FCC Test Report

Report No.: AGC02931220402FE10

FCC ID	:	2AS4FEPCOTX-680AV
PRODUCT DESIGNATION	:	Digital DMR Transceiver
BRAND NAME	:	tXPRO
MODEL NAME	:	TX-680AV
APPLICANT	:	EL PASO COMMUNICATION SYSTEMS, INC
DATE OF ISSUE	:	Jul. 01, 2022
STANDARD(S)	:	FCC Part 90 Rules
REPORT VERSION	:	V 1.0

*A*ttestation of *G*lobal *C*ompliance (Shenzhen) Co., Ltd

REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jul. 01, 2022	Valid	Initial Release

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1. GENERAL INFORMATION

Applicant	EL PASO COMMUNICATION SYSTEMS, INC
Address	1630 E PAISANO DR. EL PASO, TX 79901 United States
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	Digital DMR Transceiver
Brand Name	tXPRO
Test Model	TX-680AV
Deviation from Standard	None
Date of Receipt	Apr. 19, 2022
Date of Test	Apr. 19, 2022~Jun. 30, 2022
Test Result	Pass

WE HEREBY CERTIFY THAT:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) 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. The test results of this report relate only to the tested sample identified in this report.

Prepared By	Bibo Zhang	
	Bibo Zhang (Project Engineer)	Jun. 30, 2022
Reviewed By	Calvin Liu	
	Calvin Liu (Reviewer)	Jul. 01, 2022
Approved By	Max Zhang	
	Max Zhang Authorized Officer	Jul. 01, 2022

2. PRODUCT INFORMATION

2.1 PRODUCT TECHNICAL DESCRIPTION

Hardware Version	D211804-35810U-V1.2	
Software Version	V2.00	
Power Supply	DC 7.4V,2200mAh by battery, charging for DC8.4V, 0.5A	
Communication Type	Voice / Data	
Operation Frequency Range	From 136MHz to 174MHz	
Modulation Type	Analog Voice:	FM
	Digital Voice/Digital Data:	4FSK
Digital Type	DMR	
Channel Separation	Analog Voice:	12.5 kHz
	Digital Voice/Digital Data:	12.5 kHz
Emission Designator	Analog Voice:	11K0F3E
	Digital Voice/Digital Data:	☒ VHF:7K82F1D-5W-12.5kHz ☒ VHF:7K82F1W-5W-12.5kHz
Rated Output Power	VHF:5W/2W, UHF:4.5W/1W (It was fixed by the manufacturer, any individual can't arbitrarily change it.)	
Maximum Transmitter Power	VHF:36.92dBm(5W-12.5kHz)-Analog	VHF: 29.93dBm(1W-12.5kHz)-Analog
	VHF: 36.83dBm(5W-12.5kHz)-Digital	VHF:29.88dBm(1W-12.5kHz)-Digital
Antenna Designation	Detachable	
Antenna Gain	1.5dBi	

Note:

1. The product has the same digital working characters when operating in both two digitized voice/data mode. So only one set of test results for digital modulation modes are provided in this test report.
2. This equipment is capable of supporting a minimum data rate of 4800 bits per second per 6.25 kHz of channel bandwidth. DMR interphone's bandwidth is 12.5 kHz, and it has a double time slot, one is the speech time slot, one is the data time slot, just language sequence is satisfied with 4800 bps/6.25 kHz BW.

2.2 TEST FREQUENCY LIST

Operation mode	Channel Separation	Operation Frequency Range	Test channel	Test Frequency
Analog/ Digital	12.5 kHz	136-174MHz	Bottom	136.025 MHz
	12.5 kHz	136-174MHz	Middle	155.750 MHz
	12.5 kHz	136-174MHz	Top	173.975 MHz

Note:
In section KDB 634817 D01 Sections II) (f) (1) and (2):
Test at least one frequency in each band for each rule part applied under and ensure the device is capable of operating on the frequency under each rule part. This requirement may result in testing on multiple frequencies. Testing on one frequency may be acceptable if multiple listed bands for a rule part with a continuous frequency range are split to remove a conflict with other rules and the technical requirements in the split bands are the same. Additional requirements for RF exposure may apply.

2.3 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for FCC ID: **2AS4FEPCOTX-680AV,** filing to comply with Part 2, Part 90 of the Federal Communication Commission rules.

2.4 TEST METHODOLOGY

The tests were performed according to following standards:

No.	Identity	Document Title
1	FCC 47 CFR Part 90	Private Land Mobile Radio Services
2	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
3	ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
4	ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
5	KDB 971168 D01	KDB 971168 D01 Power Meas License Digital Systems v03r01
6	KDB 579009 D03	KDB 579009 D03 Applications Part 90 Refarming Bands v01
7	KDB 634817 D01	KDB 634817 D01 Freq Range Listing for Grants v04r01

2.5 CALCULATION OF EMISSION INDICATORS

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

For FM Mode (ChannelSpacing: 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 kHz + 2.5 kHz) = 11 kHz = 11K0
F3E portion of the designator represents an FM voice transmission.
Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

For FM Mode (Channel Spacing: 25kHz)
Emission Designator 16K0F3E
In this case, the maximum modulating frequency is 3.0 kHz with a 5.0 kHz deviation.
BW = 2(M+D) = 2*(3.0 kHz + 5.0 kHz) = 16 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.

2.6 SPECIAL ACCESSORIES

Not available for this EUT intended for grant.

2.7 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

3. TEST ENVIRONMENT

3.1 ADDRESS OF THE TEST LABORATORY

Laboratory: Attestation of Global Compliance (Shenzhen) Co., Ltd.

Address: 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

3.2 TEST FACILITY

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

CNAS-Lab Code: L5488

Attestation of Global Compliance (Shenzhen) Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 5054.02

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 975832

Attestation of Global Compliance (Shenzhen) Co., Ltd. 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 our files with Registration 975832.

IC-Registration No.: 24842

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Certification and Engineering Bureau of Industry Canada. The acceptance letter from the IC is maintained in our files with Registration 24842.

3.3 ENVIRONMENTAL CONDITIONS

	NORMAL CONDITIONS	EXTREME CONDITIONS
Temperature range (℃)	15 - 35	-20 - 50
Relative humidty range	20 % - 75 %	20 % - 75 %
Pressure range (kPa)	86 - 106	86 - 106
Power supply	DC 7.4V	LV:DC 6.29V/HV: DC 8.51V
Note: The Extreme Temperature and Extreme Voltages declared by the manufacturer.		

3.4 MEASUREMENT UNCERTAINTY

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

Test Items	Measurement Uncertainty
Frequency stability	±0.5%
Transmitter power conducted	±0.8dB
Transmitter power Radiated	±1.3dB
Conducted spurious emission 9kHz-40 GHz	±2.7dB
Conducted Emission	±3.2 dB
Radiated Emission below 1GHz	±3.9 dB
Radiated Emission above 1GHz	±4.8 dB
Occupied Channel Bandwidth	±2 %
FM deviation	±2 %
Audio level	±0.98dB
Low Pass Filter Response	±0.65dB
Modulation Limiting	0.42 %
Transient Frequency Behavior	6.8 %

3.5 LIST OF EQUIPMENTS USED

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Mar. 28, 2022	Mar. 27, 2023
EXA Signal Analyzer	Aglient	N9020A	W1312-60196	Aug. 18, 2021	Aug. 17, 2022
EXA Signal Analyzer	Aglient	N9020A	MY52090123	Sep. 06, 2021	Sep. 05, 2022
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Oct. 31, 2021	Oct. 30, 2023
preamplifier	ChengYi	EMC184045SE	980508	Oct. 29, 2021	Oct. 28, 2023
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-205	Jun. 07, 2021	Jun. 06, 2022
Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-205	Jun. 05, 2022	Jun. 04, 2023
HORN ANTENNA	EM	EM-AH-10180	/	Feb.24, 2022	Feb.23, 2023
SIGNAL GENERATOR	AGILENT	E4421B	MY43351603	Mar. 04, 2022	Mar. 03, 2023
SIGNAL GENERATOR	R&S	SMT03	A0304261	Jun. 07, 2021	Jun. 06, 2022
ANTENNA	SCHWARZBECK	VULB9168	VULB9168-494	Jan. 08, 2021	Jan. 07, 2023
ANTENNA	SCHWARZBECK	VULB9168	D69250	Apr. 28, 2021	Apr. 27, 2023
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Mar. 12, 2022	Mar. 11, 2023
Modulation Domain Analyzer	HP	53310A	3121A02467	Jul. 03, 2020	Jul. 02, 2022
Small environmental tester	ESPEC	SH-242	--	Sep. 03, 2020	Sep. 02, 2022
RF Communication Test Set	HP	8920B	US35010161	Sep. 06, 2020	Sep. 05, 2022
Attenuator	Weinachel Corp	58-30-33	ML030	Oct. 24, 2021	Oct. 23, 2022
RF Cable	R&S	1#	--	Each time	N/A
RF Cable	R&S	2#	--	Each time	N/A
Fliter-UHF	Microwave	N25155M2	498705	May 09, 2021	May 08, 2022
Fliter-UHF	Microwave	N25155M2	498705	May 07, 2022	May 06, 2023

4.SYSTEM TEST CONFIGURATION

4.1 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.

4.2 EUT EXERCISE

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

4.3 CONFIGURATION OF TESTED SYSTEM

Fig. 2-1 Configuration of Tested System

Table 2-1 Equipment Used in Tested System

4.4 EQUIPMENT USED IN TESTED SYSTEM

The Following Peripheral Devices And Interface Cables Were Connected During The Measurement:
☐ Test Accessories Come From The Laboratory
☒ Test Accessories Come From The Manufacturer

Item	Equipment	Model No.	Identifier	Note
1	Digital DMR Transceiver	Digital DMR Transceiver	FCC ID: 2AS4FEPCOTX-680AV	EUT
2	Battery	LB-85L	DC 7.4V 2200mAh	Accessories
3	Back clip	N/A	N/A	Accessories
4	Lanyard	N/A	N/A	Accessories
5	Adapter	N/A	Input: AC 100-240V,50/60HZ, 0.2A Output: DC 12.5V,0.5A	Accessories
6	Charger	N/A	Input: DC 12.5V 0.5A Output: 8.4V,0.5A	Accessories

4.5 SUMMARY OF TEST RESULTS

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

5.DESCRIPTION OF TEST MODES

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

NO.	TEST MODE DESCRIPTION	CHANNEL SEPARATION
1	TX Bottom channel-VHF	12.5 kHz
2	TX Middle channel-VHF	12.5 kHz
3	TX Top channel-VHF	12.5 kHz

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. The battery is full-charged during the test.
3. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
4. For Conducted Test method, a temporary antenna connector is provided by the manufacture.
5. Manufacturers use computer PC programming software to switch and operate frequency points, refer to the instructions for details

6.FREQUENCY TOLERANCE

6.1 PROVISIONS APPLICABLE

a). According to FCC §2.1055,§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.

6.2 MEASUREMENT PROCEDURE

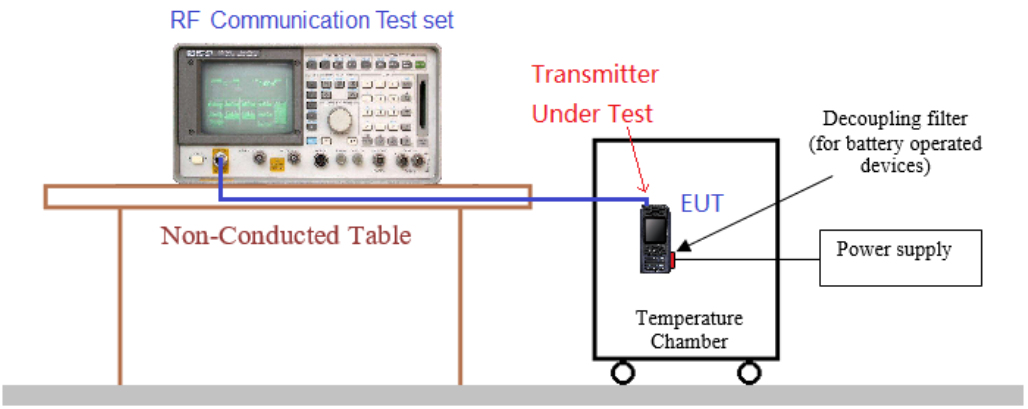
6.2.1 Frequency stability versus environmental temperature

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℃. 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.

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℃ to 25℃. Otherwise, an environment chamber set for a temperature of 20℃ 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 MEASUREMENT SETUP



6.4 MEASUREMENT RESULTS

12.5 kHz Channel Separation, Analog modulation, Assigned Frequency For VHF-5W						
Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage (V)	Temp (℃)	Test Frequency (MHz)				
		136.025	155.750	173.975		
7.40	-30	0.712	0.818	0.482	2.5	Pass
	-20	0.798	0.725	0.427		
	-10	1.050	0.563	0.793		
	0	0.765	0.936	0.420		
	10	0.507	0.680	0.548		
	20	0.715	0.772	0.451		
	30	0.969	0.790	0.988		
	40	0.970	0.959	0.960		
	50	0.916	0.714	0.336		
8.51	20	0.592	0.499	0.687		
6.29	20	0.864	0.814	0.720		

12.5 kHz Channel Separation, Analog modulation, Assigned Frequency For VHF-1W						
Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage (V)	Temp (℃)	Test Frequency (MHz)				
		136.025	155.750	173.975		
7.40	-30	0.644	0.721	0.949	2.5	Pass
	-20	0.840	0.388	0.606		
	-10	1.047	0.897	0.645		
	0	0.869	0.384	0.510		
	10	0.708	0.443	0.352		
	20	0.795	0.734	0.307		
	30	0.780	0.443	0.901		
	40	0.785	0.854	0.765		
	50	0.731	0.490	0.936		
8.51	20	0.644	0.721	0.949		
6.29	20	0.840	0.388	0.606		

12.5 kHz Channel Separation, Digital modulation, Assigned Frequency For VHF-5W						
Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage (V)	Temp (℃)	Test Frequency (MHz)				
		136.025	155.750	173.975		
7.40	-30	0.917	0.331	0.569	2.5	Pass
	-20	0.734	0.682	0.752		
	-10	1.062	0.976	0.473		
	0	0.639	0.332	0.876		
	10	1.029	0.432	0.822		
	20	0.966	0.510	0.521		
	30	1.003	0.709	0.564		
	40	1.036	0.586	0.776		
	50	0.925	0.948	0.761		
8.51	20	0.917	0.331	0.569		
6.29	20	0.734	0.682	0.752		

12.5 kHz Channel Separation, Digital modulation, Assigned Frequency For VHF-1W						
Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage (V)	Temp (℃)	Test Frequency (MHz)				
		136.025	155.750	173.975		
7.40	-30	0.575	0.568	0.694	2.5	Pass
	-20	0.518	0.594	0.674		
	-10	0.660	0.451	0.773		
	0	0.507	0.505	0.577		
	10	1.029	0.665	0.475		
	20	0.703	0.855	0.448		
	30	0.958	0.561	0.445		
	40	0.896	0.549	0.321		
	50	0.551	0.668	0.772		
8.51	20	0.575	0.568	0.694		
6.29	20	0.518	0.594	0.674		

7. EMISSION BANDWIDTH

7.1 PROVISIONS APPLICABLE

FCC Part 90.209 & FCC Part 2.1049:
The authorized bandwidth shall be 11.25 kHz for 12.5 kHz channel separation and 6 kHz for 6.25 kHz channel separation.

7.2 MEASUREMENT PROCEDURE

1.The EUT was modulated by 2.5kHz sine wave audio signal; the level of the audio signal employed is 16dB greater than that necessary to produce 50% of rated system deviation.

Rated system deviation is 2.5 kHz for 12.5kHz channel spacing).

2.Spectrum set as follow:

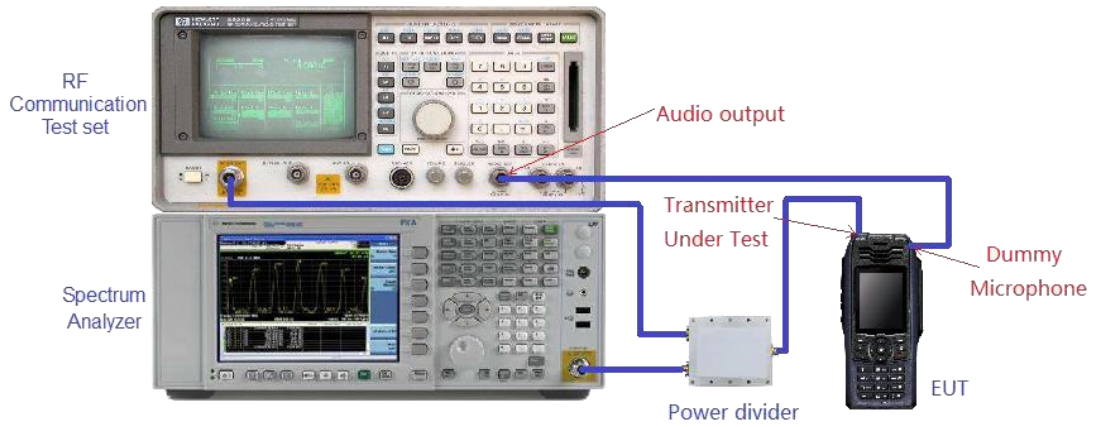
Centre frequency = fundamental frequency, span=50kHz for 12.5kHz channel spacing, RBW=100Hz, VBW=300Hz, Sweep = auto,

Detector function = peak, Trace = max hold

3.Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.

4.Measure and record the results in the test report.

7.3 MEASUREMENT SETUP



7.4 MEASUREMENT RESULTS

Measurement Result of VHF-Analog Modulation-5W				
Operating Frequency	12.5 kHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
136.025MHz	9.887 kHz	10.15 kHz	11.25 kHz	Pass
155.750MHz	9.914 kHz	10.15 kHz	11.25 kHz	Pass
173.975MHz	9.915 kHz	10.15 kHz	11.25 kHz	Pass

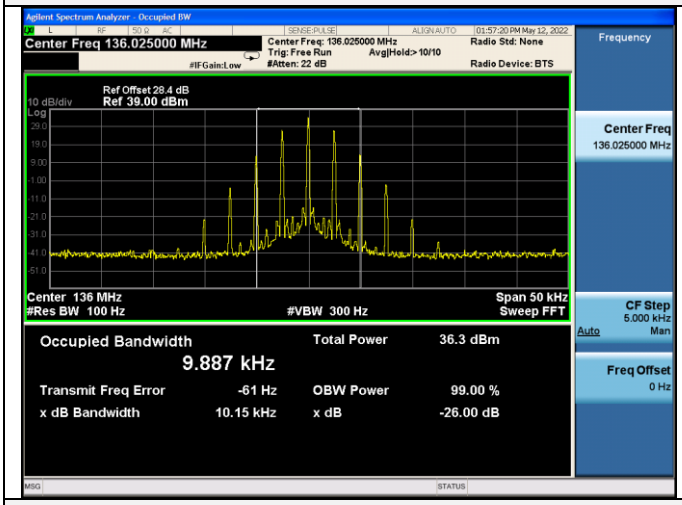
Measurement Result of VHF-Analog Modulation-1W				
Operating Frequency	12.5 kHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
136.025MHz	9.897 kHz	10.15 kHz	11.25 kHz	Pass
155.750MHz	9.914 kHz	10.15 kHz	11.25 kHz	Pass
173.975MHz	9.918 kHz	10.15 kHz	11.25 kHz	Pass

Measurement Result of VHF- Digital Modulation-5W				
Operating Frequency	12.5 kHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
136.025MHz	7.822 kHz	9.466 kHz	11.25 kHz	Pass
155.750MHz	7.471 kHz	9.652 kHz	11.25 kHz	Pass
173.975MHz	7.534 kHz	9.435 kHz	11.25 kHz	Pass

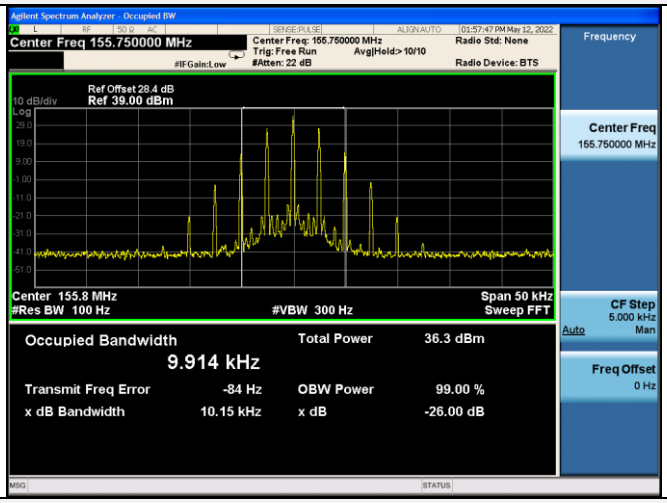
Measurement Result of VHF- Digital Modulation-1W				
Operating Frequency	12.5 kHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
136.025MHz	7.438 kHz	9.874 kHz	11.25 kHz	Pass
155.750MHz	7.469 kHz	9.874 kHz	11.25 kHz	Pass
173.975MHz	7.463 kHz	9.896 kHz	11.25 kHz	Pass

Test plot as follows:

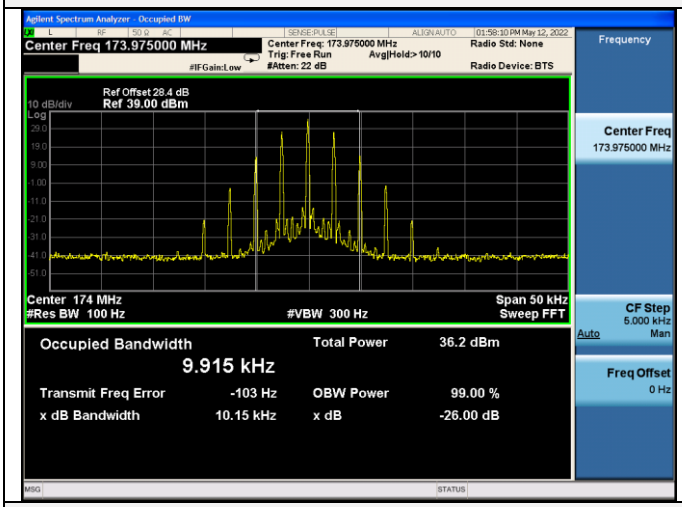
12.5kHz, FM Modulation:136.025MHz-5W



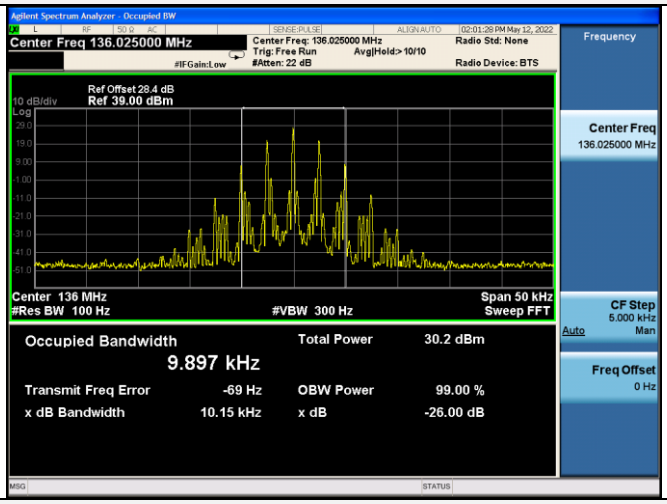
12.5kHz, FM Modulation:155.750MHz-5W



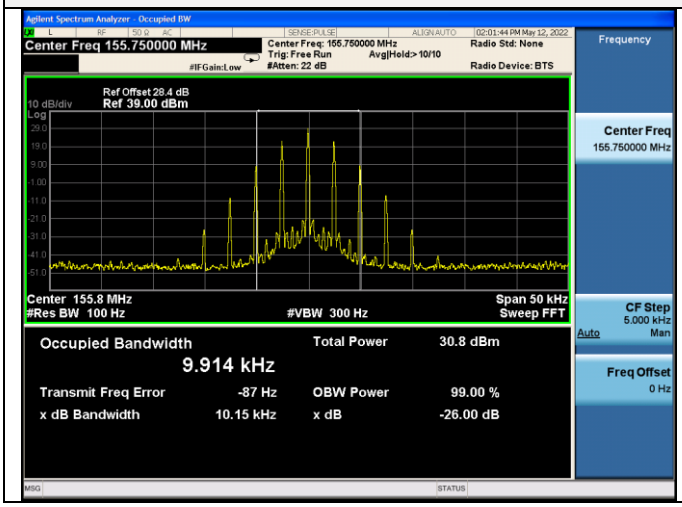
12.5kHz, FM Modulation:173.975MHz-5W



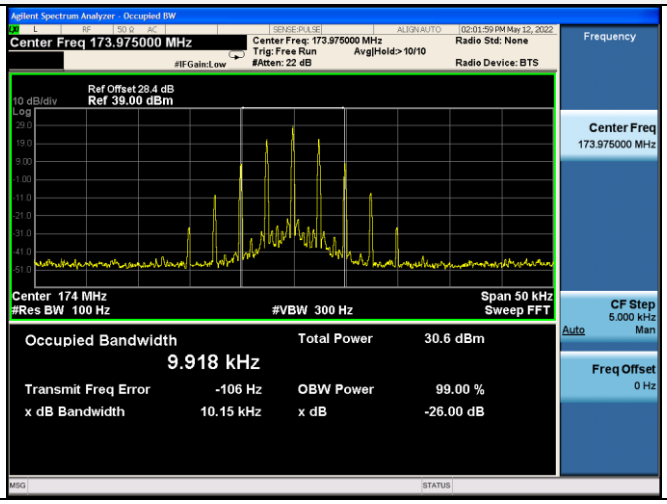
12.5kHz, FM Modulation:136.025MHz-1W

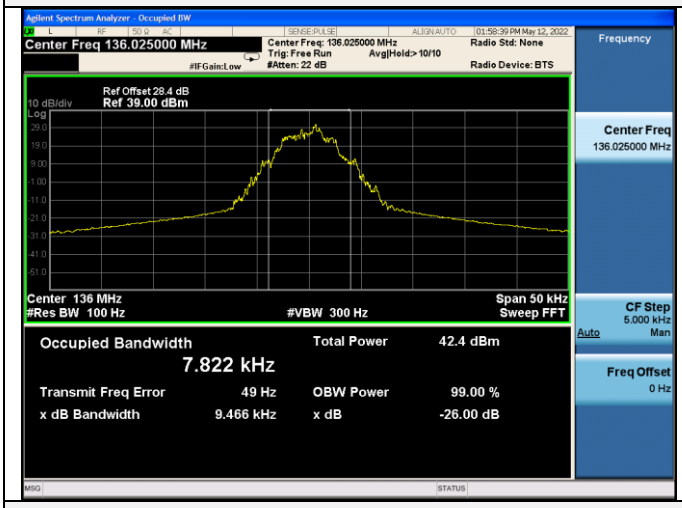
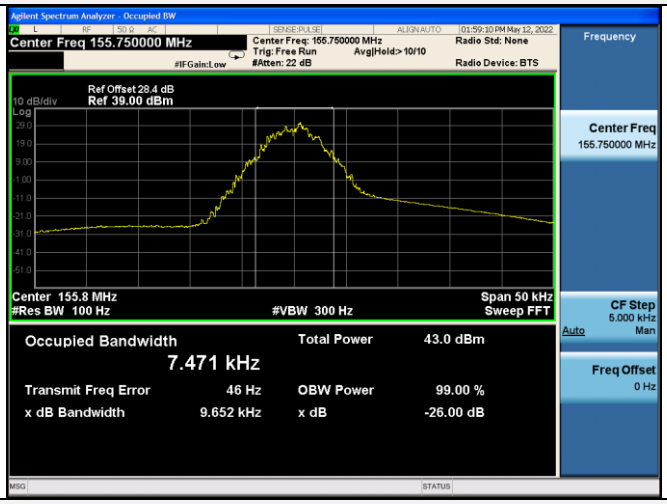
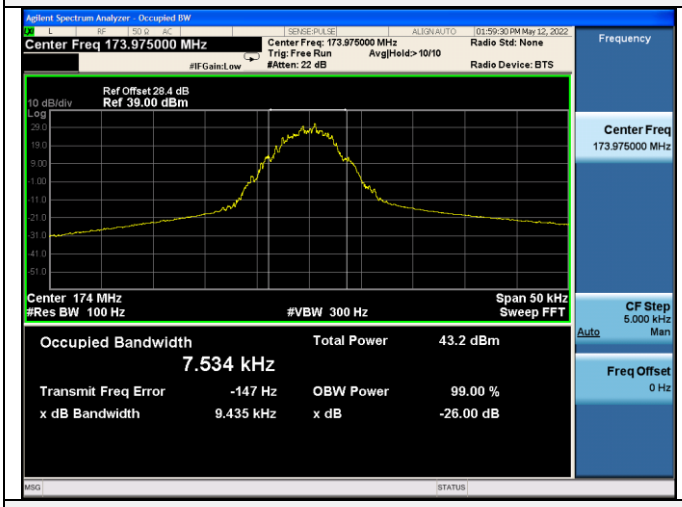
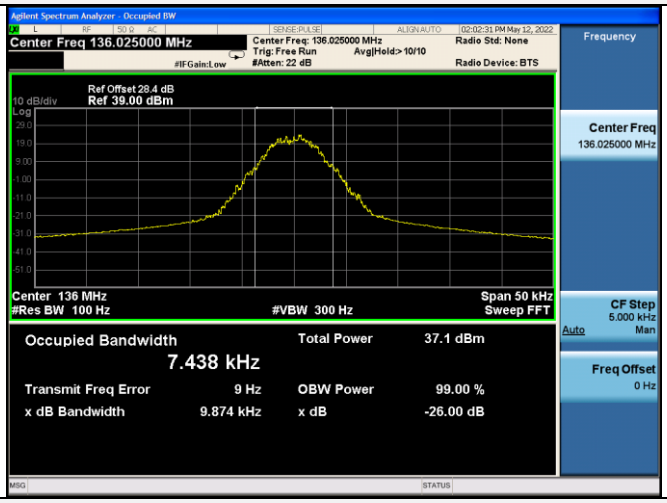
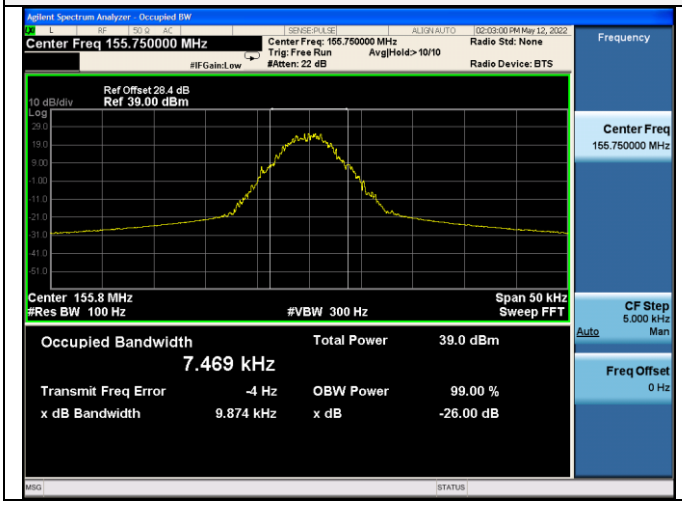
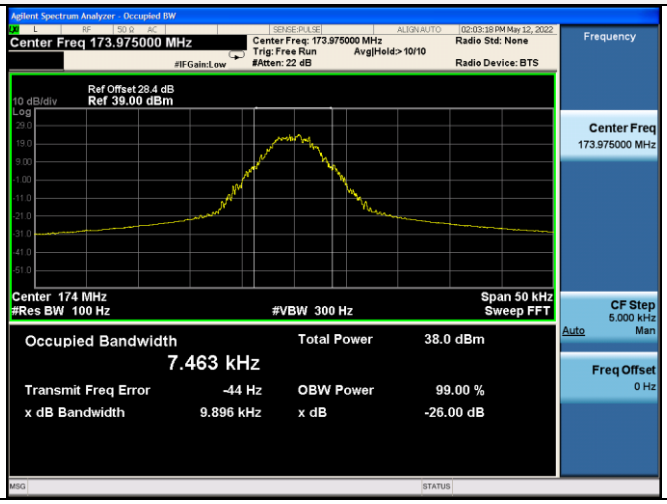


12.5kHz, FM Modulation:155.750MHz-1W



12.5kHz, FM Modulation:173.975MHz-1W



12.5kHz, 4FSK Modulation:136.025MHz-5W	12.5kHz, 4FSK Modulation:155.750MHz-5W
	
12.5kHz, 4FSK Modulation:173.975MHz-5W	12.5kHz, 4FSK Modulation:136.025MHz-1W
	
12.5kHz, 4FSK Modulation:155.750MHz-1W	12.5kHz, 4FSK Modulation:173.975MHz-2W
	

8. SPURIOUS RATIATED EMISSION

8.1 PROVISIONS APPLICABLE

According to FCC §2.1053 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:

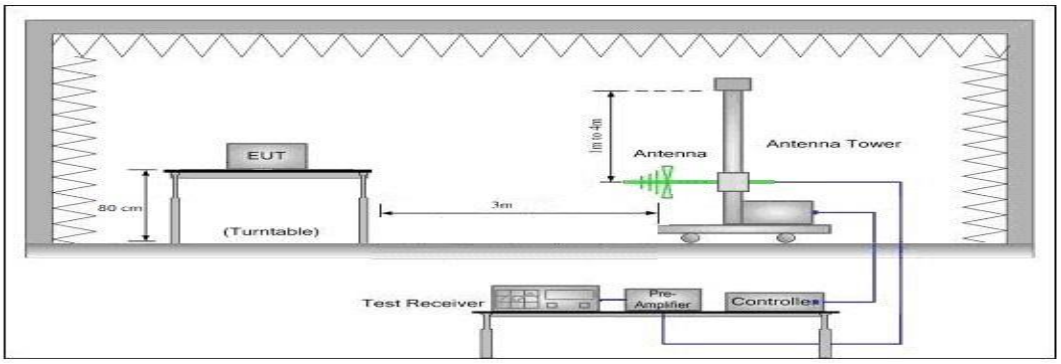
(1) On any frequency removed from the center of the authorized bandwidth fo to 5.625 kHz removed from fo: Zero dB.
(2) On any frequency removed from the center of the authorized bandwidth by a displacement Frequency (fd in kHz) fo of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd-2.88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

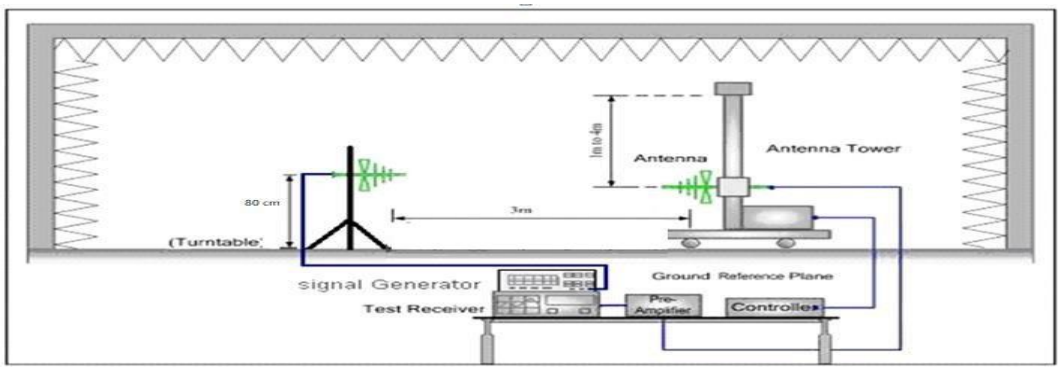
8.2 MEASUREMENT PROCEDURE

(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 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.

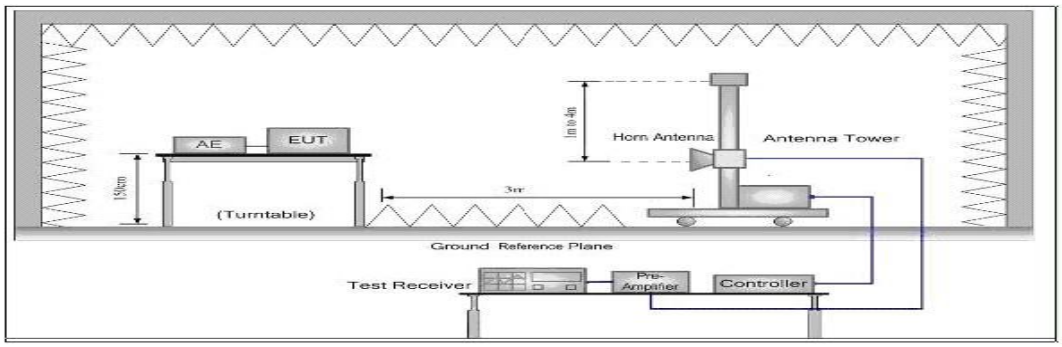
8.3 MEASUREMENT SETUP

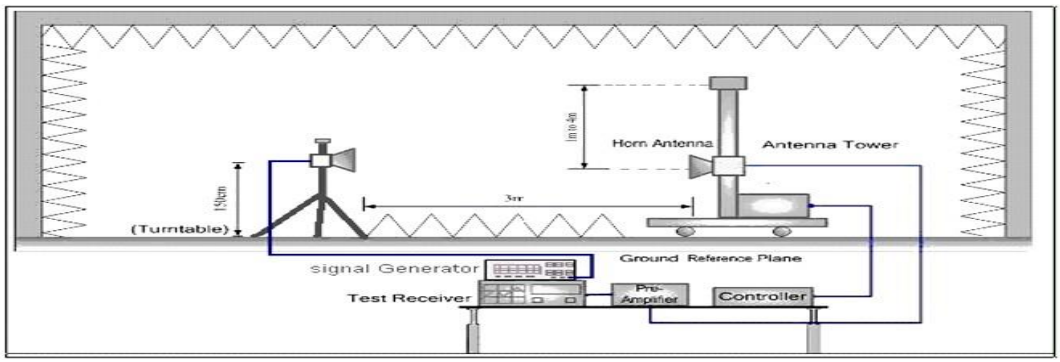
RADIATED BELOW 1GHZ





RADIATED ABOVE 1 GHZ





8.4 MEASUREMENT RESULTS

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.

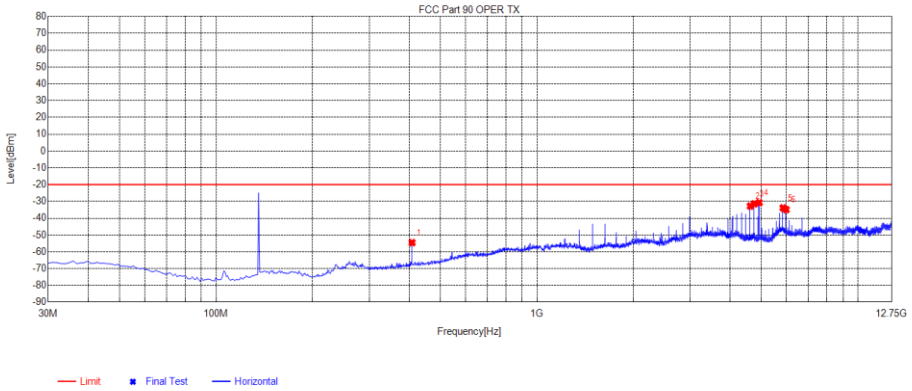
EIRP = “Read Value” + Measured substitution value + 2.15.

Test limit calculation:

Preliminary calculation	Final Result
At least 50+10 log (P) =50+10log (5) =56.99 (dB)	Limit=P- Preliminary calculation=36.99-56.99=-20 dBm
At least 50+10 log (P) =50+10log (1) =50.00(dB)	Limit=P- Preliminary calculation=30.00-50.00=-20 dBm

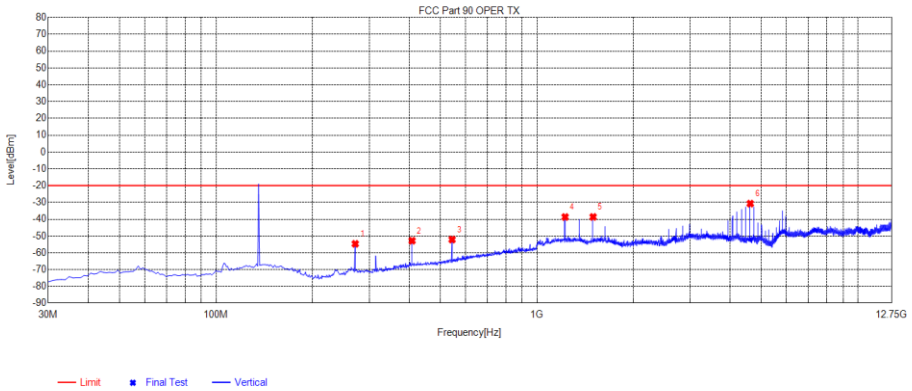
Note: The report only reflects high-power test data as the worst.

Test Mode:	TX:136.025MHz-FM 5W	Polarity:	Horizontal



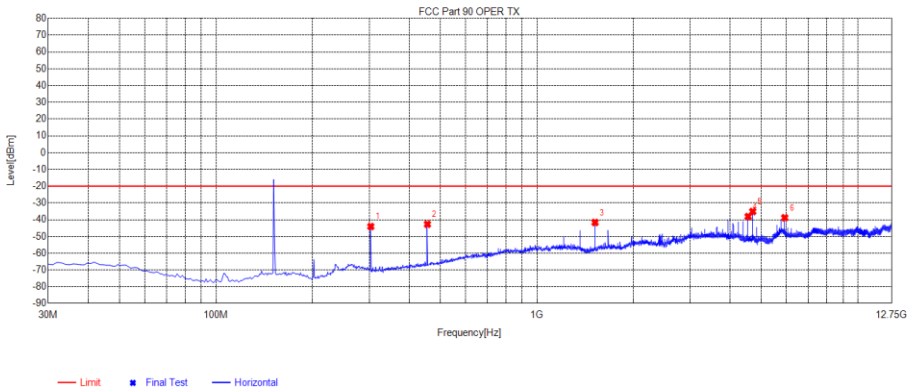
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	408.3	-89.13	-54.55	-20.00	34.55	34.58	157	Horizontal
2	4625.2375	-36.33	-32.78	-20.00	12.78	3.55	359	Horizontal
3	4761.5512	-35.08	-31.46	-20.00	11.46	3.62	351	Horizontal
4	4934.2934	-34.47	-30.76	-20.00	10.76	3.71	258	Horizontal
5	5849.71	-44.09	-33.86	-20.00	13.86	10.23	283	Horizontal
6	5984.8485	-45.62	-34.88	-20.00	14.88	10.74	359	Horizontal

Test Mode:	TX:136.025MHz-FM 5W	Polarity:	Vertical



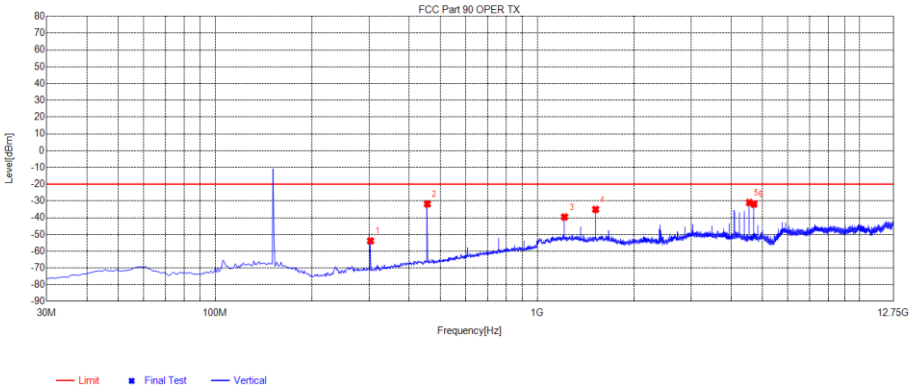
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	271.53	-84.84	-54.66	-20.00	34.66	30.18	17	Vertical
2	408.3	-87.92	-52.81	-20.00	32.81	35.11	360	Vertical
3	544.1	-89.52	-52.11	-20.00	32.11	37.41	195	Vertical
4	1224.4474	-39.03	-38.70	-20.00	18.70	0.33	136	Vertical
5	1497.0747	-40.80	-38.66	-20.00	18.66	2.14	204	Vertical
6	4625.2375	-34.00	-30.73	-20.00	10.73	3.27	153	Vertical

Test Mode:	TX:155.750MHz-FM 5W	Polarity:	Horizontal



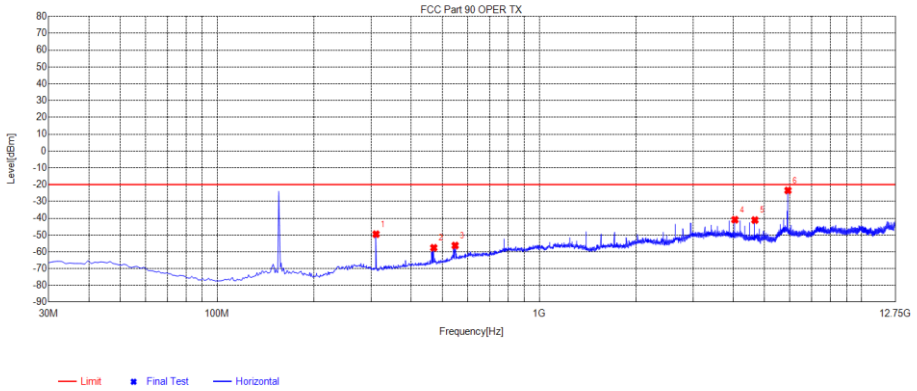
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	303.54	-76.11	-44.06	-20.00	24.06	32.05	298	Horizontal
2	455.83	-78.19	-42.70	-20.00	22.70	35.49	170	Horizontal
3	1518.2268	-38.58	-41.65	-20.00	21.65	-3.07	0	Horizontal
4	4555.9056	-41.65	-38.14	-20.00	18.14	3.51	145	Horizontal
5	4707.4958	-38.74	-35.15	-20.00	15.15	3.59	359	Horizontal
6	5922.5673	-49.38	-38.87	-20.00	18.87	10.51	359	Horizontal

Test Mode:	TX:155.750MHz-FM 5W	Polarity:	Vertical



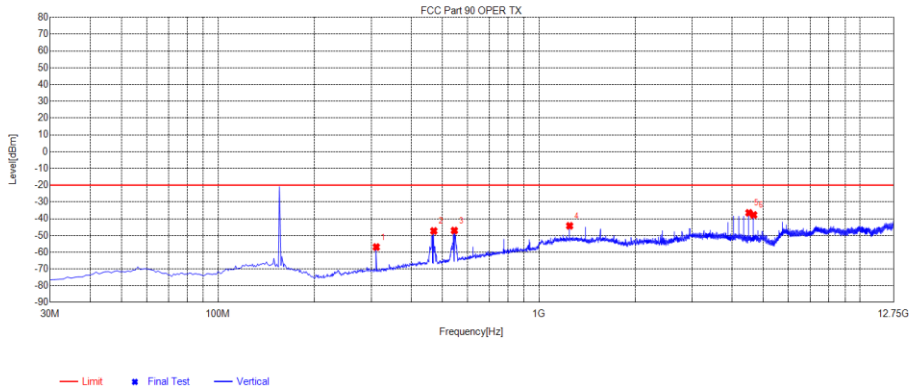
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	303.54	-84.92	-53.85	-20.00	33.85	31.07	29	Vertical
2	455.83	-67.58	-31.81	-20.00	11.81	35.77	172	Vertical
3	1215.0465	-39.86	-39.59	-20.00	19.59	0.27	198	Vertical
4	1518.2268	-37.16	-35.06	-20.00	15.06	2.10	198	Vertical
5	4555.9056	-34.12	-30.97	-20.00	10.97	3.15	156	Vertical
6	4707.4958	-35.33	-31.92	-20.00	11.92	3.41	156	Vertical

Test Mode:	TX:173.975MHz-FM 5W	Polarity:	Horizontal



NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	311.3	-81.76	-49.52	-20.00	29.52	32.24	139	Horizontal
2	470.38	-93.37	-57.61	-20.00	37.61	35.76	173	Horizontal
3	547.98	-94.29	-56.27	-20.00	36.27	38.02	359	Horizontal
4	4049.4299	-45.55	-40.93	-20.00	20.93	4.62	317	Horizontal
5	4672.2422	-44.70	-41.13	-20.00	21.13	3.57	317	Horizontal
6	5919.0419	-33.98	-23.48	-20.00	3.48	10.50	20	Horizontal

Test Mode:	TX:173.975MHz-FM 5W	Polarity:	Vertical



NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	311.3	-88.31	-56.92	-20.00	36.92	31.39	356	Vertical
2	470.38	-83.31	-47.33	-20.00	27.33	35.98	348	Vertical
3	545.07	-84.52	-47.08	-20.00	27.08	37.44	119	Vertical
4	1246.7747	-44.76	-44.28	-20.00	24.28	0.48	204	Vertical
5	4517.1267	-39.61	-36.52	-20.00	16.52	3.09	154	Vertical
6	4672.2422	-41.11	-37.76	-20.00	17.76	3.35	154	Vertical

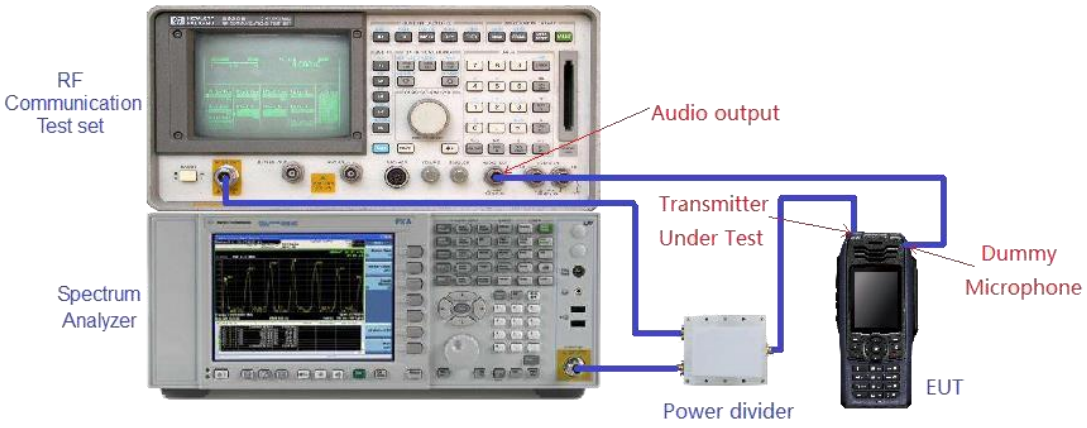
8.5 EMISSION MASK PLOT

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

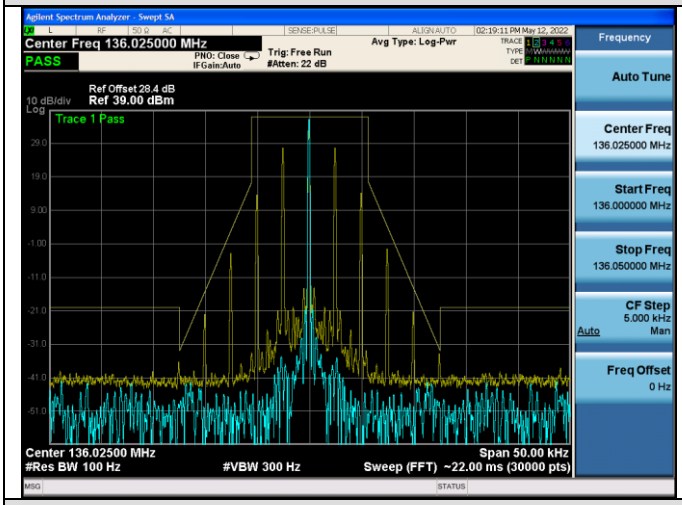
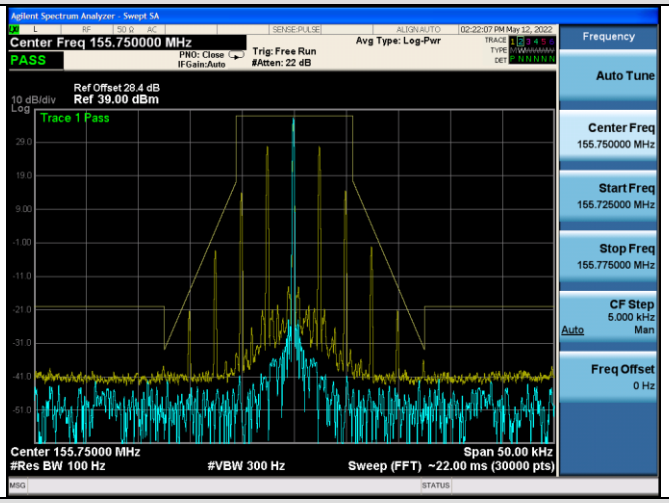
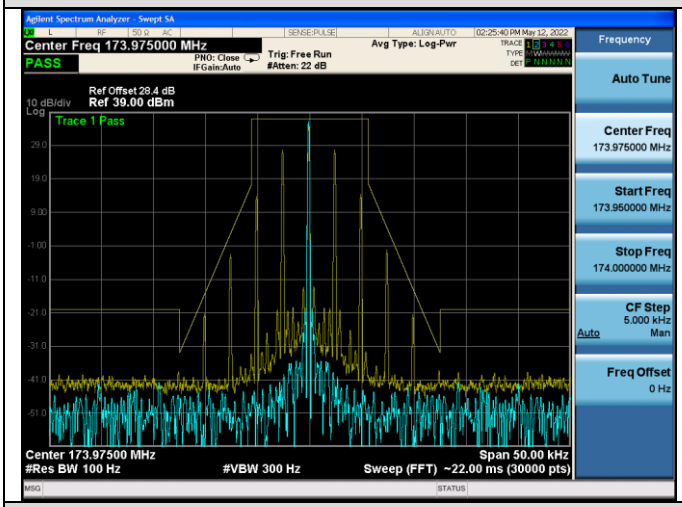
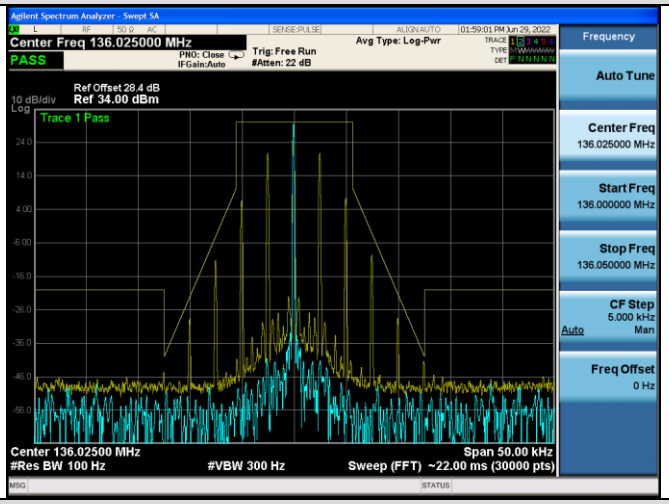
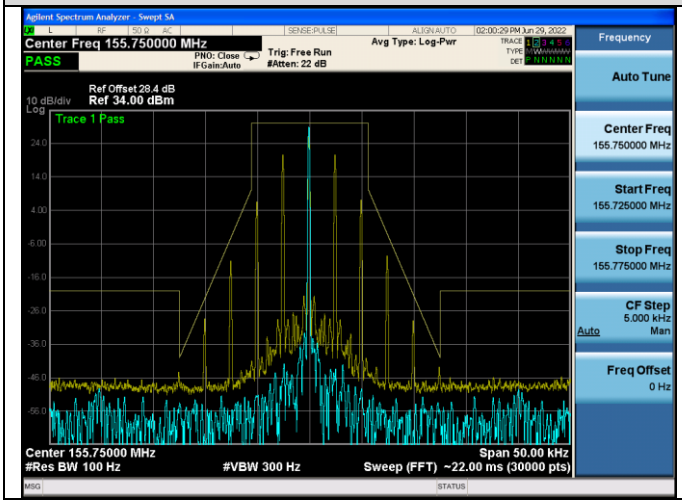
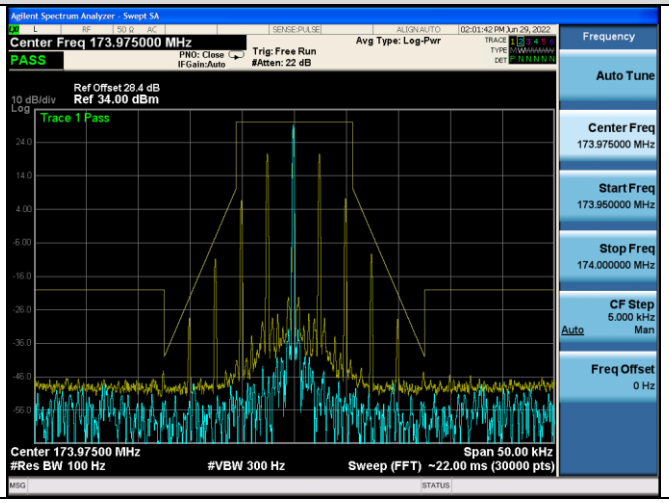
-Connect the equipment as illustrated.

-Spectrum set as follow:

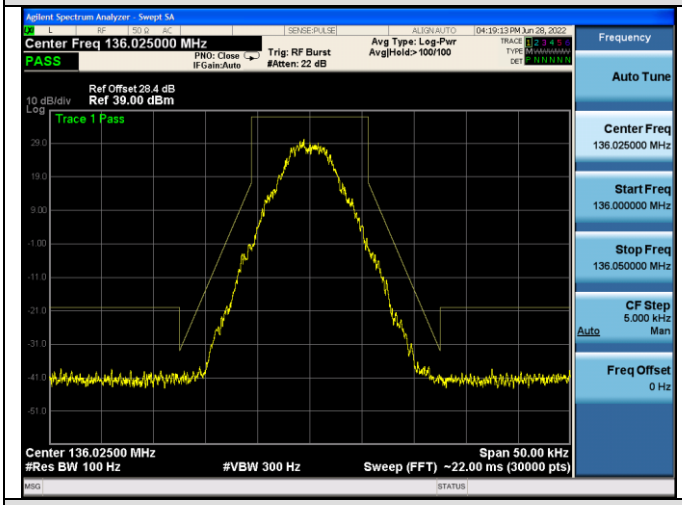
1. Centre frequency = fundamental frequency, Span=50kHz for 12.5kHz and 25kHz channel spacing, RBW=100Hz, VBW=300Hz for 12.5kHz, RBW=300Hz, VBW=1000Hz for 25kHz, Sweep = auto, Detector function = peak, Trace = max hold
2. Key the transmitter, and set the level of the unmodulated carrier to a fullscale 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.



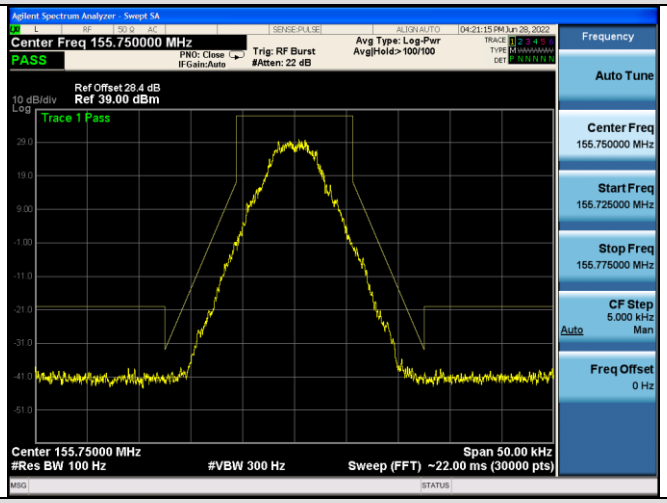
Test plot as follows:

Emission Mask D@136.025MHz-5W-FM	Emission Mask D@155.750MHz-5W-FM
	
Emission Mask D@173.975MHz-5W-FM	**Emission Mask D@136.025MHz-1W-FM**
	
Emission Mask D@155.750MHz-1W-FM	**Emission Mask D@173.975MHz-1W-FM**
	

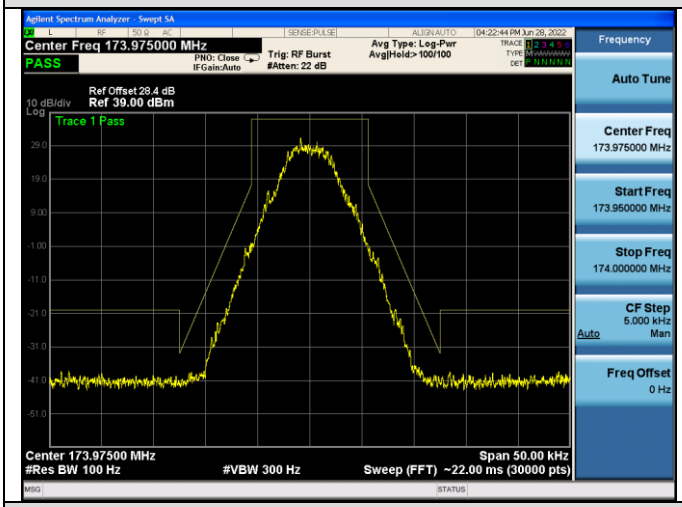
Emission Mask D@136.025MHz-5W-4FSK



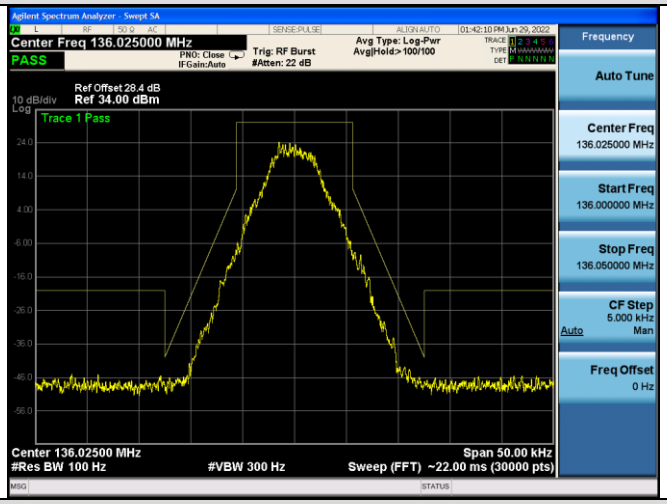
Emission Mask D@155.750MHz-5W-4FSK



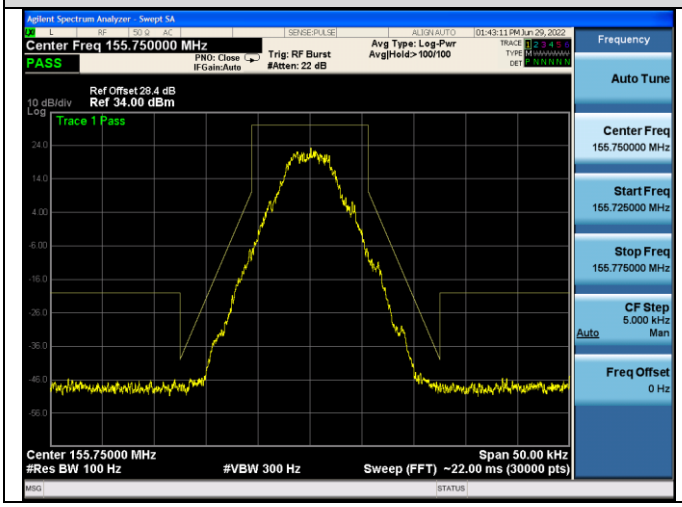
Emission Mask D@173.975MHz-5W-4FSK



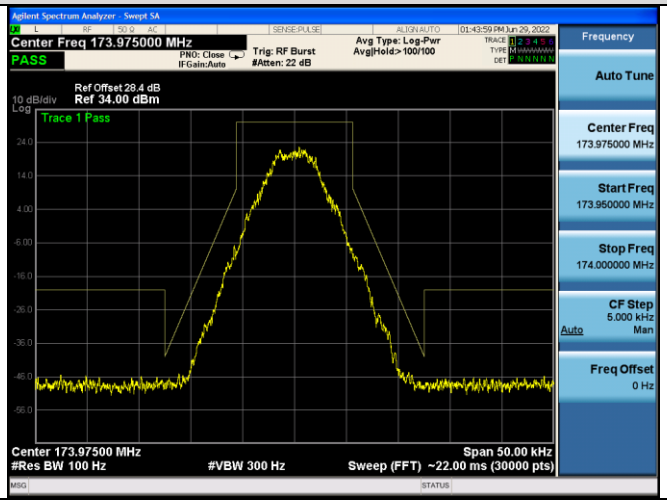
Emission Mask D@136.025MHz-1W-4FSK



Emission Mask D@155.750MHz-1W-4FSK



Emission Mask D@173.975MHz-1W-4FSK



9.MODULATION CHARACTERISTICS

9.1 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.

9.2 MEASUREMENT METHOD

9.2.1 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.

9.2.2 Audio Frequency Response

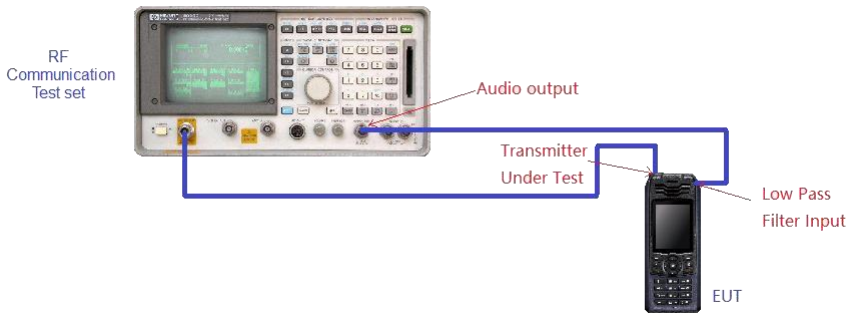
(1). Configure the EUT as shown in figure 1.

(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).

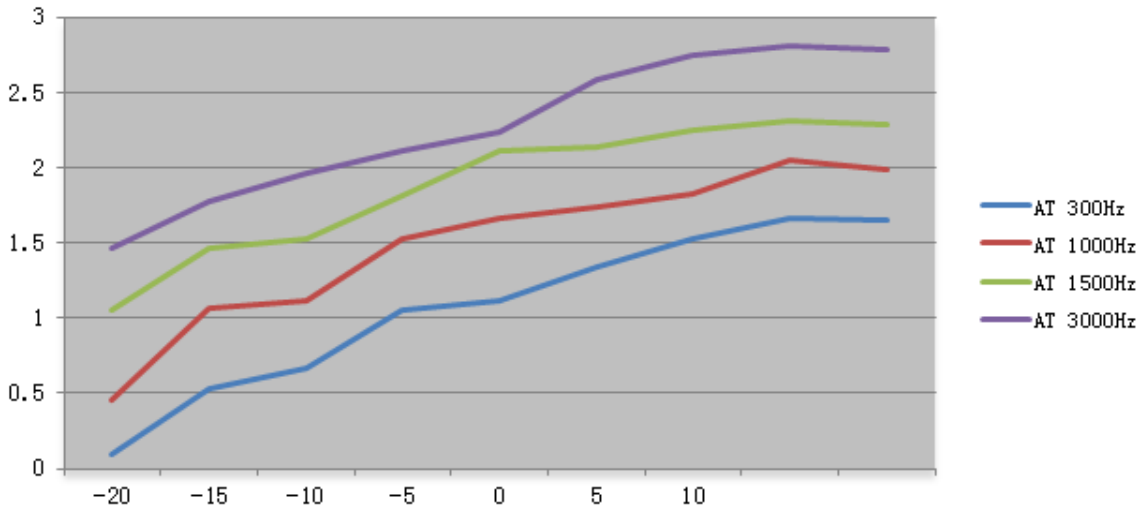
9.3 MEASUREMENT SETUP



9.4 MEASUREMENT RESULTS

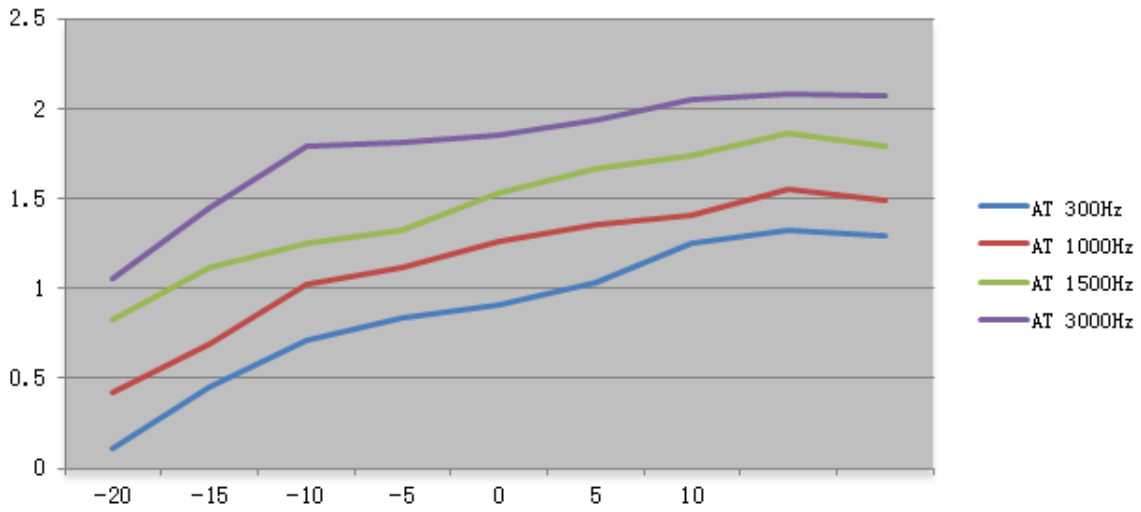
(A). MODULATION LIMIT:

12.5kHz, Analog modulation, Assigned Frequency:136.025MHz-High Power				
Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (kHz)	Peak Freq. Deviation At 1000 Hz (kHz)	Peak Freq. Deviation At 1500 Hz (kHz)	Peak Freq. Deviation At 3000 Hz (kHz)
-20	0.09	0.46	1.05	1.46
-15	0.53	1.06	1.46	1.78
-10	0.66	1.12	1.52	1.96
-5	1.05	1.52	1.81	2.11
0	1.12	1.66	2.11	2.23
+5	1.34	1.74	2.13	2.58
+10	1.52	1.82	2.25	2.74
+15	1.66	2.05	2.31	2.81
+20	1.65	1.98	2.29	2.78



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

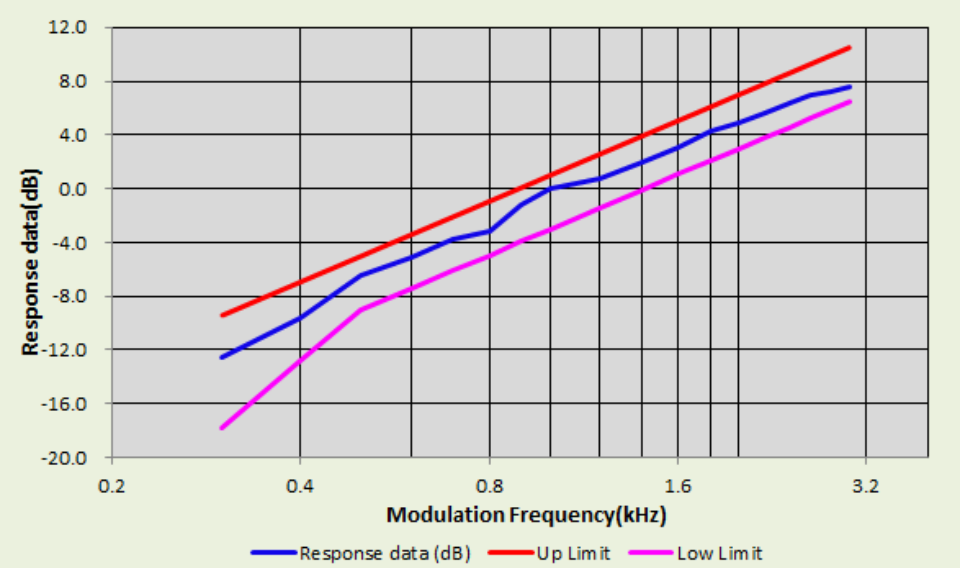
12.5kHz, Analog modulation, Assigned Frequency:136.025MHz-Low Power				
Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (kHz)	Peak Freq. Deviation At 1000 Hz (kHz)	Peak Freq. Deviation At 1500 Hz (kHz)	Peak Freq. Deviation At 3000 Hz (kHz)
-20	0.11	0.42	0.82	1.05
-15	0.45	0.69	1.11	1.45
-10	0.71	1.02	1.25	1.79
-5	0.83	1.12	1.32	1.81
0	0.91	1.26	1.53	1.85
+5	1.03	1.35	1.66	1.93
+10	1.25	1.41	1.74	2.05
+15	1.32	1.55	1.86	2.08
+20	1.29	1.49	1.79	2.07



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

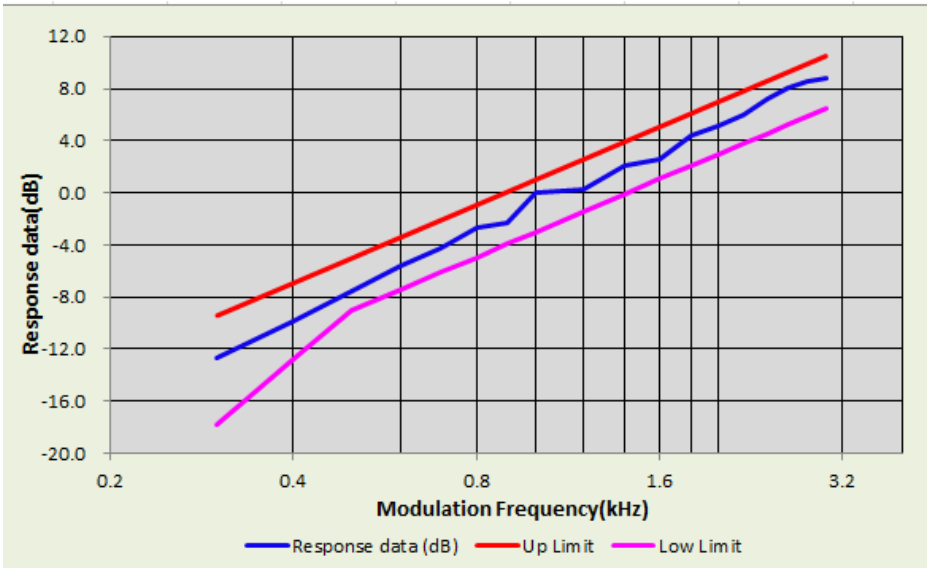
(B). AUDIO FREQUENCY RESPONSE:

12.5kHz, Analog modulation, Assigned Frequency:136.025MHz- High Power		
Frequency (Hz)	Deviation (kHz)	Audio Frequency Response(dB)
100	--	--
200	--	--
300	0.18	-12.51
400	0.25	-9.66
500	0.36	-6.49
600	0.42	-5.15
700	0.49	-3.81
800	0.53	-3.13
900	0.66	-1.23
1000	0.76	0.00
1200	0.83	0.77
1400	0.96	2.03
1600	1.08	3.05
1800	1.25	4.32
2000	1.33	4.86
2400	1.46	5.67
2500	1.58	6.36
2800	1.69	6.94
3000	1.74	7.19



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

12.5kHz, Analog modulation, Assigned Frequency:136.025MHz- Low Power		
Frequency (Hz)	Deviation (kHz)	Audio Frequency Response(dB)
100	--	--
200	--	--
300	0.16	-12.69
400	0.22	-9.93
500	0.29	-7.53
600	0.36	-5.65
700	0.42	-4.31
800	0.51	-2.63
900	0.53	-2.29
1000	**0.69**	0.00
1200	0.71	0.25
1400	0.88	2.11
1600	0.93	2.59
1800	1.15	4.44
2000	1.25	5.16
2400	1.37	5.96
2500	1.58	7.20
2800	1.74	8.03
3000	1.85	8.57



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

10. MAXIMUMN TRANSMITTER POWER

10.1 PROVISIONS APPLICABLE

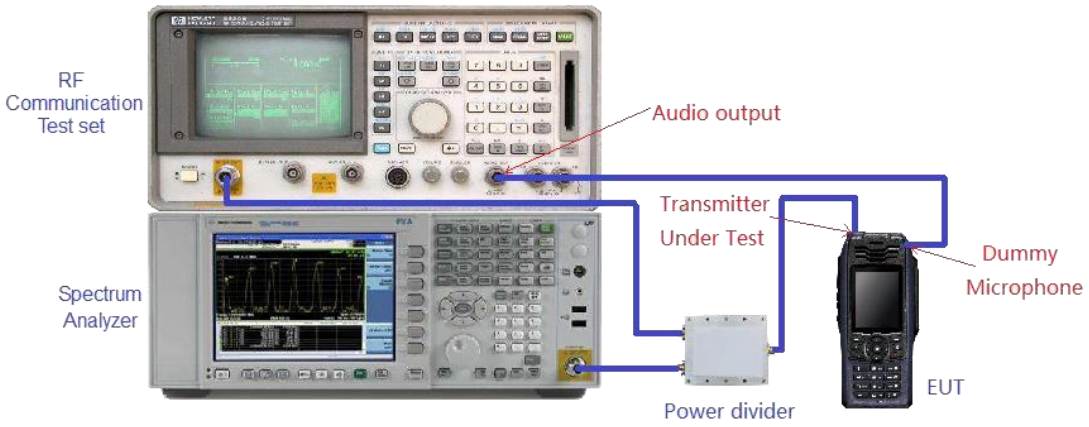
Per FCC §2.1046. § 90.205: Maximum ERP is dependent upon the station's antenna HAAT and required service area.

10.2 MEASUREMENT METHOD

The RF output of Two-way Radio was 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.

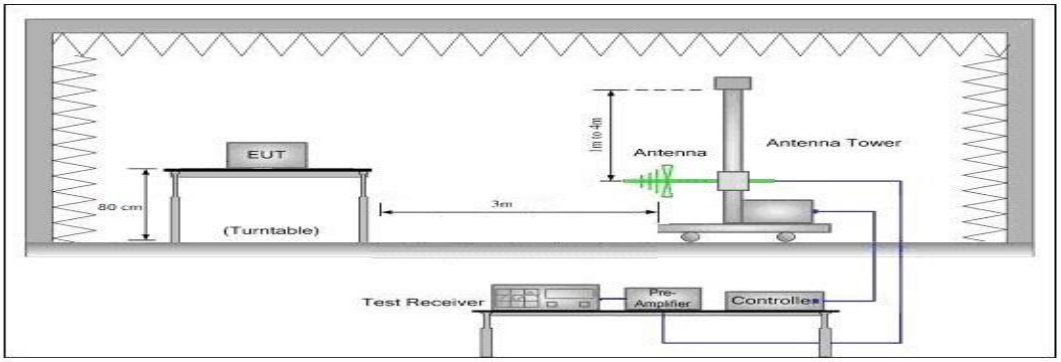
10.3 MEASUREMENT METHOD

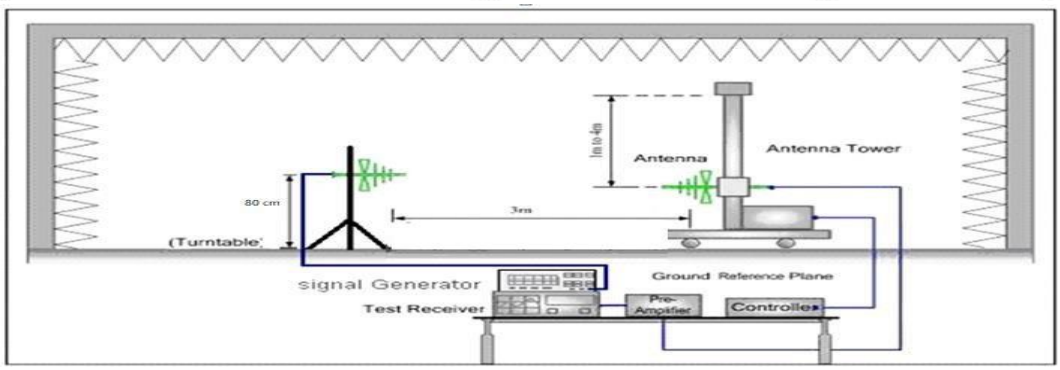
CONDUCTED OUTPUT POWER:



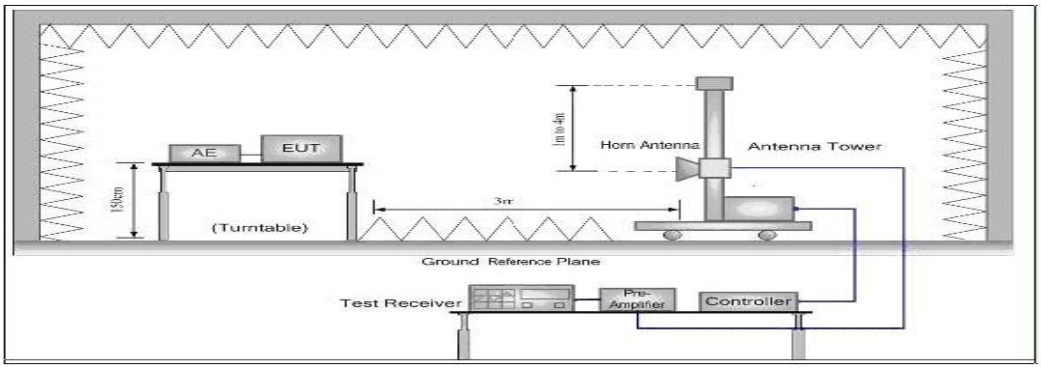
EFFECTIVE RADIATED POWER:

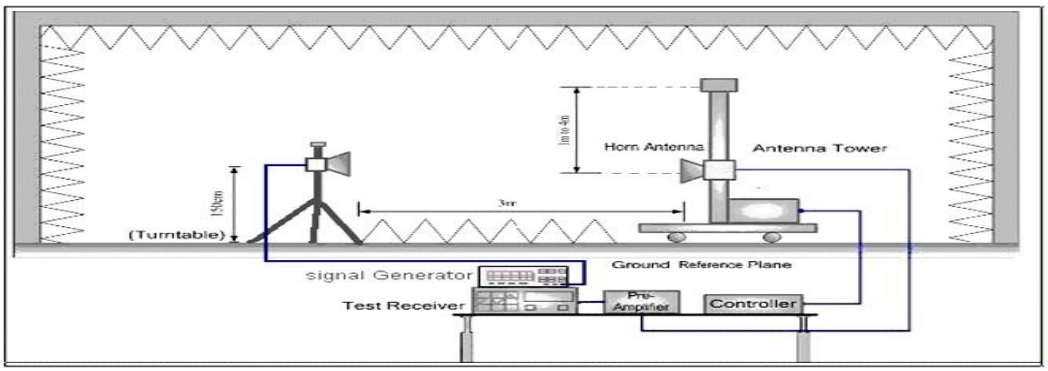
Radiated Below1GHz





Radiated Above 1 GHz





10.4 MEASUREMENT RESULTS

Conducted Power Measurement Results			
Mode	Channel Separation	Test Channel	Measurement Result (dBm)
			For 36.99dBm(5W)
Analog +Vioce	12.5 kHz	Bottom(136.025MHz)	36.89
		Middle(155.750MHz)	**36.92**
		Top (173.975MHz)	36.85
Digital +Vioce	12.5 kHz	Bottom(136.025MHz)	36.80
		Middle(155.750MHz)	**36.83**
		Top (173.975MHz)	36.79
Digital+ Data	12.5 kHz	Middle(151.850MHz)	36.69
		Middle(155.750MHz)	36.71
		Top (173.975MHz)	36.65

Radiated Power Measurement Results			
Mode	Channel Separation	Test Channel	Measurement Result (dBm)
			For 36.99dBm(5W)
Analog +Vioce	12.5 kHz	Bottom(136.025MHz)	36.69
		Middle(155.750MHz)	36.70
		Top (173.975MHz)	36.65
Digital +Vioce	12.5 kHz	Bottom(136.025MHz)	36.53
		Middle(155.750MHz)	36.59
		Top (173.975MHz)	36.51
Digital+ Data	12.5 kHz	Middle(151.850MHz)	36.41
		Middle(155.750MHz)	36.49
		Top (173.975MHz)	36.45

Conducted Power Measurement Results			
Mode	Channel Separation	Test Channel	Measurement Result (dBm)
			For 30.00dBm(1W)
Analog +Vioce	12.5 kHz	Bottom(136.025MHz)	**29.93**
		Middle(155.750MHz)	29.90
		Top (173.975MHz)	29.87
Digital +Vioce	12.5 kHz	Bottom(136.025MHz)	**29.88**
		Middle(155.750MHz)	29.85
		Top (173.975MHz)	29.84
Digital+ Data	12.5 kHz	Middle(151.850MHz)	29.75
		Middle(155.750MHz)	29.71
		Top (173.975MHz)	29.69

Radiated Power Measurement Results			
Mode	Channel Separation	Test Channel	Measurement Result (dBm)
			For 30.00dBm(1W)
Analog +Vioce	12.5 kHz	Bottom(136.025MHz)	29.65
		Middle(155.750MHz)	29.58
		Top (173.975MHz)	29.55
Digital +Vioce	12.5 kHz	Bottom(136.025MHz)	29.43
		Middle(155.750MHz)	29.39
		Top (173.975MHz)	29.35
Digital+ Data	12.5 kHz	Middle(151.850MHz)	29.29
		Middle(155.750MHz)	29.24
		Top (173.975MHz)	29.22

Note: Calculation Formula: CP = R + A + L

(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) All polarities of radiated power have been evaluated, and only the worst vertical polarity data is recorded in the report

11. SPURIOUS EMISSION ON ANTENNA PORT

11.1 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:

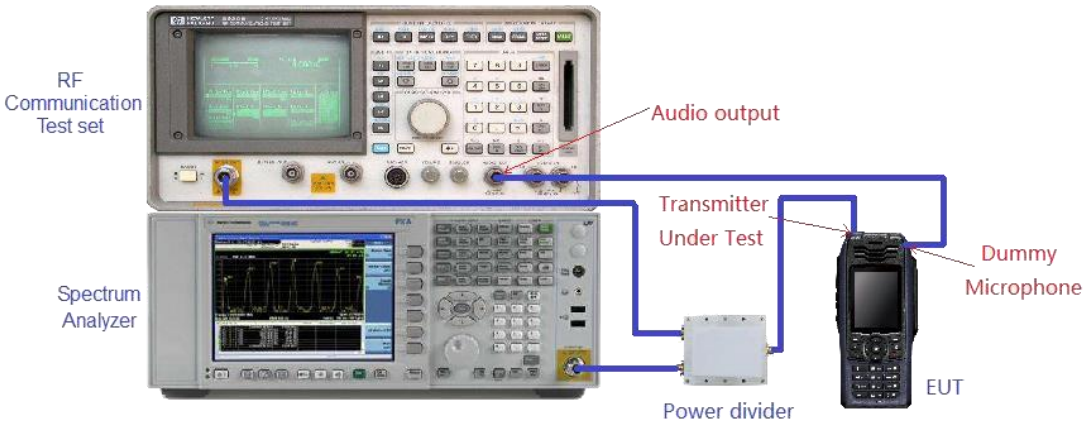
FCC Rules	Attenuation Limit (dBc)
§ 90.210	At least 50 + 10 log (P) dB

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

11.2 MEASUREMENT METHOD

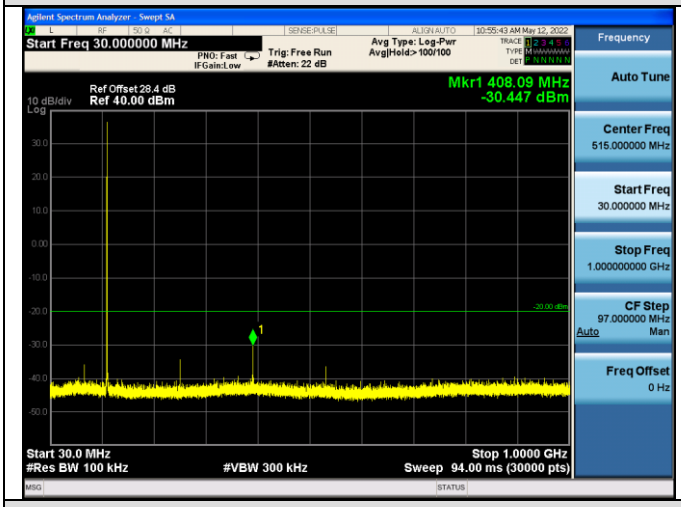
1. The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was set to 100 kHz. Sufficient scans were taken to show any out of band emission up to 10th . Harmonic for the lower and the highest frequency range.
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.

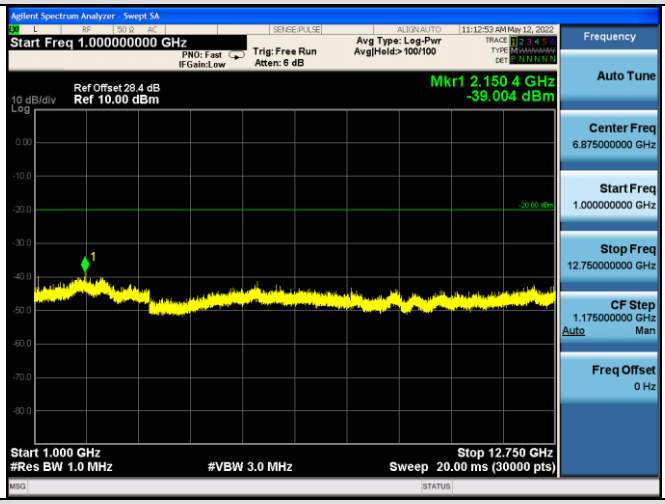
11.3 MEASUREMENT SETUP



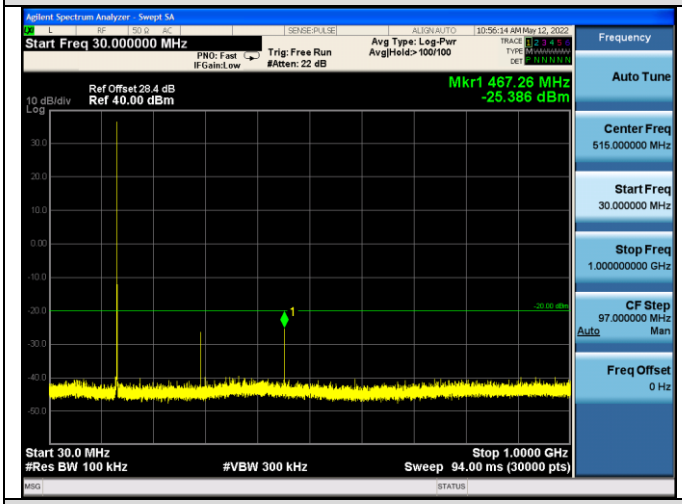
11.4 MEASUREMENT RESULTS

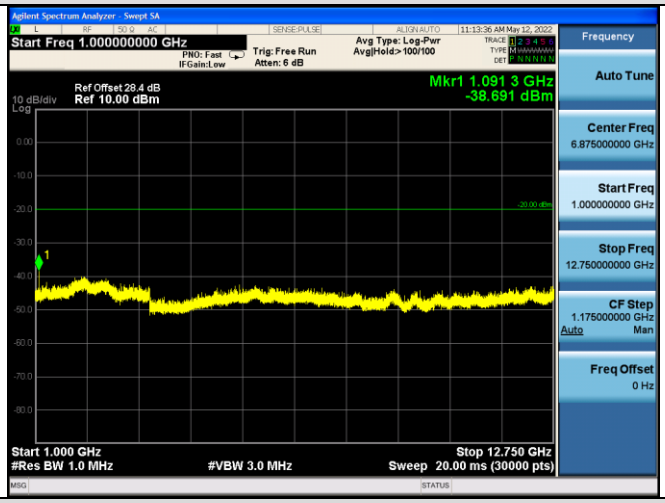
12.5kHz, Analog modulation, Assigned Frequency:136.025MHz, High Power





12.5kHz, Analog modulation, Assigned Frequency:155.750MHz, High Power





12.5kHz, Analog modulation, Assigned Frequency:173.975MHz, High Power