

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TPDK5B Hand Portable Transceiver

Tested in accordance with:

FCC 47 CFR Part 90, & 90 Subpart-R

RSS-119 Issue 11

RSS-Gen Issue 3

Report Revision: 1

Issue Date: 30-September-2014

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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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REVISION

Date	Revision	Comments
30-September-2014	1	Initial test report

INTRODUCTION

REASON FOR REPORT					
This report demonstrates compliance of the Intrinsically Safe TPK5B handportable to FCC 47 Part 90 & 90-R, and RSS-119 Issue 11 & RSS-Gen Issue 3.					
Modulation		Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
Analogue FM		12.5 kHz 25.0 kHz	1	-	-
FFSK	Fast Frequency Shift Keying	12.5 kHz 25.0 kHz	-	1200	1200
		12.5 kHz 25.0 kHz	-	2400	2400
Digital Mobile Radio (DMR)	4 Level FSK (2 slot TDMA) (ETSI TS102 361-1)	12.5 kHz	2	4800	9600
APCO P25 Phase 1	C4FM (TIA 102)	12.5 kHz	1	4800	9600
APCO P25 Phase 2	H-CPM (2 slot TDMA) (TIA 102)	12.5 kHz	2	6000	12000

REPORT PREPARED FOR

Tait Communications
PO Box 1645
558 Wairakei Road
Christchurch
New Zealand

DESCRIPTION OF SAMPLE

Manufacturer: Tait Limited
Equipment: Hand Portable Transceiver
Type: TPK5B
Product Code: T03-22112-KBDA
Serial Number(s): 25565520
Quantity: 1

HARDWARE & SOFTWARE – Analog & DMR

Hardware ID: TPDB1X-K502_0006
Boot Code: QPD1B_S00_3.01.03.0001
DSP: QPD1A_E00_2.00.00.0015
Radio Application: QPD1F_E00_2.00.00.0015
FPGA Image: QPD1G_S00_1.07.00.0002

HARDWARE & SOFTWARE – P25 Phase-1 & -2

Hardware ID: TPDB1X-K502_0006
Boot Code: QPD1B_S00_3.01.03.0001
DSP: QPD1A_A02ML_2.01.00.4567
Radio Application: QPD1F_A00ML_2.01.00.4567
FPGA Image: QPD1G_S00_1.07.00.0002

TEST CONDITIONS

All testing was performed between 25th August → 30th September 2014, and under the following conditions:

Ambient temperature: 15°C → 30°C

Relative Humidity: 20% → 75%

Standard Test Voltage 7.5 V_{DC}

Note:

Testing of FCC Itinerant Channel 774.9875 MHz was automatically limited by the EUT to 1W output for compliance with FCC-47 90.531 when using P25-1 and P25-2 modulation.

When using analog, FFSK, and DMR modulations the output was tested at 3W. When configured for FCC compliance the EUT observes Itinerant Channel requirements.

STATEMENT OF COMPLIANCE

We, TELTEST LABORATORIES of 558 Wairakei Road, Christchurch, New Zealand, declare under our sole responsibility that the product:

Equipment: Hand Portable Transceiver
Type: TPK5B
Product Code: T03-22112-KBDA
Serial Number(s): 25565520
Quantity: 1

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

FCC 47 CFR Part 90 & 90-R

RSS-119 Issue 11 & RSS-Gen Issue 3

Signature: _____

M.C. James
Laboratory Technical Manager

Date: _____

MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

MODULATION TYPES:

F3E	Analogue Frequency Modulation (FM)	
F2D	FFSK	1200 bps & 2400 bps
FXW	DMR Digital Voice	9600 bps
FXD	DMR Digital Data	9600 bps
F1E, F7E	P25 phase 1 Digital Voice	9600 bps
F1D, F7D	P25 phase 1 Digital Data	9600 bps
F1W	P25 phase 2 Digital Voice / Data	12000 bps

EMISSION DESIGNATORS:

CHANNEL SPACINGS	12.5 kHz	25.0 kHz
Analog FM	11K0F3E	16K0F3E
FFSK Data 1200 bps	6K60F2D	9K60F2D
FFSK Data 2400 bps	7K80F2D	10K8F2D
Digital Voice DMR	7K60FXW	~
Digital Data DMR	7K60FXD	~
Digital Voice P25 phase 1	8K10F1E	~
	8K10F7E	~
Digital Data P25 phase 1	8K10F1D	~
	8K10F7D	~
Digital Voice P25 phase 2	8K10F1W	~
Digital Data P25 phase 2	8K10F1W	~

CALCULATIONS

Equation: $B_n = 2M + 2Dk$

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

Analog Voice 12.5 kHz Bandwidth

Necessary bandwidth

M = 3.0 kHz

D = 2.5 kHz

$$B_n = (2 \times 3.0) + (2 \times 2.5) \times 1$$

$$= 11.0 \text{ kHz}$$

Emission Designator

11K0F3E

F3E represents an FM voice transmission

Analog Voice 25.0 kHz Bandwidth

Necessary bandwidth

M = 3.0 kHz

D = 5.0 kHz

$$B_n = (2 \times 3.0) + (2 \times 5.0) \times 1$$

$$= 16.0 \text{ kHz}$$

Emission Designator

16K0F3E

F3E represents an FM voice transmission

Fast Frequency Shift Keying (FFSK – 1200 bps) 12.5 kHz Bandwidth

Necessary bandwidth

M = 1.8 kHz

D = 1.5 kHz (60% of peak deviation)

$$B_n = (2 \times 1.8) + (2 \times 1.5) \times 1$$

$$= 6.6 \text{ kHz}$$

Emission Designator

6K60F2D

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

Fast Frequency Shift Keying (FFSK – 1200 bps) 25.0 kHz Bandwidth

Necessary bandwidth

M = 1.8 kHz

D = 3.0 kHz (60% of peak deviation)

