TEST REPORT

Applicant:	Holybro Tech Co.,LTD
Address of Applicant:	Room 407, Area B, Kaicheng High-tech Park, Taoyuan Community, Dalang Street, Longhua District, Shenzhen, Guangdong,China.
Manufacturer/Factory:	Holybro Tech Co.,LTD
Address of Manufacturer/Factory:	Room 407, Area B, Kaicheng High-tech Park, Taoyuan Community, Dalang Street, Longhua District, Shenzhen, Guangdong,China.

Equipment Under Test (EUT)

Product Name:	Microhard Telemetry Radio-P400
Model No.:	HT08
FCC ID:	2BNF8-HT08
Applicable standards:	FCC CFR Title 47 Part 2 FCC CFR Title 47 Part 90
Date of sample receipt:	Nov. 18, 2024
Date of Test:	Nov. 18, 2024 ~ Feb. 20, 2025
Date of report issued:	Feb. 20, 2025
Test Result :	PASS *

* In the configuration tested, the EUT complied with the standards specified above

Authorized Signature:

Robinson Luo
Laboratory Manager

2 Version

Version No.	Date	Description
00	*Feb. 20, 2025*	*Original*

Prepared By: ***Date:*** ***Feb. 20, 2025***

Project Engineer

Check By: ***Date:*** ***Feb. 20, 2025***

Reviewer

3 Contents

4 Test Summary

Item	FCC Rules	Description Of Test	Result
1	FCC PART 90	Antenna Equipment	Pass
2	§90.205& 2.1046	Maximum Transmitter Power	Pass
3	2.1047	Modulation Characteristic-Audio Frequency Response	N/A
4	§90.207& 2.1047	Modulation Characteristic-Modulation Limiting	Pass
5	§2.1047	Audio Low Pass Filter Response	N/A
6	§90.209& 2.1049	Occupied Bandwidth	Pass
7	§90.210& 2.1049	Emission Mask	Pass
8	§90.213& 2.1055	Frequency Tolerance	Pass
9	§90.214	Transmitter Frequency Behavior	Pass
10	§90.210& 2.1051	Spurious Emission on Antenna Port	Pass
11	§90.210& 2.1053	Spurious Ratiated Emission	Pass
12	15.107	AC Power Line Conducted Emissions	N/A

Remarks:

1. *Pass: The EUT complies with the essential requirements in the standard.*
2. *N/A: Not applicable.*

5 General Information

5.1 General Description of EUT

Communication Type	Voice/ Data only
Modulation	4FSK
Emission Type	7K70F1D/4K68F1D
Occupied Bandwidth (99%)	Digital: 7.708KHz(for 12.5 kHz Channel Spacing) 4.687KHz(for 6.25 kHz Channel Spacing)
Maximum Transmitter Power	Digital: 36.81dBm(5W), 32.97dBm (1W) ---UHF
Output power Modification	UHF:35W/5W (It was fixed by the manufacturer, any individual can't arbitrarily change it.)
Data Rate	9600bps/12.5KHz(Channel Spacing) 9600bps/6.25KHz(Channel Spacing)
Antenna Designation	Detachable
Antenna Type	Terminal Antenna
Antenna Gain	4.2dBi
Power Supply	DC12V by adapter
Operation Frequency Range and Channel	Frequency Range: 410 MHz to 480 MHz (UHF) Channel Separation: 6.25KHz/12.5KHz(Digital)
	Low Channel: 410.025MHz Middle Channel: 465.025MHz High Channel: 478.025MHz
Frequency Tolerance	1.085ppm

Remark:
1. Antenna gain information provided by the customer
2. The relevant information of the sample is provided by the entrusting company, and the laboratory is not responsible for its authenticity.

Test Frequency

Frequency Range (MHz)	Rated Transmit Power(W)(Conducted)	Transmit Mode/Emission Designator
400-480	5W/1W	7K60FXD/7K60FXW(9600Data/Digital Voice NB)
400-480	5W/1W	7K60FXD/7K60FXW(4800Data/Digital Voice NB)

Channel No. (6.25KHz)	Channel No. (12.5KHz)	6.25KHz/12.5KHz Channel Spaced 400MHz Band Plan(MHz)
1	1-2	410.025
2		
3	3-4	465.025
4		
5	5-6	478.025

5.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is filing to comply with Section Part 22/24/27 of the FCC CFR 47 Rules.

5.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures document on ANSI C63.26:2015 and FCC CFR 47.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057

5.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC—Registration No.: 381383**

Designation Number: CN5029

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files.

● **ISED —Registration No.: 9079A**

CAB identifier: CN0091

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of ISED for radio equipment testing

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

5.5 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

Tel: 0755-27798480

Fax: 0755-27798960

6 Test Instruments list

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	Jun. 22, 2024	Jun. 21, 2027
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	Apr. 11, 2024	Apr. 10, 2025
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9168	GTS640	Mar. 19, 2023	Mar. 18, 2025
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	Apr. 17, 2023	Apr. 16, 2025
6	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	Apr. 11, 2024	Apr. 10, 2025
7	Loop Antenna	ZHINAN	ZN30900A	GTS534	Nov.12, 2024	Nov.11, 2025
8	Broadband Preamplifier	SCHWARZBECK	BBV9718	GTS535	Apr. 11, 2024	Apr. 10, 2025
9	Amplifier(1GHz-26.5GHz)	HP	8449B	GTS601	Apr. 11, 2024	Apr. 10, 2025
10	Horn Antenna (15GH-40GHz)	SCHWARZBECK	01296	GTS691	Mar. 07, 2024	Mar. 06, 2025
11	FSV·Signal Analyzer (10Hz-40GHz)	Keysight	FSV-40-N	GTS666	Mar. 12, 2024	Mar. 11, 2025
12	Amplifier	/	LNA-1000-30S	GTS650	Apr. 11, 2024	Apr. 10, 2025
13	CDNE M2+M3-16A	HCT	30MHz-300MHz	GTS692	Nov. 07, 2024	Nov. 06, 2025
14	Wideband Amplifier	/	WDA-01004000-15P35	GTS602	Apr. 11, 2024	Apr. 10, 2025
15	Thermo meter	JINCHUANG	GSP-8A	GTS643	Apr. 18, 2024	Apr. 17, 2025
16	RE cable 1	GTS	N/A	GTS675	Jul. 02, 2024	Jul. 01, 2025
17	RE cable 2	GTS	N/A	GTS676	Jul. 02, 2024	Jul. 01, 2025
18	RE cable 3	GTS	N/A	GTS677	Jul. 02, 2024	Jul. 01, 2025
19	RE cable 4	GTS	N/A	GTS678	Jul. 02, 2024	Jul. 01, 2025
20	RE cable 5	GTS	N/A	GTS679	Jul. 02, 2024	Jul. 01, 2025
21	RE cable 6	GTS	N/A	GTS680	Jul. 02, 2024	Jul. 01, 2025
22	RE cable 7	GTS	N/A	GTS681	Jul. 05, 2024	Jul. 04, 2025
23	RE cable 8	GTS	N/A	GTS682	Jul. 05, 2024	Jul. 04, 2025
24	EMI Test Software	AUDIX	E3-6.100614a	GTS725	N/A	N/A

Conducted Emission						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	Jul. 12, 2022	Jul. 11, 2027
2	EMI Test Receiver	R&S	ESCI 7	GTS552	Apr. 11, 2024	Apr. 10, 2025
3	LISN	ROHDE & SCHWARZ	ENV216	GTS226	Apr. 11, 2024	Apr. 10, 2025
4	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
5	Thermo meter	JINCHUANG	GSP-8A	GTS642	Apr. 18, 2024	Apr. 17, 2025
6	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	Apr. 11, 2024	Apr. 10, 2025
7	ISN	SCHWARZBECK	NTFM 8158	GTS565	Apr. 11, 2024	Apr. 10, 2025
8	High voltage probe	SCHWARZBECK	TK9420	GTS537	Apr. 11, 2024	Apr. 10, 2025
9	Antenna end assembly	Weinschel	1870A	GTS560	Apr. 11, 2024	Apr. 10, 2025
10	EMI Test Software	AUDIX	E3-6.100622	GTS726	N/A	N/A

RF Conducted Test:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	Apr. 13, 2024	Apr. 12, 2025
2	EMI Test Receiver	R&S	ESCI 7	GTS552	Apr. 13, 2024	Apr. 12, 2025
3	PSA Series Spectrum Analyzer	Agilent	E4440A	GTS536	Apr. 13, 2024	Apr. 12, 2025
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	Apr. 13, 2024	Apr. 12, 2025
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	Apr. 13, 2024	Apr. 12, 2025
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	Apr. 13, 2024	Apr. 12, 2025
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	Apr. 13, 2024	Apr. 12, 2025
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	Apr. 13, 2024	Apr. 12, 2025
9	Thermo meter	JINCHUANG	GSP-8A	GTS641	Apr. 18, 2024	Apr. 17, 2025
10	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	June. 21.2024	June. 20.2025
11	Spctrum Analyzer	Rohde&Schwarz	FSP 40	100501	Sep. 21.2024	Sep. 22.2025

General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Barometer	KUMAO	SF132	GTS647	Apr. 18, 2024	Apr. 17, 2025

7 System test configuration

7.1 Test mode

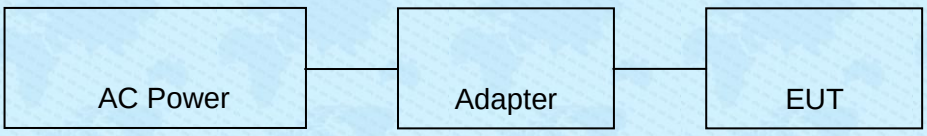
During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission.

Frequency Range (MHz)	Rated Transmit Power(W)(Conducted)	Transmit Mode/Emission Designator
400-480	5W/1W	7K60FXD/7K60FXW(9600Data/Digital Voice NB)
400-480	5W/1W	7K60FXD/7K60FXW(4800Data/Digital Voice NB)

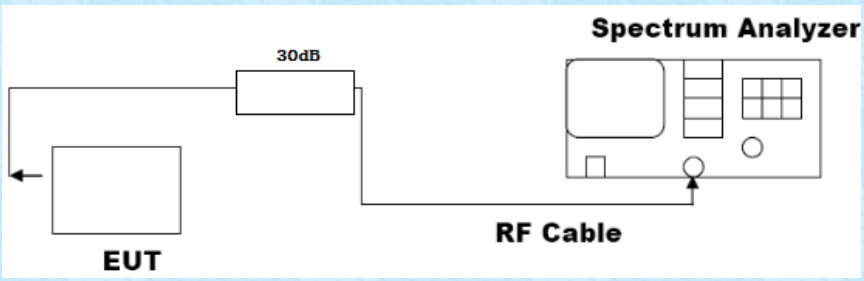
No.	TEST MODES	CHANNEL SEPARATION
1	Low Channel	12.5 KHz
2	Middle Channel	12.5 KHz
3	High Channel	12.5 KHz

7.2 Configuration of Tested System

Operation of EUT during Conducted and Radiation testing:



Operation of EUT during RF Conducted testing:



8 FREQUENCY TOLERANCE

8.1 Provisions Applicable

a). According to FCC §2.1055 and §90.213, the frequency stability shall be measured with variation of ambient temperature from –30℃ to +50℃ 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.

8.2 Measurement Procedure

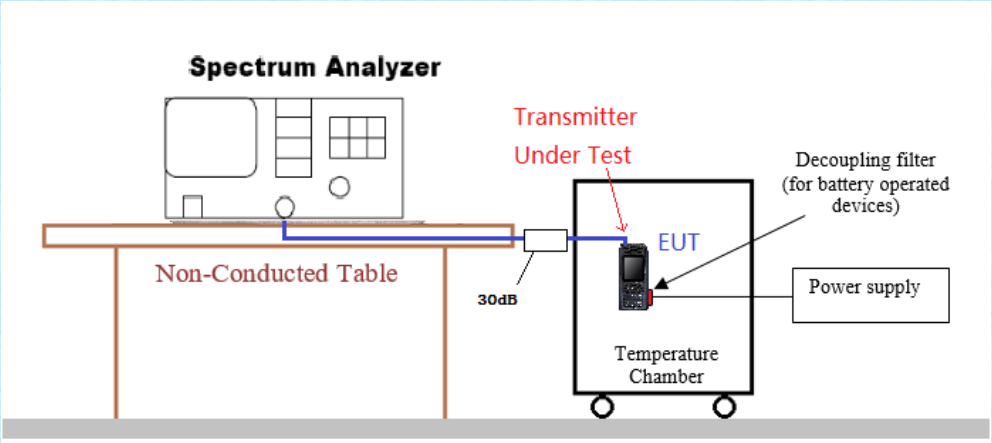
8.2.1 Frequency stability versus environmental temperature

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℃. 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℃ decreased per stage until the lowest temperature -30℃ is measured, record all measured frequencies on each temperature step.

8.2.2 Frequency stability versus input voltage

1. Setup the configuration per figure 1 for frequencies measured at temperature if it is within 15℃ to 25℃. Otherwise, an environment chamber set for a temperature of 20℃ shall be used. The EUT shall be powered by DC 12V.
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.

8.3 TEST SETUP BLOCK DIAGRAM



8.4 Test Results

Frequency stability versus input voltage (Supply nominal voltage is 12V)**-2W-12.5KHz**

Environment Temperature(℃)	Power (V)	Reference Frequency			Limit: ppm
		410.025MHz	465.025MHz	478.025MHz	
50	DC 13.2V	0.994	0.653	0.595	2.5
40	DC 13.2V	0.987	0.749	0.881	
30	DC 13.2V	0.813	0.689	0.712	
20	DC 12V	0.802	1.063	0.989	
10	DC 10.8V	0.585	0.831	0.846	
0	DC 10.8V	1.067	1.085	0.594	
-10	DC 10.8V	0.591	1.068	0.533	
-20	DC 10.8V	1.022	0.527	0.873	
-30	DC 10.8V	0.954	0.946	0.680	
Result	Pass				

Frequency stability versus input voltage (Supply nominal voltage is 12V)**-1W-12.5KHz**

Environment Temperature(℃	Power	Reference Frequency			Limit:
	(V)	410.025MHz	465.025MHz	478.025MHz	ppm
50	DC 13.2V	0.542	0.998	0.982	2.5
40	DC 13.2V	0.558	0.995	0.691	
30	DC 13.2V	0.971	0.580	0.625	
20	DC 12V	0.839	0.789	1.028	
10	DC 10.8V	0.659	0.942	0.516	
0	DC 10.8V	0.695	0.687	0.578	
-10	DC 10.8V	0.564	0.878	1.050	
-20	DC 10.8V	0.527	0.747	0.629	
-30	DC 10.8V	0.602	0.914	0.978	
Result	Pass				

9. EMISSION BANDWIDTH

9.1 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.

9.2 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).

Voice or Digital Modulation Through a Voice Input Port @2.1049(c)(i):- The transmitter was modulated by a 2.5 KHz tone signal at an input level 16 dB greater than that required to produce 50% modulation (e.g.: +2.5 KHz peak deviation at 1 KHz modulating frequency). The input level was established at the frequency of maximuml response of the audio modulating circuit.

Digital Modulation Through a Data Input Port @2.1049(h):-Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximuml rated conditions under which the equipment will be operated. The signal shall be applied through any filterl networks, pseudo-random generators or other devices required in normal service. Additionally, the Emission Masks shall be shown for operation with any devices used for modifying the spectrum when such devices are operational at the discretion of the user.

3). Set SPA Center Frequency = fundamental frequency,

For 25 KHz Channel Spacing: RBW= 300 Hz, VBW= 1kHz, Span =100 KHz;

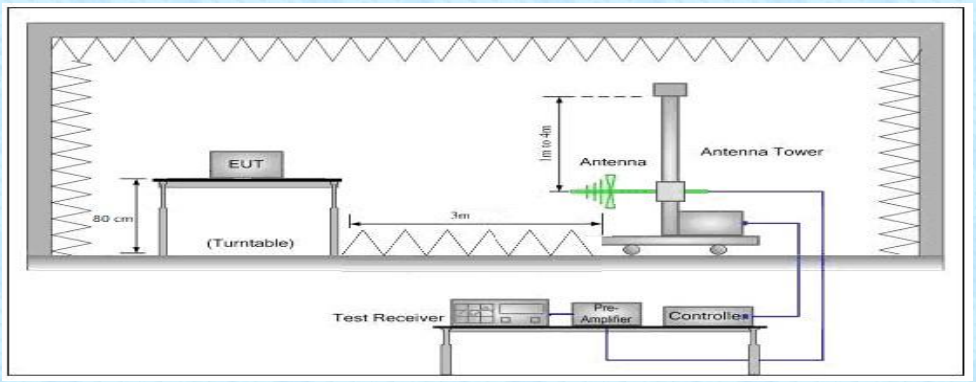
For 12.5 KHz or 6.25 KHz Channel Spacing: RBW=100Hz, VBW= 300 Hz, Span =50 KHz.

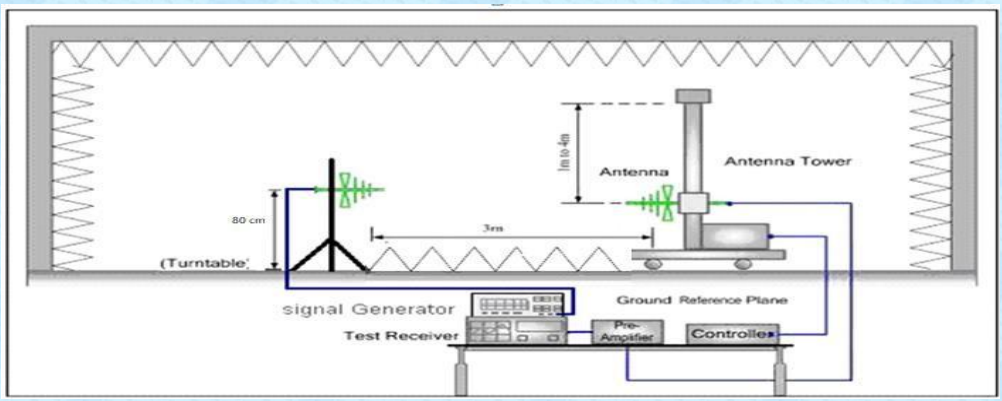
4). Set SPA Max hold. Mark peak, -26 dB.

9.3 Test Setup Block Diagram

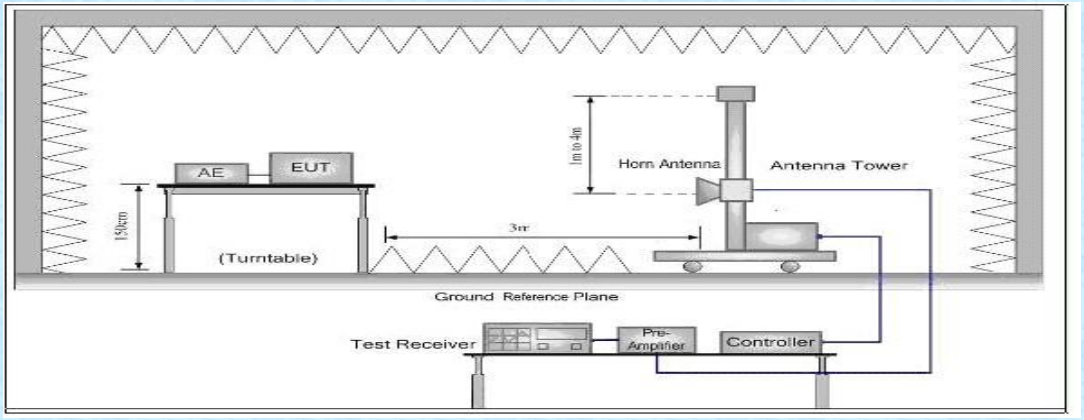
Radiation method:

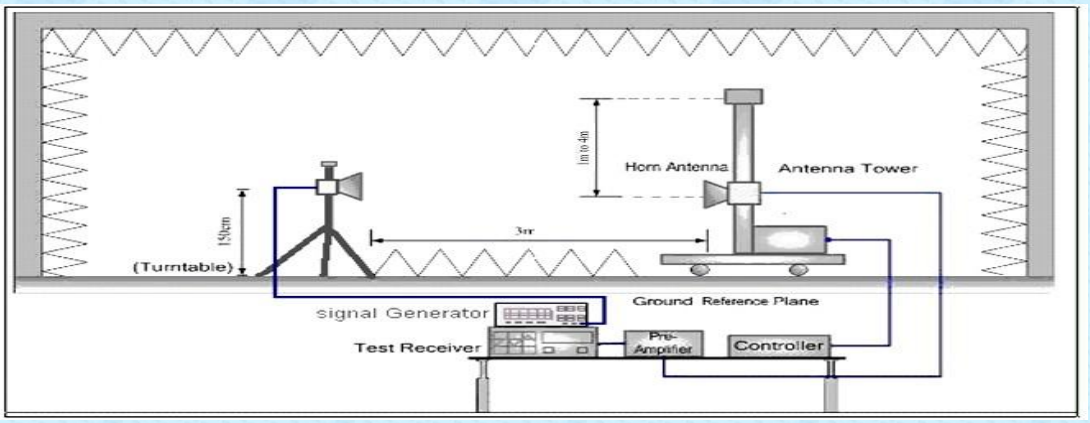
Radiated Below1GHz



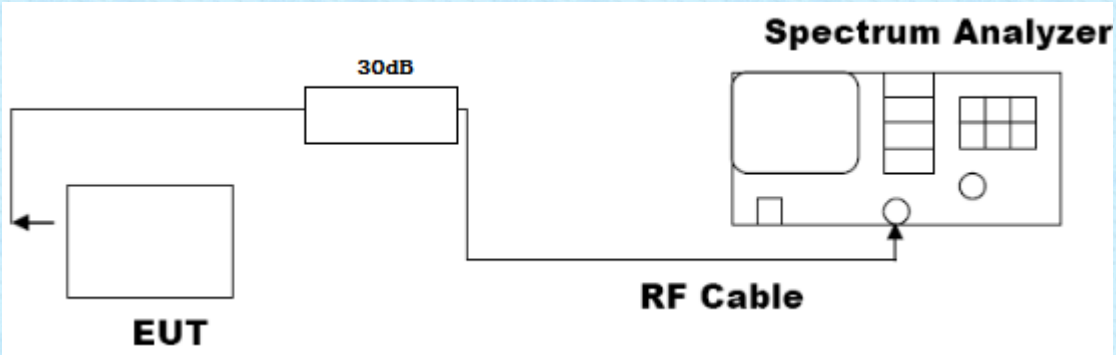


Radiated Above 1 GHz





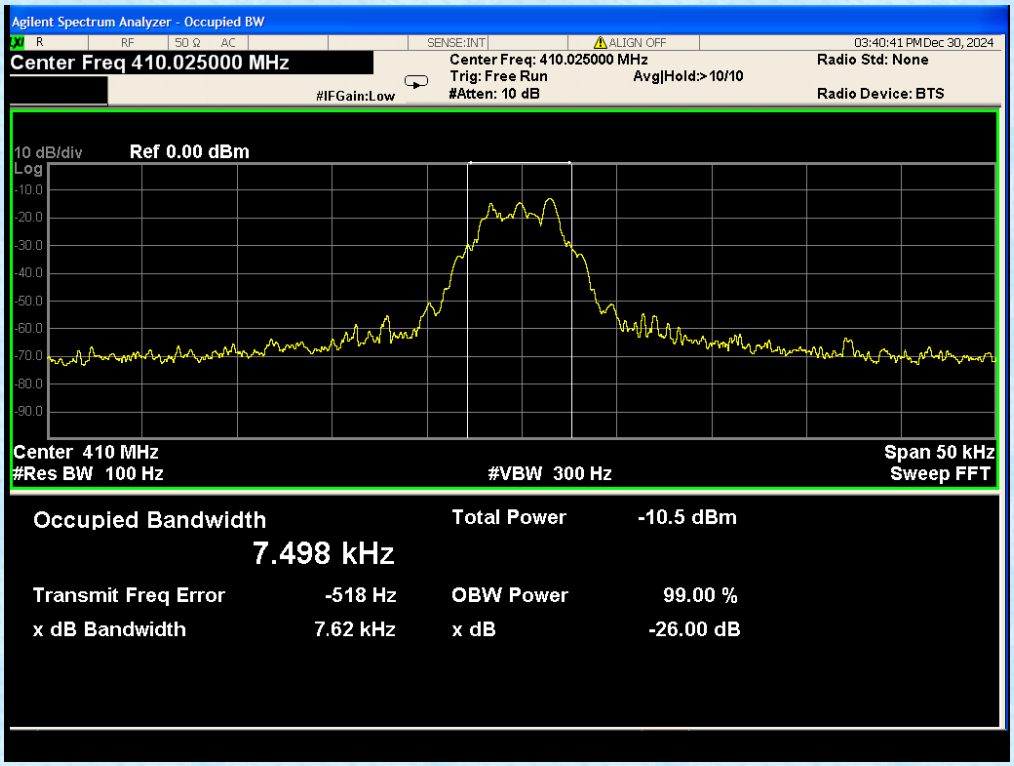
Conduction method:



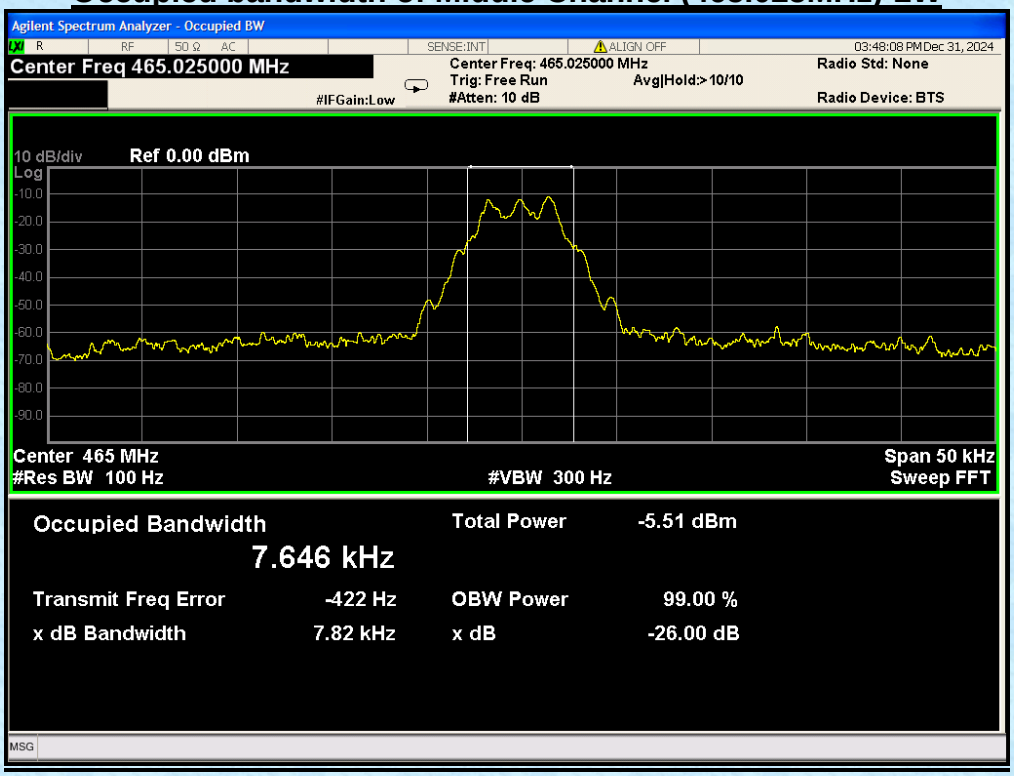
9.4 MEASUREMENT RESULT

Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
410.025MHz	7.498 KHz	7.62 KHz	11.25 KHz	Pass
465.025MHz	7.646 KHz	7.82 KHz	11.25 KHz	Pass
478.025MHz	7.346 KHz	7.67 KHz	11.25 KHz	Pass

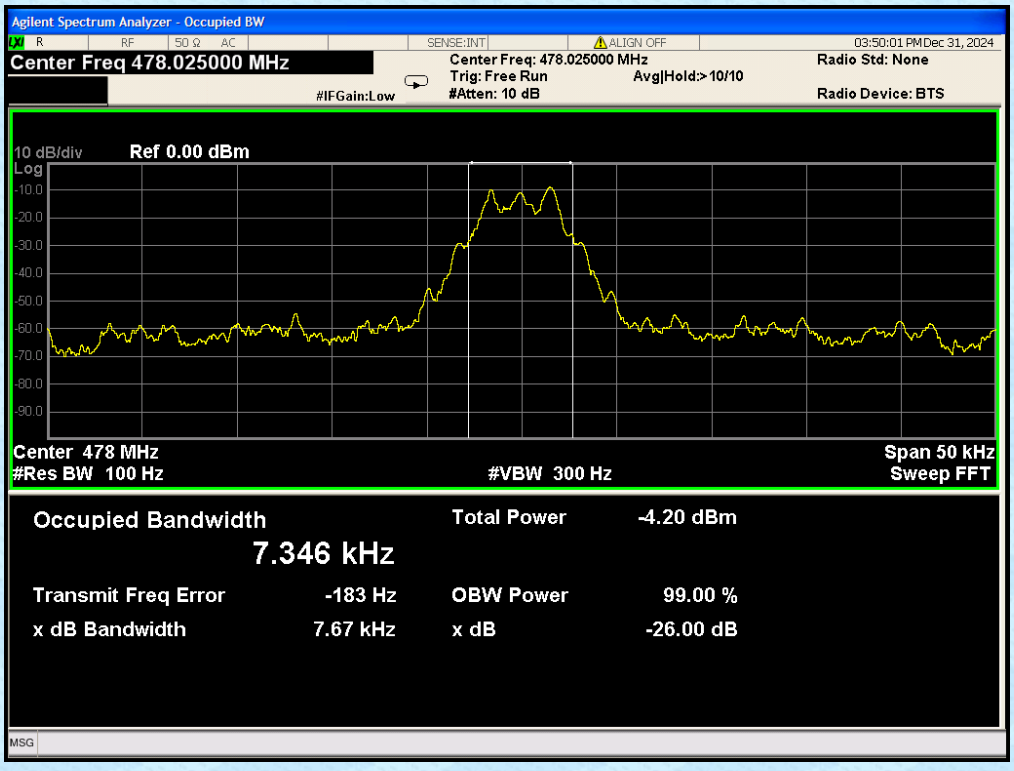
Occupied bandwidth of Low Channel (410.025MHz)-2W



Occupied bandwidth of Middle Channel (465.025MHz)-2W

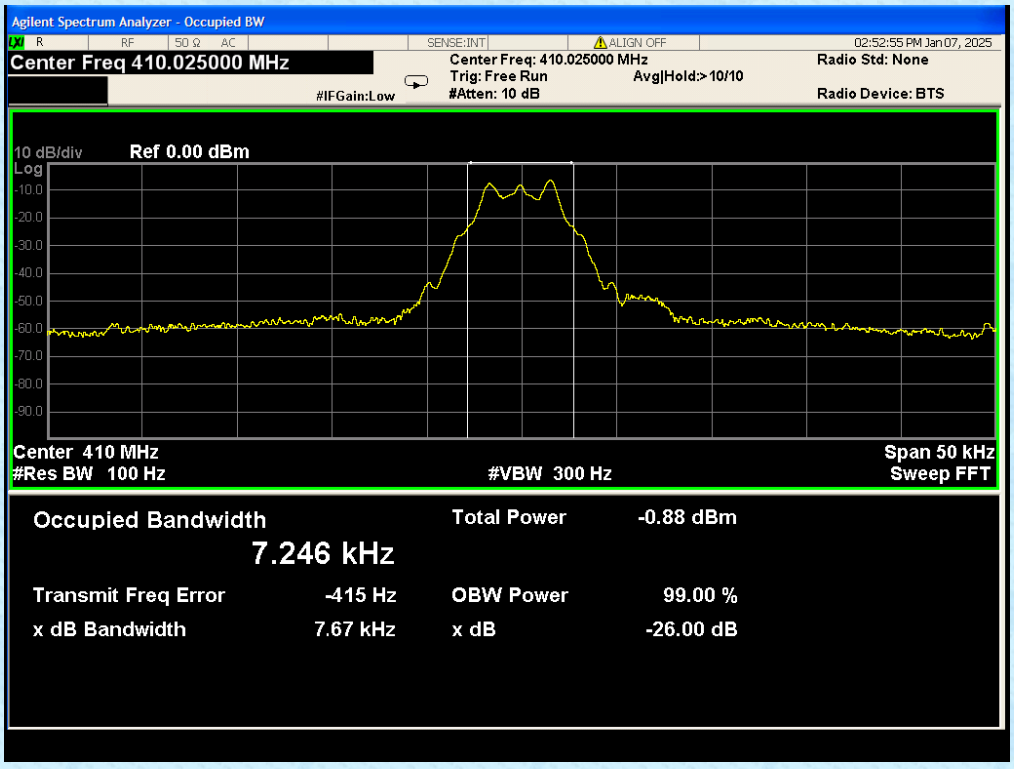


Occupied bandwidth of High Channel (478.025MHz)-2W

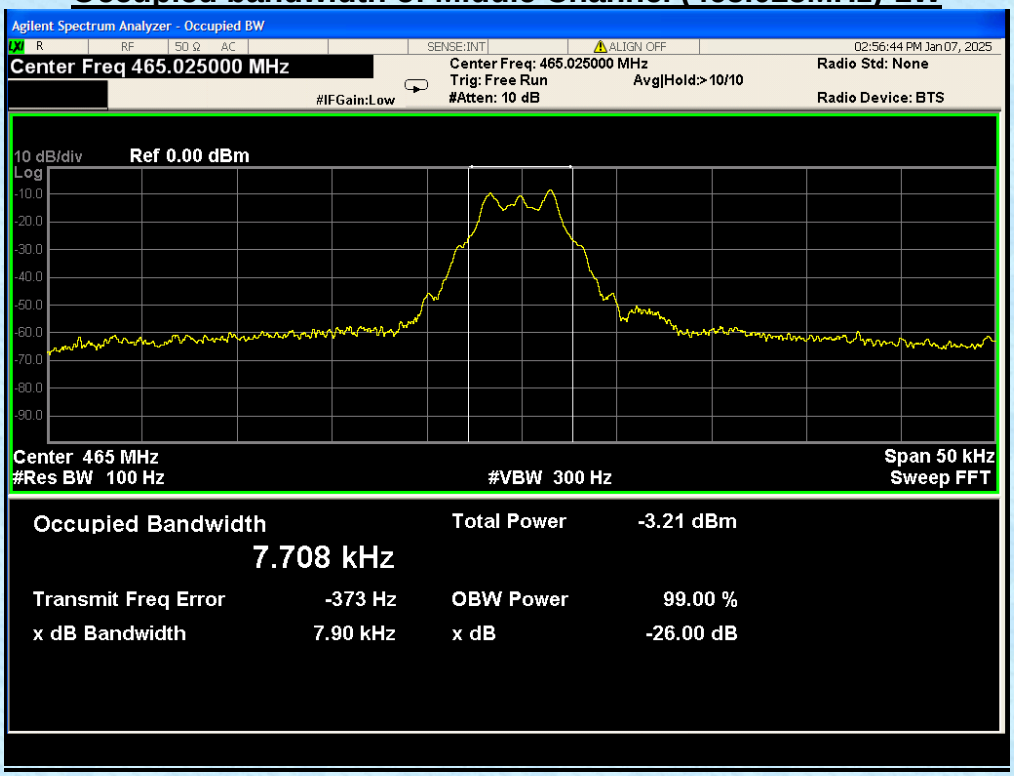


Emission Bandwidth Measurement Result				
Operating Frequency	12.5 KHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
410.025MHz	7.246 KHz	7.67 KHz	11.25 KHz	Pass
465.025MHz	7.708 KHz	7.90 KHz	11.25 KHz	Pass
478.025MHz	7.170 KHz	7.26 KHz	11.25 KHz	Pass

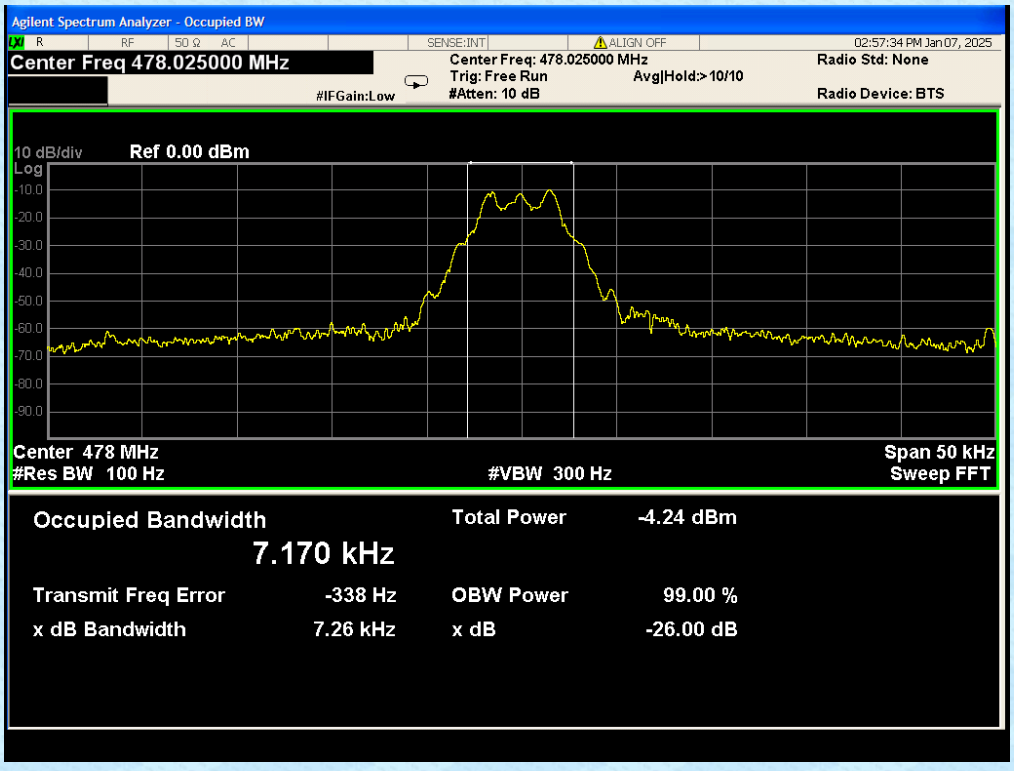
Occupied bandwidth of Low Channel (410.025MHz)-1W



Occupied bandwidth of Middle Channel (465.025MHz)-1W

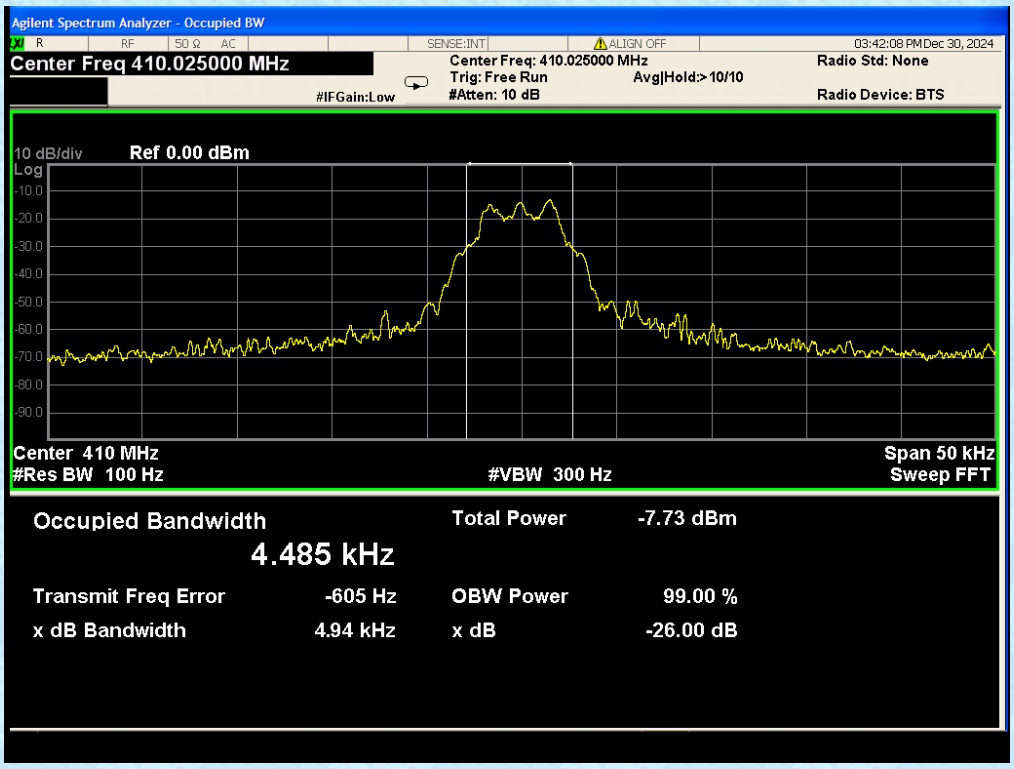


Occupied bandwidth of High Channel (478.025MHz)-1W

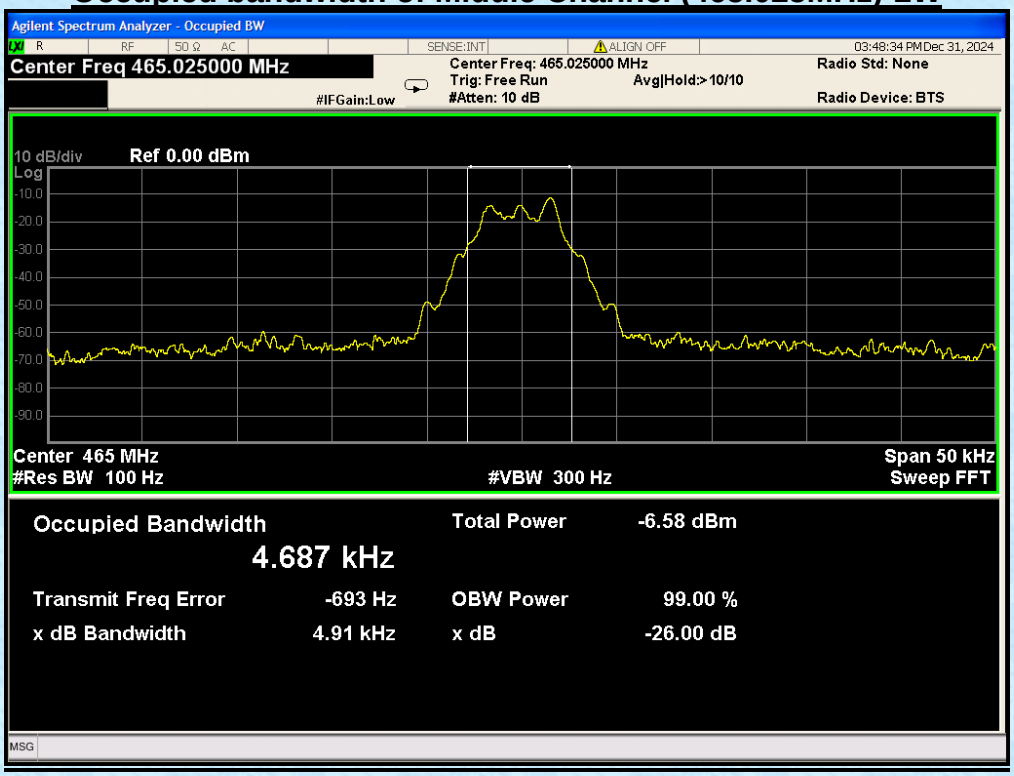


Emission Bandwidth Measurement Result				
Operating Frequency	6.5 KHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
410.025MHz	4.485 KHz	4.94 KHz	6.5 KHz	Pass
465.025MHz	4.687 KHz	4.91 KHz	6.5 KHz	Pass
478.025MHz	4.373 KHz	4.85 KHz	6.5 KHz	Pass

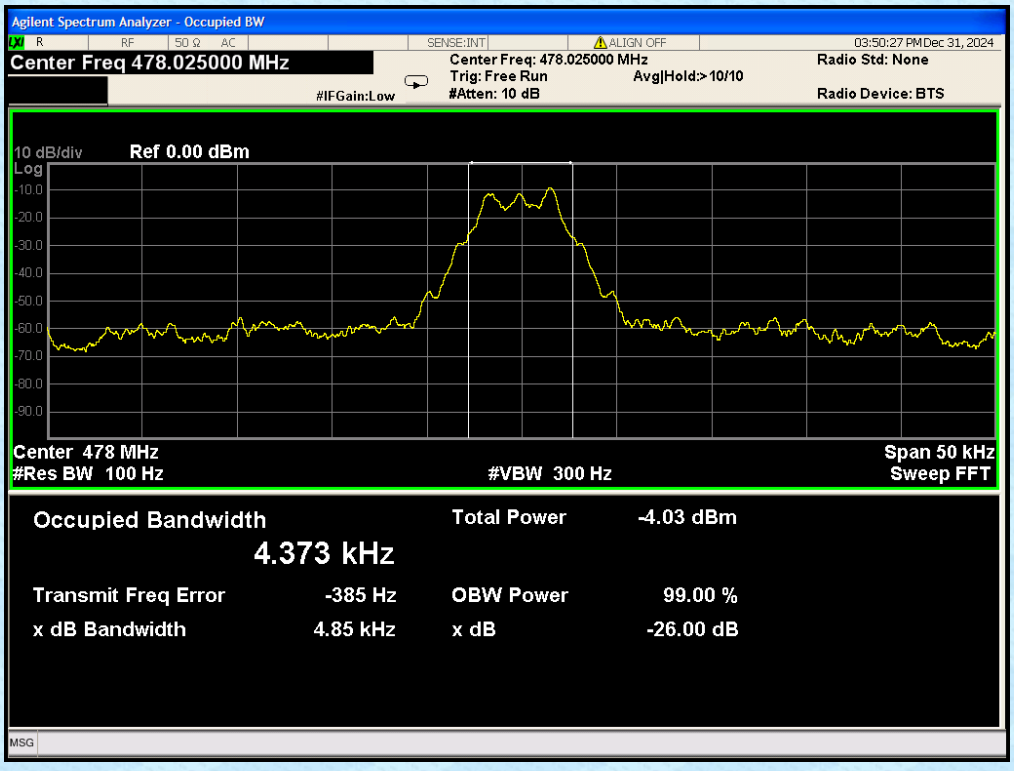
Occupied bandwidth of Bottom Channel (410.025MHz)-2W



Occupied bandwidth of Middle Channel (465.025MHz)-2W

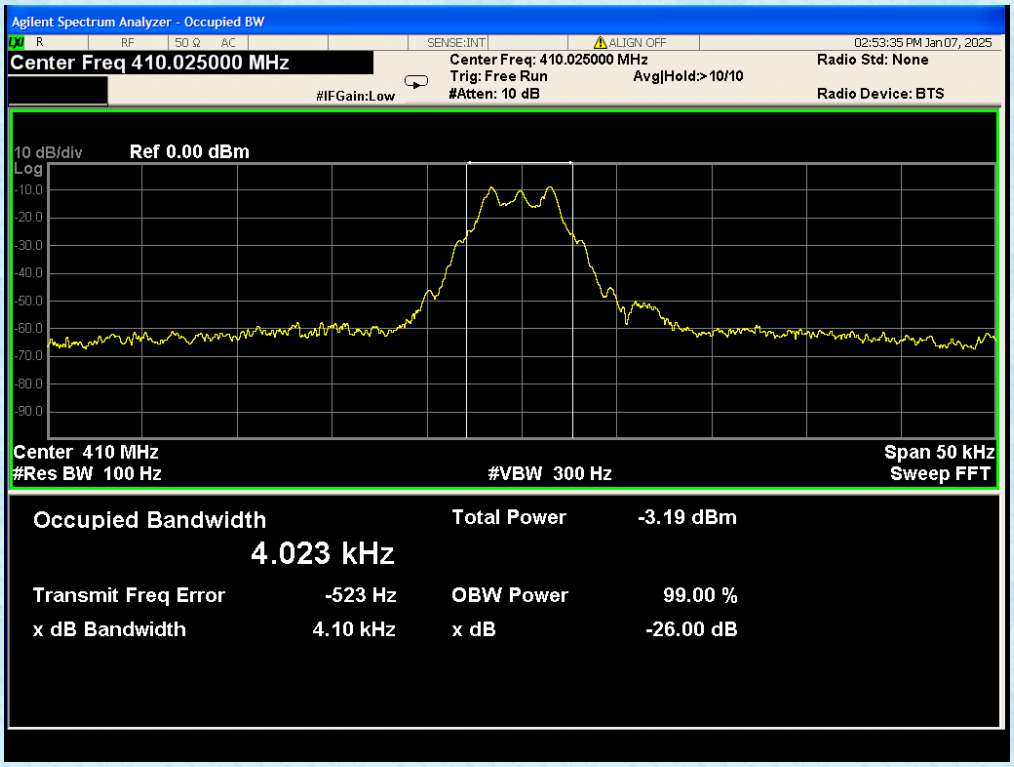


Occupied bandwidth of Top Channel (478.025MHz)-2W

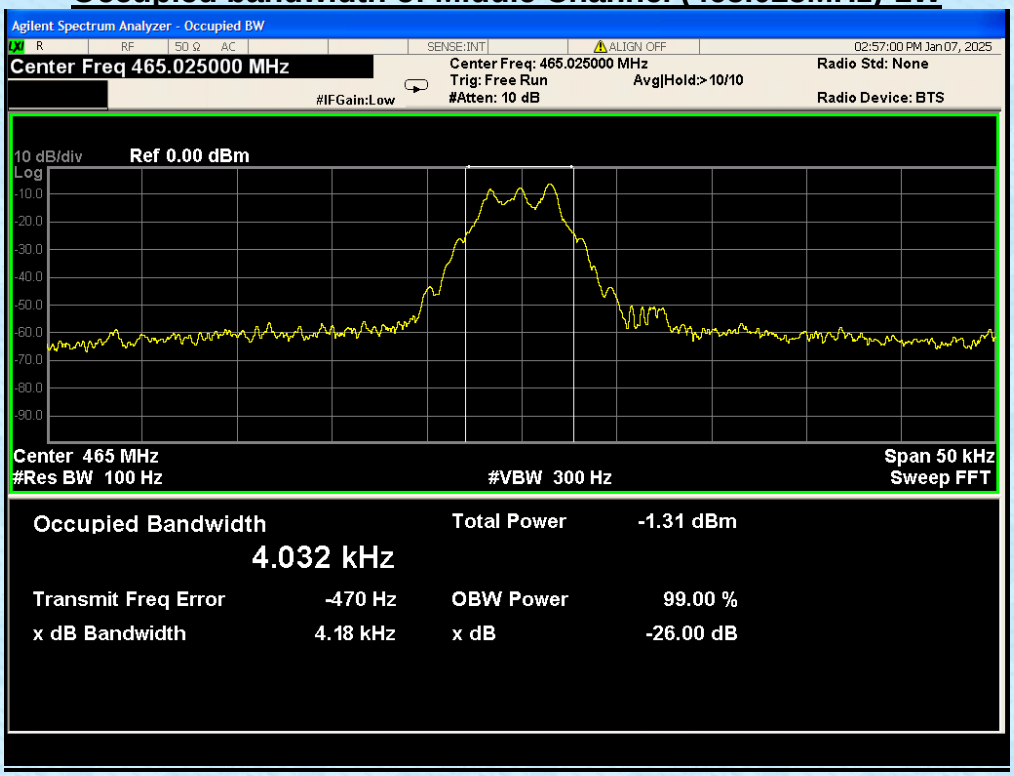


Emission Bandwidth Measurement Result				
Operating Frequency	6.5 KHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
410.025MHz	4.023 KHz	4.10 KHz	6.5 KHz	Pass
465.025MHz	4.032 KHz	4.18 KHz	6.5 KHz	Pass
478.025MHz	4.345 KHz	4.55 KHz	6.5 KHz	Pass

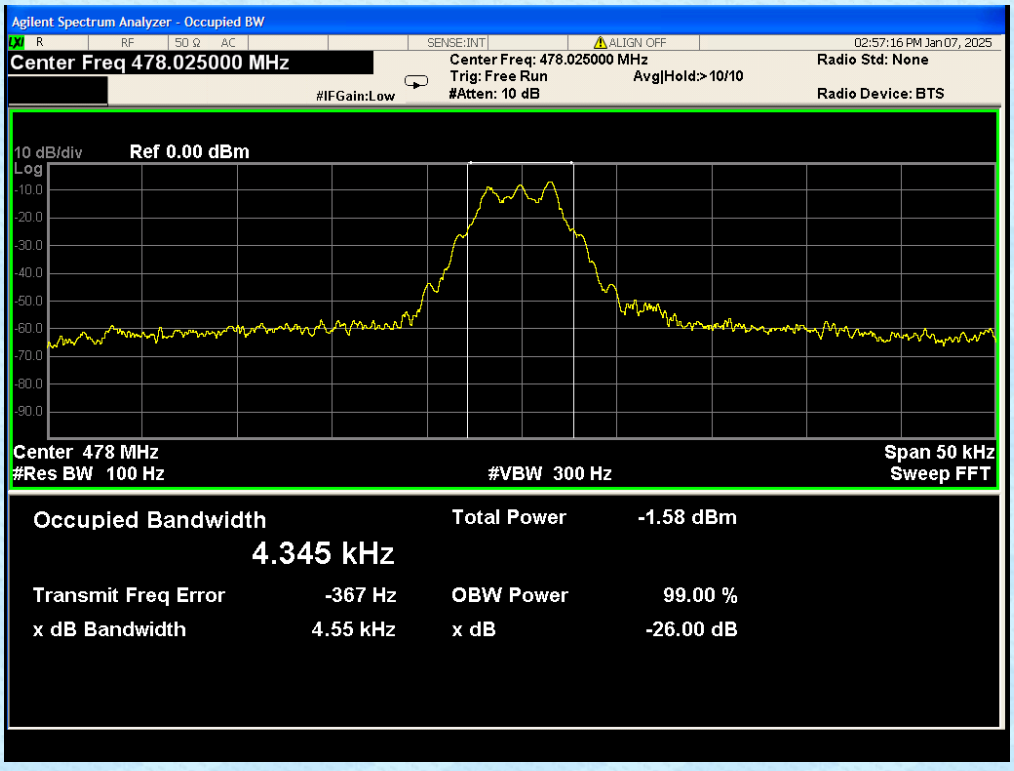
Occupied bandwidth of Bottom Channel (410.025MHz)-1W



Occupied bandwidth of Middle Channel (465.025MHz)-1W



Occupied bandwidth of Top Channel (478.025MHz)-1W



10. UNWANTED RADIATION

10.1 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 fo to 5.625 KHz removed from fo: Zero dB.

(2).On any frequency removed from the center of the authorized bandwidth by a displacement Frequency (fd in KHz) fo of more than 5.625 KHz but no more than 12.5 KHz: At least 7.27(fd-2.88 KHz) dB

(3).On any frequency removed from the center of the authorized bandwidth by a displacement Frequency (fd in KHz)fo of more than 12.5 KHz: At least 50+10 log(P) dB or 70 dB, whichever is lesser attenuation.

10.2 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 than 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.

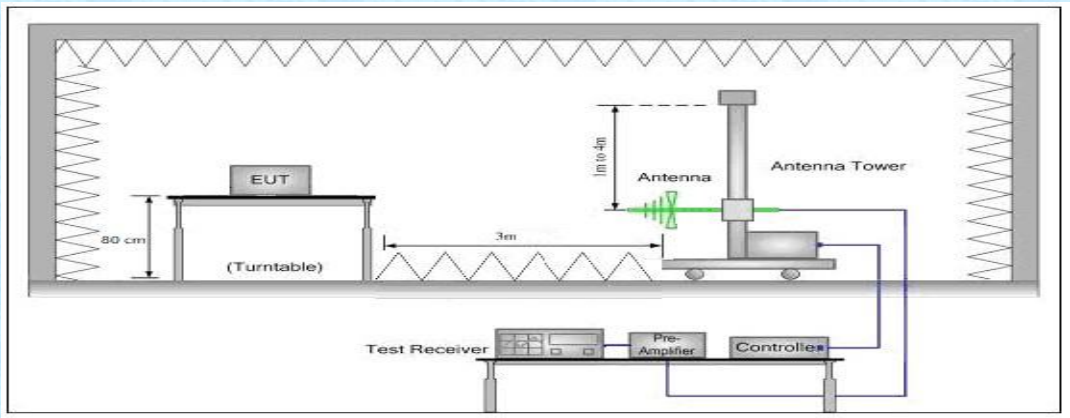
(17)The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

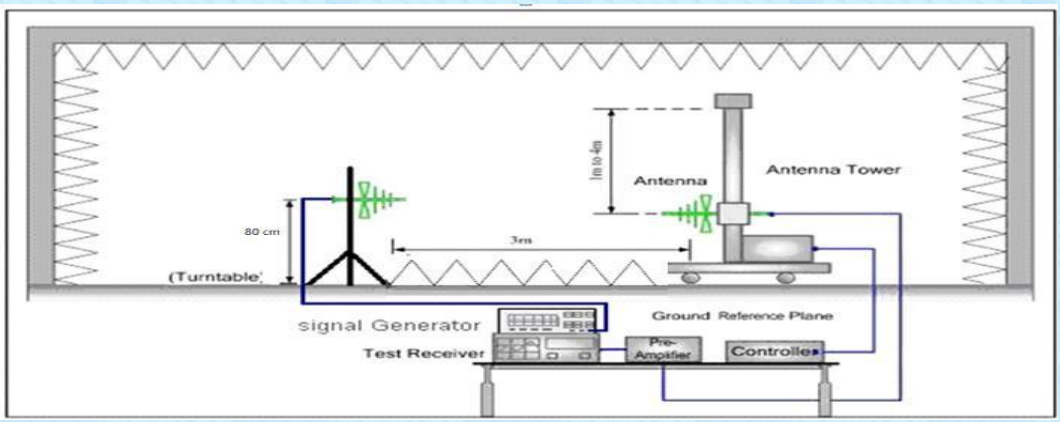
10.3 Test Setup Block Diagram

SUBSTITUTION METHOD: (Radiated Emissions)

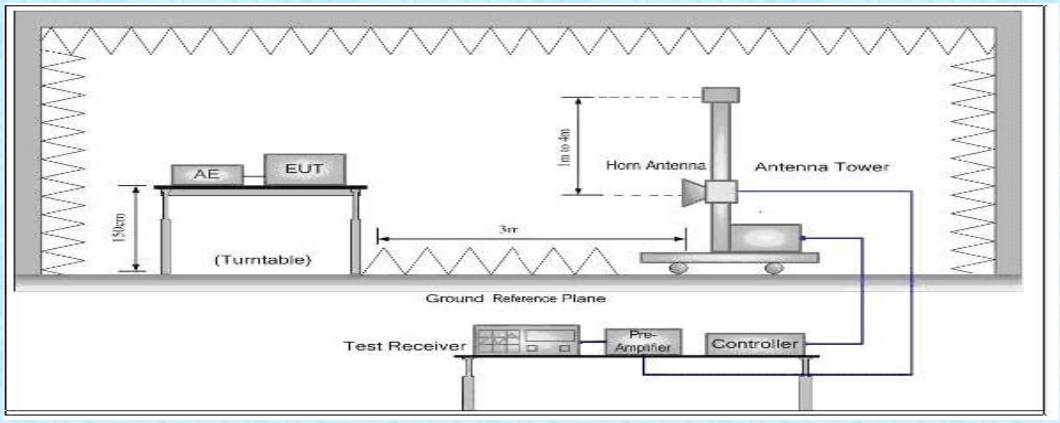
Radiation method:

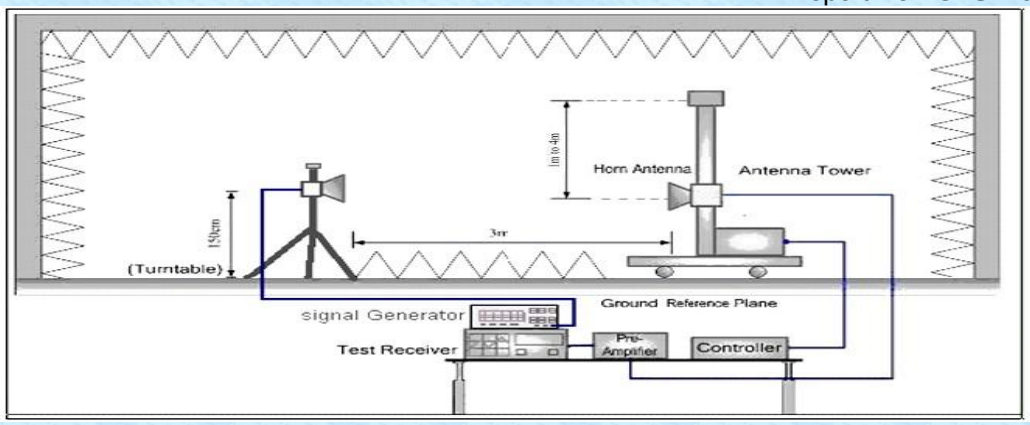
Radiated Below1GHz





Radiated Above 1 GHz





10.4 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 (fd 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 = “Read Value” + Measured substitution value + 2.15.

Limit: At least 50+10 log (P) =50+10log (2) =53.01 (dB)—2W 33.01-53.01=-20dBm

At least 50+10 log (P) =50+10log (1) =50.00 (dB)—1W 30.00-50.00=-20dBm

Measurement Result for 12.5 KHz Channel Separation @ 410.025MHz-2W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
410.025	H	0		pass
550.050	H	-24.62	-20	pass
1200.075	H	-25.18	-20	pass
1605.100	H	-27.67	-20	pass
2400.125	H	-29.12	-20	pass
2470.150	H	-29.99	-20	pass
2808.175	H	-32.89	-20	pass
3270.200	H	-28.91	-20	pass
3600.225	H	-30.04	-20	pass
4150.250	H	-31.44	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
410.025	V	0		pass
808.050	V	-25.15	-20	pass
1270.075	V	-27.49	-20	pass
1600.100	V	-27.95	-20	pass
2000.125	V	-29.85	-20	pass
2470.150	V	-29.19	-20	pass
2800.175	V	-33.46	-20	pass
3240.200	V	-27.71	-20	pass
3650.225	V	-32.37	-20	pass
4700.250	V	-33.91	-20	pass

Measurement Result for 12.5 KHz Channel Separation @ 465.025MHz-2W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
465.025	H	0		pass
875.050	H	-26.82	-20	pass
1355.075	H	-27.32	-20	pass
1740.100	H	-28.89	-20	pass
2175.125	H	-29.46	-20	pass
2650.150	H	-30.10	-20	pass
3045.175	H	-31.41	-20	pass
3480.200	H	-28.22	-20	pass
3915.225	H	-31.36	-20	pass
4370.250	H	-32.78	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
465.025	V	0		pass
880.050	V	-26.15	-20	pass
1305.075	V	-25.29	-20	pass
1740.100	V	-27.74	-20	pass
2145.125	V	-29.13	-20	pass
2610.150	V	-33.26	-20	pass
3045.175	V	-34.22	-20	pass
3480.200	V	-29.19	-20	pass
3945.225	V	-27.55	-20	pass
4770.250	V	-33.55	-20	pass

Measurement Result for 12.5 KHz Channel Separation @ 478.025MHz-2W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
478.025	H	0		pass
939.950	H	-27.85	-20	pass
1409.925	H	-29.11	-20	pass
1889.900	H	-29.81	-20	pass
2349.875	H	-31.75	-20	pass
2819.850	H	-28.67	-20	pass
3289.825	H	-32.35	-20	pass
3789.800	H	-28.75	-20	pass
4229.775	H	-31.54	-20	pass
4449.750	H	-32.22	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
478.025	V	0		pass
939.950	V	-27.82	-20	pass
1409.925	V	-29.04	-20	pass
1879.900	V	-28.88	-20	pass
2349.875	V	-30.74	-20	pass
2819.850	V	-29.61	-20	pass
3289.825	V	-31.73	-20	pass
3759.800	V	-29.24	-20	pass
4229.775	V	-30.53	-20	pass
4649.750	V	-33.84	-20	pass

Measurement Result for 12.5 KHz Channel Separation @ 410.025MHz-1W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
410.025	H	0		pass
700.050	H	-25.52	-20	pass
1240.075	H	-28.35	-20	pass
1650.100	H	-27.85	-20	pass
2000.125	H	-27.51	-20	pass
2470.150	H	-31.97	-20	pass
2800.175	H	-32.35	-20	pass
3200.200	H	-28.62	-20	pass
3670.225	H	-31.43	-20	pass
4050.250	H	-31.85	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
410.025	V	0		pass
800.050	V	-26.06	-20	pass
1240.075	V	-26.12	-20	pass
1600.100	V	-24.64	-20	pass
2000.125	V	-24.79	-20	pass
2400.150	V	-30.02	-20	pass
2840.175	V	-28.07	-20	pass
3200.200	V	-32.16	-20	pass
3600.225	V	-33.62	-20	pass
4070.250	V	-36.27	-20	pass

Measurement Result for 12.5 KHz Channel Separation @ 465.025MHz-1W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
465.025	H	0		pass
870.050	H	-27.24	-20	pass
1305.075	H	-25.76	-20	pass
1780.100	H	-30.67	-20	pass
2175.125	H	-30.15	-20	pass
2610.150	H	-33.43	-20	pass
3045.175	H	-35.30	-20	pass
3480.200	H	-30.12	-20	pass
3915.225	H	-29.80	-20	pass
4355.250	H	-34.77	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
465.025	V	0		pass
885.050	V	-28.26	-20	pass
1305.075	V	-29.45	-20	pass
1740.100	V	-30.10	-20	pass
2175.125	V	-30.65	-20	pass
2610.150	V	-31.85	-20	pass
3045.175	V	-33.44	-20	pass
3480.200	V	-30.14	-20	pass
3915.225	V	-34.32	-20	pass
4350.250	V	-32.84	-20	pass

Measurement Result for 12.5 KHz Channel Separation @ 478.025MHz-1W

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
478.025	H	0		pass
939.950	H	-27.35	-20	pass
1409.925	H	-26.56	-20	pass
1879.900	H	-28.39	-20	pass
2349.875	H	-28.76	-20	pass
2819.850	H	-33.05	-20	pass
3289.825	H	-35.42	-20	pass
3759.800	H	-29.16	-20	pass
4229.775	H	-28.25	-20	pass
4699.750	H	-35.35	-20	pass

Emission Frequency (MHz)	Ant.Polarity (H/V)	Measurement Result (dBm)	Limit (dBm)	Result (P/F)
478.025	V	0		pass
939.950	V	-27.92	-20	pass
1409.925	V	-27.45	-20	pass
1879.900	V	-28.59	-20	pass
2349.875	V	-29.78	-20	pass
2819.850	V	-30.65	-20	pass
3289.825	V	-32.89	-20	pass
3759.800	V	-29.28	-20	pass
4229.775	V	-32.36	-20	pass
4679.750	V	-33.64	-20	pass

10.5 Emission Mask Plot

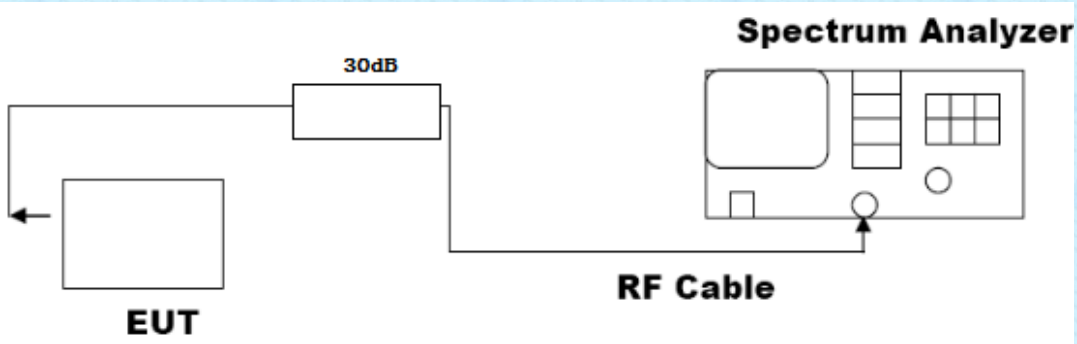
The detailed procedure employed for Emission Mask measurements are specified as following:

-Connect the equipment as illustrated.

-Spectrum set as follow:

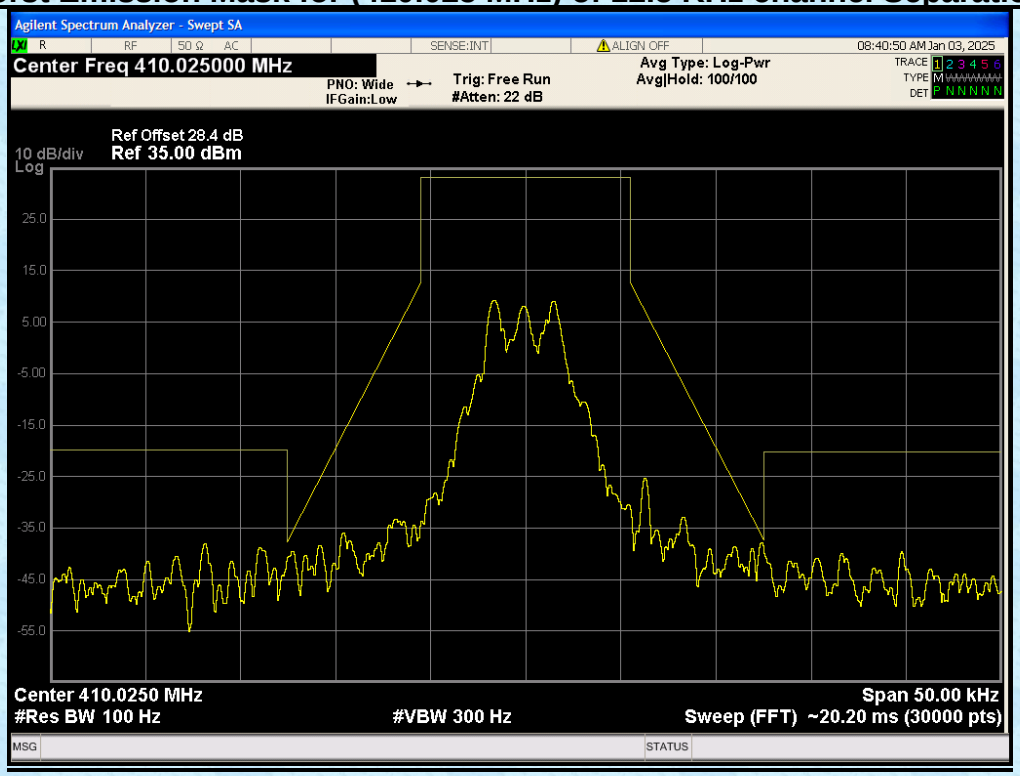
1. Centre frequency = fundamental frequency, Span=50KHz for 12.5kHz and 25kHz channel spacing,
   RBW=100Hz, VBW=300Hz for 12.5kHz, RBW=300Hz, VBW=1000Hz for 25kHz,Sweep = auto, Detector function = peak, Trace = max hold
2. Key the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the
   0dB reference for the measurement.
3. Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to
   produce 50% of rated system deviation(Rated system deviation is 2.5 kHz for 12.5kHz channel spacing).
   The input level shall be established at the frequency of maximum response of the audio modulating circuit.
4. Transmitters employing digital modulation techniques that bypass the limiter and the audio low-pass filter
   shall be modulated as specified by the manufacturer
5. Measure and record the results in the test report.

10.6 TEST SETUP BLOCK DIAGRAM

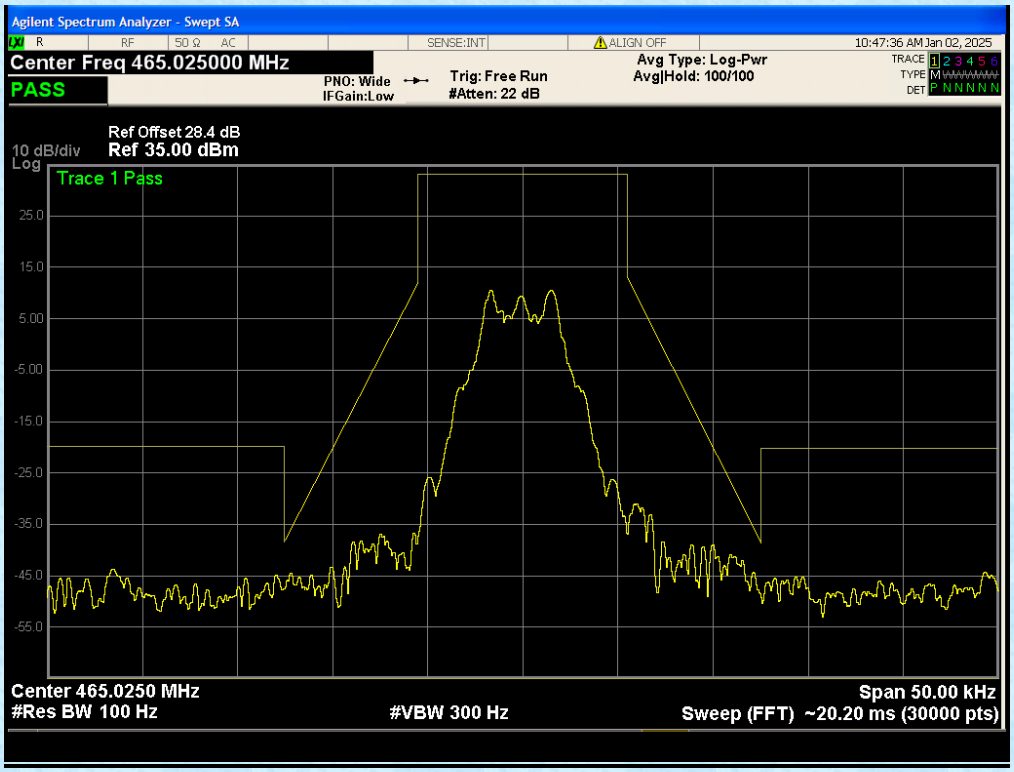


10.7 MEASUREMENT RESULTS:

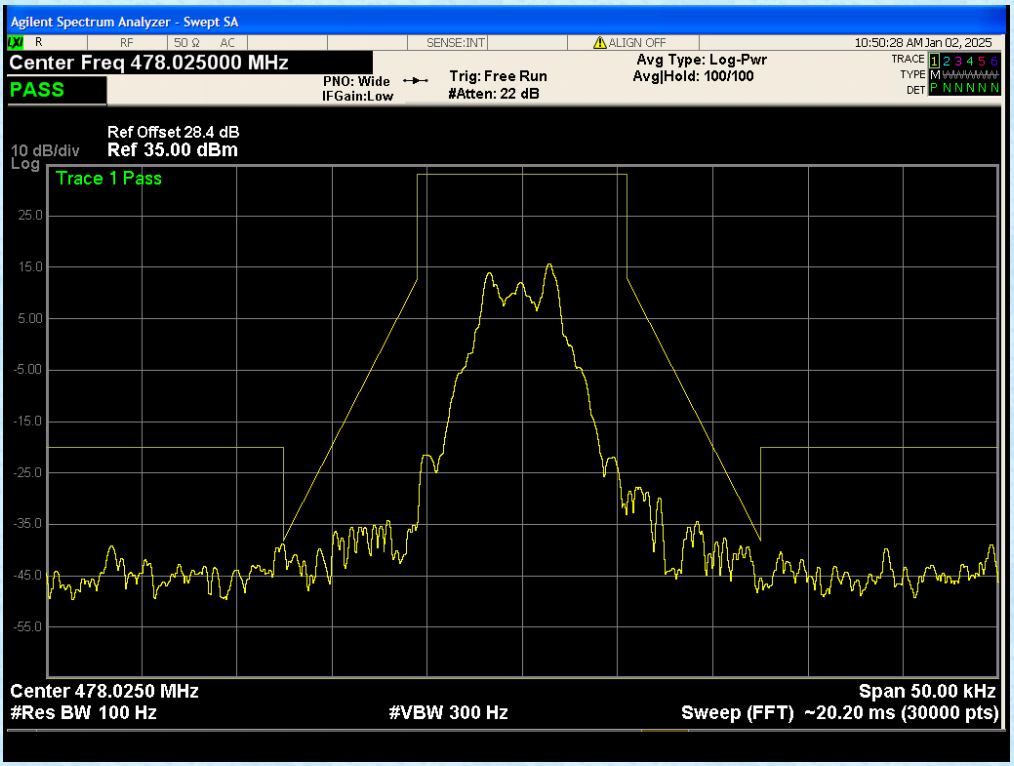
The Worst Emission Mask for (410.025 MHz) of 12.5 KHz channel Separation (2W)



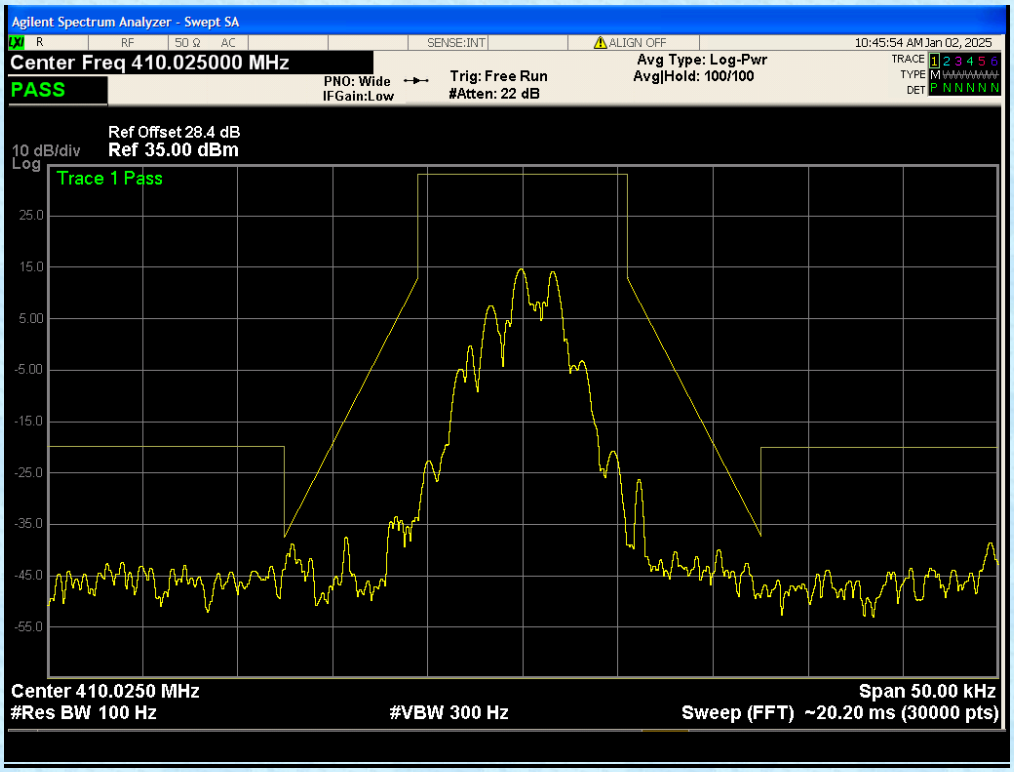
The Worst Emission Mask for (465.025 MHz) of 12.5 KHz channel Separation (2W)



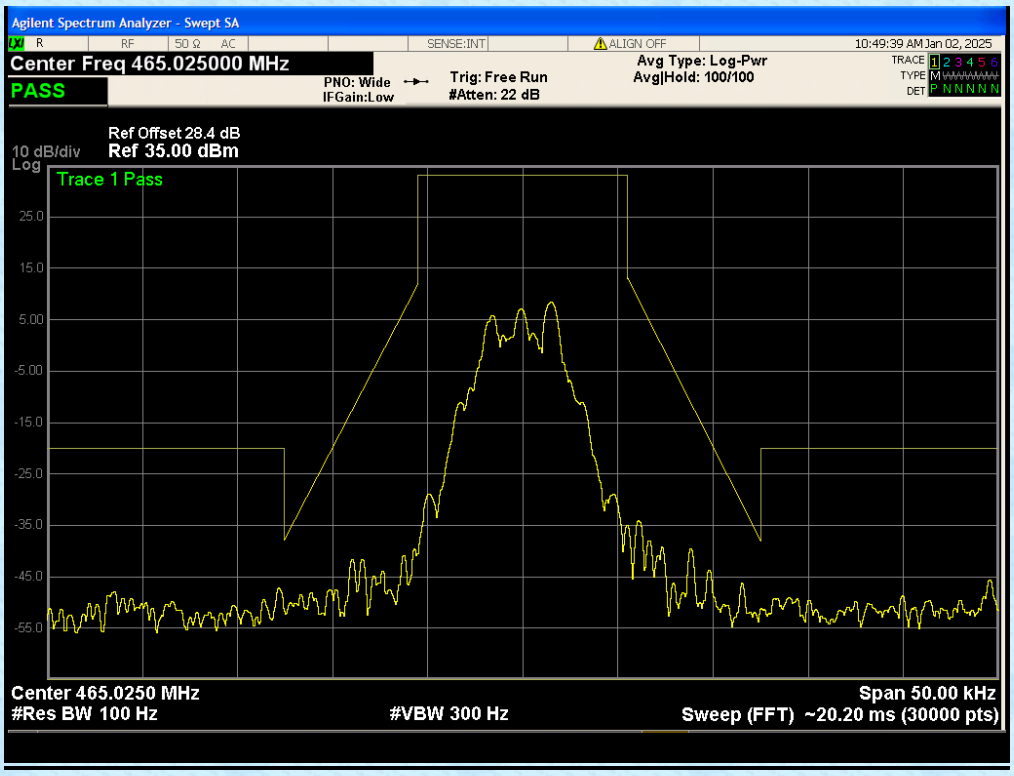
The Worst Emission Mask for (478.025 MHz) of 12.5 KHz channel Separation (2W)



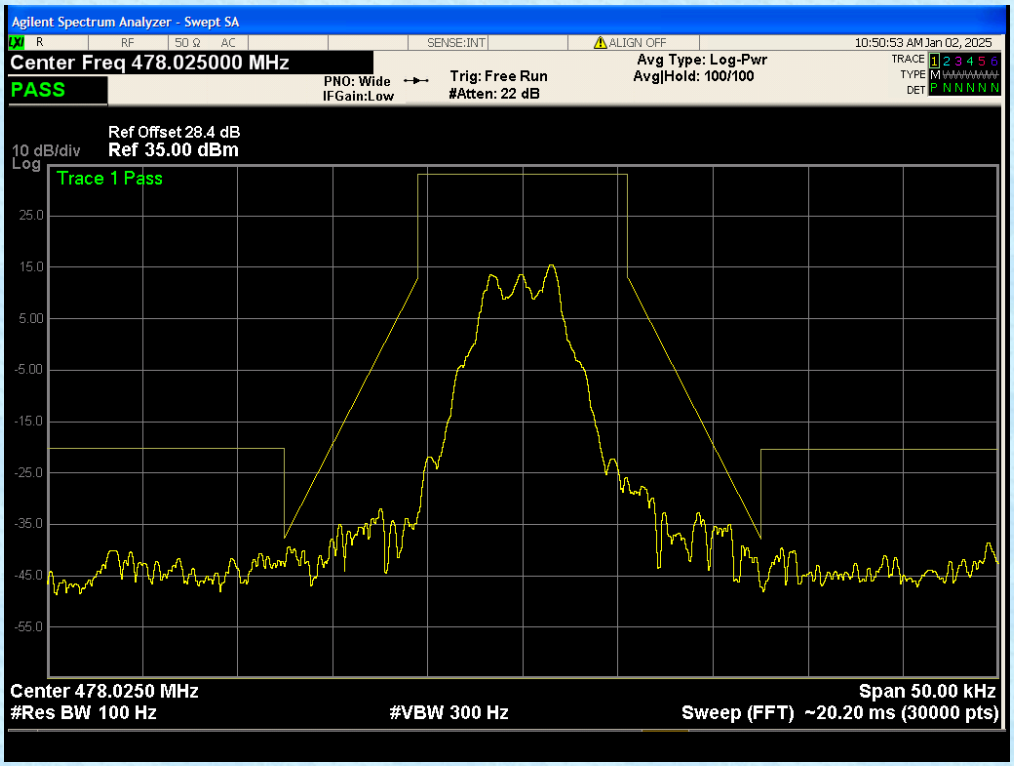
The Worst Emission Mask for (410.025 MHz) of 12.5 KHz channel Separation (1W)



The Worst Emission Mask for (465.025 MHz) of 12.5 KHz channel Separation (1W)



The Worst Emission Mask for (478.025 MHz) of 12.5 KHz channel Separation (1W)



11. MODULATION CHARACTERISTICS

11.1 Provisions Applicable

According to FCC§2.1047 and §90.207, for Voice Modulation Communication Equipment, the frequency response of the audio modulation circuit over a range of 100 to 5000Hz shall be measured.

2.1047(b): Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to. show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

Recommended frequency deviation characteristics are given below:

1.25 kHz for 6.25 kHz Channel Spacing System

2.5 kHz for 12.5 kHz Channel Spacing System

5 kHz for 25 kHz Channel Spacing System

11.2 Measurement Method

10.2.1 Modulation Limit

(1). Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1KHz using this level as a reference (0dB) and vary the input level from –20 to +20dB. Record the frequency deviation obtained as a function of the input level.

(2). Repeat step 1 with input frequency changing to 300, 1000, 1500 and 3000Hz in sequence.

10.2.2 Audio Frequency Response

(1). Configure the EUT as shown in figure 1.

(2). Adjust the audio input for 20% of rated system deviation at 1 KHz using this level as a reference (0 dB).

(3). Vary the Audio frequency from 100 Hz to 10 KHz and record the frequency deviation.

(4). Audio Frequency Response = 20log10 (Deviation of test frequency/Deviation of 1 KHz reference).

11.3 TEST SETUP BLOCK DIAGRAM

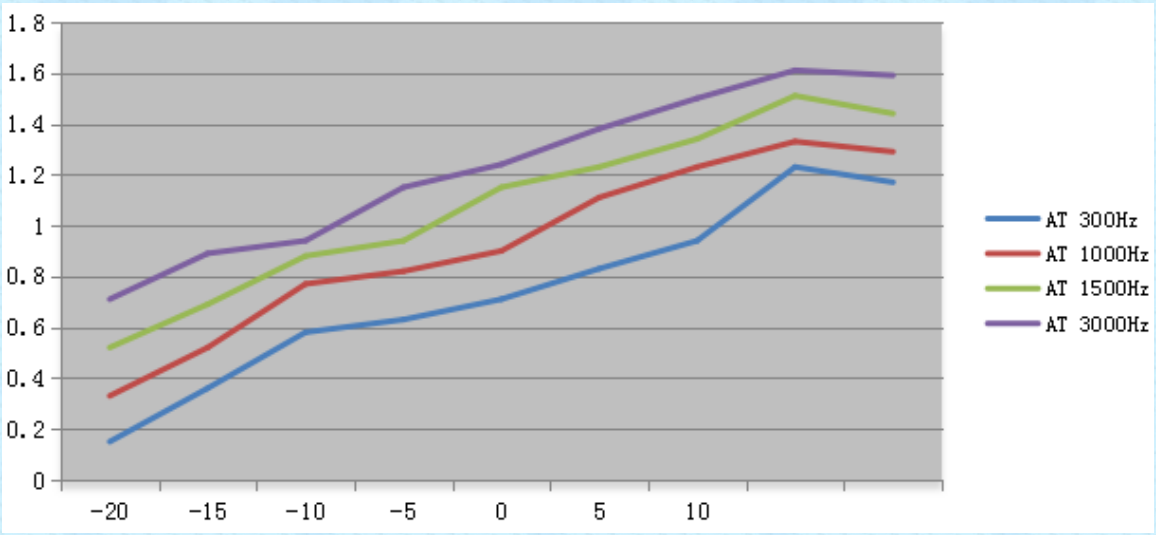
11.3 Measurement Result

TEST RESULT TS FOR 2W

MODULATION LIMIT:

Bottom Channel @ 12.5 KHz Channel Separations

Modulation Level (dB)	Peak Freq. Deviation At 300 Hz	Peak Freq. Deviation At 1000 Hz	Peak Freq. Deviation At 1500 Hz	Peak Freq. Deviation At 3000 Hz
-20	0.15	0.33	0.52	0.71
-15	0.36	0.52	0.69	0.89
-10	0.58	0.77	0.88	0.94
-5	0.63	0.82	0.94	1.15
0	0.71	0.90	1.15	1.24
+5	0.83	1.11	1.23	1.38
+10	0.94	1.23	1.34	1.50
+15	1.23	1.33	1.51	1.61
+20	1.17	1.29	1.44	1.59



Note: All the modes had been tested, but only the worst data recorded in the report.

12. MAXIMUMN TRANSMITTER POWER (CONDUCTED OUTPUT POWER) Peak Power

11.1 Provisions Applicable

Per FCC §2.1046 and §90.205: Maximum ERP is dependent upon the station's antenna HAAT and required service area.

11.2 Test Procedure

The RF output of Analog Transceiverwas conducted to a spectrum analyzer through an appropriate attenuator.

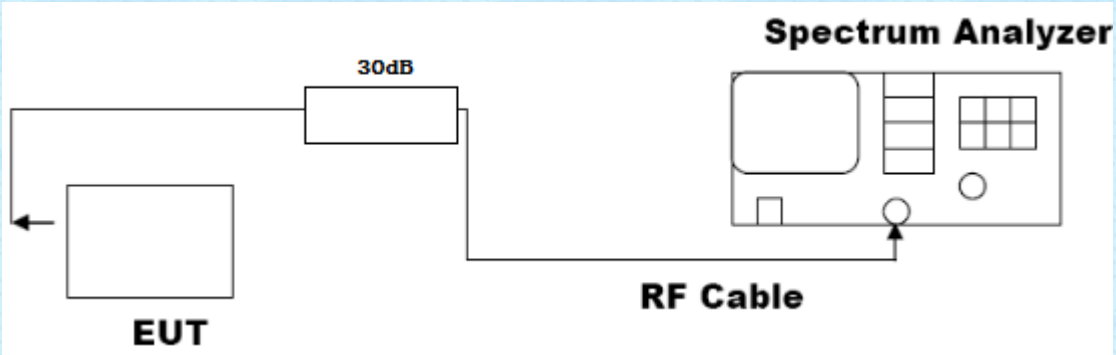
In the semi-anechoic chamber, setup as illustrated above the DUT placed on the 0.8m height of Turn Table, rotated the table 45 degree each interval to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the 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 = "Read Value" + Measured substitution value + 2.15.

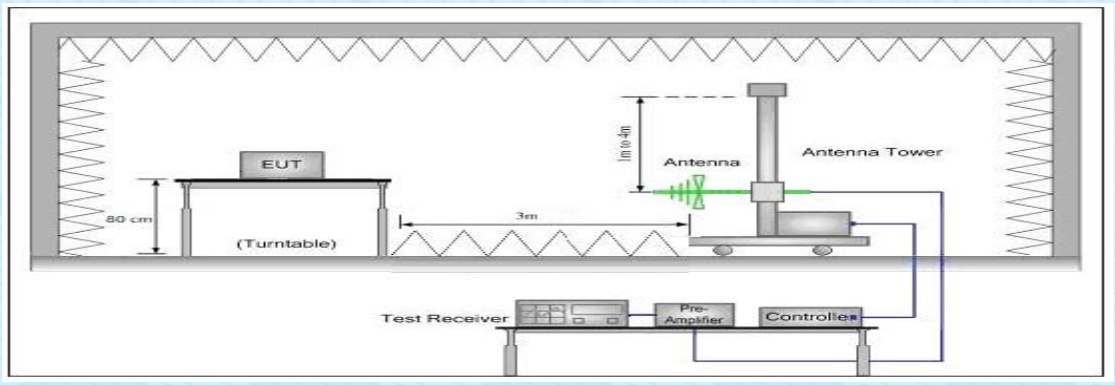
12.3 Test Configuration

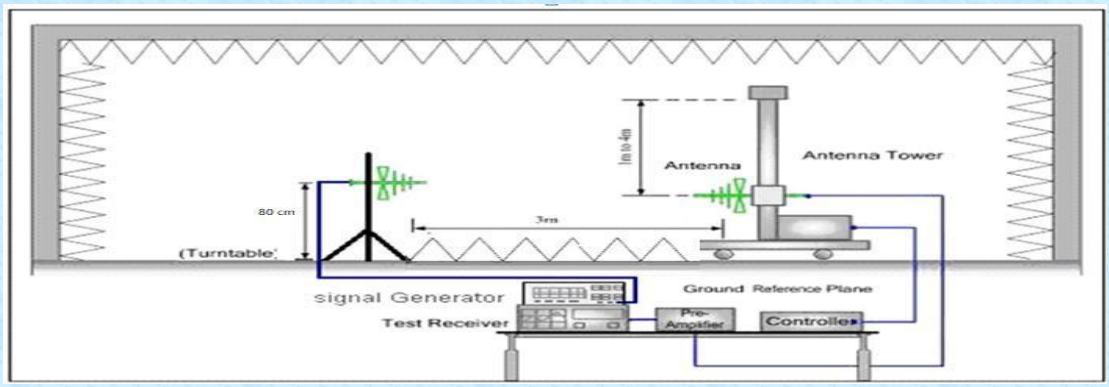
Conducted Output Power:



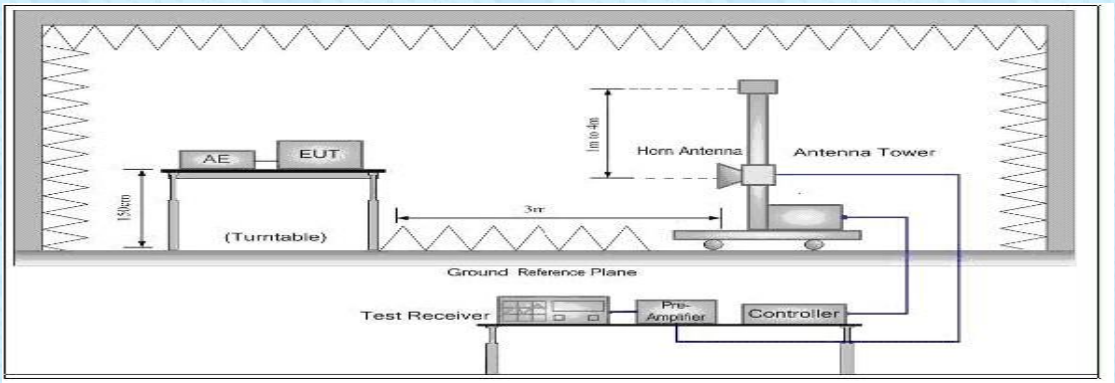
Effective Radiated Power

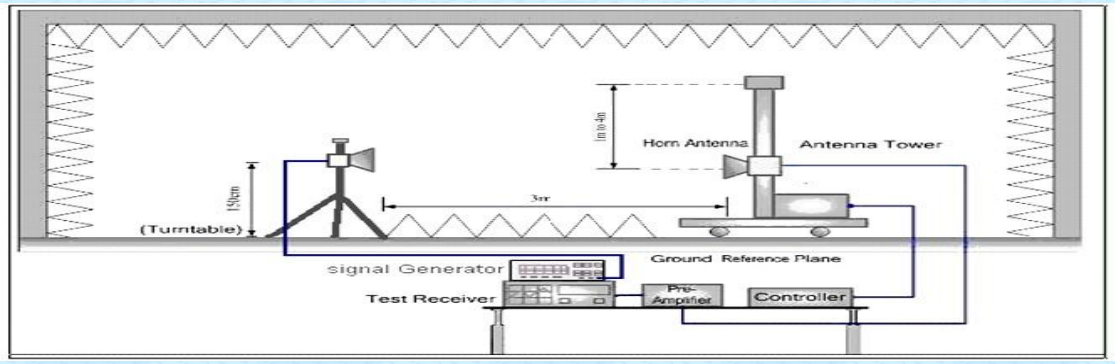
Radiated Below1GHz





Radiated Above 1 GHz





12.4 Test Result

The maximum Conducted Power (CP) for UHF is
Digital: 5W/1W for 12.5 KHz Channel Separation UHF
Calculation Formula: CP = R + A + L

Note:
(1) CP: The final Conducted Power
(2) R : The reading value from spectrum analyzer
(3) A : The attenuation value of the used attenuator
(4) L : The loss of all connection cables
(5) Measurement Result=Peak Power(Max)
(6) Both vertical and horizontal has been tested.

Conducted Power Measurement Results-2W		
Channel Separation	**Channel**	**Measurement Result (dBm)**
		For 33.01dBm(2W)
12.5 KHz	Low(410.025MHz)	**32.97**
	Middle(465.025MHz)	32.88
	High(478.025Hz)	32.95

Radiated Power Measurement Results-2W		
Channel Separation	**Channel**	**Measurement Result (dBm)**
		For 33.01dBm(2W)
12.5 KHz	Low(410.025MHz)	32.88
	Middle(465.025MHz)	32.75
	High(478.025Hz)	32.81

Conducted Power Measurement Results-1W		
Channel Separation	**Channel**	**Measurement Result (dBm)**
		For 30.00dBm(1W)
12.5 KHz	Bottom(410.025MHz)	29.87
	Middle(465.025MHz)	29.84
	High(478.025Hz)	**29.95**

Radiated Power Measurement Results-1W		
Channel Separation	**Channel**	**Measurement Result (dBm)**
		For 30.00dBm(1W)
12.5 KHz	Bottom(410.025MHz)	29.74
	Middle(465.025MHz)	29.69
	High(478.025Hz)	26.72

13. Spurious Emission on Antenna Port

13.1 Provisions Applicable

Please refer to FCC 47 CFR 2.1051, 2.1057 & 90.210 for specification details.
Emissions shall be attenuated below the mean output power of the transmitter as follows:

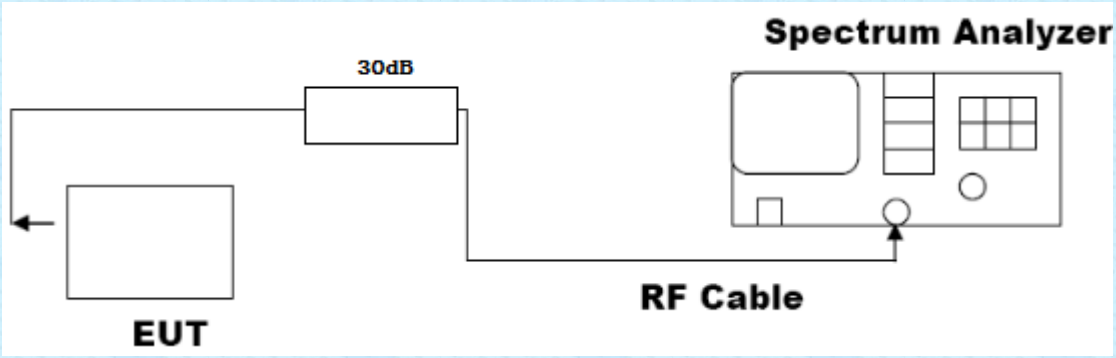
FCC Rules	Attenuation Limit (dBc)
§ 90.210	At least 50 + 10 log (P) dB

50 +10 log (Pwatts)
Note: In general, the worse case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-50-10log10 (TP)
EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is P(dBm)
Limit (dBm) = P(dBm)-50-10 log (Pwatts) = -20dBm

13.2 Test Procedure

1. The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was set to 100 kHz. Sufficient scans were taken to
show any out of band emission up to 10th . Harmonic for the lower and the highest frequency range.
3. Set RBW 100 kHz, VBW 300 kHz in the frequency band 30MHz to 1GHz,while set
RBW=1MHz.VBW=3MHz from the 1GHz to 10th Harmonic.
4. The audio input was set the unmodulated carrier, the resulting picture is print out for each channel
separation.

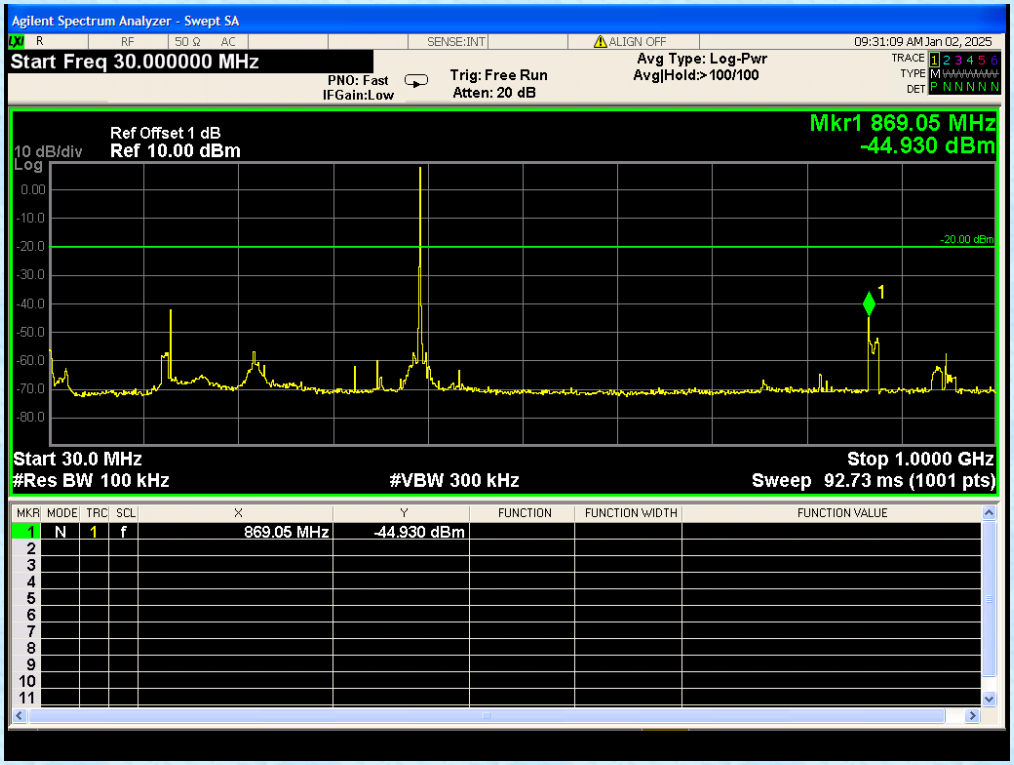
13.3 Test Configuration



13.4 Test Result

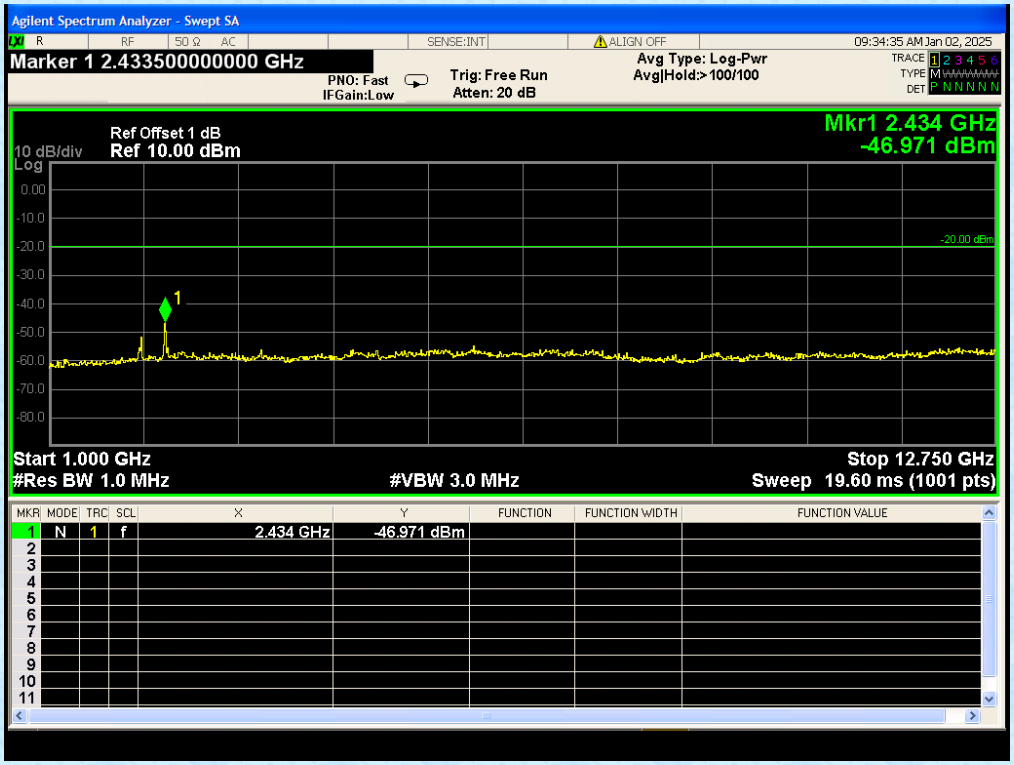
Conducted Spurious Emission (worst) @ 410.025MHz With 12.5 KHz Channel Separation-2W

30MHz-1GHz



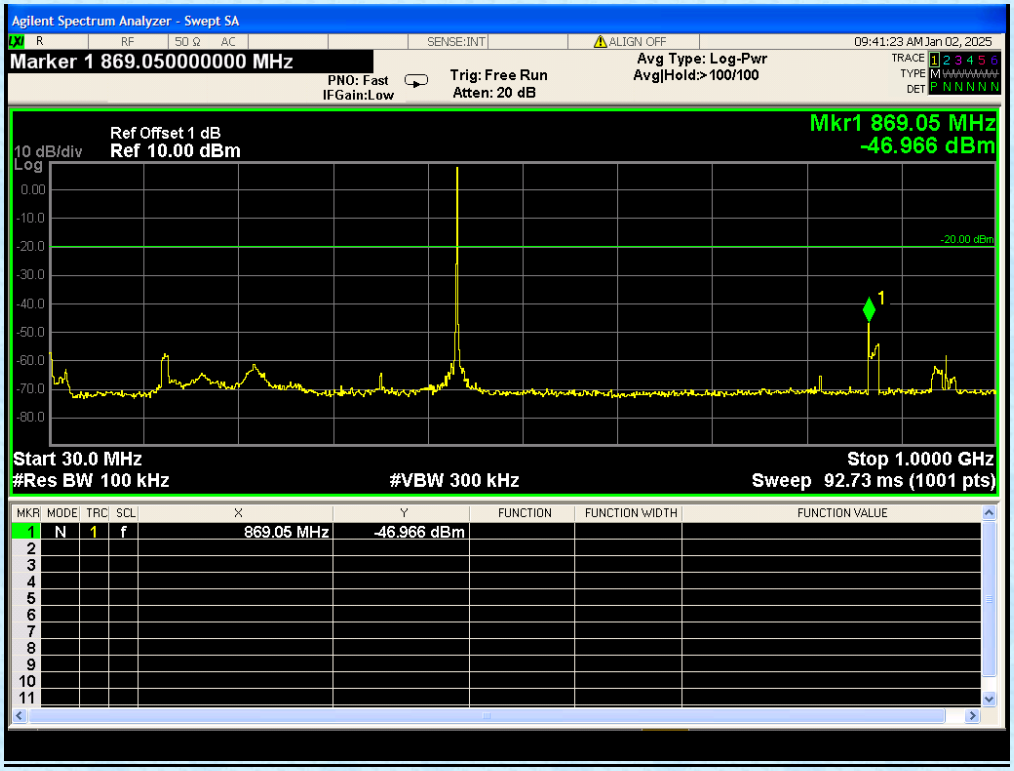
Conduct Spurious Emission (worst) @ 410.025MHz With 12.5 KHz Channel Separation-2W

1GHz-12.75GHz



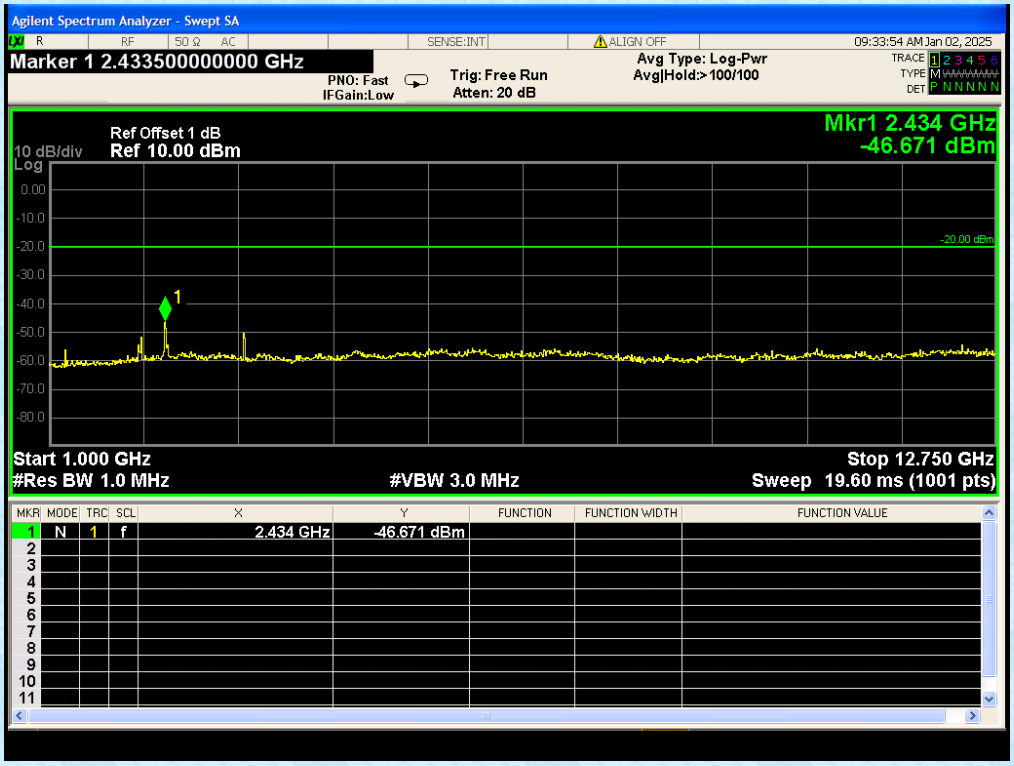
Conducted Spurious Emission (worst) @ 465.025 MHz With 12.5 KHz Channel Separation-2W

30MHz-1GHz



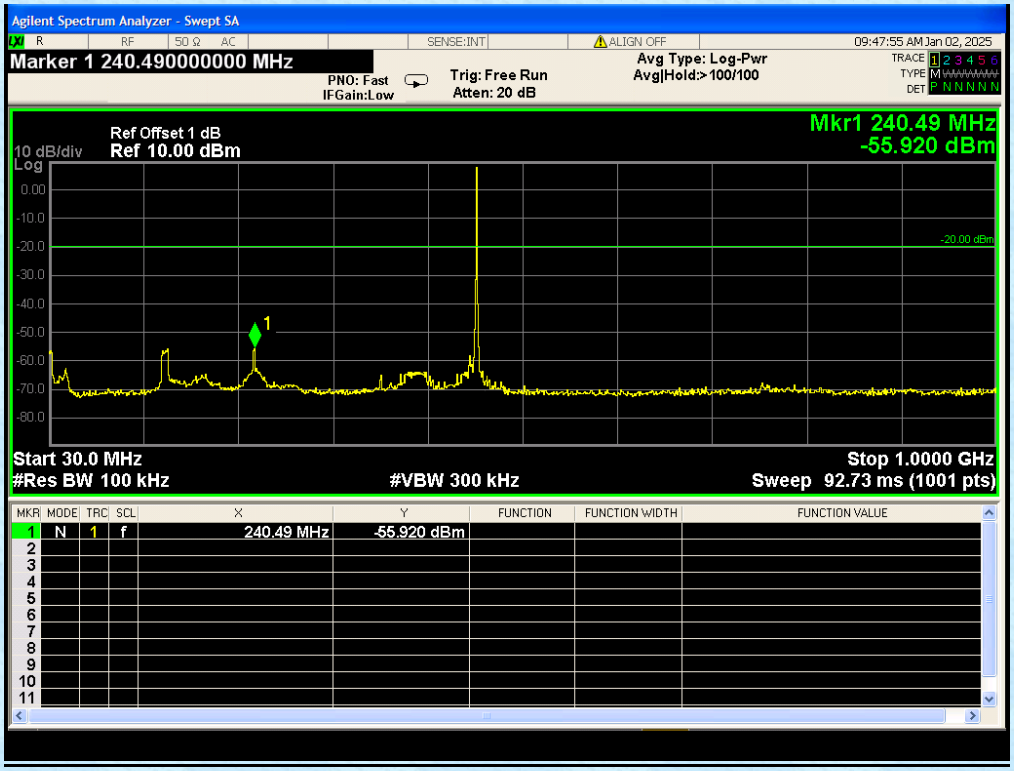
Conduct Spurious Emission (worst) @ 465.025 MHz With 12.5 KHz Channel Separation-2W

1GHz-12.75GHz



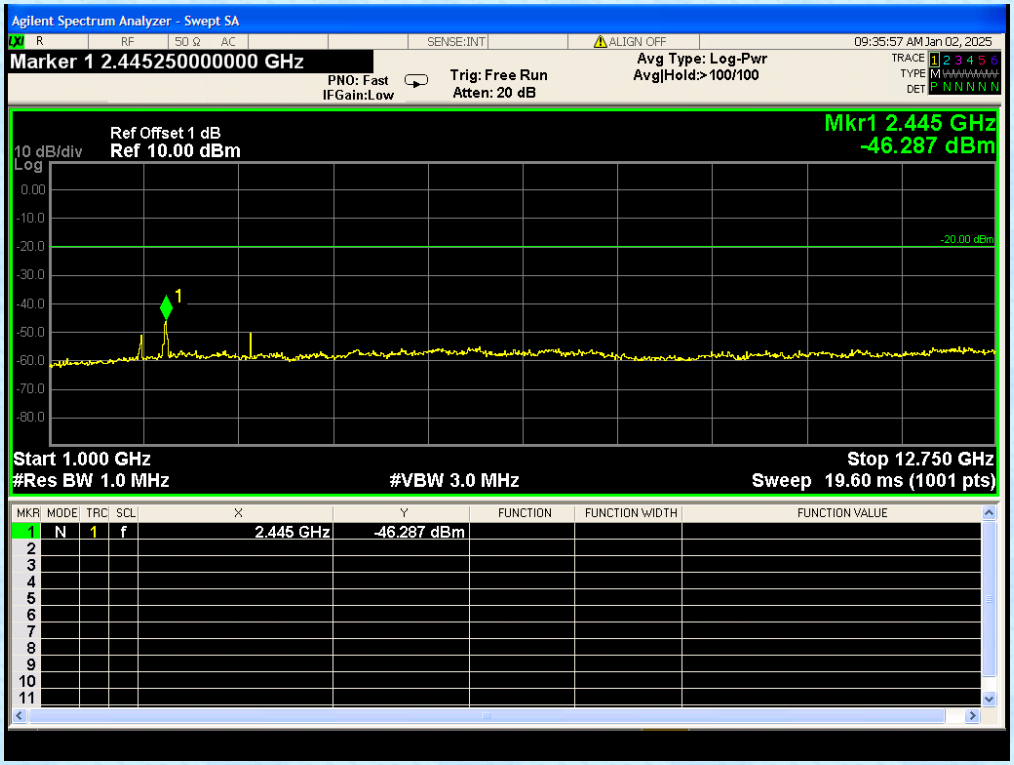
Conducted Spurious Emission (worst) @ 478.025MHz With 12.5 KHz Channel Separation-2W

30MHz-1GHz



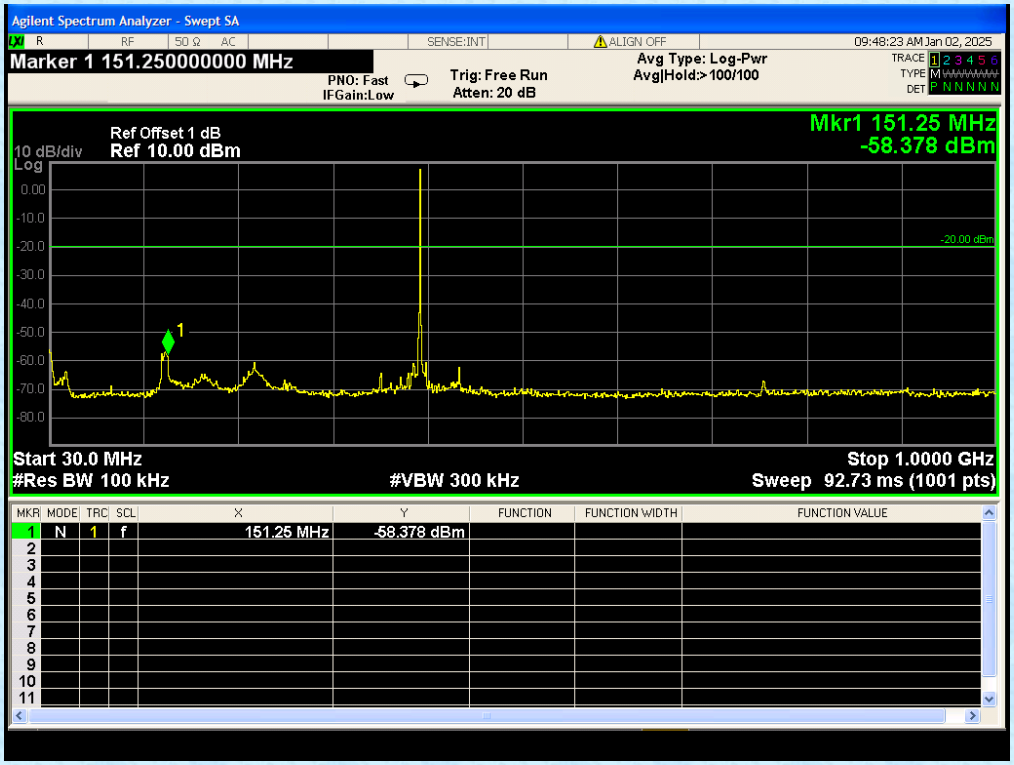
Conduct Spurious Emission (worst) @ 478.025MHz With 12.5 KHz Channel Separation-2W

1GHz-12.75GHz



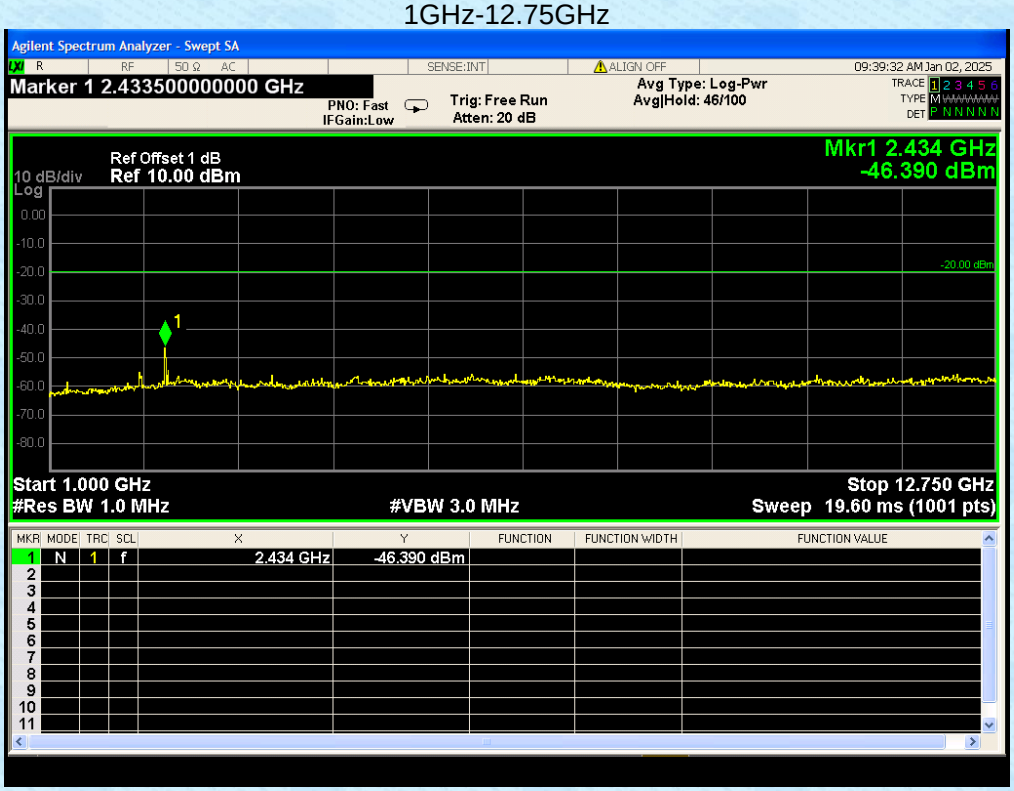
Conducted Spurious Emission (worst) @ 410.025MHz With 12.5 KHz Channel Separation-1W

30MHz-1GHz



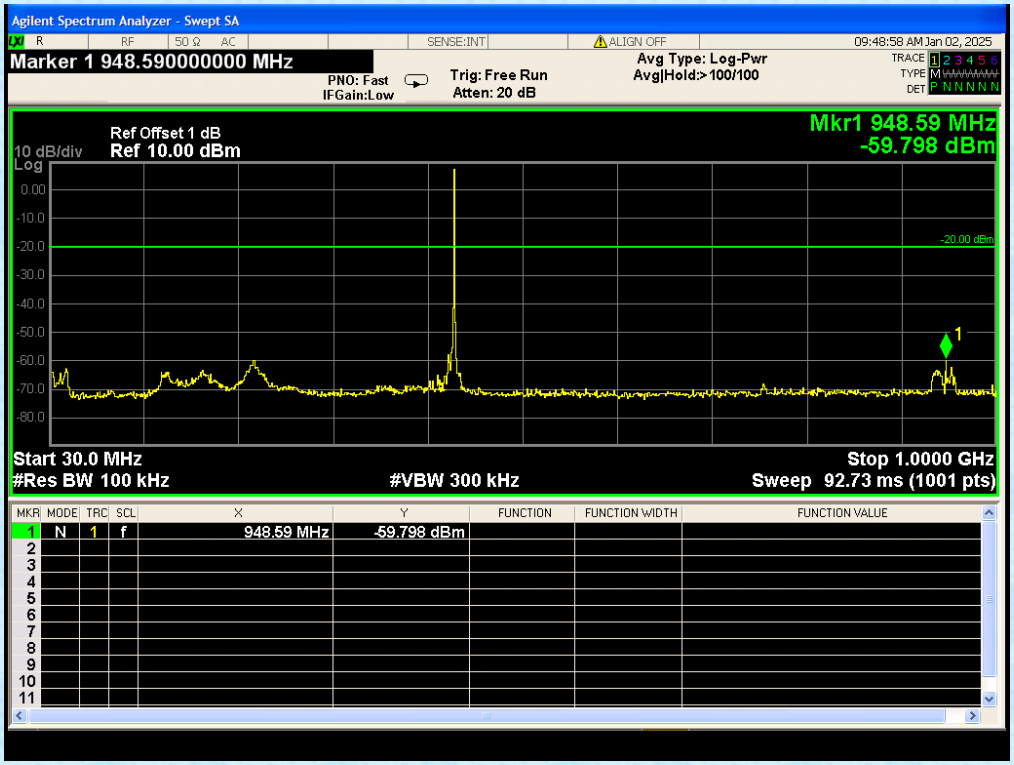
Conduct Spurious Emission (worst) @ 410.025MHz With 12.5 KHz Channel Separation-1W

1GHz-12.75GHz



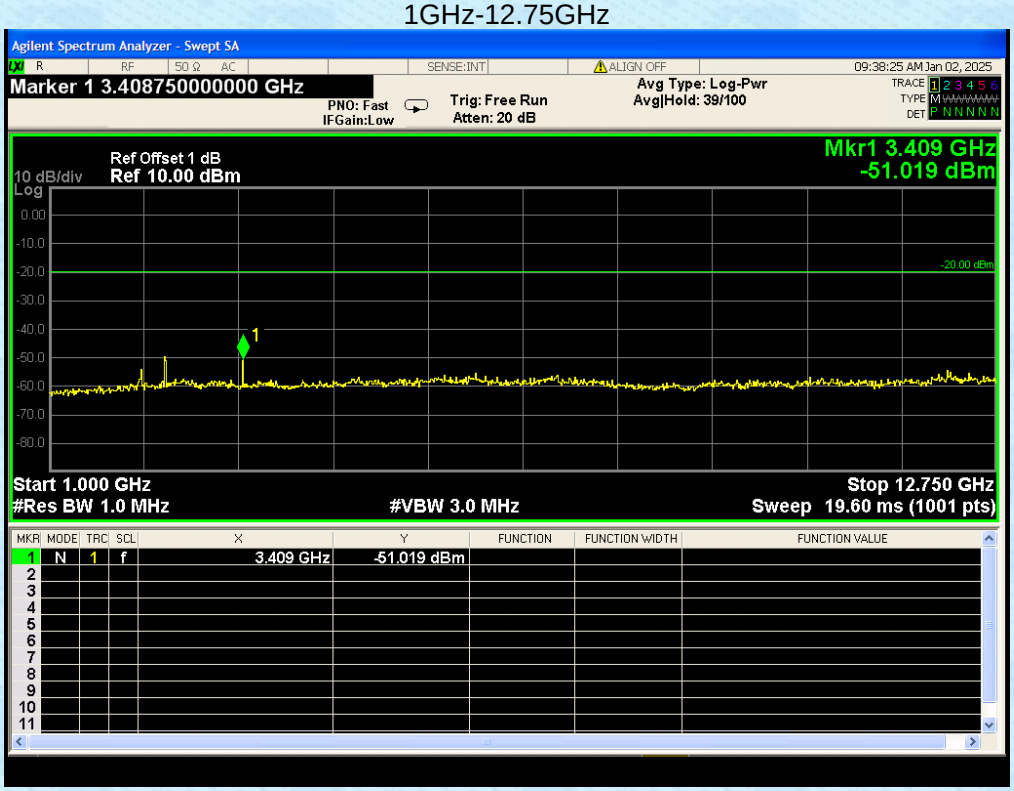
Conducted Spurious Emission (worst) @ 465.025 MHz With 12.5 KHz Channel Separation-1W

