
FCC Part 90 Rules Test Report

Report No.: AGC02931200702FE10

FCC ID : PODTH-UVF9
PRODUCT DESIGNATION : Two-way Radio
BRAND NAME : TYT
MODEL NAME : TH-UVF9, TH-UVF8
APPLICANT : TYT ELECTRONICS CO., LTD
DATE OF ISSUE : Jul 23, 2020
STANDARD(S) : FCC Part 90 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	/	Jul. 23, 2020	Valid	Class II Permissive Change

Note: The original test report Ref. No. (AGC092120801-2F2) (dated 2013-03-27), was modified on 2020-07-23 to include the following changes and additions for:

- Updated serial model name.
- Update the appearance color of the main test and series
- Delete DTMF module & vibration motor.
- Updated battery capacity;
- Replacement antenna base & antenna connector;
- Increase low power 1W;
- Updated Hardware version and software version;

For the above described changes, update all evaluation tests and data.



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1. VERIFICATION OF COMPLIANCE

Applicant:	TYT ELECTRONICS CO., LTD
Address	Block 39-1, Optoelectronics-information industry base, Nan'an, Quanzhou, Fujian, China.
Manufacturer:	TYT ELECTRONICS CO., LTD
Address	Block 39-1, Optoelectronics-information industry base, Nan'an, Quanzhou, Fujian, China.
Factory	TYT ELECTRONICS CO., LTD
Address	Block 39-1, Optoelectronics-information industry base, Nan'an, Quanzhou, Fujian, China.
Product Designation:	Two-way Radio
Brand Name:	TYT
Test Model	TH-UVF9
Serial Model	TH-UVF8
Difference Description	Only the model and appearance are different, others are the same
Measurement Procedure	TIA/EIA 603-E-2016
Deviation	No any deviation from the test method.
Date of Test:	Jul. 14, 2020~Jul. 23, 2020
Condition of Test Sample	Normal
Test Result	Pass

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

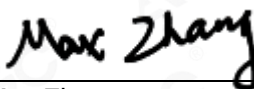
Prepared By



Calvin Liu
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Jul. 23, 2020

Reviewed By



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Jul. 23, 2020

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Jul. 23, 2020



2. GENERAL INFORMATION

2.1 PRODUCT DESCRIPTION

The EUT is a **Two-way Radio** 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/ Tone only	
Hardware Version	F9-VHF/UHF/1.08	
Software Version	V2.2	
Modulation	FM	
Emission Type	11K0F3E	
Emission Bandwidth	VHF: 10.17KHz(5W-12.5 KHz) 10.17KHz(1W-12.5 KHz) UHF: 10.17KHz(5W-12.5KHz) 10.17KHz(1W-12.5 KHz)	
Peak Frequency Deviation	1.71KHz	
Audio Frequency Response	6.41dB	
Maximum Transmitter Power	VHF: 36.43dBm(5W-12.5 KHz) 29.94dBm(1W-12.5 KHz) UHF: 35.71dBm(5W-12.5 KHz) 29.91dBm(1W-12.5 KHz)	
Output power Modification	5W/1W (It was fixed by the manufacturer, any individual can't arbitrarily change it.)	
Data Rate	12.5KHz(Channel Spacing)	
Antenna Designation	Detachable	
Antenna Gain	1.5dBi	
Power Supply	DC 7.4V,1600mAh by battery, charging for DC8.4V	
Limiting Voltage	DC 6.29V-8.51V	
Operation Frequency Range and Channel	Frequency Range:136MHz to 174MHz(VHF), 400 MHz to 470 MHz (UHF) Channel Separation: 12.5KHz(Analog)	
	Bottom Channel: 136.025MHz Middle Channel:151.850MHz Middle Channel:155.025MHz High Channel: 173.975MHz	Bottom Channel: 400.025MHz Middle Channel: 435.025MHz Middle Channel: 454.025MHz High Channel: 469.975MHz
Frequency Tolerance	1.095ppm	



Frequency Range (MHz)	Rated Transmit Power(W)(Conducted)	Transmit Mode/Emission Designator
136-174	5W/1W	11K0F3E(Analog Voice;NB)
400-470	5W/1W	11K0F3E(Analog Voice;NB)

Channel No. (6.25KHz)	Channel No. (12.5KHz)	12.5KHz Channel Spaced 400MHz Band Plan(MHz)
1	1-2	136.025
2		
3	3-4	155.025
4		
5	5-6	173.975
6		

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	455.025
4		
5	5-6	469.975
6		



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.

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

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: 20kHz)

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 20 kHz channel spacing FM mode is 16K0F3E.

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.



2.2 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for FCC ID: **PODTH-UVF9**, 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.



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 requirements:

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



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	Two-way Radio	TH-UVF9	FCC ID: PODTH-UVF9	EUT
3	Adapter	AD-V3	Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 8.5V 600mA	Accessory
4	Battery	LB-75L	DC 7.4V 1600mAh	Accessory
5	Back clip	N/A	N/A	Accessory

Note: The battery is full-charged during the test

4. SUMMARY OF TEST RESULTS

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



LIST OF EQUIPMENTS USED

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2020	May 14, 2022
EXA Signal Analyzer	Aglient	N9020A	W1312-60196	Oct. 08, 2019	Oct. 07, 2020
EXA Signal Analyzer	Aglient	N9020A	MY52090123	Oct. 08, 2019	Oct. 07, 2020
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep.16, 2019	Sep.15, 2021
preamplifier	ChengYi	EMC184045SE	980508	Oct.29, 2019	Oct 28, 2020
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	/	Mar.01, 2018	Feb.29, 2020
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
Small environmental tester	ESPEC	SH-242	--	Feb. 25, 2019	Feb. 24, 2020
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
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

NOTE: 8920B can generate audio modulation frequency.



5. DESCRIPTION OF TEST MODES

RF TEST MODES

The EUT (**Two-way Radio**) 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.

Analogue:

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.



6. FREQUENCY TOLERANCE

6.1 PROVISIONS APPLICABLE

- a). According to FCC §2.1055 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

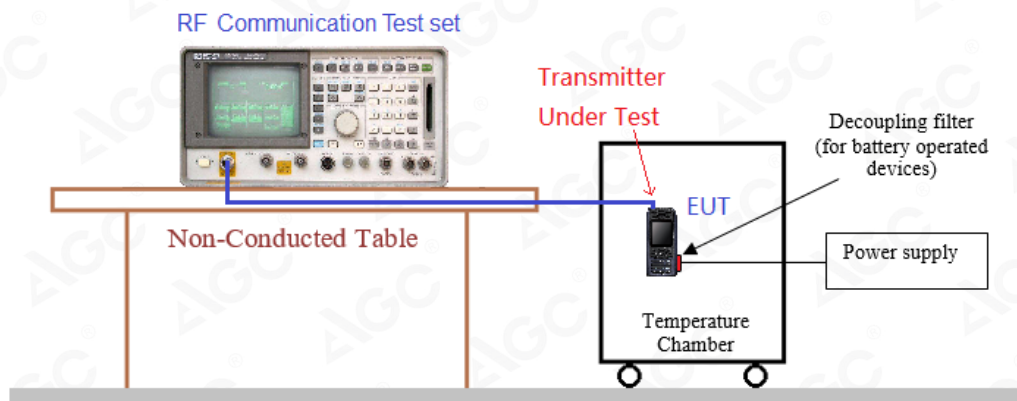
1. Setup the configuration per figure 1 for frequencies measurement inside an environment chamber, Install new battery in the EUT.
2. Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1KHz and Video Resolution Bandwidth to 1KHz and Frequency Span to 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



6.4 TEST RESULTS

VHF:

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

2) Frequency stability: Varies input voltage (Supply nominal voltage is 7.15V) SW 2200KHz						
Environment Temperature(℃)	Power Supply	Reference Frequency				Limit:
	(V)	136.025MHz	151.85MHz	155.025MHz	173.975MHz	ppm
50	DC 7.40 V	0.494	0.653	0.824	0.606	5
40	DC 7.40 V	0.576	0.591	0.697	0.669	
30	DC 7.40 V	0.809	0.837	1.095	0.436	
20	DC 7.40 V	1.089	1.016	0.717	0.817	
10	DC 7.40 V	1.060	0.629	0.514	0.694	
0	DC 7.40 V	1.034	0.746	0.823	0.634	
-10	DC 7.40 V	0.802	0.562	0.679	0.668	
-20	DC 7.40 V	0.720	0.764	0.530	0.471	
-30	DC 7.40 V	0.697	0.960	0.751	0.543	
Result	Pass					

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

Environment Temperature(℃)	Power Supply	Reference Frequency				Limit:
	(V)	136.025MHz	151.85MHz	155.025MHz	173.975MHz	ppm
50	DC 6.29 V	0.567	0.689	0.544	0.662	5
40	DC 6.29 V	0.996	0.705	1.022	0.303	
30	DC 6.29 V	1.076	0.721	0.972	0.558	
20	DC 6.29 V	1.051	0.930	1.078	0.327	
10	DC 6.29 V	0.987	0.530	0.586	0.334	
0	DC 6.29 V	1.061	0.586	0.548	0.740	
-10	DC 6.29 V	0.780	0.871	0.646	0.578	
-20	DC 6.29 V	0.830	0.846	0.570	0.834	
-30	DC 6.29 V	0.993	0.521	0.864	0.979	
Result	Pass					



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

b) Frequency stability: Vcc=7.4V, Input Voltage (Supply nominal Voltage is 7.4V), 200 Hz, 100 kHz						
Environment Temperature(℃)	Power Supply	Reference Frequency				Limit:
	(V)	136.025MHz	151.85MHz	155.025MHz	173.975MHz	ppm
50	DC 7.40 V	1.073	0.976	0.933	0.485	5
40	DC 7.40 V	0.792	0.502	1.071	0.301	
30	DC 7.40 V	0.539	0.945	0.526	0.926	
20	DC 7.40 V	0.995	0.925	0.935	0.696	
10	DC 7.40 V	0.548	1.073	0.907	0.638	
0	DC 7.40 V	0.973	0.915	0.833	0.315	
-10	DC 7.40 V	0.631	0.593	0.812	0.457	
-20	DC 7.40 V	0.698	0.922	0.683	0.520	
-30	DC 7.40 V	0.755	0.505	0.578	0.515	
Result	Pass					

