Tait Electronics Limited Report Number 2675

# **Laboratory Test Report**

#### For the

## TPCH6A HANDPORTABLE Transceiver

Tested In accordance with

FCC 47 CFR Parts 22, 74, 90 and 95A

Report Revision: 1

Issue Date: 16-Oct-2007 FCC ID: CASTPCH6A

PREPARED BY: Robin Kidson \_\_\_\_\_

**Test Technician** 

CHECKED & APPROVED BY: Steve Crompton

Laboratory Manager



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
16-Oct-2007	1	Initial test report

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## INTRODUCTION

Type Approval Testing of the T03-00003-DAAA (Serial No 25002917) in accordance with:

#### FCC CFR 47 Parts 22, 74, 90 & 95A

#### REPORT PREPARED FOR

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

## **DESCRIPTION OF SAMPLE**

Equipment: HANDPORTABLE Transceiver

Frequency Range: 450 – 530 MHz

Type: TPCH6A

Product code: T03-00003-DAAA

Serial Numbers: 25002917

Quantity: 1

Configuration Data: QPC1B std 1.00.00.0000; QPC1C std 1.00.00.0002

## STATEMENT OF COMPLIANCE

The T03-00003-DAAA HANDPORTABLE transceiver as tested in this report was found to conform to the following standards:

## FCC CFR 47 Parts 22, 74, 90 & 95A

## **TEST CONDITIONS**

All testing was performed at the following conditions.

Ambient Temperature  $15^{\circ}\text{C} \rightarrow 30^{\circ}\text{C}$ Relative Humidity  $20\% \rightarrow 75\%$ 

Standard Test Voltage 7.5 Vdc

## **EMISSION DESIGNATORS**

Analogue Voice 11K0F3E
Analogue Voice 16K0F3E
FFSK 6K60F2D
FFSK 9K60F2D

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## **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: 4 W and 1 W

Nominal 4W	450.1 MHz	459.9 MHz	469.9 MHz	511.9 MHz
Measured	4.0	4.0	3.8	3.8
Variation (%)	0.0	0.0	5.0	5.0
Nominal 1W	450.1 MHz	459.9 MHz	469.9 MHz	511.9 MHz
Measured	1.0	1.0	1.0	1.0
Variation (%)	0.0	0.0	0.0	0.0
Measuremer	t Uncertainty	± 0.6 dB		

LIMIT CLAUSE: FCC 47 CFR 90.205 (r)

Radio Type: Mobile Transceiver Frequency Band: 450 MHz ~ 512 MHz

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

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#### 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.

#### **MEASUREMENT RESULTS:**

See the plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings.

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LIMIT CLAUSE: TIA/EIA-603C 3.2.6

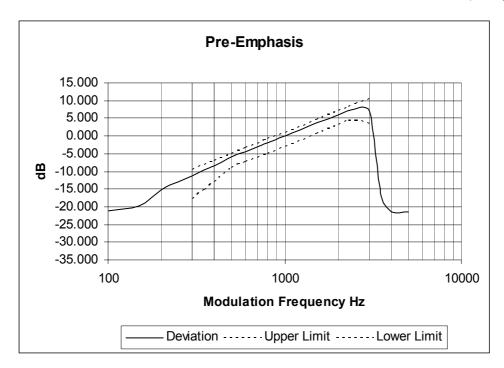
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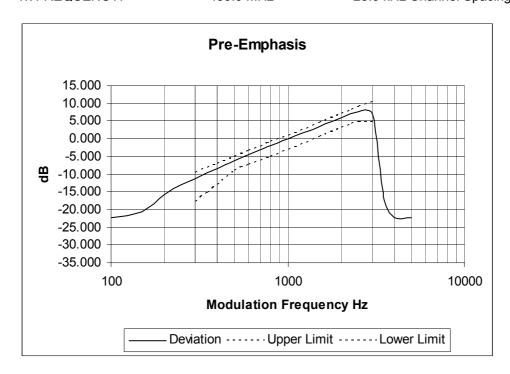
#### TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 459.9 MHz 12.5 kHz Channel Spacing



Tx FREQUENCY: 459.9 MHz 25.0 kHz Channel Spacing



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## TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

