

Laboratory Test Report

For the
TBBB1A Base Station Transceiver

Tested In accordance with
FCC 47 CFR Parts 22 and 90

Report Revision: 1
Issue Date: 29-June-2007
FCC ID: CASTBBB1A

PREPARED BY: Garry Pringle _____
Test Technician

CHECKED & APPROVED BY: Steve Crompton _____
Laboratory Manager



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

This document must not be reproduced except in full, without the written permission of the Compliance Laboratory Manager.

TABLE OF CONTENTS

REVISION HISTORY	3
INTRODUCTION	4
REPORT PREPARED FOR	4
DESCRIPTION OF SAMPLE	4
STATEMENT OF COMPLIANCE	4
TEST CONDITIONS	4
MODULATION TYPES AND EMISSION DESIGNATORS	5
TEST RESULTS	6
TRANSMITTER OUTPUT POWER (CONDUCTED)	6
TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS	7
TRANSMITTER MODULATION LIMITING	9
OCCUPIED BANDWIDTH	9
ANALOGUE VOICE	9
FFSK 1200 bps	9
FFSK 2400 bps	9
THSD	9
SPURIOUS EMISSIONS (CONDUCTED)	9
SPURIOUS EMISSIONS (RADIATED)	9
TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)	9
TRANSMITTER FREQUENCY STABILITY (VOLTAGE)	9
TRANSIENT FREQUENCY BEHAVIOR	9
TEST EQUIPMENT USED	9
ANNEX A	9
TEST SETUP DETAILS	9

REVISION HISTORY

Date	Revision	Comments
29-June-2007	1	Initial test report

INTRODUCTION

Type Approval Testing of the TBBB1B1-A10-00 (Serial No 18035296)
in accordance with:

- **FCC CFR 47 Parts 22 & 90**

REPORT PREPARED FOR

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

DESCRIPTION OF SAMPLE

Equipment: Base Station Transceiver (136 MHz to 174 MHz)
Type: TBBB1A
Product code: TBBB1B1-A10-00
Serial Number: 18035296
Quantity: 1
Hardware & Software

Receiver SN:19251818	
Hardware ID,	TMAB13-B1R1_0102, OK,Torso,0,
Radio Application,	QMA1F_std_02.13.00.10, OK,Torso,0,
Boot Code,	QMA1B_std_1.03.00.0005, OK,Torso,0,
FPGA Image,	QMA1G_std_1.07.02.0001, OK,Torso,0,
Transmitter SN:19251803	
Hardware ID,	TMAB13-B1T1_0102, OK,Torso,0,
Radio Application,	QMA1F_std_02.13.00.10, OK,Torso,0,
Boot Code,	QMA1B_std_1.03.00.0005, OK,Torso,0,
FPGA Image,	QMA1G_std_1.07.02.0001, OK,Torso,0,

STATEMENT OF COMPLIANCE

The TBBB1B1-A10-00 Base Station transceiver as tested in this report was found to conform to the following standards:

- **FCC CFR 47 Parts 22 & 90**

TEST CONDITIONS

All testing was performed at the following conditions.

Ambient Temperature 15°C → 30°C
Relative Humidity 20% → 75%
Standard Test Voltage 120 Vac

MODULATION TYPES AND EMISSION DESIGNATORS

Modulation Types:

F3E	Analogue FM
F2D	FFSK Data (1200 bps, 2400 bps)
F1D	THSD (12000 bps, 19200 bps)

Channel Spacings:

12.5 kHz,
25.0 kHz

Emission Designators:

Analogue FM	11k0F3E, 16k0F3E
FFSK Data 1200bps	6k60F2D, 9k60F2D
FFSK Data 2400bps	7k80F2D, 10k8F2D
THSD	7k70F1D, 12k7F1D

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:

Manufacturer's Rated Output Power: Switchable from 25 W to 1 W

155.1 MHz	25 W nominal	1 W nominal
POWER (W)	28.2	1.12
Variation from Nominal (%)	12.8	12.0
Measurement Uncertainty	± 0.6 dB	

LIMIT CLAUSE: FCC 47 CFR 90.205 (r)

Radio Type: Mobile Transceiver

Frequency Band: 136 MHz ~ 174 MHz

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.

MEASUREMENT RESULTS:

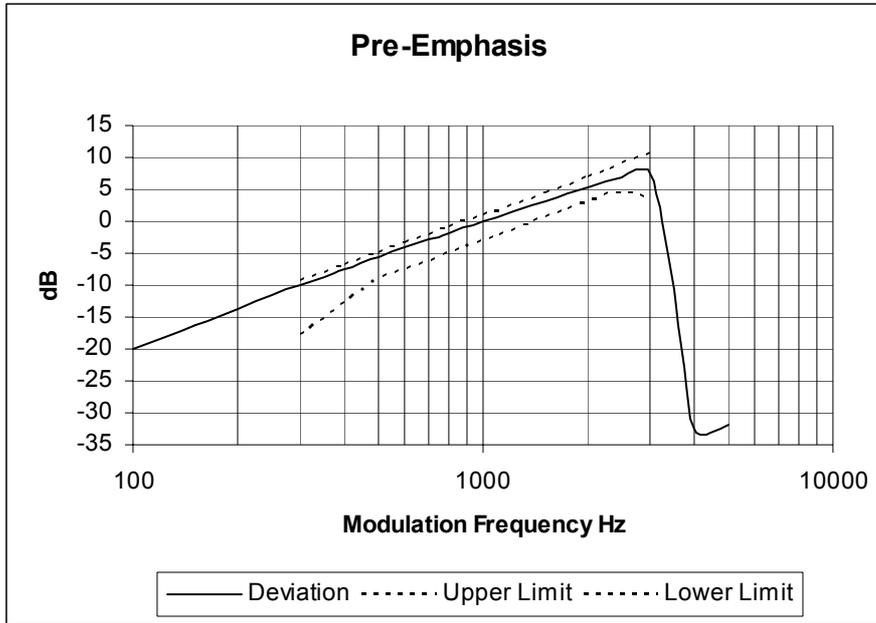
See the plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings.

LIMIT CLAUSE: TIA/EIA-603C 3.2.6

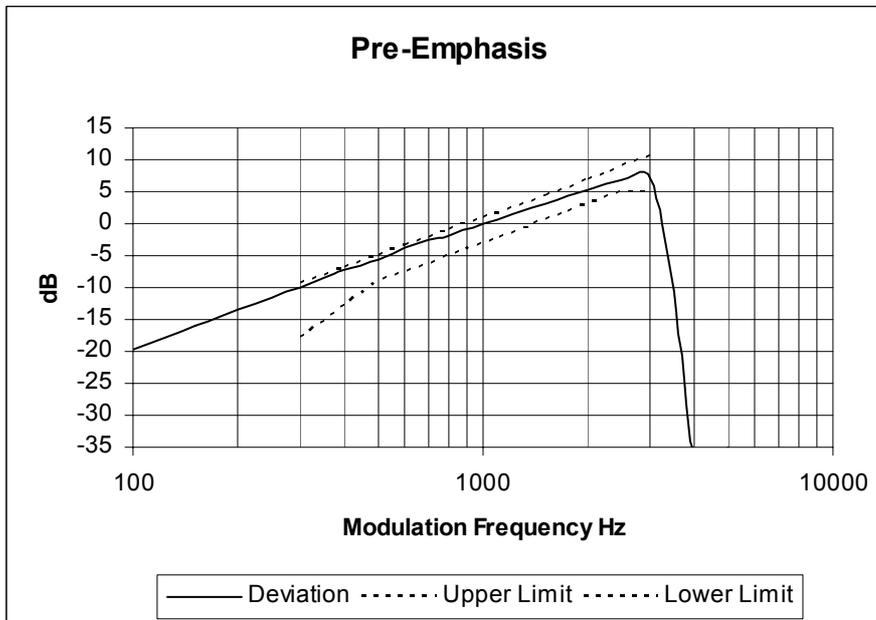
TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 155.1 MHz 12.5 kHz Channel Spacing



Tx FREQUENCY: 155.1 MHz 25 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

MEASUREMENT PROCEDURE:

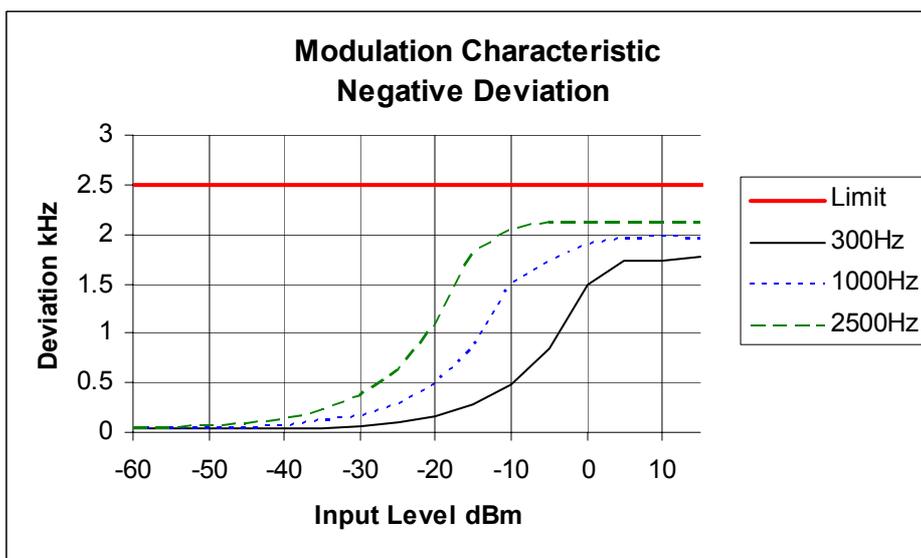
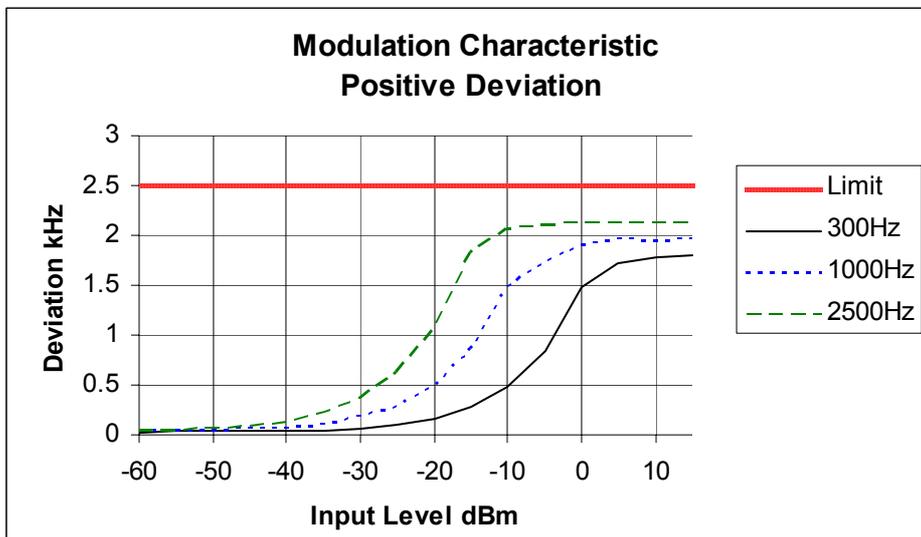
1. Refer Annex A for Equipment set up.
2. The modulation response was measured at three audio frequencies while varying the input level.
3. Measurements were made for both Positive and Negative Deviation.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: TIA/EIA-603C 1.3.4.4

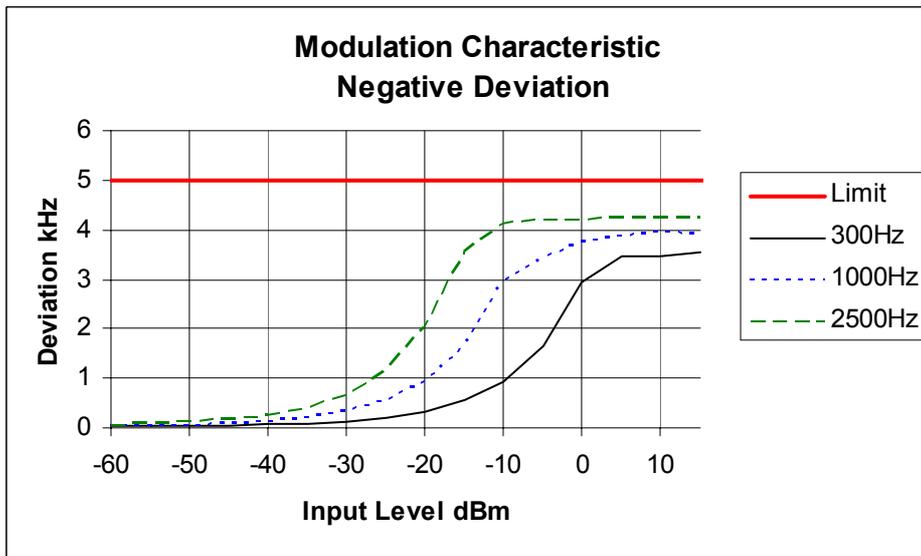
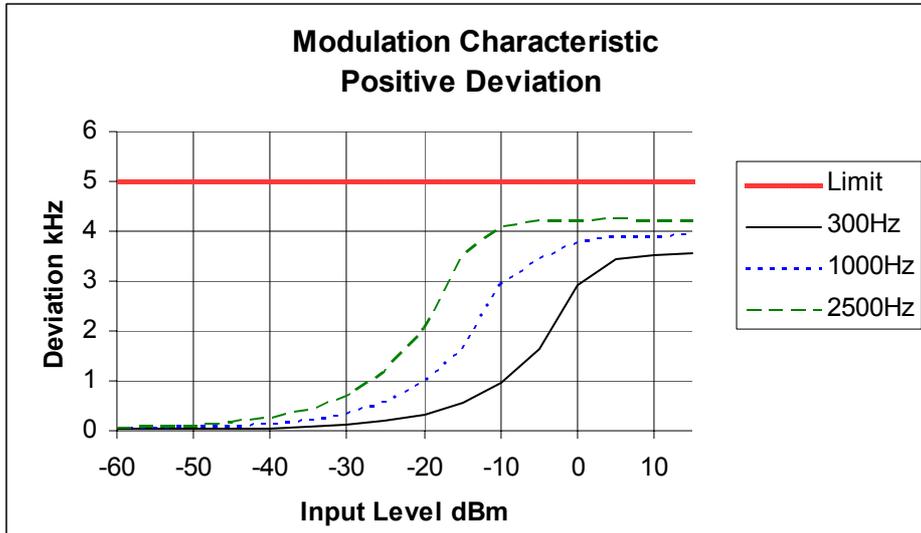
Tx FREQUENCY: 155.1 MHz 12.5 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 155.1 MHz 25.0 kHz Channel Spacing



OCCUPIED BANDWIDTH

SPECIFICATION: FCC 47 CFR 2.1049 (c)

GUIDE: TIA/EIA-603C 2.2.11

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
2. For analog 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.

