

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBCB1E 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: 2

Issue Date: 22 February 2016

PREPARED BY: Aaron Fan

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

TABLE OF CONTENTS

REVISION	3
INTRODUCTION	4
STATEMENT OF COMPLIANCE	5
MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS	6
TEST RESULTS.....	7
TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS.....	7
TRANSMITTER MODULATION LIMITING	11
TRANSMITTER OCCUPIED BANDWIDTH AND SPECTRUM MASKS	15
TEST EQUIPMENT LIST.....	23
ANNEX A – TEST SETUP DETAILS.....	24

REVISION

Date	Revision	Comments
3 February 2016	1	Initial test report
22 February 2016	2	Correction to IC identifier in page footer

INTRODUCTION

Type approval testing of the TBCB1E, 100 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 Analogue FM to the list of modulations supported.
The original test report is TARF 3377. 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: TBCB1E
Quantity: 1

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

HARDWARE & SOFTWARE

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01105-DAZY	18221342	dmr-2.10.00.0004	0
Power Amplifier	T01-01136-CBAA	18218549	314	1
PMU	TBA30A0-0100	18217789	316	1
Front Panel	T01-01110-CCAA	18218672	1.07.00.0002	0.04

TEST CONDITIONS

All testing was performed on 2 February 2016, 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: TBCB1E
With reciter: TBCB3Y (148 to 174 MHz)
Quantity: 1 of each

Consisting Of:

HARDWARE & SOFTWARE – Analogue Modulation Testing

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01105-DAZY	18221342	dmr-2.10.00.0004	0
Power Amplifier	T01-01136-CBAA	18218549	314	1
PMU	TBA30A0-0100	18217789	316	1
Front Panel	T01-01110-CCAA	18218672	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:

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:

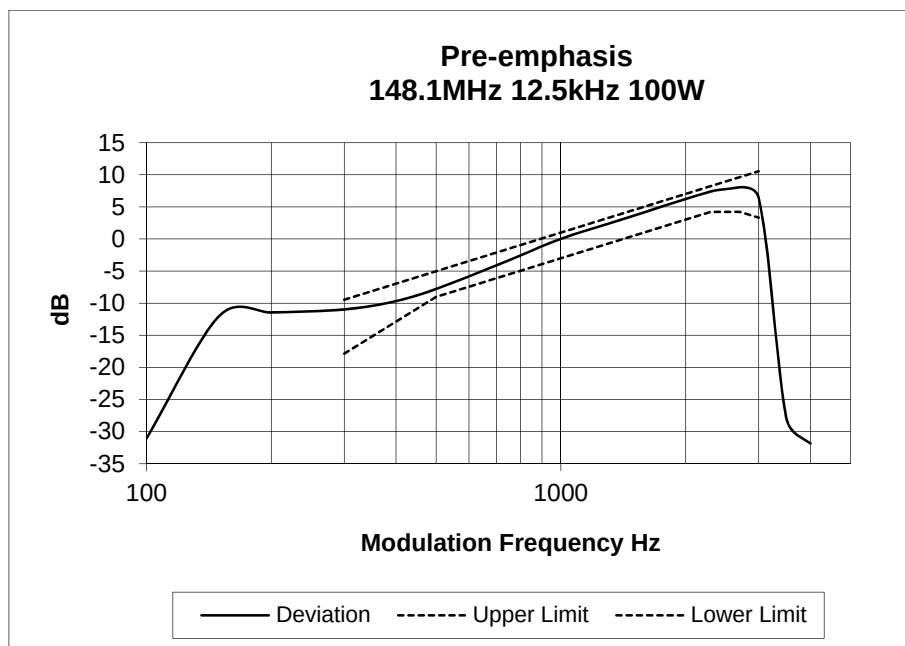
See the plots on the following pages for 12.5 kHz channel spacing tested at 100 W transmit power.

LIMIT CLAUSE: TIA/EIA-603D 3.2.6

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 148.1 MHz

12.5 kHz Channel Spacing

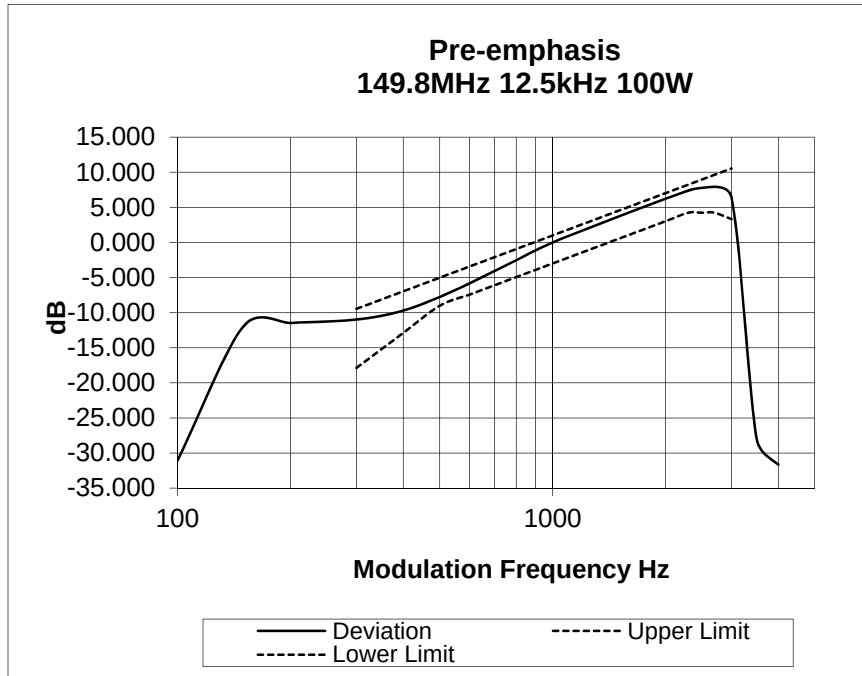


Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 149.8 MHz

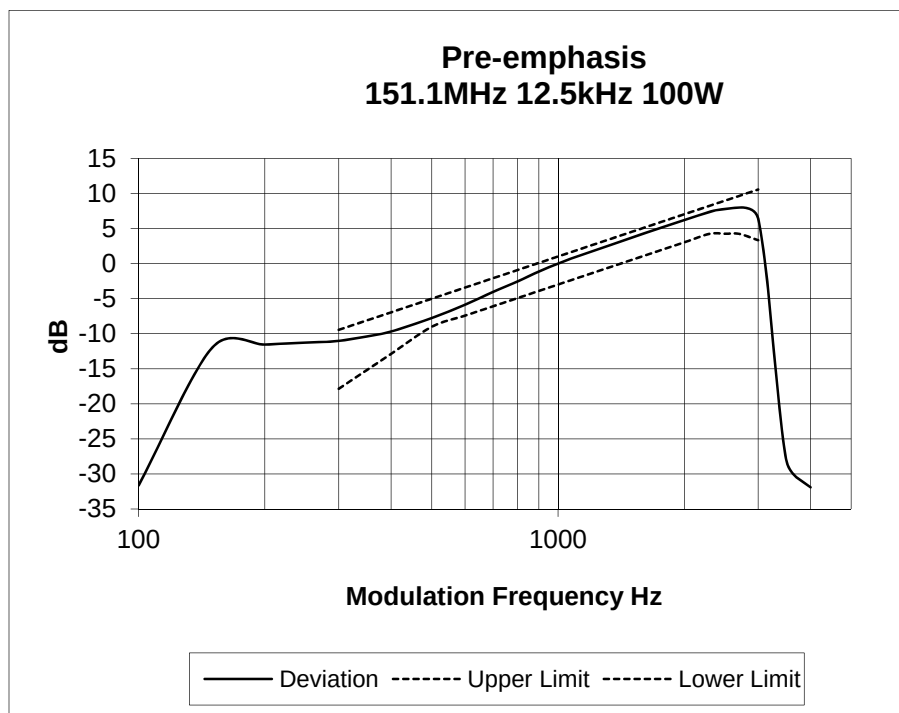
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 151.1 MHz

