

FCC Part 90& Part 22 Rules Test Report

Report No.: AGC02931200704FE10

FCC ID : 2AWYH-H1RB
PRODUCT DESIGNATION : DMR Digital Transceiver
BRAND NAME : RUGGED RADIOS
MODEL NAME : R1
APPLICANT : RUGGED RADIOS
DATE OF ISSUE : Nov. 27, 2020
STANDARD(S) : FCC Part 90 Rules
: FCC Part 22 Rules
REPORT VERSION : V 1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd



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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Nov. 27, 2020	Valid	Initial Release

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1. VERIFICATION OF COMPLIANCE

Applicant:	Rugged Radios
Address	951 E Grand Ave, Arroyo Grande, CA 93420
Manufacturer:	Rugged Radios
Address	951 E Grand Ave, Arroyo Grande, CA 93420
Factory	Rugged Radios
Address	951 E Grand Ave, Arroyo Grande, CA 93420
Product Designation:	DMR Digital Transceiver
Brand Name:	RUGGED RADIOS
Test Model	R1
Date of Test:	Jul. 17, 2020~Nov. 27, 2020

WE HEREBY CERTIFY THAT:

The above equipment was tested by Shenzhen Attestation of Global Compliance Science & Technology Co., Ltd. The data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI/TIA-603-E (2016). The sample tested as described in this report is in compliance with the FCC Rules Part 90 and FCC Rules Part 22 requirements

The test results of this report relate only to the tested sample identified in this report.

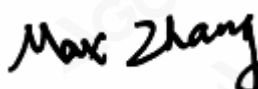
Prepared By



Calvin Liu
(Project Engineer)

Nov. 27, 2020

Reviewed By



Max Zhang
(Reviewer)

Nov. 27, 2020

Approved By



Forrest Lei
Authorized Officer

Nov. 27, 2020

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2. GENERAL INFORMATION

2.1 PRODUCT DESCRIPTION

The EUT is a **DMR Digital Transceiver** designed for voice/data communication. It is designed by way of utilizing the FM/4FSK modulation achieves the system operating.

A major technical description of EUT is described as following:

Communication Type	Voice / Data	
Hardware Version	V2.1.4	
Software Version	Ver 1.0	
Modulation	FM/4FSK	
Emission Type	7K60F1D/7K60F1E/11K0F3E	
Emission Bandwidth	Analog:10.19KHz(5W-12.5 KHz), 10.18KHz(1W-12.5 KHz) ---VHF Digital: 9.998KHz(5W),10.25 KHz(1W) ---VHF Analog:10.22KHz(5W-12.5 KHz), 10.21KHz(1W-12.5 KHz) ---UHF Digital: 10.15KHz(5W), 9.960KHz(1W) ---UHF	
Peak Frequency Deviation	1.86KHz	
Audio Frequency Response	6.51dB	
Maximum Transmitter Power	Analog:36.94dBm(5W-12.5 KHz), 29.94dBm (1W-12.5 KHz) ---VHF Digital: 36.82dBm(5W), 29.88dBm (1W) ---VHF Analog:36.93dBm(5W-12.5 KHz), 29.91dBm (1W-12.5 KHz) ---UHF Digital: 36.81dBm(5W), 29.81dBm (1W) ---UHF	
Output power Modification	VHF:5W/1W UHF:5W/1W (It was fixed by the manufacturer, any individual can't arbitrarily change it.)	
Data Rate	9600bps/12.5KHz(Channel Spacing)	
Antenna Designation	Detachable	
Antenna Gain	1.2dBi	
Power Supply	DC 7.4V	
Limiting Voltage	DC 6.29 V~ 8.51V	
Operation Frequency Range and Channel	Frequency Range: 136 MHz to 174 MHz (VHF) 400 MHz to 480 MHz (UHF) Channel Separation: 12.5KHz(Digital/ Analog)	
	Bottom Channel: 136.025MHz Middle Channel:151.85MHz Middle Channel:155.025MHz Middle Channel:161.61MHz High Channel: 173.975MHz	Bottom Channel: 400.025MHz Middle Channel: 453.225MHz Middle Channel: 454.025MHz High Channel: 479.975MHz
Frequency Tolerance	1.098ppm	

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Frequency Range (MHz)	Rated Transmit Power(W)(Conducted)	Transmit Mode/Emission Designator
400-480	5W/1W	11K0F3E(Analog Voice;NB)
400-480	5W/1W	7K60F1D/7K60F1W(9600Data/Digital Voice NB)

Frequency Range (MHz)	Rated Transmit Power(W)(Conducted)	Transmit Mode/Emission Designator
136-174	5W/1W	11K0F3E(Analog Voice;NB)
136-174	5W/1W	7K60F1D/7K60F1W(9600Data/Digital Voice NB)

Channel No. (6.25KHz)	Channel No. (12.5KHz)	12.5KHz Channel Spaced 400MHz Band Plan(MHz)
1	1-2	400.025
2		
3	3-4	440.025
4		
5	5-6	479.975
6		

Channel No. (6.25KHz)	Channel No. (12.5KHz)	12.5KHz Channel Spaced 136MHz Band Plan(MHz)
1	1-2	136.025
2		
3	3-4	155.025
4		
5	5-6	173.975
6		

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FCC Rules and Regulations Part 2.202: Necessary Bandwidth and Emission Bandwidth

For FM Mode (Channel Spacing: 12.5kHz)

Emission Designator 11K0F3E

In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.

$$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 2.5 \text{ kHz}) = 11 \text{ kHz} = 11K0$$

F3E portion of the designator represents an FM voice transmission

Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

For FM Mode (Channel Spacing: 25kHz)

Emission Designator 16K0F3E

In this case, the maximum modulating frequency is 3.0 kHz with a 5.0 kHz deviation.

$$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 5.0 \text{ kHz}) = 16 \text{ kHz} = 16K0$$

F3E portion of the designator represents an FM voice transmission

Therefore, the entire designator for 25 kHz channel spacing FM mode is 16K0F3E.

For Digital Mode (Channel Spacing: 12.5 kHz)

Emission Designator 7K60F1D and 7K60F1W

The 99% energy rule was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz.

F1D and F1E portion of the designator indicates digital information.

Therefore, the entire designator for 12.5 kHz channel spacing digital mode is 7K60F1D and 7K60F1W.

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2.2 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for FCC ID: 2AWYH-H1RB, filing to comply with Part 2, Part 22, and Part 90 of the Federal Communication Commission rules.

2.3 TEST METHODOLOGY

The radiated emission testing was performed according to the procedures of ANSI/TIA-603-E (2016).

2.4 TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

2.5 SPECIAL ACCESSORIES

Not available for this EUT intended for grant.

2.6 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

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3. SYSTEM TEST CONFIGURATION

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

3.3 GENERAL TECHNICAL REQUIREMENTS

For FCC Part 90& Part 22 requirements:

- (1). Section 90.205 & 22.565: RF Output Power
- (2). Section 90.207: Modulation Characteristic
- (3). Section 90.209 & 22.359: Occupied Bandwidth
- (4). Section 90.210 & 22.359: Emission Mask
- (5). Section 90.213 & 22.355: Frequency Tolerance
- (6). Section 90.214: Transient Frequency Behavior
- (7). Section 90.210 & 22.359: Spurious Emission on Antenna Port
- (8). Section 90.210 & 22.359: Spurious Radiated Emission

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3.4 CONFIGURATION OF TESTED SYSTEM

Fig. 2-1 Configuration of Tested System



Table 2-1 Equipment Used in Tested System

Item	Equipment	Model No.	Identifier	Note
1	DMR Digital Transceiver	R1	FCC ID: 2AWYH-H1RB	EUT
2	Battery	BAT-R1	DC 7.4V 2000mAh	Accessories
3	Back clip	N/A	N/A	Accessories
4	Adapter	CG-1U0510	Input: 100-240V, 50/60Hz Output: DC 5V 1A	Accessories
5	USB Cable	N/A	N/A	Accessories

Note: The battery is full-charged during the test

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3.5 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, $U_c = \pm 3.2$ dB
- Uncertainty of Radiated Emission below 1GHz, $U_c = \pm 3.9$ dB
- Uncertainty of Radiated Emission above 1GHz, $U_c = \pm 4.8$ dB
- Uncertainty of total RF power, conducted, $U_c = \pm 0.8$ dB
- Uncertainty of spurious emissions, conducted, $U_c = \pm 2.7$ dB
- Uncertainty of Occupied Channel Bandwidth: $U_c = \pm 2$ %
- Uncertainty of Frequency: $U_c = \pm 2$ %
- Uncertainty of FM deviation: $U_c = \pm 2$ %
- Uncertainty of Audio Level: $U_c = \pm 0.98$ dB
- Uncertainty of Modulation Limiting: $U_c = \pm 0.42$ %
- Uncertainty of Transient Frequency Behavior: $U_c = \pm 6.8$ %
- Uncertainty of Low Pass Filter Response: $U_c = \pm 0.76$ dB

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4. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§90.205 & 22.565 §2.1046	Maximum Transmitter Power	Compliant
§90.207 & 2.1047	Modulation Characteristic	Compliant
§90.209 & 22.359 §2.1049	Occupied Bandwidth	Compliant
§90.210 & 22.359 §2.1049	Emission Mask	Compliant
§90.213 & 22.355 §2.1055	Frequency Tolerance	Compliant
§90.214	Transient Frequency Behavior	Compliant
§90.210 & 22.359 §2.1051	Spurious Emission on Antenna Port	Compliant
§90.210 & 22.359 §2.1053	Spurious Radiated Emission	Compliant

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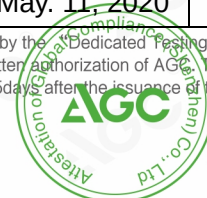
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LIST OF EQUIPMENTS USED

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2020	May 14, 2021
EXA Signal Analyzer	Aglient	N9020A	W1312-60196	Oct. 08, 2019	Oct. 07, 2020
EXA Signal Analyzer	Aglient	N9020A	W1312-60196	Oct. 06, 2020	Oct. 05, 2021
EXA Signal Analyzer	Aglient	N9020A	MY52090123	Oct. 08, 2019	Oct. 07, 2020
EXA Signal Analyzer	Aglient	N9020A	MY52090123	Oct. 06, 2020	Oct. 05, 2021
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep.16, 2019	Sep.15, 2021
preamplifier	ChengYi	EMC184045SE	980508	Oct.29, 2019	Oct 28, 2020
preamplifier	ChengYi	EMC184045SE	980508	Oct 27, 2020	Oct 26, 2021
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 17, 2019	May. 16, 2021
Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-205	Jun. 09, 2020	Jun. 08, 2021
HORN ANTENNA	EM	EM-AH-10180	/	Feb.28, 2020	Feb.27, 2021
SIGNAL GENERATOR	AGILENT	E4421B	MY43351603	Jun. 09, 2020	Jun. 08, 2021
SIGNAL GENERATOR	R&S	SMT03	A0304261	Jun. 09, 2020	Jun. 08, 2021
ANTENNA	SCHWARZBECK	VULB9168	VULB9168-494	Jan. 09, 2019	Jan. 08, 2021
ANTENNA	SCHWARZBECK	VULB9168	D69250	Sep.26, 2018	Sep.25, 2020
Modulation Domain Analyzer	HP	53310A	3121A02467	Oct. 30, 2019	Oct. 29, 2020
Modulation Domain Analyzer	HP	53310A	3121A02467	Oct. 28, 2020	Oct. 27, 2021
Small environmental tester	ESPEC	SH-242	--	Feb. 23, 2020	Feb. 22, 2021
RF Communication Test Set	HP	8920B	--	Jun. 09, 2020	Jun. 08, 2021
Attenuator	Weinachel Corp	58-30-33	ML030	Oct. 28, 2019	Oct. 27, 2020
Attenuator	Weinachel Corp	58-30-33	ML030	Oct. 26, 2020	Oct. 25, 2021
RF Cable	R&S	1#	--	Each time	N/A
RF Cable	R&S	2#	--	Each time	N/A
Fliter-UHF	Microwave	N25155M2	498705	May. 11, 2020	May. 10, 2021
Fliter-VHF	Microwave	N26460M1	498703	May. 11, 2020	May. 10, 2021

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5. DESCRIPTION OF TEST MODES

RF TEST MODES

The EUT (**DMR Digital Transceiver**) has been tested under normal operating condition. (The top channel, the middle channel and the bottom channel) are chosen for testing at each channel separation.

Analog:

No.	TEST MODES	CHANNEL SEPARATION
1	Low Channel	12.5 KHz
2	Middle Channel	12.5 KHz
3	High Channel	12.5 KHz

Digital:

No.	TEST MODES	CHANNEL SEPARATION
1	Low Channel	12.5 KHz
2	Middle Channel	12.5 KHz
3	High Channel	12.5 KHz

Note: Only the result of the worst case was recorded in the report.

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6. FREQUENCY TOLERANCE

6.1 PROVISIONS APPLICABLE

- a). According to FCC §2.1055, § 22.355 and §90.213, the frequency stability shall be measured with variation of ambient temperature from -30°C to $+50^{\circ}\text{C}$ centigrade.
- b). According to FCC Part 2 Section 2.1055(d)(2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacturer.
- c). According to FCC Part 90 Section 90.213, the frequency tolerance must be maintained within 0.00025% for 12.5 KHz channel separation and 0.0001% for 6.25 KHz channel separation.

6.2 MEASUREMENT PROCEDURE

6.2.1 Frequency stability versus environmental temperature

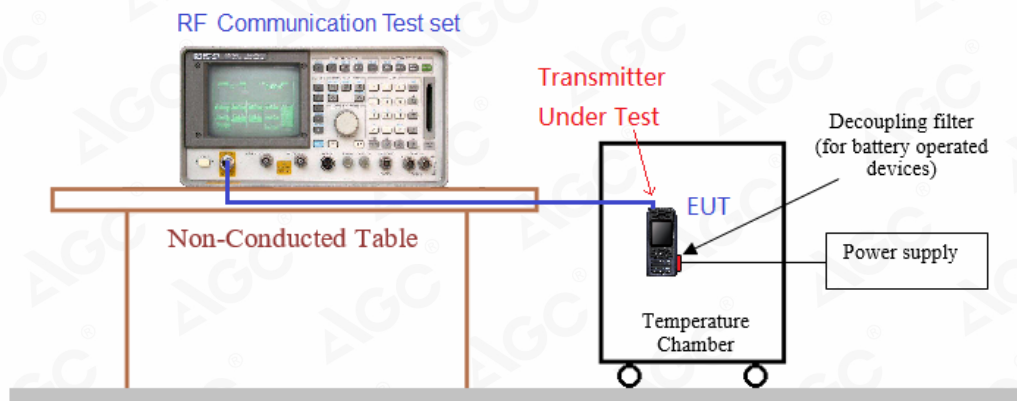
1. Setup the configuration per figure 1 for frequencies measurement inside an environment chamber, Install new battery in the EUT.
2. Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1KHz and Video Resolution Bandwidth to 1KHz and Frequency Span to 50KHz. Record this frequency as reference frequency.
3. Set the temperature of chamber to 50°C . Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10°C decreased per stage until the lowest temperature -30°C is measured, record all measured frequencies on each temperature step.

6.2.2 Frequency stability versus input voltage

1. Setup the configuration per figure 1 for frequencies measured at temperature if it is within 15°C to 25°C . Otherwise, an environment chamber set for a temperature of 20°C shall be used. The EUT shall be powered by DC 7.4V.
2. Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 KHz and Video Resolution Bandwidth to 1KHz. Record this frequency as reference frequency.
3. Supply the EUT primary voltage at the operating end point which is specified by manufacturer and record the frequency.



