

Laboratory Test Report

For the

TPCH5A Handportable Transceiver

Tested In accordance with

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

Report Revision: 1
Issue Date: 12-October 2007
FCC ID: CASTPCH5A

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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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TABLE OF CONTENTS

REVISION HISTORY	3
INTRODUCTION	4
REPORT PREPARED FOR	4
DESCRIPTION OF SAMPLE	4
STATEMENT OF COMPLIANCE	4
TEST CONDITIONS	4
TYPES OF EMISSION	4
TEST RESULTS	5
TRANSMITTER OUTPUT POWER (CONDUCTED)	5
TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS	6
TRANSMITTER MODULATION LIMITING	8
SIDEBAND SPECTRUM	10
SPURIOUS EMISSIONS (CONDUCTED)	19
SPURIOUS EMISSIONS (RADIATED)	22
TRANSMITTER FREQUENCY STABILITY (TEMPERATURE)	24
TRANSMITTER FREQUENCY STABILITY (VOLTAGE)	25
TRANSIENT FREQUENCY BEHAVIOR	26
TEST EQUIPMENT USED	31
ANNEX A	32
TEST SETUP DETAILS	32

REVISION HISTORY

Date	Revision	Comments
12-October 2007	1	Initial test report

INTRODUCTION

Type Approval Testing of the

T03-00003-CAAA

400 MHz → 470 MHz Handportable Transceiver

Serial No 25002913

in accordance with:

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

REPORT PREPARED FOR

Tait Electronics Ltd

PO Box 1645

558 Wairakei Rd

Christchurch

New Zealand

DESCRIPTION OF SAMPLE

Equipment: Handportable Transceiver

Type: TPCH5A

Product code: T03-00003-CAAA

Serial Numbers: 25002913

Quantity: 1

Software QPC1B std 1.00.00.0000; QPC1C std 1.00.00.0002

STATEMENT OF COMPLIANCE

The T03-00003-CAAA Handportable Transceiver as tested in this report was found to conform to the following standards:

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

TEST CONDITIONS

All testing was performed at the following conditions.

Ambient Temperature 15°C → 30°C

Relative Humidity 20% → 75%

Standard Test Voltage 7.5 V_{DC}

TYPES OF EMISSION

Analog Voice 11K0F3E

Analog Voice 16K0F3E

FFSK 6K60F2D

FFSK 9K60F2D

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 4 W	406.2	429.9	450.1	459.9	469.9
Measured	3.9	3.7	3.7	3.7	3.9
Variation (%)	-2.5	-7.5	-7.5	-7.5	-2.5
Nominal 1 W	406.2	429.9	450.1	459.9	469.9
Measured	0.99	0.88	0.93	0.92	0.94
Variation (%)	-1.0	-12.0	-7.0	-8.0	-6.0
Measurement Uncertainty	± 0.6 dB				

LIMIT CLAUSE: FCC 47 CFR 90.205 (r)

Radio Type: Handportable Transceiver

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.

MEASUREMENT RESULTS:

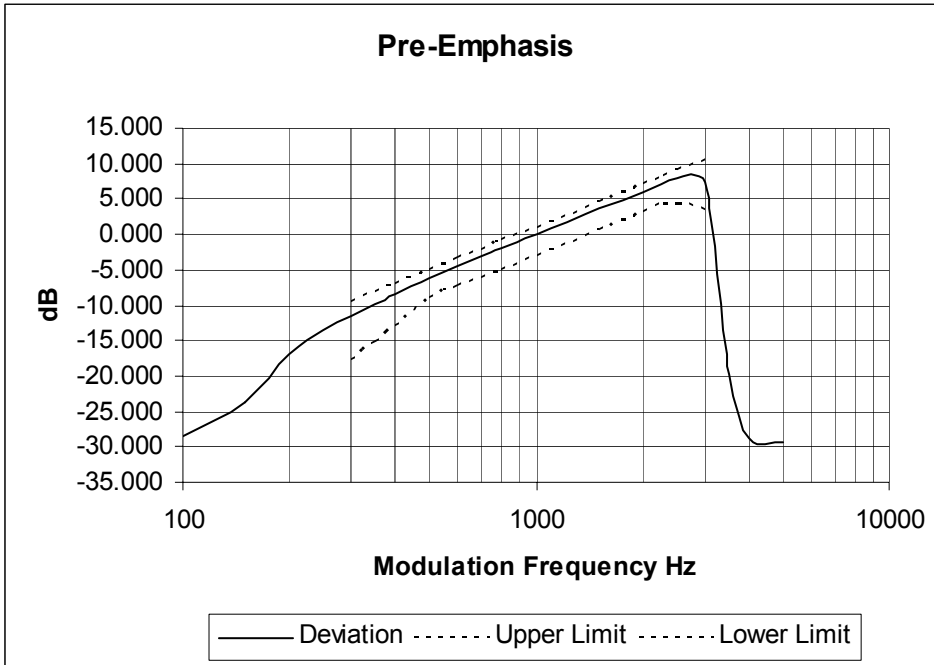
See the plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings.

LIMIT CLAUSE: TIA/EIA-603C 3.2.6

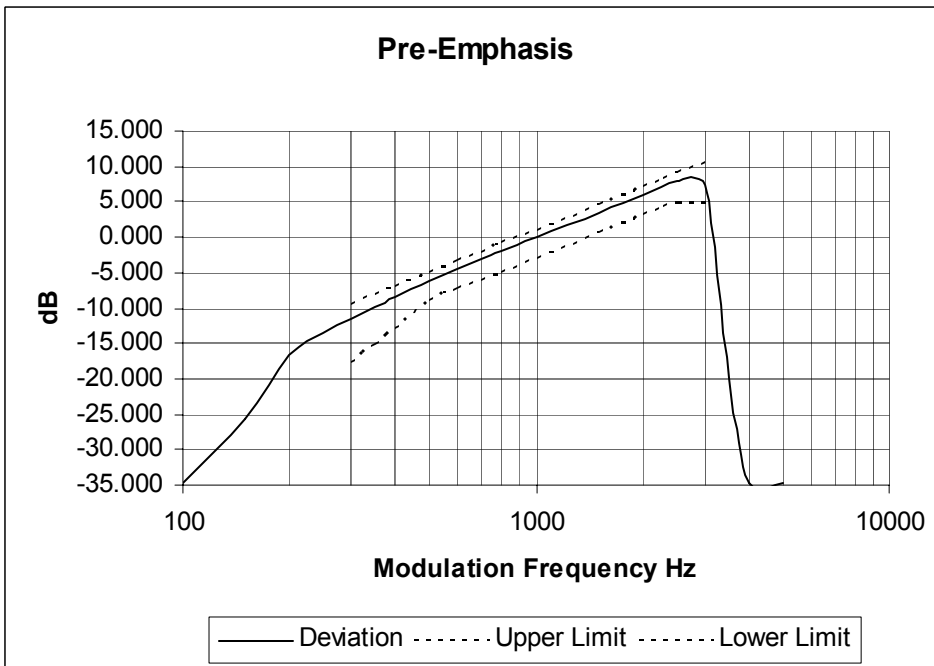
TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 429.9 MHz 12.5 kHz Channel Spacing



Tx FREQUENCY: 429.9 MHz 25.0 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

MEASUREMENT PROCEDURE:

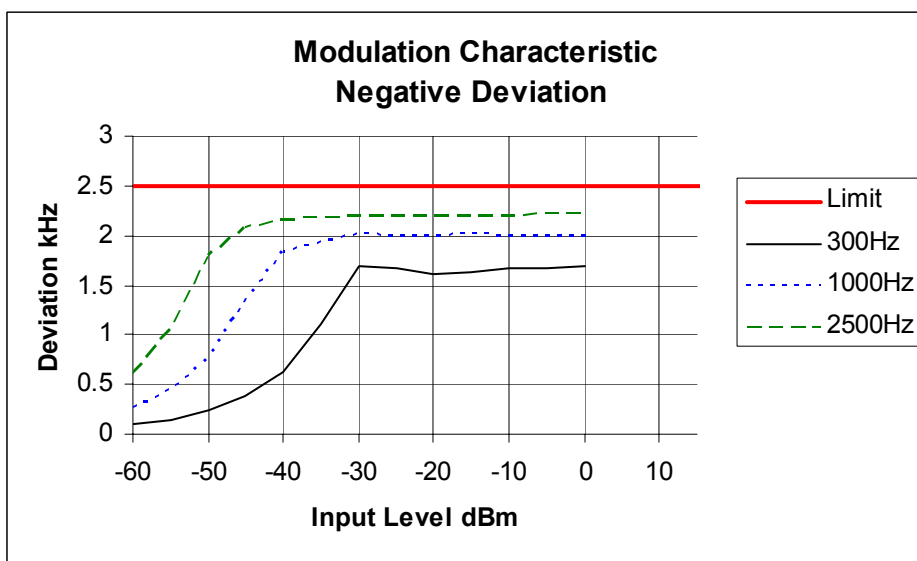
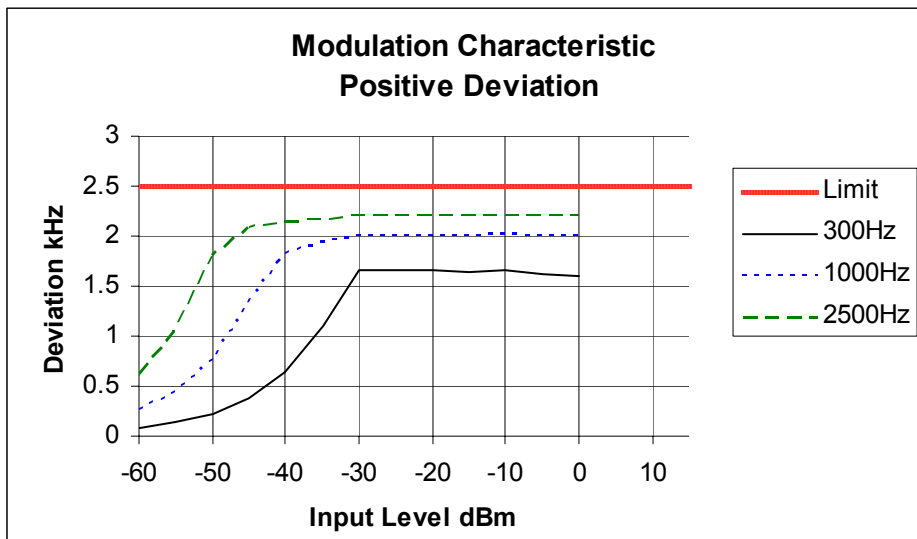
1. Refer Annex A for Equipment set up.
2. The modulation response was measured at three audio frequencies while varying the input level.
3. Measurements were made for both Positive and Negative Deviation.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: TIA/EIA-603C 1.3.4.4

