

TEST REPORT

Applicant Name : NiceRF Wireless Technology LTD.
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Report Number : RA230111-02080E-RF-00
FCC ID: 2AD66-DMR818S-U

Test Standard (s)

FCC PART 90

Sample Description

Product Type: Digital walkie talkie module
Model No.: DMR818S-U
Multiple Model(s) No.: N/A
Trade Mark: G-NiceRF
Date Received: 2023/01/11
Report Date: 2023/04/06

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Approved By:



Nick Fang
EMC Engineer

Candy Li
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230111-02080E-RF-00	Original Report	2023-04-06

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	400-470MHz
Rated Transmit Power	1 Watts(High), 0.5Watt(Low)
Channel separation	12.5kHz
Modulation Technique	4FSK/FM
Antenna Specification*	2.5dBi (provided by the applicant)
Voltage Range	DC 4.2V(Typical)
Sample serial number	23Q0_1 (Assigned by ATC)
Sample/EUT Status	Good condition

Objective

This test report is in accordance with Part 2, and Part 90 of the Federal Communication Commissions rules.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-E, ANSI C63.26-2015.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		0.082×10^{-7}
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Audio Frequency Response		0.1dB
Low Pass Filter Response		1.2dB
Modulation Limiting		1%
Emissions, Radiated	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
	26.5GHz - 40GHz	4.72dB
Temperature		1 °C
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISED), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in a test mode which has been done in the factory.

Equipment Modifications

No modification was made to the EUT.

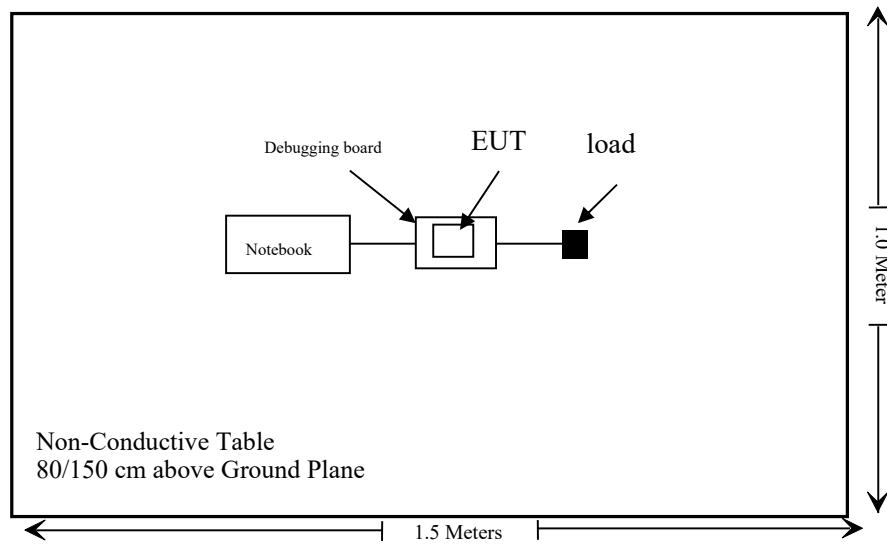
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Unknown	Load	Unknown	Unknown
Dell	Notebook	E5430	Unknown
NiceRF	Debugging board	Unknown	Unknown

External I/O Cable

Cable Description	Length (m)	From Port	To
USB cable	0.5	Notebook	Debugging board
RF cable	1.2	Debugging board	Load

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliant
§2.1046; §90.205	RF Output Power	Compliant
§2.1047; §90.207	Modulation Characteristic	Compliant
§2.1049; §90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliant
§2.1051;§90.210	Spurious Emission at Antenna Terminal	Compliant
§2.1053;§90.210	Spurious Radiated Emissions	Compliant
§2.1055;§90.213	Frequency Stability	Compliant
§90.214	Transient Frequency Behavior	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24
Mini-Circuits	High Pass Filter	NHP-600+	15542	2022/11/25	2023/11/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-194	2022/11/30	2025/11/29
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-655	2022/12/26	2025/12/25
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2022/11/30	2025/11/29
Unknown	RF Coaxial Cable	No.16	N200	2022/11/25	2023/11/24
Agilent	Signal Generator	N5183A	MY51040755	2022/11/25	2023/11/24

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101948	2022/11/25	2023/11/24
SPECTRUM ANALYZER	Rohde & Schwarz	FSU26	200982	2022/07/04	2023/07/03
R&S	Audio Analyzer	UPV	101782	2022/07/04	2023/07/03
Fluke	Digital Multimeter	287	19000011	2022/02/21	2023/02/20
instek	DC Power Supply	GPS-3030DD	EM832096	NCR	NCR
HP Agilent	RF Communication test set	8920B	3325U00859	2022/09/02	2023/09/01
WEINSCHTEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Aeroflex/Weinsche 1	30dB Attenuator (Input 250W/Output 50W)	58-30-33	PS467	2022/11/25	2023/11/24
REALE	Temp. & Humid. Chamber	RHP-800BT	R2017031831 0	2022/11/23	2023/11/22
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2022/04/24	2023/04/24

* **Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

§2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f ²)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

f = frequency in MHz. * = Plane-wave equivalent power density.

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Frequency (MHz)	Antenna Gain		Tune up conducted power		Distance (cm)	Power density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)			
400-470	2.5	1.78	31	1258.93	20	0.446	1.33

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance

FCC §2.1046 & §90.205 - RF OUTPUT POWER

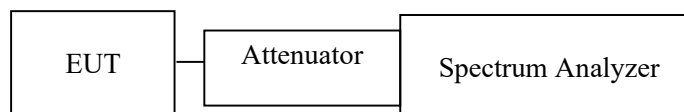
Applicable Standard

FCC §2.1046 and §90.205

Test Procedure

According to ANSI C63.26-2015 section 5.2.3.3

Conducted RF Output Power:



Note: The path loss from EUT to Spectrum Analyzer has included in the result.

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

Spectrum Analyzer Setting:

R B/W	Video B/W
100 kHz	300 kHz

Test Data

Environmental Conditions

Temperature:	26.7 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2023-02-17.

Test Mode: Transmitting

Test Result: Pass. Please refer to following table and plots.

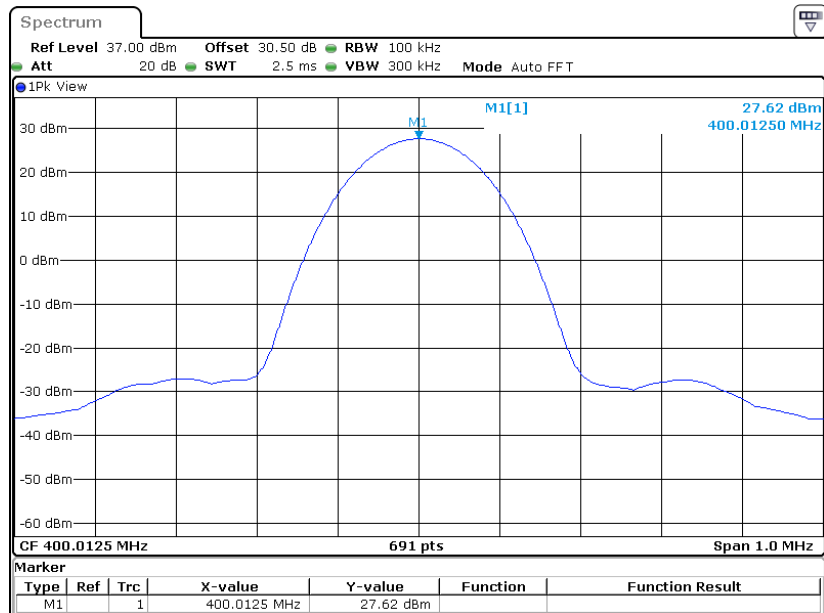
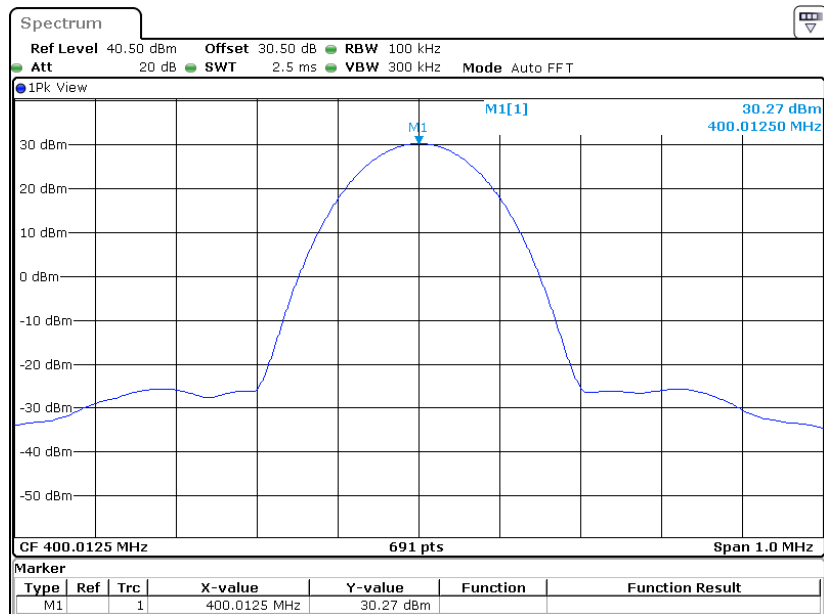
Mode	Frequency Spacing (kHz)	Frequency (MHz)	Power level	Output (dBm)	Output Power (W)
Analog	12.5	400.0125	L	27.62	0.578
			H	30.27	1.064
	12.5	435.0125	L	27.45	0.556
			H	30.30	1.072
	12.5	469.9875	L	27.28	0.537
			H	30.70	1.175
Digital	12.5	400.0125	L	27.53	0.566
			H	29.14	0.820
	12.5	435.0125	L	27.13	0.516
			H	29.24	0.839
	12.5	469.9875	L	27.50	0.562
			H	29.18	0.828

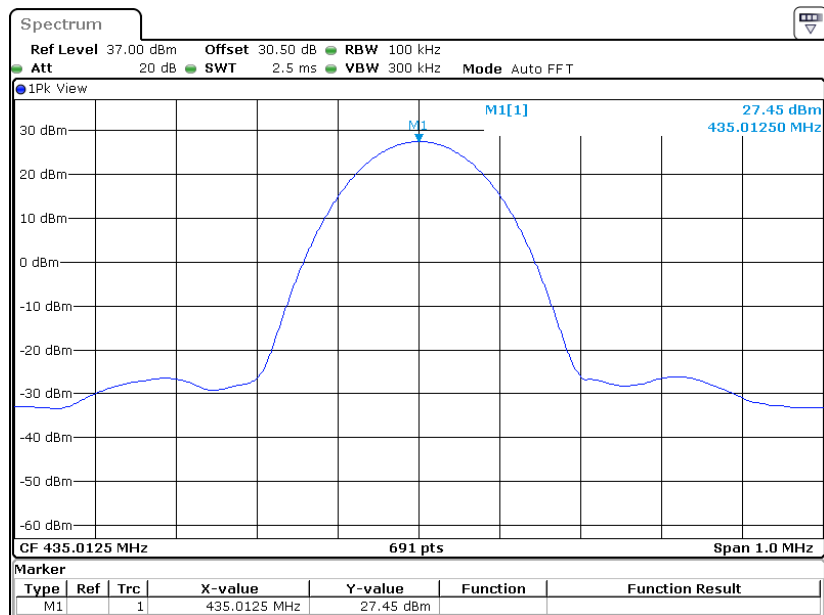
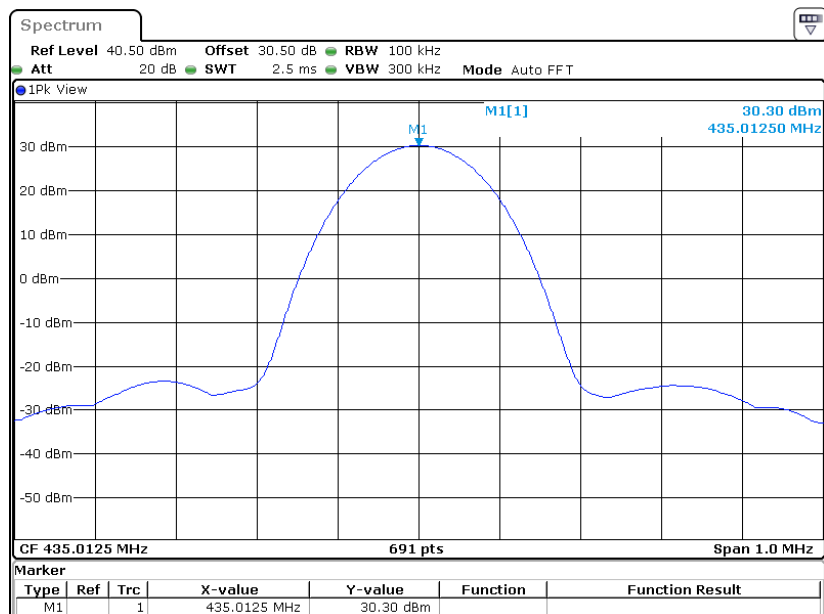
Note: The output power shall not exceed by more than 20 percent the manufacturer's rated output power.