#### MEASUREMENT PROCEDURE:

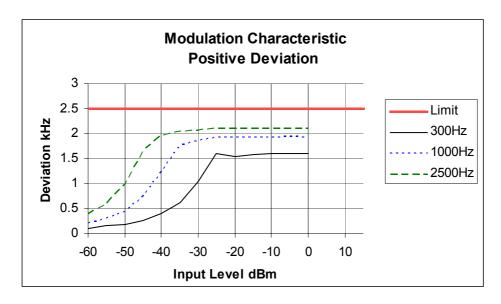
- 1. Refer Annex A for Equipment set up.
- The modulation response was measured at three audio frequencies while varying the input level.
- 3. Measurements were made for both Positive and Negative Deviation.

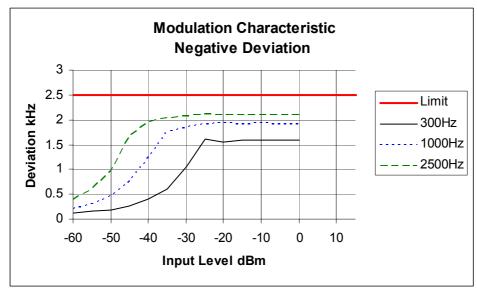
#### **MEASUREMENT RESULTS:**

See the plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings.

LIMIT CLAUSE: TIA/EIA-603C 1.3.4.4

Tx FREQUENCY: 459.9 MHz 12.5 kHz Channel Spacing





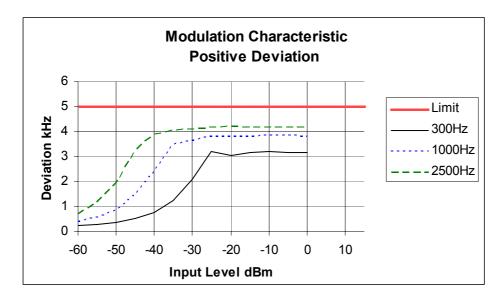
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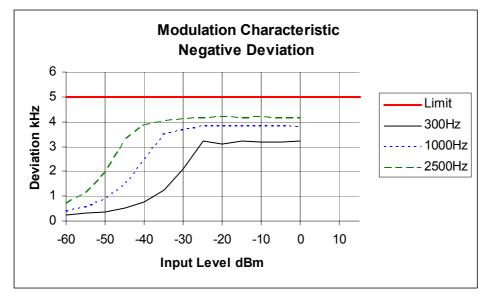
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#### TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 459.9 MHz 25.0 kHz Channel Spacing





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#### 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 Preamble bit sequence at the appropriate Baud rates.
- The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as follows.

Emission Mask D – Resolution Bandwidth = 100Hz, Video Bandwidth = 1 kHz Emission Mask B, and C – Resolution bandwidth = 300Hz, Video Bandwidth = 3 kHz

#### **MEASUREMENT RESULTS:**

See the plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings.

LIMIT CLAUSE: FCC 47 CFR 90.210

**EMISSION MASKS** 

Emission Mask D 12.5 kHz Channel Spacing Analogue; FFSK Emission Mask B 25.0 kHz Channel Spacing Analogue; Emission Mask C 25.0 kHz Channel Spacing FFSK

DATA SPEED

FFSK 12.5 kHz Channel Spacing 1200 bps FFSK 25.0 kHz Channel Spacing 1200 bps

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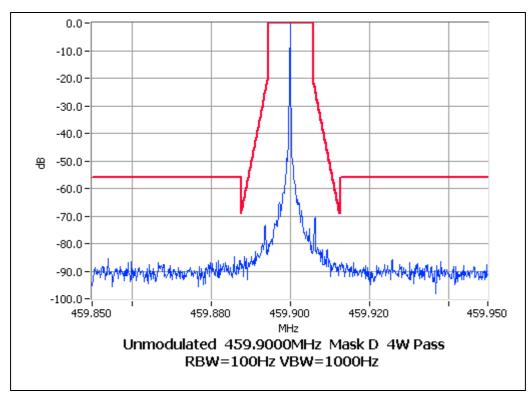
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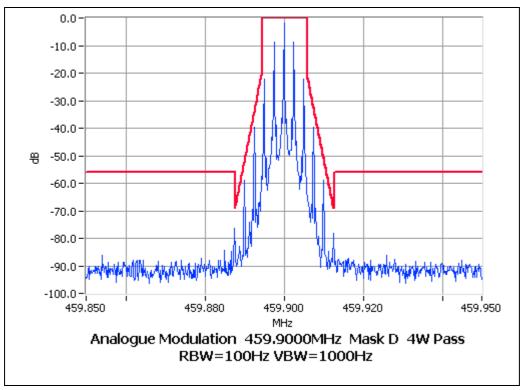
#### **OCCUPIED BANDWIDTH**

## ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing





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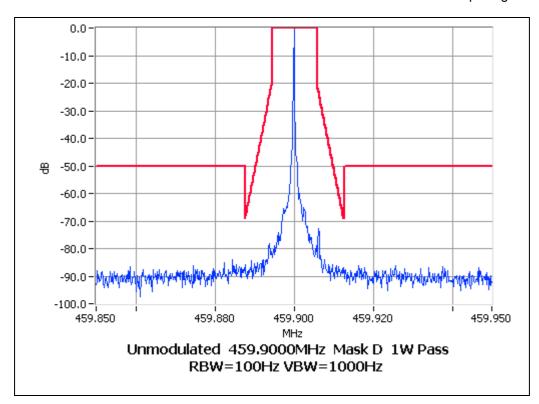
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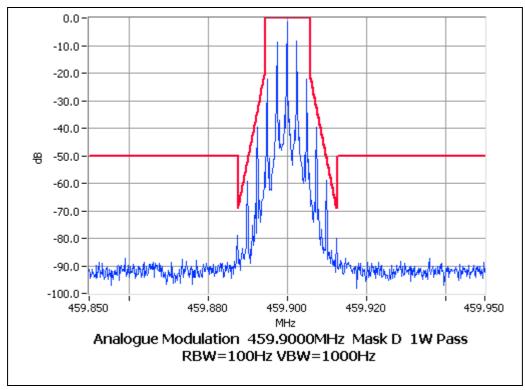
#### **OCCUPIED BANDWIDTH**

## ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing





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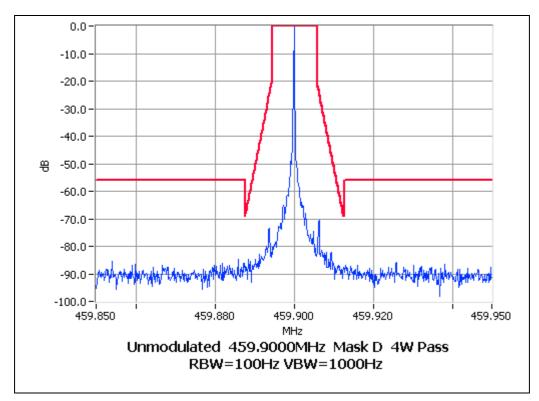
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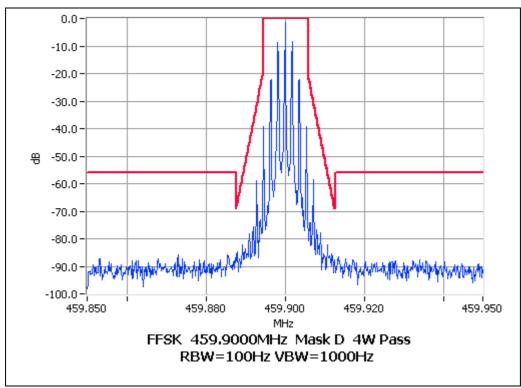
#### **OCCUPIED BANDWIDTH**

