

## Laboratory Test Report

For the

TPAB12-K500A Portable Transceiver

Tested In accordance with

FCC 47 CFR Parts 22, 90S and 90R

Report Revision: 1  
Issue Date: 13-Oct-2005  
FCC ID: CASTPAK5A

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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
13-Oct-2005	1	Initial test report

## INTRODUCTION

Type Approval Testing of the TPAB12-K500A (Serial No 21001664)  
in accordance with:

FCC CFR 47 Parts 22, 90S & 90R

## REPORT PREPARED FOR

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

## DESCRIPTION OF SAMPLE

Equipment:	Portable Transceiver
Type:	TPAK5A
Product code:	TPAB12-K500A
Serial Numbers:	21001664
Quantity:	1
Frequency range:	Transmit - 762 – 870 MHz Receive - 762 – 776 MHz 850 – 870 MHz
Output Power:	Switchable between 1 and 3W
Channel Spacings:	12.5 kHz, 20kHz, 25kHz

## STATEMENT OF COMPLIANCE

The TPAB12-K500A mobile transceiver as tested in this report was found to conform to the following standards:

**FCC CFR 47 Parts 22, 90S & 90R**

## 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	7.5 Vdc

## 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	Emission Designator
	$M = 3 \text{ kHz}$	<b>11K0F3E</b>
	$D = 2.5 \text{ kHz}$	F3E represents a FM voice transmission
	$B_n = 6 + 5 \times 1$	
	$= 11\text{kHz}$	
25kHz Bandwidth	Necessary bandwidth	Emission Designator
	$M = 3 \text{ kHz}$	<b>16K0F3E</b>
	$D = 5 \text{ kHz}$	F3E represents a FM voice transmission
	$B_n = 6 + 10 \times 1$	
	$= 16 \text{ kHz}$	

### 2. Fast Frequency Shift Keying (FFSK)

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

**2. Digital Voice /Data (C4FM 4 – Level FSK) – CFR 47 90.212 (b)**

Digital Voice/data transmissions use a 4 level frequency shift keying modulation scheme.

The necessary bandwidth as been measured using the 99% energy rule, and in accordance with TIA/EIA 102 CAAB 2.2.5.2

12.5kHz Bandwidth    99% bandwidth  
8.1 kHz

Emission Designator

**8K10F1E**

F1E represents a digital FM voice transmission

**8K10F7E**

F7E represents two or more channels containing quantized or digital voice information

**8K10F1D**

F1D represents a digital FM data transmission

**8K10F7D**

F7D represents two or more channels containing quantized or digital information

**5. Digital Voice Encryption (C4FM 4 – Level FSK) – CFR 47 90.212 (b)**

12.5kHz Bandwidth    99% bandwidth  
8.1 kHz

Emission Designator

**8K10F1E**

F1E represents a digital FM voice transmission

## 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:**

Frequency Range: 806 – 824 MHz

Limit Clause FCC 47 CFR 90.653

Frequency	Nominal Power (W)	Measured Power (W)	Variation from Nominal (%)
807.55 MHz	3	2.79	7
807.55 MHz	1	0.83	17
816.5125 MHz	3	2.73	9
816.5125 MHz	1	0.85	15
Measurement Uncertainty (dB)	+0.63 -0.68		

Frequency Range: 794 – 806 MHz

Limit Clause FCC 47 CFR 90.541 (c), (d)

Frequency	Nominal Power (W)	Measured Power (W)	Variation from Nominal (%)
795.9875 MHz	3	2.76	8
975.9875 MHz	1	0.85	15
794 MHz	2	1.84	8
Measurement Uncertainty (dB)	+0.63 -0.68		

FCC 47 CFR 90.205 (r)

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:

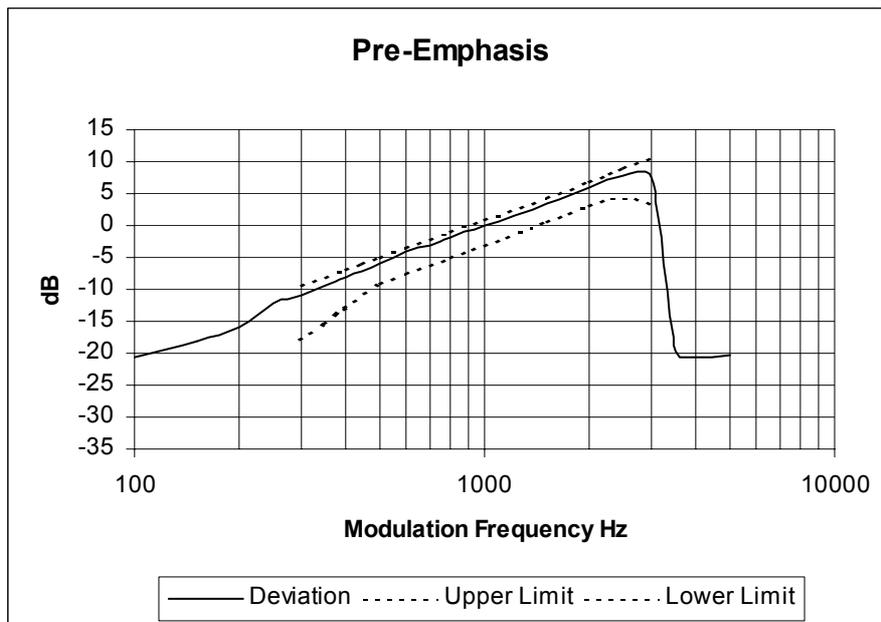
1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000Hz was applied with the level set to obtain 20% of maximum deviation. This was used as the 0dB reference point.
3. The AF was varied while the audio level was held constant.
4. The response in dB relative to 1000Hz was measured.

LIMIT CLAUSE: TIA/EIA-603C 3.2.6

MEASUREMENT RESULTS:

See the plots on the following pages.

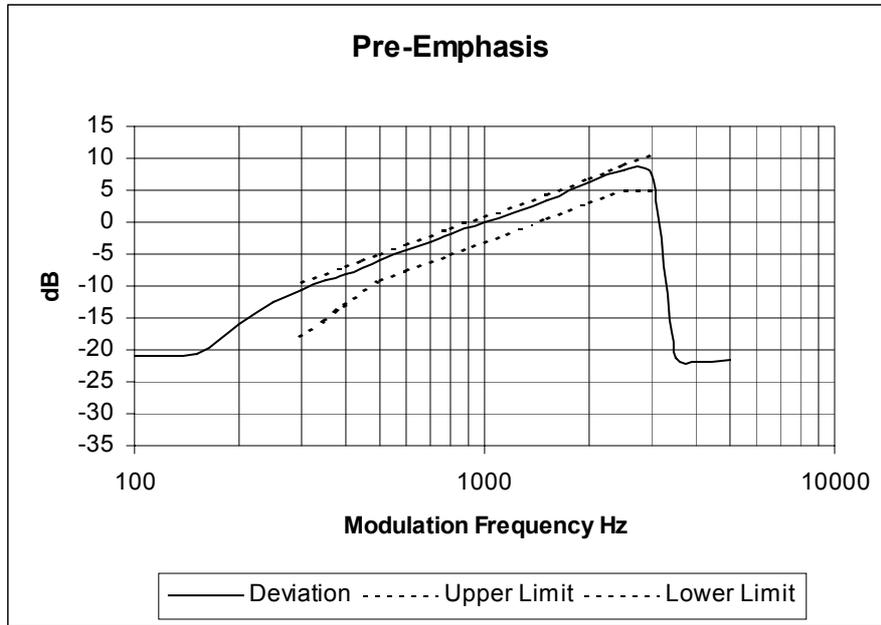
Tx FREQUENCY: 807.55 MHz                      12.5 kHz Channel Spacing



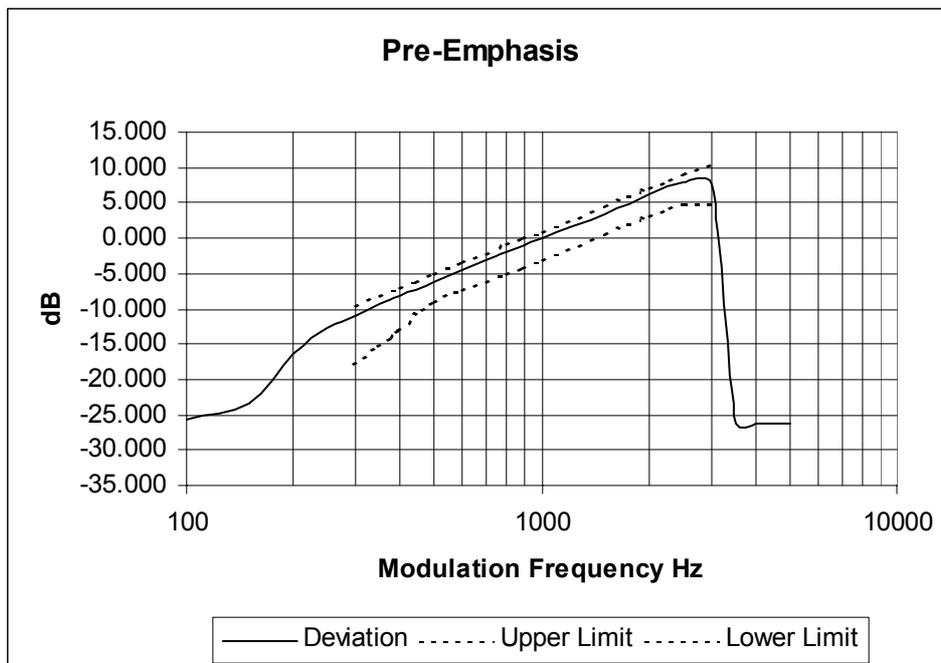
TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 807.55 MHz 25 kHz Channel Spacing



Tx FREQUENCY: 816.5125 MHz 25 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

MEASUREMENT PROCEDURE:

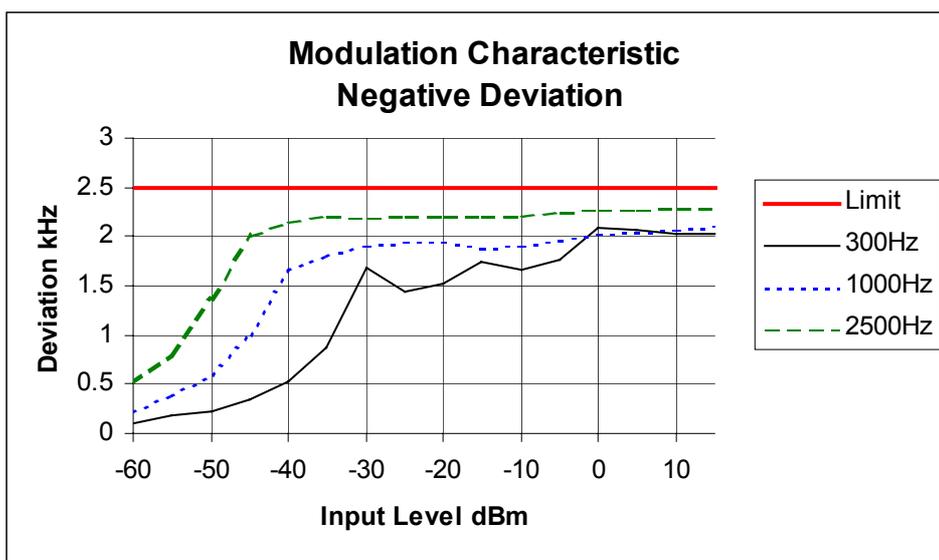
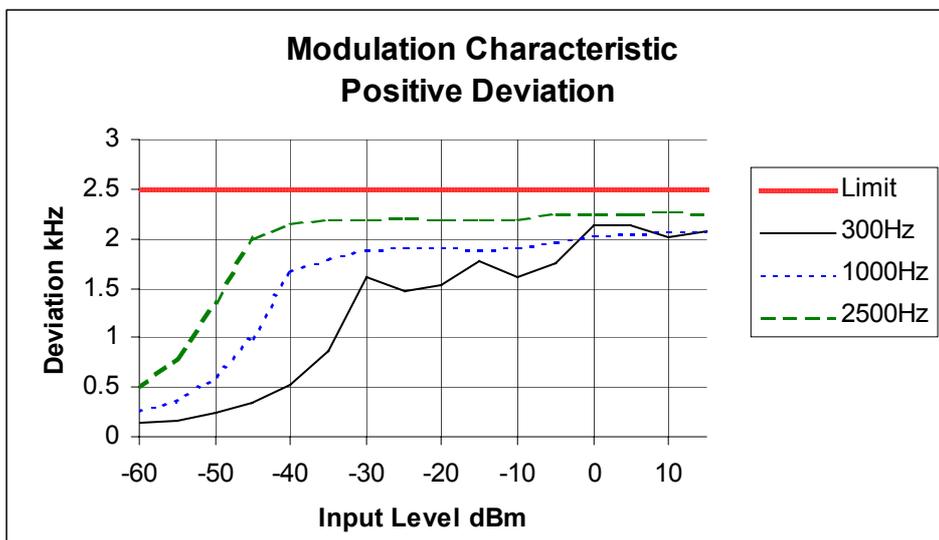
1. Refer Annex A for Equipment set up.
2. The modulation response was measured at three audio frequencies while varying the input level.
3. Measurements were made for both Positive and Negative Deviation.

MEASUREMENT RESULTS:

See the plots on the following pages.

