

# LABORATORY TEST REPORT

## RADIO PERFORMANCE MEASUREMENTS

for the

TBDB3G 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:

3-February-2016

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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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FCC ID: CASTBDB3G  
IC : 737A-TBDB3G

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Report Revision: 2  
Issue Date: 3-February-2016

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## REVISION

Date	Revision	Comments
27-January-2016	1	Original report
3-February-2016	2	Audio Frequency response - Pre-emphasis & Modulation Limiting tests added

## INTRODUCTION

Type approval testing of the TBDB3G, 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 radio supports analogue and Digital Mobile Radio (DMR) modulations.

Type Approval Testing of the TB7310-B3B0-0000-00AE-10  
Serial number 18230628  
Frequency range 148 → 174 MHz

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: TBDB3G  
Product Code: TB7310-B3B0-0000-00AE-10  
Serial Number(s): 18230628  
Quantity: 1

Modulation		Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
Analog FM		12.5 kHz	1	-	-
Digital Mobile Radio (DMR)	4 Level FSK (2 slot TDMA) (ETSI TS102 361-1)	12.5 kHz	2	4800	9600

### HARDWARE & SOFTWARE

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter 148-174 MHz	T01-01403-DAAA	18229866	dmr-2.012.01.0002	0.11
Power Amplifier	T01-01406-BZZZ	18229879	no firmware	0.01
Front Panel	T01-01410-AAAA	2863849	1.07.00.0002	0.01

### TEST CONDITIONS

All testing was performed between 19 → 22 January 2016, and under the following conditions:

Ambient temperature: 15°C → 30°C  
Relative Humidity: 20% → 75%  
Standard Test Voltage 13.8 V<sub>DC</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: TBDB3G  
Product Code: TB7310-B3B0-0000-00AE-10  
Serial Number(s): 18230628  
Quantity: 1

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	FM Voice		
FXW	Digital Voice / Data	4800 symbols/sec	9600 bps
FXD	Digital Data	4800 symbols/sec	9600 bps

CHANNEL SPACING: 12.5 kHz

### EMISSION DESIGNATORS:

Analog FM	11K0F3E
DMR Digital Voice / Data	7K60FXW
DMR Digital Data	7K60FXD

### 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)

Analog Voice 12.5 kHz Bandwidth

Necessary bandwidth

M = 3.0 kHz

D = 2.5 kHz

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

Emission Designator

**11K0F3E**

F3E represents an FM voice transmission

Digital Mobile Radio (DMR)

4 level FSK (as per ETSI TS 102 361-1)

4800 symbols/sec 9600 bps

Digital Data 12.5 kHz Channel Spacing – 7K60FXW

99% bandwidth

= 7.6 kHz

Emission Designator

**7K60FXW**

FXW represents FM combination of data and telephony.

Digital Data 12.5 kHz Channel Spacing – 7K60FXD

99% bandwidth

= 7.6 kHz

Emission Designator

**7K60FXD**

FXD represents FM data only

## TEST RESULTS

### TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046  
RSS-119 5.4

GUIDE: TIA-102.CAAA-C 2.2.1

#### MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up.
2. The coaxial attenuator has an impedance of 50 Ohms.
3. The unmodulated output power was measured with an RF Power meter.

#### MEASUREMENT RESULTS:

Manufacturer's Rated Output Power:

Switchable: 50 W and 2 W

Nominal 50	148.1 MHz	149.8 MHz	150.1 MHz	152.1 MHz	153.1 MHz	158.1 MHz	162.1 MHz	173.1 MHz
Measured	51.2	51.4	50.0	50.3	49.6	49.2	49.3	52.0
Variation (%)	2.37	2.72	-0.07	0.66	-0.86	-1.60	-1.37	3.99
Variation (dB)	0.1	0.1	0.0	0.0	0.0	-0.1	-0.1	0.2
Nominal 2	148.1 MHz	149.8 MHz	150.1 MHz	152.1 MHz	153.1 MHz	158.1 MHz	162.1 MHz	173.1 MHz
Measured	2.1	2.0	2.0	2.0	2.0	2.0	2.0	1.9
Variation (%)	3.06	2.23	-0.55	-0.34	1.48	-0.50	0.83	-2.71
Variation (dB)	0.1	0.1	0.0	0.0	0.1	0.0	0.0	-0.1
Measurement Uncertainty					± 0.6 dB			

#### LIMIT CLAUSES:

##### FCC 47 CFR 90.205 (s)

The output power shall not exceed by more than 20%... the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

##### RSS-119 5.4

The output power shall be within ±1.0 dB of the manufacturer's rated power.

## 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.

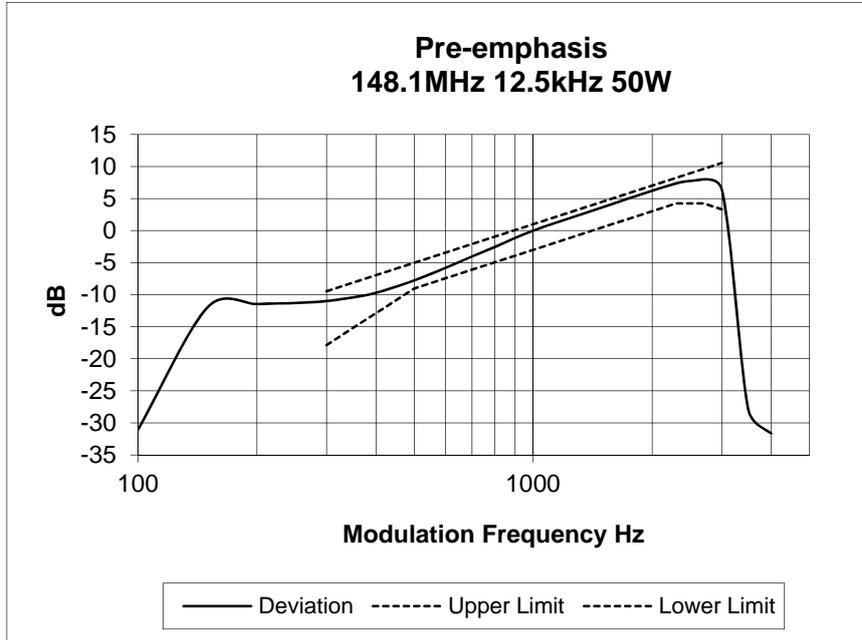
LIMIT CLAUSE: TIA/EIA-603D 3.2.6

### Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 148.1 MHz

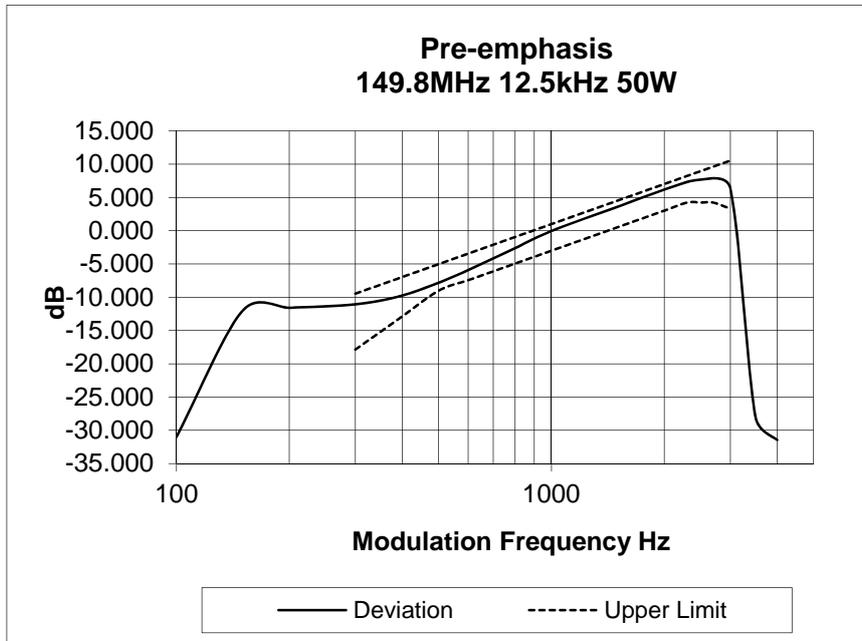
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 149.8 MHz

12.5 kHz Channel Spacing

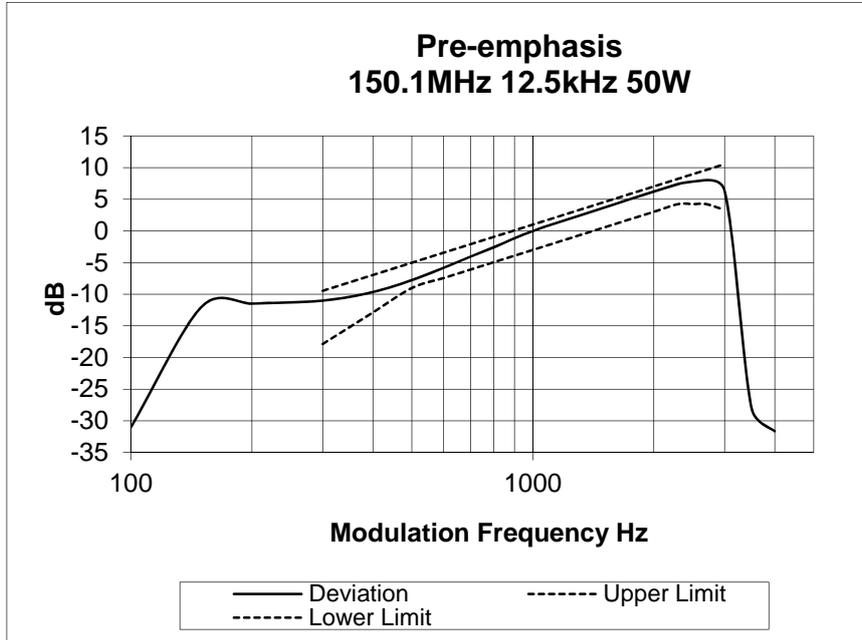


### Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 150.1 MHz

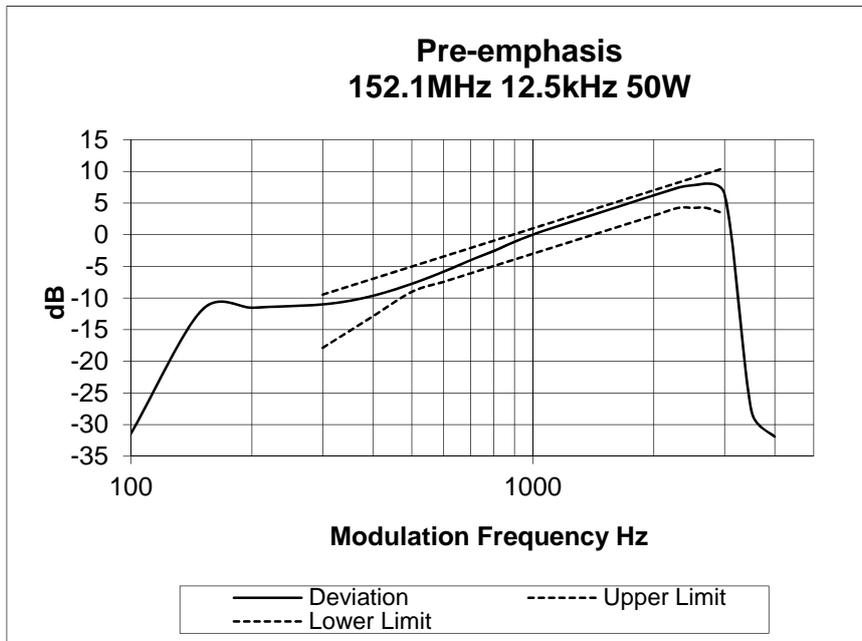
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 152.1 MHz

12.5 kHz Channel Spacing

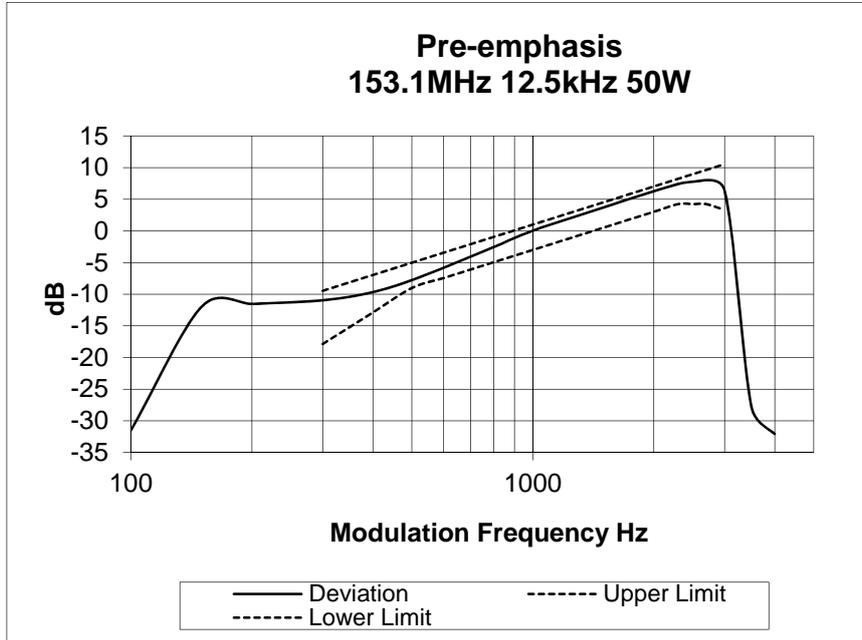


### Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 153.1 MHz

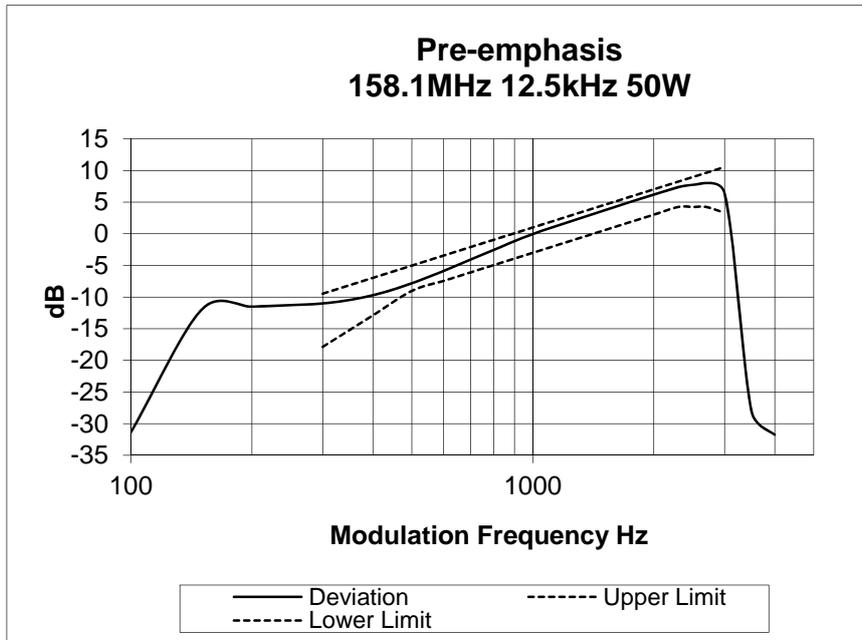
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 158.1 MHz

12.5 kHz Channel Spacing

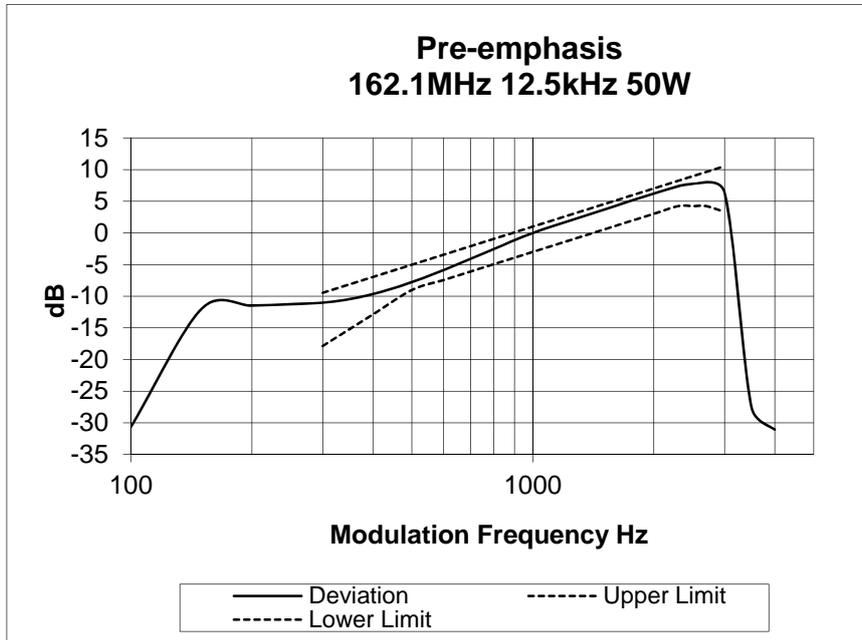


### Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 162.1 MHz

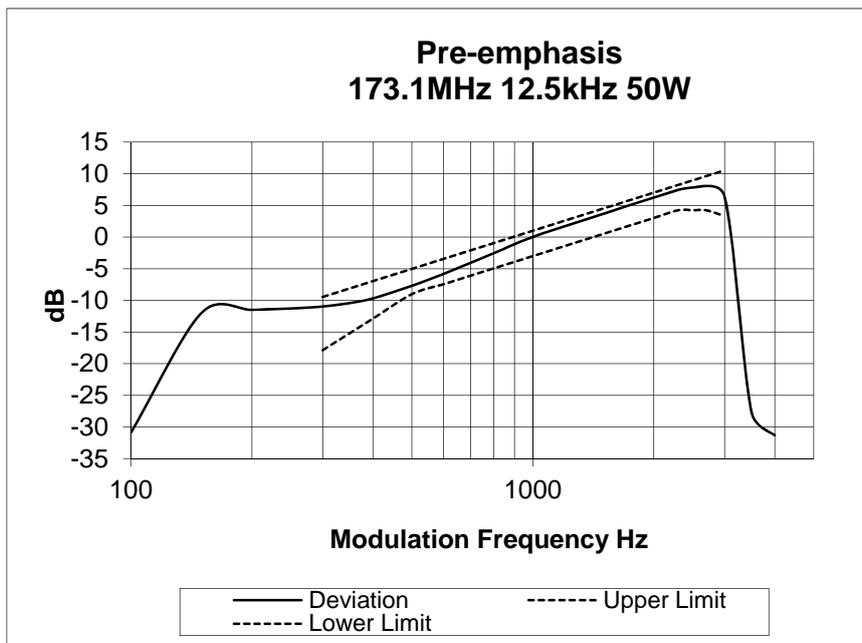
12.5 kHz Channel Spacing



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.

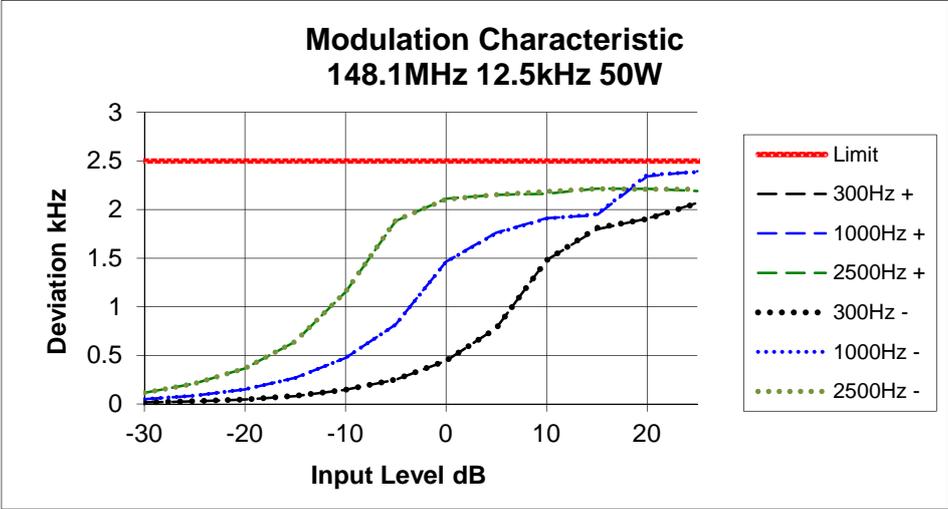
LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 148.1 MHz

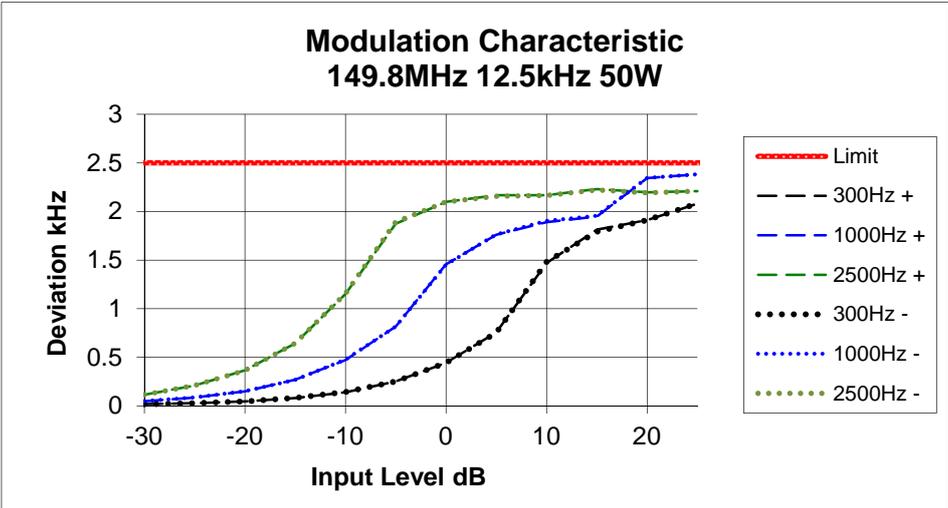
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 149.8 MHz

12.5 kHz Channel Spacing

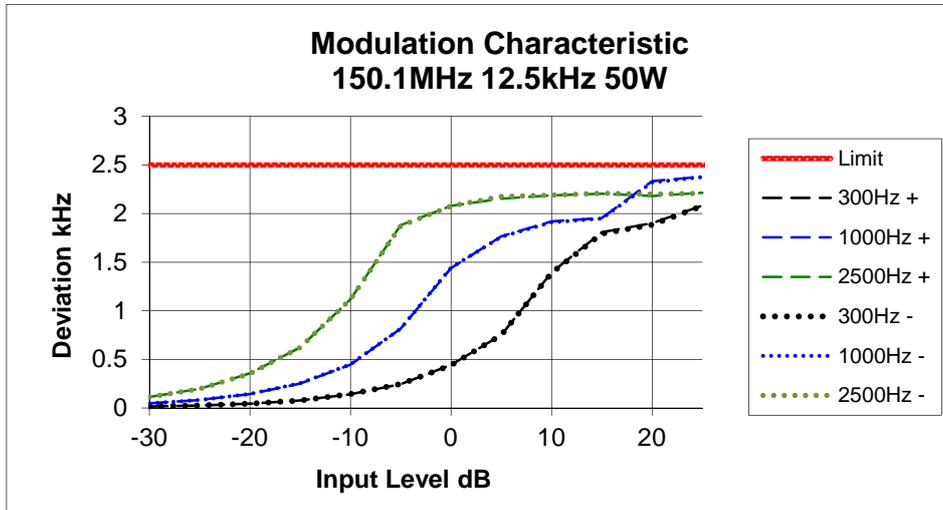


### Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 150.1 MHz

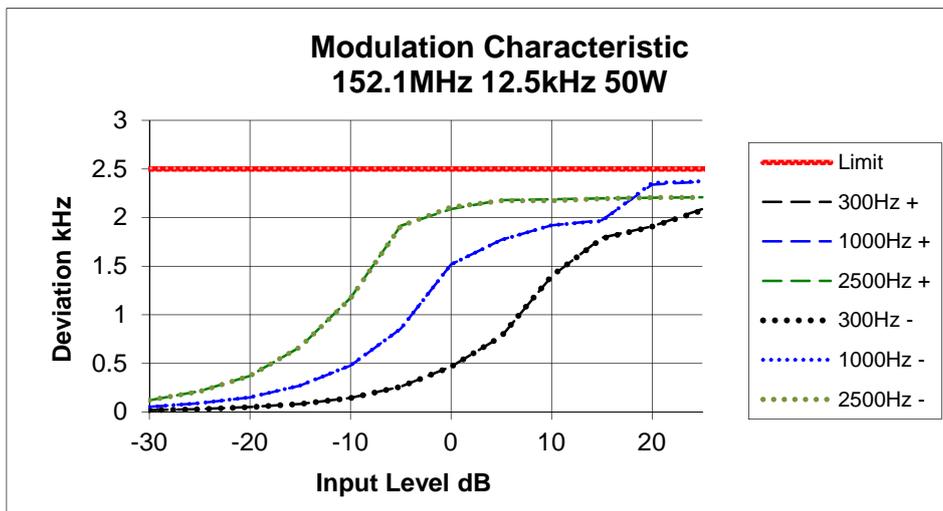
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 152.1 MHz

