

Laboratory Test Report

For the
TBBA4A4-A00-00 Base Station Transceiver

Tested In accordance with
FCC 47 CFR Parts 22 and 90

Report Revision: 1
Issue Date: 21-Sep-2005
FCC ID: CASTBBA4A

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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
21-Sep-05	1	Initial test report

INTRODUCTION

Type Approval Testing of the TBBA4A4-A00-00 (Serial No 18013477)
in accordance with:

FCC CFR 47 Parts 22 & 90

REPORT PREPARED FOR

Tait Electronics Ltd
PO Box 1645
558 Wairakei Rd
Christchurch
New Zealand

DESCRIPTION OF SAMPLE

Equipment:	Base Station Transceiver
Type:	TBBA4A
Product code:	TBBA4A4-A00
Serial Numbers:	18013477
Quantity:	1

A detailed description can be found in the Production Identification Form in Annex B

STATEMENT OF COMPLIANCE

The TBBA4A4-A00.00 Base Station transceiver as tested in this report was found to conform to the following standards:

FCC CFR 47 Parts 22 & 90

TEST CONDITIONS

All testing was performed at the following conditions.

Ambient Temperature	15°C to 30°C
Relative Humidity	20% to 75%
Standard Test Voltage	13.8Vdc

NECESSARY BANDWIDTH AND EMISSION DESIGNATORS

SPECIFICATION: FCC 47 CFR 2.202

The Necessary Bandwidth is the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed.

This is calculated using the following formula.

$$B_n = 2M + 2DK$$

Where: B_n = Necessary Bandwidth

M = Maximum modulation frequency

For Data transmission

$$M = B/2$$

Where: B = Modulation rate in Baud

D = Peak deviation

K = Constant

For Analogue transmission this is 1

For Data transmission this is typically 1.2

1. Analogue Voice

25kHz Bandwidth

Necessary bandwidth

$$M = 3 \text{ kHz}$$

$$D = 5 \text{ kHz}$$

$$B_n = 6 + 10 \times 1$$

$$= 16 \text{ kHz}$$

Emission Designator

16K0F3E

F3E represents a FM voice transmission

2. Fast Frequency Shift Keying (FFSK)

25kHz Bandwidth

Necessary bandwidth

$$M = 1.8 \text{ kHz}$$

$$D = 3 \text{ kHz}$$

$$B_n = 3.6 + 6 \times 1$$

$$= 9.6 \text{ kHz}$$

Emission Designator

9K60F2D

F2D represents a FM data transmission with the use of a modulating sub carrier

3. Tait High Speed Data (THSD)

THSD uses a 4 level gaussian frequency shift keying (CP-4GFSK) modulation scheme. It can be used when transferring data between two radios. Data is transmitted at a rate of 12000bps for narrow band channels, and 19200bps for wide-band channels.

Due to the difficulties in determining the value of k , the necessary bandwidth has been measured using the 99% energy rule.

25kHz Bandwidth

99% bandwidth

12.6 kHz

Emission Designator

12K6F1D

F1D represents a FM data transmission without the use of a modulating sub carrier

TEST RESULTS

TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046

GUIDE: TIA/EIA-603C 2.2.1

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.

MEASUREMENT RESULTS:

Manufacturer's Rated Output Power: Switchable: 1 W and 25 W

75.74 MHz	1 W nominal	25 W nominal
POWER (W)	0.99	25.4
Variation from Nominal (%)	-1.0	+1.6
Measurement Uncertainty (dB)	+0.63 -0.68	

LIMIT CLAUSE: FCC 47 CFR 90.205 (r)

Radio Type: Base Station Transceiver

Frequency Band: 72 MHz to 76 MHz

The output power shall not exceed by more than 20% the manufacturer's rated output power for the particular transmitter.

TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: TIA/EIA-603C 2.2.6

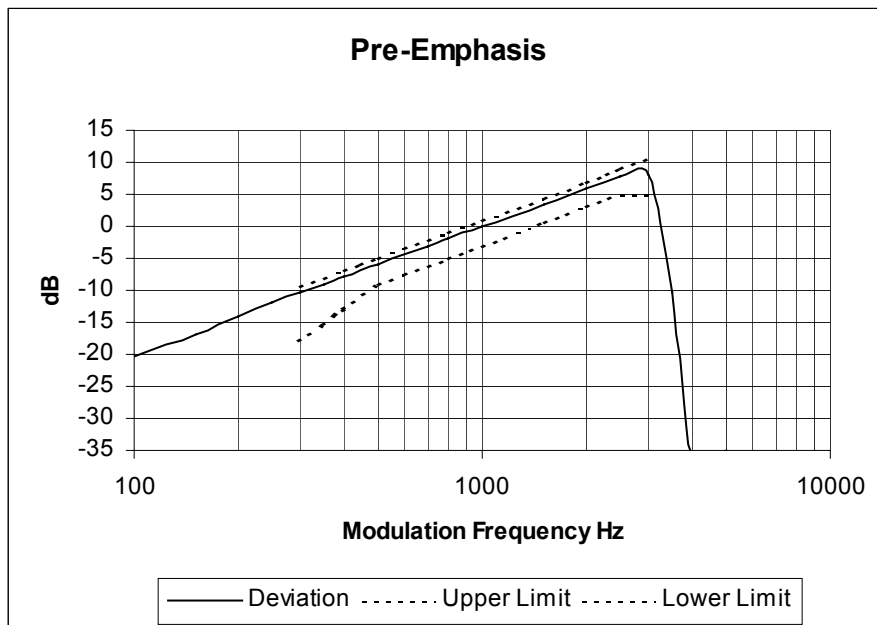
MEASUREMENT PROCEDURE:

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

LIMIT CLAUSE: TIA/EIA-603C 3.2.6

MEASUREMENT RESULTS:

Tx FREQUENCY: 75.74 MHz 25 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

MEASUREMENT PROCEDURE:

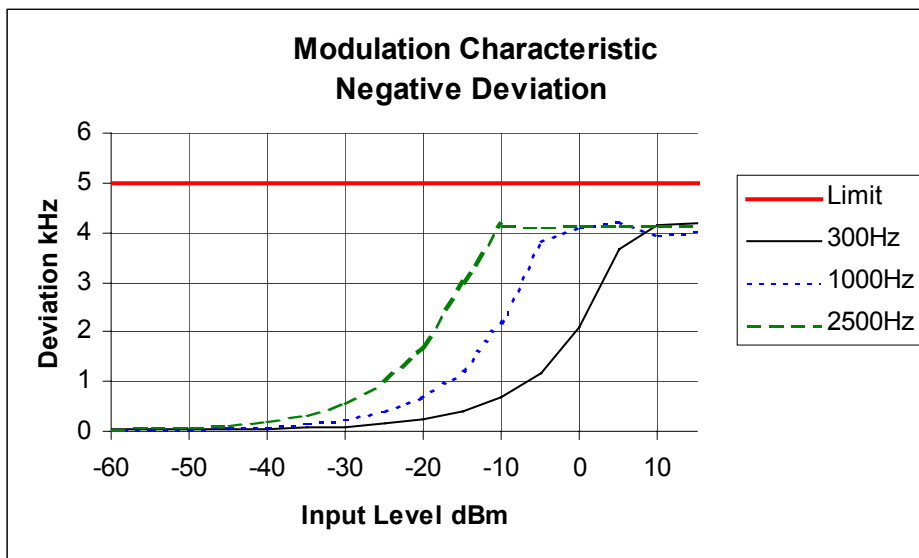
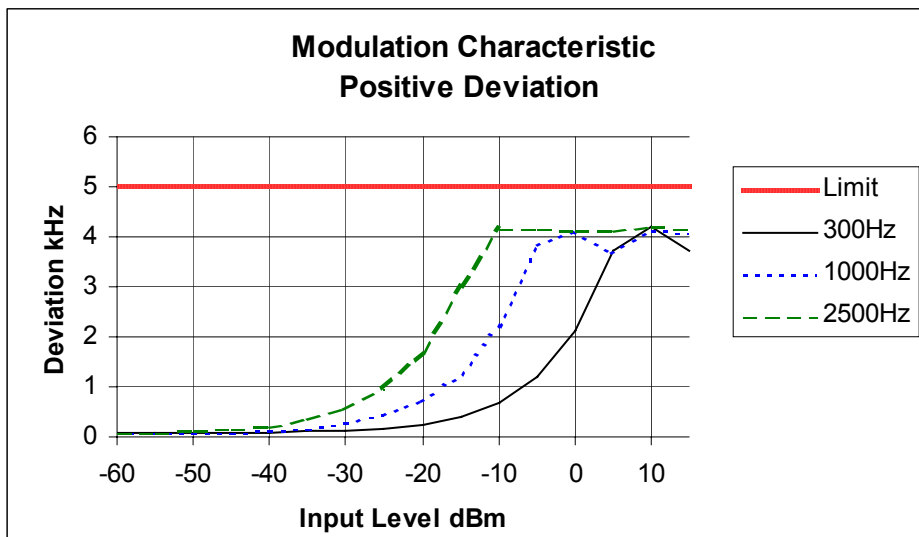
1. Refer Annex A for Equipment set up.
2. The modulation response was measured at three audio frequencies while varying the input level.
3. Measurements were made for both Positive and Negative Deviation.

MEASUREMENT RESULTS:

See the plots on the following pages for 25.0 kHz channel spacings.

LIMIT CLAUSE: TIA/EIA-603C 1.3.4.4

Tx FREQUENCY: 75.74 MHz 25 kHz Channel Spacing



OCCUPIED BANDWIDTH

SPECIFICATION: FCC 47 CFR 2.1049 (c)

GUIDE: TIA/EIA-603C 2.2.11

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
2. For analogue measurements: The EUT was modulated by a 2500Hz tone at an input level 16dB 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 B, and C – Resolution bandwidth = 300Hz, Video Bandwidth = 3 kHz

MEASUREMENT RESULTS:

See the plots on the following pages for 25.0 kHz channel spacings.

LIMIT CLAUSE: FCC 47 CFR 90.210

EMISSION MASKS

Emission Mask B	25.0 kHz Channel Spacing	Analogue;
Emission Mask C	25.0 kHz Channel Spacing	FFSK; THSD

DATA SPEED

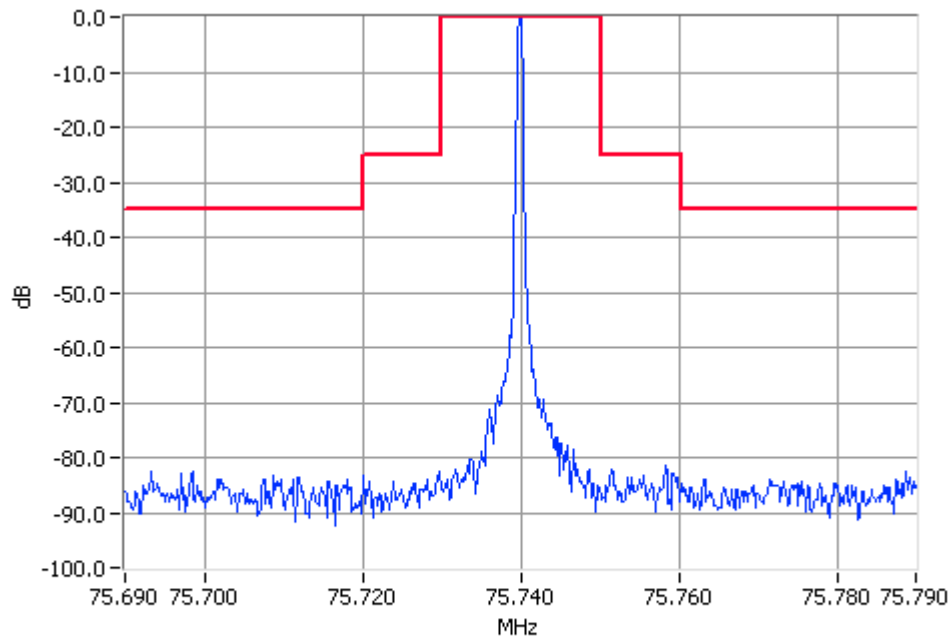
FFSK	1200 bps	25.0 kHz Channel Spacing
THSD	19200 bps	25.0 kHz Channel Spacing

