is a modular base station transceiver consisting of:

Module	Product Designation Code	Serial Number	Description
Reciter	TBA40C2-0B00	18009809	Frequency Range 193 – 225 MHz
Power Amplifier	TBA70C0-0000 TBA71C0-0000	18005074 18022791	1 – 5 Watts in 1 Watt steps
Power Management Unit	TBA30A0-0000	18004653	Input 88 – 264 Vac 45 – 65 Hz Output: 28 Vdc
User Interface	XBA2020	18004403	-

Additional Equipment used for testing:

High Stability Oscillator	T801-20-00	13122298	10 MHz output 0.01ppm
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Statement of Compliance

The TBAC0 base station transceiver as tested in this report was found to conform to the following standards:

FCC CFR 47 Part 80 and 90T

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	120 Vac (PMU input voltage)
	13.8 Vdc (12V PA input voltage)

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.

$B_n = 2M + 2DK$ Where: B_n = 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 $M = 3 \text{ KHz}$ $D = 2.5 \text{ kHz}$ $B_n = 6 + 5 \times 1$ $= 11 \text{ kHz}$	Emission Designator 11K0F3E F3E represents a FM voice transmission
25kHz Bandwidth	Necessary bandwidth $M = 3 \text{ kHz}$ $D = 5 \text{ kHz}$ $B_n = 6 + 10 \times 1$ $= 16 \text{ kHz}$	Emission Designator 16K0F3E F3E represents a FM voice transmission

2. Fast Frequency Shift Keying (FFSK, Data speed = 1200 bps)

12.5kHz Bandwidth	Necessary bandwidth $M = 1.8 \text{ kHz}$ $D = 1.5 \text{ kHz}$ $B_n = 3.6 + 3 \times 1$ $= 6.6 \text{ kHz}$	Emission Designator 6K60F2D F2D represents a FM data transmission with the use of a modulating sub carrier
25kHz Bandwidth	Necessary bandwidth $M = 1.8 \text{ kHz}$ $D = 3 \text{ kHz}$ $B_n = 3.6 + 6 \times 1$ $= 9.6 \text{ kHz}$	Emission Designator 9K60F2D F2D represents a FM data transmission with the use of a modulating sub carrier

Test Results

TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046

GUIDE: TIA/EIA-603C 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:

FCC 47 CFR 80.215

216 – 220 MHz

Power Amplifier: TBA70C0 (PMU driven PA)		
219.1 MHz	5 W nominal	1 W nominal
POWER (W)	5.1	1.01
Variation from Nominal (%)	2.0	1.0
Measurement Uncertainty (dB)	± 0.6	

FCC 47 CFR 90.729

Power Amplifier: TBA70C0 (PMU driven PA)		
221.5 MHz	5 W nominal	1 W nominal
POWER (W)	5.2	1.02
Variation from Nominal (%)	4.0	2.0
Measurement Uncertainty (dB)	± 0.6	

LIMIT CLAUSE: FCC 47 CFR 90.205 (r)

Radio Type: Base Station Transceiver

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

TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046

MEASUREMENT RESULTS:

FCC 47 CFR 80.215

216 – 220 MHz

Power Amplifier: TBA71C0 (12V PA)		
219.1 MHz	5 W nominal	1 W nominal
POWER (W)	5.1	1.01
Variation from Nominal (%)	2.0	1.0
Measurement Uncertainty (dB)	± 0.6	

FCC 47 CFR 90.729

Power Amplifier: TBA71C0 (12V PA)		
221.5 MHz	5 W nominal	1 W nominal
POWER (W)	5.1	1.02
Variation from Nominal (%)	2.0	2.0
Measurement Uncertainty (dB)	± 0.6	

LIMIT CLAUSE: FCC 47 CFR 90.205 (r)

Radio Type: Base Station Transceiver

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-603C 2.2.6

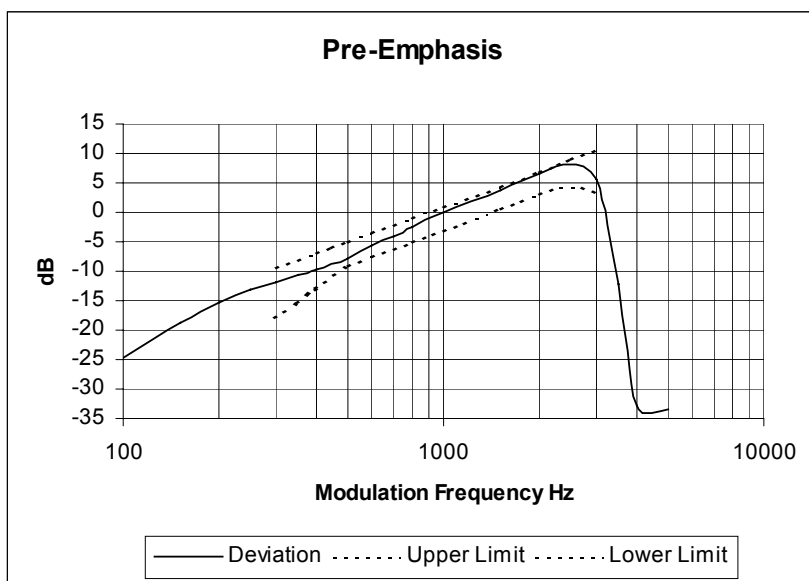
MEASUREMENT PROCEDURE:

1. Refer Annex 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.

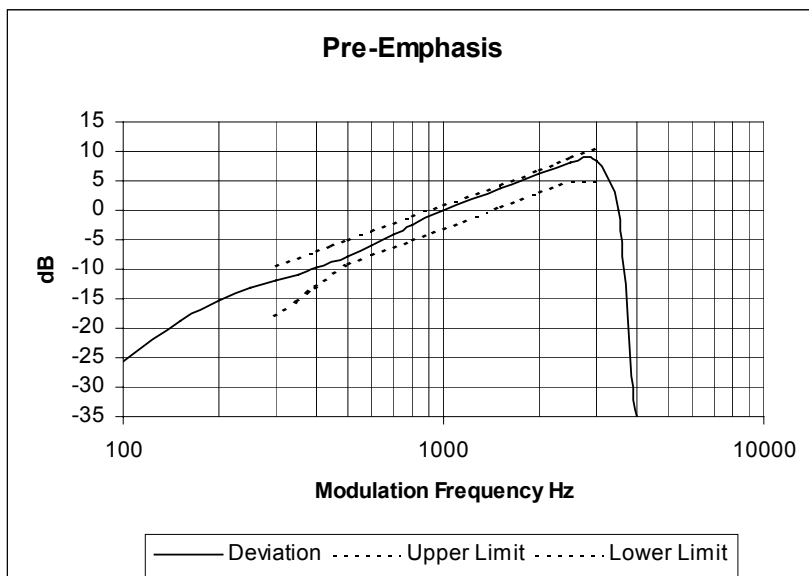
LIMIT CLAUSE: TIA/EIA-603C 3.2.6

MEASUREMENT RESULTS:

219.1 MHz 12.5 kHz Channel Spacing 5 Watts



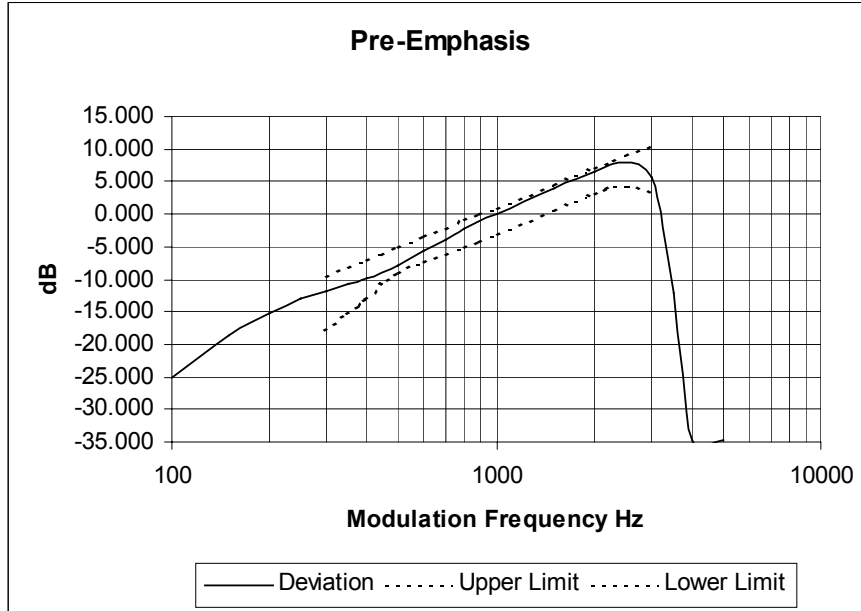
219.1 MHz 25.0 kHz Channel Spacing 5 Watts



TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 221.5 MHz 12.5 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

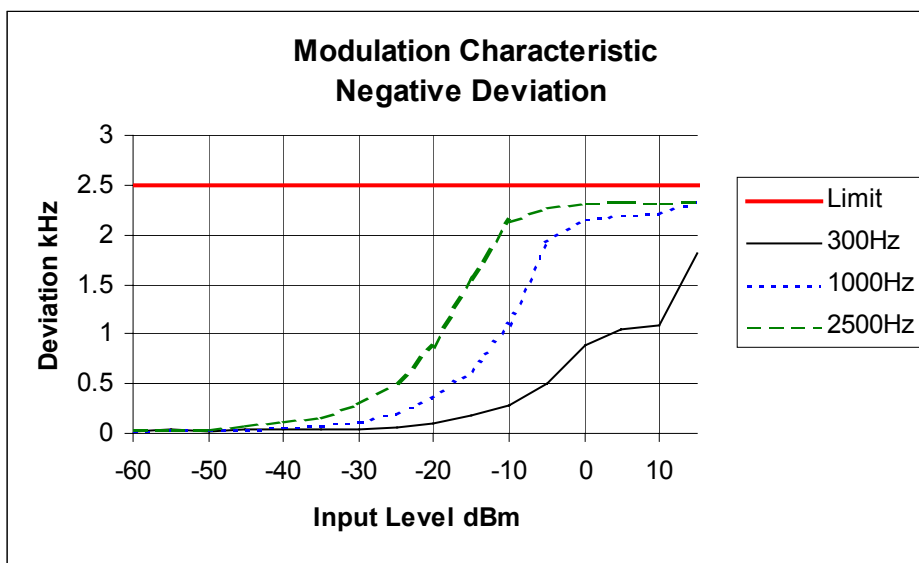
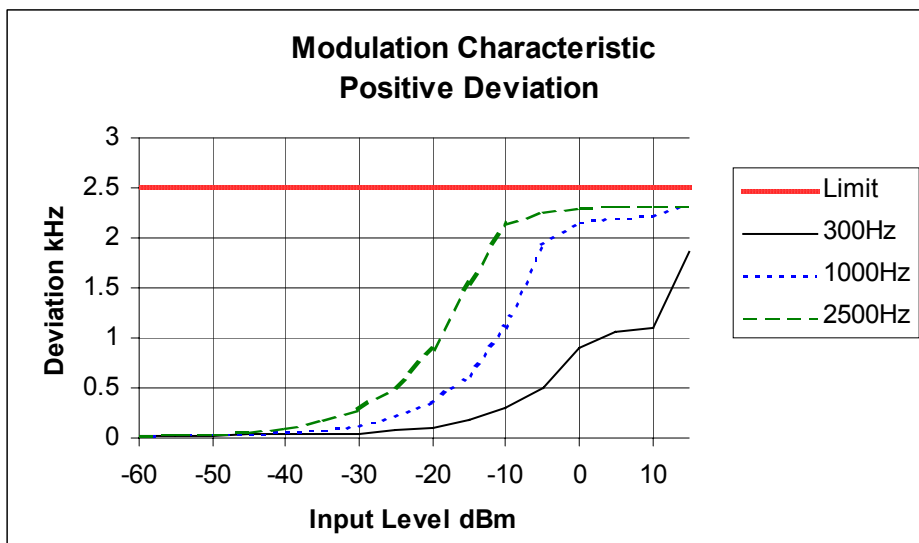
MEASUREMENT PROCEDURE:

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.

LIMIT CLAUSE: TIA/EIA-603C 1.3.4.4

MEASUREMENT RESULTS:

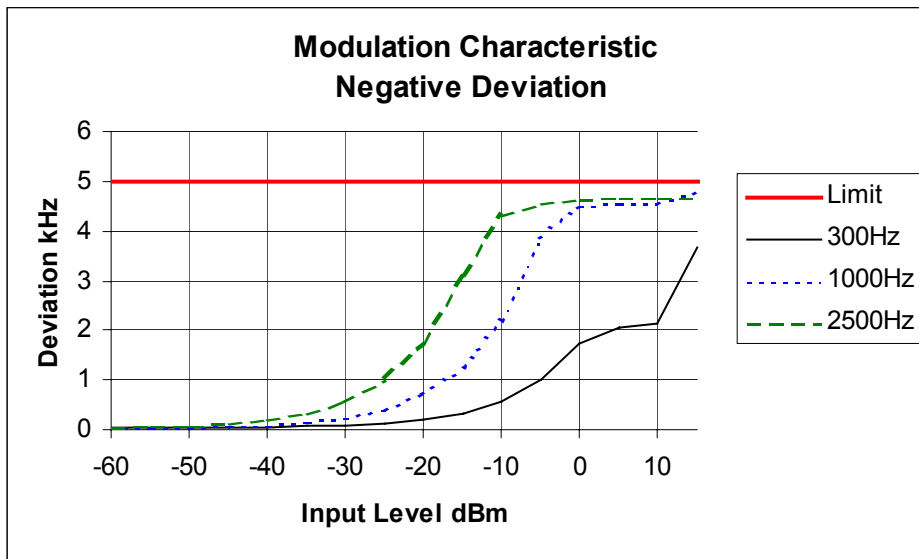
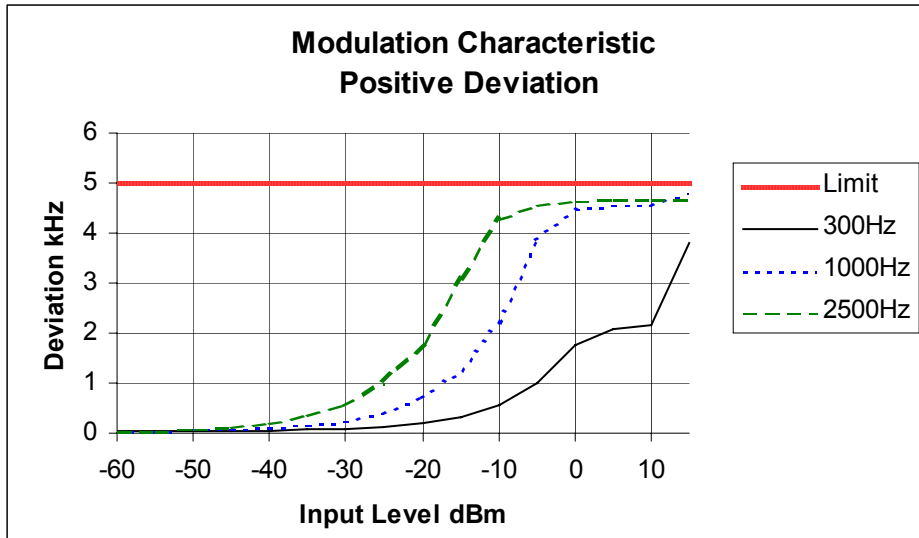
Tx FREQUENCY: 219.1 MHz 12.5 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

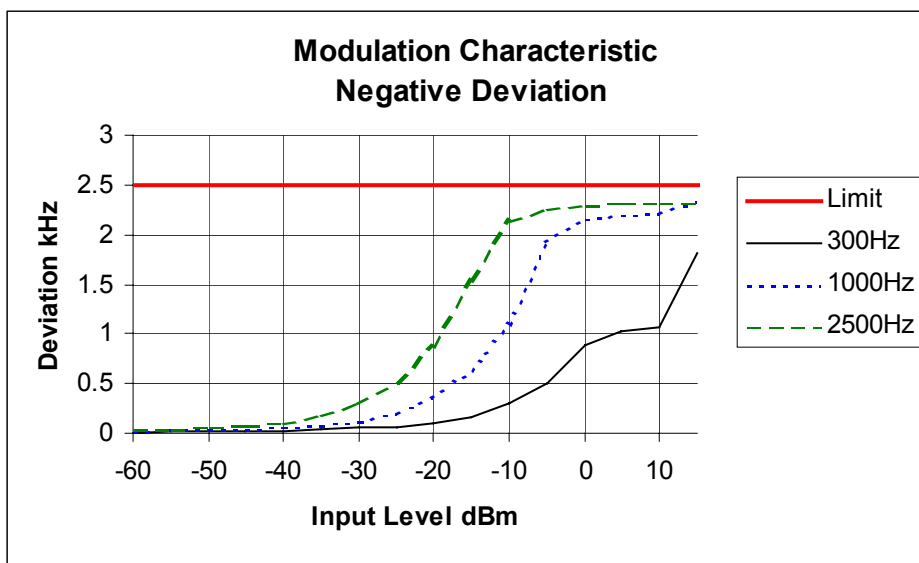
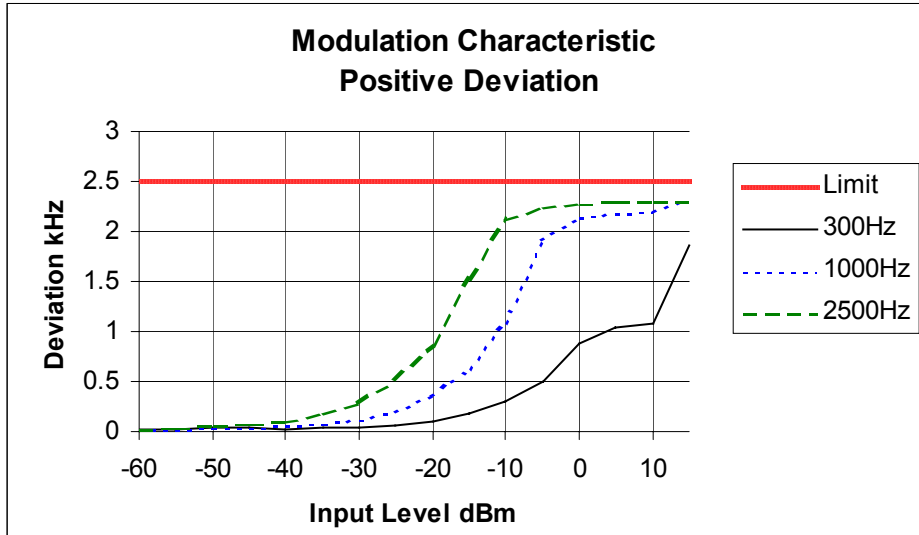
Tx FREQUENCY: 219.1 MHz 25.0 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 221.5 MHz 12.5 kHz Channel Spacing