12.5 kHz Channel Spacing

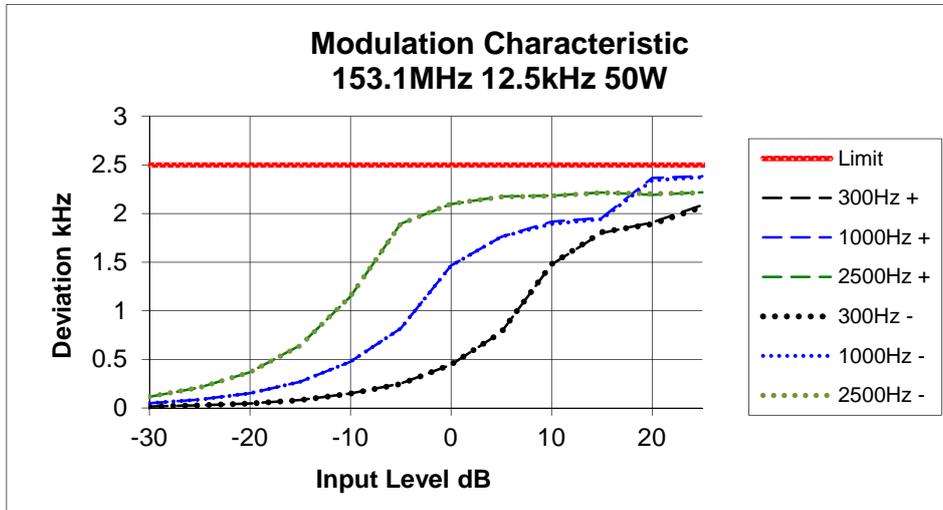


### Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 153.1 MHz

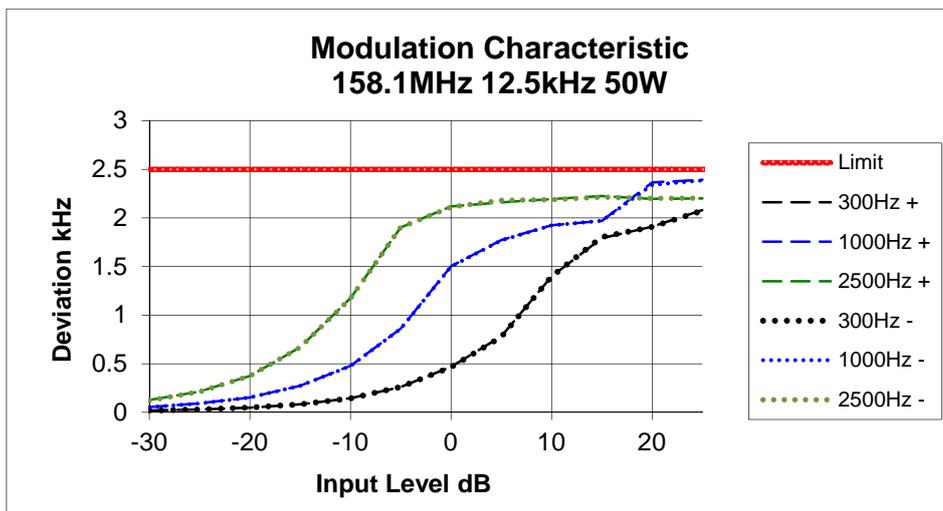
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 158.1 MHz

12.5 kHz Channel Spacing

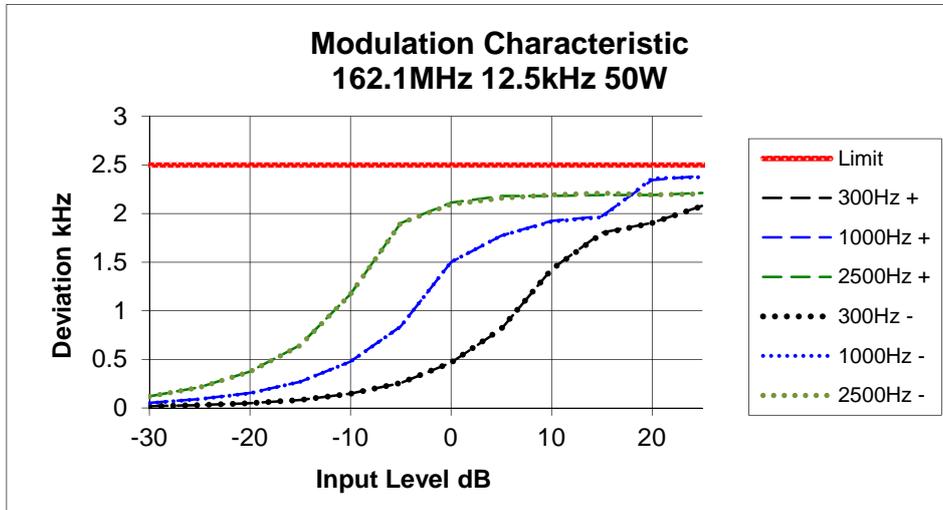


### Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 162.1 MHz

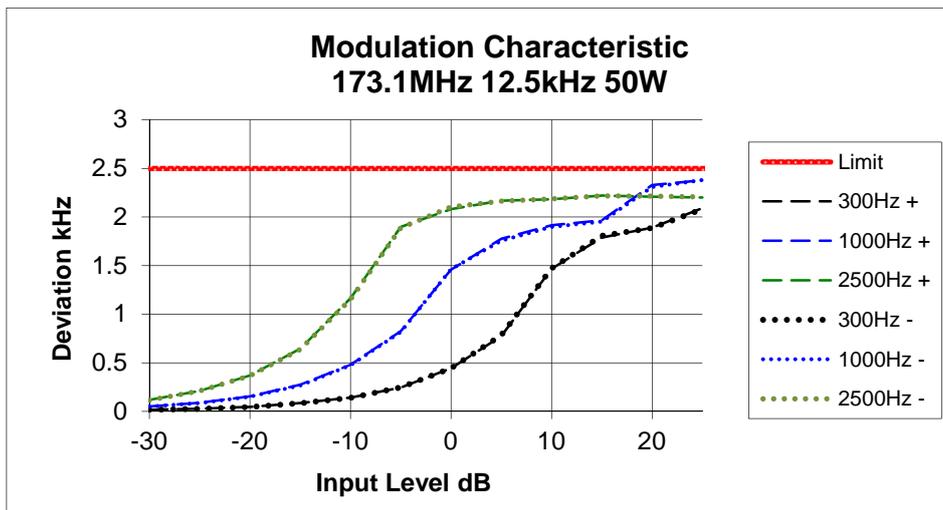
12.5 kHz Channel Spacing



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 (Analog)  
TIA-102.CAAA-C 2.2.5 (Digital)

### MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.  
The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
2. 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, Digital Voice/Data

### DATA SPEED

Digital Voice/Data 12.5 kHz Channel Spacing 9600 bps (DMR)

### Occupied Bandwidth and Spectrum Masks

#### ANALOG FM MODULATION

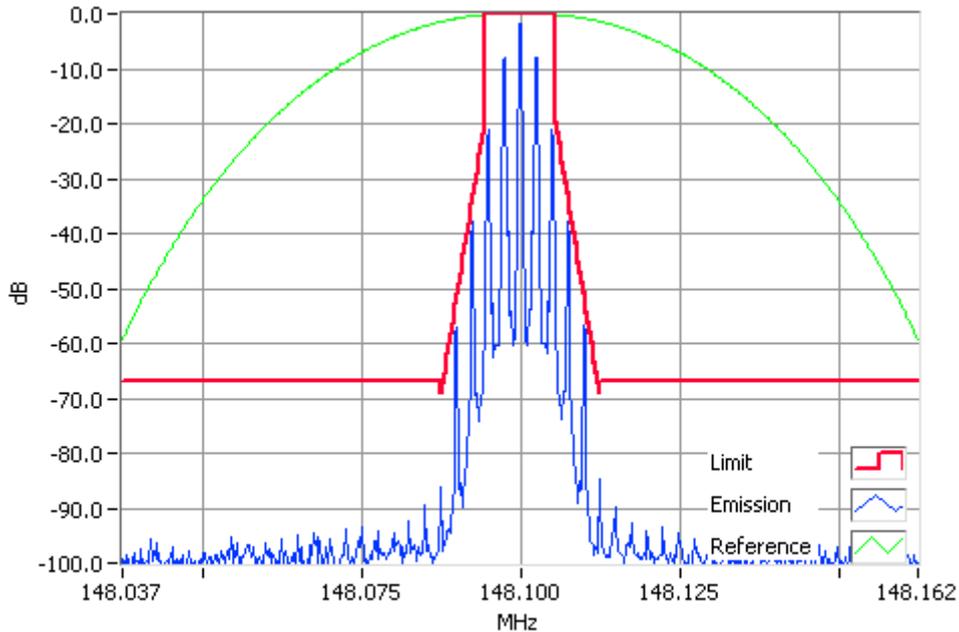
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

Tx FREQUENCY: 148.1 MHz

50 W

12.5 kHz Channel Spacing

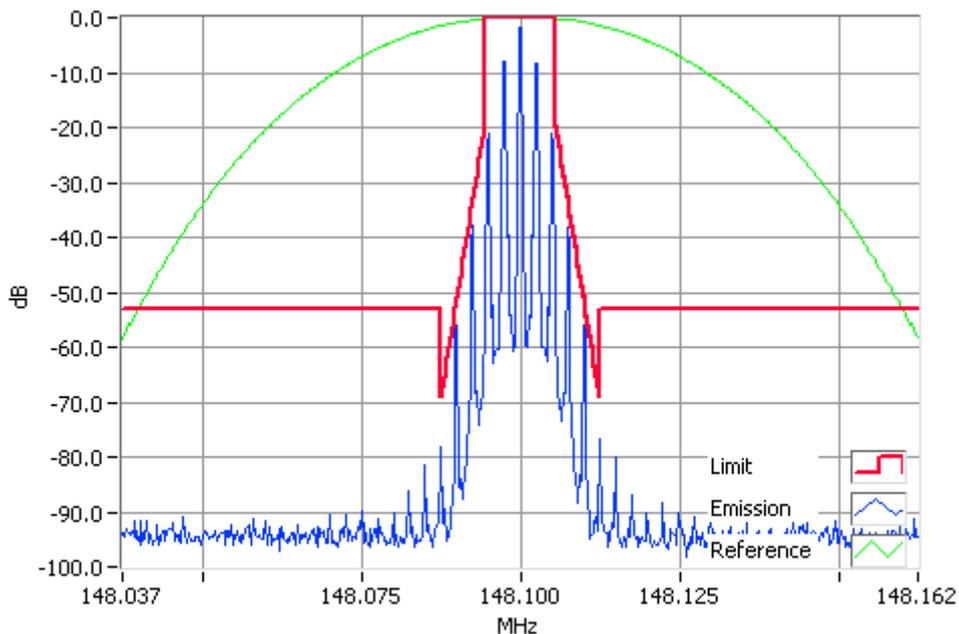


**Analogue Modulation 148.1000MHz Mask D 50W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

Tx FREQUENCY: 148.1 MHz

2 W

12.5 kHz Channel Spacing



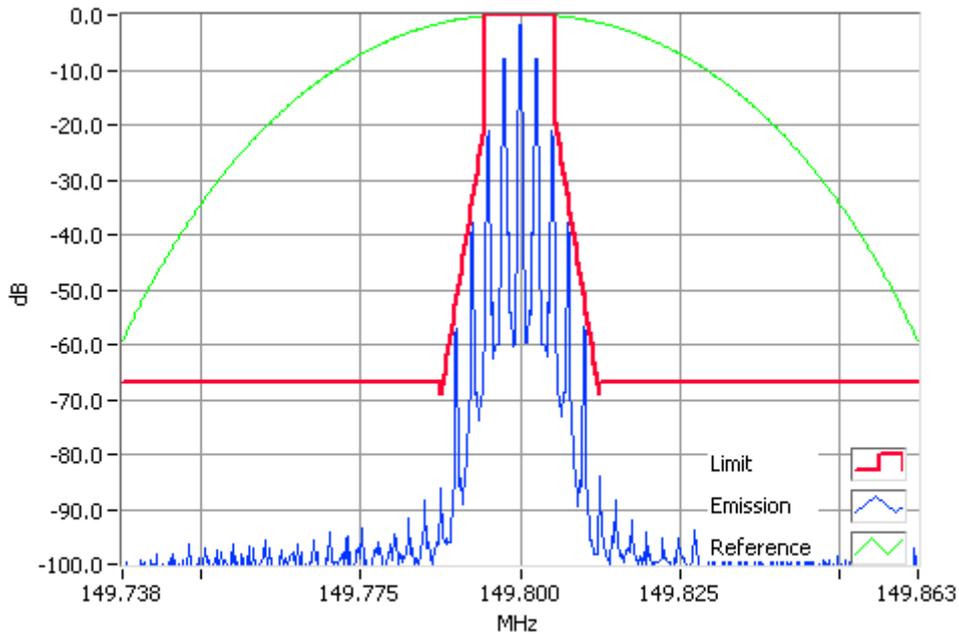
**Analogue Modulation 148.1000MHz Mask D 2W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

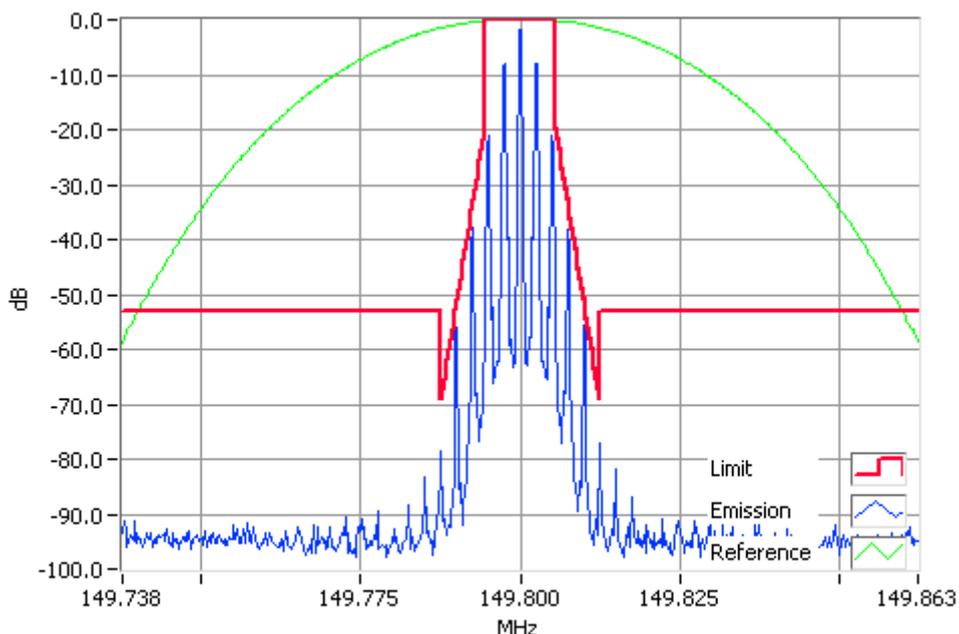
RSS-119 5.5

Tx FREQUENCY: 149.8 MHz 50 W 12.5 kHz Channel Spacing



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

Tx FREQUENCY: 149.8 MHz 2 W 12.5 kHz Channel Spacing



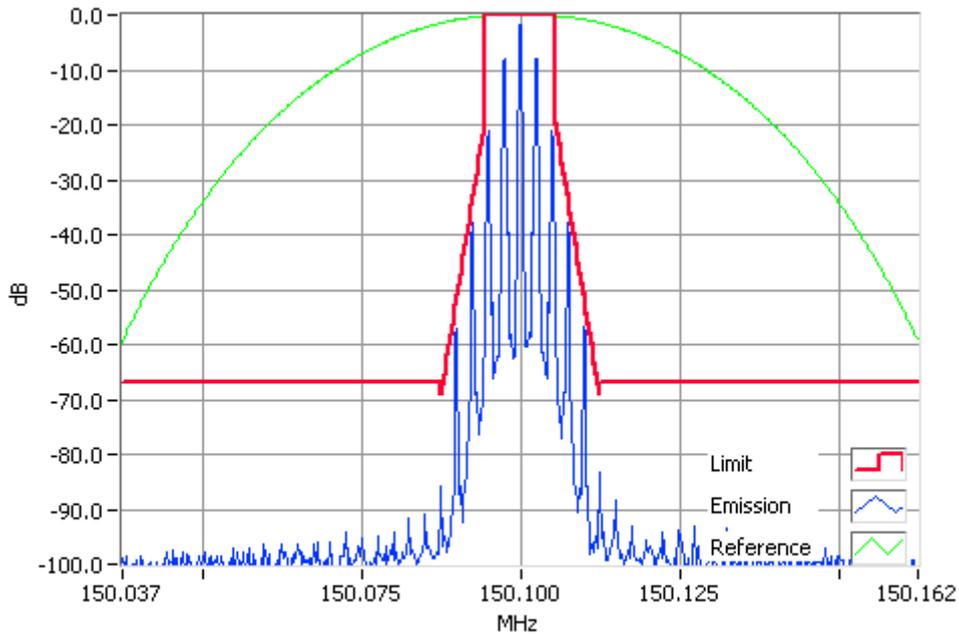
**Analogue Modulation 149.8000MHz Mask D 2W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

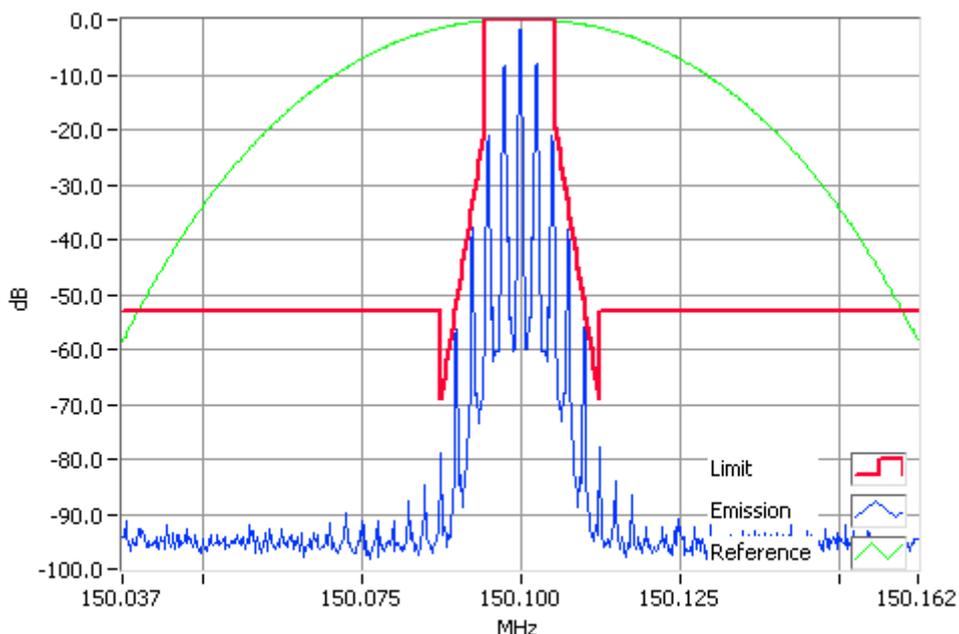
RSS-119 5.5

Tx FREQUENCY: 150.1 MHz      50 W      12.5 kHz Channel Spacing



**Analogue Modulation 150.1000MHz Mask D 50W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

Tx FREQUENCY: 150.1 MHz      2 W      12.5 kHz Channel Spacing



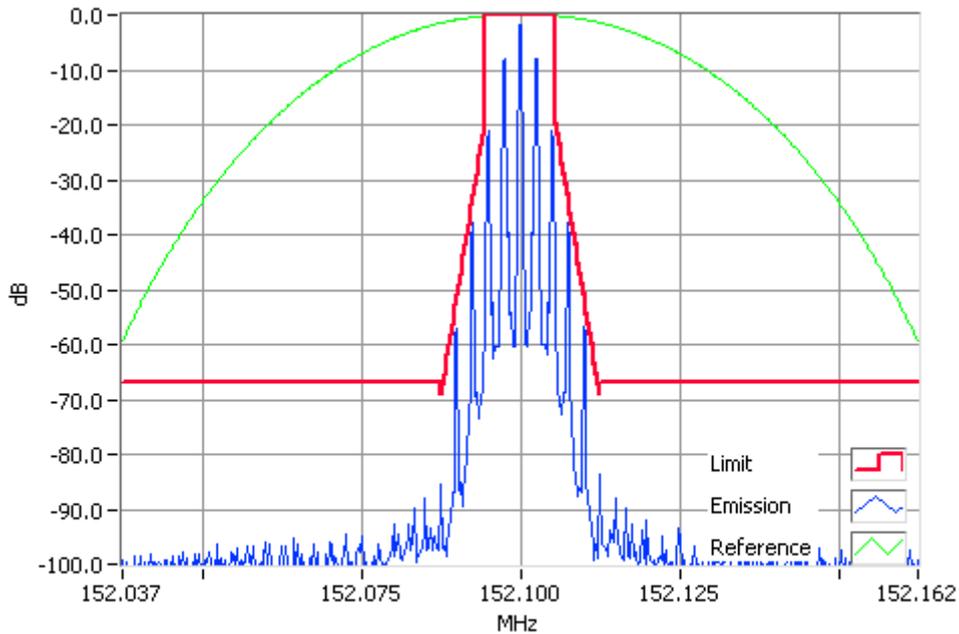
**Analogue Modulation 150.1000MHz Mask D 2W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

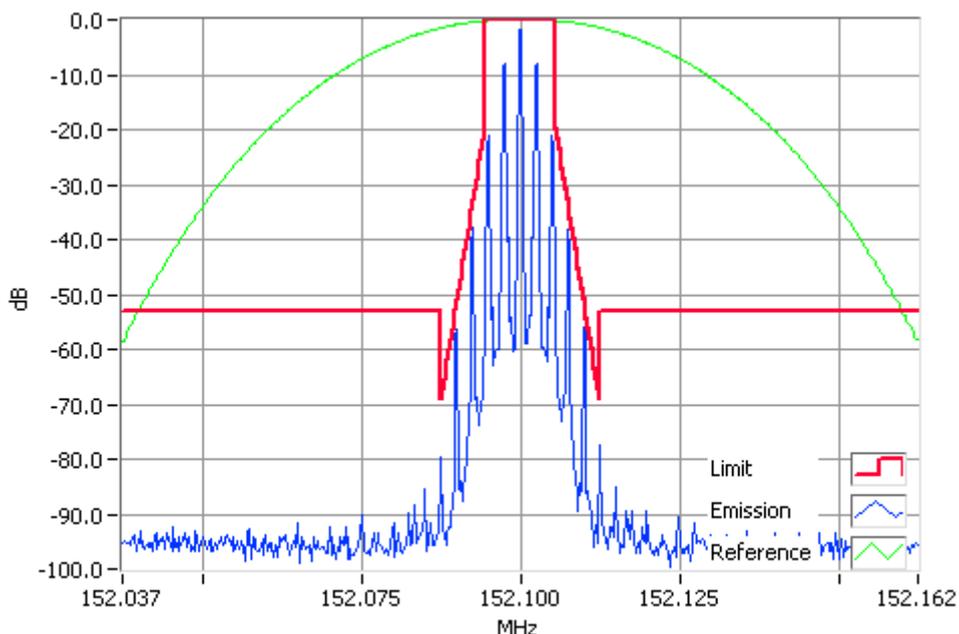
RSS-119 5.5

Tx FREQUENCY: 152.1 MHz 50 W 12.5 kHz Channel Spacing



**Analogue Modulation 152.1000MHz Mask D 50W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

Tx FREQUENCY: 152.1 MHz 2 W 12.5 kHz Channel Spacing



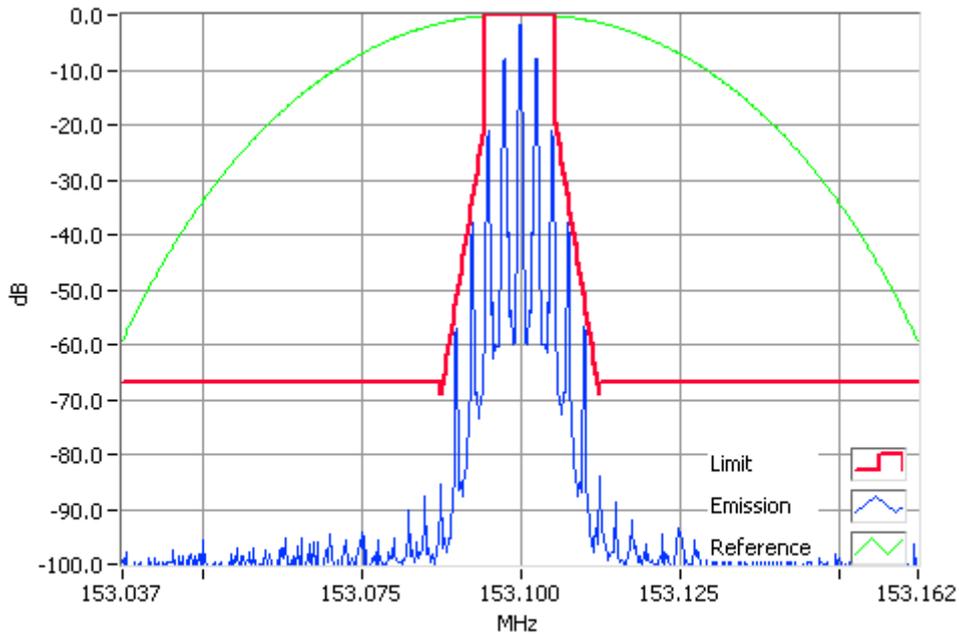
**Analogue Modulation 152.1000MHz Mask D 2W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