Rated high power: 1W (Limit: $\leq 1.2W$)

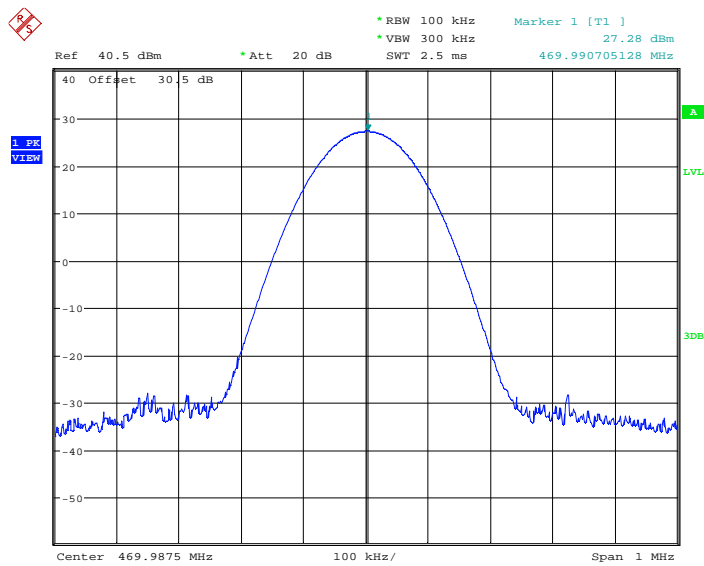
Rated low power: 0.5W (Limit: $\leq 0.6W$)

Analog:

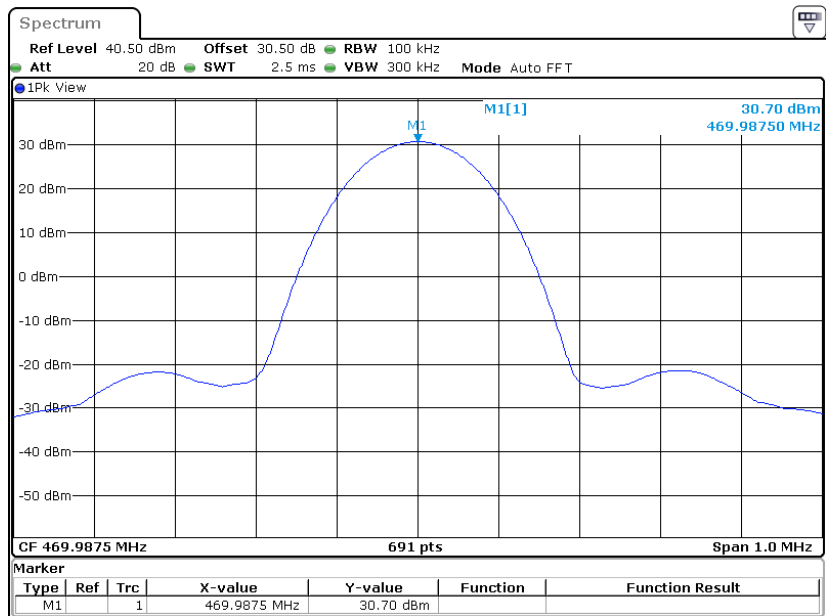
Frequency 400.0125MHz, Low Power**Frequency 400.0125 MHz, High Power**

Frequency 435.0125MHz, Low Power**Frequency 435.0125MHz, High Power**

Frequency 469.9875 MHz, Low Power

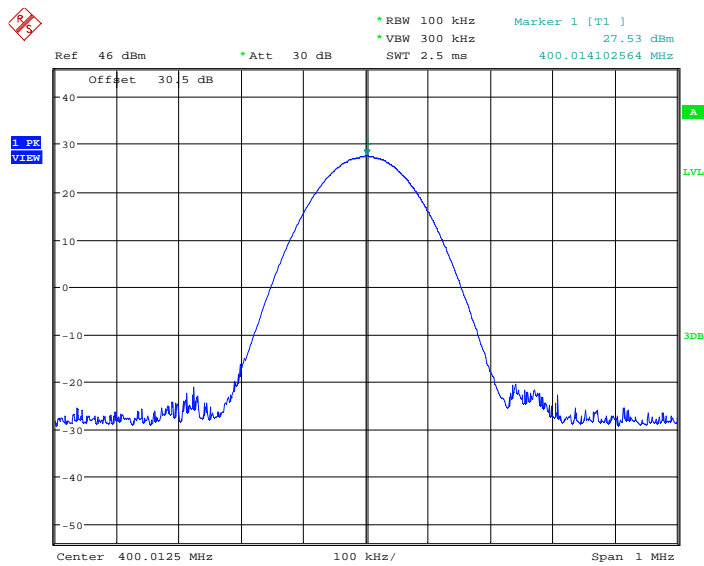


Frequency 469.9875 MHz, High Power

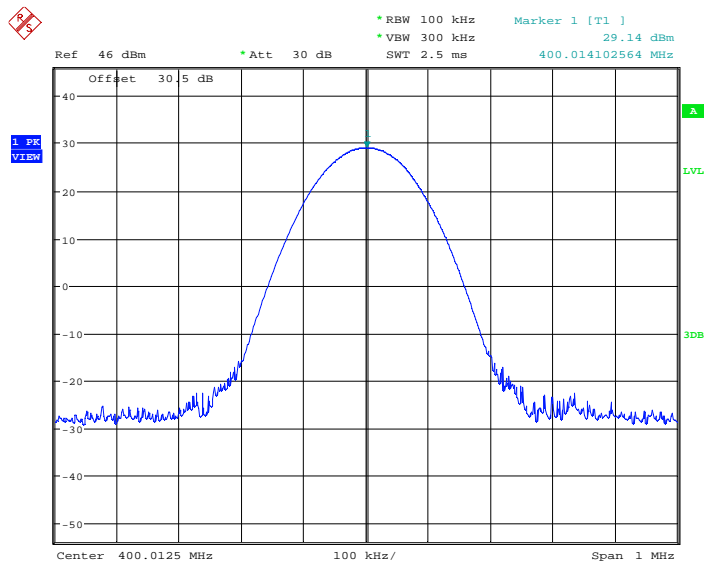


Digital:

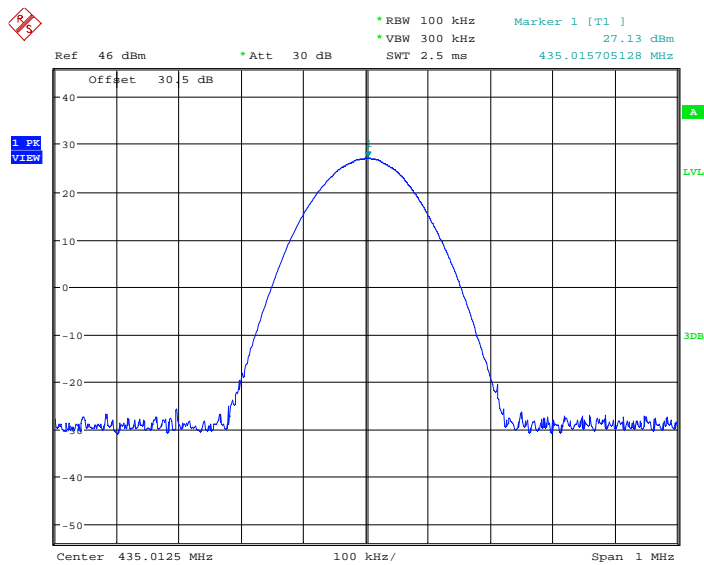
Frequency 400.0125MHz, Low Power



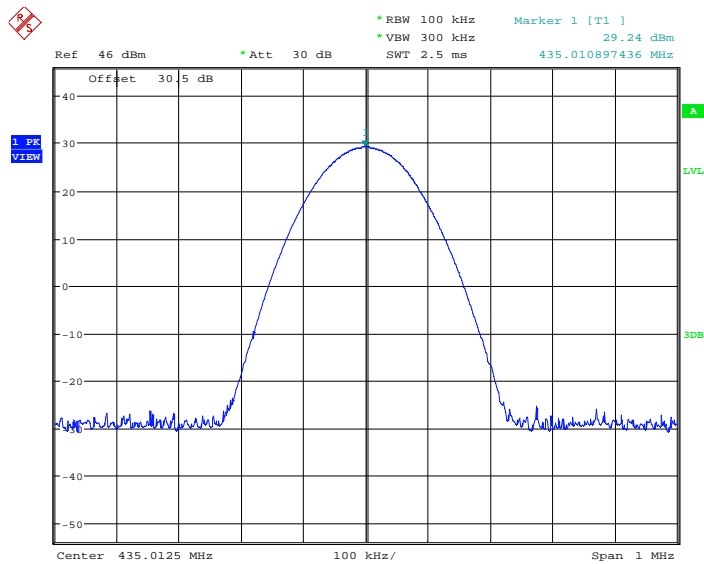
Frequency 400.0125 MHz, High Power



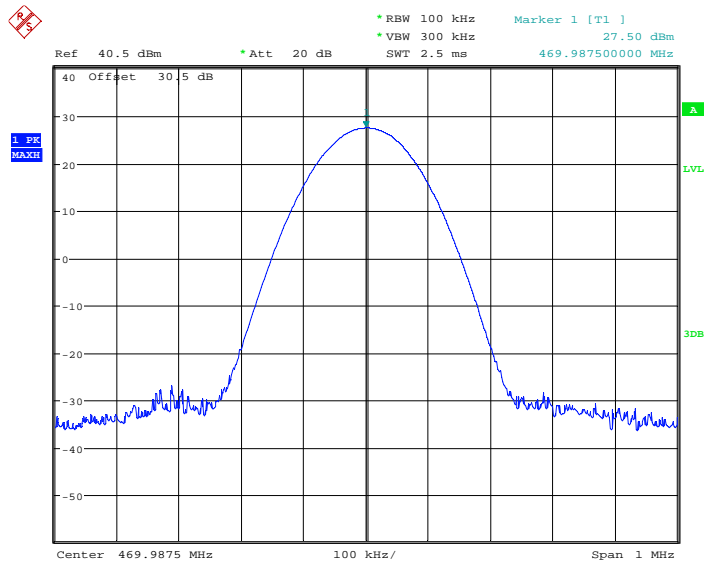
Frequency 435.0125MHz, Low Power



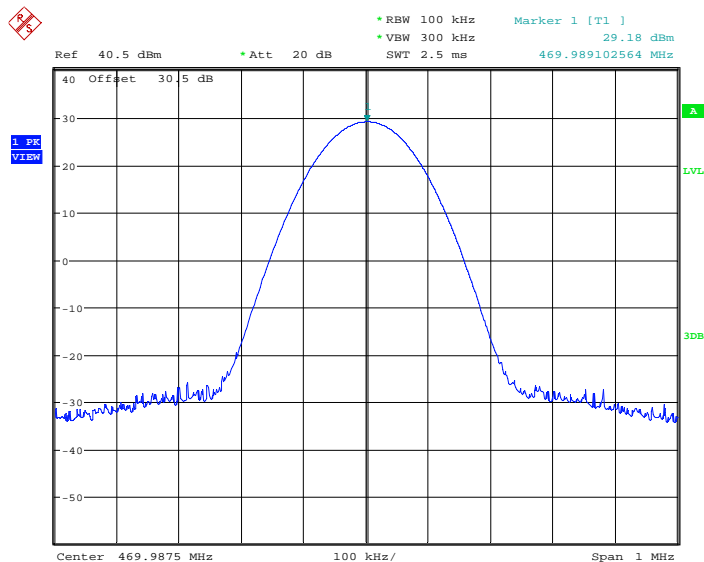
Frequency 435.0125MHz, High Power



Frequency 469.9875 MHz, Low Power



Frequency 469.9875 MHz, High Power



FCC §2.1047 & §90.207 - MODULATION CHARACTERISTIC

Applicable Standard

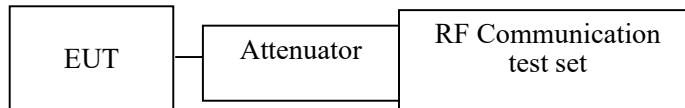
FCC§2.1047 and §90.207:

- (a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
- (b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

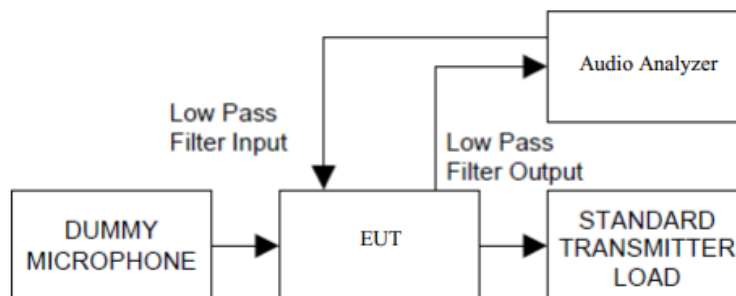
Test Procedure

Test Method: ANSI C63.26-2015 section 5.3

For modulation limiting and audio frequency response:



For Audio Low Pass Filter Response:



Test Data

Environmental Conditions

Temperature:	26.7 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2023-02-17.

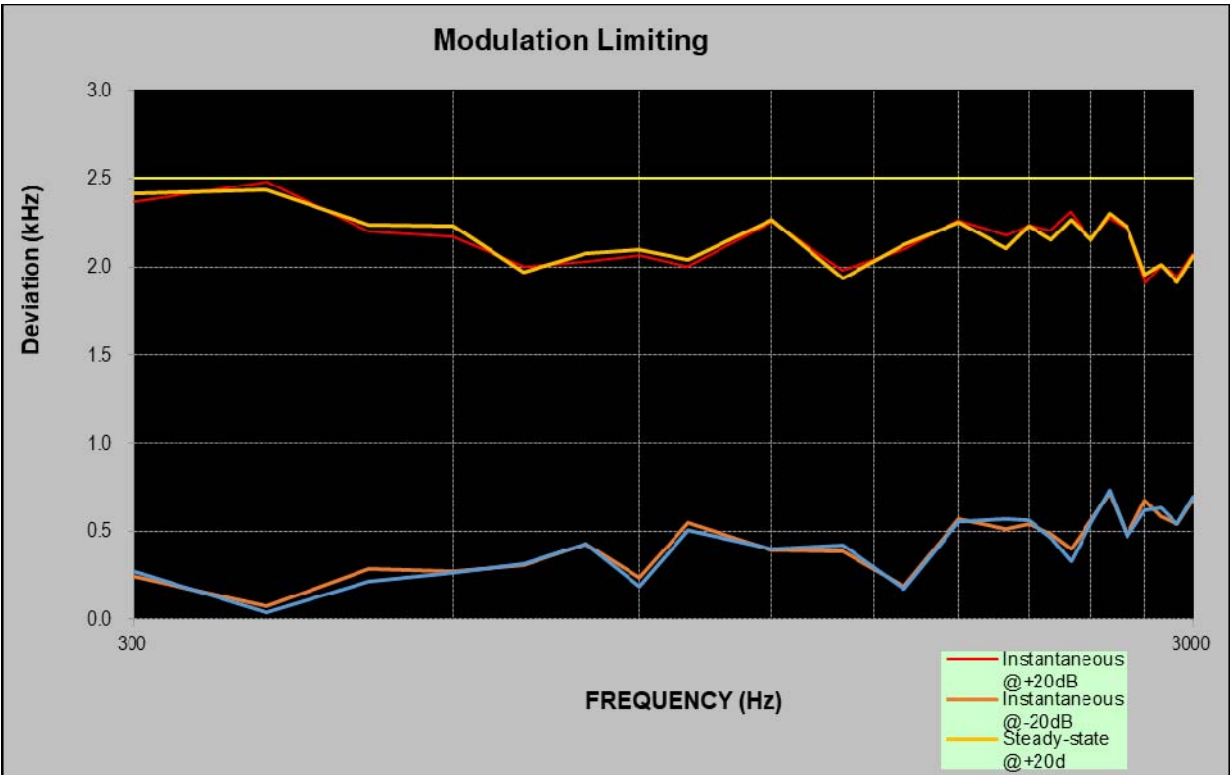
Test Mode: Transmitting

Test Result: Pass. Please refer to the following tables and plots.

