TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 22, 74, 80 and 90

TEST REPORT

For

Hytera Communications Corporation Limited

Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, 518057 China

FCC ID: YAMRD62XIU2

Report Type:	**Product Type:**
Original Report	Digital Wall-mounted Repeater

Report Number:	RDG180524012-00A
Report Date:	2018-06-20
Reviewed By:	Jerry Zhang EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	Digital Wall-mounted Repeater
EUT Model:	RD622i U(2)
Mutiple Models:	RD625i U(2), RD626i U(2), RD628i U(2)
FCC ID:	YAMRD62XIU2
Rated Input Voltage:	120V AC or 13.6V DC
External Dimension:	348mm(L)*210mm(W)*108mm(H)
Serial Number:	180524012
EUT Received Date:	2018.05.25

Note: The series product, models RD622i U(2), RD625i U(2), RD626i U(2), RD628i U(2) are electrically identical, The difference between them please refer to the declaration letter for details. For marketing purpose, we selected RD622i U(2) for fully test.

Objective

This test report is prepared on behalf of *Hytera Communications Corporation Limited* in accordance with Part 2, and Part 22,74,80 and 90 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s).

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 22 – Public Mobile Service
Part 74 – Experimental Radio, Auxiliary, Special Broadcast and other Program Distributonal Service
Part 80 –Stations in the Maritime Services
Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-D.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Dongguan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Unwanted Emissions, radiated	30MHz ~ 1GHz:5.85 dB 1G~26.5GHz: 5.23 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, 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. : 897218,the FCC Designation No. : CN1220.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062D.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

EUT Specification:

Operating Frequency Band	450-512MHz
Modulation Mode	FM/4FSK
Channel Spacing	12.5/25kHz
Rated Output Power	High: 25 W Low: 1 W

EUT Exercise Software

No exercise software was used.

Special Accessories

No special accessory was used.

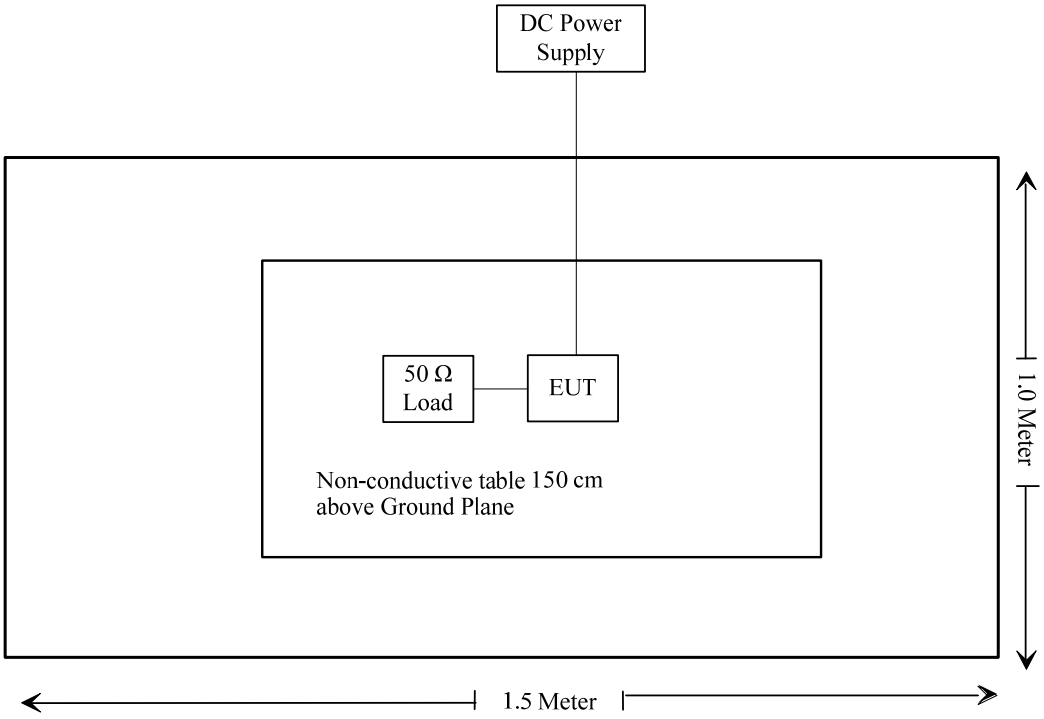
Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Unknown	Terminal Load (50 Ω)	N/A	N/A
Pro instrument	DC Power Supply	pps3300	3300012
HP	RF Communications Test Set	8920A	00 247

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1310&§2.1091	Maximum Permissible Exposure (MPE)	Compliance
§2.1046; § 22.727; §80.215; §74.461; §90.205	RF Output Power	Compliance
§2.1047	Modulation Characteristic	Compliance
§2.1049;§22.357;§ 22.731; §74.462;§80.205; §80.207 §90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliance
§2.1051; §22.861; §74.462; §80.211;§90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053;§22.861; §74.462;§80.211;§90.210	Spurious Radiated Emissions	Compliance
§2.1055; § 22.355; §74.464; §80.209; §90.213	Frequency Stability	Compliance
§90.214	Transient Frequency Behavior	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
R&S	EMI Test Receiver	ESCI	100224	2017-12-11	2018-12-11
HP	Amplifier	8447D	2727A05902	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2017-09-05	2018-09-05
Agilent	Signal Generator	E8247C	MY43321350	2017-12-11	2018-12-11
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2017-09-05	2018-09-05
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
TDK RF	Horn Antenna	HRN-0118	130 084	2016-01-05	2019-01-04
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Agilent	Spectrum Analyzer	E4440A	SG43360054	2018-01-04	2019-01-04
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2017-09-05	2018-09-05
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017-09-05	2018-09-05
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2017-08-31	2018-08-31
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
Mini-Circuits	Bandpass filter	BPF-C495+	N/A	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	0E01201047	2018-05-06	2019-05-06
E-Microwave	Coaxial Attenuators	EMCA40-200SN-6	OE01201046	2017-09-05	2018-09-05
HP	RF Communications Test Set	8920A	00 235	2017-07-11	2018-07-11
Dongzhixu	High Temperature Test Chamber	DP1000	201105083-4	2017-08-28	2018-08-28
UNI-T	Multimeter	UT39A	M130199938	2018-05-09	2019-05-09
Pro instrument	DC Power Supply	pps3300	3300012	N/A	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to 1.1310, 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.

Limits for Maximum Permissible Exposure (MPE)

Limits for Occupational/Controlled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time |E|, |H| or S (minutes)
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
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6

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

MPE Calculation

Prediction of power density at the distance of the applicable MPE limit

$$S = PG/4\pi R^2$$

Where: S = power density (in appropriate units, e.g. mW/cm^2);
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
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

MPE Results

Frequency (MHz)	Antenna Gain		Maximum output power including Tune-up Tolerance	With PTT (%)	Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(mW)				
450-512	5.0	3.16	25000	50	50	0.874	1.5

Note: the target power is 25 W.

Result: The device meet FCC MPE at 50 cm distance

FCC §2.1046 & § 22.727 & §74.461 & §80.215& §90.205 - RF OUTPUT POWER

Applicable Standard

FCC §2.1046, § 22.727, §74.461, §80.215 and §90.205

Test Procedure

Conducted RF Output Power:

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:	27.1 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

The testing was performed by Andy Huang on 2018-06-13.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Modulation Mode	Channel Separation (kHz)	f_c (MHz)	Reading (W)		Note
			High Power Level	Low Power Level	
FM	12.5	453.2125	24.099	1.125	**FCC part 90**
		481	24.547	1.062	
		511.9875	23.496	1.009	
4FSK	12.5	453.2125	24.434	1.125	
		481	24.604	1.064	
		511.9875	23.496	1.014	
FM	25	459.9875	24.434	1.089	**FCC part 80**
		469.9875	23.988	1.030	
FM	12.5	450.03125	24.717	1.159	**FCC part 74**
		485	24.210	1.067	
	25	450.03125	24.660	1.161	**FCC part 74**
		485	24.210	1.069	
4FSK	12.5	450.03125	24.604	1.159	**FCC part 74**
		485	24.155	1.069	
FM	12.5	454.0125	24.155	1.132	**FCC part 22**
		483	24.547	1.089	
		511.9875	23.550	1.009	
	25	454.0125	24.266	1.130	
		483	24.547	1.091	
		511.9875	23.388	1.009	
4FSK	12.5	454.0125	24.266	1.130	
		483	24.434	1.086	
		511.9875	23.442	1.014	

Note: The high rated power level is 25W, and low rated power level is 1 W.

FCC §2.1047 - MODULATION CHARACTERISTIC

Applicable Standard

FCC §2.1047

(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: TIA/EIA-603 2.2.3

Test Data

Environmental Conditions

Temperature:	27.1 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

The testing was performed by Andy Huang on 2018-06-13.

Test Mode: Transmitting

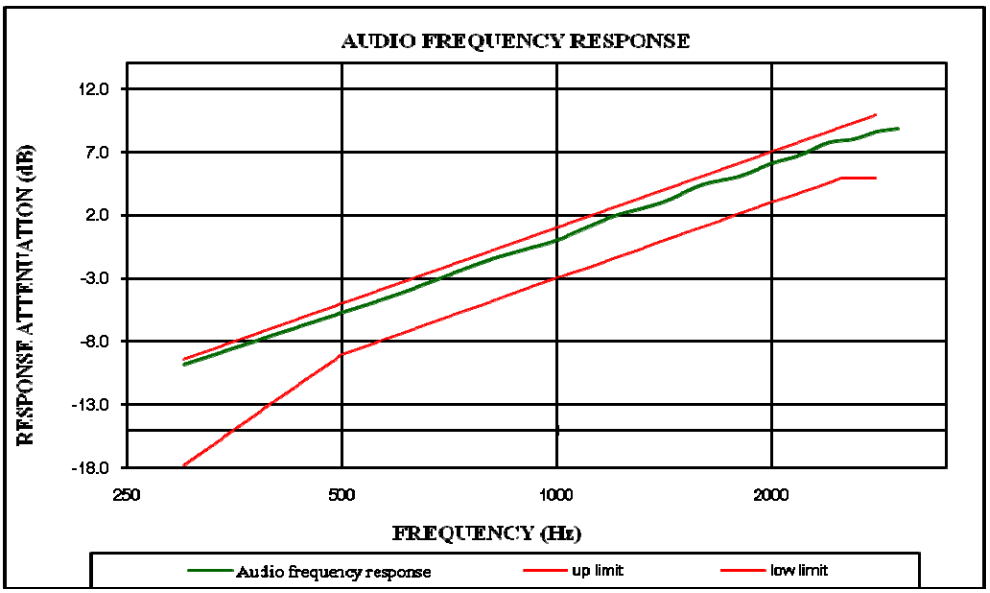
Result: Compliance.

12.5kHz：

Audio Frequency Response – High Power

Carrier Frequency: 453.2125 MHz

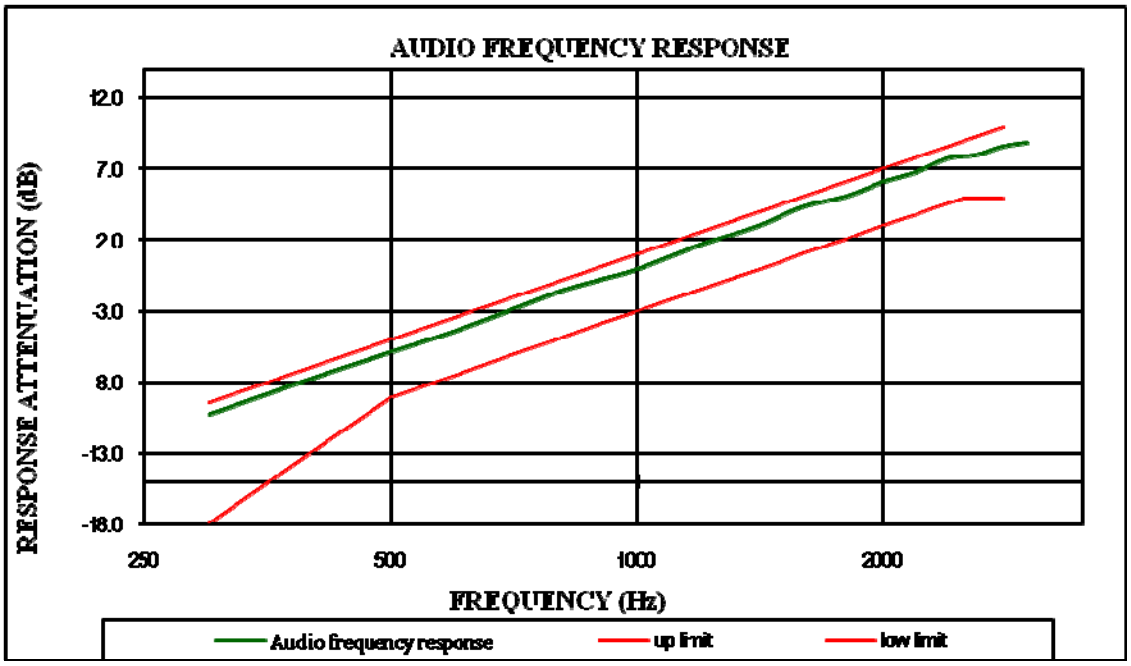
Modulation Frequency (Hz)	Response data (dB)
300	-9.85
400	-7.51
500	-5.73
600	-4.25
700	-2.82
800	-1.60
900	-0.74
1000	0.00
1200	1.88
1400	2.95
1600	4.39
1800	5.03
2000	6.07
2200	6.75
2400	7.72
2600	7.97
2800	8.56
3000	8.81



