Laboratory Test Report

For the

TMAA42-B100 External Radio Frequency Power Amplifier

Tested In accordance with

FCC 47 CFR Parts 22 and 90

Report Revision: 2
Issue Date: 03-Nov-2005
FCC ID: CASTMAB1Z

PREPARED BY: Garry Pringle _____
Test Technician

CHECKED & APPROVED BY: Hamish Newton _____
Senior Technician

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
19-Sep-2005	1	Initial test report
03-Oct-2005	2	Re-tested conducted emissions after improvements in LPF

INTRODUCTION

Type Approval Testing of the TMAA42-B100 (Serial No 13133324) 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

FCC ID:	CASTMAB1Z
Type:	TMAB1Z
Product code:	TMAA42-B100
Serial Numbers:	13133324
Quantity:	1

The TMAB1Z is an External Radio Frequency Power Amplifier designed to operate in the 136MHz to 174MHz band. It has a fixed output power of 110W, and output impedance of 50 ohms. It has been tested with the TMAB32-B100 (serial number 19057434) mobile, which has the output power fixed at 1 watt. The mobile performs all modulation, and the TMAB1Z is only used to increase the output power of the mobile.

STATEMENT OF COMPLIANCE

The TMAA42-B100 External Radio Frequency Power Amplifier 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	$15^{o}C \rightarrow 30^{o}C$
Relative Humidity	20% → 75%
Standard Test Voltage	13.8Vdc

NECESSARY BANDWIDTH AND EMISSION DESIGNATORS

The TMAA42-B100 ERFPA does not provide any modulation.
It is intended to be used with the following types of emissions as defined in 90.207

F3E – FM, Analogue Voice
F1E – FM, Digital Voice
F1D – FM, Digital Data, no subcarrier
F2D – FM, Digital Data, modulated subcarrier
F7E – FM, Two or more channels containing quantized or digital voice information
F7D – FM, Two or more channels containing quantized or digital information

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: 110 Watts

162.1 MHz	110 W nominal	W nominal
POWER (W)	107.0	
Variation from Nominal (%)	-2.7	
Measurement Uncertainty (dB)	+0.63 -0.68	

LIMIT CLAUSE: FCC 47 CFR 90.205 (r)

Radio Type: Mobile Transceiver
Frequency Band: 150 MHz → 174 MHz

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

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 D – Resolution Bandwidth = 100Hz, Video Bandwidth = 1 kHz

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

LIMIT CLAUSE: FCC 47 CFR 90.210

EMISSION MASKS

Emission Mask D	12.5 kHz Channel Spacing	Analogue; FFSK; C4FM

DATA SPEED

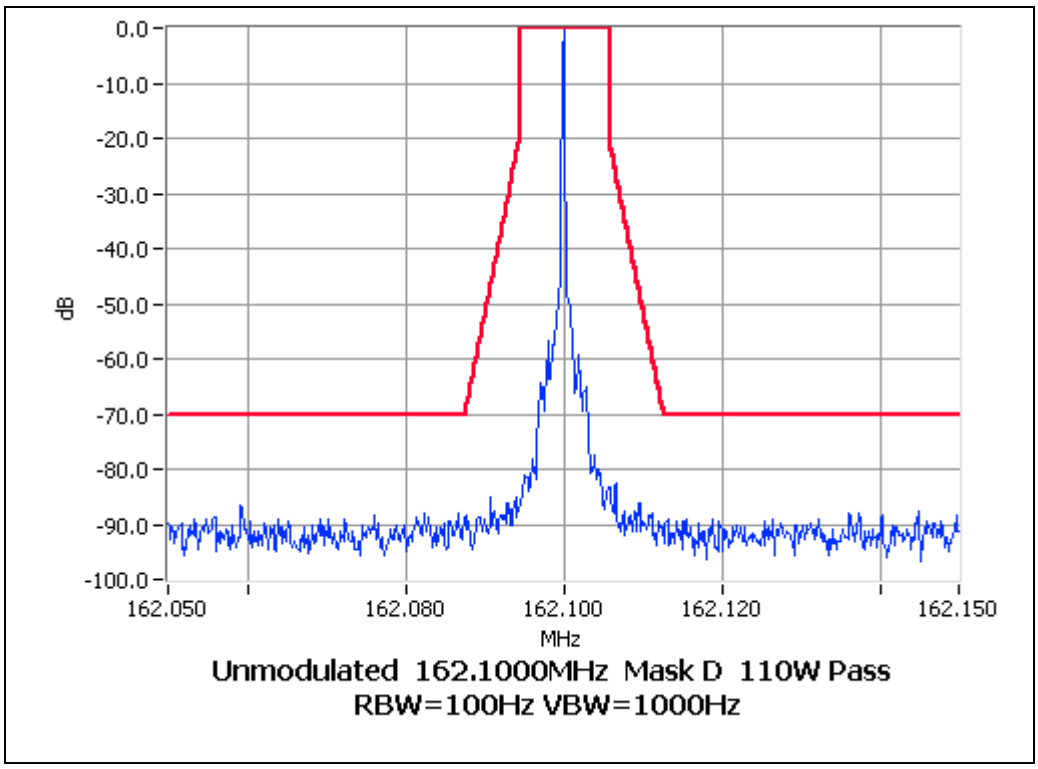
FFSK	1200 bps	12.5 kHz Channel Spacing
C4FM	9600 bps	12.5 kHz Channel Spacing

