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FCC PARTS 2, 90 TEST REPORT

Applicant	Dali Wireless, Inc.
Address	8618 Commerce Court, Burnaby, British Columbia, V5A 4N6, Canada
FCC ID	HCOT43DQDD1A
Model Number	t43-DQD-D1D
Product Description	700, 800 Remote Unit, Dual-Band High Power
Date Sample Received	July 21 th , 2014
Date Sample Tested	July 21 th to August 11 th , 2014
Tested by	Guihua Sophie Piao
Approved by	Daryl Meerkerk
Report No.	T43-DQD-D1D
Test Results	Compliant

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Revision History

Revision	Date	Reason For Change	Author(s)
0.1	July 30 th , 2014	Initial Data	S. Piao
0.2	August 4 th , 2014	TIMCO Feedback	S. Piao
0.3	August 11 th , 2014	TIMCO Feedback, separate 700MHz band into 758MHz-763MHz and 763MHz-775MHz, where part27 and part 90 applied, respectively; separate 800MHz band into 851MHz – 854MHz and 854MHz – 869MHz, where part 90S and part 90I applied, respectively; part 20 industrial booster report presented.	S. Piao
0.4	August 12 th , 2014	TIMCO Feedback, Changed FCC ID referred from HCOT43DQDD1B to HCOT43DQDD1A	S. Piao
0.5	Oct. 06 th , 2014	FCC Review	S.Piao
0.6	Nov. 24 th , 2014	FCC Audit Response	S.Piao

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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
LTE	Long Term Evolution
MHz	Mega Hertz
NB	Narrow Band
NPSPAC	National Public Safety Planning Advisory Committee
OBW	Occupied Bandwidth
PS	Public Safety
PSBB	Public Safety Broad Band
PS-B/ILT-SMR	Public Safety – Business, Industrial/Land Transportation, Specialized Mobile Radio
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, 90I, 90R and 90S 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:

A handwritten signature in purple ink, appearing to read "Guihua Piao".

Signature:

Guihua Sophie Piao

Function: Test Engineer

Date: August 11th, 2014

1.3 Report Summary

Disclaimer	The test results relate only to the items tested.
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Report Purpose	To demonstrate the DUT compliance with FCC Parts 2, 90I, 90R, 90S requirements for a dual band digital repeater.
Applicable Rule Parts	FCC CFR 47 Part 2.1046 (a), 90.219 FCC CFR 47 Part 2.1049, 90.209 FCC CFR 47 Part 90.543 (c), (e) FCC CFR 47 Part 90.210(c), (h) FCC CFR 47 Part 2.1055, 90.213
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.

1.6 Device Under Test Information

Manufactured by	Dali Wireless Inc.
DUT Description	700, 800 Remote Unit, Dual-Band Bi-directional Distributed Antenna System/Repeater.
FCC ID	HCOT43DQDD1A
Model Name	t43™ – DQD-D1D
Operating Frequency	Downlink 758 – 775 MHz, Uplink 788 – 805 MHz; Downlink 85 – 869 MHz, Uplink 806 – 824 Mhz; where the uplink does not transmit over the air.
Emission Designators	F9W, D9W
Modulations	LTE in 700 MHz PS BB (FirstNet) P25 in 700MHz PS NB incumbent PS in 763-768MHz P25 in 851 – 862 MHz incumbent PS in 862-869 MHz
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	$\pm 1^{\circ}\text{C}$
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
Spectrum Analyzer	Agilent	EXA-N9010A	MY50210629	2 years	13-Jun-2015
Power Meter	Agilent	U2000A	MY50000426	1 year	19-Sep-2014
Power Meter	Agilent	U2000A	MY48000438	1 year	06-Mar-2015
Signal Generator	Agilent	MXG-N5182B	MY53050168	3 years	25-Jul-2017
Signal Generator	Agilent	EXG-N5182A	MY50140256	3 years	15-Jul-2017

1.9 Test Procedure

General

The t43 remote, is connected to the tHost 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 tHost and spectrum analyzer is connected to the appropriate downlink antenna output through an attenuator, nominally 40 dB for the band under consideration.

The passing band of the equipment under test (EUT) is covering 700 (758 – 775 MHz) MHz and 800 MHz (851 – 869 MHz) public safety (PS) bands.

Inside the 700 MHz passing band, the APCO FirstNet PS BB (758 – 768 MHz) as well as the private land mobile service (PS NB) is supported. The 800 MHz passing band covers NPSPAC for 851 – 854 MHz, interleaved PS-B/ILT-SMR for 854 – 862 MHz and the ESMR band for 862 – 869 MHz.

LTE signal was tested in 758 – 768 MHz. On the upper 5 MHz in the PS BB spectrum, the device is intended to operate on qualified PS NB licenses. So P25 was also tested in this spectrum and the PS NB spectrum (769 – 775 MHz).

The EUT is only intended to operate on qualified PS licenses on 800 Band. P25 signal was the modulation tested on PS bands (851- 854 MHz and 854 – 862 MHz), also on the ESMR spectrum (862 – 869 MHz).

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 ESMR modulations and 100 kHz for LTE modulation.

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.

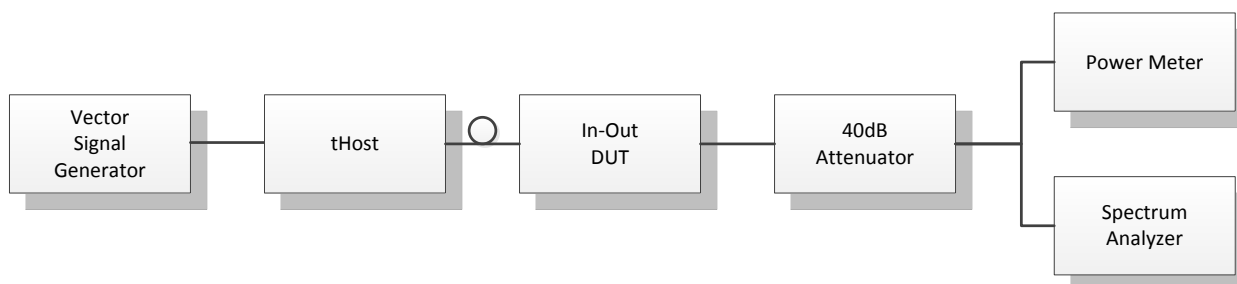
Frequency Stability

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.

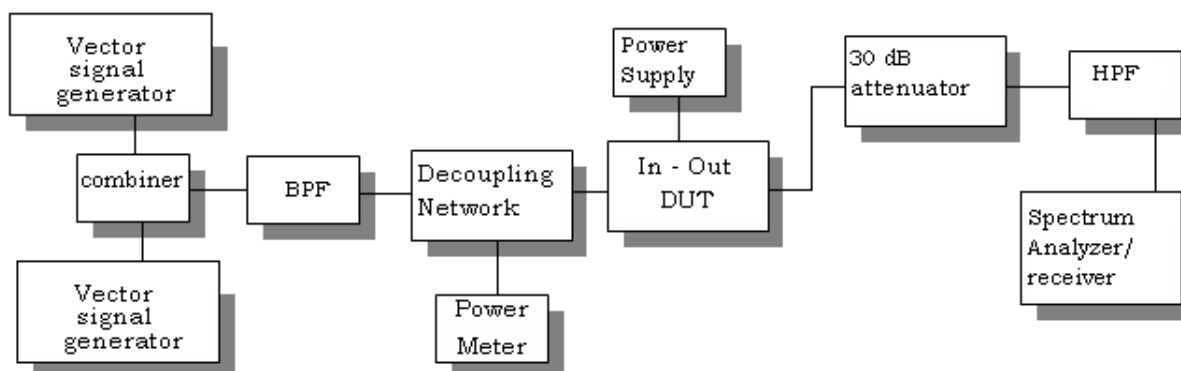
Test Setup for Output Power, Occupied Bandwidth, Spectrum Emission Mask, Conducted Spurious Emission, Frequency Stability, and Passband Gain and Bandwidth



Intermodulation Product Spurious Emissions

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. Two tones (CW) method was used. The input power to the amplifier was set at maximum drive level by combining the two tones. The two tones were chosen in such a way (1) the third order intermodulation product frequencies are located within the pass band of the DUT and (2) they produce the worst-case emissions out of band. All signals were modulated.

Test Setup for Intermodulation



1.10 Operational Description

Dali's all-digital, high power, dual-band radio remote, **t43ps**, (43 dBm, 20 W) is designed for distributed antenna system applications. It bi-directionally transfers two public safety bands over a single optical fiber (SFP –Single Mode Fiber) to/from the RF Router, *tHost®* at 6 Gb/s up to 40 km. It can be easily combined with a second unit to create a compact, integrated quad-band transceiver. It also accommodates 1 Gb/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 1-1 700 MHz DL Measurement Matrix

Modulation	# Carriers	Notation	Frequency (MHz)
LTE 5MHz BW QPSK	1	LTE5M	760.5, 765.5
LTE 1.4MHz BW QPSK	2	LTE1.4M	760.5, 765.5
P25 Phase I 12.5kHz C4FM	1	P25 I-F	769.0125, 772, 774.9875
P25 Phase II 12.5kHz H-DQPSK	1	P25 II	769.0125, 772, 774.9875
P25 Phase I 6.5kHz CQPSK	1	P25 I-P	763.00625, 760.50625, 767.99375 769.00625, 772.50625, 774.99375

Table 1-2 800 MHz DL Measurement Matrix

Modulation	# Carriers	Notation	Frequency (MHz)
P25 Phase I 6.5kHz CQPSK	1	P25 I-P	851.0125, 861.9875 862.0125, 868.9875
P25 Phase I 12.5kHz C4FM	1	P25 I-F	851.0125, 861.9875 862.0125, 868.9875
P25 Phase II 12.5kHz H-DQPSK	1	P25 II	851.0125, 861.9875 862.0125, 868.9875

For measurement of output power and occupied bandwidth, a representative LTE signal with 5 MHz of bandwidth was tested in the 700 MHz PS BB (758 MHz – 769 MHz).

In order to measure the unwanted spurious emission, two E-TM1.1 channels according to the TS36.141 of 1.4 MHz bandwidth generated on separate center frequencies since the passing

band of the 700 MHz PS BB is wider than 2.8 MHz. Single carrier of P25 signal with different modulation types was injected in the 700 MHz PS NB.

