TELTEST Laboratories
Tait International Ltd
Report Number 4036

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBCH2A Base Station 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:	22 October 2019
PREPARED BY:	L. M. White Test Technician
CHECKED & APPROVED BY:	M. C. James Laboratory Technical Manager

ACCREDITED LABORATORY

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

Date	Revision	Comments
22 October 2019	1	Initial test report

INTRODUCTION

This report is to prove continued compliance of the TBCH2A 50 watt Base Station Transceiver, after a change to the IQ Filter which affects Analogue Modulation, and also adding two further modulation types; Digital FFSK and Digital Mobile Radio (DMR). This radio also supports APCO P25 phase-1 and APCO P25 phase-2 modulations. This report is to be read in combination with TELTEST reports 3586, 3741 and 3807.

Type Approval Testing of the TBCH2A
Frequency range 440 → 480 MHz

in accordance with:
FCC 47 CFR Parts 22 and 90
RSS-119 Issue 12 & RSS-Gen Issue 5

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

DESCRIPTION OF SAMPLE
Manufacturer Tait International Limited
Equipment: Base Station Transceiver
Type: TBCH2A
Quantity: 1

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
Digital Mobile Radio (DMR)	4 Level FSK (2 slot TDMA) (ETSI TS102 361-1)	12.5 kHz	2	4800	9600

HARDWARE & SOFTWARE

Module	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01103-LAAA	18302511	dmr-trunk.20191015T084706	1.01
Power Amplifier	T01-01121-LAAA	18302520	0.01.00.master.20191001T185944.0001	0.06
Front Panel	T01-01110-BAAA	18302645	0.01.00.master.20190702T175230.0001	1.00
Power management unit	TBA30A0-0100	18302487	3.16	1.00

TEST CONDITIONS
All testing was performed on 22 October 2019, and under the following conditions:
Ambient temperature: 15°C → 30°C
Relative Humidity: 20% → 75%
Standard Test Voltage 120 V_{AC}

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	N1
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	N1
RSS-119 5.4	FCC 47 CFR 2.1046	Transmitter Output Power (Conducted)	RSS-Gen 6.12 ANSI C63.26 5.2.4.2	N1
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	N2
RSS-119 5.8	FCC 47 CFR 2.1053	Transmitter Spurious Emissions (Radiated)	RSS-Gen 6.13 ANSI C63.26 5.5	N2
RSS-119 5.9	FCC 47 CFR 90.214	Transient Frequency Behaviour	TIA 603E 2.2.2	N/A
RSS-Gen 7	FCC 47CFR 15.111	Receiver Spurious Emissions (Conducted)	RSS-Gen 7.4 TIA-603E 2.1.2	N1

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
N1: This report is for a Class 2 permissive change to add Analogue, FFSK and DMR modulations. There are no changes affecting these parameters. See the original submission.
N2: The original report (Teltest 3586) tested these parameters using P25 Phase 1 C4FM modulation (TIA 102) The added modulations have constant envelope characteristics and it has been assessed that they are highly unlikely to give significantly different results outside the spectrum masks.

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: TBCH2A

Module	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01103-LAAA	18302511	dmr-trunk.20191015T084706	1.01
Power Amplifier	T01-01121-LAAA	18302520	0.01.00.master.20191001T185944.0001	0.06
Front Panel	T01-01110-BAAA	18302645	0.01.00.master.20190702T175230.0001	1.00
Power management unit	TBA30A0-0100	18302487	3.16	1.00

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:

Mike James
Technical Manager

Date: 29 November 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	FM Analogue Voice	-	-
F2D	Fast Frequency Shift Keying	1200 symbols/sec	1200 bps
FXW	Digital Voice / Data	4800 symbols/sec	9600 bps
FXD	Digital Data	4800 symbols/sec	9600 bps

CHANNEL SPACING: 12.5 kHz

EMISSION DESIGNATORS:

Analogue Voice	11K0F3E
FFSK	7K60F2D
DMR Digital Voice / Data	7K60FXW
DMR Digital Data	7K60FXD

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 Channel Spacing

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 Channel Spacing

Necessary bandwidth
M = 1.8 kHz
D = 2.0 kHz
Bn = (2 x 1.8) + (2 x 2.0) x 1
= 7.6 kHz

Emission Designator
7K60F2D
F2D represents a FM data transmission with the use of a modulating sub carrier

Digital Mobile Radio (DMR) 4 level FSK (as per ETSI TS 102 361-1) 4800 symbols/sec 9600 bps

Digital Data 12.5 kHz Channel Spacing – 7K60FXW

99% bandwidth
= 7.6 kHz

Emission Designator
7K60FXW
FXW represents FM combination of data and telephony.