SIDEBAND SPECTRUM

SPECIFICATION: FCC 47 CFR 2.1049 (c)
FCC 47 CFR 80.211
FCC 47 CFR 90.733 (d), (e)

GUIDE: TIA/EIA-603C 2.2.11

MEASUREMENT PROCEDURE:

1. Refer Annex 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 externally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Sideband Spectrum 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 80.211 (f)
FCC 47 CFR 90.210 (f)

216 – 220 MHz		
Emission Mask D	12.5 kHz Channel Spacing	Analogue Voice; FFSK
Emission Mask B	25.0 kHz Channel Spacing	Analogue Voice
Emission Mask C	25.0 kHz Channel Spacing	FFSK
220 – 222 MHz		
Emission Mask F x 5 (5 contiguous channels)	12.5 kHz Channel Spacing	Analogue Voice; FFSK

DATA SPEED

FFSK	1200 bps	12.5 kHz Channel Spacing
FFSK	1200 bps	25.0 kHz Channel Spacing

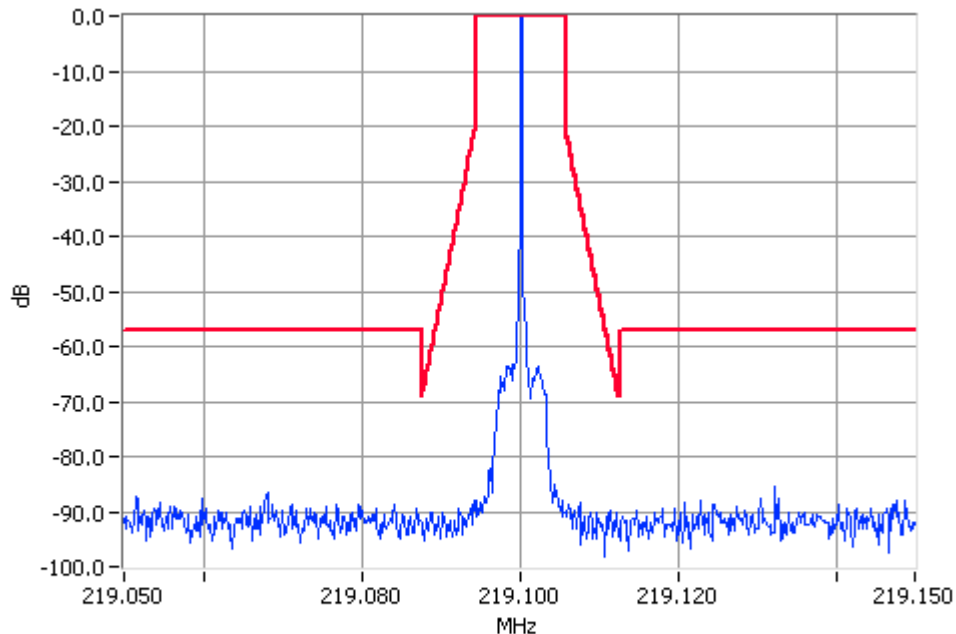
SIDEBAND SPECTRUM

ANALOGUE VOICE

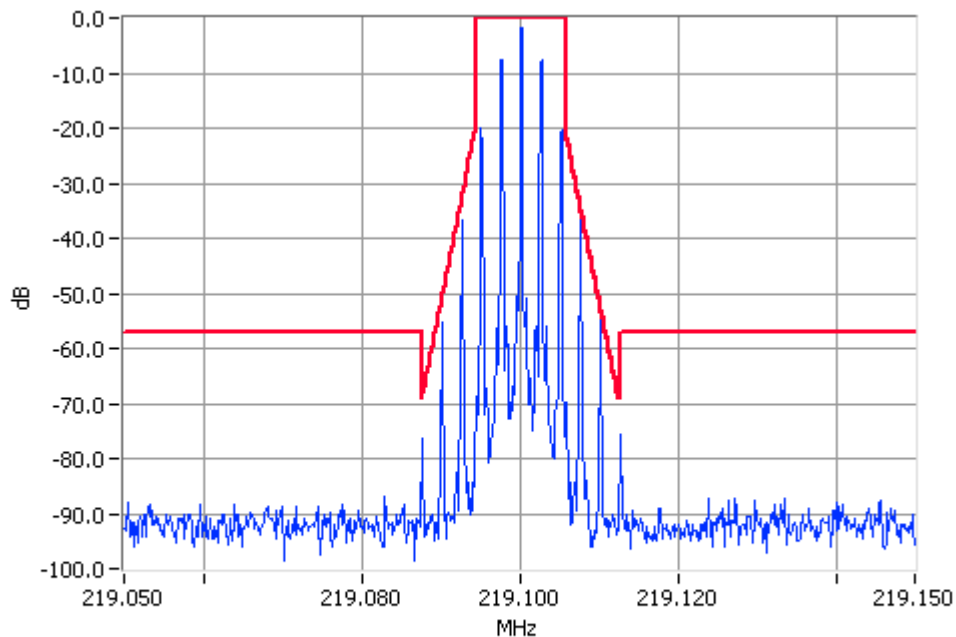
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 219.1 MHz 5 W 12.5 kHz Channel Spacing



Unmodulated 219.1000MHz Mask D 5W Pass
RBW=100Hz VBW=1000Hz



Analogue Modulation 219.1000MHz Mask D 5W Pass
RBW=100Hz VBW=1000Hz

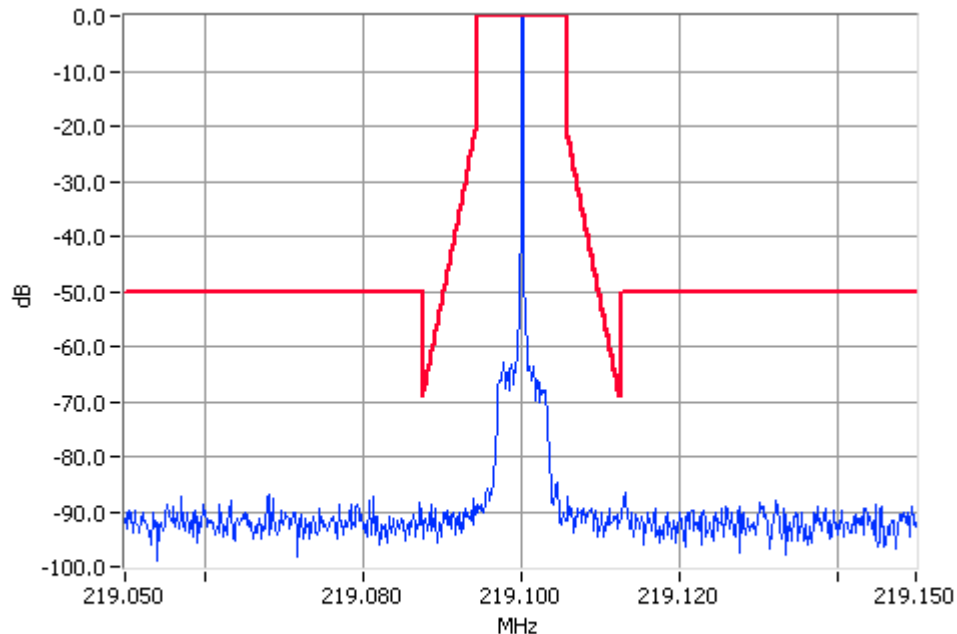
SIDEBAND SPECTRUM

ANALOGUE VOICE

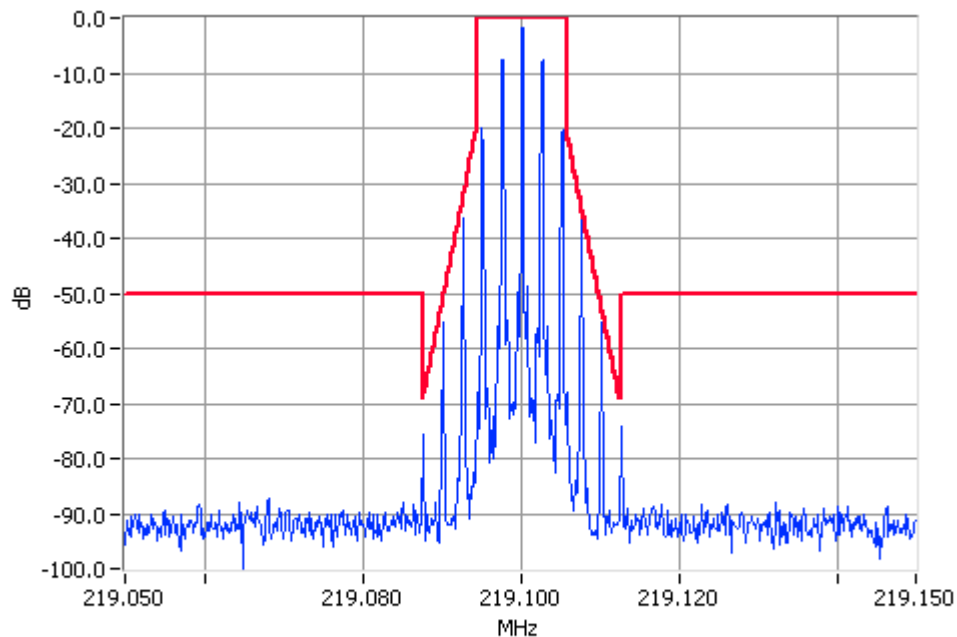
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 219.1 MHz 1 W 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

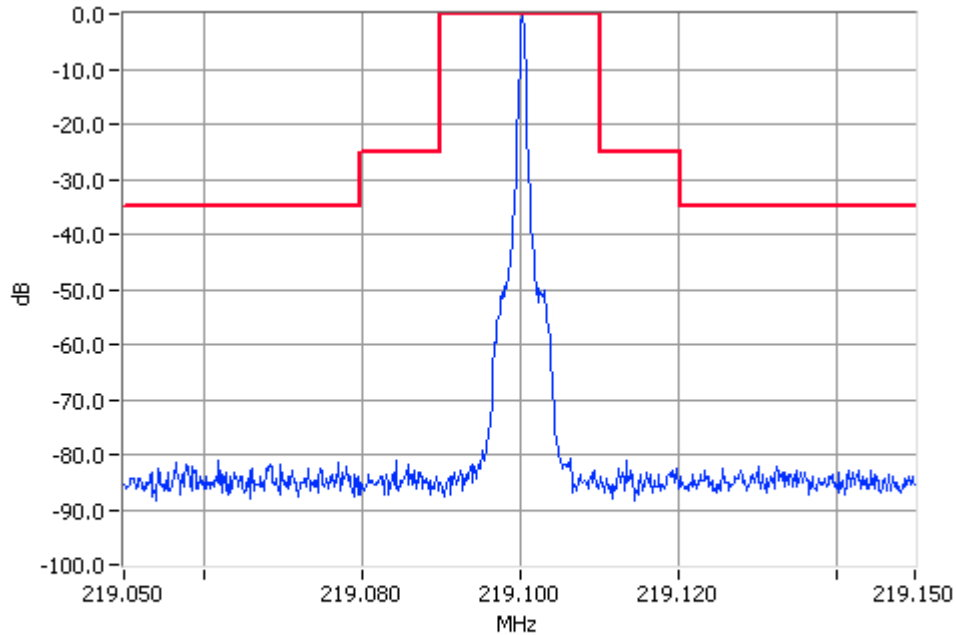
SIDEBAND SPECTRUM

ANALOGUE VOICE

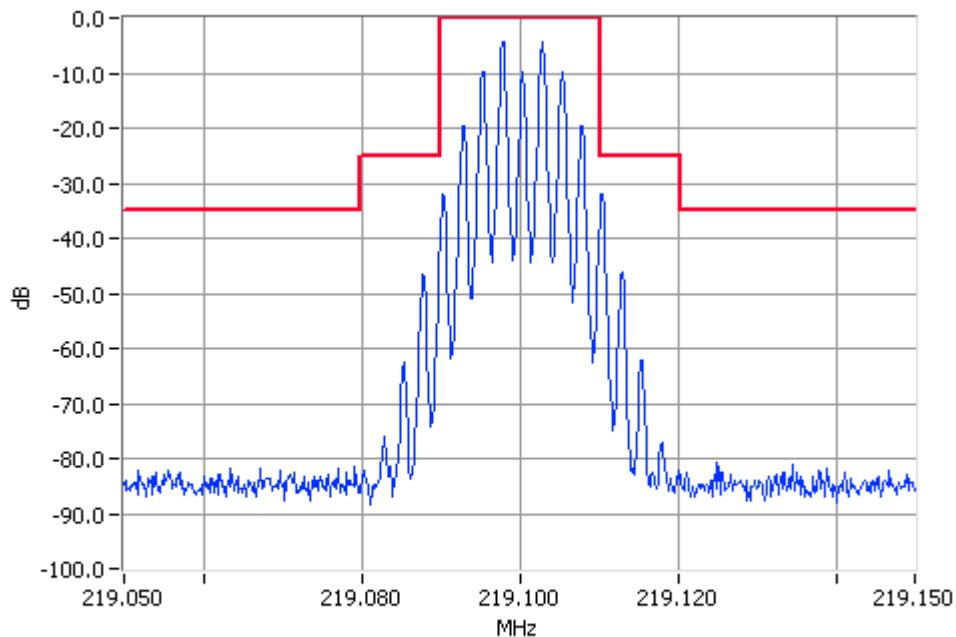
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 219.1 MHz 5 W 25.0 kHz Channel Spacing



Unmodulated 219.1000MHz Mask B 5W Pass
RBW=300Hz VBW=3000Hz



Analogue Modulation 219.1000MHz Mask B 5W Pass
RBW=300Hz VBW=3000Hz

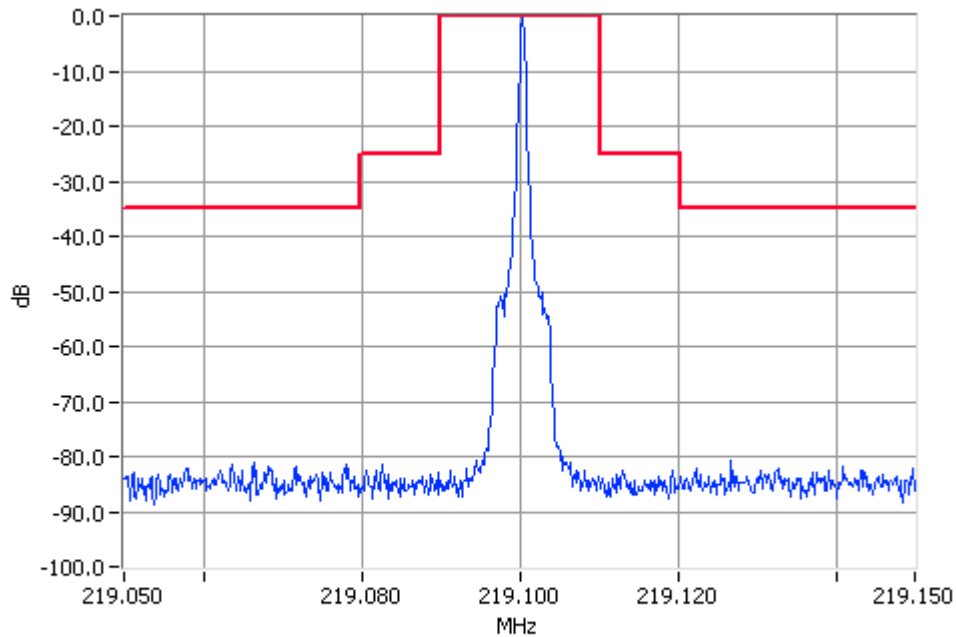
SIDEBAND SPECTRUM

ANALOGUE VOICE

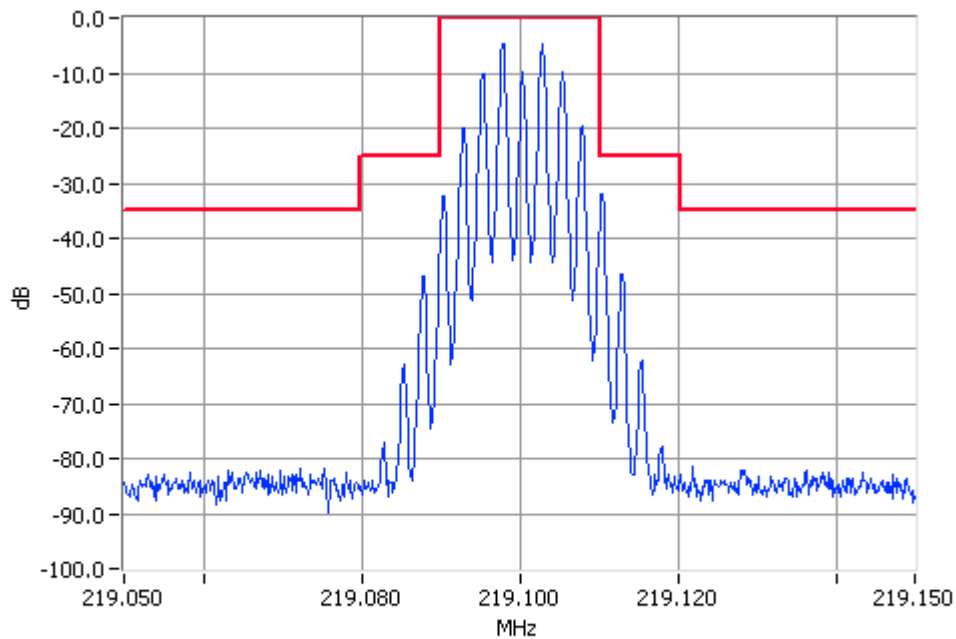
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 219.1 MHz 1W 25.0 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

