

# LABORATORY TEST REPORT

## RADIO PERFORMANCE MEASUREMENTS

for the

TBCB1D BASE STATION Transceiver

Tested in accordance with:

FCC 47 CFR Parts 22, 74 and 90

RSS-119 Issue 12  
RSS-Gen Issue 4

Report Revision:

1

Issue Date:

01 June 2016

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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.

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## REVISION

<b>Date</b>	<b>Revision</b>	<b>Comments</b>
1 June 2016	1	Initial test report

## INTRODUCTION

Type approval testing of the TBCB1D, 50 Watt, BASE STATION transceiver in order to demonstrate compliance with FCC 47 Parts 22, 74 & 90, and RSS-119 Issue 12 & RSS-Gen Issue 4. This Class-2 Permissive Change report adds FFSK to the list of modulations supported. The original test report is TARF 3376. This report only applies to frequencies covered by the TBCB3Y reciter (148MHz to 174MHz)

in accordance with:

FCC 47 CFR Parts 22, 74 and 90  
RSS-119 Issue 12 & RSS-Gen Issue 4

### REPORT PREPARED FOR

Tait Ltd  
245 Wooldridge Road  
Harewood  
Christchurch 8051  
New Zealand

### DESCRIPTION OF SAMPLE

Manufacturer: Tait Limited  
Equipment: BASE STATION Transceiver  
Type: TBCB1D  
Quantity: 1

FFSK tests were performed using a 511 bit pseudo-random sequence.  
Data rate: 1200 bits/second

### HARDWARE & SOFTWARE

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01105-DAZY	18221342	dmr-trunk.20160523T175409	0
Power Amplifier	T01-01136-CAAA	18218547	314	1
PMU	TBA30A0-0100	18213913	316	1
Front Panel	T01-01110-CCAA	18218671	1.07.00.0002	0.04

### TEST CONDITIONS

All testing was performed on 1 June 2016, and under the following conditions:

Ambient temperature: 15°C → 30°C  
Relative Humidity: 20% → 75%  
Standard Test Voltage 120 V<sub>AC</sub>

## 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: TBCB1D  
With reciter: TBCB3Y (148 to 174 MHz)  
Quantity: 1 of each

Consisting Of:

### HARDWARE & SOFTWARE

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01105-DAZY	18221342	dmr-trunk.20160523T175409	0
Power Amplifier	T01-01136-CAAA	18218547	314	1
PMU	TBA30A0-0100	18213913	316	1
Front Panel	T01-01110-CCAA	18218671	1.07.00.0002	0.04

