TELTEST Laboratories
Tait International Ltd
Report Number 4021

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

PREPARED BY: L. M. White

L White
Test Technician

CHECKED & APPROVED BY: M. C. James

Laboratory Technical Manager

FCC REGISTRATION: 838288
ISED REGISTRATION: 737A

TELTEST Laboratories (A Division of Tait International Ltd)
PO Box 1645, 558 Wairakei Road, Christchurch, New Zealand.

Telephone: 64 3 358 3399
FAX: 64 3 359 4632

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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_{DC}

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 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 ANSI C63.26 5.6.5	Pass
RSS-119 5.4	FCC 47 CFR 2.1046	Transmitter Output Power (Conducted)	RSS-Gen 6.12 ANSI C63.26 5.2.4.2	Pass
RSS-119 5.5	FCC 47CFR 90.209	Transmitter 99% Emission Bandwidth	RSS-Gen 6.7 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 TIA-603-E 2.2.11	Pass
RSS-119 5.8	FCC 47 CFR 2.1051	Transmitter Spurious Emissions (Conducted)	RSS-Gen 6.13 ANSI C63.26 5.7	Pass
RSS-119 5.8	FCC 47 CFR 2.1053	Transmitter Spurious Emissions (Radiated)	RSS-Gen 6.13 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 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:

	12.5 kHz
Analog FM	11K0F3E
FFSK Data 1200 bps	6K60F2D
FFSK Data 2400 bps	7K80F2D
Digital Voice DMR	7K60FXW
Digital Data DMR	7K60FXD
Digital Voice P25 phase 1	8K10F1E
Digital Data P25 phase 1	8K10F1D
Digital Data and Voice P25 phase 2	8K10F1W

CALCULATIONS

Equation: Bn = 2M + 2Dk
(M is highest modulating frequency; D is peak allowable deviation; k is a constant of 1 for FM)

Analogue Voice 12.5 kHz Bandwidth

Necessary bandwidth
M = 3.0 kHz
D = 2.5 kHz
Bn = (2x3.0) + (2x2.5) x 1
= 11.0 kHz

Emission Designator
11K0F3E
F3E represents an FM voice transmission

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

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

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

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)
Bn = (2 x 2.4) + (2 x 1.5) x 1
= 7.8 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	Emission Designator
= 7.6 kHz	**7K60FXW**
	FXW represents a FM Time Division Multiple Access (TDMA) combination of data and telephony

Digital Data 12.5 kHz Bandwidth DMR

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

Digital Voice 12.5 kHz Bandwidth P25 phase 1

99% bandwidth	Emission Designator
= 8.1 kHz	**8K10F1E**
	F1E represents a digital FM voice transmission

Digital Data 12.5 kHz Bandwidth P25 phase 1

99% bandwidth	Emission Designator
= 8.1 kHz	**8K10F1D**
	F1D represents an digital FM data transmission

Digital Data and Voice 12.5 kHz Bandwidth P25 phase 2

99% bandwidth	Emission Designator
= 8.1 kHz	**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 Ω
TPA-AN-038	Helical	1dBi	50 Ω
TPA-AN-038A	Helical		50 Ω

The equipment tested has a 50 Ω 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^(36.17dBm)/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.

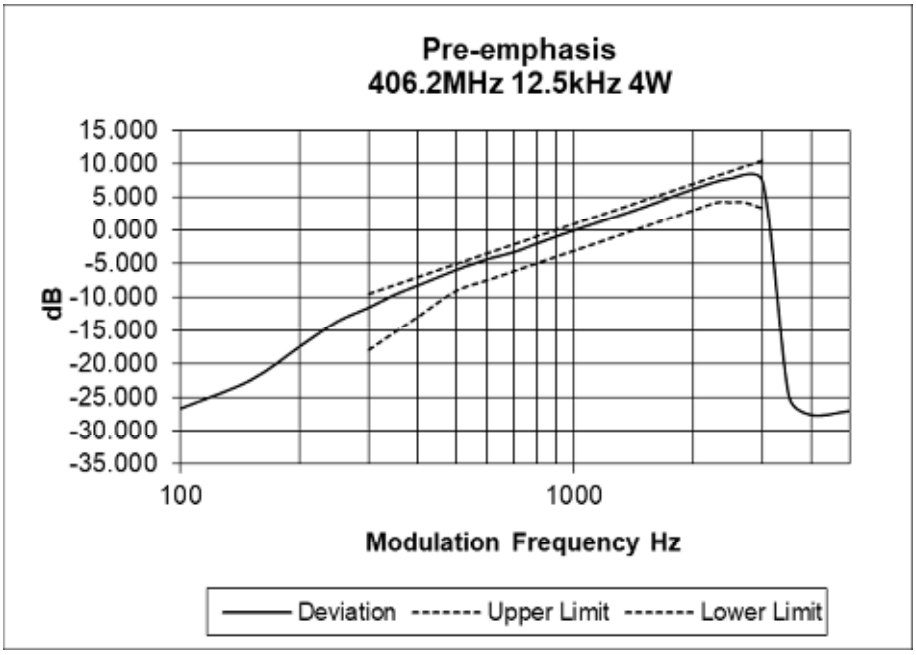
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing tested at 4 W transmit power.

LIMIT CLAUSE: TIA/EIA-603D 3.2.6

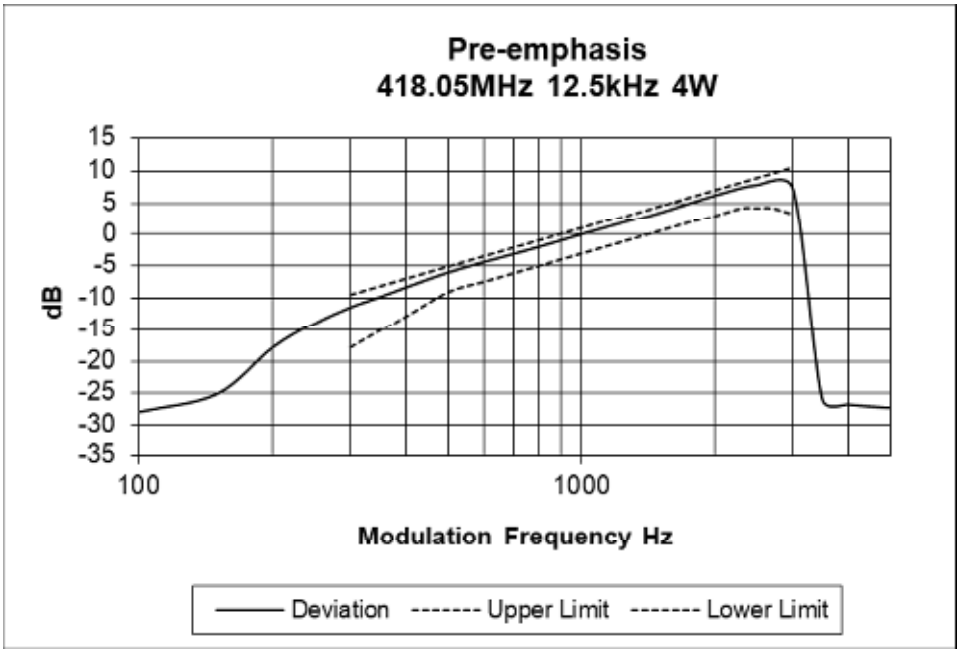
MEASUREMENT UNCERTAINTY: ± 1.5 %

Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 406.2 MHz 12.5 kHz Channel Spacing

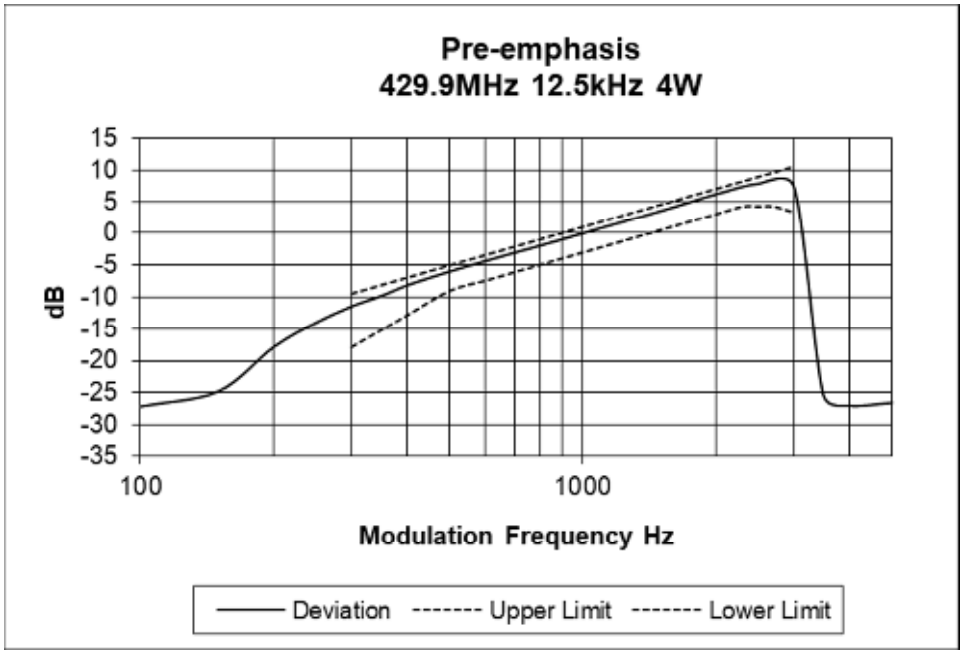


Tx FREQUENCY: 418.05 MHz 12.5 kHz Channel Spacing

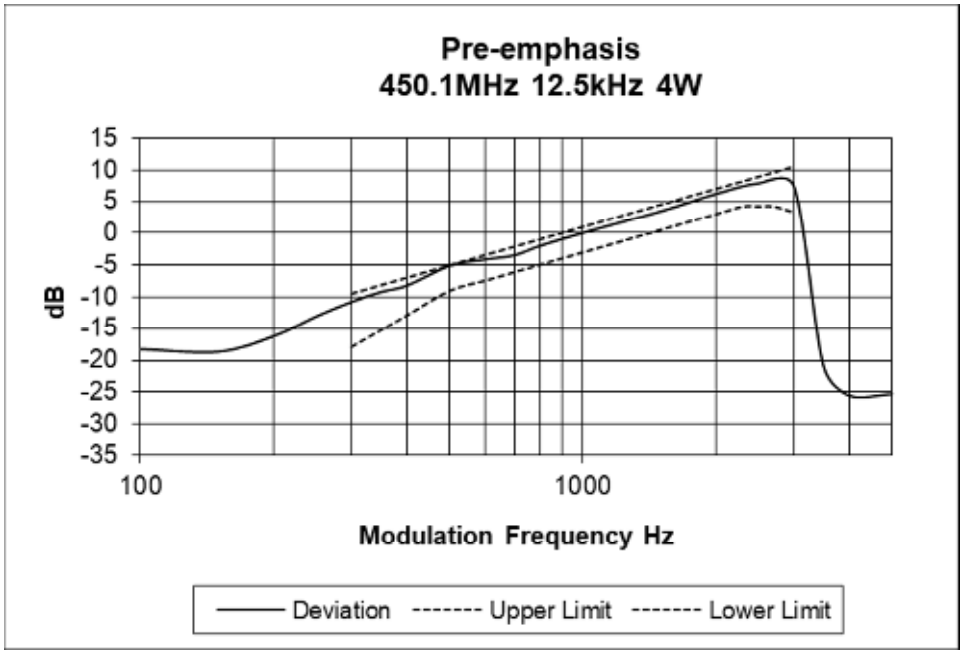


Transmitter Audio Frequency Response – Pre-emphasis

Tx FREQUENCY: 429.9 MHz 12.5 kHz Channel Spacing

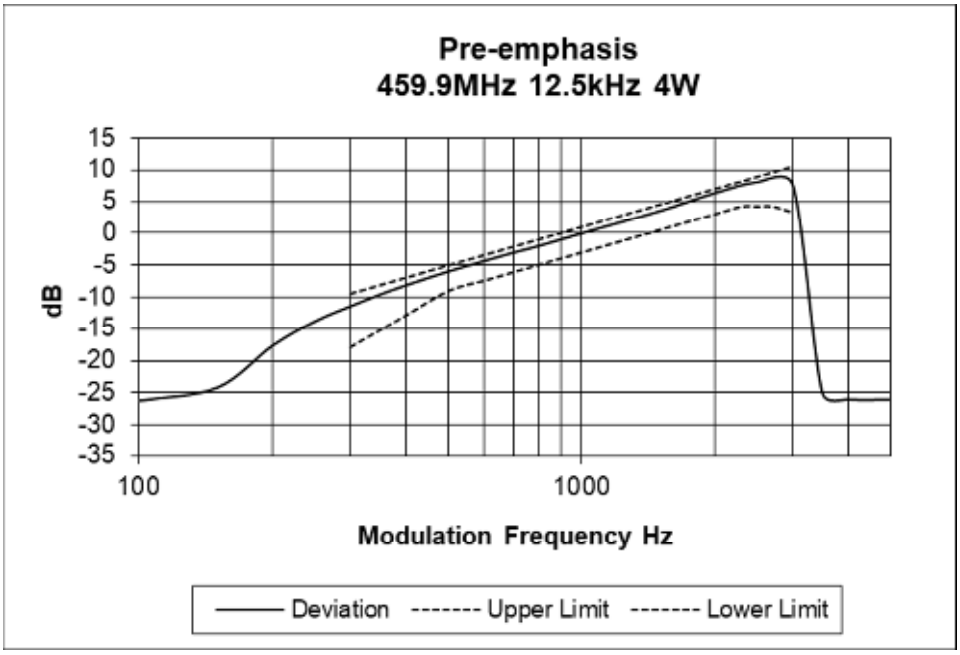


Tx FREQUENCY: 450.1 MHz 12.5 kHz Channel Spacing

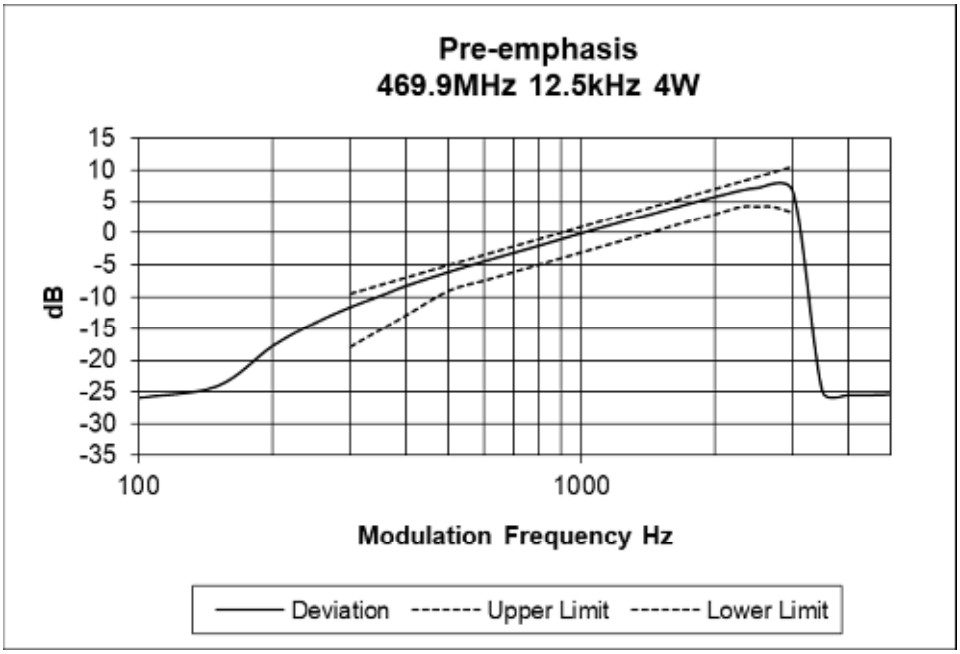


Transmitter Audio Frequency Response – Pre-emphasis

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.

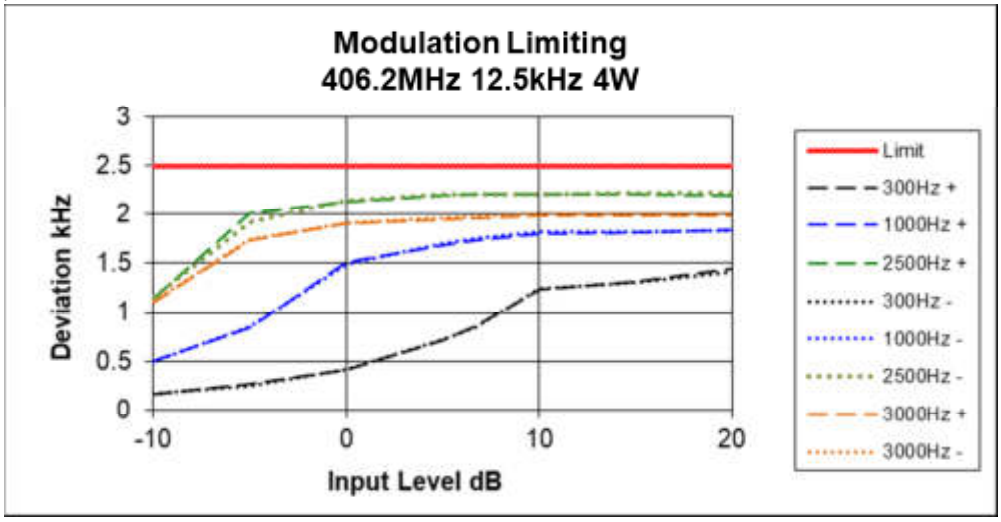
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

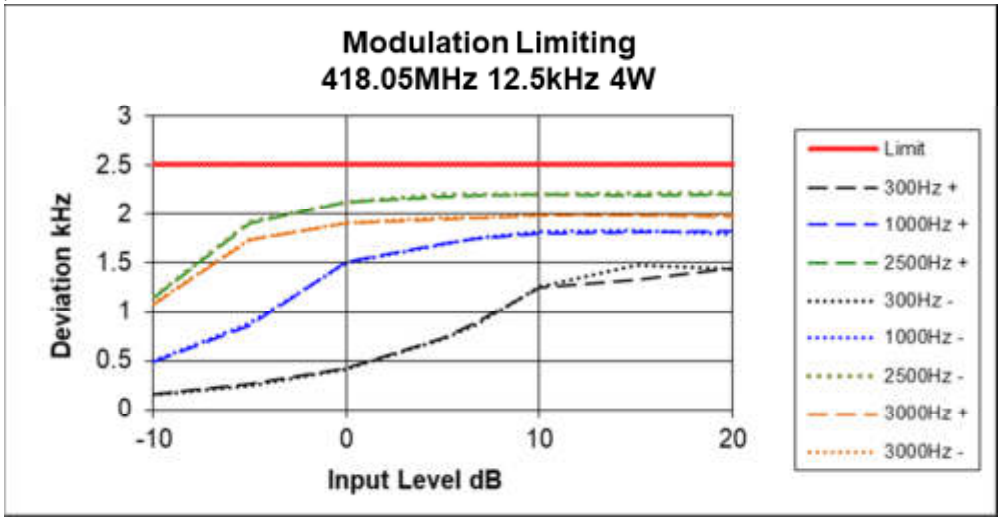
MEASUREMENT UNCERTAINTY: ± 1.5 %

Transmitter Modulation Limiting

Tx FREQUENCY: 406.2 MHz 12.5 kHz Channel Spacing

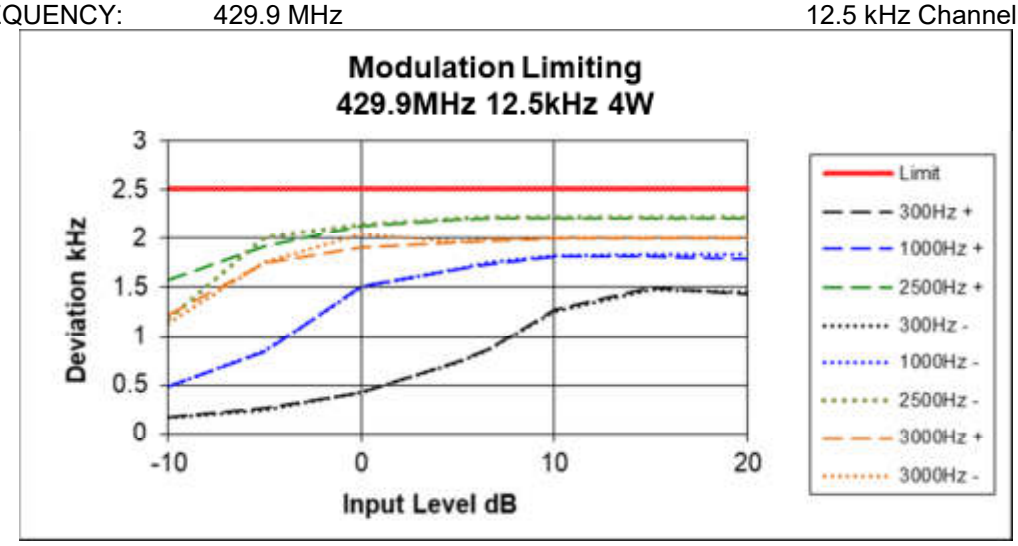


Tx FREQUENCY: 418.05 MHz 12.5 kHz Channel Spacing

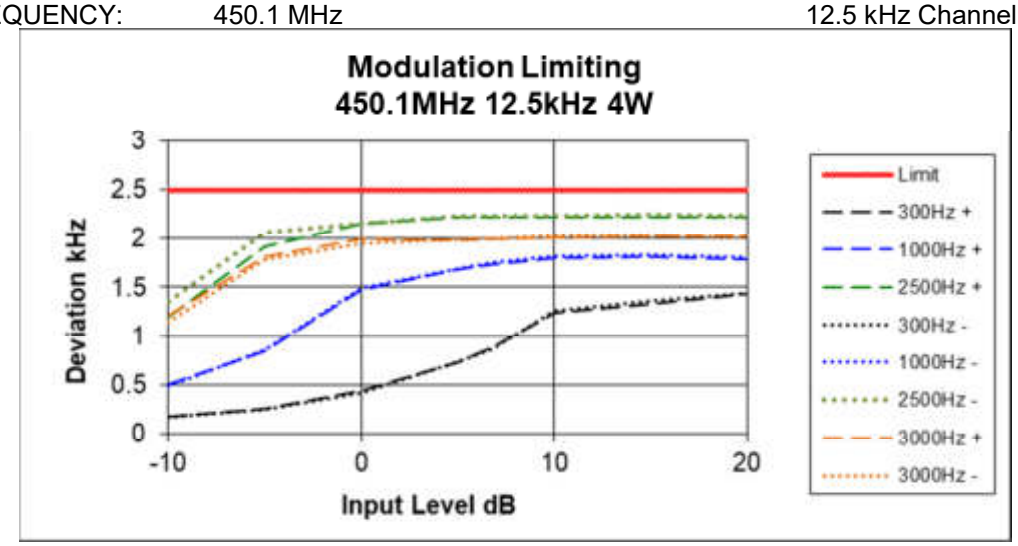


Transmitter Modulation Limiting

Tx FREQUENCY: 429.9 MHz 12.5 kHz Channel Spacing

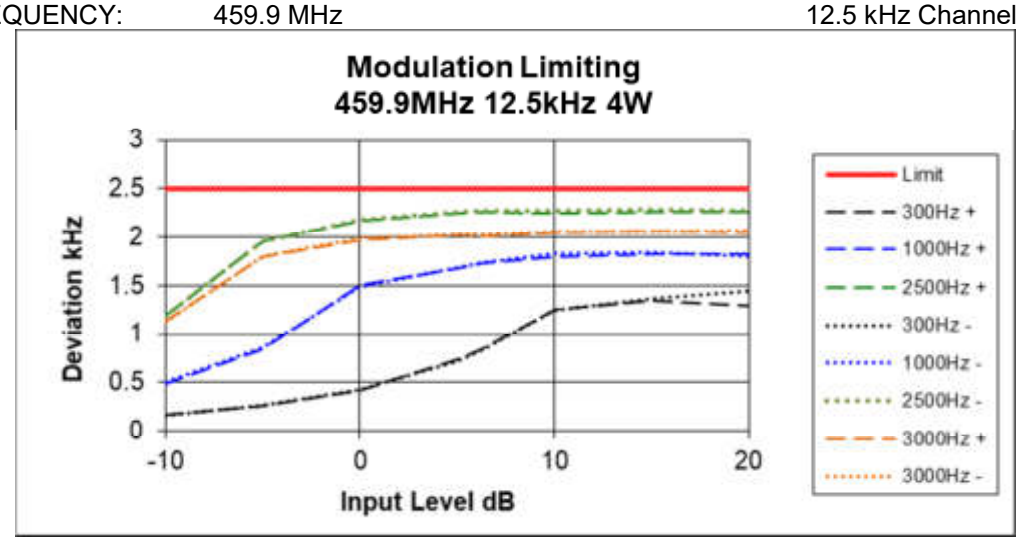


Tx FREQUENCY: 450.1 MHz 12.5 kHz Channel Spacing

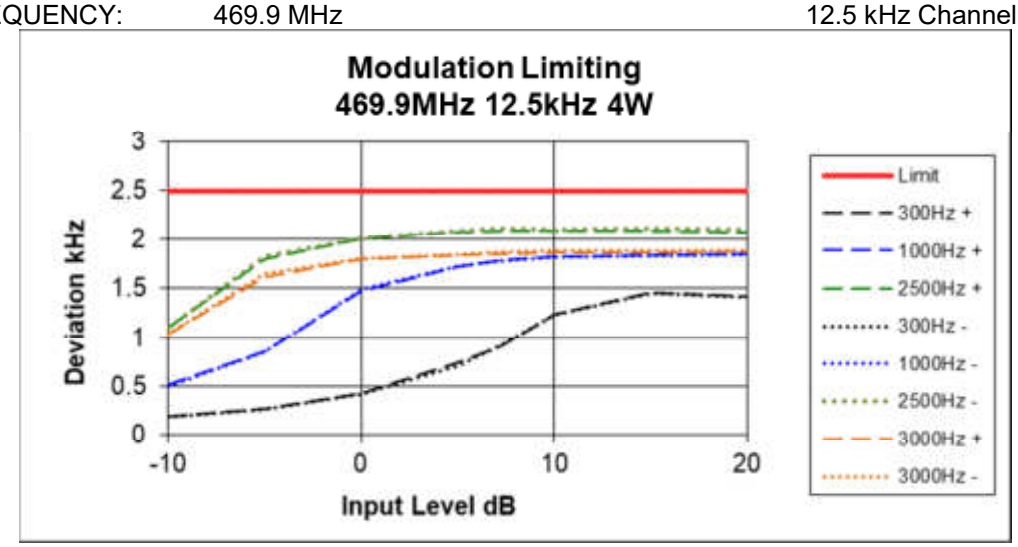


Transmitter Modulation Limiting

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:

		Bandwidths (kHz)					
Channel Spacing (MHz)	Channel Spacing (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 Authorized Bandwidth 47 CFR 90.209 RSS 119 5.5		11.25	11.25	11.25	11.25	11.25	11.25
Necessary BW used in 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.

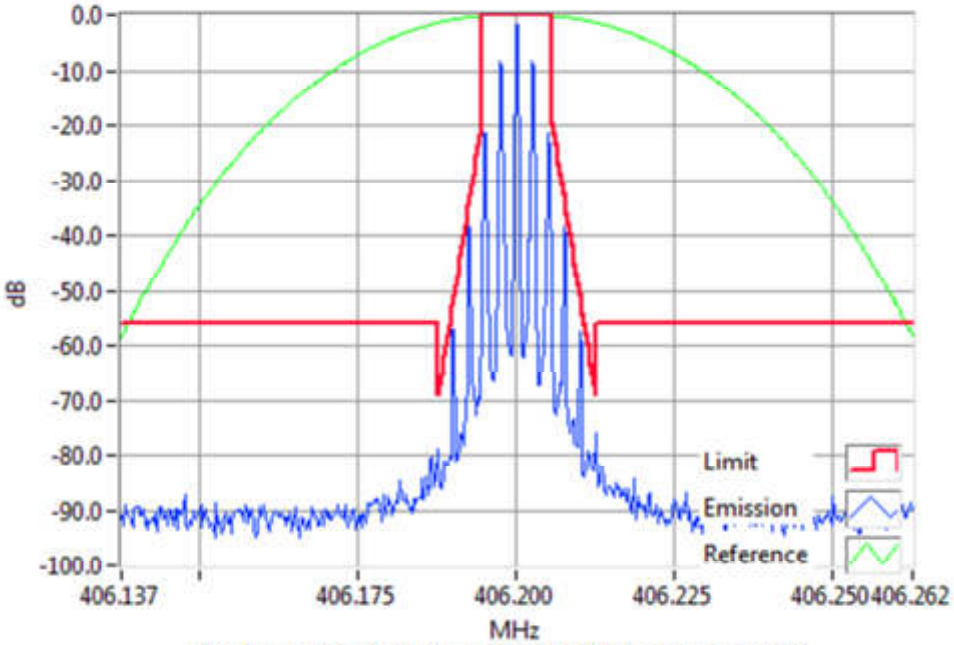
MEASUREMENT UNCERTAINTY 95% ±0.65dB

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

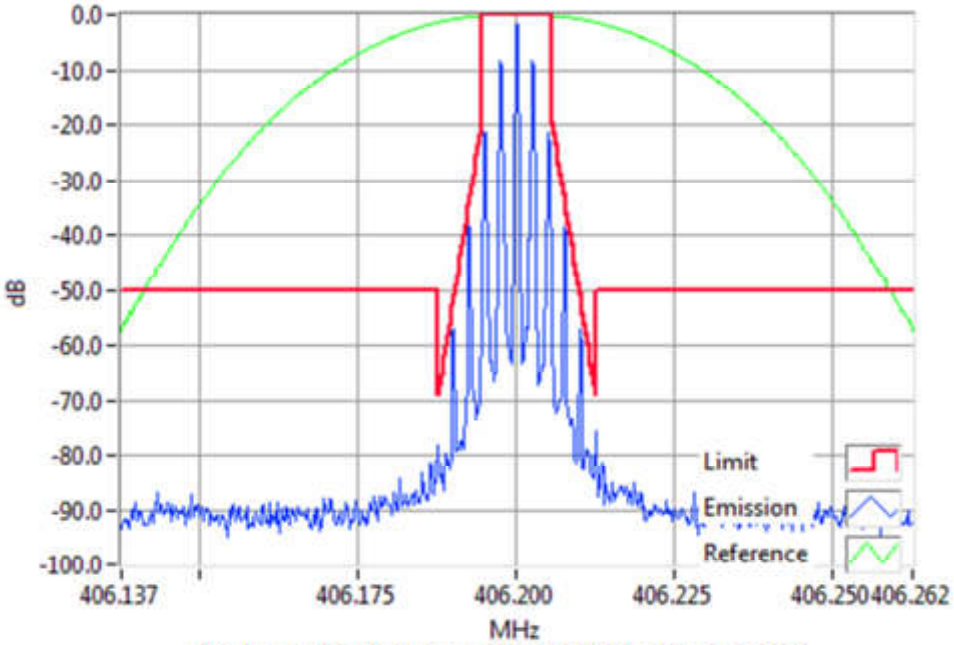
ANALOGUE VOICE

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



Analogue Modulation 406.2000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 406.2 MHz 1 W 12.5 kHz Channel Spacing

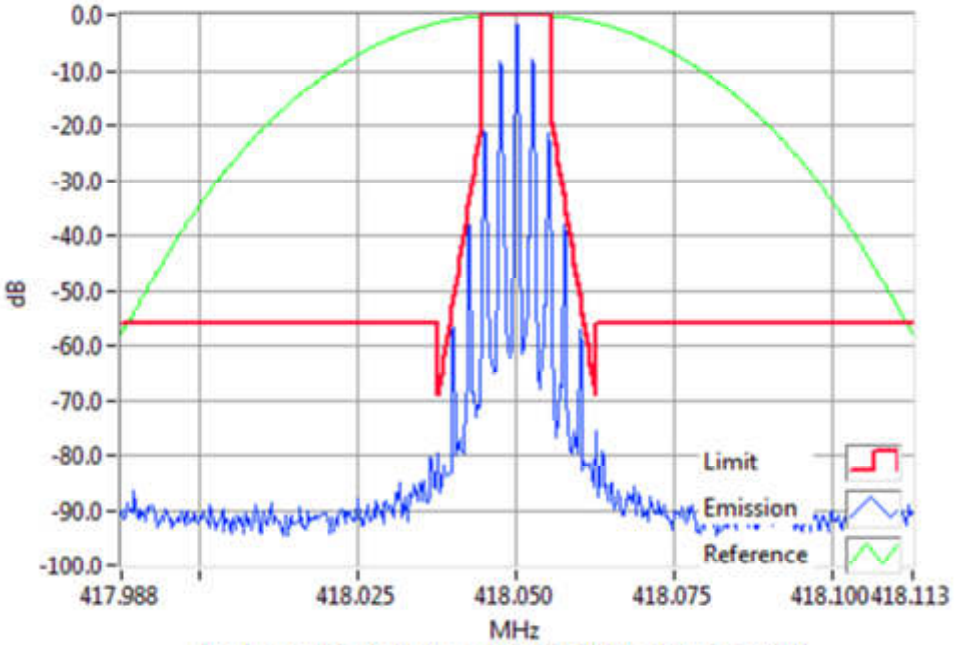


Analogue Modulation 406.2000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

