FCC Test Report

Report No.: AGC01284220704FE10

FCC ID	:	T4K-GRACES
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	CB RADIO
BRAND NAME	:	N/A
MODEL NAME	:	GRACES
APPLICANT	:	Qixiang Electron Science & Technology Co., Ltd.
DATE OF ISSUE	:	Nov. 22, 2022
STANDARD(S)	:	FCC Part 95 Rules
REPORT VERSION	:	V 1.1

Attestation of Global Compliance (Shenzhen) Co., Ltd

REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Oct. 22, 2022	Invalid	Initial Release
V1.1	1st	Nov. 22, 2022	Valid	Corrgendum

TABLE OF CONTENTS

1. GENERAL INFORMATION

Applicant	Qixiang Electron Science & Technology Co., Ltd.
Address	Qixiang Building,Tangxi Industrial Zone, Luojiang, Quanzhou, Fujian, 362011 China
Manufacturer	Qixiang Electron Science & Technology Co., Ltd.
Address	Qixiang Building,Tangxi Industrial Zone, Luojiang, Quanzhou, Fujian, 362011 China
Factory	Qixiang Electron Science & Technology Co., Ltd.
Address	Qixiang Building,Tangxi Industrial Zone, Luojiang, Quanzhou, Fujian, 362011 China
Product Designation	CB RADIO
Brand Name	N/A
Test Model	GRACES
Deviation from Standard	No any deviation from the test method
Date of Receipt	Jul. 29, 2022
Date of Test	Jul. 29, 2022~Oct. 22, 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-382-A-1998. The sample tested as described in this report is in compliance with the FCC Rules Part 95. The test results of this report relate only to the tested sample identified in this report.

Prepared By	Bibo Zhang (Project Engineer)	Nov. 22, 2022
Reviewed By	Calvin Liu (Reviewer)	Nov. 22, 2022
Approved By	Max Zhang Authorized Officer	Nov. 22, 2022

2. PRODUCT INFORMATION

2.1 PRODUCT TECHNICAL DESCRIPTION

Hardware Version	V1.0
Software Version	V1.0
Power Supply	DC 13.8V 2A
Communication Type	Voice / Tone only
Operation Frequency Range	26.965MHz-27.405MHz
Modulation Type	AM/FM
Channel Separation	10 KHz
Emission Designator	AM: 8K00A3E FM: 8K00F3E
Number of Channels:	40 Channels
Rated Output Power	4W (It was fixed by the manufacturer, any individual can't arbitrarily change it.)
Maximum Transmitter Power	AM: 35.76dBm FM:35.67dBm
Antenna Designation	Detachable
Antenna Type	External antenna
Antenna Gain	0dBi (Typical), 5dBi (Max)
Frequency Tolerance	AM:1.074ppm FM:1.036ppm

2.2 TEST FREQUENCY LIST

According to ANSI C63.26 section 5.1.2.1:
Measurements of transmitters shall be performed and, if required, reported for each frequency band in which the EUT can be operated with the device transmitting at the number of frequencies in each band specified in Table 2.

Frequency range Over which EUT operates	Number of Frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom

Operation Frequency Each of Channel			
CBRS		CBRS	
Channel	Frequency	Channel	Frequency
1	**26.965 MHz**	21	27.215 MHz
2	26.975 MHz	22	27.225 MHz
3	26.985 MHz	23	27.255 MHz
4	27.005 MHz	24	27.235 MHz
5	27.015 MHz	25	27.245 MHz
6	27.025 MHz	26	27.265 MHz
7	27.035 MHz	27	27.275 MHz
8	27.055 MHz	28	27.285 MHz
9	27.065 MHz	29	27.295 MHz
10	27.075 MHz	30	27.305 MHz
11	27.085 MHz	31	27.315 MHz
12	27.105 MHz	32	27.325 MHz
13	27.115 MHz	33	27.335 MHz
14	27.125 MHz	34	27.345 MHz
15	27.135 MHz	35	27.355 MHz
16	27.155 MHz	36	27.365 MHz
17	27.165 MHz	37	27.375 MHz
18	27.175 MHz	38	27.385 MHz
19	27.185 MHz	39	27.395 MHz
20	**27.205 MHz**	40	**27.405 MHz**

2.3 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for FCC ID: **T4K-GRACES,** filing to comply with Part 2, Part 95 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 95	Personal Radio Services
2	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
3	ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
4	ANSI EIA/TIA 382-A-1989	Minimum standards – Citizens band radio service amplitude modulated (AM) transceivers operating in the 27MHz band.

2.5 CALCULATION OF EMISSION INDICATORS

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

For AM Mode (ChannelSpacing: 10kHz)
Emission Designator 8K00A3E
Bn = 2M, M may vary between 4000 and 10000 depending on the quality desired.
Speech and music, M = 4000, Bandwidth: 8000 Hz= 8 kHz
A3E portion of the designator represents an AM voice transmission.
Therefore, the entire designator for 10 kHz channel spacing AM mode is 8K00A3E.

For FM Mode (ChannelSpacing: 10kHz)
Emission Designator 8K00F3E
Bn = 2M, M may vary between 4000 and 10000 depending on the quality desired.
Speech and music, M = 4000, Bandwidth: 8000 Hz= 8 kHz
F3E portion of the designator represents an FM voice transmission.
Therefore, the entire designator for 10 kHz channel spacing FM mode is 8K00F3E.

2.6 STATEMENT - COMPLIANCE TO §95.977

§95.977 CBRS tone transmissions.
In addition to the tones permitted under §95.377, CBRS transmitter types may be designed to transmit brief tones to indicate the beginning or end of a transmission.

This device is capable of transmitting a brief (less than one second) audio tone, “Roger Beep”, when the PTT button is released on the microphone indicating end of transmission. This function is user selectable and complies with the requirements of §95.377. See User’s Manual .
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2.7 SPECIAL ACCESSORIES

Not available for this EUT intended for grant.

2.8 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	DC13.8V	LV: DC 11.73V/HV:DC 15.87V
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
Mar. 28, 2022	R&S	ESCI	10096	Mar. 28, 2022	Mar. 27, 2023
EXA Signal Analyzer	Aglient	N9020A	W1312-60196	Aug. 16, 2022	Aug. 15, 2023
EXA Signal Analyzer	Aglient	N9020A	MY52090123	Sep. 06, 2021	Sep. 05, 2022
EXA Signal Analyzer	Aglient	N9020A	MY52090123	Sep. 04, 2022	Sep. 03, 2023
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Oct. 31, 2021	Oct. 30, 2023
preamplifier	ChengYi	EMC184045SE	980508	Sep. 29, 2021	Sep. 28, 2023
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
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. 05, 2022	Jun. 04, 2023
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	Jun. 08, 2022	Jun. 07, 2023
Small environmental tester	ESPEC	SH-242	93008290	Aug. 05, 2021	Aug. 04, 2022
Small environmental tester	ESPEC	SH-242	93008290	Aug. 03, 2022	Aug. 02, 2023
RF Communication Test Set	HP	8920B	US35010161	Aug. 05, 2021	Aug. 04, 2022
RF Communication Test Set	HP	8920B	US35010161	Aug. 03, 2022	Aug. 02, 2023
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(50MHz-1GHz)	SCH	N30687F9	--	May 23, 2022	May 22, 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	CB Radio	GRACES	FCC ID: T4K-GRACES	EUT
2	Hand microphone	-	-	Accessories

4.5 SUMMARY OF TEST RESULTS

Item	FCC Rules	Description of Test	Result
1	§ 95.967& 2.1046(a)	Maximum Transmitter Power	Pass
2	§95.975& 2.1047(a) (b)	Modulation Limit	Pass
3	§95.975& 2.1047(a)	Audio Frequency Response	Pass
4	§95.973& 2.1049	Emission Bandwidth	Pass
5	§95.979& 2.1049	Emission Mask	Pass
6	§95.965& 2.1055(a) (1)	Frequency Stability	Pass
7	§95.979& 2.1051	Spurious Emission on Antenna Port	Pass
8	§95.979& 2.1053	Ratiated Spurious Emission	Pass

5. DESCRIPTION OF TEST MODES

The EUT (**CB RADIO**) has been tested under normal operating condition. (CBRS TX) are chosen for testing at each channel separation.

NO.	TEST MODE DESCRIPTION	CHANNEL SEPARATION
1	CBRS TX CHANNEL 1	10.0 kHz
2	CBRS TX CHANNEL 20	10.0 kHz
3	CBRS TX CHANNEL 40	10.0 kHz

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. Manufacturers use computer PC programming software to switch and operate frequency points, refer to the instructions for details

6.FREQUENCY STABILITY

6.1 PROVISIONS APPLICABLE

Each CBRS transmitter type must be designed such that the transmit carrier frequency (or in the case of SSB transmissions, the reference frequency) remains within 50 parts-per- million of the channel center frequencies specified in §95.963 under all normal operating conditions.

6.2 MEASUREMENT PROCEDURE

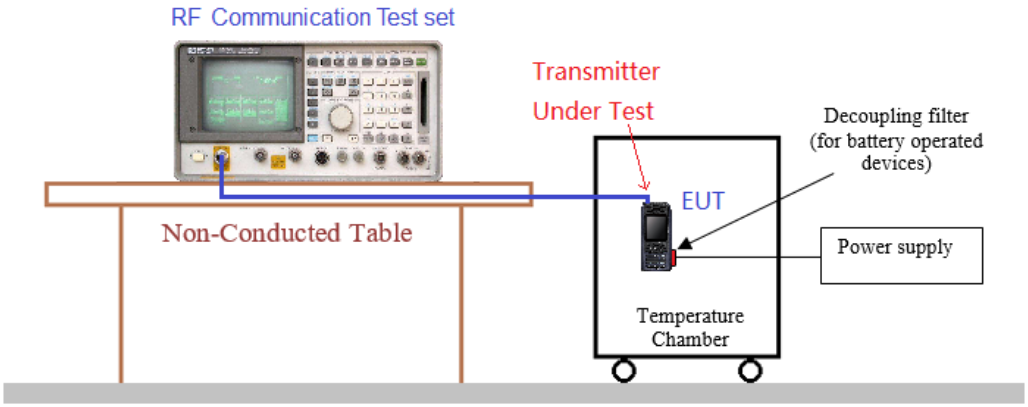
6.2.1 Frequency stability versus environmental temperature

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 13.8V.
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

10 kHz Channel Separation, AM modulation, Assigned Frequency For CBRS						
Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage (V)	Temp (℃)	Test Frequency (MHz)				
		26.965MHz	27.205MHz	27.405MHz		
13.80	-30	1.036	0.571	0.550	50	Pass
	-20	1.072	0.563	0.718		
	-10	0.987	0.773	0.886		
	0	1.072	0.814	0.605		
	10	0.658	0.704	0.967		
	20	0.524	1.039	**1.074**		
	30	1.026	0.653	0.657		
	40	0.991	0.901	0.971		
	50	0.653	0.530	0.547		
15.87	20	1.036	0.571	0.550		
11.73	20	1.072	0.563	0.718		

10 kHz Channel Separation, FM modulation, Assigned Frequency For CBRS						
Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage (V)	Temp (℃)	Test Frequency (MHz)				
		26.965MHz	27.205MHz	27.405MHz		
13.80	-30	0.836	0.663	0.610	50	Pass
	-20	0.913	0.863	0.377		
	-10	1.022	0.676	0.885		
	0	0.585	0.682	0.991		
	10	0.739	0.467	0.916		
	20	0.516	0.477	0.716		
	30	0.838	0.331	0.633		
	40	0.551	0.306	0.447		
	50	0.561	0.569	0.302		
15.87	20	**1.036**	0.937	0.822		
11.73	20	0.832	0.891	0.421		

7. EMISSION BANDWIDTH

7.1 PROVISIONS APPLICABLE

FCC Part 95.973, FCC Part 2.1049

Each CBRS transmitter type must be designed such that the occupied bandwidth does not exceed the authorized bandwidth for the emission type under test.