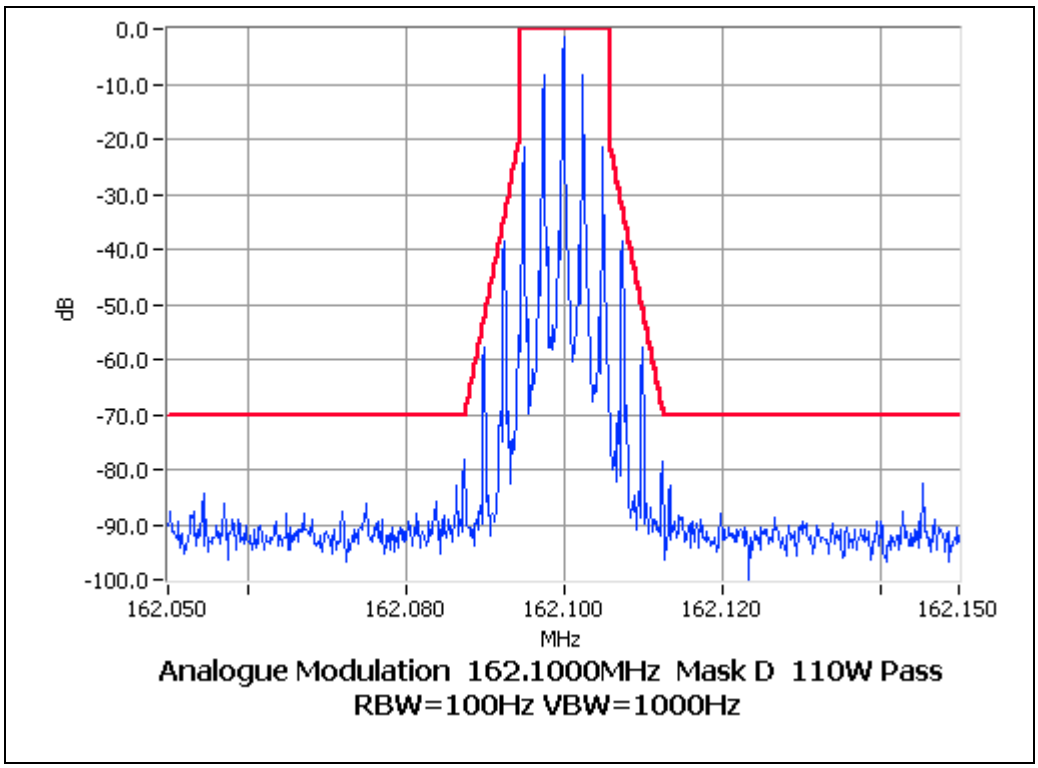
OCCUPIED BANDWIDTH

ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 162.1 MHz 110W 12.5 kHz Channel Spacing