25kHz:

Carrier Frequency: 459.9875 MHz

Modulation Frequency (Hz)	Response data (dB)
300	-10.19
400	-7.67
500	-5.82
600	-4.32
700	-2.87
800	-1.60
900	-0.75
1000	0.00
1200	1.75
1400	2.99
1600	4.41
1800	5.10
2000	6.13
2200	6.83
2400	7.79
2600	8.02
2800	8.62
3000	8.87

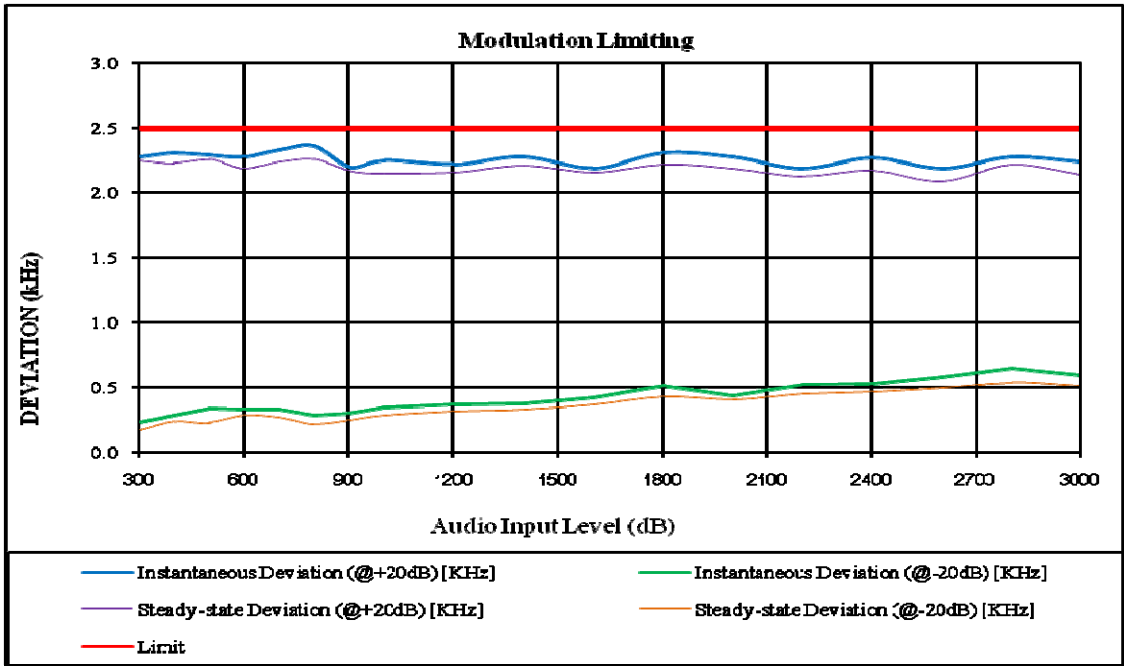


MODULATION LIMITING – High Power

12.5kHz

Carrier Frequency: 453.2125 MHz

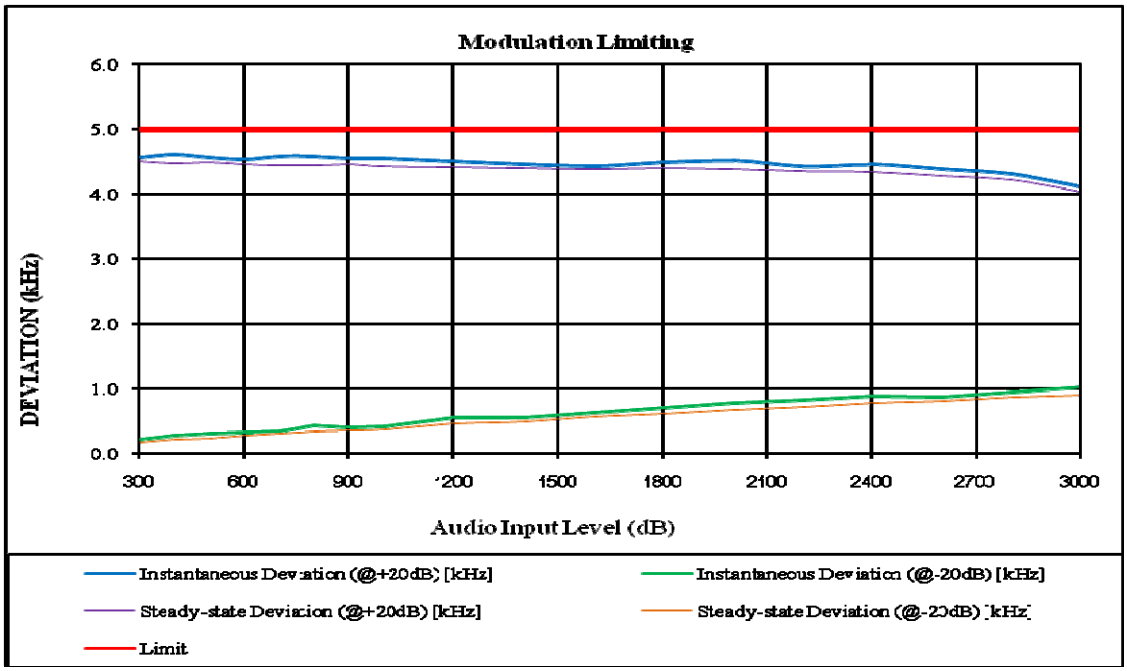
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [KHz]
	Deviation (@+20dB) [KHz]	Deviation (@-20dB) [KHz]	Deviation (@+20dB) [KHz]	Deviation (@-20dB) [KHz]	
300	2.28	0.23	2.25	0.17	2.5
400	2.31	0.29	2.23	0.24	2.5
500	2.29	0.34	2.26	0.23	2.5
600	2.28	0.33	2.19	0.29	2.5
700	2.33	0.33	2.24	0.27	2.5
800	2.36	0.29	2.26	0.22	2.5
900	2.20	0.30	2.17	0.25	2.5
1000	2.25	0.35	2.15	0.29	2.5
1200	2.22	0.37	2.16	0.32	2.5
1400	2.28	0.38	2.21	0.33	2.5
1600	2.19	0.42	2.16	0.37	2.5
1800	2.31	0.51	2.22	0.43	2.5
2000	2.28	0.44	2.19	0.41	2.5
2200	2.19	0.52	2.13	0.45	2.5
2400	2.27	0.53	2.17	0.47	2.5
2600	2.19	0.58	2.09	0.50	2.5
2800	2.28	0.65	2.22	0.54	2.5
3000	2.24	0.60	2.14	0.51	2.5



25kHz:

Carrier Frequency: 459.9875 MHz

Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [KHz]
	Deviation (@+20dB) [KHz]	Deviation (@-20dB) [KHz]	Deviation (@+20dB) [KHz]	Deviation (@-20dB) [KHz]	
300	4.57	0.23	4.51	0.18	5.0
400	4.62	0.29	4.48	0.22	5.0
500	4.57	0.31	4.49	0.24	5.0
600	4.54	0.33	4.47	0.28	5.0
700	4.59	0.35	4.45	0.31	5.0
800	4.59	0.43	4.45	0.35	5.0
900	4.56	0.41	4.46	0.36	5.0
1000	4.55	0.42	4.43	0.38	5.0
1200	4.51	0.56	4.42	0.47	5.0
1400	4.47	0.56	4.40	0.50	5.0
1600	4.44	0.63	4.39	0.58	5.0
1800	4.49	0.71	4.41	0.62	5.0
2000	4.52	0.78	4.39	0.68	5.0
2200	4.43	0.83	4.36	0.72	5.0
2400	4.46	0.89	4.35	0.79	5.0
2600	4.39	0.88	4.29	0.82	5.0
2800	4.31	0.95	4.22	0.87	5.0
3000	4.12	1.02	4.04	0.91	5.0

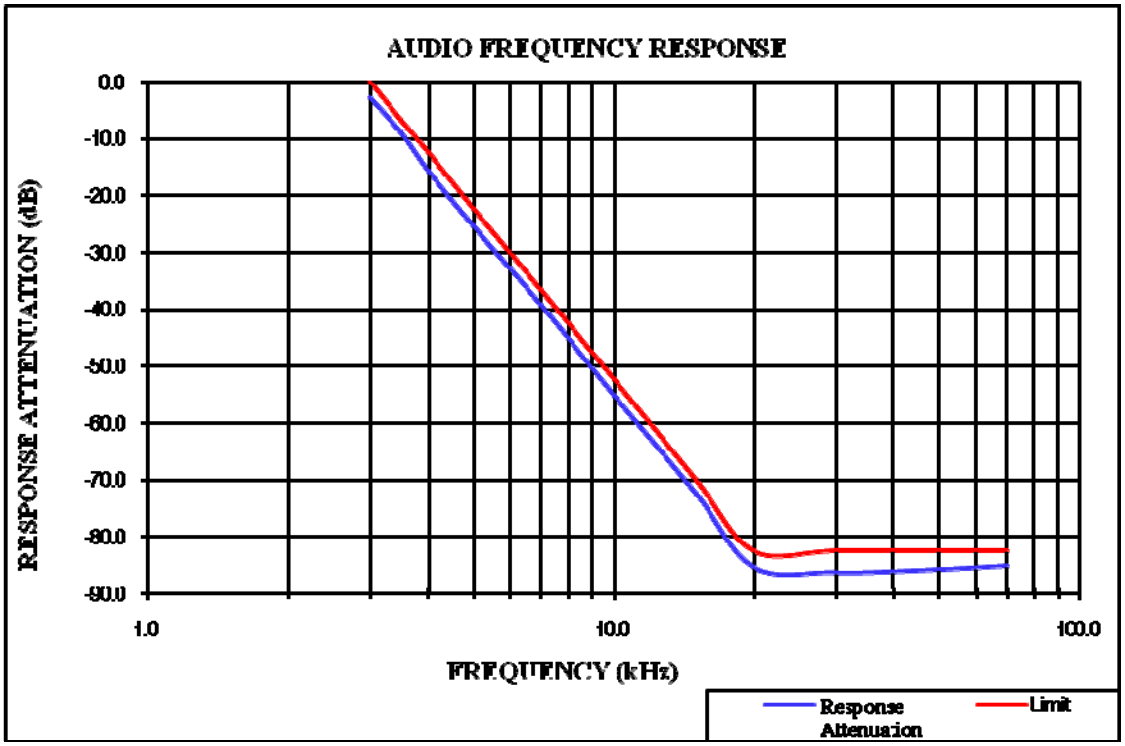


Audio Frequency Low Pass Filter Response – High Power

12.5kHz:

Carrier Frequency: 453.2125 MHz

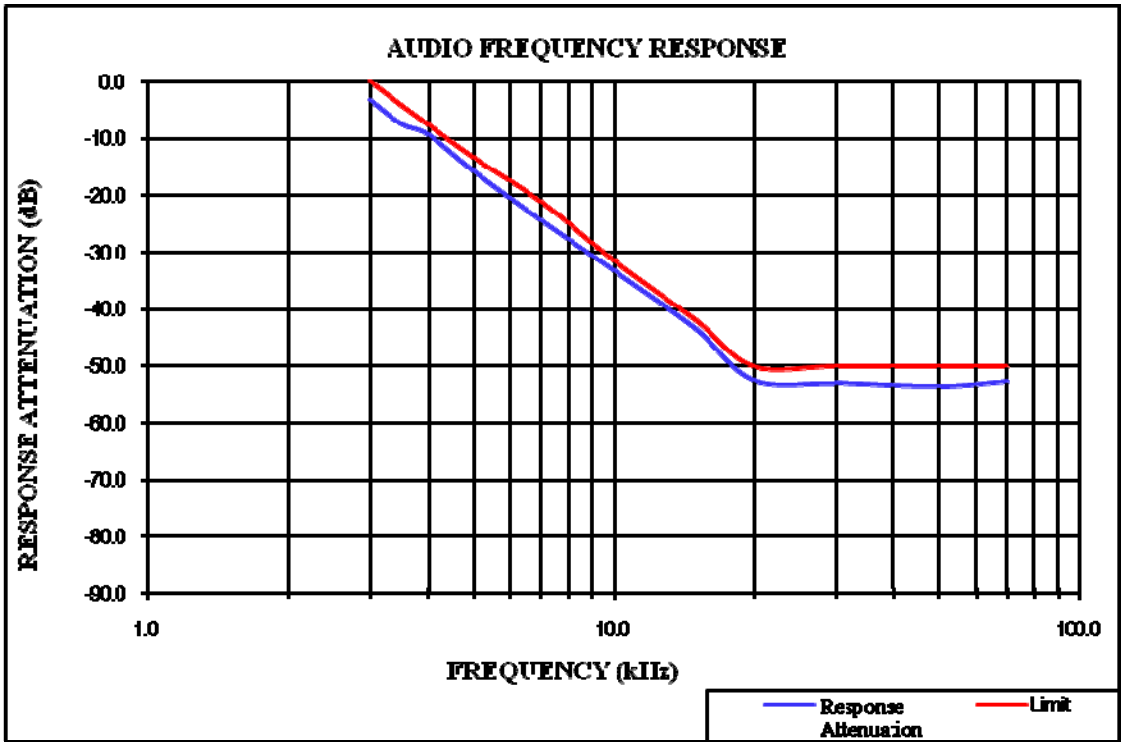
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
3.0	-2.8	0.0
3.5	-9.0	-6.7
4.0	-15.6	-12.5
5.0	-25.4	-22.2
7.0	-39.3	-36.8
10.0	-55.0	-52.3
15.0	-72.3	-69.9
20.0	-85.4	-82.5
30.0	-86.3	-82.5
50.0	-85.8	-82.5
70.0	-85.2	-82.5



25kHz:

Carrier Frequency: 459.9875 MHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
3.0	-3.2	0.0
3.5	-7.4	-4.0
4.0	-9.3	-7.5
5.0	-15.6	-13.3
7.0	-24.5	-21.1
10.0	-33.3	-31.4
15.0	-43.6	-41.9
20.0	-52.4	-50.0
30.0	-53.0	-50.0
50.0	-53.5	-50.0
70.0	-52.7	-50.0



FCC §2.1049 & §22.357 & § 22.731 & §74.462 & 80.205& §80.207& §90.209 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK

Applicable Standard

FCC §2.1049, §22.357, § 22.731, §74.462, §80.205, §80.207,§90.209 and §90.210

Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at 100 Hz or 300 Hz and the spectrum was recorded in the frequency band ±50 kHz from the carrier frequency.