$$B_n = (2 \times 1.8) + (2 \times 3.0) \times 1$$

$$= 9.6 \text{ kHz}$$

Emission Designator

9K60F2D

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

Emission Designators – Continued

Fast Frequency Shift Keying (FFSK – 2400 bps) 12.5 kHz Bandwidth

Necessary bandwidth

M = 2.4 kHz

D = 1.5 kHz (60% of peak deviation)

$$B_n = (2 \times 2.4) + (2 \times 1.5) \times 1 \\ = 7.8 \text{ kHz}$$

Emission Designator

7K80F2D

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

Fast Frequency Shift Keying (FFSK – 2400 bps) 25.0 kHz Bandwidth

Necessary bandwidth

M = 2.4 kHz

D = 3.0 kHz (60% of peak deviation)

$$B_n = (2 \times 2.4) + (2 \times 3.0) \times 1 \\ = 10.8 \text{ kHz}$$

Emission Designator

10K80F2D

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

Digital Voice 12.5 kHz Bandwidth P25 phase 1

99% bandwidth

= 8.1 kHz

Emission Designator

8K10F1E

F1E represents a digital FM voice transmission

8K10F7E

F7E represents two or more channels containing quantized or digital voice information

Digital Voice 12.5 kHz Bandwidth P25 phase 2

99% bandwidth

= 8.1 kHz

Emission Designator

8K10F1W

F1W represents a single FM telephony channel

Digital Voice 12.5 kHz Bandwidth DMR

99% bandwidth

= 7.6 kHz

Emission Designator

7K60FXW

FXW represents a FM Time Division Multiple Access (TDMA) combination of data and telephony

Digital Data 12.5 kHz Bandwidth P25 phase 1

99% bandwidth

= 8.1 kHz

Emission Designator

8K10F1D

F1D represents an digital FM data transmission

8K10F7D

F7D represents two or more channels containing quantized or digital information

Digital Data 12.5 kHz Bandwidth P25 phase 2

99% bandwidth

= 8.1 kHz

Emission Designator

8K10F1W

F1W represents digital FM data transmission

Digital Data 12.5 kHz Bandwidth DMR

99% bandwidth

= 7.6 kHz

Emission Designator

7K60FXD

FXD represents FM Time Division Multiple Access (TDMA) data only

TEST RESULTS

TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046
RSS-119 5.4

GUIDE: TIA/EIA-603D 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: 3 W and 1 W

Nominal 3 W	764.06875 MHz	770.06875 MHz	774.98750 MHz	794.06875 MHz	800.06875 MHz	806.00000 MHz	813.50000 MHz
Measured	3.0	2.9	2.8	2.9	2.9	2.9	2.9
Diff (%)	-1.3	-3.1	-5.3	-3.2	-3.5	-2.3	-4.6
Diff (dB)	-0.1	-0.1	-0.2	-0.1	-0.2	-0.1	-0.2
Nominal 3 W	821.00000 MHz	823.9875 MHz	851.06875 MHz	858.56875 MHz	866.00000 MHz	868.9875 MHz	~
Measured	2.8	2.9	2.9	3.0	3.1	3.1	~
Diff (%)	-5.0	-5.0	-2.7	-1.1	3.0	3.2	~
Diff (dB)	-0.2	-0.2	-0.1	0.0	0.1	0.1	~
Nominal 1 W	764.06875 MHz	770.06875 MHz	774.98750 MHz	794.06875 MHz	800.06875 MHz	806.00000 MHz	813.50000 MHz
Measured	1.07	1.03	1.00	0.96	0.94	1.01	0.97
Diff (%)	7.3	2.7	-0.4	-4.4	-6.3	1.3	-3.2
Diff (dB)	0.3	0.1	0.0	-0.2	-0.3	0.1	-0.1
Nominal 1 W	821.00000 MHz	823.9875 MHz	851.06875 MHz	858.56875 MHz	866.00000 MHz	868.9875 MHz	~
Measured	0.97	0.95	0.99	1.01	1.05	1.07	~
Diff (%)	-3.2	-5.1	-0.7	0.7	5.1	7.1	~
Diff (dB)	-0.1	-0.2	0.0	0.0	0.2	0.3	~
Measurement Uncertainty ± 0.6 dB							

LIMIT CLAUSES:

FCC 47 CFR 90.205 (s). The output power shall not exceed by more than 20%... the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

RSS-119 5.4. The output power shall be within ± 1.0 dB of the manufacturer's rated power.

TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: TIA/EIA-603D 2.2.6

MEASUREMENT PROCEDURE:

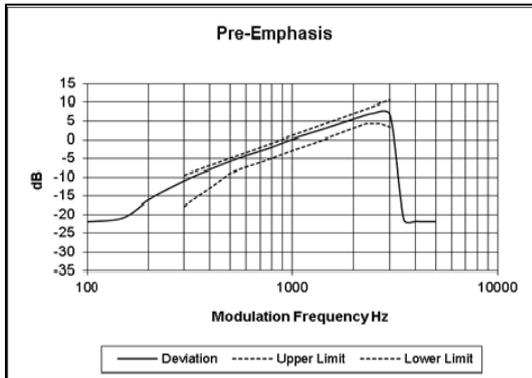
1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000 Hz was applied with the level set to obtain 20% of maximum deviation. This was used as the 0 dB reference point.
3. The AF was varied while the audio level was held constant.
4. The response in dB relative to 1000 Hz was measured.

