

Updated Submittal: November 26, 2014
Original Submittal: September 5, 2014

To: Elite Electronic Engineering
Re: Class II Permissive Change for ABZ89FC5810B, 800 MHz GTR8000 Base Radio Transmitter
Added Emission Designator for APCO 25 Dual Carrier Applications

This memo is in regards to a Motorola Solutions type approved transmitter, equipment type ABZ89FC5810B. ABZ89FC5810B was originally granted FCC type approval on May 22, 2013. It was most recently updated on October 30, 2013 to include additional digital emission designators.

A copy of the current grant is included on the following page.

Per this action, the change requested herein adds an additional emission designator that encompasses additional channel use-cases now allowed under 47CFR90.221. Specifically, up to 22 kHz may now be utilized; the appropriate mask for compliance purposes is the "ACP" mask explicitly referenced to and described in 47CFR90.221.

The FCC OET has been consulted about this change and has ruled that this change is to be filed as a Permit but Ask (PBA) and a Class II permissive change to the original grant. That correspondence is included in a pre-TCB KDB inquiry submitted in conjunction with this request.

Occupied bandwidth and adjacent channel power data is included in this package to illustrate and show 90.221 "ACP mask" compliance for dual carrier emission designators, as follows:

21K7D7E, 21K7D7D, 21K7D7W: Dual carrier, P25 2-Slot TDMA Digital Modulation (H-DQPSK)

This dual 2-slot TDMA digital modulation represents the largest bandwidth (e.g. 'worst case') of the various combinations of two carrier signals. This single emission designator is being requested in order to simplify the request rather than having a unique emission designator for each combination of possible modulation types.

Applicable compliance data for dual carrier emissions of the five other possible modulation combinations are listed as follows:

- Dual carrier, Dual P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)
- Dual carrier, Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)
- Dual carrier, Mixed P25 FDMA Linear Simulcast Modulation (LSM) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)
- Dual carrier, Dual P25 FDMA Linear Simulcast Modulation (LSM)
- Dual carrier, Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Linear Simulcast Modulation (LSM)

No schematics or photos are included in this package. This proposed change maintains the existing specifications of the equipment. Both of the base radio transmitters are completely compatible and interchangeable with the existing equipment currently shipped under equipment type ABZ89F5810B.

For the filing package currently on record with the FCC, all exhibits are considered current and valid. The exhibits shown in the "List of Exhibits" herein are supplemental to the information currently on record.

Please feel free to contact me if you need further information or have any questions and / or issues.

Regards,



Ken Weiss
Motorola Solutions, Inc.

TCB

GRANT OF EQUIPMENT
AUTHORIZATION
Certification
Issued Under the Authority of the
Federal Communications Commission
By:

TCB

Elite Electronic Engineering, Inc.
1516 Centre Circle
Downers Grove, IL 60515

Date of Grant: 10/30/2013

Application Dated: 10/30/2013

Motorola Solutions, Inc.
1301 East Algonquin Road
Schaumburg, IL 60196

Attention: Ken Weiss, Senior Staff Engineer

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: ABZ89FC5810B
Name of Grantee: Motorola Solutions, Inc.
Equipment Class: Licensed Non-Broadcast Station Transmitter
Notes: Non-Broadcast Transmitter

<u>Grant Notes</u>	<u>FCC Rule Parts</u>	<u>Frequency Range (MHz)</u>	<u>Output Watts</u>	<u>Frequency Tolerance</u>	<u>Emission Designator</u>
BC EF	90	851.0 - 870.0	100.0	1.0 PM	8K70D1E
BC EF	90	851.0 - 870.0	100.0	1.0 PM	8K70D1D
BC EF	90	851.0 - 870.0	100.0	1.0 PM	8K70D1W
BC EF	90	851.0 - 870.0	100.0	1.0 PM	8K10F1E
BC EF	90	851.0 - 870.0	100.0	1.0 PM	8K10F1D
BC EF	90	851.0 - 870.0	100.0	1.0 PM	8K10F1W
BC EF	90	851.0 - 870.0	100.0	1.0 PM	10K0F1E
BC EF	90	851.0 - 870.0	100.0	1.0 PM	10K0F1D
BC EF	90	851.0 - 870.0	100.0	1.0 PM	10K0F1W
BC EF	90	851.0 - 870.0	100.0	1.0 PM	9K80D7E
BC EF	90	851.0 - 870.0	100.0	1.0 PM	9K80D7D
BC EF	90	851.0 - 870.0	100.0	1.0 PM	9K80D7W
BC EF	90	854.0 - 870.0	50.0	1.0 PM	17K7D7D
BC EF	90	854.0 - 870.0	100.0	1.0 PM	16K0F1D
BC EF	90	854.0 - 870.0	100.0	1.0 PM	16K0F3E
BC EF	90	851.0 - 870.0	100.0	1.0 PM	11K0F3E
BC	90	851.0 - 854.0	100.0	1.0 PM	14K0F1D
BC	90	851.0 - 854.0	100.0	1.0 PM	14K0F3E
BC	90.210	851.0 - 854.0	100.0	1.0 PM	8K70D1E
BC	90.210	851.0 - 854.0	100.0	1.0 PM	8K70D1D
BC	90.210	851.0 - 854.0	100.0	1.0 PM	8K70D1W
BC	90.210	851.0 - 854.0	100.0	1.0 PM	8K10F1E
BC	90.210	851.0 - 854.0	100.0	1.0 PM	8K10F1D
BC	90.210	851.0 - 854.0	100.0	1.0 PM	8K10F1W
BC	90.210	851.0 - 854.0	100.0	1.0 PM	9K80D7E
BC	90.210	851.0 - 854.0	100.0	1.0 PM	9K80D7D
BC	90.210	851.0 - 854.0	100.0	1.0 PM	9K80D7W

Output power is conducted. The antenna(s) used for this transmitter must be fixed-mounted on outdoor permanent structures. RF exposure compliance is addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of 1.1307(b)(3). Permissive Change to add "H-Mask" for NPSAC applications.

BC: The output power is continuously variable from the value listed in this entry to 5%-10% of the value listed.

EF: This device may contain functions that are not operational in U.S Territories except as noted in the filing. This grant has extended frequencies as noted in the filing and Section 2.927(b) applies to this authorization.

LIST OF EXHIBITS (added as supplemental to the information currently on record)

EXHIBIT	DESCRIPTION	REFERENCE
E	Report on Test Measurements	2.1033-(c)(14)
E1-25	Adjacent Channel Power (ACP) measurements and recordings, dual carrier combinations: C4FM/C4FM, H-DQPSK/H-DQPSK, H-DQPSK/C4FM, LSM/C4FM, LSM/LSM, H-DQPSK/LSM	
E1-2.25a	Occupied Bandwidth Plot – Dual carrier Dual P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)	90.221 ACP Mask
E1-2.25b	Adjacent Channel Power Plot – Dual carrier Dual P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)	90.221 ACP Mask
E1-2.25c	Occupied Bandwidth Plot – Dual carrier Dual P25 2-Slot TDMA Digital Modulation (H-DQPSK)	90.221 ACP Mask
E1-2.25d	Adjacent Channel Power Plot – Dual carrier Dual P25 2-Slot TDMA Digital Modulation (H-DQPSK)	90.221 ACP Mask
E1-2.25e	Occupied Bandwidth Plot – Dual carrier Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)	90.221 ACP Mask
E1-2.25f	Adjacent Channel Power Plot – Dual carrier Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)	90.221 ACP Mask
E1-2.25g	Occupied Bandwidth Plot – Dual carrier Mixed P25 FDMA Linear Simulcast Modulation (LSM) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)	90.221 ACP Mask
E1-2.25h	Adjacent Channel Power Plot – Dual carrier Mixed P25 FDMA Linear Simulcast Modulation (LSM) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)	90.221 ACP Mask
E1-2.25i	Occupied Bandwidth Plot – Dual carrier Dual P25 FDMA Linear Simulcast Modulation (LSM)	90.221 ACP Mask
E1-2.25j	Adjacent Channel Power Plot – Dual carrier Dual P25 FDMA Linear Simulcast Modulation (LSM)	90.221 ACP Mask
E1-2.25k	Occupied Bandwidth Plot – Dual carrier Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Linear Simulcast Modulation (LSM)	90.221 ACP Mask
E1-2.25l	Adjacent Channel Power Plot – Dual carrier Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Linear Simulcast Modulation (LSM)	90.221 ACP Mask

Report on Test Measurements

Occupied Bandwidth – P25 Digital Modulations, 25 kHz Channel Spacing – 90.221 ACP-Mask Compliance

Three digital modulations, in 6 combinations, are shown. They can be used in a system configuration based upon channel usage as described in Exhibit B. The occupied bandwidth charts reference the following setup and specification requirements.