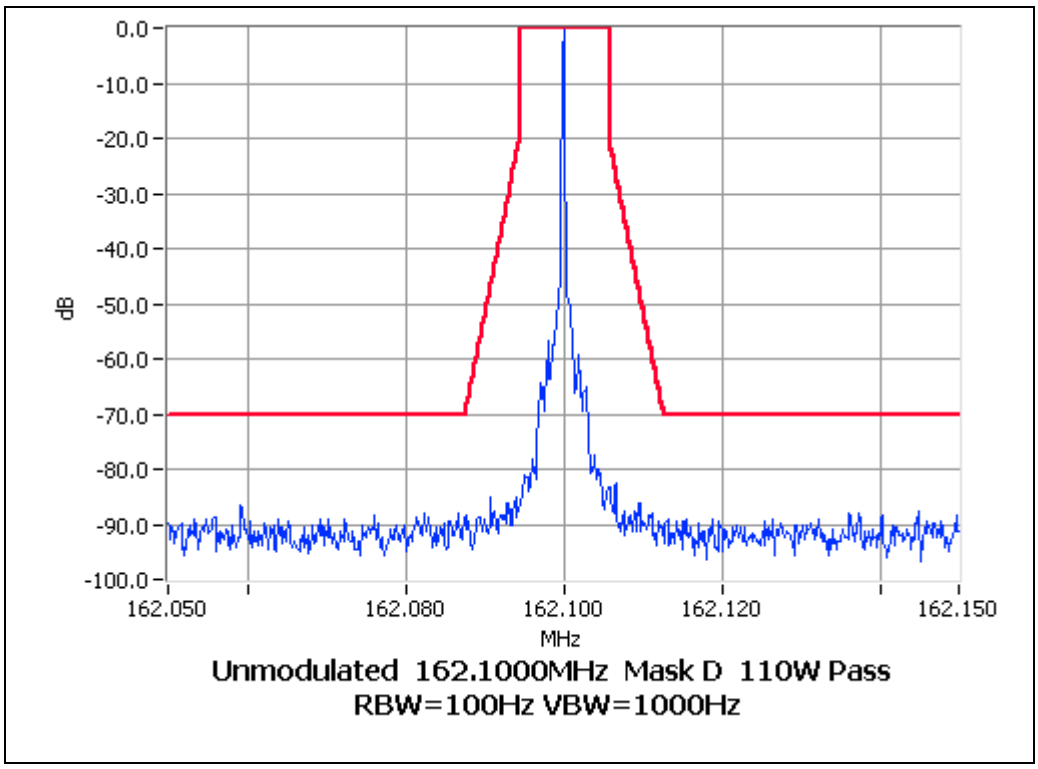


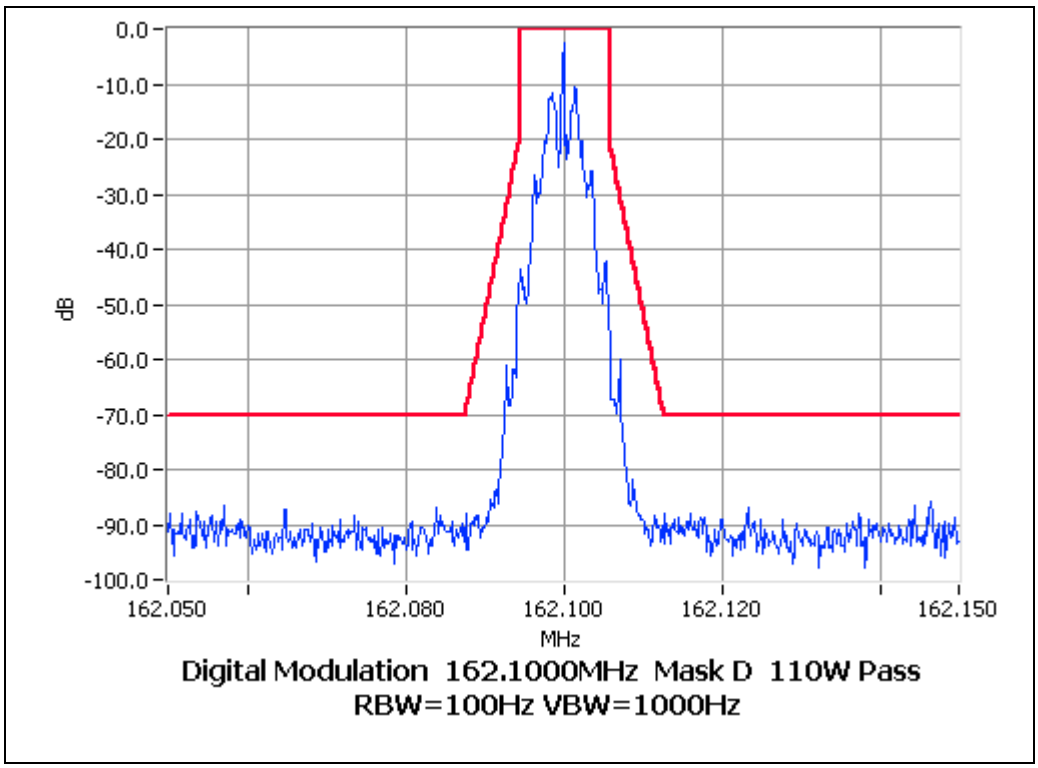
OCCUPIED BANDWIDTH

FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 162.1 MHz 110W 12.5 kHz Channel Spacing