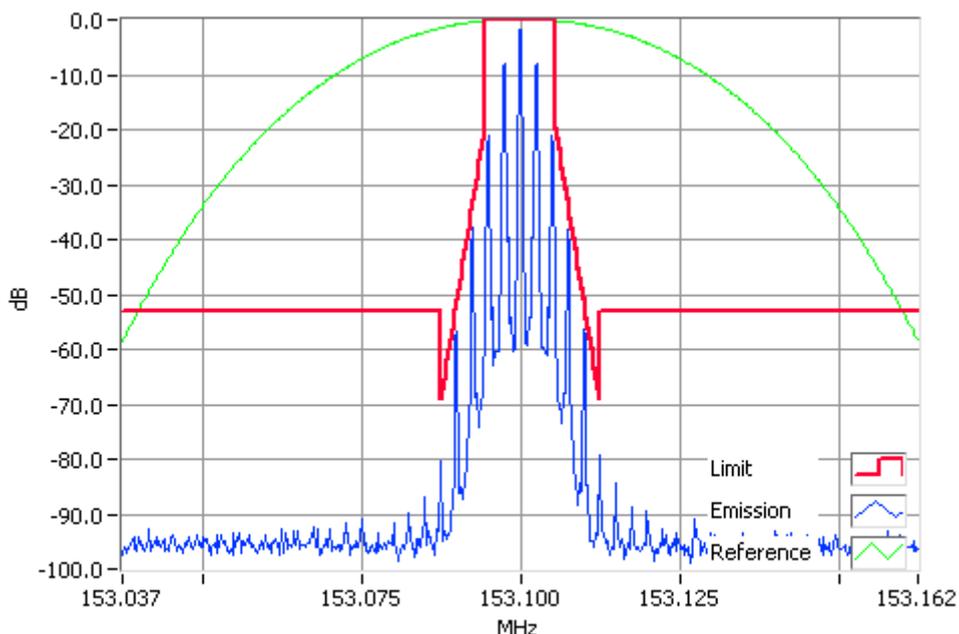
RSS-119 5.5

Tx FREQUENCY: 153.1 MHz 50 W 12.5 kHz Channel Spacing



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

Tx FREQUENCY: 153.1 MHz 2 W 12.5 kHz Channel Spacing



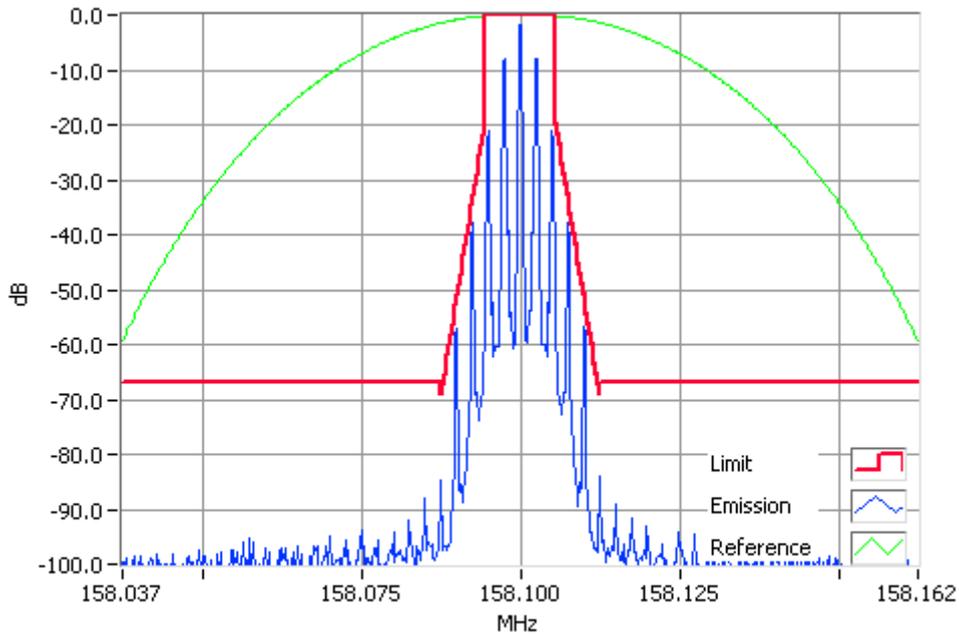
**Analogue Modulation 153.1000MHz Mask D 2W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

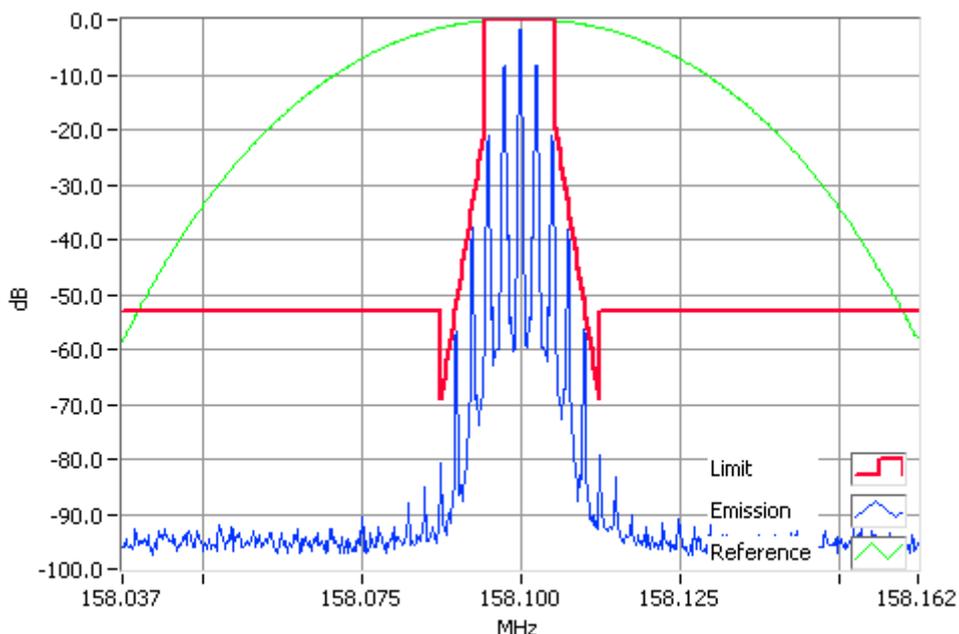
RSS-119 5.5

Tx FREQUENCY: 158.1 MHz 50 W 12.5 kHz Channel Spacing



**Analogue Modulation 158.1000MHz Mask D 50W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

Tx FREQUENCY: 158.1 MHz 2 W 12.5 kHz Channel Spacing



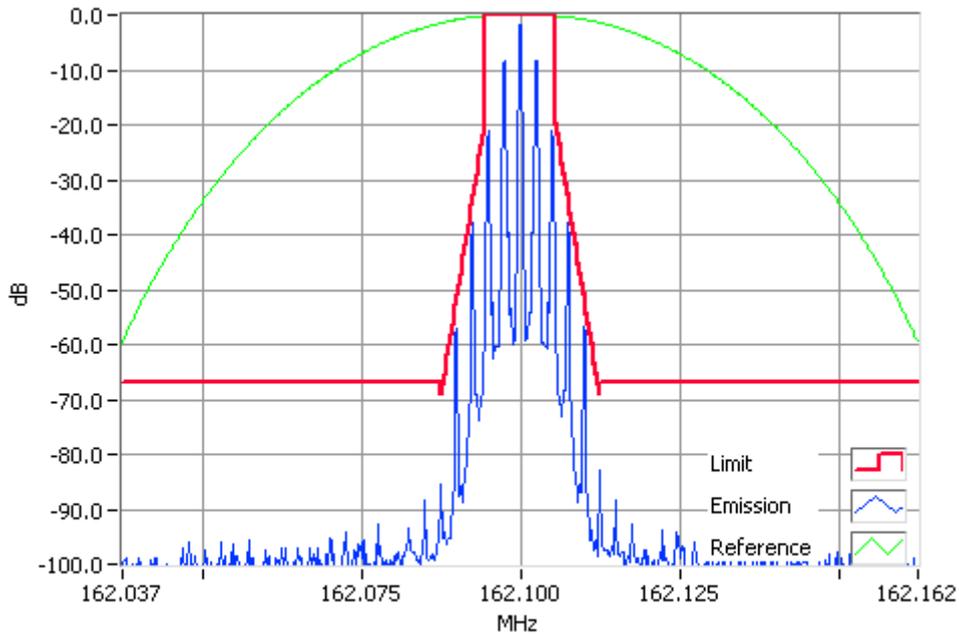
**Analogue Modulation 158.1000MHz Mask D 2W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

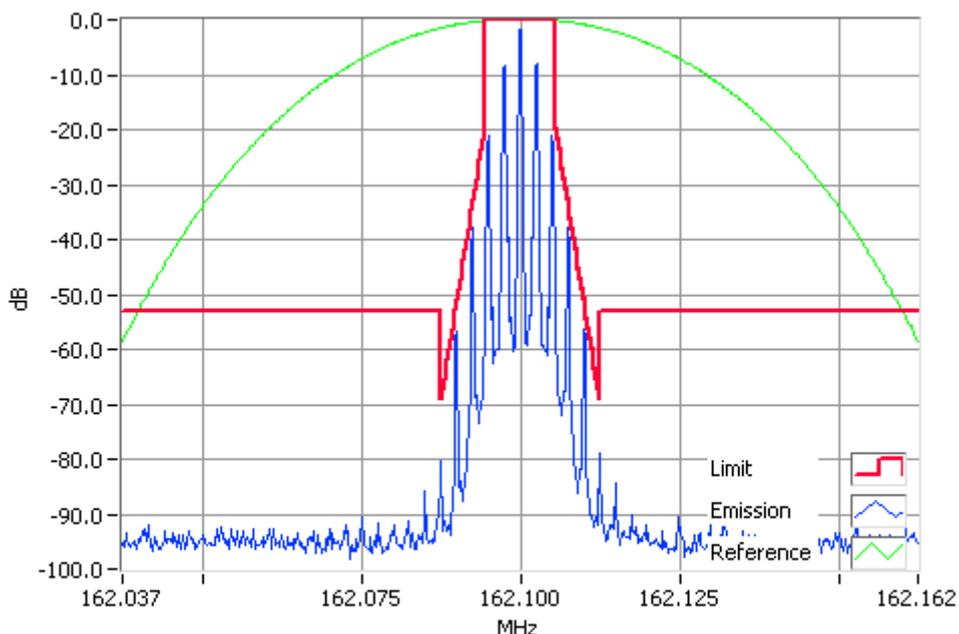
RSS-119 5.5

Tx FREQUENCY: 162.1 MHz 50 W 12.5 kHz Channel Spacing



**Analogue Modulation 162.1000MHz Mask D 50W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

Tx FREQUENCY: 162.1 MHz 2 W 12.5 kHz Channel Spacing



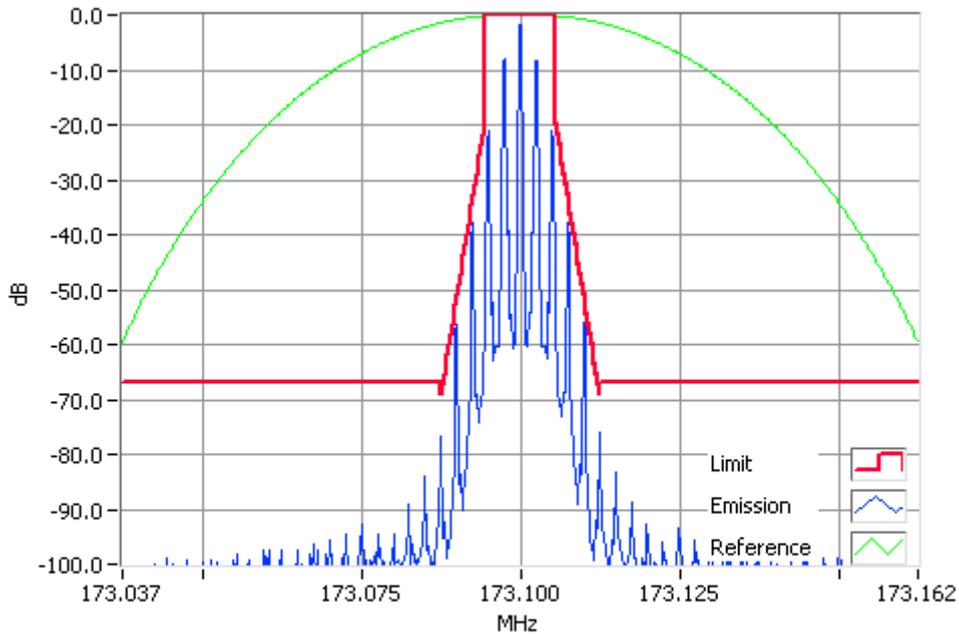
**Analogue Modulation 162.1000MHz Mask D 2W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

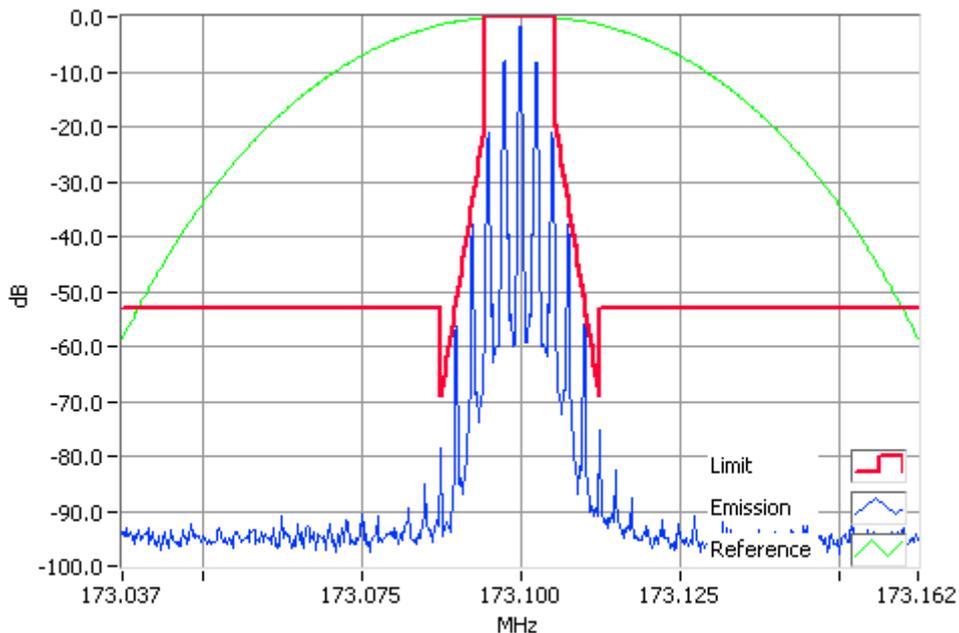
RSS-119 5.5

Tx FREQUENCY: 173.1 MHz 50 W 12.5 kHz Channel Spacing



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

Tx FREQUENCY: 173.1 MHz 2 W 12.5 kHz Channel Spacing



**Analogue Modulation 173.1000MHz Mask D 2W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

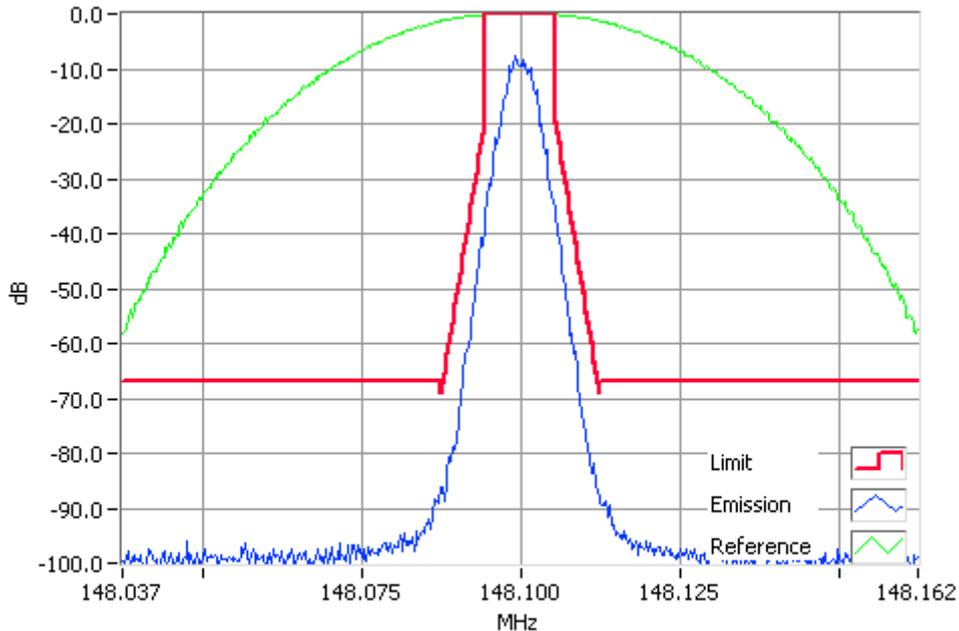
### Occupied Bandwidth and Spectrum Masks

#### DMR MODULATION

SPECIFICATION: FCC CFR 2.1049 (c)

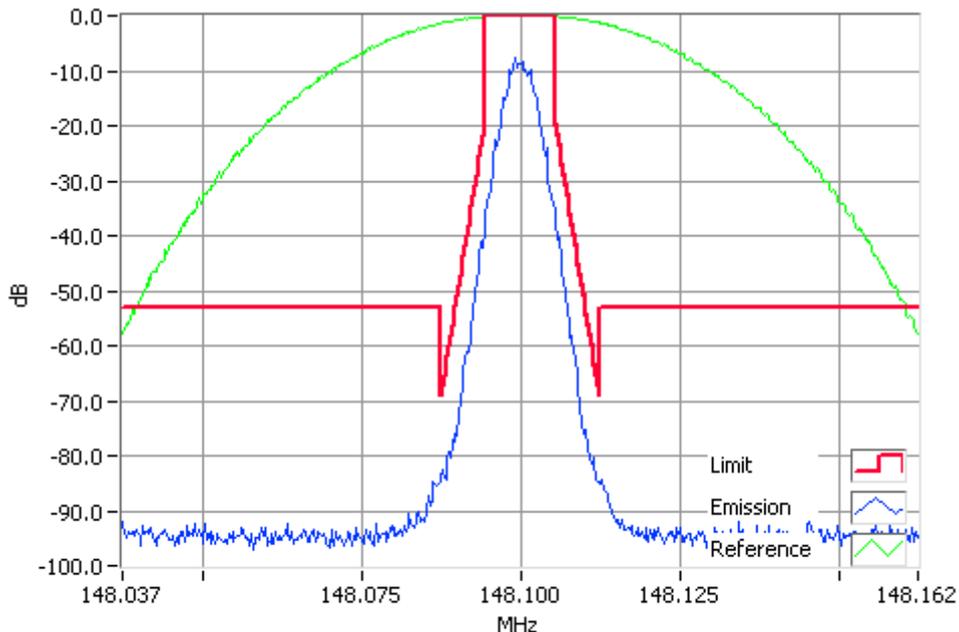
RSS-119 5.5

Tx FREQUENCY: 148.1 MHz 50 W 12.5 kHz Channel Spacing



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

Tx FREQUENCY: 148.1 MHz 2 W 12.5 kHz Channel Spacing



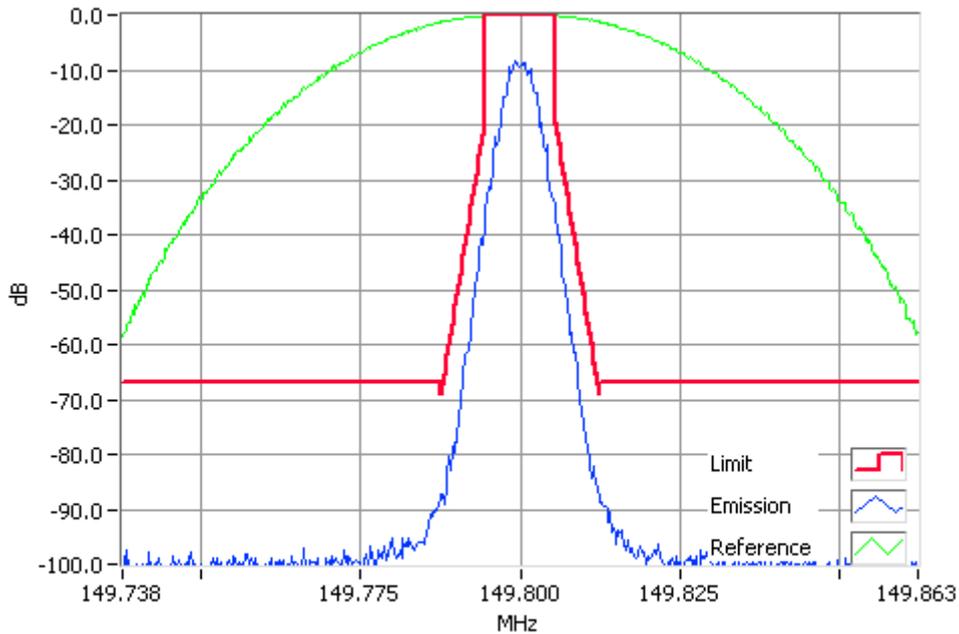
**DMR 148.1000MHz Mask D 2W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

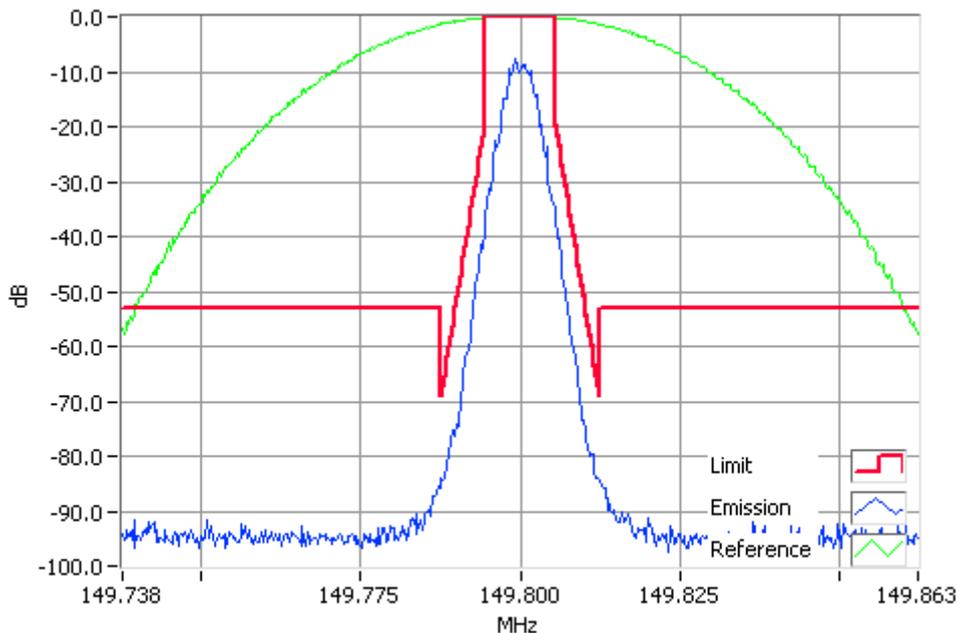
RSS-119 5.5

Tx FREQUENCY: 149.8 MHz 50 W 12.5 kHz Channel Spacing



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

Tx FREQUENCY: 149.8 MHz 2 W 12.5 kHz Channel Spacing



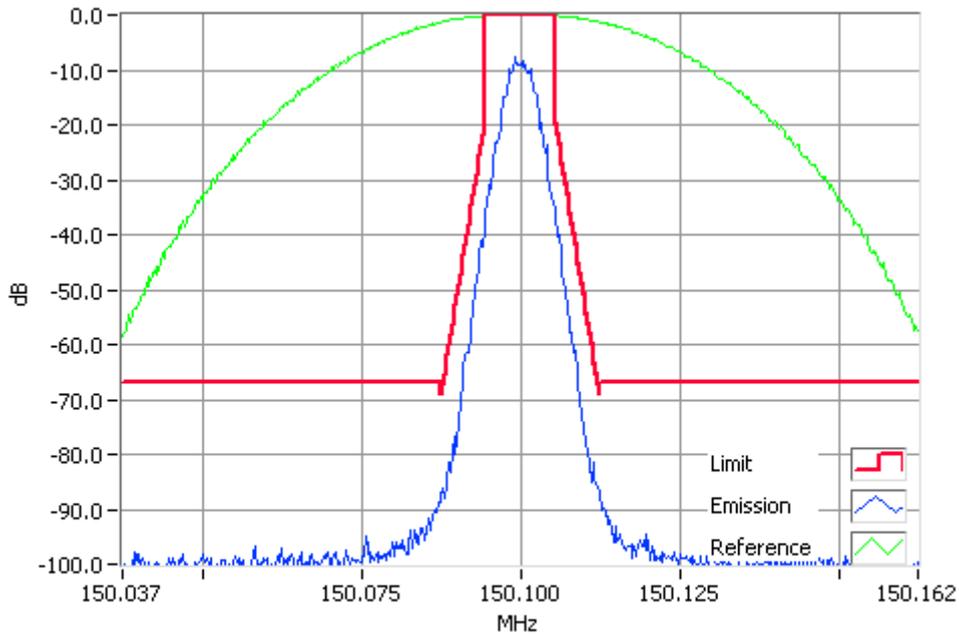
**DMR 149.8000MHz Mask D 2W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

