

# LABORATORY TEST REPORT

## RADIO PERFORMANCE MEASUREMENTS

for the

TBCH2B 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: 4-May-2016

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Test Technician

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\_\_\_\_\_  
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.

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## REVISION

| Date       | Revision | Comments            |
|------------|----------|---------------------|
| 4-May-2016 | 1        | Initial test report |
|            |          |                     |

## INTRODUCTION

Type approval testing of the TBCH2B, 100 Watt, Base Station transceiver in order to demonstrate compliance with FCC 47 Parts 22, 74 and 90, and RSS-119 Issue 12 & 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 3587.

### REPORT PREPARED FOR

Tait Ltd  
245 Wooldridge Road  
Harewood  
Christchurch 8051  
New Zealand

### DESCRIPTION OF SAMPLE

Manufacturer Tait Limited  
Equipment: Base Station Transceiver  
Type: TBCH2B  
Frequency range 440 → 480 MHz  
Transmit Power 100 Watts

| Modulation |    | Channel Spacing | Speech Channels |
|------------|----|-----------------|-----------------|
| Analogue   | FM | 12.5 kHz        | 1               |

### HARDWARE & SOFTWARE

Quantity: 1 of each

| Description           | Product Code   | Serial Number | Firmware Version | Hardware Version |
|-----------------------|----------------|---------------|------------------|------------------|
| Reciter<br>440-480MHz | T01-01103-LAAA | 18225000      | p25-2.15.00.0005 | 0.11             |
| Power Amplifier       | T01-01121-LBZZ | 18199462      | 1.08.00.0002     | 0.06             |
| PMU                   | TBA30A0-0100   | 18195930      | 3.16             | 0.01             |
| Front Panel           | T01-01110-AAAA | 18200463      | 1.08.00.0002     | 0.04             |

### TEST CONDITIONS

All testing was performed on 22-April-2016, and under the following conditions:

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

### TEST PATTERN

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: TBCH2B  
Quantity: 1

Consisting Of:  
HARDWARE & SOFTWARE

| Description           | Product Code   | Serial Number | Firmware Version | Hardware Version |
|-----------------------|----------------|---------------|------------------|------------------|
| Reciter<br>440-480MHz | T01-01103-LAAA | 18225000      | p25-2.15.00.0005 | 0.11             |
| Power Amplifier       | T01-01121-LBZZ | 18199462      | 1.08.00.0002     | 0.06             |
| PMU                   | TBA30A0-0100   | 18195930      | 3.16             | 0.01             |
| Front Panel           | T01-01110-AAAA | 18200463      | 1.08.00.0002     | 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:** \_\_\_\_\_

M. C. James  
Technical Manager

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

## MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

### MODULATION TYPES:

F3E Analogue Frequency Modulation (FM)

### EMISSION DESIGNATORS:

| Channel Spacing 12.5 kHz |         |
|--------------------------|---------|
| Analog FM                | 11K0F3E |

### CALCULATIONS

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 100 W transmit power.

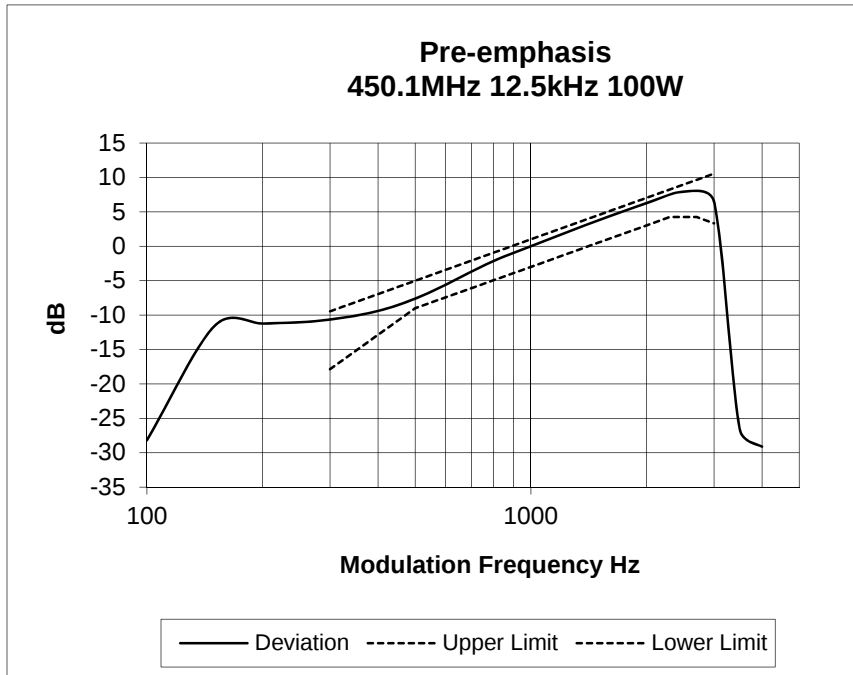
NOTE: The upper audio frequency tested was 3800 Hz due to the 8000 Hz sample rate of the modulating signal.