Analog Modulation:**MODULATION LIMITING**

Carrier Frequency: 435.0125MHz separation:12.5kHz

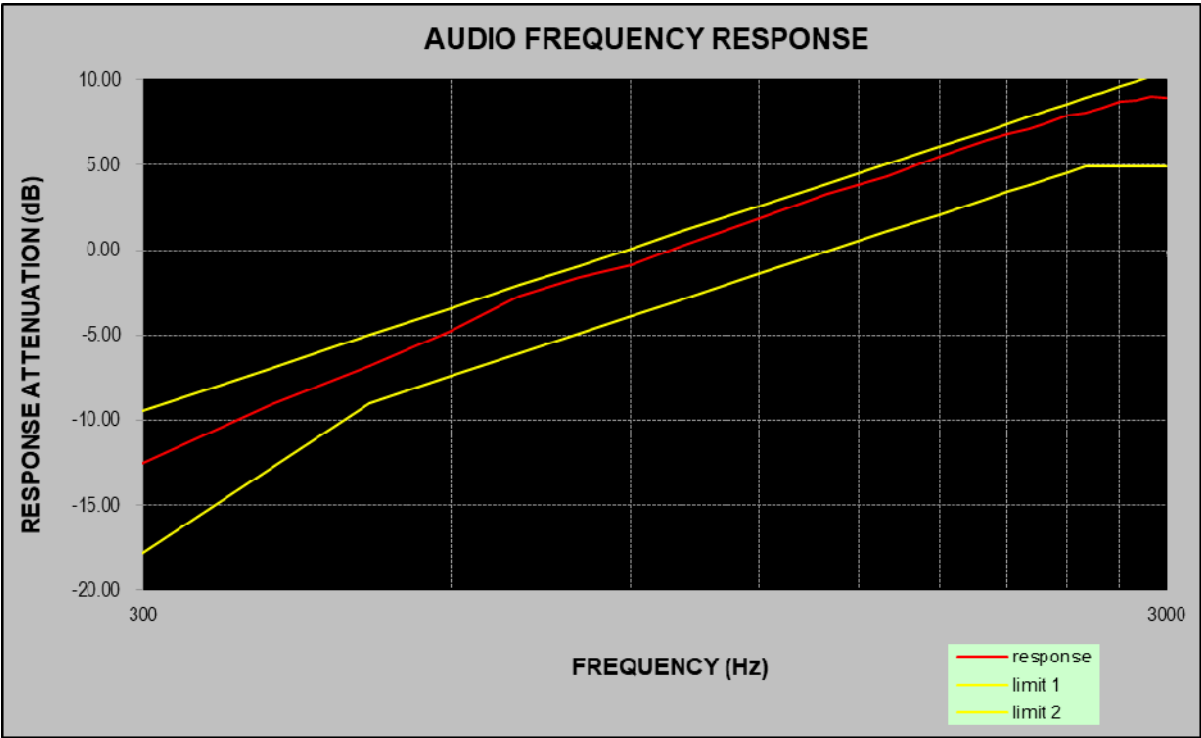
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	2.368	0.242	2.416	0.273	2.500
400	2.481	0.076	2.435	0.037	2.500
500	2.197	0.284	2.241	0.219	2.500
600	2.173	0.272	2.232	0.266	2.500
700	1.999	0.310	1.966	0.313	2.500
800	2.027	0.425	2.078	0.427	2.500
900	2.063	0.236	2.093	0.186	2.500
1000	2.000	0.548	2.039	0.502	2.500
1200	2.255	0.392	2.268	0.397	2.500
1400	1.982	0.388	1.931	0.418	2.500
1600	2.101	0.188	2.124	0.175	2.500
1800	2.261	0.566	2.253	0.556	2.500
2000	2.181	0.515	2.103	0.568	2.500
2100	2.237	0.543	2.234	0.559	2.500
2200	2.207	0.486	2.153	0.466	2.500
2300	2.311	0.401	2.264	0.329	2.500
2400	2.153	0.565	2.152	0.551	2.500
2500	2.274	0.721	2.299	0.735	2.500
2600	2.216	0.474	2.222	0.473	2.500
2700	1.910	0.673	1.952	0.621	2.500
2800	2.008	0.581	2.008	0.632	2.500
2900	1.947	0.543	1.913	0.539	2.500
3000	2.074	0.685	2.063	0.695	2.500



Audio Frequency Response

Carrier Frequency: 435.0125MHz separation:12.5kHz

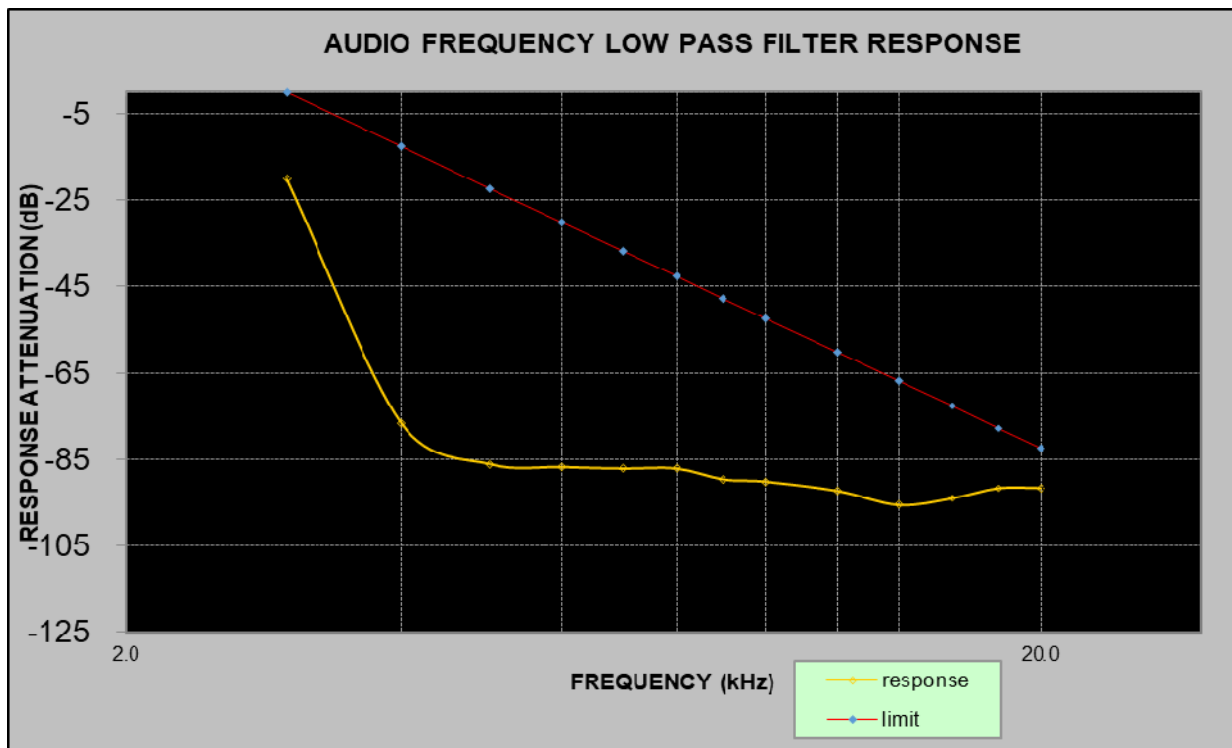
Audio Frequency (Hz)	Response Attenuation (dB)
300	-12.53
400	-9.08
500	-6.83
600	-4.74
700	-2.72
800	-1.60
900	-0.85
1000	0
1200	1.85
1400	3.29
1600	4.33
1800	5.53
2000	6.46
2100	6.83
2200	7.09
2300	7.46
2400	7.91
2500	8.08
2600	8.37
2700	8.69
2800	8.82
2900	9.02
3000	8.98



Audio frequency lows pass filter response

Carrier Frequency:435.0125MHz separation:12.5kHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	-0.5	/
3.0	-20.1	0.0
4.0	-76.6	-12.5
5.0	-86.0	-22.2
6.0	-86.7	-30.1
7.0	-87.1	-36.8
8.0	-87.1	-42.6
9.0	-89.6	-47.7
10.0	-90.1	-52.3
12.0	-92.2	-60.2
14.0	-95.5	-66.9
16.0	-94.0	-72.7
18.0	-91.6	-77.8
20.0	-91.6	-82.5



FCC §2.1049 & §90.209 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK

Applicable Standard

FCC §2.1049 and §90.210

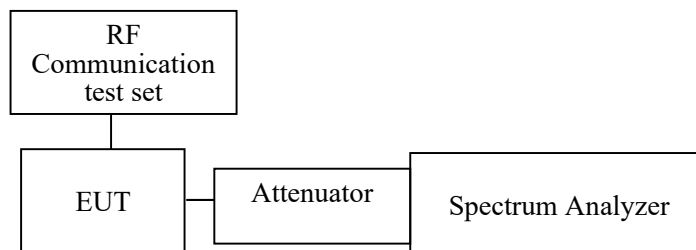
Emission Mask D - 12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) For any frequency removed from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 , 0dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 ($f_d - 2.88$ kHz) dB.
- 3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz at least: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

Test Procedure

According to ANSI C63.26-2015 section 5.4

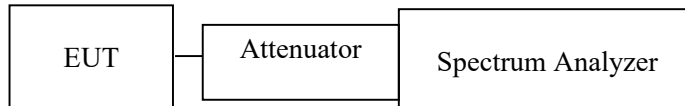
Analog mode:



Note: The path loss from EUT to Spectrum Analyzer has included in the result.

- a) Connect the equipment as illustrated.
- b) Adjust the spectrum analyzer for the following settings:
 - 1) Resolution Bandwidth: 100Hz for 12.5Hz Channel spacing, 200Hz for 25Hz Channel spacing .
 - 2) Video Bandwidth at least 10 times the resolution bandwidth.
 - 3) Sweep Speed slow enough to maintain measurement calibration.
 - 4) Detector Mode = Positive Peak.
 - 5) Span that will allow proper viewing of the test bandwidth.
- c) Set the center frequency of the spectrum analyzer to the assigned transmitter frequency. Key the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the 0 dB reference for the measurement.
- d) 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. Transmitters employing digital modulation techniques that bypass the limiter and the audio low-pass filter shall be modulated as specified by the manufacturer.

- e) Path loss for the measurement included.
- f) Measured the 26dB bandwidth, and use the spectrum analyzer Occupied bandwidth function to measurement the 99% Occupied bandwidth, save the plot
- g) Record the resulting spectrum analyzer presentation of the emission level with an on-line recording device or in a photograph. It is recommended that the emission limit be drawn on the plotted graph or photograph. The spectrum analyzer presentation is the sideband spectrum

Digital mode:

- a) Program and set radio to operate in desire test frequency and digital mode with modulation.
- b) Connect the equipment as illustrated.
- c) Adjust the spectrum analyzer for the following settings:
 - 1) Resolution Bandwidth: 100Hz.
 - 2) Video Bandwidth at least 10 times the resolution bandwidth.
 - 3) Sweep Speed slow enough to maintain measurement calibration.
 - 4) Detector Mode = Positive Peak.
 - 5) Span that will allow proper viewing of the test bandwidth.
- d) Set the center frequency of the spectrum analyzer to the assigned transmitter frequency. Key the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the 0 dB reference for the measurement.
- e) Path loss for the measurement included in plot
- f) Measured the 26dB bandwidth, and use the spectrum analyzer Occupied bandwidth function to measurement the 99% Occupied bandwidth, save the plot
- g) Record the resulting spectrum analyzer presentation of the emission level with an on-line recording device or in a photograph. It is recommended that the emission limit be drawn on the plotted graph or photograph. The spectrum analyzer presentation is the sideband spectrum

Test Data**Environmental Conditions**

Temperature:	26.7 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2023-02-17.

Test mode: transimitting

Test Result: Pass. Please refer to the following tables and plots.

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)
Analog	12.5	400.0125	L	5.15	5.24
			H	5.16	10.00
		435.0125	L	5.14	5.23
			H	5.16	7.62
		469.9875	L	5.14	5.23
			H	5.16	7.64
Digital	12.5	400.0125	L	7.29	9.29
			H	7.29	9.13
		435.0125	L	6.80	9.26
			H	6.95	9.48
		469.9875	L	7.21	9.29
			H	7.21	8.97

Note: Emission designator is base on calculation instead of measurement.

Emission Designator Per CFR 47 §2.201& §2.202&, $B_n = 2M + 2D$

For FM Mode (Channel Spacing: 12.5 kHz)

Emission Designator 11K0F3E. In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation. $BW = 2(M+D) = 2(3.0 \text{ kHz} + 2.5 \text{ kHz}) = 11 \text{ kHz} \rightarrow 11K0$*

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 Digital Mode (Channel Spacing: 12.5 kHz)

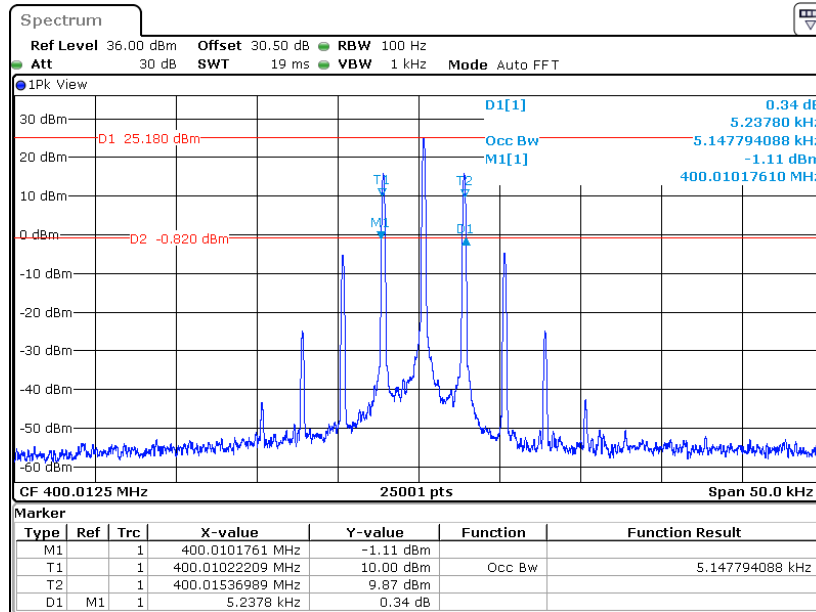
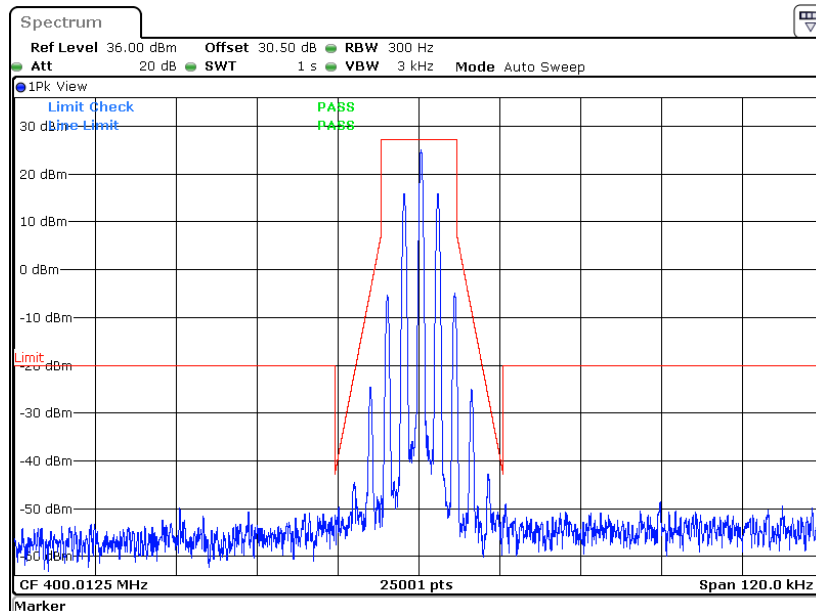
Emission Designator 7K60F1D and 7K60F1E

The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz. The emission mask was obtained from 47CFR 90.210(d).