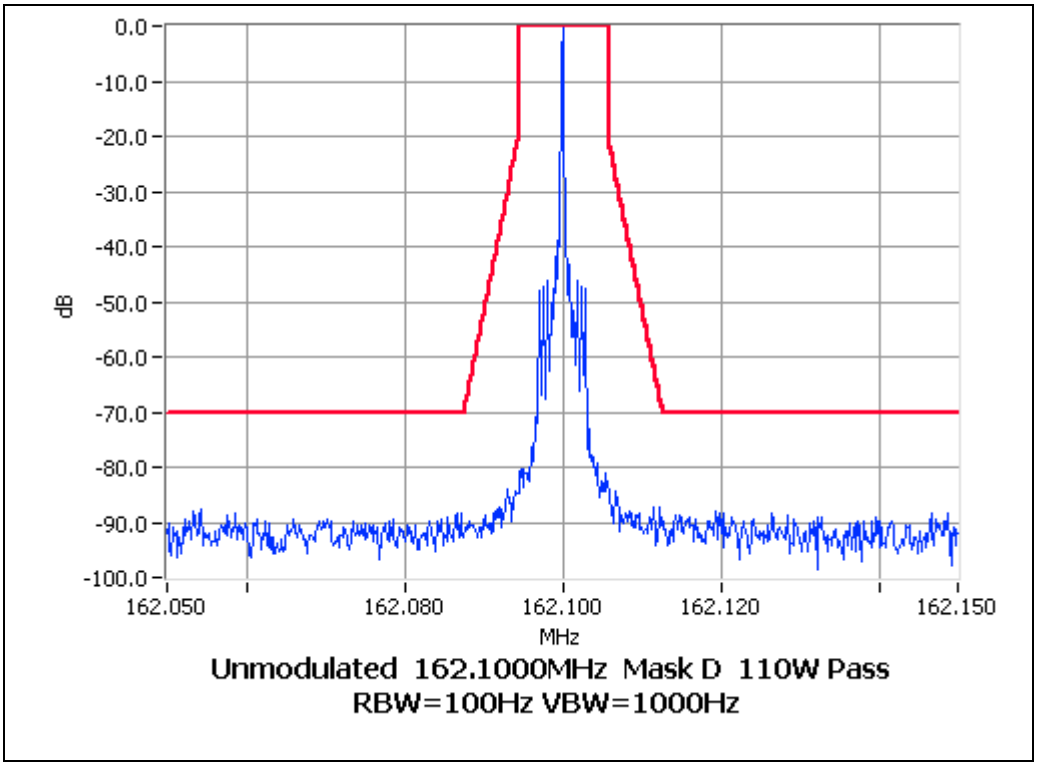


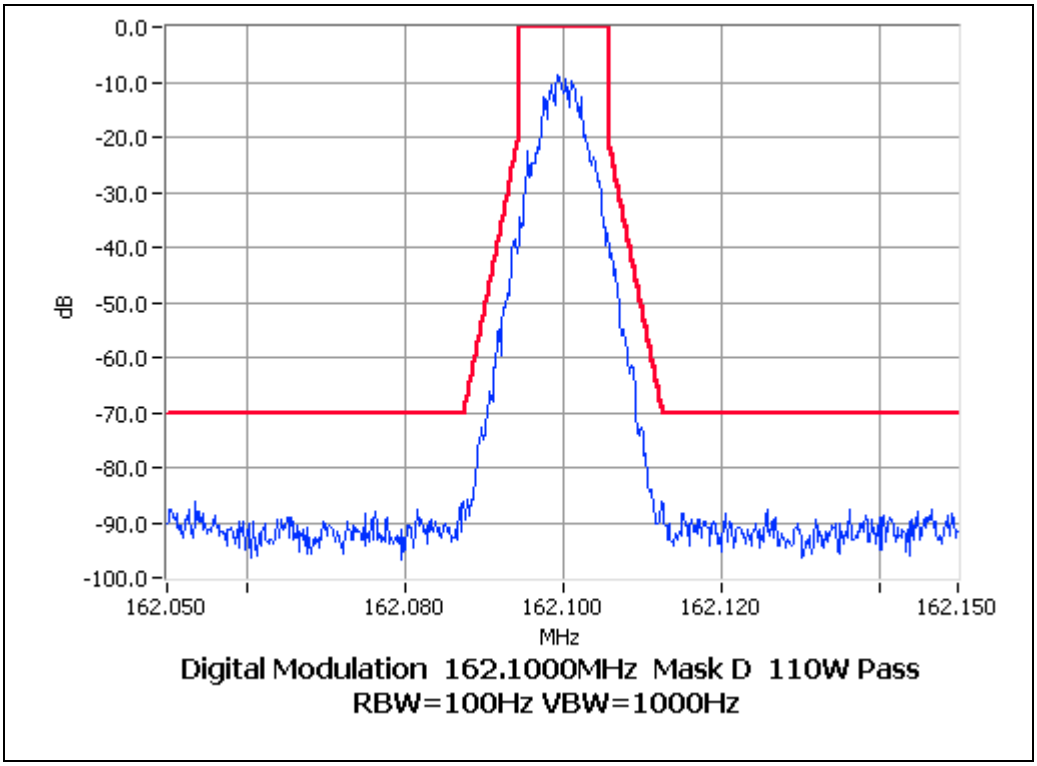
OCCUPIED BANDWIDTH

DIGITAL – Voice/Data

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 162.1 MHz 110W 12.5 kHz Channel Spacing





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 2.0 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 table on the following page for 12.5 kHz channel spacing.

LIMIT CLAUSE: FCC 47 CFR 90.210

SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 162.1 MHz

12.5 kHz Channel Spacing	162.1 MHz @ 110 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
149.0879	-35.8	86.2
162.0630	-38.3	88.7
162.1370	-37.1	87.5
175.1120	-32.5	82.9
No other 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 $50 + 10 \text{ Log}_{10} (P_{Watts})$	
110 W	-20 dBm	70.4 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^{o} 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 table on the following page

LIMIT CLAUSE: FCC 47 CFR 90.210

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 162.1 MHz

12.5 kHz Channel Spacing	162.1 MHz @ 110 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
324.200000	-31.5	81.9
486.300000	-26.2	76.6
648.400000	-40.1	90.5
810.500000	-29.0	79.4
No other 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 $50 + 10 \text{ Log}_{10} (P_{Watts})$	
110 W	-20 dBm	70.4 dBc

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 channel spacing.

LIMIT CLAUSE: FCC 47 CFR 90.214

TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 162.1 MHz 110 W 12.5 kHz Channel Spacing

FREQUENCY	162.1 MHz @ 110 W Tx	
TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t_1	-0.3	N/A
t_2	-2.0	N/A
t_3	N/A	-1.0
$t_2 \rightarrow t_3$ ppm	-2.8	
ERROR LIMIT ($t_2 \rightarrow t_3$) ppm	5.0	

Confirm that during periods t_1 and t_3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t_2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t_2 to t_3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