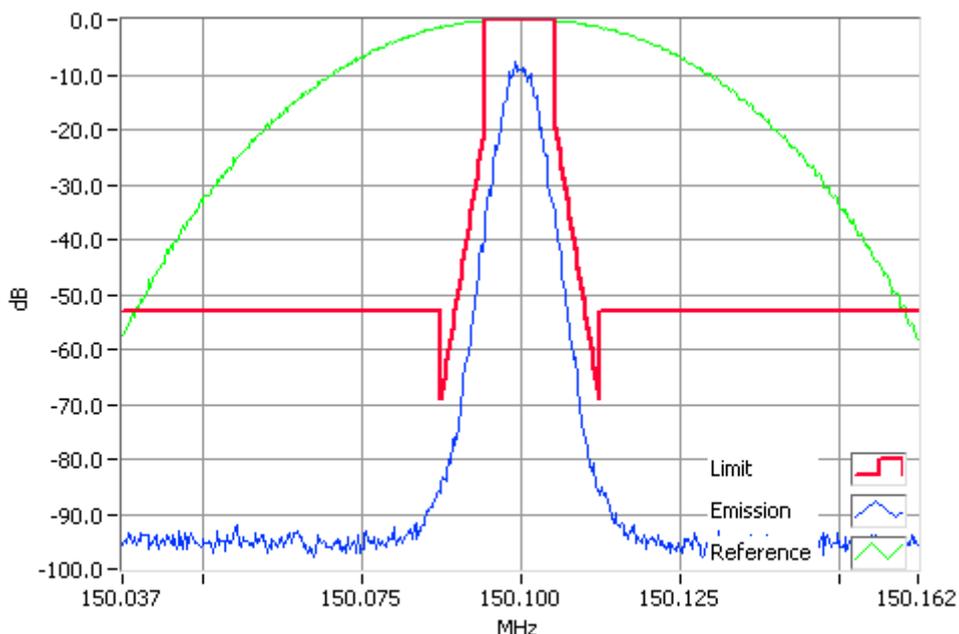
RSS-119 5.5

Tx FREQUENCY: 150.1 MHz 50 W 12.5 kHz Channel Spacing



**DMR 150.1000MHz Mask D 50W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

Tx FREQUENCY: 150.1 MHz 2 W 12.5 kHz Channel Spacing



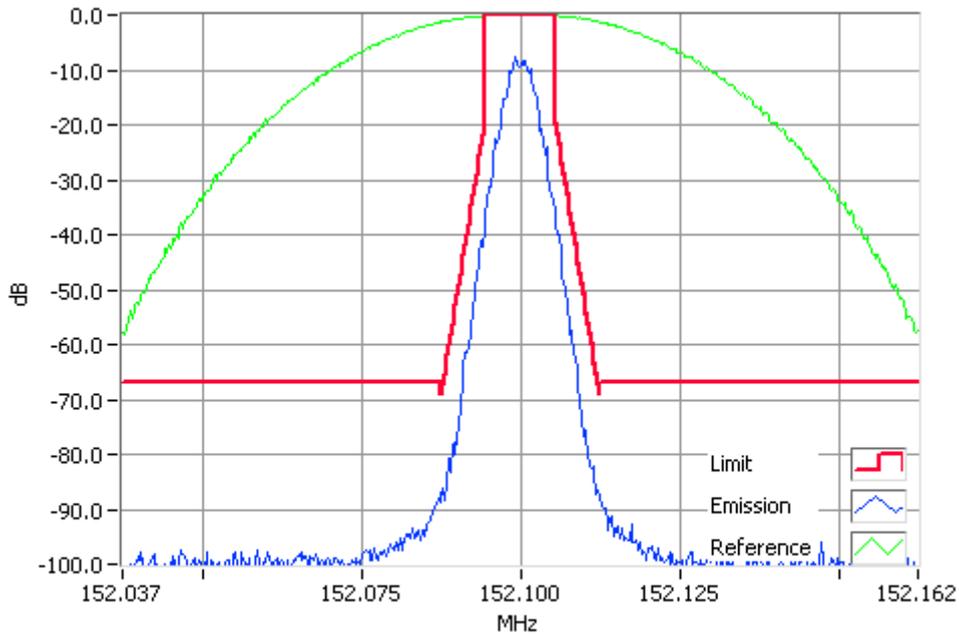
**DMR 150.1000MHz Mask D 2W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

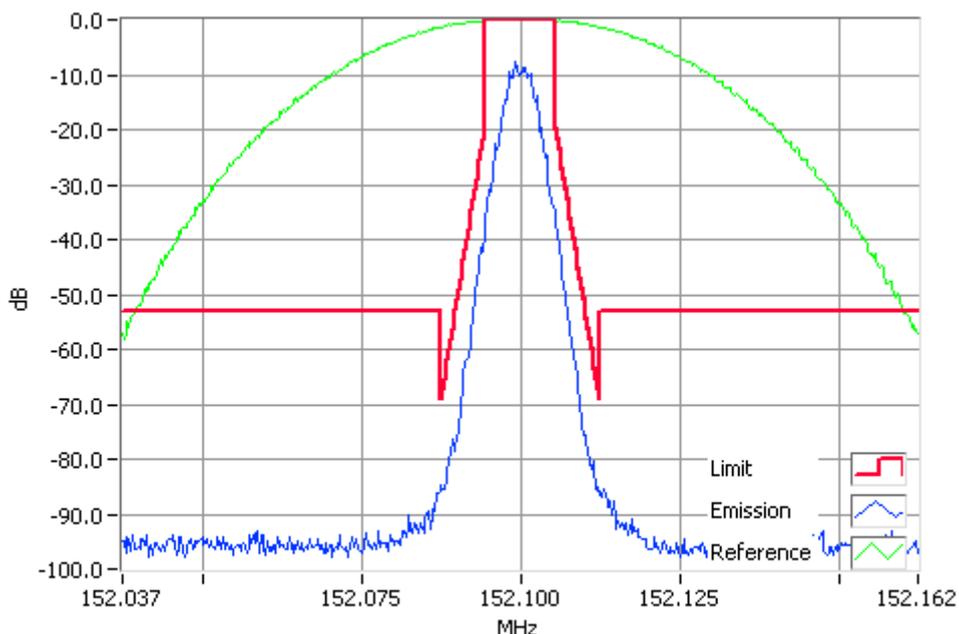
RSS-119 5.5

Tx FREQUENCY: 152.1 MHz 50 W 12.5 kHz Channel Spacing



**DMR 152.1000MHz Mask D 50W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

Tx FREQUENCY: 152.1 MHz 2 W 12.5 kHz Channel Spacing



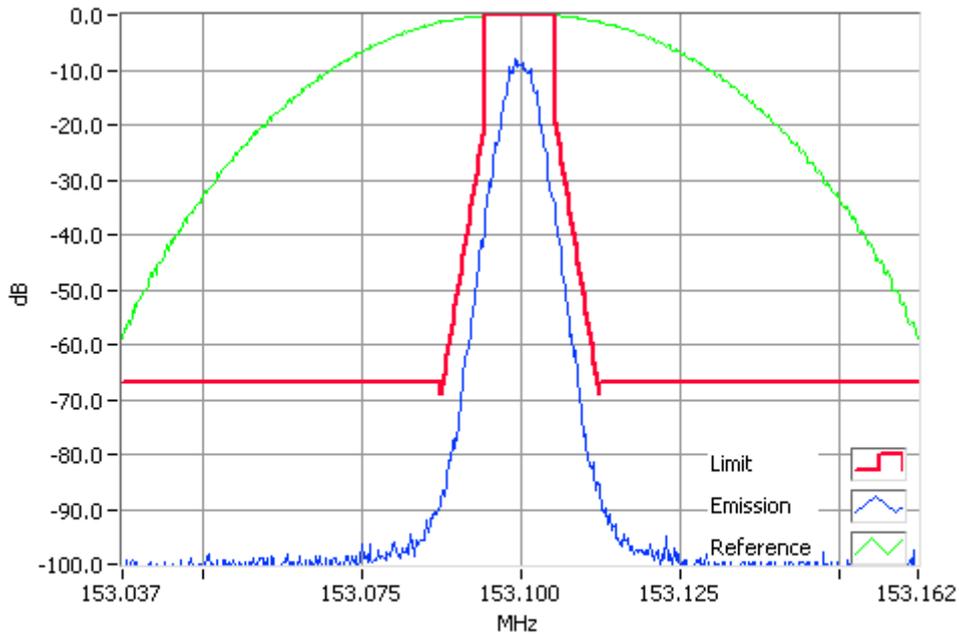
**DMR 152.1000MHz Mask D 2W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

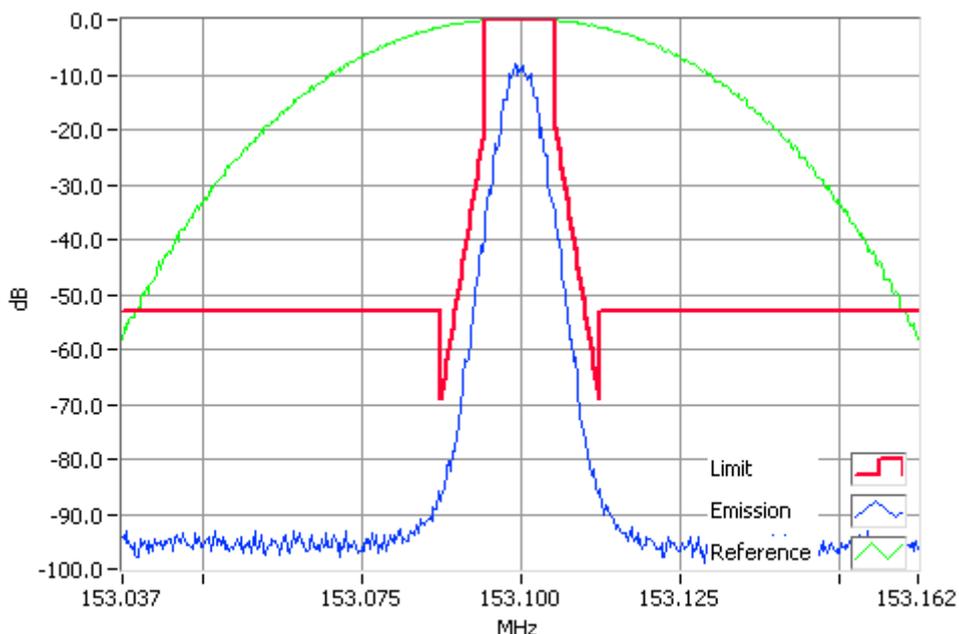
RSS-119 5.5

Tx FREQUENCY: 153.1 MHz      50 W      12.5 kHz Channel Spacing



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

Tx FREQUENCY: 153.1 MHz      2 W      12.5 kHz Channel Spacing



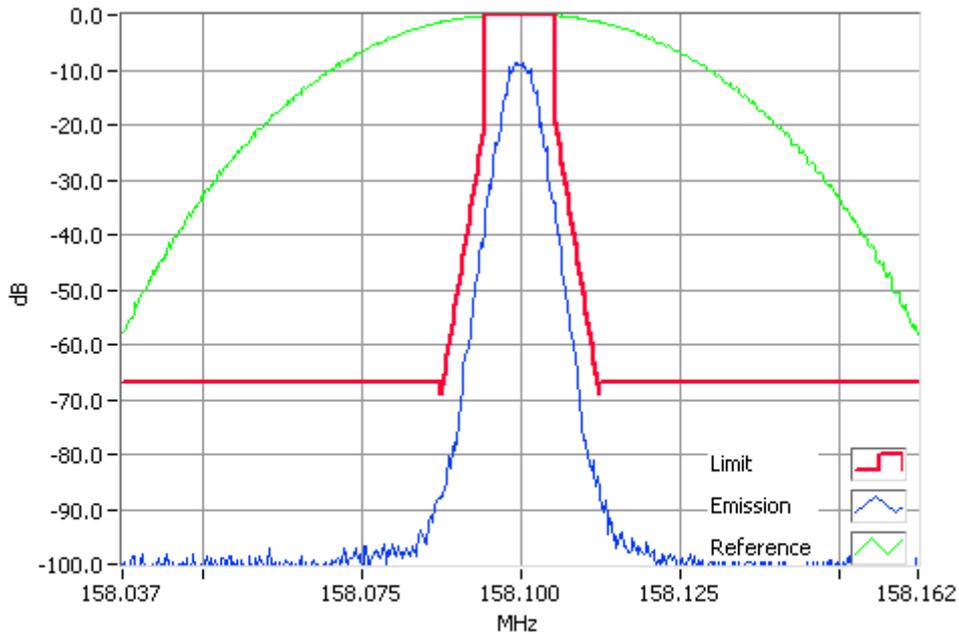
**DMR 153.1000MHz Mask D 2W**  
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**  
**Result=Pass**

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

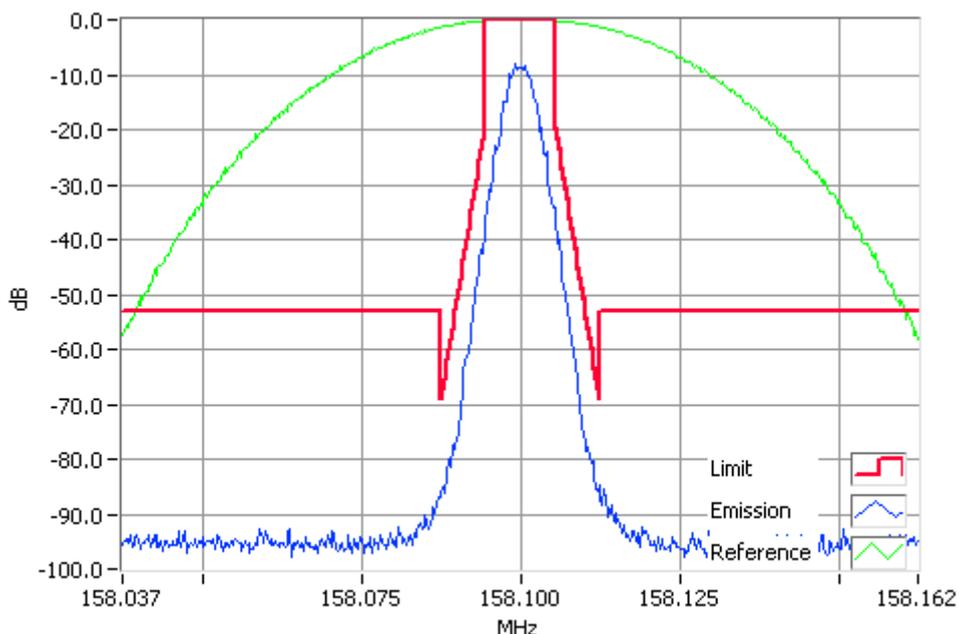
RSS-119 5.5

Tx FREQUENCY: 158.1 MHz 50 W 12.5 kHz Channel Spacing



**DMR 158.1000MHz Mask D 50W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

Tx FREQUENCY: 158.1 MHz 2 W 12.5 kHz Channel Spacing



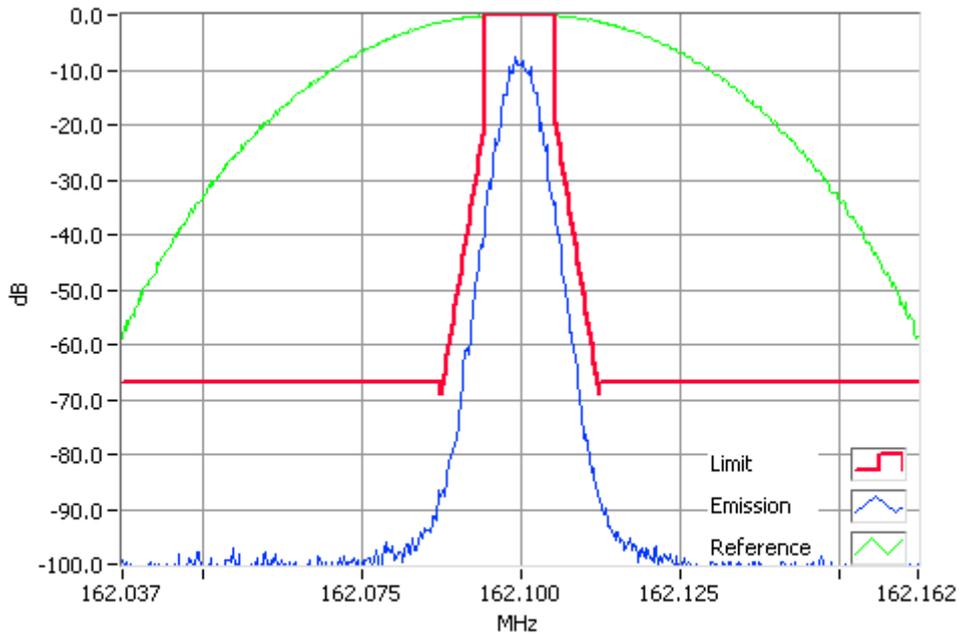
**DMR 158.1000MHz Mask D 2W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

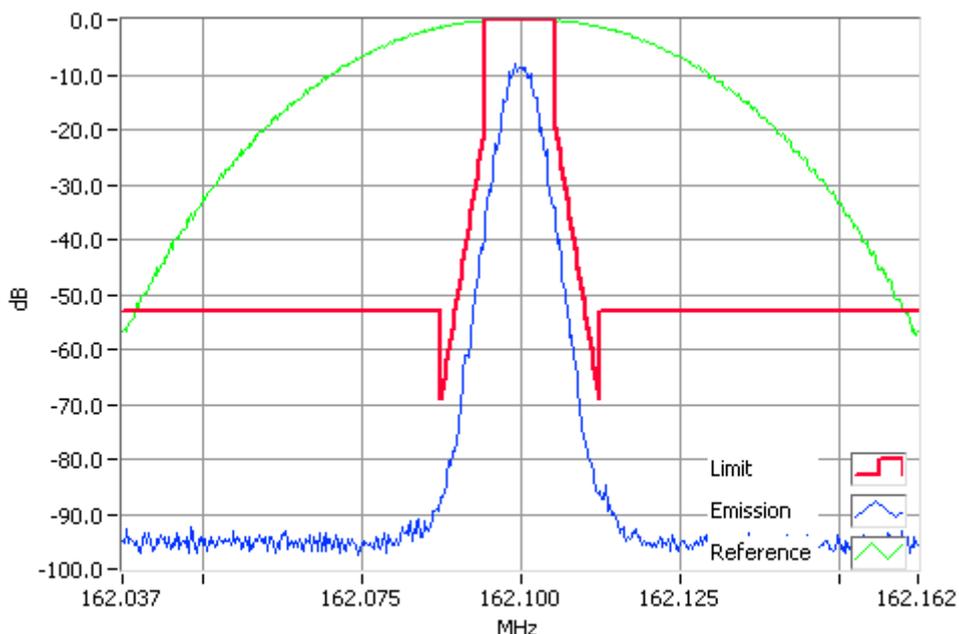
RSS-119 5.5

Tx FREQUENCY: 162.1 MHz 50 W 12.5 kHz Channel Spacing



**DMR 162.1000MHz Mask D 50W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

Tx FREQUENCY: 162.1 MHz 2 W 12.5 kHz Channel Spacing



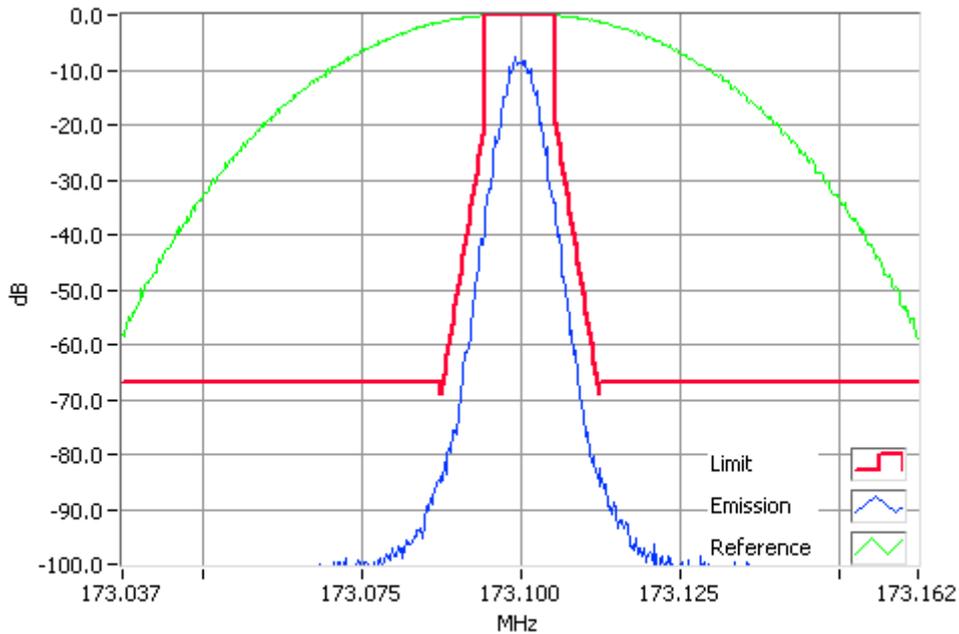
**DMR 162.1000MHz Mask D 2W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

### Occupied Bandwidth and Spectrum Masks

SPECIFICATION: FCC CFR 2.1049 (c)

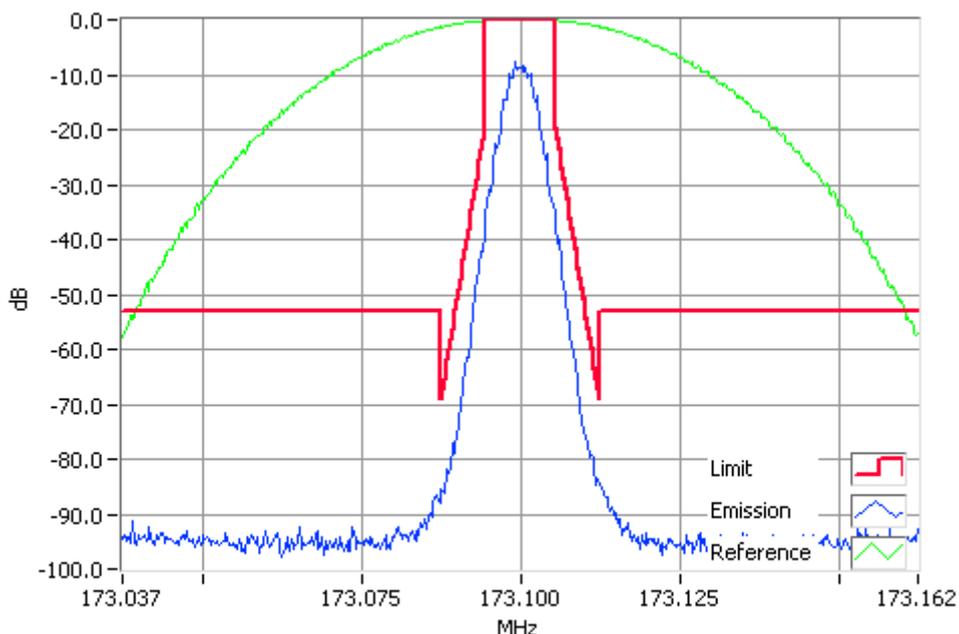
RSS-119 5.5

Tx FREQUENCY: 173.1 MHz 50 W 12.5 kHz Channel Spacing



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

Tx FREQUENCY: 173.1 MHz 2 W 12.5 kHz Channel Spacing



**DMR 173.1000MHz Mask D 2W**  
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak  
Result=Pass

## TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATIONS: FCC 47 CFR 2.1051

RSS-119 5.8

GUIDE: TIA-102.CAAA-C 2.2.7

### MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The frequency range examined was from the lowest frequency generated within the EUT, to a frequency higher than the 10<sup>th</sup> Harmonic: 100 kHz to Fc-BW  
Fc+ BW to 10Fc GHz
3. A Pre-scan is performed with a resolution bandwidth of 1 kHz, and a video bandwidth of 3 kHz. If any emissions are found to be within 20 dB of the limit a second measurement is made with the carrier modulated, and a resolution bandwidth of 10 kHz, and a video bandwidth of 30 kHz.

Spurious emissions which were attenuated by more than 20 dB below the limit were not recorded.

A photograph of the test set-up is included below.

### MEASUREMENT RESULTS:

See the tables and plots on the following pages for 12.5 kHz channel spacings.