Digital Data 12.5 kHz Channel Spacing – 7K60FXD

99% bandwidth
= 7.6 kHz

Emission Designator
7K60FXD
FXD represents FM data only

TEST RESULTS

TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: TIA/EIA-603E 2.2.6

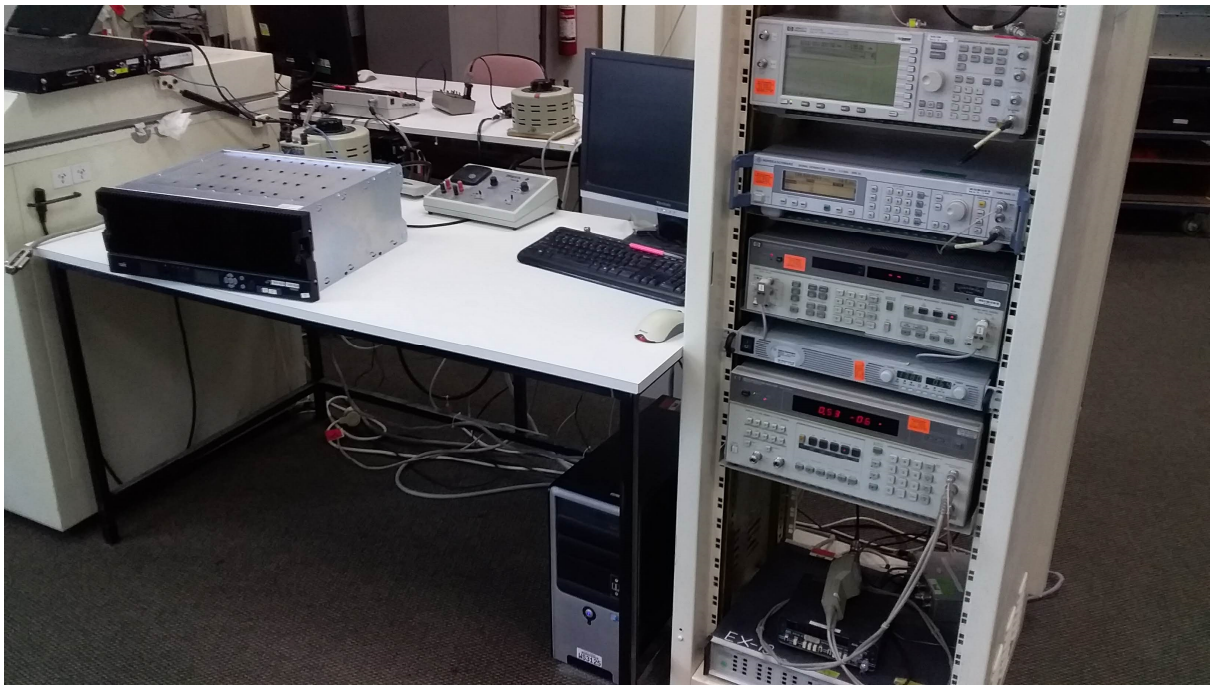
MEASUREMENT PROCEDURE:
1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000 Hz was applied with the level set to obtain 20% of maximum deviation. This was used as the 0 dB reference point.
3. The AF was varied while the audio level was held constant.
4. The response in dB relative to 1000 Hz was measured.

MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing tested at 50 W transmit power.