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

FCC 47 CFR Parts 22, 74 and 90

RSS-119 Issue 12 & RSS-Gen Issue 4

**Signature:** \_\_\_\_\_

Mike James  
Technical Manager

**Date:** \_\_\_\_\_

## MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

### MODULATION TYPES:

F2D      Fast Frequency Shift Keying      1200 symbols/sec      1200 bps

### EMISSION DESIGNATORS:

Channel Spacing 12.5 kHz	
FFSK	7K60F2D

### CALCULATIONS

Fast Frequency Shift Keying (FFSK – 1200 bps) 12.5 kHz Channel Spacing

Necessary bandwidth

M = 1.8 kHz

D = 2.0 kHz

$$B_n = (2 \times 1.8) + (2 \times 2.0) \times 1 \\ = 7.6 \text{ kHz}$$

Emission Designator

**7K60F2D**

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

## TEST RESULTS

### 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 analogue 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

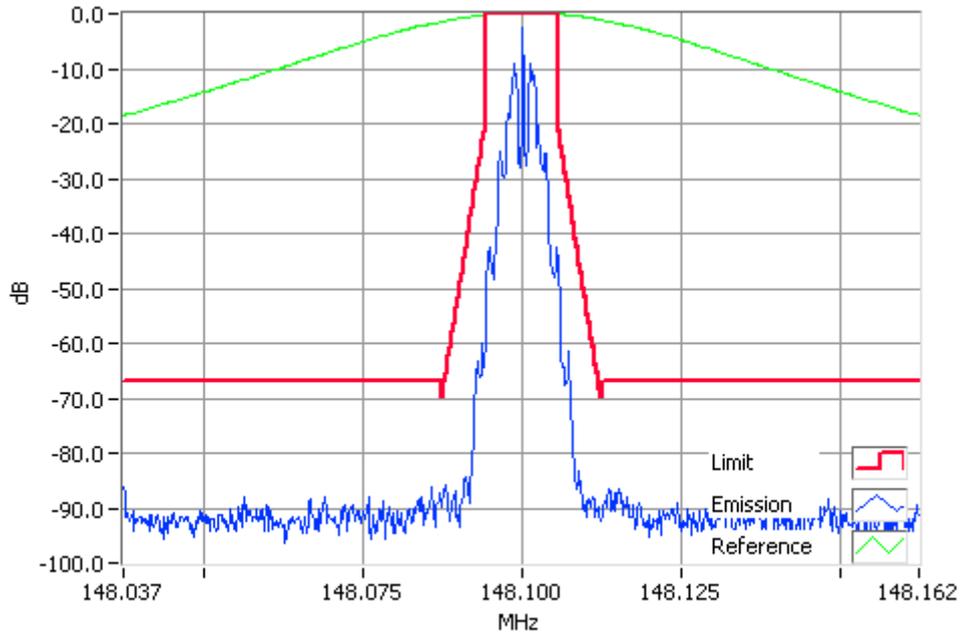
#### EMISSION MASKS

Emission Mask D 12.5 kHz Channel Spacing FFSK

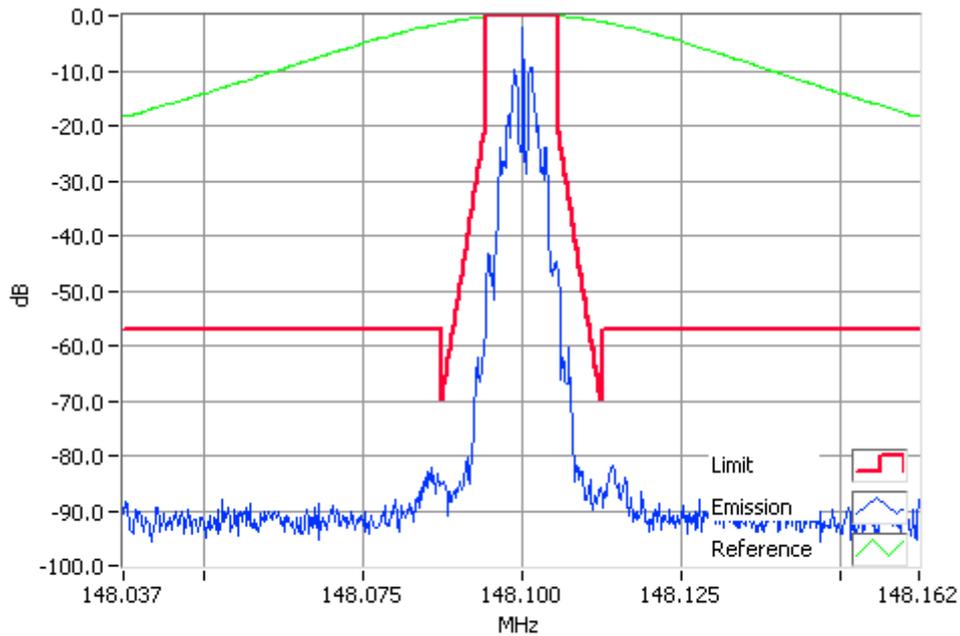
### Occupied Bandwidth and Spectrum Masks

FFSK

SPECIFICATION: FCC CFR 2.1049 (c) Mask- D      RSS-119 5.5 Mask-D  
Tx FREQUENCY: 148.1 MHz      50W & 5 W      12.5 kHz Channel Spacing