(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 22.0KHz						
Environment Temperature(°C)	Power Supply	Reference Frequency				Limit:
	(V)	136.025MHz	151.85MHz	155.025MHz	173.975MHz	ppm
50	DC 6.29 V	0.985	0.610	1.041	0.653	5
40	DC 6.29 V	0.881	0.571	0.911	0.868	
30	DC 6.29 V	0.762	0.767	0.659	0.979	
20	DC 6.29 V	1.039	0.602	0.812	0.726	
10	DC 6.29 V	0.804	1.095	0.886	0.822	
0	DC 6.29 V	0.879	0.862	0.613	0.942	
-10	DC 6.29 V	0.835	0.889	0.635	0.881	
-20	DC 6.29 V	0.910	0.668	0.903	0.748	
-30	DC 6.29 V	0.524	0.592	0.596	0.673	
Result	Pass					



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

(2) Frequency Stability: Tested Input Voltage (Supply Nominal Voltage is 4.10V) 0V Error/Hz						
Environment Temperature(℃)	Power Supply	Reference Frequency				Limit:
	(V)	400.025MHz	435.025MHz	454.025MHz	469.975MHz	ppm
50	DC 7.40 V	0.852	0.653	0.808	0.944	2.5
40	DC 7.40 V	0.707	0.642	0.535	0.860	
30	DC 7.40 V	0.611	0.921	0.903	0.429	
20	DC 7.40 V	0.515	1.040	0.714	0.558	
10	DC 7.40 V	0.705	0.781	0.507	0.786	
0	DC 7.40 V	0.582	0.989	0.695	0.865	
-10	DC 7.40 V	0.870	0.775	0.949	0.863	
-20	DC 7.40 V	0.518	1.033	0.639	0.790	
-30	DC 7.40 V	0.562	0.609	0.560	0.856	
Result	Pass					

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

Environment Temperature(℃)	Power Supply	Reference Frequency				Limit:
	(V)	400.025MHz	435.025MHz	454.025MHz	469.975MHz	ppm
50	DC 6.29 V	0.569	0.522	1.030	0.367	2.5
40	DC 6.29 V	0.539	0.843	0.747	0.758	
30	DC 6.29 V	0.824	1.055	0.623	0.564	
20	DC 6.29 V	0.833	0.931	0.605	0.448	
10	DC 6.29 V	0.976	0.549	0.920	0.672	
0	DC 6.29 V	0.646	0.835	0.804	0.649	
-10	DC 6.29 V	0.592	0.987	0.536	0.682	
-20	DC 6.29 V	0.956	0.780	0.551	0.936	
-30	DC 6.29 V	1.072	0.916	0.537	0.389	
Result	Pass					



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

Environment Temperature(℃)	Power Supply	Reference Frequency				Limit:
	(V)	400.025MHz	435.025MHz	454.025MHz	469.975MHz	ppm
50	DC 7.40 V	0.615	0.945	0.850	0.360	2.5
40	DC 7.40 V	0.643	0.668	0.697	0.603	
30	DC 7.40 V	0.861	0.978	0.737	0.967	
20	DC 7.40 V	0.890	0.948	0.710	0.912	
10	DC 7.40 V	0.961	0.503	0.806	0.802	
0	DC 7.40 V	0.789	1.024	0.802	0.345	
-10	DC 7.40 V	0.591	0.671	0.858	0.919	
-20	DC 7.40 V	1.080	0.860	0.543	0.455	
-30	DC 7.40 V	0.815	0.935	0.970	0.542	
Result	Pass					

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

(4) Frequency stability versus input voltage (Battery endpoint is 6.29V) 1W 12.0KHz						
Environment Temperature(℃)	Power Supply	Reference Frequency				Limit:
	(V)	400.025MHz	435.025MHz	454.025MHz	469.975MHz	ppm
50	DC 6.29 V	1.028	0.792	0.563	0.711	2.5
40	DC 6.29 V	0.725	1.008	0.756	0.384	
30	DC 6.29 V	0.660	0.693	0.996	0.528	
20	DC 6.29 V	0.623	0.872	0.709	0.506	
10	DC 6.29 V	1.071	0.916	0.906	0.945	
0	DC 6.29 V	0.637	1.055	0.672	0.550	
-10	DC 6.29 V	0.550	0.663	0.788	0.516	
-20	DC 6.29 V	0.761	0.656	0.729	0.403	
-30	DC 6.29 V	0.895	0.651	0.896	0.337	
Result	Pass					

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



7. EMISSION BANDWIDTH

7.1 PROVISIONS APPLICABLE

For FCC Part 90 requirements:

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

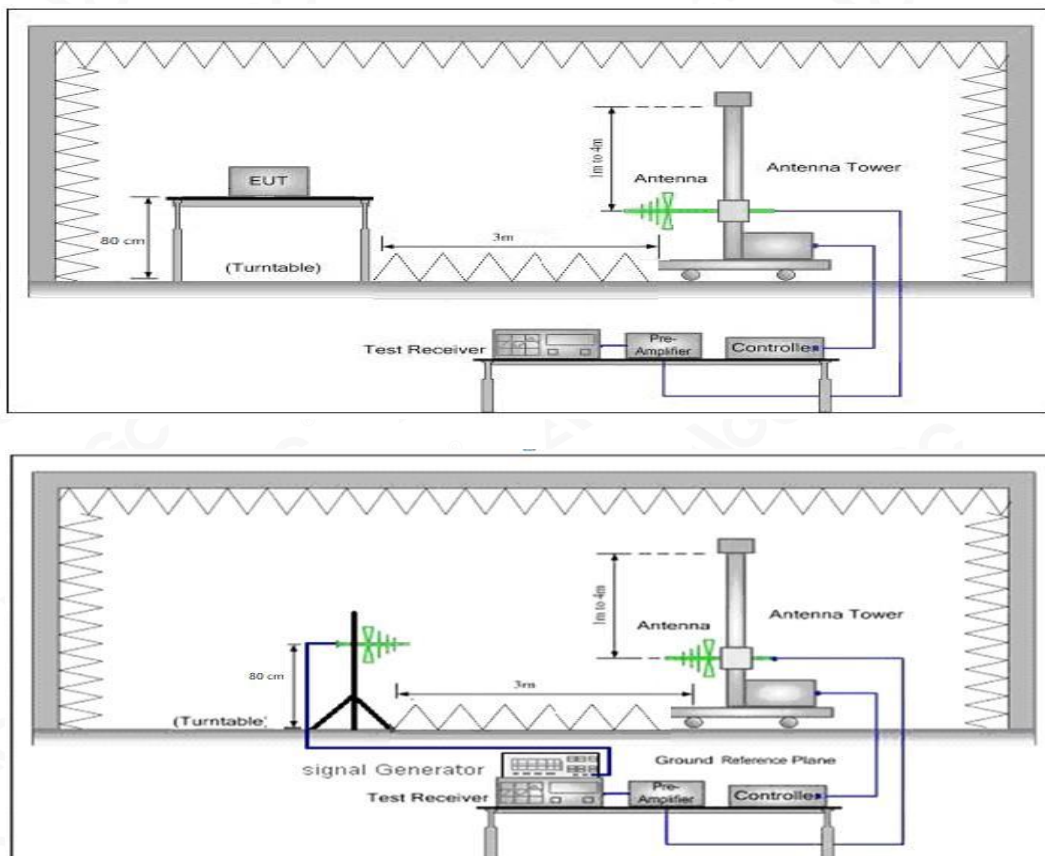
7.2 MEASUREMENT PROCEDURE

- 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.

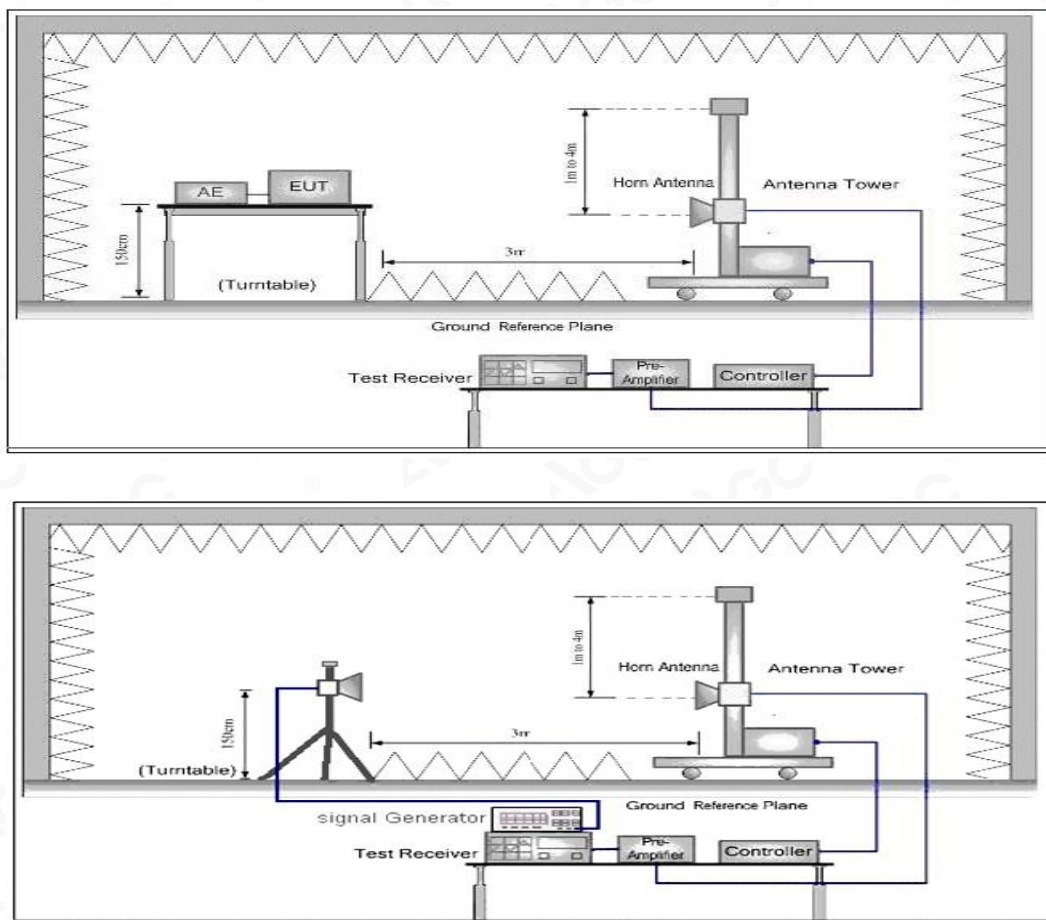
7.3 TEST SETUP BLOCK DIAGRAM

Radiation method:

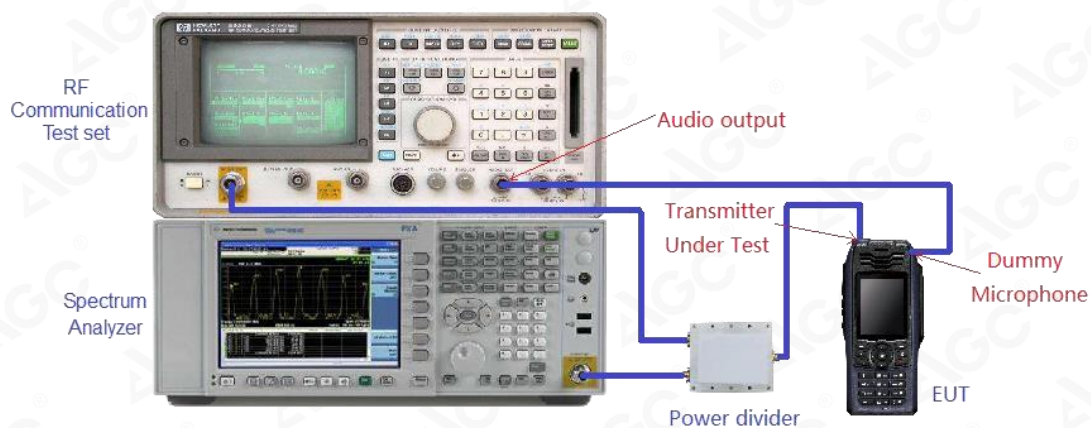
Radiated Below 1GHz



Radiated Above 1 GHz



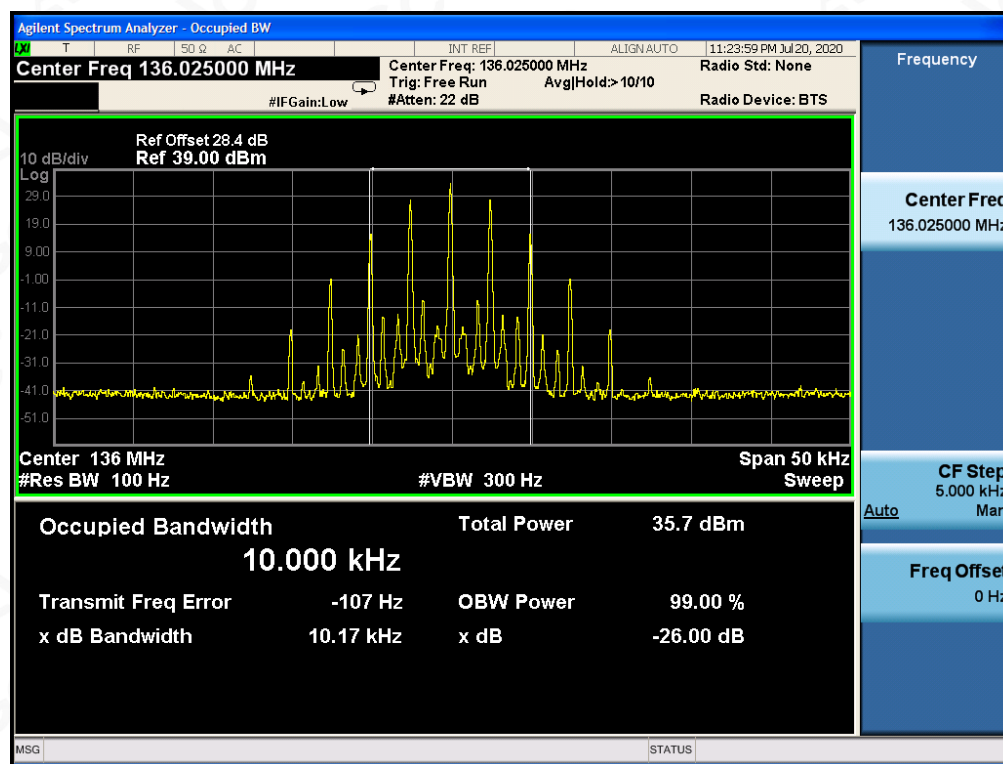
Conduction method:



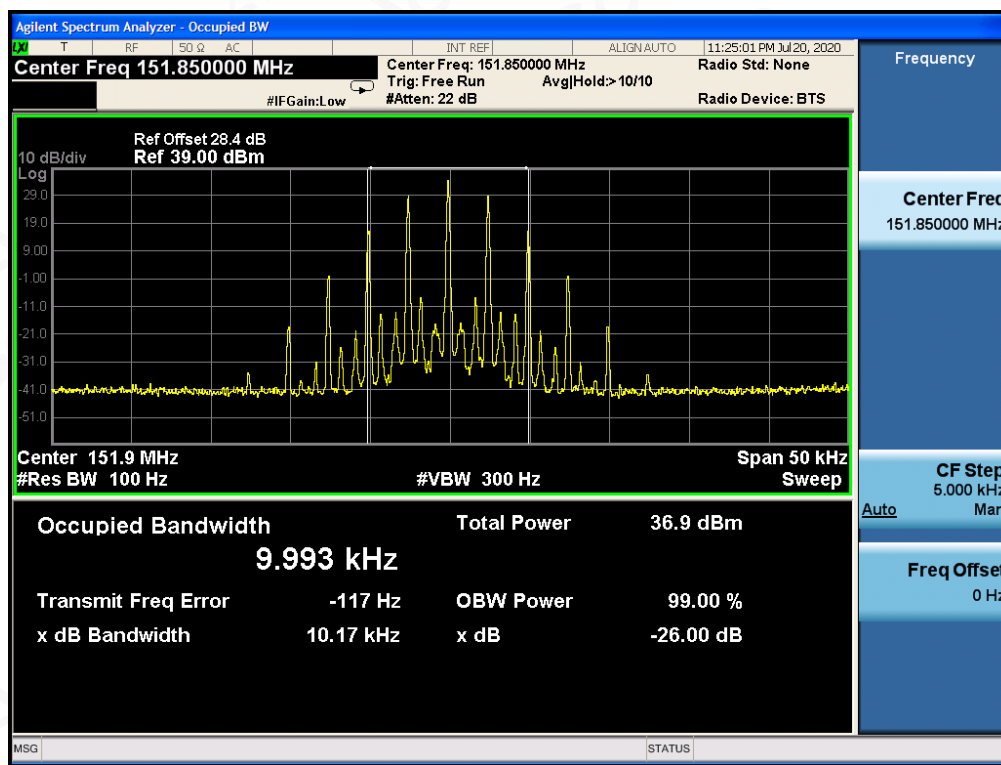
7.4 MEASUREMENT RESULT

Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHZ)	Emission Bandwidth (KHZ)	Limits	Result
136.025MHz	10.000 KHz	10.17 KHz	11.25 KHz	Pass
151.850MHz	9.993 KHz	10.17 KHz	11.25 KHz	Pass
155.025MHz	9.994 KHz	10.17 KHz	11.25 KHz	Pass
173.975MHz	10.000 KHz	10.17 KHz	11.25 KHz	Pass

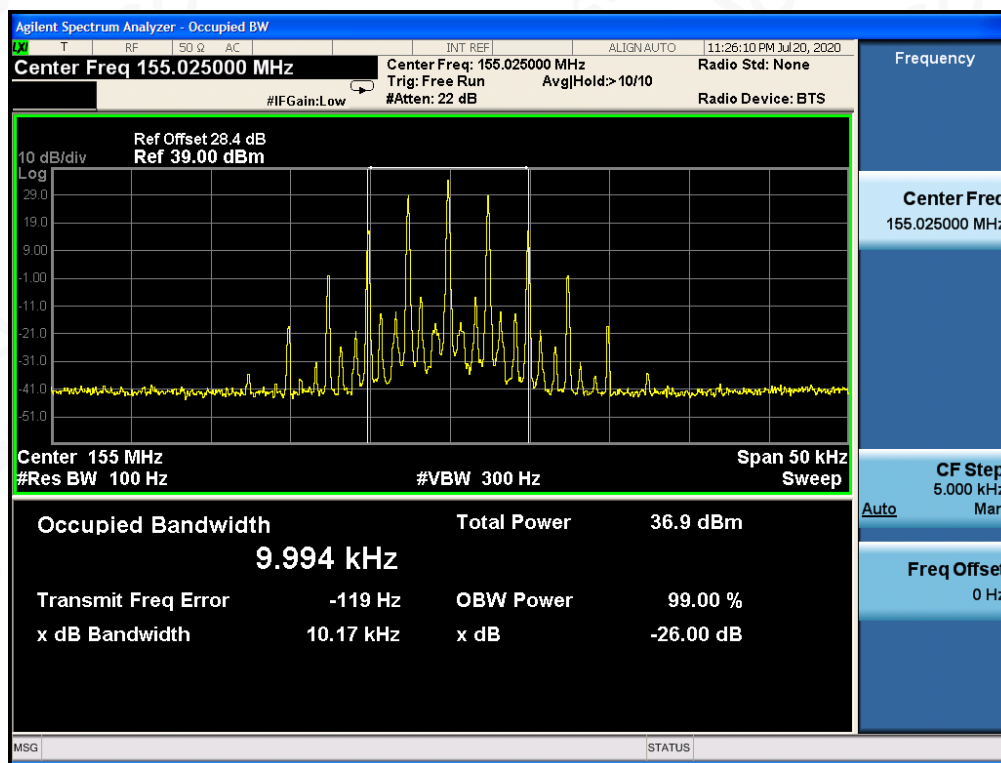
Occupied bandwidth of Bottom Channel (136.025MHz)-5W



