8618 Commerce Court
Burnaby, BC V5A 4N6, Canada
PH: 1 604.420.7760
FAX: 1 604.420.7730
EMAIL: dmeerkerk@daliwireless.com

FCC PARTS 2, 90 TEST REPORT

Applicant	Dali Wireless, Inc.
Address	8618 Commerce Court, Burnaby, British Columbia, V5A 4N6, Canada
FCC ID	HCOT37DVUS4A
Model Number	T37-DVU-S4N
Product Description	150, 450 Remote Unit, Dual-Band Medium Power
Date Sample Received	Aug 1st, 2014
Date Sample Tested	Aug 1st to Aug 12th, 2014
Tested by	Guihua Sophie Piao
Approved by	Daryl Meerkerk
Report No.	T37-DVU-S4N
Test Results	Compliant

Revision History

Revision	Date	Reason For Change	Author(s)
0.1	Aug. 04, 2014	Initial Data	S. Piao
0.2	Aug. 12, 2014	TIMCO feedback, correct the frequencies tested in 150MHz which fall into Part 90 PLMRS pools	S. Piao
0.3	Sep 10, 2014	IMD and NF data added	S. Piao
0.4	Sep 23, 2014	Declare the minimum cable loss and maximum antenna gain attached to the t37 remote unit in order to meet 90.219(e)(1) 5 W ERP limit.	S. Piao

Table of Contents

ACRONYMS AND ABBREVIATIONS

BTS	Base Transceiver Station
BW	Band Width
CW	Continuous Wave
dB	deciBel (logarithmic ratio)
dBc	deciBels related to the RF carrier amplitude
dBm	deciBels related to 1 mW
DL	Downlink
EIRP	Effective Isotropic Radiated Power
FH	Frequency High (Top edge of band)
FL	Frequency Low (Bottom edge of band)
FM	Frequency Mid (Center of band)
IF	Intermediate Frequency
IMD	Inter-Modulation Distortion
kHz	kilo Hertz
MHz	Mega Hertz
OBW	Occupied Bandwidth
PS	Public Safety
RF	Radio Frequency
RX	Receiver
SEM	Spectrum Emission Mask
TX	Transmit
UL	Uplink

1.0 Overview

1.1 Scope

The purpose of this document is to present test results in the context of a conformance test report for FCC Part 2, 90 as applicable to the equipment under test, in the setup of conducted connection. The scope of this document is limited to the tests listed below in the downlink mode where the antenna port resides.

1.2 Attestation Statement

The device under test does fulfill the general approval requirements as identified in this test report.

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report. All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025:2005 requirements.

I attest that the necessary measurements were made, under my supervision, at DALI WIRELESS, INC. located at 8618 Commerce Court, Burnaby, British Columbia, V5A 4N6, Canada.

Authorized Signatory:

Signature:
Guihua Sophie Piao
Function: Test Engineer
Date: August 12, 2014

1.3 Report Summary

Disclaimer	The test results relate only to the items tested.

Report Purpose	To demonstrate the DUT compliance with FCC Parts 2, 90 requirements for a dual band digital repeater.
Applicable Rule Parts	FCC CFR 47 Part 2.1046 (a) FCC CFR 47 Part 2.1049 FCC CFR 47 Part 90.209 FCC CFR 47 Part 90.210 (d) FCC CFR 47 Part 90.219 (e) (3) FCC CFR 47 Part 90.219 (e) (2) FCC CFR 47 Part 90.219 (d) (6)(i)
Test Procedures	ANSI/TIA-603-C: 2004
Test Status	PASS

1.4 Test Environment

Test Facilities	Tests were performed by Dali Wireless Inc. located at 8618 Commerce Court, Burnaby, BC, V5A 4N6, Canada.
Test Conditions	Temperature: 25° C Relative Humidity: 60% Atmospheric Pressure: 98.1 kPa

1.5 Test Setup

Deviation to the rules	There was no deviation from the test standards.
Modification to the DUT	No modification was made to the DUT.
Test Exercise	The DUT was placed in continuous transmit mode of operation.
Distribution Loss (cable loss)	0.75 dB for 150MHz measurements 0.72 dB for 450MHz measurements

1.6 Device Under Test Information

Manufactured by	Dali Wireless Inc.
DUT Description	150, 450 Remote Unit, Dual-Band Bi-directional Distributed Antenna System/Repeater.
FCC ID	HCOT37DVUS4A
Model Name	*T*37™ – DVU-S4N
Pass Band	150 – 174 MHz 450 – 512 MHz
Operating Frequency	150.8 - 156.2475 MHz 157.1875 - 161.575 MHz 161.775 - 161.9625 MHz 162.0375 - 173.4 MHz 450 - 454 MHz 456 - 462.5375 MHz 462.7375 - 467.5375 MHz 467.7375 - 512 MHz
Emission Designators	F9W, F9X, FXW, DXW, D9W, D9X
Modulations	P25 Phase I, P25 Phase II
User Power Range and Control	There are NO user power controls
Test Item	Production
DC Voltage and Current into final amplifier	Powered 115 or 230 VAC

Type of Equipment	Fixed

1.7 Measurement Uncertainty

Radio Frequency	±1 ppm
Total RF Power: Conducted	±1 dB
RF Power Density: Conducted	±2.75 dB
Spurious Emissions: Conducted	±3 dB
Temperature	±1ºC
Humidity	±5 %
DC and Low Frequency Voltages	±3 %

1.8 Equipment List

Description	Manufacturer	Model	Serial Number	Cal Interval	Cal Due Date
Spectrum Analyzer	Agilent	MXA-N9020A	MY52090907	2 years	10-Oct-2014
Power Meter	Agilent	U2000A	MY50000426	1 year	19-Sep-2014
Signal Generator	Agilent	MXG-N5182B	MY53050168	3 years	25-Jul-2017
Signal Generator	Agilent	EXG-N5182A	MY50140256	3 years	15-Jul-2017
Noise Source	Agilent	N4001A SNS	MY44420489	1 year	10-Feb-2015

1.9 Test Procedure

General

The *t*37 remote, is connected to the *t*Host in a manner consistent with a typical installation. A digital modulation signal generator is connected to the TX_IN port of the appropriate band of the *t*Host and spectrum analyzer is connected to the appropriate downlink antenna output through an attenuator, nominally 40 dB for the band under consideration.

The 150 MHz (150 – 174 MHz) band and 450 MHz (450 – 512 MHz) band were investigated. Measurements were performed at two modulation types (P25 Phase I C4FM and P25 Phase II H-DQPSK) for the mid, lowest and highest frequency for declared bandwidths, if applicable.

RF Power Output

RF power is measured by connecting a spectrum analyzer and coupling to a 50-ohm, resistive power meter to the RF output connector. With a nominal voltage and the amplifier properly adjusted the RF output is measured**.**

Occupied Bandwidth

Occupied Bandwidth is measured by connecting a Spectrum Analyzer to the RF output connector.

The required measurement resolution bandwidth (RBW) is 1% of the emission bandwidth. 99% energy rule was applied to measure the occupied channel bandwidth. The emission bandwidth is measured as the width of the signal between two frequency points on the channel edge, outside of which the transmission power is attenuated at least 26dB below the transmitter output power.

Spectrum Emission Mask

Spectrum Emission Mask is measured by connecting a Spectrum Analyzer to the RF output connector.

The input power was adjusted to produce maximum output power on the antenna port. The reference level was measured with integrated BW 2 times of the channel BW. The emission was measured with RBW 100 Hz for P25 modulations.

Spurious Emissions at Antenna Terminals

The procedure used was ANSI/TIA-603-C: 2004. The spectrum was scanned from 9 kHz to at least the tenth harmonic of the fundamental using a spectrum analyzer. Data on the following page shows the level of conducted spurious responses. For digital modulation, the carrier is modulated to its maximum extent. The measurements were made in accordance with standard ANSI/TIA-603-C: 2004. The maximum output power was set for each test.

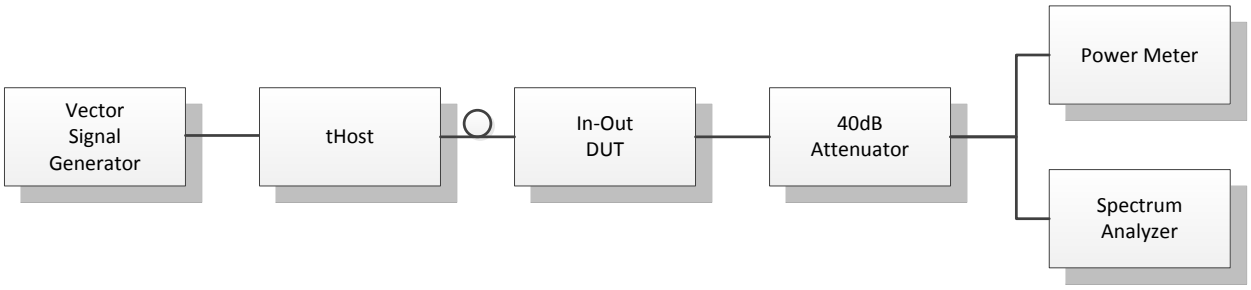
Frequency Stability

All test conditions and measurement procedures were performed in accordance with FCC CFR47 part 2 subpart J Clause 2.1055.

RF Passband Gain and Bandwidth

The procedure used was RSS-131 Issue 2. RF frequency response is measured by connecting a 50-ohm, resistive power meter to the RF output connector. With a nominal voltage and the internal gain control properly adjusted the RF output is measured by sweeping the input frequency**.**

Test Setup for Output Power, Occupied Bandwidth, Spectrum Emission Mask, Conducted Spurious Emission, Frequency Stability, and Passband Gain and Bandwith



1.10 Operational Description

Dali's ***t*37-ps,** (37 dBm, 5 W) is an all-digital, medium power, dual-band radio remote. It bi-directionally transfers two public safety bands over a single optical fiber (SFP –Single Mode Fiber) to/from the RF Router, *t*Host® at 6 Gb/s up to 40 km. It also accommodates 100 Mb/s Ethernet backhaul as well. This smart radio remote enables multiple network topologies that cater to different deployments scenarios including star, chain, hybrid and loop topologies.

1.11 RF Signal Configuration

Table 1-1 150 MHz DL Measurement Matrix

Modulation	# Carriers	Notation	Frequency (MHz)
P25 Phase I 12.5kHz C4FM	1	P25 I	150.80625, 157.19375, 161.95625, 173.39375
P25 Phase II 12.5kHz H-DQPSK	1	P25 II	150.80625, 157.19375, 161.95625, 173.39375

Table 1-2 450 MHz DL Measurement Matrix

Modulation	# Carriers	Notation	Frequency (MHz)
P25 Phase I 12.5kHz C4FM	1	P25 I	450.00625, 481, 511.99375
P25 Phase II 12.5kHz H-DQPSK	1	P25 II	450.00625, 481, 511.99375

P25 phase I and phase II signal of channel bandwidth 12.5 kHz were injected. The carrier frequency was selected following FCC public safety frequency pool in KDB 634817 D01 Freq Range Listing for Grants v03 and closest to the center and edges of the product passing bands.

2.0 Output Power – Pursuant 47 CFR 2.1046(a)

2.1 Methodology

A brief summary of applicable FCC specifications is listed in the table below.

2.1046 Measurements required: RF power output.
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the
RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

Measurements were performed at

P25 (Phase I and Phase II) for the mid, lowest and highest frequency within the 150 MHz band and 450 MHz band.

The output power plots are shown in section 2.2 for the all bands.

2.2 Test Results

The following two tables show radiated power in ERP taking into account a minimum distribution loss (cable loss) of 0.75 dB and 0.72 dB for 150 MHz band and 450 MHz band respectively.

150 MHz band

Signal	*Left (ERP in dBm)*	*Mid1 (ERP in dBm)*	*Mid2 (ERP in dBm)*	*Right (ERP in dBm)*
P25 I	36.7	37	36.8	36.19
P25 II	36.63	36.9	36.65	36.02

450 MHz band

Signal	*Left (ERP in dBm)*	*Mid (ERP in dBm)*	*Right (ERP in dBm)*
P25 I	36.84	36.27	36.35
P25 II	37	36.65	36.22

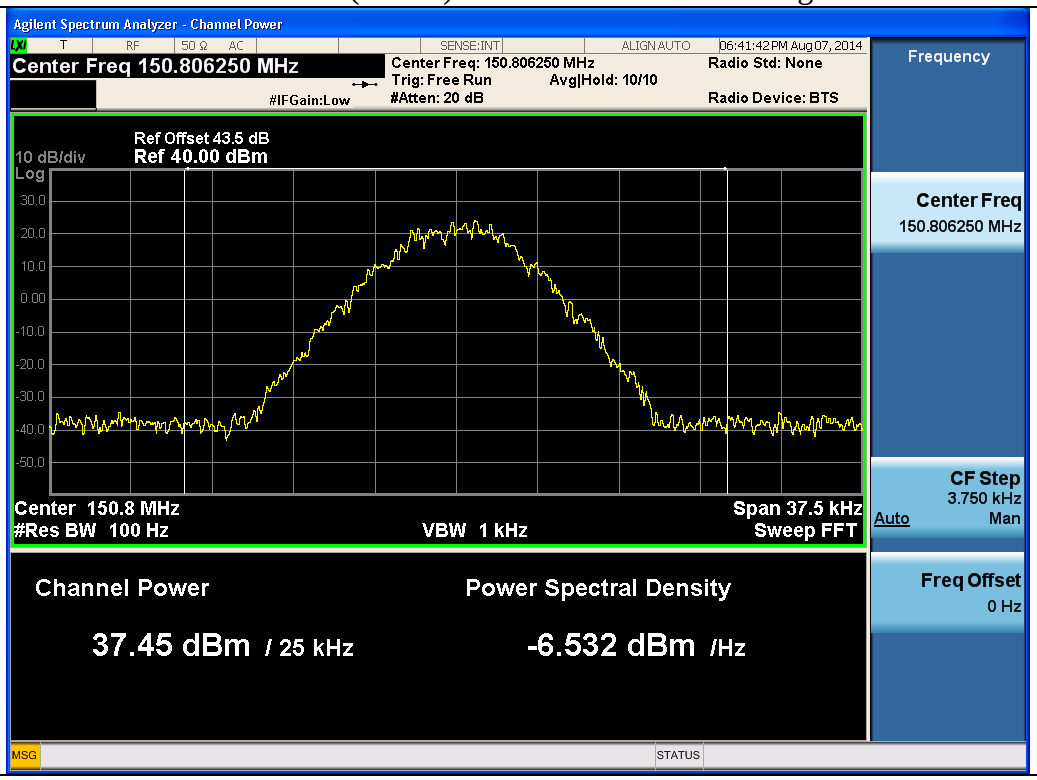
Table 2-1 Output Power Measurement

Conclusion: As the table above indicates, the maximum power output value of 37.75 dBm was obtained with P25 Phase I C4FM modulation at 157.19375 MHz.