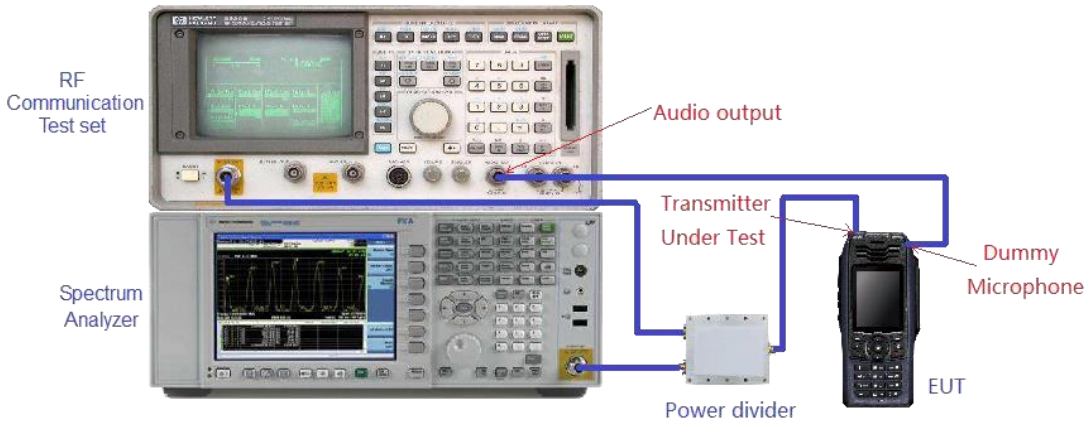
(a) AM and FM. The authorized bandwidth for emission type A3E and F3E is 8 kHz.

(b)SSB.The authorized bandwidth for emission types J3E, R3E, and H3E is 4 kHz.

7.2 MEASUREMENT PROCEDURE

1. Connect the equipment as illustrated
2. 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).
3. Spectrum set as follow:
   Centre frequency = the nominal EUT channel center frequency,
   The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient)
   RBW = 1% to 5% of the anticipated OBW, VBW ⩾ 3 × RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Set 99% Occupied Bandwidth and 26dB Bandwidth
5. Measure and record the results in the test report.

7.3 MEASUREMENT SETUP

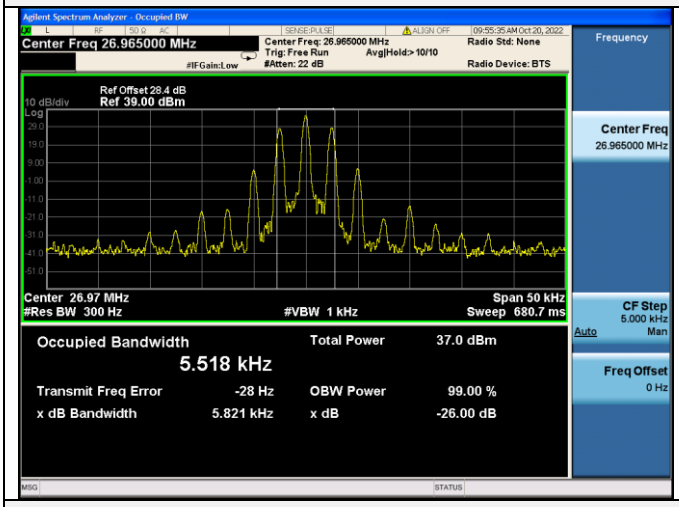


7.4 MEASUREMENT RESULTS

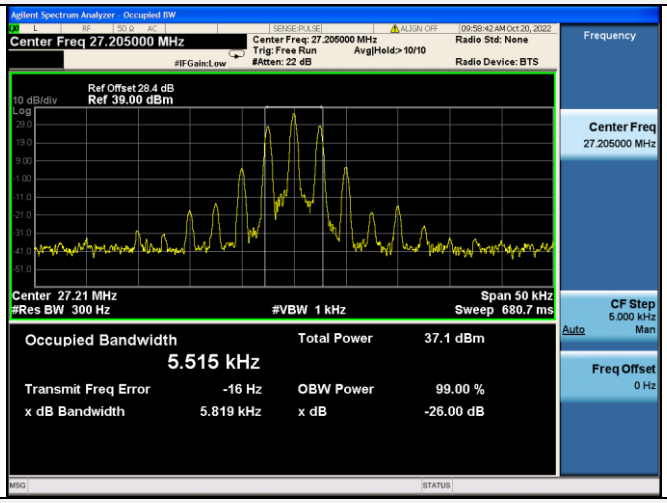
Emission Bandwidth Measurement Result-CBRS				
Operating Frequency	10 kHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
26.965 MHz	5.518 kHz	5.821 kHz	8.0 kHz	Pass
27.205 MHz	5.515 kHz	5.819 kHz	8.0 kHz	Pass
27.405 MHz	5.515 kHz	5.818 kHz	8.0 kHz	Pass

Test plot as follows:

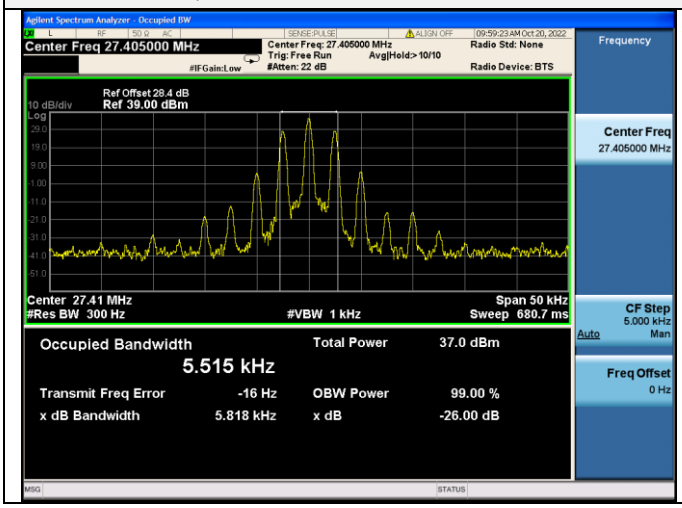
10kHz, AM Modulation:26.965MHz-4W



10kHz, AM Modulation:27.205MHz-4W



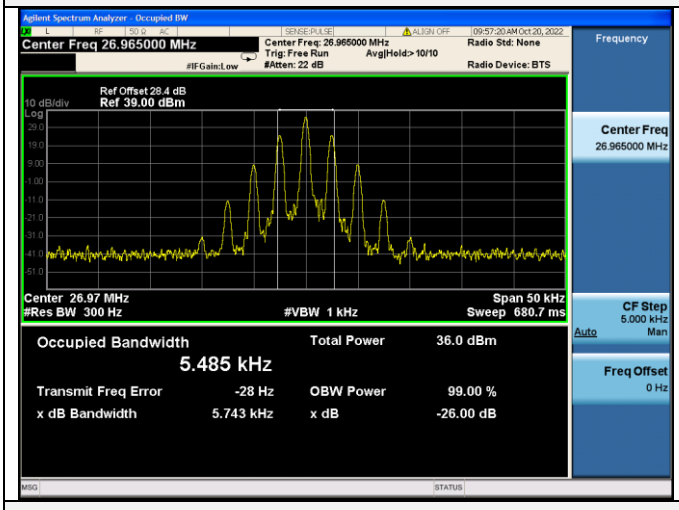
10kHz, AM Modulation:27.405MHz-4W



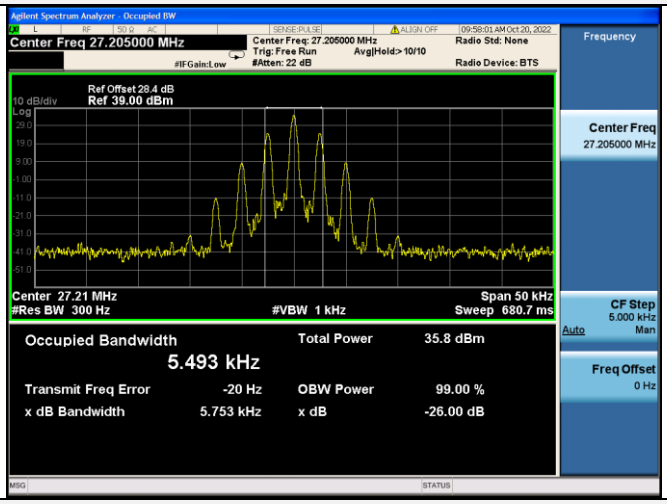
Emission Bandwidth Measurement Result-CBRS				
Operating Frequency	10 kHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
26.965 MHz	5.485 kHz	5.743 kHz	8.0 kHz	Pass
27.205 MHz	5.493 kHz	5.753 kHz	8.0 kHz	Pass
27.405 MHz	5.494 kHz	5.752 kHz	8.0 kHz	Pass

Test plot as follows:

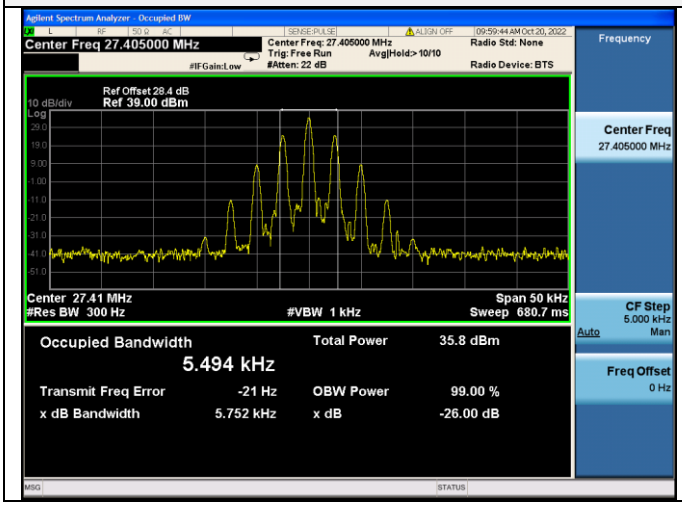
10kHz, FM Modulation:26.965MHz-4W



10kHz, FM Modulation:27.205MHz-4W



10kHz, FM Modulation:27.405MHz-4W



8. RATIATED SPURIOUS EMISSION

8.1 PROVISIONS APPLICABLE

FCC Part 95.979(a), FCC Part 2.1049

Each CBRS transmitter type must be designed to comply with the applicable unwanted emissions limits in this section.The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) as specified in the applicable paragraphs listed in the following table:

Emission type	Paragraph
A3E,F3E	(1), (3), (5), (6)
H3E, J3E, R3E	(2), (4), (5), (6)

(1) 25 dB (decibels) in the frequency band 4 kHz to 8 kHz removed from the channel center frequency;

(2) 25 dB in the frequency band 2 kHz to 6 kHz removed from the channel center frequency;

(3) 35 dB in the frequency band 8 kHz to 20 kHz removed from the channel center frequency;

(4) 35 dB in the frequency band 6 kHz to 10 kHz removed from the channel center frequency;

(5) 53 + 10 log (P) dB in any frequency band removed from the channel center frequency by more than 250% of the authorized bandwidth.