**FFSK 148.1000MHz Mask D 50W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

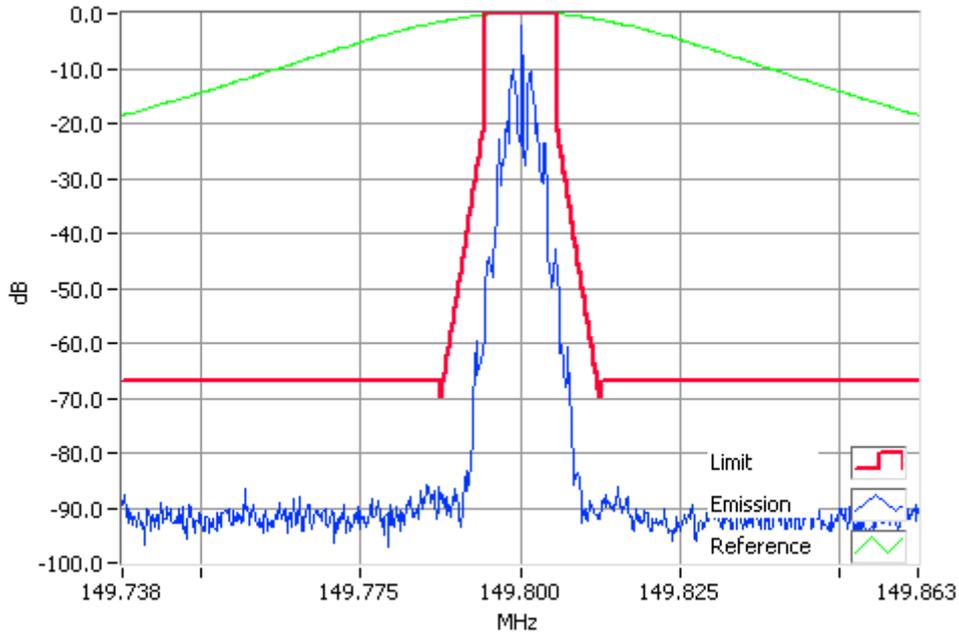


**FFSK 148.1000MHz Mask D 5W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

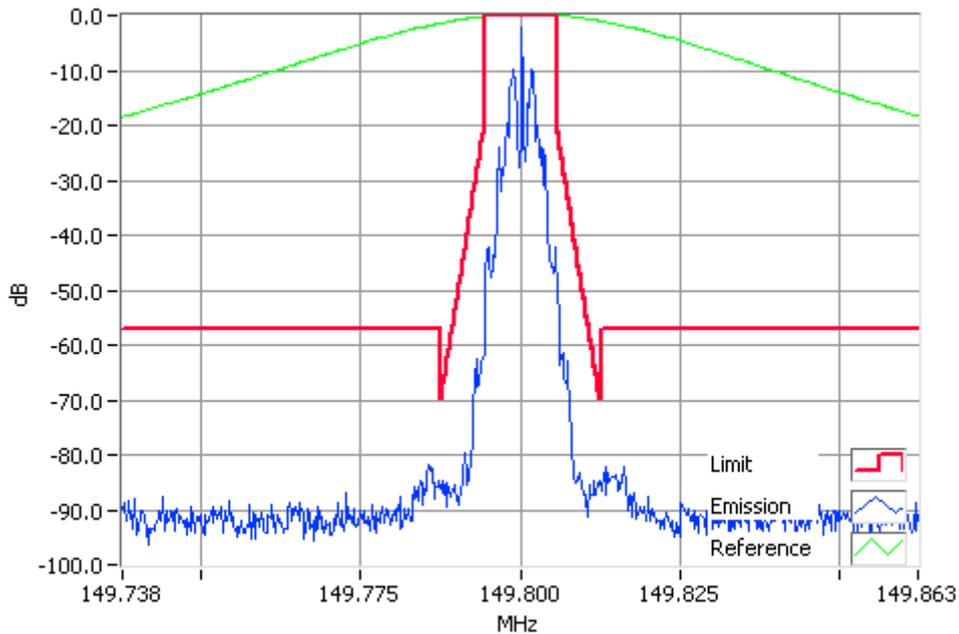
### Occupied Bandwidth and Spectrum Masks

#### FFSK

SPECIFICATION: FCC CFR 2.1049 (c) Mask- D      RSS-119 5.5 Mask-D  
Tx FREQUENCY: 149.8 MHz      50W & 5 W      12.5 kHz Channel Spacing