6.3 TEST SETUP BLOCK DIAGRAM



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6.4 TEST RESULTS

VHF-Analog:

(1) Frequency stability versus input voltage (Supply nominal voltage is 7.40V)-5W-12.5KHz

Environment Temperature(℃)	Power Supply	Reference Frequency			Limit:
	(V)	136.025MHz	155.025MHz	173.975MHz	ppm
50	DC 7.40 V	0.624	0.653	1.077	5
40	DC 7.40 V	0.645	0.548	0.672	
30	DC 7.40 V	0.670	0.994	0.568	
20	DC 7.40 V	0.676	1.058	0.988	
10	DC 7.40 V	0.932	0.706	0.706	
0	DC 7.40 V	0.509	0.810	0.584	
-10	DC 7.40 V	0.669	0.854	0.627	
-20	DC 7.40 V	1.017	0.887	0.732	
-30	DC 7.40 V	0.505	0.609	0.848	
Result	Pass				

Environment Temperature(℃)	Power Supply	Reference Frequency		Limit:
	(V)	151.85MHz	161.61MHz	ppm
50	DC 7.40 V	0.733	0.543	5
40	DC 7.40 V	1.084	0.847	
30	DC 7.40 V	0.623	1.086	
20	DC 7.40 V	0.880	0.790	
10	DC 7.40 V	0.816	0.892	
0	DC 7.40 V	0.528	0.516	
-10	DC 7.40 V	0.892	0.780	
-20	DC 7.40 V	0.796	0.631	
-30	DC 7.40 V	1.098	0.909	
Result	Pass			

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(2) Frequency stability versus input voltage (Battery endpoint is 6.29V) -5W-12.5KHz

2) Frequency Stability versus Input Voltage (Battery) (Setpoint is 1.25V) 50% Error					
Environment Temperature(°C)	Power	Reference Frequency			Limit:
	(V)	136.025MHz	155.025MHz	173.975MHz	ppm
50	DC 6.29 V	0.900	0.851	0.922	5
40	DC 6.29 V	0.616	0.734	0.693	
30	DC 6.29 V	0.880	0.844	1.063	
20	DC 6.29 V	0.504	1.018	1.042	
10	DC 6.29 V	0.849	0.566	0.729	
0	DC 6.29 V	0.608	0.861	0.673	
-10	DC 6.29 V	0.746	0.876	0.903	
-20	DC 6.29 V	0.985	0.858	1.089	
-30	DC 6.29 V	0.705	0.722	0.871	
Result	Pass				

Environment Temperature(℃)	Power Supply	Reference Frequency		Limit:
	(V)	151.85MHz	161.61MHz	ppm
50	DC 6.29 V	0.606	0.937	5
40	DC 6.29 V	0.899	0.629	
30	DC 6.29 V	0.525	0.794	
20	DC 6.29 V	1.005	1.013	
10	DC 6.29 V	0.513	0.673	
0	DC 6.29 V	0.782	0.561	
-10	DC 6.29 V	0.914	0.721	
-20	DC 6.29 V	0.680	0.746	
-30	DC 6.29 V	0.558	1.011	
Result	Pass			

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(3) Frequency stability versus input voltage (Supply nominal voltage is 7.40V)-1W-12.5KHz

3) Frequency stability versus input voltage (Supply nominal voltage is 7.40V, 200 mA current)					
Environment Temperature(°C)	Power Supply	Reference Frequency			Limit:
	(V)	136.025MHz	155.025MHz	173.975MHz	ppm
50	DC 7.40 V	1.030	0.559	0.997	5
40	DC 7.40 V	0.829	0.854	0.865	
30	DC 7.40 V	0.802	1.067	1.043	
20	DC 7.40 V	0.683	0.923	0.994	
10	DC 7.40 V	0.726	1.012	0.935	
0	DC 7.40 V	1.083	1.054	0.519	
-10	DC 7.40 V	0.906	0.599	0.995	
-20	DC 7.40 V	0.551	1.092	0.745	
-30	DC 7.40 V	0.705	0.773	0.716	
Result	Pass				

Environment Temperature(℃)	Power Supply	Reference Frequency		Limit:
	(V)	151.85MHz	161.61MHz	ppm
50	DC 7.40 V	1.085	1.075	5
40	DC 7.40 V	0.671	0.749	
30	DC 7.40 V	1.034	0.593	
20	DC 7.40 V	0.747	0.863	
10	DC 7.40 V	0.950	0.825	
0	DC 7.40 V	0.774	0.636	
-10	DC 7.40 V	0.804	0.525	
-20	DC 7.40 V	0.839	0.880	
-30	DC 7.40 V	1.018	0.716	
Result	Pass			

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(4) Frequency stability versus input voltage (Battery endpoint is 6.29V) -1W-12.5KHz

Environment Temperature(℃)	Power	Reference Frequency			Limit:
	(V)	136.025MHz	155.025MHz	173.975MHz	ppm
50	DC 6.29 V	0.736	0.959	0.501	5
40	DC 6.29 V	0.592	0.697	0.864	
30	DC 6.29 V	0.761	0.615	1.052	
20	DC 6.29 V	1.040	0.982	0.806	
10	DC 6.29 V	1.052	0.960	0.667	
0	DC 6.29 V	0.861	1.016	0.760	
-10	DC 6.29 V	0.665	1.006	0.982	
-20	DC 6.29 V	1.043	0.542	0.525	
-30	DC 6.29 V	0.687	1.001	0.524	
Result	Pass				

Environment Temperature(℃)	Power Supply	Reference Frequency		Limit:
	(V)	151.85MHz	161.61MHz	ppm
50	DC 6.29 V	0.305	0.472	5
40	DC 6.29 V	0.598	0.626	
30	DC 6.29 V	0.387	0.908	
20	DC 6.29 V	0.801	0.670	
10	DC 6.29 V	0.711	0.667	
0	DC 6.29 V	0.479	0.751	
-10	DC 6.29 V	0.606	0.746	
-20	DC 6.29 V	0.803	0.805	
-30	DC 6.29 V	0.350	0.506	
Result	Pass			

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Digital:

(1) Frequency stability versus input voltage (Supply nominal voltage is 7.40V)-5W-12.5KHz

Environment Temperature(℃)	Power Supply	Reference Frequency			Limit:
	(V)	136.025MHz	155.025MHz	173.975MHz	ppm
50	DC 7.40 V	0.545	0.789	0.834	5
40	DC 7.40 V	0.488	0.996	0.883	
30	DC 7.40 V	0.796	0.970	0.691	
20	DC 7.40 V	0.830	0.961	0.695	
10	DC 7.40 V	0.664	0.951	0.755	
0	DC 7.40 V	0.492	0.480	0.575	
-10	DC 7.40 V	0.998	0.541	0.631	
-20	DC 7.40 V	0.336	0.778	0.588	
-30	DC 7.40 V	0.353	0.787	0.480	
Result	Pass				

Environment Temperature(℃)	Power Supply	Reference Frequency		Limit:
	(V)	151.85MHz	161.61MHz	ppm
50	DC 7.40 V	0.802	0.654	5
40	DC 7.40 V	0.935	0.900	
30	DC 7.40 V	0.779	0.484	
20	DC 7.40 V	0.413	0.601	
10	DC 7.40 V	0.898	0.888	
0	DC 7.40 V	0.521	0.365	
-10	DC 7.40 V	0.899	0.872	
-20	DC 7.40 V	0.500	0.418	
-30	DC 7.40 V	0.496	0.696	
Result	Pass			

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(2) Frequency stability versus input voltage (Battery endpoint is 6.29V) -5W-12.5KHz

Environment Temperature(°C)	Power	Reference Frequency			Limit:
	(V)	136.025MHz	155.025MHz	173.975MHz	ppm
50	DC 6.29 V	0.645	0.653	0.713	5
40	DC 6.29 V	0.568	1.027	0.824	
30	DC 6.29 V	1.090	0.881	0.572	
20	DC 6.29 V	0.502	1.068	0.536	
10	DC 6.29 V	0.748	1.083	0.635	
0	DC 6.29 V	0.631	0.687	0.744	
-10	DC 6.29 V	0.687	0.702	0.684	
-20	DC 6.29 V	0.598	0.820	0.811	
-30	DC 6.29 V	0.570	0.907	1.043	
Result	Pass				

Environment Temperature(℃)	Power Supply	Reference Frequency		Limit:
	(V)	151.85MHz	161.61MHz	ppm
50	DC 6.29 V	0.980	0.704	5
40	DC 6.29 V	0.813	0.984	
30	DC 6.29 V	0.704	0.484	
20	DC 6.29 V	0.884	0.443	
10	DC 6.29 V	0.526	0.822	
0	DC 6.29 V	0.817	0.848	
-10	DC 6.29 V	0.575	0.978	
-20	DC 6.29 V	0.663	0.384	
-30	DC 6.29 V	0.326	0.857	
Result	Pass			

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(3) Frequency stability versus input voltage (Supply nominal voltage is DC 7.40V)-1W-12.5KHz

Environment Temperature(°C)	Power Supply	Reference Frequency			Limit:
	(V)	136.025MHz	155.025MHz	173.975MHz	ppm
50	DC 7.40 V	0.922	0.653	0.624	5
40	DC 7.40 V	0.781	0.512	0.747	
30	DC 7.40 V	0.822	1.029	0.654	
20	DC 7.40 V	0.856	0.632	0.557	
10	DC 7.40 V	0.947	1.005	0.729	
0	DC 7.40 V	0.570	0.674	0.999	
-10	DC 7.40 V	0.571	1.042	0.795	
-20	DC 7.40 V	0.784	0.834	0.796	
-30	DC 7.40 V	0.841	0.513	0.960	
Result	Pass				

Environment Temperature(℃)	Power Supply	Reference Frequency		Limit:
	(V)	151.85MHz	161.61MHz	ppm
50	DC 7.40 V	0.563	0.861	5
40	DC 7.40 V	0.560	0.809	
30	DC 7.40 V	0.518	0.875	
20	DC 7.40 V	0.893	0.836	
10	DC 7.40 V	0.589	0.765	
0	DC 7.40 V	0.534	0.929	
-10	DC 7.40 V	0.649	1.057	
-20	DC 7.40 V	0.885	0.637	
-30	DC 7.40 V	0.726	0.838	
Result	Pass			

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(4) Frequency stability versus input voltage (Battery endpoint is 6.29V) -1W-12.5KHz

4) Frequency Stability Versus Input Voltage (Battery endpoint is 0.25V) 1W 210KHz					
Environment Temperature(°C)	Power	Reference Frequency			Limit:
	(V)	136.025MHz	155.025MHz	173.975MHz	ppm
50	DC 6.29 V	0.924	0.943	0.964	5
40	DC 6.29 V	0.596	0.909	0.728	
30	DC 6.29 V	0.503	1.017	0.517	
20	DC 6.29 V	1.053	0.809	0.960	
10	DC 6.29 V	0.637	0.571	0.942	
0	DC 6.29 V	0.707	0.625	1.093	
-10	DC 6.29 V	1.000	0.545	0.768	
-20	DC 6.29 V	0.904	0.973	0.522	
-30	DC 6.29 V	0.640	0.792	1.067	
Result	Pass				

Environment Temperature(°C)	Power Supply	Reference Frequency		Limit:
	(V)	151.85MHz	161.61MHz	ppm
50	DC 6.29 V	0.446	0.614	5
40	DC 6.29 V	0.594	0.358	
30	DC 6.29 V	0.451	0.669	
20	DC 6.29 V	0.773	0.375	
10	DC 6.29 V	0.870	0.936	
0	DC 6.29 V	0.695	0.787	
-10	DC 6.29 V	0.714	0.547	
-20	DC 6.29 V	0.537	0.970	
-30	DC 6.29 V	0.514	0.726	
Result	Pass			

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UHF:

Analog:

(1) Frequency stability versus input voltage (Supply nominal voltage is 7.40V) **-5W-12.5KHz**

Environment Temperature(°C)	Power (V)	Reference Frequency				Limit: ppm
		400.025MHz	453.225MHz	454.025MHz	479.975MHz	
50	DC 7.40V	0.864	0.638	0.545	0.378	2.5
40	DC 7.40V	0.352	0.876	0.581	0.836	
30	DC 7.40V	0.508	0.729	0.569	0.687	
20	DC 7.40V	0.517	0.988	0.359	0.739	
10	DC 7.40V	0.961	0.970	0.792	0.654	
0	DC 7.40V	0.672	0.839	0.639	0.636	
-10	DC 7.40V	0.873	0.591	0.539	0.734	
-20	DC 7.40V	0.652	0.971	0.760	0.381	
-30	DC 7.40V	0.623	0.716	0.742	0.848	
Result		Pass				

(2) Frequency stability versus input voltage (Battery endpoint is 6.29V) **-5W-12.5KHz**

Environment Temperature(°C)	Power (V)	Reference Frequency				Limit: ppm
		400.025MHz	453.225MHz	454.025MHz	479.975MHz	
50	DC 6.29V	0.929	0.825	0.735	0.663	2.5
40	DC 6.29V	0.436	0.931	0.700	0.560	
30	DC 6.29V	0.497	0.473	0.984	0.940	
20	DC 6.29V	0.752	0.620	0.894	0.379	
10	DC 6.29V	0.506	0.679	0.699	0.668	
0	DC 6.29V	0.603	0.541	0.321	0.406	
-10	DC 6.29V	0.552	0.424	0.960	0.914	
-20	DC 6.29V	0.698	0.777	0.441	0.497	
-30	DC 6.29V	0.440	0.541	0.461	0.799	
Result		Pass				

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(3) Frequency stability versus input voltage (Supply nominal voltage is DC 7.40V) **-1W-12.5KHz**

Environment Temperature(°C)	Power	Reference Frequency				Limit:
	(V)	400.025MHz	453.225MHz	454.025MHz	479.975MHz	ppm
50	DC 7.40V	0.681	0.998	0.639	0.751	2.5
40	DC 7.40V	0.642	0.649	0.527	0.793	
30	DC 7.40V	0.359	0.755	0.508	0.442	
20	DC 7.40V	0.300	0.752	0.831	0.682	
10	DC 7.40V	0.857	0.518	0.830	0.890	
0	DC 7.40V	0.536	0.643	0.652	0.444	
-10	DC 7.40V	0.966	0.790	0.694	0.521	
-20	DC 7.40V	0.684	0.620	0.870	0.809	
-30	DC 7.40V	0.585	0.973	1.000	0.314	
Result	Pass					

(4) Frequency stability versus input voltage (Battery endpoint is 6.29V) **-1W-12.5KHz**

Environment Temperature(°C)	Power	Reference Frequency				Limit:
	(V)	400.025MHz	453.225MHz	454.025MHz	479.975MHz	ppm
50	DC 6.29 V	0.300	0.909	0.868	0.372	2.5
40	DC 6.29 V	0.659	0.970	0.846	0.711	
30	DC 6.29 V	0.981	0.622	0.503	0.827	
20	DC 6.29 V	0.609	0.979	0.700	0.744	
10	DC 6.29 V	0.587	0.679	0.830	0.822	
0	DC 6.29 V	0.375	0.586	0.578	0.846	
-10	DC 6.29 V	0.569	0.642	0.676	0.830	
-20	DC 6.29 V	0.524	0.702	0.809	0.462	
-30	DC 6.29 V	0.859	0.751	0.974	0.320	
Result	Pass					

