

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBCH2A 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

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.

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REVISION

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

INTRODUCTION

Type approval testing of the TBCH2A, 50 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 3586.

REPORT PREPARED FOR

Tait Ltd
245 Wooldridge Road
Harewood
Christchurch 8051
New Zealand

DESCRIPTION OF SAMPLE

Manufacturer: Tait Limited
Equipment: Base Station Transceiver
Type: TBCH2A
Frequency range: 440 → 480 MHz
Transmit Power: 50 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 440-480MHz	T01-01103-LAAA	18224999	p25-2.15.00.0005	0.11
Power Amplifier	T01-01121-LAZZ	18199480	1.08.00.0002	0.06
PMU	TBA30A0-0100	18200251	3.16	0.01
Front Panel	T01-01110-BAAA	18200455	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_{AC}

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: TBCH2A
Quantity: 1

Consisting Of:
HARDWARE & SOFTWARE

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter 440-480MHz	T01-01103-LAAA	18224999	p25-2.15.00.0005	0.11
Power Amplifier	T01-01121-LAZZ	18199480	1.08.00.0002	0.06
PMU	TBA30A0-0100	18200251	3.16	0.01
Front Panel	T01-01110-BAAA	18200455	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 50 W transmit power.

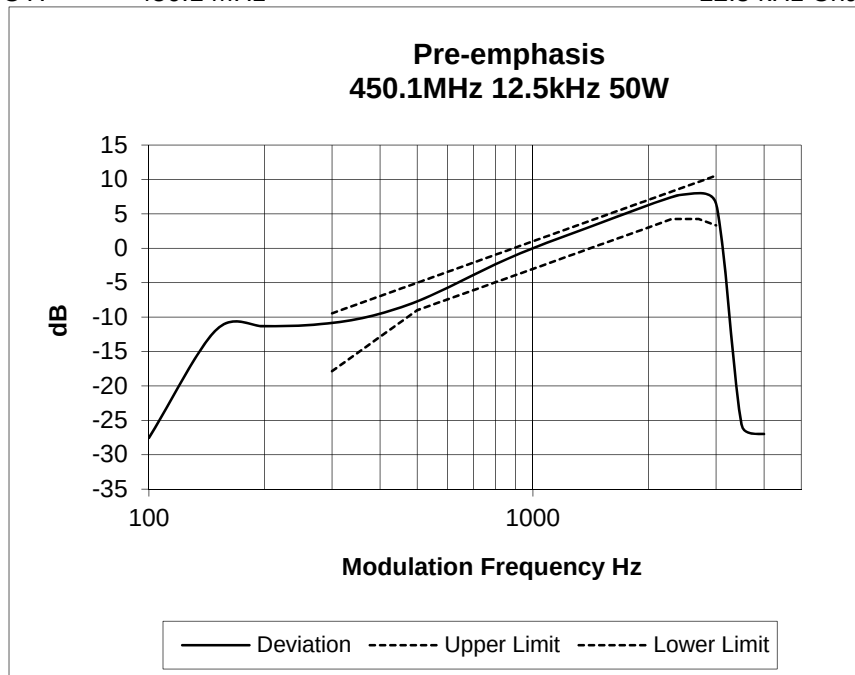
NOTE: The upper audio frequency tested was 3800 Hz due to the 8000 Hz sample rate of the modulating signal.

LIMIT CLAUSE: TIA/EIA-603D 3.2.6

SPECIFICATION: FCC CFR 2.1047 (a)