LIMIT CLAUSE: TIA/EIA-603E 3.2.6

MEASUREMENT UNCERTAINTY: ± 1.5 %

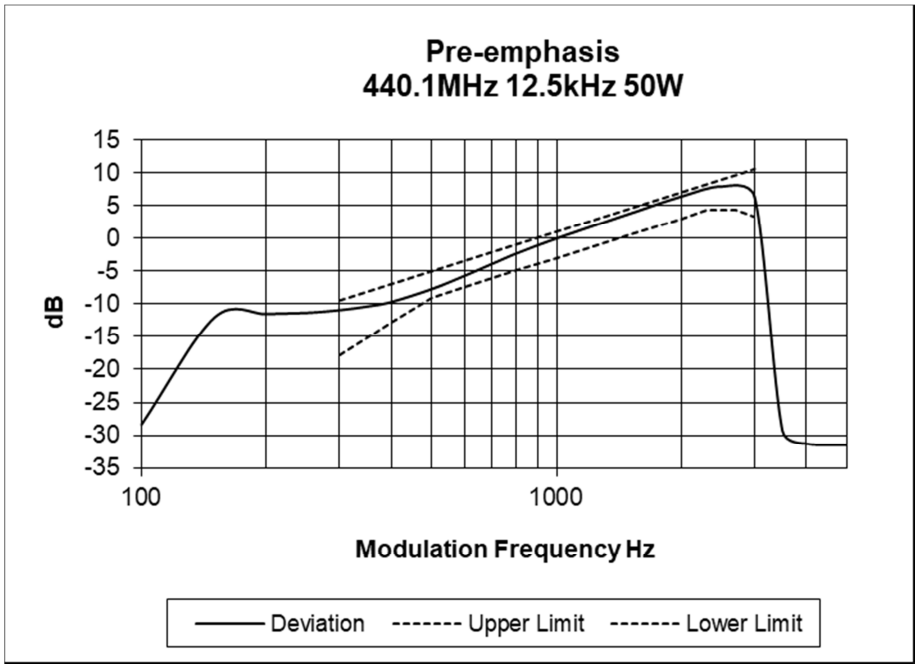
Photo: Measurement Setup



Transmitter Audio Frequency Response – Pre-emphasis

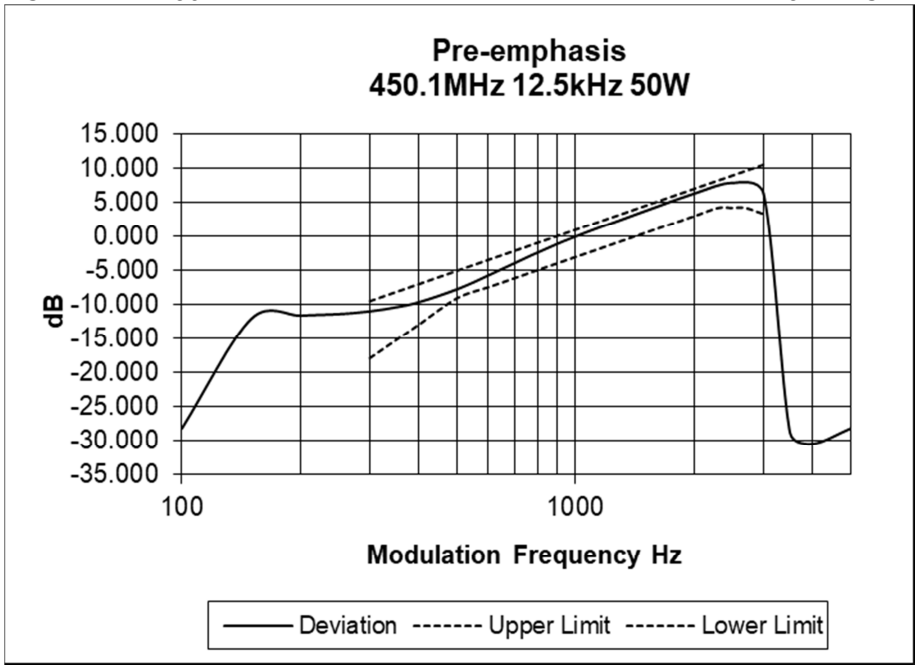
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 440.1 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