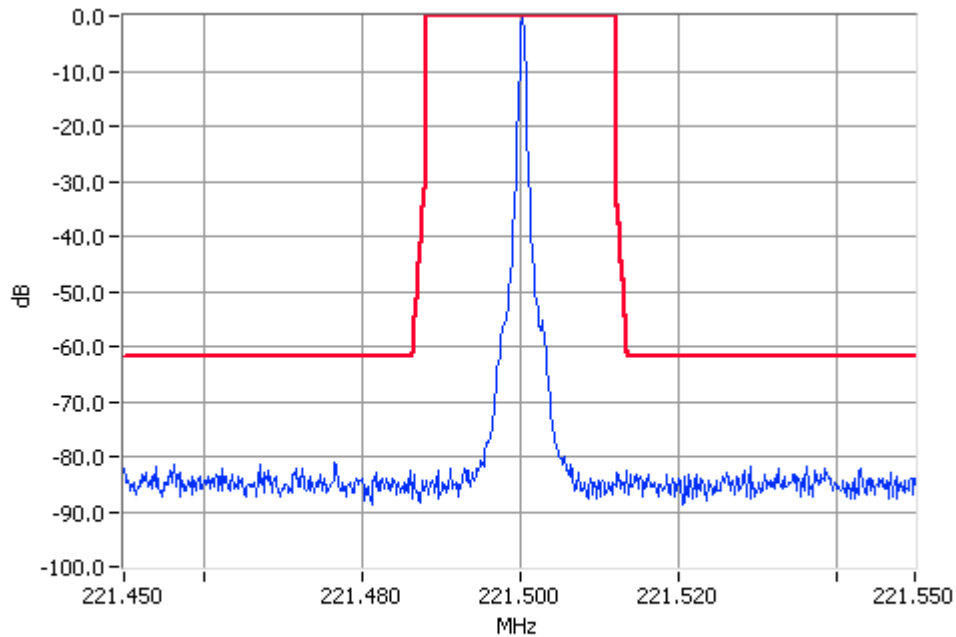
SIDEBAND SPECTRUM

ANALOGUE VOICE

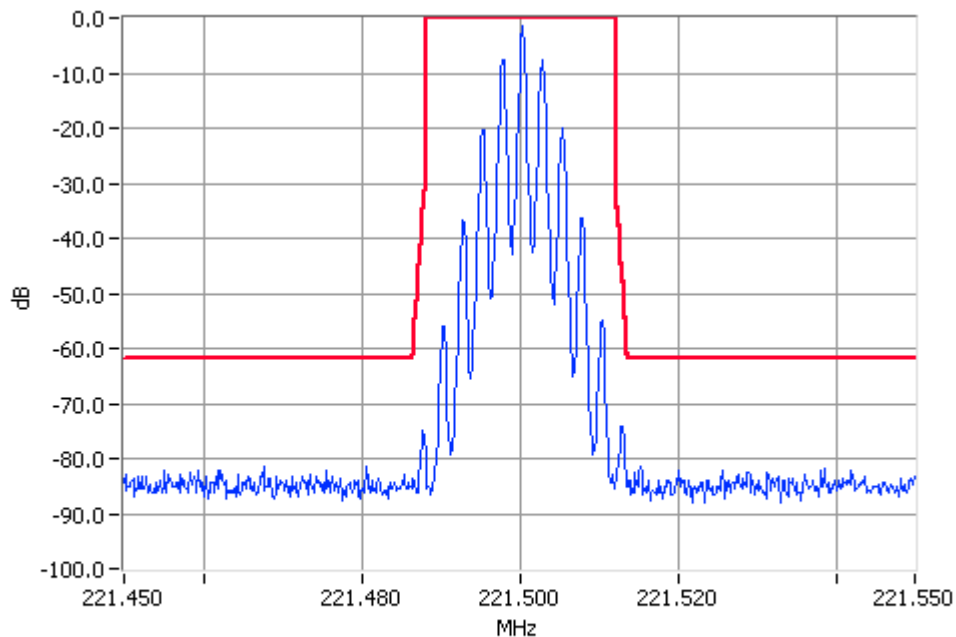
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 221.5 MHz 5 W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx5 5W Pass
RBW=300Hz VBW=3000Hz



Analogue Modulation 221.5000MHz Mask Fx5 5W Pass
RBW=300Hz VBW=3000Hz

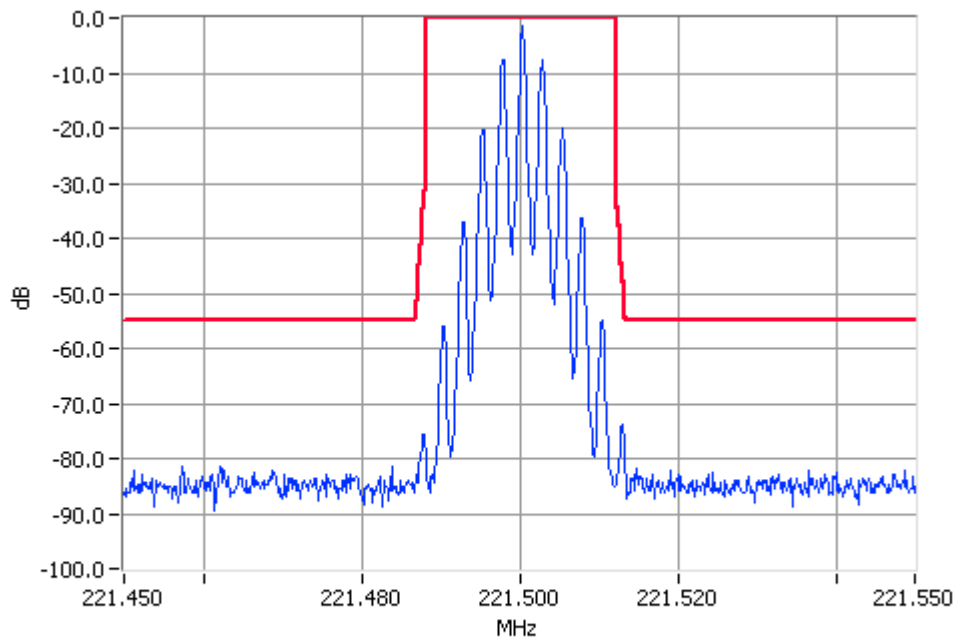
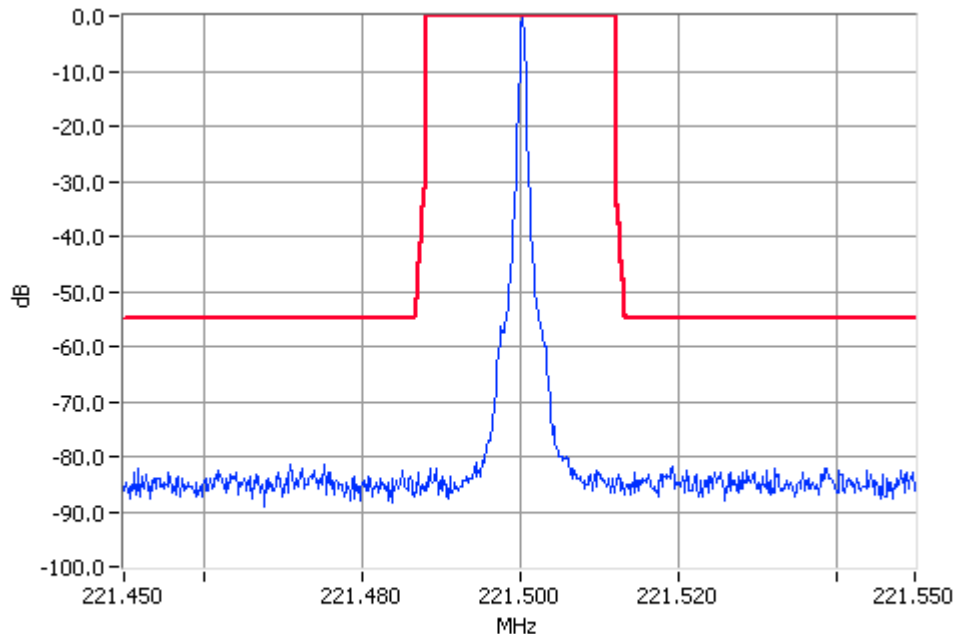
SIDEBAND SPECTRUM

ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 221.5 MHz 1 W 12.5 kHz Channel Spacing



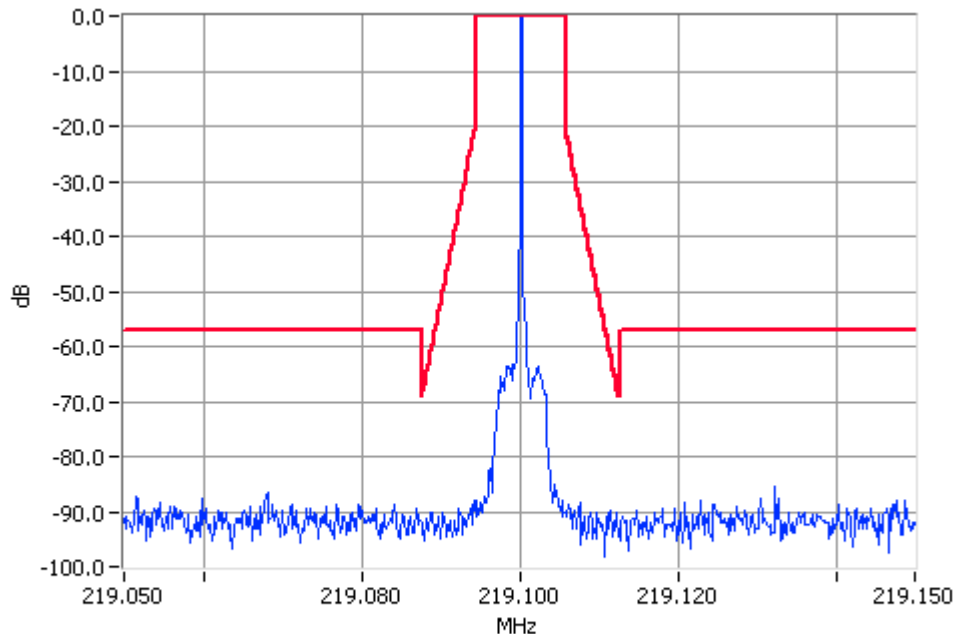
SIDEBAND SPECTRUM

FFSK

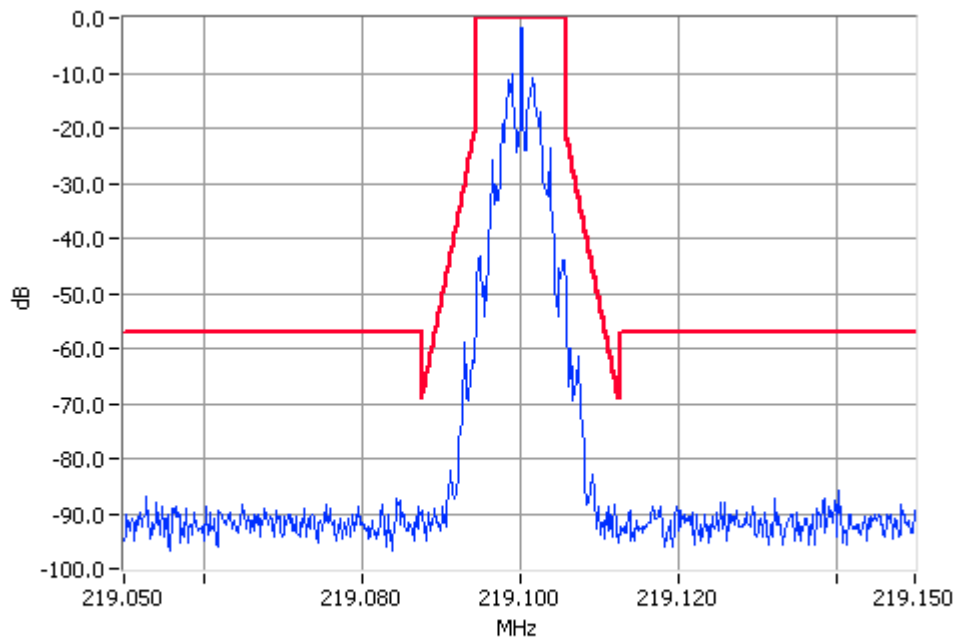
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 219.1 MHz 5 W 12.5 kHz Channel Spacing



Unmodulated 219.1000MHz Mask D 5W Pass
RBW=100Hz VBW=1000Hz



Digital Modulation 219.1000MHz Mask D 5W Pass
RBW=100Hz VBW=1000Hz

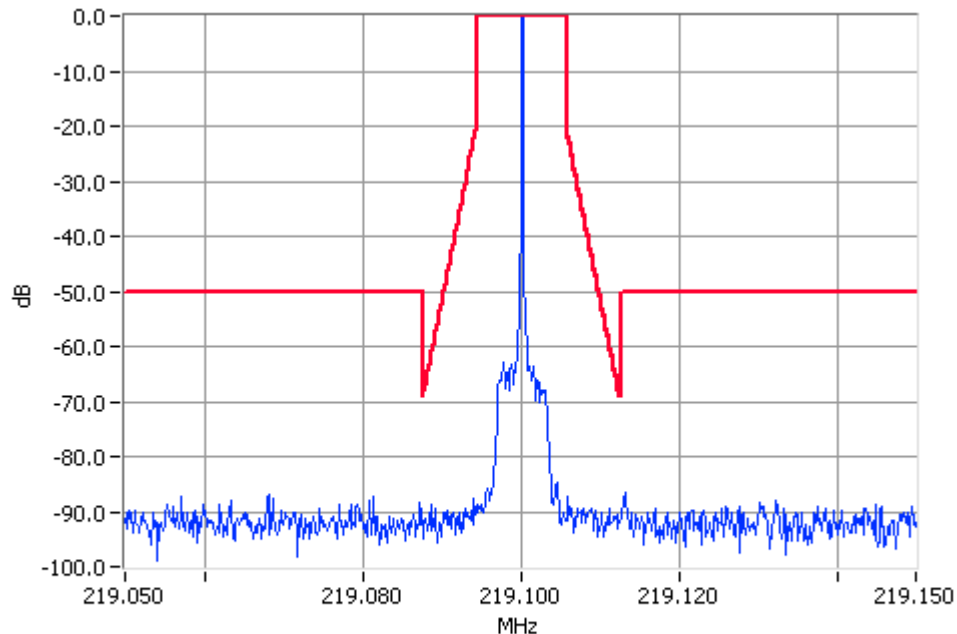
SIDEBAND SPECTRUM

FFSK

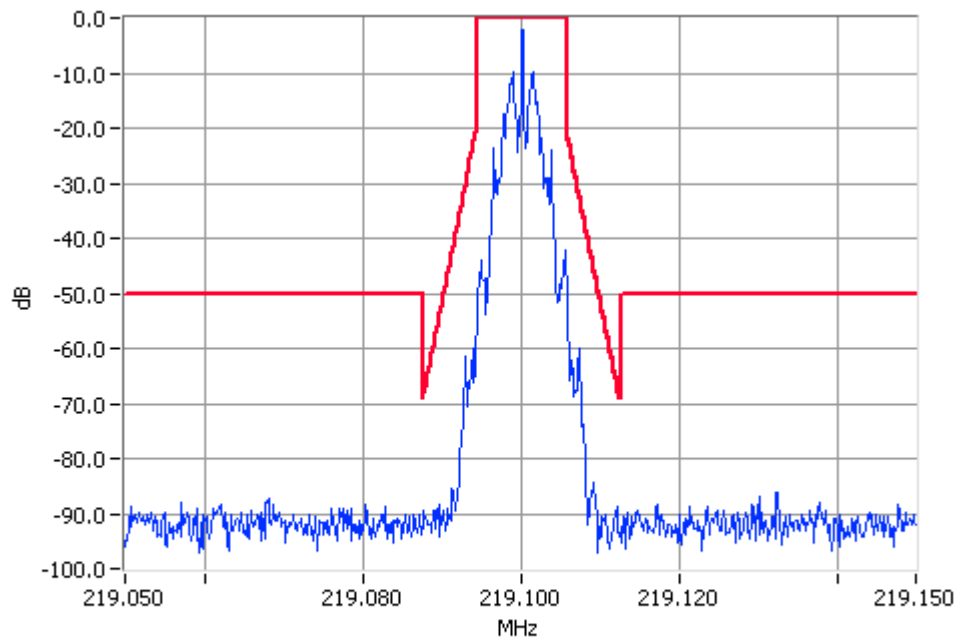
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 219.1 MHz 1 W 12.5 kHz Channel Spacing



