

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TPGHKB Hand Portable 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: 26 July 2024

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Test Technician

CHECKED & APPROVED BY: M. C. James


Laboratory Technical Manager



FCC Registration: 838288

ISED Registration: 737A

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

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REVISION HISTORY

Date	Revision	Comments
26 July 2024	1	Initial test report

INTRODUCTION

Type approval testing of the TPGHKB, 4 Watt, Hand Portable 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.

REPORT PREPARED FOR

Tait International Ltd
245 Wooldridge Road
Harewood
Christchurch 8051
New Zealand

DESCRIPTION OF SAMPLE

Manufacturer: Tait International Limited
Equipment: Hand Portable Transceiver
Type: TPGHKB
Product Code: T03-25007-EBAZ
Serial Number(s): 26966389
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 DMR tests	P25 tests
Hardware ID	TPGB11-HK01_0005	TPGB11-HK01_0005
Firmware Package	QIDMR_2024.25.7842	QIP25_2024.25.7842

TEST CONDITIONS

All testing was performed between 18 → 25 July 2024, 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 Name	Test Methods	Result
RSS-119 5.4	FCC 47 CFR 2.1046	Transmitter Output Power (Conducted)	ANSI C63.26 5.2.4.2	Pass
No specification	FCC 47 CFR 2.1047 (a)	Transmitter Audio Frequency Response – Pre-emphasis	ANSI C63.26 5.3.3.2	Pass
No specification	FCC 47 CFR 2.1047 (b)	Transmitter Modulation Limiting	ANSI C63.26 5.3.2	Pass
RSS-119 5.5	FCC 47 CFR 2.1049 (c)	Transmitter Occupied (99%) Bandwidth	ANSI C63.26 5.4.4	Pass
RSS-119 5.5	FCC 47 CFR 90.210	Transmitter Spectrum Masks	ANSI C63.26 5.7.3	Pass
RSS-119 5.8.9	FCC 47 CFR 90.543	Adjacent Channel Power Ratio	TIA-603-E 2.2.14 TIA-102.CAAA-E 2.2.8	N/A 1
RSS-119 5.8	FCC 47 CFR 2.1051	Transmitter Spurious Emissions (Conducted)	ANSI C63.26 5.7	Pass
RSS-119 5.8	FCC 47 CFR 2.1053	Transmitter Spurious Emissions (Radiated)	TIA-603-E 2.2.12	Pass
No specification	FCC CFR 90.543	Transmitter Radiated Emissions in the GNSS Band	TIA-603-E 2.2.12	N/A 1
RSS-119 5.8.9.2 rad	No specification	Transmitter Conducted Emissions in the GNSS Band	ANSI C63.26 6.5.2.7.4	N/A 1
RSS-119 5.9	FCC 47 CFR 90.214	Transient Frequency Behaviour	ANSI C63.26 6.5.2.2	Pass
RSS-119 5.3	FCC 47 CFR 2.1055, FCC 47 CFR 90.213	Transmitter Frequency Stability - Temperature	ANSI C63.26 5.6.4	Pass
RSS-119 5.3	FCC 47 CFR 2.1055 (d) (1), FCC 47 CFR 90.213	Transmitter Frequency Stability - Voltage	ANSI C63.26 5.6.5	Pass
RSS-Gen 7.4	FCC 47 CFR 15.111	Receiver Spurious Emissions (Conducted)	TIA-603-E 2.1.2	Pass

Test Case Result Definitions	
No test Performed	N
Test does not apply to the test object	N/A
Test object meets requirements	P (Pass)
Test object does not meet requirements	F (Fail)
Test object is not conclusive	I (Inconclusive)

Comments:
N/A 1: Only required where the EUT transmits in the 768-776 or 798-806 MHz band (ISED), or 769-775 or 799-805 MHz band (FCC).

STATEMENT OF COMPLIANCE

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

Equipment: Hand Portable Transceiver
Type: TPGHKB
Product Code: T03-25007-EBAZ
Serial Number(s): 26966389
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:

13 August 2024

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.

95% measurement uncertainties are stated in this report but are not applied in the assessment of results.

CHANNEL TABLE

Label	Channel Number	Receive Frequency MHz	Transmit Frequency MHz	Power Watts	Channel Spacing kHz
406M 4W	1	406.15	406.125	4	12.5
418M 4W	2	418.05	418.025	4	12.5
429M 4W	3	429.95	429.975	4	12.5
438M 4W	4	438.05	438.025	4	12.5
450M 4W	5	450.05	450.025	4	12.5
460M 4W	6	460.05	460.025	4	12.5
469M 4W	7	469.95	469.975	4	12.5
406M 1W	11	406.15	406.125	1	12.5
418M 1W	12	418.05	418.025	1	12.5
429M 1W	13	429.95	429.975	1	12.5
438M 1W	14	438.05	438.025	1	12.5
450M 1W	15	450.05	450.025	1	12.5
460M 1W	16	460.05	460.025	1	12.5
469M 1W	17	469.95	469.975	1	12.5

Programming Application Name	Version
DMR and P25 Terminals Programming Application	3.55.0.91

LIST OF ANTENNAE INTENDED FOR USE WITH THE DEVICE

Manufacturer Model Number	Manufacturer Part Number	Antenna Type	Antenna Gain dBi	Frequency Band
TPA-AN-011	007-00023-02	Whip	2	400-470MHz
TPA-AN-013	007-00040-01	Helical	1	400-470MHz
TPA-AN-027	007-00038-00	Helical	1	380-420MHz
TPA-AN-037	007-00077-01	¼ Wave Whip	1	378-470MHz
TPA-AN-038	007-00079-01	Helical	-1	378-470MHz
TPA-AN-039	007-00039-00	¼ Wave Whip	2	380-420MHz

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.

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
Analogue FM	11K0F3E
FFSK Data 1200 bps	6K60F2D
FFSK Data 2400 bps	7K80F2D
Digital Voice DMR	8K00FXW
Digital Data DMR	8K00FXD
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 Channel Spacing

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 Channel Spacing

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

DMR: Digital Voice, 12.5 kHz Channel Spacing

99% bandwidth

= 8.0 kHz

Emission Designator

8K00FXW

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

DMR: Digital Data, 12.5 kHz Channel Spacing

99% bandwidth

= 8.0 kHz

Emission Designator

8K00FXD

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

APCO P25 Phase 1: Digital Voice 12.5 kHz Channel Spacing

99% bandwidth

= 8.1 kHz

Emission Designator

8K10F1E

F1E represents a digital FM voice transmission

APCO P25 Phase 1: Digital Data 12.5 kHz Channel Spacing

99% bandwidth

= 8.1 kHz

Emission Designator

8K10F1D

F1D represents an digital FM data transmission

APCO P25 Phase 2: Digital Voice 12.5 kHz Channel Spacing

99% bandwidth

= 8.1 kHz

Emission Designator

8K10F1W

F1W represents a single FM telephony channel

APCO P25 Phase 2: Digital Data 12.5 kHz Channel Spacing

99% bandwidth

= 8.1 kHz

Emission Designator

8K10F1W

F1W represents digital FM data transmission

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

$$\begin{aligned}\text{Power in dBm} &= \text{Measured power (dBm)} + \text{attenuator and cable loss (dB)} \\ \text{Chan 1 power (dBm)} &= 5.02 \text{ dBm} + 31.25 \text{ dB} \\ &= 36.27 \text{ dBm} \\ \text{Power in Watts} &= (10^{(36.27 \text{ dBm})/10})/1000 \\ &= 4.2 \text{ W}\end{aligned}$$

MEASUREMENT UNCERTAINTY: $\pm 0.6 \text{ dB}$

MEASUREMENT RESULTS:

Manufacturer's Rated Output Power:

Switchable: 4 W and 1 W

Nominal 4 W	Measured	Variation (%)	Variation (dB)
406.125 MHz	4.2	6.0	0.3
418.025 MHz	4.3	7.4	0.3
429.975 MHz	4.2	5.2	0.2
438.025 MHz	4.2	4.2	0.2
450.025 MHz	4.2	6.1	0.3
460.025 MHz	4.3	6.3	0.3
469.975 MHz	4.3	6.6	0.3

Transmitter Output Power (Conducted) - continued

Nominal 1 W	Measured	Variation (%)	Variation (dB)
406.125 MHz	1.1	10.2	0.4
418.025 MHz	1.1	12.0	0.5
429.975 MHz	1.1	10.4	0.4
438.025 MHz	1.1	7.6	0.3
450.025 MHz	1.1	6.8	0.3
460.025 MHz	1.1	8.8	0.4
469.975 MHz	1.1	8.3	0.3

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:

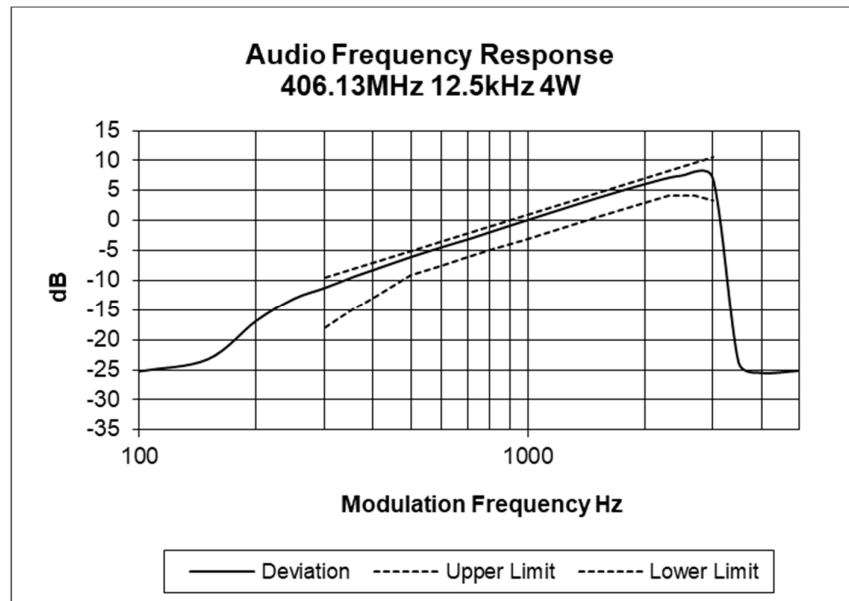
See the plots on the following pages for 12.5 kHz channel spacing tested at 4 W transmit power.

