

# LABORATORY TEST REPORT

## RADIO PERFORMANCE MEASUREMENTS

for the  
TPGHKA Handportable Transceiver

Tested in accordance with:  
FCC 47 CFR Parts 22 and 90

RSS-119 Issue 12  
RSS-Gen Issue 5

Report Revision: 1  
Issue Date: 29 November 2019

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Laboratory Technical Manager



**IANZ**  
ACCREDITED LABORATORY

FCC REGISTRATION: 838288  
ISED REGISTRATION: 737A

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## REVISION

| Date             | Revision | Comments            |
|------------------|----------|---------------------|
| 04 November 2019 | 1        | Initial test report |
|                  |          |                     |

## INTRODUCTION

Type approval testing of the TPGHKA, 4 Watt, Handportable transceiver in order to demonstrate compliance with FCC 47 Parts 22 & 90, and RSS-119 Issue 12 & RSS-Gen Issue 5. This radio supports analogue, digital FFSK, Digital Mobile Radio (DMR), APCO P25 phase-1 and APCO P25 phase-2 modulations.

Three tests were performed on the channel frequency 378.1 MHz: Output Power, Conducted Emissions and Radiated Emissions. This channel frequency is outside the frequency allocation area of the FCC. These tests were performed as per customer request.

### REPORT PREPARED FOR

Tait International Ltd  
245 Wooldridge Road  
Harewood  
Christchurch 8051  
New Zealand

### DESCRIPTION OF SAMPLE

Manufacturer: Tait International Limited  
Equipment: Handportable Transceiver  
Type: TPGHKA  
Product Code: T03-00071-EBAA  
Serial Number(s): 26204972  
Frequency range: 378 → 470 MHz  
Transmit Power: 4 W

| 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            |
| APCO P25 Phase 2           | H-CPM (2 slot TDMA) (TIA 102)                | 12.5 kHz        | 2               | 6000                      | 12000           |

### HARDWARE & SOFTWARE

Quantity: 1

|                  | Analogue, FFSK and P25 tests | DMR tests        |
|------------------|------------------------------|------------------|
| Hardware ID      | TPGB1X-HK00_0001             | TPGB1X-HK00_0001 |
| Firmware Package | QIP25_TPG.0025               | QIDMR_TPG.0025   |

### TEST CONDITIONS

All testing was performed between 8 October → 29 November 2019 and under the following conditions:

Ambient temperature: 15°C → 30°C  
Relative Humidity: 20% → 75%  
Standard Test Voltage: 7.5 V<sub>DC</sub>

## TEST REQUIREMENTS AND RESULT SUMMARY

| ISED Specification | FCC Specification         | Test Items                                       | Test Methods                        | Result |
|--------------------|---------------------------|--------------------------------------------------|-------------------------------------|--------|
| RSS-119 5.3        | FCC 47 CFR 90.214         | Transmitter Frequency Stability - Temperature    | RSS-Gen 6.11<br>ANSI C63.26 5.6.4   | Pass   |
| RSS-119 5.3        | FCC 47 CFR 2.1055 (d) (1) | Transmitter Frequency Stability - Voltage        | RSS-Gen 6.11<br>ANSI C63.26 5.6.5   | Pass   |
| RSS-119 5.4        | FCC 47 CFR 2.1046         | Transmitter Output Power (Conducted)             | RSS-Gen 6.12<br>ANSI C63.26 5.2.4.2 | Pass   |
| RSS-119 5.5        | FCC 47CFR 90.209          | Transmitter 99% Emission Bandwidth               | RSS-Gen 6.7<br>ANSI C63.26 5.4.4    | Pass   |
| RSS-119 5.5        | FCC 47 CFR 2.1049 (c)     | Transmitter Occupied Bandwidth and Spectrum Mask | RSS-119 4.2.2<br>TIA-603-E 2.2.11   | Pass   |
| RSS-119 5.8        | FCC 47 CFR 2.1051         | Transmitter Spurious Emissions (Conducted)       | RSS-Gen 6.13<br>ANSI C63.26 5.7     | Pass   |
| RSS-119 5.8        | FCC 47 CFR 2.1053         | Transmitter Spurious Emissions (Radiated)        | RSS-Gen 6.13<br>ANSI C63.26 5.5     | Pass   |
| RSS-119 5.9        | FCC 47 CFR 90.214         | Transient Frequency Behaviour                    | TIA 603E 2.2.2                      | Pass   |
| RSS-Gen 7          | FCC 47CFR 15.111          | Receiver Spurious Emissions (Conducted)          | RSS-Gen 7.4<br>TIA-603E 2.1.2       | Pass   |

## STATEMENT OF COMPLIANCE

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

Equipment: Handportable Transceiver  
Type: TPGHKA  
Product Code: T03-00071-EBAA  
Serial Number(s): 26204972  
Quantity: 1

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

FCC 47 CFR Parts 22 and 90

RSS-119 Issue 12 & RSS-Gen Issue 5

Signature:



M. C. James  
Laboratory Technical Manager

Date:

2 December 2019

The results obtained in this test report pertain only to the item(s) tested. Teltest does not make any claims of compliance for samples or variants that were not tested.

## 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 | P25 phase 1 Digital Voice          | 9600 bps              |
| F1D | P25 phase 1 Digital Data           | 9600 bps              |
| F1W | P25 phase 2 Digital Voice / Data   | 12000 bps             |

CHANNEL SPACING: 12.5 kHz

### EMISSION DESIGNATORS:

|                                    |                 |
|------------------------------------|-----------------|
|                                    | <i>12.5 kHz</i> |
| 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         |
| Digital Data and Voice P25 phase 2 | 8K10F1W         |

### CALCULATIONS

Equation:  $B_n = 2M + 2Dk$

(M is highest modulating frequency; D is peak allowable deviation; k is a constant of 1 for FM)

#### Analogue Voice 12.5 kHz Bandwidth

Necessary bandwidth

M = 3.0 kHz

D = 2.5 kHz

$$B_n = (2 \times 3.0) + (2 \times 2.5) \times 1$$

$$= 11.0 \text{ kHz}$$

Emission Designator

**11K0F3E**

F3E represents an FM voice transmission

#### 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)

$$B_n = (2 \times 1.8) + (2 \times 1.5) \times 1$$

$$= 6.6 \text{ kHz}$$

Emission Designator

**6K60F2D**

F2D represents a FM data transmission with the use of a modulating sub carrier

#### Fast Frequency Shift Keying (FFSK – 2400 bps) 12.5 kHz Bandwidth

Necessary bandwidth

M = 2.4 kHz

D = 1.5 kHz (60% of peak deviation)

$$B_n = (2 \times 2.4) + (2 \times 1.5) \times 1$$

$$= 7.8 \text{ kHz}$$

Emission Designator

**7K80F2D**

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  
= 7.6 kHz

Emission Designator

**7K60FXW**

FXW represents a FM Time Division Multiple Access (TDMA) combination of data and telephony

### Digital Data 12.5 kHz Bandwidth DMR

99% bandwidth  
= 7.6 kHz

Emission Designator

**7K60FXD**

FXD represents FM Time Division Multiple Access (TDMA) data only

### Digital Voice 12.5 kHz Bandwidth P25 phase 1

99% bandwidth  
= 8.1 kHz

Emission Designator

**8K10F1E**

F1E represents a digital FM voice transmission

### Digital Data 12.5 kHz Bandwidth P25 phase 1

99% bandwidth  
= 8.1 kHz

Emission Designator

**8K10F1D**

F1D represents an digital FM data transmission

### Digital Data and Voice 12.5 kHz Bandwidth P25 phase 2

99% bandwidth  
= 8.1 kHz

Emission Designator

**8K10F1W**

F1W represents an FM channel with a combination of digital data and voice transmission

## LIST OF ANTENNA INTENDED FOR USE WITH THE DEVICE

| Manufacturer Part Number | Antenna Type | Antenna Gain | Antenna Input Impedance |
|--------------------------|--------------|--------------|-------------------------|
| TPA-AN-037               | ¼ Wave Whip  | 2dBi         | 50 $\Omega$             |
| TPA-AN-038               | Helical      | 1dBi         | 50 $\Omega$             |
| TPA-AN-038A              | Helical      |              | 50 $\Omega$             |

The equipment tested has a 50  $\Omega$  coaxial antenna connection. No antenna was fitted to the EUT during testing the parameters in this report.

The EUT was connected as shown in Annex A, using a customer supplied test box to provide access to the analogue and digital interfaces. A “dummy” battery with connections for external DC supply was used to power the equipment.

## TEST RESULTS

### TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046  
RSS-119 5.4

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:

|                      |                                                       |
|----------------------|-------------------------------------------------------|
| Power in dBm =       | Measured power (dBm) + attenuator and cable loss (dB) |
| Chan 1 power (dBm) = | 5.53 dBm + 30.64 dB                                   |
|                      | = 36.17dBm                                            |
| Power in Watts =     | $(10^{(36.17\text{dBm}/10)})/1000$                    |
|                      | = 4.1W                                                |

#### MEASUREMENT RESULTS:

Manufacturer's Rated Output Power:

Switchable: 4 W and 1 W

| Nominal 4 W             | Measured (W) | Variation (%) | Variation (dB) |
|-------------------------|--------------|---------------|----------------|
| 378.1 MHz               | 4.1          | 3.6           | 0.2            |
| 406.2 MHz               | 4.2          | 4.5           | 0.2            |
| 418.05 MHz              | 4.2          | 5.6           | 0.2            |
| 429.9 MHz               | 4.2          | 4.8           | 0.2            |
| 450.1 MHz               | 4.2          | 4.9           | 0.2            |
| 459.9 MHz               | 4.2          | 5.5           | 0.2            |
| 469.9 MHz               | 4.2          | 5.4           | 0.2            |
| Measurement Uncertainty |              | ± 0.6 dB      |                |

Transmitter Output Power (Conducted) - continued

| Nominal 1 W             | Measured (W) | Variation (%) | Variation (dB) |
|-------------------------|--------------|---------------|----------------|
| 378.1 MHz               | 1.0          | 0.3           | 0.0            |
| 406.2 MHz               | 1.0          | 3.4           | 0.1            |
| 418.05 MHz              | 1.1          | 5.7           | 0.2            |
| 429.9 MHz               | 1.1          | 7.8           | 0.3            |
| 450.1 MHz               | 1.0          | -2.5          | -0.1           |
| 459.9 MHz               | 1.0          | 2.4           | 0.1            |
| 469.9 MHz               | 1.1          | 5.4           | 0.2            |
| 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: 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:

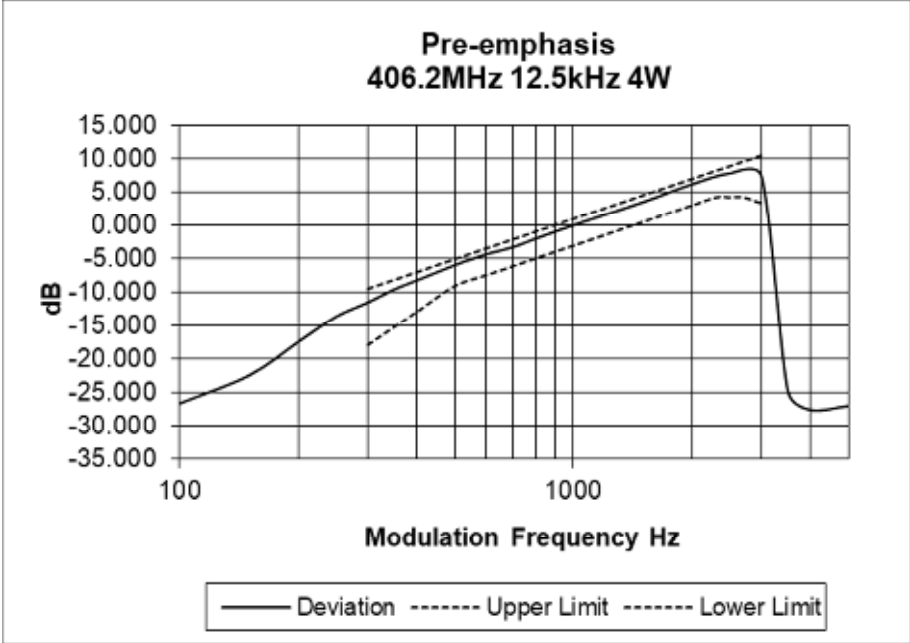
See the plots on the following pages for 12.5 kHz channel spacing tested at 4 W transmit power.

LIMIT CLAUSE: TIA/EIA-603D 3.2.6

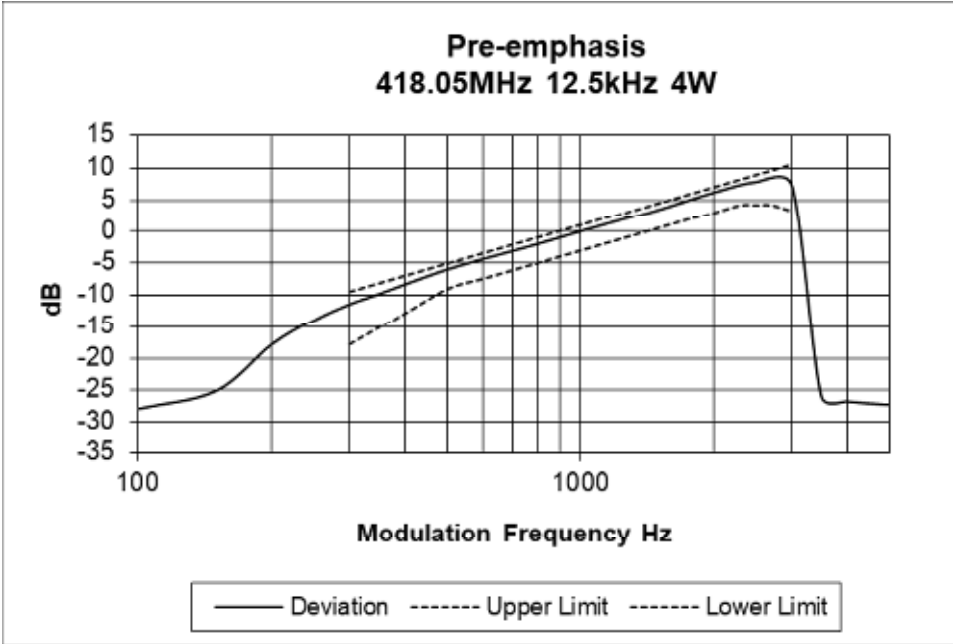
MEASUREMENT UNCERTAINTY:  $\pm 1.5 \%$

Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 406.2 MHz 12.5 kHz Channel Spacing

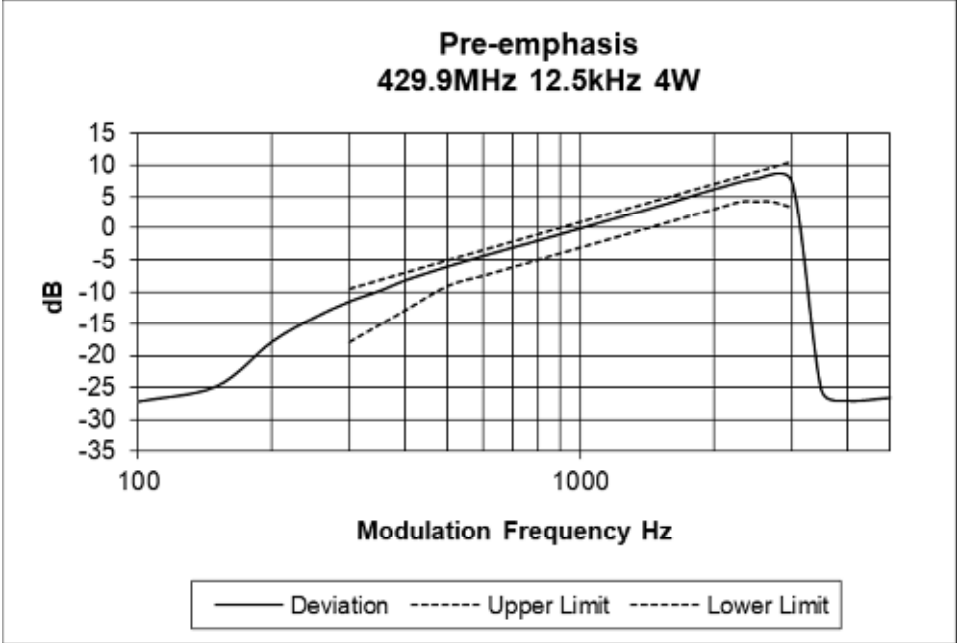


Tx FREQUENCY: 418.05 MHz 12.5 kHz Channel Spacing

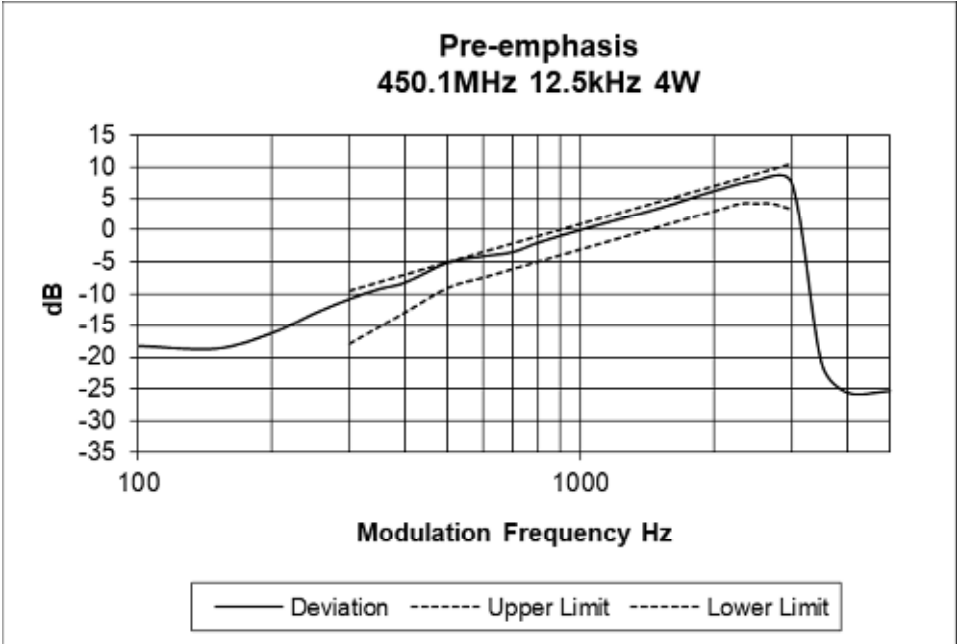


Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 429.9 MHz 12.5 kHz Channel Spacing

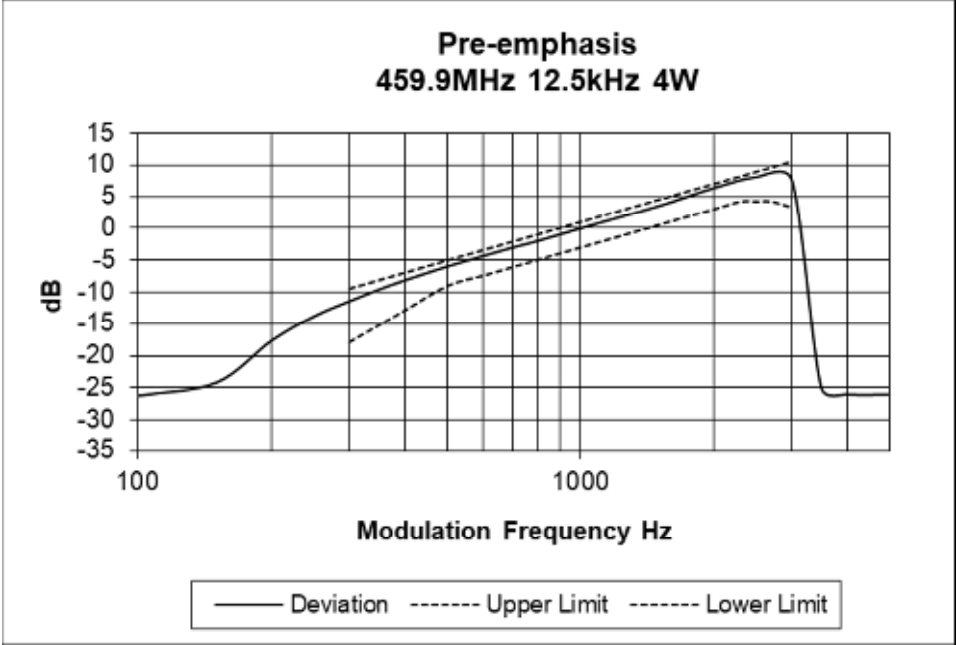


Tx FREQUENCY: 450.1 MHz 12.5 kHz Channel Spacing

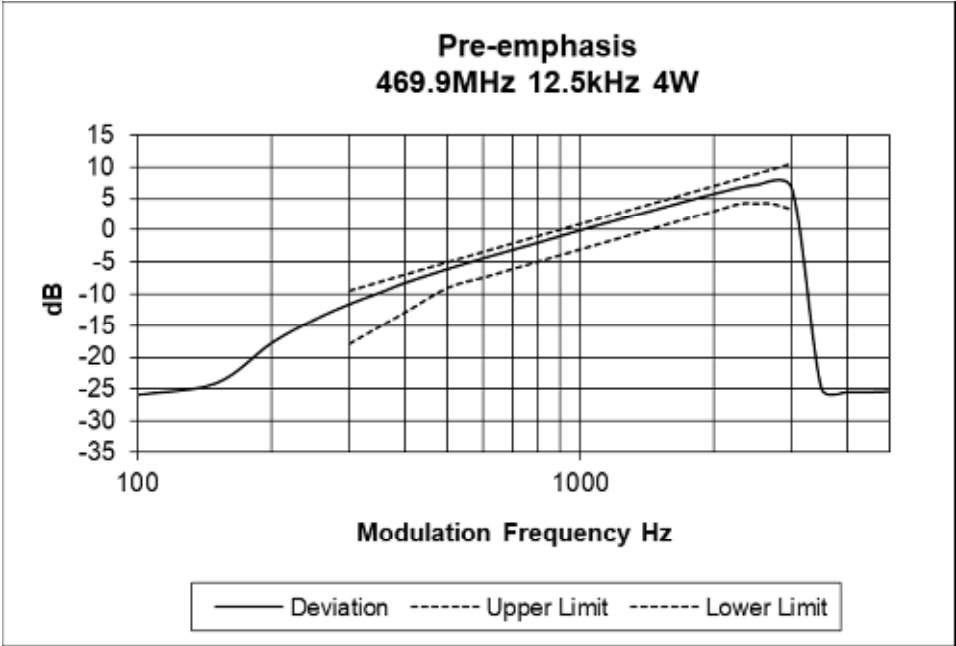


Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 459.9 MHz 12.5 kHz Channel Spacing



Tx FREQUENCY: 469.9 MHz 12.5 kHz Channel Spacing



## TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: 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:

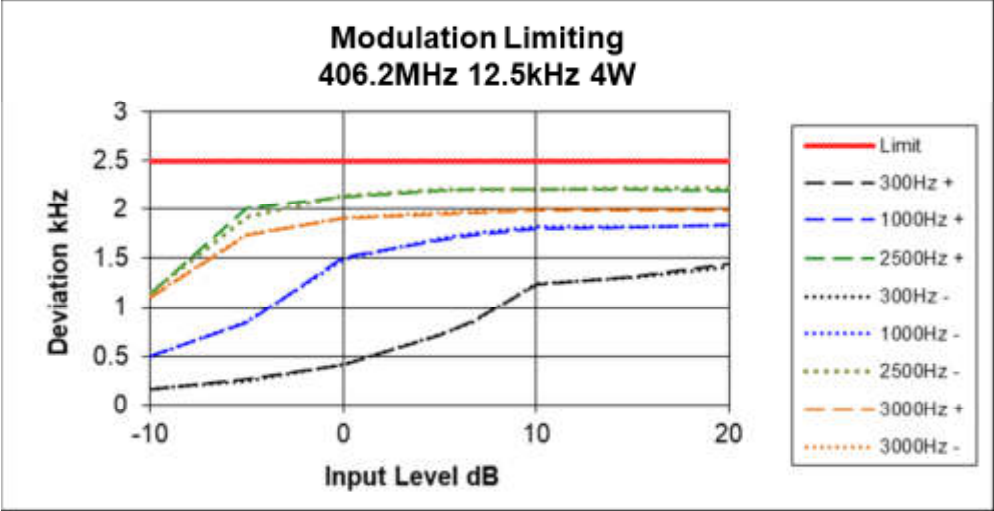
See the plots on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

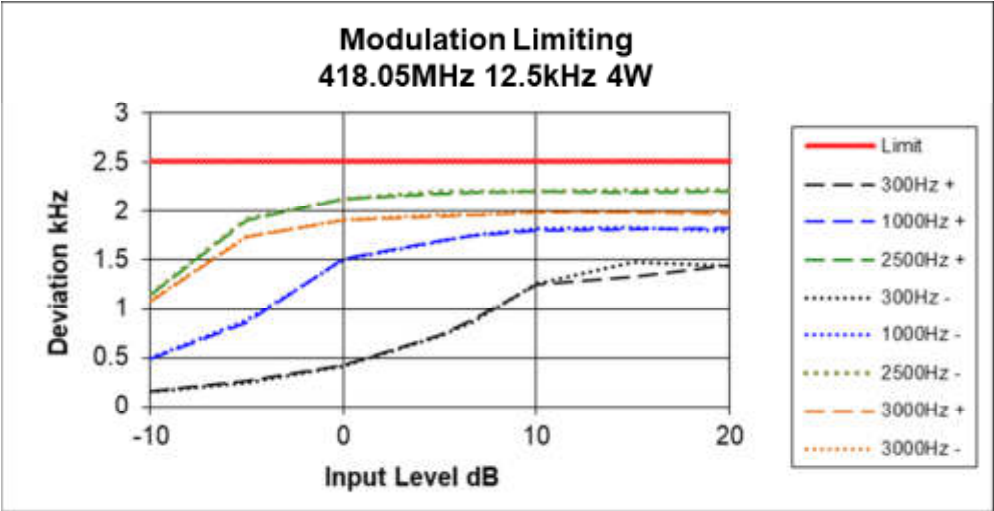
MEASUREMENT UNCERTAINTY:  $\pm 1.5 \%$

Transmitter Modulation Limiting

Tx FREQUENCY: 406.2 MHz 12.5 kHz Channel Spacing

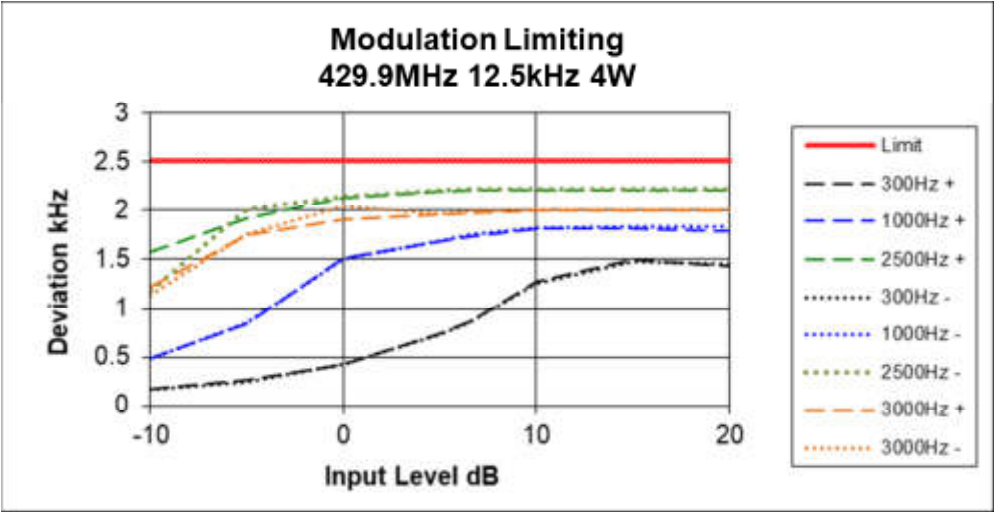


Tx FREQUENCY: 418.05 MHz 12.5 kHz Channel Spacing

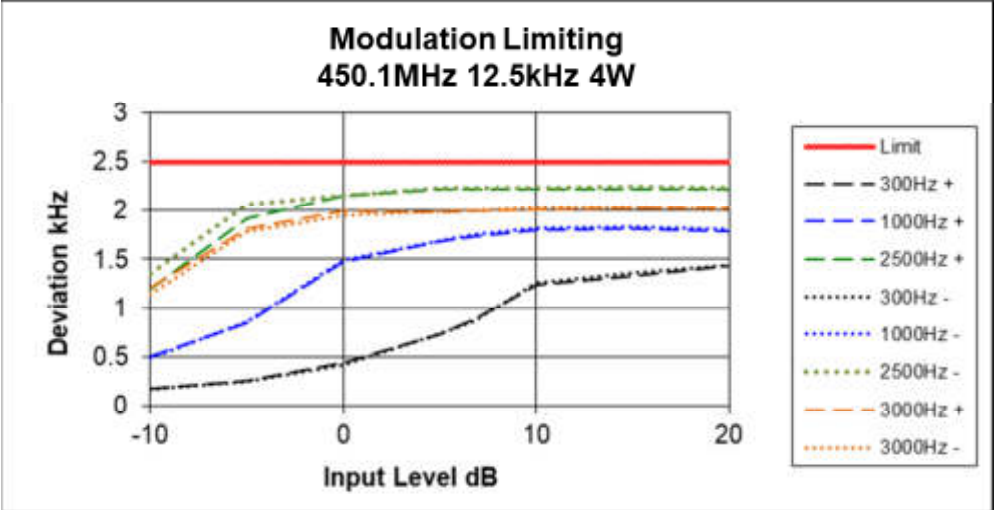


Transmitter Modulation Limiting

Tx FREQUENCY: 429.9 MHz 12.5 kHz Channel Spacing

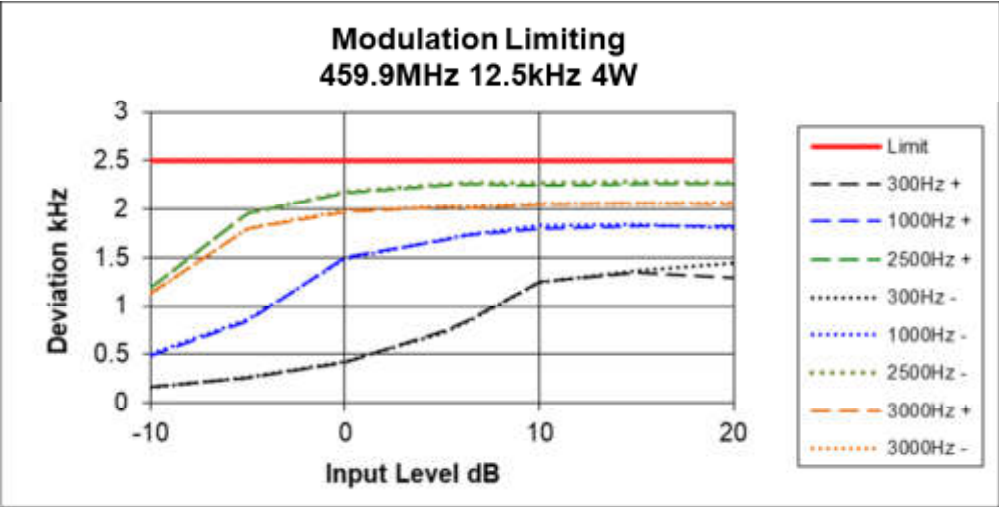


Tx FREQUENCY: 450.1 MHz 12.5 kHz Channel Spacing

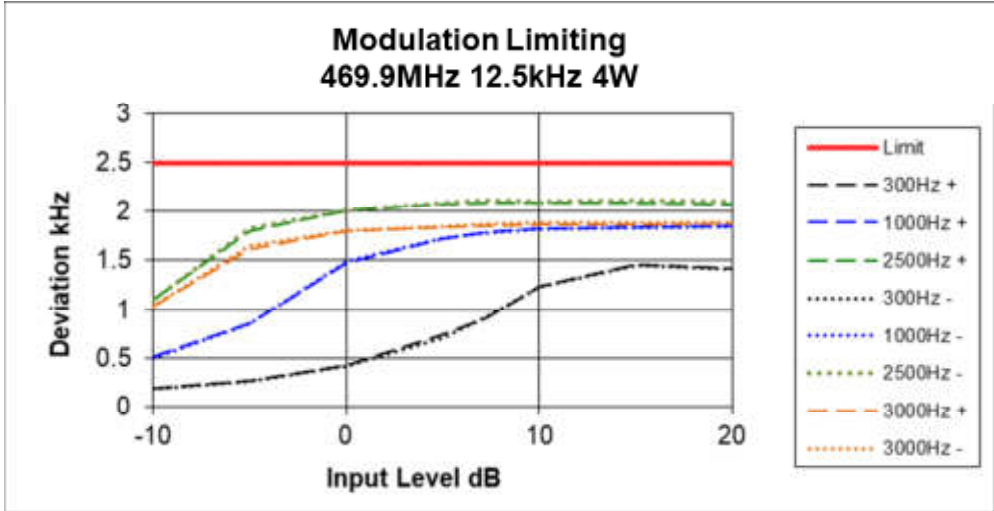


Transmitter Modulation Limiting

Tx FREQUENCY: 459.9 MHz 12.5 kHz Channel Spacing



Tx FREQUENCY: 469.9 MHz 12.5 kHz Channel Spacing



## TRANSMITTER 99% EMISSION BANDWIDTH

SPECIFICATION: RSS-119 5.5

GUIDE: RSS-Gen 6.7

### MEASUREMENT PROCEDURE:

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

### MEASUREMENT RESULTS:

| Channel Spacing (MHz)                                         | Channel Spacing (kHz) | Bandwidths (kHz) |               |               |       |                  |                   |
|---------------------------------------------------------------|-----------------------|------------------|---------------|---------------|-------|------------------|-------------------|
|                                                               |                       | Analog           | FFSK 1200 bps | FFSK 2400 bps | DMR   | APCO P25 phase I | APCO P25 phase II |
| 406.2 MHz                                                     | 12.5                  | 9.93             | 6.15          | 5.28          | 7.33  | 7.97             | 7.95              |
| 418.05 MHz                                                    | 12.5                  | 9.95             | 6.02          | 5.35          | 7.43  | 7.80             | 7.97              |
| 429.9 MHz                                                     | 12.5                  | 9.95             | 6.23          | 5.37          | 7.33  | 7.87             | 7.92              |
| 450.1 MHz                                                     | 12.5                  | 9.95             | 6.23          | 5.33          | 7.45  | 7.70             | 7.92              |
| 459.9 MHz                                                     | 12.5                  | 9.97             | 6.07          | 5.40          | 7.45  | 7.75             | 7.90              |
| 469.9 MHz                                                     | 12.5                  | 9.90             | 6.15          | 5.32          | 7.32  | 7.78             | 7.85              |
| Limit<br>Authorized Bandwidth<br>47 CFR 90.209<br>RSS 119 5.5 |                       | 11.25            | 11.25         | 11.25         | 11.25 | 11.25            | 11.25             |
| Necessary BW used in<br>emission designator                   |                       | 11.0             | 6.6           | 7.8           | 7.6   | 8.1              | 8.1               |
| Result                                                        |                       | Pass             | Pass          | Pass          | Pass  | Pass             | Pass              |

## TRANSMITTER OCCUPIED BANDWIDTH AND SPECTRUM MASKS

SPECIFICATION: FCC 47 CFR 2.1049 (c) RSS-119 5.5

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

### MEASUREMENT PROCEDURE:

4. Refer Annex A for Equipment Set up.
5. 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.
6. 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%  $\pm 0.65\text{dB}$