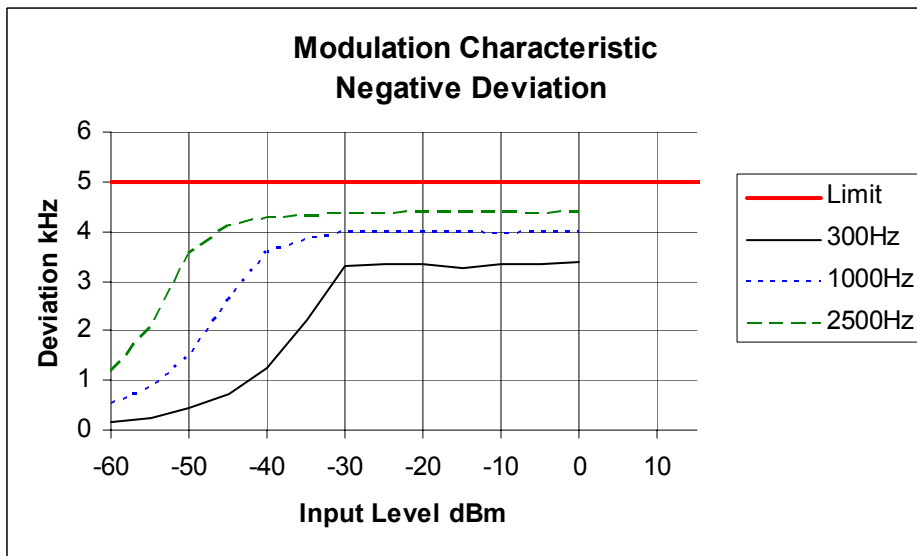
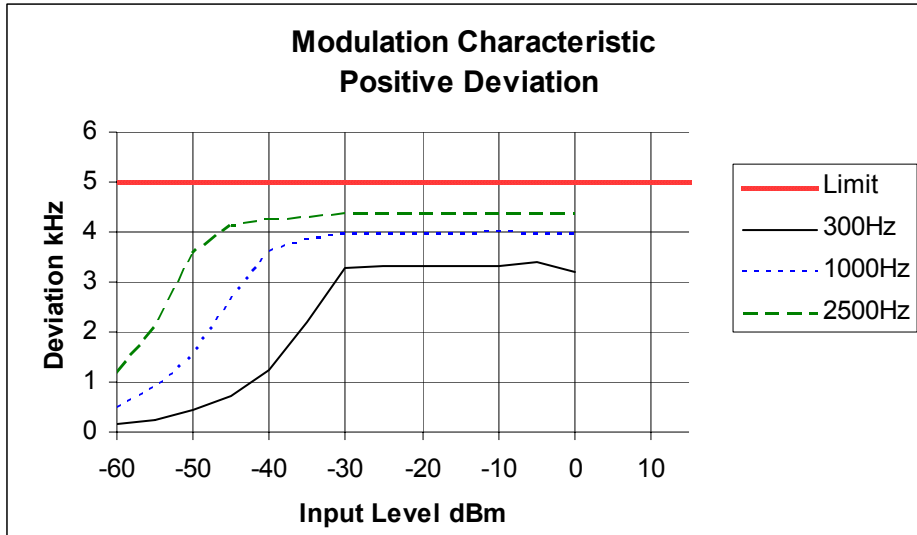
Tx FREQUENCY: 429.9 MHz 12.5 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 429.9 MHz 25.0 kHz Channel Spacing



SIDEBAND SPECTRUM

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 (0101010101) bit sequence at the appropriate Baud rates.
3. The Sideband Spectrum was measured on the Spectrum Analyser, with bandwidth settings as follows.

Emission Mask D – Resolution Bandwidth = 100Hz, Video Bandwidth = 1 kHz
Emission Mask B, – 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	Analog; FFSK
Emission Mask B	25.0 kHz Channel Spacing	Analog; FFSK

DATA SPEED

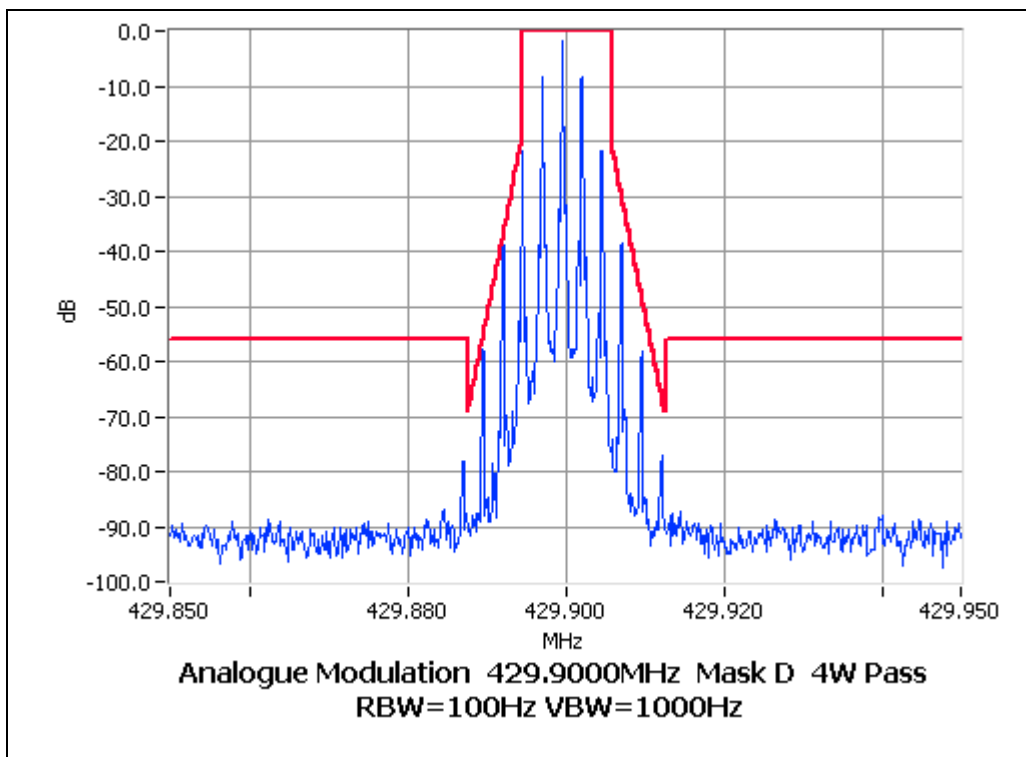
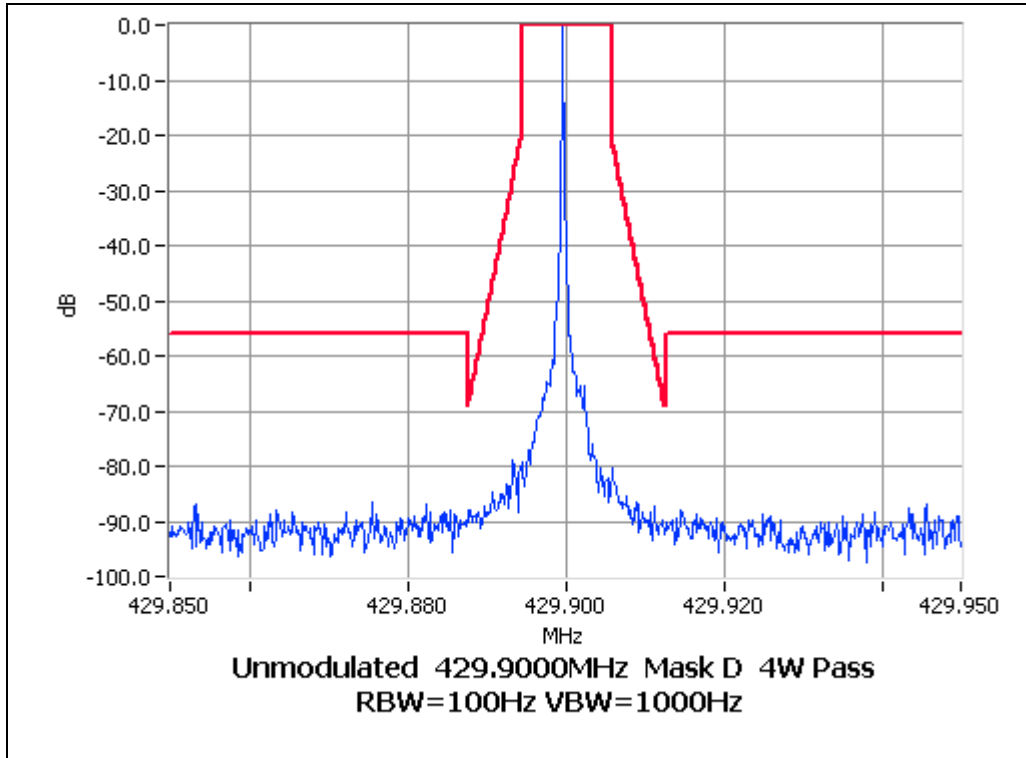
FFSK	12.5 kHz Channel Spacing	1200 bps
FFSK	25.0 kHz Channel Spacing	1200 bps