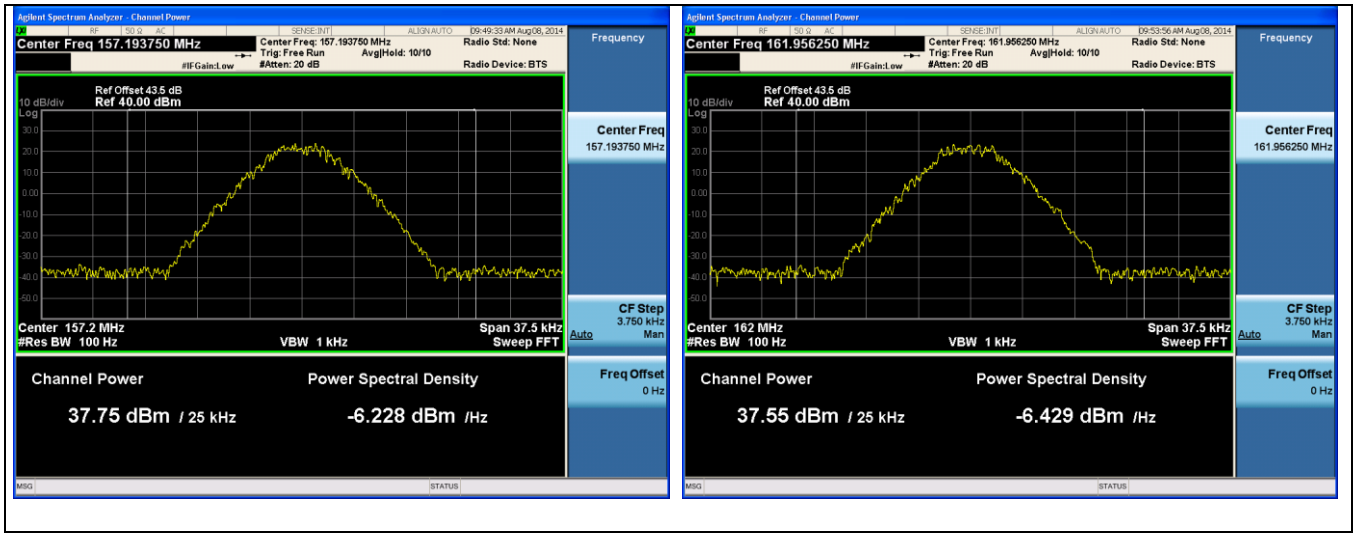
In order to comply with condition that the radiated power of any retransmitted channel should not exceed 5 W ERP, the sum of the minimum cable loss and maximum antenna gain applied to the t37 remote unit should be more than 0.75 dB.

The conducted power measurement plots were shown as follows:

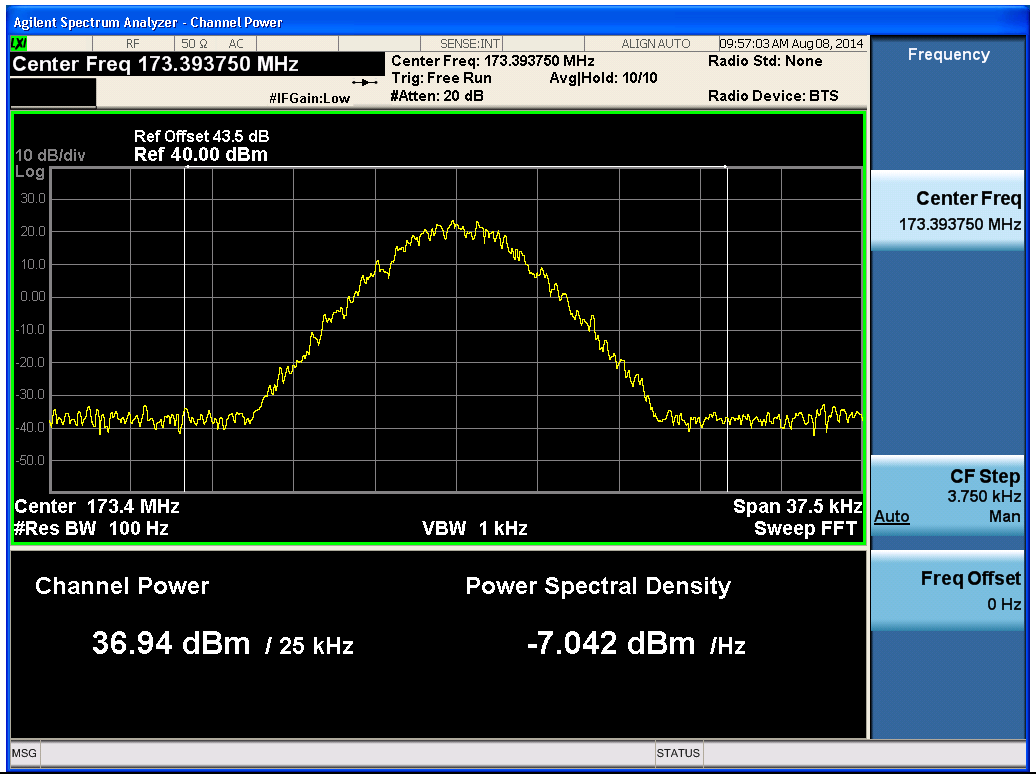
P25 Phase I (C4FM) in 150 MHz Band Left Edge



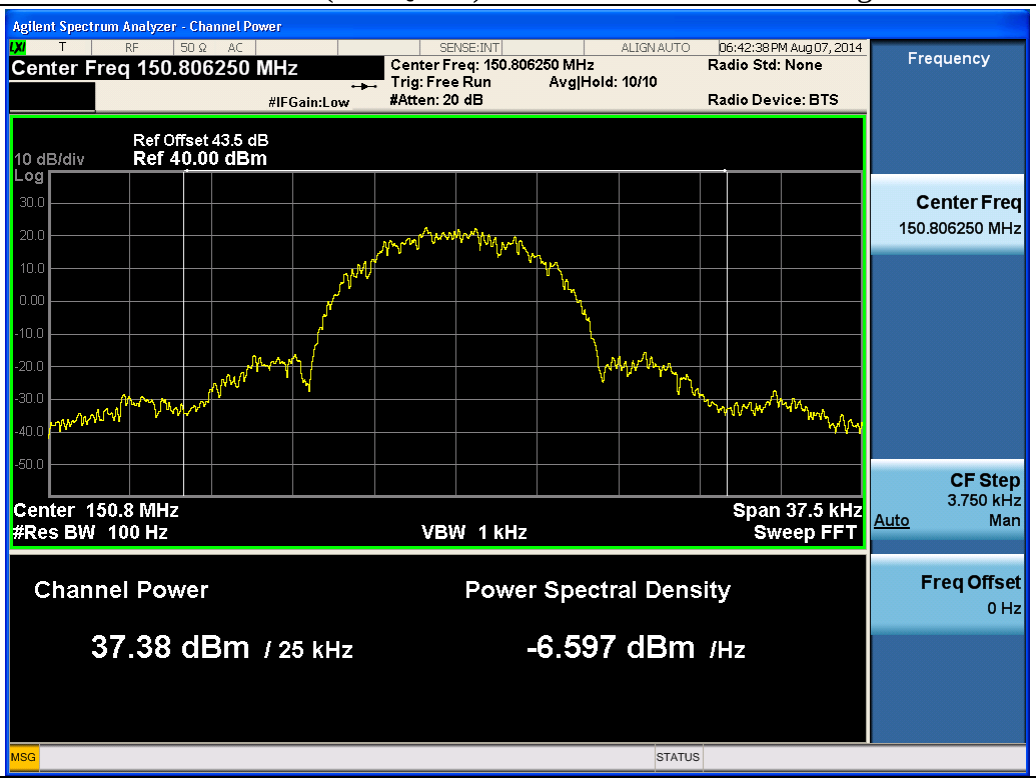
P25 Phase I (C4FM) in 150 MHz Band Center


Agilent Spectrum Analyzer - Channel Power
Center Freq 157.193750 MHz
Center Freq: 157.193750 MHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 43.5 dB
10 dB/div
Ref 40.00 dBm
Log
Center Freq
157.193750 MHz
Center 157.2 MHz
#Res BW 100 Hz
VBW 1 kHz
Span 37.5 kHz
Sweep FFT
CF Step
3.750 kHz
Auto
Man
Freq Offset
0 Hz
Channel Power
37.75 dBm / 25 kHz
Power Spectral Density
-6.228 dBm /Hz
Agilent Spectrum Analyzer - Channel Power
Center Freq 161.956250 MHz
Center Freq: 161.956250 MHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 43.5 dB
10 dB/div
Ref 40.00 dBm
Log
Center Freq
161.956250 MHz
Center 162 MHz
#Res BW 100 Hz
VBW 1 kHz
Span 37.5 kHz
Sweep FFT
CF Step
3.750 kHz
Auto
Man
Freq Offset
0 Hz
Channel Power
37.55 dBm / 25 kHz
Power Spectral Density
-6.429 dBm /Hz

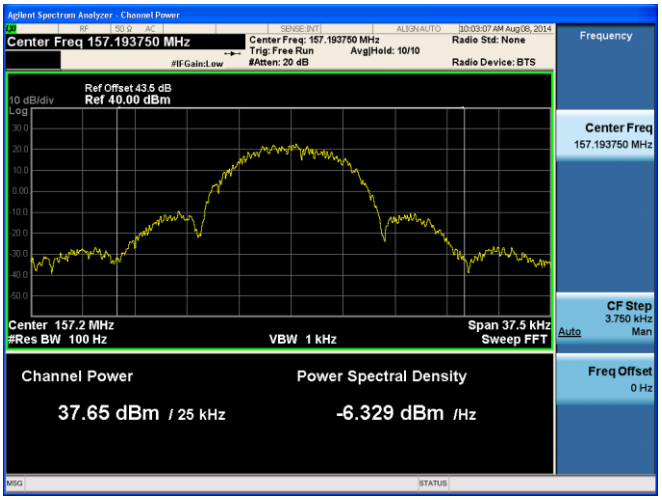
P25 Phase I (C4FM) in 150 MHz Band Upper Edge

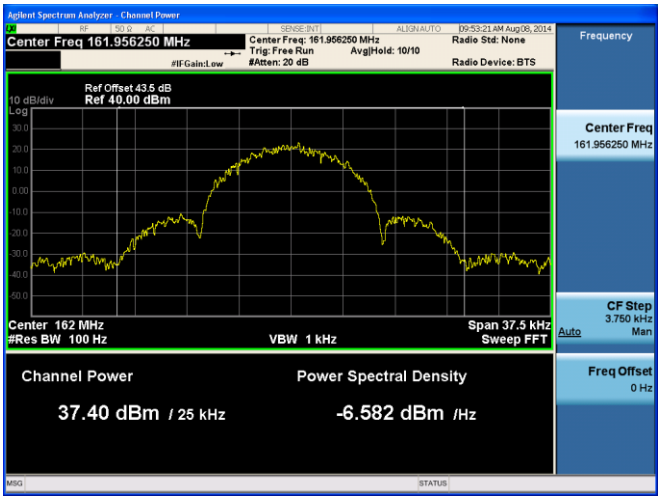


P25 Phase II (H-DQPSK) in 150 MHz Band Lower Edge

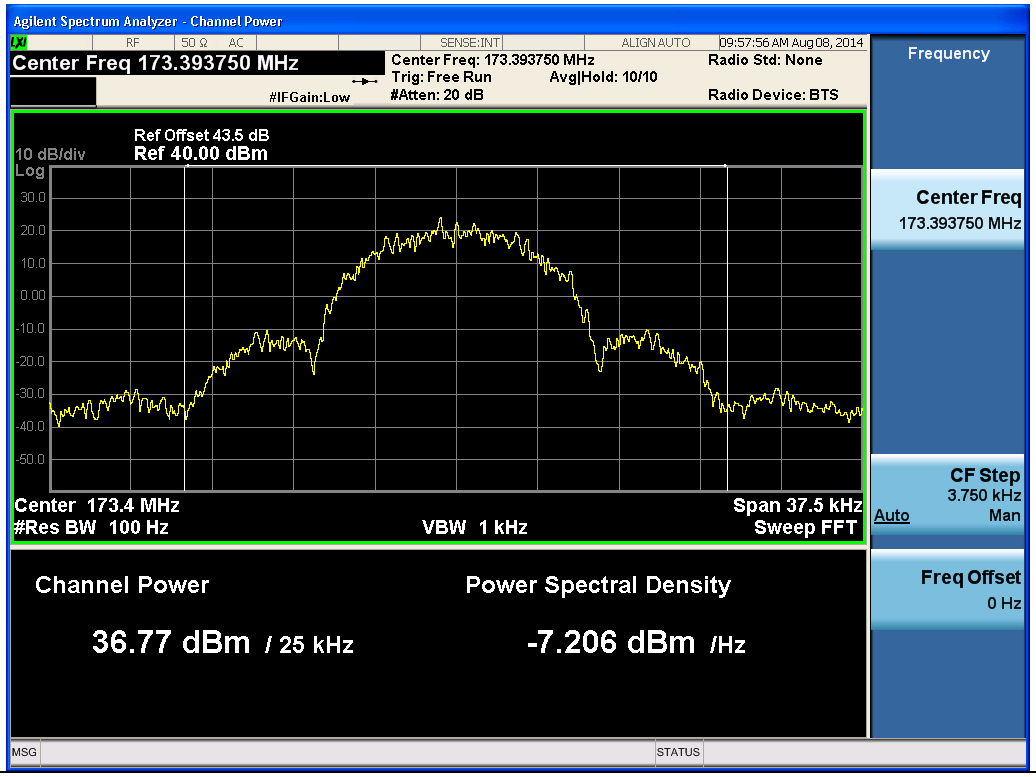


P25 Phase II (H-DQPSK) in 150 MHz Band Center

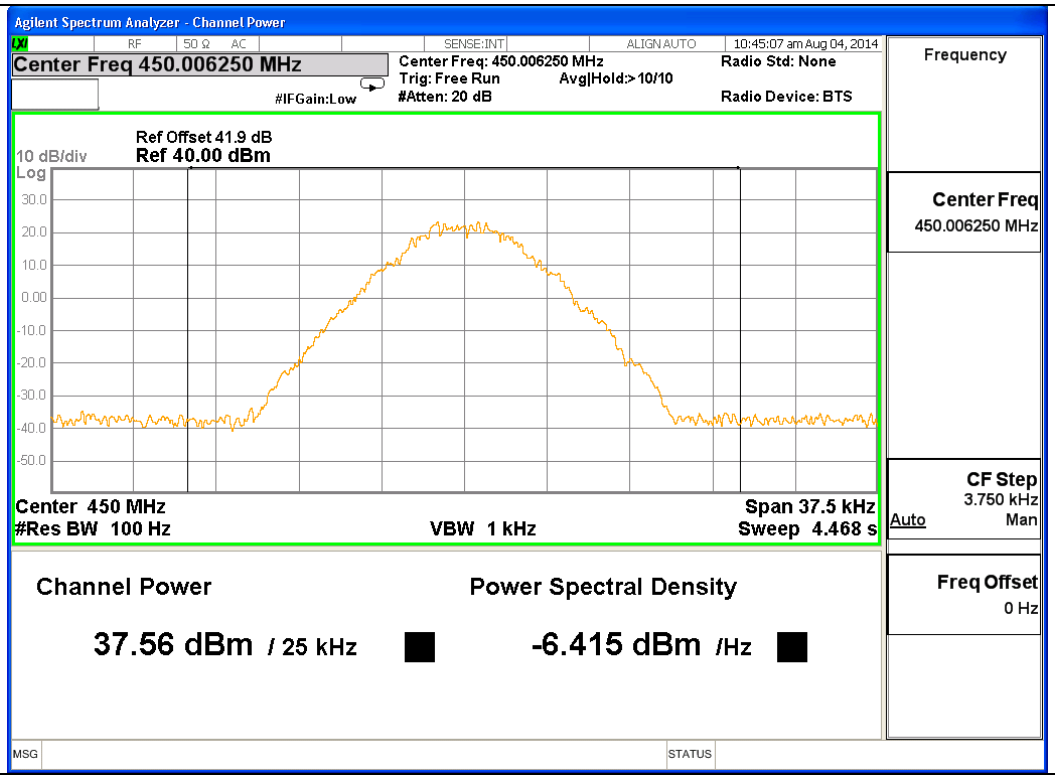




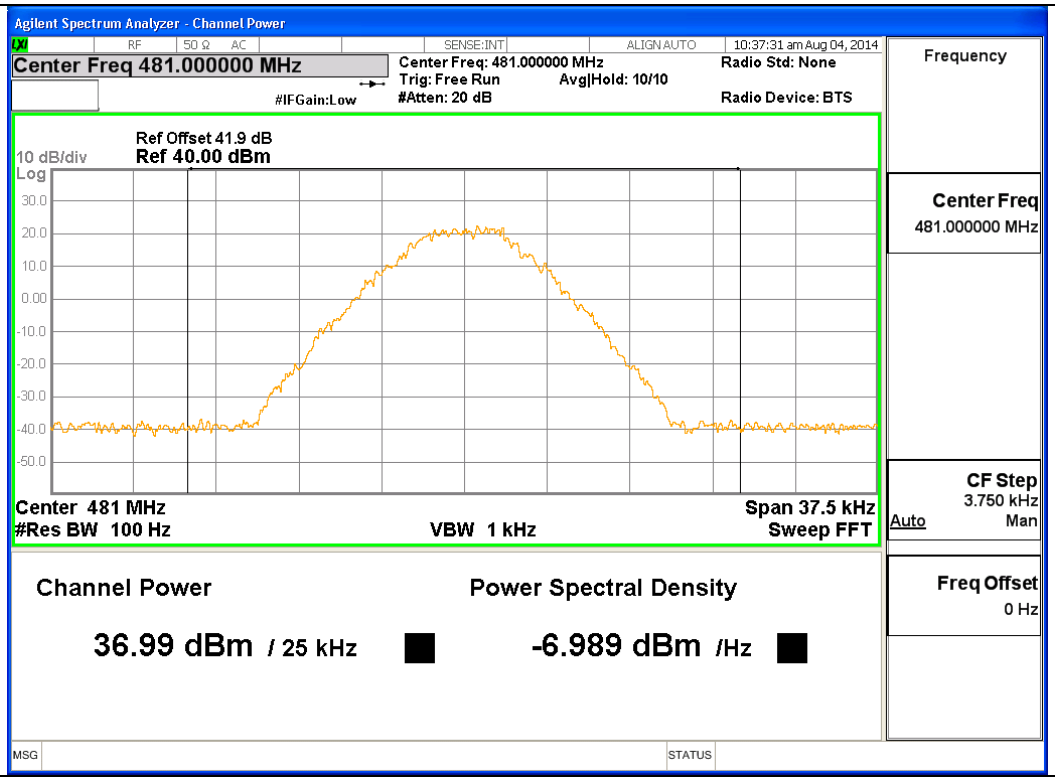
P25 Phase II (H-DQPSK) in 150 MHz Band Upper Edge