OCCUPIED BANDWIDTH

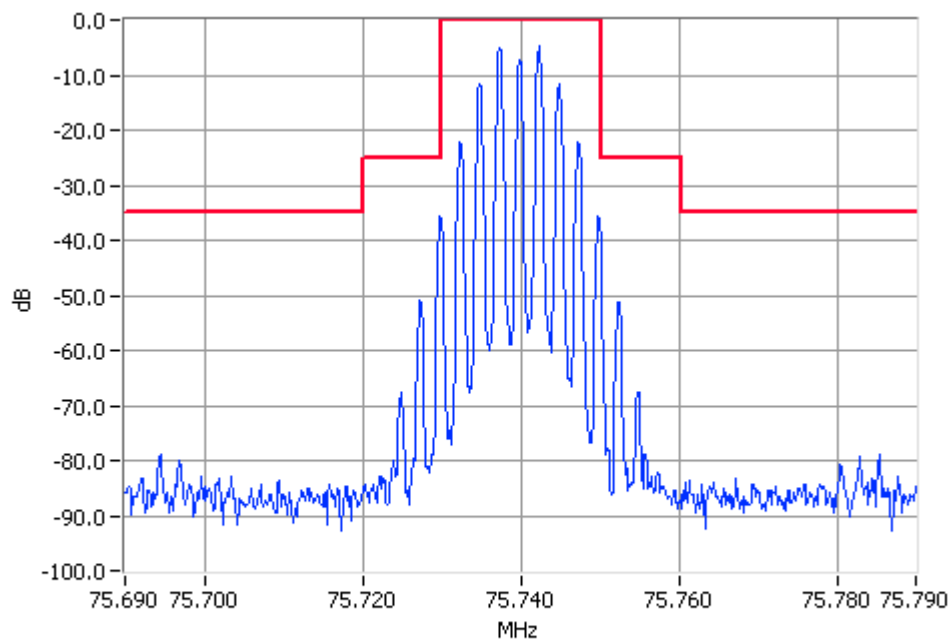
ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 75.74 MHz 25W 25 kHz Channel Spacing



Unmodulated 75.7400MHz Mask B 25W Pass
RBW=300Hz VBW=3000Hz



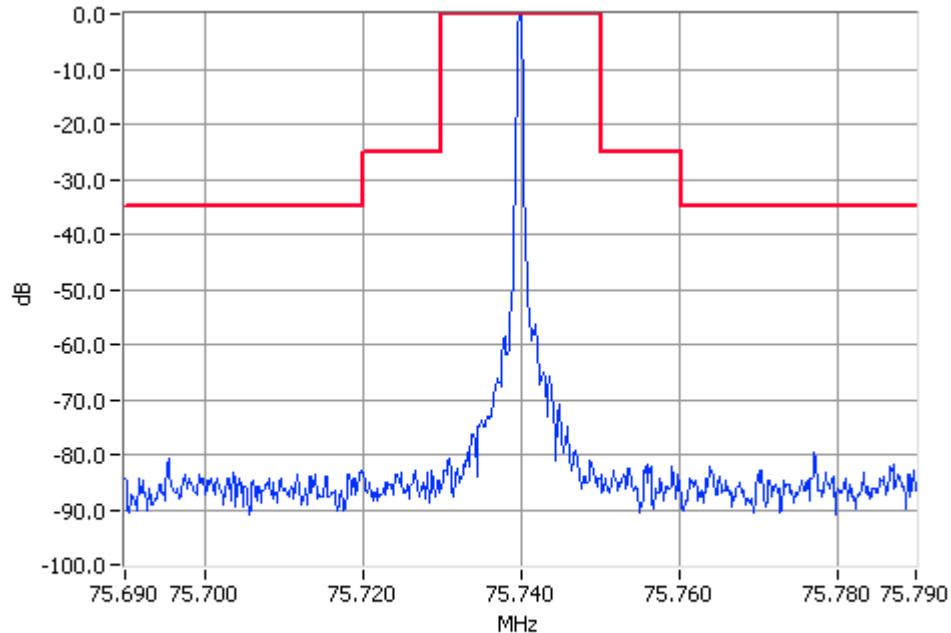
Analogue Modulation 75.7400MHz Mask B 25W Pass
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

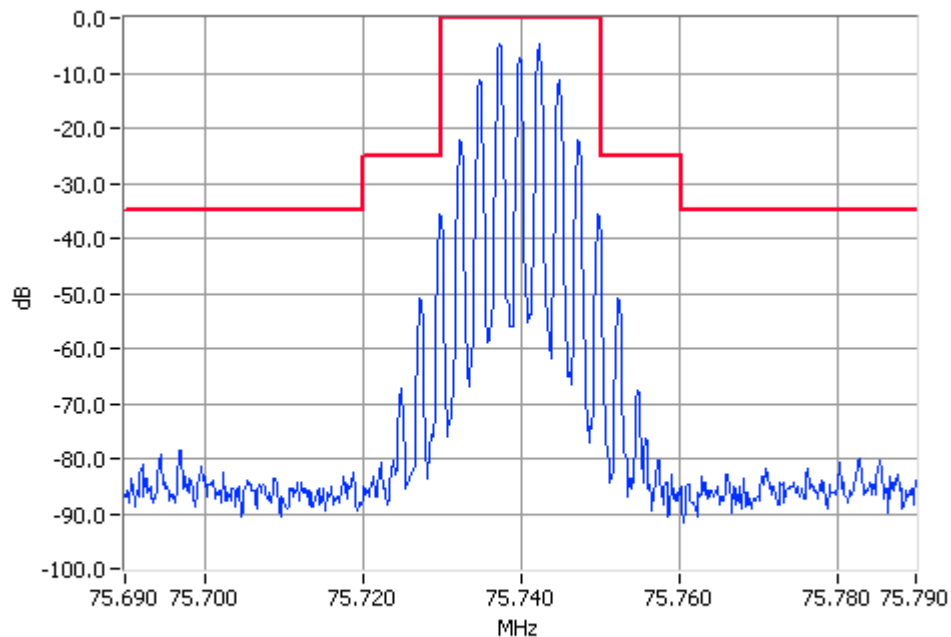
ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 75.74 MHz 1W 25 kHz Channel Spacing



Unmodulated 75.7400MHz Mask B 1W Pass
RBW=300Hz VBW=3000Hz



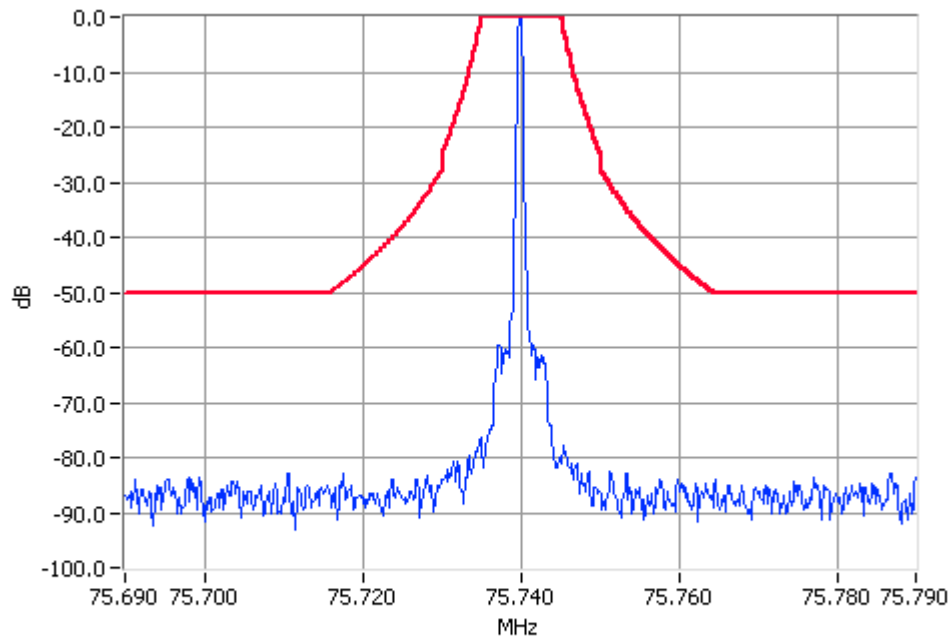
Analogue Modulation 75.7400MHz Mask B 1W Pass
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