LIMIT CLAUSE: TIA/EIA-603D 3.2.6

SPECIFICATION: FCC CFR 2.1047 (a)

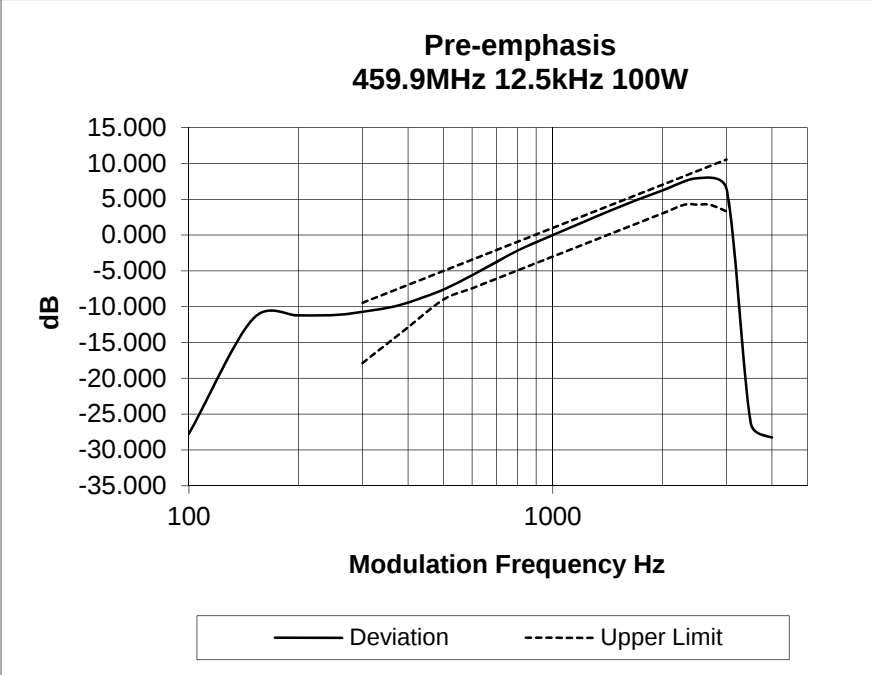
Tx FREQUENCY: 450.1 MHz

12.5 kHz Channel Spacing

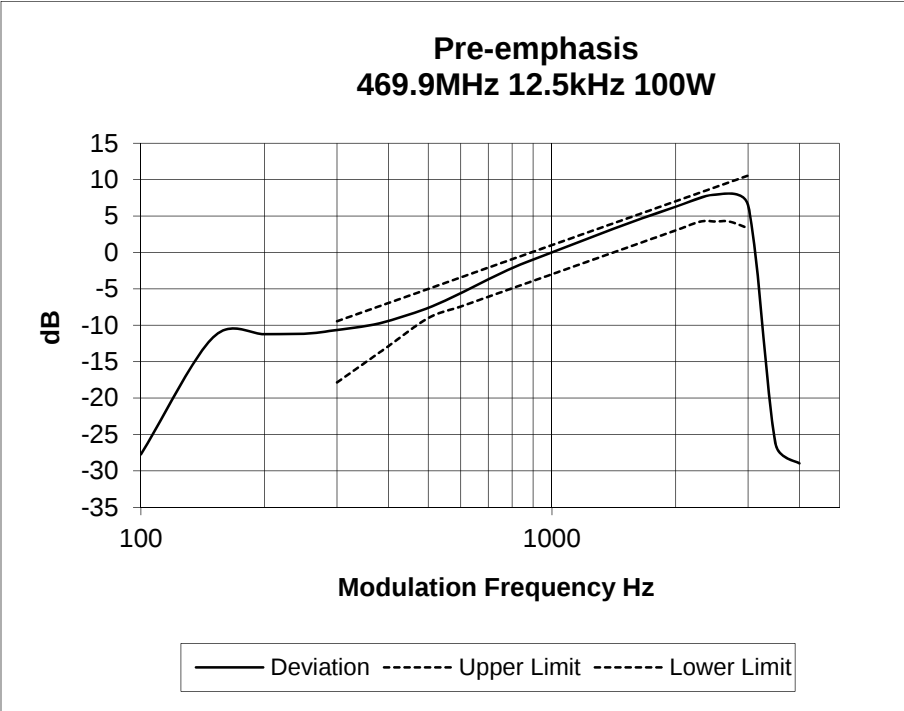


Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 459.9 MHz 12.5 kHz Channel Spacing



Tx FREQUENCY: 469.9 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.

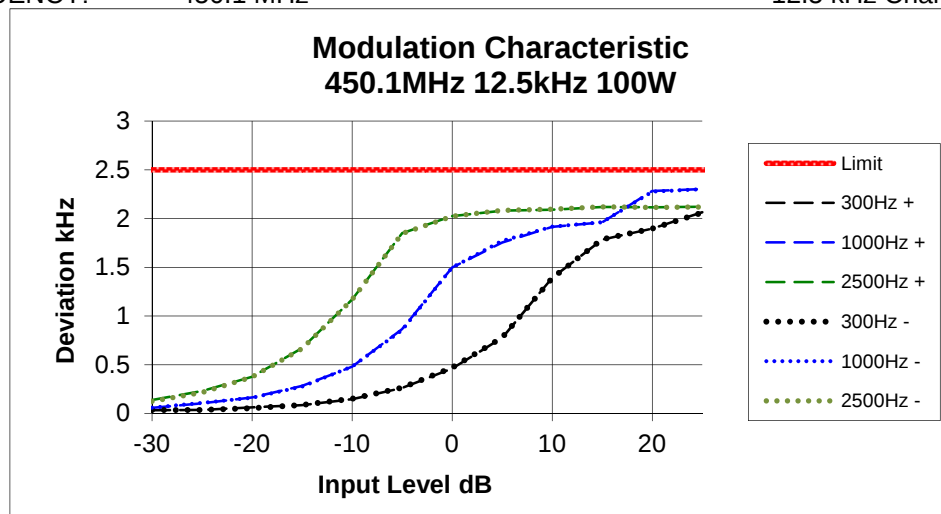
### MEASUREMENT RESULTS:

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

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

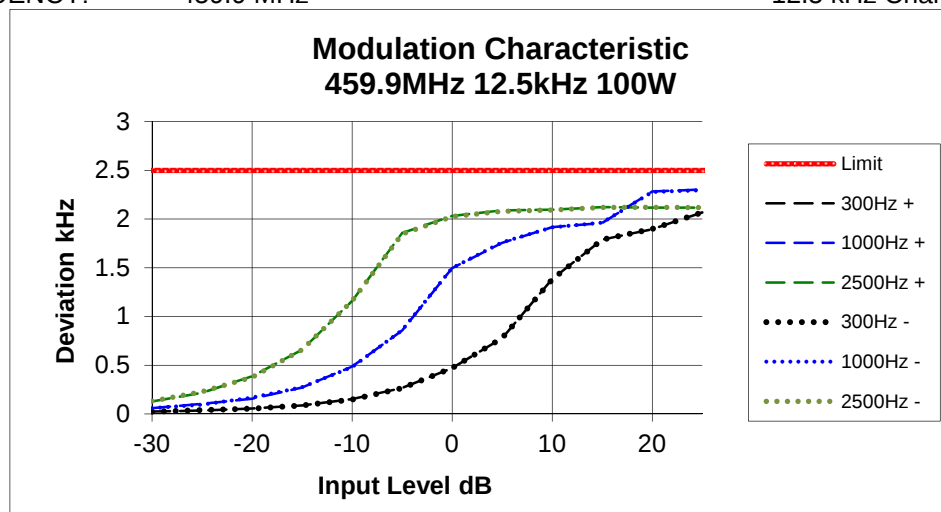
Tx FREQUENCY: 450.1 MHz

12.5 kHz Channel Spacing



Tx FREQUENCY: 459.9 MHz

12.5 kHz Channel Spacing

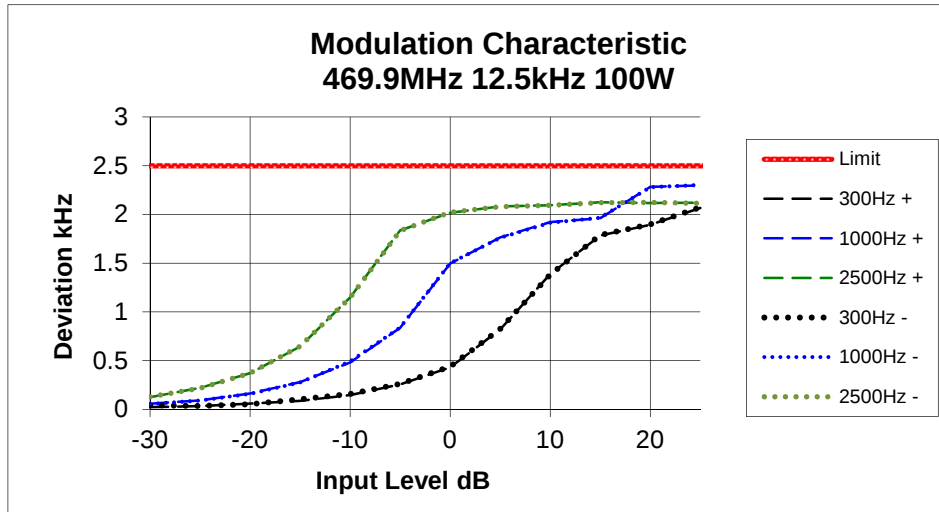


## Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 469.9 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 (Analog)

### MEASUREMENT PROCEDURE:

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

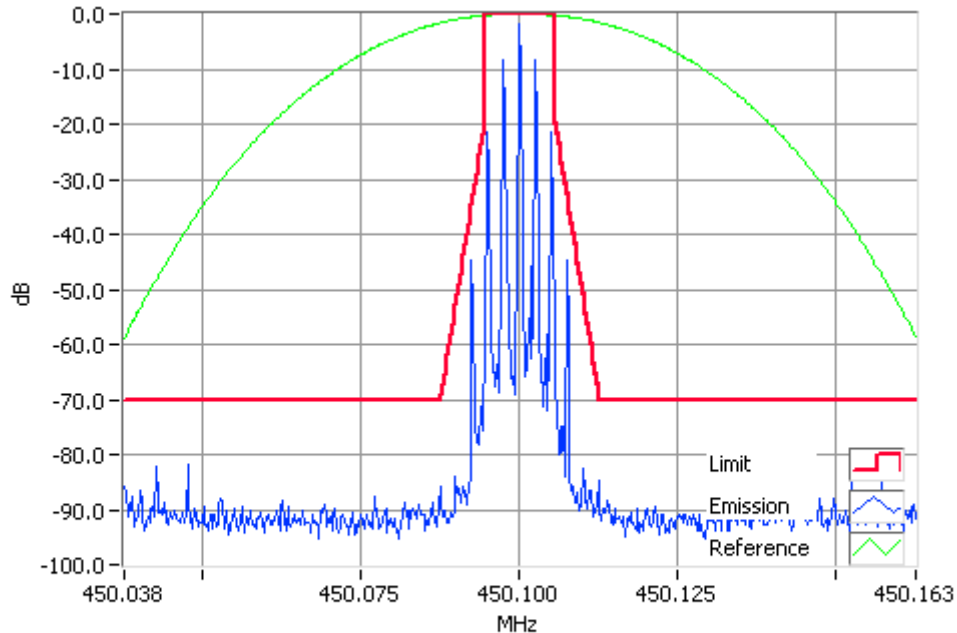
## Occupied Bandwidth and Spectrum Masks