Test Data

Environmental Conditions

Temperature:	27~27.3 ℃
Relative Humidity:	53~61 %
ATM Pressure:	101.3~101.4 kPa

The testing was performed by Andy Huang from 2018-06-11 to 2018-06-15.

Test mode: transimitting

Modulation Mode	Channel Separation (kHz)	f_c (MHz)	99% Occupied Bandwidth (kHz)	26 dB Bandwidth (kHz)	Power Level	Note
FM	12.5	453.2125	9.920	10.321	High	**FCC part 90**
			9.920	10.321	Low	
4FSK	12.5		7.615	9.319	High	
			7.816	9.419	Low	
FM	25	459.9875	14.780	16.032	High	**FCC part 80**
			14.780	16.032	Low	
FM	12.5	450.03125	9.920	10.321	High	**FCC part 74**
			9.920	10.321	Low	
	25		14.780	16.032	High	
			14.780	16.032	Low	
4FSK	12.5		7.615	9.319	High	
			7.415	9.619	Low	
FM	12.5	454.0125	9.920	10.321	High	**FCC part 22**
			9.920	10.321	Low	
	25		14.780	16.032	High	
			14.780	16.032	Low	
4FSK	12.5		7.615	9.319	High	
			7.515	10.020	Low	

Note: Emission bandwidth was based on calculation method instead of measurement.
Emission Designator

Per CFR 47 §2.201& §2.202, BW = 2M + 2D

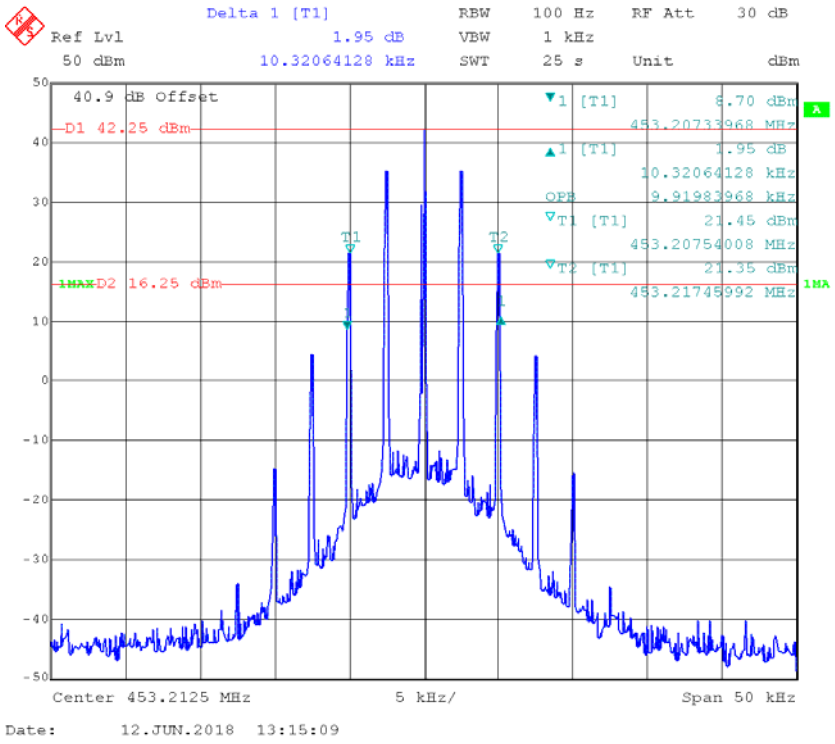
For FM Mode (Channel Spacing: 12.5 kHz)
Emission Designator 11K0F3E
In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.
BW = 2(M+D) = 2*(3.0 kHz + 2.5 kHz) = 11 kHz = 11K0
F3E portion of the designator represents an FM voice transmission
Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

For FM Mode (Channel Spacing: 25 kHz)
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.

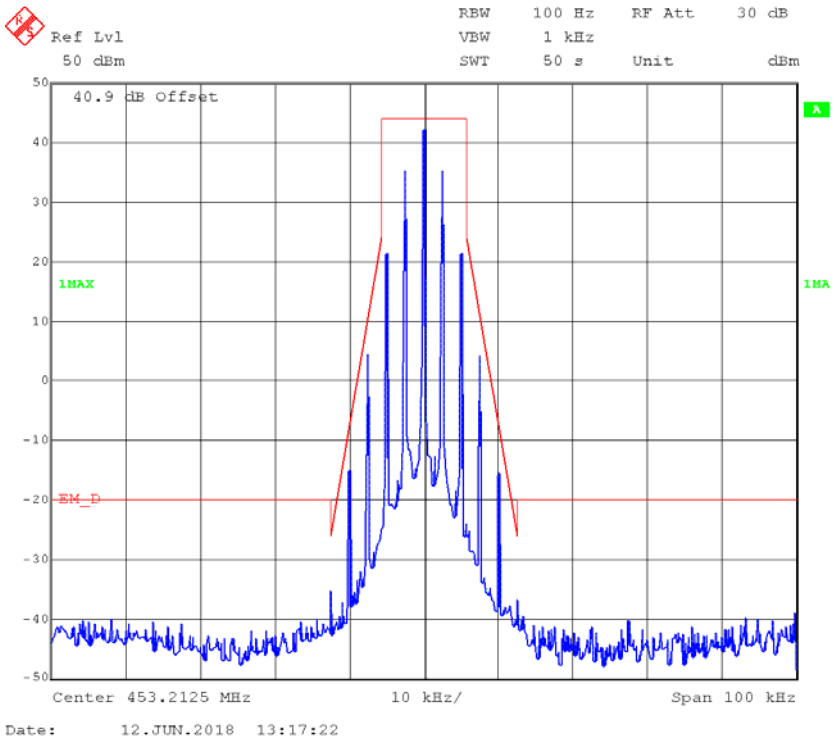
For Digital Mode (Channel Spacing: 12.5 kHz)
Emission Designator 7K60F1D and 7K60F1E
The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz. The emission mask was obtained from 47CFR 90.210(d).
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.

Part 90:

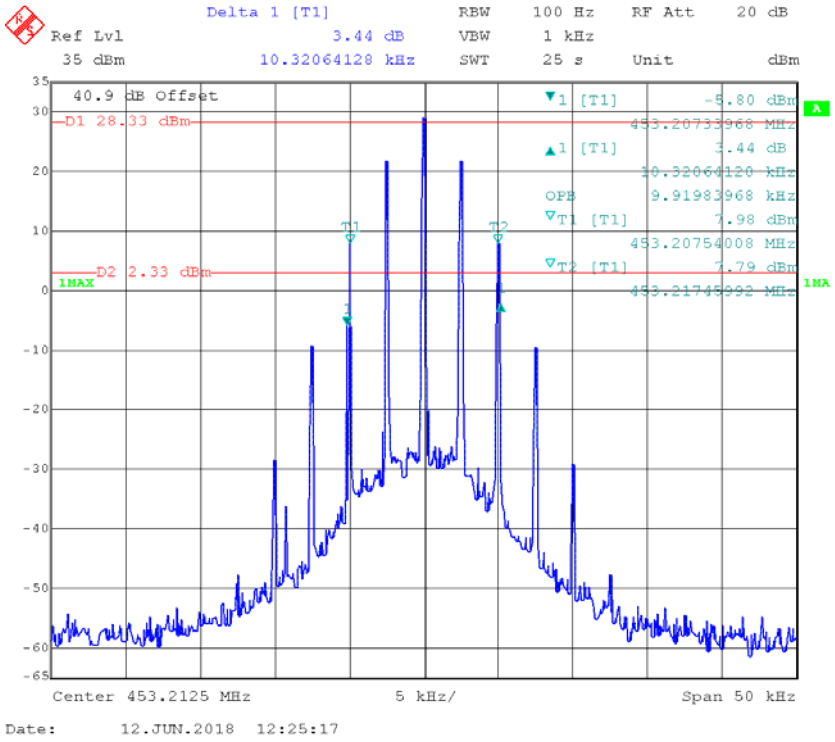
FM,12.5kHz,High Power - Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth



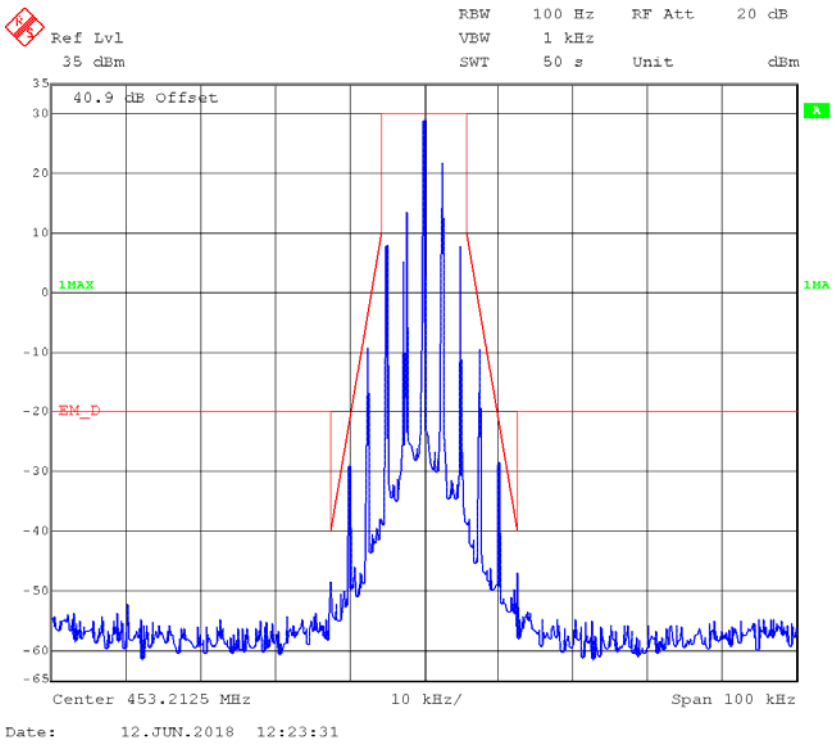
Emission Mask D



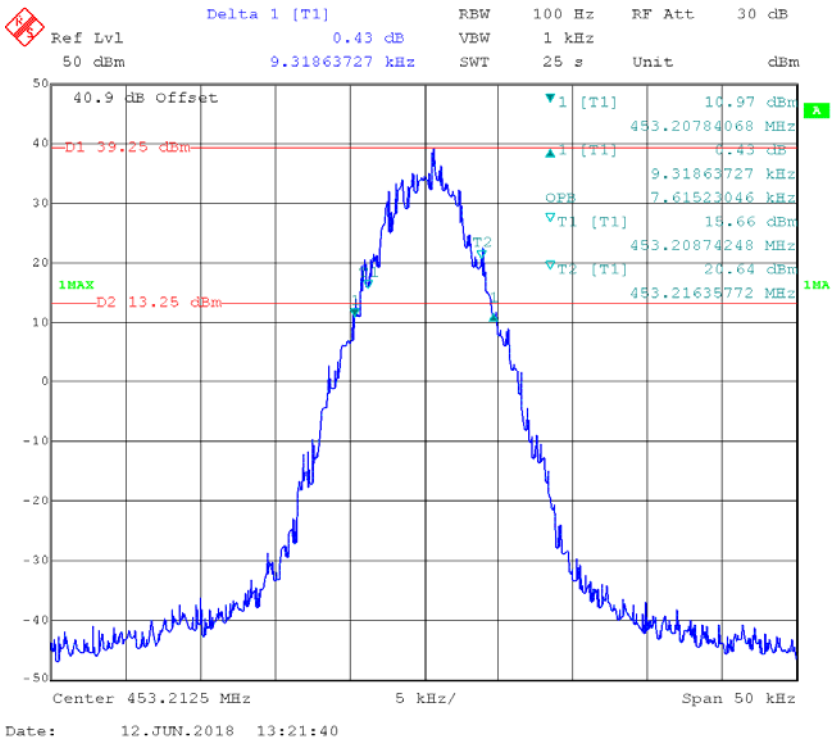
FM,12.5kHz,Low Power - Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth



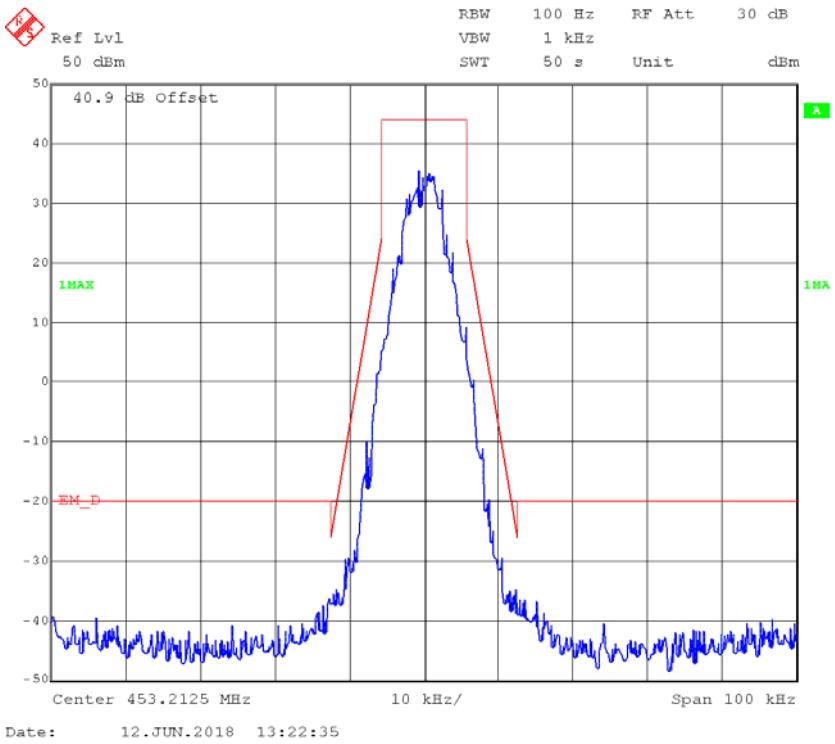
Emission Mask D



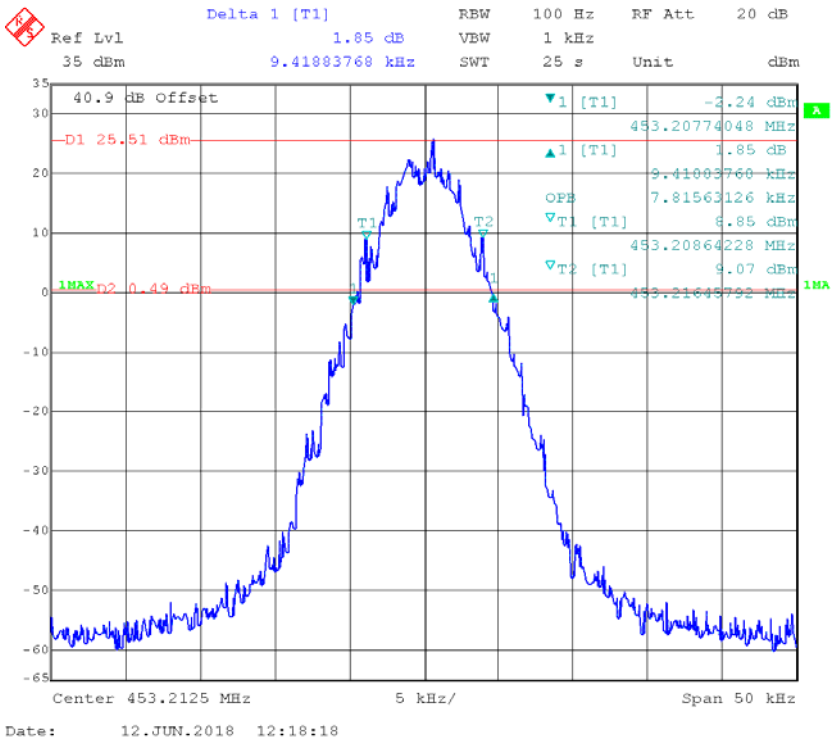
4FSK,12.5kHz,High Power - Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth



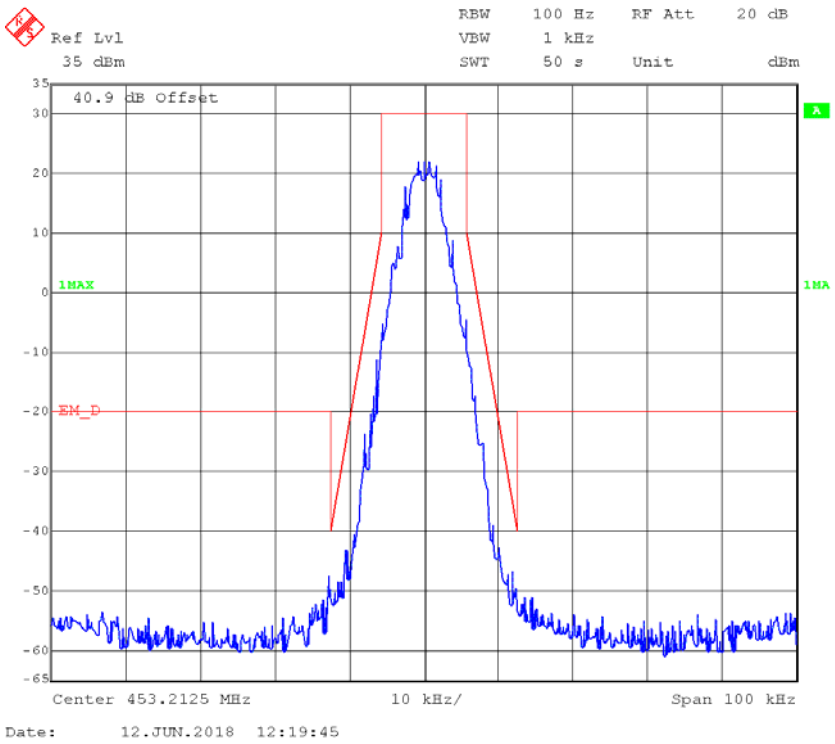
Emission Mask D



4FSK,12.5kHz,Low Power - Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth

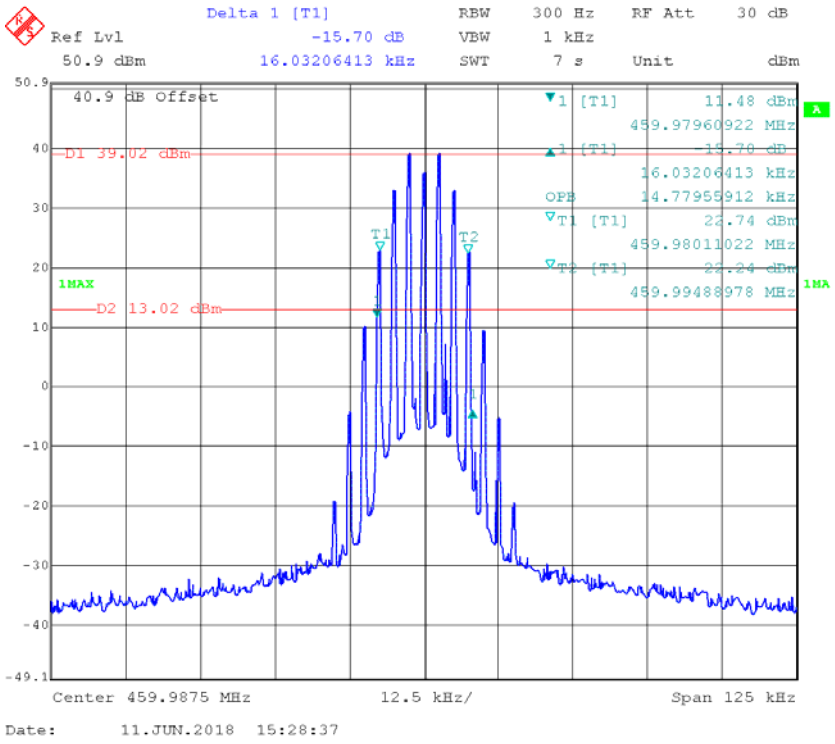


Emission Mask D

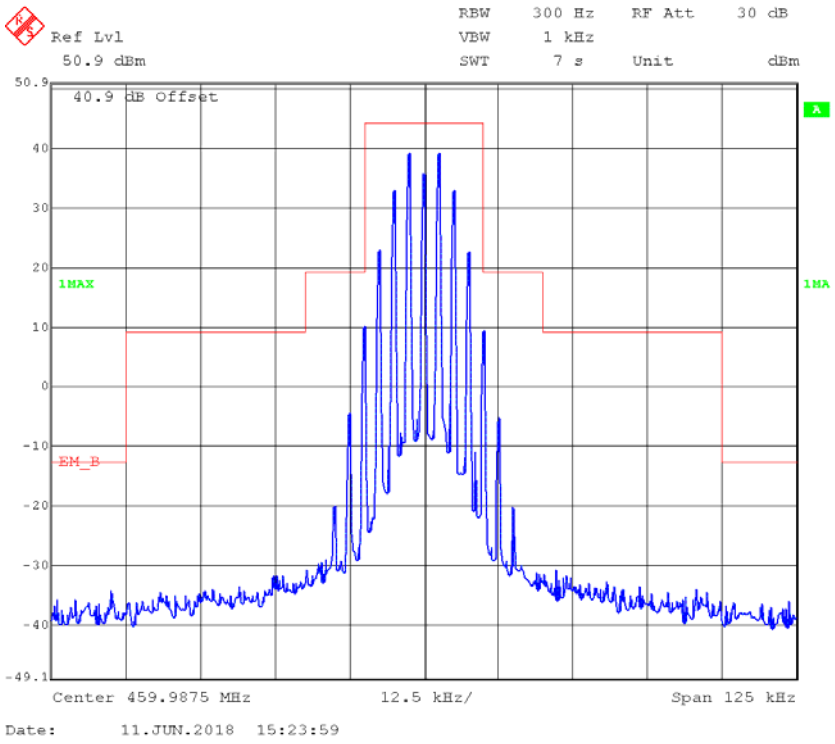


Part 80:

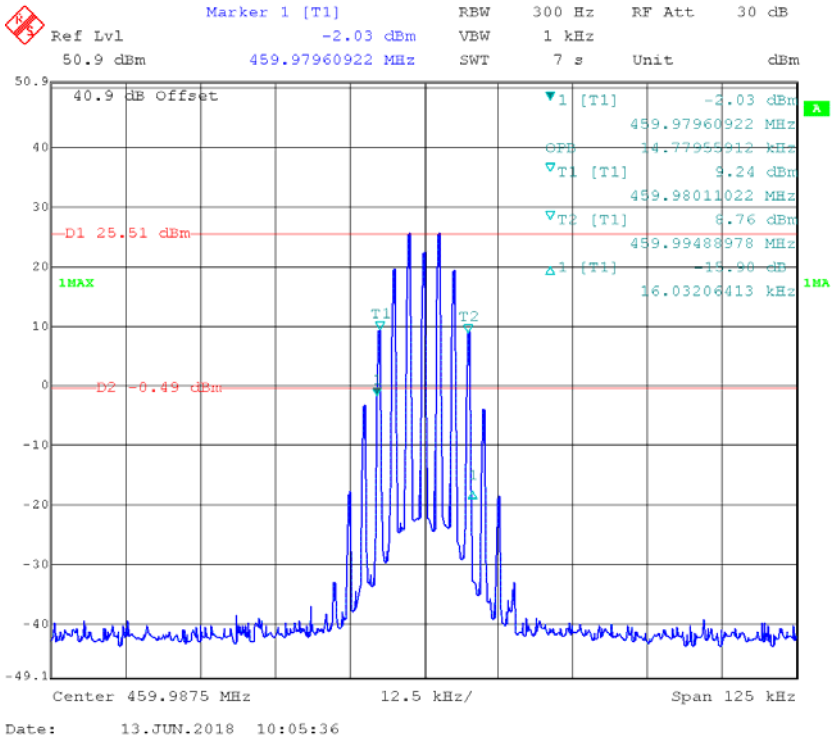
FM,25kHz, High Power - Frequency 459.9875 MHz MHz: 99% Occupied & 26 dB Bandwidth