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Digital:
(1) Frequency stability versus input voltage (Supply nominal voltage is DC 7.40V) -5W-12.5KHz

Environment Temperature(°C)	Power (V)	Reference Frequency				Limit: ppm
		400.025MHz	453.225MHz	454.025MHz	479.975MHz	
50	DC 7.40V	0.647	0.362	0.473	0.616	2.5
40	DC 7.40V	0.472	0.372	0.598	0.537	
30	DC 7.40V	0.532	0.883	0.583	0.690	
20	DC 7.40V	0.391	0.435	0.356	0.749	
10	DC 7.40V	0.484	0.801	0.409	0.330	
0	DC 7.40V	0.559	0.404	0.342	0.322	
-10	DC 7.40V	0.417	0.672	0.694	0.577	
-20	DC 7.40V	0.570	0.407	0.998	0.442	
-30	DC 7.40V	0.823	0.513	0.467	0.355	
Result		Pass				

(2) Frequency stability versus input voltage (Battery endpoint is 6.29V) -5W-12.5KHz

Environment Temperature(°C)	Power (V)	Reference Frequency				Limit: ppm
		400.025MHz	453.225MHz	454.025MHz	479.975MHz	
50	DC 6.29V	0.581	0.578	0.696	1.026	2.5
40	DC 6.29V	0.767	0.538	0.576	0.666	
30	DC 6.29V	0.575	0.944	0.992	0.508	
20	DC 6.29V	0.837	0.391	0.893	1.042	
10	DC 6.29V	0.932	0.769	0.995	0.563	
0	DC 6.29V	0.804	0.468	0.713	0.717	
-10	DC 6.29V	0.972	0.643	1.000	0.953	
-20	DC 6.29V	0.667	0.575	0.980	0.576	
-30	DC 6.29V	0.875	0.477	1.049	1.029	
Result		Pass				

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(3) Frequency stability versus input voltage (Supply nominal voltage is DC 7.40V)-1W-12.5KHz

Environment Temperature(°C)	Power	Reference Frequency				Limit:
	(V)	400.025MHz	453.225MHz	454.025MHz	479.975MHz	ppm
50	DC 7.40V	0.647	0.398	0.473	0.616	2.5
40	DC 7.40V	0.472	0.710	0.598	0.537	
30	DC 7.40V	0.532	0.699	0.583	0.690	
20	DC 7.40V	0.391	0.508	0.356	0.749	
10	DC 7.40V	0.484	0.541	0.409	0.330	
0	DC 7.40V	0.559	0.349	0.342	0.322	
-10	DC 7.40V	0.417	0.974	0.694	0.577	
-20	DC 7.40V	0.570	0.440	0.998	0.442	
-30	DC 7.40V	0.823	0.552	0.467	0.355	
Result	Pass					

(4) Frequency stability versus input voltage (Battery endpoint is 6.29V) -1W-12.5KHz

Environment Temperature(°C)	Power	Reference Frequency				Limit:
	(V)	400.025MHz	453.225MHz	454.025MHz	479.975MHz	ppm
50	DC 6.29 V	0.752	0.820	0.907	0.744	2.5
40	DC 6.29 V	0.609	0.901	0.947	0.691	
30	DC 6.29 V	0.936	0.703	0.575	1.041	
20	DC 6.29 V	0.836	0.312	1.026	0.763	
10	DC 6.29 V	0.513	0.342	0.616	0.887	
0	DC 6.29 V	0.821	0.830	0.793	0.501	
-10	DC 6.29 V	1.075	0.932	0.729	0.536	
-20	DC 6.29 V	0.741	0.722	0.983	0.921	
-30	DC 6.29 V	0.683	0.690	1.085	0.732	
Result	Pass					

Note: 1. Battery terminal voltage is declared and specified by the manufacturer.
2. All test values are in "ppm"

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7. EMISSION BANDWIDTH

7.1 PROVISIONS APPLICABLE

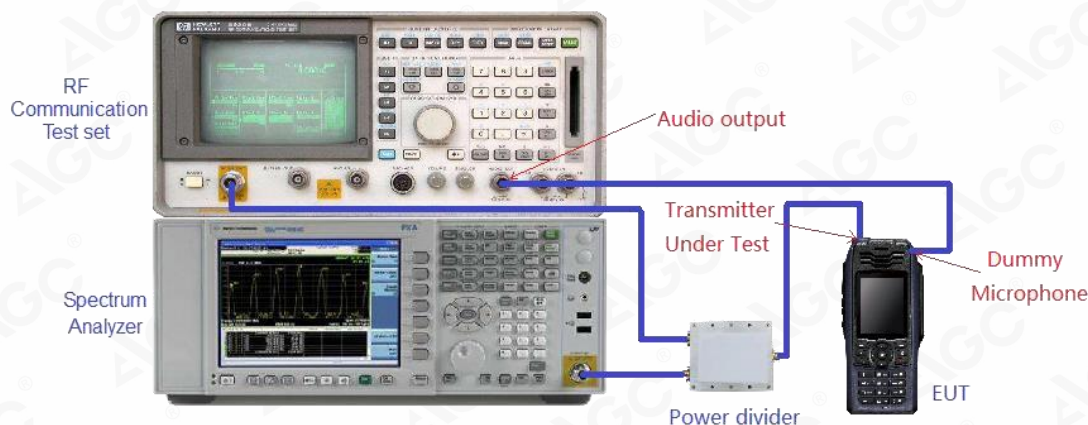
FCC Part 90.209 & FCC Part 22.359& FCC Part 2.1049:

The authorized bandwidth shall be 11.25 KHz for 12.5 KHz channel separation and 6 KHz for 6.25 KHz channel separation.

7.2 MEASUREMENT PROCEDURE

- 1). The EUT was placed on a turn table which is 0.8m above ground plane.
- 2). The EUT was modulated by 2.5 KHz Sine wave audio signal, The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz (12.5 kHz channel spacing).
- 3). Set SPA Center Frequency = fundamental frequency, RBW=100Hz.VBW= 300 Hz, Span =50 KHz.
- 4). Set SPA Max hold. Mark peak, -26 dB.

7.3 TEST SETUP BLOCK DIAGRAM



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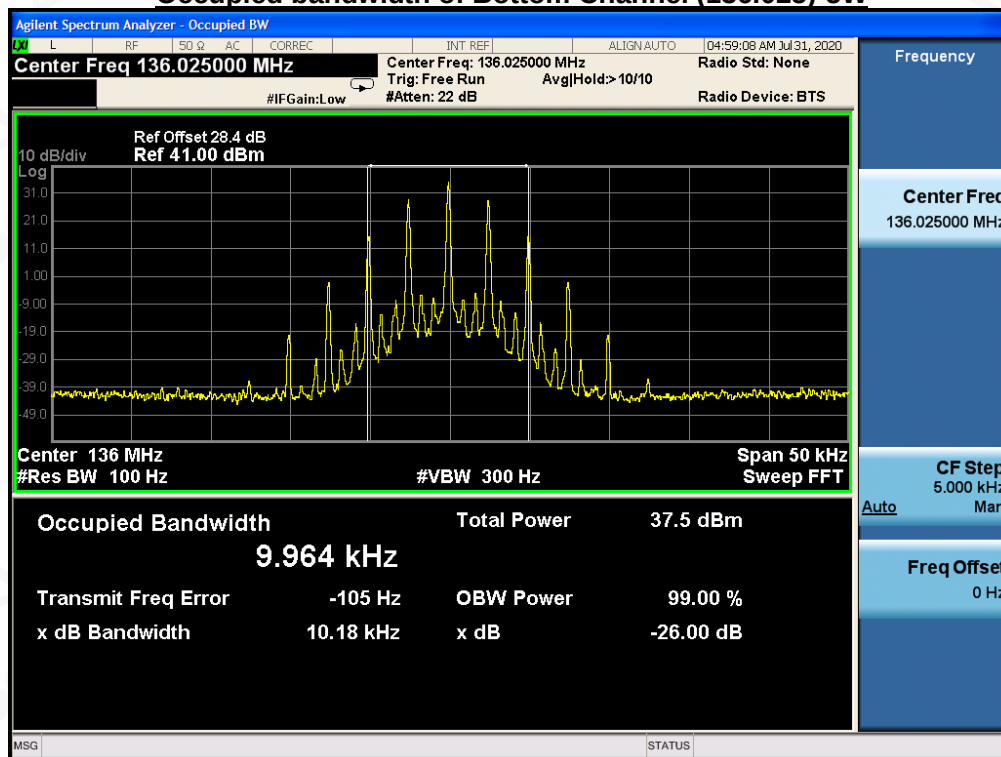
7.4 MEASUREMENT RESULT

VHF:

Analog: 12.5KHz

Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Limits	Result
136.025MHz	9.964 KHz	10.18 KHz	11.25 KHz	Pass
151.850MHz	9.960 KHz	10.19 KHz	11.25 KHz	Pass
155.025MHz	9.960 KHz	10.19 KHz	11.25 KHz	Pass
161.610MHz	9.959 KHz	10.19 KHz	11.25 KHz	Pass
173.975MHz	9.963 KHz	10.18KHz	11.25 KHz	Pass

Occupied bandwidth of Bottom Channel (136.025)-5W



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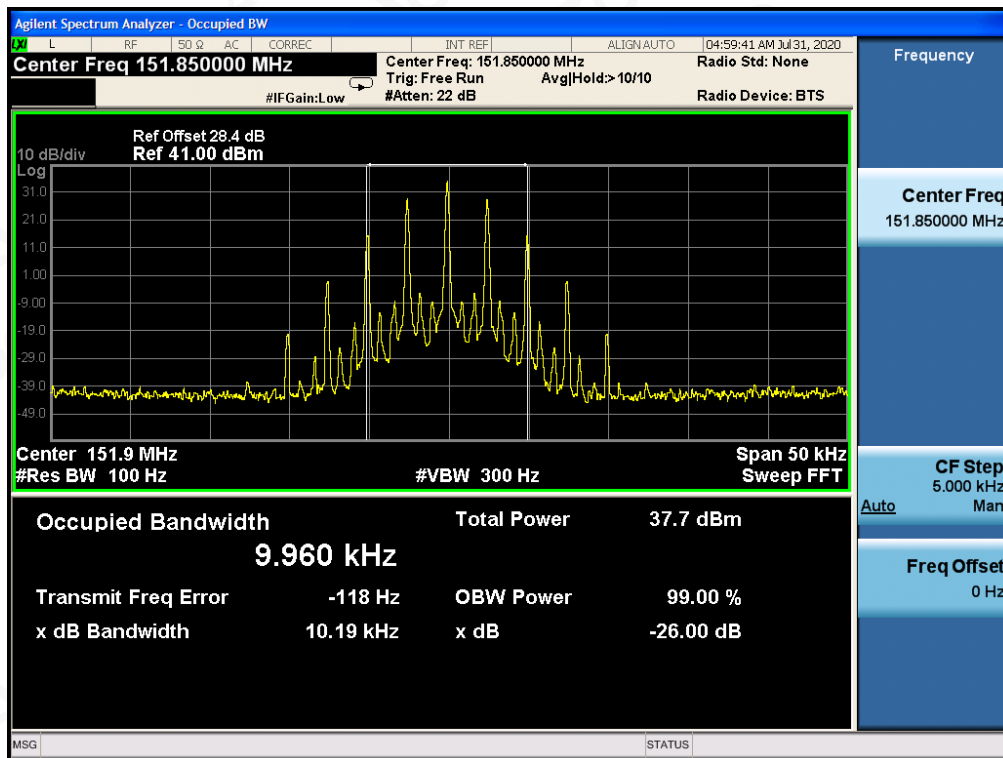
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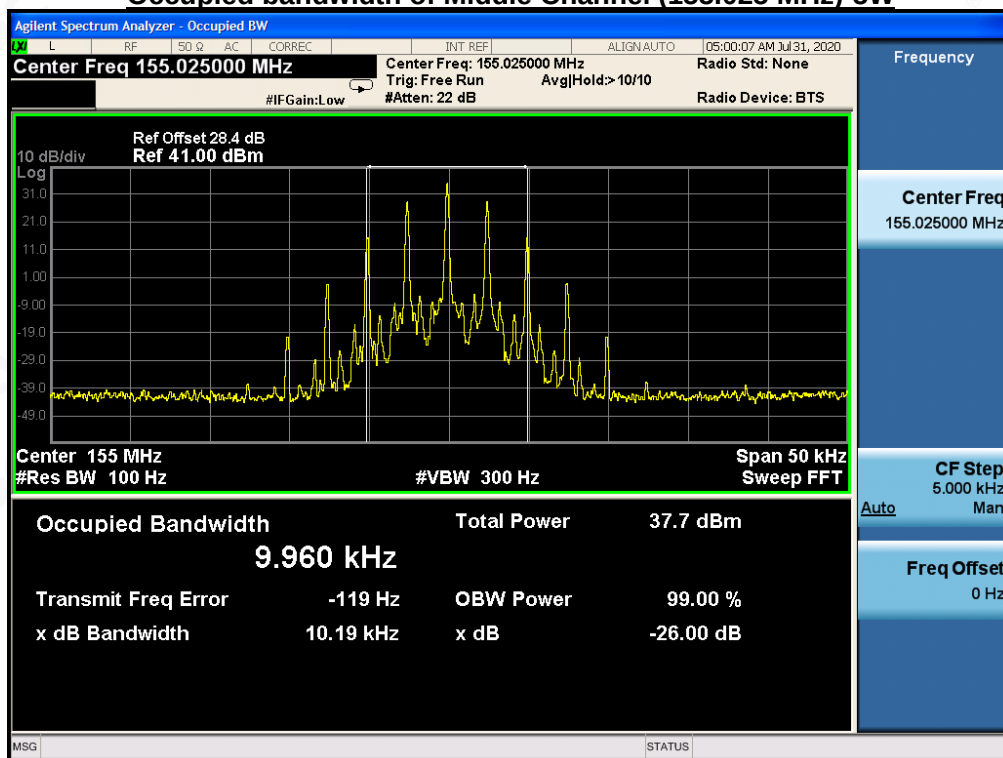
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Occupied bandwidth of Middle Channel (151.850 MHz)-5W