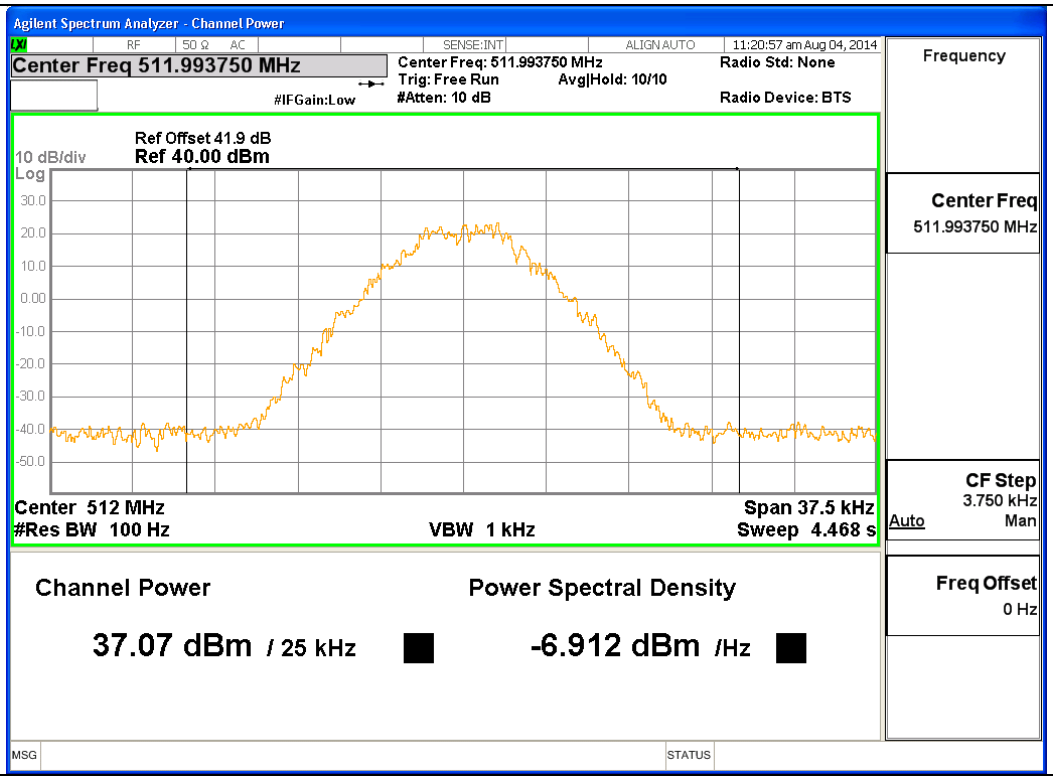
P25 Phase I (C4FM) in 450 MHz Band Lower Edge



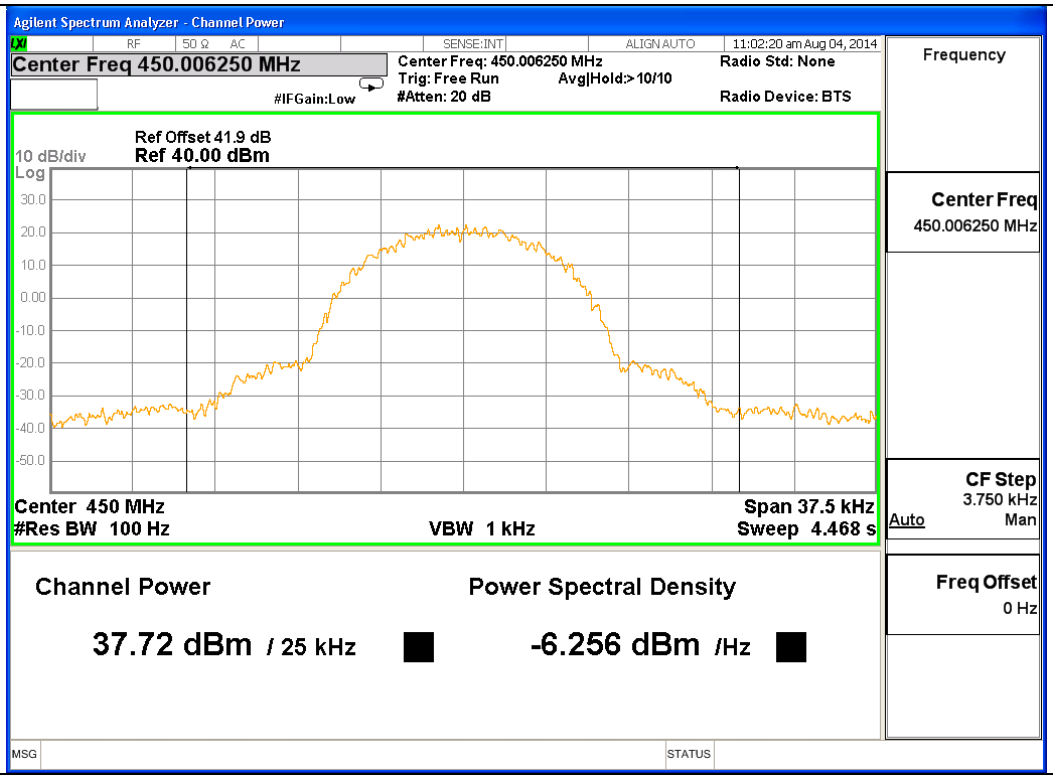
P25 Phase I (C4FM) in 450 MHz Band Center



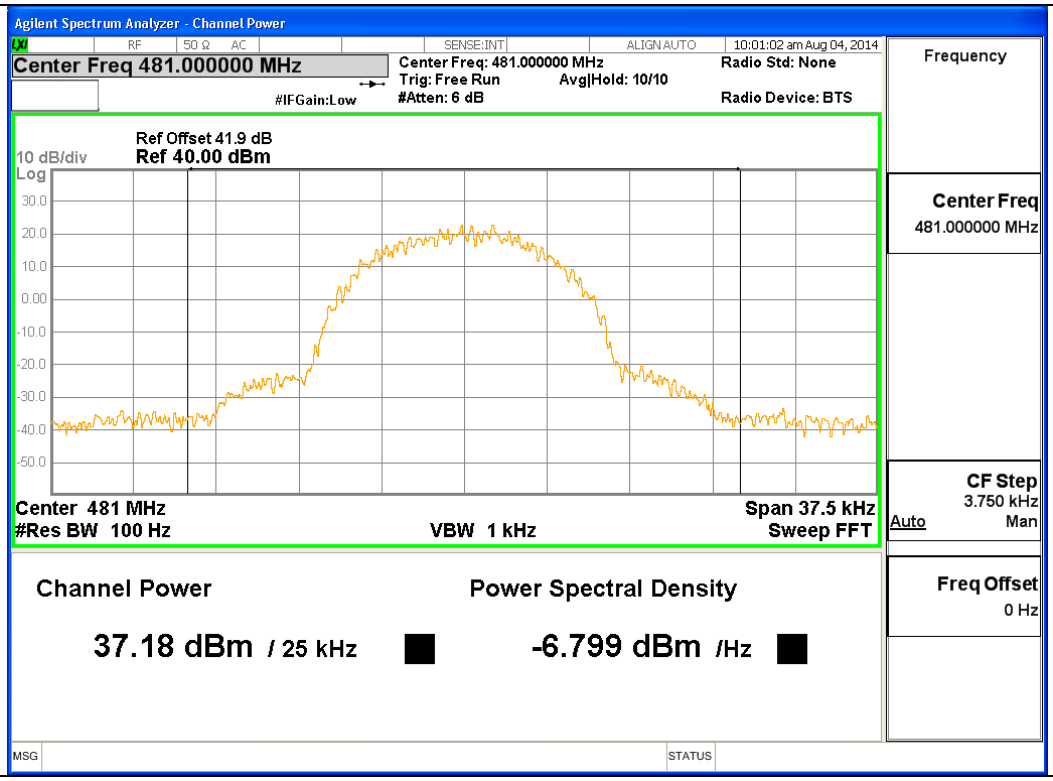
P25 Phase I (C4FM) in 450 MHz Band Upper Edge



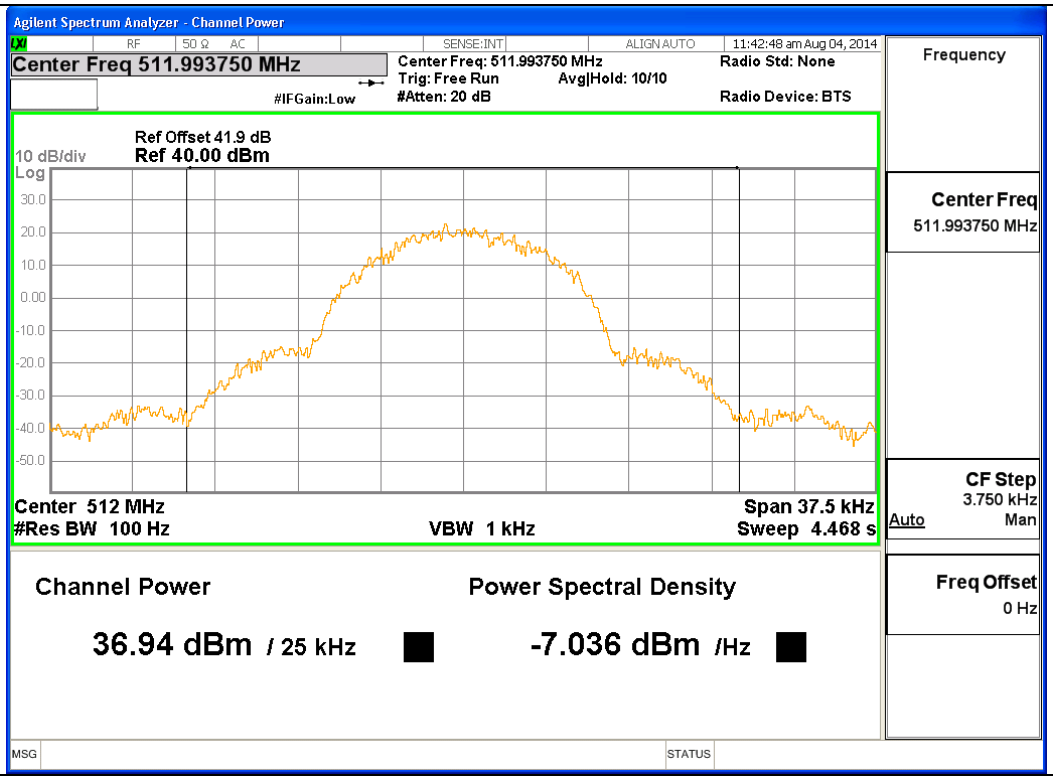
P25 Phase II (H-DQPSK) in 450 MHz Band Lower Edge



P25 Phase II (H-DQPSK) in 450 MHz Band Center



P25 Phase II (H-DQPSK) in 450 MHz Band Upper Edge



3.0 Occupied Bandwidth Pursuant 47 CFR 2.1049 and 90.209

3.1 Methodology

Measurements were performed at two modulations (P25 I and P25 II) for the mid, lowest and highest frequency within the 150 MHz band and 450 MHz band.

A brief summary of applicable FCC specifications is listed in the table below.

2.1049 Measurements required: Occupied bandwidth.
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

90.209 Bandwidth limitations:
Occupied channel bandwidth should be less than the corresponding authorized bandwidth.

Full results for occupied bandwidth measurements are shown in Table **3-1**.

The worst case measurement plots are shown in section 3.2, comparing input and output signal side by side.

3.2 Test Results

150 MHz Band

Authorized BW	OBW (kHz) @ low frequency Out / In	OBW (kHz) @ center frequency Out / In	OBW (kHz) @ high frequency Out / In	Max. In and Out difference
P25 I 11.25kHz	8.079 / 8.103	8.136 / 8.103	8.109 / 8.103	0.4%
P25 II 11.25kHz	9.754 / 9.686	9.577 / 9.686	9.59 / 9.686	1.1%

450 MHz Band

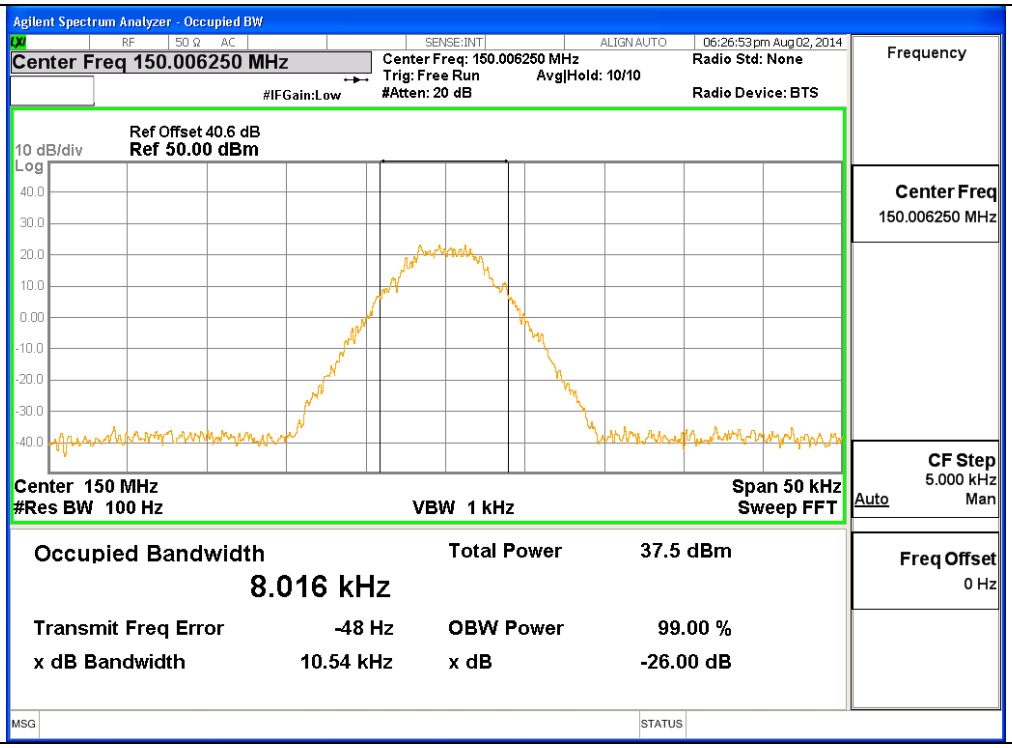
Authorized BW	OBW (kHz) @ low frequency Out / In	OBW (kHz) @ center frequency Out / In	OBW (kHz) @ high frequency Out / In	Max. In and Out difference
P25 I 11.25kHz	8.161 /8.103	8.159 / 8.103	8.361 / 8.103	3.2%
P25 II 11.25kHz	9.837 / 9.686	9.831 / 9.686	9.823 / 9.686	1.6%