SIDEBAND SPECTRUM

ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing

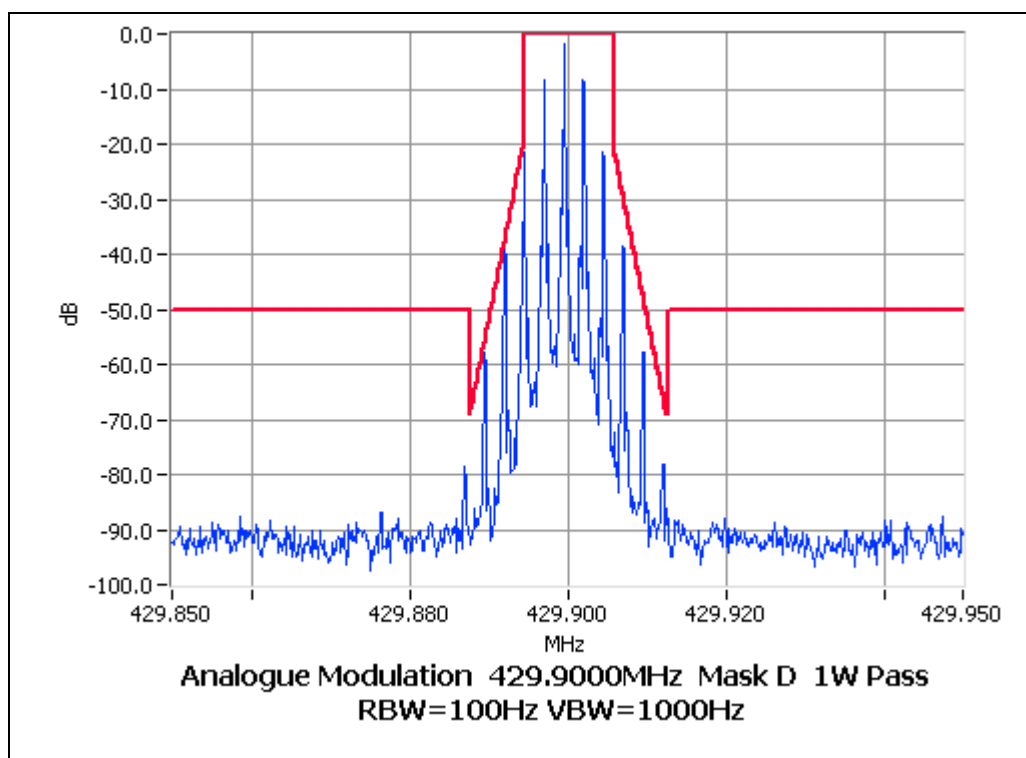
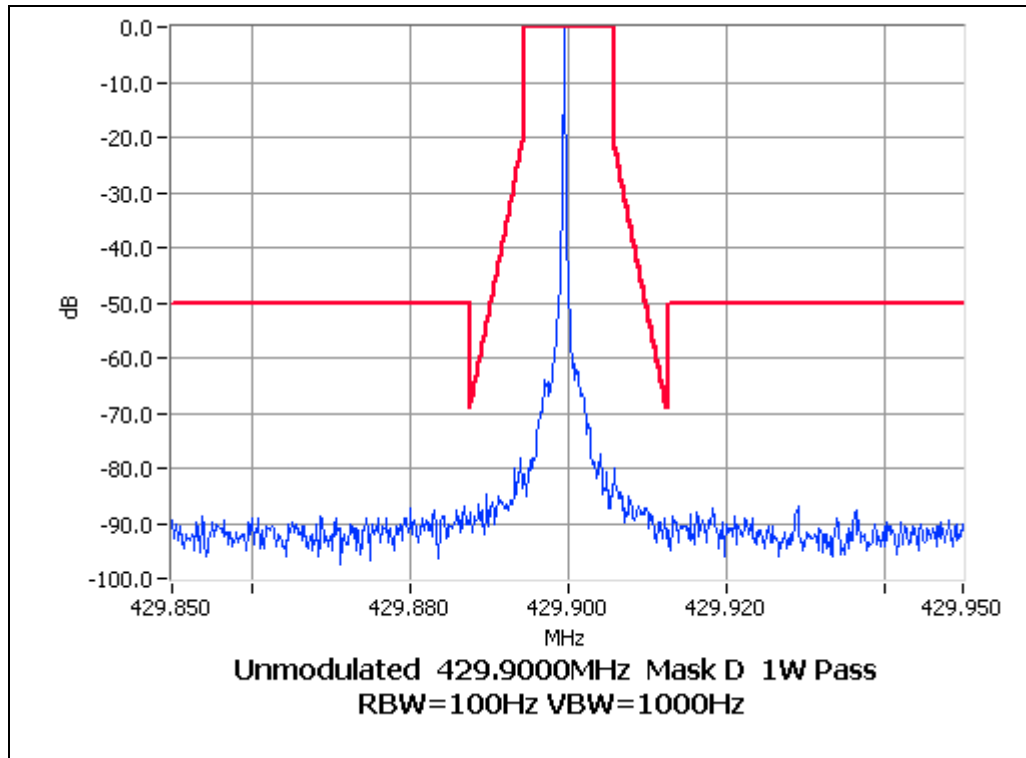


SIDEBAND SPECTRUM

ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing

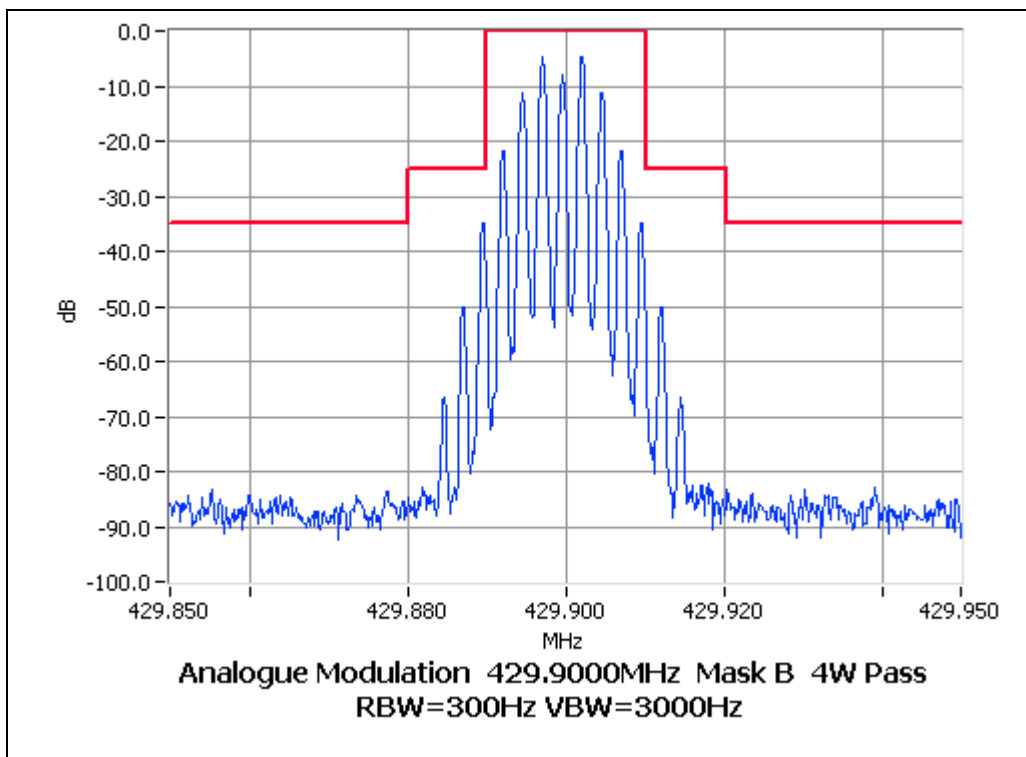
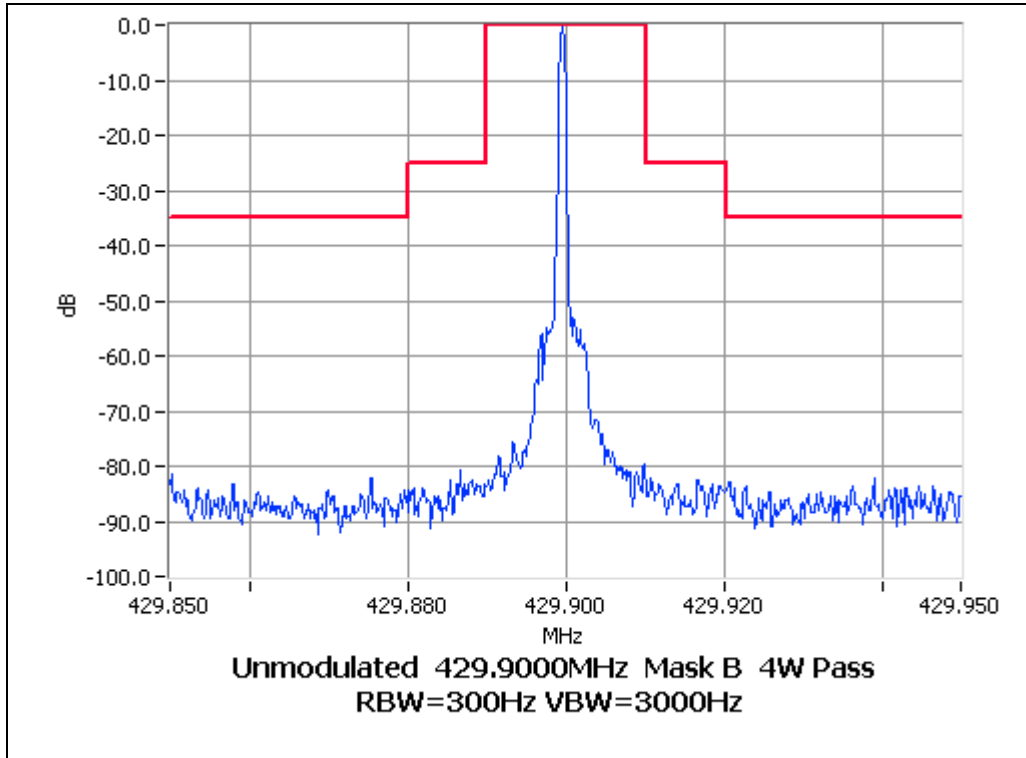


