LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBDB3G 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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Test Technician

CHECKED & APPROVED BY: M. C. James

Laboratory Technical Manager

ilac-MRA

IANZ
ACCREDITED LABORATORY

FCC REGISTRATION: 838288

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

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REVISION

Date	Revision	Comments
18 September 2019	1	Initial test report

INTRODUCTION

Type approval testing of the TBDH3G, 50-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 analogue, FFSK and DMR modulations. The original reports for this are Teltest 3711 and 3756.

Type Approval Testing of the   TBDB3G
                Frequency range   148 → 174 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:	TBDB3G
Product Code:	TB7310-B3B0-0000-00AE-10
Serial Number(s):	18294621
Frequency range	148 → 174 MHz
Transmit Power	50 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:

Module	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01403-DAAA	18294645	p25-trunk.20190607T162306	1.01
Power Amplifier	T01-01405-BAAA	18294840	n/a	0.01
Front Panel	T01-01410-AAAA	4666877	0.01.00.master.20180703T105202.0001	00.01

TEST CONDITIONS

All testing was performed on 13 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: TBDB3G
Product Code: TB7310-B3B0-0000-00AE-10
Serial Number(s): 18294621
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   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

TEST RESULTS

TRANSMITTER OCCUPIED BANDWIDTH AND SPECTRUM MASKS

SPECIFICATION: FCC 47 CFR 2.1049 (c)

GUIDE: TIA/EIA-603D 2.2.11 (Analog)
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 Analyser, with bandwidth settings as noted on the recorded plots.

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

MEASUREMENT UNCERTAINTY 95%   ±0.65dB

LIMIT CLAUSE: FCC 47 CFR 90.210

EMISSION MASKS
Emission Mask D   12.5 kHz Channel Spacing   Digital Voice/data

DATA SPEED
Digital Voice/Data   12.5 kHz Channel Spacing   9600 bps

Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

SPECIFICATION: FCC 47 CFR 2.1049 (c)