Table 3-1. Occupied bandwidth measurements (Output signal)

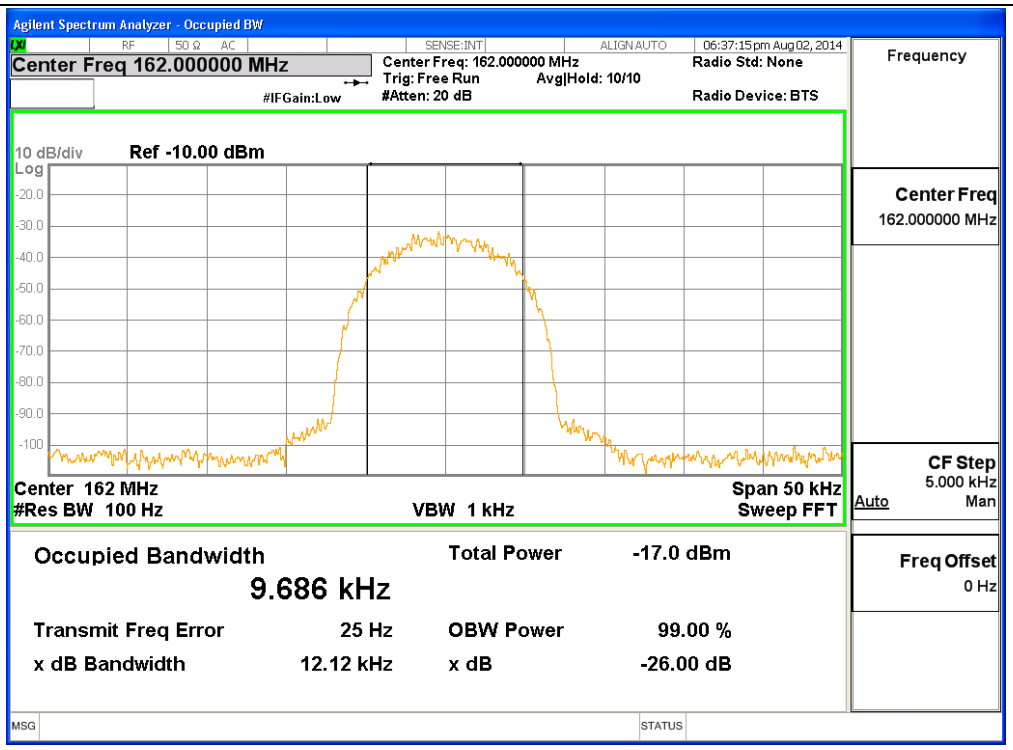
Note:
- The difference of the output signal and input signal bandwidth is less than 3.2%. The spectrum shapes of output are similar to the input.
- The measured bandwidth is less than the authorized bandwidth.

Input Signal - Representatives

P25 I

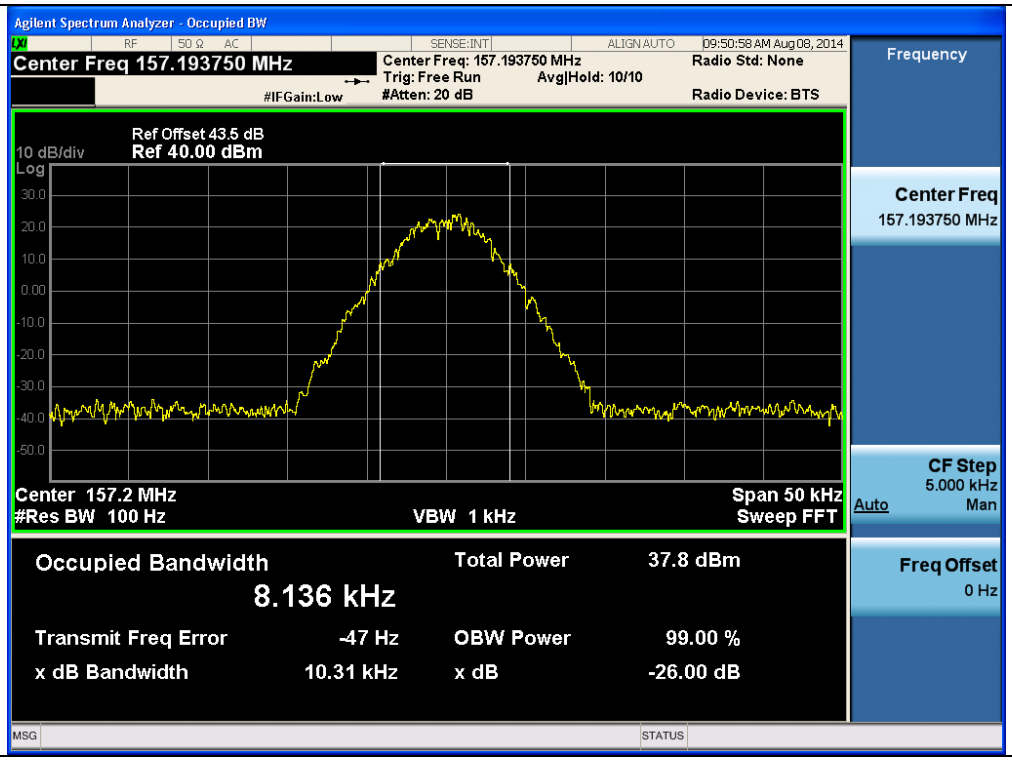


P25 II

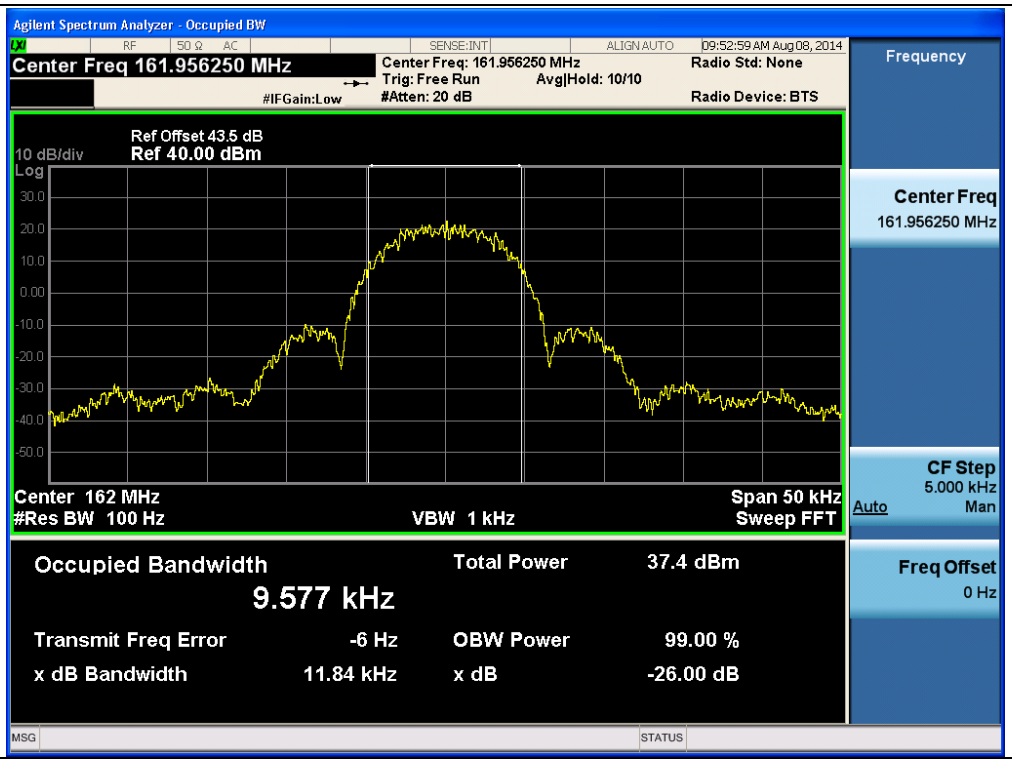


150 MHz Band Output – Worst Case

P25 I

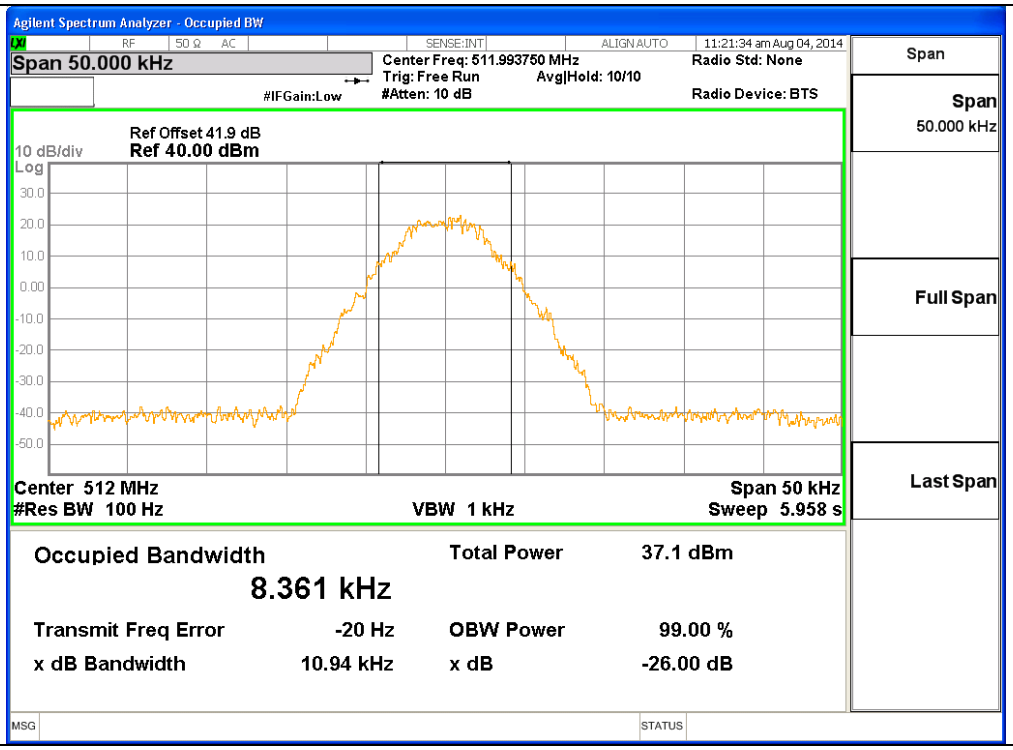


P25 II

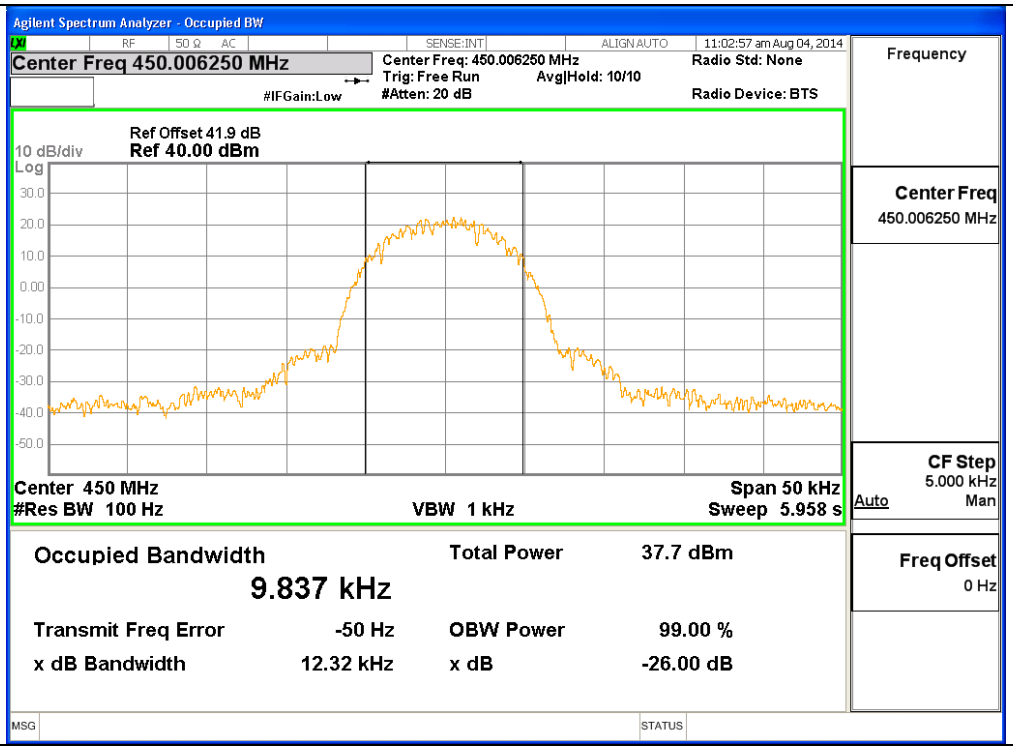


450 MHz Band Output – Worst Cases

P25 I



P25 II



4.0 Spectrum Emission Mask Pursuant 90.210 (d)

4.1 Methodology

All test conditions and measurement procedures were performed in accordance with FCC CFR47 part 90.210.

Measurements were performed at two modulations (P25 I, and P25 II) for the lowest, center and highest frequency within the band.

The RBW was set to 100Hz, up to 50 kHz frequency offset was interested.

A brief summary of the applicable FCC specifications are listed in the table below.

90.210
For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:
(d) 150 MHz and 450 MHz operation band falls into the emission mask (d).
(1) 0 ≤ fd ≤ 5.625 kHz: 0 dB
(2) 5.625 kHz ≤ fd ≤ 12.5kHz: at least 7.27 (fd – 2.88 kHz) dB;
(3) more than 12.5 kHz: at least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation

(o) *Instrumentation.* The reference level for showing compliance with the emission mask shall be established, except as indicated in §§90.210 (d), (e), and (k), using standard engineering practices for the modulation characteristic used by the equipment under test. When measuring emissions in the 150-174 MHz and 421-512 MHz bands, the following procedures will apply: A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For frequencies more than 50 kHz removed from the edge of the authorized bandwidth a resolution of at least 100 kHz must be used for frequencies below 1000 MHz. Above 1000 MHz the resolution bandwidth of the instrumentation must be at least 1 MHz. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, then an alternate procedure may be used provided prior Commission approval is obtained.

4.2 Test Results

On the plots below shown the worst case when the carrier was set to the edges or center with different modulations.