(6) 60 dB in any frequency band centered on a harmonic (i.e., an integer multiple of two or more times) of the carrier frequency.

8.2 MEASUREMENT PROCEDURE

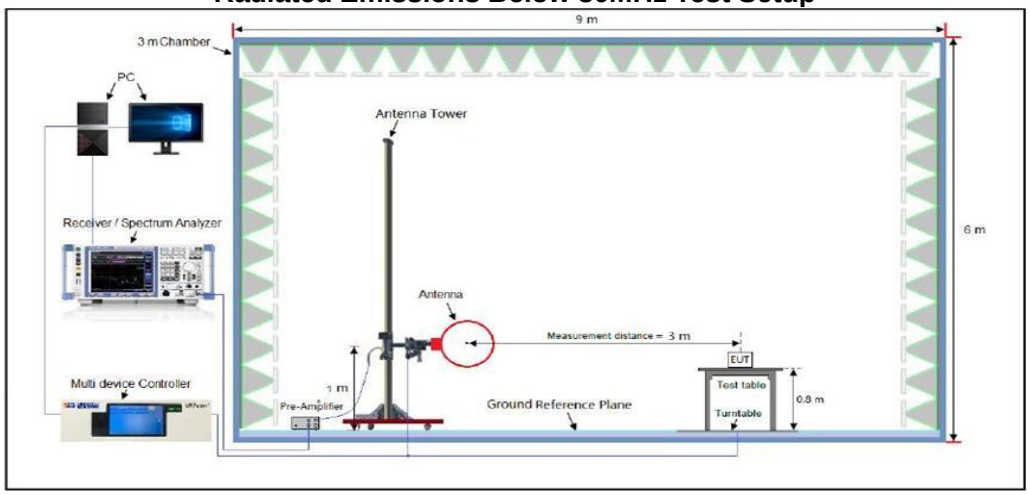
1. EUT was placed on a 0.8 or 1.5meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made. The radiated emission measurements of all transmit frequencies in all channels were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz for above 1GHz and RBW=100kHz, VBW=300kHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (Pr).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the

substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

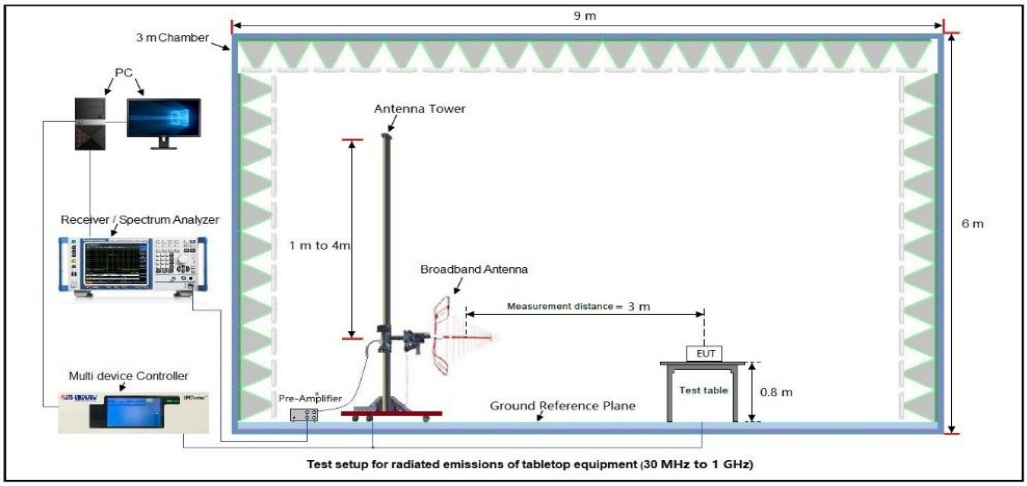
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test
6. The measurement results are obtained as described below: Power(EIRP)=PMea- PAg - Pcl - Ga The measurement results are amend as described below:Power(EIRP)=PMea- Pcl - Ga
7. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
8. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.
9. Test the EUT in the lowest channel, the middle channel the Highest channel

8.3 MEASUREMENT SETUP

Radiated Emissions Below 30MHz Test Setup

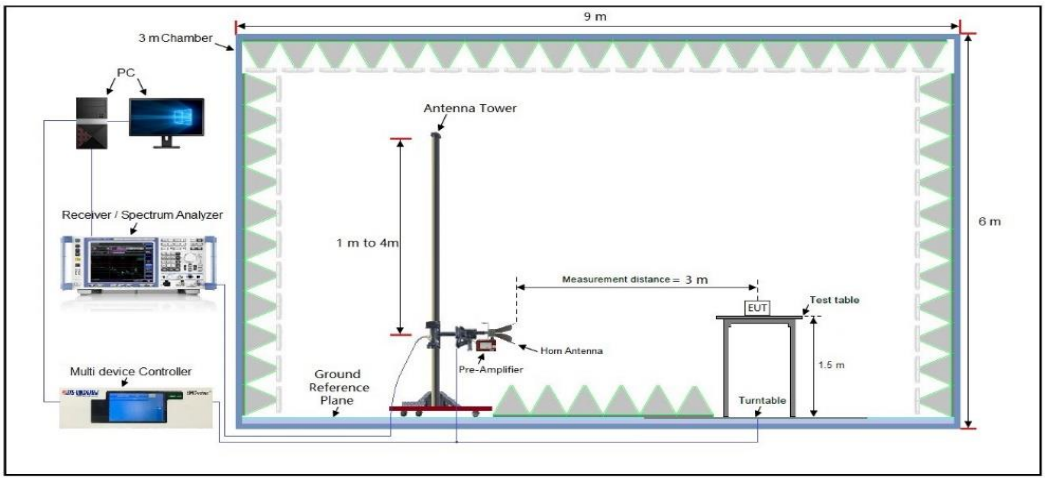


Radiated Emissions Below 30MHz-1GHz Test Setup



Test setup for radiated emissions of tabletop equipment (30 MHz to 1 GHz)

Radiated Emissions Above 1GHz Test Setup

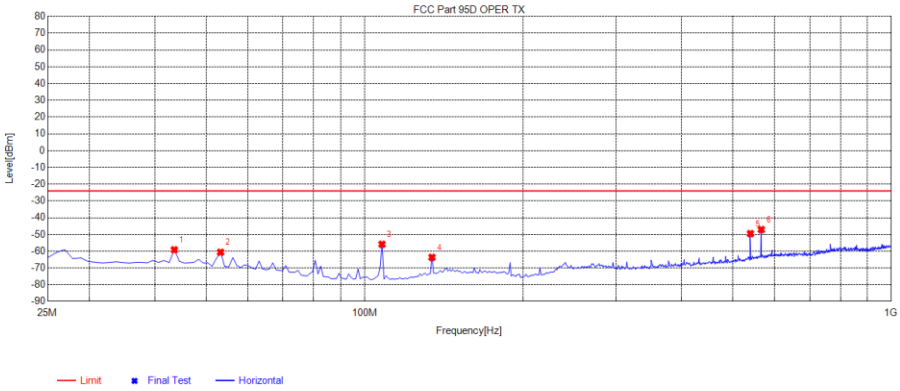


8.4 MEASUREMENT RESULTS

Preliminary calculation	Final Result
P(dBm)=30+10log【P(W)】=36.02dBm	Limit= Preliminary calculation-60dB=-24dBm

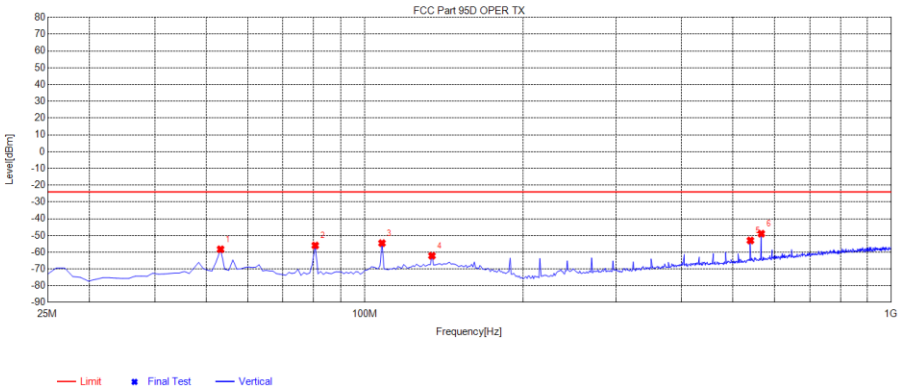
1. Factor=Antenna Factor + Cable loss. (Below 1GHz)
2. Factor=Antenna Factor+ Cable loss -Pre-amplifier. (Above 1 GHz)
3. Margin=Limit- Level
4. the unwanted emission should be attenuated below TP by at least 60 dB.
5. In the frequency range of 9KHz-30MHz, in addition to displaying the Fundamental level, the radiated spurious emission level is much less than 60dB of the carrier power, so it is ignored.

Test Mode:	TX-CH1	Polarity:	Horizontal



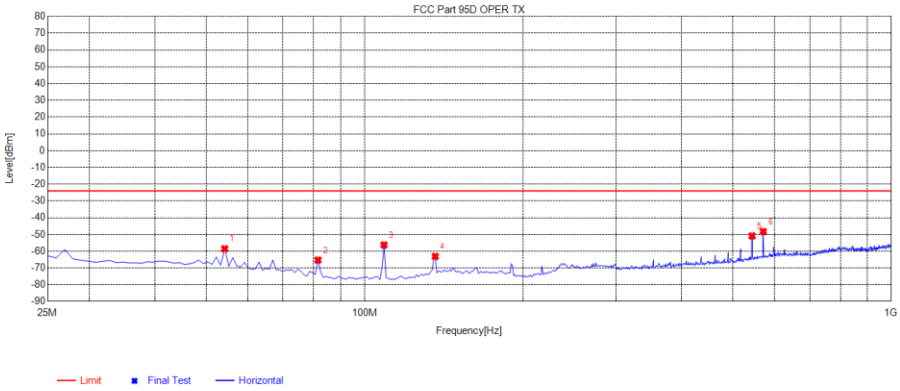
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	43.525	-93.70	-59.17	-24.00	35.17	34.53	121	Horizontal
2	53.275	-93.34	-60.62	-24.00	36.62	32.72	9	Horizontal
3	107.875	-80.85	-55.88	-24.00	31.88	24.97	195	Horizontal
4	134.2	-91.93	-63.67	-24.00	39.67	28.26	47	Horizontal
5	539.8	-87.25	-49.52	-24.00	25.52	37.73	329	Horizontal
6	566.125	-85.77	-47.11	-24.00	23.11	38.66	329	Horizontal