Tx FREQUENCY: 148.1 MHz   50 W   12.5 kHz Channel Spacing

P25 Ph1-C4FM 148.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass
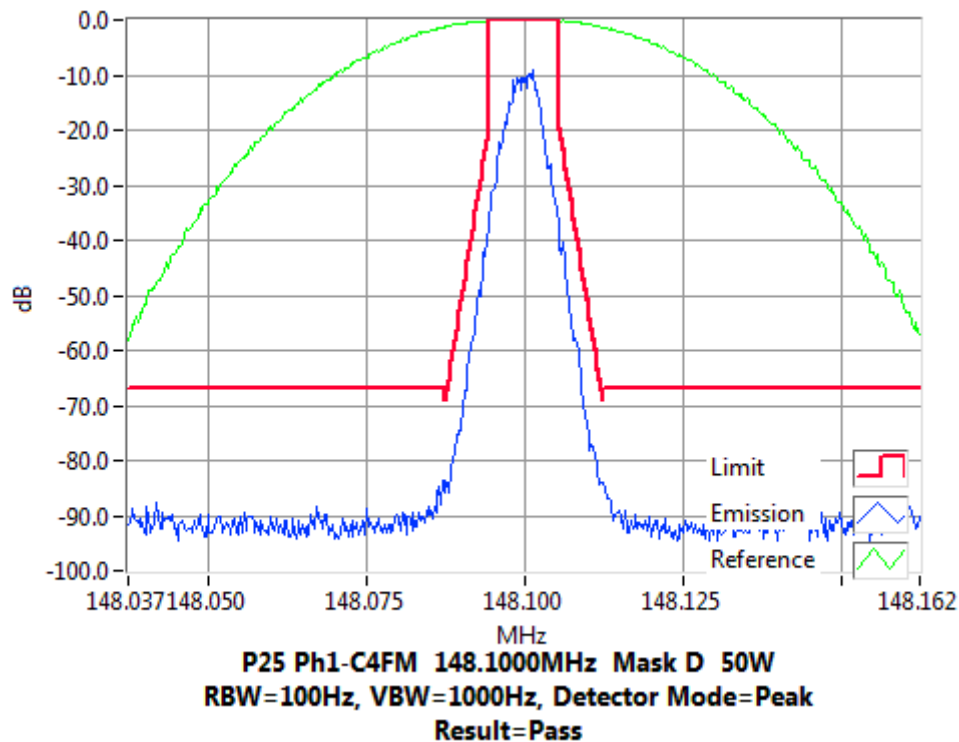
Tx FREQUENCY: 148.1 MHz   2 W   12.5 kHz Channel Spacing
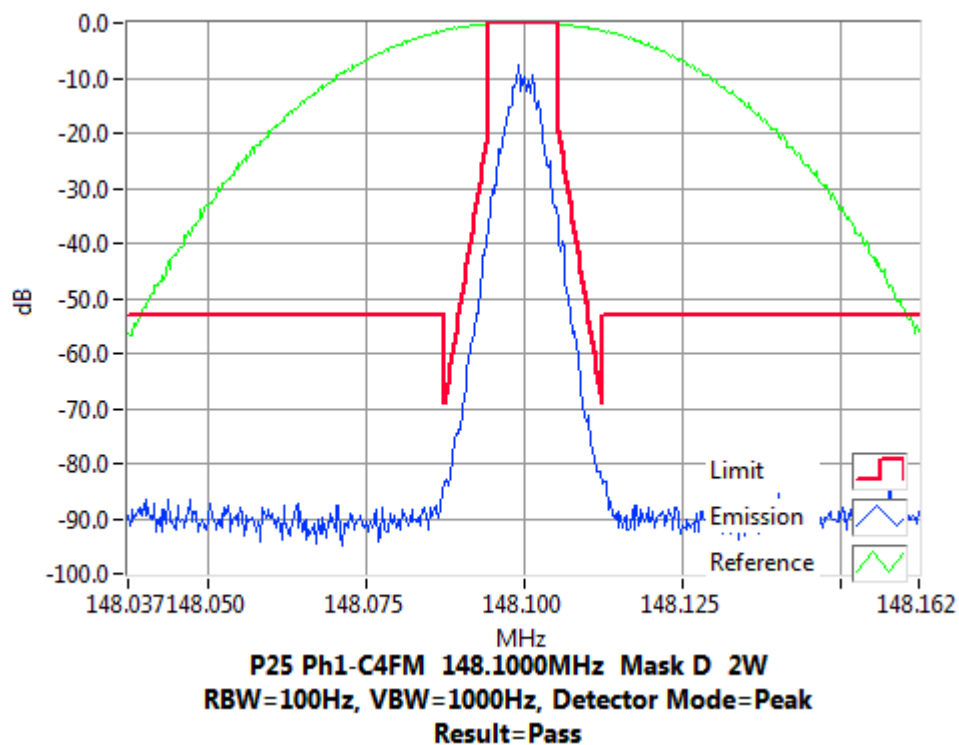
P25 Ph1-C4FM 148.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass
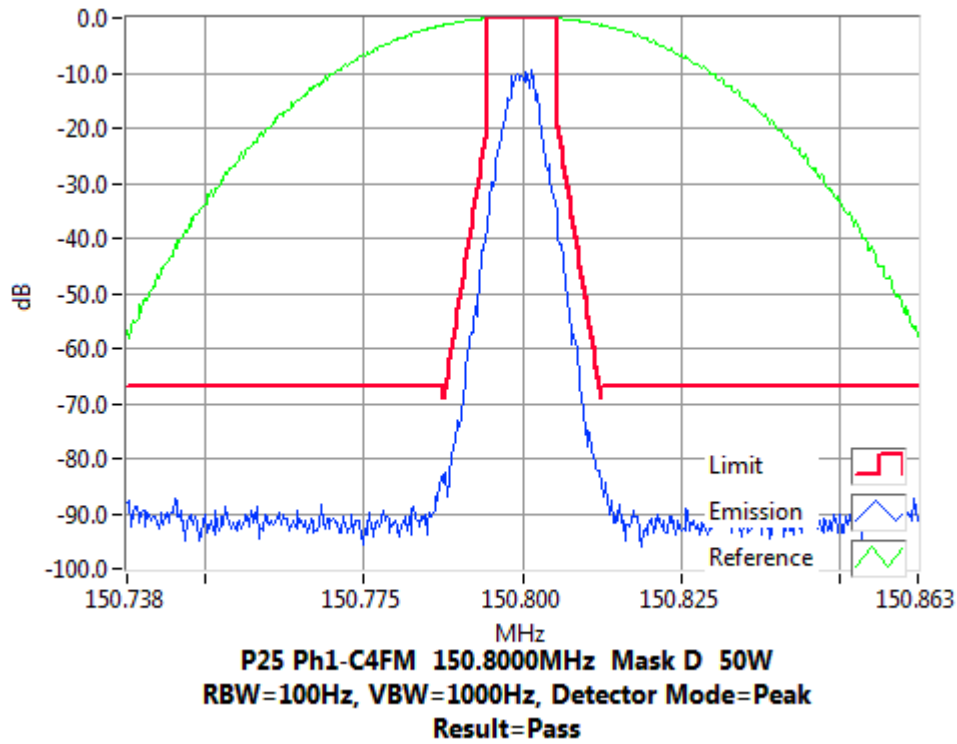
Occupied Bandwidth and Spectrum Masks
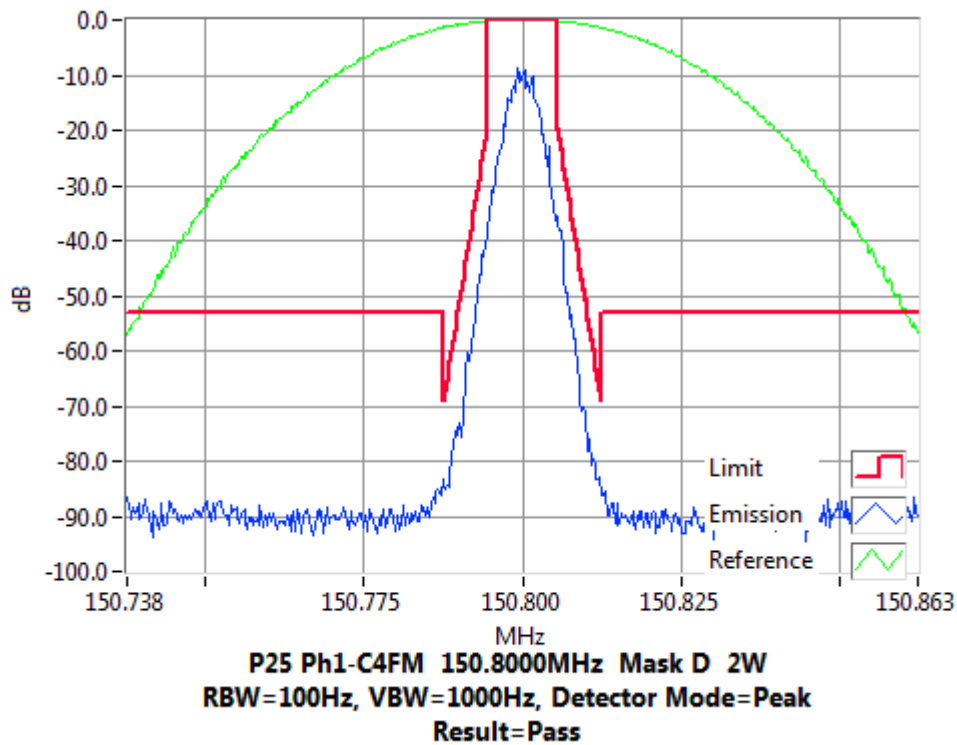
APCO P25 phase-1

