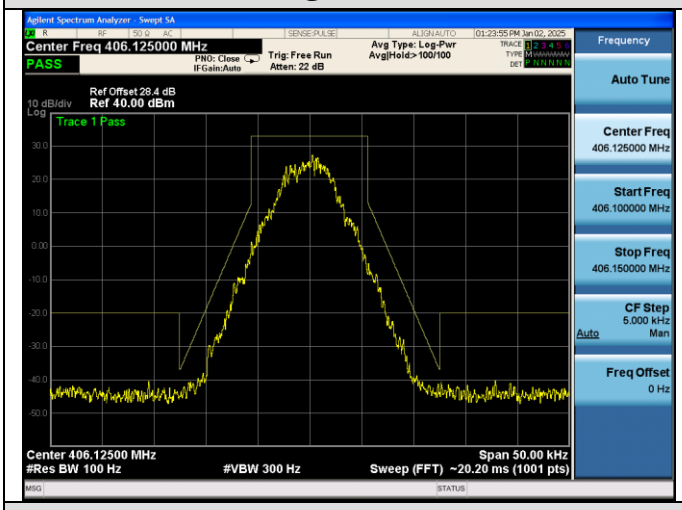
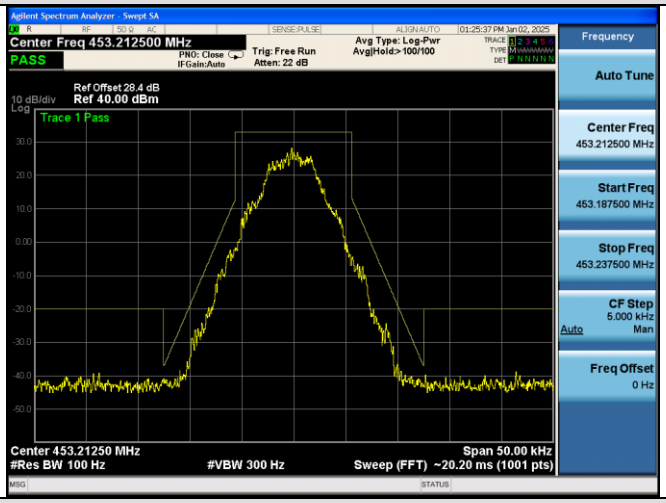
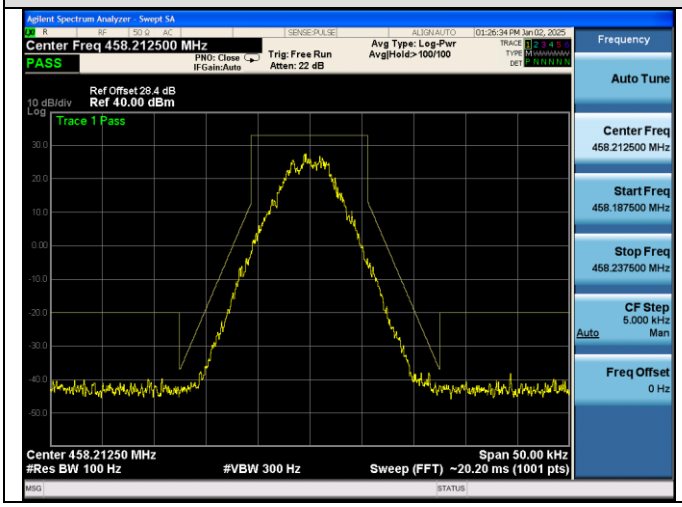
Emission Mask D@406.125MHz-2W-4FSK



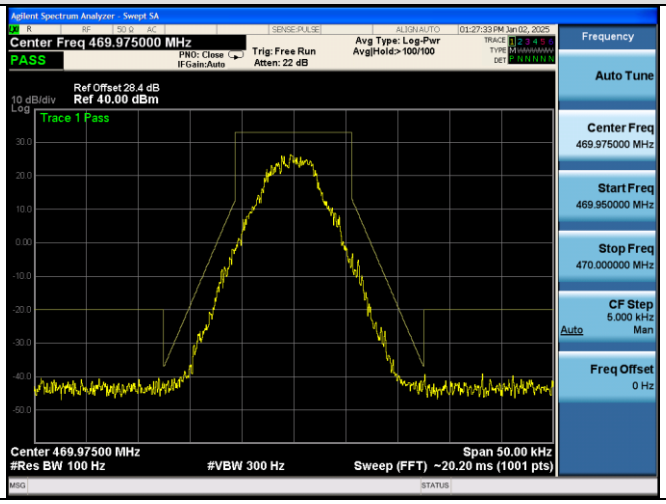
Emission Mask D@453.2125MHz-2W-4FSK



Emission Mask D@458.2125MHz-4W-4FSK



Emission Mask D@469.9750MHz-4W-4FSK



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9. Modulation Characteristics

9.1 Provisions Applicable

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

9.2 Measurement Procedure

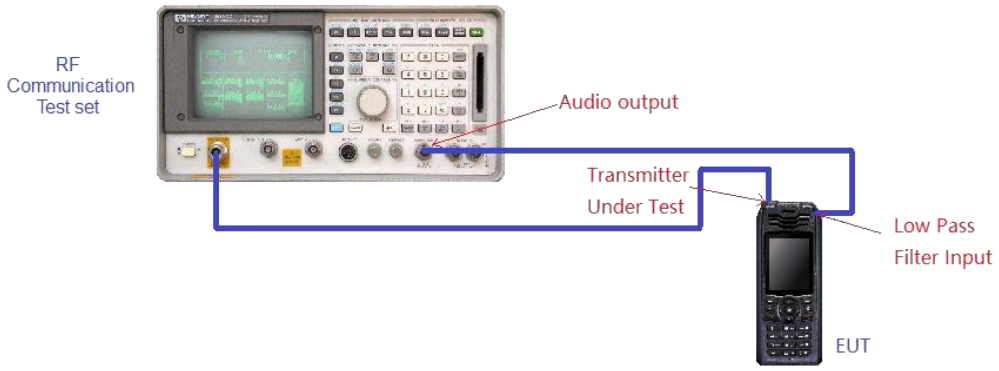
- **Modulation Limit**

1. Test layout and build equipment as shown below.
2. adjust the audio input for 60% of rated system deviation at 1kHz using this level as a reference (0dB).
3. Vary the input level from –20 to +20dB.
4. Record the frequency deviation obtained as a function of the input level.
5. Repeat step 2 with input frequency changing to 300, 1000, 1500 and 3000Hz in sequence.

- **Audio Frequency Response**

1. Test layout and build equipment as shown below.
2. Adjust the audio input for 20% of rated system deviation at 1 kHz using this level as a reference (0 dB).
3. Vary the Audio frequency from 100 Hz to 10 kHz and record the frequency deviation.
4. Audio Frequency Response = 20log10 (Deviation of test frequency/Deviation of 1 kHz reference).

9.3 Measurement Setup



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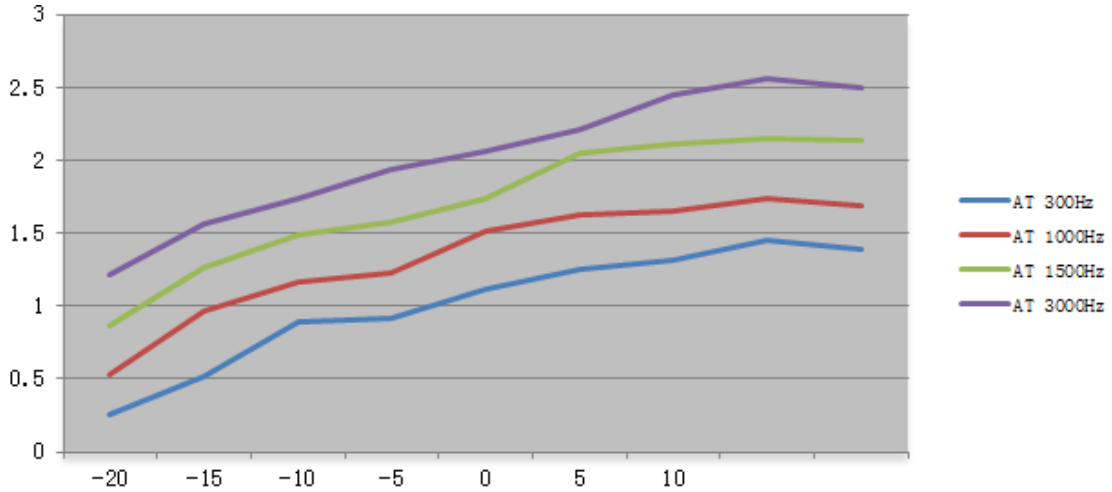
9.4 Measurement Result

A. Modulation Limit:

12.5kHz, Analog modulation, Assigned Frequency:406.1250MHz-5W				
Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (kHz)	Peak Freq. Deviation At 1000 Hz (kHz)	Peak Freq. Deviation At 1500 Hz (kHz)	Peak Freq. Deviation At 3000 Hz (kHz)
-20	0.25	0.53	0.86	1.21
-15	0.52	0.96	1.26	1.56
-10	0.89	1.16	1.49	1.74
-5	0.91	1.23	1.58	1.93
0	1.11	1.51	1.74	2.06
+5	1.25	1.62	2.05	2.21
+10	1.31	1.65	2.11	2.45
+15	1.45	1.74	2.15	2.56
+20	1.39	1.69	2.13	2.49