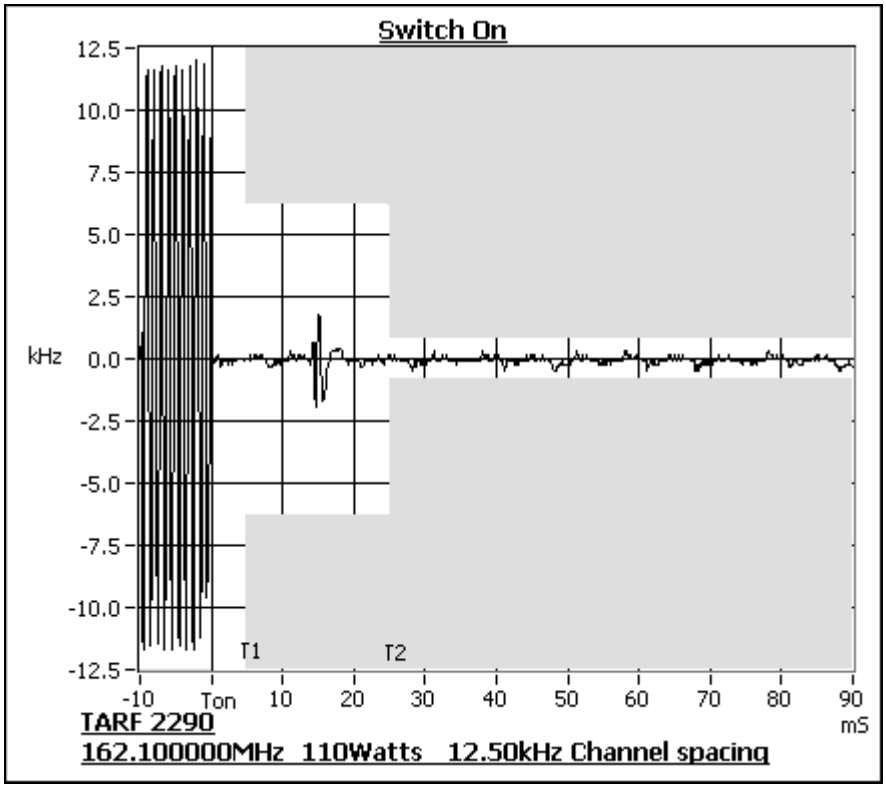
LIMIT:

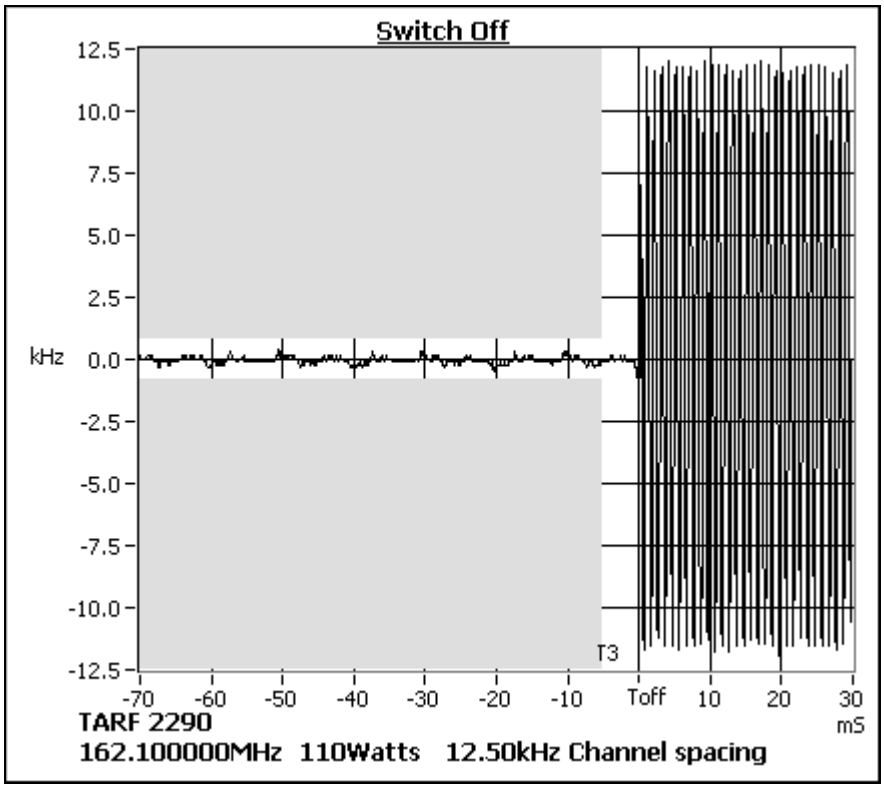
TRANSIENT PERIODS	FREQUENCY RANGE 150MHz – 174 MHz	FREQUENCY RANGE 421MHz – 512 MHz
t_1 (ms)	5 ms	10 ms
t_2 (ms)	20 ms	25 ms
t_3 (ms)	5 ms	10 ms

TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 162.1 MHz 110 W 12.5 kHz Channel Spacing