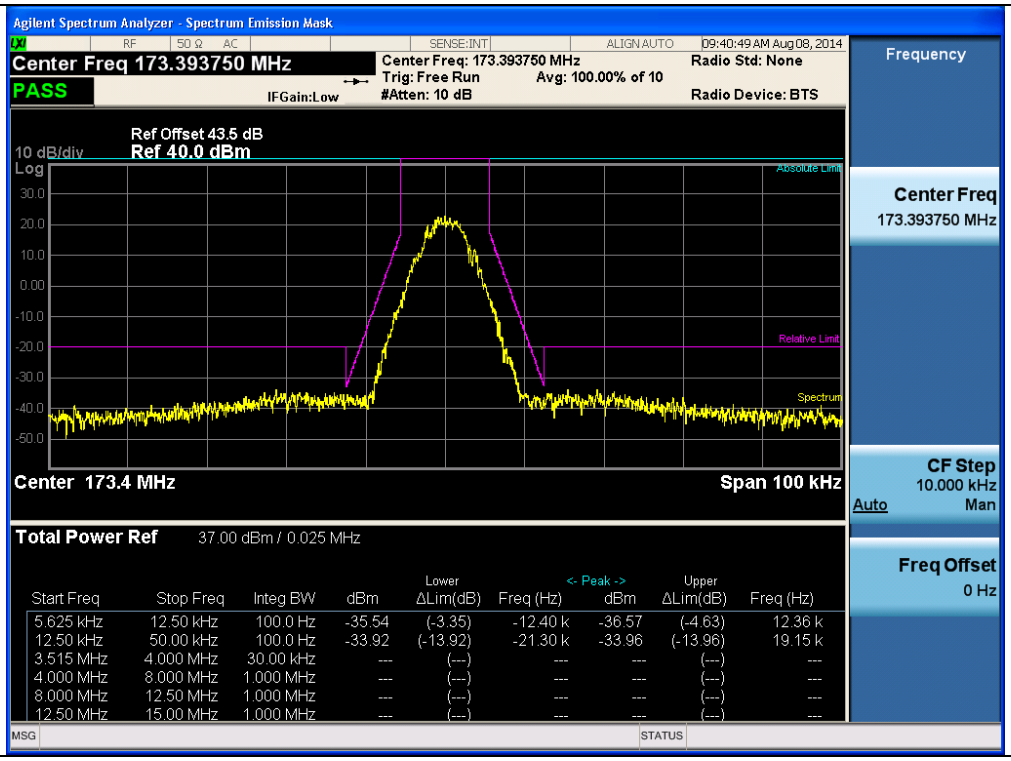
On 150 MHz band:
The emission level of P25 signal is below the limit by more than 1.2 dB.

On 450 MHz band:
The emission level of P25 signal is below the limit by more than 2.8 dB.

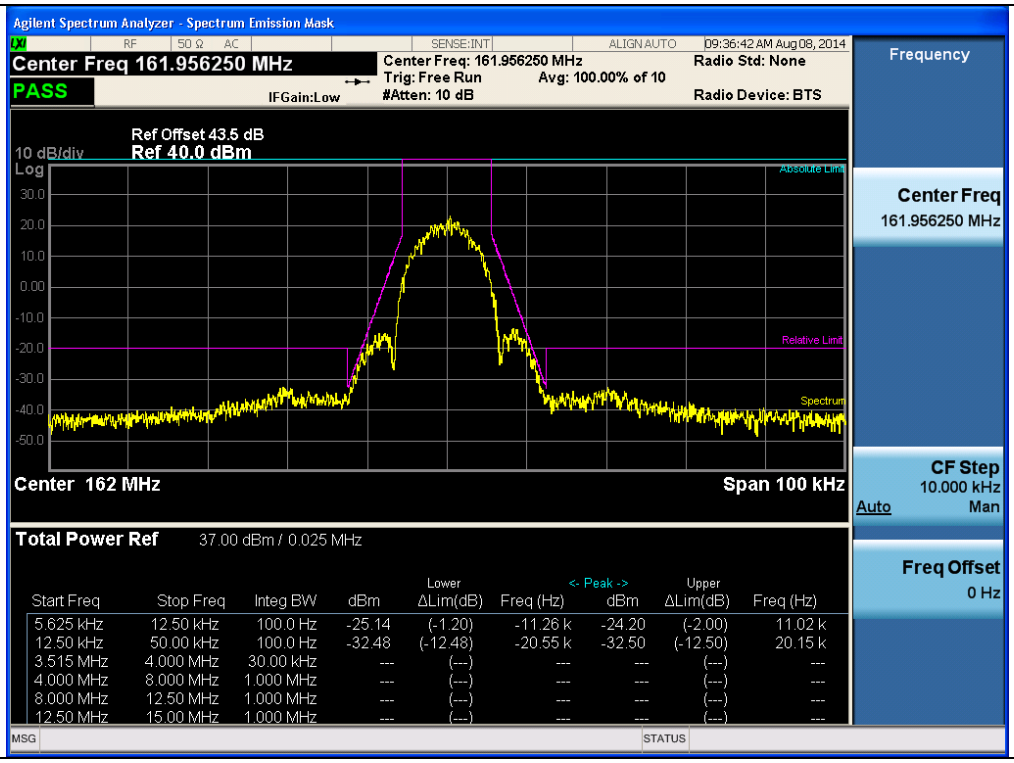
So the emission immediately adjacent to the signal channel is compliant with the FCC standard.

150 MHz Band

P25 I

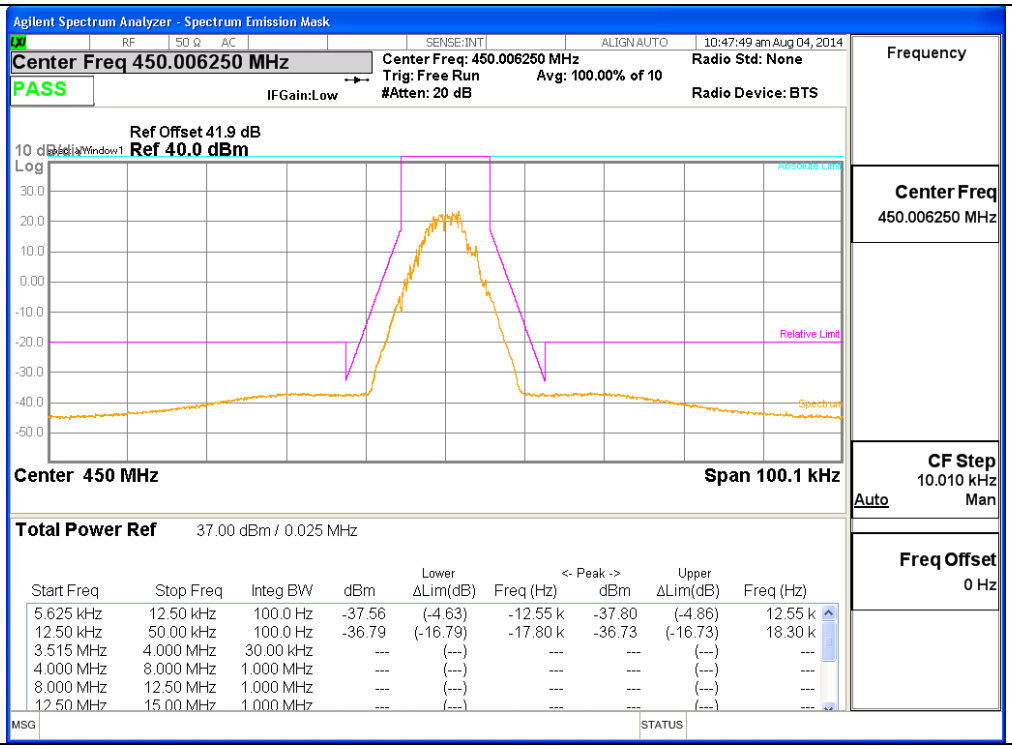


P25 II

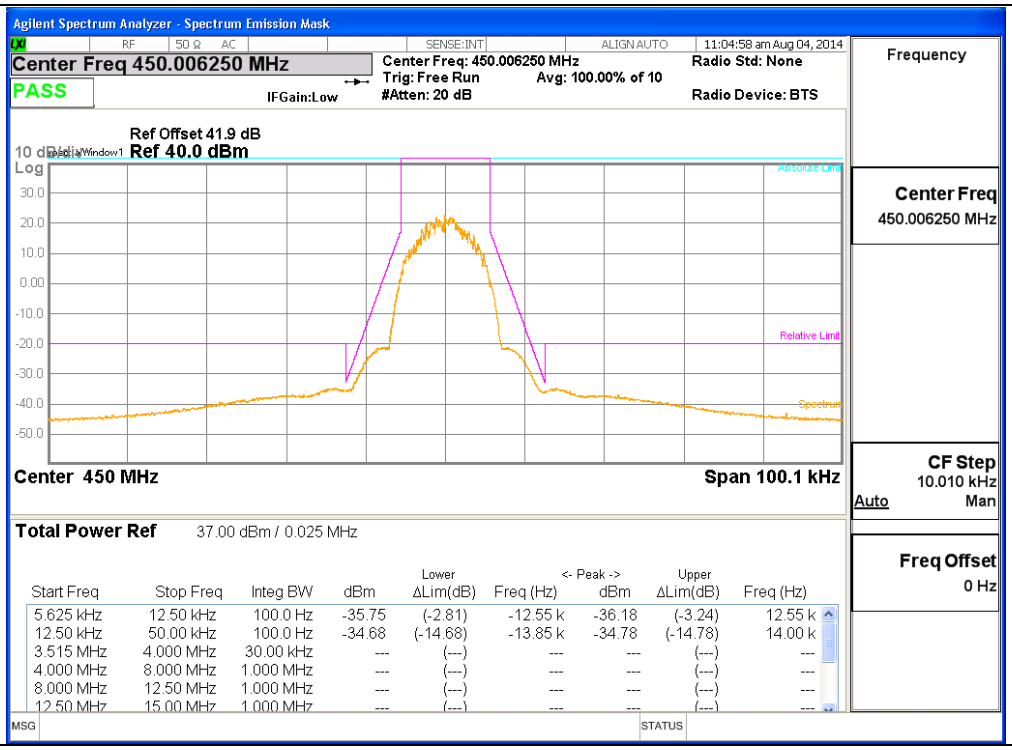


450 MHz Band

P25 I



P25 II



5.0 Unwanted Emissions - Conducted Spurious Pursuant 90.219(e)(3)

5.1 Methodology

All test conditions and measurement procedures were performed in accordance with FCC CFR47 part 2 subpart J Clause 2.1051.

A brief summary of the applicable FCC specifications are listed in the table below.

2.1051 Measurements required: Spurious emissions at antenna terminals.
The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in§ 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

2.1057 Frequency spectrum to be investigated.
(a) In all of the measurements set forth in §§ 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

90.219 (e)
A signal booster must meet
(3)Spurious emissions from a signal booster must not exceed -13dBm within any 100 kHz measurement bandwidth.

90.210
(o) *Instrumentation.* The reference level for showing compliance with the emission mask shall be established, except as indicated in §§90.210 (d), (e), and (k), using standard engineering practices for the modulation characteristic used by the equipment under test. When measuring emissions in the 150-174 MHz and 421-512 MHz bands, the following procedures will apply: A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For frequencies more than 50 kHz removed from the edge of the authorized bandwidth a resolution of at least 100 kHz must be used for frequencies below 1000 MHz. Above 1000 MHz the resolution bandwidth of the instrumentation must be at least 1 MHz. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, then an alternate procedure may be used provided prior Commission approval is obtained.

The out-of-band emission limit is

- -13 dBm

Up to 50 kHz offset from the lowest and highest edge of authorized channel was tested. Less than 50 kHz offset was subject to spectrum emission mask addressed in the previous Section 4.

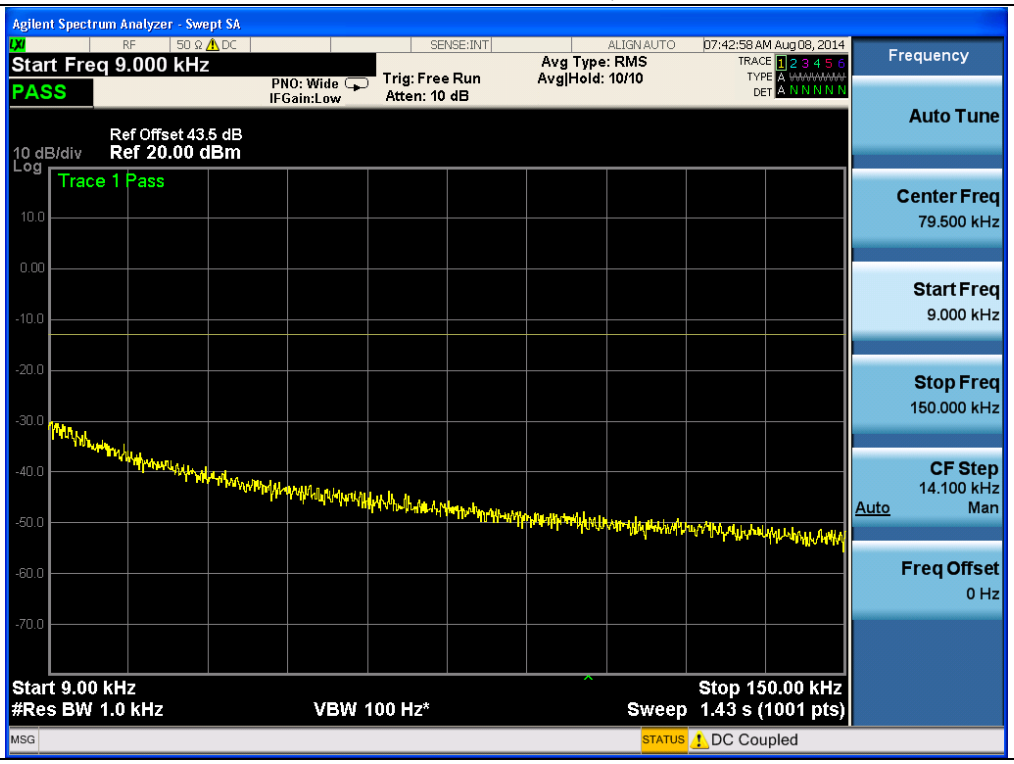
5.2 Test Results

On the plots below shown the worst case when the carrier was set to the edge with different modulations.
The horizontal straight line is marking the emission limit.
The emission level in the frequency range other than 30MHz – 1G is not affected by the modulation applied, i.e. only emissions close to the operating frequency block is affected by the modulation applied.

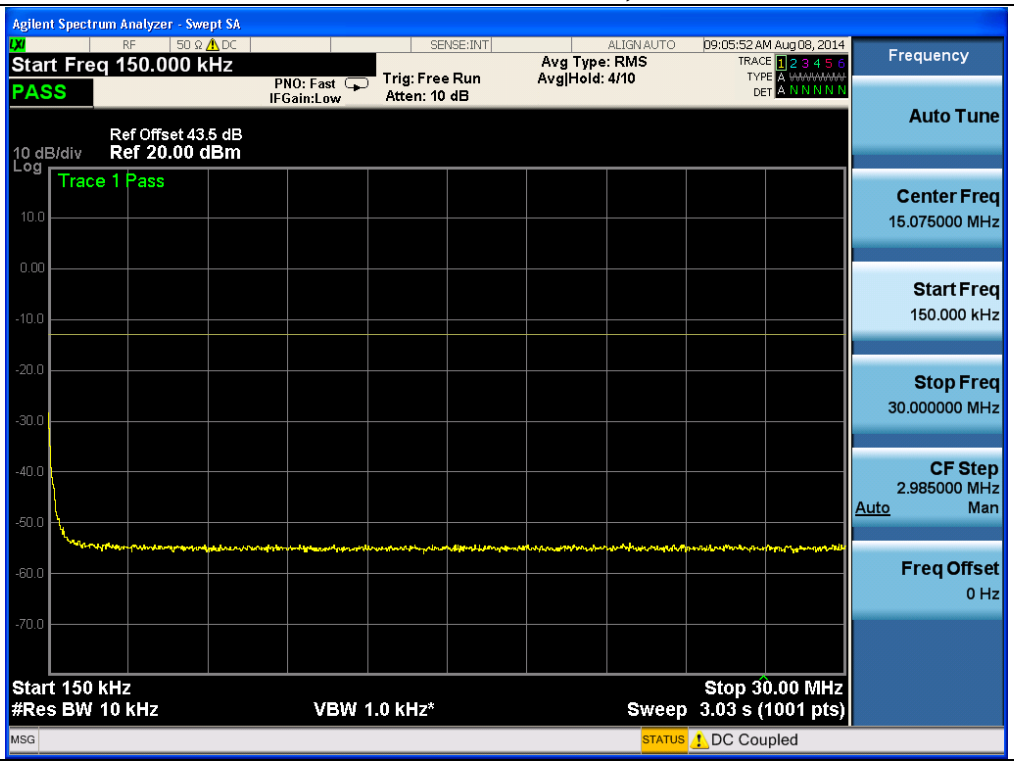
The emission level is below the limit, so the conducted emission is compliant with the FCC standard.