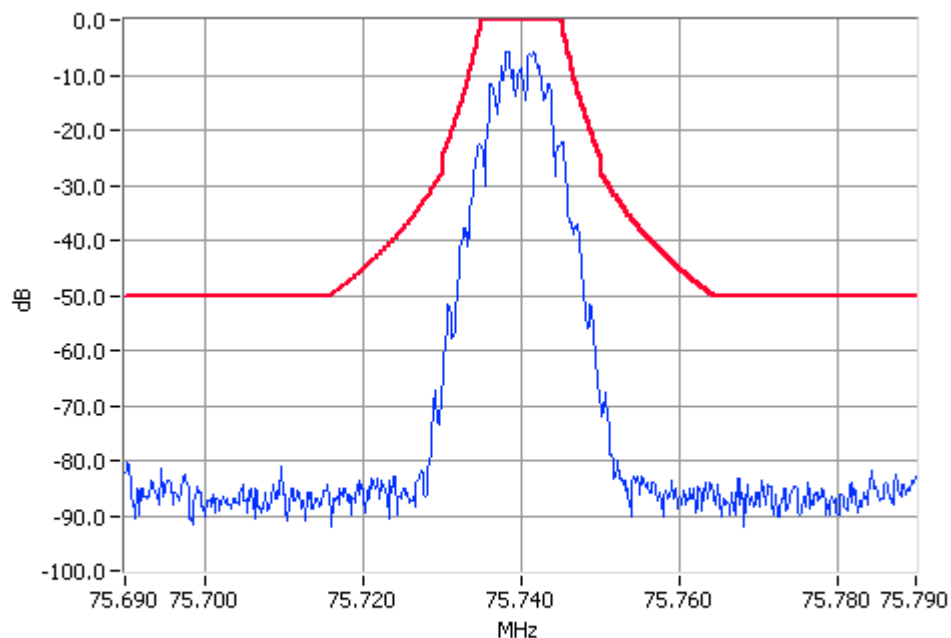
FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 75.74 MHz 25W 25 kHz Channel Spacing



Unmodulated 75.7400MHz Mask C 25W Pass
RBW=300Hz VBW=3000Hz



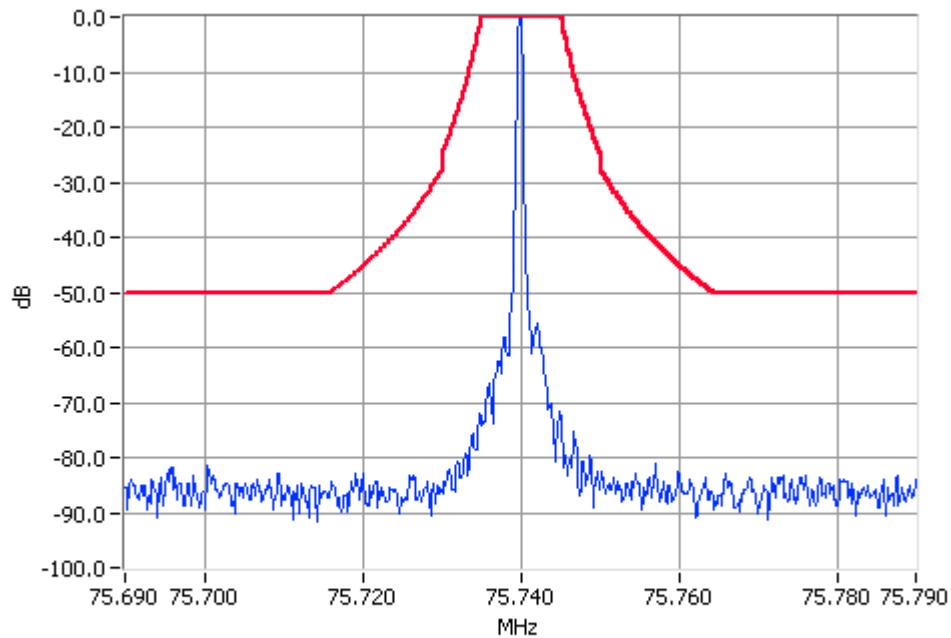
Digital Modulation 75.7400MHz Mask C 25W Pass
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

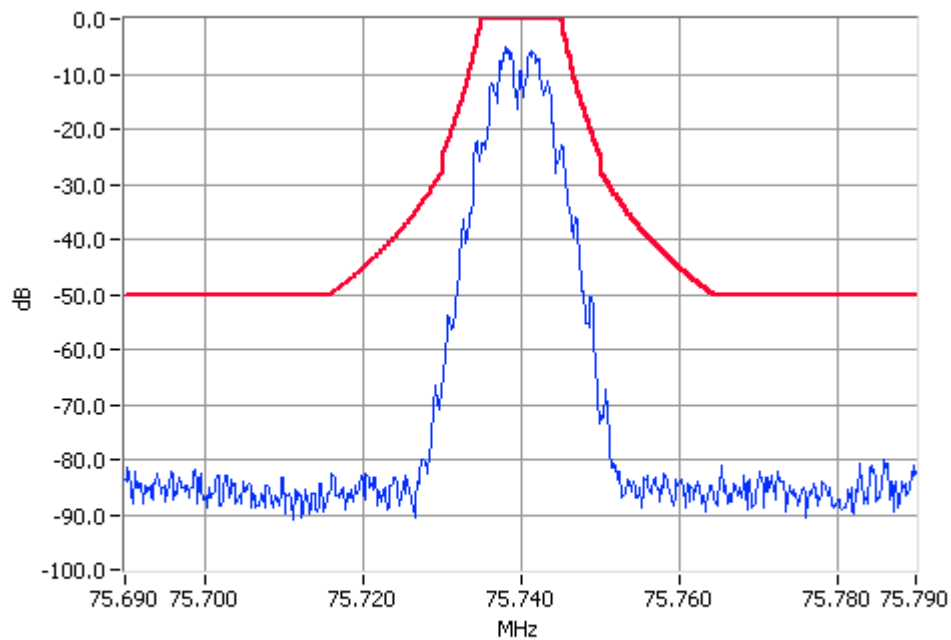
FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 75.74 MHz 1W 25 kHz Channel Spacing



