

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBCB1A Base Station Transceiver

Tested in accordance with:

FCC 47 CFR Parts 22, 74 & 90

RSS-119 Issue 12
RSS-Gen Issue 4

Report Revision: 1

Issue Date: 13-July-2015

PREPARED BY: Garry Pringle

Test Technician

CHECKED & APPROVED BY: M. C. James

Laboratory Technical Manager



OATS FCC LISTING REGISTRATION: 837095
OATS IC LISTING REGISTRATION: SITE# 737A-1

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

TELTEST Laboratories (A Division of Tait Communications)
PO Box 1645, 558 Wairakei Road, Christchurch, New Zealand.

Telephone: 64 3 358 3399
FAX: 64 3 359 4632

FCC ID: CASTBCB1A
IC : 737A-TBCB1A

Page 1 of 28

Report Revision: 2
Issue Date: 13-July-2015

TABLE OF CONTENTS

REVISION	3
INTRODUCTION	4
STATEMENT OF COMPLIANCE	6
MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS	7
TEST RESULTS.....	8
TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS.....	8
TRANSMITTER MODULATION LIMITING	12
TRANSMITTER OCCUPIED BANDWIDTH AND SPECTRUM MASKS.....	19
TEST EQUIPMENT LIST.....	27
ANNEX A – TEST SETUP DETAILS.....	28

REVISION

Date	Revision	Comments
5-June-2015	1	Initial test report
13-July-2015	2	RSS-119 updated to issue 12 – No change in results or relevant limits

INTRODUCTION

Type approval testing of the TBCB1A, 50 Watt, Base Station transceiver in order to demonstrate compliance with FCC 47 Parts 22, 74 & 90, and RSS-119 Issue 11 & RSS-Gen Issue 4.
This Class-2 Permissive Change report adds Analogue FM to the list of modulations supported.
The original test report is TARF 3535.

REPORT PREPARED FOR

Tait Communications
PO Box 1645
558 Wairakei Road
Christchurch
New Zealand

DESCRIPTION OF SAMPLE

Manufacturer Tait Limited
Equipment: Base Station Transceiver
Type: TBCB1A
Sales Package Code TB9415-B3H0-B3H0-A3AA-10
Frequency range 148 → 174 MHz
Transmit Power 50W

Modulation		Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
Analogue	FM	12.5 kHz	1	~	~

HARDWARE & SOFTWARE – Analogue Modulation Testing

Quantity: 1 of each

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01103-DAAA	18184254	p25-trunk.20150508T172430	00.11
Power Amplifier	T01-01121-DAAA	18185218	0.01.00.trunk.360976.20140918 T113436.0002	0006
PMU	TBA30A0-0100	18184741	0316	00.03
Front Panel	T01-01110-BAAA	18184704	0.01.00.trunk.375640.20150225 T133901.0002	00.04

TEST CONDITIONS

All testing was performed between 3rd June → 5th June 2015, and under the following conditions:

Ambient temperature: 15°C → 30°C

Relative Humidity: 20% → 75%

Standard Test Voltage 120 V_{AC}

Analogue modulation is provided via an Ethernet UDP connection and is encoded according to ITU-T G.711 (μ-law).

STATEMENT OF COMPLIANCE

We, TELTEST LABORATORIES of 558 Wairakei Road, Christchurch, New Zealand, declare under our sole responsibility that the product:

Equipment: Base Station Transceiver
Type: TBCB1A
Sales Package Code: TB9415-B3H0-B3H0-A3AA-10
Quantity: 1 of each

Consisting Of:

HARDWARE & SOFTWARE – Analogue Modulation Testing

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01103-DAAA	18184254	p25-trunk.20150508T172430	00.00
Power Amplifier	T01-01121-DAAA	18185218	0.01.00.trunk.360976.20140918 T113436.0002	0006
PMU	TBA30A0-0100	18184741	0316	01.00
Front Panel	T01-01110-BAAA	18184704	0.01.00.trunk.375640.20150225 T133901.0002	00.04

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

FCC 47 CFR Parts 22, 74 & 90

RSS-119 Issue 12 & RSS-Gen Issue 4

Signature: _____

M. C. James
Laboratory Technical Manager

Date: _____

MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

MODULATION TYPES:

F3E Analogue Frequency Modulation (FM)

EMISSION DESIGNATORS:

Channel Spacing 12.5 kHz	
FM	11K0F3E

CALCULATIONS

FM

Equation: $B_n = 2M + 2Dk$

(M is highest modulating frequency; D is peak allowable deviation; k is a constant of 1 for FM)

Analogue Voice 12.5 kHz Bandwidth

Necessary bandwidth

M = 3.0 kHz

D = 2.5 kHz

$$\begin{aligned} B_n &= (2 \times 3.0) + (2 \times 2.5) \times 1 \\ &= 11.0 \text{ kHz} \end{aligned}$$

Emission Designator

11K0F3E

F3E represents an FM voice transmission

TEST RESULTS

TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: TIA/EIA-603D 2.2.6

MEASUREMENT PROCEDURE:

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

MEASUREMENT RESULTS:

See the plots on the following pages for 12.5 kHz channel spacing tested at 50 W transmit power.

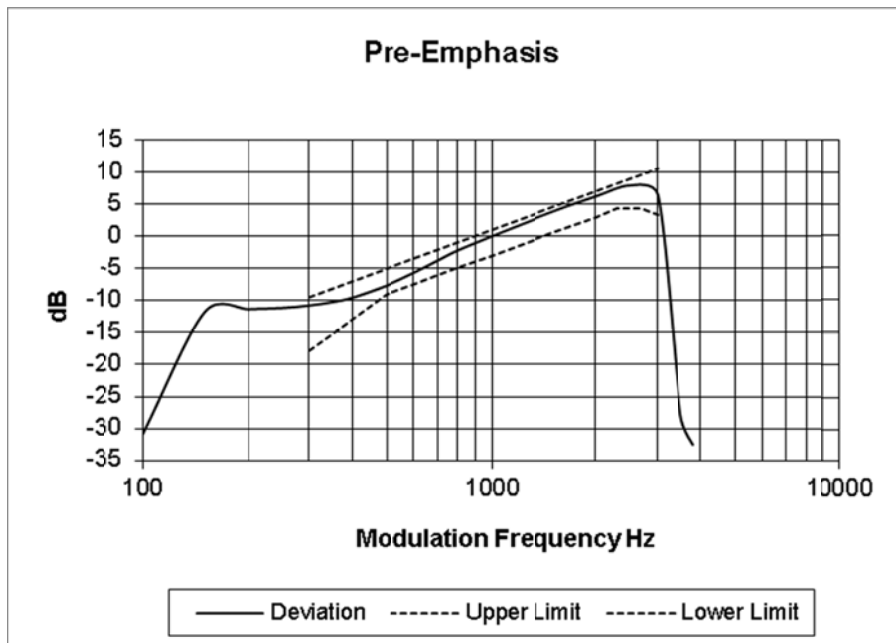
NOTE: The upper audio frequency tested was 3800 Hz due to the 8000 Hz sample rate of the modulating signal.

LIMIT CLAUSE: TIA/EIA-603D 3.2.6

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 148.100 MHz

12.5 kHz Channel Spacing

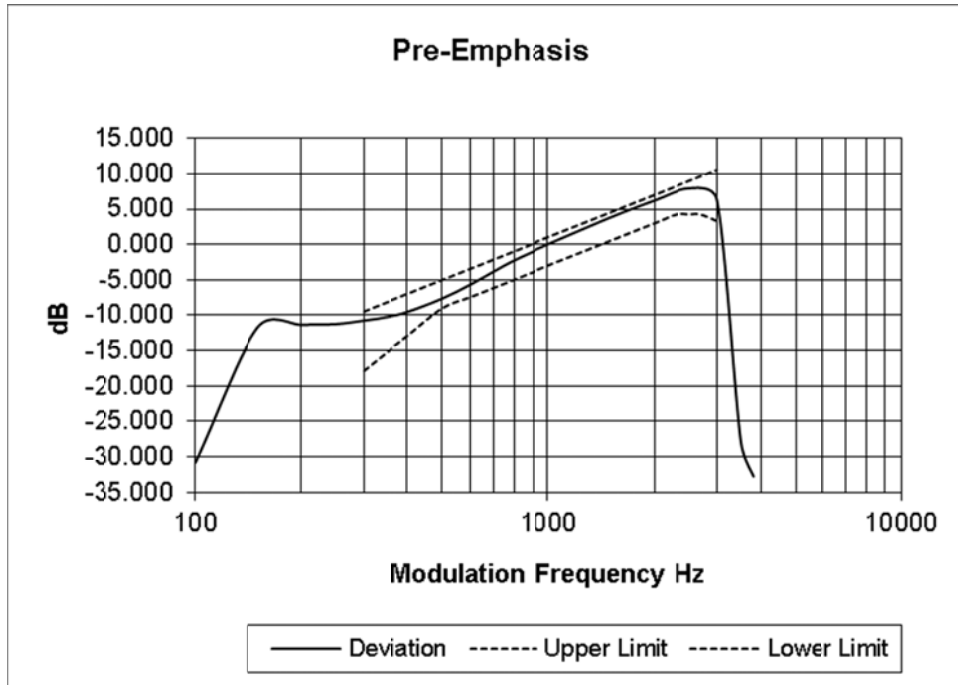


Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 149.800 MHz

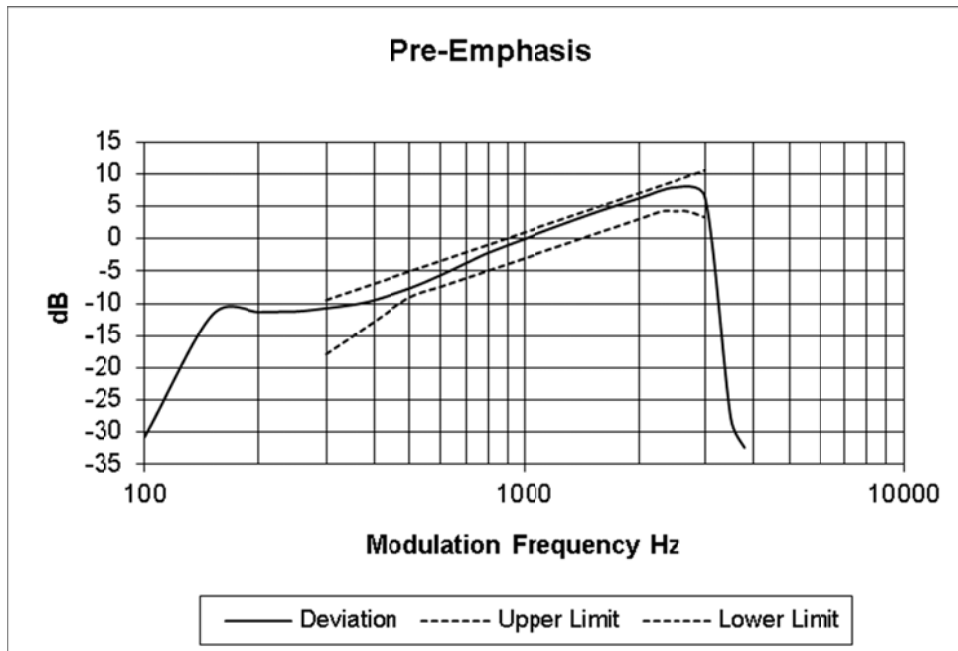
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 151.100 MHz