MEASUREMENT RESULTS:

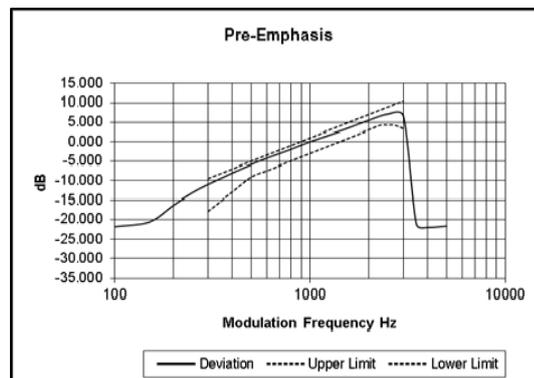
See the plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings tested at 3 W transmit power.

LIMIT CLAUSE: TIA/EIA-603D 3.2.6

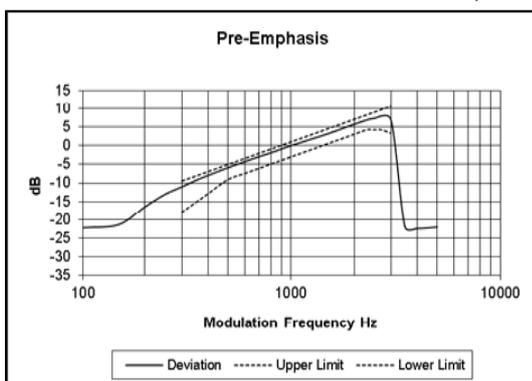
764.06875 MHz 12.5 kHz Channel Spacing



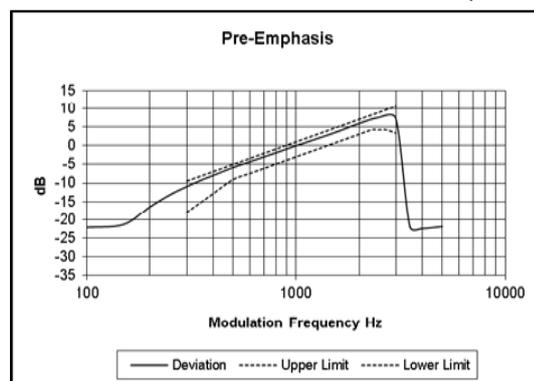
770.06875 MHz 12.5 kHz Channel Spacing



774.98750 MHz 12.5 kHz Channel Spacing

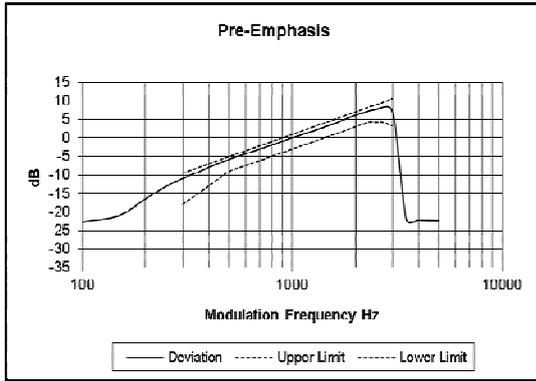


794.06875 MHz 12.5 kHz Channel Spacing

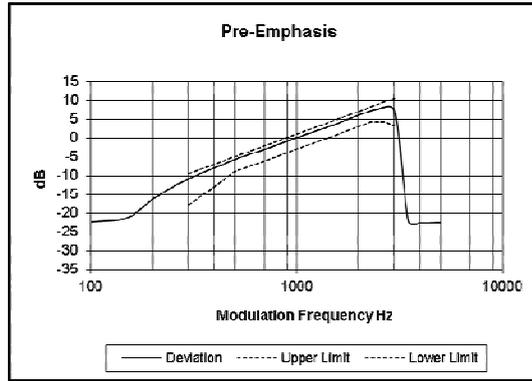


Transmitter Audio Frequency Response – Pre-emphasis

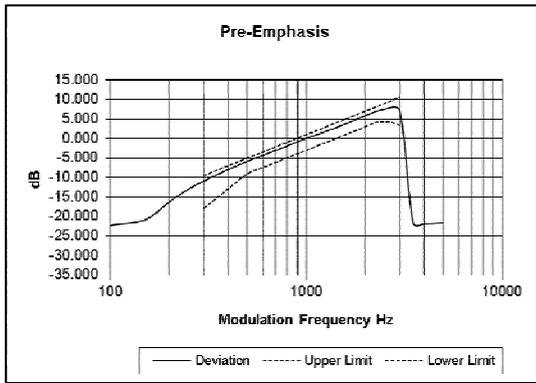
800.06875 MHz 12.5 kHz Channel Spacing



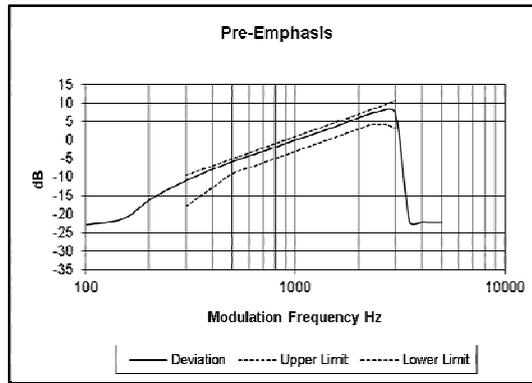
806.00000 MHz 12.5 kHz Channel Spacing