SPECIFICATION: FCC 47 CFR 2.1049 (c)

Tx FREQUENCY: 150.8 MHz   50 W   12.5 kHz Channel Spacing

P25 Ph1-C4FM 150.8000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 150.8 MHz   2 W   12.5 kHz Channel Spacing

P25 Ph1-C4FM 150.8000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
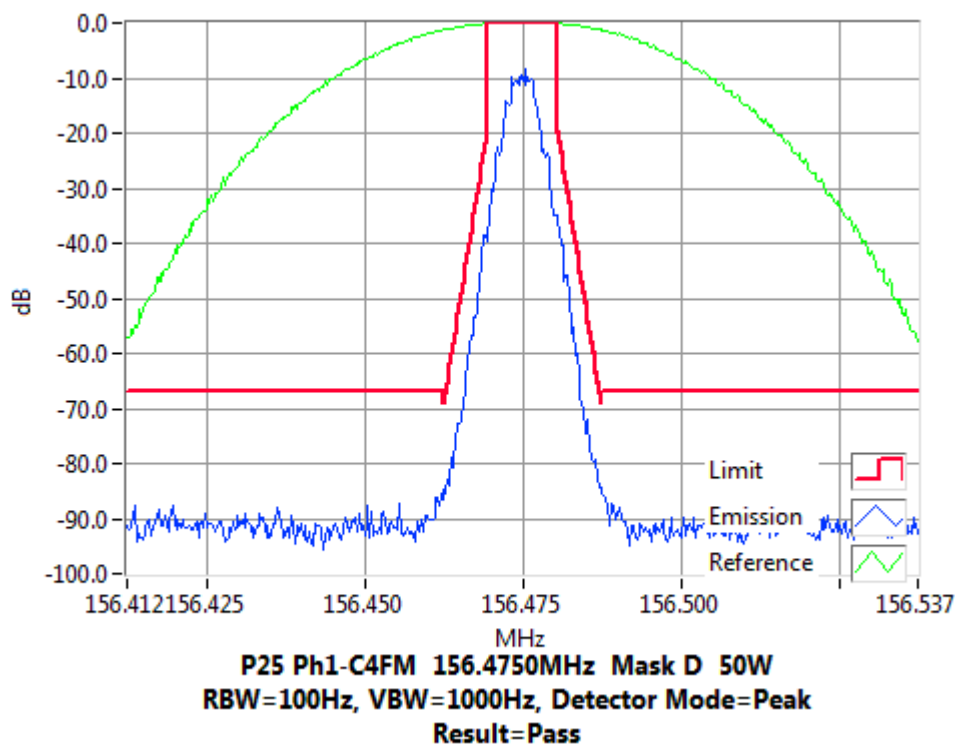**Result=Pass**