12.5 kHz Channel Spacing

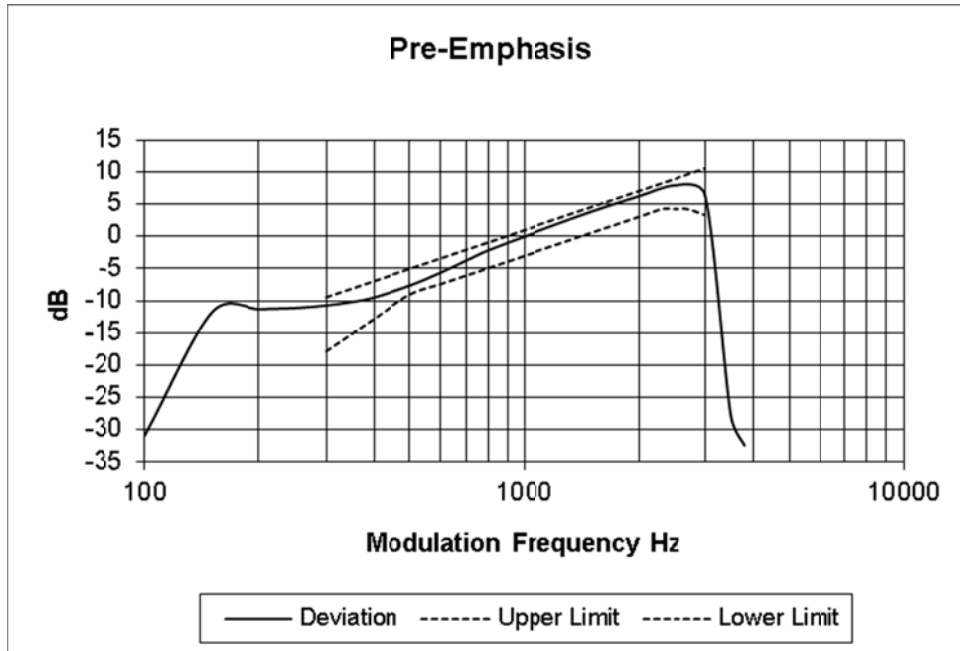


Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 153.100 MHz

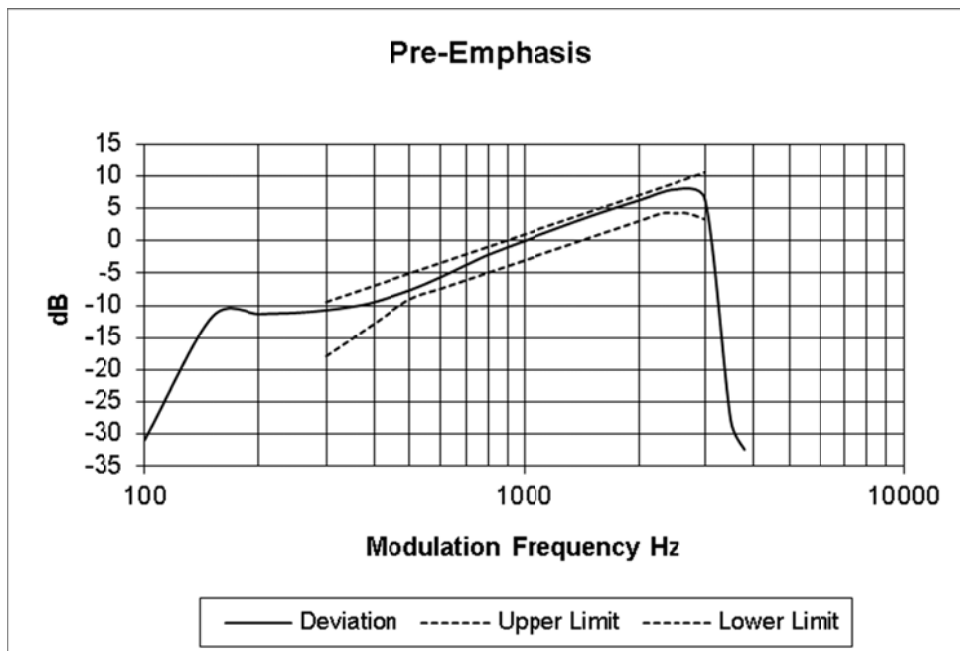
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 155.100 MHz

12.5 kHz Channel Spacing

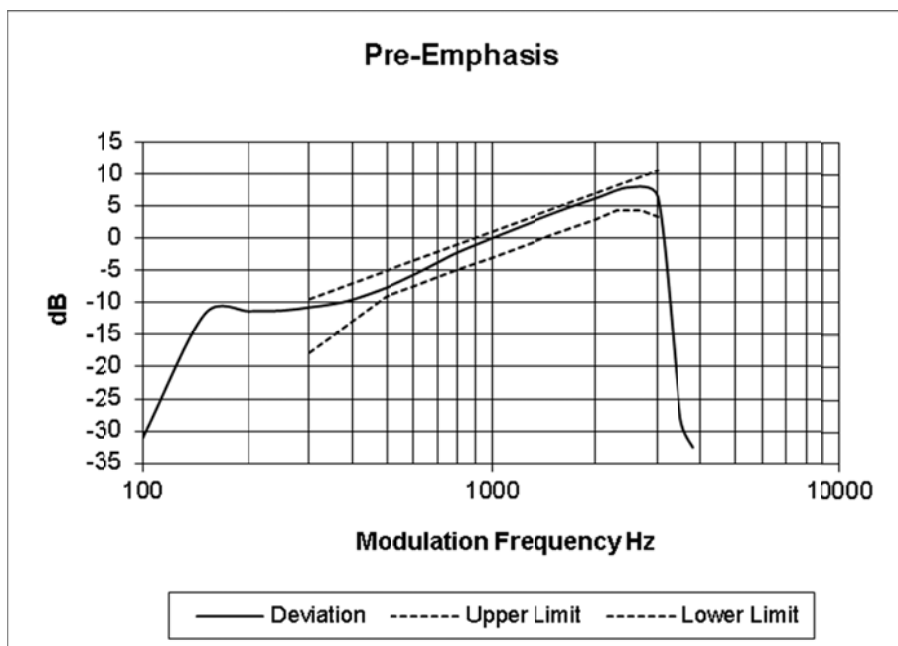


Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 159.100 MHz

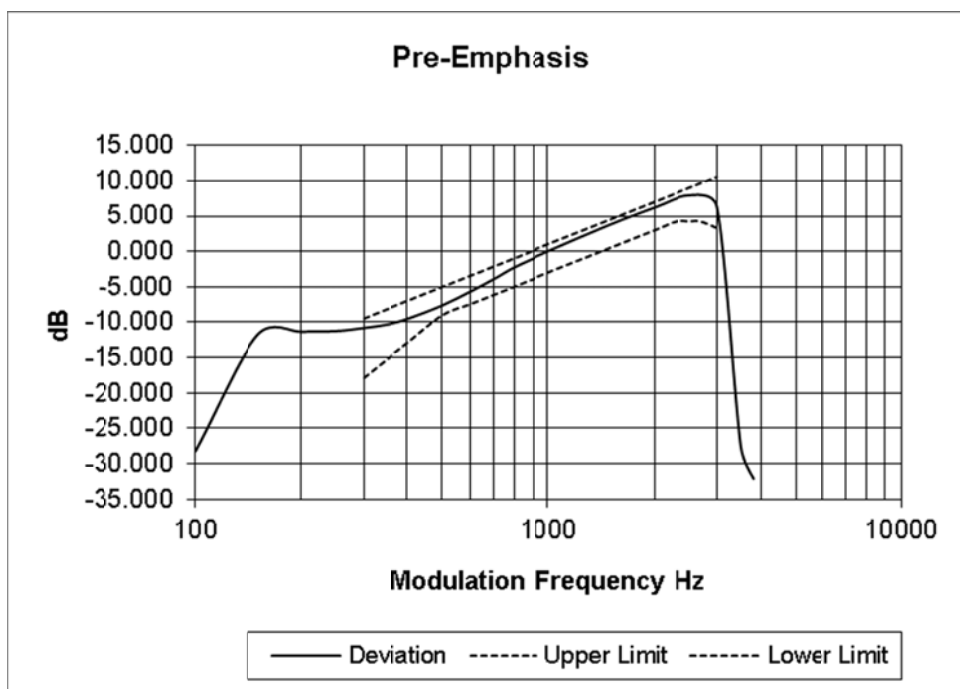
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 173.100 MHz

12.5 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: TIA/EIA-603D 2.2.3

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.