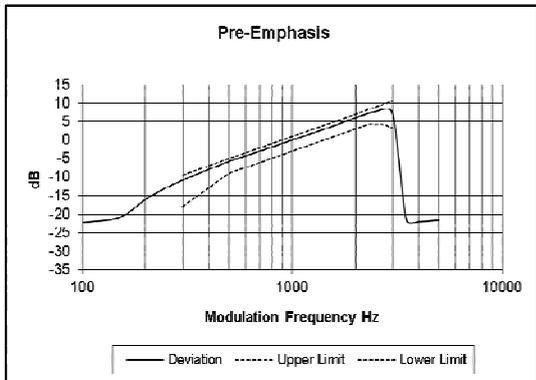
813.50000 MHz 12.5 kHz Channel Spacing



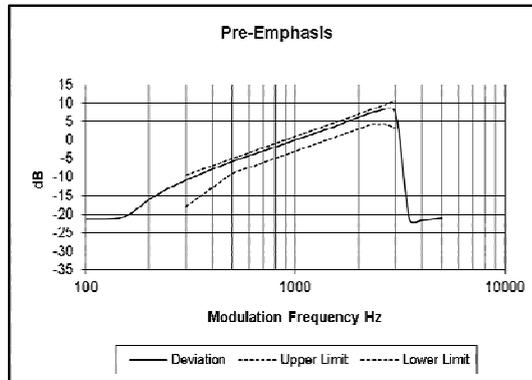
821.00000 MHz 12.5 kHz Channel Spacing



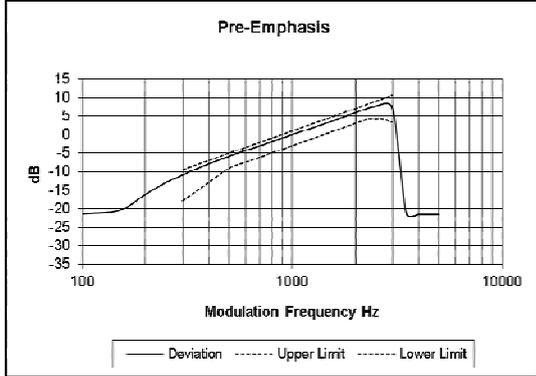
823.98750 MHz 12.5 kHz Channel Spacing



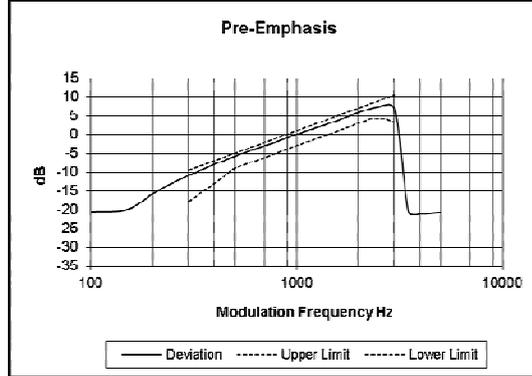
851.06875 MHz 12.5 kHz Channel Spacing



858.56875 MHz 12.5 kHz Channel Spacing

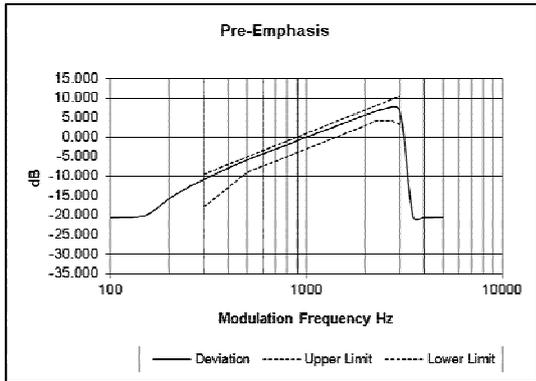


866.00000 MHz 12.5 kHz Channel Spacing

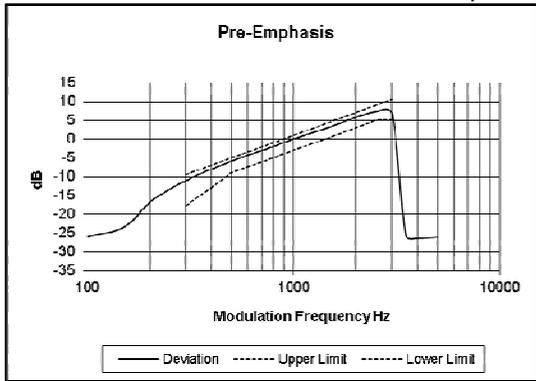


Transmitter Audio Frequency Response – Pre-emphasis

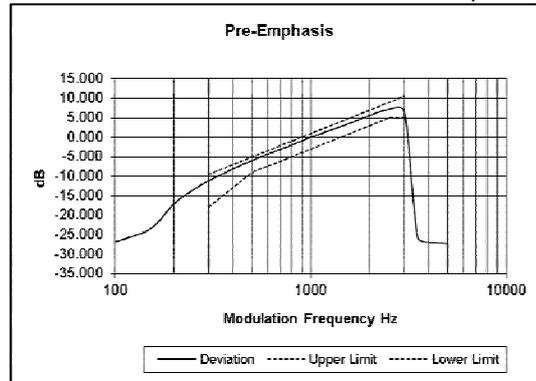
868.98750 MHz 12.5 kHz Channel Spacing



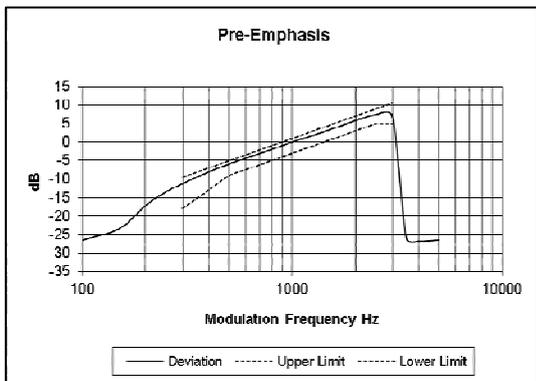
764.06875 MHz 25.0 kHz Channel Spacing