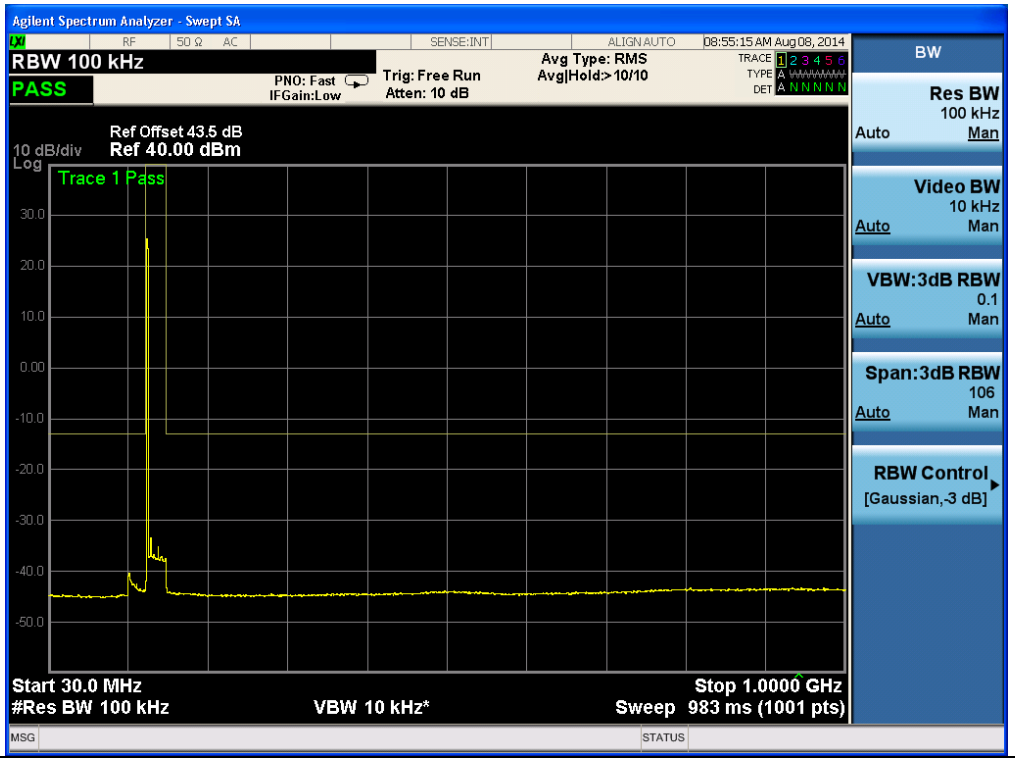
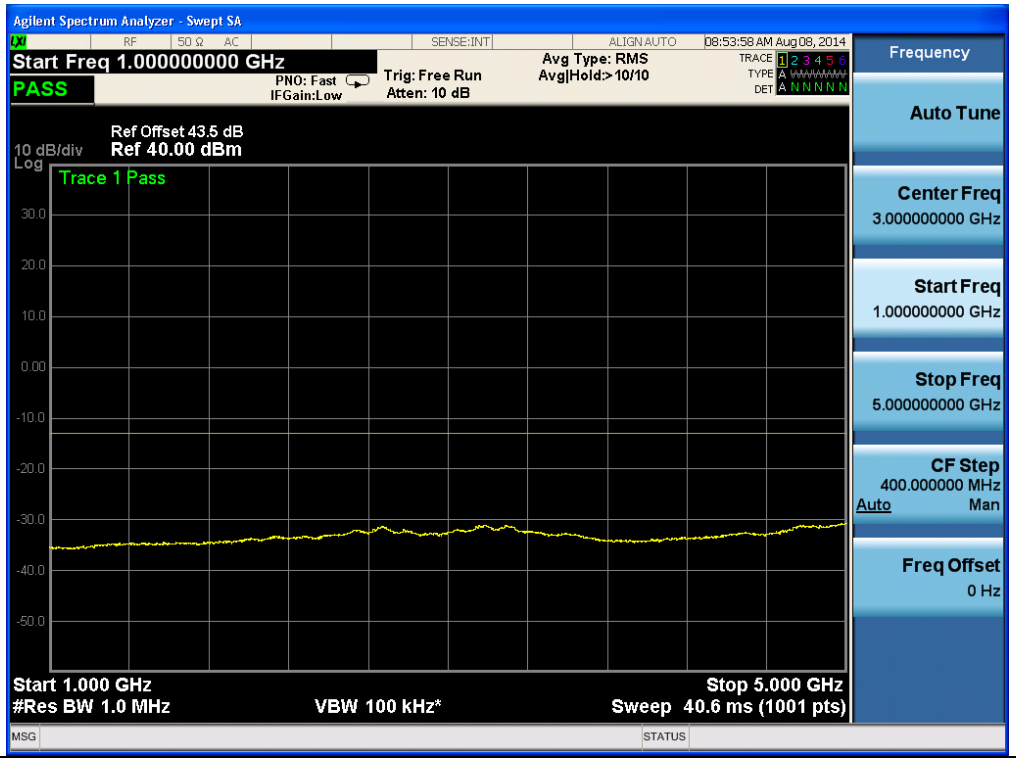
150 MHz Band

9 kHz – 150 kHz,

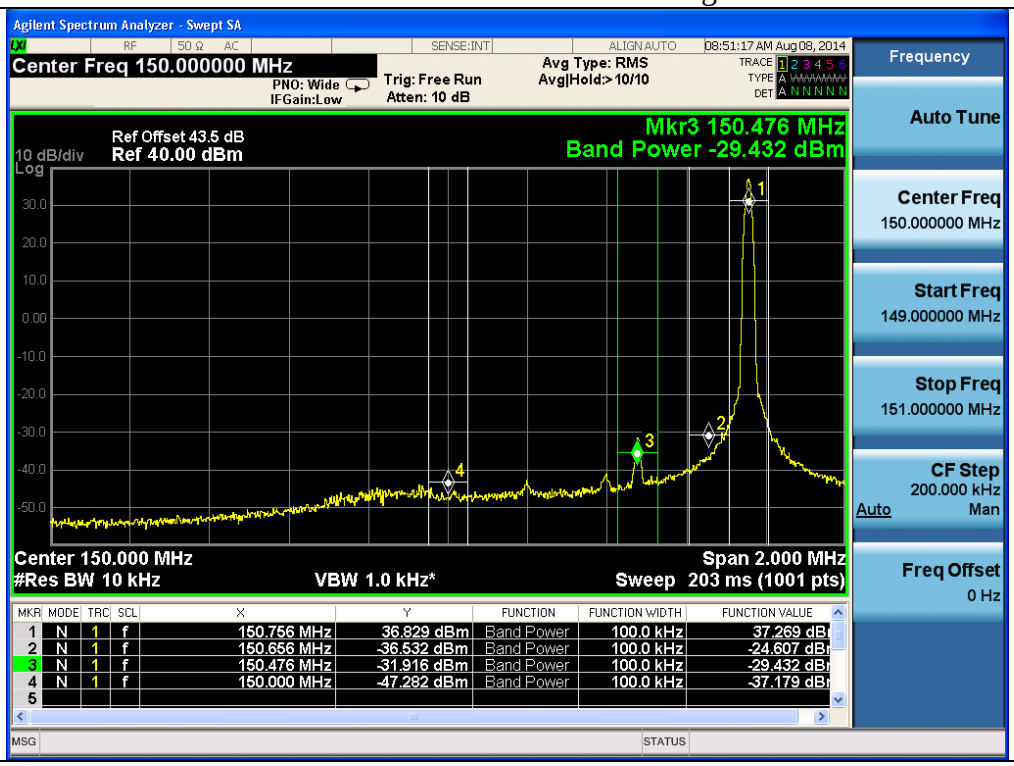


150 kHz – 30 MHz,

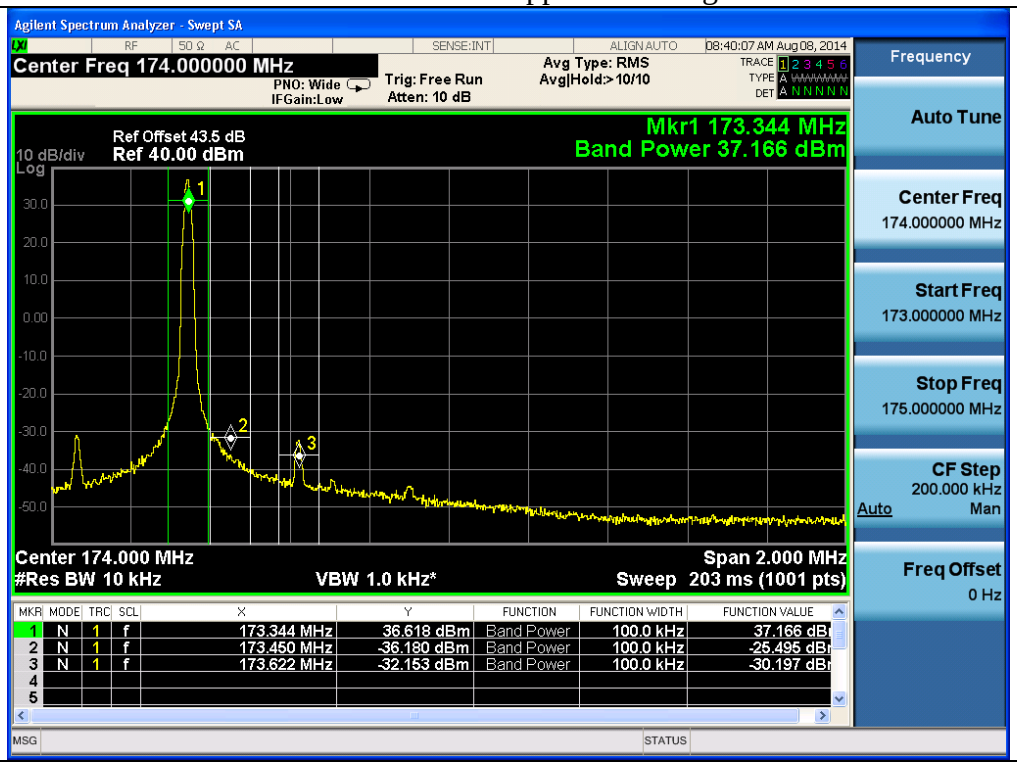


30 MHz – 1 GHz - with P25 Phase II on the Lower Edge

1 GHz – 5 GHz


Zoom in, P25 I 50 kHz Offset from Channel Edge, Marker Function with 100 kHz Band Interval Power – Lower Band Edge

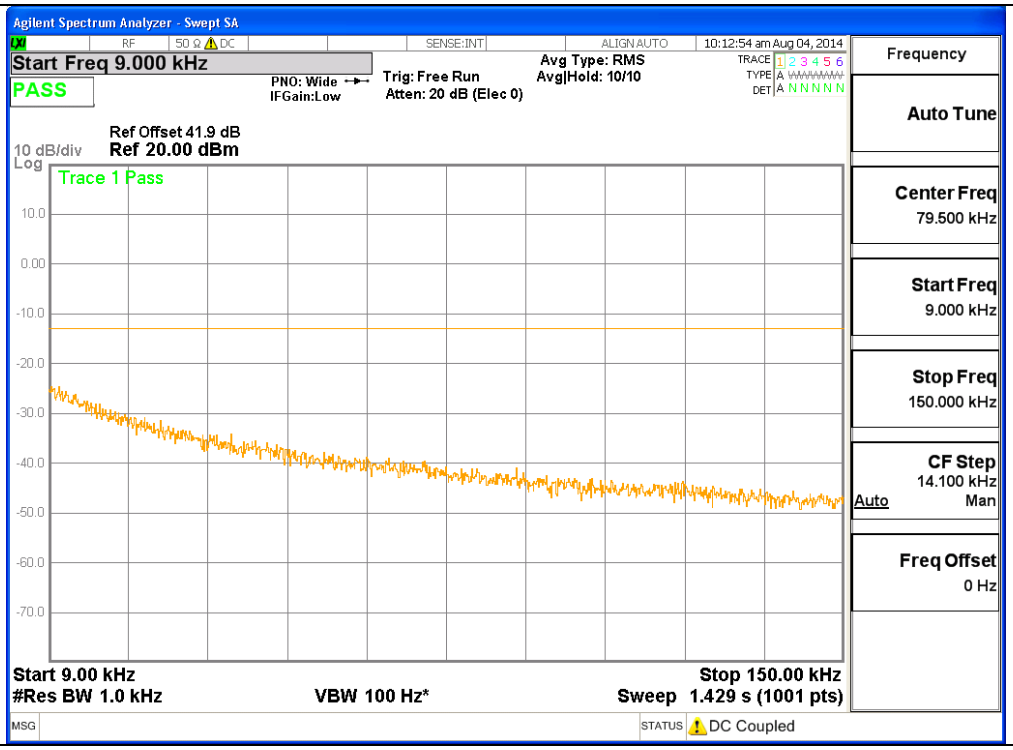


Zoom in, P25 II 50 kHz Offset from Channel Edge, Marker Function with 100 kHz Band Interval Power – Upper Band Edge

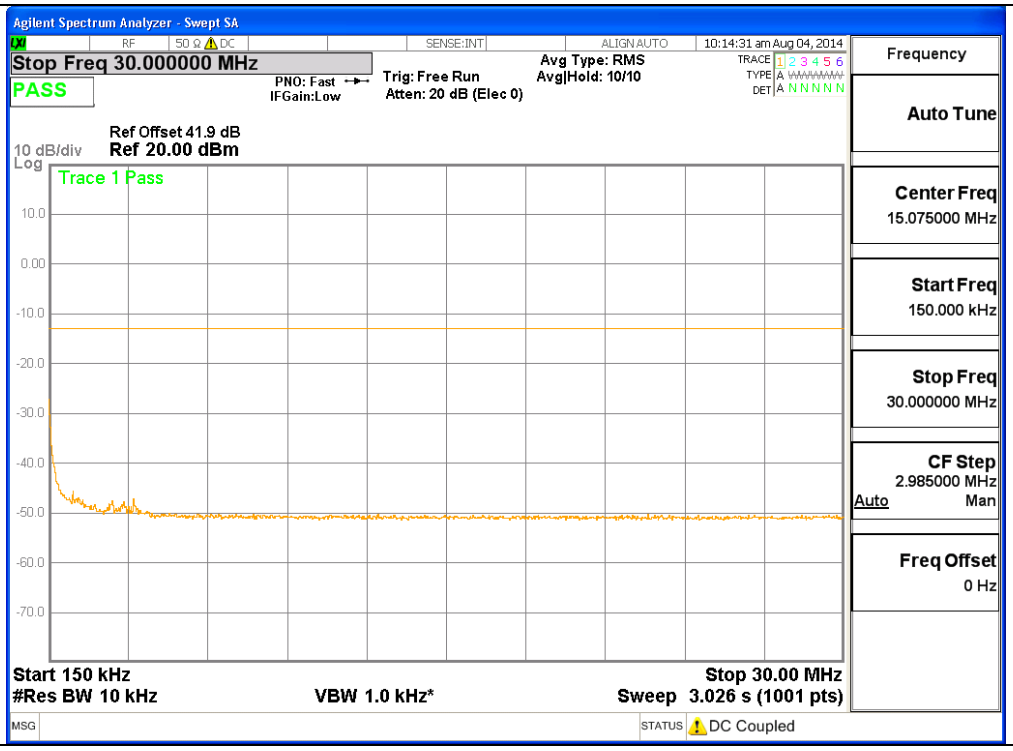


450 MHz Band

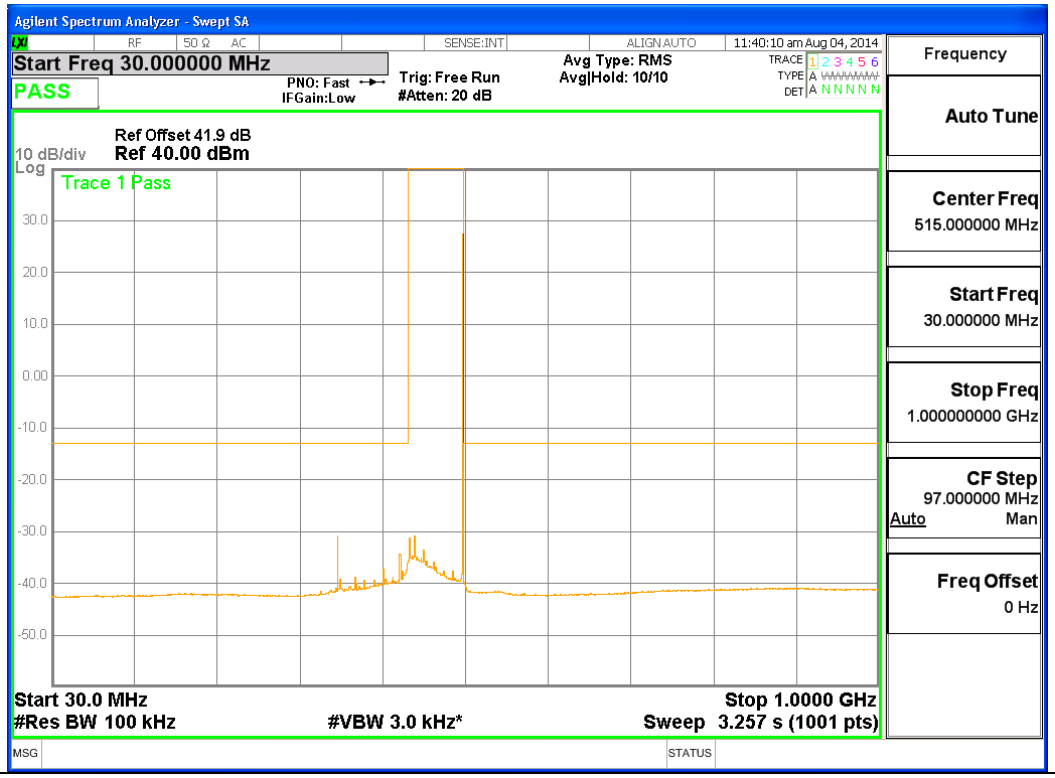
9 kHz – 150 kHz



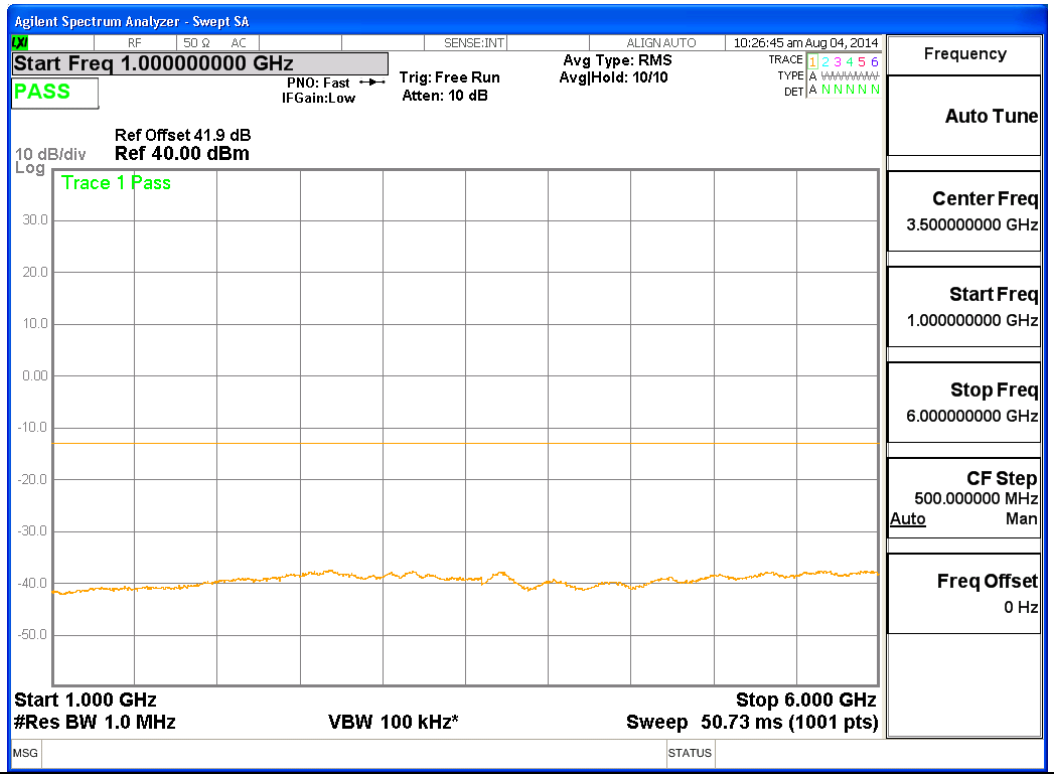
150 kHz – 30 MHz



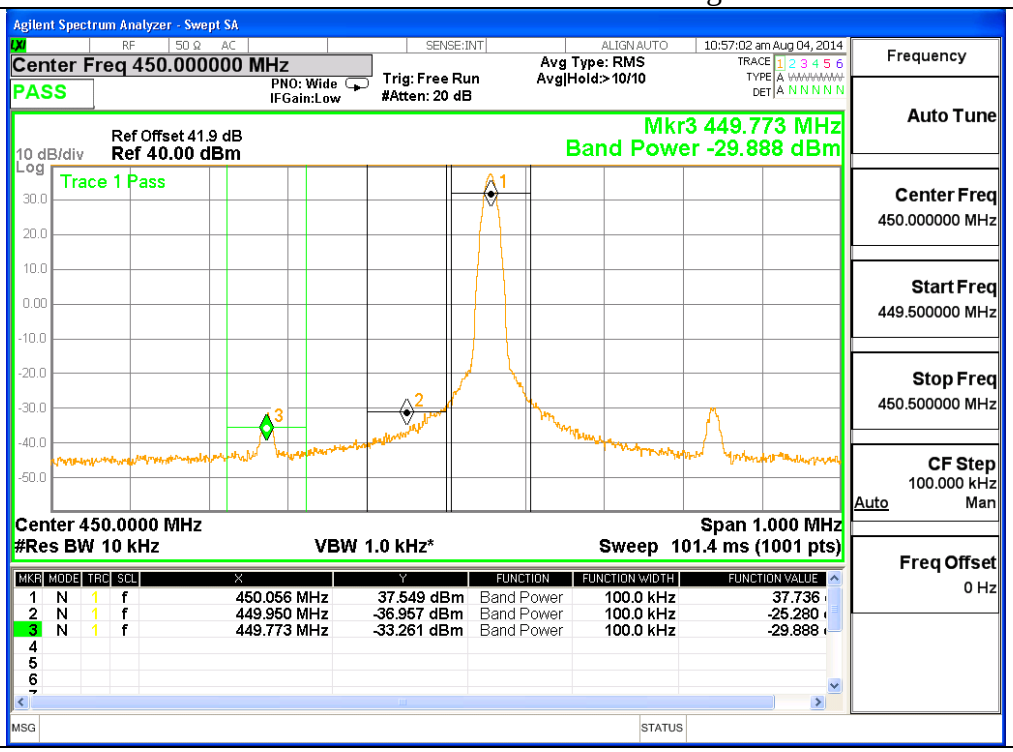
30 MHz – 1 GHz – with P25 Phase II on the Upper Edge



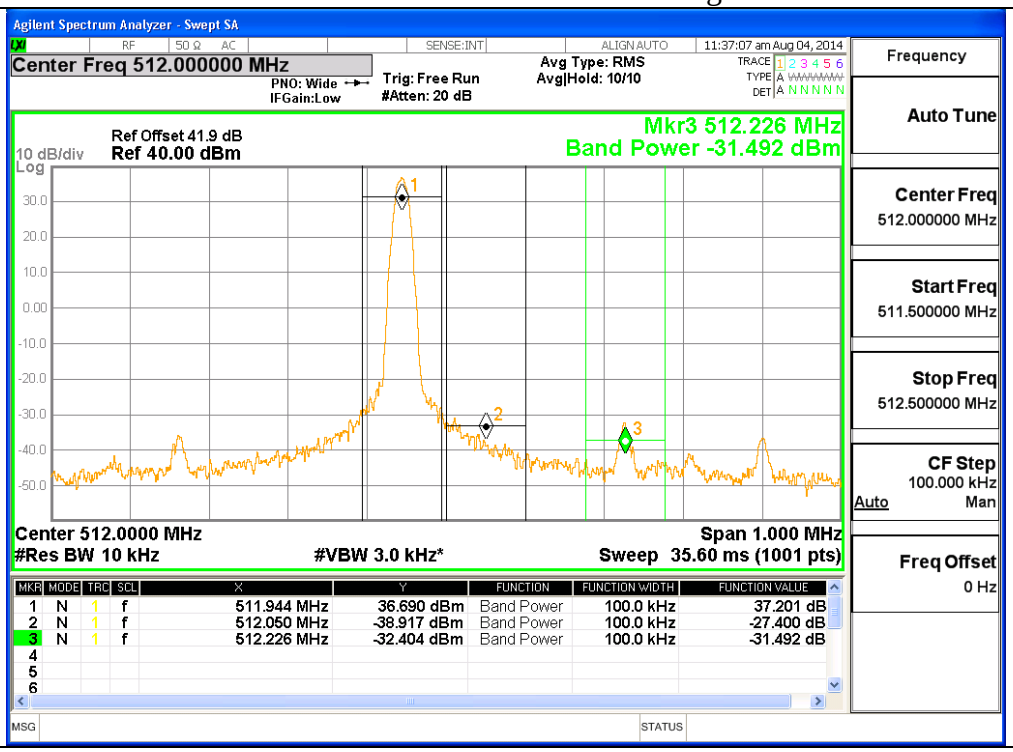
1 GHz – 6 GHz



Zoom in, P25 II 50 kHz Offset from Channel Edge, Marker Function with 100 kHz Band Interval Power – Lower Band Edge



Zoom in, P25 II 50 kHz Offset from Channel Edge, Marker Function with 100 kHz Band Interval Power – Lower Band Edge



6.0 Frequency Stability Pursuant 47 CFR 90.213

6.1 Methodology

Measurements were performed at CW.

Data is shown in the table in section 6.2.

A brief summary of the applicable FCC specifications are listed in the table below.

2.1055 Frequency stability.
(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following. The frequency stability shall be measured with variation of ambient ambient temperature as follows from -30° to +50° centigrade for all equipment

90.213 Minimum Frequency Stability
For Fixed and base stations:
Frequency range in 150 – 174 MHz with 6.25 kHz channel bandwidth: 1 ppm
Frequency range in 450 – 512 MHz with 6.25 kHz channel bandwidth: 0.5 ppm

All test conditions and measurement procedures were performed in accordance with FCC CFR47 part 2 subpart J Clause 2.1055.

- Temperature Variation: Data was collected continuously over temperature range of -5 °C to 40 °C using a max hold function.

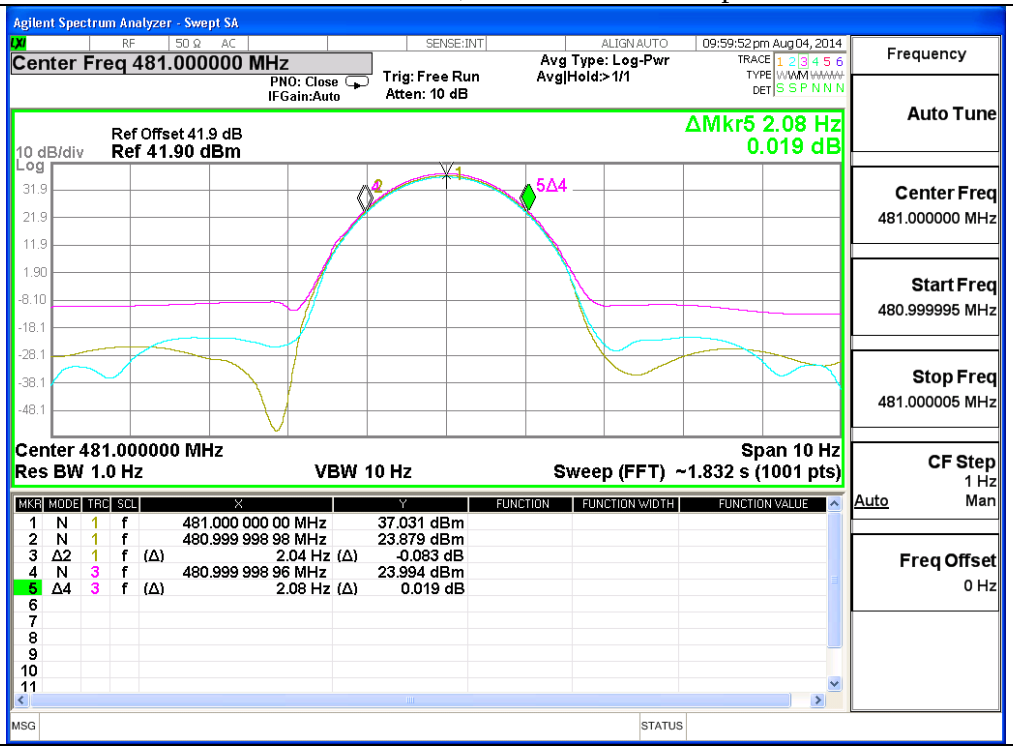
6.2 Test Results

Frequency	Change in Hz – Temperature Variation	Change in ppm	Compliant
167 MHz	2.03 – 1.95 = 0.08	0.0	Yes
481 MHz	2.08 – 2.04 = 0.04	0.0	Yes

Table 6-1. Frequency error in ppm

Frequency Stability vs Temperature Variation - 150 MHz band
Trace 3: Max Hold; Trace 1: Initial Snap Shot

Frequency Stability vs Temperature Variation - 450 MHz band
Trace 3: Max Hold; Trace 1: Initial Snap Shot



