

LABORATORY TEST REPORT

CLASS 2 PERMISSIVE CHANGE

RADIO PERFORMANCE MEASUREMENTS

for the

TBCK4B Base Station Transceiver

Tested in accordance with:

FCC 47 CFR Parts 22, and 90 (Subpart R)

RSS-119 Issue 12
RSS-Gen Issue 4

Report Revision: 1
Issue Date: 13-July-2015

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Test Technician

CHECKED & APPROVED BY: M. C. James
Laboratory Technical Manager



OATS FCC LISTING REGISTRATION: 837095
OATS IC LISTING REGISTRATION: SITE# 737A-1

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

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FCC ID: CASTBCK4B
IC : 737A-TBCK4B

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Report Revision: 1
Issue Date: 13-July-2015

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REVISION

Date	Revision	Comments
13-July-2015	1	Initial test report

INTRODUCTION

Type approval testing of the TBCK4A, 100 Watt, Base Station transceiver in order to demonstrate compliance with FCC 47 Parts 22, & 90 (Subpart R), and RSS-119 Issue 12 & RSS-Gen Issue 4. This Class-2 Permissive Change report adds Analogue FM to the list of modulations supported. The original test report for this equipment is TARF 3311

REPORT PREPARED FOR

Tait Communications
PO Box 1645
558 Wairakei Road
Christchurch
New Zealand

DESCRIPTION OF SAMPLE

Manufacturer: Tait Limited
Equipment: Base Station Transceiver
Type: TBCK4B
Sales Package Code: TB9435-K4M0-0000-A1FB-10
Frequency range: 762 → 870 MHz
Transmit Power: 100 W

Modulation	Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
Analogue FM	12.5 kHz	1	-	-

HARDWARE & SOFTWARE

Quantity: 1 of each

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01103-NAAA	18209182	p25-trunk.20150622T134255	0.01
Power Amplifier	T01-01121-NBAA	18162711	0.01.00.trunk.360976.20140918 T113436.0002	0.06
PMU	TBA30A0-0100	18160560	0316	0.03
Front Panel	T01-01110-AAAA	18161003	0.01.00.trunk.375640.20150225 T133901.0002	0.04

TEST CONDITIONS

All testing was performed between 26-June → 13-July-2015, and under the following conditions:

Ambient temperature: 15°C → 30°C
Relative Humidity: 20% → 75%
Standard Test Voltage 120 V_{AC}

Analogue modulation is provided via an Ethernet UDP connection and is encoded according to ITU-T G.711 (μ-law).

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: TBCK4B
Sales Package Code: TB9435-K4M0-0000-A1FB-10

Consisting of:
HARDWARE & SOFTWARE

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01103-NAAA	18209182	p25-trunk.20150622T134255	0.01
Power Amplifier	T01-01121-NBAA	18162711	0.01.00.trunk.360976.20140918 T113436.0002	0.06
PMU	TBA30A0-0100	18160560	0316	0.03
Front Panel	T01-01110-AAAA	18161003	0.01.00.trunk.375640.20150225 T133901.0002	0.04

to which this declaration relates, is in conformity with the following standards:

FCC 47 CFR Parts 22, and 90 (Subpart R)

RSS-119 Issue 12 & RSS-Gen Issue 4

Signature: _____

M. C. James
Laboratory Technical Manager

Date: _____

MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

MODULATION TYPES:

F3E Analogue Frequency Modulation (FM)

EMISSION DESIGNATORS:

Channel Spacing 12.5 kHz	
FM	11K0F3E

CALCULATIONS

FM

Equation: $B_n = 2M + 2Dk$

(M is highest modulating frequency; D is peak allowable deviation; k is a constant of 1 for FM)

Analogue Voice 12.5 kHz Bandwidth

Necessary bandwidth

M = 3.0 kHz

D = 2.5 kHz

$$\begin{aligned} B_n &= (2 \times 3.0) + (2 \times 2.5) \times 1 \\ &= 11.0 \text{ kHz} \end{aligned}$$

Emission Designator

11K0F3E

F3E represents an FM voice transmission

TEST RESULTS

TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: TIA/EIA-603D 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:

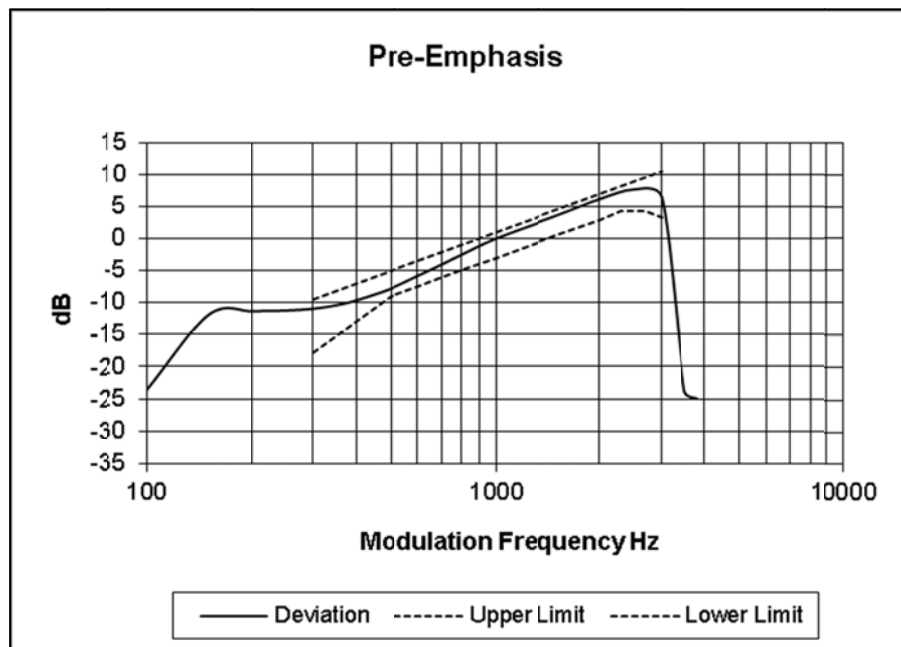
See the plots on the following pages for 12.5 kHz channel spacing tested at 100 W transmit power.

NOTE: The upper audio frequency tested was 3800 Hz due to the 8000 Hz sample rate of the modulating signal.

LIMIT CLAUSE: TIA/EIA-603D 3.2.6

SPECIFICATION: FCC CFR 2.1047 (a)

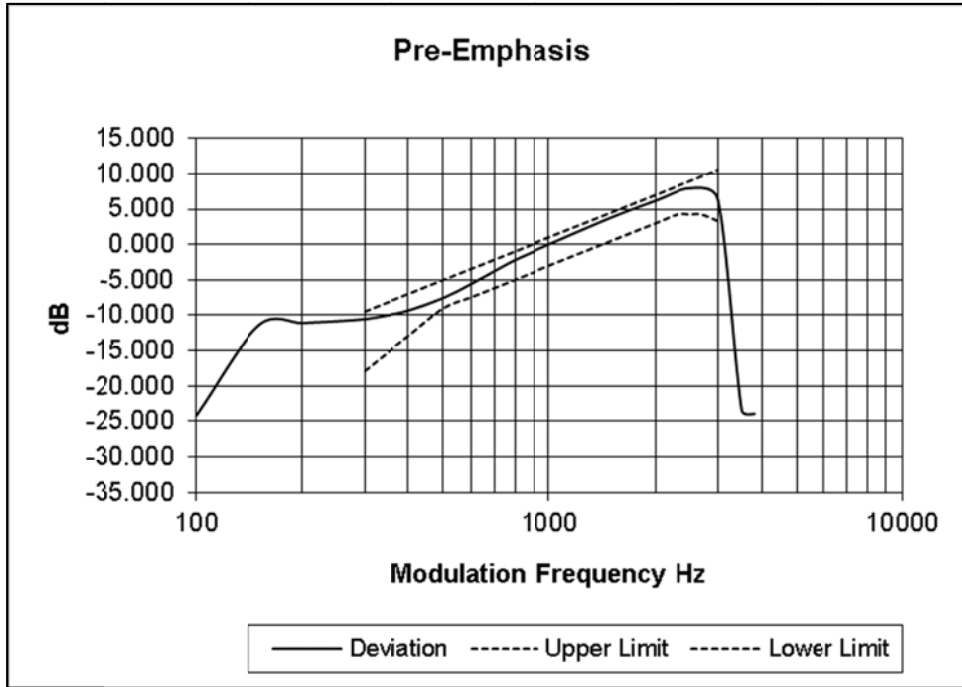
Tx FREQUENCY: 764.1 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