Test Mode:	TX-CH1	Polarity:	Vertical



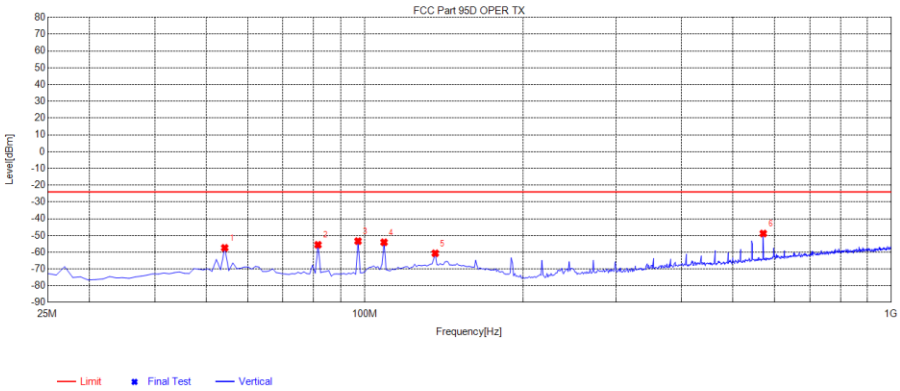
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	53.275	-88.58	-58.26	-24.00	34.26	30.32	277	Vertical
2	80.575	-84.58	-55.97	-24.00	31.97	28.61	135	Vertical
3	107.875	-85.34	-54.59	-24.00	30.59	30.75	174	Vertical
4	134.2	-96.11	-62.11	-24.00	38.11	34.00	295	Vertical
5	539.8	-90.30	-52.99	-24.00	28.99	37.31	230	Vertical
6	566.125	-86.87	-48.95	-24.00	24.95	37.92	258	Vertical

Test Mode:	TX-CH20	Polarity:	Horizontal



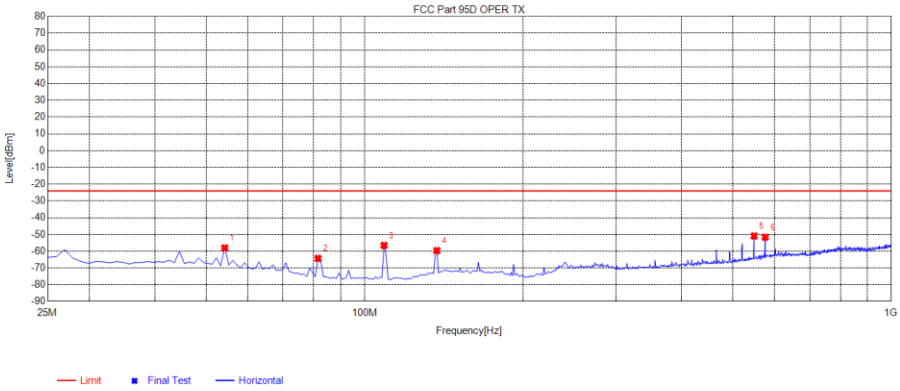
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	54.25	-90.97	-58.53	-24.00	34.53	32.44	17	Horizontal
2	81.55	-91.73	-65.28	-24.00	41.28	26.45	223	Horizontal
3	108.85	-81.28	-56.26	-24.00	32.26	25.02	204	Horizontal
4	136.15	-91.72	-63.08	-24.00	39.08	28.64	213	Horizontal
5	543.7	-88.75	-50.88	-24.00	26.88	37.87	330	Horizontal
6	571	-87.10	-48.27	-24.00	24.27	38.83	348	Horizontal

Test Mode:	TX-CH19	Polarity:	Vertical



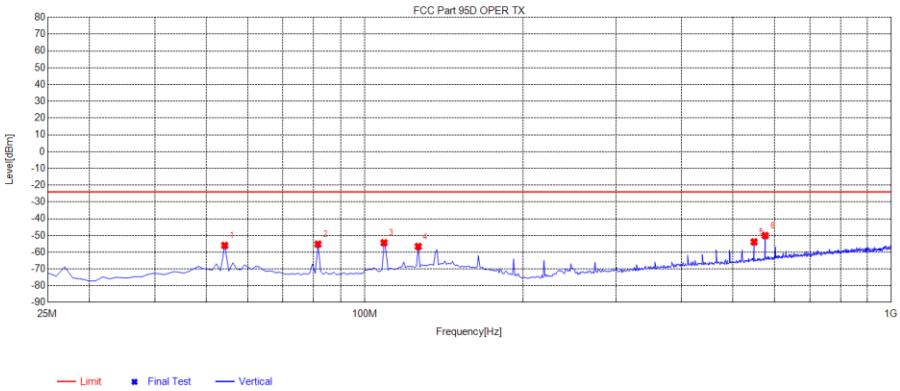
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	54.25	-87.87	-57.39	-24.00	33.39	30.48	306	Vertical
2	81.55	-84.15	-55.58	-24.00	31.58	28.57	138	Vertical
3	97.15	-82.33	-53.38	-24.00	29.38	28.95	0	Vertical
4	108.85	-85.03	-54.09	-24.00	30.09	30.94	156	Vertical
5	136.15	-94.78	-60.65	-24.00	36.65	34.13	130	Vertical
6	571	-86.88	-48.84	-24.00	24.84	38.04	245	Vertical

Test Mode:	TX-CH40	Polarity:	Horizontal



NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	54.25	-90.49	-58.05	-24.00	34.05	32.44	9	Horizontal
2	81.55	-90.76	-64.31	-24.00	40.31	26.45	203	Horizontal
3	108.85	-81.55	-56.53	-24.00	32.53	25.02	194	Horizontal
4	137.125	-88.48	-59.65	-24.00	35.65	28.83	212	Horizontal
5	548.575	-88.97	-50.93	-24.00	26.93	38.04	328	Horizontal
6	575.875	-90.63	-51.63	-24.00	27.63	39.00	212	Horizontal

Test Mode:	TX-CH40	Polarity:	Vertical



NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	54.25	-86.43	-55.95	-24.00	31.95	30.48	296	Vertical
2	81.55	-83.77	-55.20	-24.00	31.20	28.57	141	Vertical
3	108.85	-85.27	-54.33	-24.00	30.33	30.94	178	Vertical
4	126.4	-90.04	-56.57	-24.00	32.57	33.47	36	Vertical
5	548.575	-91.36	-53.84	-24.00	29.84	37.52	85	Vertical
6	575.875	-88.24	-50.09	-24.00	26.09	38.15	240	Vertical

8.5 EMISSION MASK PLOT

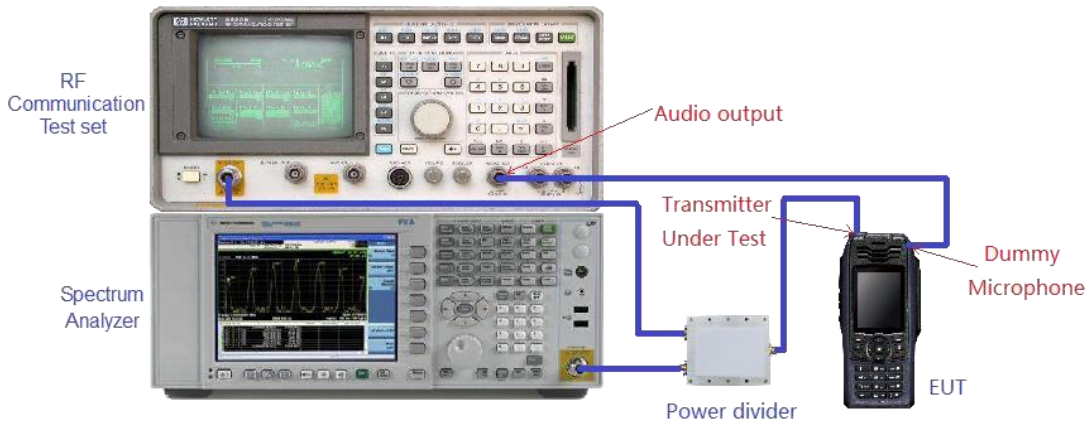
The detailed procedure employed for Emission Mask measurements are specified as following:

-Connect the equipment as illustrated.

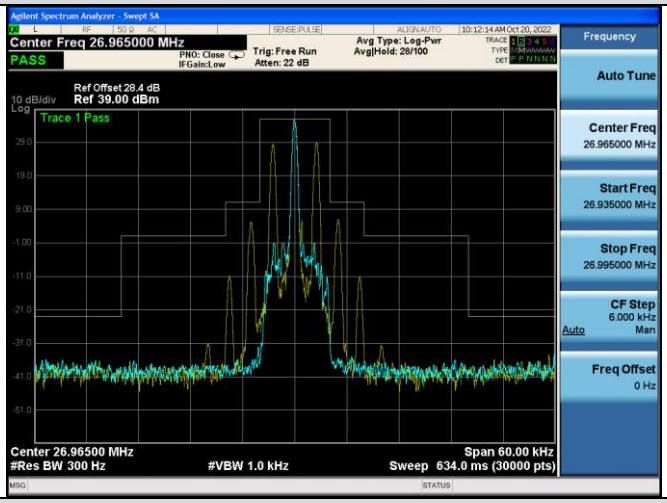
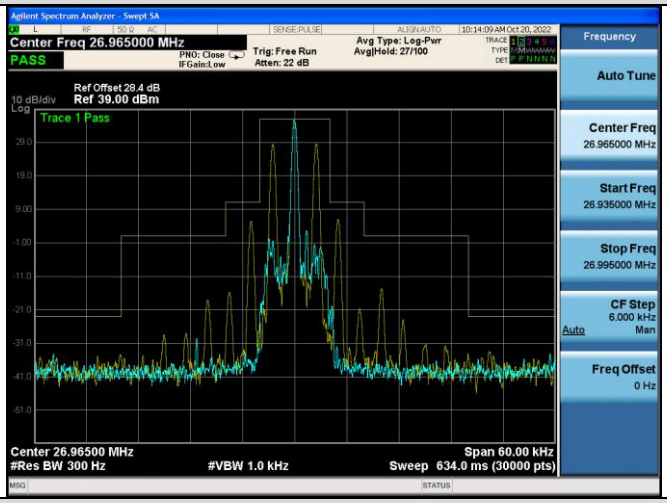
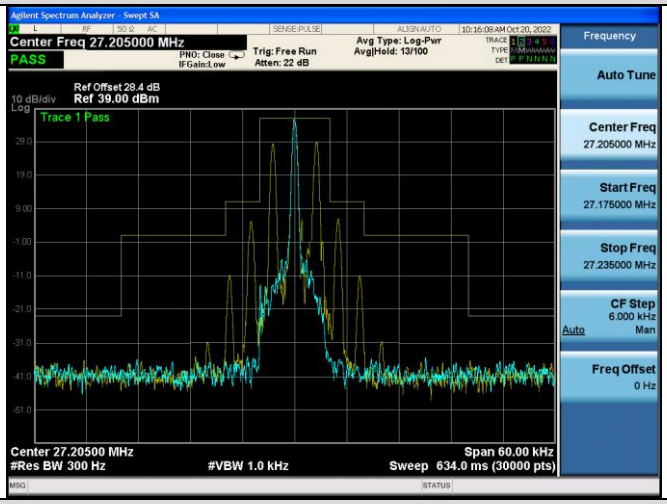
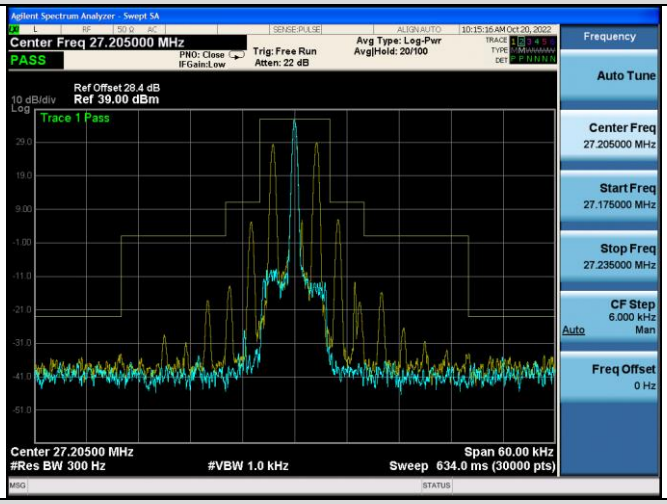
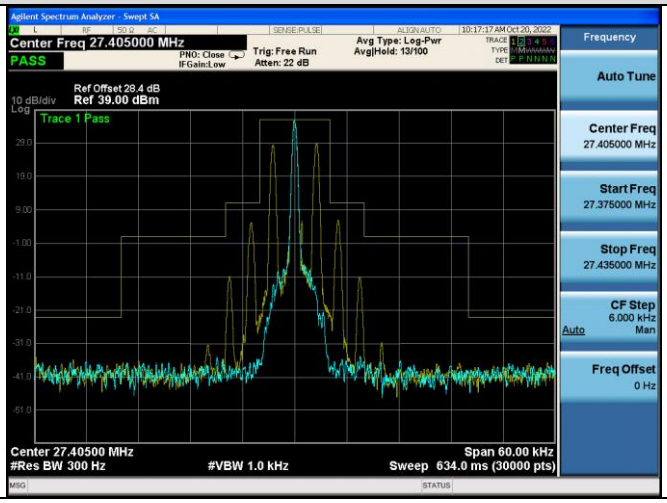
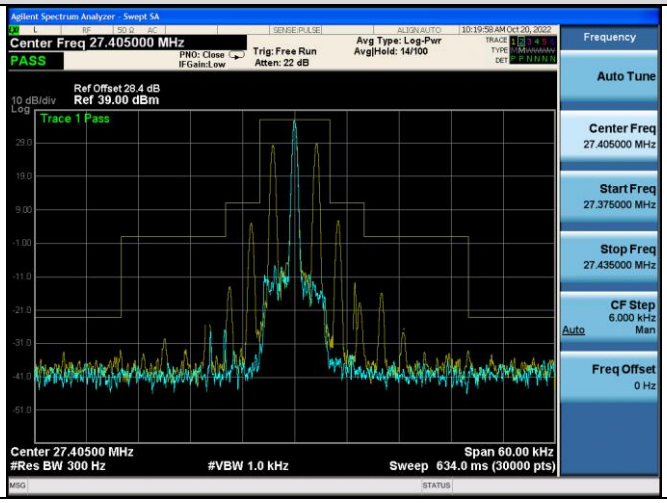
-Spectrum set as follow:

1. Centre frequency = fundamental frequency, Span=50kHz for 10kHz , RBW=300Hz, VBW=1000Hz ;
2. Sweep = auto, Detector function = peak, Trace = max hold
3. 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.
4. 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

   The input level shall be established at the frequency of maximum response of the audio modulating circuit.
5. Transmitters employing digital modulation techniques that bypass the limiter and the audio low-pass filter shall be modulated as specified by the manufacturer.
6. Measure and record the results in the test report.



Test plot as follows:

Emission Mask- FM Modulation @ 26.965MHz-4W	Emission Mask- AM Modulation @ 26.965MHz-4W
	
Emission Mask- FM Modulation @ 27.205MHz-4W	**Emission Mask- AM Modulation @ 27.205MHz-4W**
	
Emission Mask- FM Modulation @ 27.405MHz-4W	**Emission Mask- AM Modulation @ 27.405MHz-4W**
	

9. SPURIOUS EMISSION ON ANTENNA PORT

9.1 PROVISIONS APPLICABLE

Please refer to FCC 47 CFR 2.1051, 2.1057 & 95.979 for specification details.
Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 95.979	At least 53 + 10 log (P) dB
§ 95.979	60 dB in any frequency band centered on a harmonic (i.e., an integer multiple of two or more times) of the carrier frequency.

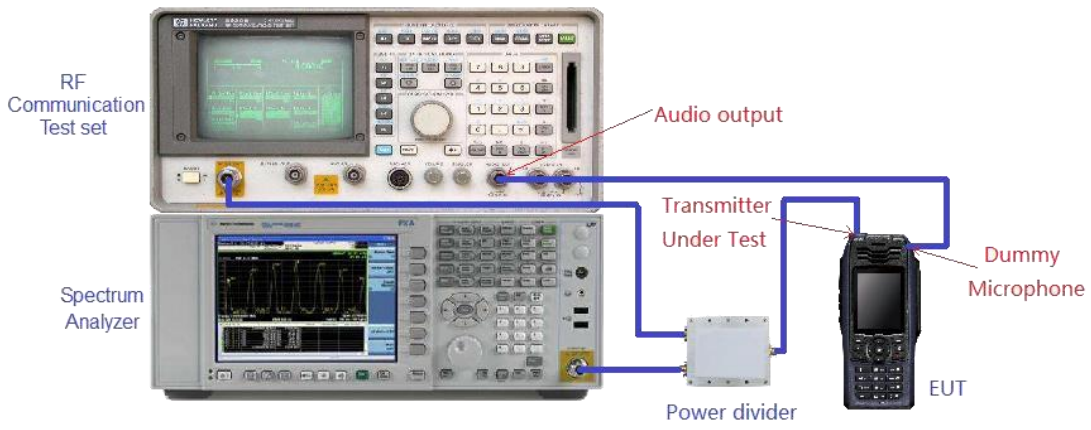
53 + 10 log (Pwatts)
Calculation: Limit (dBm) =EL-53-10log10 (TP)
Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is P(dBm).
Limit (dBm) = P(dBm)-53-10 log (Pwatts) = -23 dBm

Note:Unwanted spurious limit is -23dBm, and the main wave frequency multiplication limit is -24dBm. After evaluat ion, a stricter limit of -24dBm is used to evaluate unwanted spurious and main wave frequency multiplication.

9.2 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
3. show any out of band emission up to 10th . Harmonic for the lower and the highest frequency range.
4. Set RBW 1 kHz, VBW 3 kHz in the frequency band 9KHz to 150KHz;
   Set RBW 10 kHz, VBW 30 kHz in the frequency band 150KHz to 20MHz;
   Set RBW 100 kHz, VBW 300 kHz in the frequency band 20MHz to 1GHz;
   While set RBW=1MHz.VBW=3MHz from the 1GHz to 10th Harmonic.
5. The audio input was set the unmodulated carrier, the resulting picture is print out for each channel separation.

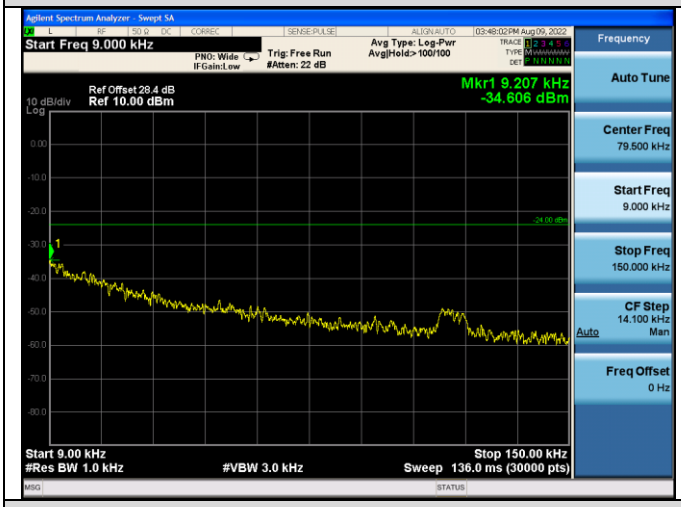
9.3 MEASUREMENT SETUP



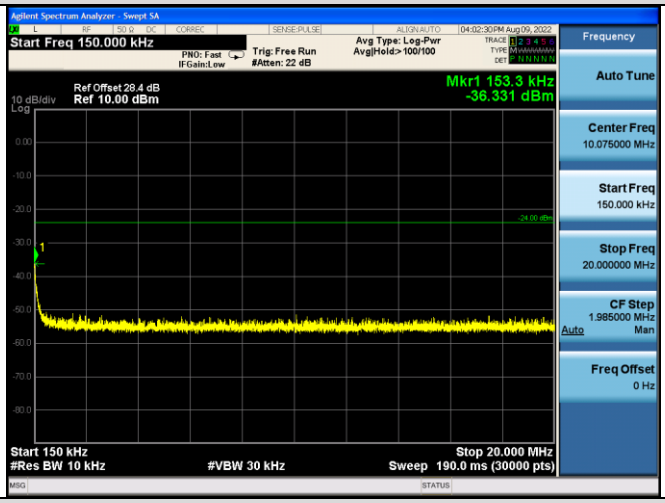
9.4 MEASUREMENT RESULTS

Test plot as follows: FM Modulation

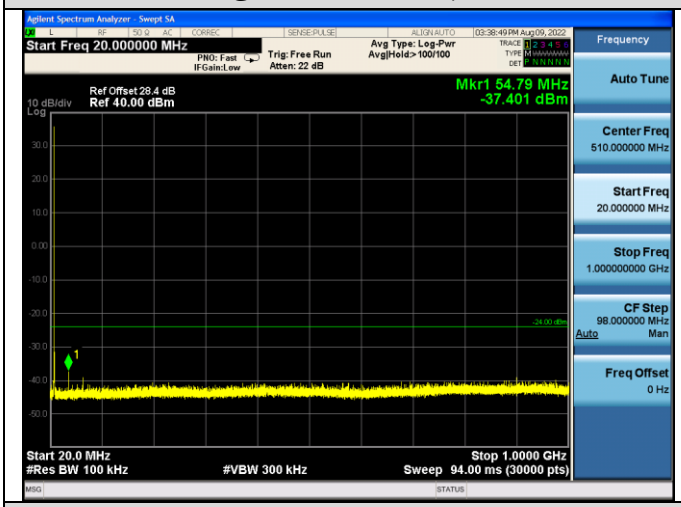
9KHz-150KHz@26.965MHz-4W, 10th Harmonic



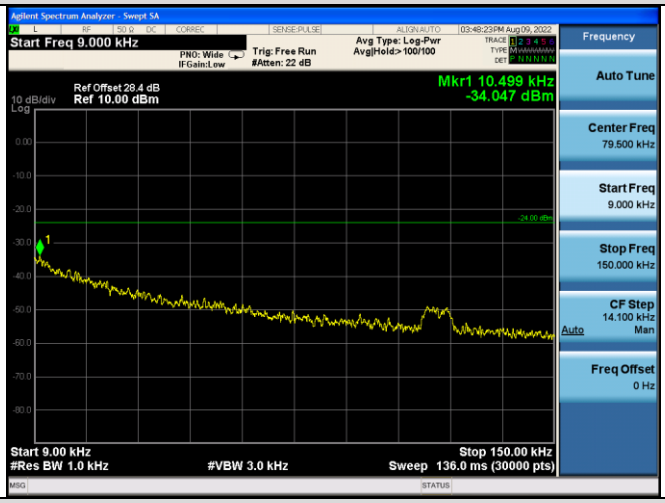
150KHz-20MHz@26.965MHz-4W ,10th Harmonic