NOTE:

FFSK = Fast Frequency Shift Keying
THSD = Tait High Speed data

LIMIT CLAUSE: FCC 47 CFR 90.210

EMISSION MASKS

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

DATA SPEED

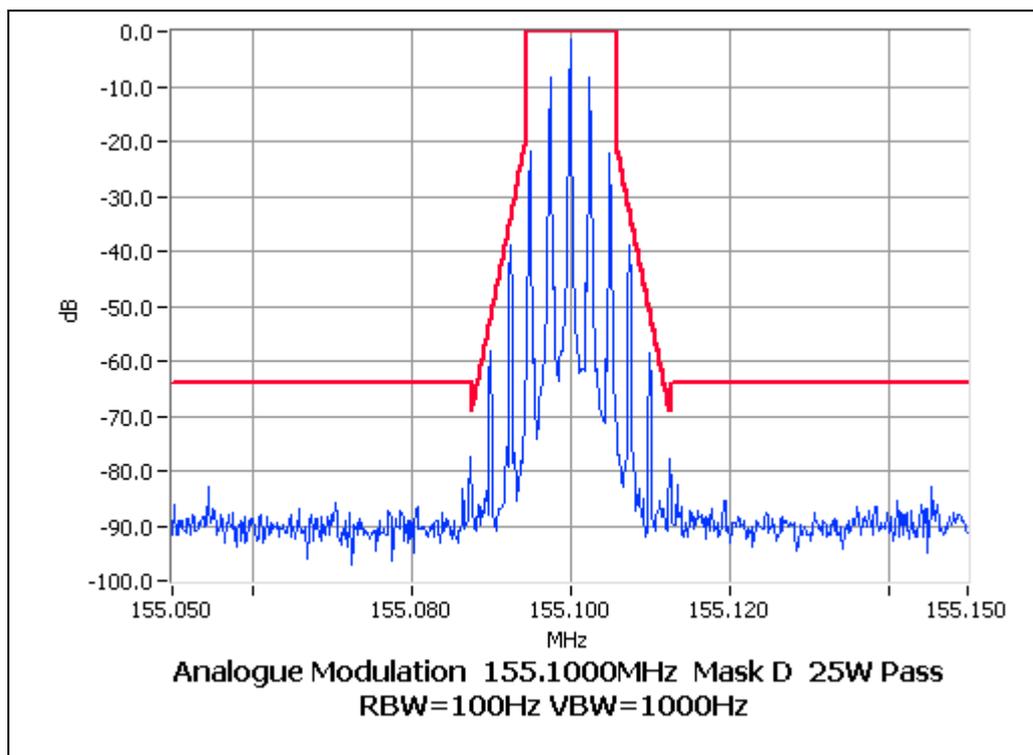
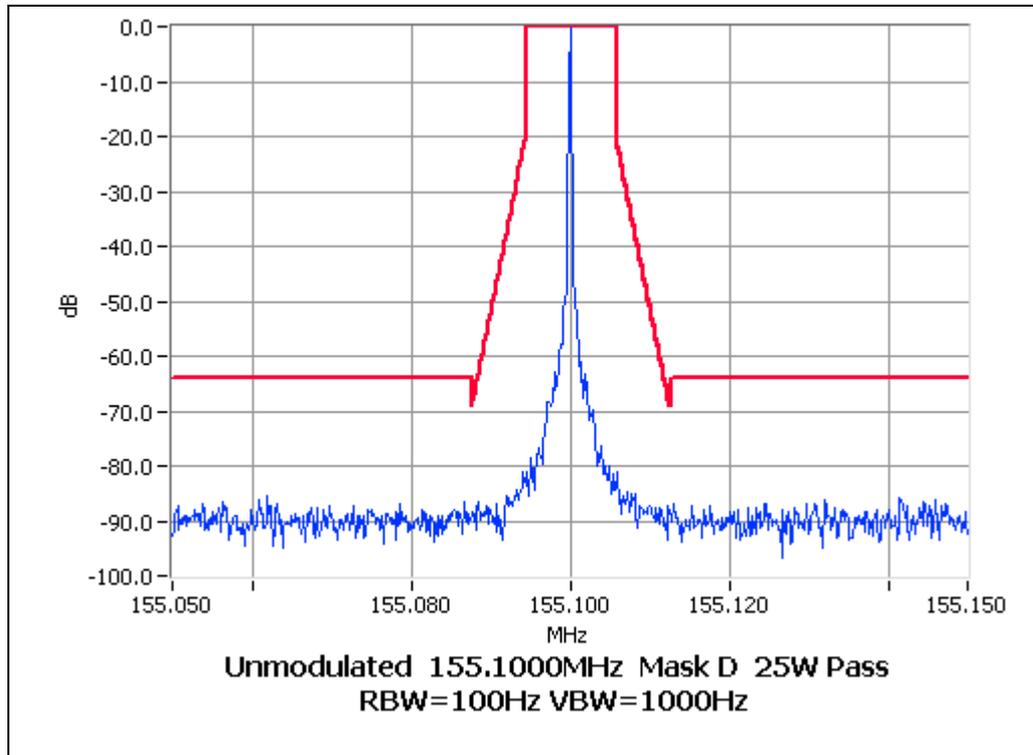
FFSK	1200 bps	12.5 kHz Channel Spacing
FFSK	1200 bps	25.0 kHz Channel Spacing
FFSK	2400 bps	12.5 kHz Channel Spacing
FFSK	2400 bps	25.0 kHz Channel Spacing
THSD	12000 bps	12.5 kHz Channel Spacing
THSD	19200 bps	25.0 kHz Channel Spacing

OCCUPIED BANDWIDTH

ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 155.1 MHz 25 W 12.5 kHz Channel Spacing

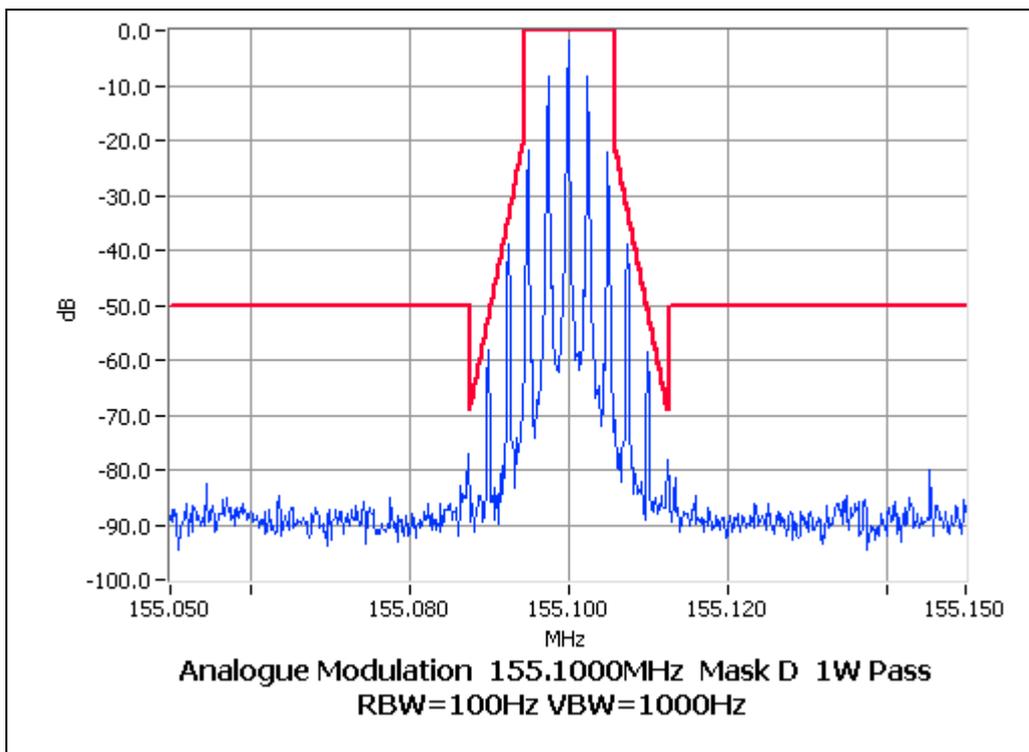
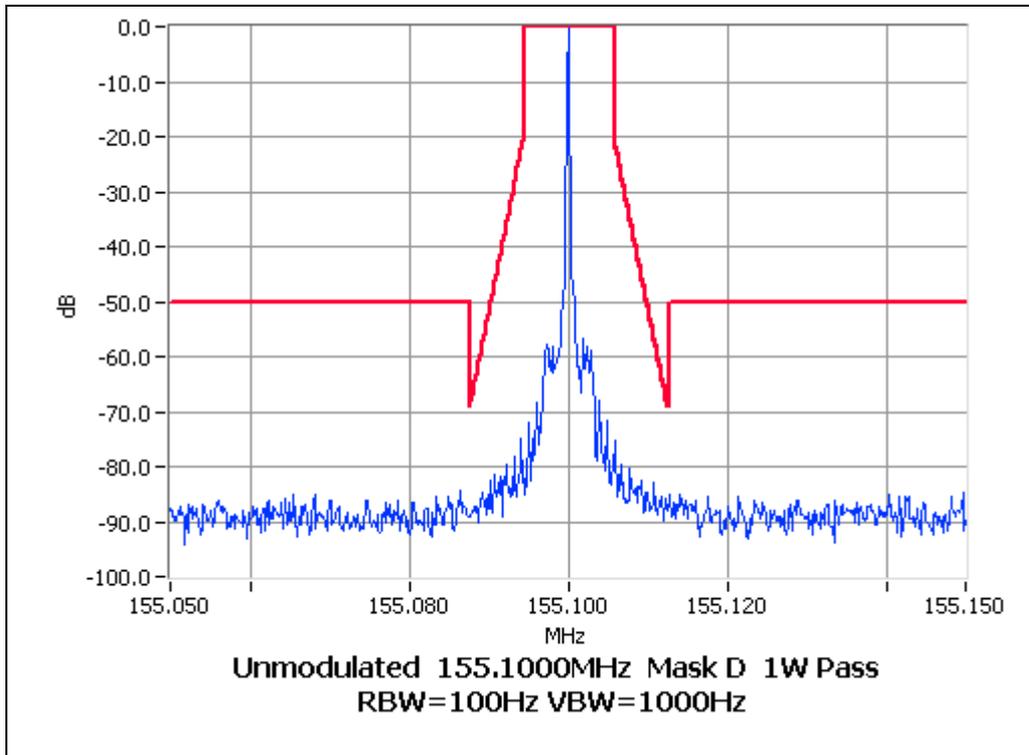


OCCUPIED BANDWIDTH

ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 155.1 MHz 1 W 12.5 kHz Channel Spacing

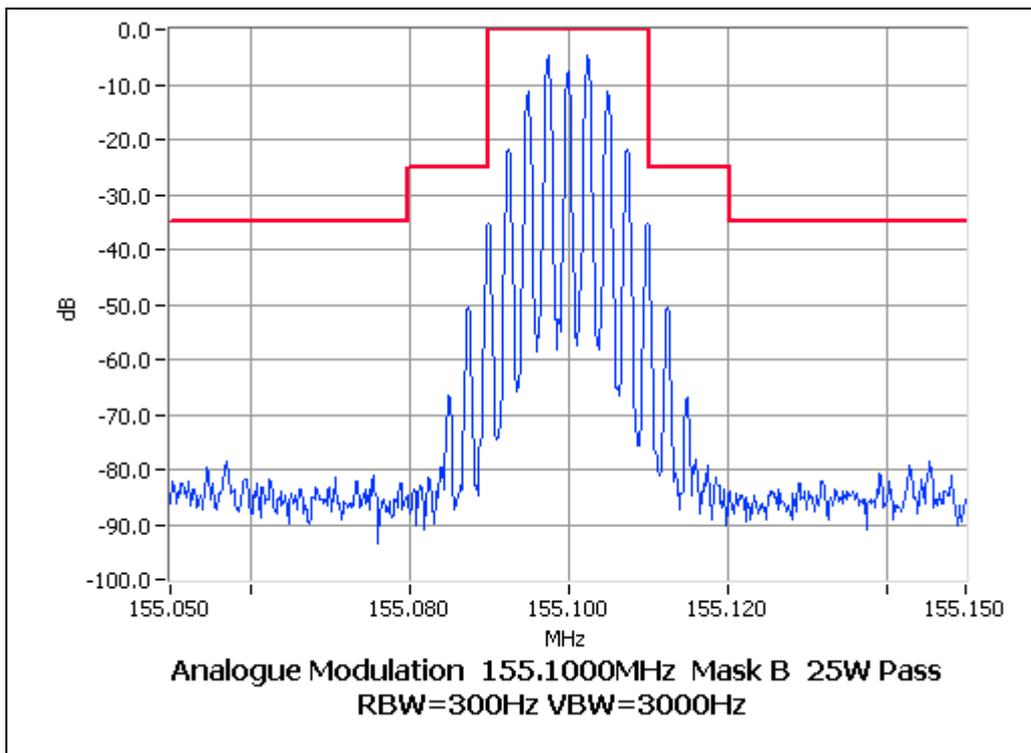
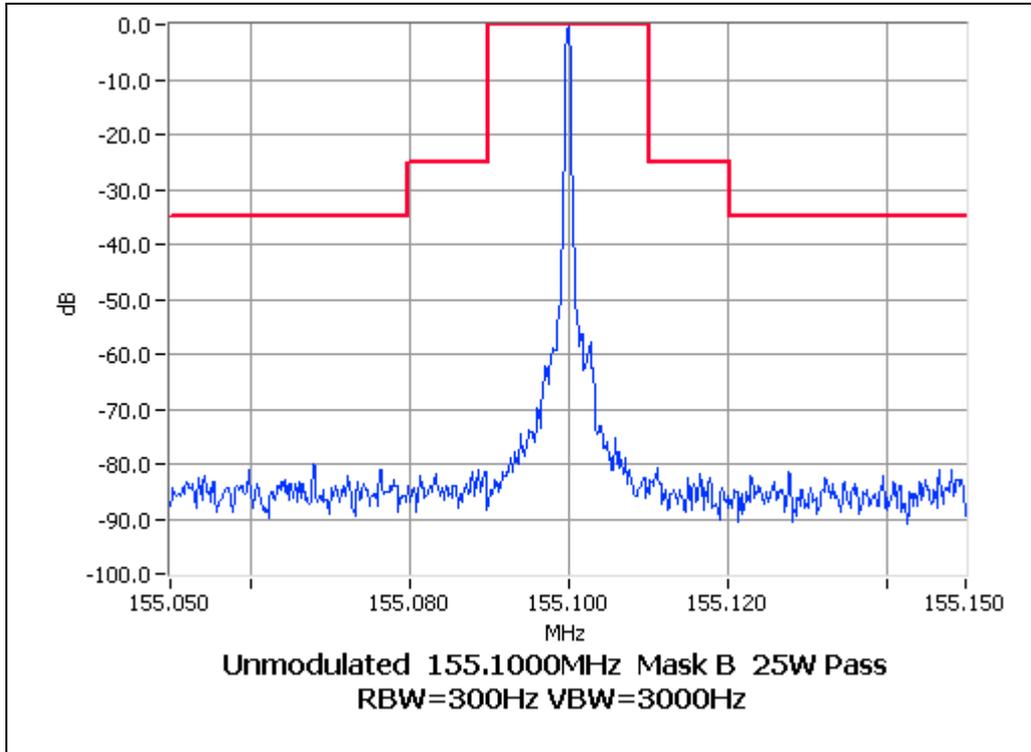