Occupied bandwidth of Middle Channel (155.025 MHz)-5W

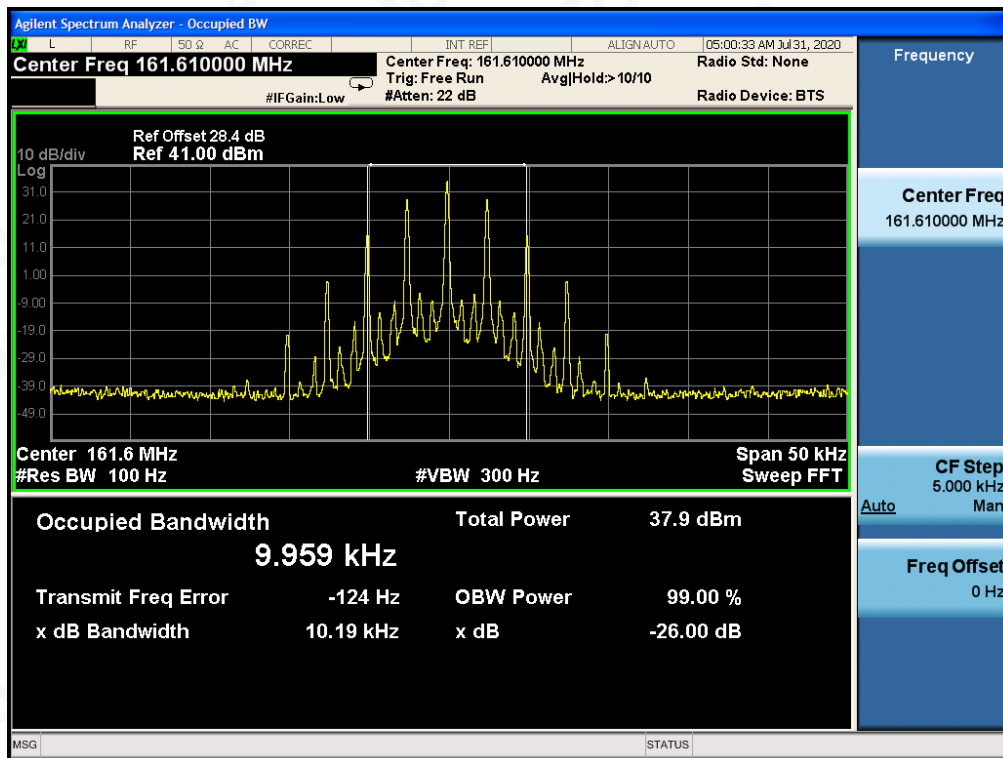


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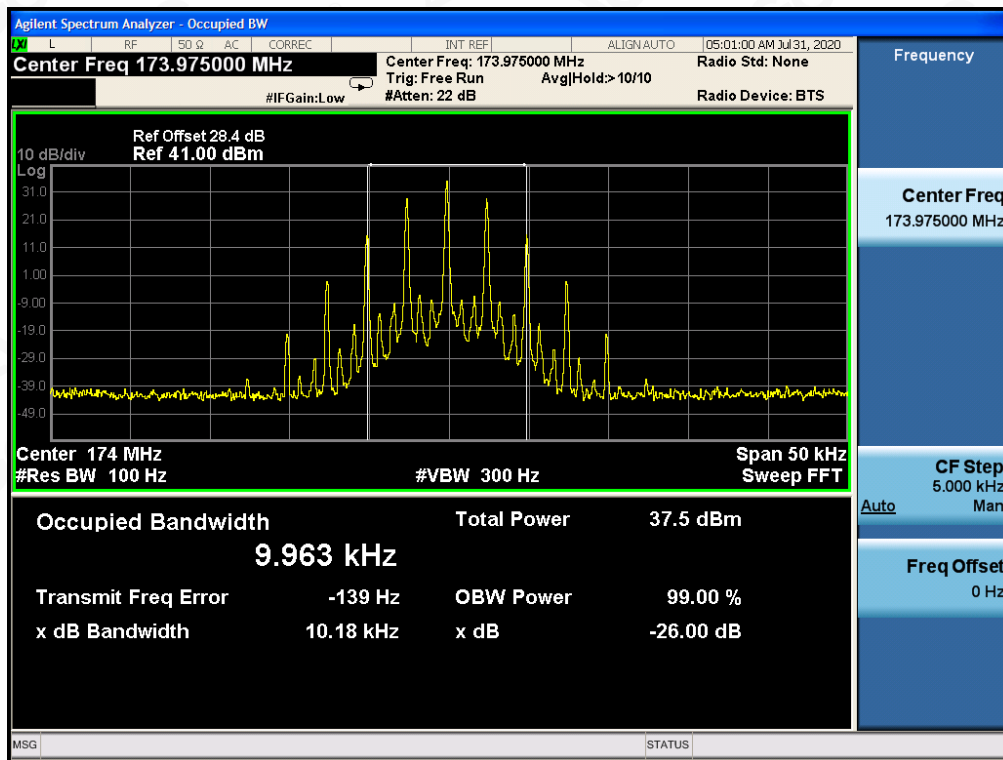
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Occupied bandwidth of Middle Channel (161.610 MHz)-5W



Occupied bandwidth of Top Channel (173.975 MHz)-5W



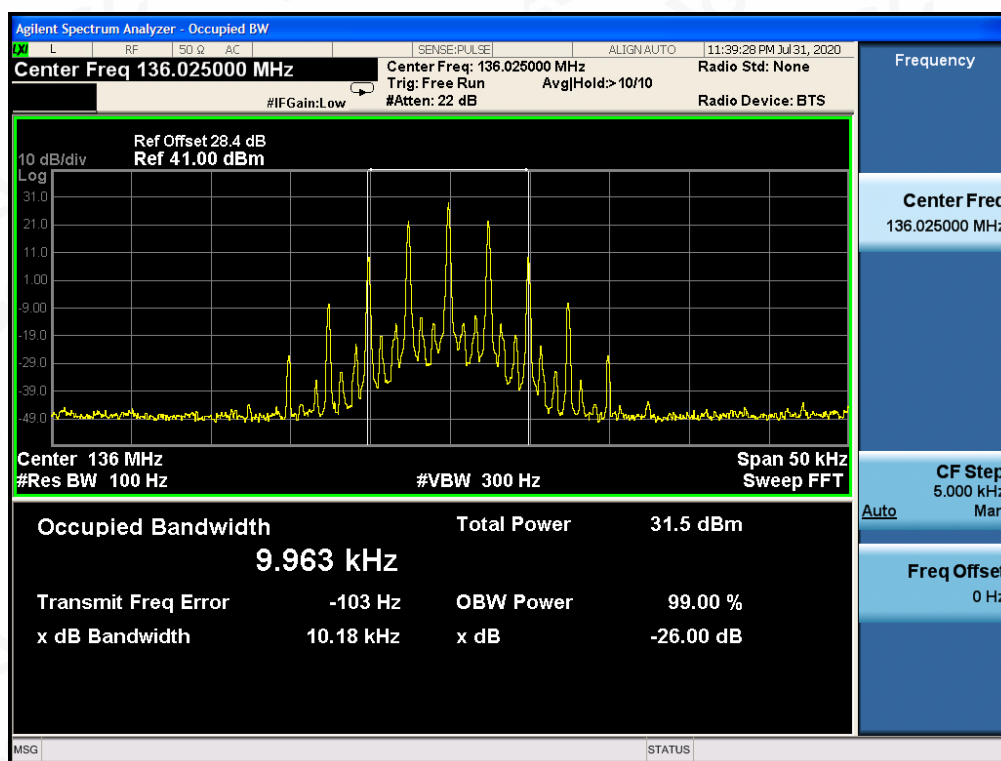
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Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Limits	Result
136.025MHz	9.963 KHz	10.18 KHz	11.25 KHz	Pass
151.850MHz	9.962 KHz	10.18 KHz	11.25 KHz	Pass
155.025MHz	9.962 KHz	10.18 KHz	11.25 KHz	Pass
161.610MHz	9.963 KHz	10.17 KHz	11.25 KHz	Pass
173.975MHz	9.963 KHz	10.18 KHz	11.25 KHz	Pass

Occupied bandwidth of Bottom Channel (136.025)-1W

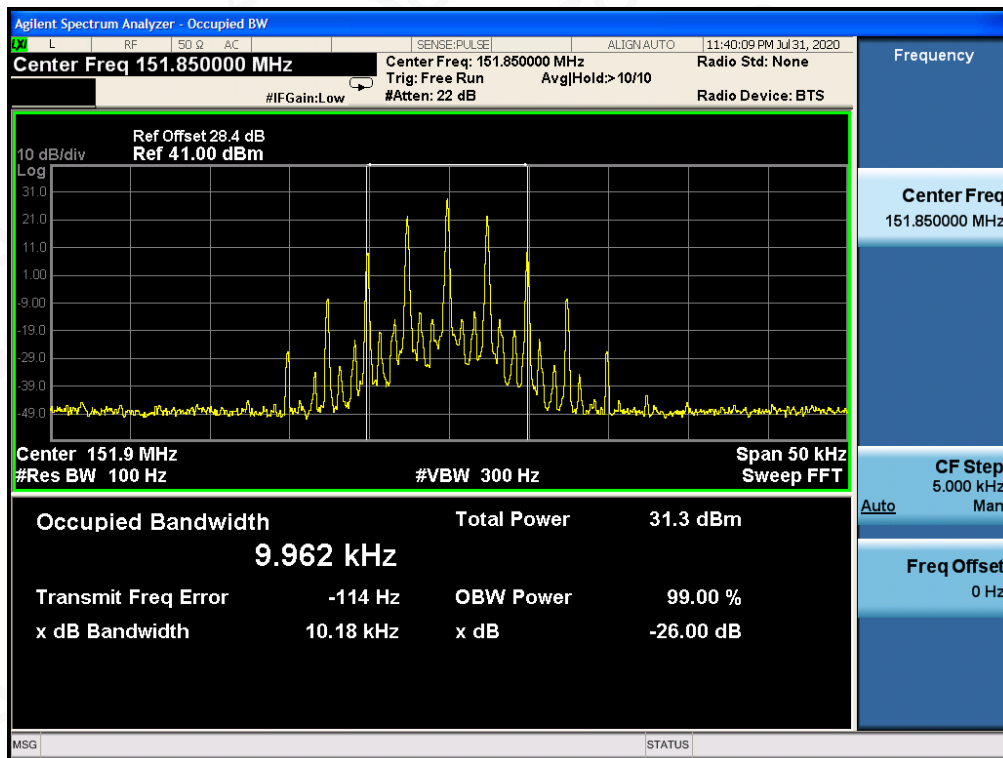


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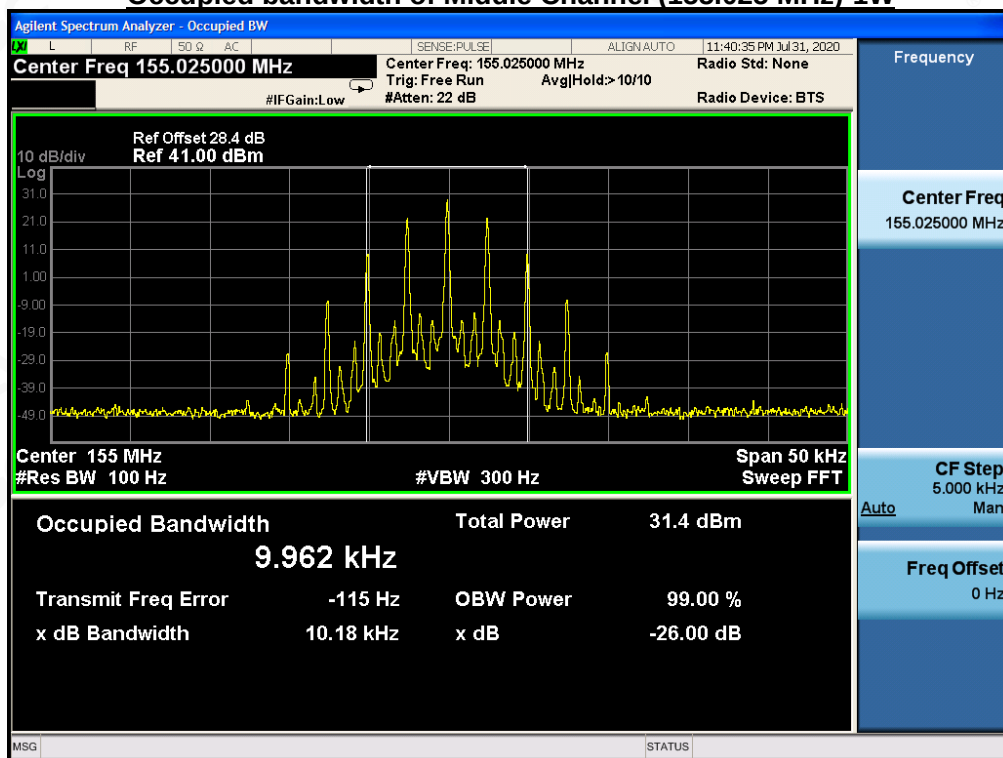
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Occupied bandwidth of Middle Channel (151.850 MHz)-1W



Occupied bandwidth of Middle Channel (155.025 MHz)-1W

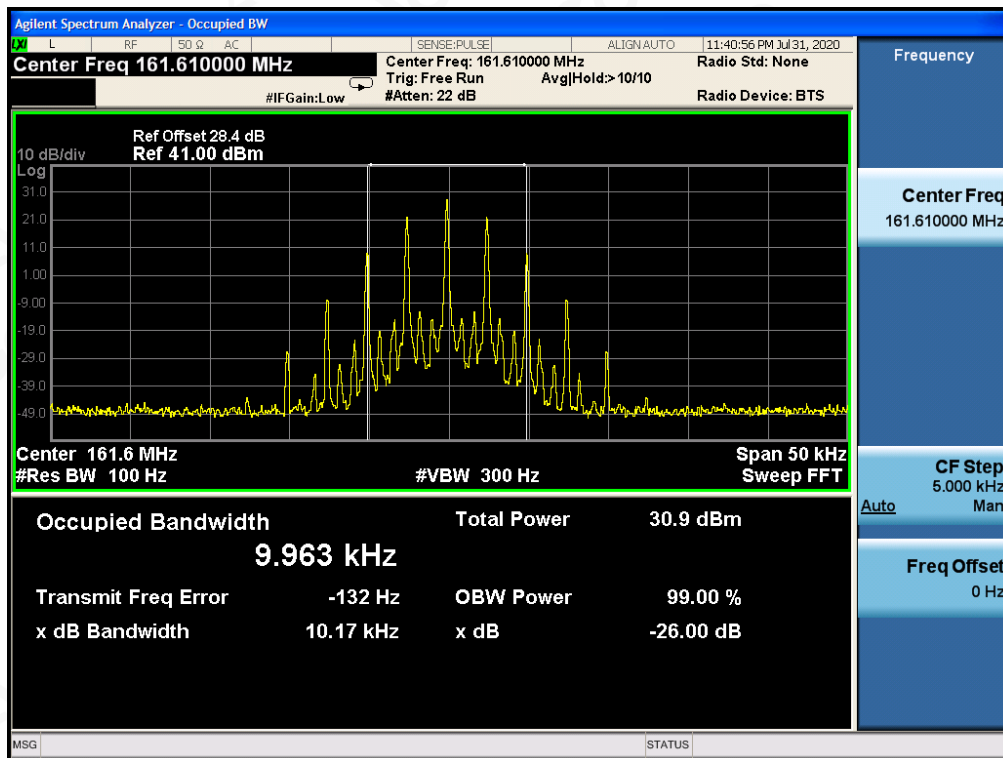


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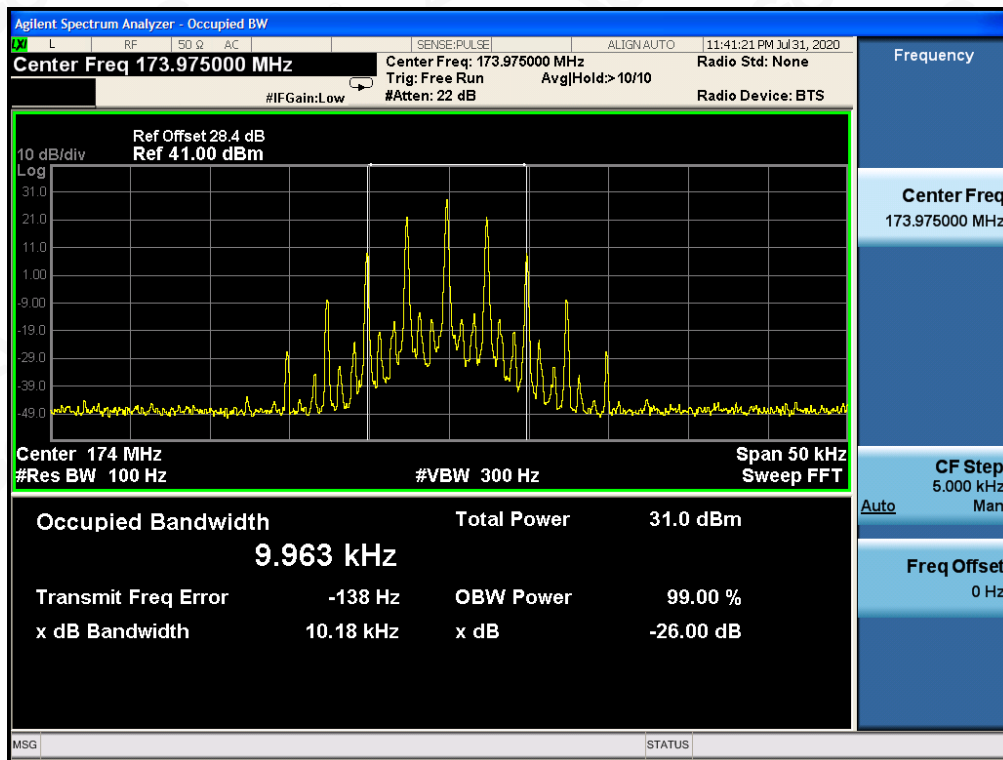
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Occupied bandwidth of Middle Channel (161.610 MHz)-1W