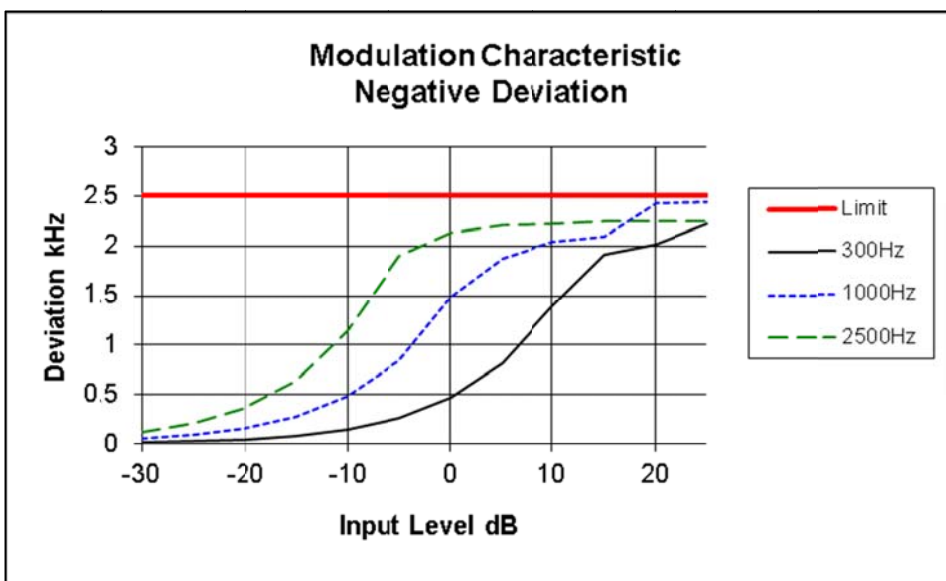
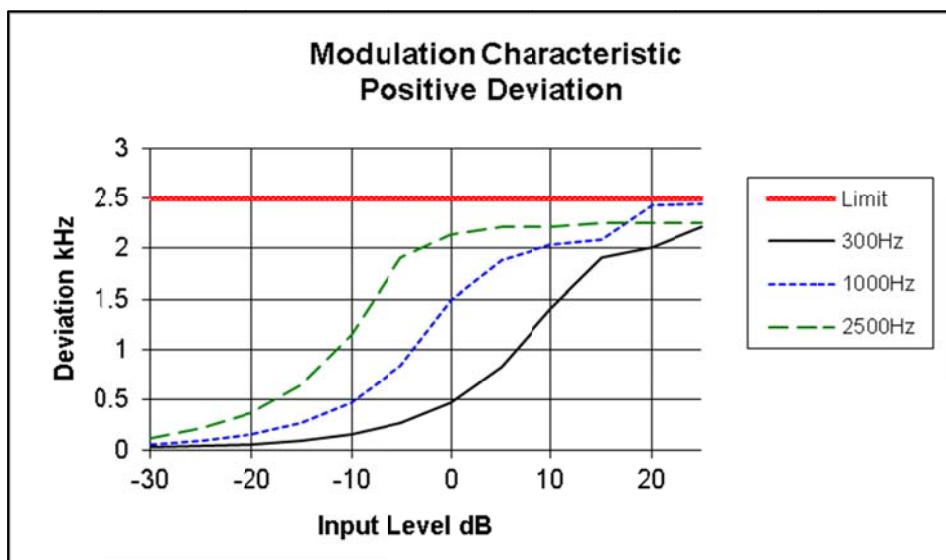
MEASUREMENT RESULTS:

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

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

Tx FREQUENCY: 148.100 MHz

12.5 kHz Channel Spacing

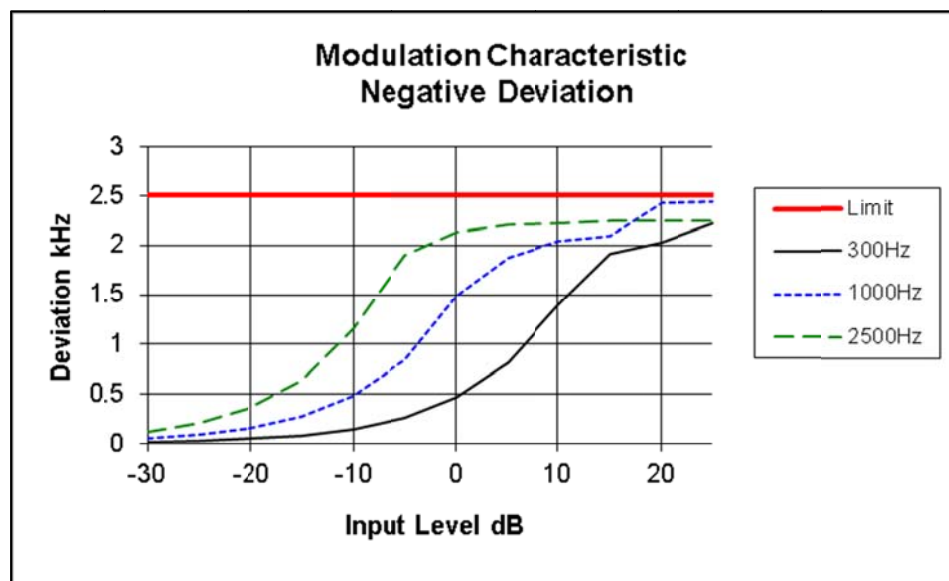
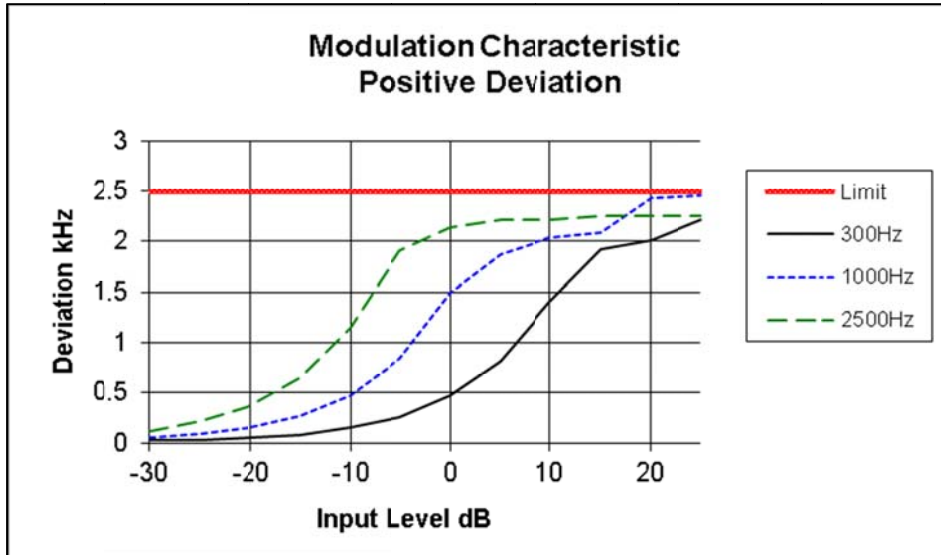


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 149.800 MHz

12.5 kHz Channel Spacing

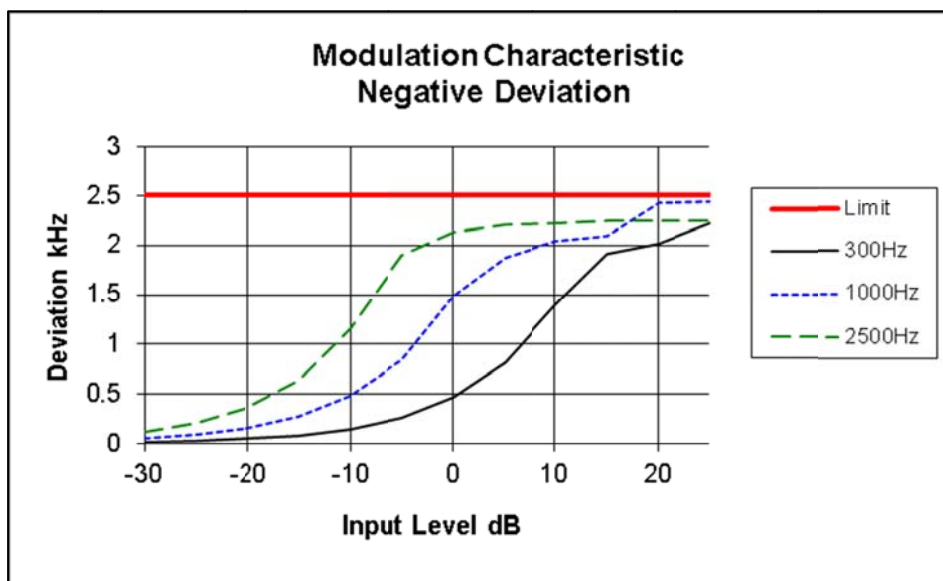
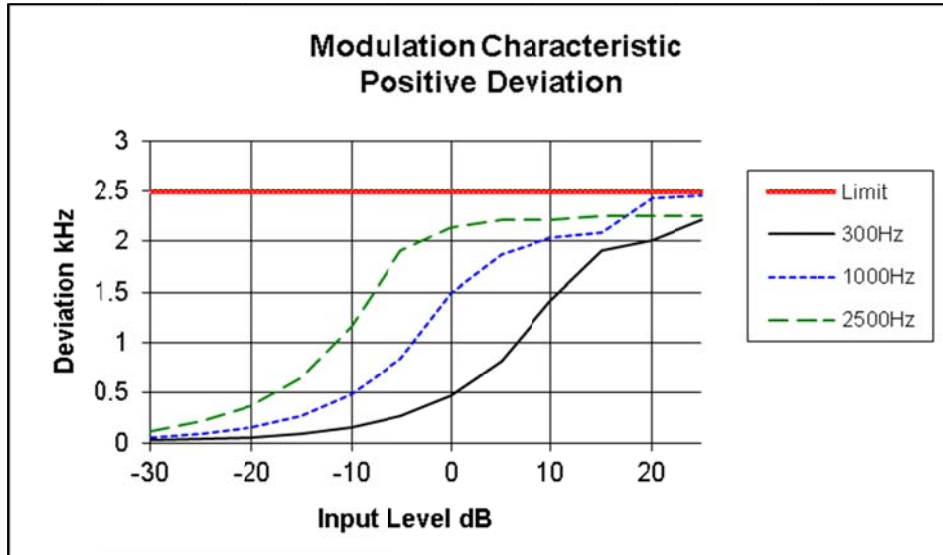