Occupied Bandwidth and Spectrum Masks
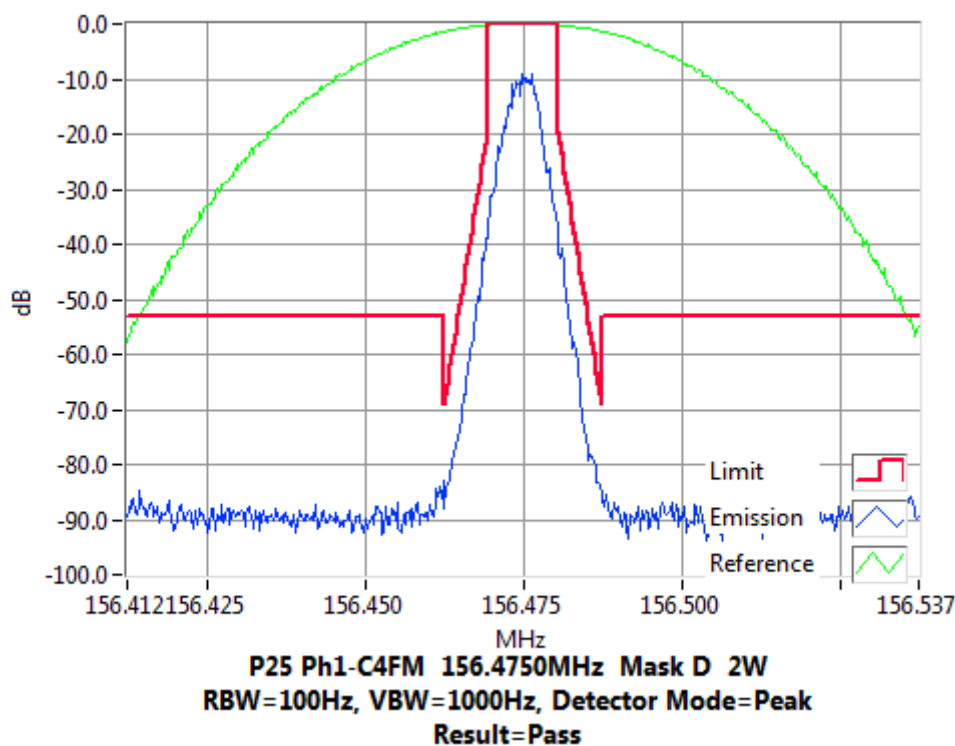
APCO P25 phase-1

SPECIFICATION: FCC 47 CFR 2.1049 (c)

Tx FREQUENCY: 156.475 MHz   50 W   12.5 kHz Channel Spacing

P25 Ph1-C4FM 156.4750MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 156.475 MHz   2 W   12.5 kHz Channel Spacing

P25 Ph1-C4FM 156.4750MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass
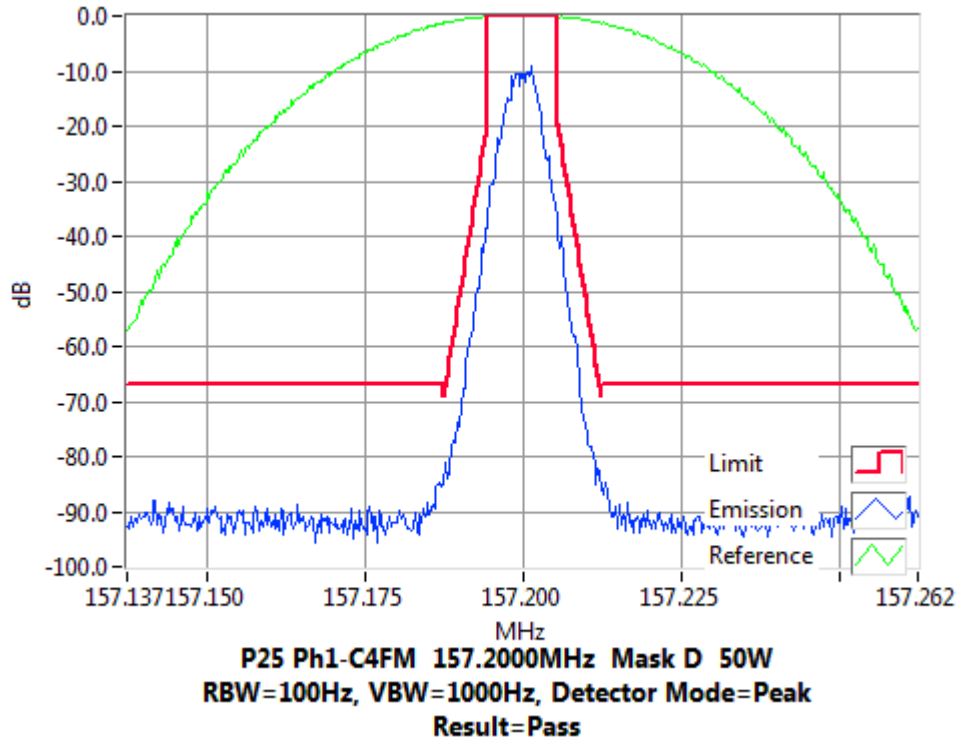
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