#### **FFSK**

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing





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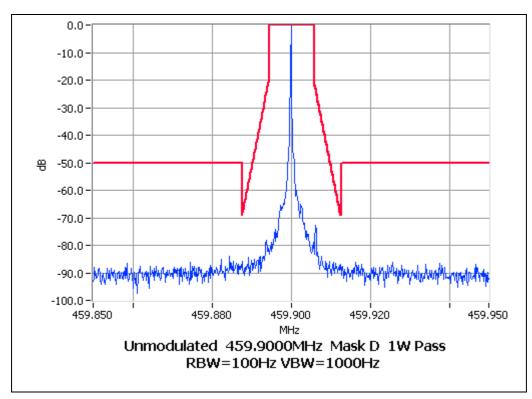
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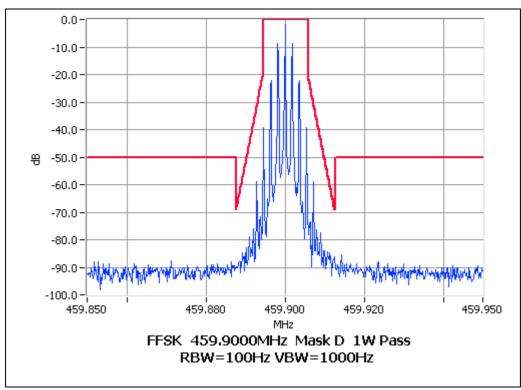
#### **OCCUPIED BANDWIDTH**

#### **FFSK**

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 459.9 MHz 1 W 12.5 kHz Channel Spacing





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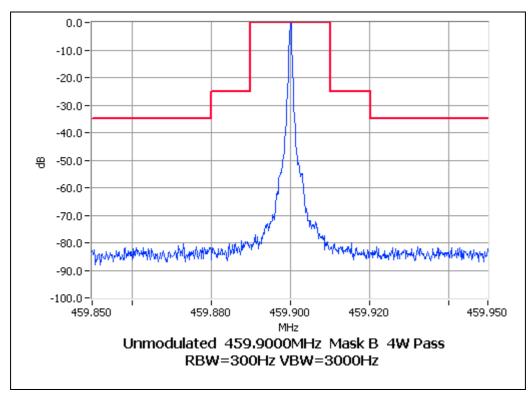
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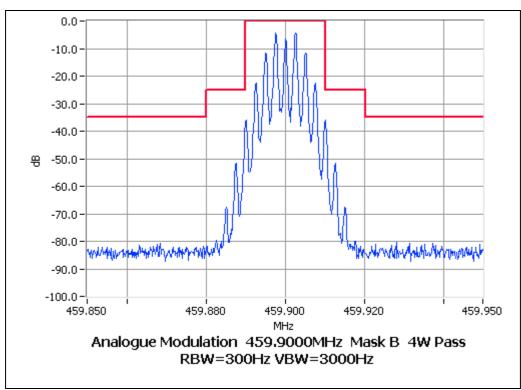
#### **OCCUPIED BANDWIDTH**

## ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 459.9 MHz 4 W 25 kHz Channel Spacing





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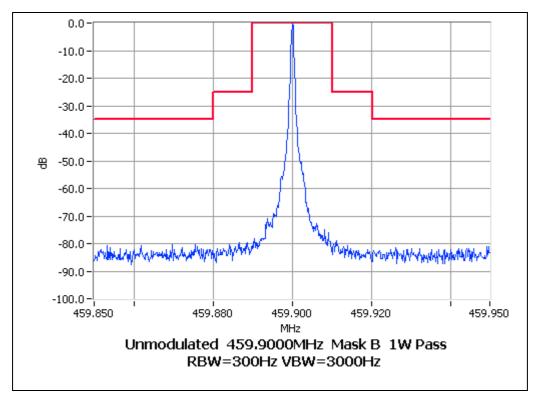
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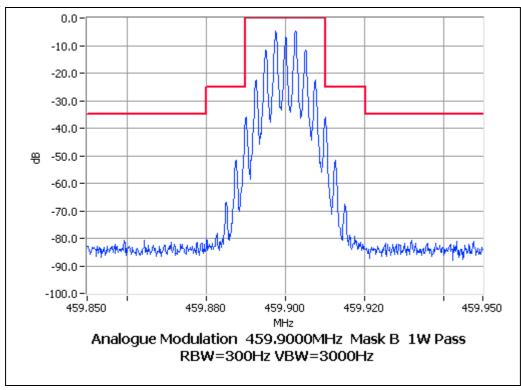
#### **OCCUPIED BANDWIDTH**

#### ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 459.9 MHz 1 W 25 kHz Channel Spacing





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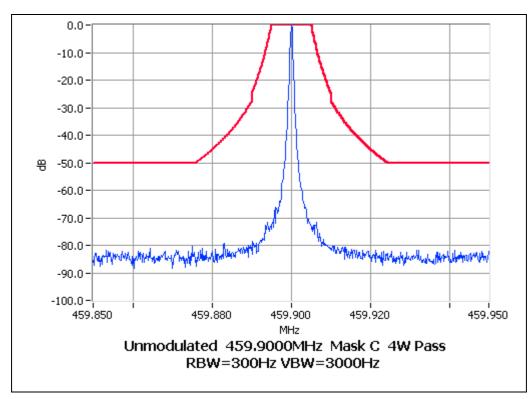
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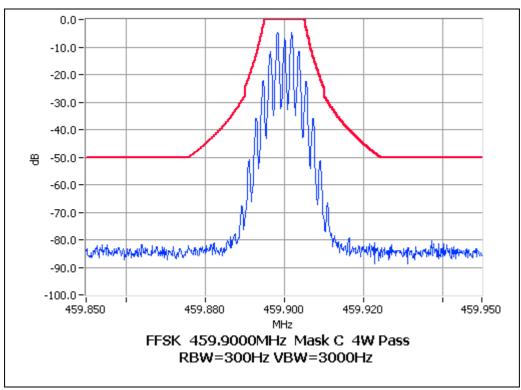
#### **OCCUPIED BANDWIDTH**

#### **FFSK**

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 459.9 MHz 4 W 25 kHz Channel Spacing





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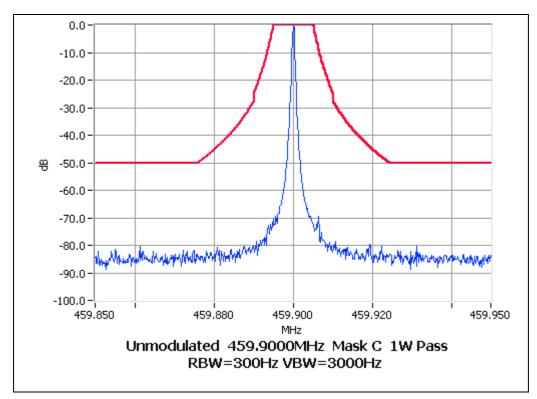
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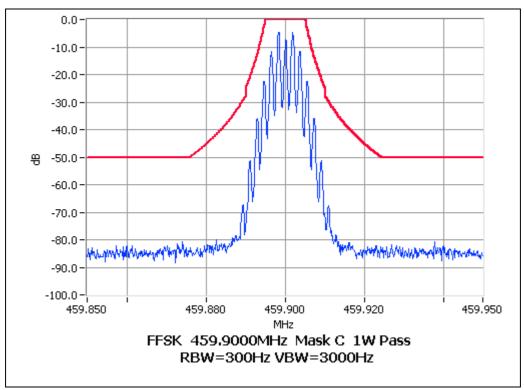
#### **OCCUPIED BANDWIDTH**

#### **FFSK**

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 459.9 MHz 1 W 25 kHz Channel Spacing





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## 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 10<sup>th</sup> Harmonic: 100kHz to Fc-BW

Fc+BW to 10Fc 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 30 kHz.

Spurious emissions which were attenuated by more than 20 dB below the limit were not recorded.

#### **MEASUREMENT RESULTS:**

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

LIMIT CLAUSE: FCC 47 CFR 90.210

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# SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

12.5 kHz Channel Spa	cing 450.1 MHz @ 4 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing 450.1 MHz @ 1 W Emission Mask D		
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spa	cing 459.9 MHz @ 4 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing 459.9 MHz @ 1 W		Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

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## SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

12.5 kHz Channel Spa	cing 469.9 MHz @ 4 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing 469.9 MHz @ 1 W Emission Mask D		
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spa	cing 511.9 MHz @ 4 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing 511.9 MHz @ 1 W		Emission Mask D
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 D 12.5 kHz Channel Spacing 50 + 10 Log <sub>10</sub> (P <sub>Watts</sub> )	
4 W	-20 dBm -56 dBc	
1 W	-20 dBm -50 dBc	