**FFSK 149.8000MHz Mask D 50W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

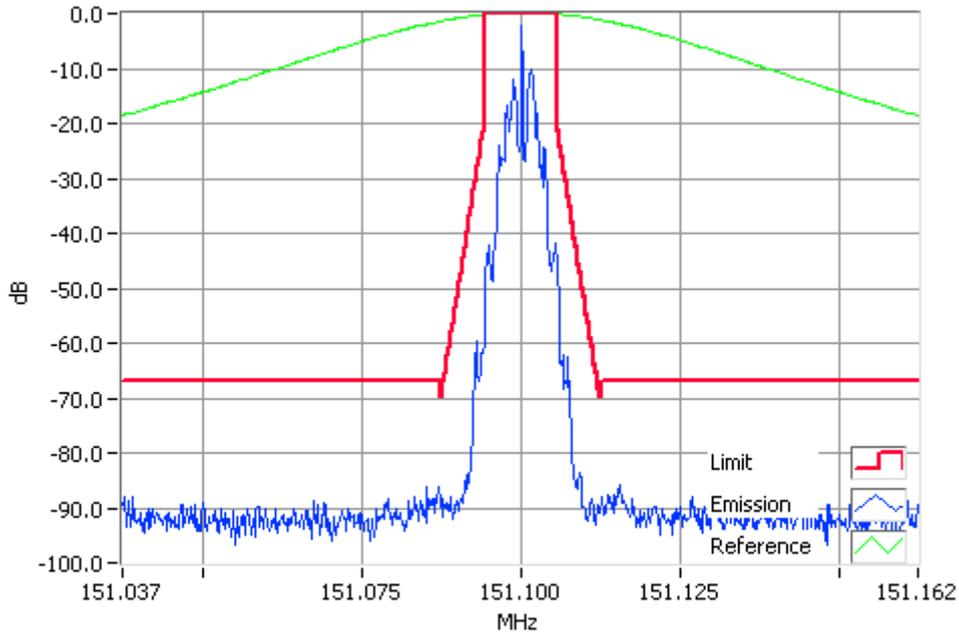


**FFSK 149.8000MHz Mask D 5W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

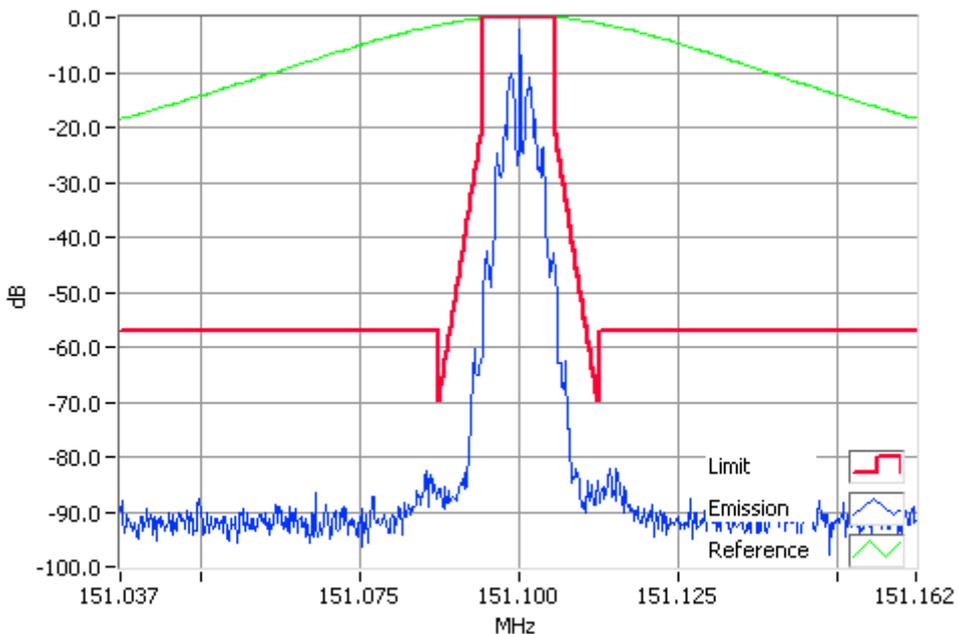
### Occupied Bandwidth and Spectrum Masks

FFSK

SPECIFICATION: FCC CFR 2.1049 (c) Mask- D      RSS-119 5.5 Mask-D  
Tx FREQUENCY: 151.1 MHz      50W & 5 W      12.5 kHz Channel Spacing