LIMIT CLAUSE: TIA/EIA-603C 1.3.4.4

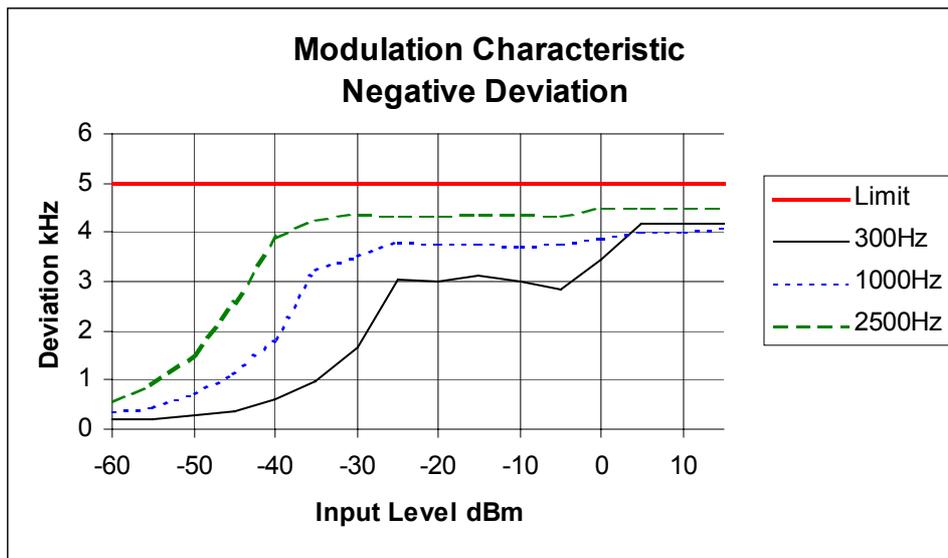
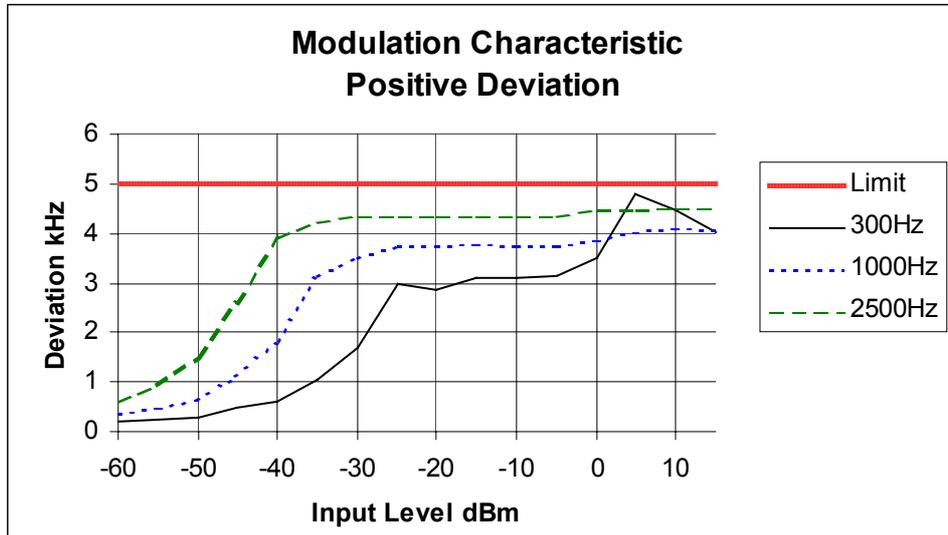
Tx FREQUENCY: 807.55 MHz 12.5 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

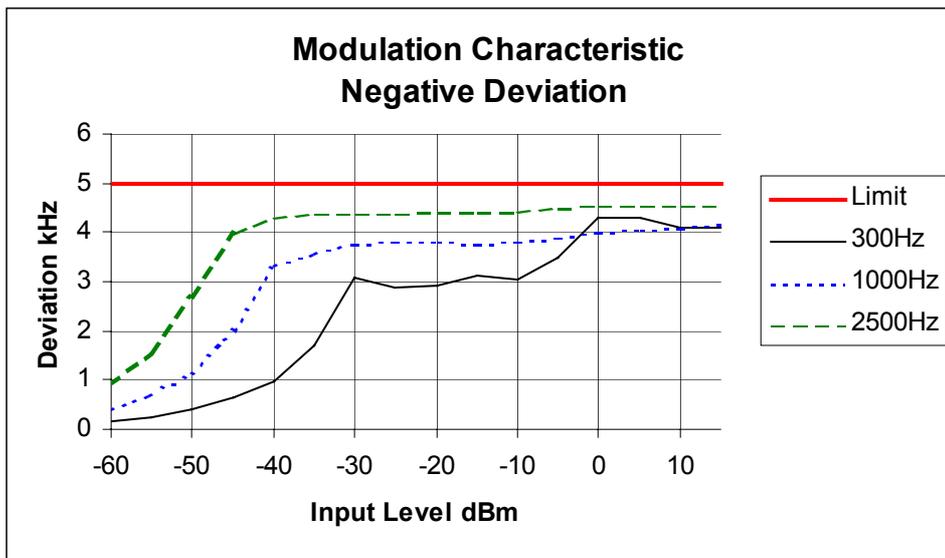
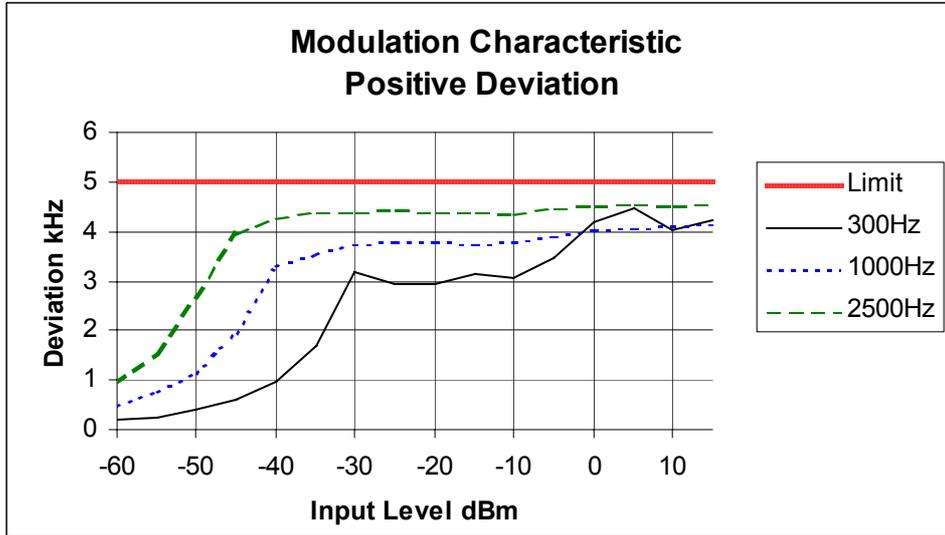
Tx FREQUENCY: 807.55 MHz 25.0 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 816.5125 MHz 25.0 kHz Channel Spacing



### OCCUPIED BANDWIDTH

SPECIFICATION: FCC 47 CFR 2.1049 (c)

GUIDE: TIA/EIA-603C 2.2.11  
TIA/EIA-102CAAA-A 2.2.5

**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 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, G and H – 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**

Frequency	Channel Spacing	Modulation Type	Emission Mask
807.55 MHz	12.5 kHz	Analogue Voice FFSK Digital voice/Data	Mask D
	25 kHz	Analogue voice FFSK	Mask B Mask H
816.5125 MHz	25 kHz	Analogue Voice FFSK	Mask B Mask G

**DATA SPEED**

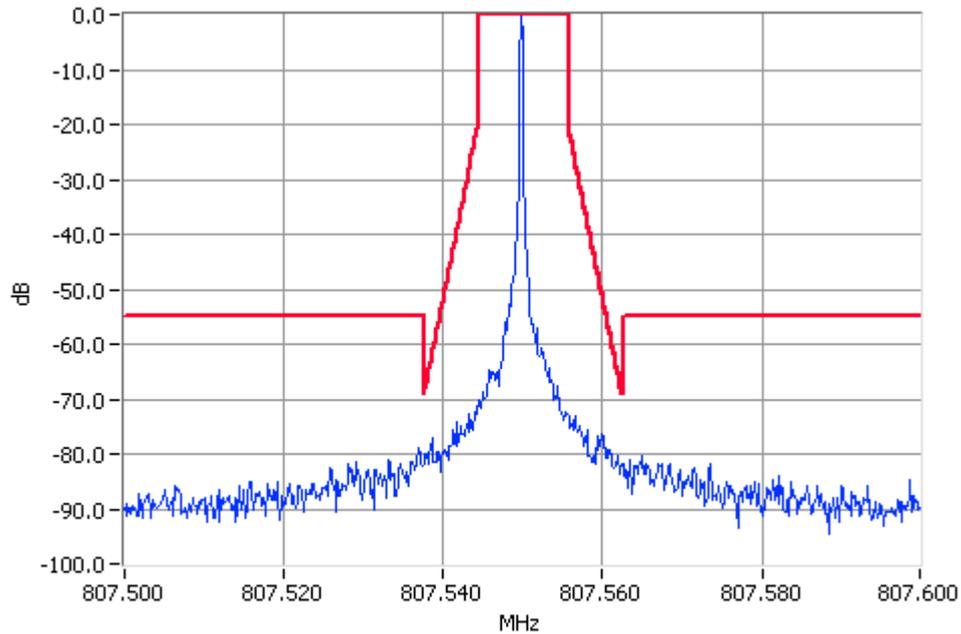
Modulation Type	Channel Spacing	Data Speed
Digital voice/Data	12.5 kHz	9600 bps
	25 kHz	
FFSK	12.5 kHz	1200 bps
	25 kHz	

OCCUPIED BANDWIDTH

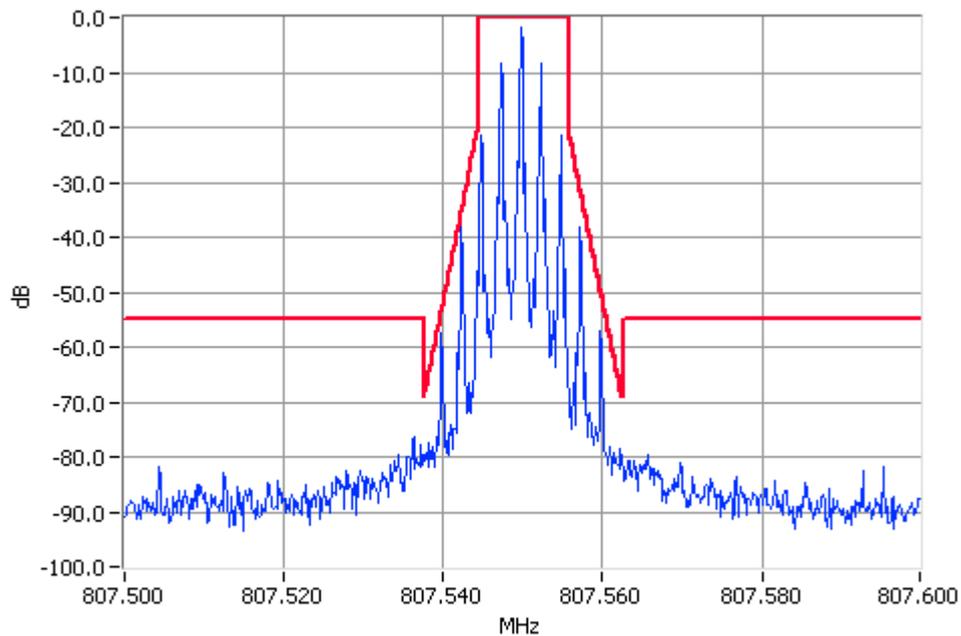
ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 807.55 MHz 3W 12.5 kHz Channel Spacing



Unmodulated 807.5500MHz Mask D 3W Pass  
RBW=100Hz VBW=1000Hz



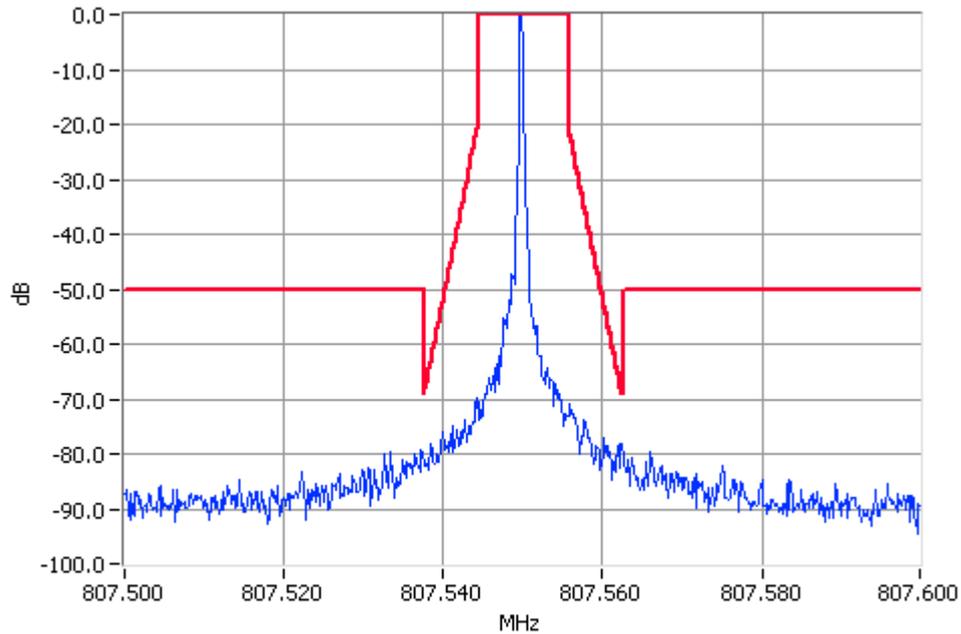
Analogue Modulation 807.5500MHz Mask D 3W Pass  
RBW=100Hz VBW=1000Hz

OCCUPIED BANDWIDTH

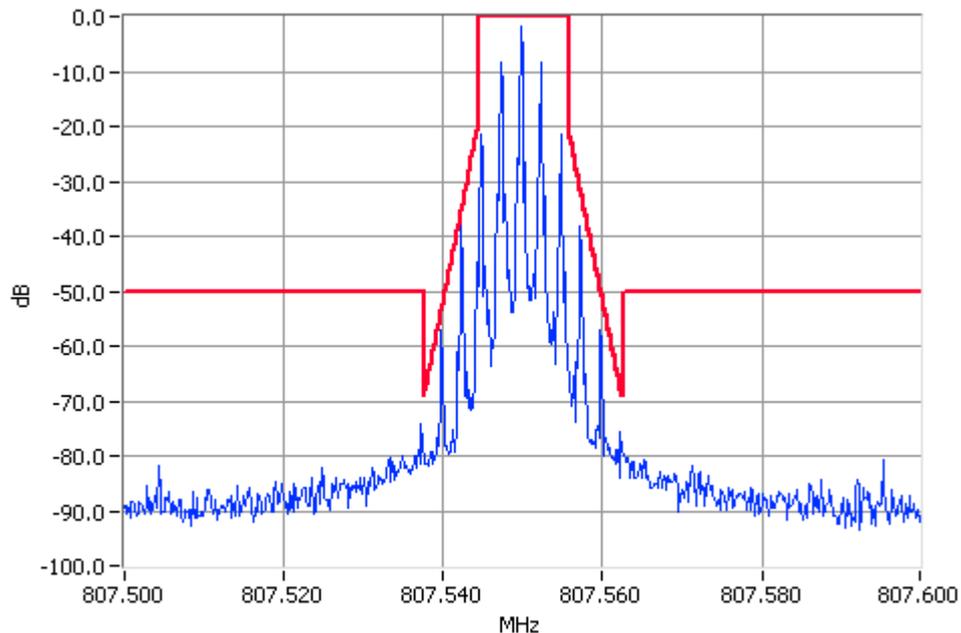
ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 807.55 MHz 1W 12.5 kHz Channel Spacing



