TELTEST Laboratories
Tait International Ltd
Report Number 4014

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBDH5G Base Station Transceiver

Tested in accordance with:

FCC 47 CFR Parts 22 and 90

Report Revision: 1

Issue Date: 18 September 2019

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FCC REGISTRATION: 838288

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REVISION

Date	Revision	Comments
18 September 2019	1	Initial test report

INTRODUCTION

Type approval testing of the TBDH5G, 40-Watt, BASE STATION transceiver in order to demonstrate compliance with FCC 47 Parts 22 & 90 when using APCO P25 phase 1 modulation. This radio has previously been tested with analogue, FFSK and DMR modulations. The original report for this is Teltest 3743.

Type Approval Testing of the TBDH5G
Frequency range 400 → 470 MHz

in accordance with:

FCC 47 CFR Parts 22 and 90

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

DESCRIPTION OF SAMPLE
Manufacturer Tait International Limited
Equipment: Base Station Transceiver
Type: TBDH5G
Product Code: TB7310-H5B0-0000-00AE-10
Serial Number(s): 18295486
Frequency range 400 → 470 MHz
Transmit Power 40 W

Modulation		Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
APCO P25 Phase 1	C4FM (TIA 102)	12.5 kHz	1	4800	9600

HARDWARE & SOFTWARE
Quantity: 1

Module	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01403-SAAA	18295500	p25-trunk.20190607T162306	1.01
Power Amplifier	T01-01405-SAAA	18295501	n/a	0.01
Front Panel	T01-01410-AAAA	4682949	0.01.00.master.20180703T105202.0001	0.01

TEST CONDITIONS
All testing was performed on 13 → 16 September 2019, and under the following conditions:
Ambient temperature: 15°C → 30°C
Relative Humidity: 20% → 75%
Standard Test Voltage 13.8 V_{DC}

STATEMENT OF COMPLIANCE

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

Equipment:	Base Station Transceiver
Type:	TBDH5G
Product Code:	TB7310-H5B0-0000-00AE-10
Serial Number(s):	18295486
Quantity:	1

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

FCC 47 CFR Parts 22 and 90

Signature: 

M. C. James
Laboratory Technical Manager

Date: 2 October 2019

MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

MODULATION TYPES:

F1E	P25 phase 1 Digital Voice	9600 bps
F1D	P25 phase 1 Digital Data	9600 bps

CHANNEL SPACING: 12.5 kHz

EMISSION DESIGNATORS:

	12.5 kHz
Digital Voice P25 phase 1	8K10F1E
Digital Data P25 phase 1	8K10F1D

CALCULATIONS

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

APCO P25 Phase 1:

Digital Voice / Data (C4FM - 4 level frequency shift keying)

Digital Voice/data transmissions use a 4 level frequency shift keying modulation scheme.
The necessary bandwidth has been measured using the 99% energy rule, and in accordance with FCC KDB 971168 D01.

Digital Voice 12.5 kHz Bandwidth P25 phase 1

99% bandwidth = 8.1 kHz

Emission Designator **8K10F1E**

F1E represents a digital FM voice transmission

Digital Data 12.5 kHz Bandwidth P25 phase 1

99% bandwidth = 8.1 kHz

Emission Designator **8K10F1D**

F1D represents an digital FM data transmission

TRANSMITTER OCCUPIED BANDWIDTH AND SPECTRUM MASKS

SPECIFICATION: FCC 47 CFR 2.1049 (c)

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

MEASUREMENT PROCEDURE:
1. Refer Annex A for Equipment Set up.
2. For 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 Analyzer, with bandwidth settings as noted on the recorded plots.

