TELTEST Laboratories
Tait International Ltd
Report Number 4008

# LABORATORY TEST REPORT

## RADIO PERFORMANCE MEASUREMENTS

for the

TBDH5F Transportable Base Station Transceiver

Tested in accordance with:

FCC 47 CFR Parts 22 and 90

Report Revision: 1

Issue Date: 18 October 2019

PREPARED BY: A. Schinkelshoek

Test Technician

CHECKED & APPROVED BY: M. C. James

Laboratory Technical Manager

ACCREDITED LABORATORY

FCC REGISTRATION: 838288



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# REVISION

| Date | Revision | Comments |
|---|---|---|
| 18 October 2019 | 1 | Initial test report |
| | | |

# INTRODUCTION

Type approval testing of the TBDH5F, 30 Watt, Transportable Base Station transceiver, in order to demonstrate compliance with FCC 47 Parts 22 & 90. This radio supports analogue, digital FFSK, Digital Mobile Radio (DMR), APCO P25 phase-1 modulations.

REPORT PREPARED FOR
Tait International Ltd
245 Wooldridge Road
Harewood
Christchurch 8051
New Zealand

DESCRIPTION OF SAMPLE

| | |
|---|---|
| Manufacturer | Tait International Limited |
| Equipment: | Transportable Base Station Transceiver |
| Type: | TBDH5F |
| Product Code: | TB7304-H580 |
| Serial Number(s): | 18298071 |
| Frequency range | 400 → 470 MHz |
| Transmit Power | 30 W |

Quantity: 1

| Modulation | | Channel Spacing | Speech Channels | Symbol Rate (symbols/sec) | Data Rate (bps) |
|---|---|---|---|---|---|
| Analogue FM | | 12.5 kHz | 1 | - | - |
| FFSK | Fast Frequency Shift Keying | 12.5 kHz | - | 1200 | 1200 |
| | | 12.5 kHz | - | 2400 | 2400 |
| Digital Mobile Radio (DMR) | 4 Level FSK (2 slot TDMA) (ETSI TS102 361-1) | 12.5 kHz | 2 | 4800 | 9600 |
| APCO P25 Phase 1 | C4FM (TIA 102) | 12.5 kHz | 1 | 4800 | 9600 |

HARDWARE & SOFTWARE

## Analog and DMR Tests:

| Module | Product Code | Serial Number | Firmware Version | Hardware Version |
|---|---|---|---|---|
| Reciter | T01-01403-SBAA | 18295659 | dmr-trunk.20190903T140206 | 01.01 |
| Power Amplifier | T01-01405-SCAA | 18301518 | < Not applicable > | 00.01 |

## P25 Tests:

| Module | Product Code | Serial Number | Firmware Version | Hardware Version |
|---|---|---|---|---|
| Reciter | T01-01403-SBAA | 18295659 | p25-trunk.20190903T112122 | 1.01 |
| Power Amplifier | T01-01405-SCAA | 18301518 | < Not applicable > | 00.01 |

TEST CONDITIONS

All testing was performed between 18 September 2019 → 17 October 2019, and under the following conditions:

Indoor Ambient temperature: 15°C → 30°C
Indoor Relative Humidity: 20% → 75%
Outdoor Ambient temperature: 48% → 77%
Outdoor Relative Humidity: 24% → 44%

All tests except Radiated emissions were done at 13.8 $V_{DC.}$
Radiated emissions were measured at 120 $V_{AC}$

# STATEMENT OF COMPLIANCE

We, TELTEST LABORATORIES of 558 Wairakei Road, Christchurch, New Zealand, declare under our sole responsibility that the product:

| | |
|---|---|
| Equipment: | Transportable Base Station Transceiver |
| Type: | TBDH5F |
| Product Code: | TB7304-H580 |
| Serial Number(s): | 18298071 |
| Quantity: | 1 |

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

FCC 47 CFR Parts 22 and 90

**Signature:** 

M. C. James
Laboratory Technical Manager

**Date:** 11 November 2014

# MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

## MODULATION TYPES:

| | | |
|---|---|---|
| F3E | Analogue Frequency Modulation (FM) | |
| F2D | FFSK | 1200 bps and 2400 bps |
| FXW | DMR Digital Voice | 9600 bps |
| FXD | DMR Digital Data | 9600 bps |
| F1E, F7E | P25 phase 1 Digital Voice | 9600 bps |
| F1D, F7D | P25 phase 1 Digital Data | 9600 bps |

## CHANNEL SPACING: 12.5 kHz

## EMISSION DESIGNATORS:

| | *12.5 kHz* |
|---|---|
| Analog FM | 11K0F3E |
| FFSK Data 1200 bps | 6K60F2D |
| FFSK Data 2400 bps | 7K80F2D |
| Digital Voice DMR | 7K60FXW |
| Digital Data DMR | 7K60FXD |
| Digital Voice P25 phase 1 | 8K10F1E |
| Digital Data P25 phase 1 | 8K10F1D |

## CALCULATIONS

Equation: Bn = 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
Bn = (2x3.0) + (2x2.5) x 1
= 11.0 kHz

Emission Designator
**11K0F3E**
F3E represents an FM voice transmission

### Fast Frequency Shift Keying (FFSK – 1200 bps) 12.5 kHz Bandwidth

Necessary bandwidth
M = 1.8 kHz
D = 1.5 kHz (60% of peak deviation)
Bn = (2 x 1.8) + (2 x 1.5) x 1
= 6.6 kHz

Emission Designator
**6K60F2D**
F2D represents a FM data transmission with the use of a modulating sub carrier

## Emission Designators – Continued

### Digital Voice 12.5 kHz Bandwidth DMR

| 99% bandwidth | Emission Designator |
|---|---|
| = 7.6 kHz | **7K60FXW**<br>FXW represents a FM Time Division Multiple Access (TDMA) combination of data and telephony |

### Digital Data 12.5 kHz Bandwidth DMR

| 99% bandwidth | Emission Designator |
|---|---|
| = 7.6 kHz | **7K60FXD**<br>FXD represents FM Time Division Multiple Access (TDMA) data only |

### Digital Voice 12.5 kHz Bandwidth P25 phase 1

| 99% bandwidth | Emission Designator |
|---|---|
| = 8.1 kHz | **8K10F1E**<br>F1E represents a digital FM voice transmission |

### Digital Data 12.5 kHz Bandwidth P25 phase 1

| 99% bandwidth | Emission Designator |
|---|---|
| = 8.1 kHz | **8K10F1D**<br>F1D represents a digital FM data transmission |

# TEST RESULTS

## TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046

GUIDE: ANSI C63.26 5.2.4.2

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.

EXAMPLE CALCULATION:

| Example calculation | |
|---|---|
| Power in dBm = | Measured power (dBm) + attenuator and cable loss (dB) |
| Chan 1 power (dBm) = | 12.77 dBm +31.05 dB |
| = | 43.82dBm |
| Power in Watts = | (10^(43.82dBm)/10)/1000 |
| = | 24.1W |

Copy from TREVA sheet.

MEASUREMENT RESULTS:

Manufacturer's Rated Output Power: Switchable: 30 W and 2 W

| Nominal 30 W | Measured (W) | Variation (%) | Variation (dB) |
|---|---|---|---|
| 406.2 MHz | 24.1 | -19.6 | -0.9 |
| 418.05 MHz | 24.4 | -18.8 | -0.9 |
| 429.9 MHz | 24.5 | -18.2 | -0.9 |
| 450.1 MHz | 24.4 | -18.5 | -0.9 |
| 454.5 MHz | 24.4 | -18.6 | -0.9 |
| 460.0 MHz | 24.4 | -18.7 | -0.9 |
| 465.0 MHz | 24.1 | -19.7 | -1.0 |
| 469.9 MHz | 24.1 | -19.5 | -0.9 |
| Measurement Uncertainty | | ± 0.6 dB | |

Transmitter Output Power (Conducted) - continued

| Nominal 2 W | Measured (W) | Variation (%) | Variation (dB) |
|---|---|---|---|
| 406.2 MHz | 2.1 | 5.5 | 0.2 |
| 418.05 MHz | 2.0 | 2.1 | 0.1 |
| 429.9 MHz | 2.0 | 1.1 | 0.0 |
| 450.1 MHz | 2.1 | 4.5 | 0.2 |
| 454.5 MHz | 2.1 | 3.7 | 0.2 |
| 460.0 MHz | 2.0 | 0.3 | 0.0 |
| 465.0 MHz | 1.9 | -5.6 | -0.2 |
| 469.9 MHz | 1.8 | -8.2 | -0.4 |
| 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.

# TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: ANSI C63.26 5.3.3.2

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.

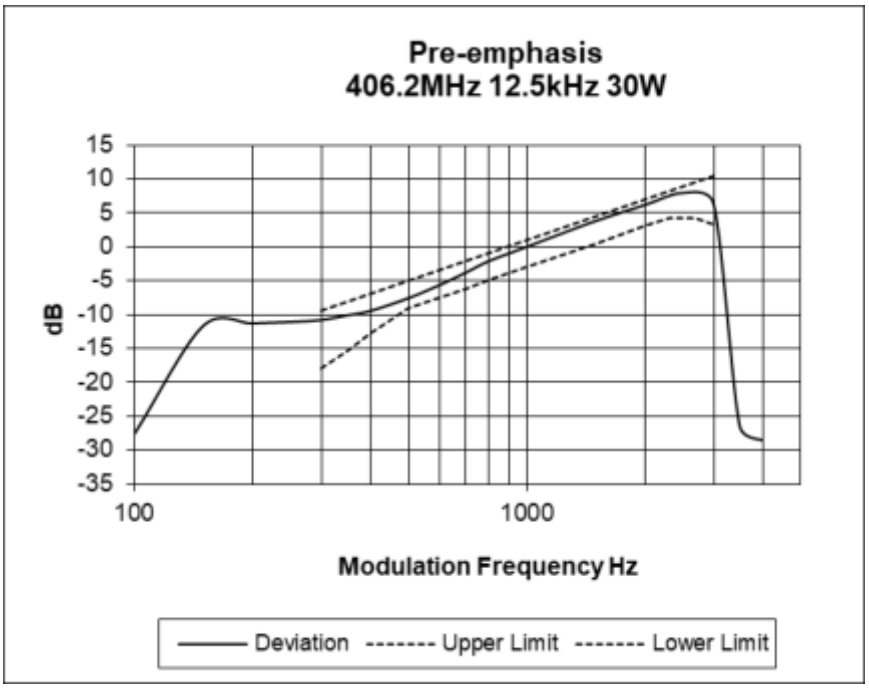
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing tested at 30 W transmit power.

LIMIT CLAUSE: TIA/EIA-603D 3.2.6

MEASUREMENT UNCERTAINTY: ± 1.5 %

SPECIFICATION: FCC CFR 2.1047 (a

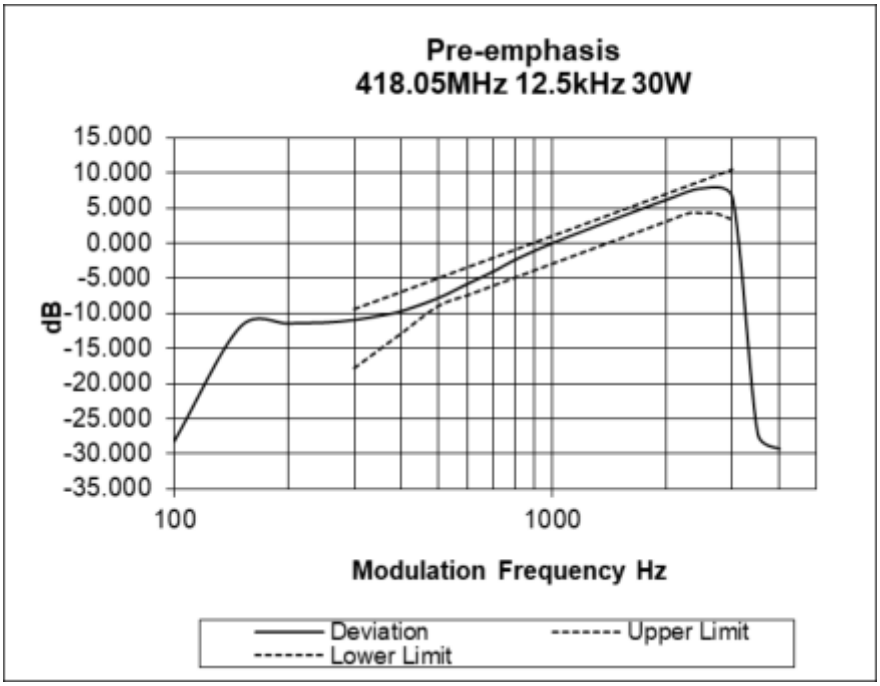
Tx FREQUENCY: 406.2 MHz 12.5 kHz Channel Spacing



# Transmitter Audio Frequency Response – Pre-emphasis

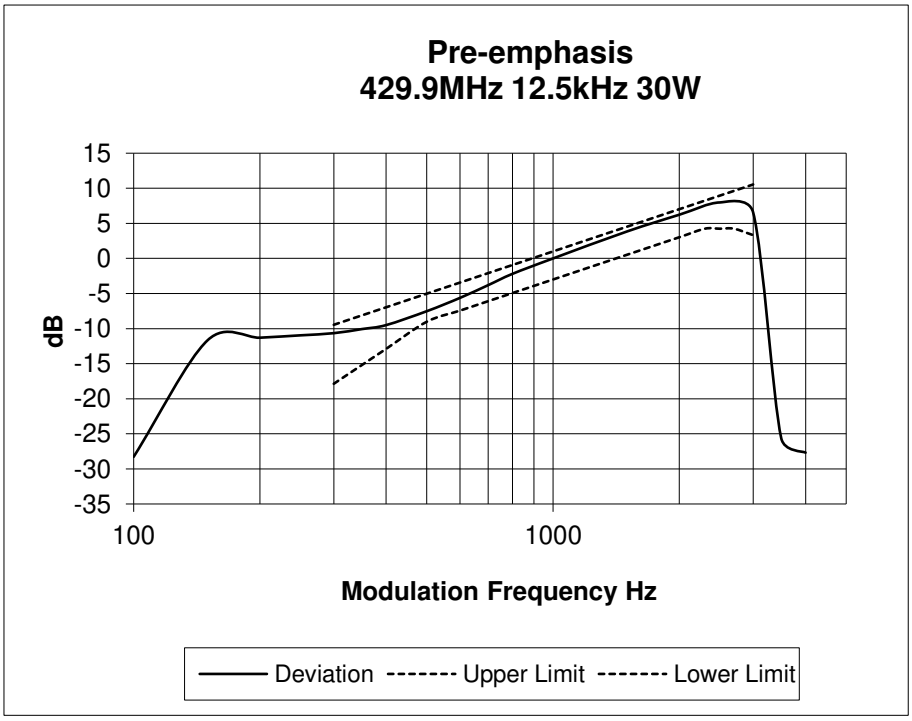
SPECIFICATION: FCC 47 CFR 2.1047 (a)

Tx FREQUENCY: 418.05 MHz 12.5 kHz Channel Spacing




SPECIFICATION: FCC 47 CFR 2.1047 (a)

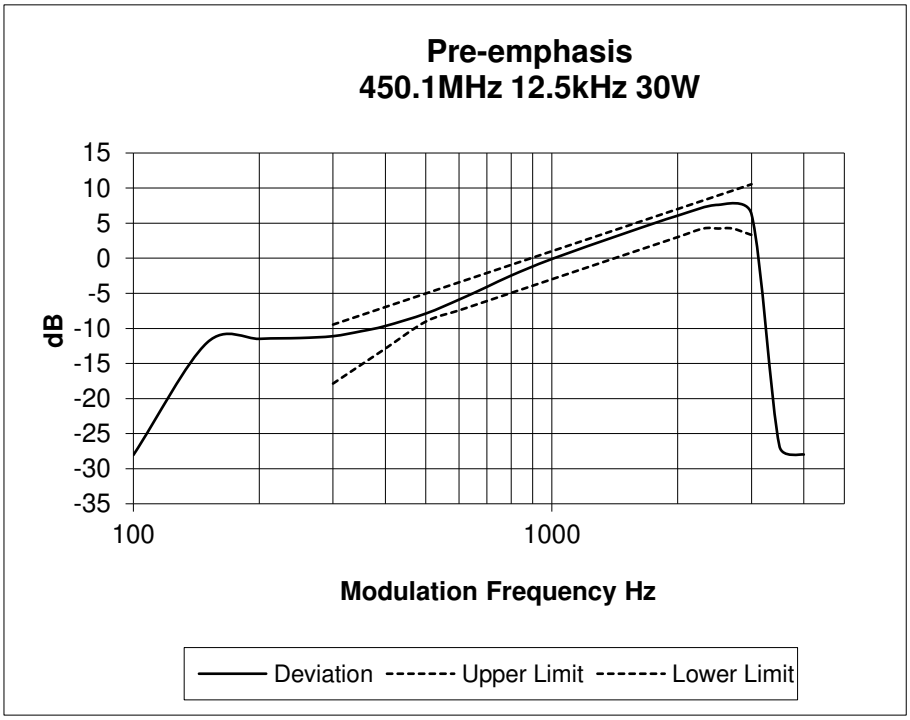
Tx FREQUENCY: 429.9 MHz 12.5 kHz Channel Spacing



## Transmitter Audio Frequency Response – Pre-emphasis

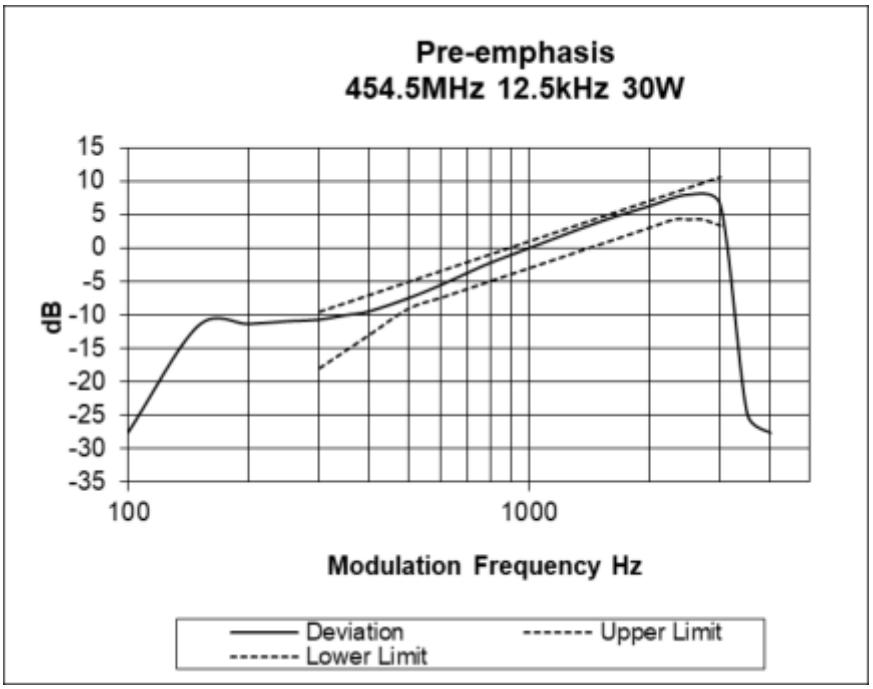
SPECIFICATION: FCC 47 CFR 2.1047 (a)

Tx FREQUENCY: 450.1 MHz 12.5 kHz Channel Spacing




SPECIFICATION: FCC 47 CFR 2.1047 (a)

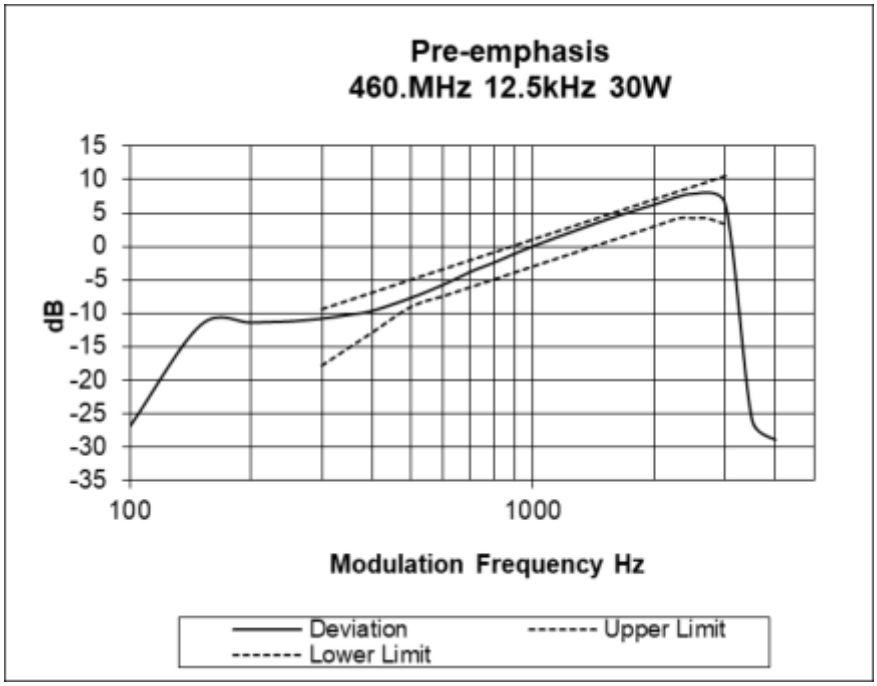
Tx FREQUENCY: 454.5 MHz 12.5 kHz Channel Spacing



# Transmitter Audio Frequency Response – Pre-emphasis

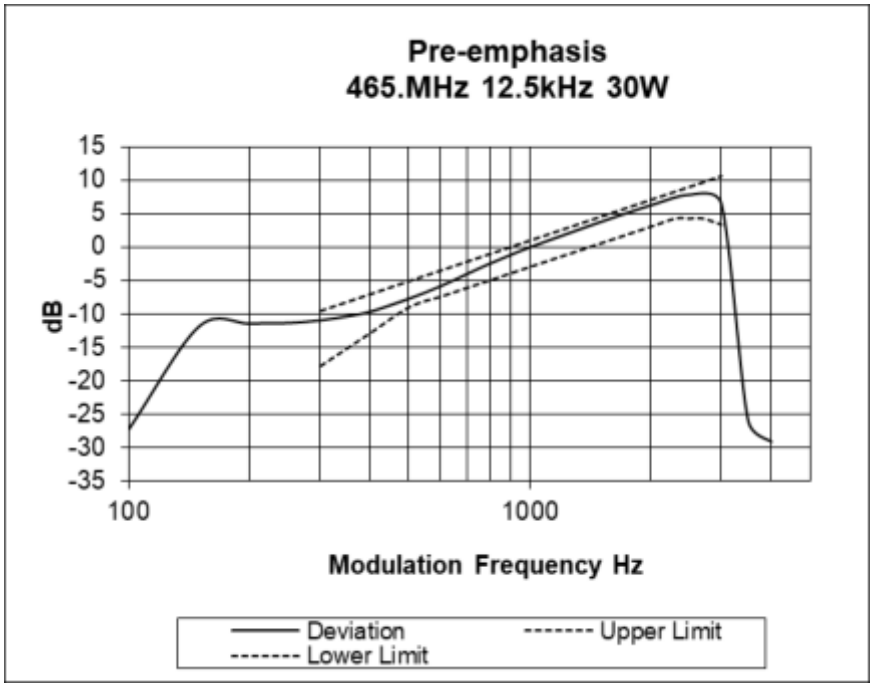
SPECIFICATION: FCC 47 CFR 2.1047 (a)

Tx FREQUENCY: 460.0 MHz 12.5 kHz Channel Spacing




SPECIFICATION: FCC 47 CFR 2.1047 (a)

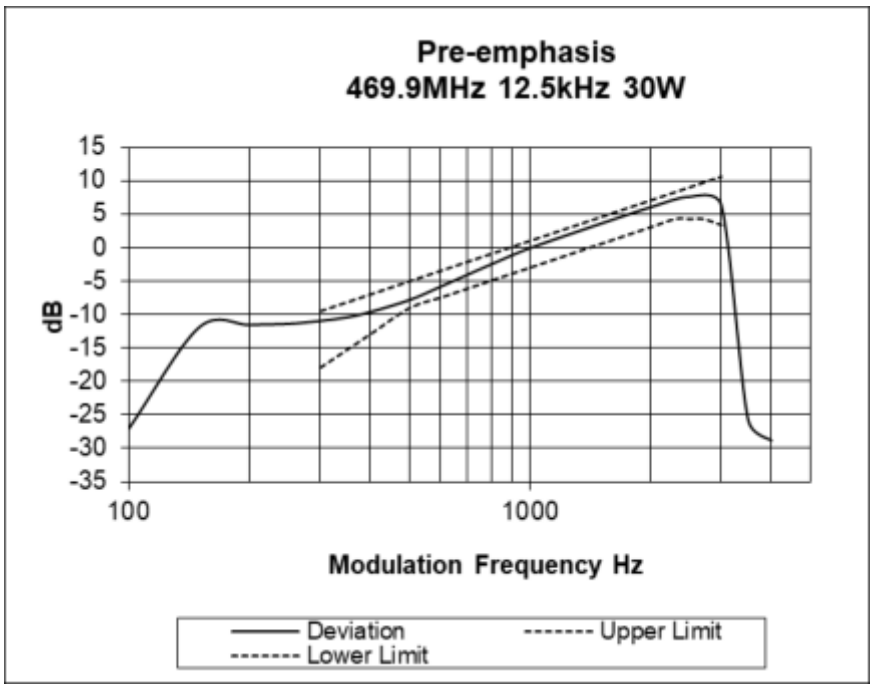
Tx FREQUENCY: 465.0 MHz 12.5 kHz Channel Spacing



# Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC 47 CFR 2.1047 (a)

Tx FREQUENCY: 469.9 MHz 12.5 kHz Channel Spacing



# TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: ANSI C63.26 5.3.2

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 60% of maximum deviation. This was used as the 0-dB reference point.
3. The modulation response was measured at four audio frequencies while increasing the input level in 5dB steps.
4. Additionally the level used to measure sideband spectrum (occupied bandwidth) was included in the level sweep.
5. Measurements were made for both Positive and Negative Deviation.

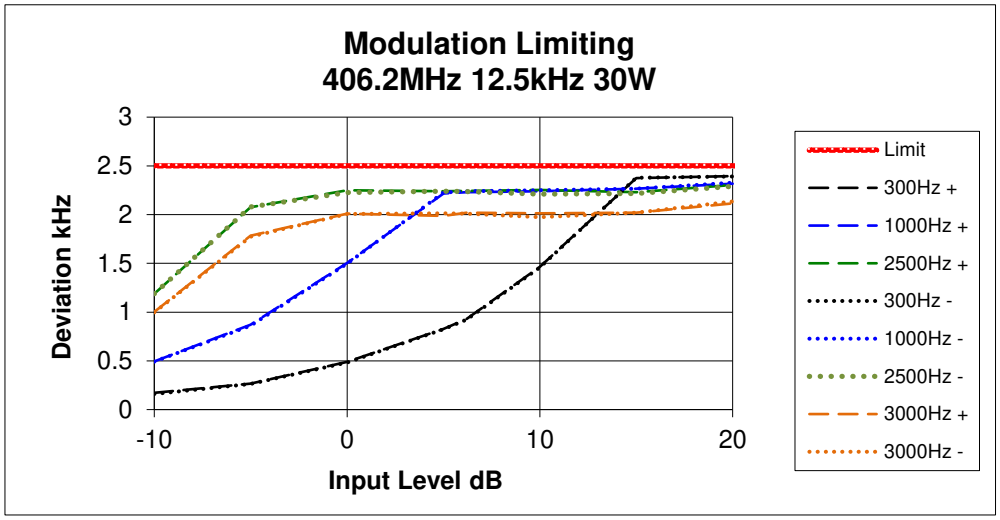
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

MEASUREMENT UNCERTAINTY: ± 1.5 %

SPECIFICATION: FCC 47 CFR 2.1047 (b)

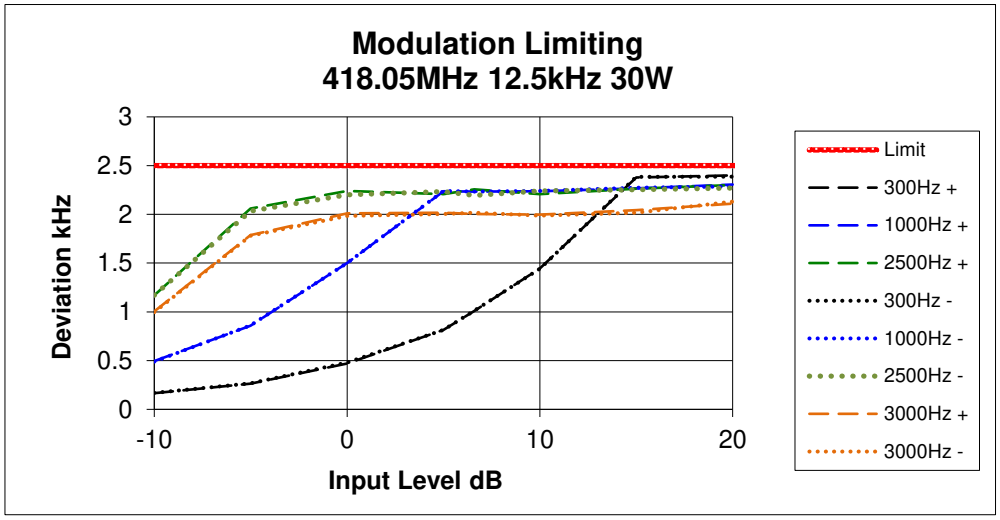
Tx FREQUENCY: 406.2 MHz 12.5 kHz Channel Spacing



# Transmitter Modulation Limiting

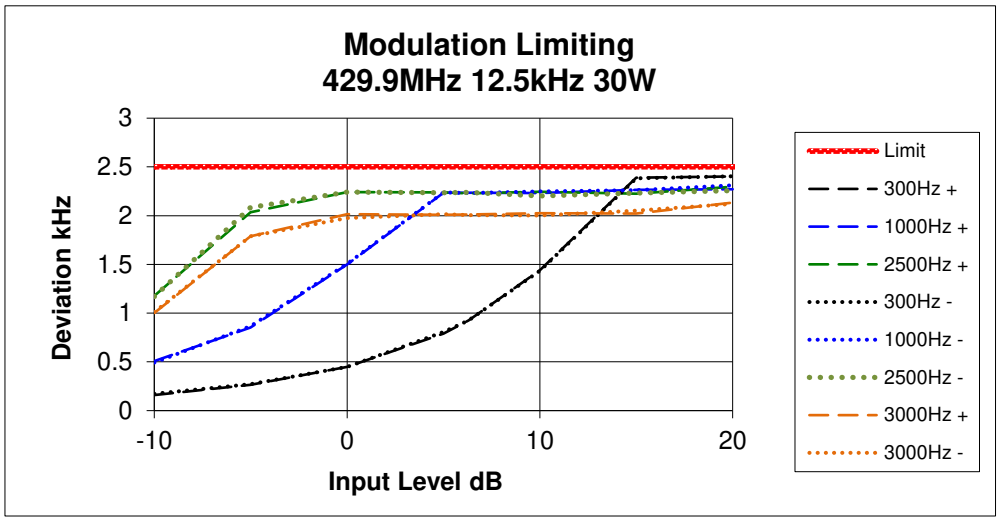
SPECIFICATION: FCC 47 CFR 2.1047 (b)

Tx FREQUENCY: 418.05 MHz 12.5 kHz Channel Spacing




SPECIFICATION: FCC 47 CFR 2.1047 (b)

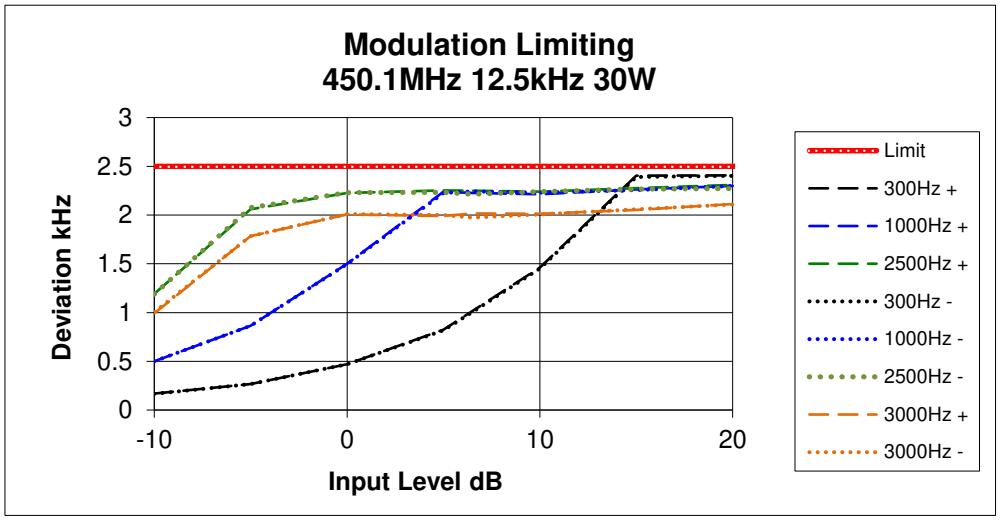
Tx FREQUENCY: 429.9 MHz 12.5 kHz Channel Spacing



# Transmitter Modulation Limiting

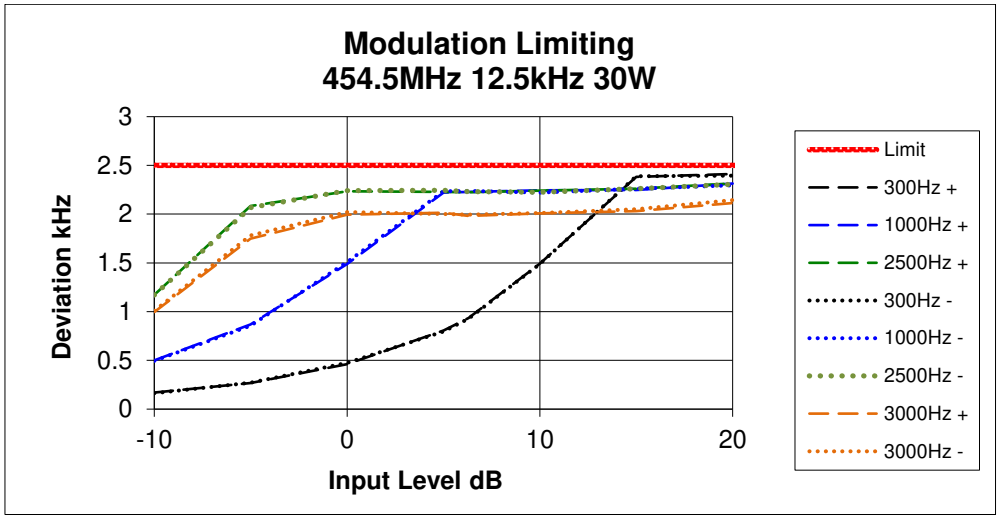
SPECIFICATION: FCC 47 CFR 2.1047 (b)

Tx FREQUENCY: 450.1 MHz 12.5 kHz Channel Spacing




SPECIFICATION: FCC 47 CFR 2.1047 (b)

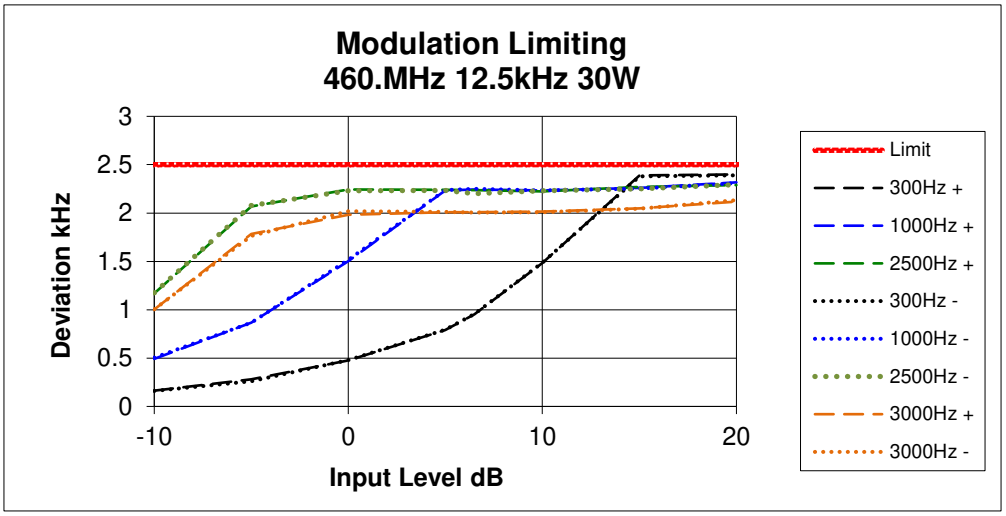
Tx FREQUENCY: 454.5 MHz 12.5 kHz Channel Spacing



# Transmitter Modulation Limiting

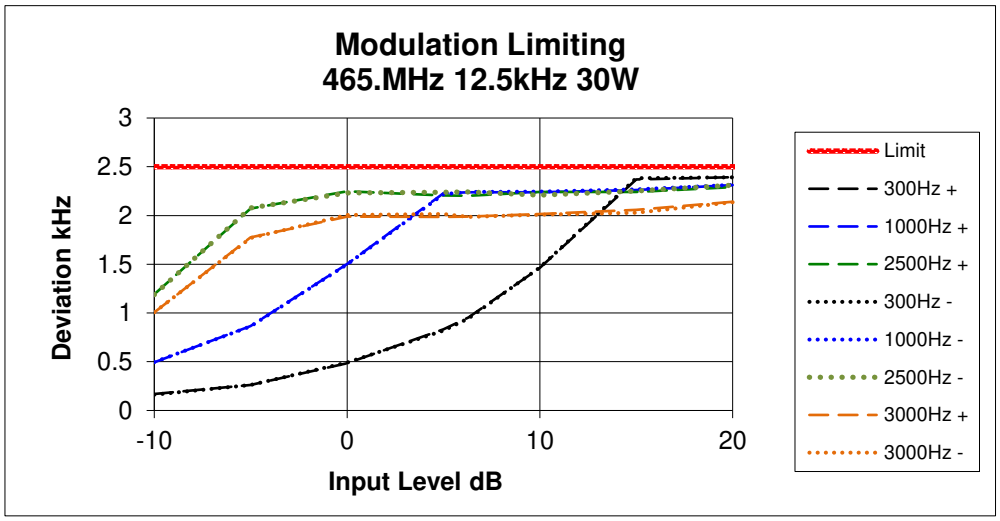
SPECIFICATION: FCC 47 CFR 2.1047 (b)

Tx FREQUENCY: 460.0 MHz 12.5 kHz Channel Spacing




SPECIFICATION: FCC 47 CFR 2.1047 (b)

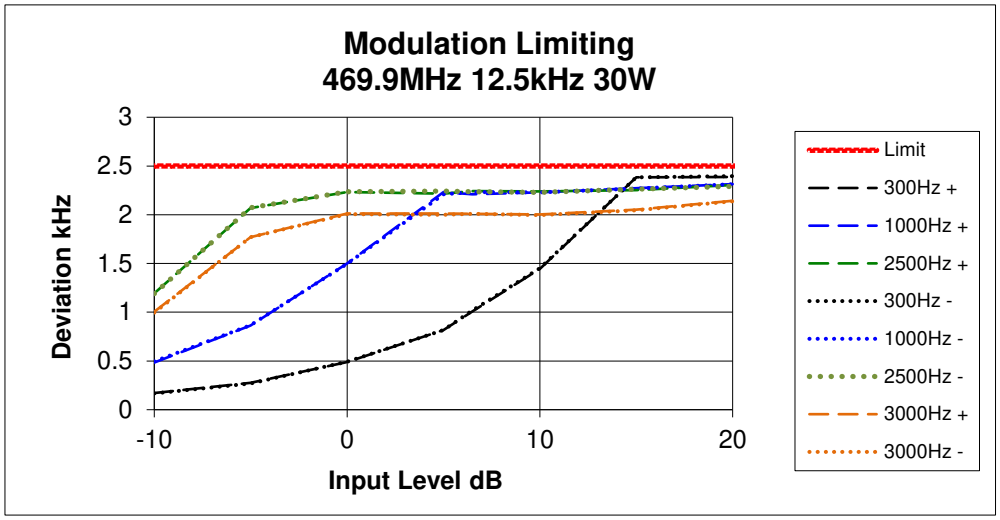
Tx FREQUENCY: 465.0 MHz 12.5 kHz Channel Spacing



# Transmitter Modulation Limiting

SPECIFICATION: FCC 47 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)

GUIDE: TIA/EIA-603D 2.2.11 (Analogue)
TIA-102.CAAA-C 2.2.5 (Digital)

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.
   For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as noted on the recorded plots.