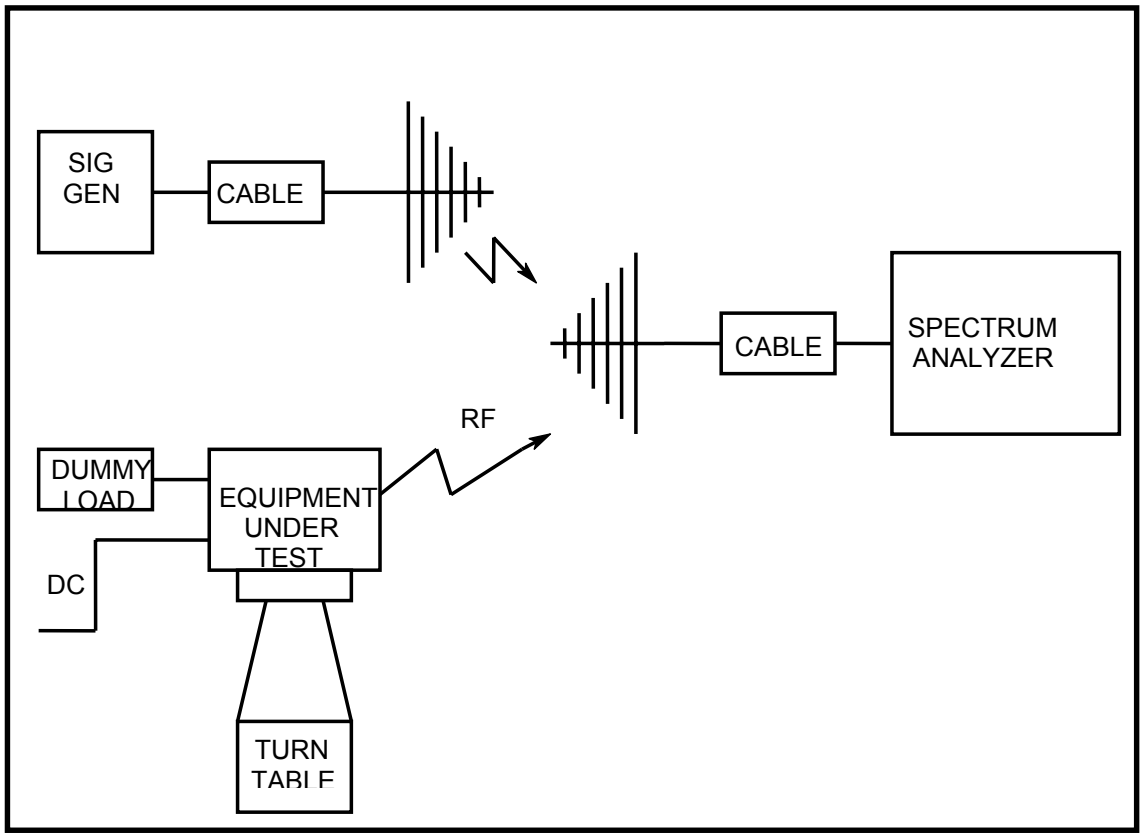
TEST EQUIPMENT USED

No#	Equipment	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
14	Power Head	Hewlett Packard	HP11722A	2320A00688	E3307	08-Nov-05
22	Oscilloscope	Tektronics	TDS340	B013611	E3585	06-Nov-05
40	Reference Dipoles	Emco	3121C DB1	9510-1164	E3559	17-Oct-06
46	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	
70	RF Load 150W	Bird	8166	524	E3625	15-Nov-05
80	20m Coax Cable	Intelcom	RG214/U-50	CBL03	E3659	30-Nov-05
82	3m Coax Cable BLUE)	Suhner	Sucoflex 104A	25033/4A	E3694	19-Nov-05
87	Audio Analyser	Hewlett Packard	HP8903B	2818A04275	E3710	12-Nov-05
88	Spectrum Analyser	Hewlett Packard	HP8562E	3821A00779	E3715	14-Nov-05
91	20m Coax Cable		RG214/U-50 (Ext Cal)	CBL01	E3404	30-Nov-05
111	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	06-Nov-05
117	RF Attenuator	Weinschel	Model 1	BL9950	E4080	10-Nov-05
121	RF Splitter Combiner	Minicircuits	ZFSC-4-1	-	E4084	11-Oct-05
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	30-May-06
129	Antenna Tower	Electrometrics	EM-4720-2	112		
130	Controller	Electrometrics	EM-4700	119		
131	Turntable	Electrometrics	EM-4704A	105		

ANNEX A

TEST SETUP DETAILS

Radiated Emissions Set up.



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.