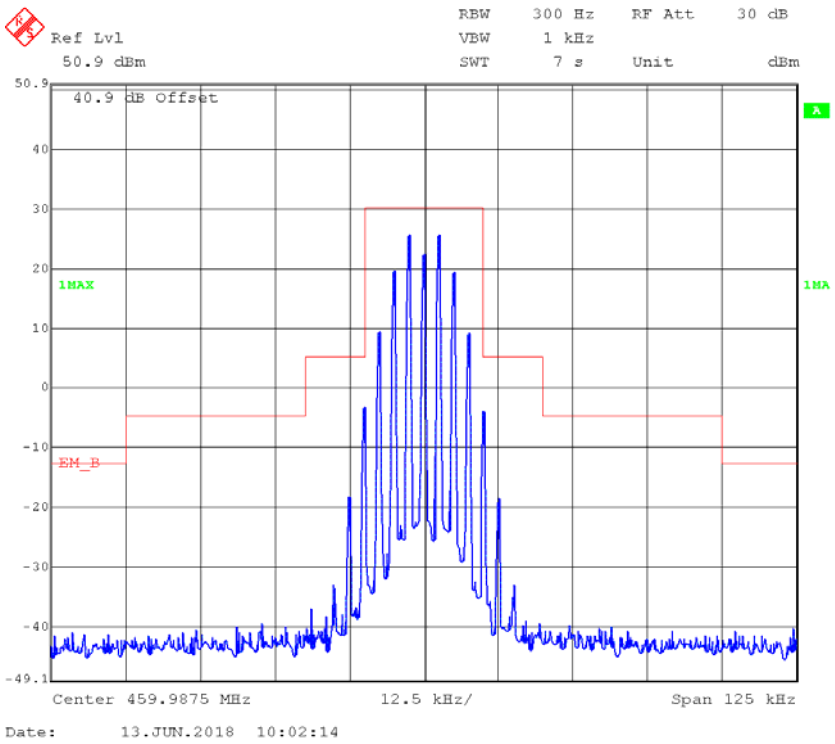
Emission Mask B



FM,25kHz,Low Power - Frequency 459.9875 MHz MHz: 99% Occupied & 26 dB Bandwidth

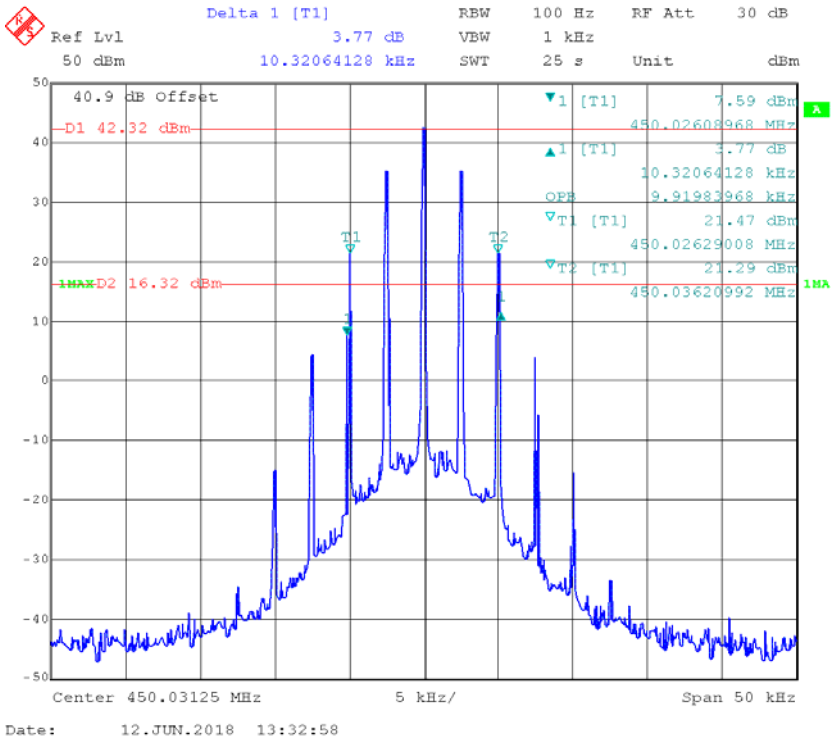


Emission Mask B

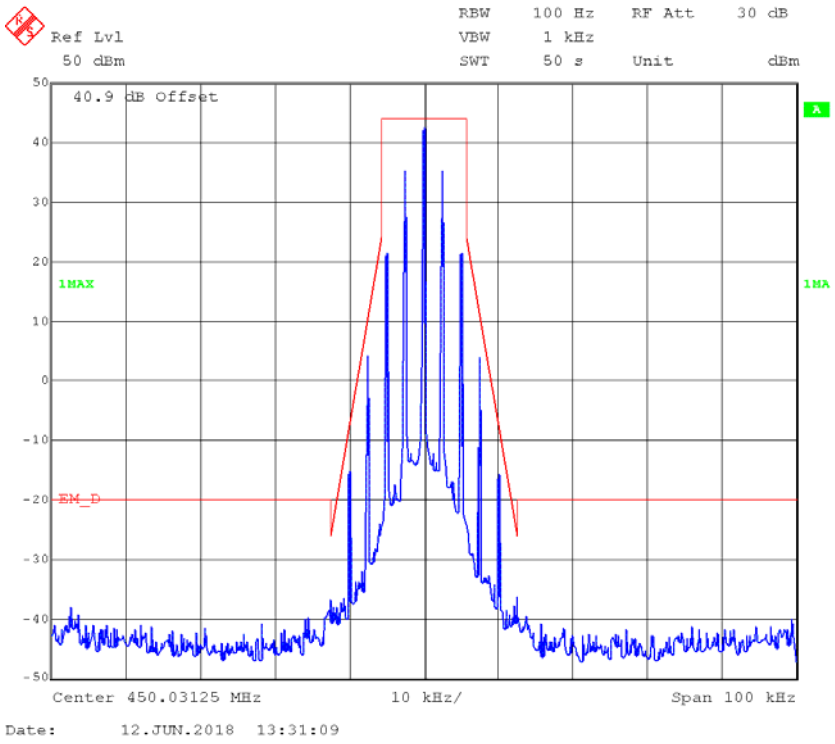


Part 74

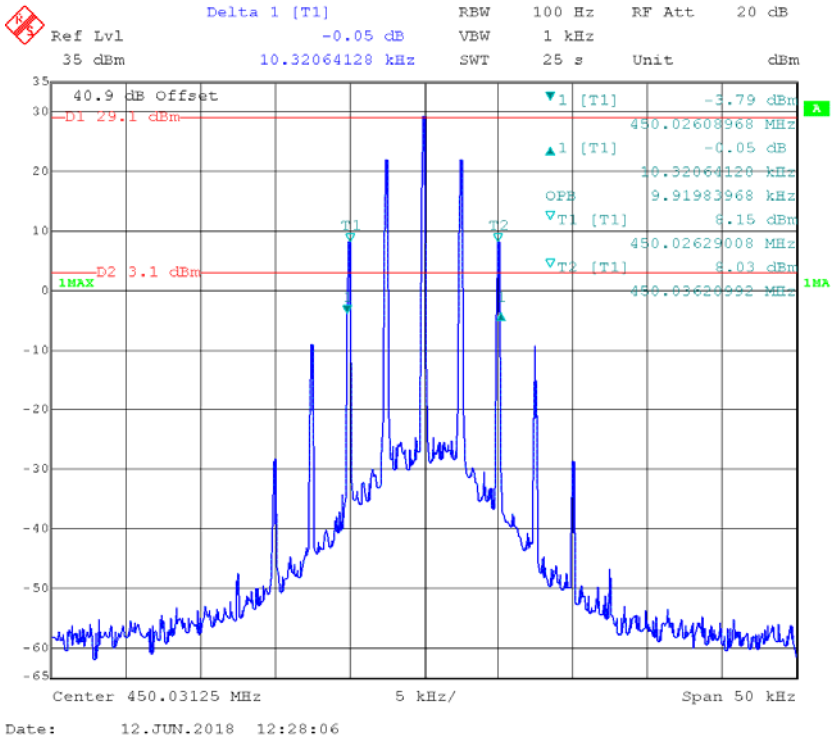
FM,12.5kHz,High Power - Frequency 450.03125 MHz: 99% Occupied & 26 dB Bandwidth



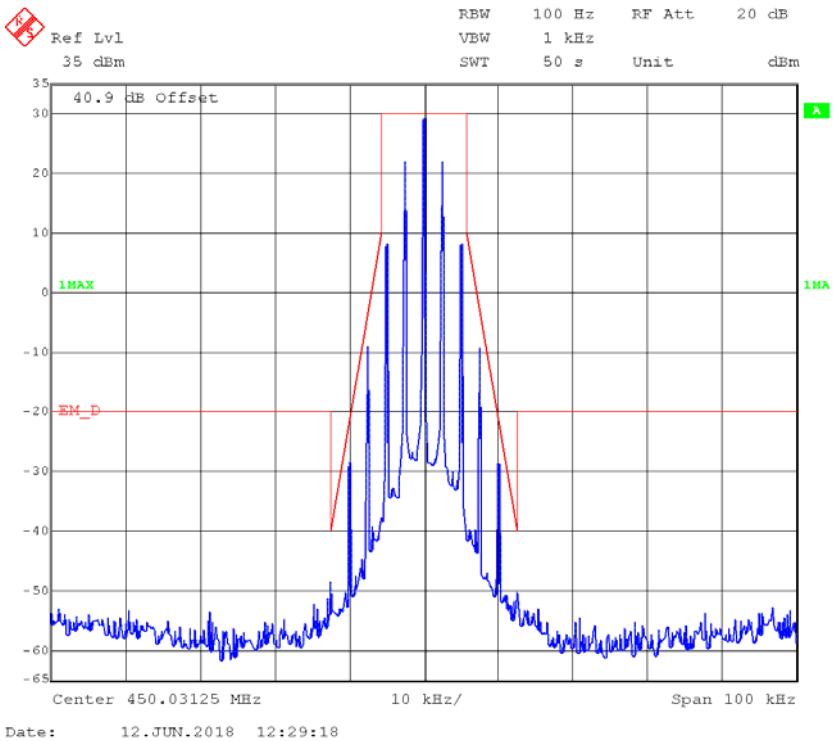
Emission Mask D



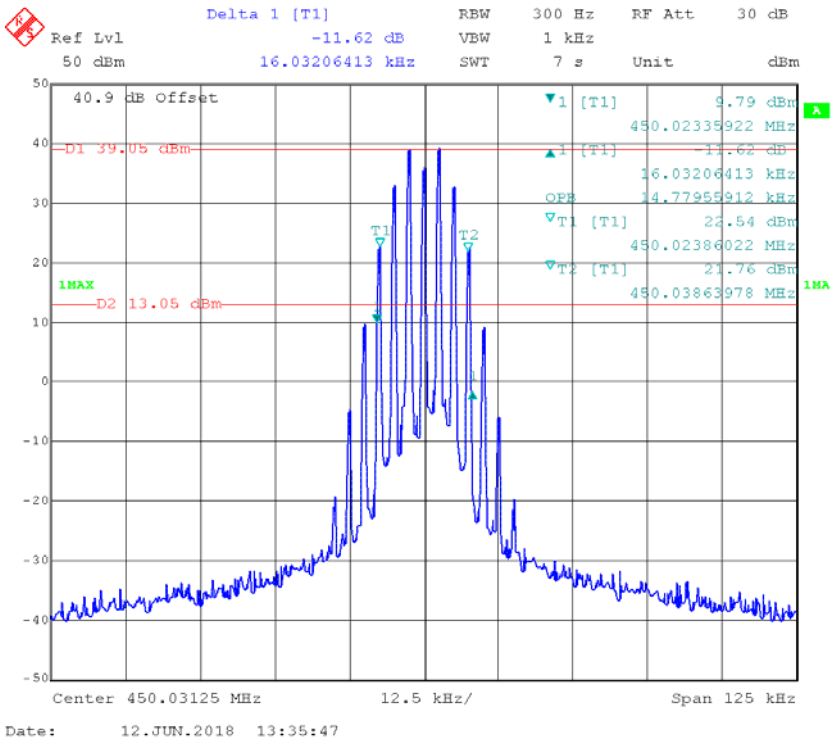
FM,12.5kHz,Low Power - Frequency 450.03125 MHz: 99% Occupied & 26 dB Bandwidth