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

MEASUREMENT UNCERTAINTY 95% ±0.65dB

LIMIT CLAUSE: FCC 47 CFR 90.210

EMISSION MASKS

| | | |
|---|---|---|
| Emission Mask D | 12.5 kHz Channel Spacing | Analogue, FFSK, Digital Voice/data |

DATA SPEED

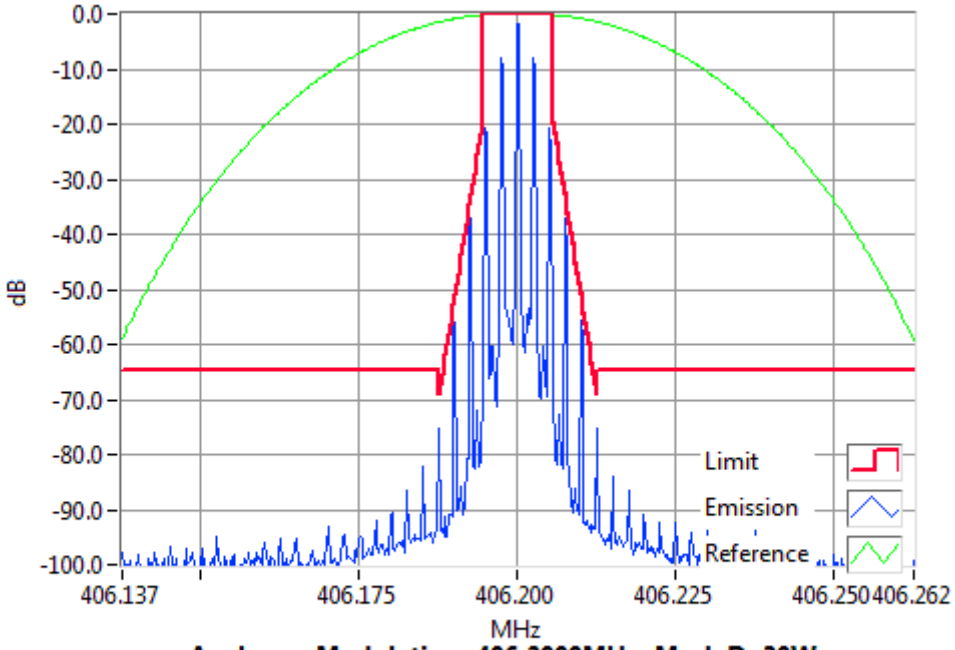
| | | |
|---|---|---|
| Digital Voice/Data | 12.5 kHz Channel Spacing | 9600 bps & 12000 bps |
| FFSK | 12.5 kHz Channel Spacing | 1200 bps & 2400 bps |

# Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

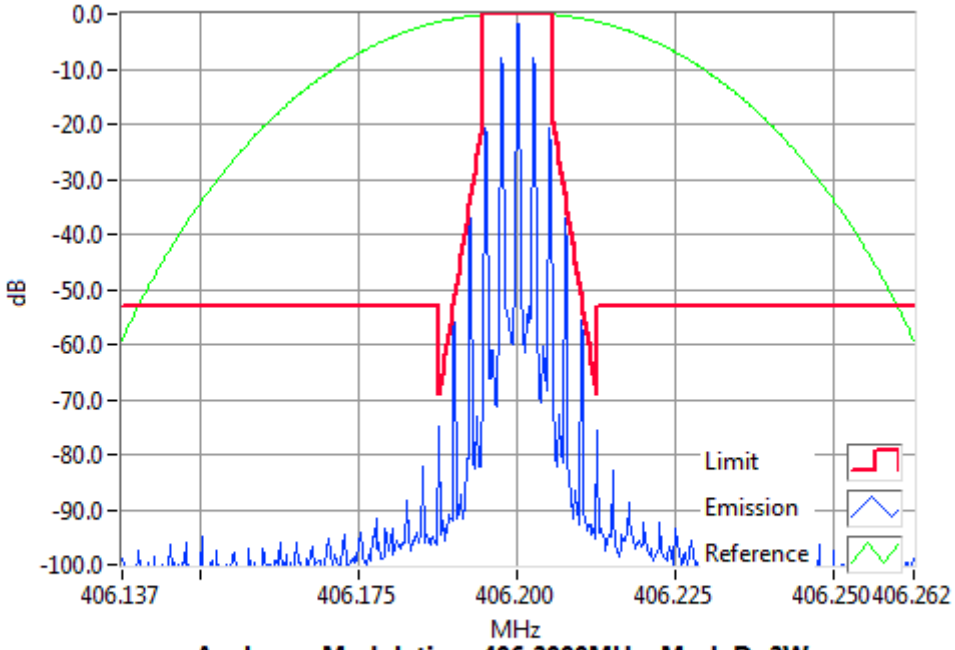
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 406.2 MHz 30 W 12.5 kHz Channel Spacing




**Analogue Modulation 406.2000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 406.2 MHz 2 W 12.5 kHz Channel Spacing



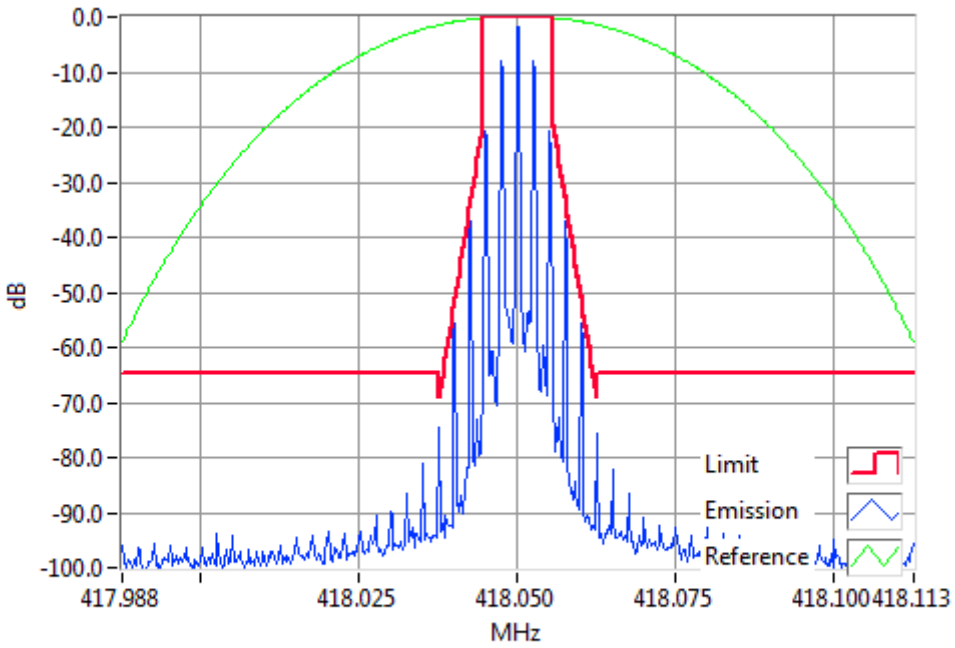

**Analogue Modulation 406.2000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

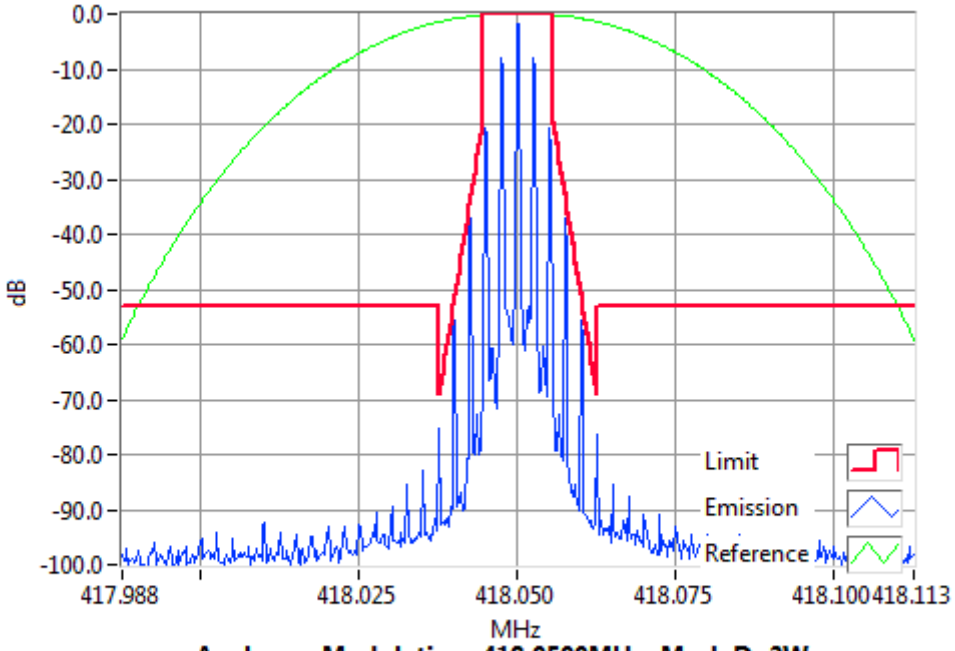
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 418.05 MHz 30 W 12.5 kHz Channel Spacing




**Analogue Modulation 418.0500MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 418.05 MHz 2 W 12.5 kHz Channel Spacing



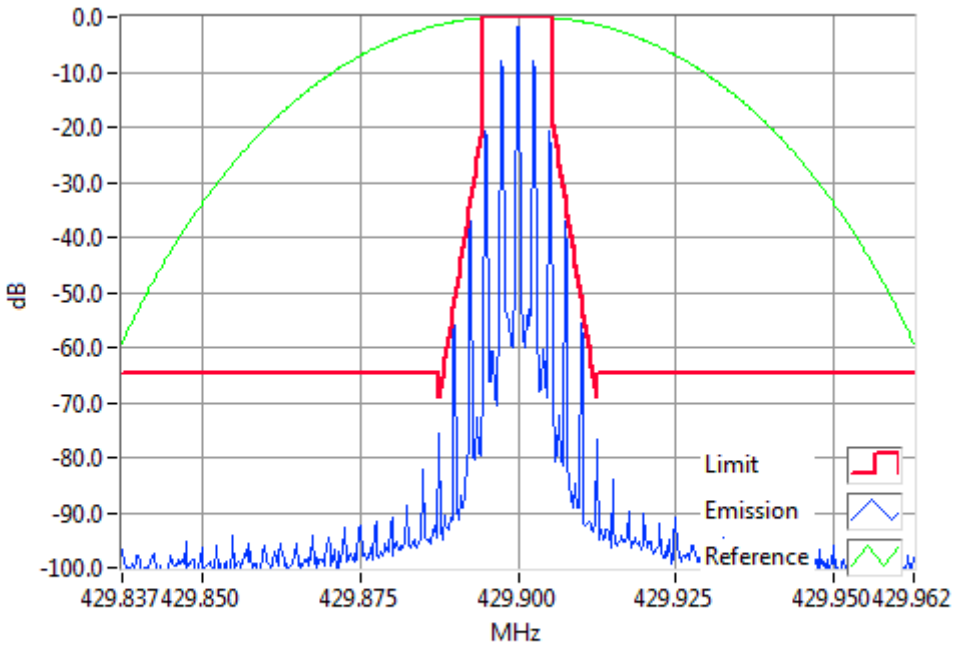

**Analogue Modulation 418.0500MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

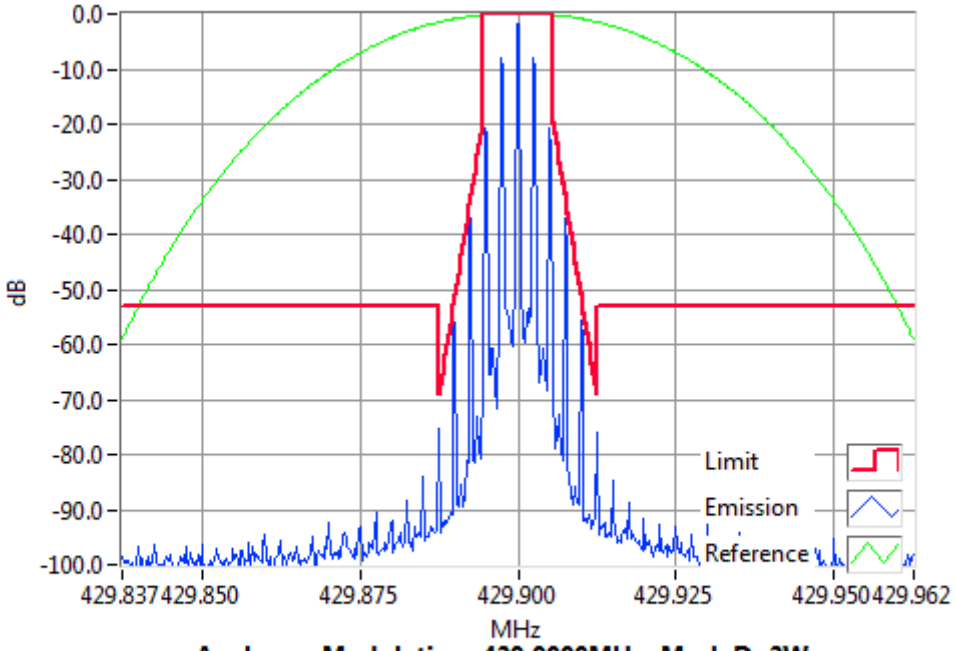
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 30 W 12.5 kHz Channel Spacing




**Analogue Modulation 429.9000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 429.9 MHz 2 W 12.5 kHz Channel Spacing



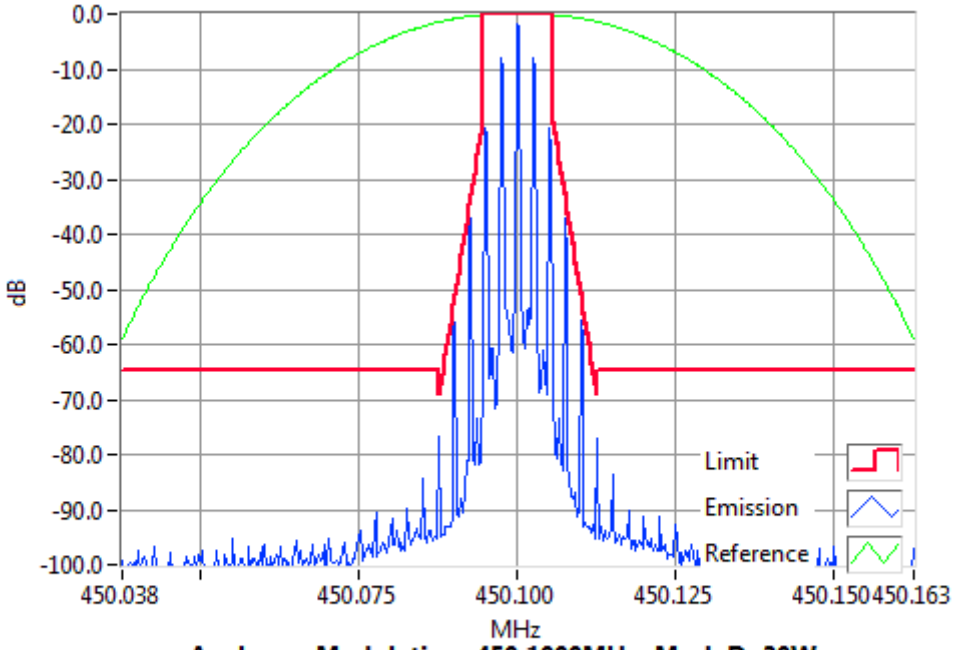

**Analogue Modulation 429.9000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

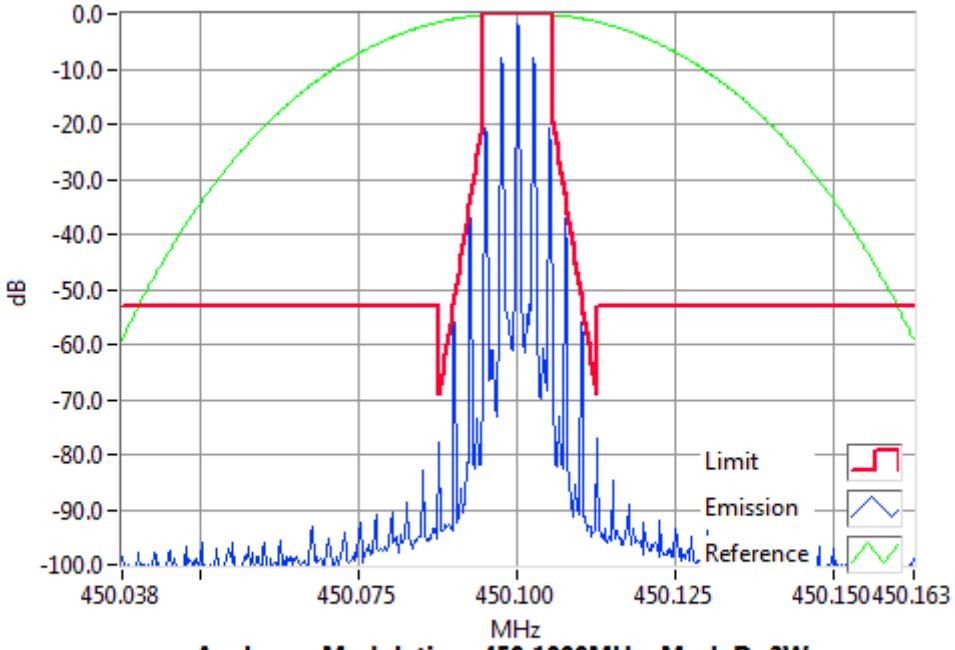
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 450.1 MHz 30 W 12.5 kHz Channel Spacing




**Analogue Modulation 450.1000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 450.1 MHz 2 W 12.5 kHz Channel Spacing



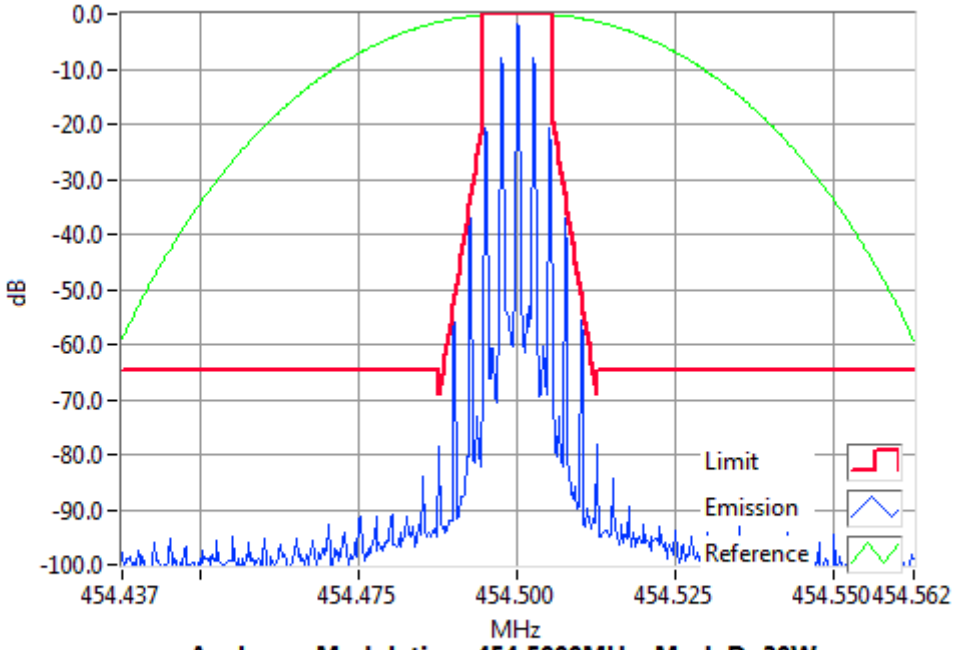

**Analogue Modulation 450.1000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

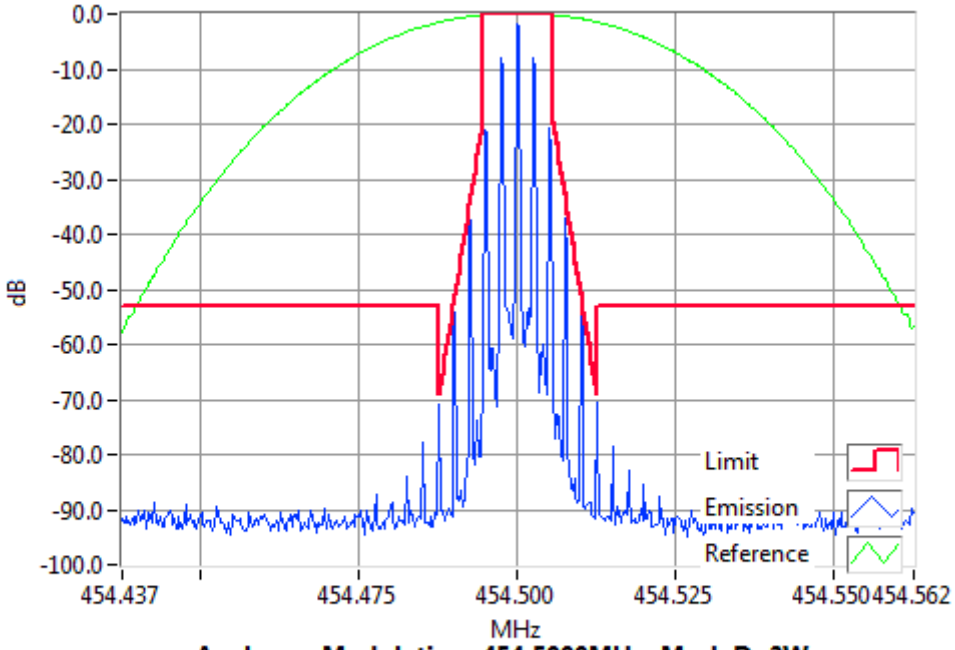
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 454.5 MHz 30 W 12.5 kHz Channel Spacing




**Analogue Modulation 454.5000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 454.5 MHz 2 W 12.5 kHz Channel Spacing



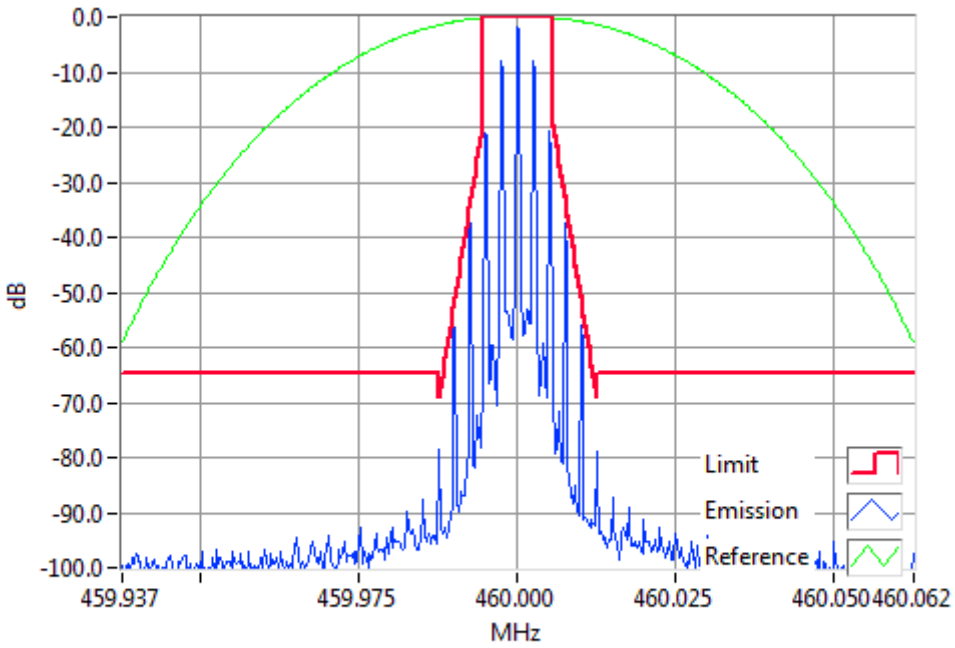

**Analogue Modulation 454.5000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

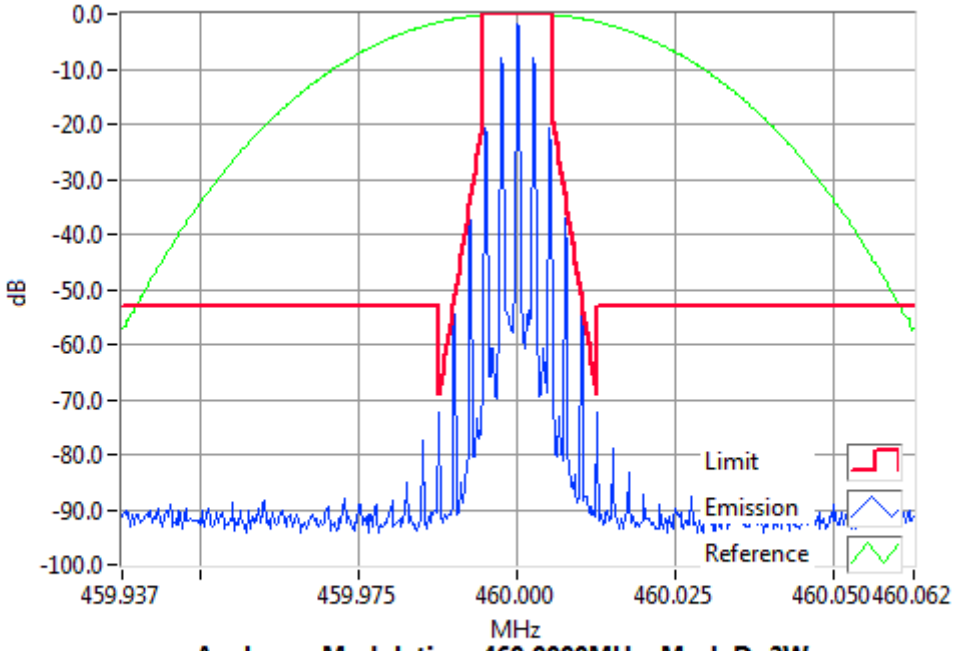
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 460.0 MHz 30 W 12.5 kHz Channel Spacing




**Analogue Modulation 460.0000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 460.0 MHz 2 W 12.5 kHz Channel Spacing



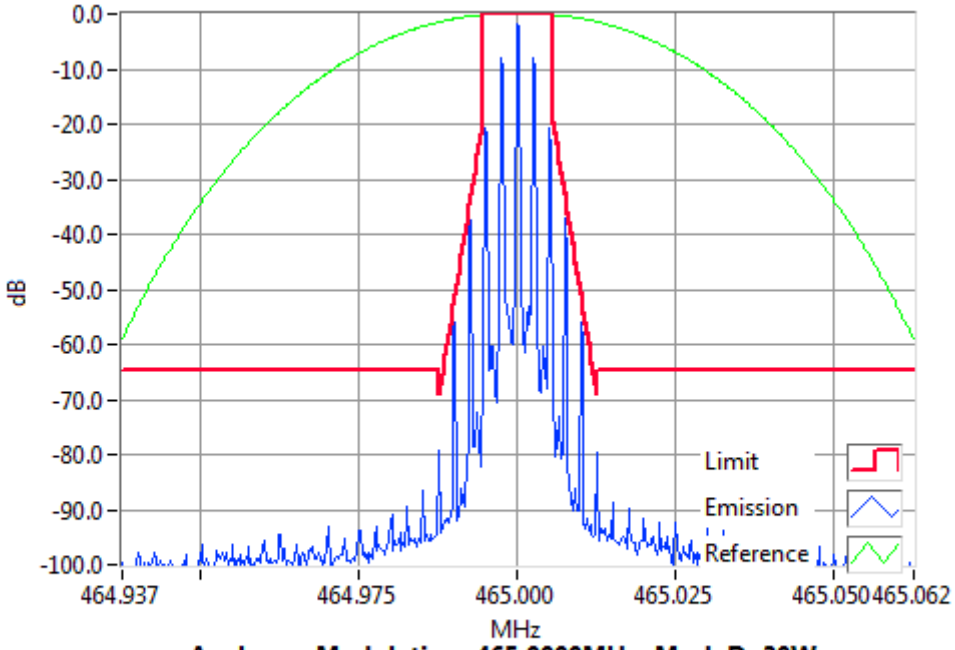

**Analogue Modulation 460.0000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

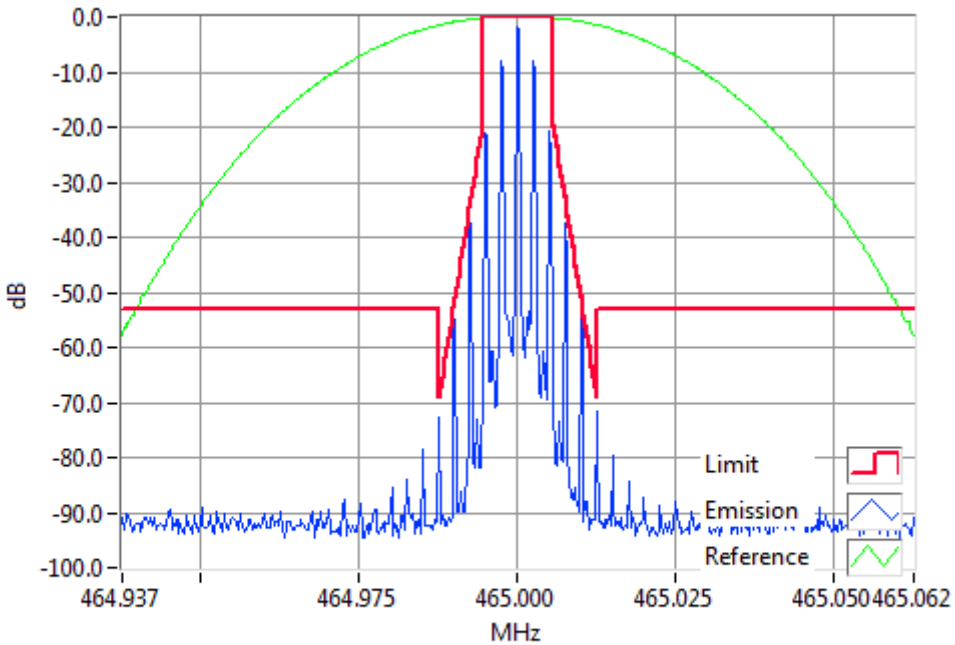
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 465.0 MHz 30 W 12.5 kHz Channel Spacing




**Analogue Modulation 465.0000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 465.0 MHz 2 W 12.5 kHz Channel Spacing