(Worst Case)

Modulation Types: H-DQPSK / H-DQPSK, Dual Carrier P25 Two Slot TDMA Digital Modulation
 Emission Designator: 21K7D7E, 21K7D7D, 21K7D7W

Channelization: 25 kHz (22 kHz max authorized bandwidth)

Power Setting: 100 Watts, Average

(Other Cases Covered)

Modulation Types:	C4FM / C4FM	H-DQPSK / C4FM
LSM / C4FM		LSM / LSM
H-DQPSK / LSM		

Specification Requirement § 90.221(d) Emission Limits – “ACP-Mask”:

§90.221 Adjacent Channel Power Limits.

(a) For the frequency bands indicated below, operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth (emphasis added) if the equipment meets the adjacent channel power (ACP) limits below. The table specifies a value for the ACP as a function of the displacement from the channel center frequency and a measurement bandwidth of 18 kHz.

(b)(1) Maximum adjacent power levels for frequencies in the 450-470 MHz band:

Frequency offset	Maximum ACP (dBc) for devices 1 Watt and less	Maximum ACP (dBc) for devices above 1 Watt
25 kHz	-55 dBc	-60 dBc
50 kHz	-70 dBc	-70 dBc
75 kHz	-70 dBc	-70 dBc

(2) In any case, no requirement in excess of -36 dBm shall apply.

(c)(1) Maximum adjacent power levels for frequencies in the 809-824 / 854-869 MHz band:

Frequency offset	Maximum ACP (dBc) for devices 15 Watts	Maximum ACP (dBc) for devices 15 Watts and above
25 kHz	-55 dBc	-55 dBc
50 kHz	-65 dBc	-65 dBc
75 kHz	-65 dBc	-70 dBc

(2) In any case, no requirement in excess of -36 dBm shall apply.

(d) On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least $43 + 10 \log (P_{\text{watts}})$ dB.

[77 FR 61538, Oct. 10, 2012]

Report on Test Measurements

Necessary Bandwidth Calculation: 47CFR90.221 sets forth an alternate method of establishing compliance with out of band emission (OOBE) limits. An Adjacent Channel Power mask and associated limits replace the standard OOBE mask sets. These are measured and recorded per 47CFR90.221. In addition, per-carrier emissions do not exceed previously stated and filed limitations currently authorized for use by equipment designated ABZ89F5810B. Refer to information provided in the associated full filing package or change packages for necessary bandwidth information for these modulations.

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings:

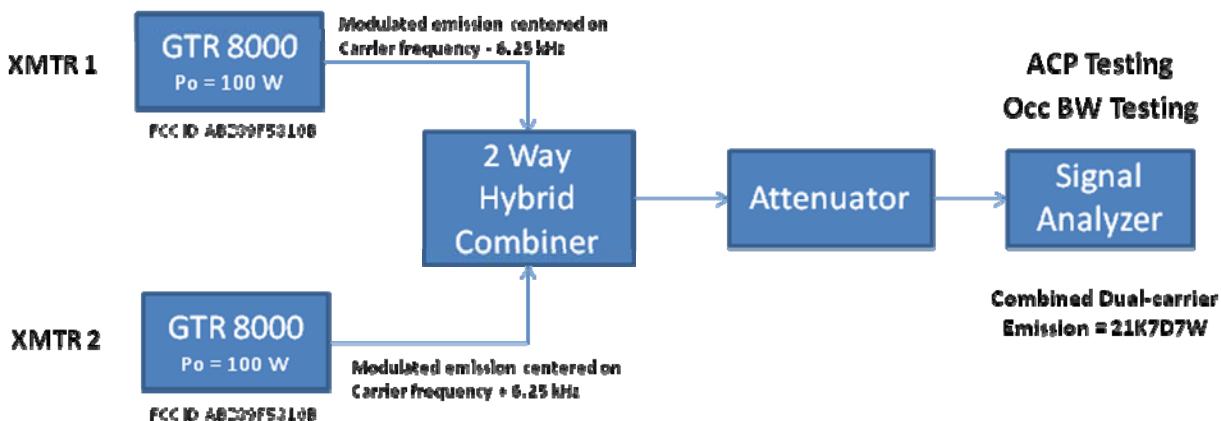
Horizontal:	20 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	10 kHz
Sweep Time:	140 Seconds (<2000 Hz / Second)	Span:	200 kHz
Detector Mode:	RMS Power, 99%		

Test Procedure:

- 1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings (Measure ACP).
- 2) Modulate transmitter 1 (XMTR 1) with the appropriate signaling pattern, (pseudorandom data) and key transmitter 1 at the full power rating on offset Channel A (center frequency minus 6.25 kHz). Modulate transmitter 2 (XMTR 2) with the appropriate signaling pattern, (pseudorandom data) and key transmitter 2 at the full power rating on offset Channel B (center frequency plus 6.25 kHz). Use the analyzer controls to set this signal to maximize dynamic range of the instrument and include noise floor into the plotted data. In this case, 31.8 dB of external attenuation (excluding the hybrid combiner loss of 3.4 dB) was utilized ahead of the spectrum analyzer. This was added into the measurements as an offset entered into the spectrum analyzer measurement criteria. The spectrum analyzer then automatically presents the corrected (actual) power level and the corrected limit lines as appropriate. Next, allow the analyzer to sweep fully and store the sweep; allow the analyzer to calculate channel power and mask ACP values.
- 3) Sweep the composite carrier and utilize the band power marker function of the spectrum analyzer to measure the power of the carrier pair in a 22 kHz bandwidth utilizing an 18 kHz filter criteria for ACP as stated in 90.221. Also, specify mask limits per 90.221 for stepped ACP limitations.
- 4) Use the composite carrier power value from the previous step to generate the ACP reference.
- 5) Plot the resulting analyzer trace and the emission mask limit; add text and labeling as appropriate.
- 6) Use the spectrum analyzer controls to measure 99% power occupied bandwidth. Plot the resulting analyzer trace; add text and labeling as appropriate.

Test Setup:

The combiner used for these measurements was a Sinclair TC-4112, with nominal loss of 3.4 dB per path. The basic test setup to measure the Adjacent Channel Power and the Occupied Bandwidth is shown below.



Report on Test Measurements

Test Results Summary:

The occupied bandwidth and adjacent channel power test results for the various modulation combinations are summarized below:

XMTR 1 Mod	XMTR 2 Mod	Occupied Bandwidth (kHz)	(Spec -55 dBc) ACP @ -25 kHz (dBc)	(Spec -65 dBc) ACP @ -50 kHz (dBc)	(Spec -70 dBc) ACP @ -75 kHz (dBc)	(Spec -55 dBc) ACP @ +25 kHz (dBc)	(Spec -65 dBc) ACP @ +50 kHz (dBc)	(Spec -70 dBc) ACP @ +75 kHz (dBc)
C4FM	C4FM	19.537	-66.967	-81.494	-82.562	-65.856	-80.968	-81.673
H-DQPSK	H-DQPSK	21.483	-67.788	-81.209	-82.148	-66.845	-80.697	-81.307
H-DQPSK	C4FM	20.515	-65.843	-81.114	-82.280	-66.113	-80.573	-81.295
LSM	C4FM	19.968	-68.142	-81.427	-82.329	-68.238	-80.827	-81.554
LSM	LSM	20.565	-68.421	-81.057	-82.297	-67.072	-80.812	-81.810
H-DQPSK	LSM	20.947	-67.114	-81.083	-82.201	-66.139	-80.711	-81.502

EXHIBIT DESCRIPTION

E1-2.25a Occupied Bandwidth Plot – Dual carrier, Dual P25 FDMA Compatible 4-Level Frequency Modulation (C4FM), 90.221 ACP Mask

E1-2.25b Adjacent Channel Power Plot – Dual carrier, Dual P25 FDMA Compatible 4-Level Frequency Modulation (C4FM), 90.221 ACP Mask