Analogue FM

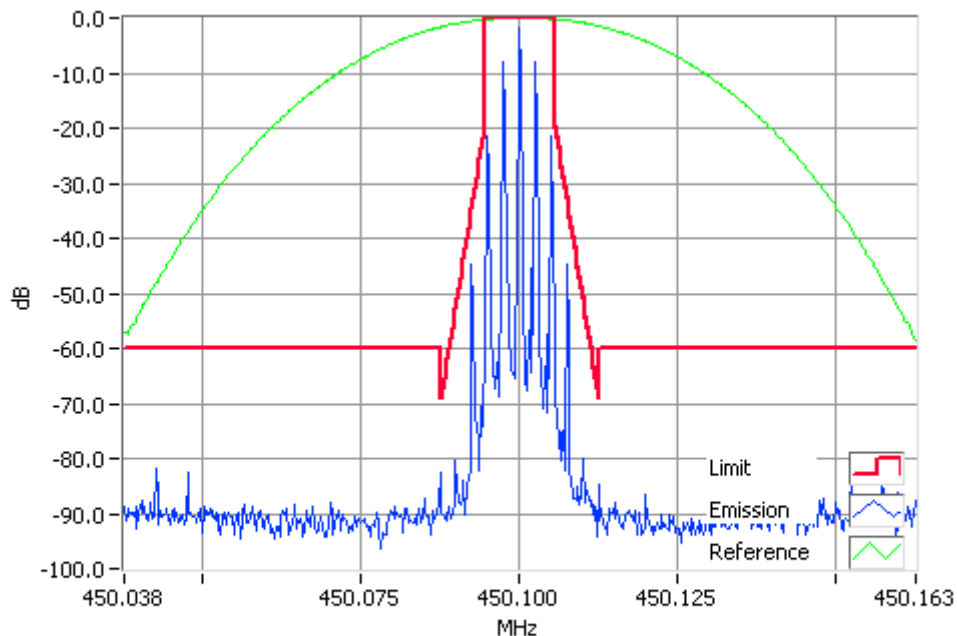
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 450.1 MHz 100 W & 10 W 12.5 kHz Channel Spacing