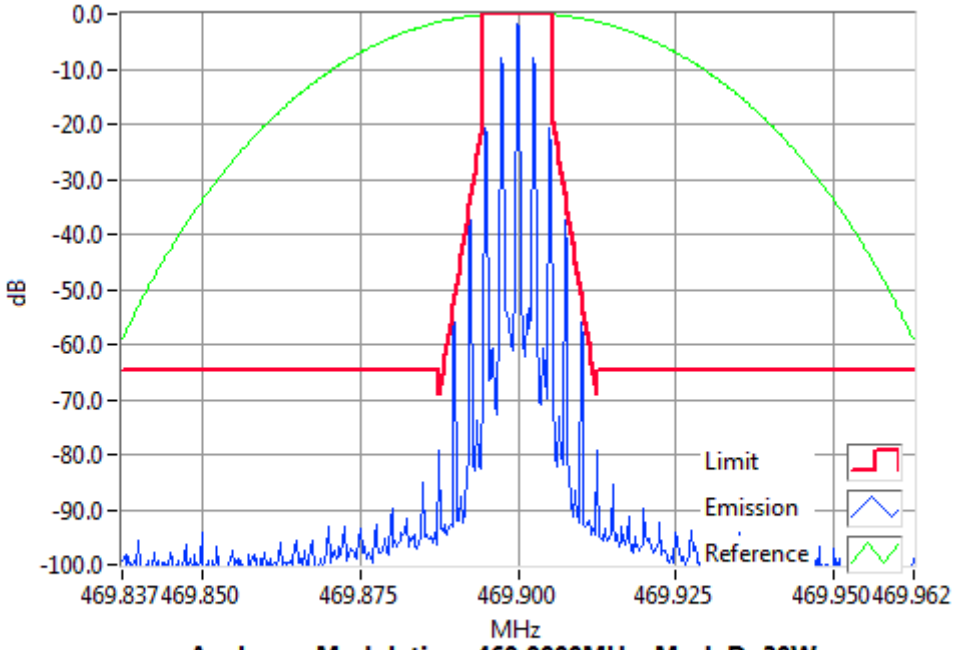

**Analogue Modulation 465.0000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

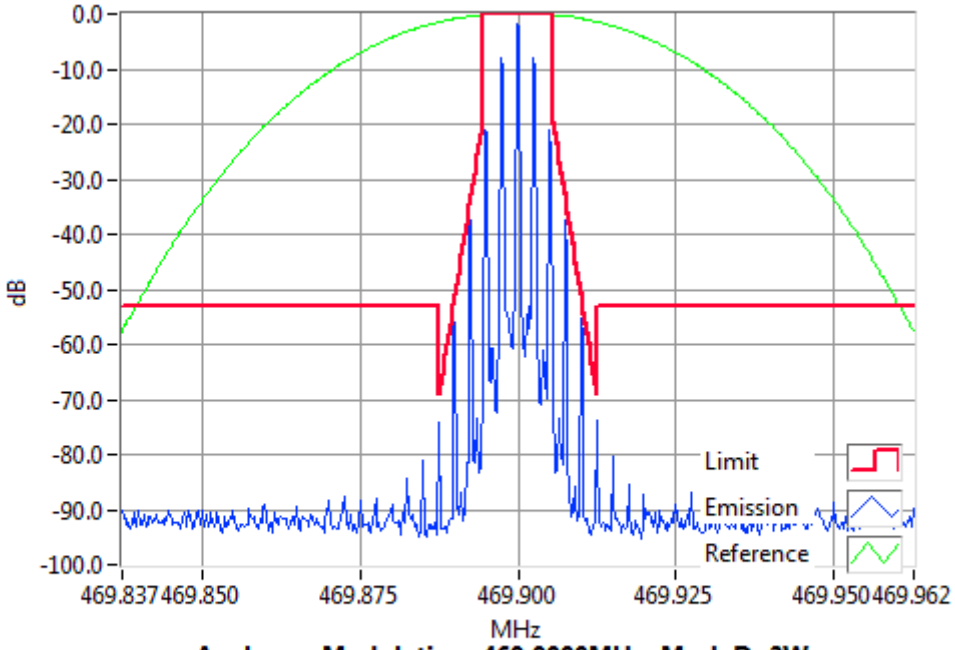
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 469.9 MHz 30 W 12.5 kHz Channel Spacing




**Analogue Modulation 469.9000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 469.9 MHz 2 W 12.5 kHz Channel Spacing



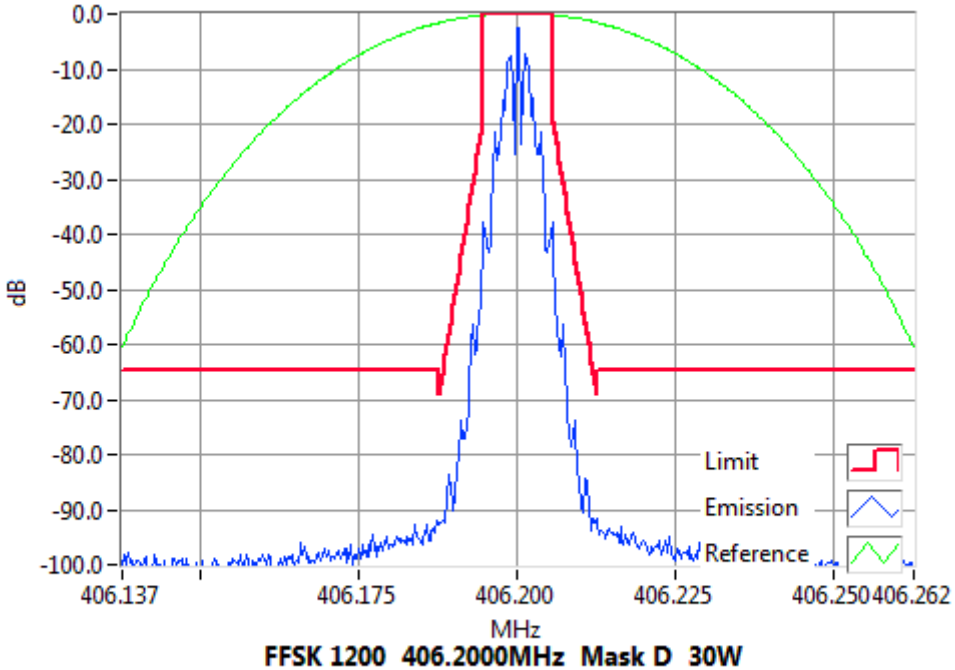

**Analogue Modulation 469.9000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

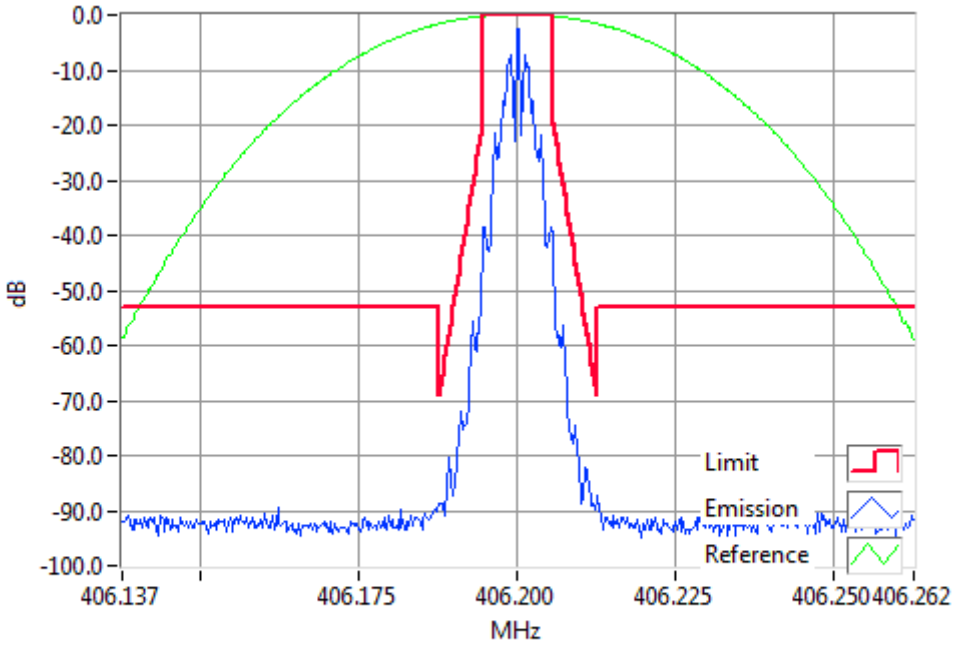
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 406.2 MHz 30 W 12.5 kHz Channel Spacing




**FFSK 1200 406.2000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 406.2 MHz 2 W 12.5 kHz Channel Spacing



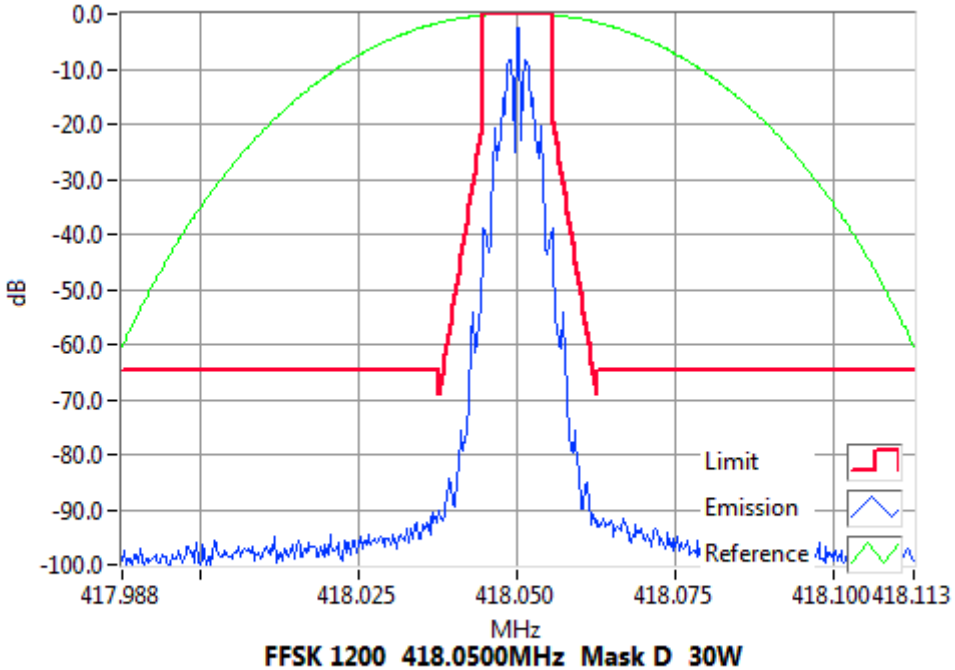

**FFSK 1200 406.2000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

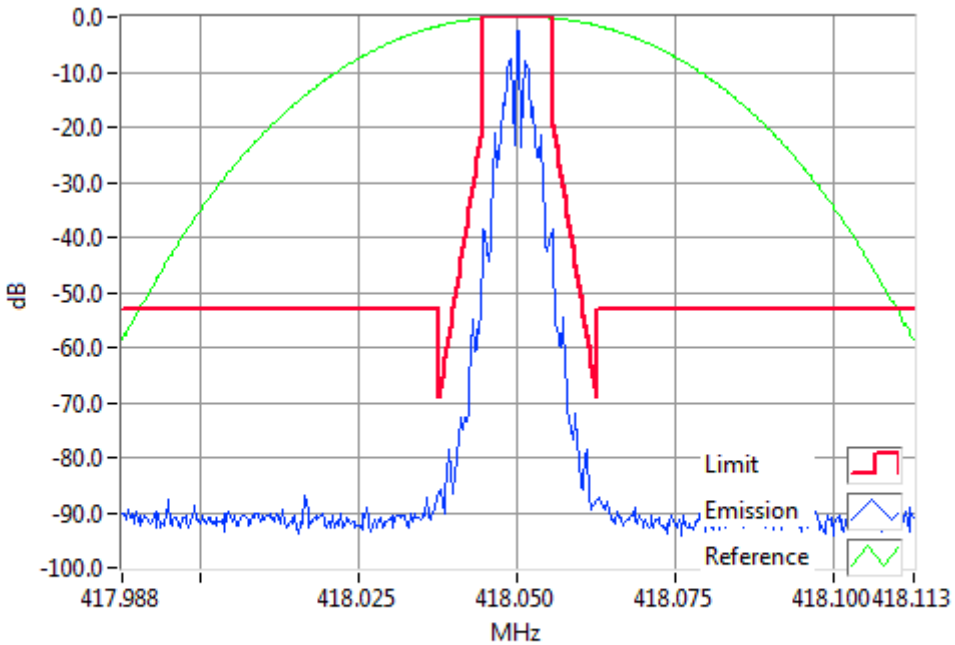
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 418.05 MHz 30 W 12.5 kHz Channel Spacing




**FFSK 1200 418.0500MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 418.05 MHz 2 W 12.5 kHz Channel Spacing



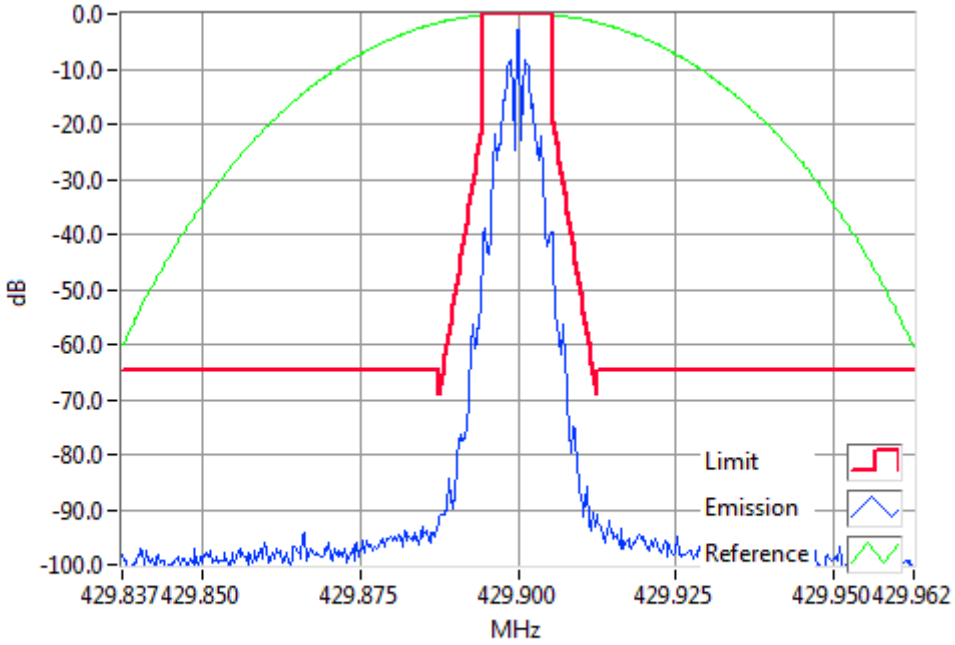

**FFSK 1200 418.0500MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

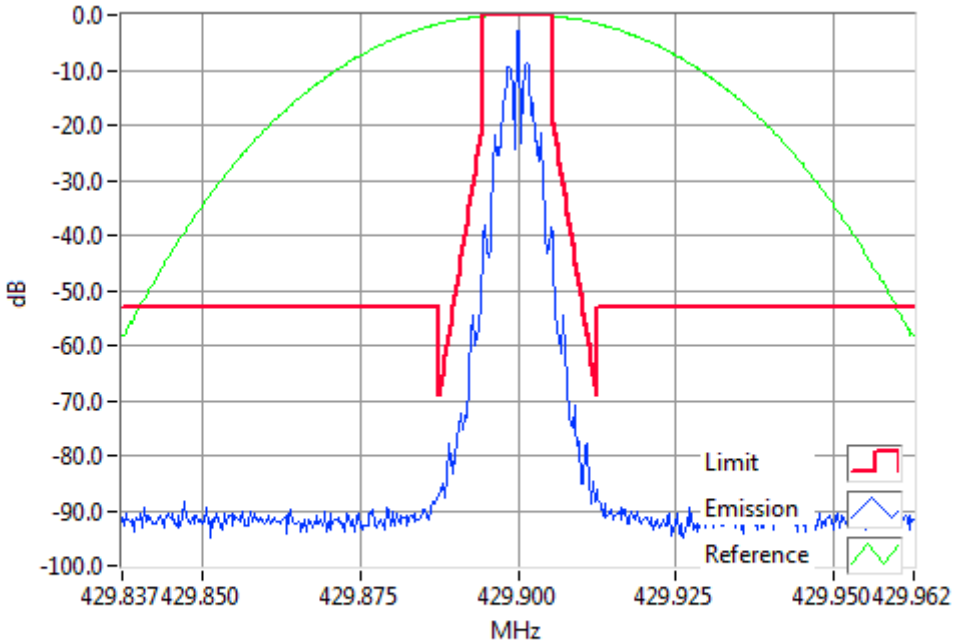
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 30 W 12.5 kHz Channel Spacing




**FFSK 1200 429.9000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 429.9 MHz 2 W 12.5 kHz Channel Spacing



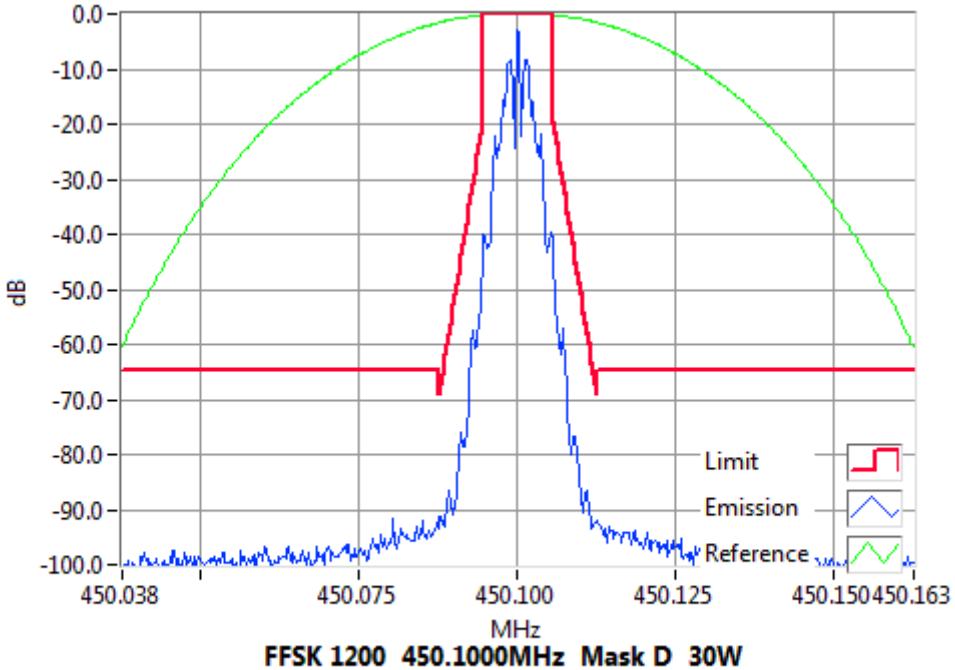

**FFSK 1200 429.9000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

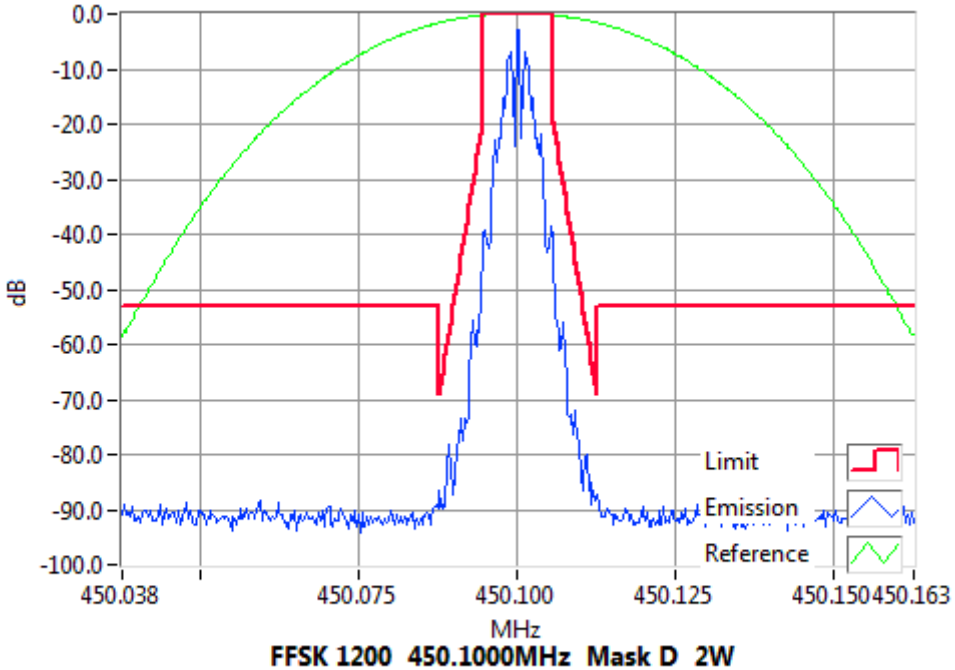
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 450.1 MHz 30 W 12.5 kHz Channel Spacing




**FFSK 1200 450.1000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 450.1 MHz 2 W 12.5 kHz Channel Spacing



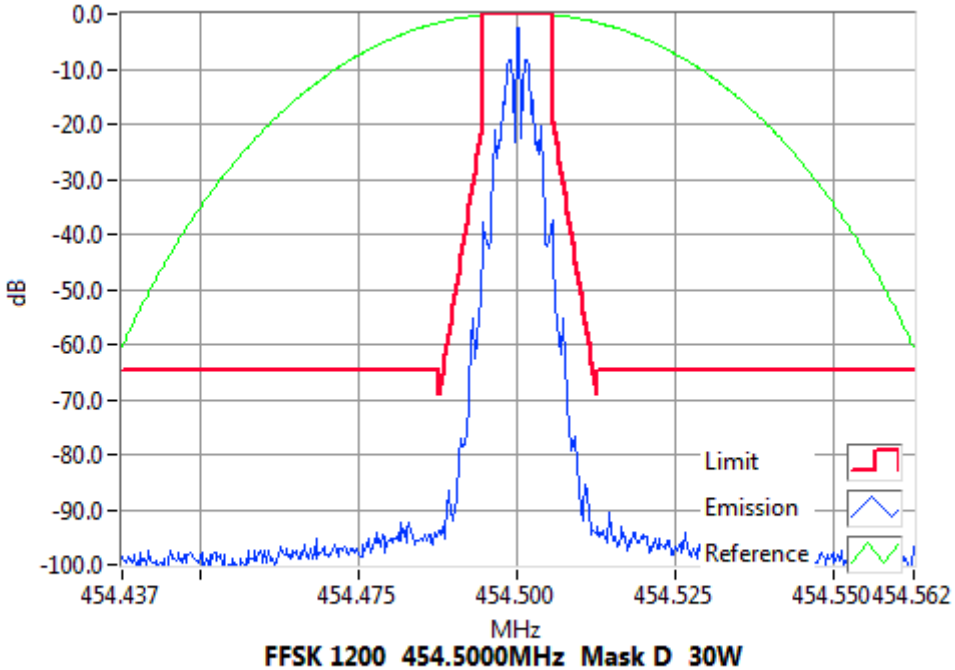

**FFSK 1200 450.1000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

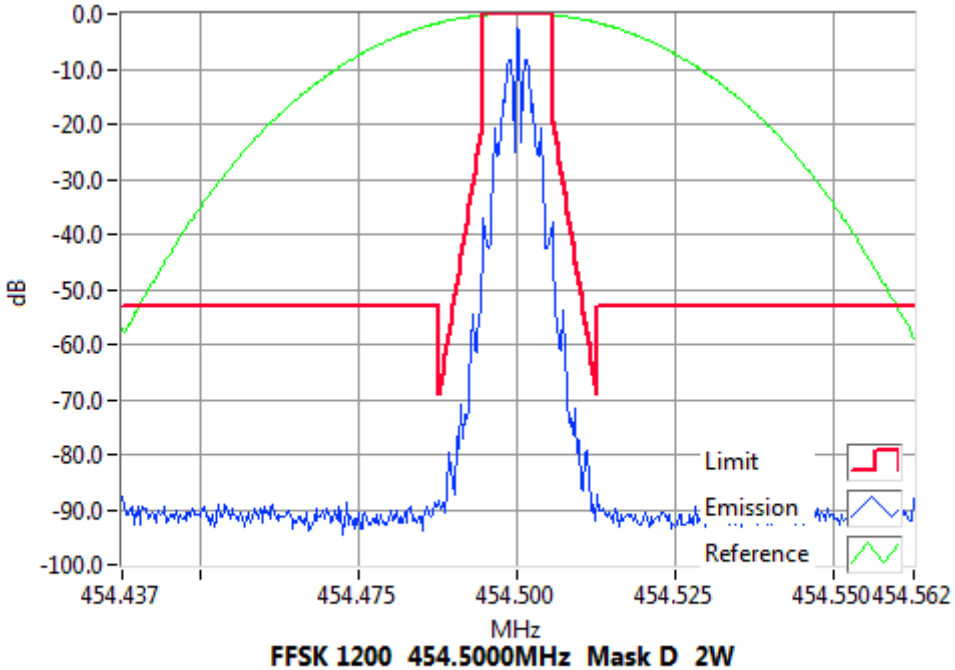
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 454.5 MHz 30 W 12.5 kHz Channel Spacing




**FFSK 1200 454.5000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 454.5 MHz 2 W 12.5 kHz Channel Spacing



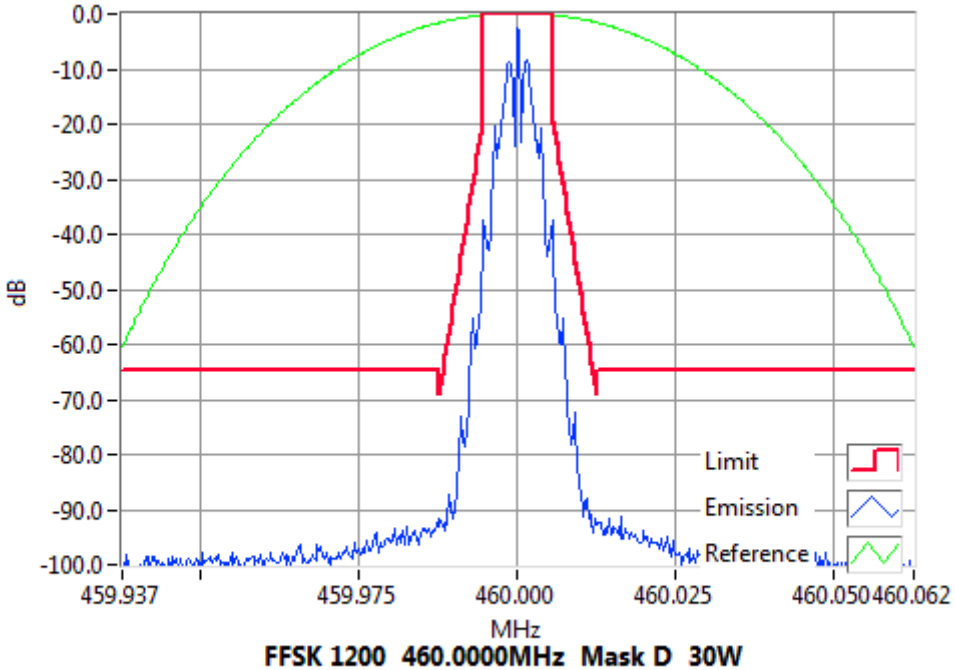

**FFSK 1200 454.5000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

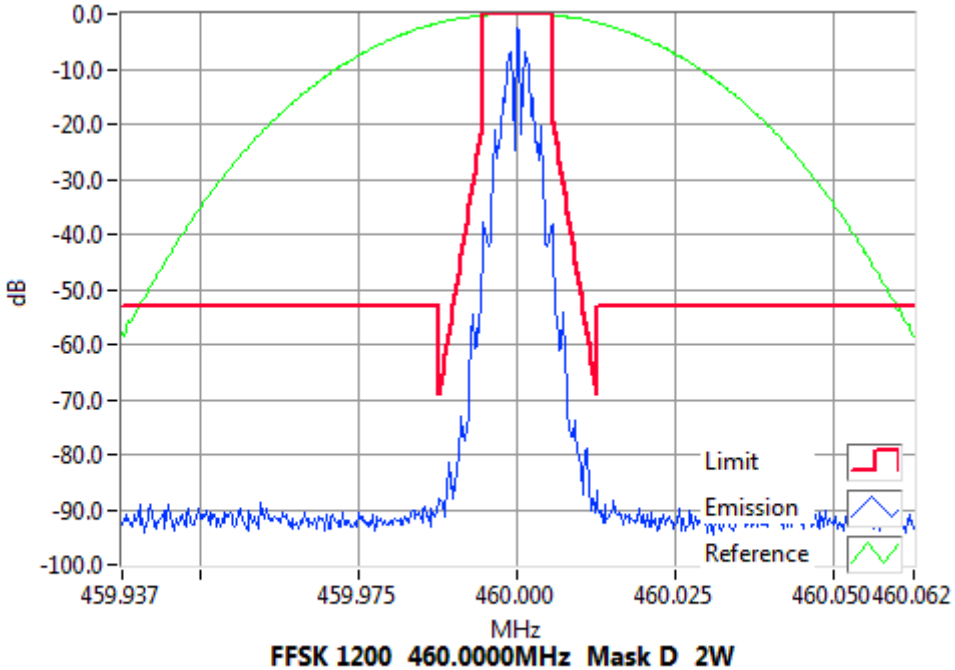
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 460.0 MHz 30 W 12.5 kHz Channel Spacing




**FFSK 1200 460.0000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 460.0 MHz 2 W 12.5 kHz Channel Spacing



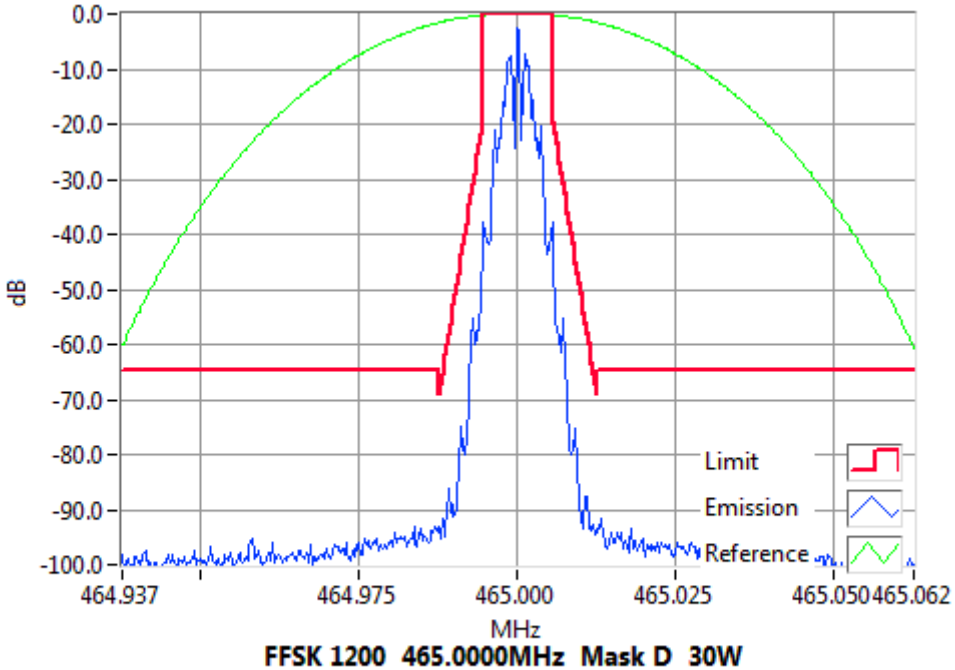

**FFSK 1200 460.0000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

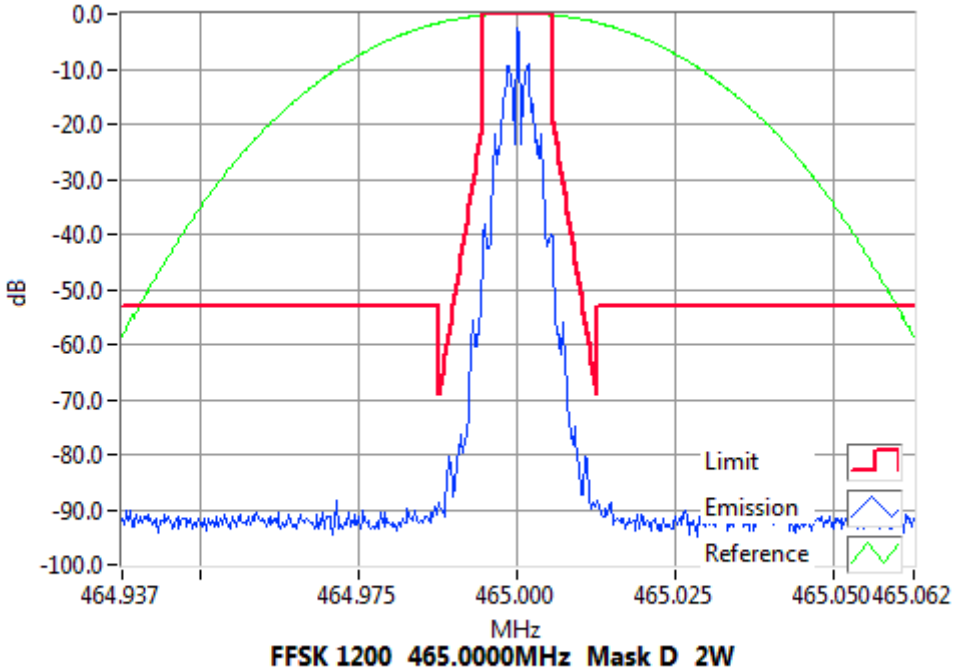
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 465.0 MHz 30 W 12.5 kHz Channel Spacing




**FFSK 1200 465.0000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 465.0 MHz 2 W 12.5 kHz Channel Spacing



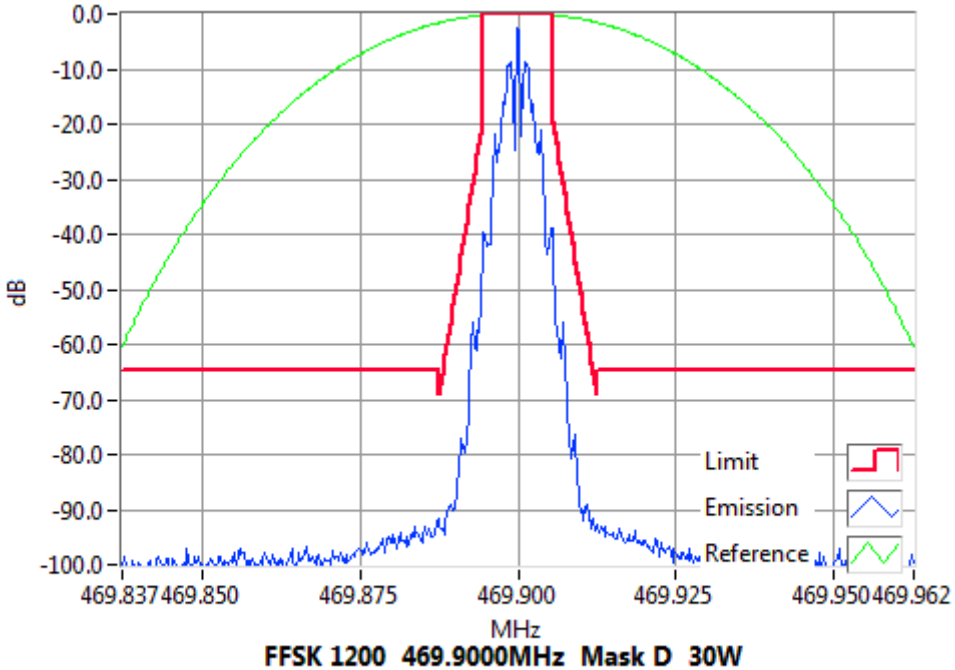

**FFSK 1200 465.0000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

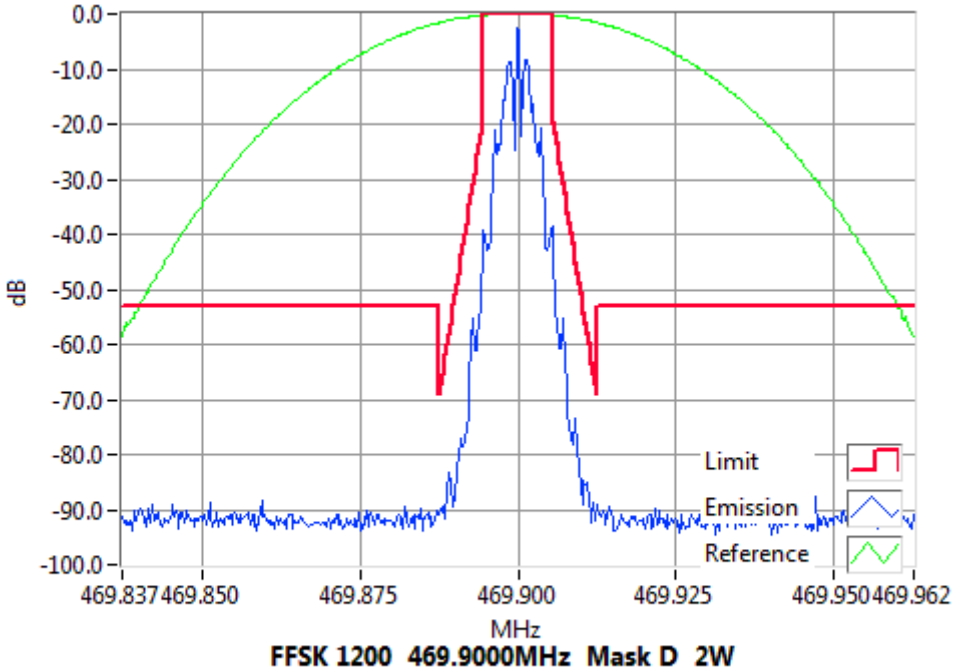
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 469.9 MHz 30 W 12.5 kHz Channel Spacing