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

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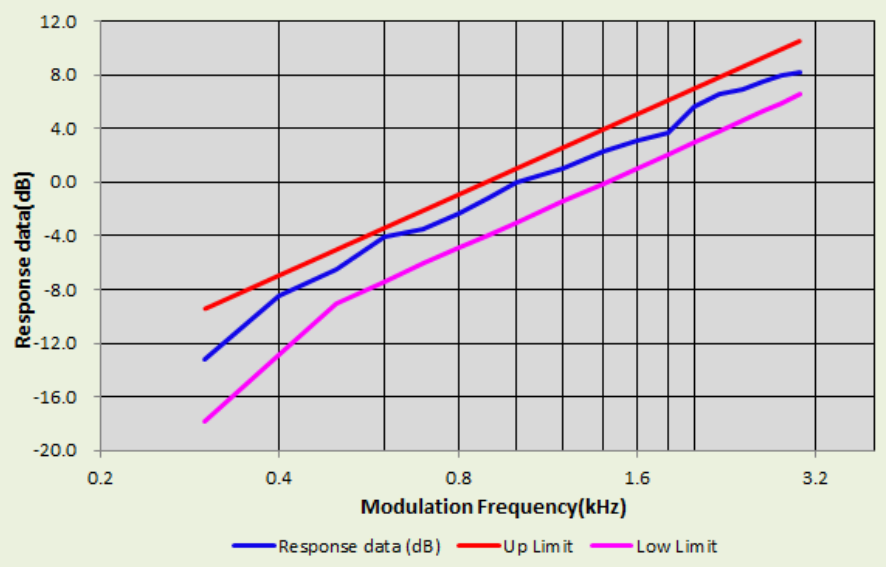
B. Audio Frequency Response:

12.5kHz, Analog modulation, Assigned Frequency:406.125MHz-4W		
Frequency (Hz)	Deviation (kHz)	Audio Frequency Response(dB)
100	--	--
200	--	--
300	0.18	-13.17
400	0.31	-8.45
500	0.39	-6.45
600	0.51	-4.12
700	0.55	-3.47
800	0.63	-2.29
900	0.72	-1.13
1000	**0.82**	0.00
1200	0.92	1.00
1400	1.06	2.23
1600	1.17	3.09
1800	1.25	3.66
2000	1.56	5.59
2400	1.74	6.53
2500	1.82	6.93
2800	1.94	7.48
3000	2.06	8.00



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

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10. Maximum Transmitter Power

10.1 Provisions Applicable

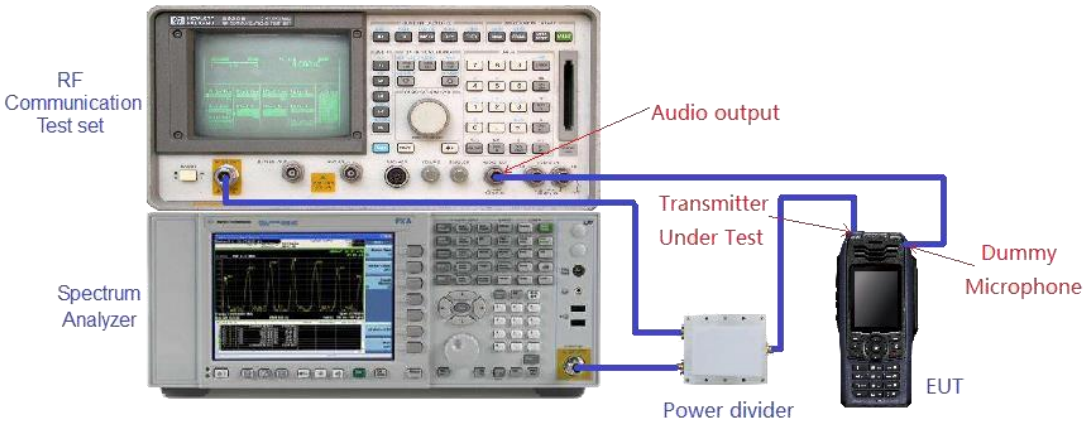
Per FCC §2.1046 and §90.205: Maximum ERP is dependent upon the station's antenna HAAT and required service area.

10.2 Measurement Procedure

The RF output of Two-way Radio was conducted to a spectrum analyzer through an appropriate attenuator.
In the semi-anechoic chamber, setup as illustrated above the DUT placed on the 0.8m height of Turn Table, rotated the table 45 degree each interval to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power for each degree interval. The "Read Value" is the spectrum reading of maximum power value.
The substitution antenna is substituted for DUT at the same position and signals generator (S.G) export the CW signal to the substitution antenna via a TX cable. The receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum radiation power. Record the power level of maximum radiation power from spectrum.
So, the Measured substitution value = Ref level of S.G + TX cables loss – Substituted Antenna Gain.
EIRP = "Read Value" + Measured substitution value + 2.15.

10.3 Measurement Setup

☒Conducted Output Power:



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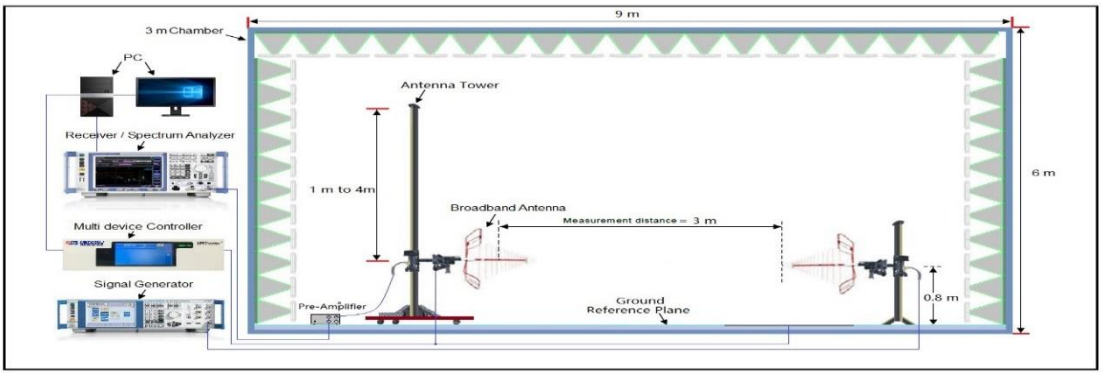
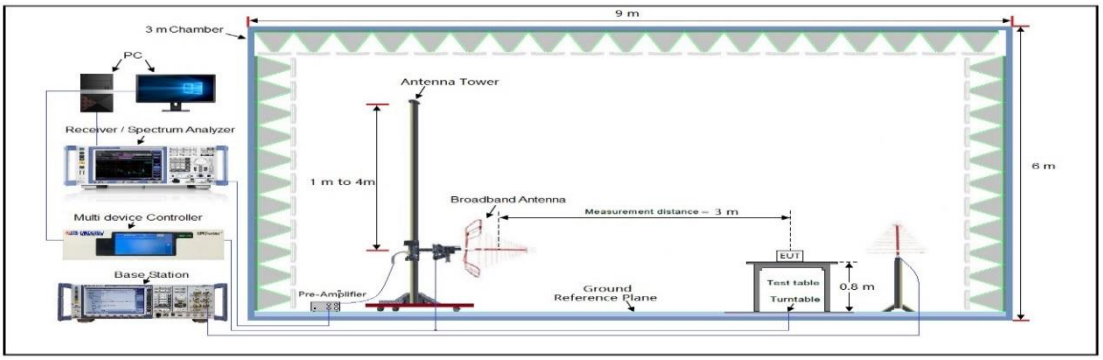
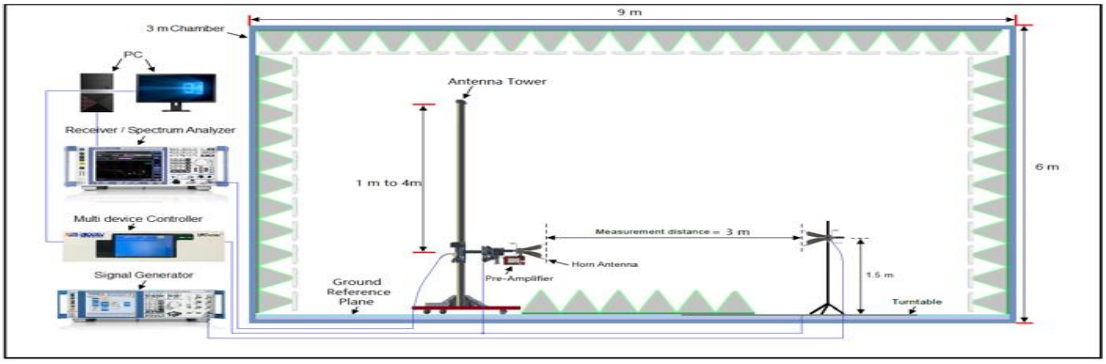
☒Effective Radiated Power:

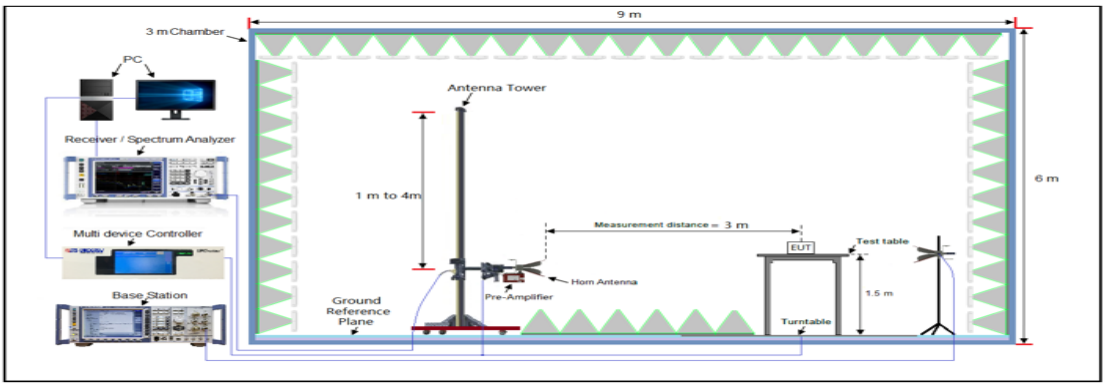
Radiated Below 1GHz





Radiated Above 1 GHz





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10.4 Measurement Result

Conducted Power Measurement Results			
Mode	Channel Separation	Test Channel	Measurement Result (dBm)
			For 36.02dBm(4W)
Analog +Voice	12.5 kHz	Bottom(406.1250MHz)	35.59
		Middle(453.2125MHz)	**35.72**
		Middle(458.2125MHz)	35.59
		Top (469.9750MHz)	35.51
Digital (Voice+Data)	12.5 kHz	Bottom(406.1250MHz)	35.67
		Middle(453.2125MHz)	**35.69**
		Middle(458.2125MHz)	35.63
		Top (469.9750MHz)	35.52