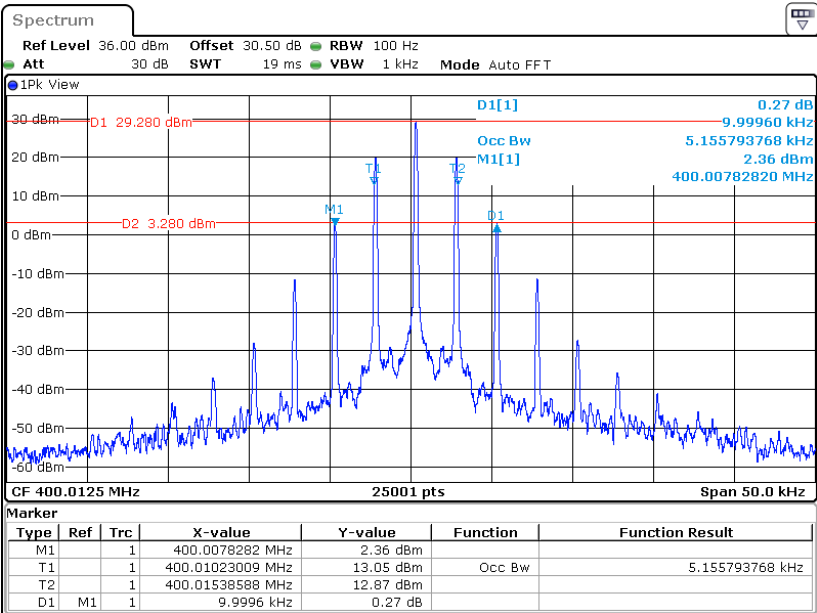
F1D and F1E portion of the designator indicates digital information.

Therefore, the entire designator for 12.5 kHz channel spacing digital mode is 7K60F1D and 7K60F1E.

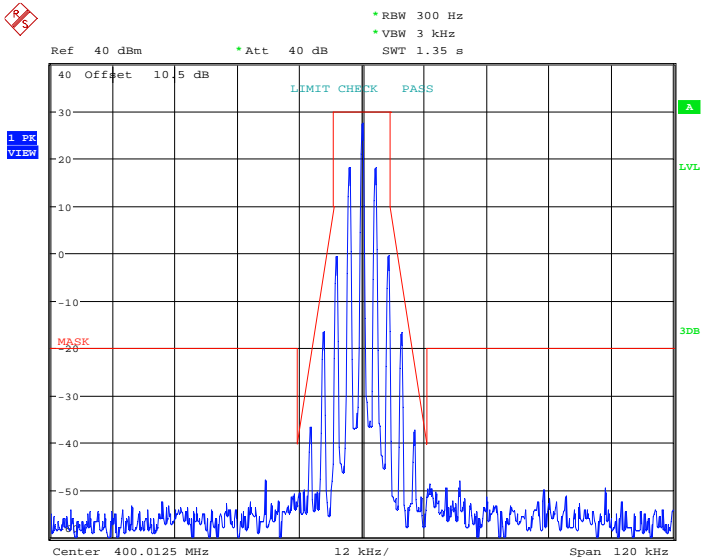
Analog

Frequency 400.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**Frequency 400.0125 MHz: Emission Mask D, Low Power**

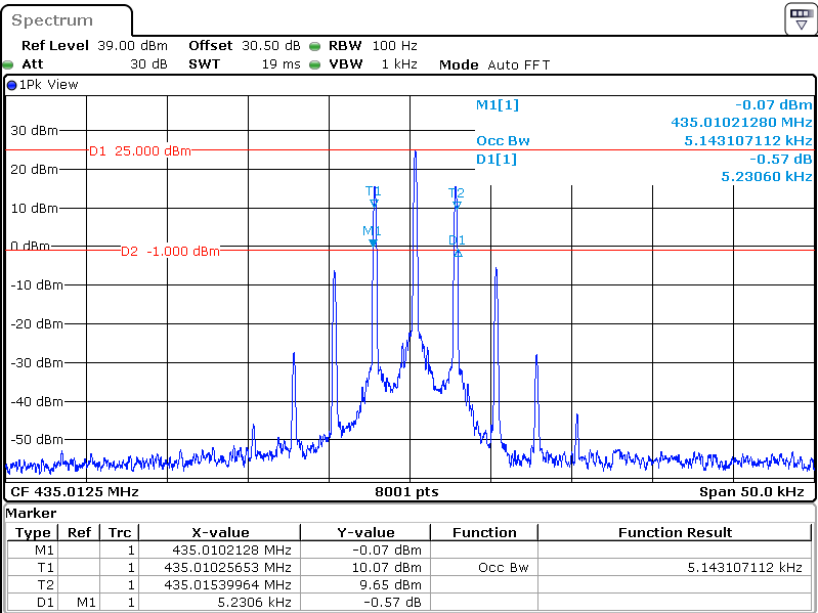
Frequency 400.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



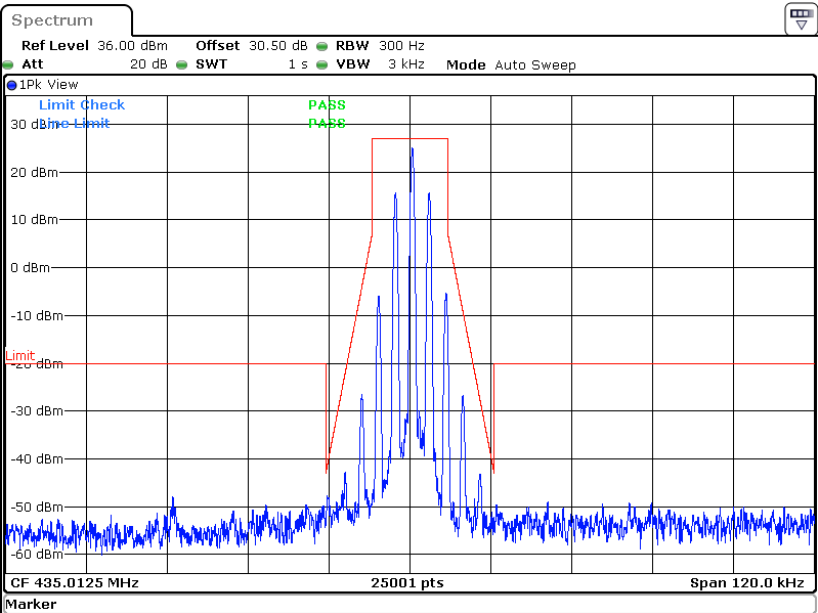
Frequency 400.0125 MHz: Emission Mask D, High Power



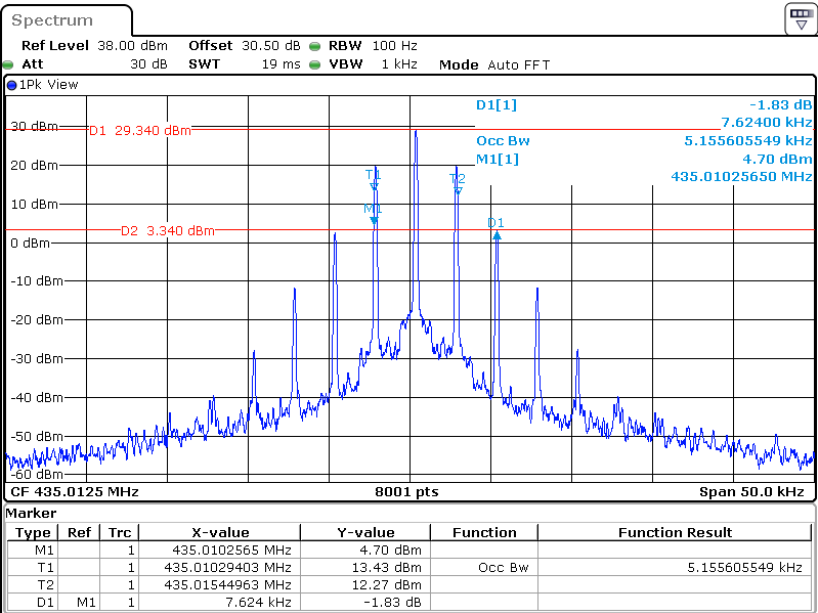
Frequency 435.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



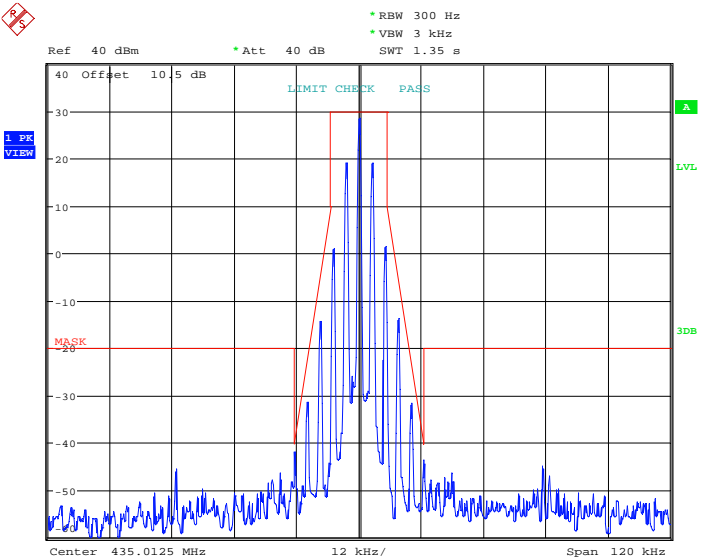
Frequency 435.0125 MHz: Emission Mask D, Low Power

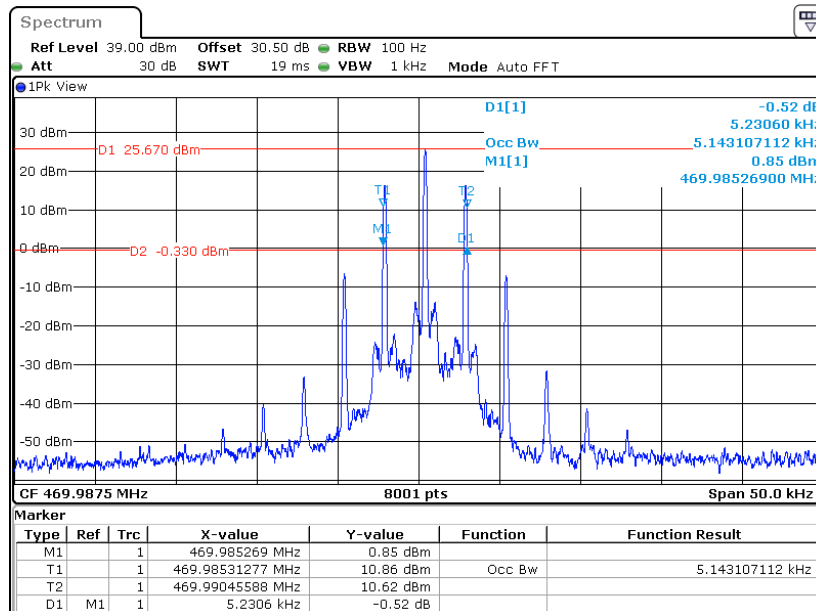
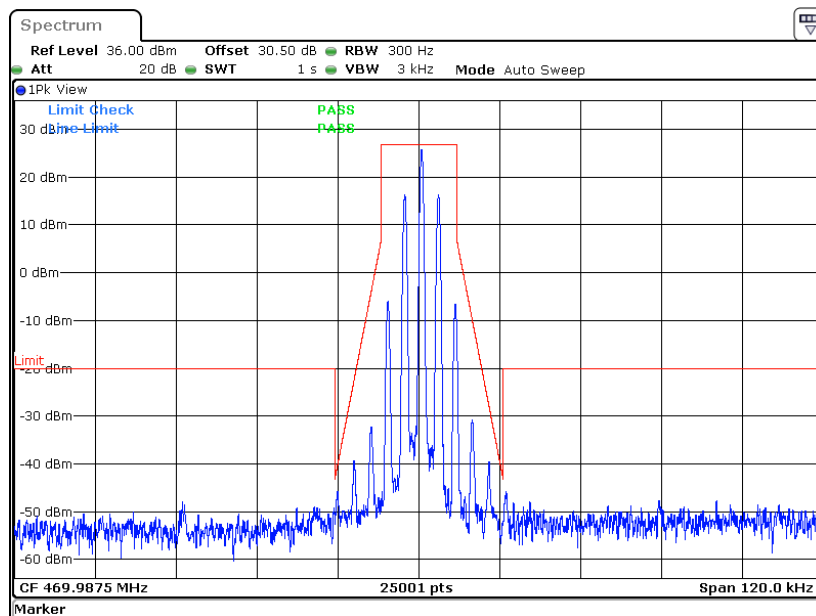