SIDEBAND SPECTRUM

ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 4 W 25.0 kHz Channel Spacing

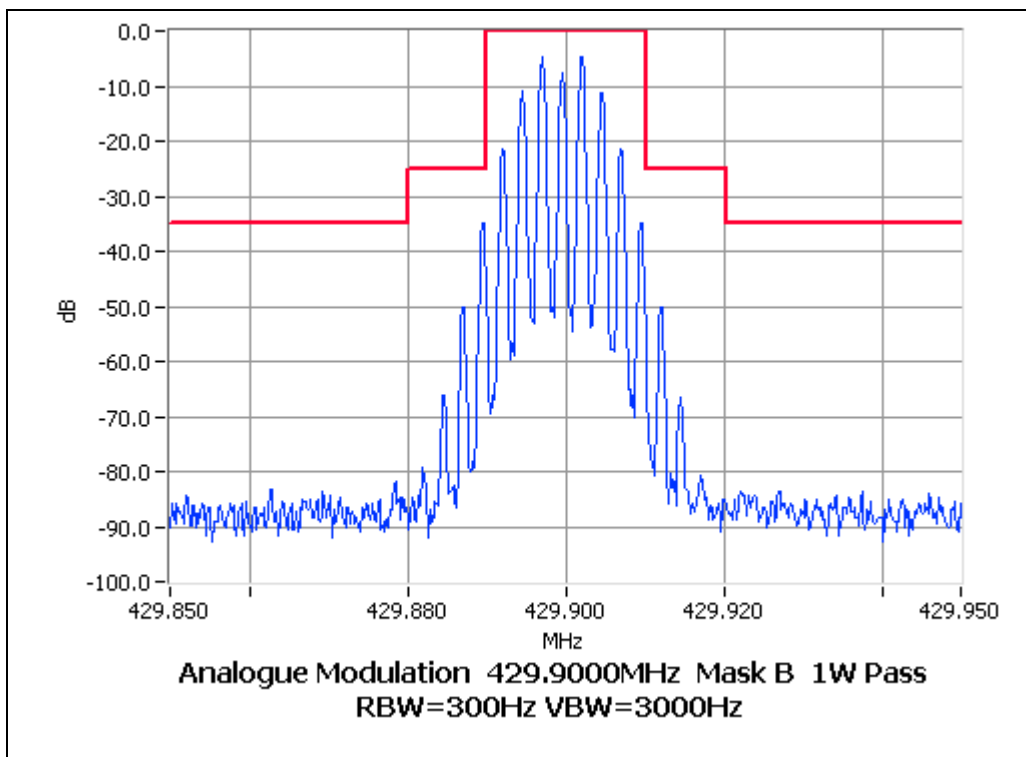
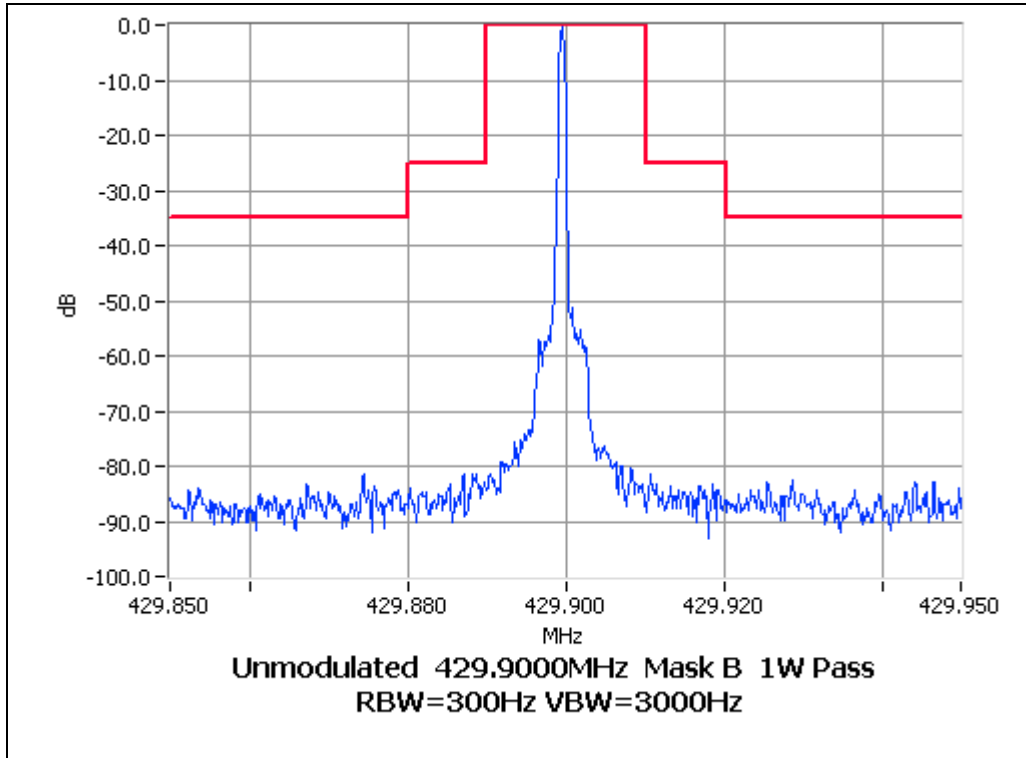


SIDEBAND SPECTRUM

ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 1 W 25.0 kHz Channel Spacing