Conducted Power Measurement Results			
Mode	Channel Separation	Test Channel	Measurement Result (dBm)
			For 33.01dBm(2W)
Analog +Voice	12.5 kHz	Bottom(406.1250MHz)	32.47
		Middle(453.2125MHz)	**32.96**
		Middle(458.2125MHz)	32.88
		Top (469.9750MHz)	32.82
Digital (Voice+Data)	12.5 kHz	Bottom(406.1250MHz)	32.38
		Middle(453.2125MHz)	**32.91**
		Middle(458.2125MHz)	32.88
		Top (469.9750MHz)	32.85

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Radiated Power Measurement Results								
Test Mode	Frequency (MHz)	Reading Level (dBuv/m)	Antenna Polarization	S.G. (dBm)	Cable Loss (dB)	Ant.Gain (dBi)	ERP Results (dBm)	Limit (dBm)
Analog +Vioce	406.1250	104.47	V	29.24	0.85	6.9	35.29	36.02
	406.1250	104.40	H	29.17	0.85	6.9	35.22	36.02
	453.2125	104.60	V	29.37	0.85	6.9	35.42	36.02
	453.2125	104.54	H	29.31	0.85	6.9	35.36	36.02
	458.2125	104.47	V	29.24	0.85	6.9	35.29	36.02
	458.2125	104.40	H	29.17	0.85	6.9	35.22	36.02
	469.9750	104.38	V	29.15	0.85	6.9	35.20	36.02
	469.9750	104.34	H	29.11	0.85	6.9	35.16	36.02
Digital (Voice+Data)	406.1250	104.52	V	29.29	0.85	6.9	35.34	36.02
	406.1250	104.44	H	29.21	0.85	6.9	35.26	36.02
	453.2125	104.54	V	29.31	0.85	6.9	35.36	36.02
	453.2125	104.47	H	29.24	0.85	6.9	35.29	36.02
	458.2125	104.50	V	29.27	0.85	6.9	35.32	36.02
	458.2125	104.43	H	29.20	0.85	6.9	35.25	36.02
	469.9750	104.50	V	29.27	0.85	6.9	35.32	36.02
	469.9750	104.39	H	29.16	0.85	6.9	35.21	36.02

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Radiated Power Measurement Results								
Test Mode	Frequency (MHz)	Reading Level (dBuv/m)	Antenna Polarization	S.G. (dBm)	Cable Loss (dB)	Ant.Gain (dBi)	ERP Results (dBm)	Limit (dBm)
Analog +Vioce	406.1250	101.34	V	26.11	0.85	6.9	32.16	33.01
	406.1250	101.27	H	26.04	0.85	6.9	32.09	33.01
	453.2125	101.83	V	26.60	0.85	6.9	32.65	33.01
	453.2125	101.77	H	26.54	0.85	6.9	32.59	33.01
	458.2125	101.72	V	26.49	0.85	6.9	32.54	33.01
	458.2125	101.64	H	26.41	0.85	6.9	32.46	33.01
	469.9750	101.70	V	26.47	0.85	6.9	32.52	33.01
	469.9750	101.65	H	26.42	0.85	6.9	32.47	33.01
Digital (Voice+Data)	406.1250	101.27	V	26.04	0.85	6.9	32.09	33.01
	406.1250	101.20	H	25.97	0.85	6.9	32.02	33.01
	453.2125	101.78	V	26.55	0.85	6.9	32.60	33.01
	453.2125	101.73	H	26.50	0.85	6.9	32.55	33.01
	458.2125	101.74	V	26.51	0.85	6.9	32.56	33.01
	458.2125	101.65	H	26.42	0.85	6.9	32.47	33.01
	469.9750	101.52	V	26.29	0.85	6.9	32.34	33.01
	469.9750	101.47	H	26.24	0.85	6.9	32.29	33.01

Note:
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)

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11. Spurious Emission on Antenna Port

11.1 Provisions Applicable

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

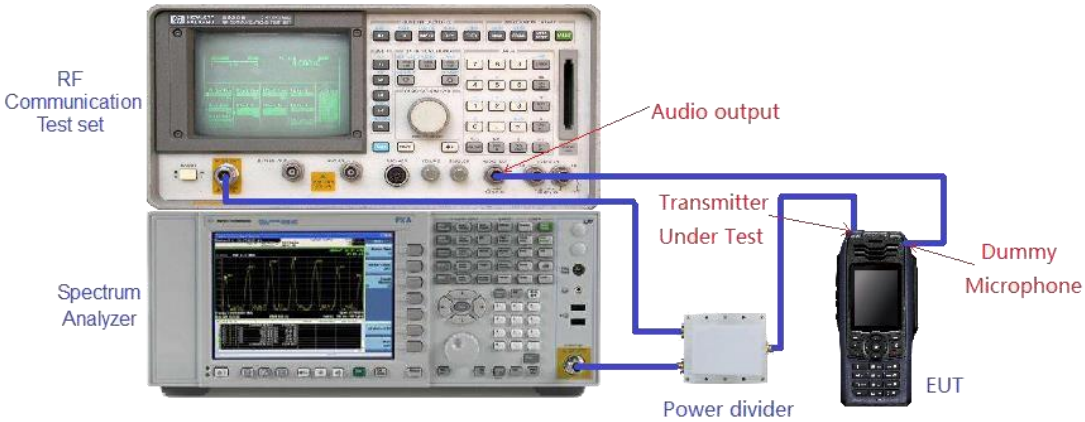
FCC Rules	Attenuation Limit (dBc)
§ 90.210	At least 50 + 10 log (P) dB

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

11.2 Measurement Procedure

1. The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was set to 100 kHz. Sufficient scans were taken to
3. 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, 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.

11.3 Measurement Setup



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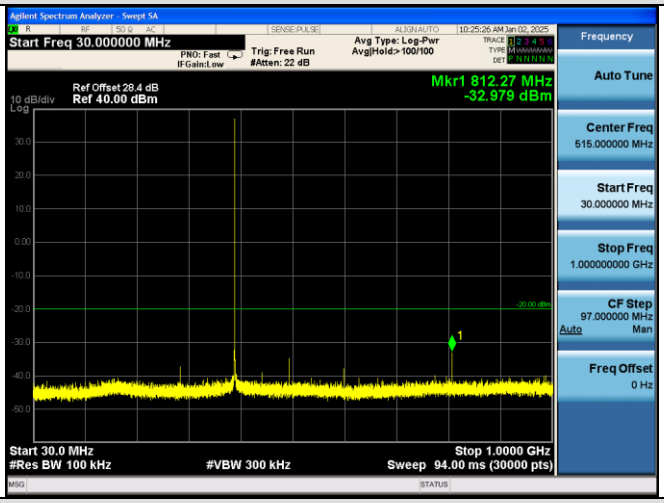
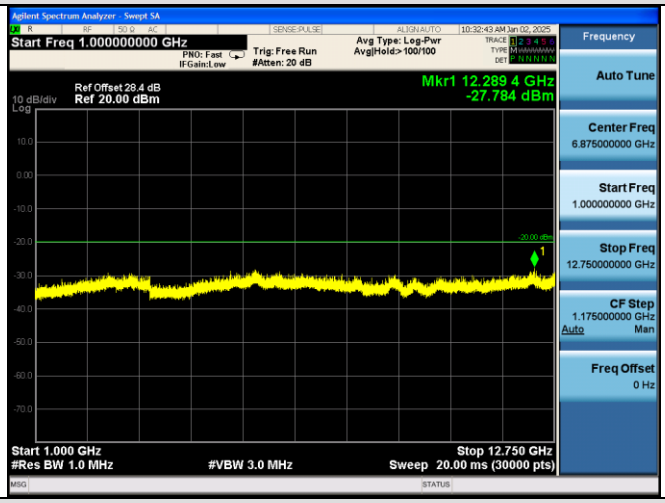
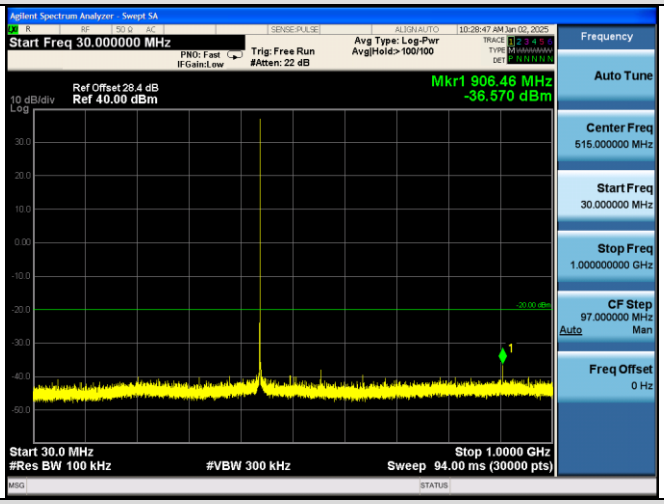
11.4 Measurement Result

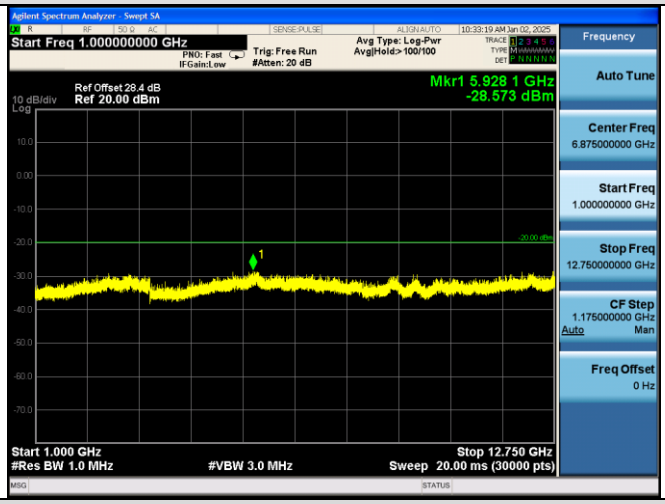
12.5kHz, Analog modulation, Assigned Frequency:406.1250MHz, 4W



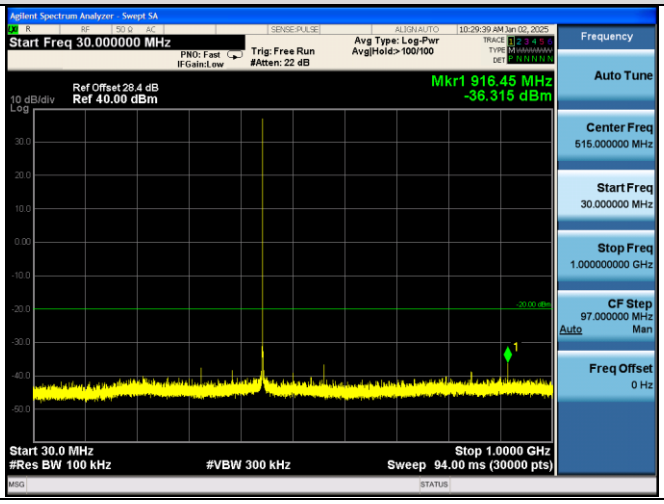


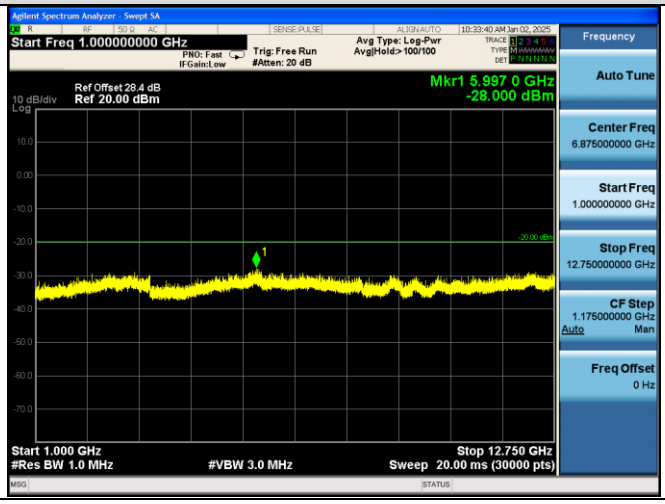
12.5kHz, Analog modulation, Assigned Frequency:453.2125MHz, 4W





12.5kHz, Analog modulation, Assigned Frequency:458.2125MHz, 4W





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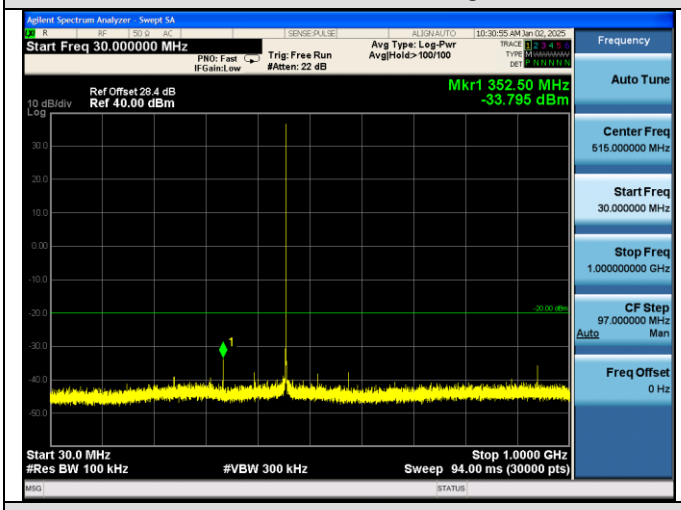
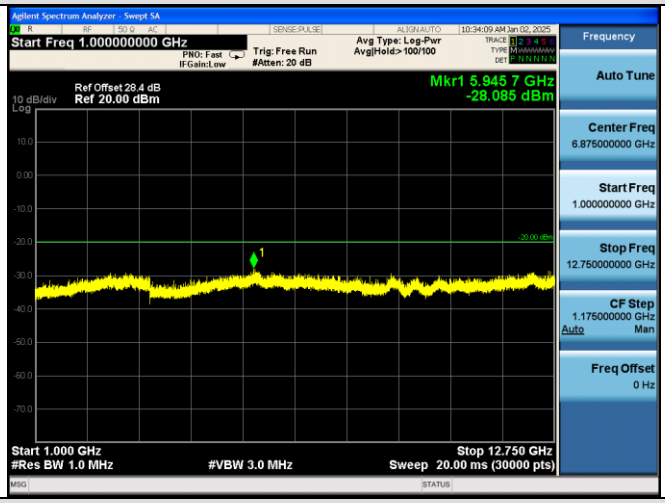
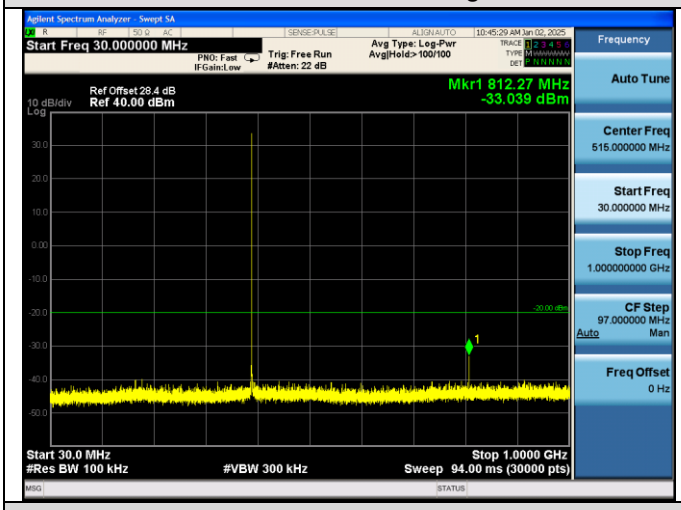
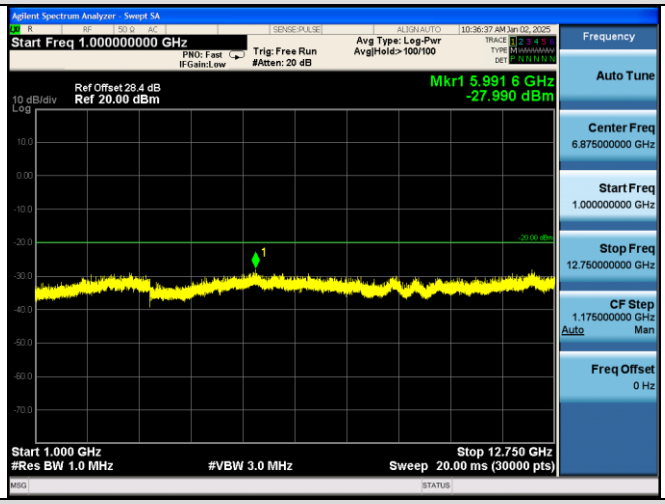
12.5kHz, Analog modulation, Assigned Frequency:469.9750MHz, 4W



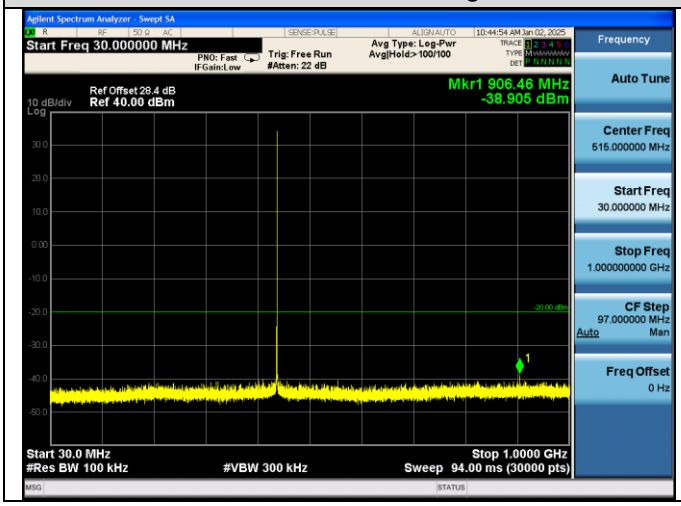


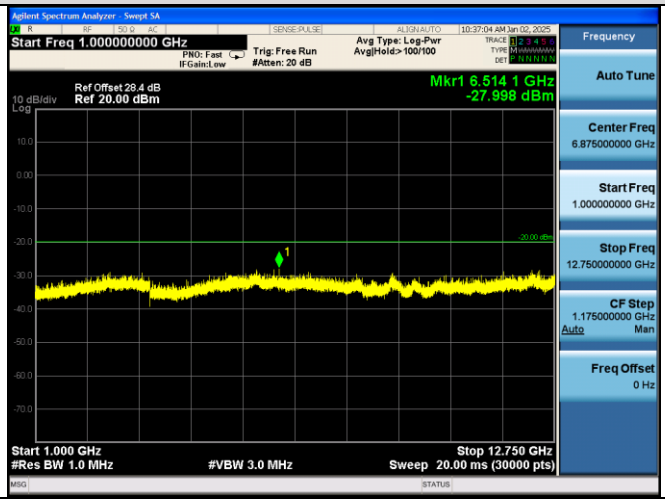
12.5kHz, Analog modulation, Assigned Frequency:406.1250MHz, 2W





