

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBCB1B Base Station Transceiver

Tested in accordance with:

FCC 47 CFR Parts 22, 74 and 90

RSS-119 Issue 11
RSS-Gen Issue 3

Report Revision:

1

Issue Date:

29 May 2013

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All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.
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OATS FCC LISTING REGISTRATION: 837095

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REVISION

Date	Revision	Comments
29 May 2013	1	Initial test report

INTRODUCTION

This report covers the requirements of FCC 47 Parts 22, 74 & 90, and RSS-119 Issue 11 & RSS-Gen Issue 3.

REASON FOR REPORT
The TB9400 B1 100W is a new addition to the Tait Communications Ltd product line capable of APCO Phase I C4FM and LSM modulation as well as APCO Phase II modulation.

Modulation		Channel Spacing	Speech Channels	Symbol Rate (Symbols/sec)	Data Rate (Bits/sec)
APCO P25 Phase 1	C4FM	12.5 kHz	1	4800	9600
Linear Simulcast Modulation	CQPSK	12.5 kHz	1	4800	9600
APCO P25 Phase 2	H-DQPSK	12.5 kHz	2	6000	12000

Type Approval Testing of the Frequency range TBCB1B
148 → 174 MHz

in accordance with:

FCC 47 CFR Parts 22, 74 and 90
RSS-119 Issue 11 & RSS-Gen Issue 3

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: TBCB1B

The TBCB1B Base Station Transceiver consisting of:

FUNCTIONAL DESCRIPTION	PRODUCT DESIGNATION CODE	SERIAL NUMBER (S)
Reciter	T01-01103-DAAA	18176602
Power Amplifier	T01-01121-DBAA	18176464
Power Management Unit	TBA30A0-0100	18176545
Front Panel	T01-01110-AAAA	18176637
Rack Frame	TB9435.B3M0-0000-A1AA-10	18176686

Quantity: 1 of each

HARDWARE & SOFTWARE Details:

FUNCTIONAL DESCRIPTION	FIRMWARE VERSION	HARDWARE VERSION
Reciter	p25-1.16.01.0001	00.11
Power Amplifier	1.04.00.0001	0006
Power Management Unit	0315	00.03
Front Panel	1.04.00.0001	00.04

TEST CONDITIONS

All testing was performed between 09 → 24 May 2013, and under the following conditions:

Ambient temperature: 15°C → 30°C

Relative Humidity: 20% → 75%

Standard Test Voltage 120 V_{AC}

STATEMENT OF COMPLIANCE

The TBCB1B base station transceiver as tested in this report was found to conform to the following standards:

FCC CFR 47 Parts 22, 74 & 90

RSS-119 Issue 11 & RSS-Gen Issue 3

MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

MODULATION TYPES FOR APCO PHASE I:

F1E	C4FM	4800 symbols/sec	9600 bps
F1D	C4FM	4800 symbols/sec	9600 bps
F7W	C4FM	4800 symbols/sec	9600 bps
D1W	LSM	4800 symbols/sec	9600 bps
D7W	LSM	4800 symbols/sec	9600 bps

MODULATION TYPES FOR APCO PHASE II:

D7W	H-DQPSK	6000 symbols/sec	12000 bps
D7W	H-D8PSK	4000 symbols/sec	12000 bps

CHANNEL SPACING: 12.5 kHz

EMISSION DESIGNATORS FOR APCO PHASE I:

C4FM	8K10F1E	8K10F1D
	8K10F7E	8K10F7D
LSM	8K70D1W	8K70D7W

EMISSION DESIGNATORS FOR APCO PHASE II:

H-DQPSK	9K80D7W
H-D8PSK	6K80D7W

MODULATION TYPES, NECESSARY BANDWIDTHS, AND EMISSION DESIGNATORS

APCO P25 Phase I:

Digital Voice / Data (C4FM 4 – Level FSK)

Digital Voice/data transmissions use a 4 level frequency shift keying modulation scheme. The necessary bandwidth as been measured using the 99% energy rule, and in accordance with TIA-102 CAAB 2.2.5.2

Digital Voice 12.5 kHz Bandwidth

99% bandwidth
= 7.6 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
= 7.6 kHz

Emission Designator

8K10F1D

F1D represents an digital FM data transmission

8K10F7D

F7D represents two or more channels containing quantized or digital information

Linear Simulcast Modulation (LSM)

Digital Voice/data transmissions use a 4 level frequency shift keying modulation scheme suitable for 12.5 kHz channel spacing. The necessary bandwidth has been measured using the 99% energy rule, and in accordance with TIA-102 CAAB 2.2.5.2

Digital Data 12.5 kHz Bandwidth

99% bandwidth
= 8.5 kHz

Emission Designator

8K70D1W

D1W represents single channels 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 II:

H-DQPSK Digital Data 12.5 kHz Bandwidth

99% bandwidth
= 9.1 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.

H-D8PSK Digital Data 12.5 kHz Bandwidth

99% bandwidth
= 6.6 kHz

Emission Designator

6K80D7W

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-102.CAAA-C 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: 100 W and 10 W

Nominal 100	148.015 MHz	152.1 MHz	153.1 MHz	158.1 MHz	173.1 MHz
Measured	91.9	92.0	90.6	92.2	92.7
Variation (%)	-8.1	-8.0	-9.4	-7.8	-7.3
Variation (dB)	-0.4	-0.4	-0.4	-0.4	-0.3
Nominal 10	148.015 MHz	152.1 MHz	153.1 MHz	158.1 MHz	173.1 MHz
Measured	10.1	10.0	9.9	9.7	10.2
Variation (%)	+1.0	0.0	-1.0	-3.0	+2.0
Variation (dB)	+0.04	0.0	-0.04	-0.13	0.09
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 OCCUPIED BANDWIDTH AND SPECTRUM MASKS

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

GUIDE: TIA-102.CAAA-C 2.2.5

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates for the different modulation types available in the web UI (diagnostic interface).
2. 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

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 D 12.5 kHz Channel Spacing Digital Voice/Data

DATA SPEED

Digital Voice/Data 12.5 kHz Channel Spacing 9600 bps for Phase I modulation types.
Digital Voice/Data 12.5 kHz Channel Spacing 12000 bps for Phase II modulation types.

Occupied Bandwidth and Spectrum Masks

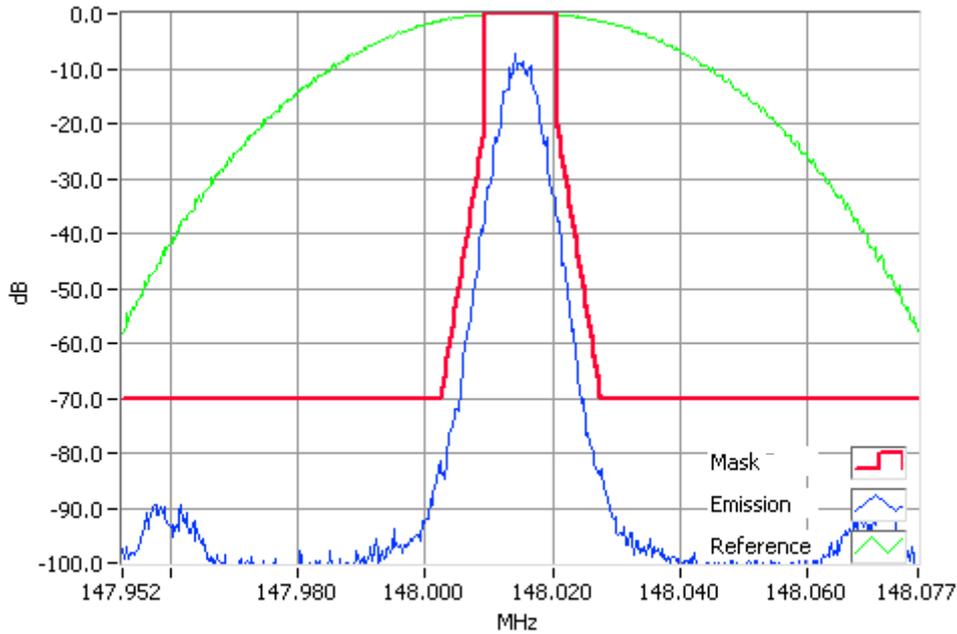
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

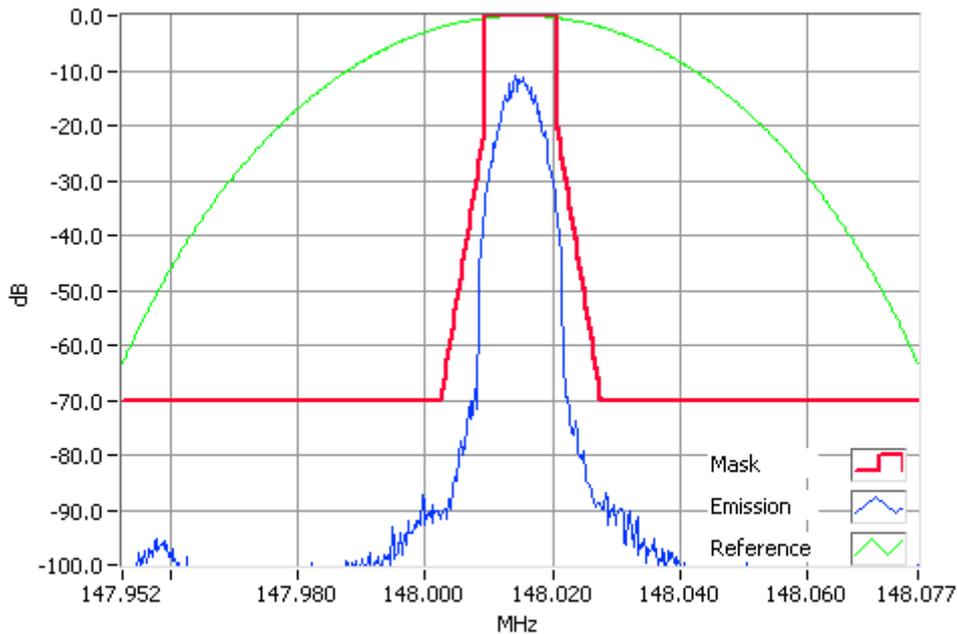
Tx FREQUENCY: 148.015 MHz

100 W

12.5 kHz Channel Spacing



**APCO_P25_PI-C4FM 148.0150MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PI-LSM 148.0150MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

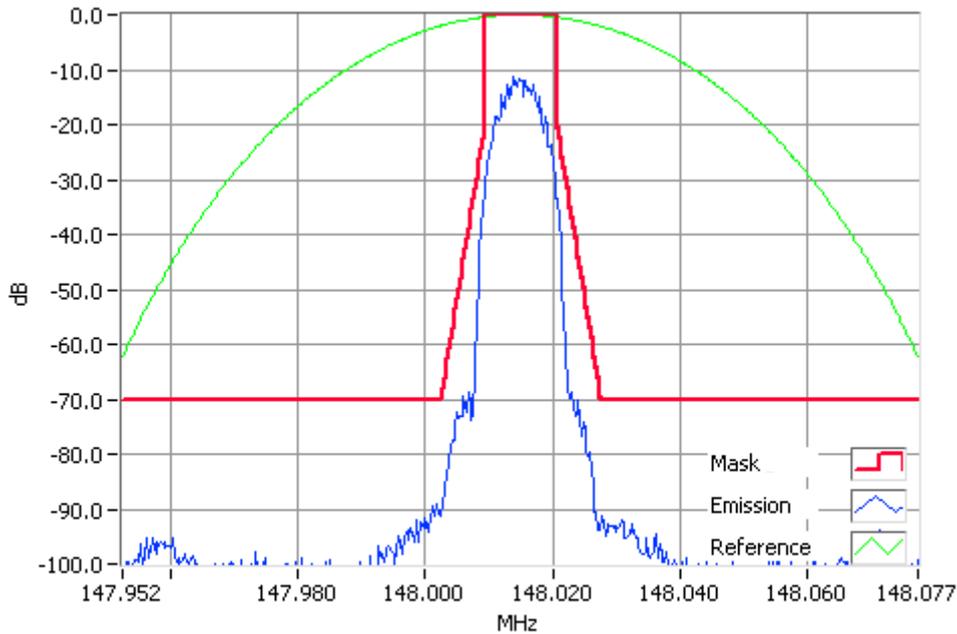
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

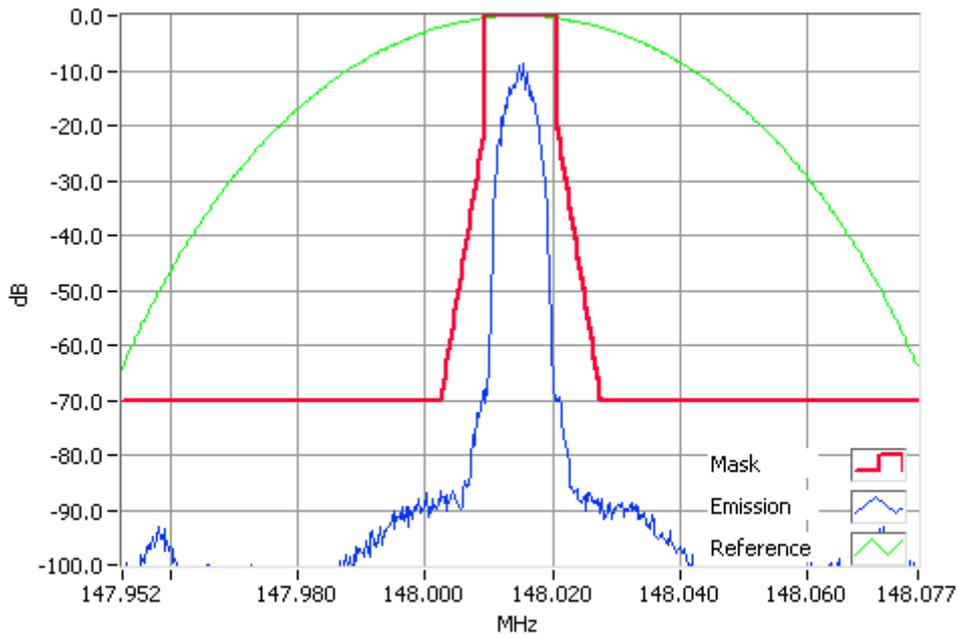
Tx FREQUENCY: 148.015 MHz

100 W

12.5 kHz Channel Spacing



**APCO_P25_PII-H-DQPSK 148.0150MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PII-H-D8PSK 148.0150MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

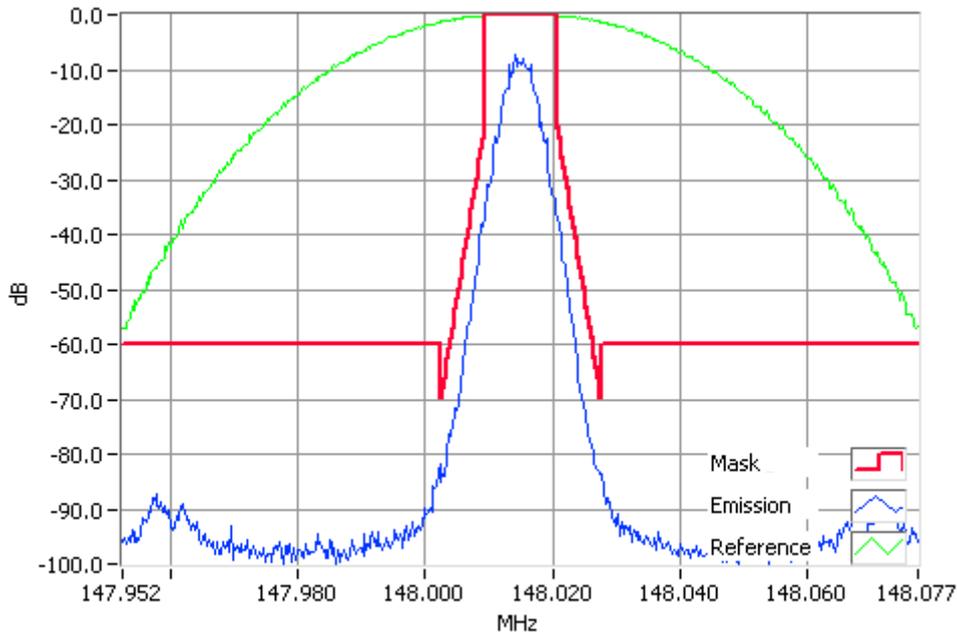
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

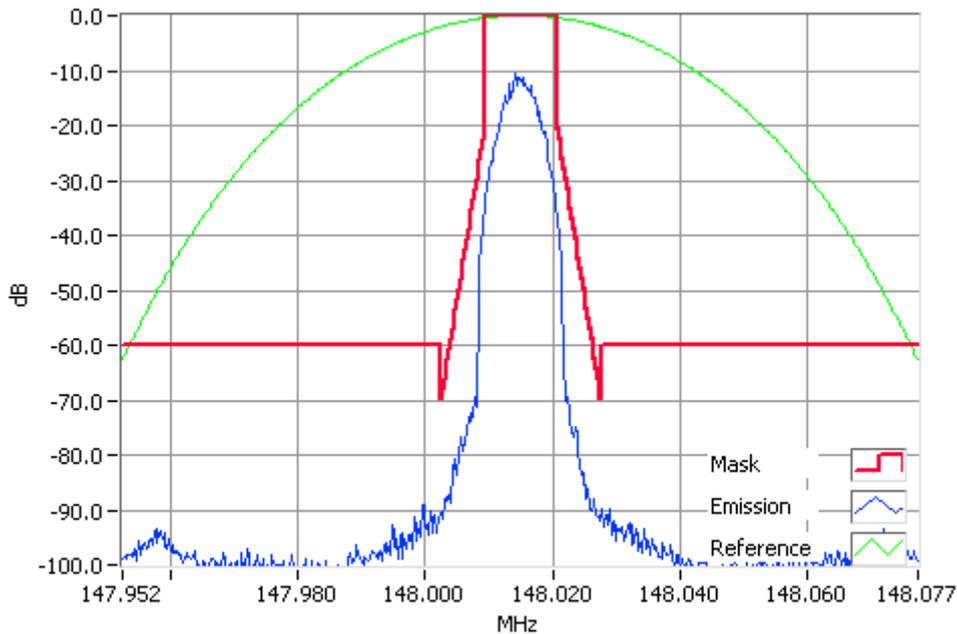
Tx FREQUENCY: 148.015 MHz

10 W

12.5 kHz Channel Spacing



APCO_P25_PI-C4FM 148.0150MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



APCO_P25_PI-LSM 148.0150MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

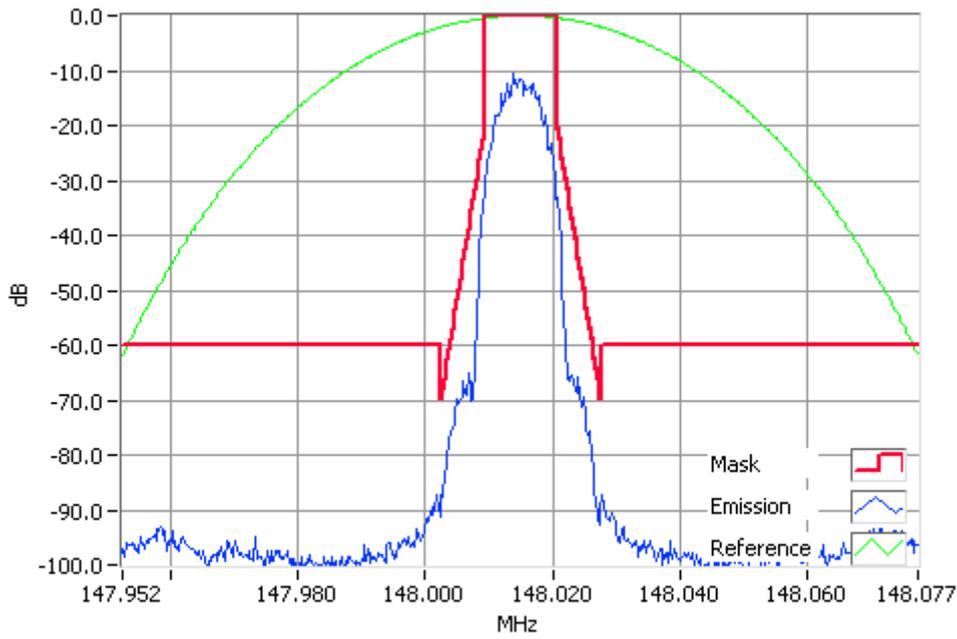
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RSS-119 5.5

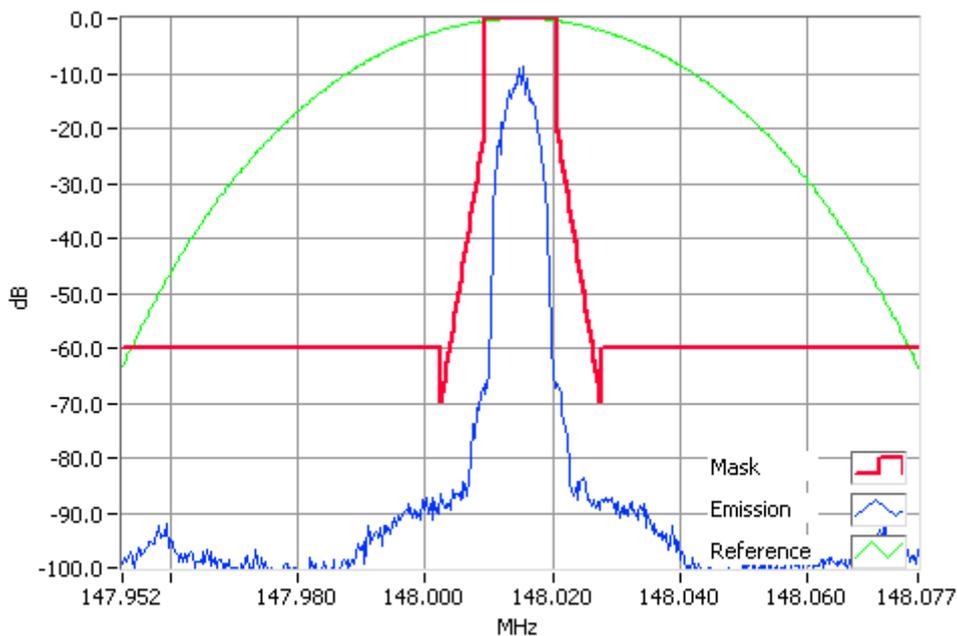
Tx FREQUENCY: 148.015 MHz

10 W

12.5 kHz Channel Spacing



**APCO_P25_PII-H-DQPSK 148.0150MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PII-H-D8PSK 148.0150MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

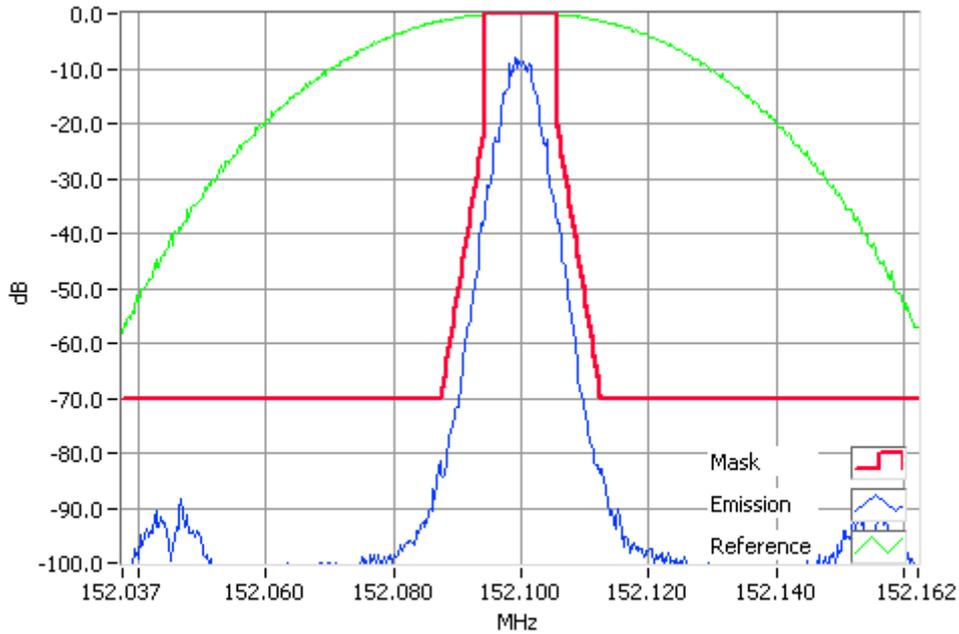
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RSS-119 5.5

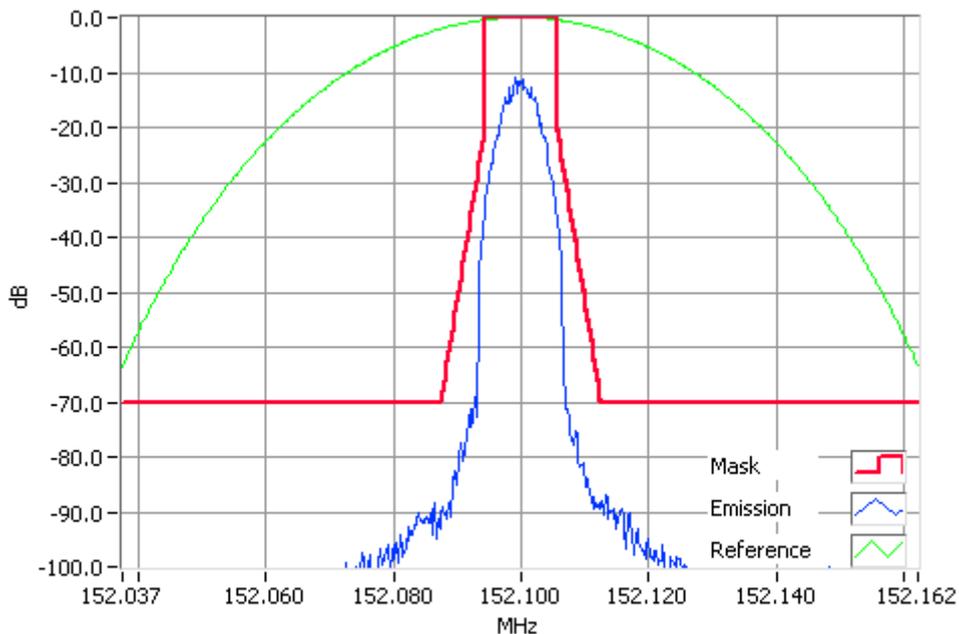
Tx FREQUENCY: 152.1 MHz

100 W

12.5 kHz Channel Spacing



**APCO_P25_PI-C4FM 152.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PI-LSM 152.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

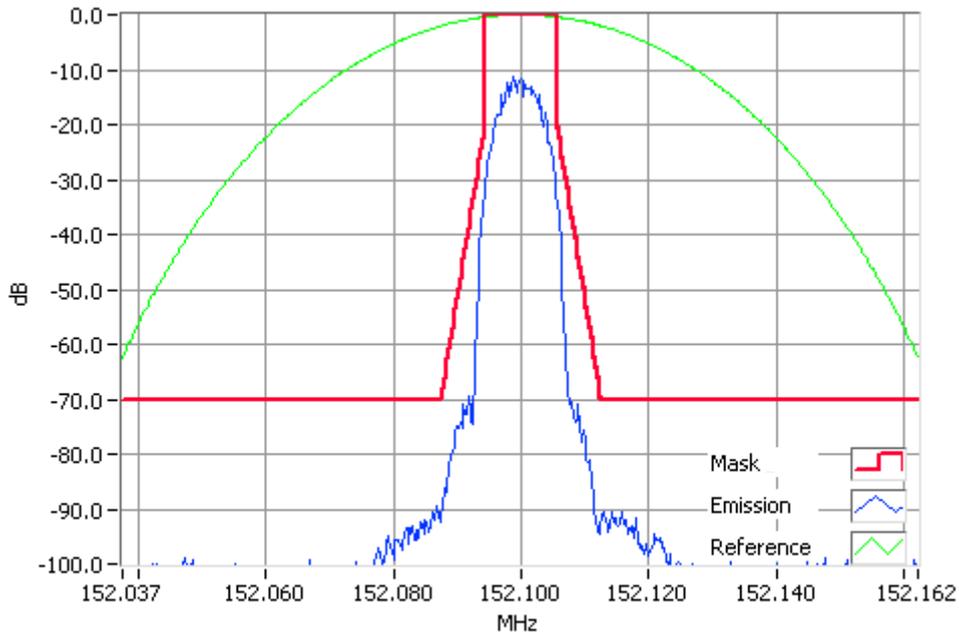
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

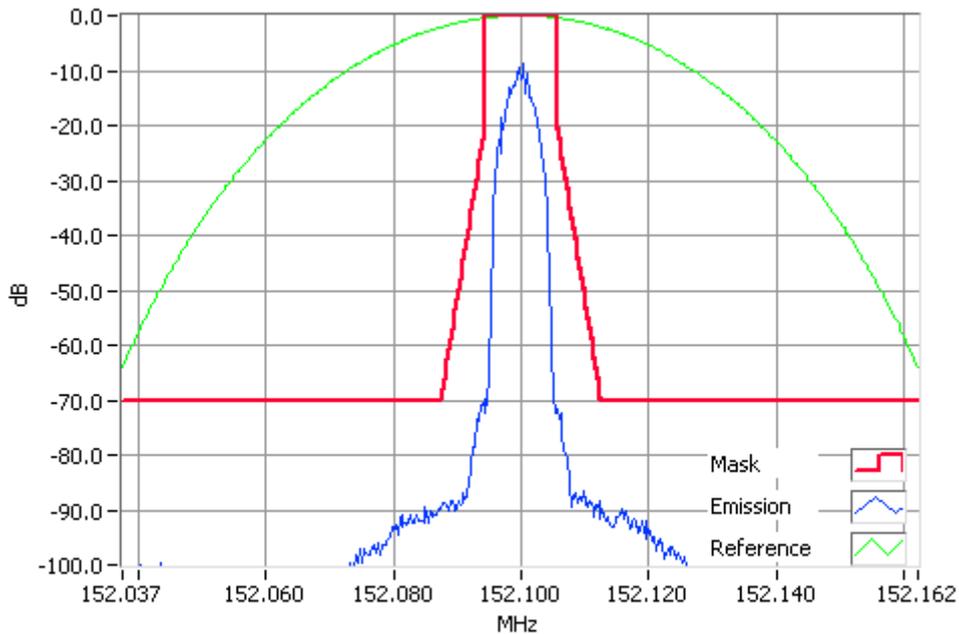
Tx FREQUENCY: 152.1 MHz

100 W

12.5 kHz Channel Spacing



**APCO_P25_PII-H-DQPSK 152.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PII-H-D8PSK 152.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

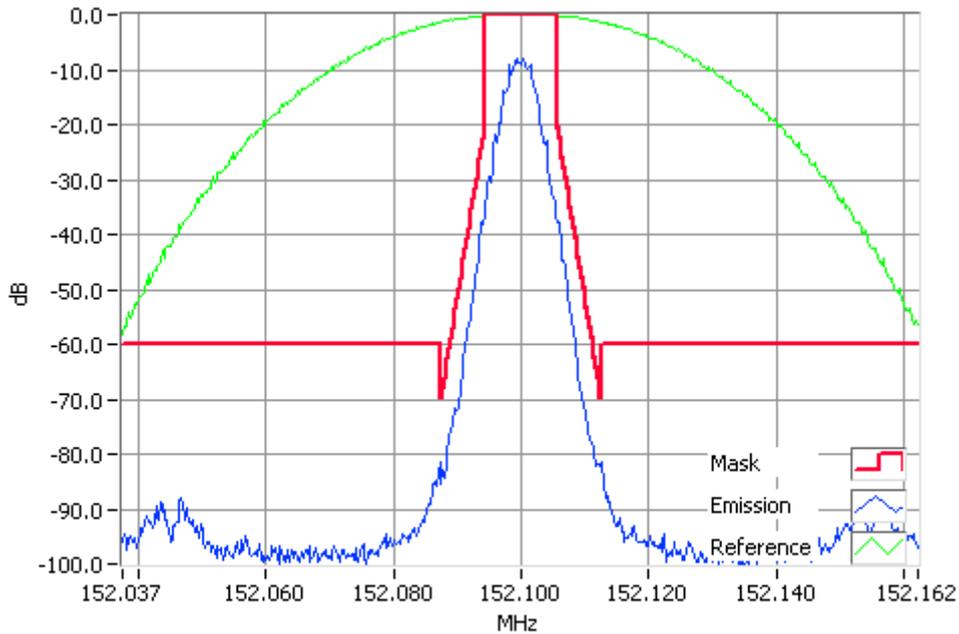
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RSS-119 5.5

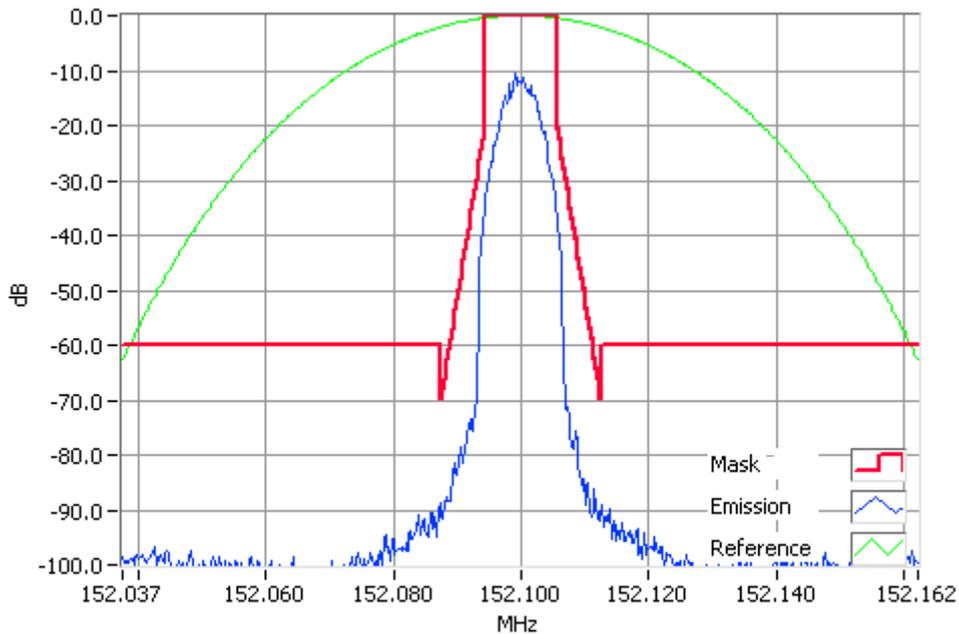
Tx FREQUENCY: 152.1 MHz

10 W

12.5 kHz Channel Spacing



**APCO_P25_PI-C4FM 152.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PI-LSM 152.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

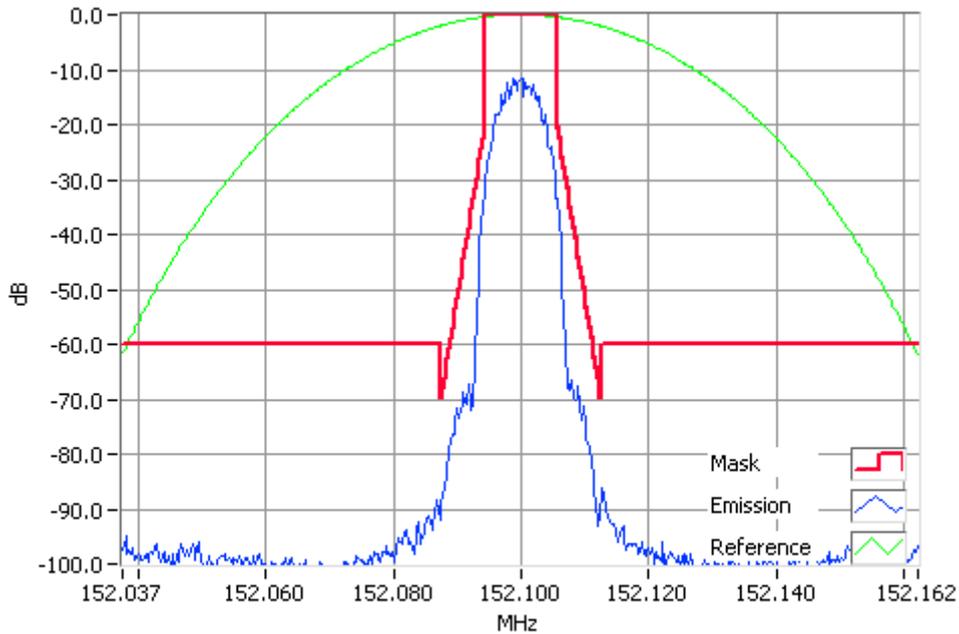
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RSS-119 5.5

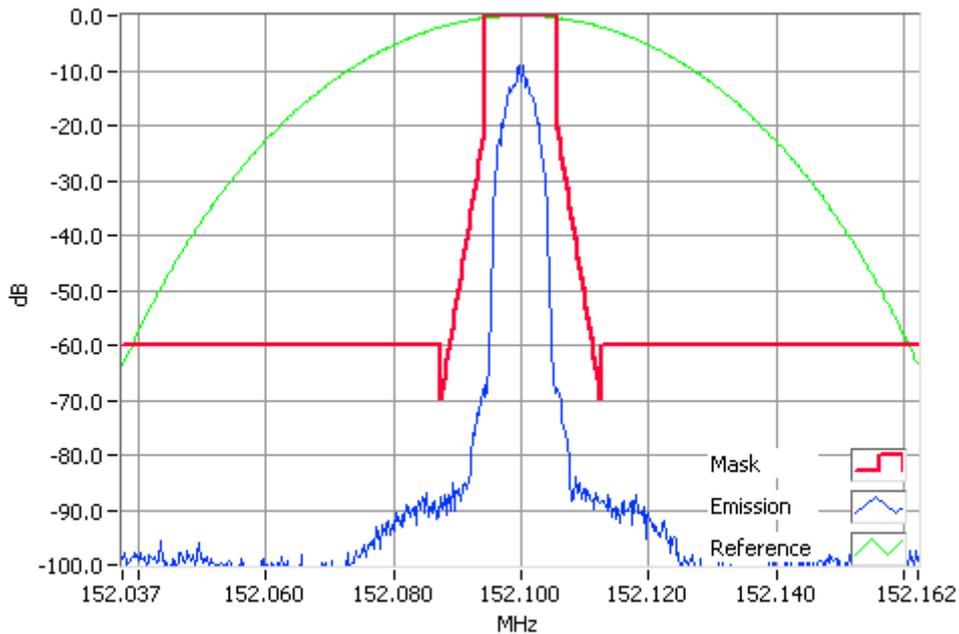
Tx FREQUENCY: 152.1 MHz

10 W

12.5 kHz Channel Spacing



APCO_P25_PII-H-DQPSK 152.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



APCO_P25_PII-H-DBPSK 152.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

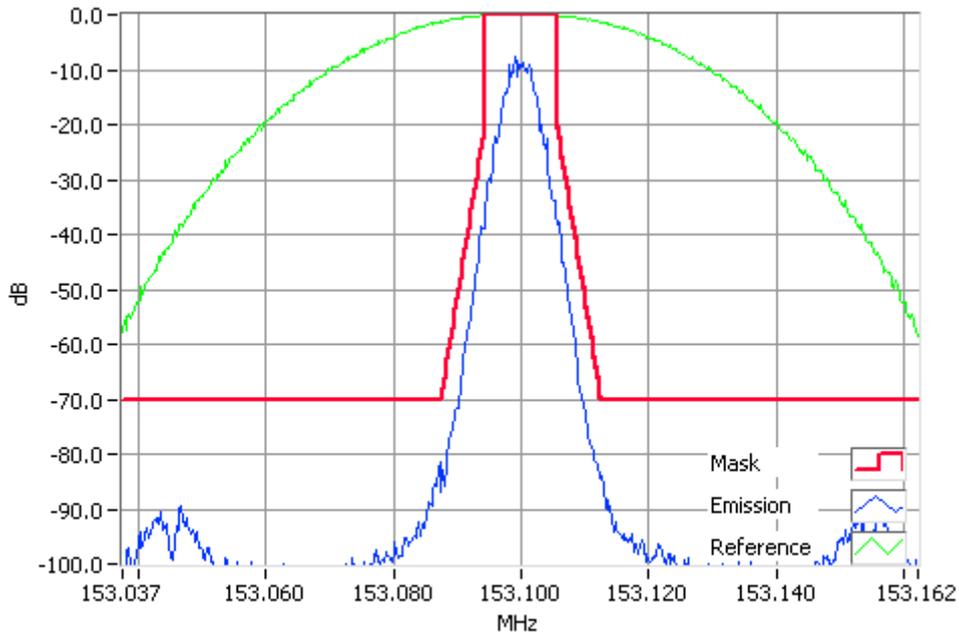
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RSS-119 5.5

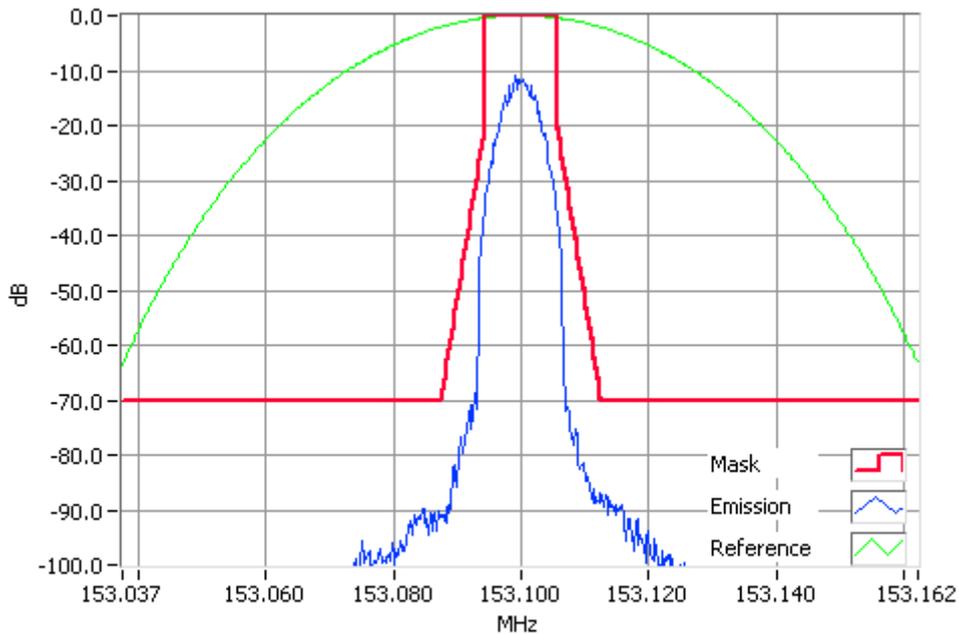
Tx FREQUENCY: 153.1 MHz

100 W

12.5 kHz Channel Spacing



**APCO_P25_PI-C4FM 153.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PI-LSM 153.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

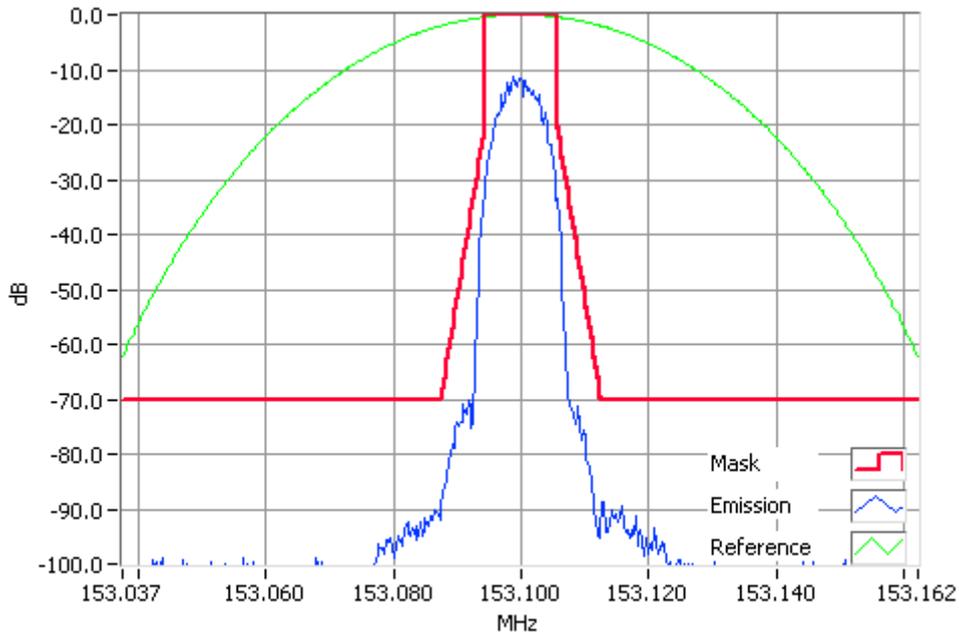
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RSS-119 5.5

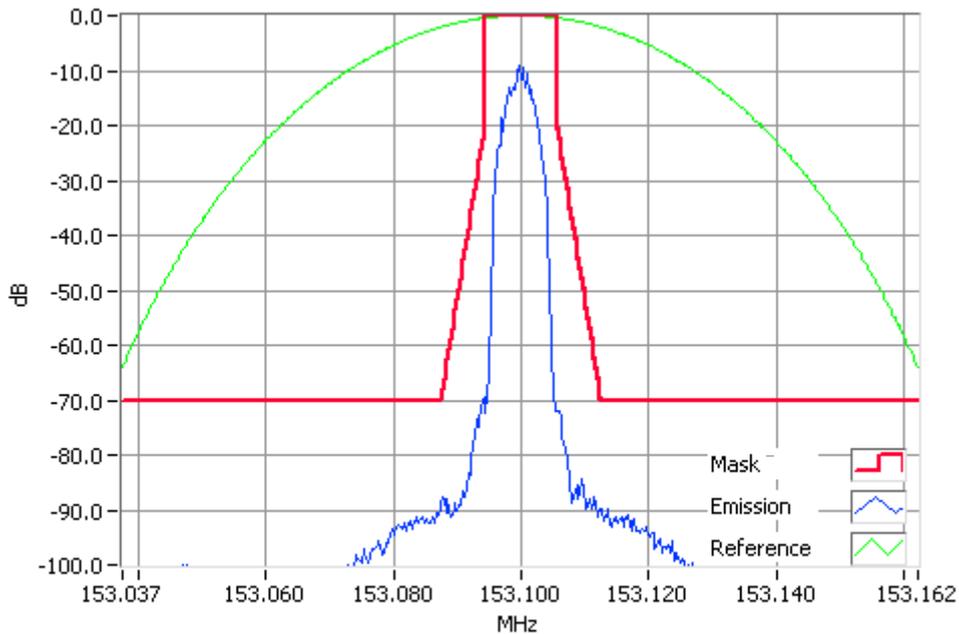
Tx FREQUENCY: 153.1 MHz

100 W

12.5 kHz Channel Spacing



**APCO_P25_PII-H-DQPSK 153.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PII-H-D8PSK 153.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

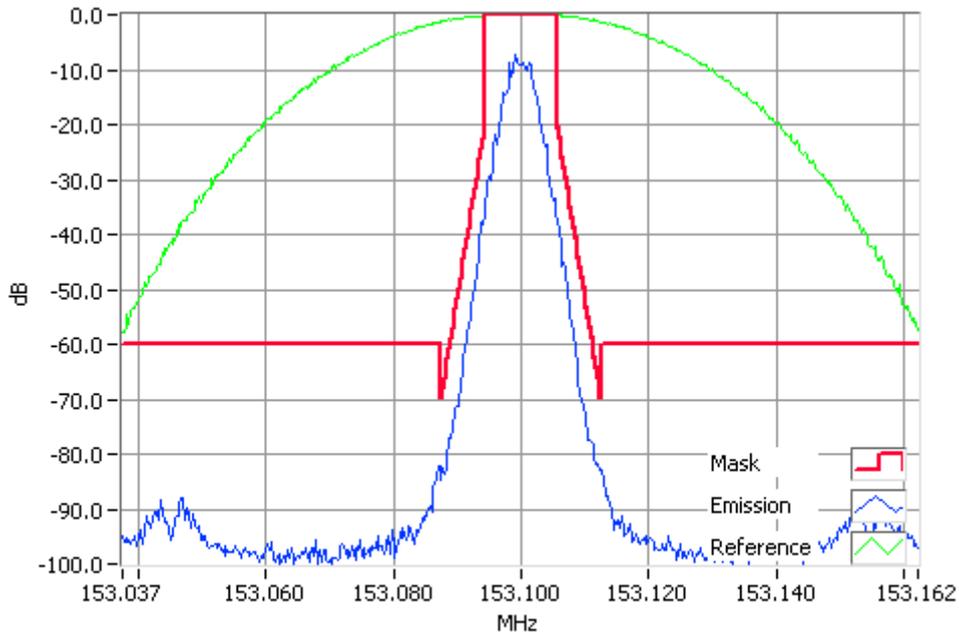
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RSS-119 5.5

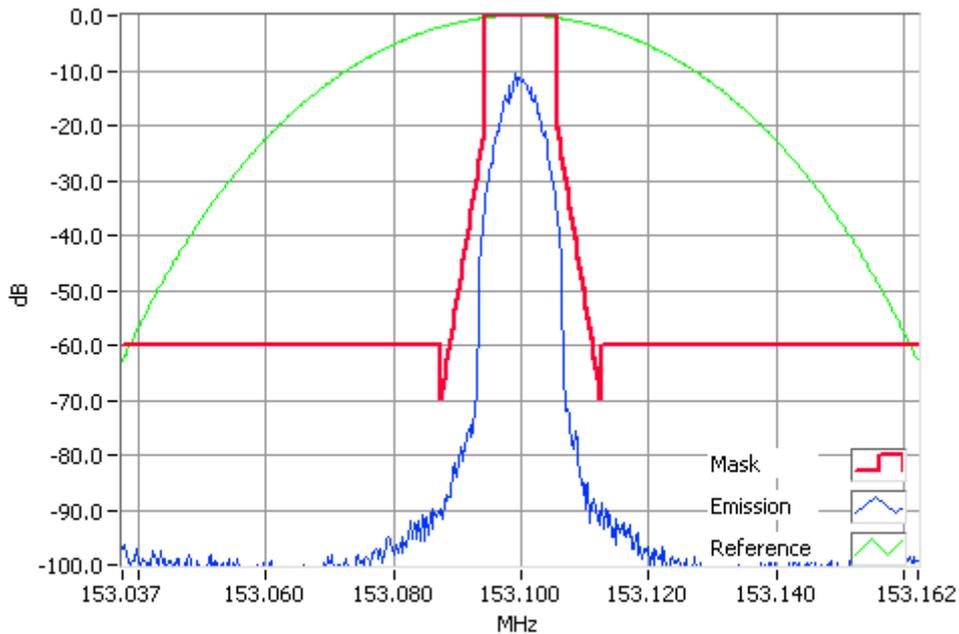
Tx FREQUENCY: 153.1 MHz

10 W

12.5 kHz Channel Spacing



APCO_P25_PI-C4FM 153.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



APCO_P25_PI-LSM 153.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

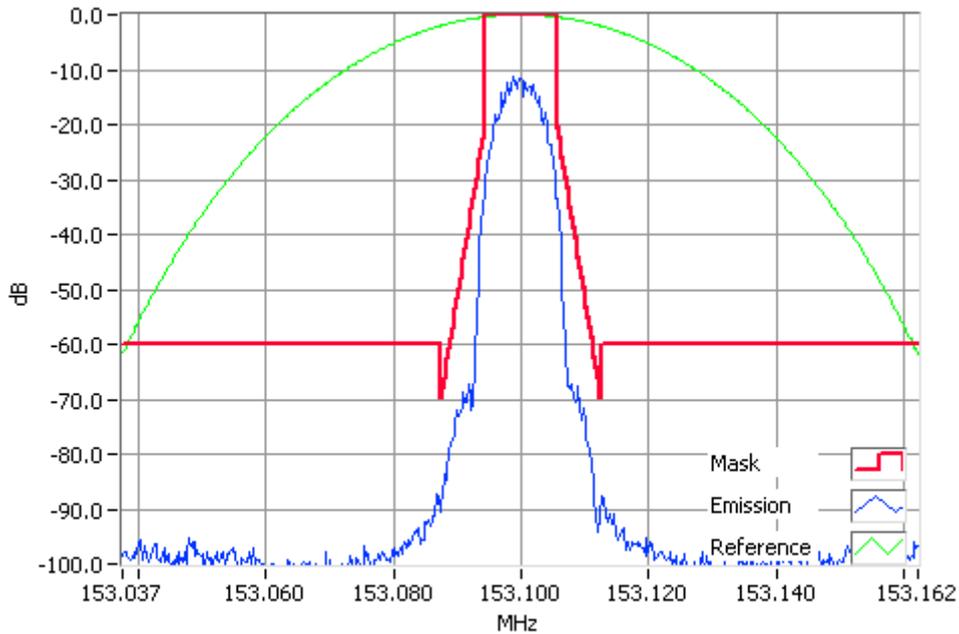
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RSS-119 5.5

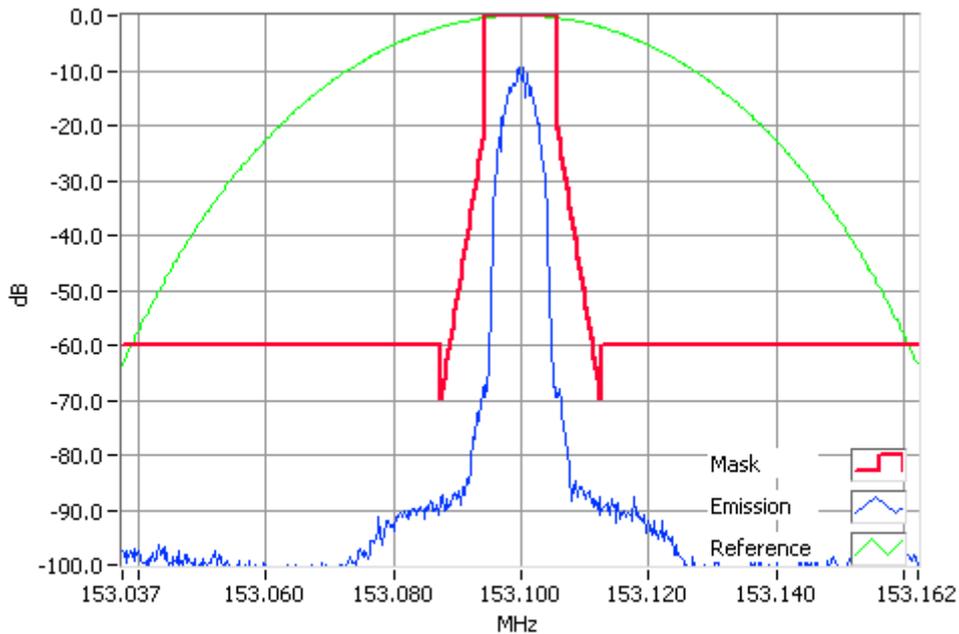
Tx FREQUENCY: 153.1 MHz

10 W

12.5 kHz Channel Spacing



**APCO_P25_PII-H-DQPSK 153.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PII-H-DBPSK 153.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

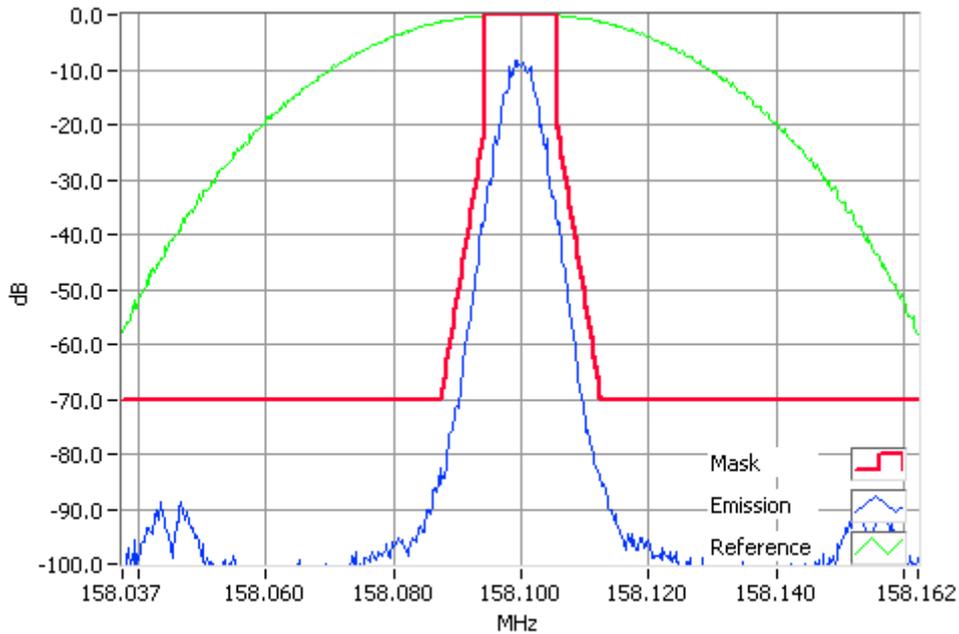
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RSS-119 5.5

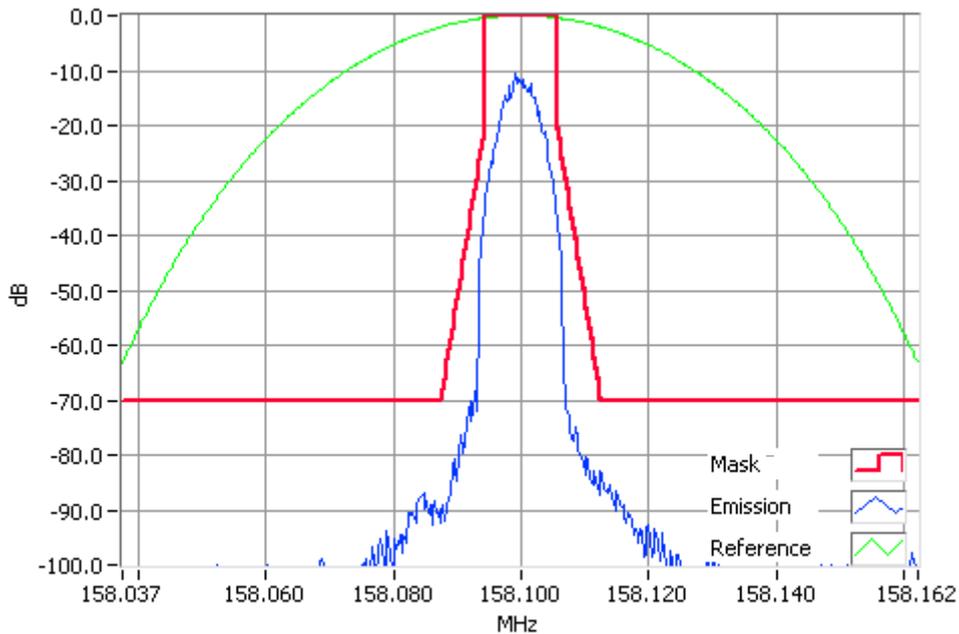
Tx FREQUENCY: 158.1 MHz

100 W

12.5 kHz Channel Spacing



**APCO_P25_PI-C4FM 158.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PI-LSM 158.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

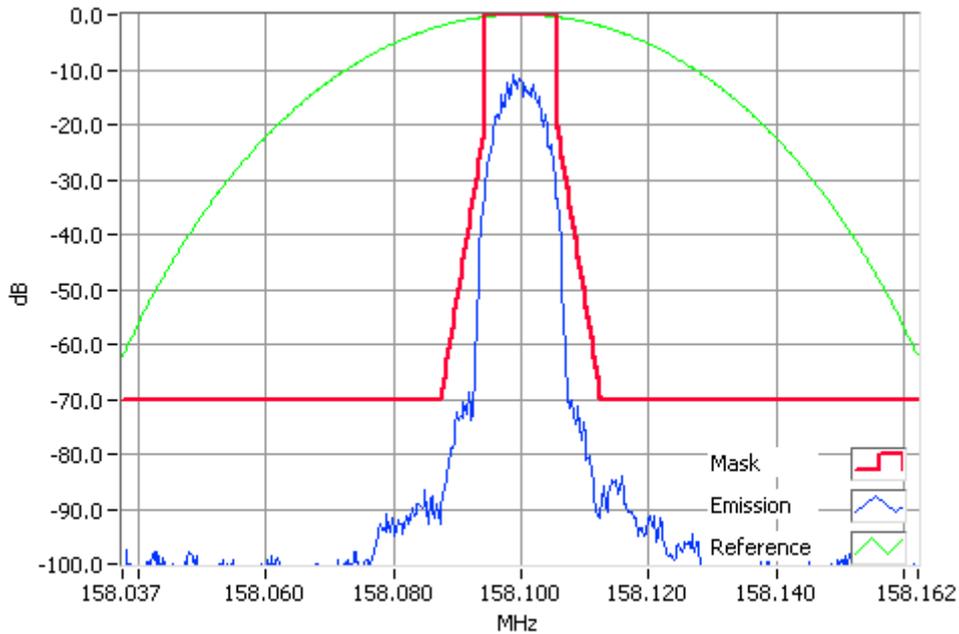
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RSS-119 5.5

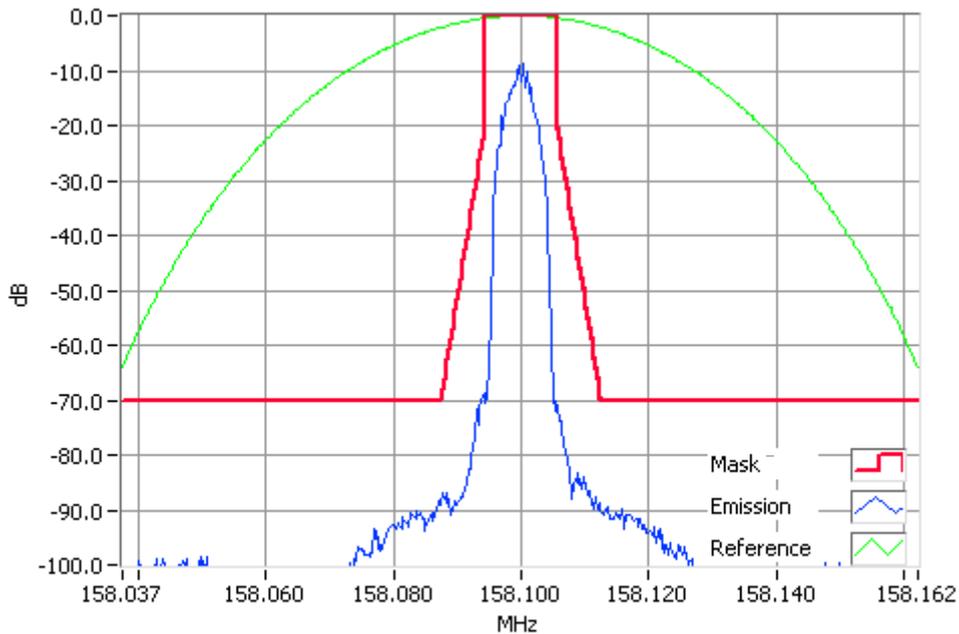
Tx FREQUENCY: 158.1 MHz

100 W

12.5 kHz Channel Spacing



**APCO_P25_PII-H-DQPSK 158.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PII-H-D8PSK 158.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

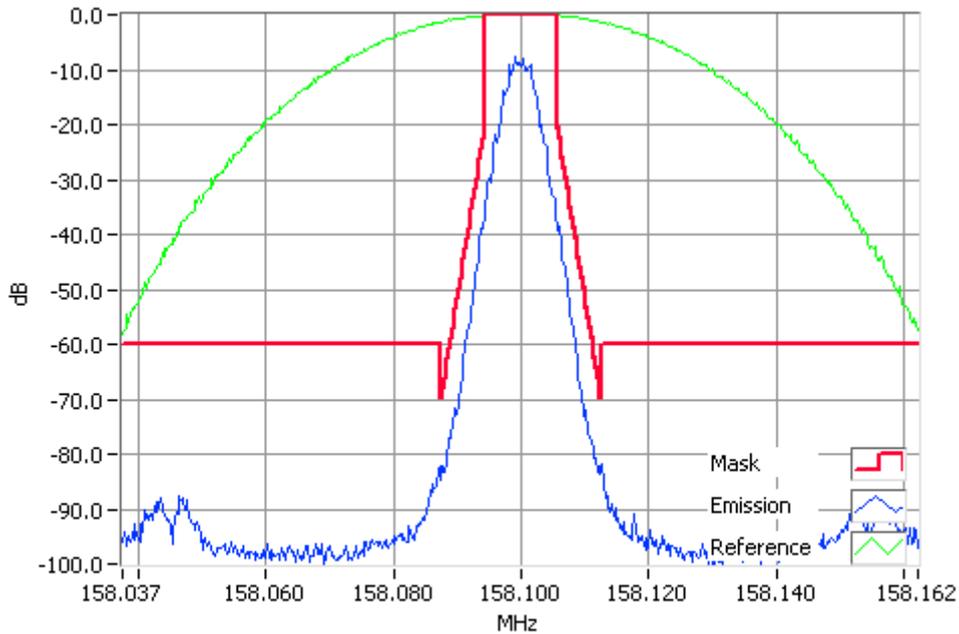
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

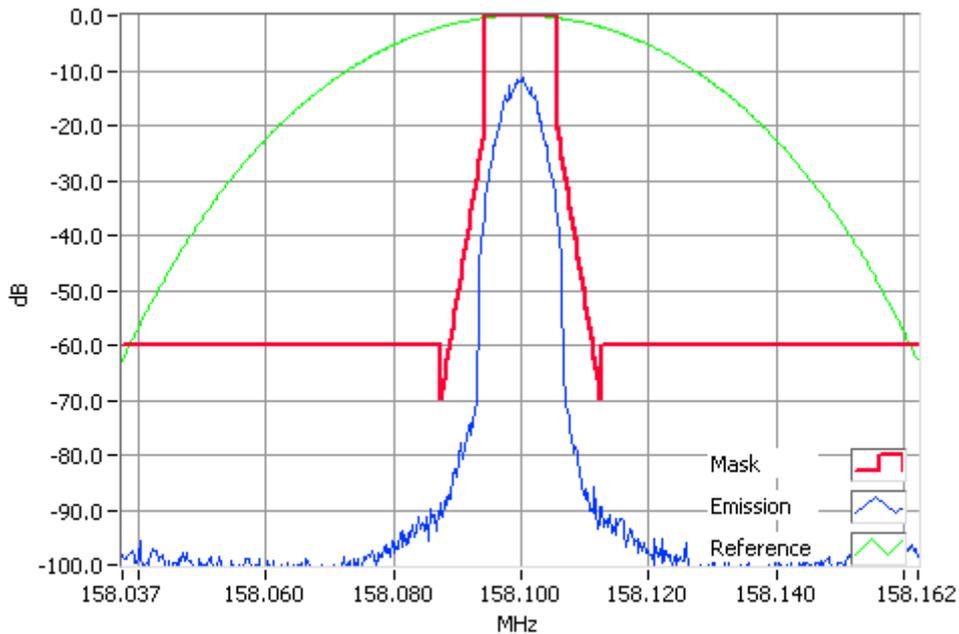
Tx FREQUENCY: 158.1 MHz

10 W

12.5 kHz Channel Spacing



**APCO_P25_PI-C4FM 158.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PI-LSM 158.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

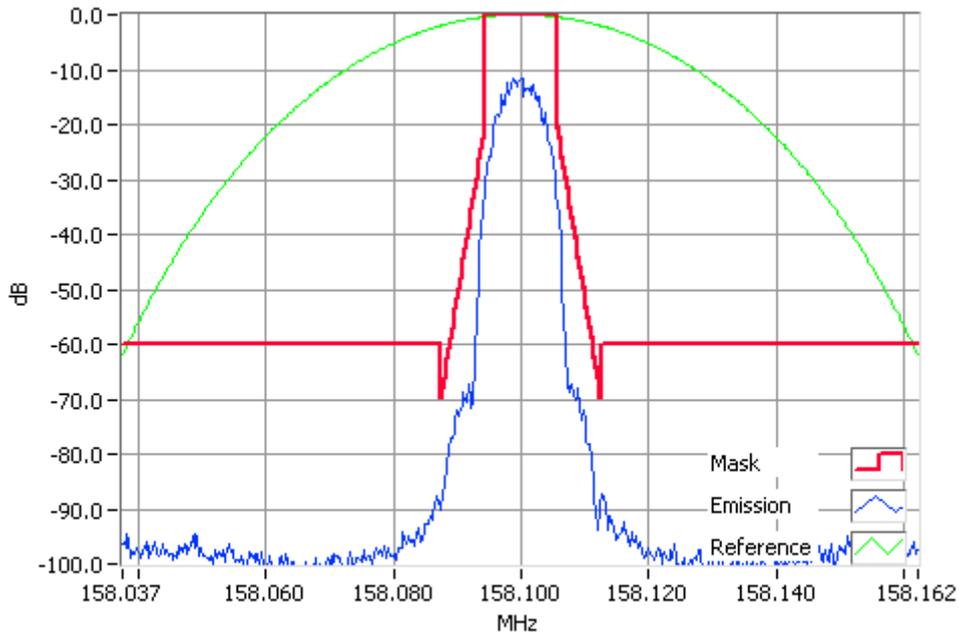
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