Occupied bandwidth of Top Channel (173.975 MHz)-1W



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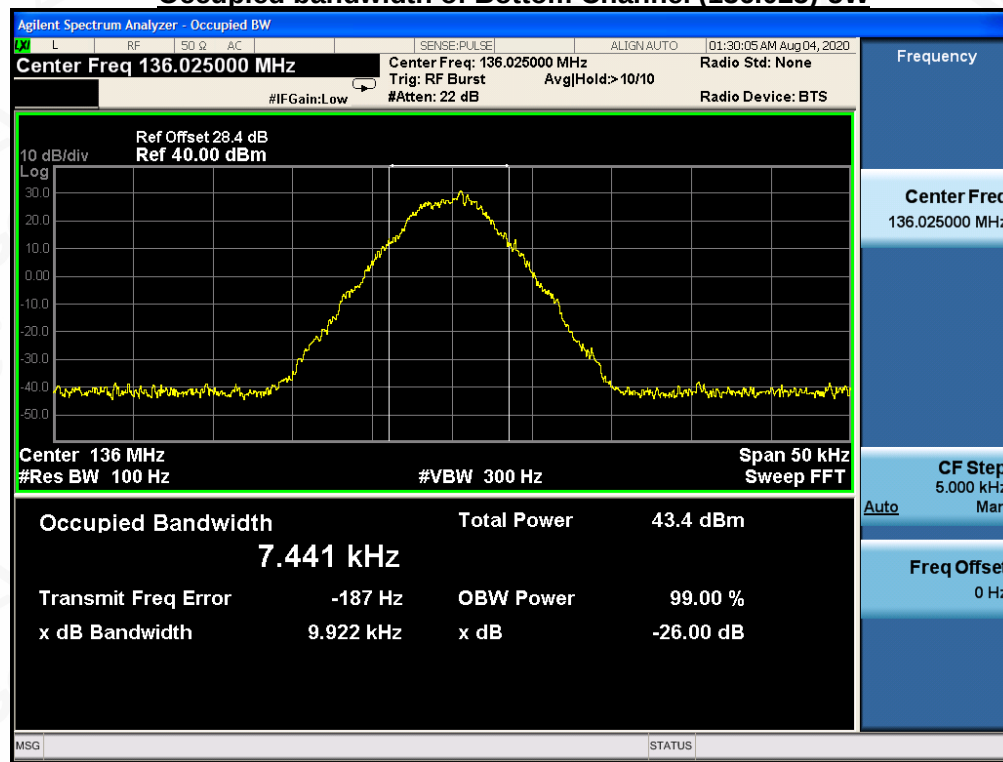
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**Digital:
VHF:
TEST RESULTS**

Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Limits	Result
136.025MHz	7.441 KHz	9.922 KHz	11.25 KHz	Pass
151.850MHz	7.595 KHz	9.890 KHz	11.25 KHz	Pass
155.025MHz	7.630 KHz	9.885 KHz	11.25 KHz	Pass
161.610MHz	7.629 KHz	9.998 KHz	11.25 KHz	Pass
173.975MHz	7.507 KHz	9.797 KHz	11.25 KHz	Pass

Occupied bandwidth of Bottom Channel (136.025)-5W

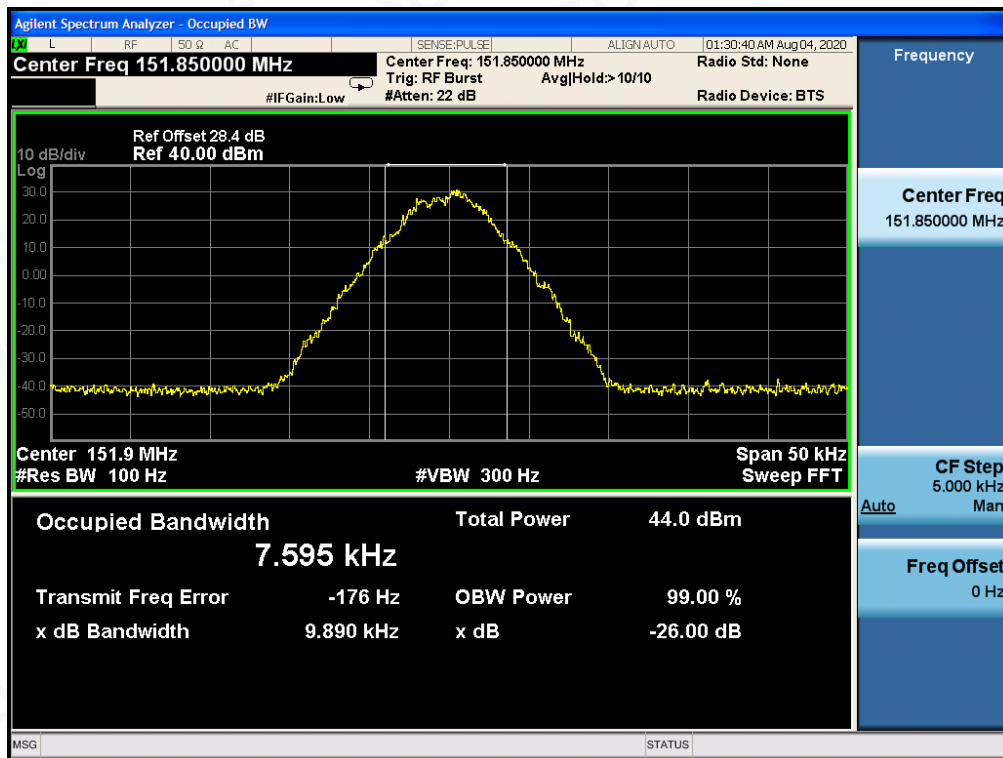


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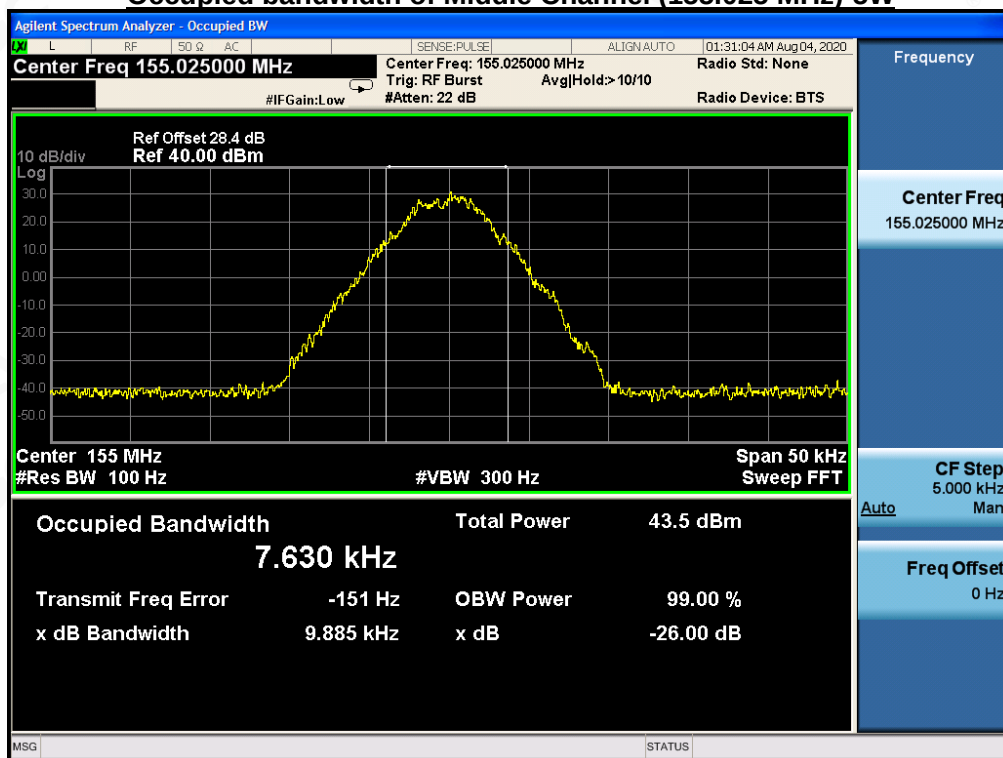
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Occupied bandwidth of Middle Channel (151.850 MHz)-5W



Occupied bandwidth of Middle Channel (155.025 MHz)-5W

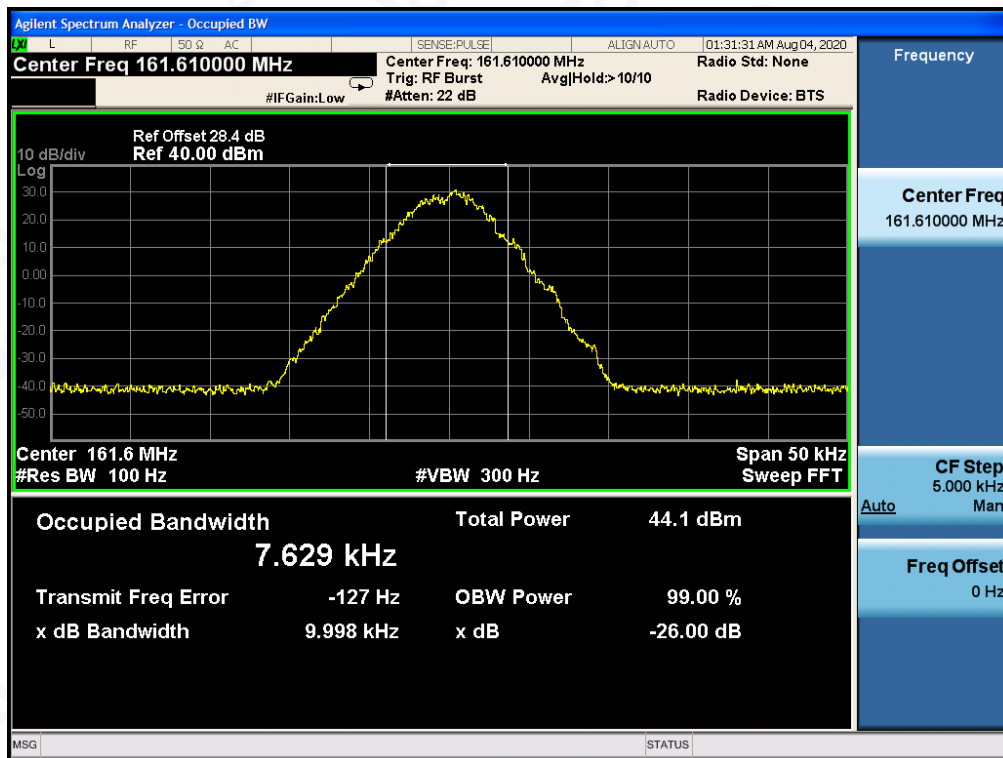


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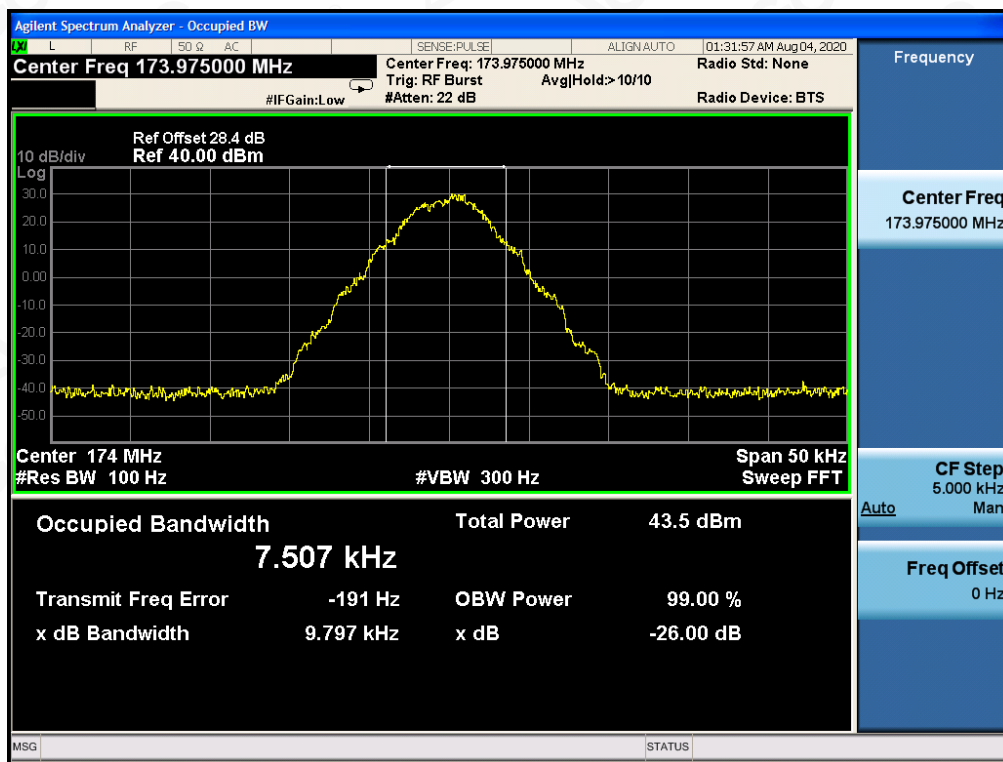
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Occupied bandwidth of Middle Channel (161.610 MHz)-5W



Occupied bandwidth of Top Channel (173.975 MHz)-5W



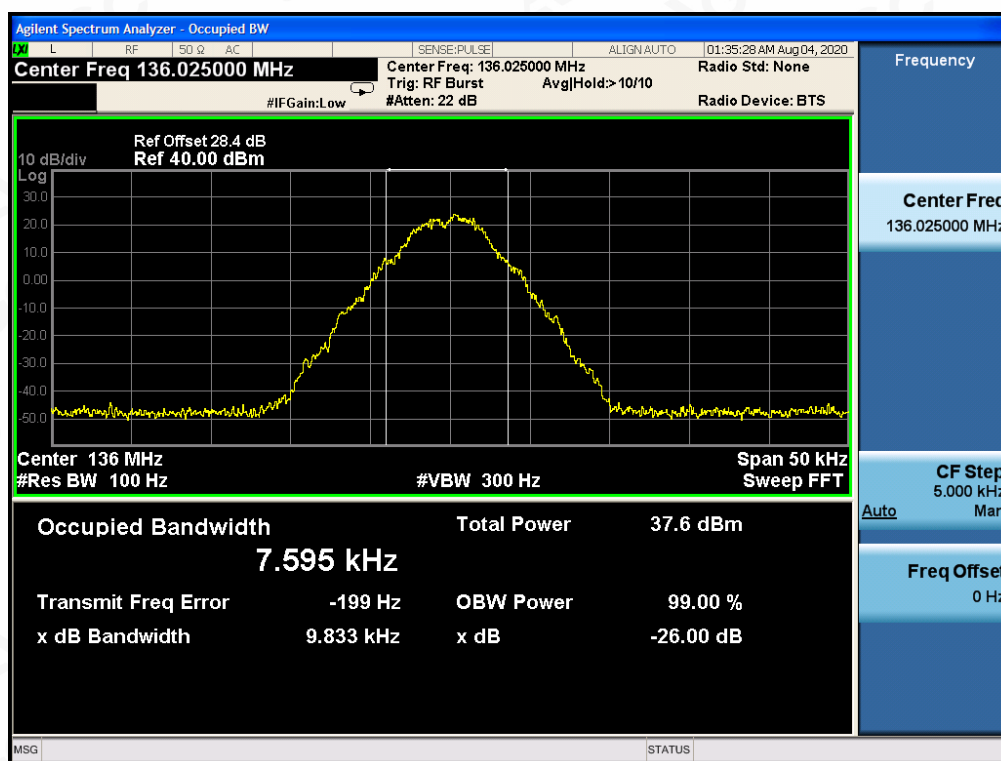
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Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Limits	Result
136.025MHz	7.595 KHz	9.833 KHz	11.25 KHz	Pass
151.850MHz	7.668 KHz	9.743 KHz	11.25 KHz	Pass
155.025MHz	7.734 KHz	9.717 KHz	11.25 KHz	Pass
161.610MHz	7.453 KHz	9.556 KHz	11.25 KHz	Pass
173.975MHz	7.599 KHz	10.25 KHz	11.25 KHz	Pass

Occupied bandwidth of Bottom Channel (136.025)-1W

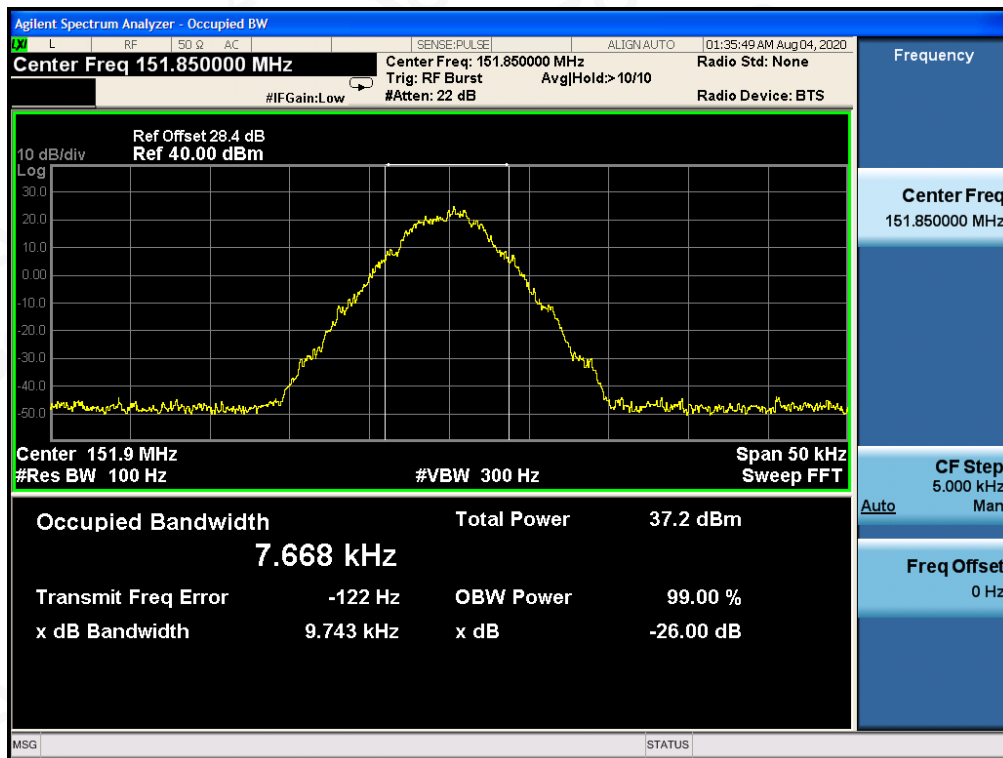


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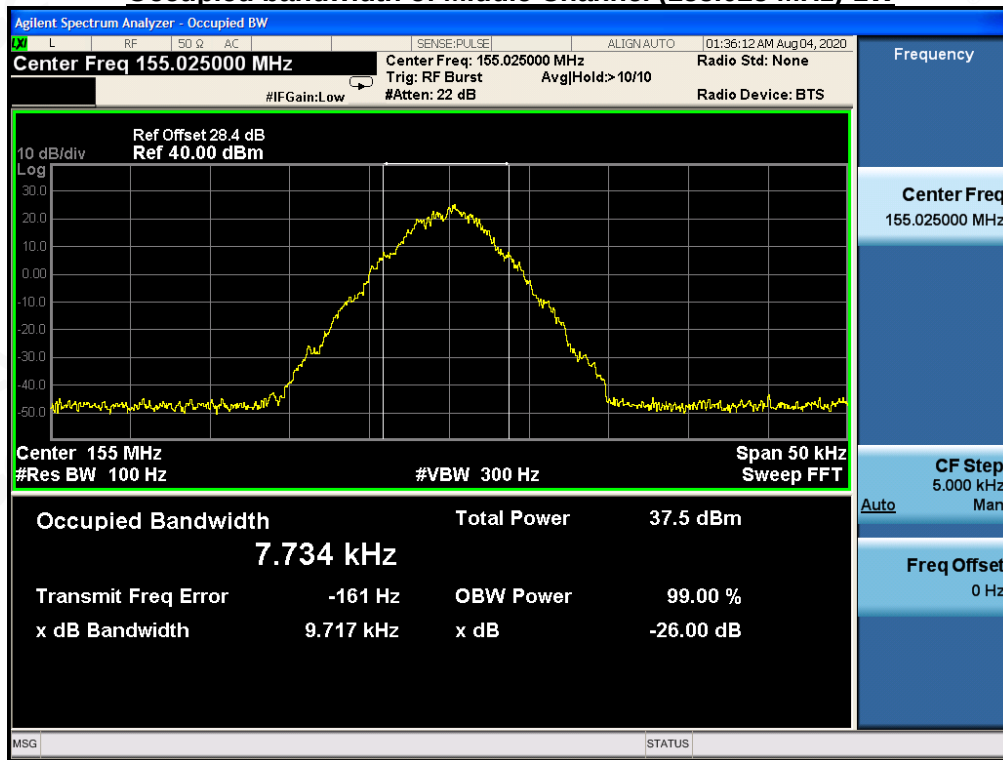
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Occupied bandwidth of Middle Channel (151.850 MHz)-1W



Occupied bandwidth of Middle Channel (155.025 MHz)-1W

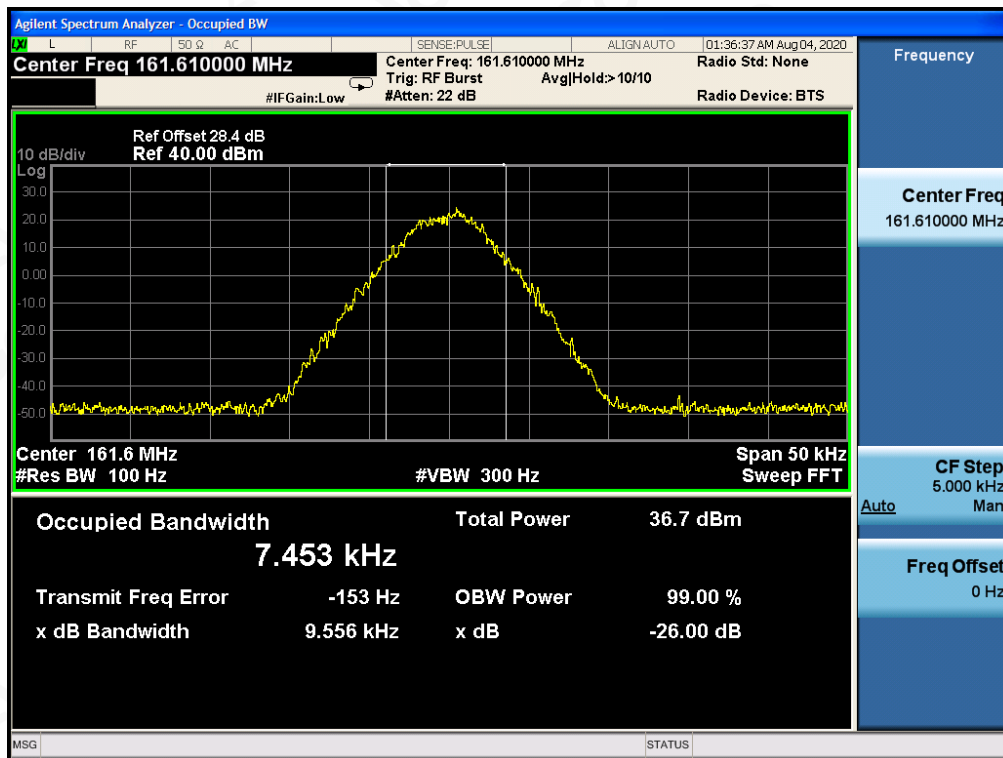


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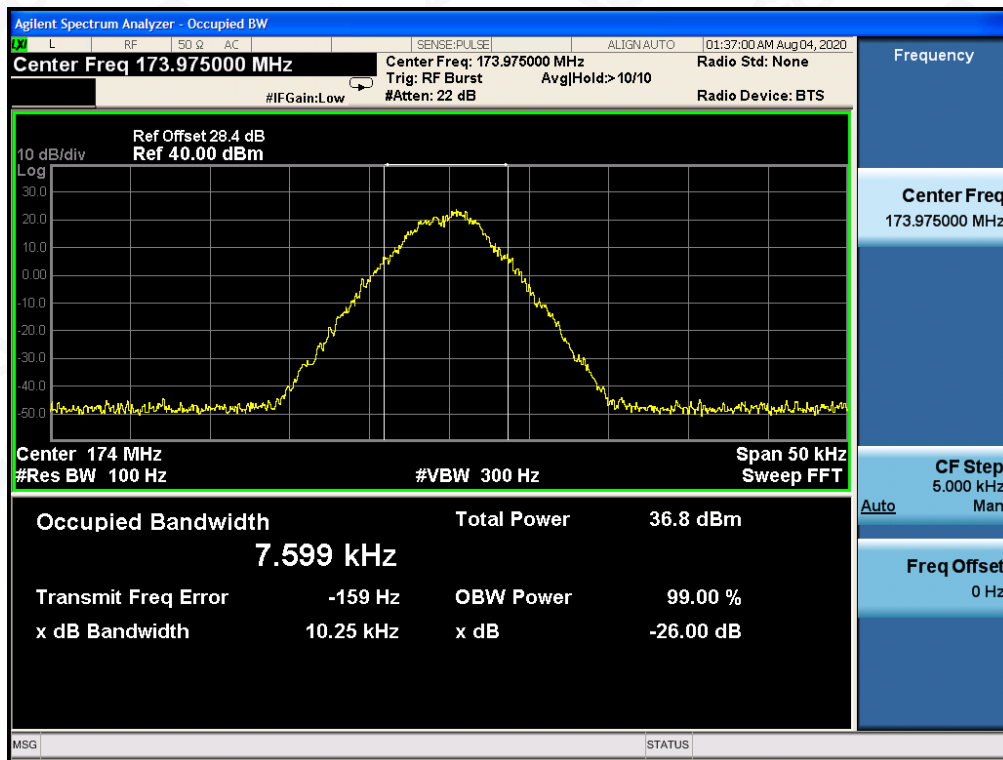
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Occupied bandwidth of Middle Channel (161.610 MHz)-1W



Occupied bandwidth of Top Channel (173.975 MHz)-1W



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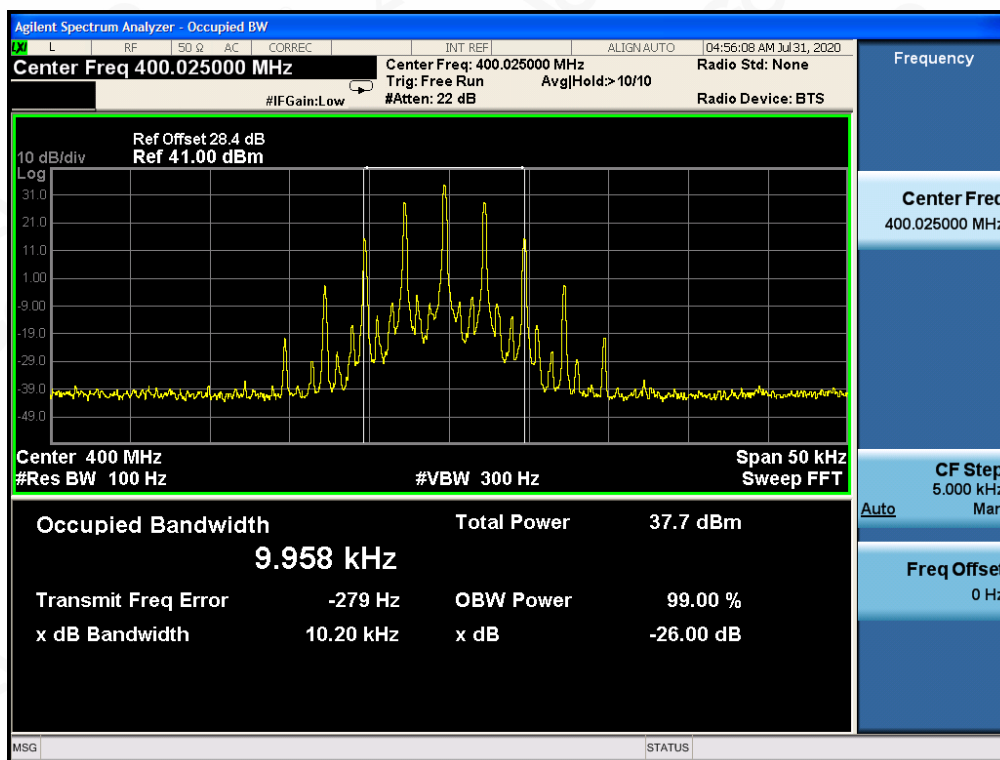
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UHF:
Analog:

Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Limits	Result
400.025MHz	9.958 KHz	10.20 KHz	KHz	Pass
453.225MHz	9.951 KHz	10.22 KHz	KHz	Pass
454.025MHz	9.951 KHz	10.21 KHz	KHz	Pass
479.975MHz	9.950 KHz	10.22 KHz	KHz	Pass