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



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

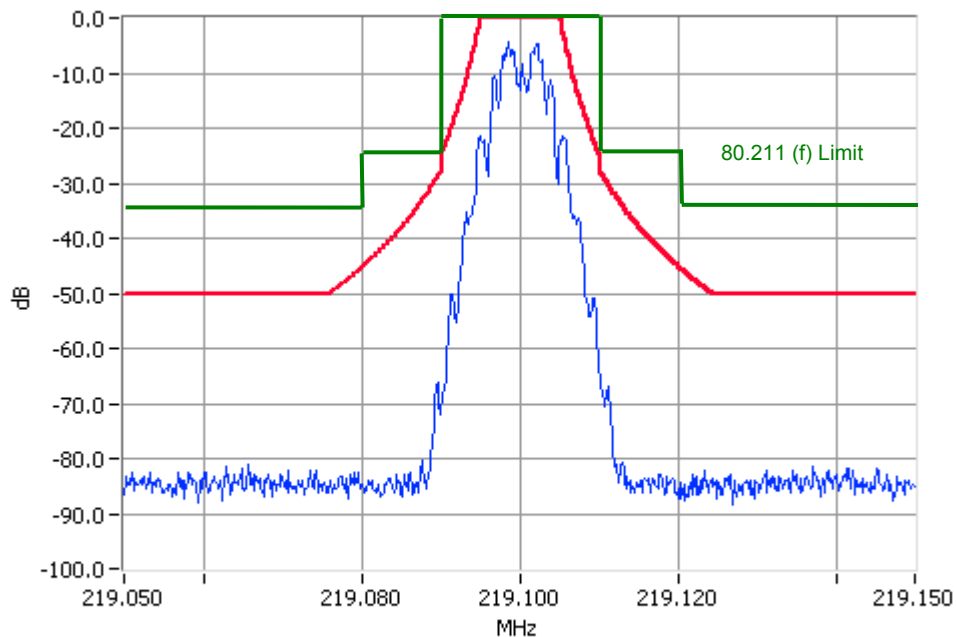
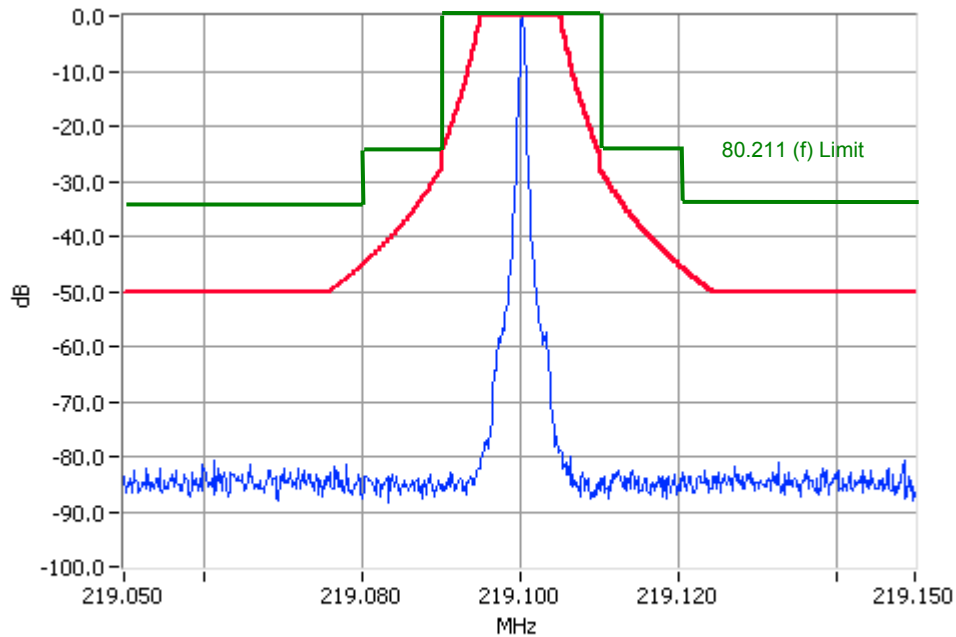
SIDEBAND SPECTRUM

FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 219.1 MHz 5 W 25.0 kHz Channel Spacing



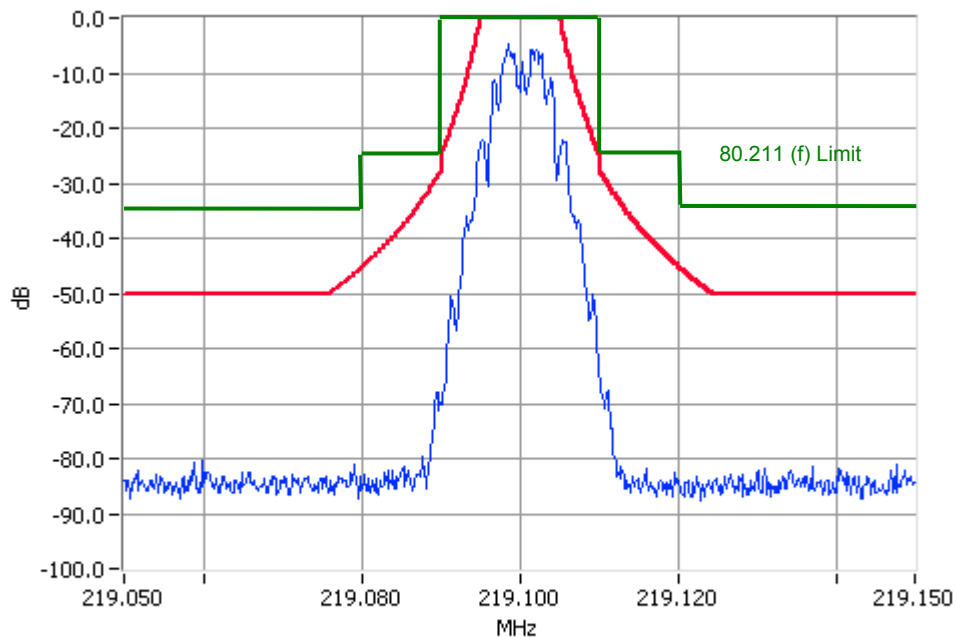
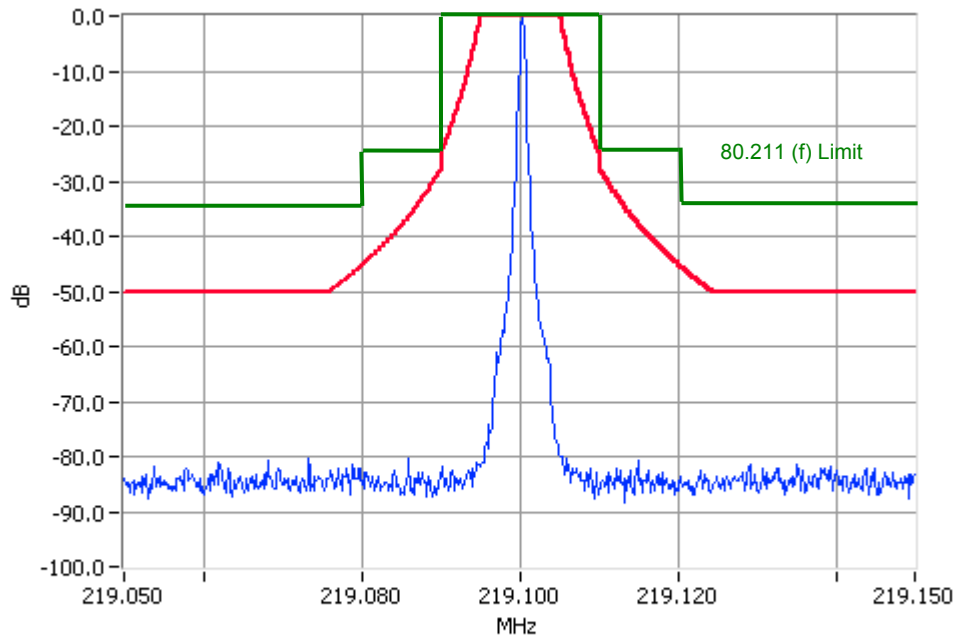
SIDEBAND SPECTRUM

FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 219.1 MHz 1 W 25.0 kHz Channel Spacing



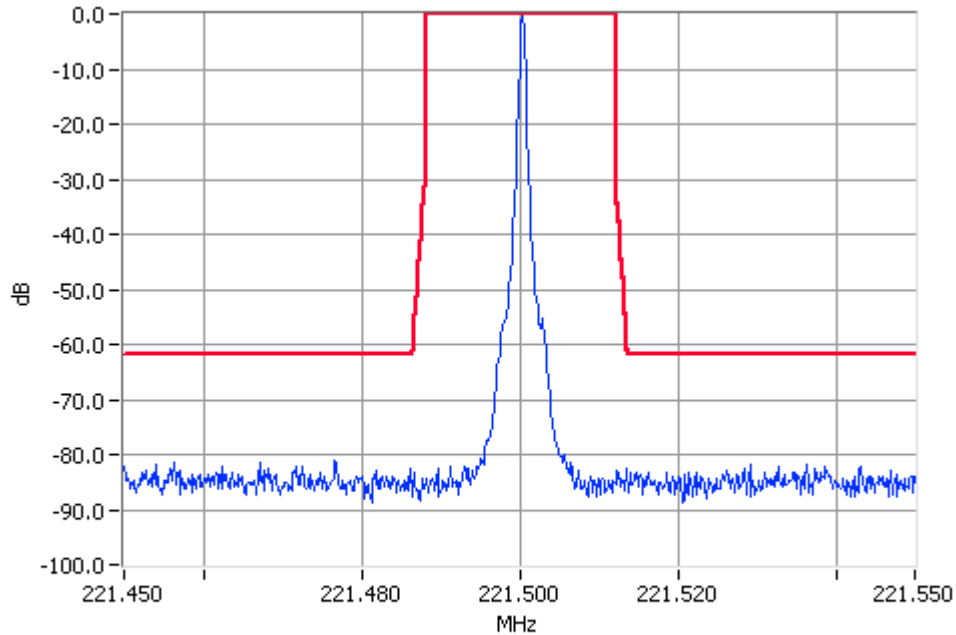
SIDEBAND SPECTRUM

FFSK

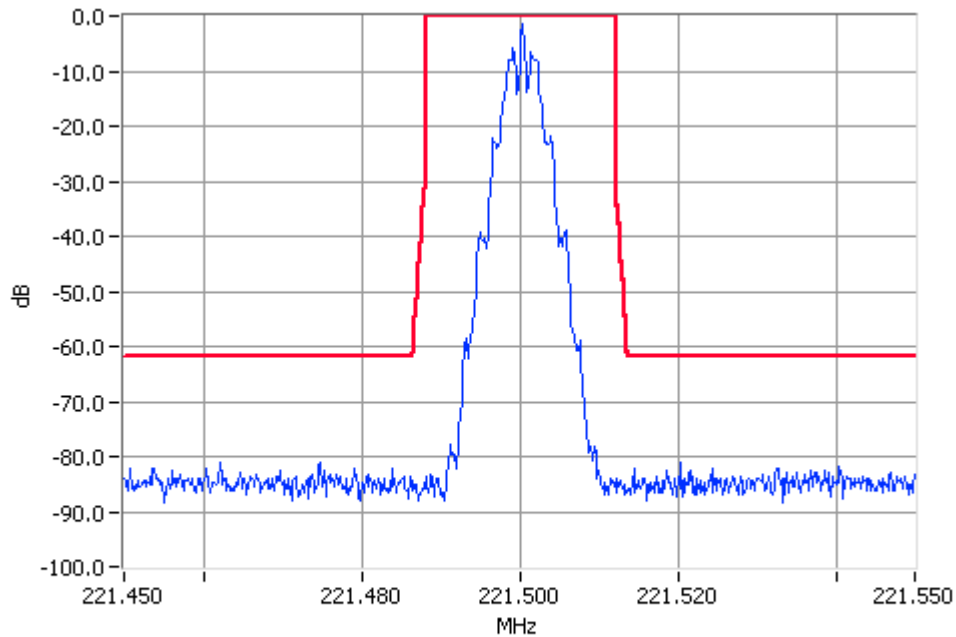
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 221.5 MHz 5 W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx5 5W Pass
RBW=300Hz VBW=3000Hz



Digital Modulation 221.5000MHz Mask Fx5 5W Pass
RBW=300Hz VBW=3000Hz

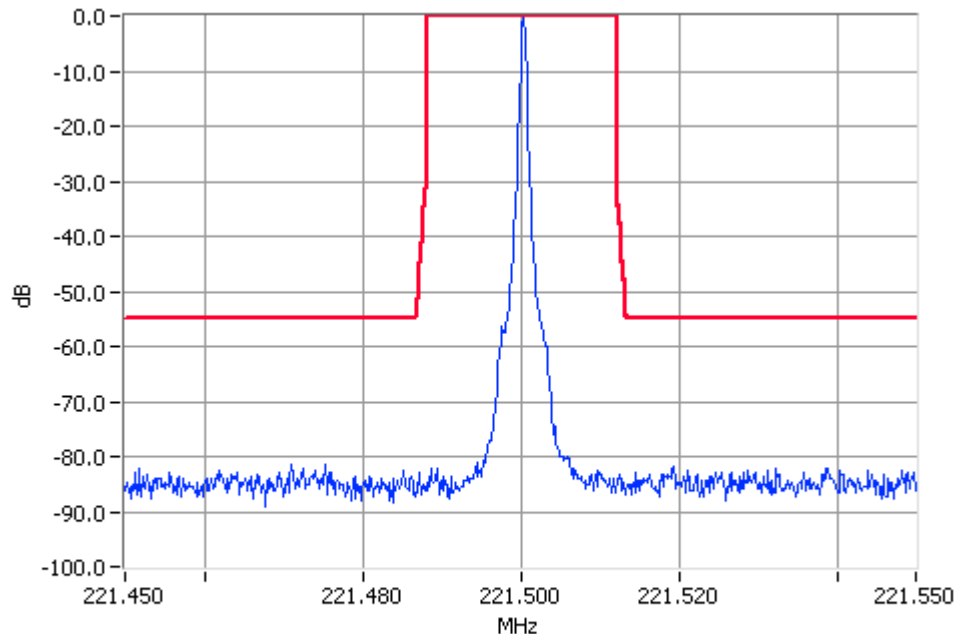
SIDEBAND SPECTRUM

FFSK

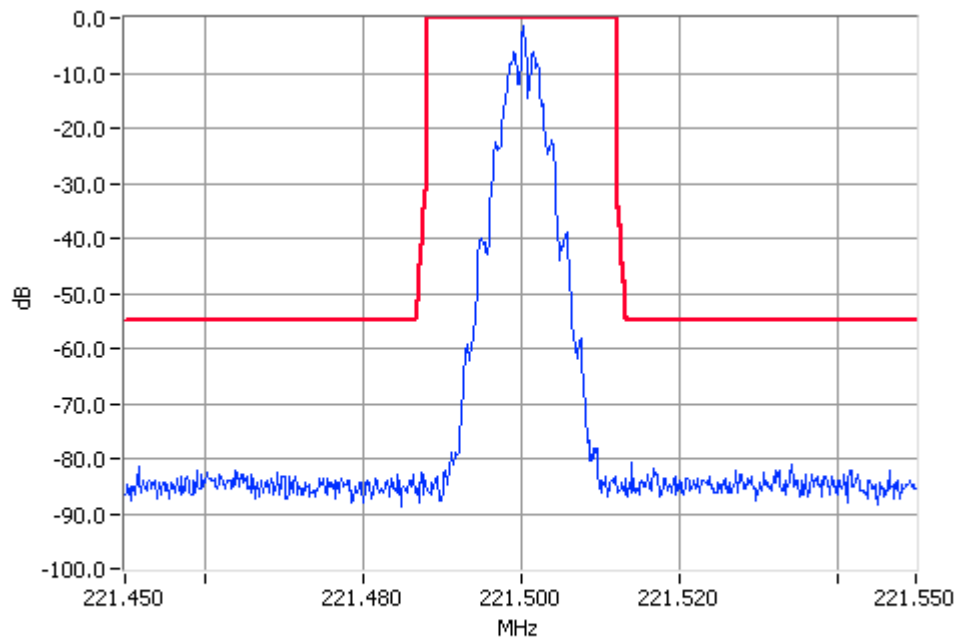
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA70C0 (PMU driven PA)

Tx FREQUENCY: 221.5 MHz 1 W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx5 1W Pass
RBW=300Hz VBW=3000Hz