LIMIT CLAUSES: FCC 47 CFR 90.210

RSS-119 5.8

Photo: Conducted Emissions Test Setup



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

Tx FREQUENCY: 148.1 MHz

12.5 kHz Channel Spacing

148.1 MHz @ 50 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing

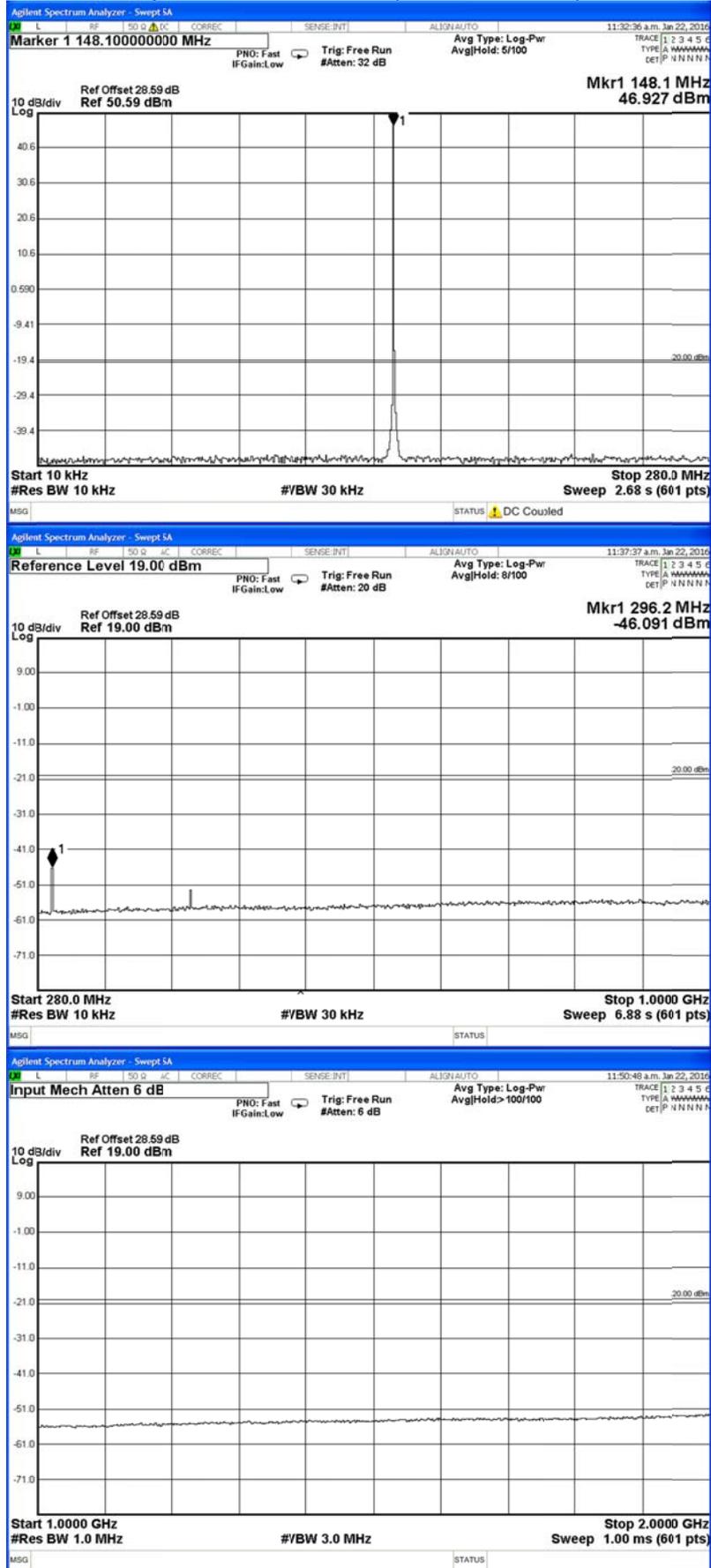
148.1 MHz @ 2 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

### Spurious Emissions (Tx Conducted)



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

Tx FREQUENCY: 149.8 MHz

12.5 kHz Channel Spacing

149.8 MHz @ 50 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing

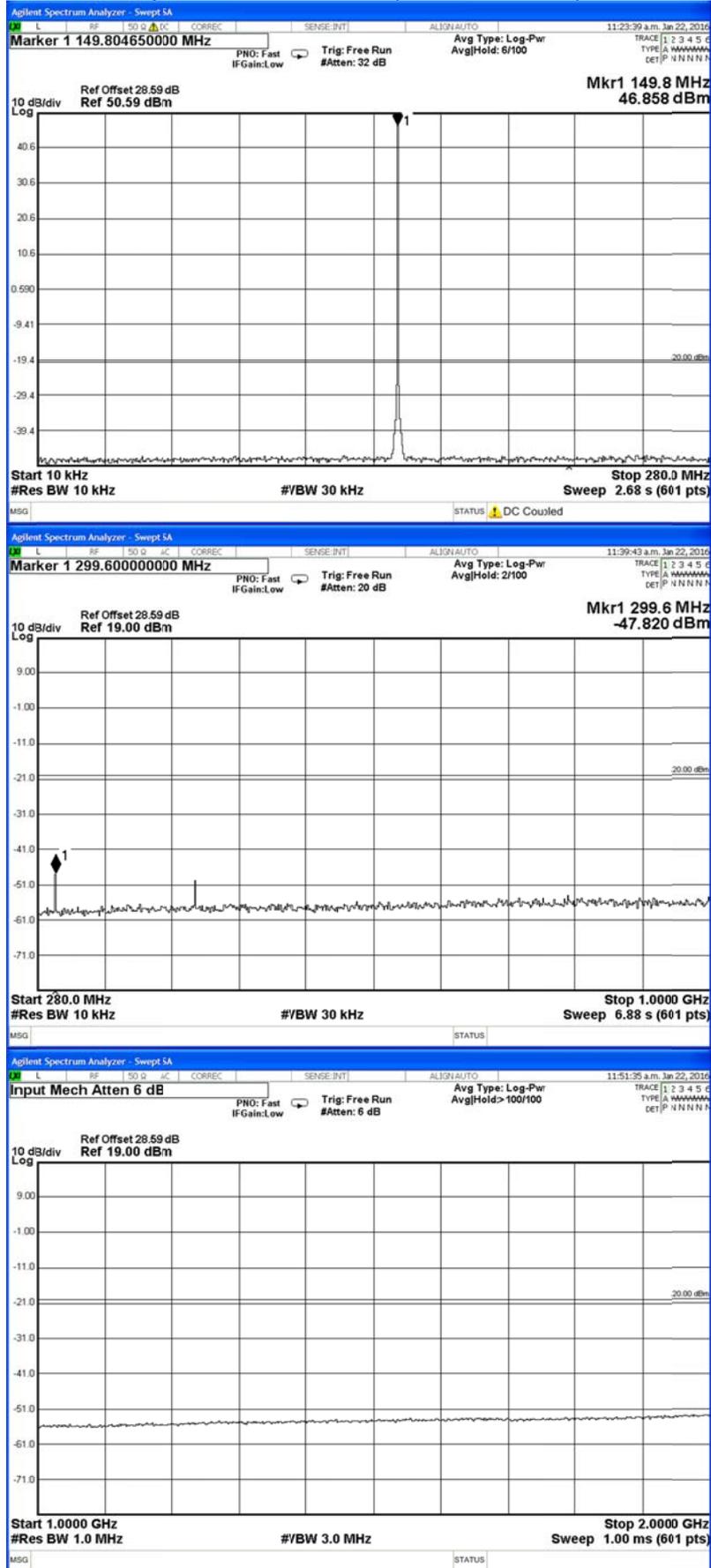
149.8 MHz @ 2 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

### Spurious Emissions (Tx Conducted)



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

Tx FREQUENCY: 150.1 MHz

12.5 kHz Channel Spacing

150.1 MHz @ 50 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing

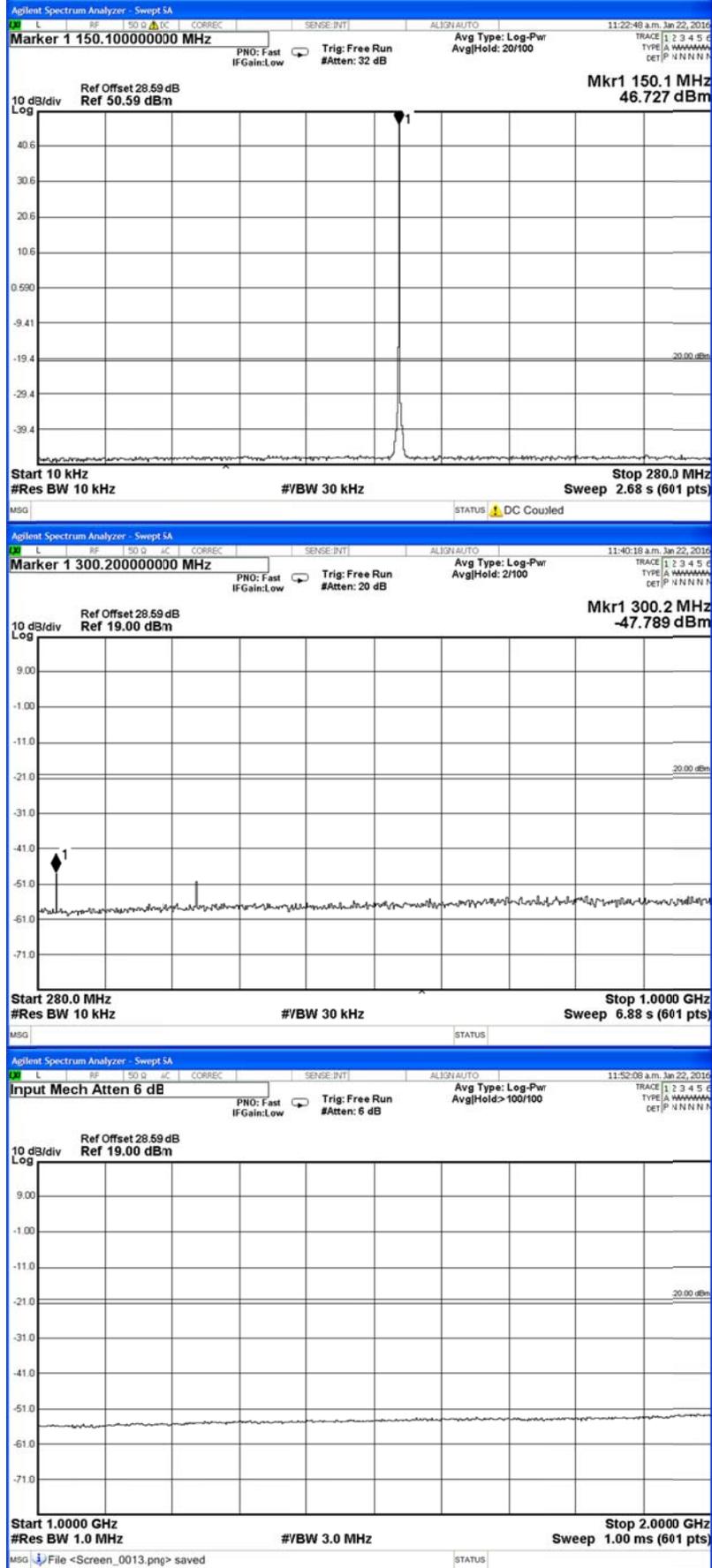
150.1 MHz @ 2 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

### Spurious Emissions (Tx Conducted)



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

Tx FREQUENCY: 152.1 MHz

12.5 kHz Channel Spacing

152.1 MHz @ 50 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing

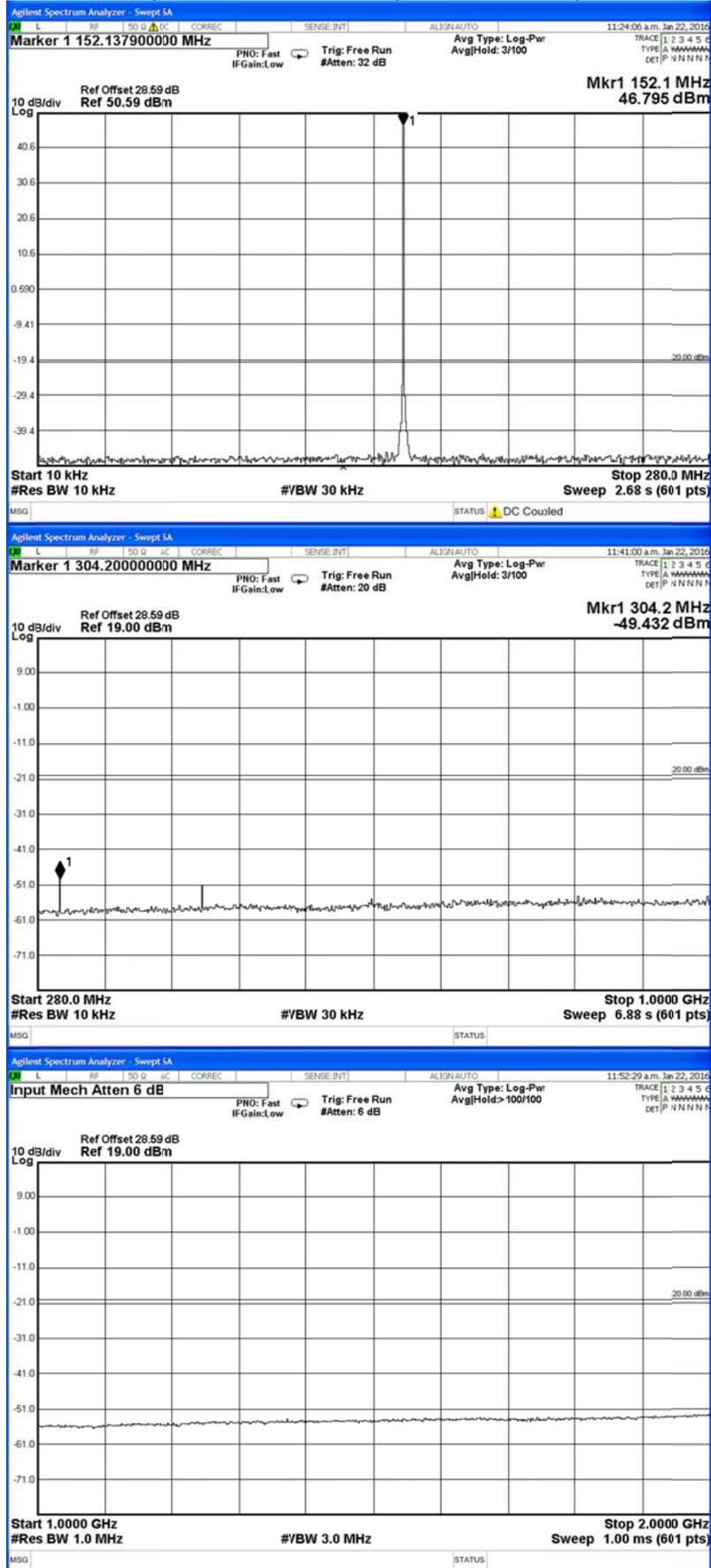
152.1 MHz @ 2 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

### Spurious Emissions (Tx Conducted)



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

Tx FREQUENCY: 153.1 MHz

12.5 kHz Channel Spacing

153.1 MHz @ 50 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing

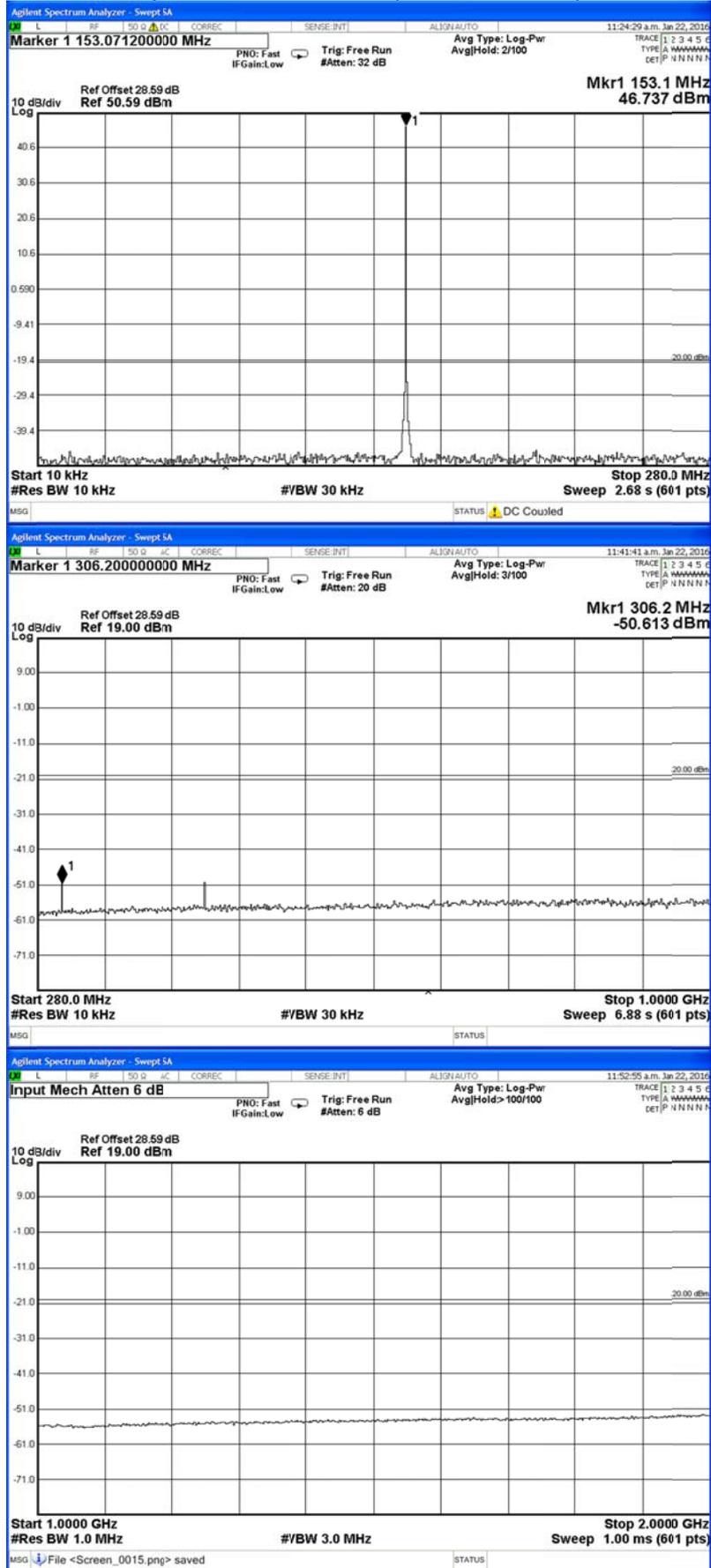
153.1 MHz @ 2 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

### Spurious Emissions (Tx Conducted)



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

Tx FREQUENCY: 158.1 MHz

12.5 kHz Channel Spacing

158.1 MHz @ 50 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing

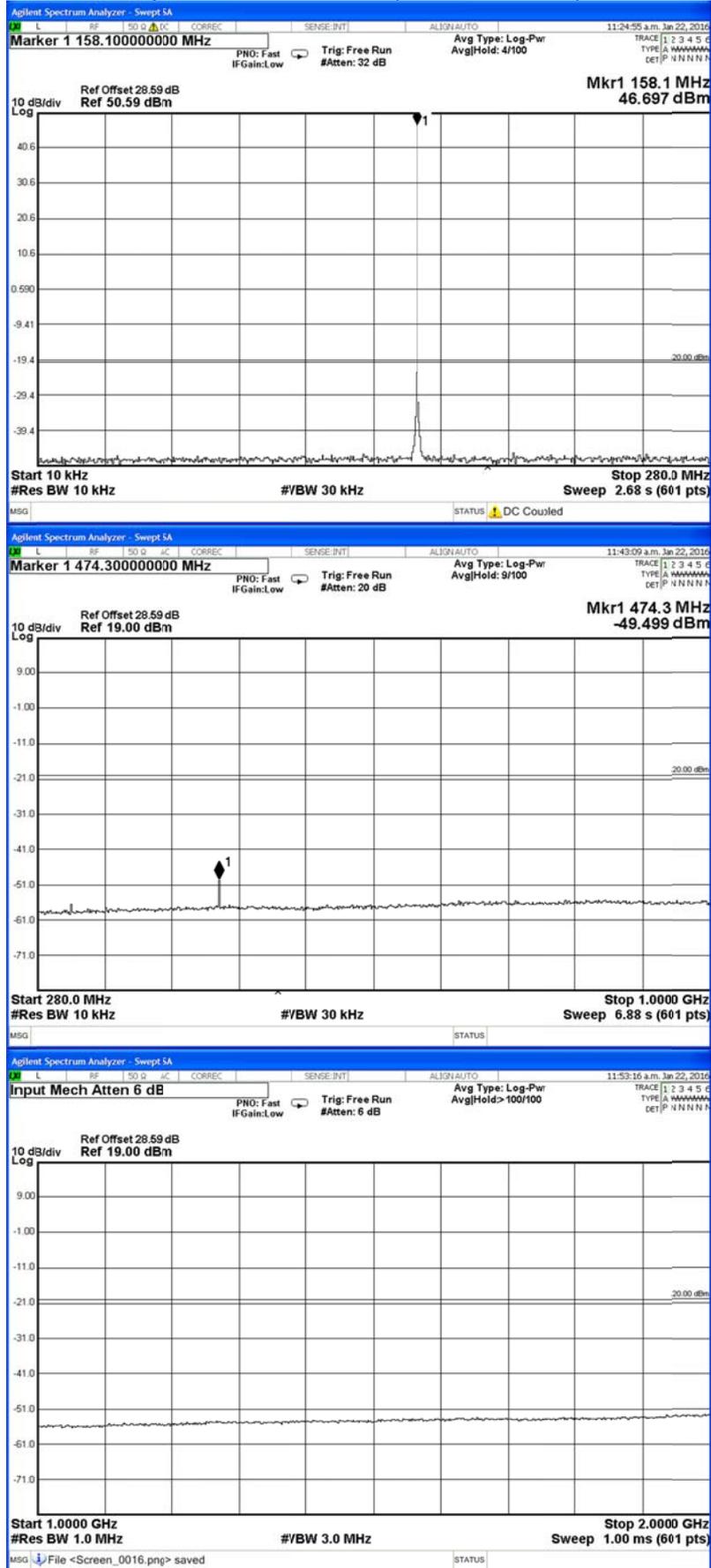
158.1 MHz @ 2 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

### Spurious Emissions (Tx Conducted)



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

Tx FREQUENCY: 162.1 MHz

12.5 kHz Channel Spacing

162.1 MHz @ 50 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing

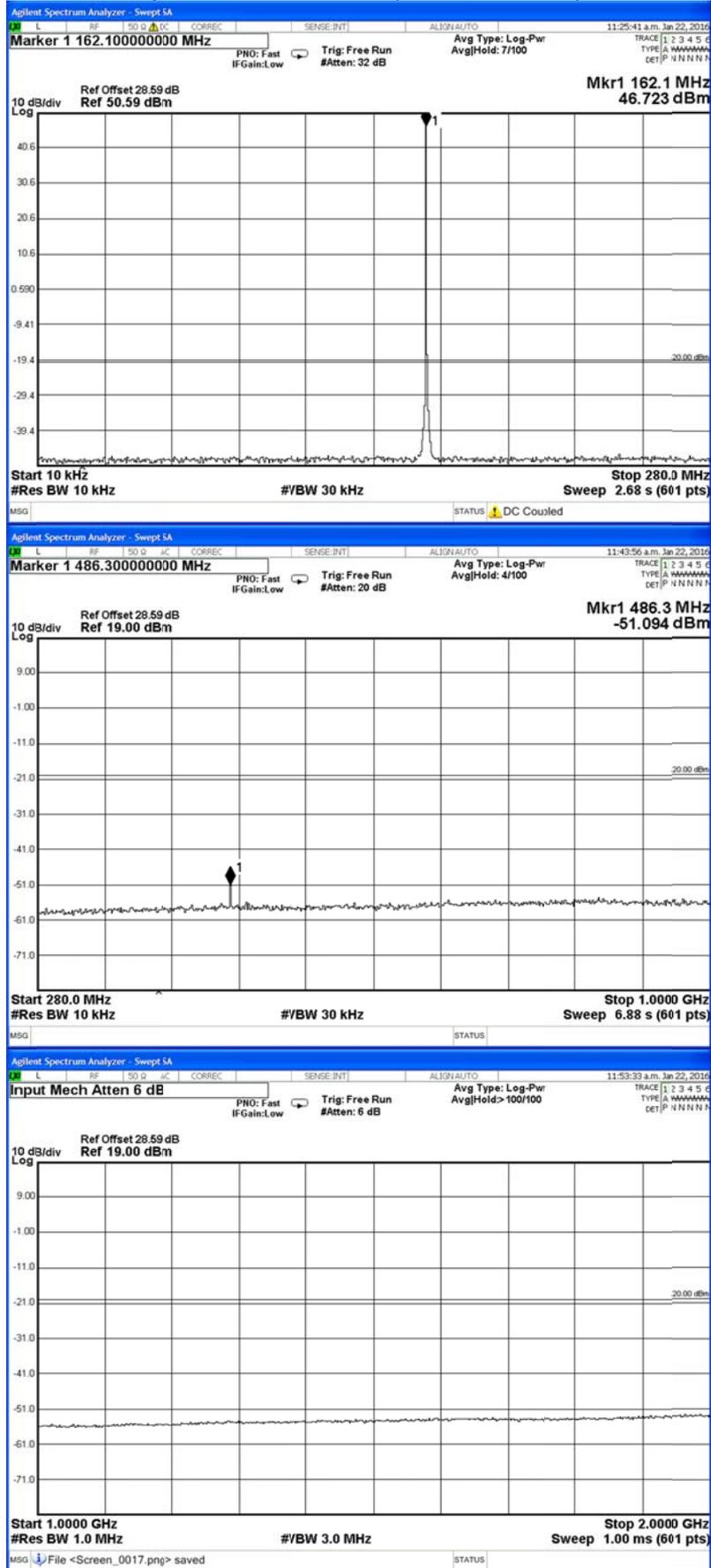
162.1 MHz @ 2 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

### Spurious Emissions (Tx Conducted)



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

Tx FREQUENCY: 173.1 MHz

12.5 kHz Channel Spacing

173.1 MHz @ 50 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing

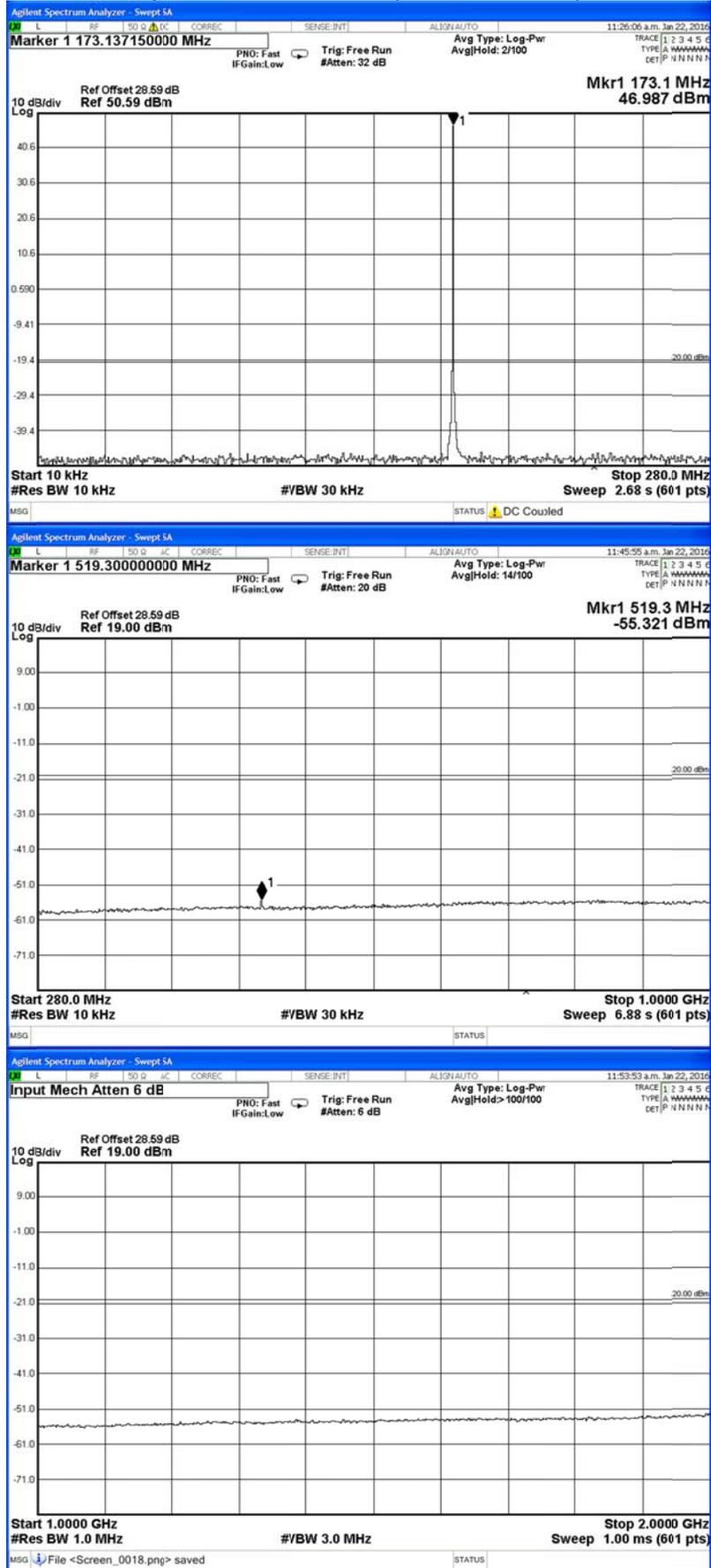
173.1 MHz @ 2 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

### Spurious Emissions (Tx Conducted)



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8  
LIMITS: FCC 47 CFR 90.210 RSS-119 5.8

Carrier Output Power	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
	50 W	-20 dBm
2 W	-20 dBm	-53 dBc

## TRANSMITTER SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA-102.CAAA-C 2.2.6

### MEASUREMENT PROCEDURE:

#### Initial Scan:

1. The EUT is placed in the S-Line TEM cell and emissions are measured from 30 MHz to 800 MHz. Any emission within 20 dB of the limit is then re-tested on the OATS.
2. The EUT is placed in the reverberation chamber and emissions are measured from 800 MHz to the upper frequency required. Any emission within 20 dB of the limit is then re-tested on the OATS.
3. The harmonics emissions up to the 6<sup>th</sup> harmonic of the fundamental frequency are measured on the OATS

#### OATS Measurement:

1. The EUT is placed on a wooden turntable at a distance of three metres from the test antenna. The output terminal is connected to an RF dummy load.
2. The test antenna is raised from 1 m to 4 m to obtain a maximum reading; the turntable is then rotated through 360° to obtain the maximum response of each spurious emission. Valid emissions are determined by switching the EUT on and off.
3. The EUT is then replaced by a signal generator and substitution antenna to make measurements by the substitution method.