Unmodulated 75.7400MHz Mask C 1W Pass
RBW=300Hz VBW=3000Hz



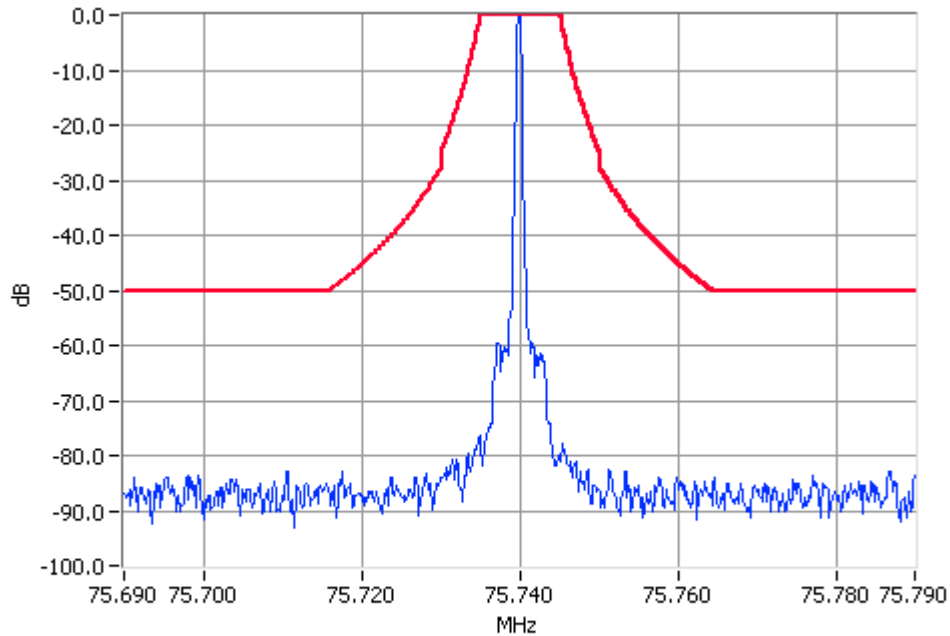
Digital Modulation 75.7400MHz Mask C 1W Pass
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

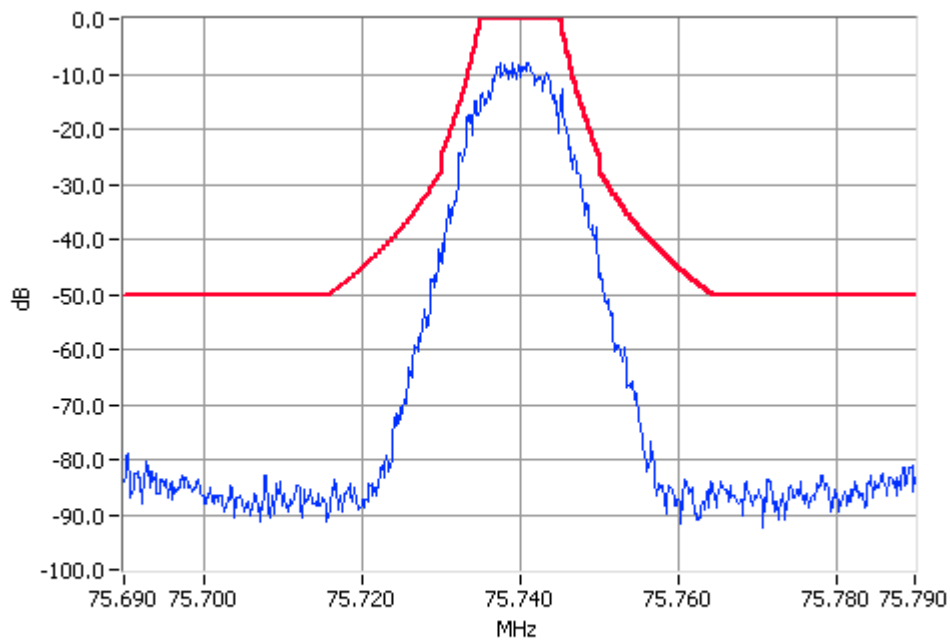
THSD

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 75.74 MHz 25W 25 kHz Channel Spacing



Unmodulated 75.7400MHz Mask C 25W Pass
RBW=300Hz VBW=3000Hz



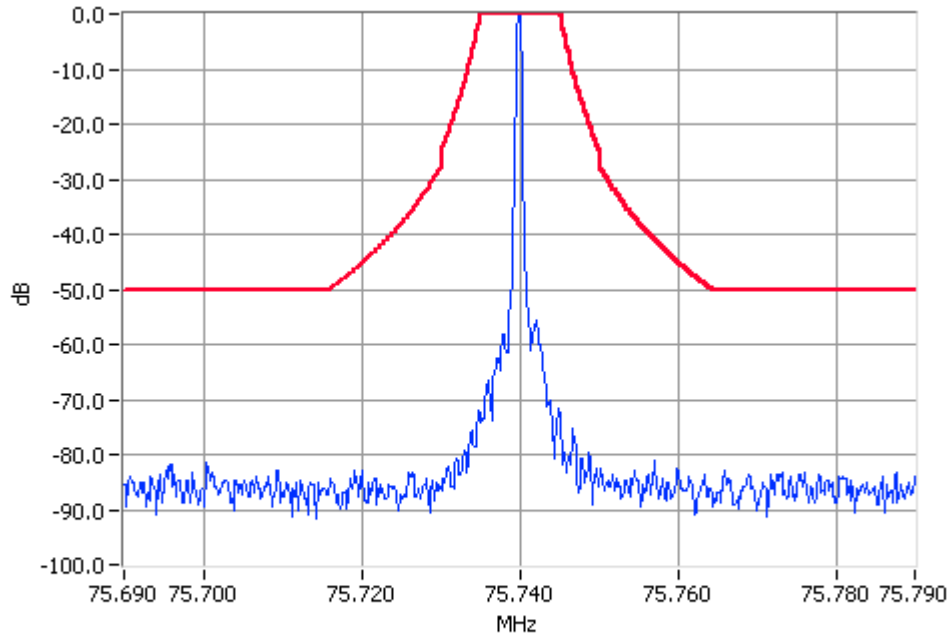
Digital Modulation 75.7400MHz Mask C 25W Pass
RBW=300Hz VBW=3000Hz