Digital Modulation 221.5000MHz Mask Fx5 1W Pass
RBW=300Hz VBW=3000Hz

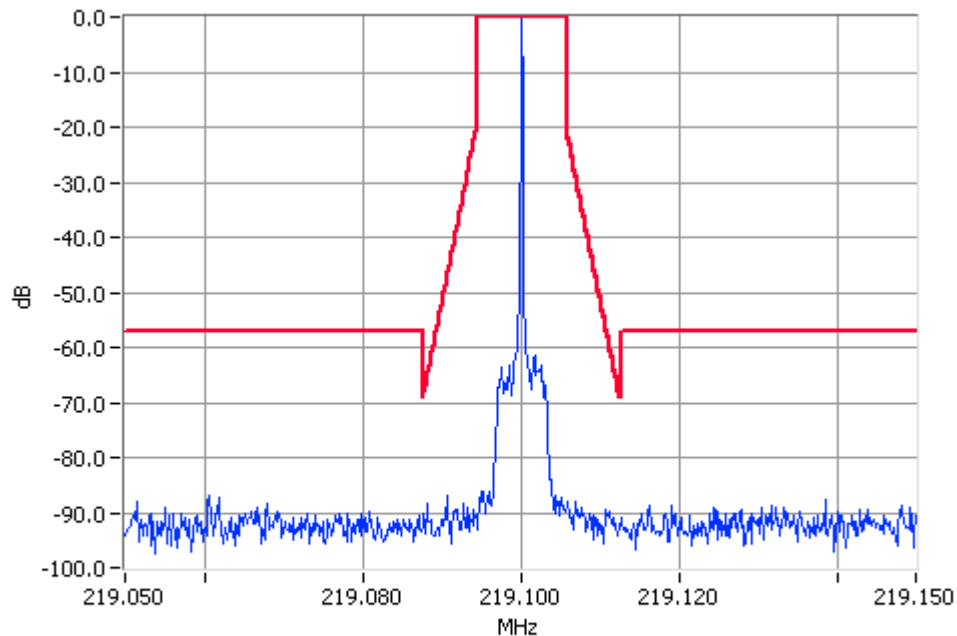
SIDEBAND SPECTRUM

ANALOGUE VOICE

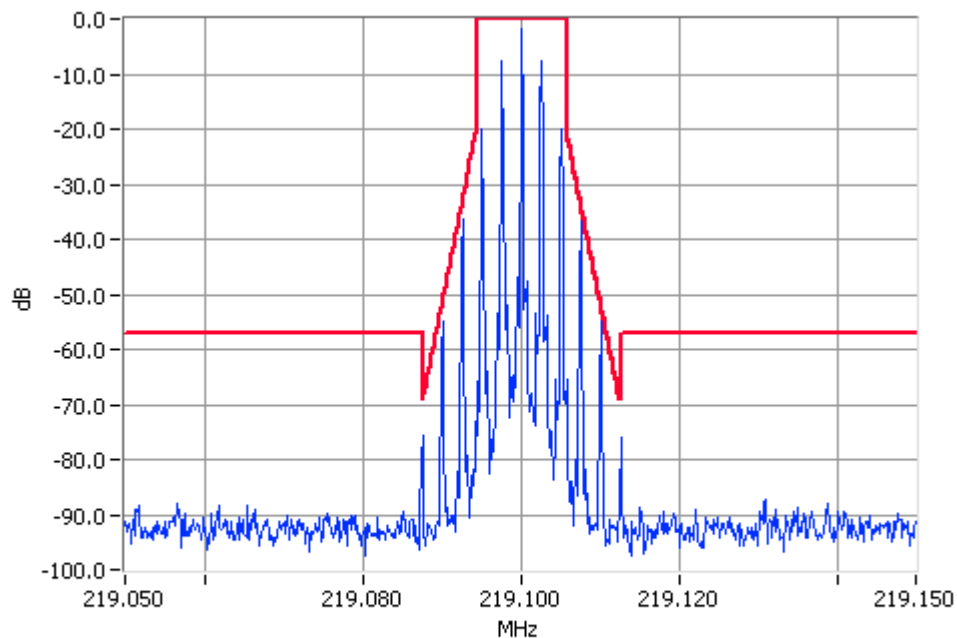
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 219.1 MHz 5 W 12.5 kHz Channel Spacing



Unmodulated 219.1000MHz Mask D 5W Pass
RBW=100Hz VBW=1000Hz



Analogue Modulation 219.1000MHz Mask D 5W Pass
RBW=100Hz VBW=1000Hz

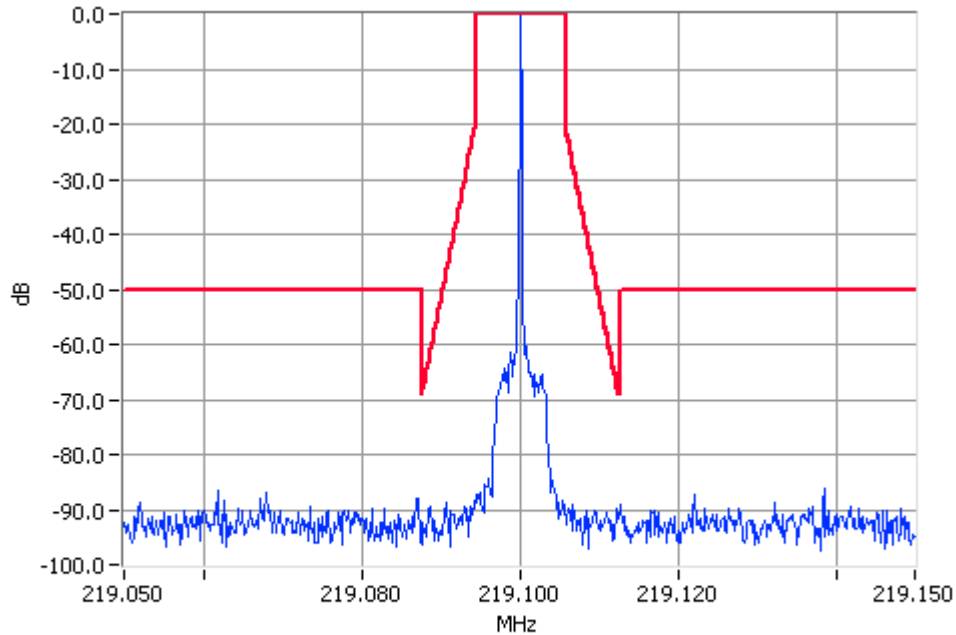
SIDEBAND SPECTRUM

ANALOGUE VOICE

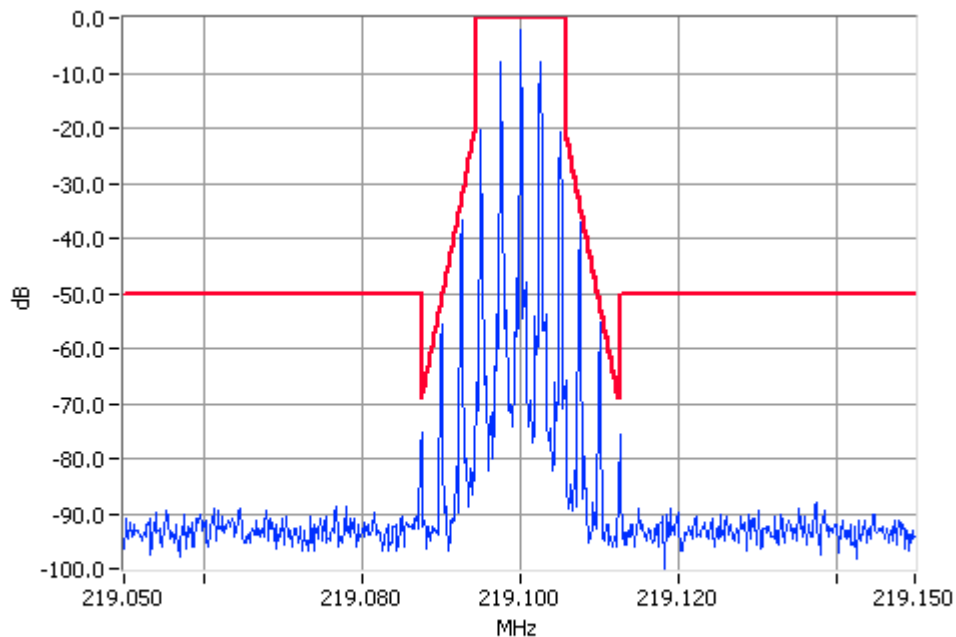
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 219.1 MHz 1 W 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

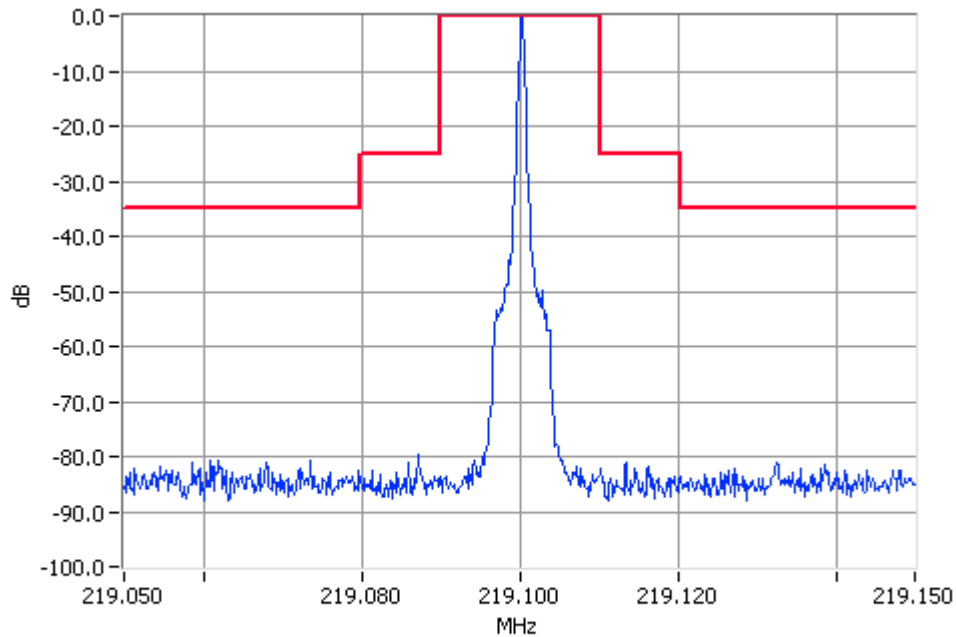
SIDEBAND SPECTRUM

ANALOGUE VOICE

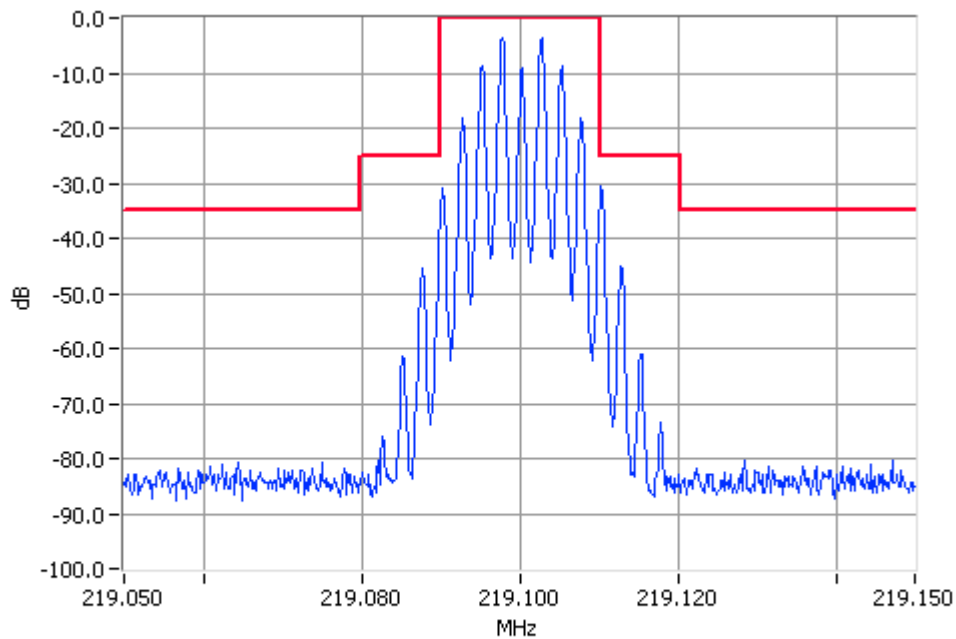
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 219.1 MHz 5 W 25.0 kHz Channel Spacing



Unmodulated 219.1000MHz Mask B 5W Pass
RBW=300Hz VBW=3000Hz



Analogue Modulation 219.1000MHz Mask B 5W Pass
RBW=300Hz VBW=3000Hz

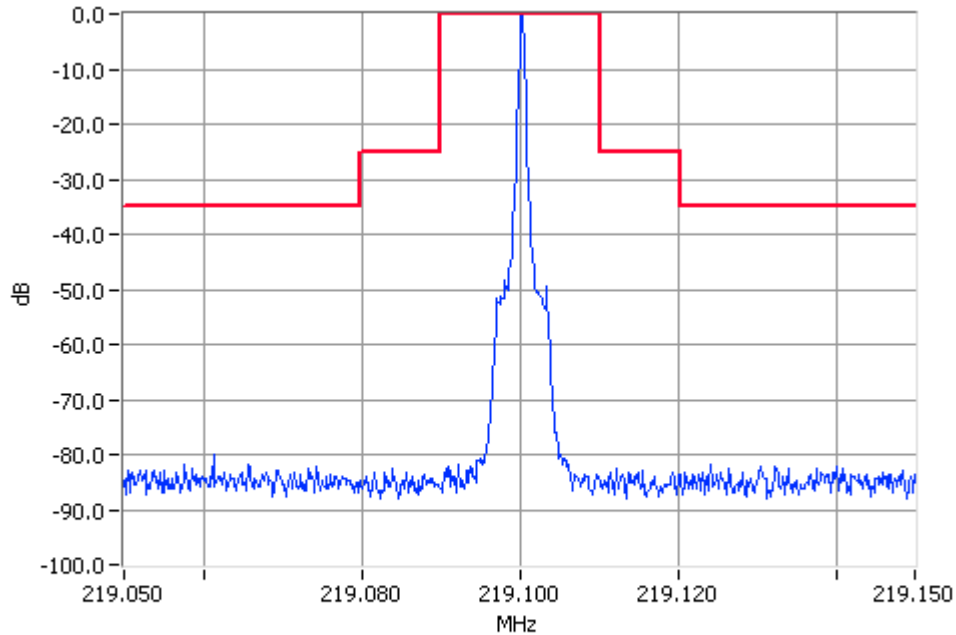
SIDEBAND SPECTRUM

ANALOGUE VOICE

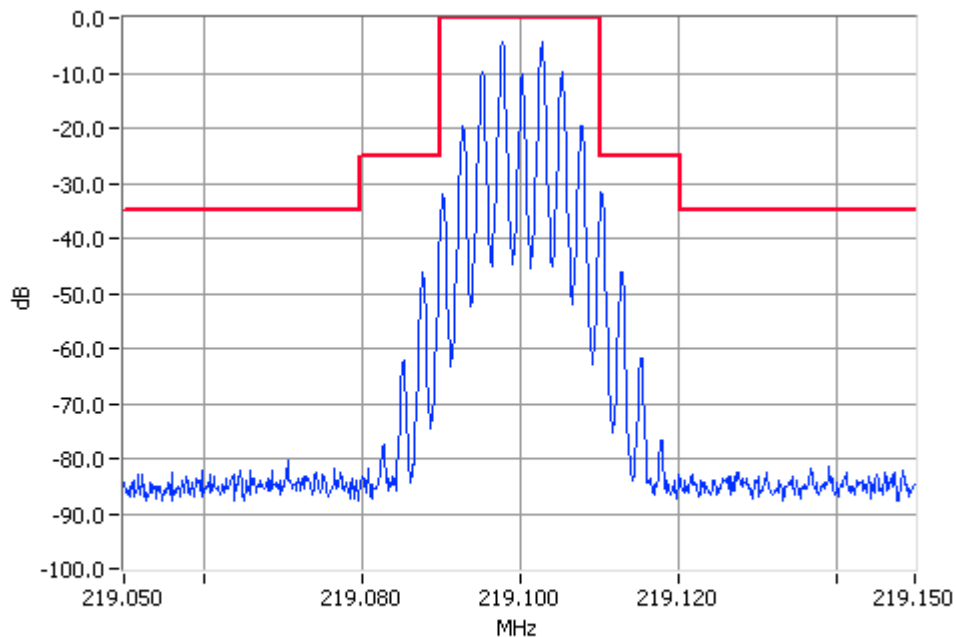
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 219.1 MHz 1W 25.0 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

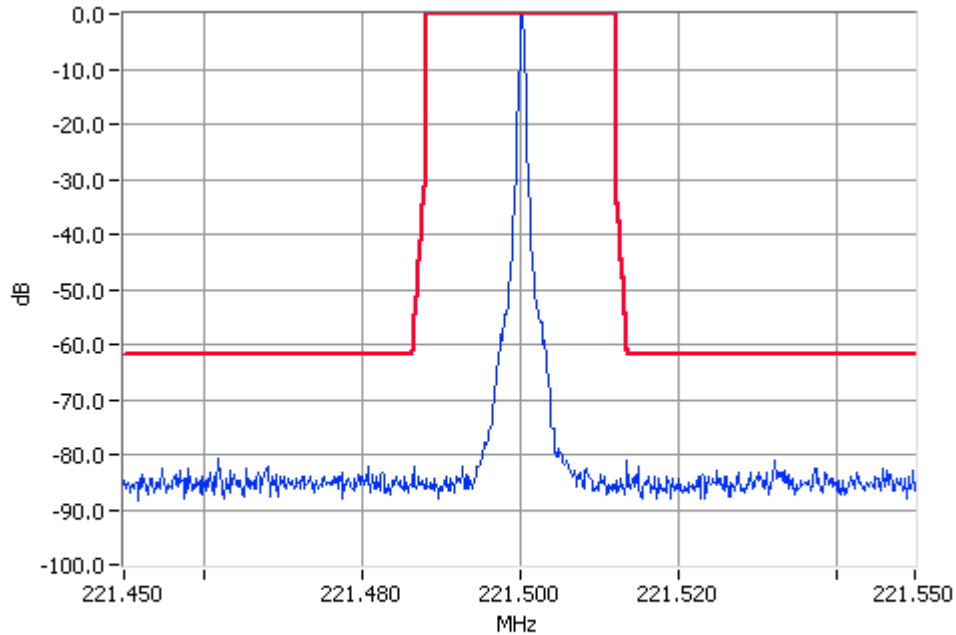
SIDEBAND SPECTRUM

ANALOGUE VOICE

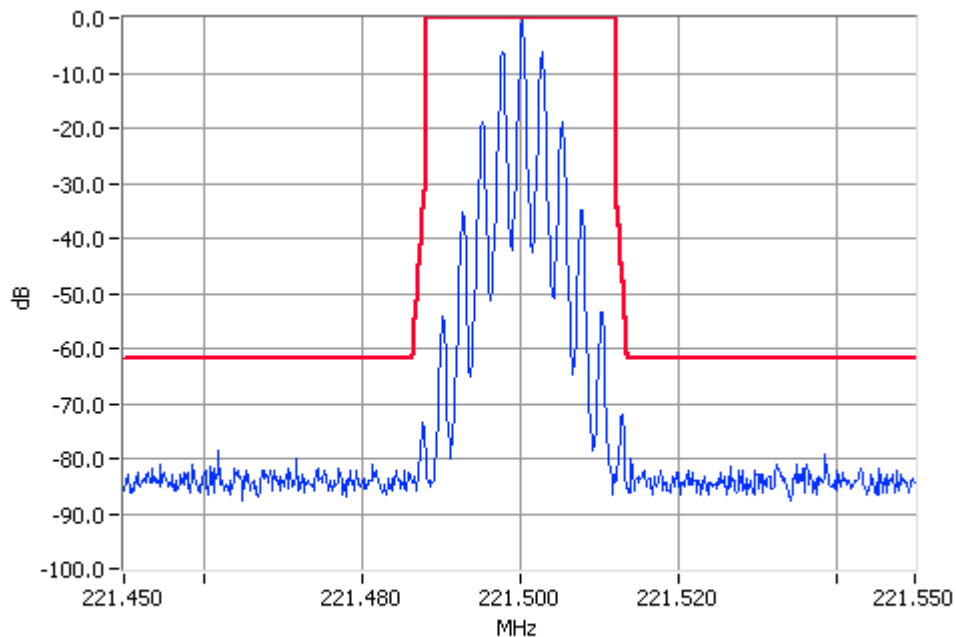
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 221.5 MHz 5 W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx5 5W Pass
RBW=300Hz VBW=3000Hz