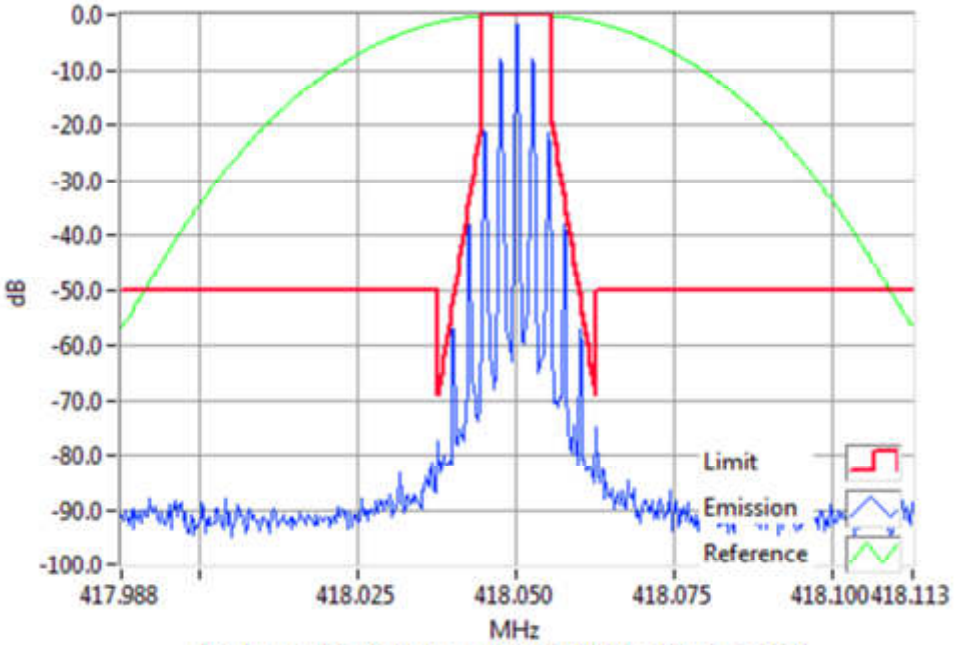
ANALOGUE VOICE

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



Analogue Modulation 418.0500MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 418.05 MHz 1 W 12.5 kHz Channel Spacing

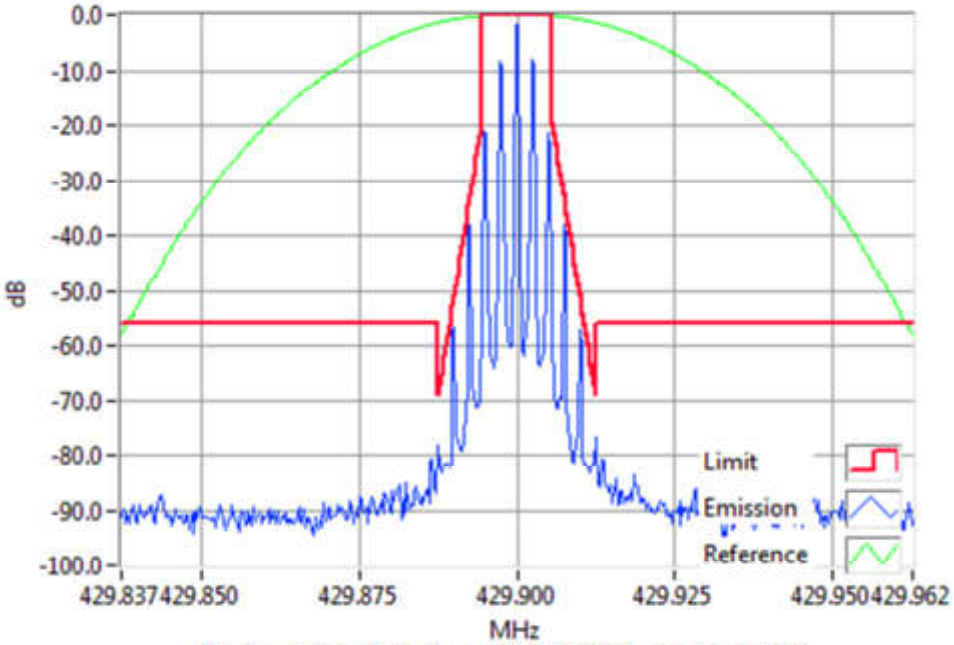


Analogue Modulation 418.0500MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

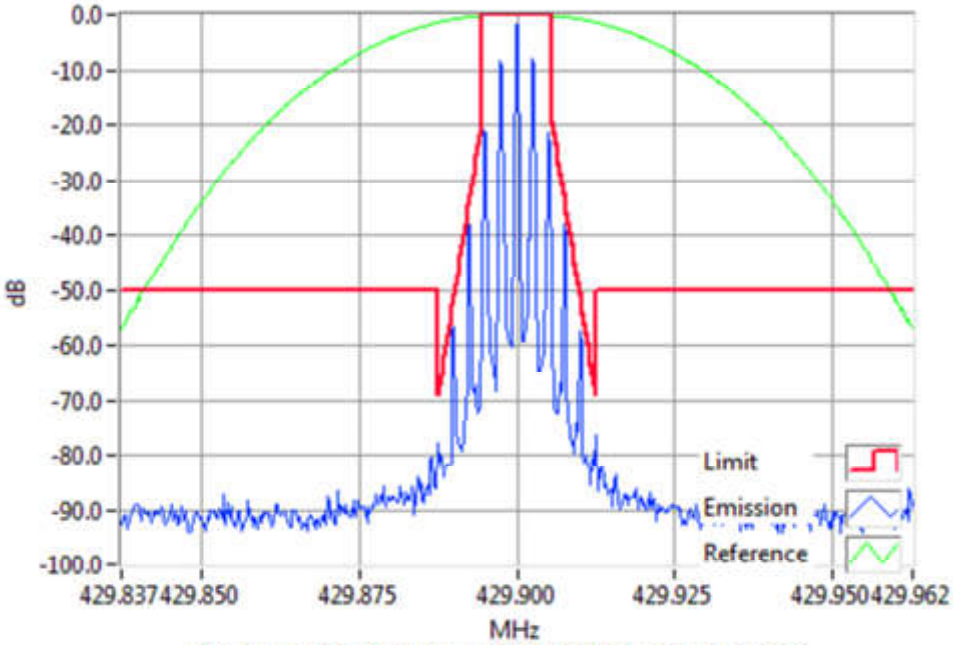
ANALOGUE VOICE

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



Analogue Modulation 429.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing

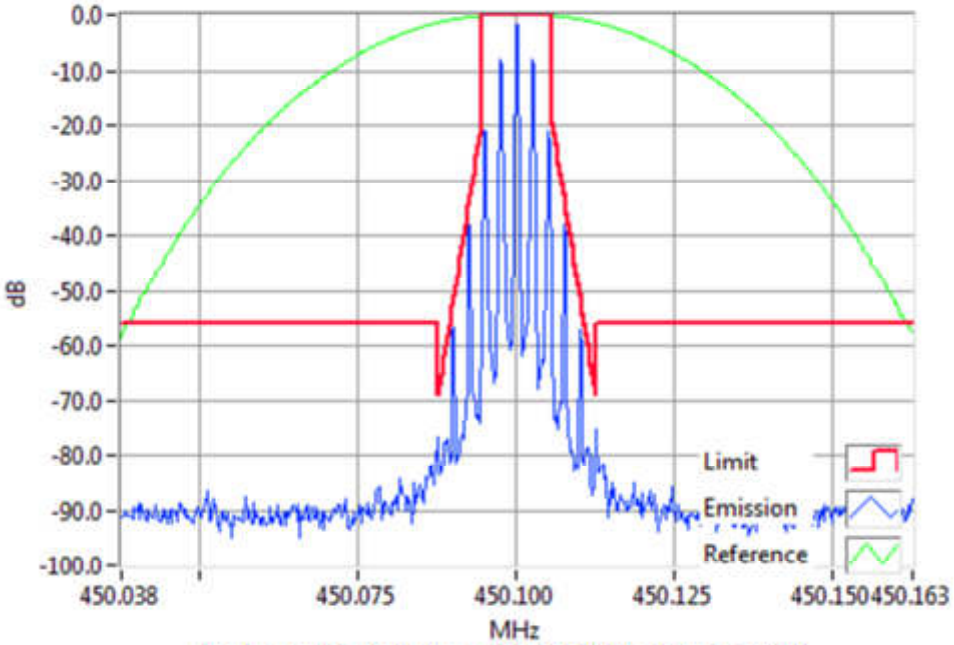


Analogue Modulation 429.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

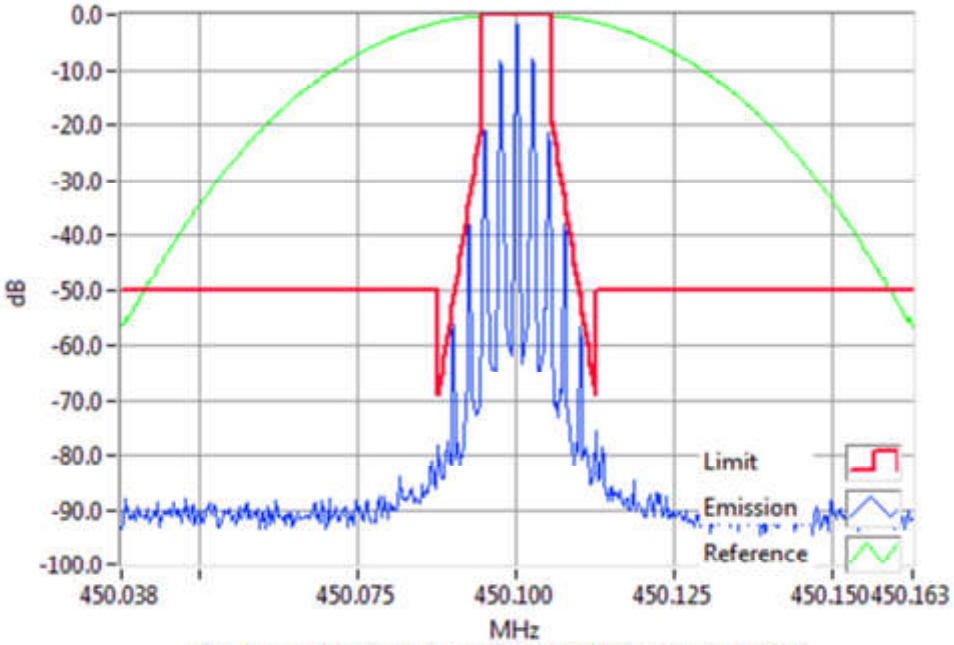
ANALOGUE VOICE

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



Analogue Modulation 450.1000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 450.1 MHz 1 W 12.5 kHz Channel Spacing

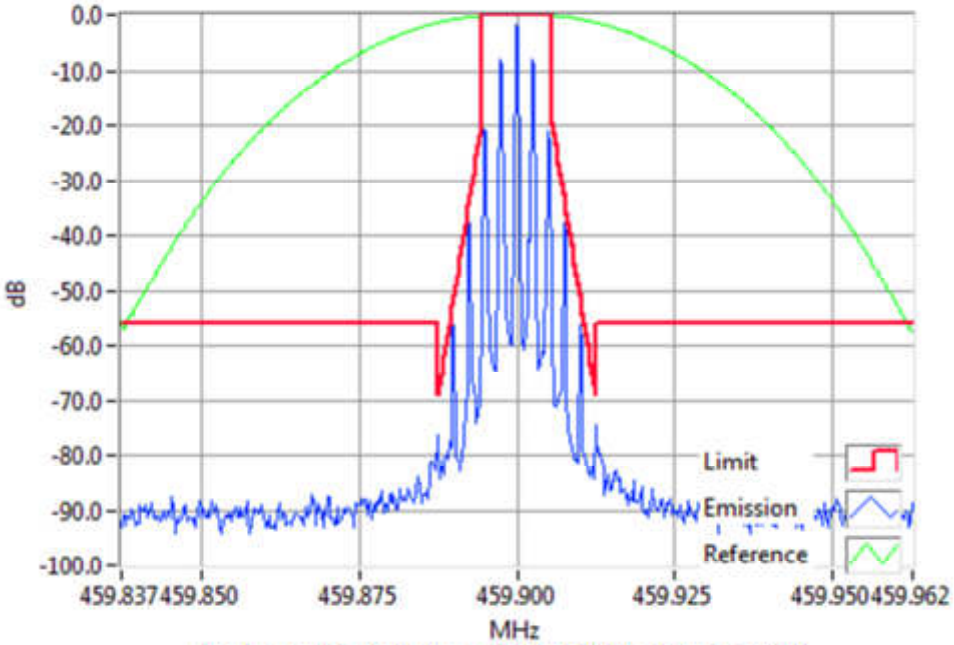


Analogue Modulation 450.1000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

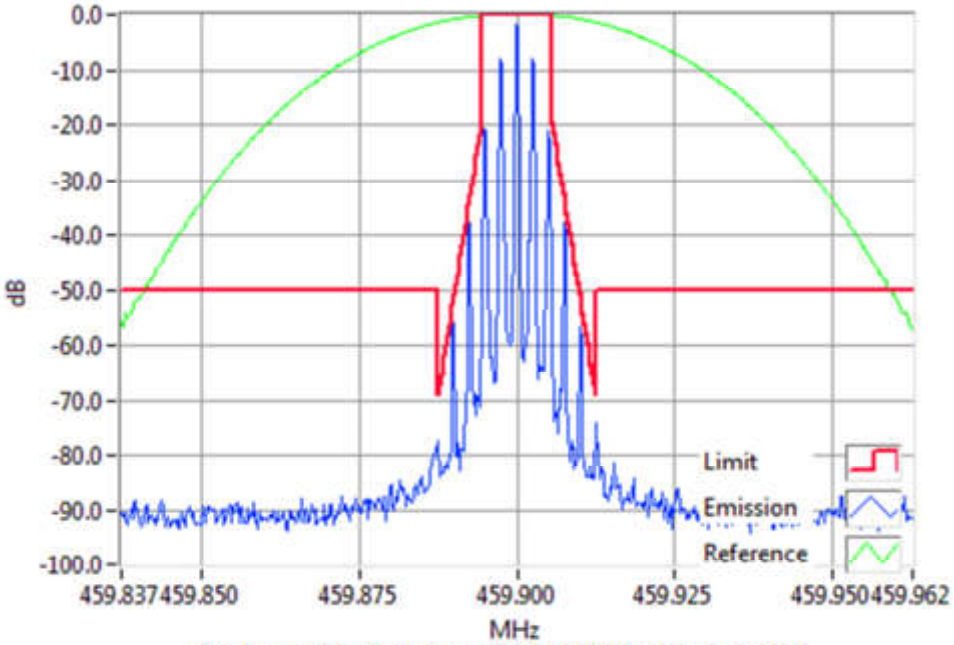
ANALOGUE VOICE

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



Analogue Modulation 459.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing

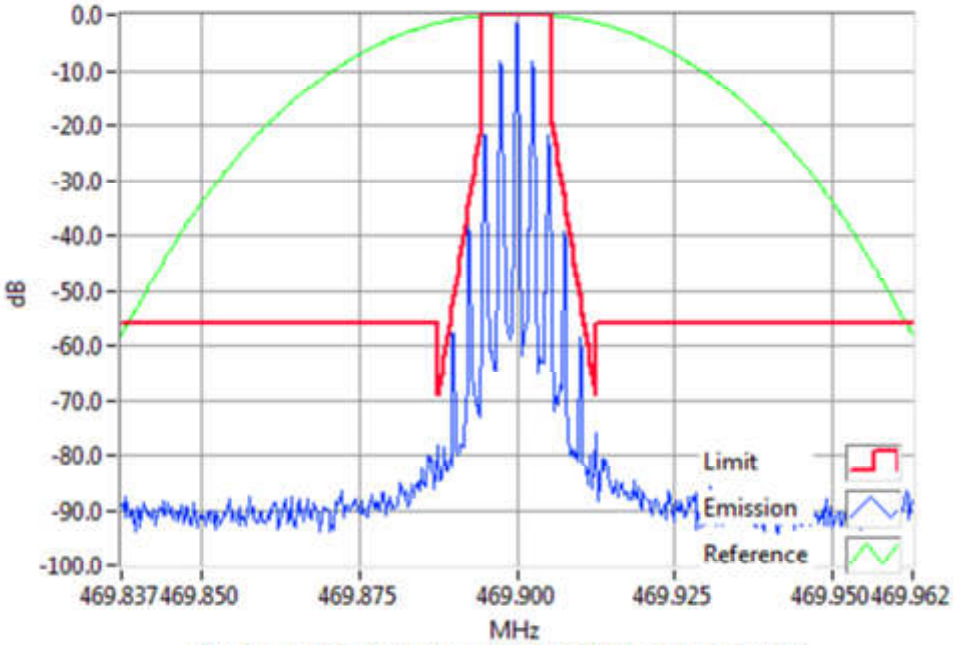


Analogue Modulation 459.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

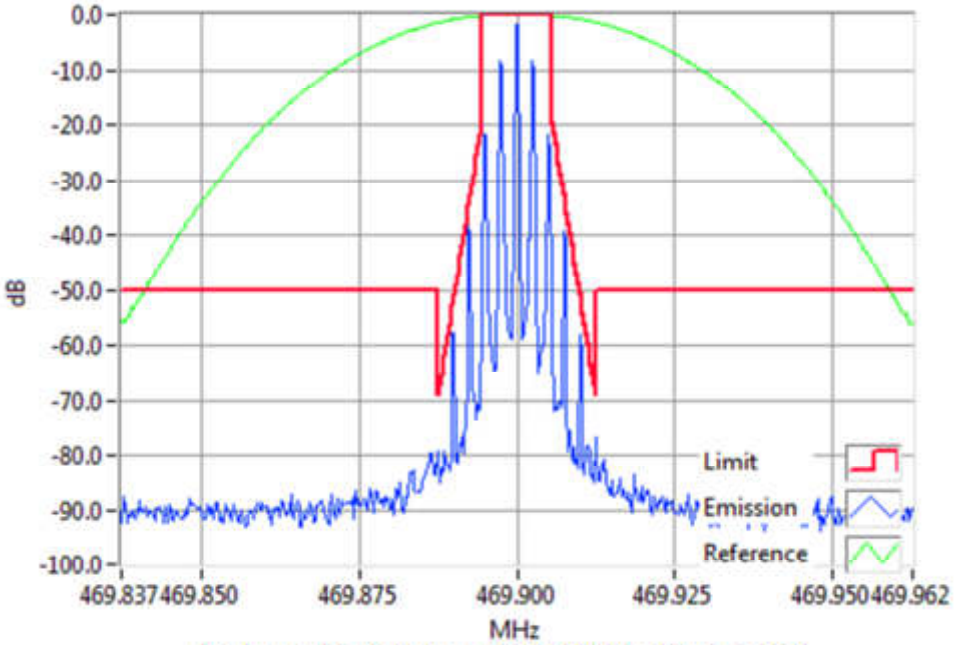
ANALOGUE VOICE

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



Analogue Modulation 469.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 469.9 MHz 1 W 12.5 kHz Channel Spacing

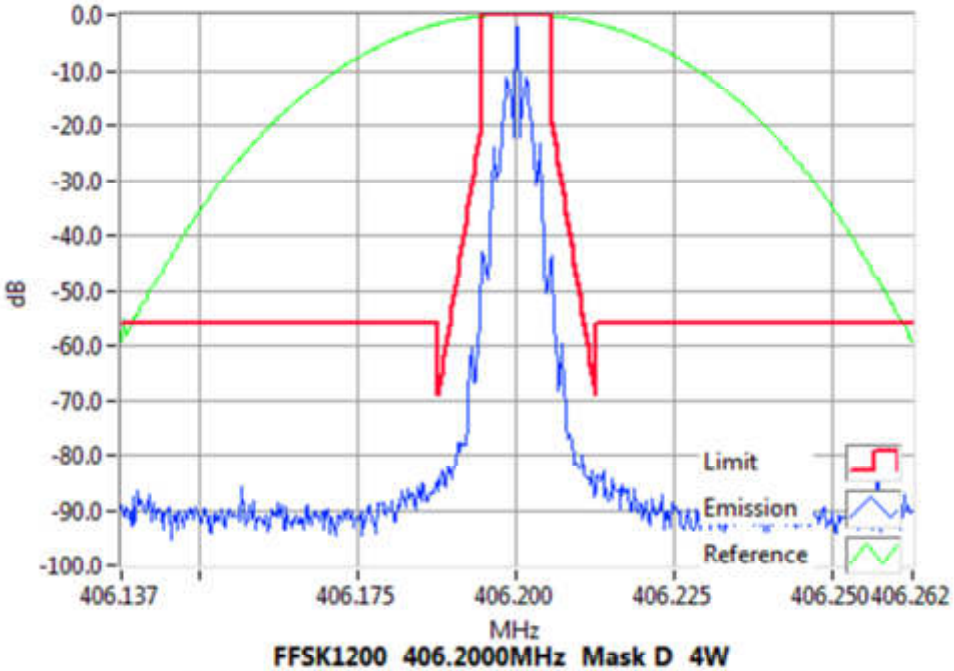


Analogue Modulation 469.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

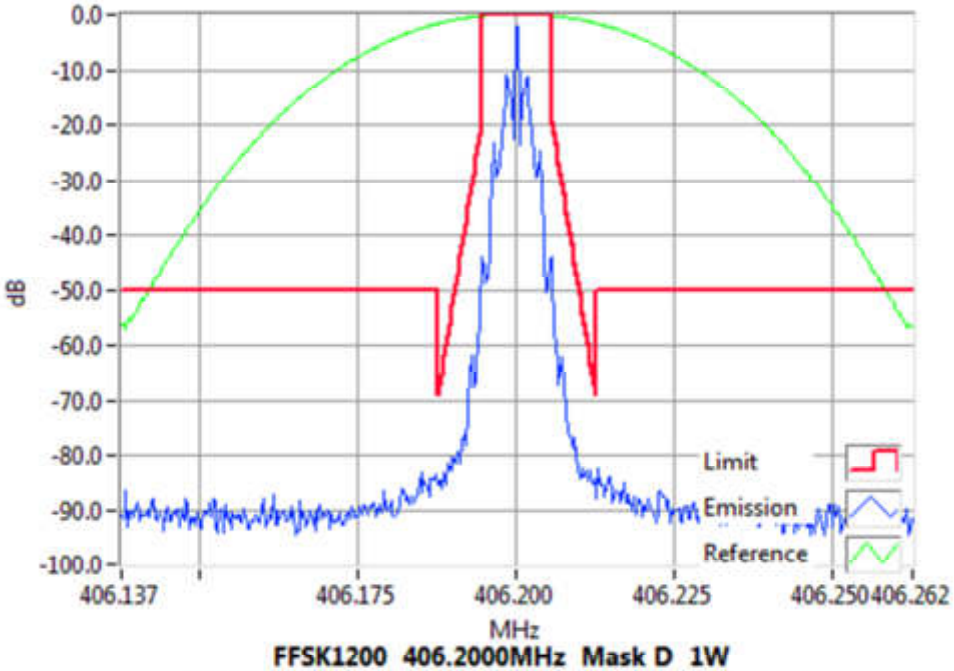
FFSK 1200 bps

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



FFSK1200 406.2000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 406.2 MHz 1 W 12.5 kHz Channel Spacing

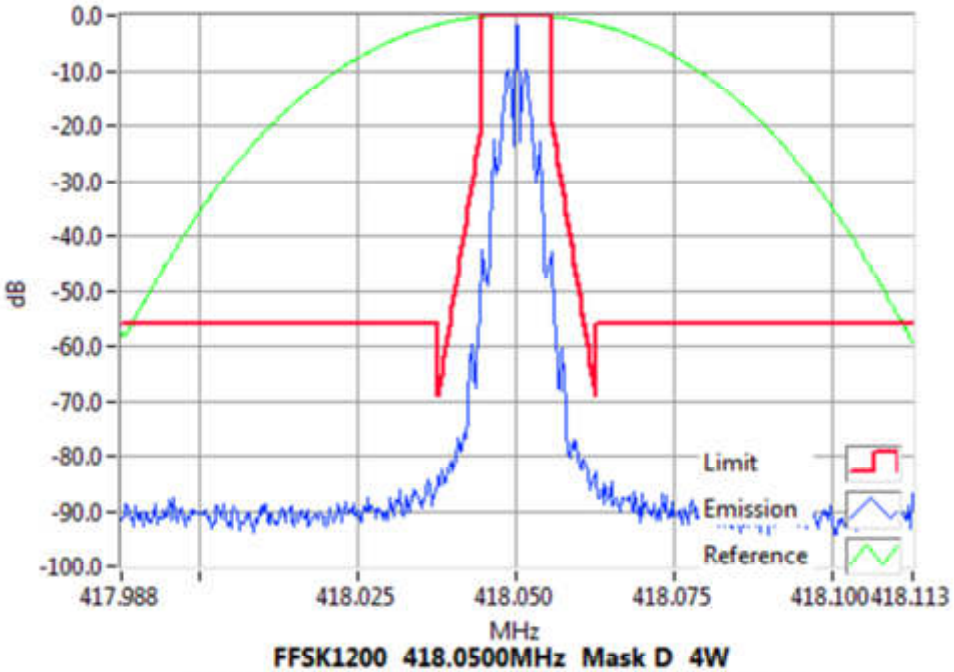


FFSK1200 406.2000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

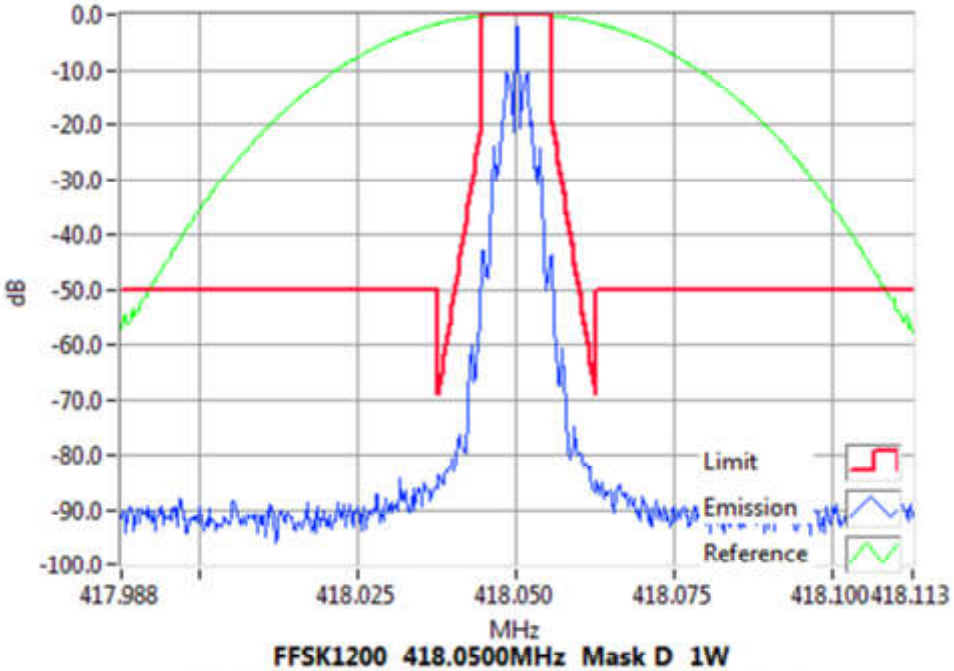
FFSK 1200 bps

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



FFSK1200 418.0500MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 418.05 MHz 1 W 12.5 kHz Channel Spacing

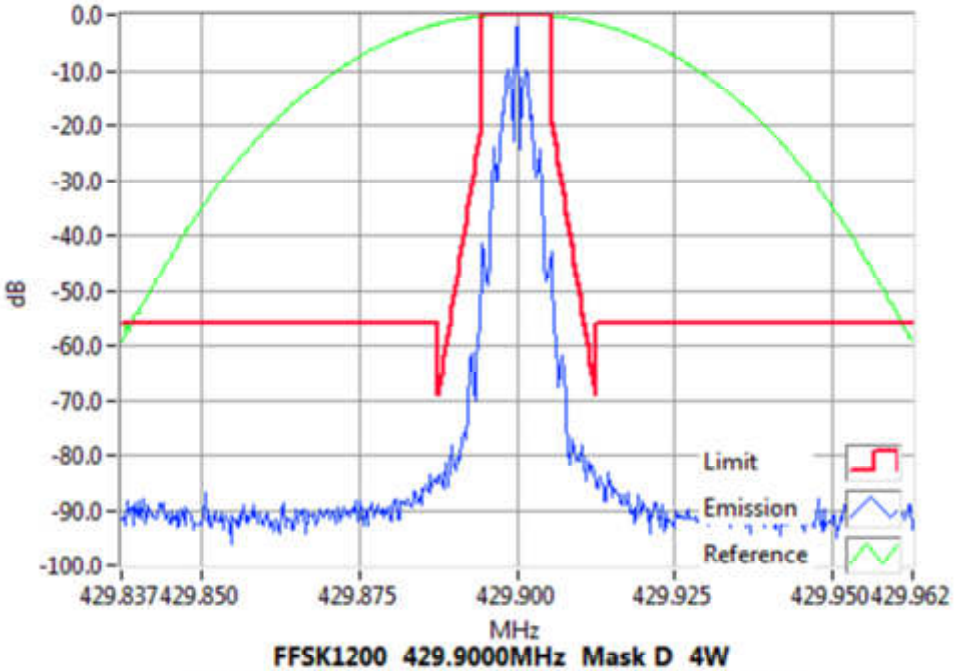


FFSK1200 418.0500MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

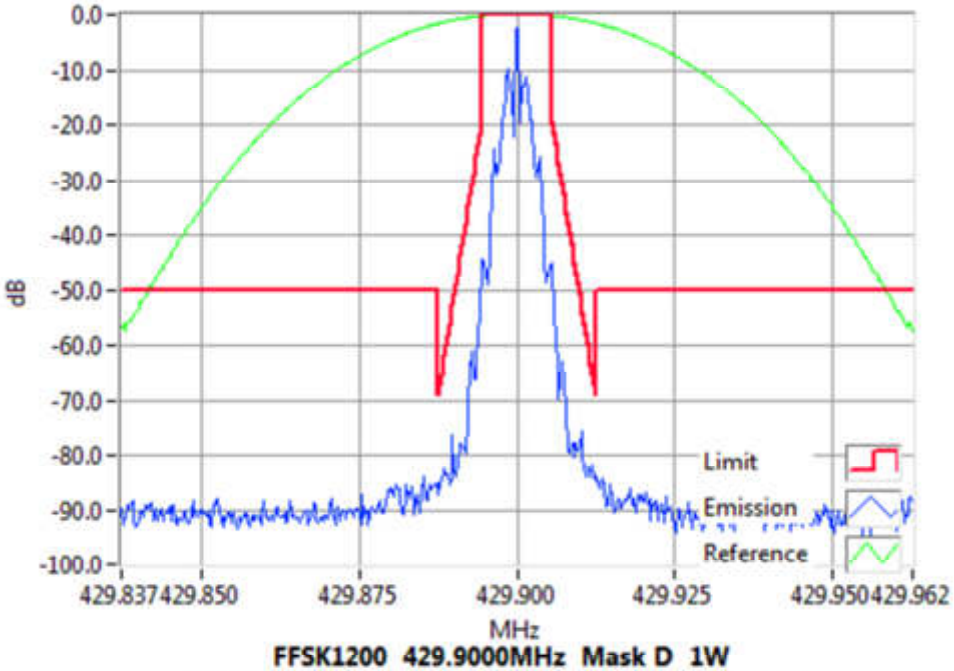
FFSK 1200 bps

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



FFSK1200 429.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing

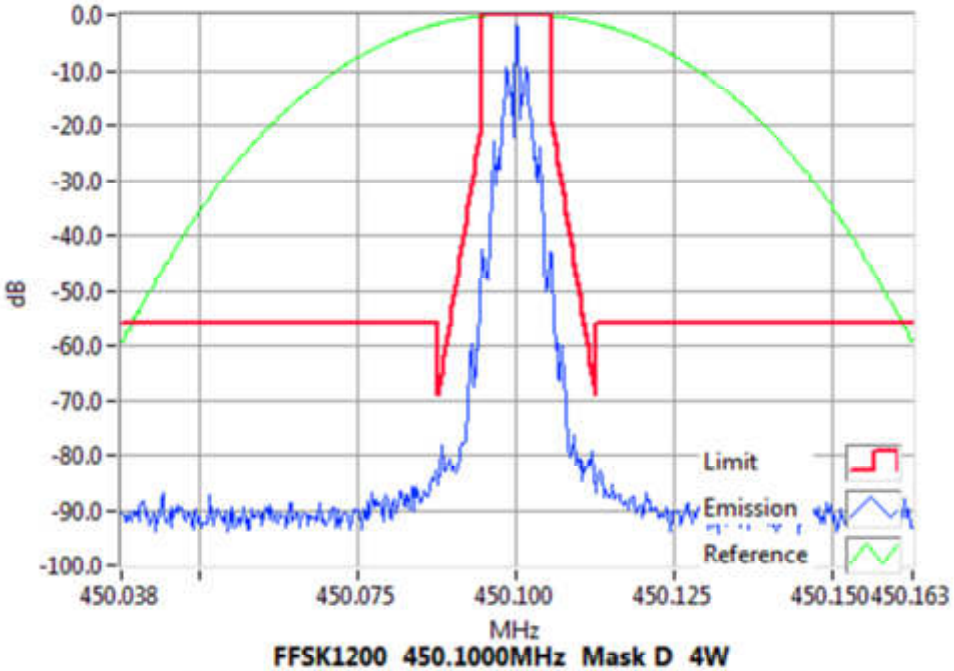


FFSK1200 429.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

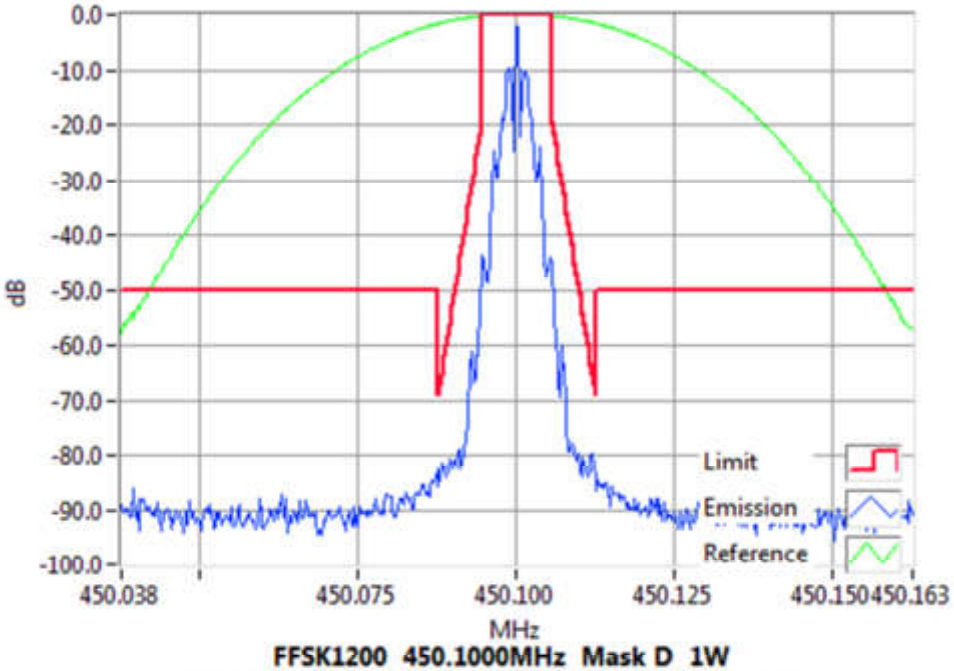
FFSK 1200 bps

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



FFSK1200 450.1000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 450.1 MHz 1 W 12.5 kHz Channel Spacing

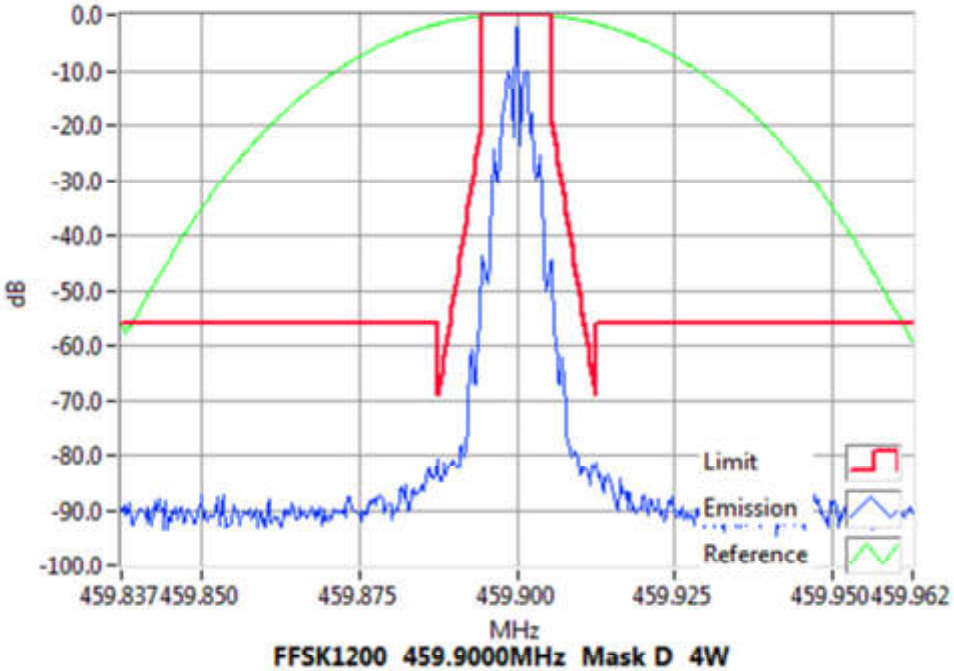


FFSK1200 450.1000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

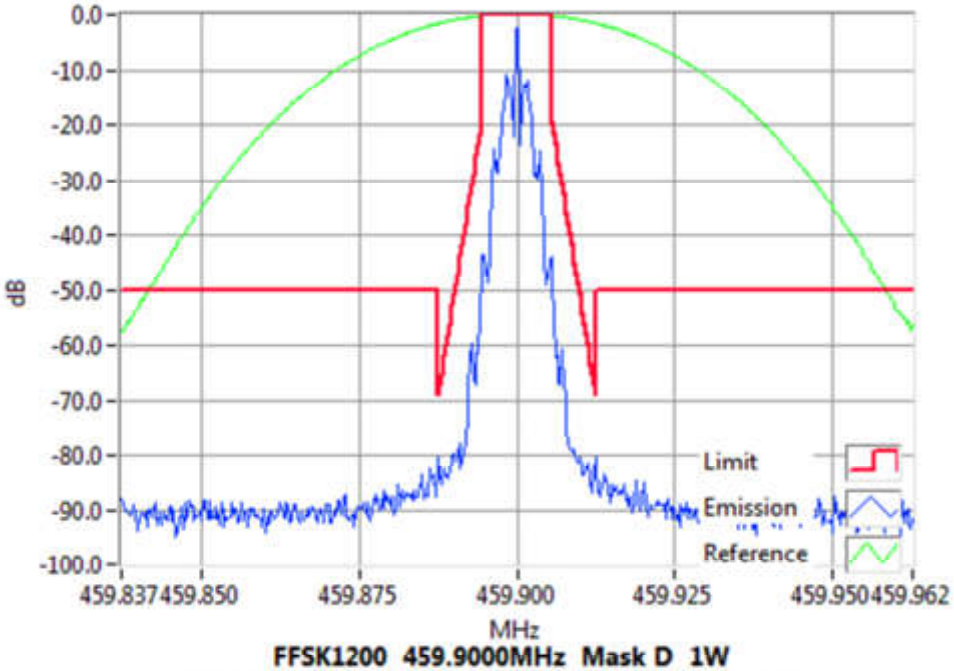
FFSK 1200 bps

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



FFSK1200 459.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing

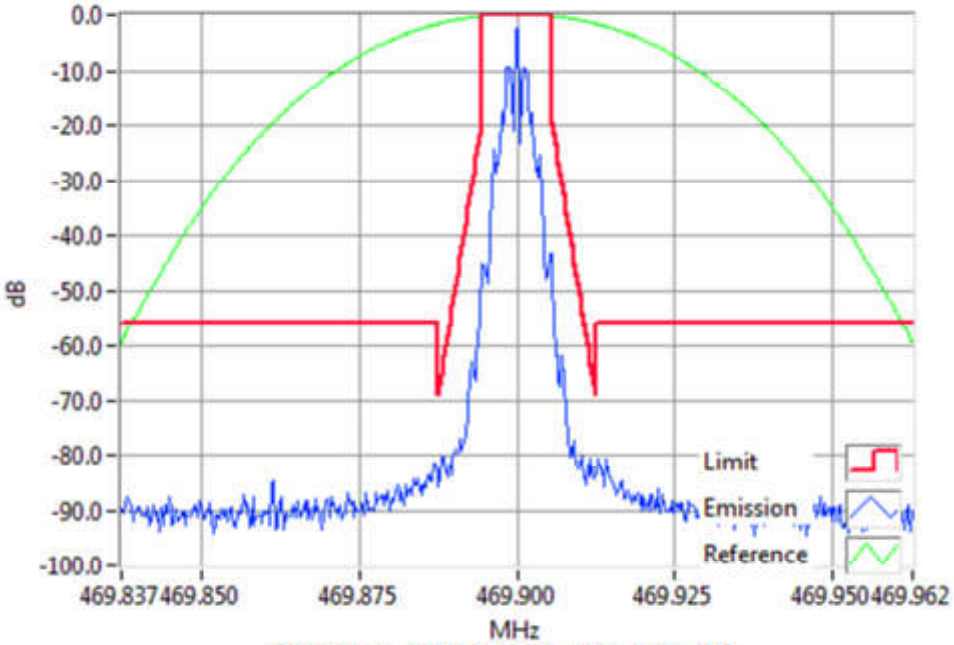


FFSK1200 459.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

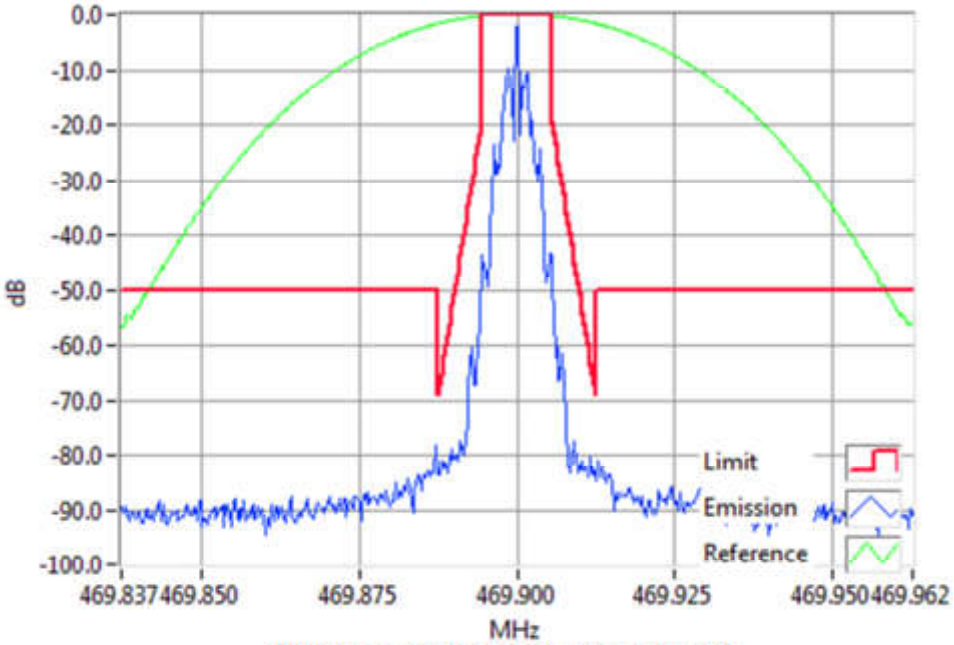
FFSK 1200 bps

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



FFSK1200 469.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 469.9 MHz 1 W 12.5 kHz Channel Spacing

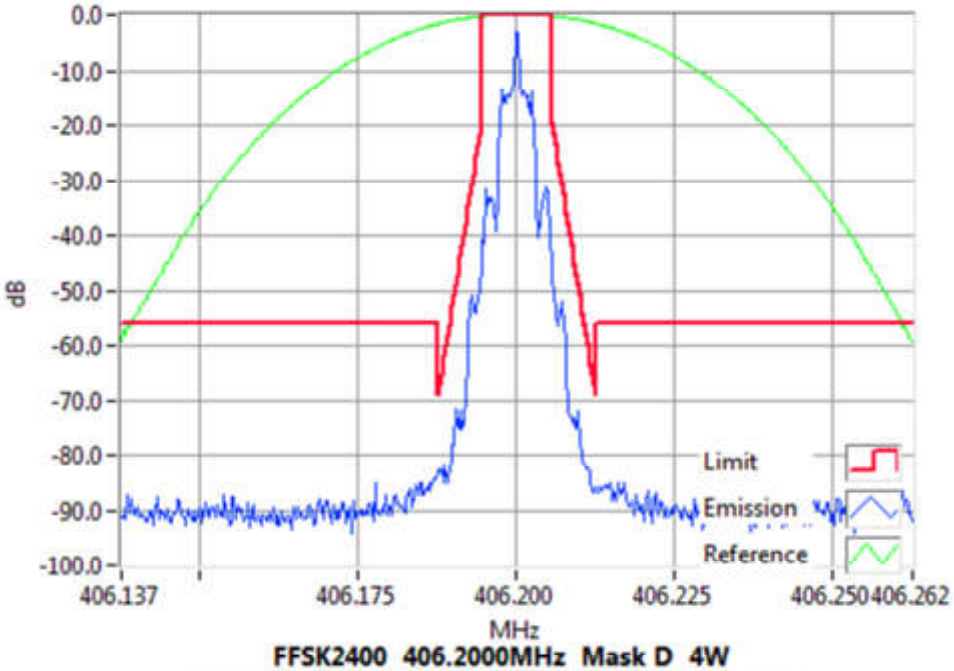


FFSK1200 469.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

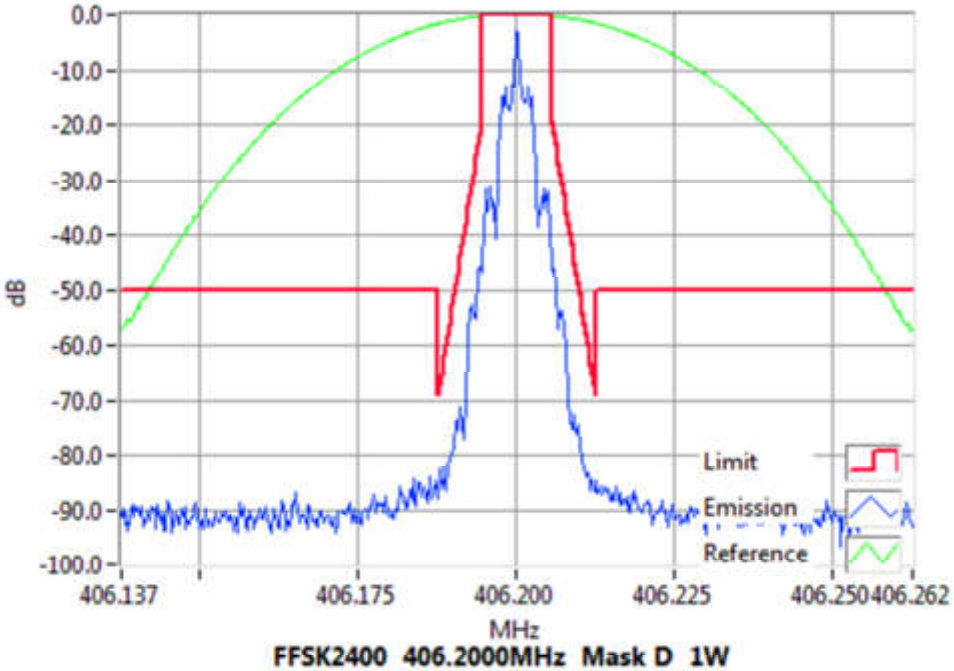
FFSK 2400 bps

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



FFSK2400 406.2000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 406.2 MHz 1 W 12.5 kHz Channel Spacing

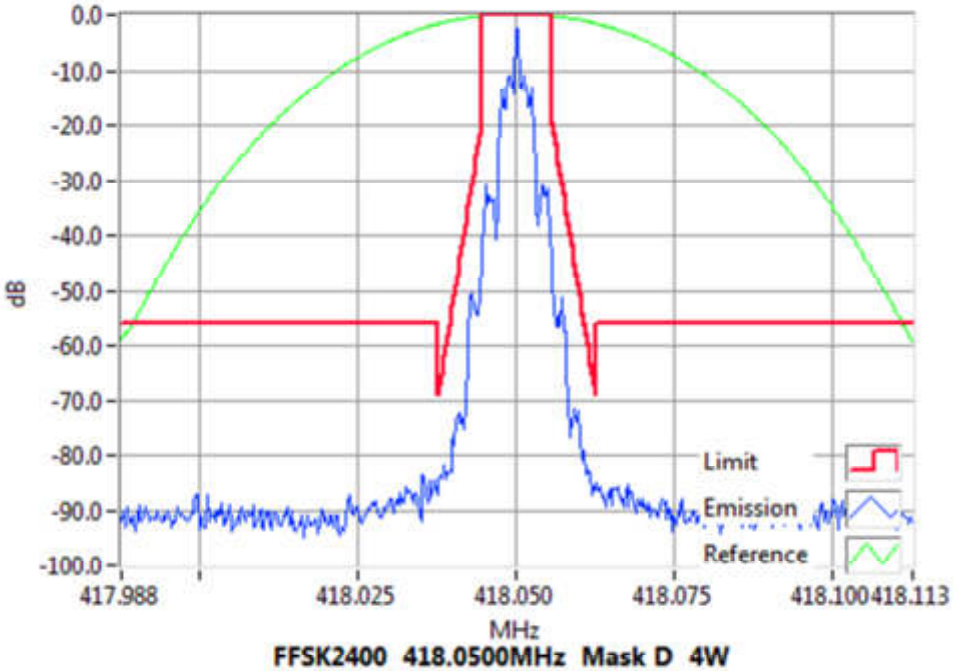


FFSK2400 406.2000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

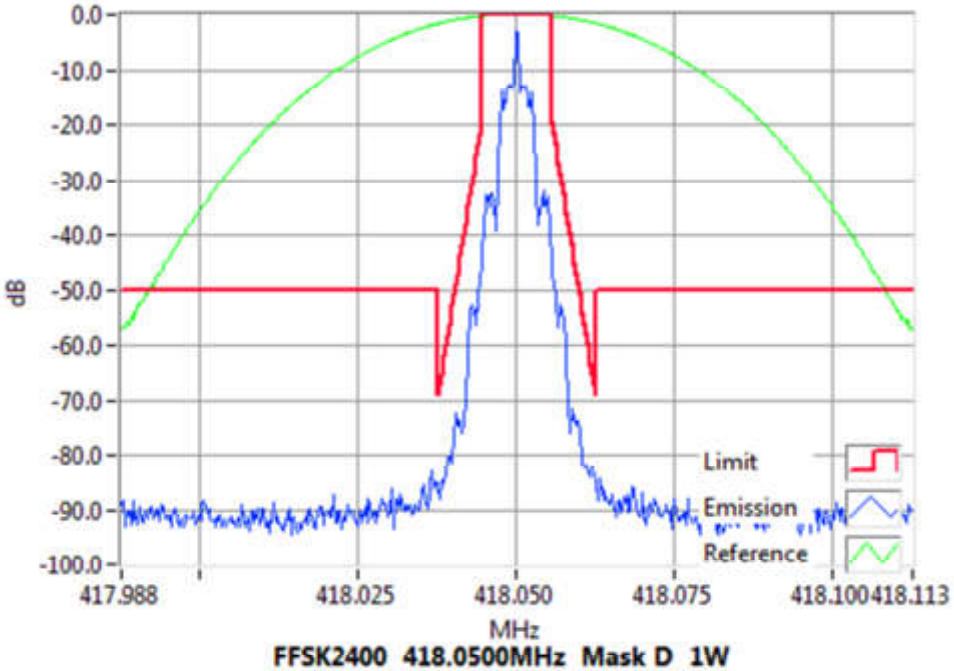
FFSK 2400 bps

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



FFSK2400 418.0500MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 418.05 MHz 1 W 12.5 kHz Channel Spacing

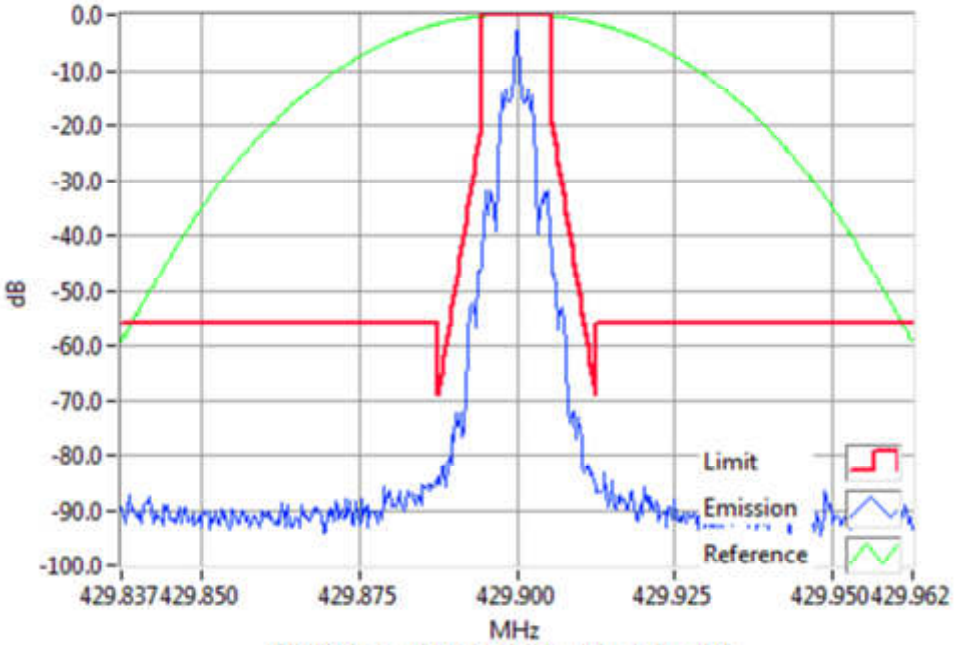


FFSK2400 418.0500MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

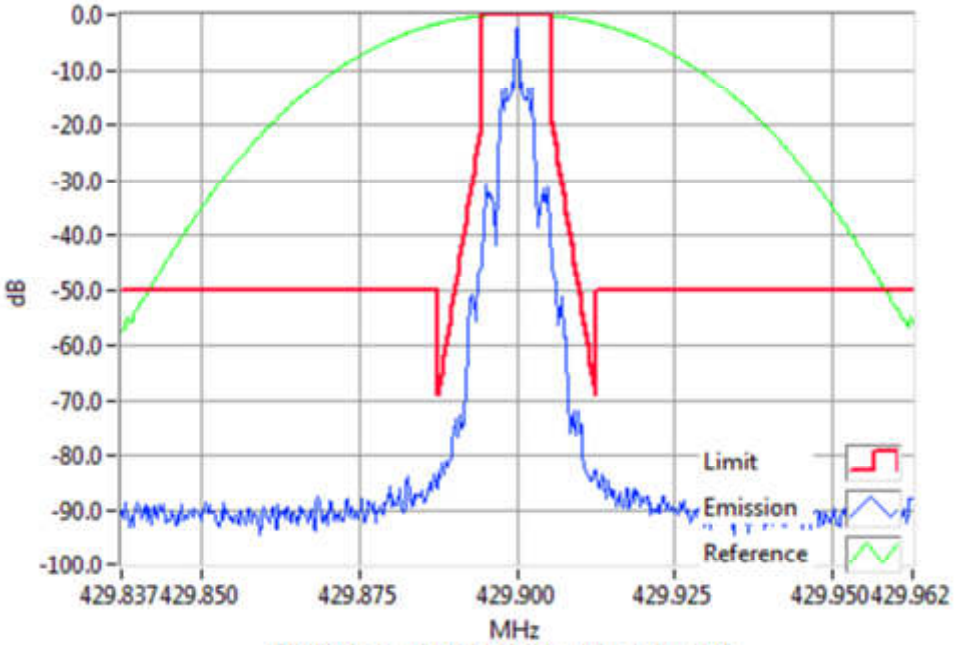
FFSK 2400 bps

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



FFSK2400 429.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing

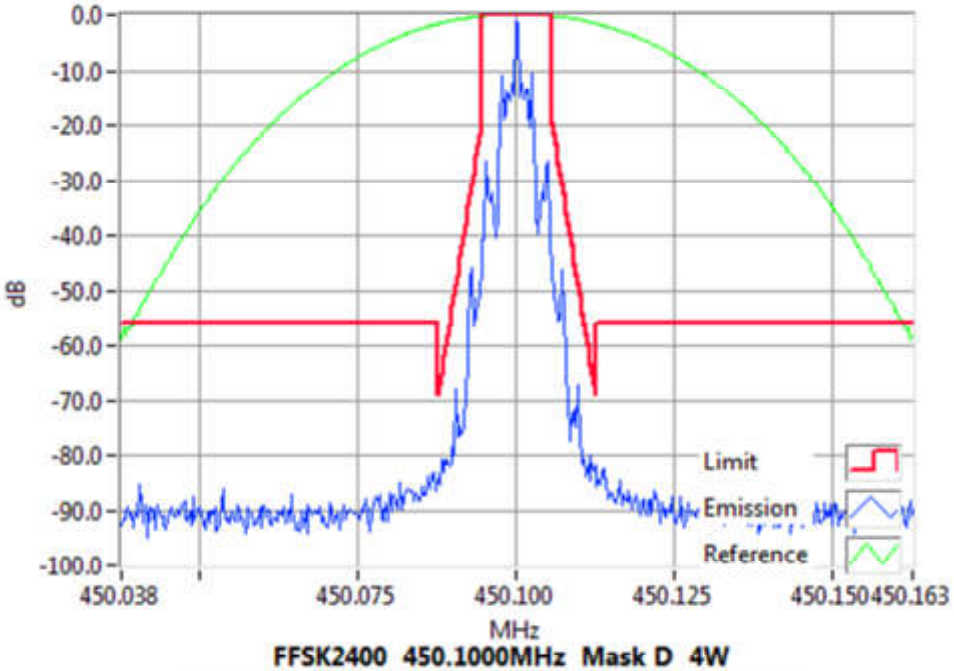


FFSK2400 429.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

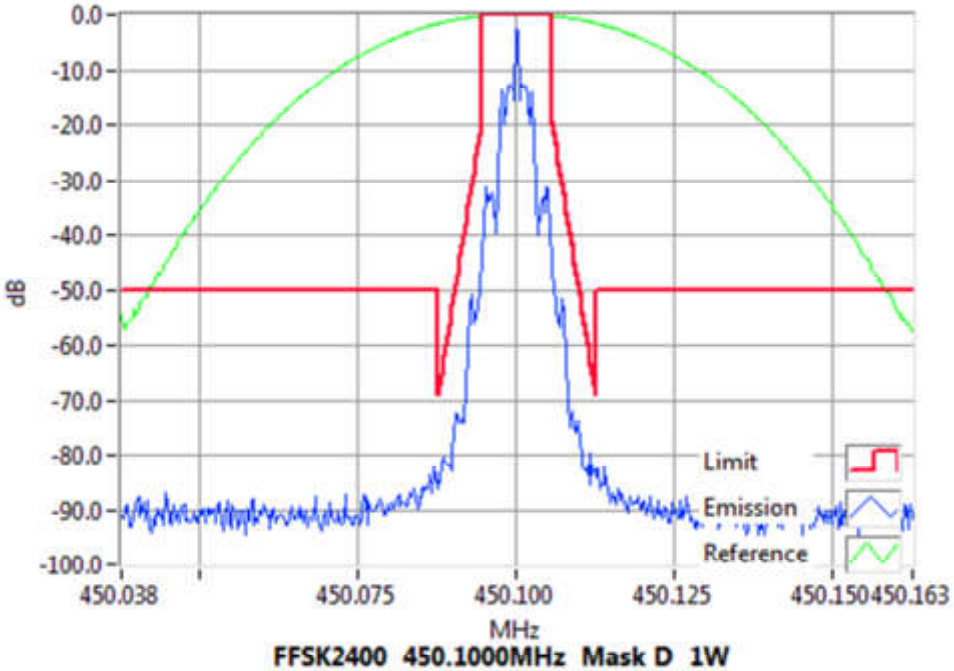
FFSK 2400 bps

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



FFSK2400 450.1000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 450.1 MHz 1 W 12.5 kHz Channel Spacing

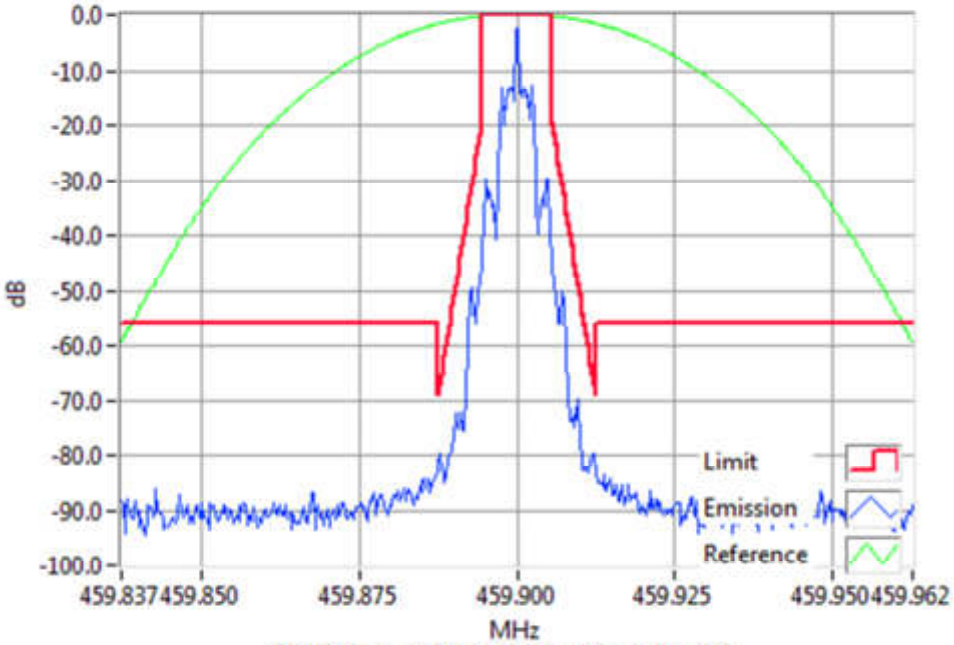


FFSK2400 450.1000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

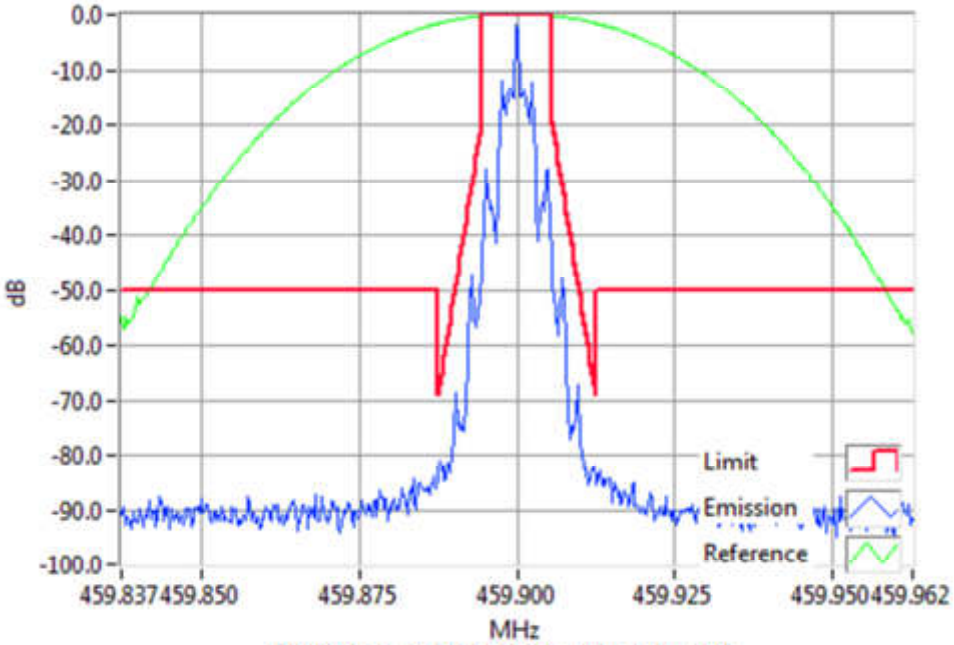
FFSK 2400 bps

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



FFSK2400 459.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing

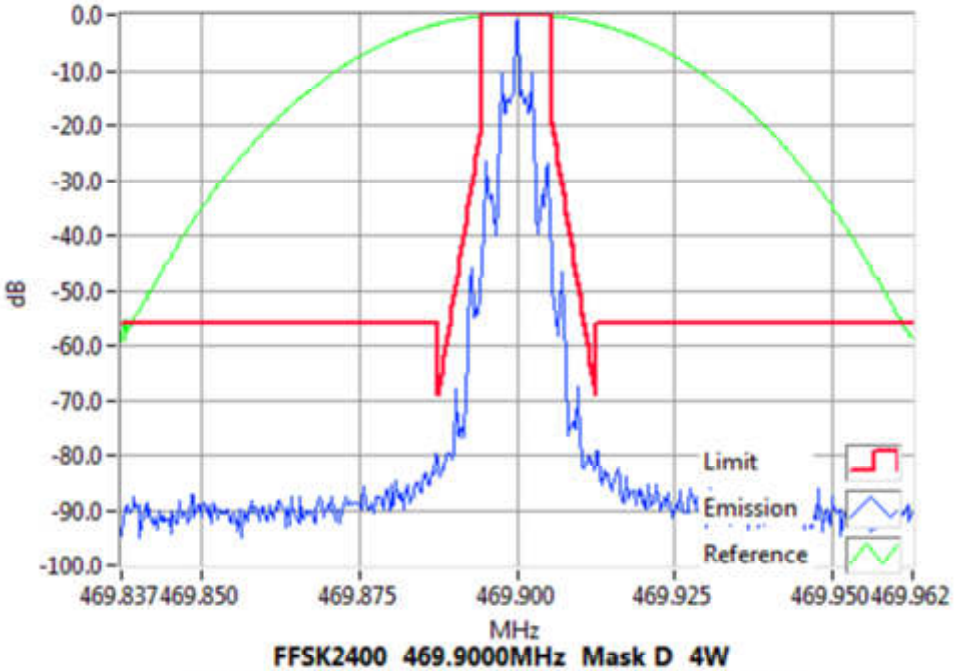


FFSK2400 459.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

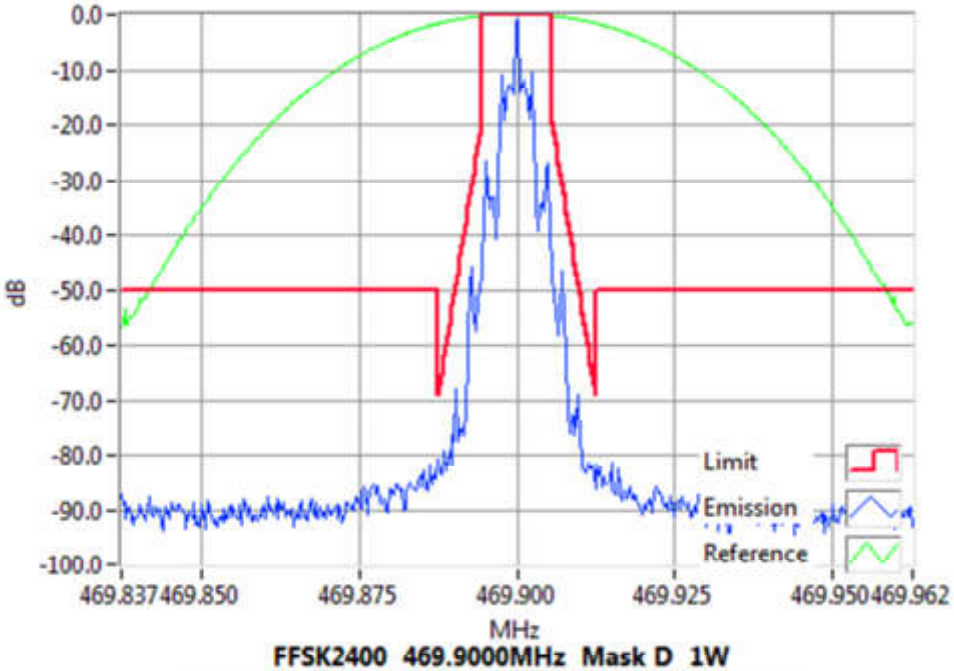
FFSK 2400 bps

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



FFSK2400 469.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 469.9 MHz 1 W 12.5 kHz Channel Spacing