Unmodulated 807.5500MHz Mask D 1W Pass  
RBW=100Hz VBW=1000Hz



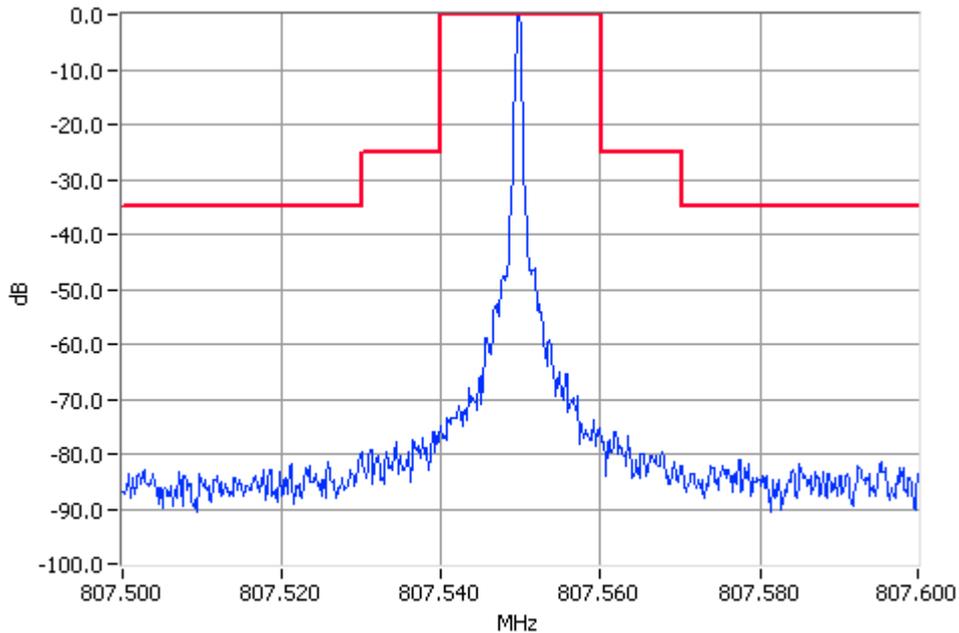
Analogue Modulation 807.5500MHz Mask D 1W Pass  
RBW=100Hz VBW=1000Hz

**OCCUPIED BANDWIDTH**

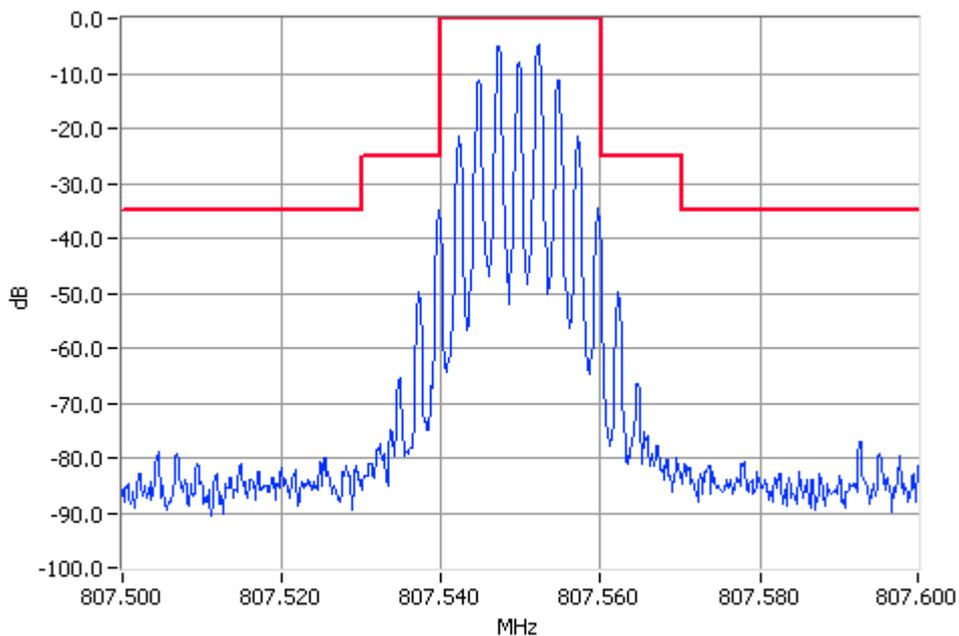
ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 807.55 MHz 3W 25 kHz Channel Spacing



**Unmodulated 807.5500MHz Mask B 3W Pass  
RBW=300Hz VBW=3000Hz**



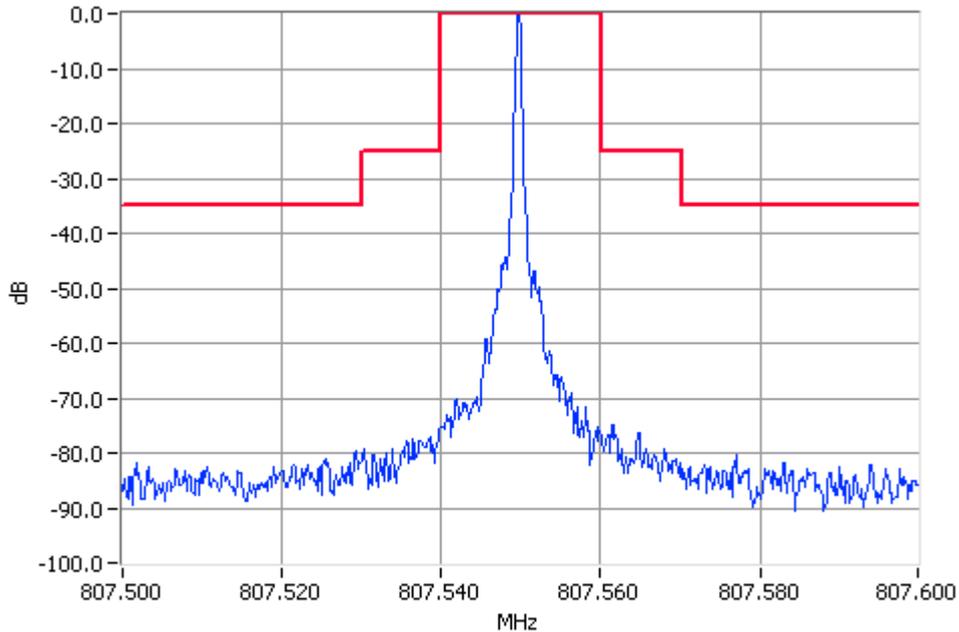
**Analogue Modulation 807.5500MHz Mask B 3W Pass  
RBW=300Hz VBW=3000Hz**

OCCUPIED BANDWIDTH

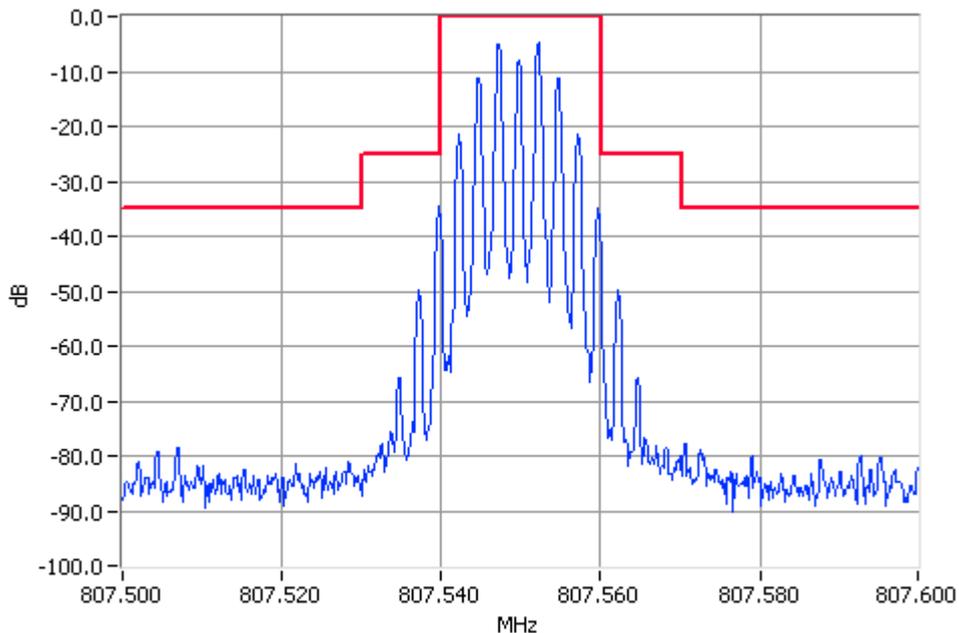
ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 807.55 MHz 1W 25 kHz Channel Spacing



Unmodulated 807.5500MHz Mask B 1W Pass  
RBW=300Hz VBW=3000Hz



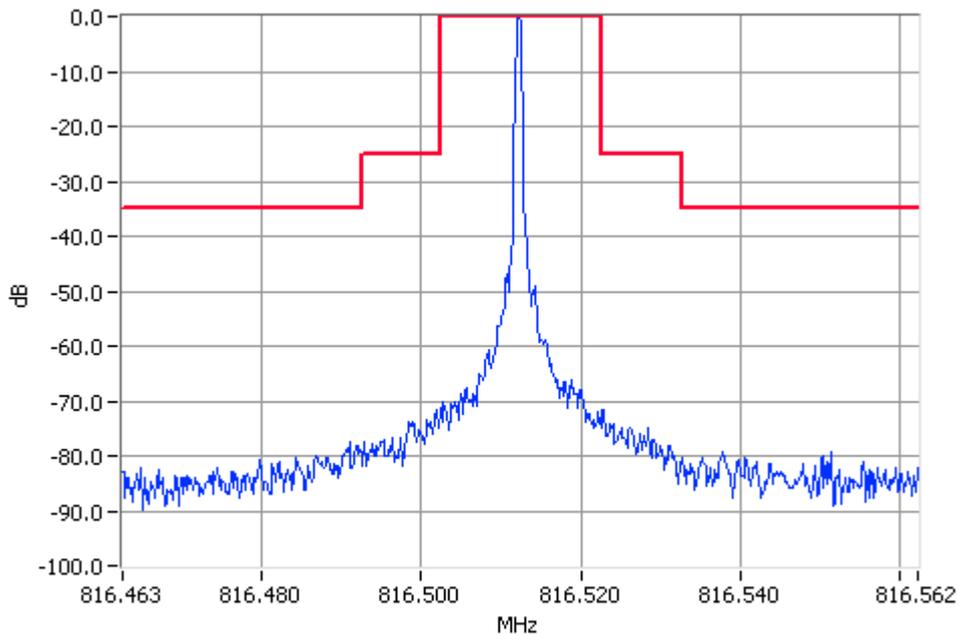
Analogue Modulation 807.5500MHz Mask B 1W Pass  
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

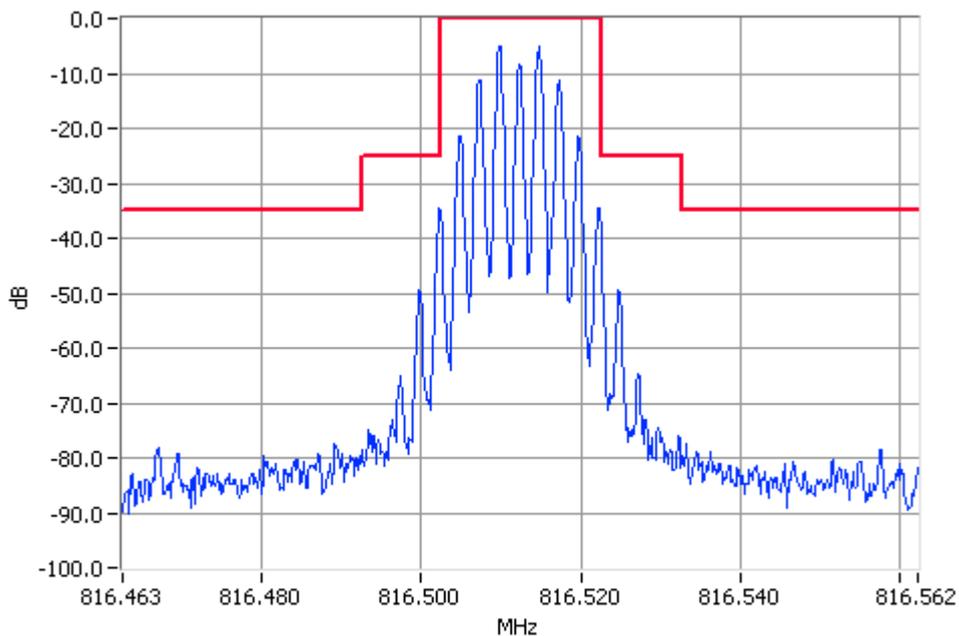
ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 816.5125 MHz 3W 25 kHz Channel Spacing