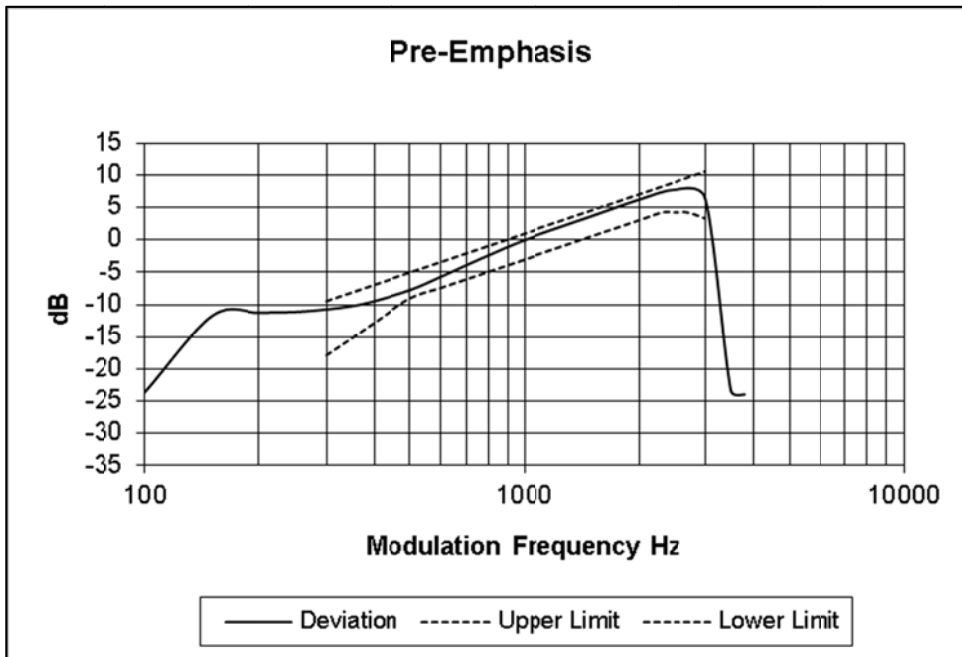
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 770.1 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

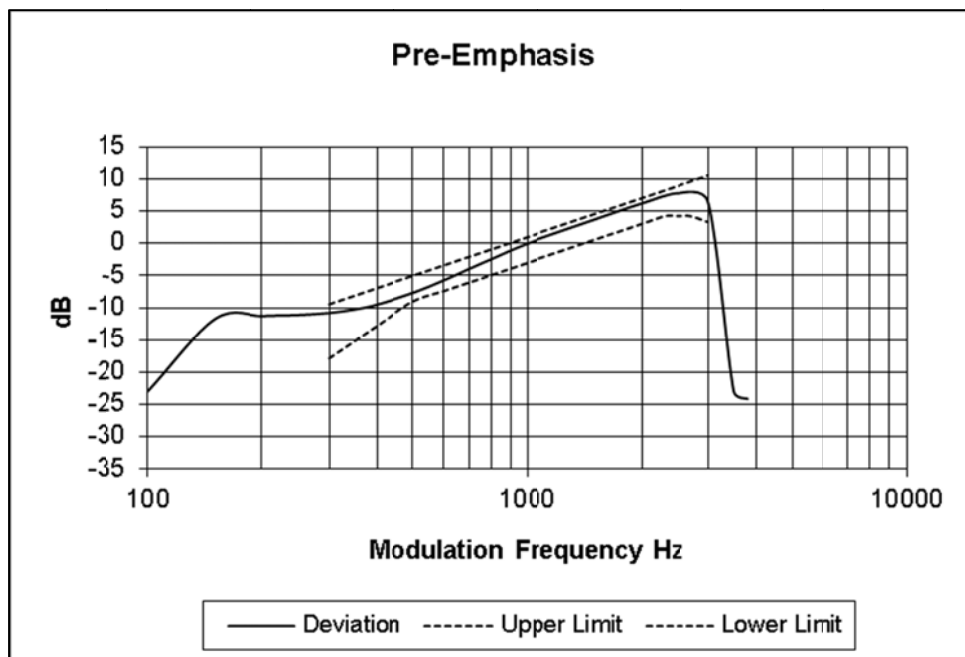
Tx FREQUENCY: 774.9 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

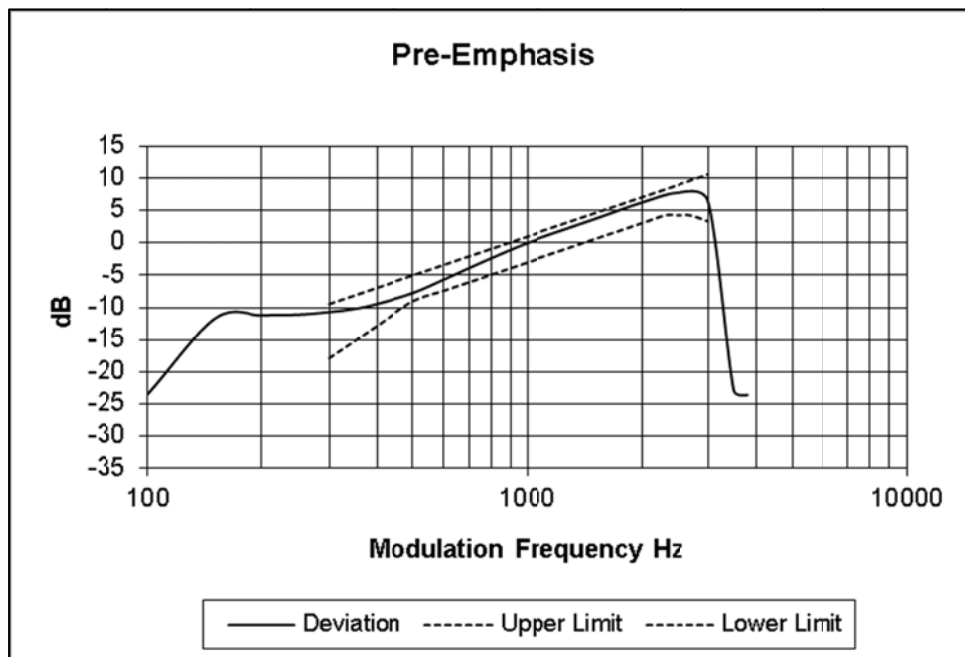
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 851.1 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