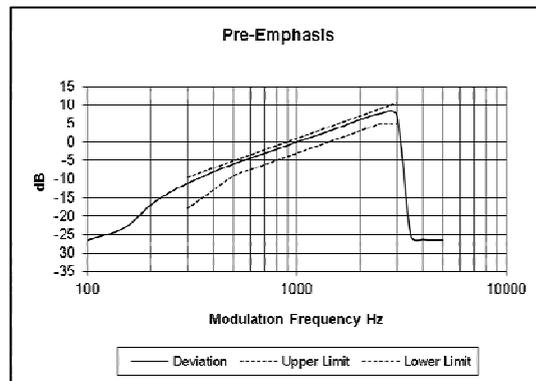
770.06875 MHz 25.0 kHz Channel Spacing



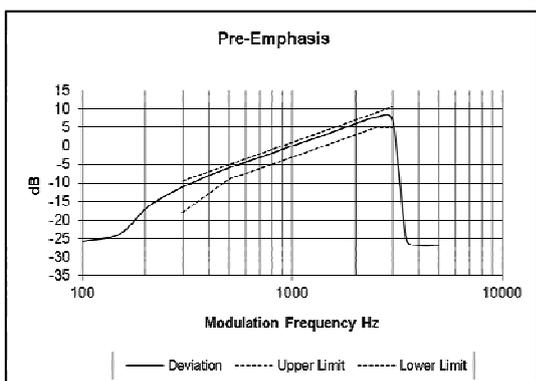
774.98750 MHz 25.0 kHz Channel Spacing



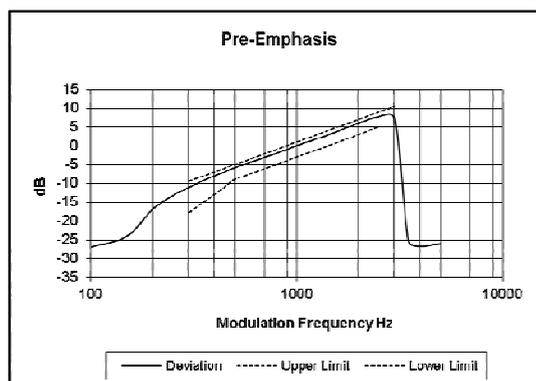
794.06875 MHz 25.0 kHz Channel Spacing



800.06875 MHz 25.0 kHz Channel Spacing

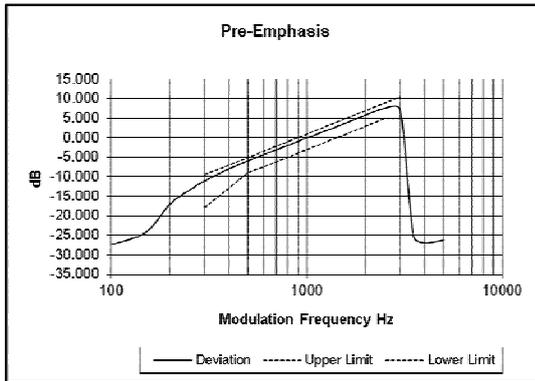


806.00000 MHz 25.0 kHz Channel Spacing

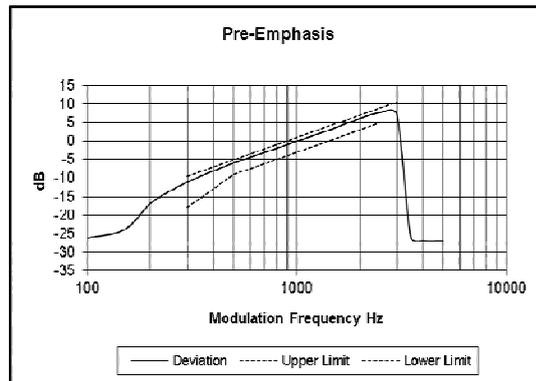


Transmitter Audio Frequency Response – Pre-emphasis

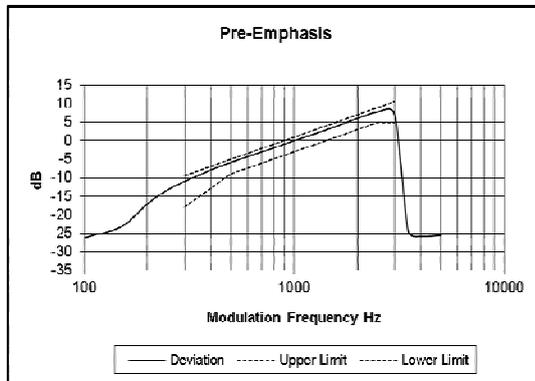
813.50000 MHz 25.0 kHz Channel Spacing



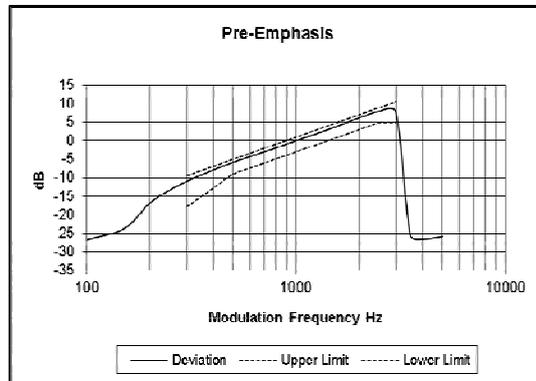
821.00000 MHz 25.0 kHz Channel Spacing



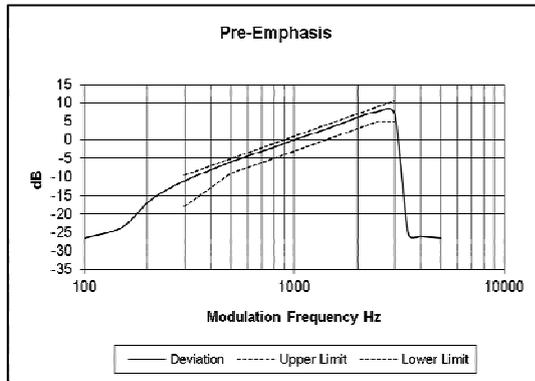
823.98750 MHz 25.0 kHz Channel Spacing



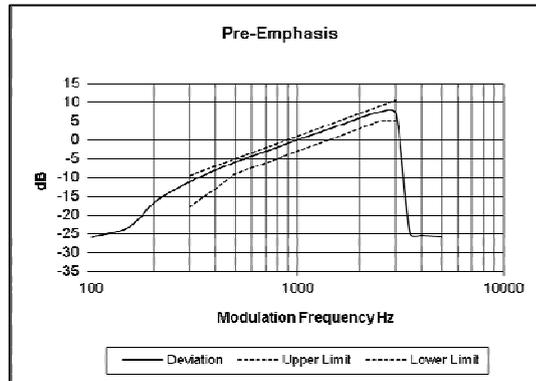
851.06875 MHz 25.0 kHz Channel Spacing



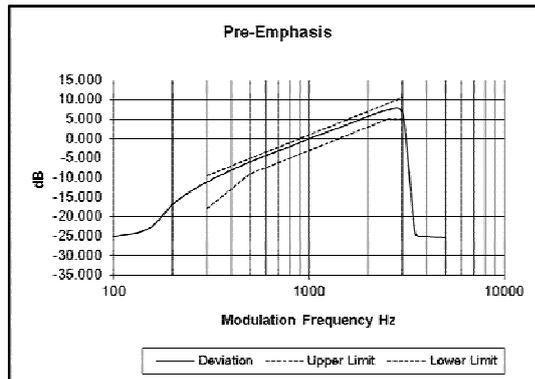
858.56875 MHz 25.0 kHz Channel Spacing



866.00000 MHz 25.0 kHz Channel Spacing



868.98750 MHz 25.0 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: TIA/EIA-603D 2.2.3

MEASUREMENT PROCEDURE:

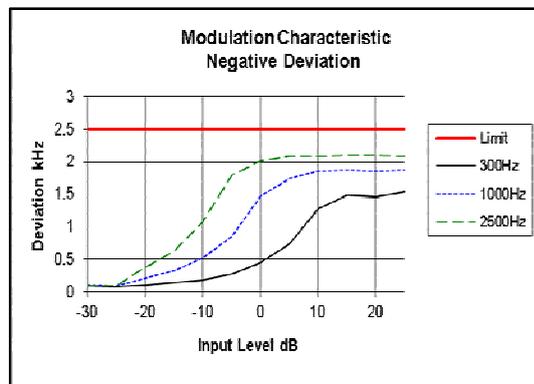
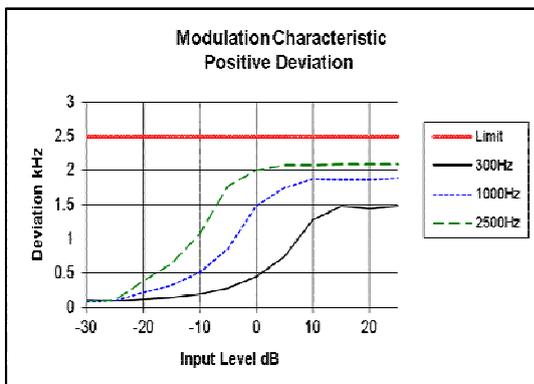
1. Refer Annex A for Equipment set up.
2. The modulation response was measured at three audio frequencies while varying the input level.
3. Measurements were made for both Positive and Negative Deviation.

MEASUREMENT RESULTS:

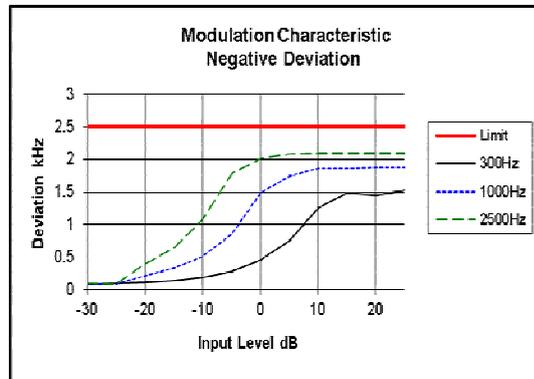
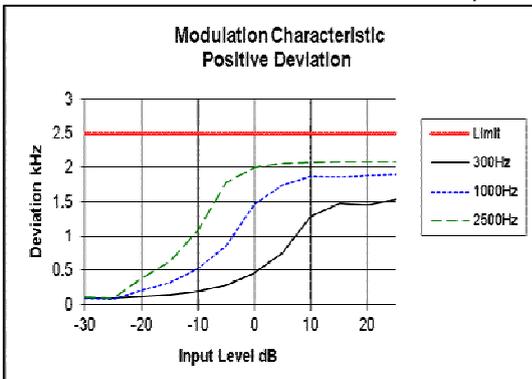
See the plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings.