**FFSK 151.1000MHz Mask D 50W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

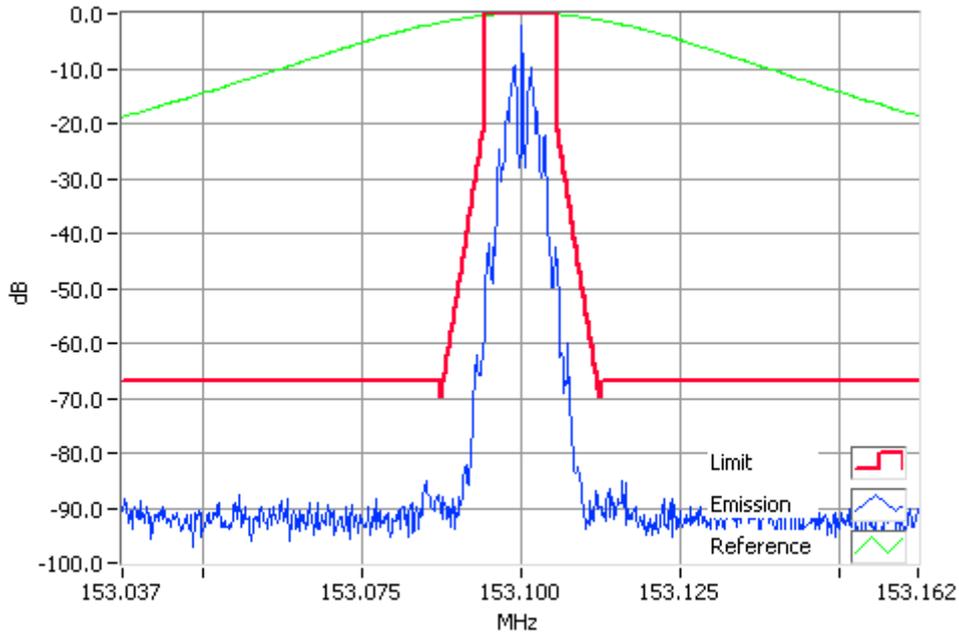


**FFSK 151.1000MHz Mask D 5W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

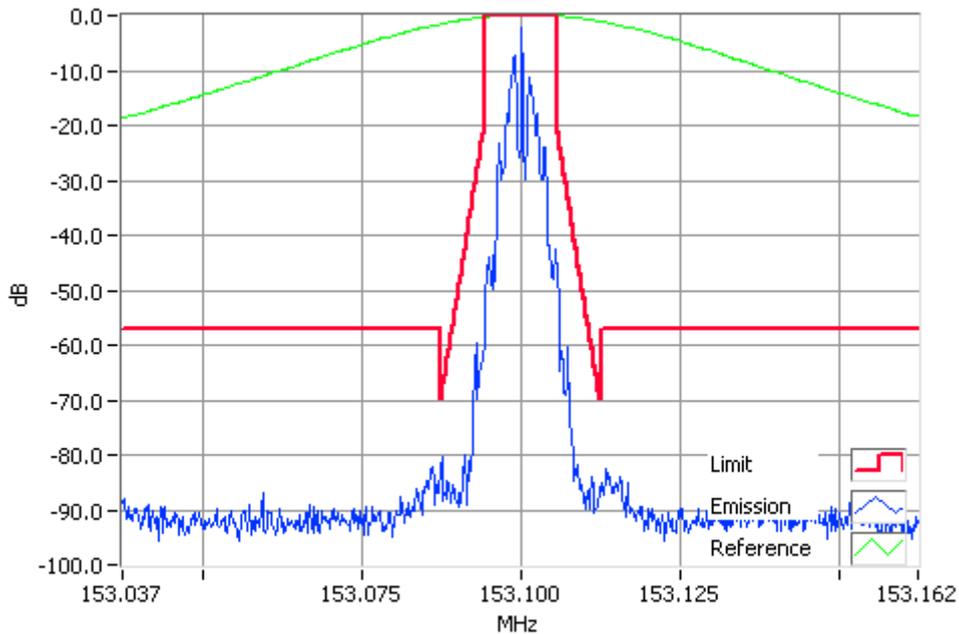
### Occupied Bandwidth and Spectrum Masks

FFSK

SPECIFICATION: FCC CFR 2.1049 (c) Mask- D      RSS-119 5.5 Mask-D  
Tx FREQUENCY: 153.1 MHz      50W & 5 W      12.5 kHz Channel Spacing