12.5kHz, Analog modulation, Assigned Frequency:453.2125MHz, 2W





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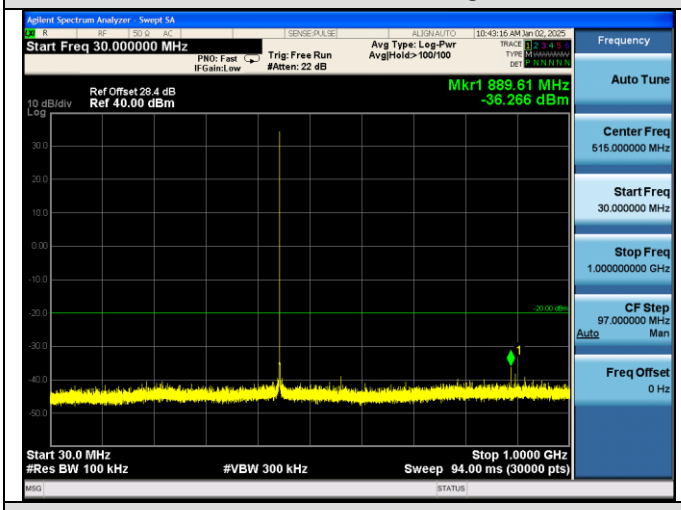
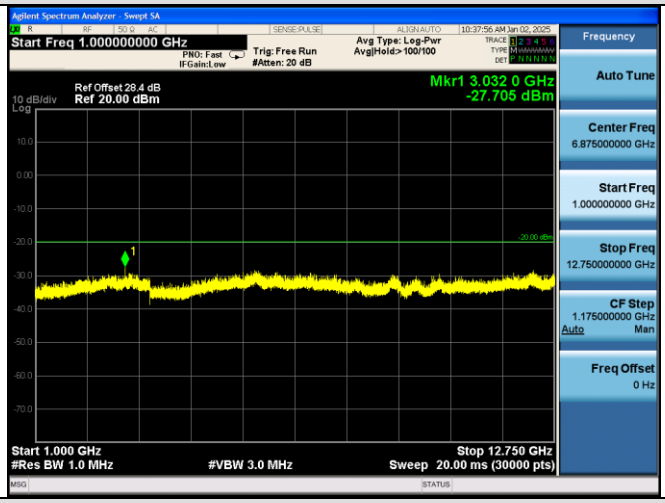
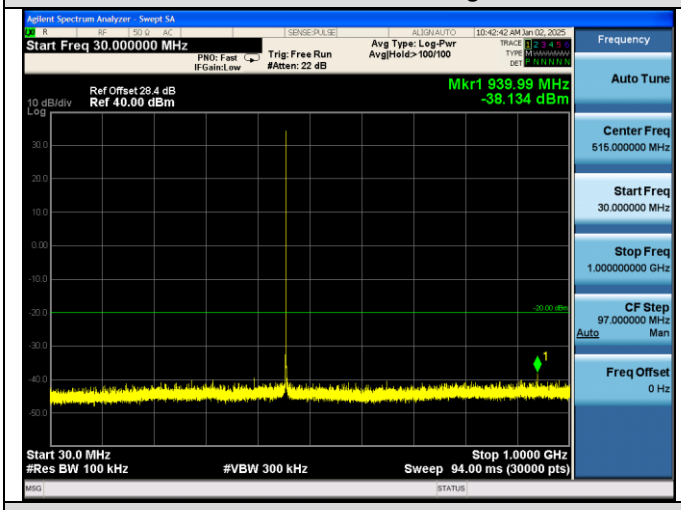
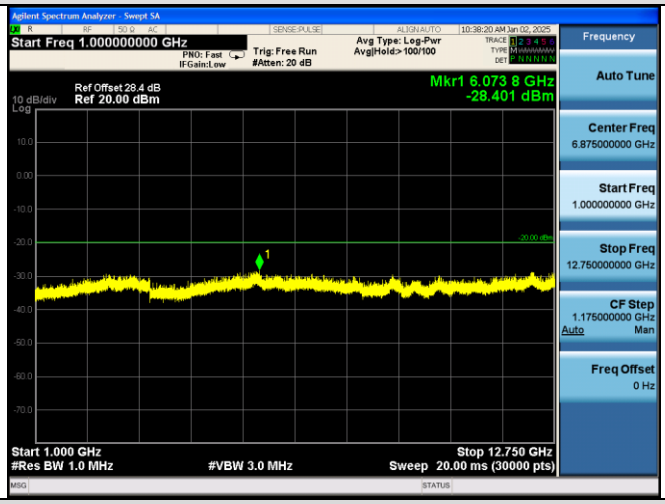
12.5kHz, Analog modulation, Assigned Frequency:458.2125MHz, 2W



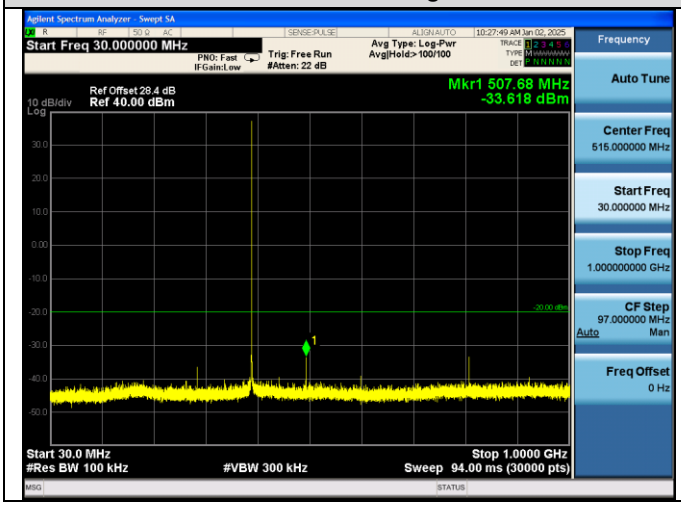


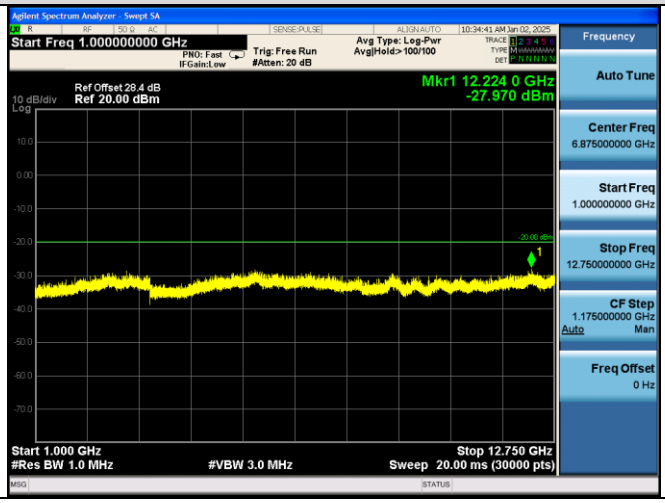
12.5kHz, Analog modulation, Assigned Frequency:469.9750MHz, 2W





12.5kHz, Digital modulation, Assigned Frequency:406.1250MHz, 4W





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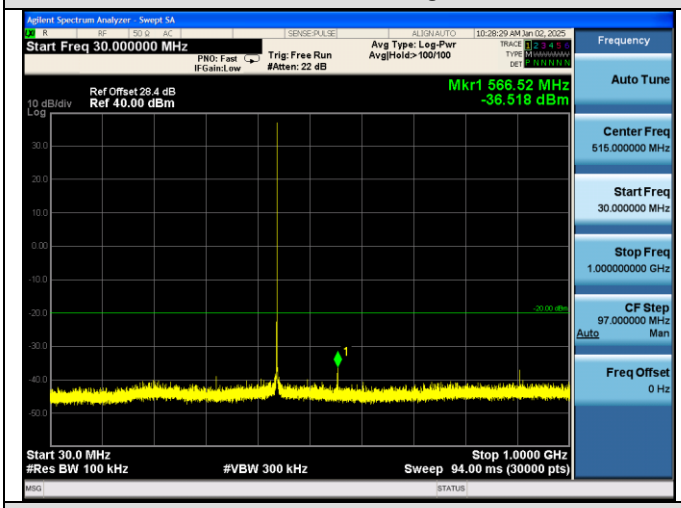
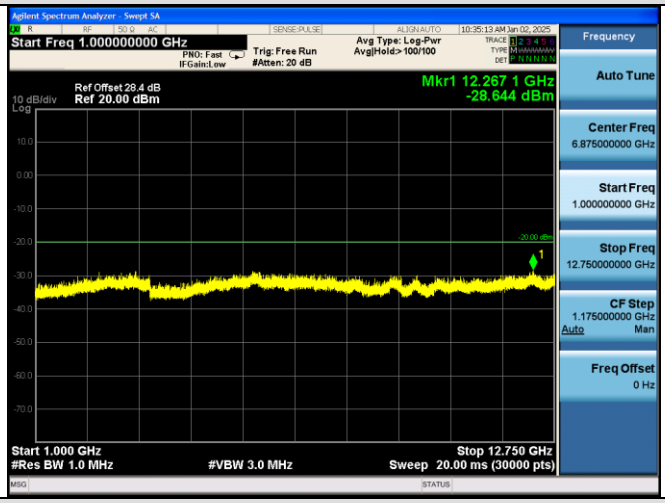
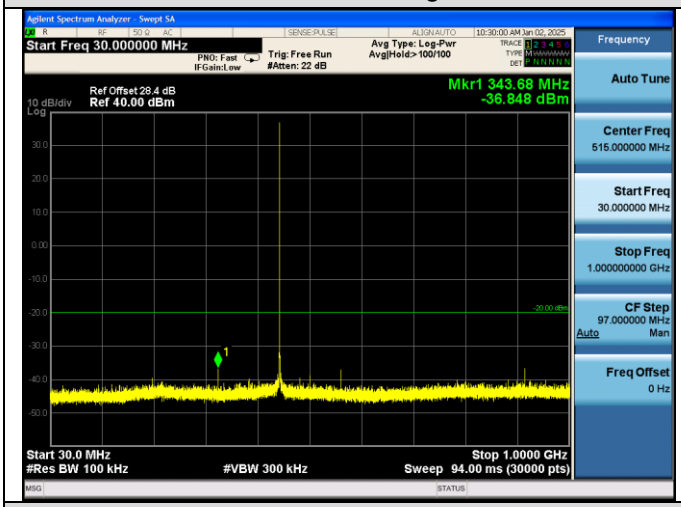
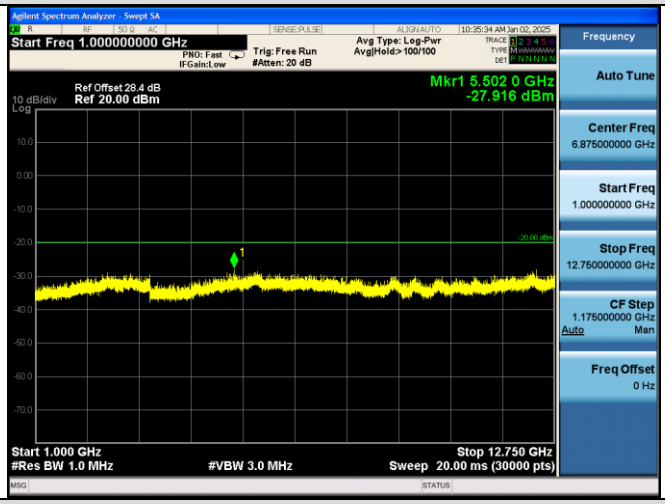
12.5kHz, Digital modulation, Assigned Frequency:453.2125MHz, 4W



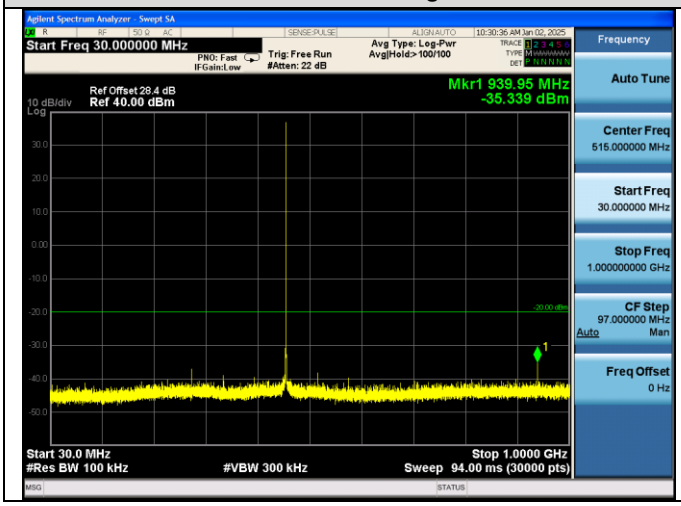


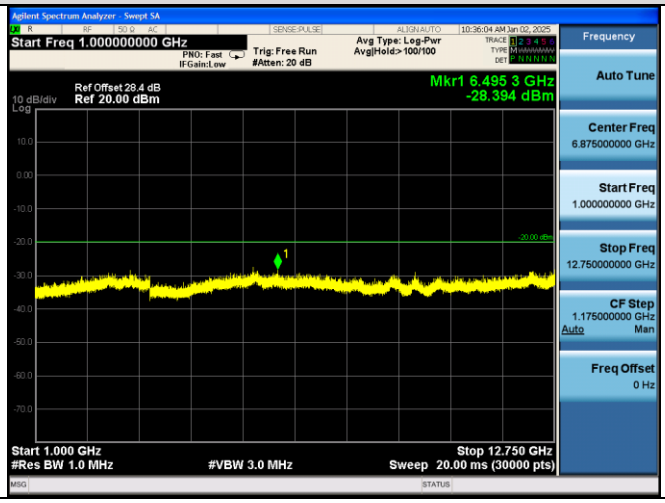
12.5kHz, Digital modulation, Assigned Frequency:458.2125MHz, 4W





12.5kHz, Digital modulation, Assigned Frequency:469.9750MHz, 4W





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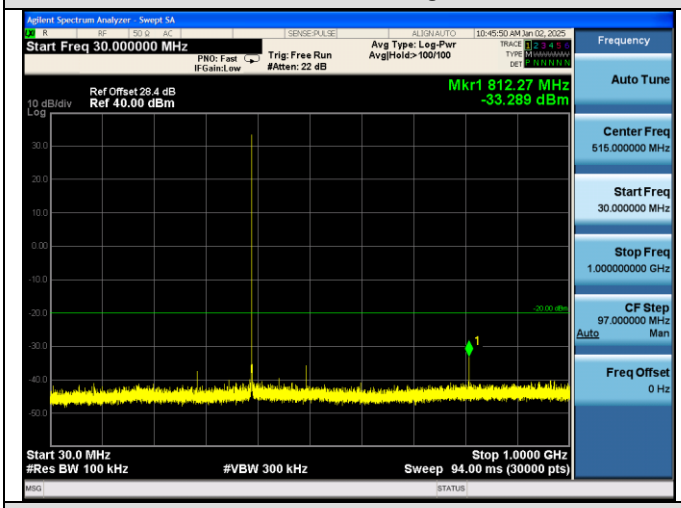
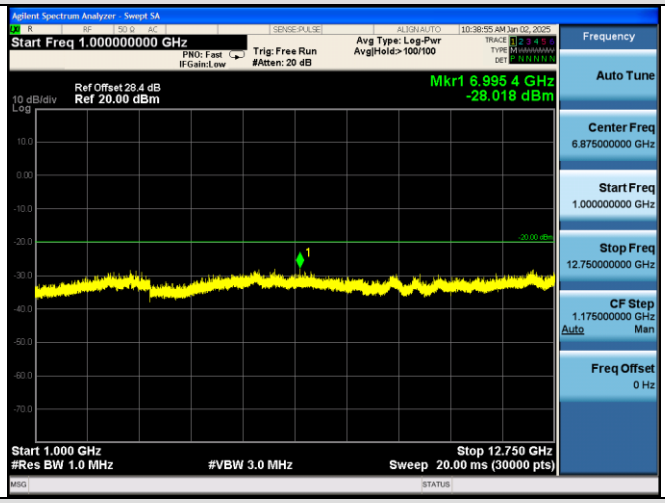
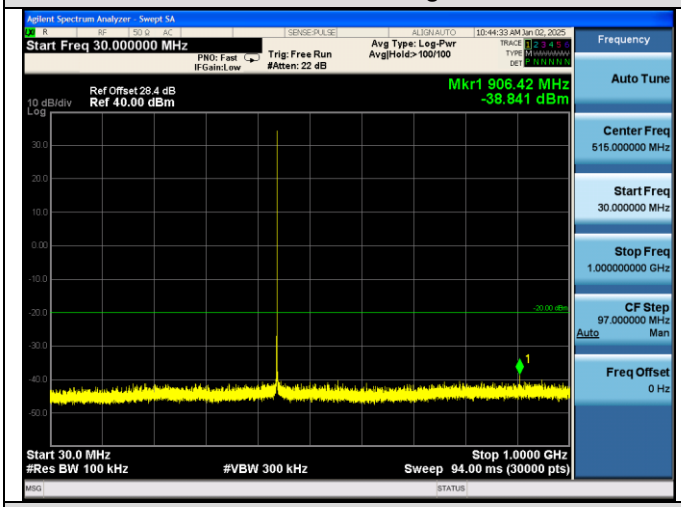
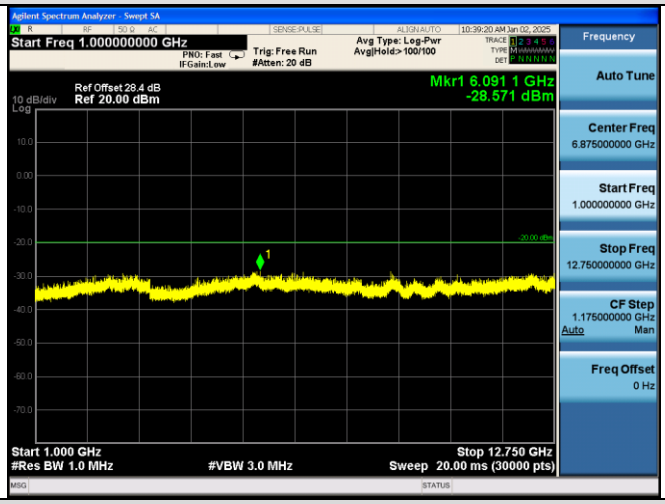
12.5kHz, Digital modulation, Assigned Frequency:406.1250MHz, 2W



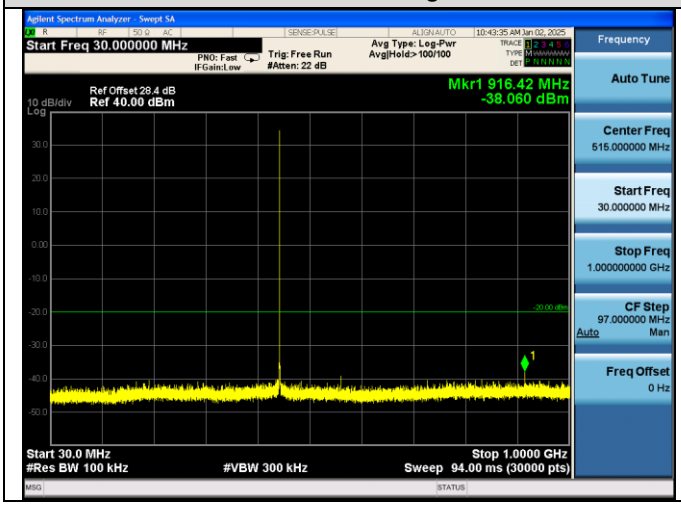


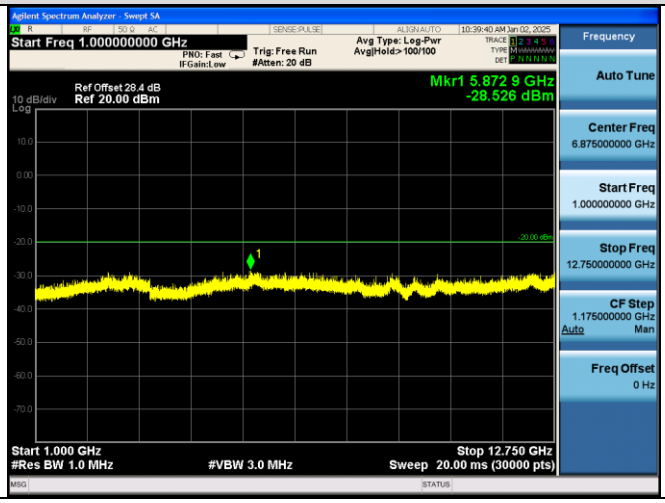
12.5kHz, Digital modulation, Assigned Frequency:453.2125MHz, 2W