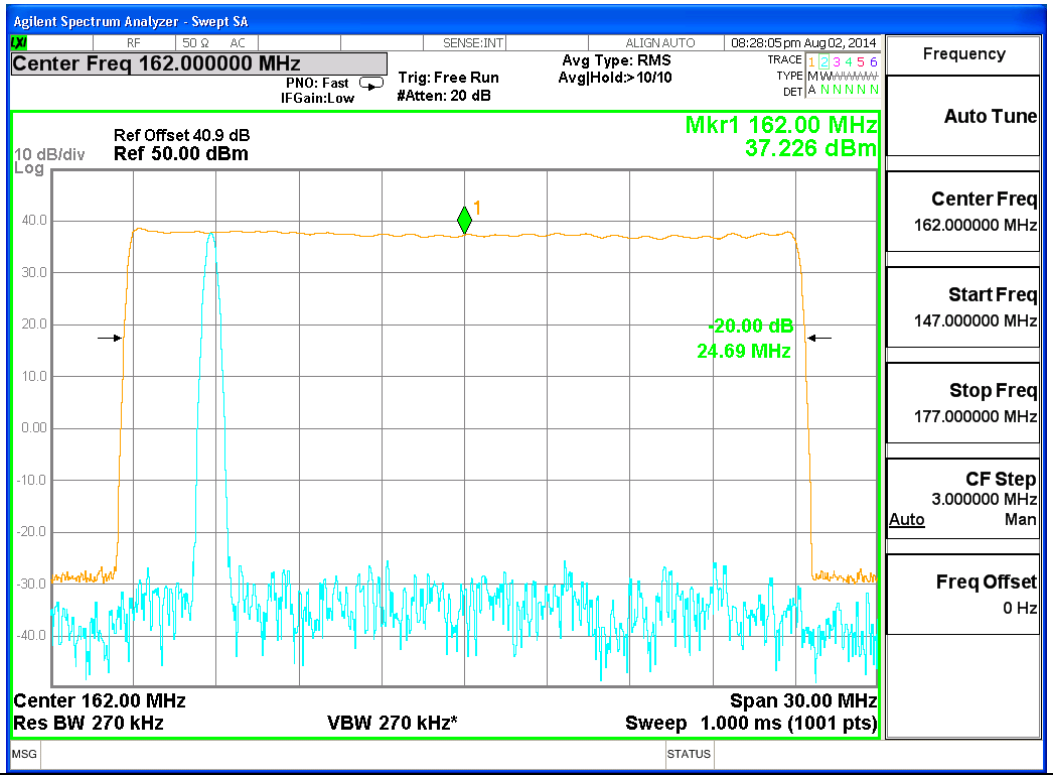
7.0 Passband Gain and Bandwidth

7.1 Methodology

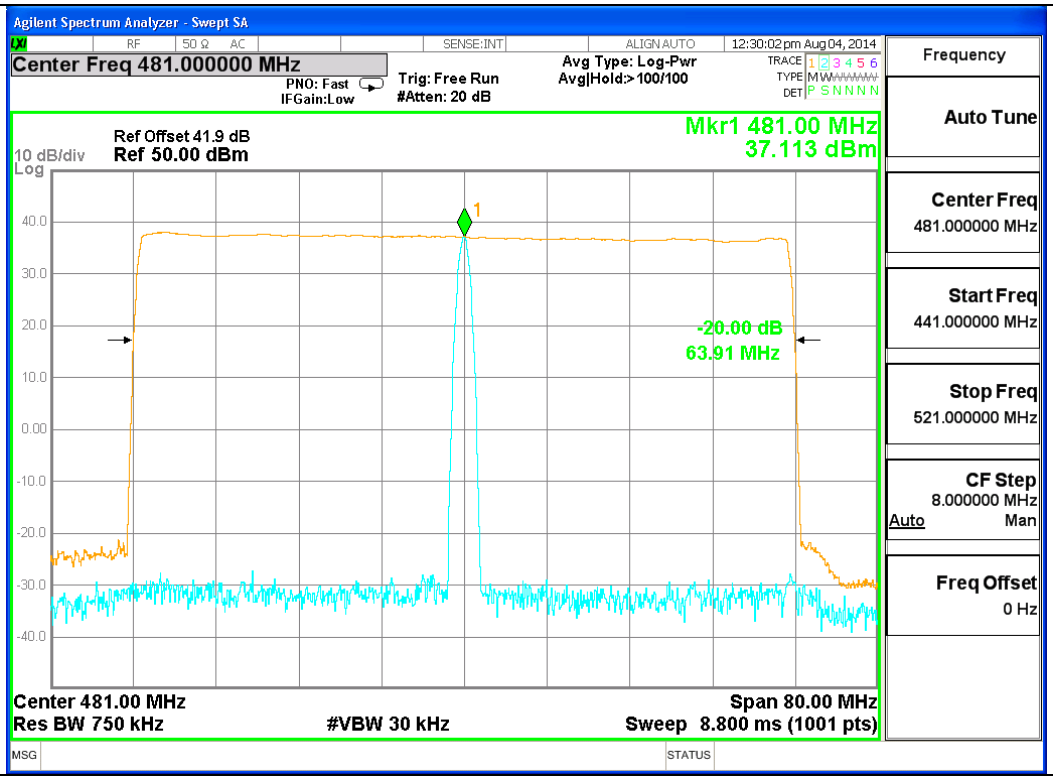
Measurements were performed at CW signal for sweeping across the measured frequency span.

Test data is shown in section 7.2 for each band.

7.2 Test Results

150 MHz Band


450 MHz Band



Operating Band	Nominal Input @ tHost (dBm)	Passband Gain (dB)	20 dB Passband Bandwidth (MHz)
150	-17	54	24.69
450	-17	54	63.91

Table 7-1 RF Output Passband Gain and Bandwidth

8.0 Noise Figure Pursuant 90.219(e)(2)

8.1 Methodology

Agilent SNS Noise Source was used to test the noise figure on the uplink path. The noise figure was measured by a proceeding noise path calibration.

Data is shown in the table in section 8.2.

A brief summary of the applicable FCC specifications are listed in the table below.

90.219 (e) A signal booster must meet (2) The noise figure of a signal booster must not exceed 9 dB in either direction

8.2 Test Results

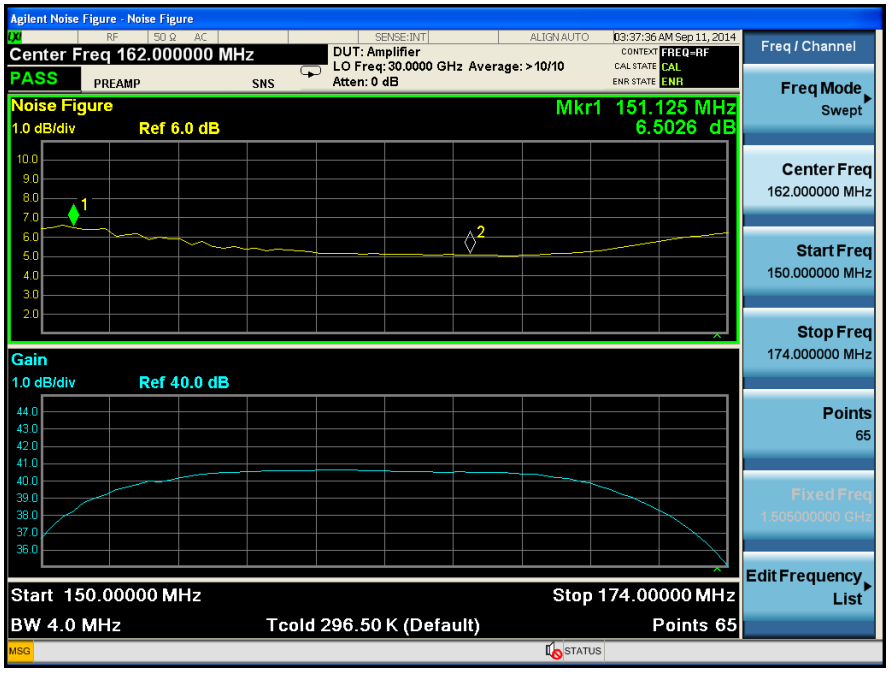


Figure 8-1 150 band Noise Figure

Figure 8-2 450 band Noise Figure

Operating Band	Min. NF reading (dB)	Max NF reading (dB)
150	5	6.51
450	3.5	7.2

Table 8-1 Noise Figure Results

9.0 Intermodulation Pursuant 90.219(d)(6)(i)

9.1 Methodology

Measurements were performed using CW signals.

Data is shown in the table in section 9.3.

A brief summary of the applicable FCC specifications are listed in the table below.

90.219 (d)
(6) Good engineering practice must be used in regard to the radiation of intermodulation products and noise, such that interference to licensed communications systems is avoided. In the event of harmful interference caused by any given deployment, the FCC may require additional attenuation or filtering of the emissions and/or noise from signal boosters or signal booster systems, as necessary to eliminate the interference.
(i) In general, the ERP of intermodulation products should not exceed −30 dBm in 10 kHz measurement bandwidth

9.2 Test Setup

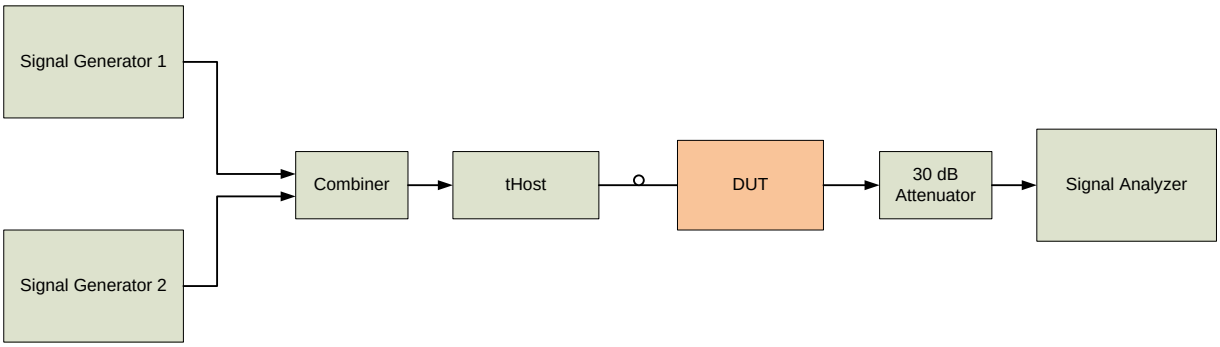


Figure 9-1 Intermodulation Test Setup

Two tones method was used to test the intermodulation level. Two tones were generated at 600 kHz apart and with the total output power at the nominal output power, i.e. 37dBm. Two tones were allocated at the high band edge or at the low band edge. The 3rd order intermodulation was produced to be the last or first carrier within the operating band.

9.3 Test Results

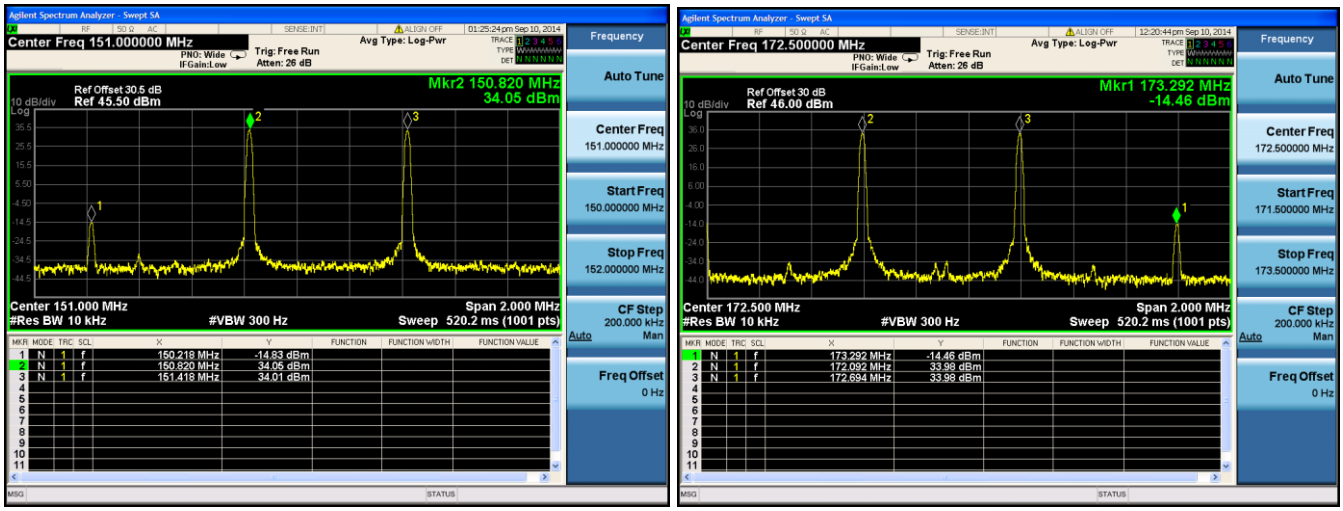


Figure 9-2 150 band Intermodulation – Low and High Band Edge

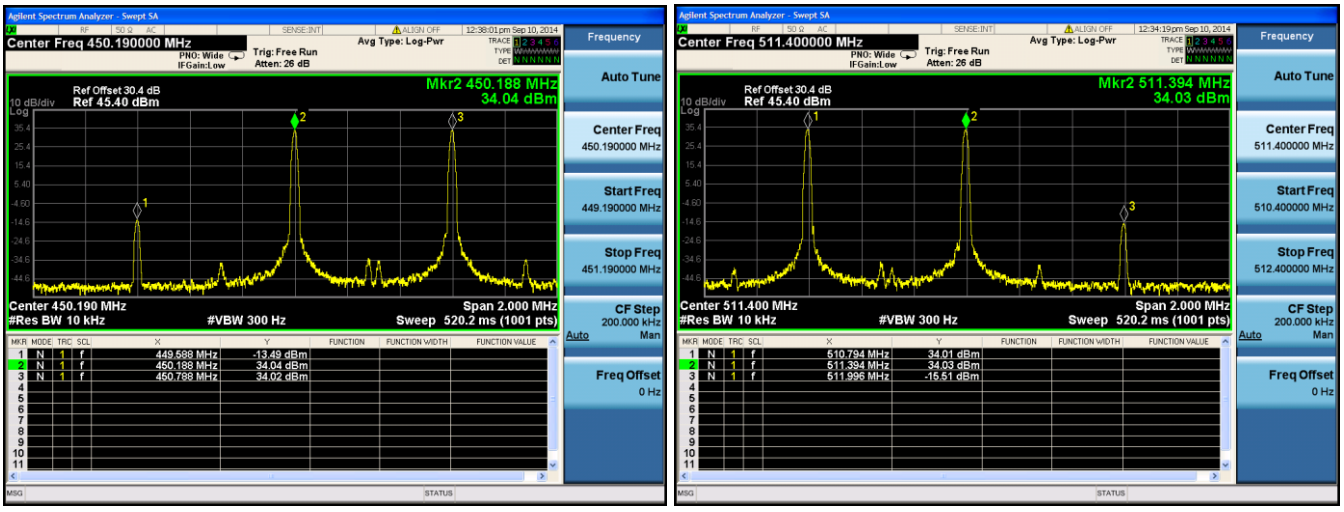


Figure 9-3 450 band Intermodulation – Low and High Band Edge

Operating Band	Intermodulation Level Low Band Edge (dBm)	Intermodulation Level High Band Edge (dBm)
150	-14.83	-14.46
450	-13.49	-15.51

Table 9-1 Intermodulation Results

In order to comply with condition that the ERP of intermodulation products should not exceed −30 dBm in 10 kHz measurement bandwidth, a minimum amount of loss between the t37 remote unit antenna port and antenna radiated power shall be 17 dB.

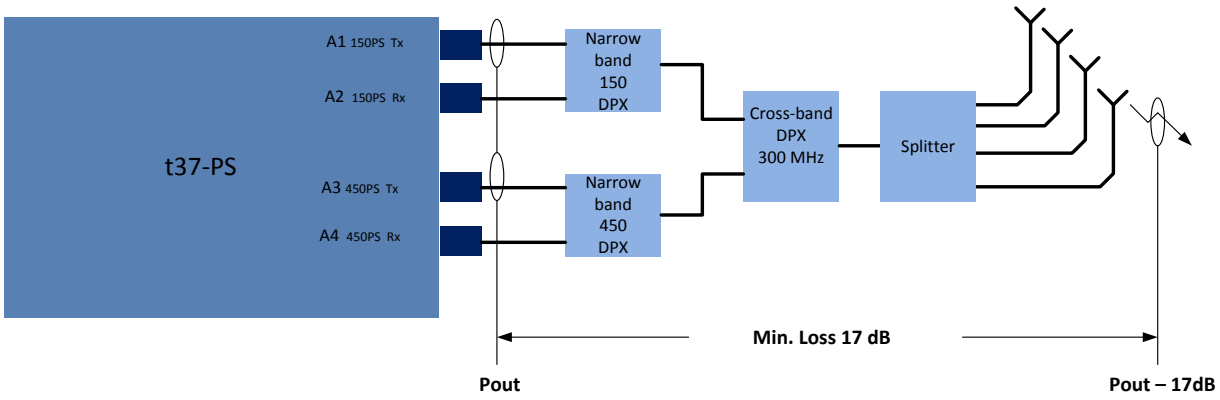


Figure 9-4 Implementation Diagram

Appendix A: Test Setup Photos

Conducted Test Setup – EUT

Conducted Test Setup – Measurement Instruments