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

MEASUREMENT UNCERTAINTY 95% ±0.65dB

LIMIT CLAUSE: FCC 47 CFR 90.210

EMISSION MASKS

Emission Mask D	12.5 kHz Channel Spacing	Digital Voice/data

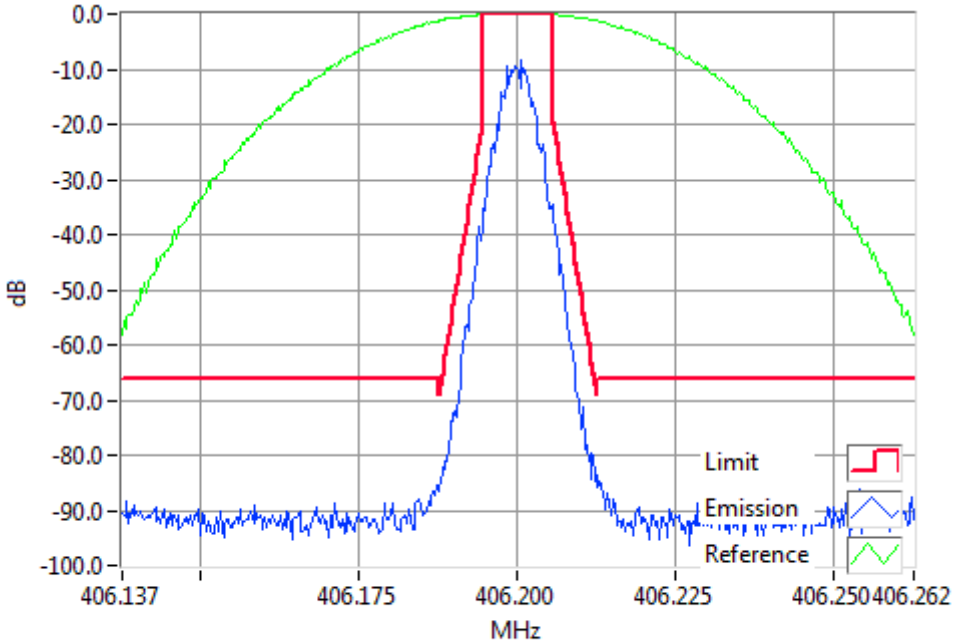
DATA SPEED

Digital Voice/Data	12.5 kHz Channel Spacing	9600 bps

Occupied Bandwidth and Spectrum Masks

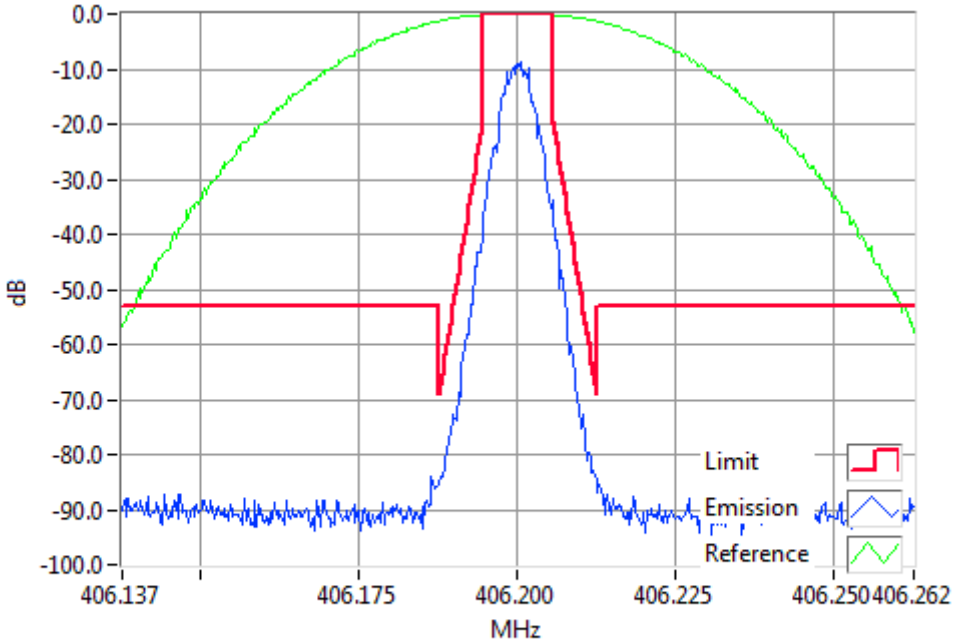
APCO P25 phase-1

Tx FREQUENCY: 406.2 MHz 40 W 12.5 kHz Channel Spacing



P25 Ph1-C4FM 406.2000MHz Mask D 40W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 406.2 MHz 2 W 12.5 kHz Channel Spacing