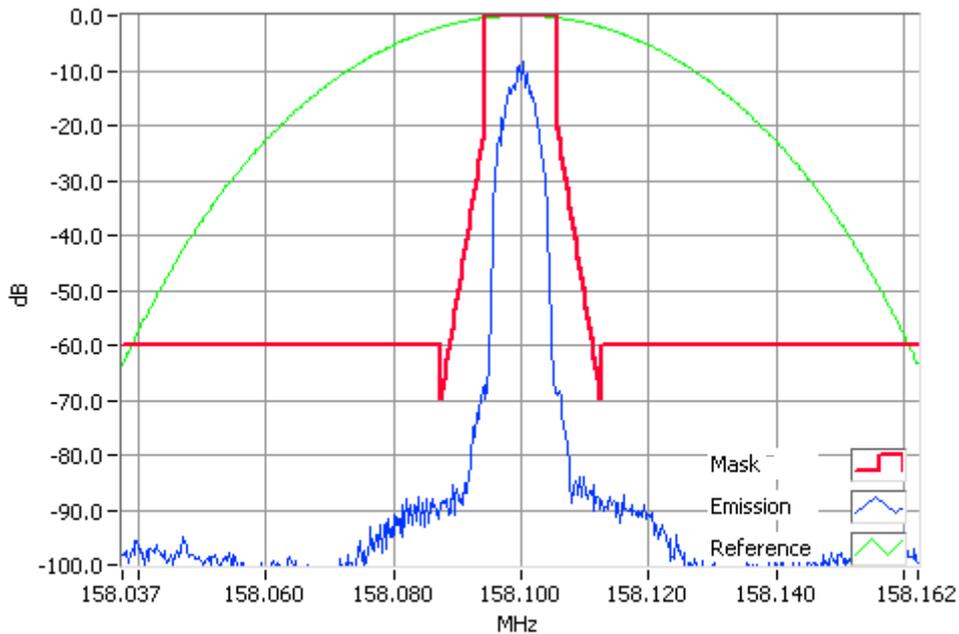
Tx FREQUENCY: 158.1 MHz

10 W

12.5 kHz Channel Spacing



APCO_P25_PII-H-DQPSK 158.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



APCO_P25_PII-H-D8PSK 158.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Occupied Bandwidth and Spectrum Masks

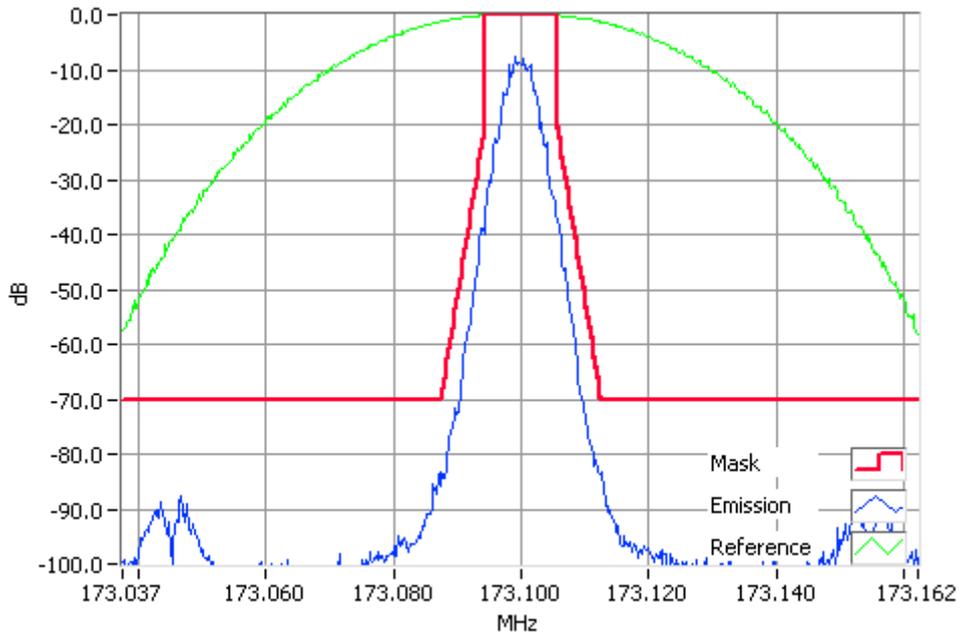
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

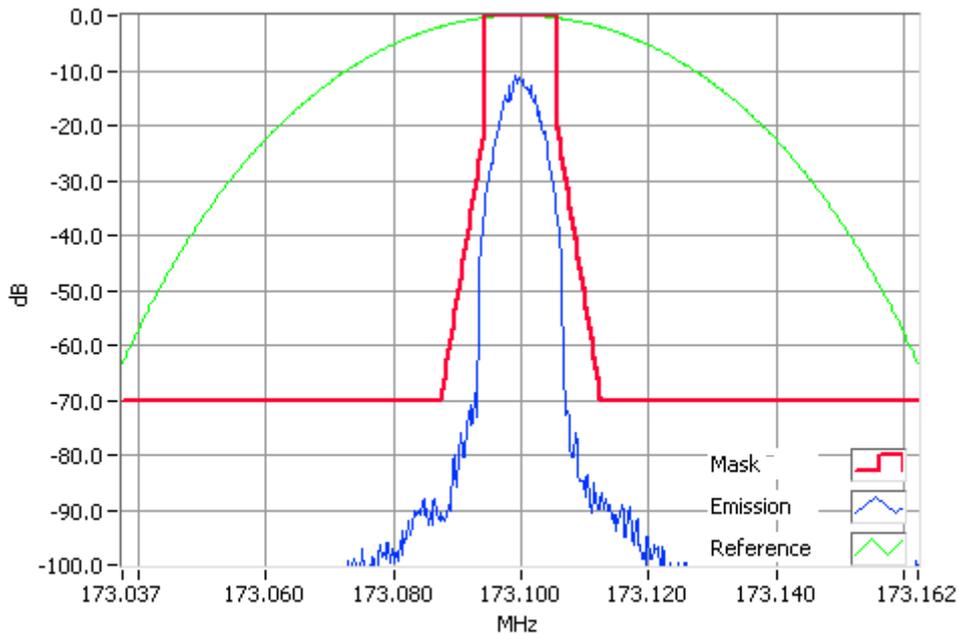
Tx FREQUENCY: 173.1 MHz

100 W

12.5 kHz Channel Spacing



**APCO_P25_PI-C4FM 173.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PI-LSM 173.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

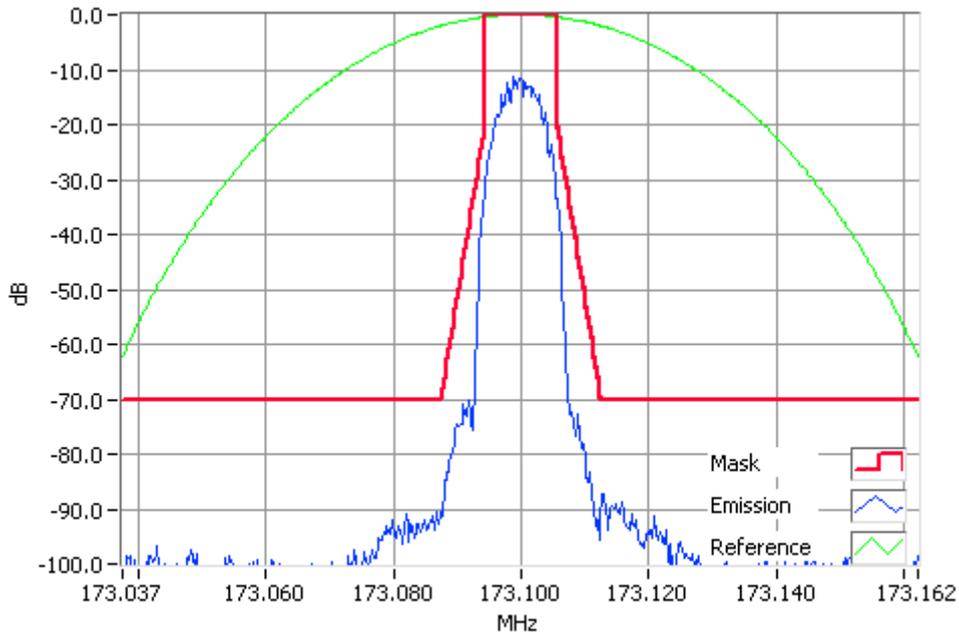
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

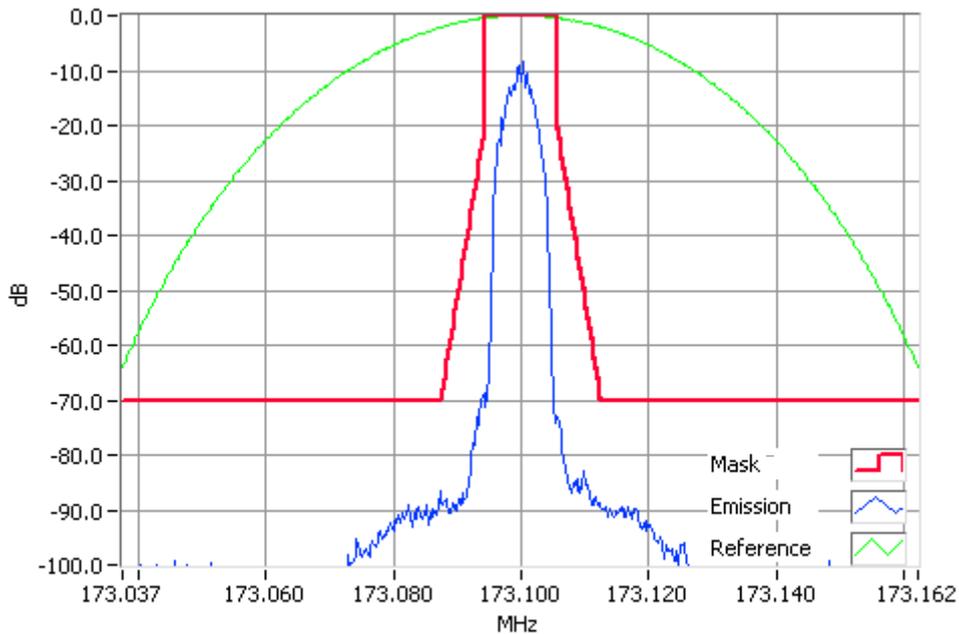
Tx FREQUENCY: 173.1 MHz

100 W

12.5 kHz Channel Spacing



**APCO_P25_PII-H-DQPSK 173.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PII-H-D8PSK 173.1000MHz Mask D 100W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

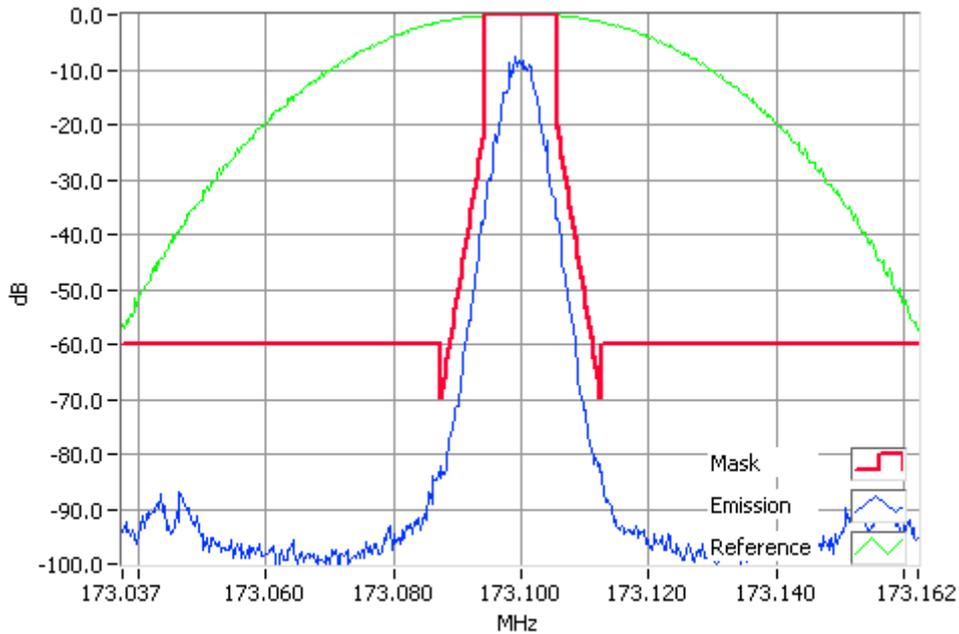
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

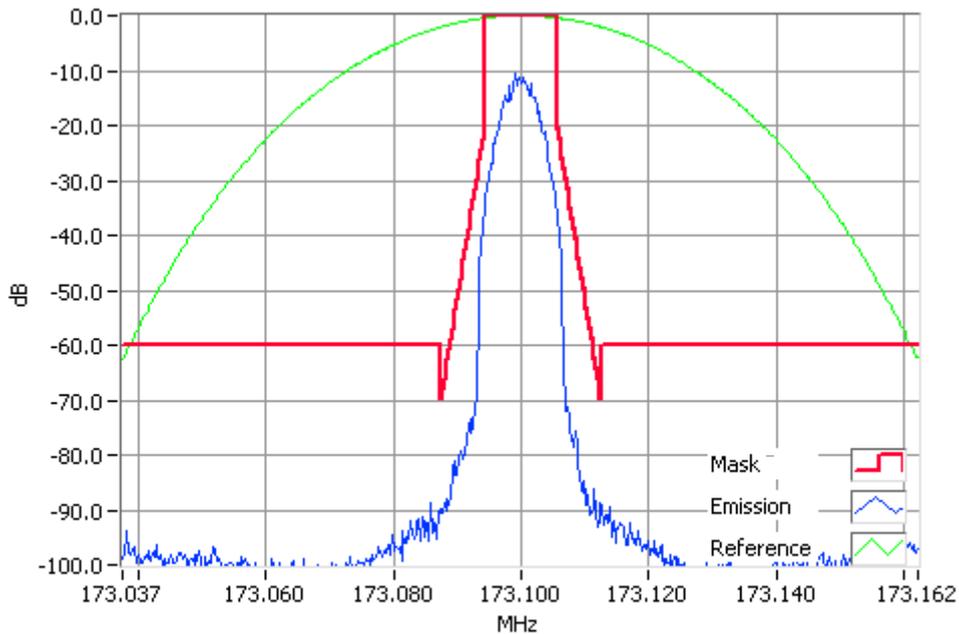
Tx FREQUENCY: 173.1 MHz

10 W

12.5 kHz Channel Spacing



**APCO_P25_PI-C4FM 173.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**



**APCO_P25_PI-LSM 173.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass**

Occupied Bandwidth and Spectrum Masks

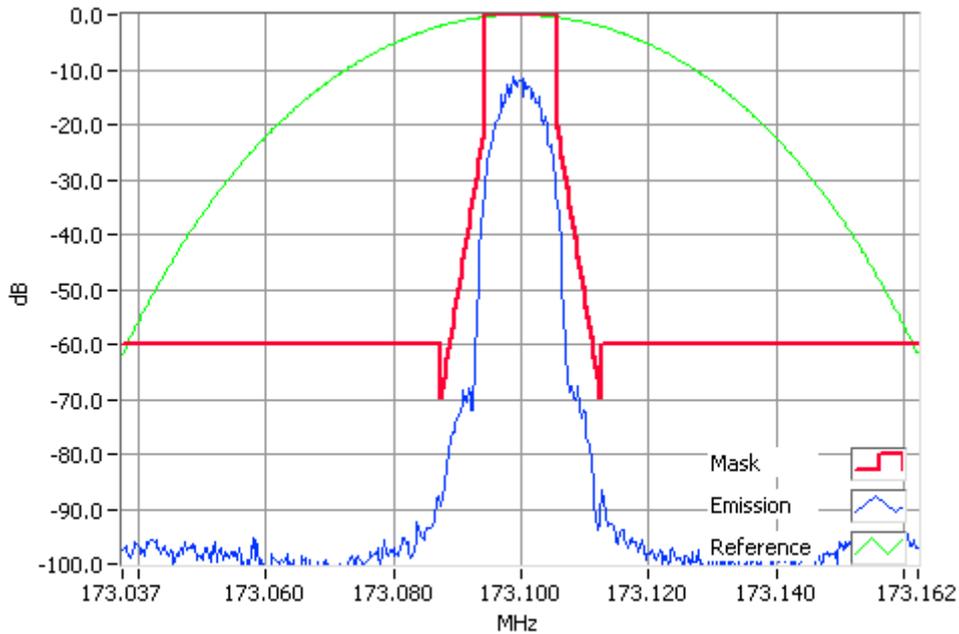
SPECIFICATION: FCC CFR 2.1049 (c)

RSS-119 5.5

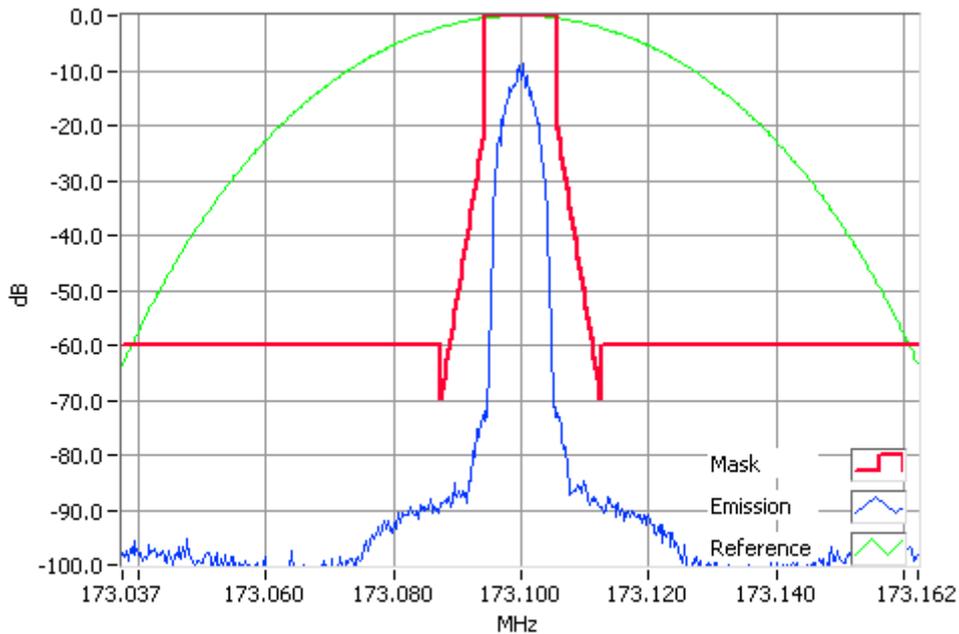
Tx FREQUENCY: 173.1 MHz

10 W

12.5 kHz Channel Spacing



APCO_P25_PII-H-DQPSK 173.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass



APCO_P25_PII-H-DBPSK 173.1000MHz Mask D 10W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATIONS: FCC 47 CFR 2.1051

RSS-119 5.8

GUIDE: TIA-102.CAAA-C 2.2.13

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The frequency range examined was from the lowest frequency generated within the EUT, to a frequency higher than the 10th Harmonic: 100 kHz to Fc-BW
Fc+ BW to 10Fc GHz
3. A Pre-scan is performed with a resolution bandwidth of 1 kHz, and a video bandwidth of 3 kHz. If any emissions are found to be within 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.

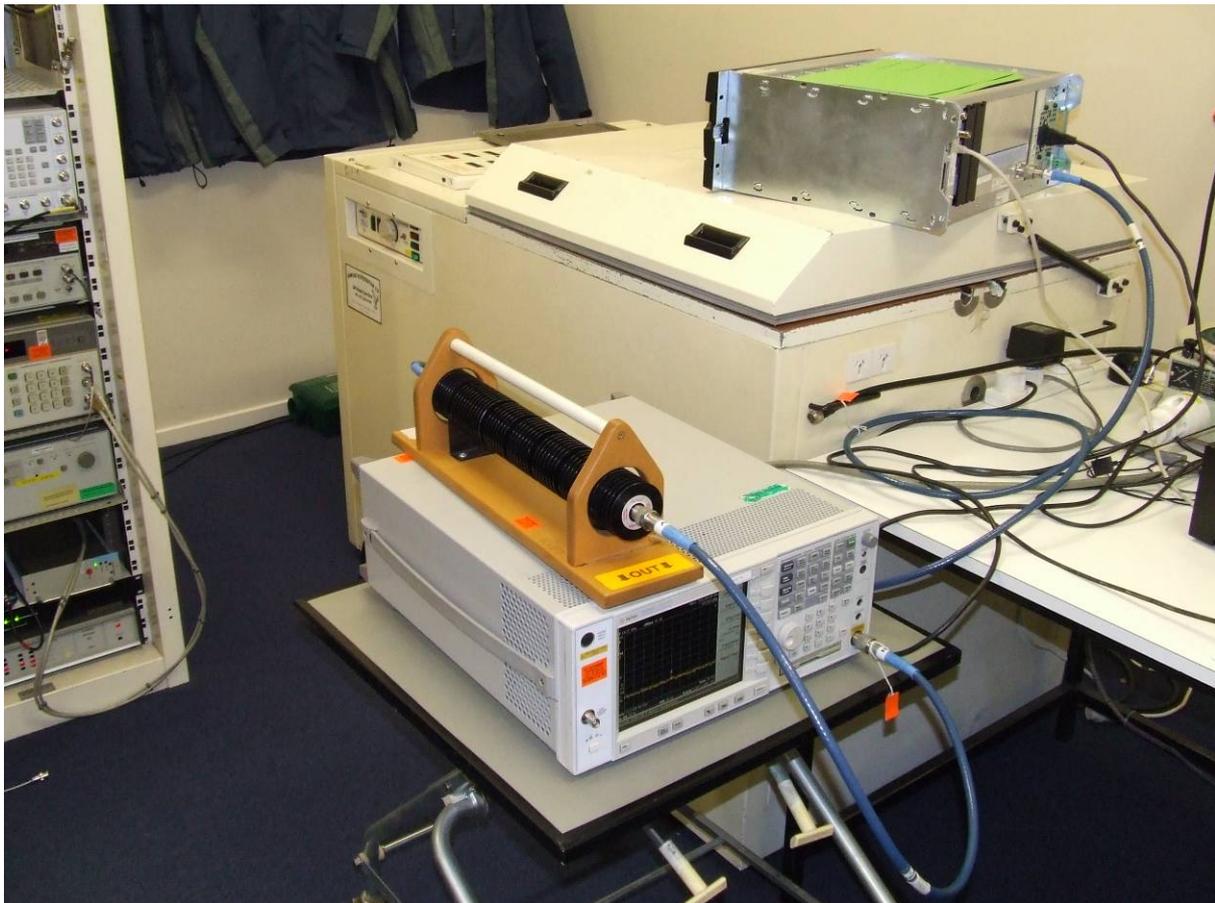
MEASUREMENT RESULTS:

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

Tx FREQUENCY: 148.015 MHz

12.5 kHz Channel Spacing

148.015 MHz @ 100 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

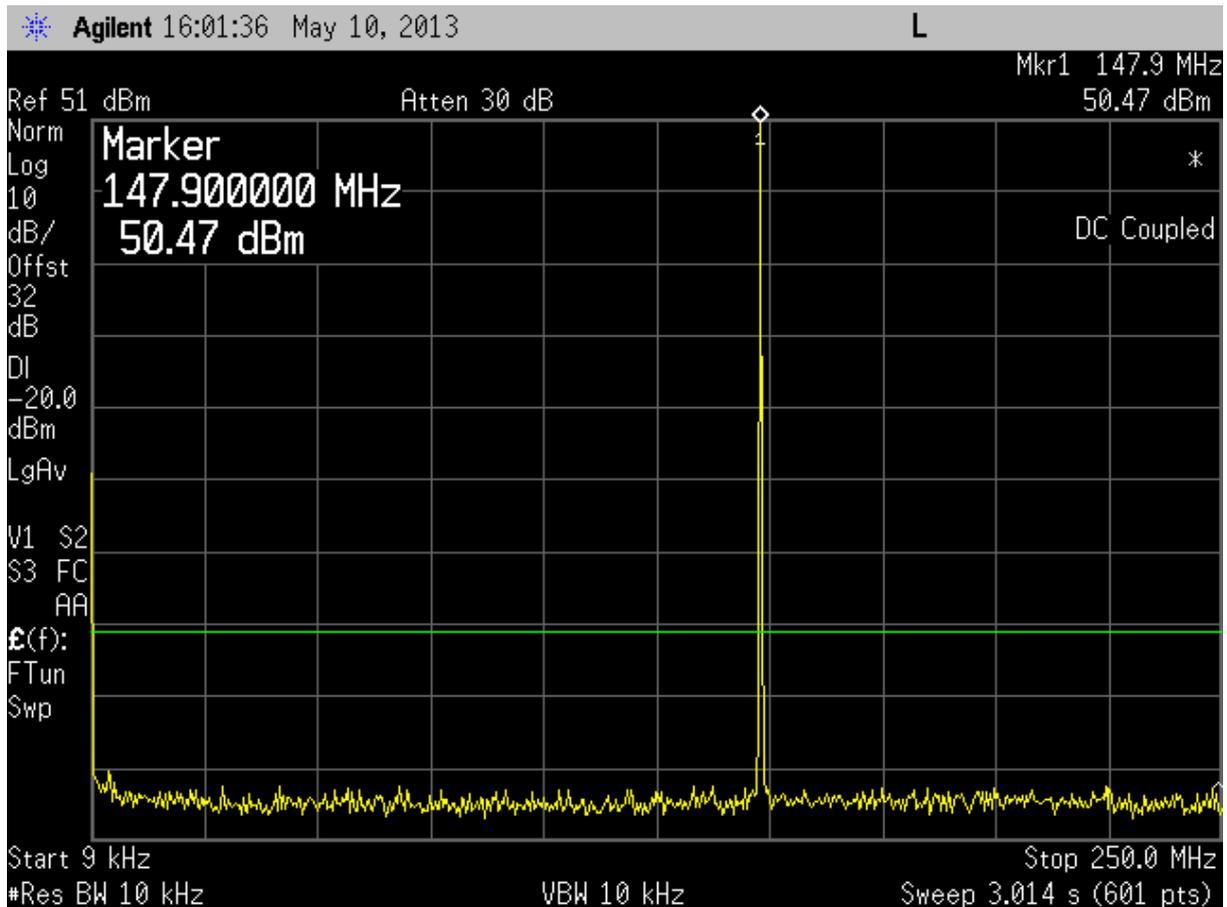
12.5 kHz Channel Spacing

148.015 MHz @ 10 W

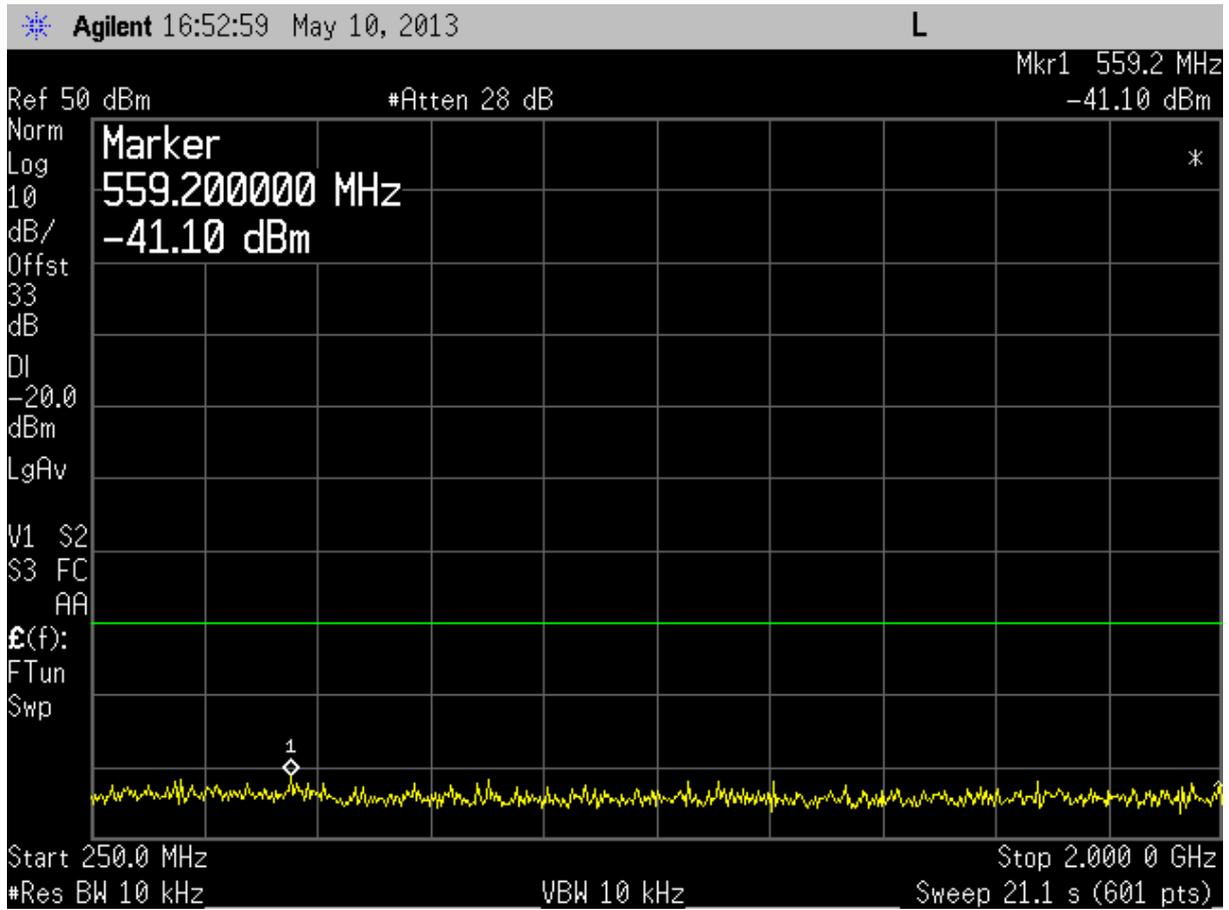
Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		
Measurement Uncertainty	± 3.0 dB	

148.015 MHz @ 100 W Plots:



Spurious Emissions (Tx Conducted)



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing 152.1 MHz @ 100 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

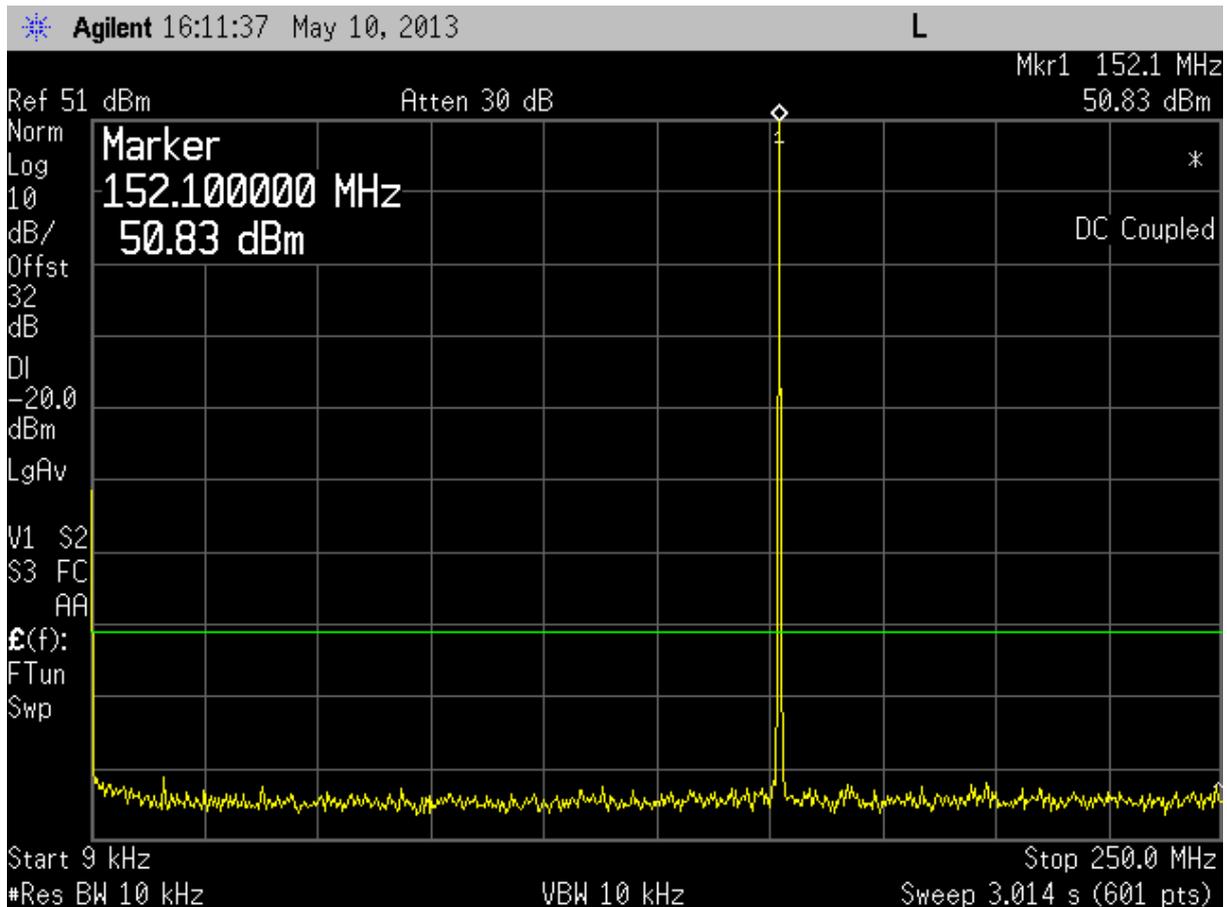
12.5 kHz Channel Spacing 152.1 MHz @ 10 W Emission Mask D

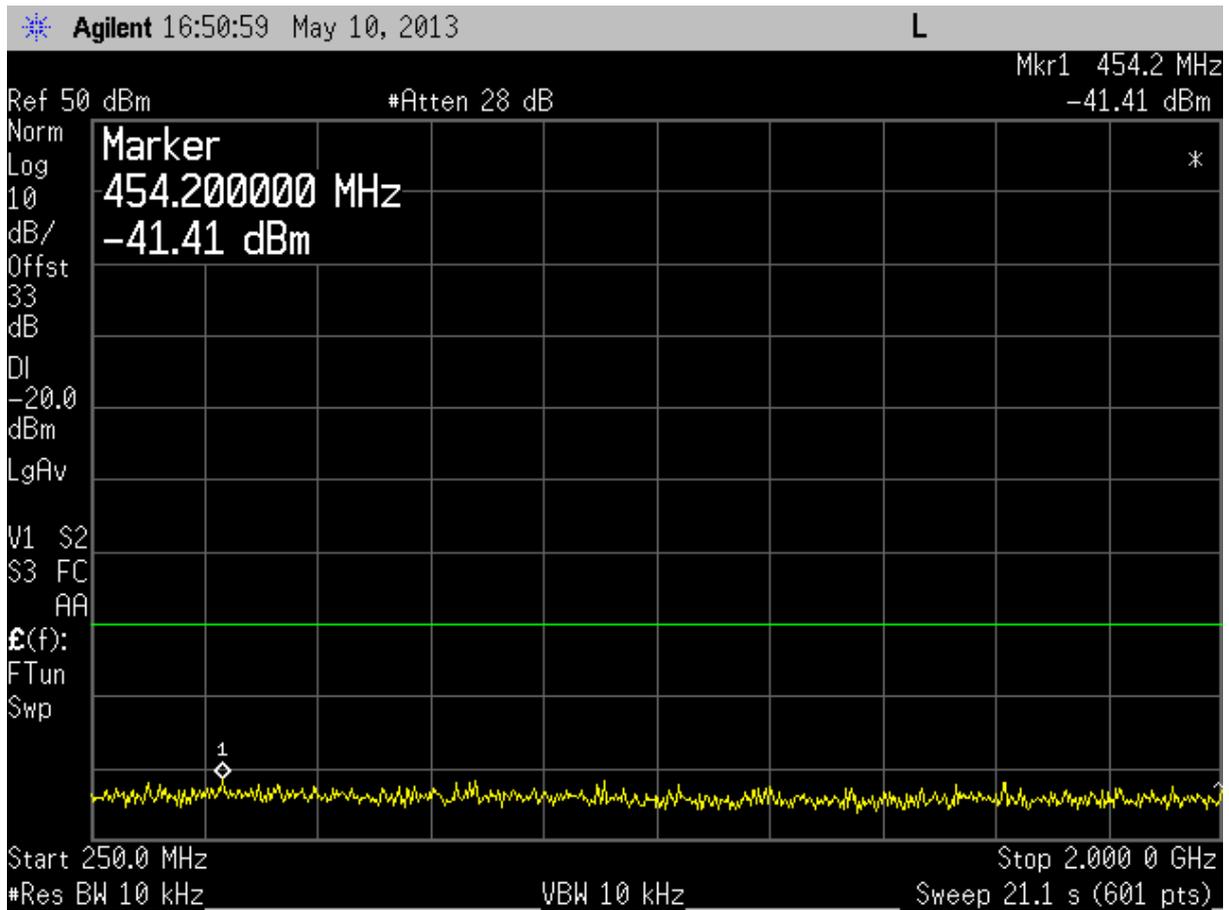
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

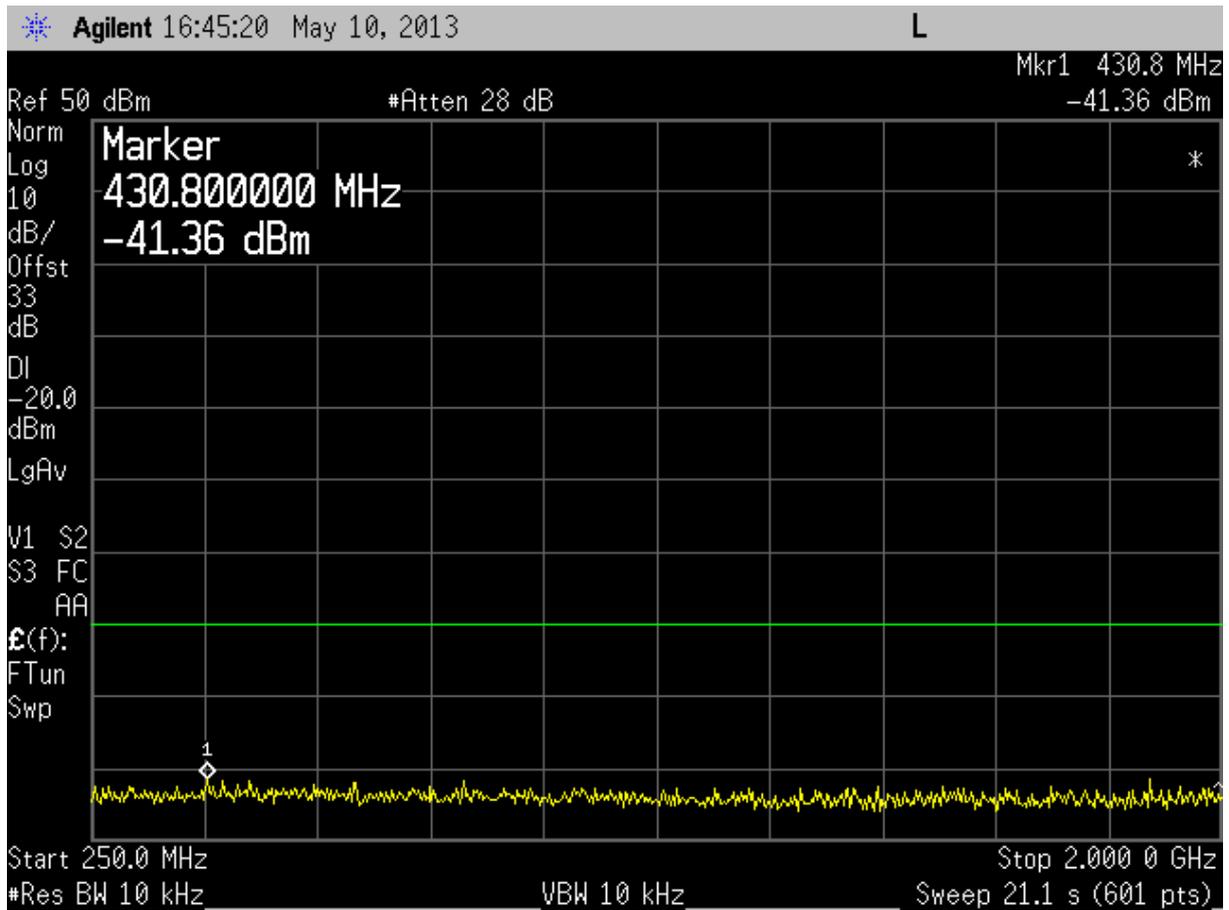
No emissions were detected at a level greater than 20 dB below the limit.

Measurement Uncertainty	± 3.0 dB
-------------------------	----------

152.1 MHz @ 100 W Plots:







Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

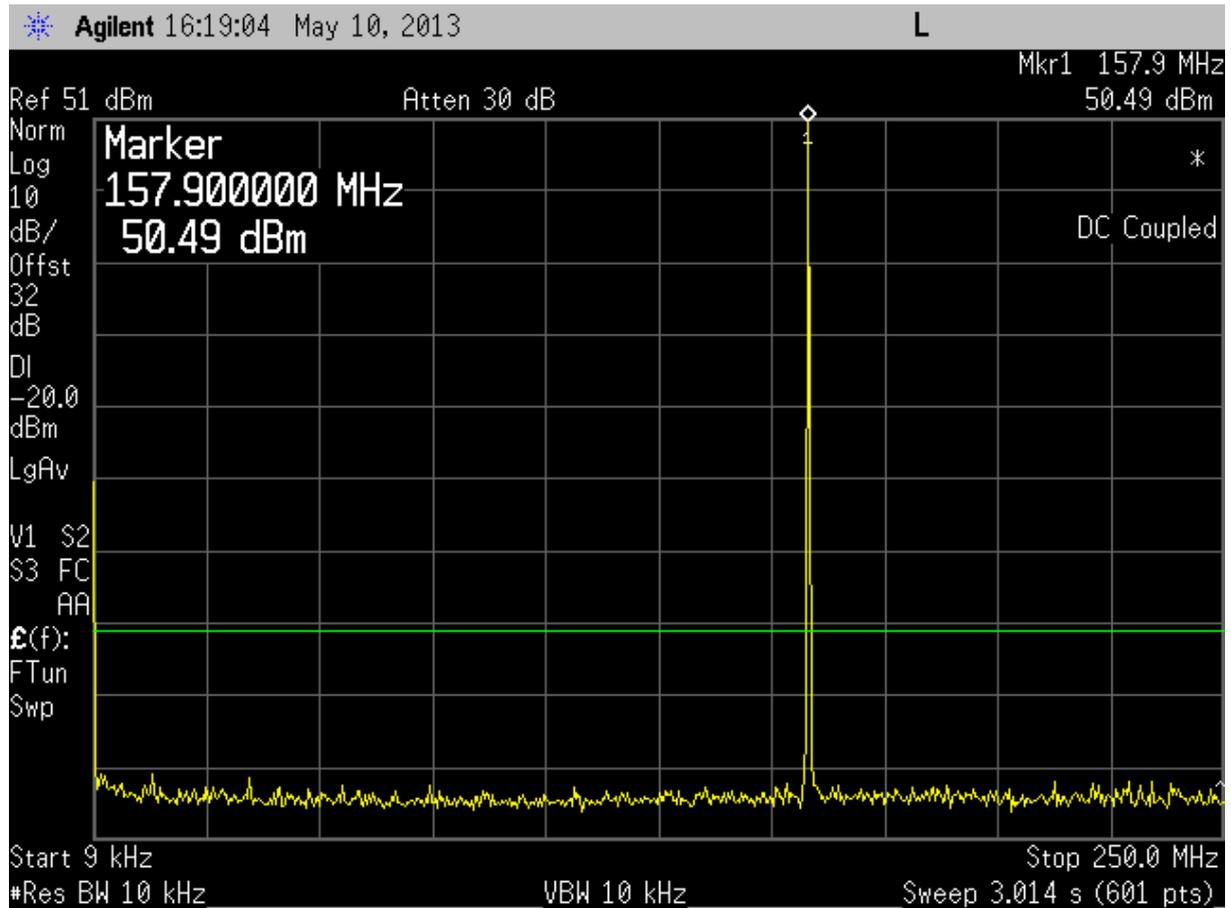
12.5 kHz Channel Spacing 158.1 MHz @ 100 W Emission Mask D

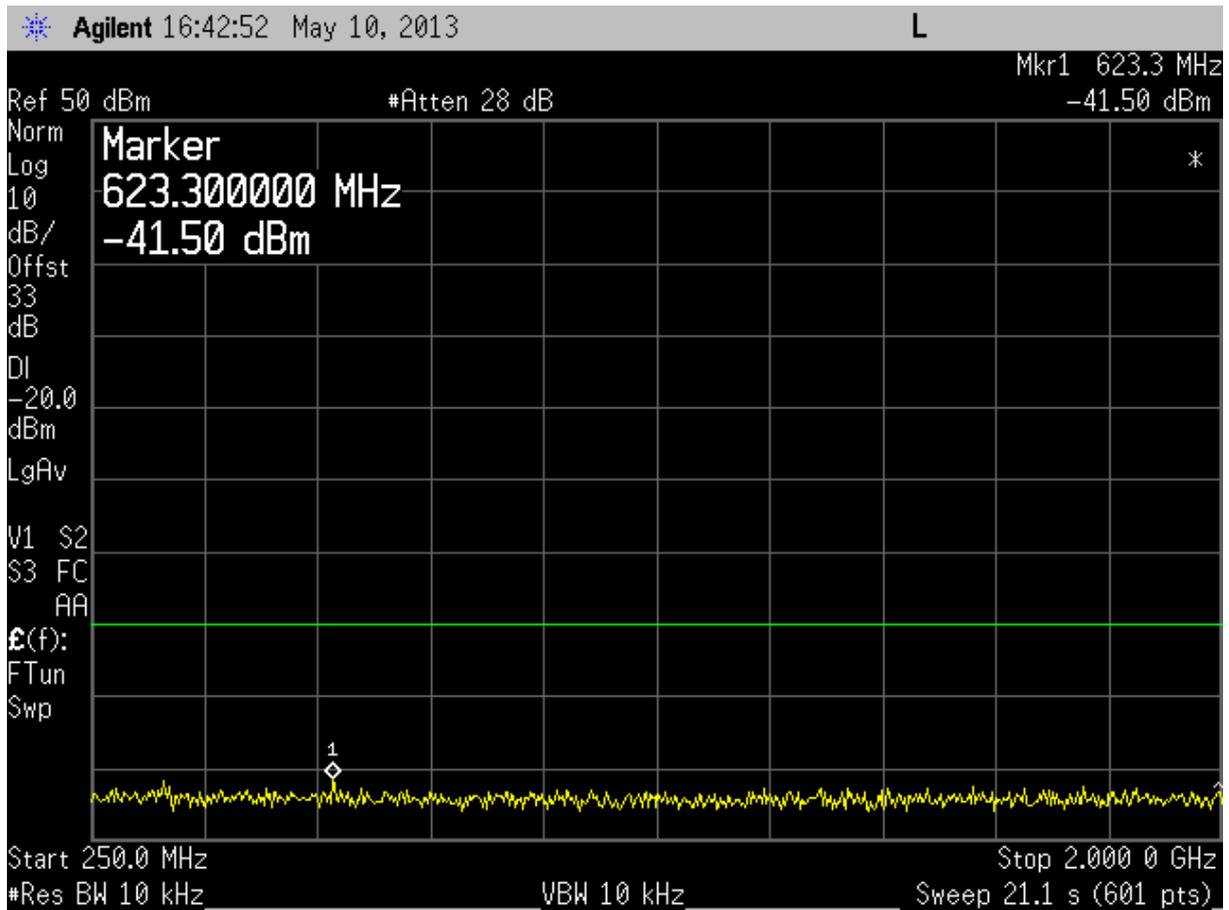
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 158.1 MHz @ 10 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		
Measurement Uncertainty	± 3.0 dB	