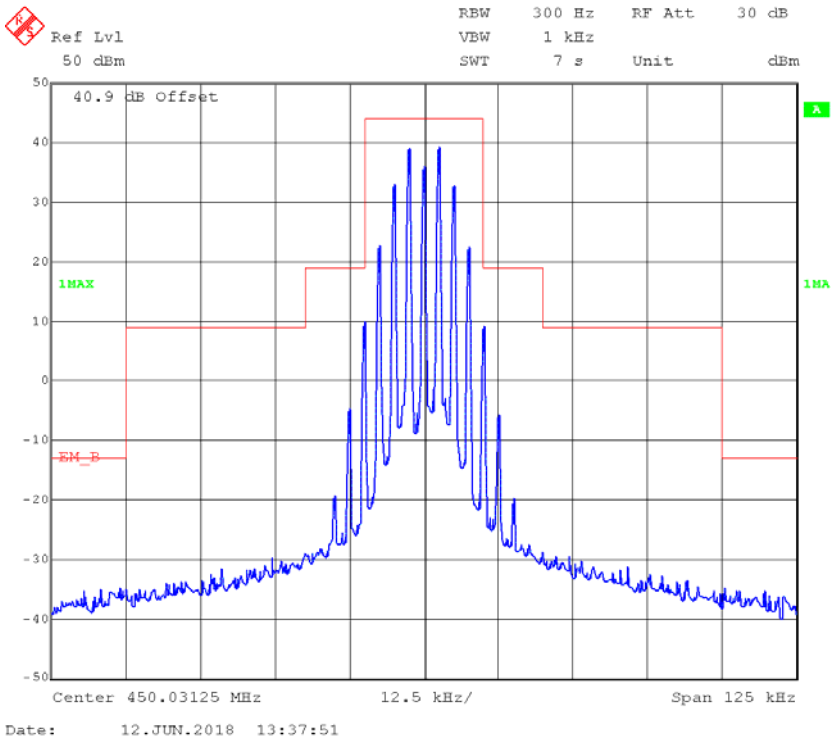
Emission Mask D



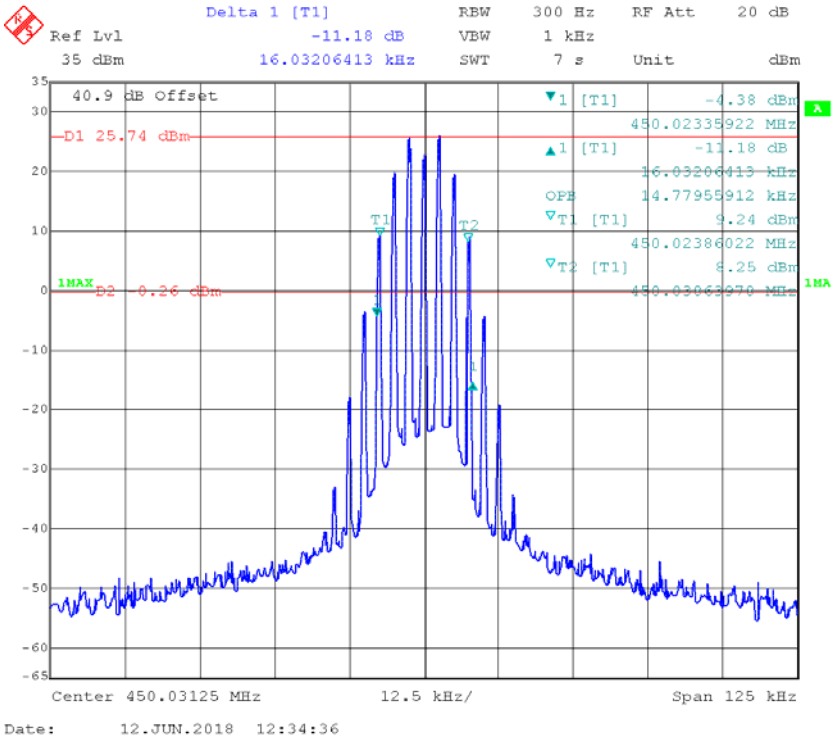
FM,25kHz,High Power - Frequency 450.03125 MHz: 99% Occupied & 26 dB Bandwidth



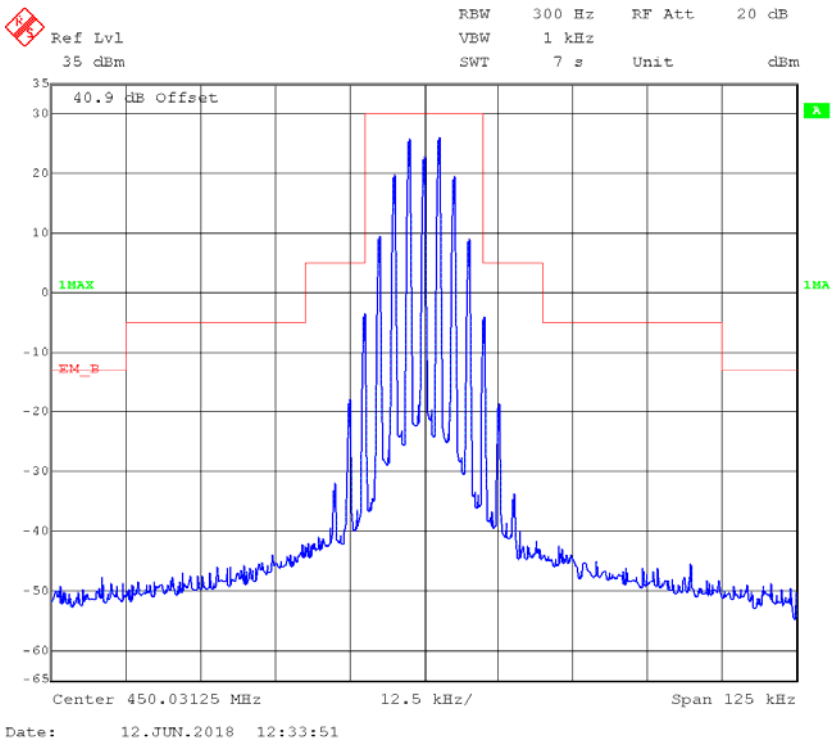
Emission Mask B



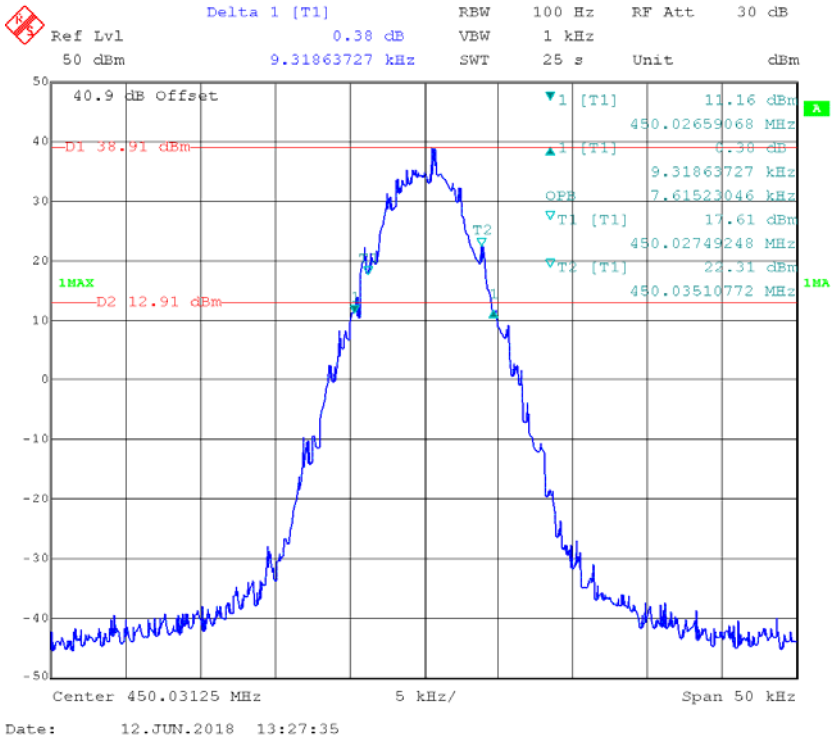
FM,25kHz,Low Power - Frequency 450.03125 MHz: 99% Occupied & 26 dB Bandwidth



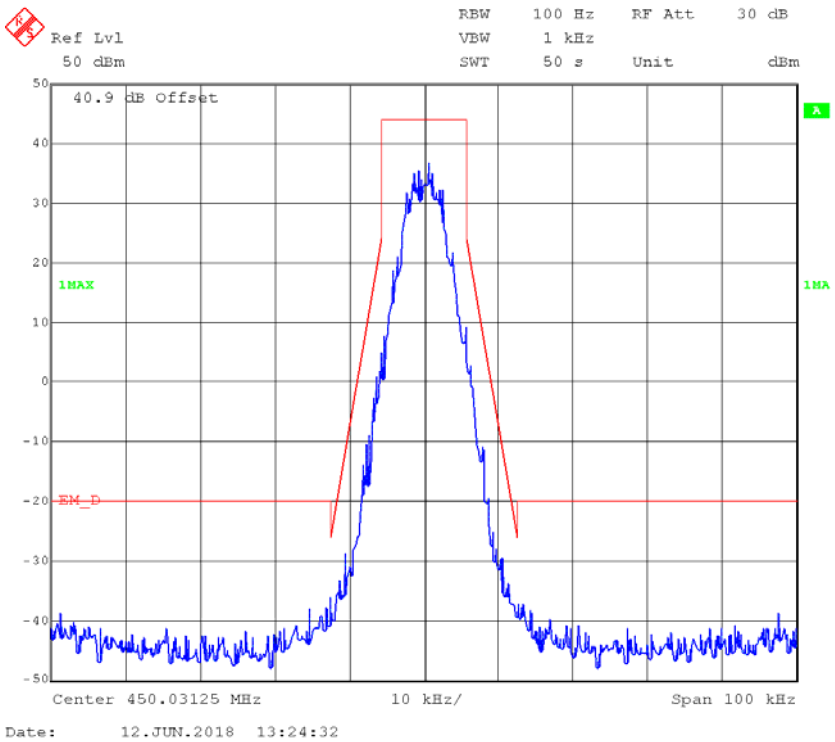
Emission Mask B



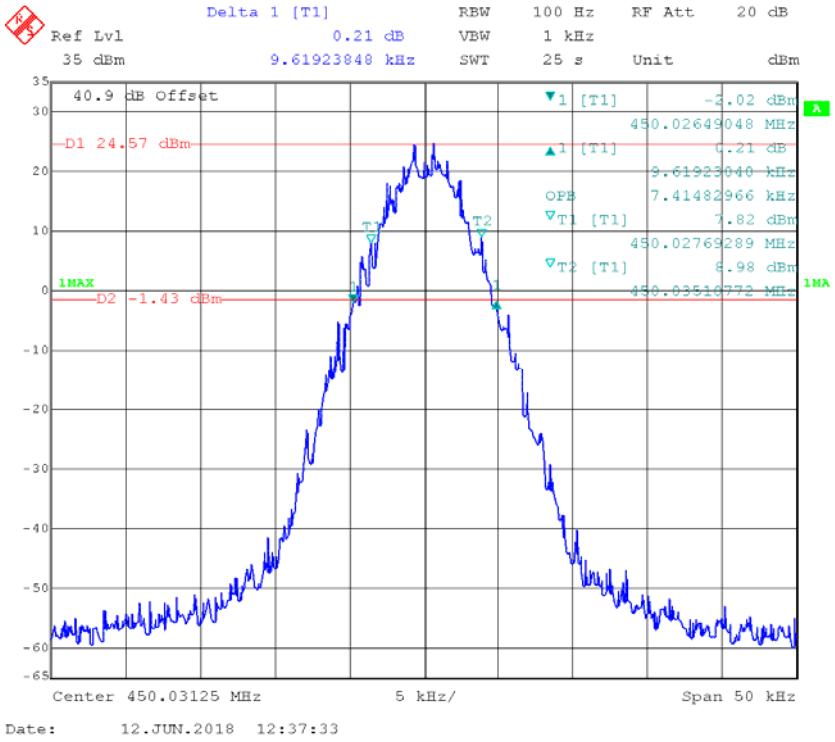
4FSK,12.5kHz,High Power - Frequency 450.03125 MHz: 99% Occupied & 26 dB Bandwidth