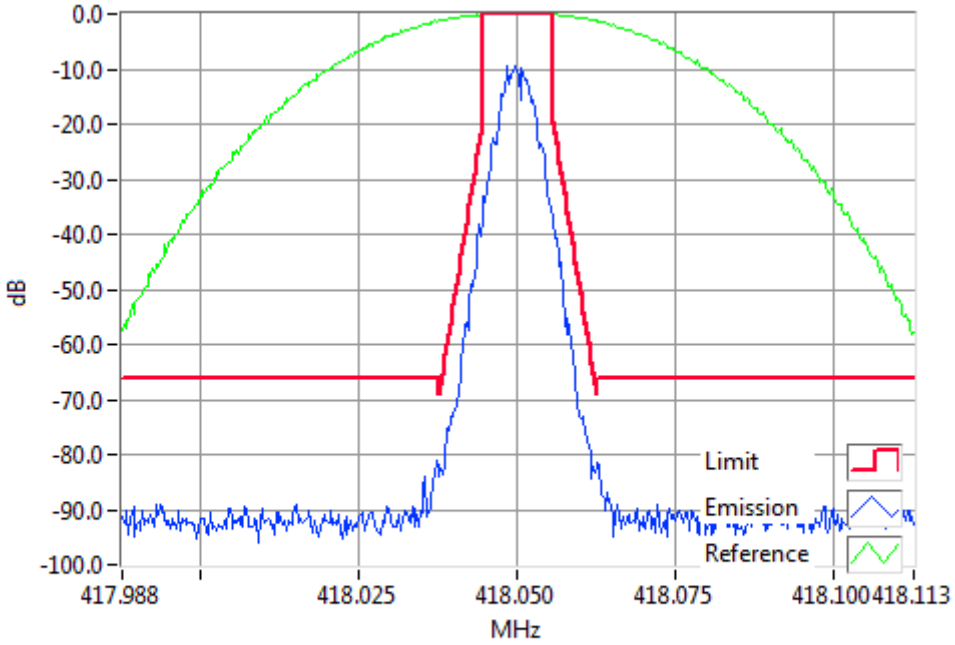


P25 Ph1-C4FM 406.2000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

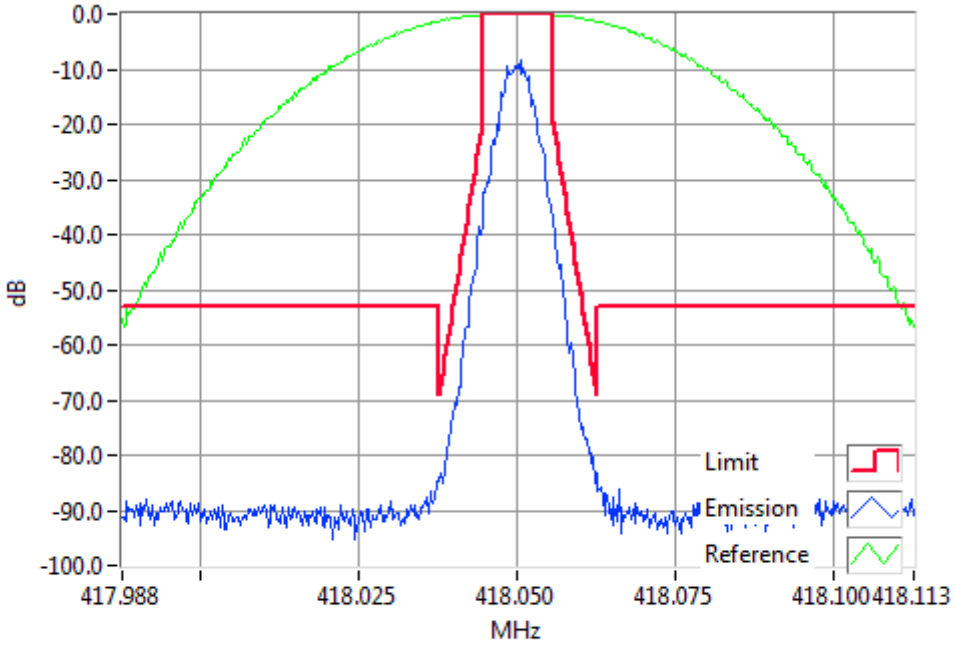
APCO P25 phase-1

Tx FREQUENCY: 418.05 MHz 40 W 12.5 kHz Channel Spacing



P25 Ph1-C4FM 418.0500MHz Mask D 40W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 418.05 MHz 2 W 12.5 kHz Channel Spacing