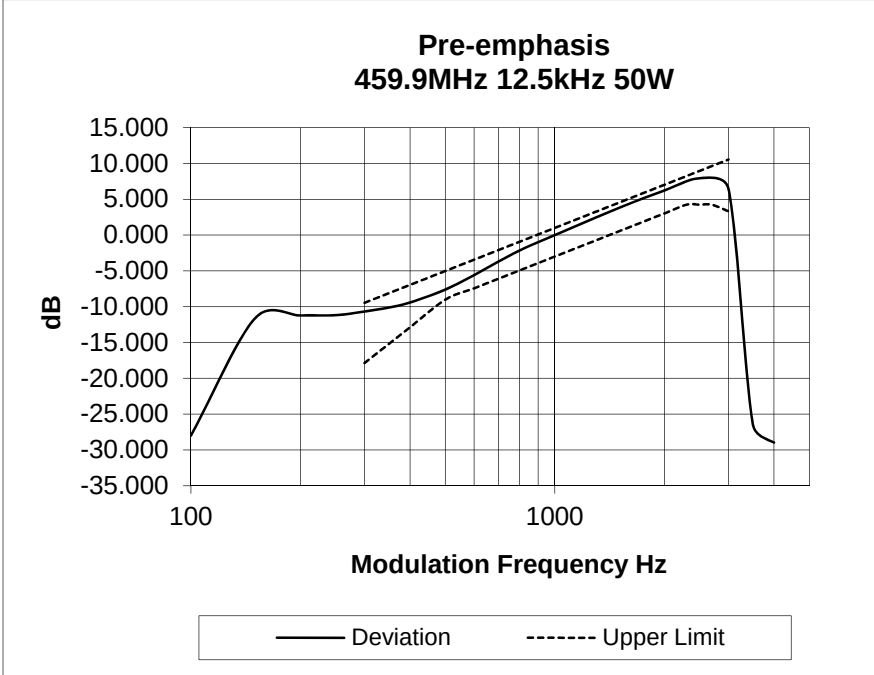
Tx FREQUENCY: 450.1 MHz

12.5 kHz Channel Spacing

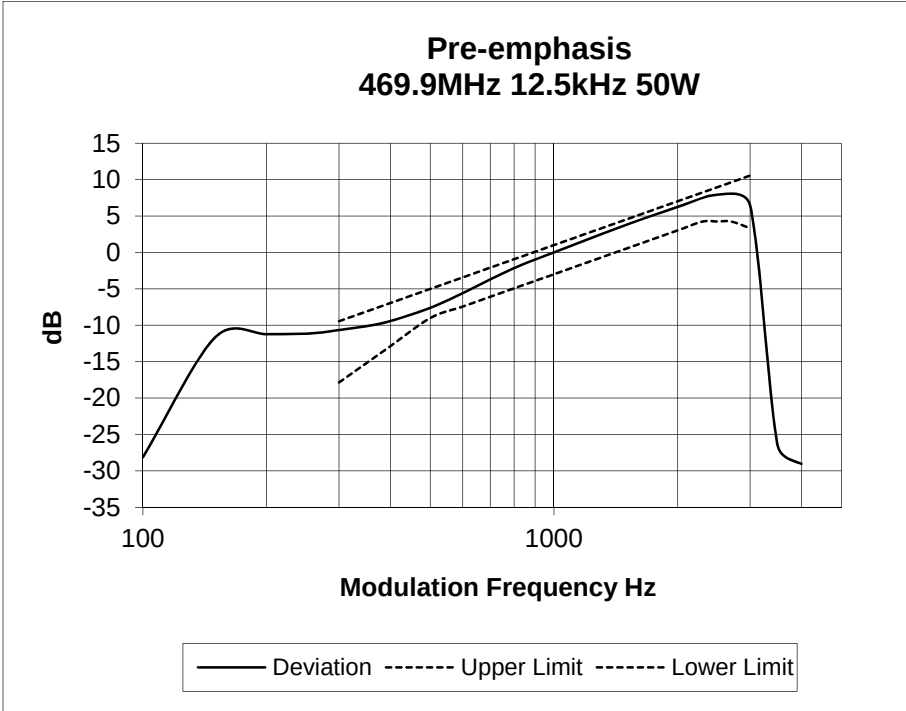


Transmitter Audio Frequency Response – Pre-emphasis

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.

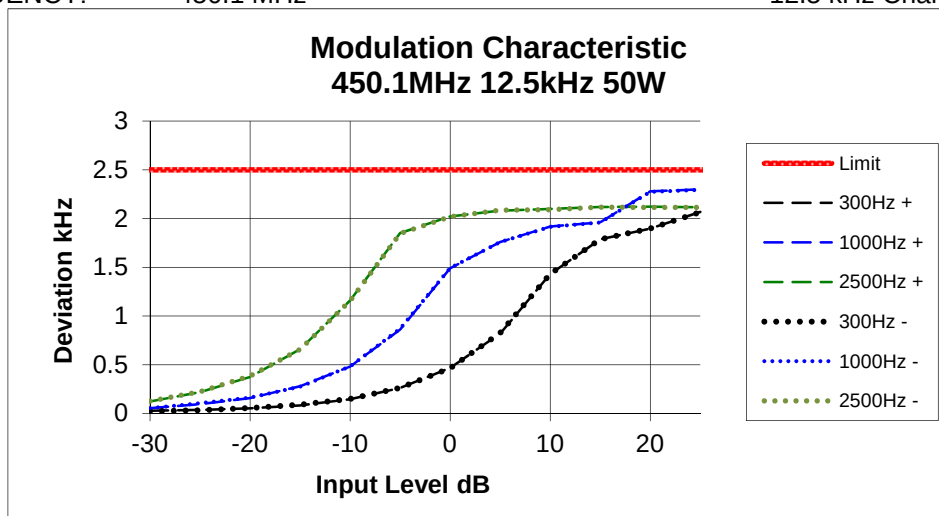
MEASUREMENT RESULTS:

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

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

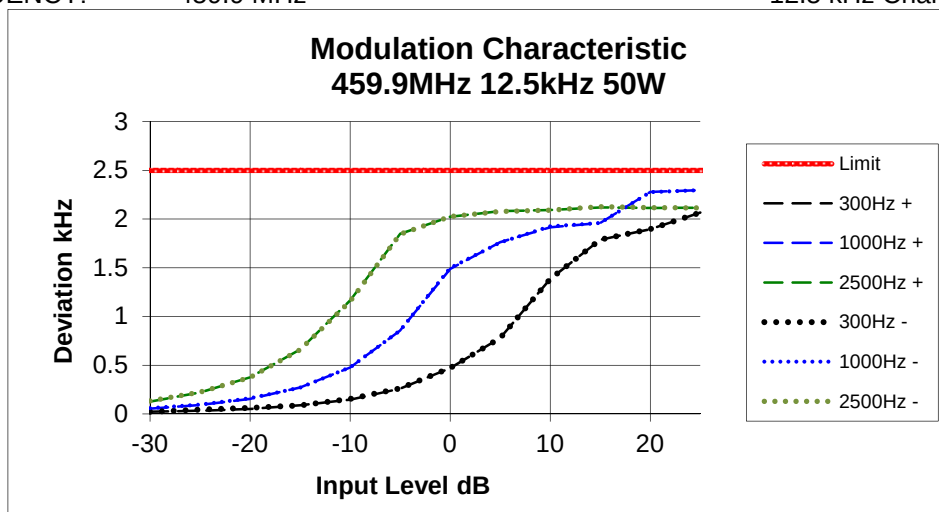
Tx FREQUENCY: 450.1 MHz

12.5 kHz Channel Spacing



Tx FREQUENCY: 459.9 MHz

12.5 kHz Channel Spacing

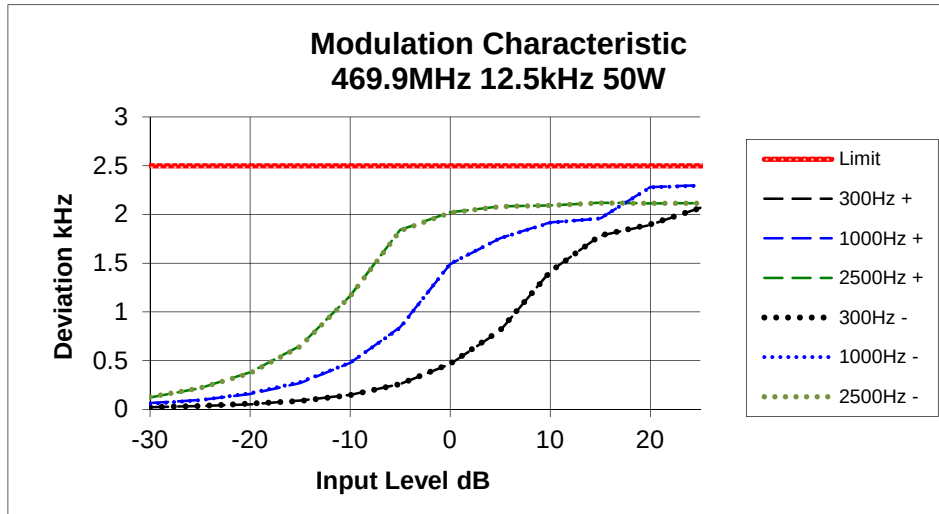