SPECIFICATION: FCC 47 CFR 2.1049 (c)

Tx FREQUENCY: 157.2 MHz   50 W   12.5 kHz Channel Spacing

P25 Ph1-C4FM 157.2000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 157.2 MHz   2 W   12.5 kHz Channel Spacing
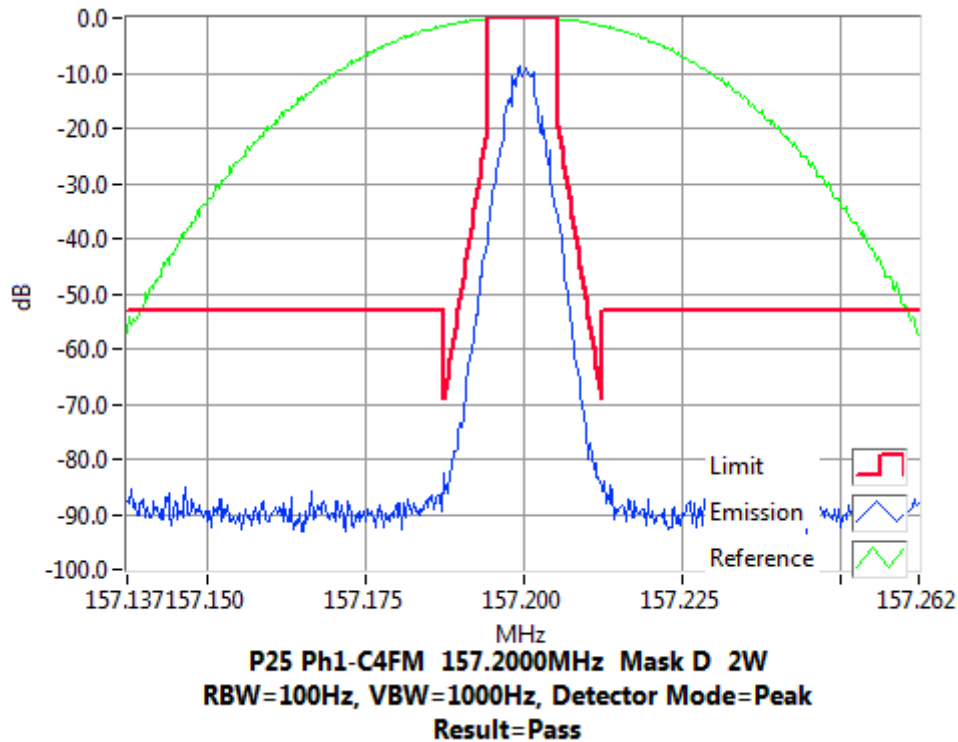
P25 Ph1-C4FM 157.2000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass
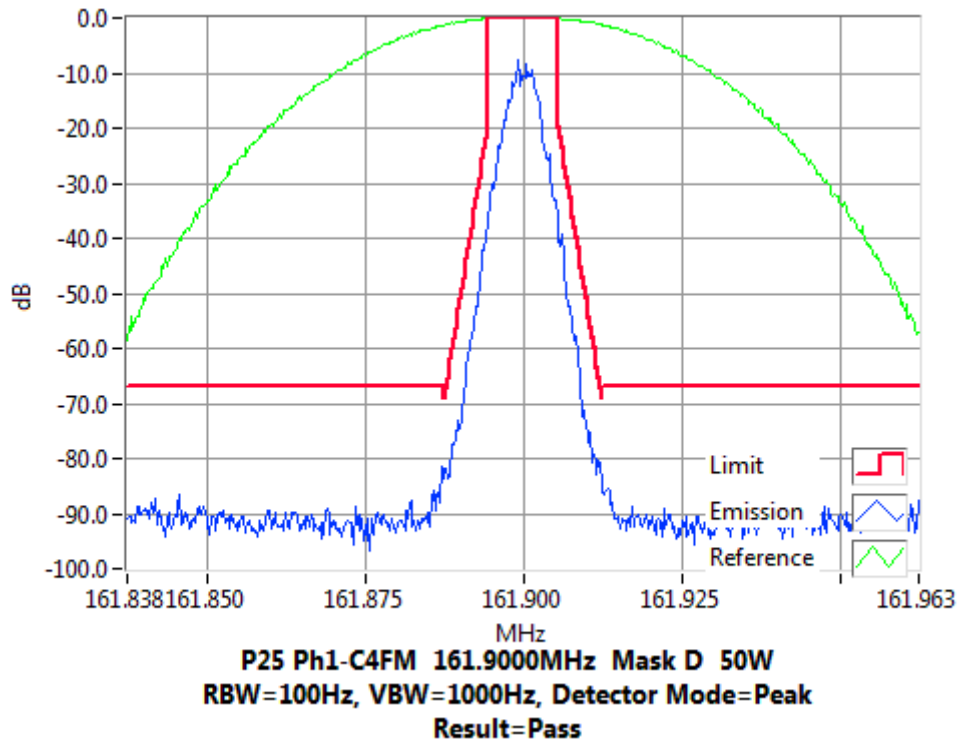
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