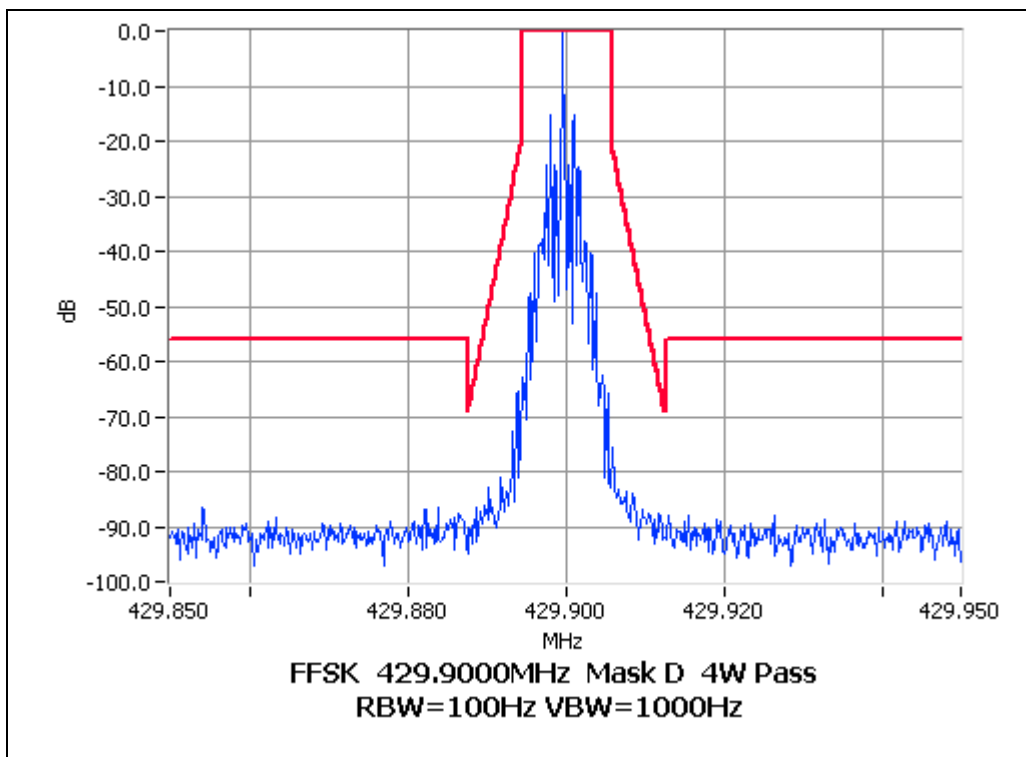
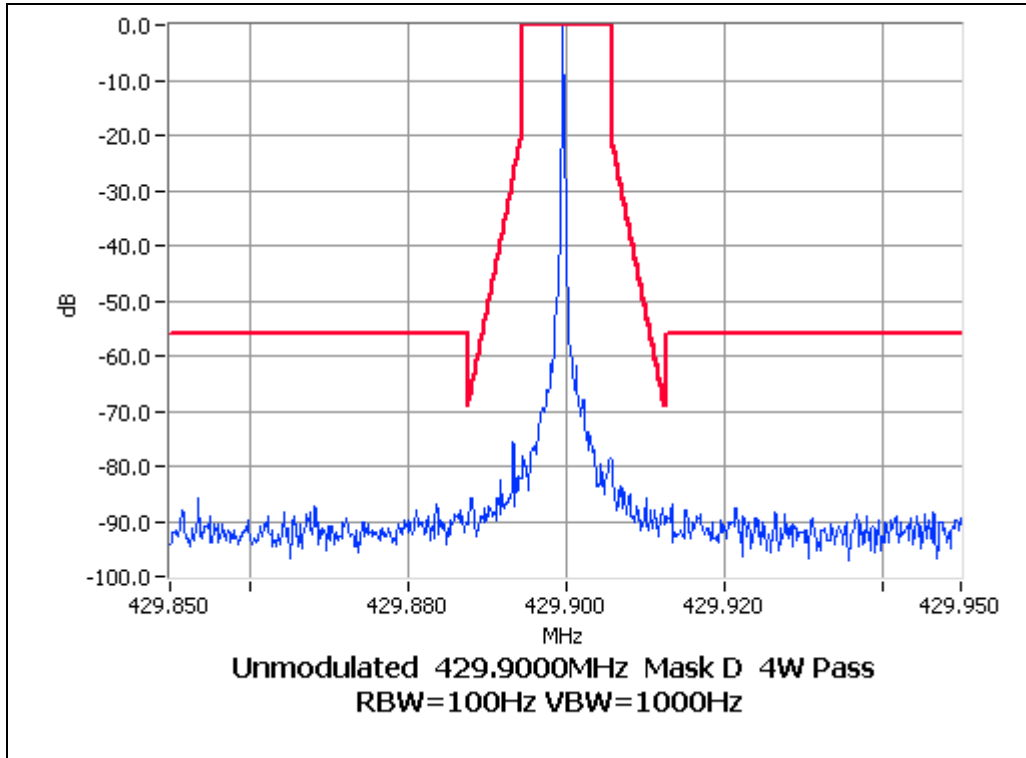


SIDEBAND SPECTRUM

FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing

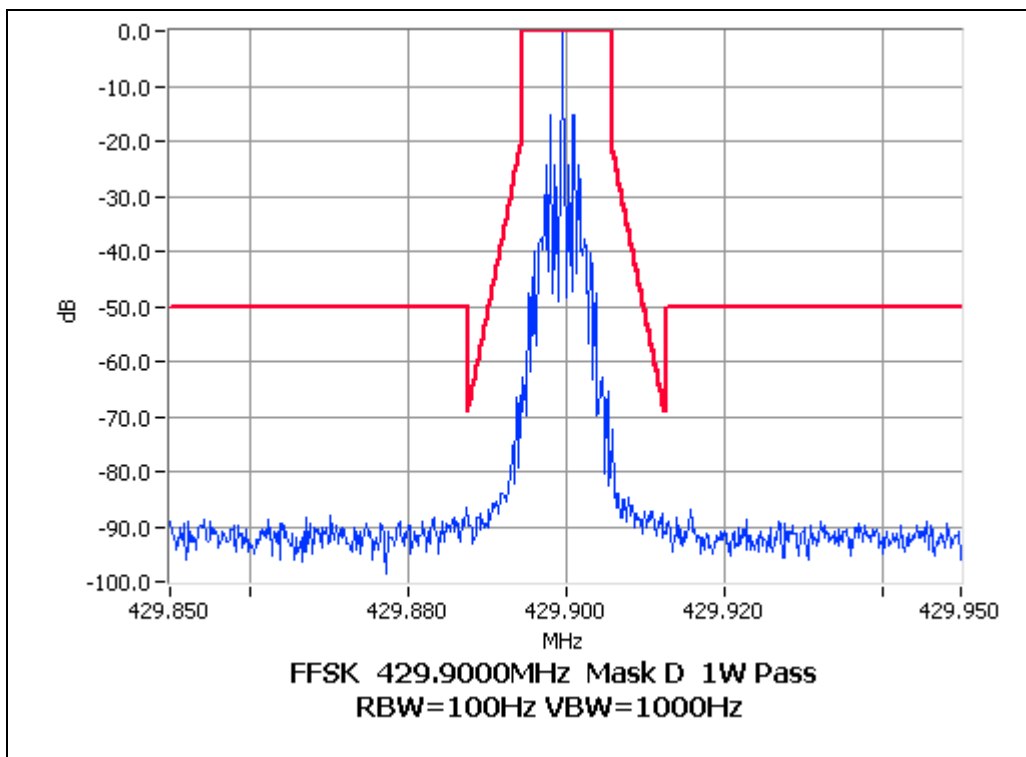
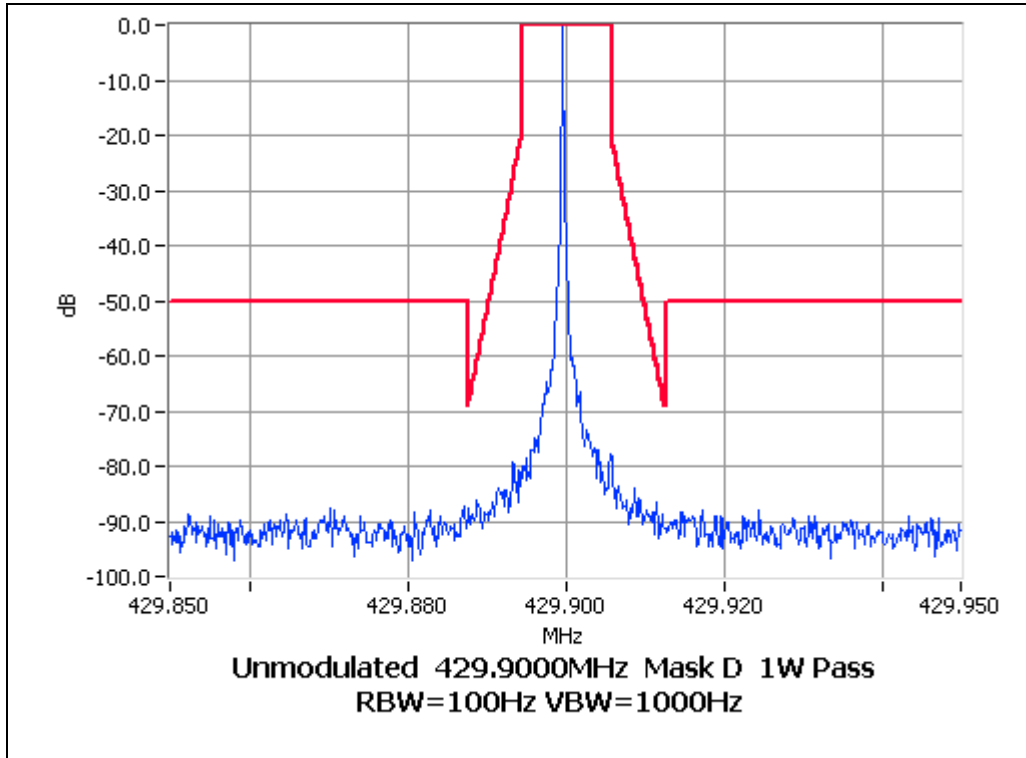


SIDEBAND SPECTRUM

FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 1 W 12.5 kHz Channel Spacing