Single carrier P25 of different modulations was tested in the band of NPSPAC 851 – 854 MHz and PB-ILT/SMR 854 – 862 MHz. Due to the fact of coexistence of multiple technologies designated on the ESMR band 862 – 869 MHz before the reconfiguration completed, P25 signal was also tested on this band.

2.0 Output Power – Pursuant 47 CFR Part 2.1046(a) and 90.219 (d) (3)

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. 90.219 (d) Deployment rules. Deployment of signal boosters must be carried out in accordance with the rules in this paragraph. (3) Signal boosters must be deployed such that the radiated power of the each retransmitted channel, on the forward link and on the reverse link, does not exceed 5 Watts effective radiated power (ERP).
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Measurements were performed at

LTE5M within the 700 D block (758 MHz – 763 MHz),
LTE5M and P25 I-P within the Band14 PSBB band (763MHz – 768 MHz),
P25 I-P, P25 I-F and P25 II within the PS NB (769 MHz – 775 MHz)

P25 I-P, I-F and P25 II within the 800 band (851 MHz – 869 MHz).

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 6.7 dB for 700 MHz band and 800 MHz band.

700 D Block and B14 PSBB

<i>Signal</i>	<i>758MHz – 763MHz (ERP)</i>	<i>763MHz – 768MHz (ERP)</i>	
LTE5M	36.37 dBm	36.44 dBm	
P25 I-P	-	36.7 dBm	
<i>Signal</i>	<i>769 MHz – 775 MHz (ERP)</i>		
	<i>Low</i>	<i>Mid</i>	<i>High</i>
P25 I-P	36.42 dBm	36.18 dBm	35.51 dBm
P25 I-F	36.99 dBm	36.51 dBm	36.29 dBm
P25 II	36.95 dBm	36.5 dBm	36.37 dBm

800 MHz band

<i>Signal</i>	<i>851 – 862 MHz (ERP)</i>		<i>862 – 869 MHz (ERP)</i>	
	Low	High	Low	High
P25 I-P	36.4 dBm	36.51 dBm	36.46 dBm	36.49 dBm
P25 I-P	36.5 dBm	36.29 dBm	36.3 dBm	36.31 dBm
P25 II	36.5 dBm	36.4 dBm	36.44 dBm	36.52 dBm

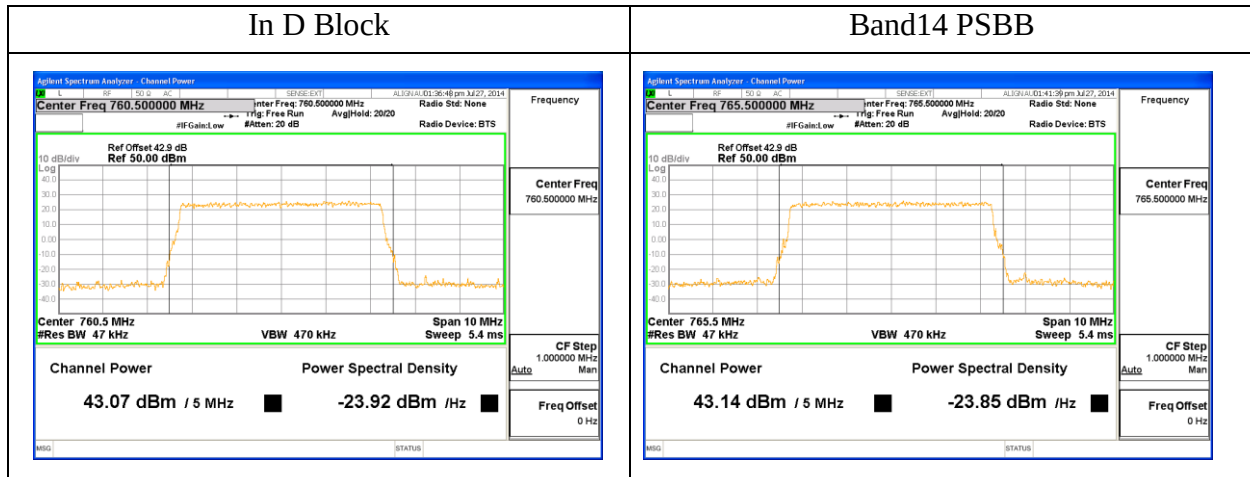
Table 2-1 Output Power Measurement

Conclusion: As the table above indicates, the maximum power output value of 36.99 dBm was obtained with C4FM modulation at 769 MHz within PS NB.

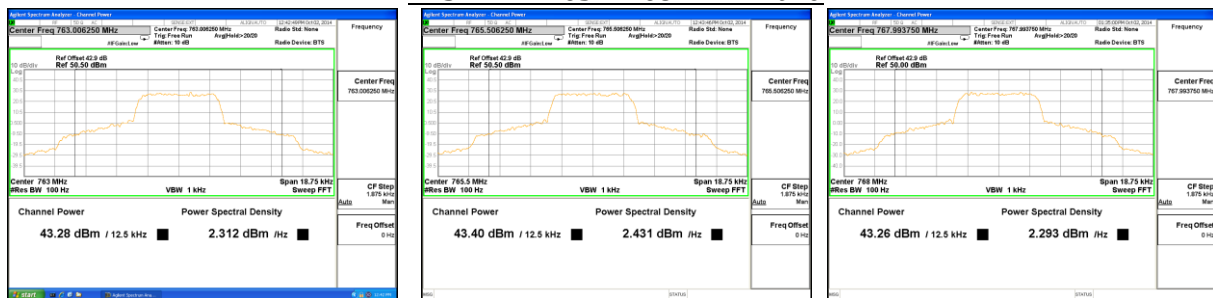
In order to comply with condition that the radiated power of any retransmitted channel should not exceed 5 W ERP (pursuant 90.219), the sum of the minimum cable loss and maximum antenna gain applied to the t43 remote unit should be more than 6.7 dB.

The conducted power measurement plots were shown as follows:

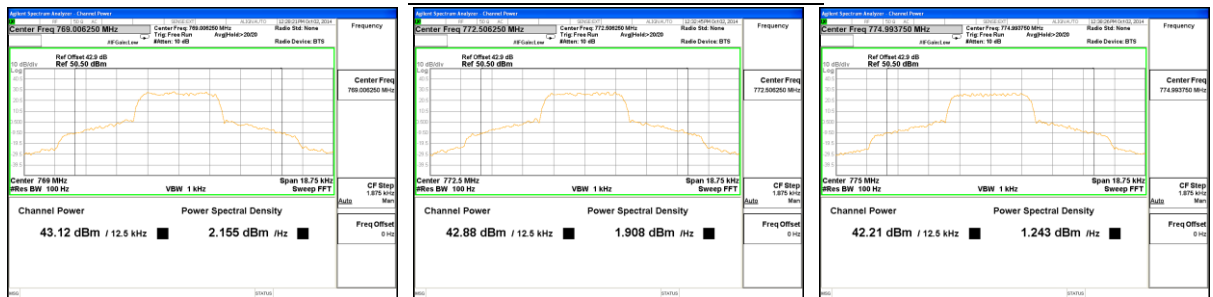
LTE5M in 700 Band



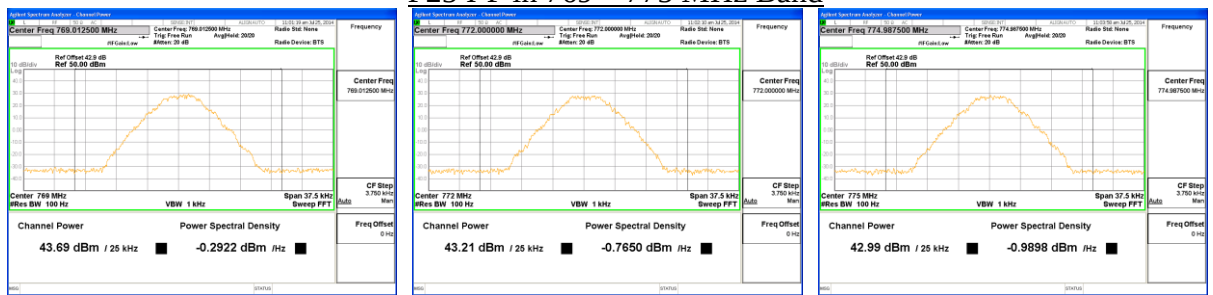
P25 I-P in 763 – 768 MHz Band



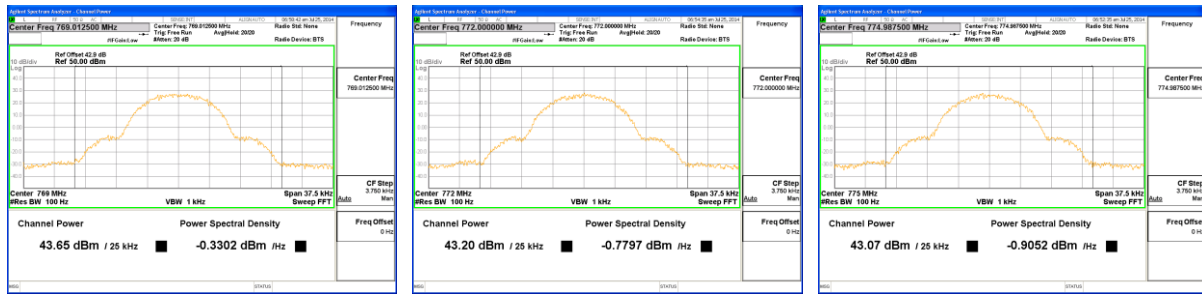
P25 I-P in 769 – 775 MHz Band



P25 I-F in 769 – 775 MHz Band

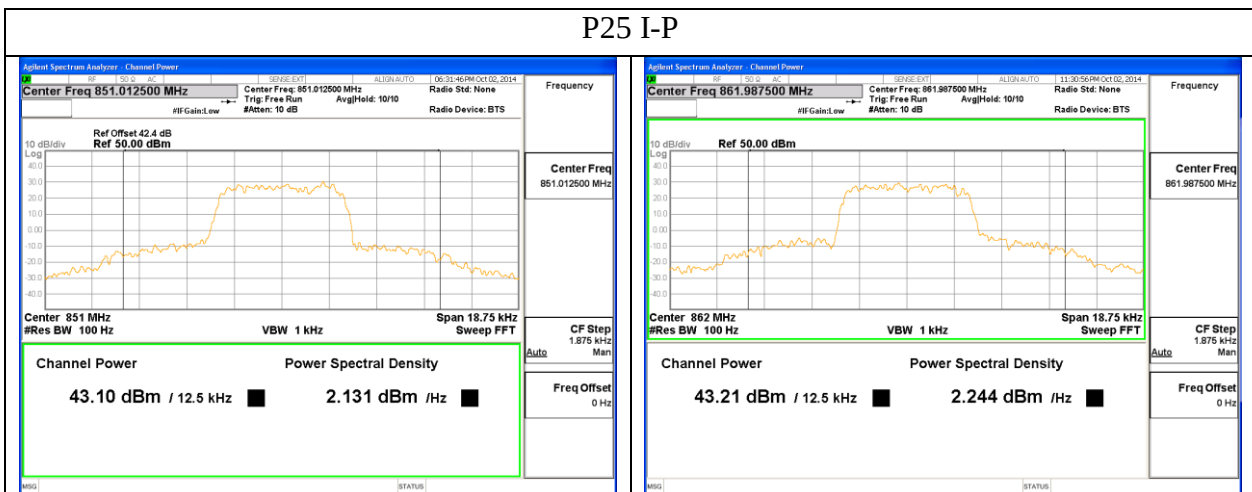


P25 II in 769 – 775 MHz Band

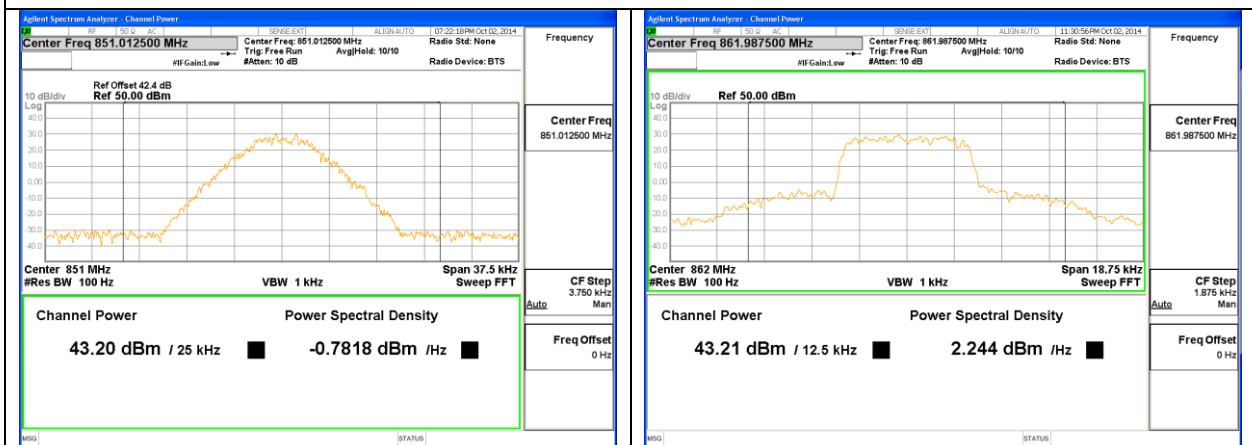


851 – 862 MHz Band

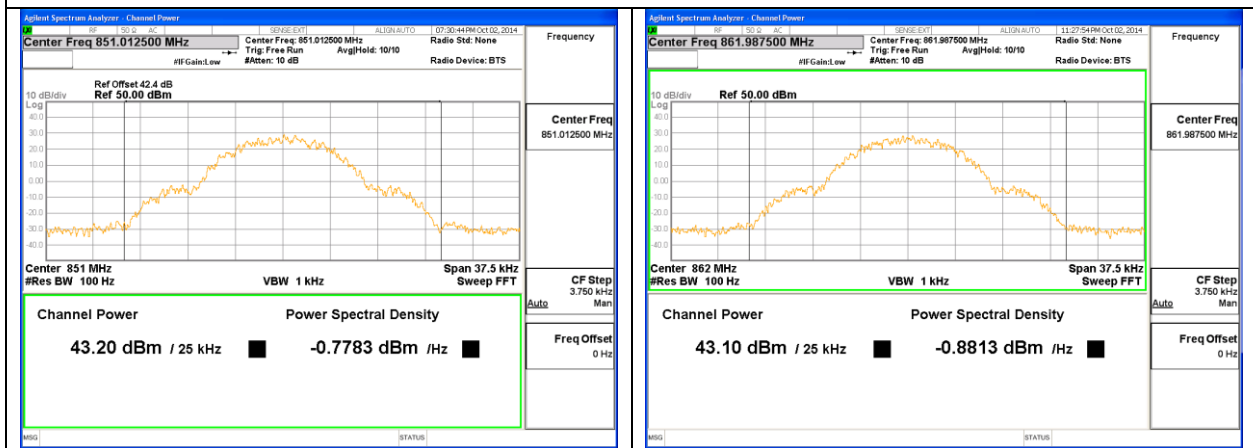
P25 I-P



P25 I-F

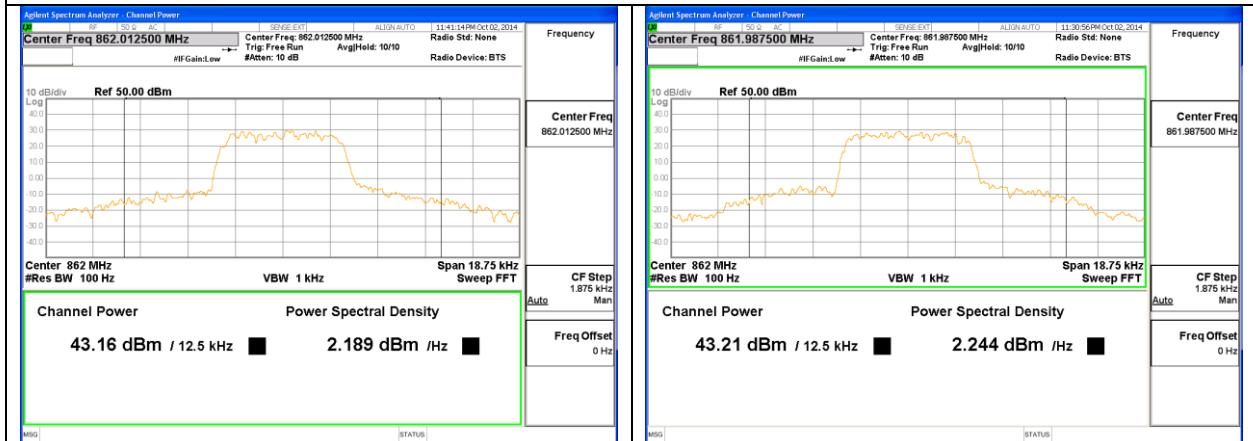


P25 II

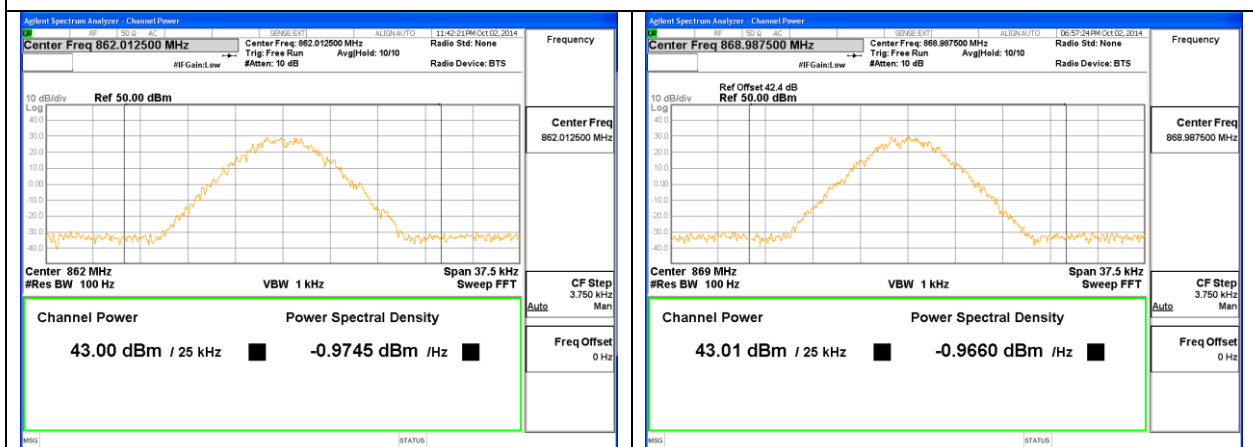


862 – 869 MHz

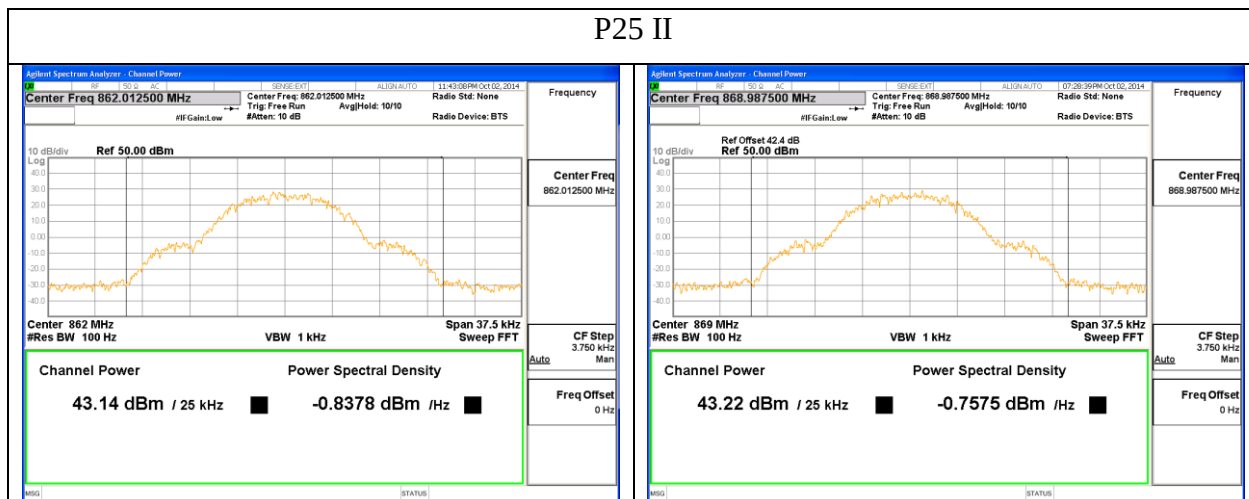
P25 I-P



P25 I-F



P25 II



3.0 Occupied Bandwidth Pursuant 47 CFR Part 2 and Part 90I

3.1 Methodology

Measurements were performed at

LTE5M within the 700 D block (758 MHz – 763 MHz),
 LTE5M and P25 I-P within the Band14 PSBB band (763MHz – 768 MHz),
 P25 I-P, P25 I-F and P25 II within the PS NB (769 MHz – 775 MHz)

P25 I-P, I-F and P25 II within the 800 band (851 MHz – 869 MHz).