SPECIFICATION: FCC 47 CFR 2.1049 (c)

Tx FREQUENCY: 161.9 MHz   50 W   12.5 kHz Channel Spacing

P25 Ph1-C4FM 161.9000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 161.9 MHz   2 W   12.5 kHz Channel Spacing
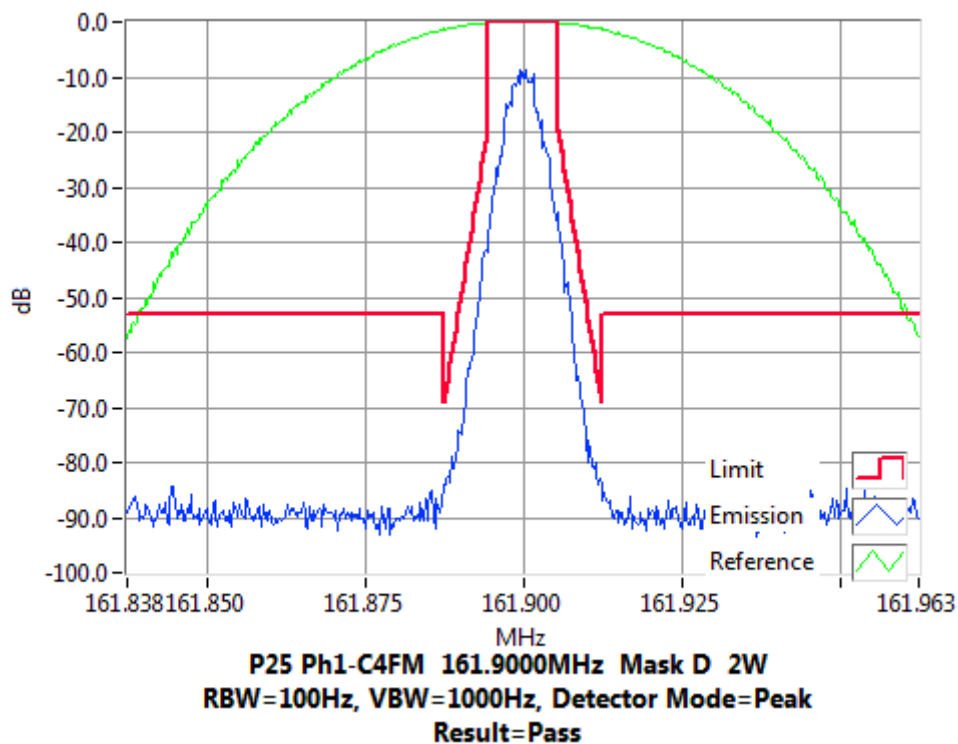
P25 Ph1-C4FM 161.9000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass
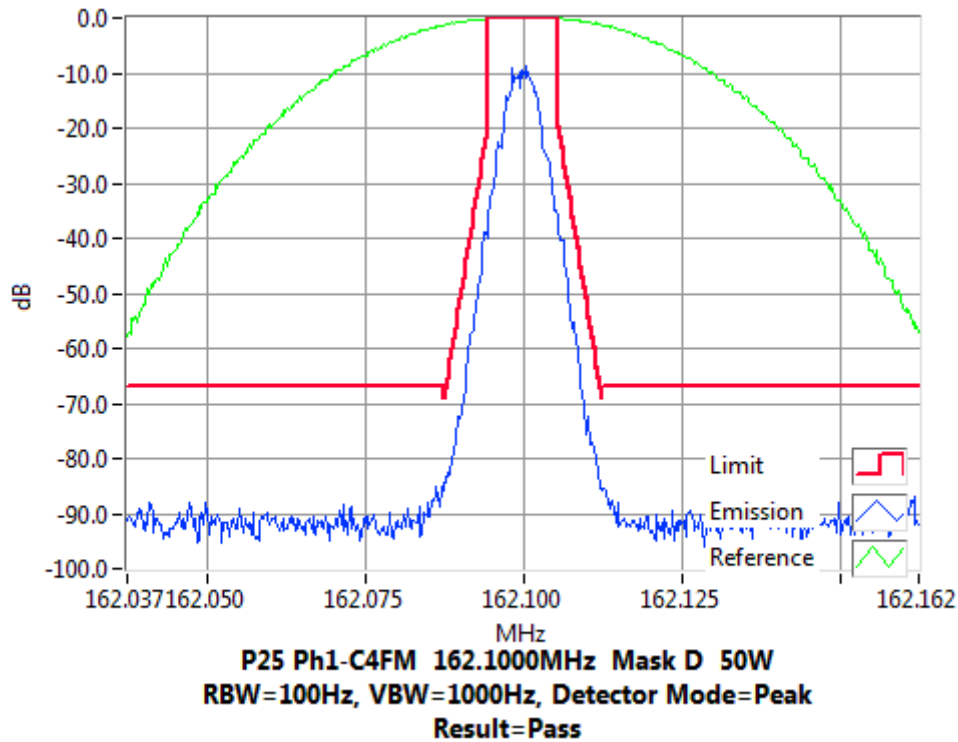
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