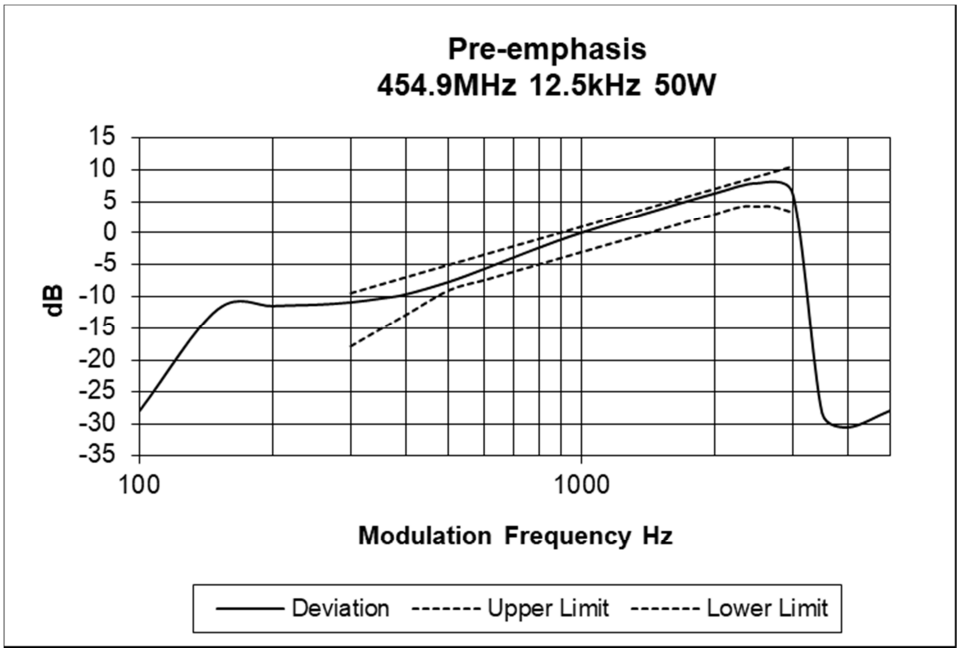
Tx FREQUENCY: 450.1 MHz 12.5 kHz Channel Spacing

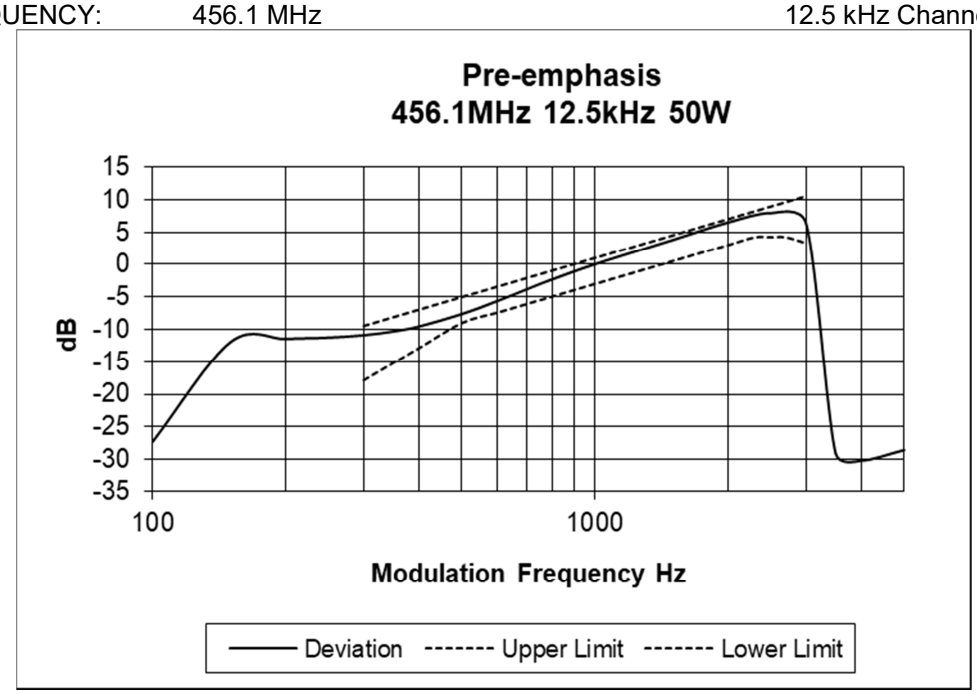


Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 454.9 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 456.1 MHz 12.5 kHz Channel Spacing