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

700 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
LTE5M 5MHz	4,482.2 / 4,481.1	4,482.4 / 4, 480.7	-	0.04 %
P25 I-P 6.25kHz (763 – 768 MHz)	4.836 / 4.834	4.843 / 4.87	4.885 / 4.794	1.90 %
P25 I-P 6.25kHz (769 – 775 MHz)	4. 833 / 4.868	4.884 / 4.888	4.878 / 4.860	0.72 %
P25 I-F 6.25kHz (769 – 775 MHz)	8.086 / 8.119	8.147 / 8.229	8.069 / 8.178	1.33 %
P25 II 6.25kHz (769 – 775 MHz)	9.938 / 9.857	9.978 / 9.849	9.922 / 9.849	1.31 %

800 MHz band

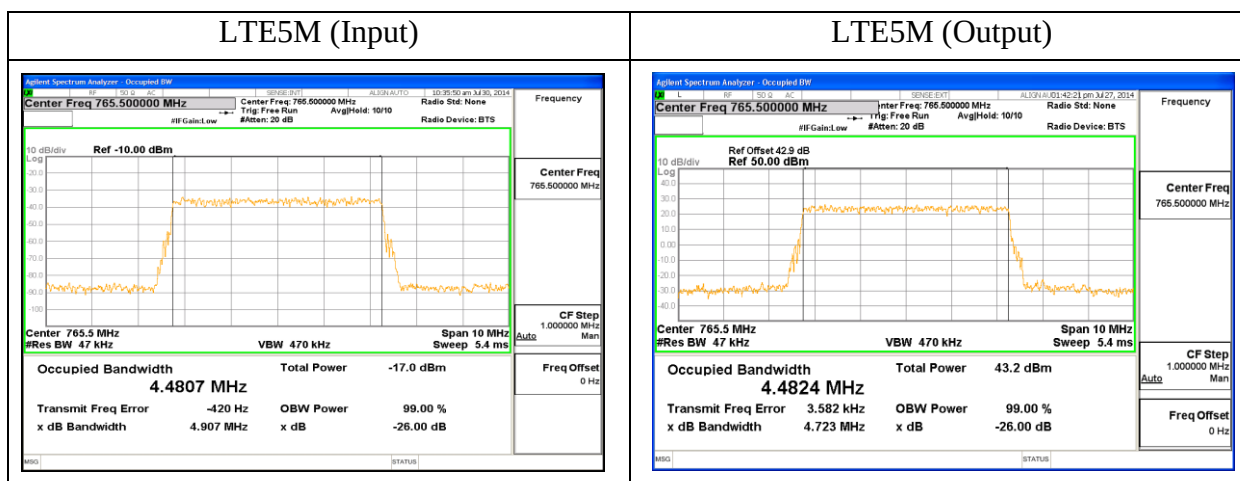
Authorized BW	OBW (kHz) @ low frequency Out / In	OBW (kHz) @ high frequency Out / In	Max. In and Out difference
P25 I-P 6.25kHz (851 – 862 MHz)	4.858 / 4.799	4.911 / 4.86	1.23 %
P25 I-F 6.25kHz (851 – 862 MHz)	8.158 / 8.062	8.004 / 7.917	1.19 %
P25 II 12.5kHz (851 – 862 MHz)	10.014 / 9.813	10.126 / 9.769	3.65 %
P25 I-P 6.25kHz (862 – 869 MHz)	4.831 / 4.813	4.907 / 4.841	1.36 %
P25 I-F 12.5kHz (862 – 869 MHz)	7.955 / 8.331	8.132 / 8.032	4.72 %
P25 II 12.5kHz (862 – 869 MHz)	10.077 / 9.754	10.126 / 9.731	4.06 %

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

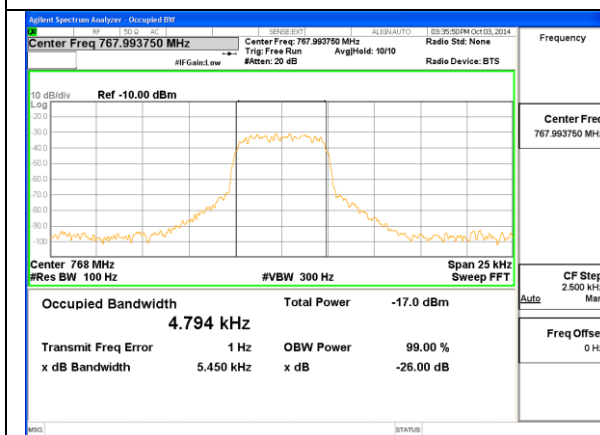
Note:

- The difference of the output signal and input signal bandwidth is less than 5%.
The spectrum shapes of output are similar to the input.
- The measured bandwidth is less than the authorized bandwidth.

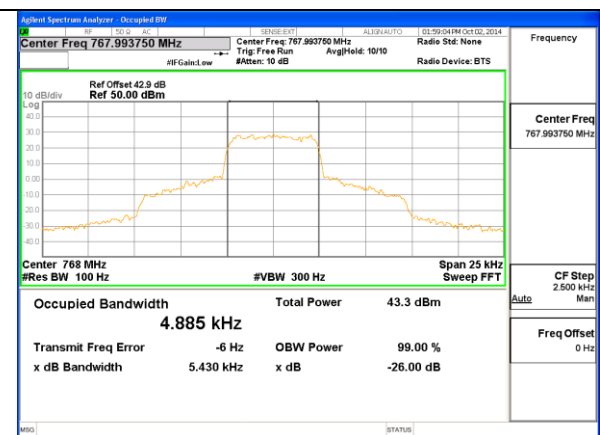
700 MHz Band



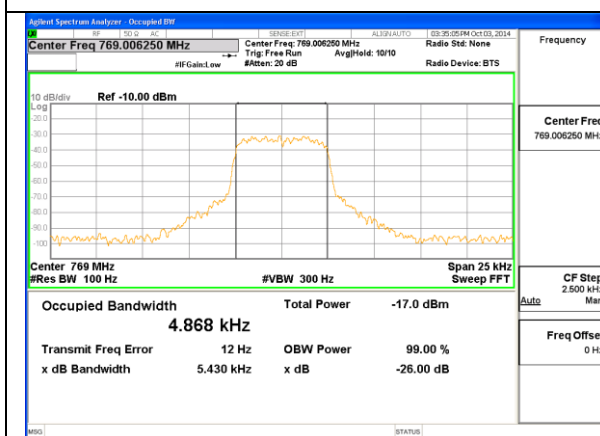
P25 I-P (Input)



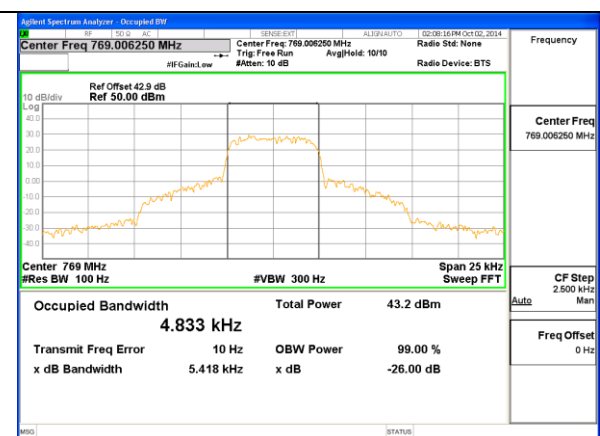
P25 I-P (Output)



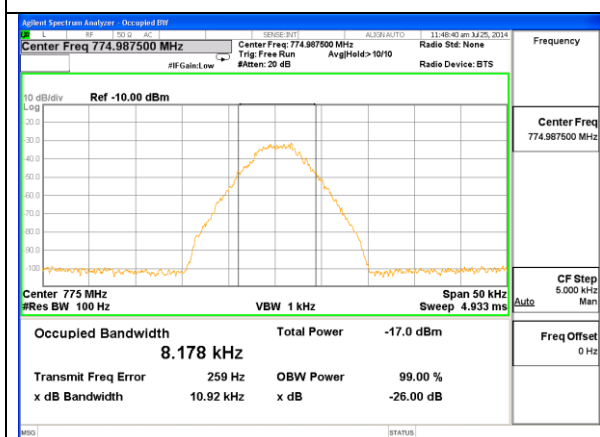
P25 I-P (Input)



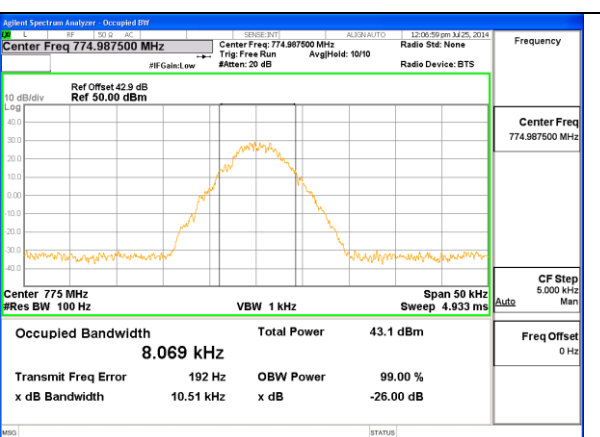
P25 I-P (Output)