OCCUPIED BANDWIDTH

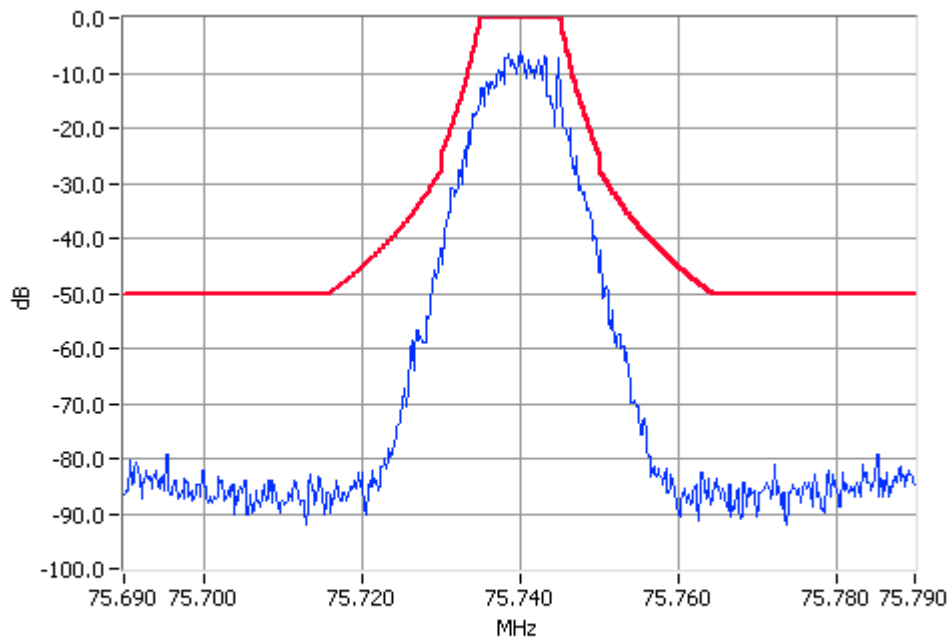
THSD

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 75.74 MHz 1W 25 kHz Channel Spacing



Unmodulated 75.7400MHz Mask C 1W Pass
RBW=300Hz VBW=3000Hz



Digital Modulation 75.7400MHz Mask C 1W Pass
RBW=300Hz VBW=3000Hz

SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1051

GUIDE: TIA/EIA-603C 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: 100kHz to Fc-BW
Fc+BW to 4.7 GHz
3. A Pre-scan is performed with a resolution bandwidth of 1 kHz, and a video bandwidth of 3 kHz. If any emissions are found to be within 20dB of the limit a second measurement is made with the carrier modulated, and a resolution bandwidth of 10 kHz, and a video bandwidth of 30kHz.
4. Spurious emissions which were attenuated more than 20dB below the limit were not recorded.

MEASUREMENT RESULTS:

See the tables on the following pages for 25.0 kHz channel spacings.

LIMIT CLAUSE: FCC 47 CFR 90.210

SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 75.74 MHz

25 kHz Channel Spacing		75.74 MHz @ 25 W	Emission Mask B
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
~	~	~	
No emissions were detected at a level greater than 20 dB below the limit.			

LIMITS:

Carrier Output Power Watts	Emission Mask B 12.5 kHz Channel Spacing $43 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-13 dBm	43 dBc
25 W	-13 dBm	57 dBc

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA/EIA-603C 2.2.12

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The EUT was placed on a wooden turntable at a distance of three metres from the test antenna. The output terminal was connected to an RF dummy load.
3. The turntable was rotated through 360° to obtain the maximum response of each spurious emission. Valid emissions were determined by switching the EUT on and off.
4. The EUT was 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 (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 75.74 MHz

25 kHz Channel Spacing	75.74 MHz @ 25 W	Emission Mask B
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

LIMITS:

Carrier Output Power Watts	Emission Mask B 12.5 kHz Channel Spacing $43 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-13 dBm	43 dBc
25 W	-13 dBm	57 dBc

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 75.74 MHz

25 kHz Channel Spacing		75.74 MHz @ 25 W	Emission Mask B
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
~	~	~	
No emissions were detected at a level greater than 20 dB below the limit.			

LIMITS:

Carrier Output Power Watts	Emission Mask B 12.5 kHz Channel Spacing $43 + 10 \log_{10}(P_{\text{Watts}})$	
1 W	-13 dBm	43 dBc
25 W	-13 dBm	57 dBc

TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

SPECIFICATION: FCC 47 CFR 2.1055 (a) (1)

GUIDE: TIA/EIA-603C 2.2.2

MEASUREMENT PROCEDURE:

1. Refer Appendix A for equipment set up.
2. The EUT was tested for frequency error from -30°C to $+50^{\circ}\text{C}$ in 10°C increments
3. The frequency error was recorded in parts per million (ppm).

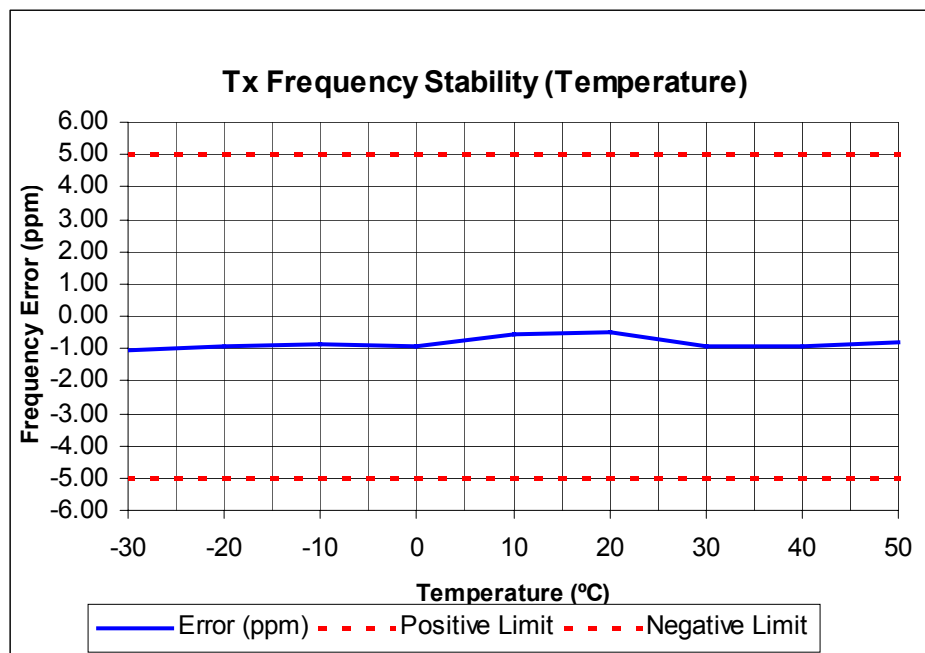
LIMIT CLAUSE: FCC 47 CFR 90.213

Frequency Range: 72 MHz to 76 MHz

Channel Spacing (kHz)	Frequency Error (ppm)
25.0	5.0

MEASUREMENT RESULTS:

Tx FREQUENCY: 75.74 MHz 25W 25.0 kHz channel Spacing



TRANSMITTER FREQUENCY STABILITY (VOLTAGE)

SPECIFICATION: FCC 47 CFR 2.1055 (d) (1)

GUIDE: TIA/EIA-603C 2.2.2

MEASUREMENT PROCEDURE:

1. Refer Appendix A for equipment set up.
2. The EUT was tested for frequency error at an input voltage to the radio of 85% to 115%.
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS: Frequency Range: 72 MHz to 76 MHz

Channel Spacing (kHz)	FREQUENCY ERROR (ppm) @ 75.74 MHz		
	11.7 V DC	13.8 V DC	15.9 V DC
25.0	-1.14	-1.19	-1.20

LIMIT CLAUSE: FCC 47 CFR 90.213

Channel Spacing (kHz)	Frequency Error (ppm)
25.0	5.0

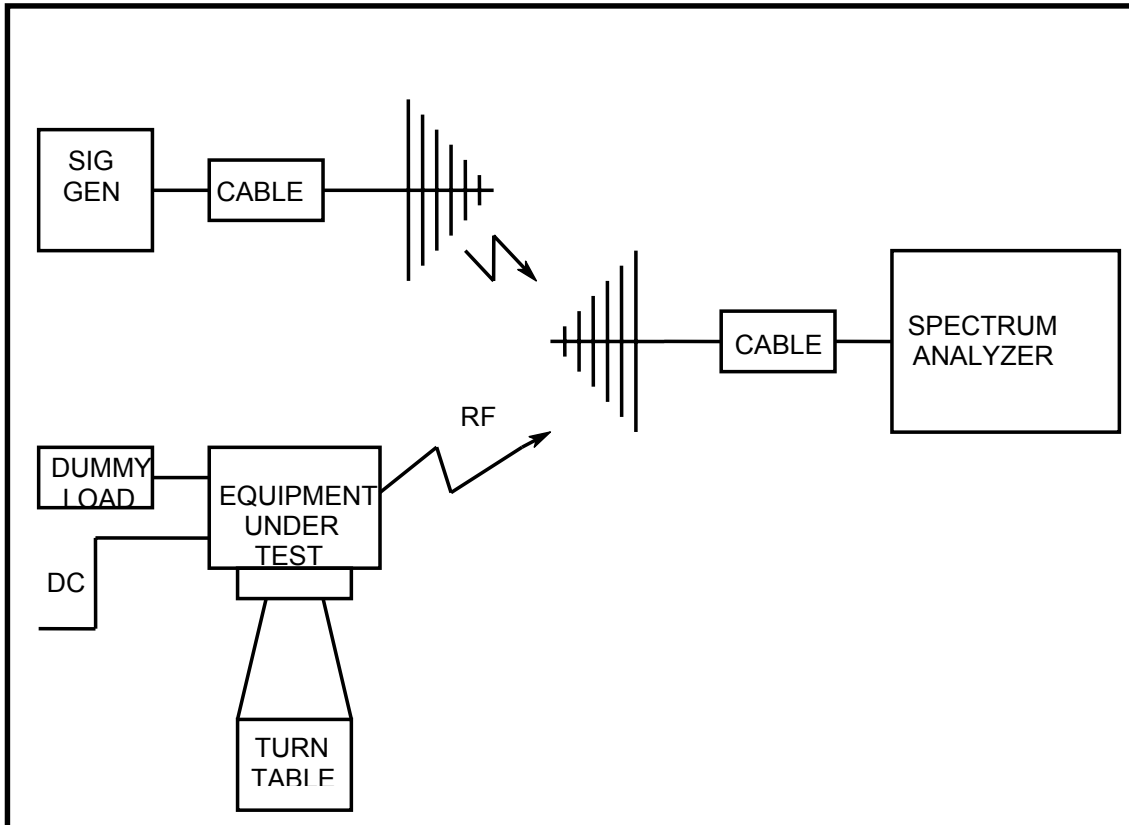
TEST EQUIPMENT USED

No#	Equipment	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
11	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073	30-Nov-05
13	Audio Analyser	Hewlett Packard	HP8903A	2308A02597	E3074	30-Nov-05
20	Power Supply	Hewlett Packard	HP6032A	2441A-0041Z	E3075	19-Nov-05
46	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	
72	RF Load 50W	Weinschel	F1426	AE2490	E3624	07-Nov-05
90	Power Supply	Hewlett Packard	HP6012B	2524A00616	E3712	21-Jul-05
116	Power Head	Hewlett Packard	HP11722A	2716A02037	E1575	30-Nov-05
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	30-May-06
135	Attenuator	Weinschel	67-30-33	BR0531	E4280	13-Aug-05
137	1m Multiflex Cable	Suhner	MF141	TT007		08-Aug-06
138	1m Multiflex Cable	Suhner	MF141	TT086		08-Aug-06

ANNEX A

TEST SETUP DETAILS

Radiated Emissions Set up.





ANNEX B

Product Identification Form

TA30Issue 21/6/2002 13pp

MANUFACTURER'S DETAILS	
COMPANY NAME: Tait Electronics Ltd	
ADDRESS:	558 Wairakei Road Christchurch New Zealand
NAME FOR CONTACT PURPOSES: Ian MacKay	
TELEPHONE NUMBER:	64-3-358 0306
FAX NUMBER:	64-3-358 0432
EMAIL:	ian.mackay@tait.co.nz

TYPE DESIGNATION

Please enter the Product Code*:

[TBBA4A4-A00-00]

***A unique-to-product alpha-numeric character group used for commercial transactions and Compliance. For many regulators, the Product Code is the only mandatory Compliance mark. Refer to GR0293 definitions.**

EQUIPMENT CLASSIFICATION

- | | | |
|---|----------------|---|
| [☒] | Base Station | [Equipment fitted with an antenna socket for use with an external antenna, and intended for use in a fixed location]. |
| [] | Mobile Station | [Mobile equipment fitted with an antenna socket, for use with an external antenna, normally used in a vehicle or as a transportable station]. |
| [] | Handportable | [Fitted with an antenna socket] |
| [] | | [Without an external antenna socket integral antenna equipment, but fitted with a permanent internal or a temporary internal 50 Ohm RF connector which allows access to the transmitter output and the receiver input]. |
| [] | <u>Other</u> | |

Base Station

- | | | | |
|---|-------------|---------|---|
| [] | Transmitter | [] | Simplex |
| [] | Receiver | [] | Duplex |
| [☒] | Transceiver | [] | Communal Site Use
[70 dB Intermod Limit] |

Mobile Station

- | | | | |
|---------|-------------|---------|---------------------|
| [] | Transmitter | [] | Simplex |
| [] | Receiver | [] | Duplex |
| [] | Transceiver | [] | Remote Control Head |

Handportable

- | | | | |
|---------|-------------|---------|-----------------|
| [] | Transmitter | [] | Simplex |
| [] | Receiver | [] | Duplex |
| [] | Transceiver | [] | Battery Charger |

TRANSMITTER MODULATION

Angle [FREQUENCY] [☒]

Phase []

Other []

Transmitter Modulation Input Characteristics - Analogue

Modulation input signal level for 60% of maximum deviation at [1000] Hz.