LIMIT CLAUSE: FCC 47 CFR 90.210 RSS-119 5.5

### EMISSION MASKS

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

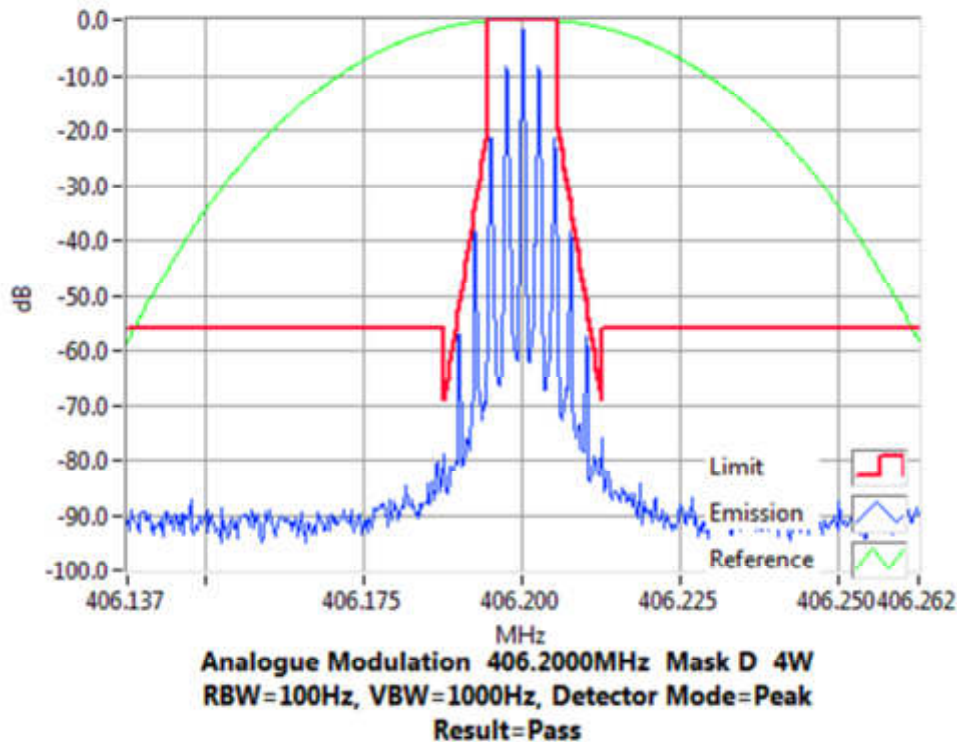
### DATA SPEED

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

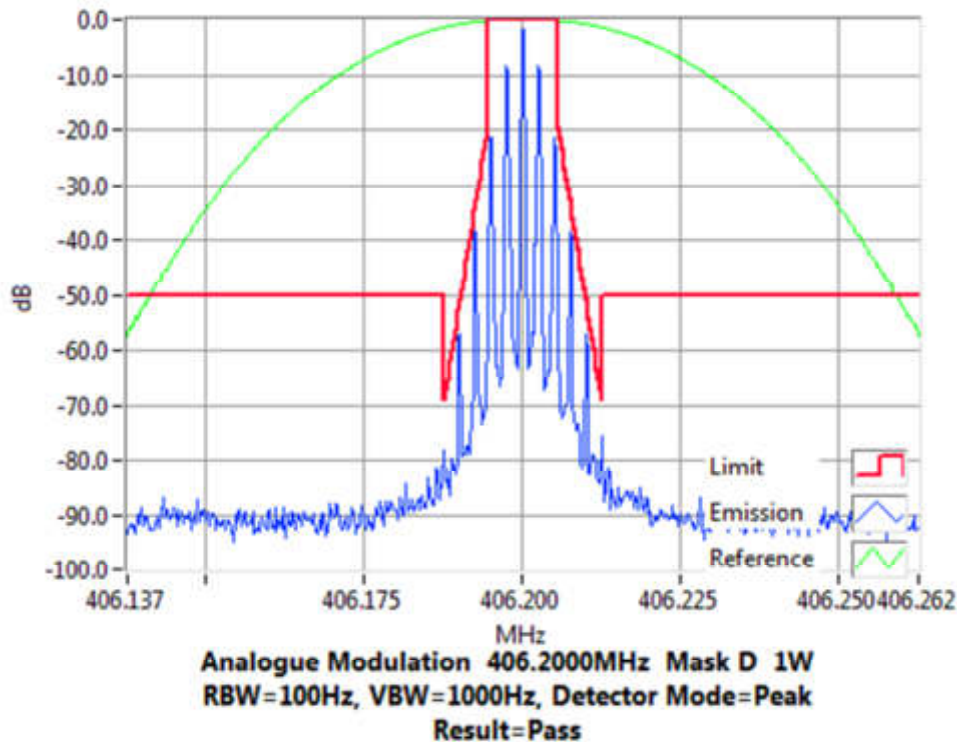
Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



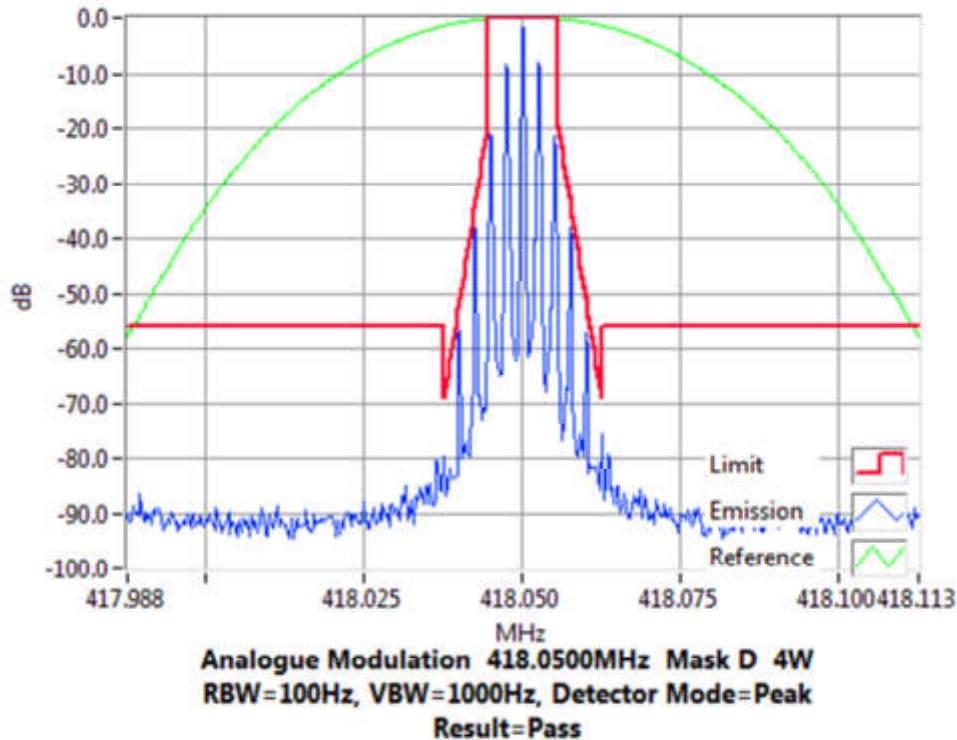
Tx FREQUENCY: 406.2 MHz 1 W 12.5 kHz Channel Spacing



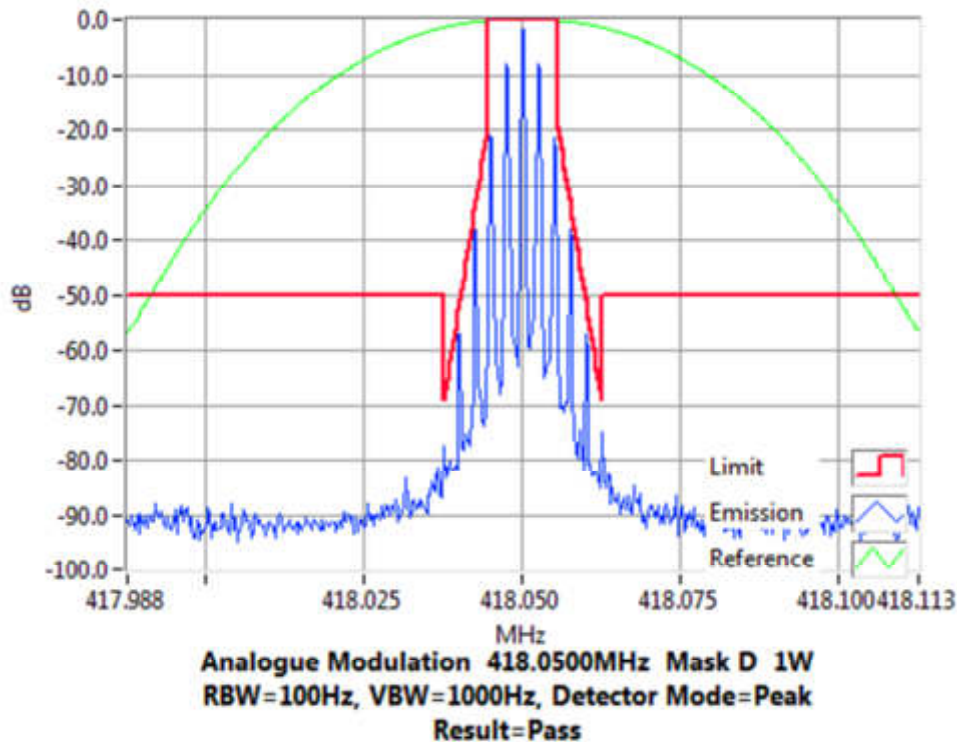
Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



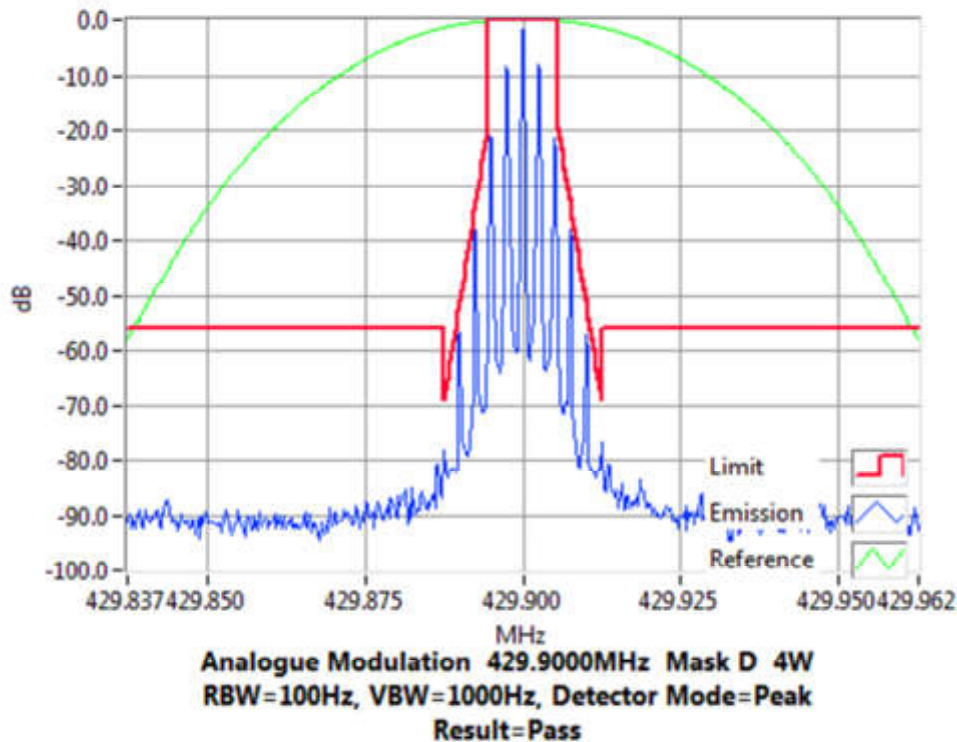
Tx FREQUENCY: 418.05 MHz 1 W 12.5 kHz Channel Spacing



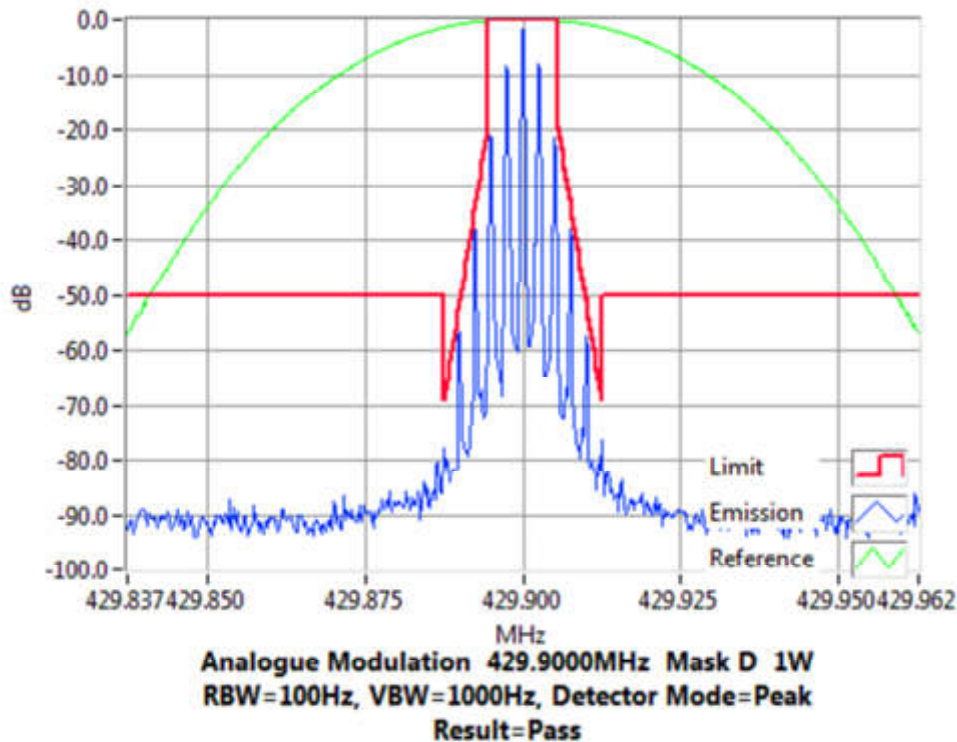
Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



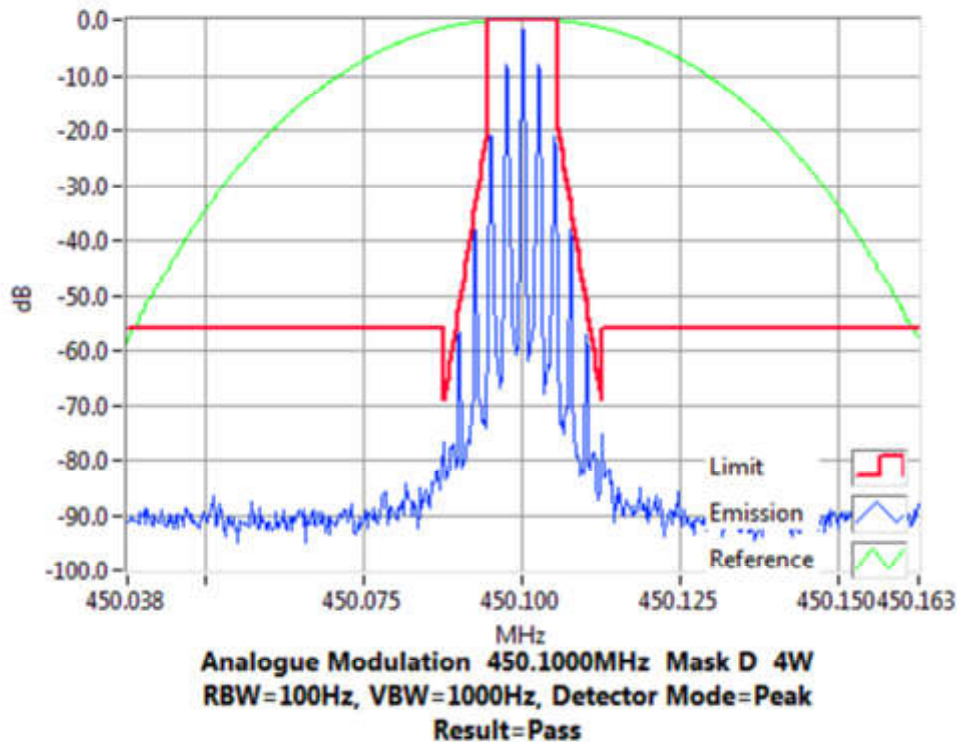
Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing



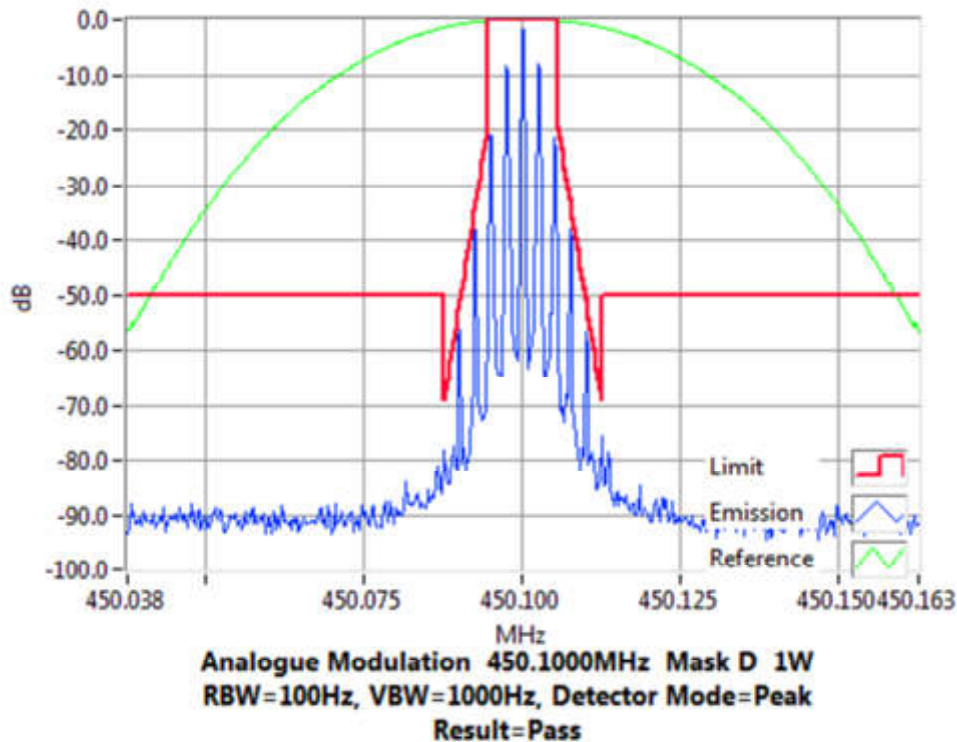
Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



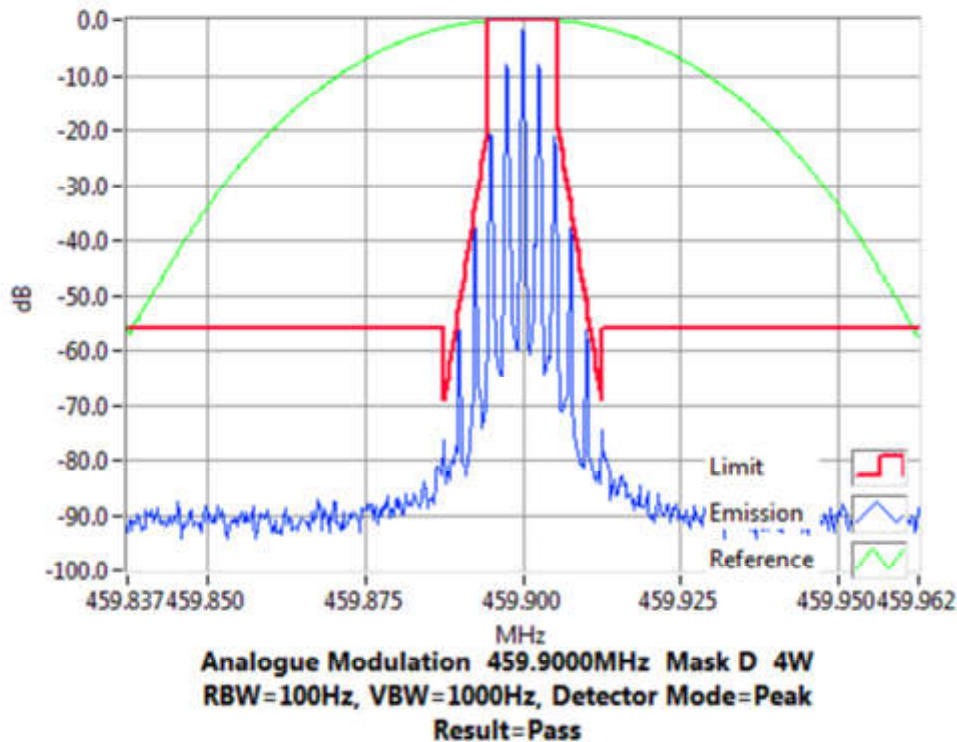
Tx FREQUENCY: 450.1 MHz 1 W 12.5 kHz Channel Spacing



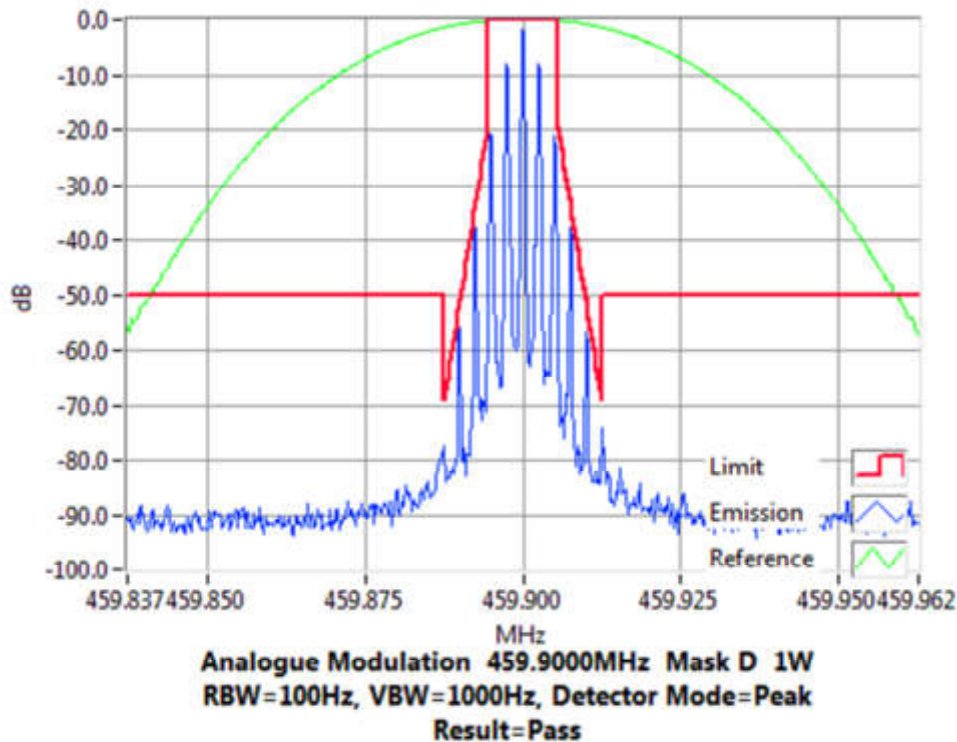
Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



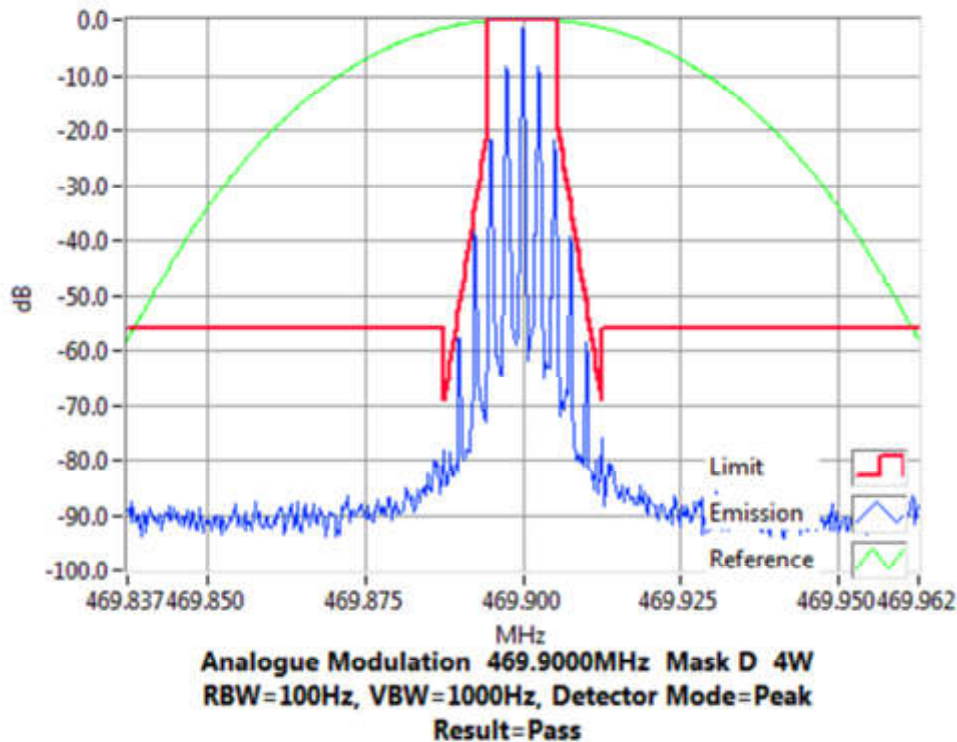
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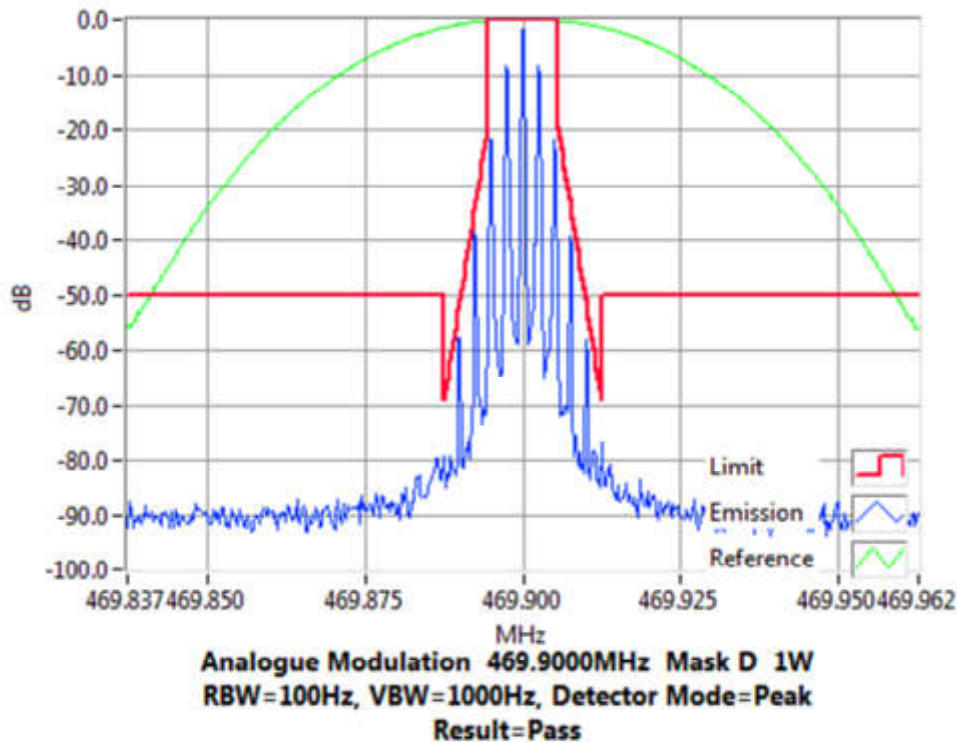
Occupied Bandwidth and Spectrum Masks

ANALOGUE VOICE

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



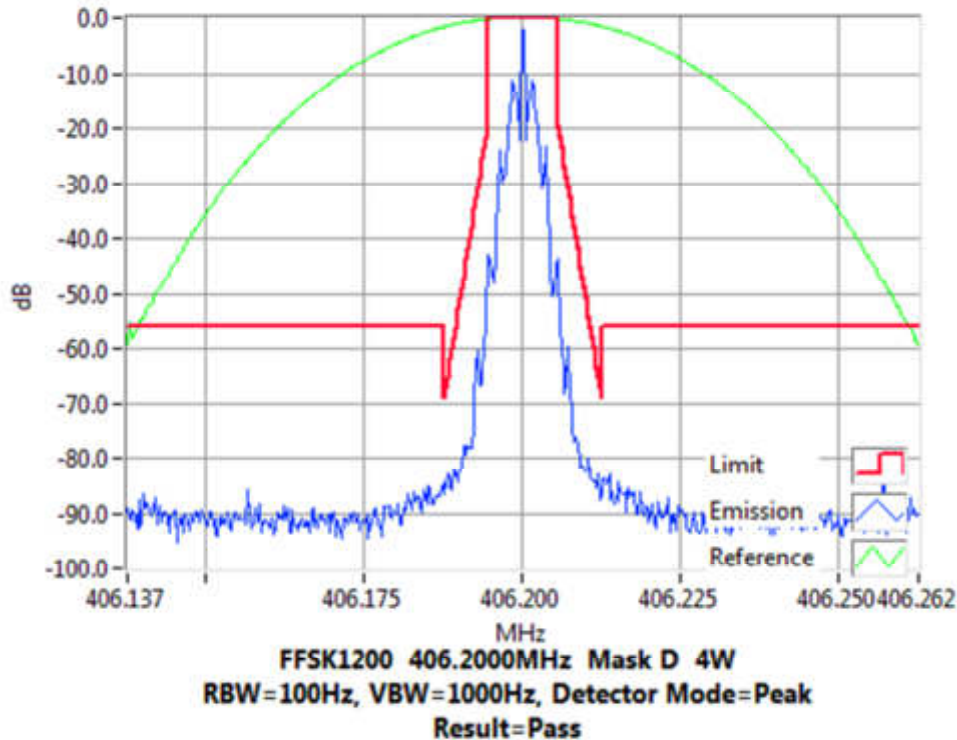
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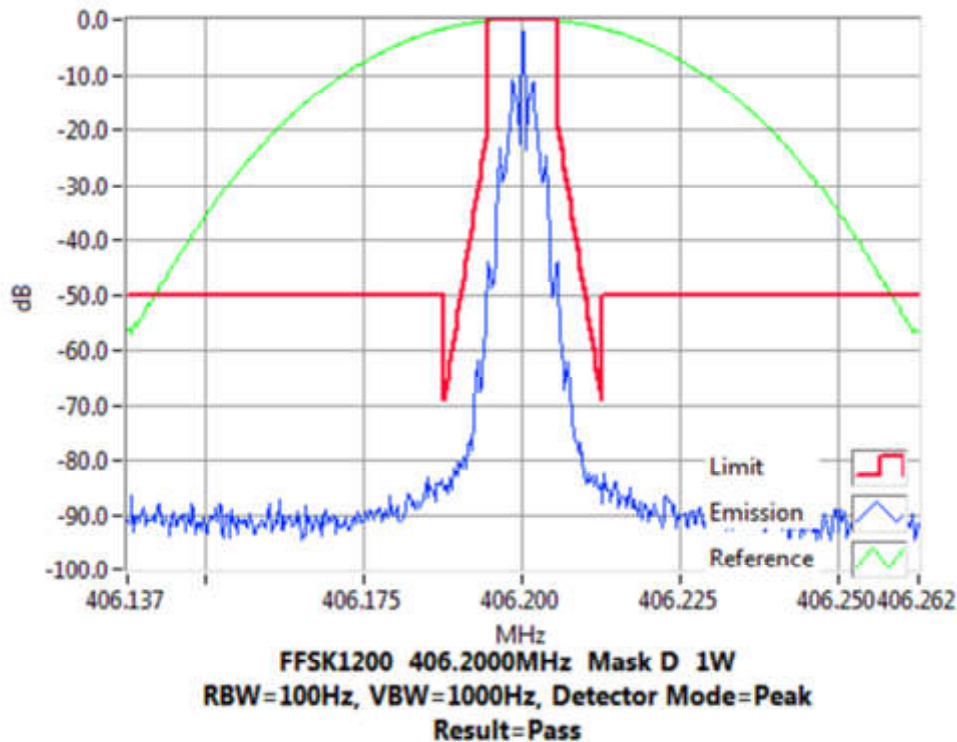
Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



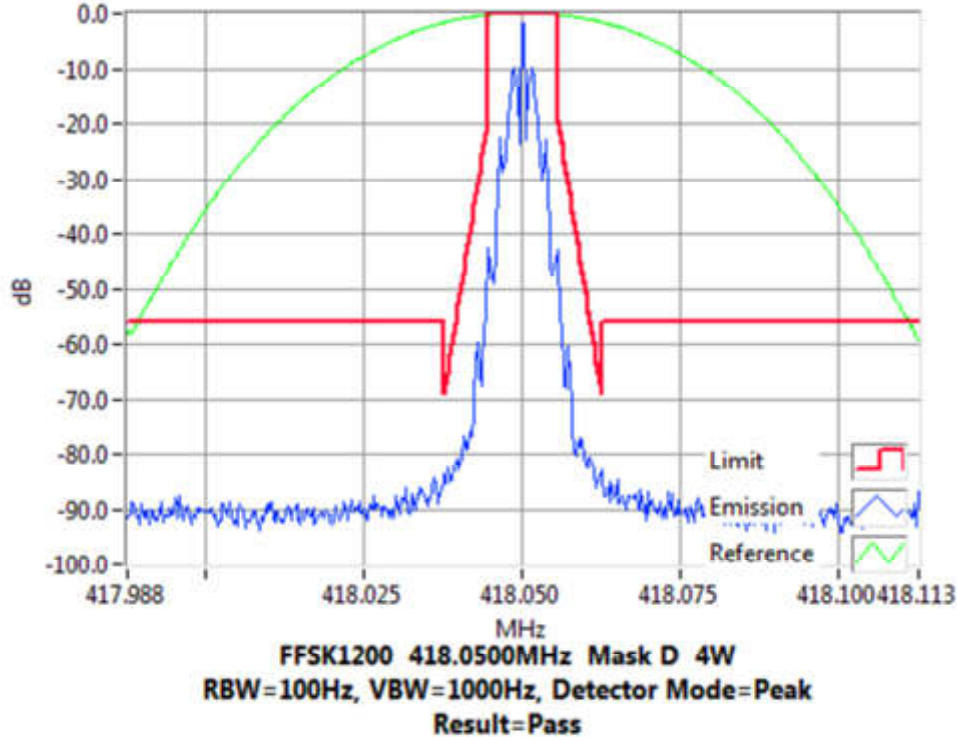
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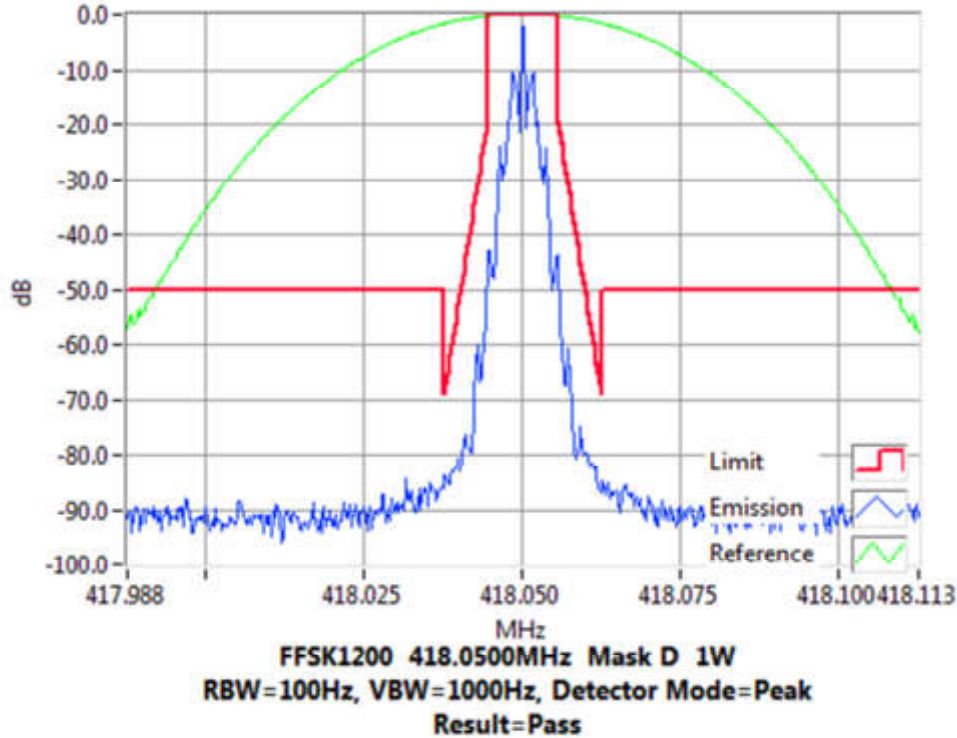
Occupied Bandwidth and Spectrum Masks

FSK 1200 bps

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



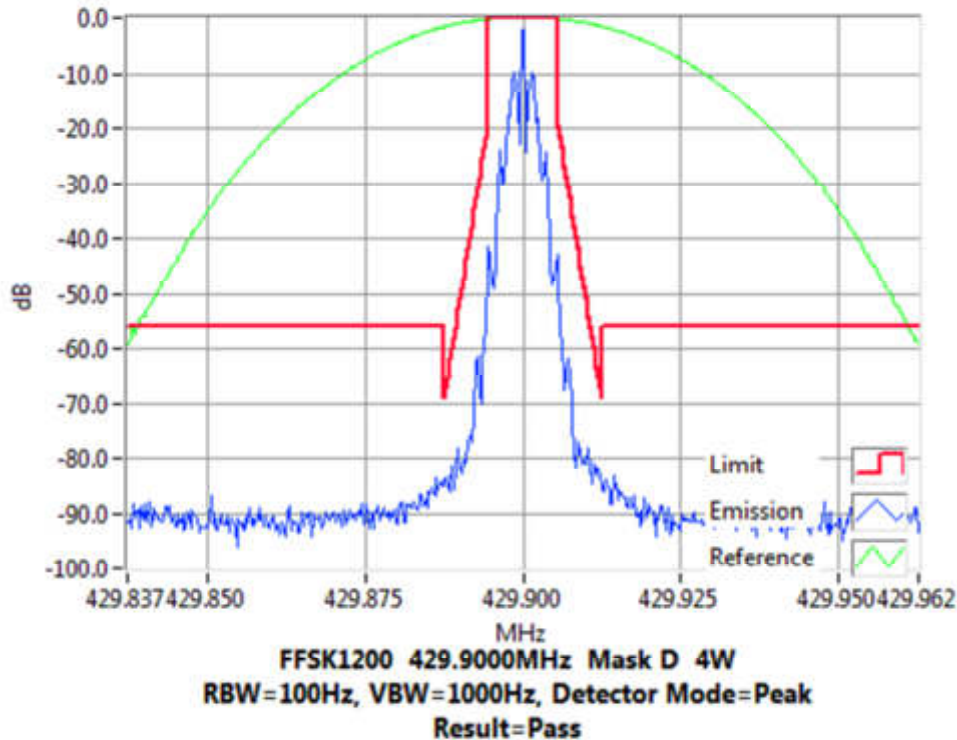
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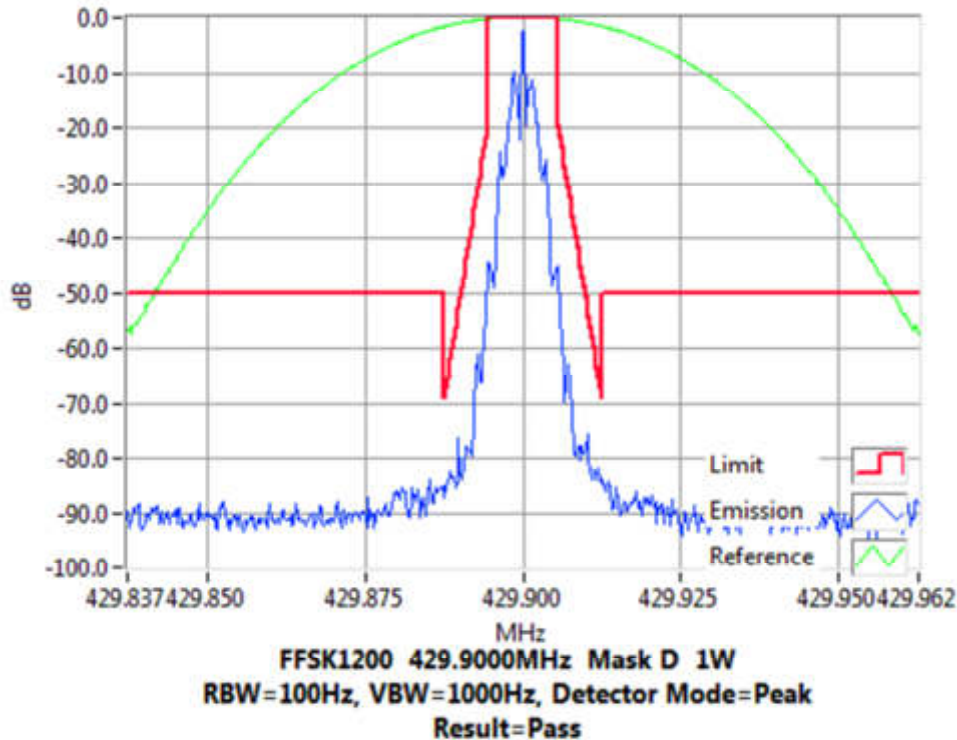
Occupied Bandwidth and Spectrum Masks