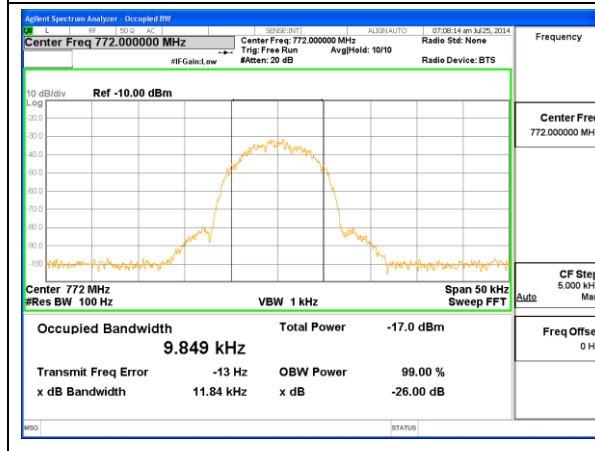
P25 I-F (Input)



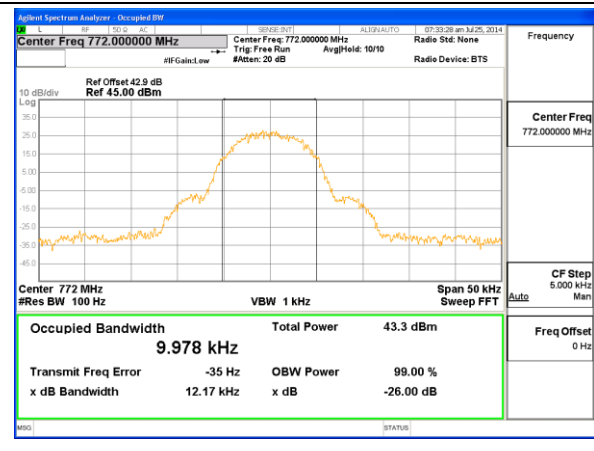
P25 I-F (Output)



P25 II (Input)



P25 II (Output)

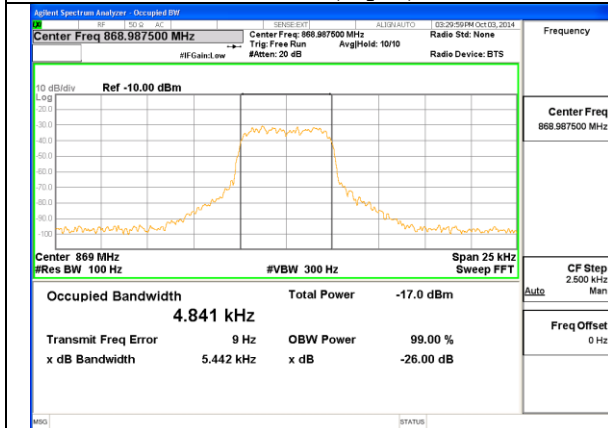


851 - 862 MHz Band

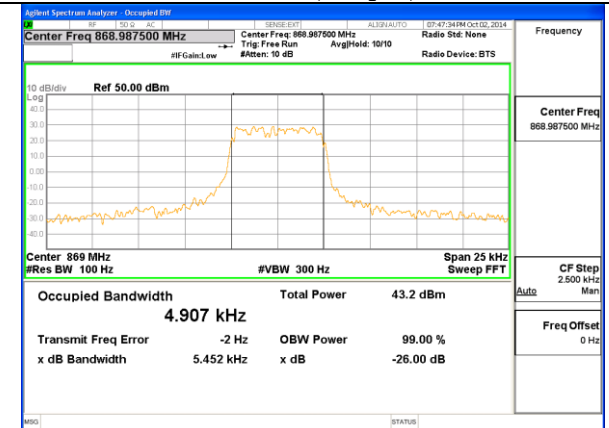


862 - 869 MHz Band

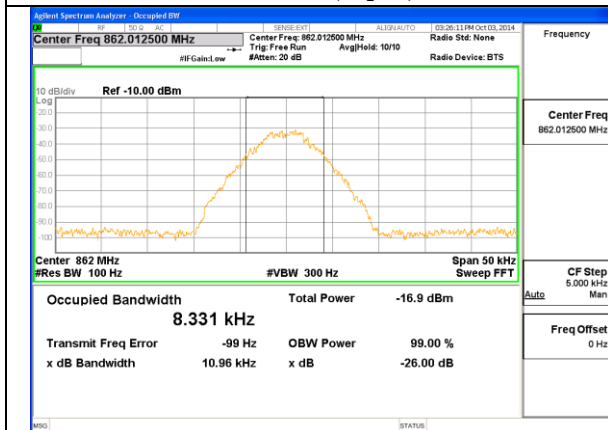
P25 I-P (Input)



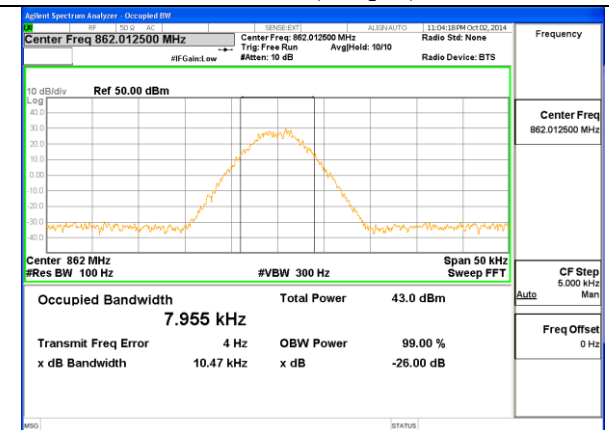
P25 I-P (Output)



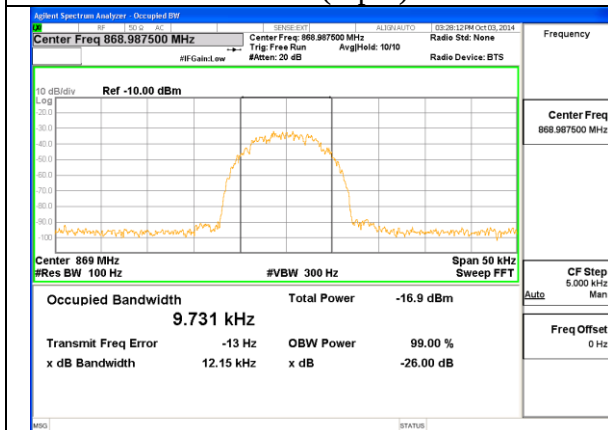
P25 I-F (Input)



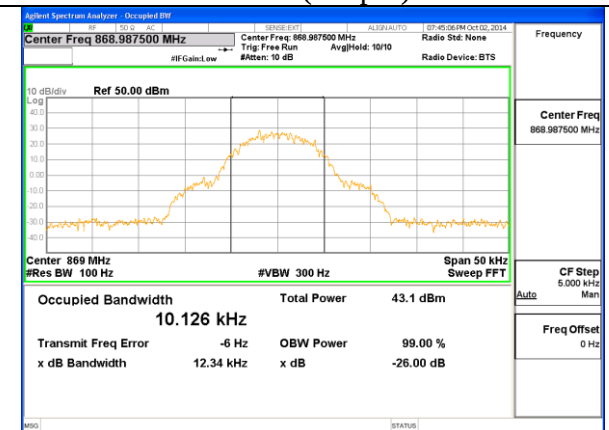
P25 I-F (Output)



P25 II (Input)



P25 II (Output)



4.0 Unwanted Emissions - Conducted Spurious Pursuant 47 CFR 90.543 (c), 90.543 (e)(3), 90210 (g)(2) and 90.210 (h)(5)

4.1 Methodology

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

Measurements were performed at

- LTE5M within the 700 D block (758 MHz – 763 MHz),
- LTE5M and P25 I-P within the Band14 PSBB band (763MHz – 768 MHz),
- P25 I-P, P25 I-F and P25 II within the PS NB (769 MHz – 775 MHz)

P25 I-P, I-F and P25 II within the 800 band (851 MHz – 869 MHz).

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. 90.543 (c) Out-of-band emission limit. For transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands, on any frequency outside of the frequency ranges covered by the ACP tables in this section (>12 MHz), the power of any emission must be reduced below the mean output power (P) by at least $43 + 10 \log_{10}(P)$ dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz. 90.543 (e) For operations in the 758 – 768 MHz, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following: (3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least $43 + 10 \log(P)$ dB 90.210(g) (2) For 854MHz – 869 MHz operation band, on any frequency offset from the carrier by more than $2.5 \times$ authorized bandwidth: at least $43 + 10 \log(P)$ dB 90.210(h) (5) For 851MHz – 854 MHz operation band, on any frequency offset from the carrier by more than 25kHz: at least $43 + 10 \log(P)$ dB
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The out-of-band emission limit is