Microphone socket [6.5] mV Impedance [2200] Ohms

Accessory socket [] mV Impedance [] Ohms

Other [4] [] mV Impedance [] Ohms

Levels expected from line input	Maximum	[]	dBm
	Minimum	[]	dBm

Lowest audio modulation frequency transmitted by the equipment:
[67] Hz

[4] For use where direct connection is provided for test purposes.

Transmitter Modulation Input Characteristics - Data

Modulation bit rate [1200] bit/s FFSK – Fast Frequency Shift Keying
[12K0] bit/s THSD – Tait High Speed Data

Type of modulation:

Subcarrier:

MSK	YES	[☒]	NO	[☒]
FFSK	YES	[☒]	NO	[]

Direct:

DIRECT FSK	YES	[]	NO	[☒]
GMSK	YES	[]	NO	[☒]
Generalised Tamed FM	YES	[]	NO	[☒]
Multilevel State FM	YES	[]	NO	[☒]
PLL-4PSK	YES	[]	NO	[☒]
8 PSK	YES	[]	NO	[☒]
Other	YES	[☒]	NO	[]

CP4GFSK - THSD

INTERFACE FOR DATA TRANSMISSION

Signal Level

V28 []

Other [☒] Details: 0 ~ 3V via Mic port

Definition of Signals

V24 []

Other [☒] Details: Pseudo-Random bit sequence

NORMAL TEST SIGNAL

Can the equipment transmit continuous bitstreams [☒] Yes
[] No

If NO, give details of the format and information.

NOTE: It is recommended that details of the agreed format are stated on the page of the type test report titled "Additional information supplementary to the test report".

TYPE OF CONNECTOR

25 Pin RS-232 []

9 Pin RS-232 []

Male []

Female []

Other [☒] Details: RJ45 Socket

RECEIVER TECHNICAL CHARACTERISTICS

RECEIVER – FREQUENCY

Method Of Frequency Generation

Crystal []
Synthesizer [☒]
Other []

Intermediate Frequencies

1st [21.400029] MHz
2nd [0.064] MHz
3rd []

Is the local oscillator injection frequency higher or lower than the receiver nominal frequency?

Higher []
Lower [☒]

Receiver Channel Switching Frequency Range

[22] MHz

Receiver Frequency Alignment Range

[66] MHz to [88] MHz [22 MHz]

RECEIVER AUDIO [AF] CHARACTERISTICS

Maximum Rated Audio [AF] Frequency Output Power

Into Loudspeaker [3] Watts
To Line [0.004] Watts
Into Earpiece [] Watts

Balanced [☒] Yes
[] No
Unbalanced [] Yes
[☒] No

Does connection carry DC voltage?

[] Yes If yes, state value [] Volts
[☒] No

TELTEST Laboratories

Tait Electronics Limited

Report Number 2292

Normal Audio Load Impedance

At Loudspeaker [16] Ohms

At Earpiece [] Ohms

At Line Output [600] Ohms

At Audio Accessory Connection Or Facility Socket [If Fitted]

Output [3] Watts

Impedance [16] Ohms

Max Input Level At Audio Accessory Socket

Level [] mV

Impedance [] Ohms

TRANSMITTER AND RECEIVER CHARACTERISTICS

ITU Designation Or Class Of Emission: [16K0F3E; 9K60F2D; 12K6F1D]

Channel Separation: [25 kHz]

State the maximum number of channels over which the equipment can operate: [100]

Extreme Temperature Range over which equipment is to be type tested.

Low temperature: [-30] °C

High Temperature [+60] °C

Construction of Equipment

Single Unit [5] [✓]

Multiple Units []

If multiple units describe each one clearly below:

[5] Unit means a physically separate item of the equipment

AUTOMATIC EQUIPMENT SWITCH-OFF

If the equipment is designed to automatically switch off at a predetermined voltage level which is higher or lower in value than the battery minimum and maximum calculated values this shall be clearly stated.

Applies ☒ Cutoff voltage [16.0] V
Does NOT apply ☐

POWER SOURCE

AC Mains ☐
State voltage [] V AC Mains Frequency [] Hz
Single phase ☐
Three phase ☐

DC Voltage [13.8] V DC Maximum Current [8.0] Amps

Other []

BATTERY

Nickel Cadmium ☐
Lead Acid [vehicle regulated] ☐
Other ☐

Volts nominal [] V

Endpoint voltage as quoted
by equipment manufacturer: []

SIGNALLING

Is selective signalling fitted ☒ Yes
☐ No

Is selective signalling: ☒ Analogue
☐ Digital

If analogue, state format [ZVEI-1]
Tone frequencies [1060, 1270, 1530, 2000, 2400 Hz]

If digital, state modulation method []
Bit rate [] bit/s

OTHER ITEMS SUPPLIED

Spare batteries	[☐] Yes
eg portable equipment	[☒] No
Battery charging device	[☐] Yes
	[☒] No
Special tools for dismantling equipment	[☐] Yes
	[☒] No
Encoder: Selcall, Data	[☐] Yes
	[☒] No
Test interface box [if applicable] or where appropriate the RF test fixture.	[☒] Yes
	[☐] No
Full documentation on equipment [Handbook and circuit diagrams]	[☐] Yes
	[☒] No
Other	[☐] Yes
	[☒] No

If "Yes", please specify.

SOFTWARE VERSION

Transmitter

Hardware ID TMAB13-A4T1_0102
QMA1F_std_02.08.00.00
QMA1B_std_1.03.00.0005
QMA1F-std_01.03.03.02

Receiver

Hardware ID TMAB13-A4R1_0102
QMA1F_std_02.08.00.00
QMA1B_std_1.03.00.0005
QMA1F-std_01.03.03.02

DECLARATION

Are the equipments submitted representative production models?

☒ Yes

☐ No

If not are the equipments pre-production models?

☐ Yes

☐ No

If pre-production equipments are submitted will the final production equipments be identical in all respects with the equipment tested?

☐ Yes

☐ No

If no, supply full details:

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature:

Name:

Position Held:

Date: