

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBCK4A Base Station Transceiver

Tested in accordance with:

FCC 47 CFR Parts 22, and 90-subpart R

RSS-119 Issue 11
RSS-Gen Issue 4

Report Revision: 1

Issue Date: 18-May-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: CASTBCK4A
IC : 737A-TBCK4A

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Report Revision: 1
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REVISION

Date	Revision	Comments
18-May-2015	1	Initial test report

INTRODUCTION

Type approval testing of the TBCK4A, 50 Watt, Base Station transceiver, in order to demonstrate compliance with FCC 47 Parts 22, & 90-subpart R, and RSS-119 Issue 11 & RSS-Gen Issue 4. This radio supports Analogue, APCO P25 phase-1 and APCO P25 phase-2 modulations.

REPORT PREPARED FOR

Tait Communications
PO Box 1645
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Christchurch
New Zealand

DESCRIPTION OF SAMPLE

Manufacturer Tait Limited
Equipment: Base Station Transceiver
Type: TBCK4A
Sales Package Code TB9415-K4H0-K4H0-A1BA-10
Frequency range 762 → 870 MHz
Transmit Power 50W

Modulation		Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
Analogue	FM	12.5 kHz	1	~	~
APCO P25 Phase 1	C4FM	12.5 kHz	1	4800	9600
	LSM	12.5 kHz	1	4800	9600
APCO P25 Phase 2	H-DQPSK	12.5 kHz	2	6000	12000

HARDWARE & SOFTWARE – Digital Modulation Testing

Quantity: 1of each

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01103-NAAA	18209183	p25-2.00.00.0005	00.00
Power Amplifier	T01-01121-NAAA	18209414	1.07.00.0002	0006
PMU	TBA30A0-0100	18208873	0316	01.00
Front Panel	T01-01110-BAAA	18210060	1.07.00.0002	00.04

HARDWARE & SOFTWARE – Analogue Modulation Testing

Quantity: 1of each

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01103-NAAA	18209183	p25-trunk.20150508T172430	00.00
Power Amplifier	T01-01121-NAAA	18209414	0.01.00.trunk.360976.20140918 T113436	0006
PMU	TBA30A0-0100	18208873	0316	01.00
Front Panel	T01-01110-BAAA	18210060	0.01.00.trunk.375640.20150225 T133901	00.04

TEST CONDITIONS

All testing was performed between 20th April → 18th May 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).

P25 Phase I modulations tested are C4FM and π/4DQPSK for LSM. The tests were performed using the 1011 Hz tone test pattern specified in TIA-102.CAAA.

The P25 Phase II modulation tested is 2-slot TDMA using H-DQPSK (Harmonised Differential Quadrature Phase Shift Keying) for the downlink (base station to terminal). The tests were performed using the 1031 Hz tone test pattern specified in TIA-102.CCAA.

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: TBCK4A
Sales Package Code: TB9415-K4H0-K4H0-A1BA-10
Quantity: 1 of each
Consisting Of:

HARDWARE & SOFTWARE – Digital Modulation Testing

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01103-NAAA	18209183	p25-2.00.00.0005	00.00
Power Amplifier	T01-01121-NAAA	18209414	1.07.00.0002	0006
PMU	TBA30A0-0100	18208873	0316	01.00
Front Panel	T01-01110-BAAA	18210060	1.07.00.0002	00.04

HARDWARE & SOFTWARE – Analogue Modulation Testing

Description	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01103-NAAA	18209183	p25-trunk.20150508T172430	00.00
Power Amplifier	T01-01121-NAAA	18209414	0.01.00.trunk.360976.20140918 T113436	0006
PMU	TBA30A0-0100	18208873	0316	01.00
Front Panel	T01-01110-BAAA	18210060	0.01.00.trunk.375640.20150225 T133901	00.04

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

FCC 47 CFR Parts 22, & 90-subpart R

RSS-119 Issue 11 & 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)	
F1E, F7E	P25 phase 1 Digital Voice	9600 bps
F1D, F7D	P25 phase 1 Digital Data	9600 bps
D1W, D7W	LSM	9600 bps
F1W	P25 phase 2 Digital Voice / Data	12000 bps

EMISSION DESIGNATORS:

Channel Spacing 12.5 kHz	
FM	11K0F3E
Digital Voice P25 phase 1	8K10F1E
	8K10F7E
Digital Data P25 phase 1	8K10F1D
	8K10F7D
LSM	8K70D1W
	8K70D7W
Digital Data P25 phase 2	9K80D7W

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

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

$$= 11.0 \text{ kHz}$$

Emission Designator

11K0F3E

F3E represents an FM voice transmission

APCO P25 Phase 1: C4FM

Digital Voice / Data (C4FM - 4 level frequency shift keying)

Digital Voice/data transmissions use a 4 level frequency shift keying modulation scheme.

The necessary bandwidth has been measured using the 99% energy rule, and in accordance with FCC KDB 971168 D01 and RSS-Gen 4.6.1.

Digital Voice 12.5 kHz Bandwidth

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 Data 12.5 kHz Bandwidth

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

Emission Designators - Continued

APCO P25 Phase 1: Linear Simulcast Modulation (LSM)

Digital Voice/data transmissions use a 4 level frequency shift keying modulation scheme. The necessary bandwidth has been measured using the 99% energy rule, and in accordance with FCC KDB 971168 D01 and RSS-Gen 4.6.1.

CQPSK Digital Data 12.5 kHz Bandwidth
99% bandwidth
= 8.7 kHz

Emission Designator

8k70D1W

D1W represents a single channel containing quantized or digital information combining of two modulation modes simultaneously (amplitude + angle) for a data/telephony combination.

8K70D7W

D7W represents two or more channels containing quantized or digital information combining of two modulation modes simultaneously (amplitude + angle) for a data/telephony combination.

APCO P25 Phase-2: H-DQPSK

H-DQPSK is a non-constant envelope modulation scheme using 4-symbols which each contain 2-bits. The necessary bandwidth has been measured using the 99% energy rule, and in accordance with FCC KDB 971168 D01 and RSS-Gen 4.6.1.

H-DQPSK Digital Data 12.5 kHz Bandwidth
99% bandwidth
= 9.8 kHz

Emission Designator

9K80D7W

D7W represents two or more channels containing quantized or digital information combining of two modulation modes simultaneously (amplitude + angle) for a data/telephony combination.

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: 50 W and 5 W

Nominal 50W	764.06875 MHz	770.06875 MHz	774.98750 MHz	851.06875 MHz	858.56875 MHz
Measured	51.8	51.3	53.0	51.5	52.9
Variation %	3.5	2.5	6.0	3.1	5.9
Variation dB	0.2	0.1	0.3	0.1	0.2

Nominal 50W	866.00000 MHz	868.98750 MHz	~	~	~
Measured	54.4	55.0	~	~	~
Variation %	8.8	10.0	~	~	~
Variation dB	0.4	0.4	~	~	~

Nominal 5W	764.06875 MHz	770.06875 MHz	774.98750 MHz	851.06875 MHz	858.56875 MHz
Measured	5.0	5.0	5.0	5.3	5.5
Variation %	-0.5	0.3	0.4	7.0	10.7
Variation dB	0.0	0.0	0.0	0.3	0.4

Nominal 5W	866.00000 MHz	868.98750 MHz	~	~	~
Measured	5.5	5.6	~	~	~
Variation %	10.2	11.8	~	~	~
Variation dB	0.4	0.5	~	~	~

Measurement Uncertainty	± 0.6 dB
-------------------------	----------

Transmitter Output Power (Conducted) - continued

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 channel spacing tested at 50 W transmit power.

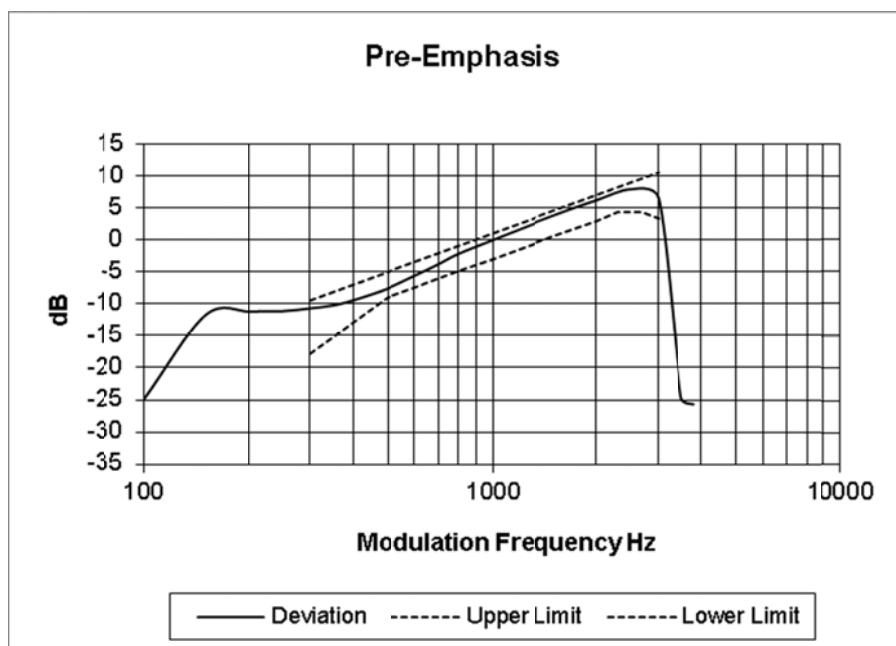
NOTE: The upper audio frequency tested was 3800 Hz due to the 8000 Hz sample rate of the modulating signal.

LIMIT CLAUSE: TIA/EIA-603D 3.2.6

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 764.06875 MHz

12.5 kHz Channel Spacing

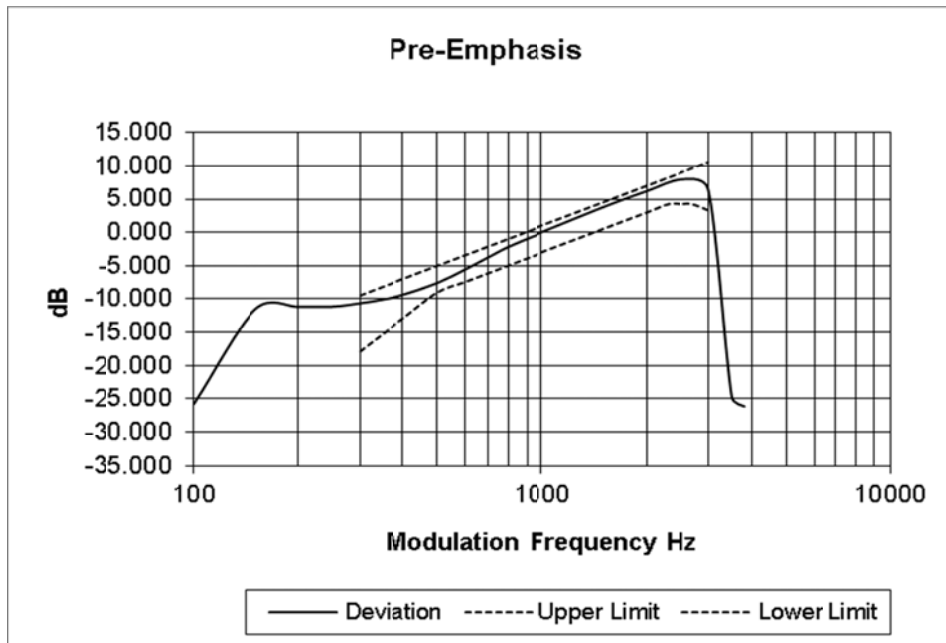


Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 770.06875 MHz

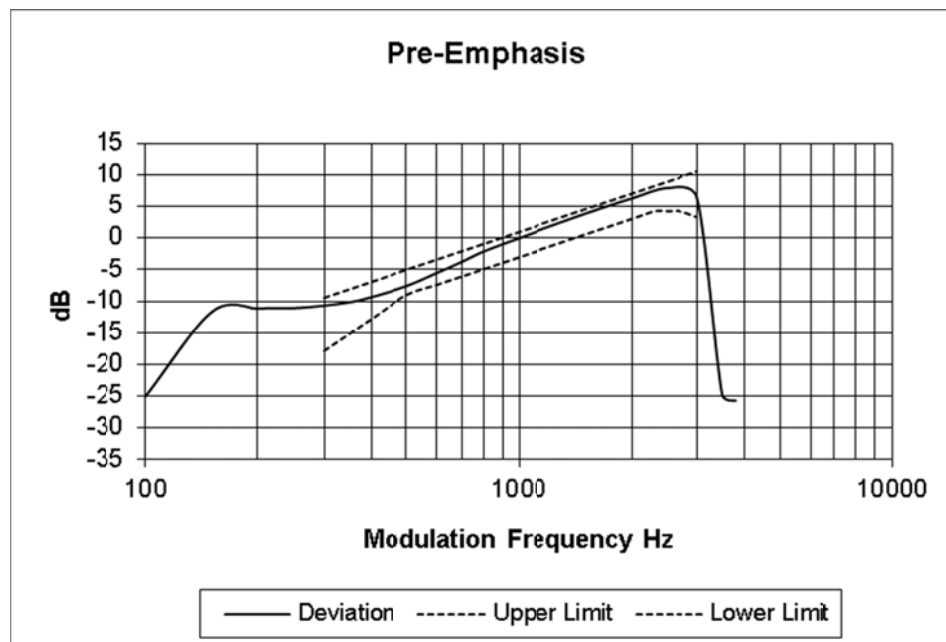
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 774.98750 MHz

12.5 kHz Channel Spacing

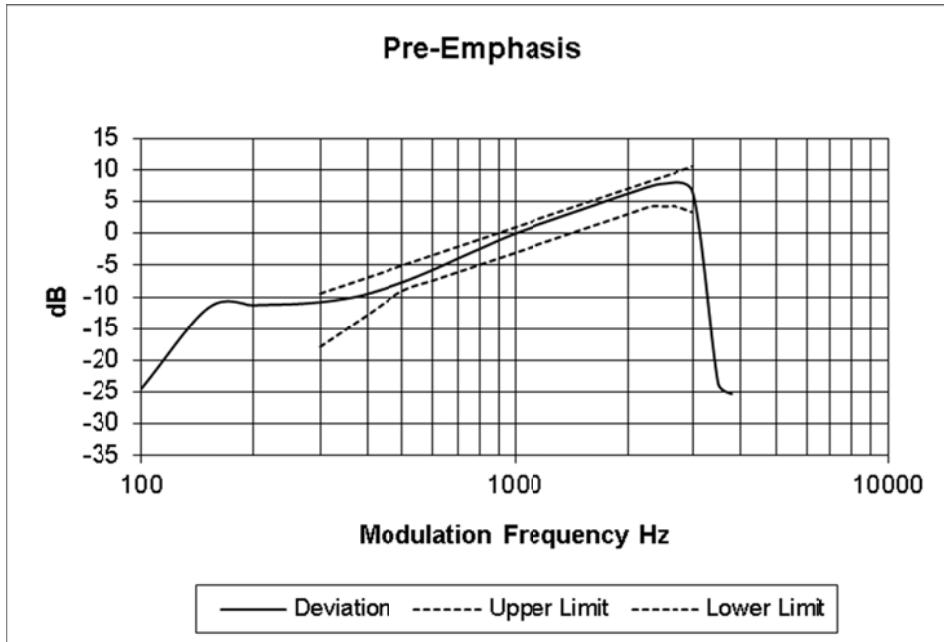


Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 851.06875 MHz

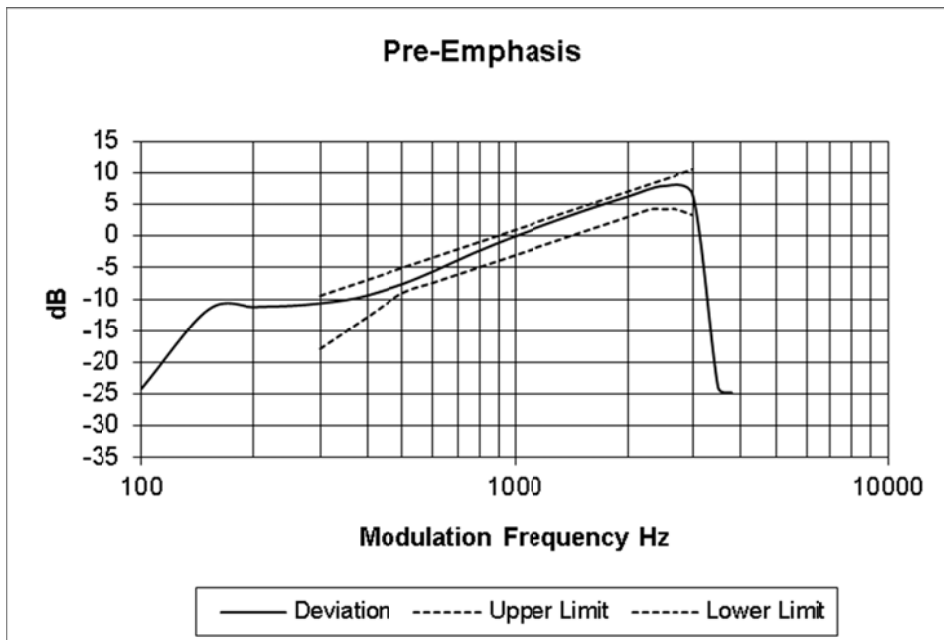
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 858.56875 MHz

12.5 kHz Channel Spacing

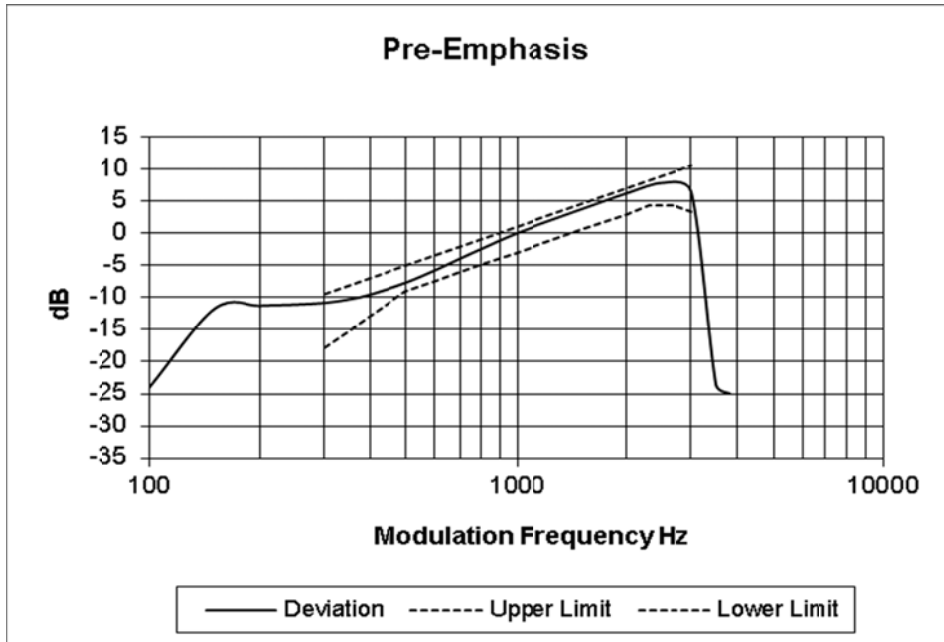


Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 866.00000 MHz

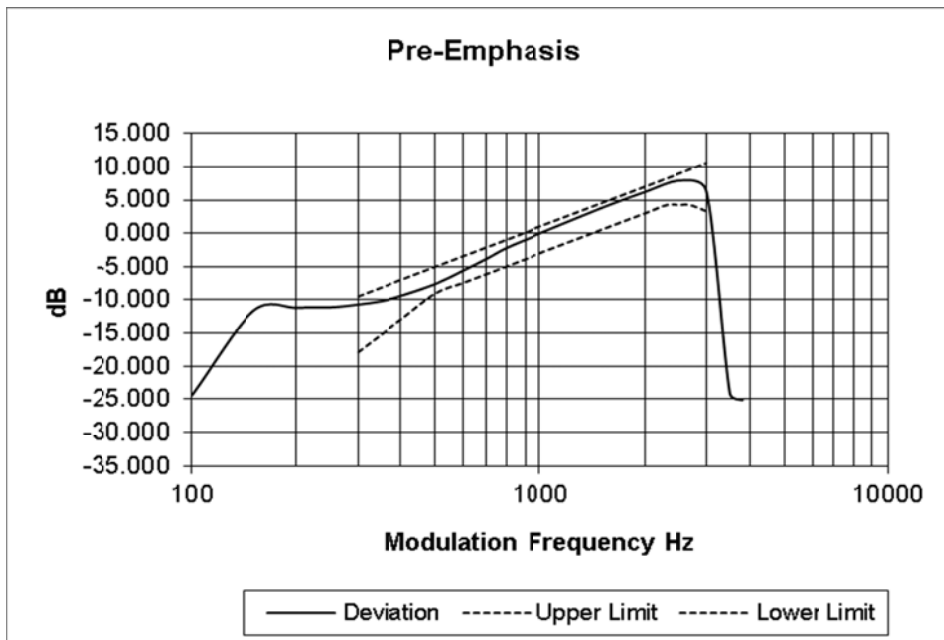
12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 868.98750 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.

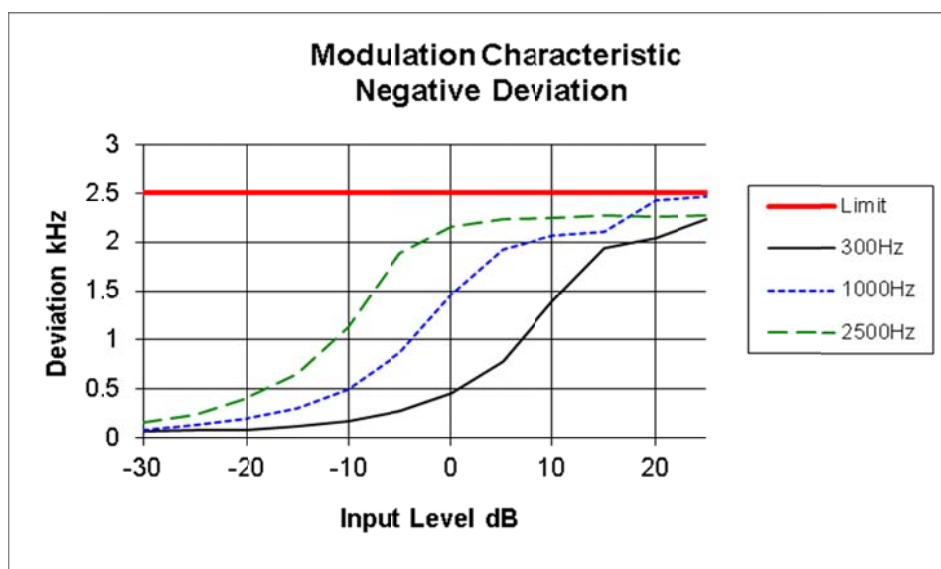
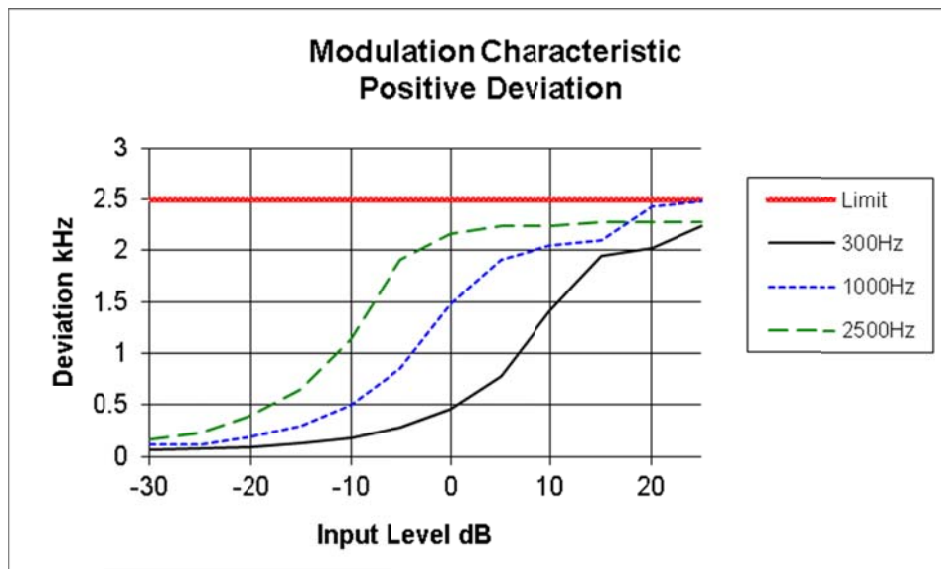
MEASUREMENT RESULTS:

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

LIMIT CLAUSE: TIA/EIA-603D 1.3.4.4

Tx FREQUENCY: 764.06875 MHz

12.5 kHz Channel Spacing

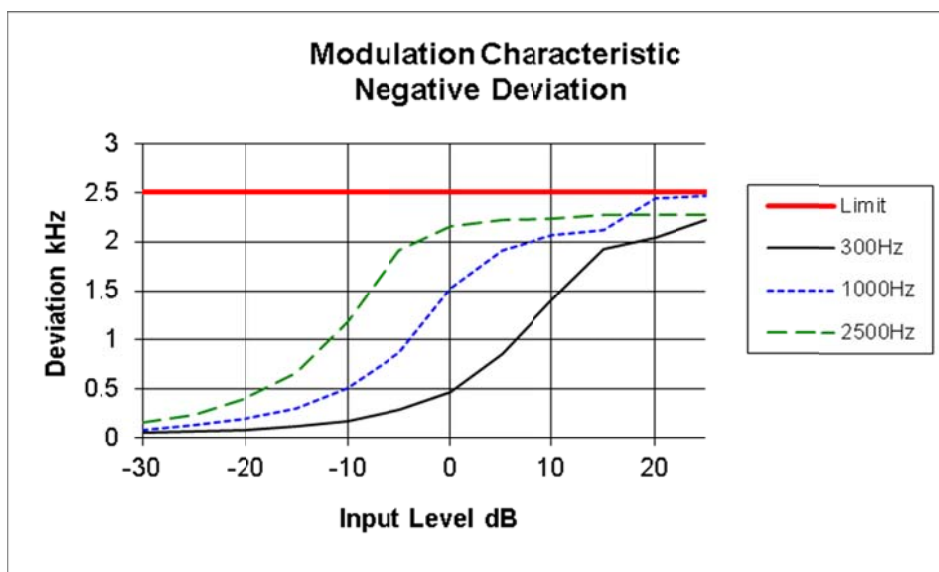
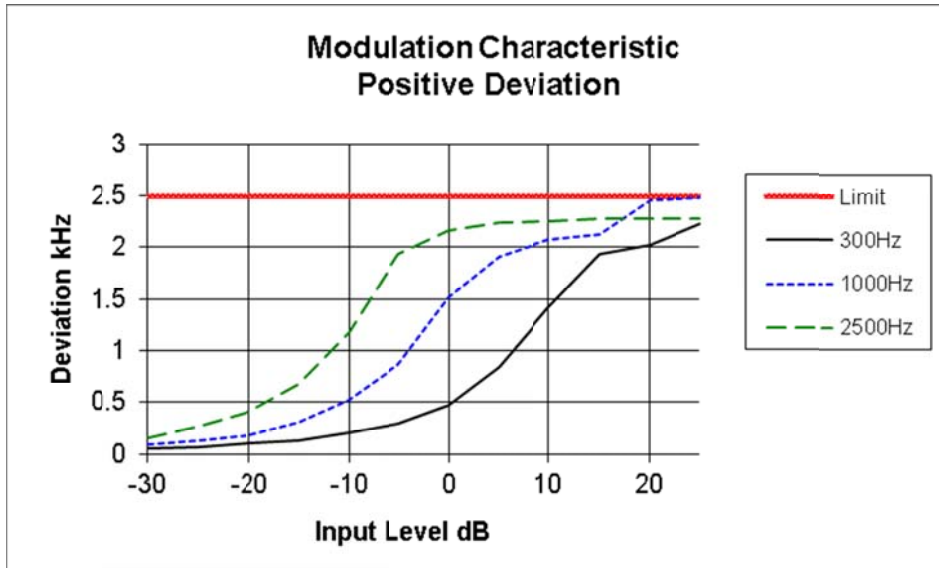


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 770.06875 MHz

12.5 kHz Channel Spacing

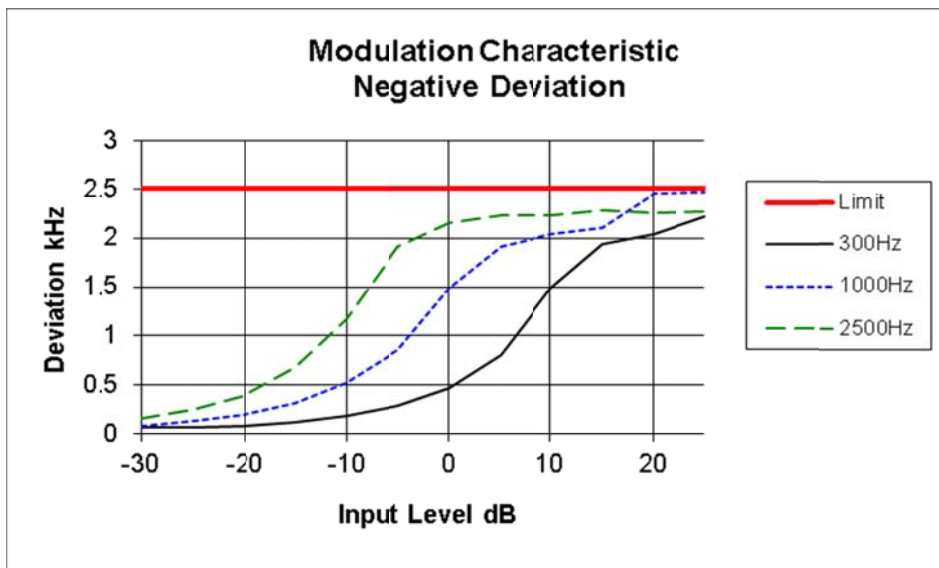
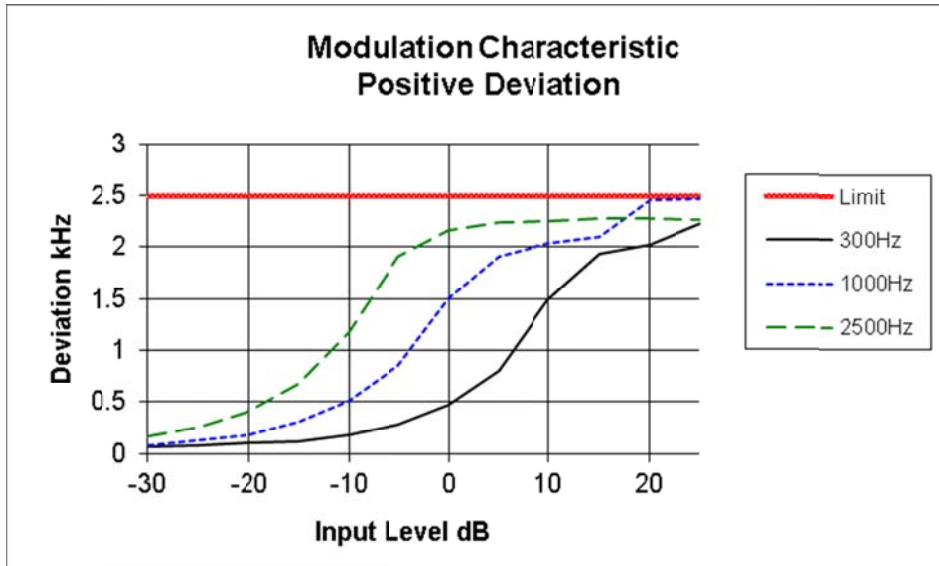


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 774.98750 MHz

12.5 kHz Channel Spacing

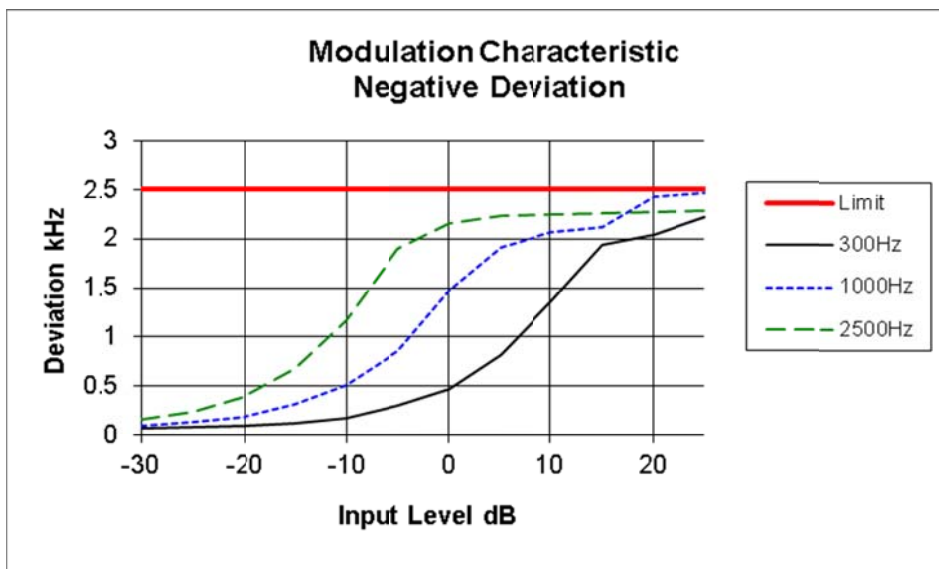
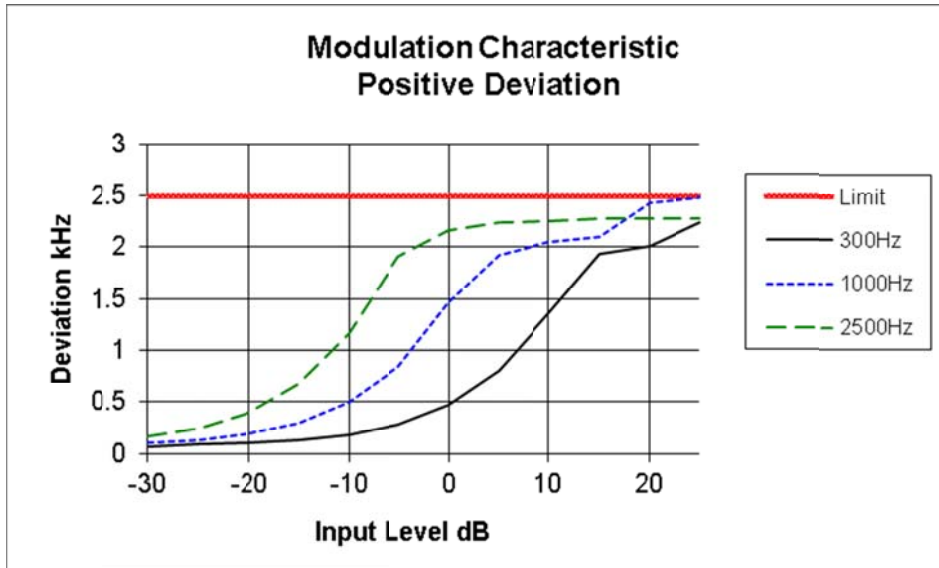


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 851.06875 MHz

12.5 kHz Channel Spacing

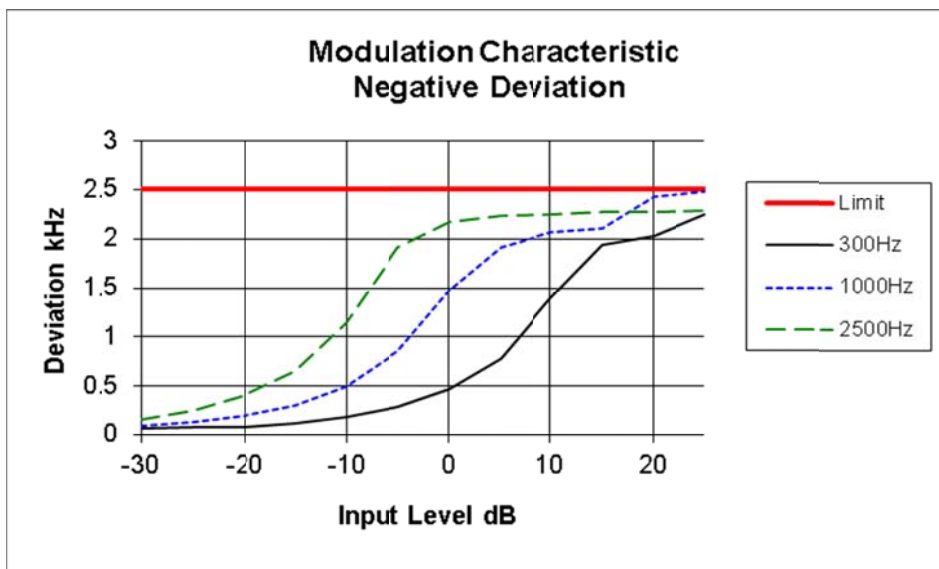
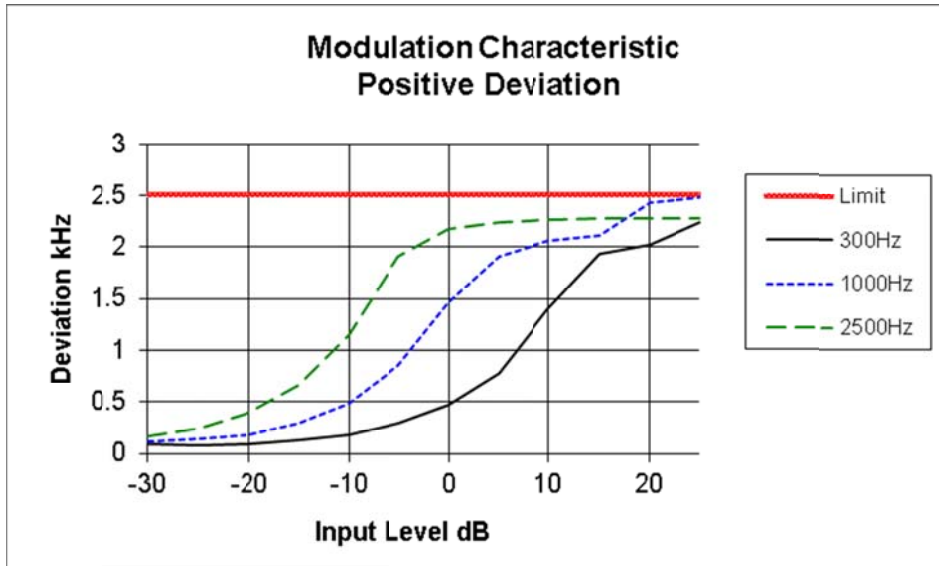


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 858.56875 MHz

12.5 kHz Channel Spacing

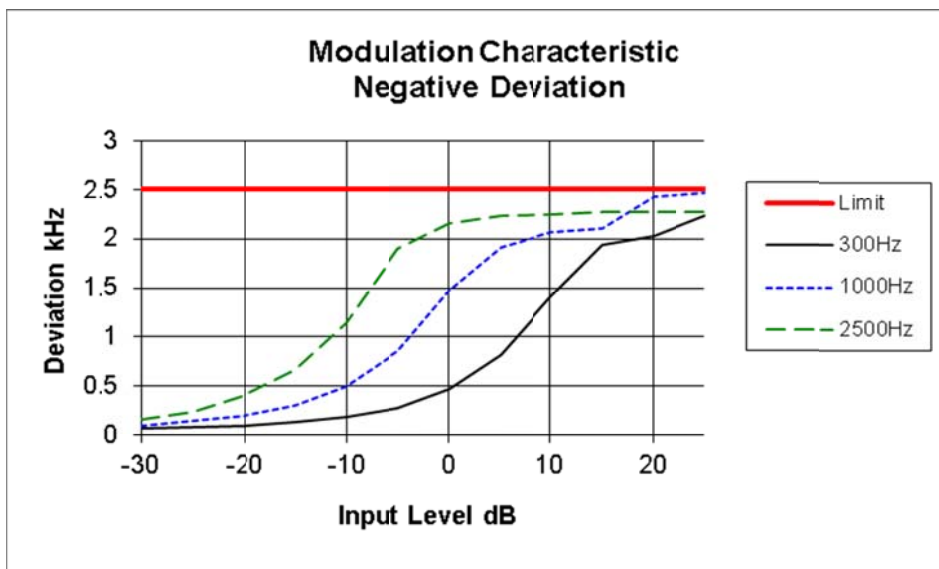
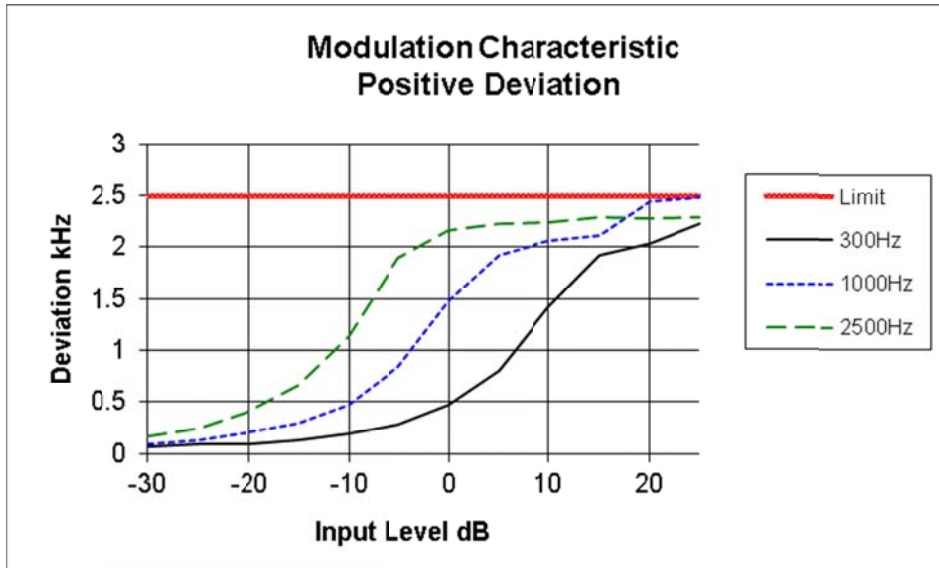


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 866.00000 MHz

12.5 kHz Channel Spacing

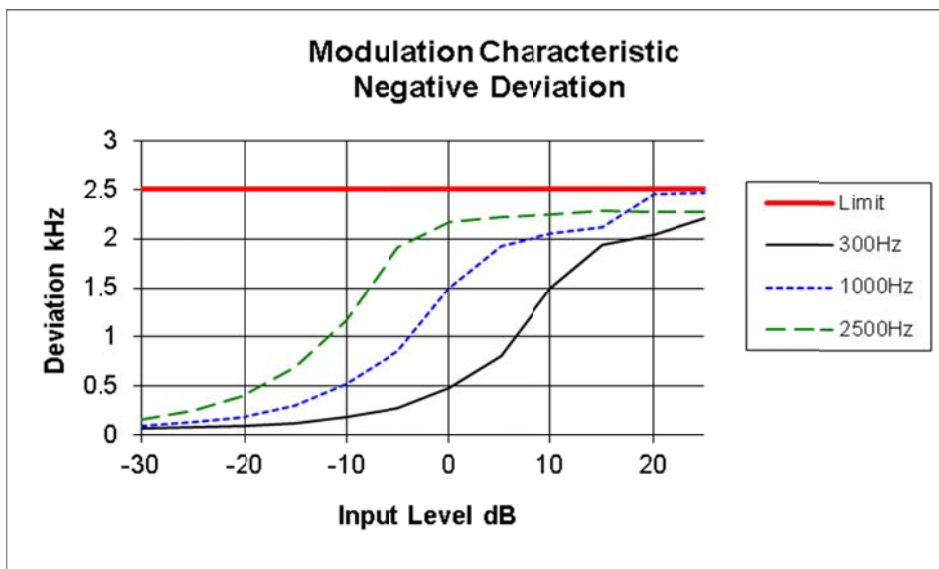
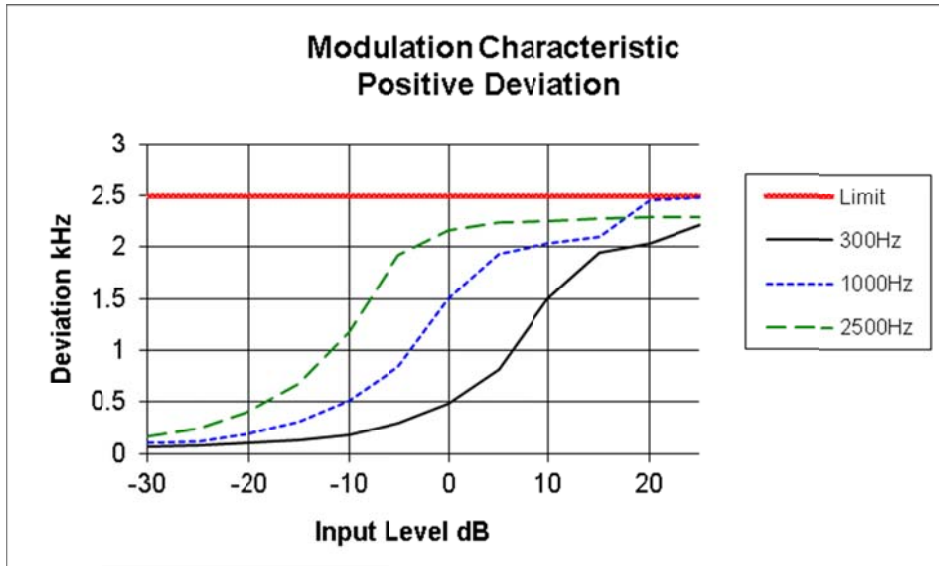


Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 868.98750 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.
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 = 100 Hz, Video Bandwidth = 1 kHz

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

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

Emission Mask H – Resolution Bandwidth = 300 Hz, Video Bandwidth = 3 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, Digital Voice/data
Emission Mask D	12.5 kHz Channel Spacing	Analog, Digital Voice/data
Emission Mask G	12.5 kHz Channel Spacing	Analog, Digital Voice/data
Emission Mask H	12.5 kHz Channel Spacing	Analog, Digital Voice/data

DATA SPEED

Digital Voice/Data	12.5 kHz Channel Spacing	9600 bps & 12000 bps
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Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-1 C4FM

Tx FREQUENCY: 764.06875 MHz 50 W & 5 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: 770.06875 MHz 50 W & 5 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: 774.98750 MHz 50 W & 5 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

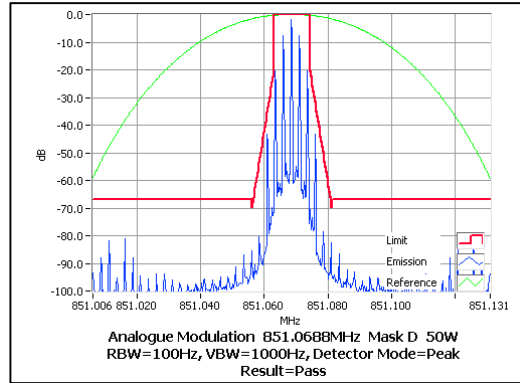
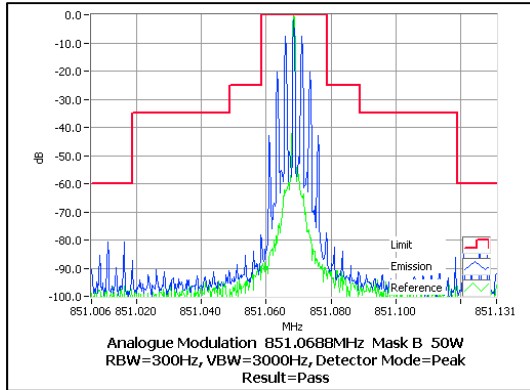
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & D

RSS-119 5.5 Mask-D

Tx FREQUENCY: 851.06875 MHz

50 W

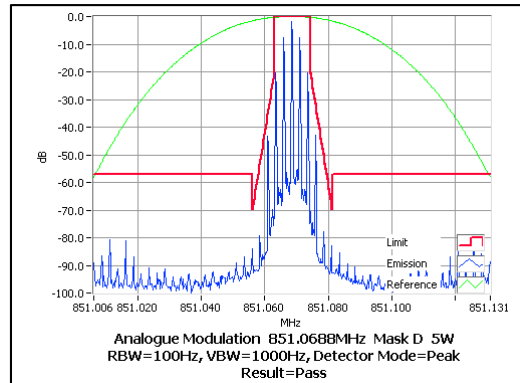
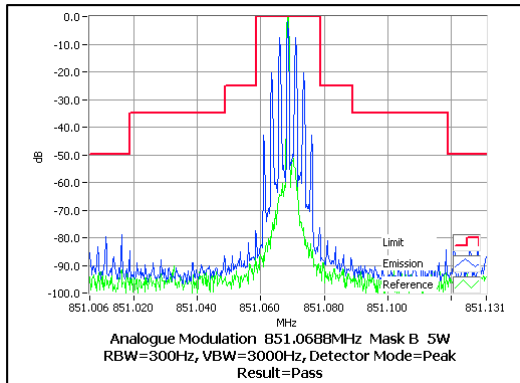
12.5 kHz Channel Spacing



Tx FREQUENCY: 851.06875 MHz

5 W

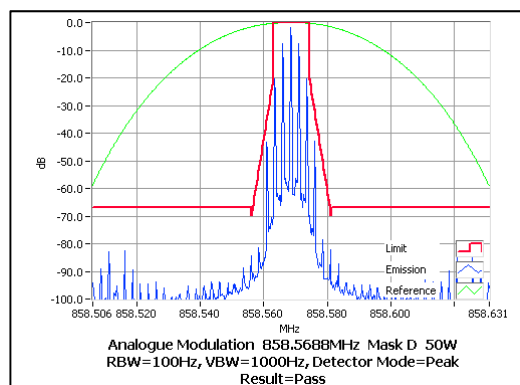
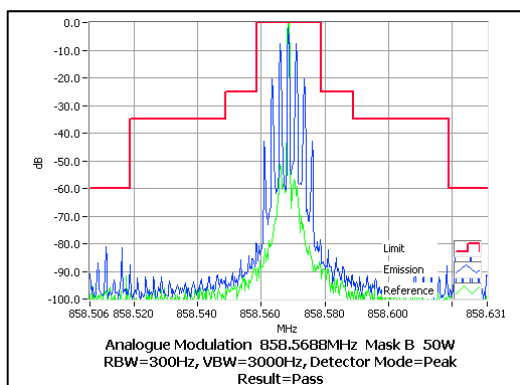
12.5 kHz Channel Spacing



Tx FREQUENCY: 858.56875 MHz

50 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

Analogue

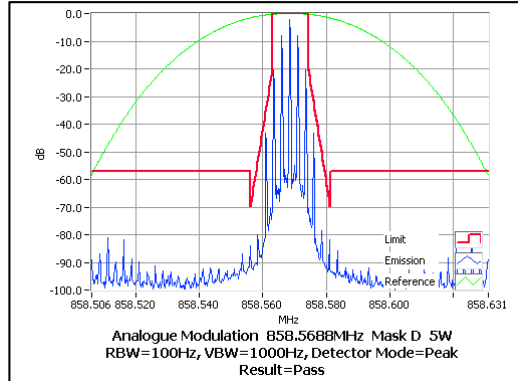
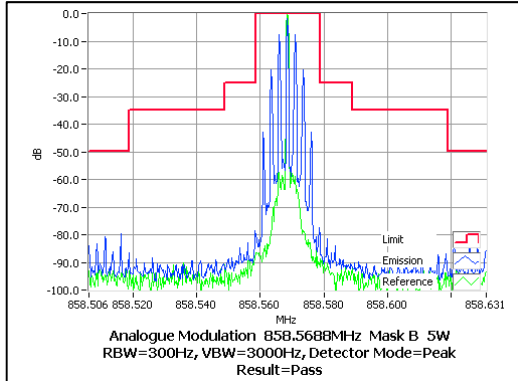
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & D

RSS-119 5.5 Mask-D

Tx FREQUENCY: 858.56875 MHz

5 W

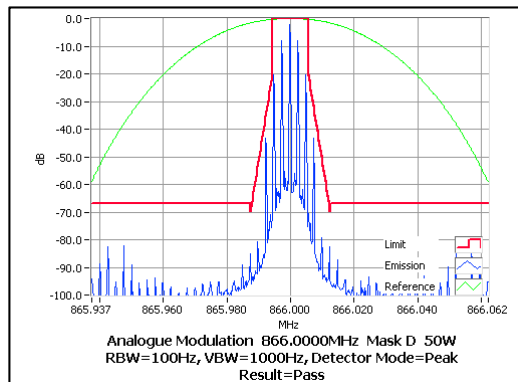
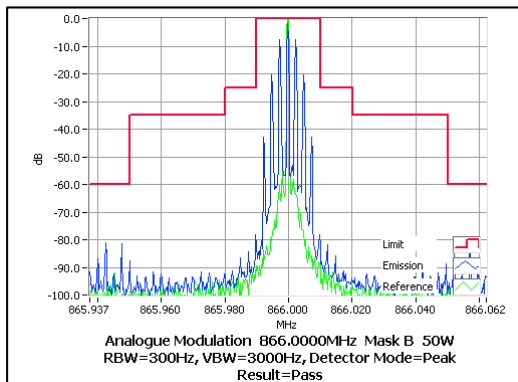
12.5 kHz Channel Spacing



Tx FREQUENCY: 866.00000 MHz

50 W

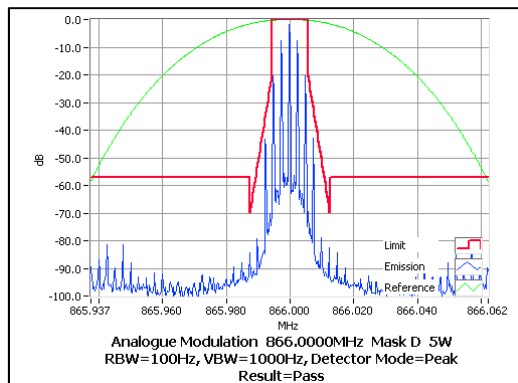
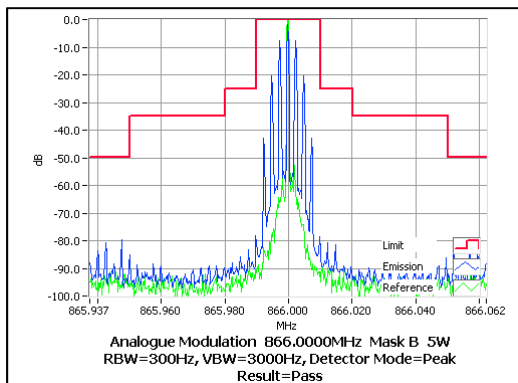
12.5 kHz Channel Spacing



Tx FREQUENCY: 866.00000 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

Analogue

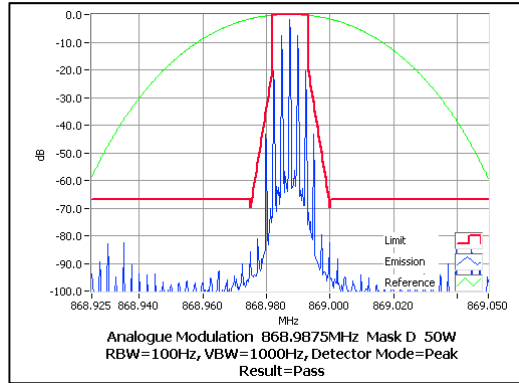
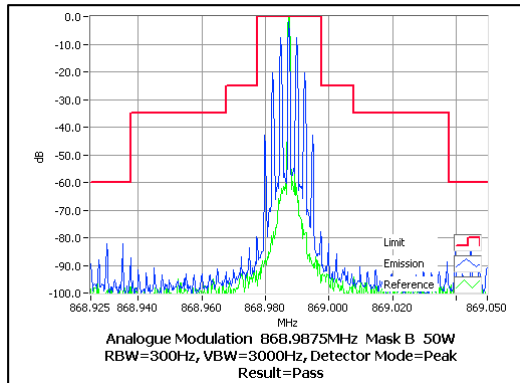
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & D

RSS-119 5.5 Mask-D

Tx FREQUENCY: 868.98750 MHz

50 W

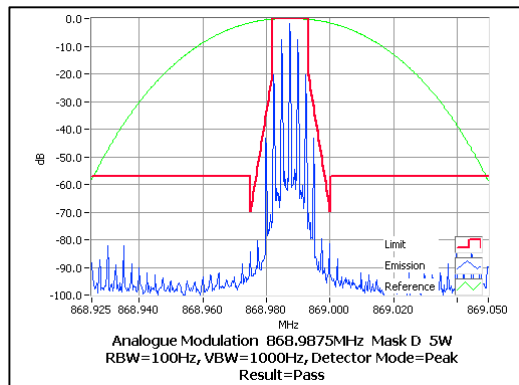
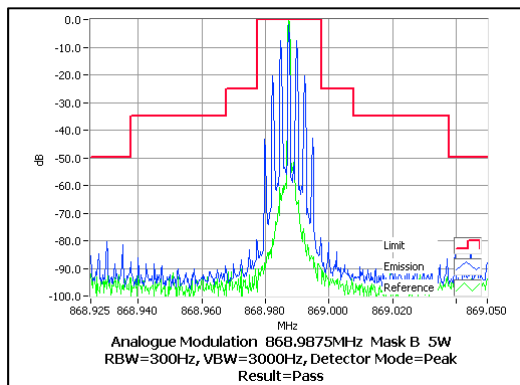
12.5 kHz Channel Spacing



Tx FREQUENCY: 868.98750 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-1 C4FM

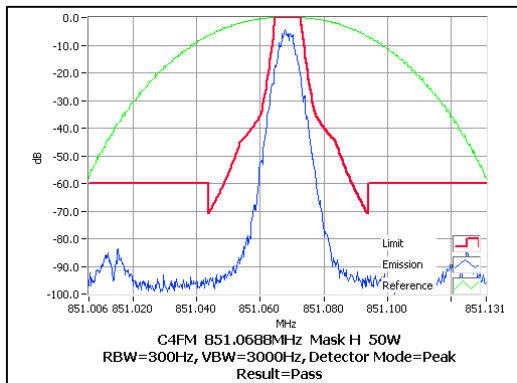
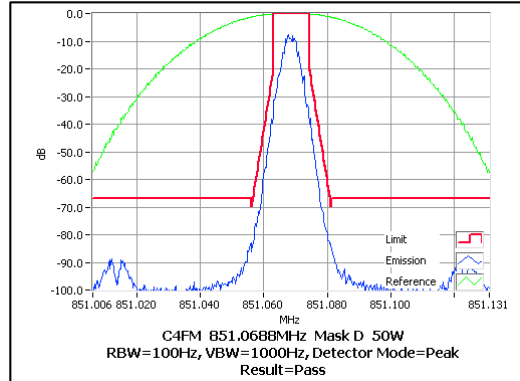
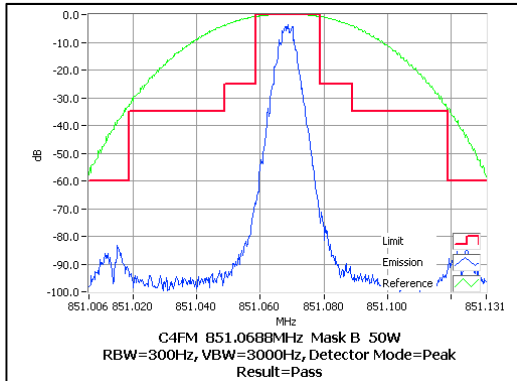
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & H

RSS-119 5.5 Mask-D

Tx FREQUENCY: 851.06875 MHz

50 W

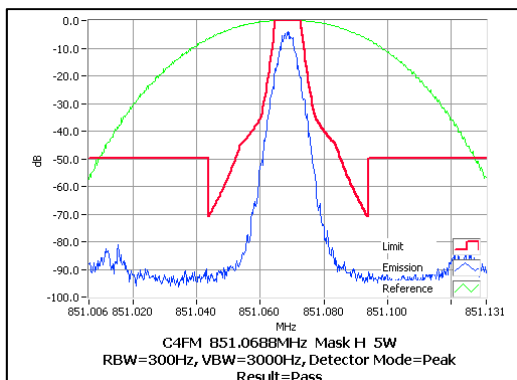
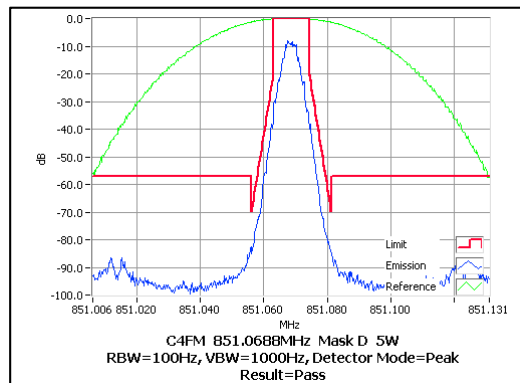
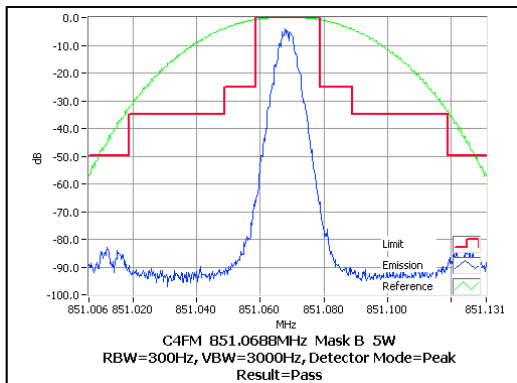
12.5 kHz Channel Spacing



Tx FREQUENCY: 851.06875 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-1 C4FM

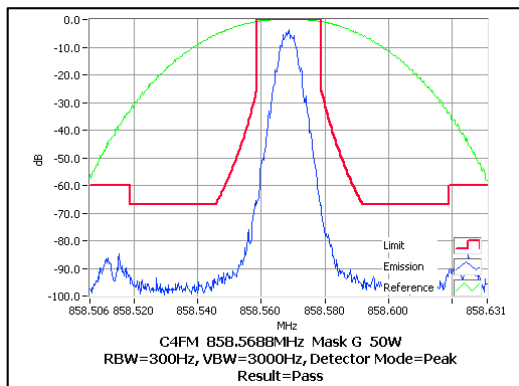
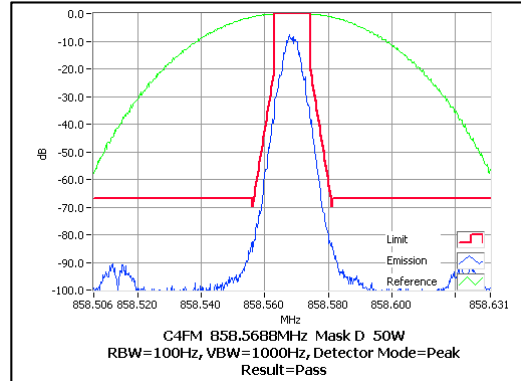
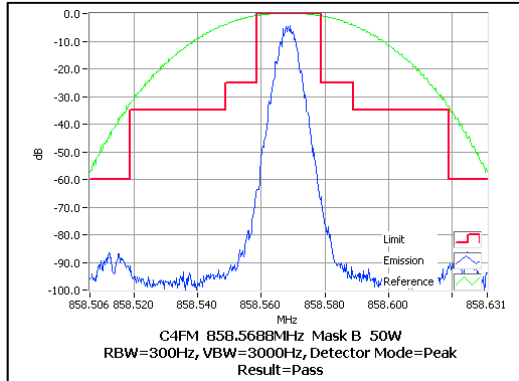
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & G

RSS-119 5.5 Mask-D

Tx FREQUENCY: 858.56875 MHz

50 W

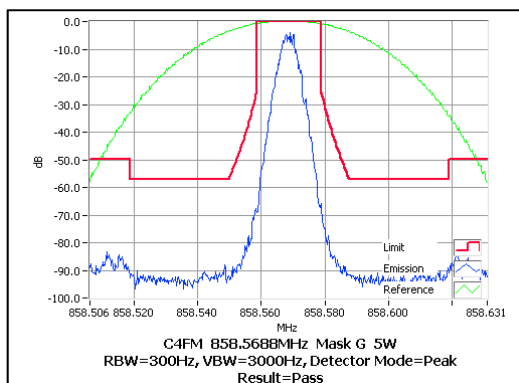
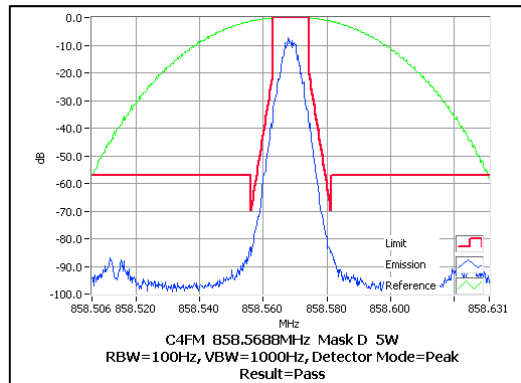
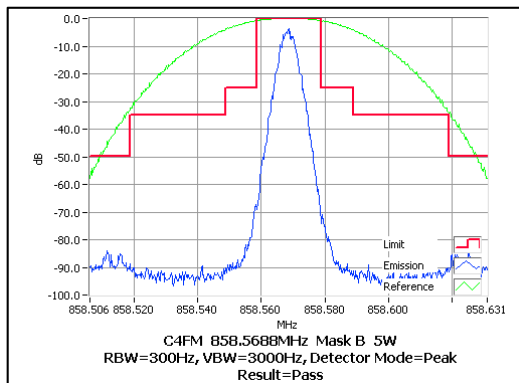
12.5 kHz Channel Spacing



Tx FREQUENCY: 858.56875 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-1 C4FM