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#### SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

**GUIDE:** TIA/EIA-603C 2.2.12

#### MEASUREMENT PROCEDURE:

#### Initial Scan:

- 1. The EUT is placed in the S-Line TEM cell and emissions are measured from 30MHz to 1000MHz. Any emission within 10dB of the limit is then re-tested on the OATS along with measurements from 1000MHz to the 10<sup>th</sup> harmonic of the fundamental frequency.
- The EUT is then placed on a wooden turntable at a distance of 0.5 metres from the test antenna and emissions are measured from 1000MHz to the upper frequency required. Any emission within 10 dB of the limit is then re-tested on the OATS.

#### **OATS Measurement:**

- 1. The EUT is placed on a wooden turntable at a distance of three metres from the test antenna. The output terminal is connected to an RF dummy load.
- The test antenna is raised from 1m to 4m to obtain a maximum reading, the turntable is then rotated through 360° to obtain the maximum response of each spurious emission. Valid emissions are determined by switching the EUT on and off.
- The EUT is then replaced by a signal generator and substitution antenna to make measurements by the substitution method.

#### **MEASUREMENT RESULTS:**

See the tables on the following pages

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# SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

12.5 kHz Channel Spa	cing 459.9 MHz @ 4 W	Emission Mask D		
Emission Frequency (MHz)	Level (dBm)	Level (dBc)		
2299.50	-24.48	-60.50		
12.5 kHz Channel Spacing 459.9 MHz @ 1 W		Emission Mask D		
Emission Frequency (MHz)	Level (dBm)	Level (dBc)		
2299.50	-23.76	-53.76		
No other emissions was	No other emissions were detected at a level greater than 10 dD helevy the limit			
No other emissions were detected at a level greater than 10 dB below the limit.				

## LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing 50 + 10 Log <sub>10</sub> (P <sub>Watts</sub> )	
4 W	-20 dBm -56 dBc	
1 W	-20 dBm -50 dBc	

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## TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)

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

GUIDE: TIA/EIA-603C 2.2.2

#### MEASUREMENT PROCEDURE:

- 1. Refer Annex A for equipment set up.
- 2. The EUT was tested for frequency error from -30 °C to +50 °C in 10 °C increments
- 3. The frequency error was recorded in parts per million (ppm).

#### **MEASUREMENT RESULTS:**

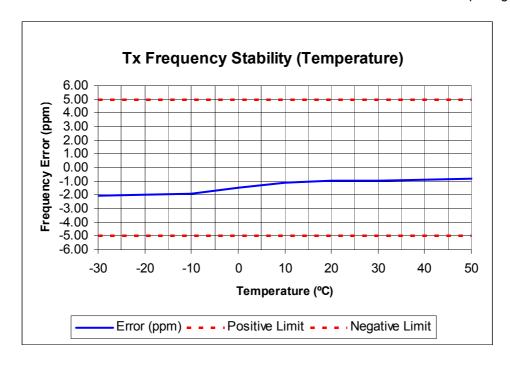
See the plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings.

LIMIT CLAUSE: FCC 47 CFR 90.213

Frequency Range: 450 MHz ~ 530 MHz

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	5.0
25.0	5.0

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz channel Spacing



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## TRANSMITTER FREQUENCY STABILITY (VOLTAGE)

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

**GUIDE**: TIA/EIA-603C 2.2.2

#### **MEASUREMENT PROCEDURE:**

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

MEASUREMENT RESULTS: Frequency Range: 450 MHz ~ 530 MHz

Channel Spacing	FREQUENCY ERROR (ppm) @ 459.9 MHz		
(kHz)	6.0 V DC	7.5 V DC	
12.5	-0.95	-1.00	
25.0	-0.96	-0.92	

LIMIT CLAUSE: FCC 47 CFR 90.213

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	5.0
25.0	5.0

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#### TRANSIENT FREQUENCY BEHAVIOR

SPECIFICATION: FCC 47 CFR 90.214

GUIDE: TIA/EIA-603C 2.2.19

#### **MEASUREMENT PROCEDURE:**

- 1. Refer Annex A for equipment set up.
- 2. Measurements and plots were made following the TIA/EIA procedure.