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

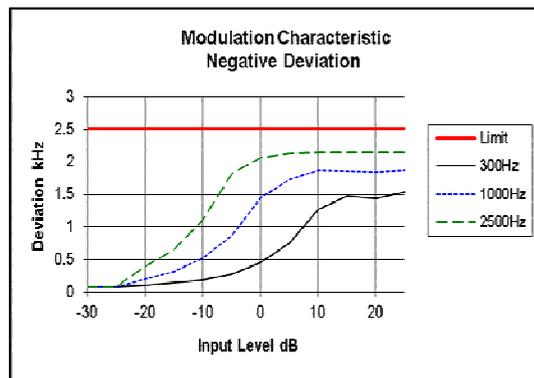
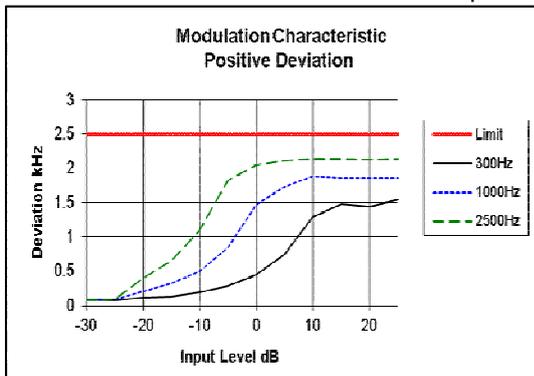
764.06875 MHz 12.5 kHz Channel Spacing



770.06875 MHz 12.5 kHz Channel Spacing

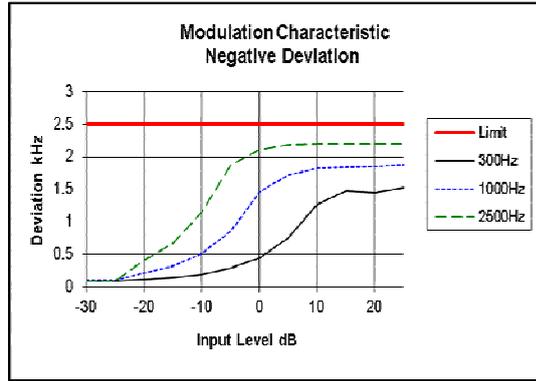
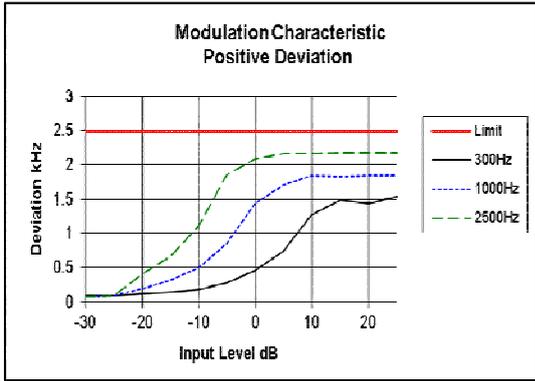


774.98750 MHz 12.5 kHz Channel Spacing

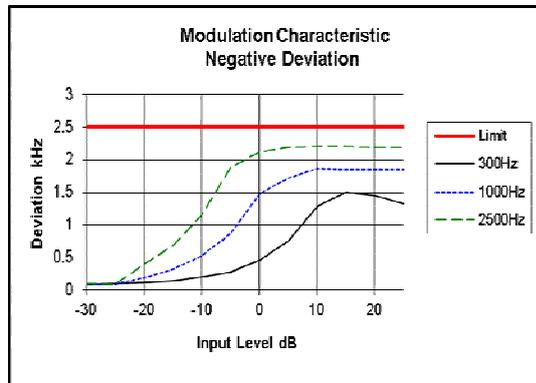
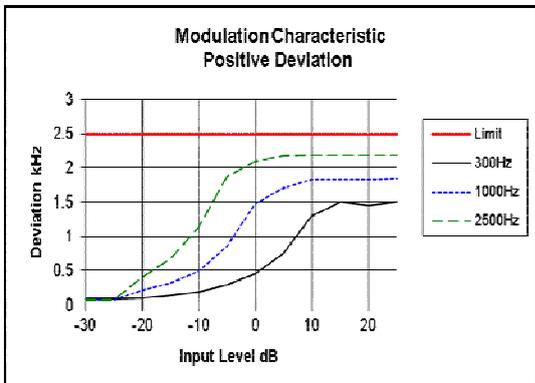


Transmitter Modulation Limiting

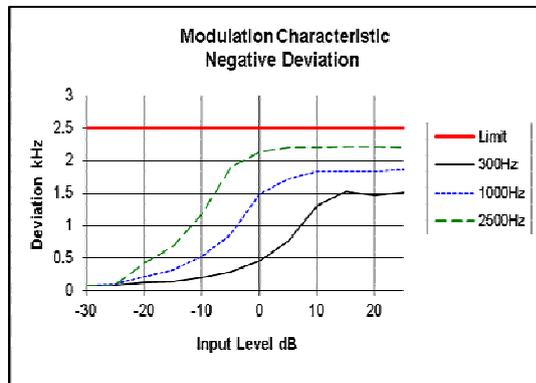
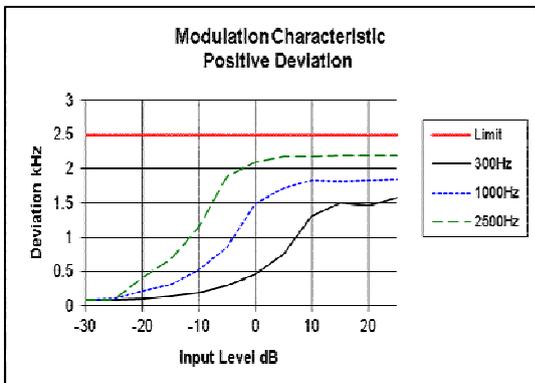
794.06875 MHz 12.5 kHz Channel Spacing