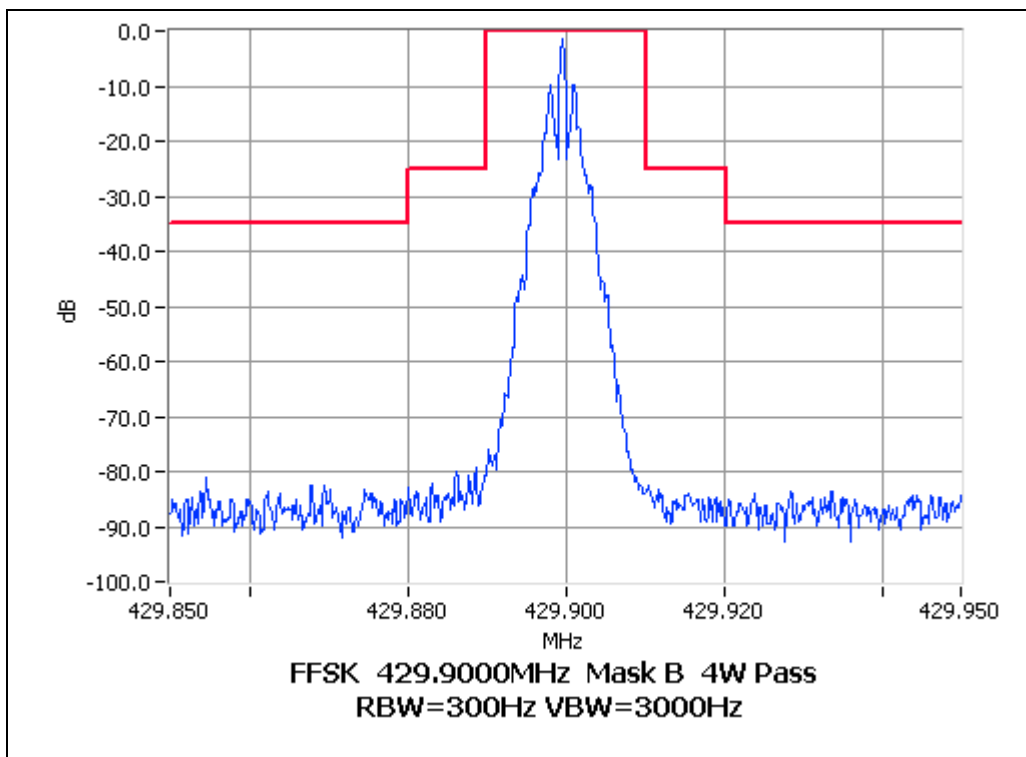
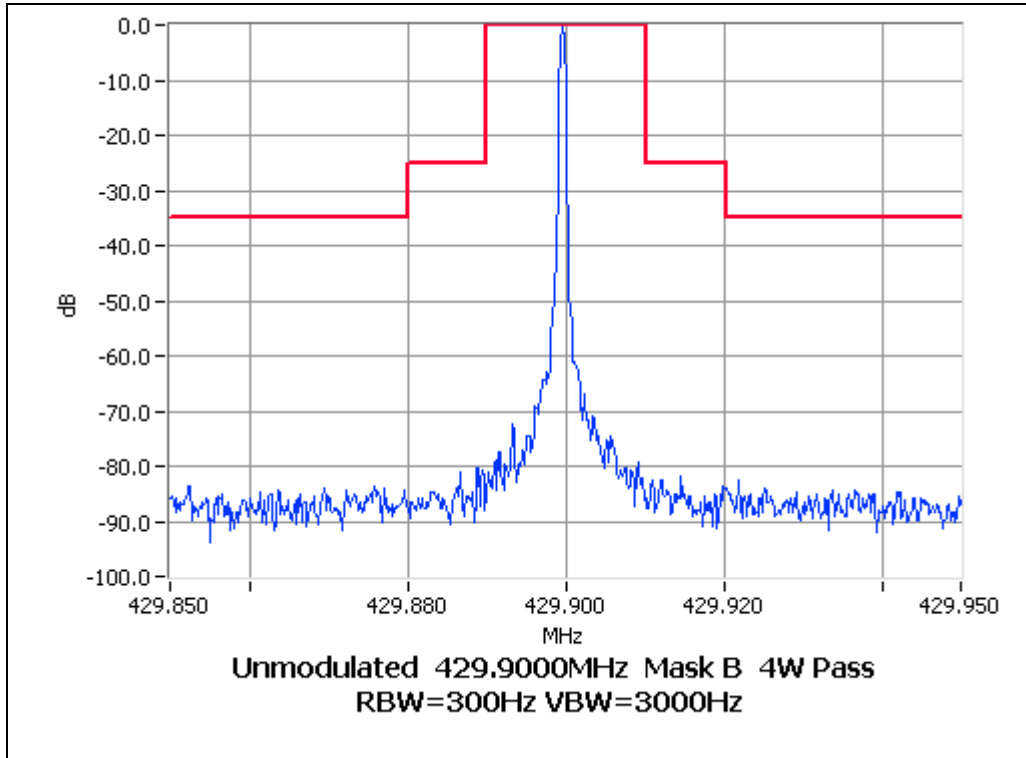


SIDEBAND SPECTRUM

FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 4 W 25.0 kHz Channel Spacing

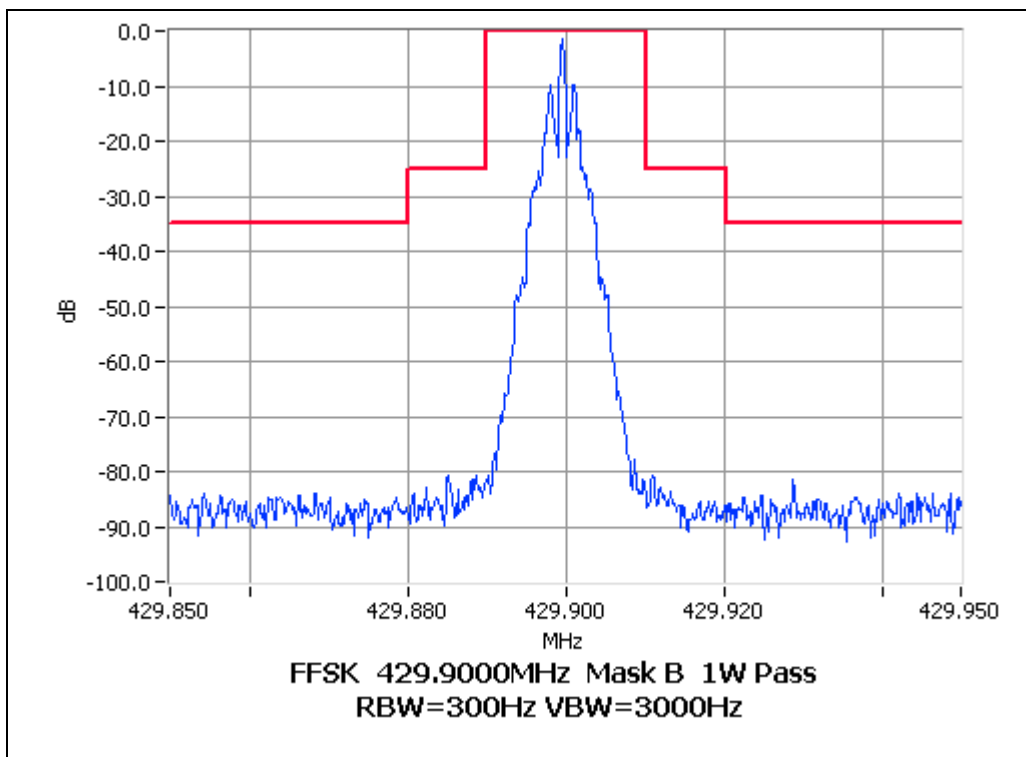
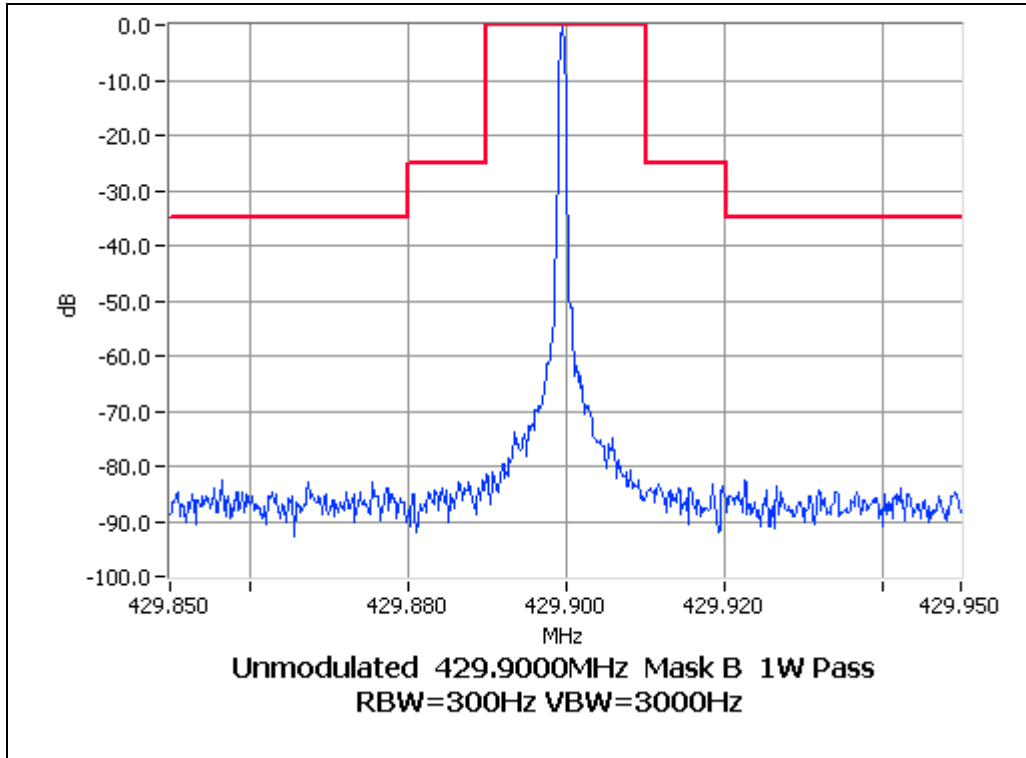


SIDEBAND SPECTRUM

FFSK

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 429.9 MHz 1 W 25.0 kHz Channel Spacing



SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: FCC CFR 2.1051

12.5 kHz Channel Spacing 406.2 MHz @ 4 W Emission Mask D		
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
405.2006	-37.9	73.9
407.1986	-38.0	74.0
12.5 kHz Channel Spacing 406.2 MHz @ 1 W Emission Mask D		
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing 429.9 MHz @ 4 W Emission Mask D		
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
428.9072	-38.8	74.8
430.8918	-38.2	74.2
12.5 kHz Channel Spacing 429.9 MHz @ 1 W Emission Mask D		
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing 450.1 MHz @ 4 W Emission Mask D		
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
449.1171	-39.9	75.9
451.0819	-39.2	75.2
12.5 kHz Channel Spacing 450.1 MHz @ 1 W Emission Mask D		
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing 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 other emissions were detected at a level greater than 20 dB below the limit.		

