FCC Test Report

Report No.: AGC15733241203FR01

FCC ID	:	AIERIT57-220M
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	VHF MURS Analog Two-Way Radio
BRAND NAME	:	RITRON
MODEL NAME	:	HR-220M
APPLICANT	:	Ritron Inc
DATE OF ISSUE	:	Jan. 16, 2025
STANDARD(S)	:	FCC Part 95 Subpart J
REPORT VERSION	:	V1.0

Attestation Of ***G***lobal ***C***ompliance (Shenzhen) Co., Ltd

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 16, 2025	Valid	Initial Release

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1. General Information

Applicant	Ritron Inc
Address	505 West Carmel Drive, Carmel, Indiana 46032,United States
Manufacturer	Ritron Inc
Address	505 West Carmel Drive, Carmel, Indiana 46032,United States
Factory	Lisheng Communications Co., Ltd.
Address	5#, Chongxiang St., Econ. & Tech. Area, Quanzhou, Fujian, China
Product Designation	VHF MURS Analog Two-Way Radio
Brand Name	RITRON
Test Model	HR-220M
Series Model(s)	N/A
Difference Description	N/A
Date of receipt of test item	Dec. 06, 2024
Date of Test	Dec. 06, 2024~Jan. 16, 2025
Deviation from Standard	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Test Report Form No	AGCER-FCC-MURS-V1

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

Prepared By	Bibo Zhang (Project Engineer)	Jan. 16, 2025
Reviewed By	Calvin Liu (Reviewer)	Jan. 16, 2025
Approved By	Angela Li (Authorized Officer)	Jan. 16, 2025

2. Product Information

2.1 Product Technical Description

Communication Type	Voice/Tone only		
Operation Frequency	☒151.820MHz	☒151.880MHz	☒151.940MHz
	☒154.570MHz	☒154.600MHz	
Hardware Version	V1.2		
Software Version	V1.0		
Modulation Type	FM		
Channel Separation	☒12.5kHz ☒25.0kHz		
Emission Bandwidth	15.56 kHz		
Emission Designator	11K0F3E/16K0F3E		
Number of Channels	5 of Channels		
Rated Output Power	☒High Power: 2W; ☐Low Power: N/A		
	It was fixed by the manufacturer, any individual can't arbitrarily change it.		
Maximum Transmitter Power	32.97dBm for MURS		
Antenna Designation	Detachable Antenna		
Antenna Gain	2.15dBi		
Power Supply	DC 7.4V 1800mAh by battery		

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

- Frequency and Channel list for MURS:

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
01	151.820	02	151.880
03	151.940	04	154.570
05	154.600		

2.3 Related Submittal(S) / Grant (S)

This submittal(s) (test report) is intended for FCC ID: **AIERIT57-220M,** 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 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 95	Personal Radio Services
3	ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
4	ANSI/TIA-603-E-2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

2.5 Calculation of Emission Indicators

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

- **For FM Mode (Channel Spacing: 12.5kHz)**

Emission Designator 11K0F3E
In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.
BW = 2(M+D) = 2*(3.0 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 follow 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 follow 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 (CAB identifier: CN0063)

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	-30 - 50
Relative Humidity 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
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

3.5 List of Equipment Use

● RF Conducted Test System							
Used	Equipment No.	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
☒	AGC-ER-E086	Spectrum Analyzer	KEYSIGHT	N9020A	MY53300860	2024-05-23	2025-05-22
☒	AGC-EM-E002	Wireless Connectivity Tester	HP	8920B	US35010161	2024-05-24	2025-05-23
☐	AGC-EM-E001	Digital Connectivity Tester	Aeroflex	3920B	N/A	2023-05-11	2025-05-10
☒	AGC-ER-E075	Small Environmental Tester	SH-242	ESPEC	93008290	2024-07-24	2026-07-23
☒	AGC-EM-A007	30dB Attenuator	Weinachel	58-30-33	ML030	2023-06-01	2025-05-31
☐	AGC-EM-E040	Directional coupler	Werlatone	C5571-10	99463	2024-02-01	2026-01-31
☒	--	RF Connection Cable	N/A	1#	N/A	Each time	N/A
☒	--	RF Connection Cable	N/A	2#	N/A	Each time	N/A

● Radiated Spurious Emission							
Used	Equipment No.	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
☒	AGC-EM-E046	EMI Test Receiver	R&S	ESCI	10096	2024-02-01	2025-01-31
☒	AGC-EM-E061	Spectrum Analyzer	Agilent	N9010A	MY53470504	2024-05-28	2025-05-27
☒	AGC-EM-E001	Wideband Antenna	SCHWARZBECK	VULB9168	D69250	2023-06-03	2025-06-02
☐	AGC-EM-E005	Wideband Antenna	SCHWARZBECK	VULB9168	VULB9168-494	2025-01-03	2026-01-02
☒	AGC-EM-E029	Broadband Ridged Horn Antenna	ETS	3117	00034609	2024-03-31	2025-03-30
☐	AGC-EM-E102	Broadband Ridged Horn Antenna	ETS	3117	00154520	2023-06-03	2025-06-02
☐	AGC-EM-E082	Horn Antenna	SCHWARZBECK	BBHA 9170	#768	2023-09-24	2025-09-23
☒	AGC-EM-E146	Pre-amplifier	ETS	3117-PA	00246148	2024-07-24	2026-07-23
☐	AGC-ER-E037	Signal Generator	Agilent	N5182A	MY50140530	2024-05-23	2025-05-22
☒	AGC-EM-A089	VHF Filter	Microwave	N26460M1	498703	2024-05-23	2025-05-22

● Test Software					
Used	Equipment No.	Test Equipment	Manufacturer	Model No.	Version Information
☒	AGC-EM-S011	RSE Test System	Tonscend	TS^{+} Ver2.1(JS36-RSE)	4.0.0.0

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

No.	Equipment	Manufacturer	Model No.	Specification Information	Cable
1	--	--	--	--	--
2	--	--	--	--	--

☒ Test Accessories Come From The Manufacturer

No.	Equipment	Manufacturer	Model No.	Specification Information	Cable
1	Battery	Lisheng Communications Co., Ltd.	BP-HR15-Li	DC 7.4V 1800mAh	--
2	Adapter	Shenzhen Nalin Elec Tech Company Limited	NLA050120W1A6	Input: AC 100-240V 50/60Hz, 0.2A Output: DC 12V 0.5A	1.0m unshielded

4.5 Summary of Test Results

Item	FCC Rules	Description of Test	Result
1	FCC 47 CFR PART 95	Antenna Equipment	Pass
2	§95.2765& 2.1055(a)(1)	Frequency Stability	Pass
3	§95.2767& 2.1046(a)	Maximum Transmitter Power	Pass
4	§95.2773	26dB Emission Bandwidth	Pass
5	§2.1049	99% Occupied Bandwidth	Pass
6	§95.2779& 2.1053	Radiated Spurious Emission	Pass
7	§95.2779& 2.1049	Emission Mask	Pass
8	§95.2779& 2.1051	Conducted Spurious Emission	Pass
9	§95.2775	Audio Low Pass Filter Response	Pass

5. Description of Test Modes

The EUT (**VHF MURS Analog Two-Way Radio**) has been tested under normal operating condition. (MURS TX) are chosen for testing at each channel separation.

No.	Test Mode Description	Channel Separation	Power Level
1	MURS TX for Channel 02	12.5kHz	2W
2	MURS TX for Channel 04	12.5kHz	2W
3	MURS TX for Channel 04	25.0kHz	2W

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. 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

Standard Applicable [FCC Part 95.1765] The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

- The carrier frequency of each MURS transmitter transmitting an emission with an occupied bandwidth of 6.25 kHz or less must remain within 2 ppm
- The carrier frequency of each MURS transmitter transmitting an emission with an occupied bandwidth greater than 6.25 kHz must remain within 5 ppm

6.2 Measurement Procedure

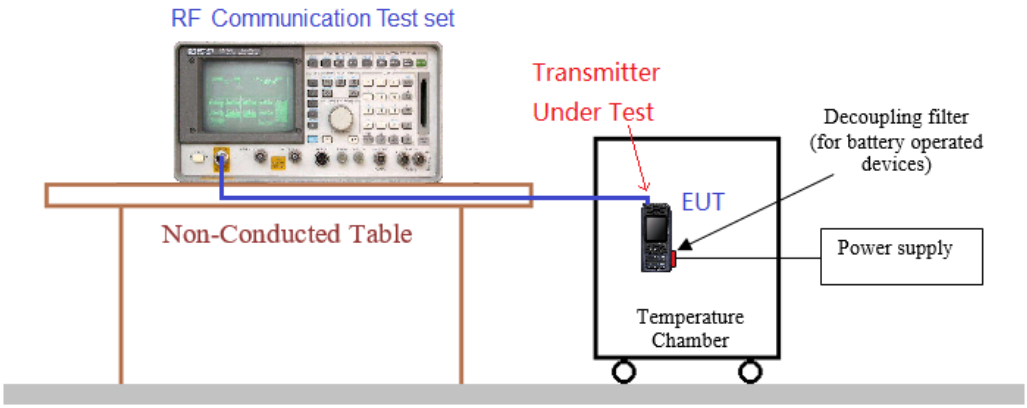
6.2.1 Frequency stability versus environmental temperature

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 Result

12.5 kHz Channel Separation, FM modulation, Assigned Frequency For MURS					
Test conditions		Frequency error (ppm)		Limit (ppm)	Result
Voltage (V)	Temp (℃)	Test Frequency (MHz)			
		151.880	154.570		
7.40	-30	0.714	0.431	5	Pass
	-20	0.555	0.359		
	-10	0.822	0.563		
	0	0.751	0.272		
	10	0.940	0.591		
	20	0.605	0.632		
	30	0.833	0.581		
	40	0.851	0.534		
	50	0.807	0.121		
8.51	20	0.985	0.782		
6.29	20	1.033	0.670		

25.0 kHz Channel Separation, FM modulation, Assigned Frequency For MURS				
Test conditions		Frequency error (ppm)	Limit (ppm)	Result
Voltage (V)	Temp (℃)	Test Frequency (MHz)		
		154.570		
7.40	-30	0.653	5	Pass
	-20	0.659		
	-10	0.563		
	0	1.072		
	10	0.596		
	20	0.631		
	30	0.580		
	40	0.536		
	50	1.028		
8.51	20	1.083		
6.29	20	0.784		

7. 26dB Emission Bandwidth and 99% Occupied Bandwidth

7.1 Provisions Applicable

Each MURS transmitter type must be designed to meet the emission bandwidth limitations in this section.

a) The occupied bandwidth of emissions transmitted on the center frequencies 151.820 MHz, 151.880 MHz, and 151.940 MHz must not exceed 11.25 kHz.

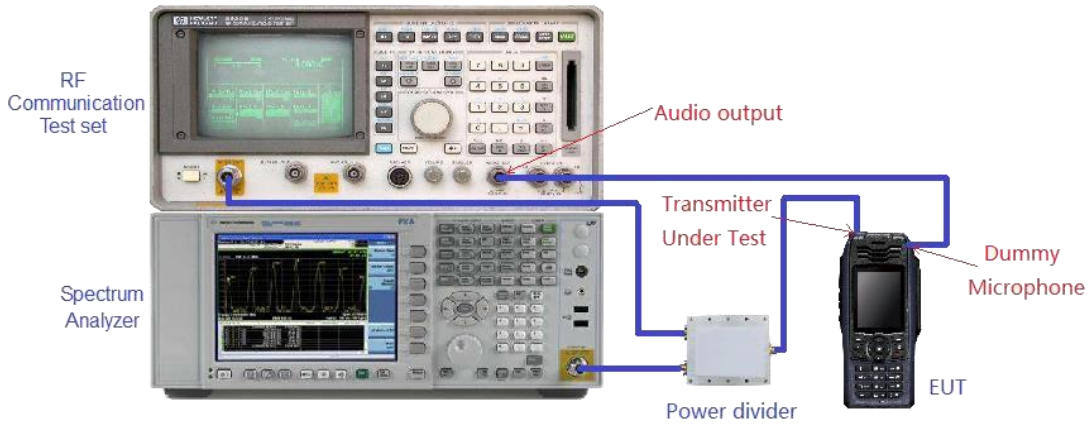
b) The occupied bandwidth of emissions transmitted on the center frequencies 154.570 MHz and 154.600 MHz must not exceed 20.0 kHz.

c) The occupied bandwidth of type A3E emissions must not exceed 8.0 kHz.

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.
2. For rated system deviation is 2.5 kHz for 12.5kHz channel spacing.
3. For rated system deviation is 3.0 kHz for 25.0kHz channel spacing.
4. Spectrum set as follow:
5. Centre frequency = Fundamental Frequency
6. Span=50kHz for 12.5kHz Channel Spacing, RBW=300Hz, VBW=1kHz, Sweep = Auto.
7. Span=50kHz for 25.0kHz Channel Spacing, RBW=300Hz, VBW=1kHz, Sweep = Auto.
8. Detector Function = Peak, Trace = Max Hold
9. Set 99% Occupied Bandwidth and 26dB Emission Bandwidth.
10. Measure and record the results in the test report.

7.3 Measurement Setup

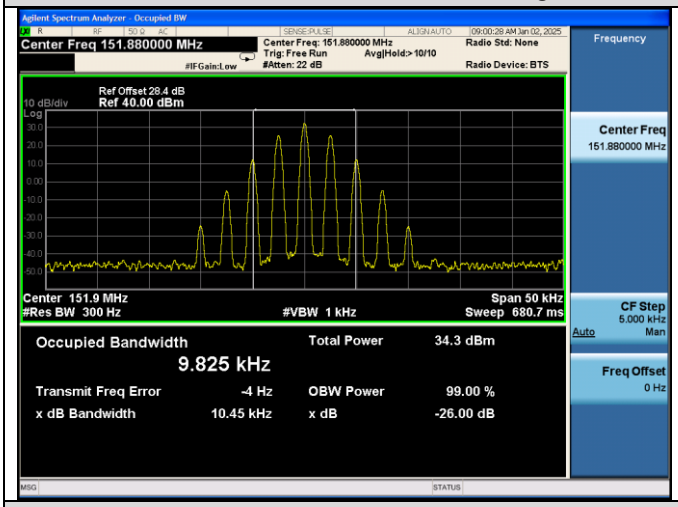
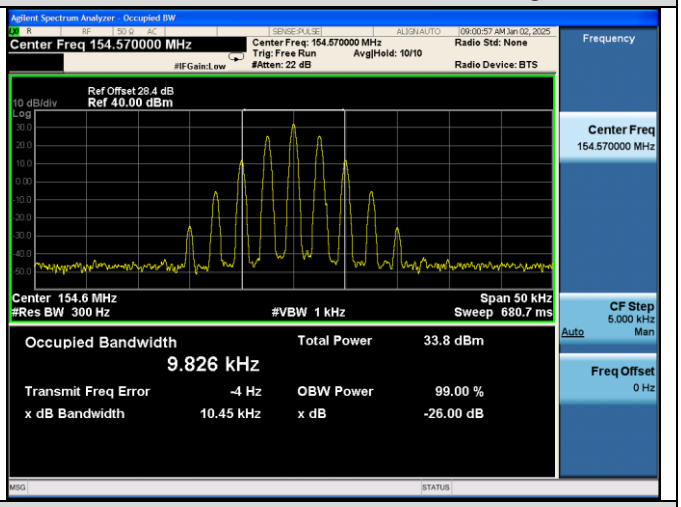
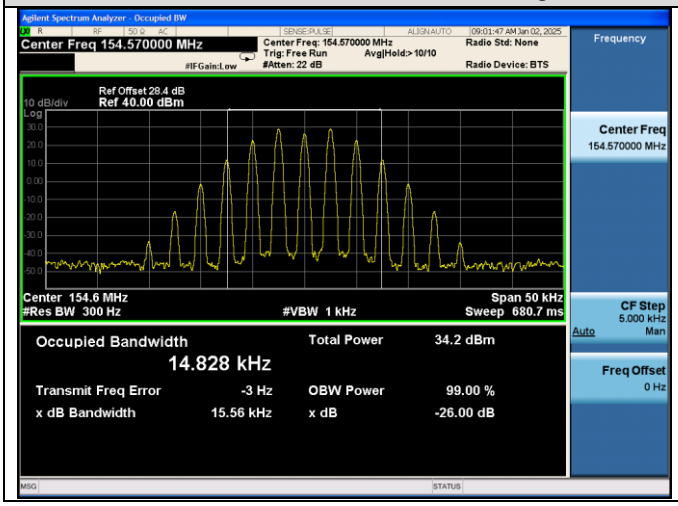


7.4 Measurement Results

Emission Bandwidth Measurement Result-MURS-High Power				
Operating Frequency (MHz)	12.5 kHz Channel Separation			
	Occupied Bandwidth (kHz)	Emission Bandwidth (kHz)	Limits (kHz)	Result
151.880	9.825	10.45	11.25	Pass
154.570	9.826	10.45	20.00	Pass

Emission Bandwidth Measurement Result-MURS-High Power				
Operating Frequency (MHz)	25.0 kHz Channel Separation			
	Occupied Bandwidth (kHz)	Emission Bandwidth (kHz)	Limits (kHz)	Result
154.570	14.828	15.56	20.00	Pass

- Test plot as follows:

12.5kHz, FM Modulation:151.820MHz-High Power	12.5kHz, FM Modulation:154.570MHz-High Power
	
25.0kHz, FM Modulation:154.570MHz-High Power	
	

8. Radiated Spurious Emission and Emission Mask

8.1 Provisions Applicable

Each MURS transmitter type must be designed to comply with the applicable unwanted emissions limits in this section.

a) Emission masks. Emission masks applicable to transmitting equipment in the MURS are defined by the requirements in the following table. The numbers in the paragraphs column refer to attenuation requirement rule paragraph numbers under paragraph (b) of this section. The words “audio filter” refer to the audio filter described in §95.2775.

Emission Types Filter	Attenuation Requirements
151.820, 151.880 and 151.940	(1), (2).
154.570 & 154.600, with audio filter	(3), (4), (7)
154.570 & 154.600, without audio filter	(5), (6), (7)

1) Each MURS transmitter type that transmits F3E or G3E emissions on 154.570 MHz or 154.600 MHz and incorporates an audio filter satisfying the requirements of § 95.2775 in its design may comply with the less stringent unwanted emissions attenuation requirements set forth in paragraphs (b)(3), (4), and (7) of this section.

2) Each MURS transmitter type that transmits on 154.570 MHz or 154.600 MHz, but does not incorporate an audio filter satisfying the requirements of § 95.2775 in its design, must comply with the unwanted emissions attenuation requirements set forth in paragraphs (b)(5) through (7) of this section.

b) Attenuation requirements. The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) by at least:

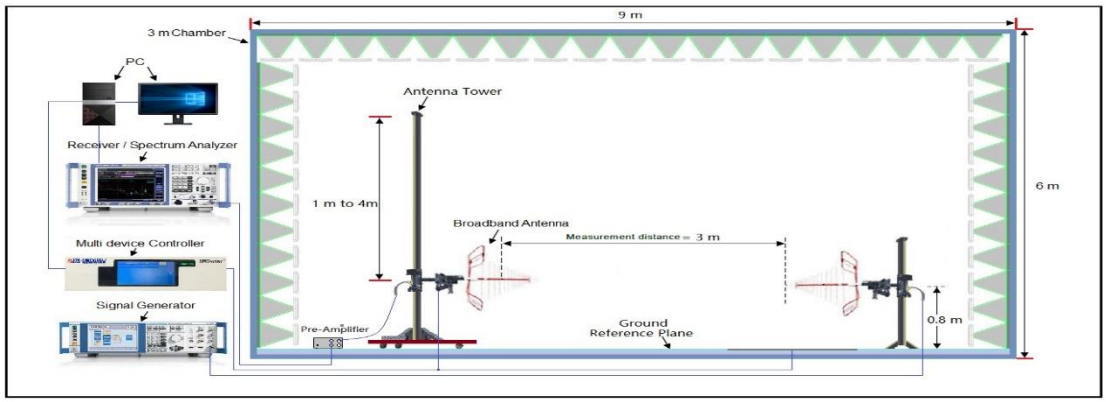
1) 7.27*(fd−2.88kHz) dB on any frequency removed from the channel center frequency by a displacement frequency (fd in kHz) that is more than 5.625 kHz, but not more than 12.5 kHz.
2) 50+10*log*(P) dB or 70dB, whichever is the lesser attenuation, on any frequency removed from the channel center frequency by more than 12.5 kHz.
3) 25dB on any frequency removed from the channel center frequency by more than 10 kHz, but not more than 20 kHz.
4) 35dB on any frequency removed from the channel center frequency by more than 20 kHz, but not more than 50 kHz.
5) 83*log*(fd÷5) dB on any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) that is more than 5 kHz, but not more than 10 kHz.
6) 29*log8(fd^2 ÷11) dB or 50dB, whichever is the lesser attenuation on any frequency removed from the channel center frequency by a displacement frequency (fd in kHz) that is more than 10 kHz, but not more than 50 kHz.
7) 43+10*log*(P) dB on any frequency removed from the channel center frequency by more than 50 kHz

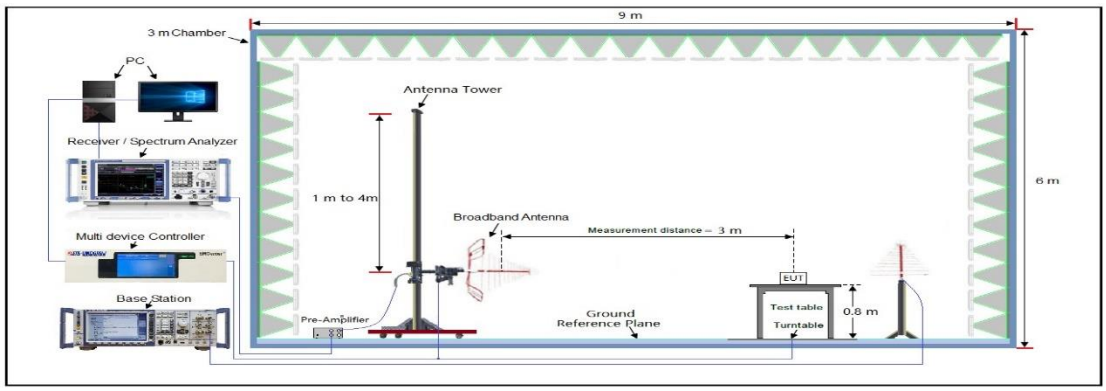
8.2 Measurement Procedure

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 (P_r).
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 (P_{Mea}) 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 (P_r). The power of signal source (P_{Mea}) 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 (P_{cl}) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (P_{Ag}) should be recorded after test
6. The measurement results are obtained as described below: Power(E.I.R.P.) = P_{Mea}-P_{Ag}-P_{cl}-Ga The measurement results are amend as described below: Power(E.I.R.P.)=P_{Mea}- P_{cl} - 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. E.R.P. can be calculated from E.I.R.P. by subtracting the gain of the dipole, E.R.P. = E.I.R.P.-2.15dBi.
9. Test the EUT in the lowest channel, the middle channel the Highest channel

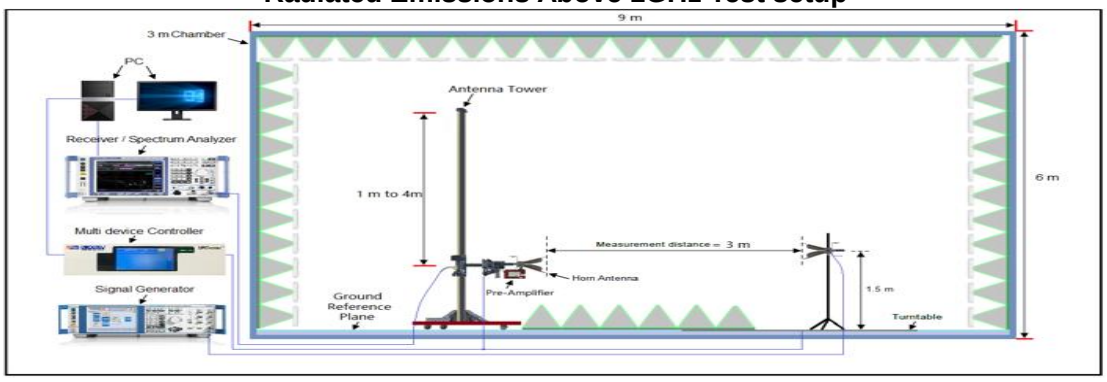
8.3 Measurement Setup

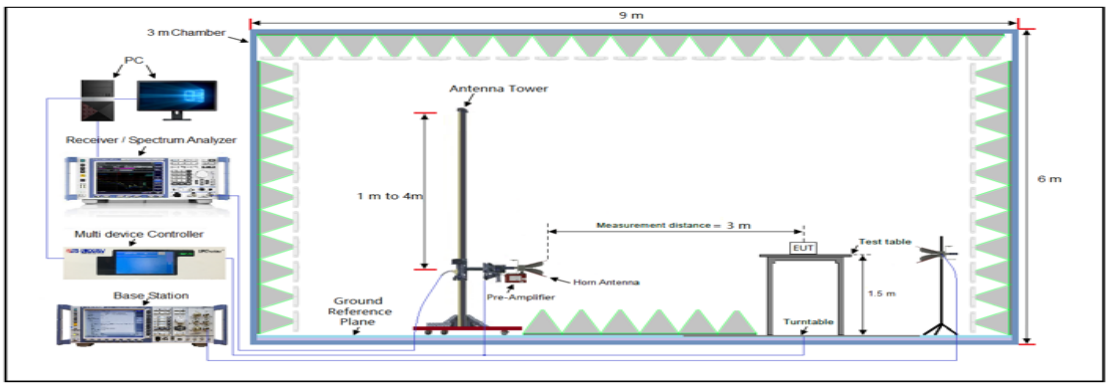
Radiated Emissions 30MHz to 1GHz Test setup





Radiated Emissions Above 1GHz Test setup





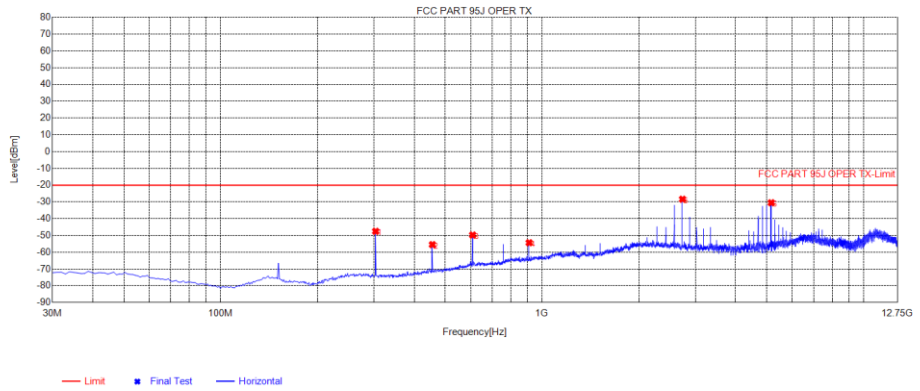
8.4 Measurement Results

Preliminary calculation	Limit Conversion Result
At least 43+10*log*(P)	-13 dBm
At least 50+10*log*(P)	-20 dBm

- Limit = P_{dBm}-[(43+10 log*(P)] = 10*log*(P*1000)-[43-10*log*P] = -43 + 30 = -13dBm
- Limit = P_{dBm}-(50+10 log*(P)) = 10*log*(P*1000)-[50-10 log*P] = -50 + 30 = -20dBm

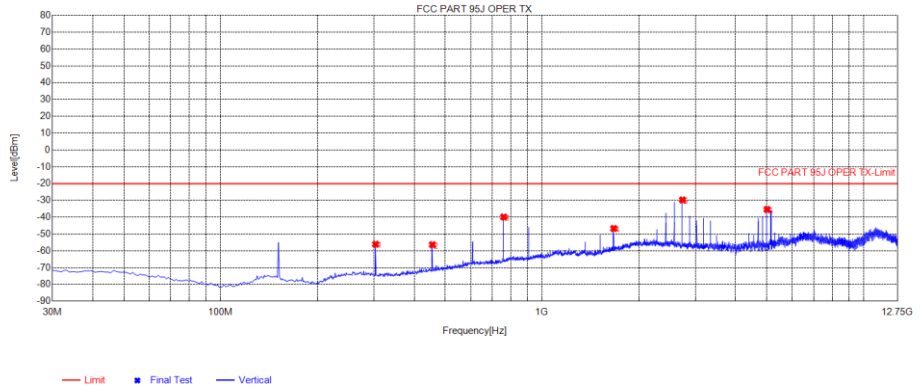
Remark:
1. Factor=Antenna Factor + Cable loss. (Below 1GHz)
2. Factor=Antenna Factor+ Cable loss -Pre-amplifier. (Above 1 GHz)
3. Margin=Limit- Level

Test Mode:	Mode 1	Polarity:	Horizontal



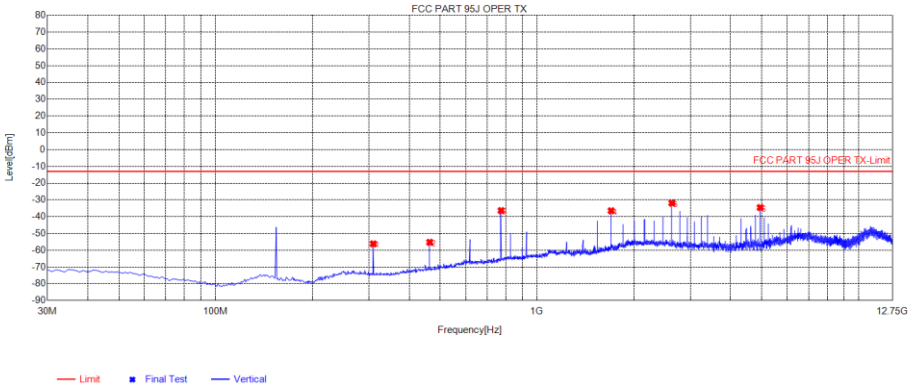
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	303.54	-75.56	-47.54	-20.00	27.54	28.02	98	Horizontal
2	455.83	-86.57	-55.48	-20.00	35.48	31.09	10	Horizontal
3	608.12	-84.60	-49.77	-20.00	29.77	34.83	1	Horizontal
4	911.73	-92.12	-54.35	-20.00	34.35	37.77	10	Horizontal
5	2734.4734	-30.46	-28.41	-20.00	8.41	2.05	20	Horizontal
6	5164.6165	-35.76	-30.51	-20.00	10.51	5.25	54	Horizontal

Test Mode:	Mode 1	Polarity:	Vertical



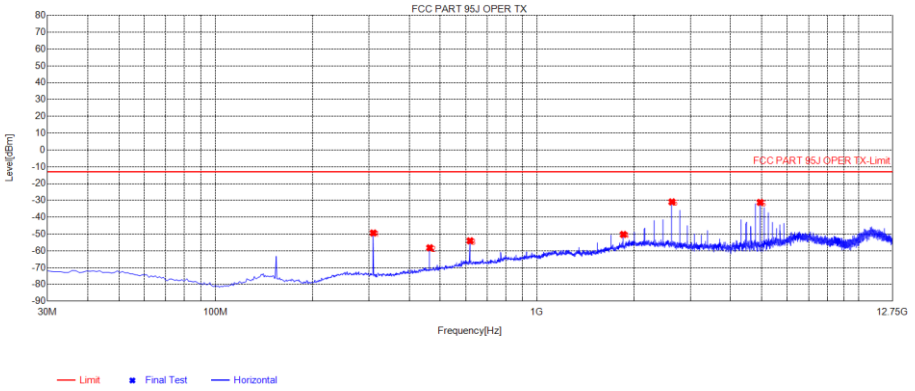
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	303.54	-84.14	-56.12	-20.00	36.12	28.02	359	Vertical
2	455.83	-87.46	-56.37	-20.00	36.37	31.09	359	Vertical
3	759.44	-75.90	-39.88	-20.00	19.88	36.02	324	Vertical
4	1670.9921	-44.68	-46.71	-20.00	26.71	-2.03	254	Vertical
5	2734.4734	-31.78	-29.73	-20.00	9.73	2.05	342	Vertical
6	5011.8512	-40.44	-35.43	-20.00	15.43	5.01	282	Vertical

Test Mode:	Mode 2	Polarity:	Horizontal



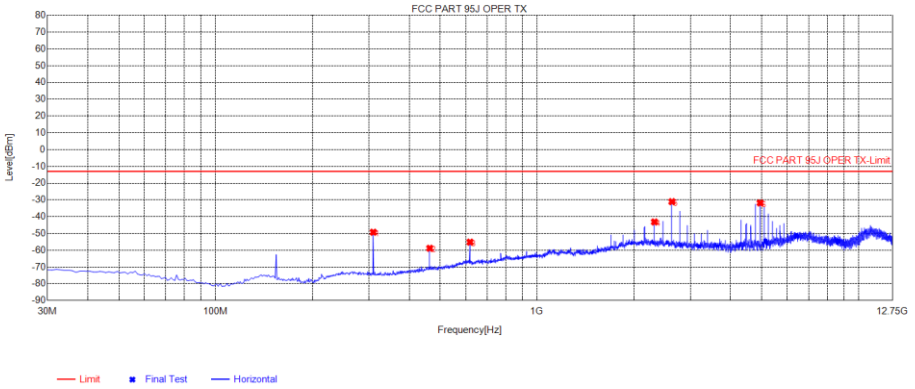
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	309.36	-84.24	-56.19	-13.00	43.19	28.05	360	Horizontal
2	463.59	-86.50	-55.27	-13.00	42.27	31.23	1	Horizontal
3	773.02	-72.98	-36.39	-13.00	23.39	36.59	1	Horizontal
4	1700.37	-34.82	-36.49	-13.00	23.49	-1.67	128	Horizontal
5	2627.5378	-34.19	-31.91	-13.00	18.91	2.28	138	Horizontal
6	4946.0446	-39.46	-34.53	-13.00	21.53	4.93	224	Horizontal