**FFSK 1200 469.9000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 469.9 MHz 2 W 12.5 kHz Channel Spacing



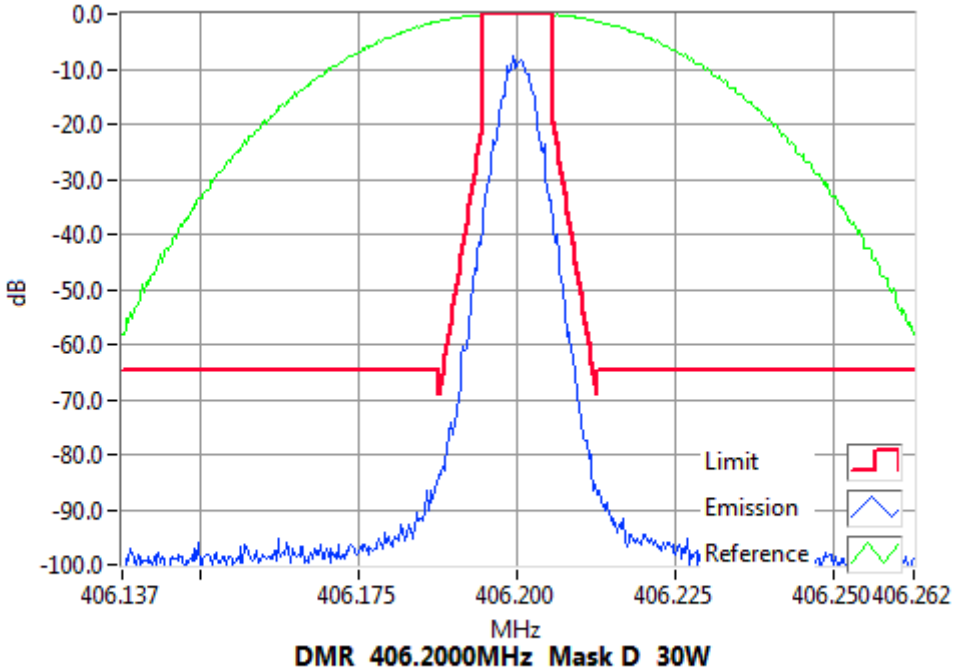

**FFSK 1200 469.9000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

DMR

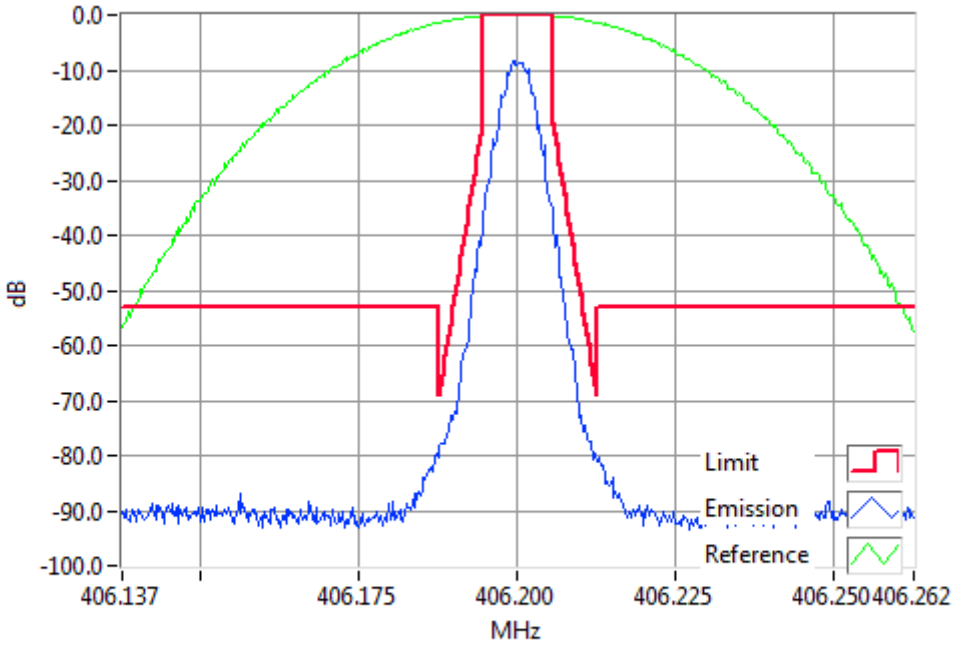
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 406.2 MHz 30 W 12.5 kHz Channel Spacing




**DMR 406.2000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 406.2 MHz 2 W 12.5 kHz Channel Spacing



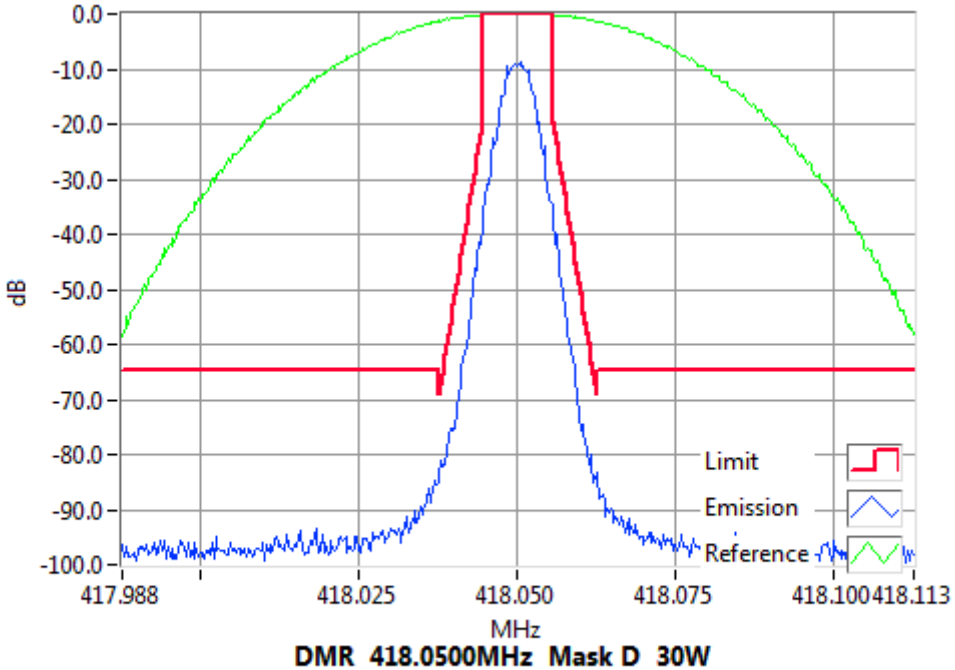

**DMR 406.2000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

DMR

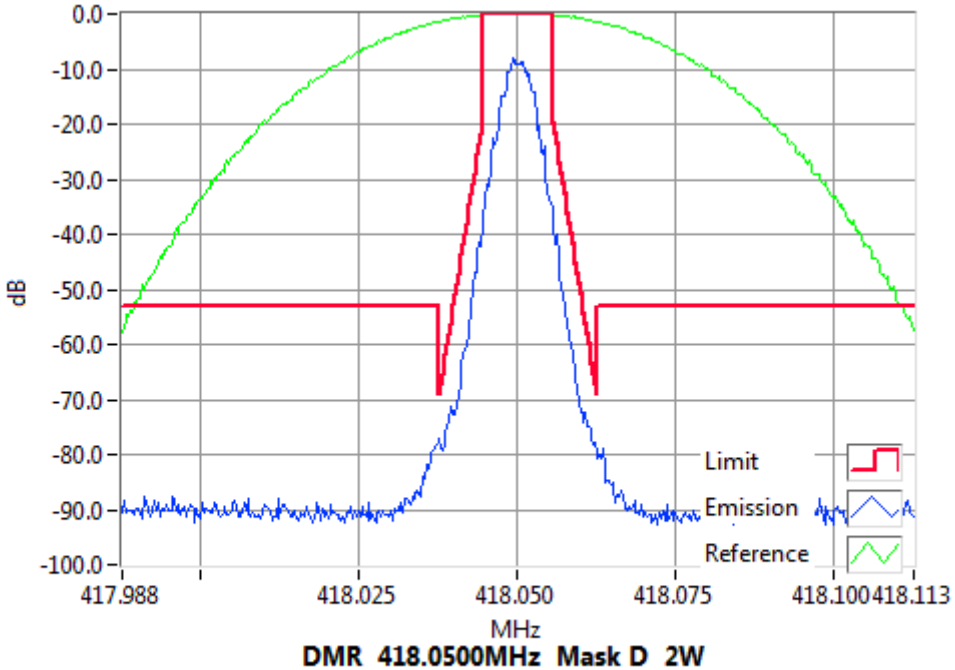
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 418.05 MHz 30 W 12.5 kHz Channel Spacing




**DMR 418.0500MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 418.05 MHz 2 W 12.5 kHz Channel Spacing



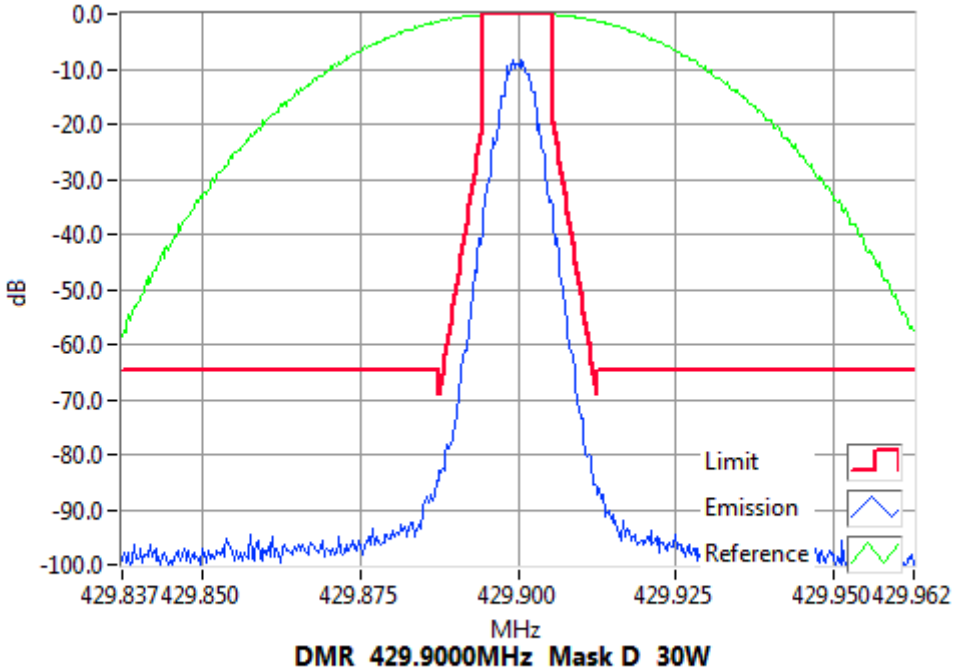

**DMR 418.0500MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

DMR

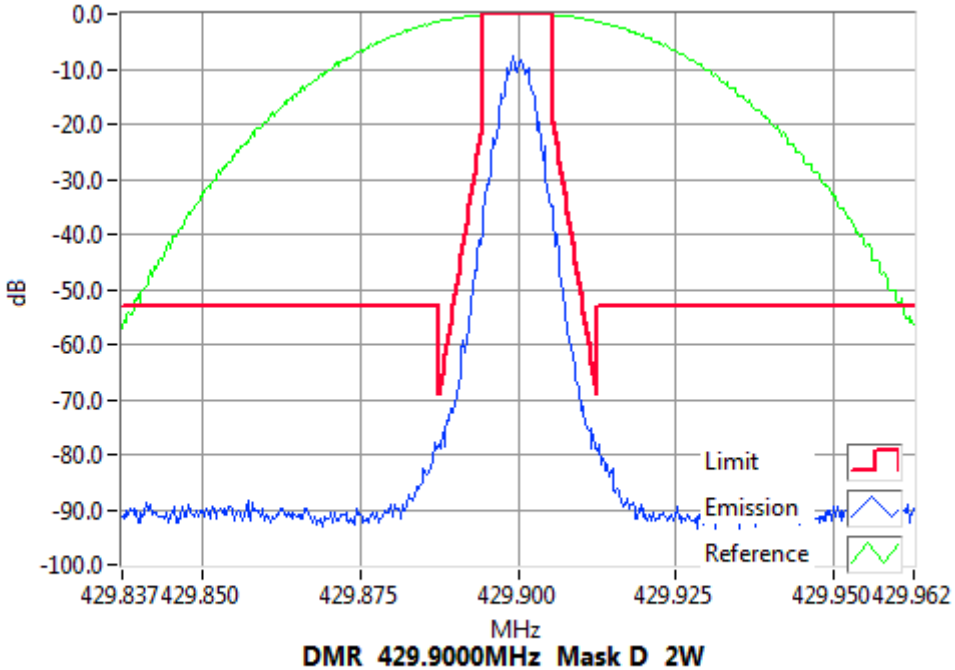
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 30 W 12.5 kHz Channel Spacing




**DMR 429.9000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 429.9 MHz 2 W 12.5 kHz Channel Spacing



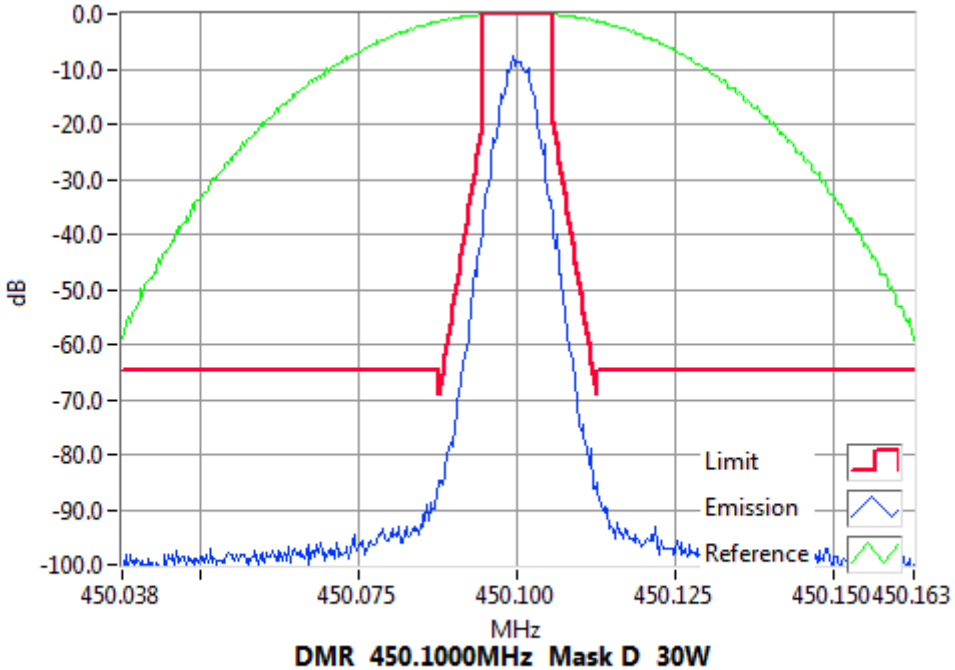

**DMR 429.9000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

DMR

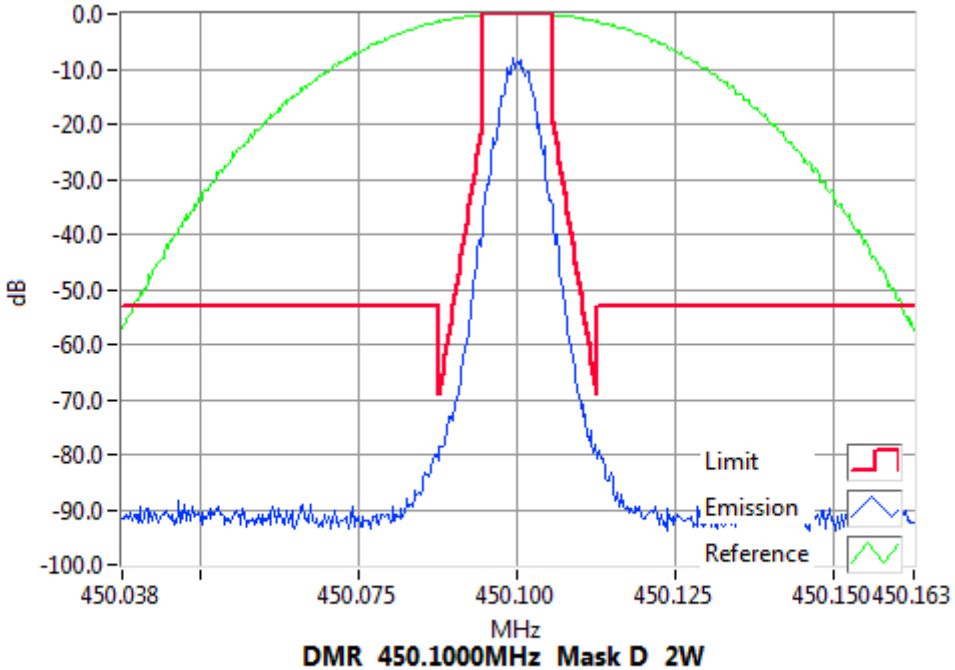
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 450.1 MHz 30 W 12.5 kHz Channel Spacing




**DMR 450.1000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 450.1 MHz 2 W 12.5 kHz Channel Spacing



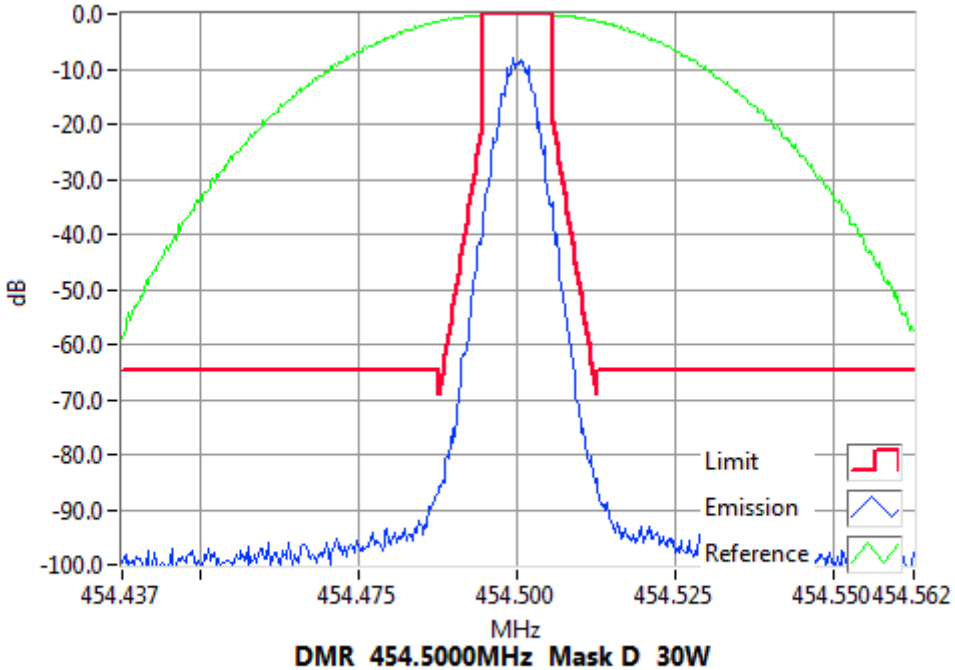

**DMR 450.1000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

DMR

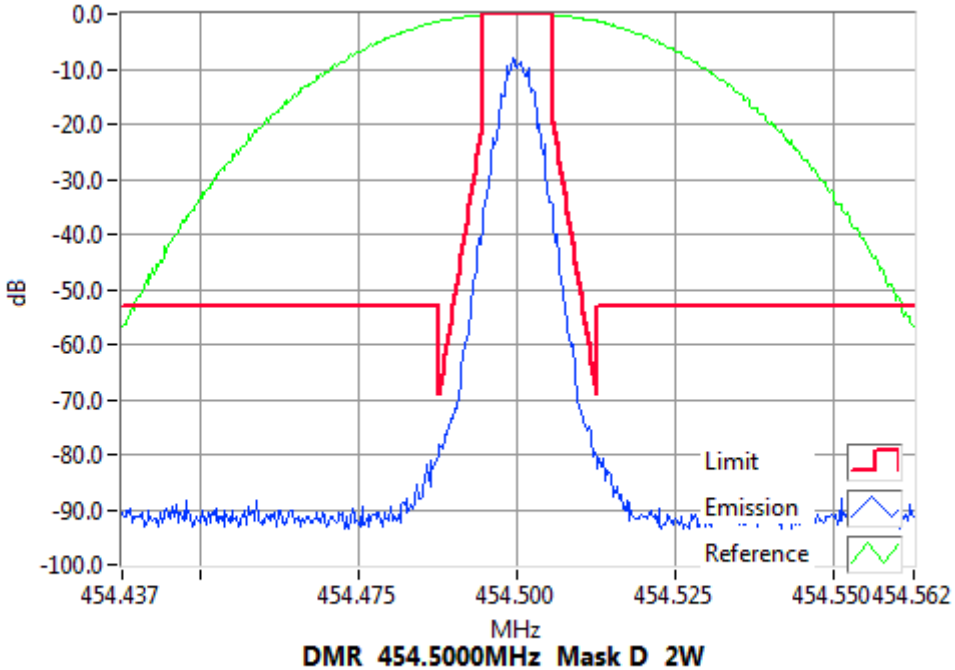
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 454.5 MHz 30 W 12.5 kHz Channel Spacing




**DMR 454.5000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 454.5 MHz 2 W 12.5 kHz Channel Spacing



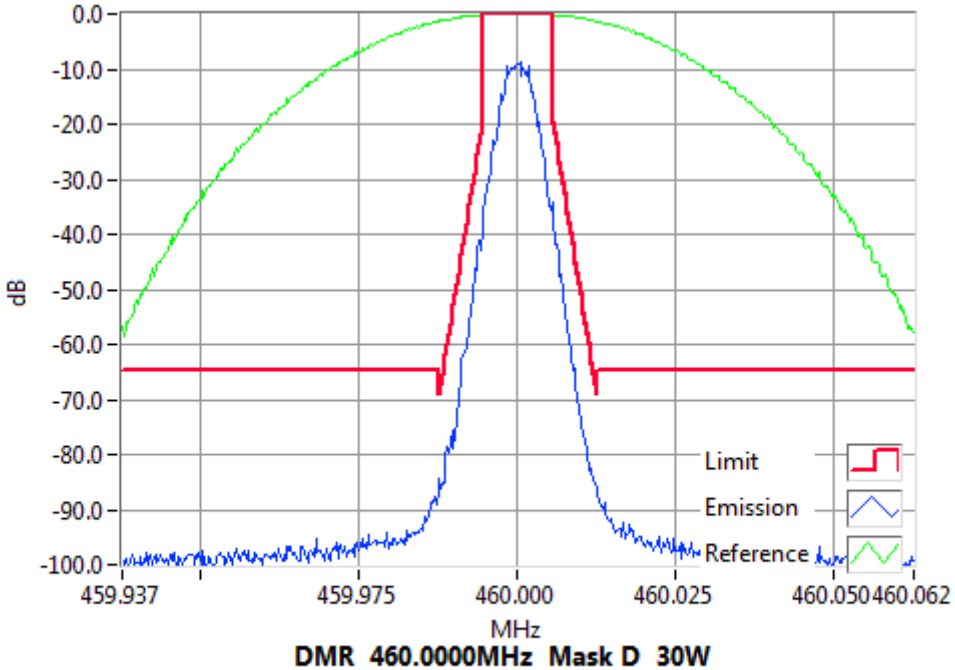

**DMR 454.5000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

DMR

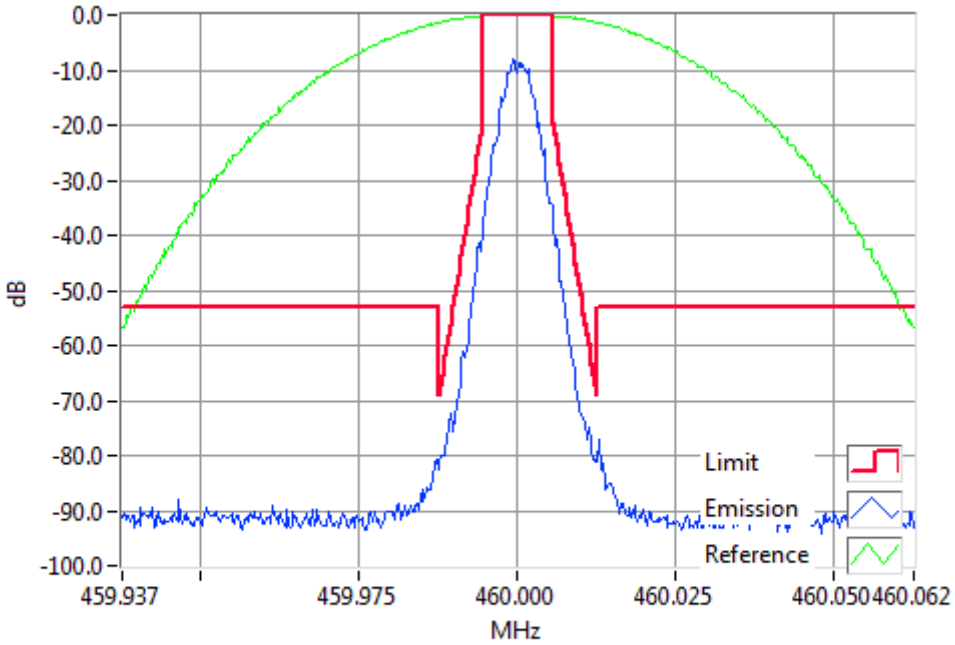
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 460.0 MHz 30 W 12.5 kHz Channel Spacing




**DMR 460.0000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 460.0 MHz 2 W 12.5 kHz Channel Spacing



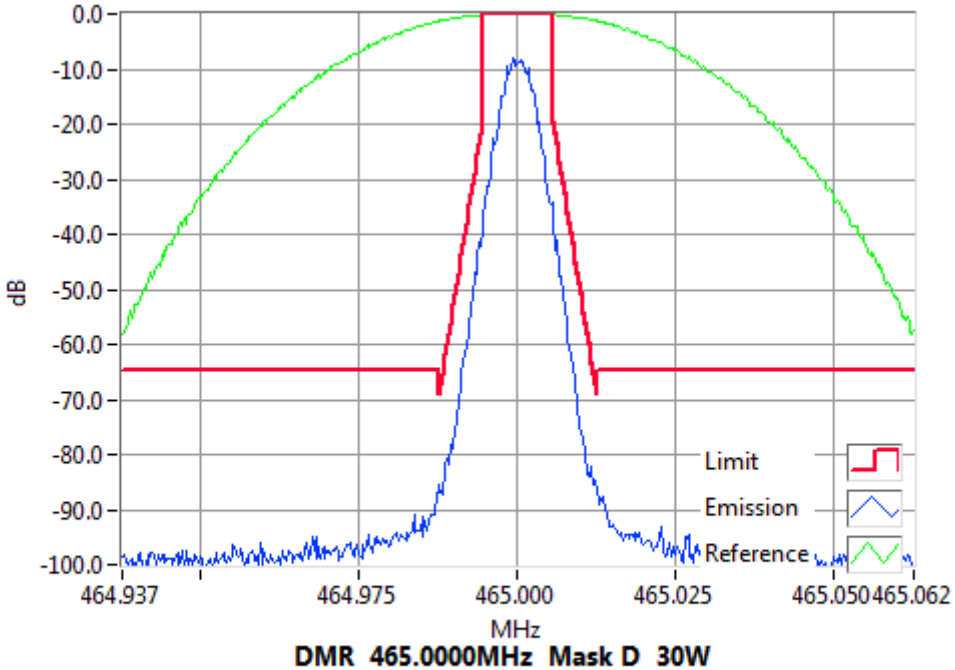

**DMR 460.0000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

DMR

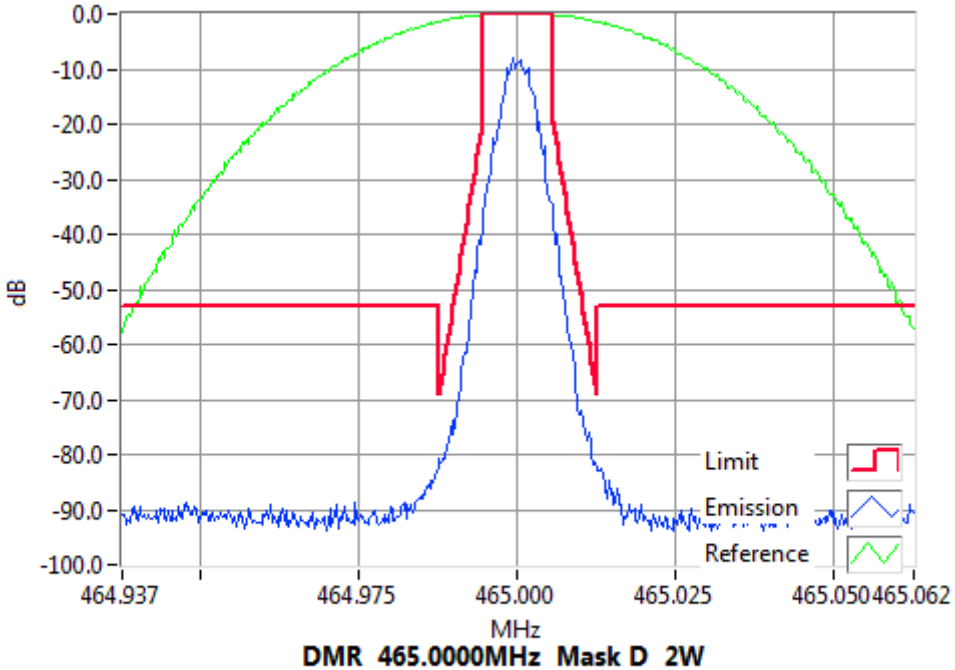
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 465.0 MHz 30 W 12.5 kHz Channel Spacing




**DMR 465.0000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 465.0 MHz 2 W 12.5 kHz Channel Spacing



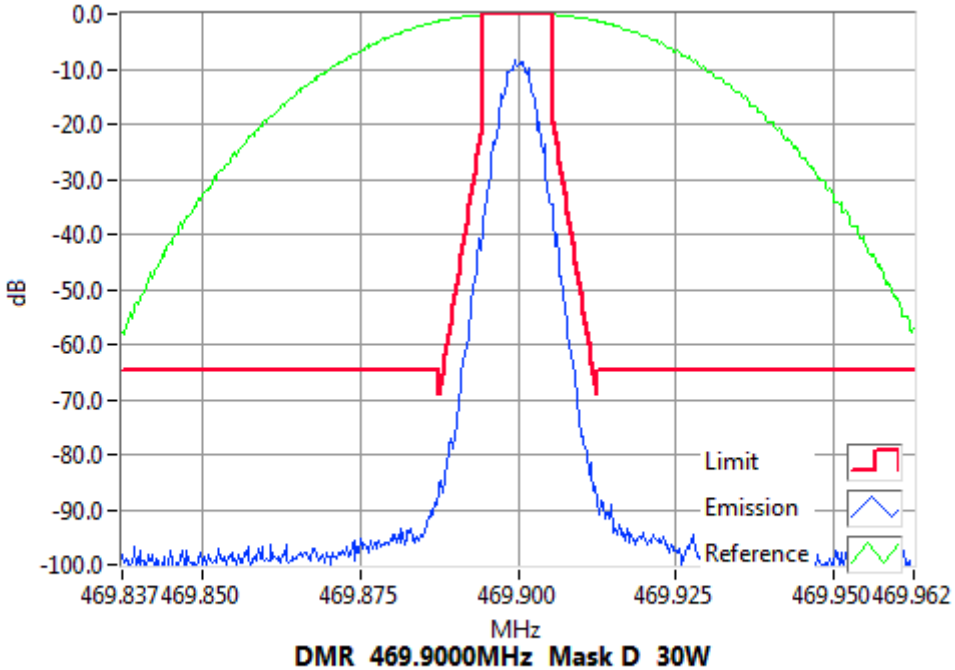

**DMR 465.0000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

DMR

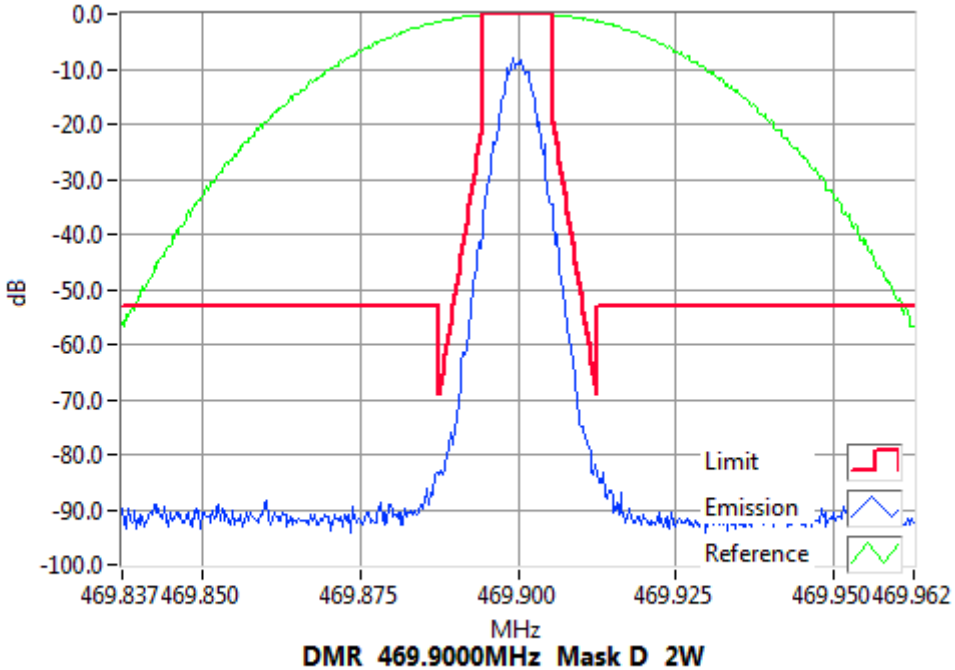
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 469.9 MHz 30 W 12.5 kHz Channel Spacing