**Analogue Modulation 450.1000MHz Mask D 100W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

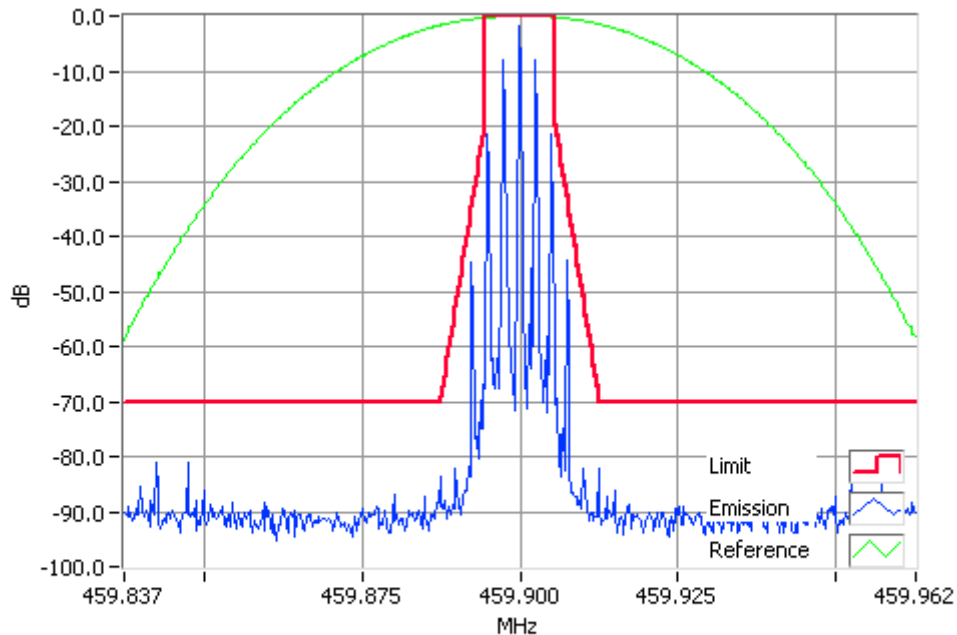


**Analogue Modulation 450.1000MHz Mask D 10W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

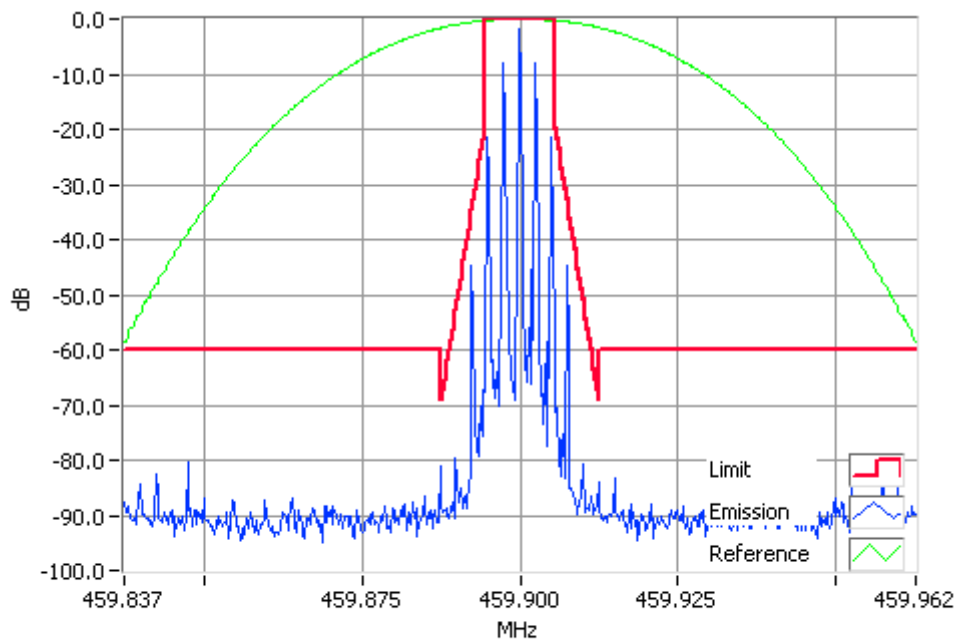
## Occupied Bandwidth and Spectrum Masks