### MEASUREMENT RESULTS:

See the tables on the following pages

LIMIT CLAUSE: FCC 47 CFR 90.210

Spurious Emissions (Tx Radiated)

SPECIFICATION: FCC CFR 2.1053

12.5 kHz Channel Spacing                      148.1 MHz @ 50 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing                      148.1 MHz @ 2 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

12.5 kHz Channel Spacing                      149.8 MHz @ 50 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing                      149.8 MHz @ 2 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

12.5 kHz Channel Spacing                      150.1 MHz @ 50 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing                      150.1 MHz @ 2 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

No emissions were detected at a level greater than 20 dB below the limit.

Tx Radiated Emissions - Continued

12.5 kHz Channel Spacing                      152.1 MHz @ 50 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing                      152.1 MHz @ 2 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing                      153.1 MHz @ 50 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing                      153.1 MHz @ 2 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing                      158.1 MHz @ 50 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing                      158.1 MHz @ 2 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

Tx Radiated Emissions - Continued

12.5 kHz Channel Spacing                      162.1 MHz @ 50 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
486.3	-36.90	-83.90

12.5 kHz Channel Spacing                      162.1 MHz @ 2 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No other emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing                      173.1 MHz @ 50 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
519.3	-33.81	-80.81

12.5 kHz Channel Spacing                      173.1 MHz @ 2 W                      Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No other emissions were detected at a level greater than 20 dB below the limit.		

LIMITS:                      FCC CFR 2.1053

Carrier Output Power	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
	50 W	-20 dBm
2 W	-20 dBm	-53 dBc

Tx Radiated Emissions - Continued

Open Area Test Site Results:

12.5 kHz Channel Spacing

162.1 MHz @ 50 W

Emission Mask D

Harmonics Emission Frequency (MHz)	Level (dBm)	Level (dBc)
324.2	-41.96	-88.96
486.3	-36.90	-83.90
648.4	-51.31	-98.31
810.5	-61.72	-108.72
972.6	-58.18	-105.18

Photo: OATS Setup



## TRANSIENT FREQUENCY BEHAVIOR

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

GUIDE: TIA-102.CAAA-C 2.2.18

### MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. Measurements and plots were made following the TIA procedure.

### MEASUREMENT RESULTS:

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

LIMIT CLAUSES: FCC 47 CFR 90.214 RSS-119 5.9

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 148.1 MHz

50 W

12.5 kHz Channel Spacing

148.1 MHz @ 50 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	1.2	N/A
t2	-0.2	N/A
t3	N/A	0.6

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	<input type="checkbox"/>

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

### Transient Frequency Behaviour

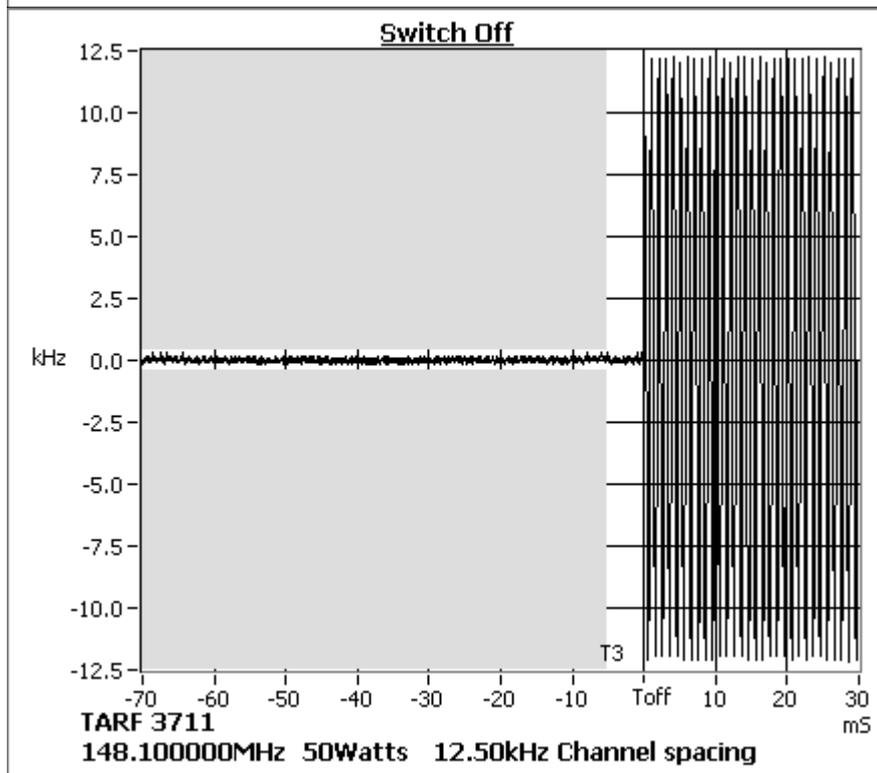
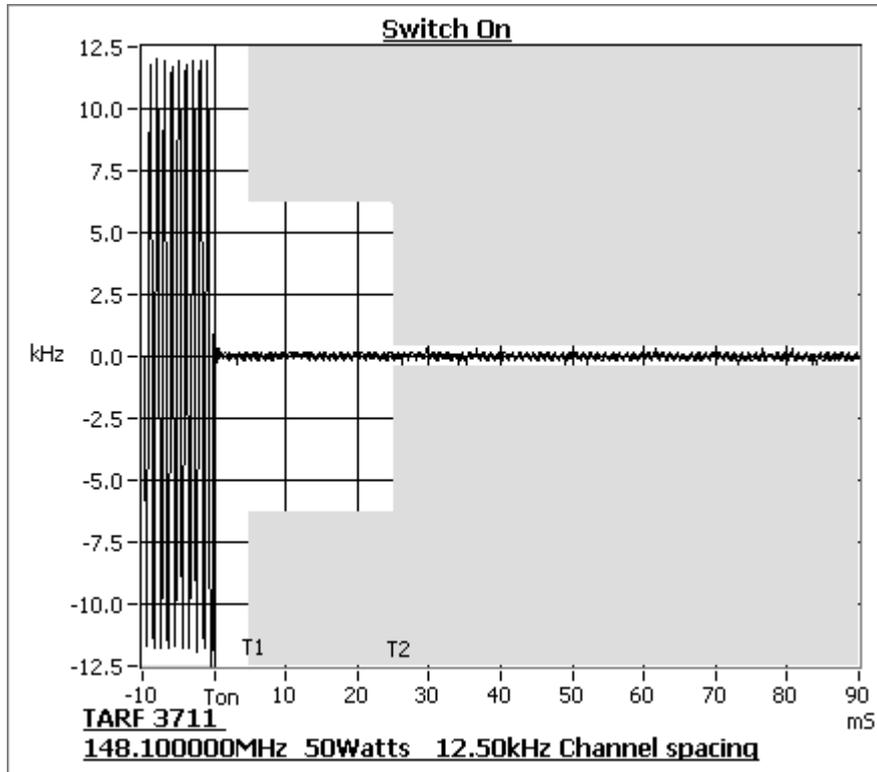
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 148.1 MHz

50 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 149.8 MHz 50 W 25.0 kHz Channel Spacing

149.8 MHz @ 2 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	1.3	N/A
t2	0.3	N/A
t3	N/A	1.0

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	<input type="checkbox"/>

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

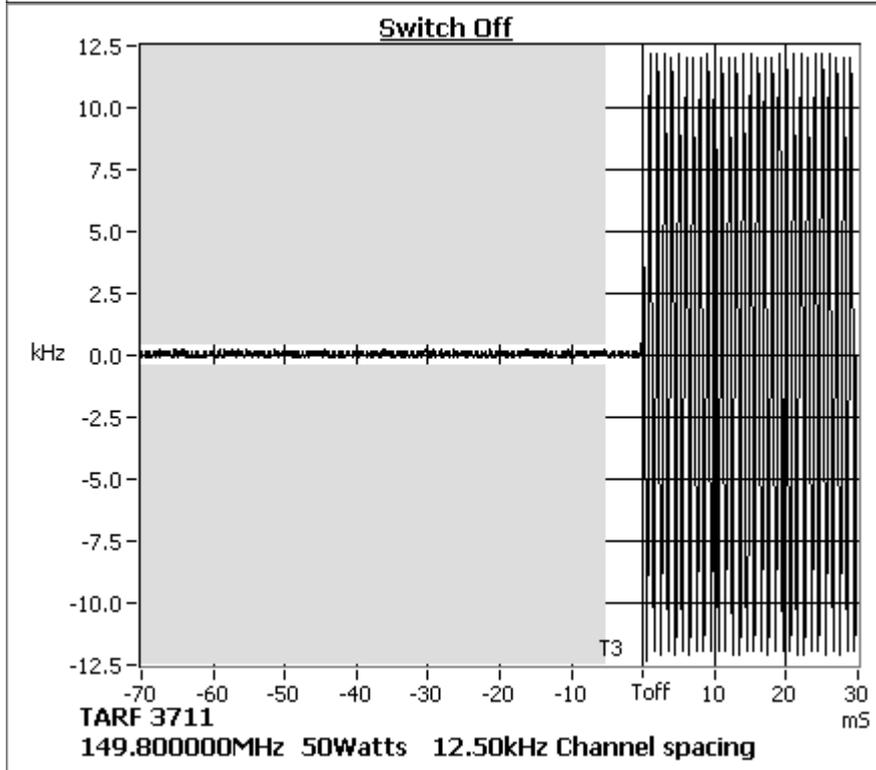
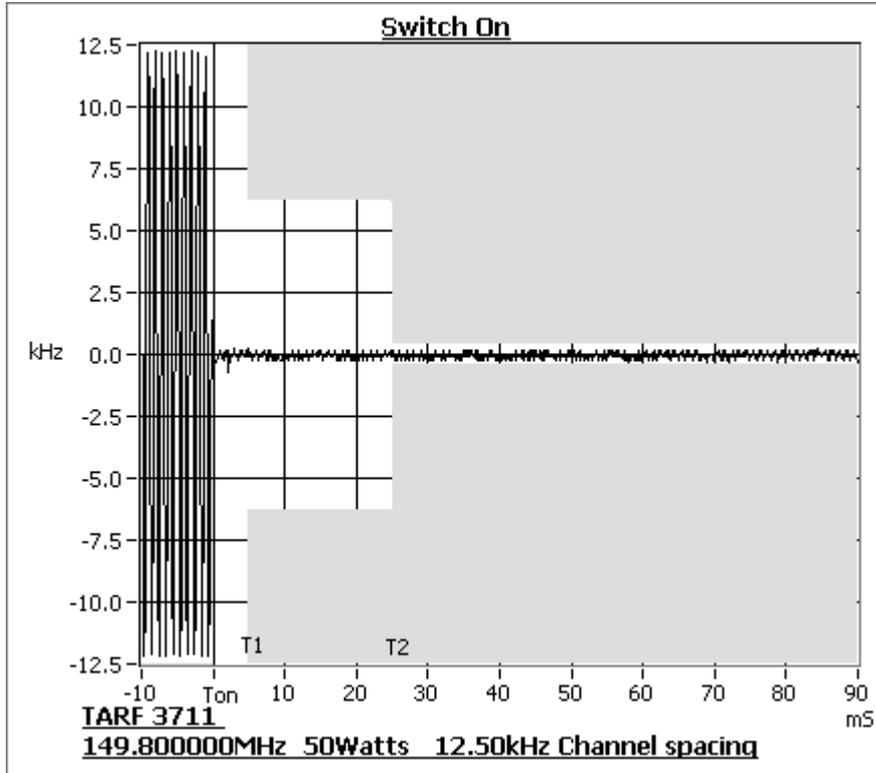
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

### Transient Frequency Behavior

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 149.8 MHz      50 W      25.0 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 150.1 MHz

50 W

12.5 kHz Channel Spacing

150.1 MHz @ 50 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	0.7	N/A
t2	-0.3	N/A
t3	N/A	-0.5

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	<input type="checkbox"/>

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

### Transient Frequency Behaviour

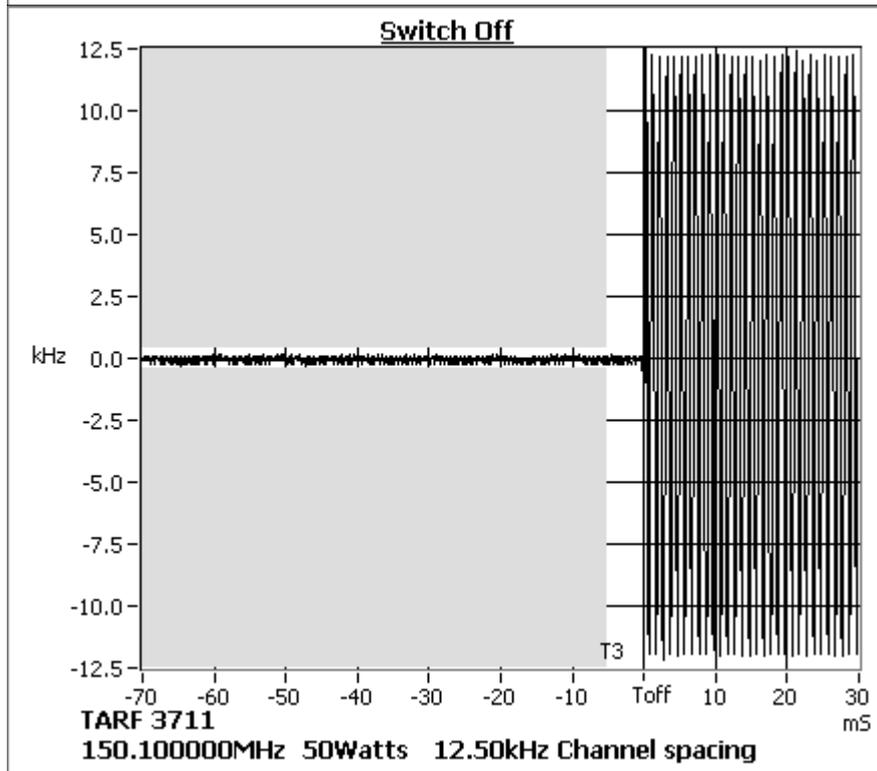
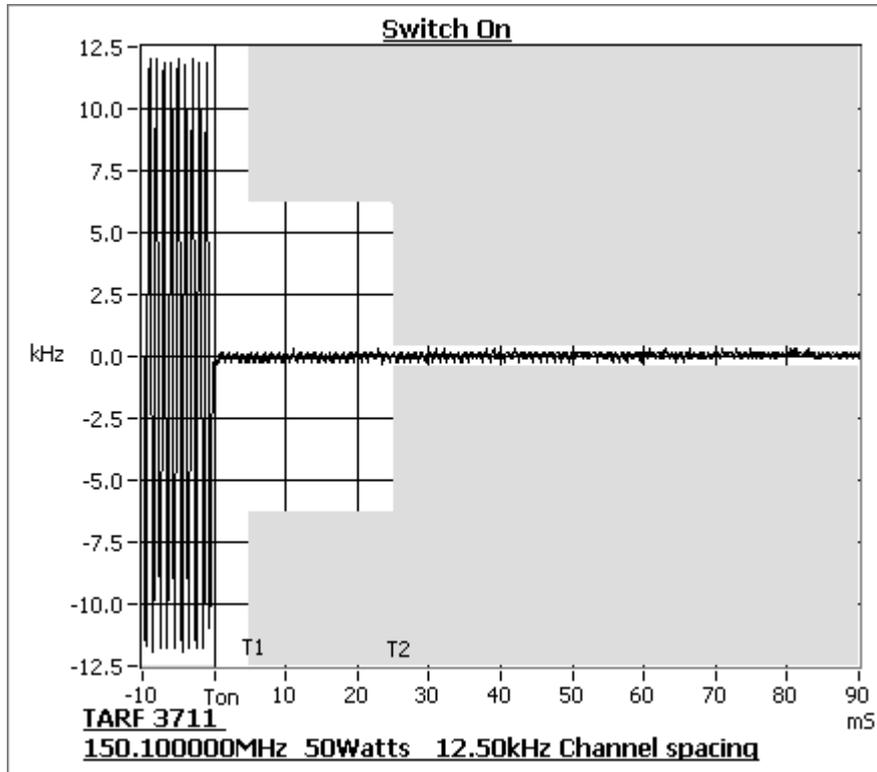
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 150.1 MHz

50 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 152.1 MHz

50 W

12.5 kHz Channel Spacing

152.1 MHz @ 50 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	1.2	N/A
t2	-0.3	N/A
t3	N/A	-0.6

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	<input type="checkbox"/>

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

### Transient Frequency Behaviour

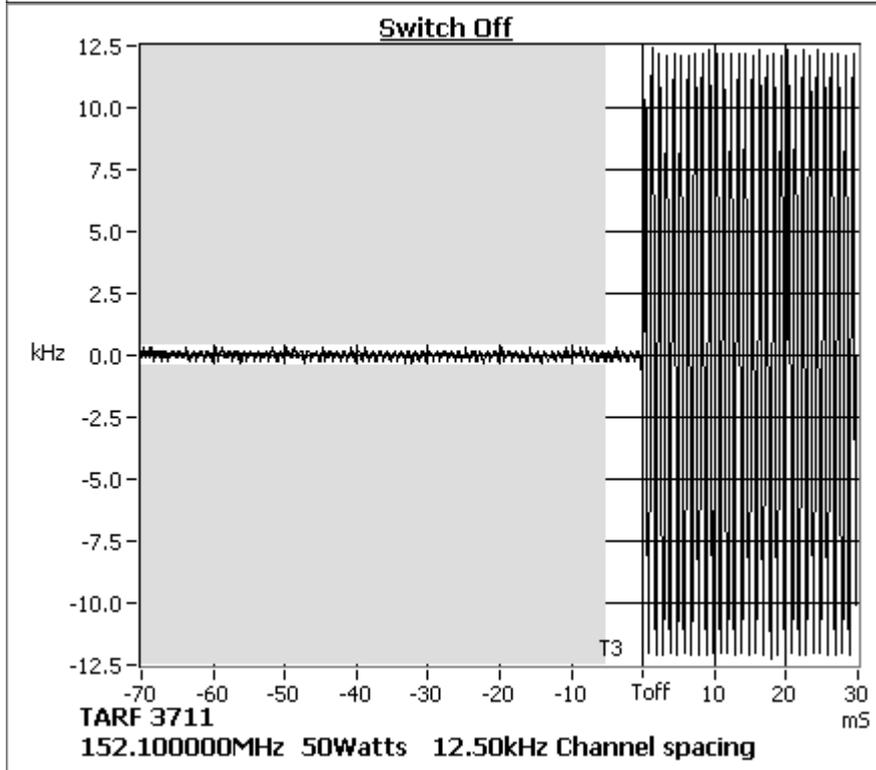
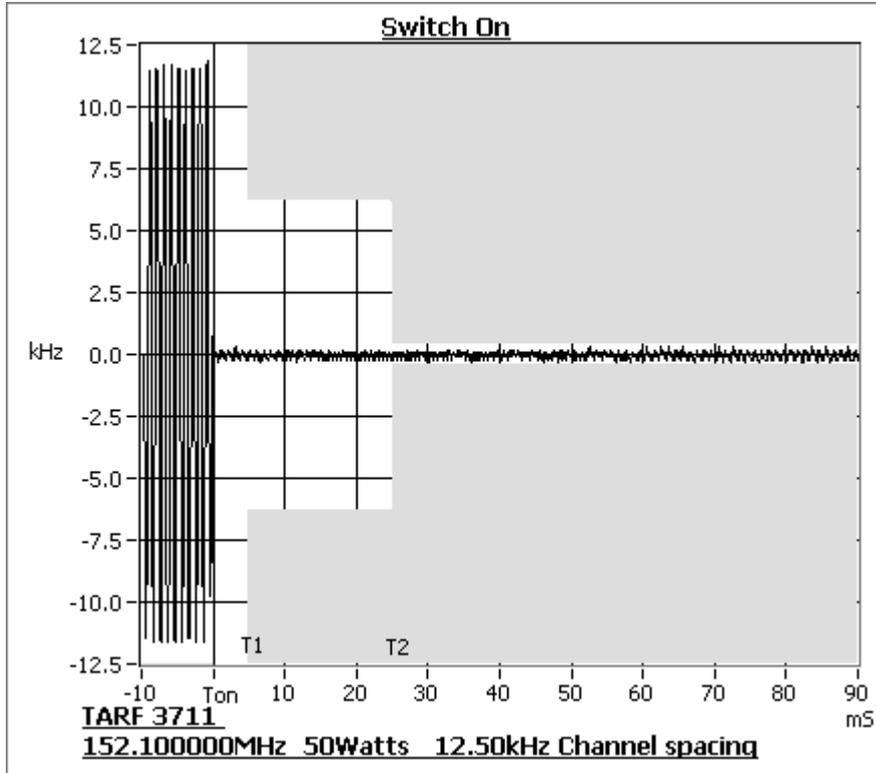
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 152.1 MHz