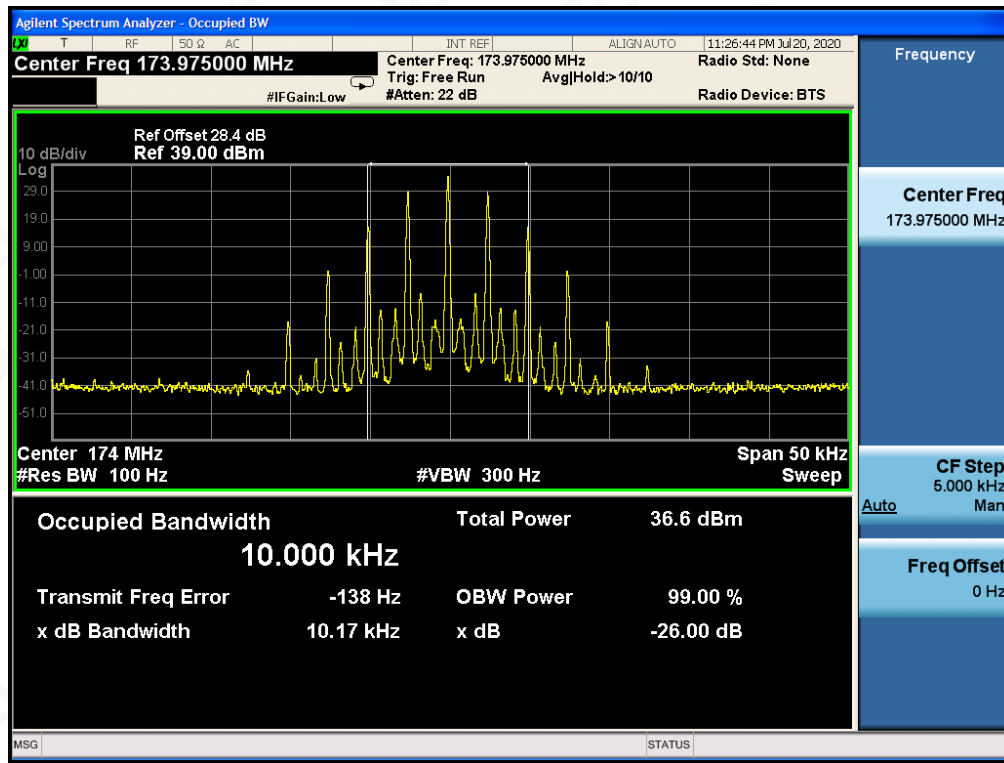
Occupied bandwidth of Bottom Channel (151.850MHz)-5W



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

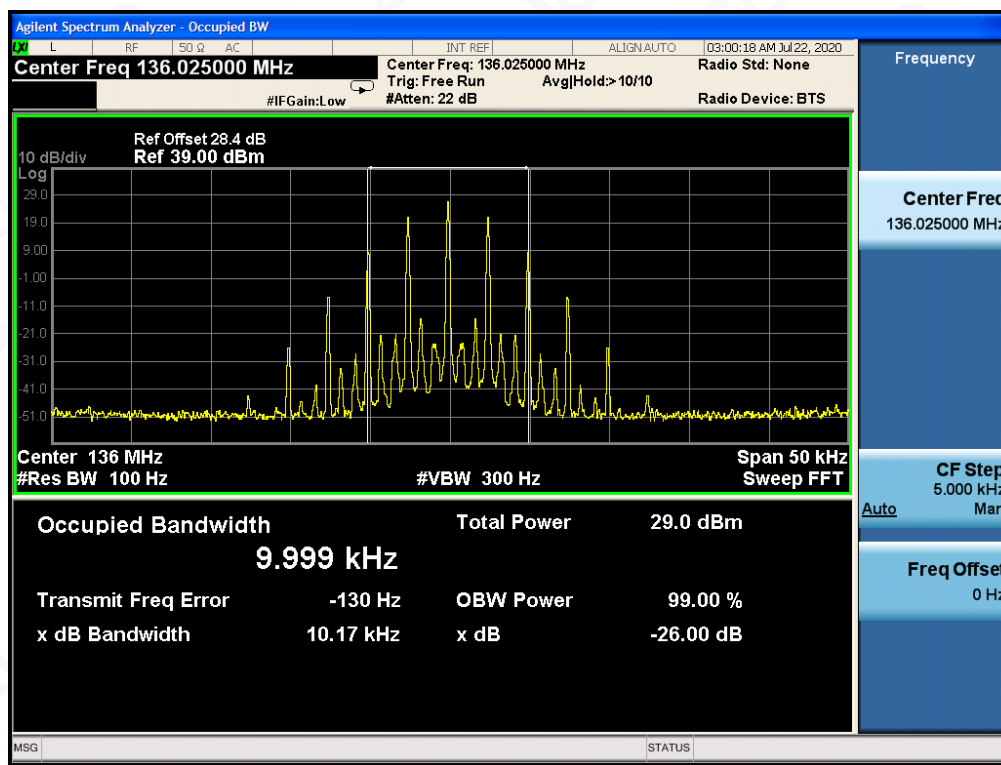


Occupied bandwidth of Bottom Channel (173.975MHz)-5W

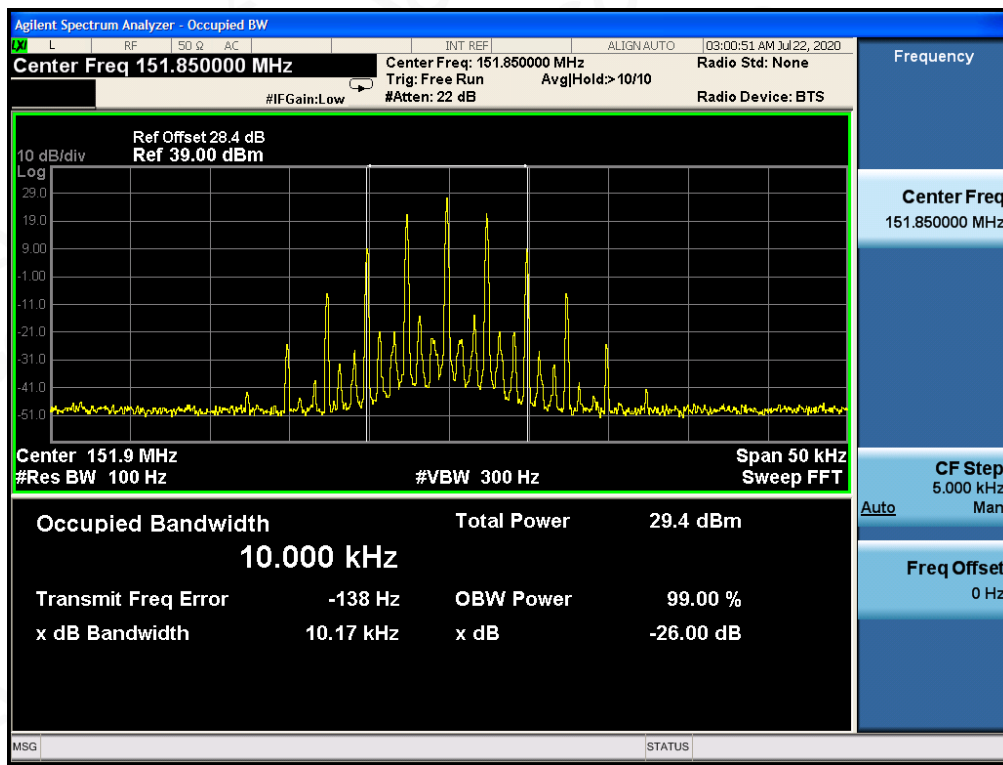


Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHZ)	Emission Bandwidth (KHZ)	Limits	Result
136.025MHz	9.999 KHz	10.17 KHz	11.25 KHz	Pass
151.850MHz	10.000 KHz	10.17 KHz	11.25 KHz	Pass
155.025MHz	10.000 KHz	10.17 KHz	11.25 KHz	Pass
173.975MHz	10.001 KHz	10.17 KHz	11.25 KHz	Pass

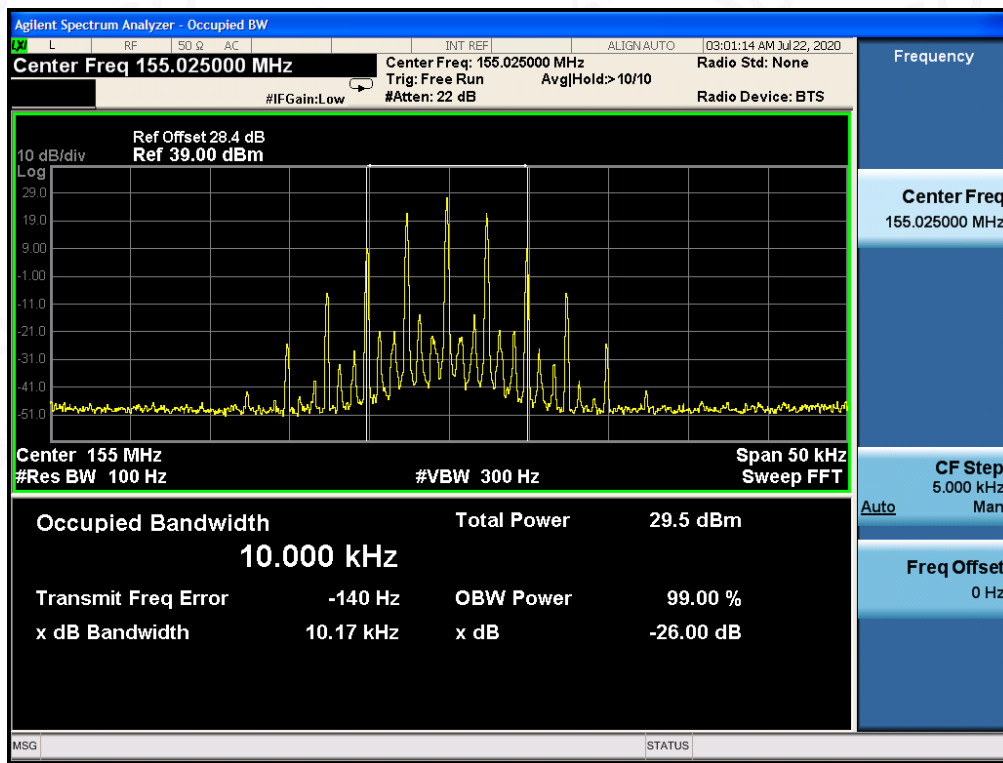
Occupied bandwidth of Bottom Channel (136.025MHz)-1W