12.5 kHz Channel Spacing

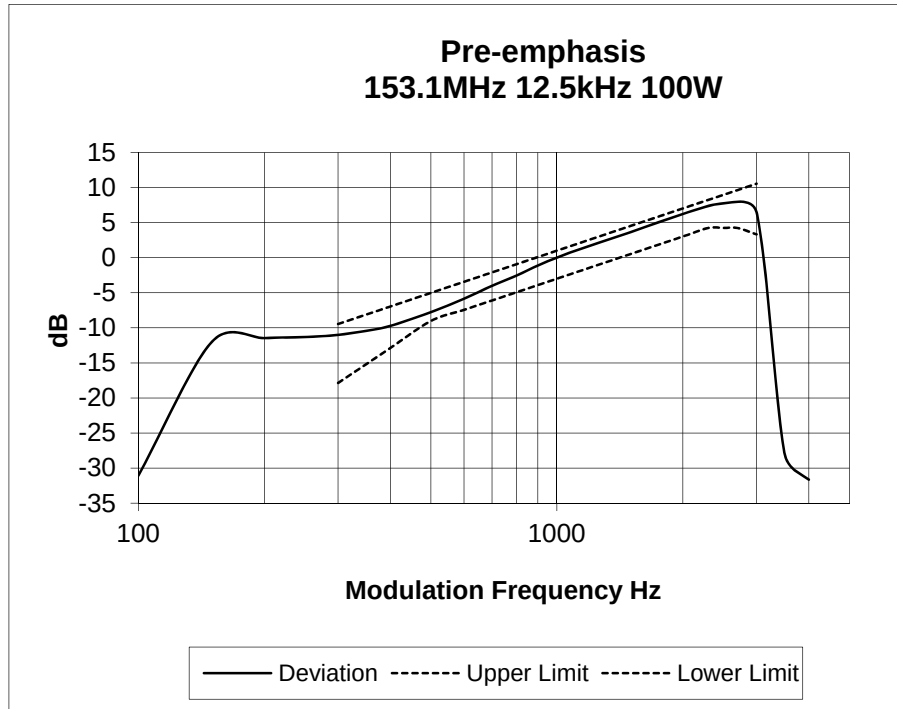


Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 153.1 MHz

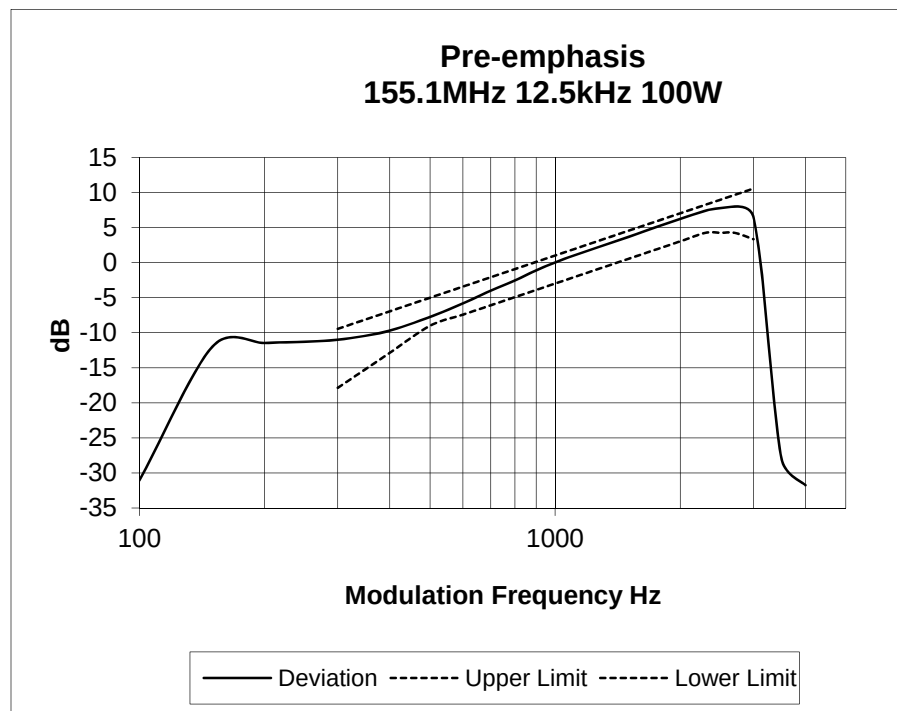
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