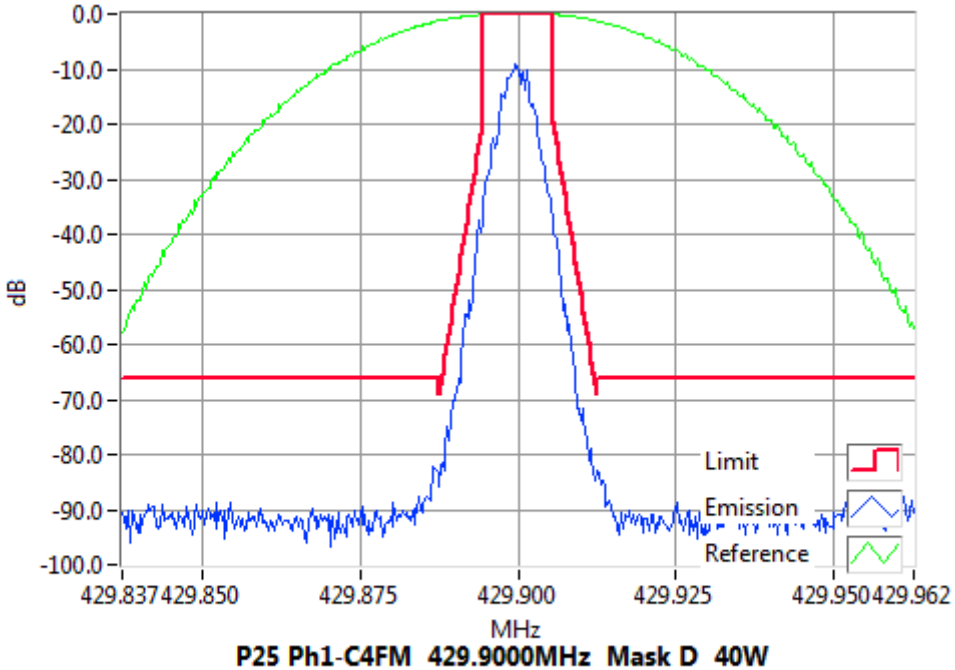


P25 Ph1-C4FM 418.0500MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

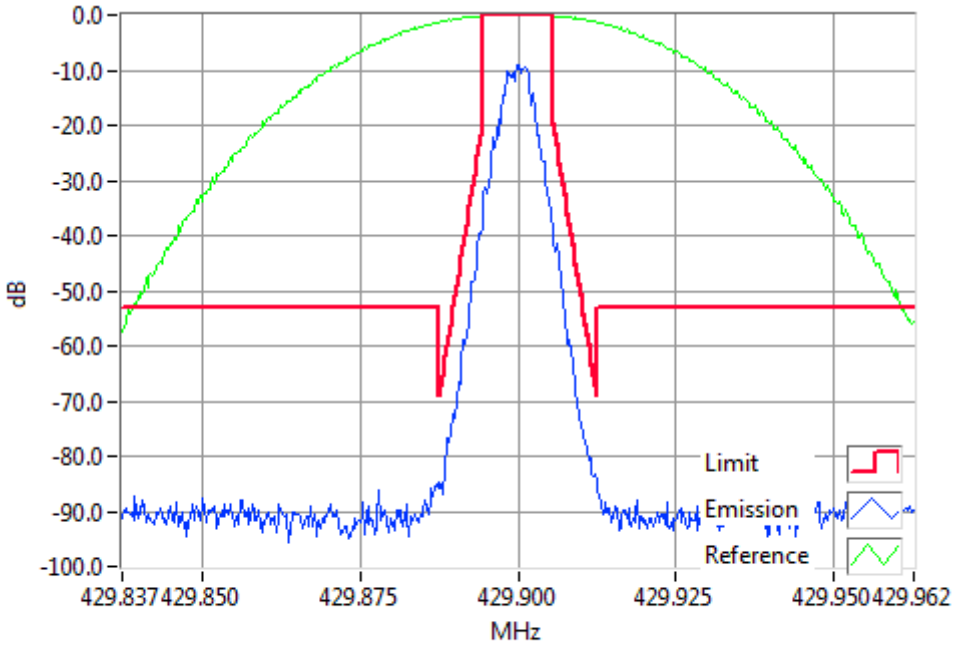
APCO P25 phase-1

Tx FREQUENCY: 429.9 MHz 40 W 12.5 kHz Channel Spacing



P25 Ph1-C4FM 429.9000MHz Mask D 40W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 429.9 MHz 2 W 12.5 kHz Channel Spacing