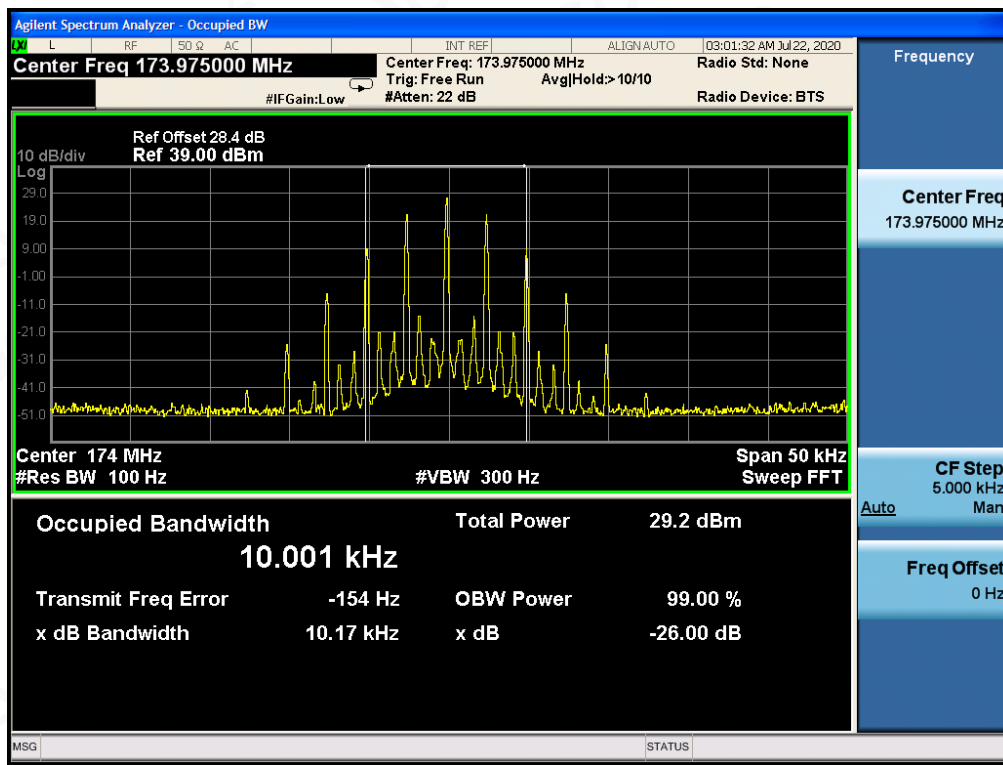
Occupied bandwidth of Bottom Channel (151.850MHz)-1W



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



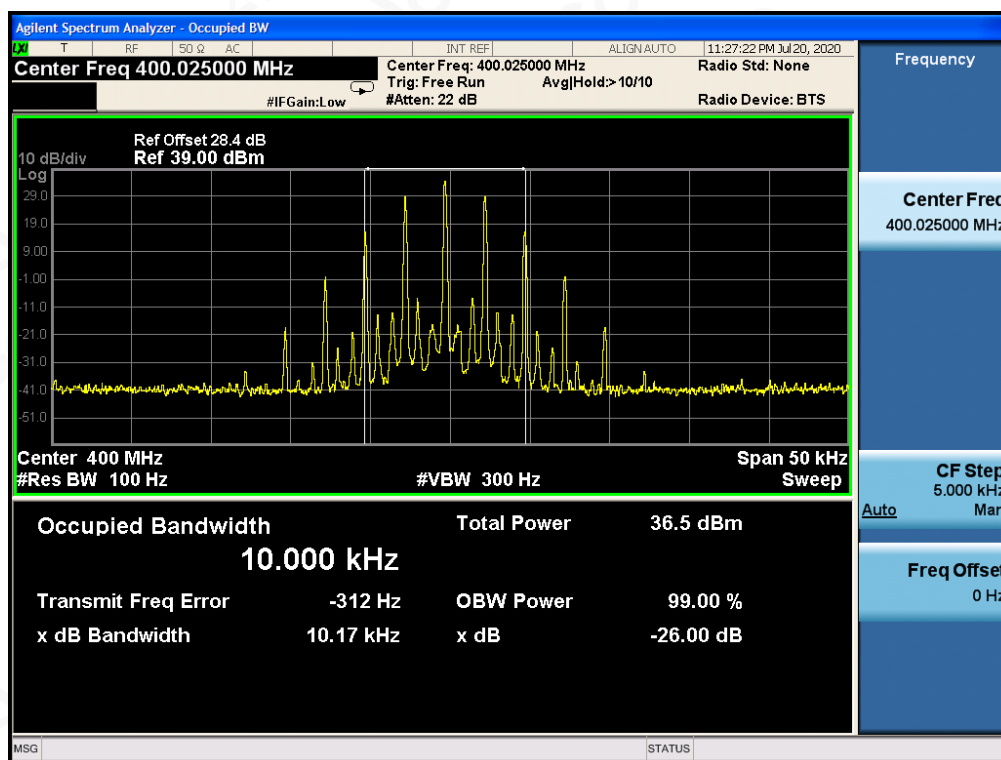
Occupied bandwidth of Bottom Channel (173.975MHz)-1W



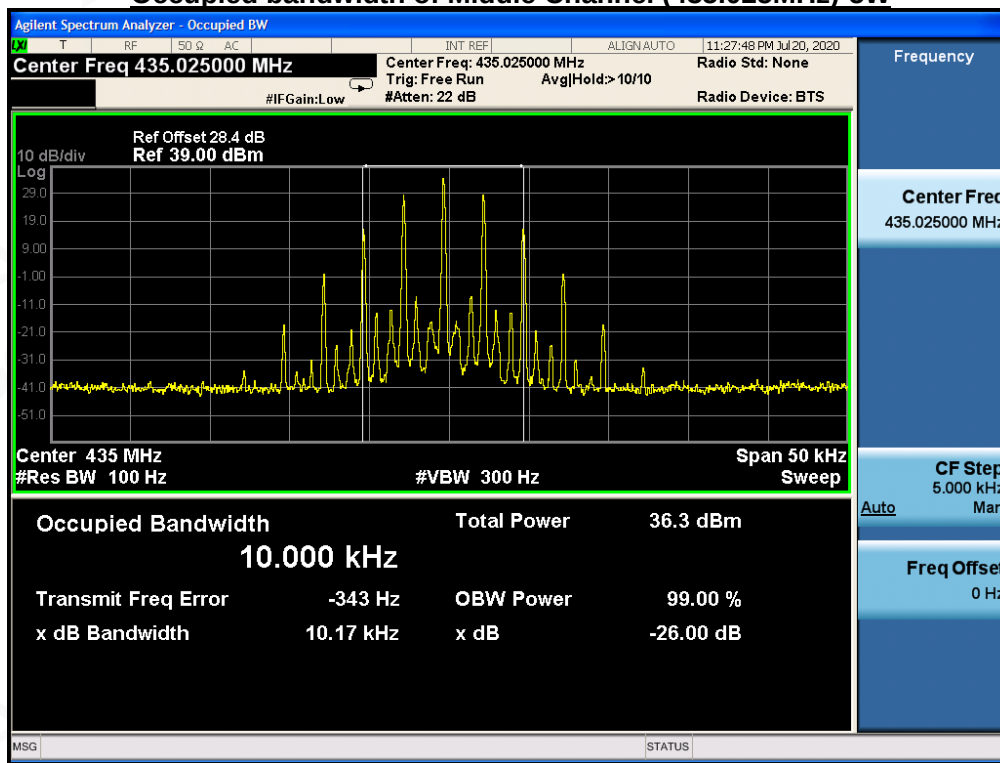
UHF:

Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHZ)	Emission Bandwidth (KHZ)	Limits	Result
400.025MHz	10.000 KHz	10.17 KHz	11.25 KHz	Pass
435.025MHz	10.000 KHz	10.17 KHz	11.25 KHz	Pass
454.025MHz	10.000 KHz	10.17 KHz	11.25 KHz	Pass
469.975MHz	10.000 KHz	10.17 KHz	11.25 KHz	Pass

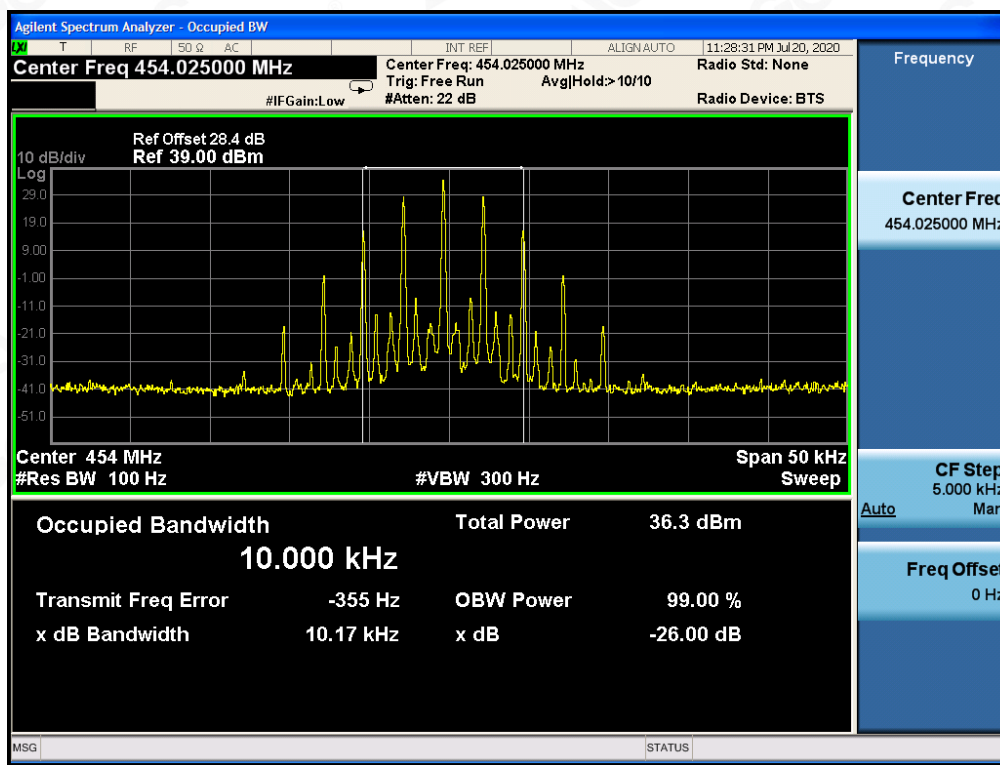
Occupied bandwidth of Bottom Channel (400.025MHz)-5W



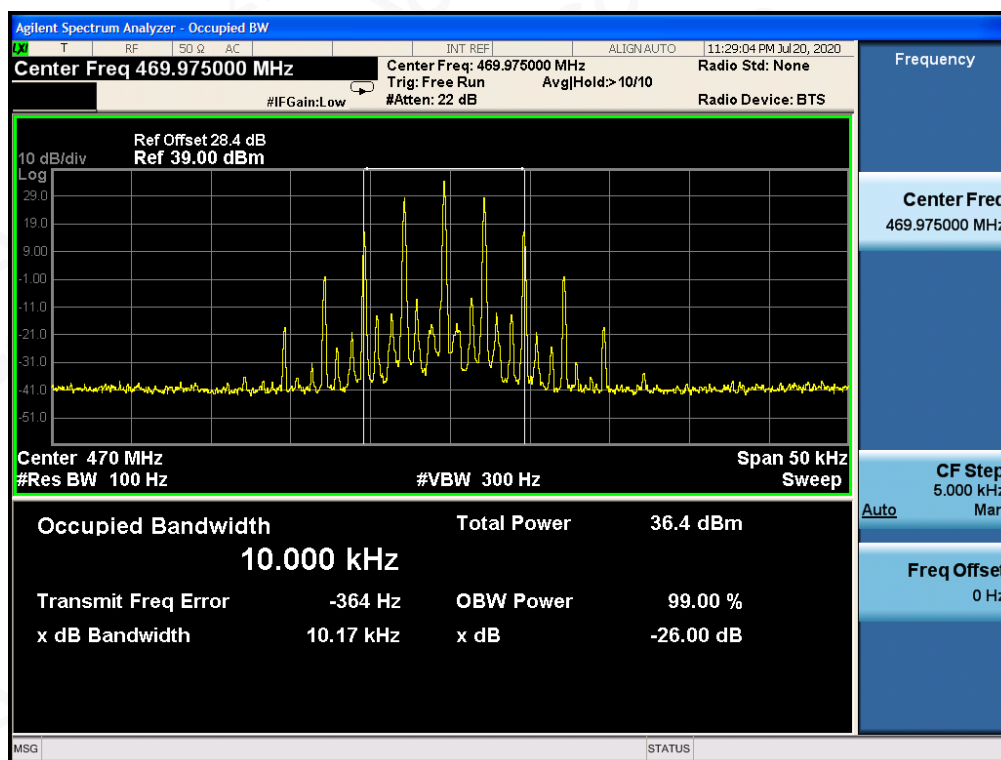
Occupied bandwidth of Middle Channel (435.025MHz)-5W



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

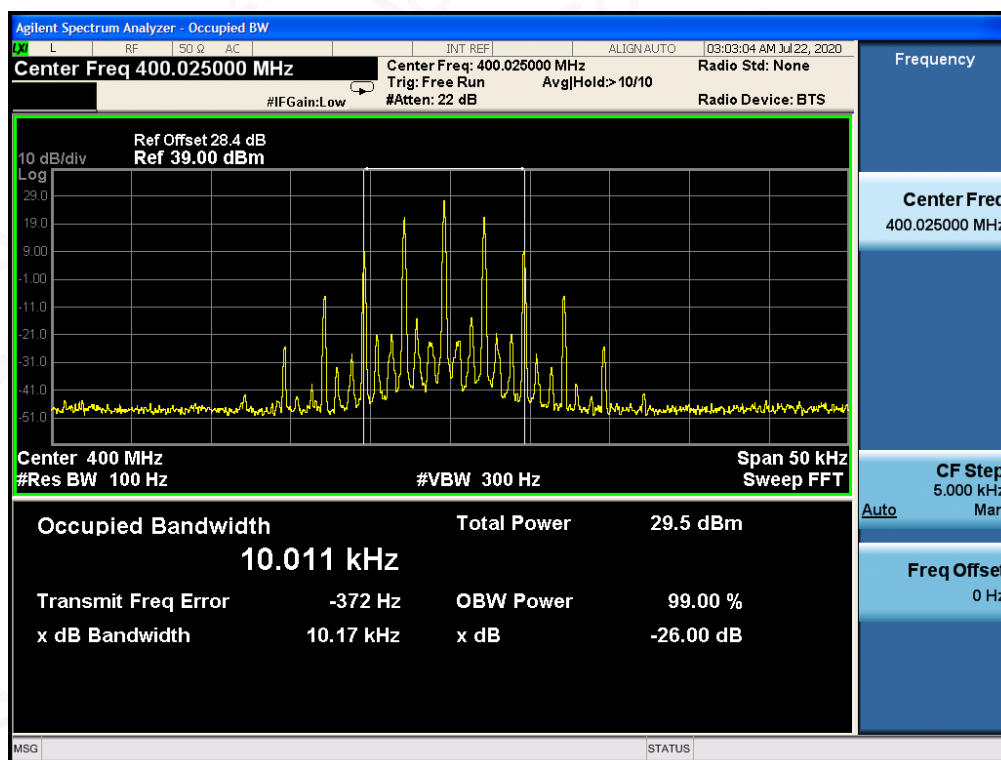


Occupied bandwidth of Top Channel (469.975MHz)-5W

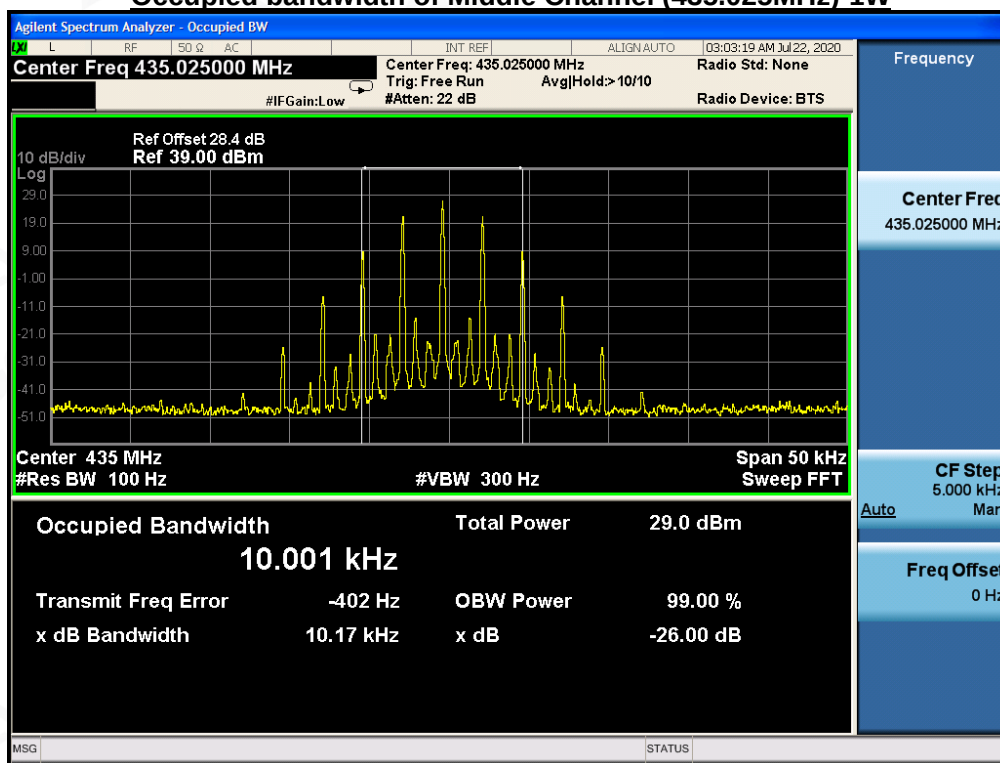


Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Limits	Result
400.025MHz	10.011 KHz	10.17 KHz	11.25 KHz	Pass
435.025MHz	10.001 KHz	10.17 KHz	11.25 KHz	Pass
454.025MHz	9.993 KHz	10.17 KHz	11.25 KHz	Pass
469.975MHz	9.999 KHz	10.17 KHz	11.25 KHz	Pass

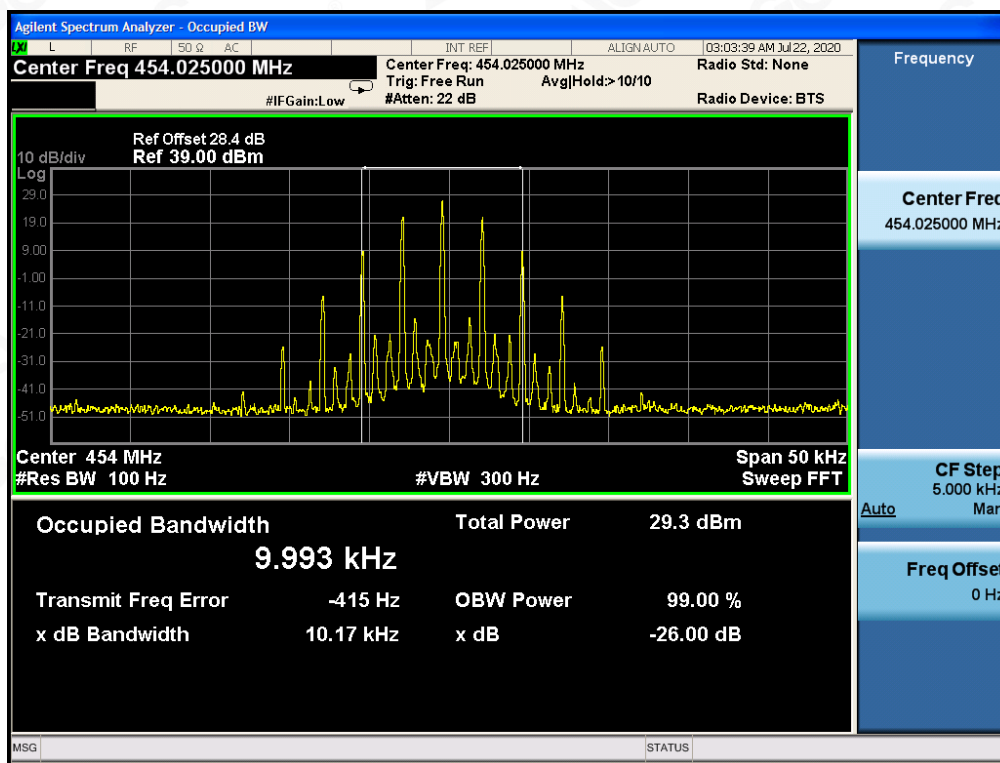
Occupied bandwidth of Bottom Channel (400.025MHz)-1W