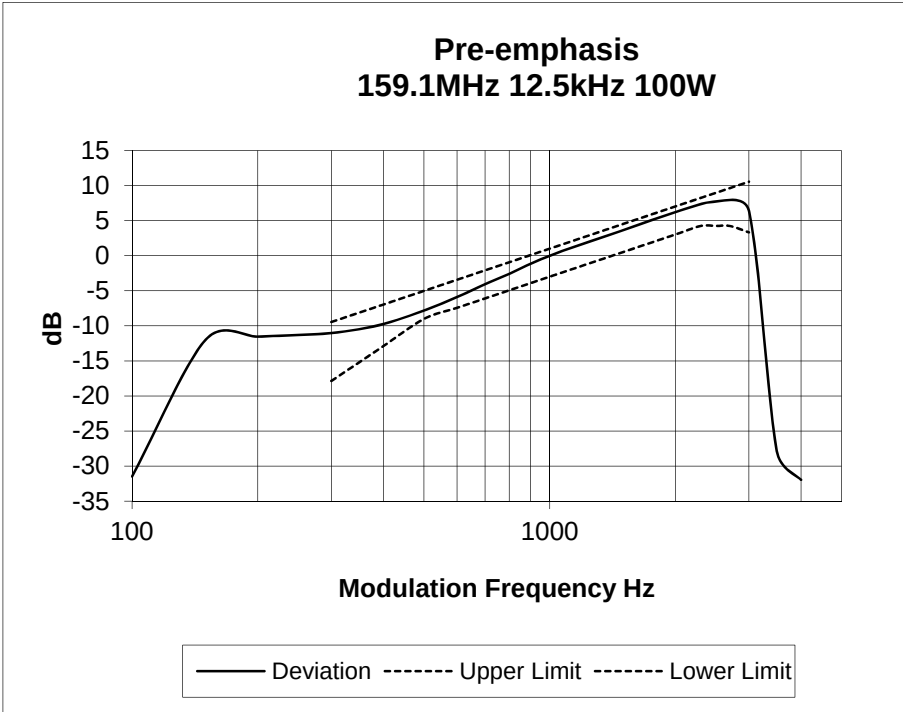
Tx FREQUENCY: 155.1 MHz

12.5 kHz Channel Spacing

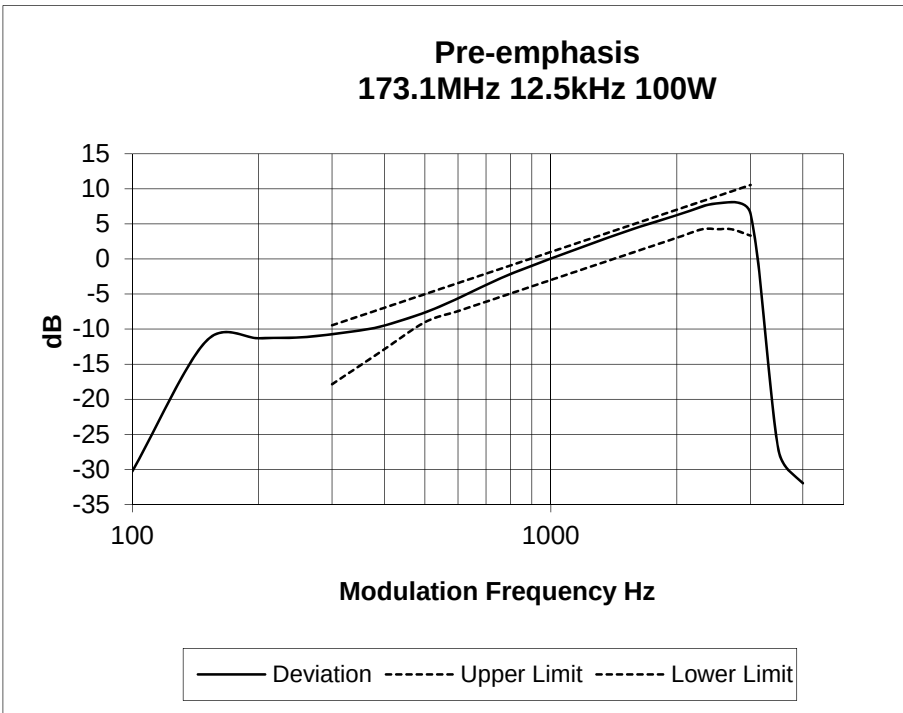


Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)
Tx FREQUENCY: 159.1 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)
Tx FREQUENCY: 173.1 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.

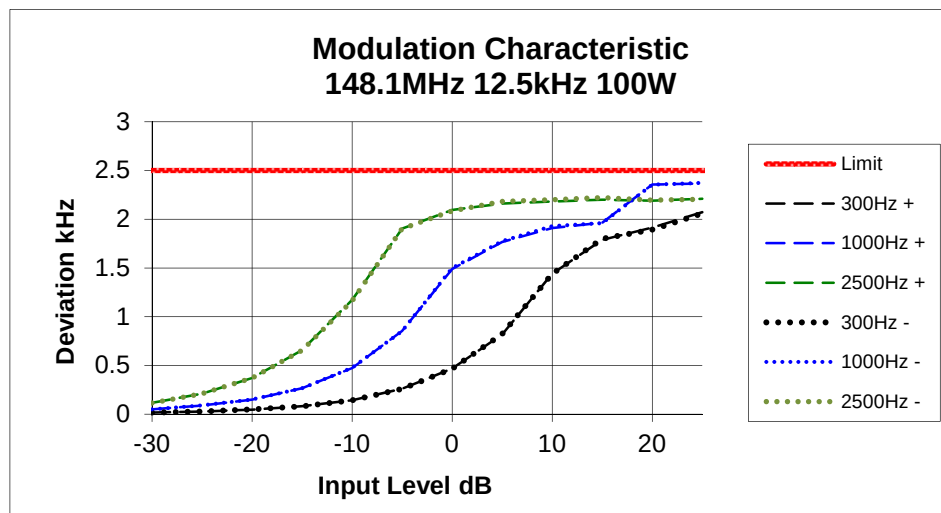
MEASUREMENT RESULTS:

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

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

Tx FREQUENCY: 148.1 MHz

12.5 kHz Channel Spacing

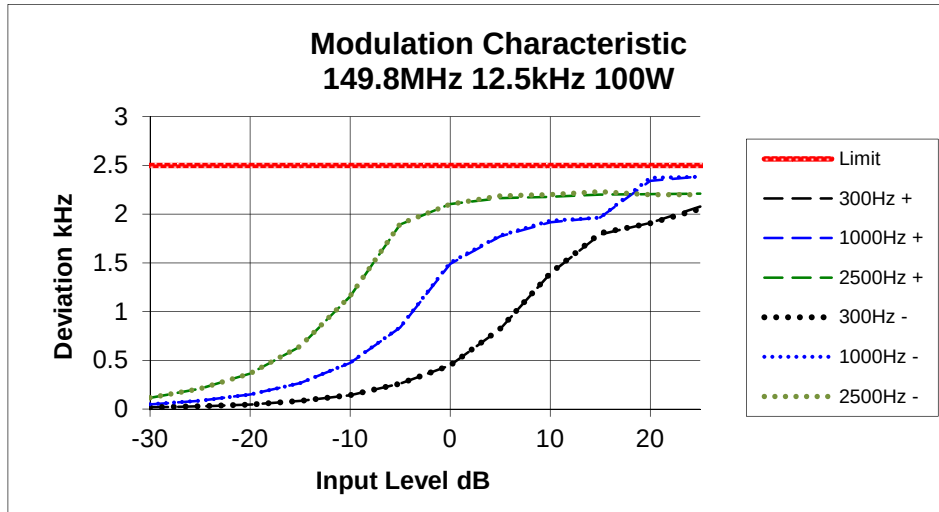


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 149.8 MHz

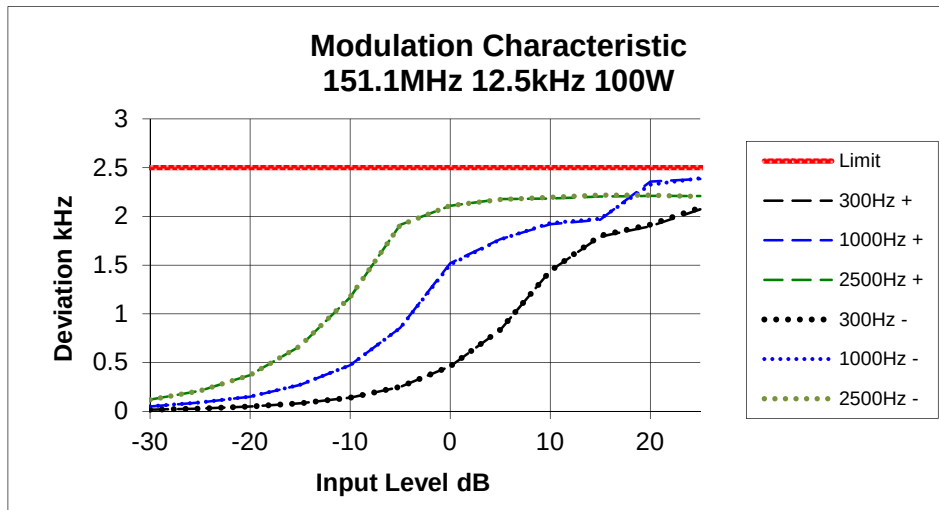
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 151.1 MHz