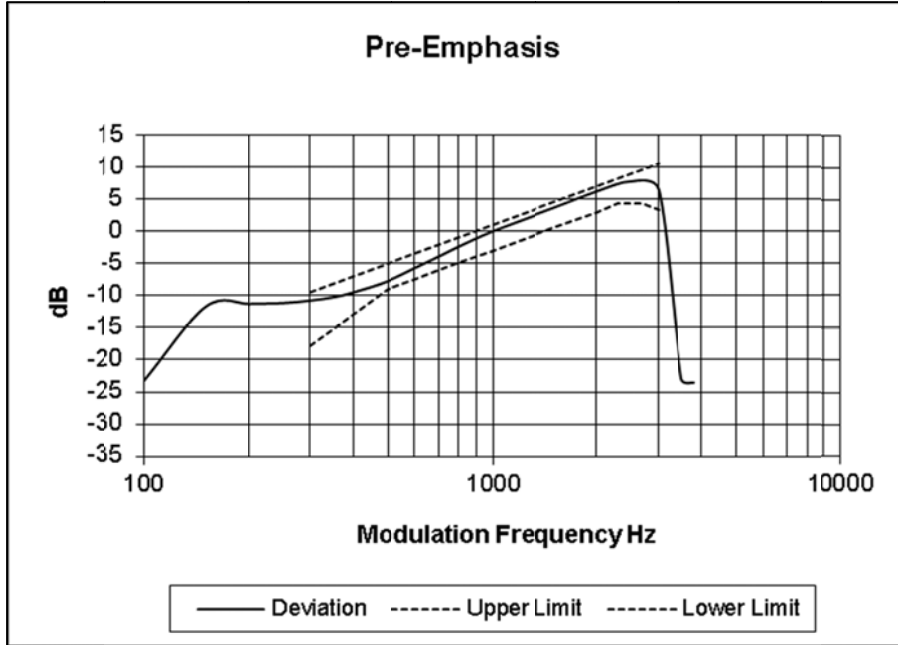
Tx FREQUENCY: 858.5 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

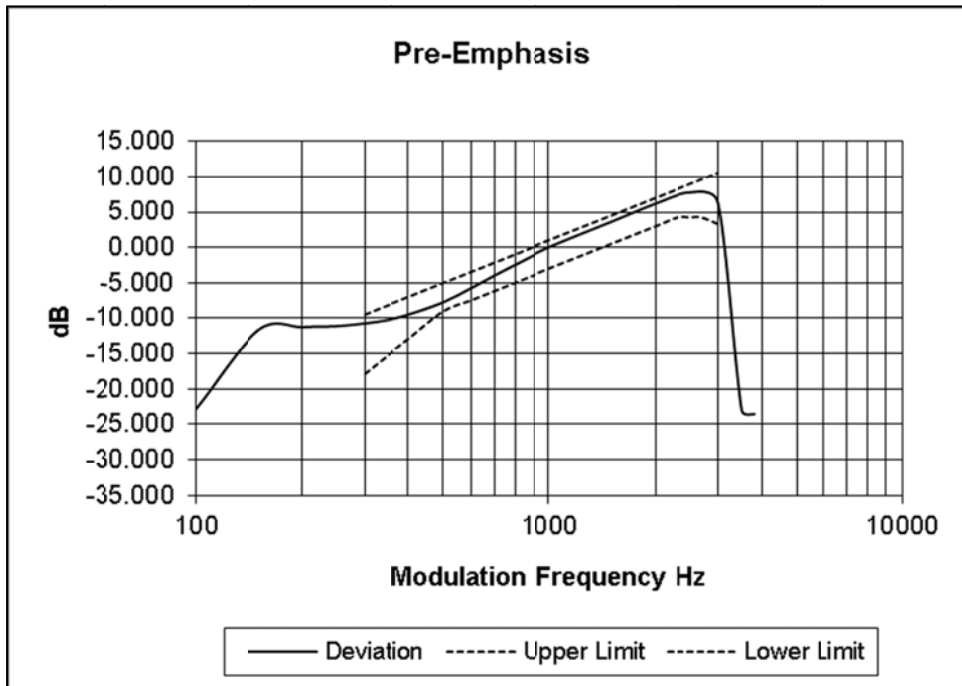
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 866.0 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 868.9 MHz 12.5 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: TIA/EIA-603D 2.2.3

MEASUREMENT PROCEDURE:

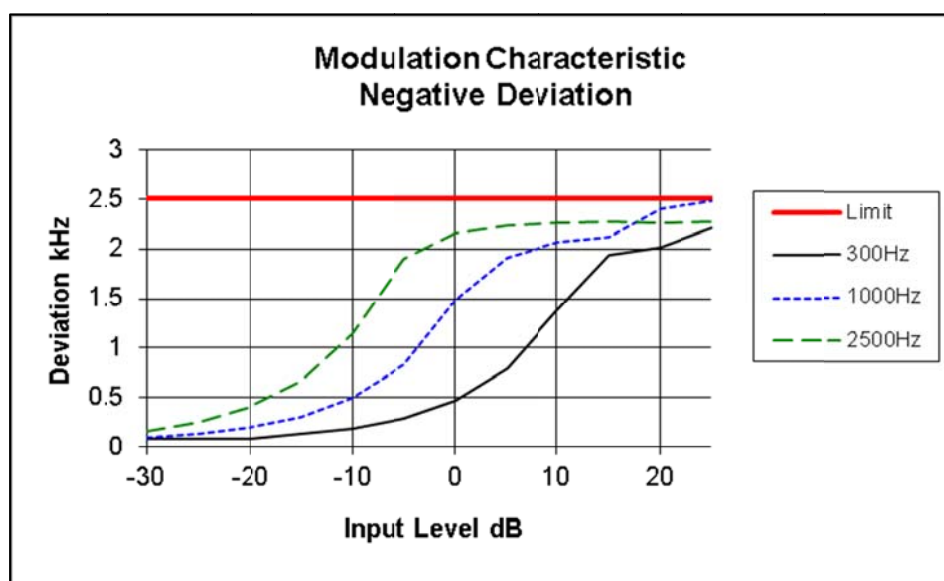
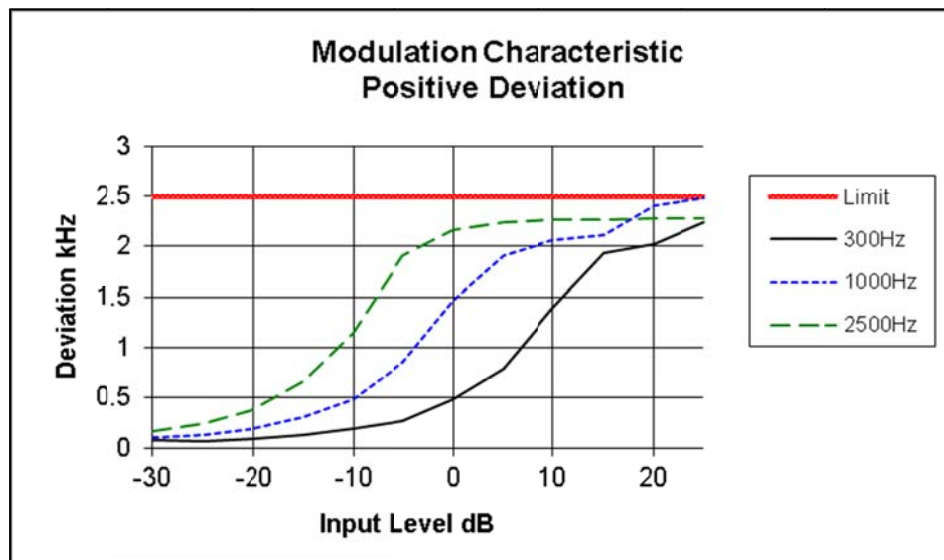
1. Refer Annex A for Equipment set up.
2. The modulation response was measured at three audio frequencies while varying the input level.
3. Measurements were made for both Positive and Negative Deviation.