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Spurious Emissions - Conducted

12.5 kHz Channel Spacing		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.			

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
4 W	-20 dBm	56 dBc
1 W	-20 dBm	50 dBc

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 10th harmonic of the fundamental frequency.
2. 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.
2. 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.
3. 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

LIMIT CLAUSE: FCC 47 CFR 90.210

SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 429.9 MHz

12.5 kHz Channel Spacing		429.9 MHz @ 4 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
859.800	-38.5		74.5
12.5 kHz Channel Spacing		429.9 MHz @ 1 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)		Level (dBc)
859.800	-38.5		74.5
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 $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
4 W	-20 dBm	56 dBc
1 W	-20 dBm	50 dBc

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 $+50^{\circ}\text{C}$ in 10°C increments
3. The frequency error was recorded in parts per million (ppm).

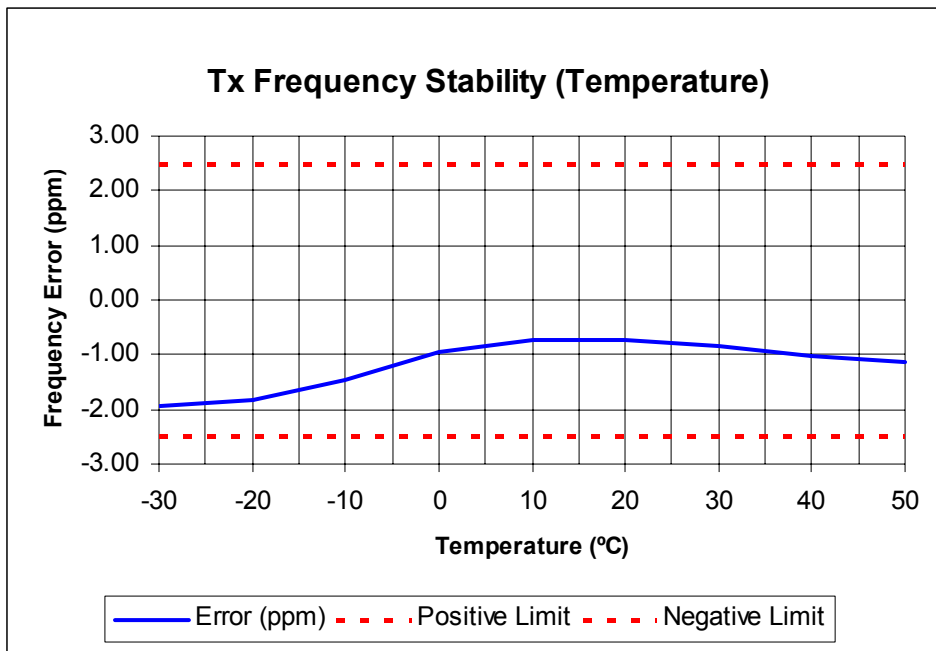
MEASUREMENT RESULTS:

See the plot below for 12.5 kHz channel spacing.

LIMIT CLAUSE: FCC 47 CFR 90.213

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	2.5
25.0	5.0

Tx FREQUENCY: 429.9 MHz 4 W 12.5 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 Annex 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).

Channel Spacing (kHz)	FREQUENCY ERROR (ppm) @ 429.9 MHz	
	6.0 V DC	7.5 V DC
12.5	-0.78	-0.82
25.0	-0.77	-0.82

LIMIT CLAUSE: FCC 47 CFR 90.213

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	2.5
25.0	5.0

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

TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 429.9 MHz 4 W 12.5 kHz Channel Spacing

FREQUENCY	429.9 MHz @ 4 W Tx	
TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t ₁	-1.7	N/A
t ₂	-0.7	N/A
t ₃	N/A	-0.8
t ₂ → t ₃ ppm	-2.5	
ERROR LIMIT (t ₂ → t ₃) ppm	2.5	

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	

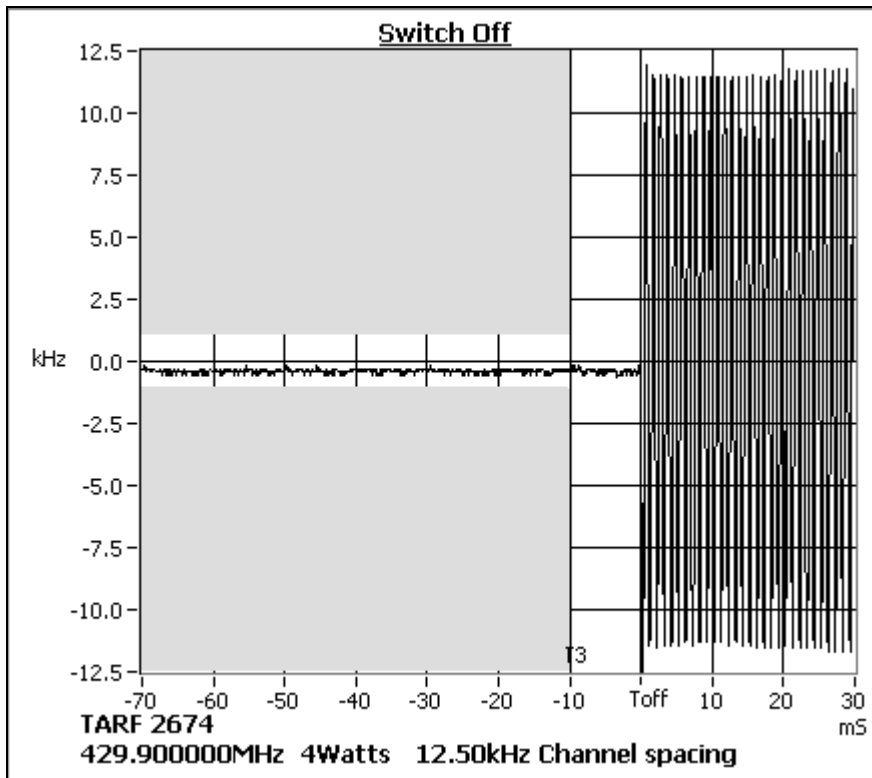
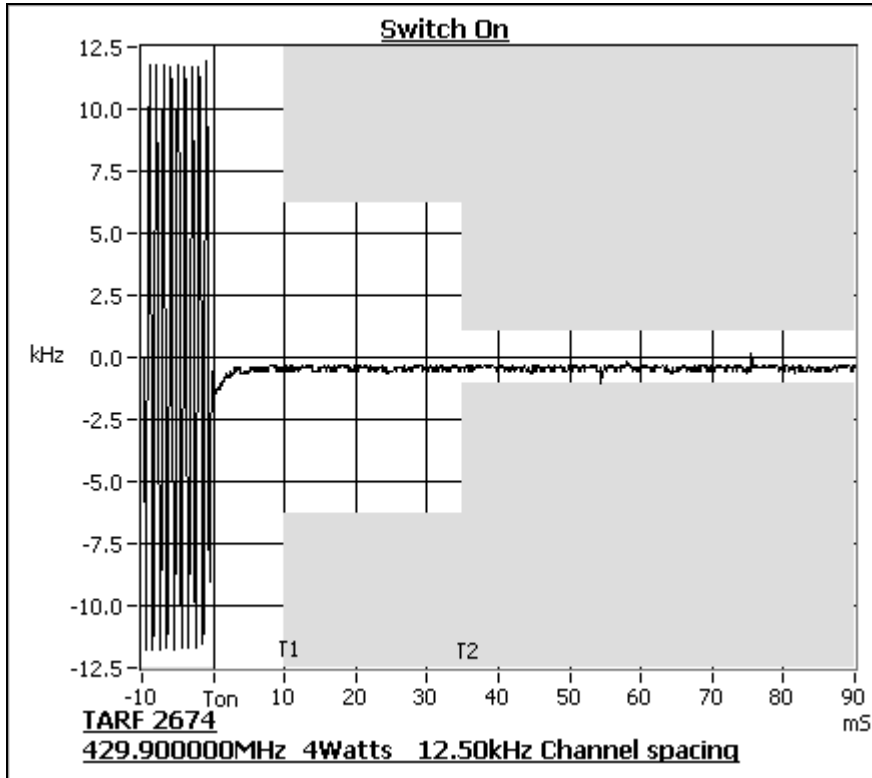
LIMIT:

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: 429.9 MHz 4 W 12.5 kHz Channel Spacing



TRANSIENT FREQUENCY BEHAVIOUR

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 429.9 MHz 4 W 25.0 kHz Channel Spacing

FREQUENCY	429.9 MHz @ 4 W Tx	
TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t_1	-1.8	N/A
t_2	-0.8	N/A
t_3	N/A	-0.5
$t_2 \rightarrow t_3$ ppm	-2.4	
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	