50 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 153.1 MHz

50 W

12.5 kHz Channel Spacing

153.1 MHz @ 50 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	1.9	N/A
t2	0.4	N/A
t3	N/A	1.4

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	<input type="checkbox"/>

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

### Transient Frequency Behaviour

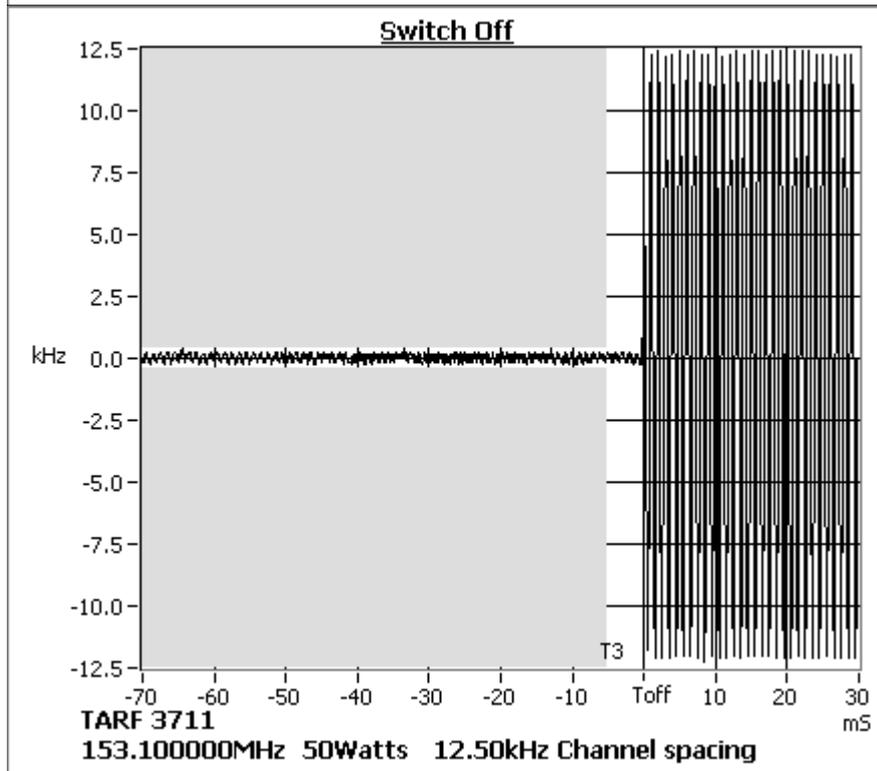
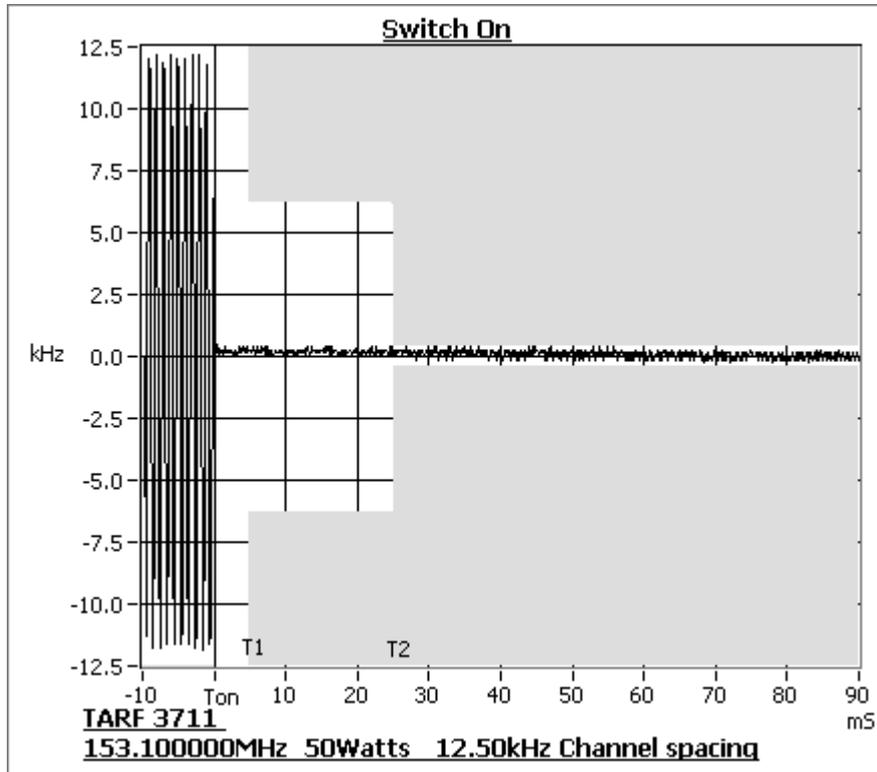
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 153.1 MHz

50 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 158.1 MHz 50 W

12.5 kHz Channel Spacing

158.1 MHz @ 50 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-1.2	N/A
t2	0.3	N/A
t3	N/A	-0.6

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	<input type="checkbox"/>

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

### Transient Frequency Behaviour

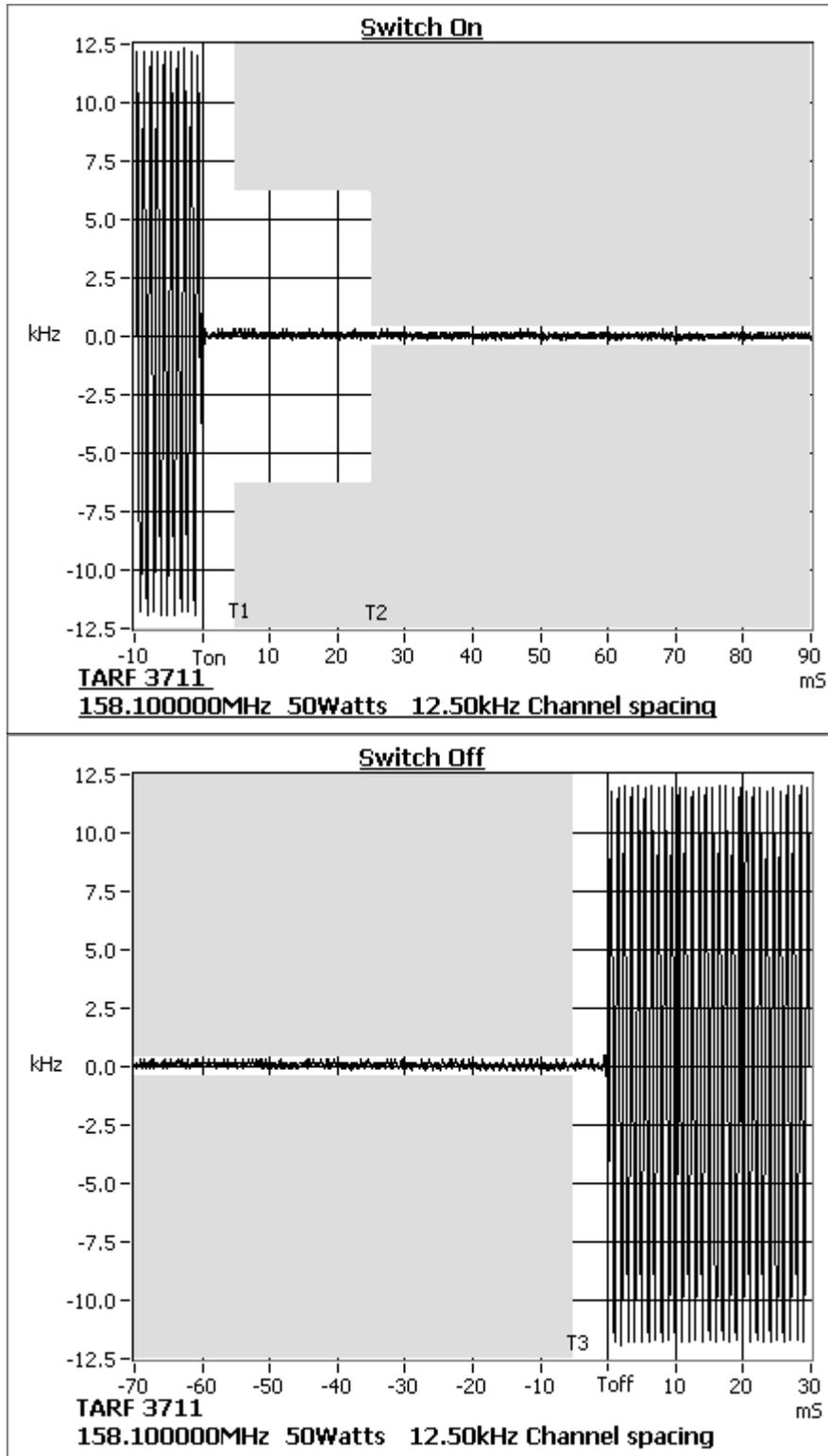
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 158.1 MHz

50 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 162.1 MHz

50 W

12.5 kHz Channel Spacing

162.1 MHz @ 50 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.9	N/A
t2	-0.3	N/A
t3	N/A	0.7

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	<input type="checkbox"/>

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

### Transient Frequency Behaviour

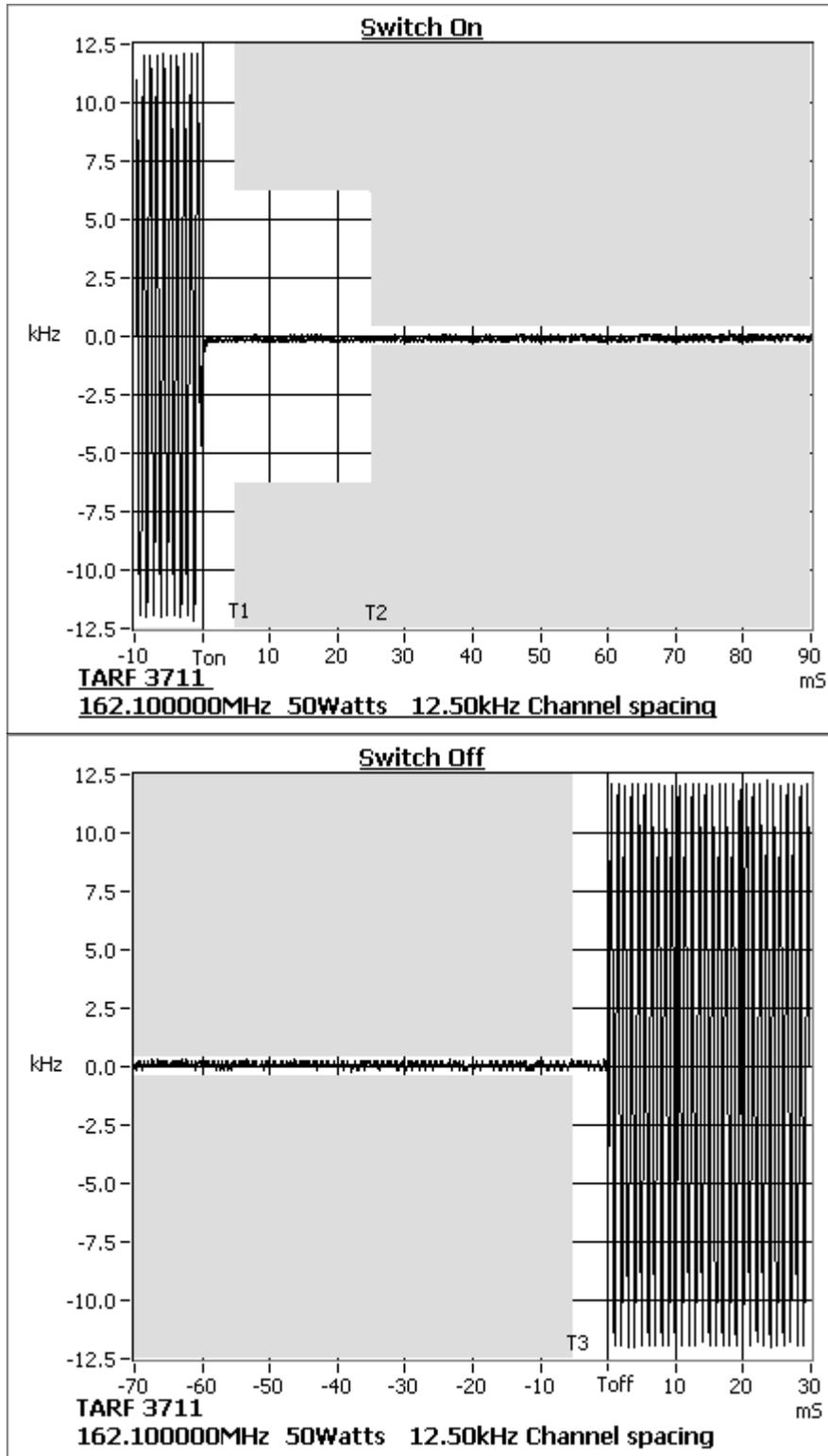
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 162.1 MHz

50 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 173.1 MHz 50 W

12.5 kHz Channel Spacing

173.1 MHz @ 50 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.8	N/A
t2	-0.3	N/A
t3	N/A	0.6

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	<input type="checkbox"/>
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	<input type="checkbox"/>

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

### Transient Frequency Behaviour

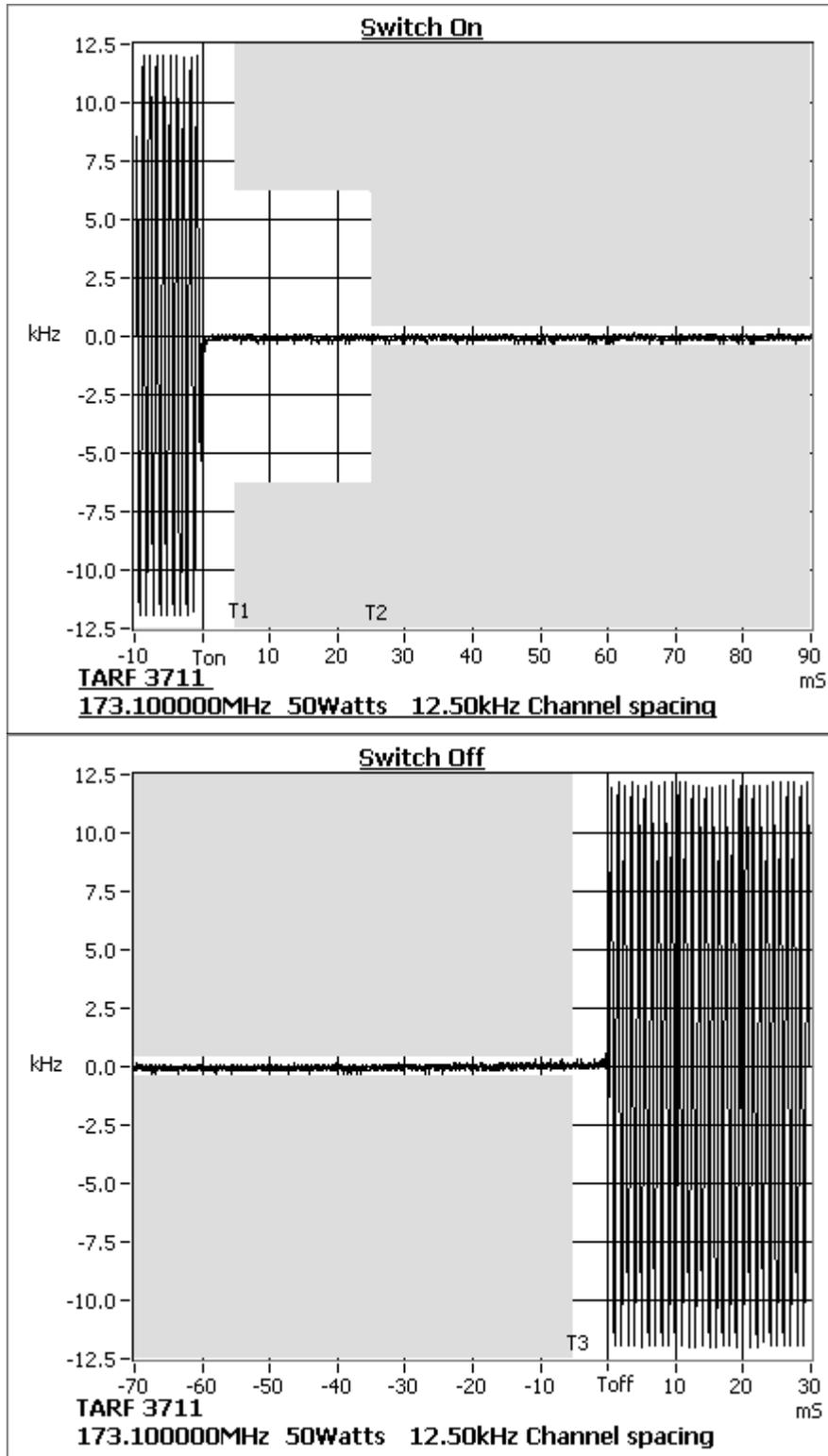
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 173.1 MHz

50 W

12.5 kHz Channel Spacing



TRANSMITTER FREQUENCY STABILITY - TEMPERATURE

SPECIFICATION: FCC 47 CFR 2.1055 (a) (1)

RSS-119 5.3

GUIDE: TIA-102.CAAA-C 2.2.2

MEASUREMENT PROCEDURE:

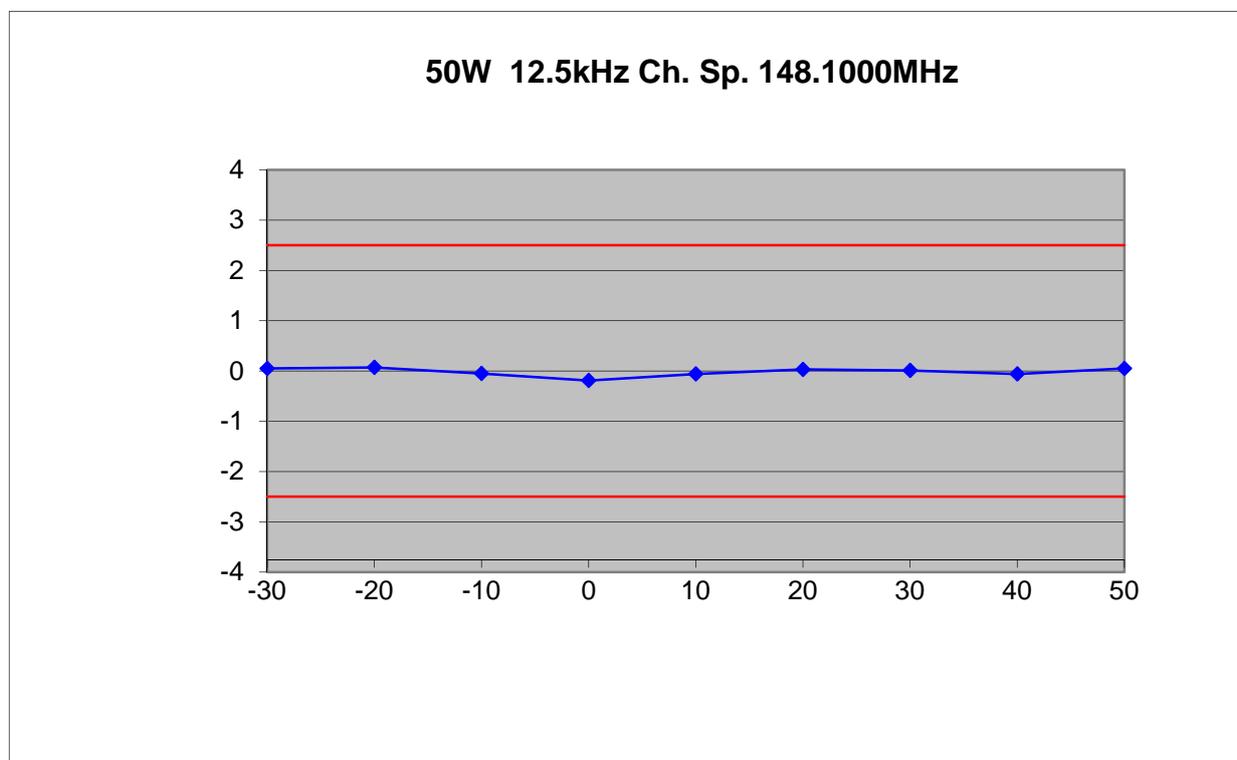
1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error from -30° C to +50° C in 10° C increments
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

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

148.1 MHz

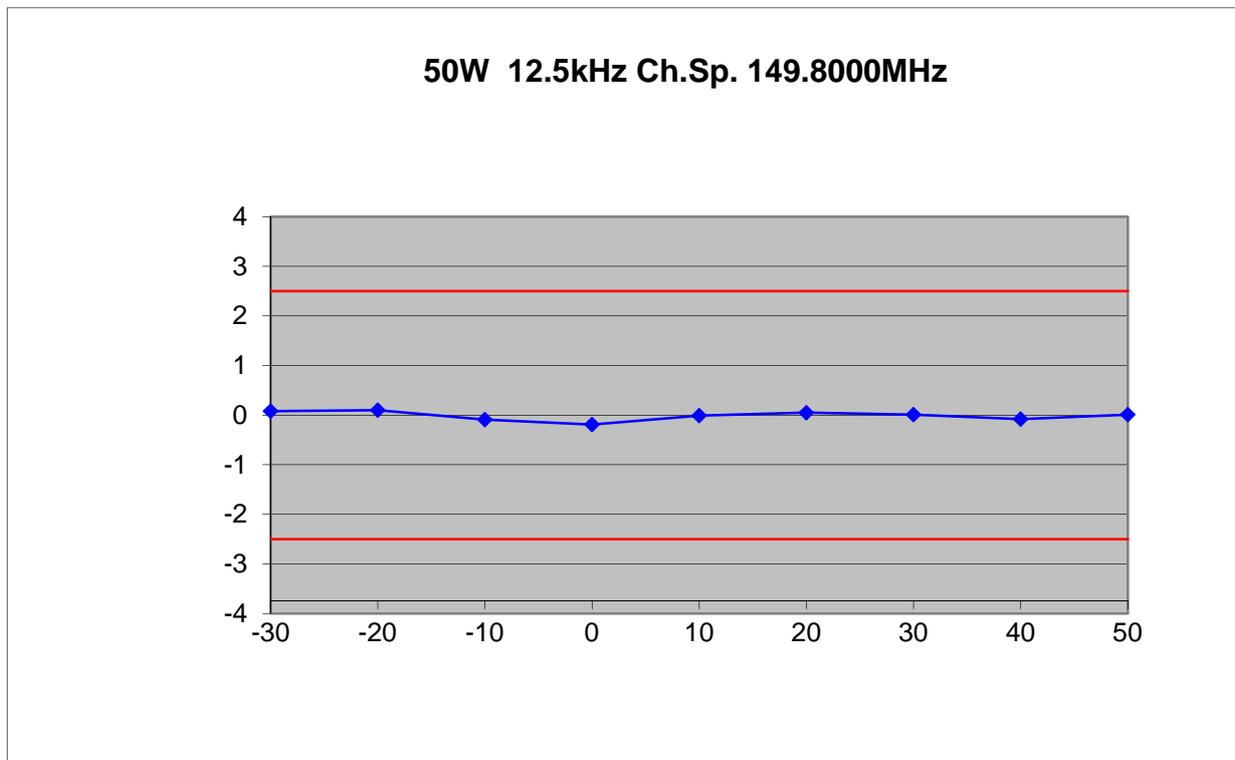
Temperature (°C)	Frequency (Hz)	Error (ppm)
-30	8	0.05
-20	10	0.07
-10	-7	-0.05
0	-28	-0.19
10	-9	-0.06
20	4	0.03
30	1	0.01
40	-9	-0.06
50	7	0.05



Transmitter Frequency Stability - Temperature

149.8 MHz

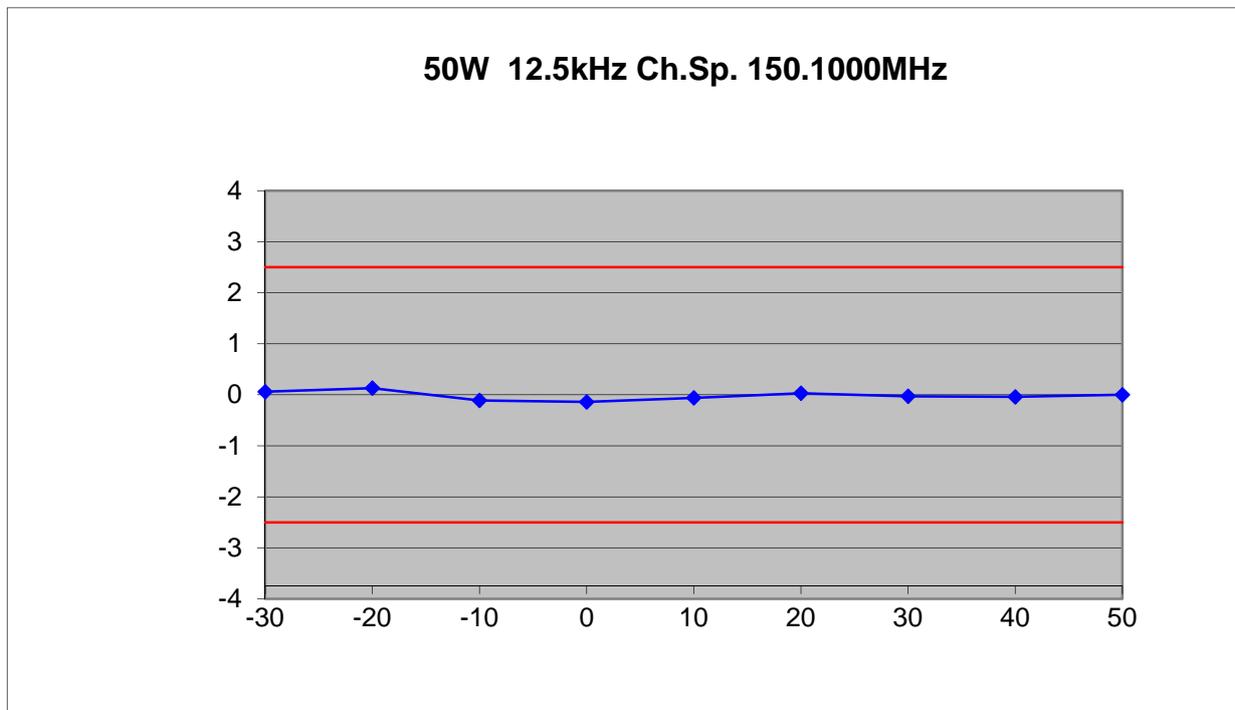
Temperature (°C)	Frequency (MHz)	Error (ppm)
-30	12	0.08
-20	15	0.1
-10	-14	-0.09
0	-28	-0.19
10	-2	-0.01
20	7	0.05
30	2	0.01
40	-12	-0.08
50	2	0.01