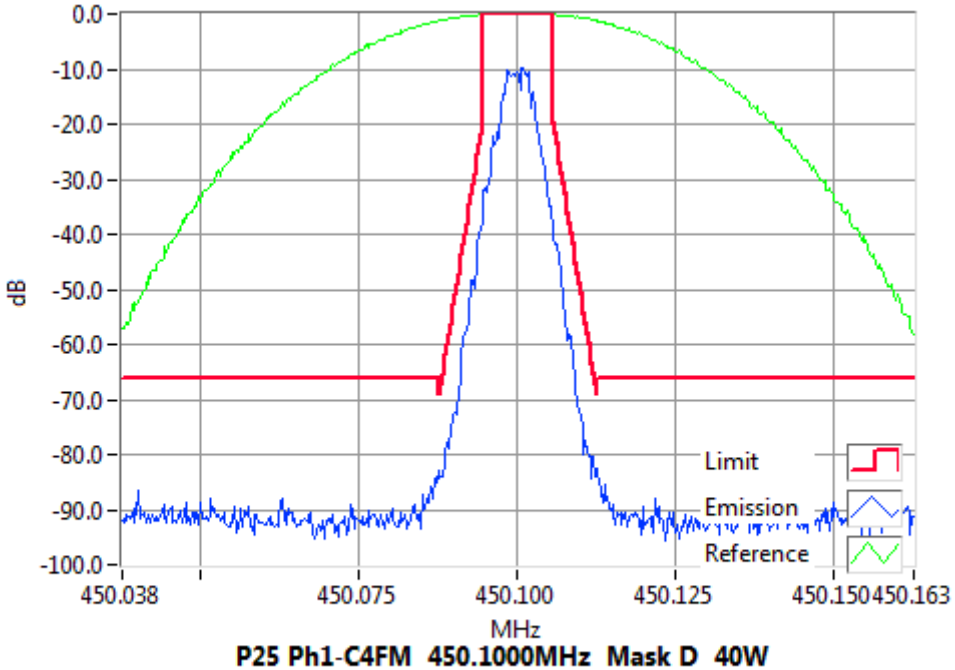


P25 Ph1-C4FM 429.9000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

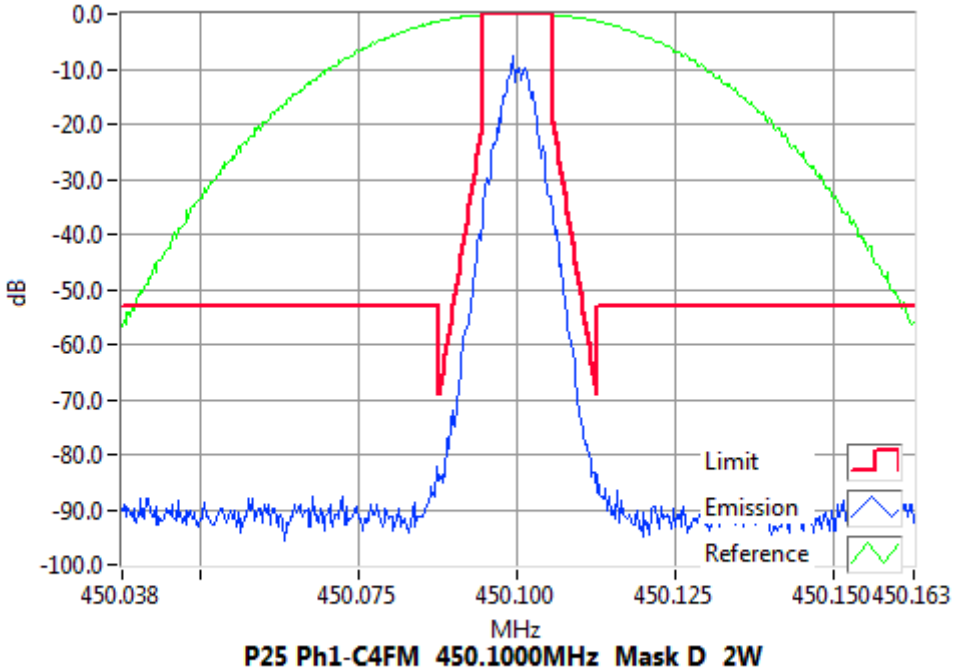
APCO P25 phase-1

Tx FREQUENCY: 450.1 MHz 40 W 12.5 kHz Channel Spacing



P25 Ph1-C4FM 450.1000MHz Mask D 40W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 450.1 MHz 2 W 12.5 kHz Channel Spacing