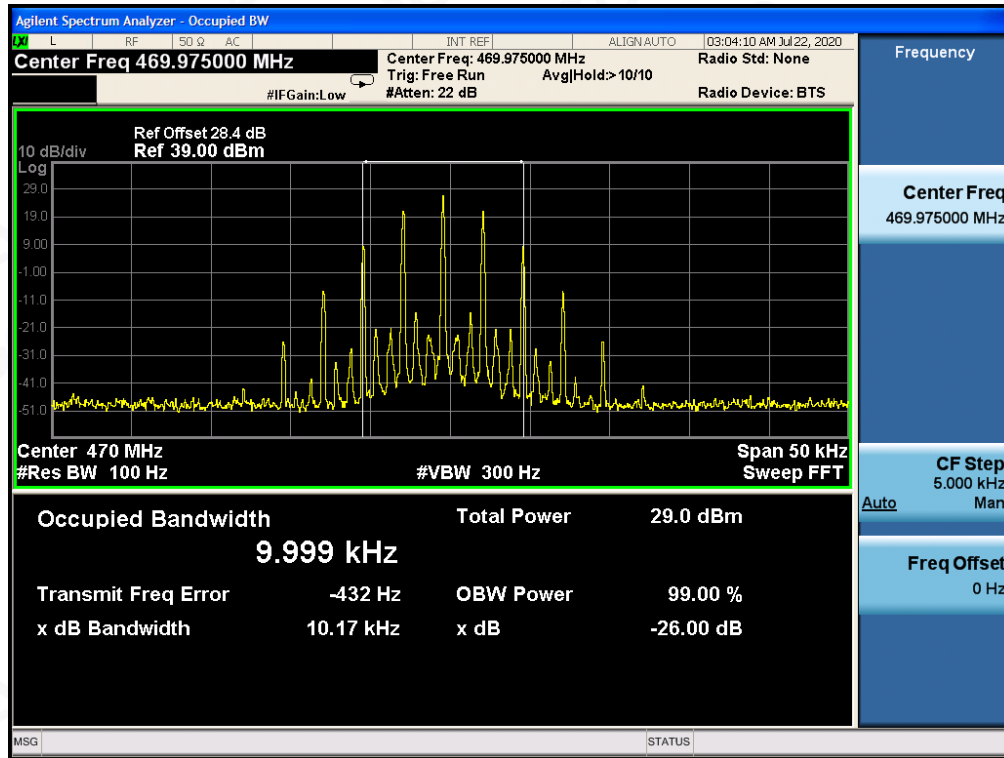
Occupied bandwidth of Middle Channel (435.025MHz)-1W



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



Occupied bandwidth of Top Channel (469.975MHz)-1W



8. UNWANTED RADIATION

8.1 PROVISIONS APPLICABLE

According to FCC §2.1049 and §90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with each channel separation.

Emission Mask D -for 12.5 KHz Channel Separation:

- (1). On any frequency removed from the center of the authorized bandwidth f_0 to 5.625 KHz removed from f_0 : Zero dB.
- (2). On any frequency removed from the center of the authorized bandwidth by a displacement Frequency (f_d in KHz) f_0 of more than 5.625 KHz but no more than 12.5 KHz: At least $7.27(f_d - 2.88 \text{ KHz})$ dB
- (3). On any frequency removed from the center of the authorized bandwidth by a displacement Frequency (f_d in KHz) f_0 of more than 12.5 KHz: At least $50 + 10 \log(P)$ dB or 70 dB, whichever is lesser attenuation.

8.2 MEASUREMENT PROCEDURE

- (1) On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- (2) The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
- (3) The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- (4) The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- (5) The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
- (6) The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- (7) The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
- (8) The maximum signal level detected by the measuring receiver shall be noted.
- (9) The measurement shall be repeated with the test antenna set to horizontal polarization.
- (10) Replace the antenna with a proper Antenna (substitution antenna).
- (11) The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.
- (12) The substitution antenna shall be connected to a calibrated signal generator.
- (13) If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- (14) The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- (15) The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- (16) The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- (17) The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

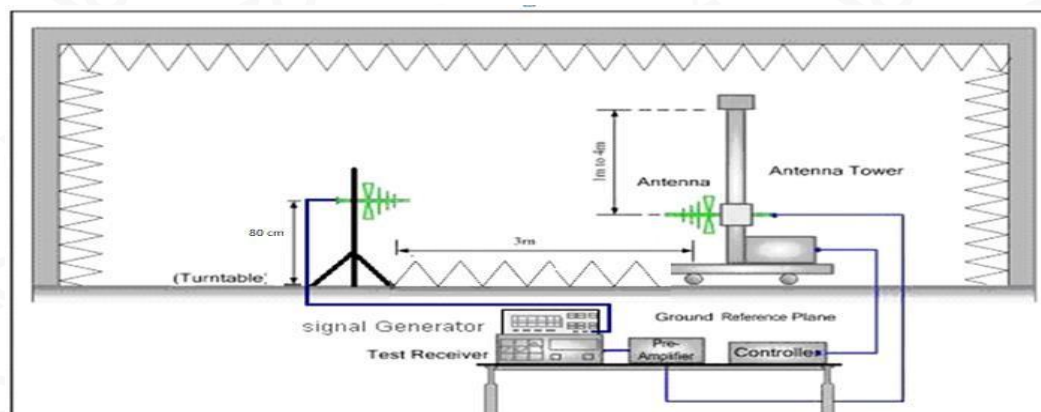
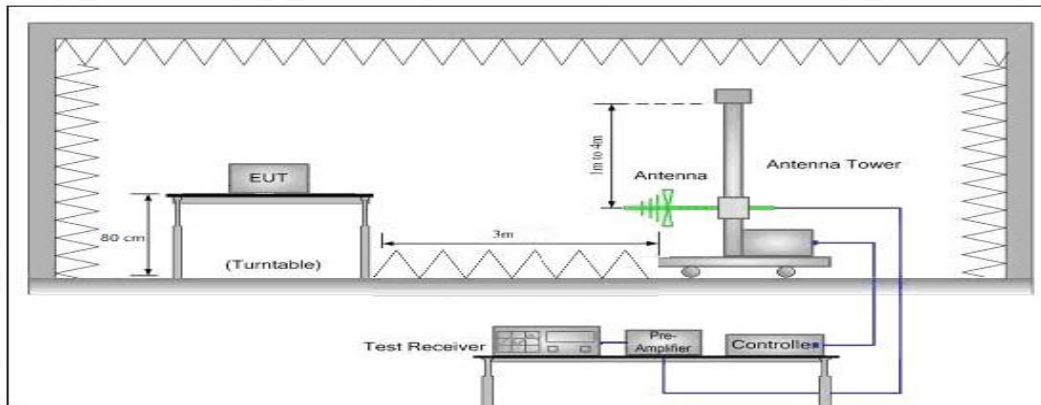


8.3 TEST SETUP BLOCK DIAGRAM

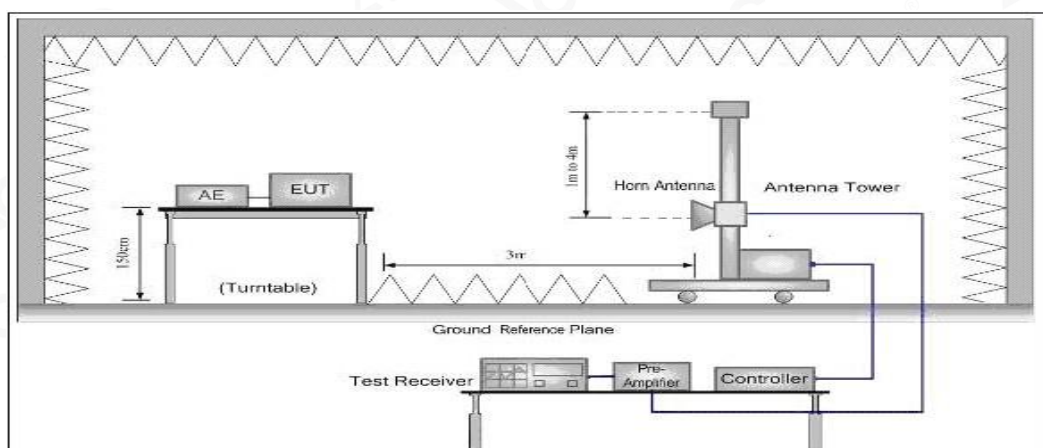
SUBSTITUTION METHOD: (Radiated Emissions)

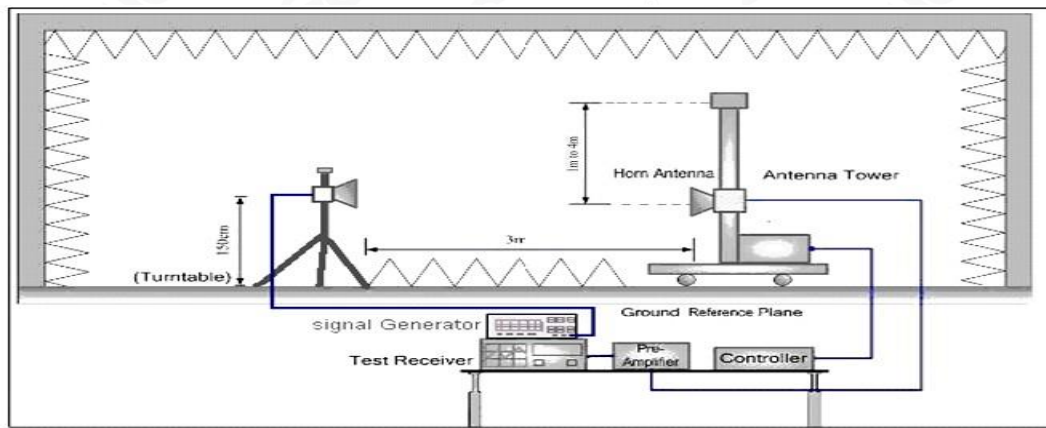
Radiation method:

Radiated Below 1GHz



Radiated Above 1 GHz





8.4 MEASUREMENT RESULTS:

Applicable Standard

FCC §2.1053 and §90.210

On any frequency removed from the center of the authorized bandwidth by a displacement

Frequency (f_d in KHz) for of more than 12.5 KHz: at least $50+10 \log(P)$ dB or 70 dB, whichever is lesser attenuation.

Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for below 1GHz, and 1MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10 harmonic.

In the semi-anechoic chamber, setup as illustrated above the DUT placed on the 0.8m height of Turn Table, rotated the table 45 degree each interval to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power for each degree interval. The "Read Value" is the spectrum reading of maximum power value.

The substitution antenna is substituted for DUT at the same position and signals generator (S.G) export the CW signal to the substitution antenna via a TX cable. The receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum radiation power. Record the power level of maximum radiation power from spectrum. So, the Measured substitution value = Ref level of S.G + TX cables loss – Substituted Antenna Gain.