MEASUREMENT RESULTS:

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

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

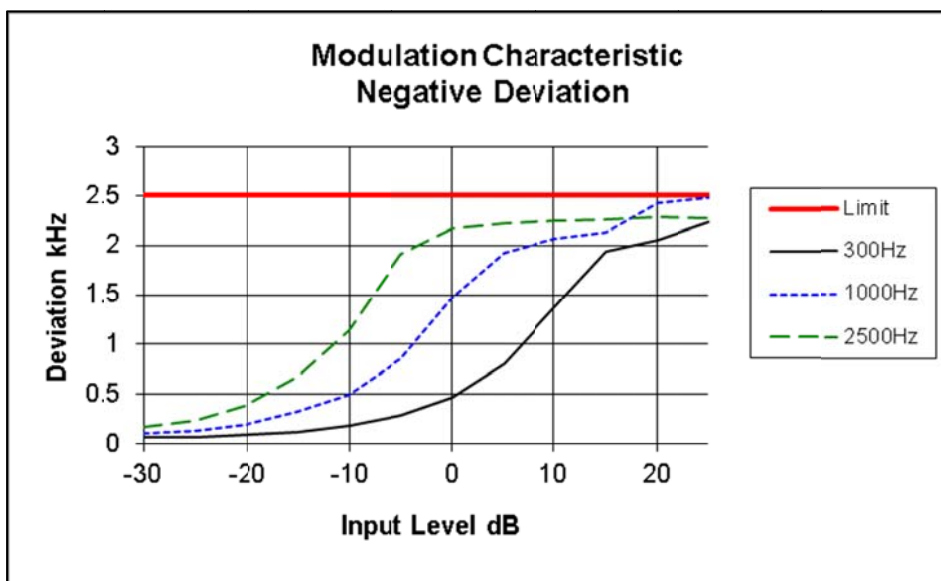
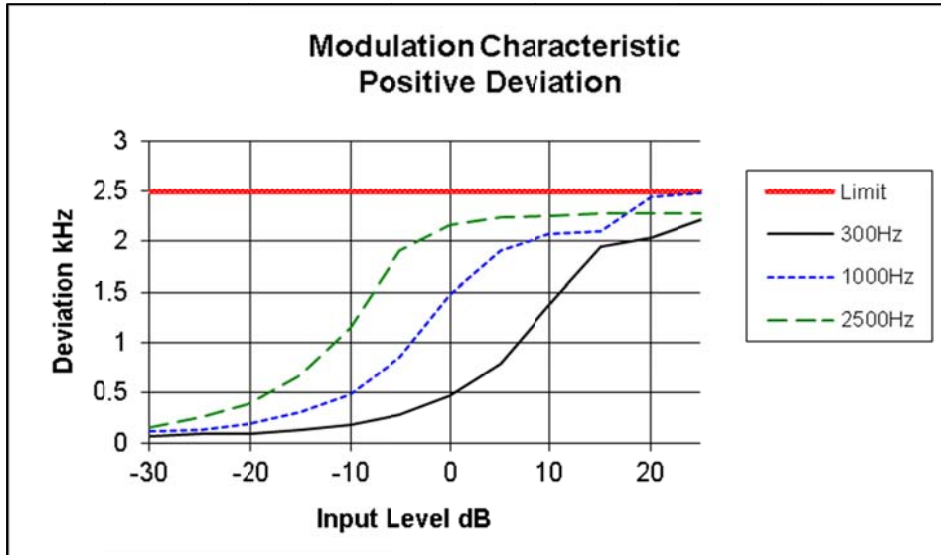
Tx FREQUENCY: 764.1 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

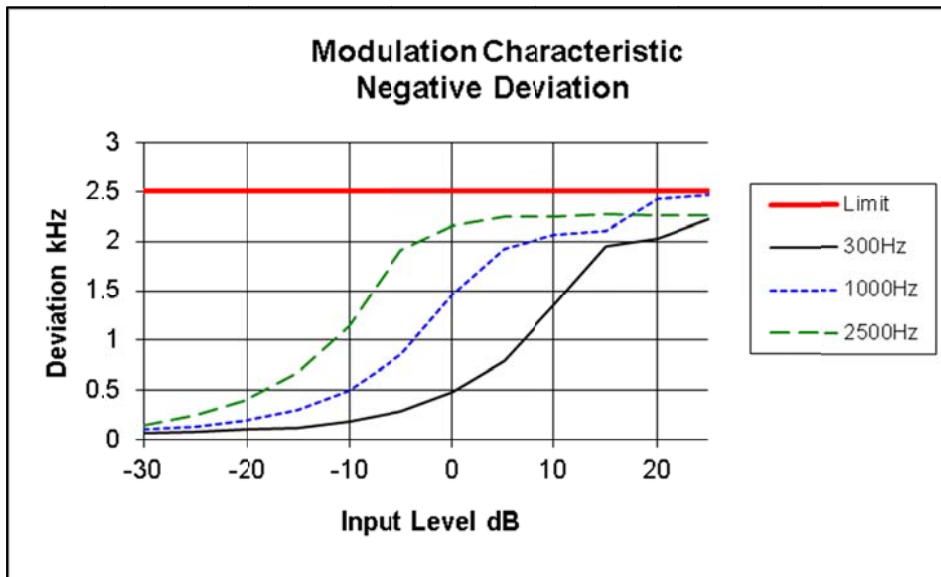
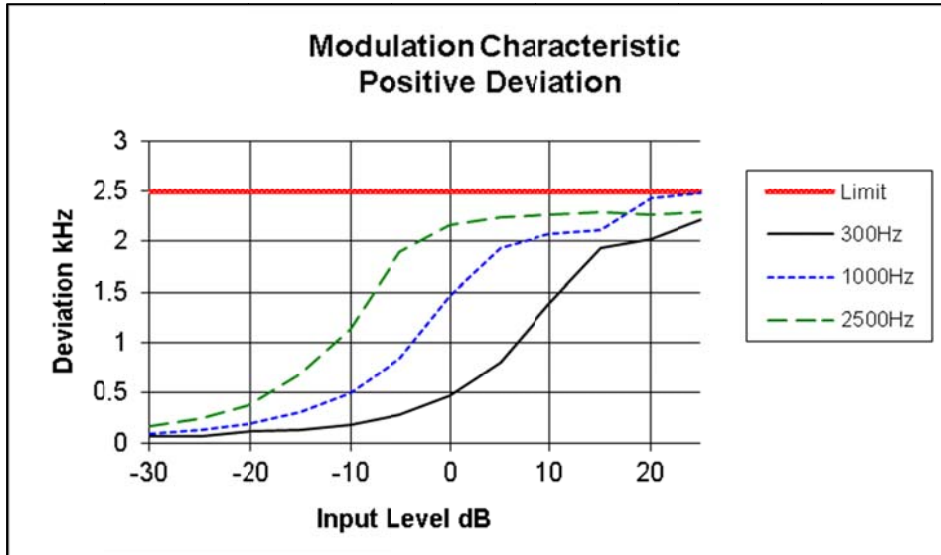
Tx FREQUENCY: 770.1 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