Analogue FM

Tx FREQUENCY: 459.9 MHz 100 W & 10 W 12.5 kHz Channel Spacing



**Analogue Modulation 459.9000MHz Mask D 100W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

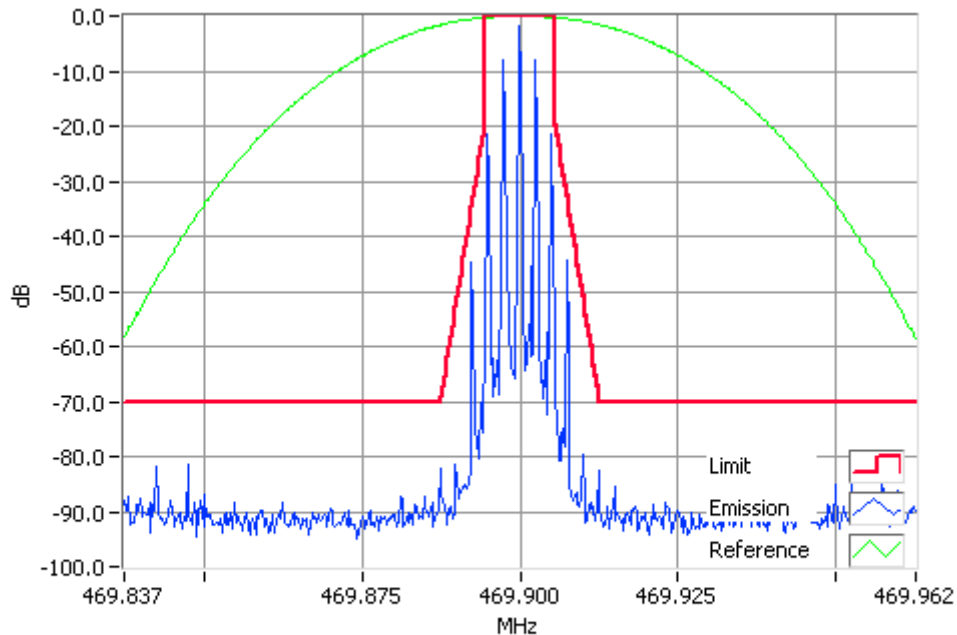


**Analogue Modulation 459.9000MHz Mask D 10W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

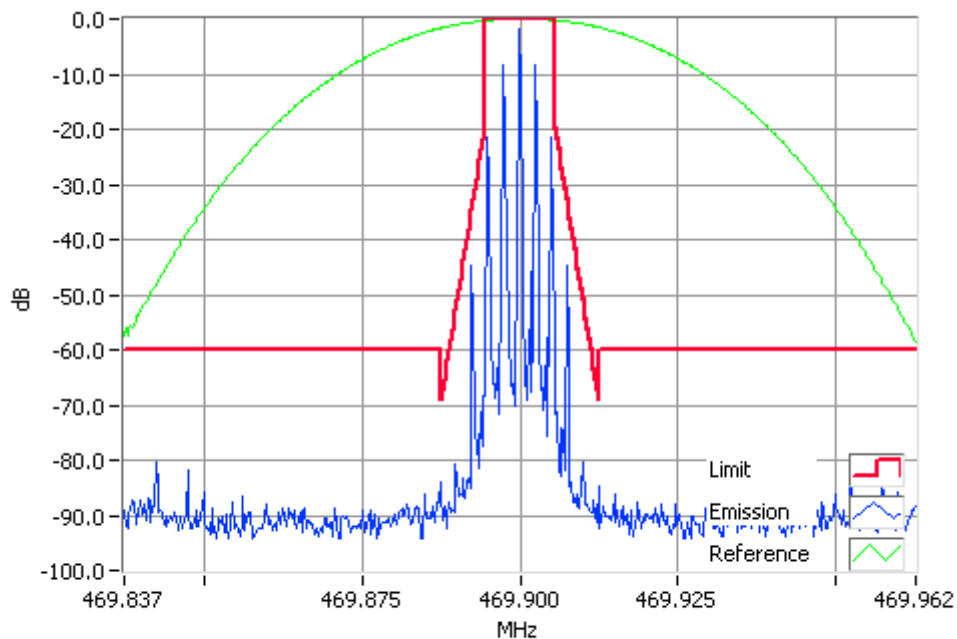
## Occupied Bandwidth and Spectrum Masks

Analogue FM

Tx FREQUENCY: 469.9 MHz 100 W & 10 W 12.5 kHz Channel Spacing



**Analogue Modulation 469.9000MHz Mask D 100W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**



**Analogue Modulation 469.9000MHz Mask D 10W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

## TEST EQUIPMENT LIST

| Equipment Type             | Information                  | Manufacturer    | Model No           | Serial No#    | Tait ID | Cal Due   |
|----------------------------|------------------------------|-----------------|--------------------|---------------|---------|-----------|
| AC Voltmeter               |                              | Tait            |                    | 1             |         | 19-Aug-16 |
| Audio Analyser             | TREVA1                       | Hewlett Packard | HP8903A            | 2437A04625    | E4986   | 21-Oct-16 |
| Coax Cable                 | 2m Black                     | Suhner          | RG214HF/Nm/Nm/2000 | TeltestBlack4 | E4653   | 16-Oct-16 |
| Coax Cable                 | 2m Black                     | Suhner          | RG214HF/Nm/Nm/2000 | TeltestBlack5 | E4850   | 16-Oct-16 |