$EIRP = \text{"Read Value"} + \text{Measured substitution value} + 2.15.$

Limit: At least $50+10 \log(P) = 50+10 \log(5) = 56.99$ (dB)—5W 36.99-56.99=-20dBm
At least $50+10 \log(P) = 50+10 \log(1) = 50.00$ (dB)—1W 30.00-50.00=-20dBm

VHF:

Measurement Result for 12.5 KHz Channel Separation @ 136.025MHz-5W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
136.025	H	0		pass
272.050	H	-25.64	-20	pass
408.075	H	-26.60	-20	pass
544.100	H	-29.37	-20	pass
680.125	H	-30.03	-20	pass
816.150	H	-31.53	-20	pass
952.175	H	-32.44	-20	pass
1088.200	H	-27.09	-20	pass
1224.225	H	-28.91	-20	pass
1360.250	H	-35.49	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
136.025	V	0		pass
272.050	V	-25.42	-20	pass
408.075	V	-27.08	-20	pass
544.100	V	-30.53	-20	pass
680.125	V	-31.51	-20	pass
816.150	V	-32.81	-20	pass
952.175	V	-32.79	-20	pass
1088.200	V	-28.56	-20	pass
1224.225	V	-29.03	-20	pass
1360.250	V	-32.85	-20	pass



Measurement Result for 12.5 KHz Channel Separation @ 151.850MHz-5W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
151.850	H	0		pass
303.700	H	-25.68	-20	pass
455.550	H	-27.32	-20	pass
607.400	H	-28.66	-20	pass
759.250	H	-29.07	-20	pass
911.100	H	-28.21	-20	pass
1062.950	H	-30.65	-20	pass
1214.800	H	-27.42	-20	pass
1366.650	H	-29.16	-20	pass
1518.500	H	-33.90	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
151.850	V	0		pass
303.700	V	-26.40	-20	pass
455.550	V	-28.77	-20	pass
607.400	V	-30.12	-20	pass
759.250	V	-30.46	-20	pass
911.100	V	-28.33	-20	pass
1062.950	V	-31.71	-20	pass
1214.800	V	-28.09	-20	pass
1366.650	V	-29.79	-20	pass
1518.500	V	-34.81	-20	pass



Measurement Result for 12.5 KHz Channel Separation @ 155.025MHz-5W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
155.025	H	0		pass
310.050	H	-25.10	-20	pass
465.075	H	-28.48	-20	pass
620.100	H	-26.12	-20	pass
775.125	H	-26.91	-20	pass
930.150	H	-29.58	-20	pass
1085.175	H	-32.73	-20	pass
1240.200	H	-28.82	-20	pass
1395.225	H	-31.26	-20	pass
1550.250	H	-32.93	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
155.025	V	0		pass
310.050	V	-26.60	-20	pass
465.075	V	-27.81	-20	pass
620.100	V	-28.70	-20	pass
775.125	V	-30.19	-20	pass
930.150	V	-29.11	-20	pass
1085.175	V	-32.05	-20	pass
1240.200	V	-27.76	-20	pass
1395.225	V	-29.82	-20	pass
1550.250	V	-34.67	-20	pass



Measurement Result for 12.5 KHz Channel Separation @ 173.975MHz-5W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
173.975	H	0		pass
347.950	H	-24.22	-20	pass
521.925	H	-25.79	-20	pass
695.900	H	-23.38	-20	pass
869.875	H	-22.87	-20	pass
1043.850	H	-28.31	-20	pass
1217.825	H	-27.40	-20	pass
1391.800	H	-30.53	-20	pass
1565.775	H	-31.64	-20	pass
1739.750	H	-36.30	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
173.975	V	0		pass
347.950	V	-25.06	-20	pass
521.925	V	-26.90	-20	pass
695.900	V	-24.19	-20	pass
869.875	V	-23.64	-20	pass
1043.850	V	-28.81	-20	pass
1217.825	V	-28.56	-20	pass
1391.800	V	-30.74	-20	pass
1565.775	V	-32.03	-20	pass
1739.750	V	-34.47	-20	pass



Measurement Result for 12.5 KHz Channel Separation @ 136.025MHz-1W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
136.025	H	0		pass
272.050	H	-25.73	-20	pass
408.075	H	-27.01	-20	pass
544.100	H	-29.92	-20	pass
680.125	H	-30.59	-20	pass
816.150	H	-32.64	-20	pass
952.175	H	-33.61	-20	pass
1088.200	H	-28.34	-20	pass
1224.225	H	-29.15	-20	pass
1360.250	H	-36.06	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
136.025	V	0		pass
272.050	V	-25.96	-20	pass
408.075	V	-26.98	-20	pass
544.100	V	-28.96	-20	pass
680.125	V	-30.32	-20	pass
816.150	V	-27.90	-20	pass
952.175	V	-31.38	-20	pass
1088.200	V	-26.27	-20	pass
1224.225	V	-28.42	-20	pass
1360.250	V	-32.62	-20	pass



Measurement Result for 12.5 KHz Channel Separation @ 151.850MHz-1W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
151.850	H	0		pass
303.700	H	-26.80	-20	pass
455.550	H	-28.53	-20	pass
607.400	H	-28.82	-20	pass
759.250	H	-30.52	-20	pass
911.100	H	-29.51	-20	pass
1062.950	H	-32.15	-20	pass
1214.800	H	-27.65	-20	pass
1366.650	H	-30.11	-20	pass
1518.500	H	-35.27	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
151.850	V	0		pass
303.700	V	-26.24	-20	pass
455.550	V	-28.67	-20	pass
607.400	V	-28.80	-20	pass
759.250	V	-29.57	-20	pass
911.100	V	-28.47	-20	pass
1062.950	V	-31.54	-20	pass
1214.800	V	-28.91	-20	pass
1366.650	V	-30.20	-20	pass
1518.500	V	-34.87	-20	pass



Measurement Result for 12.5 KHz Channel Separation @ 155.025MHz-1W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
155.025	H	0		pass
310.050	H	-25.25	-20	pass
465.075	H	-28.82	-20	pass
620.100	H	-25.68	-20	pass
775.125	H	-26.70	-20	pass
930.150	H	-30.73	-20	pass
1085.175	H	-33.20	-20	pass
1240.200	H	-28.86	-20	pass
1395.225	H	-31.07	-20	pass
1550.250	H	-32.10	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
155.025	V	0		pass
310.050	V	-24.48	-20	pass
465.075	V	-26.19	-20	pass
620.100	V	-23.50	-20	pass
775.125	V	-23.26	-20	pass
930.150	V	-29.15	-20	pass
1085.175	V	-27.85	-20	pass
1240.200	V	-31.26	-20	pass
1395.225	V	-32.78	-20	pass
1550.250	V	-34.34	-20	pass



Measurement Result for 12.5 KHz Channel Separation @ 173.975MHz-1W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
173.975	H	0		pass
347.950	H	-25.27	-20	pass
521.925	H	-24.94	-20	pass
695.900	H	-27.21	-20	pass
869.875	H	-27.78	-20	pass
1043.850	H	-31.78	-20	pass
1217.825	H	-33.86	-20	pass
1391.800	H	-27.07	-20	pass
1565.775	H	-27.76	-20	pass
1739.750	H	-34.63	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
173.975	V	0		pass
347.950	V	-25.84	-20	pass
521.925	V	-26.26	-20	pass
695.900	V	-27.76	-20	pass
869.875	V	-28.47	-20	pass
1043.850	V	-28.21	-20	pass
1217.825	V	-31.23	-20	pass
1391.800	V	-26.68	-20	pass
1565.775	V	-30.16	-20	pass
1739.750	V	-31.60	-20	pass



UHF:

Measurement Result for 12.5 KHz Channel Separation @ 400.025MHz-5W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
400.025	H	0		pass
800.050	H	-25.36	-20	pass
1200.075	H	-25.17	-20	pass
1600.100	H	-28.45	-20	pass
2000.125	H	-28.68	-20	pass
2400.150	H	-32.82	-20	pass
2800.175	H	-34.91	-20	pass
3200.200	H	-27.80	-20	pass
3600.225	H	-28.95	-20	pass
4000.250	H	-35.42	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
400.025	V	0		pass
800.050	V	-27.01	-20	pass
1200.075	V	-27.58	-20	pass
1600.100	V	-28.92	-20	pass
2000.125	V	-29.62	-20	pass
2400.150	V	-28.88	-20	pass
2800.175	V	-32.66	-20	pass
3200.200	V	-27.53	-20	pass
3600.225	V	-31.24	-20	pass
4000.250	V	-32.97	-20	pass



Measurement Result for 12.5 KHz Channel Separation @ 435.025MHz-5W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
435.025	H	0		pass
870.050	H	-26.93	-20	pass
1305.075	H	-26.23	-20	pass
1740.100	H	-29.20	-20	pass
2175.125	H	-29.29	-20	pass
2610.150	H	-28.97	-20	pass
3045.175	H	-30.93	-20	pass
3480.200	H	-26.94	-20	pass
3915.225	H	-30.73	-20	pass
4350.250	H	-31.80	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
435.025	V	0		pass
870.050	V	-25.65	-20	pass
1305.075	V	-24.57	-20	pass
1740.100	V	-27.31	-20	pass
2175.125	V	-28.03	-20	pass
2610.150	V	-31.90	-20	pass
3045.175	V	-33.52	-20	pass
3480.200	V	-27.75	-20	pass
3915.225	V	-27.33	-20	pass
4350.250	V	-33.47	-20	pass



Measurement Result for 12.5 KHz Channel Separation @ 454.025MHz-5W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
454.025	H	0		pass
908.050	H	-27.12	-20	pass
1362.075	H	-27.53	-20	pass
1816.100	H	-29.22	-20	pass
2270.125	H	-29.98	-20	pass
2724.150	H	-29.48	-20	pass
3178.175	H	-31.54	-20	pass
3632.200	H	-27.83	-20	pass
4086.225	H	-29.74	-20	pass
4540.250	H	-35.32	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
454.025	V	0		pass
908.050	V	-27.01	-20	pass
1362.075	V	-27.34	-20	pass
1816.100	V	-29.81	-20	pass
2270.125	V	-30.02	-20	pass
2724.150	V	-28.43	-20	pass
3178.175	V	-31.25	-20	pass
3632.200	V	-27.57	-20	pass
4086.225	V	-29.39	-20	pass
4540.250	V	-34.25	-20	pass



Measurement Result for 12.5 KHz Channel Separation @ 469.975MHz-5W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
469.975	H	0		pass
939.950	H	-26.87	-20	pass
1409.925	H	-27.92	-20	pass
1879.900	H	-29.39	-20	pass
2349.875	H	-30.55	-20	pass
2819.850	H	-28.51	-20	pass
3289.825	H	-30.99	-20	pass
3759.800	H	-27.71	-20	pass
4229.775	H	-30.45	-20	pass
4699.750	H	-34.61	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
469.975	V	0		pass
939.950	V	-26.90	-20	pass
1409.925	V	-28.57	-20	pass
1879.900	V	-28.82	-20	pass
2349.875	V	-29.40	-20	pass
2819.850	V	-29.35	-20	pass
3289.825	V	-31.24	-20	pass
3759.800	V	-28.17	-20	pass
4229.775	V	-30.33	-20	pass
4699.750	V	-34.37	-20	pass