Transmitter Frequency Stability - Temperature

150.1 MHz

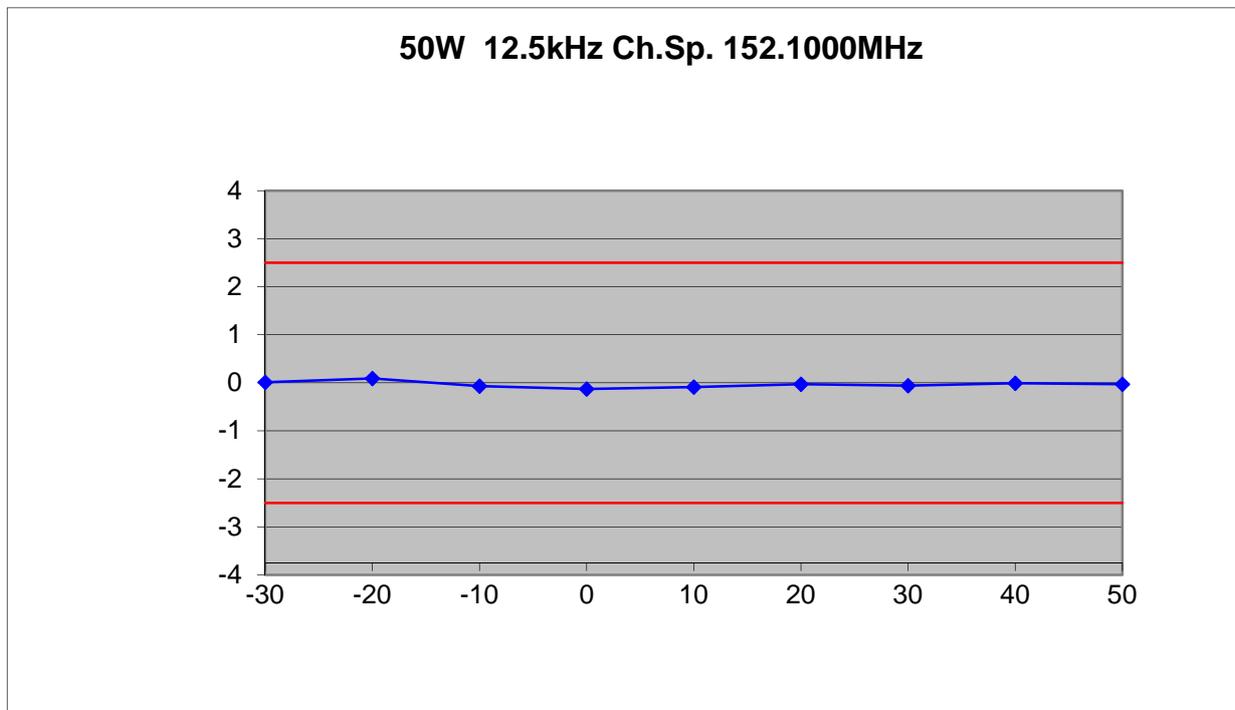
Temperature (°C)	Frequency (MHz)	Error (ppm)
-30	9	0.06
-20	19	0.13
-10	-17	-0.11
0	-21	-0.14
10	-9	-0.06
20	4	0.03
30	-4	-0.03
40	-6	-0.04
50	0	0



Transmitter Frequency Stability - Temperature

152.1 MHz

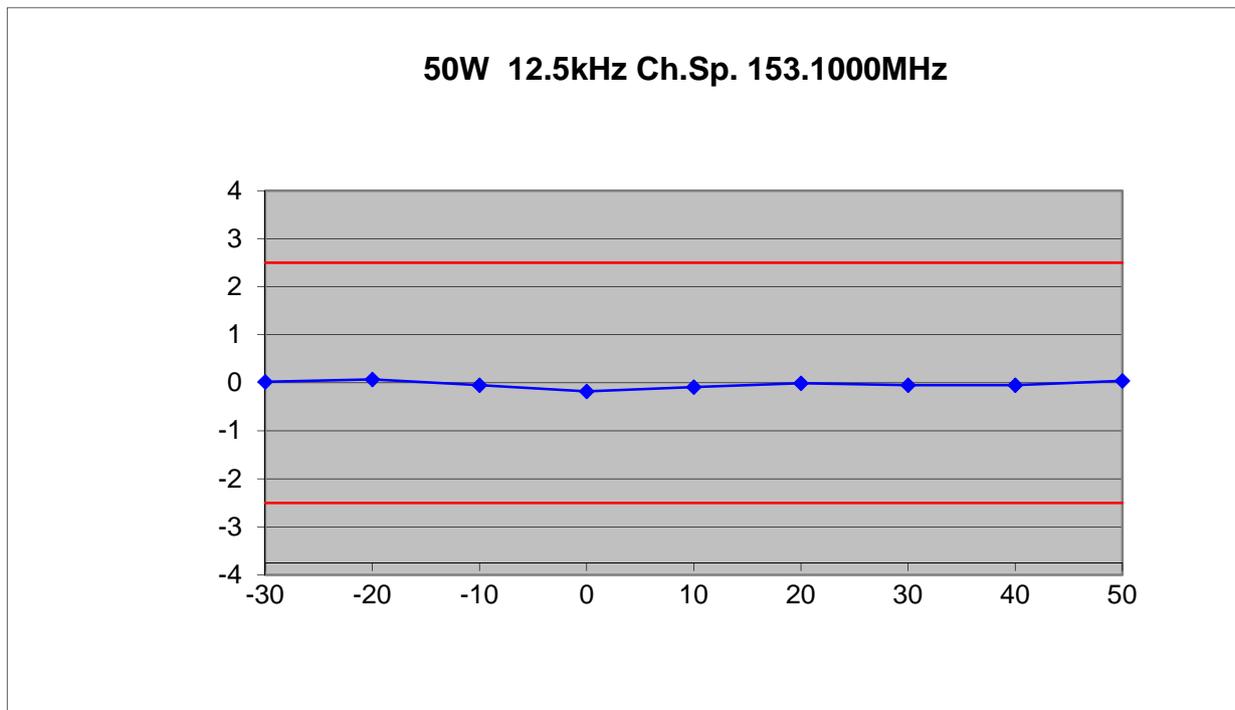
Temperature (°C)	Frequency (MHz)	Error (ppm)
-30	2	0.01
-20	14	0.09
-10	-10	-0.07
0	-20	-0.13
10	-13	-0.09
20	-5	-0.03
30	-9	-0.06
40	-1	-0.01
50	-4	-0.03



Transmitter Frequency Stability - Temperature

153.1 MHz

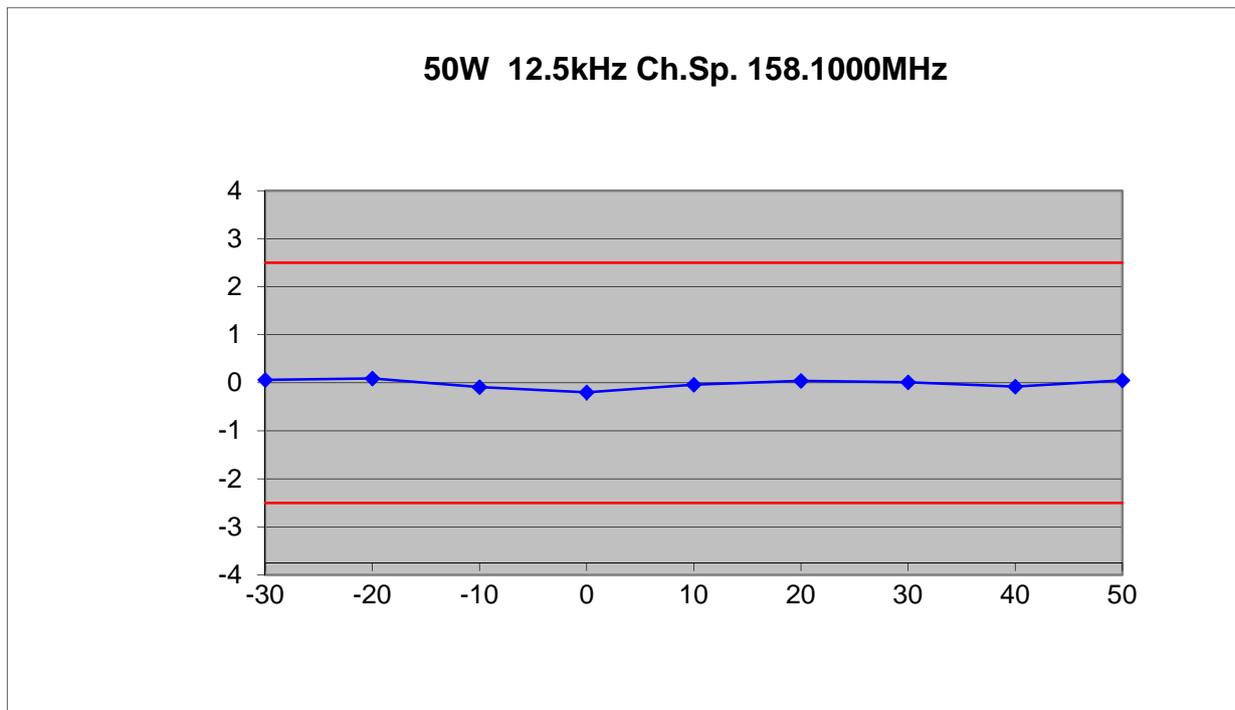
Temperature (°C)	Frequency (MHz)	Error (ppm)
-30	3	0.02
-20	11	0.07
-10	-7	-0.05
0	-27	-0.18
10	-14	-0.09
20	-2	-0.01
30	-8	-0.05
40	-8	-0.05
50	6	0.04



Transmitter Frequency Stability - Temperature

158.1 MHz

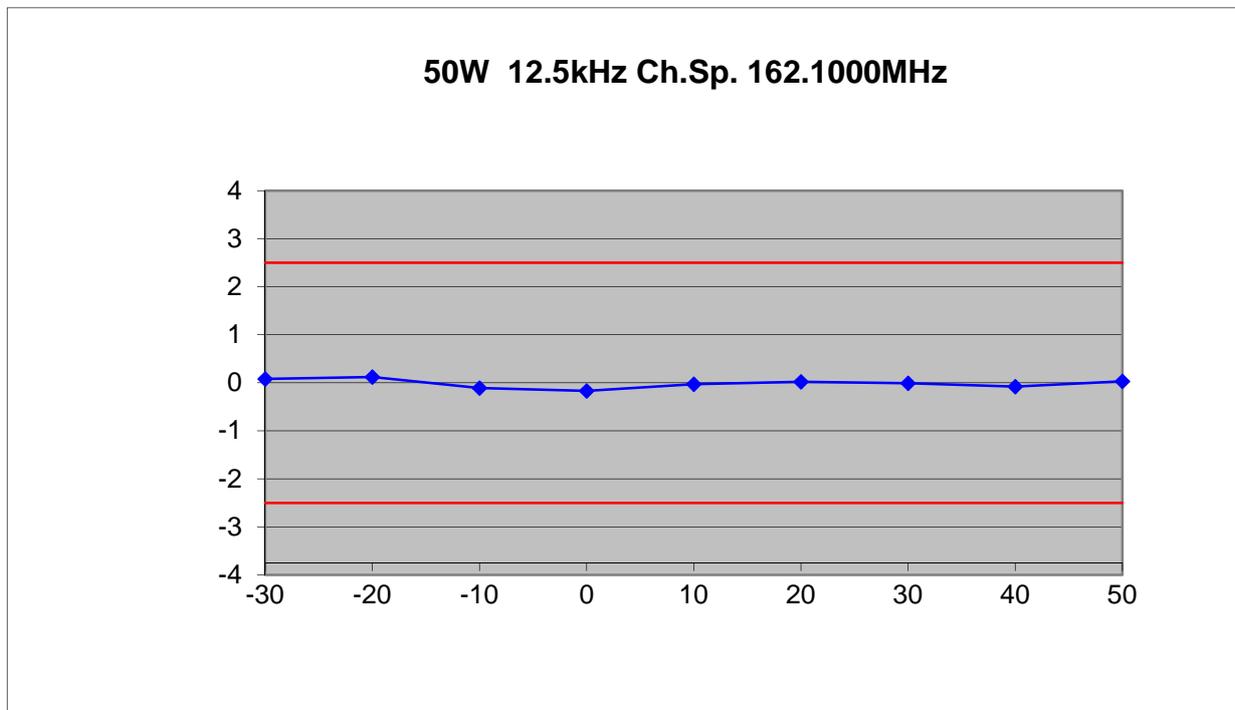
Temperature (°C)	Frequency (MHz)	Error (ppm)
-30	10	0.06
-20	14	0.09
-10	-14	-0.09
0	-31	-0.2
10	-7	-0.04
20	6	0.04
30	1	0.01
40	-13	-0.08
50	8	0.05



Transmitter Frequency Stability - Temperature

162.1 MHz

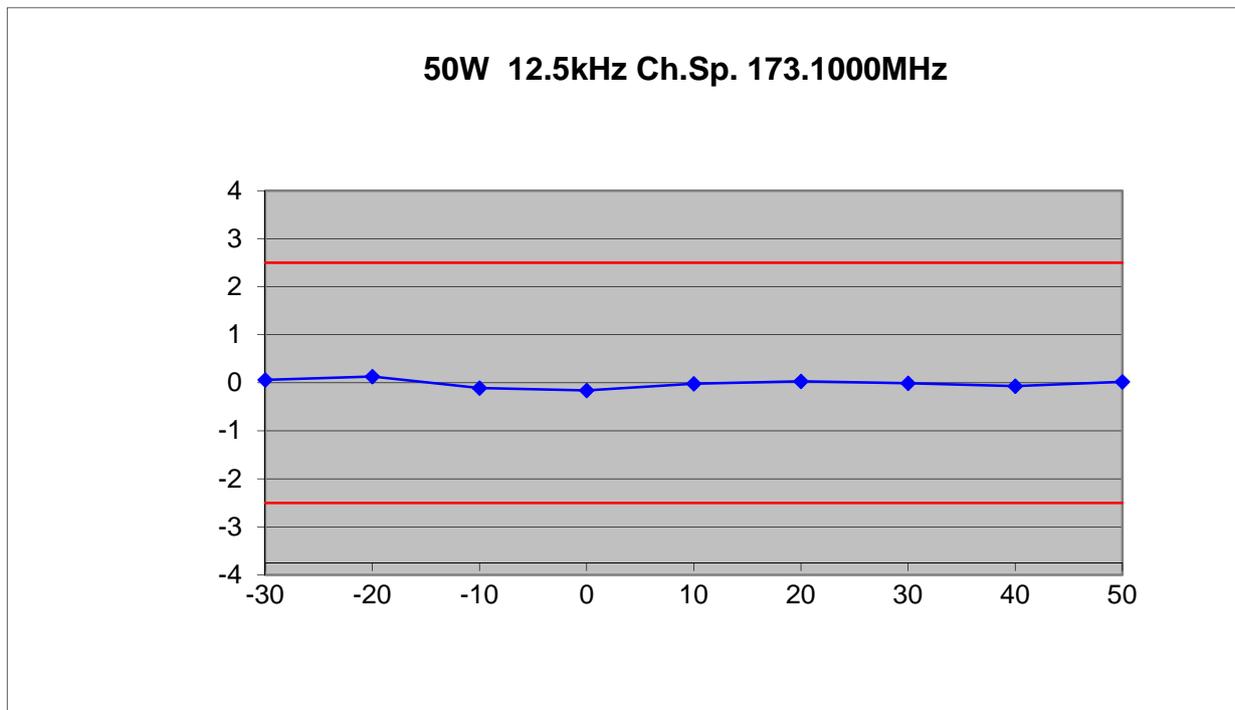
Temperature (°C)	Frequency (MHz)	Error (ppm)
-30	13	0.08
-20	19	0.12
-10	-18	-0.11
0	-27	-0.17
10	-5	-0.03
20	4	0.02
30	-1	-0.01
40	-13	-0.08
50	5	0.03



Transmitter Frequency Stability - Temperature

173.1 MHz

Temperature (°C)	Frequency (MHz)	Error (ppm)
-30	11	0.06
-20	22	0.13
-10	-19	-0.11
0	-27	-0.16
10	-4	-0.02
20	5	0.03
30	-2	-0.01
40	-12	-0.07
50	4	0.02



LIMIT:	FCC 47 CFR 90.213	RSS-119 5.3
	Channel Spacing (kHz)	Frequency Error (ppm)
	12.5	2.5

TRANSMITTER FREQUENCY STABILITY - VOLTAGE

SPECIFICATION: FCC 47 CFR 2.1055 (d) (1)

RSS-119 5.3

GUIDE: TIA-102.CAAA-C 2.2.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error at an input voltage to the radio of 85% to 115%.
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

Voltage	FREQUENCY ERROR (ppm) for 12.5 kHz							
	148.1 MHz	149.8 MHz	150.1 MHz	152.1 MHz	153.1 MHz	158.1 MHz	162.1 MHz	173.1 MHz
13.8 V <sub>DC</sub>	0.03	0.02	0.03	-0.01	0.03	-0.03	-0.02	0.00
11.7 V <sub>DC</sub>	-0.03	0.03	0.00	-0.03	-0.03	0.03	-0.02	-0.03
15.9 V <sub>DC</sub>	0.04	0.01	0.00	-0.03	-0.03	-0.04	-0.01	0.02

LIMIT CLAUSES: FCC 47 CFR 90.213

RSS-119 5.3

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	2.5

RECEIVER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: RSS-119 5.11

GUIDE: TIA-102.CAAA-C 2.1.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up diagram.
2. The frequency range examined was from 30 MHz to 3 times highest tunable frequency.
3. Spurious emissions which were attenuated more than 20 dB below the limit were not recorded.

148.1 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

149.8 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

150.1 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

162.1 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

Receiver Conducted Emissions - Continued

173.1 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

LIMIT CLAUSE: RSS-Gen 6(b)

LIMIT	30 → 1000 MHz	2 nW	- 57 dBm
	> 1000 MHz	5 nW	- 53 dBm

TRANSMITTER STANDBY SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: RSS-119 5.11

GUIDE: TIA-102.CAAA-C 2.1.2

MEASUREMENT PROCEDURE:

4. Refer Annex A for Equipment set up diagram.
5. The frequency range examined was from 30 MHz to 3 times highest tunable frequency.
6. Spurious emissions which were attenuated more than 20 dB below the limit were not recorded.

148.1 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

149.8 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

150.1 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

152.1 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

Transmitter Conducted Emissions - Continued

153.1 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

158.1 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

162.1 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

173.1 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

LIMIT CLAUSE: RSS-Gen 6(b)

LIMIT	30 → 1000 MHz	2 nW	- 57 dBm
	> 1000 MHz	5 nW	- 53 dBm

## TEST EQUIPMENT LIST

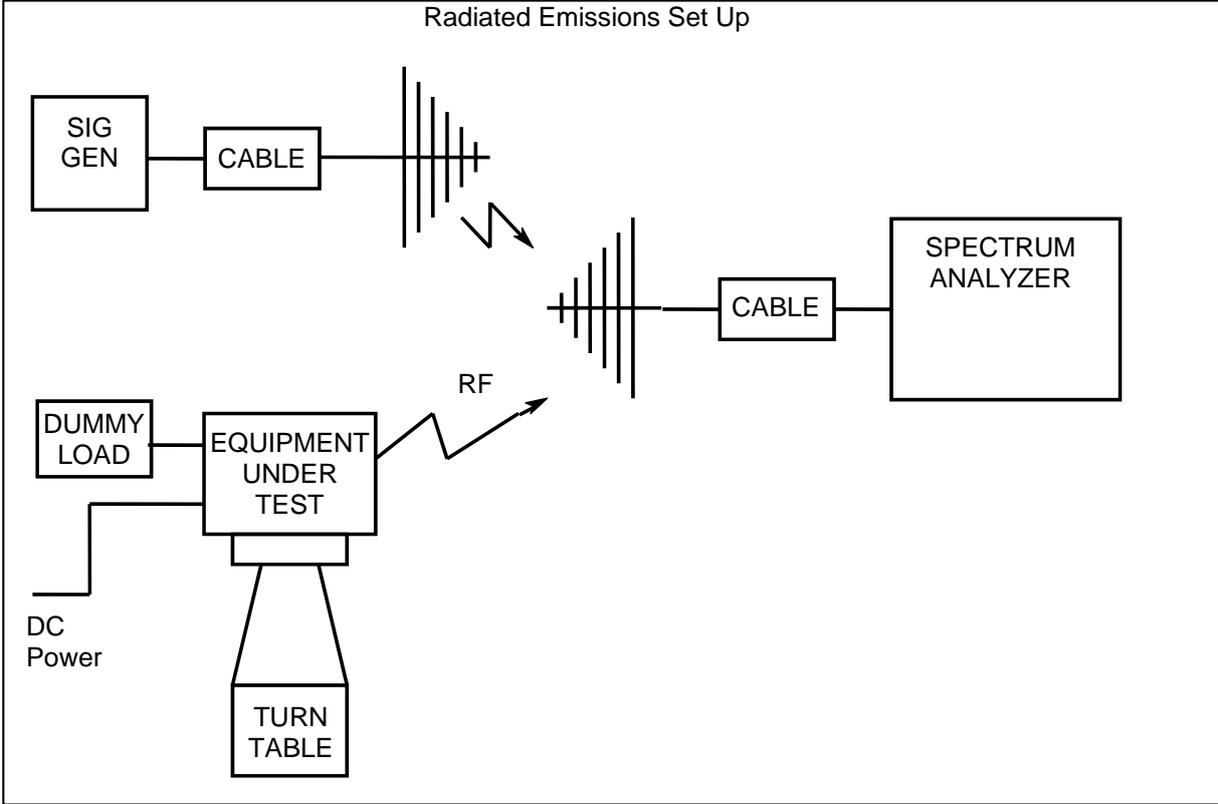
Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
Antenna	Reference Dipoles	Emco	3121C DB1	9510-1164	E3559	30-Jan-16
Antenna	Biconical	Emco	3110B	9307-1680	E3033	
Antenna	18GHz DRG	Emco	DRG3115	9512-4638	E3560	6-Mar-16
Antenna	Log Periodic	Schwarzbeck	VUSLP	9111-219	E4617	
Antenna	Reverb - 1-18GHz DRG	Schwarzbeck	BBHA 9120 D	9120D-885	E4857	
Antenna	Reverb - 1-18GHz DRG	Schwarzbeck	BBHA 9120 D	9120D-884	E4858	
Audio Analyser	TREVA2	Hewlett Packard	HP8903B	2818A04275	E3710	20-Oct-16
Coax Cable	2m Black	Suhner	RG214HF/Nm/ Nm/2000	TeltestBlack2	E4623	18-Oct-16
Coax Cable	2m Black	Suhner	RG214HF/Nm/ Nm/2000	TeltestBlack3	E4624	18-Oct-16
Coax Cable	OATS Turntable Cable 1	Intelcom	RG214	OATS1	E4621	20-Oct-16
Coax Cable	OATS Tower Cable	Intelcom	RG214	OATS2	E4622	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
Coax Cable	Reverb - 4.5m Multiflex 141	TeltestBlue6	MF 141	TeltestBlue6	E4843	20-Oct-16
Coax Cable	Reverb - 2m Multiflex 141	TeltestBlue5	MF 141	TeltestBlue5	E4844	20-Oct-16
Coax Cable	Reverb - 2m Multiflex 141	TeltestBlue4	MF 141	TeltestBlue4	E4845	20-Oct-16
Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue3	MF 141	TeltestBlue3	E4846	20-Oct-16
Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue1	MF 141	TeltestBlue1	E4848	20-Oct-16
Coax Cable	OATS Turntable Cable 2	Intelcom	RG215	OATS3	E4995	20-Oct-16
Environ. Chamber	Chest	Contherm	Chest	E3397	E3397	1-Aug-17
Modulation Analyser	TREVA2	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	20-Oct-16
Multimeter		Fluke	77	35069359	E3237	13-Oct-16
OATS	NSA	Tait				9-Jun-16
OATS	Antenna Tower	Electrometrics	EM-4720-2	112	E4447	
OATS	Controller	Electrometrics	EM-4700	119	E4445	
OATS	Turntable	Electrometrics	EM-4704A	105	E4446	
OATS	FCC Listing Registration			837095		12-May-16
Oscilloscope	100MHz Digital	Tektronics	TDS340	B013611	E3585	13-Oct-17
Power Meter	TREVA2 Power Head for HP8901	Hewlett Packard	HP11722A	2716A02037	1575	20-Oct-16
Power Supply		Rohde & Schwarz	NGS M32/10 192.0810.31	Fnr 434	E3556	22-Mar-16
Power Supply	TREVA2 60V/25A	Agilent	N5767A	US09F4901H	E4656	18-Oct-17
Power Supply	60V/50A/1000W	Hewlett Packard	HP6012B	2524A00616	E3712	15-Oct-17
Power Supply	60V/25A	Agilent	N5767A	3111A05573	E4979	18-Oct-17
RF Amplifier	+21.7 dB 1GHz	Tait	ZFL-1000LN	E3660	E3360	17-Jan-17
RF Amplifier	Pre-amplifier	Agilent	87405C	MY47010688	E4941	20-Oct-16
RF Attenuator	10dB 150W	Weinschel	57-10-34	LB590	E3674	18-Oct-16
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	

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RF Chamber	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	29-Sep-16
RF Chamber	Reverb - Stirrer controller for reverb chamber	Teseq	Stirrer Controller	29765.1	E4854	
RF Chamber	Reverb - 0.5 - 18GHz Reverberation Chamber	Teseq	RVC XS	29765	E4855	
RF Combiner	TREVA2	Minicircuits	ZFSC-4-1	-	E4084	
RF Load	150W	Bird	8166	524	E3625	
Signal Generator	Analog 4GHz	Agilent	E4422B	GB40050320	E3788	18-Oct-16
Signal Generator	Digital 4GHz	Agilent	E4433B	US38440446	E4147	22-Oct-16
Signal Generator	TREVA2 Analog 3.3GHz	Rohde & Schwarz	SML03 1090.3000.13	100597	E4050	18-Oct-16
Spectrum Analyser	26.5GHz	Agilent	PXA N9030A	MY49432161	E4907	6-Jul-16
Spectrum Analyser	13.2GHz	Agilent	E4445A	MY42510072	E4139	22-Oct-16
Temp & Humidity datalogger		Hobo	U21-011	10134276	E4981	14-Aug-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 other 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.