| Environ. Chamber           | Upright                      | Contherm        | 5400 RHSLT.M       | 1416          | E4051   | 1-Aug-17  |
| Modulation Analyser        | TREVA1                       | Hewlett Packard | HP8901B (Opt 002)  | 2441A00393    | E3073   | 21-Oct-16 |
| Power Meter                | TREVA1 Power Head for HP8901 | Hewlett Packard | HP11722A           | 3111A05573    | E7054   | 21-Oct-16 |
| Power Supply               | AC Variac                    | Yamabishi       | S-260-5            | TX-533        | E1737   |           |
| RF Attenuator              | 30dB 350W                    | Weinschel       | 67-30-33           | BR0531        | E4280   | 18-Oct-16 |
| RF Attenuator              | TREVA1 3dB                   | Weinschel       | Model 1            | BL9958        | E4081   |           |
| RF Attenuator              | 20dB 150W                    | Weinschel       | 40-20-23           | MF817         | E4082   | 19-Oct-16 |
| RF Combiner                | TREVA1                       | Minicircuits    | ZFSC-4-1           | -             | E4083   |           |
| Spectrum Analyser          | 26.5GHz                      | Agilent         | PXA N9030A         | MY49432161    | E4907   | 6-Jul-16  |
| Temp & Humidity datalogger |                              | Hobo            | U21-011            | 10134276      | E4981   | 14-Aug-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.