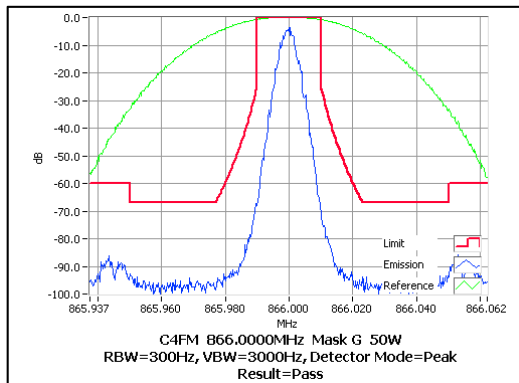
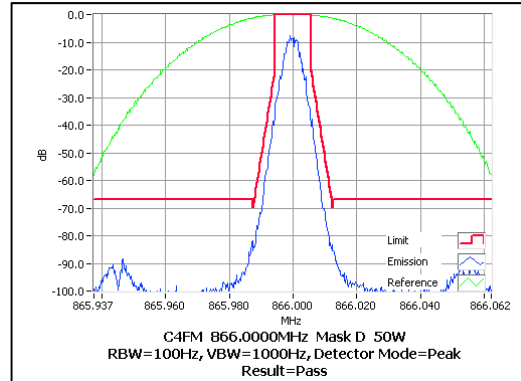
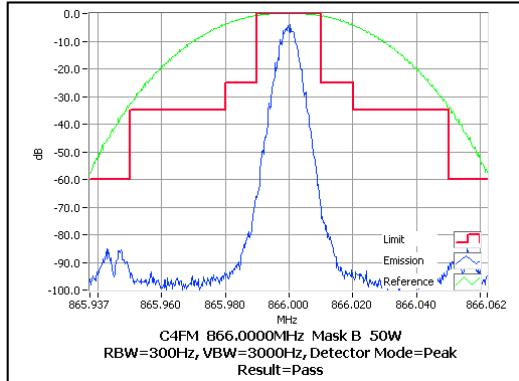
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & G

RSS-119 5.5 Mask-D

Tx FREQUENCY: 866.00000 MHz

50 W

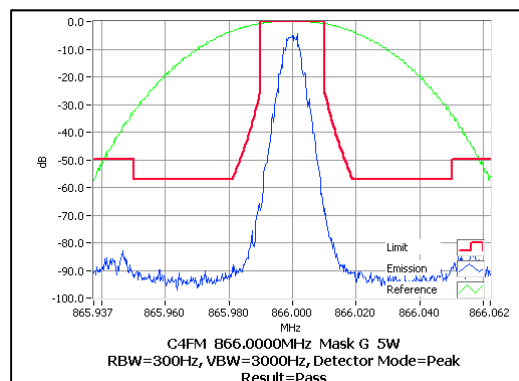
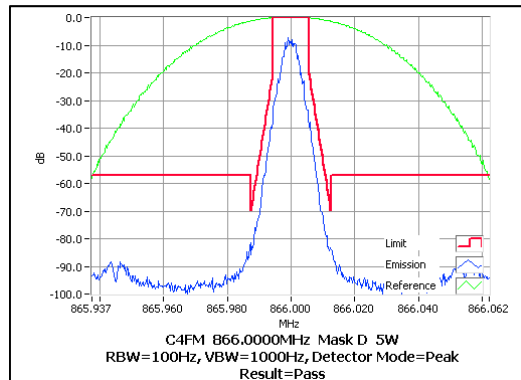
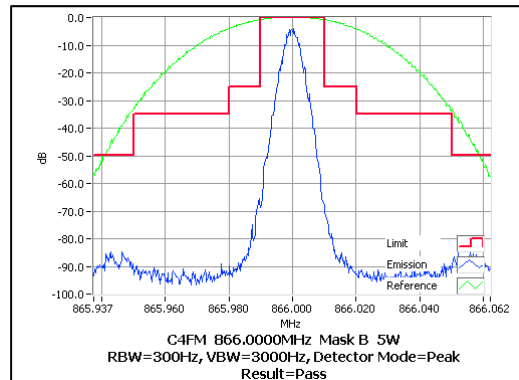
12.5 kHz Channel Spacing



Tx FREQUENCY: 866.00000 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-1 C4FM

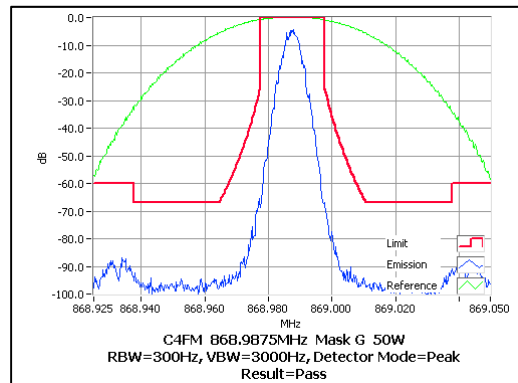
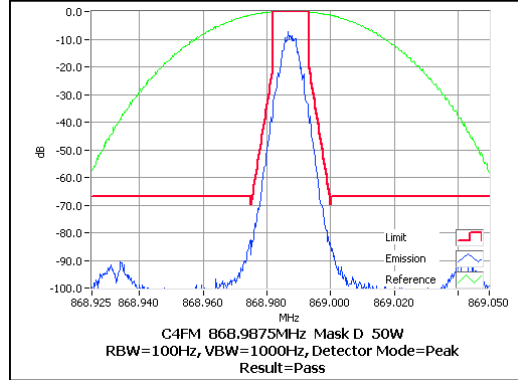
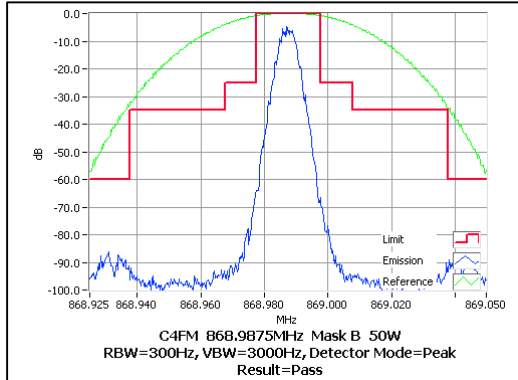
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & G

RSS-119 5.5 Mask-D

Tx FREQUENCY: 868.98750 MHz

50 W

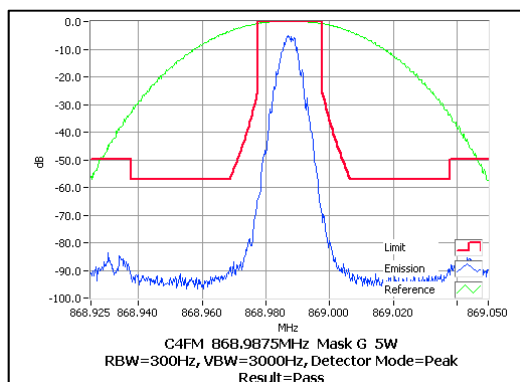
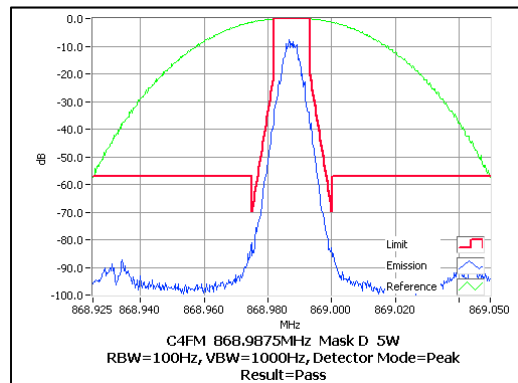
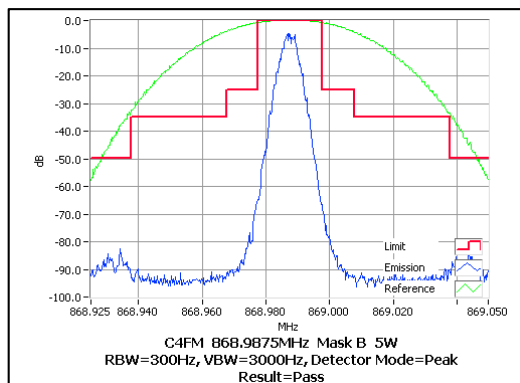
12.5 kHz Channel Spacing



Tx FREQUENCY: 868.98750 MHz

5 W

12.5 kHz Channel Spacing



APCO P25 Phase-1 LSM

Tx FREQUENCY: 764.06875 MHz 50 W & 5 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: 770.06875 MHz 50 W & 5 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: 774.98750 MHz 50 W & 5 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

APCO P25 Phase-1 LSM

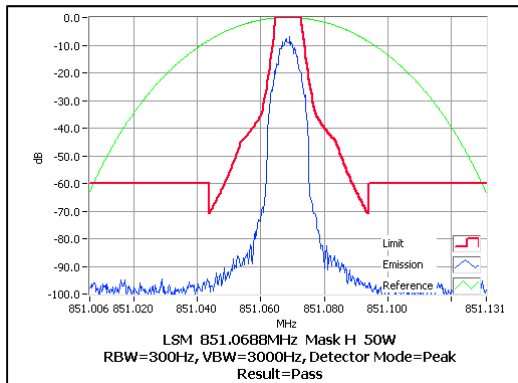
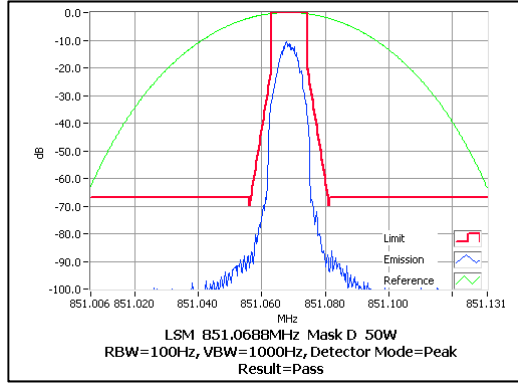
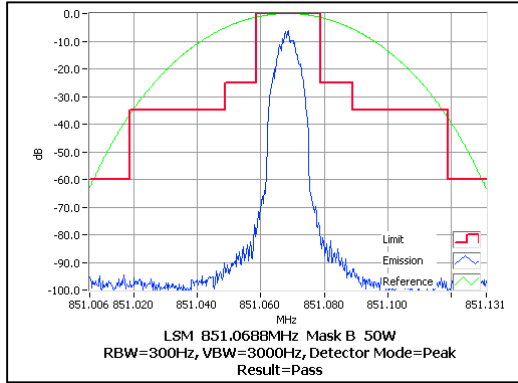
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & H

RSS-119 5.5 Mask-D

Tx FREQUENCY: 851.06875 MHz

50 W

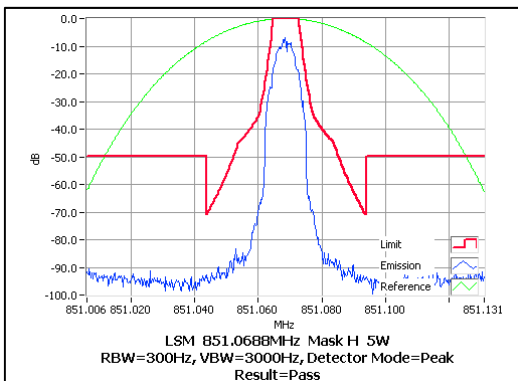
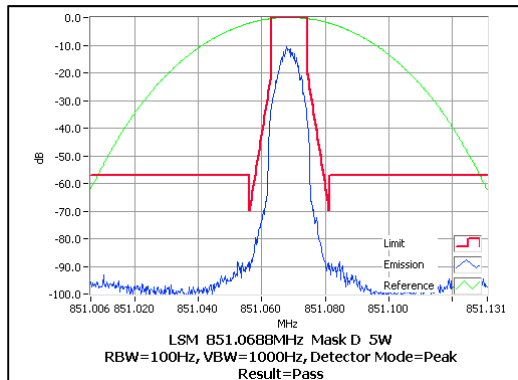
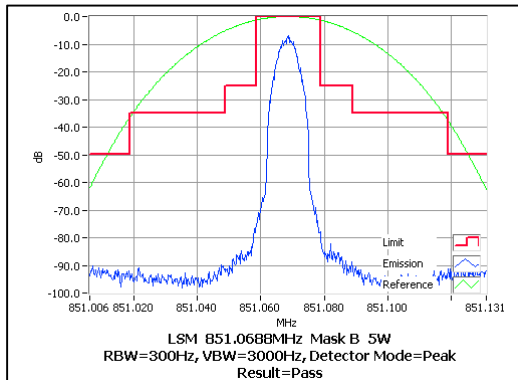
12.5 kHz Channel Spacing



Tx FREQUENCY: 851.06875 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-1 LSM

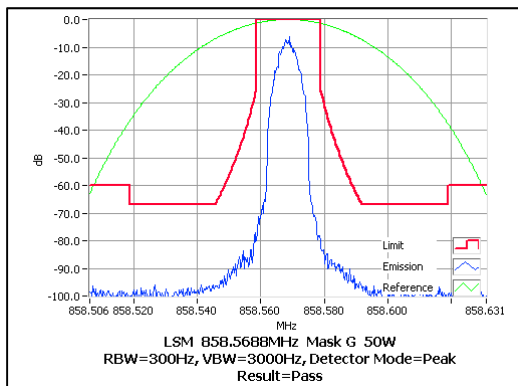
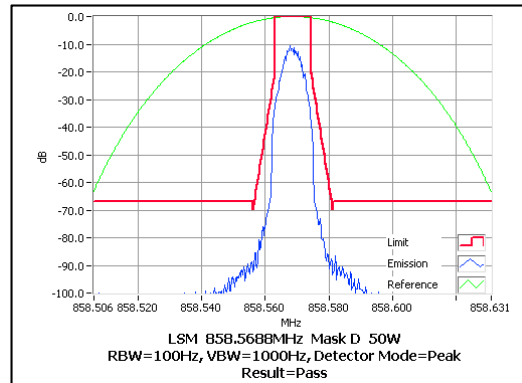
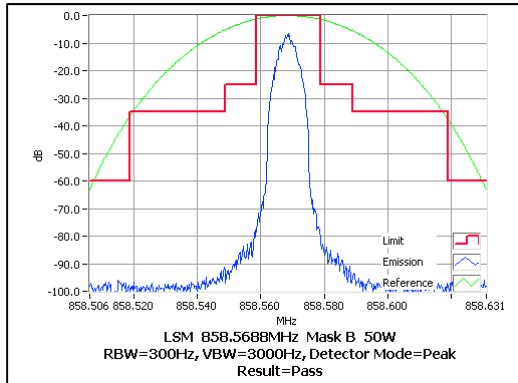
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & G

RSS-119 5.5 Mask-D

Tx FREQUENCY: 858.56875 MHz

50 W

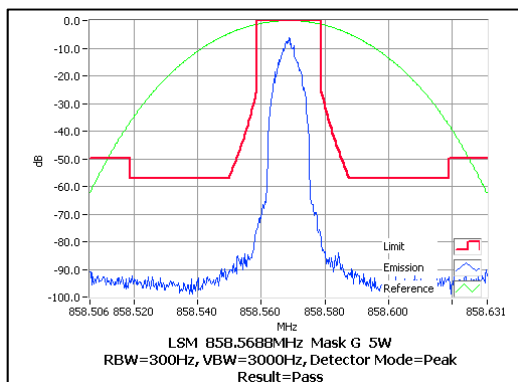
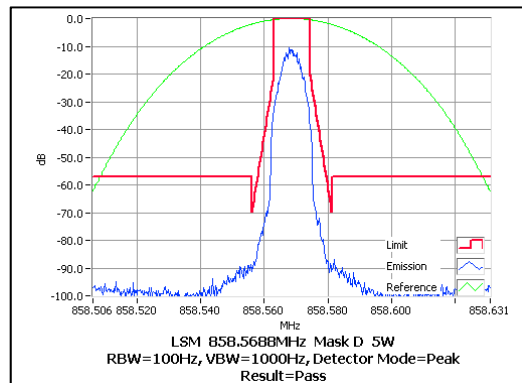
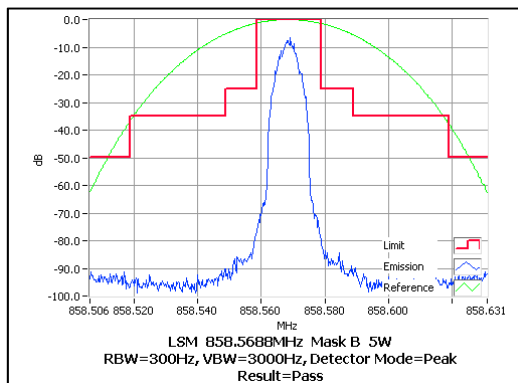
12.5 kHz Channel Spacing



Tx FREQUENCY: 858.56875 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-1 LSM

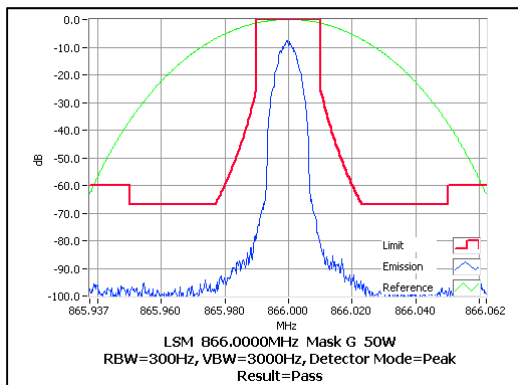
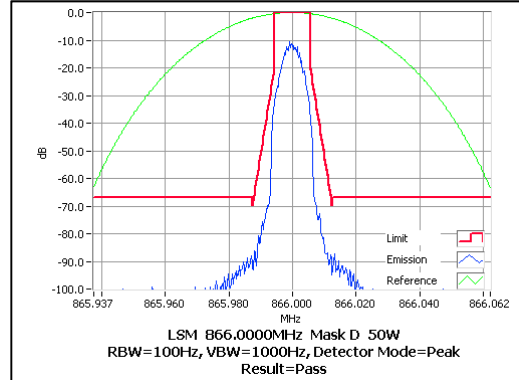
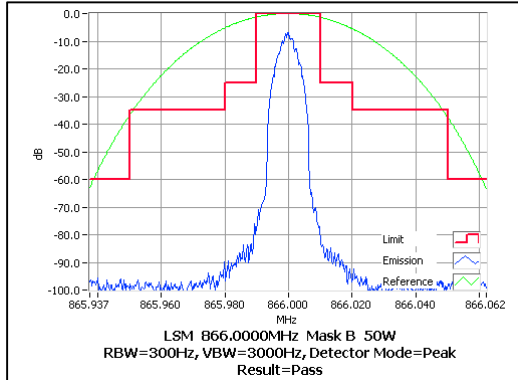
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & G

RSS-119 5.5 Mask-D

Tx FREQUENCY: 866.00000 MHz

50 W

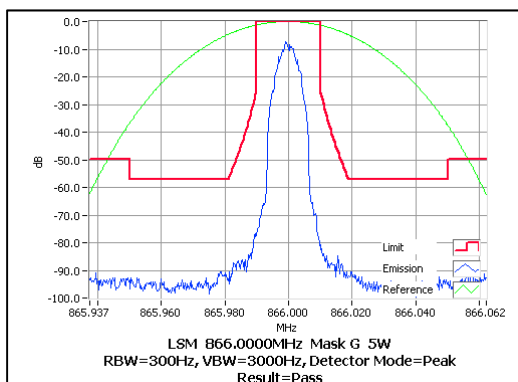
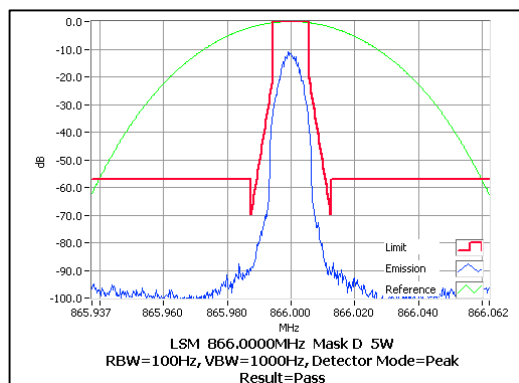
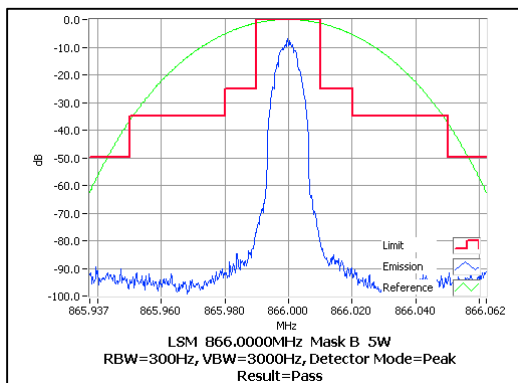
12.5 kHz Channel Spacing



Tx FREQUENCY: 866.00000 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-1 LSM

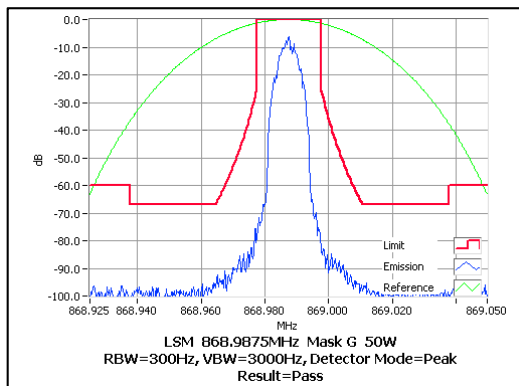
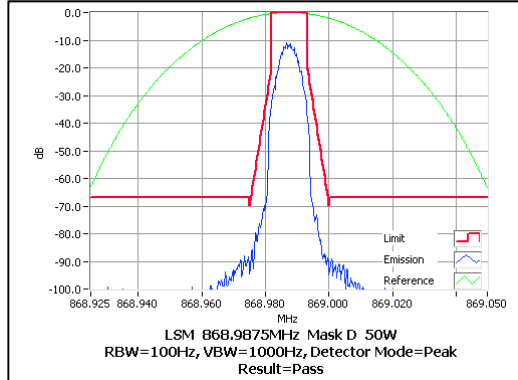
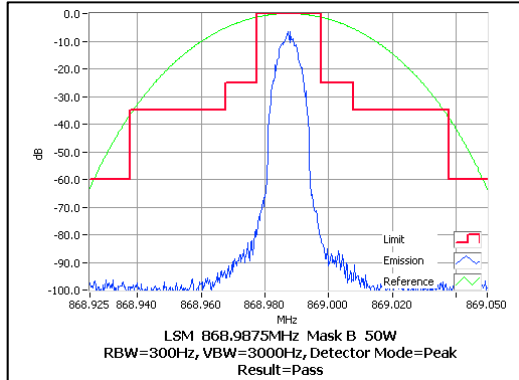
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & G