#### **MEASUREMENT RESULTS:**

See the tables and plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings.

LIMIT CLAUSE: FCC 47 CFR 90.214

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## TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing

FREQUENCY	459.9 MHz @ 4 W Tx		
TRANSIENT RESPONSE	CARRIER PEAK VARIATION FROM NORMAL		
PERIOD	Key ON (kHz)	Key OFF (kHz)	
t1	-1.6	N/A	
t <sub>2</sub>	-0.9	N/A	
t <sub>3</sub>	N/A	-0.7	
t2 → t3 ppm	-1.8		
ERROR LIMIT (t2 → t3) ppm	5.0		

Confirm that during periods t1 and t3 the frequency	YES	NO
difference does not exceed the value of one channel separation.	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period to to to the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

## LIMIT:

Environ.				
TRANSIENT PERIODS	FREQUENCY RANGE 150MHz – 174 MHz	FREQUENCY RANGE 421MHz – 512 MHz		
t1 (ms)	5 ms	10 ms		
t2 (ms)	20 ms	25 ms		
t3 (ms)	5 ms	10 ms		

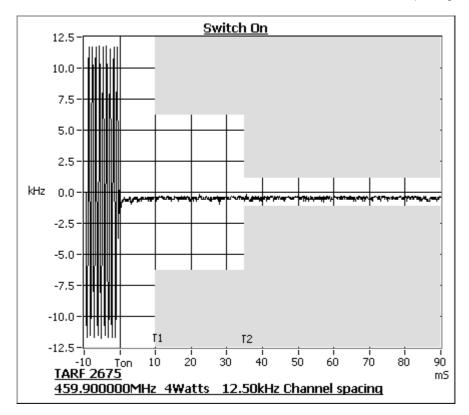
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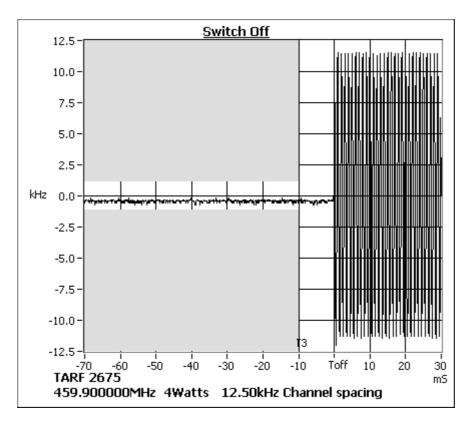
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## TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 459.9 MHz 4 W 12.5 kHz Channel Spacing





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## TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 459.9 MHz 4 W 25.0 kHz Channel Spacing

FREQUENCY	459.9 MHz @ 4 W Tx		
TRANSIENT RESPONSE	CARRIER PEAK VARIATION FROM NORMAL		
PERIOD	Key ON (kHz)	Key OFF (kHz)	
t1	-1.4	N/A	
t <sub>2</sub>	-0.7	N/A	
t <sub>3</sub>	N/A	-0.7	
t2 → t3 ppm	-2.6		
ERROR LIMIT (t2 → t3) ppm	5.0		

Confirm that during periods t1 and t3 the frequency	YES	NO
difference does not exceed the value of one channel separation.	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency	YES	NO
difference does not exceed the frequency error limit.	Y	

## LIMIT:

TRANSIENT PERIODS	FREQUENCY RANGE 150MHz – 174 MHz	FREQUENCY RANGE 421MHz – 512 MHz
<b>t</b> 1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

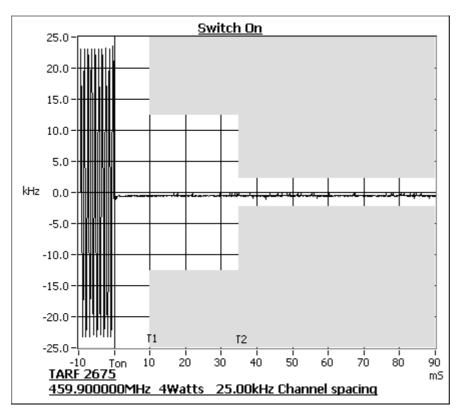
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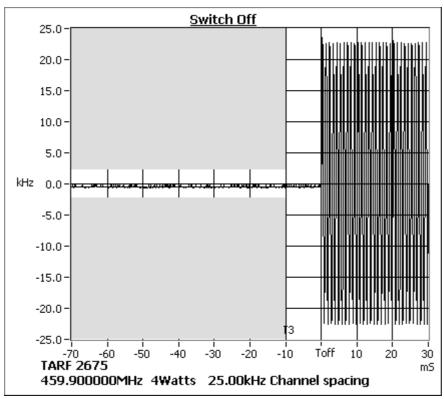
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## TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 459.9 MHz 4 W 25.0 kHz Channel Spacing