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 151.100 MHz

12.5 kHz Channel Spacing

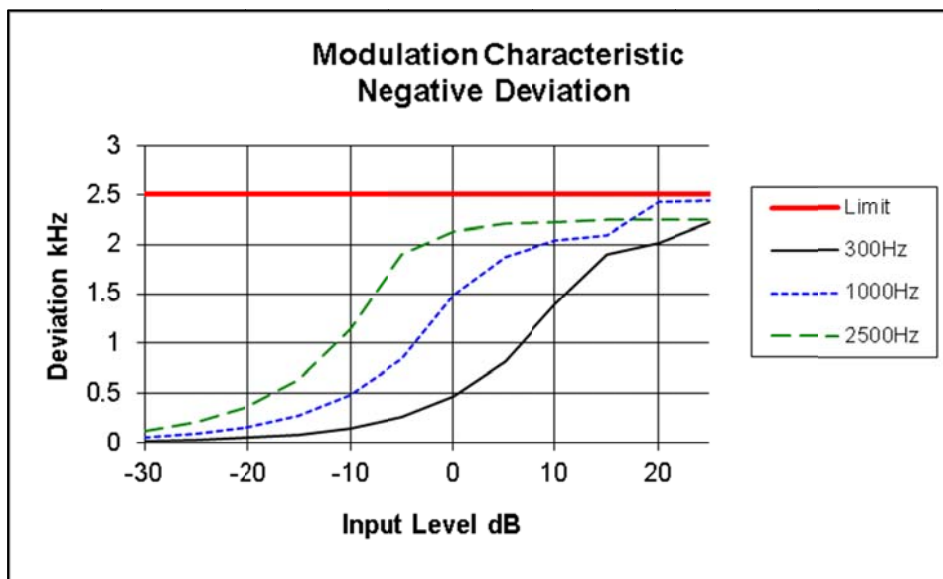
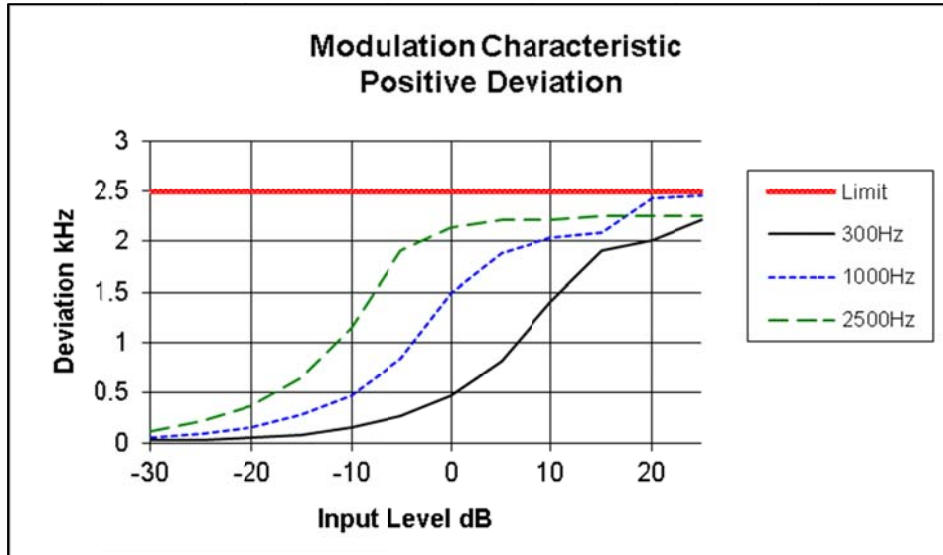


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 153.100 MHz

12.5 kHz Channel Spacing

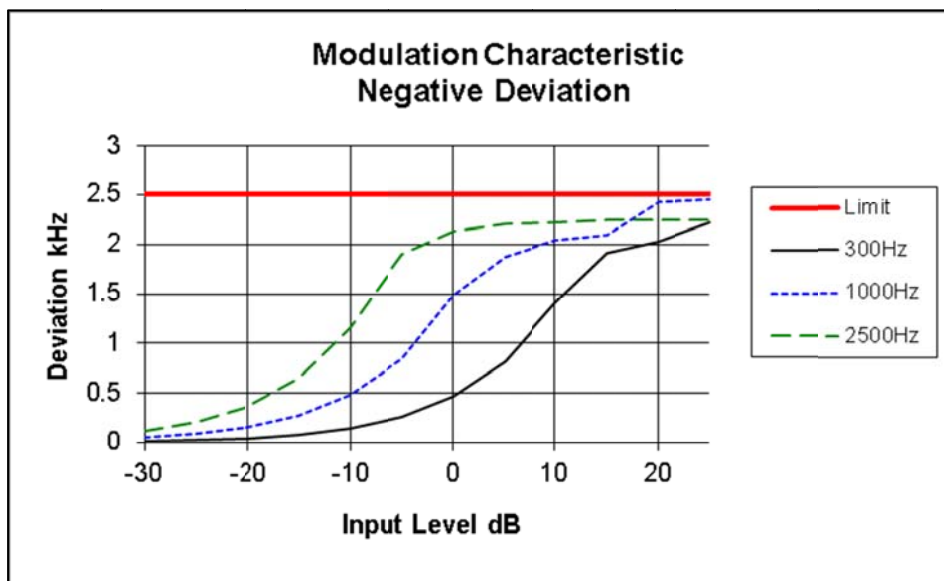
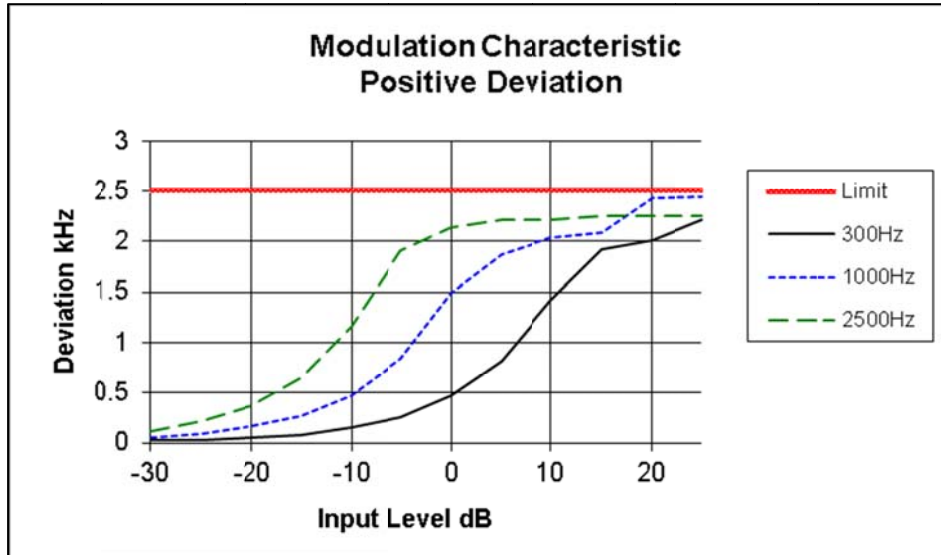


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 155.100 MHz

12.5 kHz Channel Spacing

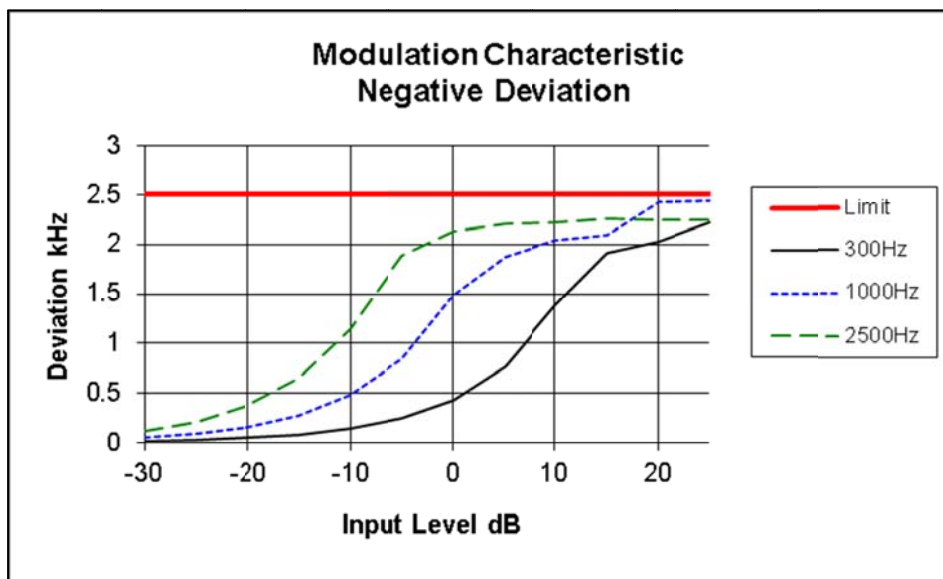
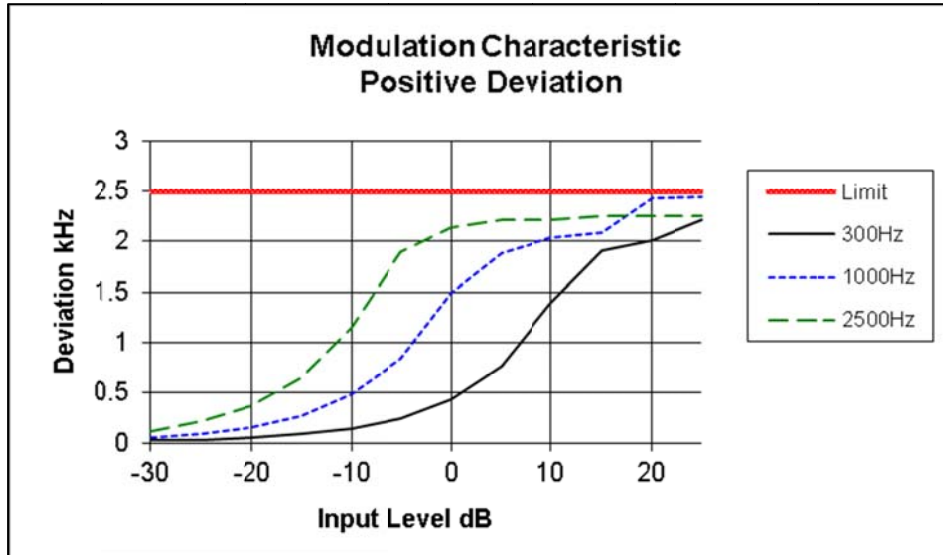


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 159.100 MHz

12.5 kHz Channel Spacing

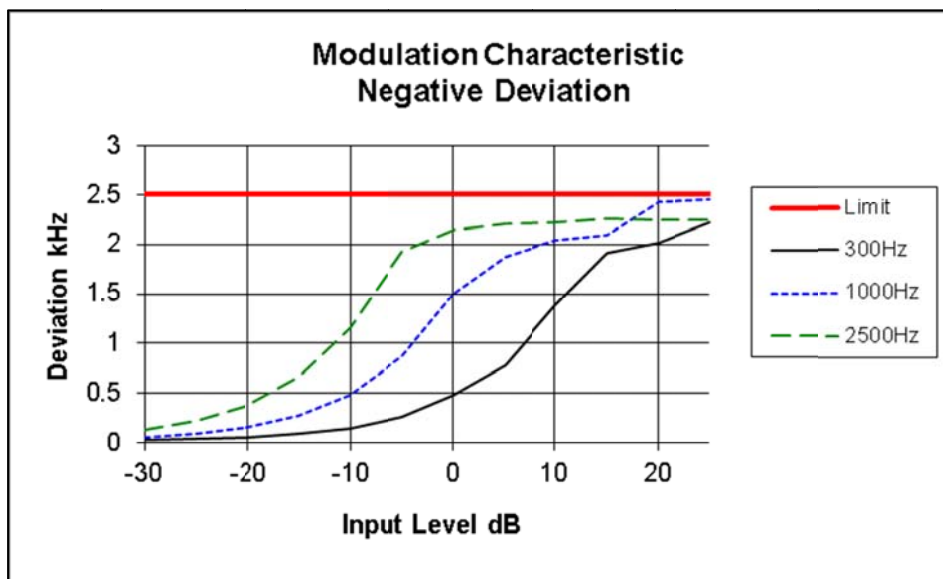
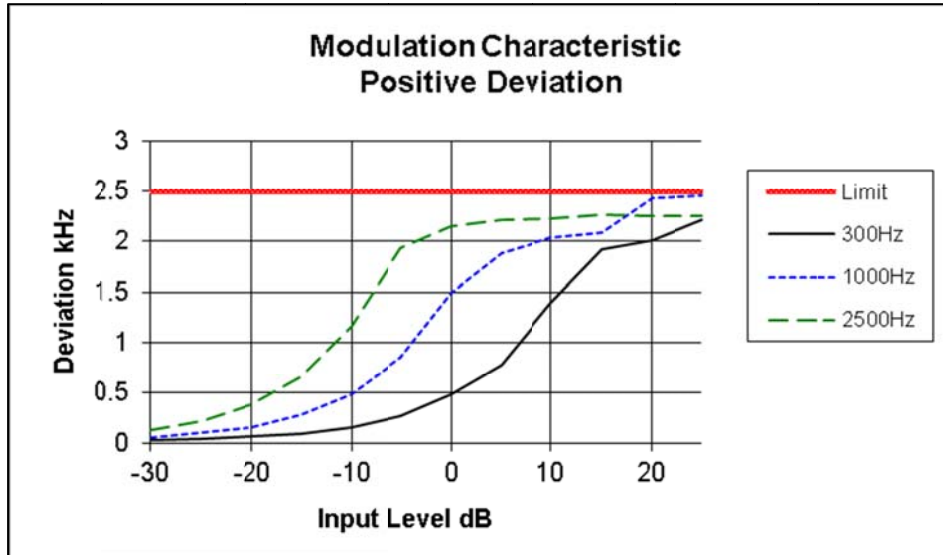


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 173.100 MHz

12.5 kHz Channel Spacing



TRANSMITTER OCCUPIED BANDWIDTH AND SPECTRUM MASKS

SPECIFICATION: FCC 47 CFR 2.1049 (c) RSS-119 5.5

GUIDE: TIA/EIA-603D 2.2.11

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
2. For analog measurements: The EUT was modulated by a 2500 Hz tone at an input level 16 dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as follows.

Emission Mask D – Resolution Bandwidth = 100 Hz, Video Bandwidth = 1 kHz

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: FCC 47 CFR 90.210 RSS-119 5.5

EMISSION MASKS

Emission Mask D 12.5 kHz Channel Spacing Analog

Occupied Bandwidth and Spectrum Masks

Analogue

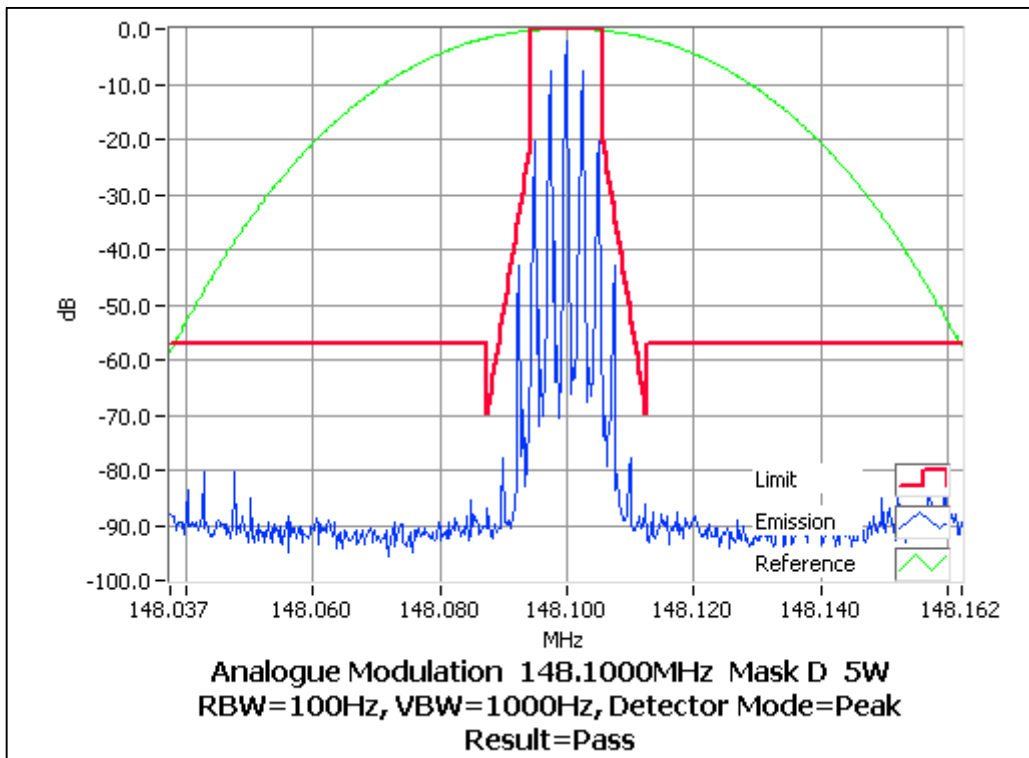
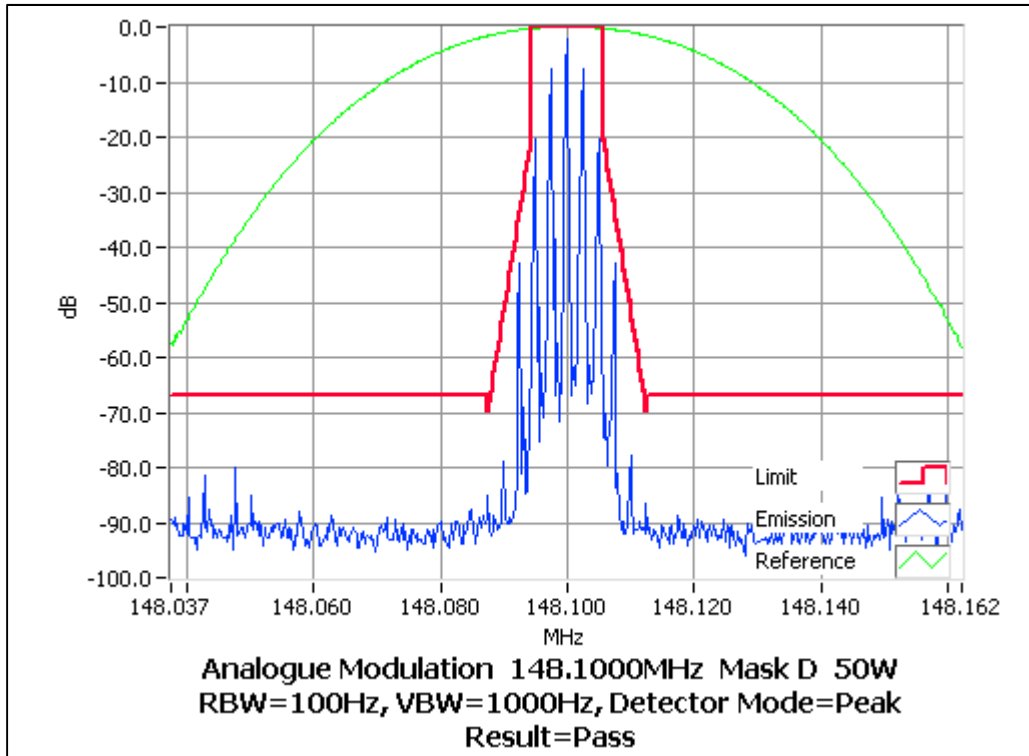
SPECIFICATION: FCC CFR 2.1049 (c) Mask- D

RSS-119 5.5 Mask-D

Tx FREQUENCY: 148.100MHz

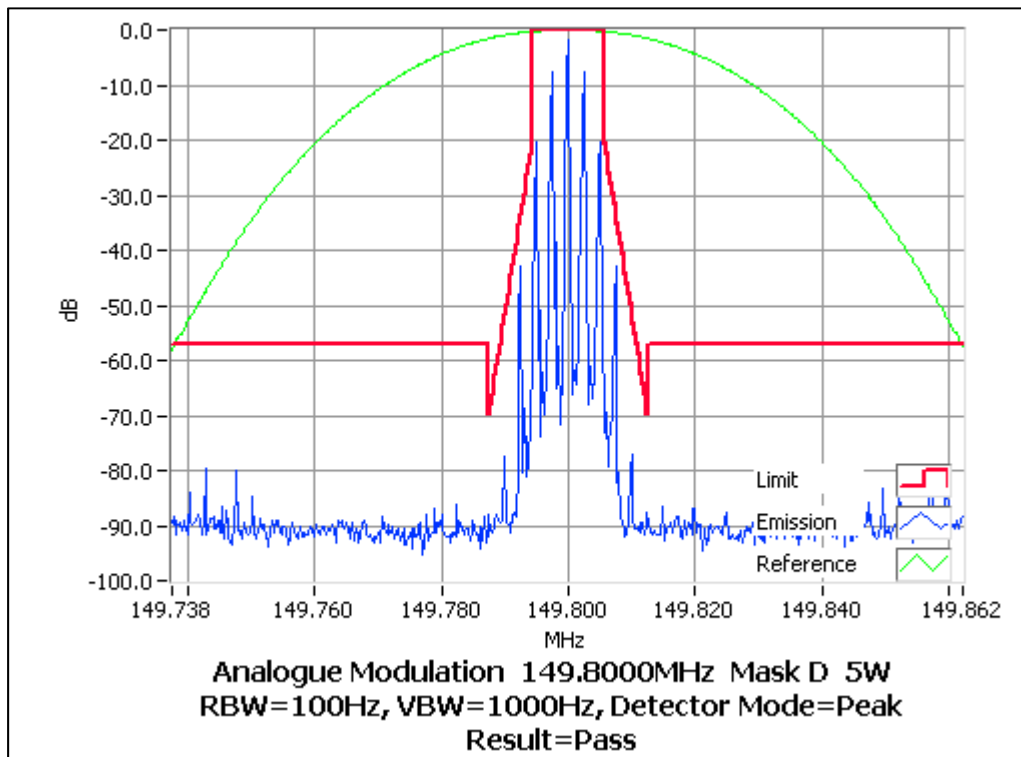
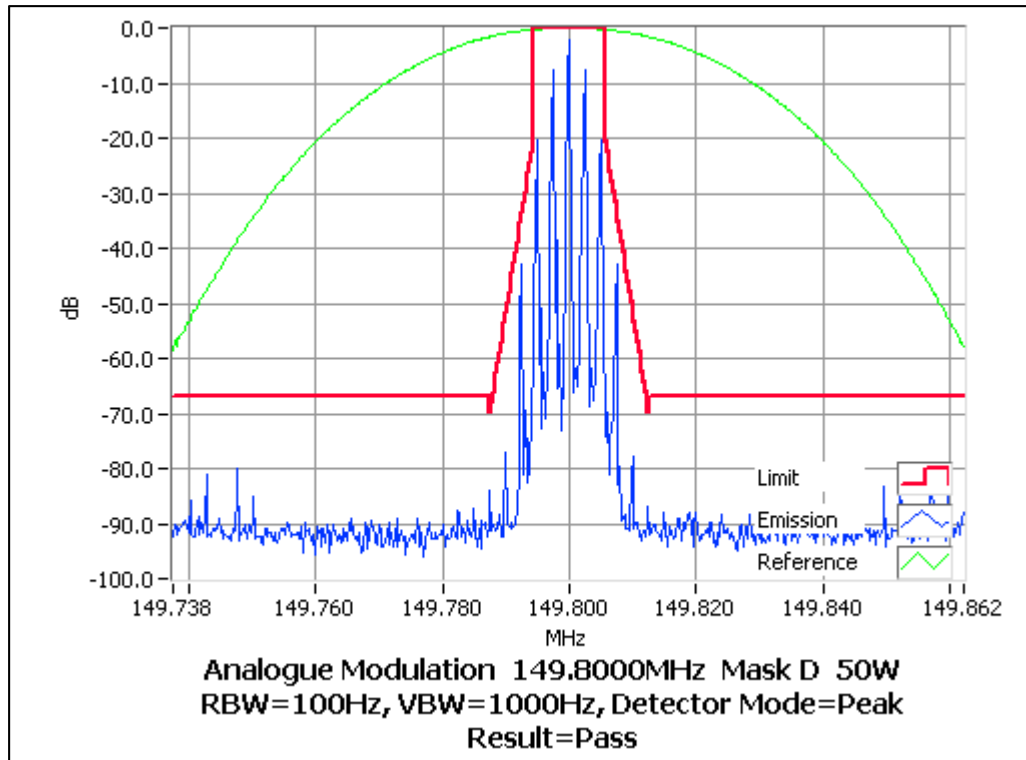
50 W & 5 W

12.5 kHz Channel Spacing



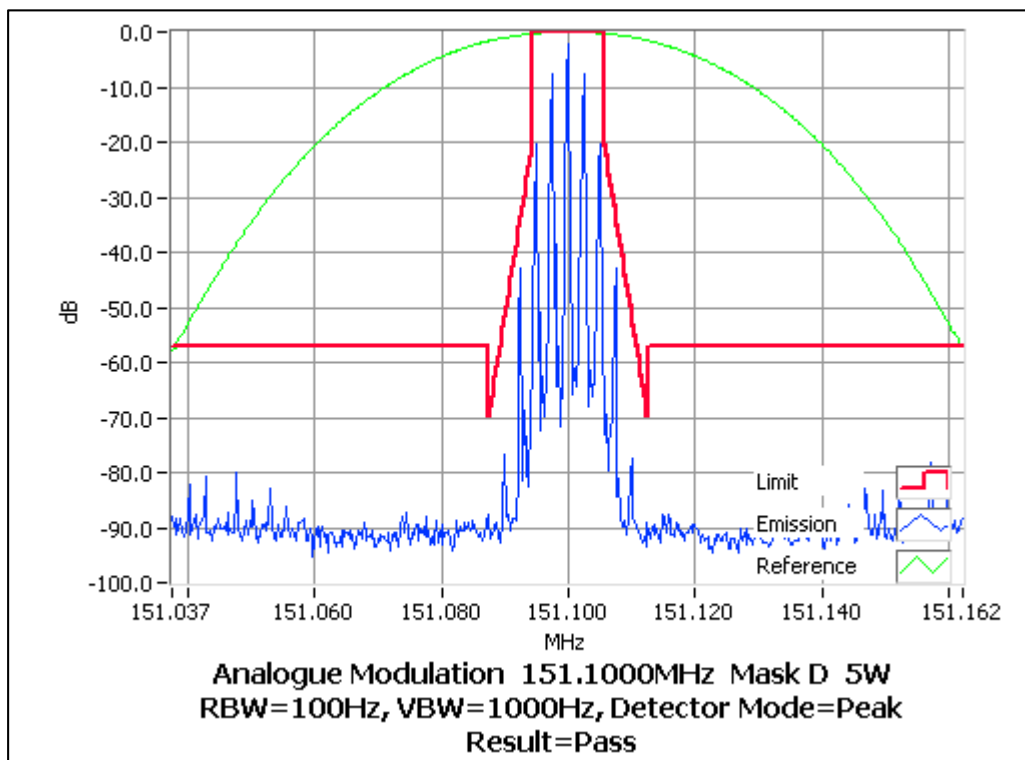
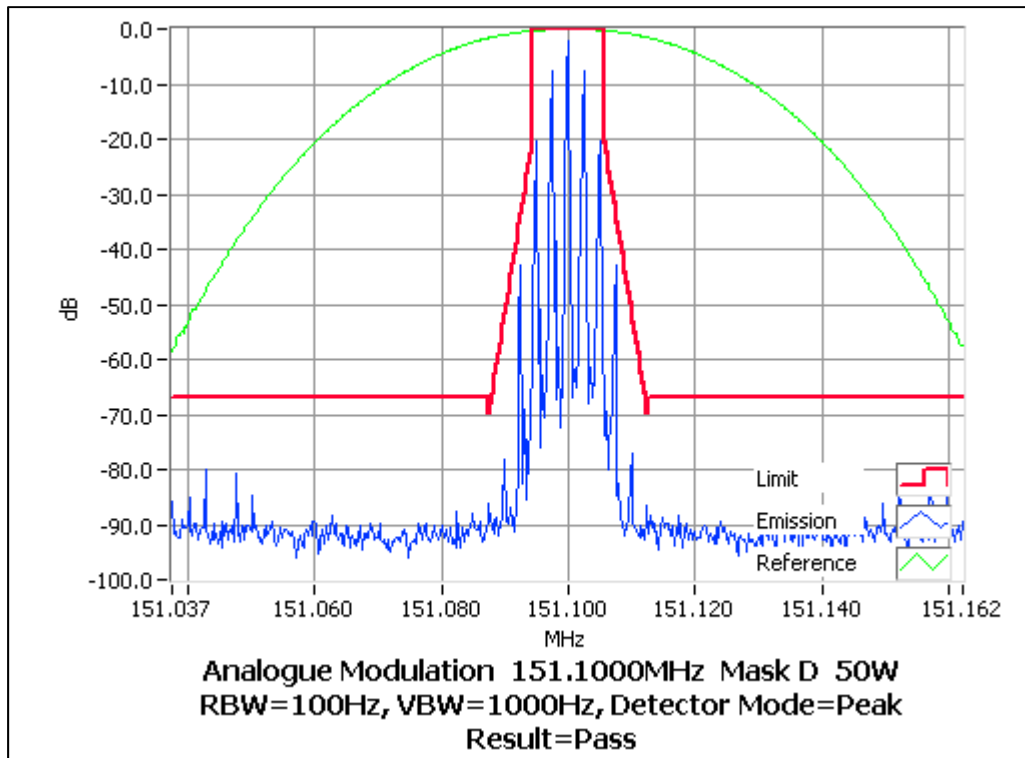
Occupied Bandwidth and Spectrum Masks