FSK 1200 bps

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



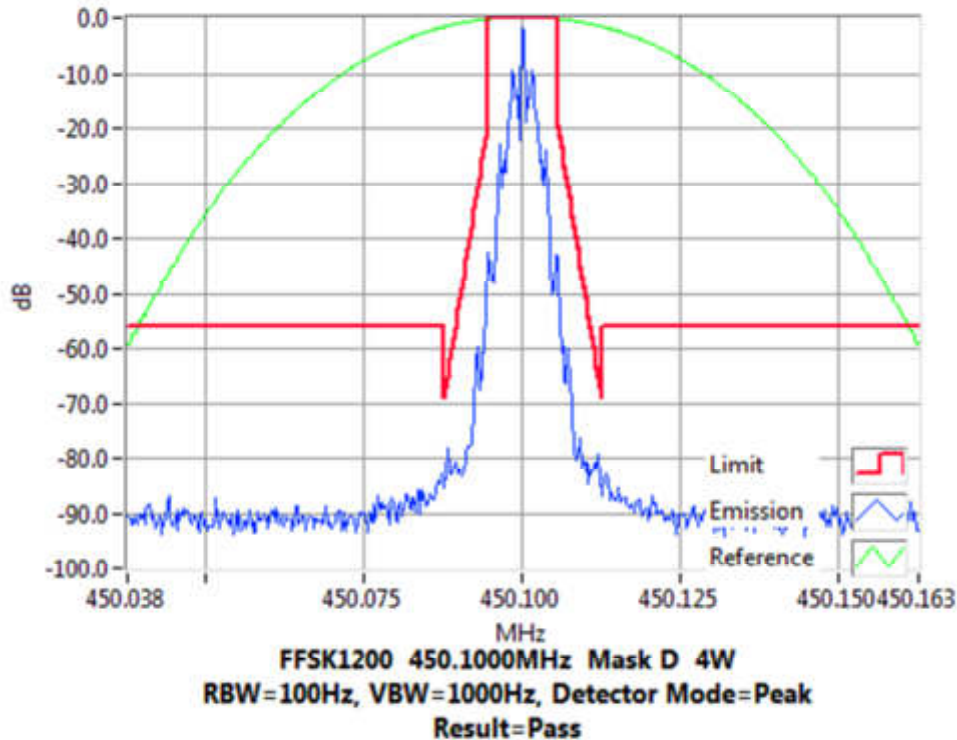
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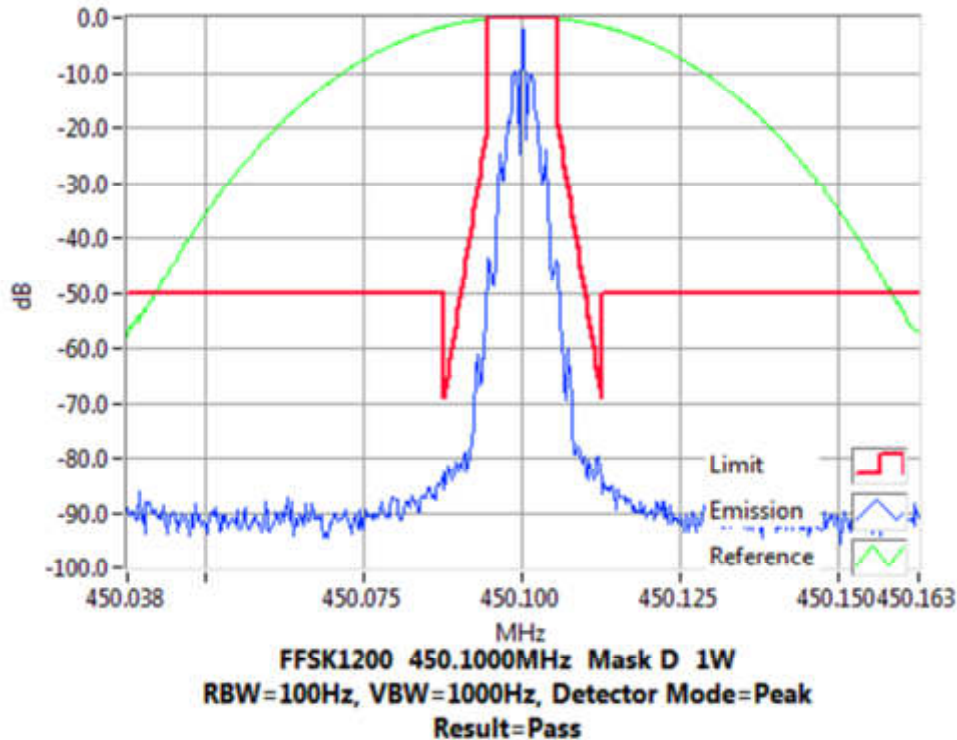
Occupied Bandwidth and Spectrum Masks

FSK 1200 bps

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



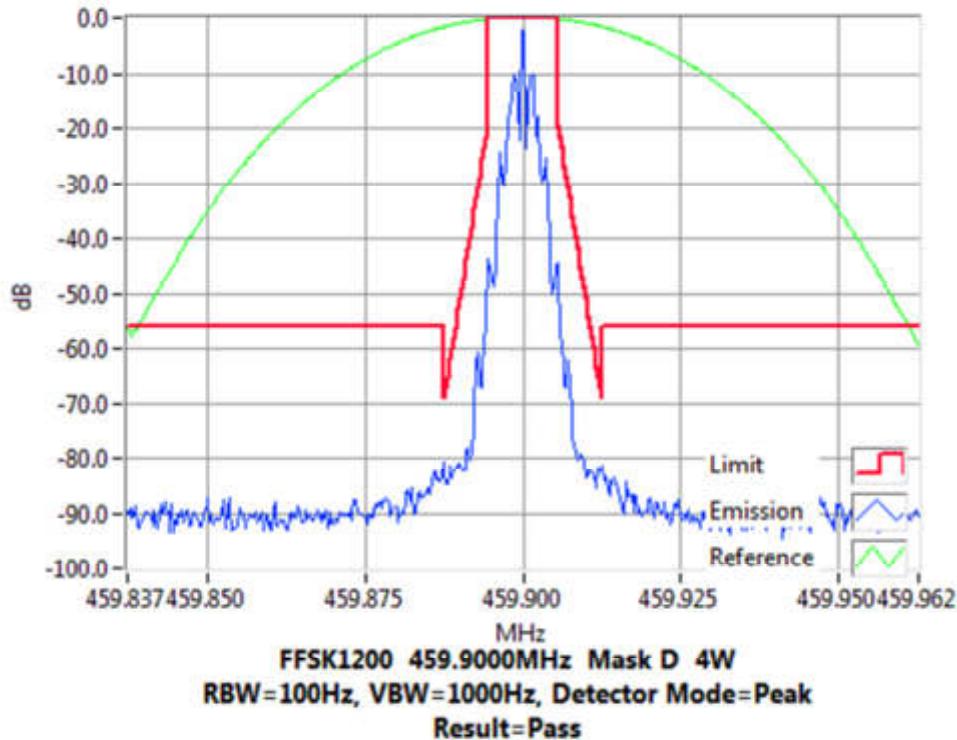
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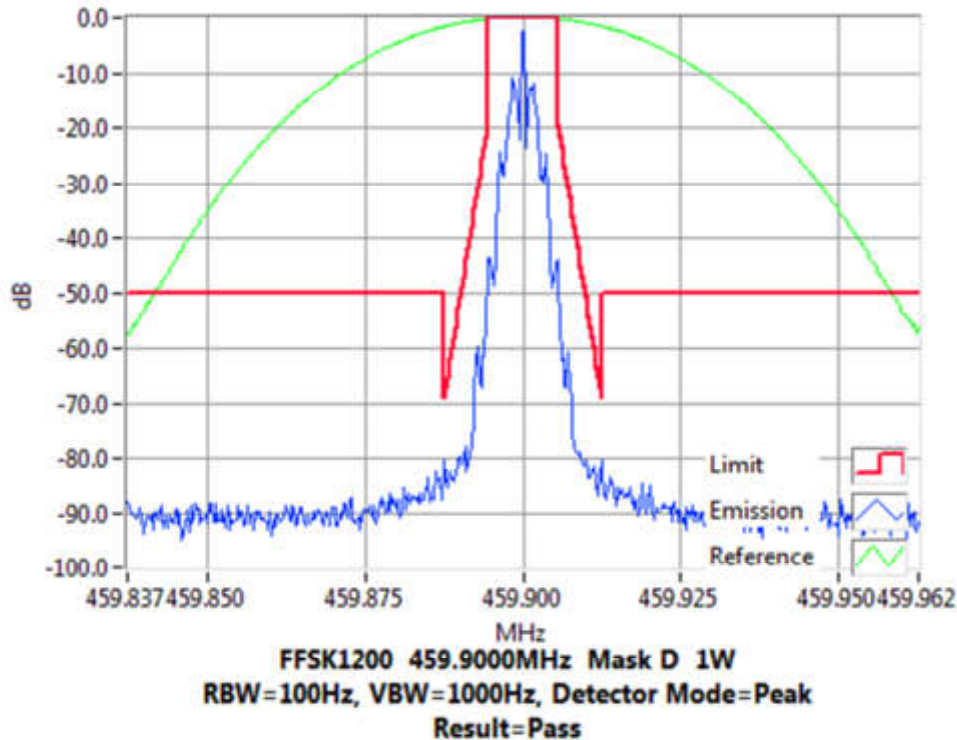
Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



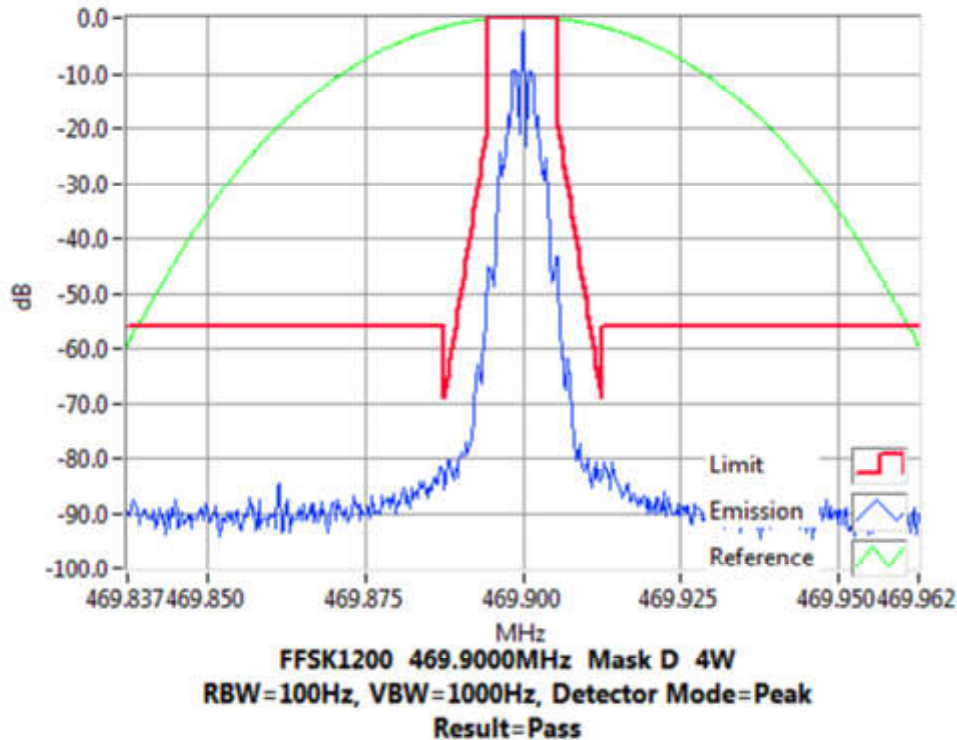
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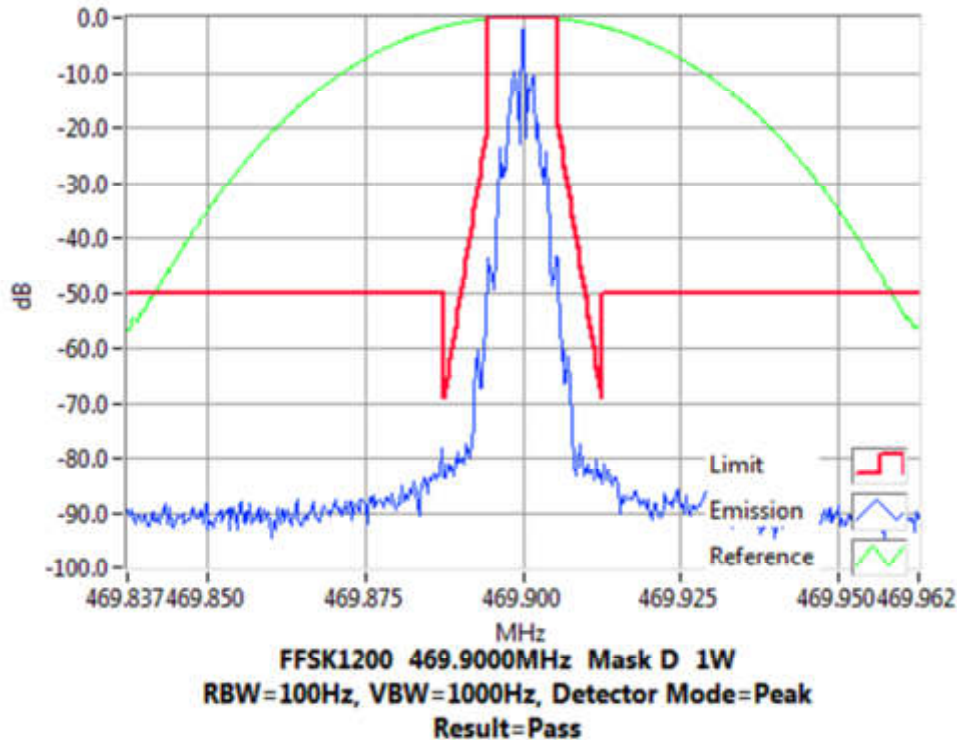
Occupied Bandwidth and Spectrum Masks

FFSK 1200 bps

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



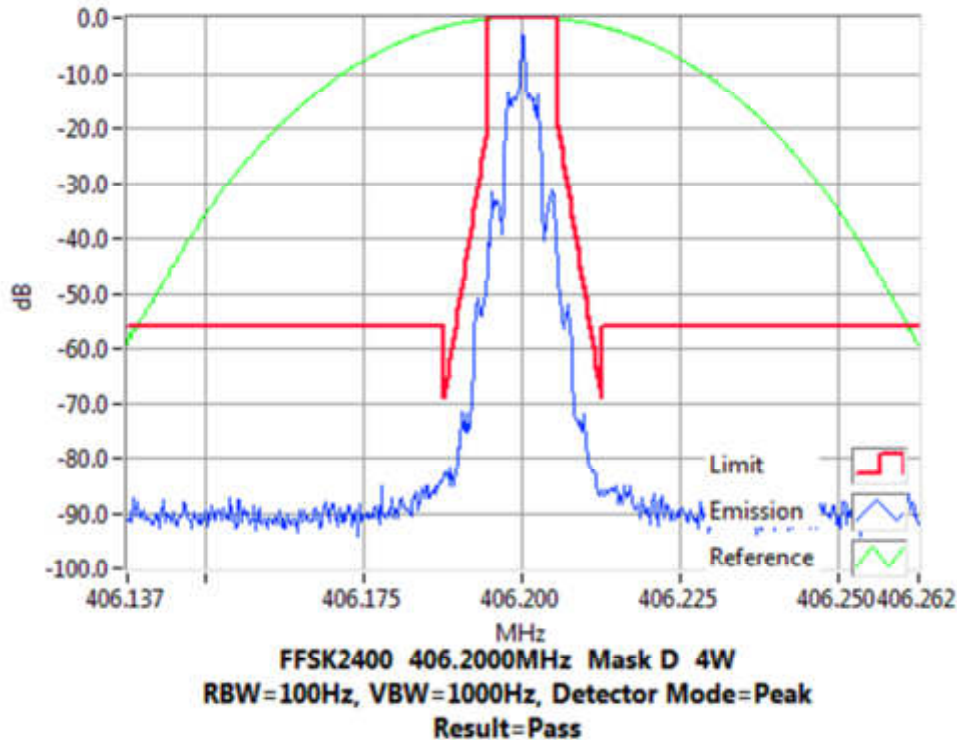
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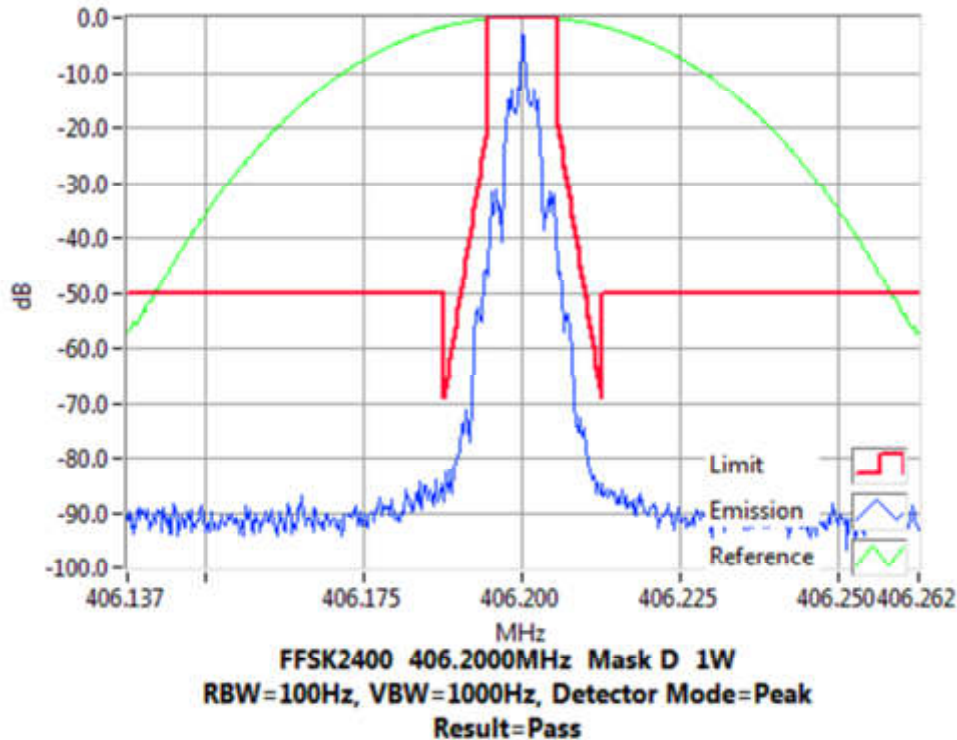
Occupied Bandwidth and Spectrum Masks

FFSK 2400 bps

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



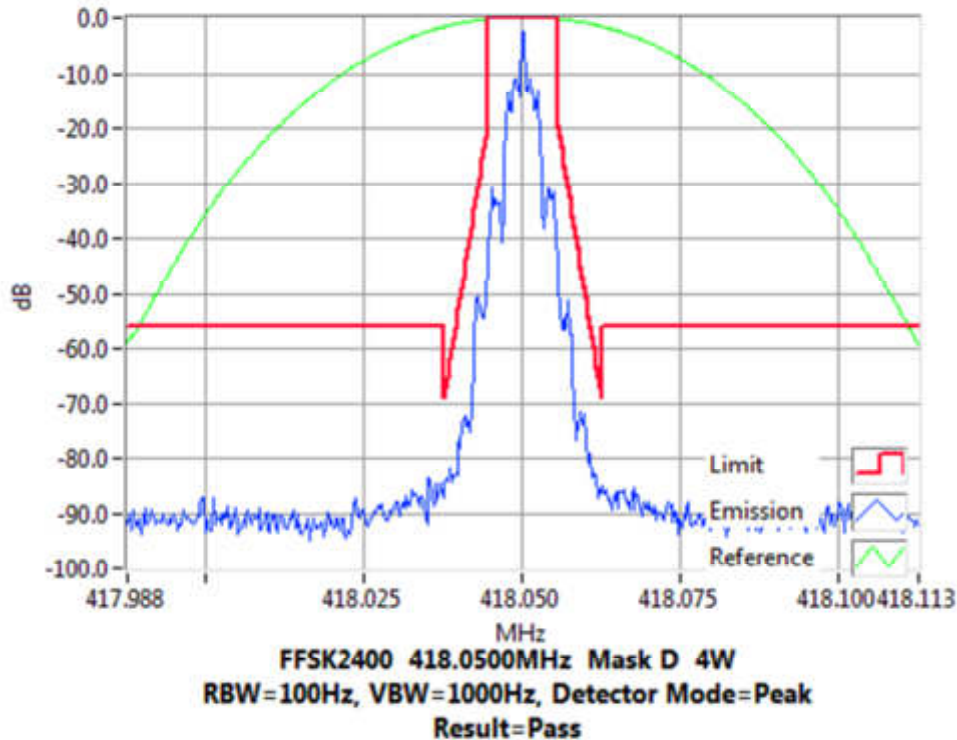
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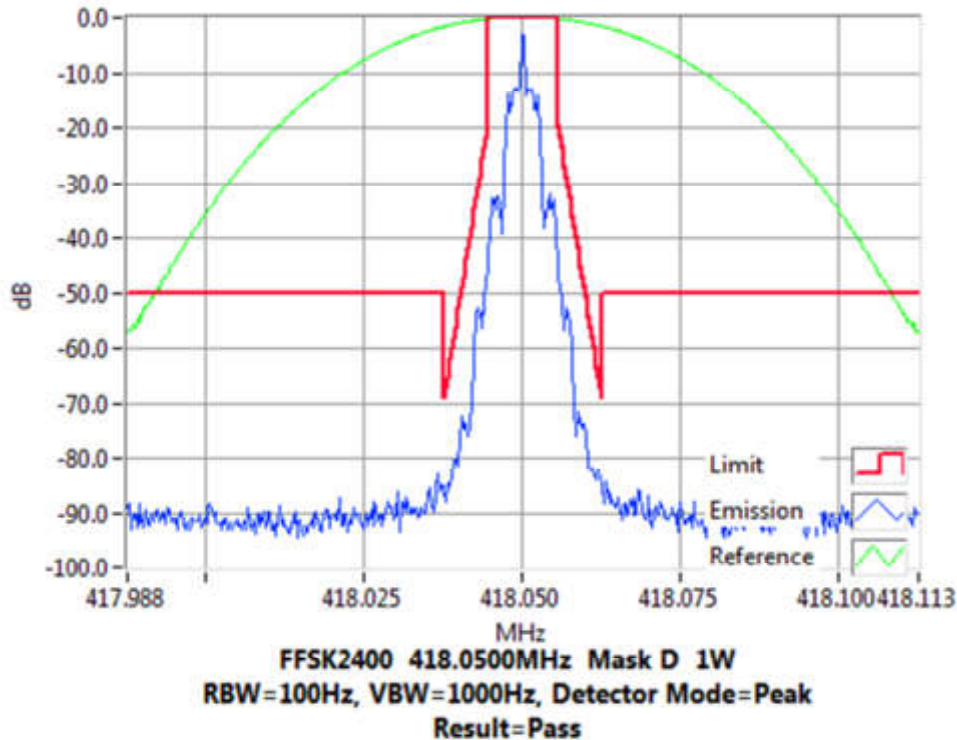
Occupied Bandwidth and Spectrum Masks

FFSK 2400 bps

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



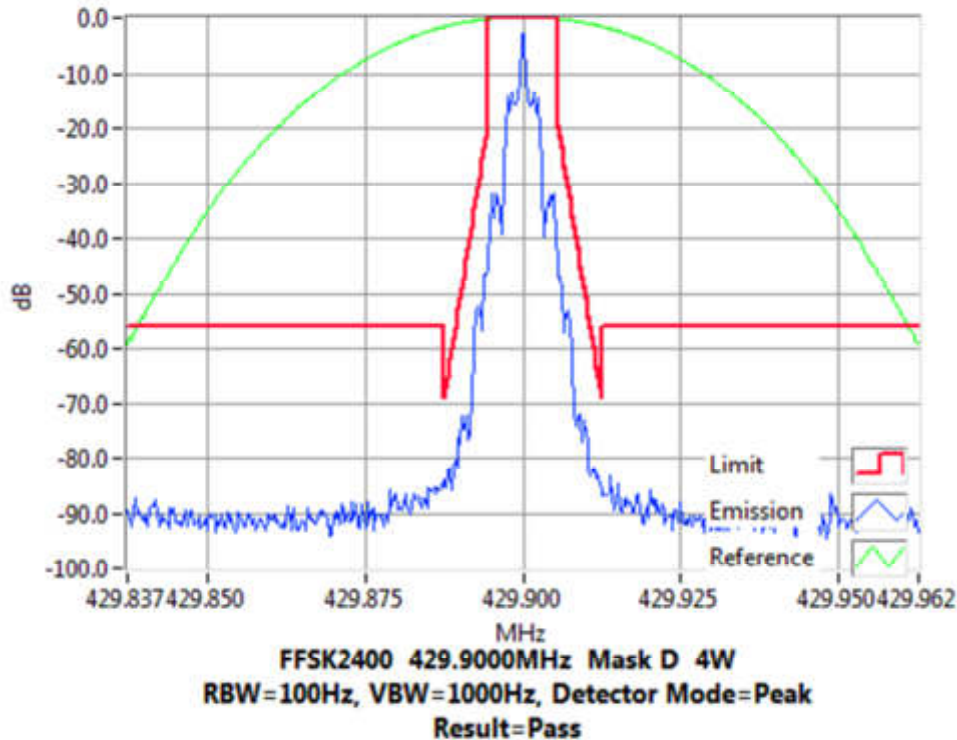
Tx FREQUENCY: 418.05 MHz 1 W 12.5 kHz Channel Spacing



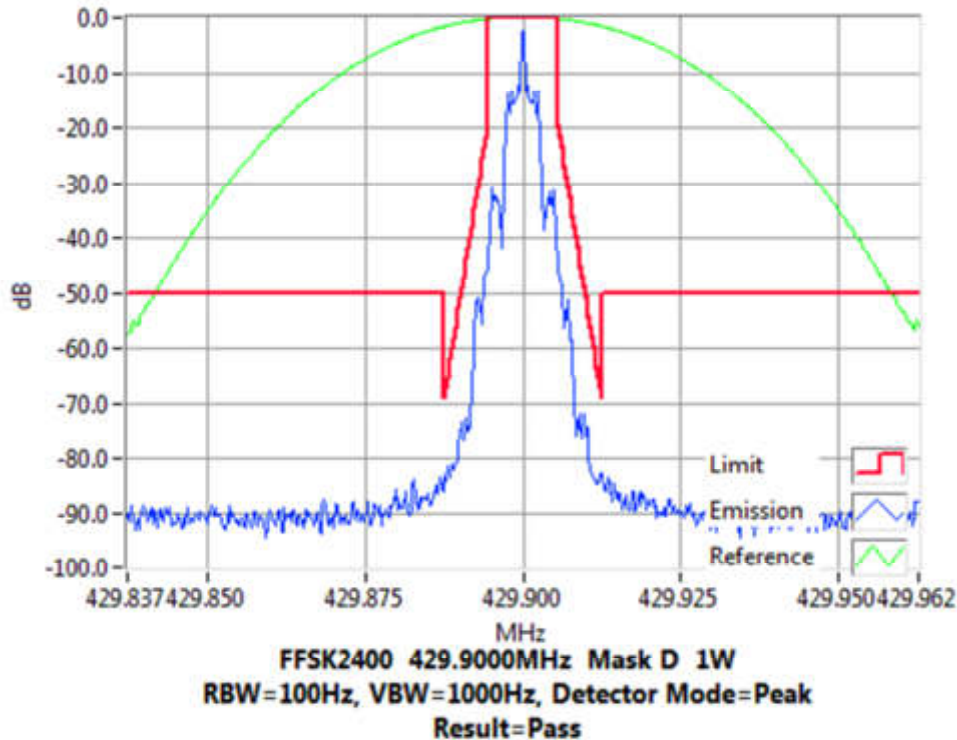
Occupied Bandwidth and Spectrum Masks

FFSK 2400 bps

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



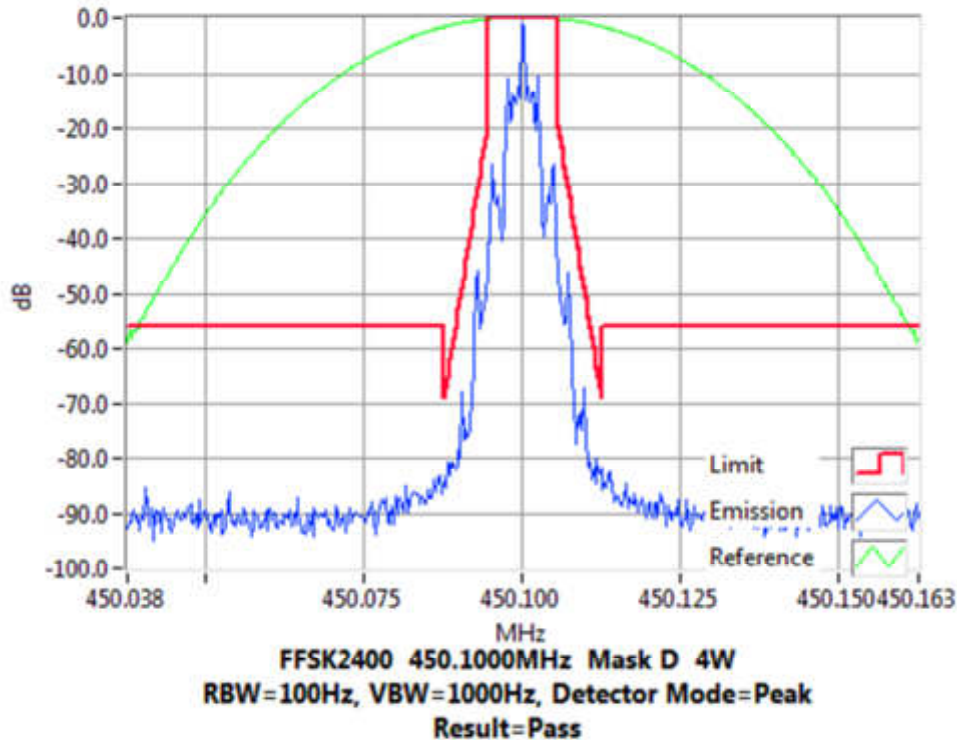
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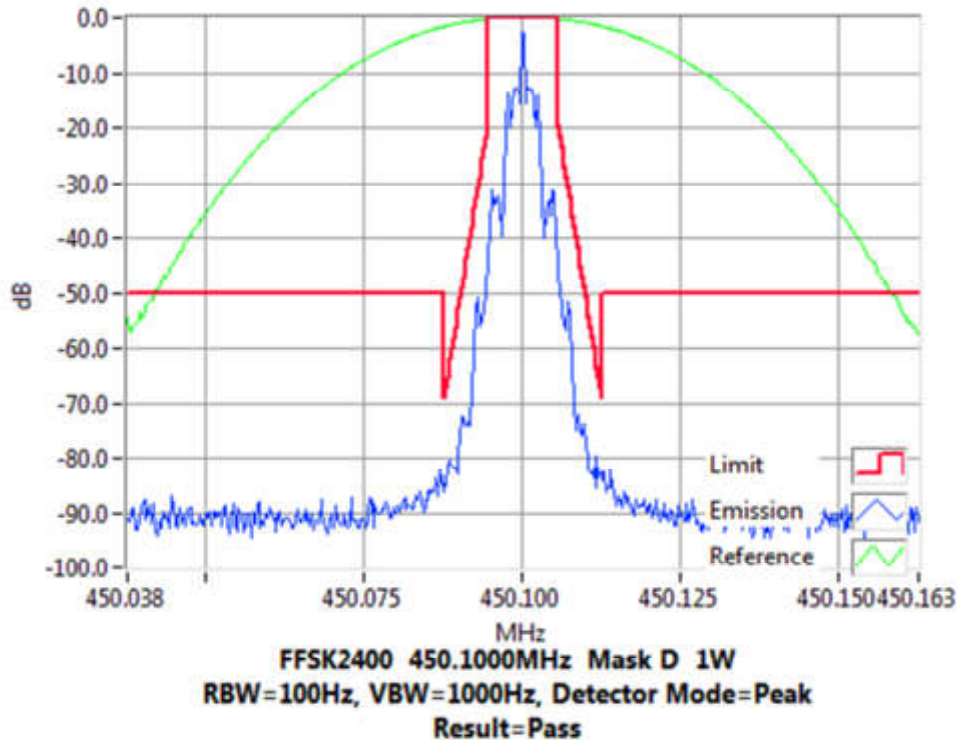
Occupied Bandwidth and Spectrum Masks

FFSK 2400 bps

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



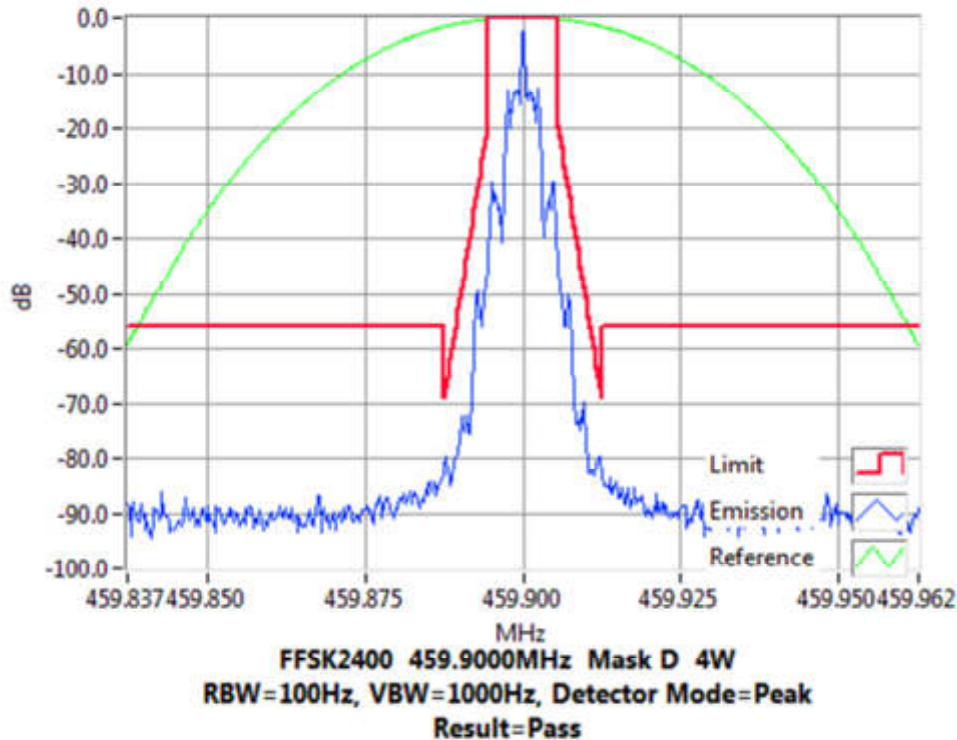
Tx FREQUENCY: 450.1 MHz 1 W 12.5 kHz Channel Spacing