30MHz-1GHz



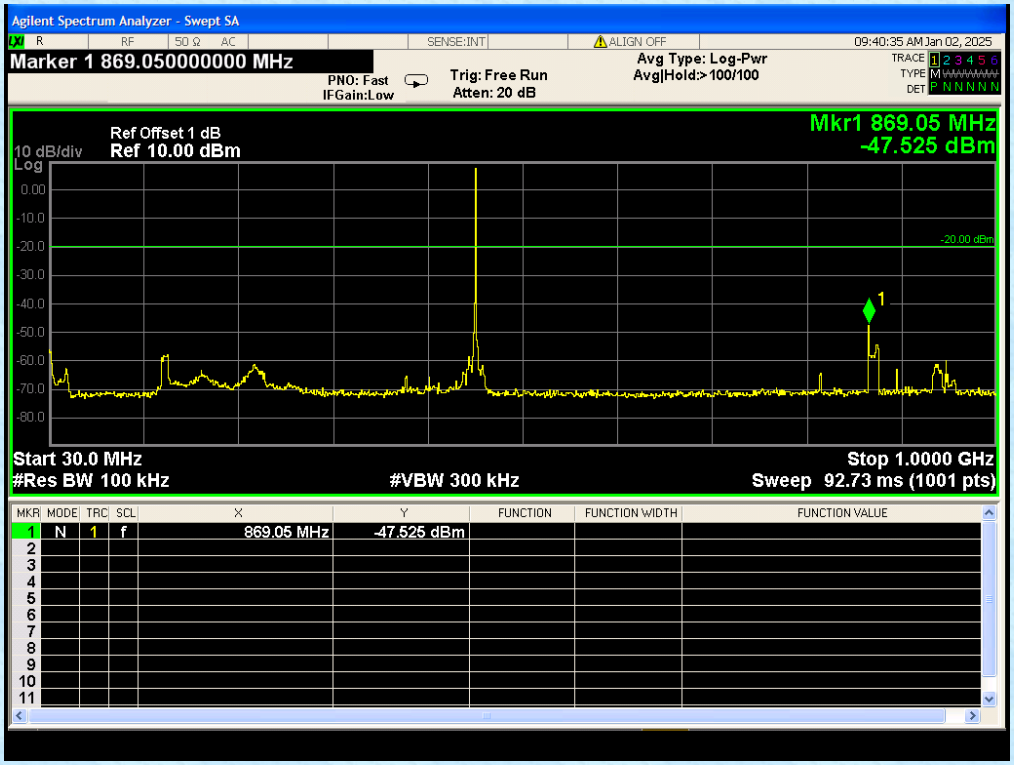
Conduct Spurious Emission (worst) @ 465.025 MHz With 12.5 KHz Channel Separation-1W

1GHz-12.75GHz



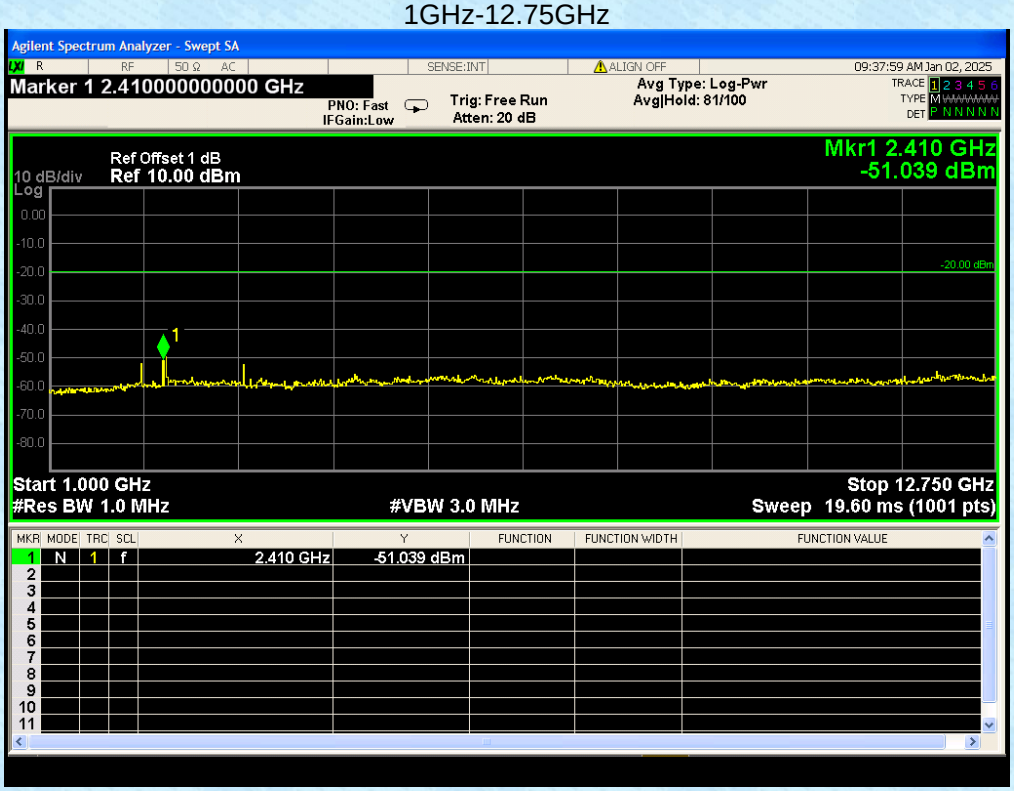
Conducted Spurious Emission (worst) @ 478.025MHz With 12.5 KHz Channel Separation-1W

30MHz-1GHz



Conduct Spurious Emission (worst) @ 478.025MHz With 12.5 KHz Channel Separation-1W

1GHz-12.75GHz



Note: All the test frequencies was tested, but only the worst data be recorded in this part

14. TRANSMITTER FREQUENCY BEHAVIOR

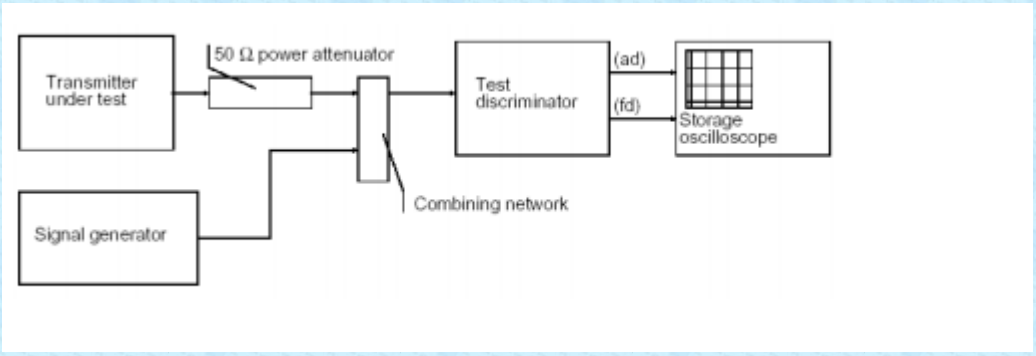
14.1Provisions Applicable

FCC §90.214

Time intervals [1, 2]	Maximum frequency difference [3]	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1 [4]	± 25.0 kHz	5.0 ms	10.0 ms
t_2	± 12.5 kHz	20.0 ms	25.0 ms
t_3 [4]	± 25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t_1 [4]	± 12.5 kHz	5.0 ms	10.0 ms
t_2	± 6.25 kHz	20.0 ms	25.0 ms
t_3 [4]	± 12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t_1 [4]	± 6.25 kHz	5.0 ms	10.0 ms
t_2	± 3.125 kHz	20.0 ms	25.0 ms
t_3 [4]	± 6.25 kHz	5.0 ms	10.0 ms

[1] t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
t_1 is the time period immediately following t_{on}.
t_2 is the time period immediately following t_1.
t_3 is the time period from the instant when the transmitter is turned off until t_{off}.
t_{off} is the instant when the 1 kHz test signal starts to rise.
[2] During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in §90.213.
[3] Difference between the actual transmitter frequency and the assigned transmitter frequency.
[4] If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

14.2 Test Configuration



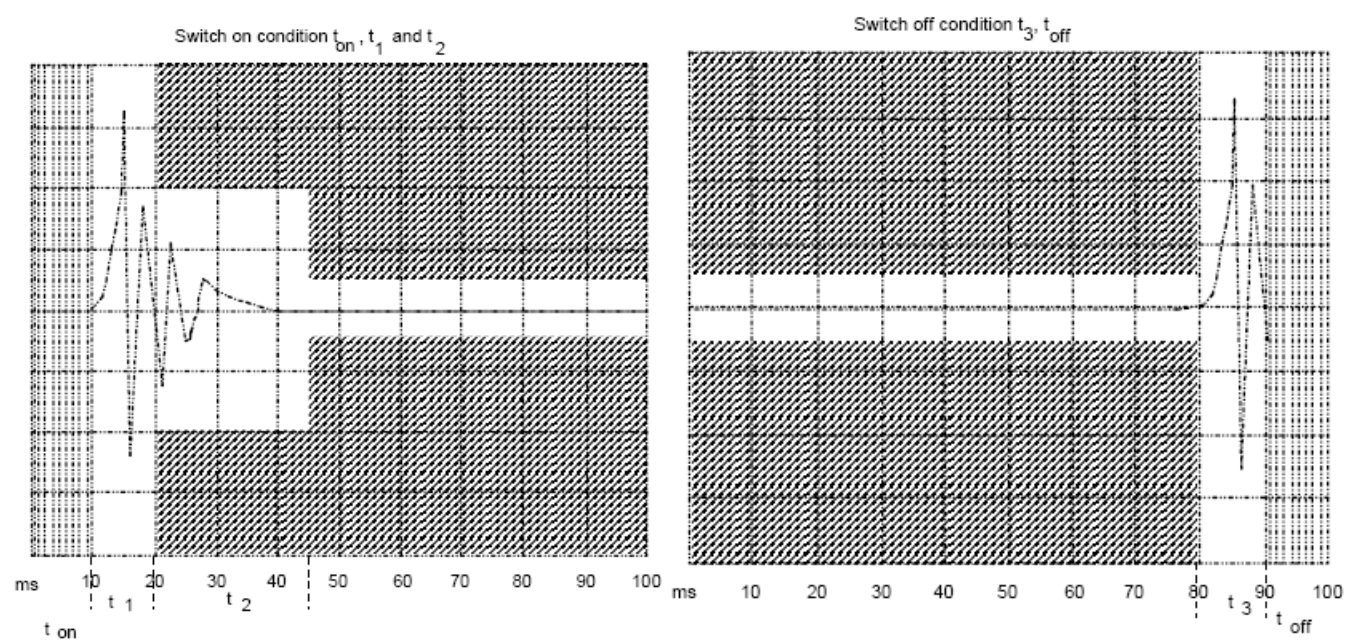
14.3 Test Method

According to TIA/EIA-603 2.2.19 requirement, as for the product different from PTT, we use test steps as
follows:
1. Connect DUT into Test discriminator and Storage Oscilloscope and keep DUT stats ON;
2. Input 1kHz signal into DUT;
3. Set the modulation domain analyzer to trigger on the rising edge of the waveform in order to capture a
single-shot turn-on of the transmitter signals;
4. Keep DUT in OFF state and Key the PTT;
5. Observe the stored oscilloscope of modulation domain analyzer. The signal trace shall be maintained
within the allowable limits during the periods t1 and t2,and shall also remain within limits following t2;
6. Adjust the modulation domain analyzer to trigger on the falling edge of the transmitter waveform in order
to capture a single-shot turn-off transmitter of the transmitter signal.
7. Keep the digital portable radio in ON state and unkey the PTT;
8. Observe the stored oscilloscope of modulation domain analyzer, The signal trace shall be maintained
within the allowable limits during the period t3.
9. Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at ±12.5
kHz deviation and set its output level to -100dBm.
10. Turn on the transmitter.
11. Supply sufficient attenuation via the RF attenuator to provide an input level to the stored oscilloscope
12. that is 40 dB below the maximum allowed input power when the transmitter is operating at its rated power
level. Note this power level on the stored oscilloscope as P0.
13. Turn off the transmitter.
14. Adjust the RF level of the signal generator to provide RF power equal to P0. This signal generator RF level
shall be maintained throughout the rest of the measurement.

15. Remove the attenuation, so the input power to the stored oscilloscope is increased by 30 dB when the
transmitter is turned on.
16. Adjust the vertical amplitude control of the stored oscilloscope to display the 1000 Hz at ±4 divisions
vertically centered on the display. Set trigger mode of the Spectrum Analyzer to “Video”, and tune the
“trigger level” on suitable level. Then set the “tiger offset” to -10ms for turn on and -15ms for turn off.
17. Turn on the transmitter and the transient wave will be captured on the screen of Spectrum Analyzer.
Observe the stored display. The instant when the 1 kHz test signal is completely suppressed is considered to be ton. The trace should be maintained within the allowed divisions during the period t1 and
t2.
18. Then turn off the transmitter, and another transient wave will be captured on the screen of Spectrum
19. Analyzer. The trace should be maintained within the allowed divisions during the period t3.

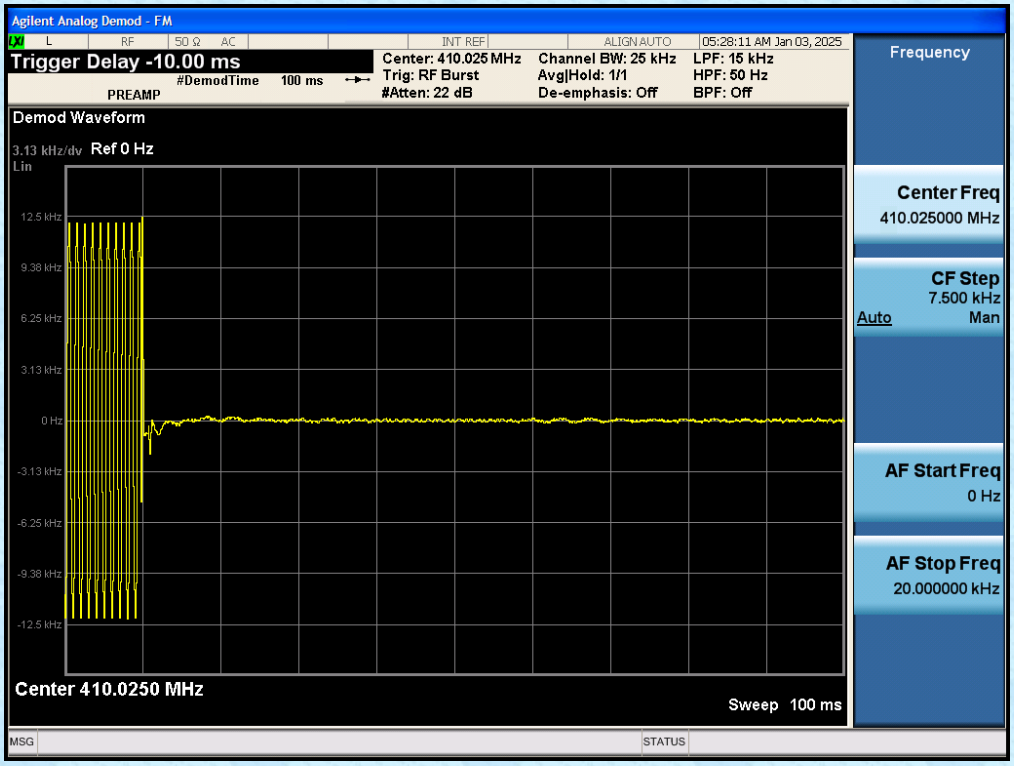
14.4 DESCRIBE LIMIT LINE OF RANSMITTER FREQUENCY BEHAVIOR

ton: The switch-on instant ton of a transmitter is defined by the condition when the output power, measured at the antenna terminal, exceeds 0,1 % of the full output power (-30 dBc).
t1: period of time starting at ton and finishing according to above 11.1
t2: period of time starting at the end of t1 and finishing according to above 11.1
toff: switch-off instant defined by the condition when the output power falls below 0,1 % of the full output power (-30 dBc).
t3: period of time that finishing at toff and starting according to above 11.1



14.5 MEASURE RESULT

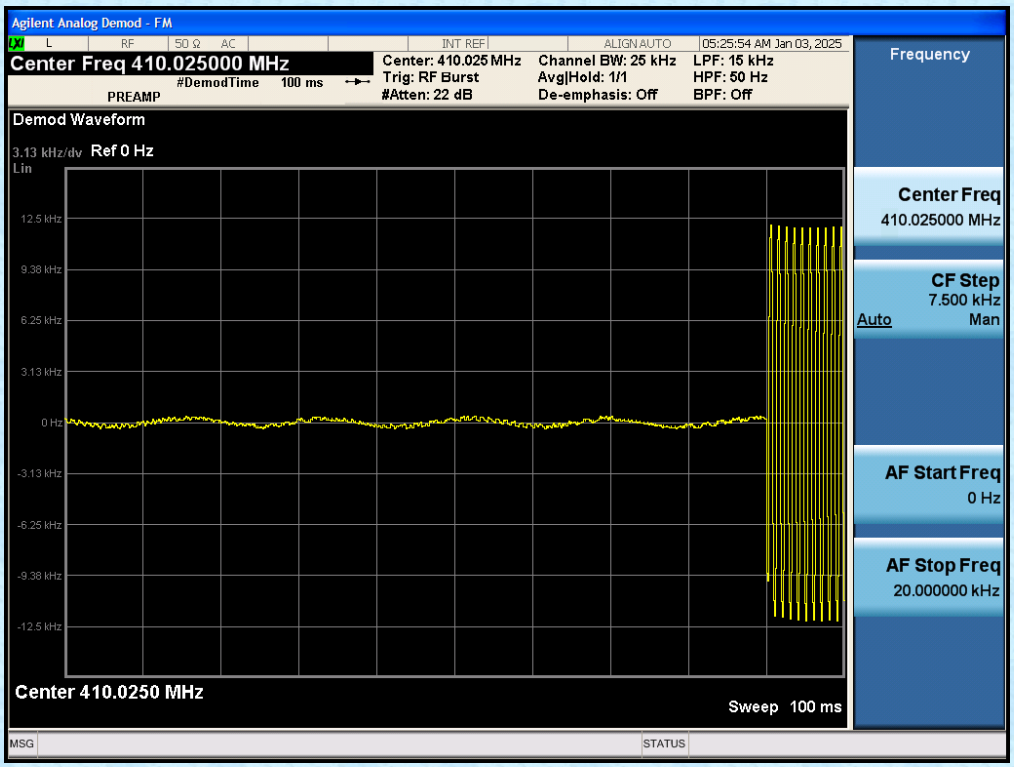
Transmitter Frequency Behavior @ 12.5 KHz Channel Separation--Off to On



Authorized Signature:

Robinson Luo
Laboratory Manager

Transmitter Frequency Behavior @ 12.5 KHz Channel Separation--On to Off



Note: All the test frequencies was tested, but only the worst data be recorded in this part.

15. Test Setup Photo

Reference to the **Test Setup Photo** for details.

16. EUT Constructional Details

Reference to the **External Photos and Internal Photos** for details.

------End------