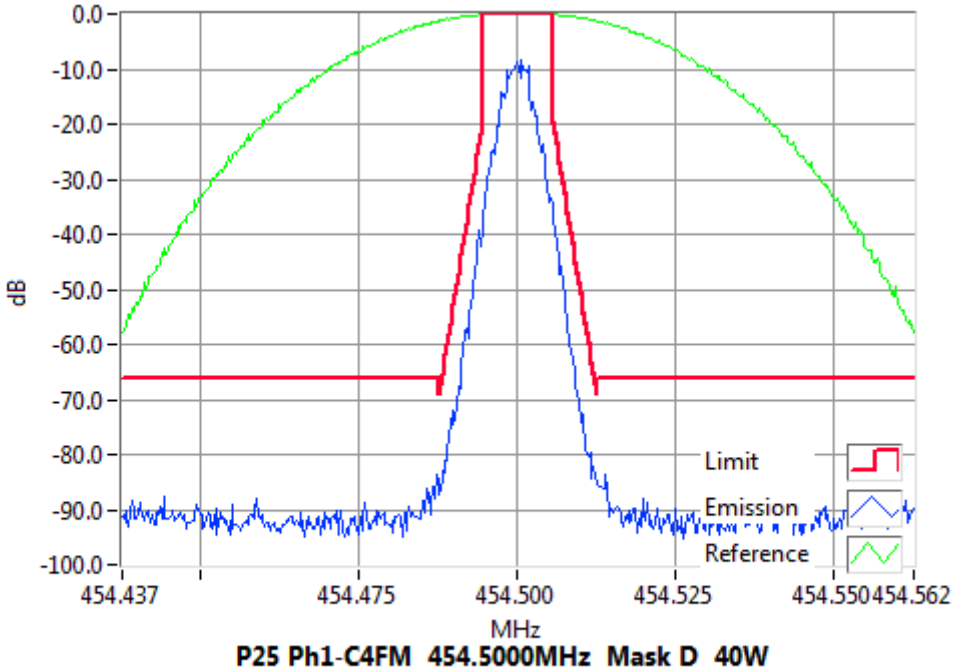


P25 Ph1-C4FM 450.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

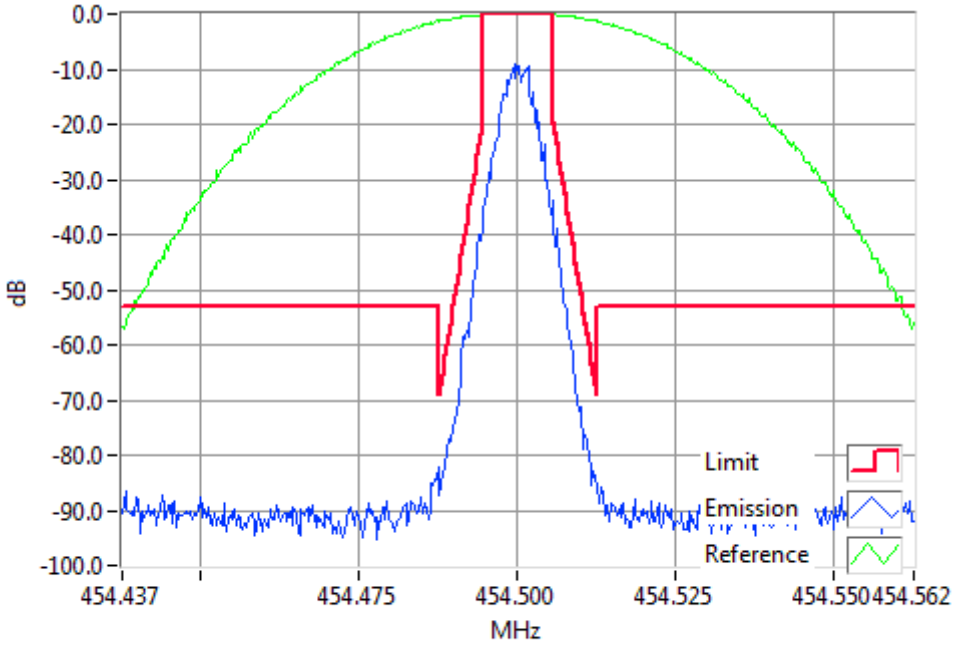
APCO P25 phase-1

Tx FREQUENCY: 454.5 MHz 40 W 12.5 kHz Channel Spacing



P25 Ph1-C4FM 454.5000MHz Mask D 40W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 454.5 MHz 2 W 12.5 kHz Channel Spacing

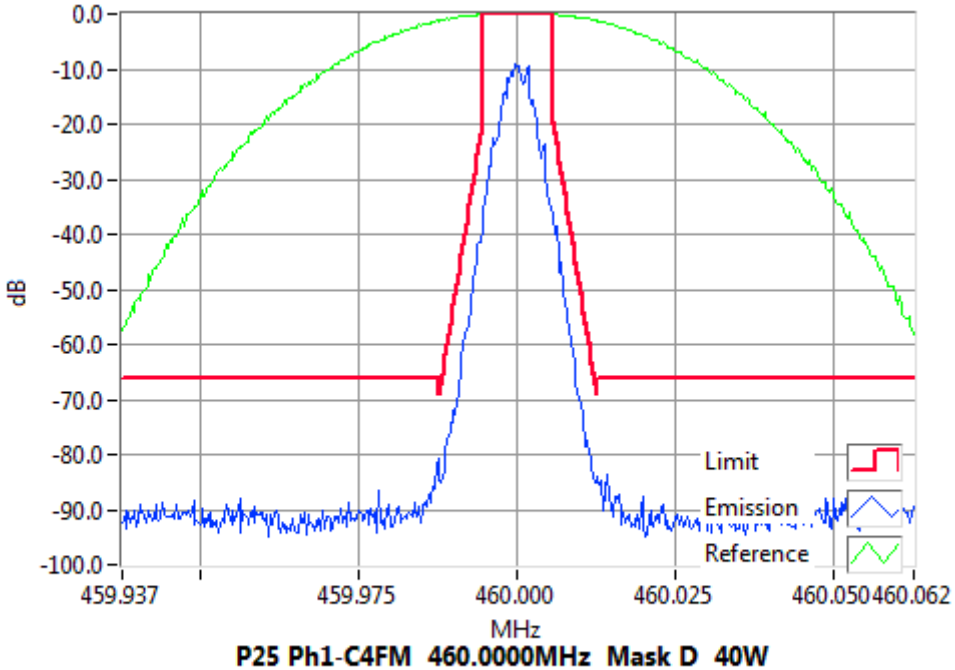


P25 Ph1-C4FM 454.5000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

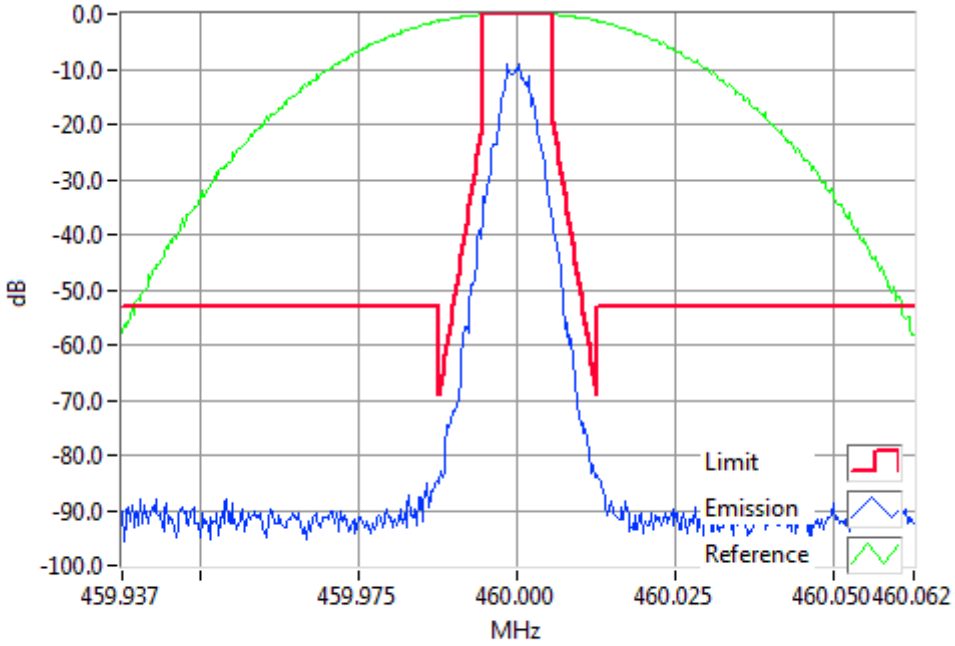
APCO P25 phase-1

Tx FREQUENCY: 460.0 MHz 40 W 12.5 kHz Channel Spacing



P25 Ph1-C4FM 460.0000MHz Mask D 40W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 460.0 MHz 2 W 12.5 kHz Channel Spacing