12.5kHz, Digital modulation, Assigned Frequency:458.2125MHz, 2W





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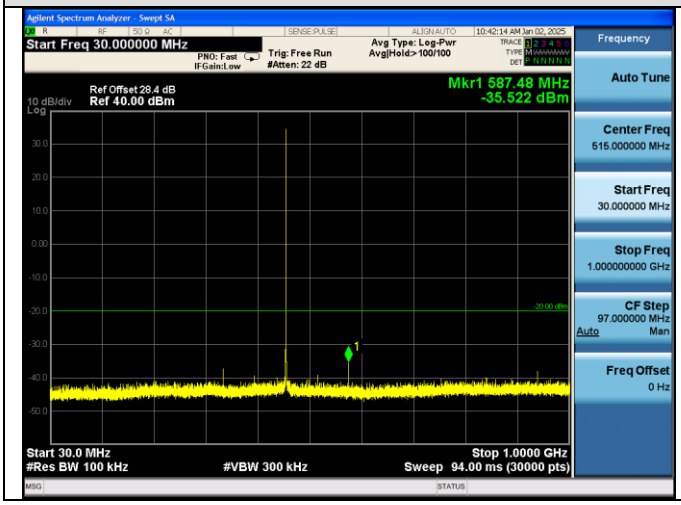
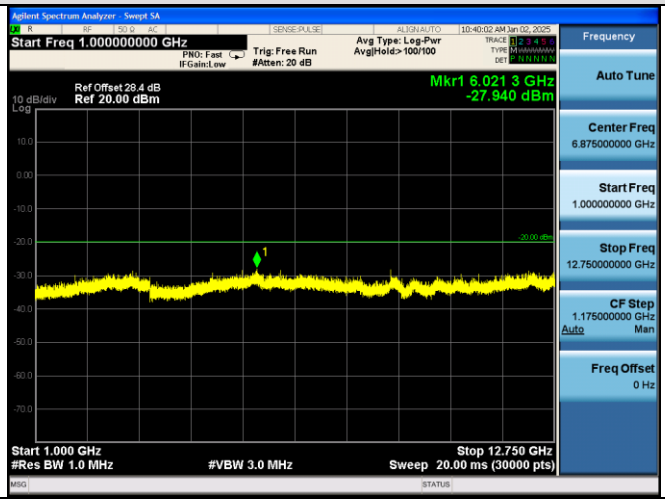
12.5kHz, Digital modulation, Assigned Frequency:469.9750MHz, 2W	
	

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

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12. Transmitter Frequency Behavior

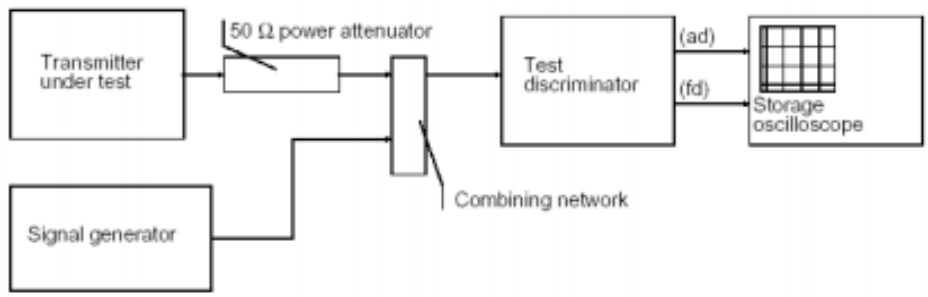
12.1 Provisions Applicable

47CFR FCC PART §90.214

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

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

12.2 Measurement Setup



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12.3 Measurement Procedure

According to TIA/EIA-603 2.2.19 requirement, as for the product different from PTT, we use test steps as follows:

1. Connect DUT into Test discriminator and Storage Oscilloscope and keep DUT stats ON;
2. Input 1kHz signal into DUT;
3. Set the modulation domain analyzer to trigger on the rising edge of the waveform in order to capture a
4. single-shot turn-on of the transmitter signals;
5. Keep DUT in OFF state and Key the PTT;
6. Observe the stored oscilloscope of modulation domain analyzer. The signal trace shall be maintained within the allowable limits during the periods t1 and t2,and shall also remain within limits following t2;
7. Adjust the modulation domain analyzer to trigger on the falling edge of the transmitter waveform in order to capture a single-shot turn-off transmitter of the transmitter signal.
8. Keep the digital portable radio in ON state and unkey the PTT;
9. Observe the stored oscilloscope of modulation domain analyzer, The signal trace shall be maintained within the allowable limits during the period t3.
10. Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at ±12.5 kHz deviation and set its output level to -100dBm.
11. Turn on the transmitter.
12. Supply sufficient attenuation via the RF attenuator to provide an input level to the stored oscilloscope that is 40 dB below the maximum allowed input power when the transmitter is operating at its rated power
13. level. Note this power level on the stored oscilloscope as P0.
14. Turn off the transmitter.
15. Adjust the RF level of the signal generator to provide RF power equal to P0. This signal generator RF level shall be maintained throughout the rest of the measurement.
16. Remove the attenuation, so the input power to the stored oscilloscope is increased by 30 dB when the transmitter is turned on.
17. Adjust the vertical amplitude control of the stored oscilloscope to display the 1000 Hz at ±4 divisions vertically centered on the display. Set trigger mode of the Spectrum Analyzer to “Video”, and tune the “trigger level” on suitable level. Then set the “tiger offset” to -10ms for turn on and -15ms for turn off.
18. Turn on the transmitter and the transient wave will be captured on the screen of Spectrum Analyzer.
19. Observe the stored display. The instant when the 1 kHz test signal is completely suppressed is considered to be ton. The trace should be maintained within the allowed divisions during the period t1 and t2.
20. Then turn off the transmitter, and another transient wave will be captured on the screen of Spectrum Analyzer. The trace should be maintained within the allowed divisions during the period t3.

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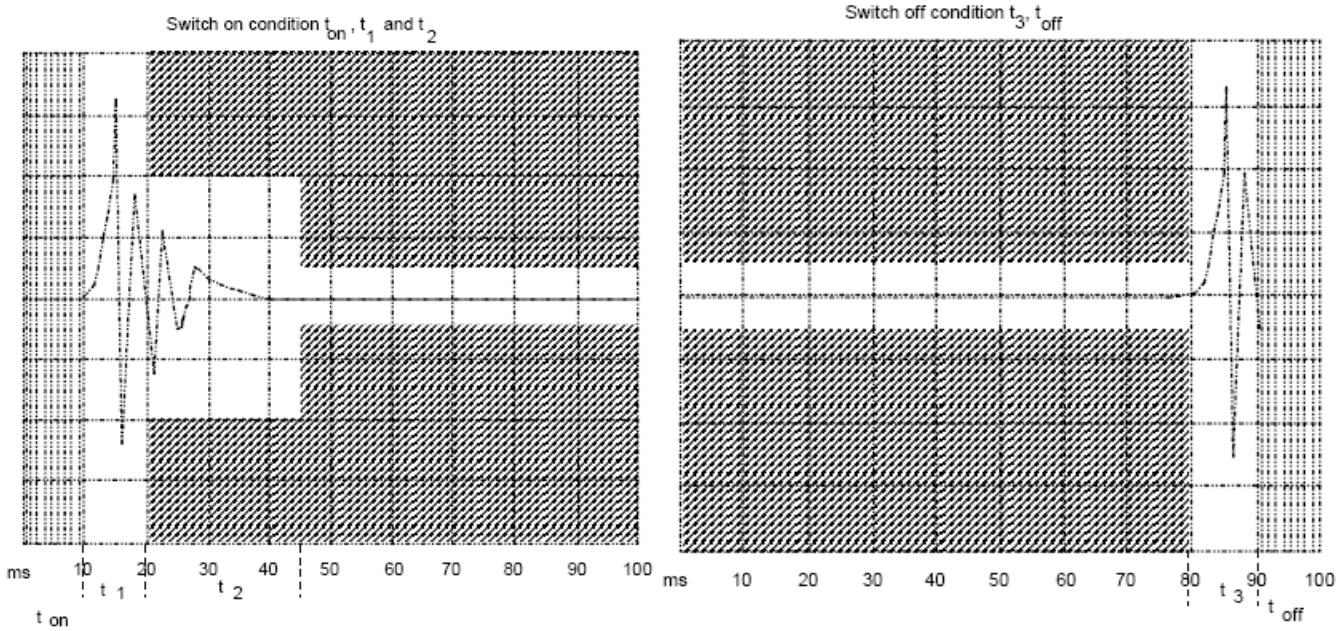
■ **Describe limit line of transmitter frequency behavior:**