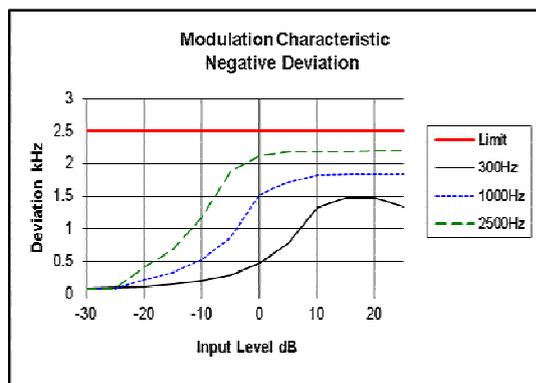
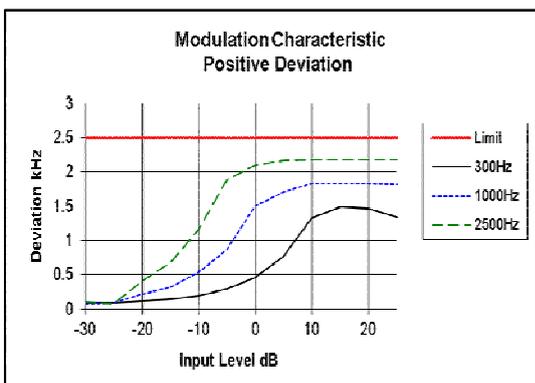
800.06875 MHz 12.5 kHz Channel Spacing



806.00000 MHz 12.5 kHz Channel Spacing

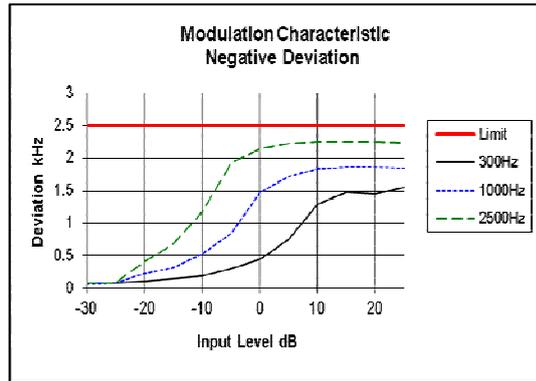
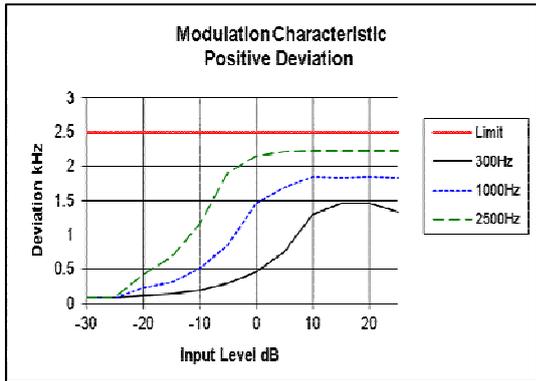


813.50000 MHz 12.5 kHz Channel Spacing

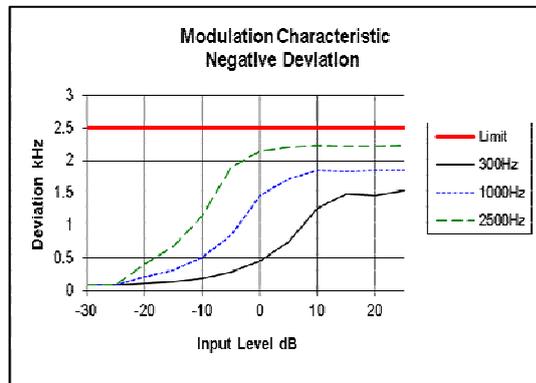
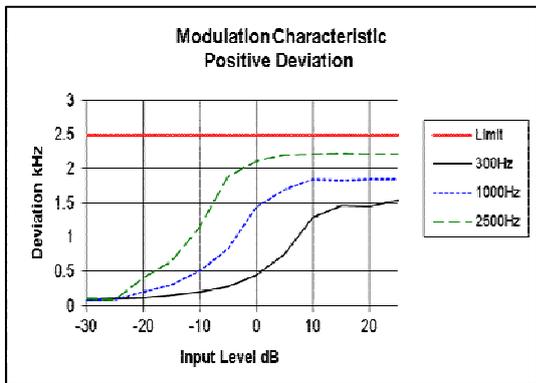


Transmitter Modulation Limiting

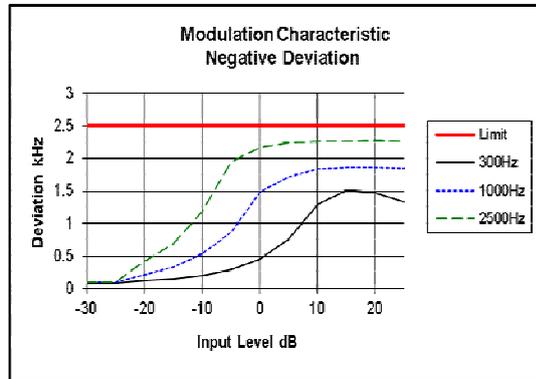
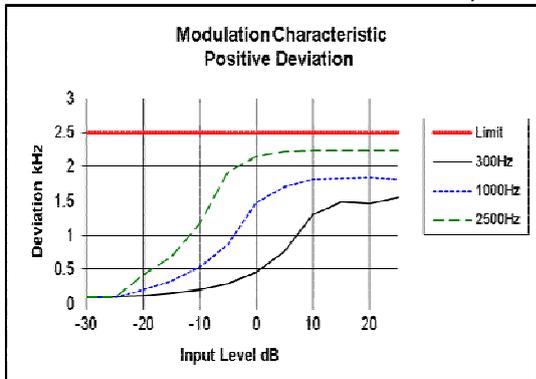
821.00000 MHz 12.5 kHz Channel Spacing



823.98750 MHz 12.5 kHz Channel Spacing



851.06875 MHz 12.5 kHz Channel Spacing



858.56875 MHz 12.5 kHz Channel Spacing