158.1 MHz @ 100 W Plots:





Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051

RSS-119 5.8

12.5 kHz Channel Spacing

173.1 MHz @ 100 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

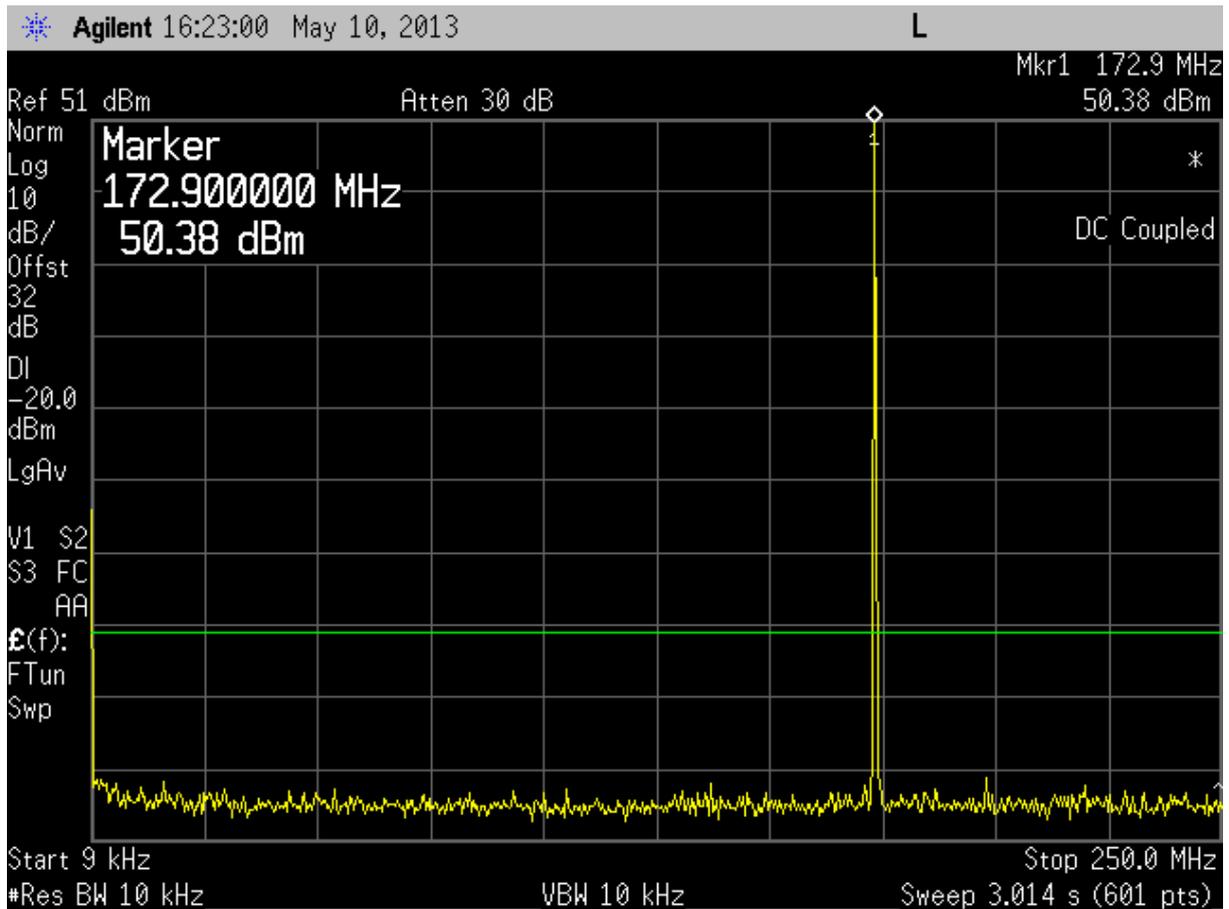
12.5 kHz Channel Spacing

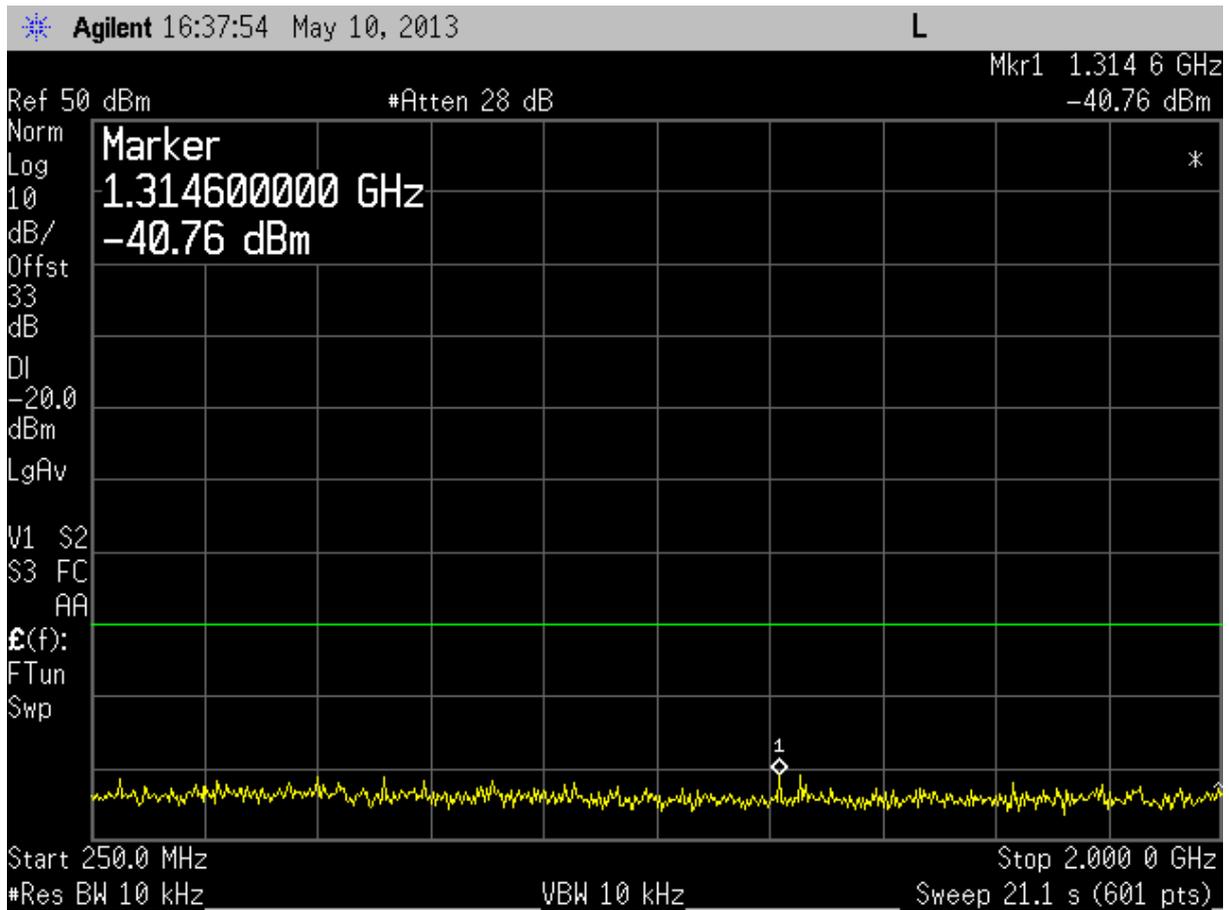
173.1 MHz @ 10 W

Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
No emissions were detected at a level greater than 20 dB below the limit.		
Measurement Uncertainty	± 3.0 dB	

173.1 MHz @ 100 W Plots:





SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8
 LIMITS: FCC 47 CFR 90.210 RSS-119 5.8

Carrier Output Power	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
	100 W	-20 dBm
10 W	-20 dBm	-60 dBc

TRANSMITTER SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA-102.CAAA-C 2.2.6

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 10 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 10 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 meters 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

SPECIFICATION: FCC CFR 2.1053

12.5 kHz Channel Spacing 148.015 MHz @ 100 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 148.015 MHz @ 10 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.		
Measurement Uncertainty	± 4.6 dB	

12.5 kHz Channel Spacing 152.1 MHz @ 100 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 152.1 MHz @ 10 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.		
Measurement Uncertainty	± 4.6 dB	

12.5 kHz Channel Spacing 153.1 MHz @ 100 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 153.1 MHz @ 10 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.		
Measurement Uncertainty	± 4.6 dB	

12.5 kHz Channel Spacing 158.1 MHz @ 100 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 158.1 MHz @ 10 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.		
Measurement Uncertainty	± 4.6 dB	

12.5 kHz Channel Spacing 173.1 MHz @ 100 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 173.1 MHz @ 10 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.		
Measurement Uncertainty	± 4.6 dB	

LIMITS: FCC CFR 2.1053

Carrier Output Power	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
	100 W	-20 dBm
10 W	-20 dBm	-60 dBc

Tx Radiated Emissions - Continued

Open Area Test Site Results:

12.5 kHz Channel Spacing

153.1 MHz @ 100 W

Emission Mask D

Harmonics Emission Frequency (MHz)	Level (dBm)	Level (dBc)
306.200000	-85.1	-135.1
459.300000	-84.5	-134.5
612.400000	-65.5	-115.5
765.500000	-67.7	-117.7
918.600000	-56.6	-106.6
1071.700000	-51.1	-101.1
No emissions were detected at a level greater than 10 dB below the limit.		
Measurement Uncertainty	± 4.6 dB	

Photo of OATS Setup:



TRANSIENT FREQUENCY BEHAVIOR

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

GUIDE: TIA-102.CAAA-C 2.2.18

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. Measurements and plots were made following the TIA-102 procedure.

MEASUREMENT RESULTS:

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

MEASUREMENT UNCERTAINTY: ± 130 Hz

LIMIT CLAUSES: FCC 47 CFR 90.214 RSS-119 5.9

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 148.015 MHz

100 W

12.5 kHz Channel Spacing

148.015 MHz @ 100 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	0.2	N/A
t2	0.3	N/A
t3	N/A	-0.3
t2 → t3 ppm	2.1	
ERROR LIMIT (t2 → t3) ppm	2.5	

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

Transient Frequency Behaviour

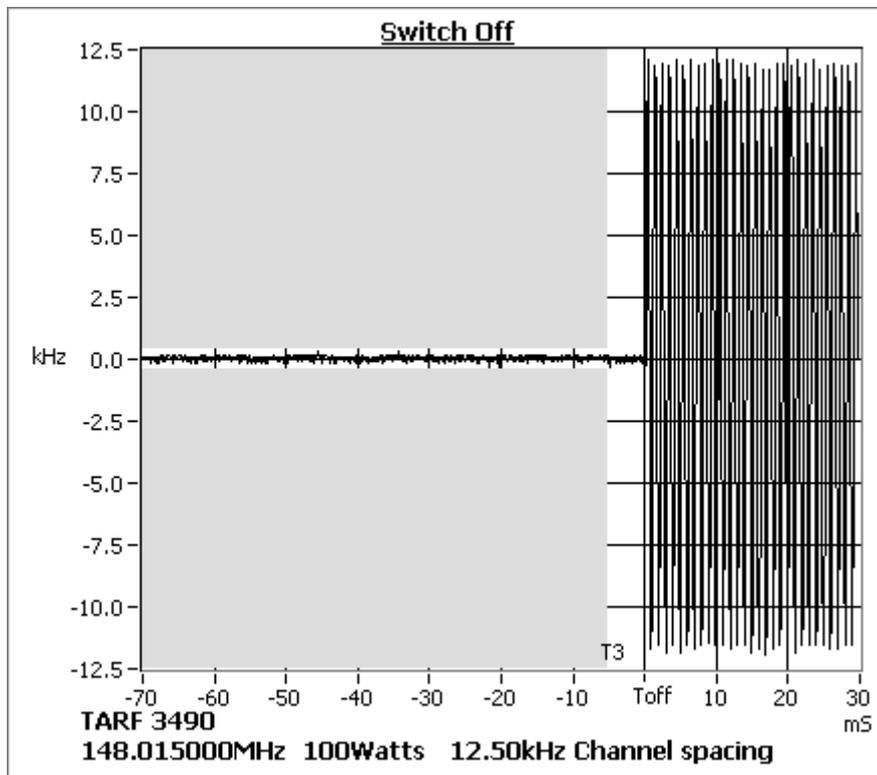
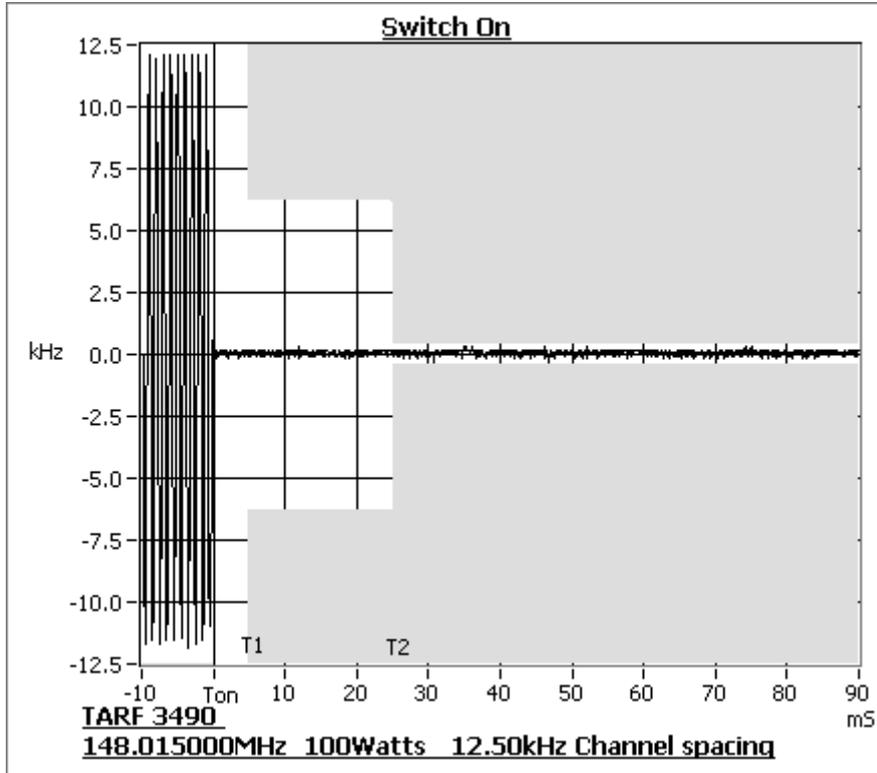
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 148.015 MHz

100 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 148.015 MHz 10 W 12.5 kHz Channel Spacing

148.015 MHz @ 10 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-1.1	N/A
t2	-0.5	N/A
t3	N/A	-1.3
t2 → t3 ppm	-2.2	
ERROR LIMIT t2 → t3 (ppm)	2.5	

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

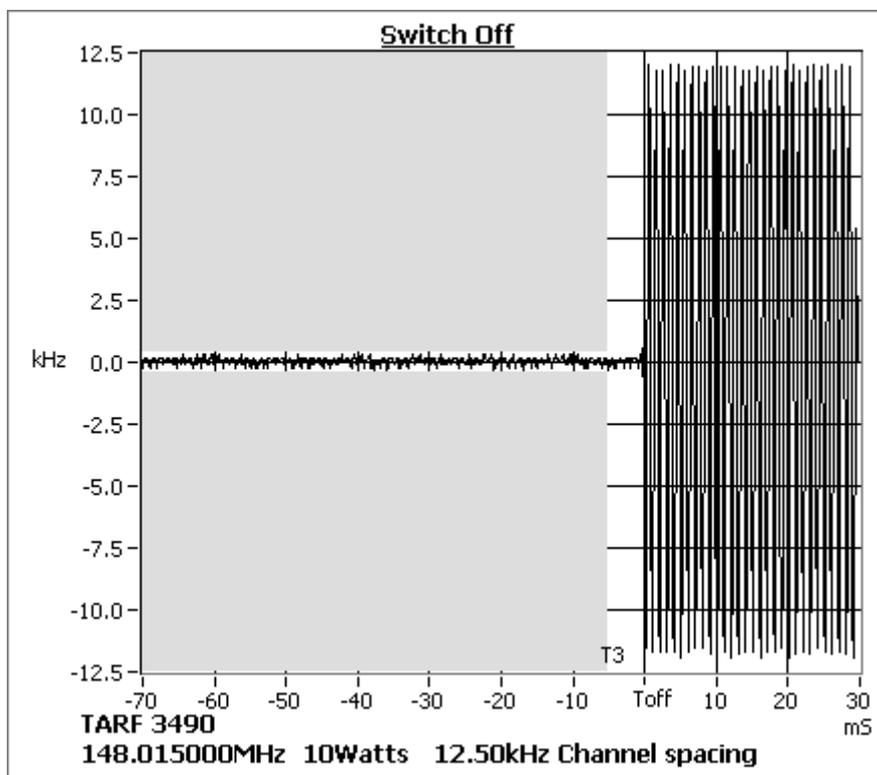
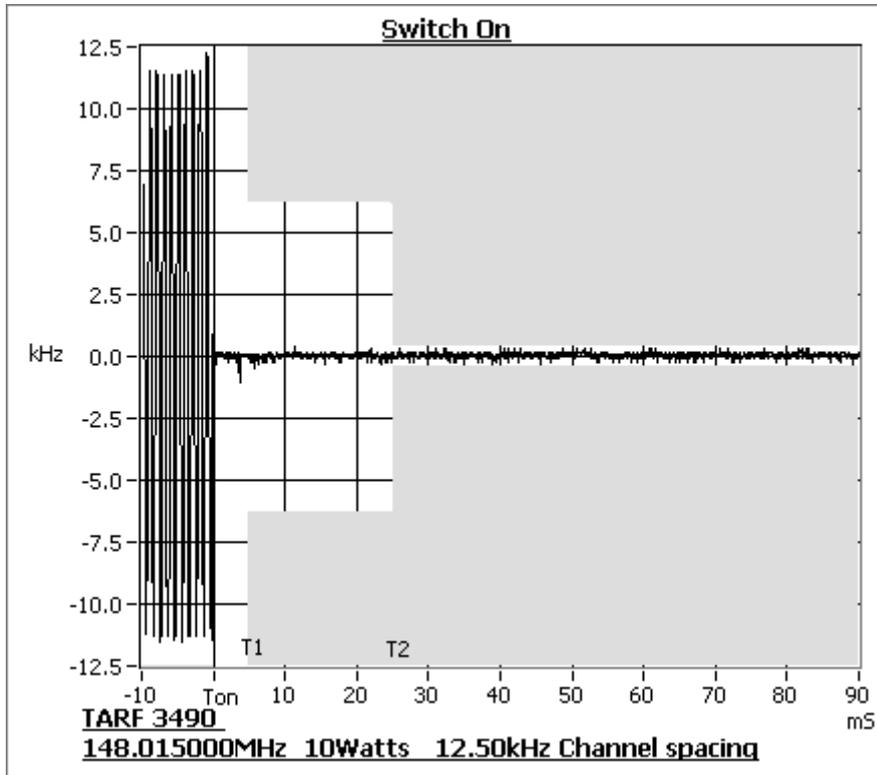
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

Transient Frequency Behavior

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 148.015 MHz 10 W 12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 152.1 MHz

100 W

12.5 kHz Channel Spacing

152.1 MHz @ 100 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.4	N/A
t2	-0.4	N/A
t3	N/A	-0.4
t2 → t3 ppm	-2.3	
ERROR LIMIT (t2 → t3) ppm	2.5	