SPECIFICATION: FCC 47 CFR 2.1049 (c)

Tx FREQUENCY: 162.1 MHz   50 W   12.5 kHz Channel Spacing

P25 Ph1-C4FM 162.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 162.1 MHz   2 W   12.5 kHz Channel Spacing
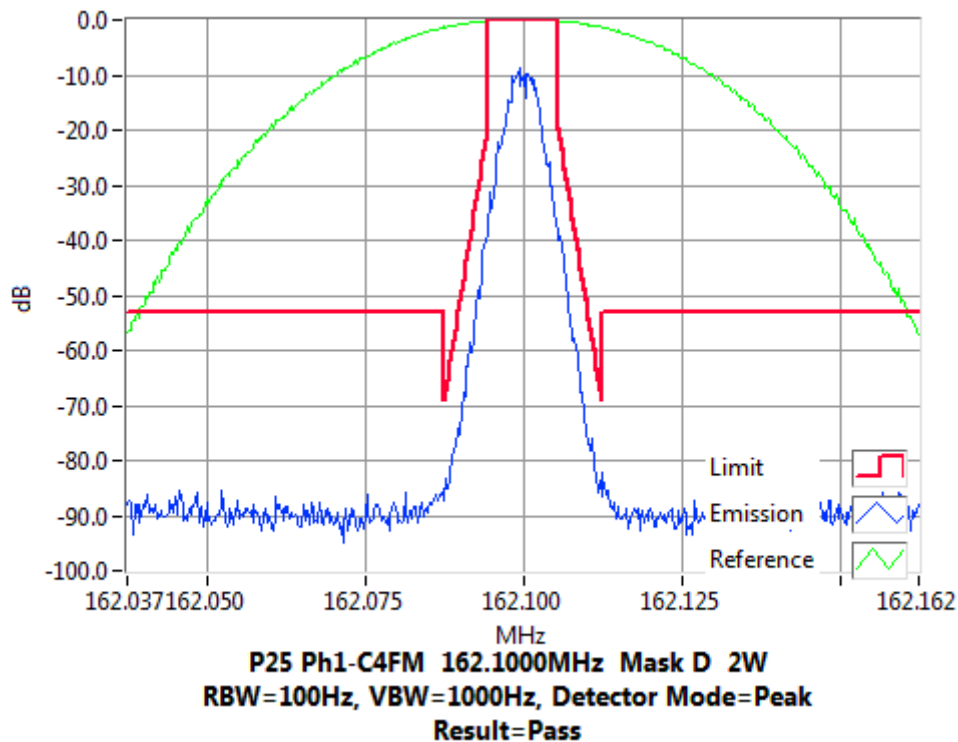
P25 Ph1-C4FM 162.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass
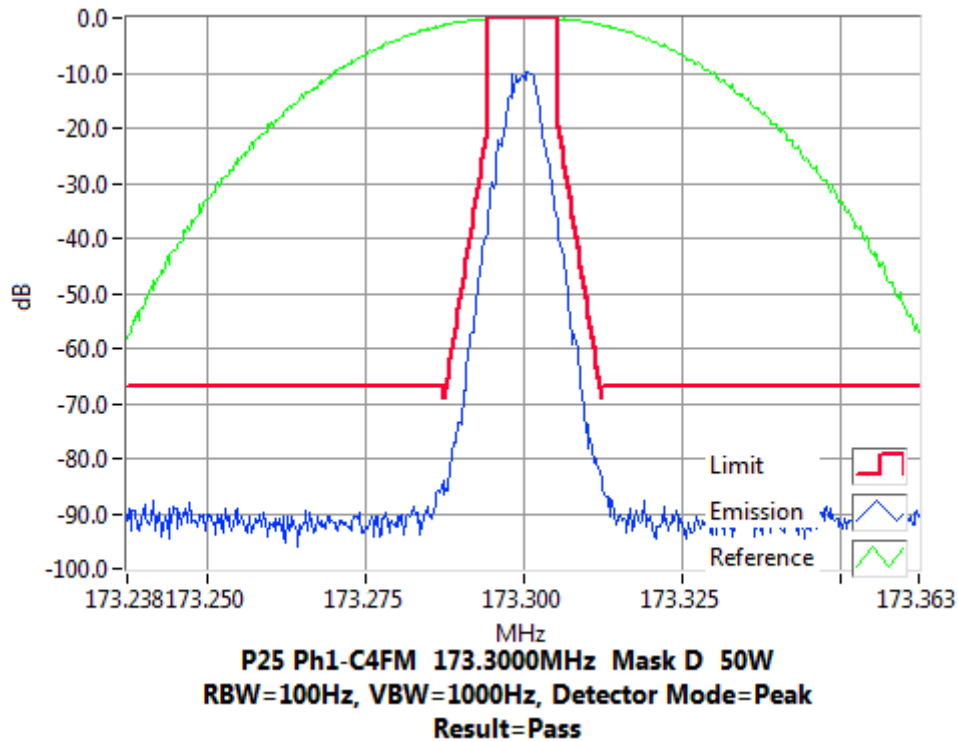
Occupied Bandwidth and Spectrum Masks