MEASUREMENT UNCERTAINTY: $\pm 1.5\%$

SPECIFICATION: FCC 47 CFR 2.1047 (a)

Tx FREQUENCY: 406.125 MHz

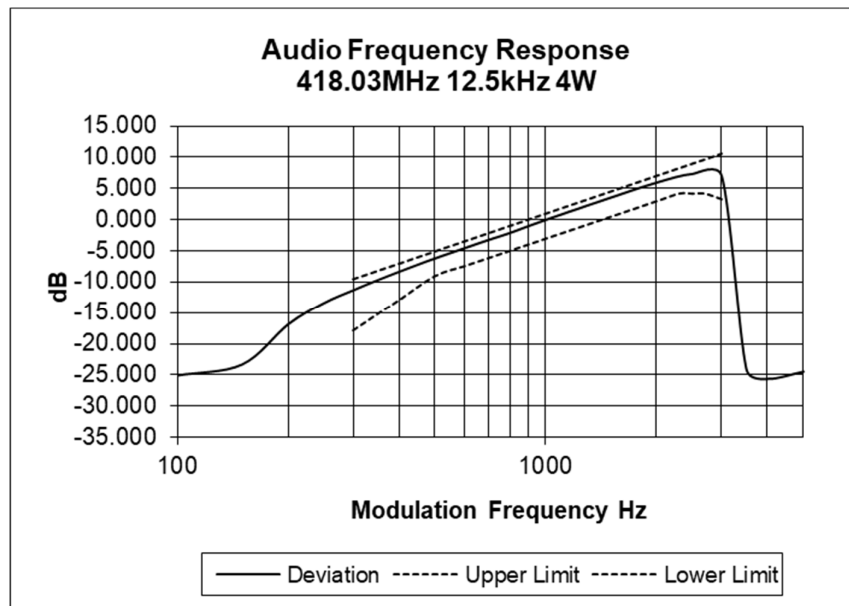
12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

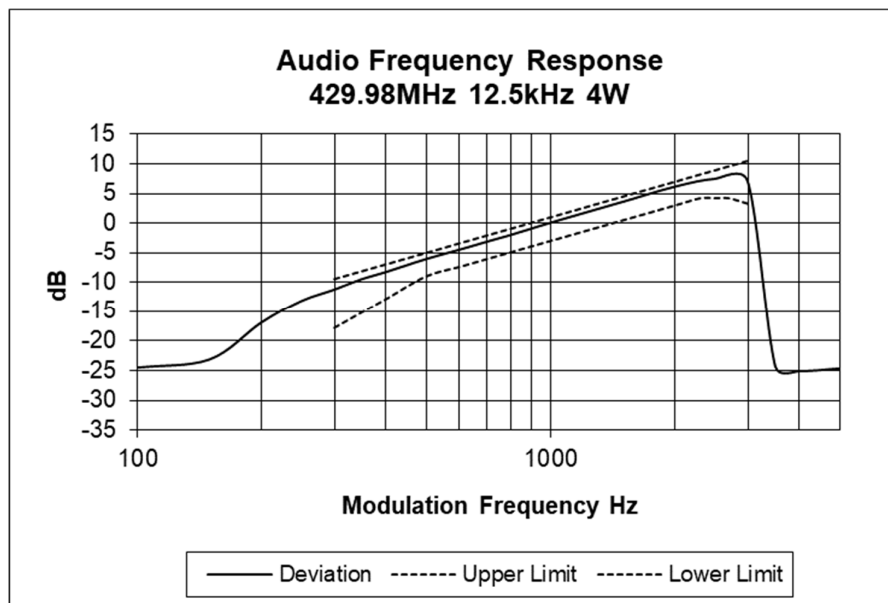
Tx FREQUENCY: 418.025 MHz

12.5 kHz Channel Spacing



Tx FREQUENCY: 429.975 MHz

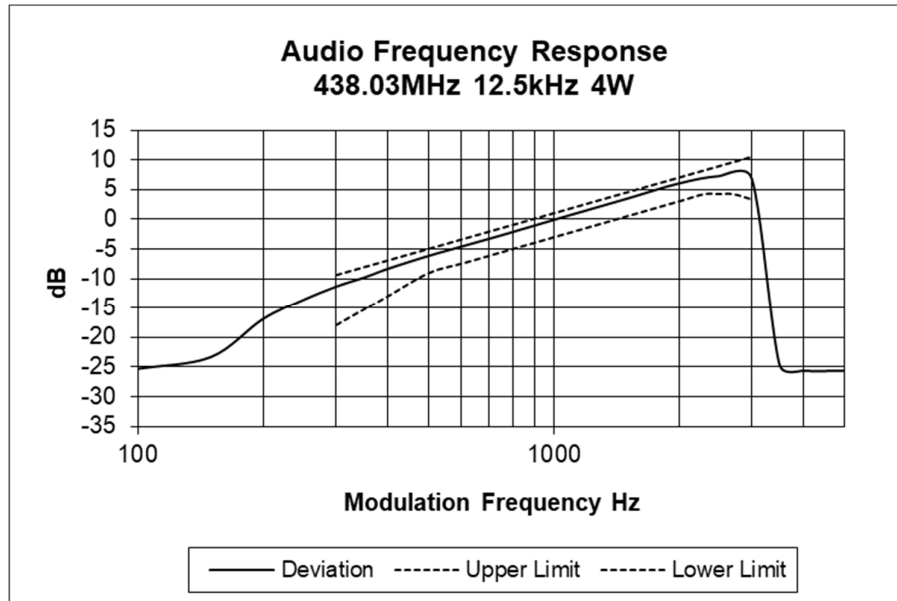
12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

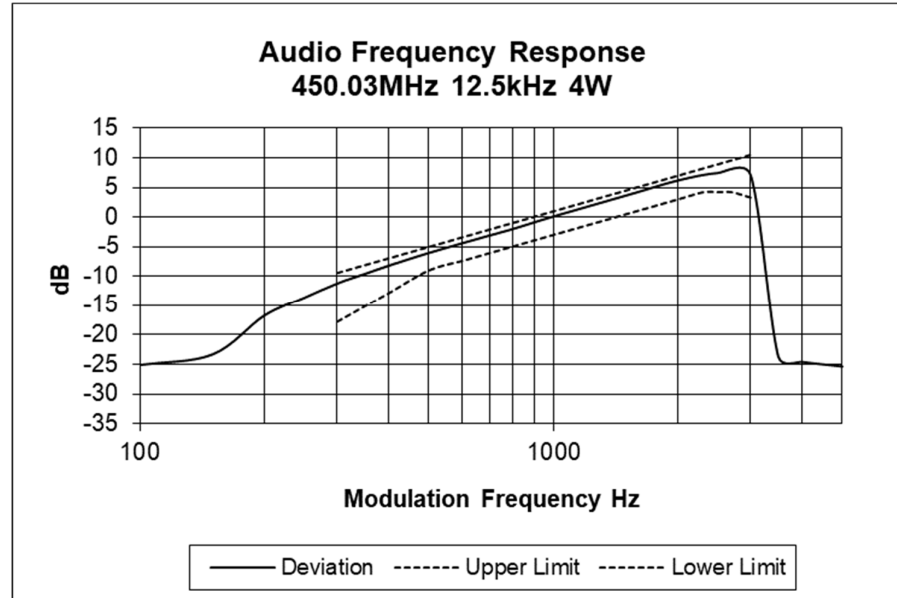
Tx FREQUENCY: 438.025 MHz

12.5 kHz Channel Spacing



Tx FREQUENCY: 450.025 MHz

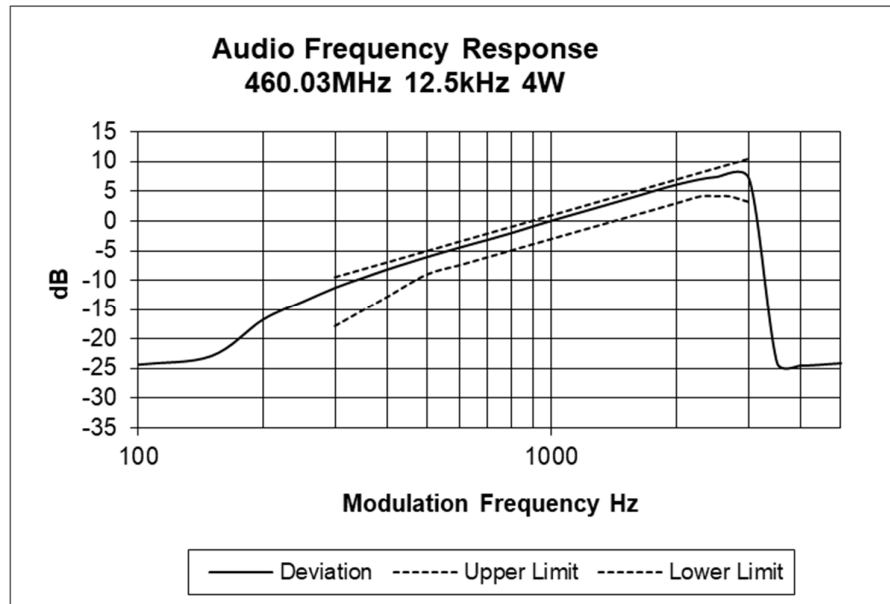
12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

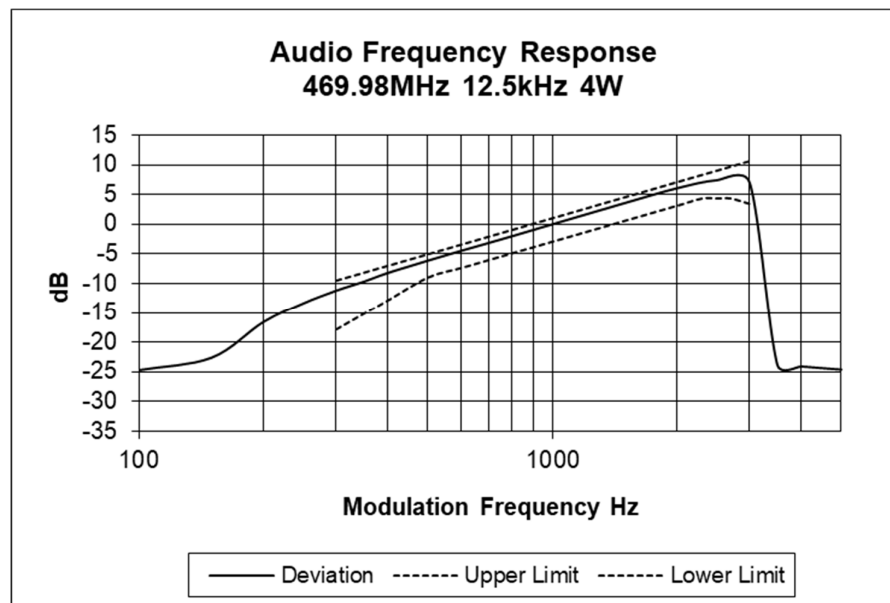
Tx FREQUENCY: 460.025 MHz

12.5 kHz Channel Spacing



Tx FREQUENCY: 469.975 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. The modulation response was measured at three audio frequencies while varying the input level.
3. Measurements were made for both Positive and Negative Deviation.