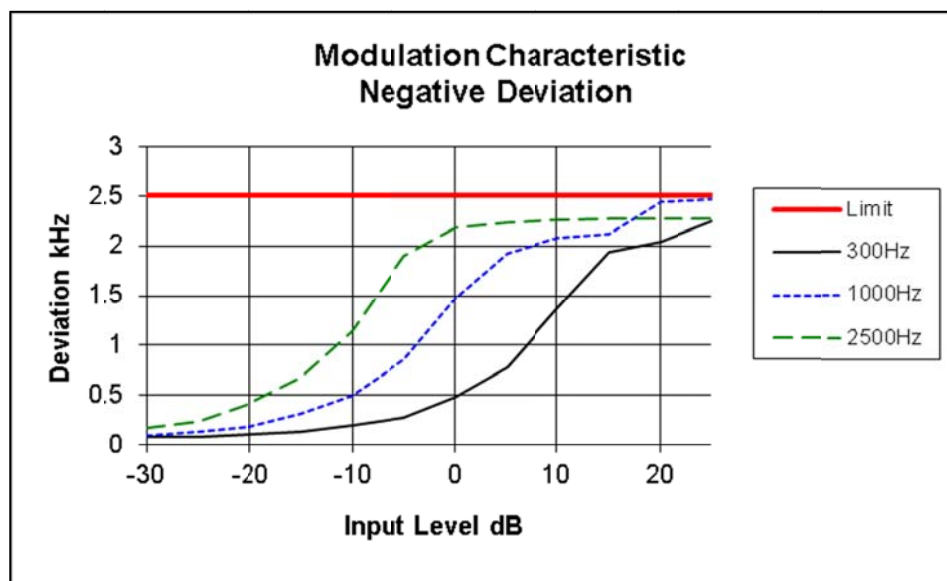
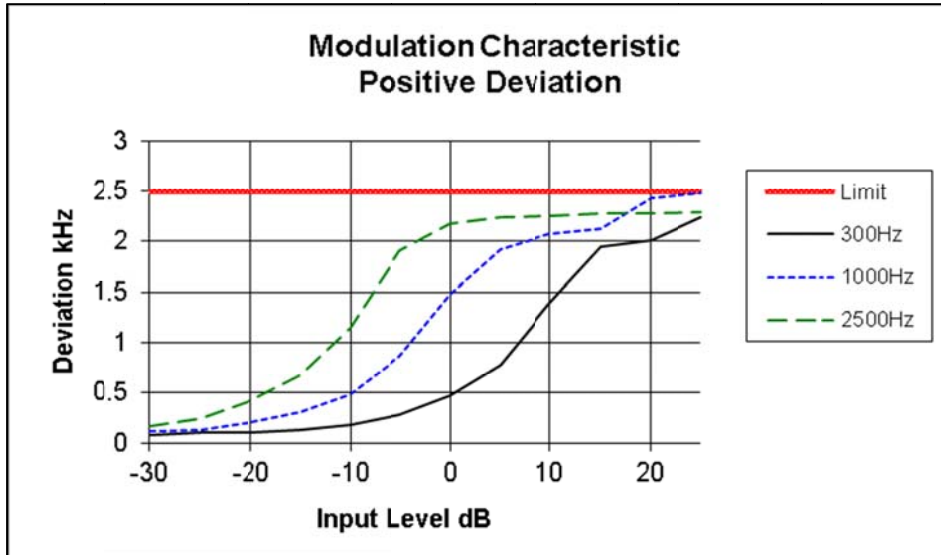
Tx FREQUENCY: 774.9 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

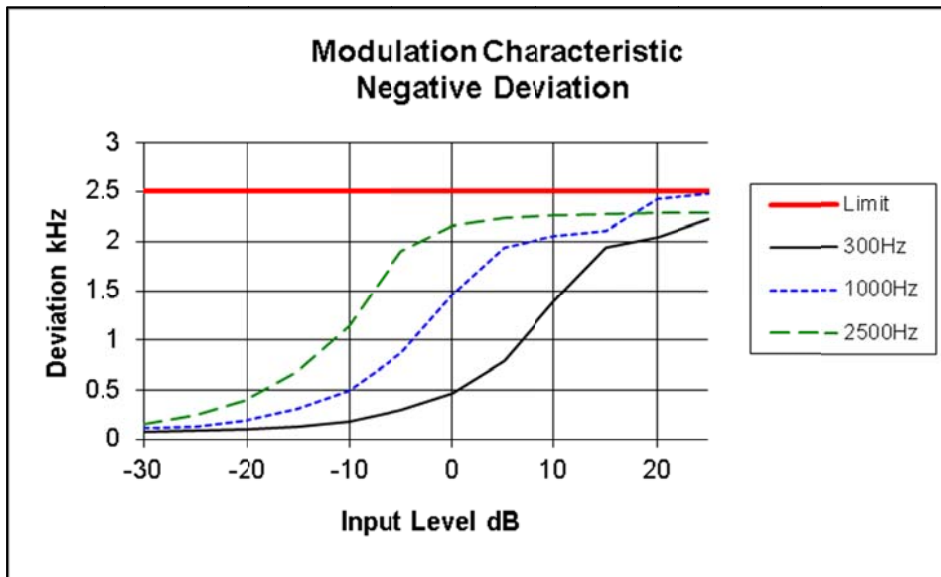
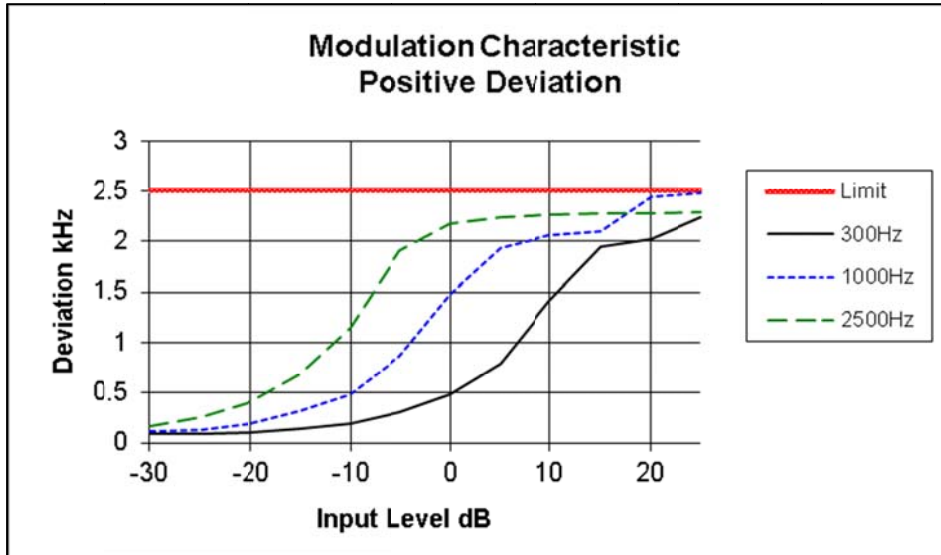
Tx FREQUENCY: 851.1 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