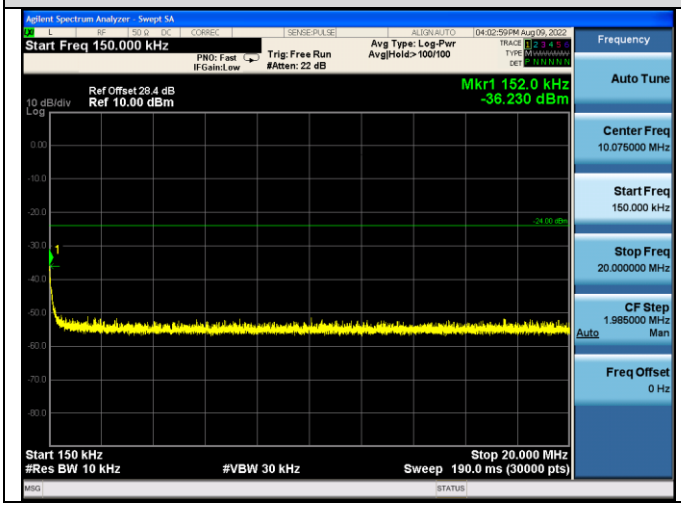
20MHz-1GHz@26.965MHz-4W,10th Harmonic



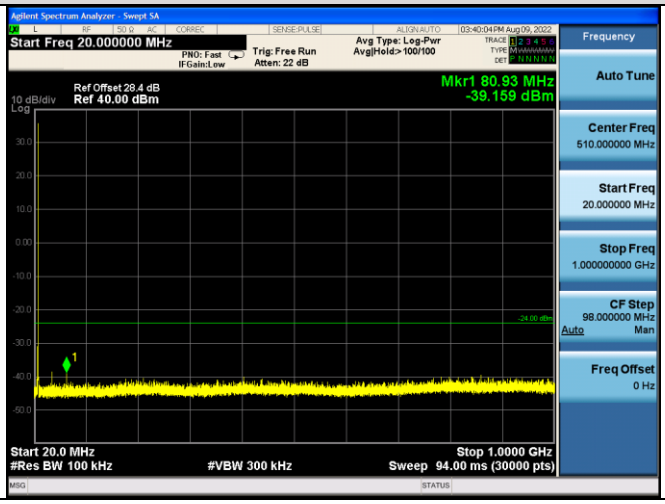
9KHz-150KHz@27.205MHz-4W, 10th Harmonic

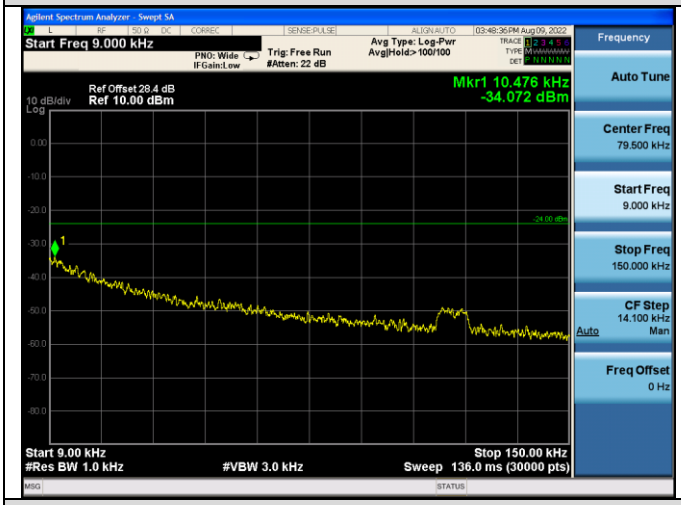
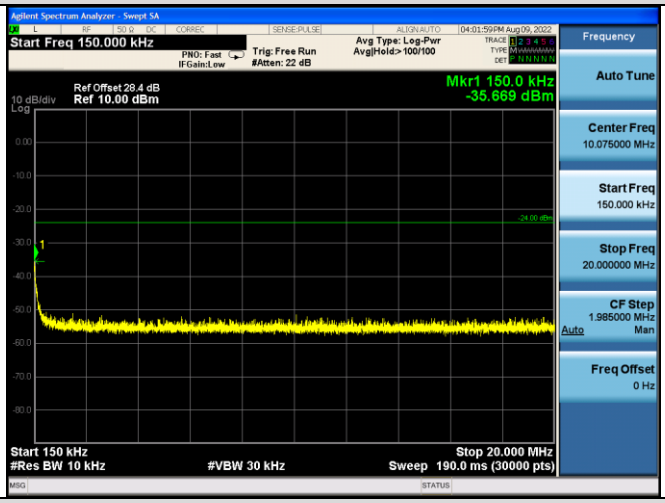
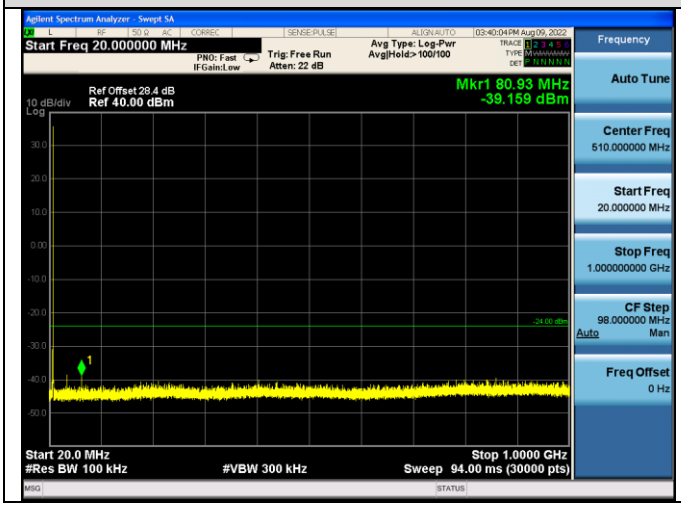


150KHz-20MHz@27.205MHz-4W ,10th Harmonic



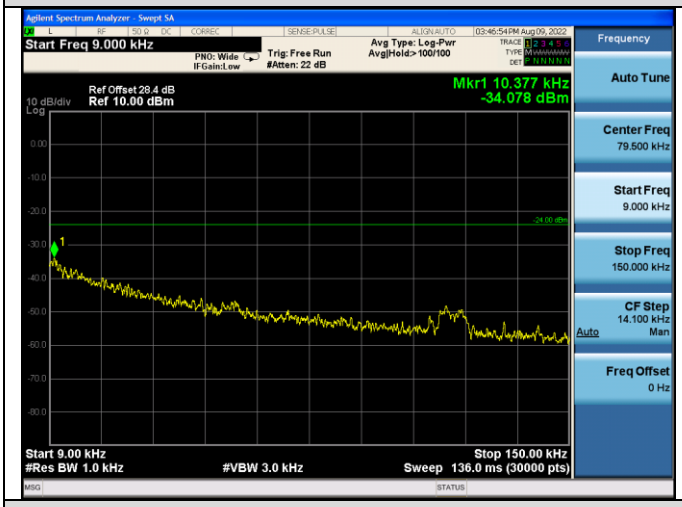
20MHz-1GHz@27.205MHz-4W,10th Harmonic



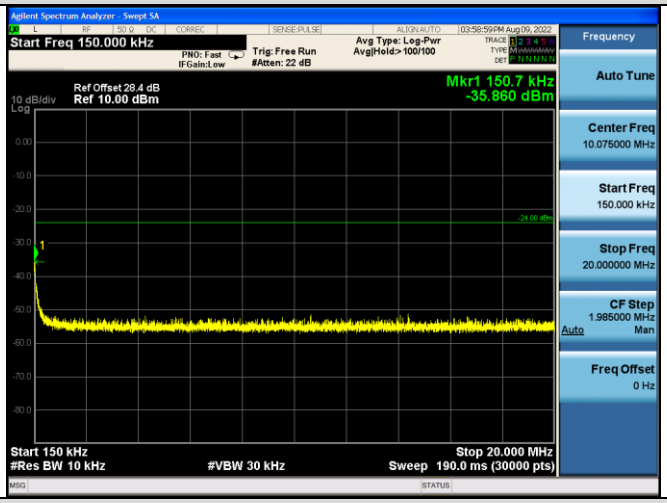
9KHz-150KHz@27.405MHz-4W, 10th Harmonic	150KHz-20MHz@27.405MHz-4W ,10th Harmonic
	