Analogue Modulation 221.5000MHz Mask Fx5 5W Pass
RBW=300Hz VBW=3000Hz

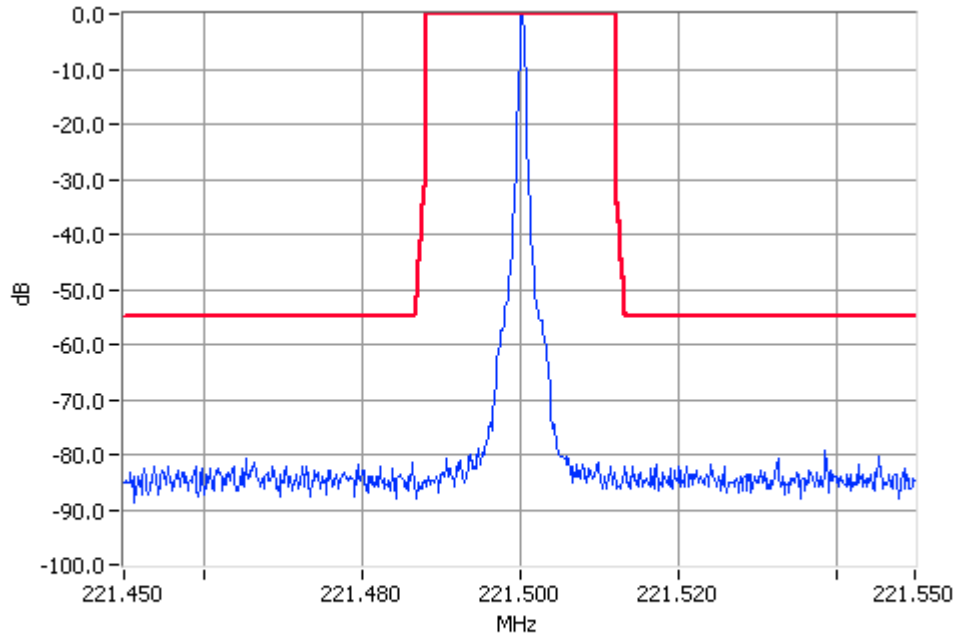
SIDEBAND SPECTRUM

ANALOGUE VOICE

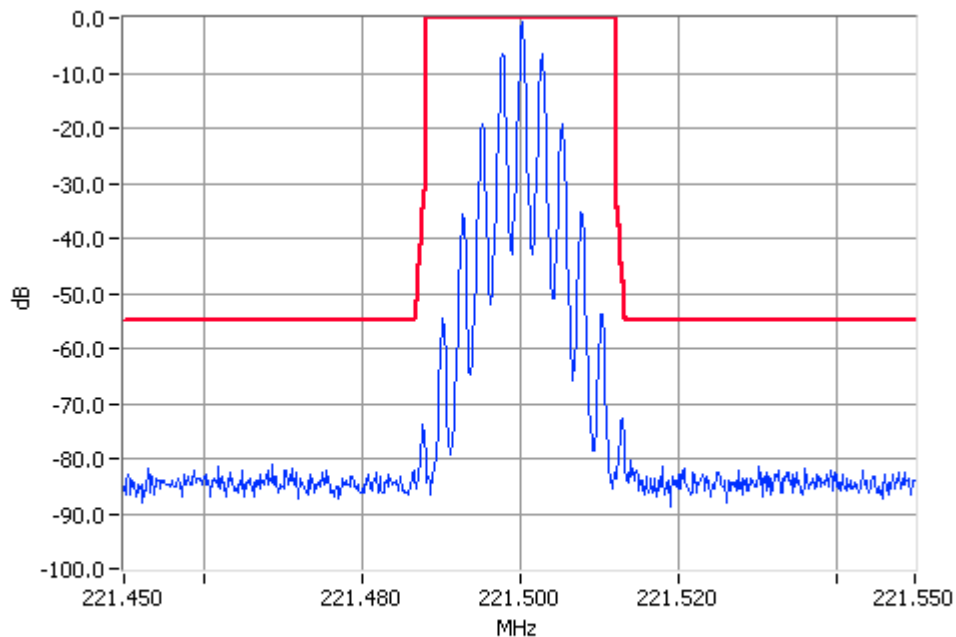
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 221.5 MHz 1 W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx5 1W Pass
RBW=300Hz VBW=3000Hz



Analogue Modulation 221.5000MHz Mask Fx5 1W Pass
RBW=300Hz VBW=3000Hz

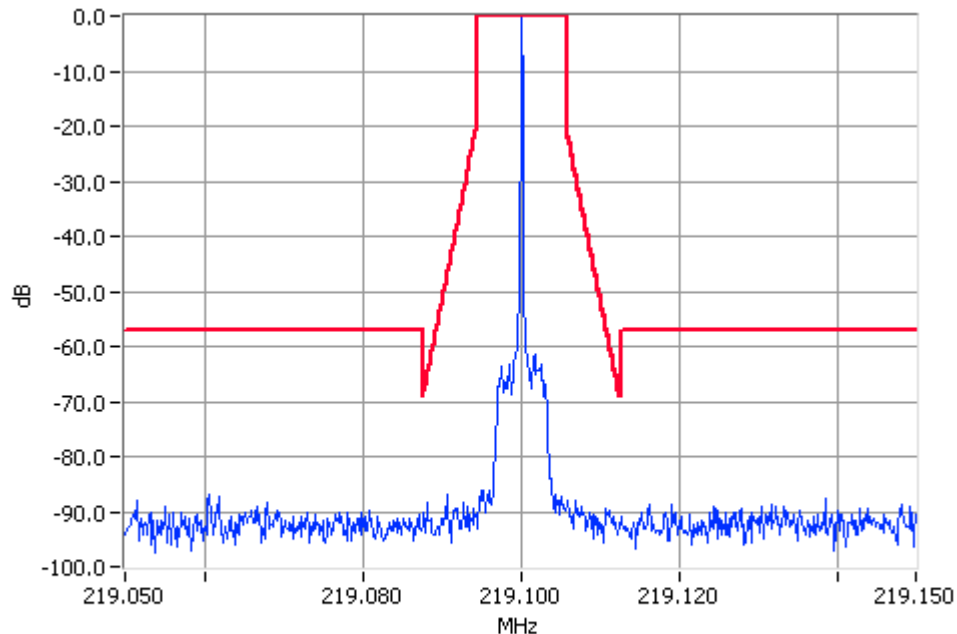
SIDEBAND SPECTRUM

FFSK

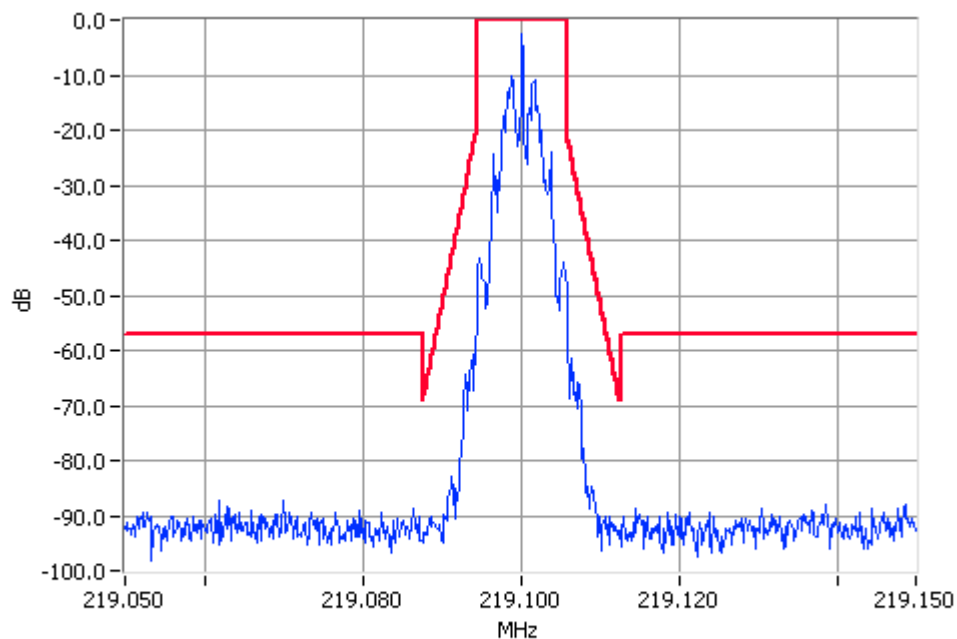
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 219.1 MHz 5 W 12.5 kHz Channel Spacing



Unmodulated 219.1000MHz Mask D 5W Pass
RBW=100Hz VBW=1000Hz



Digital Modulation 219.1000MHz Mask D 5W Pass
RBW=100Hz VBW=1000Hz

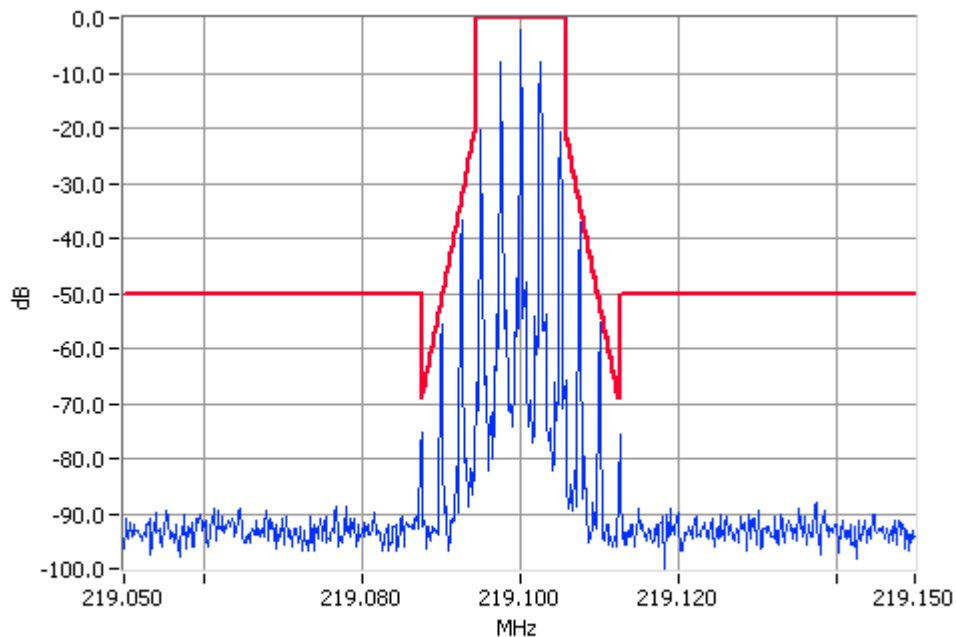
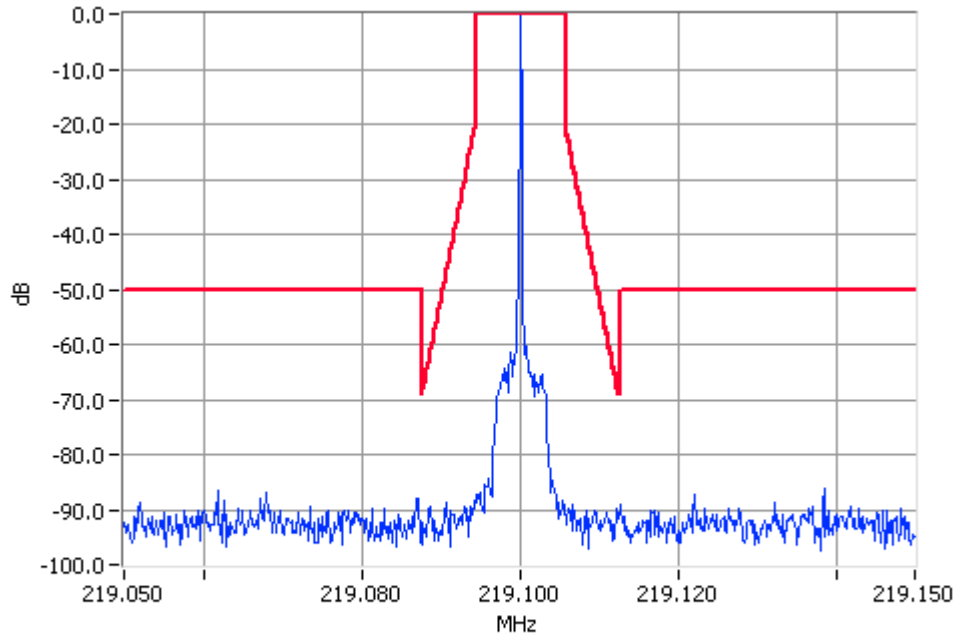
SIDEBAND SPECTRUM

FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 219.1 MHz 1 W 12.5 kHz Channel Spacing



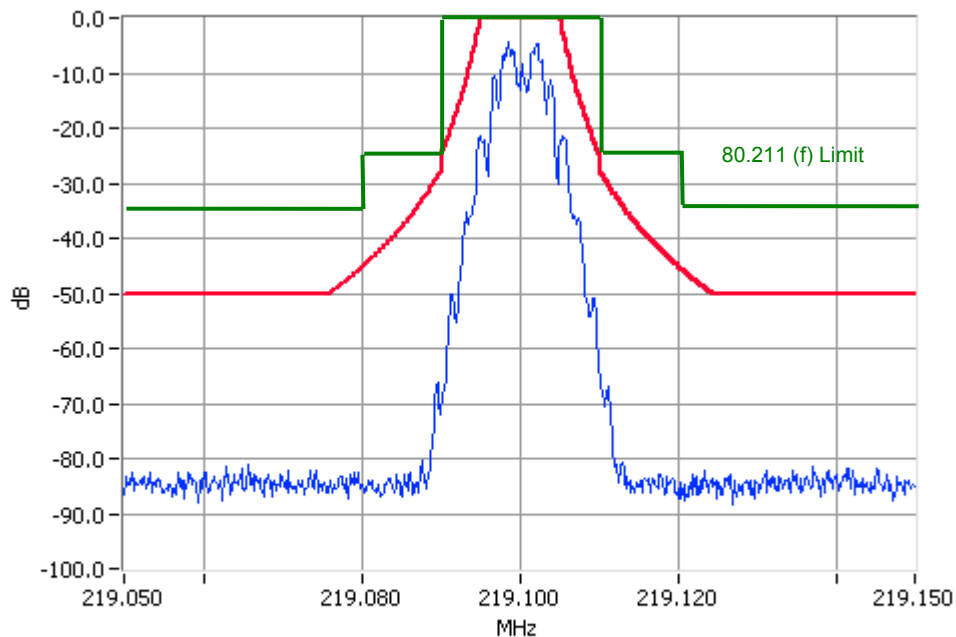
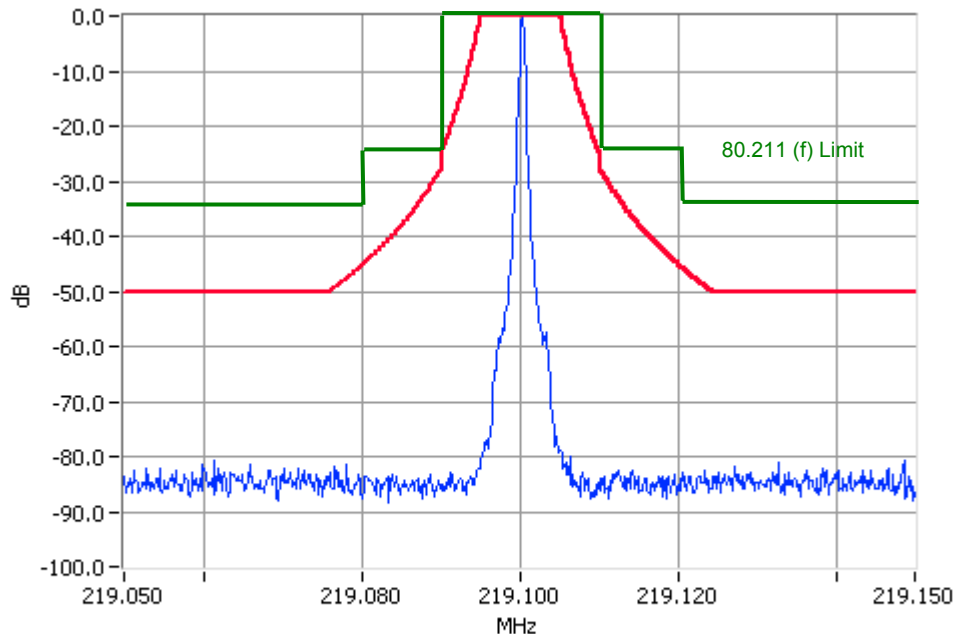
SIDEBAND SPECTRUM

FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 219.1 MHz 5 W 25.0 kHz Channel Spacing