Frequency 435.0125MHz: 99% Occupied & 26 dB Bandwidth, High Power

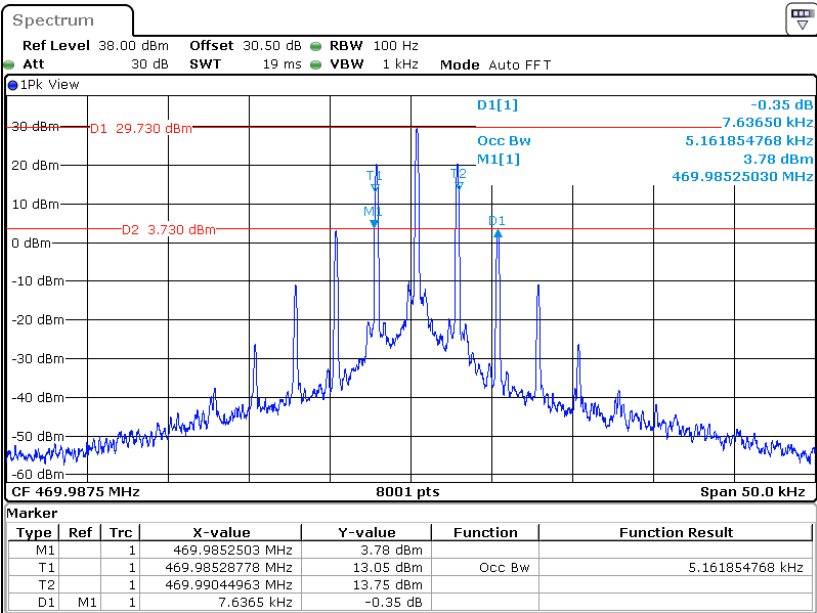


Frequency 435.0125 MHz: Emission Mask D, High Power

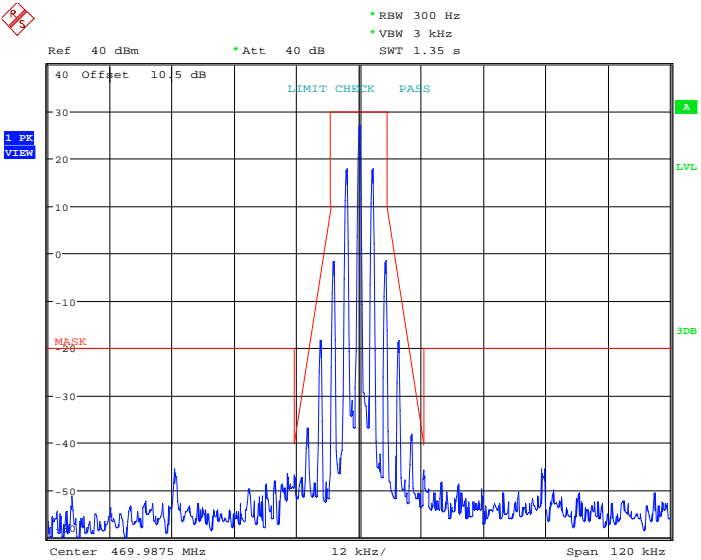


Frequency 469.9875 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**Frequency 469.9875 MHz: Emission Mask D, Low Power**

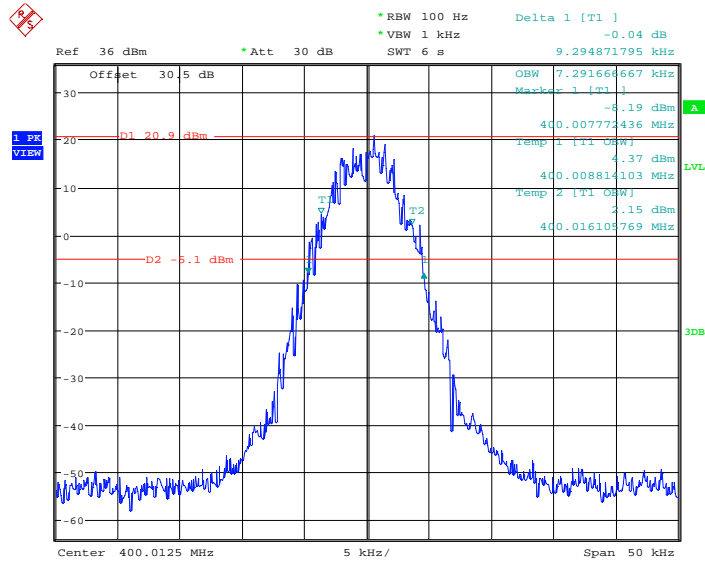
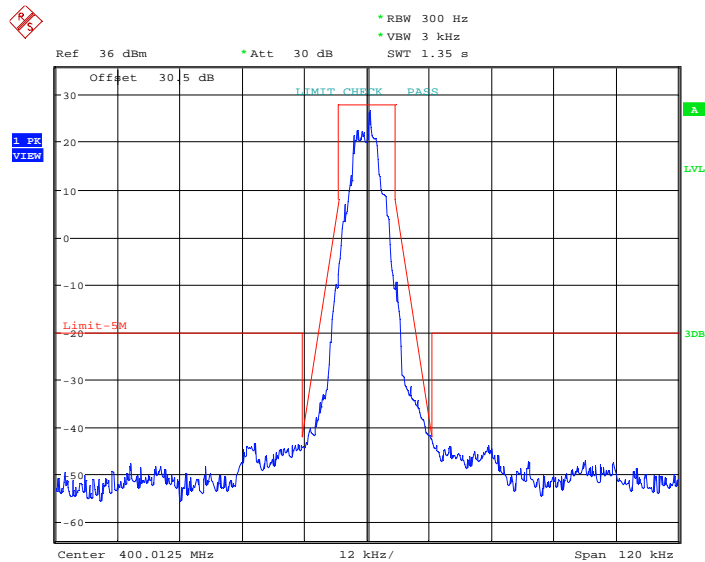
Frequency 469.9875 MHz: 99% Occupied & 26 dB Bandwidth, High Power

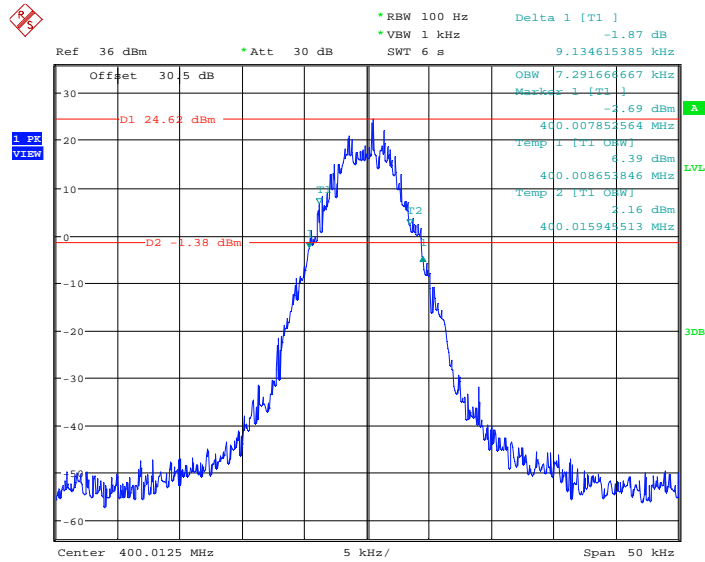
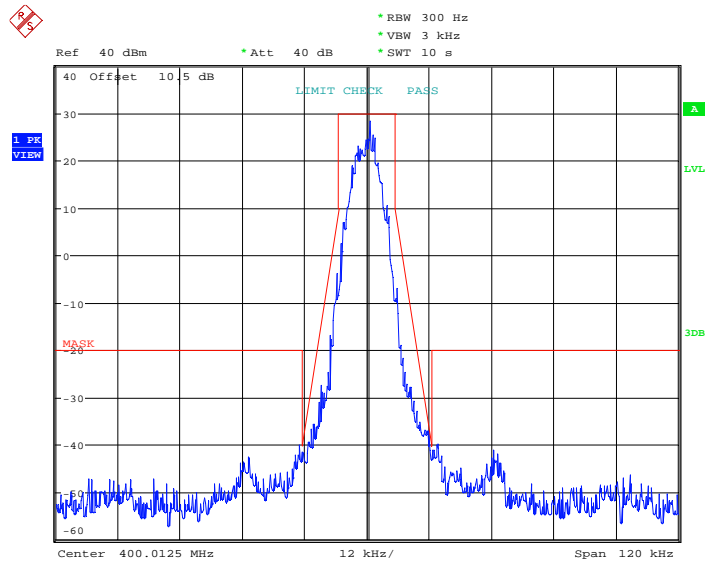


Frequency 469.9875 MHz: Emission Mask D, High Power

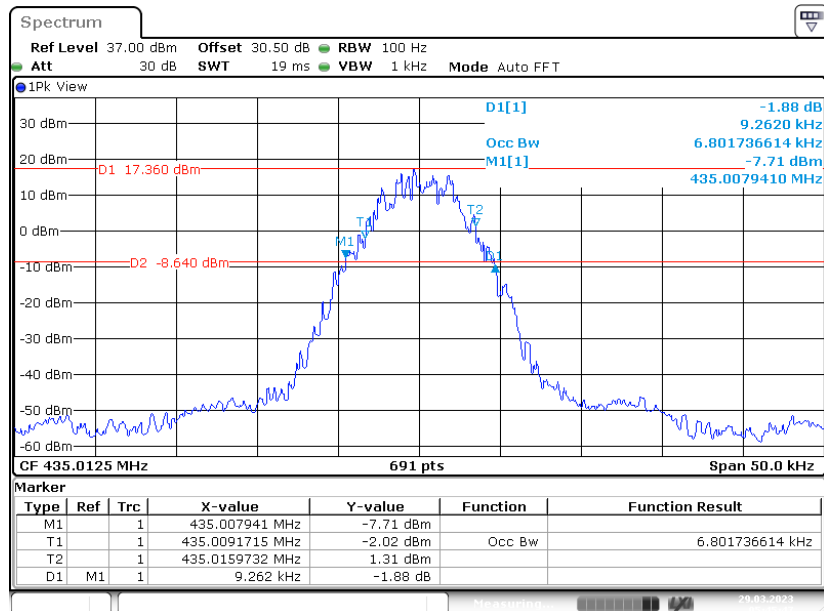


Digital

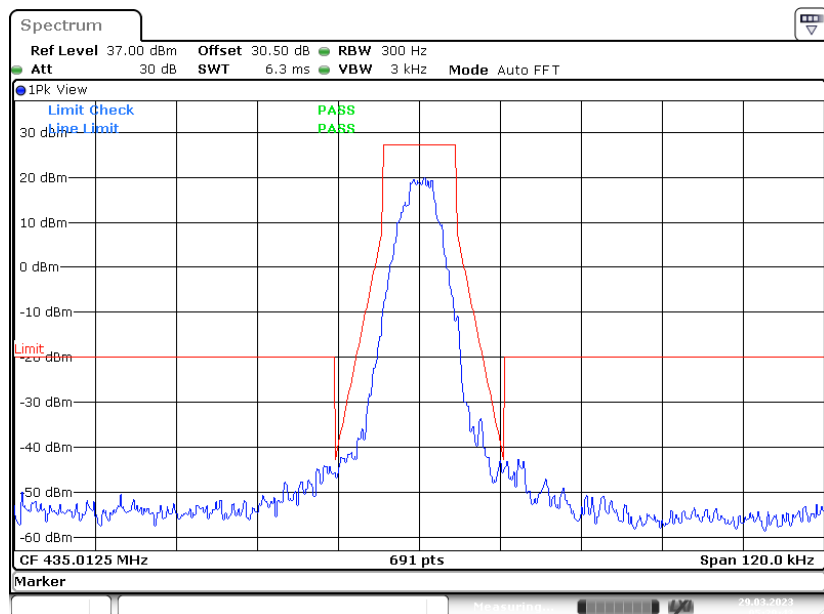
Frequency 400.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**Frequency 400.0125 MHz: Emission Mask D, Low Power**

Frequency 400.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power**Frequency 400.0125 MHz: Emission Mask D, High Power**

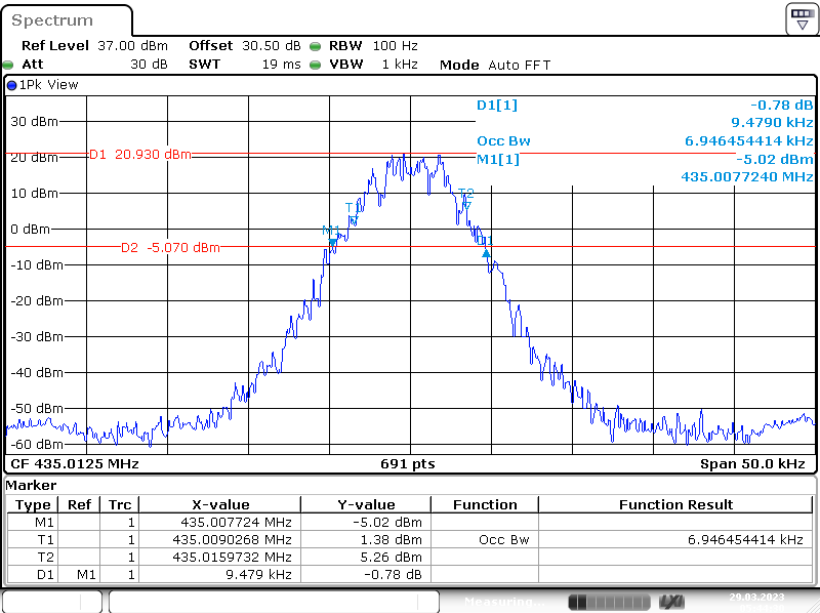
Frequency 435.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



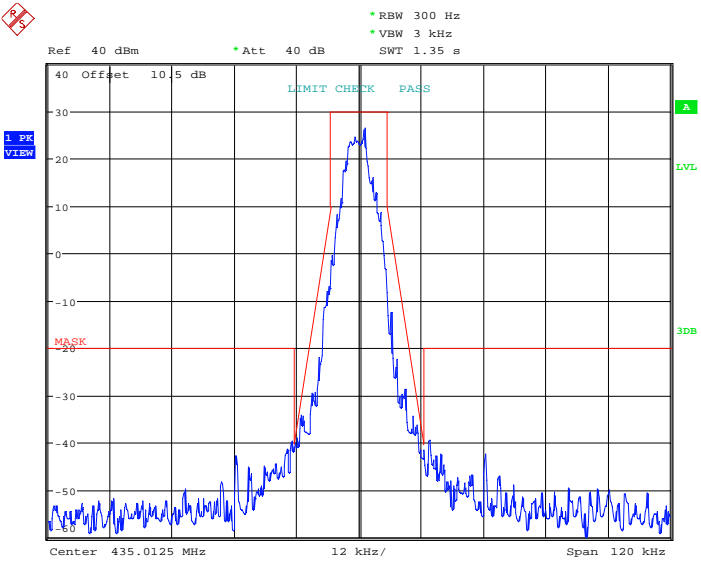
Frequency 435.0125 MHz: Emission Mask D, Low Power