OCCUPIED BANDWIDTH

ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 155.1 MHz 25 W 25 kHz Channel Spacing

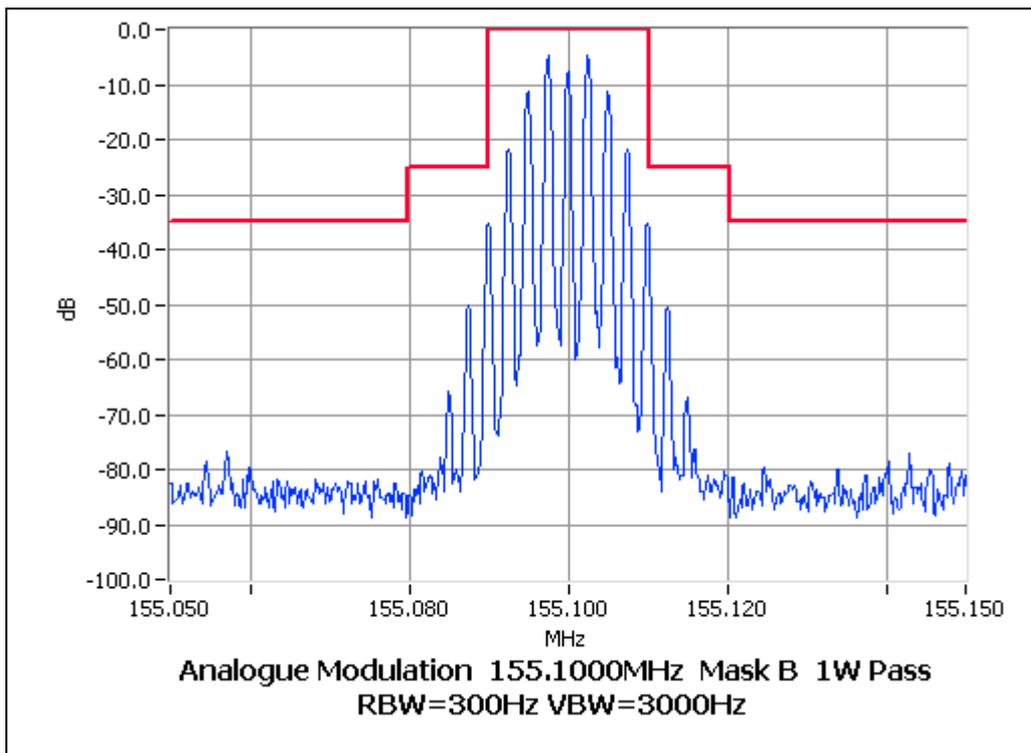
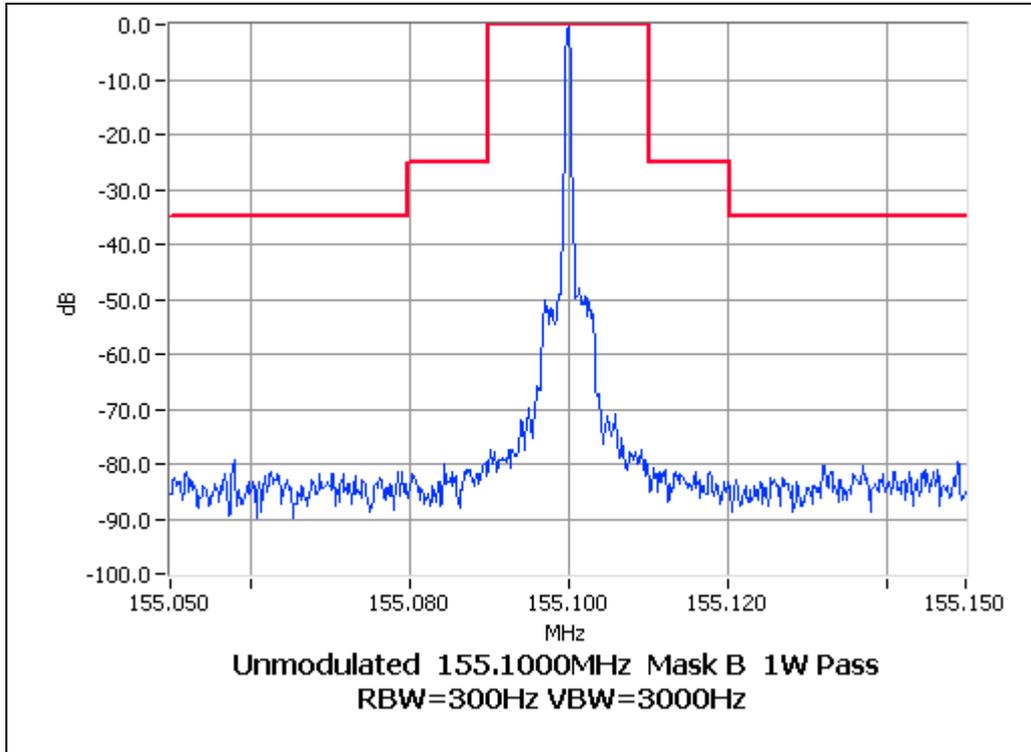


OCCUPIED BANDWIDTH

ANALOGUE VOICE

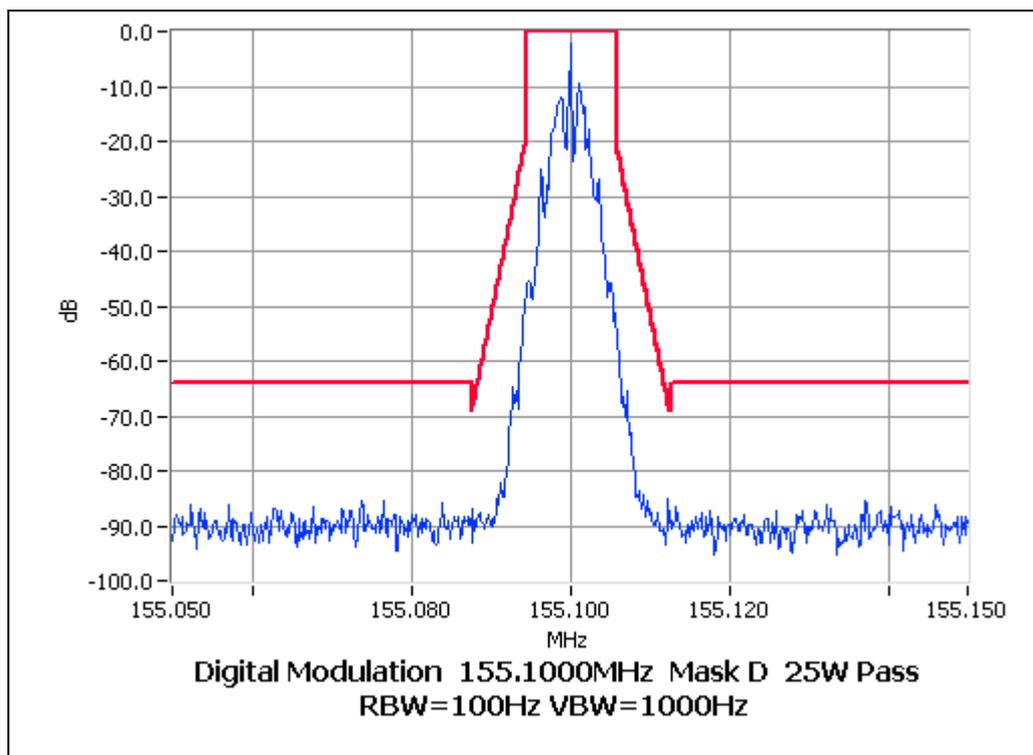
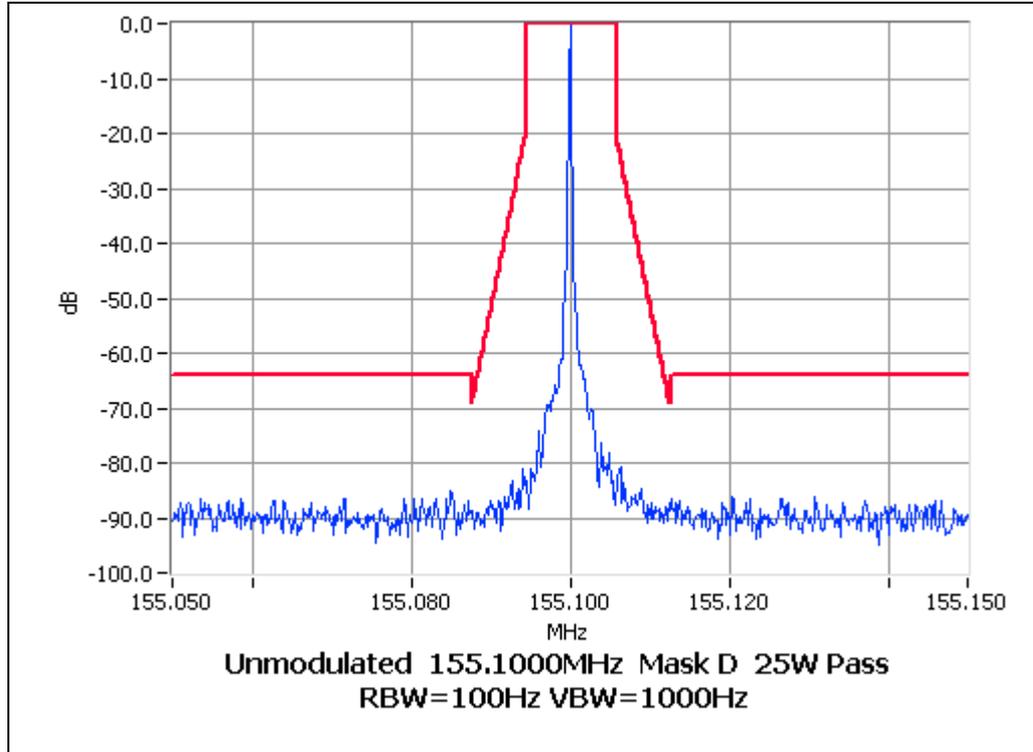
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 155.1 MHz 1 W 25 kHz Channel Spacing



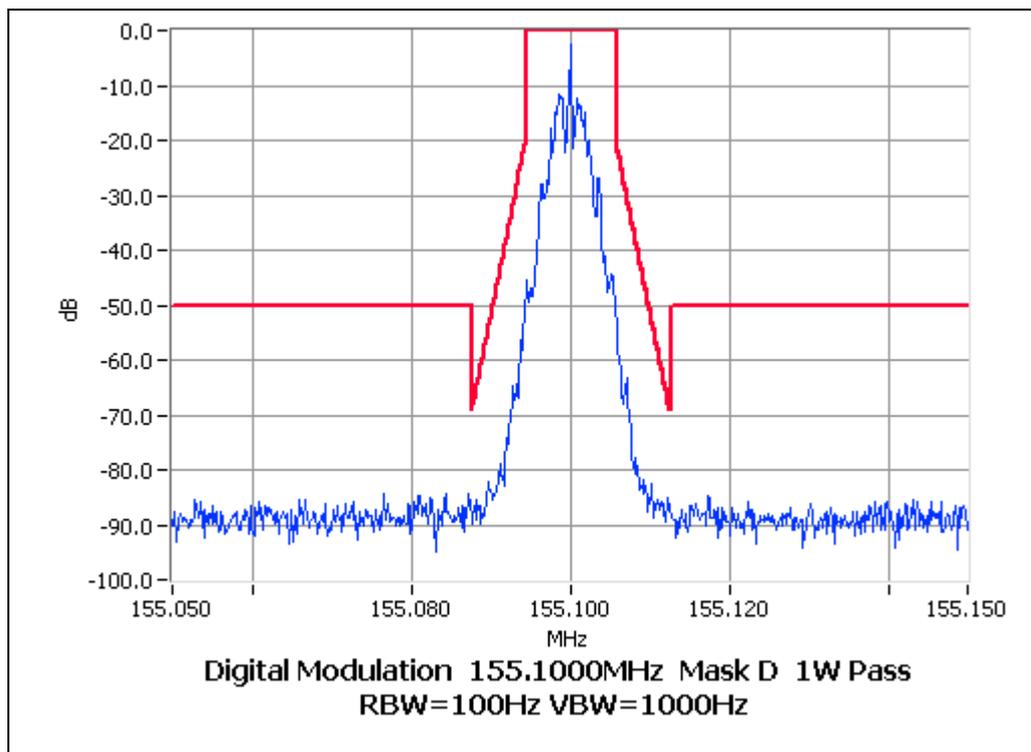
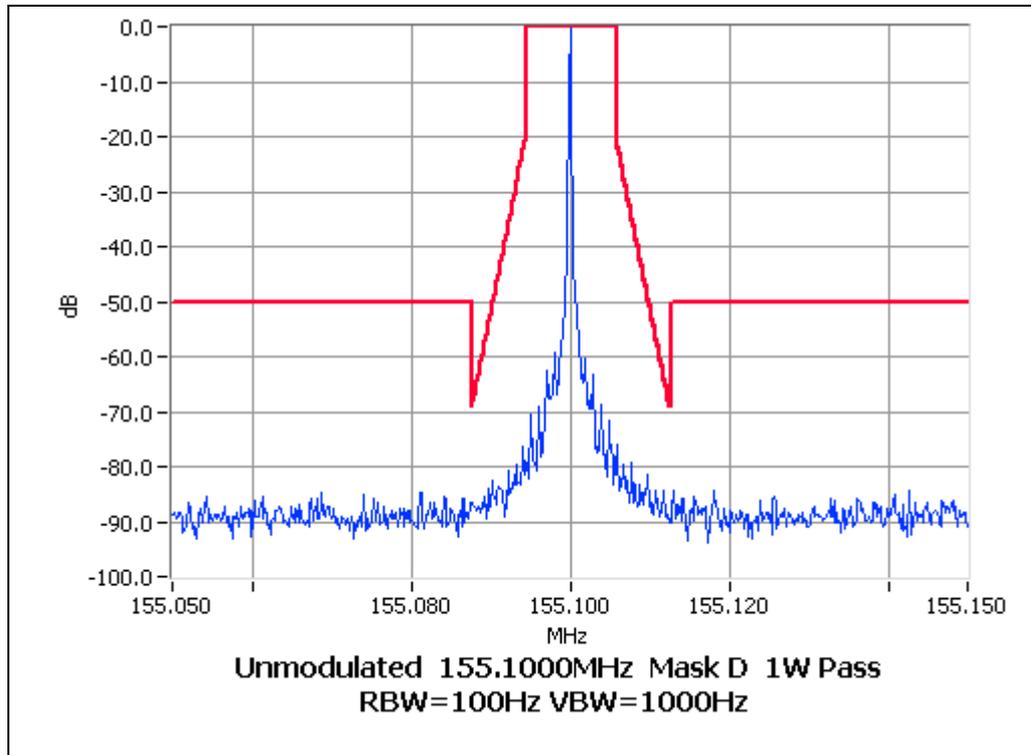
OCCUPIED BANDWIDTH

FFSK 1200 bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 25 W 12.5 kHz Channel Spacing



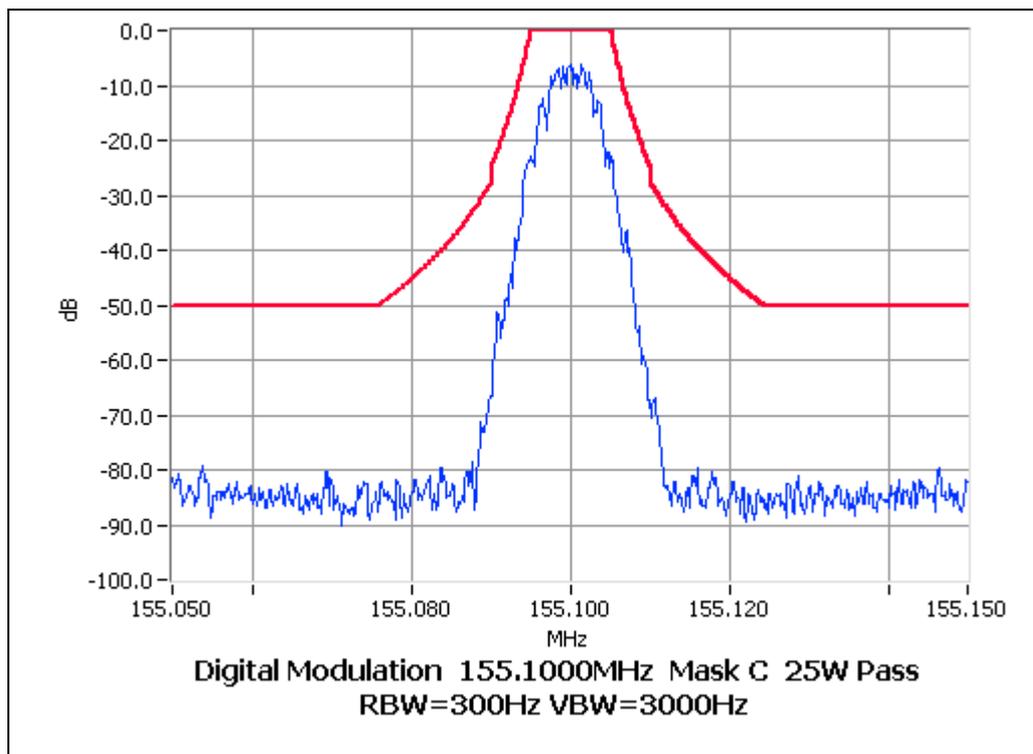
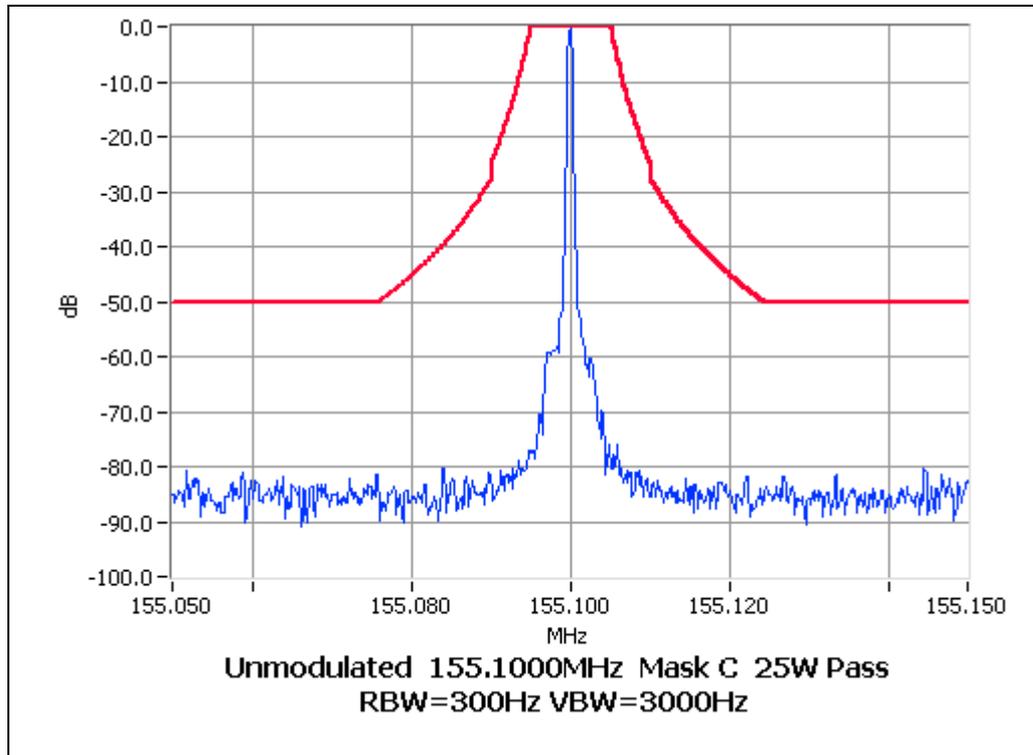
OCCUPIED BANDWIDTH

FFSK 1200 bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 1 W 12.5 kHz Channel Spacing



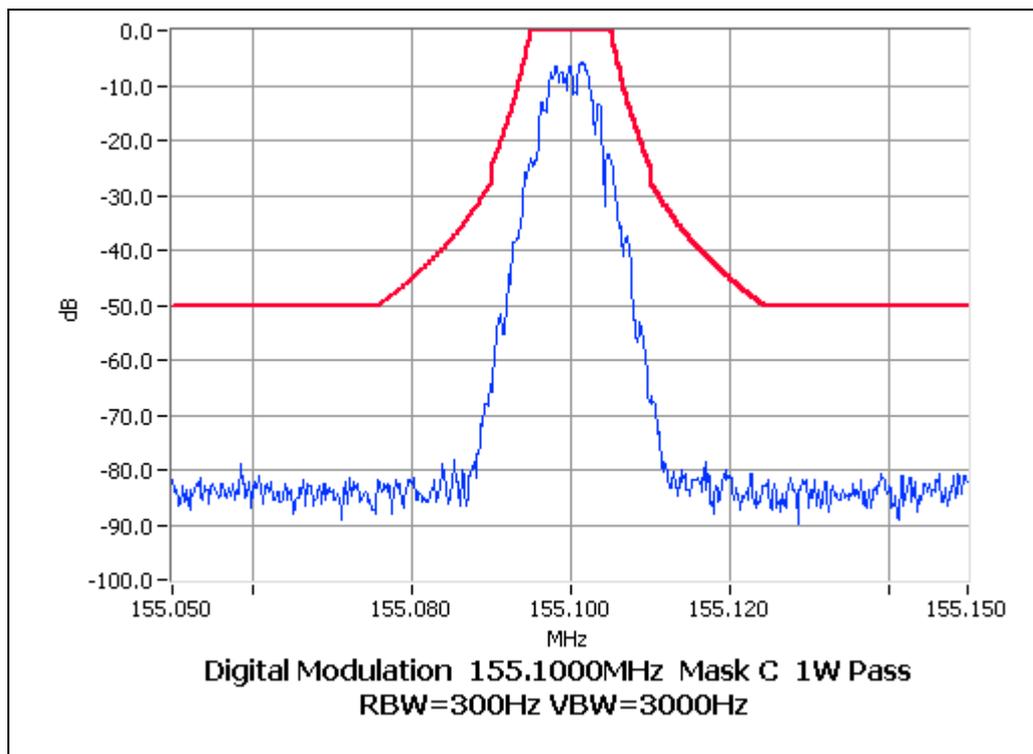
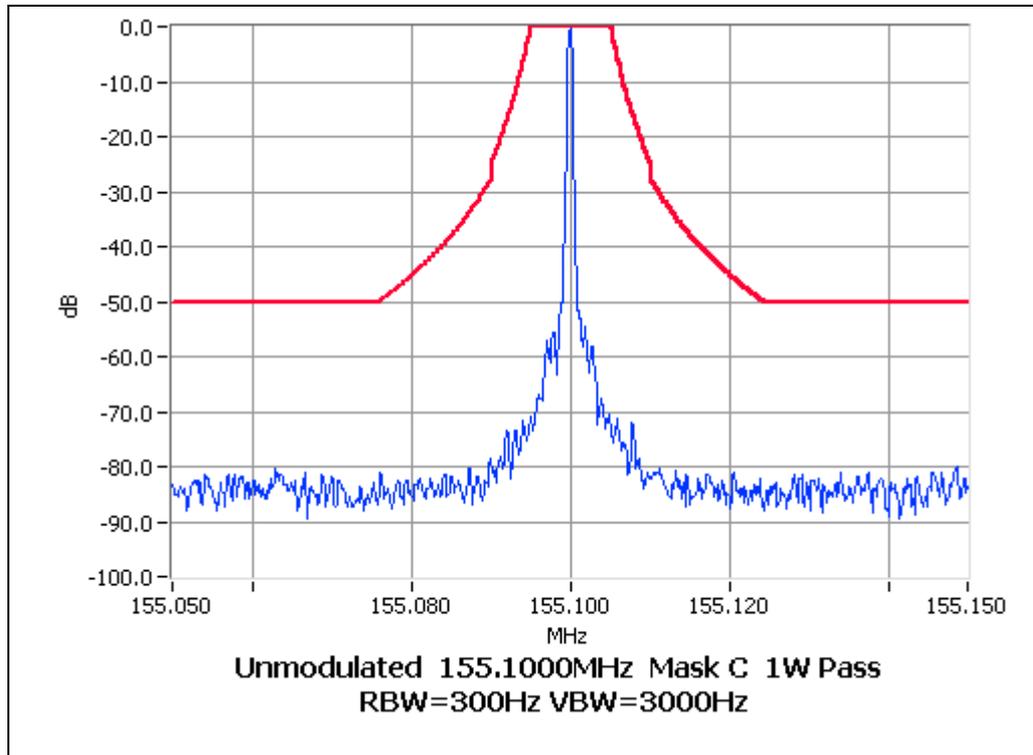
OCCUPIED BANDWIDTH

FFSK 1200 bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 25 W 25 kHz Channel Spacing



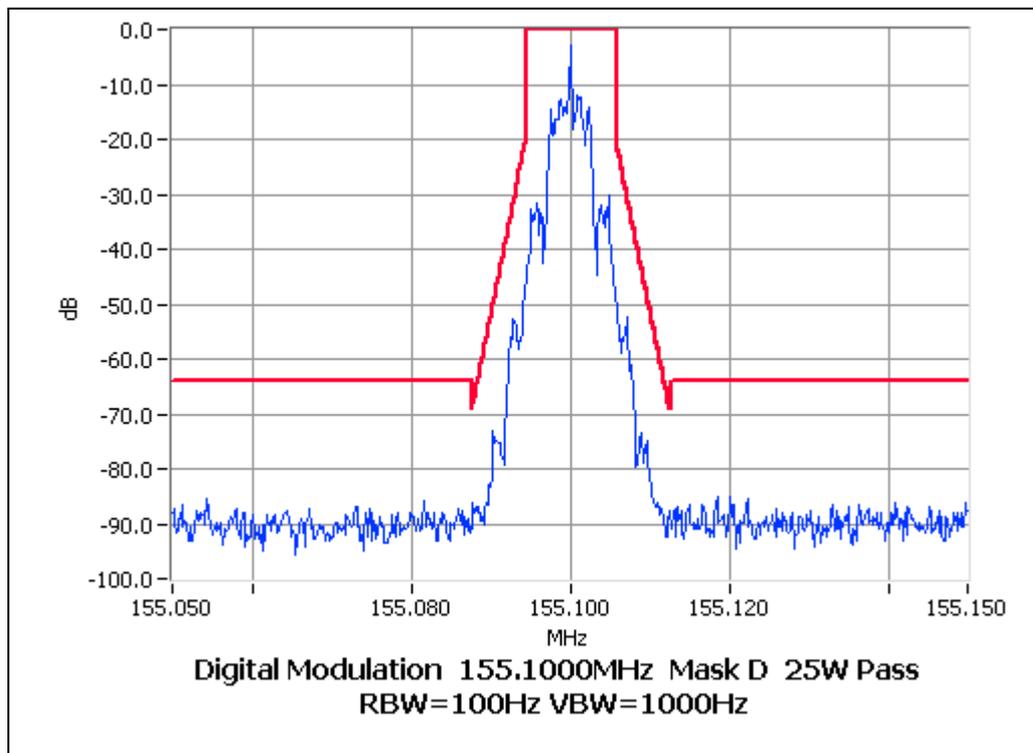
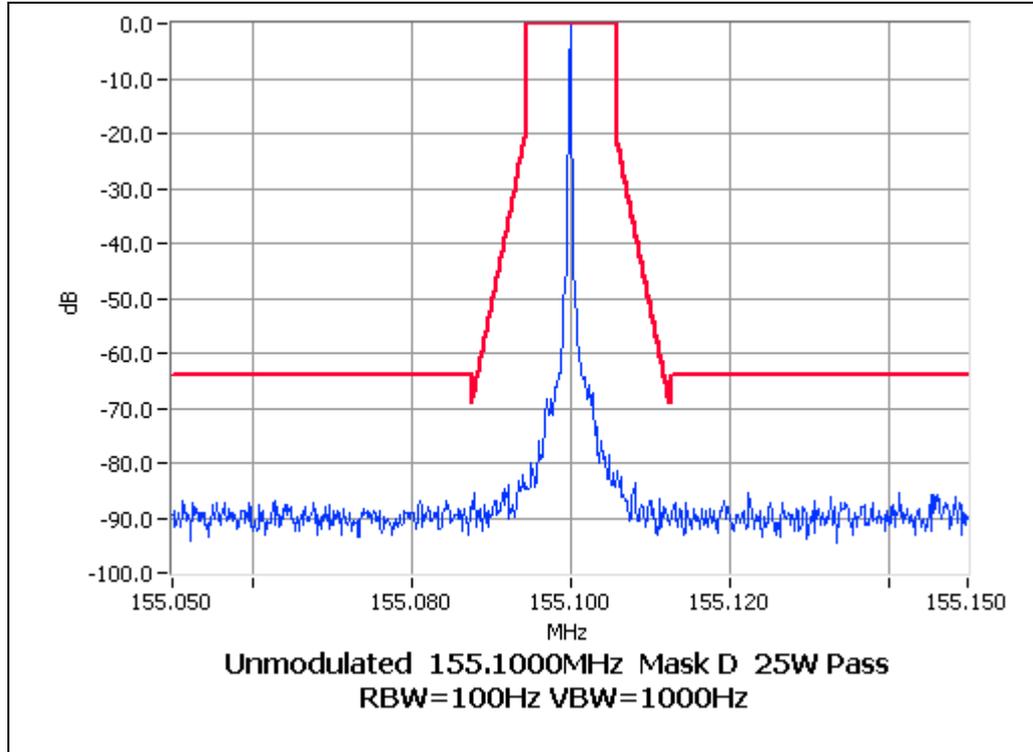
OCCUPIED BANDWIDTH

FFSK 1200 bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 1 W 25 kHz Channel Spacing



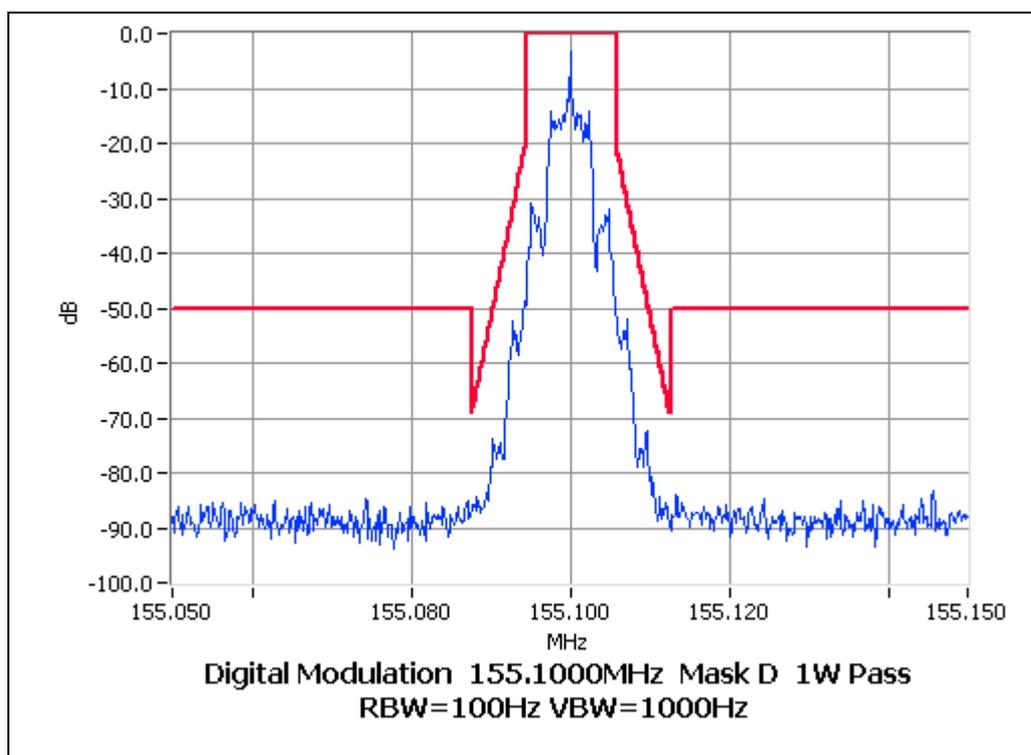
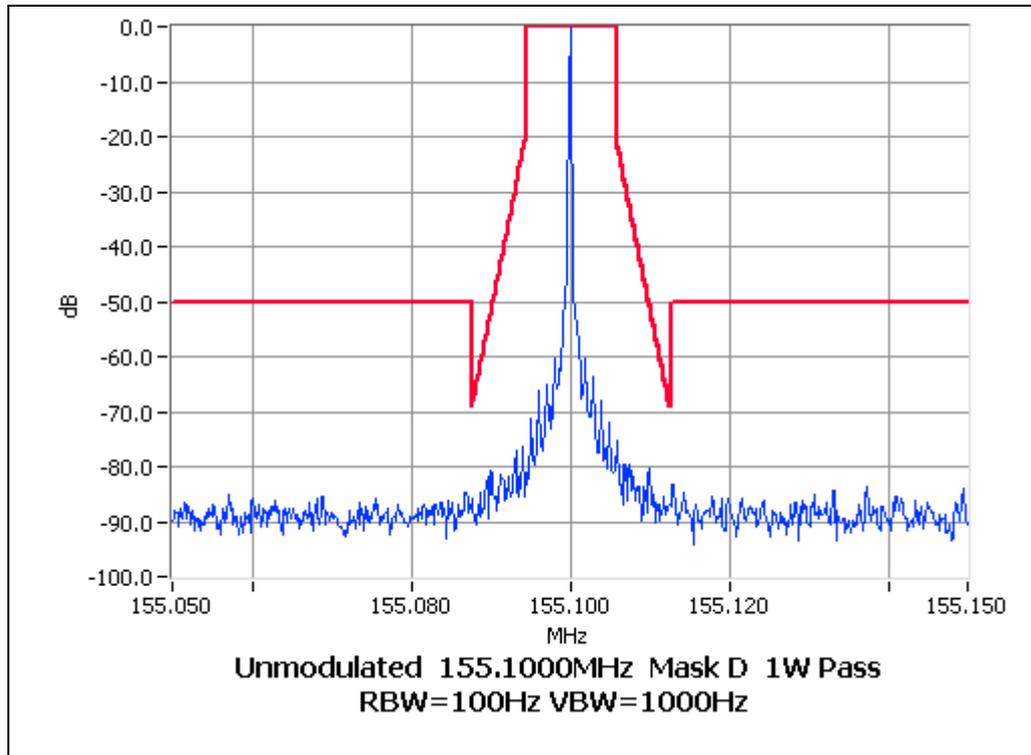
OCCUPIED BANDWIDTH

FFSK 2400 bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 25 W 12.5 kHz Channel Spacing



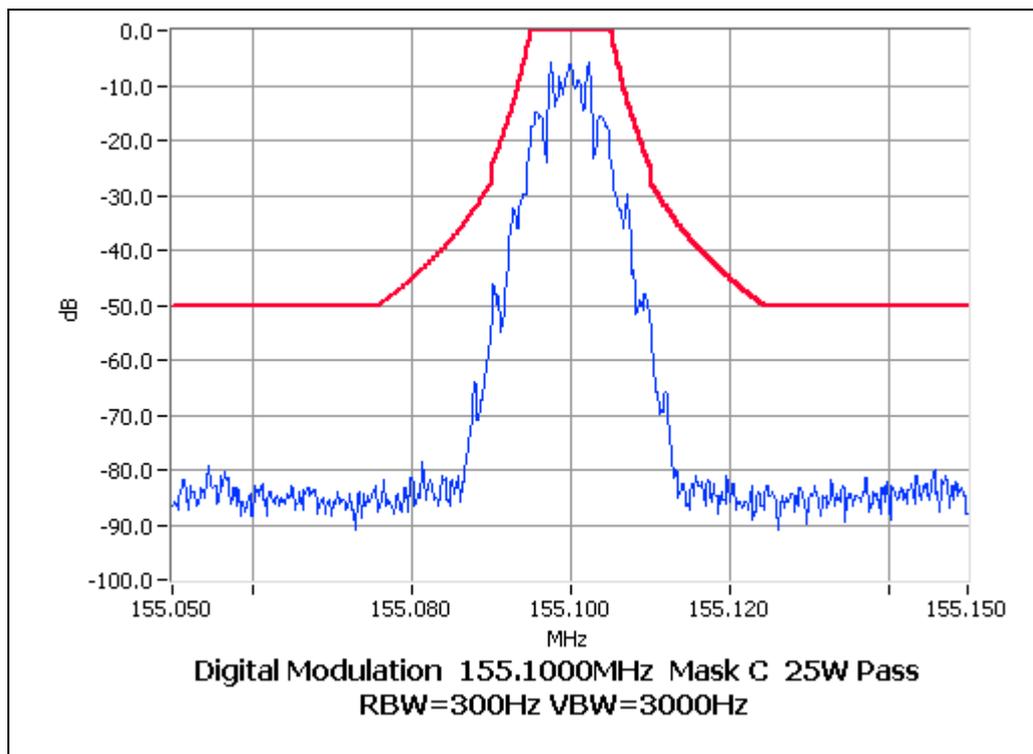
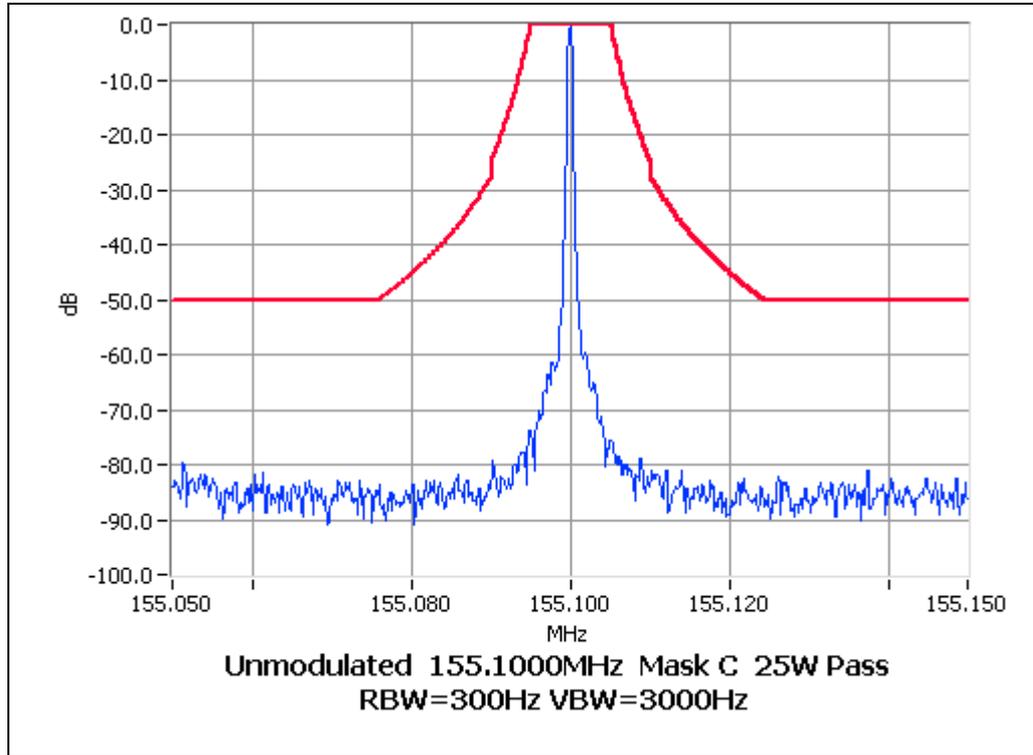
OCCUPIED BANDWIDTH

FFSK 2400 bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 1 W 12.5 kHz Channel Spacing



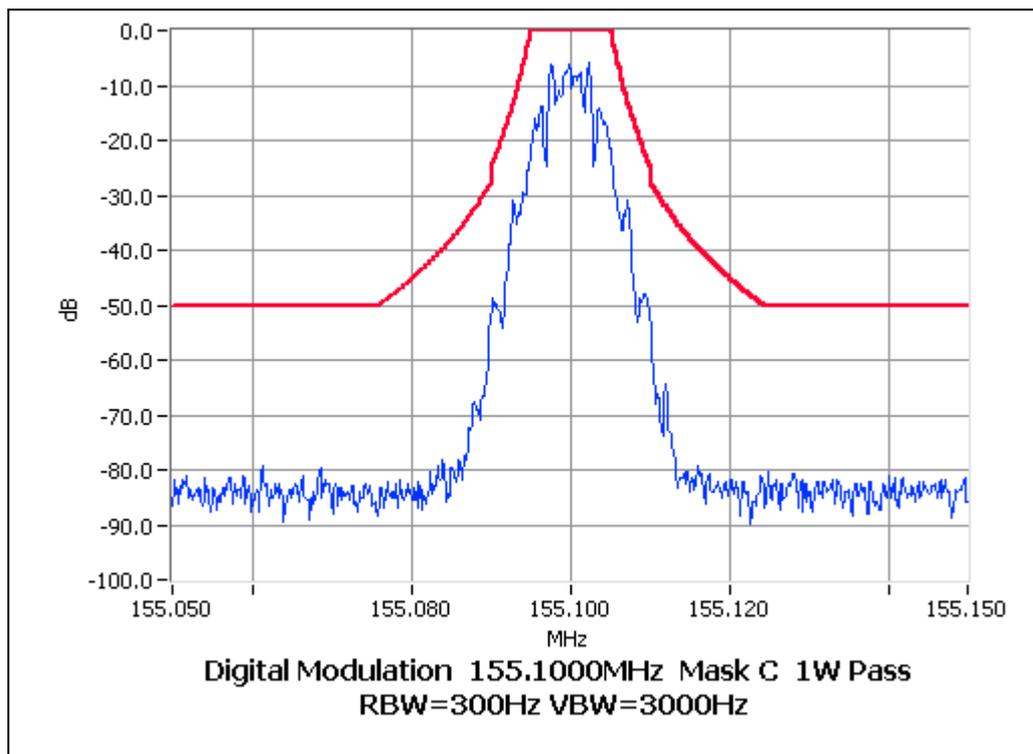
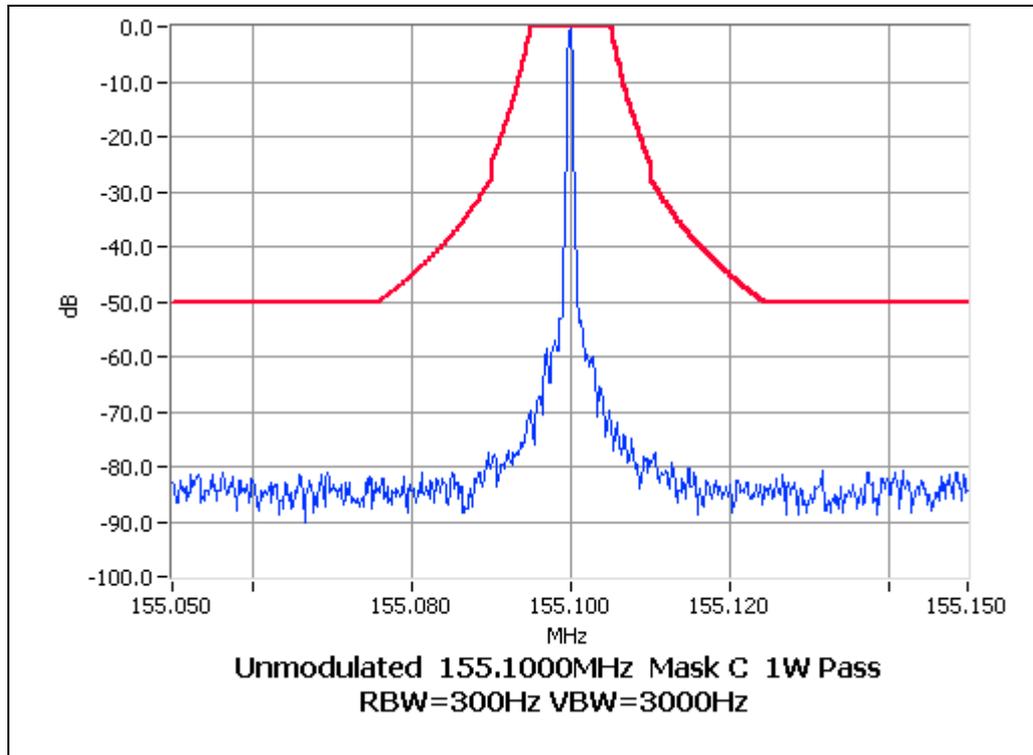
OCCUPIED BANDWIDTH

FFSK 2400 bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 25 W 25 kHz Channel Spacing



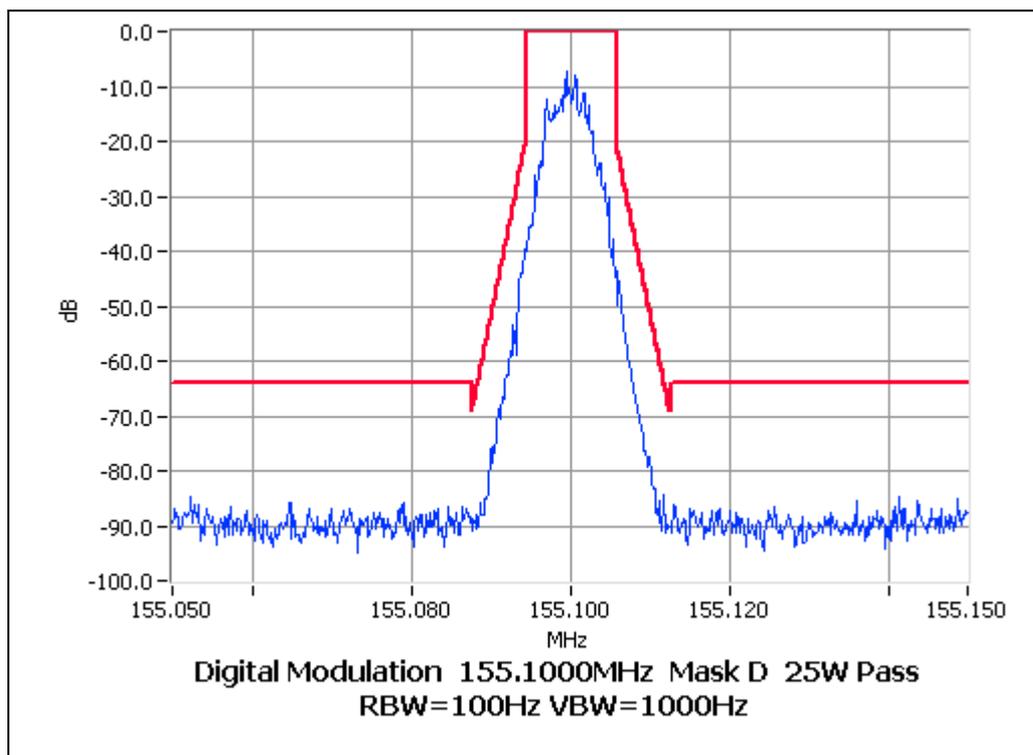
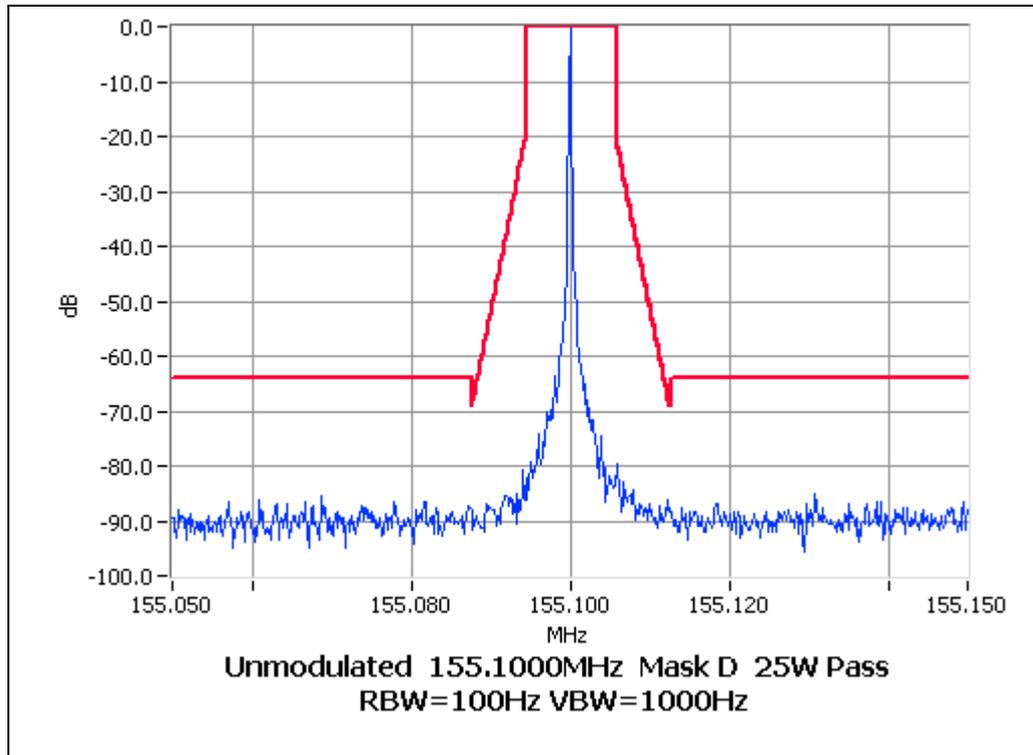
OCCUPIED BANDWIDTH

FFSK 2400 bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 1 W 25 kHz Channel Spacing



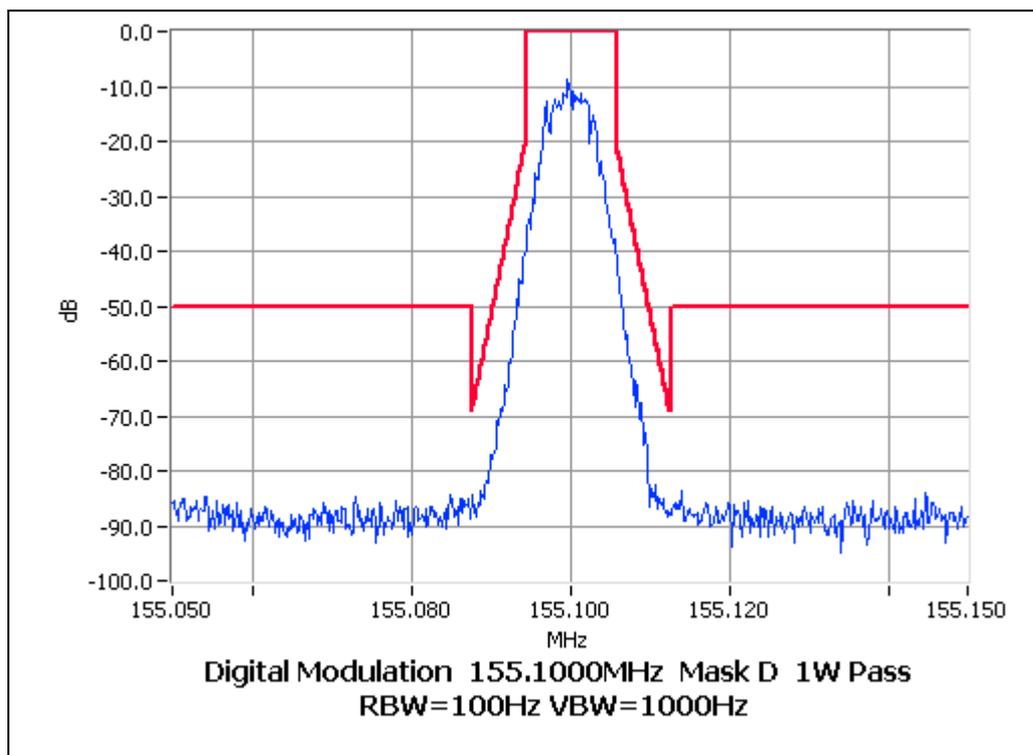
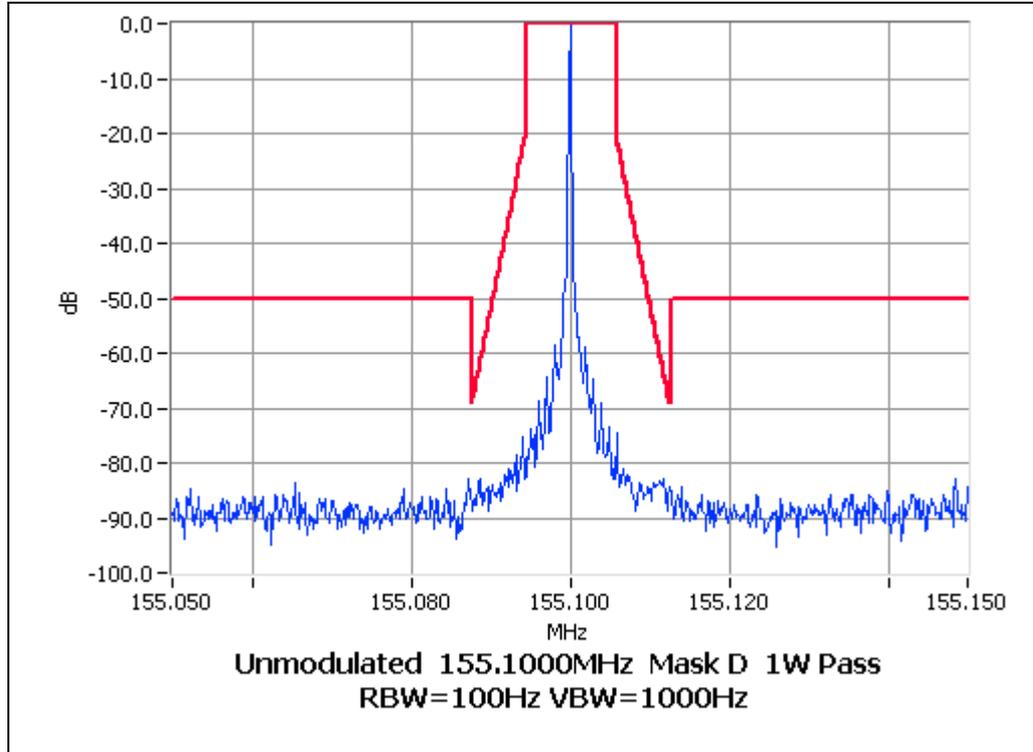
OCCUPIED BANDWIDTH

THSD 12000bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 25 W 12.5 kHz Channel Spacing



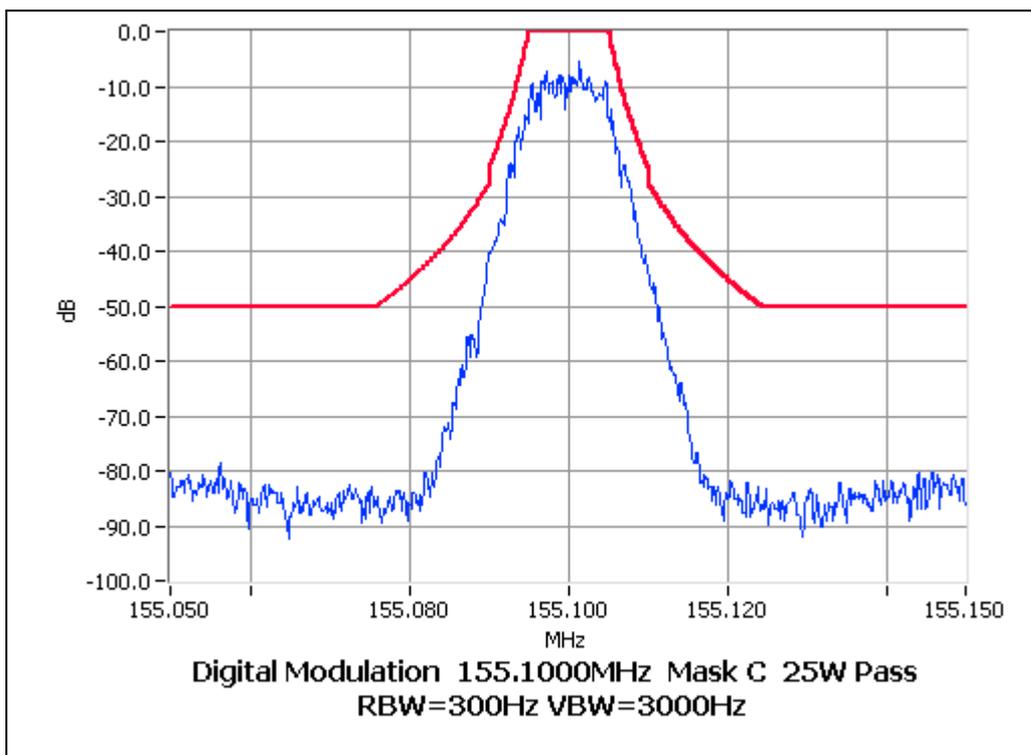
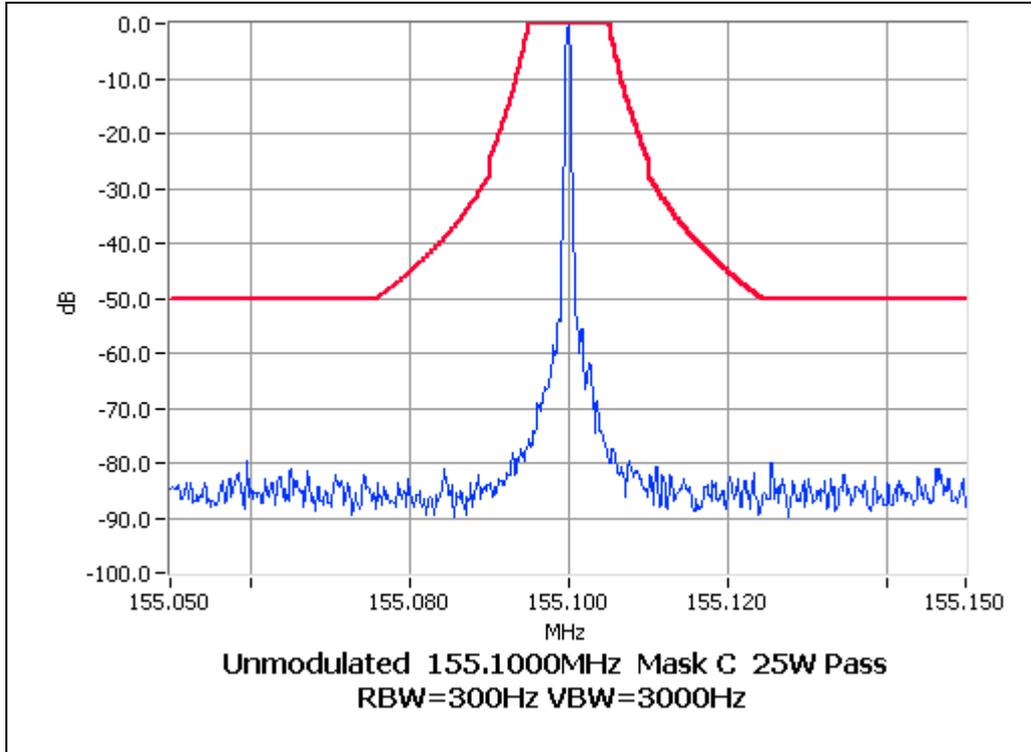
OCCUPIED BANDWIDTH

THSD 12000bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 1 W 12.5 kHz Channel Spacing



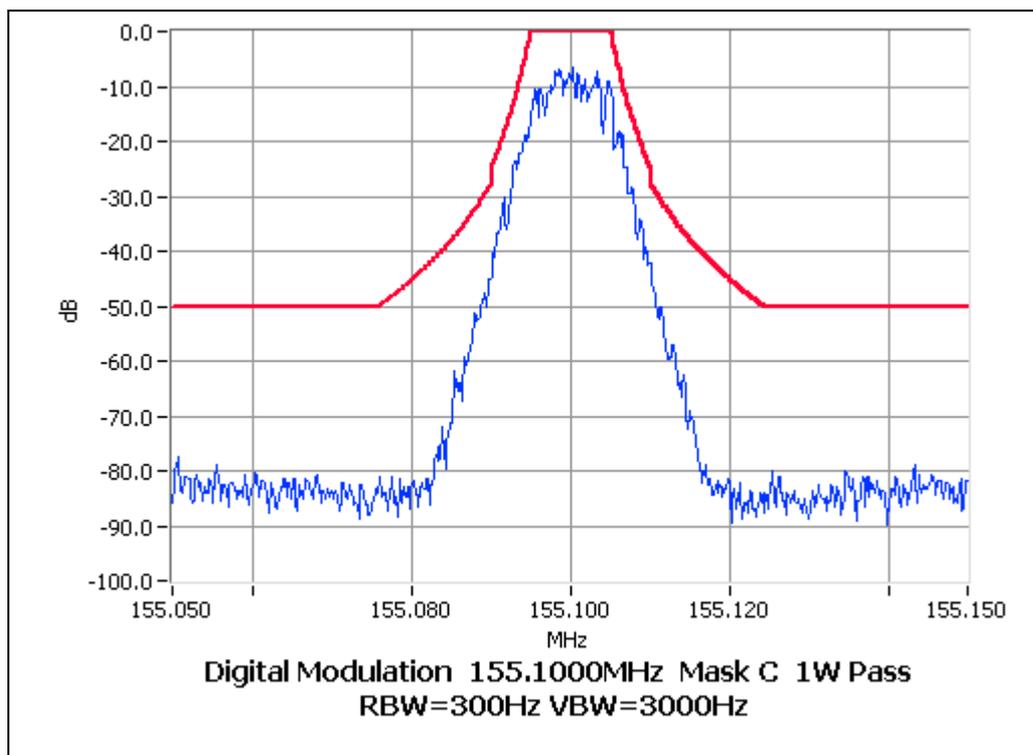
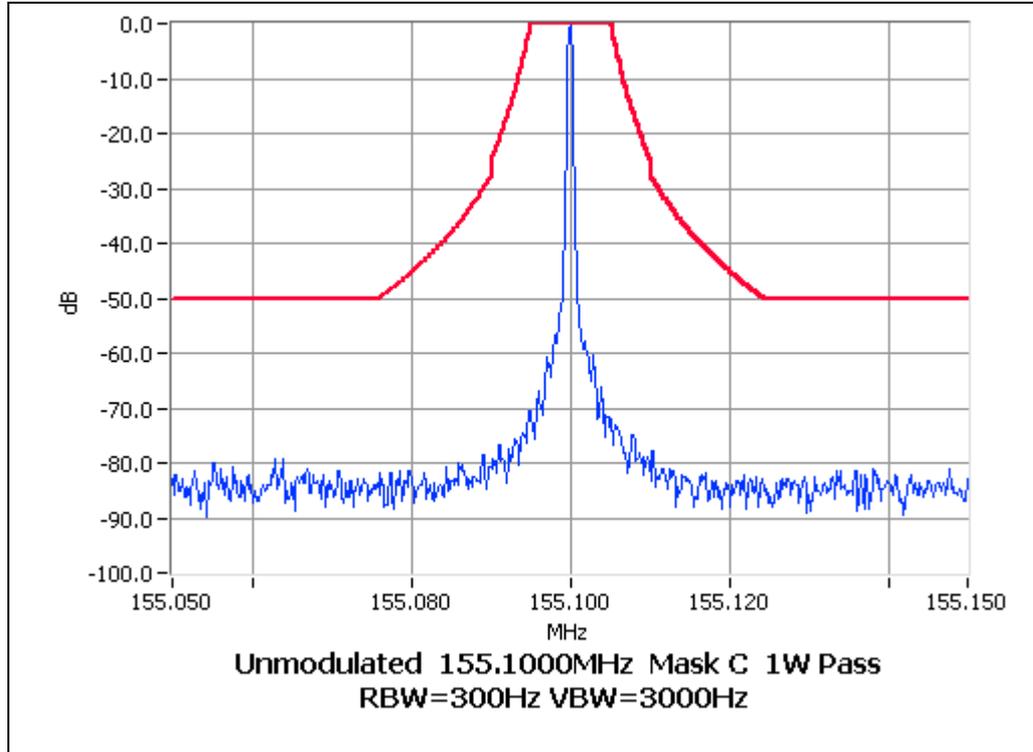
OCCUPIED BANDWIDTH

THSD 19200bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 25 W 25 kHz Channel Spacing



OCCUPIED BANDWIDTH

THSD 19200bps
SPECIFICATION: FCC CFR 2.1049 (c)
Tx FREQUENCY: 155.1 MHz 1 W 25 kHz Channel Spacing



TELTEST Laboratories
Tait Electronics Limited
Report Number 2628

SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 155.1 MHz

12.5 kHz Channel Spacing		155.1 MHz @ 25 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
154.8675	-37.9	81.9	
155.3317	-37.0	81.0	
No other emissions were detected at a level greater than 20 dB below the limit.			

12.5 kHz Channel Spacing		155.1 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 $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
25 W	-20 dBm	64 dBc
1 W	-20 dBm	50 dBc

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA/EIA-603C 2.2.12

MEASUREMENT PROCEDURE:

Initial Scan:

1. The EUT is placed in the S-Line TEM cell and emissions are measured from 30MHz to 1000MHz. Any emission within 10dB of the limit is then re-tested on the OATS along with measurements from 1000MHz to the 10th harmonic of the fundamental frequency.
2. The EUT is then placed on a wooden turntable at a distance of 0.5 metres from the test antenna and emissions are measured from 1000MHz to the upper frequency required. Any emission within 10 dB of the limit is then re-tested on the OATS.

OATS Measurement:

1. The EUT is placed on a wooden turntable at a distance of three metres from the test antenna. The output terminal is connected to an RF dummy load.
2. The test antenna is raised from 1m to 4m to obtain a maximum reading, the turntable is then rotated through 360° to obtain the maximum response of each spurious emission. Valid emissions are determined by switching the EUT on and off.
3. The EUT is then replaced by a signal generator and substitution antenna to make measurements by the substitution method.

MEASUREMENT RESULTS:

See the tables on the following pages

LIMIT CLAUSE: FCC 47 CFR 90.210

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 155.1 MHz

12.5 kHz Channel Spacing		155.1 MHz @ 25 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
~	~	~	
No emissions were detected at a level greater than 10 dB below the limit.			

12.5 kHz Channel Spacing		155.1 MHz @ 1 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
~	~	~	
No emissions were detected at a level greater than 10 dB below the limit.			

LIMITS:

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

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).

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: FCC 47 CFR 90.213

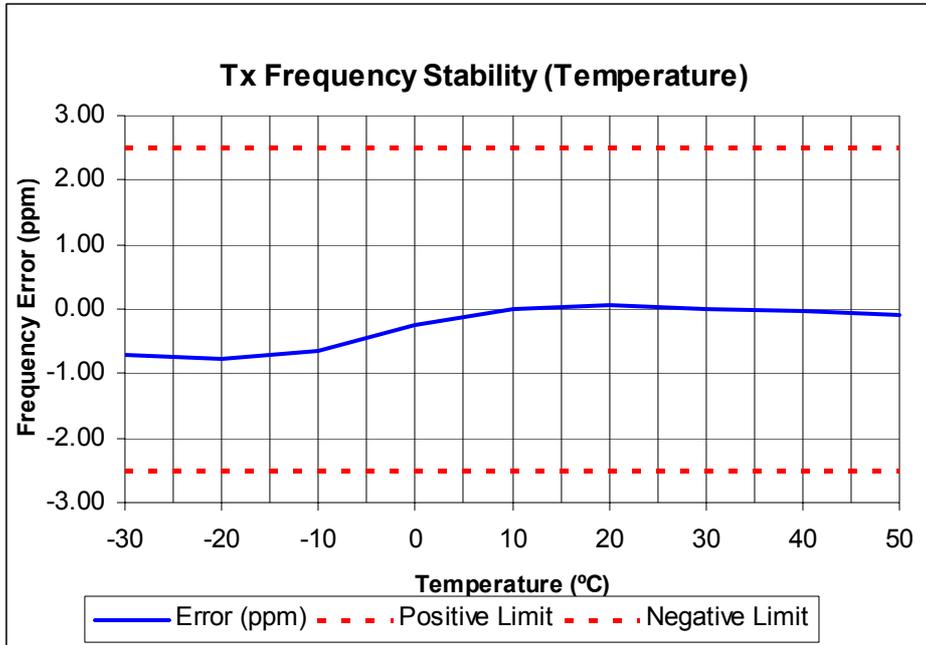
Frequency Range: 136 MHz ~ 174 MHz

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	2.5
25.0	5.0

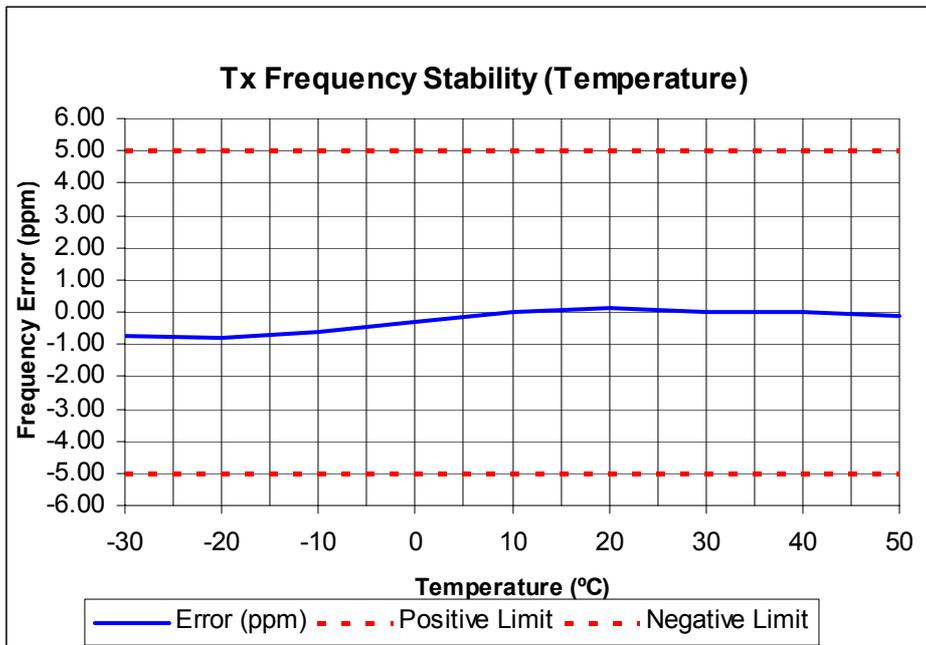
TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

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

Tx FREQUENCY: 155.1 MHz 25 W 12.5 kHz channel Spacing



Tx FREQUENCY: 155.1 MHz 25 W 25.0 kHz channel Spacing



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: Frequency Range: 136 MHz ~ 174 MHz

Channel Spacing (kHz)	FREQUENCY ERROR (ppm) @ 155.1 MHz		
	102 V _{ac}	120 V _{ac}	138 V _{ac}
12.5	-0.01	-0.02	0.03
25.0	-0.01	-0.03	-0.05

LIMIT CLAUSE: FCC 47 CFR 90.213

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	2.5
25.0	5.0

TRANSIENT FREQUENCY BEHAVIOR

SPECIFICATION: FCC 47 CFR 90.214

GUIDE: TIA/EIA-603C 2.2.19

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. Measurements and plots were made following the TIA/EIA procedure.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: FCC 47 CFR 90.214

TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 155.1 MHz 25 W 12.5 kHz Channel Spacing

FREQUENCY	155.1 MHz @ 25 W Tx	
TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t ₁	-0.4	N/A
t ₂	-0.3	N/A
t ₃	N/A	0.4
t ₂ → t ₃ ppm	2.4	
ERROR LIMIT (t ₂ → t ₃) ppm	2.5	

Confirm that during periods t ₁ and t ₃ the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t ₂ the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t ₂ to t ₃ the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

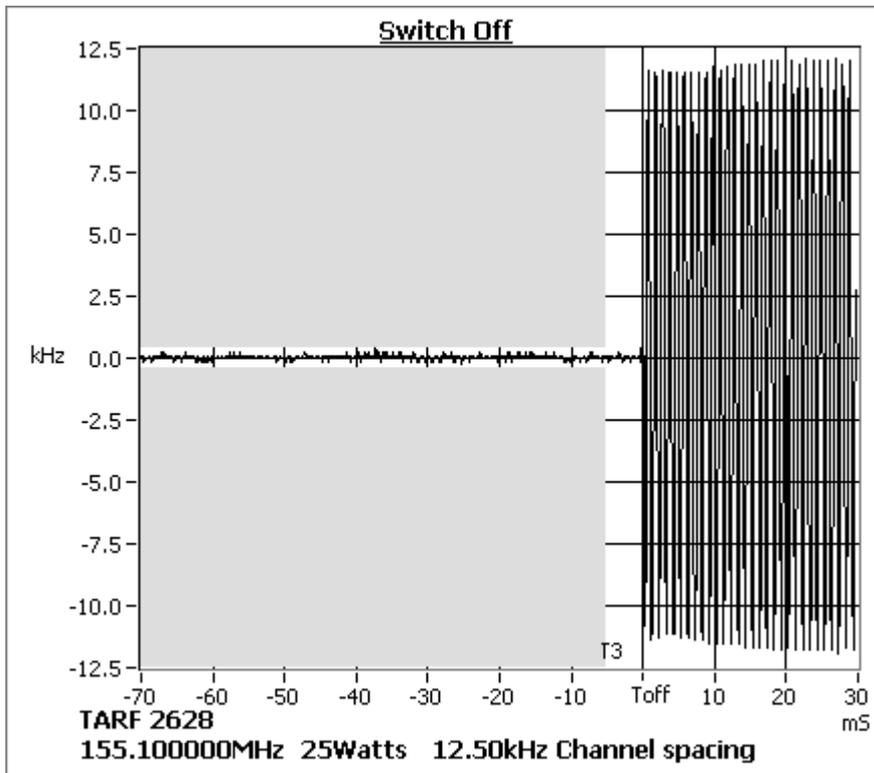
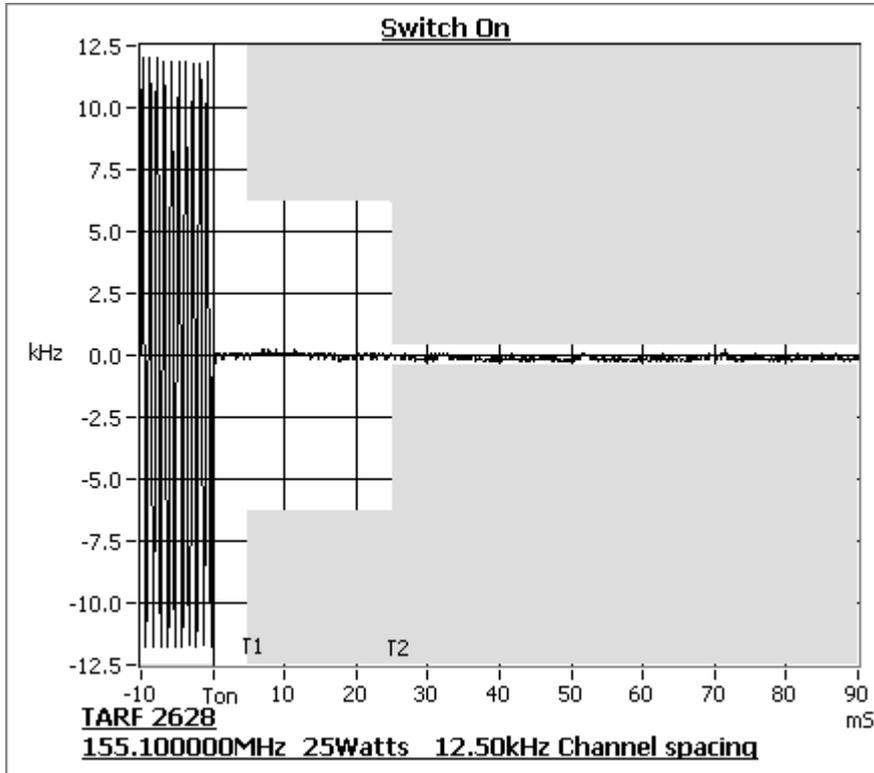
LIMIT:

TRANSIENT PERIODS	FREQUENCY RANGE 150MHz – 174 MHz	FREQUENCY RANGE 421MHz – 512 MHz
t ₁ (ms)	5 ms	10 ms
t ₂ (ms)	20 ms	25 ms
t ₃ (ms)	5 ms	10 ms

TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 155.1 MHz 25 W 12.5 kHz Channel Spacing



TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 155.1 MHz 25 W 25.0 kHz Channel Spacing

FREQUENCY	155.1 MHz @ 25 W Tx	
TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t ₁	-0.4	N/A
t ₂	-0.4	N/A
t ₃	N/A	-0.2
t ₂ → t ₃ ppm	-4.3	
ERROR LIMIT (t ₂ → t ₃) ppm	5.0	

Confirm that during periods t ₁ and t ₃ the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t ₂ the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t ₂ to t ₃ the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

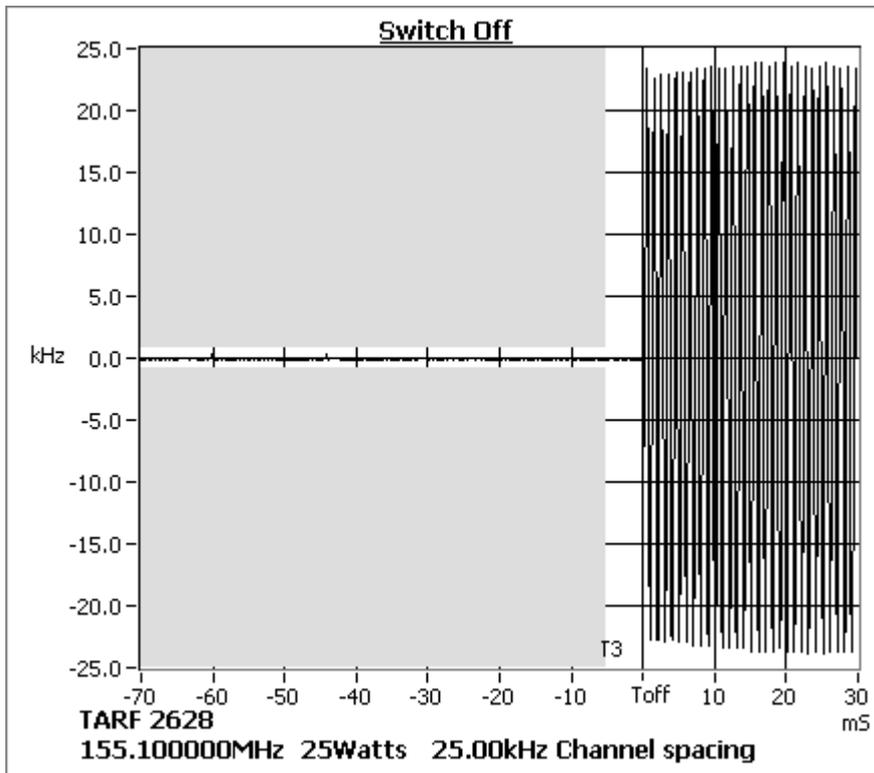
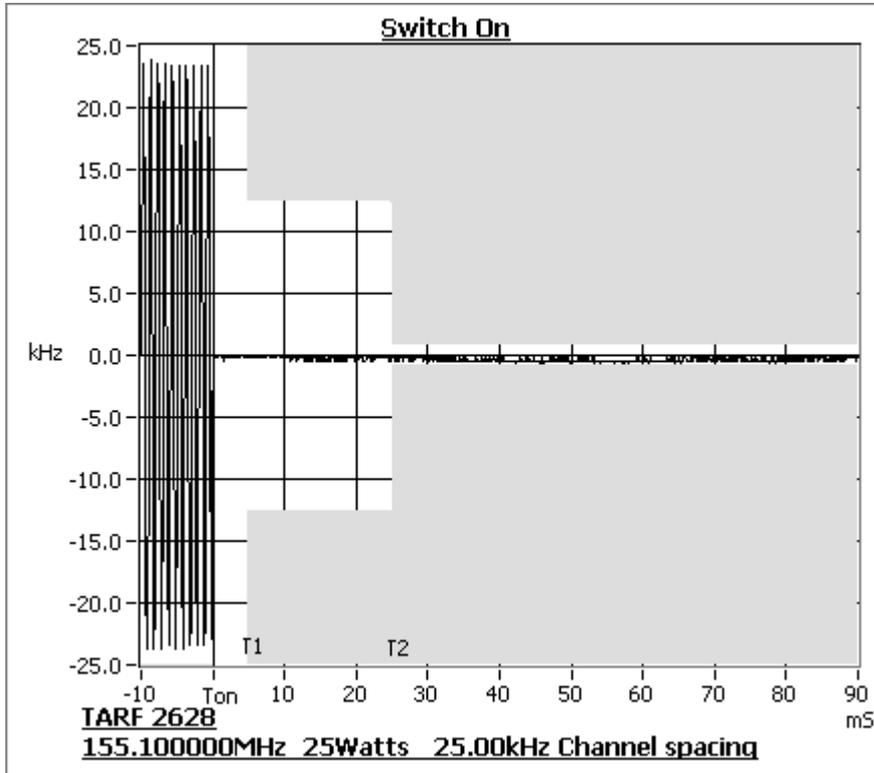
LIMIT:

TRANSIENT PERIODS	FREQUENCY RANGE 150MHz – 174 MHz	FREQUENCY RANGE 421MHz – 512 MHz
t ₁ (ms)	5 ms	10 ms
t ₂ (ms)	20 ms	25 ms
t ₃ (ms)	5 ms	10 ms

TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 155.1 MHz 25 W 25.0 kHz Channel Spacing



TELTEST Laboratories
Tait Electronics Limited
Report Number 2628

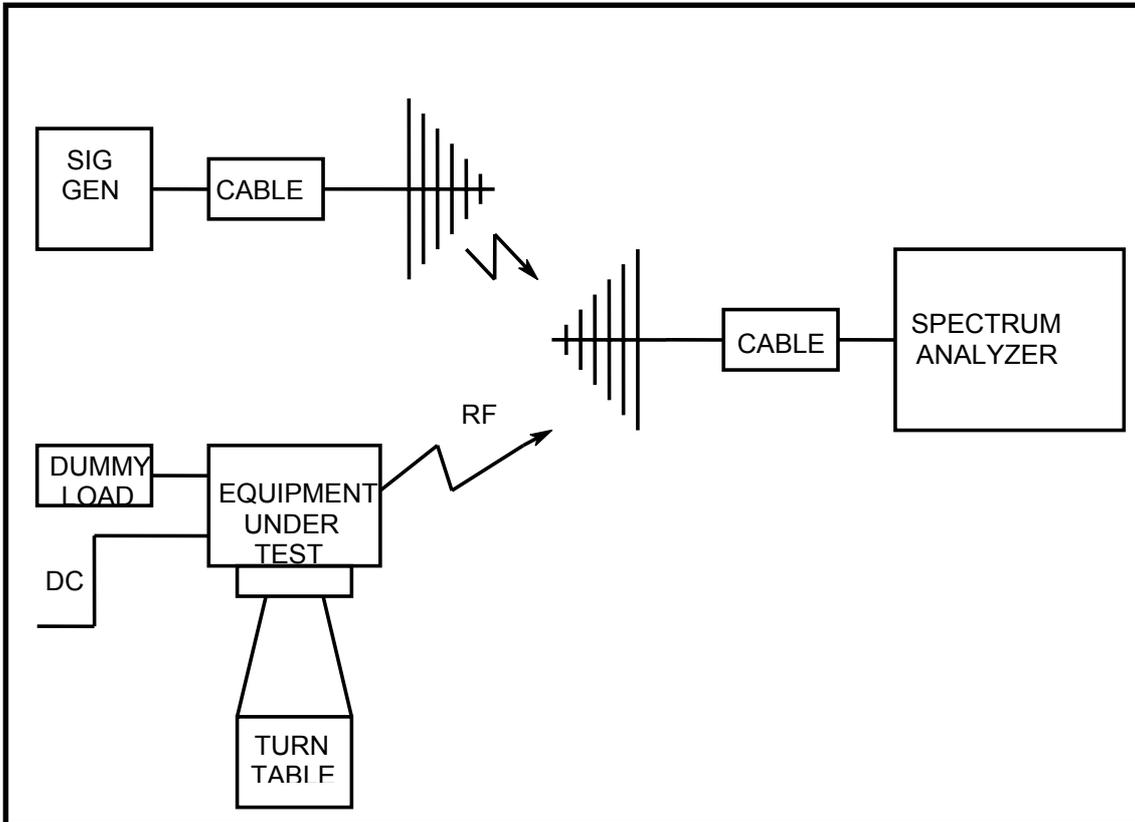
TEST EQUIPMENT USED

No#	Equipment	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
	Modulation		HP8901B (Opt			
11	Analyser	Hewlett Packard	002)	2441A00393	E3073	02-Nov-07
13	Audio Analyser	Hewlett Packard	HP8903A	2308A02597	E3074	02-Nov-07
22	Oscilloscope	Tektronics	TDS340	B013611	E3585	02-Nov-07
	Reference Horn					
42	Antenna	Emco	DRG3115	9512-4638	E3560	16-Nov-09
46	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	20-Mar-09
115	Environ. Chamber	Contherm	5400 RHSLT.M	1416	E4051	12-Sep-07
116	Power Head	Hewlett Packard	HP11722A	3111A05573	E7054	02-Nov-07
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	04-Jul-07
135	Attenuator	Weinschel	67-30-33	BR0531	E4280	10-Jan-08
137	1m Multiflex Cable	Suhner	MF141	TT007	E4443	30-Oct-07
138	1m Multiflex Cable	Suhner	MF141	TT086	E4444	30-Oct-07

ANNEX A

TEST SETUP DETAILS

Radiated Emissions Set up.



TELTEST Laboratories
Tait Electronics Limited
Report Number 2628

All other testing is performed using the Teltest Radio **EVAL**uation system (TREVA), which is configured as shown below. The Spectrum Analyser is connected to the EUT via the attenuator network for Conducted Emissions testing, and Occupied Bandwidth.