Test Mode:	Mode 2	Polarity:	Vertical



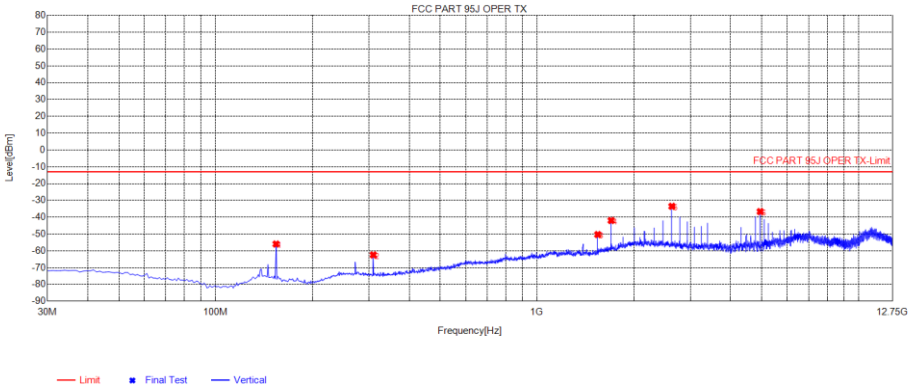
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	309.36	-77.45	-49.40	-13.00	36.40	28.05	274	Vertical
2	463.59	-89.45	-58.22	-13.00	45.22	31.23	66	Vertical
3	618.79	-88.87	-54.07	-13.00	41.07	34.80	324	Vertical
4	1855.4855	-50.52	-50.28	-13.00	37.28	0.24	152	Vertical
5	2627.5378	-33.18	-30.90	-13.00	17.90	2.28	316	Vertical
6	4946.0446	-36.14	-31.21	-13.00	18.21	4.93	230	Vertical

Test Mode:	Mode 3	Polarity:	Horizontal



NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	309.36	-77.32	-49.27	-13.00	36.27	28.05	278	Horizontal
2	463.59	-90.07	-58.84	-13.00	45.84	31.23	96	Horizontal
3	618.79	-89.98	-55.18	-13.00	42.18	34.80	287	Horizontal
4	2318.4818	-45.49	-43.15	-13.00	30.15	2.34	342	Horizontal
5	2627.5378	-33.33	-31.05	-13.00	18.05	2.28	334	Horizontal
6	4946.0446	-36.77	-31.84	-13.00	18.84	4.93	268	Horizontal

Test Mode:	Mode 3	Polarity:	Vertical



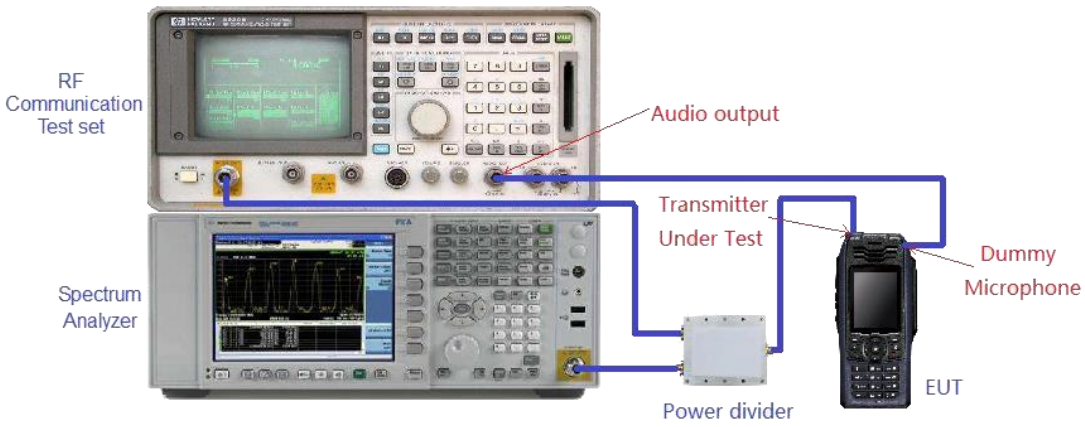
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	154.16	-81.58	-55.98	-13.00	42.98	25.60	0	Vertical
2	309.36	-90.50	-62.45	-13.00	49.45	28.05	0	Vertical
3	1545.2545	-46.76	-50.33	-13.00	37.33	-3.57	204	Vertical
4	1700.37	-40.31	-41.98	-13.00	28.98	-1.67	178	Vertical
5	2627.5378	-35.81	-33.53	-13.00	20.53	2.28	308	Vertical
6	4946.0446	-41.60	-36.67	-13.00	23.67	4.93	204	Vertical

8.5 Emission Mask Measurement Part

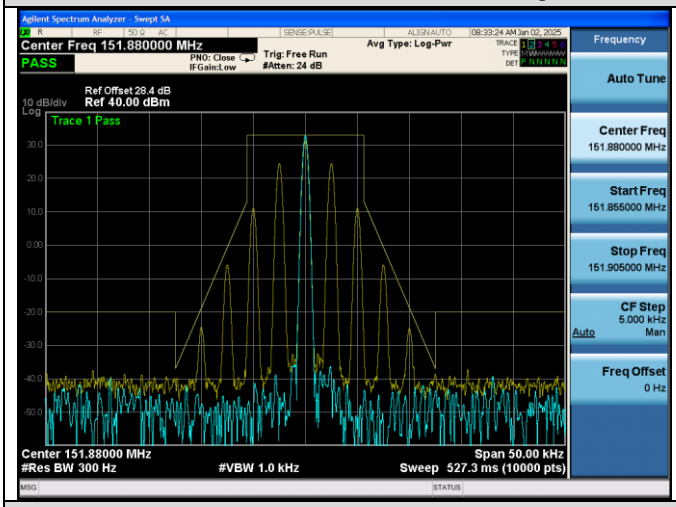
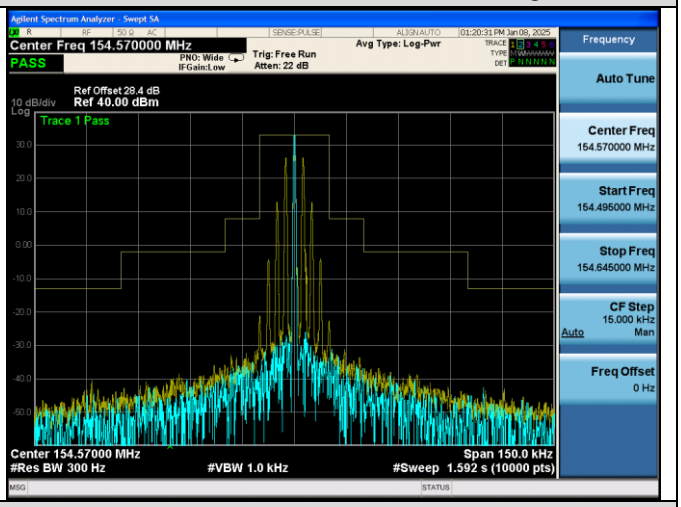
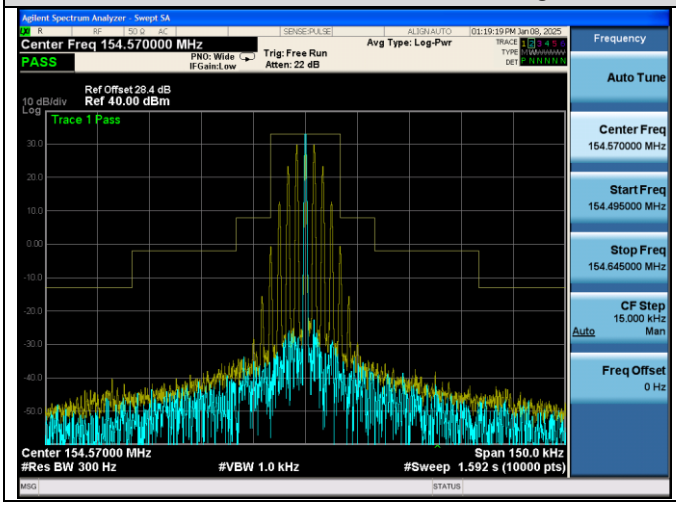
- The detailed procedure employed for Emission Mask measurements are specified as following:
- Connect the equipment as illustrated.
- Spectrum set as follow:

1. Centre frequency = fundamental frequency, Span=50kHz or 150kHz for 12.5kHz and 25kHz channel spacing.
2. RBW=300Hz, VBW=1000Hz for 12.5kHz, RBW=300Hz, VBW=1000Hz for 25kHz, Sweep = auto,
3. Detector function = peak, Trace = max hold
4. 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.
5. 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).
6. The input level shall be established at the frequency of maximum response of the audio modulating circuit.
7. Transmitters employing digital modulation techniques that bypass the limiter and the audio low-pass filter shall be modulated as specified by the manufacturer.
8. Measure and record the results in the test report.

- Test Setup



- Test plot as follows:

12.5kHz, FM Modulation:151.880MHz-High Power	12.5kHz, FM Modulation:154.570MHz-High Power
	
25.0kHz, FM Modulation:154.570MHz-High Power	
	

9. Maximum Transmitter Power

9.1 Provisions Applicable

Each MURS transmitter type must be designed such that the transmitter power output does not exceed 2 Watts under normal operating conditions.

9.2 Measurement Procedure

☐For Radiated Power Measurement

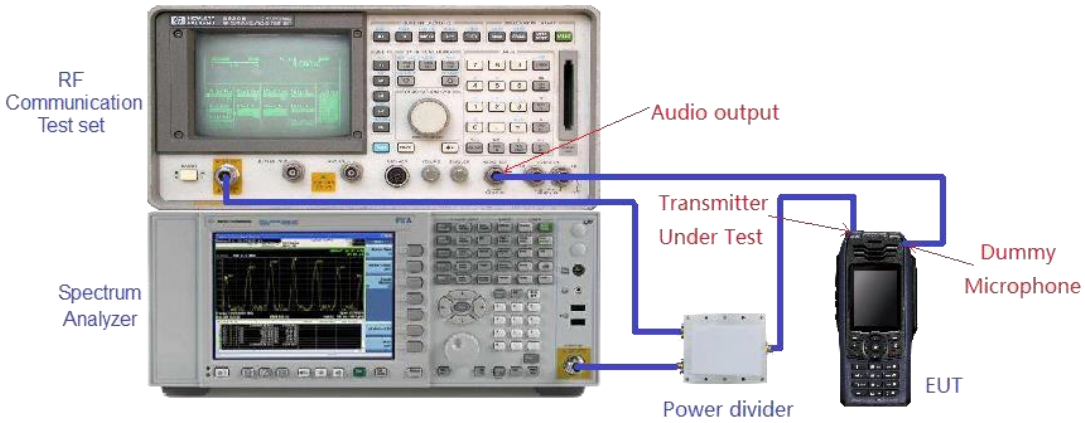
1. EUT was placed on a 0.8 or 1.5meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The disturbance of the transmitter was maximized on the test receiver display by raising 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 (P_r). The power of signal source (P_{Mea}) 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 (P_{cl}) ,the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test
6. The measurement results are obtained as described below: E.I.R.P.=P_{Mea}- P_{Ag} - P_{cl} - G_a The measurement results are amend as described below: E.I.R.P.=P_{Mea}- P_{cl} - G_a
7. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
8. E.R.P. can be calculated from E.I.R.P. by subtracting the gain of the dipole, E.R.P.= E.I.R.P.-2.15dBi.
9. Test the EUT in the lowest channel, the middle channel the Highest channel

☒For Conducted Power Measurement

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.
3. The DUT was set to transmit at its maximum Duty Cycle.
4. Spectrum set as follow:
   - Centre frequency = Fundamental Frequency
   - Span=150kHz, RBW=30kHz, VBW=30kHz
   - Sweep = Auto
   - Detector Function = Peak
   - Trace=Max Hold
5. Calculation Formula: CP = R + A + L
   - CP: The final Conducted Power
   - R: The reading value from spectrum analyzer
   - A: The attenuation value of the used attenuator
   - L: The loss of all connection cables
   - Measurement Result=Peak Power (Max)

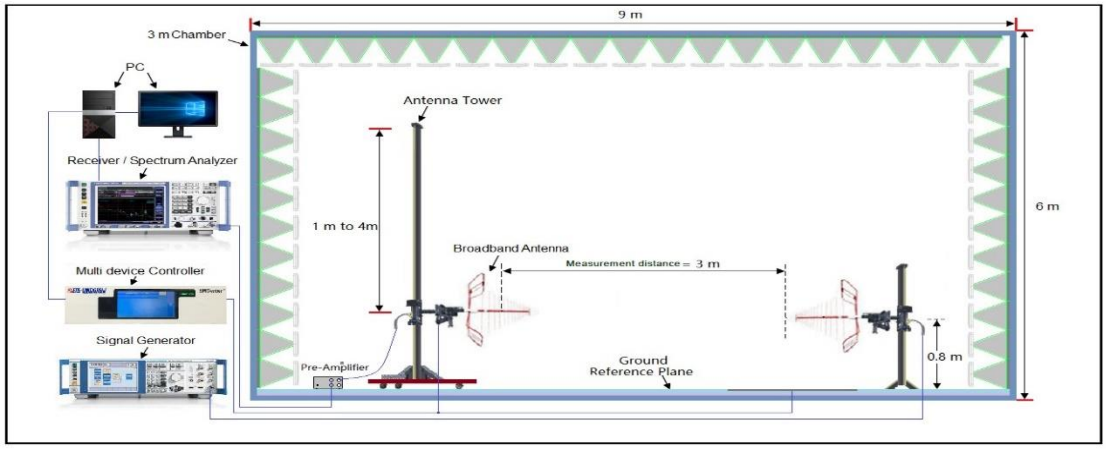
9.3 Measurement Setup

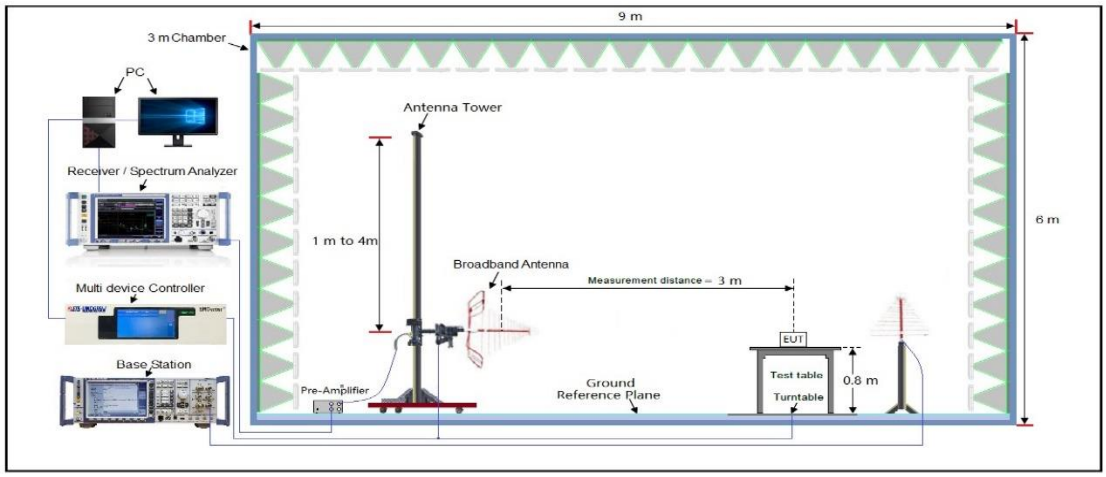
☒For Conducted Power Measurement



☐For Radiated Power Measurement

Radiated Emissions 30MHz to 1GHz Test setup



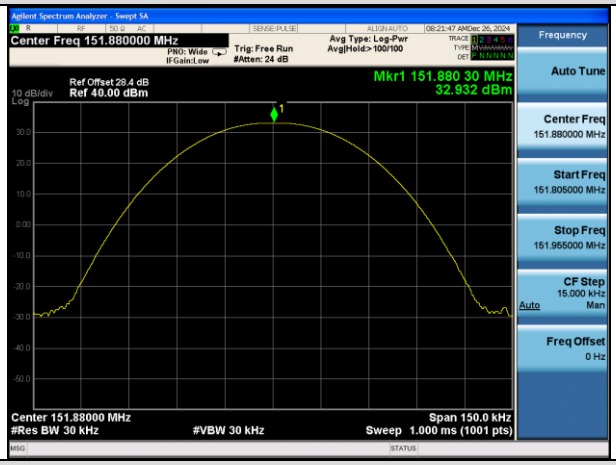


9.4 Measurement Results

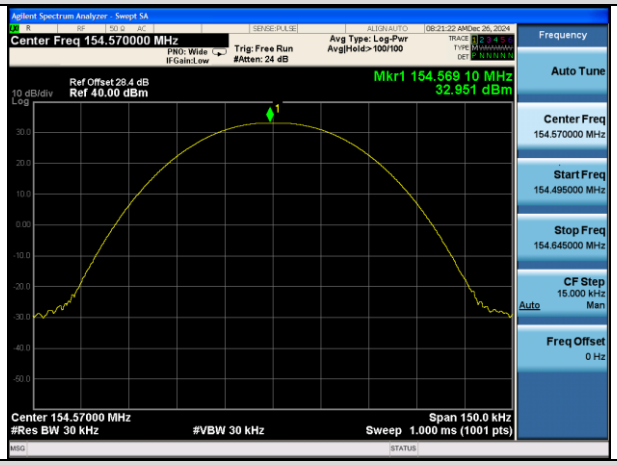
Conducted Power Measurement Results						
Test Mode	Frequency (MHz)	Channel Separation	Test Result (dBm)	Test Result (W)	Limit (W)	Result
MURS TX (High Power)	151.880	12.5kHz	32.93	1.96	2.00	Pass
	154.570	12.5kHz	32.95	1.97	2.00	Pass
	154.570	25.0kHz	32.97	1.98	2.00	Pass

- Test plot as follows:

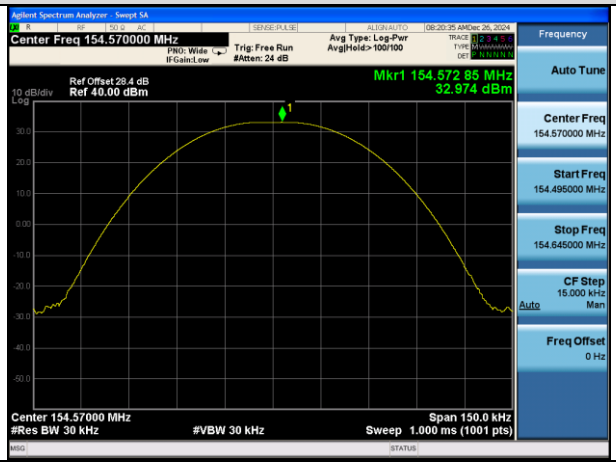
12.5kHz, FM Modulation:151.880MHz-High Power



12.5kHz, FM Modulation:154.570MHz-High Power



25.0kHz, FM Modulation:154.570MHz-High Power



10. Conducted Spurious Emission

10.1 Provisions Applicable

Each MURS transmitter type must be designed to comply with the applicable unwanted emissions limits in this section.

a) Emission masks. Emission masks applicable to transmitting equipment in the MURS are defined by the requirements in the following table. The numbers in the paragraphs column refer to attenuation requirement rule paragraph numbers under paragraph (b) of this section. The words “audio filter” refer to the audio filter described in §95.2775.

Emission Types Filter	Attenuation Requirements
151.820, 151.880 and 151.940	(1), (2).
154.570 & 154.600, with audio filter	(3), (4), (7)
154.570 & 154.600, without audio filter	(5), (6), (7)

1) Each MURS transmitter type that transmits F3E or G3E emissions on 154.570 MHz or 154.600 MHz and incorporates an audio filter satisfying the requirements of § 95.2775 in its design may comply with the less stringent unwanted emissions attenuation requirements set forth in paragraphs (b)(3), (4), and (7) of this section.

2) Each MURS transmitter type that transmits on 154.570 MHz or 154.600 MHz, but does not incorporate an audio filter satisfying the requirements of § 95.2775 in its design, must comply with the unwanted emissions attenuation requirements set forth in paragraphs (b)(5) through (7) of this section.

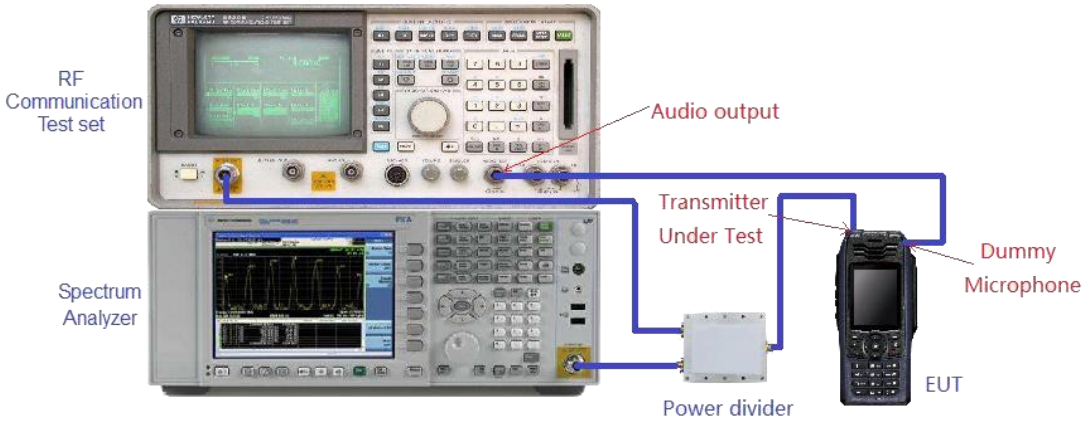
b) Attenuation requirements. The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) by at least:

1) 7.27*(fd−2.88 kHz) dB on any frequency removed from the channel center frequency by a displacement frequency (fd in kHz) that is more than 5.625 kHz, but not more than 12.5 kHz.
2) 50+10*log*(P) dB or 70 dB, whichever is the lesser attenuation, on any frequency removed from the channel center frequency by more than 12.5 kHz.
3) 25 dB on any frequency removed from the channel center frequency by more than 10 kHz, but not more than 20 kHz.
4) 35 dB on any frequency removed from the channel center frequency by more than 20 kHz, but not more than 50 kHz.
5) 83*log*(fd÷5) dB on any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) that is more than 5 kHz, but not more than 10 kHz.
6) 29*log*(fd^2÷11)dB or 50 dB, whichever is the lesser attenuation on any frequency removed from the channel center frequency by a displacement frequency (fd in kHz) that is more than 10 kHz, but not more than 50 kHz.
7) 43+10*log*(P) dB on any frequency removed from the channel center frequency by more than 50 kHz

10.2 Measurement Procedure

1. The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation
2. The audio input was set the unmodulated carrier, the resulting picture is print out for each channel separation.
3. 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.
4. Set RBW 100 kHz, VBW 300 kHz in the frequency band 30MHz to 1GHz
5. While set RBW=1MHz.VBW=3MHz from the 1GHz to 10th Harmonic.
6. The corresponding Mark cursor records the worst power intensity value and records it in the report

10.3 Measurement Setup



10.4 Measurement Results

Measurement Conditions	Attenuation Limit (dBc)
151.820, 151.880 and 151.940	At least 50+10*log*(P) dB
154.570 & 154.600, with audio filter	At least 43+10*log*(P) dB

➢ 50+10 log (P_{watts})

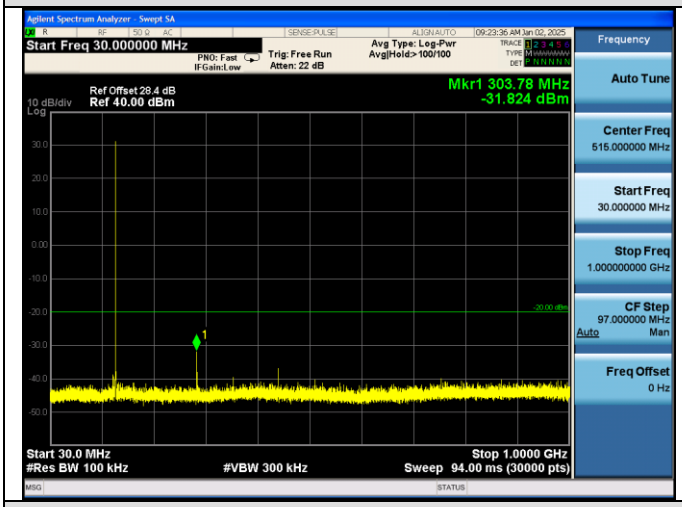
Note: In general, the worse case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-50-10*log* (TP)
EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is P(dBm)
Limit (dBm) = P(dBm)-50-10*log*(P_{watts})=-20dBm

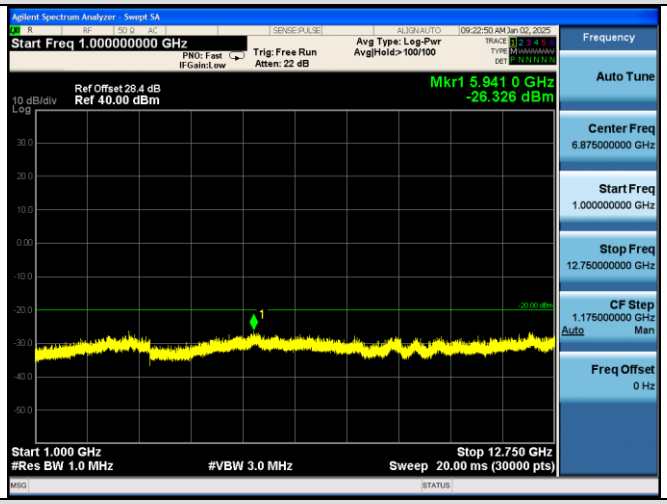
➢ 43+10 log (P_{watts})

Note: In general, the worse case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-43-10*log* (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)-43-10*log*(P_{watts})=-13dBm

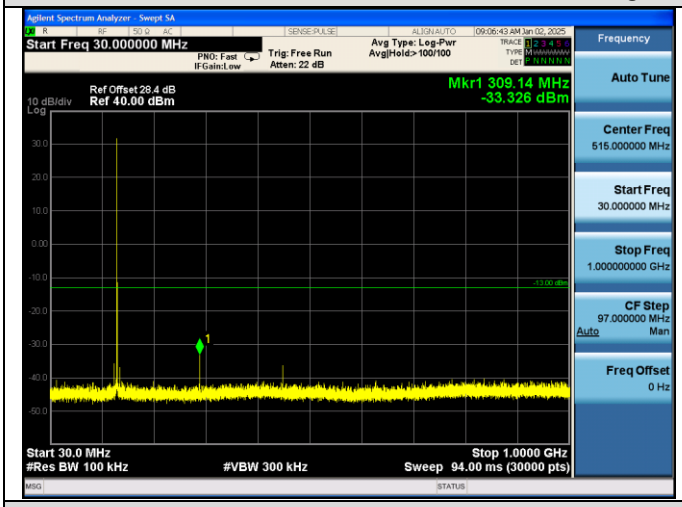
- Test plot as follows:

12.5kHz, FM modulation, Assigned Frequency:151.820MHz, High Power

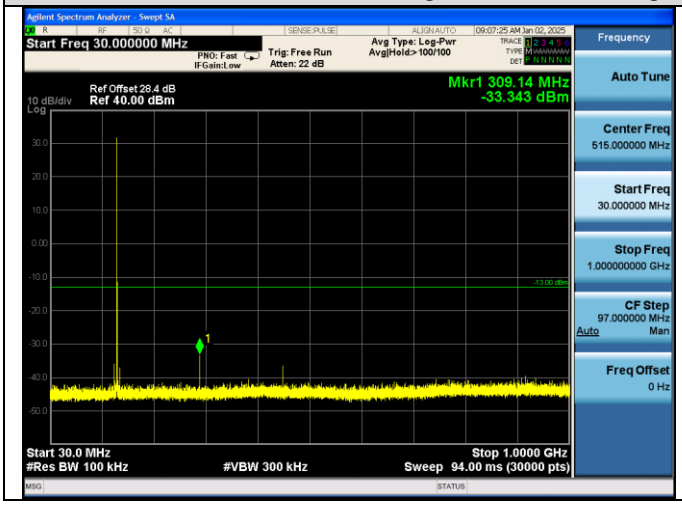


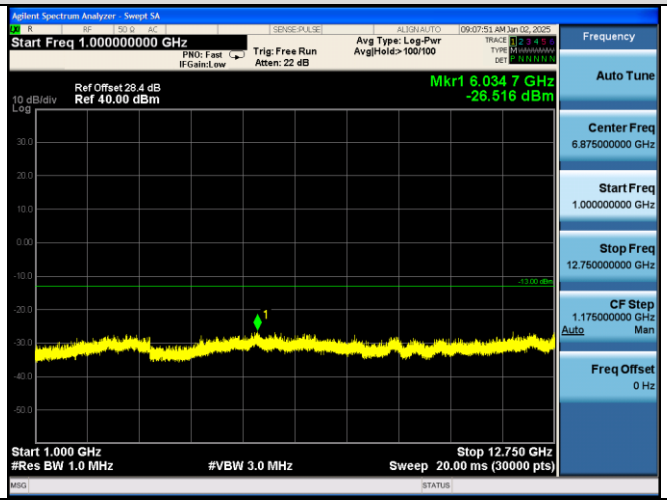


12.5kHz, FM modulation, Assigned Frequency:154.570MHz, High Power



25.0kHz, Analog modulation, Assigned Frequency:154.570MHz, High Power





11. Audio Low Pass Filter Response

11.1 Provisions Applicable

According to section 95.2775 MURS Audio filter requirements are as follows:

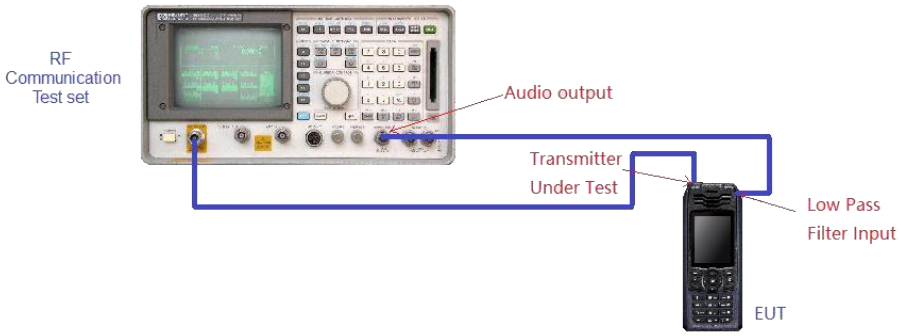
a) The audio filter must be between the modulation limiter and the modulated stage of the transmitter.

b) At any frequency (f in kHz) between 3 and 15 kHz, the filter must have an attenuation of at least 40 log (f/3) dB more than the attenuation at 1 kHz. Above 15 kHz, it must have an attenuation of at least 28 dB more than the attenuation at 1 kHz.

11.2 Measurement Procedure

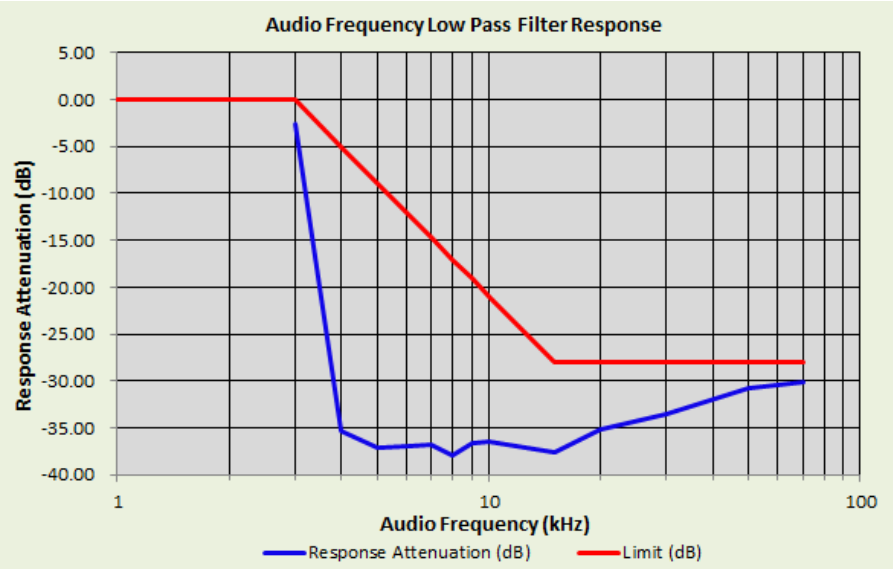
1. The DUT transmitter output port was connected to Modulation Analyzer.
2. Path loss for the measurement included.
3. Press 23.1SPCL on modulation analyzer to enable the external LO from SIgen.
4. Set the Sigen frequency to Fc + 1.5MHz, RF output level to 0dBm without modulation.
5. Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 60% of the maximum deviation.
6. Up the amplitude by 20dB.
7. On DSA, get the reference point to 0dB.
8. Vary the frequency on audio analyzer from 3 kHz to 30 kHz, record the audio tone from DSA.

11.3 Measurement Setup



11.4 Measurement Results

12.5kHz, FM modulation, Assigned Frequency:151.880MHz		
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1	0	/
3	-2.63	0.00
4	-35.26	-5.00
5	-37.12	-8.87
6	-36.89	-12.04
7	-36.86	-14.72
8	-37.89	-17.04
9	-36.66	-19.08
10	-36.48	-20.92
15	-37.63	-28.00
20	-35.21	-28.00
30	-33.55	-28.00
50	-30.74	-28.00
70	-30.11	-28.00



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

Appendix I: Photographs of Test Setup

Refer to the Report No.: AGC15733241203AP01

Appendix II: Photographs of Test EUT

Refer to the Report No.: AGC15733241203AP02

-----End of Report-----

Conditions of Issuance of Test Reports

1. All samples and goods are accepted by the Attestation of Global Compliance (Shenzhen) Co., Ltd (the "Company") solely for testing and reporting in accordance with the following terms and conditions. The company provides its services on the basis that such terms and conditions constitute express agreement between the company and any person, firm or company requesting its services (the "Clients").

2. Any report issued by Company as a result of this application for testing services (the "Report") shall be issued in confidence to the Clients and the Report will be strictly treated as such by the Company. It may not be reproduced either in its entirety or in part and it may not be used for advertising or other unauthorized purposes without the written consent of the Company. The Clients to whom the Report is issued may, however, show or send it, or a certified copy thereof prepared by the Company to its customer, supplier or other persons directly concerned. The Company will not, without the consent of the Clients, enter into any discussion or correspondence with any third party concerning the contents of the Report, unless required by the relevant governmental authorities, laws or court orders.

3.The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.

4. In the event of the improper use of the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.

5. Samples submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.

6. The Company will not be liable for or accept responsibility for any loss or damage however arising from the use of information contained in any of its Reports or in any communication whatsoever about its said tests or investigations.

7.Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.

8. The Company is not responsible for recalling the electronic version of the original report when any revision is made to them. The Client assumes the responsibility to providing the revised version to any interested party who uses them.

9. Subject to the variable length of retention time for test data and report stored hereinto as otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of the test report for a period of six years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after retention period. Under no circumstances shall we be liable for damage of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.