- -13 dBm for 700 MHz band and 800 MHz

4.2 Test Results

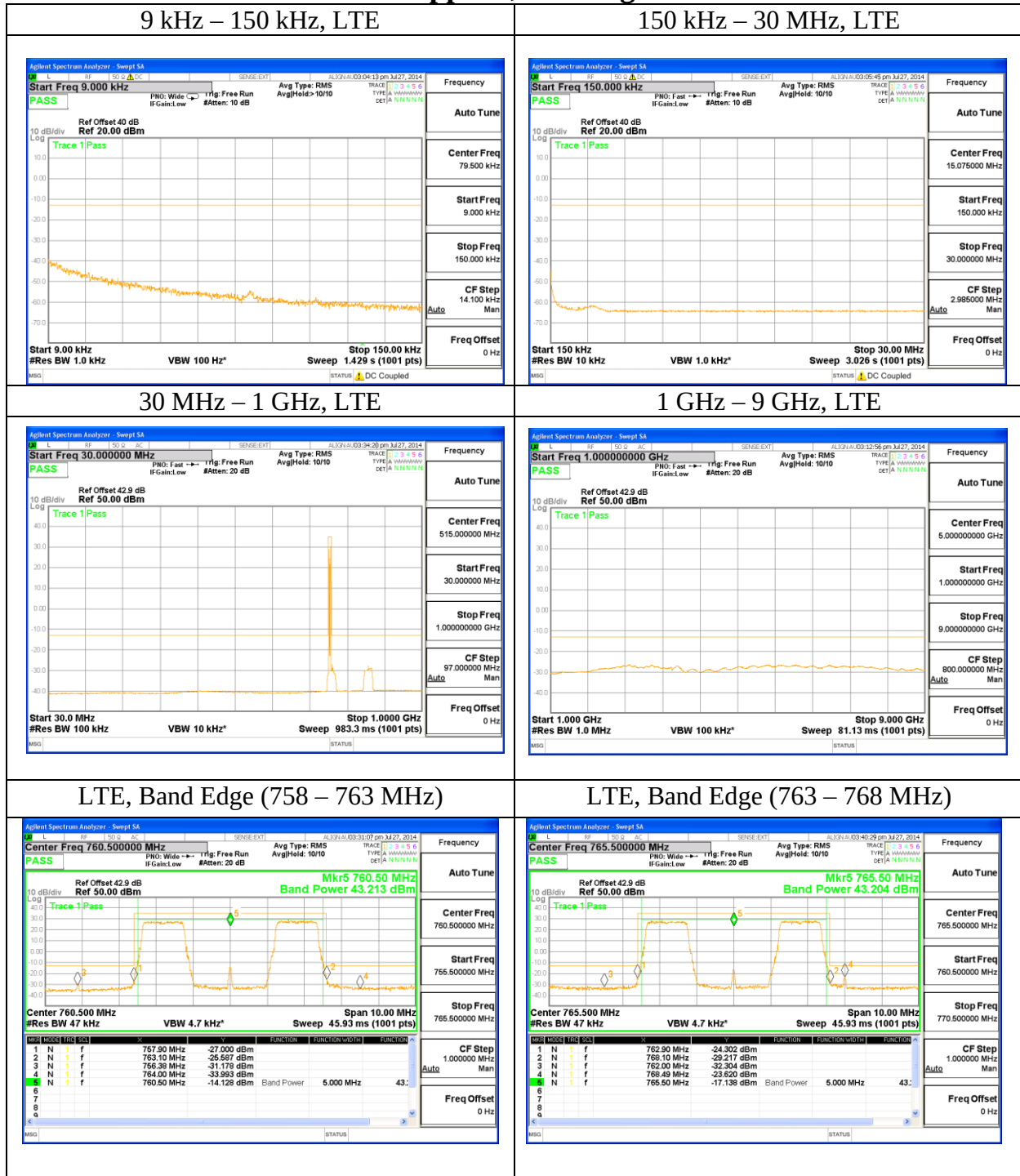
On the plots below shown the worst case when the carrier was set to the band edge with different modulations.

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.

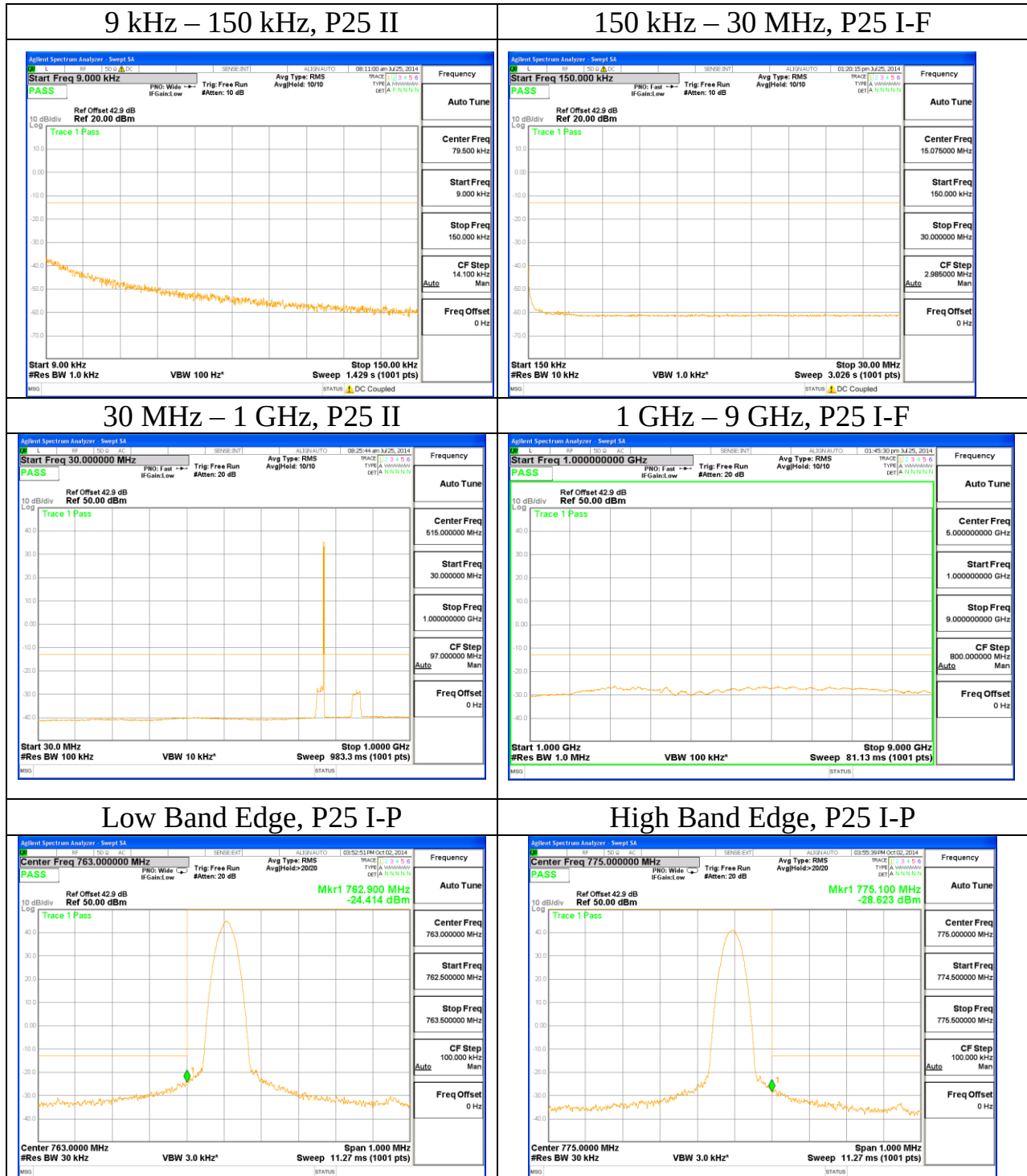
The emission level is below the limit. Hence the conducted emission is compliant with the FCC standard.

758 MHz – 768 MHz Part 90R Applied, LTE Signal Used

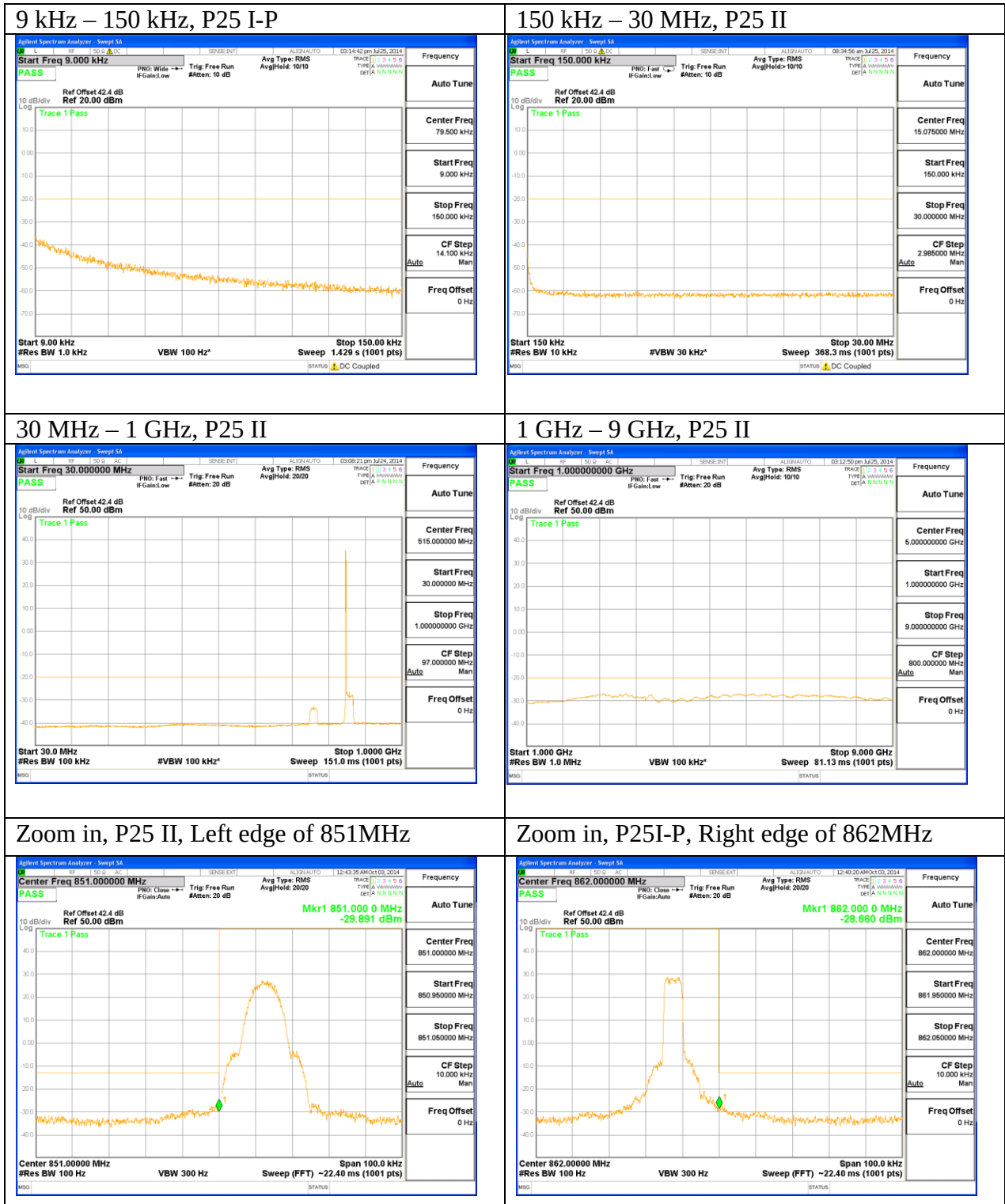


763 MHz – 775 MHz Band

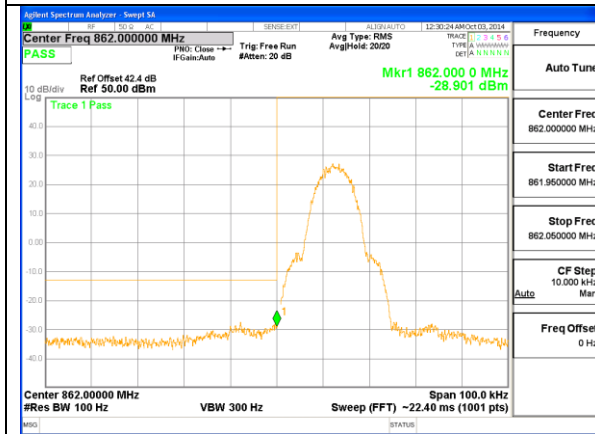
Part 90R Applied, P25 Phase I and P25 Phase II Signal Used