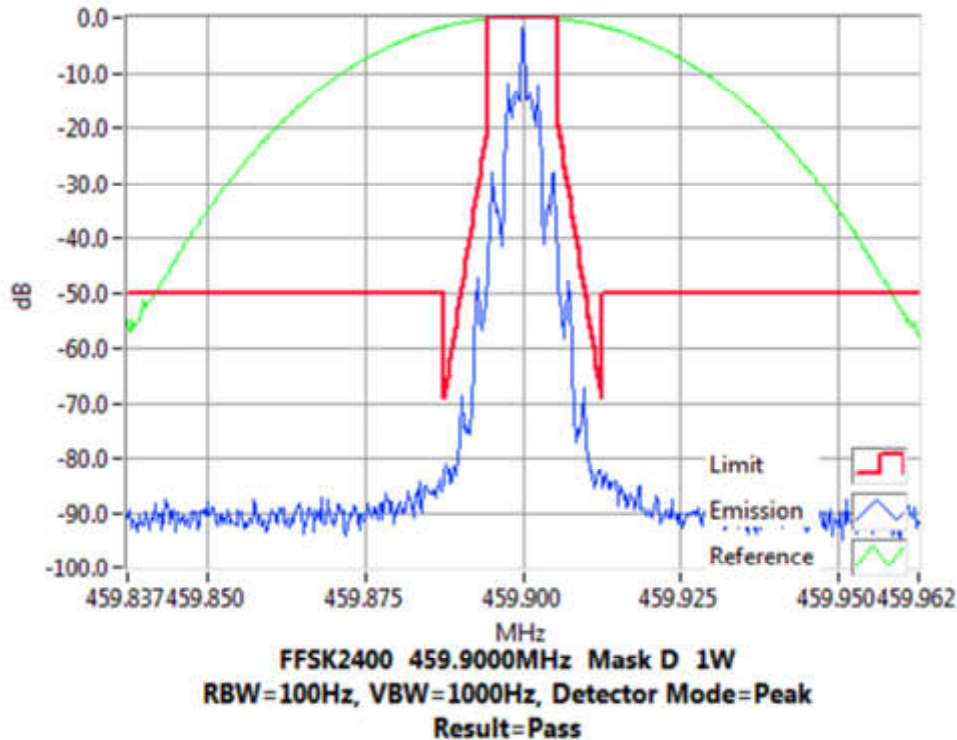
Occupied Bandwidth and Spectrum Masks

FFSK 2400 bps

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



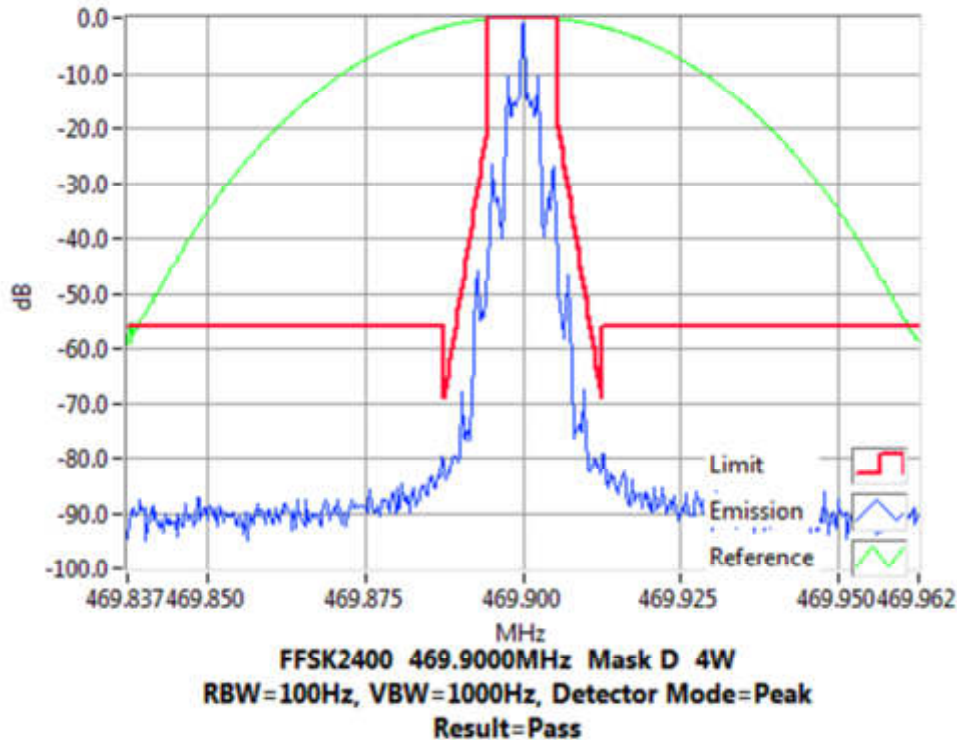
Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing



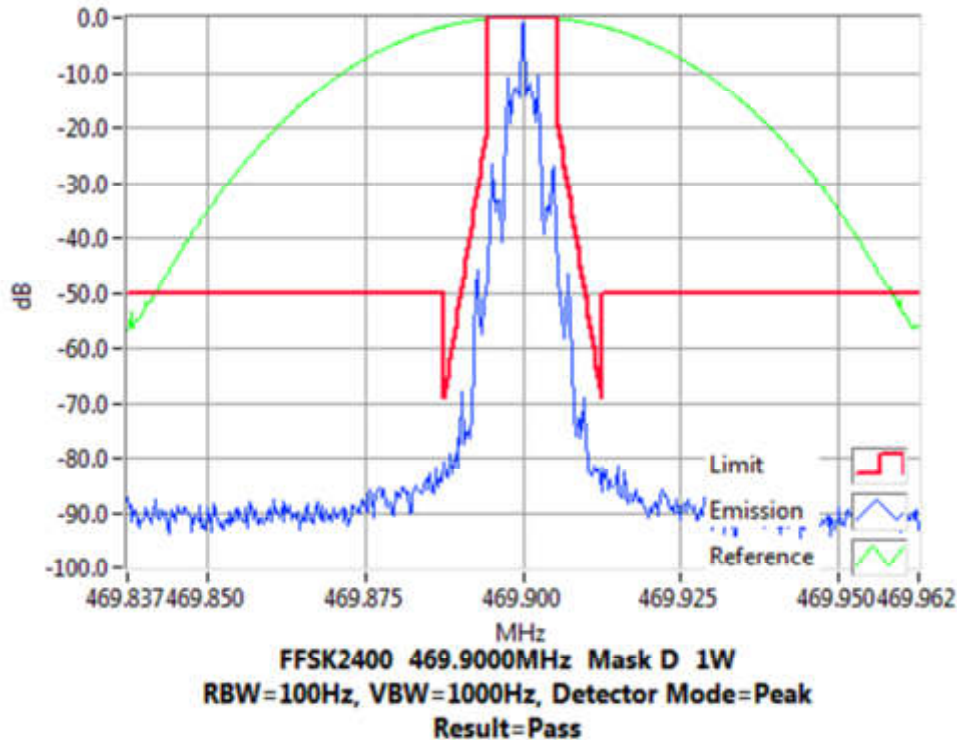
Occupied Bandwidth and Spectrum Masks

FFSK 2400 bps

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



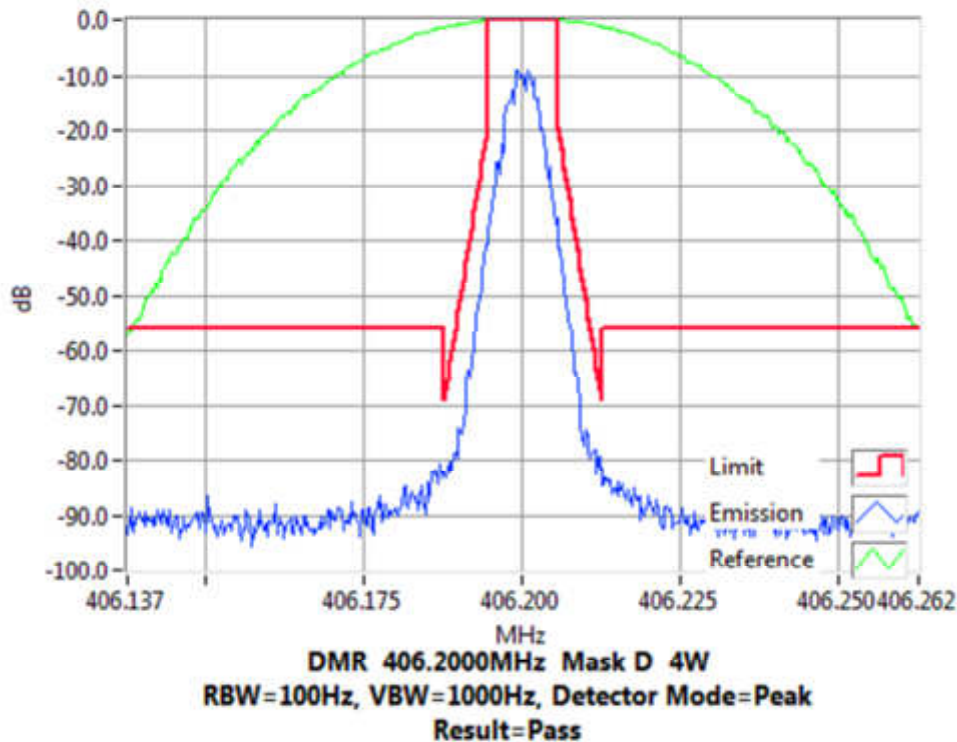
Tx FREQUENCY: 469.9 MHz 1 W 12.5 kHz Channel Spacing



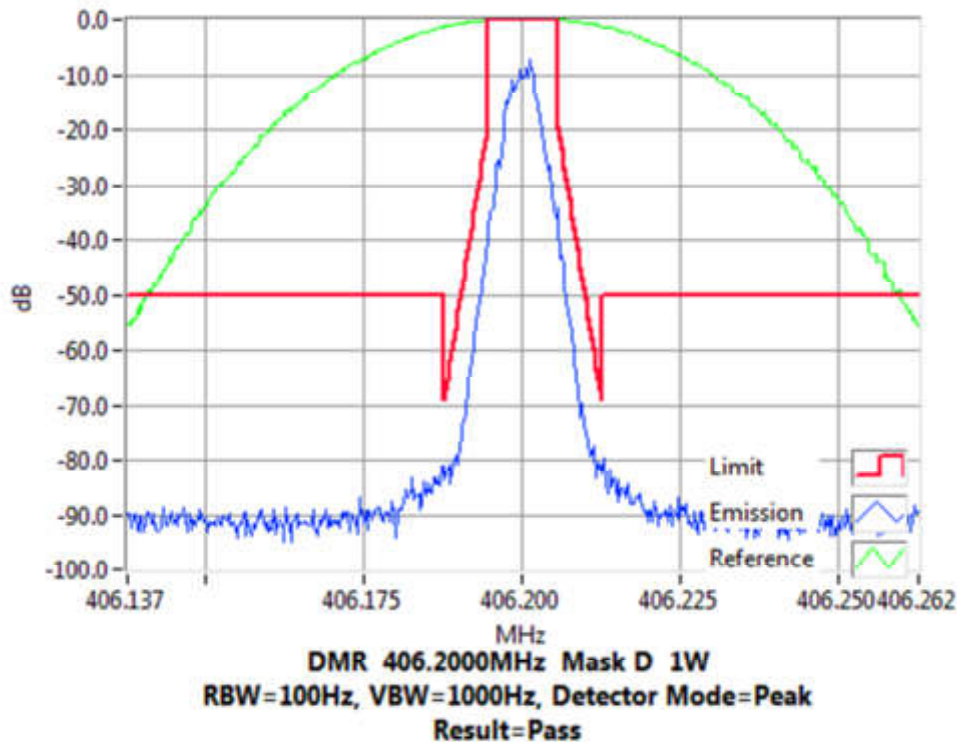
Occupied Bandwidth and Spectrum Masks

DMR

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



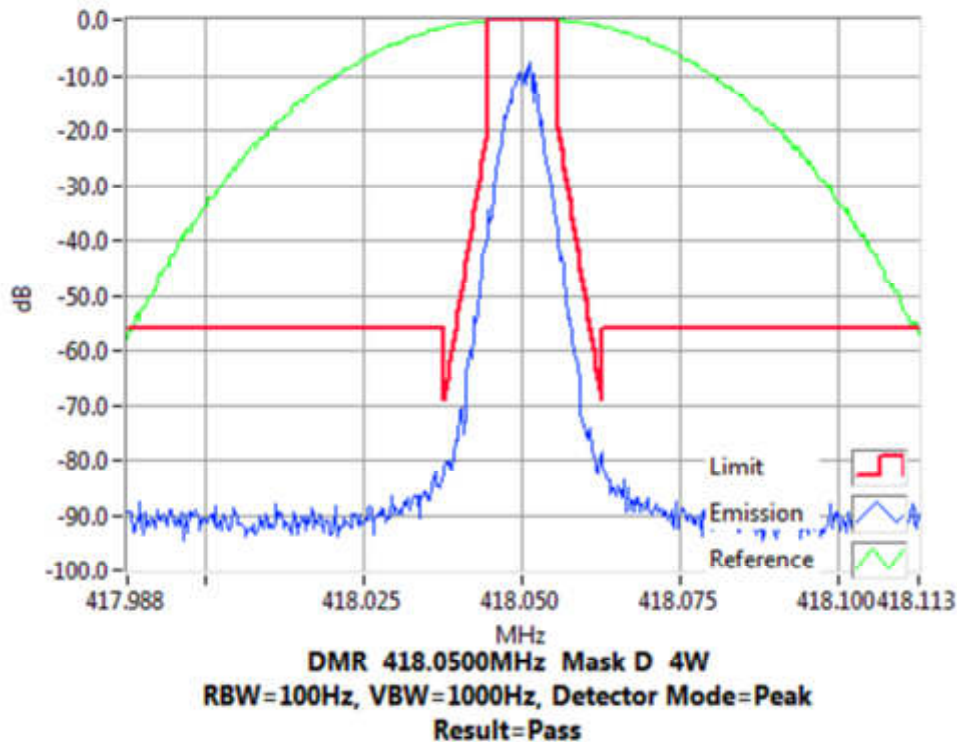
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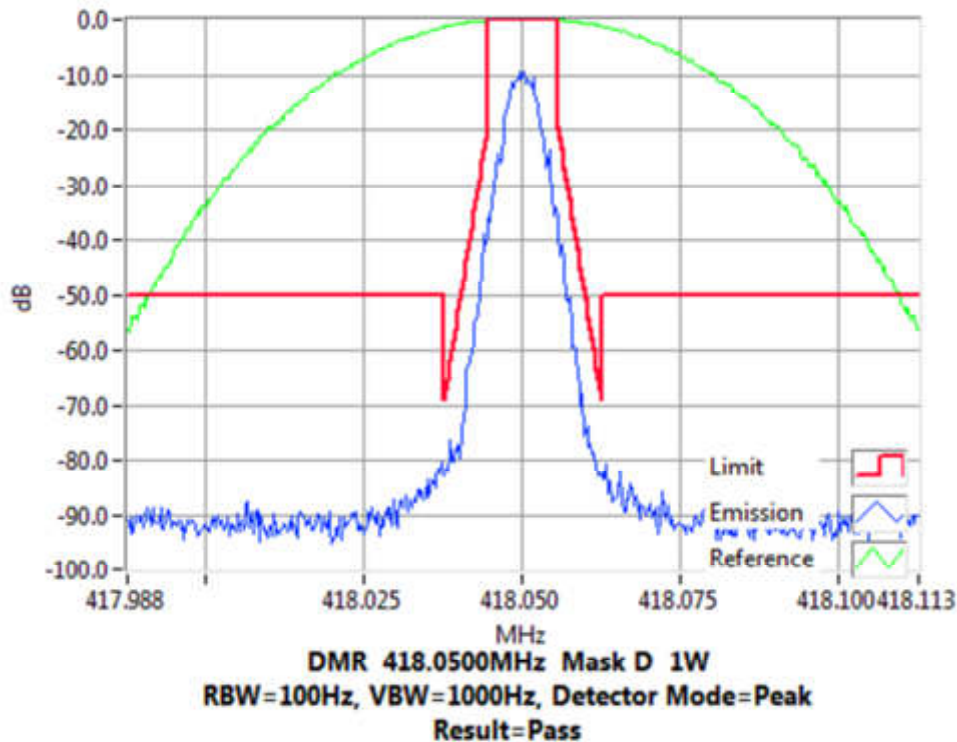
Occupied Bandwidth and Spectrum Masks

DMR

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



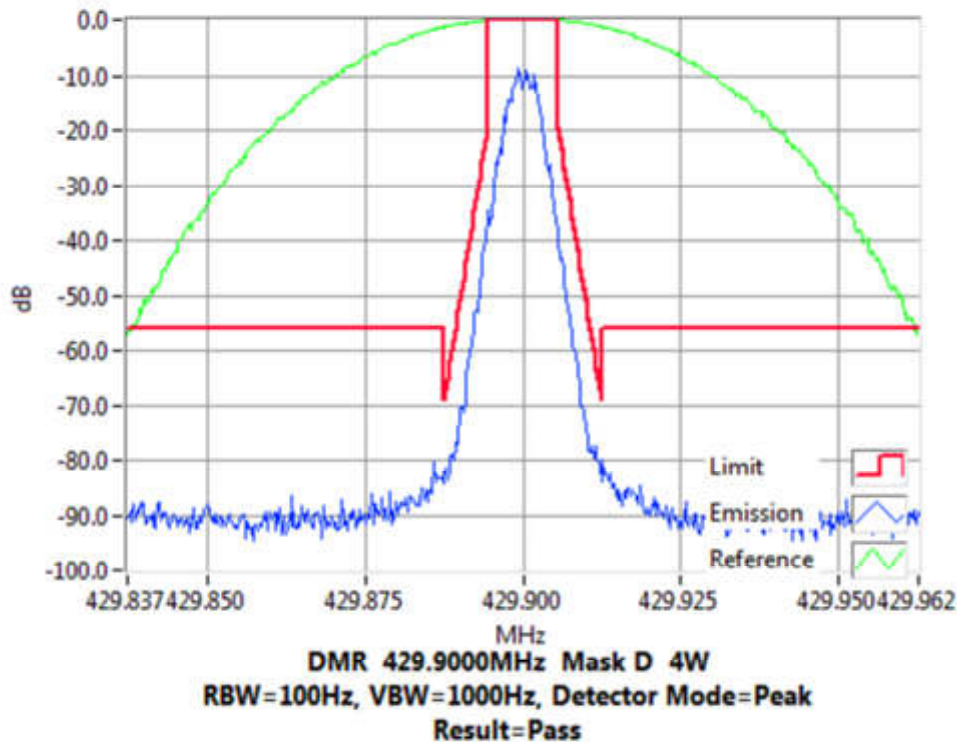
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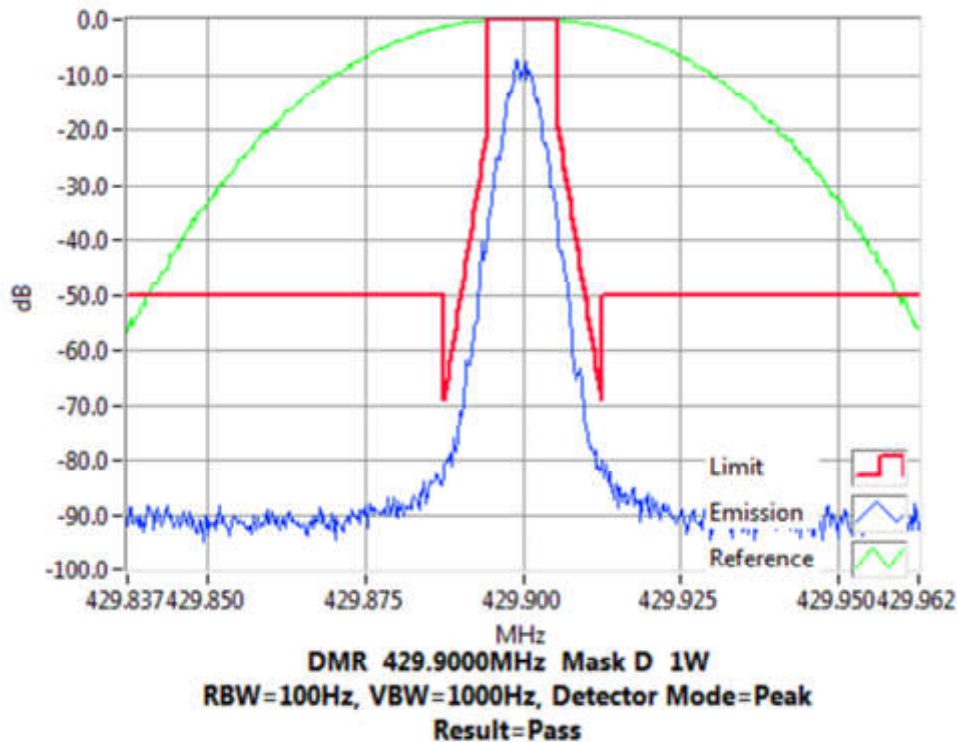
Occupied Bandwidth and Spectrum Masks

DMR

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



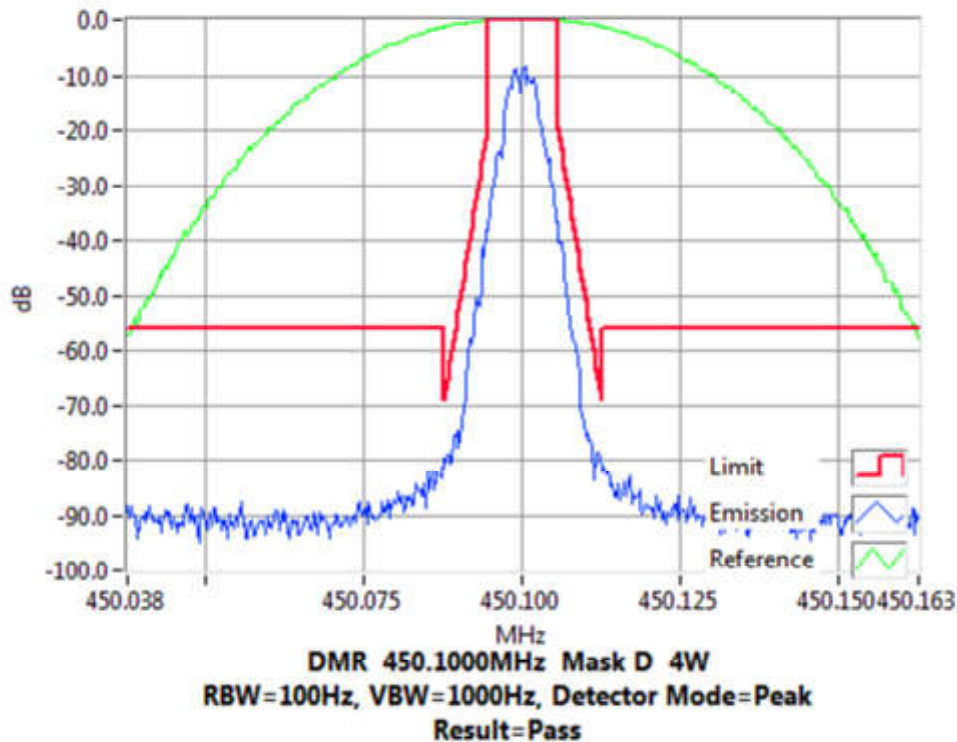
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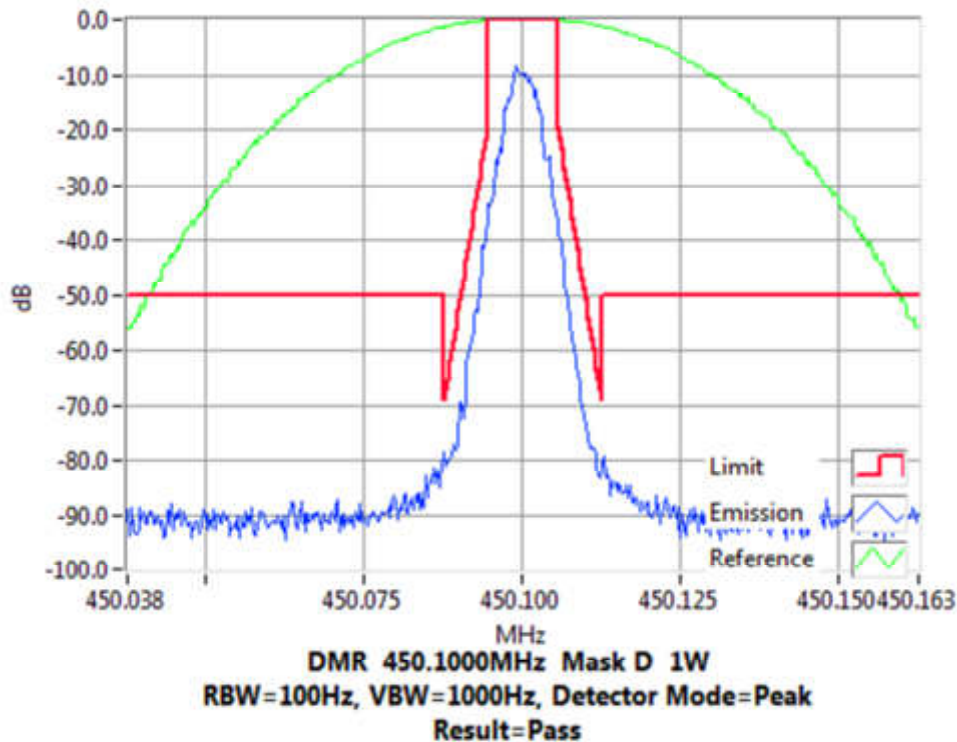
Occupied Bandwidth and Spectrum Masks

DMR

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



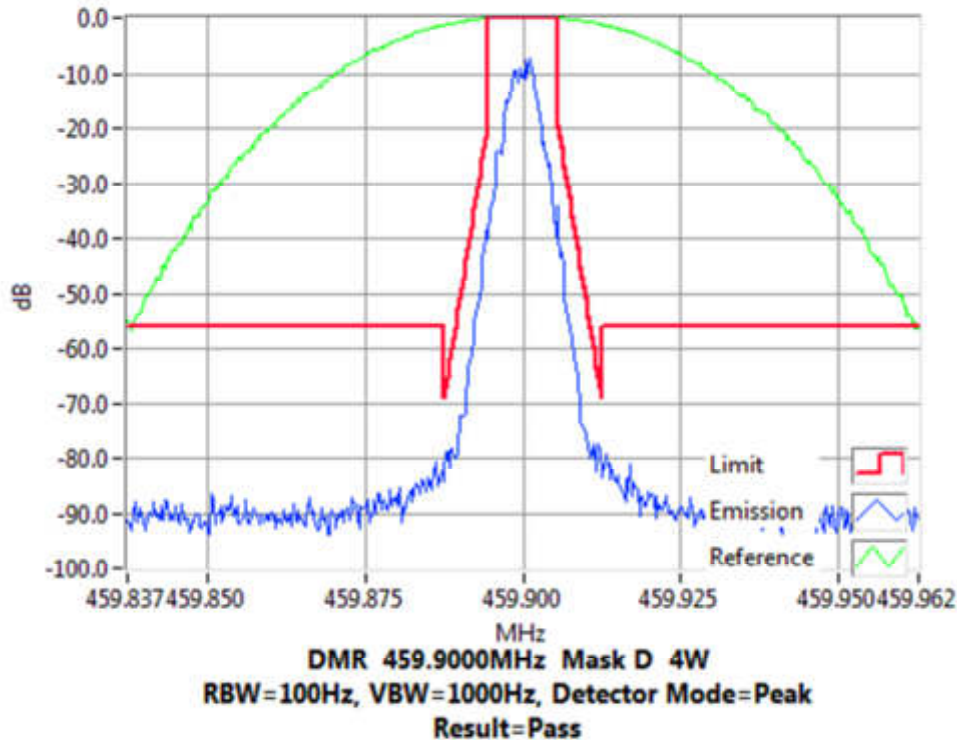
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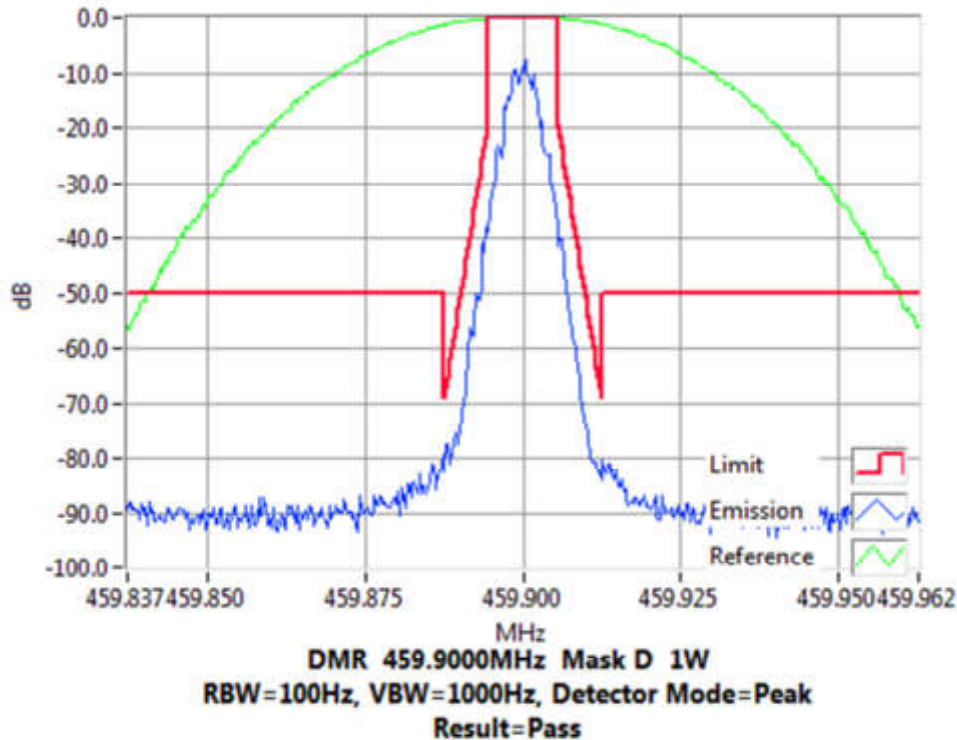
Occupied Bandwidth and Spectrum Masks

DMR

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



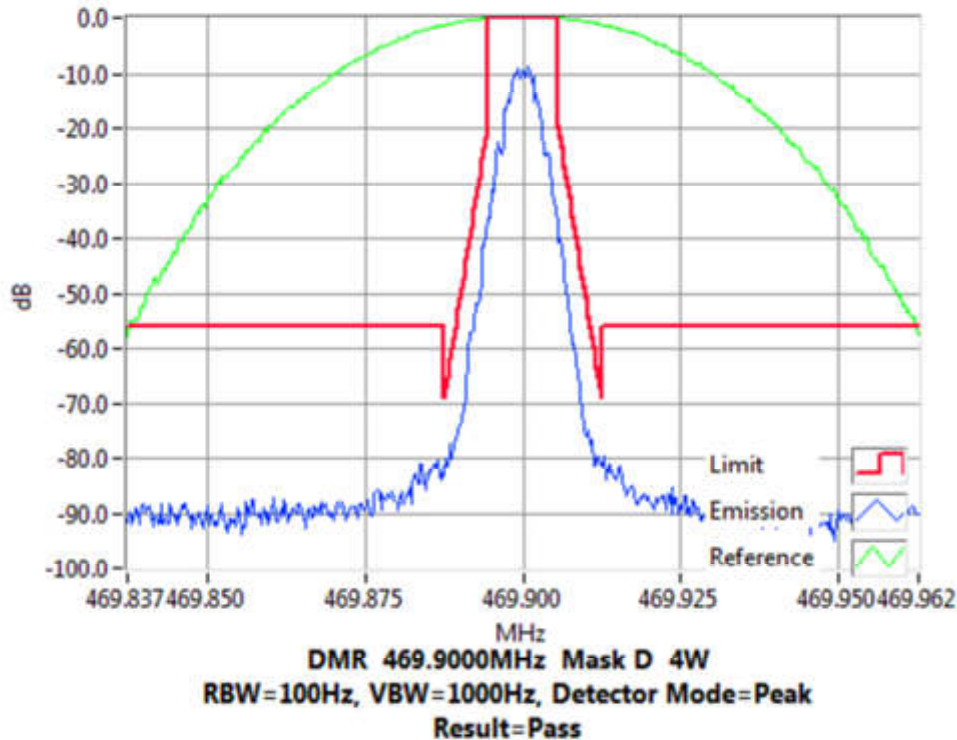
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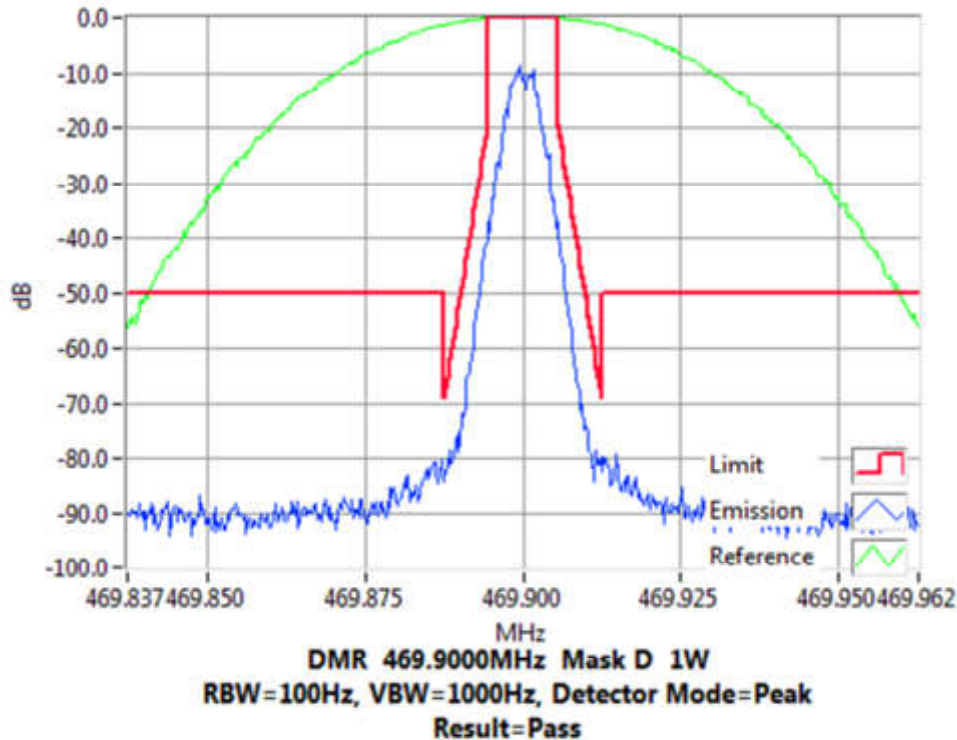
Occupied Bandwidth and Spectrum Masks

DMR

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



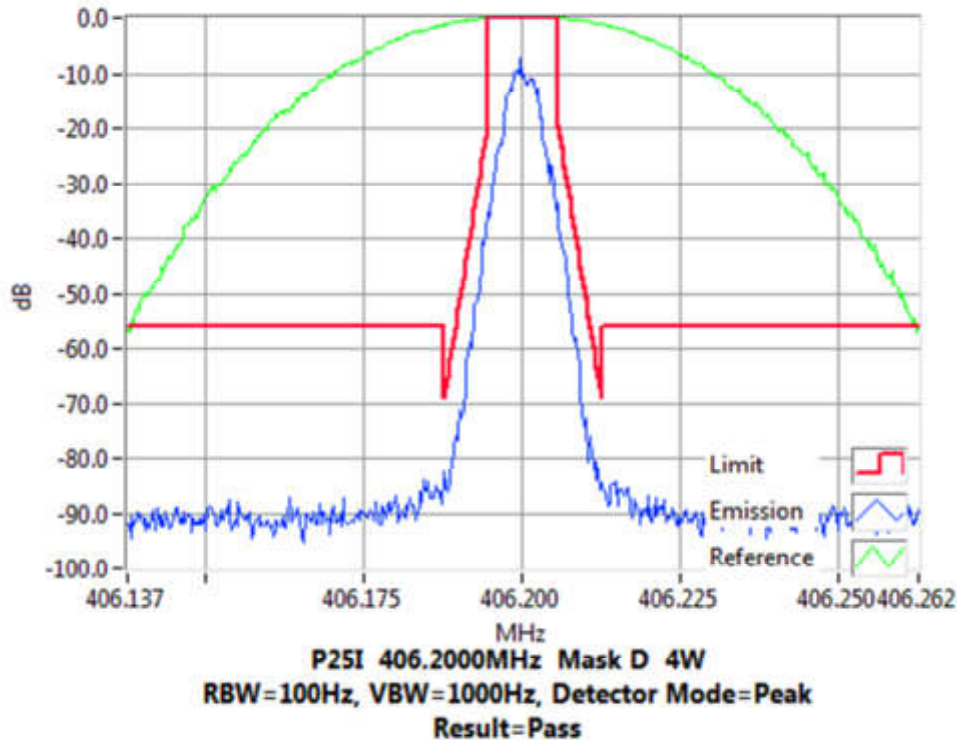
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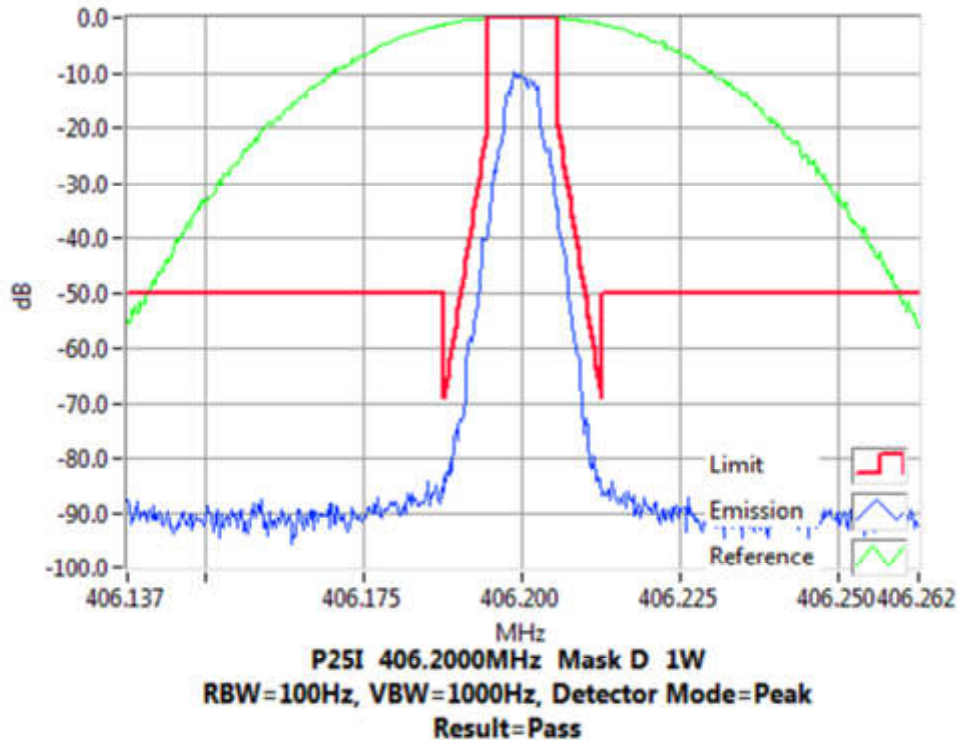
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