E1-2.25c Occupied Bandwidth Plot – Dual carrier, Dual P25 2-Slot TDMA Digital Modulation (H-DQPSK), 90.221 ACP Mask

E1-2.25d Adjacent Channel Power Plot – Dual carrier, Dual P25 2-Slot TDMA Digital Modulation (H-DQPSK), 90.221 ACP Mask

E1-2.25e Occupied Bandwidth Plot – Dual carrier, Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM), 90.221 ACP Mask

E1-2.25f Adjacent Channel Power Plot – Dual carrier, Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM), 90.221 ACP Mask

E1-2.25g Occupied Bandwidth Plot – Dual carrier, P25 FDMA Linear Simulcast Modulation (LSM) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM), 90.221 ACP Mask

E1-2.25h Adjacent Channel Power Plot – Dual carrier, P25 FDMA Linear Simulcast Modulation (LSM) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM), 90.221 ACP Mask

E1-2.25i Occupied Bandwidth Plot – Dual carrier, Dual P25 FDMA Linear Simulcast Modulation (LSM), 90.221 ACP Mask

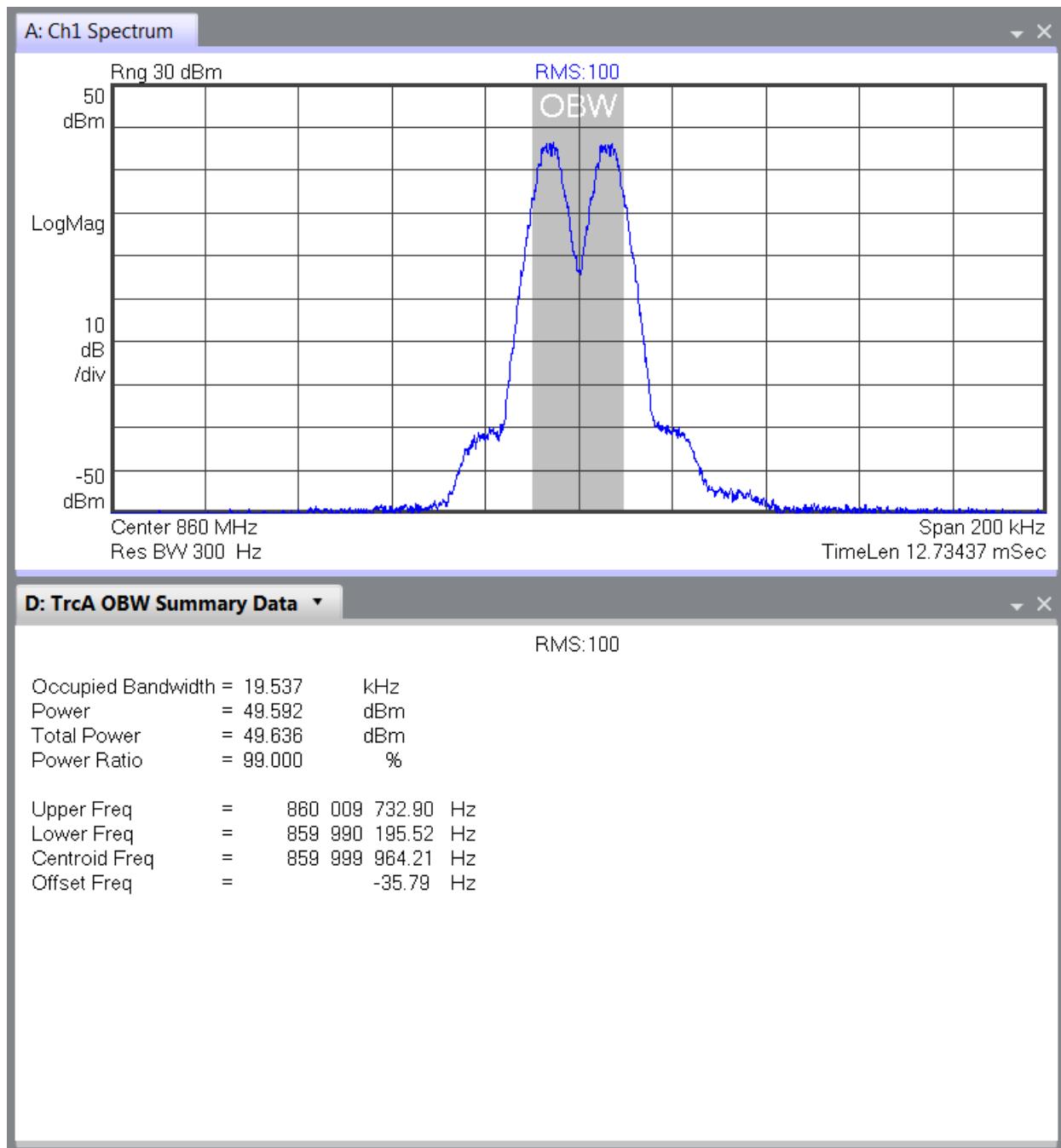
E1-2.25j Adjacent Channel Power Plot – Dual carrier, Dual P25 FDMA Linear Simulcast Modulation (LSM), 90.221 ACP Mask

E1-2.25k Occupied Bandwidth Plot – Dual carrier, Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Linear Simulcast Modulation (LSM), 90.221 ACP Mask

E1-2.25l Adjacent Channel Power Plot – Dual carrier, Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Linear Simulcast Modulation (LSM), 90.221 ACP Mask

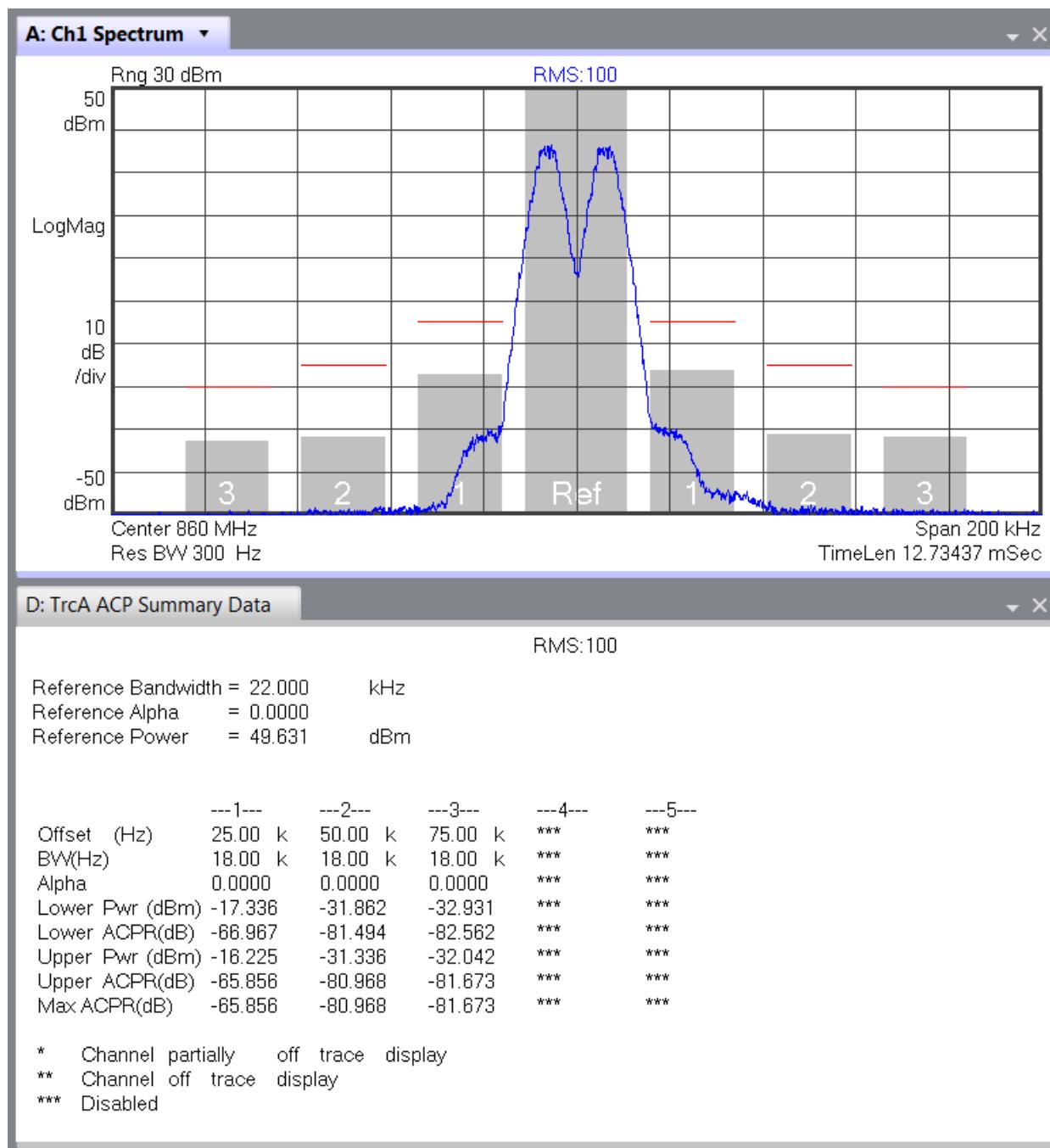
Report on Test Measurements

Occupied Bandwidth Plot – Dual carrier
Dual P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)
90.221 ACP Mask