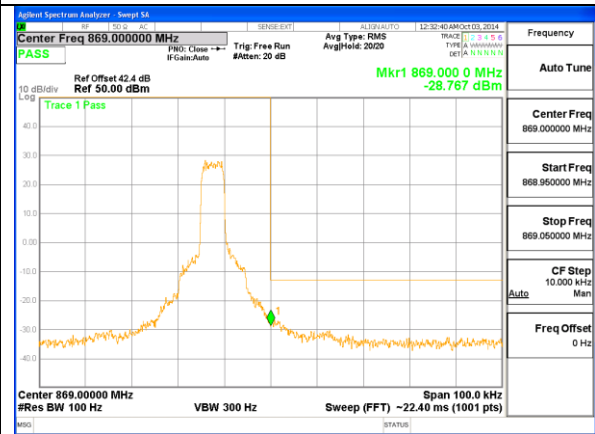
851 MHz – 869 MHz Part 90S Applied, P25 Signal Used



Zoom in, P25 II, Left edge of 862MHz



Zoom in, P25 I-P, Right edge of 869MHz



5.0 Spectrum Emission Mask Pursuant 47 CFR Part 90.210

5.1 Methodology

Measurements were performed at

LTE5M within the 700 D block (758 MHz – 763 MHz),
 LTE5M and P25 I-P within the Band14 PSBB band (763MHz – 768 MHz),
 P25 I-P, P25 I-F and P25 II within the PS NB (769 MHz – 775 MHz)

P25 I-P, I-F and P25 II within the 800 band (851 MHz – 869 MHz).

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

90.210 Emission Masks (h) 851MHz – 854 MHz operation band falls into the emission mask (h) (1) $f_d \leq 4$ kHz: 0 (2) $4 \text{ kHz} \leq f_d \leq 8.5$ kHz: at least $107 \log(f_d/4)$ dB (3) $8.55 \text{ kHz} \leq f_d \leq 15$ kHz: at least $40.5 \log(f_d/1.16)$ dB (4) $15 \text{ kHz} \leq f_d \leq 25$ kHz: at least $116 \log(f_d/6.1)$ dB (5) $f_d \geq 25$ kHz: at least $43 + 10 \log(P)$ dB (g) 854 MHz – 869 MHz Emission Mask G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows: (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth: At least $116 \log(f_d/6.1)$ dB, or $50 + 10 \log(P)$ dB, or 70 dB, whichever is the lesser attenuation; (2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log(P)$ dB. 90.210 SEM for all other bands (c) Emission Mask C. 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: (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz, but not more than 10 kHz: At least $83 \log(f_d/5)$ dB; (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least $29 \log(f_d/11)$ dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log(P)$ dB. 3GPP 36.143 Table 9.1.5.1-2: General operating band unwanted emission limits for repeater pass bandwidth 5 MHz and above (E-UTRA bands < 1 GHz) for Category A: (1) $0 \text{ MHz} \leq f_d \leq 5 \text{ MHz}$: $-5.5 \text{ dBm} - 7/5(f_d/\text{MHz} - 0.05)$ dB with RBW 100 kHz (2) $5 \text{ MHz} \leq f_d \leq 10 \text{ MHz}$: -12.5 dBm with RBW 100kHz (3) $f_d \geq 10 \text{ MHz}$: -13 dBm with RBW 100 kHz
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90.210 (h) is more stringent than 90.210 (g).

90.210 (h) was used for P25 emission mask of 800 MHz band.

Dual-carrier TM1.1 LTE signal was used for LTE emission mask test. The combined bandwidth of the two carriers was 5 MHz.

The RBW was set to 100Hz for P25 SEM measurement as the general technical standard in Part 90.210 and 100 kHz for LTE SEM measurement.

5.2 Test Results

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

Within 758 - 768 MHz band:

The emission level of LTE signal is below the limit by more than 3.5 dB.

Within 763 – 775 MHz band:

The emission level of LTE signal is below the limit by more than 3.5 dB.

The emission level of P25 signal is below the limit by more than 11.8 dB.

Within 851 – 862 MHz band:

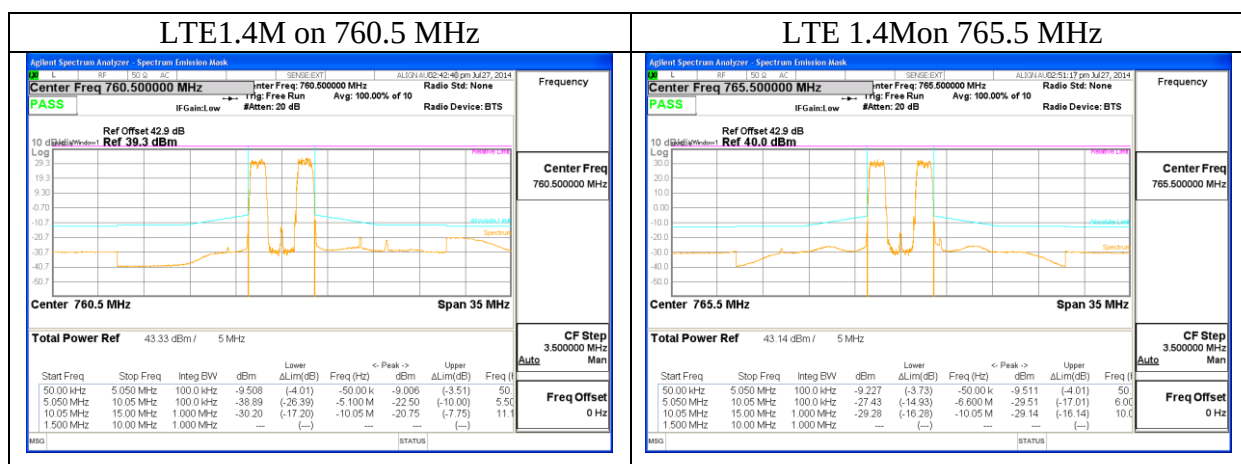
The emission level of P25 signal is below the limit by more than 4 dB.

Within 862 – 869 MHz band:

The emission level of P25 signal is below the limit by more than 6 dB.

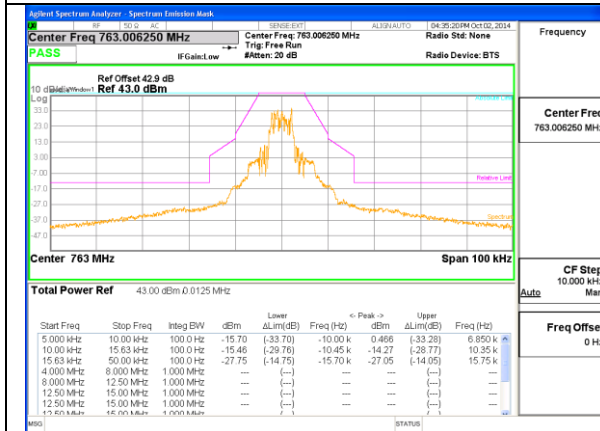
So the emission immediately adjacent to the signal channel is compliant with the FCC standard.