Occupied bandwidth of Bottom Channel (400.025MHz)-5W

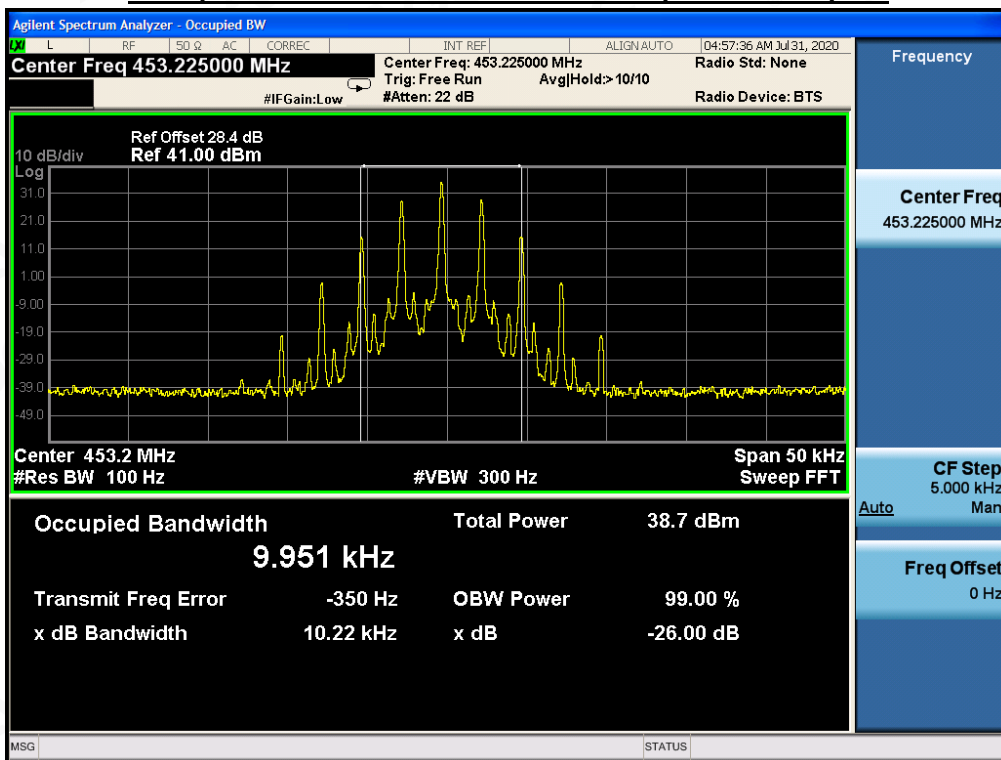


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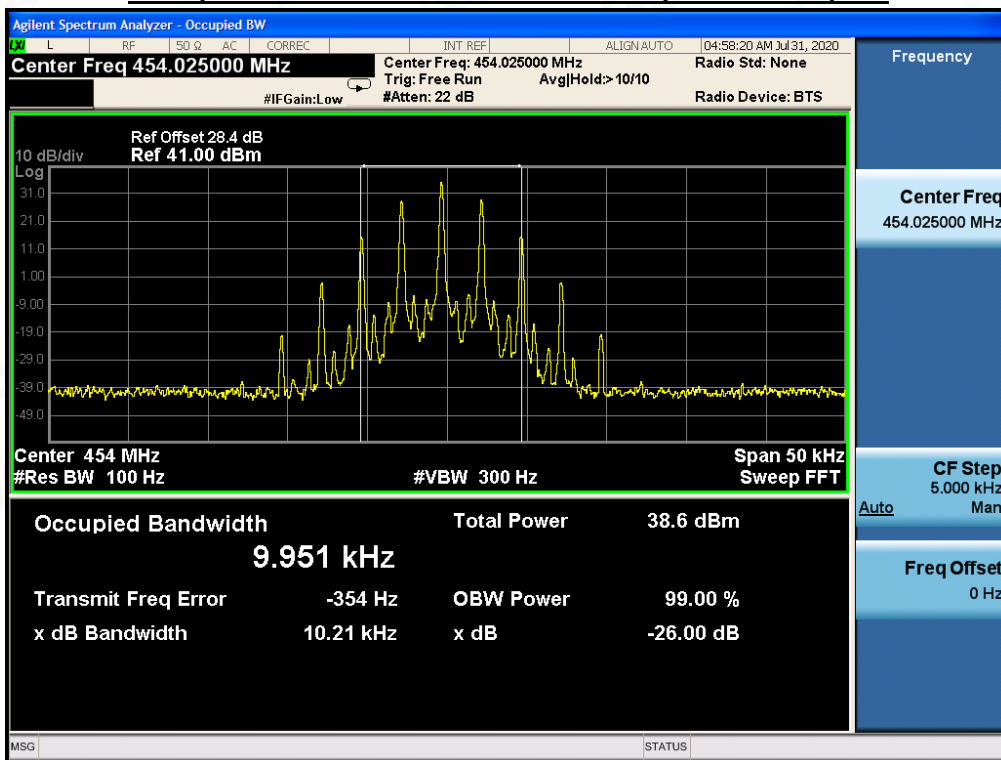
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Occupied bandwidth of Middle Channel (453.225MHz)-5W



Occupied bandwidth of Middle Channel (454.025MHz)-5W

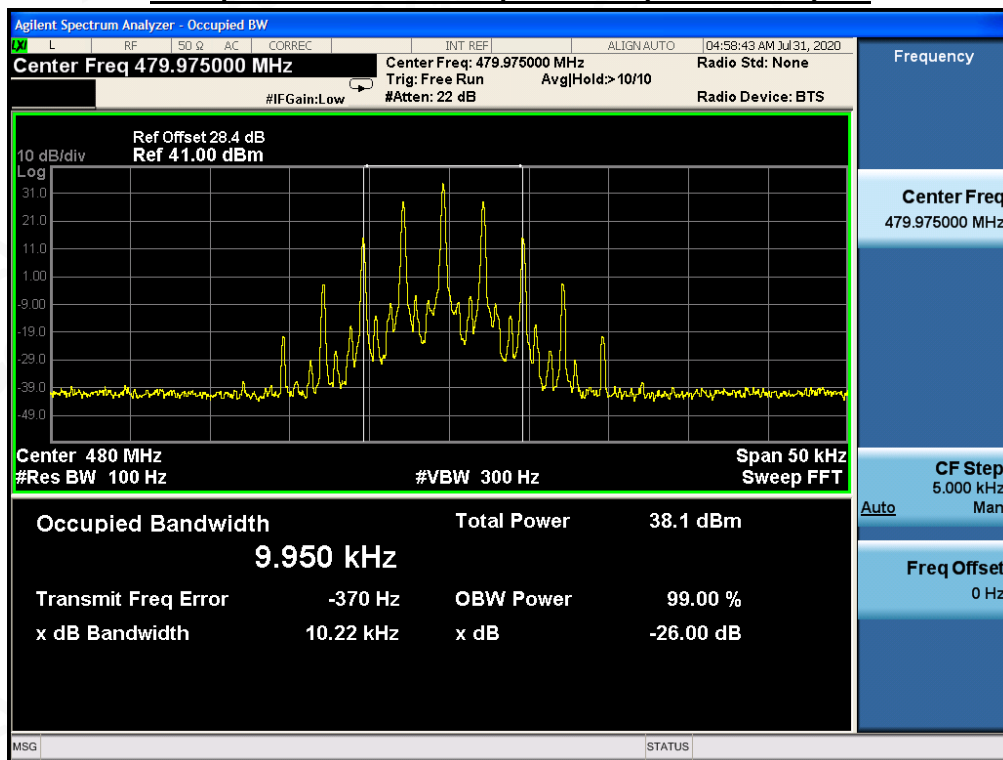


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Occupied bandwidth of Top Channel (479.975MHz)-5W



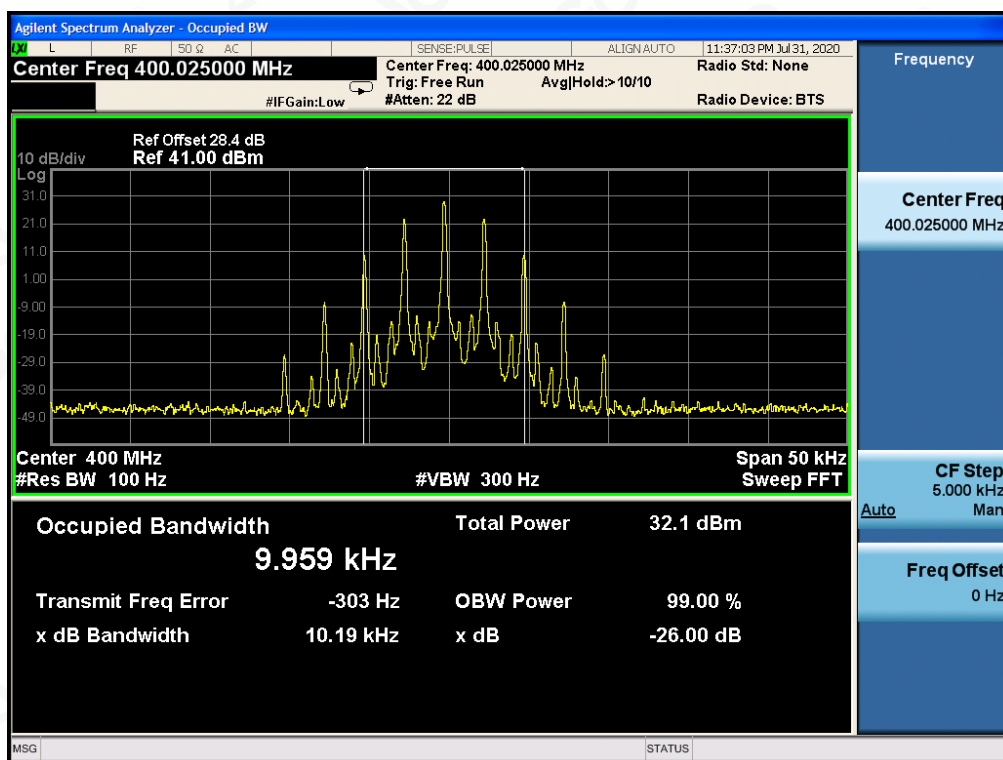
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Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Limits	Result
400.025MHz	9.959 KHz	10.19 KHz	KHz	Pass
453.225MHz	9.955 KHz	10.20 KHz	KHz	Pass
454.025MHz	9.952 KHz	10.21 KHz	KHz	Pass
479.975MHz	9.956 KHz	10.19 KHz	KHz	Pass

Occupied bandwidth of Bottom Channel (400.025MHz)-1W

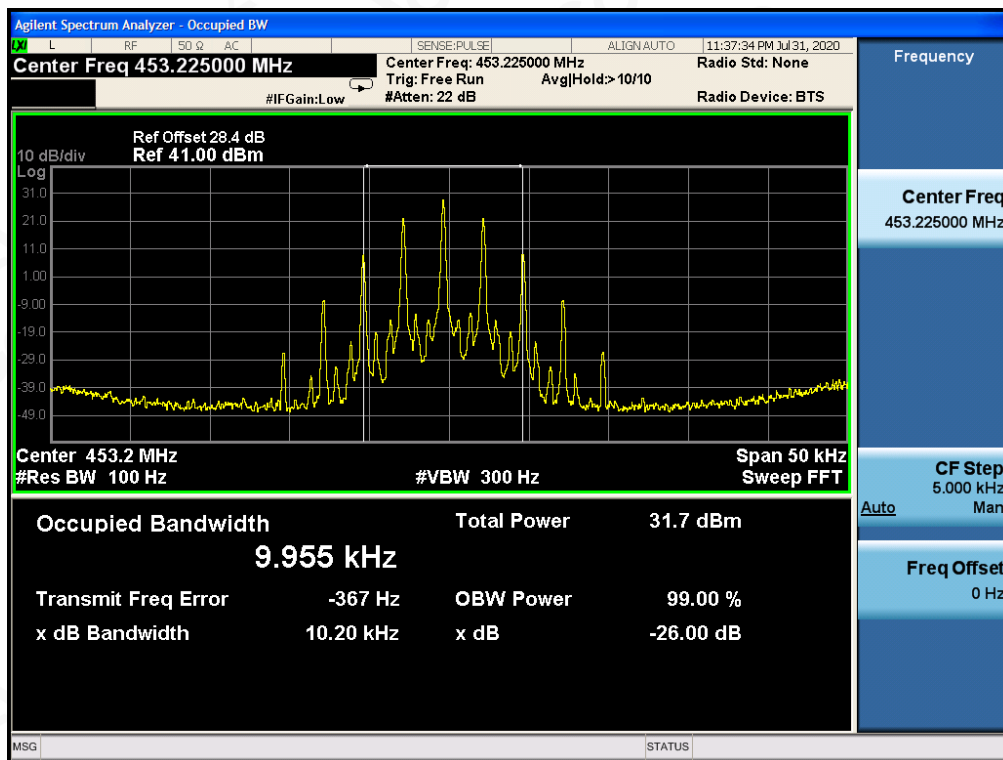


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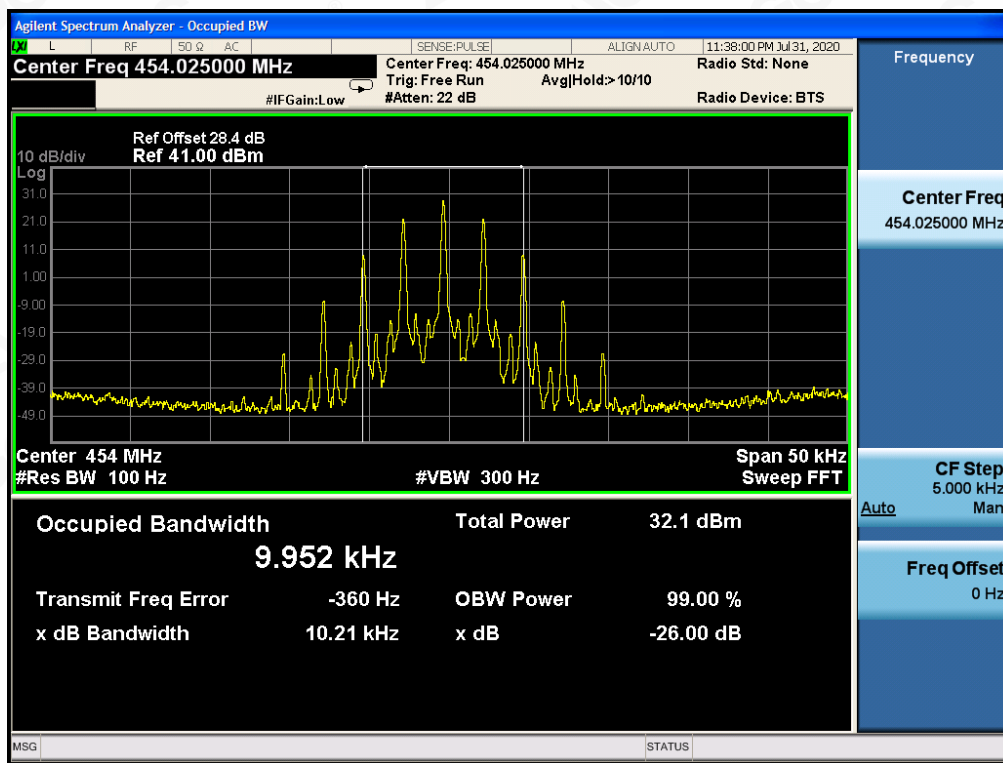
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Occupied bandwidth of Middle Channel (453.225MHz)-1W