20MHz-1GHz@27.405MHz-4W,10th Harmonic	
	

Test plot as follows: AM Modulation

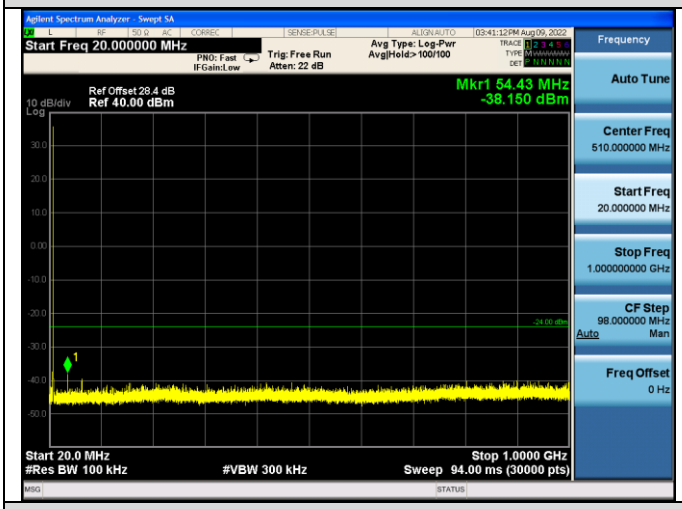
9KHz-150KHz@26.965MHz-4W, 10th Harmonic



150KHz-20MHz@26.965MHz-4W ,10th Harmonic

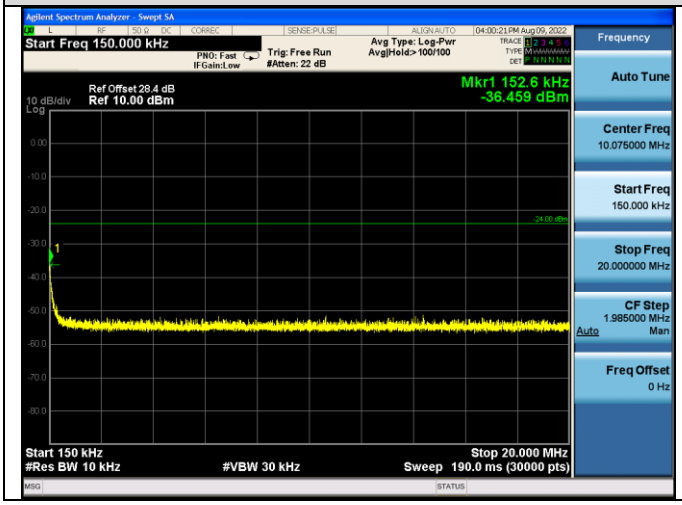


20MHz-1GHz@26.965MHz-4W,10th Harmonic

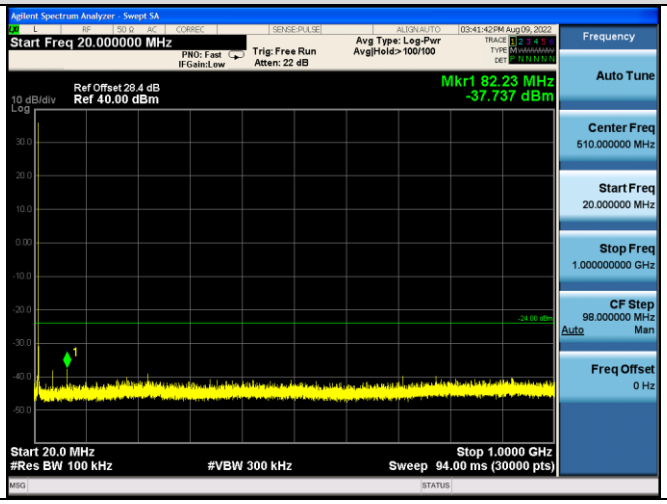


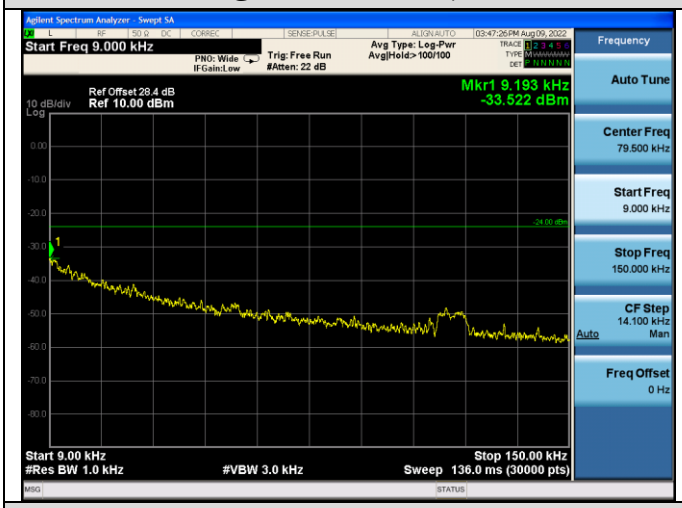
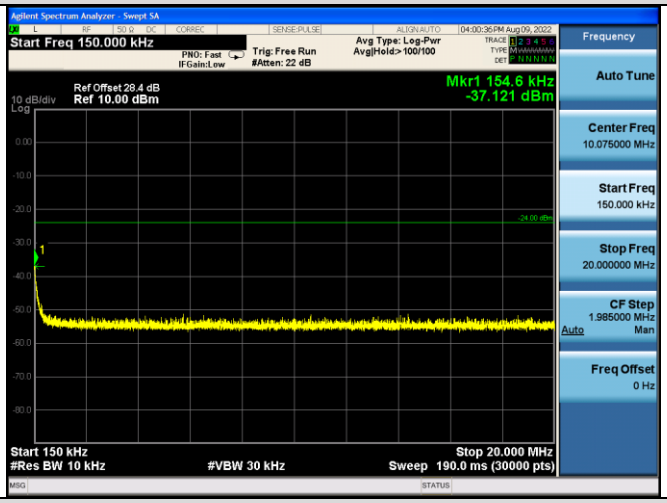
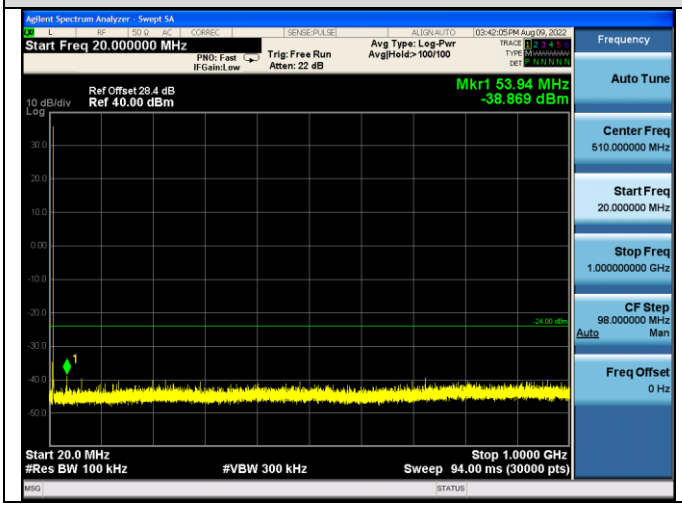
9KHz-150KHz@27.205MHz-4W, 10th Harmonic

150KHz-20MHz@27.205MHz-4W ,10th Harmonic



20MHz-1GHz@27.205MHz-4W,10th Harmonic



9KHz-150KHz@27.405MHz-4W, 10th Harmonic	150KHz-20MHz@27.405MHz-4W ,10th Harmonic
	
20MHz-1GHz@27.405MHz-4W,10th Harmonic	
	

10. MAXIMUMN TRANSMITTER POWER

10.1 PROVISIONS APPLICABLE

FCC Part 95.967, FCC Part2.1046(a)

Each CBRS transmitter type must be designed such that the transmitter power can not exceed the following limits:

(a) When transmitting amplitude modulated (AM) voice signals or frequency modulated (FM) voice signals, the mean carrier power must not exceed 4 Watts

(b) When transmitting single sideband (SSB) voice signals, the peak envelope power must not exceed 12 Watts.

10.2 MEASUREMENT METHOD

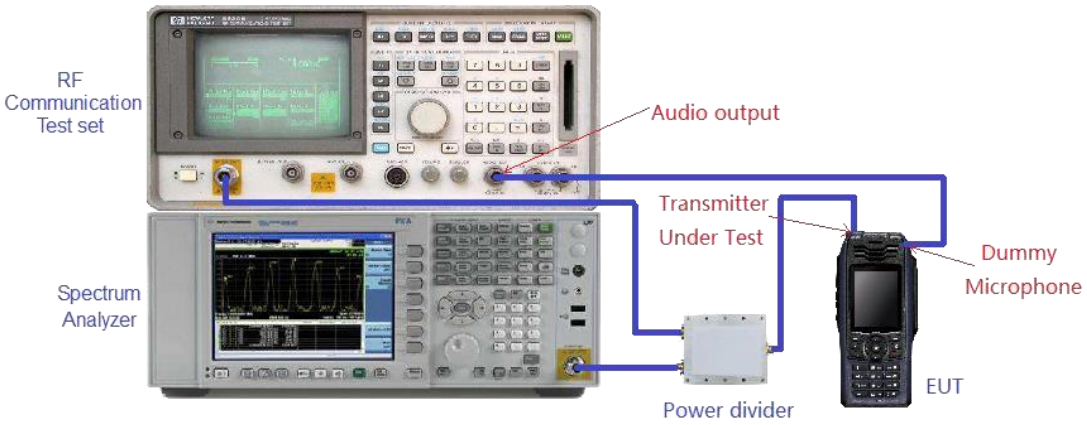
Conducted RF Output Power:

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as above using the Automatic 6dB Cursor Bandwidth measurement. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at its maximum Duty Cycle.
3. Spectrum set as follow:

   Centre frequency = fundamental frequency, Span=50kHz , RBW=300Hz, VBW=3KHz ;

   Sweep = auto, Detector function = peak, Trace = max hold

10.3 MEASUREMENT SETUP

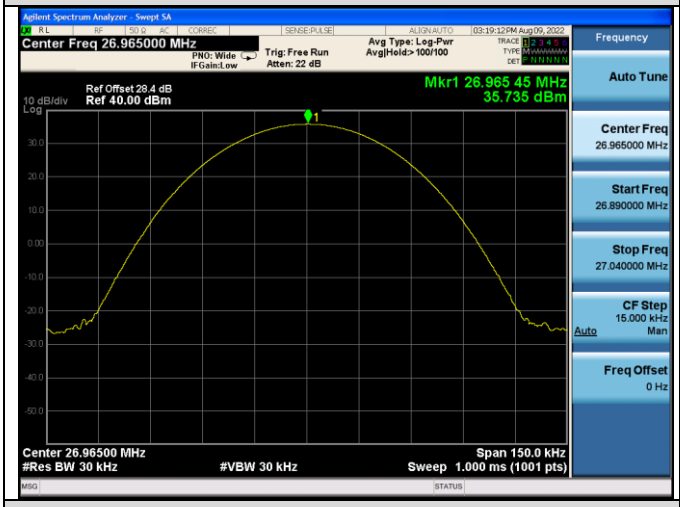


10.4 MEASUREMENT RESULTS

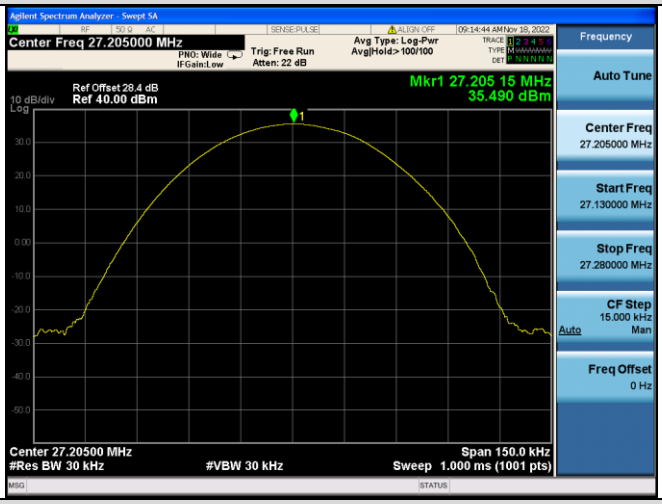
Conducted Power Measurement Results			
Mode	Channel Separation	Test Channel	Measurement Result (dBm)
CBRS TX	10 kHz	26.965 MHz	35.74
		27.205 MHz	35.49
		27.405 MHz	**35.76**

Test plot as follows:

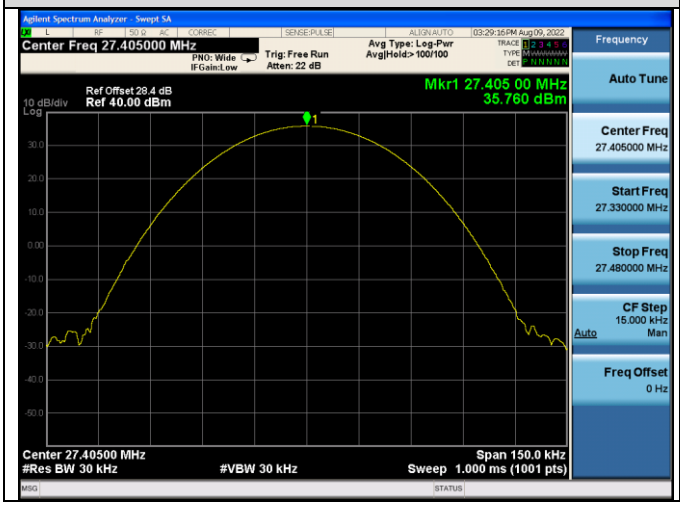
10kHz, AM Modulation:26.965MHz-4W



10kHz, AM Modulation:27.205MHz-4W



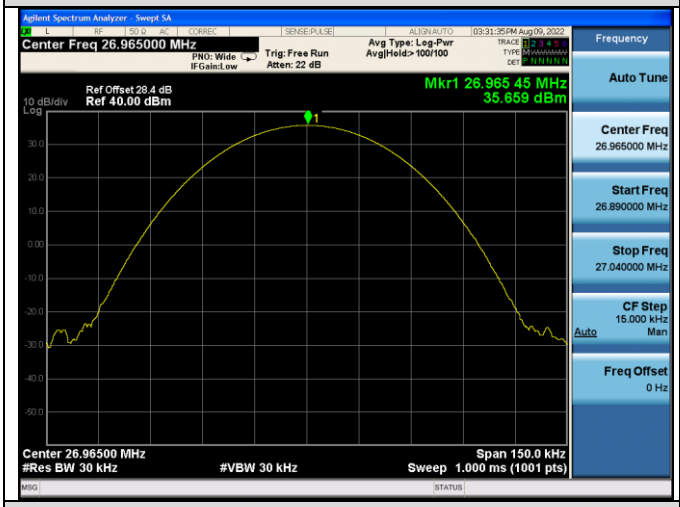
10kHz, AM Modulation:27.405MHz-4W



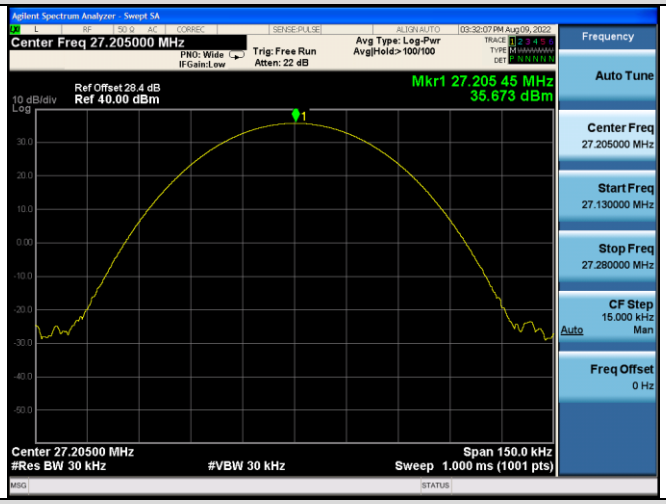
Conducted Power Measurement Results			
Mode	Channel Separation	Test Channel	Measurement Result (dBm)
CBRS TX	10 kHz	26.965 MHz	35.66
		27.205 MHz	**35.67**
		27.405 MHz	35.64

Test plot as follows:

10kHz, FM Modulation:26.965MHz-4W



10kHz, FM Modulation:27.185MHz-4W



10kHz, FM Modulation:27.405MHz-4W

11.MODULATION CHARACTERISTICS

11.1 PROVISIONS APPLICABLE

FCC Part 95.975, FCC Part 2.1047(b)
Each CBRS transmitter type must be designed such that the modulation characteristics are in compliance with the rules in this section.

a) When emission type A3E is transmitted with voice modulation, the modulation percentage must be at least 85%, but not more than 100%.
b) When emission type A3E is transmitted by a CBRS transmitter having a transmitter output power of more than 2.5 W, the transmitter must contain a circuit that automatically prevents the modulation percentage from exceeding 100%.
c) When emission type F3E is transmitted the peak frequency deviation shall not exceed ±2 kHz.

11.2 MEASUREMENT METHOD_(AM)

(A) Audio frequency response
Connect the equipment as illustrated.
Adjust to deliver 50% modulation at the audio frequency that produces the maximum modulation level
Record the modulation input level (mV) and use this level as 0dB for plotting modulation limiting.
Vary the modulating frequency from 100Hz to 10000Hz and record the input levels necessary to maintain a constant 50% modulation.
Graph the audio level in dB relative to the 0dB reference level as a function of the modulating frequency. Record audio frequency where it is impossible to perform the measurement.

(B) Modulation limiting
Connect the equipment as illustrated.
Adjust to deliver 50% modulation at the audio frequency that produces the maximum modulation level
Record the modulation input level (mV) and use this level as 0dB for plotting modulation limiting.
Increment the audio signal level to 40dB above the reference level. Record the modulation level (%).
Repeat the measurements using a 400Hz and a 2500Hz sinusoidal audio signal, record the modulation level (%), perform for both positive and negative modulation.

11.3 MEASUREMENT METHOD_(FM)

(C) Modulation limiting

(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.

(D) Audio frequency response

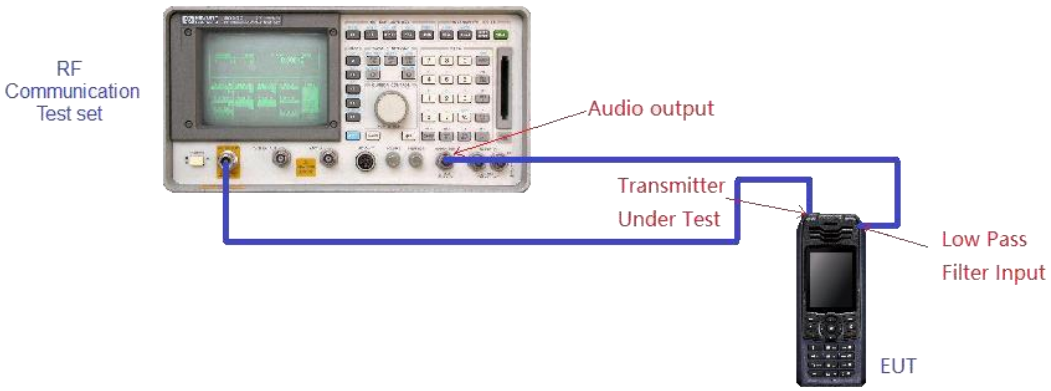
(1). Configure the EUT as shown in figure 1.

(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).

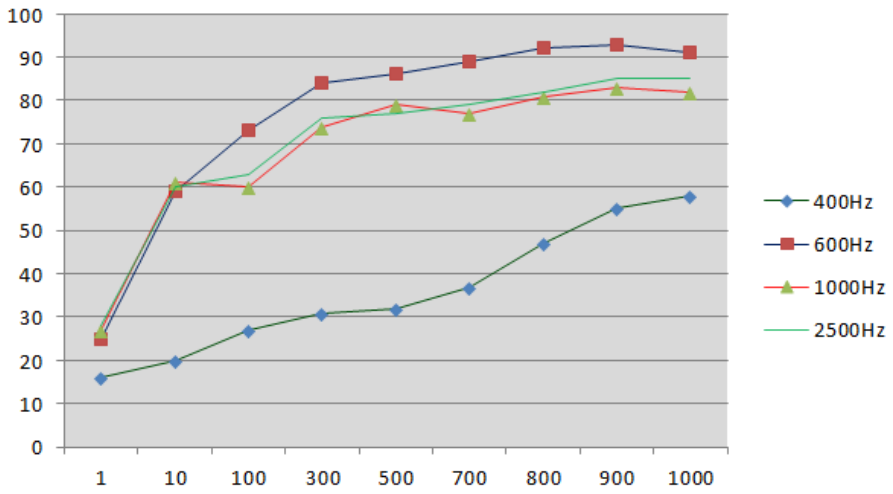
11.4 MEASUREMENT SETUP



11.5 MEASUREMENT RESULTS

(A). MODULATION LIMIT:

10kHz, AM modulation, Assigned Frequency:27.405MHz-4W				
Modulation Level (mV)	Peak Freq. Deviation At 300 Hz (%)	Peak Freq. Deviation At 600 Hz (%)	Peak Freq. Deviation At 1000 Hz (%)	Peak Freq. Deviation At 2500 Hz (%)
1	16	25	27	28
10	20	59	61	60
100	27	73	60	63
300	31	84	74	76
500	32	86	79	77
700	37	89	77	79
800	47	92	81	82
900	55	93	83	85
1000	58	91	82	85

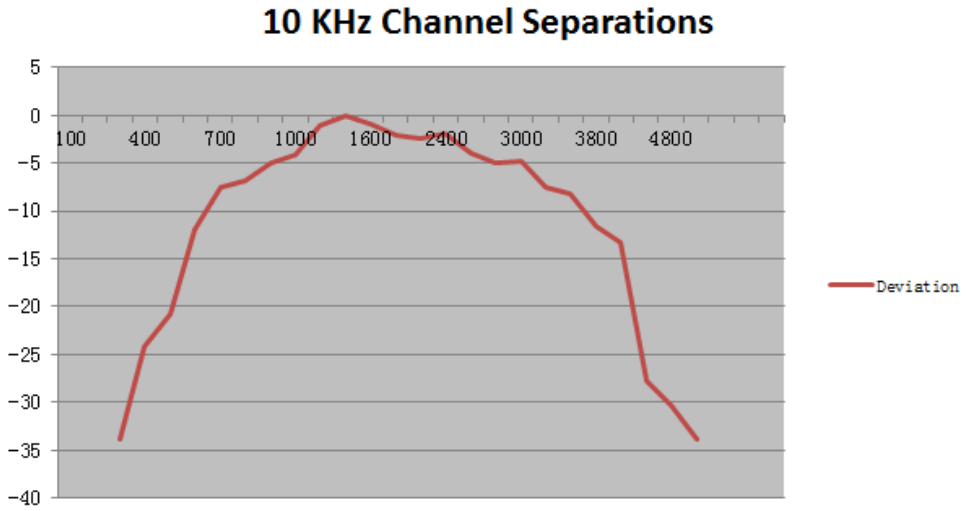


Note:
1. All the modes had been tested, but only the worst data recorded in the report
2.The equipment circuit comes with circuit control that automatically prevents the modulation limit from exceed ing 100%.

(B). AUDIO FREQUENCY RESPONSE:

10kHz, AM modulation, Assigned Frequency:27.405MHz-4W			
Frequency (Hz)	modulation level (mV)	Deviation (kHz)	Audio Frequency Response(dB)
100		--	--
200		--	--
300	19.14	0.02	-33.80
400	13.46	0.06	-24.26
500	12.02	0.09	-20.74
600	8.94	0.25	-11.87
700	7.14	0.41	-7.57
800	7.23	0.45	-6.76
900	6.42	0.55	-5.02
1000	6.39	0.61	-4.12
1200	6.74	0.86	-1.13
1400	6.52	0.98	0.00
1600	5.44	0.89	-0.84
1800	5.37	0.77	-2.09
2000	5.41	0.74	-2.44
2400	5.19	0.79	-1.87
2500	5.23	0.62	-3.98
2800	5.21	0.55	-5.02
3000	6.41	0.56	-4.86
3200	7.36	0.41	-7.57
3600	8.41	0.38	-8.23
3800	9.69	0.26	-11.53
4000	10.74	0.21	-13.38
4200	11.05	0.04	-27.78
4800	14.10	0.03	-30.28
5200	19.33	0.02	-33.80
6000	--	--	--

Audio Frequency Response@50%MI



Note:1.All the modes had been tested, but only the worst data recorded in the report.
2. 50% MI Could not be achieved above 5200 Hz.