**DMR 469.9000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 469.9 MHz 2 W 12.5 kHz Channel Spacing



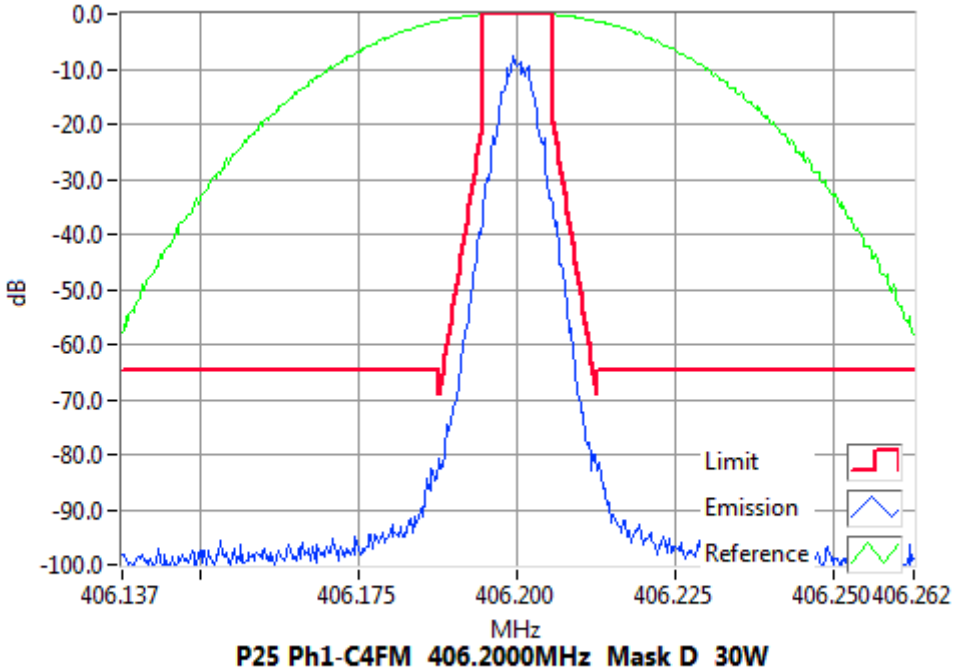

**DMR 469.9000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

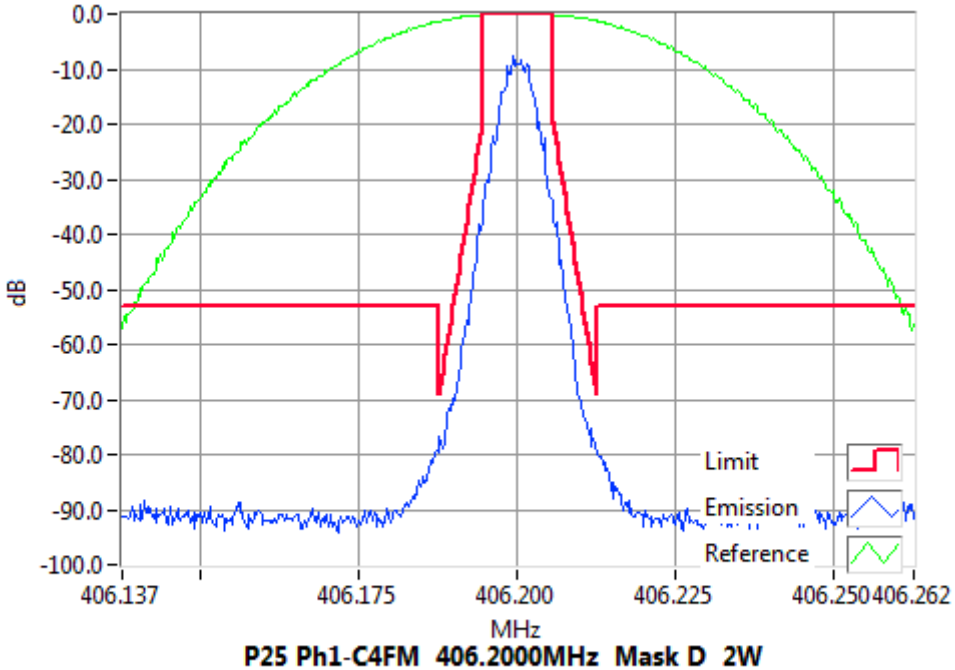
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 406.2 MHz 30 W 12.5 kHz Channel Spacing




**P25 Ph1-C4FM 406.2000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 406.2 MHz 2 W 12.5 kHz Channel Spacing



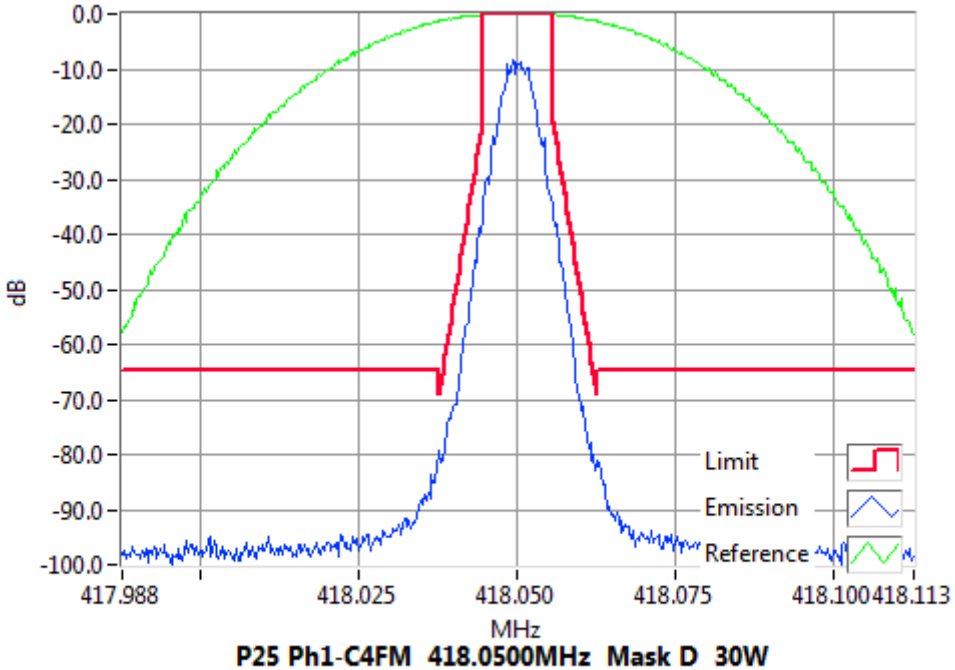

**P25 Ph1-C4FM 406.2000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

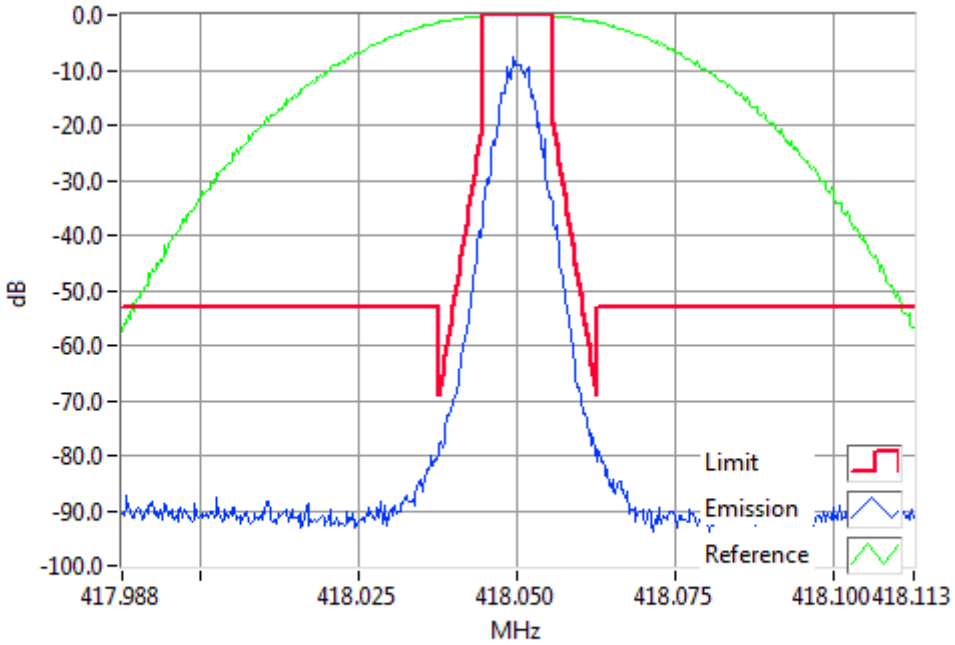
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 418.05 MHz 30 W 12.5 kHz Channel Spacing




**P25 Ph1-C4FM 418.0500MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 418.05 MHz 2 W 12.5 kHz Channel Spacing



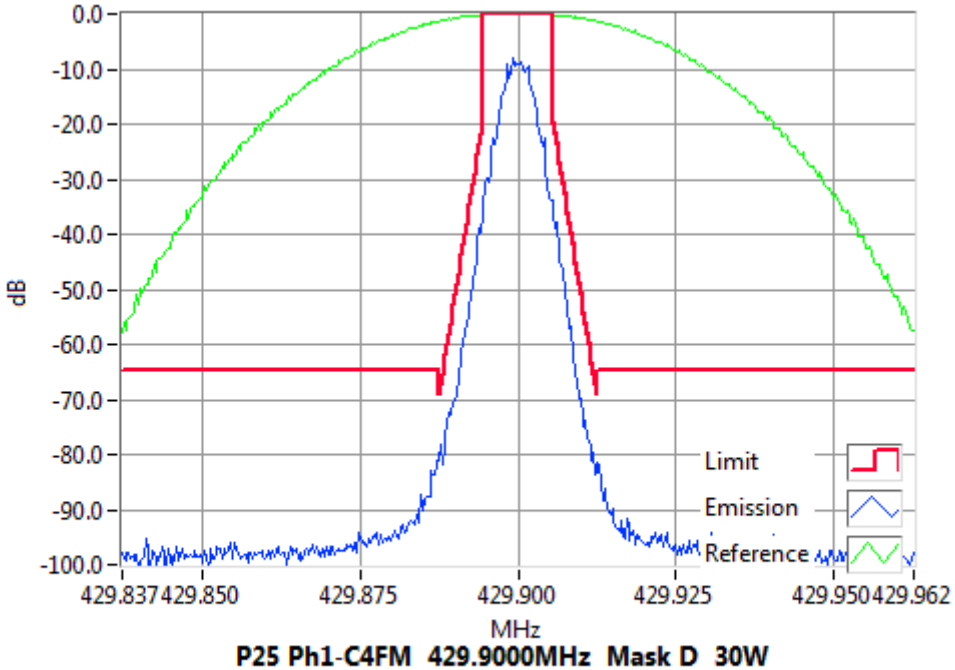

**P25 Ph1-C4FM 418.0500MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

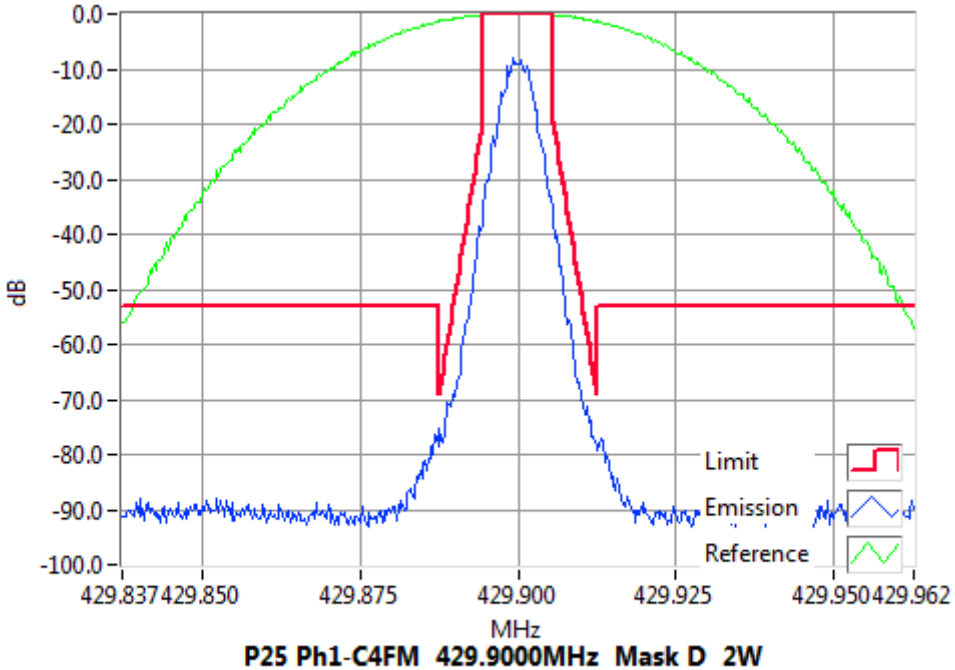
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 30 W 12.5 kHz Channel Spacing




**P25 Ph1-C4FM 429.9000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 429.9 MHz 2 W 12.5 kHz Channel Spacing



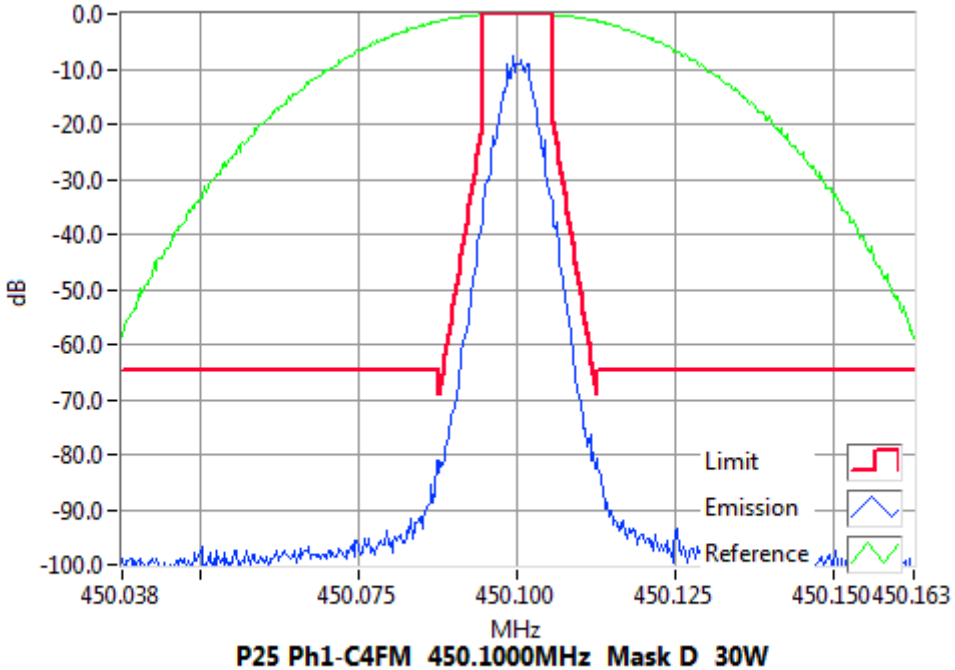

**P25 Ph1-C4FM 429.9000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

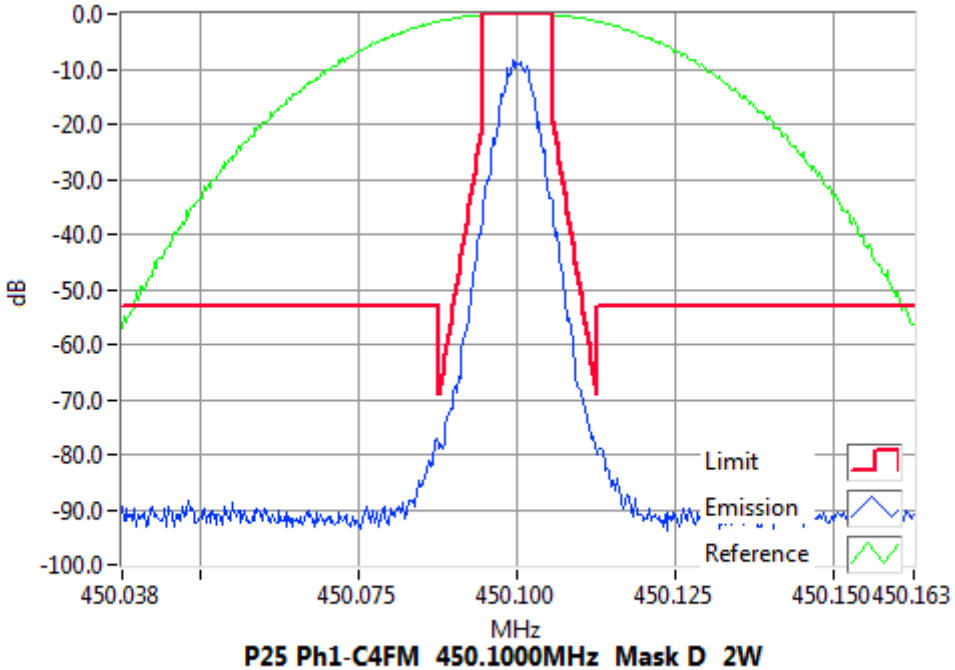
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 450.1 MHz 30 W 12.5 kHz Channel Spacing




**P25 Ph1-C4FM 450.1000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 450.1 MHz 2 W 12.5 kHz Channel Spacing



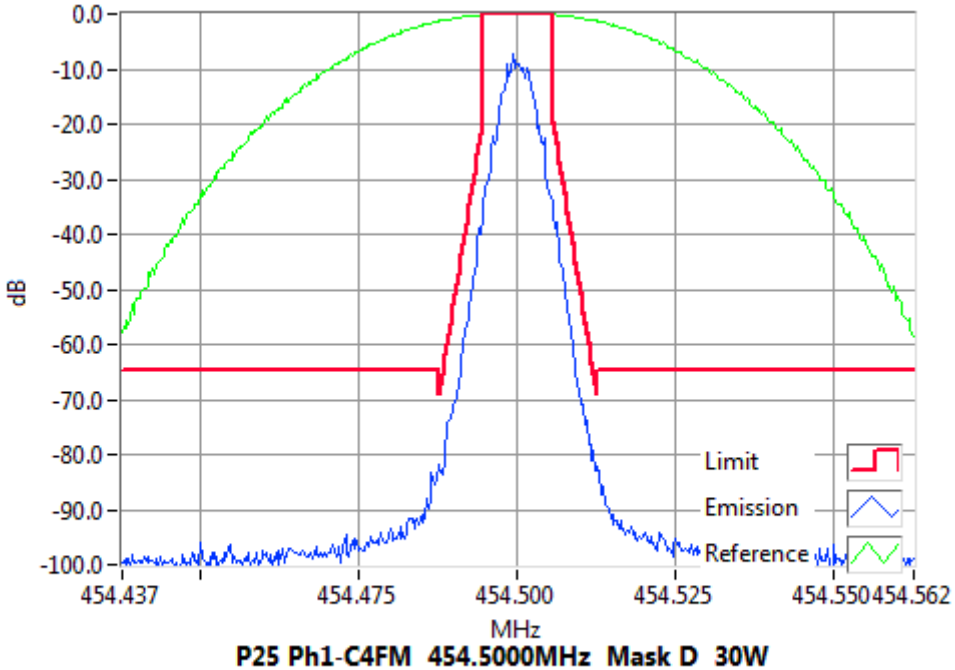

**P25 Ph1-C4FM 450.1000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

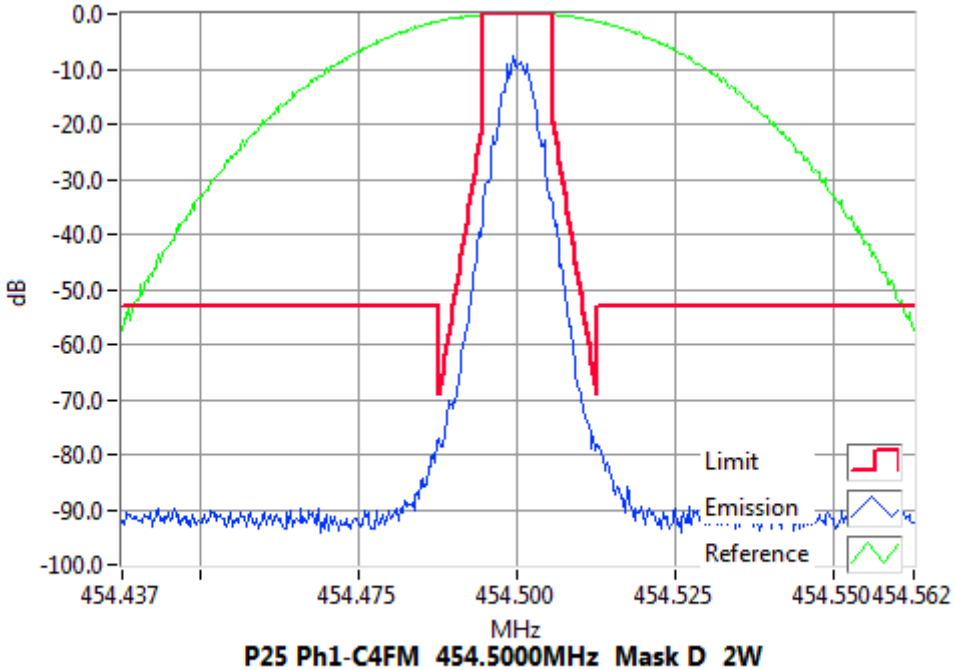
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 454.5 MHz 30 W 12.5 kHz Channel Spacing




**P25 Ph1-C4FM 454.5000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 454.5 MHz 2 W 12.5 kHz Channel Spacing



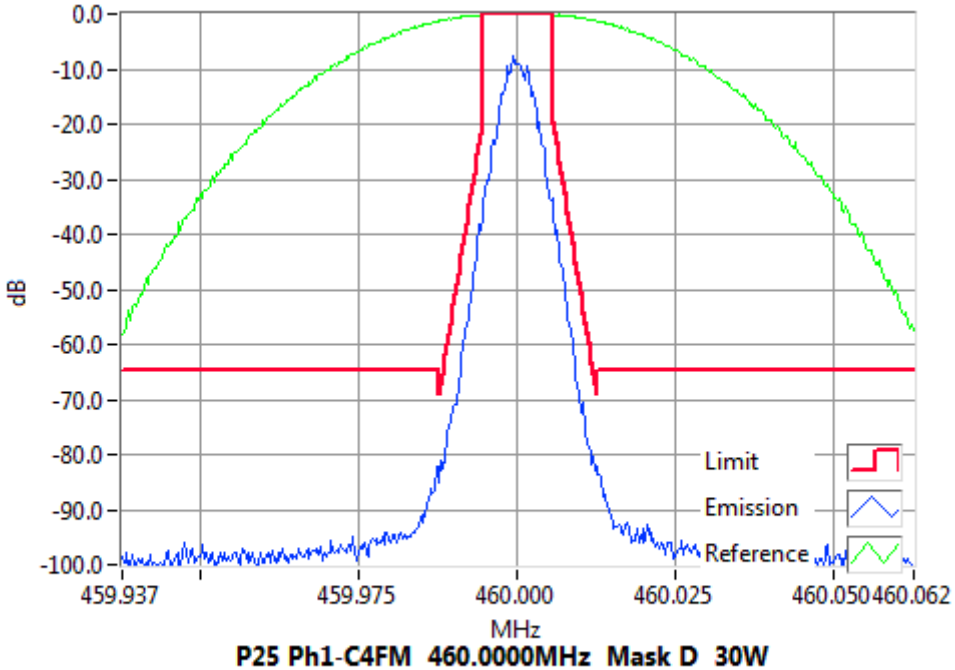

**P25 Ph1-C4FM 454.5000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

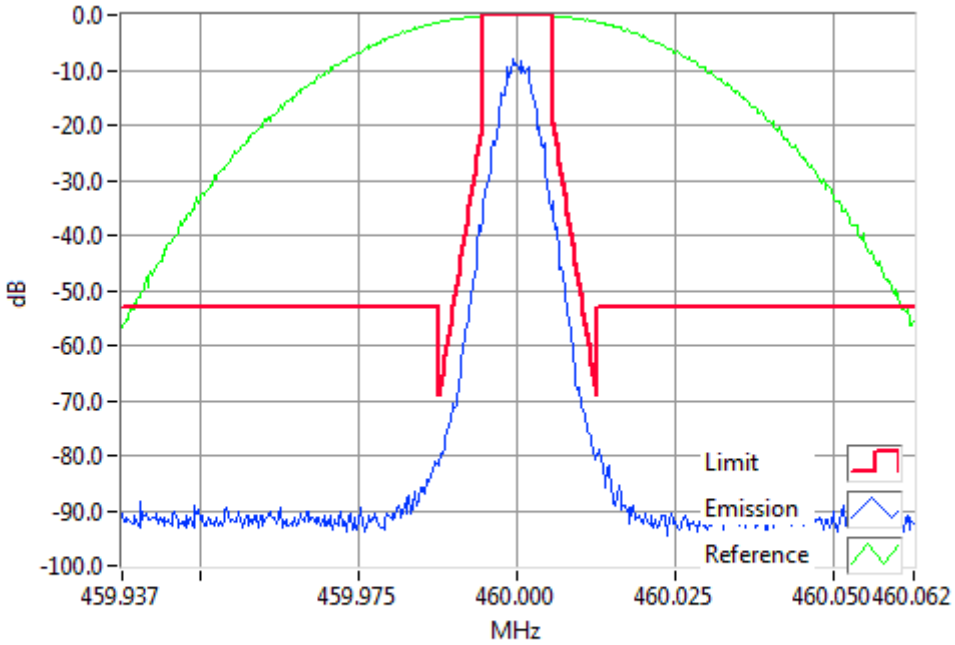
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 460.0 MHz 30 W 12.5 kHz Channel Spacing




**P25 Ph1-C4FM 460.0000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 460.0 MHz 2 W 12.5 kHz Channel Spacing



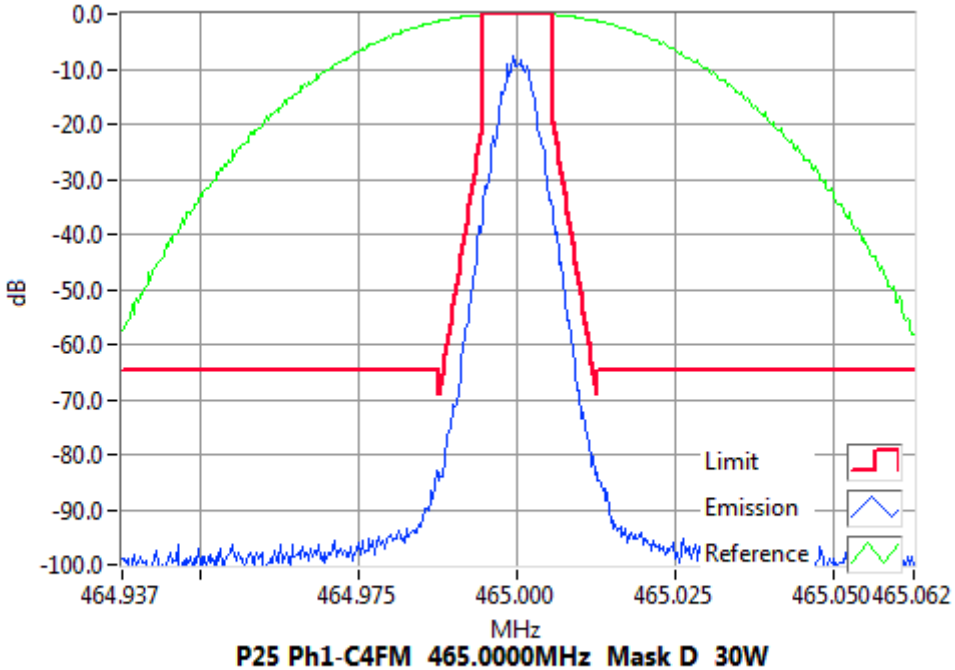

**P25 Ph1-C4FM 460.0000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

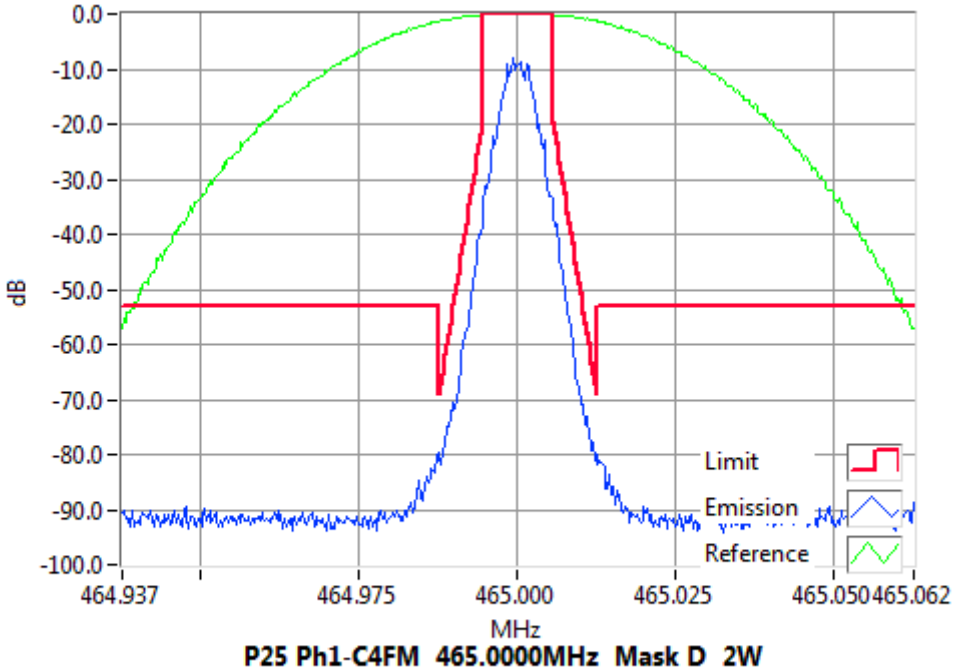
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 465.0 MHz 30 W 12.5 kHz Channel Spacing




**P25 Ph1-C4FM 465.0000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 465.0 MHz 2 W 12.5 kHz Channel Spacing



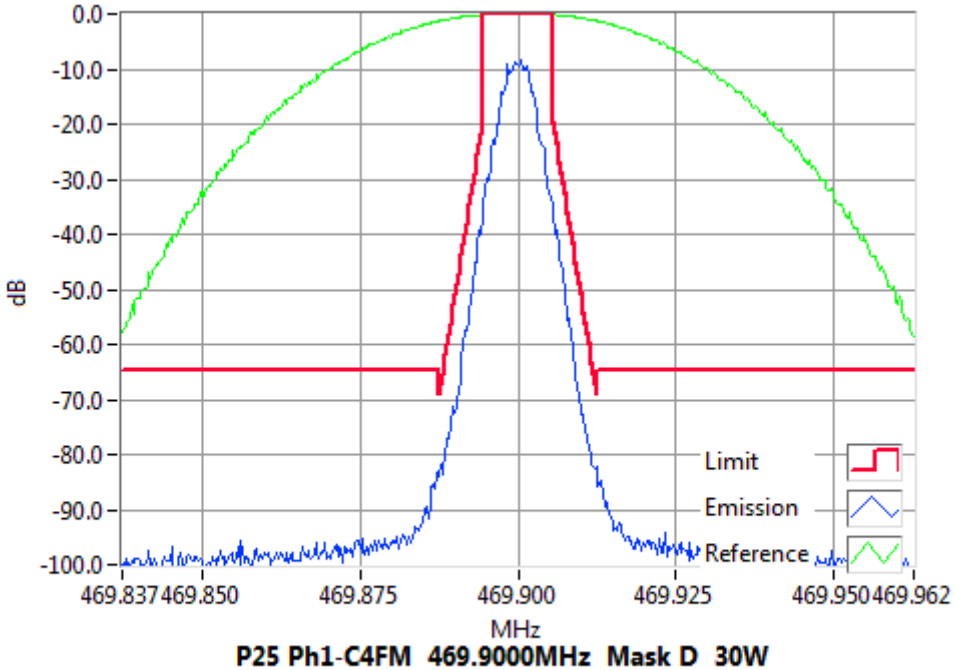

**P25 Ph1-C4FM 465.0000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

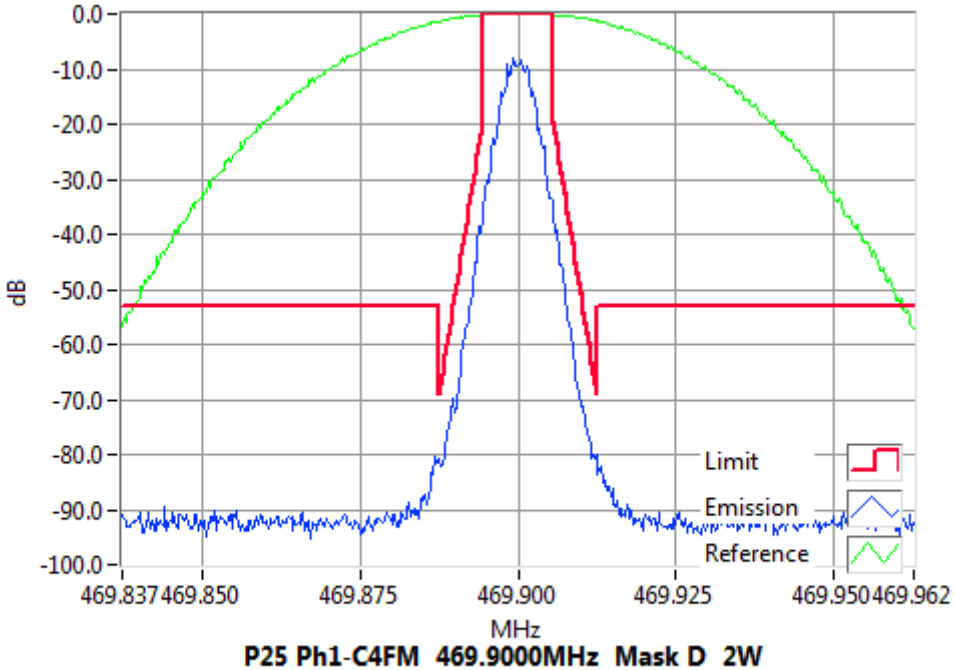
SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 469.9 MHz 30 W 12.5 kHz Channel Spacing




**P25 Ph1-C4FM 469.9000MHz Mask D 30W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

Tx FREQUENCY: 469.9 MHz 2 W 12.5 kHz Channel Spacing




**P25 Ph1-C4FM 469.9000MHz Mask D 2W**
**RBW=100Hz, VBW=1000Hz, Detector Mode=Peak**
**Result=Pass**

# TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATIONS: FCC 47 CFR 2.1051

GUIDE: TIA/EIA-603D 2.2.13

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 10th Harmonic: 100 kHz to Fc-BW
   Fc+ BW to 10Fc (4.700 GHz)
3. The EUT was set to transmit high or low power, modulated with P25 Phase 1 (C4FM). A scan is performed with a resolution bandwidth of 10 kHz and a video bandwidth of 30 kHz for frequencies up to 1 GHz, and a resolution bandwidth of 1 MHz and a video bandwidth of 3 MHz for frequencies above 1 GHz. A filter was used for frequencies just below the second harmonic to 4.000 GHz.
4. For each frequency range the spectrum analyser was loaded with the appropriate calibration figures to compensate for the cables, attenuator and filter losses, allowing the emission levels to be read directly with no further calculation.
   The calibrations are loaded as an overall reference level offset plus a set of correction factors for the required frequency band.