APCO P25 phase-1

SPECIFICATION: FCC 47 CFR 2.1049 (c)

Tx FREQUENCY: 173.3 MHz   50 W   12.5 kHz Channel Spacing

P25 Ph1-C4FM 173.3000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 173.3 MHz   2 W   12.5 kHz Channel Spacing

P25 Ph1-C4FM 173.3000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass
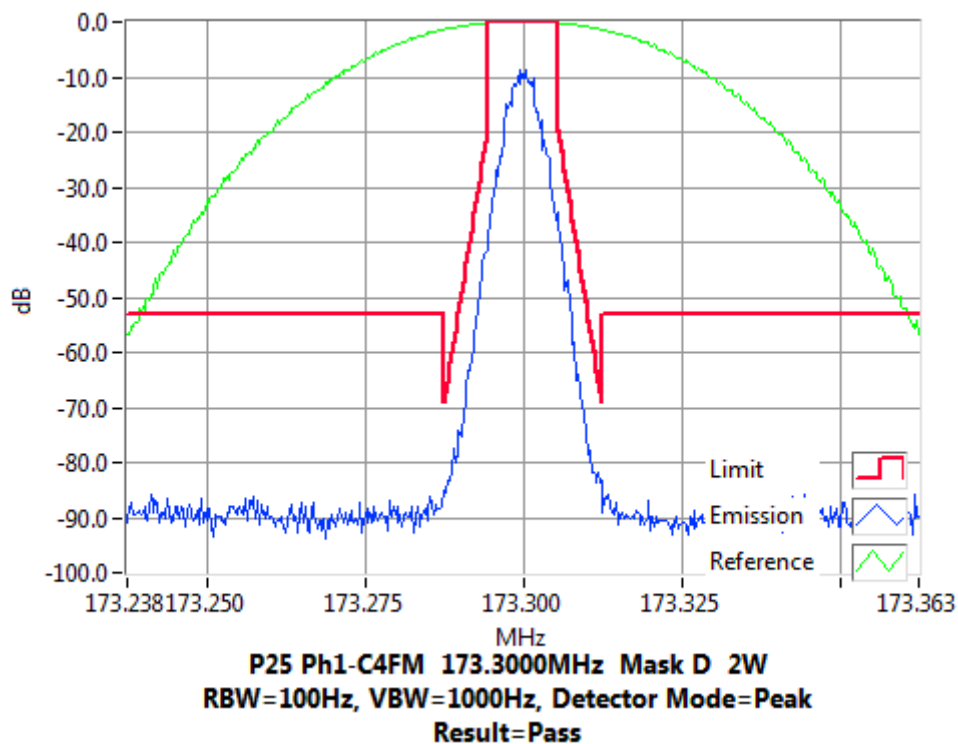
TEST EQUIPMENT LIST

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	-	-	-

ANNEX A – TEST SETUP DETAILS

All 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.