Occupied bandwidth of Middle Channel (454.025MHz)-1W

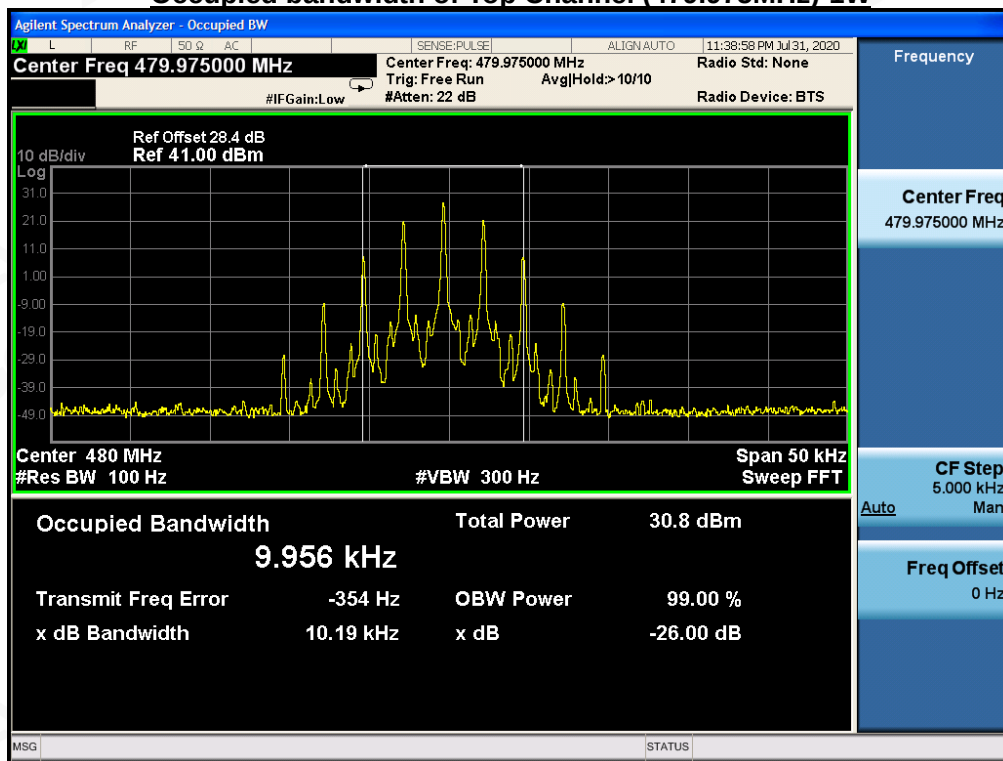


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Occupied bandwidth of Top Channel (479.975MHz)-1W



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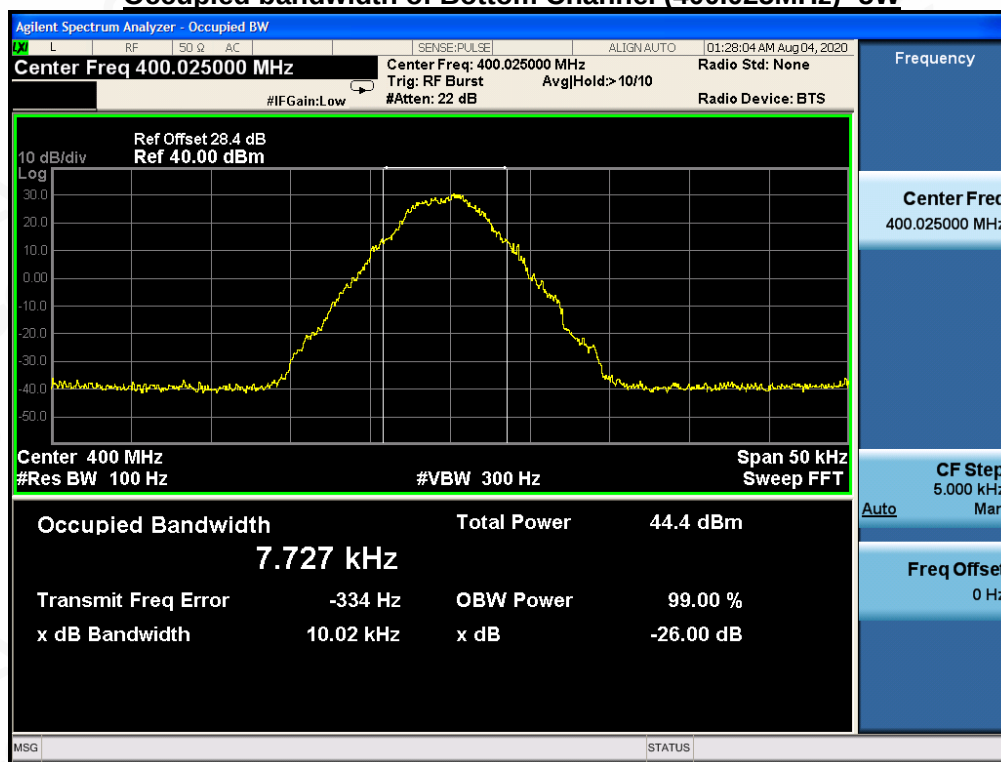
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Digital:
UHF:
TEST RESULTS

Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Limits	Result
400.025MHz	7.727 KHz	10.02 KHz	KHz	Pass
453.225MHz	7.749 KHz	9.865 KHz	KHz	Pass
454.025MHz	7.615 KHz	9.742 KHz	KHz	Pass
479.975MHz	7.718 KHz	10.15 KHz	KHz	Pass

Occupied bandwidth of Bottom Channel (400.025MHz) -5W

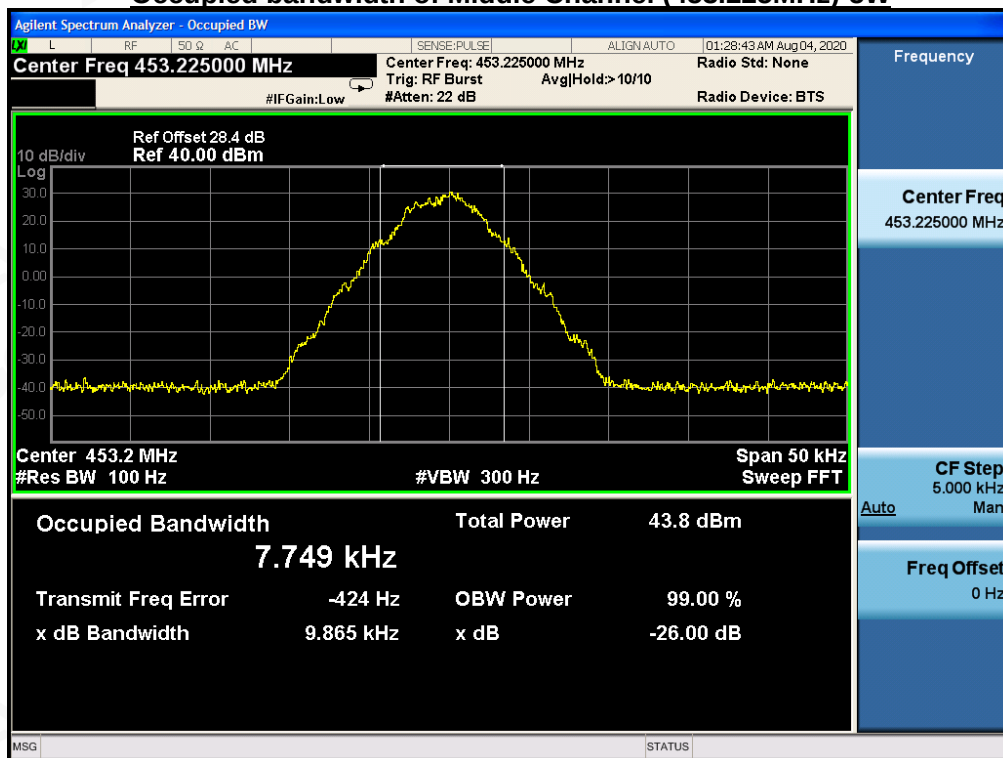


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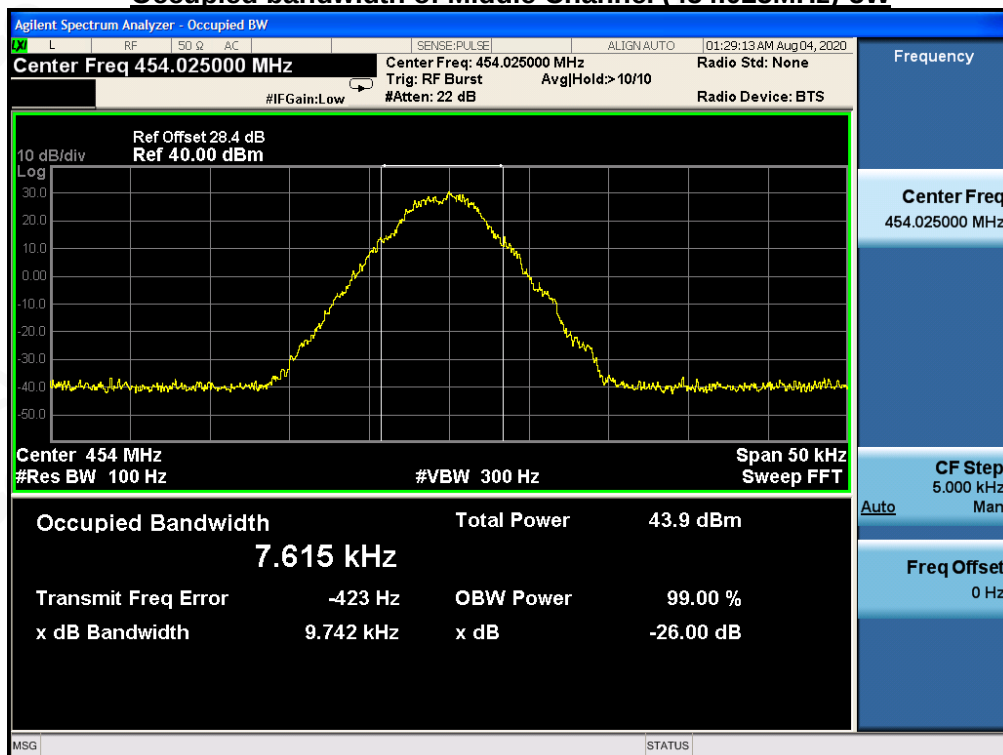
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Occupied bandwidth of Middle Channel (453.225MHz)-5W



Occupied bandwidth of Middle Channel (454.025MHz)-5W

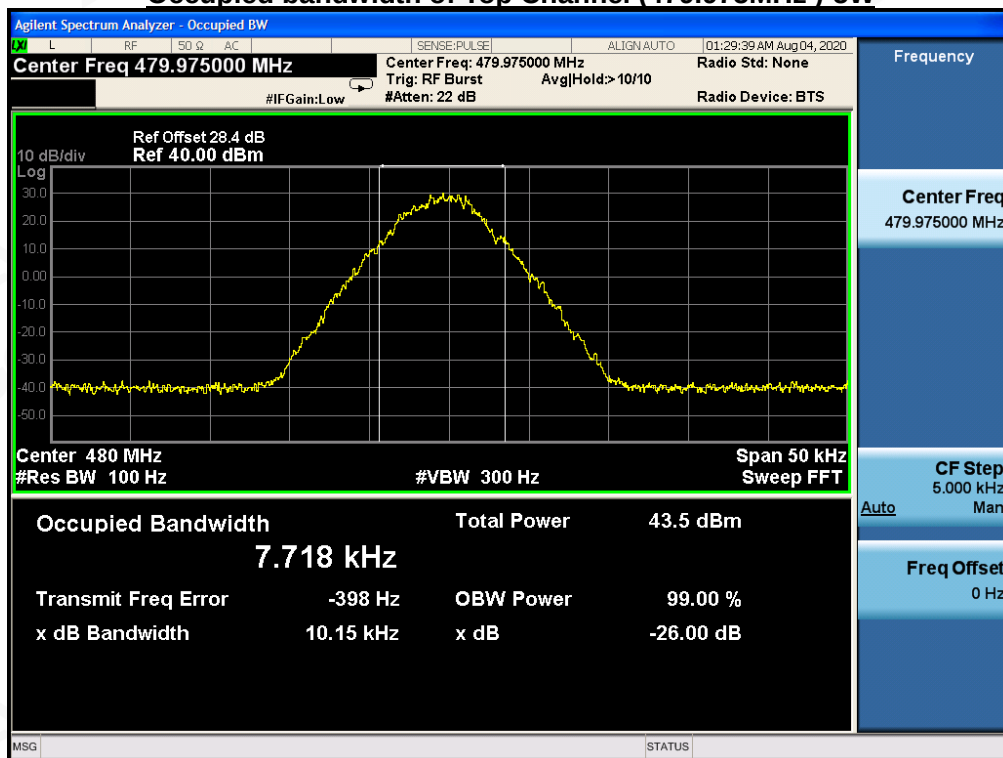


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Occupied bandwidth of Top Channel (479.975MHz)-5W



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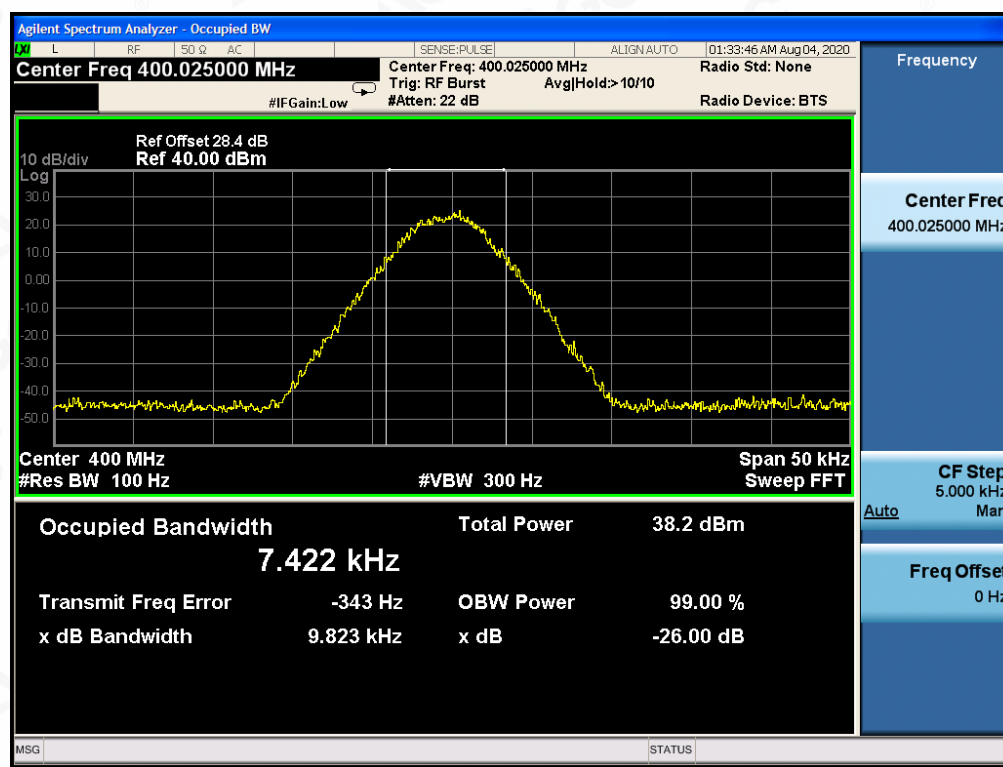
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TEST RESULTS

Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Limits	Result
400.025MHz	7.422 KHz	9.823 KHz	KHz	Pass
453.225MHz	7.408 KHz	9.871 KHz	KHz	Pass
454.025MHz	7.801 KHz	9.960 KHz	KHz	Pass
479.975MHz	7.426 KHz	9.913 KHz	KHz	Pass

Occupied bandwidth of Bottom Channel (400.025MHz)-1W



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