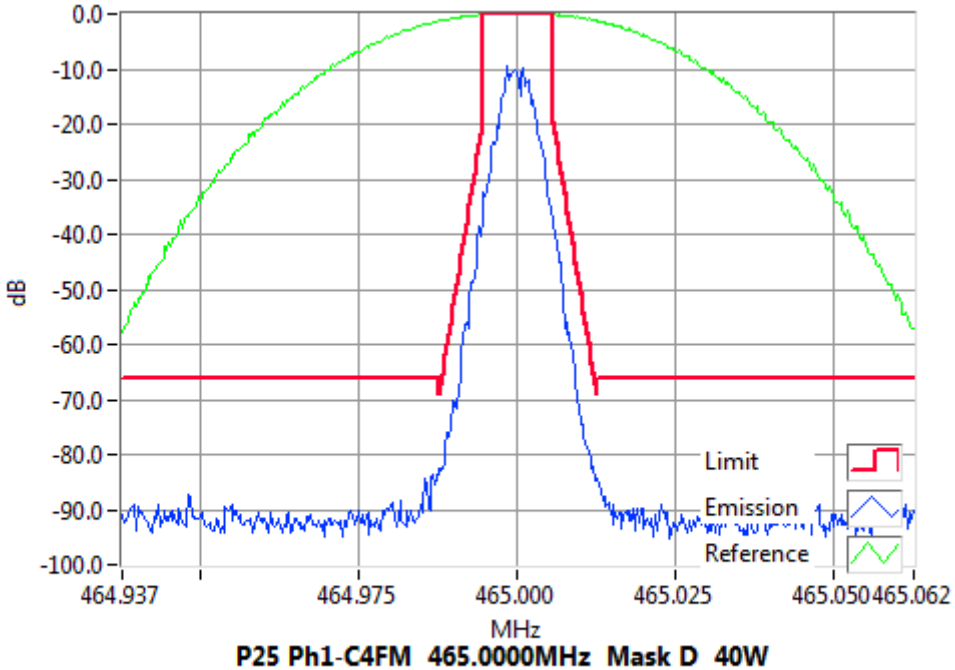


P25 Ph1-C4FM 460.0000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

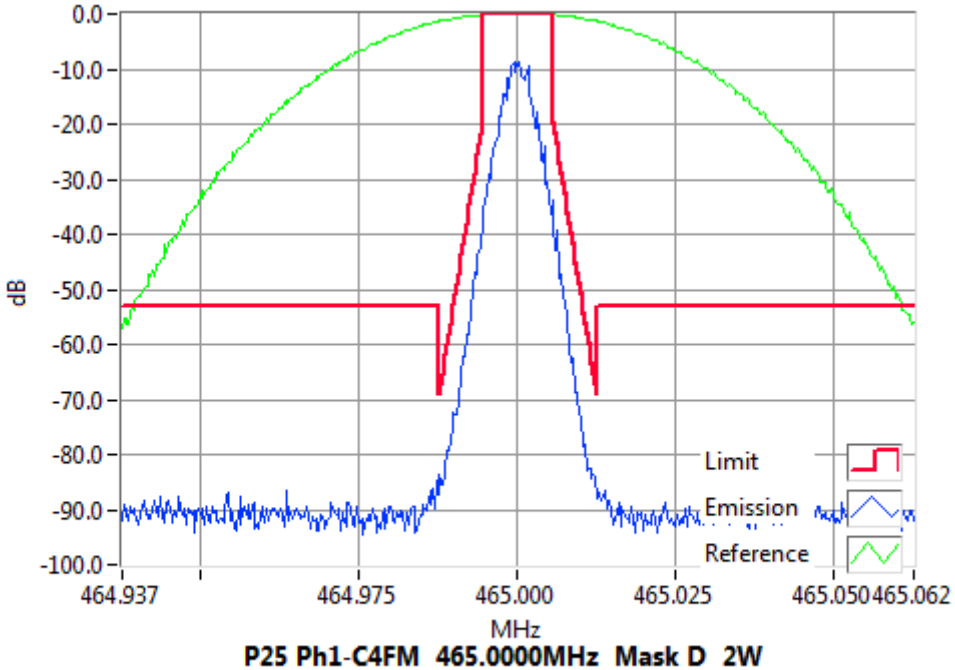
APCO P25 phase-1

Tx FREQUENCY: 465.0 MHz 40 W 12.5 kHz Channel Spacing



P25 Ph1-C4FM 465.0000MHz Mask D 40W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 465.0 MHz 2 W 12.5 kHz Channel Spacing