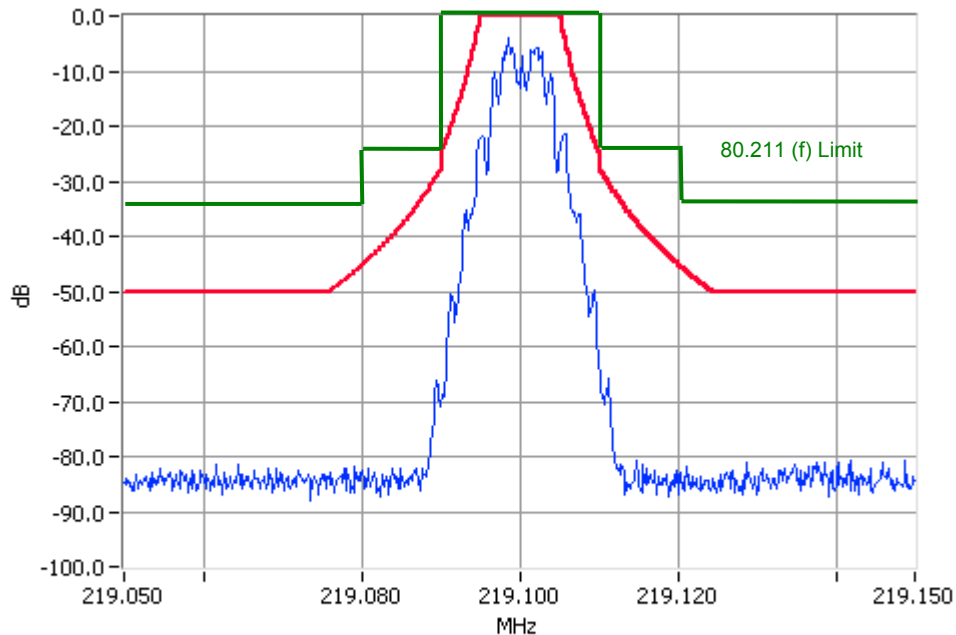
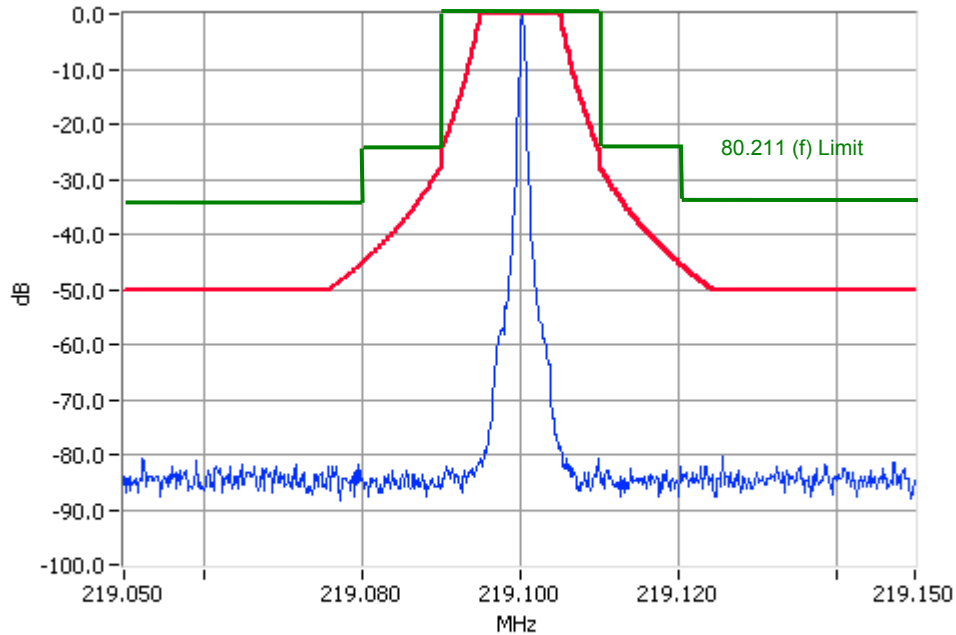
SIDEBAND SPECTRUM

FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 219.1 MHz 1 W 25.0 kHz Channel Spacing



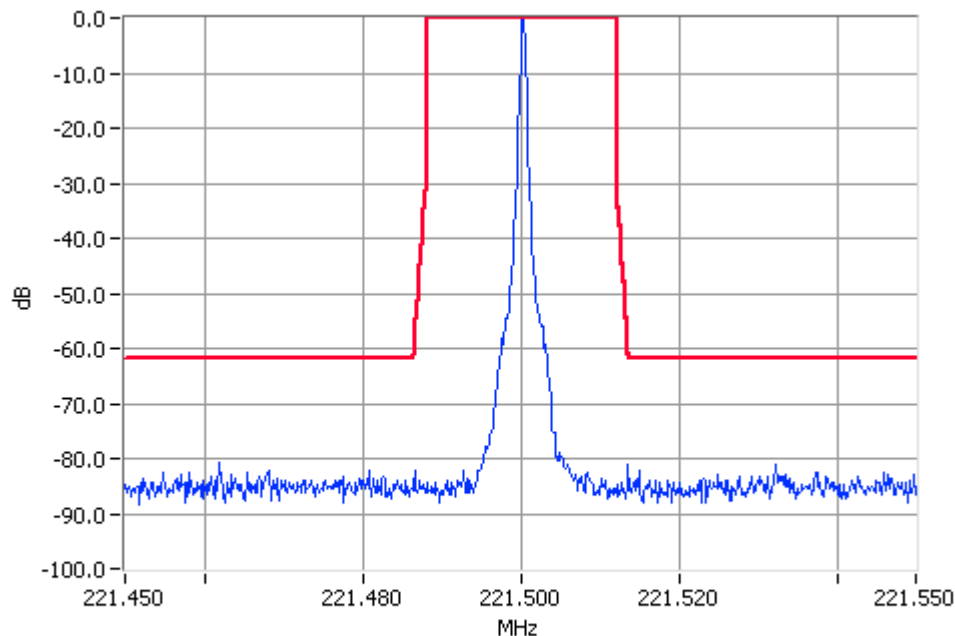
SIDEBAND SPECTRUM

FFSK

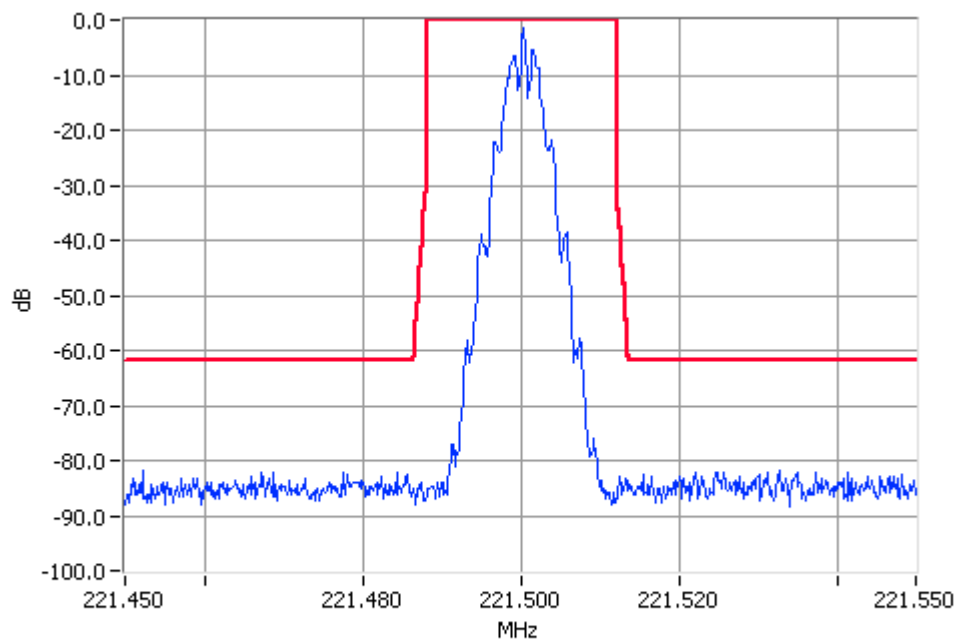
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 221.5 MHz 5 W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx5 5W Pass
RBW=300Hz VBW=3000Hz



Digital Modulation 221.5000MHz Mask Fx5 5W Pass
RBW=300Hz VBW=3000Hz

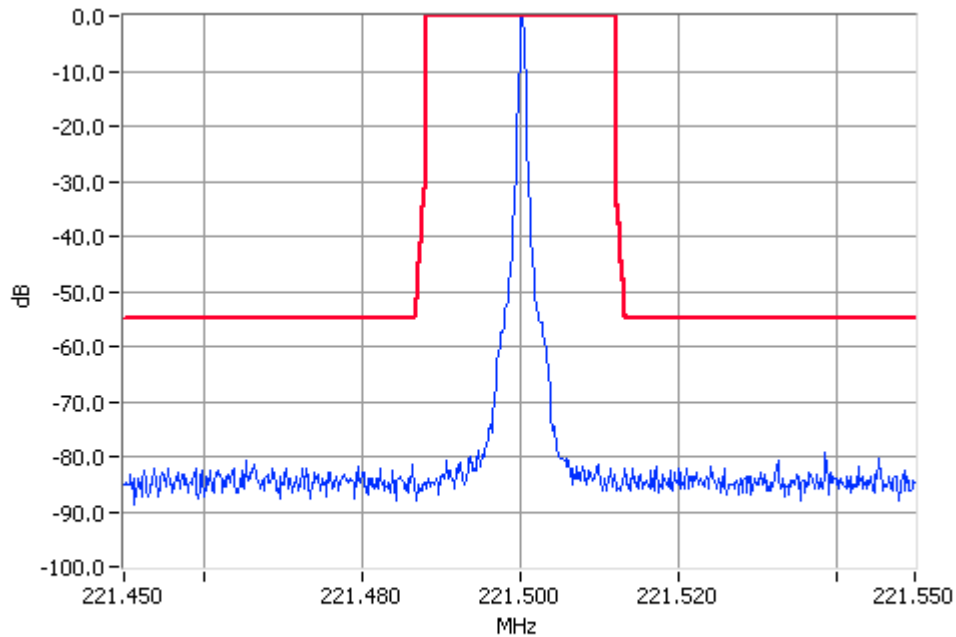
SIDEBAND SPECTRUM

FFSK

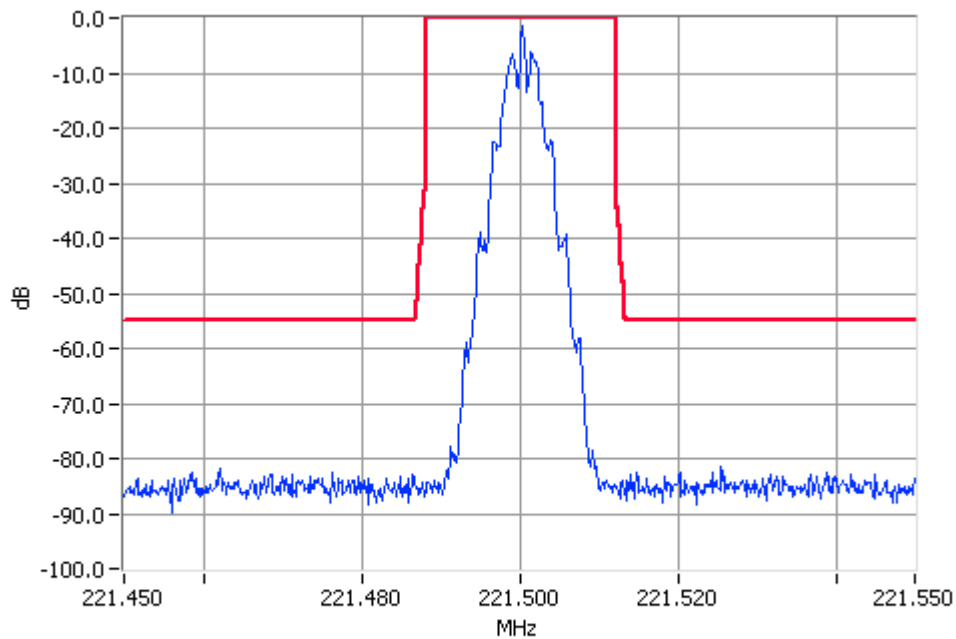
SPECIFICATION: FCC CFR 2.1049 (c)

Power Amplifier: TBA71C0 (12V PA)

Tx FREQUENCY: 221.5 MHz 1 W 12.5 kHz Channel Spacing



Unmodulated 221.5000MHz Mask Fx5 1W Pass
RBW=300Hz VBW=3000Hz



Digital Modulation 221.5000MHz Mask Fx5 1W Pass
RBW=300Hz VBW=3000Hz

SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1051

GUIDE: TIA/EIA-603C 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:
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:

Power Amplifier: TBA70C0 (PMU driven PA)		
25.0 kHz Channel Spacing 219.1 MHz @ 5 W		
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	FCC 47 CFR 80.211 (f) $43 + 10 \log_{10} (P_{\text{Watts}})$	
5 W	-13 dBm	50 dBc
1 W	-13 dBm	43 dBc

Measurement Uncertainty (dB)	± 3.0
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SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1051

GUIDE: TIA/EIA-603C 2.2.13

Power Amplifier: TBA70C0 (PMU driven PA)		
25.0 kHz Channel Spacing 219.1 MHz @ 1 W		
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	FCC 47 CFR 80.211 (f) $43 + 10 \log_{10} (P_{\text{Watts}})$	
5 W	-13 dBm	50 dBc
1 W	-13 dBm	43 dBc

Measurement Uncertainty (dB)	± 3.0
---------------------------------	-------

SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 221.5 MHz

Power Amplifier: TBA70C0 (PMU driven PA)		
12.5 kHz Channel Spacing	221.5 MHz @ 5 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 $55 + 10 \log_{10}(P_{\text{Watts}})$	
5 W	-25 dBm	62 dBc
1 W	-25 dBm	55 dBc

Measurement Uncertainty (dB)	± 3.0
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Tx FREQUENCY: 221.5 MHz

LIMITS:

Measurement Uncertainty (dB)	± 3.0
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SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1051

GUIDE: TIA/EIA-603C 2.2.13

Power Amplifier: TBA71C0 (12V PA)		
25.0 kHz Channel Spacing 219.1 MHz @ 5 W		
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	FCC 47 CFR 80.211 (f) $43 + 10 \log_{10} (P_{\text{Watts}})$	
5 W	-13 dBm	50 dBc
1 W	-13 dBm	43 dBc

Measurement Uncertainty (dB)	± 3.0
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SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1051

GUIDE: TIA/EIA-603C 2.2.13

Power Amplifier: TBA71C0 (12V PA)		
25.0 kHz Channel Spacing 219.1 MHz @ 1 W		
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	FCC 47 CFR 80.211 (f) $43 + 10 \log_{10} (P_{\text{Watts}})$	
5 W	-13 dBm	50 dBc
1 W	-13 dBm	43 dBc

Measurement Uncertainty (dB)	± 3.0
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SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 221.5 MHz

Power Amplifier: TBA71C0 (12V PA)		
12.5 kHz Channel Spacing	221.5 MHz @ 5 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 $55 + 10 \log_{10}(P_{\text{Watts}})$	
5 W	-25 dBm	62 dBc
1 W	-25 dBm	55 dBc

Measurement Uncertainty (dB)	± 3.0
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Tx FREQUENCY: 221.5 MHz

LIMITS:

Measurement Uncertainty (dB)	± 3.0
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SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA/EIA-603C 2.2.12

MEASUREMENT PROCEDURE:

1. Refer Appendix A for equipment set up.
2. Initial Scan
 - a) The EUT is placed in S-Line TEM cell and emissions are measured from 30MHz to 1000MHz. The output terminal was connected to an RF dummy load.
 - b) Any emission within 20dB of the limit is then re-tested on the OATS, along with measurements from 1000MHz to the 10th harmonic of the fundamental.
3. OATS Measurement
 - a) 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.
 - b) 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. Valid emissions were determined by switching the EUT on and off.
 - c) The EUT was then replaced by a signal generator and substitution antenna to make measurements by the substitution method.

MEASUREMENT RESULTS:

Power Amplifier: TBA70C0 (PMU driven PA)		
25.0 kHz Channel Spacing 219.1 MHz @ 5 W		
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	FCC 47 CFR 80.211 (f) $43 + 10 \log_{10}(P_{\text{Watts}})$	
5 W	-13 dBm	50 dBc
1 W	-13 dBm	43 dBc

Measurement Uncertainty (dB)	± 4.6
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FCC ID: CASTBA7C0

Report Revision: 1
Issue Date: 17-Oct-2005

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Power Amplifier: TBA70C0 (PMU driven PA)		
25.0 kHz Channel Spacing 219.1 MHz @ 1 W		
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	FCC 47 CFR 80.211 (f) $43 + 10 \log_{10}(P_{\text{Watts}})$	
5 W	-13 dBm	50 dBc
1 W	-13 dBm	43 dBc

Measurement Uncertainty (dB)	± 4.6
---------------------------------	-------

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 221.5 MHz

Power Amplifier: TBA70C0 (PMU driven PA)		
25.0 kHz Channel Spacing 221.5 MHz @ 5 W		
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 $55 + 10 \log_{10} (P_{\text{Watts}})$	
5 W	-25 dBm	62 dBc
1 W	-25 dBm	55 dBc

Measurement Uncertainty (dB)	± 4.6
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SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 221.5 MHz

Power Amplifier: TBA70C0 (PMU driven PA)		
25.0 kHz Channel Spacing 221.5 MHz @ 1 W		
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 $55 + 10 \log_{10}(P_{\text{Watts}})$	
5 W	-25 dBm	62 dBc
1 W	-25 dBm	55 dBc

Measurement Uncertainty (dB)	± 4.6
---------------------------------	-------

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Power Amplifier: TBA71C0 (12V PA)		
25.0 kHz Channel Spacing 219.1 MHz @ 5 W		
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	FCC 47 CFR 80.211 (f) $43 + 10 \log_{10}(P_{\text{Watts}})$	
5 W	-13 dBm	50 dBc
1 W	-13 dBm	43 dBc

Measurement Uncertainty (dB)	± 4.6
---------------------------------	-------

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Power Amplifier: TBA71C0 (12V PA)		
25.0 kHz Channel Spacing 219.1 MHz @ 1 W		
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	FCC 47 CFR 80.211 (f) $43 + 10 \log_{10}(P_{\text{Watts}})$	
5 W	-13 dBm	50 dBc
1 W	-13 dBm	43 dBc

Measurement Uncertainty (dB)	± 4.6
---------------------------------	-------

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 221.5 MHz

Power Amplifier: TBA71C0 (12V PA)		
25.0 kHz Channel Spacing 221.5 MHz @ 5 W		
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 $55 + 10 \log_{10}(P_{\text{Watts}})$	
5 W	-25 dBm	62 dBc
1 W	-25 dBm	55 dBc

Measurement Uncertainty (dB)	± 4.6
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SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 221.5 MHz

Power Amplifier: TBA71C0 (12V PA)		
25.0 kHz Channel Spacing 221.5 MHz @ 1 W		
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 $55 + 10 \log_{10}(P_{\text{Watts}})$	
5 W	-25 dBm	62 dBc
1 W	-25 dBm	55 dBc

Measurement Uncertainty (dB)	± 4.6
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TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

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

GUIDE: TIA/EIA-603C 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).