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



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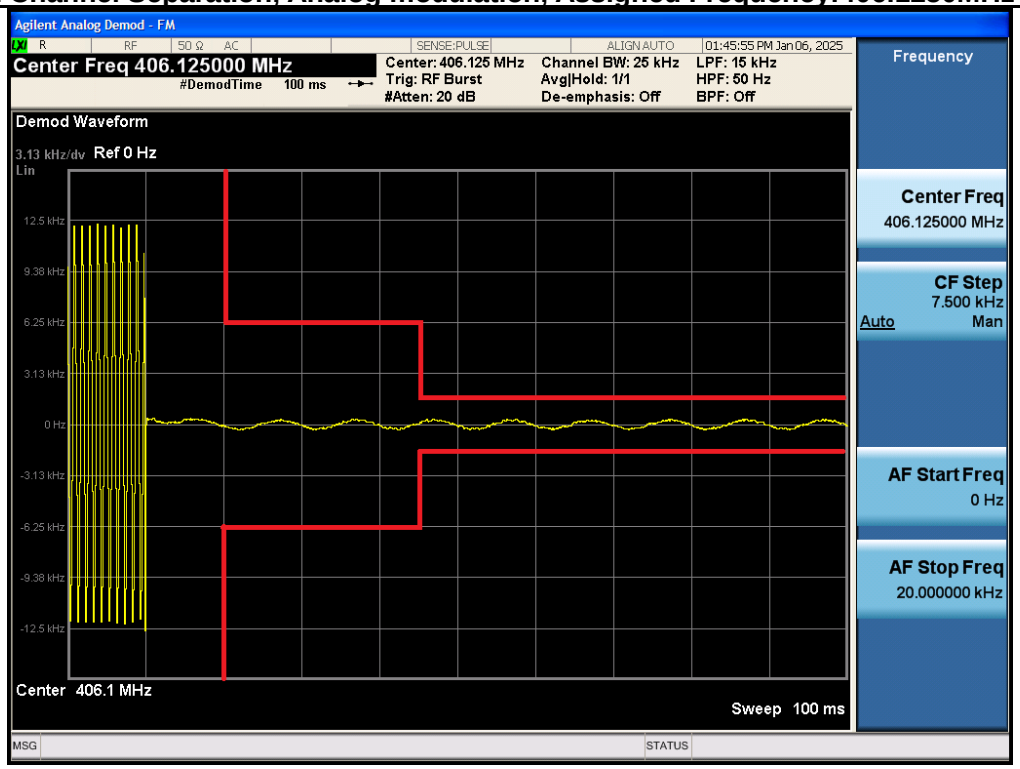
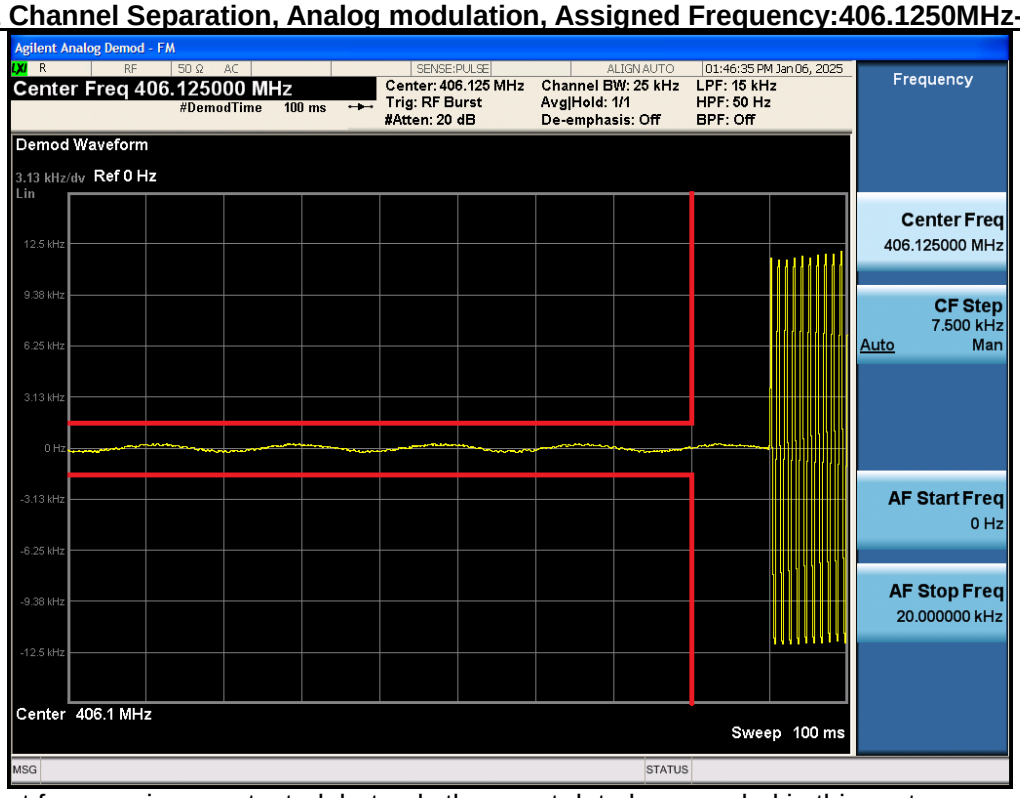
12.4 Measurement Result

12.5 kHz Channel Separation, Analog modulation, Assigned Frequency:406.1250MHz-Turn On



12.5 kHz Channel Separation, Analog modulation, Assigned Frequency:406.1250MHz-Turn Off



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

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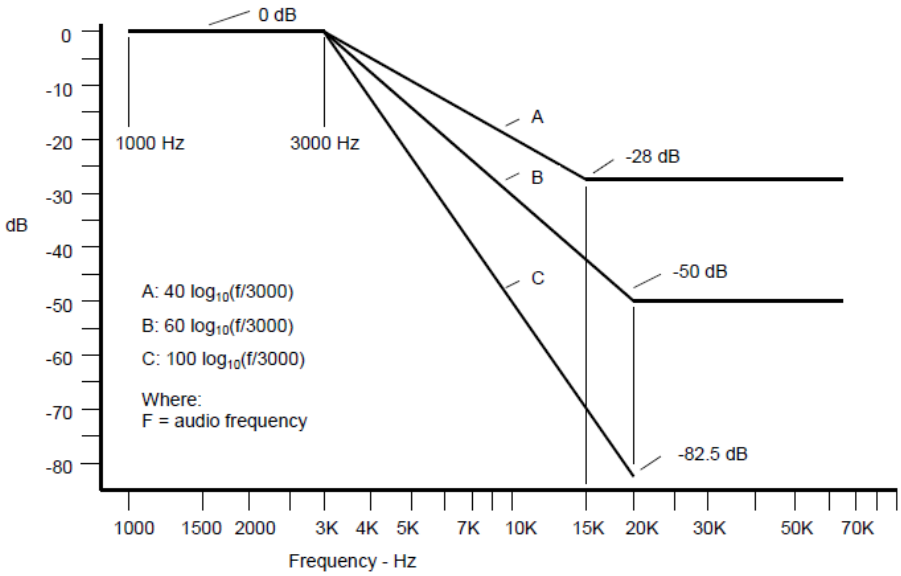
13. Audio Low Pass Filter Response

13.1 Provisions Applicable

2.1047(a): Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

ANSI TIA/EIA 603-E:2016 3.2.15: Recommended audio filter attenuation characteristics are given below:



For audio frequencies above 3000 Hz, the audio response of the post limiter low-pass filter shall meet or exceed the following requirements:

a) For equipment operating on 20, 25 or 30 kHz channel bandwidth in the 25 MHz to 174 MHz range:

At frequencies from 3000 Hz through 15,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least: 40 log10 (f / 3000) dB where: f is the audio frequency in Hz.

At frequencies above 15,000 Hz, the attenuation shall be greater than the attenuation at 1000 Hz, by at least: 28 dB.

b) For equipment operating with 25 kHz bandwidth channels between 406 and 512 MHz through 896 MHz, and between 929 MHz through 930 MHz: At frequencies from 3000 Hz through 20,000 Hz, the attenuation shall be greater

than the attenuation at 1000 Hz by at least: 60 log10 (f / 3000) dB where: f is the audio frequency in Hz.

At frequencies above 20,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least: 50 dB.

c) For equipment operating on channels between 896 MHz through 901 MHz, between 935 MHz through 940 MHz, and 12.5 or 15 kHz spaced channels in the frequency range 138-174 MHz and 406-512 MHz.

At frequencies from 3000 Hz through 20,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least: 100 log10 (f / 3000) dB where: f is the audio frequency in Hz.

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13.2 Measurement Procedure

The rated audio input signal was applied to the input of the audio low-pass filter (or of all modulation stages) using an audio oscillator, this input signal level and its corresponding output signal were then measured and recorded using the FFT Digital Spectrum Analyzer. Tests were repeated at different audio signal frequencies from 0 to 50 kHz.

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 + 1.5 MHz, RF output level to 0dBm without modulation.

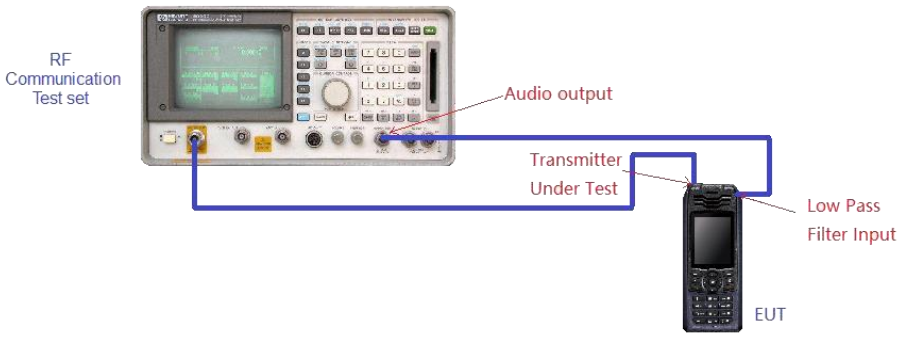
5) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 60% of the Full rated system deviation.

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 20 kHz, record the audio tone from DSA

13.3 Measurement Setup



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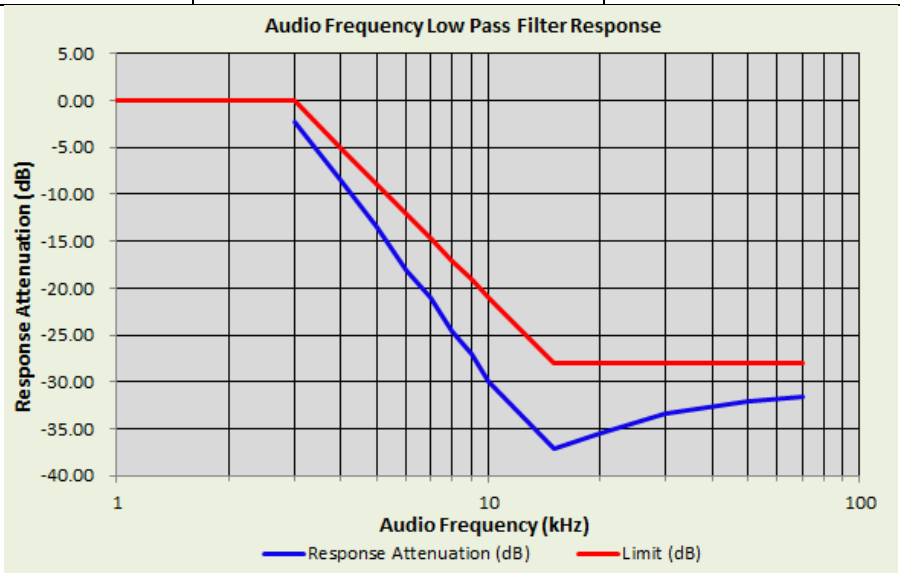
13.4 Measurement Result

12.5kHz, Analog modulation, Assigned Frequency:406.1250MHz-4W		
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1	0	/
3	-2.23	0.00
4	-8.51	-5.00
5	-13.50	-8.87
6	-18.00	-12.04
7	-20.94	-14.72
8	-24.56	-17.04
9	-27.04	-19.08
10	-30.03	-20.92
15	-37.16	-28.00
20	-35.52	-28.00
30	-33.36	-28.00
50	-32.12	-28.00
70	-31.52	-28.00



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

Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.

Appendix I: Photographs of Test Setup

Refer to the Report No.: AGC15733241202AP01

Appendix II: Photographs of Test EUT

Refer to the Report No.: AGC15733241202AP02

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

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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.

Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.