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

Transient Frequency Behaviour

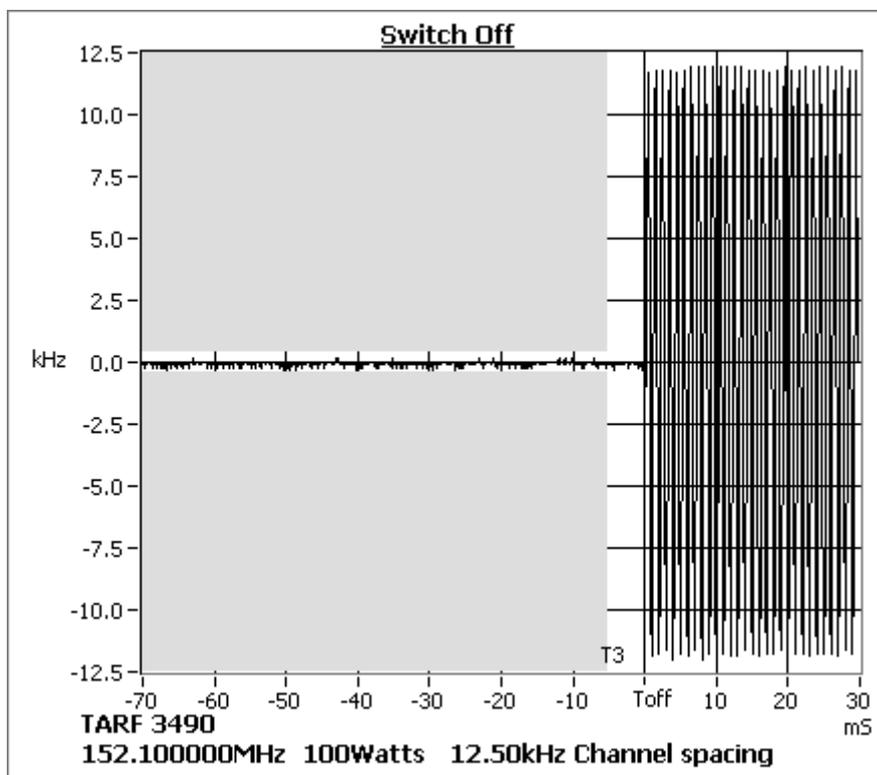
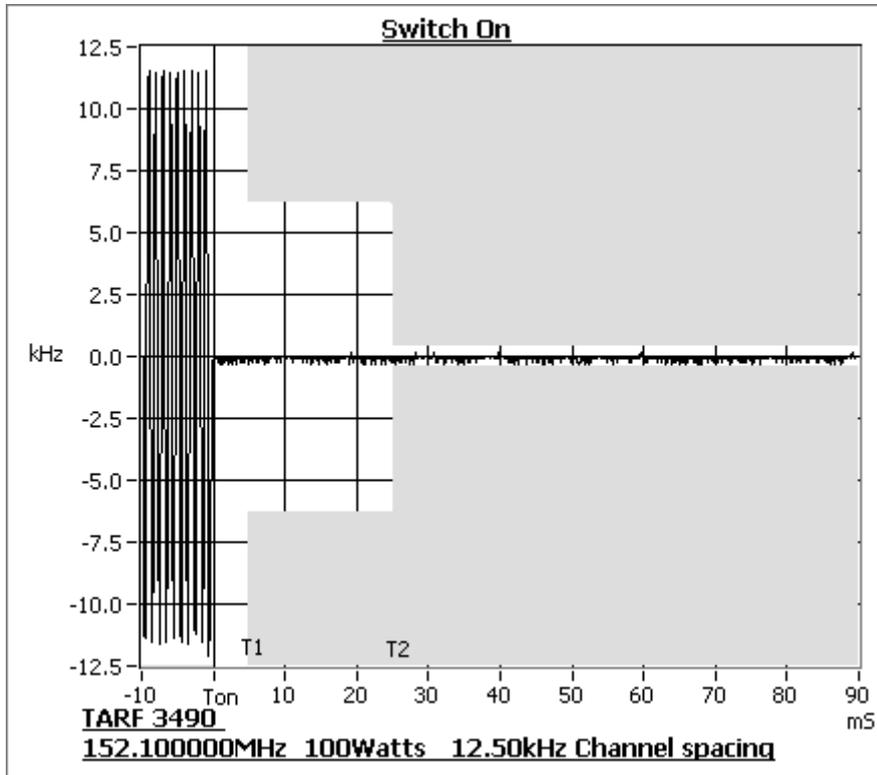
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 152.1 MHz

100 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 152.1 MHz 10 W 12.5 kHz Channel Spacing

152.1 MHz @ 10 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.3	N/A
t2	-0.3	N/A
t3	N/A	-0.4
t2 → t3 ppm	2.2	
ERROR LIMIT t2 → t3 (ppm)	2.5	

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

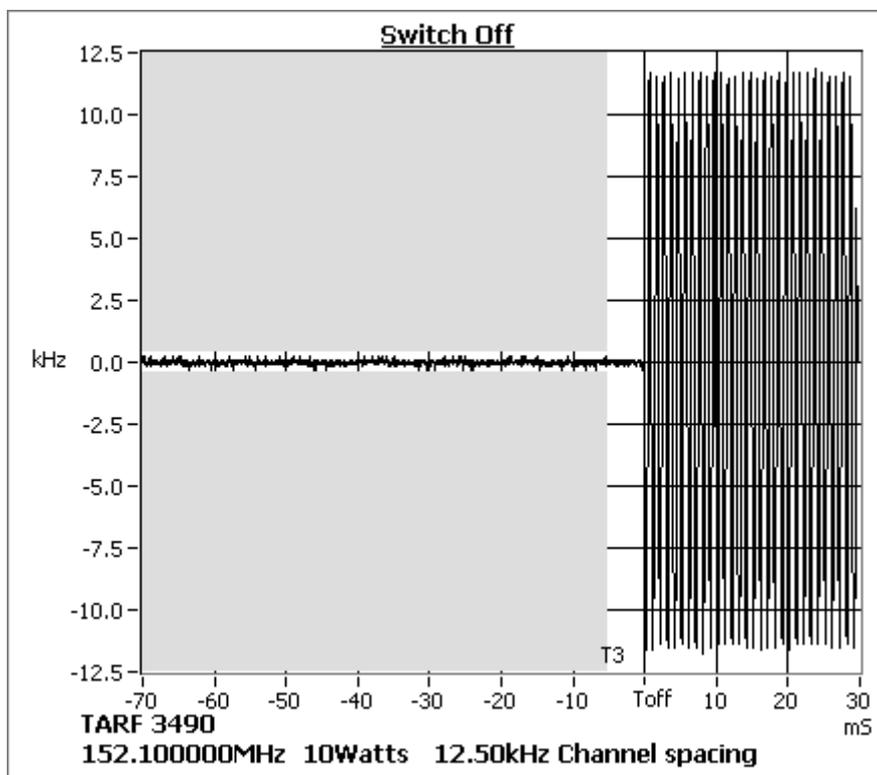
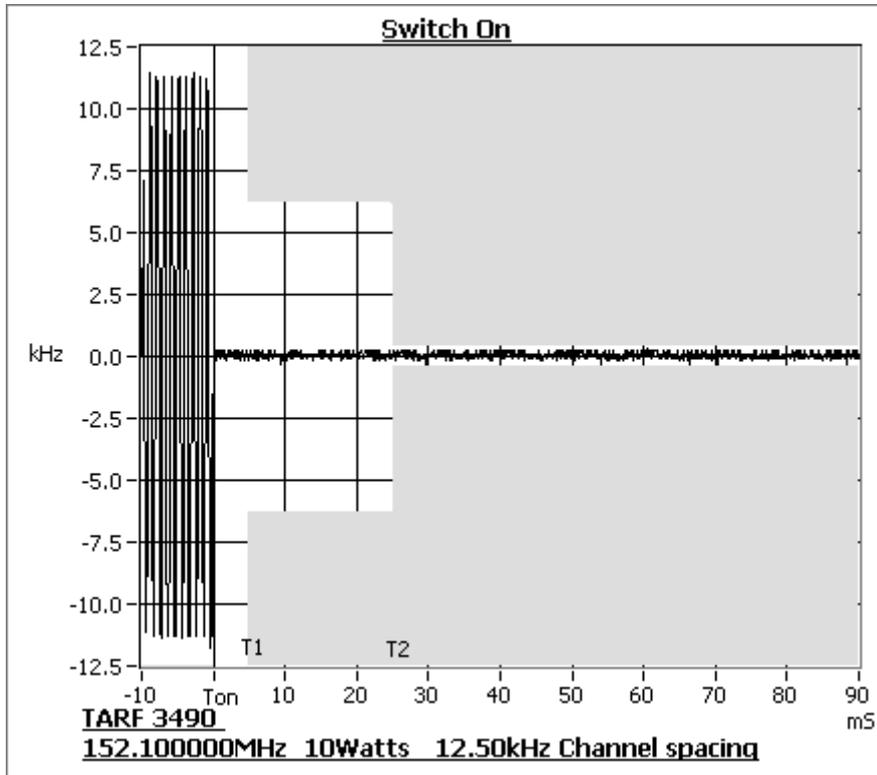
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

Transient Frequency Behavior

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 152.1 MHz 10 W 12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 153.1 MHz

100 W

12.5 kHz Channel Spacing

153.1 MHz @ 100 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.3	N/A
t2	-0.3	N/A
t3	N/A	-0.3
t2 → t3 ppm	-2.0	
ERROR LIMIT (t2 → t3) ppm	2.5	

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

Transient Frequency Behaviour

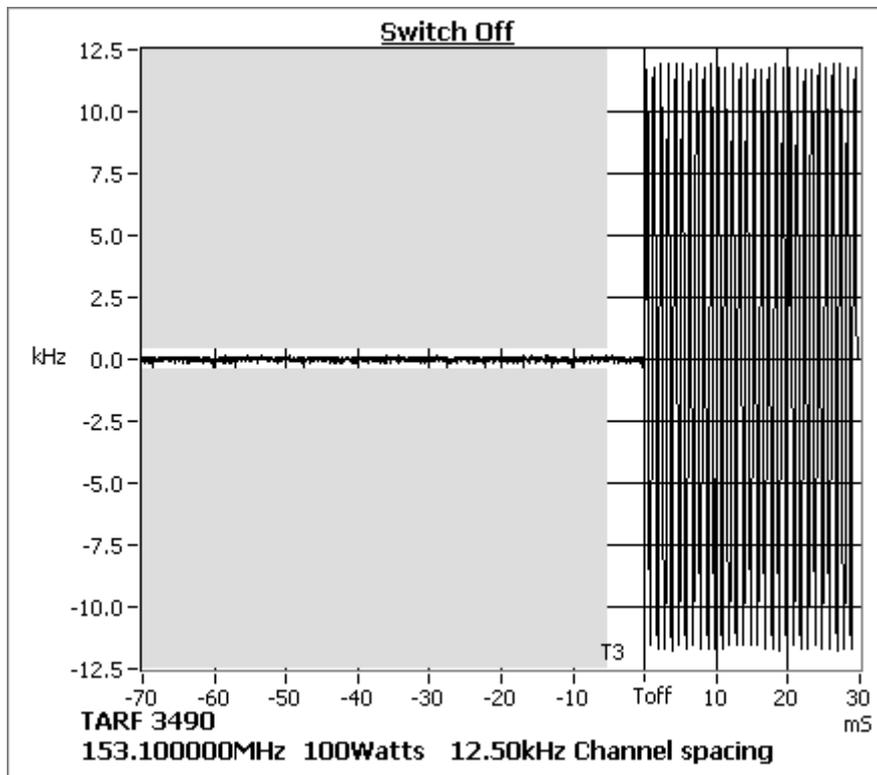
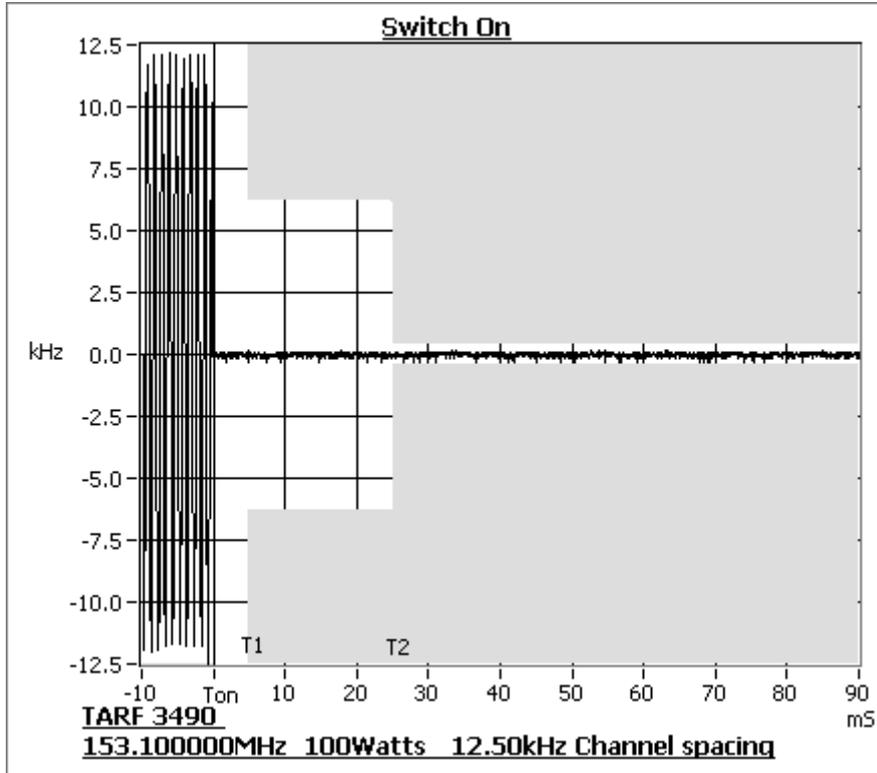
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 153.1 MHz

100 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 153.1 MHz 10 W 12.5 kHz Channel Spacing

153.1 MHz @ 10 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.8	N/A
t2	-0.4	N/A
t3	N/A	-0.5
t2 → t3 ppm	2.2	
ERROR LIMIT t2 → t3 (ppm)	2.5	

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

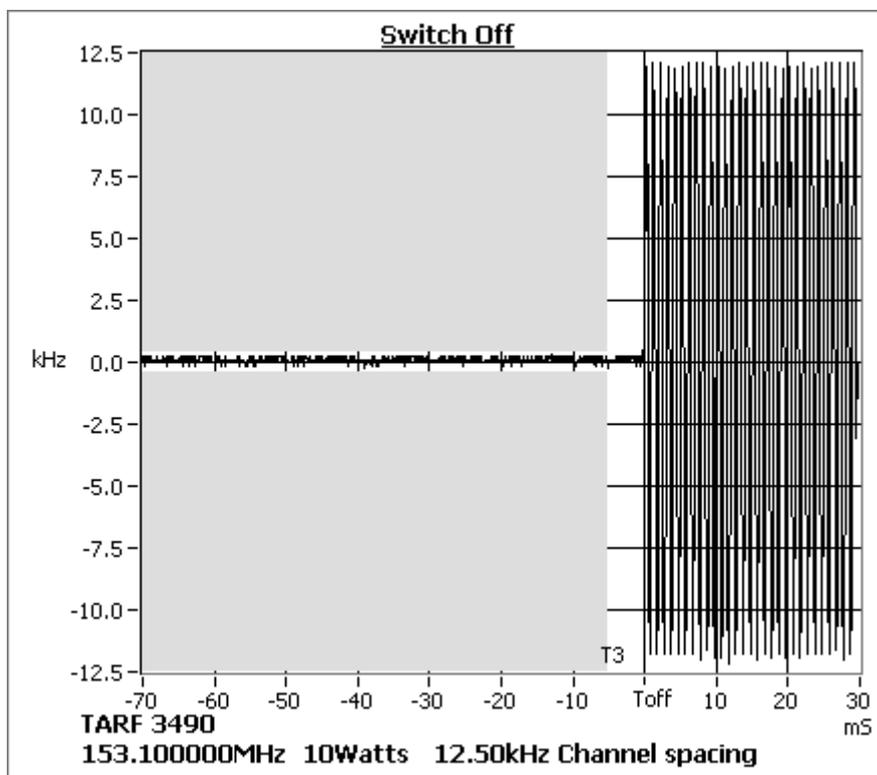
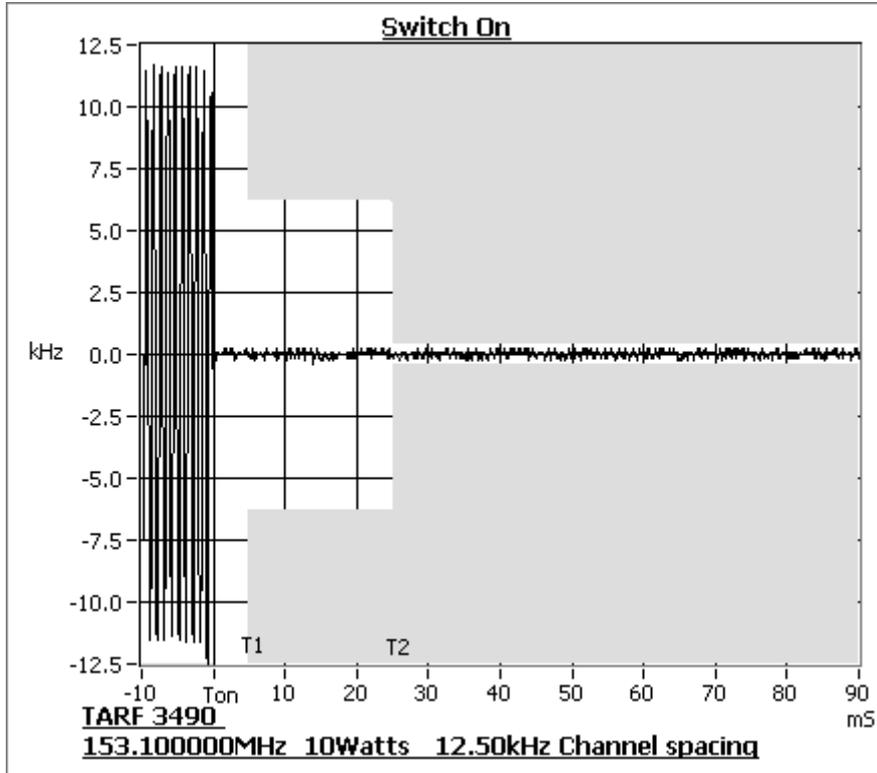
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

Transient Frequency Behavior

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 153.1 MHz 10 W 12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 158.1 MHz

100 W

12.5 kHz Channel Spacing

158.1 MHz @ 100 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.4	N/A
t2	-0.4	N/A
t3	N/A	-0.1
t2 → t3 ppm	-2.5	
ERROR LIMIT (t2 → t3) ppm	2.5	

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

Transient Frequency Behaviour

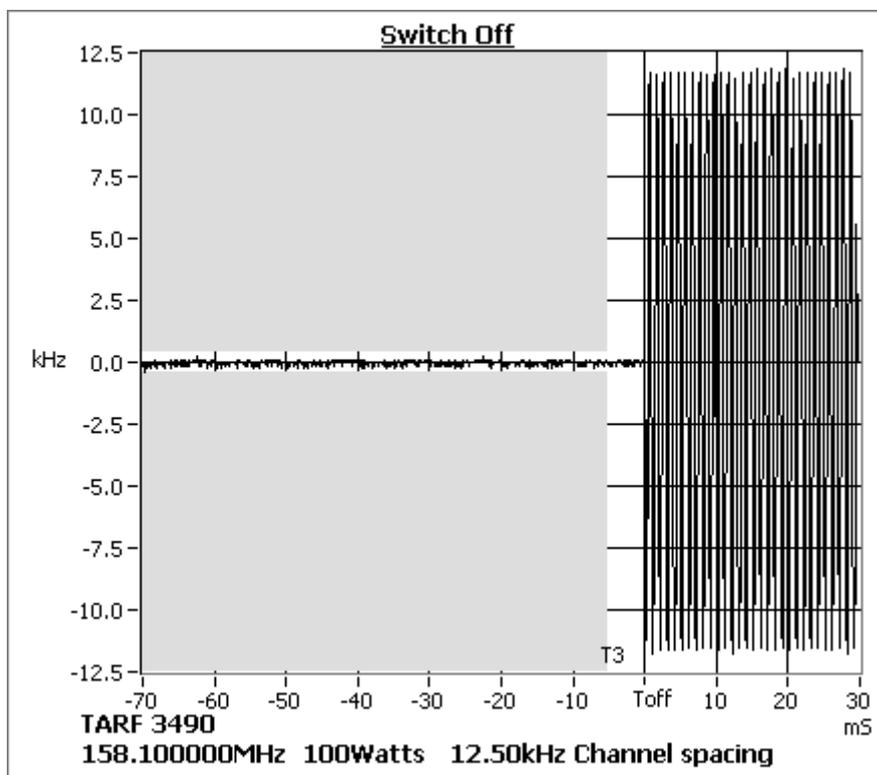
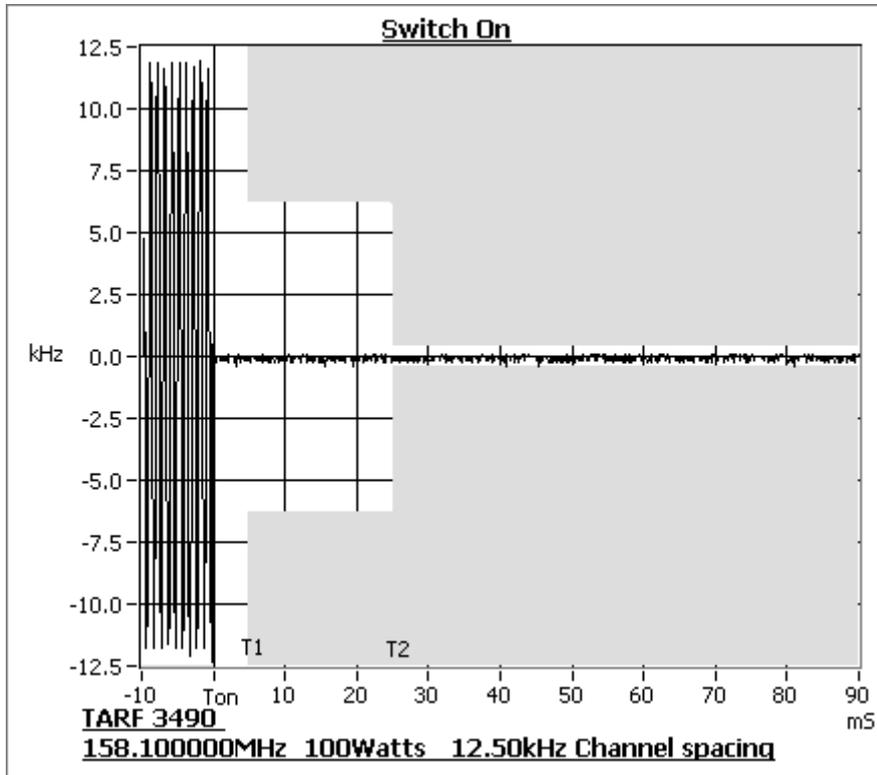
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 158.1 MHz

100 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 158.1 MHz 10 W 12.5 kHz Channel Spacing

158.1 MHz @ 10 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.6	N/A
t2	-0.3	N/A
t3	N/A	0.6
t2 → t3 ppm	2.1	
ERROR LIMIT t2 → t3 (ppm)	2.5	