RSS-119 5.5 Mask-D

Tx FREQUENCY: 868.98750 MHz

50 W

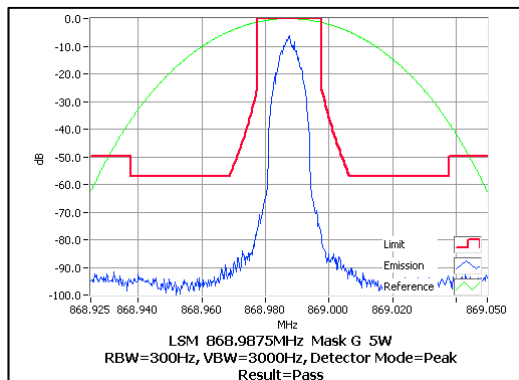
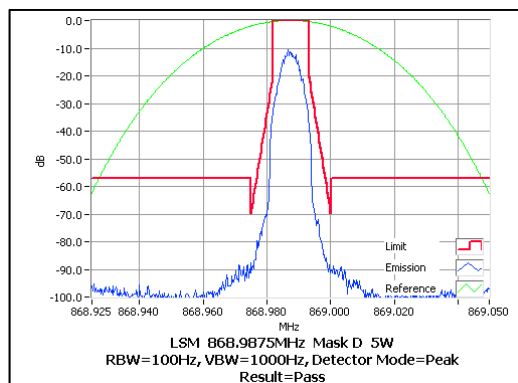
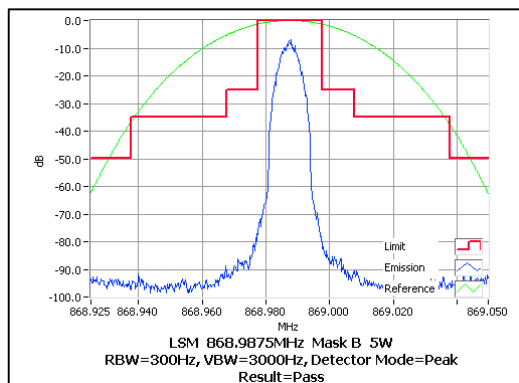
12.5 kHz Channel Spacing



Tx FREQUENCY: 868.98750 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-2 H-DQPSK

Tx FREQUENCY: 764.06875 MHz 50 W & 5 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: 770.06875 MHz 50 W & 5 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: 774.98750 MHz 50 W & 5 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

APCO P25 Phase-2 H-DQPSK

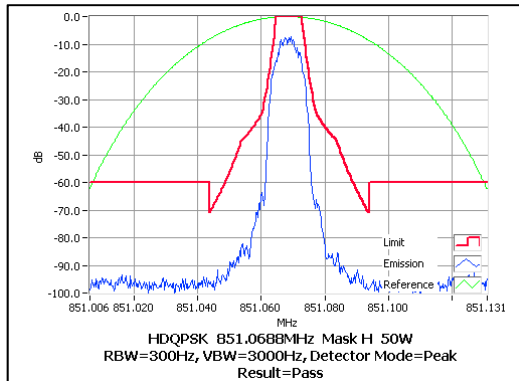
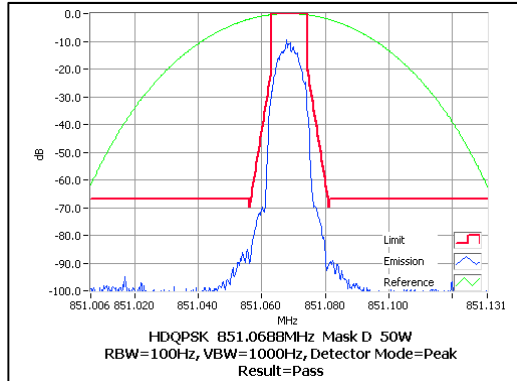
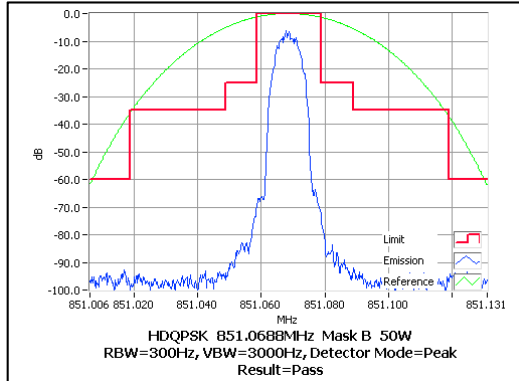
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & H

RSS-119 5.5 Mask-D

Tx FREQUENCY: 851.06875 MHz

50 W

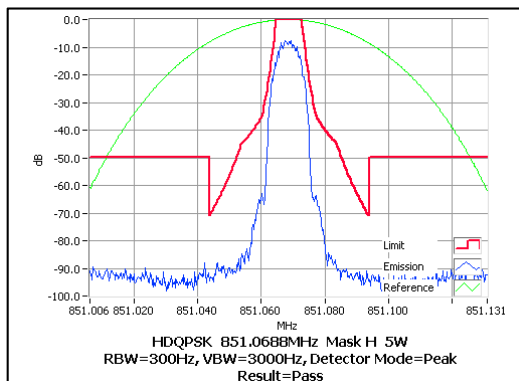
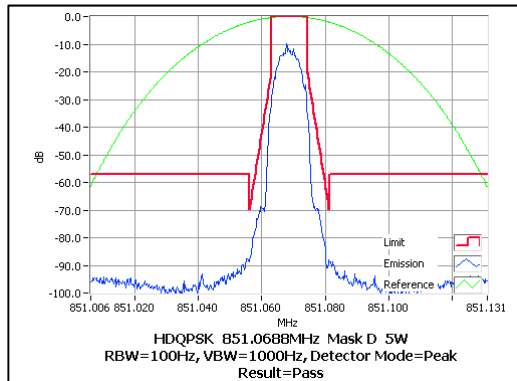
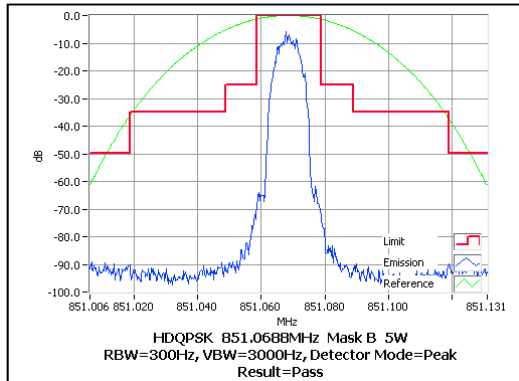
12.5 kHz Channel Spacing



Tx FREQUENCY: 851.06875 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-2 H-DQPSK

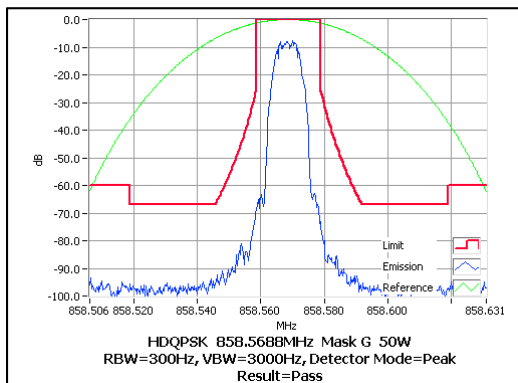
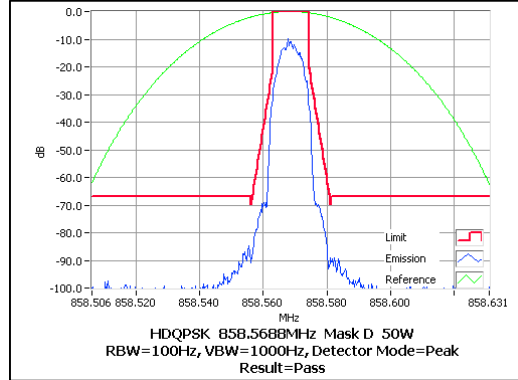
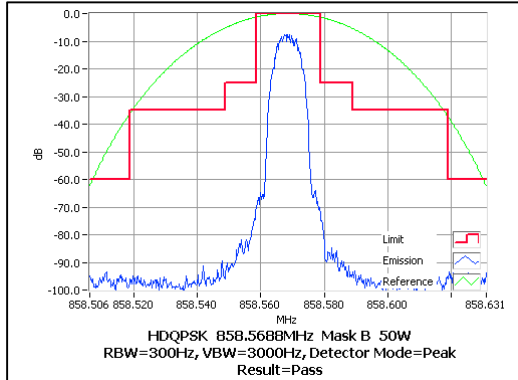
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & G

RSS-119 5.5 Mask-D

Tx FREQUENCY: 858.56875 MHz

50 W

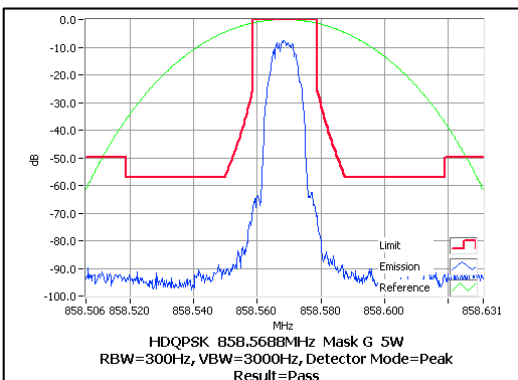
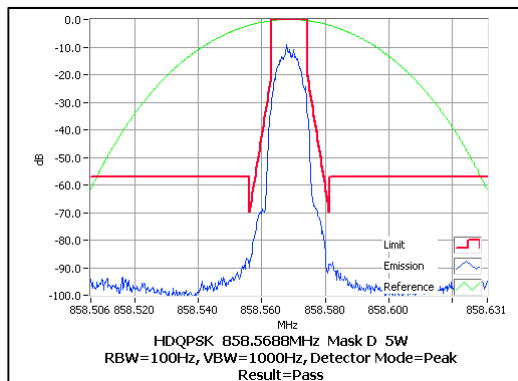
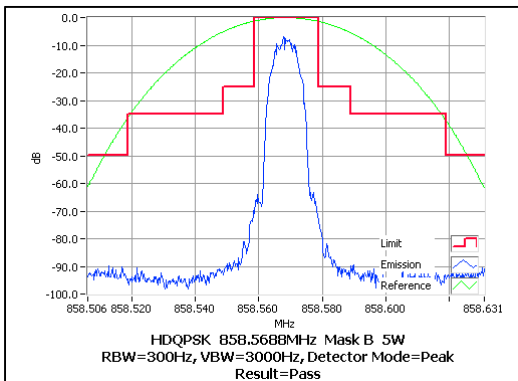
12.5 kHz Channel Spacing



Tx FREQUENCY: 858.56875 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-2 H-DQPSK

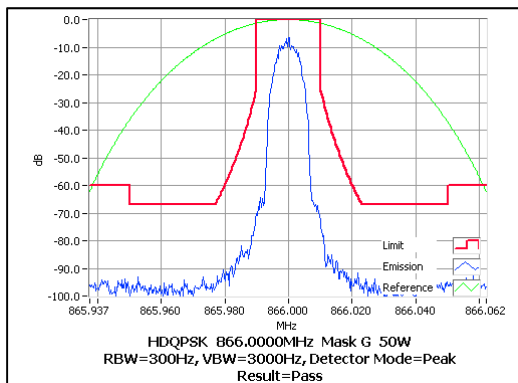
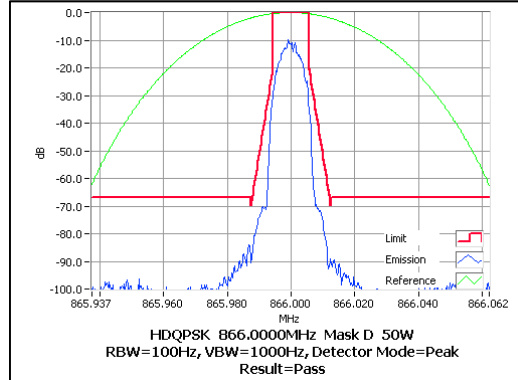
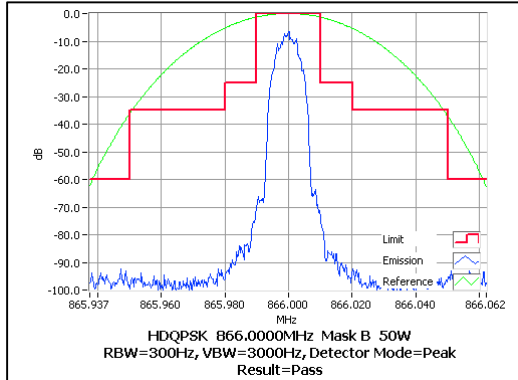
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & G

RSS-119 5.5 Mask-D

Tx FREQUENCY: 866.00000 MHz

50 W

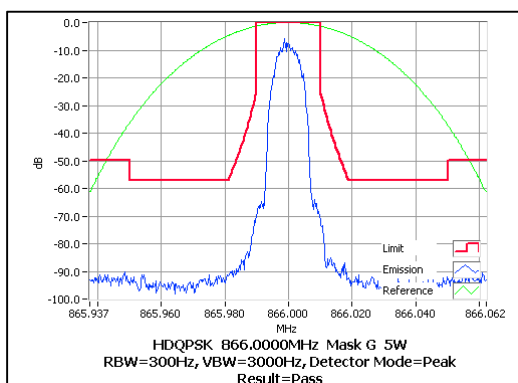
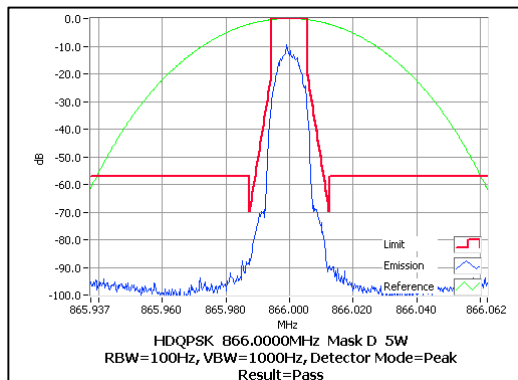
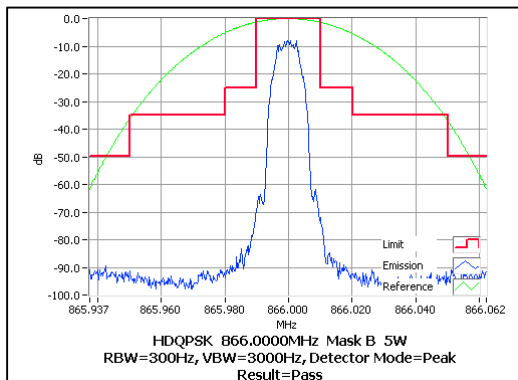
12.5 kHz Channel Spacing



Tx FREQUENCY: 866.00000 MHz

5 W

12.5 kHz Channel Spacing



Occupied Bandwidth and Spectrum Masks

APCO P25 Phase-2 H-DQPSK

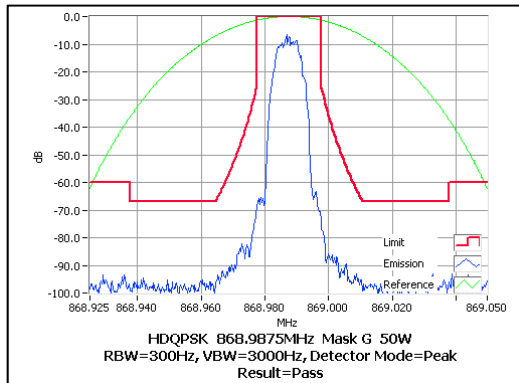
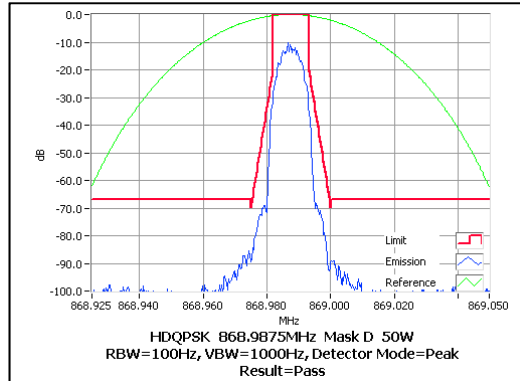
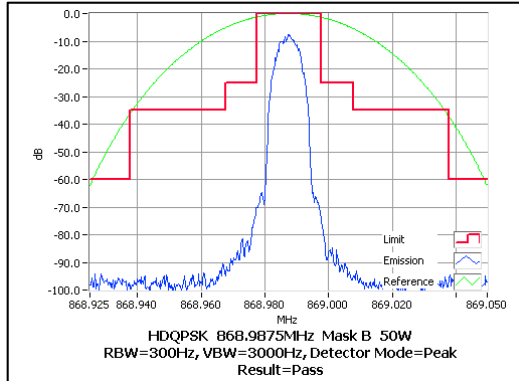
SPECIFICATION: FCC CFR 2.1049 (c) Mask-B & G

RSS-119 5.5 Mask-D

Tx FREQUENCY: 868.98750 MHz

50 W

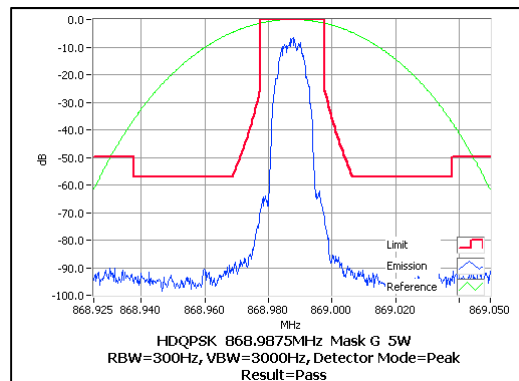
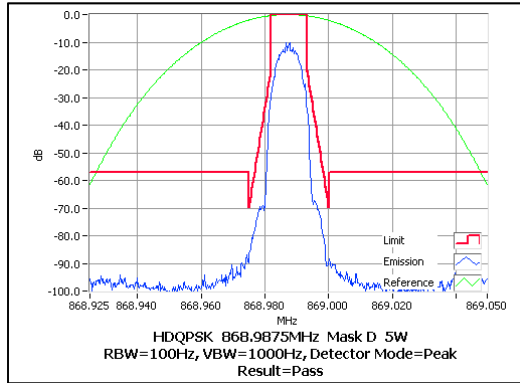
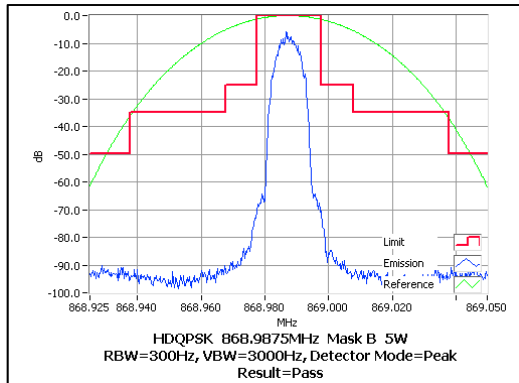
12.5 kHz Channel Spacing



Tx FREQUENCY: 868.98750 MHz

5 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: 764.06875 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-43.21	-43.11	-40
15.625 kHz	6.25 kHz	-82.70	-84.86	-60
21.875 kHz	6.25 kHz	-88.59	-88.41	-60
37.5 kHz	25 kHz	-83.09	-83.20	-60
62.5 kHz	25 kHz	-78.24	-78.37	-65
87.5 kHz	25 kHz	-82.62	-82.48	-65
150 kHz	100 kHz	-75.22	-75.14	-65
250 kHz	100 kHz	-79.94	-79.95	-65
350 kHz	100 kHz	-84.22	-84.20	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.37		-80
12 MHz to paired receive band	30 kHz (swept)	-103.61		-80
In the paired receive band	30 kHz (swept)	-116.04		-100

Adjacent Channel Power - Continued

Analogue

Tx FREQUENCY: 770.06875 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-43.22	-43.11	-40
15.625 kHz	6.25 kHz	-82.80	-85.03	-60
21.875 kHz	6.25 kHz	-88.70	-88.37	-60
37.5 kHz	25 kHz	-83.11	-83.25	-60
62.5 kHz	25 kHz	-78.29	-78.40	-65
87.5 kHz	25 kHz	-82.77	-82.57	-65
150 kHz	100 kHz	-75.74	-75.62	-65
250 kHz	100 kHz	-81.31	-81.40	-65
350 kHz	100 kHz	-90.12	-87.02	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.39		-80
12 MHz to paired receive band	30 kHz (swept)	-102.66		-80
In the paired receive band	30 kHz (swept)	-115.66		-100

Analogue

Tx FREQUENCY: 774.98750 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-43.26	-43.13	-40
15.625 kHz	6.25 kHz	-83.33	-84.96	-60
21.875 kHz	6.25 kHz	-86.60	-86.57	-60
37.5 kHz	25 kHz	-82.55	-82.60	-60
62.5 kHz	25 kHz	-78.74	-78.82	-65
87.5 kHz	25 kHz	-82.41	-82.30	-65
150 kHz	100 kHz	-75.57	-75.66	-65
250 kHz	100 kHz	-81.16	-81.37	-65
350 kHz	100 kHz	-88.86	-86.56	-65
>400 kHz to 12 MHz	30 kHz (swept)	-89.56		-80
12 MHz to paired receive band	30 kHz (swept)	-102.76		-80
In the paired receive band	30 kHz (swept)	-115.85		-100

Adjacent Channel Power - Continued

P25 Phase-1 C4FM

Tx FREQUENCY: 764.06875 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-40.75	-42.32	-40
15.625 kHz	6.25 kHz	-79.92	-80.52	-60
21.875 kHz	6.25 kHz	-88.71	-88.74	-60
37.5 kHz	25 kHz	-84.50	-84.54	-60
62.5 kHz	25 kHz	-79.31	-79.33	-65
87.5 kHz	25 kHz	-82.80	-82.52	-65
150 kHz	100 kHz	-75.25	-75.10	-65
250 kHz	100 kHz	-79.78	-79.72	-65
350 kHz	100 kHz	-83.97	-84.06	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.02		-80
12 MHz to paired receive band	30 kHz (swept)	-101.00		-80
In the paired receive band	30 kHz (swept)	-115.37		-100

P25 Phase-1 C4FM

Tx FREQUENCY: 770.06875 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-40.62	-42.22	-40
15.625 kHz	6.25 kHz	-79.83	-80.27	-60
21.875 kHz	6.25 kHz	-88.63	-88.73	-60
37.5 kHz	25 kHz	-84.53	-84.56	-60
62.5 kHz	25 kHz	-79.23	-79.33	-65
87.5 kHz	25 kHz	-82.87	-82.62	-65
150 kHz	100 kHz	-76.33	-75.46	-65
250 kHz	100 kHz	-80.90	-80.14	-65
350 kHz	100 kHz	-85.26	-84.51	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.44		-80
12 MHz to paired receive band	30 kHz (swept)	-101.52		-80
In the paired receive band	30 kHz (swept)	-115.27		-100