**FFSK 153.1000MHz Mask D 50W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

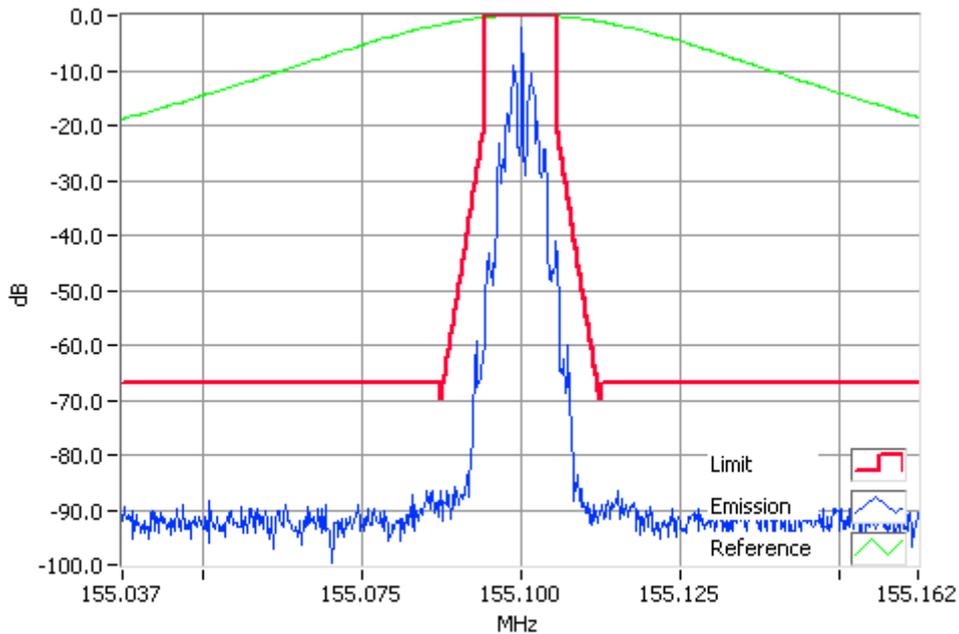


**FFSK 153.1000MHz Mask D 5W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

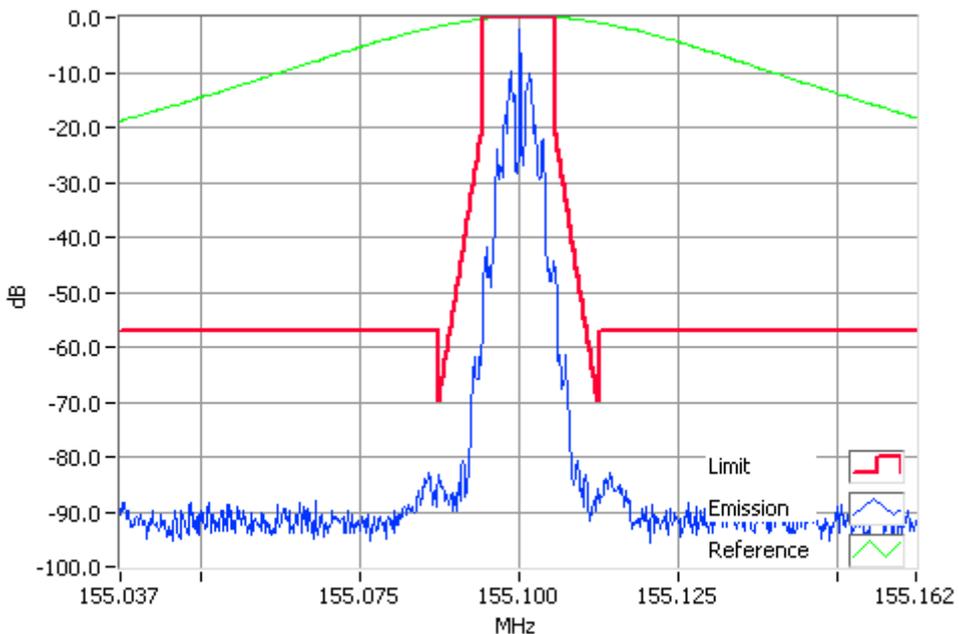
### Occupied Bandwidth and Spectrum Masks

#### FFSK

SPECIFICATION: FCC CFR 2.1049 (c) Mask- D      RSS-119 5.5 Mask-D  
Tx FREQUENCY: 155.1 MHz      50W & 5 W      12.5 kHz Channel Spacing