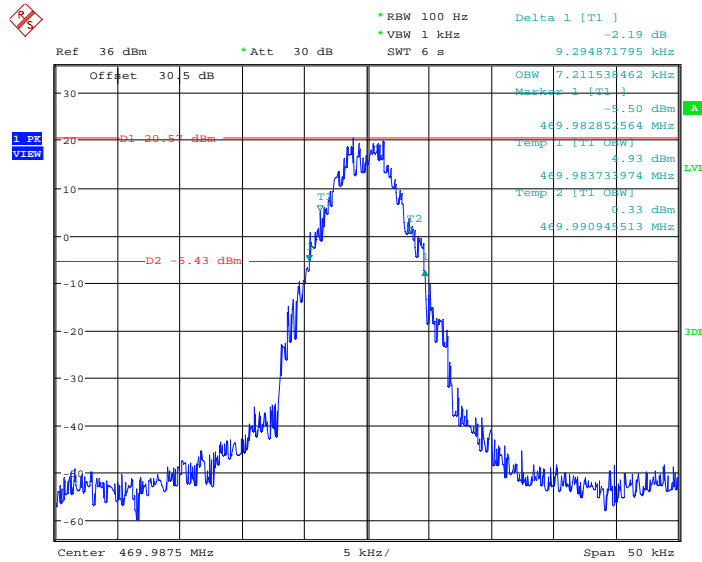
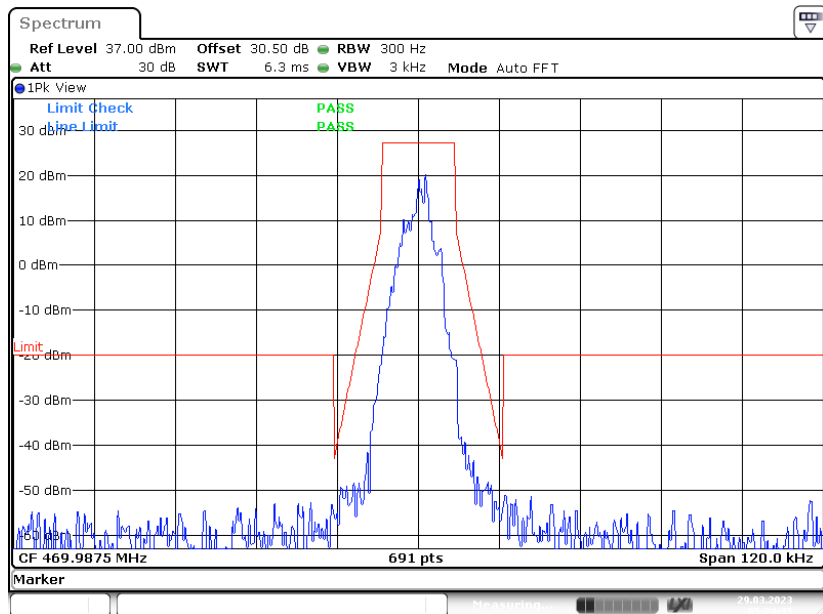


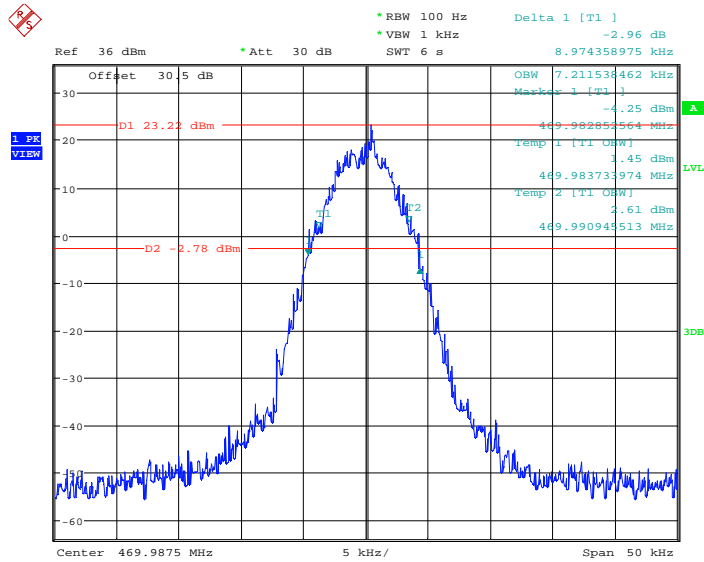
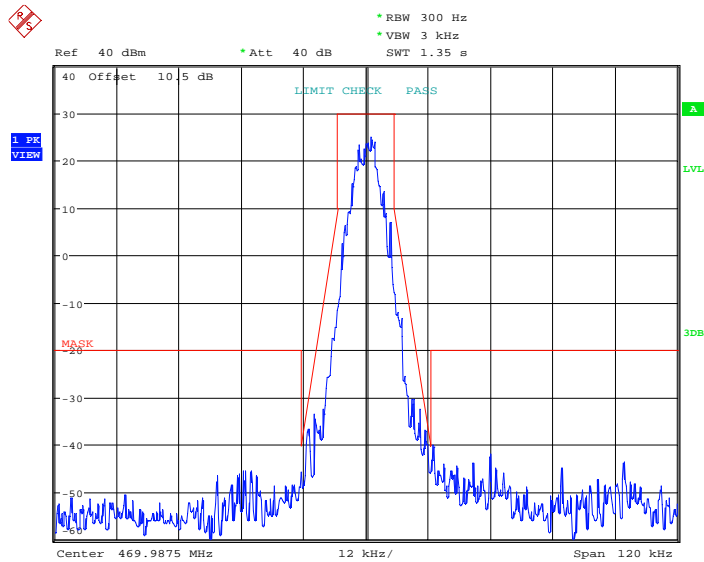
Frequency 435.0125MHz: 99% Occupied & 26 dB Bandwidth, High Power



Frequency 435.0125 MHz: Emission Mask D, High Power



Frequency 469.9875 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**Frequency 469.9875 MHz: Emission Mask D, Low Power**

Frequency 469.9875 MHz: 99% Occupied & 26 dB Bandwidth, High Power**Frequency 469.9875 MHz: Emission Mask D, High Power**

FCC §2.1051 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

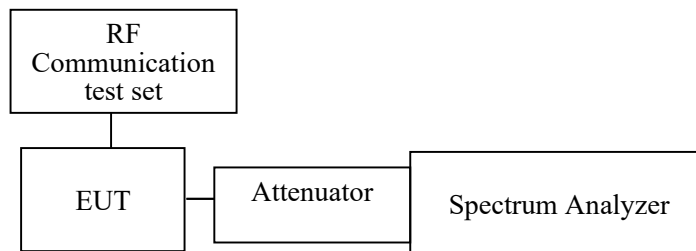
Applicable Standard

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) For any frequency removed from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 , 0 dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 ($f_d - 2.88$ kHz) dB.
- 3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

Test Procedure

According to ANSI C63.26-2015 section 5.7



Note: The path loss from EUT to Spectrum Analyzer has included in the result.

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100kHz for below 1GHz, and 1MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

Test Data

Environmental Conditions

Temperature:	22.6~26.7 °C
Relative Humidity:	46~52 %
ATM Pressure:	100.3~101.0 kPa

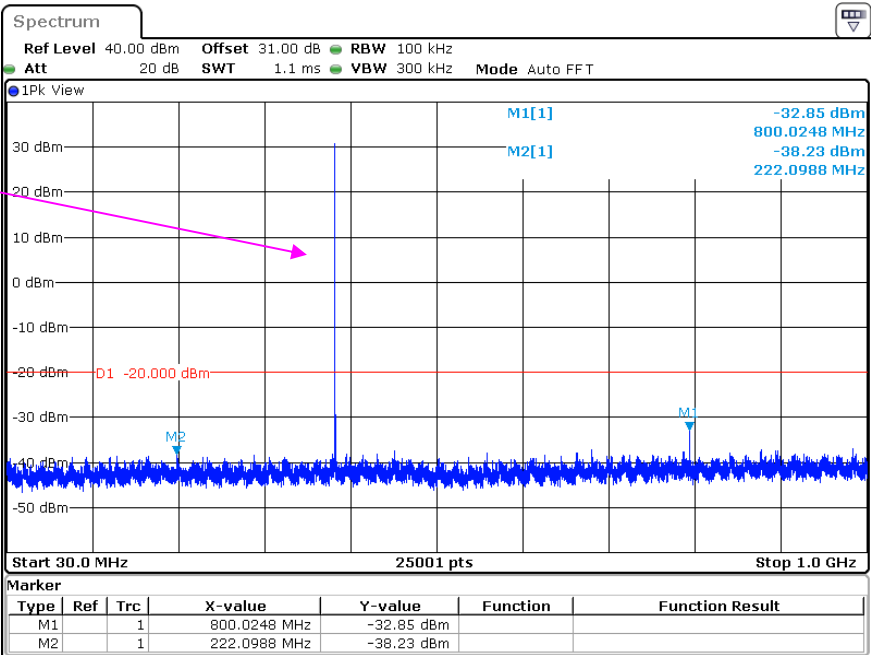
The testing was performed by Nick Fang from 2023-02-17 to 2023-02-23.

Test Mode: Transmitting, worst case for high power level.

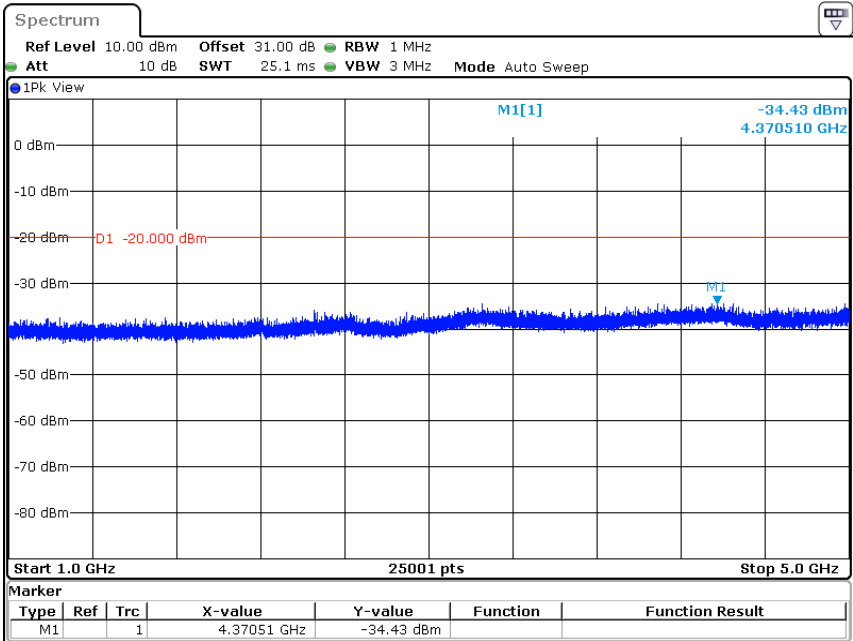
Test Result: Pass. Please refer to the following plots.