Adjacent Channel Power - Continued

P25 Phase-1 C4FM

Tx FREQUENCY: 774.98750 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-41.19	-43.30	-40
15.625 kHz	6.25 kHz	-80.03	-80.63	-60
21.875 kHz	6.25 kHz	-87.15	-87.27	-60
37.5 kHz	25 kHz	-83.47	-83.47	-60
62.5 kHz	25 kHz	-79.68	-79.79	-65
87.5 kHz	25 kHz	-82.42	-82.33	-65
150 kHz	100 kHz	-75.35	-75.27	-65
250 kHz	100 kHz	-79.82	-79.71	-65
350 kHz	100 kHz	-84.07	-84.07	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.95		-80
12 MHz to paired receive band	30 kHz (swept)	-99.58		-80
In the paired receive band	30 kHz (swept)	-115.95		-100

P25 Phase-1 LSM

Tx FREQUENCY: 764.06875 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-44.59	-47.42	-40
15.625 kHz	6.25 kHz	-80.13	-80.04	-60
21.875 kHz	6.25 kHz	-86.17	-86.22	-60
37.5 kHz	25 kHz	-83.67	-83.81	-60
62.5 kHz	25 kHz	-83.64	-83.50	-65
87.5 kHz	25 kHz	-82.67	-82.18	-65
150 kHz	100 kHz	-76.47	-75.91	-65
250 kHz	100 kHz	-80.37	-80.35	-65
350 kHz	100 kHz	-84.47	-84.36	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.88		-80
12 MHz to paired receive band	30 kHz (swept)	-99.39		-80
In the paired receive band	30 kHz (swept)	-115.86		-100

Adjacent Channel Power - Continued

P25 Phase-1 LSM

Tx FREQUENCY: 770.06875 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-44.63	-47.06	-40
15.625 kHz	6.25 kHz	-80.05	-79.88	-60
21.875 kHz	6.25 kHz	-86.17	-86.06	-60
37.5 kHz	25 kHz	-83.75	-83.91	-60
62.5 kHz	25 kHz	-83.67	-83.62	-65
87.5 kHz	25 kHz	-82.69	-82.12	-65
150 kHz	100 kHz	-76.54	-76.09	-65
250 kHz	100 kHz	-80.52	-80.43	-65
350 kHz	100 kHz	-84.68	-84.76	-65
>400 kHz to 12 MHz	30 kHz (swept)	-89.30		-80
12 MHz to paired receive band	30 kHz (swept)	-96.12		-80
In the paired receive band	30 kHz (swept)	-116.15		-100

P25 Phase-1 LSM

Tx FREQUENCY: 774.98750 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-44.68	-47.18	-40
15.625 kHz	6.25 kHz	-80.10	-79.82	-60
21.875 kHz	6.25 kHz	-85.42	-85.35	-60
37.5 kHz	25 kHz	-82.97	-83.16	-60
62.5 kHz	25 kHz	-83.28	-83.28	-65
87.5 kHz	25 kHz	-82.41	-81.95	-65
150 kHz	100 kHz	-76.39	-75.89	-65
250 kHz	100 kHz	-80.22	-80.09	-65
350 kHz	100 kHz	-84.30	-84.18	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.87		-80
12 MHz to paired receive band	30 kHz (swept)	-98.29		-80
In the paired receive band	30 kHz (swept)	-116.61		-100

Adjacent Channel Power - Continued

P25 Phase-2 H-DQPSK

Tx FREQUENCY: 764.06875 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-41.90	-43.36	-40
15.625 kHz	6.25 kHz	-80.02	-81.56	-60
21.875 kHz	6.25 kHz	-86.58	-86.85	-60
37.5 kHz	25 kHz	-82.78	-83.03	-60
62.5 kHz	25 kHz	-82.49	-82.50	-65
87.5 kHz	25 kHz	-82.73	-82.22	-65
150 kHz	100 kHz	-76.07	-75.59	-65
250 kHz	100 kHz	-80.38	-80.19	-65
350 kHz	100 kHz	-84.59	-84.54	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.66		-80
12 MHz to paired receive band	30 kHz (swept)	-100.03		-80
In the paired receive band	30 kHz (swept)	-115.77		-100

P25 Phase-2 H-DQPSK

Tx FREQUENCY: 770.06875 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-41.97	-43.41	-40
15.625 kHz	6.25 kHz	-80.08	-81.22	-60
21.875 kHz	6.25 kHz	-86.64	-86.96	-60
37.5 kHz	25 kHz	-82.78	-83.14	-60
62.5 kHz	25 kHz	-82.59	-82.57	-65
87.5 kHz	25 kHz	-82.84	-82.31	-65
150 kHz	100 kHz	-76.34	-76.03	-65
250 kHz	100 kHz	-80.63	-80.53	-65
350 kHz	100 kHz	-84.96	-85.00	-65
>400 kHz to 12 MHz	30 kHz (swept)	-91.03		-80
12 MHz to paired receive band	30 kHz (swept)	-97.15		-80
In the paired receive band	30 kHz (swept)	-115.72		-100

Adjacent Channel Power - Continued

P25 Phase-2 H-DQPSK

Tx FREQUENCY: 774.98750 MHz 50 W 12.5 kHz Channel Spacing

Frequency Offset	Measurement Bandwidth	ACP Measured Lower (dBc)	ACP Measured Upper (dBc)	Maximum ACP (dBc) Base Limits
9.375 kHz	6.25 kHz	-42.03	-43.76	-40
15.625 kHz	6.25 kHz	-79.72	-80.57	-60
21.875 kHz	6.25 kHz	-85.70	-85.88	-60
37.5 kHz	25 kHz	-81.92	-82.18	-60
62.5 kHz	25 kHz	-81.82	-81.78	-65
87.5 kHz	25 kHz	-81.93	-81.47	-65
150 kHz	100 kHz	-76.28	-75.84	-65
250 kHz	100 kHz	-80.34	-80.21	-65
350 kHz	100 kHz	-84.47	-84.45	-65
>400 kHz to 12 MHz	30 kHz (swept)	-90.71		-80
12 MHz to paired receive band	30 kHz (swept)	-97.07		-80
In the paired receive band	30 kHz (swept)	-116.76		-100

TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATIONS: FCC 47 CFR 2.1051

RSS-119 5.8

GUIDE: TIA/EIA-603D 2.2.13

MEASUREMENT PROCEDURE:

4. Refer Annex A for equipment set up.
5. The frequency range examined was from the lowest frequency generated within the EUT, to a frequency higher than the 10th Harmonic: 100 kHz to Fc-BW
Fc+ BW to 10Fc GHz
6. 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 20 dB 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.

A photograph of the test set-up is included below.

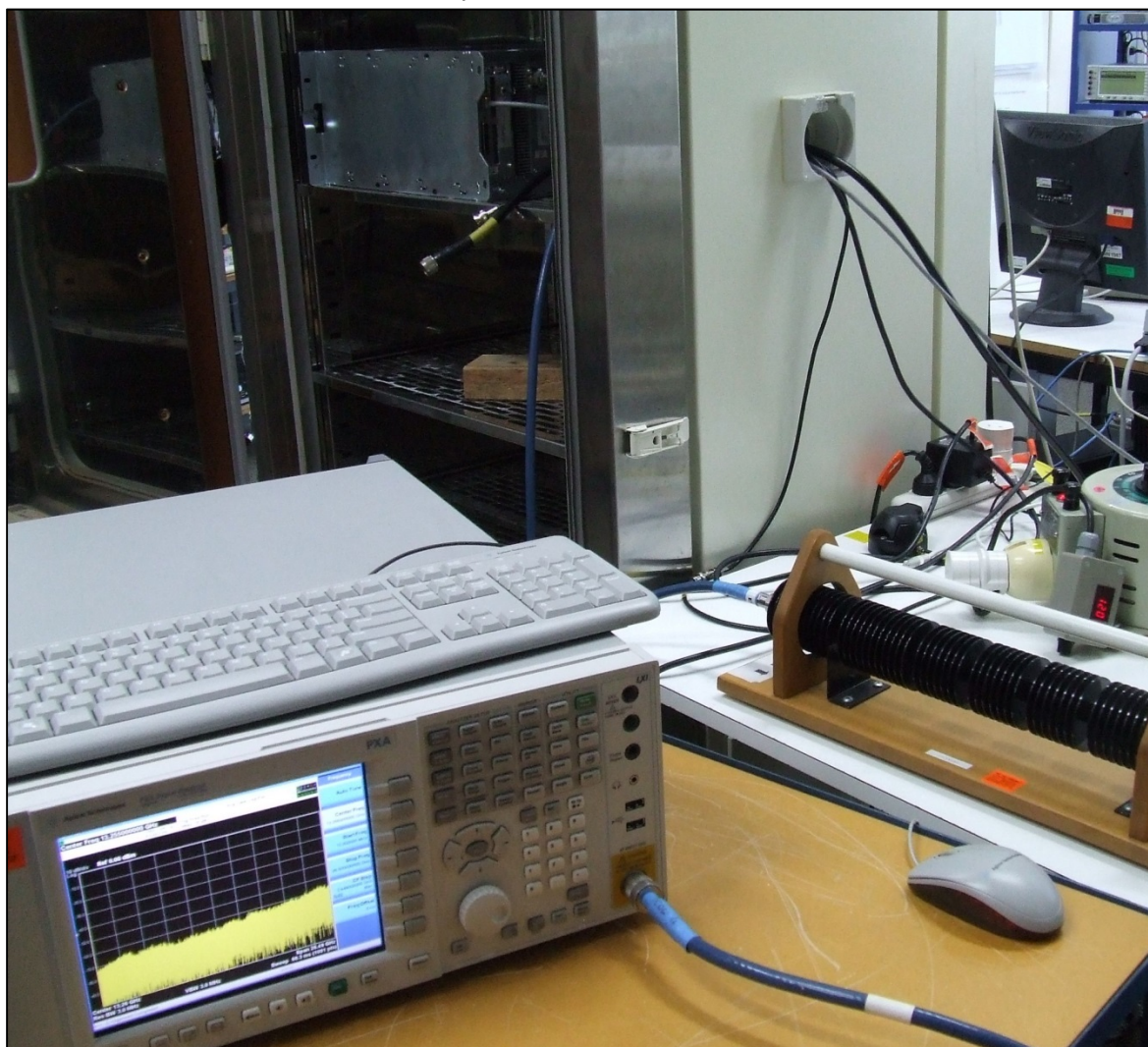
MEASUREMENT RESULTS:

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

LIMIT CLAUSES: FCC 47 CFR 90.210

RSS-119 5.8

Photo: Conducted Emissions Test Setup

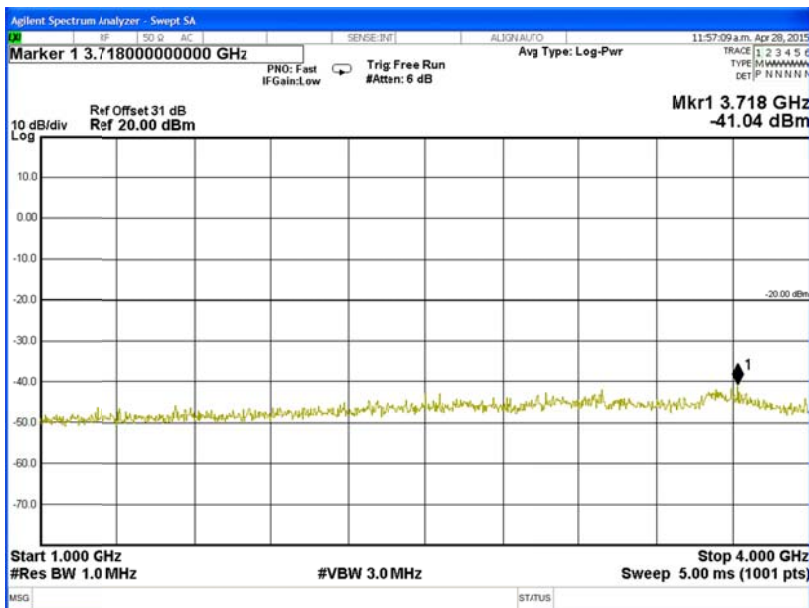
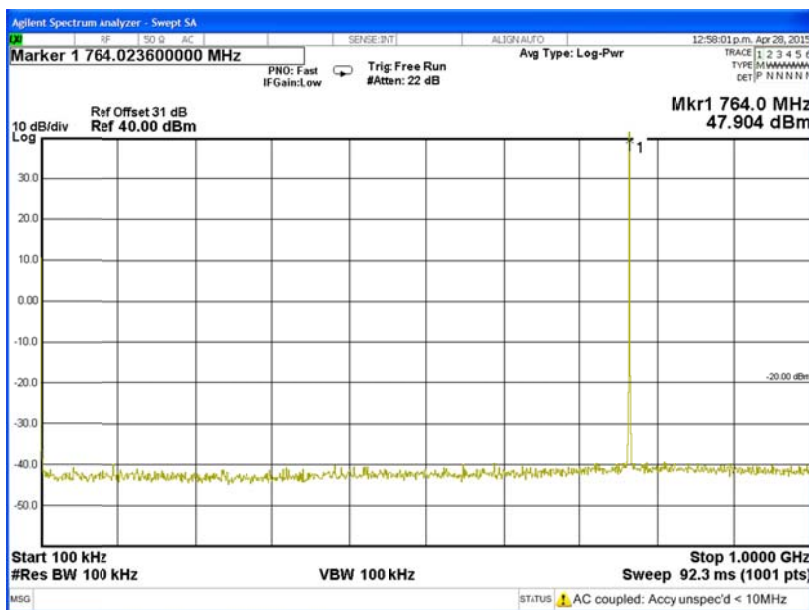


Spurious Emissions (Tx Conducted)

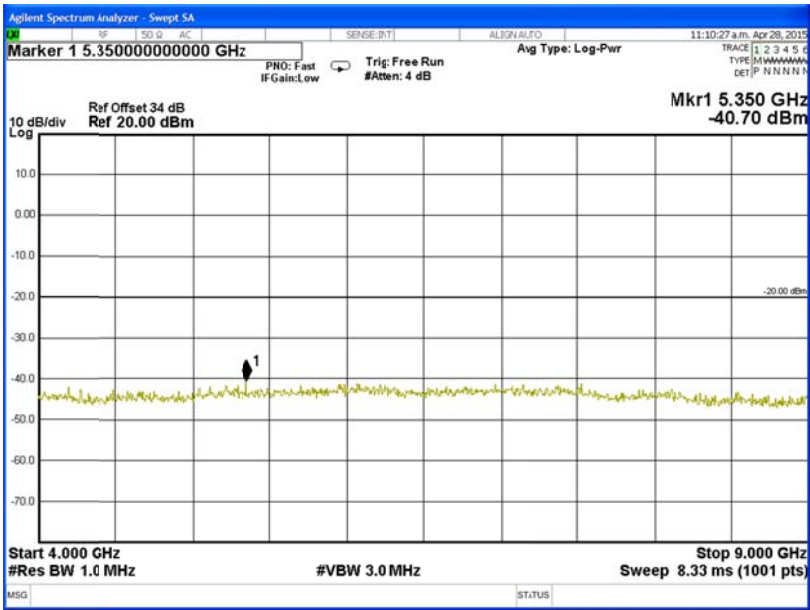
SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing	764.06875 MHz @ 50 W	FCC 90.543 (c) $43 + 10 \log_{10} (P_{\text{Watts}})$
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	764.06875 MHz @ 5 W	FCC 90.543 (c) $43 + 10 \log_{10} (P_{\text{Watts}})$
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		



Spurious Emissions (Tx Conducted)

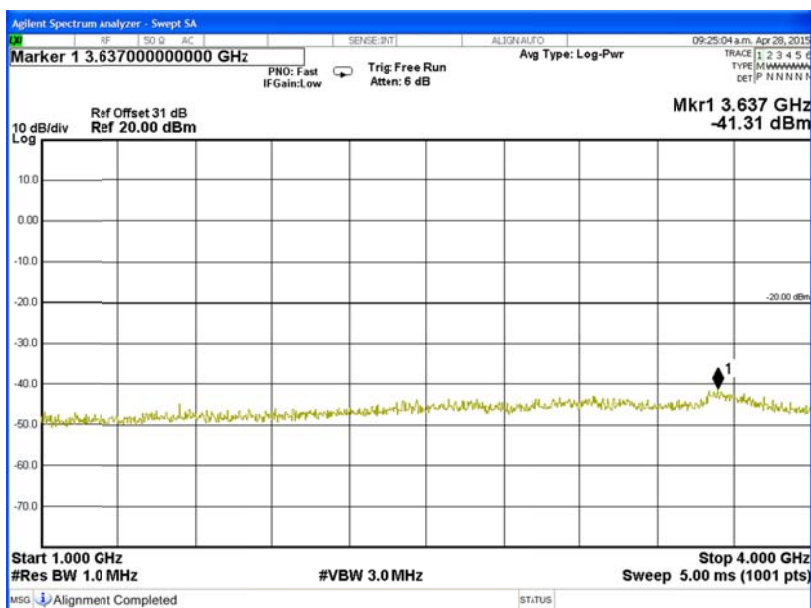
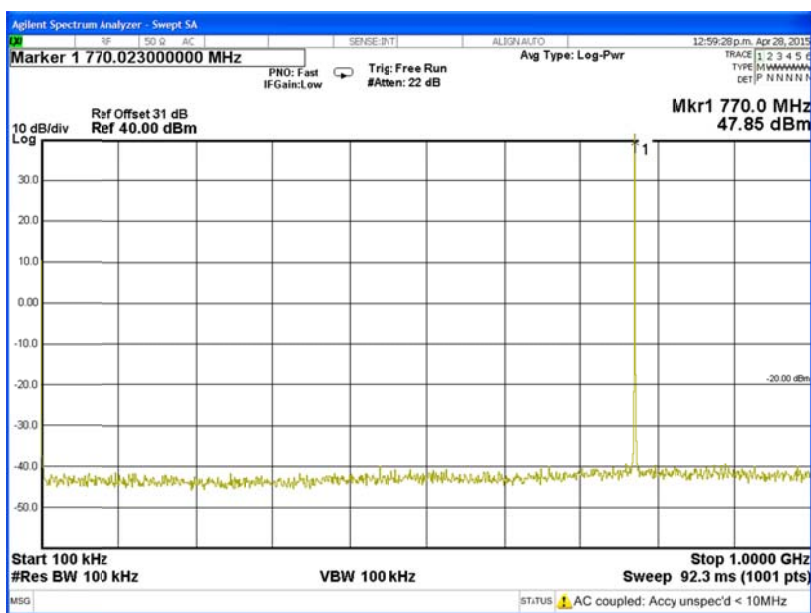


Spurious Emissions (Tx Conducted)

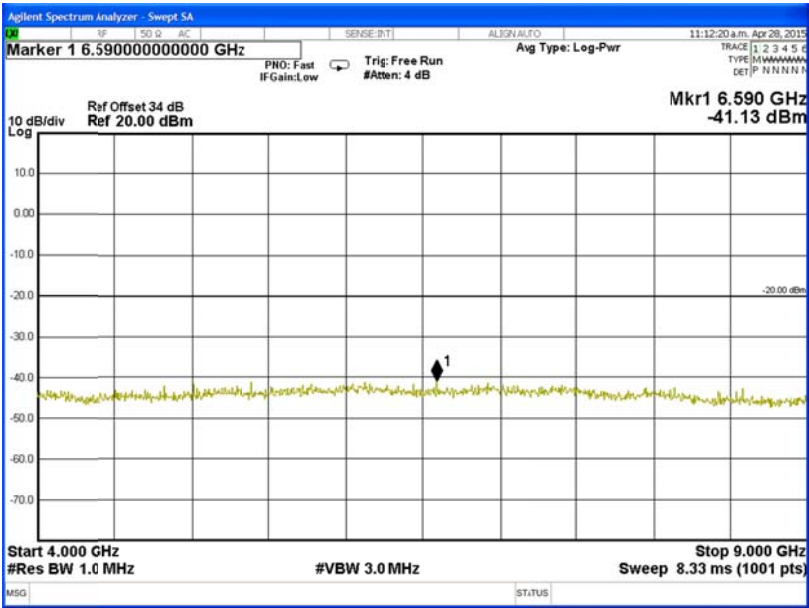
SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing	770.06875 MHz @ 50 W	FCC 90.543 (c) $43 + 10 \log_{10} (P_{\text{Watts}})$
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	770.06875 MHz @ 5 W	FCC 90.543 (c) $43 + 10 \log_{10} (P_{\text{Watts}})$
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		



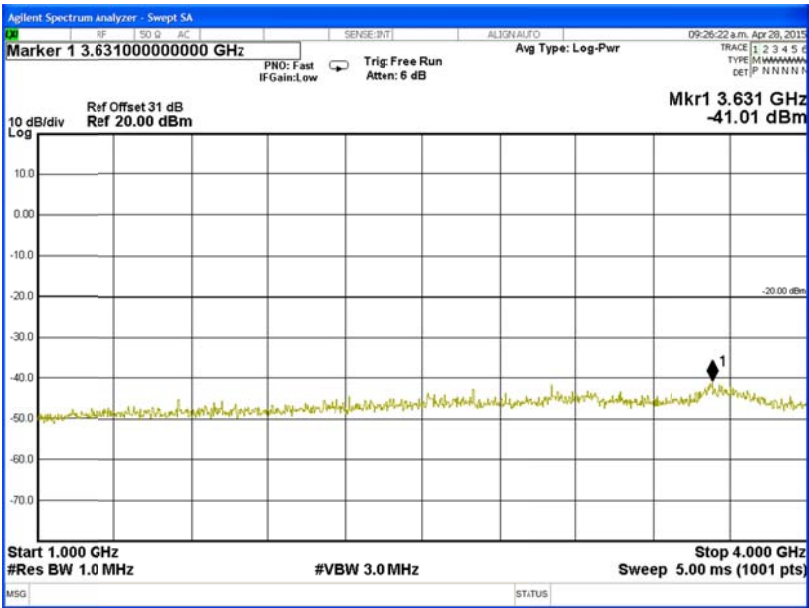
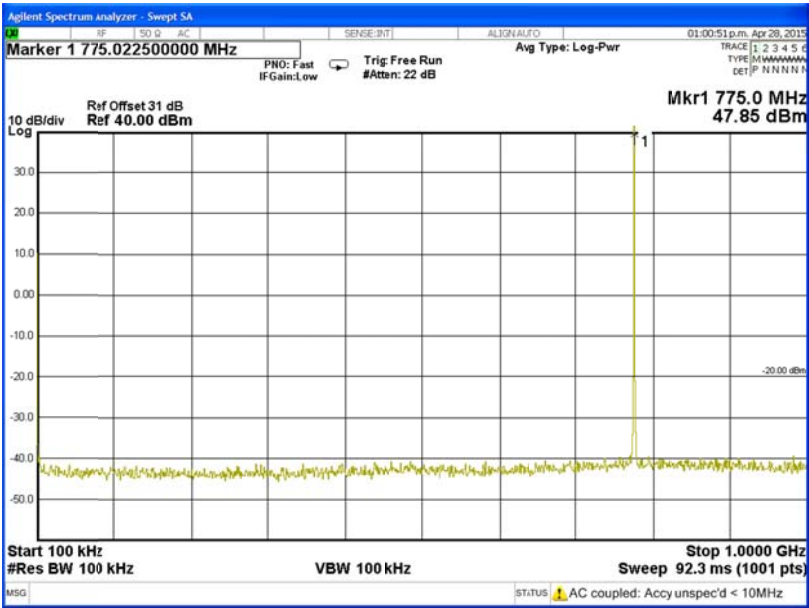
Spurious Emissions (Tx Conducted)