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## **TEST EQUIPMENT USED**

No#	Equipment	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
21	Power Supply	Rohde & Schwarz	NGS M32/10 192.0810.31	Fnr 434	E3556	16-Oct-07
24	Environ. Chamber	Contherm	Spatial Cal	E3397	E3397	
42	Reference Horn Antenna	Emco	DRG3115	9512-4638	E3560	16-Nov-09
43	Horn Antenna	Emco	DRG3115	2084	E3076	25-Nov-09
46	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	20-Mar-09
64	RF Attenuator 50W	Weinschel	24-10-34	AZ0401	E3388	31-Oct-07
66	RF Attenuator 25W	Weinschel	33-20-33	BD5871	E3673	31-Oct-07
82	3m Coax Cable BLUE)	Suhner	Sucoflex 104A	44610/4A	E4619	6-Sep-08
84	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25005/4A	E4620	6-Sep-08
87	Audio Analyser	Hewlett Packard	HP8903B	2818A04275	E3710	1-Nov-07
111	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	1-Nov-07
117	RF Attenuator	Weinschel	Model 1	BL9950	E4080	
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	17-Jul-08
127	OATS Tower Cable	Intelcom	RG214	OATS1	E4621	6-Jun-08
128	OATS Turntable Cable	Intelcom	RG215	OATS2	E4622	7-Jun-08
129	Antenna Tower	Electrometrics	EM-4720-2	112	E4447	
130	Controller	Electrometrics	EM-4700	119	E4445	
131	Turntable	Electrometrics	EM-4704A	105	E4446	

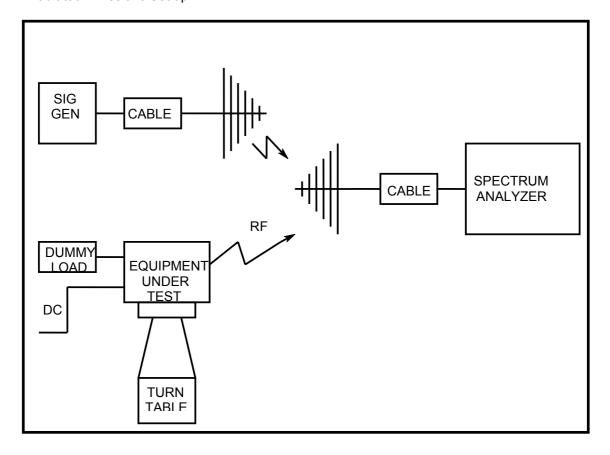
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## ANNEX A

## TEST SETUP DETAILS

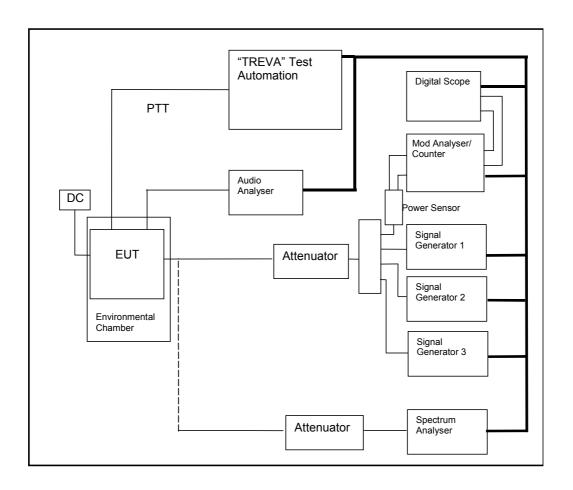
Radiated Emissions Set up.



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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.



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