MEASUREMENT RESULTS:

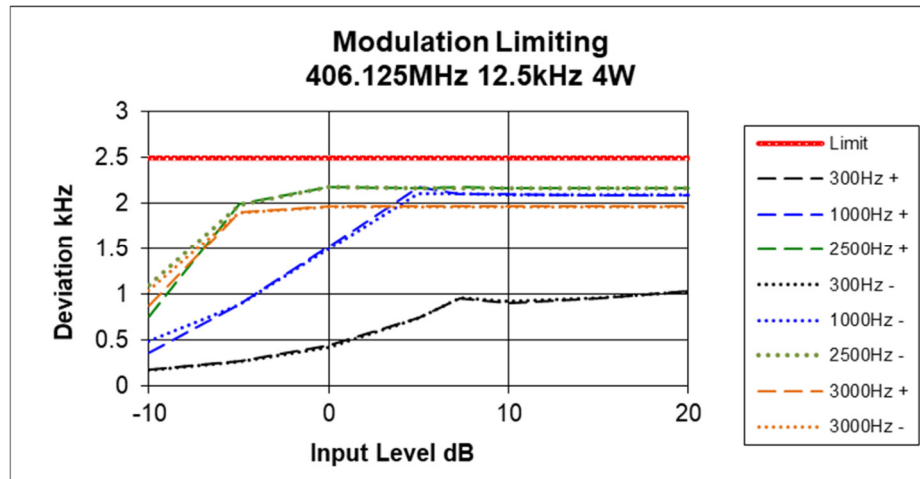
See the plots on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

MEASUREMENT UNCERTAINTY: $\pm 1.5\%$

Tx FREQUENCY: 406.125 MHz

12.5 kHz Channel Spacing

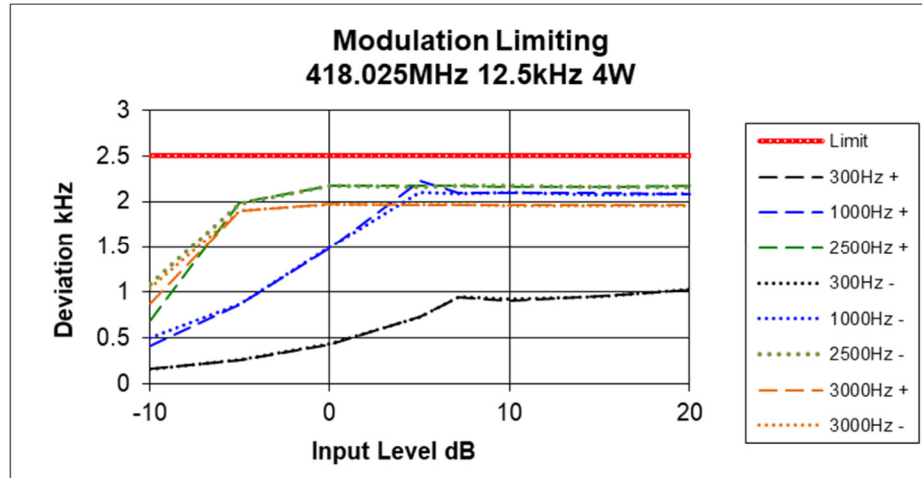


Transmitter Modulation Limiting

SPECIFICATION: FCC 47 CFR 2.1047 (b)

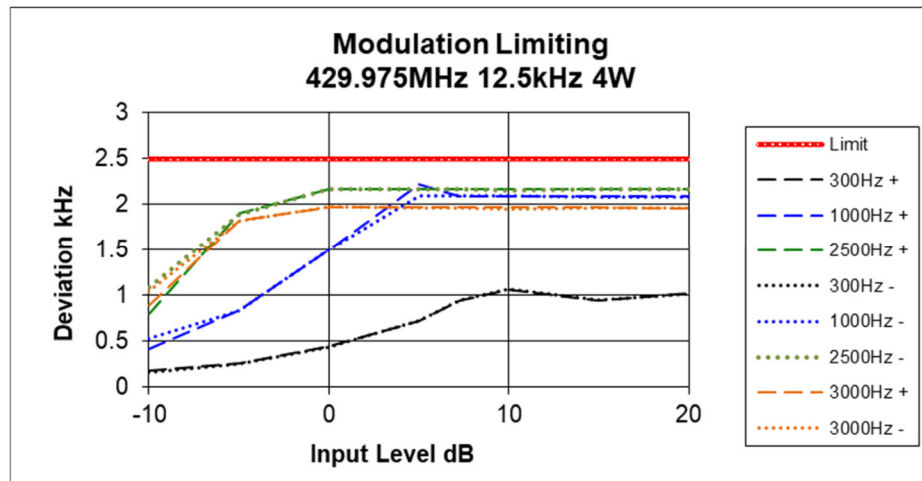
Tx FREQUENCY: 418.025 MHz

12.5 kHz Channel Spacing



Tx FREQUENCY: 429.975 MHz

12.5 kHz Channel Spacing

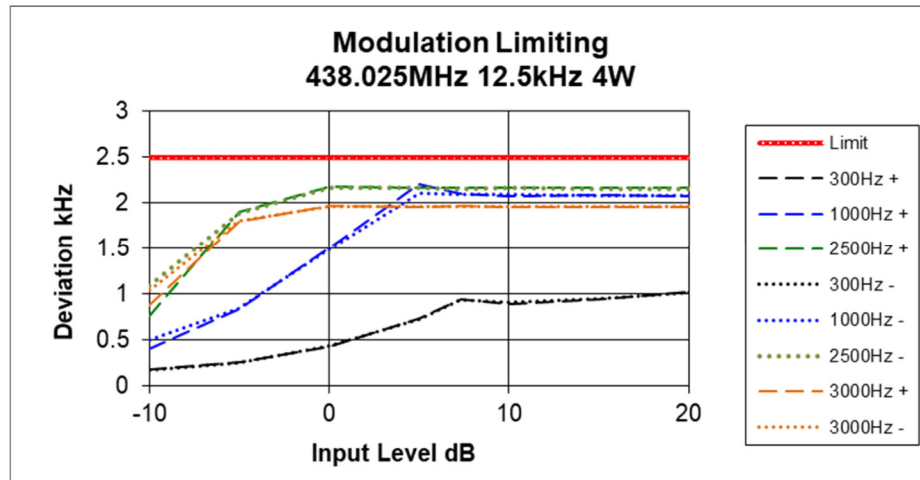


Transmitter Modulation Limiting

SPECIFICATION: FCC 47 CFR 2.1047 (b)

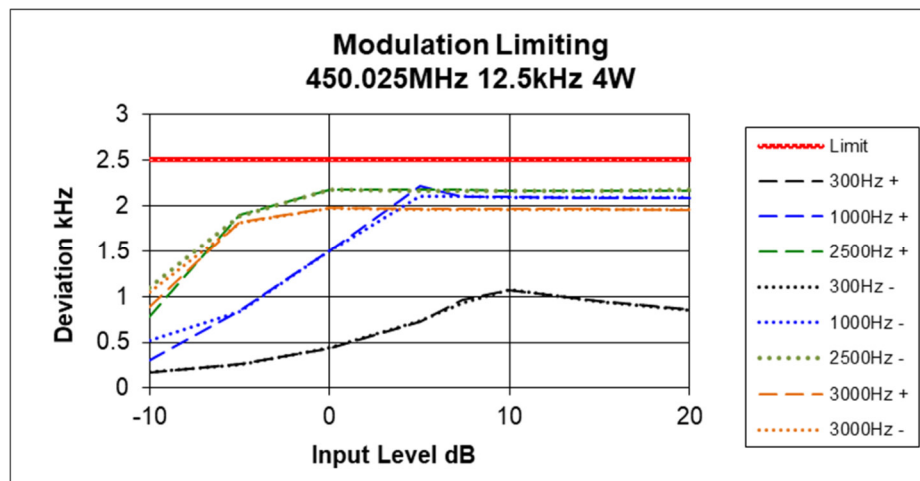
Tx FREQUENCY: 438.025 MHz

12.5 kHz Channel Spacing



Tx FREQUENCY: 450.025 MHz

12.5 kHz Channel Spacing

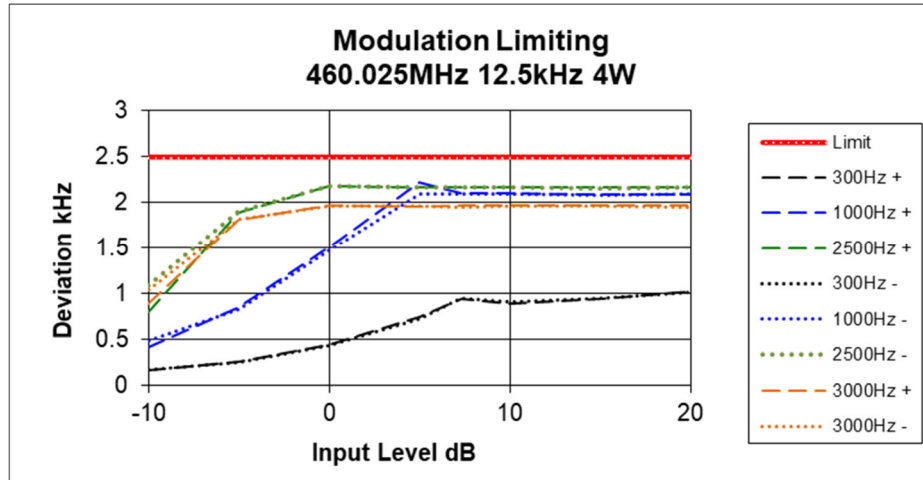


Transmitter Modulation Limiting

SPECIFICATION: FCC 47 CFR 2.1047 (b)

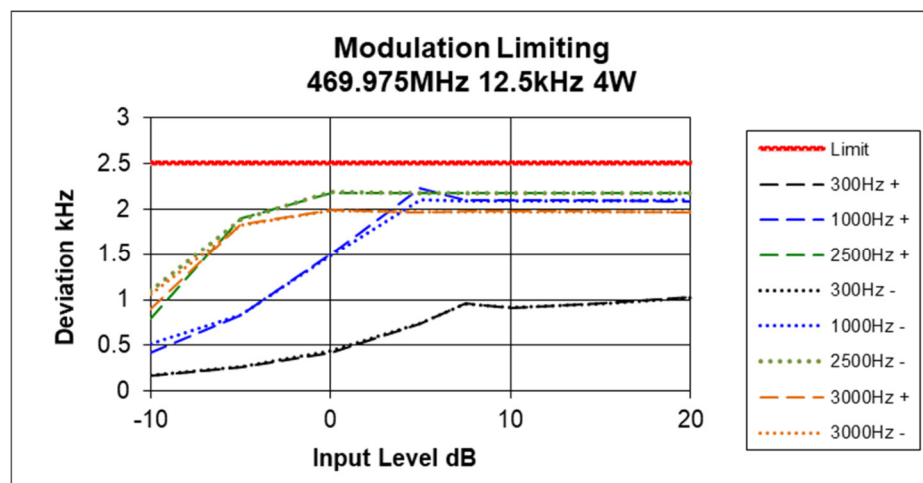
Tx FREQUENCY: 460.025 MHz

12.5 kHz Channel Spacing



Tx FREQUENCY: 469.975 MHz

12.5 kHz Channel Spacing



TRANSMITTER OCCUPIED (99%) BANDWIDTH

SPECIFICATION: FCC 47 CFR 2.1046
RSS-119 5.5

GUIDE: ANSI C63.26 5.4.4

MEASUREMENT PROCEDURE:

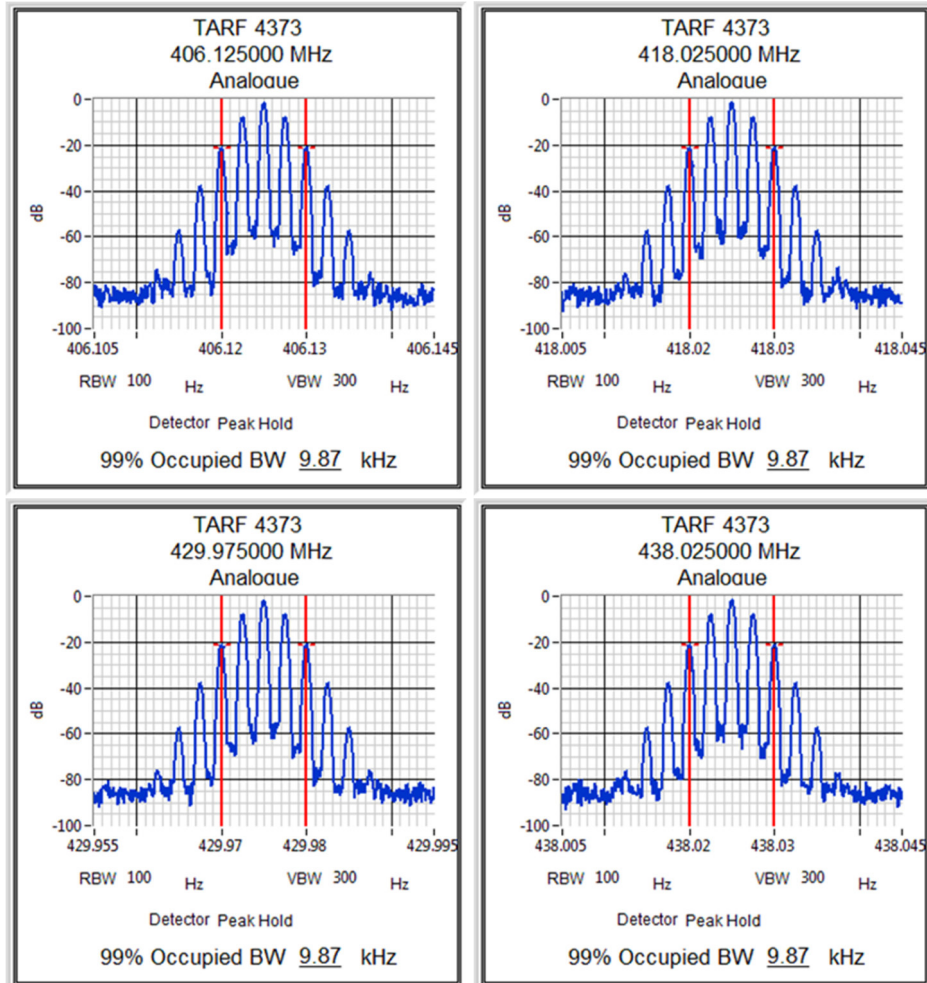
1. Refer Annex A for Equipment Set up.
2. For analogue measurements: The EUT was modulated by a 2500 Hz tone at an input level 16 dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.
For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as follows.
Resolution Bandwidth = 100 Hz, Video Bandwidth = 300 Hz

MEASUREMENT RESULTS:

Channel Frequency (MHz)	Channel Spacing (kHz)	Bandwidths (kHz)					
		Analogue	FFSK 1200 bps	FFSK 2400 bps	DMR	APCO P25 phase I	APCO P25 phase II
406.125 MHz	12.5	9.87	6.07	5.60	7.67	8.00	8.00
418.025 MHz	12.5	9.87	6.13	5.53	7.67	7.87	8.00
429.975 MHz	12.5	9.87	6.47	5.47	7.73	7.80	7.80
438.025 MHz	12.5	9.87	6.07	5.47	7.33	7.60	7.80
450.025 MHz	12.5	9.87	6.33	5.47	7.53	7.80	7.67
460.025 MHz	12.5	9.87	6.13	5.47	7.53	7.33	7.73
469.975 MHz	12.5	9.87	6.20	5.53	7.60	7.87	7.87
<u>Limit</u> 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	8.0	8.1	8.1
Result		Pass	Pass	Pass	Pass	Pass	Pass

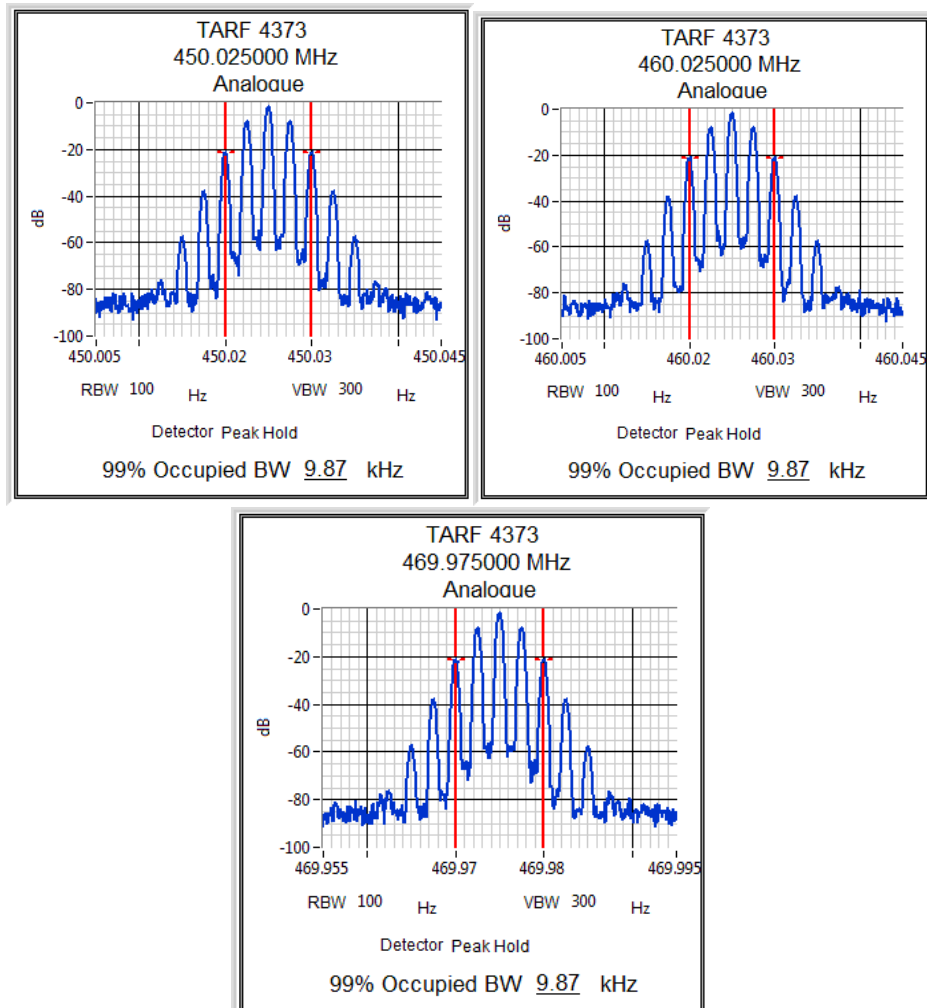
Transmitter Occupied (99%) Bandwidth

Channel 1-4 4 watts 12.5 kHz ch spacing Analogue Modulation



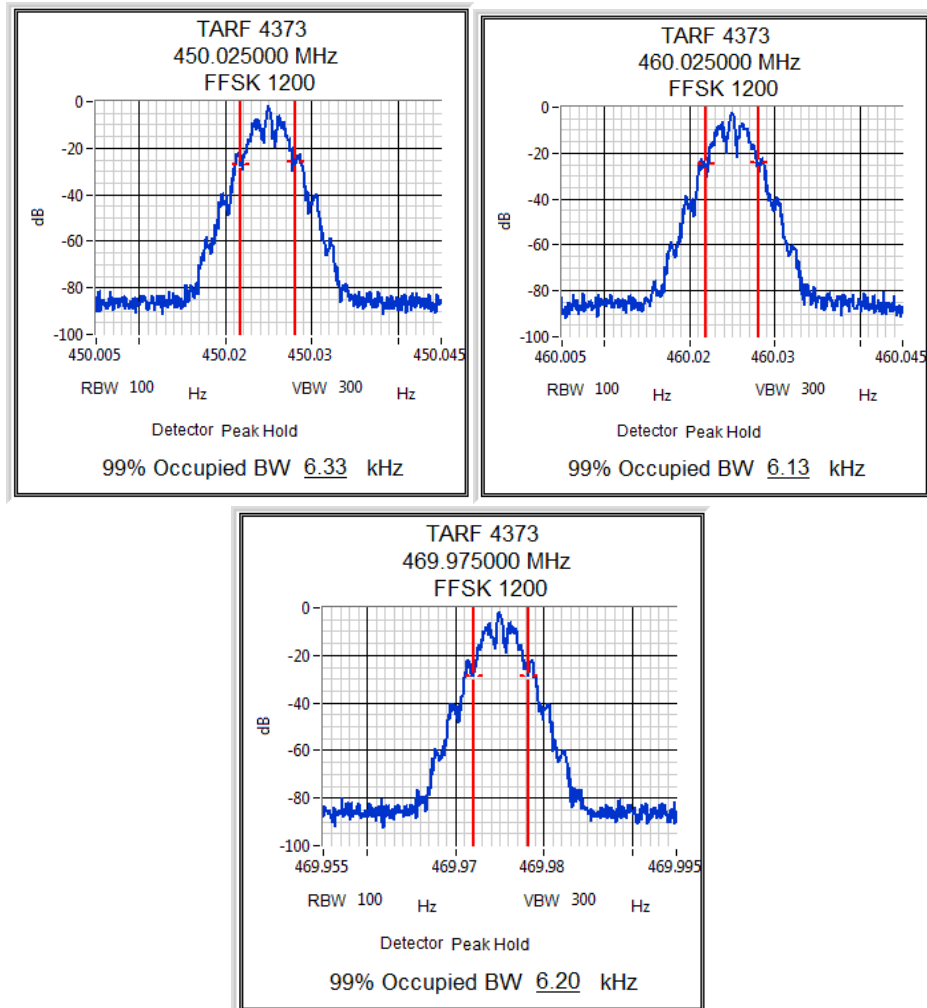
Transmitter Occupied (99%) Bandwidth

Channel 5-7 4 watts 12.5 kHz ch spacing Analogue Modulation



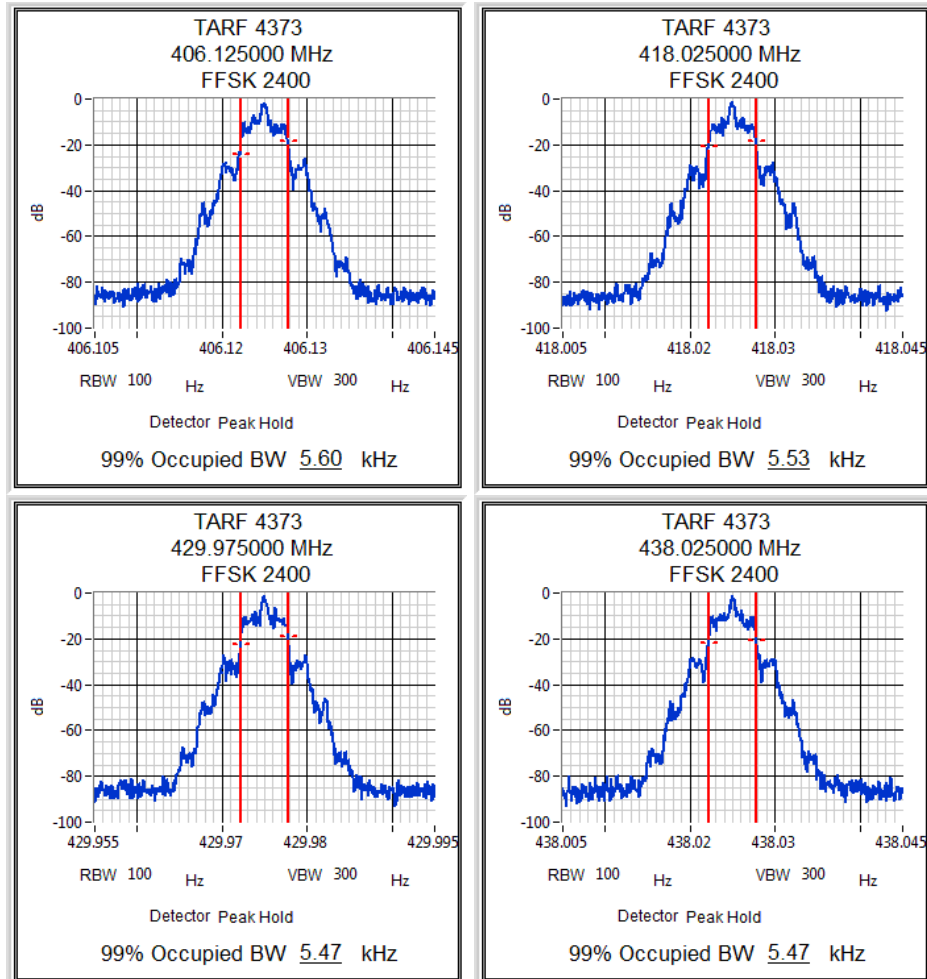
Transmitter Occupied (99%) Bandwidth

Channel 5-7 4 watts 12.5 kHz ch spacing FFSK 1200 Modulation



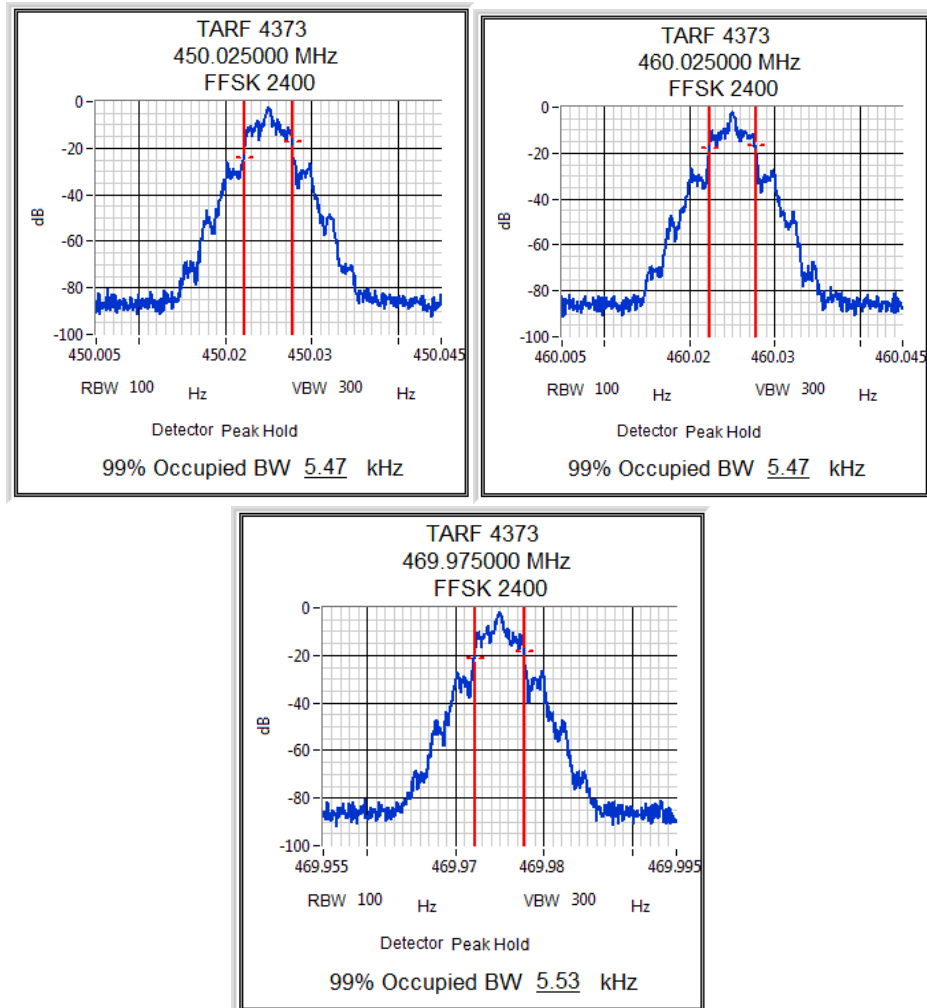
Transmitter Occupied (99%) Bandwidth

Channel 1-4 4 watts 12.5 kHz ch spacing FFSK 2400 Modulation



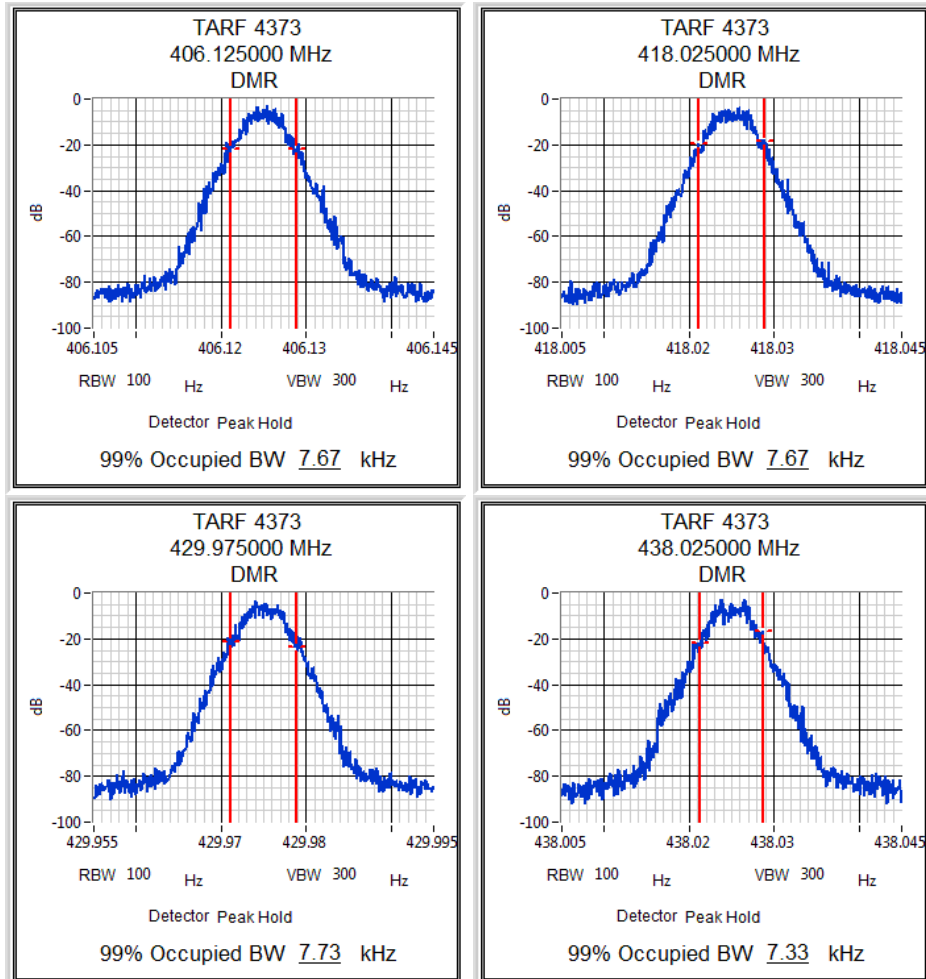
Transmitter Occupied (99%) Bandwidth

Channel 5-7 4 watts 12.5 kHz ch spacing FFSK 2400 Modulation



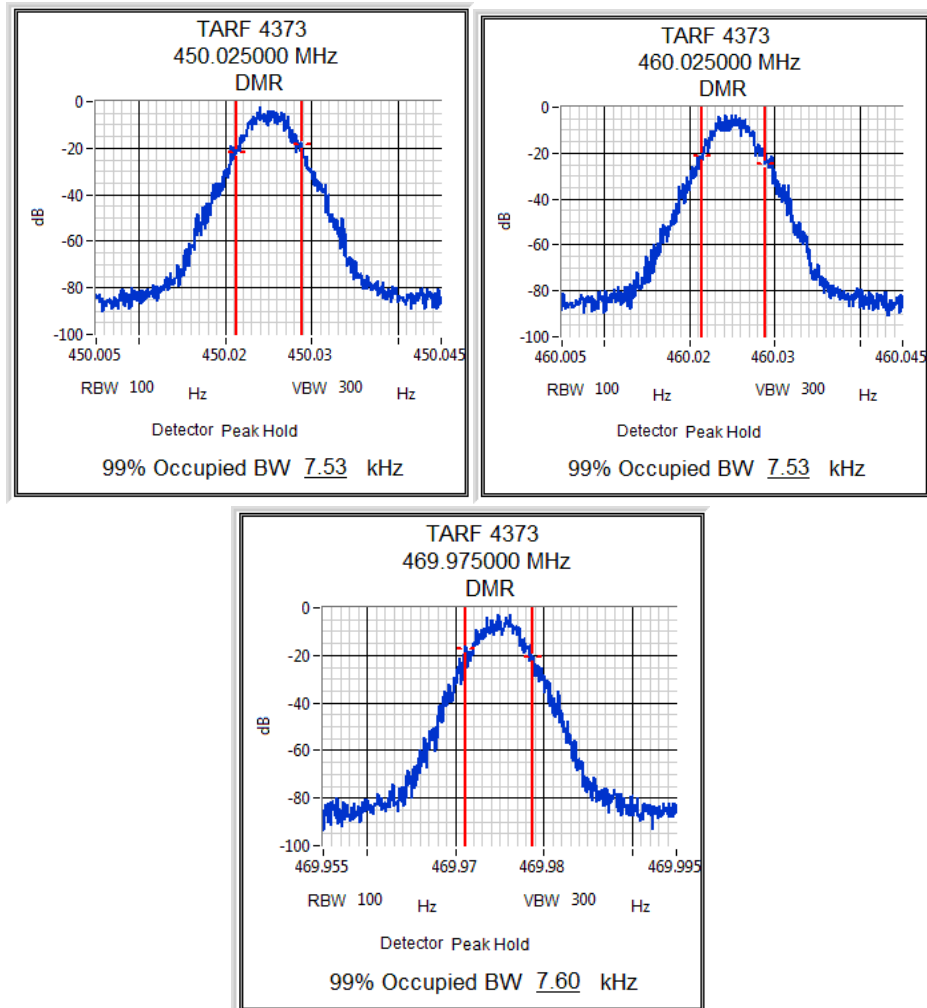
Transmitter Occupied (99%) Bandwidth

Channel 1-4 4 watts 12.5 kHz ch spacing DMR Modulation



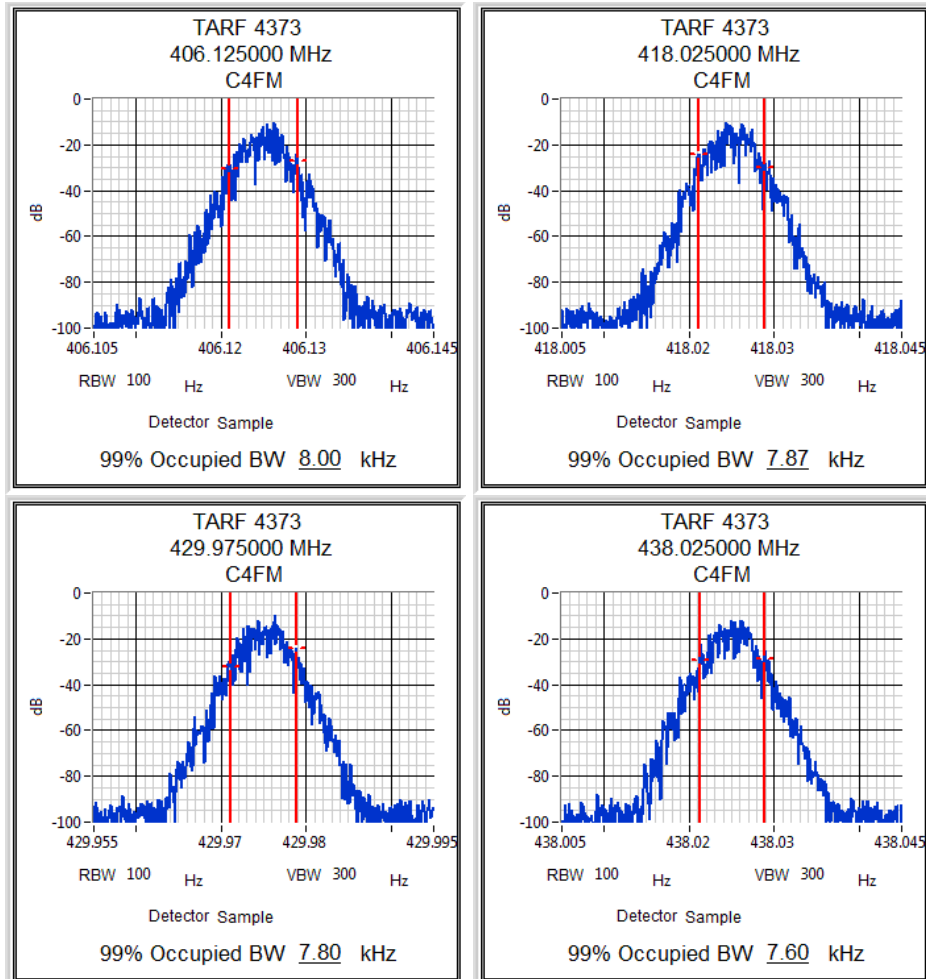
Transmitter Occupied (99%) Bandwidth

Channel 5-7 4 watts 12.5 kHz ch spacing DMR Modulation



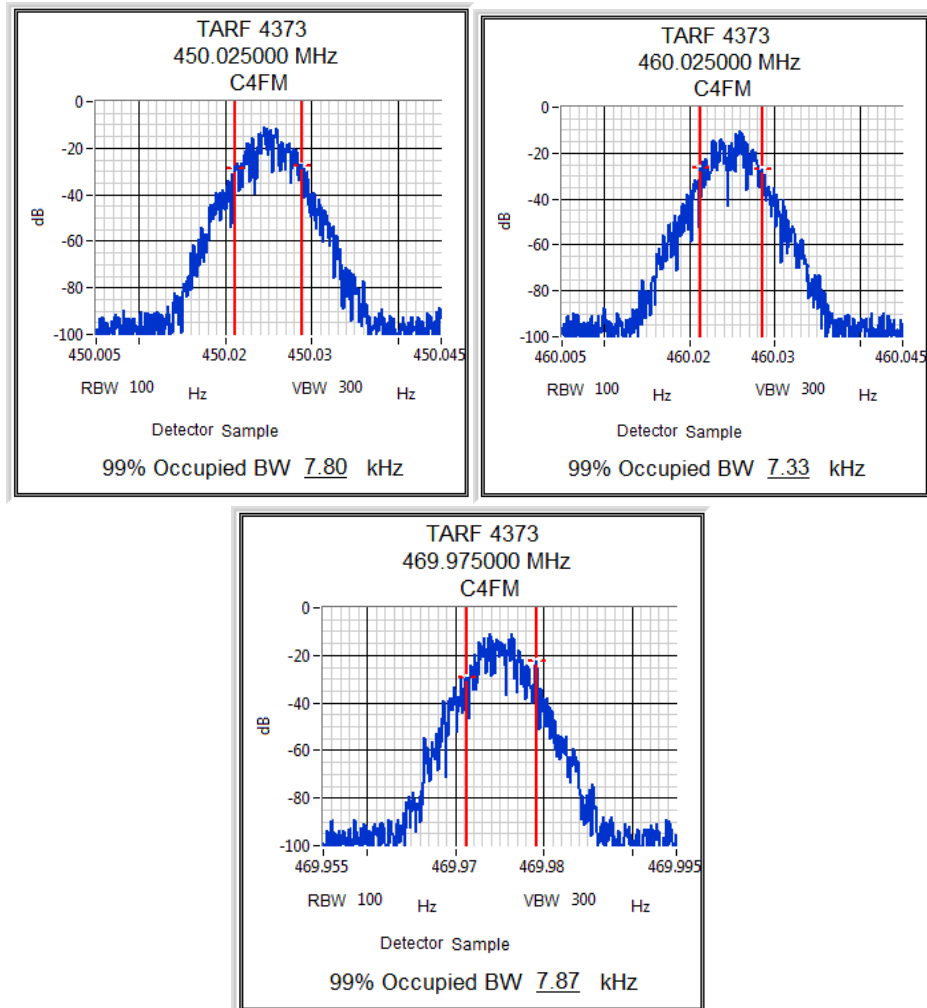
Transmitter Occupied (99%) Bandwidth

Channel 1-4 4 watts 12.5 kHz ch spacing P25 Phase 1 C4FM Modulation



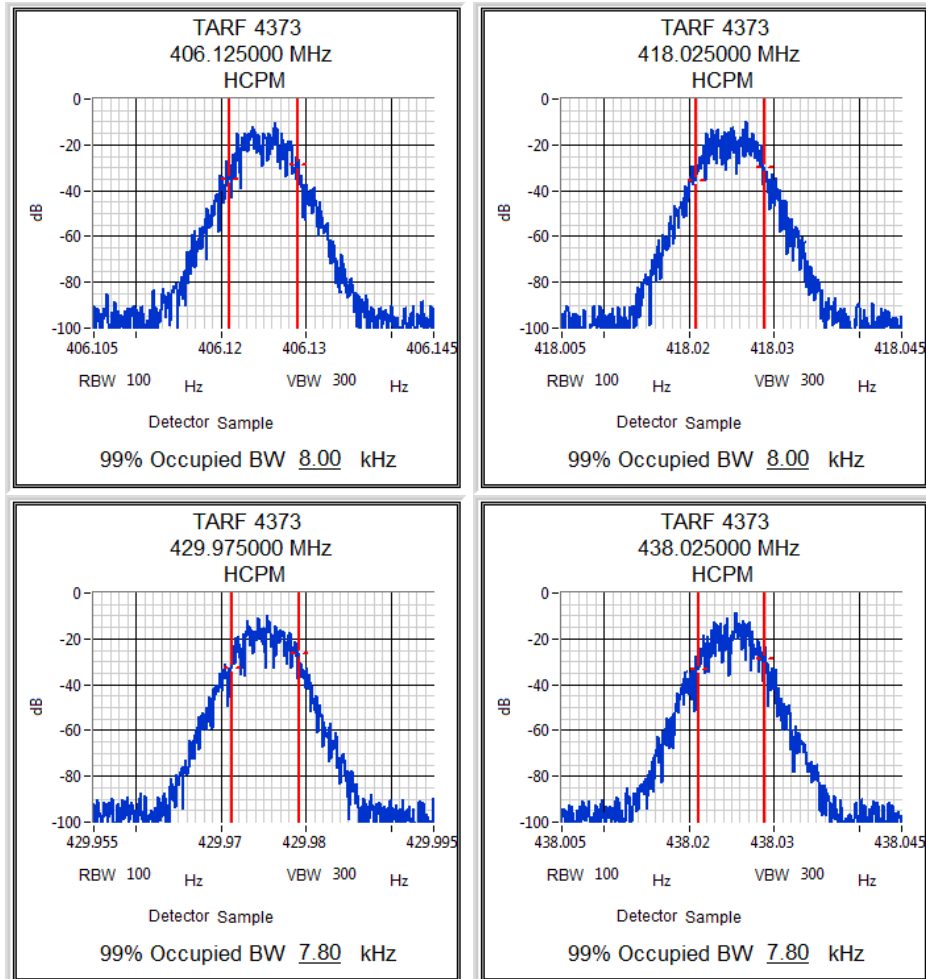
Transmitter Occupied (99%) Bandwidth

Channel 5-7 4 watts 12.5 kHz ch spacing P25 Phase 1 C4FM Modulation



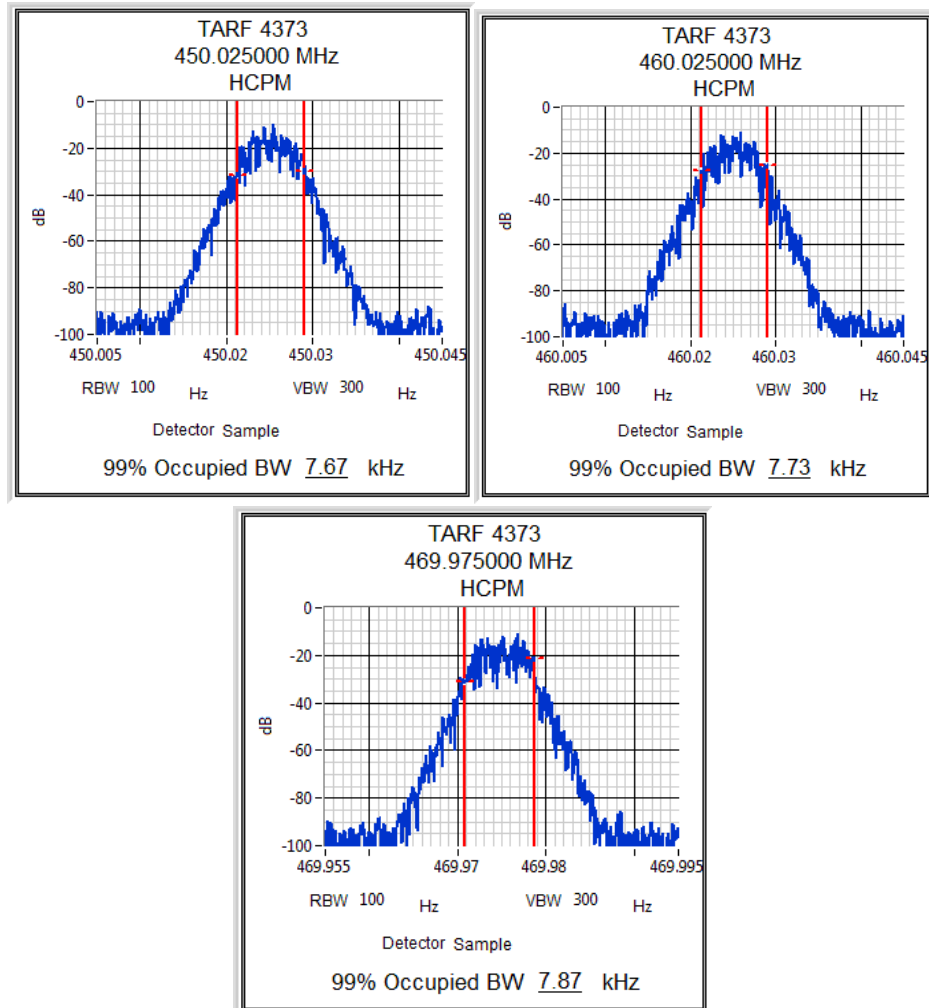
Transmitter Occupied (99%) Bandwidth

Channel 1-4 4 watts 12.5 kHz ch spacing P25 Phase 2 HCPM Modulation



Transmitter Occupied (99%) Bandwidth

Channel 5-7 4 watts 12.5 kHz ch spacing P25 Phase 2 HCPM Modulation



TRANSMITTER SPECTRUM MASKS

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

GUIDE: ANSI C63.26.5.7.3

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
2. For analogue measurements: The EUT was modulated by a 2500 Hz tone at an input level 16 dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.
For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as follows.

Emission Mask D – Resolution Bandwidth = 100 Hz, Video Bandwidth = 1 kHz

MEASUREMENT RESULTS:

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

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

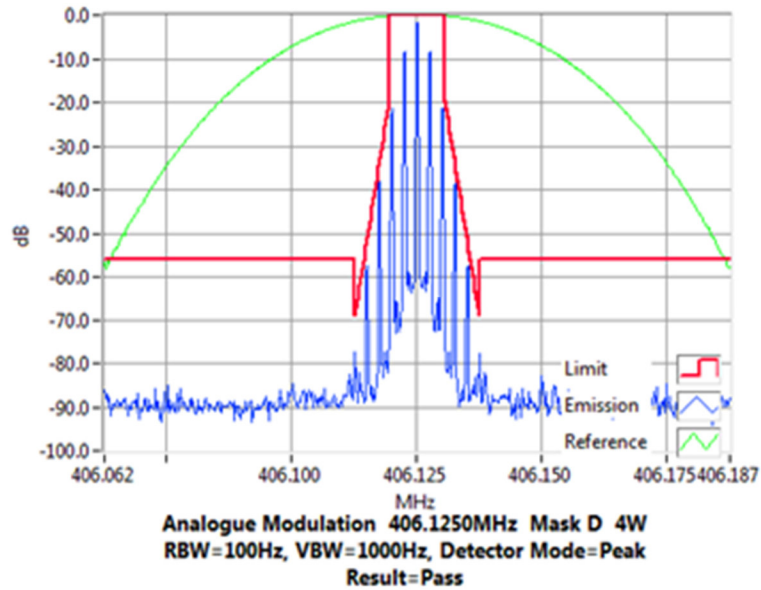
Digital Voice/Data	12.5 kHz Channel Spacing	9600 bps & 12000 bps
FFSK	12.5 kHz Channel Spacing	1200 bps & 2400 bps

Transmitter Spectrum Masks

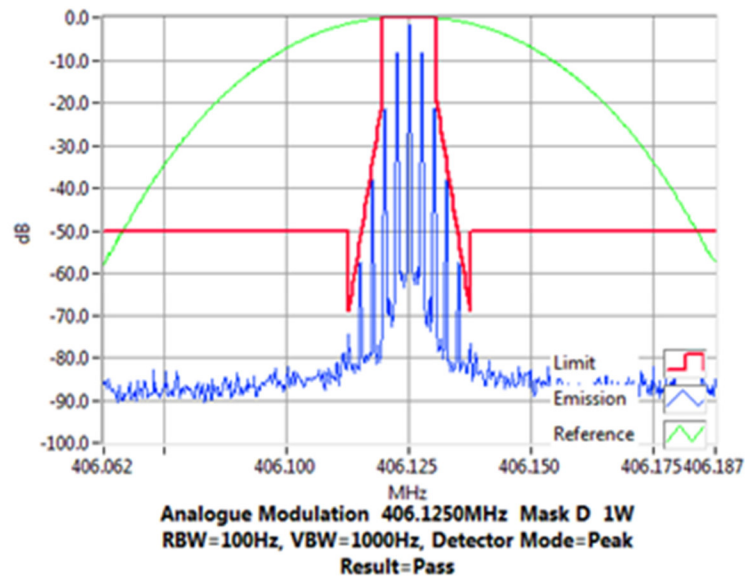
ANALOGUE VOICE

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

Tx FREQUENCY: 406.125 MHz 4 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 406.125 MHz 1 W 12.5 kHz Channel Spacing

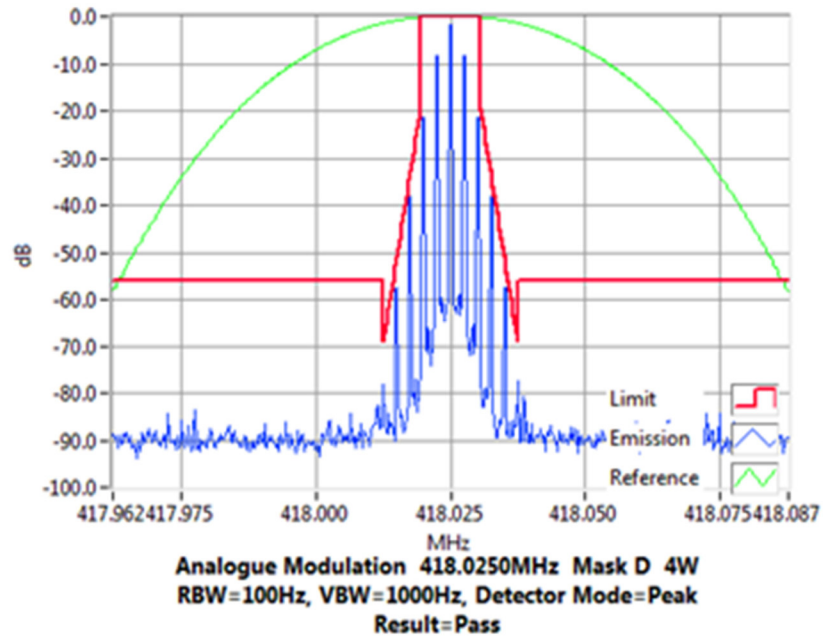


Transmitter Spectrum Masks

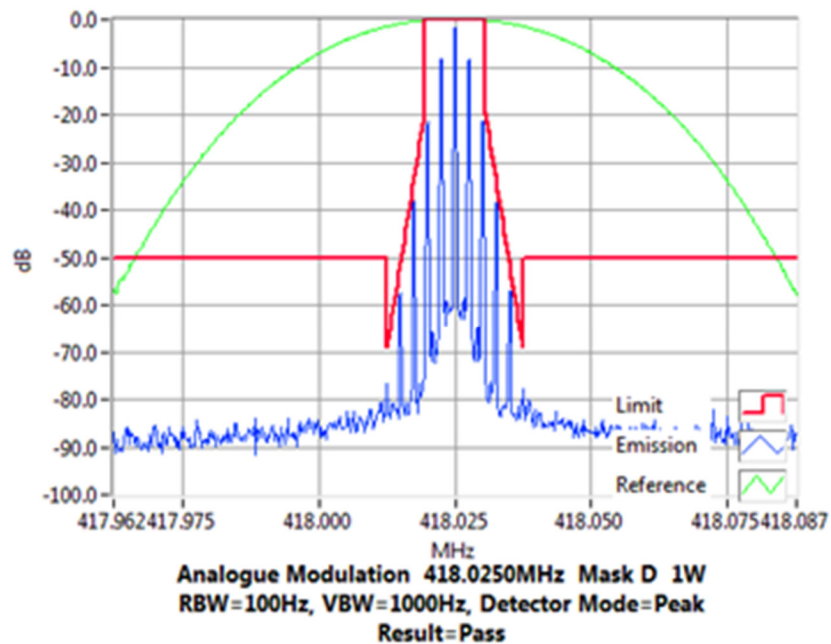
ANALOGUE VOICE

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

Tx FREQUENCY: 418.025 MHz 4 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 418.025 MHz 1 W 12.5 kHz Channel Spacing

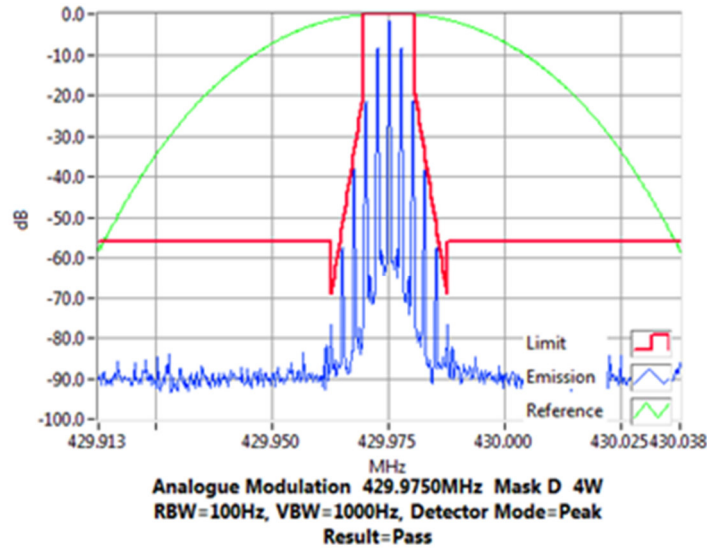


Transmitter Spectrum Masks

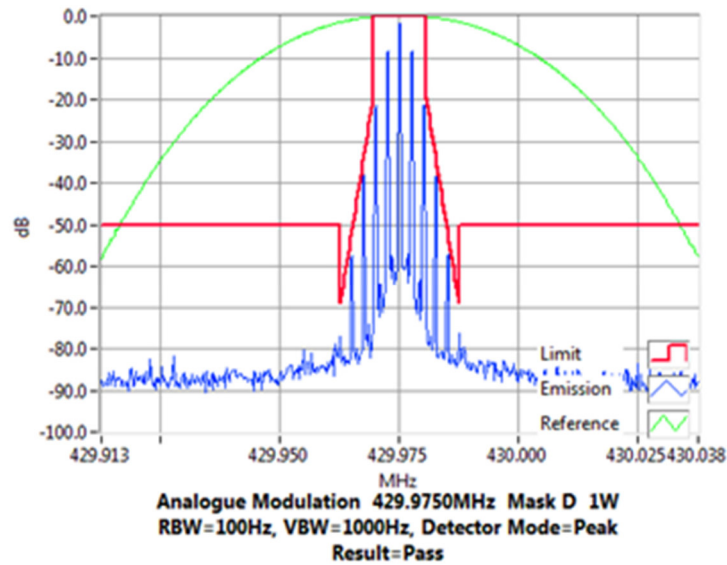
ANALOGUE VOICE

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

Tx FREQUENCY: 429.975 MHz 4 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 429.975 MHz 1 W 12.5 kHz Channel Spacing

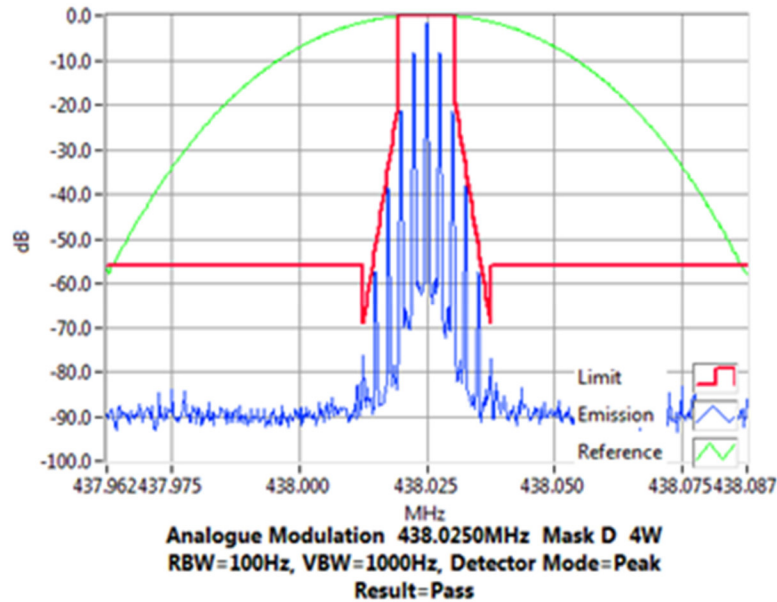


Transmitter Spectrum Masks

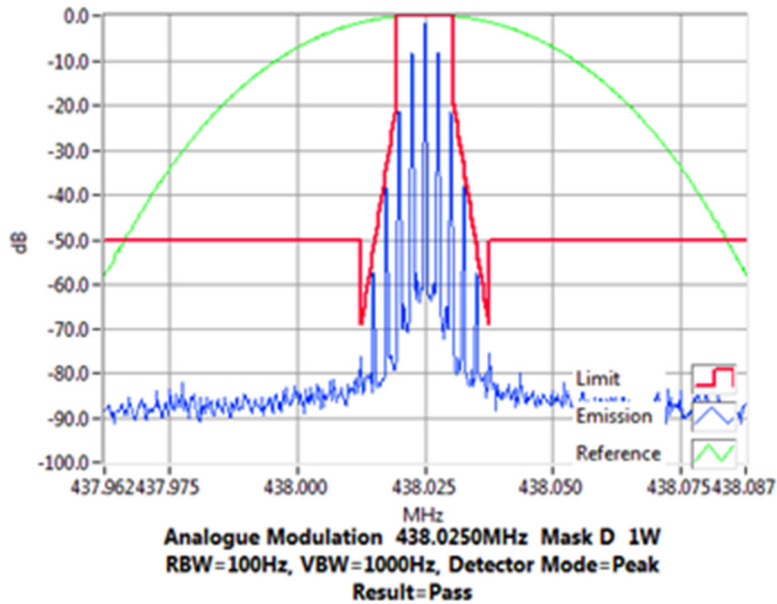
ANALOGUE VOICE

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

Tx FREQUENCY: 438.025 MHz 4 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 438.025 MHz 1 W 12.5 kHz Channel Spacing

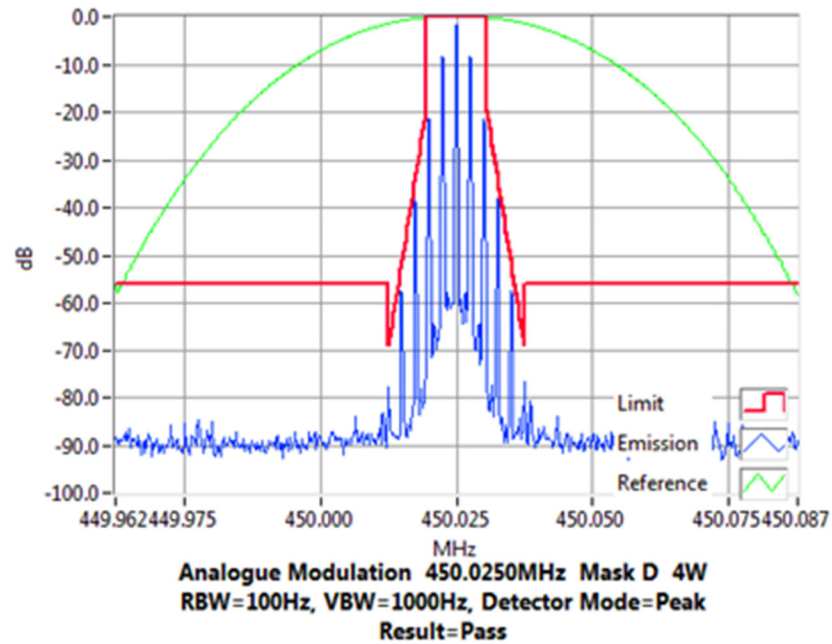


Transmitter Spectrum Masks

ANALOGUE VOICE

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

Tx FREQUENCY: 450.025 MHz 4 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 450.025 MHz 1 W 12.5 kHz Channel Spacing