Tx FREQUENCY: 149.800MHz 50 W & 5 W 12.5 kHz Channel Spacing



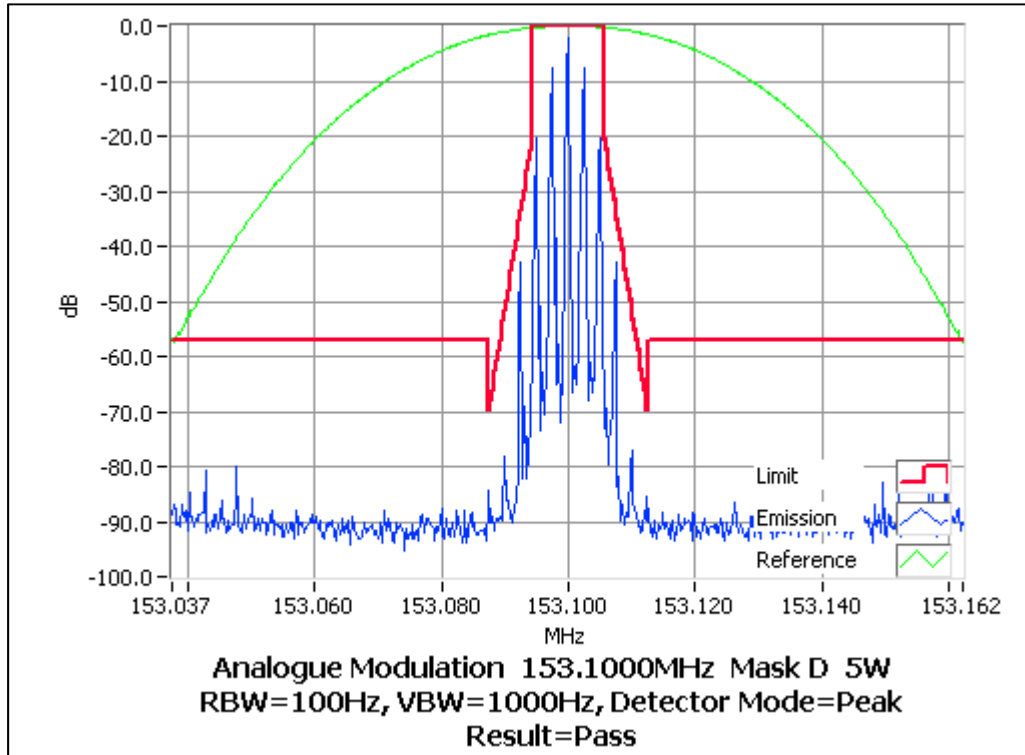
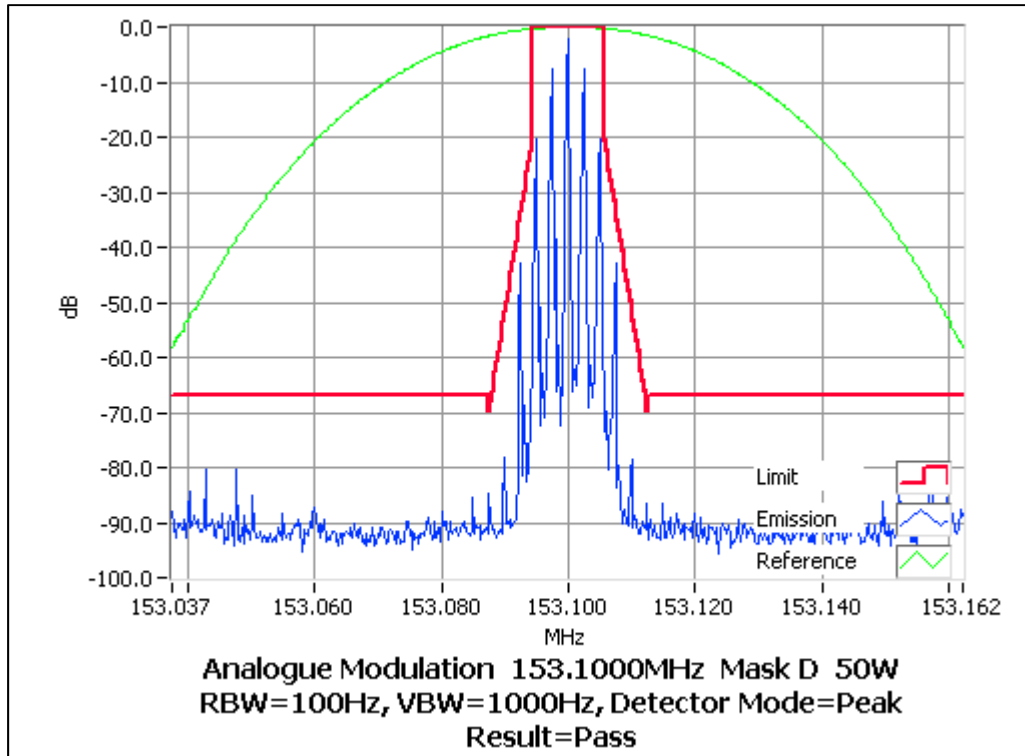
Occupied Bandwidth and Spectrum Masks

Tx FREQUENCY: 151.100 MHz 50 W & 5 W 12.5 kHz Channel Spacing



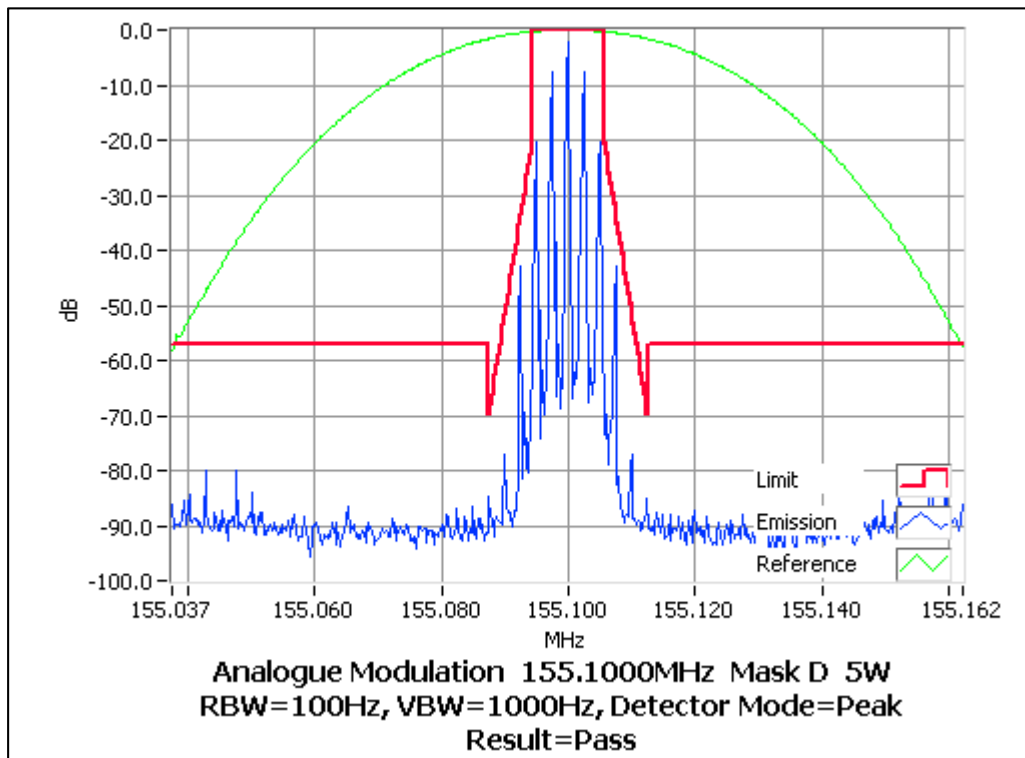
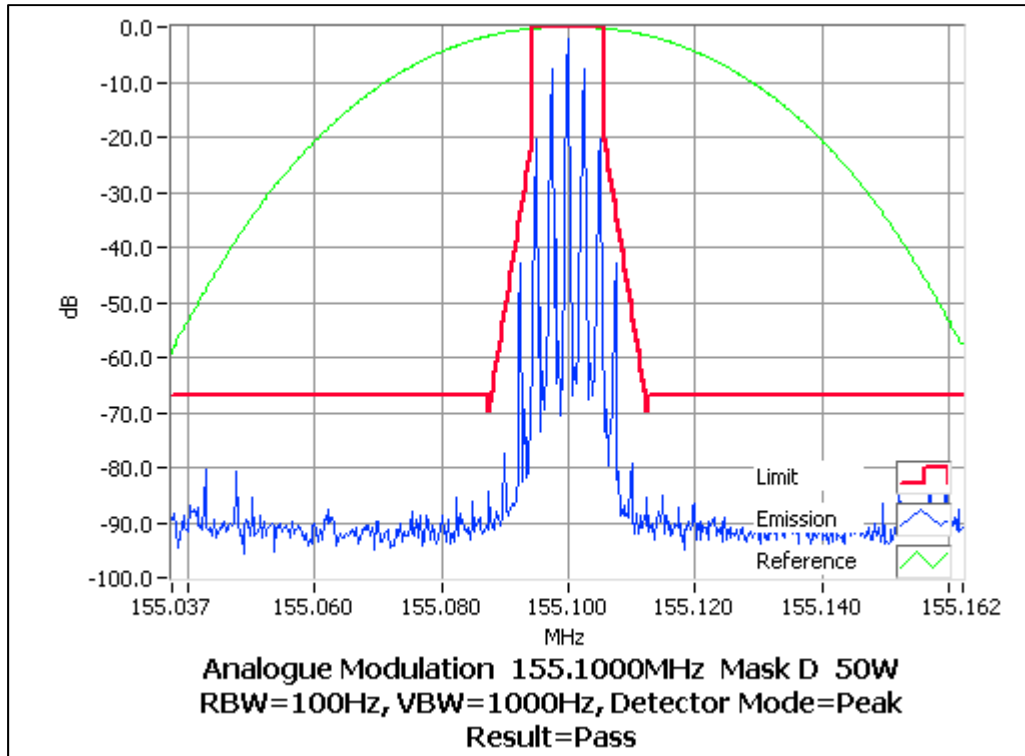
Occupied Bandwidth and Spectrum Masks