Unmodulated 816.5125MHz Mask B 3W Pass  
RBW=300Hz VBW=3000Hz



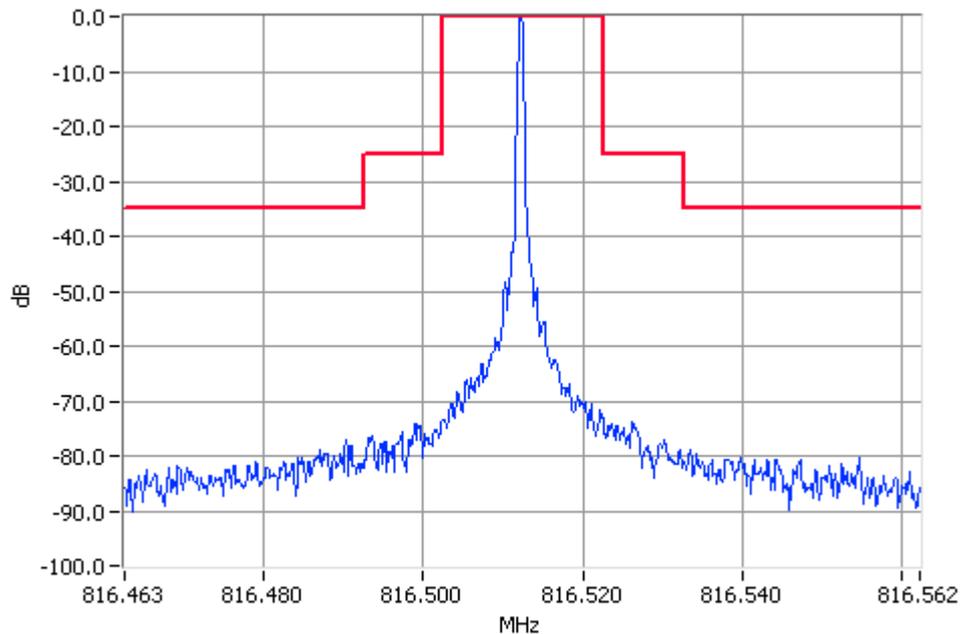
Analogue Modulation 816.5125MHz Mask B 3W Pass  
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

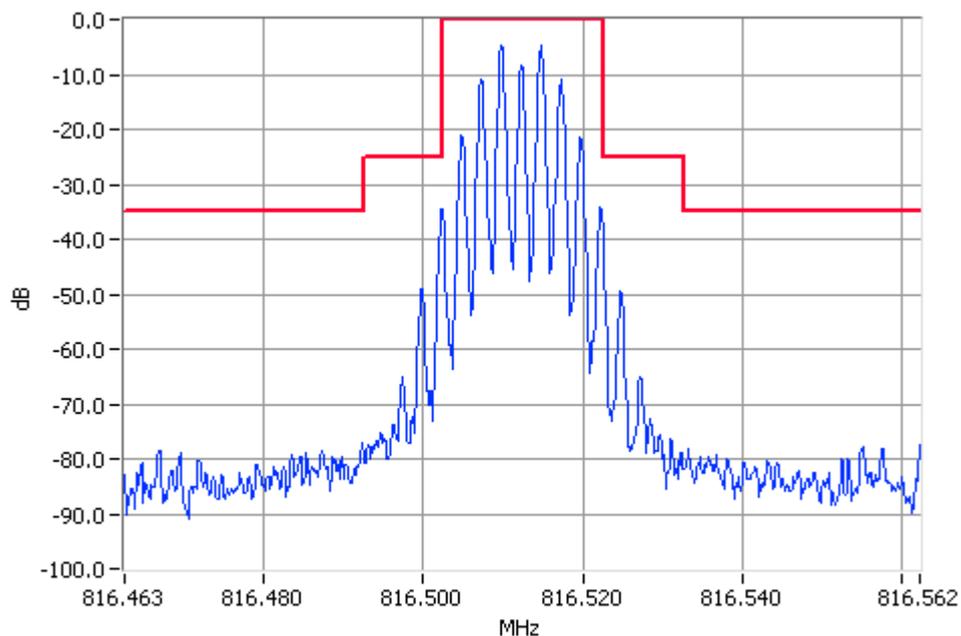
ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 816.5125 MHz 1W 25 kHz Channel Spacing



Unmodulated 816.5125MHz Mask B 1W Pass  
RBW=300Hz VBW=3000Hz



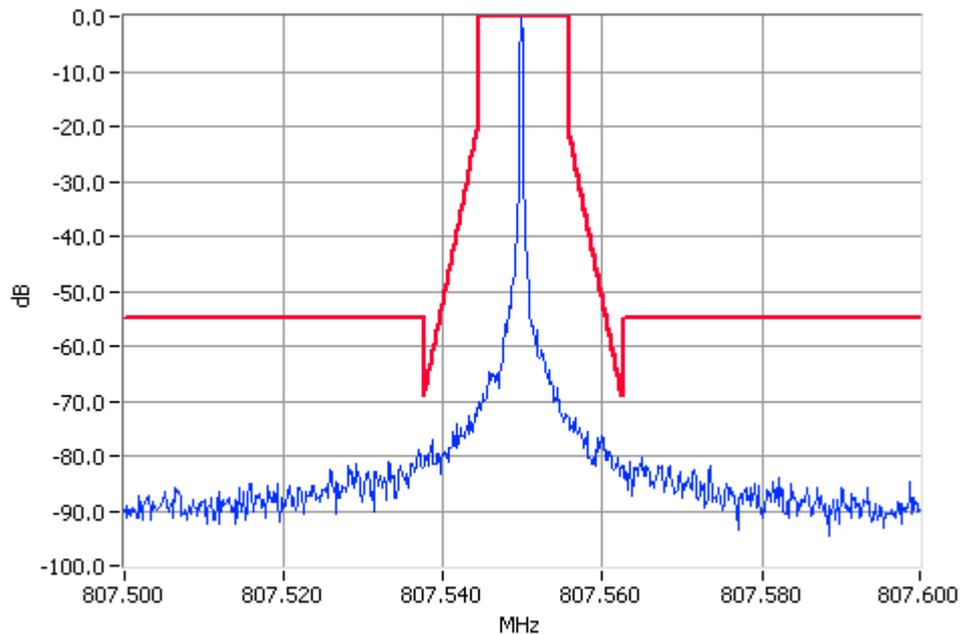
Analogue Modulation 816.5125MHz Mask B 1W Pass  
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

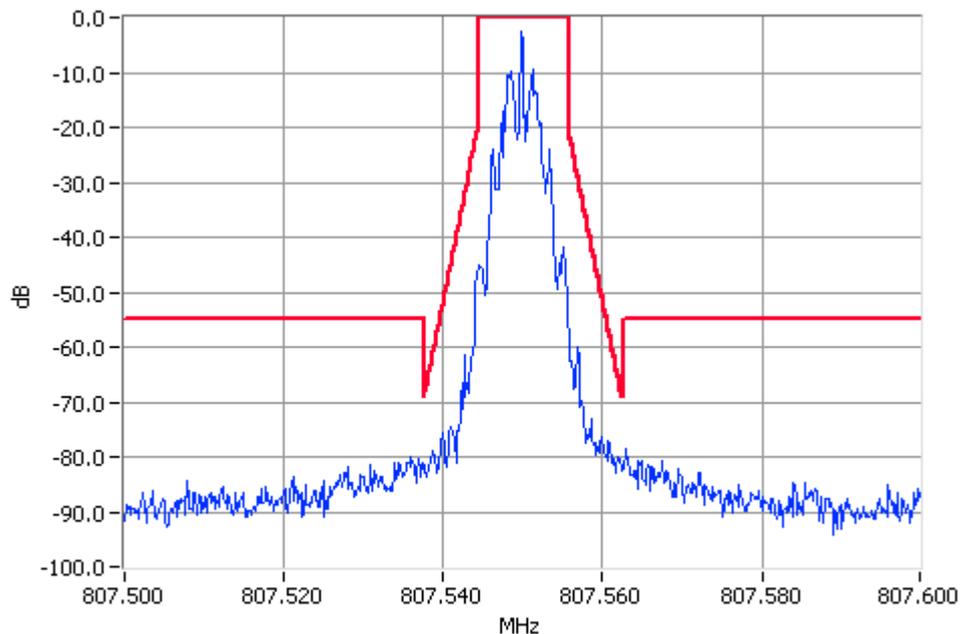
FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 807.55 MHz 3W 12.5 kHz Channel Spacing



Unmodulated 807.5500MHz Mask D 3W Pass  
RBW=100Hz VBW=1000Hz



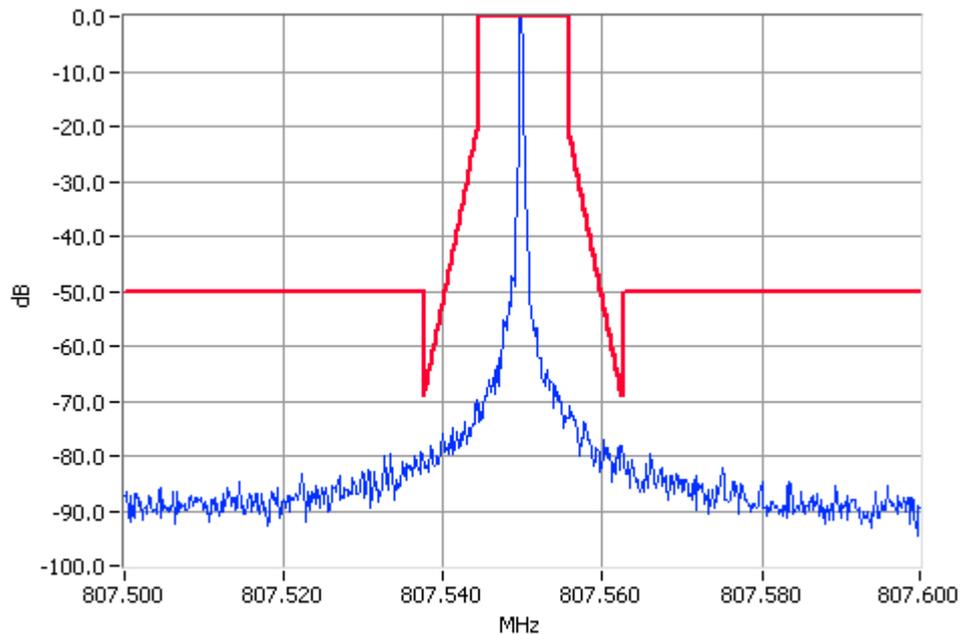
Digital Modulation 807.5500MHz Mask D 3W Pass  
RBW=100Hz VBW=1000Hz

OCCUPIED BANDWIDTH

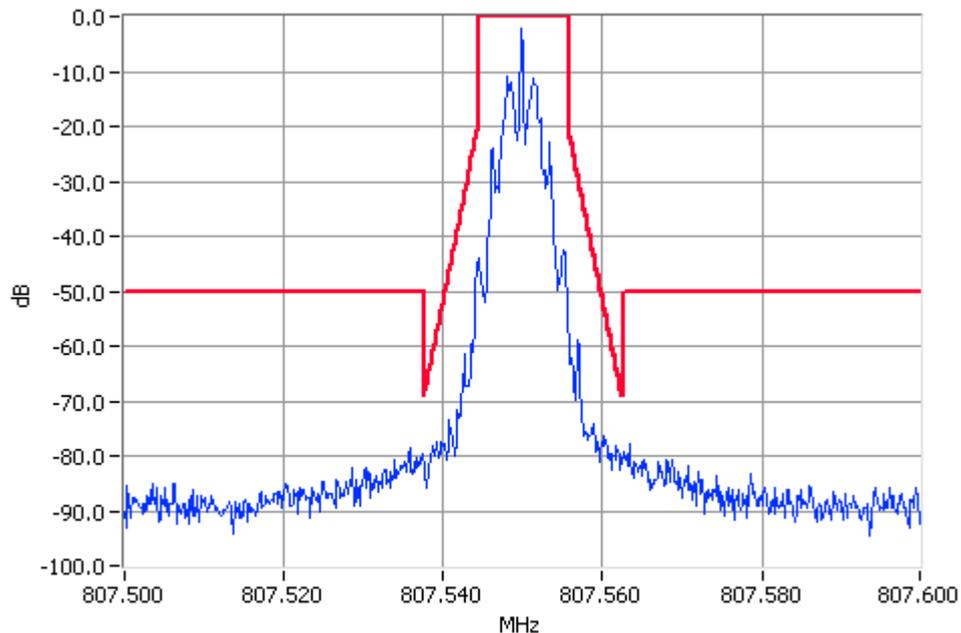
FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 807.55 MHz 1W 12.5 kHz Channel Spacing



Unmodulated 807.5500MHz Mask D 1W Pass  
RBW=100Hz VBW=1000Hz



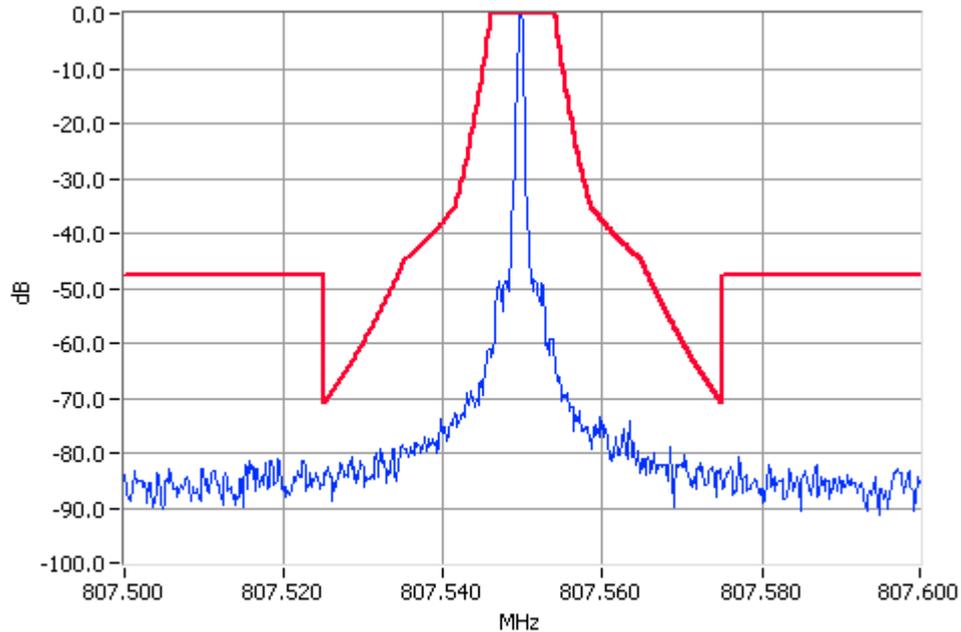
Digital Modulation 807.5500MHz Mask D 1W Pass  
RBW=100Hz VBW=1000Hz