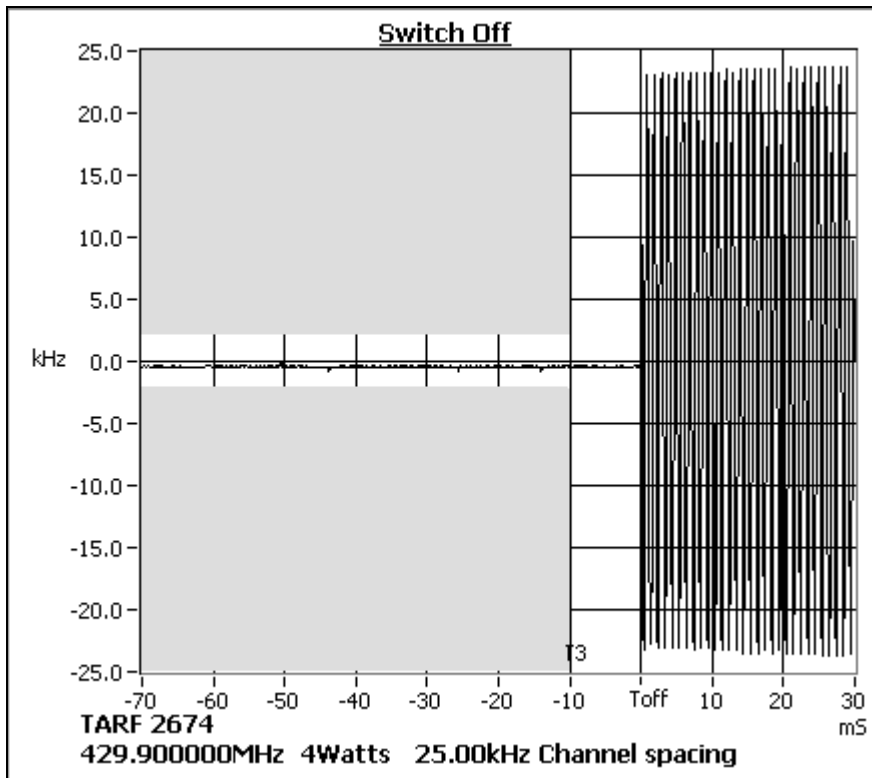
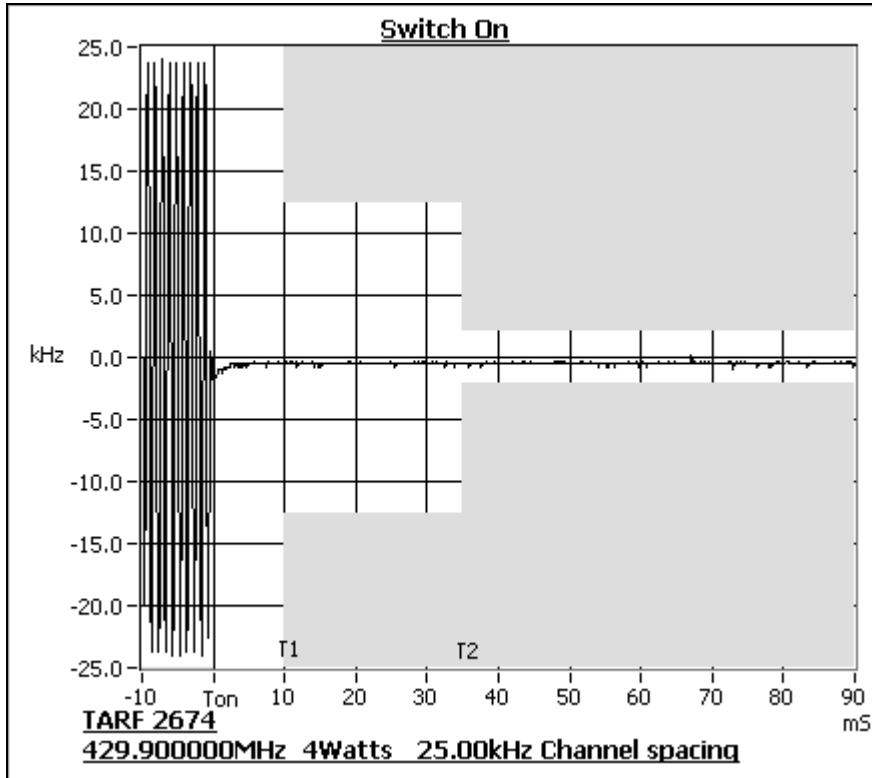
LIMIT:

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: 429.9 MHz 4 W 25.0 kHz Channel Spacing



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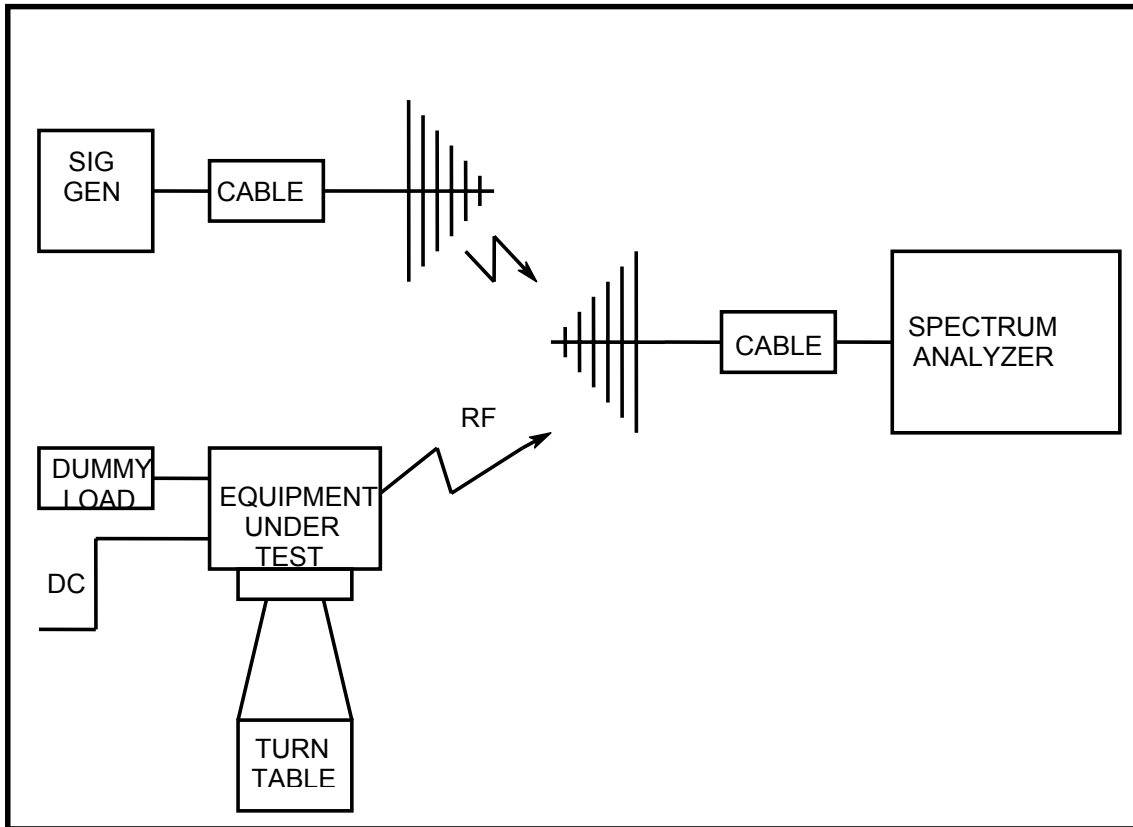
TEST EQUIPMENT USED

No#	Equipment	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
11	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073	02-Nov-07
13	Audio Analyser	Hewlett Packard	HP8903A	2308A02597	E3074	02-Nov-07
20	Power Supply	Hewlett Packard	HP6032A	2441A00412	E3075	21-Nov-07
22	Oscilloscope	Tektronics	TDS340	B013611	E3585	02-Nov-07
40	Reference Dipoles	Emco	3121C DB1	9510-1164	E3559	23-Nov-09
149	Log Periodic Antenna	Schwarzbeck	VUSLP	9111-219	E4617	Cal on use
46	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	20-Mar-09
52	Amplifier +21.7 dB	Tait	ZFL-1000LN	E3660	E3360	On use
66	RF Attenuator 25W	Weinschel	33-20-33	BD5871	E3673	31-Oct-07
71	RF Load 50W	Weinschel	F1426	BF0487	E3675	31-Oct-07
72	RF Load 50W	Weinschel	F1426	AE2490	E3624	31-Oct-07
82	3m Coax Cable BLUE)	Suhner	Sucoflex 104A	44610/4A	E4619	06-Sep-08
85	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	44611/4A	E3691	30-Oct-07
88	Spectrum Analyser	Hewlett Packard	HP8562E	3821A00779	E3715	31-Oct-07
115	Environ. Chamber	Contherm	5400 RHSLT.M	1416	E4051	16-Jul-08
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	17-Jul-08
127	OATS Tower Cable	Intelcom	RG214	OATS1	E4621	06-Jun-08
128	OATS Turntable Cable	Intelcom	RG215	OATS2	E4622	07-Jun-08

ANNEX A

TEST SETUP DETAILS

Radiated Emissions Set up.



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Tait Electronics Limited
Report Number 2674

All other testing is performed using the Teltest Radio **EVAL**uation 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 Sideband Spectrum.