Tx FREQUENCY: 153.100 MHz 50 W & 5 W 12.5 kHz Channel Spacing



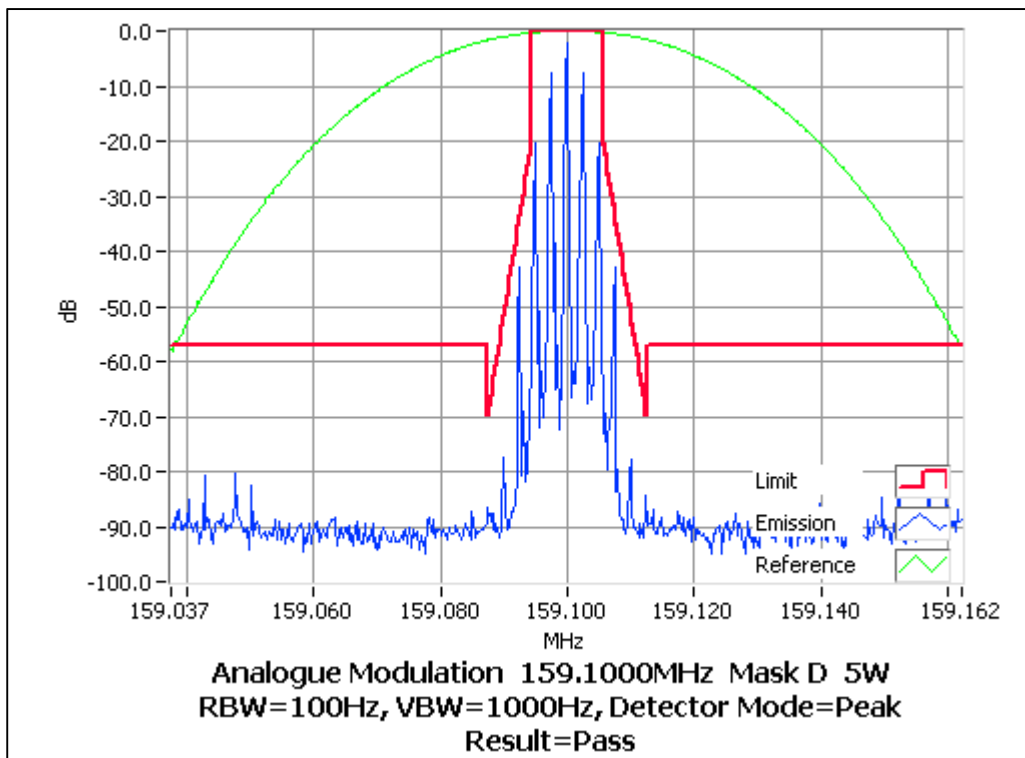
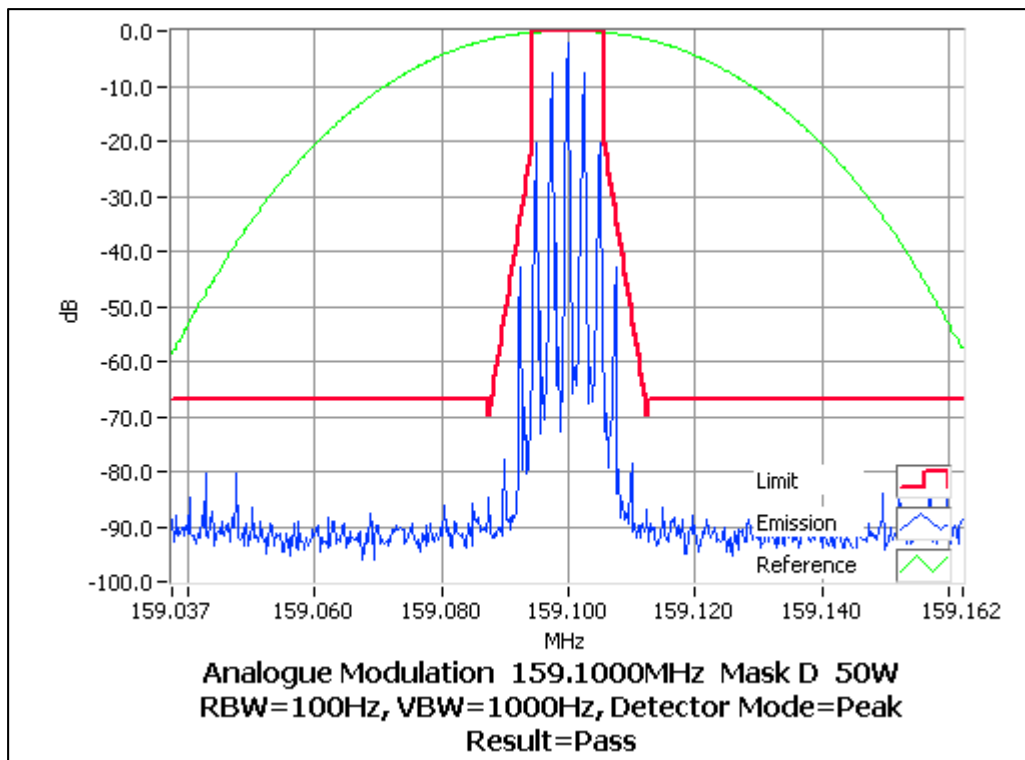
Occupied Bandwidth and Spectrum Masks

Tx FREQUENCY: 155.100 MHz 50 W & 5 W 12.5 kHz Channel Spacing



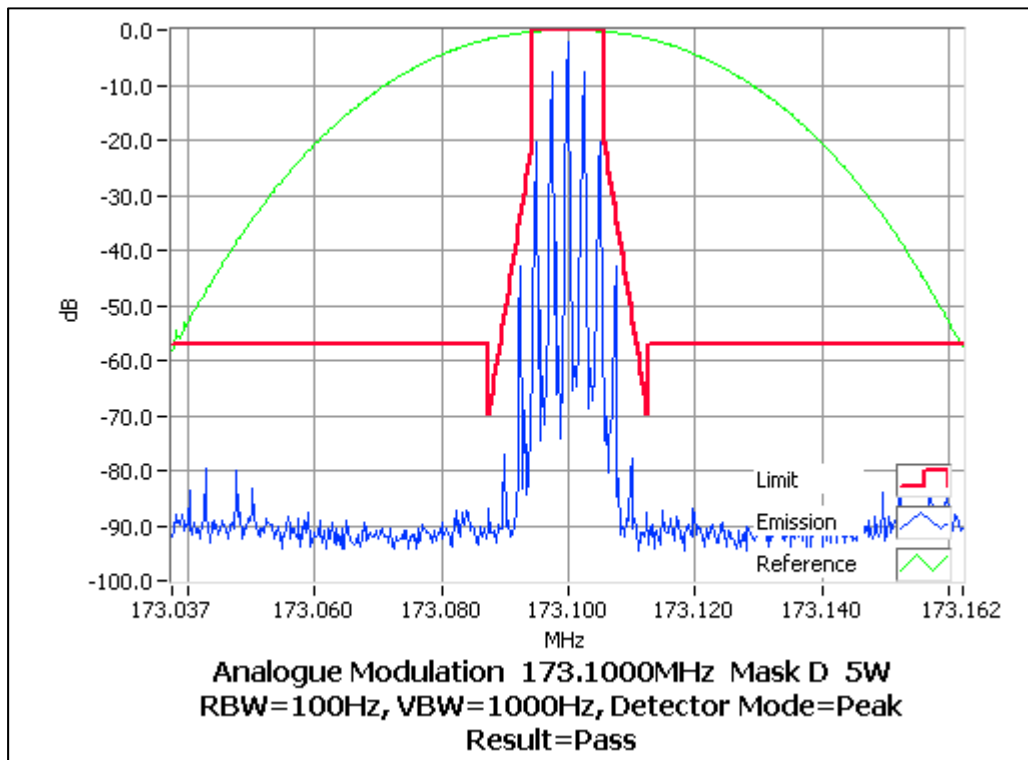
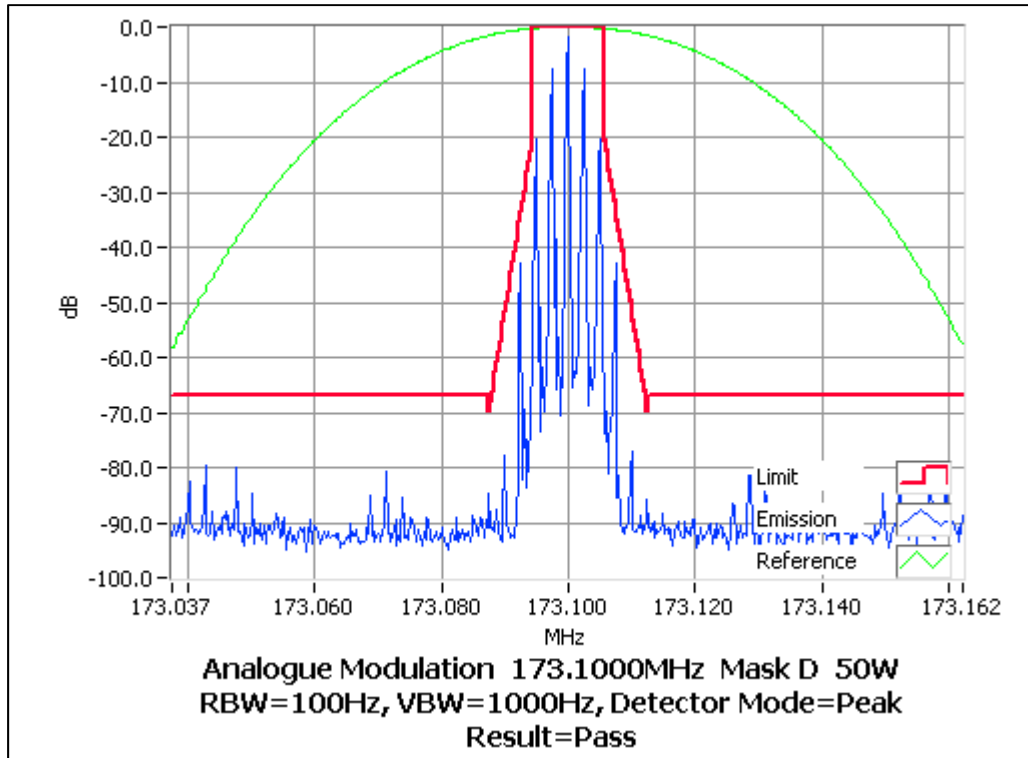
Occupied Bandwidth and Spectrum Masks

Tx FREQUENCY: 159.100 MHz 50 W & 5 W 12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

Tx FREQUENCY: 173.100 MHz 50 W & 5 W 12.5 kHz Channel Spacing



TEST EQUIPMENT LIST

No#	Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
27	Power Supply	AC Variac	Yamabishi	S-260-5	TX-533	E1737	
33	Spectrum Analyser	26.5GHz	Agilent	PXA N9030A	MY49432161	E4907	6-Jul-16
51	RF Attenuator	TREVA2 20dB 150W	Weinschel	40-20-33	CJ405	E3733	15-Oct-15
90	Modulation Analyser	TREVA2	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	18-Oct-15
97	RF Attenuator	TREVA2 3dB	Weinschel	Model 1	BL9950	E4080	
101	RF Combiner	TREVA2	Minicircuits	ZFSC-4-1	-	E4084	
103	Spectrum Analyser	13.2GHz	Agilent	E4445A	MY42510072	E4139	22-Oct-16
117	Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack5	E4850	14-Oct-15
127	Power Meter	TREVA2 Power Head for HP8901	Hewlett Packard	HP11722A	2716A02037	1575	18-Oct-15
133	TREVA 2		Teltest	-	2	-	3-Nov-15

* NOTE: Items without calibration dates are calibrated immediately before use, or set using calibrated instruments.

ANNEX A – TEST SETUP DETAILS

All testing is performed using the **Teltest Radio EVALuation** 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.