OCCUPIED BANDWIDTH

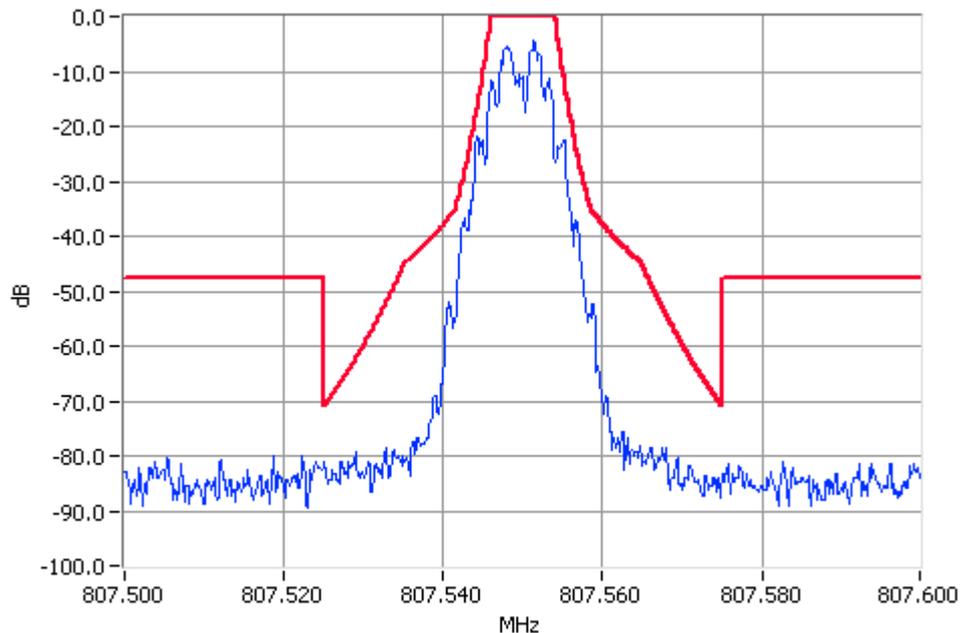
FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 807.55 MHz 3W 25 kHz Channel Spacing



Unmodulated 807.5500MHz Mask H 3W Pass  
RBW=300Hz VBW=3000Hz



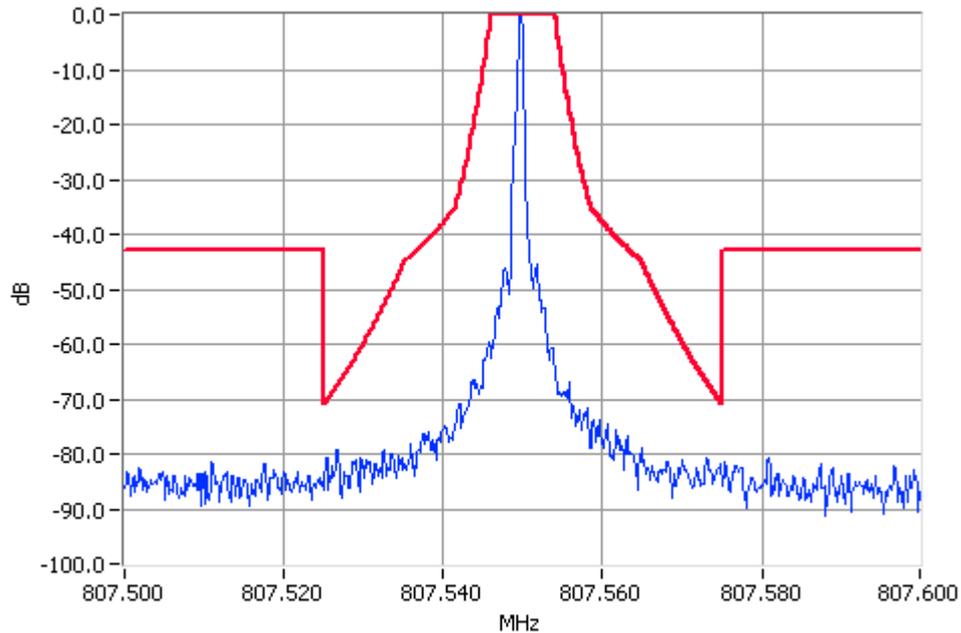
Digital Modulation 807.5500MHz Mask H 3W Pass  
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

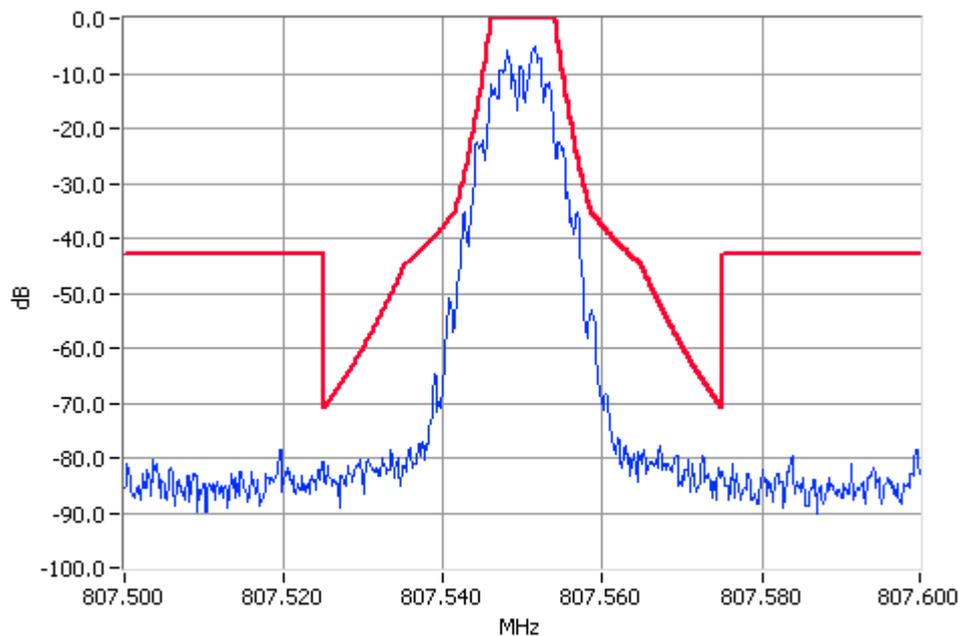
FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 807.55 MHz 1W 25 kHz Channel Spacing



Unmodulated 807.5500MHz Mask H 1W Pass  
RBW=300Hz VBW=3000Hz



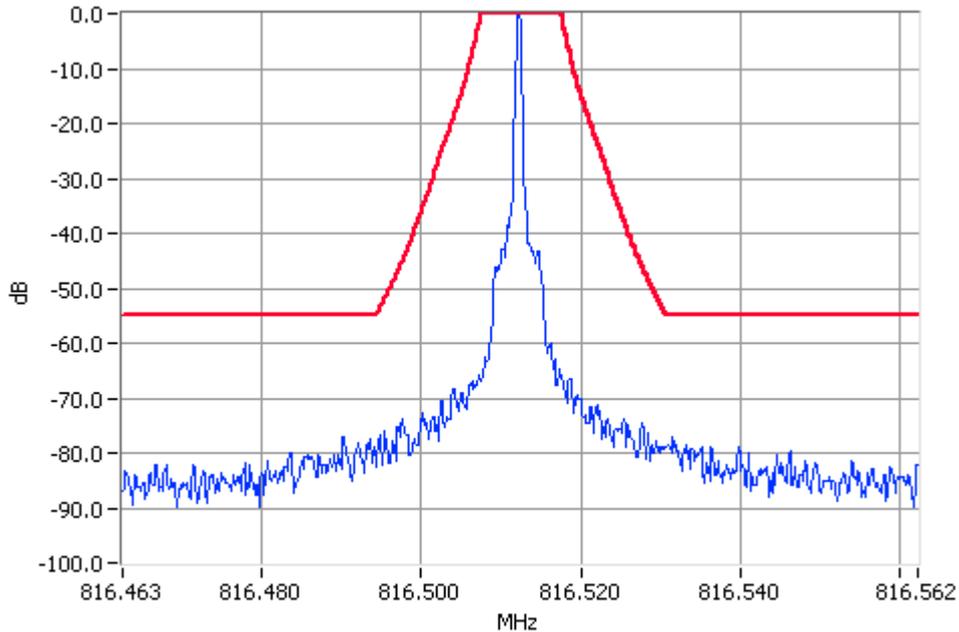
Digital Modulation 807.5500MHz Mask H 1W Pass  
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

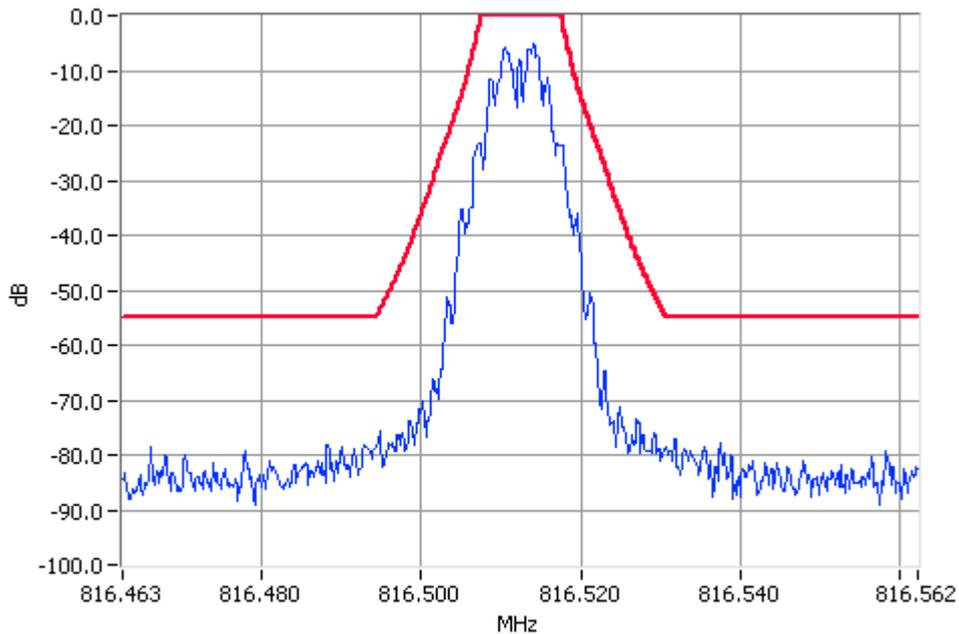
FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 816.5125 MHz 3W 25 kHz Channel Spacing



Unmodulated 816.5125MHz Mask G 3W Pass  
RBW=300Hz VBW=3000Hz



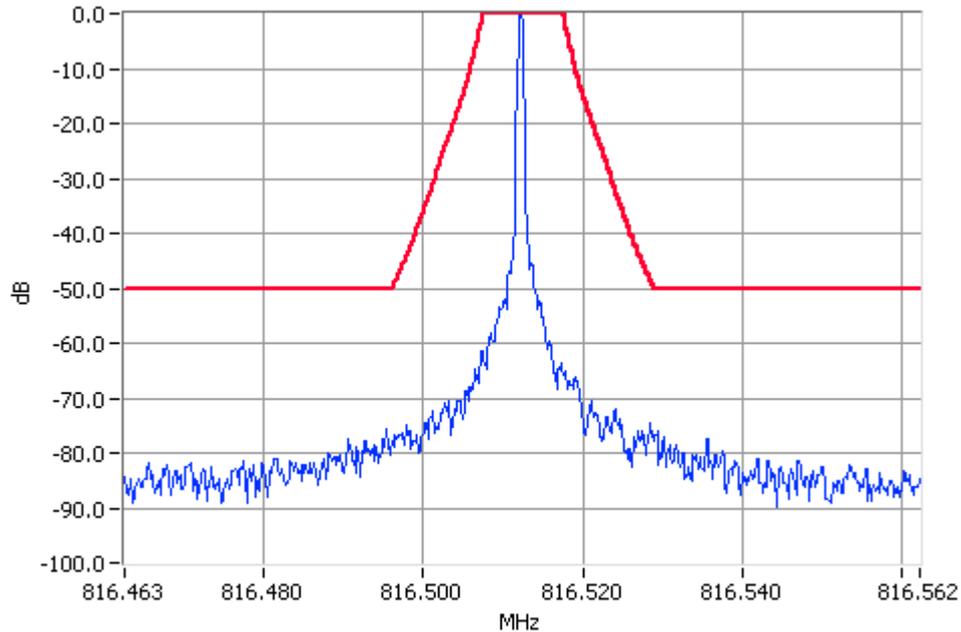
Digital Modulation 816.5125MHz Mask G 3W Pass  
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

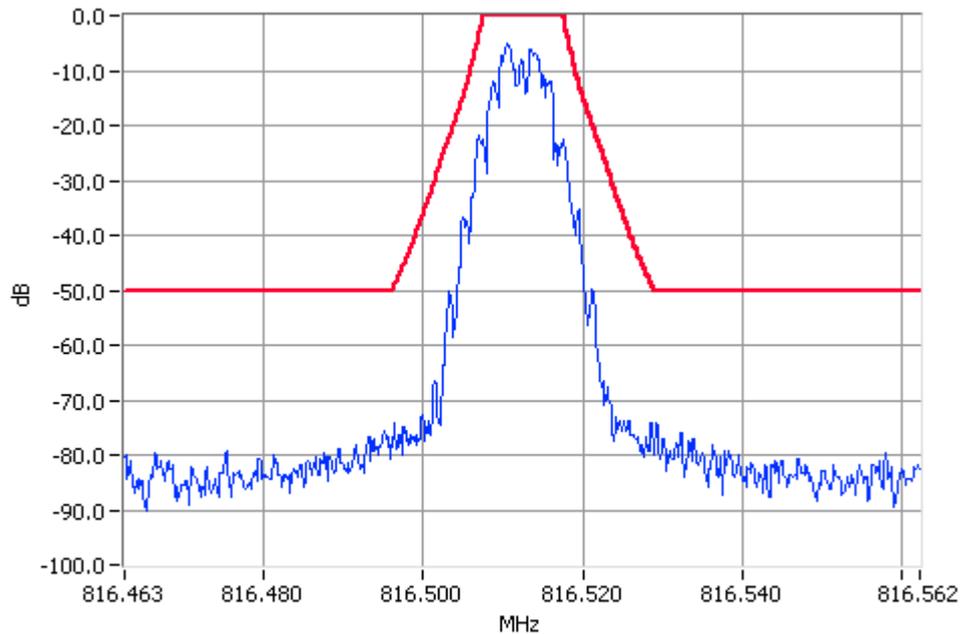
FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 816.5125 MHz 1W 25 kHz Channel Spacing



**Unmodulated 816.5125MHz Mask G 1W Pass**  
**RBW=300Hz VBW=3000Hz**



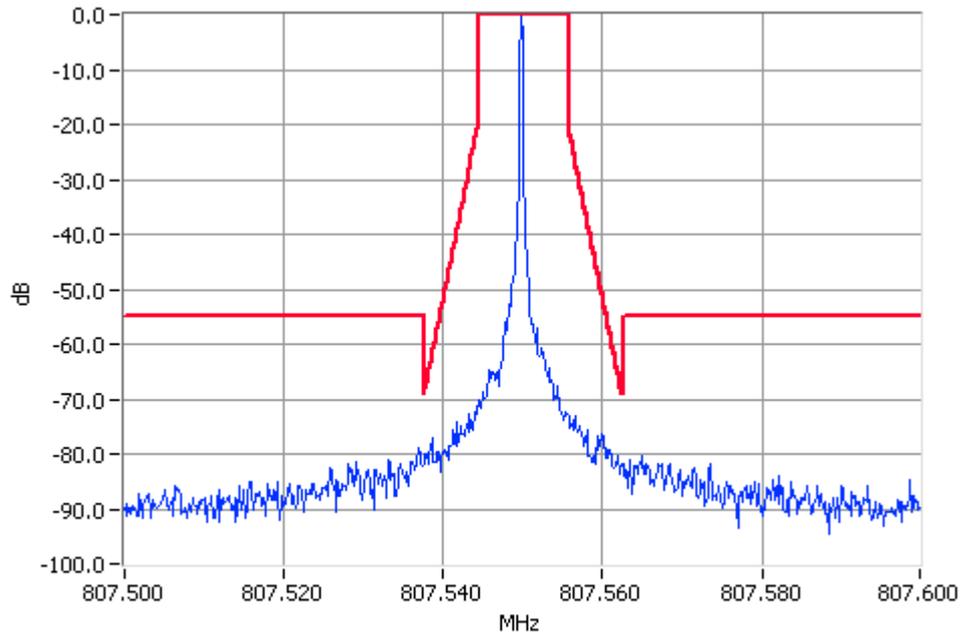
**Digital Modulation 816.5125MHz Mask G 1W Pass**  
**RBW=300Hz VBW=3000Hz**

OCCUPIED BANDWIDTH

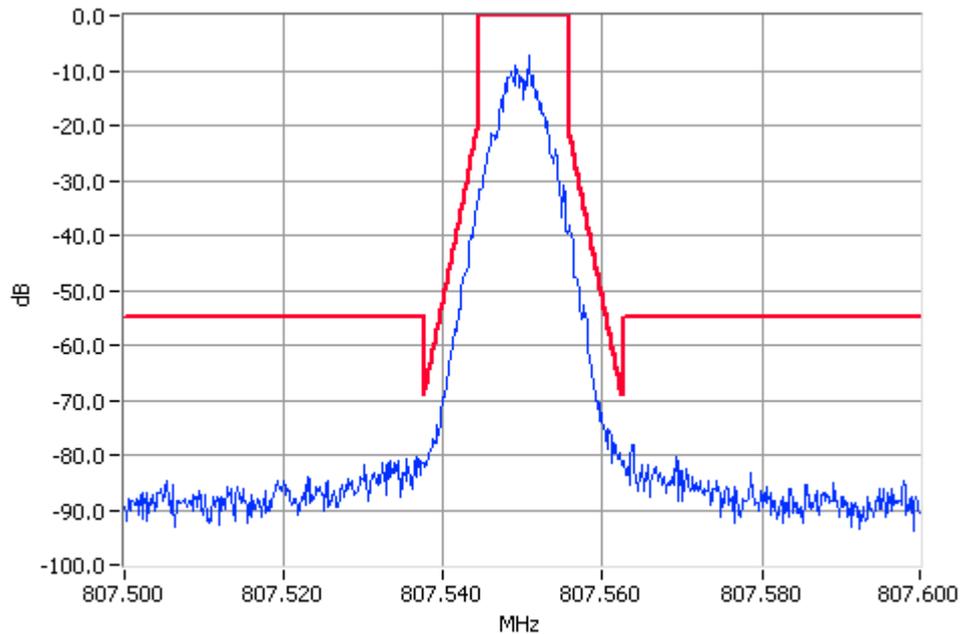
DIGITAL – (4 Level FSK)

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 807.55 MHz 3W 12.5 kHz Channel Spacing



Unmodulated 807.5500MHz Mask D 3W Pass  
RBW=100Hz VBW=1000Hz



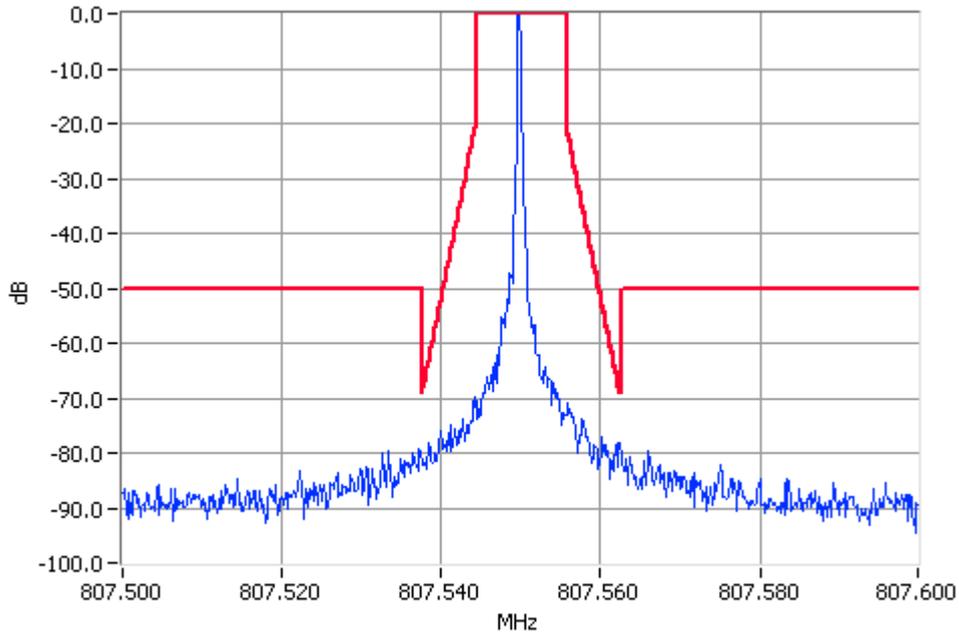
Digital Modulation 807.5500MHz Mask D 3W Pass  
RBW=100Hz VBW=1000Hz

OCCUPIED BANDWIDTH

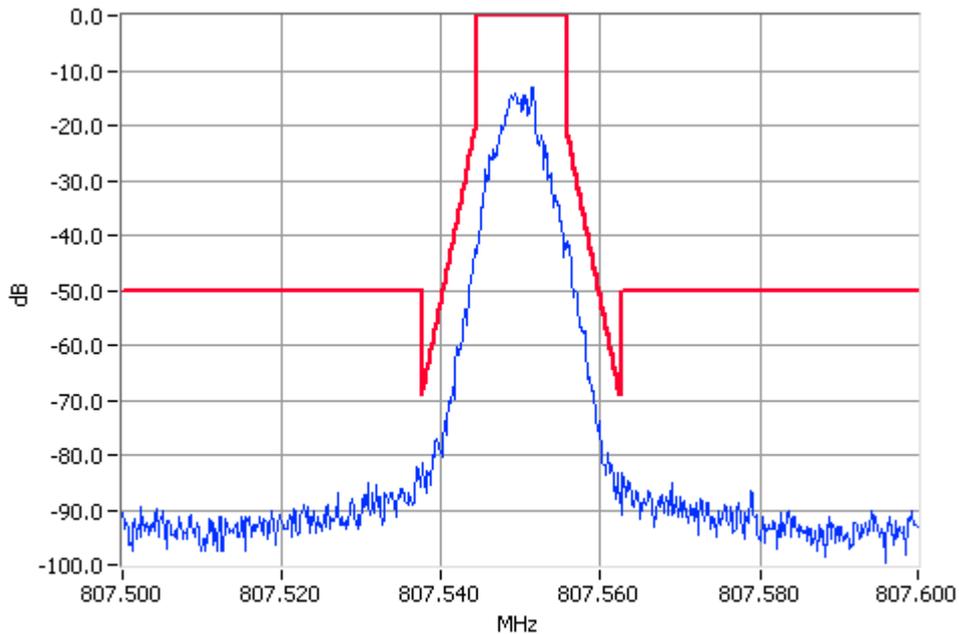
DIGITAL – (4 Level FSK)

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 807.55 MHz 1W 12.5 kHz Channel Spacing



Unmodulated 807.5500MHz Mask D 1W Pass  
RBW=100Hz VBW=1000Hz



Digital Modulation 807.5500MHz Mask D 1W Pass  
RBW=100Hz VBW=1000Hz

**ADJACENT CHANNEL POWER**

SPECIFICATION: FCC 47 CFR 90.543

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The transmitter is modulated with the standard test pattern for FFSK, and digital modulation, and in accordance with TIA/EIA 603C 2.2.14 for analogue voice.
3. The test is performed in accordance with 47 CFR 90.543

LIMIT CLAUSE: FCC 47 CFR 90.543

MEASUREMENT RESULTS:

**ANALOGUE VOICE**

Tx FREQUENCY: 795.9875 MHz 3 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
9.375 kHz	6.25 kHz	-42.77	-43.62	-40
15.625 kHz	6.25 kHz	-71.27	-71.68	-60
21.875 kHz	6.25 kHz	-73.87	-73.74	-60
37.5 kHz	25 kHz	-69.86	-70.09	-60
62.5 kHz	25 kHz	-73.87	-73.80	-65
87.5 kHz	25 kHz	-77.17	-77.68	-65
150 kHz	100 kHz	-75.11	-75.32	-65
250 kHz	100 kHz	-79.43	-79.53	-65
350 kHz	100 kHz	-81.17	-81.35	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.11	-89.63	-75
12 MHz to paired receive band	30 kHz (swept)	-85.16		-75
In the paired receive band	30 kHz (swept)	-103.29		-100

Tx FREQUENCY: 795.9875 MHz 1 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
9.375 kHz	6.25 kHz	-42.10	-44.48	-40
15.625 kHz	6.25 kHz	-71.38	-71.71	-60
21.875 kHz	6.25 kHz	-73.42	-73.71	-60
37.5 kHz	25 kHz	-69.81	-69.88	-60
62.5 kHz	25 kHz	-73.39	-73.64	-65
87.5 kHz	25 kHz	-76.90	-77.25	-65
150 kHz	100 kHz	-75.46	-75.85	-65
250 kHz	100 kHz	-80.82	-81.12	-65
350 kHz	100 kHz	-83.66	-83.74	-65
>400 kHz to 12 MHz	30 kHz (swept)	-92.32	-90.91	-75
12 MHz to paired receive band	30 kHz (swept)	-85.35		-75
In the paired receive band	30 kHz (swept)	-104.81		-100

**ADJACENT CHANNEL POWER**

SPECIFICATION: FCC 47 CFR 90.543

ANALOGUE VOICE

Tx FREQUENCY: 795.9875 MHz 3 W 25 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
15.625 kHz	6.25 kHz	-63.07	-65.04	-40
21.875 kHz	6.25 kHz	-73.63	-73.74	-60
37.5 kHz	25 kHz	-69.21	-69.41	-60
62.5 kHz	25 kHz	-73.30	-73.39	-65
87.5 kHz	25 kHz	-77.07	-77.23	-65
150 kHz	100 kHz	-75.27	-75.21	-65
250 kHz	100 kHz	-79.59	-79.54	-65
350 kHz	100 kHz	-81.44	-81.32	-65
>400 kHz to 12 MHz	30 kHz (swept)	-93.34	-92.61	-75
12 MHz to paired receive band	30 kHz (swept)	-87.21		-75
In the paired receive band	30 kHz (swept)	-105.11		-100

Tx FREQUENCY: 795.9875 MHz 1 W 25 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
15.625 kHz	6.25 kHz	-62.79	-65.16	-40
21.875 kHz	6.25 kHz	-73.79	-73.68	-60
37.5 kHz	25 kHz	-69.25	-69.31	-60
62.5 kHz	25 kHz	-73.36	-73.46	-65
87.5 kHz	25 kHz	-77.28	-77.42	-65
150 kHz	100 kHz	-75.54	-75.66	-65
250 kHz	100 kHz	-81.04	-81.04	-65
350 kHz	100 kHz	-83.74	-83.84	-65
>400 kHz to 12 MHz	30 kHz (swept)	-92.90	-92.22	-75
12 MHz to paired receive band	30 kHz (swept)	-86.77		-75
In the paired receive band	30 kHz (swept)	-104.21		-100

**TELTEST Laboratories**  
Tait Electronics Limited  
Report Number 2291

**ADJACENT CHANNEL POWER**

SPECIFICATION: FCC 47 CFR 90.543

FFSK

Tx FREQUENCY: 795.9875 MHz 3 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
9.375 kHz	6.25 kHz	-56.80	-59.33	-40
15.625 kHz	6.25 kHz	-71.66	-71.50	-60
21.875 kHz	6.25 kHz	-73.71	-73.78	-60
37.5 kHz	25 kHz	-69.89	-69.98	-60
62.5 kHz	25 kHz	-73.95	-73.85	-65
87.5 kHz	25 kHz	-77.13	-77.23	-65
150 kHz	100 kHz	-75.12	-75.23	-65
250 kHz	100 kHz	-79.37	-79.39	-65
350 kHz	100 kHz	-81.21	-81.03	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.89	-89.65	-75
12 MHz to paired receive band	30 kHz (swept)	-85.85		-75
In the paired receive band	30 kHz (swept)	-103.98		-100

Tx FREQUENCY: 795.9875 MHz 1 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
9.375 kHz	6.25 kHz	-57.23	-59.65	-40
15.625 kHz	6.25 kHz	-71.27	-72.30	-60
21.875 kHz	6.25 kHz	-73.86	-73.48	-60
37.5 kHz	25 kHz	-69.92	-70.10	-60
62.5 kHz	25 kHz	-73.72	-73.77	-65
87.5 kHz	25 kHz	-77.11	-77.09	-65
150 kHz	100 kHz	-75.55	-75.71	-65
250 kHz	100 kHz	-80.90	-80.97	-65
350 kHz	100 kHz	-83.83	-83.62	-65
>400 kHz to 12 MHz	30 kHz (swept)	-93.53	-91.55	-75
12 MHz to paired receive band	30 kHz (swept)	-88.62		-75
In the paired receive band	30 kHz (swept)	-104.63		-100

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**ADJACENT CHANNEL POWER**

SPECIFICATION: FCC 47 CFR 90.543

FFSK

Tx FREQUENCY: 795.9875 MHz 3 W 25 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
15.625 kHz	6.25 kHz	-70.88	-71.30	-40
21.875 kHz	6.25 kHz	-73.69	-73.42	-60
37.5 kHz	25 kHz	-69.71	-69.92	-60
62.5 kHz	25 kHz	-73.53	-73.75	-65
87.5 kHz	25 kHz	-77.30	-77.25	-65
150 kHz	100 kHz	-75.06	-75.05	-65
250 kHz	100 kHz	-79.21	-79.27	-65
350 kHz	100 kHz	-81.21	-80.96	-65
>400 kHz to 12 MHz	30 kHz (swept)	-92.88	-90.31	-75
12 MHz to paired receive band	30 kHz (swept)	-86.44		-75
In the paired receive band	30 kHz (swept)	-103.33		-100

Tx FREQUENCY: 795.9875 MHz 1 W 25 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
15.625 kHz	6.25 kHz	-70.91	-71.23	-40
21.875 kHz	6.25 kHz	-73.31	-73.42	-60
37.5 kHz	25 kHz	-69.53	-69.74	-60
62.5 kHz	25 kHz	-73.53	-73.59	-65
87.5 kHz	25 kHz	-77.24	-77.33	-65
150 kHz	100 kHz	-75.61	-75.57	-65
250 kHz	100 kHz	-80.99	-80.83	-65
350 kHz	100 kHz	-83.90	-83.65	-65
>400 kHz to 12 MHz	30 kHz (swept)	-92.06	-91.96	-75
12 MHz to paired receive band	30 kHz (swept)	-85.97		-75
In the paired receive band	30 kHz (swept)	-104.78		-100

**ADJACENT CHANNEL POWER**

SPECIFICATION: FCC 47 CFR 90.543

DIGITAL – (4 Level FSK)

Tx FREQUENCY: 795.9875 MHz 3 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
9.375 kHz	6.25 kHz	-47.61	-47.06	-40
15.625 kHz	6.25 kHz	-62.73	-63.30	-60
21.875 kHz	6.25 kHz	-69.27	-69.10	-60
37.5 kHz	25 kHz	-68.64	-68.33	-60
62.5 kHz	25 kHz	-72.52	-72.68	-65
87.5 kHz	25 kHz	-75.58	-75.60	-65
150 kHz	100 kHz	-74.17	-73.99	-65
250 kHz	100 kHz	-79.07	-78.89	-65
350 kHz	100 kHz	-81.26	-81.16	-65
>400 kHz to 12 MHz	30 kHz (swept)	-82.49	-82.78	-75
12 MHz to paired receive band	30 kHz (swept)	-81.21		-75
In the paired receive band	30 kHz (swept)	-103.4		-100

Tx FREQUENCY: 795.9875 MHz 1 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc)
9.375 kHz	6.25 kHz	-47.56	-47.00	-40
15.625 kHz	6.25 kHz	-62.79	-63.10	-60
21.875 kHz	6.25 kHz	-68.68	-68.46	-60
37.5 kHz	25 kHz	-68.76	-68.61	-60
62.5 kHz	25 kHz	-72.63	-72.67	-65
87.5 kHz	25 kHz	-75.88	-75.86	-65
150 kHz	100 kHz	-74.21	-74.28	-65
250 kHz	100 kHz	-79.01	-78.82	-65
350 kHz	100 kHz	-81.45	-81.12	-65
>400 kHz to 12 MHz	30 kHz (swept)	-81.29	-80.65	-75
12 MHz to paired receive band	30 kHz (swept)	-80.7		-75
In the paired receive band	30 kHz (swept)	-104.9		-100



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**SPURIOUS EMISSIONS (CONDUCTED)**

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 795.9875 MHz

12.5 kHz Channel Spacing		795.9875 MHz @ 3 W	
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
~	~	~	
No emissions were detected at a level greater than 20 dB below the limit.			

12.5 kHz Channel Spacing		795.9875 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 90.453 (c) 12.5 kHz Channel Spacing $43 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
3 W	-13 dBm	47.8 dBc
1 W	-13 dBm	43 dBc

**SPURIOUS EMISSIONS (CONDUCTED)**

SPECIFICATION:                   FCC CFR 2.1051

Tx FREQUENCY:                   807.55 MHz

12.5 kHz Channel Spacing	807.55 MHz @ 3 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.		

12.5 kHz Channel Spacing	807.55 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 $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
	3 W	-20 dBm
1 W	-20 dBm	50 dBc

**SPURIOUS EMISSIONS (CONDUCTED)**

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 816.5125 MHz

25 kHz Channel Spacing	816.5125 MHz @ 3 W	Emission Mask B
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

25 kHz Channel Spacing	816.5125 MHz @ 1 W	Emission Mask B
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 25 kHz Channel Spacing $43 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
3 W	-13 dBm	47.8 dBc
1 W	-13 dBm	43 dBc

**SPURIOUS EMISSIONS (RADIATED)**

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA/EIA-603C 2.2.12  
TIA/EIA-102CAAA-A 2.2.7

**MEASUREMENT PROCEDURE:**

1. Refer Annex A for equipment set up.
2. 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. The output terminal of the EUT 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

LIMIT CLAUSE: FCC 47 CFR 90.210  
FCC 47 CFR 90.543 (c)

**SPURIOUS EMISSIONS (RADIATED)**

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 795.9875 MHz

12.5 kHz Channel Spacing      795.9875 MHz @ 3 W			
Emission Frequency (MHz)	Polarisation	Level (dBm)	Level (dBc)
2387.9625	Horizontal	-24.63	59.03
2387.9625	Vertical	-25.87	60.29
No other emissions were detected at a level greater than 20 dB below the limit.			

12.5 kHz Channel Spacing      795.9875 MHz @ 1 W			
Emission Frequency (MHz)	Polarisation	Level (dBm)	Level (dBc)
2387.9625	Vertical	-29.56	58.85
No other emissions were detected at a level greater than 20 dB below the limit.			

**LIMITS:**

Carrier Output Power Watts	FCC 47 CFR 90.453 (c) 12.5 kHz Channel Spacing $43 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
3 W	-13 dBm	47.8 dBc
1 W	-13 dBm	43 dBc

**SPURIOUS EMISSIONS (RADIATED)**

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 807.55 MHz

12.5 kHz Channel Spacing		807.55 MHz @ 3 W	
Emission Frequency (MHz)	Polarisation	Level (dBm)	Level (dBc)
2422.65	Horizontal	-26.76	61.22
2422.65	Vertical	-27.99	62.45
3230.2	Horizontal	-37.76	72.22
No other emissions were detected at a level greater than 20 dB below the limit.			

12.5 kHz Channel Spacing		807.55 MHz @ 1 W	
Emission Frequency (MHz)	Polarisation	Level (dBm)	Level (dBc)
2422.65	Horizontal	-22.94	52.13
2422.65	Vertical	-27.0	56.19
No other 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 $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
	3 W	-20 dBm
1 W	-20 dBm	50 dBc

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**SPURIOUS EMISSIONS (RADIATED)**

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 816.5125 MHz

25 kHz Channel Spacing		816.5125 MHz @ 3 W	
Emission Frequency (MHz)	Polarisation	Level (dBm)	Level (dBc)
2449.5375	Horizontal	-23.37	
2449.5375	Vertical	-24.71	
No other emissions were detected at a level greater than 20 dB below the limit.			

25 kHz Channel Spacing		816.5125 MHz @ 1 W	
Emission Frequency (MHz)	Polarisation	Level (dBm)	Level (dBc)
2449.5375	Horizontal	-23.01	
2449.5375	Vertical	-28.24	
No other emissions were detected at a level greater than 20 dB below the limit.			

LIMITS:

Carrier Output Power Watts	Emission Mask B 25 kHz Channel Spacing $43 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
	-13 dBm	47.8 dBc
3 W	-13 dBm	47.8 dBc
1 W	-13 dBm	43 dBc

**SPURIOUS EMISSIONS (EIRP in the GNSS Band)**

SPECIFICATION: FCC CFR 90.543 (e)

GUIDE: TIA/EIA-102CAAA-A 2.2.6.3

**MEASUREMENT PROCEDURE:**

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

**MEASUREMENT RESULTS:**

Tx FREQUENCY: 795.9875 MHz

12.5 kHz Channel Spacing		795.9875 MHz @ 3 W	Antenna Type: TPA-AN-021
Emission Frequency (MHz)	Polarisation	Measured ERP (dBm)	Calculated EIRP (dBm)
1591.9875	Horizontal	-44.98	-42.83
1591.9875	Vertical	-43.71	-41.56
No other emissions were detected at a level greater than 20 dB below the limit.			

LIMIT CLAUSE FCC 47 CFR 90.543 (c)	-40 dBm EIRP
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**TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)**

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

GUIDE: TIA/EIA-603C 2.2.2

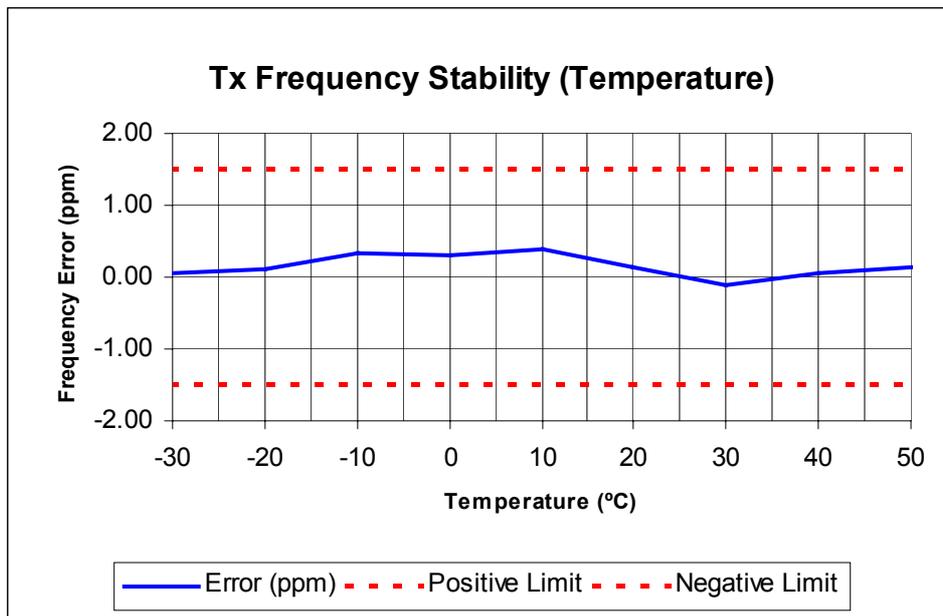
**MEASUREMENT PROCEDURE:**

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

Limit Clause	Frequency range	Test Frequency (MHz)	Frequency Error (ppm)
47 CFR 90.539	794 – 806 MHz	795.9875	1.5
47 CFR 90.213	806 – 809 MHz	807.55	1.5
	809 – 824 MHz	816.5125	2.5

**MEASUREMENT RESULTS:**

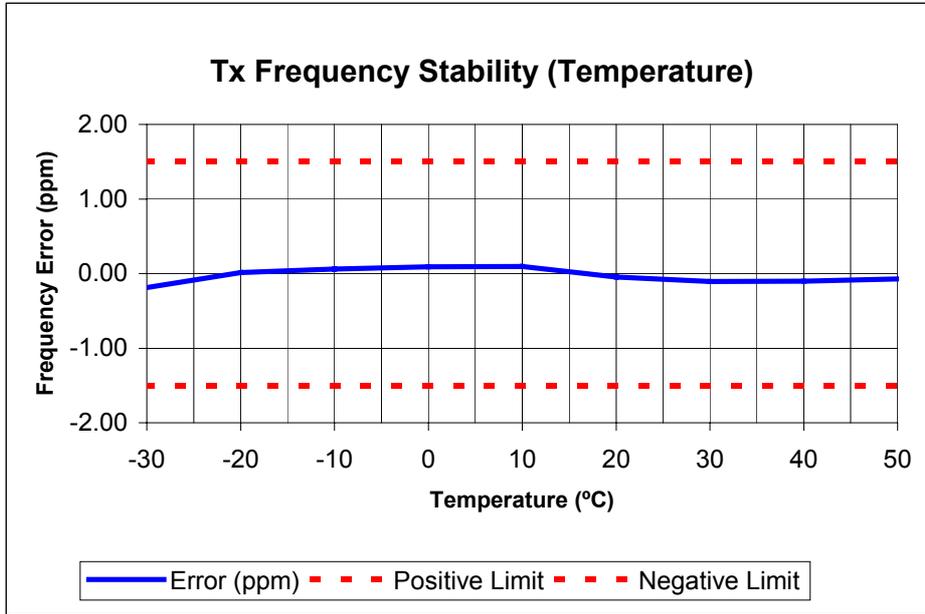
Tx FREQUENCY: 795.9875MHz 3W 12.5 kHz channel Spacing



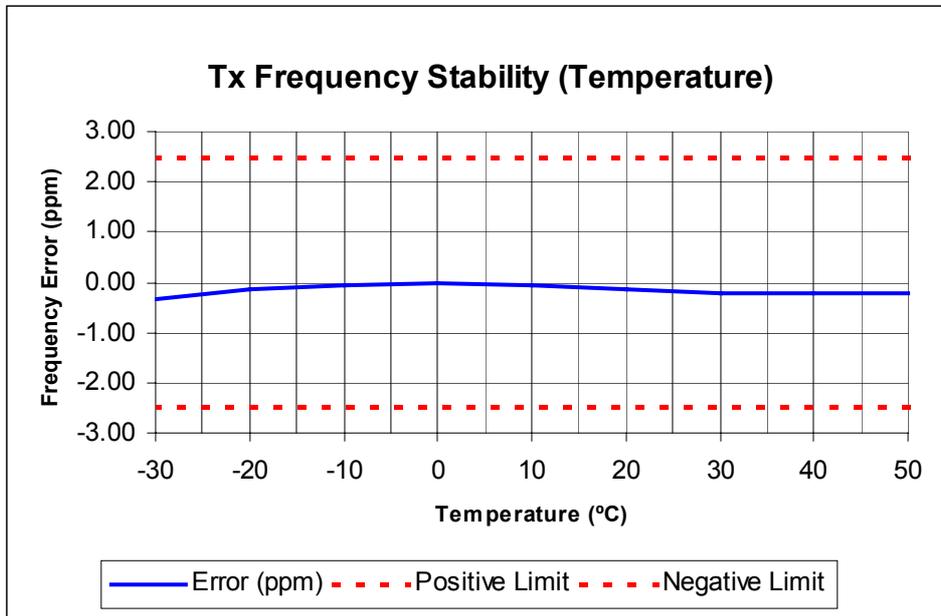
TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

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

Tx FREQUENCY: 807.55 MHz 3W 12.5 kHz channel Spacing



Tx FREQUENCY: 816.5125 MHz 3W 25 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 the nominal battery voltage, and at the end point voltage of the battery.
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

Frequency (MHz)	FREQUENCY ERROR (ppm)	
	7.5 V DC	6.0 V DC
795.8975	0.13	0.14
807.55	-0.15	-0.13
816.5125	-0.19	-0.21

Limit Clause	Frequency range	Test Frequency (MHz)	Frequency Error (ppm)
47 CFR 90.539	794 – 806 MHz	795.9875	1.0
47 CFR 90.213	806 – 809 MHz	807.55	1.5
	809 – 824 MHz	816.5125	2.5

**TRANSMITTER FREQUENCY STABILITY (With AFC)**

SPECIFICATION: FCC 47 CFR 90.539 (c)

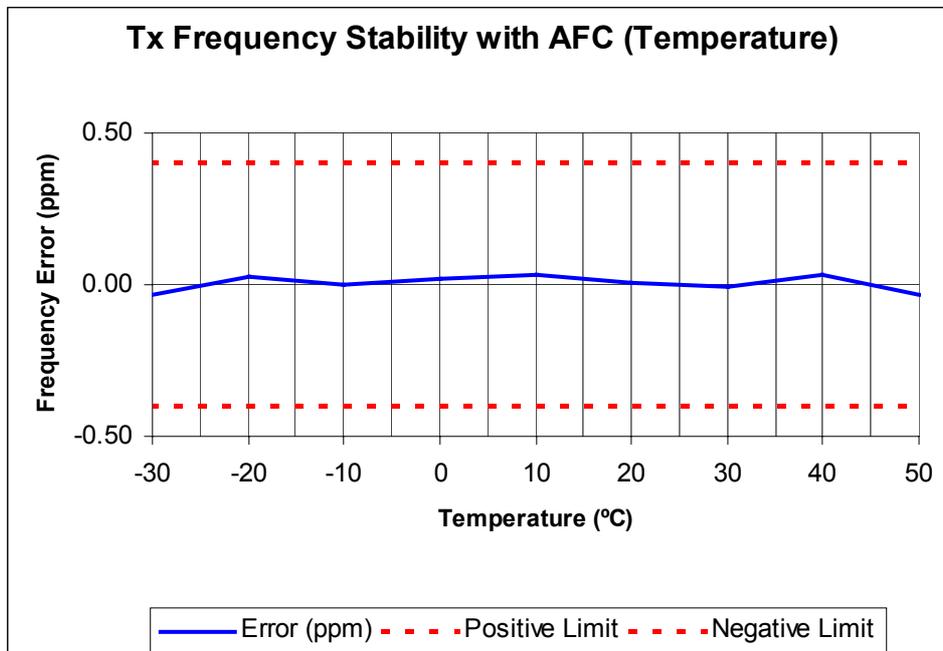
GUIDE: TIA/EIA-102.CAAA-A 2.2.2.3

**MEASUREMENT PROCEDURE:**

1. Refer Annex A for equipment set up.
2. The signal generator was modulated with the AFC test pattern.
3. For temperature stability the EUT was tested for frequency error from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  in  $10^{\circ}\text{C}$  increments.
4. For the voltage stability the EUT was tested for frequency error at the nominal battery voltage, and at the end point voltage of the battery.
5. The frequency error was recorded in parts per million (ppm).

**MEASUREMENT RESULTS: Temperature**

Tx FREQUENCY: 795.9875MHz 3W 12.5 kHz channel Spacing



**MEASUREMENT RESULTS: Voltage**

Frequency (MHz)	FREQUENCY ERROR (ppm)	
	7.5 V DC	6.0 V DC
795.8975	-0.04	-0.02

Limit Clause	Frequency range	Test Frequency (MHz)	Frequency Error (ppm)
47 CFR 90.539	794 – 806 MHz	795.9875	0.4

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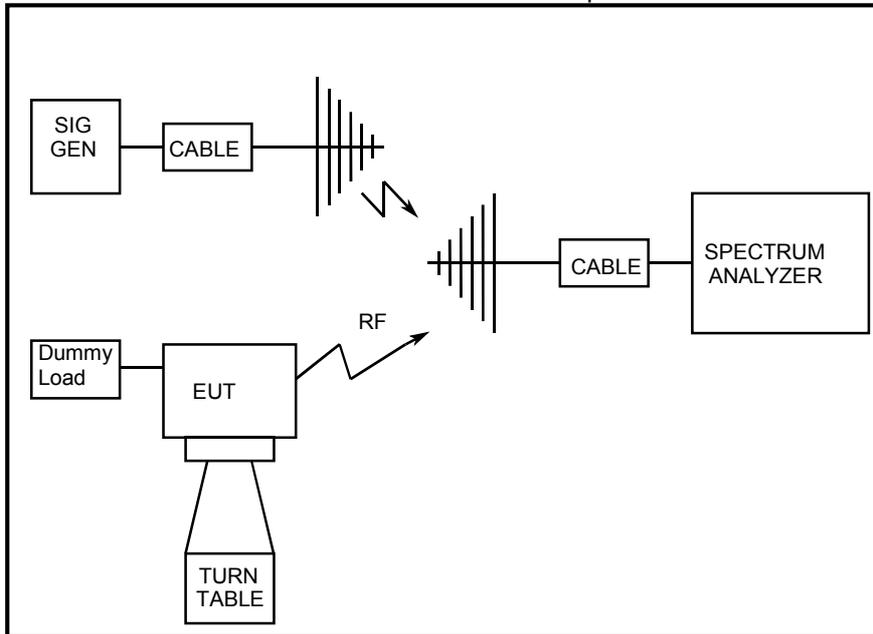
**TEST EQUIPMENT USED**

<b>No#</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Serial No#</b>	<b>Tait ID</b>	<b>Cal Due</b>
1	Signal Generator	Hewlett Packard	HP8642B (Opt 001)	2512A00176	E3064	07-Feb-06
2	Signal Generator	Hewlett Packard	HP8648A	3430U00344	E3579	06-Nov-05
11	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073	30-Nov-05
13	Audio Analyser	Hewlett Packard	HP8903A	2308A02597	E3074	30-Nov-05
14	Power Head	Hewlett Packard	HP11722A	2320A00688	E3307	08-Nov-05
20	Power Supply	Hewlett Packard	HP6032A	2441A-0041Z	E3075	19-Nov-05
21	Power Supply	Rohde & Schwarz	NGS M32/10 192.0810.31	Fnr 434	E3556	26-Sep-06
22	Oscilloscope	Tektronics	TDS340	B013611	E3585	06-Nov-05
24	Environ. Chamber	Contherm	Temp Control	E3397	E3397	13-Apr-06
30	Directional Coupler	Hewlett Packard	HP778D-012	1144A07392	E3292	13-Nov-05
42	Reference Horn Antenna	Emco	DRG3115	9512-4638	E3560	27-Sep-06
43	Horn Antenna	Emco	DRG3115	2084	E3076	27-Sep-06
46	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	
61	RF Attenuator 150W	Weinschel	40-20-33	CJ404	E3387	15-Nov-05
64	RF Attenuator 50W	Weinschel	24-10-34	AZ0401	E3388	30-Nov-05
67	RF Attenuator 150W Treva	Weinschel	40-20-33	CJ405	E3733	08-Nov-05
72	RF Load 50W	Weinschel	F1426	AE2490	E3624	07-Nov-05
80	20m Coax Cable	Intelcom	RG214/U-50	CBL03	E3659	30-Nov-05
82	3m Coax Cable BLUE)	Suhner	Sucoflex 104A	25033/4A	E3694	19-Nov-05
88	Spectrum Analyser	Hewlett Packard	HP8562E	3821A00779	E3715	14-Nov-05
91	20m Coax Cable		RG214/U-50 (Ext Cal)	CBL01	E3404	30-Nov-05
111	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	06-Nov-05
112	Signal Generator	Agilent	E4433B	US38440446	E4147	25-Jul-06
115	Environ. Chamber	Contherm	5400 RHSLT.M	1416	E4051	14-Apr-06
116	Power Head	Hewlett Packard	HP11722A	2716A02037	E1575	30-Nov-05
117	RF Attenuator	Weinschel	Model 1	BL9950	E4080	10-Nov-05
118	RF Attenuator	Weinschel	Model 1	BL9958	E4081	04-Jan-06
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	30-May-06
129	Antenna Tower	Electrometrics	EM-4720-2	112		
130	Controller	Electrometrics	EM-4700	119		
131	Turntable	Electrometrics	EM-4704A	105		
135	Attenuator	Weinschel	67-30-33	BR0531	E4280	30-Nov-05
137	1m Multiflex Cable	Suhner	MF141	TT007		08-Aug-06
138	1m Multiflex Cable	Suhner	MF141	TT086		08-Aug-06

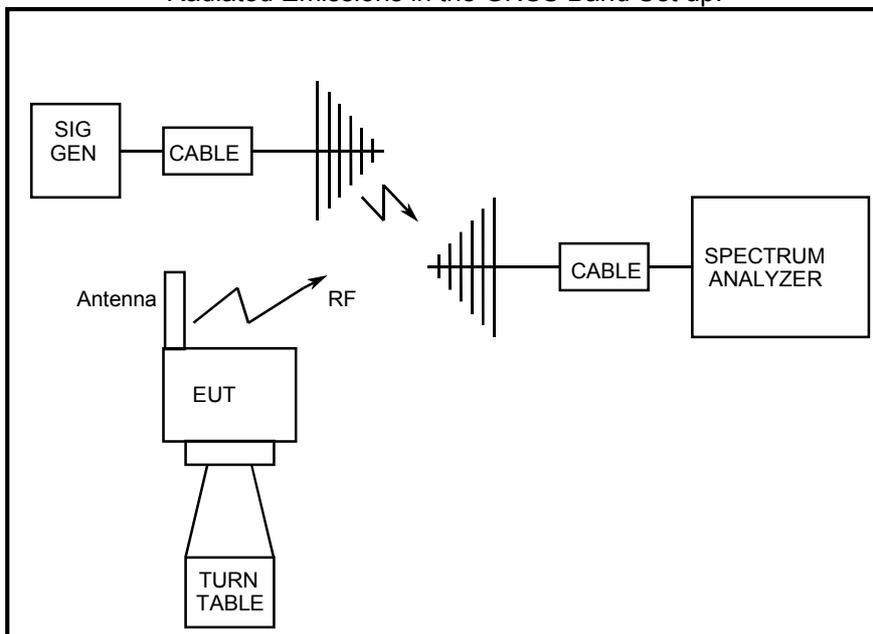
ANNEX A

TEST SETUP DETAILS

Radiated Emissions Set up.

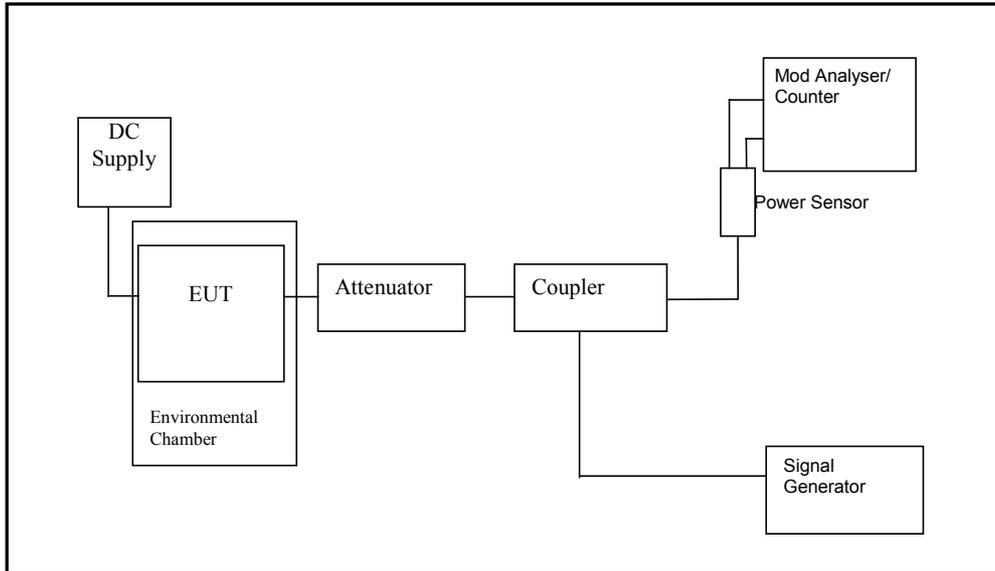


Radiated Emissions in the GNSS Band Set up.



TEST SETUP DETAILS

Frequency stability with AFC



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, Occupied Bandwidth, and ACP measurements