758 MHz – 768 MHz: 3GPP 36.143 Applied

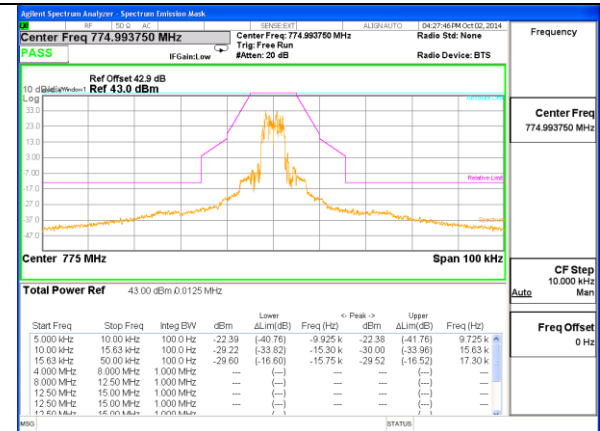


763 MHz – 775 MHz: 90.210(c) Applied

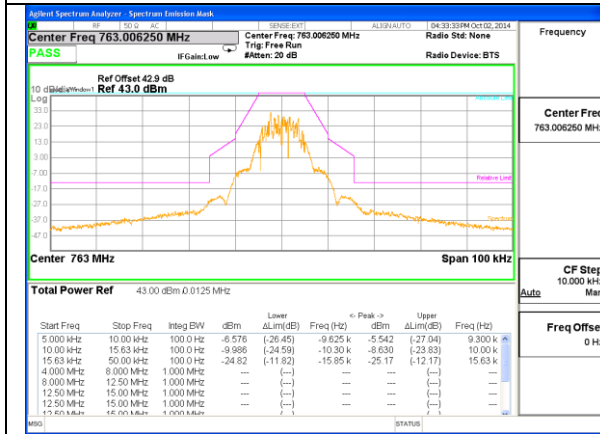
P25 I-P on 763.00625 MHz



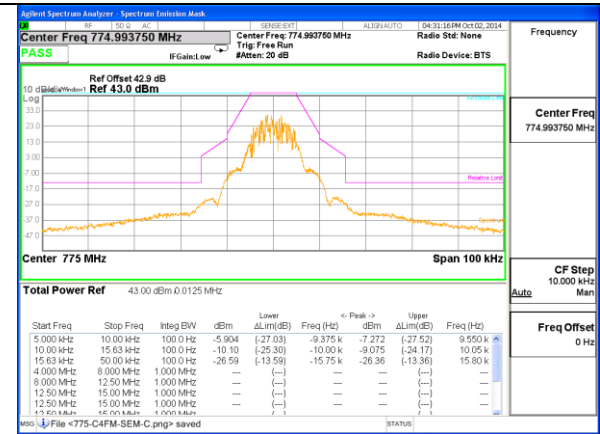
P25 I-P on 774.99375 MHz



P25 II on 763.00625 MHz

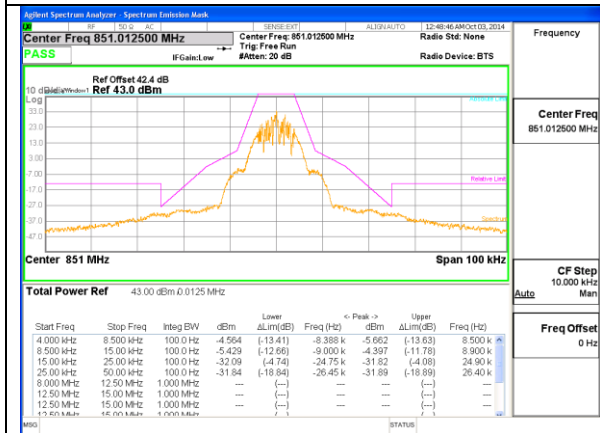


P25 II on 774.99375 MHz

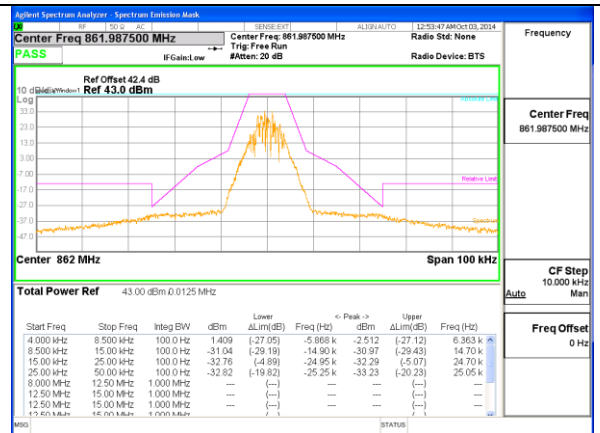


851 – 862 MHz band 90.210(h) Applied

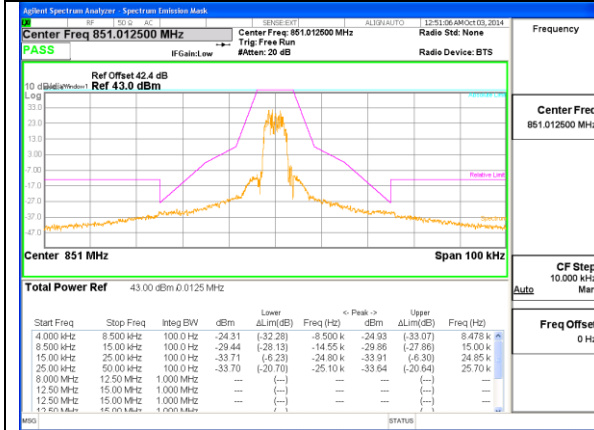
P25 II on 851.0125 MHz



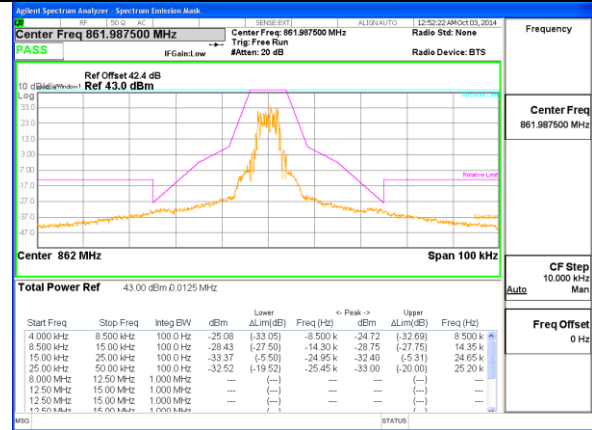
P25 I-F on 861.9875 MHz



P25 I-P on 851.0125 MHz

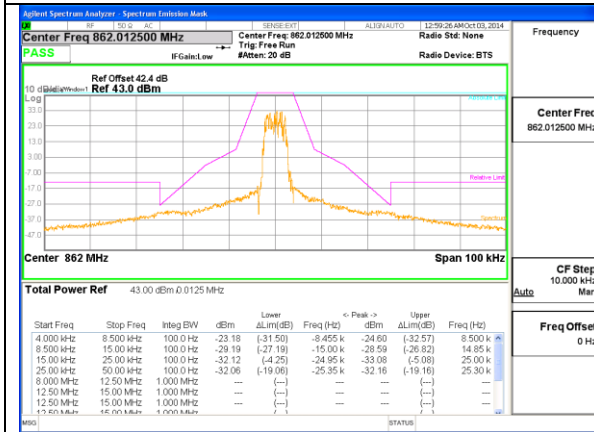


P25 I-P on 861.9875 MHz

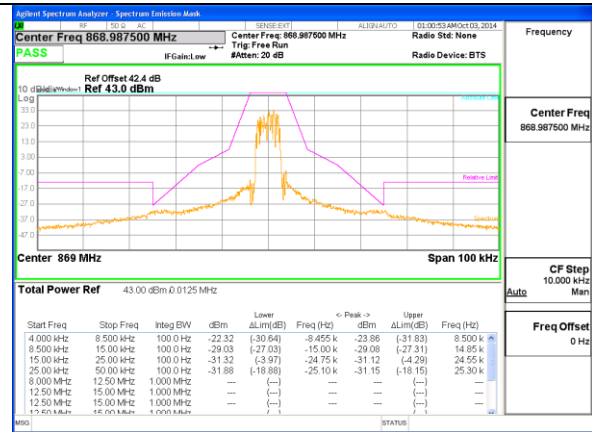


862 - 869 MHz band 90.210(h) Applied

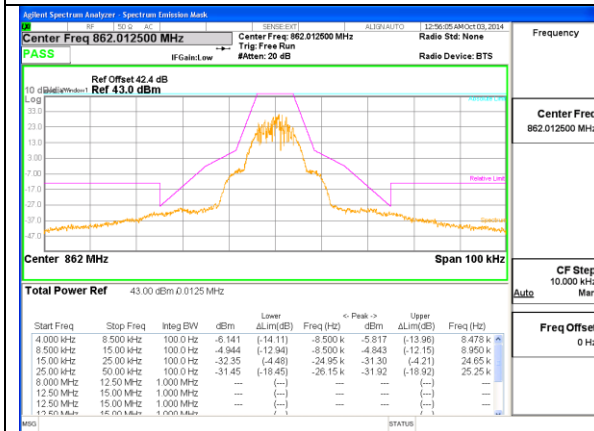
P25 I-P on 862.0125 MHz



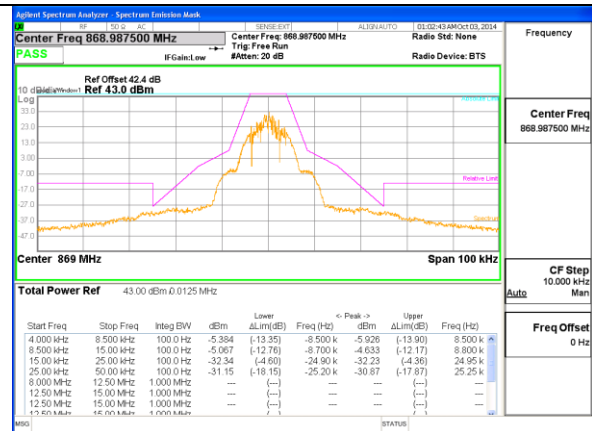
P25 I-P on 868.9875 MHz



P25 II on 862.0125 MHz



P25 II on 868.9875 MHz



6.0 Frequency Stability Pursuant 47 CFR Part 27C and Part 90I

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... Vary primary supply voltage from 85 to 115 percent of the nominal value 90.213 Minimum Frequency Stability For Fixed and base stations: Frequency range in 851 – 854 MHz: 1 ppm Frequency range in 854 – 869 MHz: 1.5 ppm

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

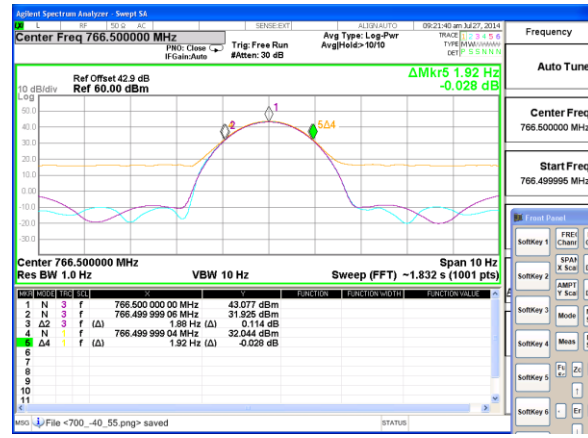
- Temperature Variation: Data was collected continuously over temperature range of -40C to 55C using a max hold function.
- Voltage Variation: Data was collected while varying the power supply voltage to the EUT from 85% to 115% of the nominal value (29V) measured at the input of the EUT.

6.2 Test Results

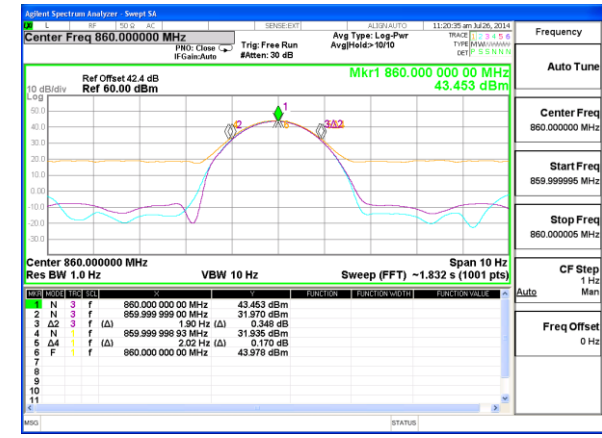
Frequency	Change in Hz – Temperature Variation	Change in ppm	Change in Hz – Voltage Variation	Change in ppm	Compliant
766.5 MHz	0.04	0.0	0.05	0.0	Yes
860 MHz	0.13	0.0	0.06	0.0	Yes

Table 6-1. Frequency error in ppm

Frequency Stability vs Temperature Variation - 700 MHz band



Frequency Stability vs Temperature Variation - 800 MHz band



Frequency Stability vs Voltage Variation - 700 MHz band



Frequency Stability vs Voltage Variation - 800 MHz band