Analog

30MHz – 1 GHz, - Low Channel

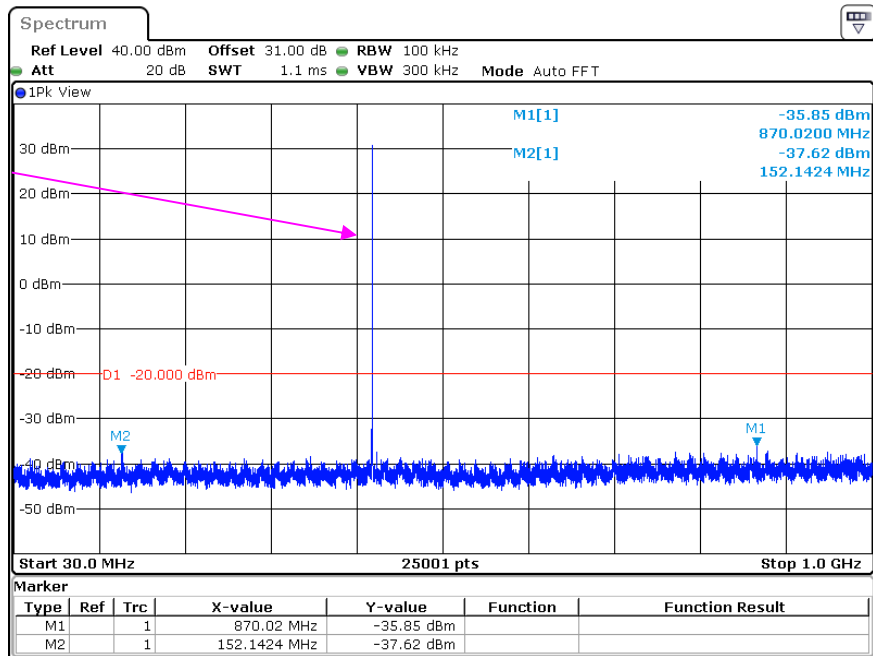


1 GHz – 5 GHz, - Low Channel

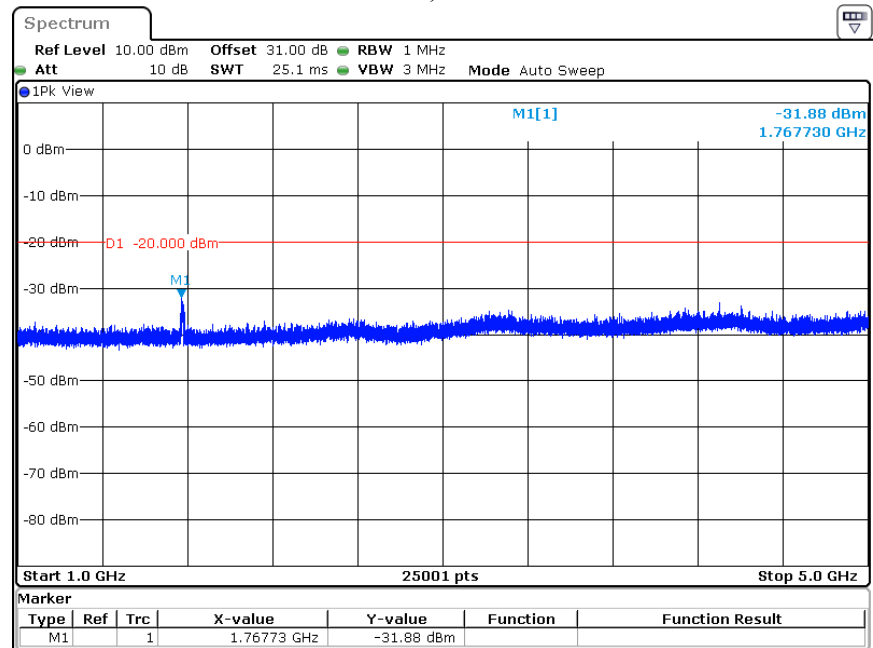


30MHz – 1 GHz, - Middle Channel

Fundamental test

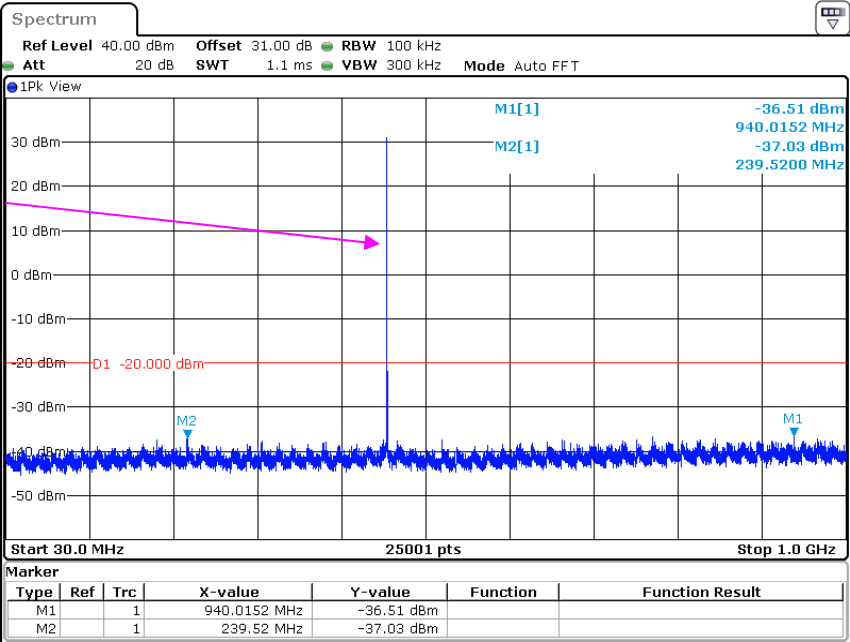


1 GHz – 5 GHz, Middle Channel

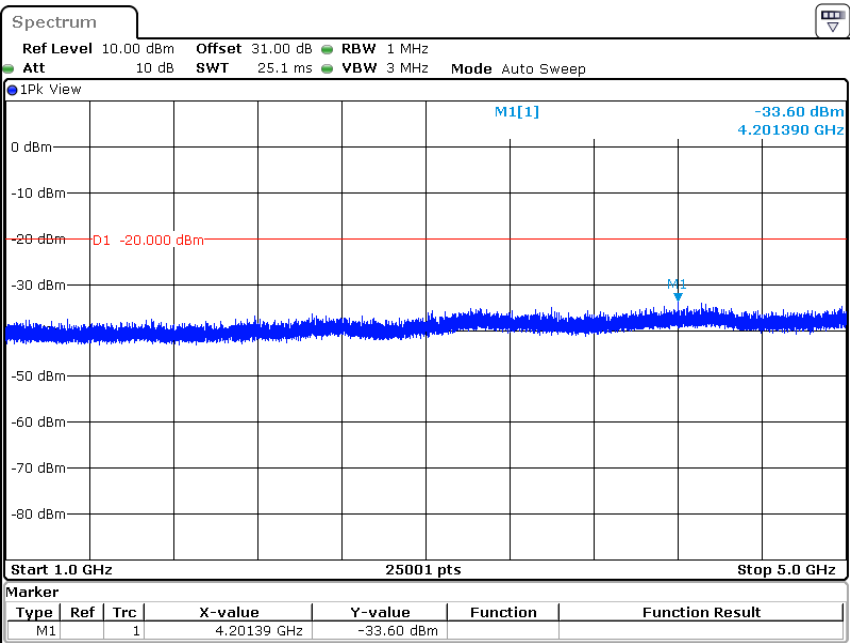


30MHz – 1 GHz, - High Channel

Fundamental test

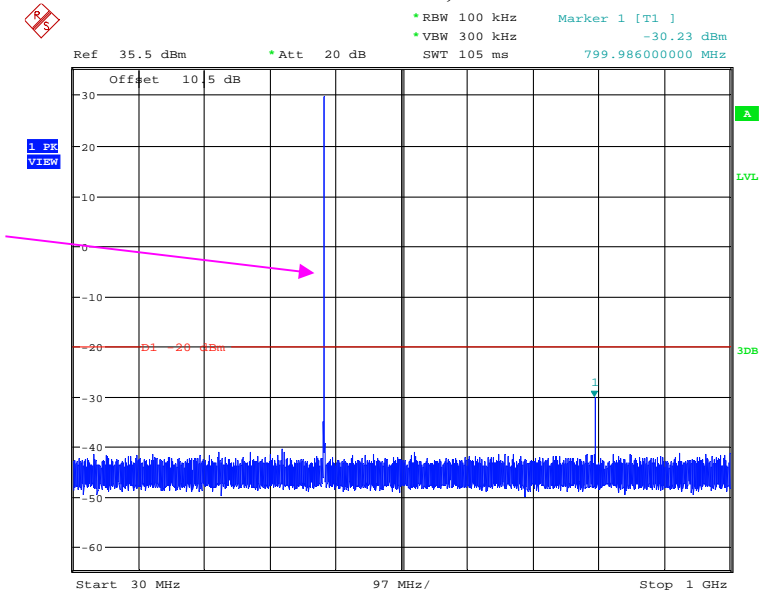


1 GHz – 5 GHz, High Channel



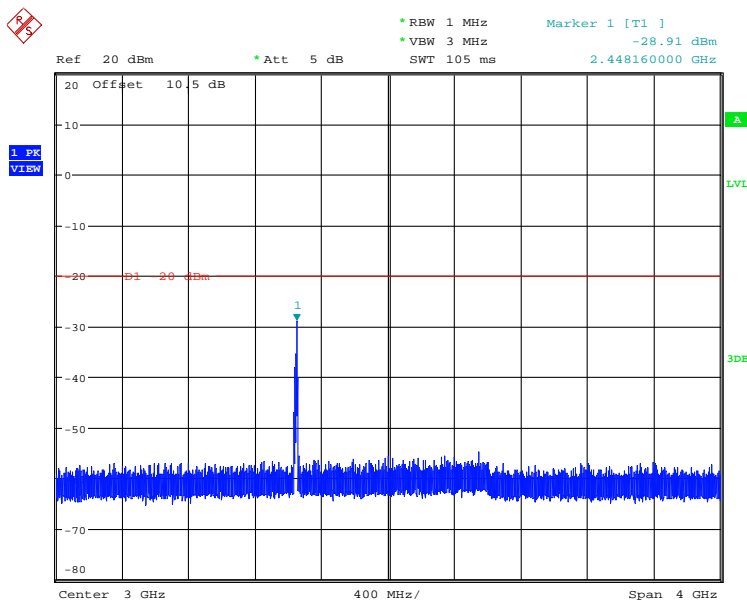
Digital

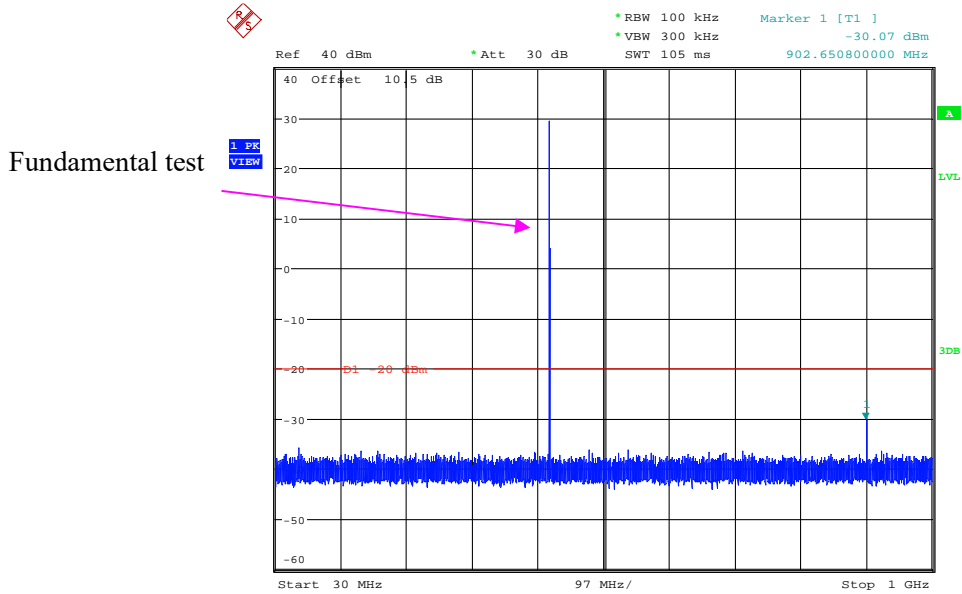
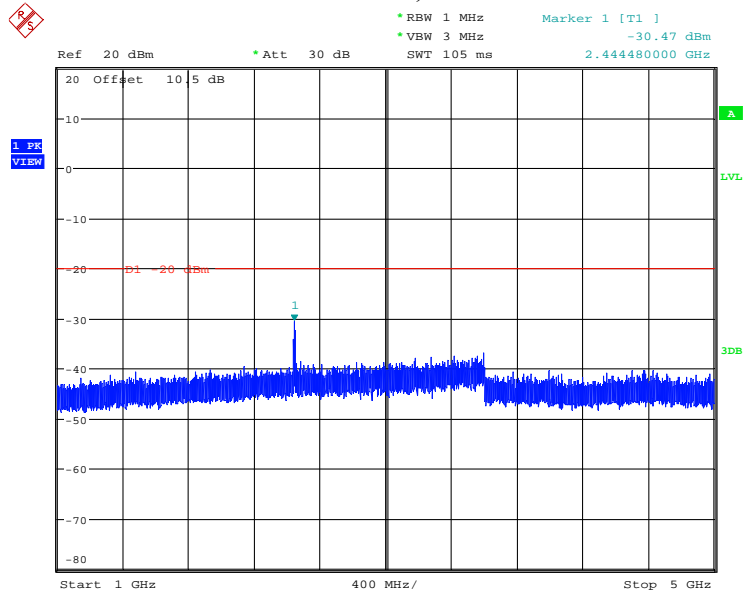
30MHz – 1 GHz, - Low Channel



Fundamental test

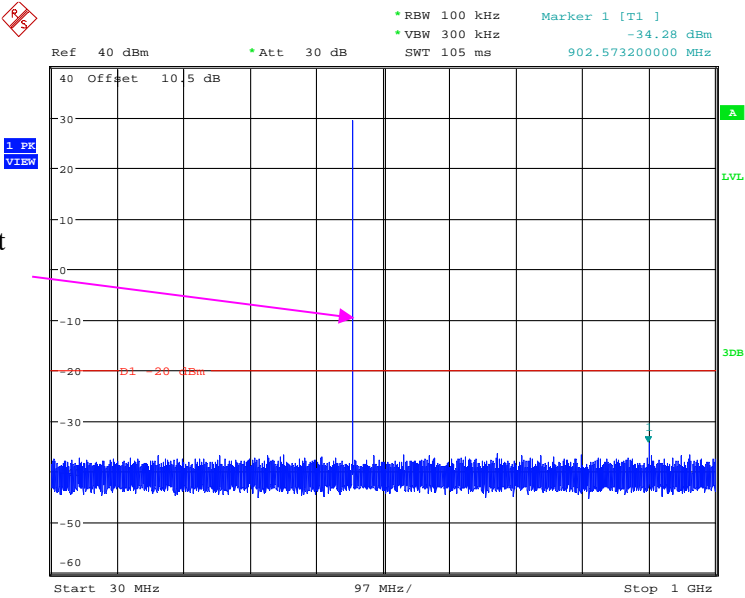
1 GHz – 5 GHz, - Low Channel



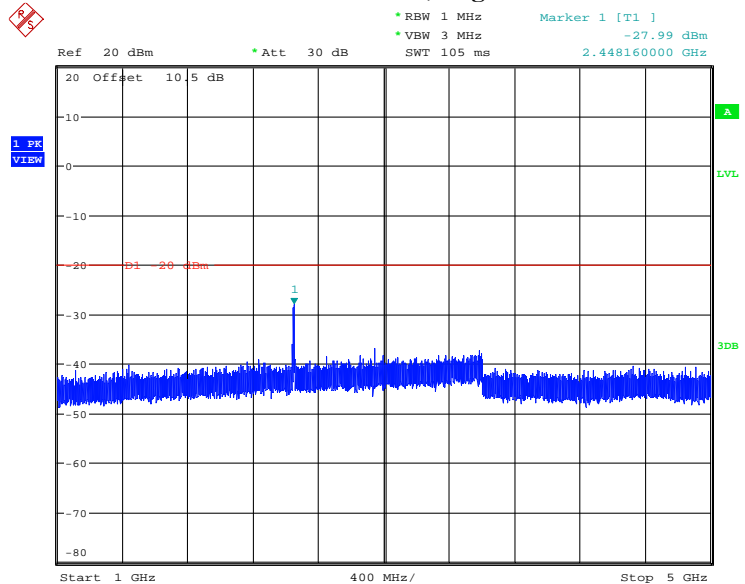
30MHz – 1 GHz, - Middle Channel**1 GHz – 5 GHz, Middle Channel**

30MHz – 1 GHz, - High Channel

Fundamental test



1 GHz – 5 GHz, High Channel



FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053 and §90.210

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to teeth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB = 50 + 10 Log₁₀ (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

Test Data

Environmental Conditions

Temperature:	22~24℃
Relative Humidity:	50~56 %
ATM Pressure:	101.0 kPa

The testing was performed by jimi Zheng on 2023-02-17 for below 1GHz and on 2023-02-20 for above 1GHz.

Test Mode: Transmitting, worst case for high power level.

Note: Scan with X-AXIS, Y-AXIS, Z-AXIS, the worst case Y-AXIS was recorded

Test Result: Pass. Please refer to the following tables.