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

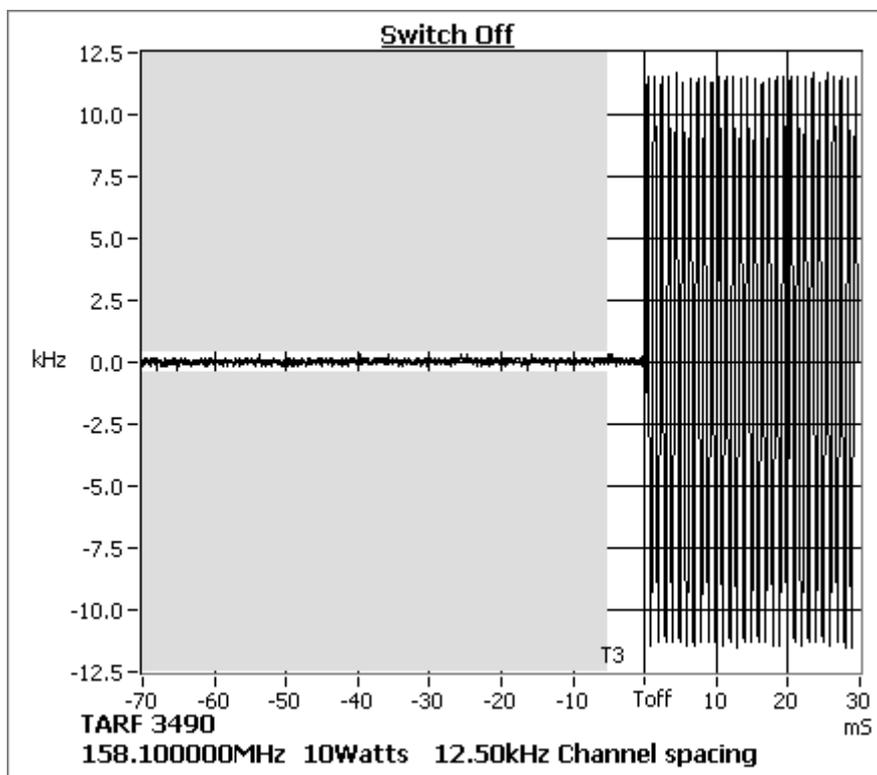
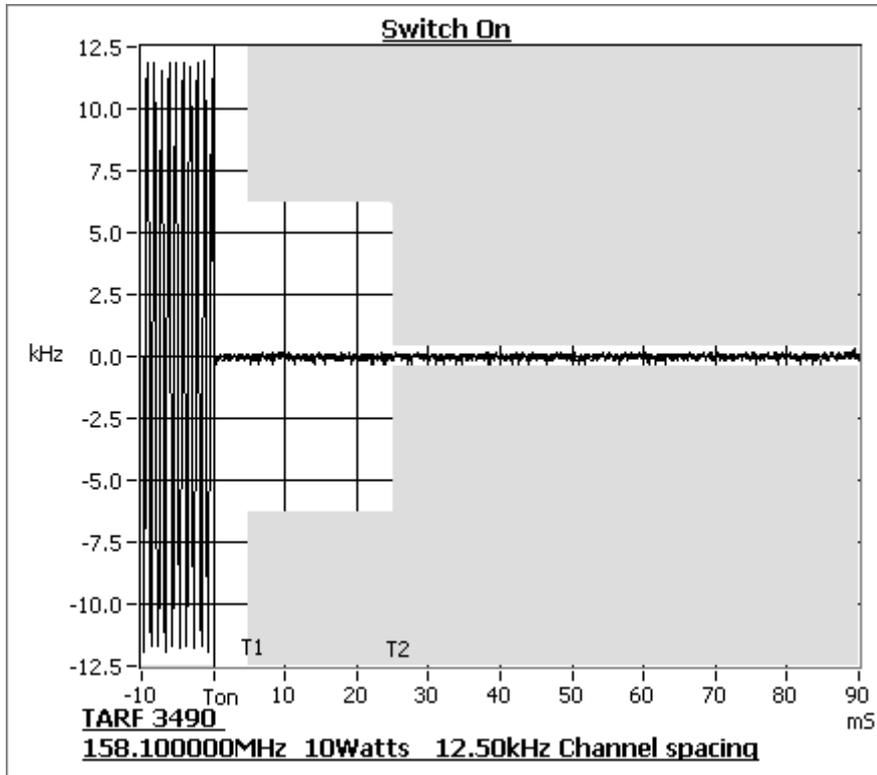
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

Transient Frequency Behavior

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 158.1 MHz 10 W 12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 173.1 MHz

100 W

12.5 kHz Channel Spacing

173.1 MHz @ 100 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.8	N/A
t2	-0.3	N/A
t3	N/A	0.3
t2 → t3 ppm	-1.9	
ERROR LIMIT (t2 → t3) ppm	2.5	

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

Transient Frequency Behaviour

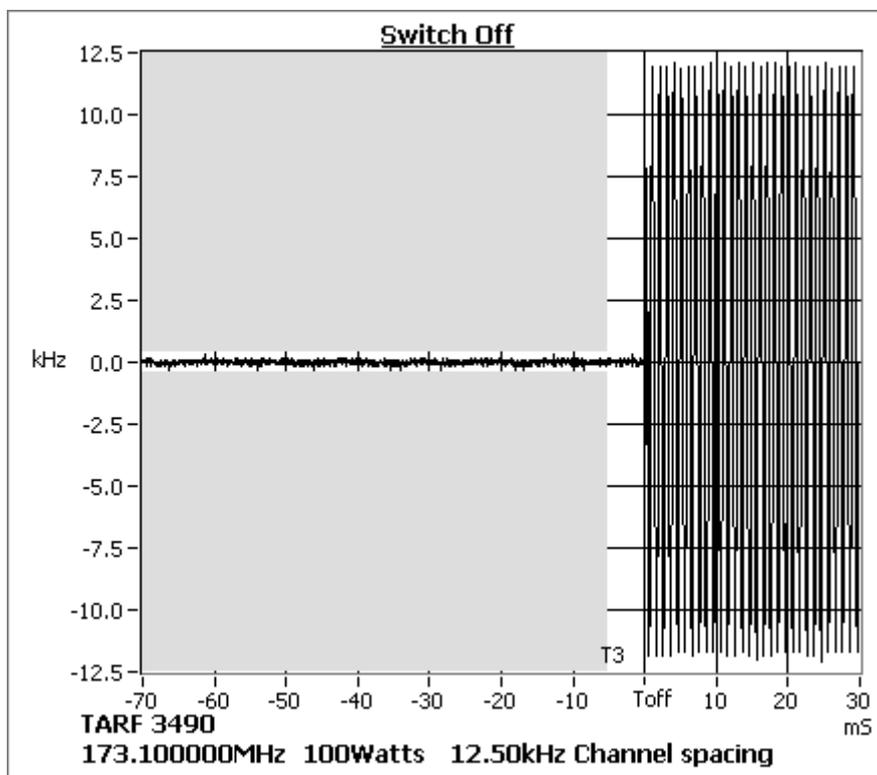
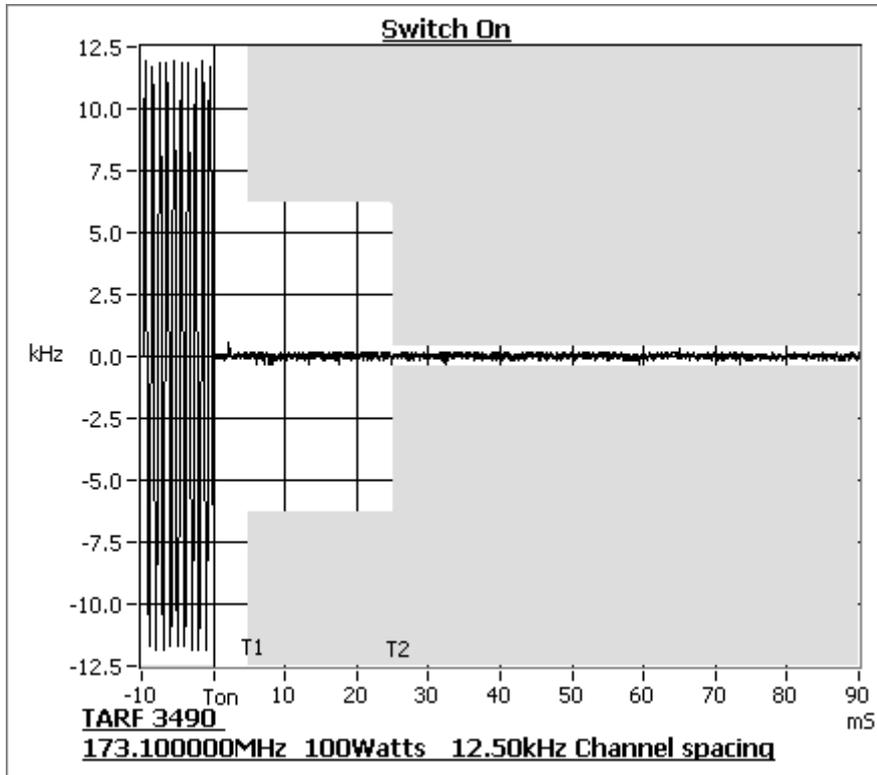
SPECIFICATION: FCC 47 CFR 90.214

RSS-119 5.9

Tx FREQUENCY: 173.1 MHz

100 W

12.5 kHz Channel Spacing



Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 173.1 MHz 10 W 12.5 kHz Channel Spacing

173.1 MHz @ 10 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.3	N/A
t2	-0.3	N/A
t3	N/A	-0.9
t2 → t3 ppm	-1.5	
ERROR LIMIT t2 → t3 (ppm)	2.5	

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	Y	
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	Y	
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	Y	

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

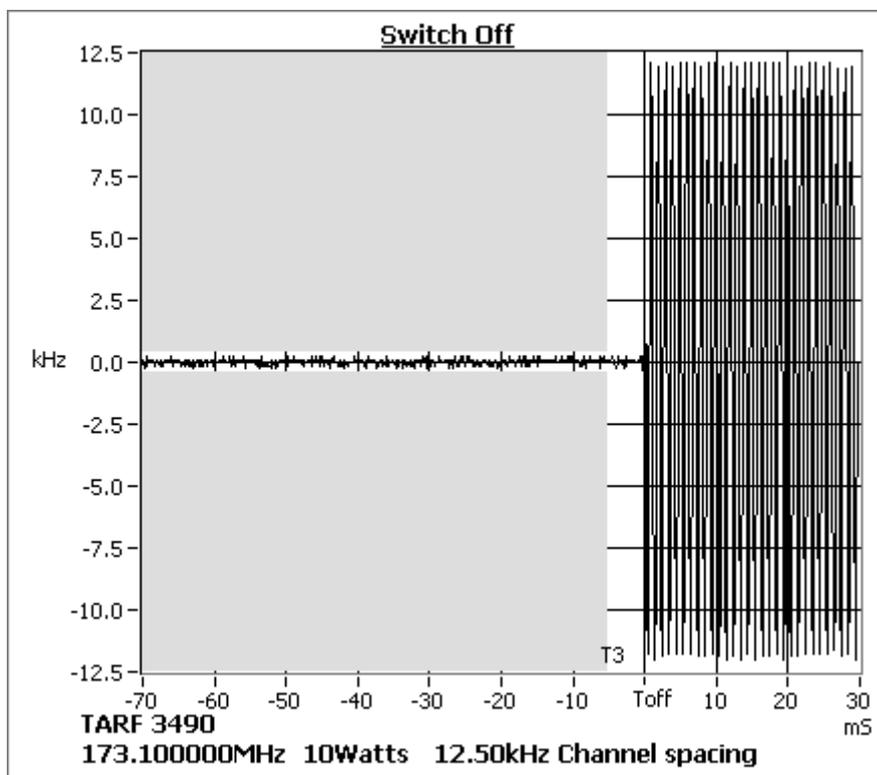
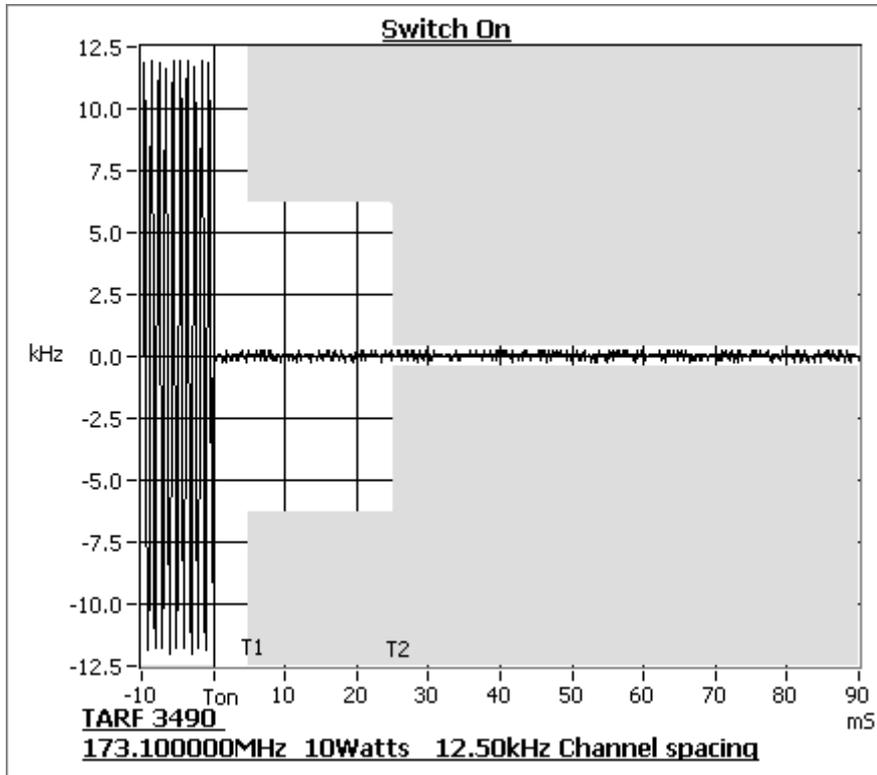
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

Transient Frequency Behavior

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 173.1 MHz 10 W 12.5 kHz Channel Spacing



TRANSMITTER FREQUENCY STABILITY - TEMPERATURE

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

RSS-119 5.3

GUIDE: TIA-102.CAAA-C 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° C in 10° C increments
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT UNCERTAINTY: ± 50 Hz

MEASUREMENT RESULTS:

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

148.015 MHz

Temperature (°C)	Frequency (MHz)	Error (ppm)
50	148.015024	0.2
40	148.015013	0.1
30	148.015012	0.1
20	148.015011	0.1
10	148.015012	0.1
0	148.014996	0.0
-10	148.014999	0.0
-20	148.015028	0.2
-30	148.015002	0.0

152.1 MHz

Temperature (°C)	Frequency (MHz)	Error (ppm)
50	152.100026	0.2
40	152.100013	0.1
30	152.100013	0.1
20	152.100011	0.1
10	152.100010	0.1
0	152.099996	0.0
-10	152.099999	0.0
-20	152.100028	0.2
-30	152.100001	0.0

Transmitter Frequency Stability - Temperature

153.1 MHz

Temperature (°C)	Frequency (MHz)	Error (ppm)
50	153.100025	0.2
40	153.100012	0.1
30	153.100011	0.1
20	153.100011	0.1
10	153.100011	0.1
0	153.099996	0.0
-10	153.099998	0.0
-20	153.100029	0.2
-30	153.100002	0.0

158.1 MHz

Temperature (°C)	Frequency (MHz)	Error (ppm)
50	158.100024	0.2
40	158.100014	0.1
30	158.100012	0.1
20	158.100009	0.1
10	158.100012	0.1
0	158.099995	0.0
-10	158.099998	0.0
-20	158.100030	0.2
-30	158.100001	0.0

173.1 MHz

Temperature (°C)	Frequency (MHz)	Error (ppm)
50	173.100028	0.2
40	173.100016	0.1
30	173.100014	0.1
20	173.100009	0.1
10	173.100013	0.1
0	173.099995	0.0
-10	173.099997	0.0
-20	173.100035	0.2
-30	173.100001	0.0

LIMIT: FCC 47 CFR 90.213 RSS-119 5.3

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

TRANSMITTER FREQUENCY STABILITY - VOLTAGE

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

RSS-119 5.3

GUIDE: TIA-102.CAAA-C 2.2.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error at an input voltage to the radio of 85% to 115%.
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

Voltage	FREQUENCY ERROR (ppm) for 12.5 kHz				
	148.015 MHz	152.1 MHz	153.1 MHz	158.1 MHz	173.1 MHz
120 V _{AC}	0.06	0.07	0.05	0.05	0.05
102 V _{AC}	0.07	0.06	0.05	0.05	0.05
138 V _{AC}	0.06	0.06	0.05	0.06	0.06

LIMIT CLAUSES: FCC 47 CFR 90.213

RSS-119 5.3

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

RECEIVER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: RSS-119 5.11

GUIDE: TIA-102 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.

MEASUREMENT UNCERTAINTY: ± 2.5 dB

148.015 MHz Receive (RX Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

152.1 MHz Receive (RX Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

153.1 MHz Receive (RX Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

158.1 MHz Receive (RX Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

173.1 MHz Receive (RX 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

TRANSMITTER STANDBY SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: RSS-119 5.11

GUIDE: TIA-102.CAAA-C 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.

MEASUREMENT UNCERTAINTY: ± 2.5 dB

148.015 MHz Transmitter Standby (TX Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

152.1 MHz Transmitter Standby (TX Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

153.1 MHz Transmitter Standby (TX Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

158.1 MHz Transmitter Standby (TX Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
No emissions were detected within 20 dB of Limit.		

173.1 MHz Transmitter Standby (TX 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

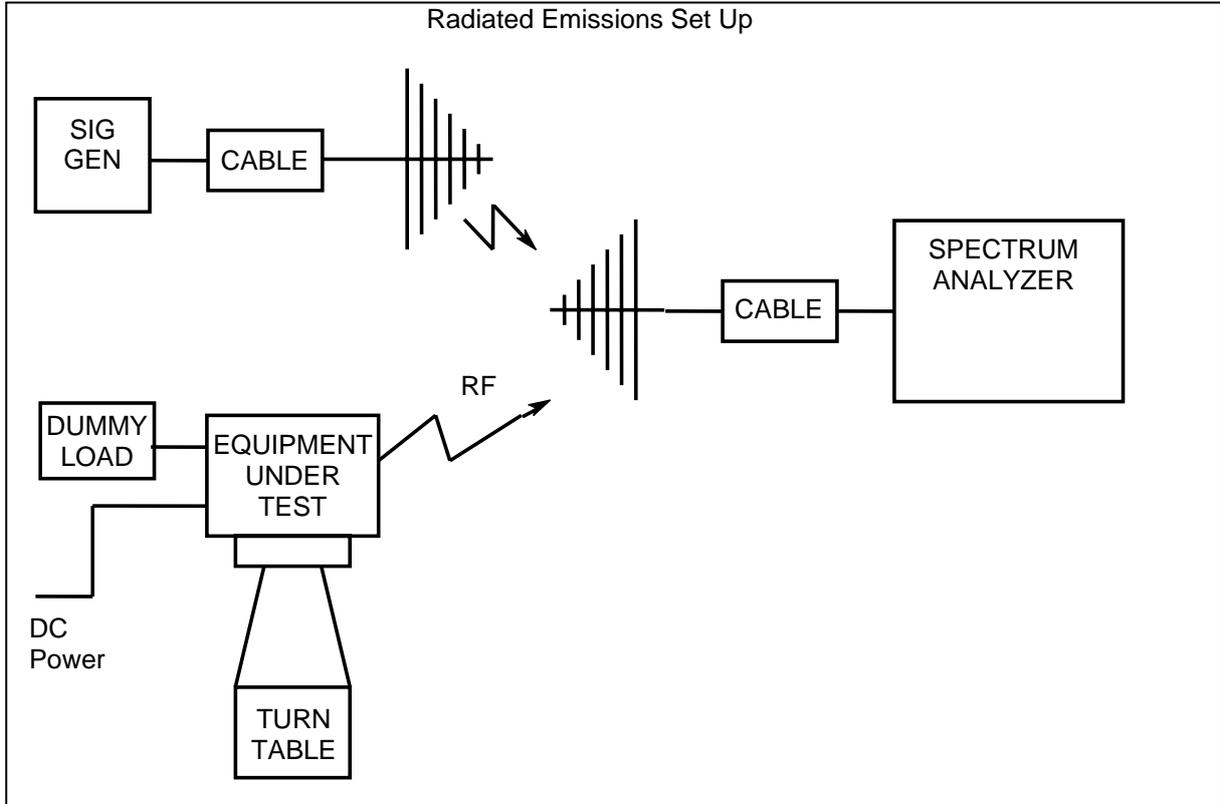
TEST EQUIPMENT LIST

Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
Signal Generator	Analog 4GHz	Agilent	E4422B	GB40050320	E3788	8-May-14
Oscilloscope	100MHz Digital	Tektronics	TDS340	B013611	E3585	10-Oct-13
Environ. Chamber	Chest	Contherm	Chest	E3397	E3397	2-Aug-15
Environ. Chamber	Chest	Contherm	Chest	E3397	E3397	2-Aug-13
Signal Generator	TREVA1 Analog 3.2GHz	Agilent	E8663D	MY50420224	E4908	18-Oct-13
Power Supply	AC Variac	Yamabishi	S-260-5	TX-533	E1737	3-Sep-13
RF Attenuator	30dB 250W	Weinschel	45-30-34	JW663	E3386	13-Oct-13
RF Attenuator	20dB 50W	Weinschel	24-20-44	AW1266	E3562	13-Oct-13
RF Attenuator	20dB 25W	Weinschel	33-20-33	BD5871	E3673	13-Oct-13
RF Attenuator	TREVA2 20dB 150W	Weinschel	40-20-33	CJ405	E3733	12-Oct-13
Audio Analyser	TREVA2	Hewlett Packard	HP8903B	2818A04275	E3710	12-Oct-13
Signal Generator	TREVA2 Analog 3.3GHz	Rohde & Schwarz	SML03 1090.3000.13	100597	E4050	17-Oct-13
Environ. Chamber	Upright	Contherm	5400 RHSLT.M	1416	E4051	2-Aug-13
RF Attenuator	TREVA2 3dB	Weinschel	Model 1	BL9950	E4080	22-Mar-14
RF Combiner	TREVA2	Minicircuits	ZFSC-4-1	-	E4084	22-Mar-14
Spectrum Analyser	13.2GHz	Agilent	E4445A	MY42510072	E4139	21-Nov-14
OATS	Antenna Tower	Electrometrics	EM-4720-2	112	E4447	Cal on Use
OATS	Controller	Electrometrics	EM-4700	119	E4445	Cal on Use
OATS	Turntable	Electrometrics	EM-4704A	105	E4446	Cal on Use
RF Attenuator	30dB 350W	Weinschel	67-30-33	BR0531	E4280	13-Oct-13
Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack5	E4850	13-Oct-13
Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack6	E4849	13-Oct-13
AC Voltmeter		Tait		1		3-Sep-13
AC Voltmeter		Tait		2		3-Sep-13
RF Attenuator	3dB 300W	Weinschel	40-3-34	A263	E4655	13-Oct-13
TREVA 2		Teltest	-	2	-	24-Sep-13
Coax Cable	Reverb - 4.5m Multiflex 141	TeltestBlue6	MF 141	TeltestBlue6	E4843	13-Oct-13
Coax Cable	Reverb - 2m Multiflex 141	TeltestBlue5	MF 141	TeltestBlue5	E4844	13-Oct-13
Coax Cable	Reverb - 2m Multiflex 141	TeltestBlue4	MF 141	TeltestBlue4	E4845	13-Oct-13
Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue3	MF 141	TeltestBlue3	E4846	13-Oct-13
Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue2	MF 141	TeltestBlue2	E4847	13-Oct-13
Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue1	MF 141	TeltestBlue1	E4848	13-Oct-13
Power Meter	Reverb - USB interface for NRT Z44	Rohde & Schwarz	NRT Z5	100586	E4852	15-Oct-13
Power Meter	Reverb - 0.2 - 4GHz directional power meter	Rohde & Schwarz	NRT Z44	105151	E4853	15-Oct-13
RF Chamber	Reverb - Stirrer controller for reverb chamber	Teseq	Stirrer Controller	29765.1	E4854	Cal on Use
RF Chamber	Reverb - 0.5 - 18GHz Reverberation Chamber	Teseq	RVC XS	29765	E4855	Cal on Use

TELTEST Laboratories
Tait Communications
Report Number 3490

Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
Antenna	Reverb - 1-18GHz DRG	Schwarzbeck	BBHA 9120 D	9120D-885	E4857	Cal on Use
Antenna	Reverb - 1-18GHz DRG	Schwarzbeck	BBHA 9120 D	9120D-884	E4858	Cal on Use
Temp & Humidity datalogger		Hobo	U21-011	10134275	E4980	8-Apr-14
Temp & Humidity datalogger		Hobo	U21-011	10134276	E4981	8-Apr-14

ANNEX A – TEST SETUP DETAILS



All other testing is performed using the Teltest Radio **EVAL**uation system (TREVA), which is configured as shown below. The Spectrum Analyser is connected to the EUT via the attenuator network for Conducted Emissions testing, and Occupied Bandwidth.