**FFSK 155.1000MHz Mask D 50W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

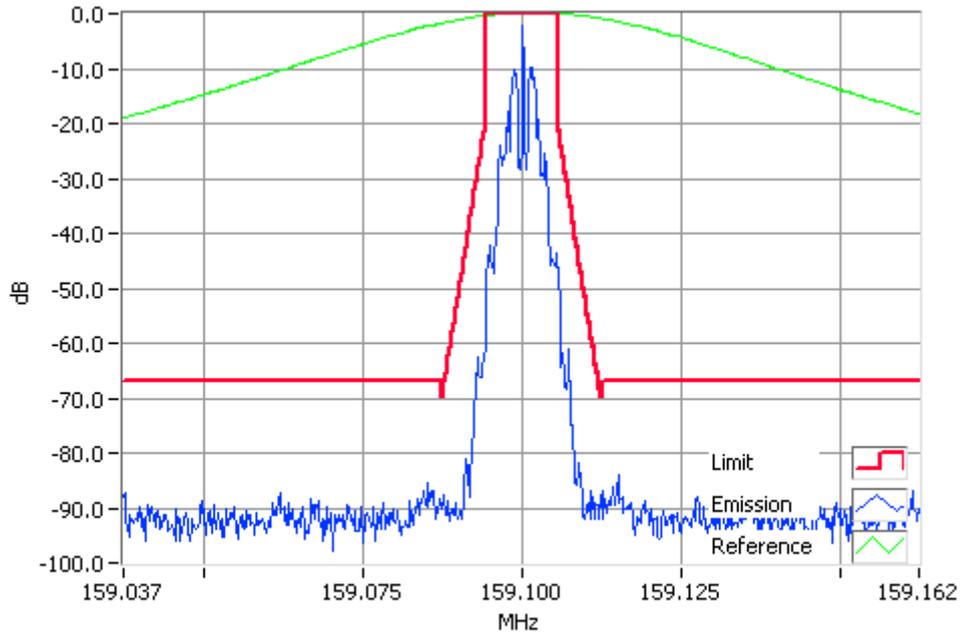


**FFSK 155.1000MHz Mask D 5W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

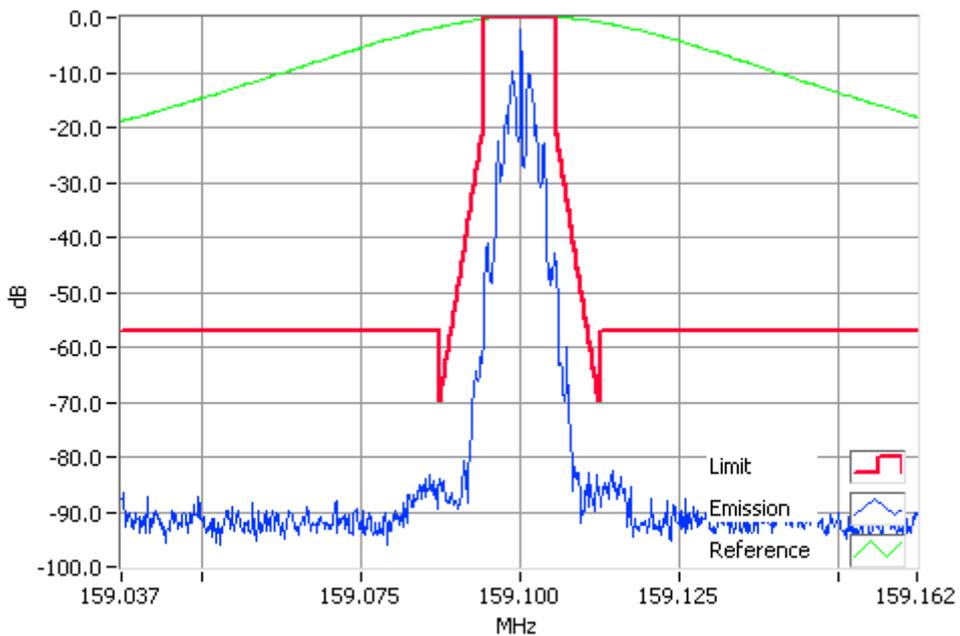
### Occupied Bandwidth and Spectrum Masks

FFSK

SPECIFICATION: FCC CFR 2.1049 (c) Mask- D      RSS-119 5.5 Mask-D  
Tx FREQUENCY: 159.1 MHz      50W & 5 W      12.5 kHz Channel Spacing