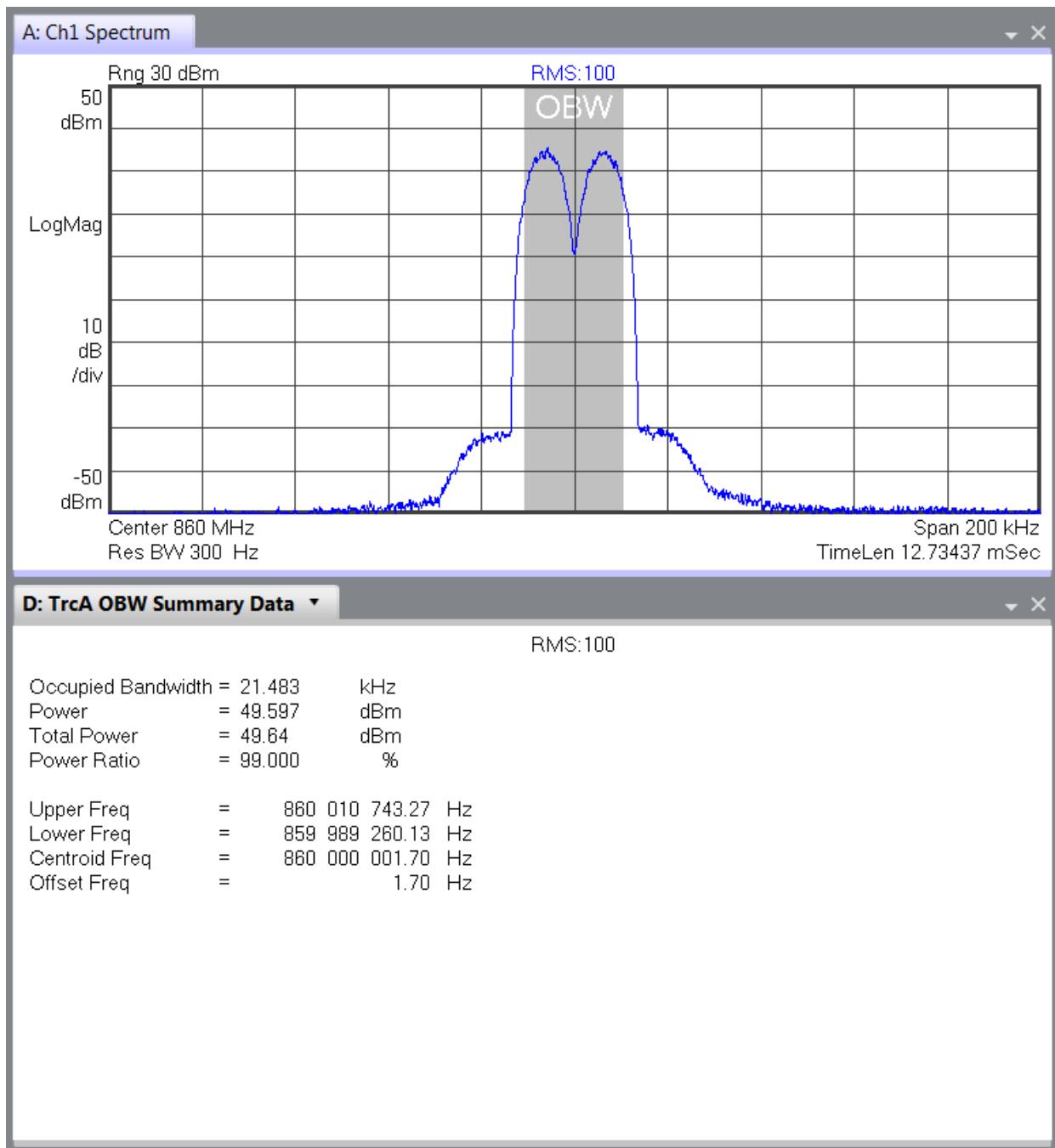
Report on Test Measurements

Adjacent Channel Power Plot – Dual carrier
 Dual P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)
 90.221 ACP Mask



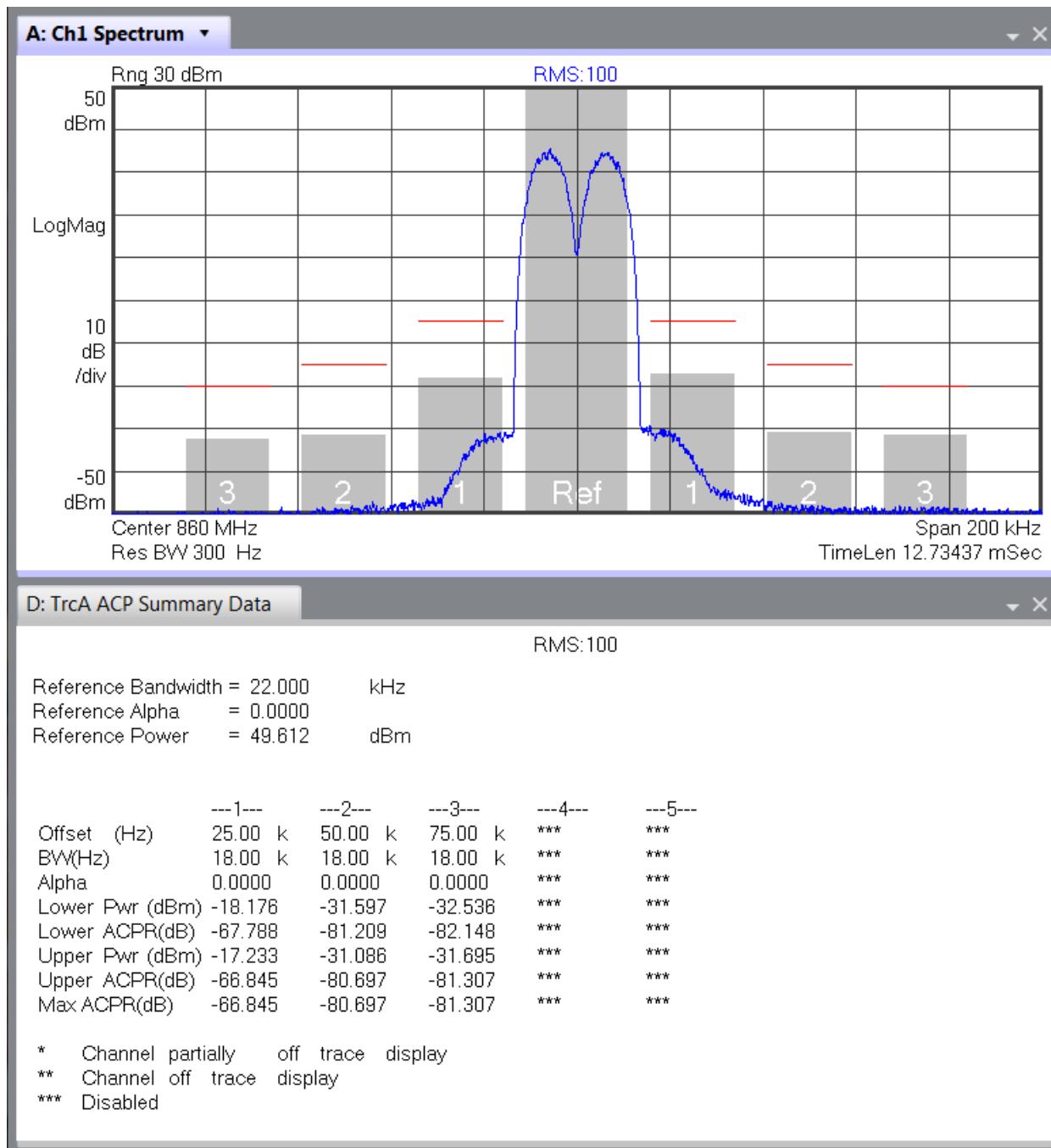
Report on Test Measurements

Occupied Bandwidth Plot – Dual carrier
Dual P25 2-Slot TDMA Digital Modulation (H-DQPSK)
90.221 ACP Mask



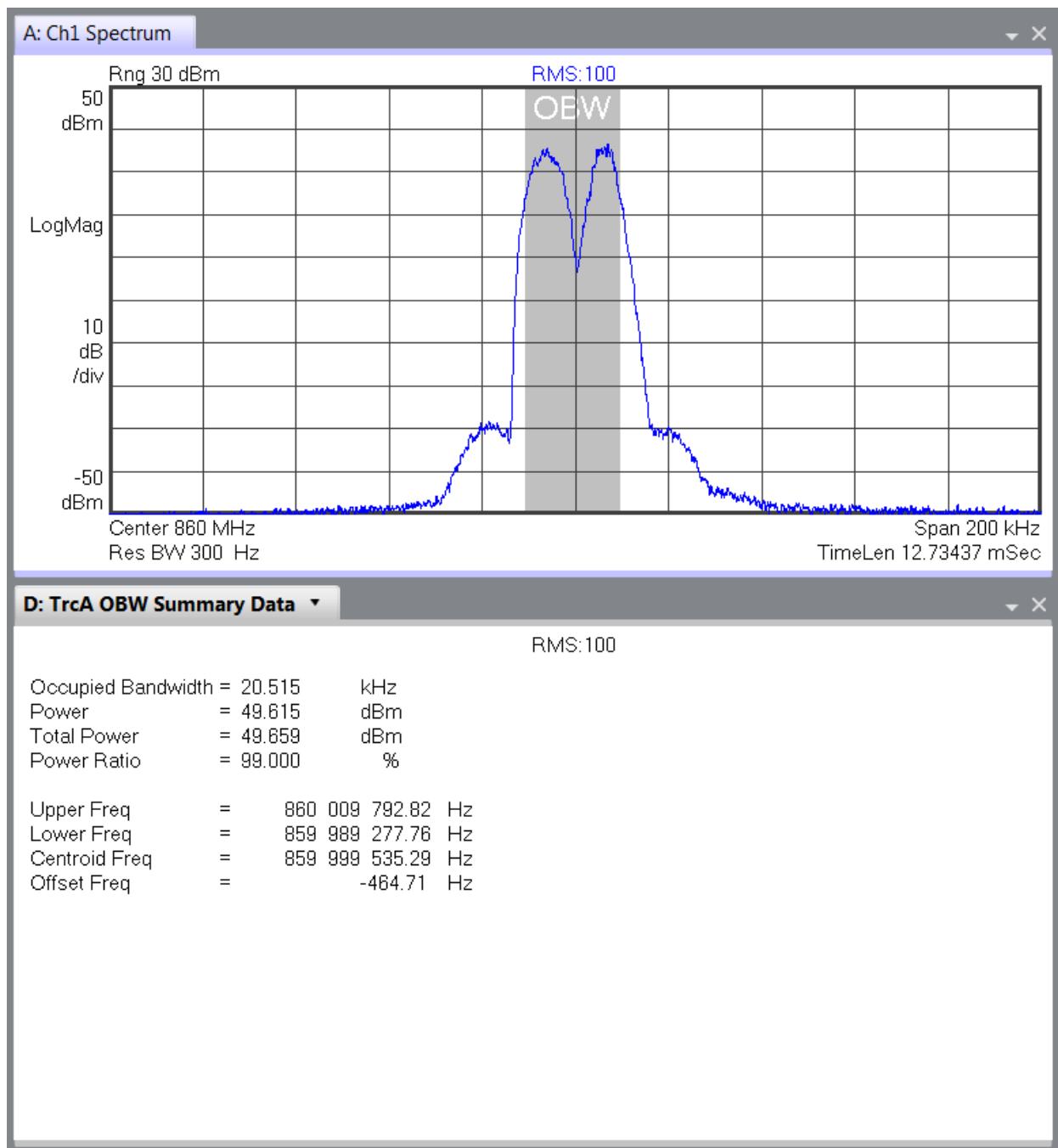
Report on Test Measurements

Adjacent Channel Power Plot – Dual carrier
Dual P25 2-Slot TDMA Digital Modulation (H-DQPSK)
90.221 ACP Mask



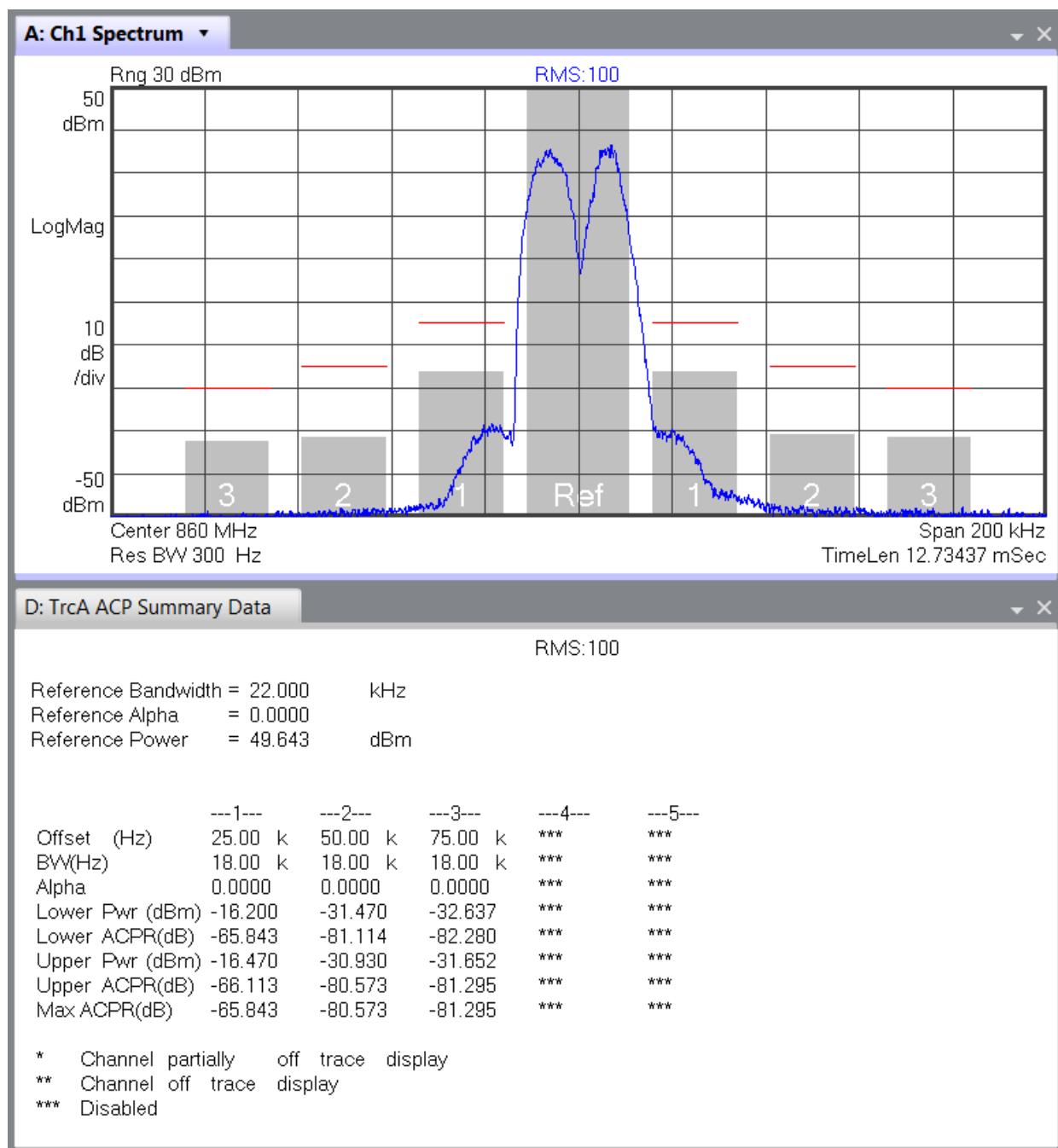
Report on Test Measurements

*Occupied Bandwidth Plot – Dual carrier
Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)
90.221 ACP Mask*