Transmitter Modulation Limiting

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

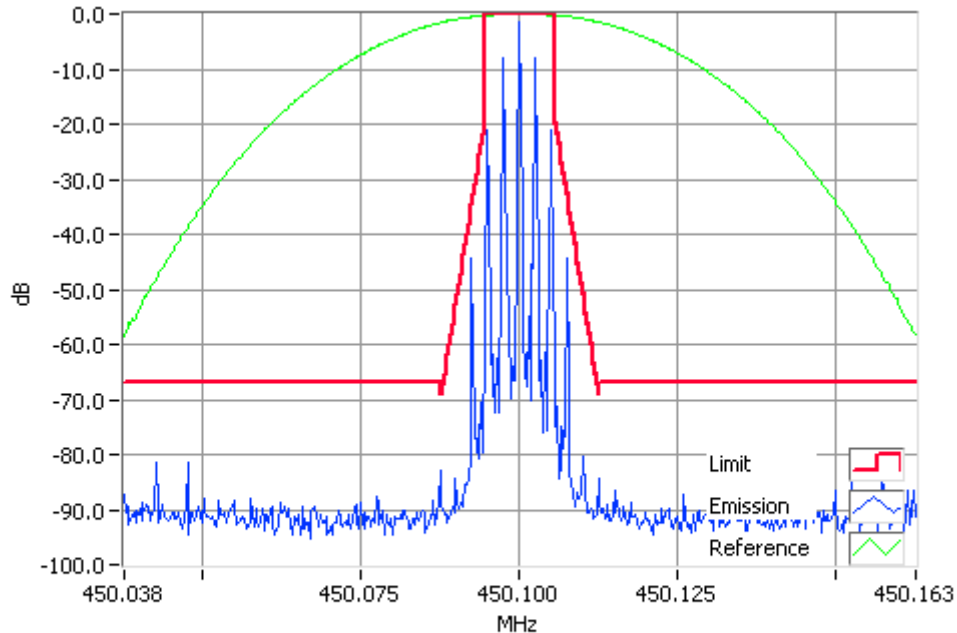
Occupied Bandwidth and Spectrum Masks

Analogue FM

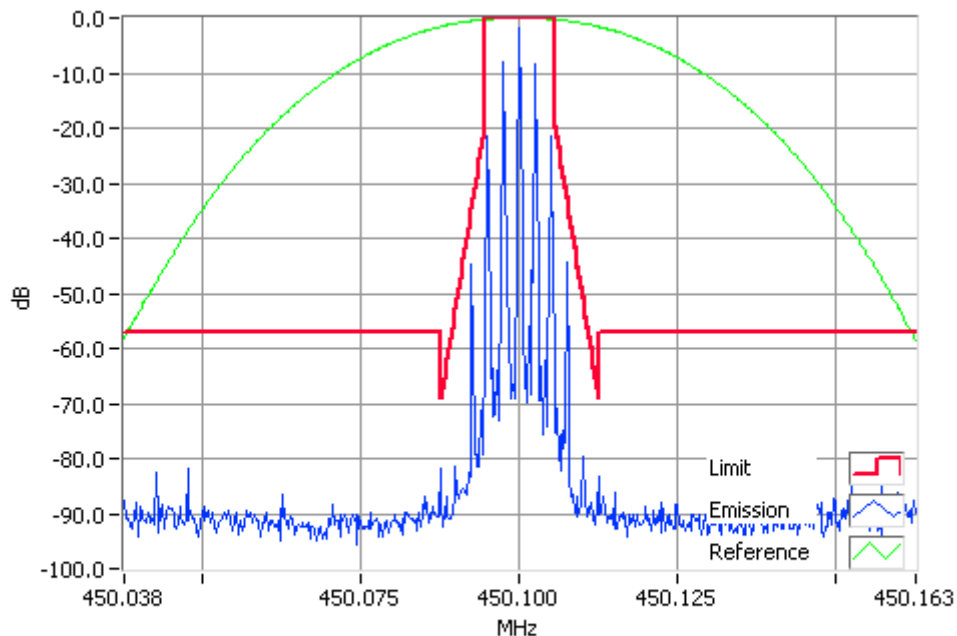
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 450.1 MHz 50 W & 5 W 12.5 kHz Channel Spacing