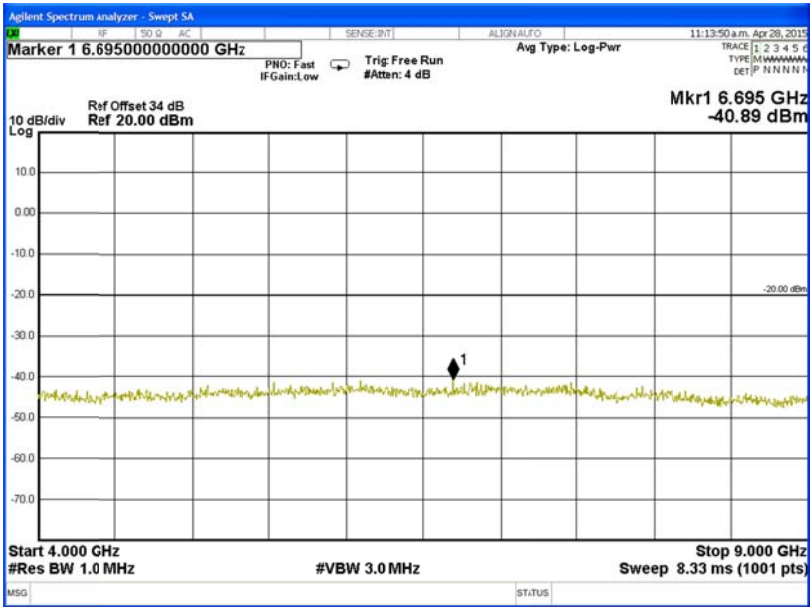
Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing	774.98750 MHz @ 50 W	FCC 90.543 (c) 43 + 10 Log ₁₀ (P _{Watts})
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	774.98750 MHz @ 5 W	FCC 90.543 (c) 43 + 10 Log ₁₀ (P _{Watts})
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		



Spurious Emissions (Tx Conducted)

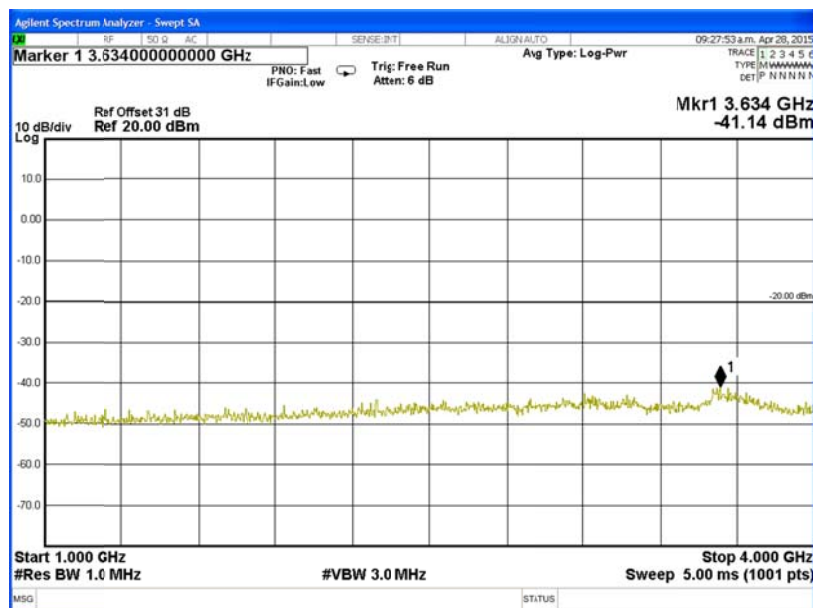
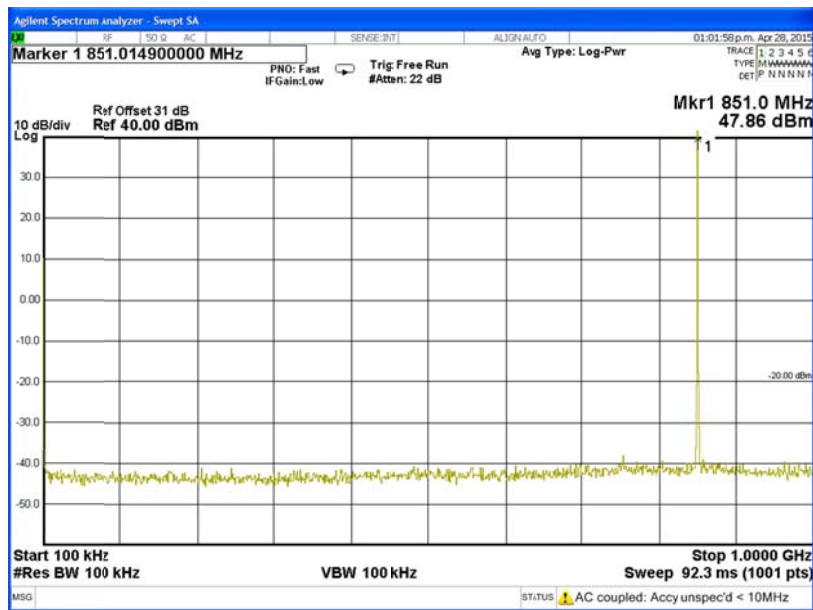


Spurious Emissions (Tx Conducted)

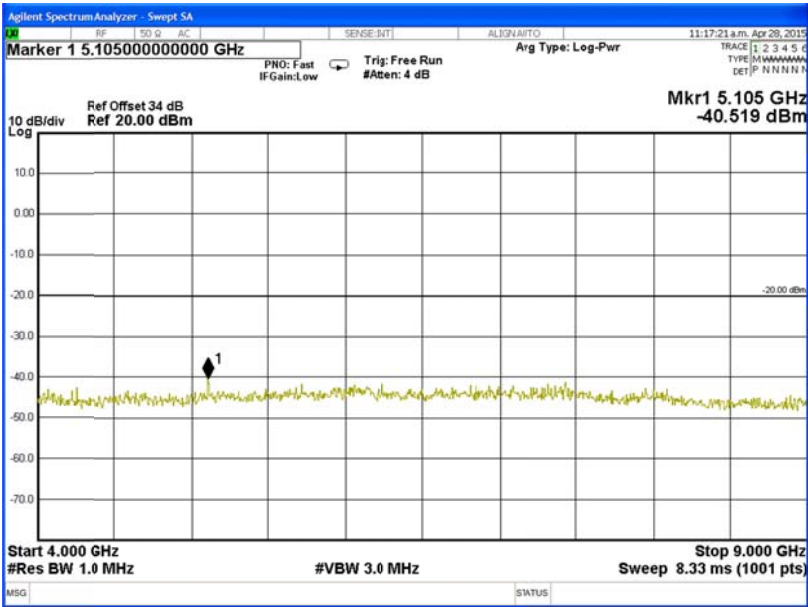
SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing	851.06875 MHz @ 50 W	RSS-119 Table-3 $50 + 10 \log_{10}(P_{\text{Watts}})$
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	851.06875 MHz @ 5 W	RSS-119 Table-3 $50 + 10 \log_{10}(P_{\text{Watts}})$
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		



Spurious Emissions (Tx Conducted)

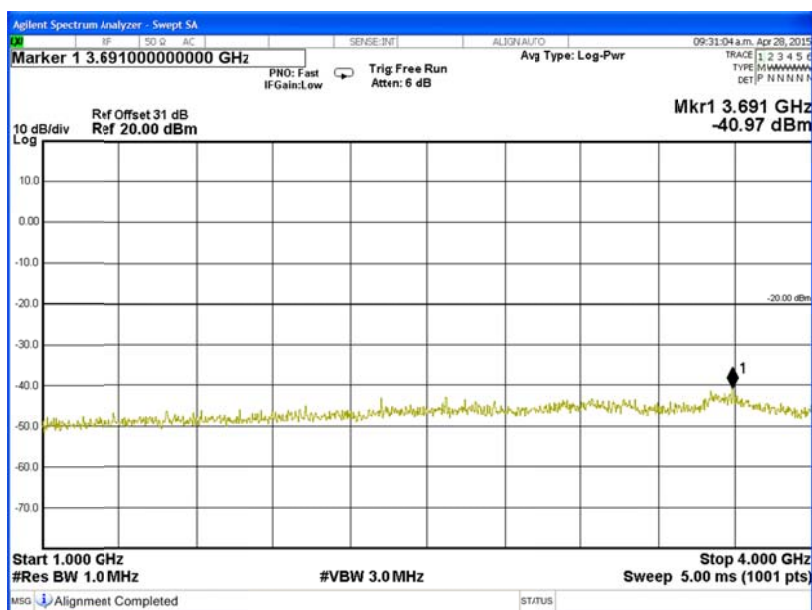
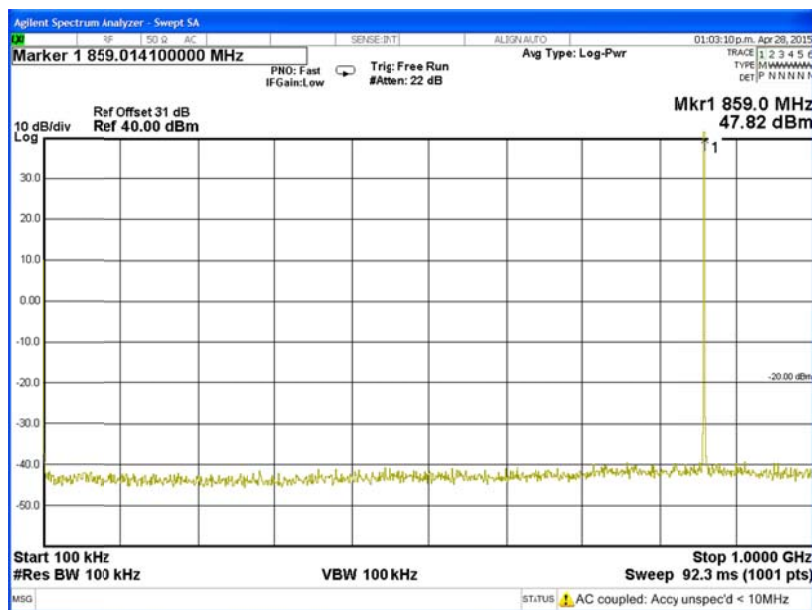


Spurious Emissions (Tx Conducted)

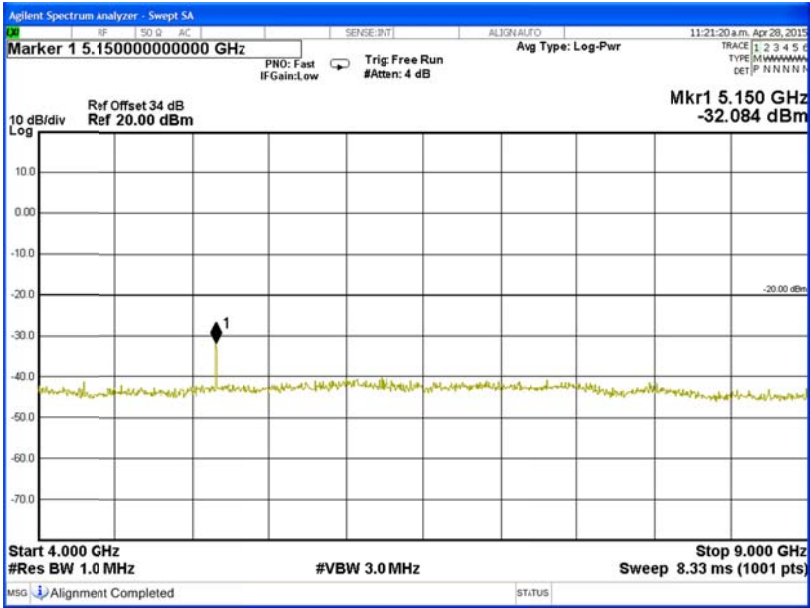
SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing	858.56875 MHz @ 50 W	RSS-119 Table-3 $50 + 10 \log_{10} (P_{\text{Watts}})$
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
5151.4125	-30.2	-77.2
12.5 kHz Channel Spacing	858.56875 MHz @ 5 W	RSS-119 Table-3 $50 + 10 \log_{10} (P_{\text{Watts}})$
~	~	~
No other emissions were detected at a level greater than 20 dB below the limit.		



Spurious Emissions (Tx Conducted)

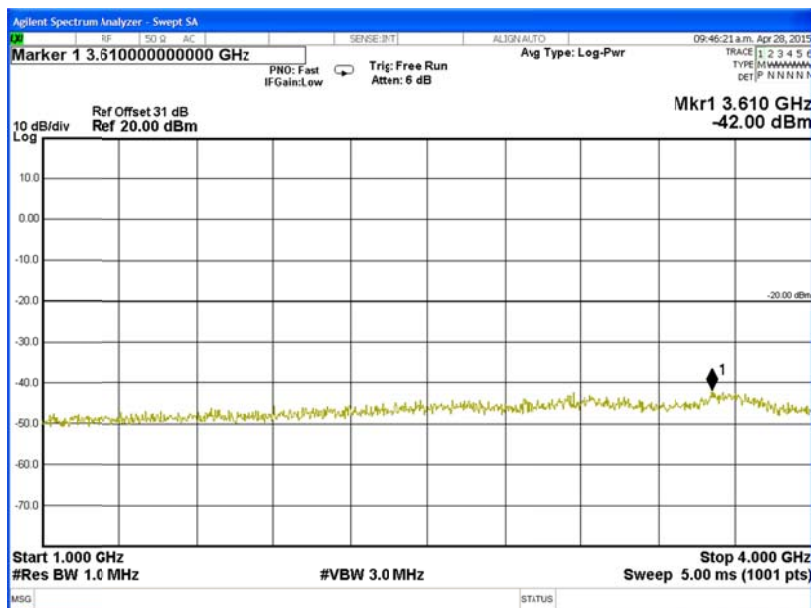
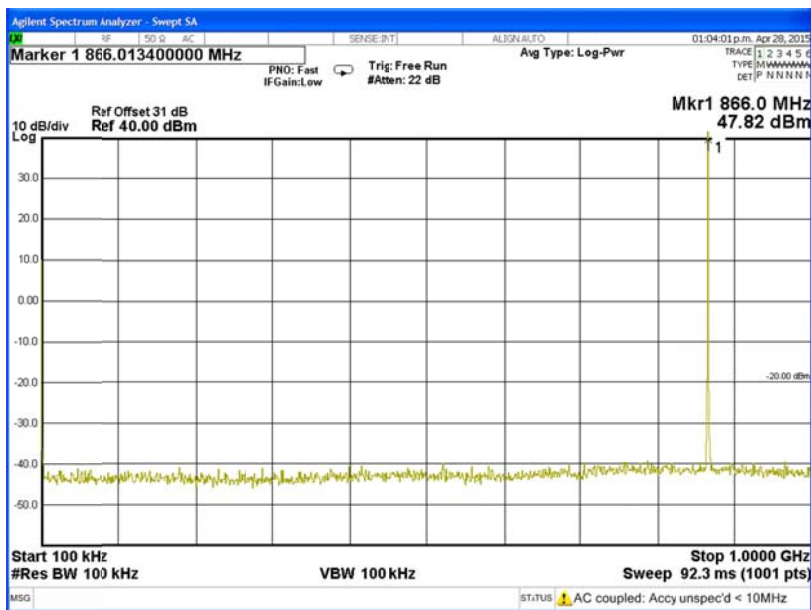


Spurious Emissions (Tx Conducted)

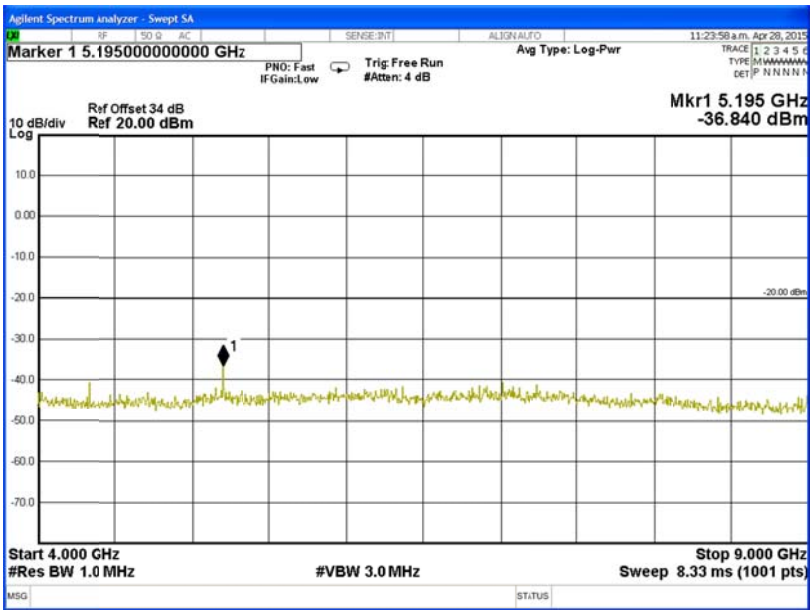
SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing	866.00000 MHz @ 50 W	RSS-119 Table-3 $50 + 10 \log_{10} (P_{\text{Watts}})$
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
5196.0000	-34.4	-81.4
12.5 kHz Channel Spacing	866.00000 MHz @ 5 W	RSS-119 Table-3 $50 + 10 \log_{10} (P_{\text{Watts}})$
~	~	~
No other emissions were detected at a level greater than 20 dB below the limit.		



Spurious Emissions (Tx Conducted)

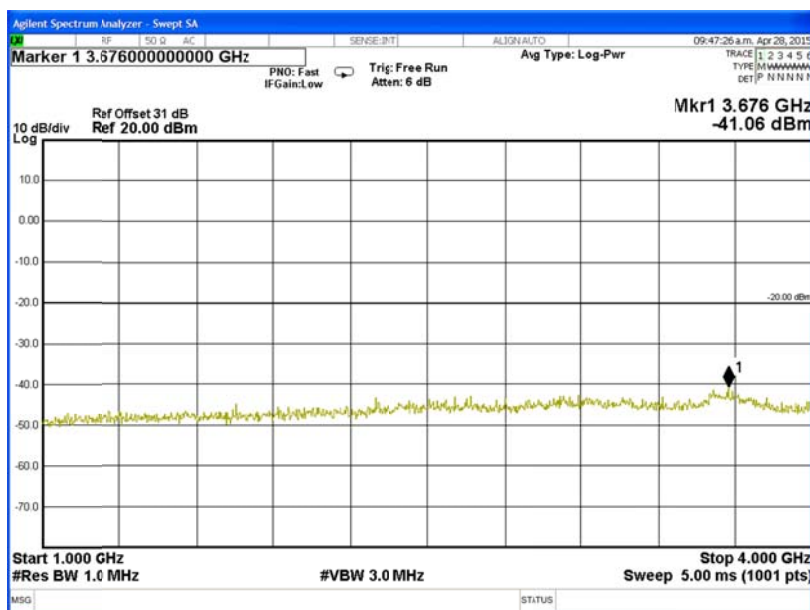
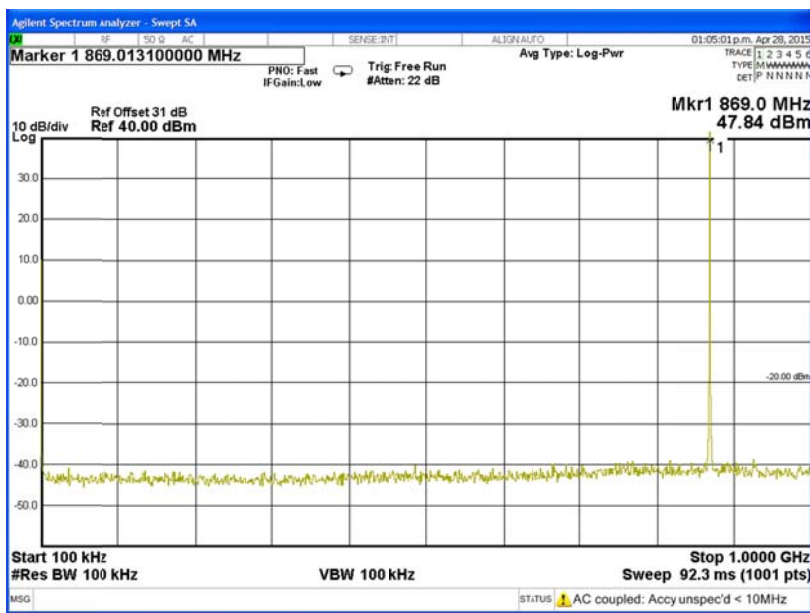


Spurious Emissions (Tx Conducted)

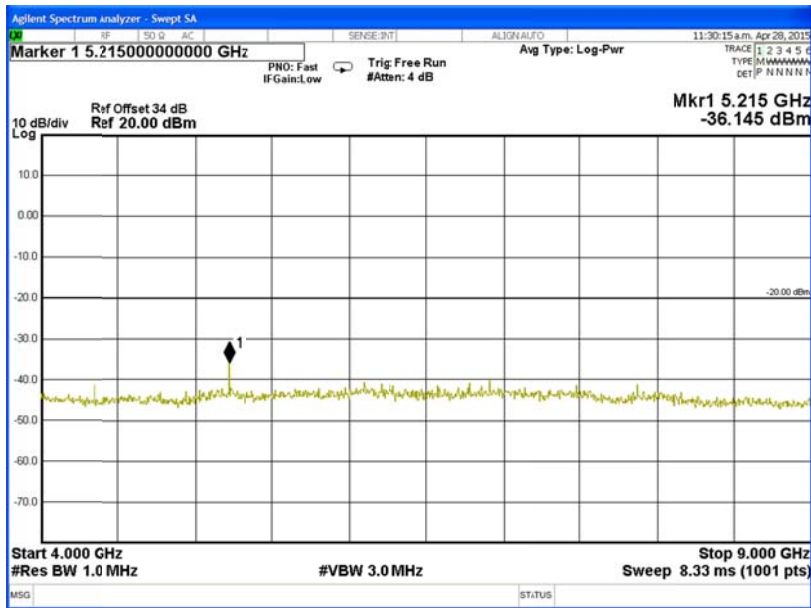
SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing	868.98750 MHz @ 50 W	RSS-119 Table-3 $50 + 10 \log_{10} (P_{\text{Watts}})$
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
5213.9250	-35.6	-82.6
12.5 kHz Channel Spacing	868.98750 MHz @ 5 W	RSS-119 Table-3 $50 + 10 \log_{10} (P_{\text{Watts}})$
~	~	~
No other emissions were detected at a level greater than 20 dB below the limit.		