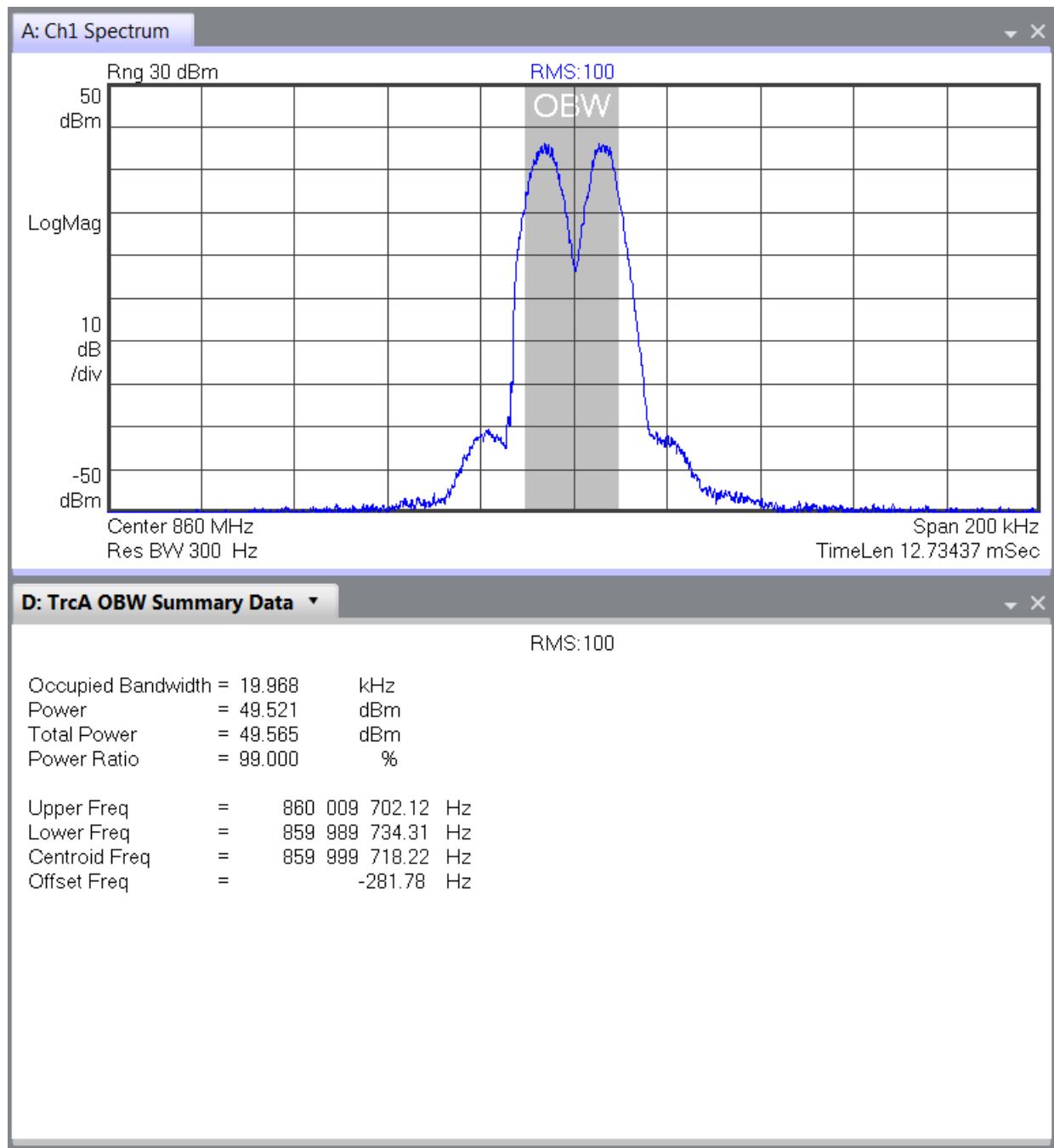
Report on Test Measurements

Adjacent Channel Power Plot – Dual carrier
 Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)
 90.221 ACP Mask



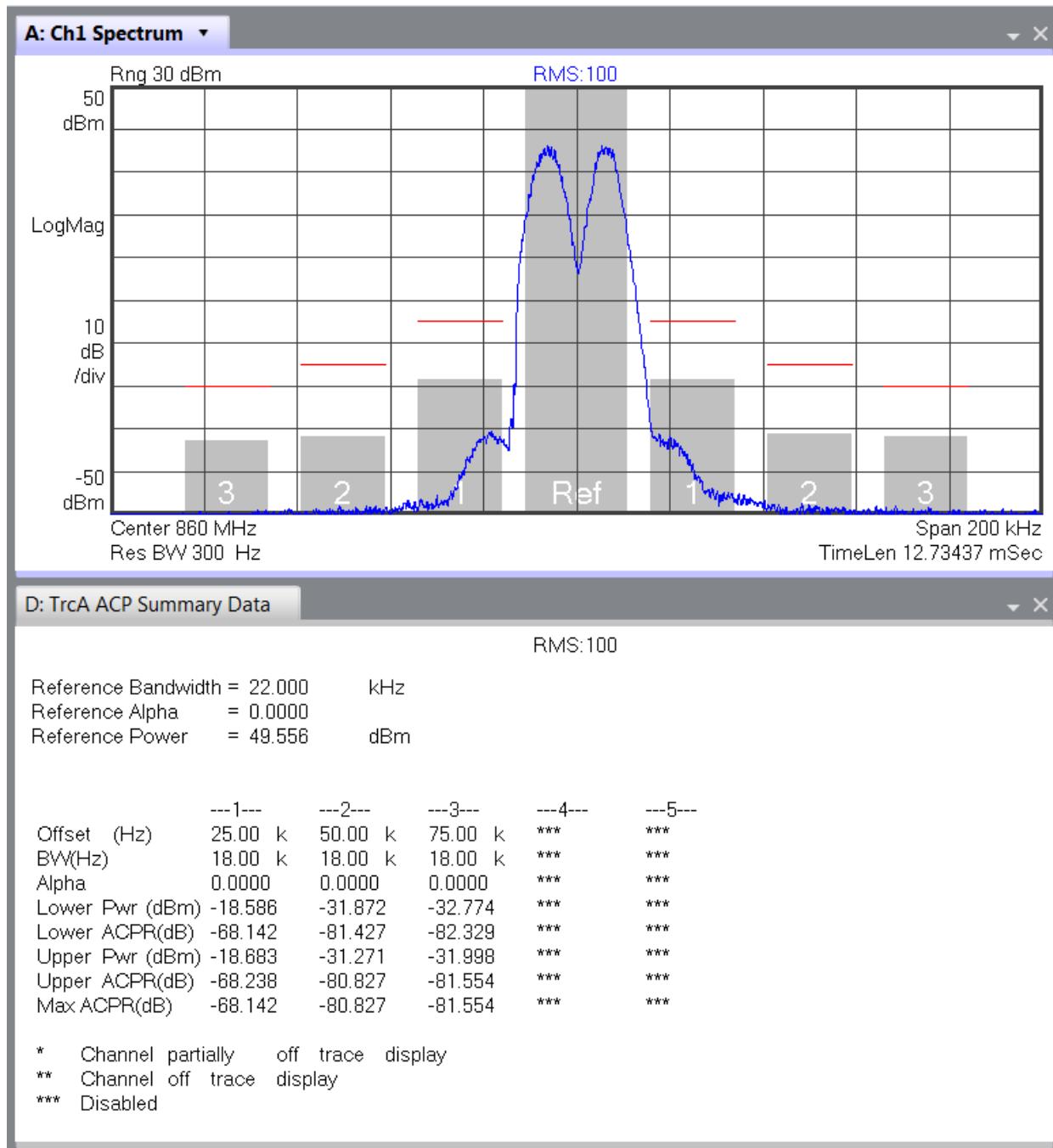
Report on Test Measurements

Occupied Bandwidth Plot – Dual carrier
Mixed Linear Simulcast Modulation (LSM) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)
90.221 ACP Mask