Analog:

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
400.0125MHz								
800.025	-75.1	271	1.8	H	10.8	-64.3	-20	-44.3
800.025	-69.2	74	1.1	V	9.7	-59.5	-20	-39.5
1200.04	-51.90	66	2.3	H	4.5	-47.40	-20	-27.40
1200.04	-50.40	63	1.1	V	3.6	-46.80	-20	-26.80
1600.05	-56.90	137	1.8	H	4.1	-52.80	-20	-32.80
1600.05	-58.90	339	1.1	V	3.2	-55.70	-20	-35.70
2000.06	-53.90	94	2.3	H	4.3	-49.60	-20	-29.60
2000.06	-52.50	255	1.3	V	3.3	-49.20	-20	-29.20
2400.08	-60.40	276	2.1	H	6.9	-53.50	-20	-33.50
2400.08	-58.30	144	2.3	V	5.9	-52.40	-20	-32.40
2800.09	-59.10	161	1.3	H	6.7	-52.40	-20	-32.40
2800.09	-58.50	331	1.4	V	6.7	-51.80	-20	-31.80
3200.10	-52.10	336	1.9	H	7	-45.10	-20	-25.10
3200.10	-52.60	18	1.8	V	6.8	-45.80	-20	-25.80
3600.11	-66.50	12	1.5	H	8.2	-58.30	-20	-38.30
3600.11	-66.40	47	1.7	V	7.3	-59.10	-20	-39.10
435.0125 MHz								
870.025	-75.8	357	2	H	11.9	-63.9	-20	-43.9
870.025	-70.8	127	2.2	V	11.7	-59.1	-20	-39.1
1305.04	-53.00	188	1.5	H	6.4	-46.60	-20	-26.60
1305.04	-54.60	360	2.4	V	5.2	-49.40	-20	-29.40
1740.05	-60.00	272	2.1	H	4.4	-55.60	-20	-35.60
1740.05	-58.90	117	1.5	V	3.1	-55.80	-20	-35.80
2175.06	-56.60	340	1.9	H	7.5	-49.10	-20	-29.10
2175.06	-56.60	77	2	V	6.9	-49.70	-20	-29.70
2610.08	-57.90	238	1.5	H	6.4	-51.50	-20	-31.50
2610.08	-56.00	324	1.2	V	5.6	-50.40	-20	-30.40
3045.09	-52.80	278	2.2	H	6.8	-46.00	-20	-26.00
3045.09	-56.50	356	1.9	V	6.6	-49.90	-20	-29.90
3480.10	-49.40	124	1	H	7.3	-42.10	-20	-22.10
3480.10	-50.40	212	1.5	V	6.3	-44.10	-20	-24.10
3915.11	-66.70	297	2.3	H	9.2	-57.50	-20	-37.50
3915.11	-64.80	113	1.8	V	8.5	-56.30	-20	-36.30

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
469.9875 MHz								
939.975	-73	177	1.1	H	9.2	-63.8	-20	-43.8
939.975	-70.6	263	1.3	V	11.7	-58.9	-20	-38.9
1409.96	-51.40	143	1.6	H	5.7	-45.70	-20	-25.70
1409.96	-49.50	343	1.7	V	5.5	-44.00	-20	-24.00
1879.95	-52.70	31	1.1	H	4	-48.70	-20	-28.70
1879.95	-52.20	235	1.8	V	3.2	-49.00	-20	-29.00
2349.94	-52.70	223	1.6	H	7.3	-45.40	-20	-25.40
2349.94	-53.90	173	2.2	V	6.4	-47.50	-20	-27.50
2819.93	-55.40	69	2.4	H	7	-48.40	-20	-28.40
2819.93	-55.30	198	1.9	V	6.6	-48.70	-20	-28.70
3289.91	-52.60	190	1.8	H	6.5	-46.10	-20	-26.10
3289.91	-52.70	70	2.1	V	5.8	-46.90	-20	-26.90
3759.90	-44.10	150	1.4	H	8.8	-35.30	-20	-15.30
3759.90	-45.80	204	1.2	V	8	-37.80	-20	-17.80

Digital:

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
400.0125MHz								
800.025	-75.2	111	1.2	H	10.8	-64.4	-20	-44.4
800.025	-70.2	1	2.1	V	9.7	-60.5	-20	-40.5
1200.04	-52.10	333	1.4	H	4.5	-47.60	-20	-27.60
1200.04	-52.20	342	1.1	V	3.6	-48.60	-20	-28.60
1600.05	-58.20	352	1.6	H	4.1	-54.10	-20	-34.10
1600.05	-60.60	232	2	V	3.2	-57.40	-20	-37.40
2000.06	-53.40	337	1.3	H	4.3	-49.10	-20	-29.10
2000.06	-52.70	199	1.7	V	3.3	-49.40	-20	-29.40
2400.08	-60.40	175	1.6	H	6.9	-53.50	-20	-33.50
2400.08	-58.50	85	2.3	V	5.9	-52.60	-20	-32.60
2800.09	-58.50	295	1.4	H	6.7	-51.80	-20	-31.80
2800.09	-58.70	89	1.8	V	6.7	-52.00	-20	-32.00
3200.10	-54.30	262	2.3	H	7	-47.30	-20	-27.30
3200.10	-54.30	155	2	V	6.8	-47.50	-20	-27.50
3600.11	-67.40	16	1.4	H	8.2	-59.20	-20	-39.20
3600.11	-65.30	318	1.6	V	7.3	-58.00	-20	-38.00
435.0125 MHz								
870.025	-75.9	42	1.9	H	11.9	-64	-20	-44
870.025	-71	86	1.2	V	11.7	-59.3	-20	-39.3
1305.04	-55.70	163	1.8	H	6.4	-49.30	-20	-29.30
1305.04	-52.10	336	1.8	V	5.2	-46.90	-20	-26.90
1740.05	-59.60	315	1.7	H	4.4	-55.20	-20	-35.20
1740.05	-58.30	304	2.4	V	3.1	-55.20	-20	-35.20
2175.06	-56.30	312	2.1	H	7.5	-48.80	-20	-28.80
2175.06	-55.80	302	1.9	V	6.9	-48.90	-20	-28.90
2610.08	-57.80	183	2.2	H	6.4	-51.40	-20	-31.40
2610.08	-55.80	318	2.3	V	5.6	-50.20	-20	-30.20
3045.09	-55.10	312	2.5	H	6.8	-48.30	-20	-28.30
3045.09	-53.50	137	2	V	6.6	-46.90	-20	-26.90
3480.10	-50.20	206	1.4	H	7.3	-42.90	-20	-22.90
3480.10	-48.70	285	2.1	V	6.3	-42.40	-20	-22.40
3915.11	-67.20	284	2.4	H	9.2	-58.00	-20	-38.00
3915.11	-65.20	278	1.8	V	8.5	-56.70	-20	-36.70

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
469.9875 MHz								
939.975	-73.1	305	1.3	H	9.2	-63.9	-20	-43.9
939.975	-70.9	289	1.1	V	11.7	-59.2	-20	-39.2
1409.96	-50.30	87	2.2	H	5.7	-44.60	-20	-24.60
1409.96	-51.70	100	1.1	V	5.5	-46.20	-20	-26.20
1879.95	-56.50	119	1.1	H	4	-52.50	-20	-32.50
1879.95	-51.90	18	1.2	V	3.2	-48.70	-20	-28.70
2349.94	-53.90	137	1.5	H	7.3	-46.60	-20	-26.60
2349.94	-51.10	199	2.3	V	6.4	-44.70	-20	-24.70
2819.93	-56.50	316	1.7	H	7	-49.50	-20	-29.50
2819.93	-54.70	51	1.1	V	6.6	-48.10	-20	-28.10
3289.91	-55.70	125	1.5	H	6.5	-49.20	-20	-29.20
3289.91	-52.80	114	1.9	V	5.8	-47.00	-20	-27.00
3759.90	-46.40	91	2.4	H	8.8	-37.60	-20	-17.60
3759.90	-45.00	336	2.4	V	8	-37.00	-20	-17.00

Note:

Absolute Level = Reading Level + Substituted Factor

Substituted Factor contains: SG Level - Cable loss+ Antenna Gain

Margin = Absolute Level - Limit

FCC §2.1055 & §90.213 - FREQUENCY STABILITY

Applicable Standard

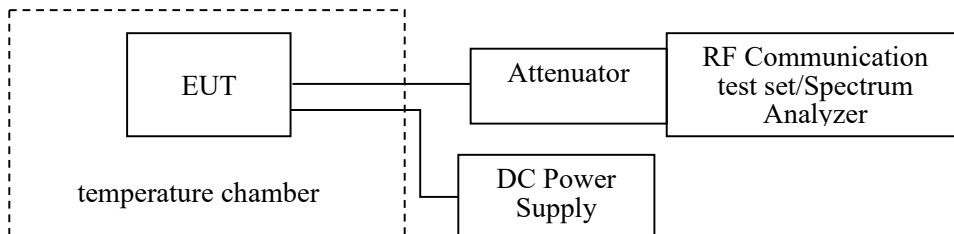
FCC §2.1055 and §90.213

Test Procedure

According to ANSI C63.26-2015 section 5.6

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The power cable and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.



Test Data

Environmental Conditions

Temperature:	26.7 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2023-02-17.

Test Mode: Transmitting, worst case for high power level.

Test Result: Pass. Please refer to the following tables.

For Analog Modulation

Reference Frequency:435.0125MHz, Limit:2.5 ppm, 12.5kHz			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
50	4.2	435.012567	0.15
40	4.2	435.012576	0.17
30	4.2	435.012533	0.08
20	4.2	435.012531	0.07
10	4.2	435.012522	0.05
0	4.2	435.012528	0.06
-10	4.2	435.012561	0.14
-20	4.2	435.012552	0.12
-30	4.2	435.012585	0.20
<i>Frequency Stability Versus Input Voltage</i>			
20	3.4	435.012567	0.15
20	5.0	435.012576	0.17

For Digital

Reference Frequency:435.0125MHz, Limit:2.5 ppm, 12.5kHz			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
50	4.2	435.012557	0.13
40	4.2	435.012579	0.18
30	4.2	435.012524	0.06
20	4.2	435.012491	-0.02
10	4.2	435.012521	0.05
0	4.2	435.012494	-0.01
-10	4.2	435.012569	0.16
-20	4.2	435.012549	0.11
-30	4.2	435.012604	0.24
<i>Frequency Stability Versus Input Voltage</i>			
20	3.4	435.012569	0.16
20	5.0	435.012595	0.22

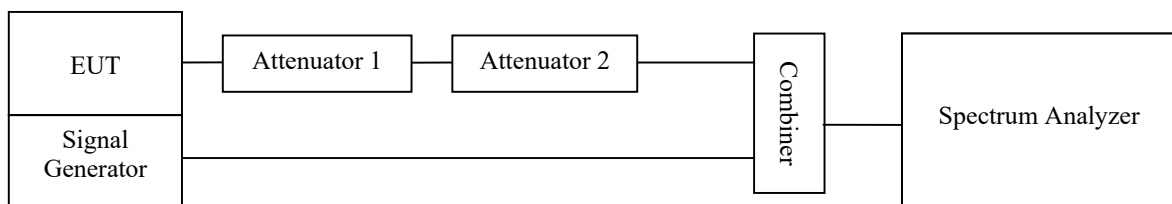
FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

Regulations: FCC §90.214
Test method: ANSI C63.26-2015

Test Procedure

- Connect the EUT and test equipment as shown on the following block diagram.
- Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
- 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.
- Turn on the transmitter.
- Supply sufficient attenuation via the RF attenuator to provide an input level to the Spectrum Analyzer that is 40 dB below the maximum allowed input power when the transmitter is operating at its rated power level. Note this power level on the Spectrum Analyzer as P_0 .
- Turn off the transmitter.
- Adjust the RF level of the signal generator to provide RF power equal to P_0 . This signal generator RF level shall be maintained throughout the rest of the measurement.
- Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
- Adjust the vertical amplitude control of the spectrum analyzer 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 "trigger offset" to -10ms for turn on and -15ms for turn off.
- Turn on the transmitter and the transient wave will be captured on the screen of Spectrum Analyzer. Observe the stored display. The instant when the 1 kHz test signal is completely suppressed is considered to be t_{on} . The trace should be maintained within the allowed divisions during the period t_1 and t_2 .
- 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 t_3 .



Test Data

Environmental Conditions

Temperature:	26.7 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2023-02-22.

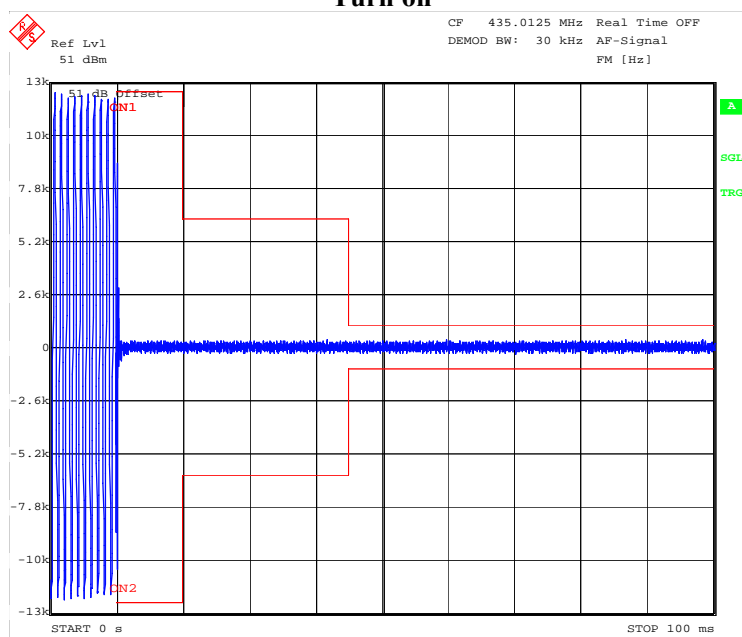
Test Result: Pass. Please refer to the following tables and plots.

Channel Separation (kHz)	Transient Period (ms)	Transient Frequency	Result
12.5	10 (t1)	<+/-12.5 kHz	Pass
	25(t2)	<+/-6.25 kHz	
	10(t3)	<+/-12.5 kHz	

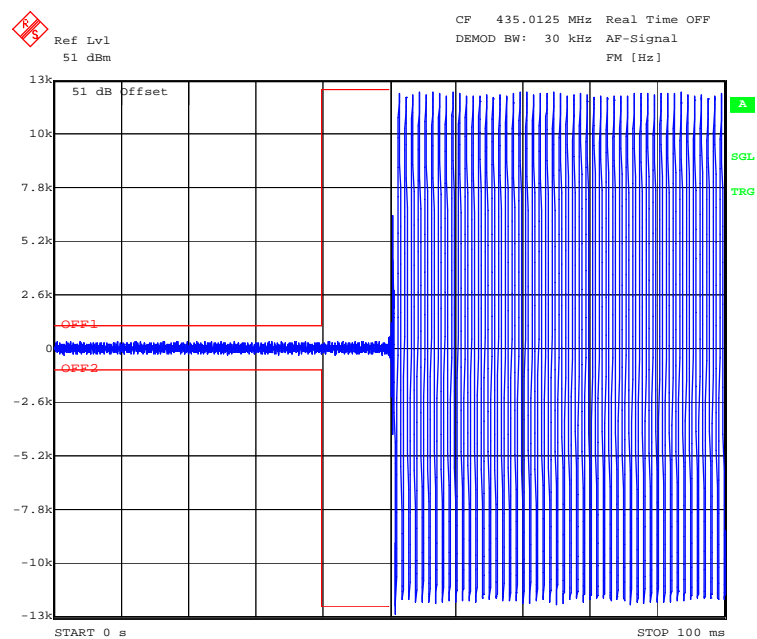
Note: During the time from the end of t₂ to the beginning of t₃, the frequency difference not exceed the limits specified in §90.213

For 435.0125MHz 12.5kHz mode, the limit is $435.0125\text{MHz} \times 2.5\text{ppm} = 1.088\text{kHz}$

Turn on



Turn off



***** END OF REPORT *****