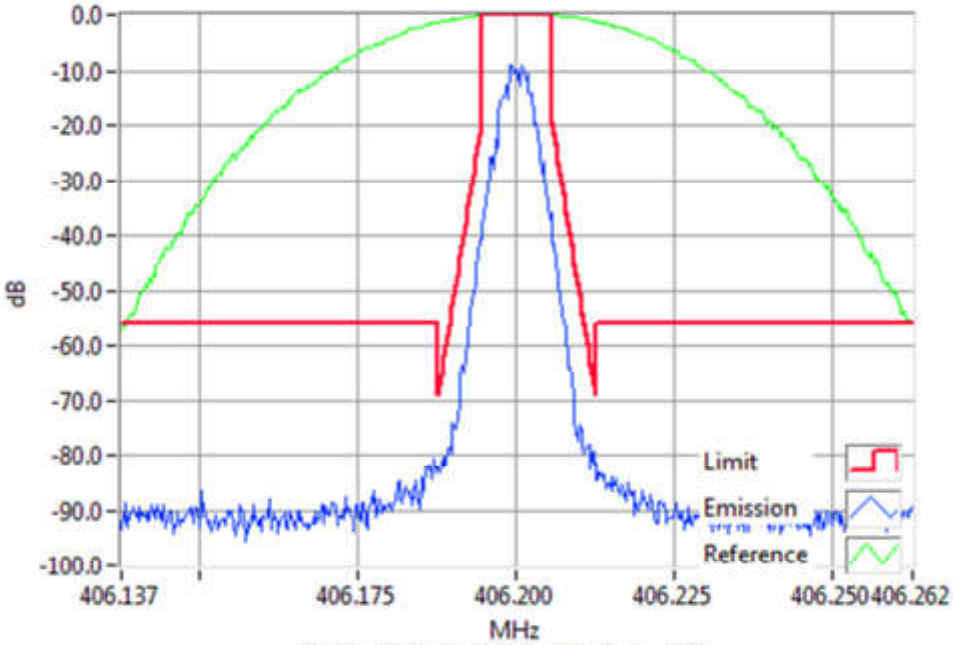


FFSK2400 469.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

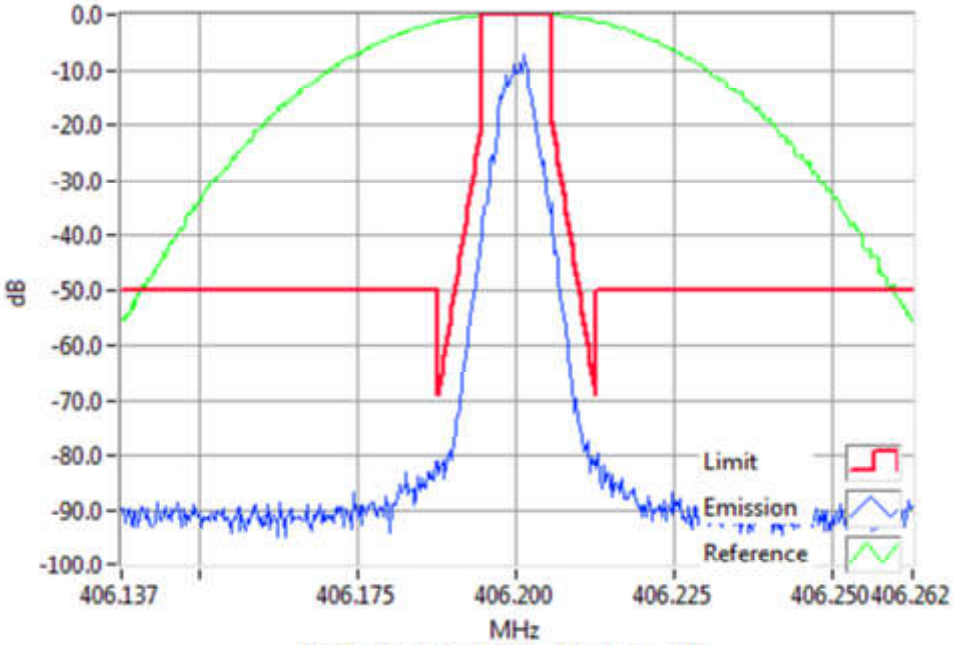
DMR

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



DMR 406.2000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 406.2 MHz 1 W 12.5 kHz Channel Spacing

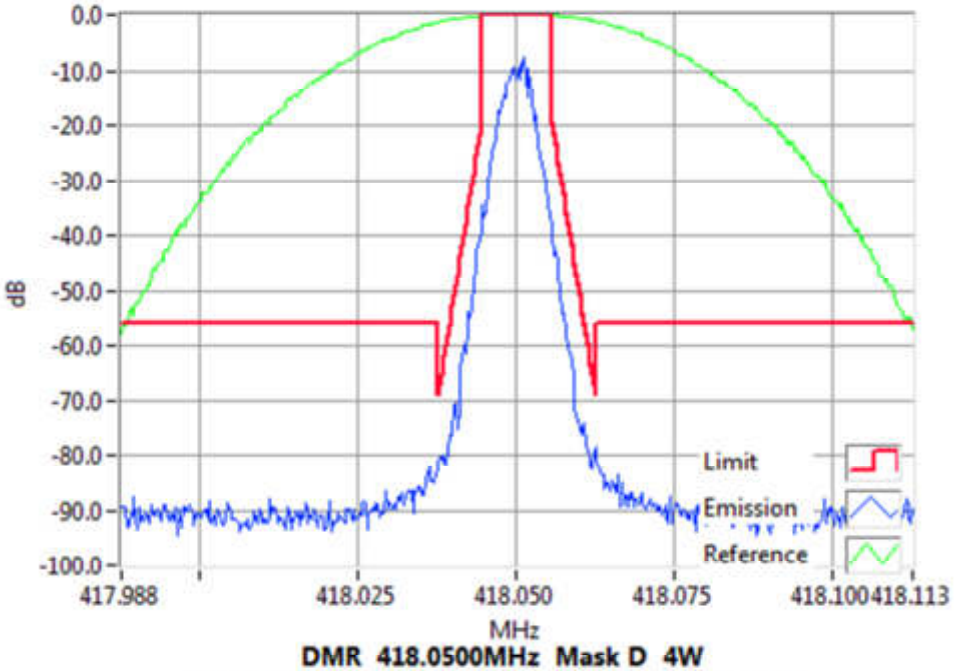


DMR 406.2000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

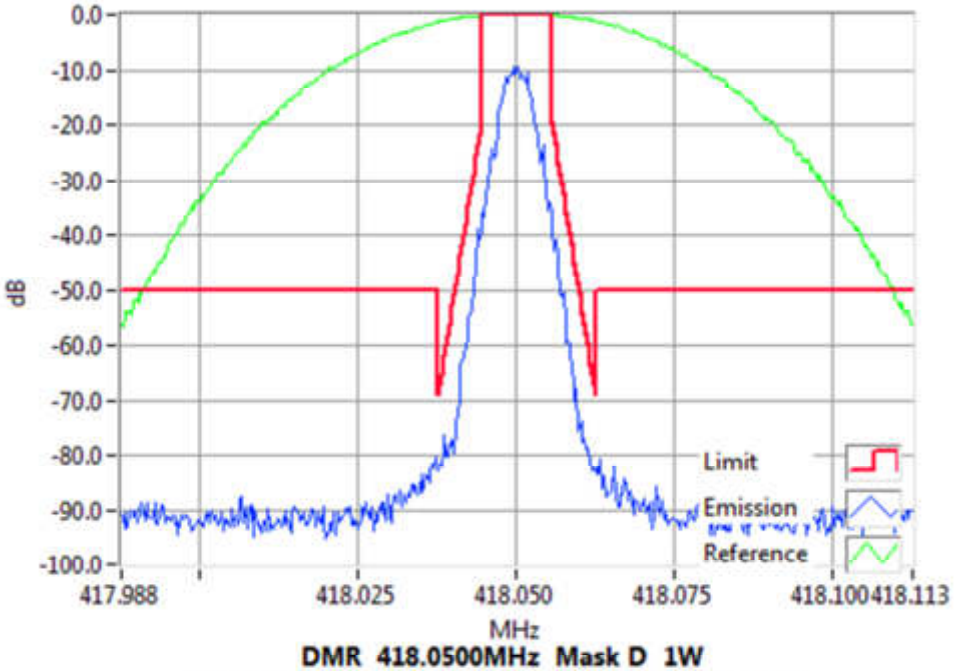
DMR

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



DMR 418.0500MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 418.05 MHz 1 W 12.5 kHz Channel Spacing

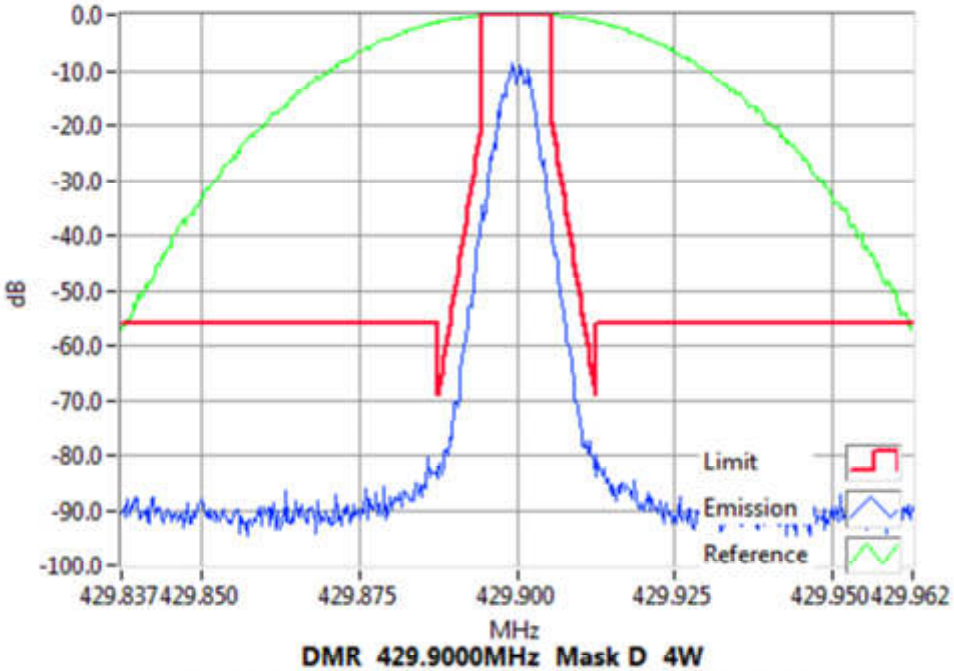


DMR 418.0500MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

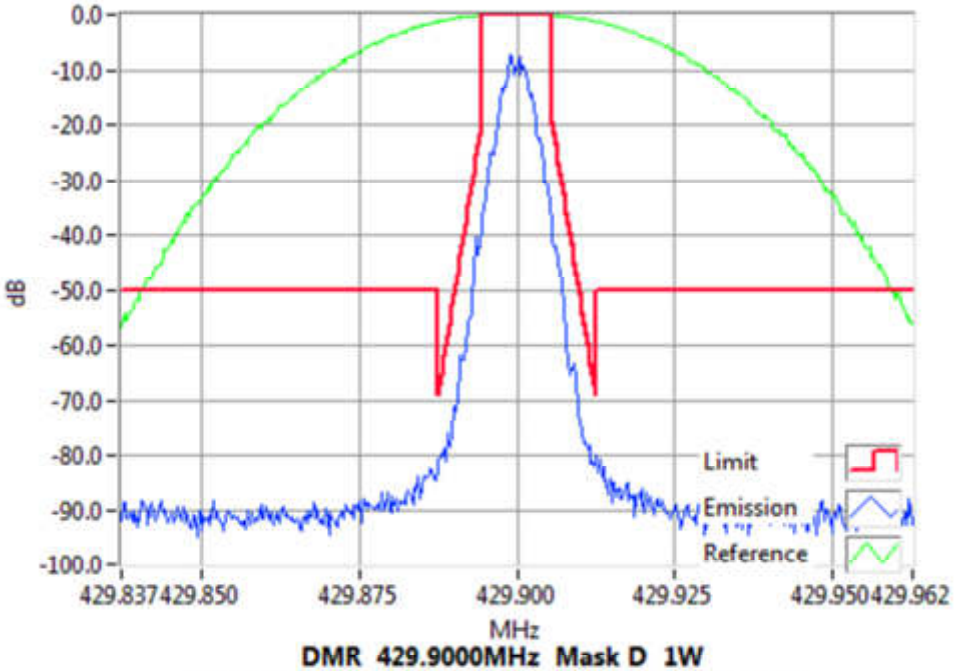
DMR

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



DMR 429.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing

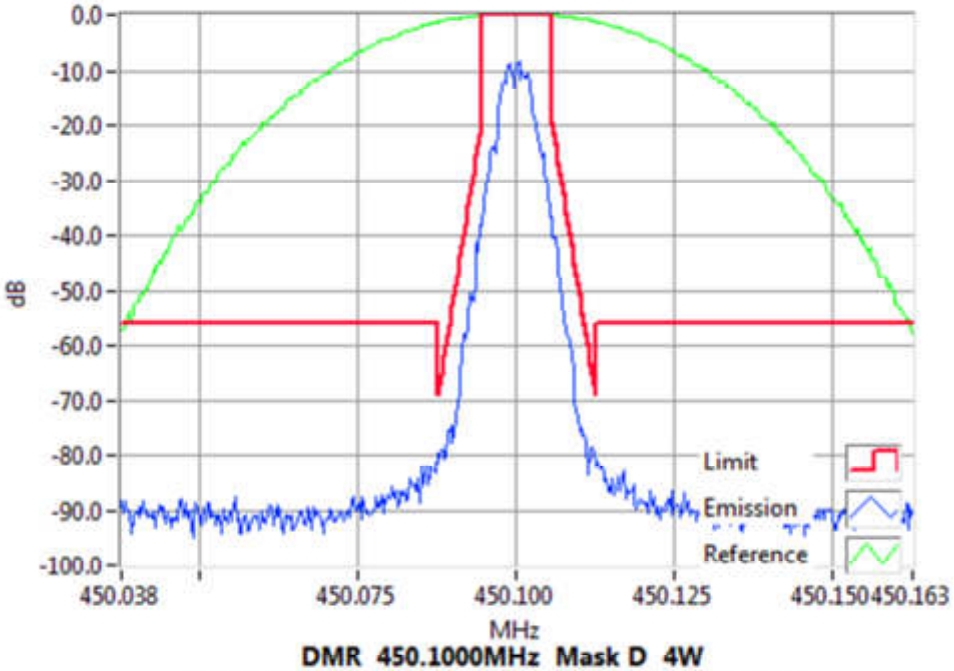


DMR 429.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

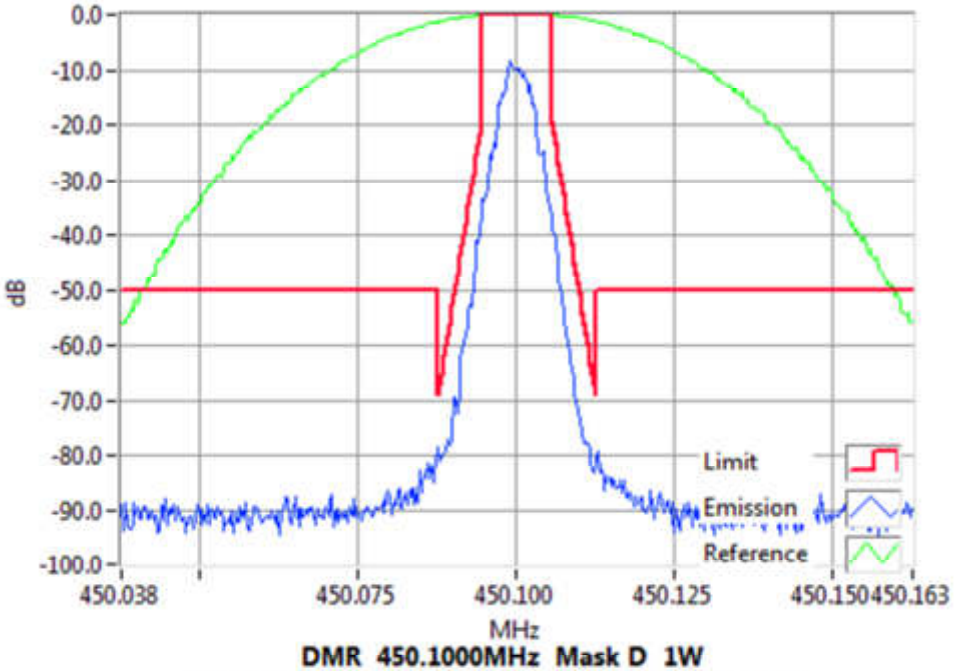
DMR

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



DMR 450.1000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 450.1 MHz 1 W 12.5 kHz Channel Spacing

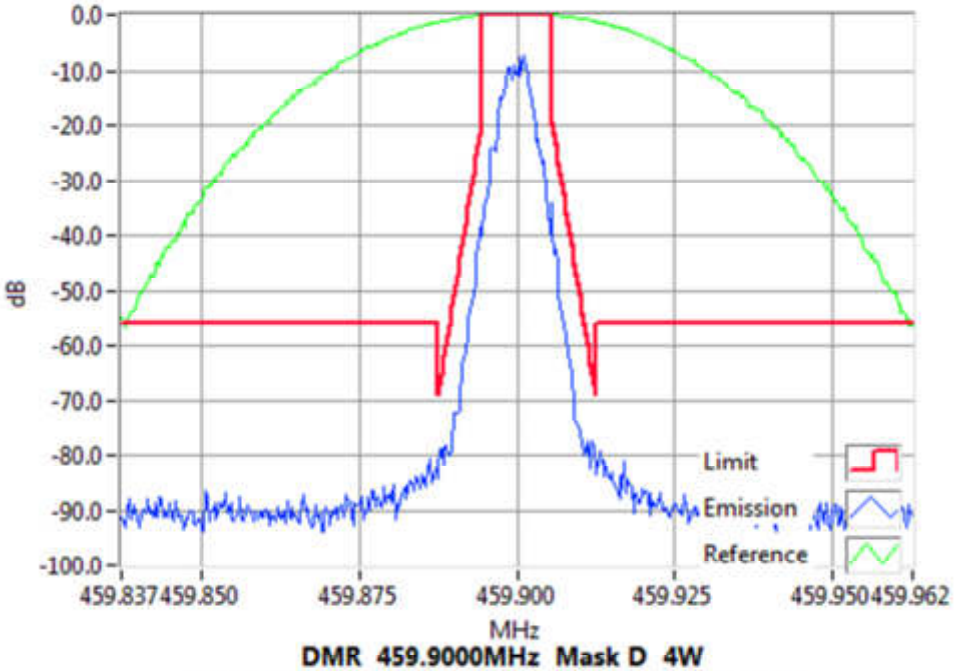


DMR 450.1000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

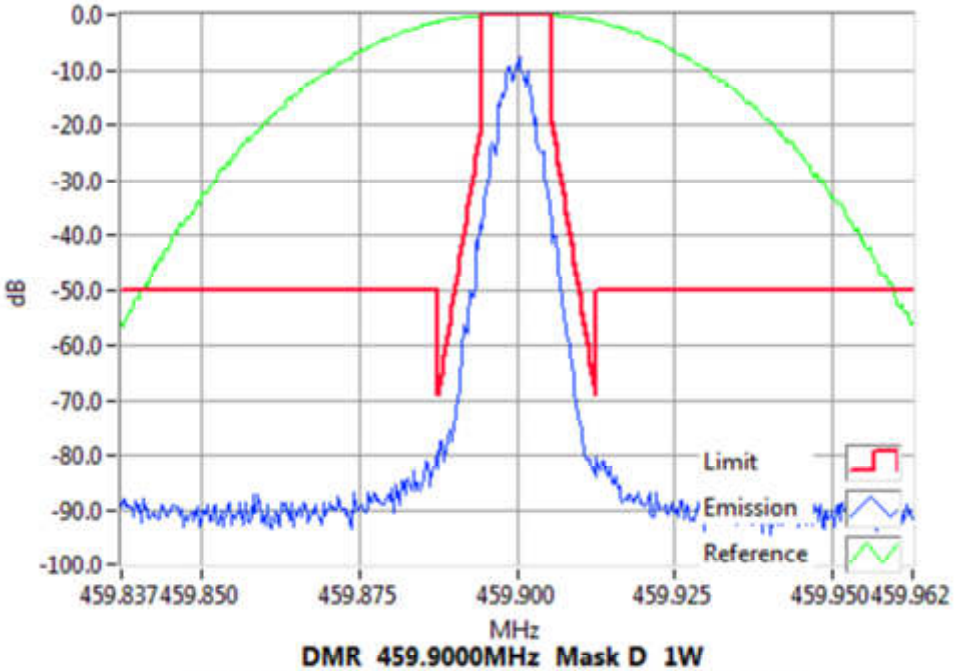
DMR

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



DMR 459.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing

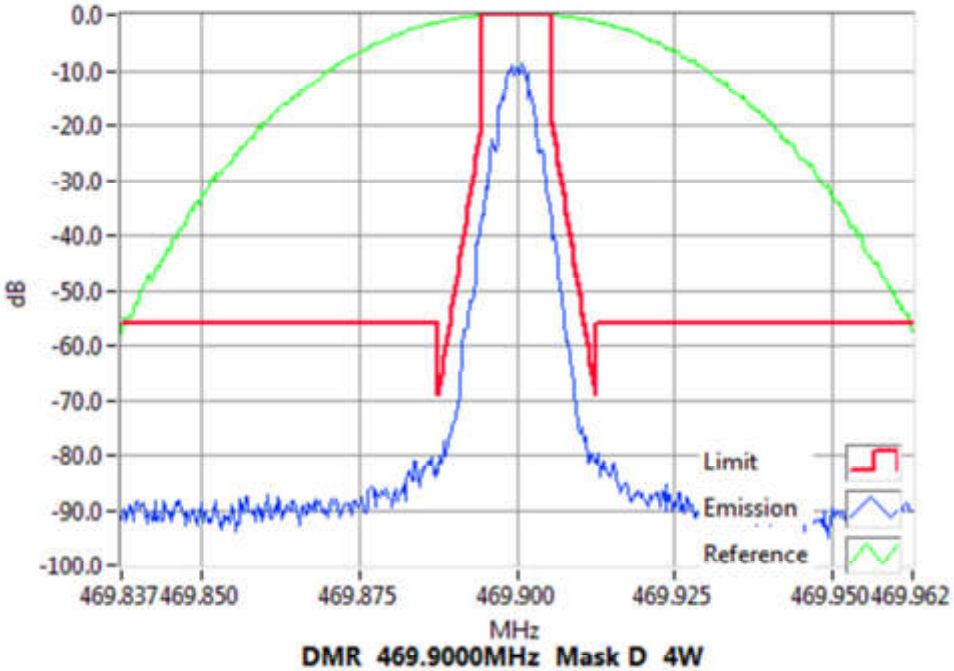


DMR 459.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

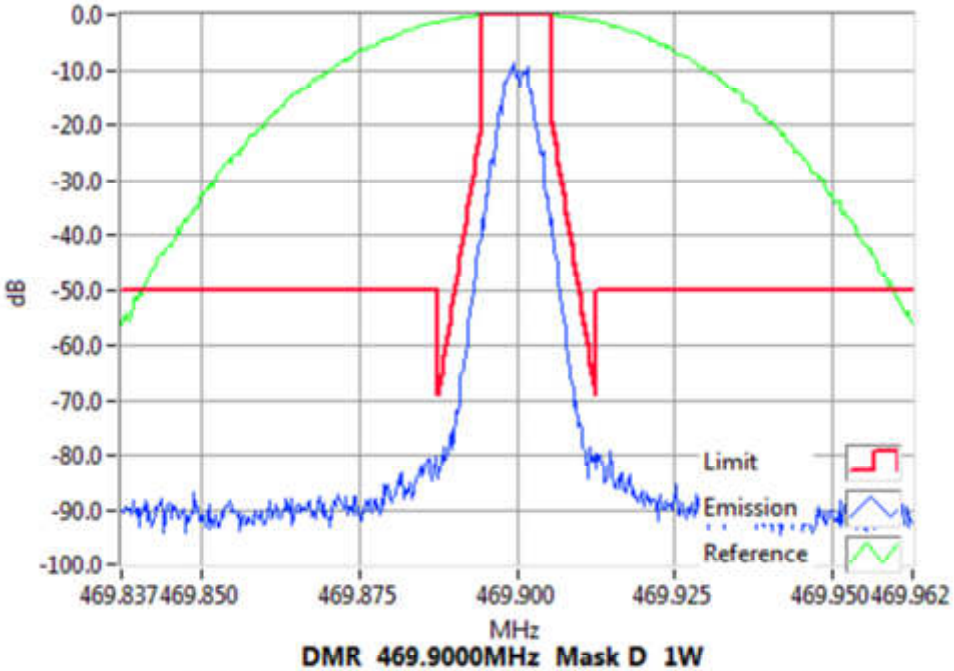
DMR

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



DMR 469.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 469.9 MHz 1 W 12.5 kHz Channel Spacing

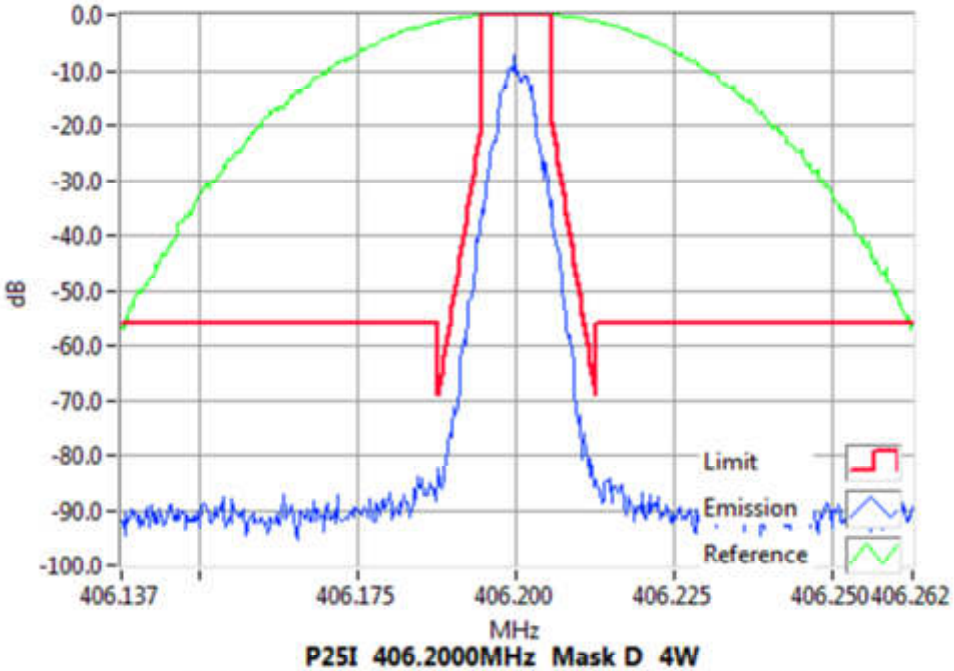


DMR 469.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

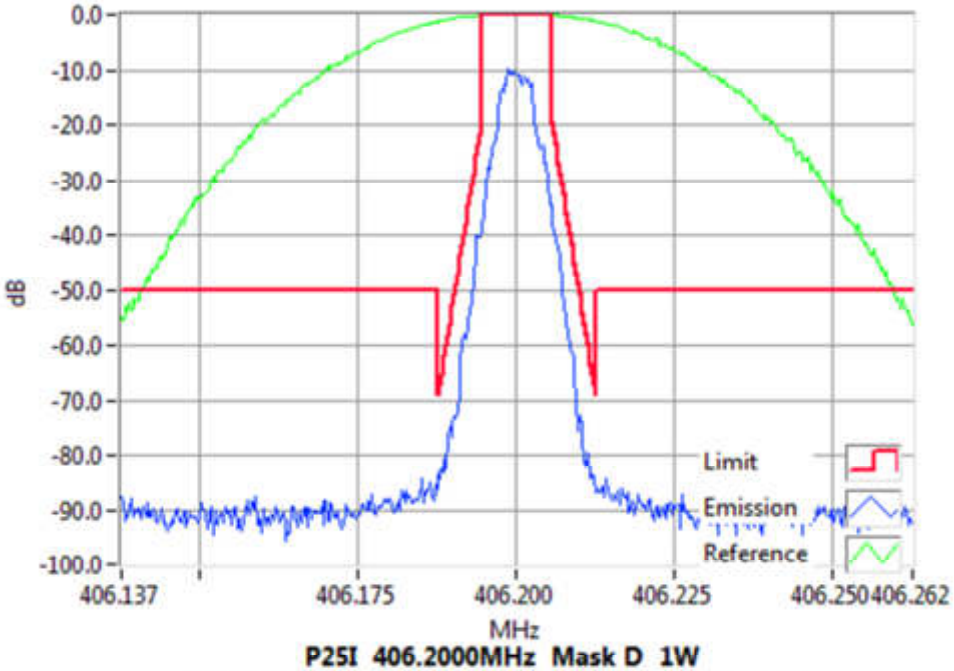
APCO P25 phase-1

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



P25I 406.2000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 406.2 MHz 1 W 12.5 kHz Channel Spacing

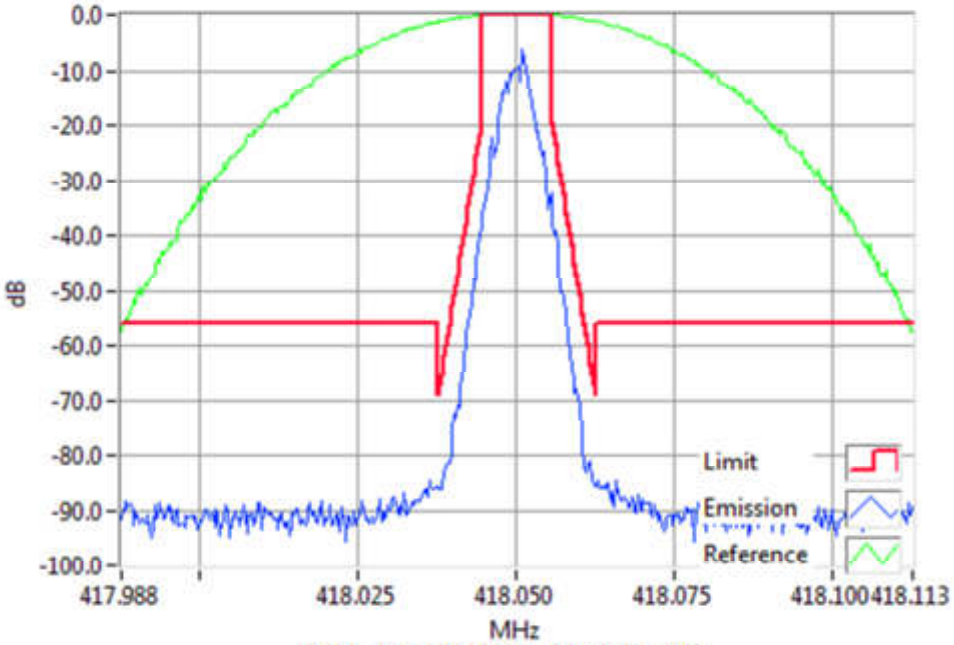


P25I 406.2000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

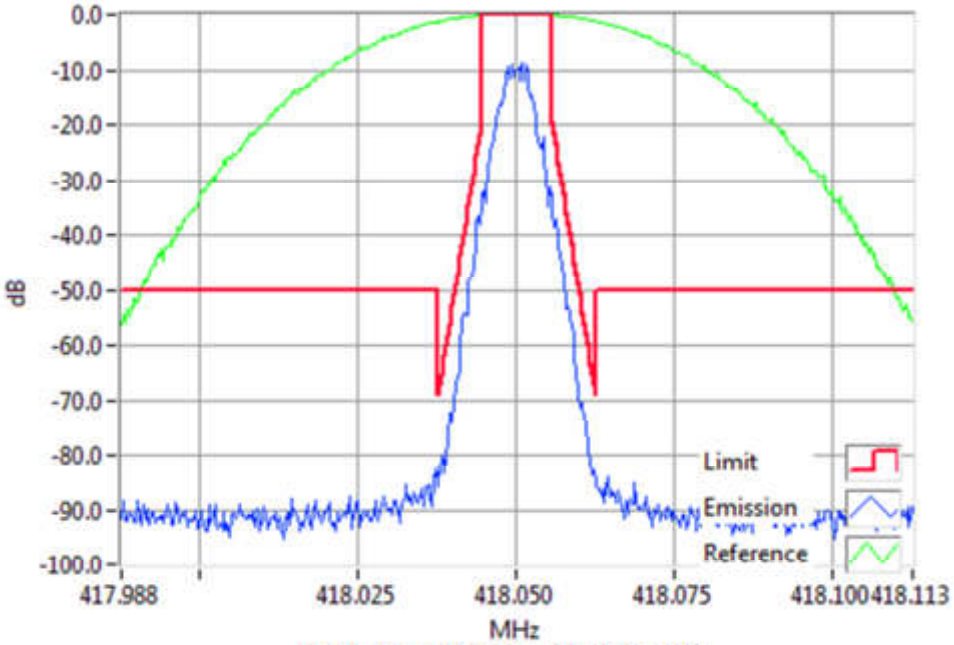
APCO P25 phase-1

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



P25I 418.0500MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 418.05 MHz 1 W 12.5 kHz Channel Spacing

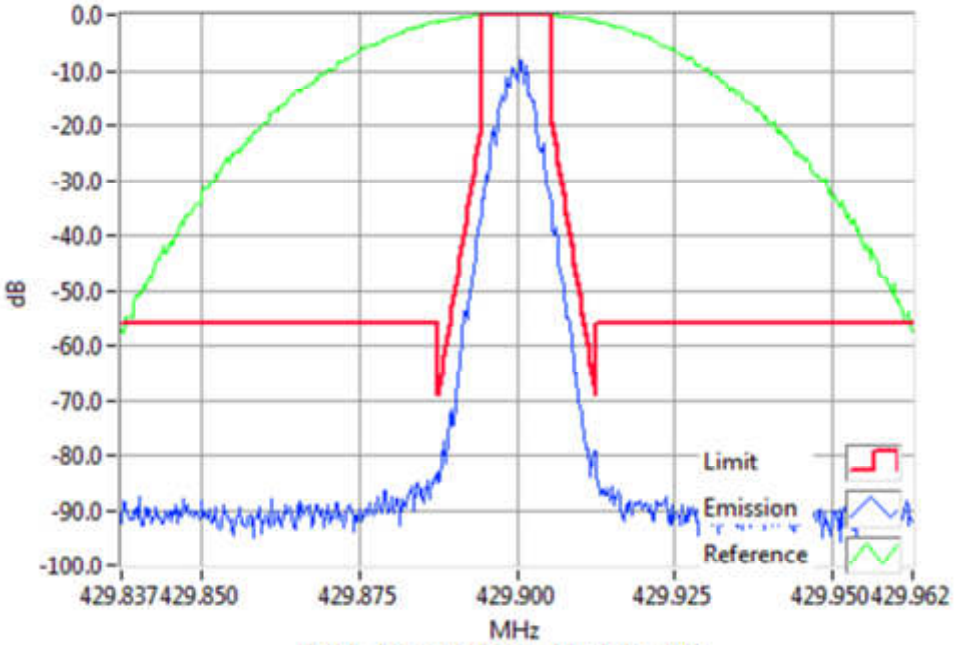


P25I 418.0500MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

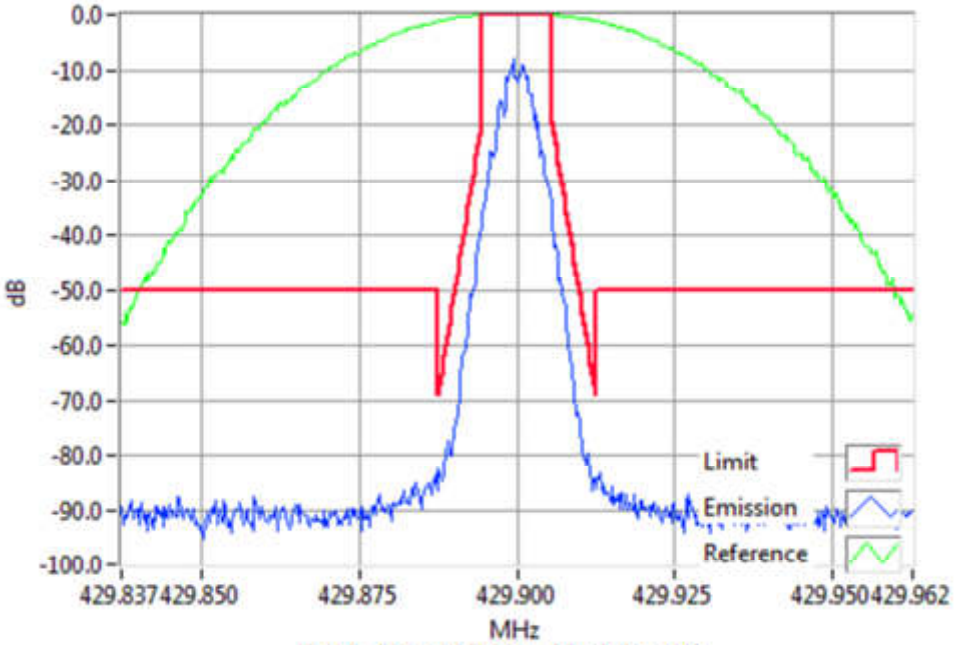
APCO P25 phase-1

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



P25I 429.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing

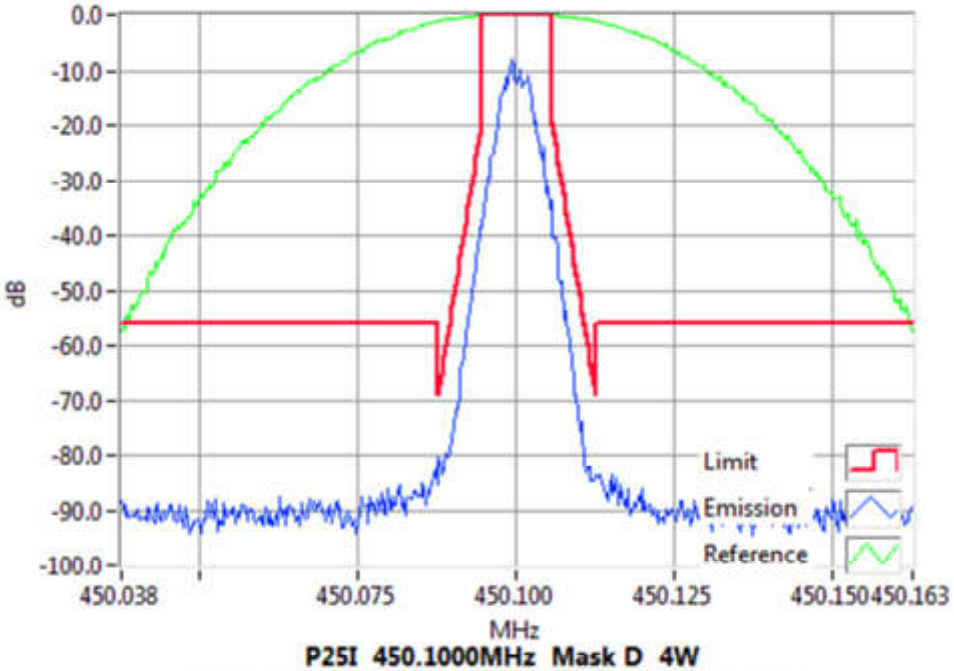


P25I 429.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

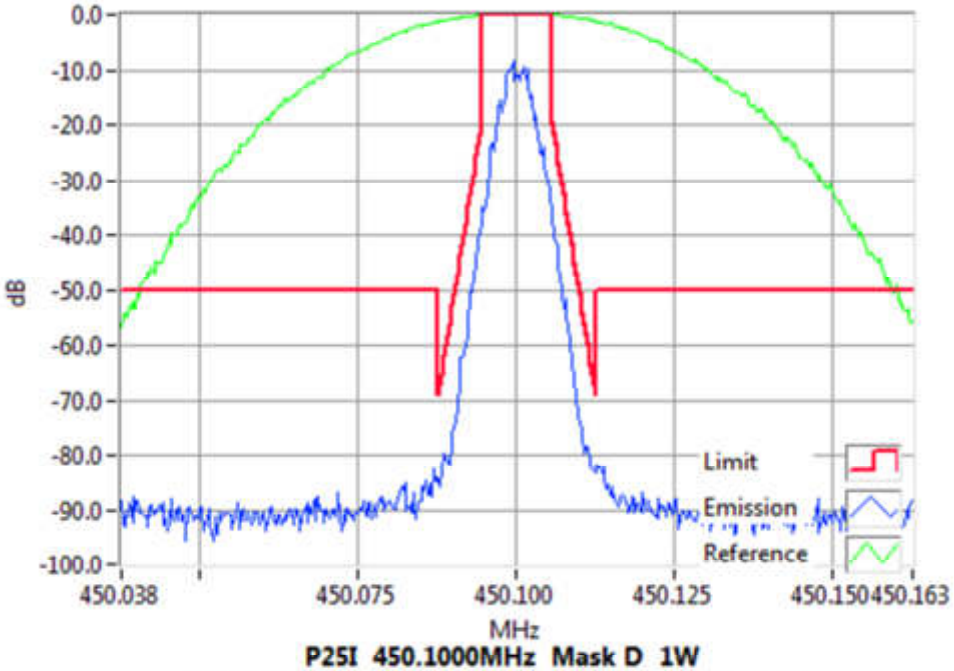
APCO P25 phase-1

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



P25I 450.1000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 450.1 MHz 1 W 12.5 kHz Channel Spacing

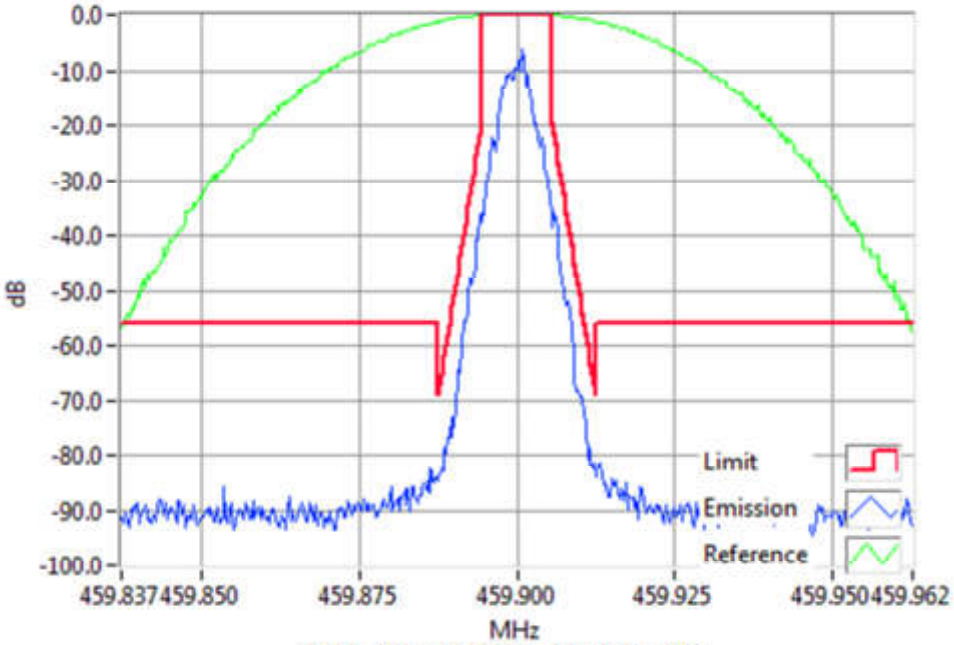


P25I 450.1000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

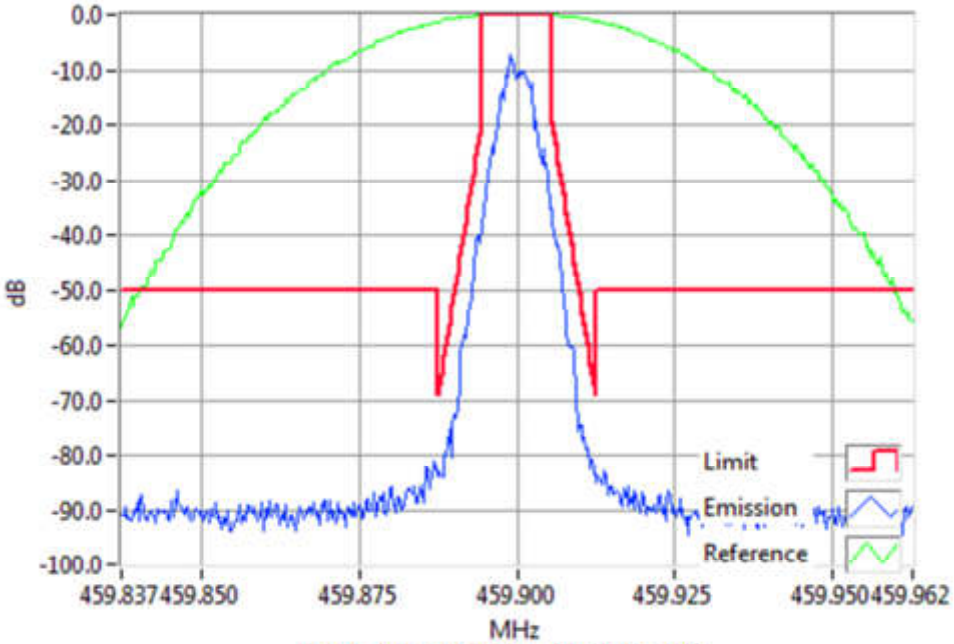
APCO P25 phase-1

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



P25I 459.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing

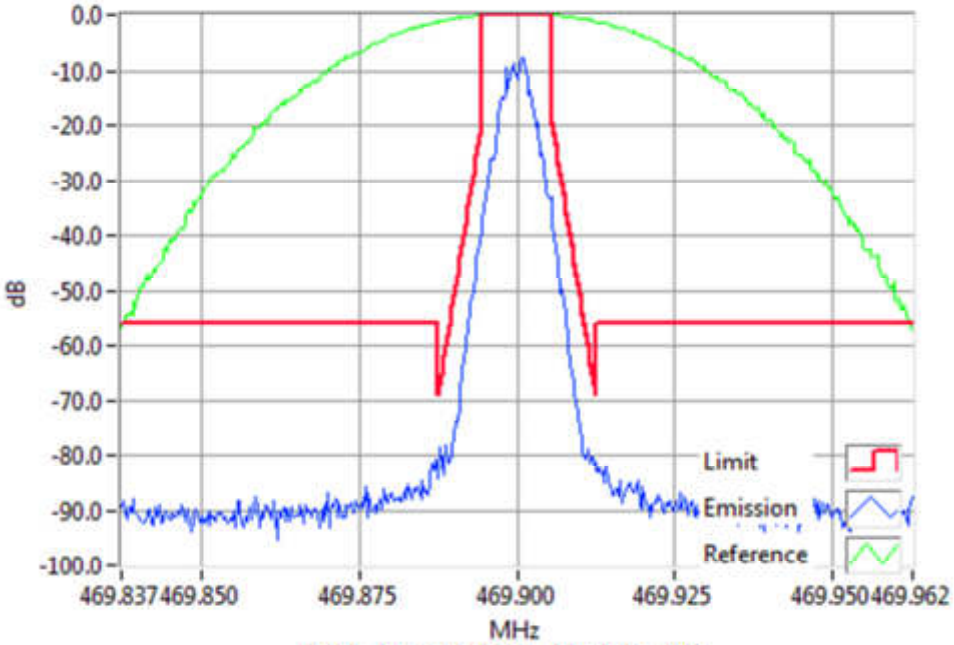


P25I 459.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

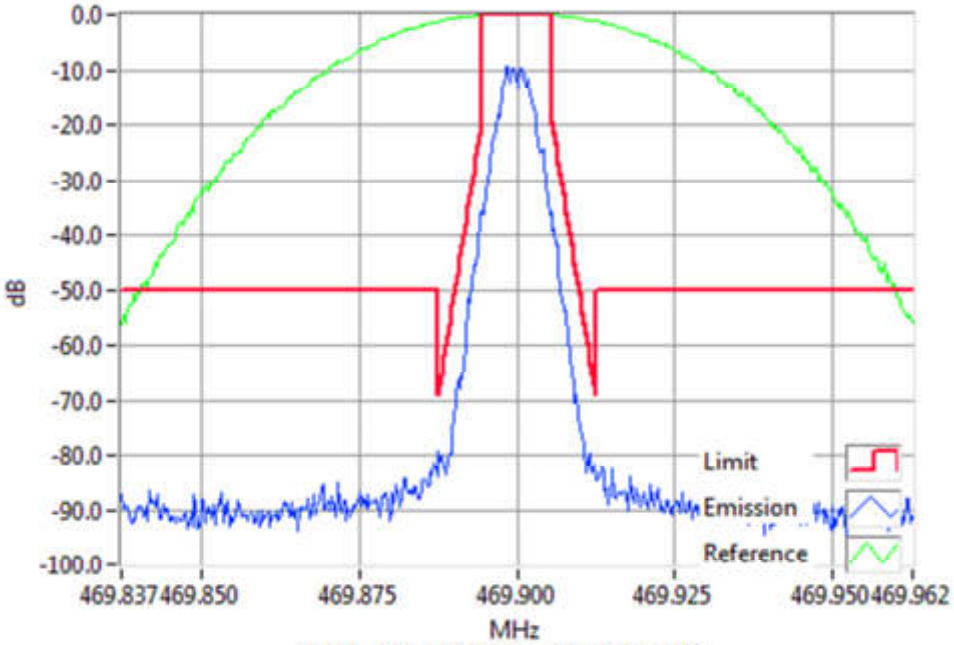
APCO P25 phase-1

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



P25I 469.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 469.9 MHz 1 W 12.5 kHz Channel Spacing

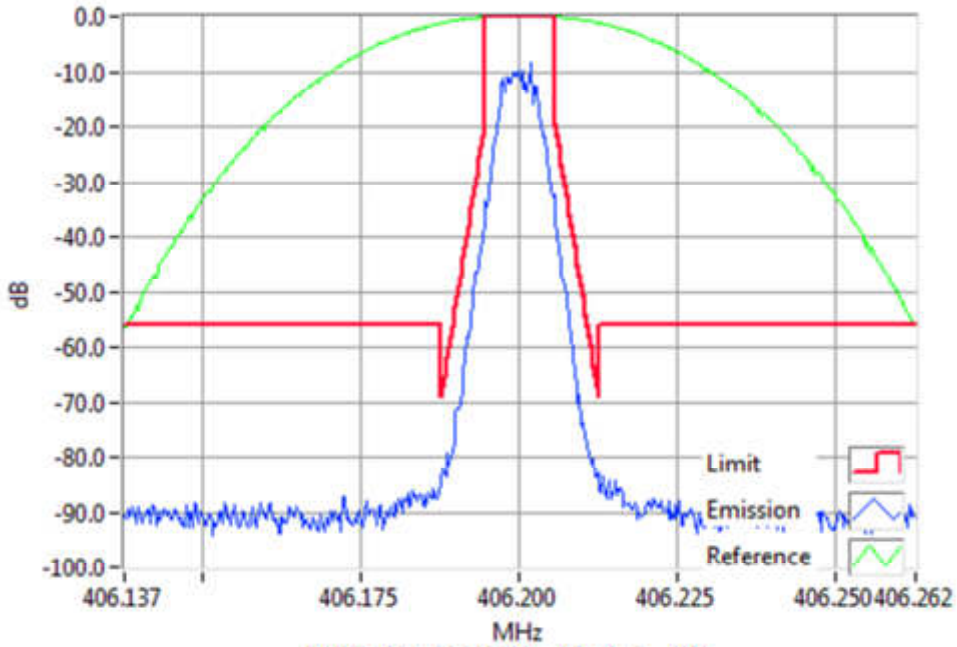


P25I 469.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

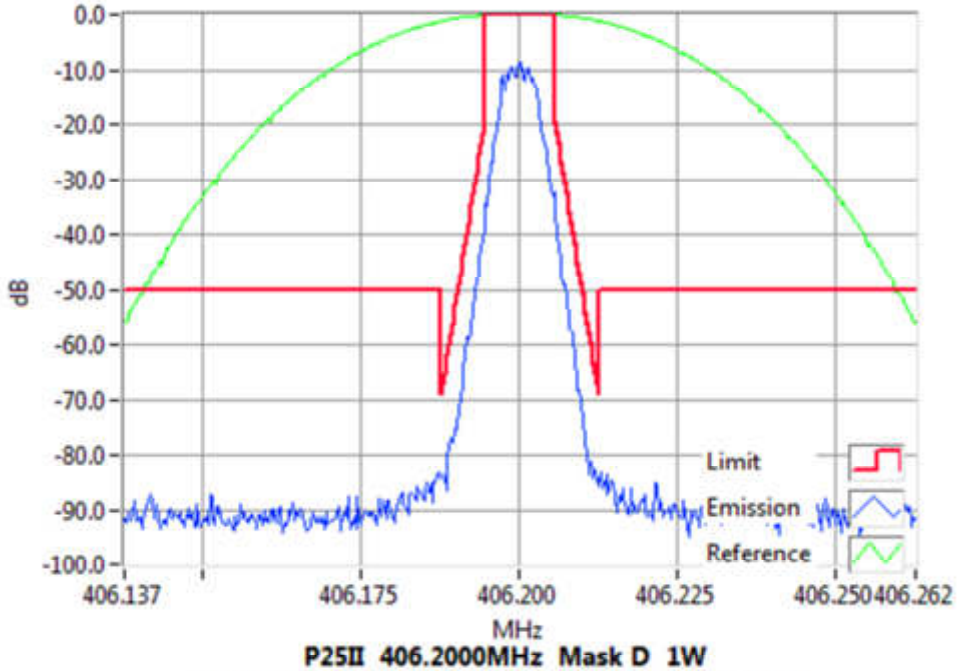
APCO P25 phase-2

Tx FREQUENCY: 406.2 MHz 4 W 12.5 kHz Channel Spacing



P25II 406.2000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 406.2 MHz 1 W 12.5 kHz Channel Spacing

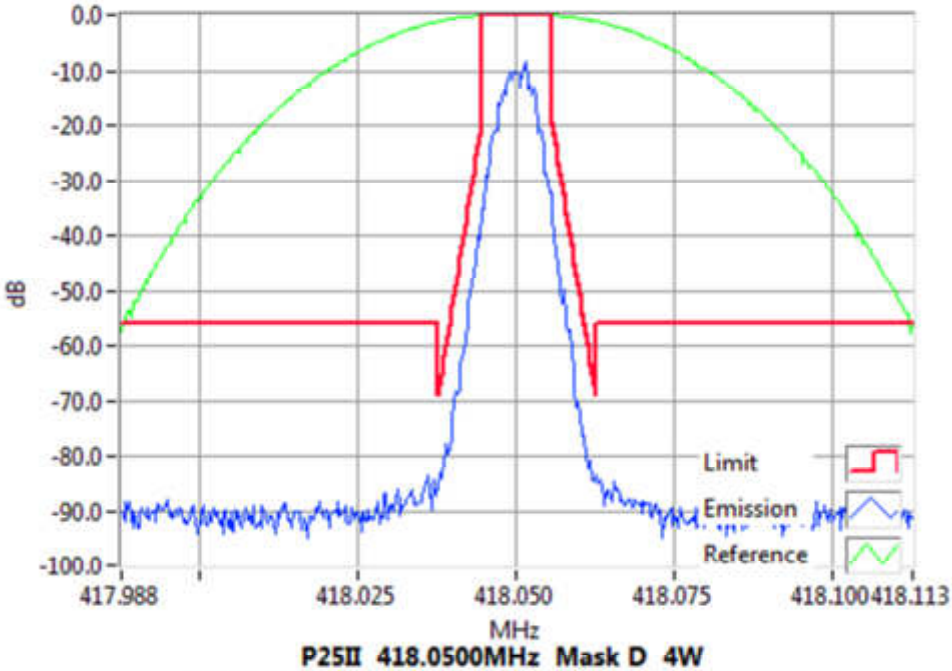


P25II 406.2000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

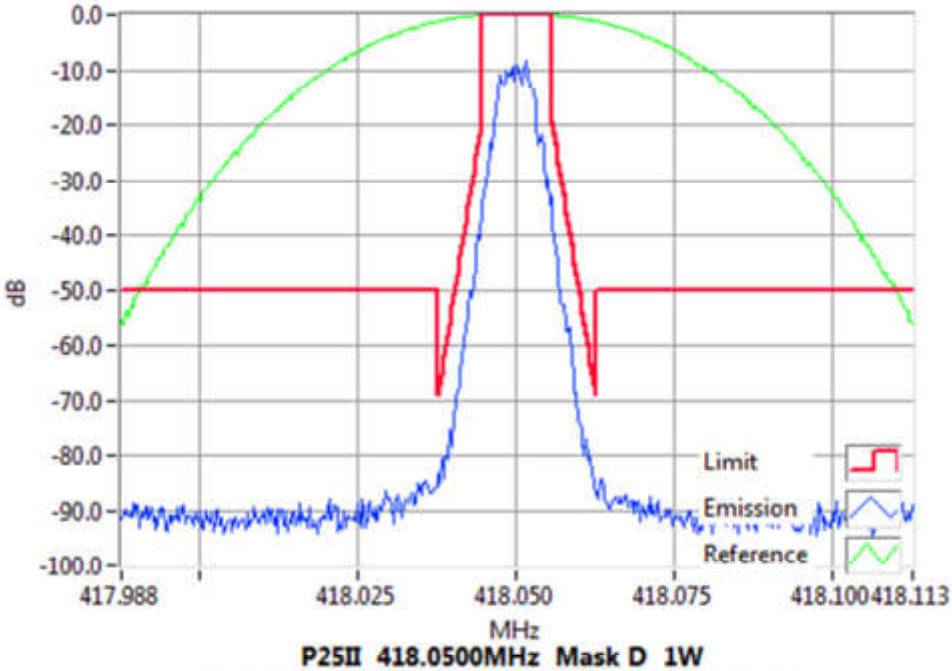
APCO P25 phase-2

Tx FREQUENCY: 418.05 MHz 4 W 12.5 kHz Channel Spacing



P25II 418.0500MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 418.05 MHz 1 W 12.5 kHz Channel Spacing

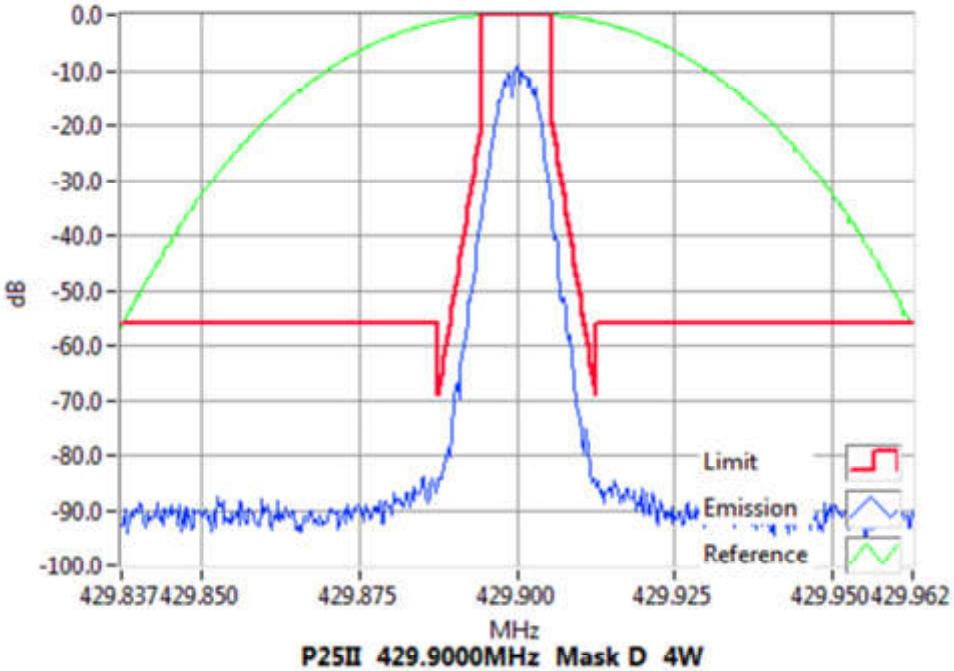


P25II 418.0500MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

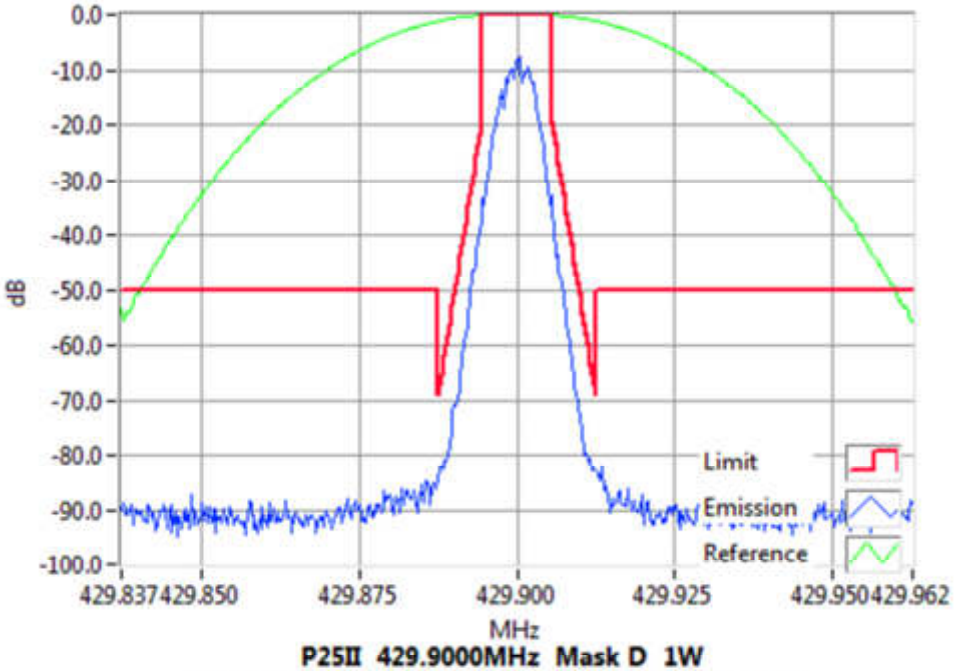
APCO P25 phase-2

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing



P25II 429.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing

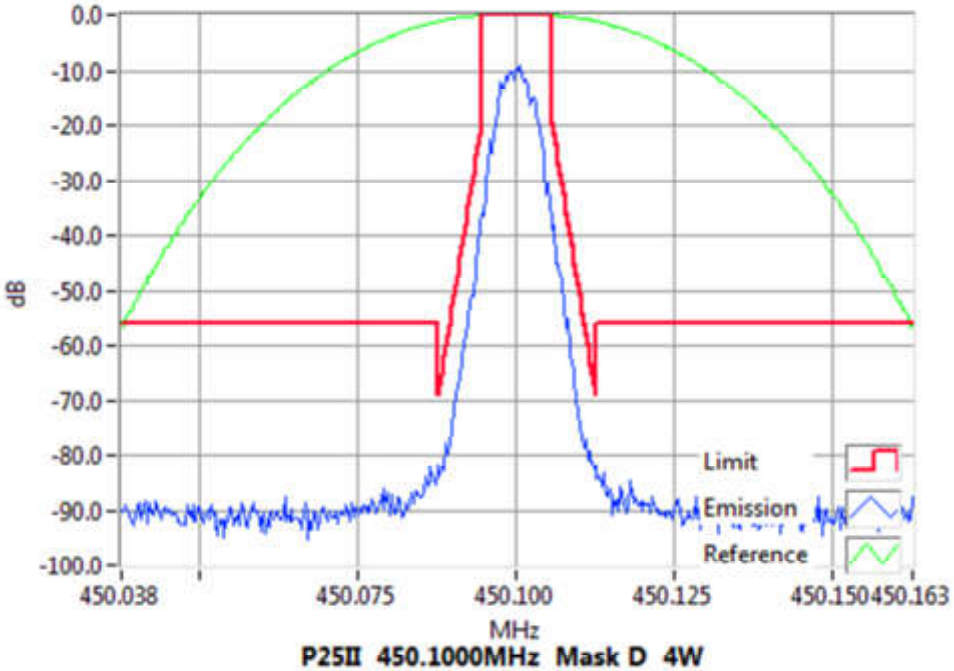


P25II 429.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

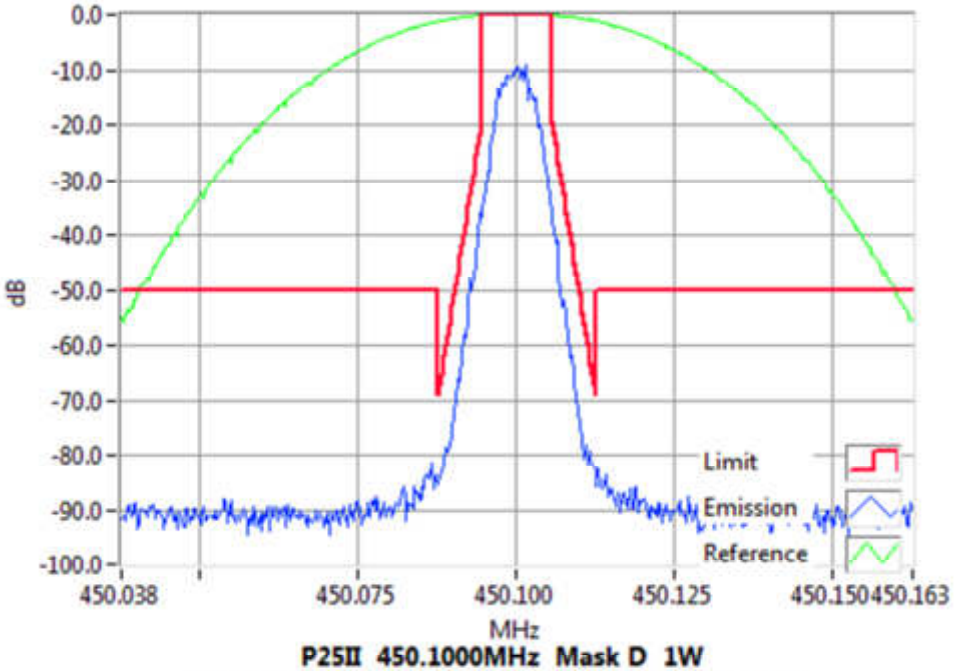
APCO P25 phase-2

Tx FREQUENCY: 450.1 MHz 4 W 12.5 kHz Channel Spacing



P25II 450.1000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 450.1 MHz 1 W 12.5 kHz Channel Spacing

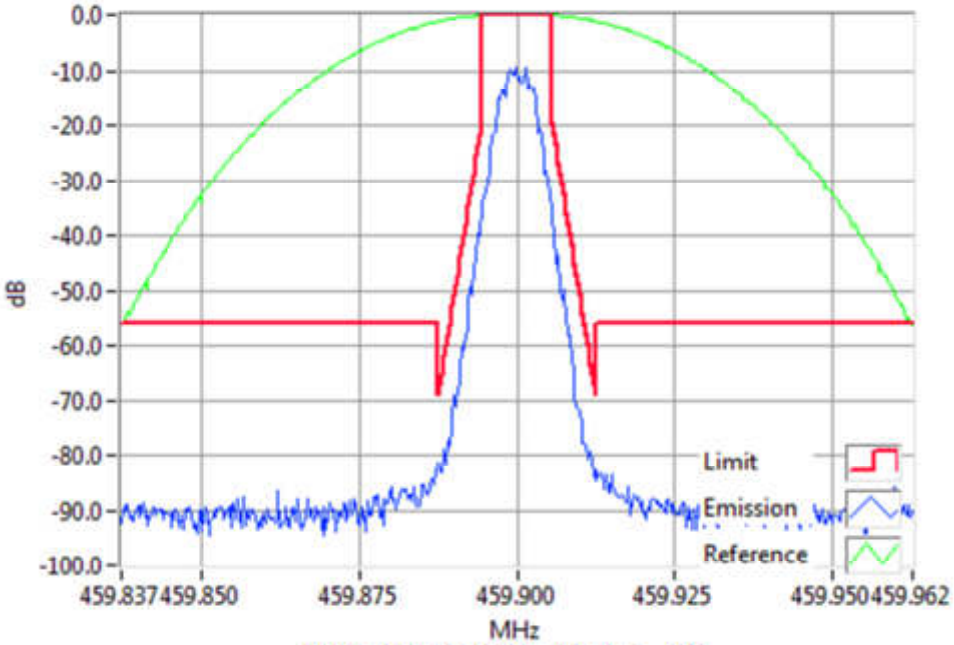


P25II 450.1000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

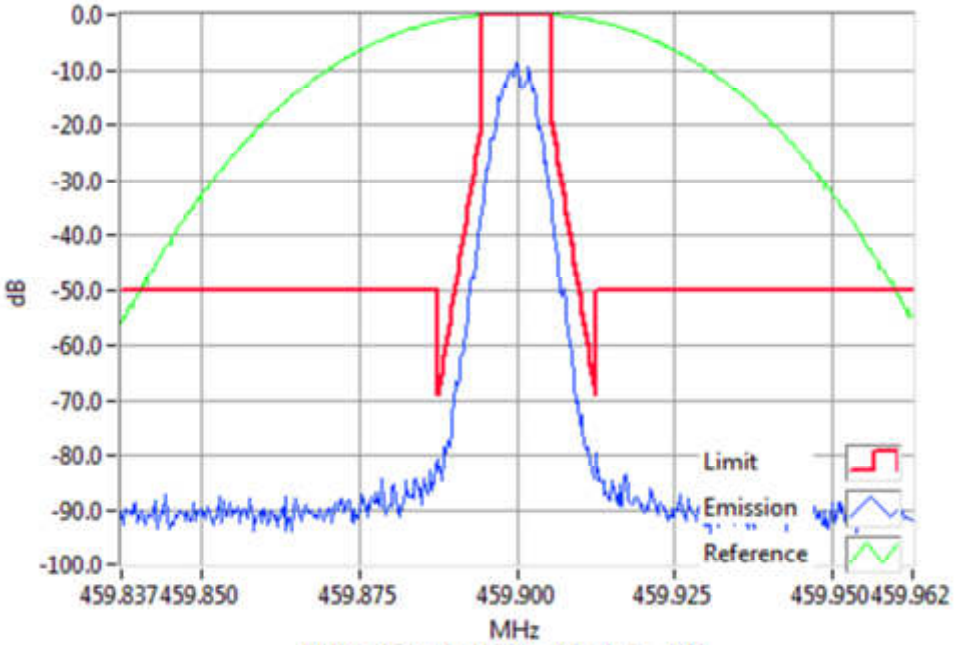
APCO P25 phase-2

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing



P25II 459.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing

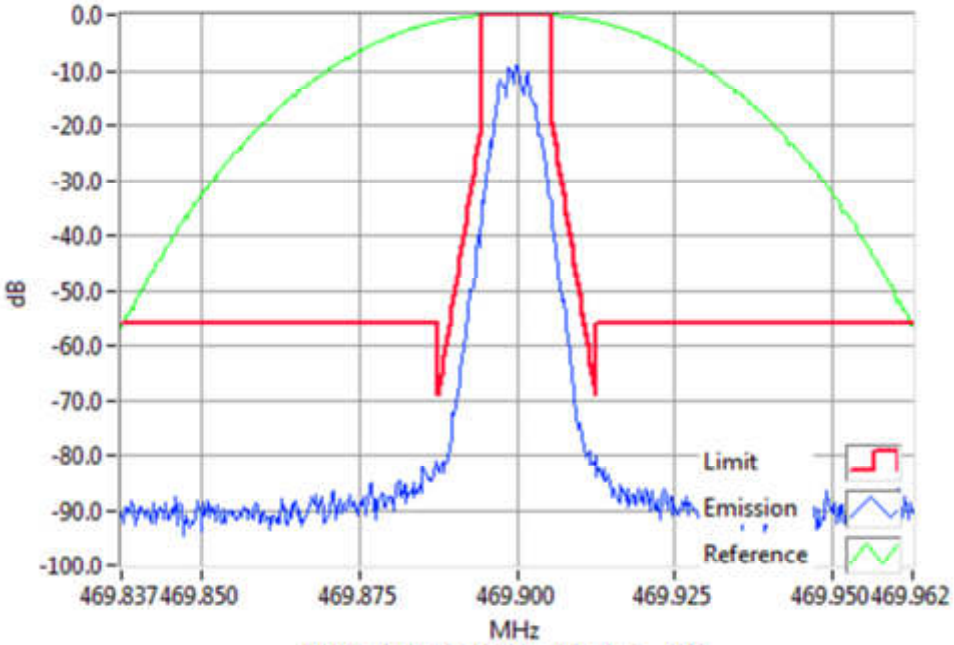


P25II 459.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

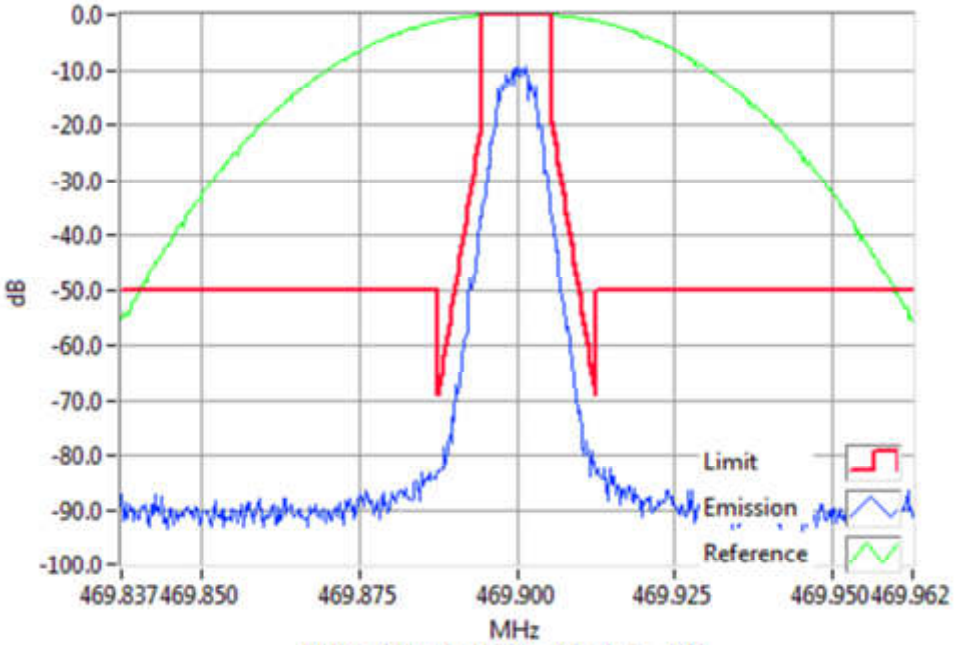
APCO P25 phase-2

Tx FREQUENCY: 469.9 MHz 4 W 12.5 kHz Channel Spacing



P25II 469.9000MHz Mask D 4W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 469.9 MHz 1 W 12.5 kHz Channel Spacing



P25II 469.9000MHz Mask D 1W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATIONS: FCC 47 CFR 2.1051 RSS-119 5.8

GUIDE: TIA/EIA-603D 2.2.13

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The frequency range examined was from the lowest frequency generated within the EUT, to a frequency higher than the 10th Harmonic: 100 kHz to Fc-BW, Fc+ BW to 10Fc
   (4 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.

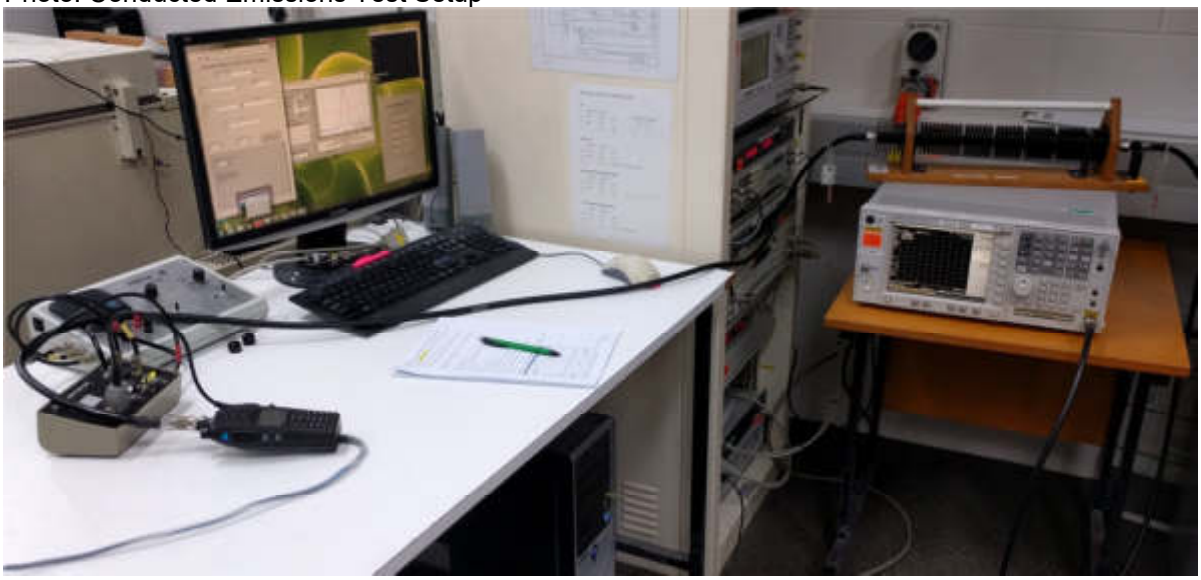
Example of attenuation correction:

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 RSS-119 5.8

Photo: Conducted Emissions Test Setup



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051 RSS-119 5.8

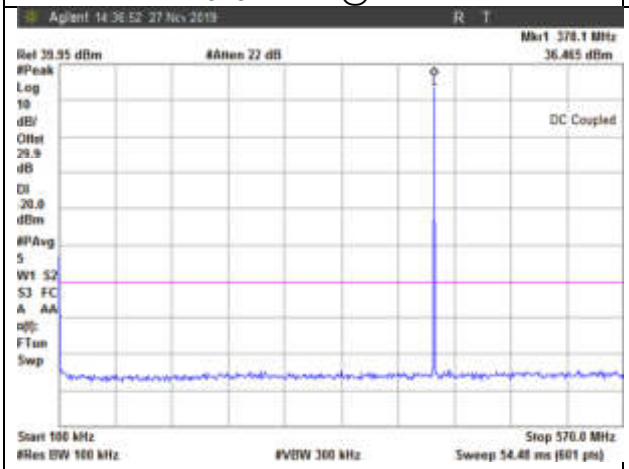
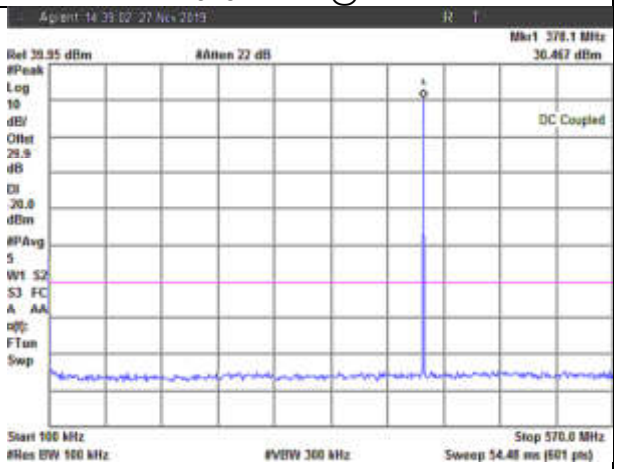
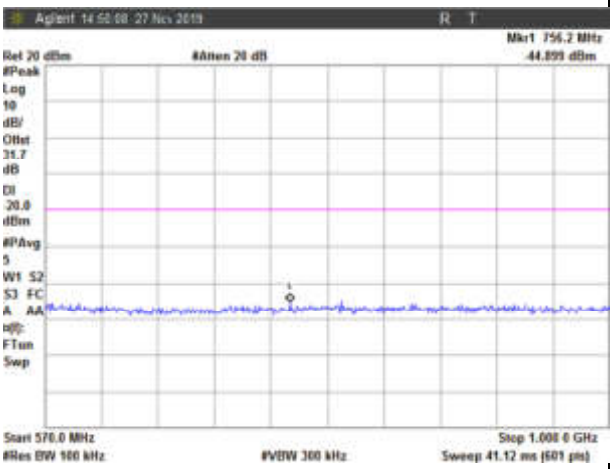
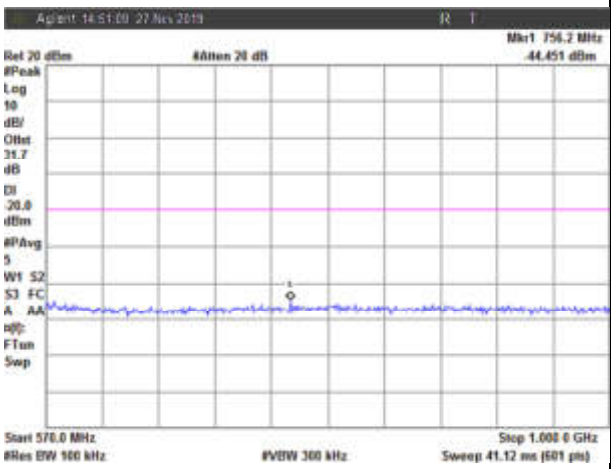
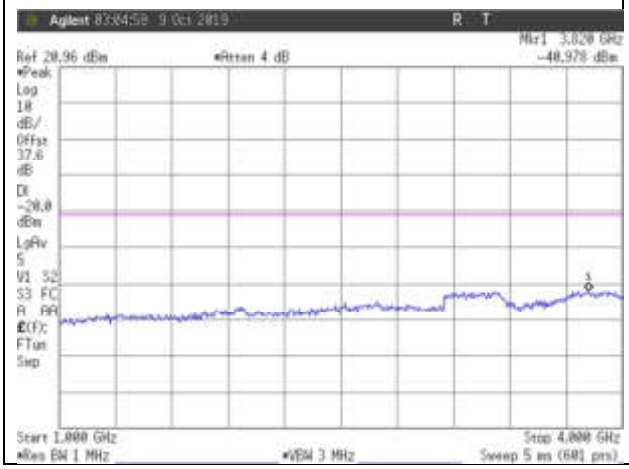
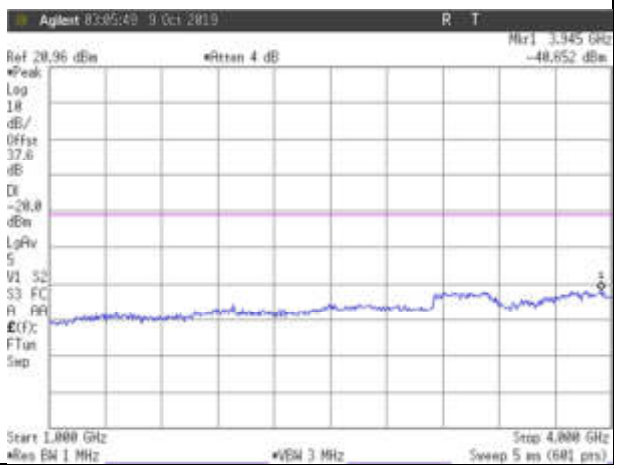
12.5 kHz Channel Spacing 378.1 MHz @ 4 W Emission Mask D

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)

378.1 MHz @ 4 W	378.1 MHz @ 1 W
	
	
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051 RSS-119 5.8

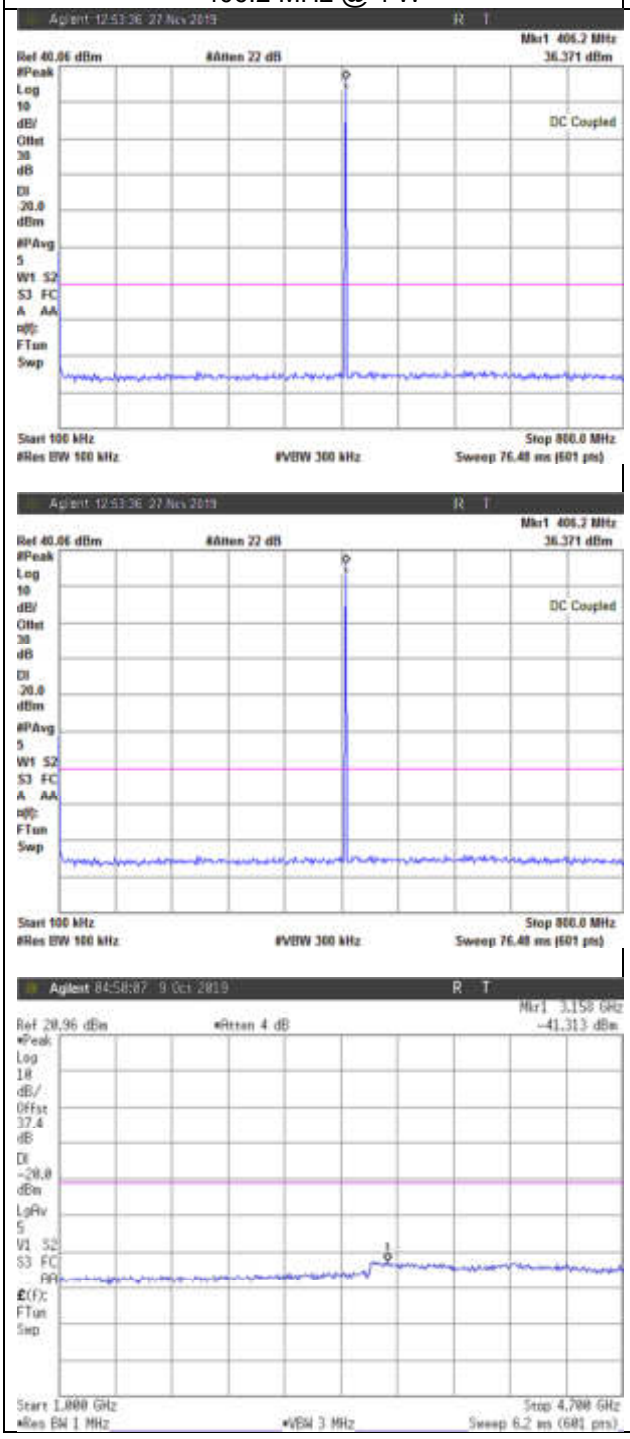
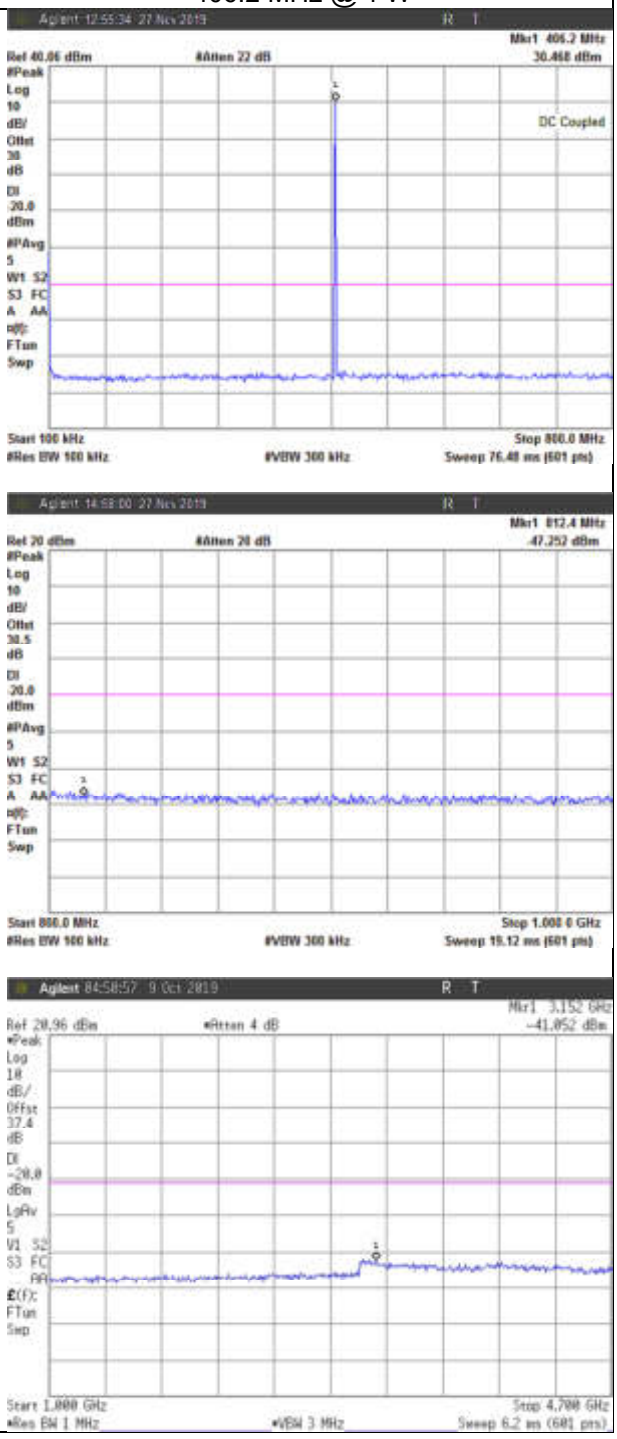
12.5 kHz Channel Spacing 406.2 MHz @ 4 W Emission Mask D

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)

406.2 MHz @ 4 W	406.2 MHz @ 1 W
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051 RSS-119 5.8

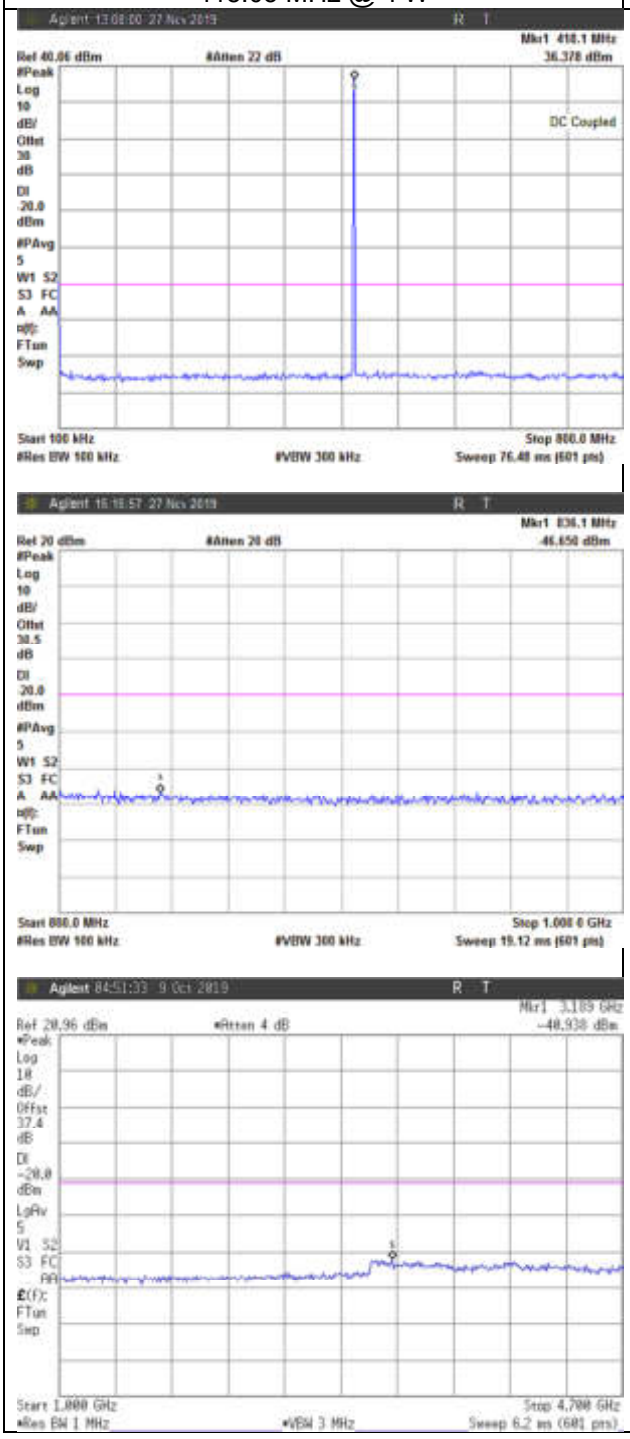
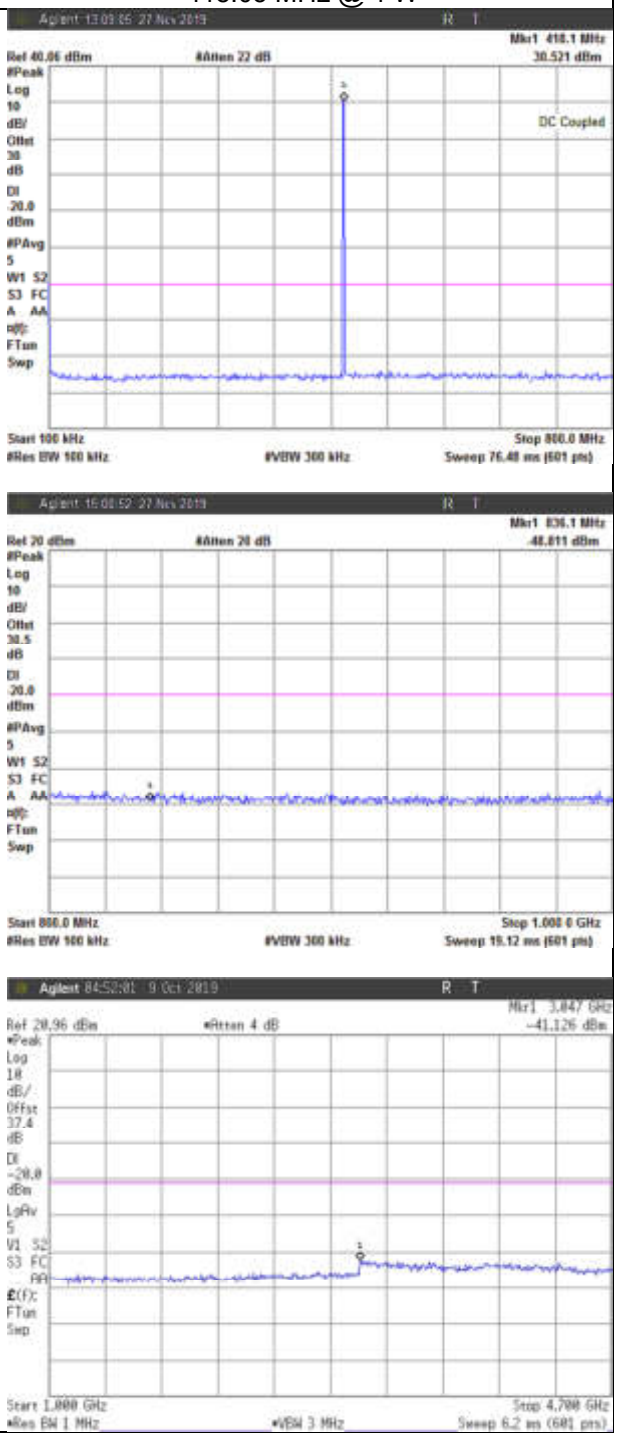
12.5 kHz Channel Spacing 418.05 MHz @ 4 W Emission Mask D

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)

418.05 MHz @ 4 W	418.05 MHz @ 1 W
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051 RSS-119 5.8

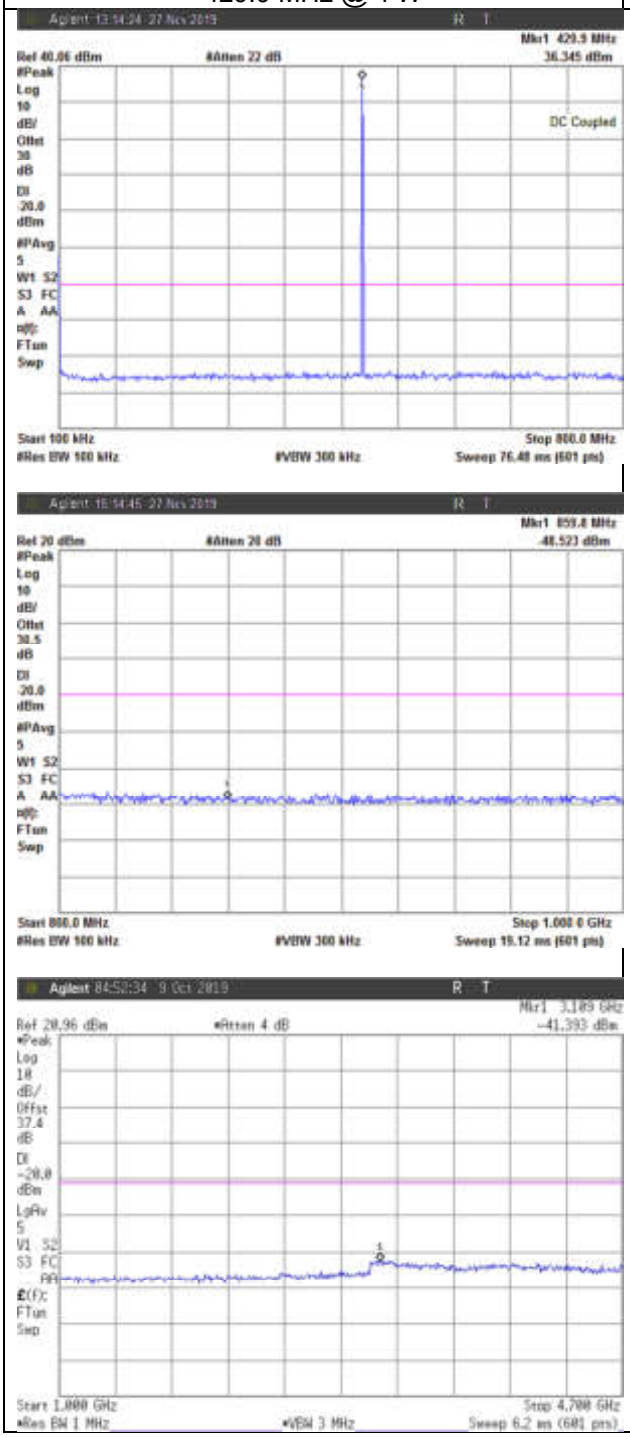
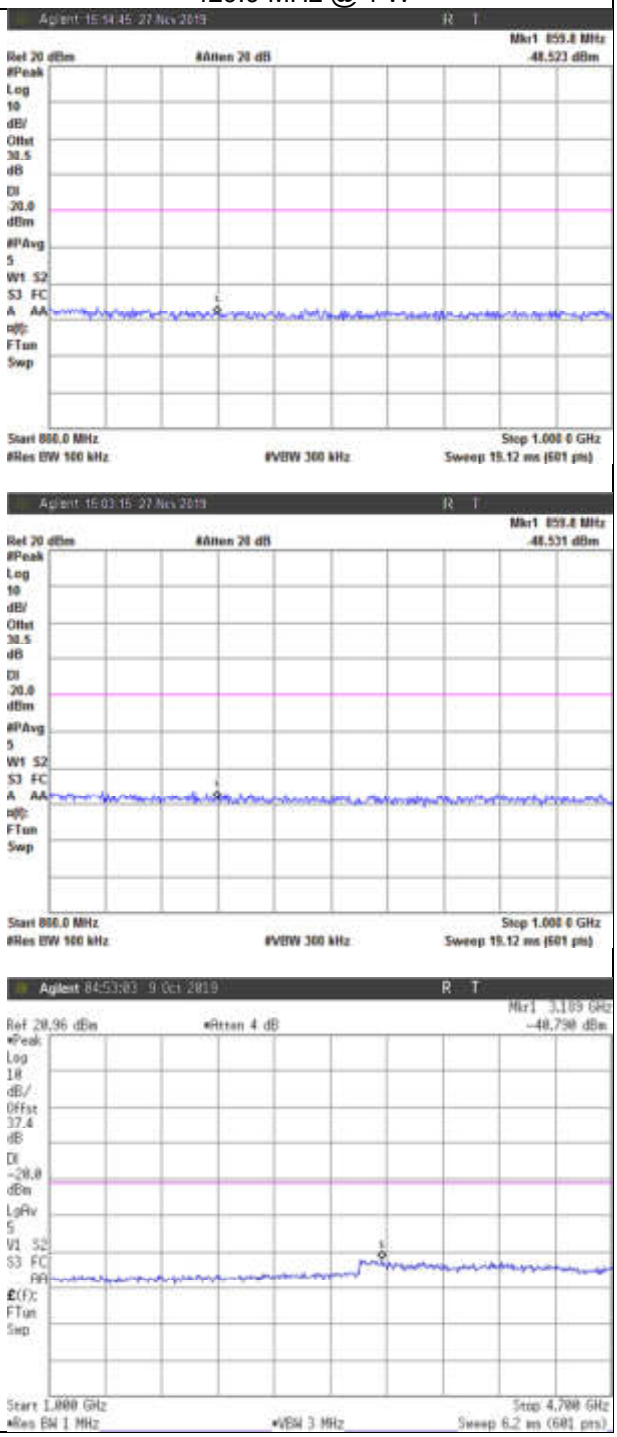
12.5 kHz Channel Spacing 429.9 MHz @ 4 W Emission Mask D

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)

429.9 MHz @ 4 W	429.9 MHz @ 1 W
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051 RSS-119 5.8

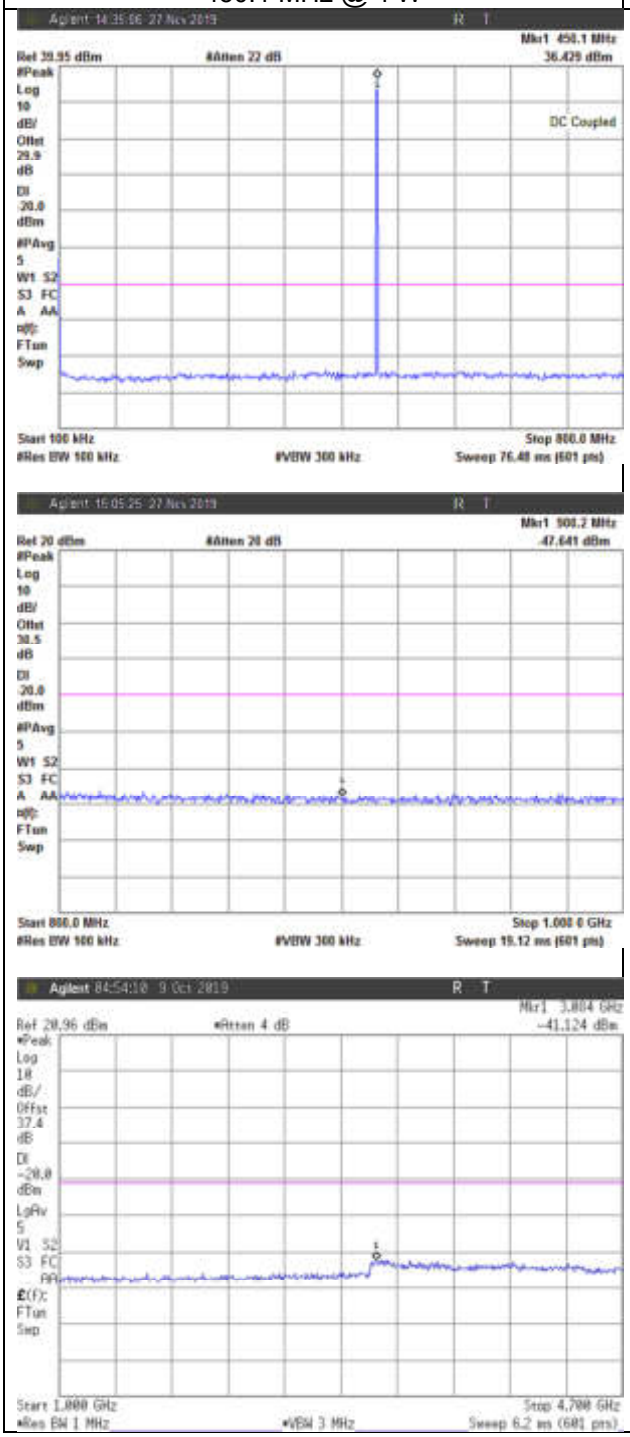
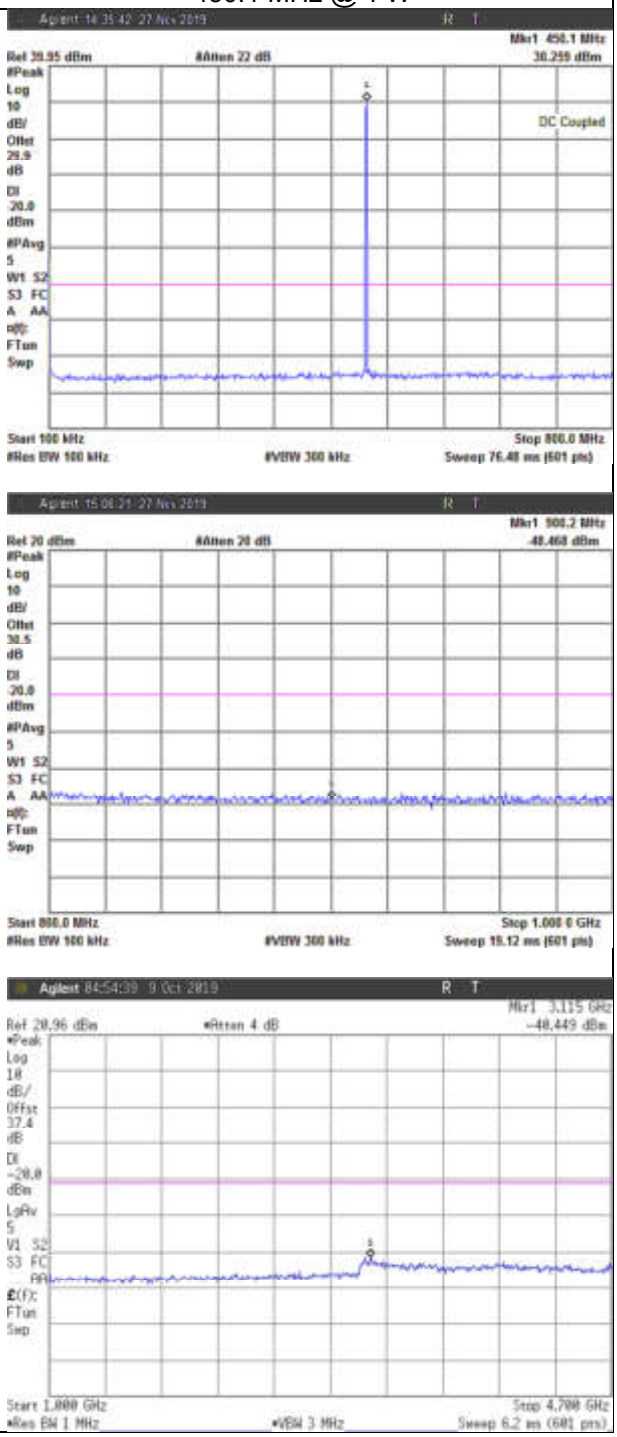
12.5 kHz Channel Spacing 450.1 MHz @ 4 W Emission Mask D

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)

450.1 MHz @ 4 W	450.1 MHz @ 1 W
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051 RSS-119 5.8

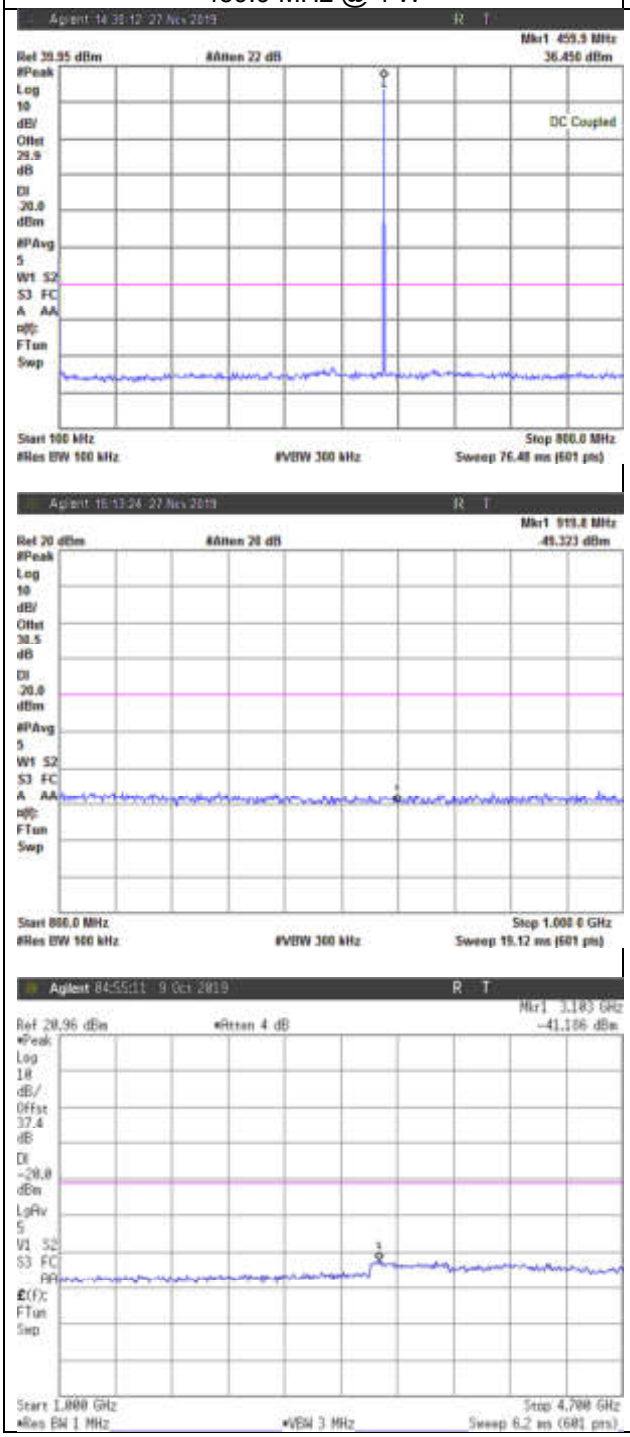
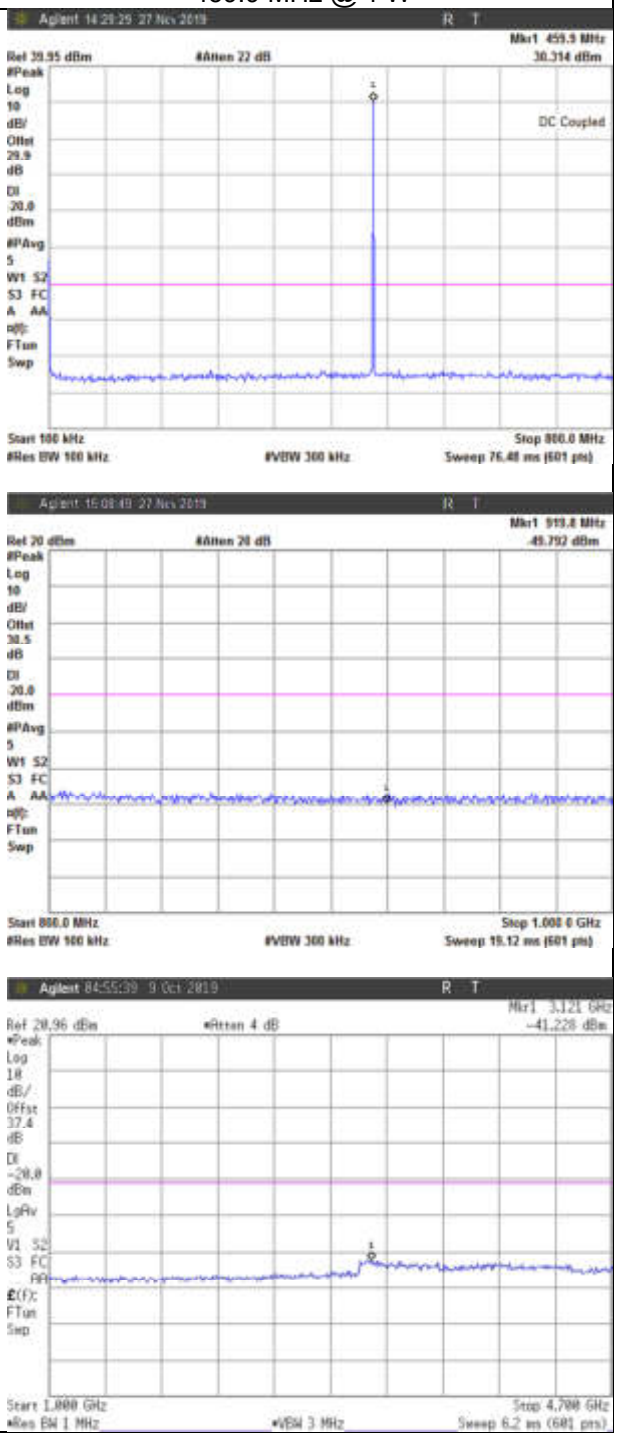
12.5 kHz Channel Spacing 459.9 MHz @ 4 W Emission Mask D

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)

459.9 MHz @ 4 W	459.9 MHz @ 1 W
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 2.1051 RSS-119 5.8

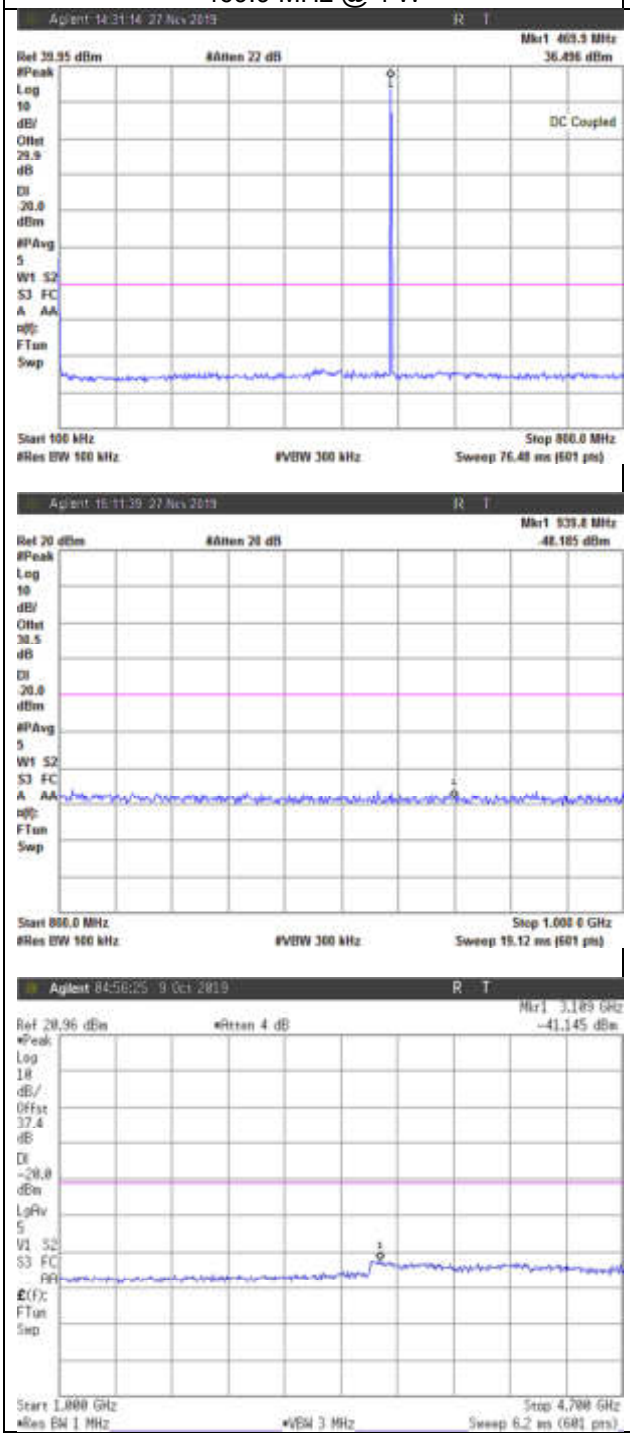
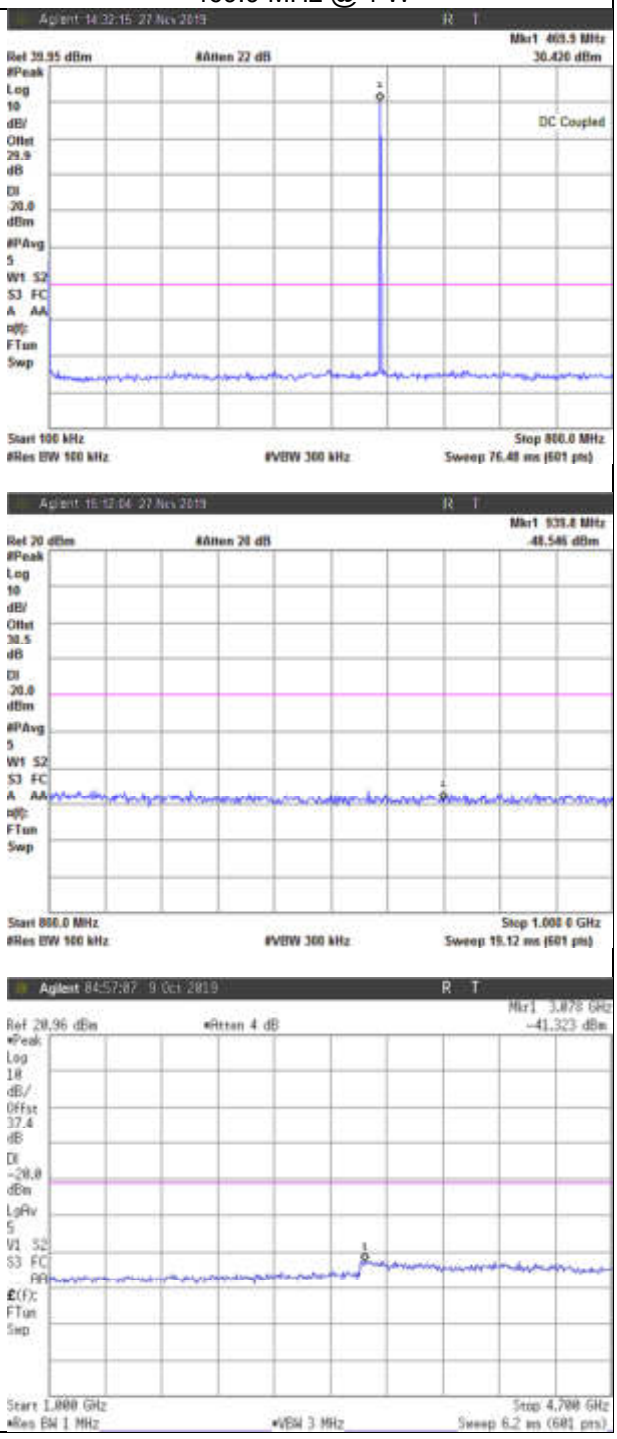
12.5 kHz Channel Spacing 469.9 MHz @ 4 W Emission Mask D

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)

469.9 MHz @ 4 W	469.9 MHz @ 1 W
	

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 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{Watts})$	
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^{th} harmonic of the fundamental frequency are measured on the OATS

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

MEASUREMENT RESULTS:
See the tables on the following pages

LIMIT CLAUSE: FCC 47 CFR 90.210

Spurious Emissions (Tx Radiated) - Continued

SPECIFICATION: FCC 47 CFR 2.1053

12.5 kHz Channel Spacing 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 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{Watts})$	
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 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	± 4.6 dB	

Sample Calculation	Measurement					
	Reference	Substitution				Result
Emission Frequency (MHz)	Reference Level (dBm)	Sig-gen Level	Cable and Attenuator Gain	Antenna Gain (dBd)	Path and Boresight corrections	dBm
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

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

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

LIMIT: FCC 47 CFR 90.214

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

LIMIT: RSS-119 5.9

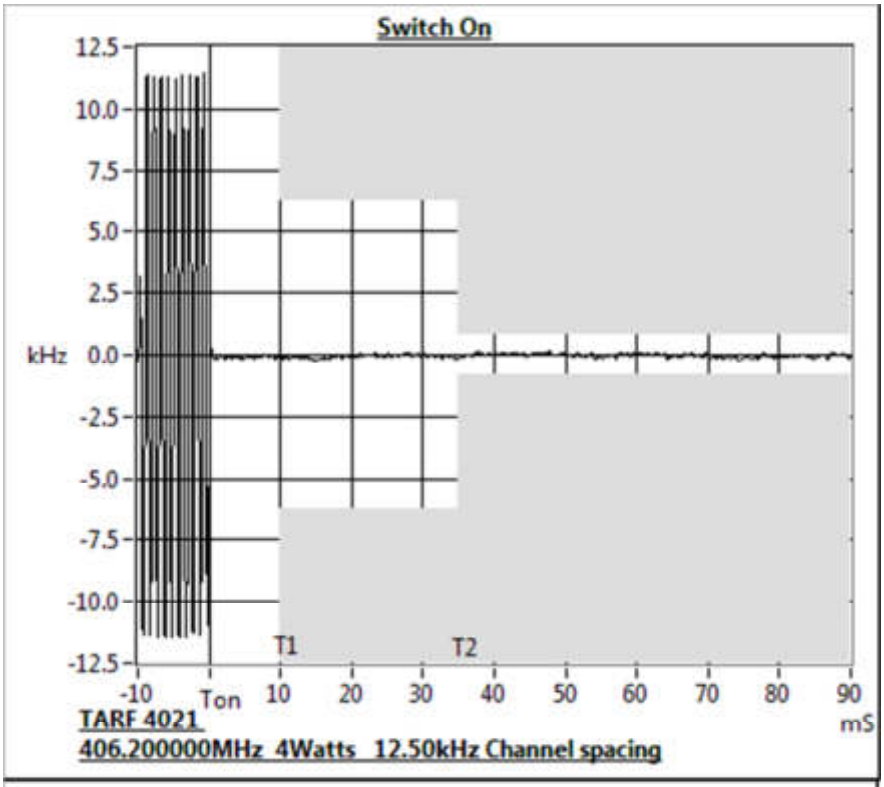
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

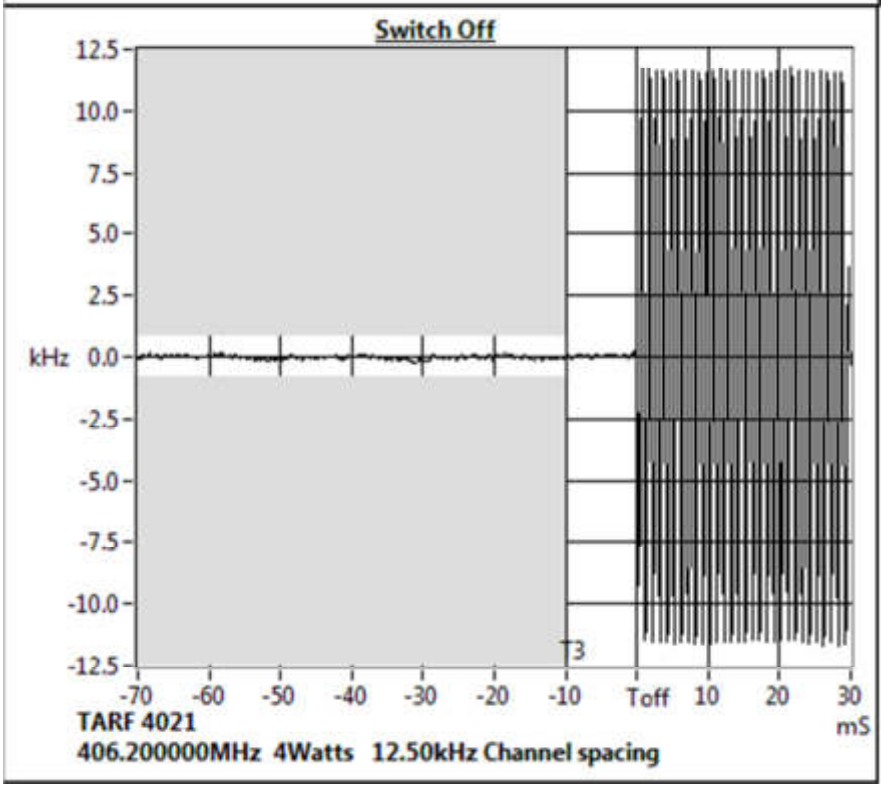
Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

Transient Frequency 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

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

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

LIMIT: FCC 47 CFR 90.214

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

LIMIT: RSS-119 5.9

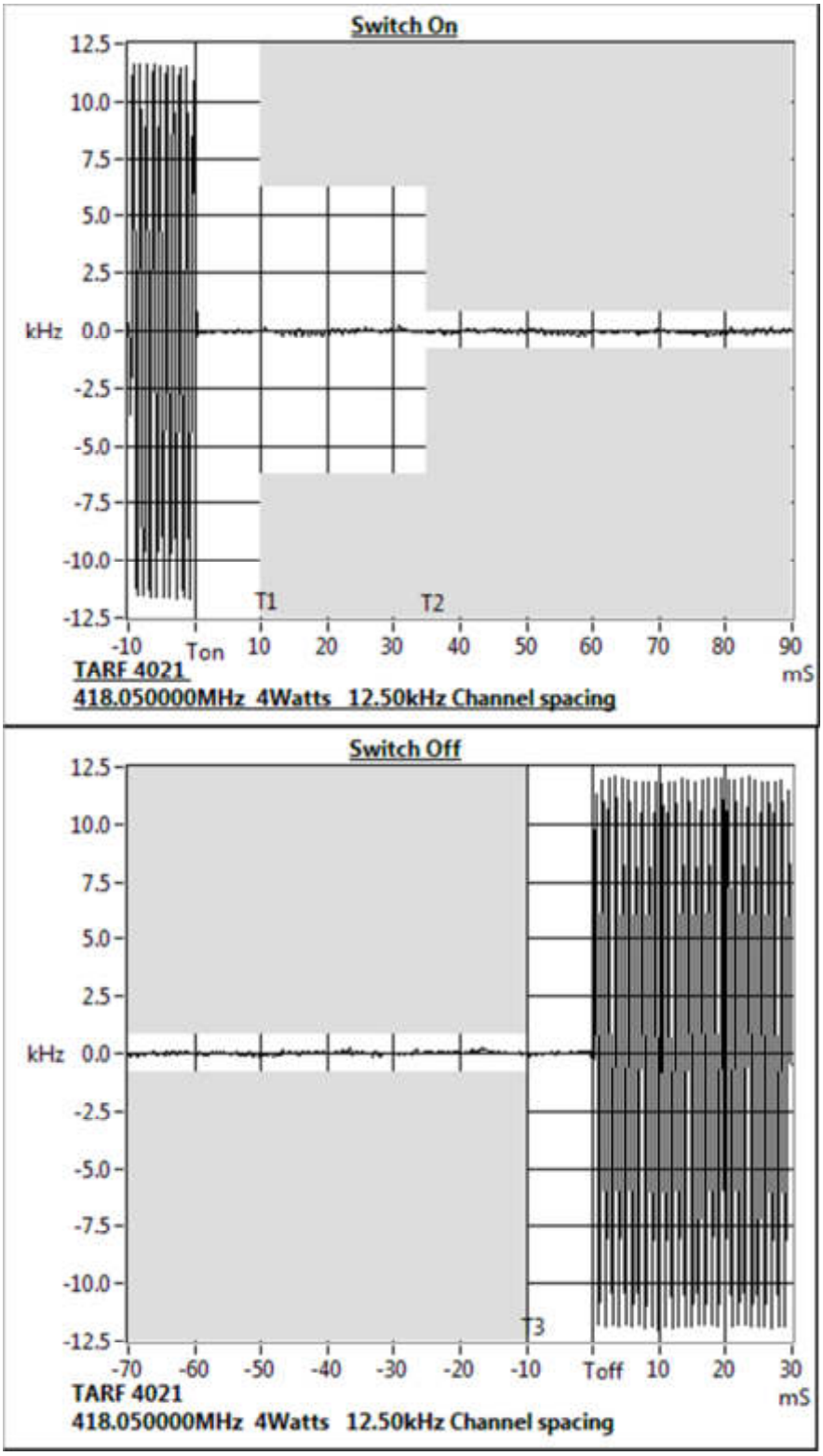
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

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

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 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

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

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

LIMIT: FCC 47 CFR 90.214

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

LIMIT: RSS-119 5.9

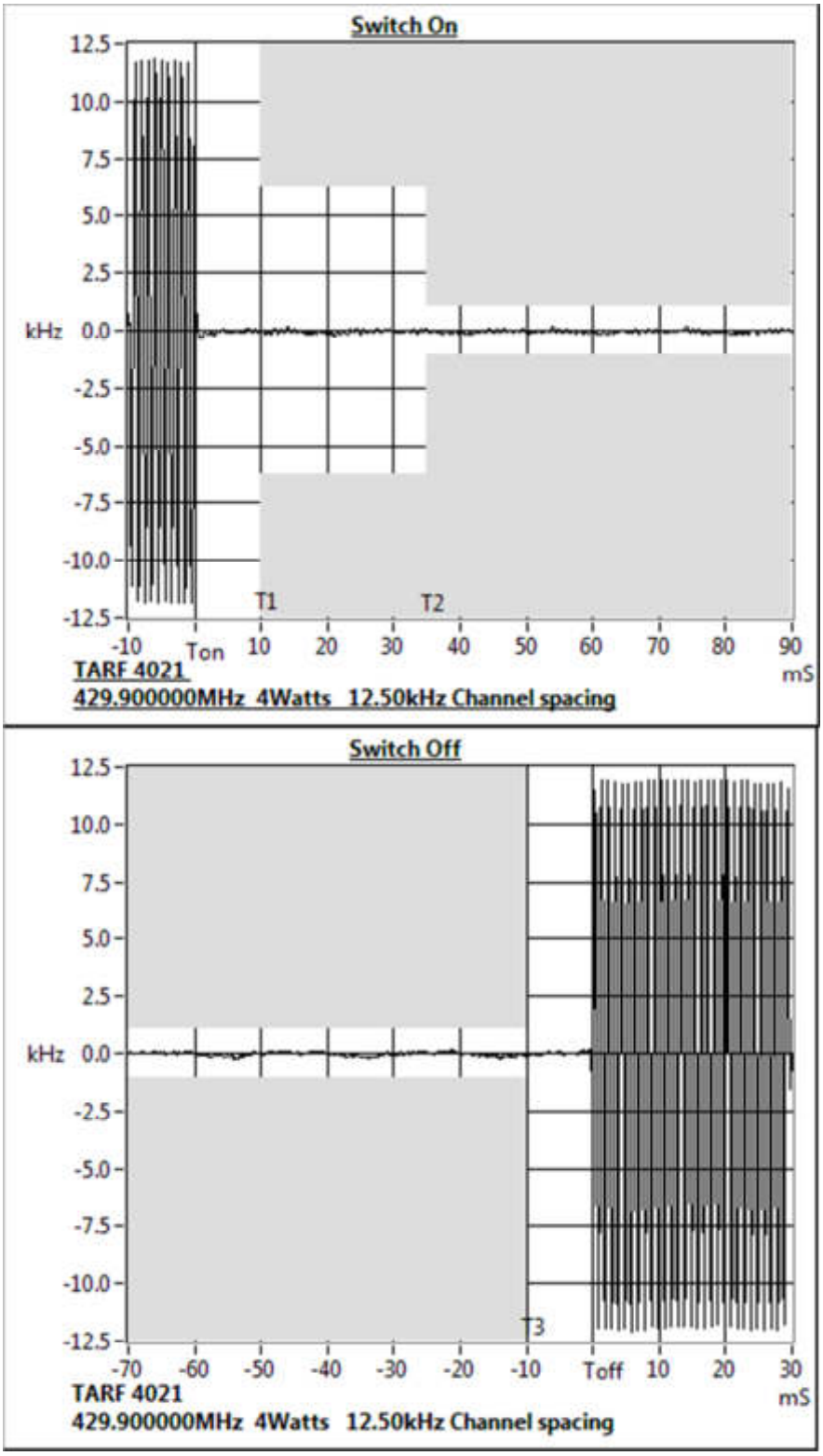
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

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

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 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

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

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

LIMIT: FCC 47 CFR 90.214

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

LIMIT: RSS-119 5.9

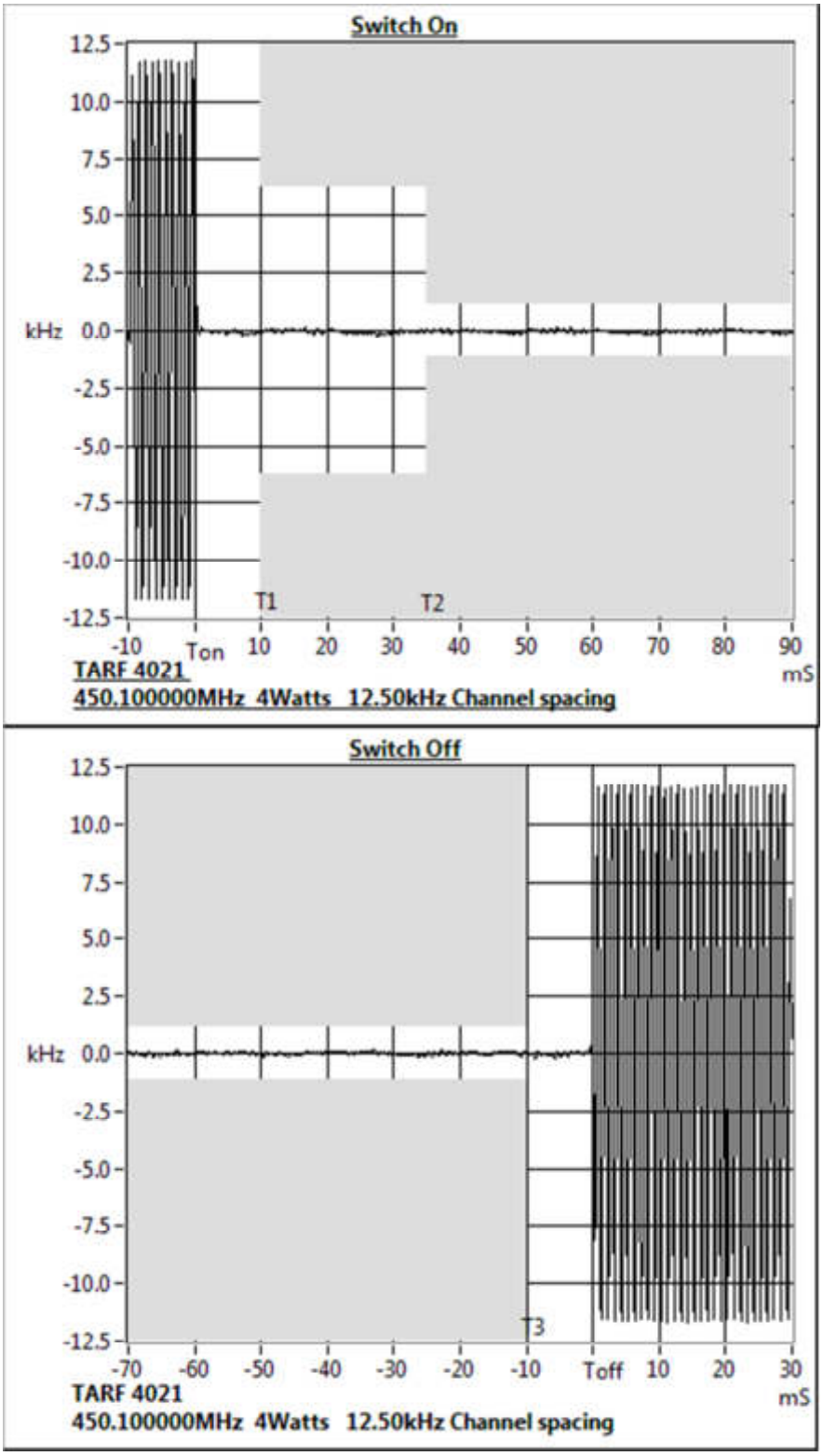
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

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

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 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

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

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

LIMIT: FCC 47 CFR 90.214

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

LIMIT: RSS-119 5.9

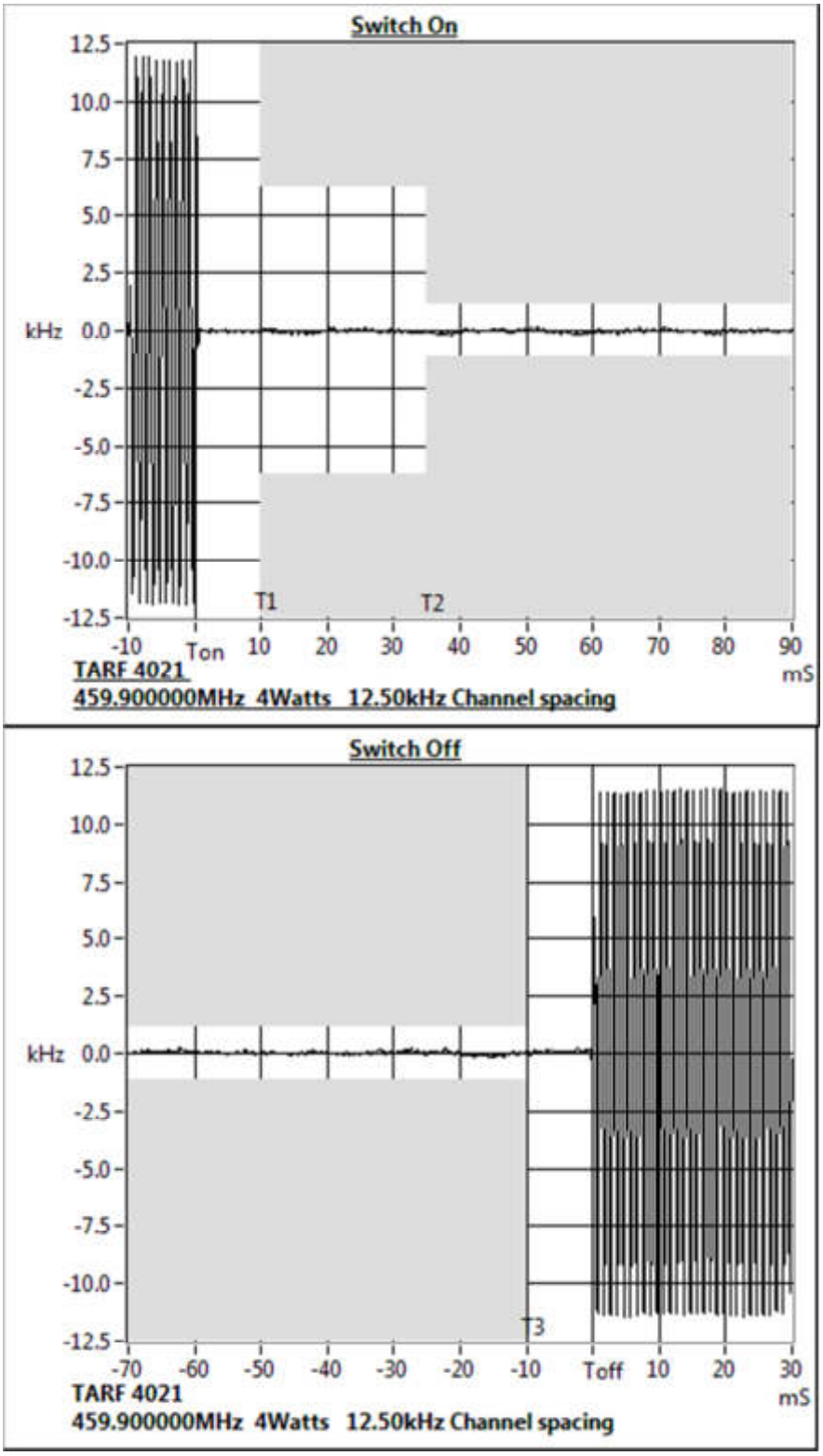
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

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

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 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

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

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

LIMIT: FCC 47 CFR 90.214

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

LIMIT: RSS-119 5.9

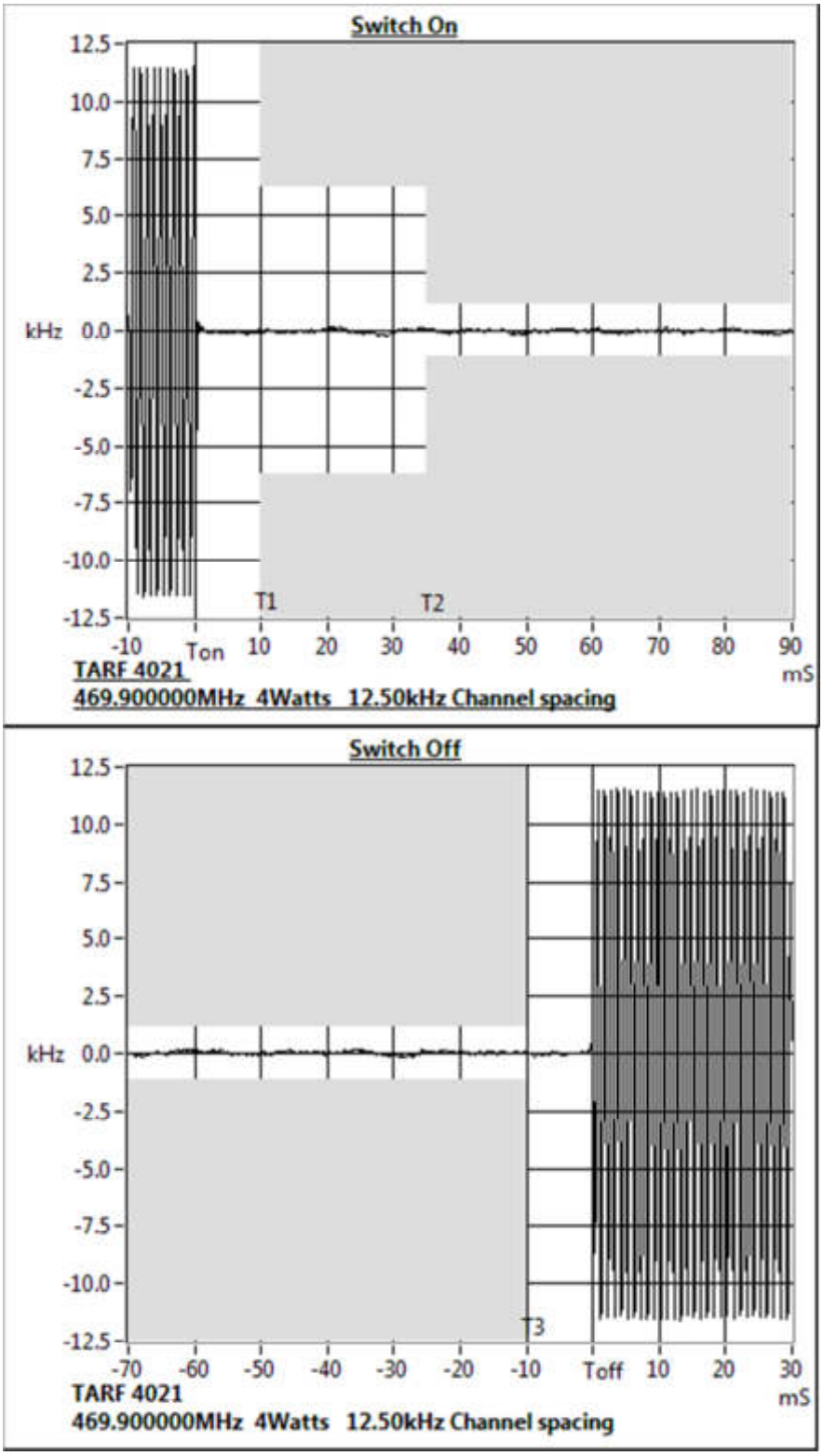
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

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

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 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° C to +50° C in 10° C increments
3. The frequency error was recorded in parts per million (ppm).

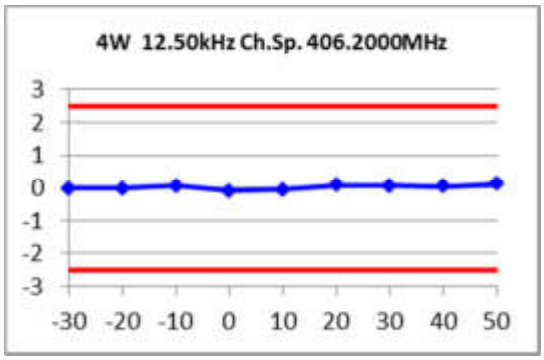
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing.

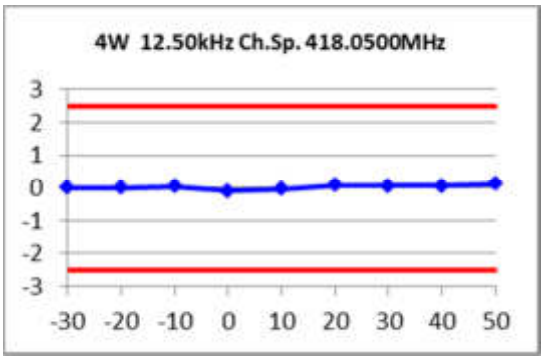
	Error (ppm)					
Temperature (ºC)	406.2 MHz	418.05 MHz	429.9 MHz	450.1 MHz	459.9 MHz	469.9 MHz
-30	-0.03	0	0.01	0.01	0.01	0
-20	-0.02	0	0.02	0.03	0.05	0.06
-10	0.05	0.04	0.01	-0.01	-0.03	-0.05
0	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
10	-0.06	-0.04	-0.03	-0.01	0	0
20	0.08	0.08	0.09	0.08	0.09	0.09
30	0.06	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			± 7 x 10^{-8}			

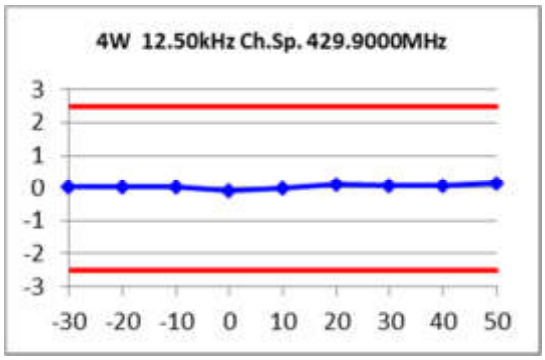
LIMIT: FCC 47 CFR 90.213 RSS-119 5.3

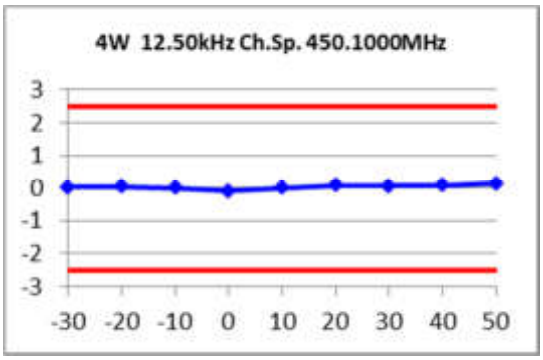
Channel Spacing (kHz)	Frequency Error (ppm)
12.5	2.5

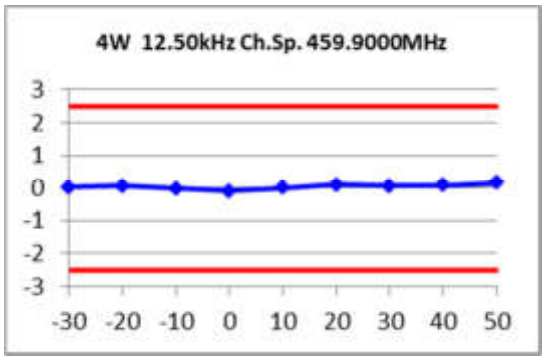
Transmitter Frequency Stability – Temperature

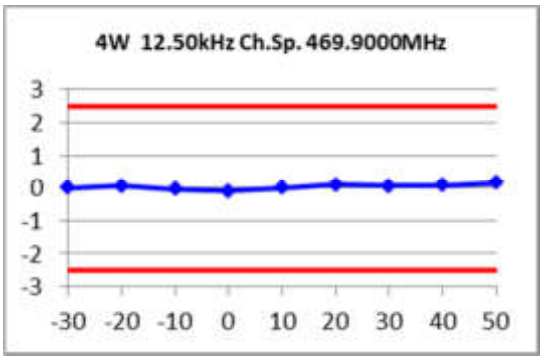












TRANSMITTER FREQUENCY STABILITY - VOLTAGE

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_{DC}	6.375 V_{DC}	7.5 V_{DC}
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		± 7 x 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:

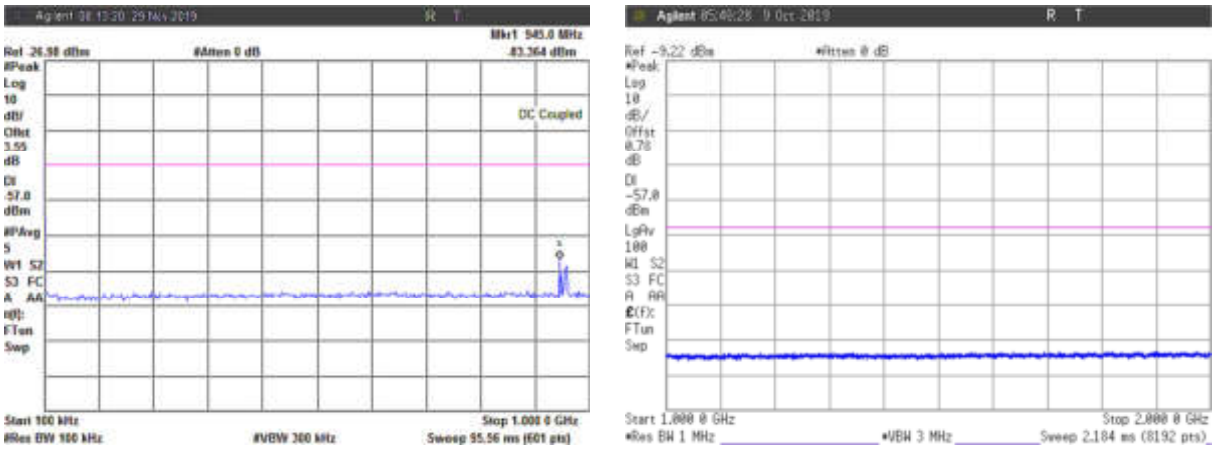
2m Black6	0.41	
Total Attenuation @ 500.000 MHz	0.41	Sum of component attenuation (a)
Amplitude offset	0.41	(b)
Correction @ 500.000 MHz	0	(a-b)

Measurement Uncertainty	≤12.75 GHz ± 3.0 dB

Receiver Spurious Emissions (Conducted) – Continued

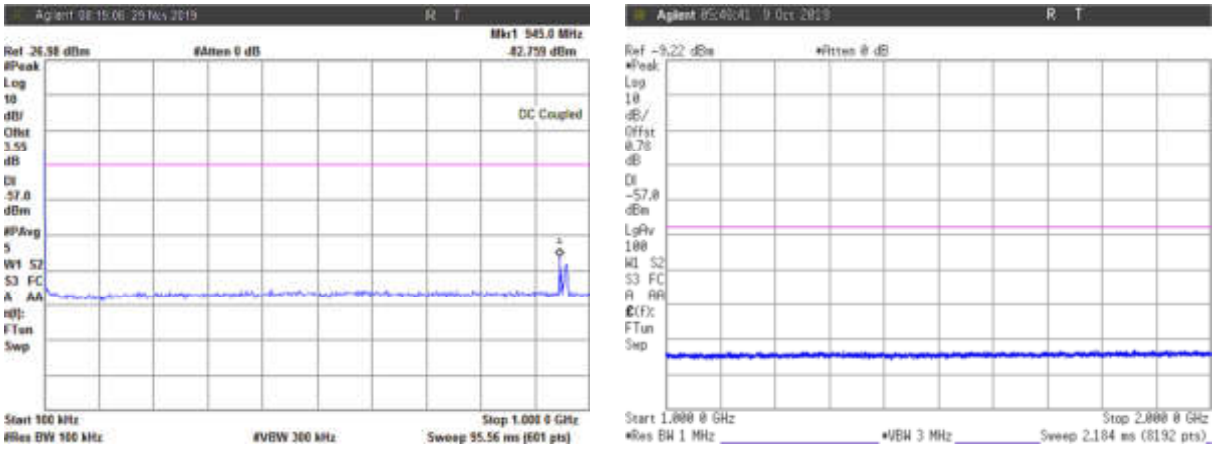
378.1 MHz Receive, 378.1 MHz Tx standby		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

378.1 MHz Receive, 378.1 MHz Tx standby



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.		

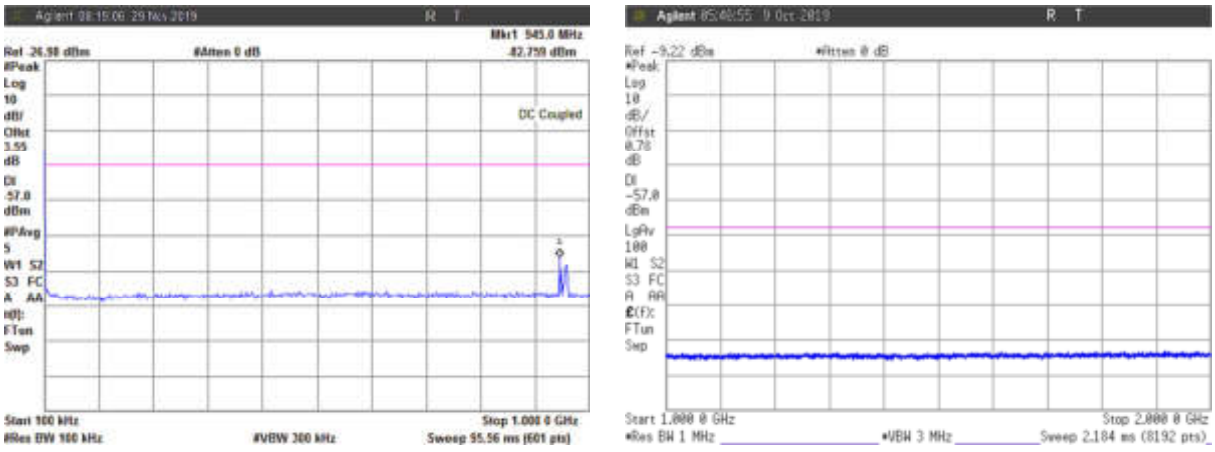
406.2 MHz Receive, 406.2 MHz Tx standby



Receiver Spurious Emissions (Conducted) – Continued

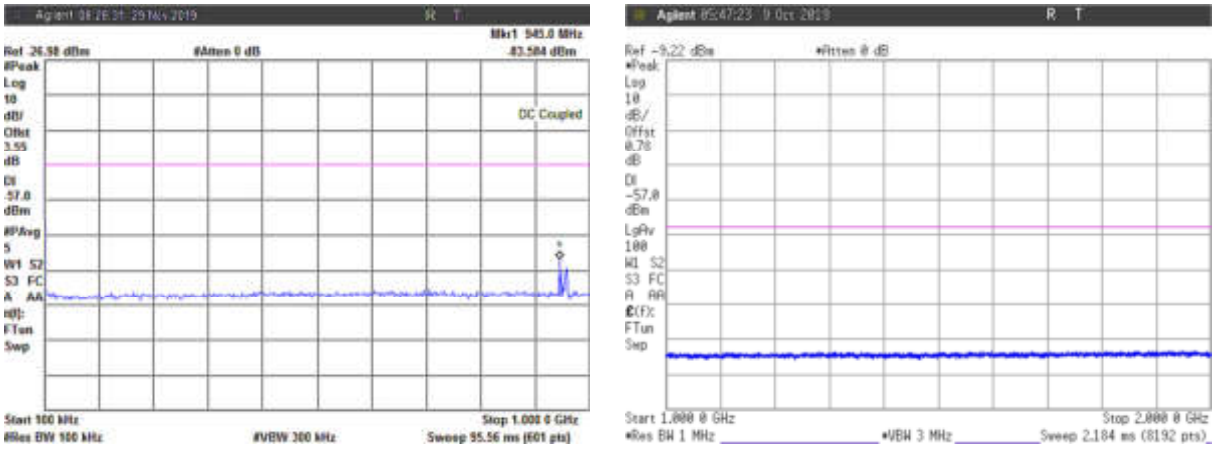
418.05 MHz Receive, 418.05 MHz Tx standby		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

418.05 MHz Receive, 418.05 MHz Tx standby



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.		

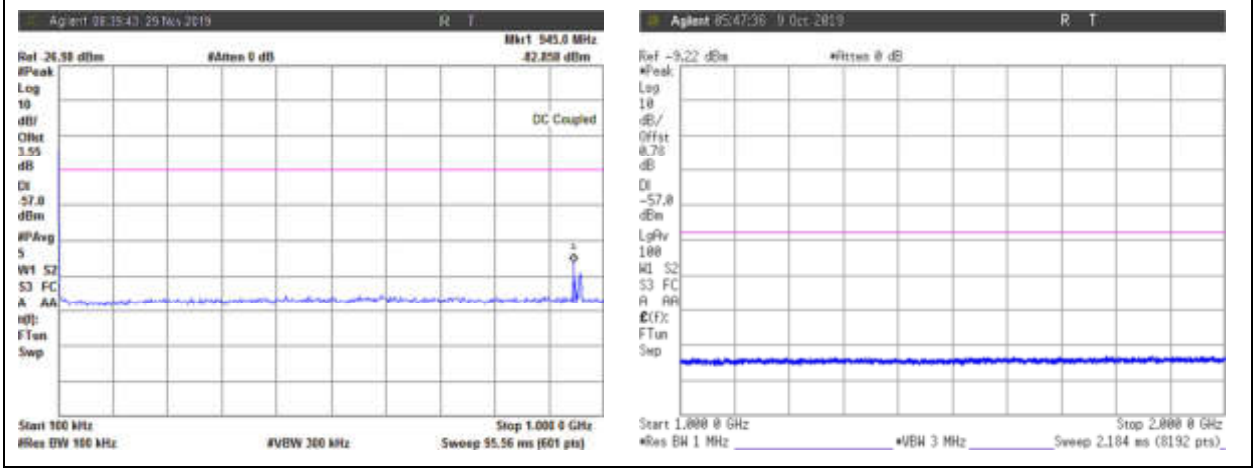
429.9 MHz Receive, 429.9 MHz Tx standby



Receiver Spurious Emissions (Conducted) – Continued

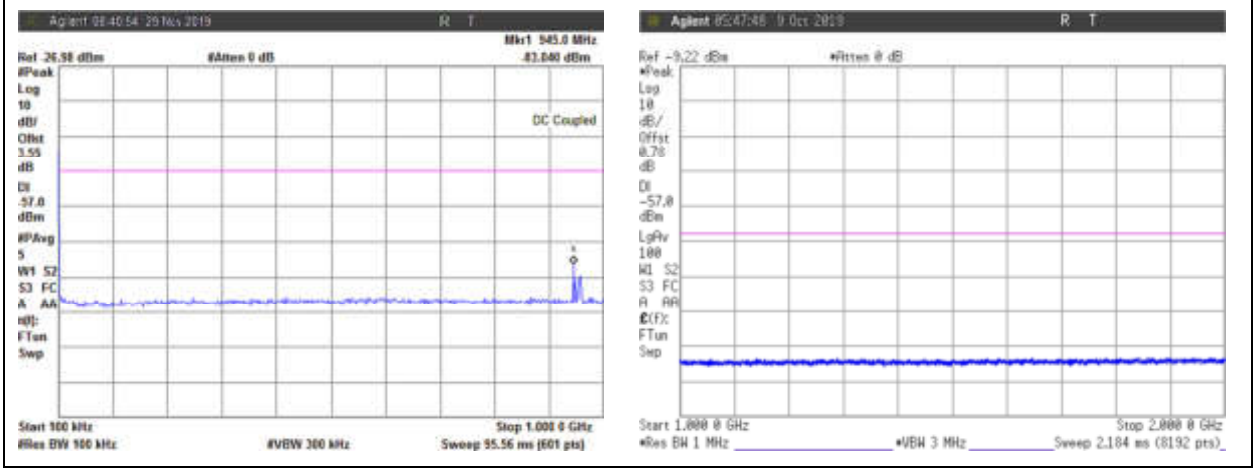
450.1 MHz Receive, 450.1 MHz Tx standby		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

450.1 MHz Receive, 450.1 MHz Tx standby



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.		

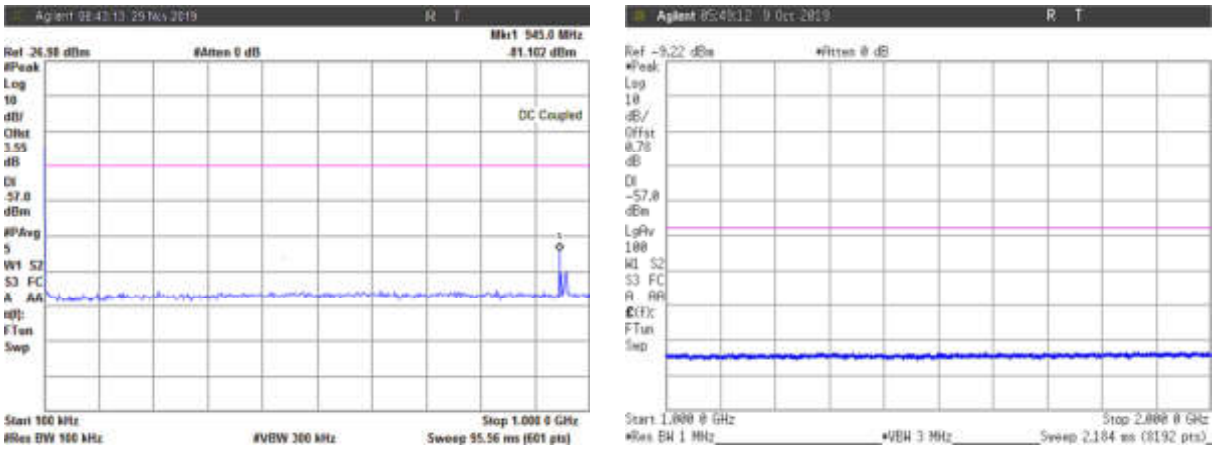
459.9 MHz Receive, 459.9 MHz Tx standby



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.		

469.9 MHz Receive, 469.9 MHz Tx standby



LIMIT CLAUSE: RSS-Gen 7.4

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

TEST EQUIPMENT LIST

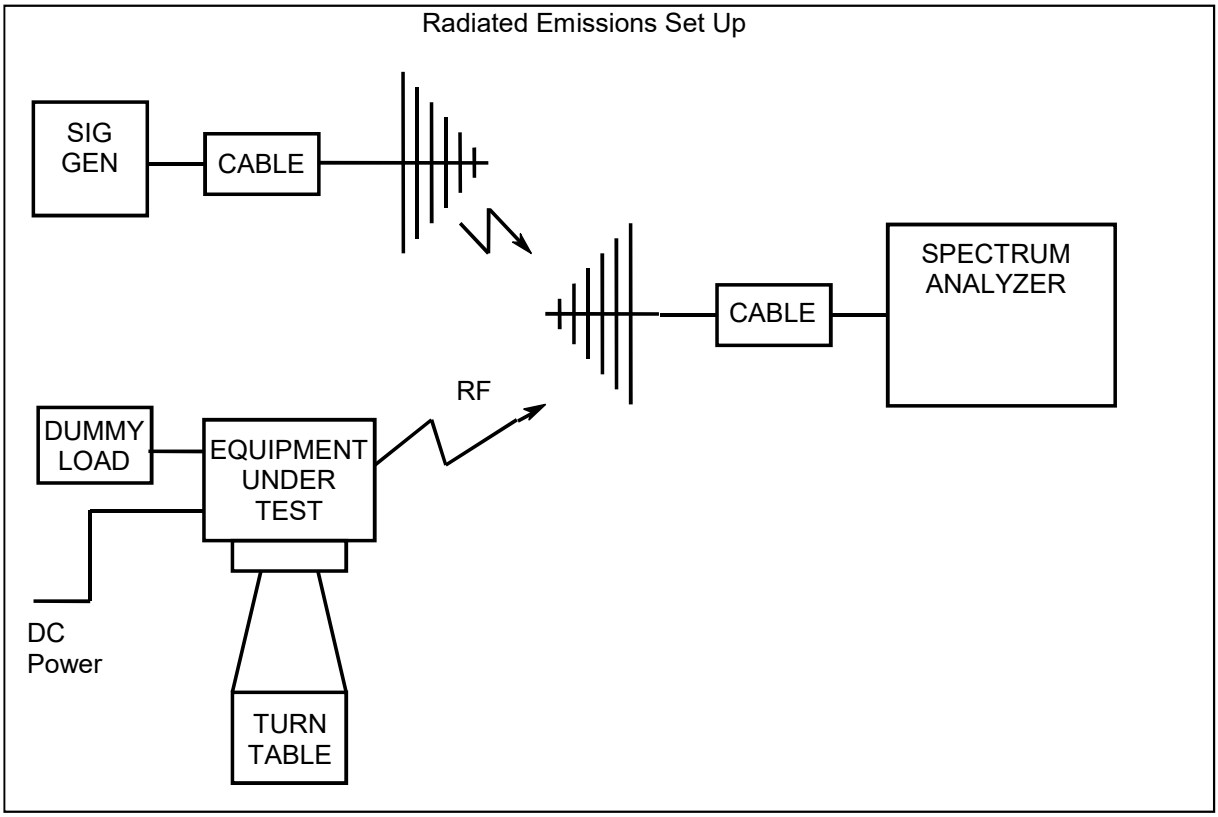
Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
Antenna	18GHz DRG	Emco	DRG3115	2084	E3076	
Antenna	Reference Dipoles	Emco	3121C DB1	9510-1164	E3559	14-May-22
Antenna	18GHz DRG	Emco	DRG3115	9512-4638	E3560	15-May-20
Antenna	Log Periodic	Schwarzbeck	VUSLP	9111-219	E4617	
Antenna	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/Nm/2000	TeltestBlack2	E4623	23-Oct-20
Coax Cable	2m Black	Suhner	RG214HF/Nm/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/Nm/2000	TeltestBlack6	E4849	23-Oct-20
Coax Cable	2m Black	Suhner	RG214HF/Nm/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/Nm/2000	TeltestBlack7	E5004	28-Oct-20
Environ. Chamber	Upright	Contherm	5400 RHSLT.M	1416	E4051	7-Aug-23
Environ. Chamber	Upright	Contherm	5400 RHSLT.M	1416	E4051	15-May-20
Filter High Pass/ Notch	235 to 370MHz	Tait		N/A	E3784	3-Nov-20
Filter High Pass/ Notch	400 to 520MHz	Tait		N/A	E3384	3-Oct-20
Modulation Analyser	43740	Hewlett Packard	HP8901B (Opt 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 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 & BW-N3W5+	CK9178	E5023	15-Jul-20

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 **T**eltest **R**adio **EVA**luation system (TREVA), which is configured as shown below. The Spectrum Analyser is connected to the EUT via the attenuator network for Conducted Emissions testing, and Occupied Bandwidth.

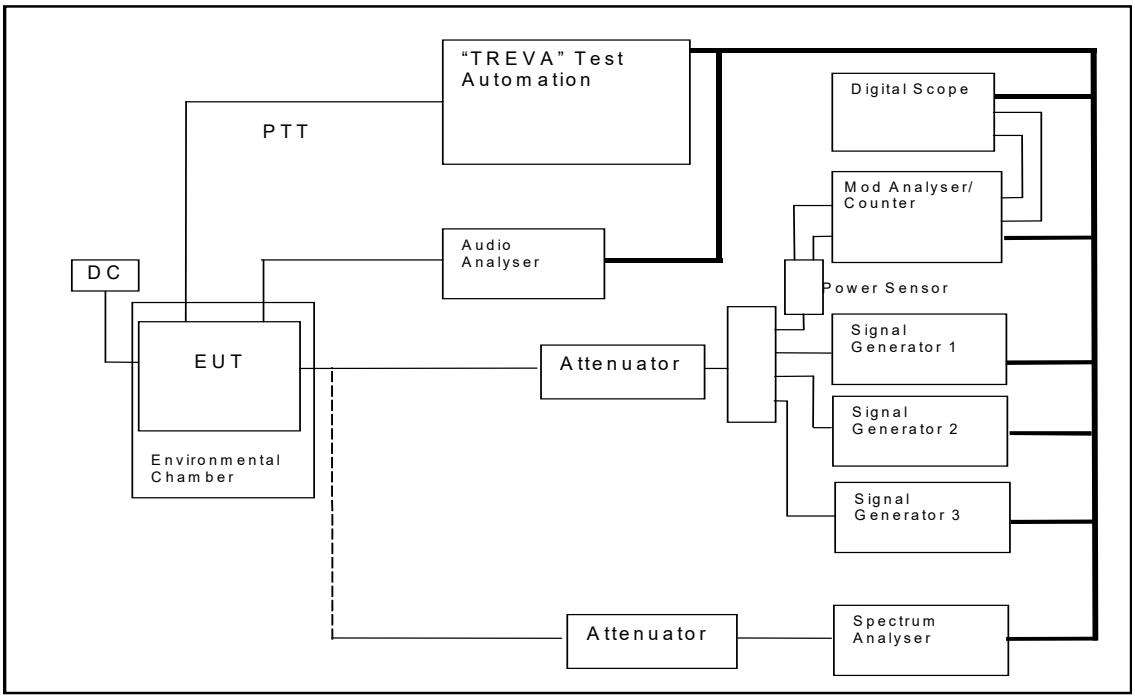


Photo showing the EUT connection to the test system using the customer supplied test box and battery eliminator.

ANNEX B – Photographs