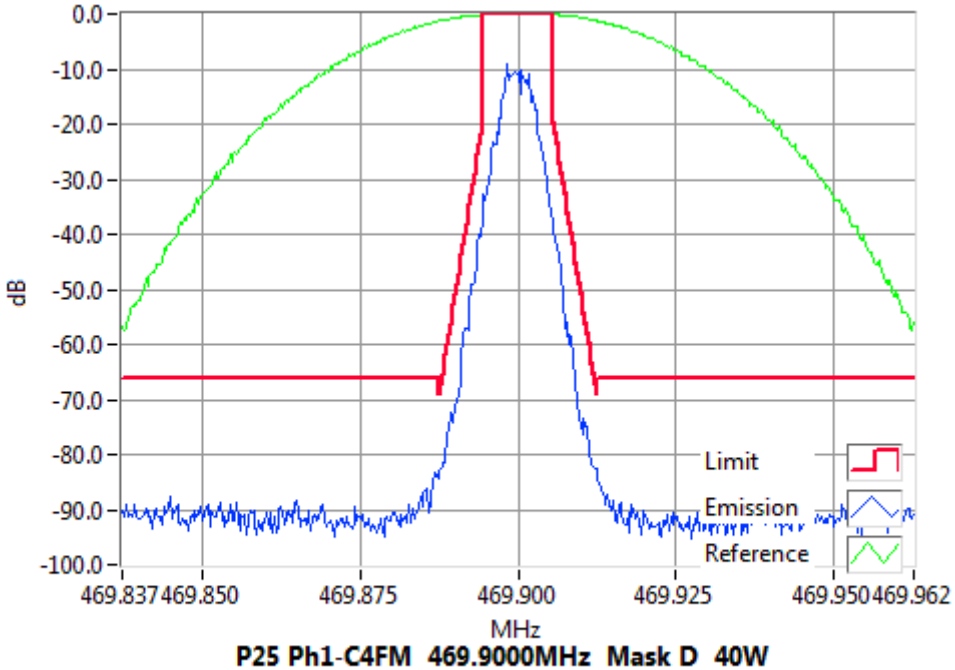


P25 Ph1-C4FM 465.0000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

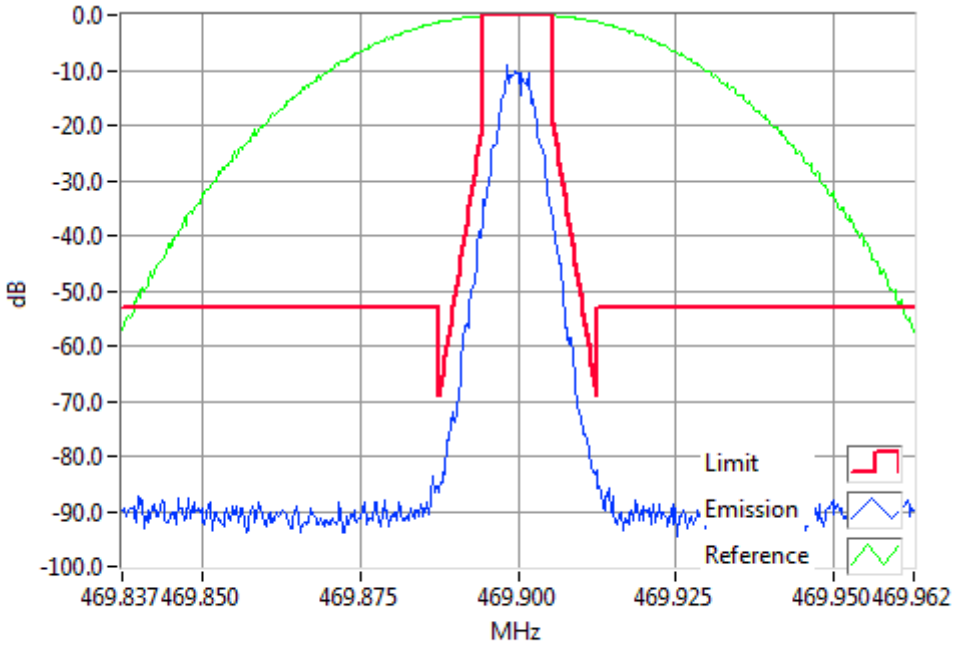
APCO P25 phase-1

Tx FREQUENCY: 469.9 MHz 40 W 12.5 kHz Channel Spacing



P25 Ph1-C4FM 469.9000MHz Mask D 40W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 469.9 MHz 2 W 12.5 kHz Channel Spacing



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

TEST EQUIPMENT LIST

Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack6	E4849	17-Oct-19
Coax Cable	2.5m Blue	Suhner	Sucoflex 104A	33449/4PEA	E4997	19-Oct-19
Power Supply	TREVA2 60V/25A	Agilent	N5767A	US09F4901H	E4656	7-Oct-19
RF Attenuator	33dB 350W	Weinschel	67-30-33 & BW-N3W5+	CK9178	E5023	15-Jul-20
Spectrum Analyser	13.2GHz	Agilent	E4445A	MY42510072	E4139	19-Jul-20
Spectrum Analyser	26.5GHz	Agilent	PXA N9030A	MY49432161	E4907	27-Oct-20
Testware	Sideband Spectrum	-	February 2017	-	-	-

* NOTE: Items without calibration dates are calibrated immediately before use, or set using calibrated instruments.

ANNEX A – TEST SETUP DETAILS

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