12.5 kHz Channel Spacing

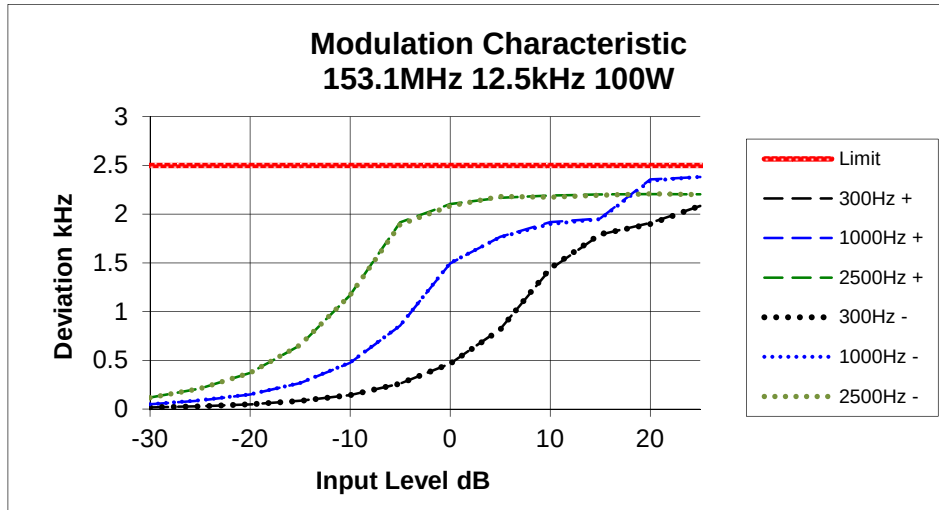


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 153.1 MHz

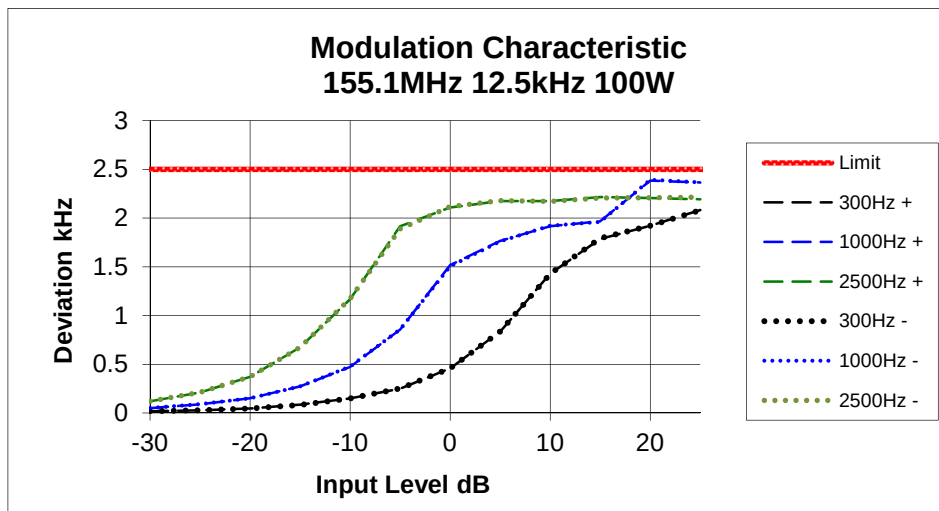
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 155.1 MHz

12.5 kHz Channel Spacing

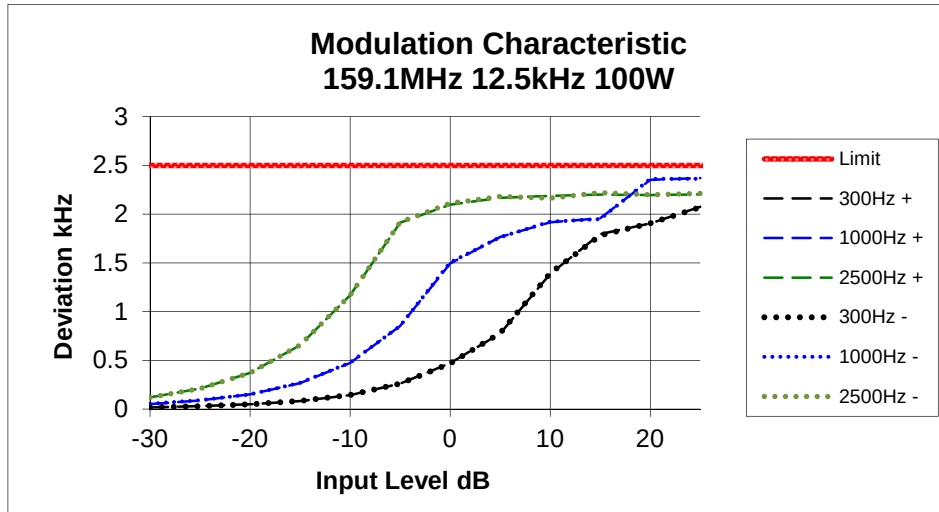


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 159.1 MHz

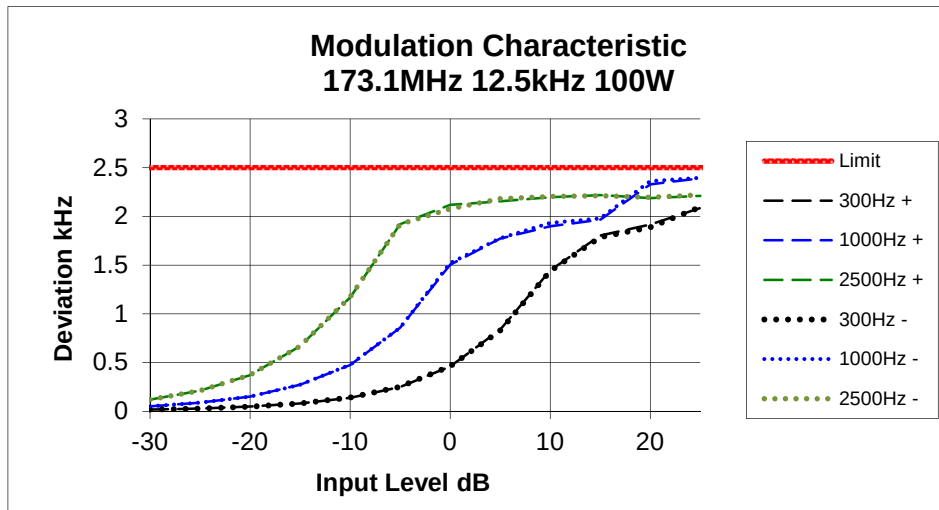
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 173.1 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 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 Analogue

Occupied Bandwidth and Spectrum Masks

Analogue

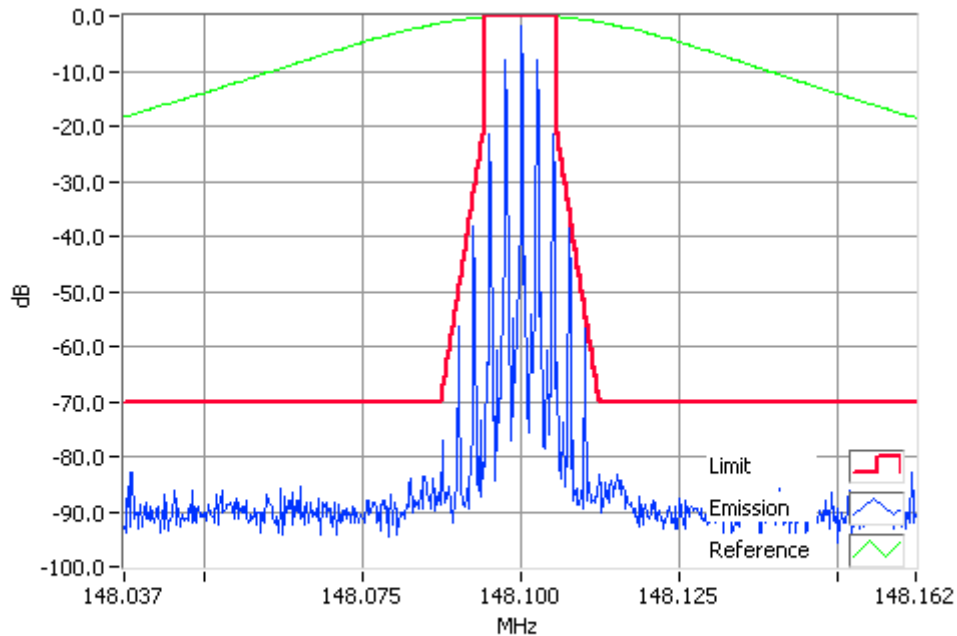
SPECIFICATION: FCC CFR 2.1049 (c) Mask- D