Analogue Modulation 450.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

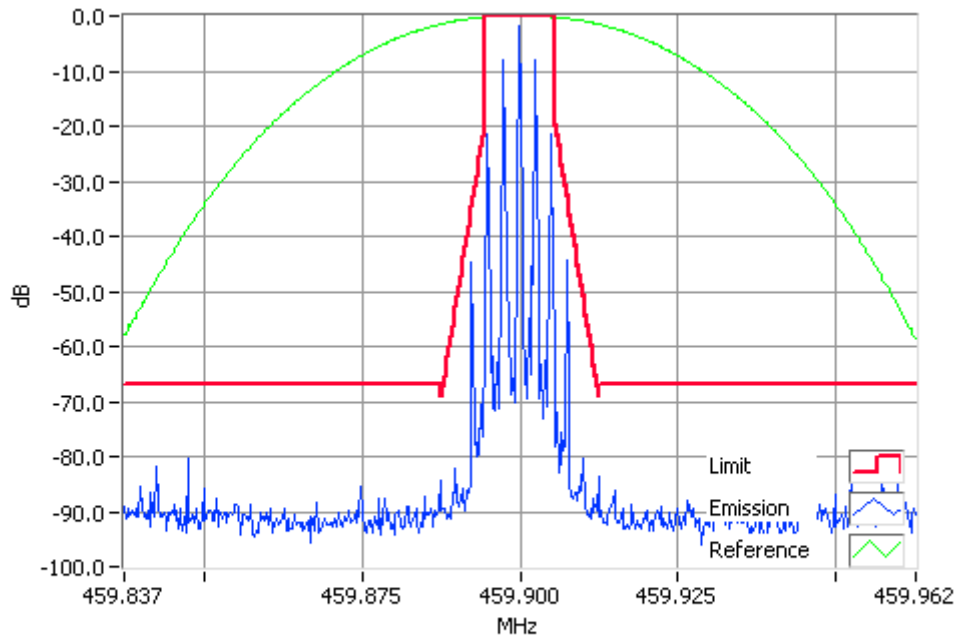


Analogue Modulation 450.1000MHz Mask D 5W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

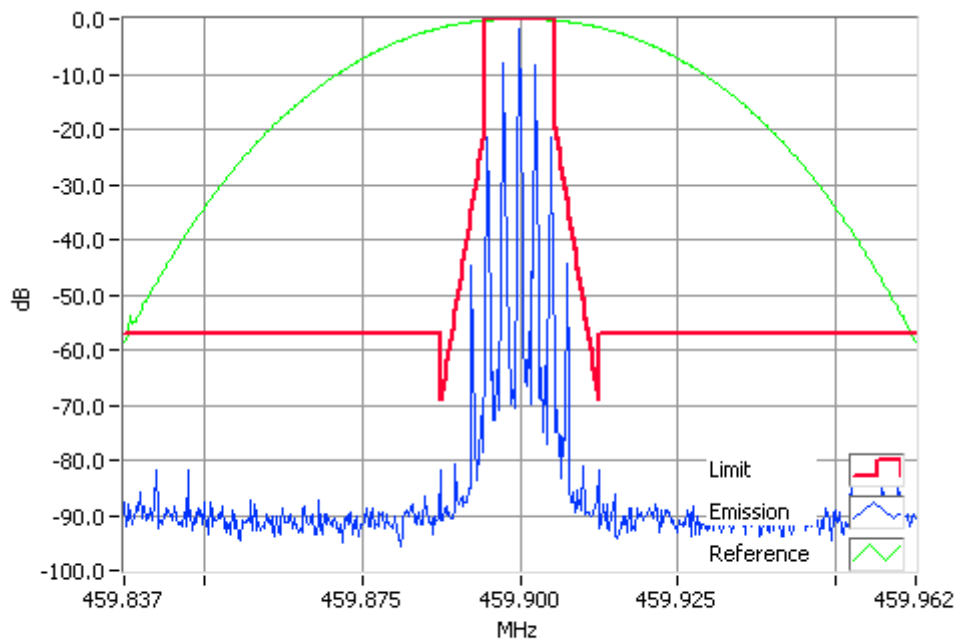
Occupied Bandwidth and Spectrum Masks

Analogue FM

Tx FREQUENCY: 459.9 MHz 50 W & 5 W 12.5 kHz Channel Spacing



Analogue Modulation 459.9000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

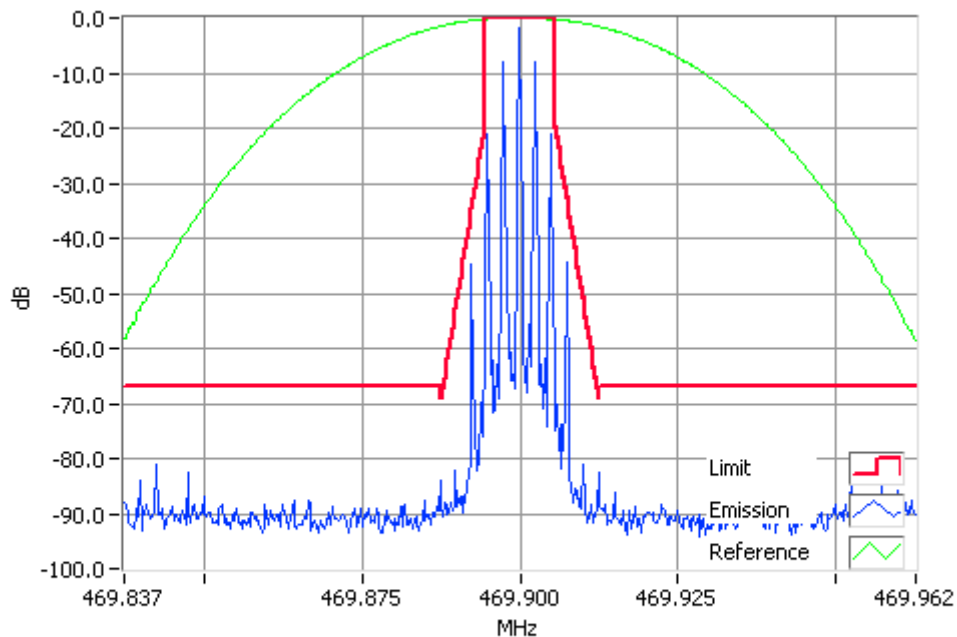


Analogue Modulation 459.9000MHz Mask D 5W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

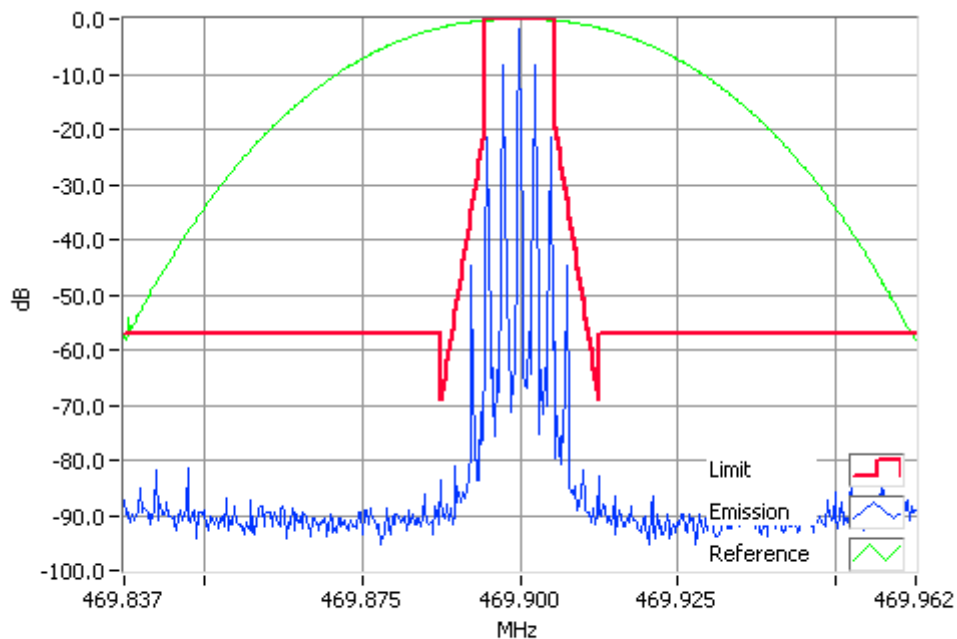
Occupied Bandwidth and Spectrum Masks

Analogue FM

Tx FREQUENCY: 469.9 MHz 50 W & 5 W 12.5 kHz Channel Spacing



Analogue Modulation 469.9000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



Analogue Modulation 469.9000MHz 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
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.