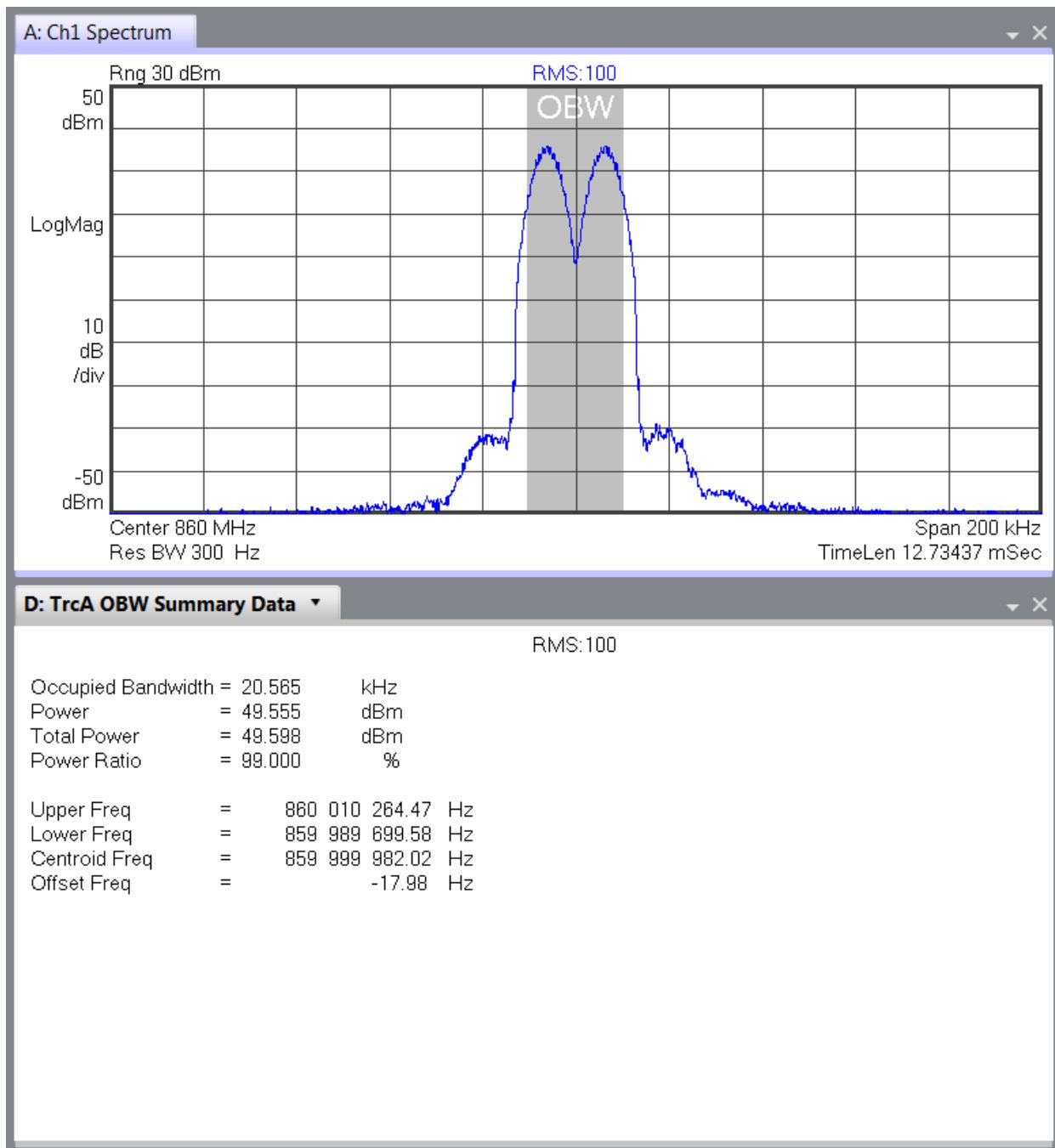
Report on Test Measurements

Adjacent Channel Power Plot – Dual carrier
 Mixed Linear Simulcast Modulation (LSM) / P25 FDMA Compatible 4-Level Frequency Modulation (C4FM)
 90.221 ACP Mask