Spurious Emissions (Tx Conducted)



LIMITS: FCC 47 CFR 90.210

RSS-119 5.8

Carrier Output Power	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \log_{10} (P_{\text{Watts}})$	
50 W	-20 dBm	-67 dBc
5 W	-20 dBm	-57 dBc

Carrier Output Power	Emission Masks B, G, H 12.5 kHz Channel Spacing $43 + 10 \log_{10} (P_{\text{Watts}})$	
50 W	-13 dBm	-60 dBc
5 W	-13 dBm	-50 dBc

TRANSMITTER SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA/EIA-603D 2.2.12

MEASUREMENT PROCEDURE:

Initial Scan:

1. The EUT is placed in the S-Line TEM cell and emissions are measured from 30 MHz to 1000 MHz. Any emission within 20 dB of the limit is then re-tested on the OATS along with measurements from 1000 MHz to the 10th harmonic of the fundamental frequency.
2. The EUT is placed in the reverberation chamber and emissions are measured from 1000 MHz to the upper frequency required. Any emission within 20 dB of the limit is then re-tested on the OATS.
3. The harmonics emissions up to the 6th harmonic of the fundamental frequency are measured 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 1 m to 4 m 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 (Tx Radiated) - Continued

SPECIFICATION: FCC CFR 2.1053

12.5 kHz Channel Spacing	764.06875 MHz @ 50 W	FCC 90.543 (c) $43 + 10 \log_{10} (P_{\text{Watts}})$
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	764.06875 MHz @ 5 W	FCC 90.543 (c) $43 + 10 \log_{10} (P_{\text{Watts}})$
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing	770.06875 MHz @ 50 W	FCC 90.543 (c) $43 + 10 \log_{10} (P_{\text{Watts}})$
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	770.06875 MHz @ 5 W	FCC 90.543 (c) $43 + 10 \log_{10} (P_{\text{Watts}})$
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing	774.98750 MHz @ 50 W	FCC 90.543 (c) $43 + 10 \log_{10} (P_{\text{Watts}})$
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	774.98750 MHz @ 5 W	FCC 90.543 (c) $43 + 10 \log_{10} (P_{\text{Watts}})$
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		

Spurious Emissions (Tx Radiated) - Continued

12.5 kHz Channel Spacing	851.06875 MHz @ 50 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
1702.13750	-33.01	-80.01
12.5 kHz Channel Spacing	851.06875 MHz @ 5 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No other emissions were detected at a level greater than 10 dB below the limit.		

12.5 kHz Channel Spacing	858.56875 MHz @ 50 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
1717.13750	-31.87	-78.87
12.5 kHz Channel Spacing	858.56875 MHz @ 5 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No other emissions were detected at a level greater than 10 dB below the limit.		

12.5 kHz Channel Spacing	866.00000 MHz @ 50 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
1732.00000	-32.14	-79.14
12.5 kHz Channel Spacing	866.00000 MHz @ 5 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No other emissions were detected at a level greater than 10 dB below the limit.		

12.5 kHz Channel Spacing	868.98750 MHz @ 50 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
12.5 kHz Channel Spacing	868.98750 MHz @ 5 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 10 dB below the limit.		

Spurious Emissions (Tx Radiated) - Continued

LIMITS: FCC CFR 2.1053

Carrier Output Power	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \log_{10} (P_{\text{Watts}})$	
50 W	-20 dBm	-67 dBc
5 W	-20 dBm	-57 dBc

Carrier Output Power	Emission Masks B, G, H 12.5 kHz Channel Spacing $43 + 10 \log_{10} (P_{\text{Watts}})$	
50 W	-13 dBm	-60 dBc
5 W	-13 dBm	-50 dBc

Spurious Emissions (Tx Radiated) - Continued

Open Area Test Site Results:

12.5 kHz Channel Spacing

866.000 MHz @ 50 W

Emission Mask D

Harmonics Emission Frequency (MHz)	Level (dBm)	Level (dBc)
1732.000	-32.14	-79.14
2598.000	-47.04	-74.04
3464.000	-42.15	-89.15
4330.000	-50.40	-97.40
5196.000	> -50 (Noise Floor)	> -97
6062.000	> -50 (Noise Floor)	> -97

Photo: OATS Setup



TRANSMITTER FREQUENCY STABILITY - TEMPERATURE

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

RSS-119 5.3

GUIDE: TIA/EIA-603D 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 plots on the following pages for 12.5 kHz channel spacing.

Temperature (°C)	Error (ppm)						
	764.06875 MHz	770.06875 MHz	774.98750 MHz	851.06875 MHz	858.56875 MHz	866.00000 MHz	868.98750 MHz
-30	-0.02	-0.02	-0.02	0.02	0.01	0.01	-0.01
-20	-0.02	-0.02	-0.01	0.04	0.04	0.05	0.06
-10	-0.02	-0.02	-0.01	-0.05	-0.05	-0.04	-0.03
0	-0.01	-0.02	-0.02	-0.11	-0.11	-0.13	-0.13
10	-0.01	-0.01	0.00	-0.22	-0.22	-0.24	-0.23
20	-0.02	-0.02	-0.02	-0.10	-0.09	-0.08	-0.07
30	-0.01	-0.02	-0.02	-0.17	-0.16	-0.19	-0.19
40	-0.02	-0.02	-0.01	-0.23	-0.23	-0.24	-0.24
50	-0.01	-0.01	-0.01	-0.19	-0.20	-0.19	-0.18

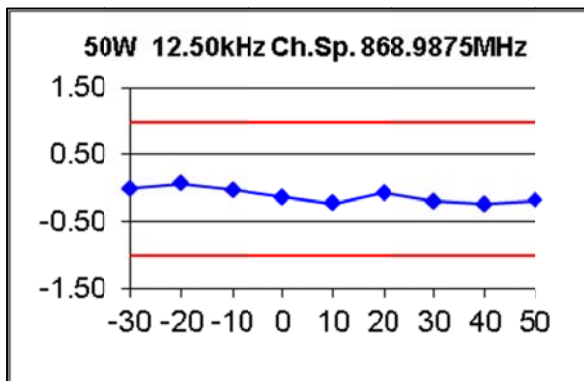
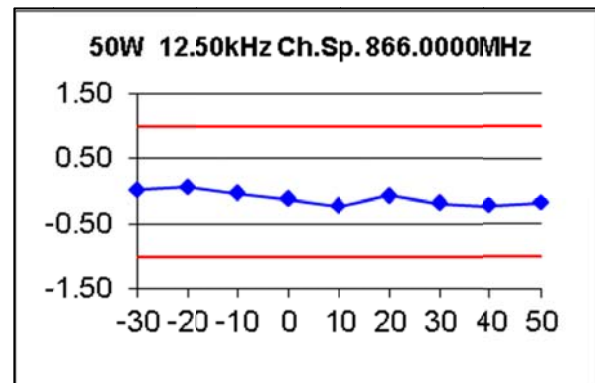
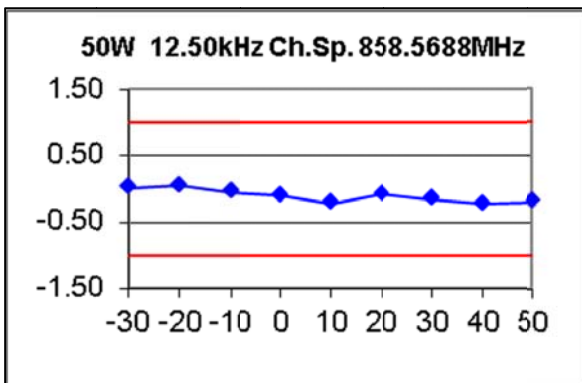
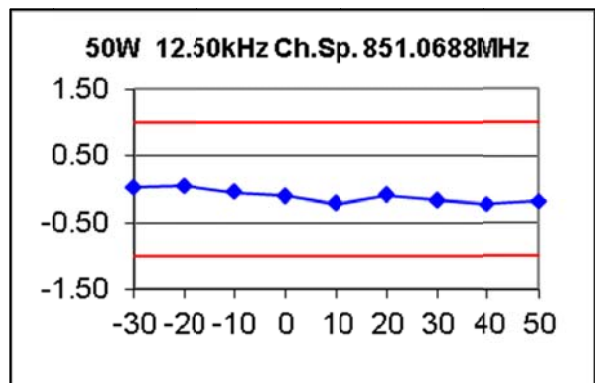
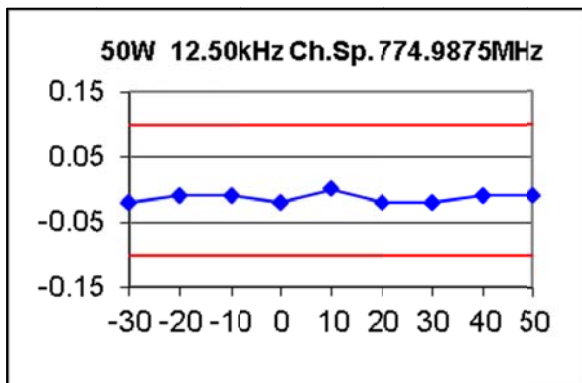
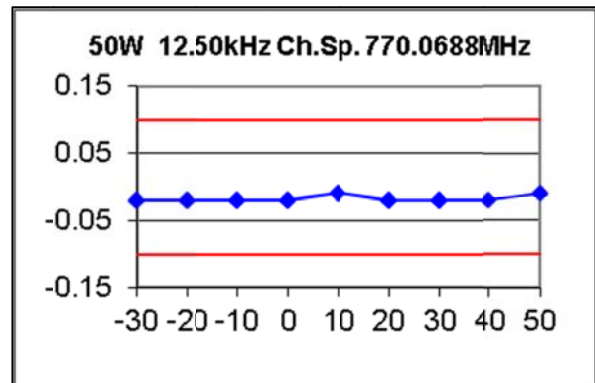
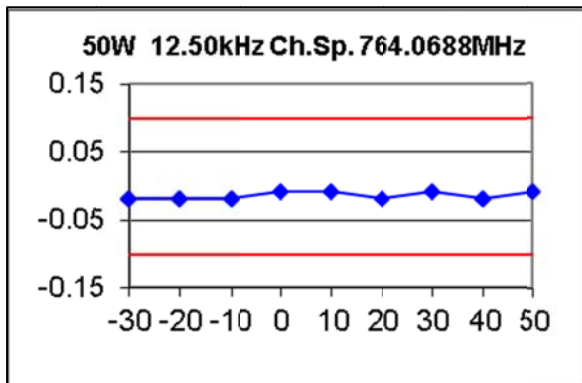
LIMIT: FCC 47 CFR 90.213

RSS-119 5.3

Channel Spacing (kHz)	Frequency Error (ppm)	Most Stringent Standard(s)
764.06875*	0.1	RSS-119 5.3
770.06875*	0.1	RSS-119 5.3
774.98750*	0.1	RSS-119 5.3
851.06875	1.0	RSS-119 5.3 & FCC 47 CFR 90.213
858.56875	1.0	RSS-119 5.3
866.00000	1.0	RSS-119 5.3
868.98750	1.0	RSS-119 5.3

* The laboratory's 10 MHz external frequency reference was used for testing.

Transmitter Frequency Stability - Temperature



TRANSMITTER FREQUENCY STABILITY - VOLTAGE

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

RSS-119 5.3

GUIDE: TIA/EIA-603D 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%. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

Nominal 50W	764.06875 MHz	770.06875 MHz	774.98750 MHz	851.06875 MHz	858.56875 MHz
120 V _{AC}	0.00	-0.05	0.00	-0.22	-0.18
102 V _{AC}	0.02	-0.04	-0.02	-0.22	-0.18
138 V _{AC}	-0.01	-0.05	-0.02	-0.22	-0.18
Maximum Error ppm	0.02	-0.05	-0.02	-0.22	-0.18

Nominal 50W	866.00000 MHz	868.98750 MHz	~	~	~
120 V _{AC}	-0.20	-0.14	~	~	~
102 V _{AC}	-0.19	-0.14	~	~	~
138 V _{AC}	-0.18	-0.13	~	~	~
Maximum Error ppm	-0.20	-0.14	~	~	~

LIMIT: FCC 47 CFR 90.213

RSS-119 5.3

Frequency (MHz)	Frequency Error (ppm)	Most Stringent Standard(s)
764.06875*	0.1	RSS-119 5.3
770.06875*	0.1	RSS-119 5.3
774.98750*	0.1	RSS-119 5.3
851.06875	1.0	RSS-119 5.3 & FCC 47 CFR 90.213
858.56875	1.0	RSS-119 5.3
866.00000	1.0	RSS-119 5.3
868.98750	1.0	RSS-119 5.3

* The laboratory's 10 MHz external frequency reference was used.

RECEIVER AND TRANSMITTER STANDBY SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: RSS-119 5.11

GUIDE: TIA/EIA-603D 2.1.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up diagram.
2. The frequency range examined was from 30 MHz to 3 times highest tunable frequency.
3. Spurious emissions which were attenuated more than 20 dB below the limit were not recorded.
4. Rx and Tx (Standby) ports are tested separately

Receive

794.06875 MHz Receive Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
800.06875 MHz Receive Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
806.00000 MHz Receive Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
813.56875 MHz Receive Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
821.00000 MHz Receive Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
823.98750 MHz Receive Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

Rx and Tx Standby Conducted Emissions – Continued

Transmitter Standby

764.06875 MHz Transmitter Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
770.06875 MHz Transmitter Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
774.98750 MHz Transmitter Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
851.06875 MHz Transmitter Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
858.56875 MHz Transmitter Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
866.00000 MHz Transmitter Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
868.98750 MHz Transmitter Port		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

LIMIT CLAUSE: RSS-Gen 6(b)

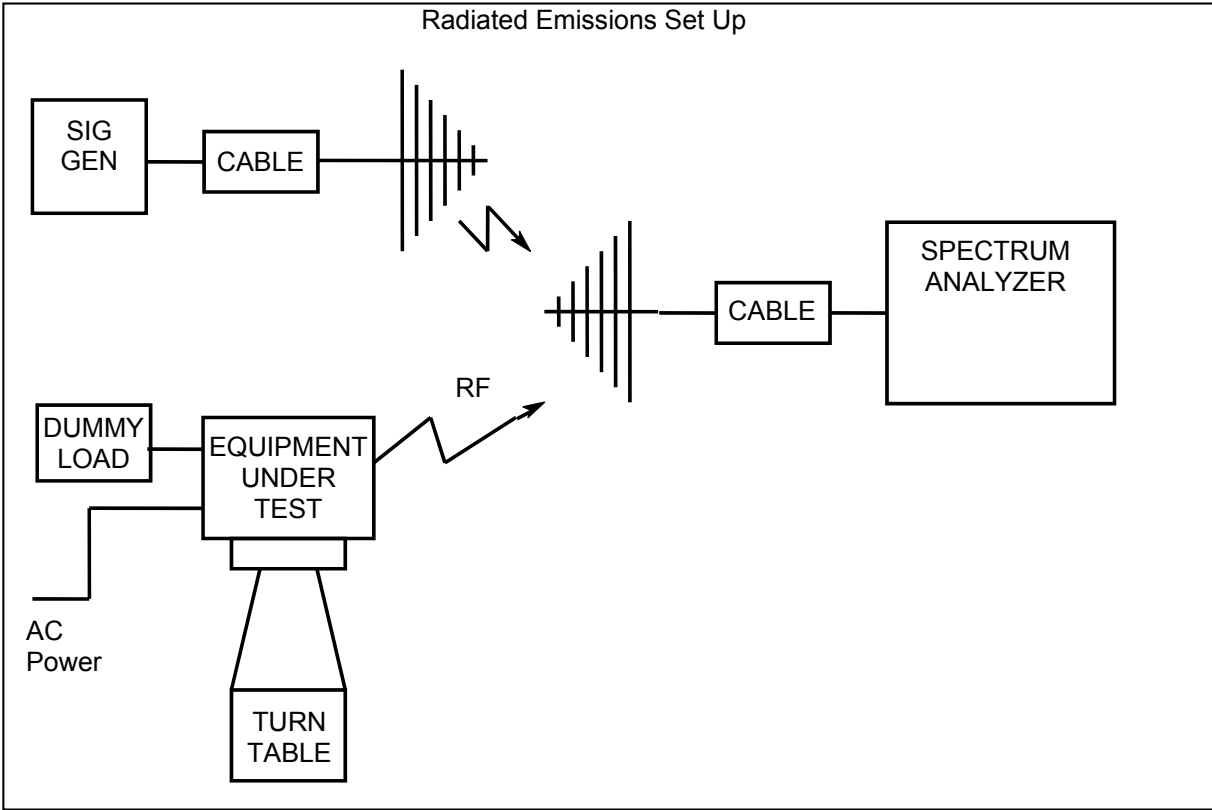
LIMIT	30 → 1000 MHz	2 nW	- 57 dBm
	> 1000 MHz	5 nW	- 53 dBm

TEST EQUIPMENT LIST

No#	Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
3	Signal Generator	Analog 4GHz	Agilent	E4422B	GB40050320	E3788	18-Oct-15
8	Modulation Analyser	TREVA1	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073	18-Oct-15
27	Power Supply	AC Variac	Yamabishi	S-260-5	TX-533	E1737	
31	Antenna	18GHz DRG	Emco	DRG3115	9512-4638	E3560	6-Mar-16
32	Antenna	18GHz DRG	Emco	DRG3115	2084	E3076	6-Mar-16
33	Spectrum Analyser	26.5GHz	Agilent	PXAN9030A	MY49432161	E4907	6-Jul-16
35	RF Chamber	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	31-Aug-15
38	RF Amplifier	+21.7 dB 1GHz	Tait	ZFL-1000LN	E3660	E3360	19-Jan-16
48	RF Attenuator	10dB 50W	Weinschel	24-10-34	AZ0401	E3388	17-Oct-15
50	RF Attenuator	20dB 25W	Weinschel	33-20-33	BD5871	E3673	14-Oct-15
52	RF Load	150W	Bird	8166	524	E3625	17-Oct-15
61	Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack2	E4623	14-Oct-15
63	Coax Cable	3m Blue	Suhner	Sucoflex 104A	44611/4A	E4620	16-Oct-15
64	Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack4	E4653	15-Oct-15
94	Environ. Chamber	Upright	Contherm	5400 RHSLT.M	1416	E4051	2-Aug-15
95	Environ. Chamber	Upright	Contherm	5400 RHSLT.M	1416	E4051	1-Aug-15
96	Power Meter	TREVA1 Power Head for HP8901	Hewlett Packard	HP11722A	3111A05573	E7054	18-Oct-15
100	RF Combiner	TREVA1	Minicircuits	ZFSC-4-1	-	E4083	
106	OATS	NSA	Tait				4-Jun-15
107	Coax Cable	OATS Turntable Cable 1	Intelcom	RG214	OATS1	E4621	23-Oct-15
108	Coax Cable	OATS Tower Cable	Intelcom	RG214	OATS2	E4622	23-Oct-15
109	OATS	Antenna Tower	Electrometrics	EM-4720-2	112	E4447	
110	OATS	Controller	Electrometrics	EM-4700	119	E4445	
111	OATS	Turntable	Electrometrics	EM-4704A	105	E4446	
112	RF Load	2W	MCL	NTRM-50	#02		19-Jan-16
115	RF Attenuator	30dB 350W	Weinschel	67-30-33	BR0531	E4280	18-Oct-15
132	TREVA 1		Teltest	-	1	-	23-Apr-15
134	Coax Cable	Reverb - 4.5m Multiflex 141	TeltestBlue6	MF 141	TeltestBlue6	E4843	13-Oct-16
135	Coax Cable	Reverb - 2m Multiflex 141	TeltestBlue5	MF 141	TeltestBlue5	E4844	14-Oct-15
136	Coax Cable	Reverb - 2m Multiflex 141	TeltestBlue4	MF 141	TeltestBlue4	E4845	14-Oct-15
137	Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue3	MF 141	TeltestBlue3	E4846	14-Oct-15
138	Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue2	MF 141	TeltestBlue2	E4847	14-Oct-15
139	Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue1	MF 141	TeltestBlue1	E4848	14-Oct-15
140	Coax Cable	2.5m Blue	Suhner	Sucoflex 104A	33449/4PEA	E4997	8-Apr-16
145	RF Chamber	Reverb - Stirrer controller for reverb chamber	Teseq	Stirrer Controller	29765.1	E4854	
146	RF Chamber	Reverb - 0.5 - 18GHz Reverberation Chamber	Teseq	RVC XS	29765	E4855	
148	Antenna	Reverb - 1-18GHz DRG	Schwarzbeck	BBHA 9120 D	9120D-885	E4857	
149	Antenna	Reverb - 1-18GHz DRG	Schwarzbeck	BBHA 9120 D	9120D-884	E4858	
150	RF Amplifier	Pre-amplifier	Agilent	87405C	MY47010688	E4941	16-Oct-15
159	OATS	FCC Listing Registration			837095		12-May-16
163	Coax Cable	OATS Turntable Cable 2	Intelcom	RG215	OATS3	E4995	23-Oct-15

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

ANNEX A – TEST SETUP DETAILS



All other testing is performed using the Teltest Radio **E**VAuation 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.