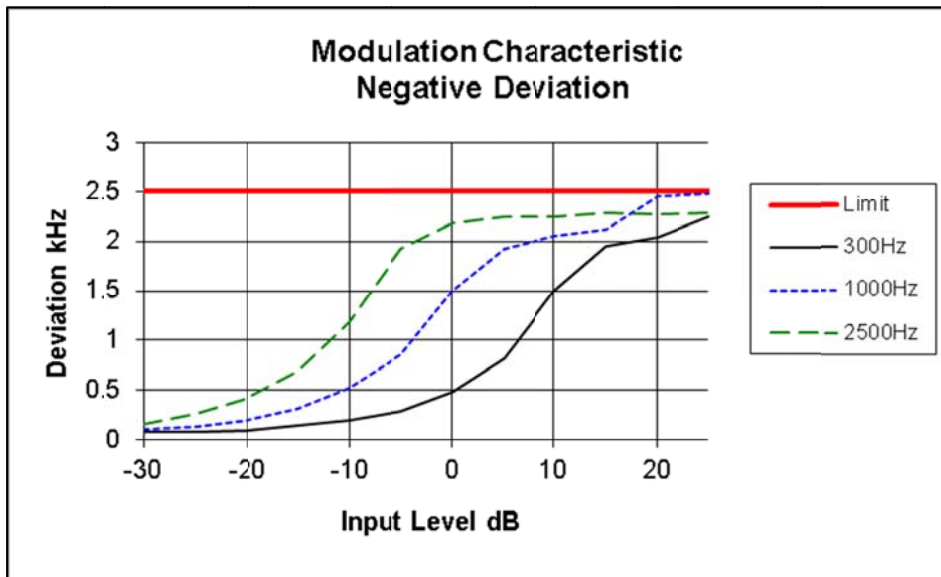
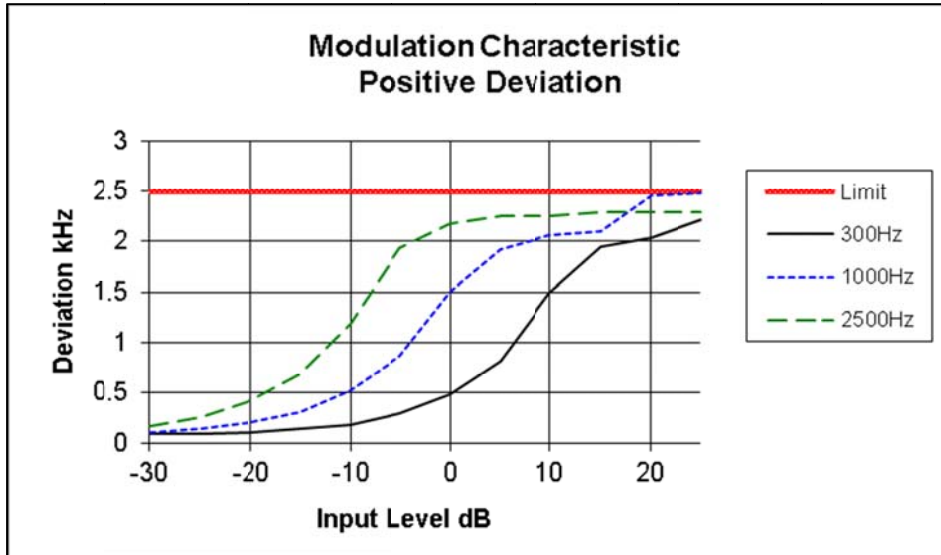
Tx FREQUENCY: 858.5 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

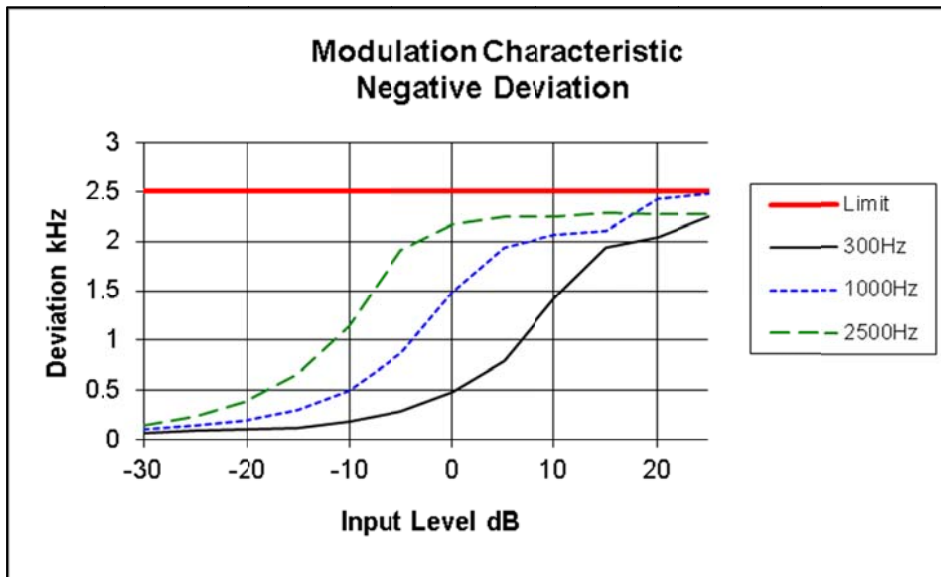
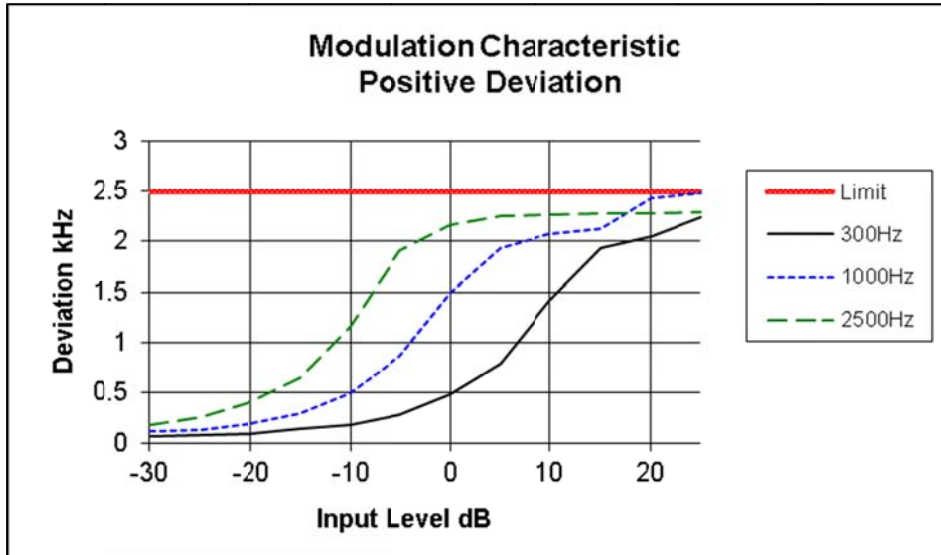
Tx FREQUENCY: 866.0 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 868.9 MHz 12.5 kHz Channel Spacing



TRANSMITTER OCCUPIED BANDWIDTH AND SPECTRUM MASKS

SPECIFICATION: FCC 47 CFR 2.1049 (c) RSS-119 5.5

GUIDE: TIA/EIA-603D 2.2.11

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
2. For analog measurements: The EUT was modulated by a 2500 Hz tone at an input level 16 dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as follows.

Emission Mask B – Resolution Bandwidth = 300 Hz, Video Bandwidth = 3 kHz

Emission Mask D – Resolution Bandwidth = 100 Hz, 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 RSS-119 5.5

EMISSION MASKS

Emission Mask B	12.5 kHz Channel Spacing	Analog
Emission Mask D	12.5 kHz Channel Spacing	Analog

Occupied Bandwidth and Spectrum Masks

Tx FREQUENCY: 764.100 MHz 100 W & 10 W 12.5 kHz Channel Spacing

Emission Masks are not required as this frequency is not within FCC 90.543 frequency band
769 → 765 MHz, and is covered by RSS-119 5.5 Table-3 ACP. .

Tx FREQUENCY: 770.100 MHz 100 W & 10 W 12.5 kHz Channel Spacing

Emission Masks are not required as emissions limits are covered by FCC 90.543 ACP and RSS-119
5.5 Table-3 ACP.

Tx FREQUENCY: 774.900 MHz 100 W & 10 W 12.5 kHz Channel Spacing

Emission Masks are not required as emissions limits are covered by FCC 90.543 ACP and RSS-119
5.5 Table-3 ACP.