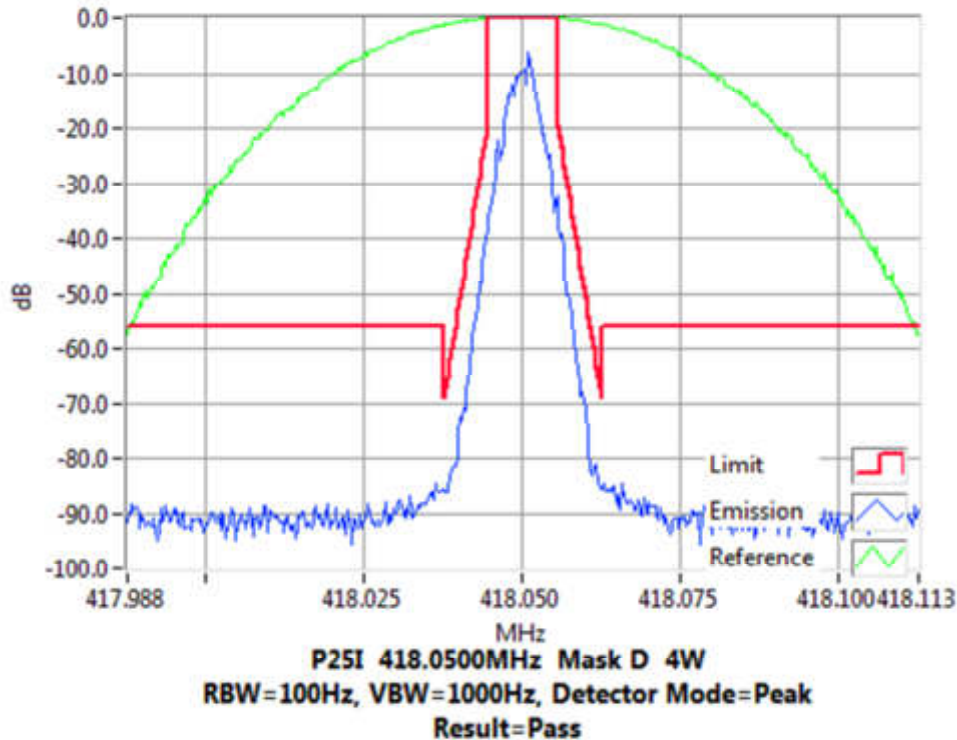
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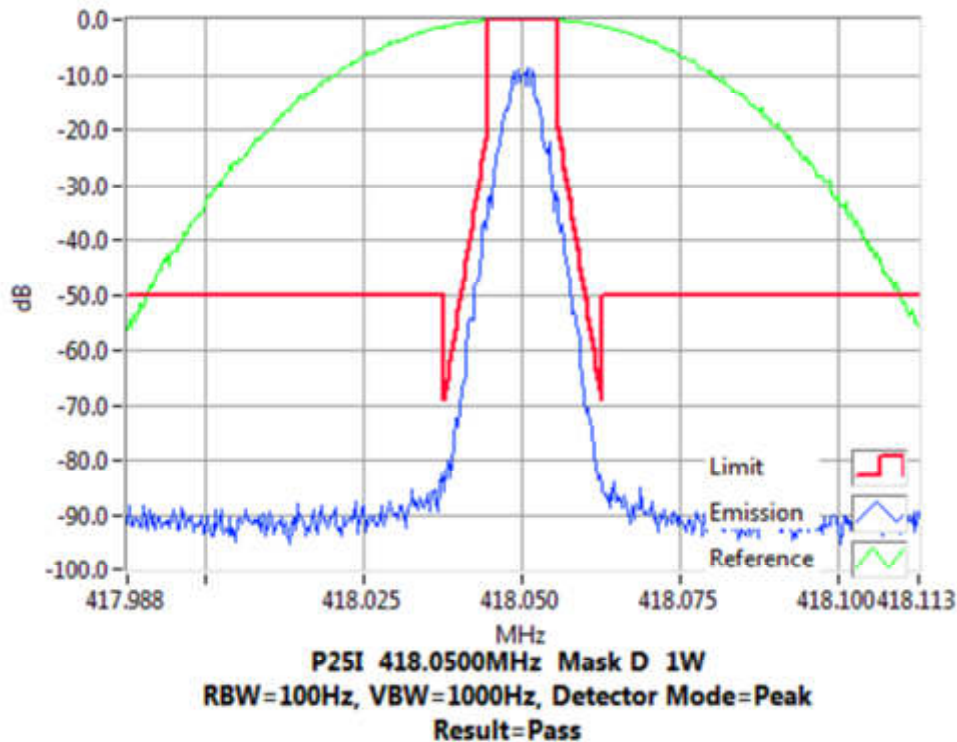
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



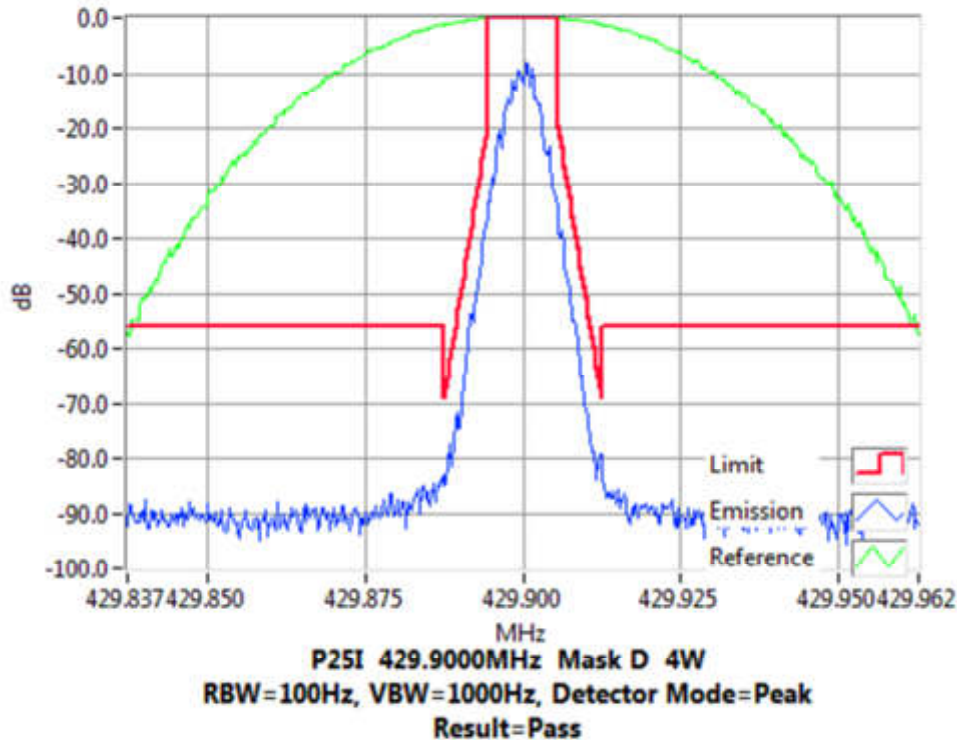
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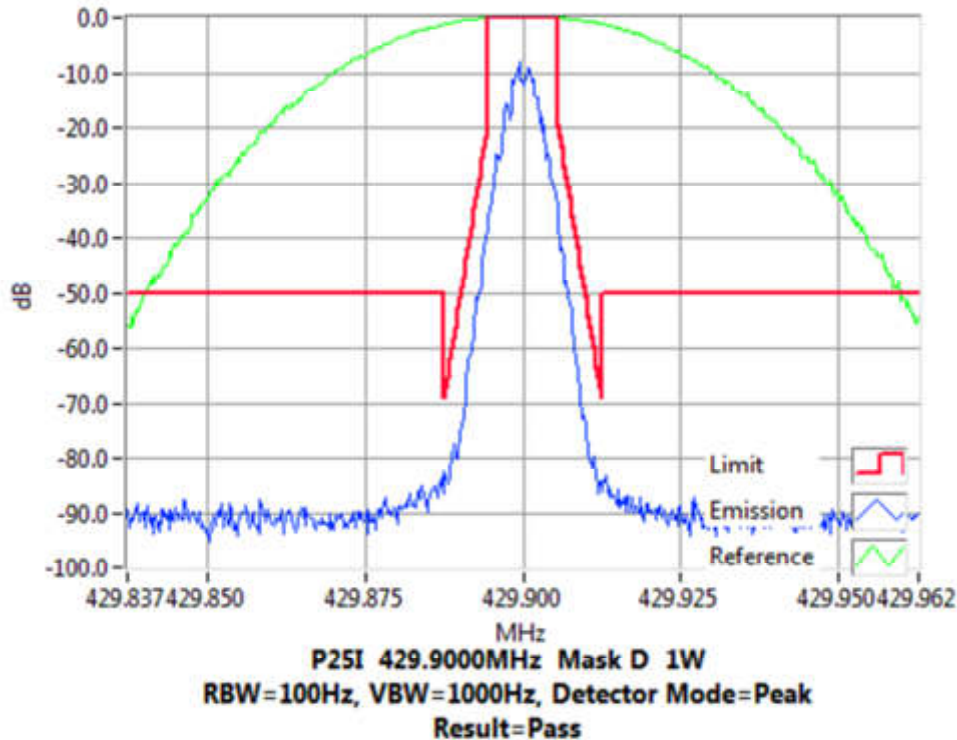
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



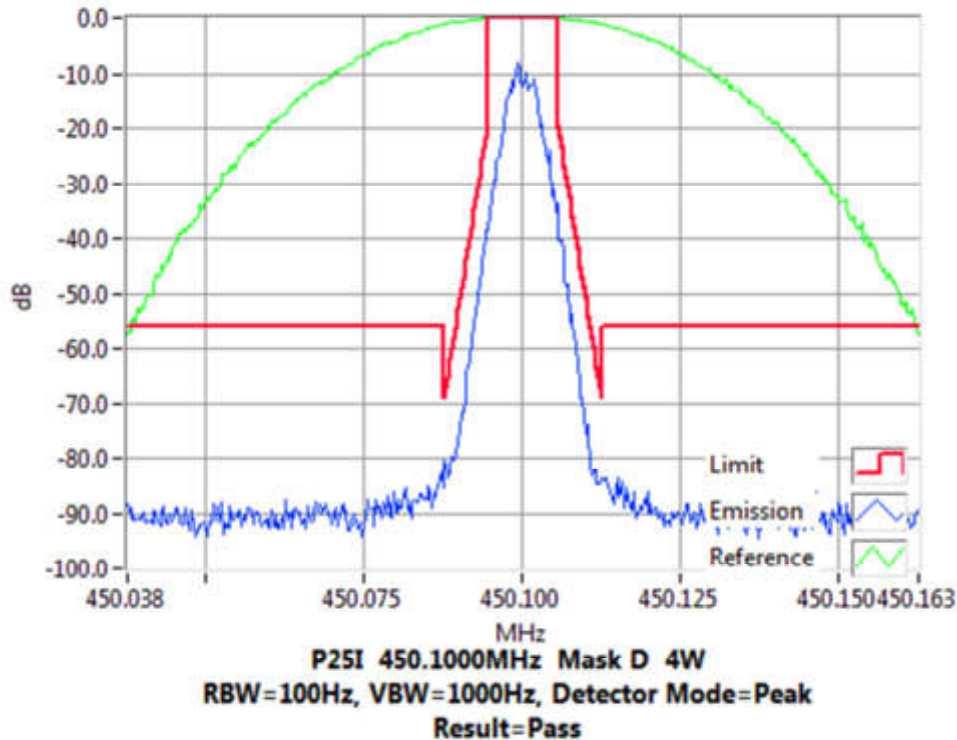
Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing



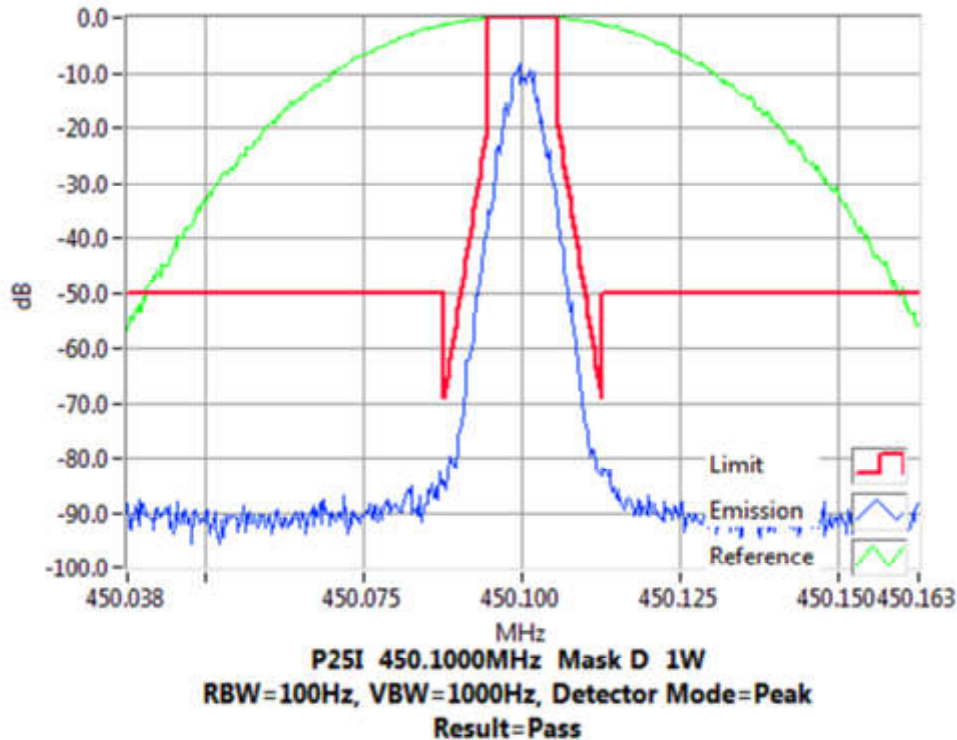
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



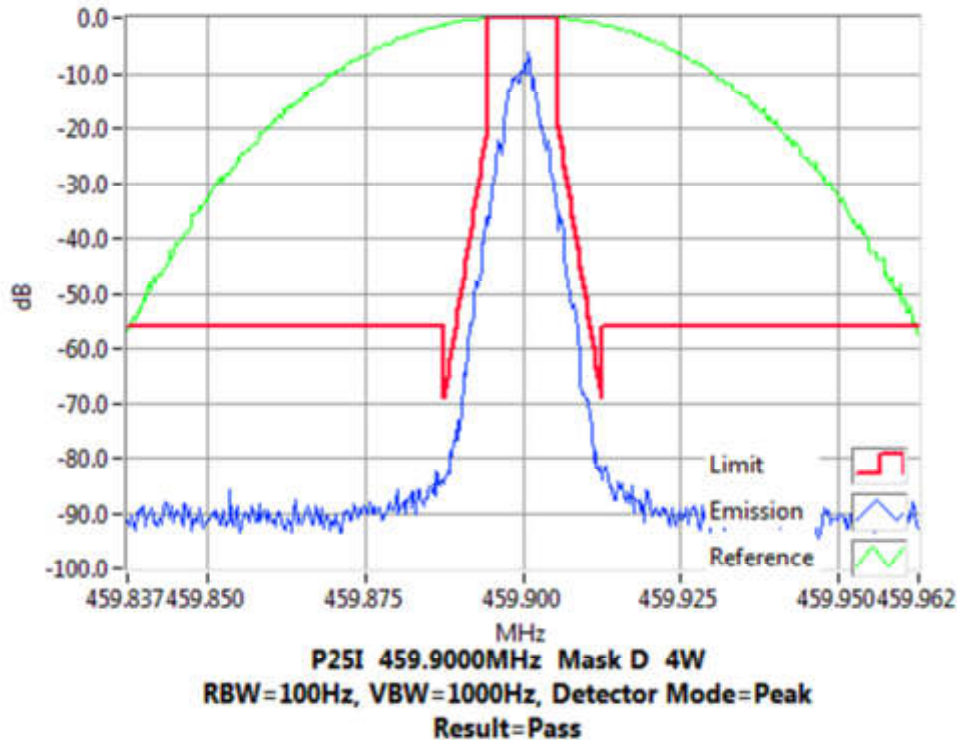
Tx FREQUENCY: 450.1 MHz 1 W 12.5 kHz Channel Spacing



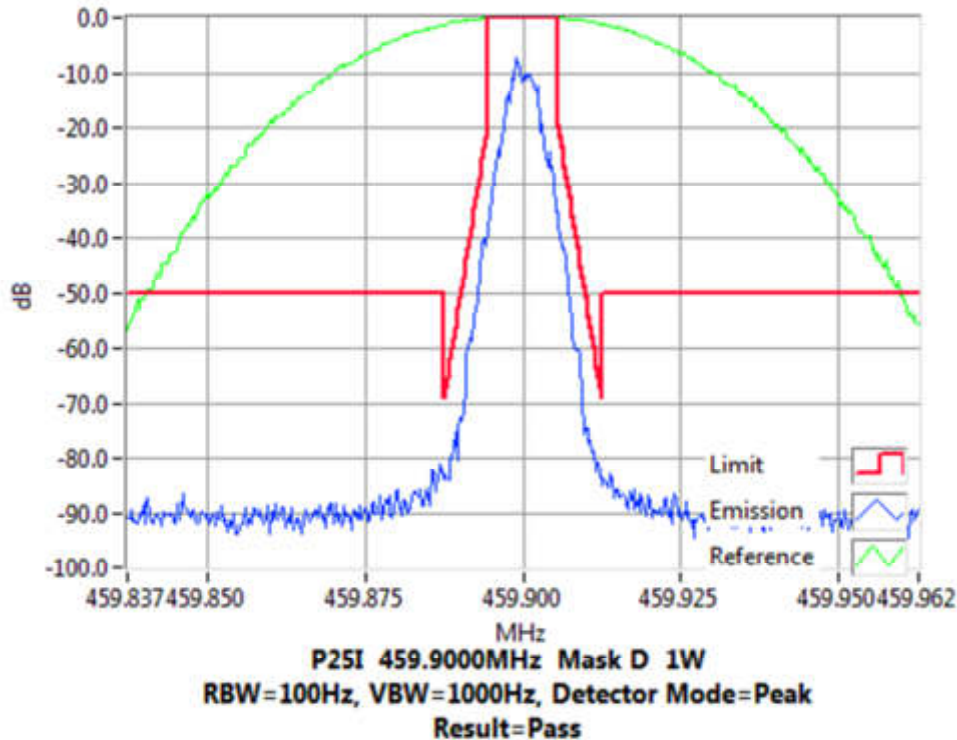
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



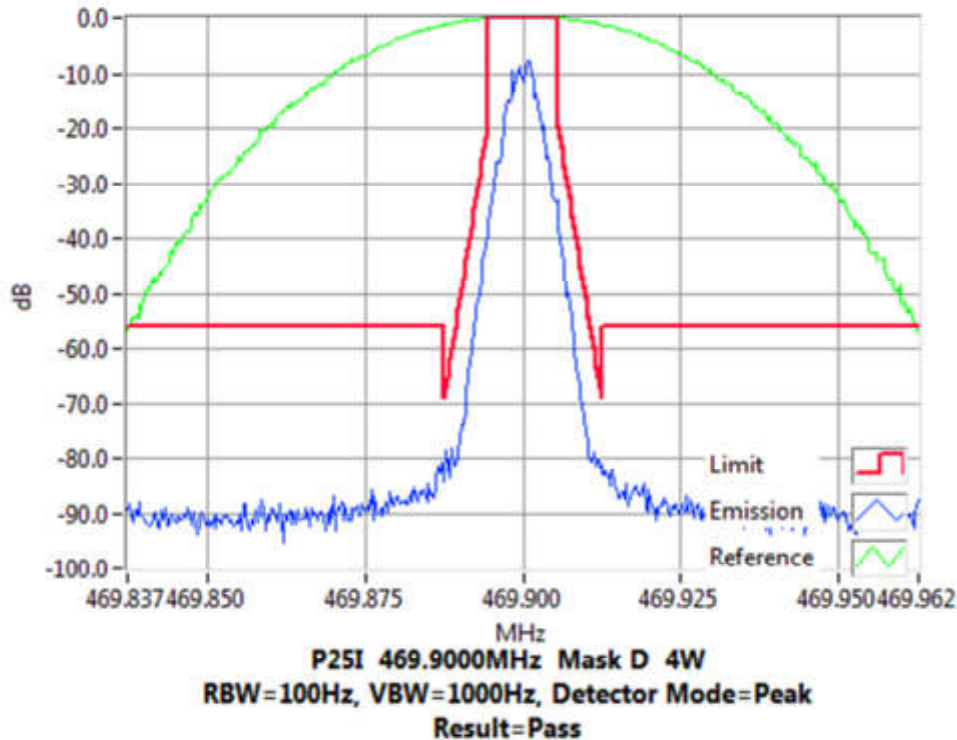
Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing



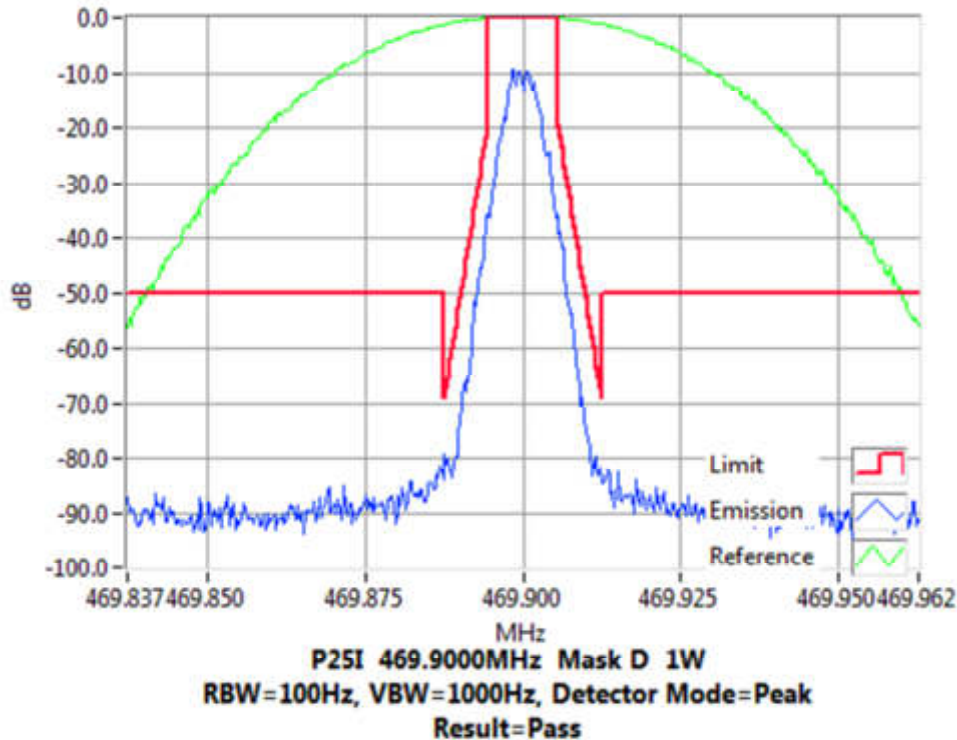
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



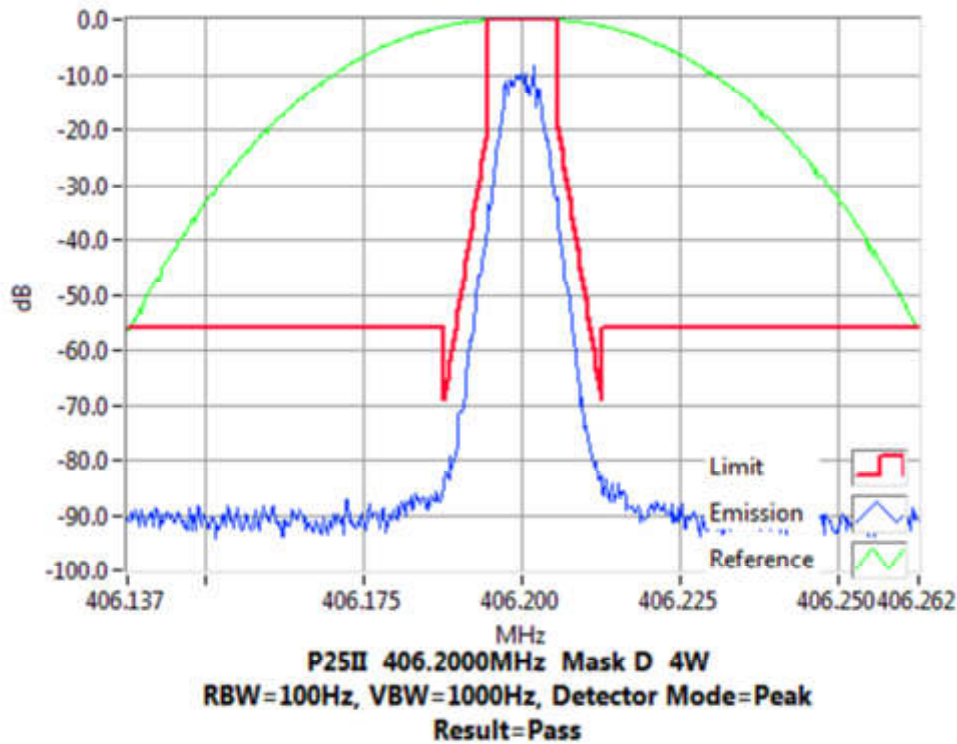
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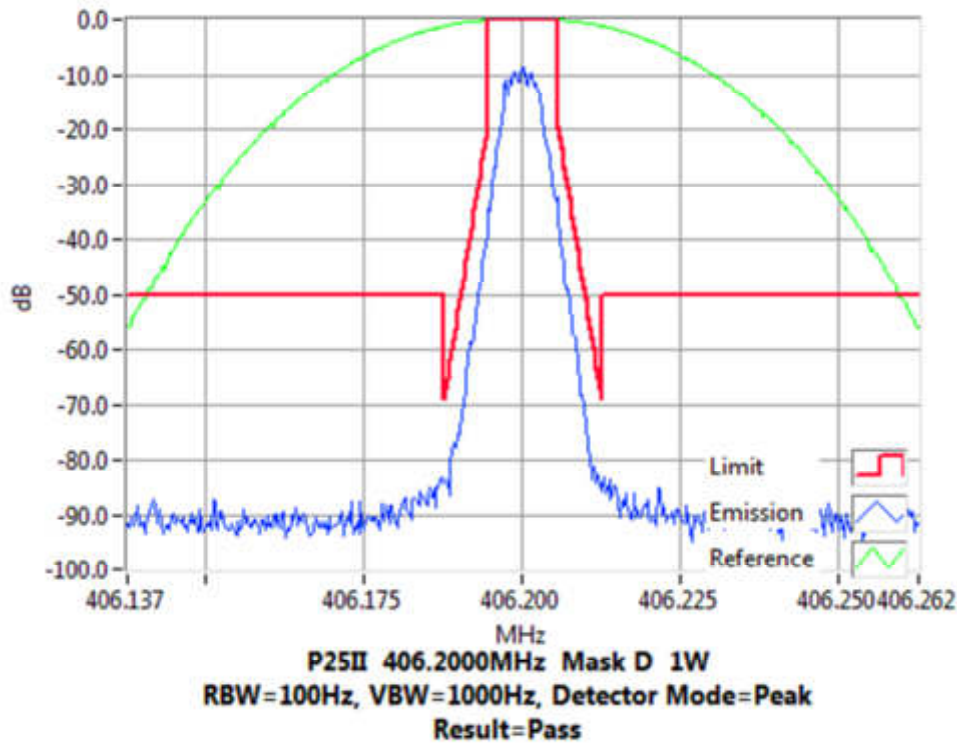
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-2

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



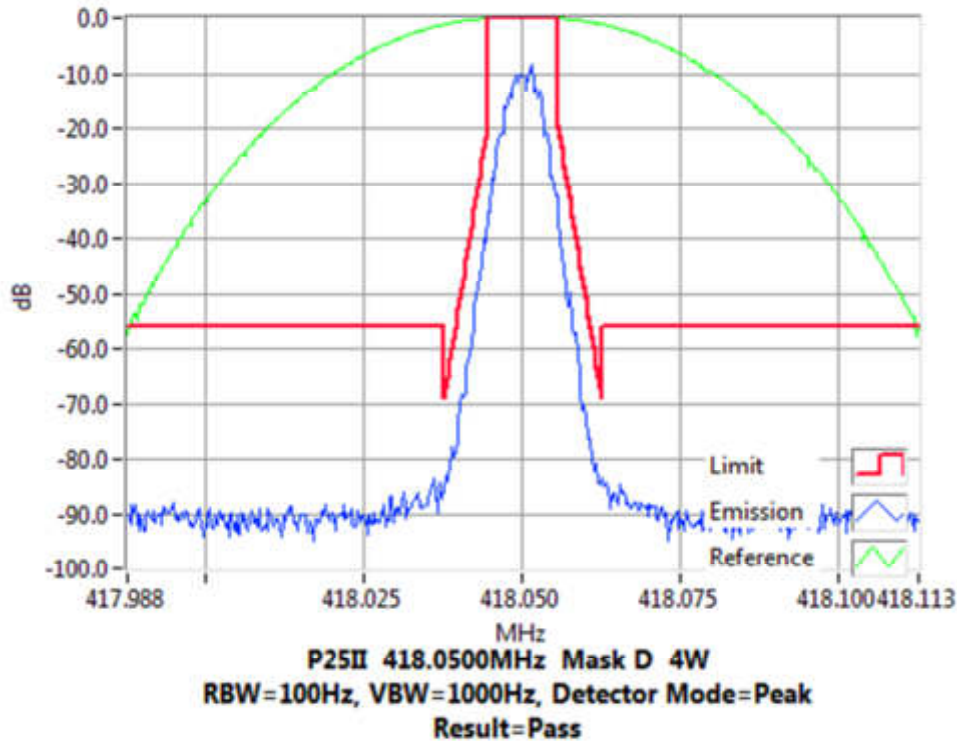
Tx FREQUENCY: 406.2 MHz 1 W 12.5 kHz Channel Spacing



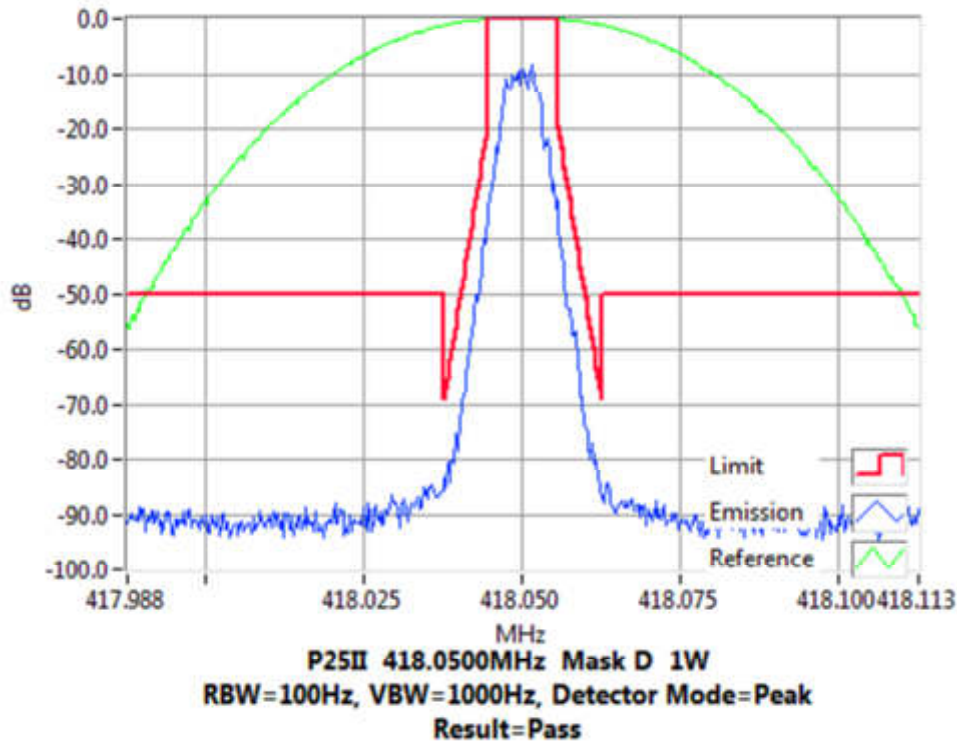
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-2

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



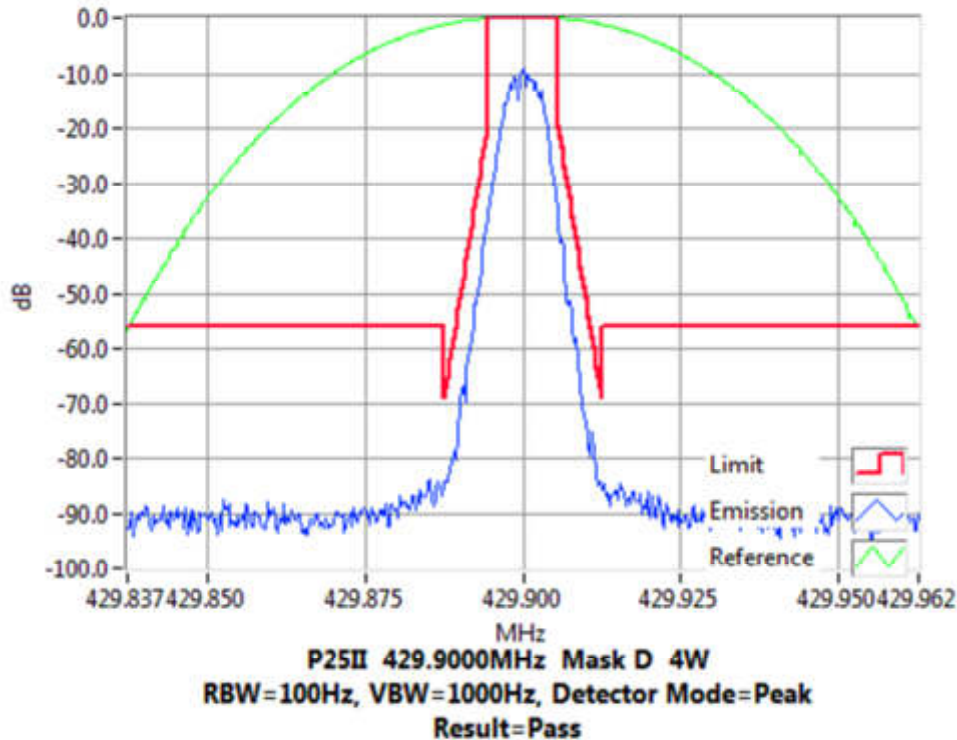
Tx FREQUENCY: 418.05 MHz 1 W 12.5 kHz Channel Spacing



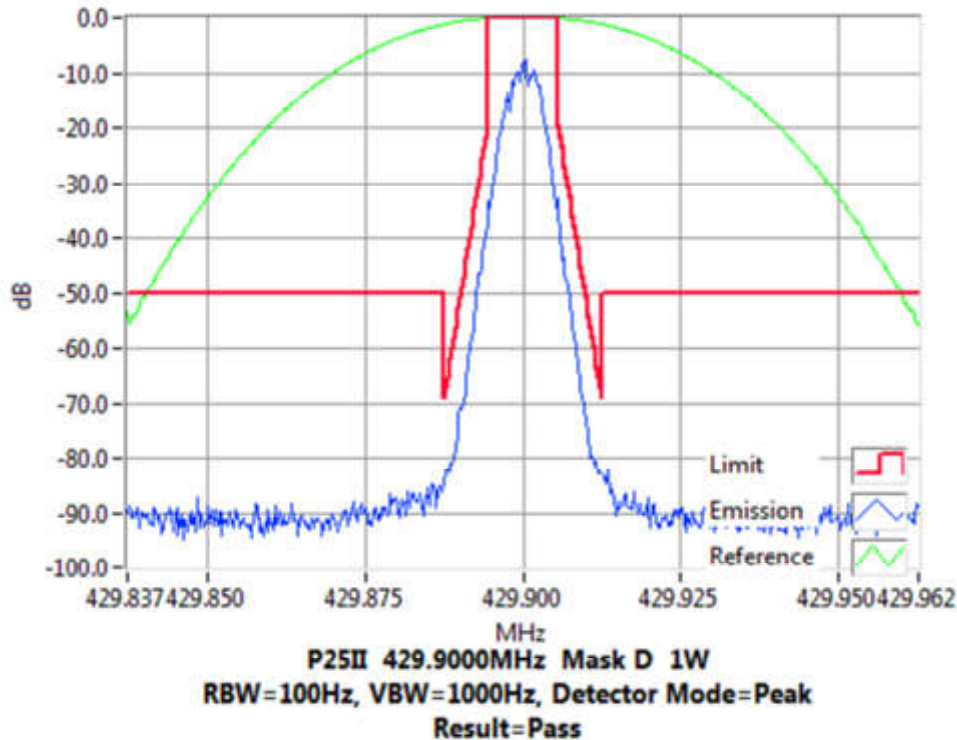
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-2