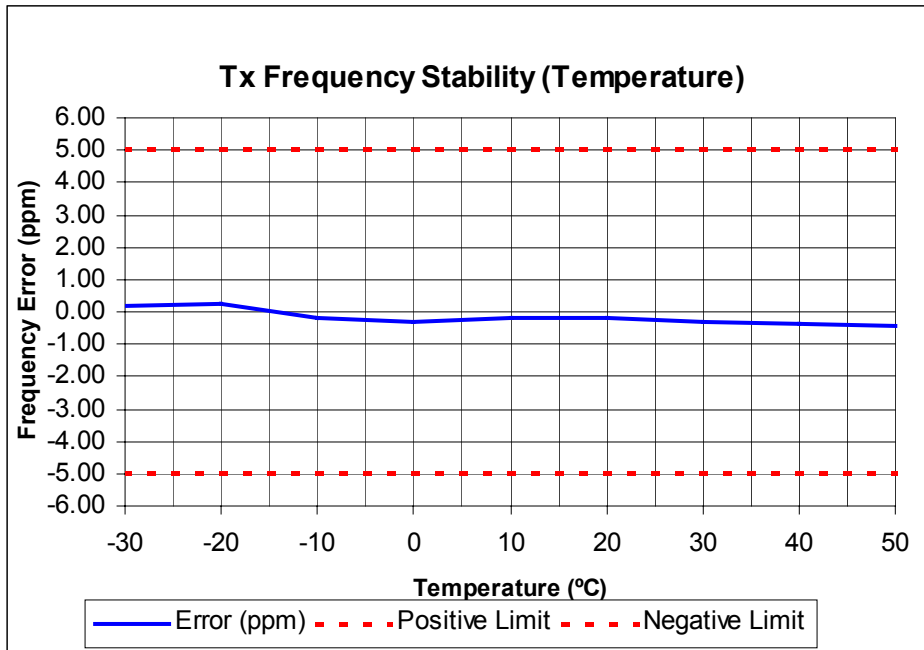
LIMIT CLAUSE: FCC 47 CFR 80.209	
Frequency Range	Frequency Error (ppm)
216 – 220 MHz	5.0
LIMIT CLAUSE: FCC 47 CFR 90.213	
Frequency Range	Frequency Error (ppm)
216 – 220 MHz	1.0
220 – 222 MHz	0.1
Tait Electronics Ltd. Claimed Frequency Stability	
193 – 225 MHz	0.5

Measurement Uncertainty (Hz)	± 50
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TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

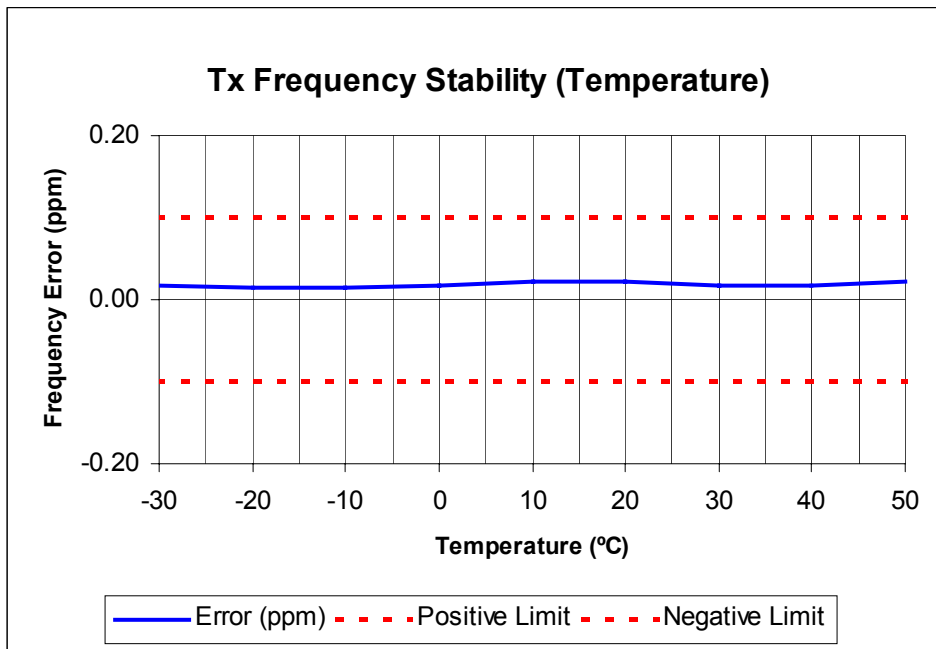
SPECIFICATION: FCC 47 CFR 2.1055 (a) (1)

Tx FREQUENCY: 219.1 MHz 5 W
Power Amplifier: TBA70C0 (PMU driven PA)



Tx FREQUENCY: 221.5 MHz 5 W
Power Amplifier: TBA70C0 (PMU driven PA)

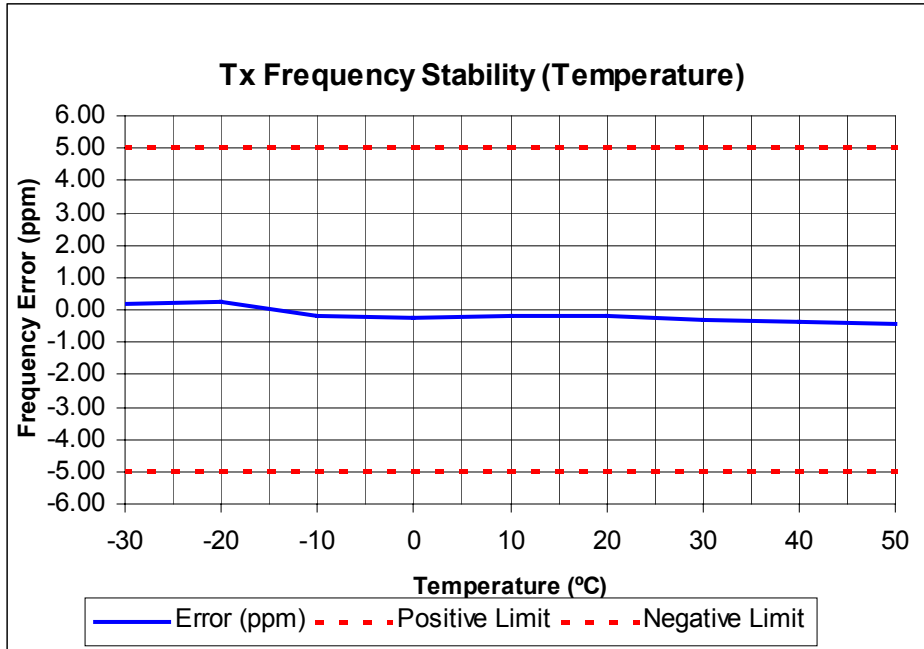
(External 10 MHz Frequency Reference T801-20-000)



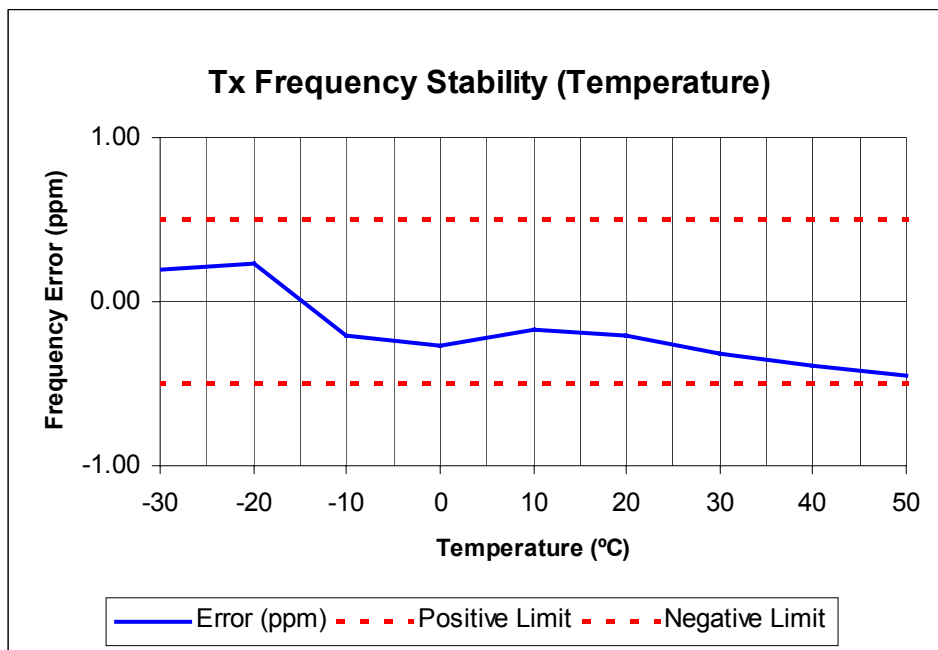
TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

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

Tx FREQUENCY: 219.1 MHz 5 W
Power Amplifier: TBA71C0 (12V PA)



Tx FREQUENCY: 221.5 MHz 5 W
Power Amplifier: TBA71C0 (12V PA)
(EUT Internal Frequency Reference)



TRANSMITTER FREQUENCY STABILITY (VOLTAGE)

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

GUIDE: TIA/EIA-603C 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 85% to 115%.
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

Power Amplifier: TBA70C0 (PMU driven PA)			
Frequency	FREQUENCY ERROR (ppm) @		
	102 V ac	120 V ac	138 V ac
219.1 MHz	0.19	0.19	0.19

Power Amplifier: TBA70C0 (PMU driven PA)			
Frequency 221.5 MHz	FREQUENCY ERROR (ppm)		
	102 V ac	120 V ac	138 V ac
EUT Internal Frequency Reference	0.20	0.20	0.19
External 10 MHz Frequency Reference T801-20-000	0.03	0.02	0.03

LIMIT CLAUSE:		FCC 47 CFR 80.209
Frequency Range	Frequency Error (ppm)	
216 – 220 MHz	5.0	
LIMIT CLAUSE:		FCC 47 CFR 90.213
Frequency Range	Frequency Error (ppm)	
216 – 220 MHz	1.0	
220 – 222 MHz	0.1	
Tait Electronics Ltd. Claimed Frequency Stability		
193 – 225 MHz	0.5	

Measurement Uncertainty (Hz)	± 50
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FCC ID: CASTBA7C0

Report Revision: 1
Issue Date: 17-Oct-2005

TRANSMITTER FREQUENCY STABILITY (VOLTAGE)

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

Power Amplifier: TBA71C0 (12V PA)			
Frequency	FREQUENCY ERROR (ppm)		
	11.7 V dc	13.8 V dc	15.9 V ac
219.1 MHz	0.20	0.20	0.21

Power Amplifier: TBA71C0 (12V PA)			
Frequency 221.5 MHz	FREQUENCY ERROR (ppm)		
	11.7 V dc	13.8 V dc	15.9 V ac
EUT Internal Frequency Reference	0.19	0.21	0.21
External 10 MHz Frequency Reference T801-20-000	0.02	0.03	0.02

LIMIT CLAUSE: FCC 47 CFR 80.209	
Frequency Range	Frequency Error (ppm)
216 – 220 MHz	5.0
LIMIT CLAUSE: FCC 47 CFR 90.213	
Frequency Range	Frequency Error (ppm)
216 – 220 MHz	1.0
220 – 222 MHz	0.1
Tait Electronics Ltd. Claimed Frequency Stability	
193 – 225 MHz	0.5

Measurement Uncertainty (Hz)	± 50
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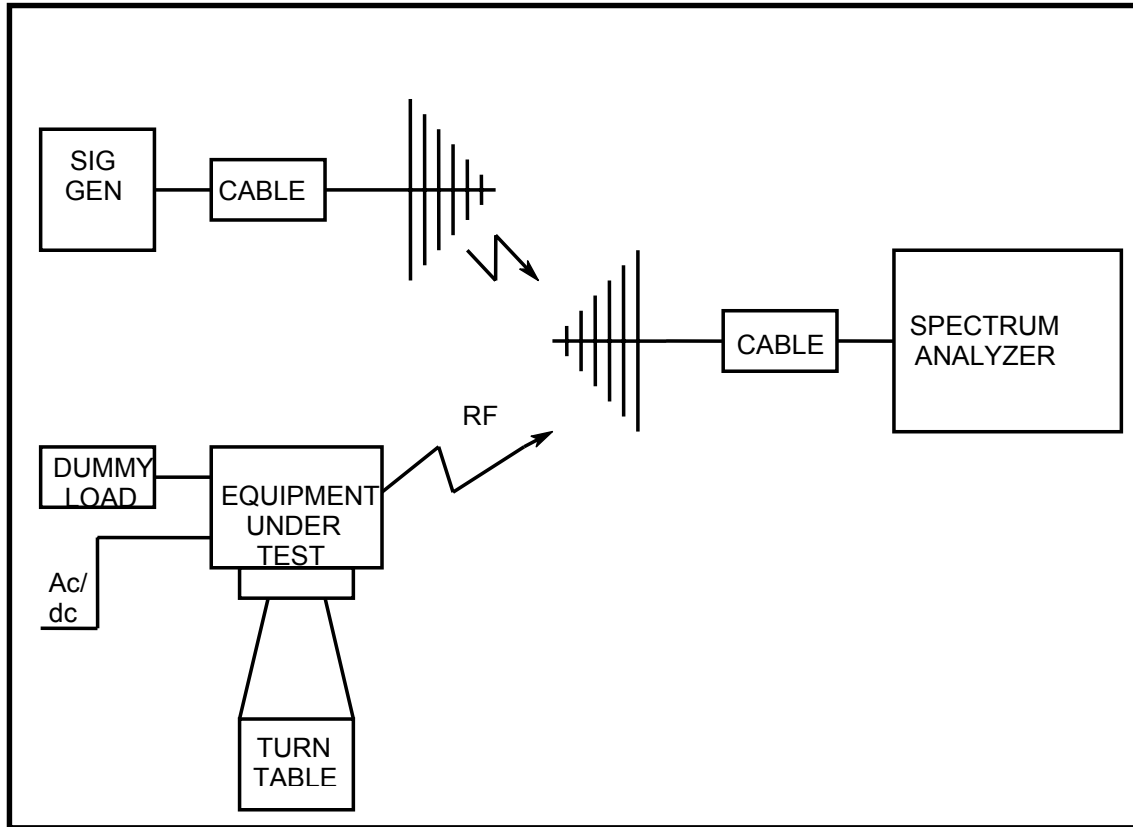
TEST EQUIPMENT USED

No #	Equipment	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
11	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073	26-Nov-06
13	Audio Analyser	Hewlett Packard	HP8903A	2308A02597	E3074	28-Nov-06
20	Power Supply	Hewlett Packard	HP6032A	2441A00412	E3075	26-Nov-06
21	Power Supply	Rohde & Schwarz	NGS M32/10 192.0810.31	Fnr 434	E3556	16-Oct-07
24	Environ. Chamber	Contherm	Spatial Cal	E3397	E3397	21-Apr-07
24	Environ. Chamber	Contherm	Temp Control	E3397	E3397	21-Apr-07
37	Variac	Yamabishi	S-260-5	TX-533	E1737	Cal on use
43	Horn Antenna	Emco	DRG3115	2084	E3076	27-Dec-07
46	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	20-Mar-09
66	RF Attenuator 25W	Weinschel	33-20-33	BD5871	E3673	24-Nov-06
71	RF Load 50W	Weinschel	F1426	BF0487	E3675	24-Nov-06
72	RF Load 50W	Weinschel	F1426	AE2490	E3624	24-Nov-06
83	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25006/4A	E3693	25-Nov-06
85	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25004/4A	E3691	25-Nov-06
87	Audio Analyser	Hewlett Packard	HP8903B	2818A04275	E3710	23-Nov-06
88	Spectrum Analyser	Hewlett Packard	HP8562E	3821A00779	E3715	25-Nov-06
111	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	23-Nov-06
115	Environ. Chamber	Contherm	5400 RHSLT.M	1416	E4051	21-Apr-07
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	4-Jul-07
144	AC Voltmeter	Tait				5-Apr-07
145	AC Voltmeter	Tait				10-Apr-07
148	Power Sensor	Hewlett Packard	11722A	3111A05573	E7054	2-Aug-07

APPENDIX A

TEST SETUP DETAILS

Radiated Emissions Set up.



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 Sideband Spectrum.