Occupied Bandwidth and Spectrum Masks

Analogue

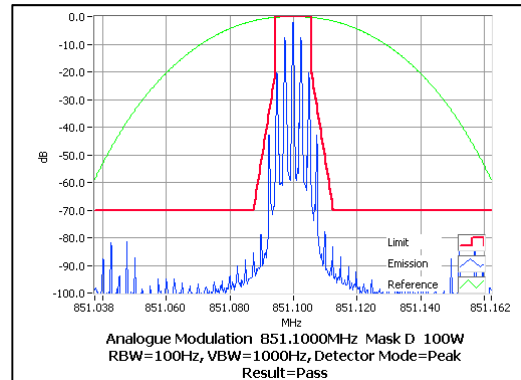
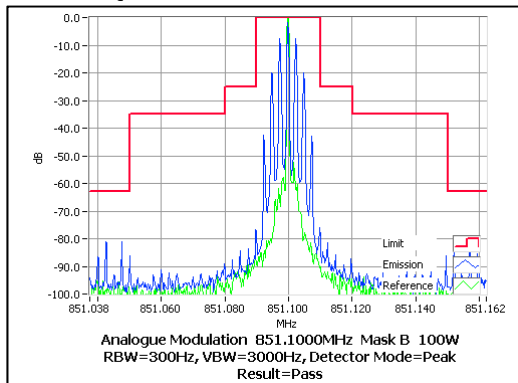
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & D

RSS-119 5.5 Mask-D

Tx FREQUENCY: 851.100 MHz

100 W

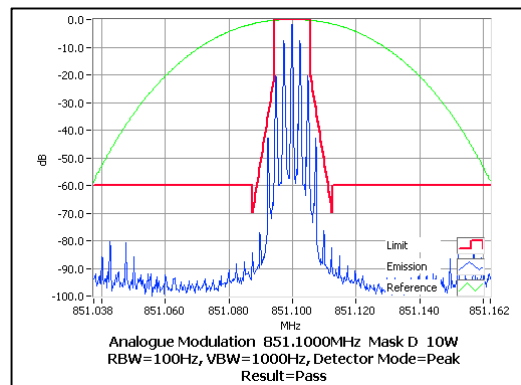
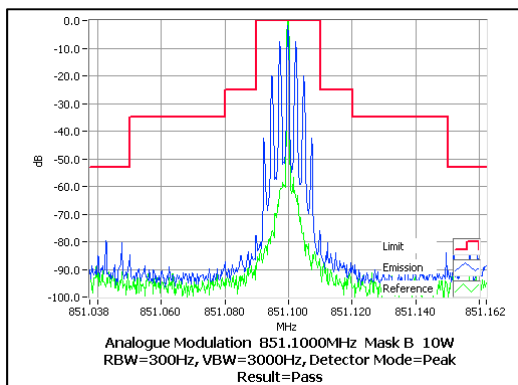
12.5 kHz Channel Spacing



Tx FREQUENCY: 851.100 MHz

10 W

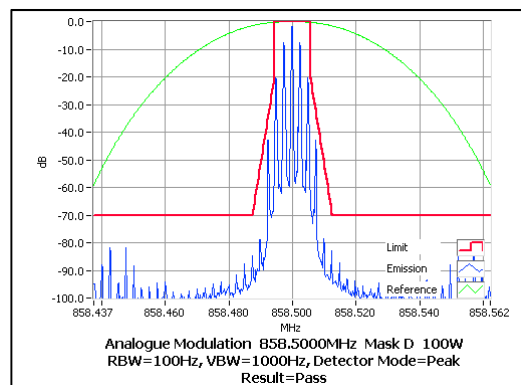
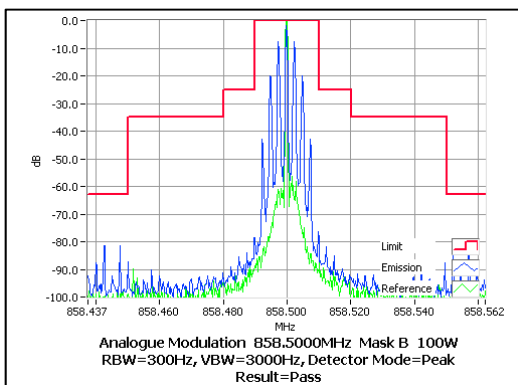
12.5 kHz Channel Spacing



Tx FREQUENCY: 858.500 MHz

100 W

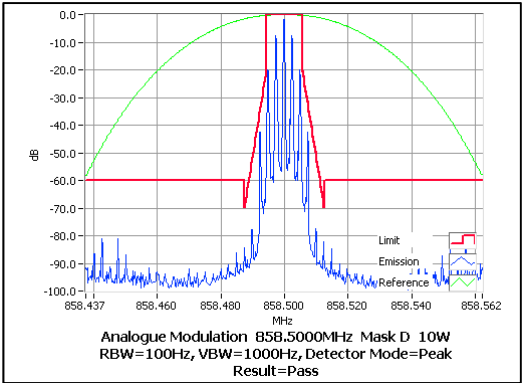
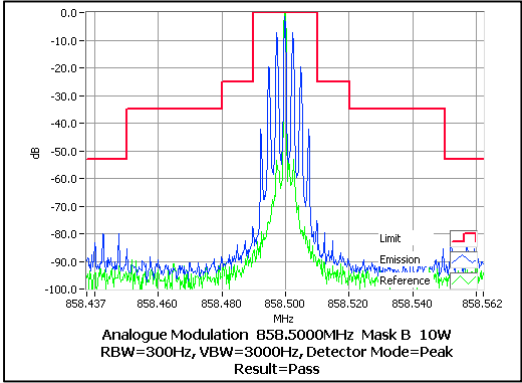
12.5 kHz Channel Spacing



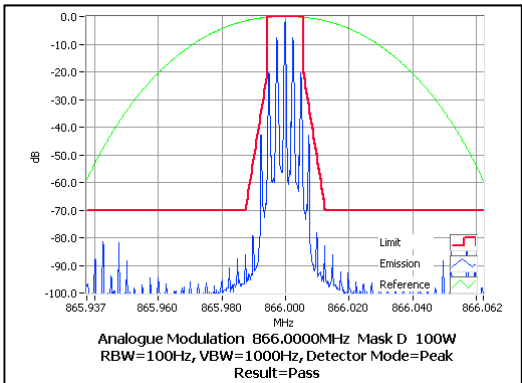
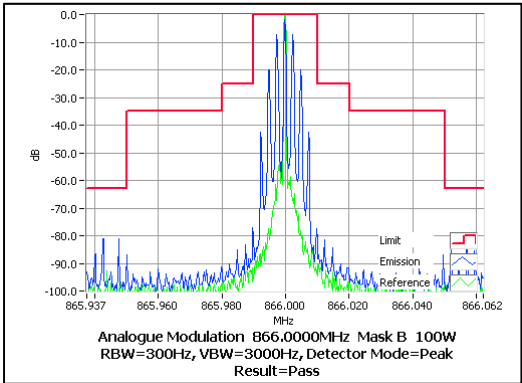
Occupied Bandwidth and Spectrum Masks

Analogue
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & D RSS-119 5.5 Mask-D