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

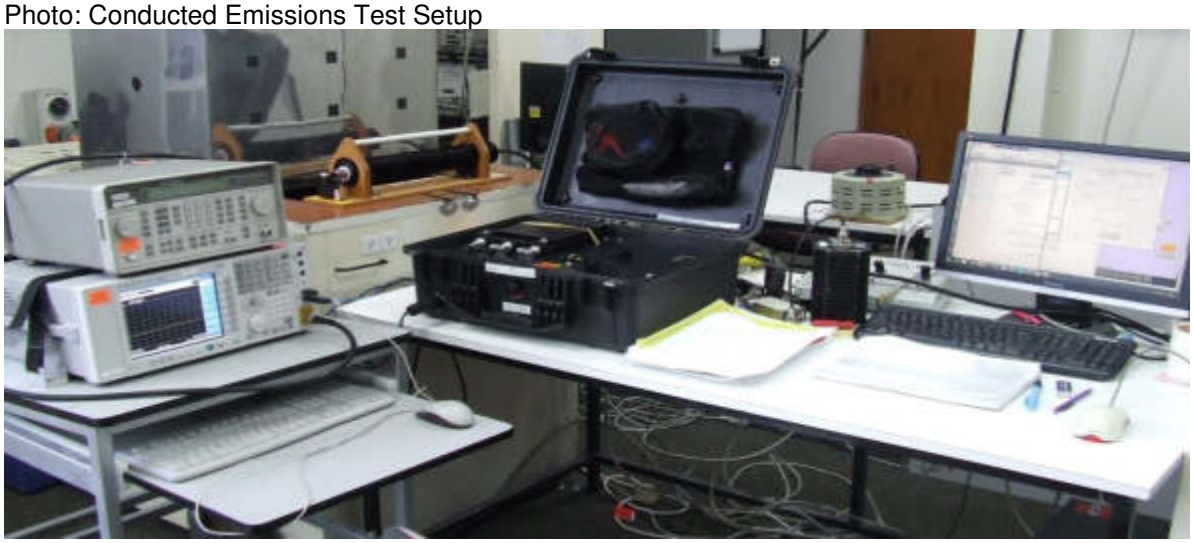
Example of attenuation correction:

| | | |
|---|---|---|
| 30dB 350W CK9178 | 32.25 | |
| 2m5 Blue 33449 | 0.76 | |
| 3m Blue 503429 | 0.69 | |
| E3384 400_520MHz HPBRF | 1.33 | |
| Total Attenuation @ 812.400M Hz | 35.04 | Sum of component attenuation (a) |
| Amplitude offset | 37.05 | (b) |
| Correction @ 812.400M Hz | -2.01 | (a-b) |

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

LIMIT CLAUSES: FCC 47 CFR 90.210

Photo: Conducted Emissions Test Setup



# Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

12.5 kHz Channel Spacing 406.2 MHz @ 30 W Emission Mask D

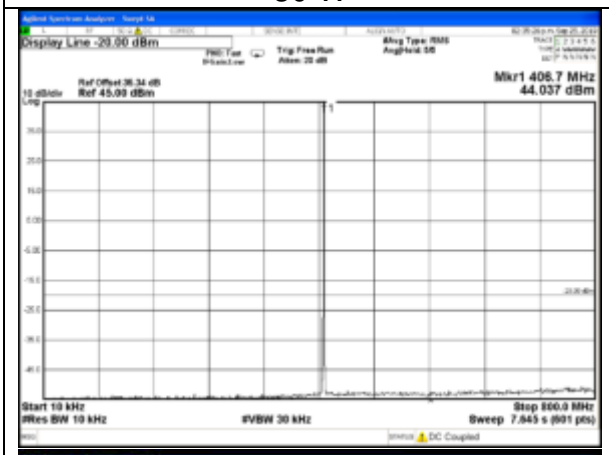
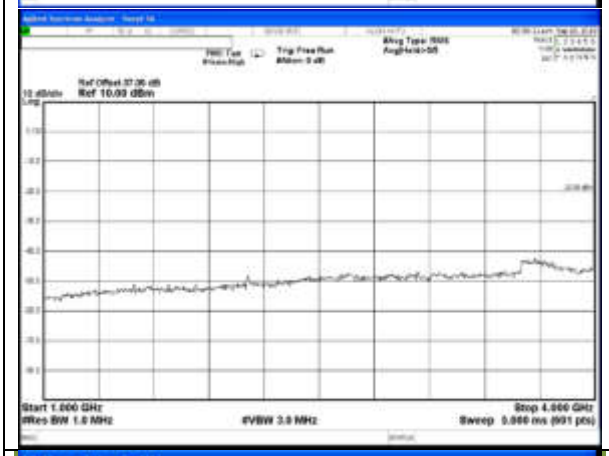
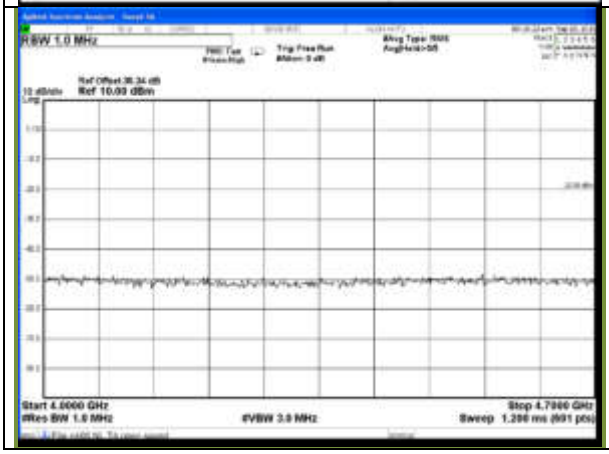
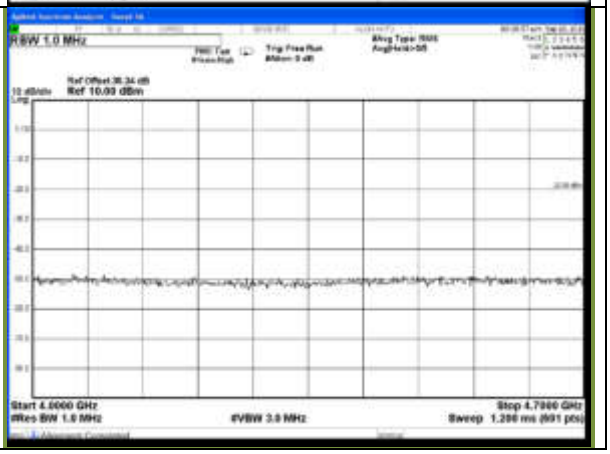
| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |

12.5 kHz Channel Spacing 406.2 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty: | ≤12.75 GHz ± 3.0 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

# Spurious Emissions (Tx Conducted)

## 406.2 MHz

| 30 W | 2 W |
|---|---|
|  |  |
|  |  |
|  |  |
|  |  |

# Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

12.5 kHz Channel Spacing 418.05 MHz @ 30 W Emission Mask D

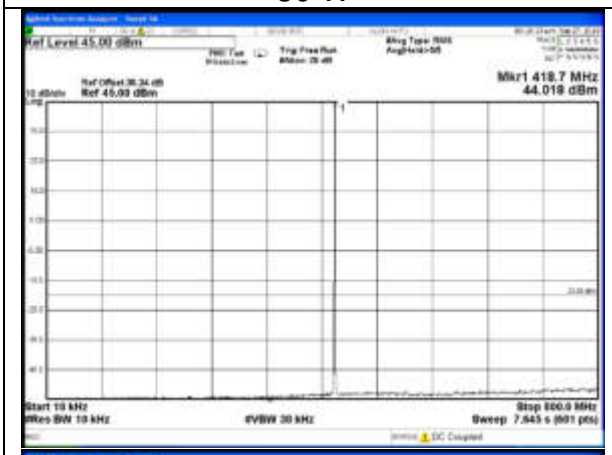
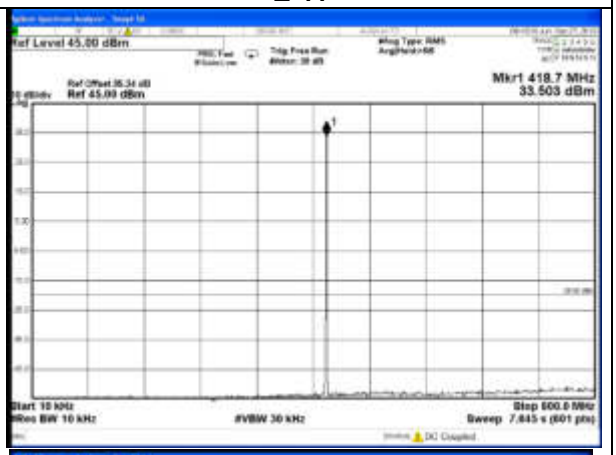
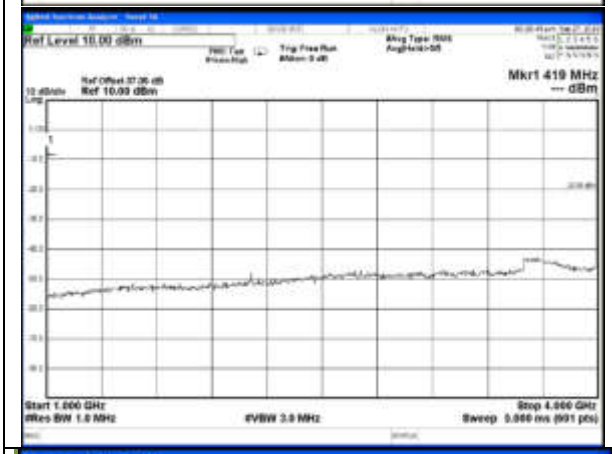
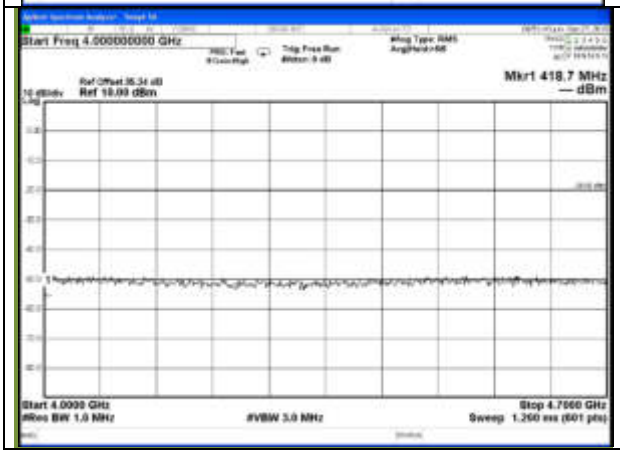
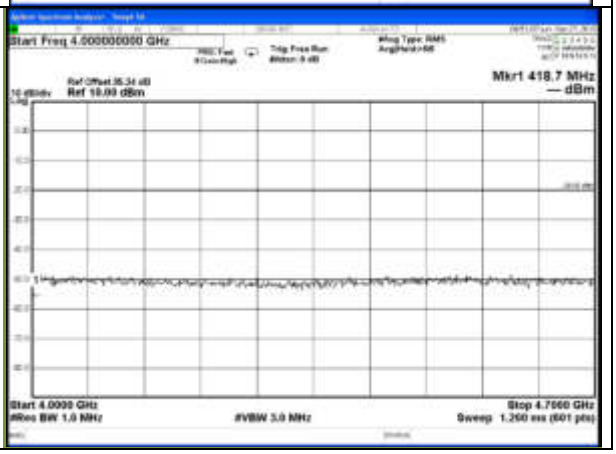
| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |

12.5 kHz Channel Spacing 418.05 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty: | ≤12.75 GHz ± 3.0 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

## Spurious Emissions (Tx Conducted)

418.05 MHz

| 30 W | 2 W |
| --- | --- |
|  |  |
|  |  |
|  |  |
|  |  |

# Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

12.5 kHz Channel Spacing 429.9 MHz @ 30 W Emission Mask D

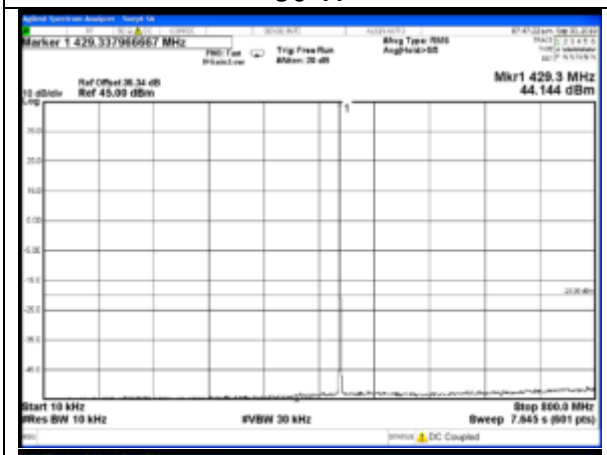
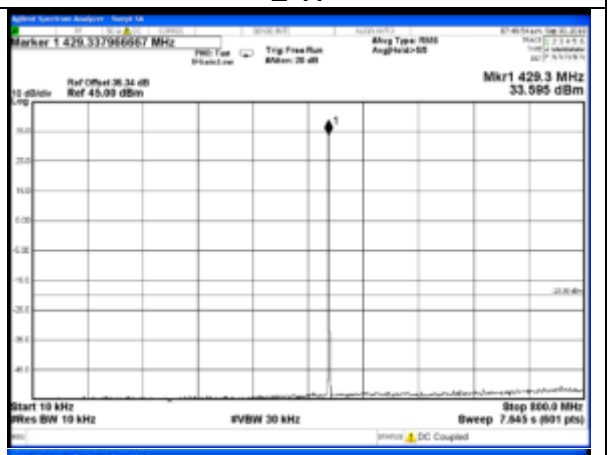
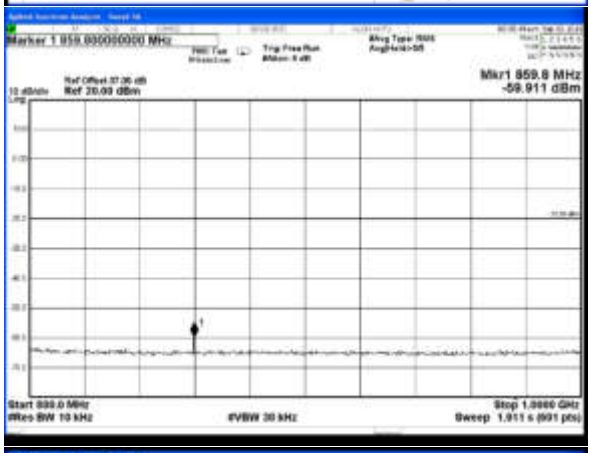
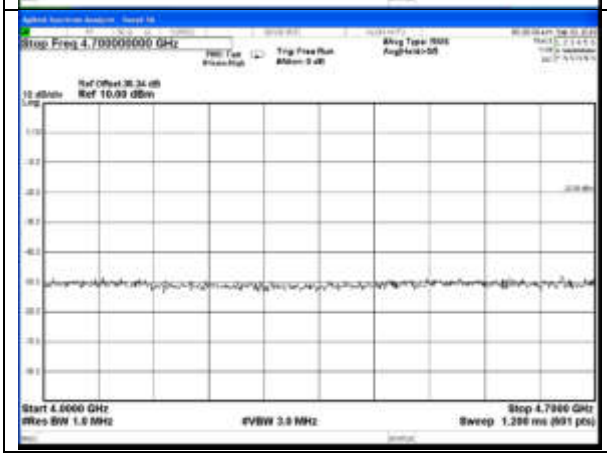
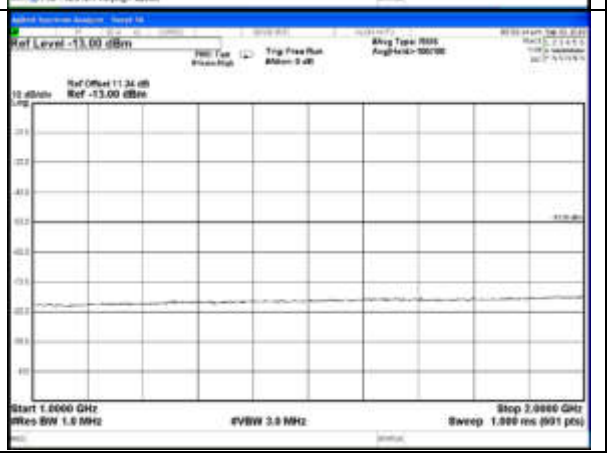
| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |

12.5 kHz Channel Spacing 429.9 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty: | ≤12.75 GHz ± 3.0 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

# Spurious Emissions (Tx Conducted)

## 429.9 MHz

| 30 W | 2 W |
|---|---|
|  |  |
|  |  |
|  |  |
|  |  |

# Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

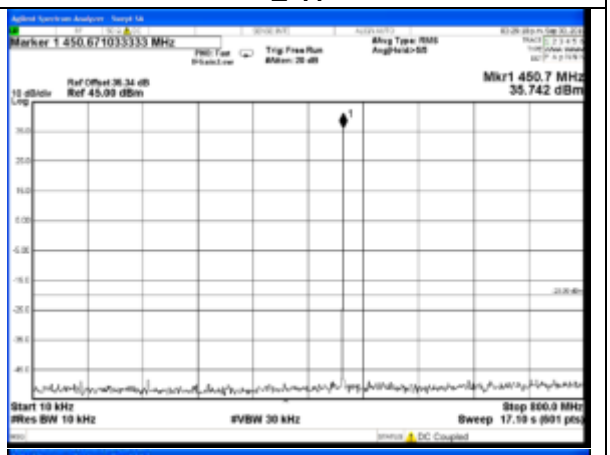
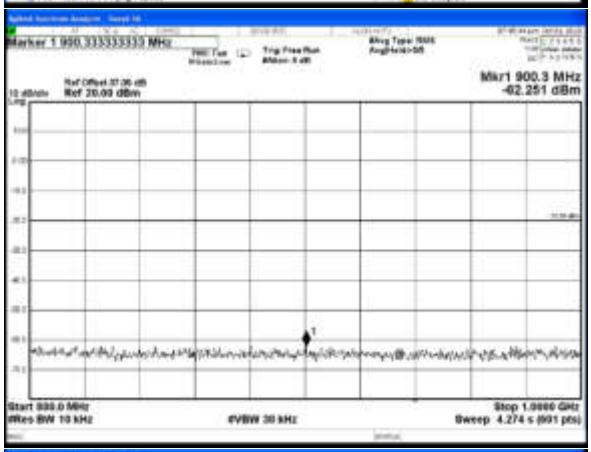
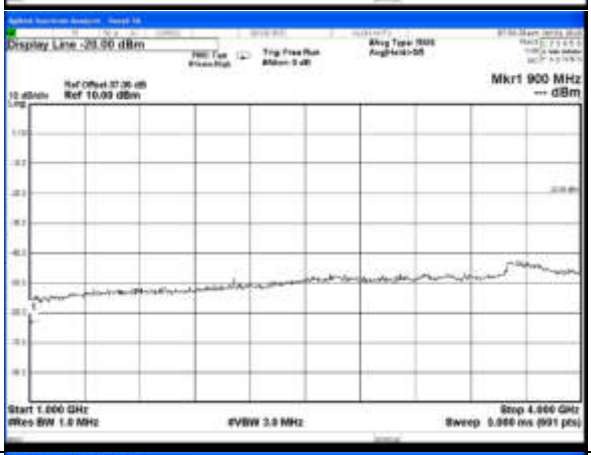
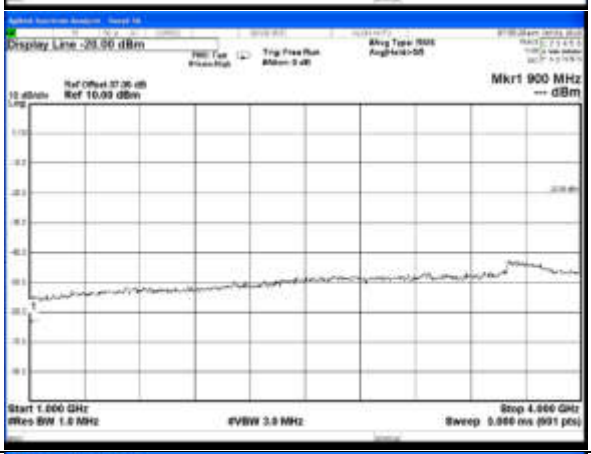
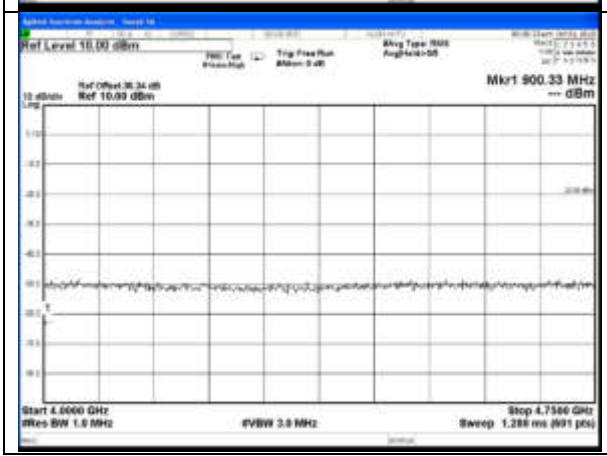
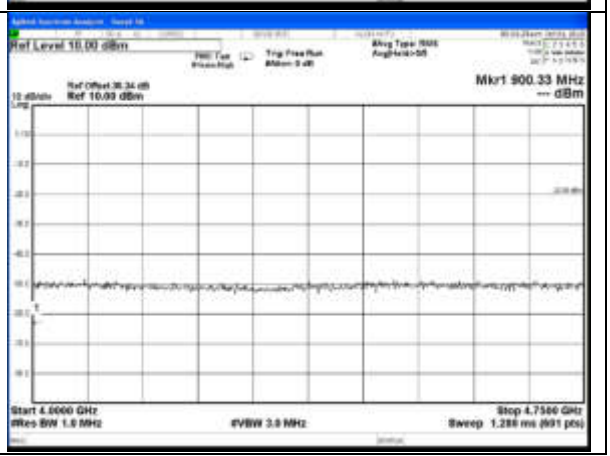
12.5 kHz Channel Spacing 450.1 MHz @ 30 W Emission Mask D

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

12.5 kHz Channel Spacing 450.1 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty: | ≤12.75 GHz ± 3.0 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

## Spurious Emissions (Tx Conducted)

| 450.1 MHz | |
|---|---|
| 30 W | 2 W |
|  |  |
|  |  |
|  |  |
|  |  |

# Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

12.5 kHz Channel Spacing 454.5 MHz @ 30 W Emission Mask D

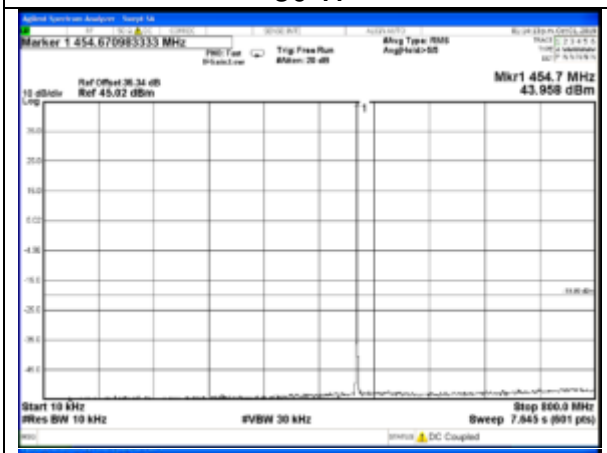
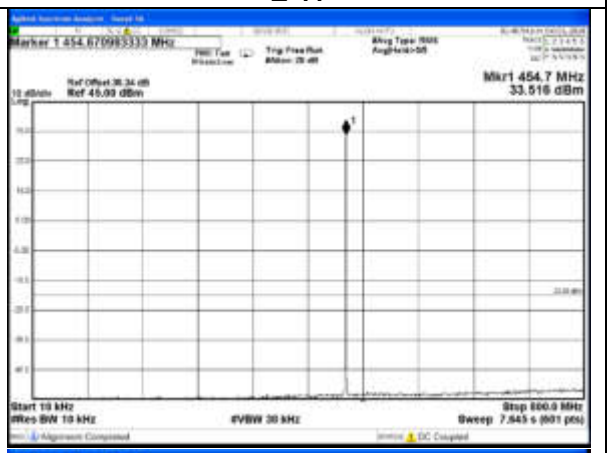
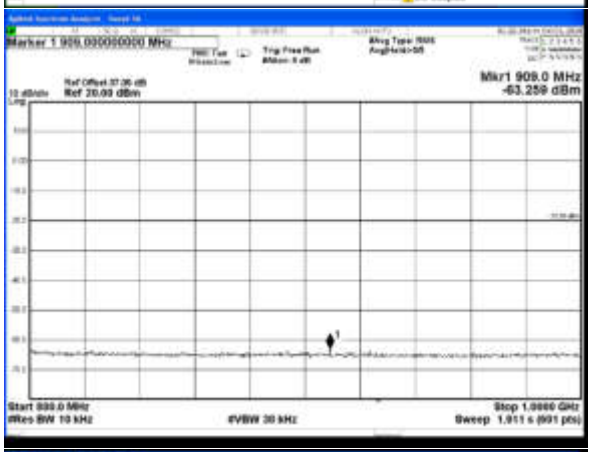
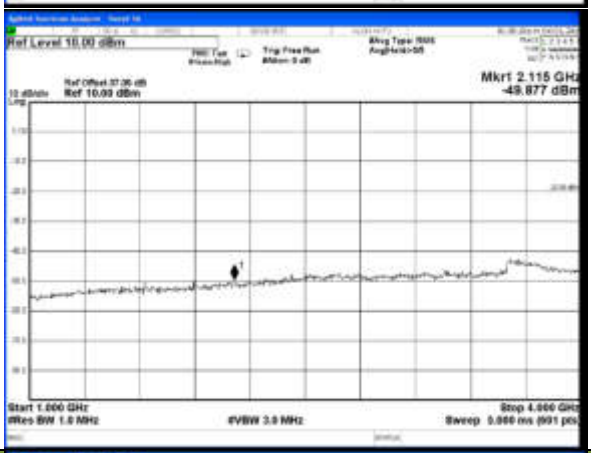
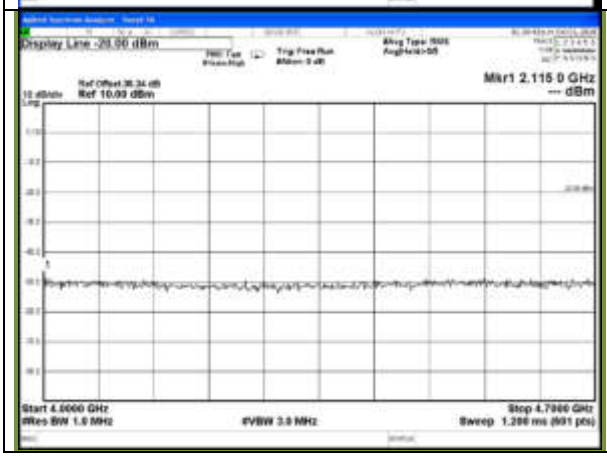
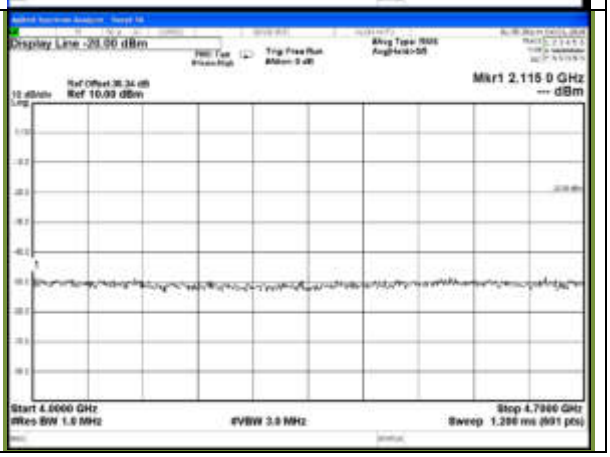
| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |

12.5 kHz Channel Spacing 454.5 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty: | ≤12.75 GHz ± 3.0 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

# Spurious Emissions (Tx Conducted)

## 454.5 MHz

| 30 W | 2 W |
|---|---|
|  |  |
|  |  |
|  |  |
|  |  |

# Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

12.5 kHz Channel Spacing 460.0 MHz @ 30 W Emission Mask D

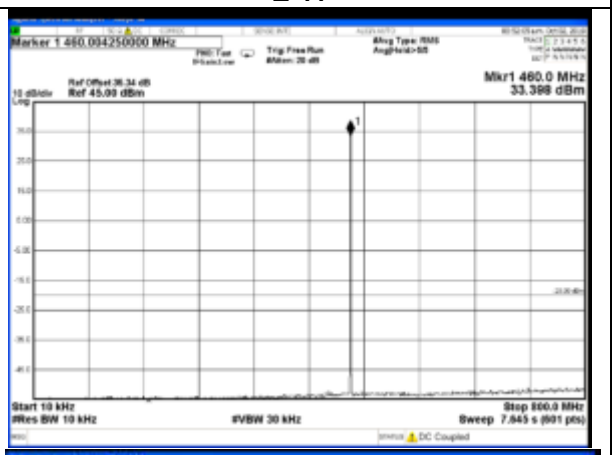
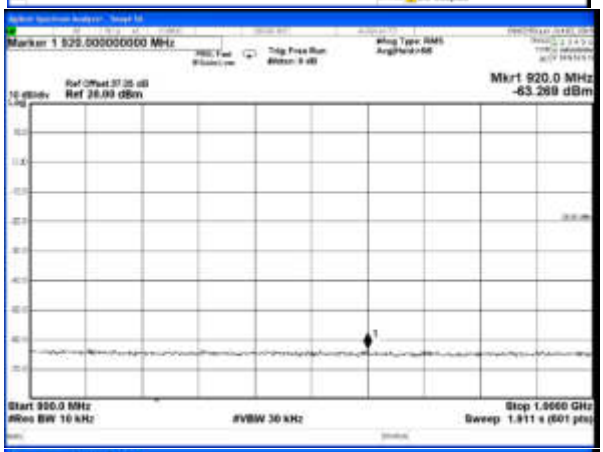
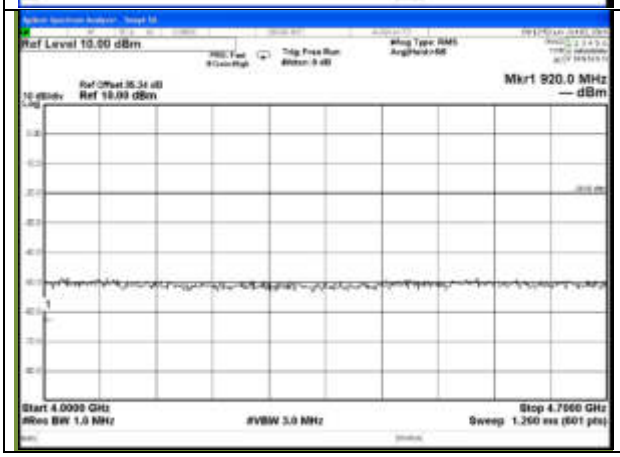
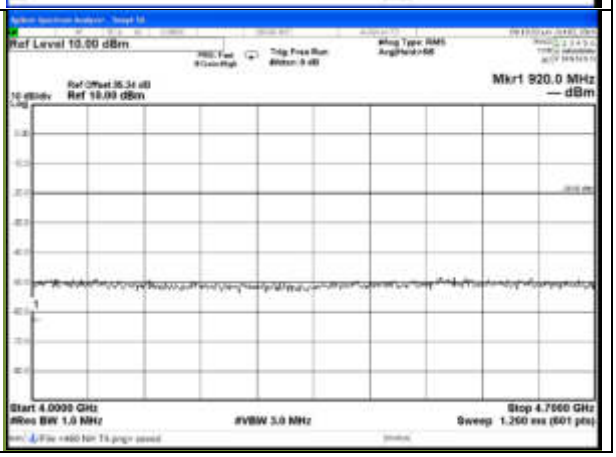
| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |

12.5 kHz Channel Spacing 460.0 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty: | ≤12.75 GHz ± 3.0 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

## Spurious Emissions (Tx Conducted)

460.0 MHz

| 30 W | 2 W |
|---|---|
|  |  |
|  |  |
|  |  |
|  |  |

# Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

12.5 kHz Channel Spacing 465.0 MHz @ 30 W Emission Mask D

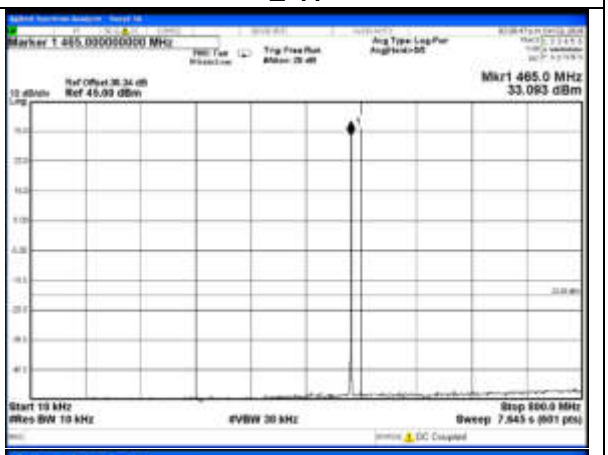
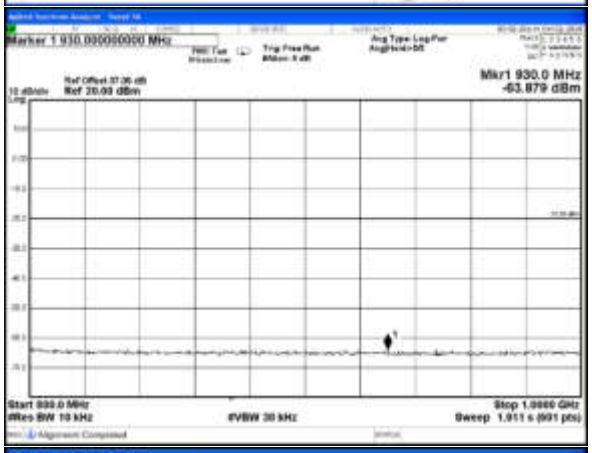
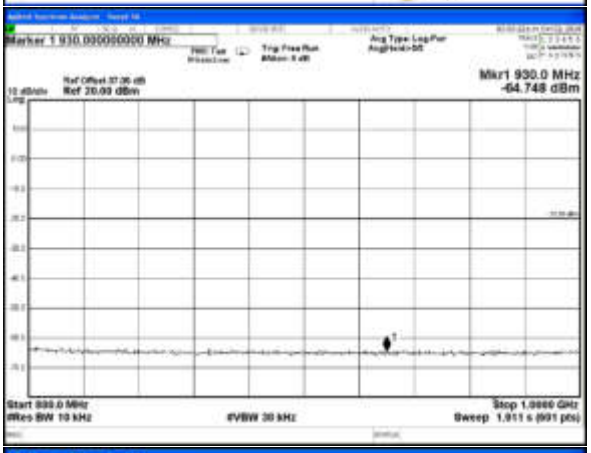
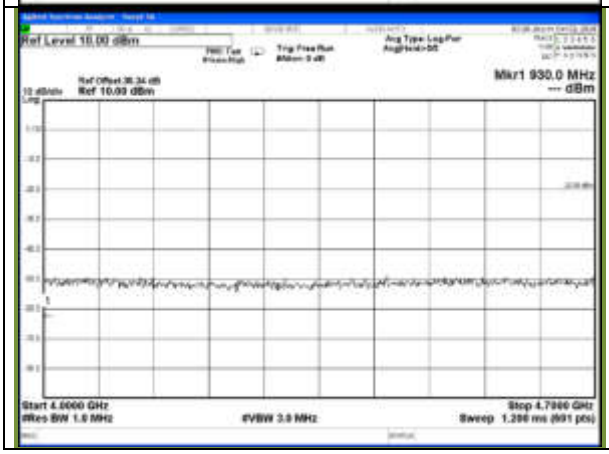
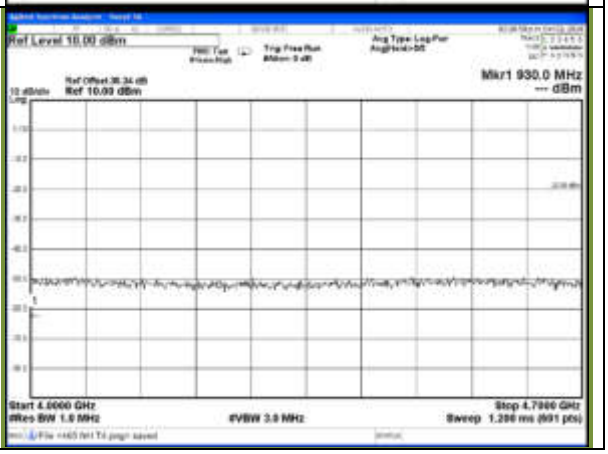
| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |

12.5 kHz Channel Spacing 465.0 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty: | ≤12.75 GHz ± 3.0 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

# Spurious Emissions (Tx Conducted)

## 465.0 MHz

| 30 W | 2 W |
|---|---|
|  |  |
|  |  |
|  |  |
|  |  |

# Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

12.5 kHz Channel Spacing 469.9 MHz @ 30 W Emission Mask D

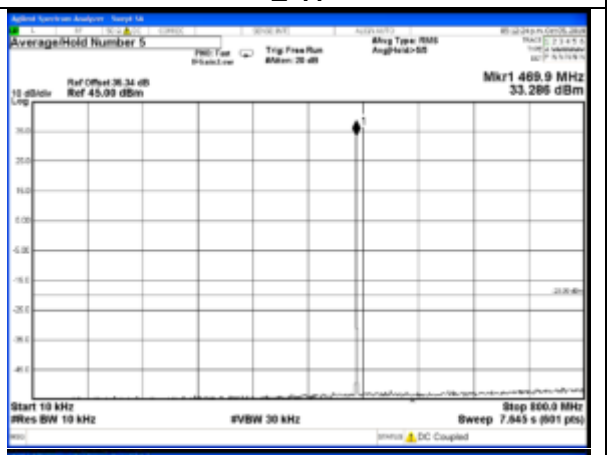
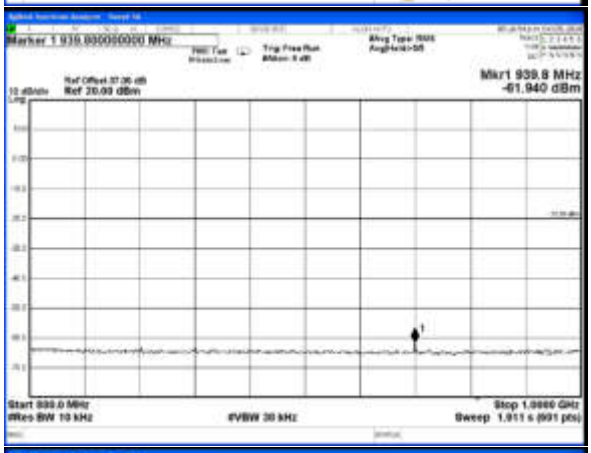
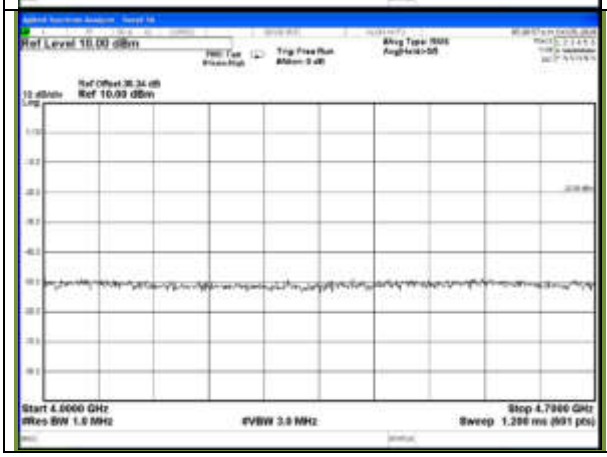
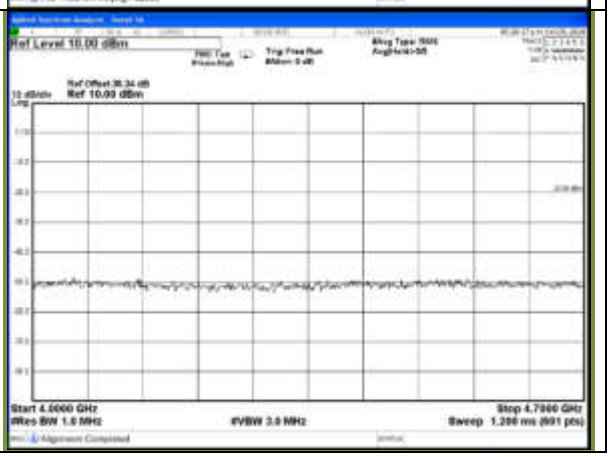
| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |

12.5 kHz Channel Spacing 469.9 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty: | ≤12.75 GHz ± 3.0 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

# Spurious Emissions (Tx Conducted)

## 469.9 MHz

| 30 W | 2 W |
|---|---|
|  |  |
|  |  |
|  |  |
|  |  |

# Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

LIMITS: FCC 47 CFR 90.210

| Carrier Output Power | Emission Mask D<br>12.5 kHz Channel Spacing<br>$50 + 10 \text{ Log}_{10} (P_{Watts})$ | |
|---|---|---|
| 30 W | -20 dBm | -64.8 dBc |
| 2 W | -20 dBm | -53.0 dBc |

# TRANSMITTER SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA/EIA-603D 2.2.12

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$^{th}$ 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$^{o}$ 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) – Continued

SPECIFICATION: FCC 47 CFR 2.1053

12.5 kHz Channel Spacing 406.2 MHz @ 30 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| 812.400000 | -38.36 | -83.4 |

12.5 kHz Channel Spacing 406.2 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty | ± 4.6 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

12.5 kHz Channel Spacing 418.05 MHz @ 30 W Emission Mask D

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

12.5 kHz Channel Spacing 418.05 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty | ± 4.6 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

12.5 kHz Channel Spacing 429.9 MHz @ 30 W Emission Mask D

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

12.5 kHz Channel Spacing 429.9 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty | ± 4.6 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

## Spurious Emissions (Tx Radiated) – Continued

12.5 kHz Channel Spacing 450.1 MHz @ 30 W Emission Mask D

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

12.5 kHz Channel Spacing 450.1 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| Measurement Uncertainty | ± 4.6 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

12.5 kHz Channel Spacing 454.5 MHz @ 30 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| 3636.000000 | -38.76 | -83.7 |
| ~ | ~ | ~ |

12.5 kHz Channel Spacing 454.5 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| 3636.000000 | -38.89 | -83.9 |
| ~ | ~ | ~ |
| Measurement Uncertainty | ± 4.6 dB | |
| No other emissions were detected at a level greater than 20 dB below the limit. | | |

12.5 kHz Channel Spacing 460.0 MHz @ 30 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| 920.000000 | -36.45 | -81.45 |
| | | |

12.5 kHz Channel Spacing 460.0 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| | | |
| Measurement Uncertainty | ± 4.6 dB | |
| No other emissions were detected at a level greater than 20 dB below the limit. | | |

## Spurious Emissions (Tx Radiated) – Continued

12.5 kHz Channel Spacing 465.0 MHz @ 30 W Emission Mask D

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

12.5 kHz Channel Spacing 465.0 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| | | |
| Measurement Uncertainty | ± 4.6 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

12.5 kHz Channel Spacing 469.9 MHz @ 30 W Emission Mask D

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

12.5 kHz Channel Spacing 469.9 MHz @ 2 W Emission Mask D

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| ~ | ~ | ~ |
| | | |
| Measurement Uncertainty | ± 4.6 dB | |
| No emissions were detected at a level greater than 20 dB below the limit. | | |

## Spurious Emissions (Tx Radiated) - Continued

LIMITS: FCC 47 CFR 2.1053

| Carrier Output Power | Emission Mask D<br>12.5 kHz Channel Spacing<br>$50 + 10 \text{ Log}_{10} (P_{Watts})$ | |
|---|---|---|
| 30 W | -20 dBm | -65 dBc |
| 2 W | -20 dBm | -53 dBc |

Open Area Test Site Results:

12.5 kHz Channel Spacing | 406.2 MHz @ 30 W | Emission Mask D

| Harmonics Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|---|---|
| 812.400000 | -38.36 | -83.36 |
| 1218.600000 | -53.20 | -98.2 |
| 1624.800000 | -59.05 | -104.05 |
| 2031.000000 | -74.17 | -119.17 |
| 2437.200000 | -64.85 | -109.85 |
| 2843.400000 | -69.22 | -114.22 |
| Measurement Uncertainty | ± 4.6 dB | |

| **Sample Calculation** | Measurement | | | | | |
|---|---|---|---|---|---|---|
| | Reference | Substitution | | | | Result |
| Emission Frequency (MHz) | Reference Level (dBm) | Sig-gen Level | Cable and Attenuator Gain | Antenna Gain (dBd) | Path and Boresight corrections | dBm |
| 812.400000 | -71.22 | -20.70 | -16.63 | -1.11 | 0.09 | -38.36 |
| | | A | B | C | D | E |

Result (E) = A+B+C+D Result
Photo: OATS Setup

# TRANSIENT FREQUENCY BEHAVIOR

SPECIFICATION: FCC 47 CFR 90.214

GUIDE: TIA/EIA-603D 2.2.19

MEASUREMENT PROCEDURE:
1. Refer Annex A for equipment set up.
2. Measurements and plots were made following the TIA/EIA 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

# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 406.2 MHz 30 W 12.5 kHz Channel Spacing

| TRANSIENT RESPONSE PERIOD | CARRIER PEAK VARIATION FROM NORMAL | |
|---|---|---|
| | Key ON (kHz) | Key OFF (kHz) |
| t1 | -0.2 | N/A |
| t2 | -0.3 | N/A |
| t3 | N/A | -0.4 |

| | YES | NO |
|---|---|---|
| Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation. | ☑ | ☐ |
| Confirm that during the period t2 the frequency difference does not exceed half a channel separation. | ☑ | ☐ |
| Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit. | ☑ | ☐ |

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

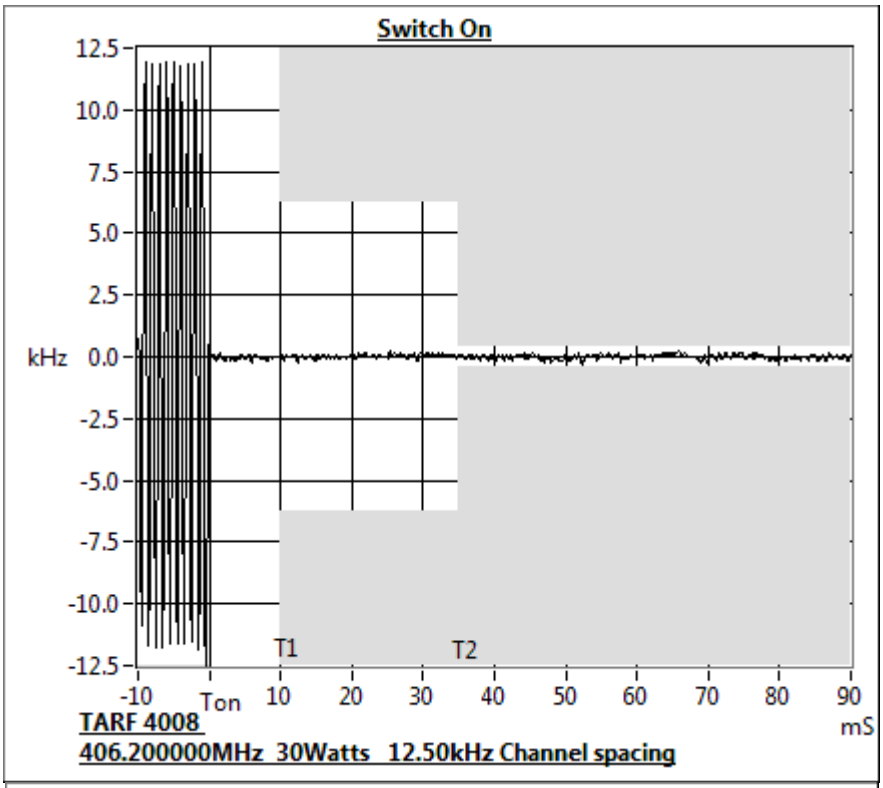
LIMIT: FCC 47 CFR 90.214

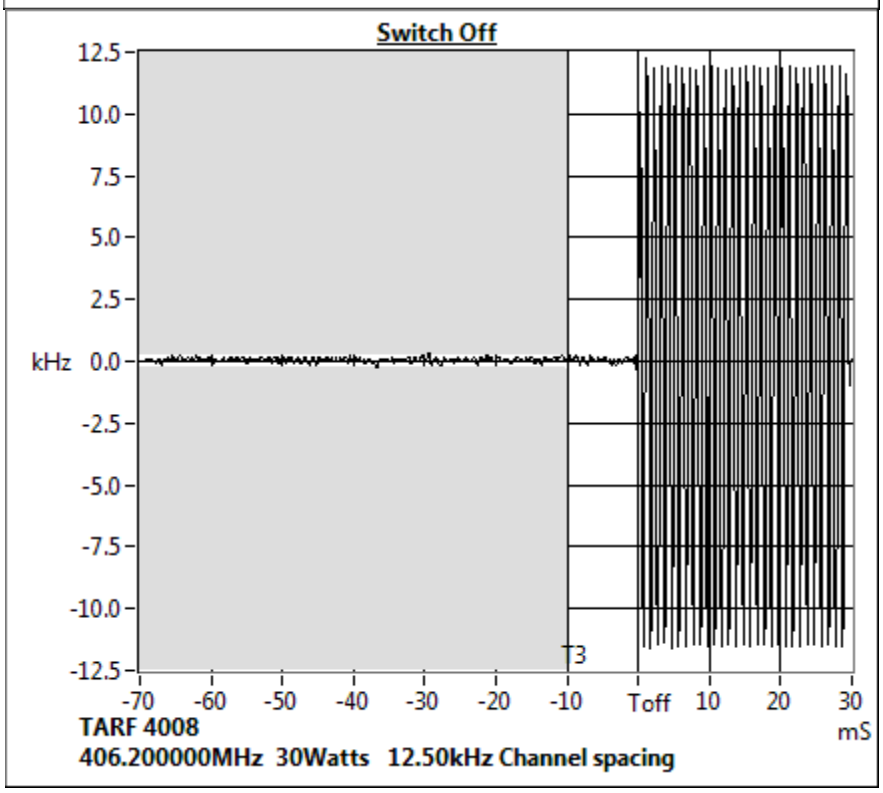
| TRANSIENT PERIODS | FREQUENCY RANGE | |
|---|---|---|
| | 150 MHz – 174 MHz | 421 MHz – 512 MHz |
| t1 (ms) | 5 ms | 10 ms |
| t2 (ms) | 20 ms | 25 ms |
| t3 (ms) | 5 ms | 10 ms |

# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 406.2 MHz 30 W 12.5 kHz Channel Spacing



# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 418.05 MHz 30 W 12.5 kHz Channel Spacing

| TRANSIENT RESPONSE PERIOD | CARRIER PEAK VARIATION FROM NORMAL | |
|---|---|---|
| | Key ON (kHz) | Key OFF (kHz) |
| t1 | 0.2 | N/A |
| t2 | 0.2 | N/A |
| t3 | N/A | -2.6 |

| | YES | NO |
|---|---|---|
| Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation. | ☑ | ☐ |
| Confirm that during the period t2 the frequency difference does not exceed half a channel separation. | ☑ | ☐ |
| Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit. | ☑ | ☐ |

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

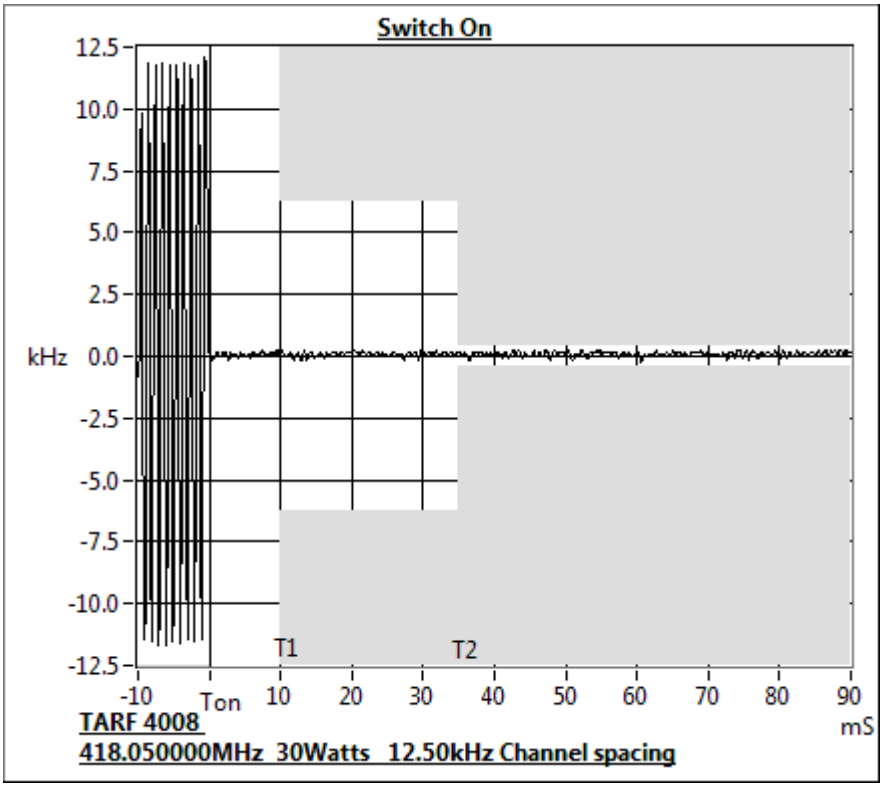
LIMIT: FCC 47 CFR 90.214

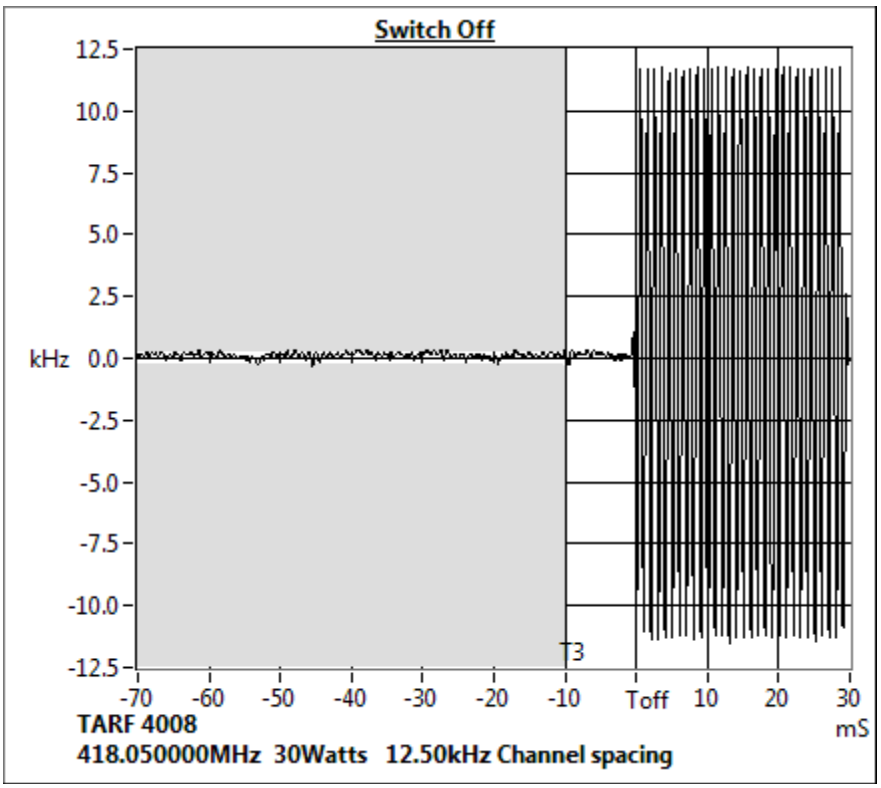
| TRANSIENT PERIODS | FREQUENCY RANGE | |
|---|---|---|
| | 150 MHz – 174 MHz | 421 MHz – 512 MHz |
| t1 (ms) | 5 ms | 10 ms |
| t2 (ms) | 20 ms | 25 ms |
| t3 (ms) | 5 ms | 10 ms |

# Transient Frequency Behavior

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 418.05 MHz 30 W 12.5 kHz Channel Spacing



# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 429.9 MHz 30 W 12.5 kHz Channel Spacing

| 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 | 1.2 |

| | YES | NO |
|---|---|---|
| Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation. | ☑ | ☐ |
| Confirm that during the period t2 the frequency difference does not exceed half a channel separation. | ☑ | ☐ |
| Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit. | ☑ | ☐ |

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

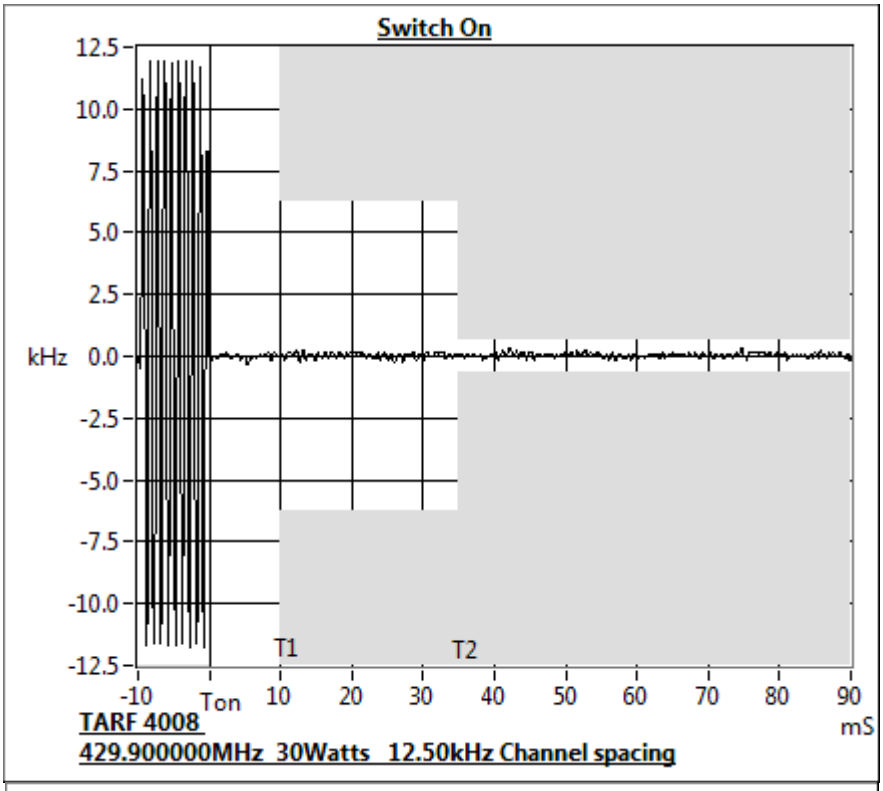
LIMIT: FCC 47 CFR 90.214

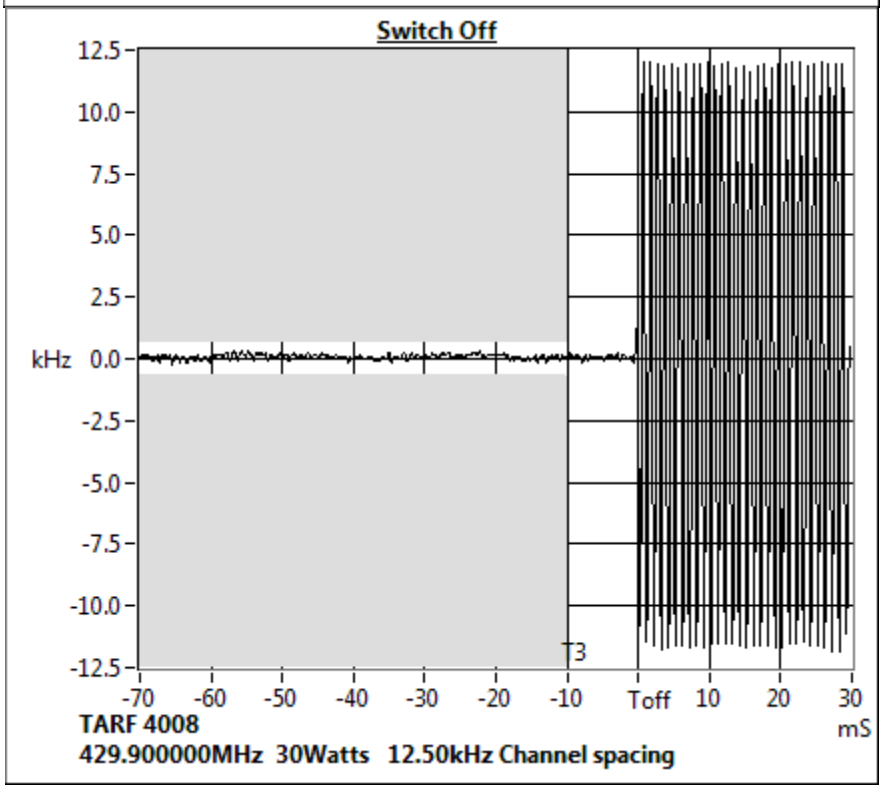
| TRANSIENT PERIODS | FREQUENCY RANGE | |
|---|---|---|
| | 150 MHz – 174 MHz | 421 MHz – 512 MHz |
| t1 (ms) | 5 ms | 10 ms |
| t2 (ms) | 20 ms | 25 ms |
| t3 (ms) | 5 ms | 10 ms |

# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 429.9 MHz 30 W 12.5 kHz Channel Spacing



# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 450.1 MHz 30 W 12.5 kHz Channel Spacing

| TRANSIENT RESPONSE PERIOD | CARRIER PEAK VARIATION FROM NORMAL | |
|---|---|---|
| | Key ON (kHz) | Key OFF (kHz) |
| t1 | 0.5 | N/A |
| t2 | -0.4 | N/A |
| t3 | N/A | -2.4 |

| | YES | NO |
|---|---|---|
| Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation. | ☑ | ☐ |
| Confirm that during the period t2 the frequency difference does not exceed half a channel separation. | ☑ | ☐ |
| Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit. | ☑ | ☐ |

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

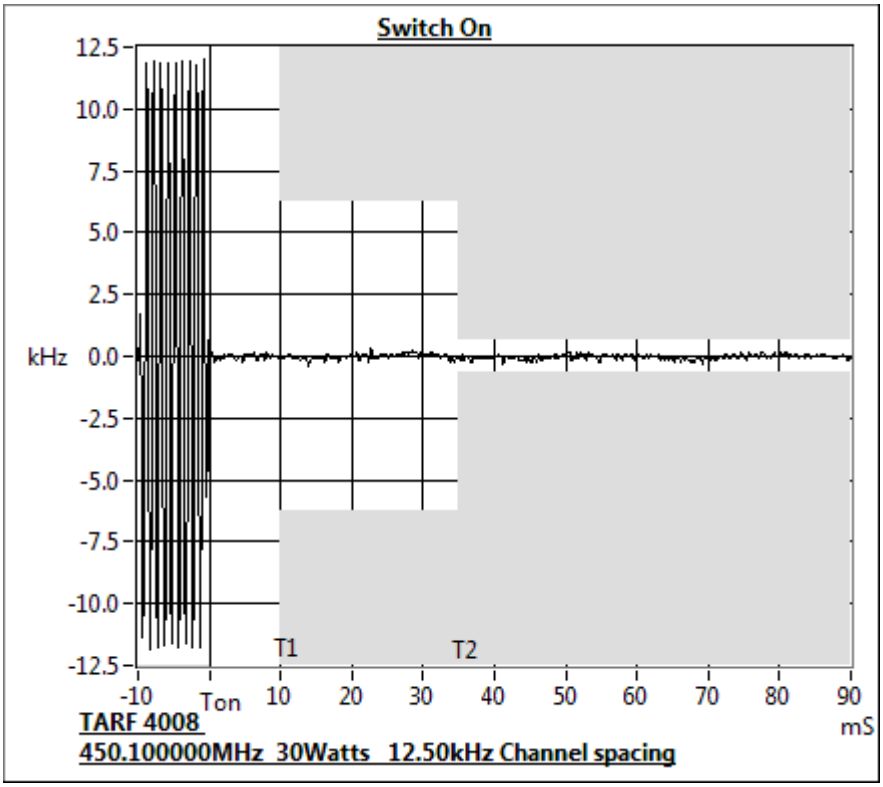
LIMIT: FCC 47 CFR 90.214

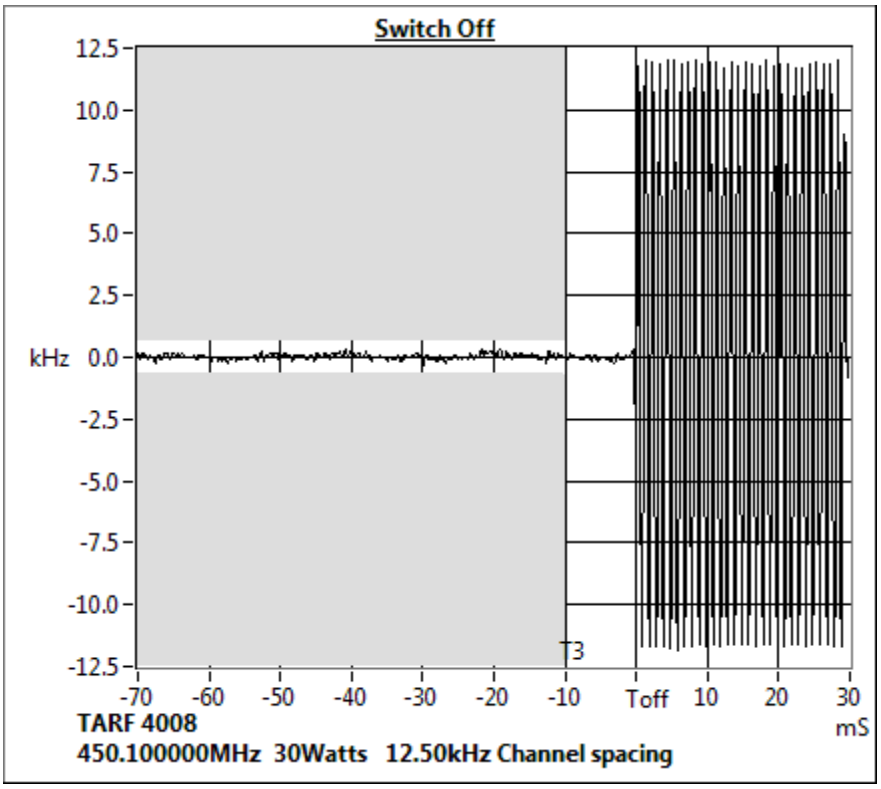
| TRANSIENT PERIODS | FREQUENCY RANGE | |
|---|---|---|
| | 150 MHz – 174 MHz | 421 MHz – 512 MHz |
| t1 (ms) | 5 ms | 10 ms |
| t2 (ms) | 20 ms | 25 ms |
| t3 (ms) | 5 ms | 10 ms |

# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 450.1 MHz 30 W 12.5 kHz Channel Spacing



# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 454.5 MHz 30 W 12.5 kHz Channel Spacing

| TRANSIENT RESPONSE PERIOD | CARRIER PEAK VARIATION FROM NORMAL | |
|---|---|---|
| | Key ON (kHz) | Key OFF (kHz) |
| t1 | -0.2 | N/A |
| t2 | 0.2 | N/A |
| t3 | N/A | 1.0 |

| | YES | NO |
|---|---|---|
| Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation. | ☑ | ☐ |
| Confirm that during the period t2 the frequency difference does not exceed half a channel separation. | ☑ | ☐ |
| Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit. | ☑ | ☐ |

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

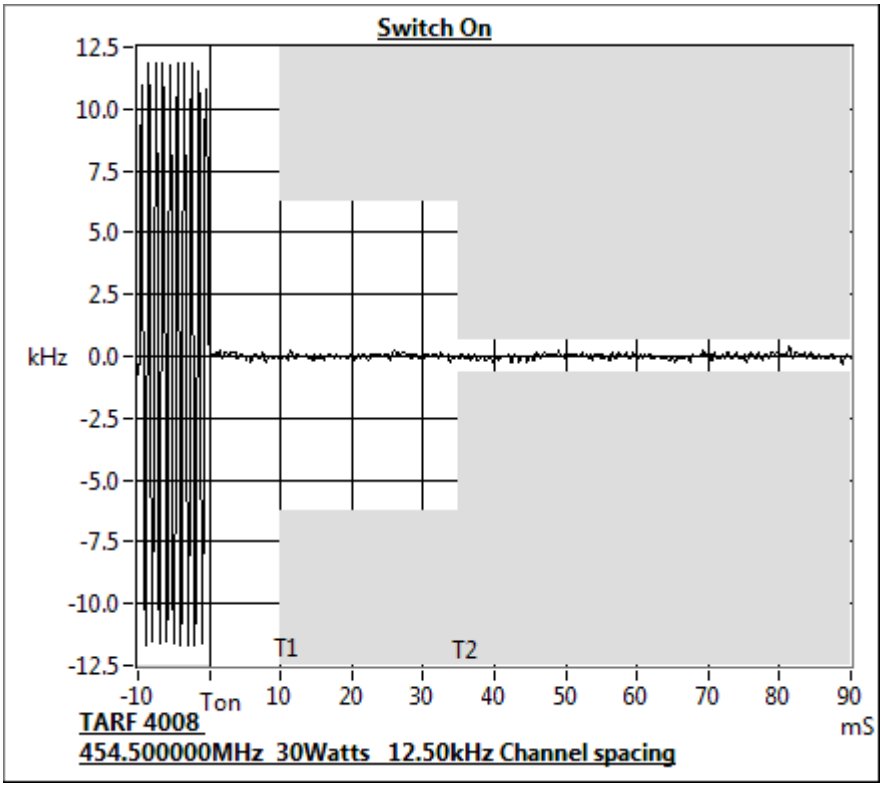
LIMIT: FCC 47 CFR 90.214

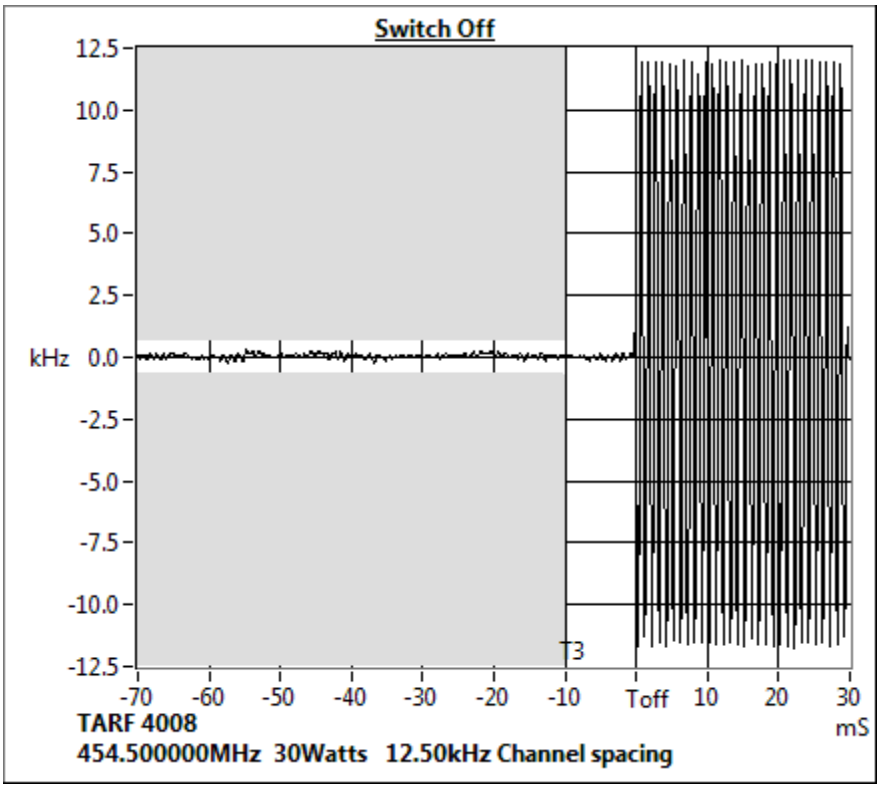
| TRANSIENT PERIODS | FREQUENCY RANGE | |
|---|---|---|
| | 150 MHz – 174 MHz | 421 MHz – 512 MHz |
| t1 (ms) | 5 ms | 10 ms |
| t2 (ms) | 20 ms | 25 ms |
| t3 (ms) | 5 ms | 10 ms |

# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 454.5 MHz 30 W 12.5 kHz Channel Spacing



## Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 460.0 MHz 30 W 12.5 kHz Channel Spacing

| TRANSIENT RESPONSE PERIOD | CARRIER PEAK VARIATION FROM NORMAL | |
|---|---|---|
| | Key ON (kHz) | Key OFF (kHz) |
| t1 | -0.2 | N/A |
| t2 | -0.6 | N/A |
| t3 | N/A | -1.0 |

| | YES | NO |
|---|---|---|
| Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation. | ☑ | ☐ |
| Confirm that during the period t2 the frequency difference does not exceed half a channel separation. | ☑ | ☐ |
| Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit. | ☑ | ☐ |

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

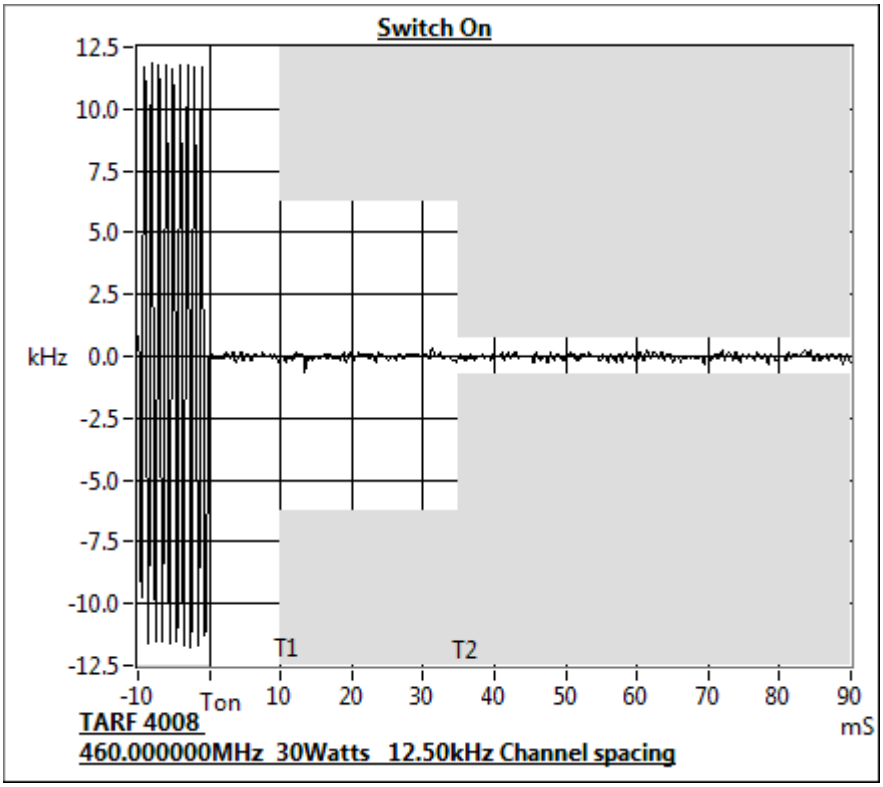
LIMIT: FCC 47 CFR 90.214

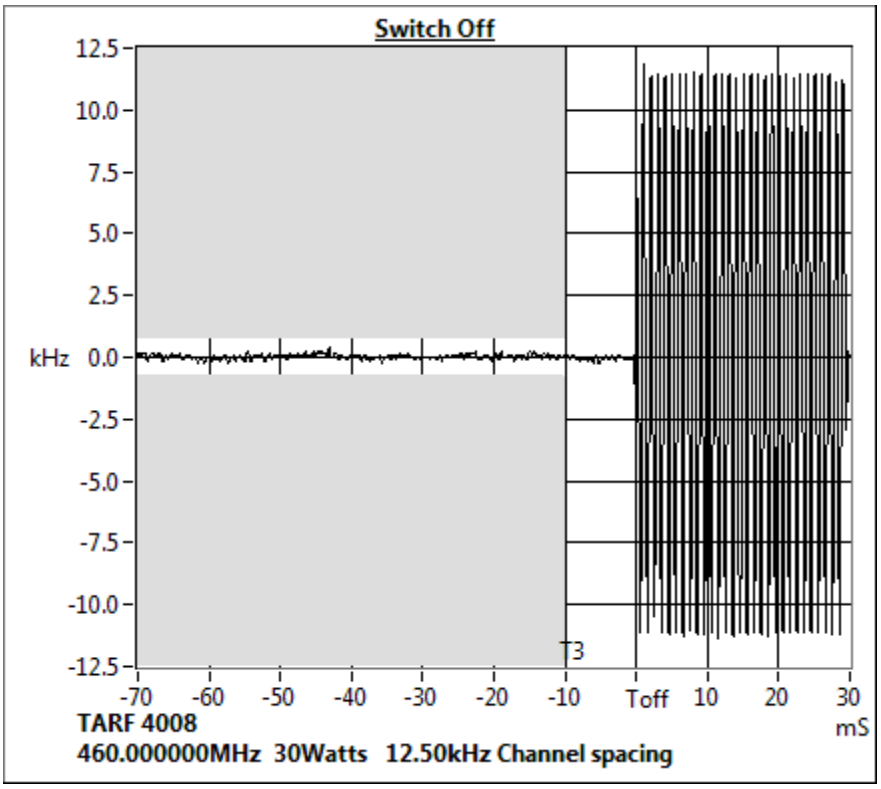
| TRANSIENT PERIODS | FREQUENCY RANGE | |
|---|---|---|
| | 150 MHz – 174 MHz | 421 MHz – 512 MHz |
| t1 (ms) | 5 ms | 10 ms |
| t2 (ms) | 20 ms | 25 ms |
| t3 (ms) | 5 ms | 10 ms |

# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 460.0 MHz 30 W 12.5 kHz Channel Spacing



## Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 465.0 MHz 30 W 12.5 kHz Channel Spacing

| TRANSIENT RESPONSE PERIOD | CARRIER PEAK VARIATION FROM NORMAL | |
|---|---|---|
| | Key ON (kHz) | Key OFF (kHz) |
| t1 | -1.5 | N/A |
| t2 | -0.3 | N/A |
| t3 | N/A | -3.9 |

| | YES | NO |
|---|---|---|
| Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation. | ☑ | ☐ |
| Confirm that during the period t2 the frequency difference does not exceed half a channel separation. | ☑ | ☐ |
| Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit. | ☑ | ☐ |

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

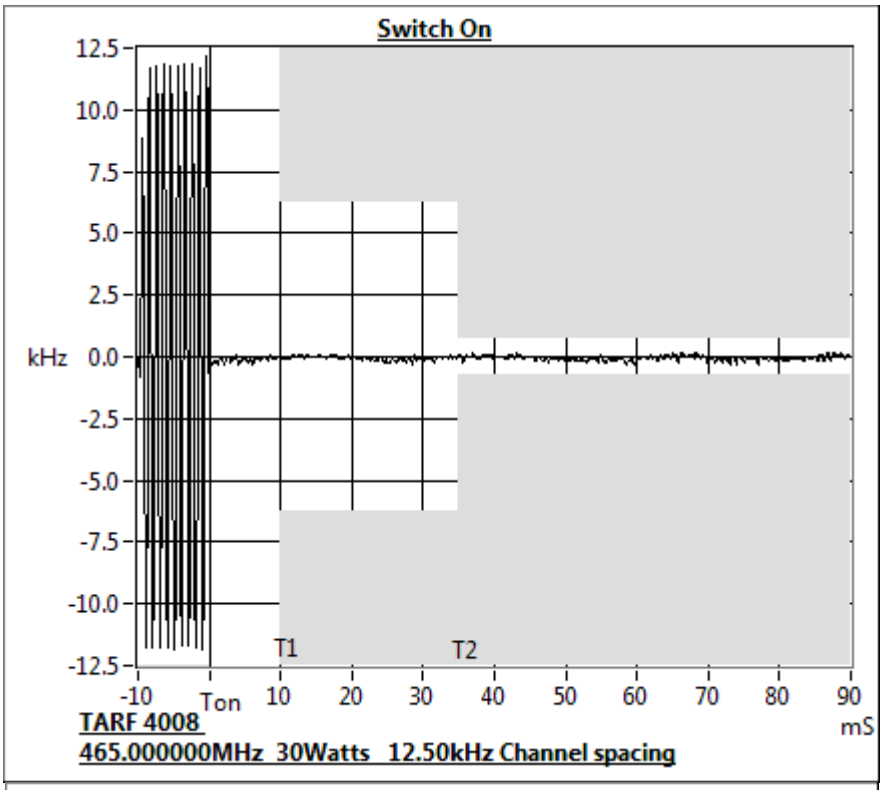
LIMIT: FCC 47 CFR 90.214

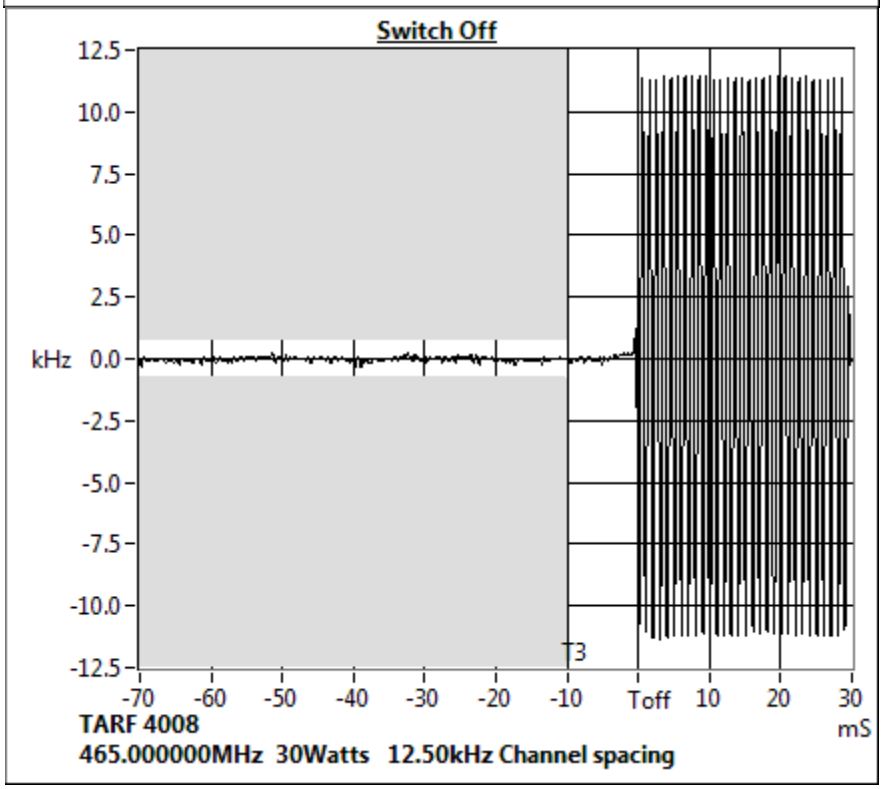
| TRANSIENT PERIODS | FREQUENCY RANGE | |
|---|---|---|
| | 150 MHz – 174 MHz | 421 MHz – 512 MHz |
| t1 (ms) | 5 ms | 10 ms |
| t2 (ms) | 20 ms | 25 ms |
| t3 (ms) | 5 ms | 10 ms |

# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 465.0 MHz 30 W 12.5 kHz Channel Spacing



## Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 469.9 MHz 30 W 12.5 kHz Channel Spacing

| TRANSIENT RESPONSE PERIOD | CARRIER PEAK VARIATION FROM NORMAL | |
|---|---|---|
| | Key ON (kHz) | Key OFF (kHz) |
| t1 | -1.1 | N/A |
| t2 | -0.3 | N/A |
| t3 | N/A | -2.9 |

| | YES | NO |
|---|---|---|
| Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation. | ☑ | ☐ |
| Confirm that during the period t2 the frequency difference does not exceed half a channel separation. | ☑ | ☐ |
| Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit. | ☑ | ☐ |

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

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

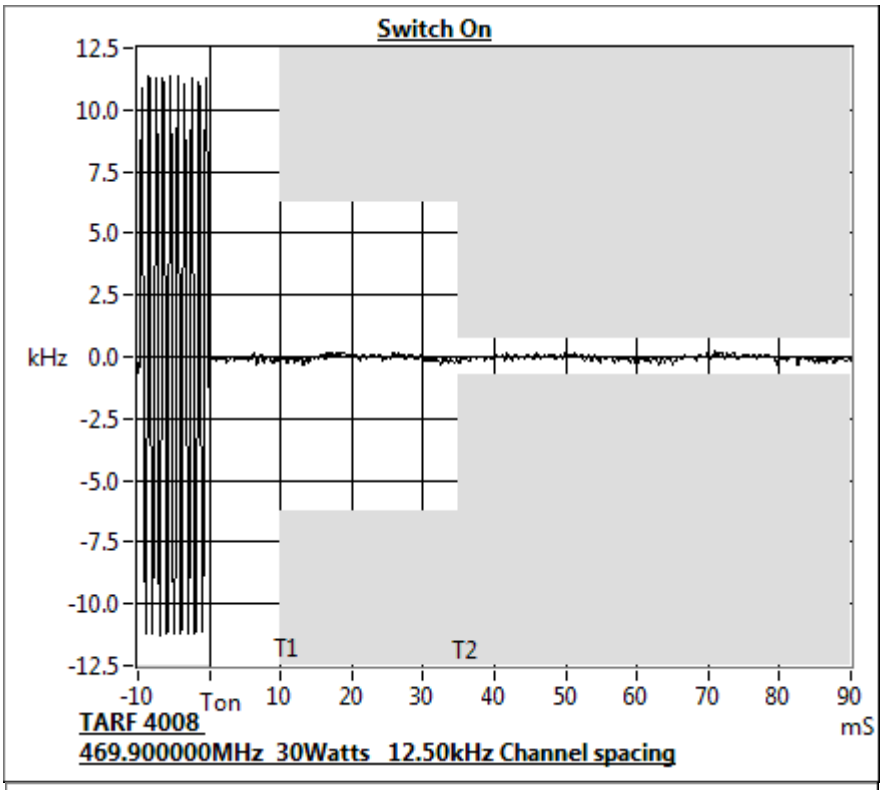
| Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels | | | |
|---|---|---|---|
| TRANSIENT PERIODS | Maximum Frequency Difference | FREQUENCY RANGE | |
| | | 138 – 174 MHz | 406.1 – 470 MHz |
| t1 (ms) | ± 12.5 kHz | 5 ms | 10 ms |
| t2 (ms) | ± 6.25 kHz | 20 ms | 25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

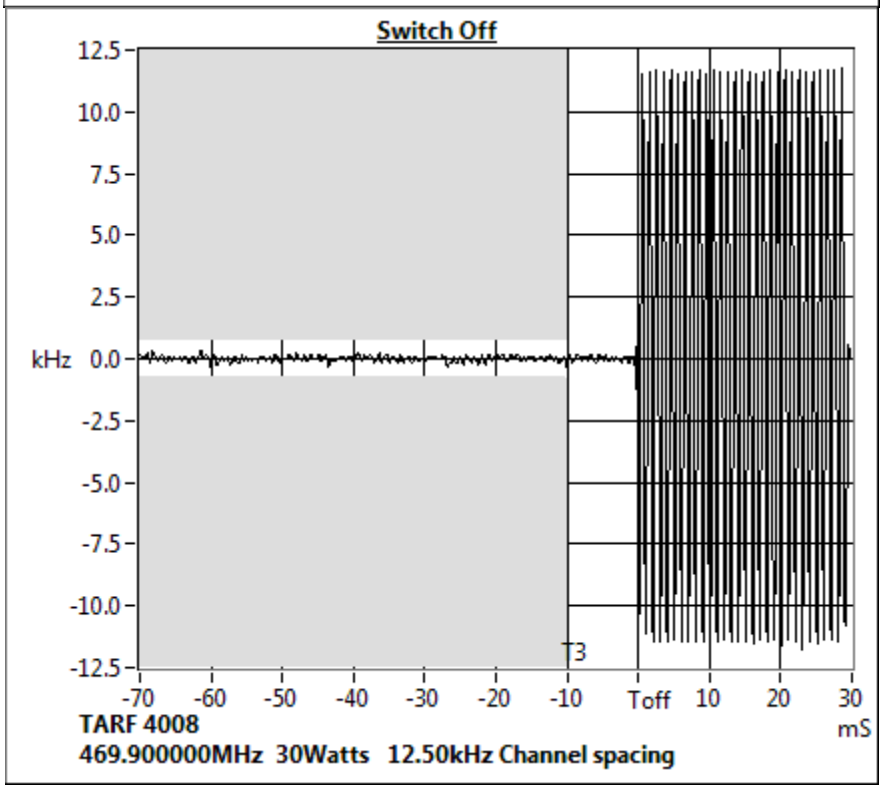
Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

# Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 469.9 MHz 30 W 12.5 kHz Channel Spacing



# TRANSMITTER FREQUENCY STABILITY - TEMPERATURE

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

GUIDE: TIA/EIA-603D 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).

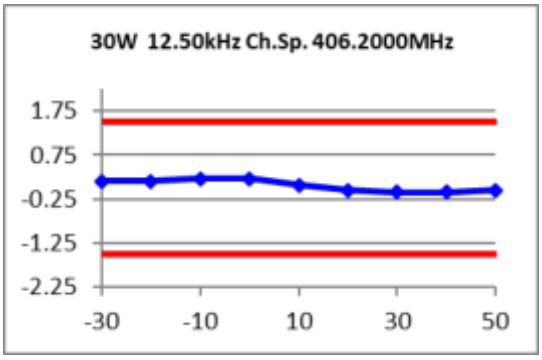
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing.

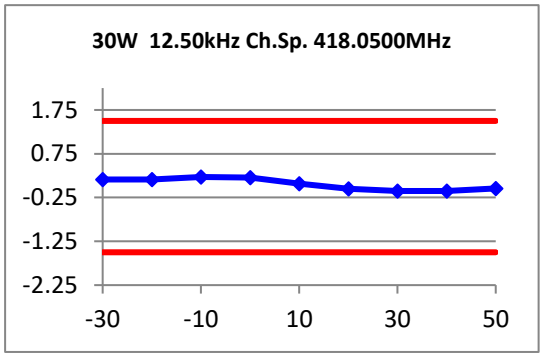
| | Error (ppm) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Temperature (ºC) | 406.2 MHz | 418.05 MHz | 429.9 MHz | 450.1 MHz | 454.5 MHz | 460.0 MHz | 465.0 MHz | 469.9 MHz |
| -30 | 0.16 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.18 | 0.17 |
| -20 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.17 | 0.17 | 0.17 |
| -10 | 0.21 | 0.22 | 0.21 | 0.22 | 0.21 | 0.22 | 0.22 | 0.22 |
| 0 | 0.21 | 0.21 | 0.21 | 0.21 | 0.2 | 0.2 | 0.21 | 0.2 |
| 10 | 0.07 | 0.07 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.06 |
| 20 | -0.05 | -0.05 | -0.05 | -0.06 | -0.06 | -0.06 | -0.05 | -0.06 |
| 30 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.09 | -0.09 | -0.1 |
| 40 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.09 | -0.09 | -0.1 |
| 50 | -0.05 | -0.04 | -0.04 | -0.04 | -0.04 | -0.04 | -0.04 | -0.04 |
| Measurement Uncertainty | | | | ± 7 x $10^{-8}$ | | | | |

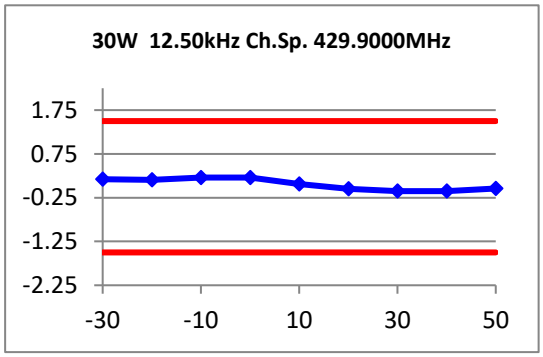
LIMIT: FCC 47 CFR 90.213

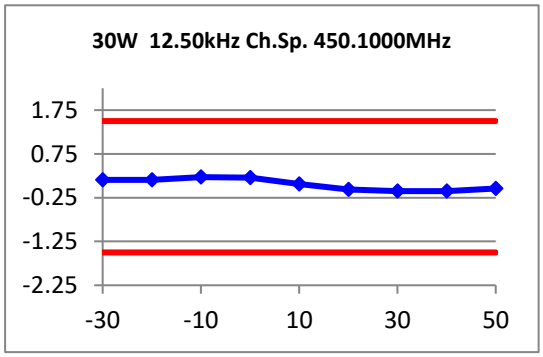
| Channel Spacing (kHz) | Frequency Error (ppm) |
|---|---|
| 12.5 | 1.5 |

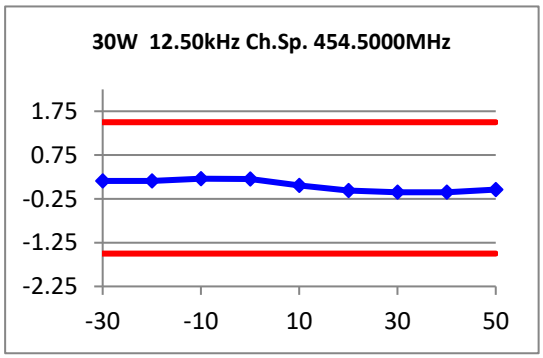
# Transmitter Frequency Stability - Temperature

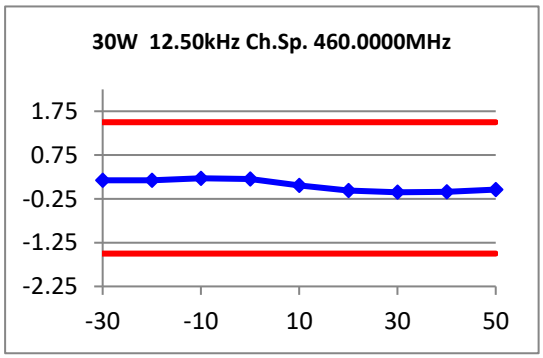


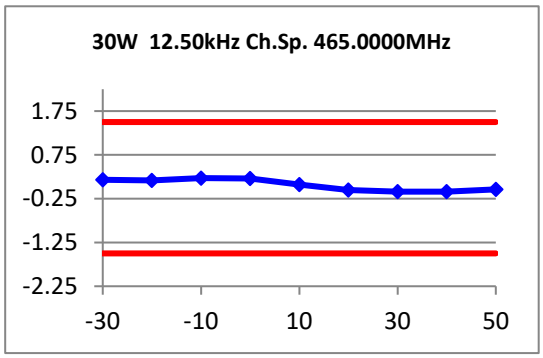



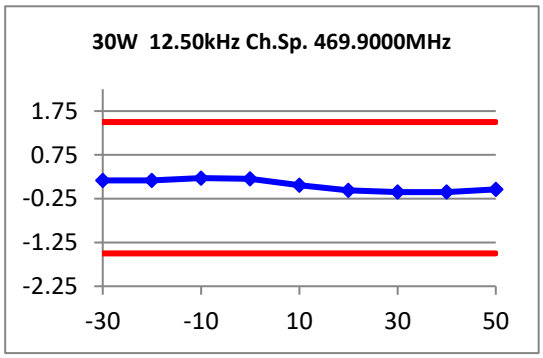



# TRANSMITTER FREQUENCY STABILITY - VOLTAGE

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

GUIDE: TIA/EIA-603D 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 nominal battery voltage and battery end point .
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

| | FREQUENCY ERROR (ppm) for 12.5 kHz | | |
|---|---|---|---|
| | 13.8 $V_{DC}$ | 11.0 $V_{DC}$ | 15.0 $V_{DC}$ |
| 406.2 MHz | -0.09 | -0.09 | -0.09 |
| 418.05 MHz | -0.09 | -0.09 | -0.09 |
| 429.9 MHz | -0.08 | -0.08 | -0.08 |
| 450.1 MHz | -0.08 | -0.08 | -0.08 |
| 454.5 MHz | -0.08 | -0.08 | -0.09 |
| 460.0 MHz | -0.08 | -0.08 | -0.08 |
| 465.0 MHz | -0.09 | -0.08 | -0.08 |
| 469.9 MHz | -0.09 | -0.09 | -0.09 |
| Measurement Uncertainty | | ± 7 x $10^{-8}$ | |

LIMIT CLAUSES: FCC 47 CFR 90.213

| Channel Spacing (kHz) | Frequency Error (ppm) |
|---|---|
| 12.5 | 1.5 |

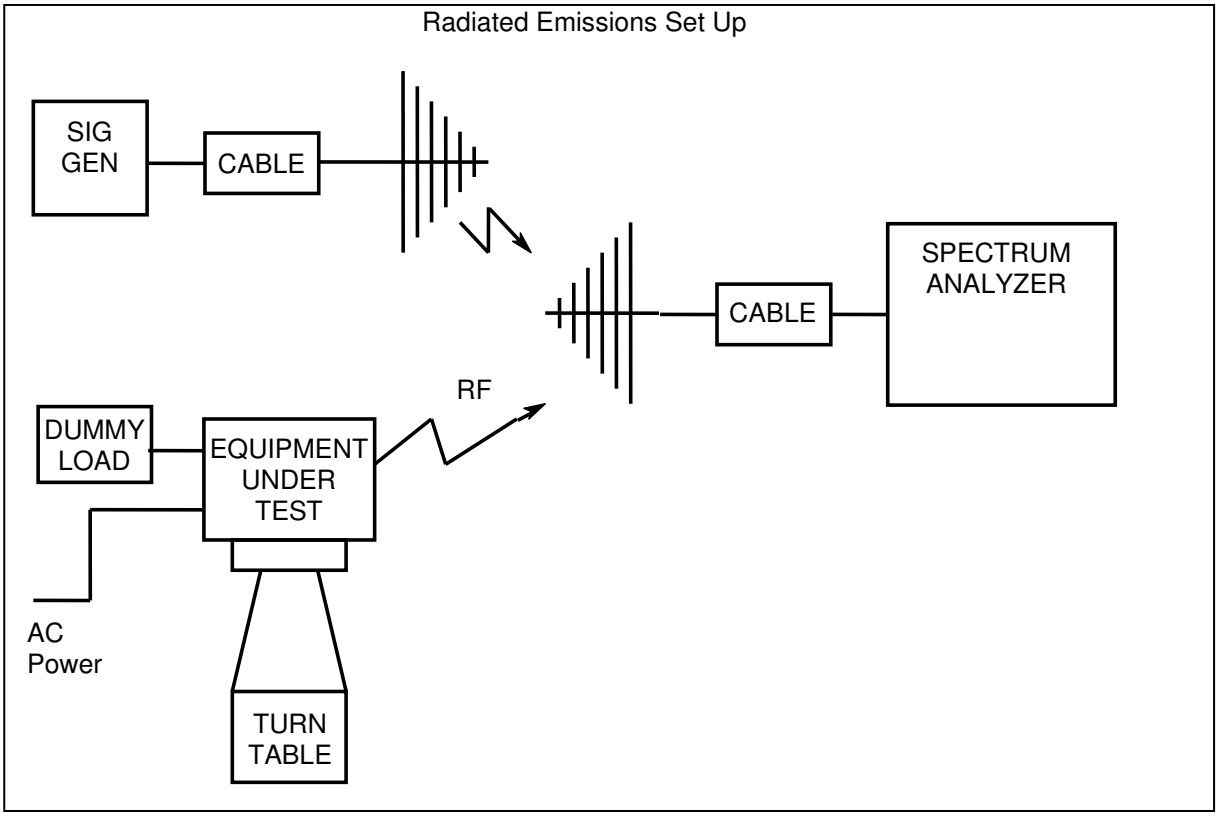
# TEST EQUIPMENT LIST

| Equipment Type | Information | Manufacturer | Model No | Serial No# | Tait ID | Cal Due |
|---|---|---|---|---|---|---|
| AC Voltmeter | | Tait | | 2 | | 15-Apr-20 |
| Antenna | 18GHz DRG | Emco | DRG3115 | 2084 | E3076 | |
| Antenna | Reference Dipoles | Emco | 3121C DB1 | 9510-1164 | E3559 | 14-May-22 |
| Antenna | 18GHz DRG | Emco | DRG3115 | 9512-4638 | E3560 | 15-May-20 |
| 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 | 9-Oct-20 |
| Coax Cable | OATS Turntable Cable 1 | Intelcom | RG214 | OATS1 | E4621 | 15-Nov-19 |
| Coax Cable | OATS Tower Cable | Intelcom | RG214 | OATS2 | E4622 | 14-Nov-19 |
| Coax Cable | 2m Black | Suhner | RG214HF/Nm/Nm/2000 | TeltestBlack2 | E4623 | 17-Oct-19 |
| Coax Cable | 2m Black | Suhner | RG214HF/Nm/Nm/2000 | TeltestBlack3 | E4624 | 17-Oct-19 |
| Coax Cable | Reverb - 4.5m Multiflex 141 | TeltestBlue6 | MF 141 | TeltestBlue6 | E4843 | 18-Oct-19 |
| Coax Cable | Reverb - 2m Multiflex 141 | TeltestBlue5 | MF 141 | TeltestBlue5 | E4844 | 18-Oct-19 |
| Coax Cable | Reverb - 2m Multiflex 141 | TeltestBlue4 | MF 141 | TeltestBlue4 | E4845 | 18-Oct-19 |
| Coax Cable | Reverb - 1m Multiflex 141 | TeltestBlue3 | MF 141 | TeltestBlue3 | E4846 | 18-Oct-19 |
| Coax Cable | Reverb - 1m Multiflex 141 | TeltestBlue2 | MF 141 | TeltestBlue2 | E4847 | 18-Oct-19 |
| Coax Cable | Reverb - 1m Multiflex 141 | TeltestBlue1 | MF 141 | TeltestBlue1 | E4848 | 18-Oct-19 |
| Coax Cable | OATS Turntable Cable 2 | Intelcom | RG215 | OATS3 | E4995 | 14-Nov-19 |
| Coax Cable | 2.5m Blue | Suhner | Sucoflex 104A | 33449/4PEA | E4997 | 19-Oct-19 |
| Coax Cable | 2m Black | Suhner | RG214HF/Nm/Nm/2000 | TeltestBlack7 | E5004 | 17-Oct-19 |
| Coax Cable | 2m Black | Suhner | RG214HF/Nm/Nm/2000 | TeltestBlack8 | E5005 | 17-Oct-19 |
| Coax Cable | 3m Blue | Suhner | Sucoflex 126EA | 503429/126EA | E5015 | 19-Oct-19 |
| Environ. Chamber | Upright | Contherm | 5400 RHSLT.M | 1416 | E4051 | 7-Aug-23 |
| Environ. Chamber | Upright | Contherm | 5400 RHSLT.M | 1416 | E4051 | 15-May-20 |
| Filter High Pass/ Notch | 400 to 520MHz | Tait | | N/A | E3384 | 25-Sep-19 |
| ISN | | Rohde & Schwarz | ENY41 | 100136 | E4277 | 27-May-20 |
| Modulation Analyser | TREVA2 | Hewlett Packard | HP8901B (Opt 002) | 3704A05837 | E3786 | 4-Oct-20 |
| OATS | Controller | Electrometrics | EM-4700 | 119 | E4445 | |
| OATS | Turntable | Electrometrics | EM-4704A | 105 | E4446 | |
| OATS | Antenna Tower | Electrometrics | EM-4720-2 | 112 | E4447 | |
| OATS | NSA | Tait | | | | 18-Jun-20 |
| Oscilloscope | 400MHz | Tektronics | TDS380 | B017095 | E3782 | 28-Sep-21 |
| Power Supply | AC Variac | Yamabishi | S-260-5 | TX-533 | E1737 | |
| Power Supply | TREVA2 60V/25A | Agilent | N5767A | US09F4901H | E4656 | 3-Oct-21 |
| RF Amplifier | +21.7 dB 1GHz | Tait | ZFL-1000LN | E3660 | E3360 | 30-Apr-20 |
| RF Amplifier | 0.2 to 4GHz 15W | Ophir | 5161FE | 1044 | E4851 | |
| RF Amplifier | Pre-amplifier | Agilent | 87405C | MY47010688 | E4941 | |
| RF Attenuator | 10dB 50W | Weinschel | 24-10-34 | AZ0401 | E3388 | 17-Oct-19 |
| RF Attenuator | 20dB 50W | Weinschel | 24-20-44 | AW1266 | E3562 | 17-Oct-19 |
| RF Attenuator | 10dB 150W | Weinschel | 57-10-34 | LB590 | E3674 | 18-Oct-19 |

| | | | | | | |
|---|---|---|---|---|---|---|
| RF Attenuator | TREVA2 20dB 150W | Weinschel | 40-20-33 | CJ405 | E3733 | 17-Oct-19 |
| RF Attenuator | 10dB 50W | Weinschel | 24-10-34 | BC3293 | E4364 | 17-Oct-19 |
| RF Attenuator | TREVA2 3dB | Weinschel | Model 1 | BL9950 | E4080 | 17-Oct-19 |
| RF Attenuator | 3dB 0.5W | Weinschel | Model 2 | CH6857 | E5012 | 17-Oct-19 |
| RF Chamber | S-LINE TEM CELL | Rohde & Schwarz | 1089.9296.02 | 338232/003 | E3636 | 12-Sep-20 |
| 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 | 50W | Weinschel | F1426 | AE2490 | E3624 | 18-Oct-19 |
| RF Load | 150W | Bird | 8166 | 524 | E3625 | 17-Oct-19 |
| Signal Generator | Analog 3.2GHz | Hewlett Packard | HP8648C | 3443U00543 | E3558 | 9-Oct-20 |
| Signal Generator | Analog 4GHz | Agilent | E4422B | GB40050320 | E3788 | 10-Oct-20 |
| Signal Generator | Digital 4GHz | Agilent | E4438C | MY49070242 | E4600 | 3-Oct-20 |
| Spectrum Analyser | 13.2GHz | Agilent | E4445A | MY42510072 | E4139 | 19-Jul-20 |
| Spectrum Analyser | 26.5GHz | Agilent | PXA N9030A | MY49432161 | E4907 | 27-Oct-20 |
| Temp & Humidity datalogger | | Hobo | U21-011 | 10134275 | E4980 | 5-May-20 |
| TREVA 2 | | Teltest | - | 2 | - | 5-Nov-19 |
| Testware | Base Station Network Audio Generator | | December 2017 | - | - | |
| Testware | Frequency Vs Temperature | | April 2018 | - | - | |
| Testware | Radiated Emissions | | April 2018 | - | - | |
| Testware | Reverb Emissions | | May 2019 | - | - | |
| Testware | Sideband Spectrum | | February 2017 | - | - | |
| Testware | TREVA | | 7 February 2019 | - | - | |
| Testware | Spec An Correction Loader | | June 2019 | - | - | |
| | | | | | | |

* 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 **T**eltest **R**adio **EVA**luation 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.