**FFSK 159.1000MHz Mask D 50W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

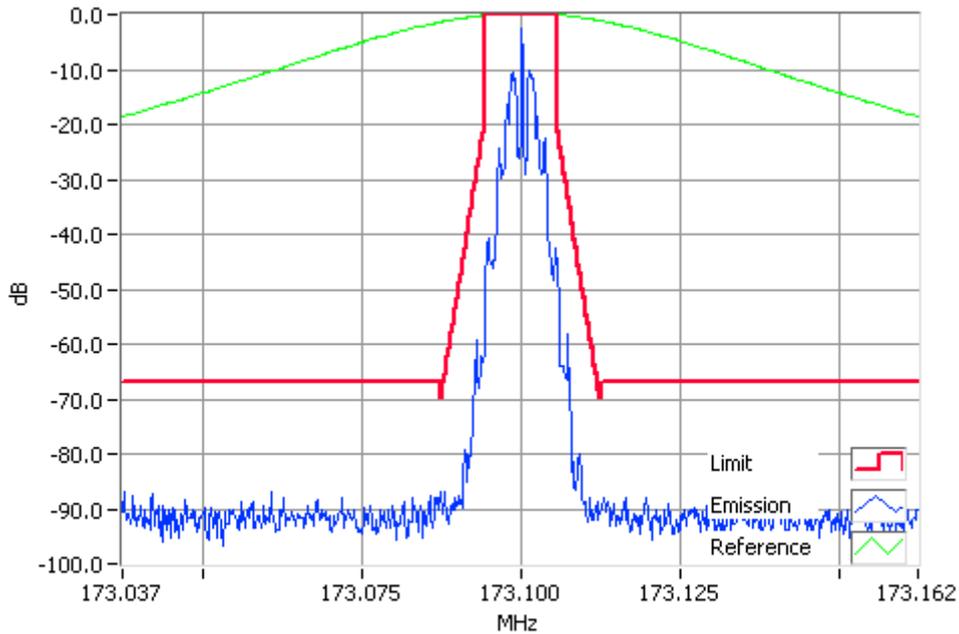


**FFSK 159.1000MHz Mask D 5W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

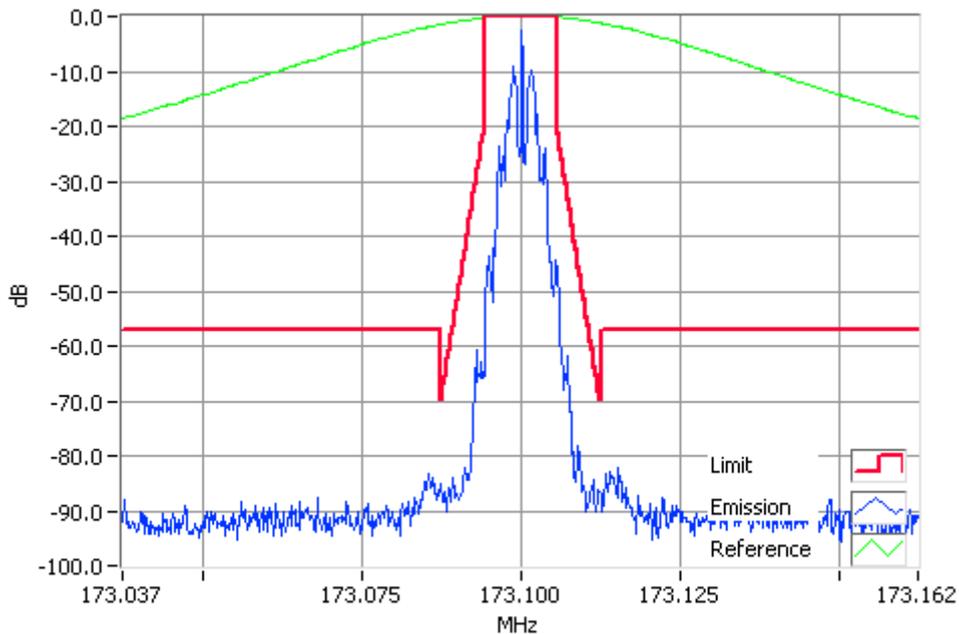
### Occupied Bandwidth and Spectrum Masks

FFSK

SPECIFICATION: FCC CFR 2.1049 (c) Mask- D      RSS-119 5.5 Mask-D  
Tx FREQUENCY: 173.1 MHz      50W & 5 W      12.5 kHz Channel Spacing



**FFSK 173.1000MHz Mask D 50W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**



**FFSK 173.1000MHz Mask D 5W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

## TEST EQUIPMENT LIST

Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
Power Supply	AC Variac	Yamabishi	S-260-5	TX-533	E1737	
Spectrum Analyser	13.2GHz	Hewlett Packard	HP8562E	3821A00779	E3715	15-Oct-16
RF Attenuator	30dB 350W	Weinschel	67-30-33	BR0531	E4280	18-Oct-16
Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack5	E4850	16-Oct-16
Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack6	E4849	16-Oct-16

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 **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.