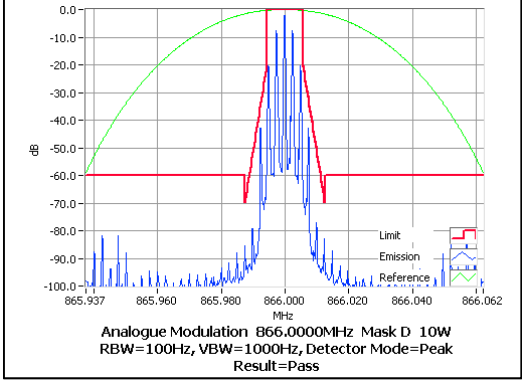
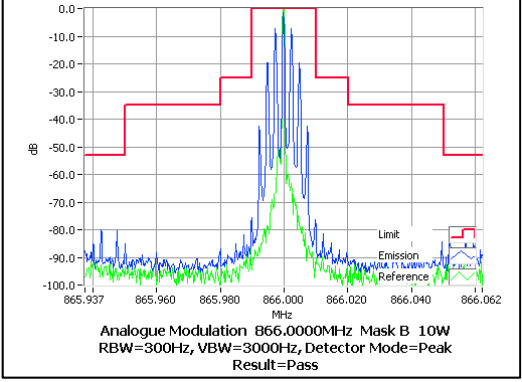
Tx FREQUENCY: 858.500 MHz 10 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 866.000 MHz 100 W 12.5 kHz Channel Spacing



Tx FREQUENCY: 866.000 MHz 10 W 12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

Analogue

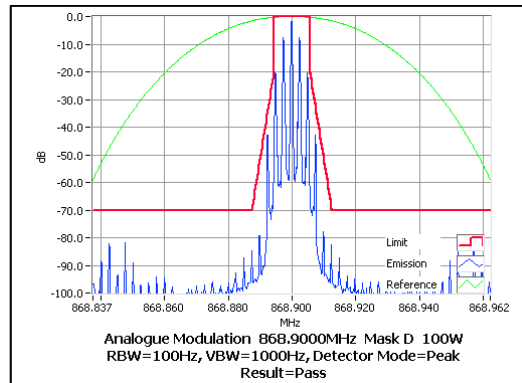
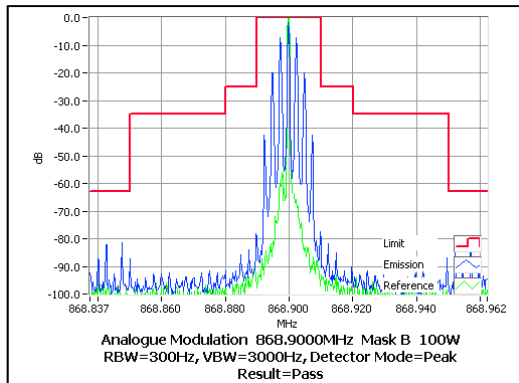
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & D

RSS-119 5.5 Mask-D

Tx FREQUENCY: 868.900 MHz

100 W

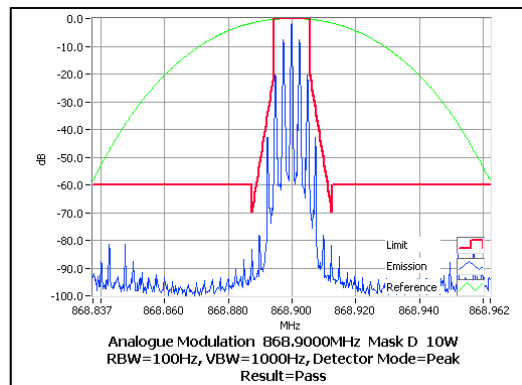
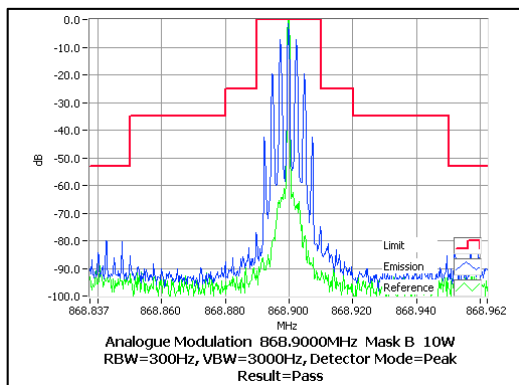
12.5 kHz Channel Spacing



Tx FREQUENCY: 868.900 MHz

10 W

12.5 kHz Channel Spacing



ADJACENT CHANNEL POWER

SPECIFICATION: FCC 47 CFR 90.543

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The transmitter is modulated with the standard test pattern for digital modulation, and in accordance with TIA/EIA 603D 2.2.14 for analogue voice.
3. The test is performed in accordance with 47 CFR 90.543

LIMIT CLAUSE: FCC 47 CFR 90.543

MEASUREMENT RESULTS:

Analogue

Tx FREQUENCY: 764.100 MHz 100 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth (kHz)	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25	-42.97	-42.90	-40
15.625 kHz	6.25	-83.08	-84.66	-60
21.875 kHz	6.25	-88.73	-88.57	-60
37.5 kHz	25	-83.29	-83.45	-60
62.5 kHz	25	-78.49	-78.59	-65
87.5 kHz	25	-82.93	-82.62	-65
150 kHz	100	-75.36	-75.26	-65
250 kHz	100	-80.30	-80.17	-65
350 kHz	100	-84.30	-84.31	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.21		-80
12 MHz to paired receive band	30 kHz (swept)	-101.65		-80
In the paired receive band	30 kHz (swept)	-118.36		-100

Adjacent Channel Power - Continued

Analogue

Tx FREQUENCY: 770.100 MHz 100 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth (kHz)	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25	-42.95	-42.87	-40
15.625 kHz	6.25	-82.66	-84.22	-60
21.875 kHz	6.25	-89.08	-88.90	-60
37.5 kHz	25	-83.13	-83.24	-60
62.5 kHz	25	-78.03	-78.12	-65
87.5 kHz	25	-82.77	-82.33	-65
150 kHz	100	-75.60	-75.50	-65
250 kHz	100	-80.60	-80.57	-65
350 kHz	100	-84.79	-84.80	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.84		-80
12 MHz to paired receive band	30 kHz (swept)	-101.78		-80
In the paired receive band	30 kHz (swept)	-118.28		-100

Analogue

Tx FREQUENCY: 774.900 MHz 100 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth (kHz)	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25	-42.99	-42.90	-40
15.625 kHz	6.25	-82.58	-84.02	-60
21.875 kHz	6.25	-87.19	-87.06	-60
37.5 kHz	25	-82.58	-82.72	-60
62.5 kHz	25	-78.40	-78.46	-65
87.5 kHz	25	-82.28	-82.01	-65
150 kHz	100	-75.45	-75.23	-65
250 kHz	100	-80.23	-80.16	-65
350 kHz	100	-84.33	-84.30	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.41		-80
12 MHz to paired receive band	30 kHz (swept)	-102.15		-80
In the paired receive band	30 kHz (swept)	-118.25		-100

TEST EQUIPMENT LIST

No#	Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
27	Power Supply	AC Variac	Yamabishi	S-260-5	TX-533	E1737	
33	Spectrum Analyser	26.5GHz	Agilent	PXA N9030A	MY49432161	E4907	6-Jul-16
51	RF Attenuator	TREVA2 20dB 150W	Weinschel	40-20-33	CJ405	E3733	15-Oct-15
65	Audio Analyser	TREVA2	Hewlett Packard	HP8903B	2818A04275	E3710	16-Oct-15
90	Modulation Analyser	TREVA2	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786	18-Oct-15
97	RF Attenuator	TREVA2 3dB	Weinschel	Model 1	BL9950	E4080	
101	RF Combiner	TREVA2	Minicircuits	ZFSC-4-1	-	E4084	
127	Power Meter	TREVA2 Power Head for HP8901	Hewlett Packard	HP11722A	2716A02037	1575	18-Oct-15
133	TREVA 2		Teltest	-	2	-	3-Nov-15

* NOTE: Items without calibration dates are calibrated immediately before use, or set using calibrated instruments.

ANNEX A – TEST SETUP DETAILS

Testing is performed using the Teltest **R**adio **E**valuation 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.