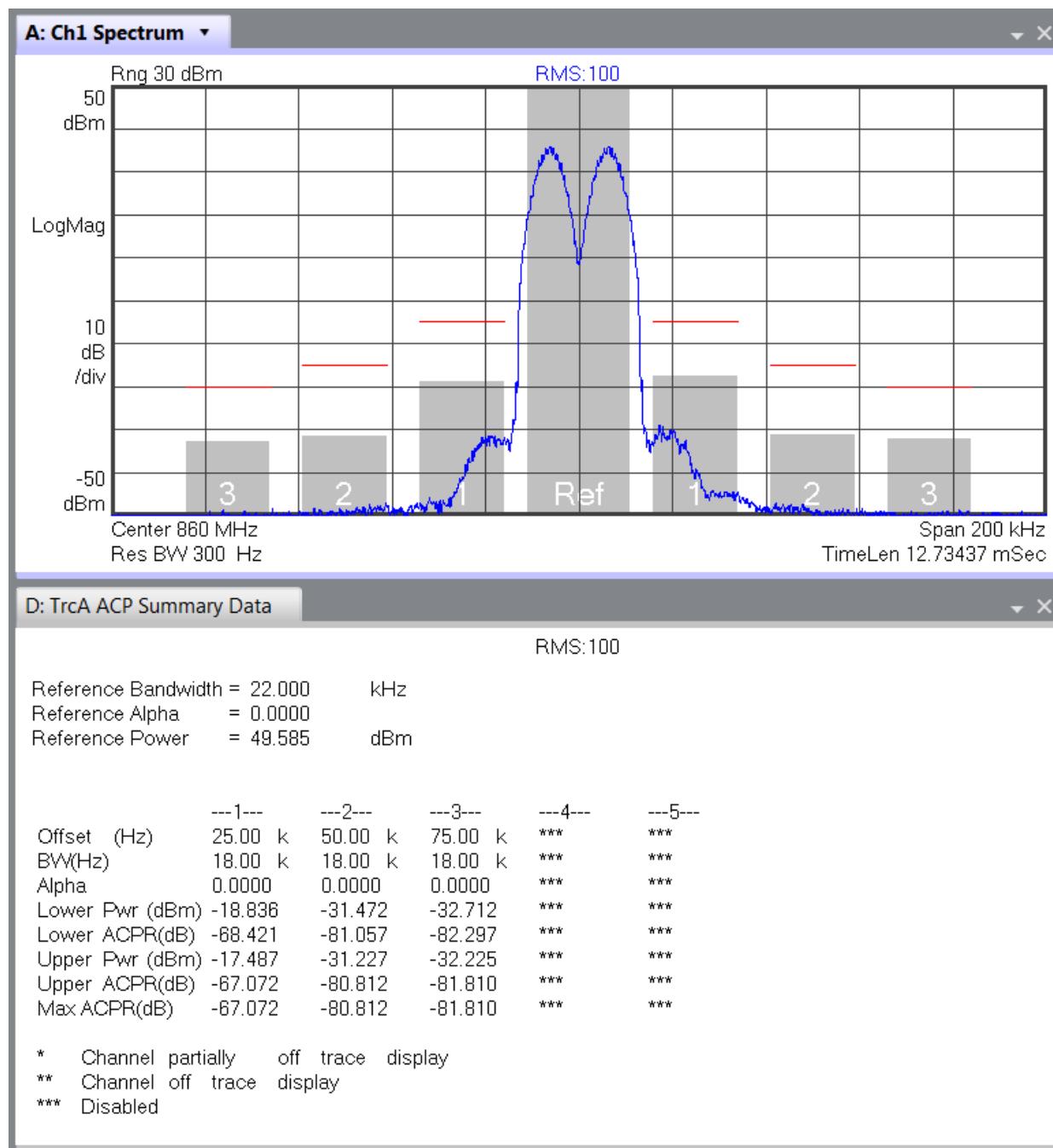
Report on Test Measurements

Occupied Bandwidth Plot – Dual carrier
Dual P25 FDMA Linear Simulcast Modulation (LSM)
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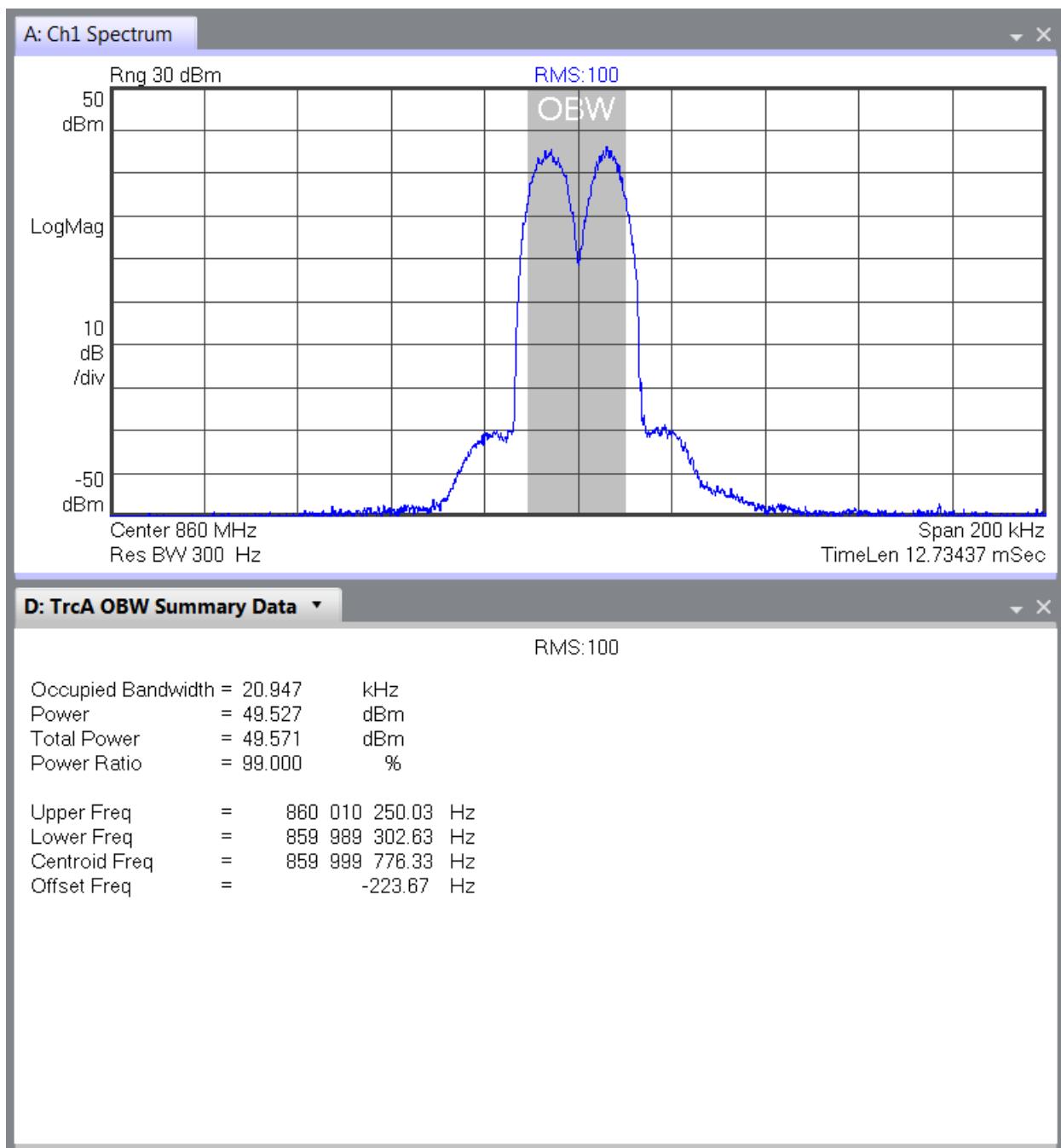
Report on Test Measurements

Adjacent Channel Power Plot – Dual carrier
 Dual P25 FDMA Linear Simulcast Modulation (LSM)
 90.221 ACP Mask



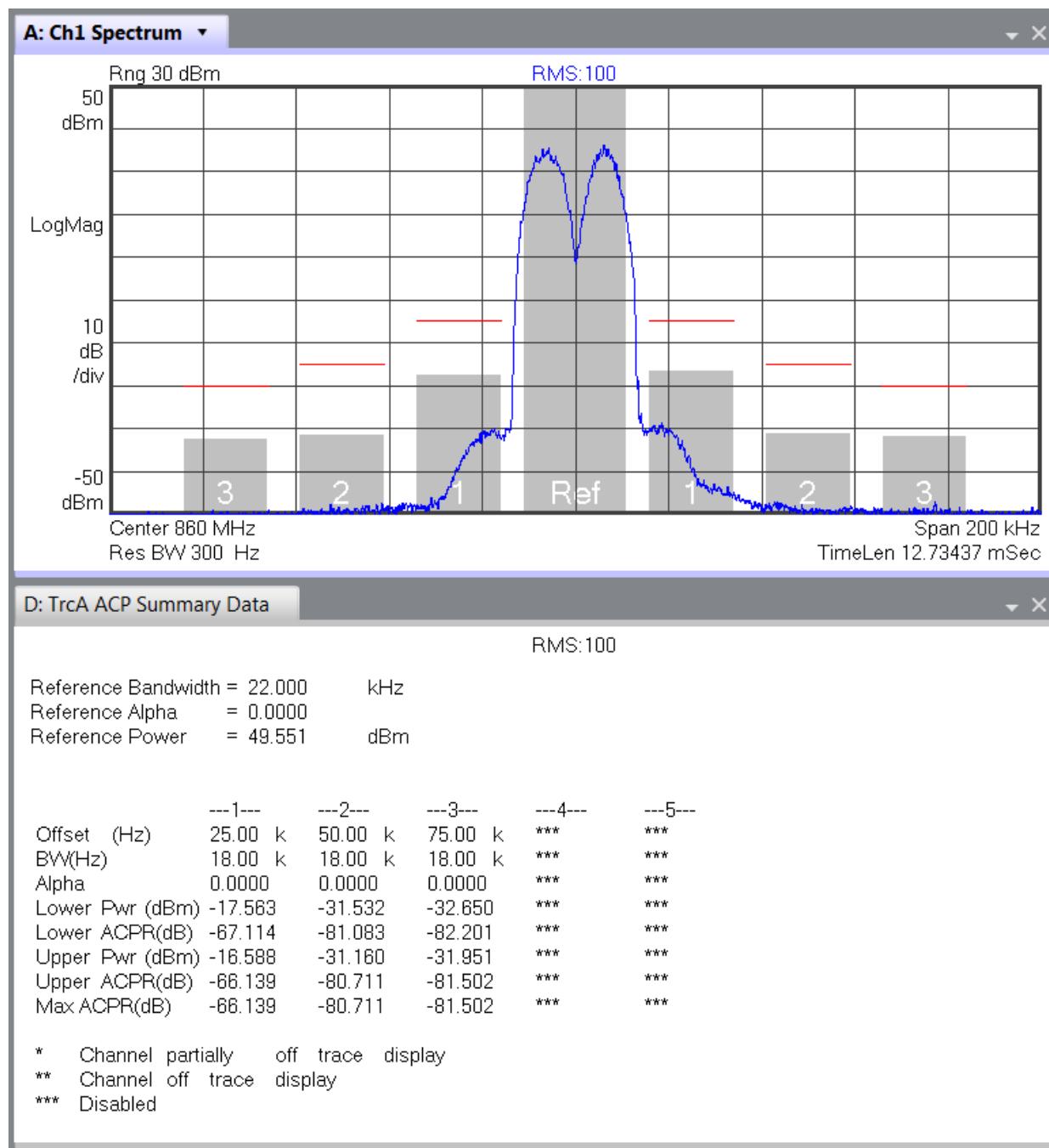
Report on Test Measurements

Occupied Bandwidth Plot – Dual carrier
Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Linear Simulcast Modulation (LSM)
90.221 ACP Mask



Report on Test Measurements

Adjacent Channel Power Plot – Dual carrier
 Mixed P25 2-Slot TDMA Digital Modulation (H-DQPSK) / P25 FDMA Linear Simulcast Modulation (LSM)
 90.221 ACP Mask



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