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



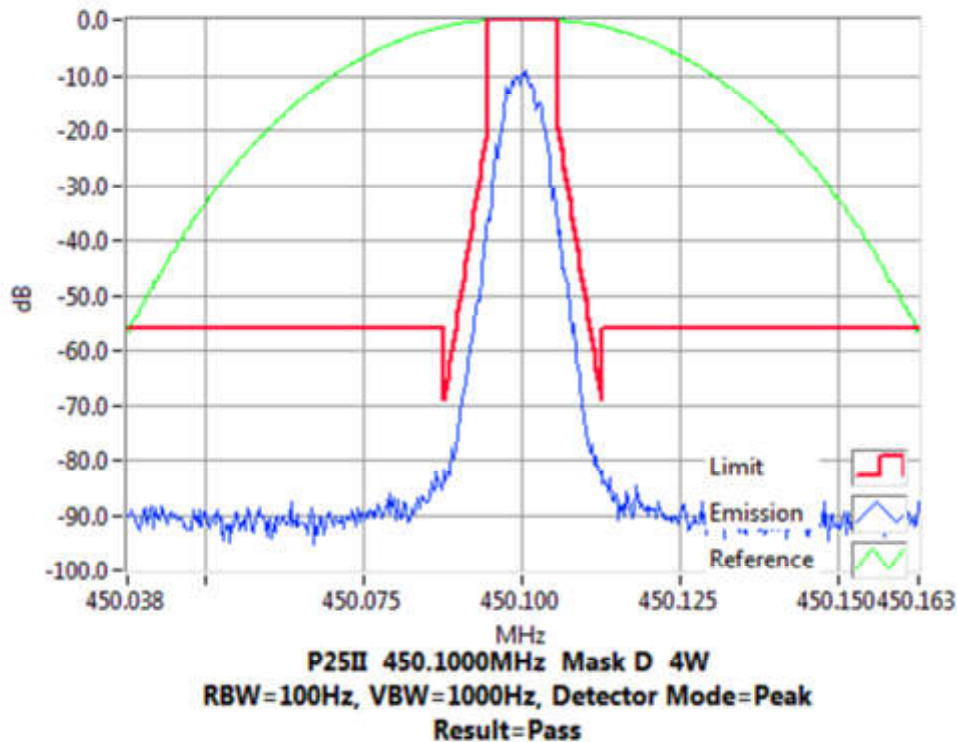
Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing



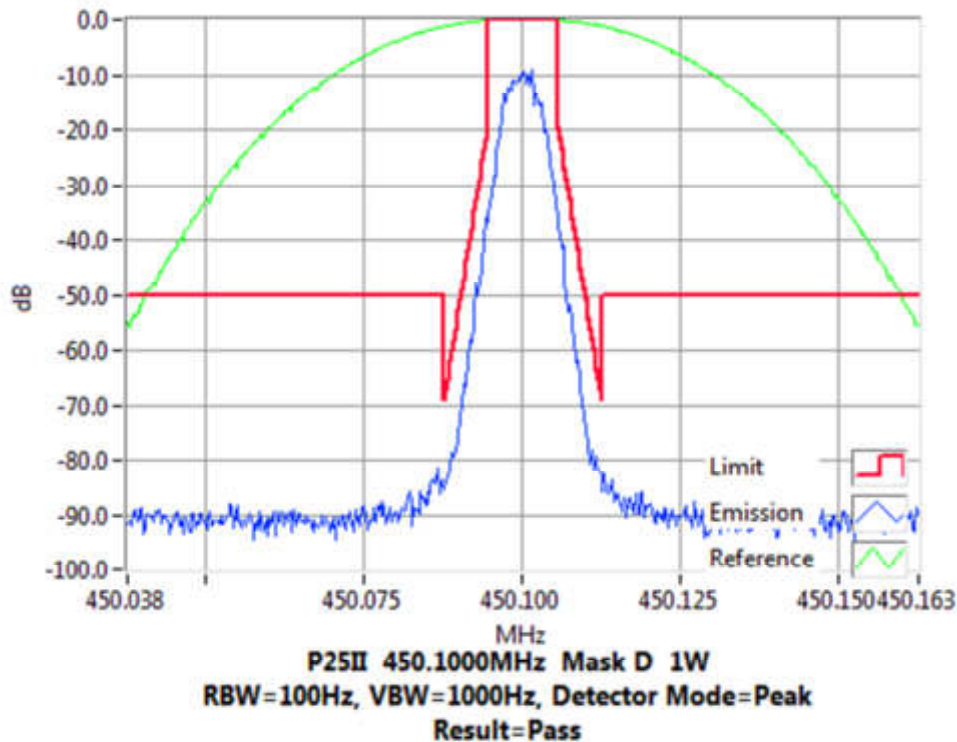
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-2

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



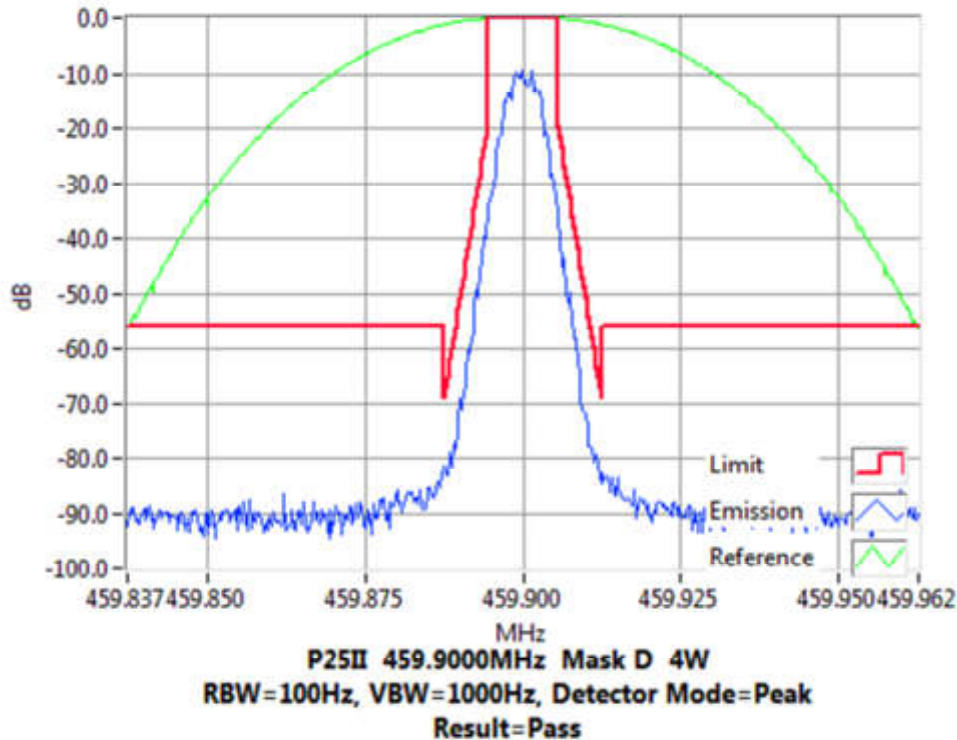
Tx FREQUENCY: 450.1 MHz 1 W 12.5 kHz Channel Spacing



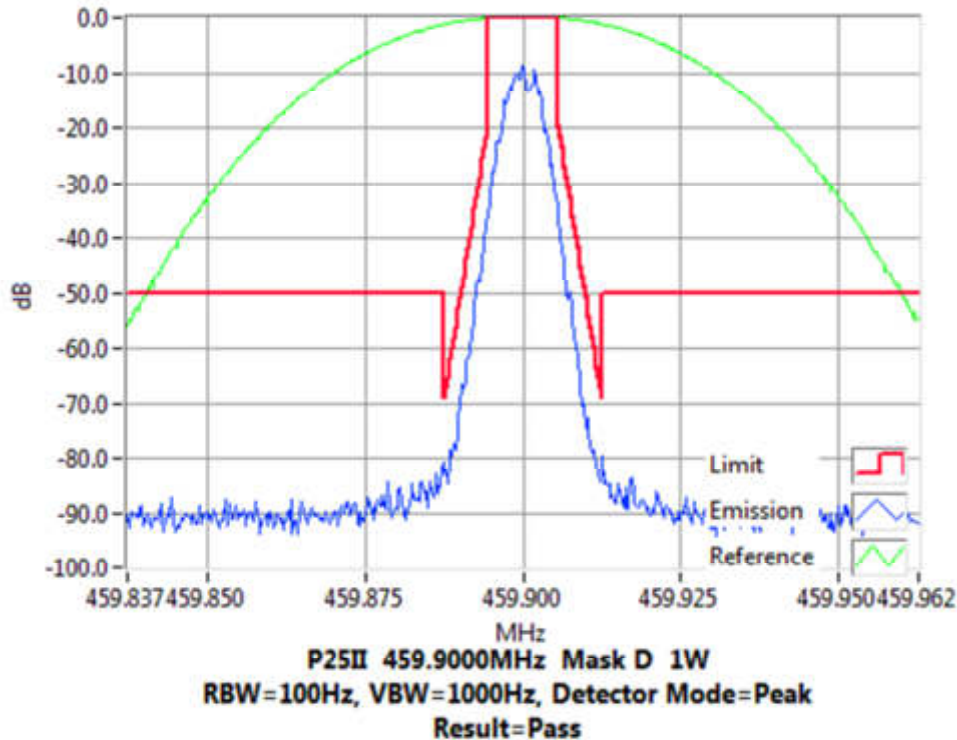
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-2

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



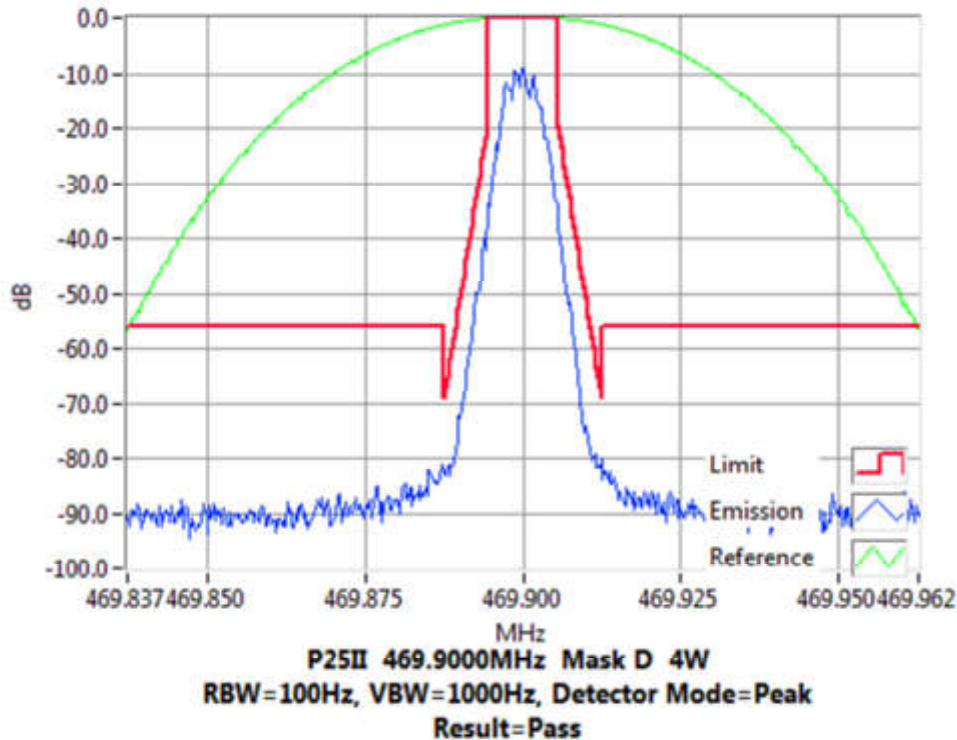
Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing



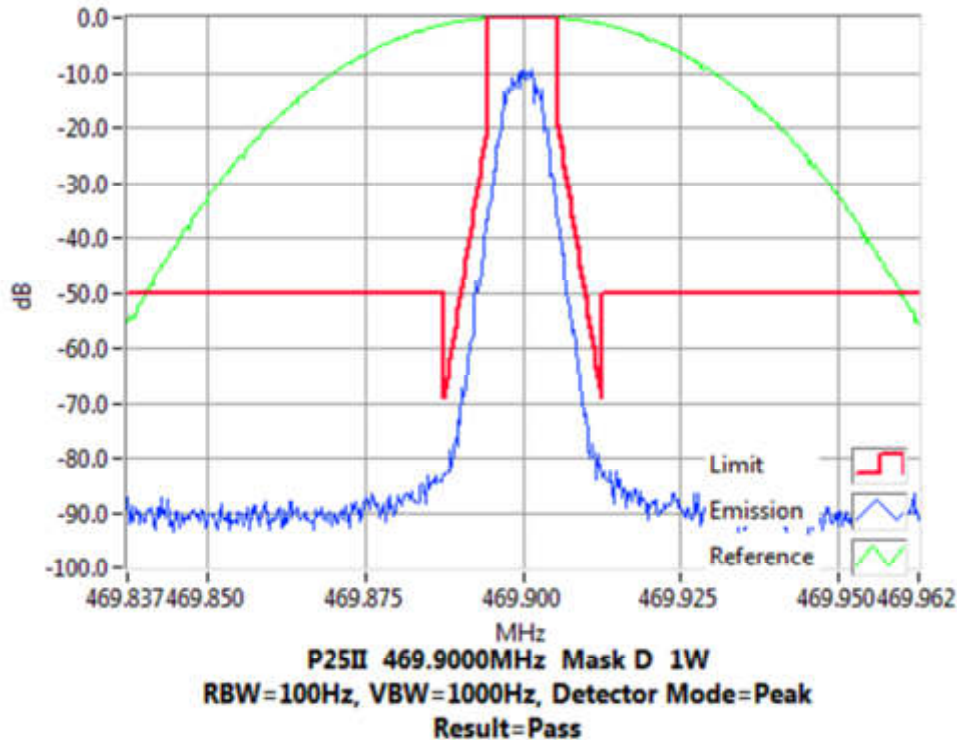
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-2

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 469.9 MHz 1 W 12.5 kHz Channel Spacing



## TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATIONS: FCC 47 CFR 2.1051

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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 10<sup>th</sup> Harmonic: 100 kHz to Fc-BW, Fc+ BW to 10Fc (4 GHz for 378.1 MHz channel, 4.7 GHz for all other channels)
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 GHz for 378.1 MHz channel, 4.7 GHz for all other channels.
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                | 32.08 |                                  |
| 2m Black6                       | 0.36  |                                  |
| 2m Black5                       | 0.34  |                                  |
| Total Attenuation @ 406.200 MHz | 32.79 | Sum of component attenuation (a) |
| Amplitude offset                | 32.78 | (b)                              |
| Correction @ 406.200 MHz        | 0     | (a-b)                            |

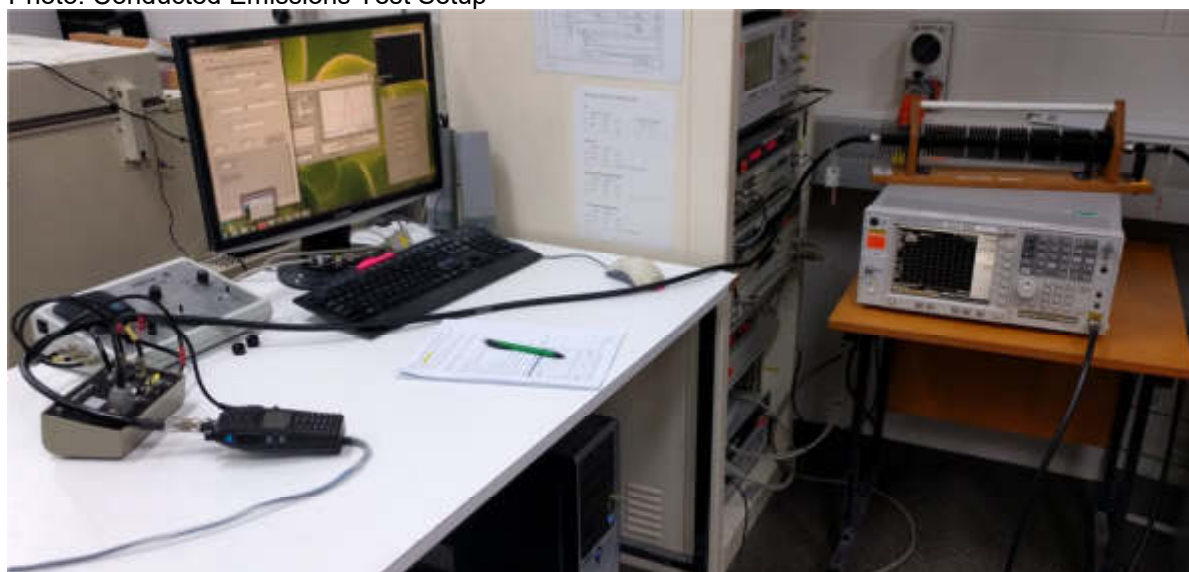
### MEASUREMENT RESULTS:

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

LIMIT CLAUSES: FCC 47 CFR 90.210

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Photo: Conducted Emissions Test Setup



## Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing

378.1 MHz @ 4 W

Emission Mask D

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

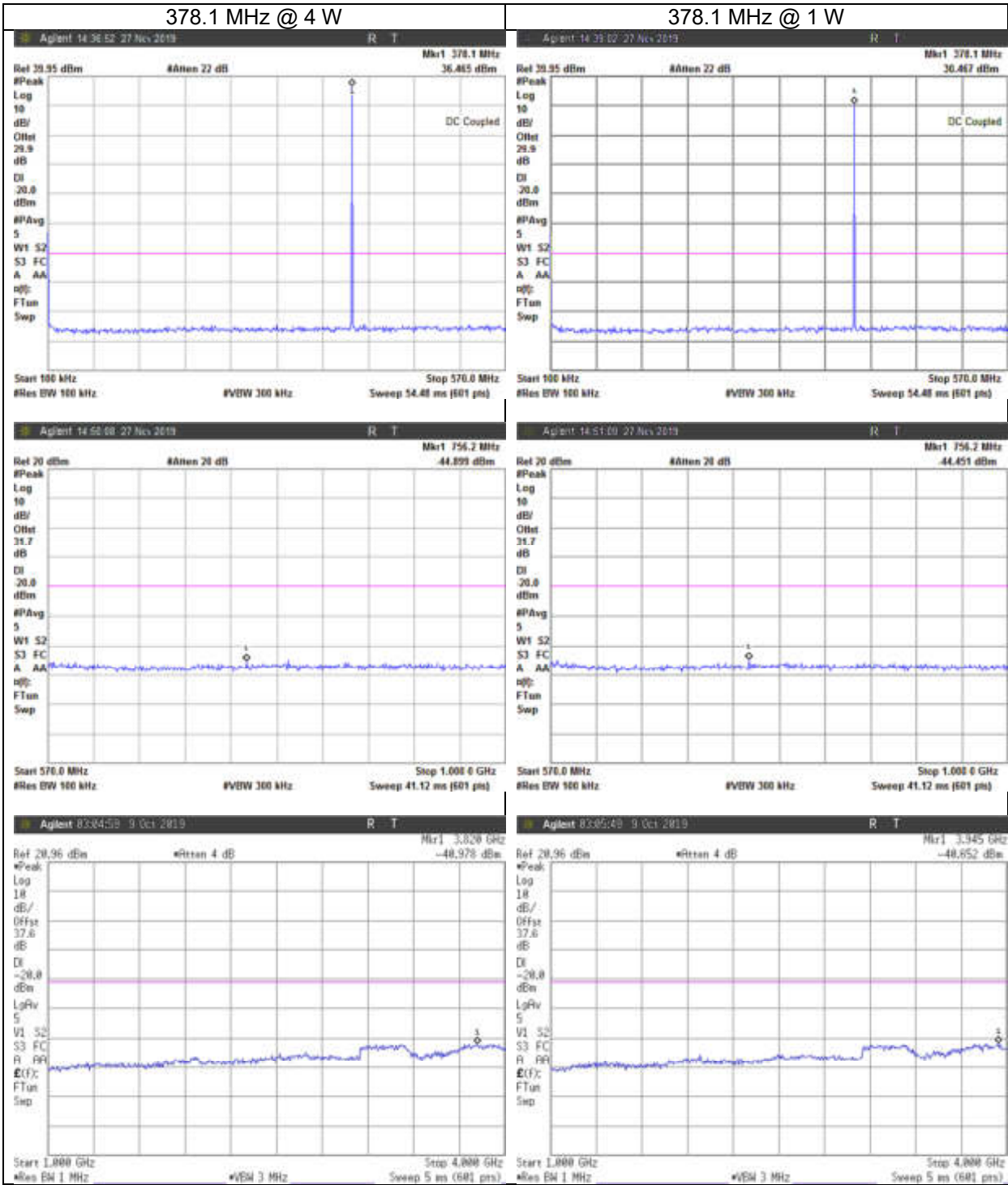
12.5 kHz Channel Spacing

378.1 MHz @ 1 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)



### Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing

406.2 MHz @ 4 W

Emission Mask D

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

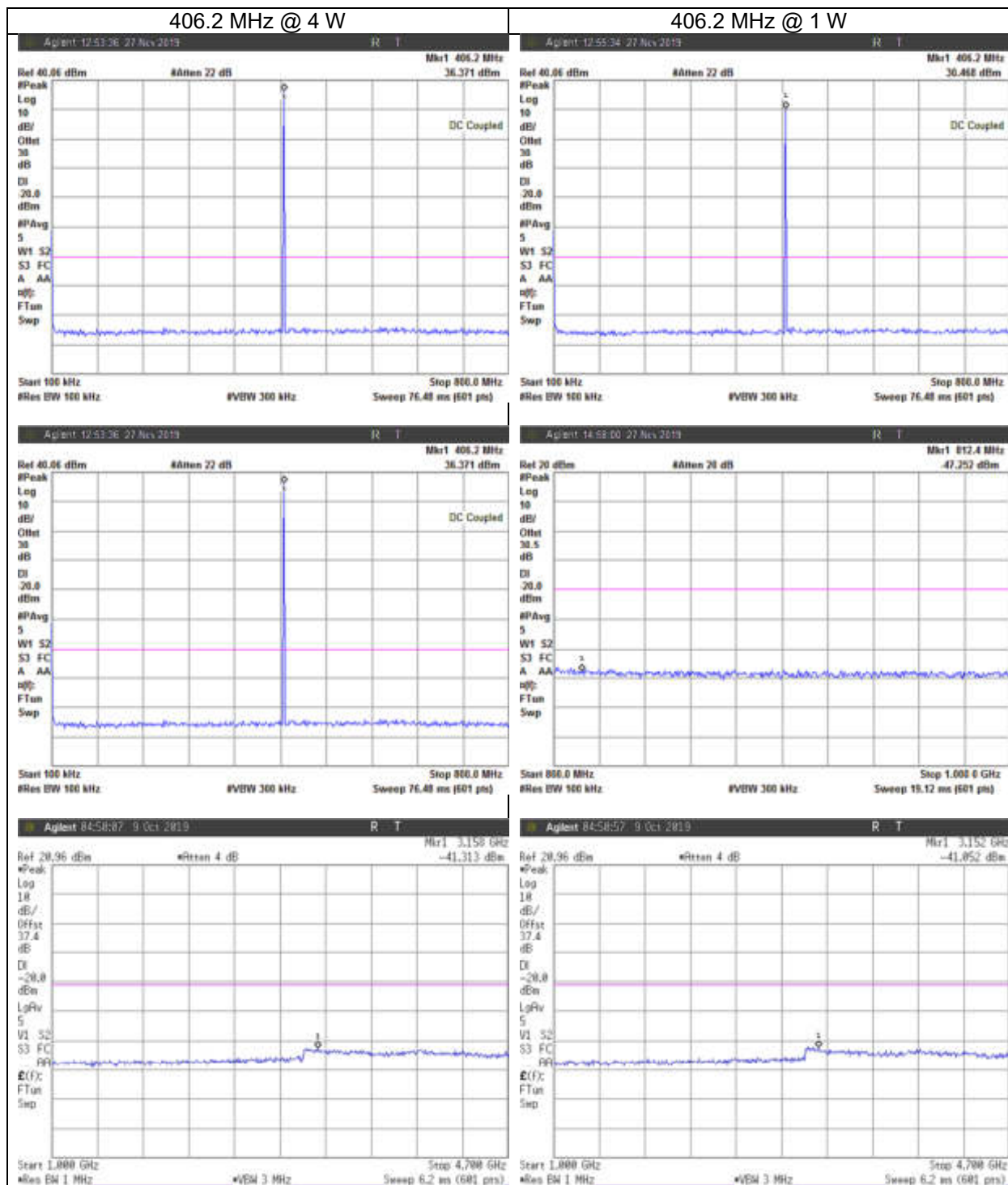
12.5 kHz Channel Spacing

406.2 MHz @ 1 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)



### Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing

418.05 MHz @ 4 W

Emission Mask D

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

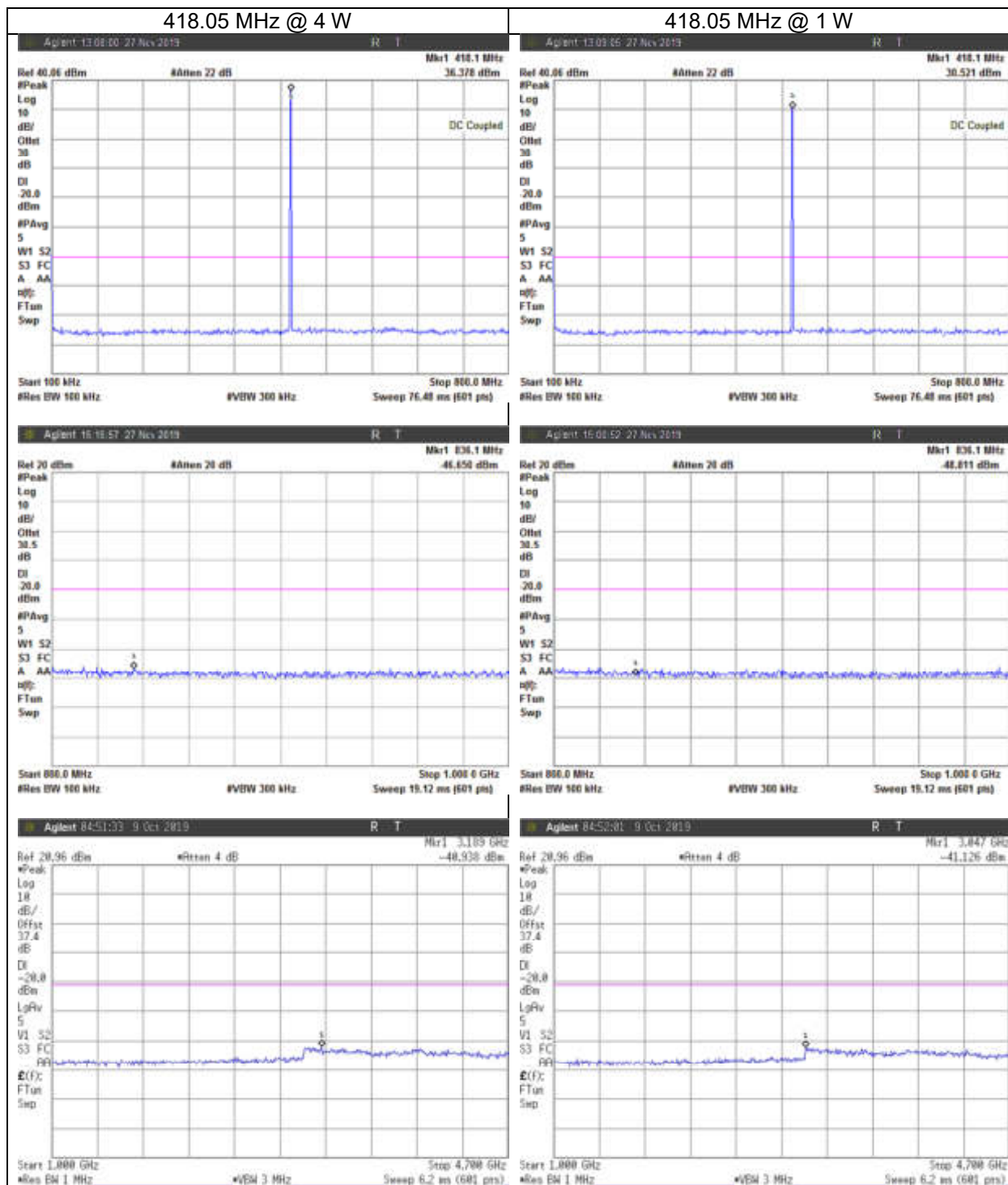
12.5 kHz Channel Spacing

418.05 MHz @ 1 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)



## Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing

429.9 MHz @ 4 W

Emission Mask D

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

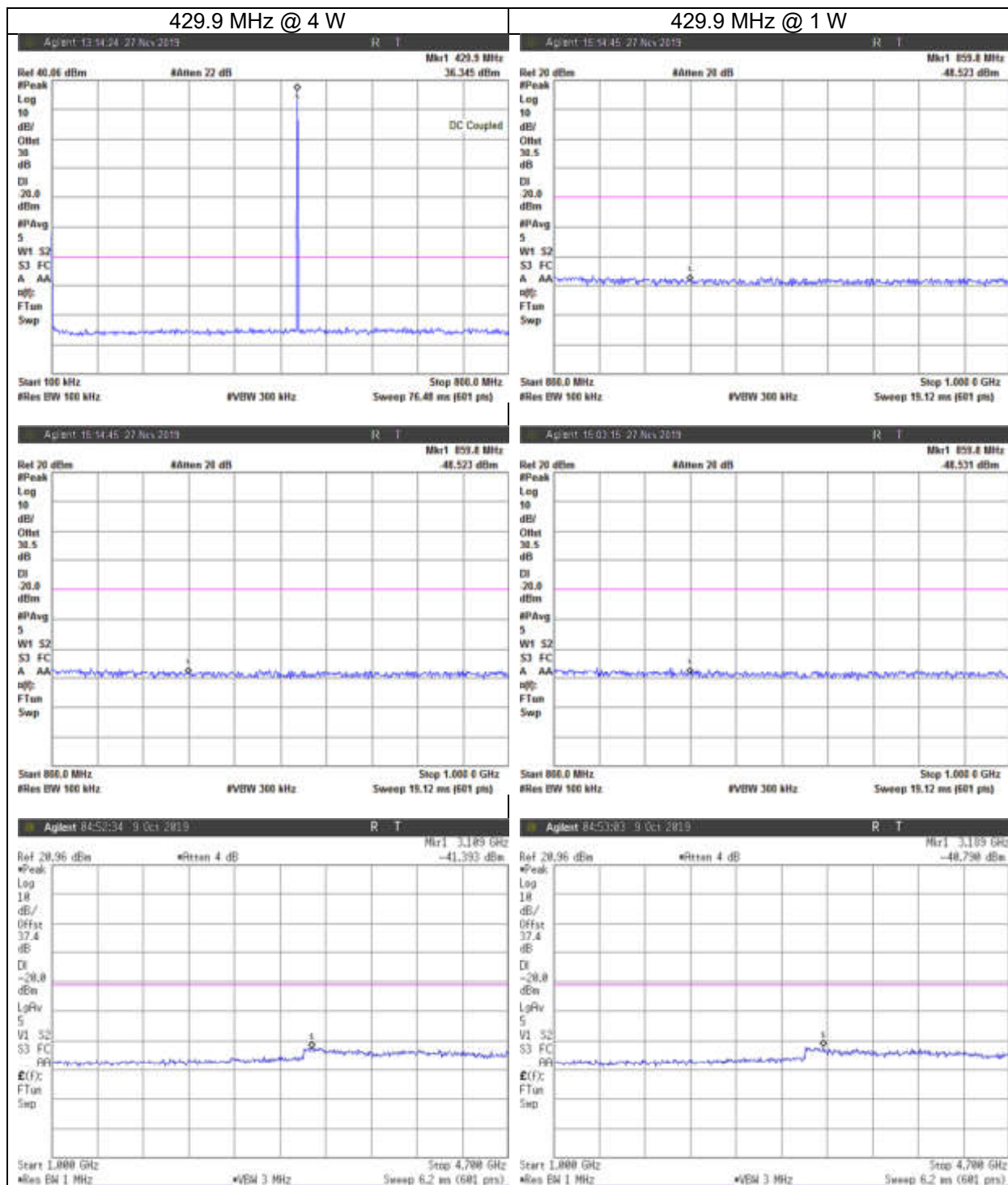
12.5 kHz Channel Spacing

429.9 MHz @ 1 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)



## Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing

450.1 MHz @ 4 W

Emission Mask D

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

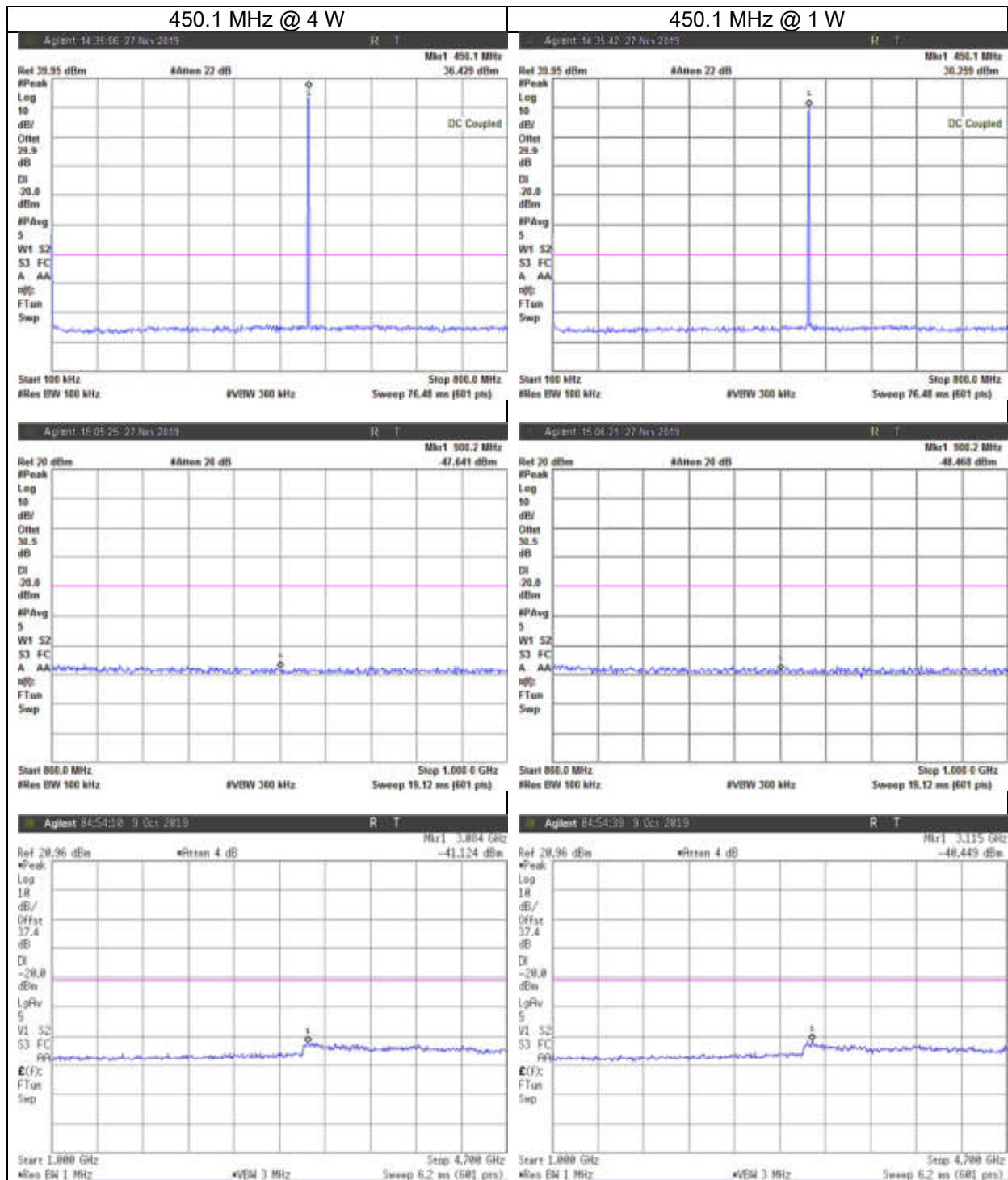
12.5 kHz Channel Spacing

450.1 MHz @ 1 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)



## Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing

459.9 MHz @ 4 W

Emission Mask D

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

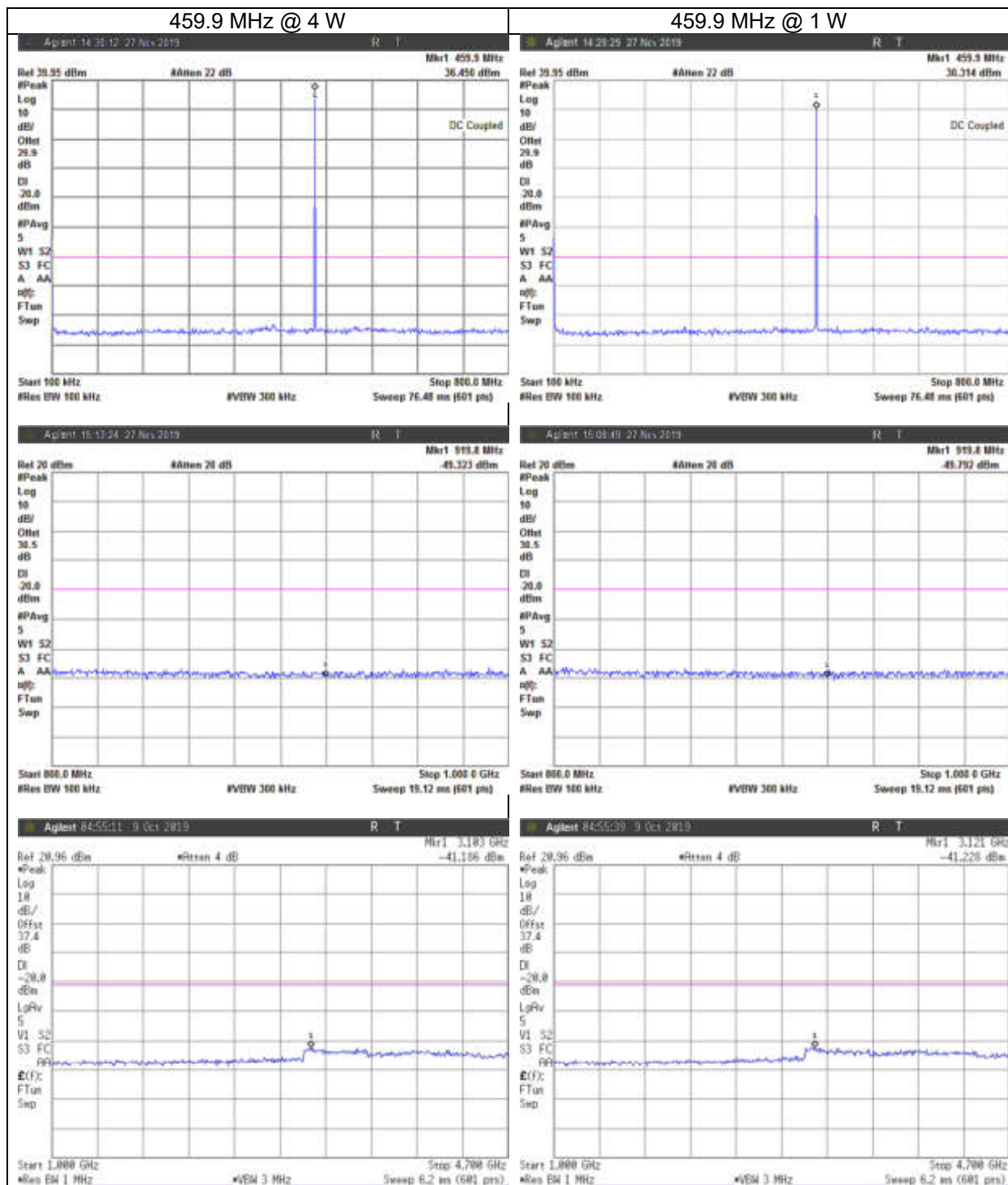
12.5 kHz Channel Spacing

459.9 MHz @ 1 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)



## Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing

469.9 MHz @ 4 W

Emission Mask D

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

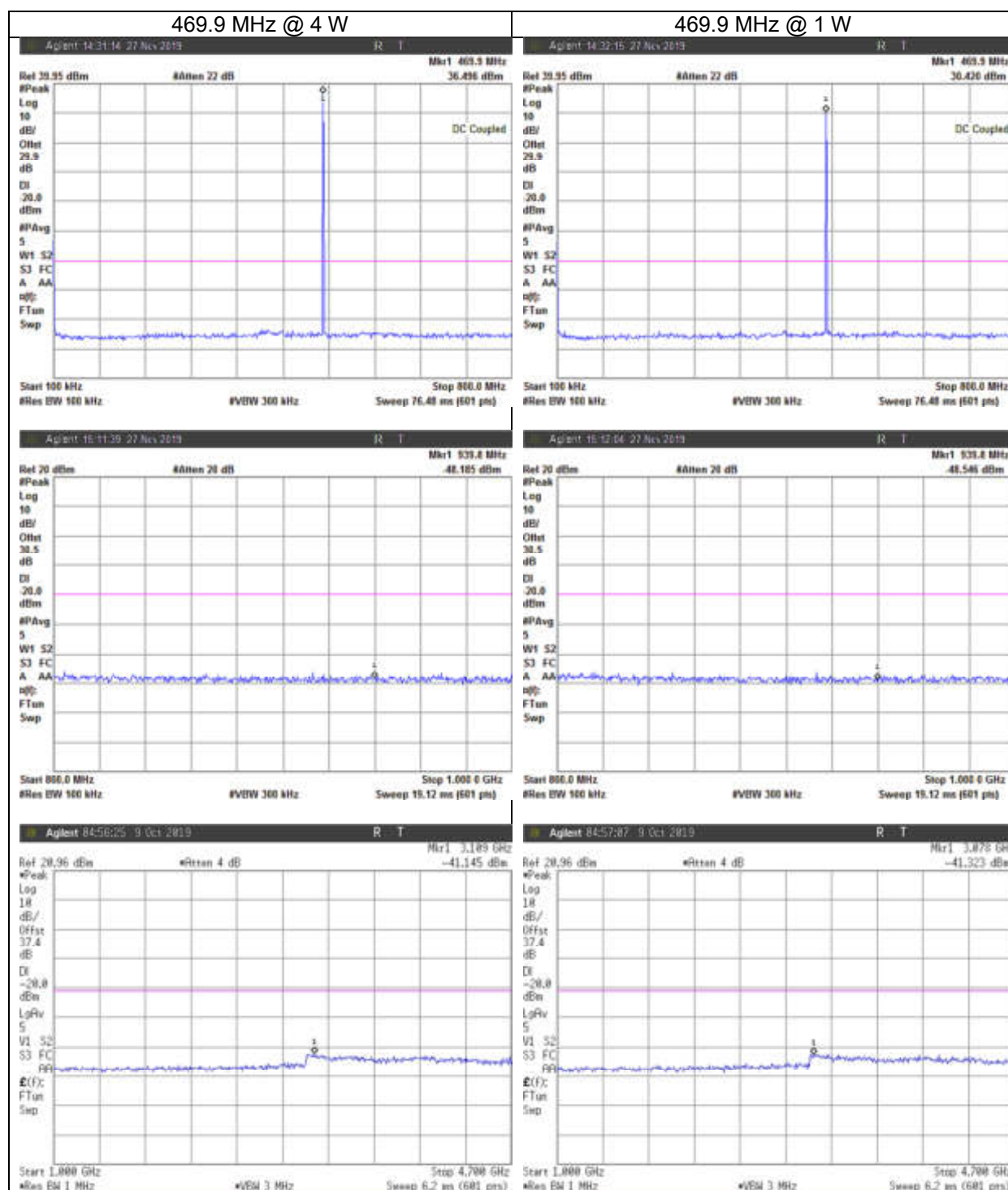
12.5 kHz Channel Spacing

469.9 MHz @ 1 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)



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051

RSS-119 5.8

LIMITS: FCC 47 CFR 90.210

RSS-119 5.8

| Carrier Output Power | Emission Mask D<br>12.5 kHz Channel Spacing<br>$50 + 10 \log_{10} (P_{\text{Watts}})$ |         |
|----------------------|---------------------------------------------------------------------------------------|---------|
|                      | -20 dBm                                                                               | -56 dBc |
| 4 W                  | -20 dBm                                                                               | -56 dBc |
| 1 W                  | -20 dBm                                                                               | -50 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<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) - Continued

SPECIFICATION: FCC 47 CFR 2.1053

12.5 kHz Channel Spacing      378.1 MHz @ 4 W      Emission Mask D

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

12.5 kHz Channel Spacing      378.1 MHz @ 1 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      406.2 MHz @ 4 W      Emission Mask D

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

12.5 kHz Channel Spacing      406.2 MHz @ 1 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 @ 4 W      Emission Mask D

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

12.5 kHz Channel Spacing      418.05 MHz @ 1 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

429.9 MHz @ 4 W

Emission Mask D

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

12.5 kHz Channel Spacing

429.9 MHz @ 1 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

450.1 MHz @ 4 W

Emission Mask D

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

12.5 kHz Channel Spacing

450.1 MHz @ 1 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

459.9 MHz @ 4 W

Emission Mask D

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

12.5 kHz Channel Spacing

459.9 MHz @ 1 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

469.9 MHz @ 4 W

Emission Mask D

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

12.5 kHz Channel Spacing

469.9 MHz @ 1 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. |             |             |

Photo: OATS Setup



## Spurious Emissions (Tx Radiated) - Continued

LIMITS: FCC 47 CFR 2.1053

| Carrier Output Power | Emission Mask D<br>12.5 kHz Channel Spacing<br>$50 + 10 \log_{10}(P_{\text{Watts}})$ |         |
|----------------------|--------------------------------------------------------------------------------------|---------|
| 4 W                  | -20 dBm                                                                              | -56 dBc |
| 1 W                  | -20 dBm                                                                              | -50 dBc |

### Open Area Test Site Results:

12.5 kHz Channel Spacing

418.05 MHz @ 4 W

Emission Mask D

| Harmonics<br>Emission Frequency (MHz) | Level (dBm)  | Level (dBc) |
|---------------------------------------|--------------|-------------|
| 836.10                                | -63.41       | -99.41      |
| 1254.15                               | -69.08       | -105.08     |
| 1672.20                               | -73.77       | -109.77     |
| 2090.25                               | -73.23       | -109.23     |
| 2508.30                               | -68.00       | -104.00     |
| 2926.35                               | -66.85       | -102.85     |
| Measurement Uncertainty               | $\pm 4.6$ dB |             |

### Sample Calculation

| Sample Calculation       | Measurement           |               |                           |                    |                                | Result |
|--------------------------|-----------------------|---------------|---------------------------|--------------------|--------------------------------|--------|
|                          | Reference             | Substitution  |                           |                    |                                |        |
| Emission Frequency (MHz) | Reference Level (dBm) | Sig-gen Level | Cable and Attenuator Gain | Antenna Gain (dBd) | Path and Boresight corrections | dBm    |
| 836.1                    | -93.67                | -45.24        | -16.75                    | -0.95              | -0.48                          | -63.41 |
|                          |                       | A             | B                         | C                  | D                              | E      |

Result (E) = A+B+C+D Result

## TRANSIENT FREQUENCY BEHAVIOR

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

GUIDE: TIA/EIA-603D 2.2.19

MEASUREMENT PROCEDURE: Refer Annex A for equipment set up.

1. 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

RSS-119 5.9

## Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 406.2 MHz 4 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                                | 0.3           |

|                                                                                                                     |     |                          |
|---------------------------------------------------------------------------------------------------------------------|-----|--------------------------|
| 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"/> |

Measurement Uncertainty: Frequency  $\pm 130$  Hz; Time  $\pm 0.2\%$

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

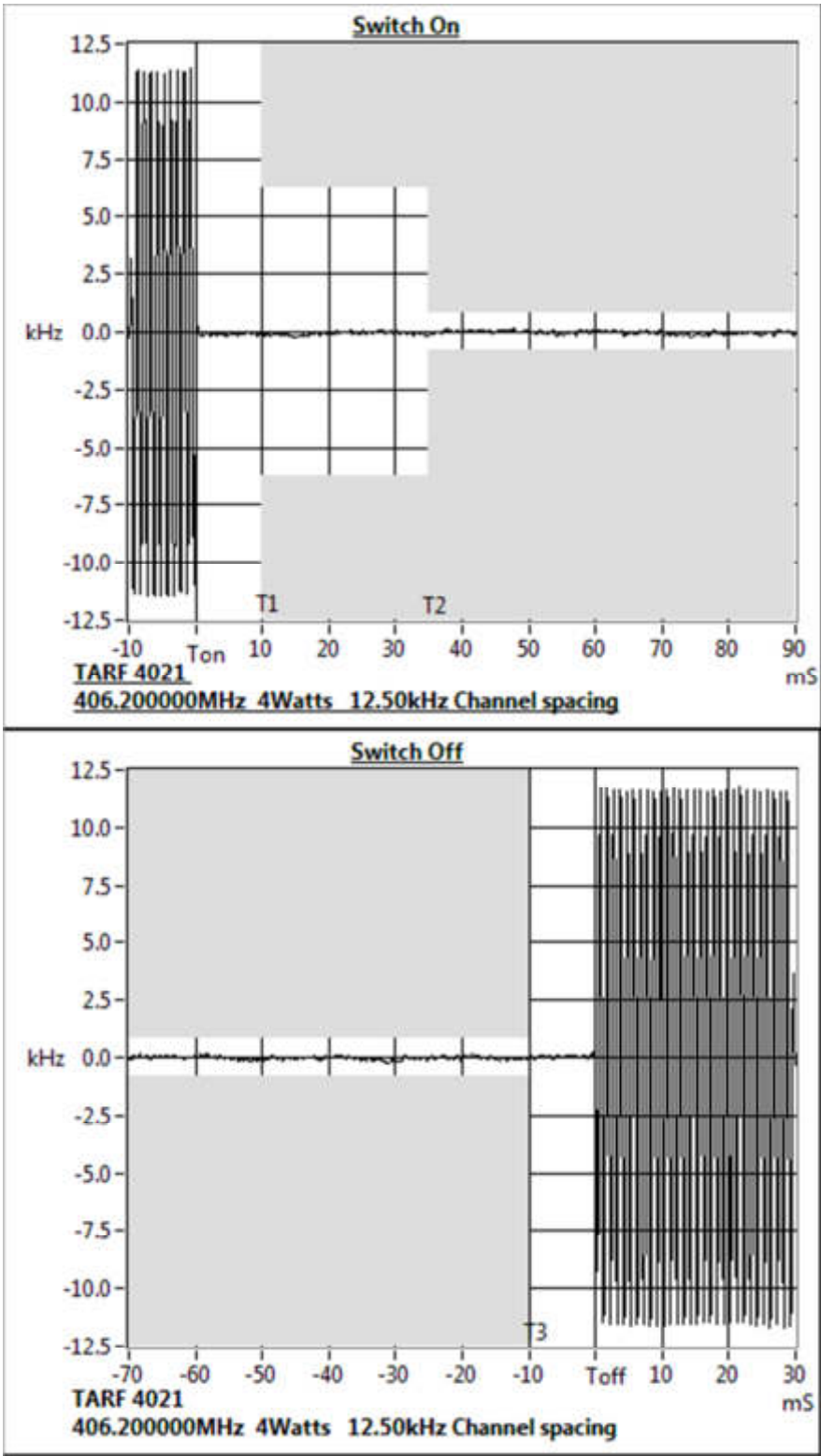
| Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels |                              |                 |                 |
|--------------------------------------------------------------------------------------|------------------------------|-----------------|-----------------|
| TRANSIENT PERIODS                                                                    | Maximum Frequency Difference | FREQUENCY RANGE |                 |
|                                                                                      |                              | 138 – 174 MHz   | 406.1 – 470 MHz |
| t1 (ms)                                                                              | $\pm 12.5$ kHz               | 5 ms            | 10 ms           |
| t2 (ms)                                                                              | $\pm 6.25$ kHz               | 20 ms           | 25 ms           |
| t3 (ms)                                                                              | $\pm 12.5$ 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: 406.2 MHz 4 W 12.5 kHz Channel Spacing



## Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 418.05 MHz 4 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          |

|                                                                                                                     |     |                          |
|---------------------------------------------------------------------------------------------------------------------|-----|--------------------------|
| 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"/> |

Measurement Uncertainty: Frequency  $\pm 130$  Hz; Time  $\pm 0.2\%$

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             |

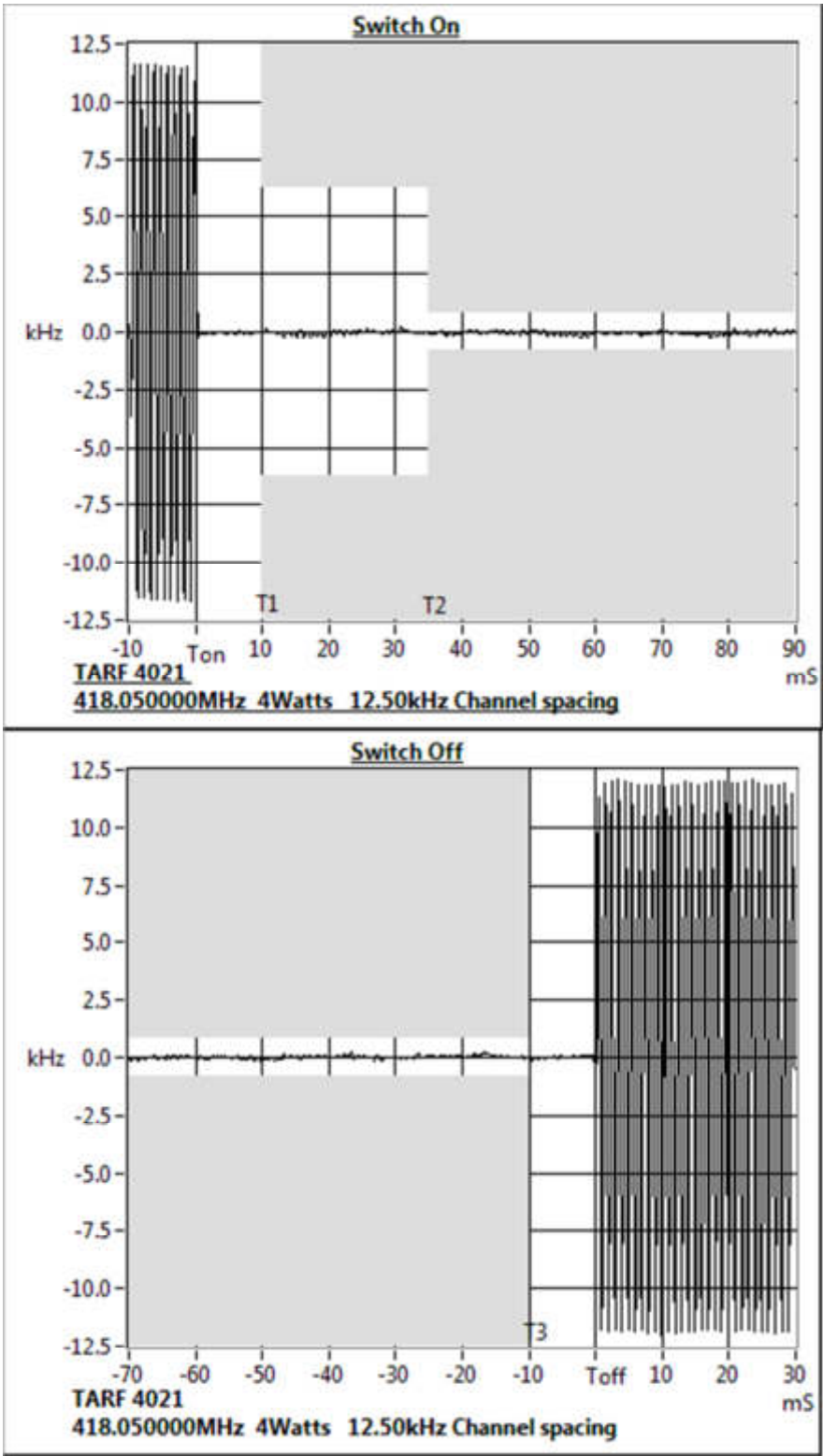
LIMIT: RSS-119 5.9

| 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)                                                                              | $\pm 12.5$ kHz               | 5 ms            | 10 ms           |
| t2 (ms)                                                                              | $\pm 6.25$ kHz               | 20 ms           | 25 ms           |
| t3 (ms)                                                                              | $\pm 12.5$ 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: 418.05 MHz 4 W 12.5 kHz Channel Spacing



## Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing

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

Measurement Uncertainty: Frequency  $\pm 130$  Hz; Time  $\pm 0.2\%$

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             |

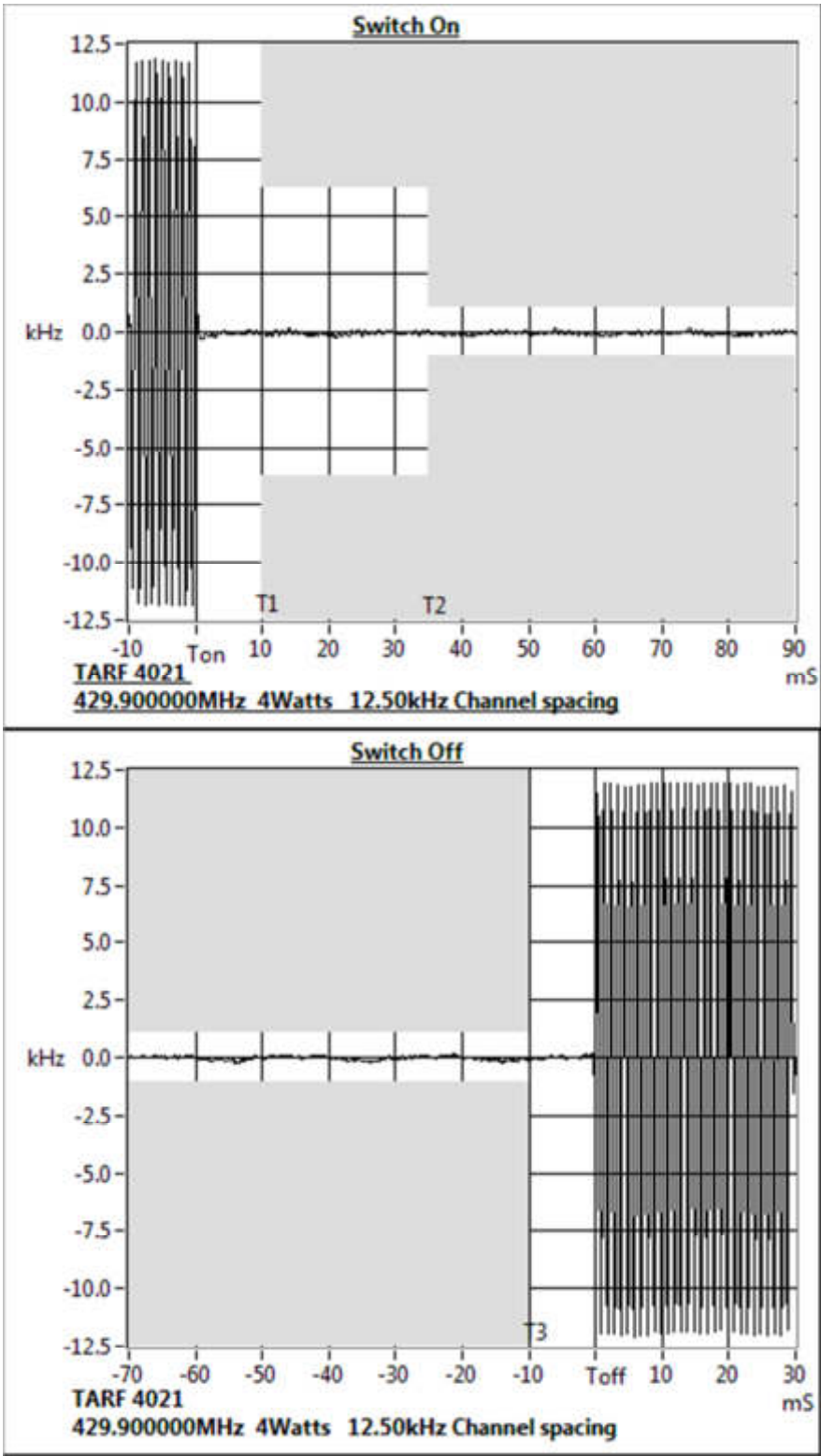
LIMIT: RSS-119 5.9

| 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)                                                                              | $\pm 12.5$ kHz               | 5 ms            | 10 ms           |
| t2 (ms)                                                                              | $\pm 6.25$ kHz               | 20 ms           | 25 ms           |
| t3 (ms)                                                                              | $\pm 12.5$ 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: 429.9 MHz 4 W 12.5 kHz Channel Spacing



## Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing

| TRANSIENT RESPONSE PERIOD | CARRIER PEAK VARIATION FROM NORMAL |               |
|---------------------------|------------------------------------|---------------|
|                           | Key ON (kHz)                       | Key OFF (kHz) |
| t1                        | 0.7                                | N/A           |
| t2                        | -0.2                               | N/A           |
| t3                        | N/A                                | 0.3           |

|                                                                                                                     |     |                          |
|---------------------------------------------------------------------------------------------------------------------|-----|--------------------------|
| 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"/> |

Measurement Uncertainty: Frequency  $\pm 130$  Hz; Time  $\pm 0.2\%$

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             |

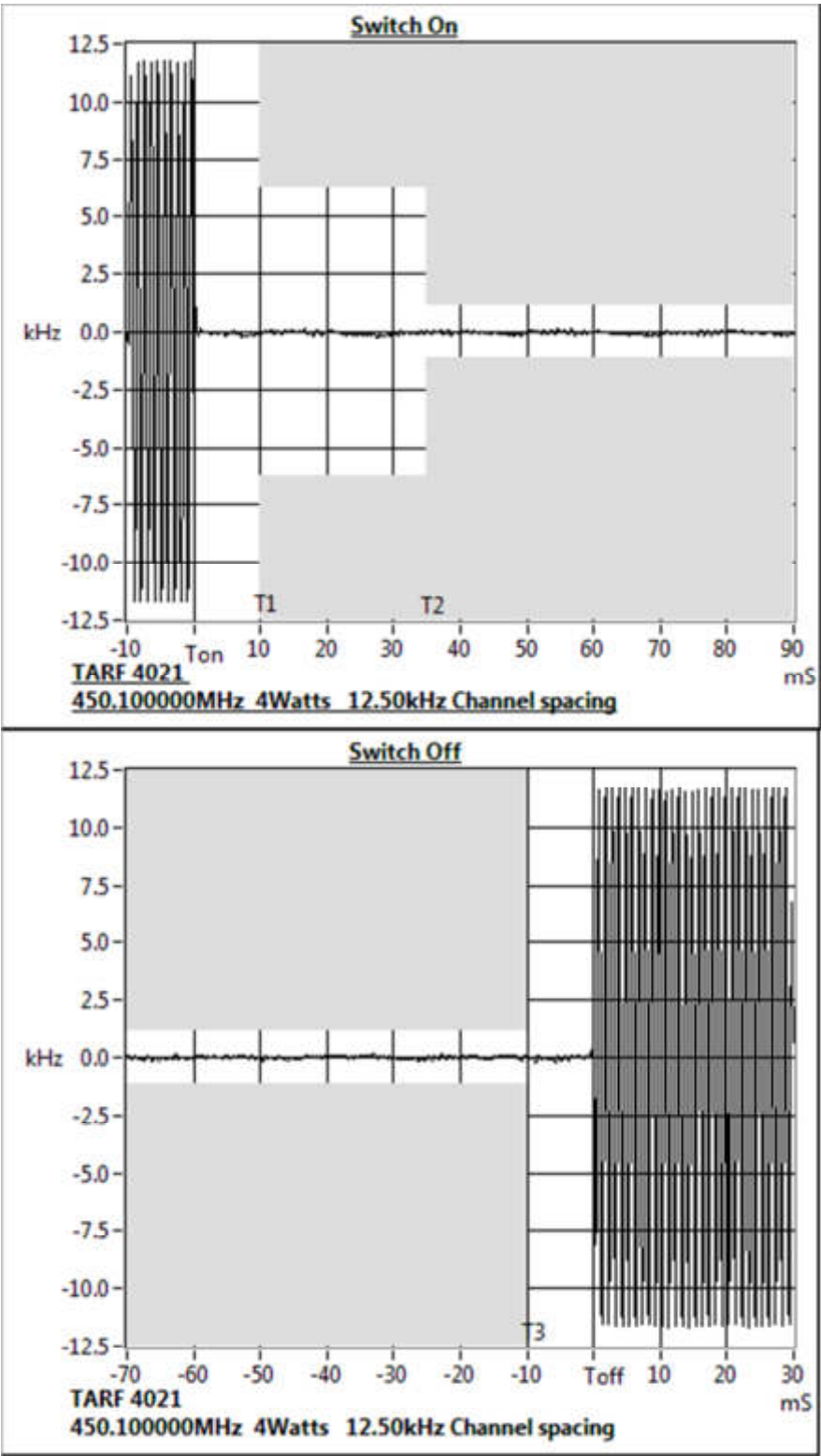
LIMIT: RSS-119 5.9

| 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)                                                                              | $\pm 12.5$ kHz               | 5 ms            | 10 ms           |
| t2 (ms)                                                                              | $\pm 6.25$ kHz               | 20 ms           | 25 ms           |
| t3 (ms)                                                                              | $\pm 12.5$ 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: 450.1 MHz 4 W 12.5 kHz Channel Spacing



## Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing

| TRANSIENT RESPONSE PERIOD | CARRIER PEAK VARIATION FROM NORMAL |               |
|---------------------------|------------------------------------|---------------|
|                           | Key ON (kHz)                       | Key OFF (kHz) |
| t1                        | 1.6                                | N/A           |
| t2                        | -0.2                               | N/A           |
| t3                        | N/A                                | -0.3          |

|                                                                                                                     |     |                          |
|---------------------------------------------------------------------------------------------------------------------|-----|--------------------------|
| 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"/> |

Measurement Uncertainty: Frequency  $\pm 130$  Hz; Time  $\pm 0.2\%$

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             |

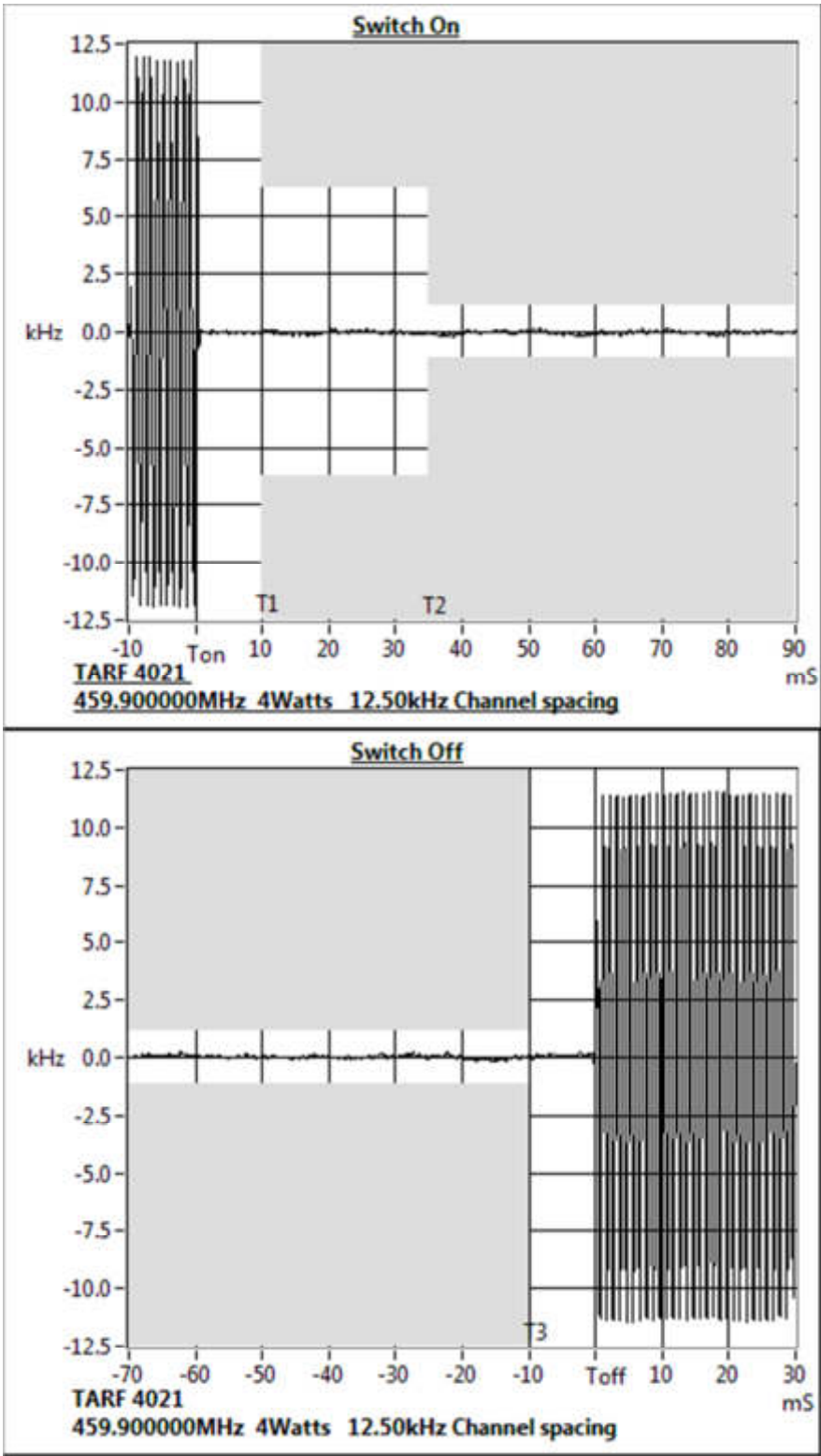
LIMIT: RSS-119 5.9

| 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)                                                                              | $\pm 12.5$ kHz               | 5 ms            | 10 ms           |
| t2 (ms)                                                                              | $\pm 6.25$ kHz               | 20 ms           | 25 ms           |
| t3 (ms)                                                                              | $\pm 12.5$ 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: 459.9 MHz 4 W 12.5 kHz Channel Spacing



## Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing

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

|                                                                                                                     |     |                          |
|---------------------------------------------------------------------------------------------------------------------|-----|--------------------------|
| 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"/> |

Measurement Uncertainty: Frequency  $\pm 130$  Hz; Time  $\pm 0.2\%$

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             |

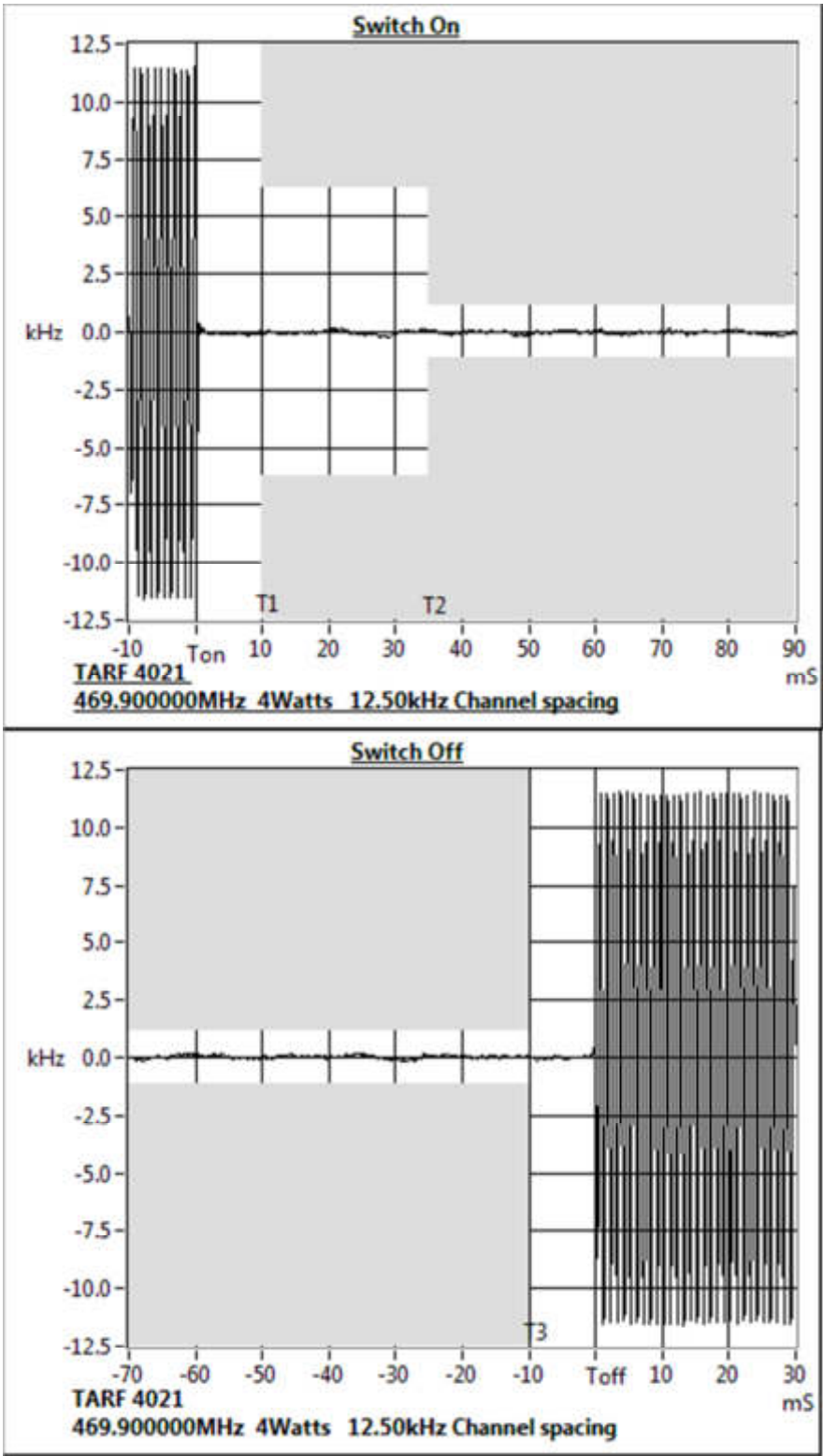
LIMIT: RSS-119 5.9

| 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)                                                                              | $\pm 12.5$ kHz               | 5 ms            | 10 ms           |
| t2 (ms)                                                                              | $\pm 6.25$ kHz               | 20 ms           | 25 ms           |
| t3 (ms)                                                                              | $\pm 12.5$ 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: 469.9 MHz 4 W 12.5 kHz Channel Spacing



## TRANSMITTER FREQUENCY STABILITY - TEMPERATURE

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

RSS-119 5.3

GUIDE: ANSI C63.26 5.6.

### MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  in  $10^{\circ}\text{C}$  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.

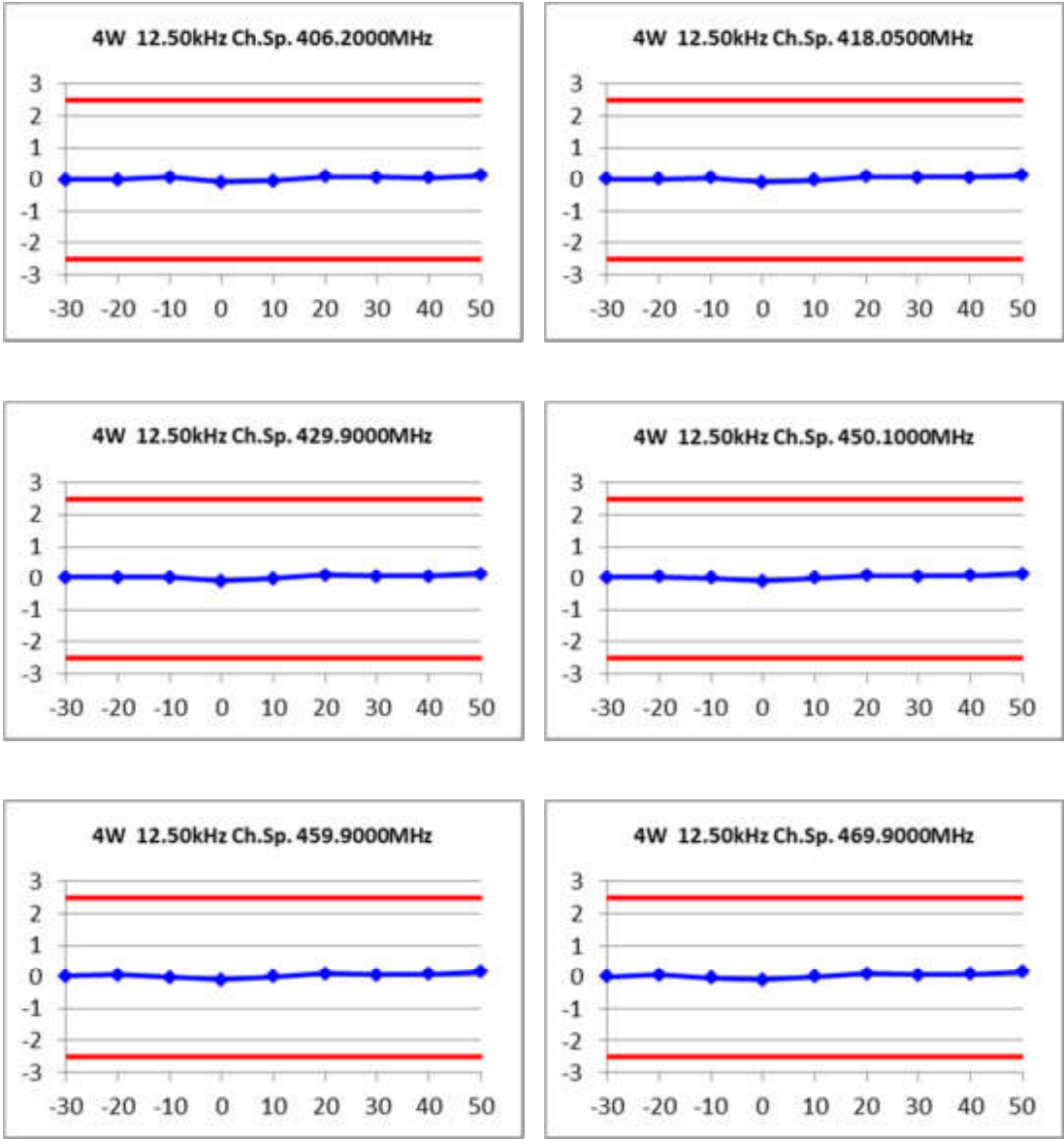
| Temperature<br>( $^{\circ}\text{C}$ ) | Error (ppm) |            |                        |           |           |           |
|---------------------------------------|-------------|------------|------------------------|-----------|-----------|-----------|
|                                       | 406.2 MHz   | 418.05 MHz | 429.9 MHz              | 450.1 MHz | 459.9 MHz | 469.9 MHz |
| -30                                   | -0.03       | 0          | 0.01                   | 0.01      | 0.01      | 0         |
| -20                                   | -0.02       | 0          | 0.02                   | 0.03      | 0.05      | 0.06      |
| -10                                   | 0.05        | 0.04       | 0.01                   | -0.01     | -0.03     | -0.05     |
| 0                                     | -0.09       | -0.09      | -0.09                  | -0.09     | -0.09     | -0.09     |
| 10                                    | -0.06       | -0.04      | -0.03                  | -0.01     | 0         | 0         |
| 20                                    | 0.08        | 0.08       | 0.09                   | 0.08      | 0.09      | 0.09      |
| 30                                    | 0.06        | 0.06       | 0.06                   | 0.06      | 0.06      | 0.05      |
| 40                                    | 0.04        | 0.06       | 0.06                   | 0.08      | 0.08      | 0.08      |
| 50                                    | 0.11        | 0.12       | 0.14                   | 0.14      | 0.16      | 0.16      |
| Measurement Uncertainty               |             |            | $\pm 7 \times 10^{-8}$ |           |           |           |

LIMIT: FCC 47 CFR 90.213

RSS-119 5.3

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

Transmitter Frequency Stability – Temperature



## TRANSMITTER FREQUENCY STABILITY - VOLTAGE

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

RSS-119 5.3

GUIDE: ANSI C63.26 5.6.5

### 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 |                        |                     |
|-------------------------|------------------------------------|------------------------|---------------------|
|                         | 7.5 V <sub>DC</sub>                | 6.375 V <sub>DC</sub>  | 7.5 V <sub>DC</sub> |
| 406.2 MHz               | 0.01                               | 0.02                   | 0.02                |
| 418.05 MHz              | 0.03                               | 0.03                   | 0.04                |
| 429.9 MHz               | 0.03                               | 0.04                   | 0.04                |
| 450.1 MHz               | 0.04                               | 0.05                   | 0.05                |
| 459.9 MHz               | 0.05                               | 0.06                   | 0.06                |
| 469.9 MHz               | 0.06                               | 0.06                   | 0.06                |
| Measurement Uncertainty |                                    | $\pm 7 \times 10^{-8}$ |                     |

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 5.8

GUIDE: TIA/EIA-603D 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. 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
4. For each frequency range the spectrum analyser was loaded with the appropriate calibration figures to compensate for the cables and attenuator losses allowing the emission levels to be read directly with no further calculation.

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

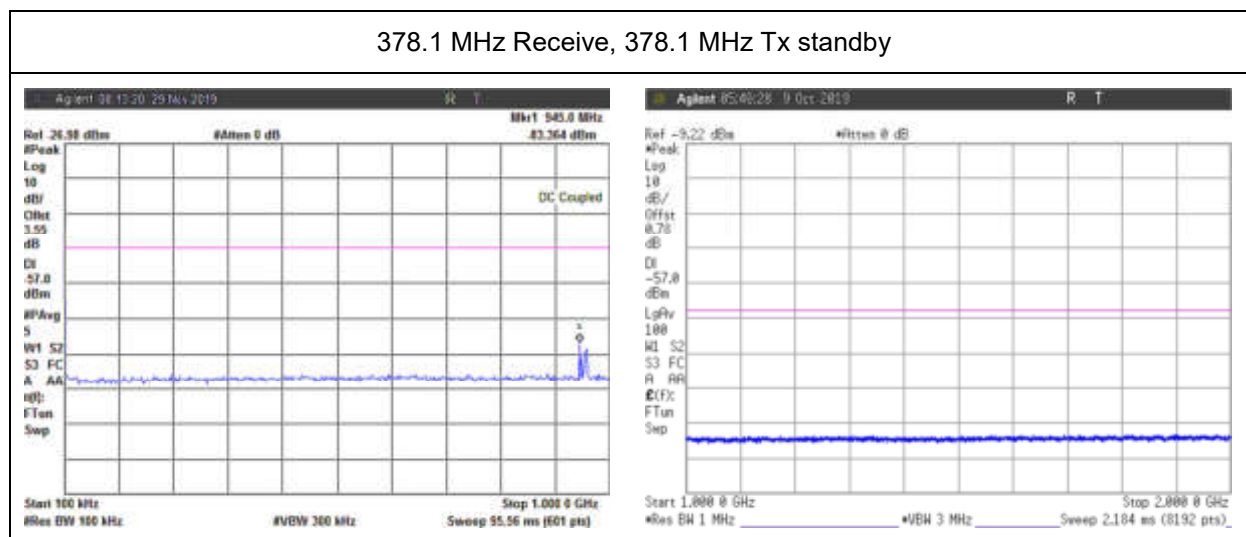
Example of attenuation correction:

|                                 |      |                                  |
|---------------------------------|------|----------------------------------|
| 2m Black6                       | 0.41 |                                  |
| Total Attenuation @ 500.000 MHz | 0.41 | Sum of component attenuation (a) |
| Amplitude offset                | 0.41 | (b)                              |
| Correction @ 500.000 MHz        | 0    | (a-b)                            |

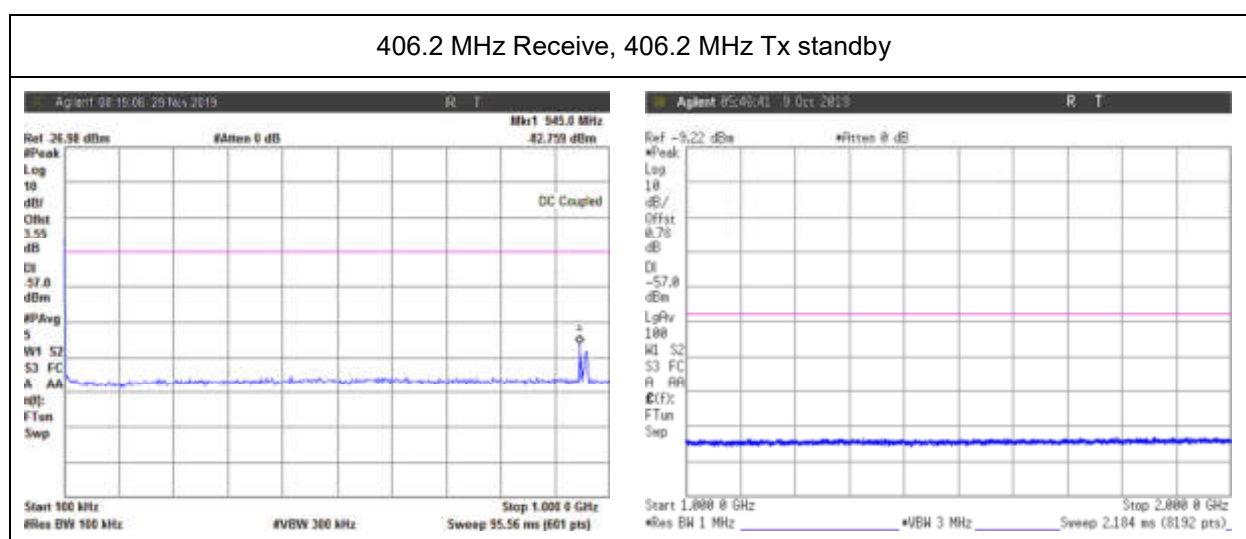
|                         |                     |
|-------------------------|---------------------|
| Measurement Uncertainty | ≤12.75 GHz ± 3.0 dB |
|-------------------------|---------------------|

Receiver Spurious Emissions (Conducted) – Continued

| 378.1 MHz Receive, 378.1 MHz Tx standby           |            |             |
|---------------------------------------------------|------------|-------------|
| Emission Frequency (MHz)                          | Level (nW) | Level (dBm) |
| ~                                                 | ~          | ~           |
| No emissions were detected within 20 dB of Limit. |            |             |

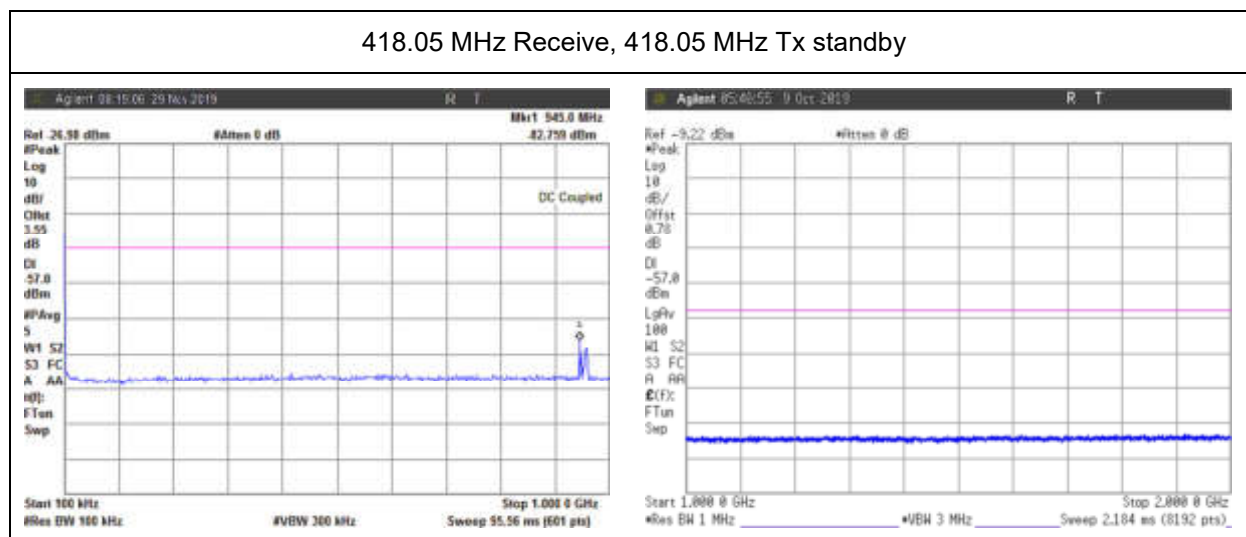


| 406.2 MHz Receive, 406.2 MHz Tx standby           |            |             |
|---------------------------------------------------|------------|-------------|
| Emission Frequency (MHz)                          | Level (nW) | Level (dBm) |
| ~                                                 | ~          | ~           |
| No emissions were detected within 20 dB of Limit. |            |             |

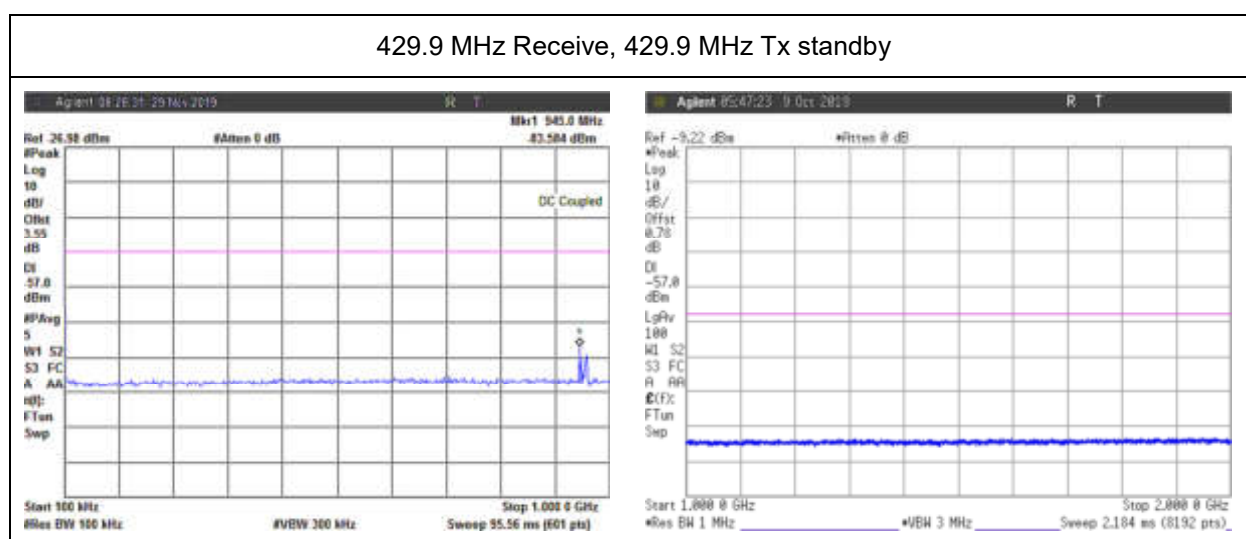


Receiver Spurious Emissions (Conducted) – Continued

| 418.05 MHz Receive, 418.05 MHz Tx standby         |            |             |
|---------------------------------------------------|------------|-------------|
| Emission Frequency (MHz)                          | Level (nW) | Level (dBm) |
| ~                                                 | ~          | ~           |
| No emissions were detected within 20 dB of Limit. |            |             |

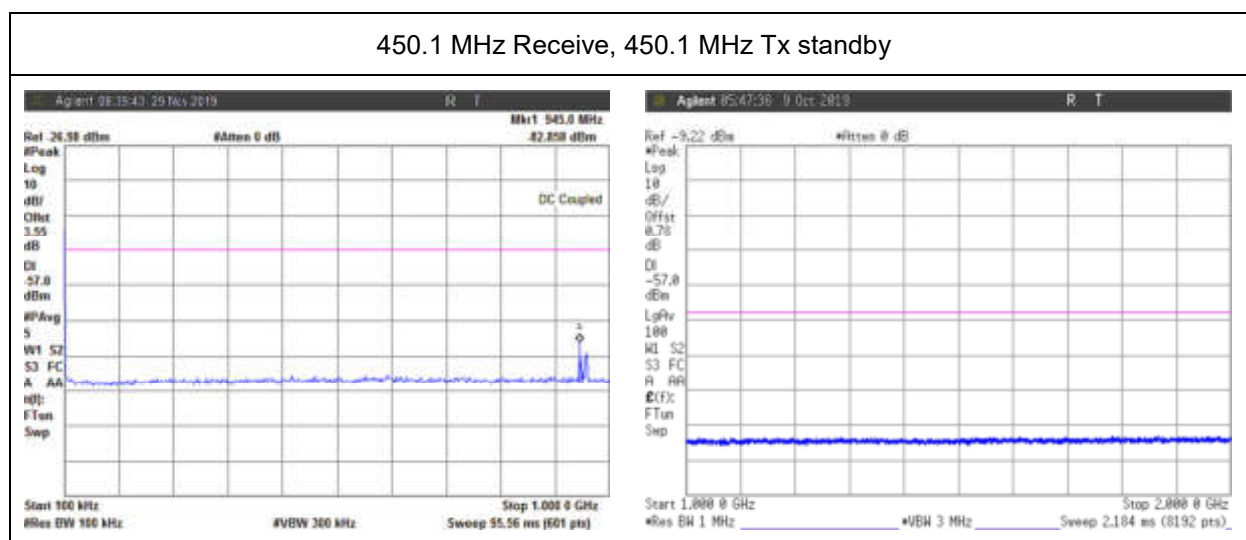


| 429.9 MHz Receive, 429.9 MHz Tx standby           |            |             |
|---------------------------------------------------|------------|-------------|
| Emission Frequency (MHz)                          | Level (nW) | Level (dBm) |
| ~                                                 | ~          | ~           |
| No emissions were detected within 20 dB of Limit. |            |             |

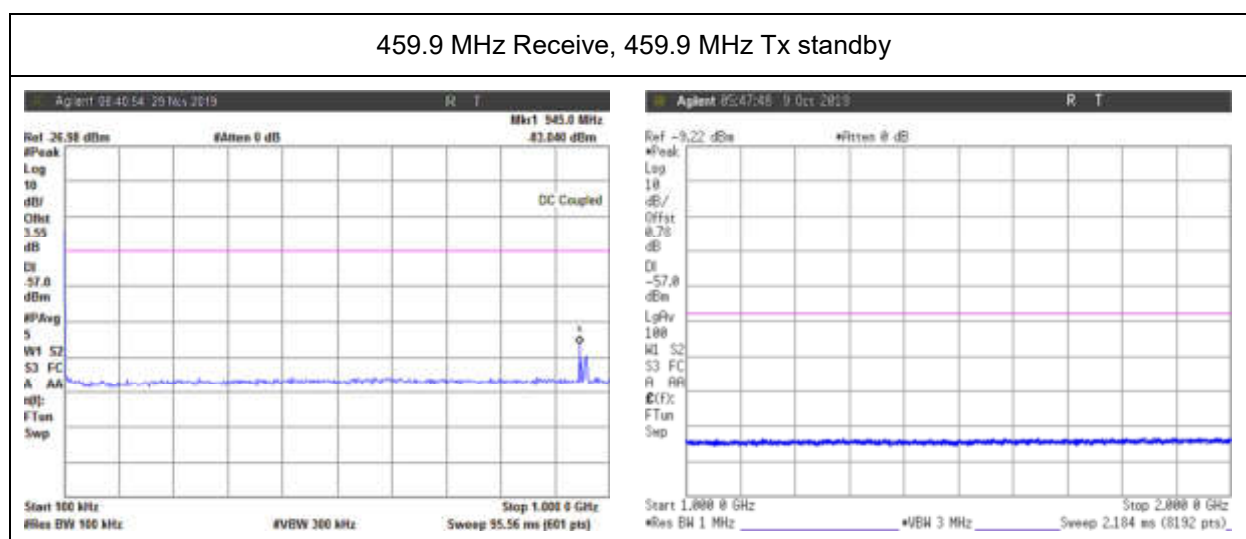


Receiver Spurious Emissions (Conducted) – Continued

| 450.1 MHz Receive, 450.1 MHz Tx standby           |            |             |
|---------------------------------------------------|------------|-------------|
| Emission Frequency (MHz)                          | Level (nW) | Level (dBm) |
| ~                                                 | ~          | ~           |
| No emissions were detected within 20 dB of Limit. |            |             |

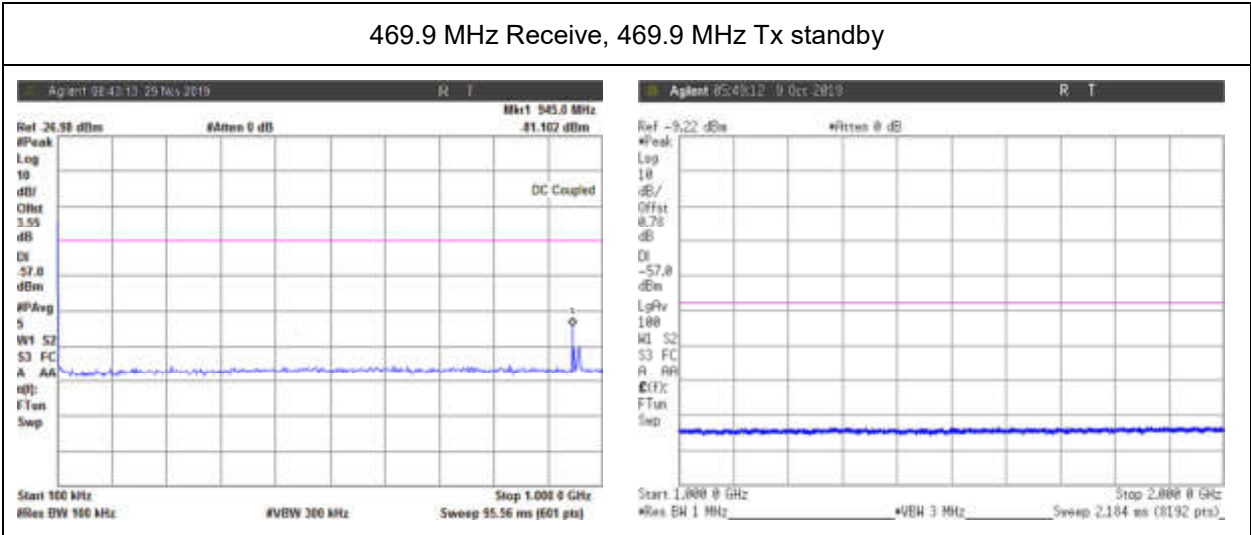


| 459.9 MHz Receive, 459.9 MHz Tx standby           |            |             |
|---------------------------------------------------|------------|-------------|
| Emission Frequency (MHz)                          | Level (nW) | Level (dBm) |
| ~                                                 | ~          | ~           |
| No emissions were detected within 20 dB of Limit. |            |             |



Receiver Spurious Emissions (Conducted) – Continued

| 469.9 MHz Receive, 469.9 MHz Tx standby           |            |             |
|---------------------------------------------------|------------|-------------|
| Emission Frequency (MHz)                          | Level (nW) | Level (dBm) |
| ~                                                 | ~          | ~           |
| No emissions were detected within 20 dB of Limit. |            |             |



|               |               |      |          |
|---------------|---------------|------|----------|
| LIMIT CLAUSE: | RSS-Gen 7.4   |      |          |
| 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                    | 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                    | 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             | TREVA1                          | Hewlett Packard | HP8903A                | 2437A04625    | E4986   | 3-Oct-20  |
| Coax Cable                 | OATS Turntable Cable 1          | Intelcom        | RG214                  | OATS1         | E4621   | 28-Oct-20 |
| Coax Cable                 | OATS Tower Cable                | Intelcom        | RG214                  | OATS2         | E4622   | 28-Oct-20 |
| Coax Cable                 | 2m Black                        | Suhner          | RG214HF/Nm/<br>Nm/2000 | TeltestBlack2 | E4623   | 23-Oct-20 |
| Coax Cable                 | 2m Black                        | Suhner          | RG214HF/Nm/<br>Nm/2000 | TeltestBlack3 | E4624   | 23-Oct-20 |
| Coax Cable                 | Reverb - 4.5m Multiflex 141     | TeltestBlue6    | MF 141                 | TeltestBlue6  | E4843   | 24-Oct-20 |
| Coax Cable                 | Reverb - 2m Multiflex 141       | TeltestBlue5    | MF 141                 | TeltestBlue5  | E4844   | 24-Oct-20 |
| Coax Cable                 | Reverb - 2m Multiflex 141       | TeltestBlue4    | MF 141                 | TeltestBlue4  | E4845   | 24-Oct-20 |
| Coax Cable                 | Reverb - 1m Multiflex 141       | TeltestBlue3    | MF 141                 | TeltestBlue3  | E4846   | 24-Oct-20 |
| Coax Cable                 | Reverb - 1m Multiflex 141       | TeltestBlue2    | MF 141                 | TeltestBlue2  | E4847   | 24-Oct-20 |
| Coax Cable                 | Reverb - 1m Multiflex 141       | TeltestBlue1    | MF 141                 | TeltestBlue1  | E4848   | 24-Oct-20 |
| Coax Cable                 | 2m Black                        | Suhner          | RG214HF/Nm/<br>Nm/2000 | TeltestBlack6 | E4849   | 23-Oct-20 |
| Coax Cable                 | 2m Black                        | Suhner          | RG214HF/Nm/<br>Nm/2000 | TeltestBlack5 | E4850   | 23-Oct-20 |
| Coax Cable                 | OATS Turntable Cable 2          | Intelcom        | RG215                  | OATS3         | E4995   | 28-Oct-20 |
| Coax Cable                 | 2m Black                        | Suhner          | RG214HF/Nm/<br>Nm/2000 | TeltestBlack7 | E5004   | 28-Oct-20 |
| Environ. Chamber           | Upright                         | Contherm        | 5400<br>RHSLT.M        | 1416          | E4051   | 7-Aug-23  |
| Environ. Chamber           | Upright                         | Contherm        | 5400<br>RHSLT.M        | 1416          | E4051   | 15-May-20 |
| Filter High Pass/<br>Notch | 235 to 370MHz                   | Tait            |                        | N/A           | E3784   | 3-Nov-20  |
| Filter High Pass/<br>Notch | 400 to 520MHz                   | Tait            |                        | N/A           | E3384   | 3-Oct-20  |
| Modulation<br>Analyser     | 43740                           | Hewlett Packard | HP8901B (Opt<br>002)   | 2441A00393    | E3073   |           |
| OATS                       | Controller                      | Electrometrics  | EM-4700                | 119           | E4445   |           |
| OATS                       | Turntable                       | Electrometrics  | EM-4704A               | 105           | E4446   |           |
| OATS                       | Antenna Tower                   | Electrometrics  | EM-4720-2              | 112           | E4447   | 18-Jun-20 |
| OATS                       | NSA                             | Tait            |                        |               |         | 3-Oct-21  |
| Oscilloscope               | 100MHz Digital                  | Tektronics      | TDS340                 | B013611       | E3585   | 30-Sep-20 |
| Power Meter                | TREVA1 Power Head for<br>HP8901 | Hewlett Packard | HP11722A               | 3111A05573    | E7054   | 24-Sep-20 |
| Power Supply               | TREVA1                          | Agilent         | HP6032A                | MY41000319    | E4045   | 14-Oct-20 |
| RF Amplifier               | +21.7 dB 1GHz                   | Tait            | ZFL-1000LN             | E3660         | E3360   | 24-Oct-20 |
| RF Amplifier               | 0.2 to 4GHz 15W                 | Ophir           | 5161FE                 | 1044          | E4851   | 15-Jul-20 |
| RF Amplifier               | Pre-amplifier                   | Agilent         | 87405C                 | MY47010688    | E4941   |           |
| RF Attenuator              | 10dB 50W                        | Weinschel       | 24-10-34               | AZ0401        | E3388   | 24-Oct-20 |
| RF Attenuator              | 33dB 350W                       | Weinschel       | 67-30-33 &<br>BW-N3W5+ | CK9178        | E5023   | 15-Jul-20 |

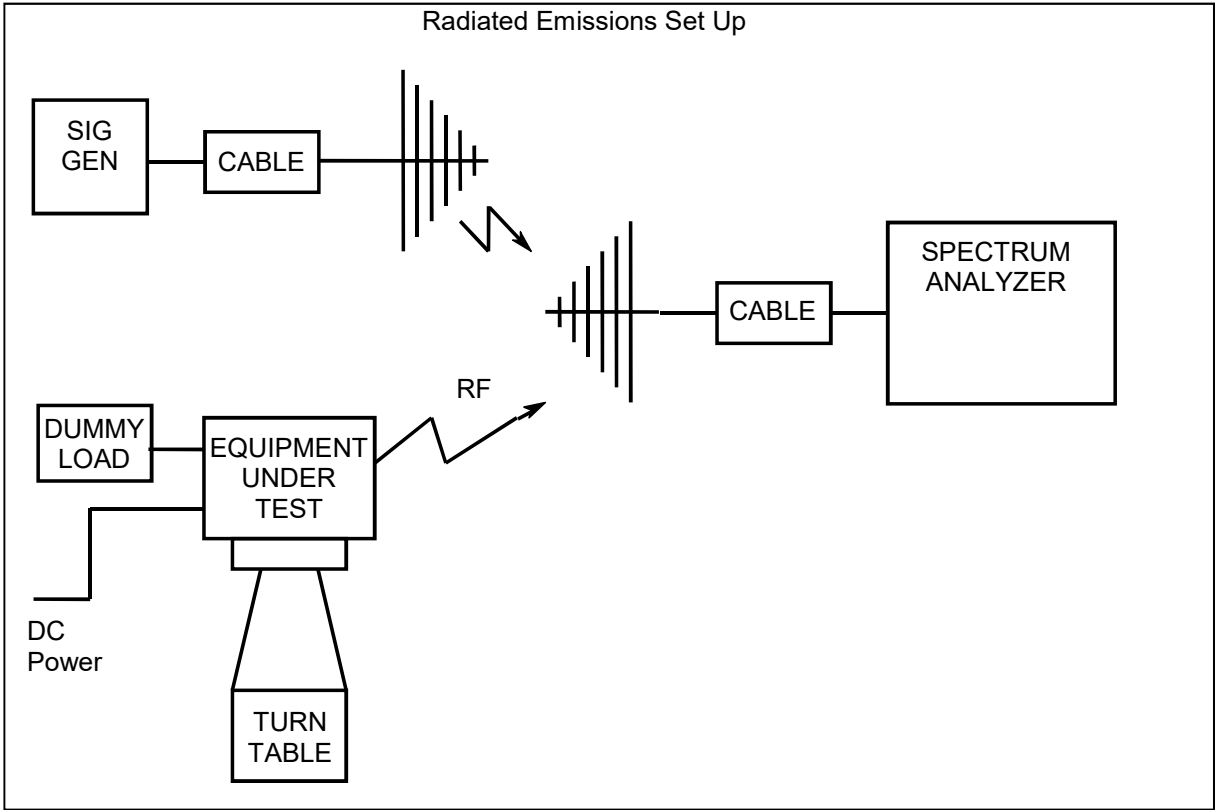
TELTEST Laboratories  
Tait International Ltd  
Report Number 4021

| Equipment Type             | Information                                    | Manufacturer    | Model No           | Serial No# | Tait ID | Cal Due   |
|----------------------------|------------------------------------------------|-----------------|--------------------|------------|---------|-----------|
| RF Attenuator              | TREVA1 3dB                                     | Weinschel       | Model 1            | BL9958     | E4081   | 24-Oct-20 |
| RF Attenuator              | TREVA 1 20dB 150W                              | Weinschel       | 40-20-23           | MF817      | E4082   | 28-Oct-20 |
| RF Attenuator              | 3dB 0.5W                                       | Weinschel       | Model 2            | CH6857     | E5012   | 23-Oct-20 |
| 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                | TREVA1                                         | Minicircuits    | ZFSC-4-1           | -          | E4083   |           |
| RF Load                    | 50W                                            | Weinschel       | F1426              | AE2490     | E3624   | 22-Oct-20 |
| Signal Generator           | Analog 4GHz                                    | Agilent         | E4422B             | GB40050320 | E3788   | 10-Oct-20 |
| Signal Generator           | Digital 3GHz                                   | Agilent         | E4438C             | MY49070242 | E4657   | 9-Oct-21  |
| Signal Generator           | TREVA1 Analog 3.2GHz                           | Agilent         | E8663D             | MY50420224 | E4908   | 2-Oct-20  |
| Spectrum Analyser          | 13.2GHz                                        | Agilent         | E4445A             | MY42510072 | E4139   | 19-Jul-20 |
| Temp & Humidity datalogger |                                                | Hobo            | U21-011            | 10134275   | E4980   | 5-May-20  |
| TREVA 1                    |                                                | Teltest         | -                  | 1          | -       | 7-May-20  |
| Testware                   | Frequency Vs Temperature                       |                 | April 2018         | -          | -       |           |
| Testware                   | Occupied Bandwidth                             |                 | July 2019          | -          | -       |           |
| 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:

- All instruments were within their calibration period at time of testing.
- 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.

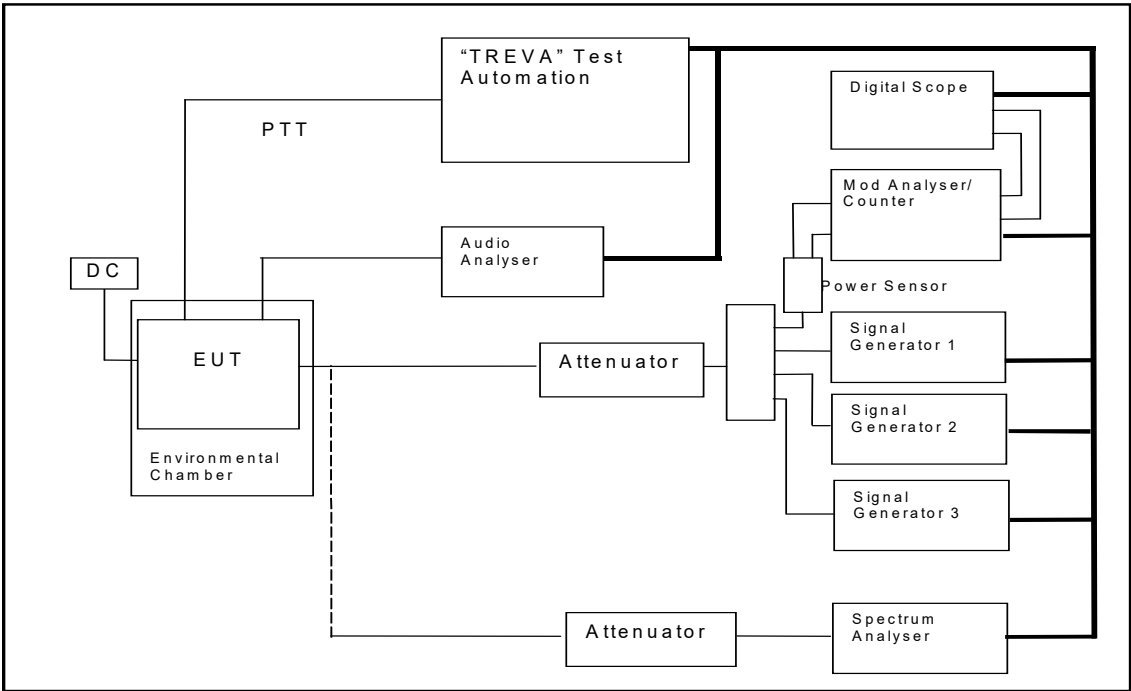


Photo showing the EUT connection to the test system using the customer supplied test box and battery eliminator.



## ANNEX B – Photographs