RSS-119 5.5 Mask-D

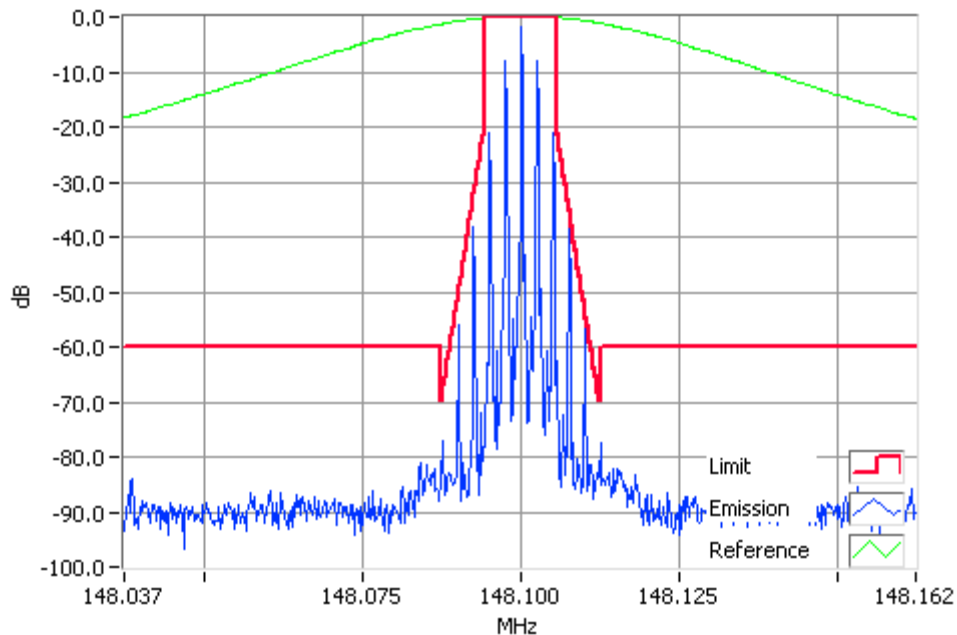
Tx FREQUENCY: 148.1 MHz

100W & 10 W

12.5 kHz Channel Spacing



Analogue Modulation 148.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



Analogue Modulation 148.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

Analogue

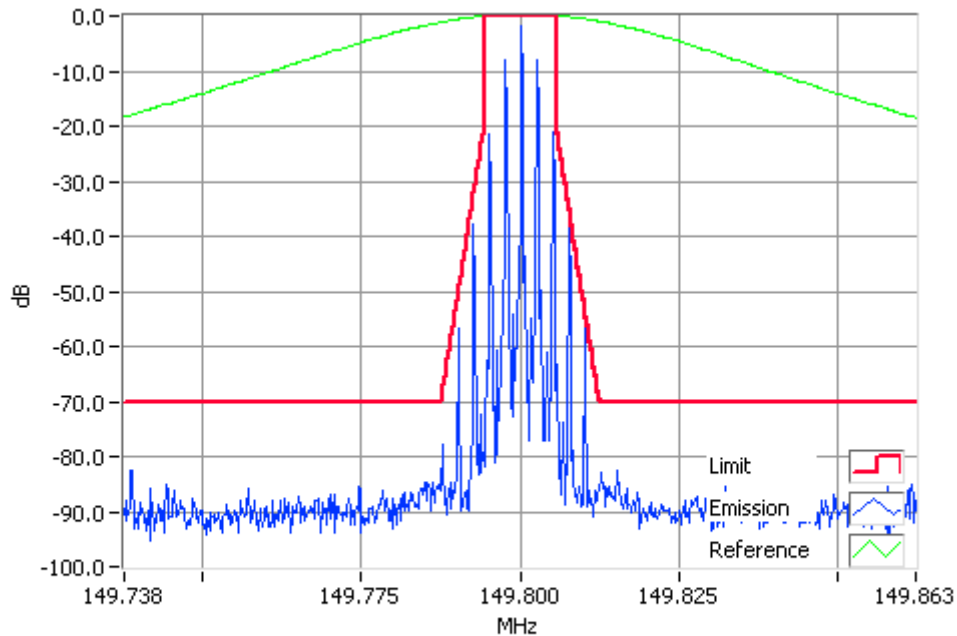
SPECIFICATION: FCC CFR 2.1049 (c) Mask- D

RSS-119 5.5 Mask-D

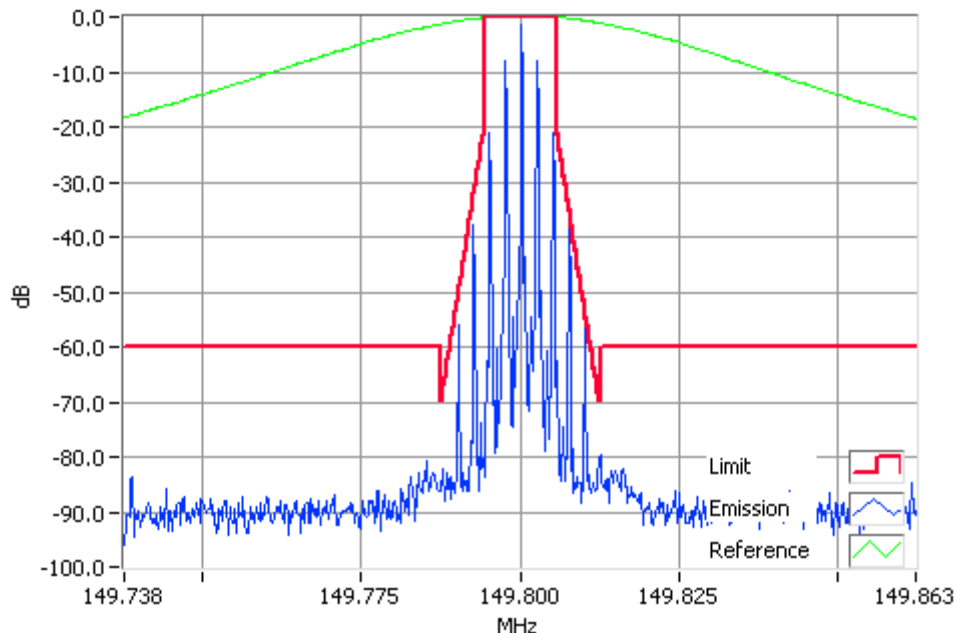
Tx FREQUENCY: 149.8 MHz

100W & 10 W

12.5 kHz Channel Spacing



Analogue Modulation 149.8000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



Analogue Modulation 149.8000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

Analogue

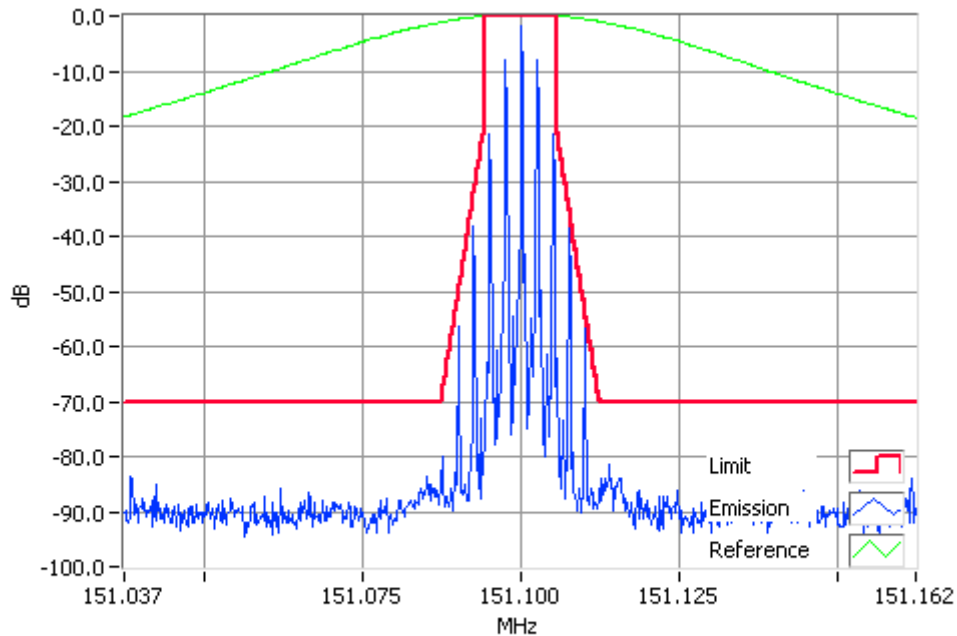
SPECIFICATION: FCC CFR 2.1049 (c) Mask- D

RSS-119 5.5 Mask-D

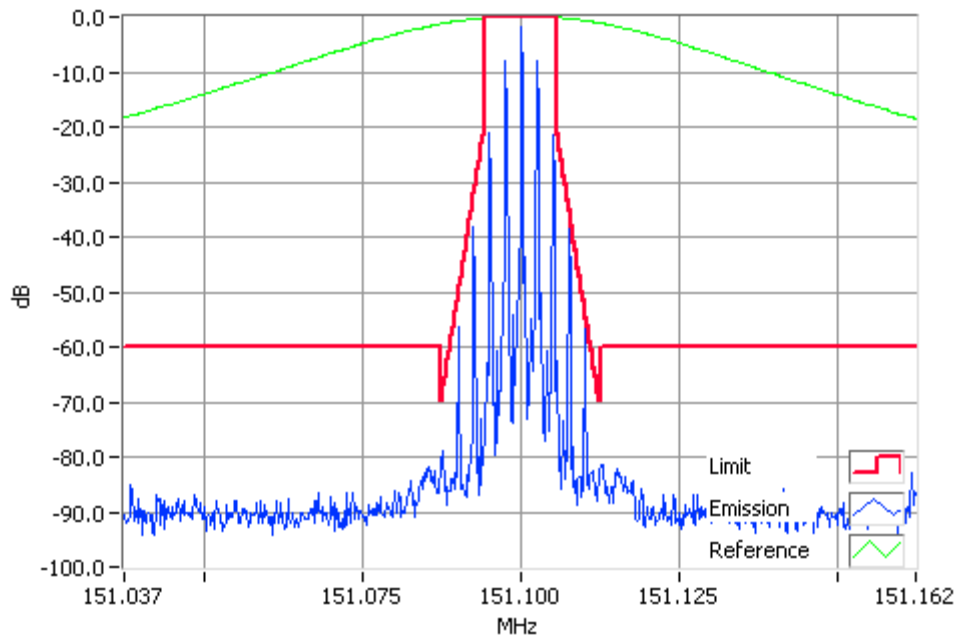
Tx FREQUENCY: 151.1 MHz

100W & 10 W

12.5 kHz Channel Spacing



Analogue Modulation 151.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



Analogue Modulation 151.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

Analogue

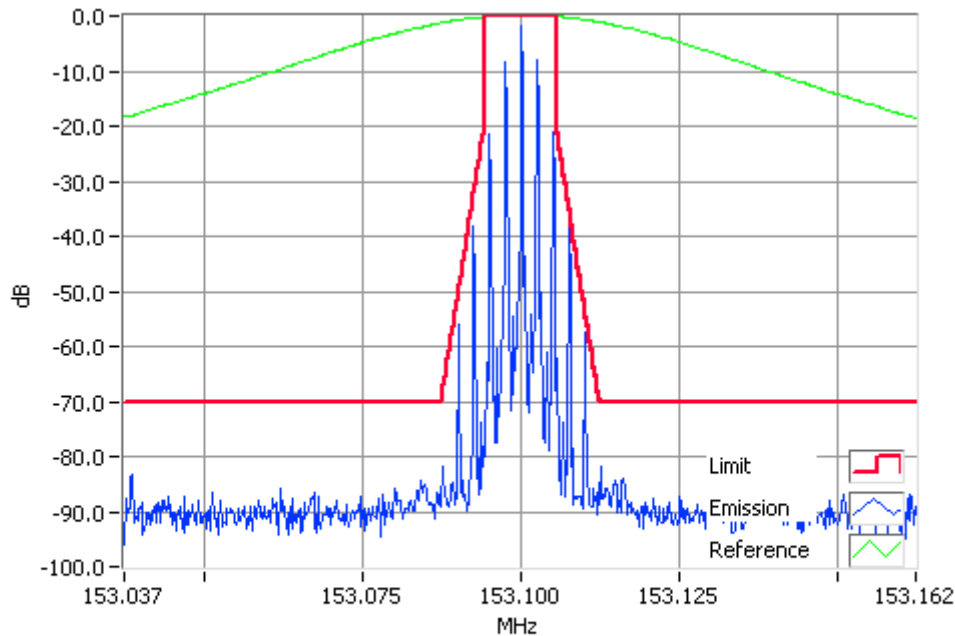
SPECIFICATION: FCC CFR 2.1049 (c) Mask- D

RSS-119 5.5 Mask-D

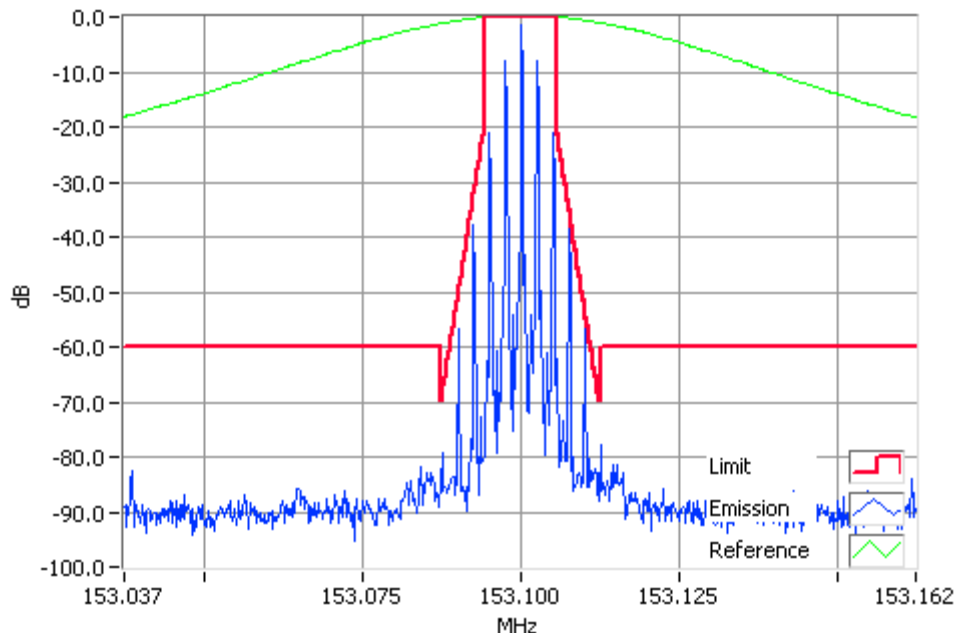
Tx FREQUENCY: 153.1 MHz

100W & 10 W

12.5 kHz Channel Spacing



Analogue Modulation 153.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



Analogue Modulation 153.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

Analogue

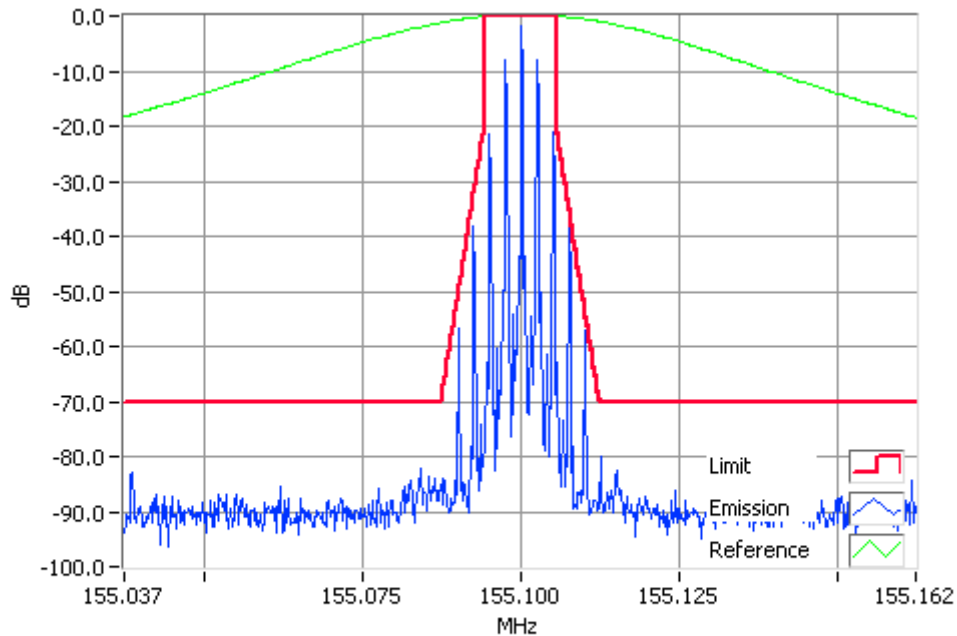
SPECIFICATION: FCC CFR 2.1049 (c) Mask- D

RSS-119 5.5 Mask-D

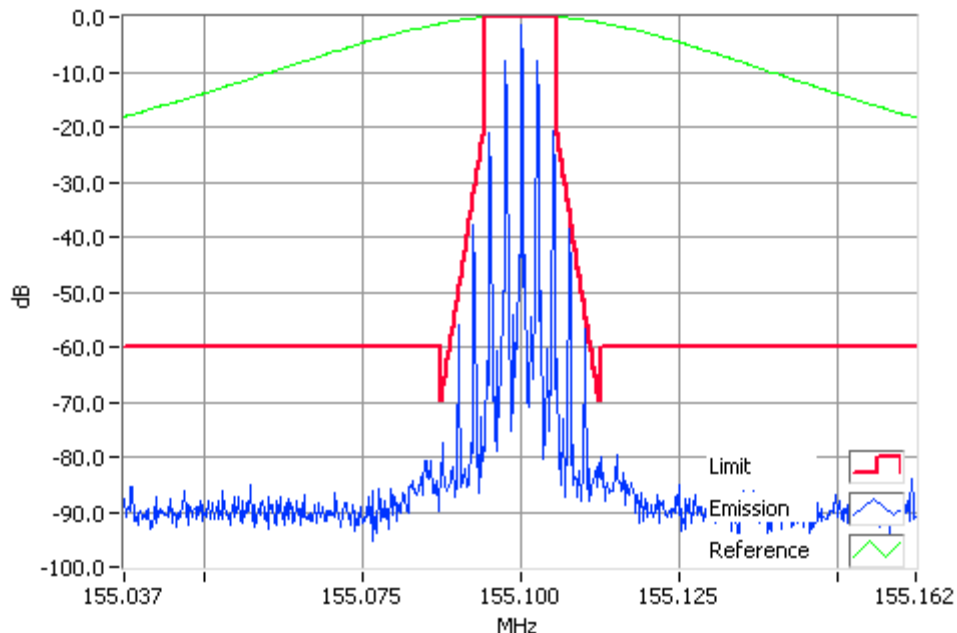
Tx FREQUENCY: 155.1 MHz

100W & 10 W

12.5 kHz Channel Spacing



Analogue Modulation 155.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



Analogue Modulation 155.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

Analogue

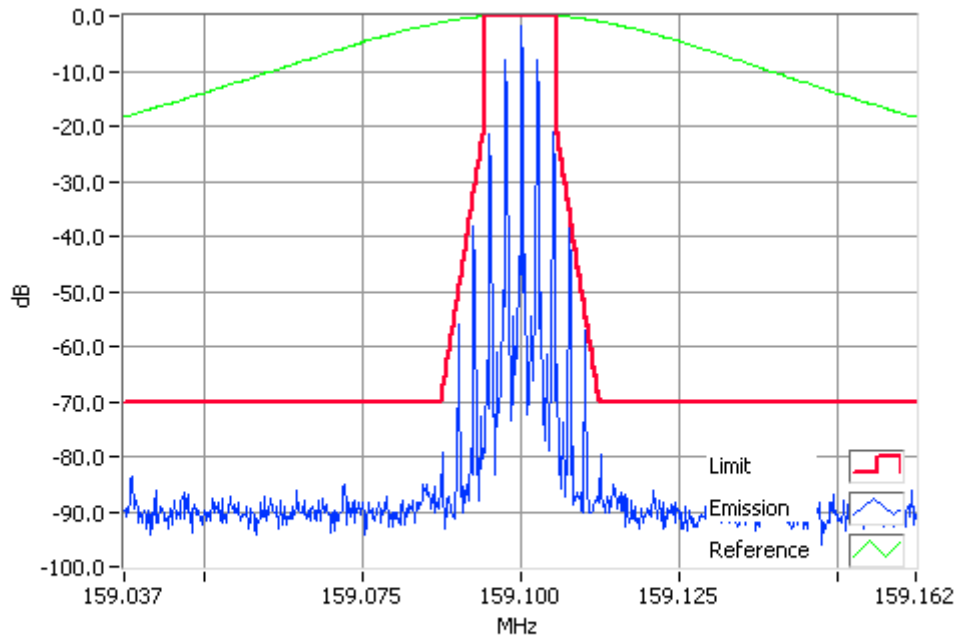
SPECIFICATION: FCC CFR 2.1049 (c) Mask- D

RSS-119 5.5 Mask-D

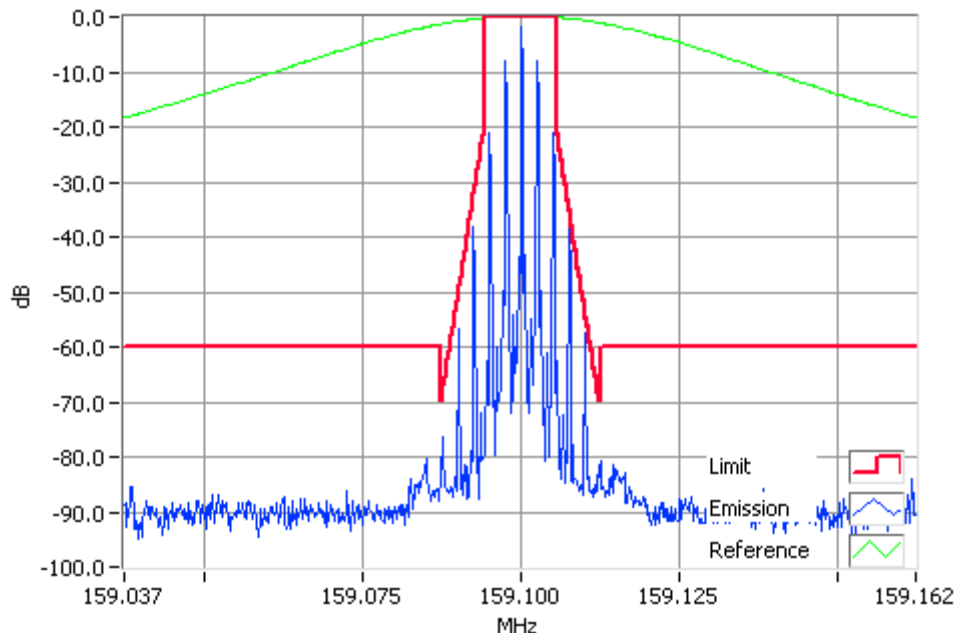
Tx FREQUENCY: 159.1 MHz

100W & 10 W

12.5 kHz Channel Spacing



Analogue Modulation 159.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



Analogue Modulation 159.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Analogue

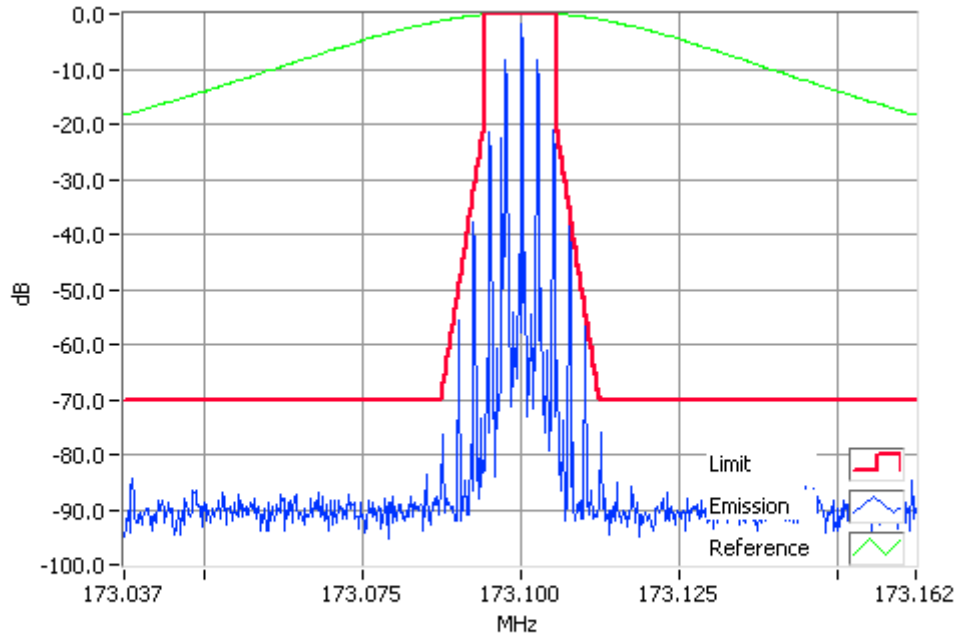
SPECIFICATION: FCC CFR 2.1049 (c) Mask- D

RSS-119 5.5 Mask-D

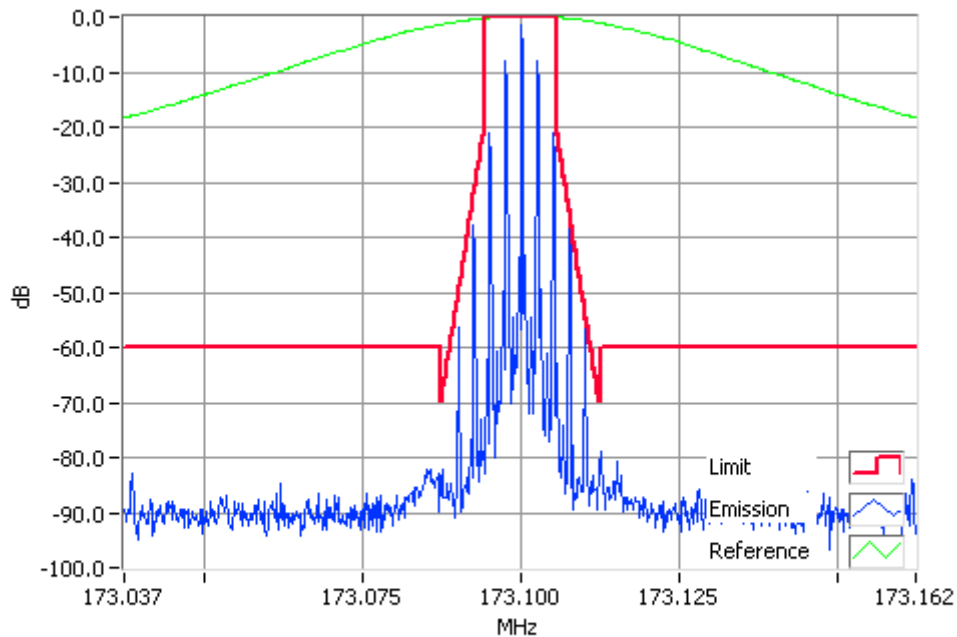
Tx FREQUENCY: 173.1 MHz

100W & 10 W

12.5 kHz Channel Spacing



Analogue Modulation 173.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



Analogue Modulation 173.1000MHz 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
Audio Analyser	TREVA2	Hewlett Packard	HP8903B	2818A04275	E3710	20-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
Modulation Analyser	TREVA2	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	20-Oct-16
Power Meter	TREVA2 Power Head for HP8901	Hewlett Packard	HP11722A	2716A02037	1575	20-Oct-16
Power Supply	AC Variac	Yamabishi	S-260-5	TX-533	E1737	
RF Attenuator	TREVA2 20dB 150W	Weinschel	40-20-33	CJ405	E3733	20-Oct-16
RF Attenuator	30dB 350W	Weinschel	67-30-33	BR0531	E4280	18-Oct-16
RF Attenuator	TREVA2 3dB	Weinschel	Model 1	BL9950	E4080	
RF Combiner	TREVA2	Minicircuits	ZFSC-4-1	-	E4084	
Spectrum Analyser	13.2GHz	Hewlett Packard	HP8562E	3821A00779	E3715	15-Oct-16
TREVA 2		Teltest	-	2	-	5-May-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 **R**adio **E**VAuation 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.