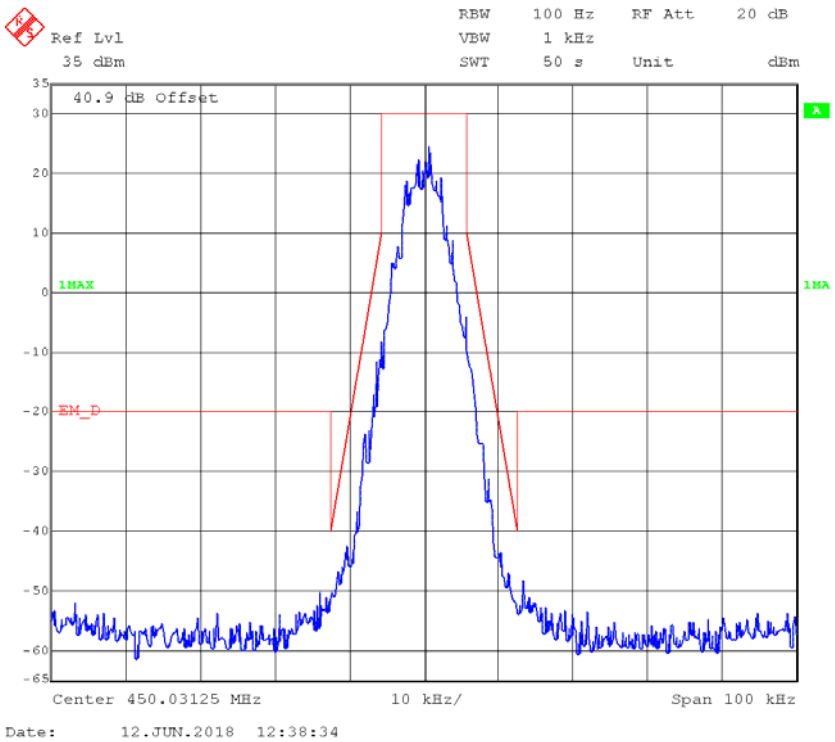
Emission Mask D



4FSK,12.5kHz,Low Power - Frequency 450.03125 MHz: 99% Occupied & 26 dB Bandwidth

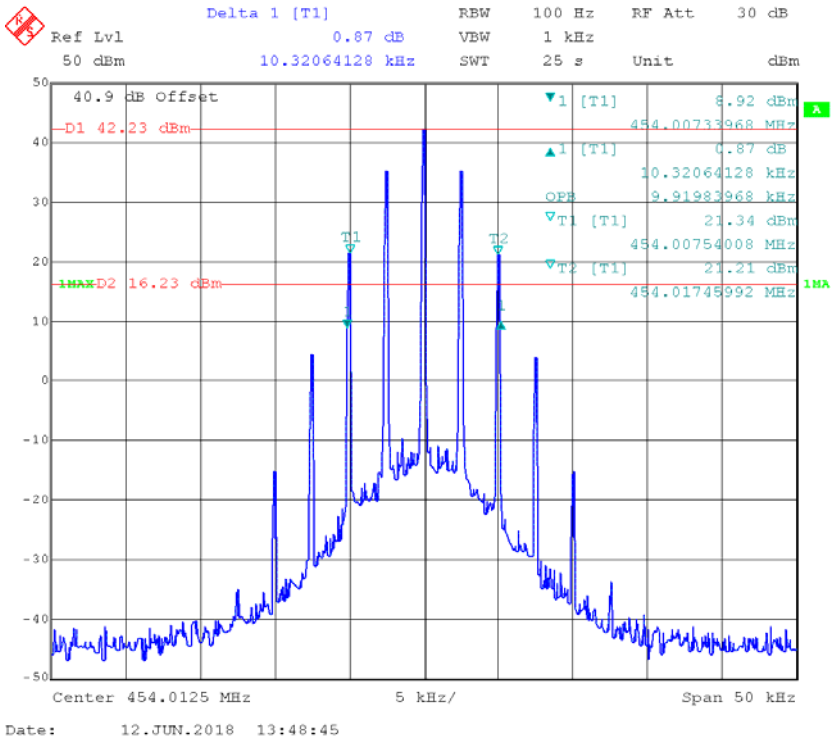


Emission Mask D

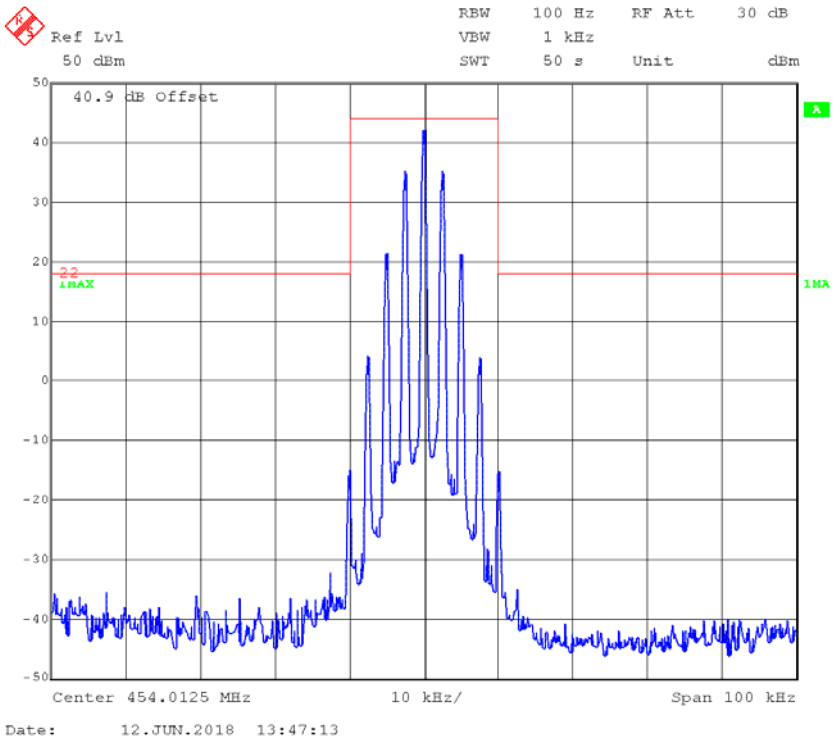


Part 22

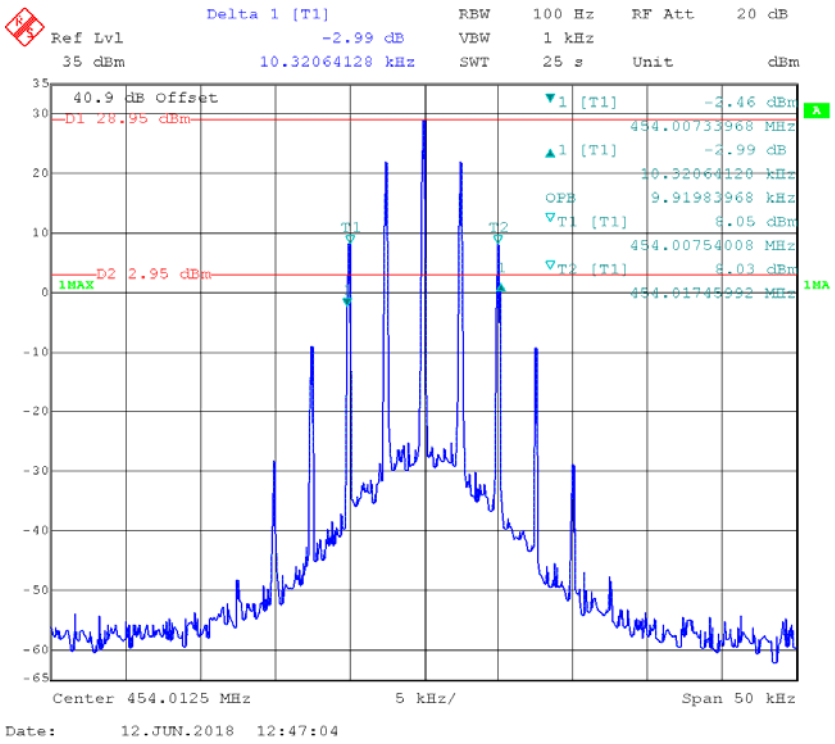
FM,12.5kHz,High Power - Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth



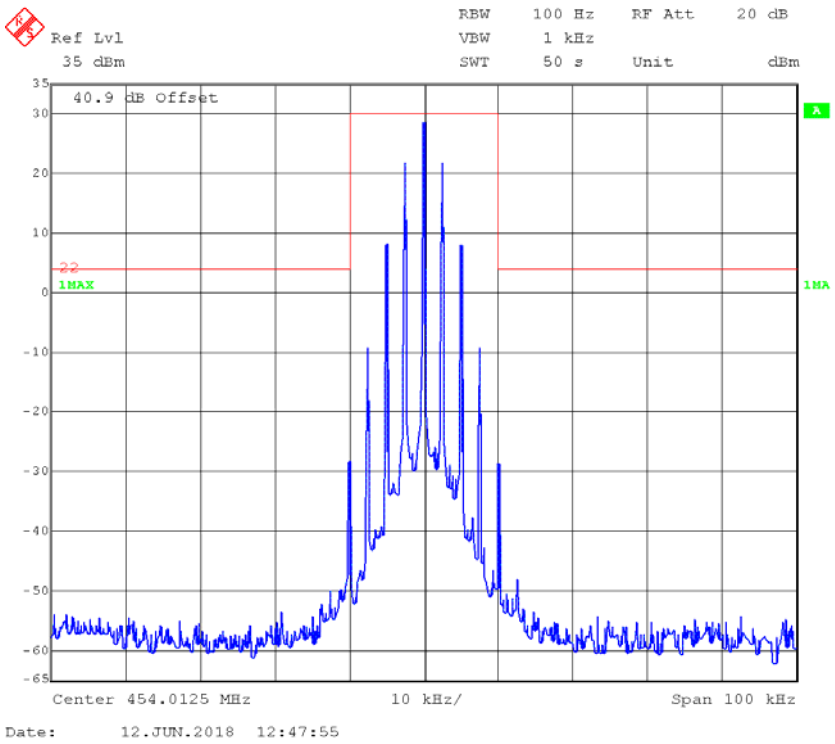
Emission Mask-§22.359



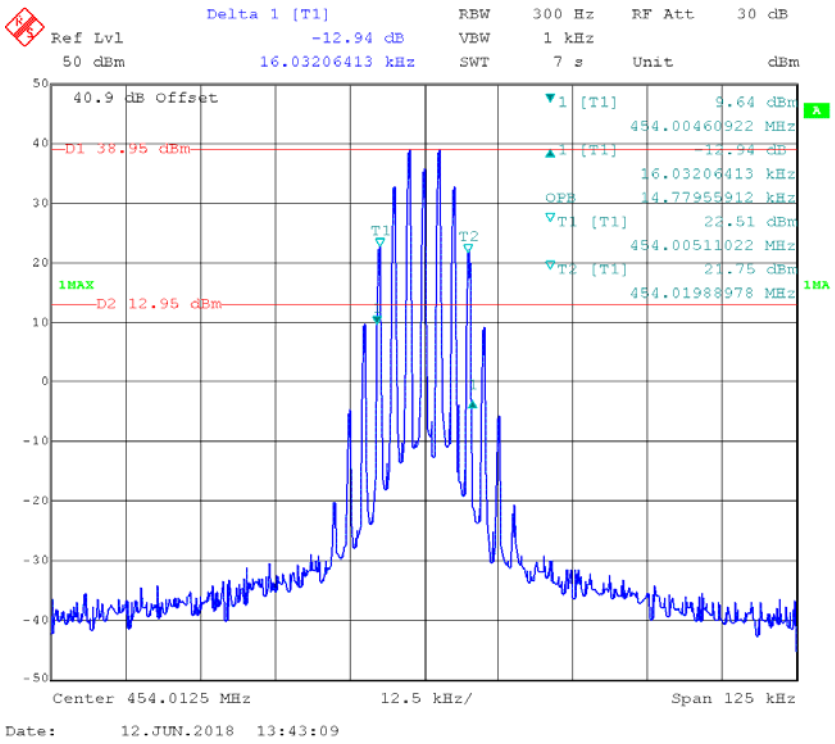
FM,12.5kHz,Low Power - Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth



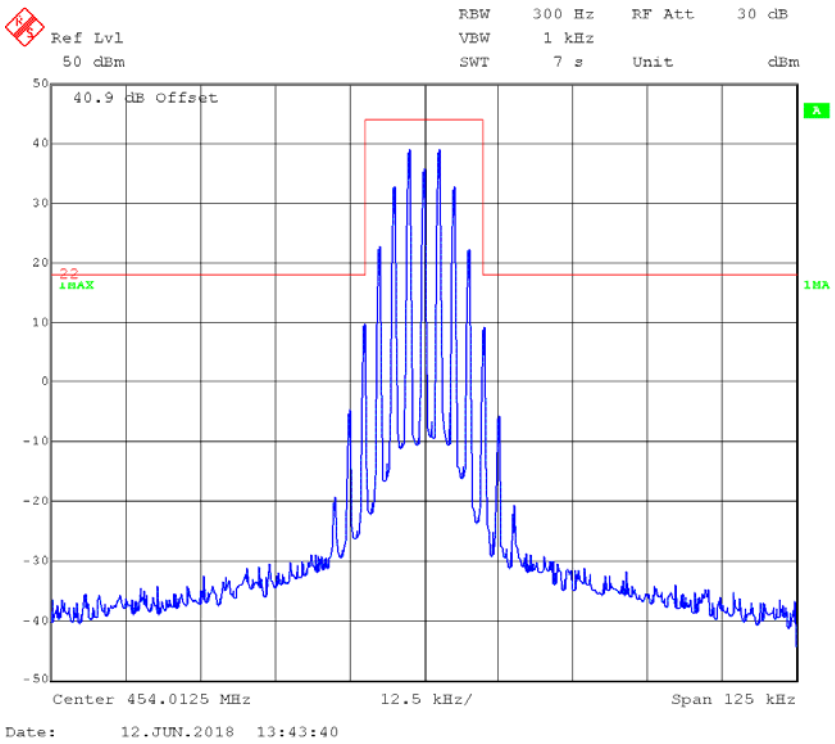
Emission Mask-§22.359



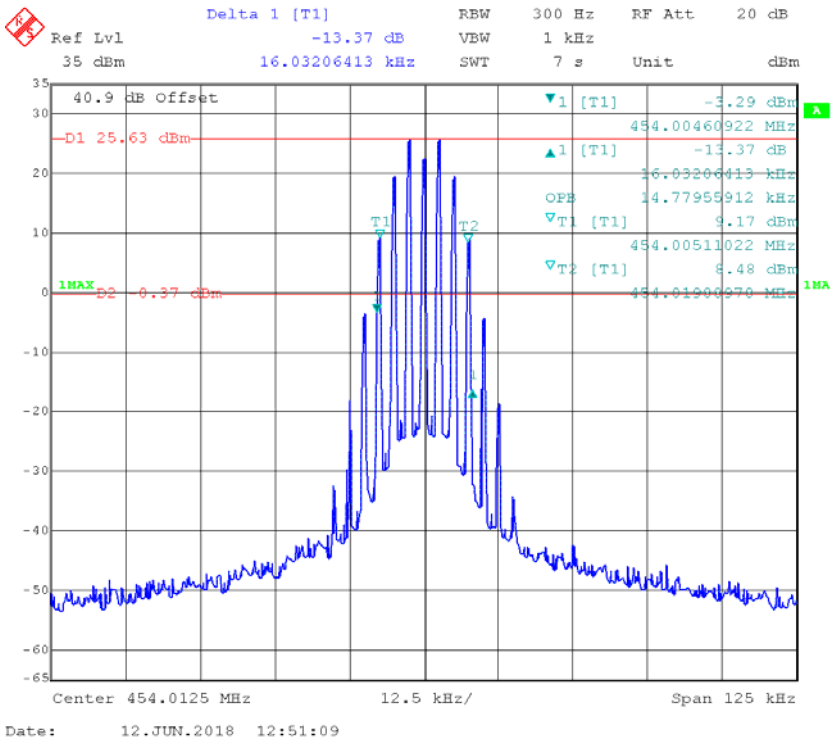
FM,25kHz,High Power - Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth



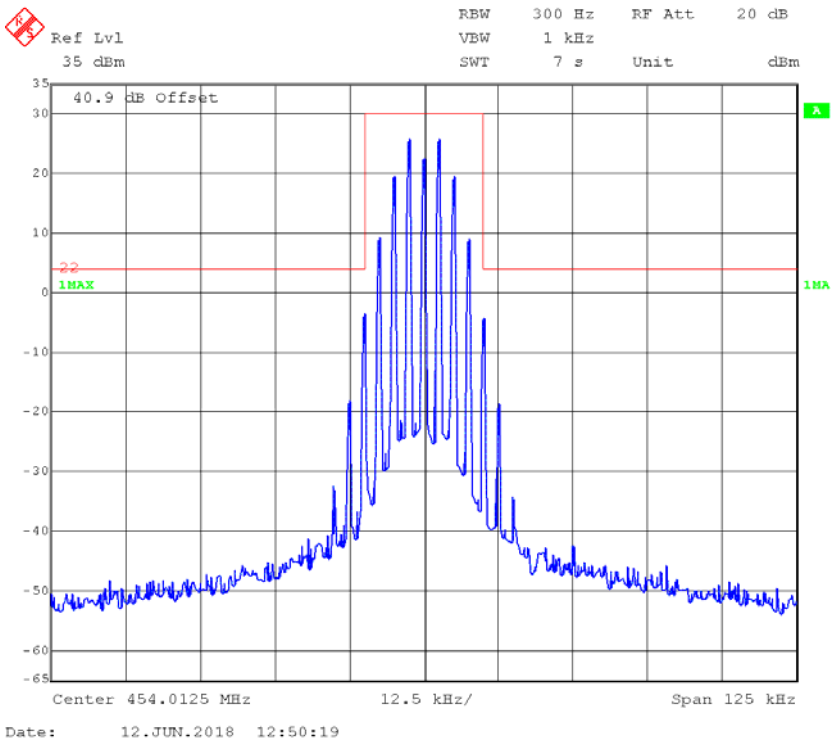
Emission Mask-§22.359



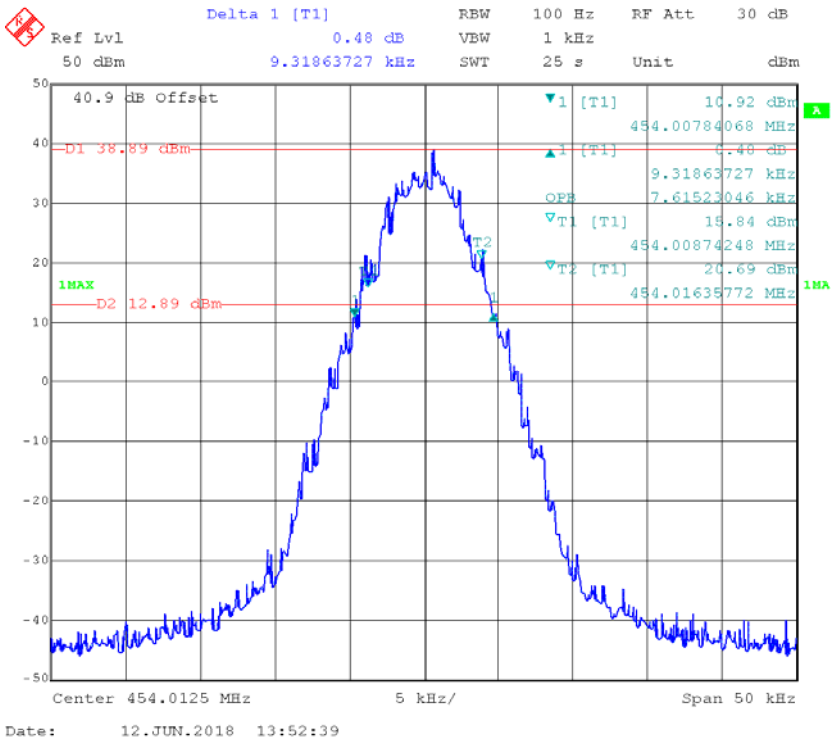
FM,25kHz,Low Power - Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth



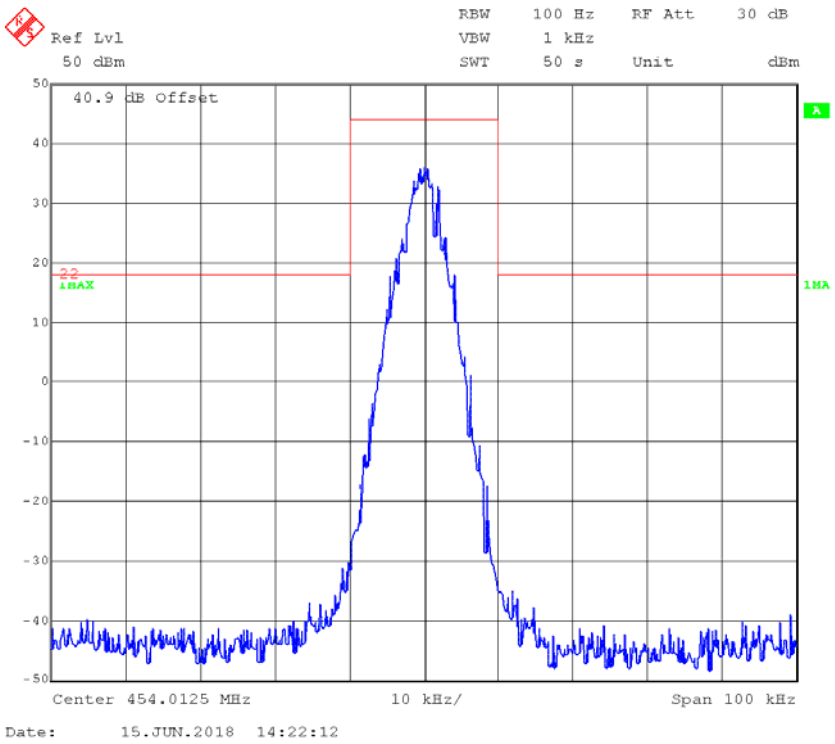
Emission Mask -§22.359



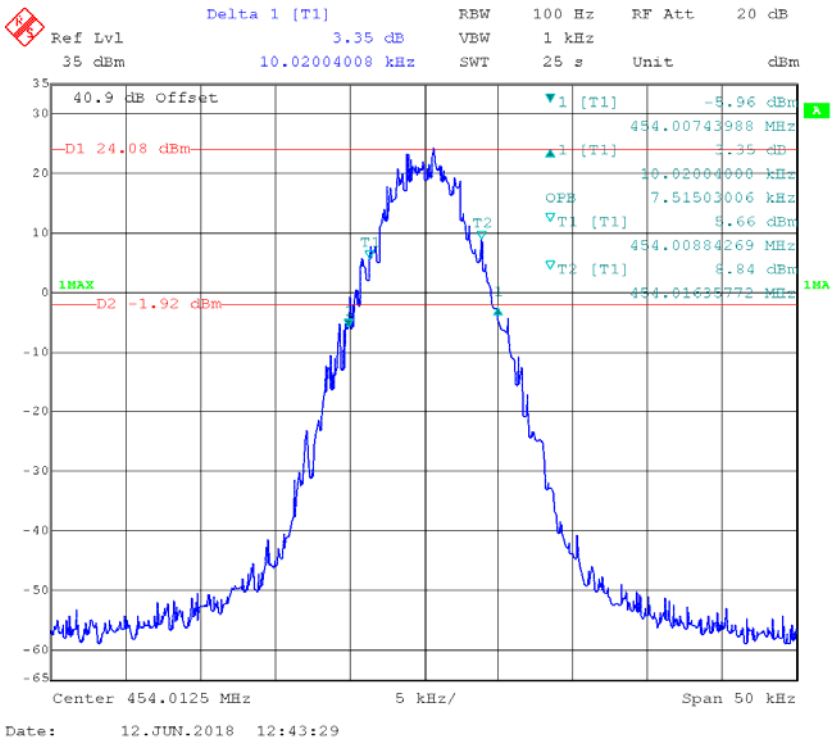
4FSK,12.5kHz,High Power - Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth



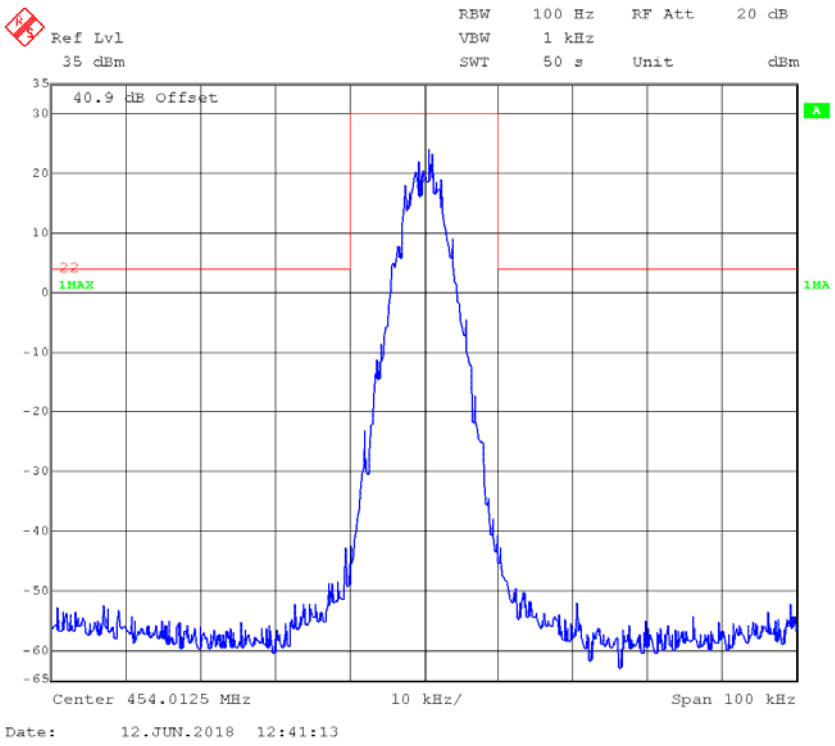
Emission Mask -§22.359



4FSK,12.5kHz,Low Power - Frequency 454.0125 MHz: 99% Occupied & 26 dB Bandwidth



Emission Mask-§22.359



FCC §2.1051 & §22.861 & §74.462 & § 80.211 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

FCC §2.1051, §22.861, §74.462, §80.211, and §90.210

Test Procedure

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:	27~27.3 ℃
Relative Humidity:	53~61 %
ATM Pressure:	101.3~101.4 kPa

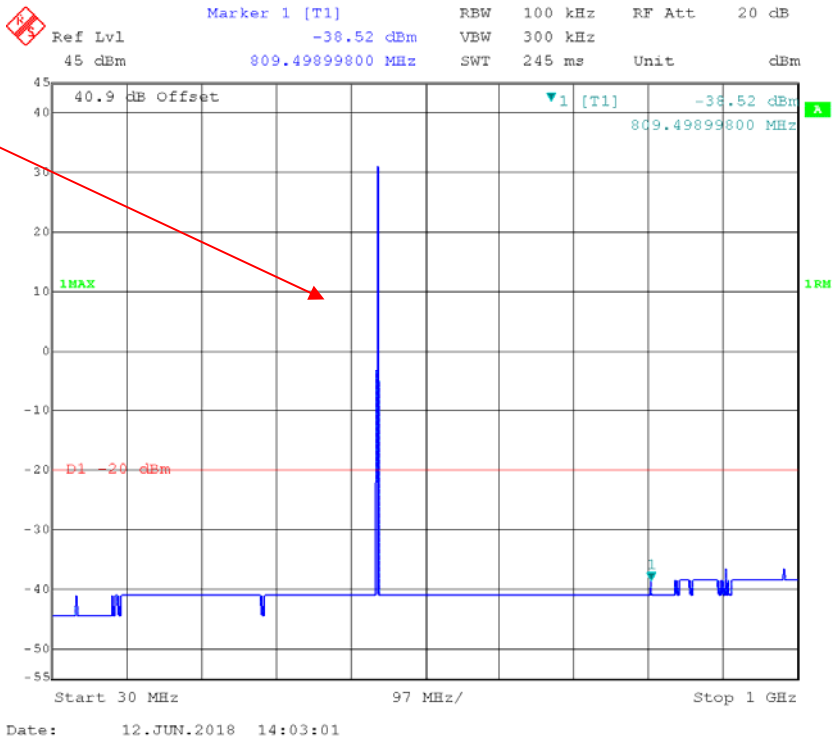
The testing was performed by Andy Huang on 2018-06-11 and 2018-06-12.

Test Mode: Transmitting, please refer to the following plots.

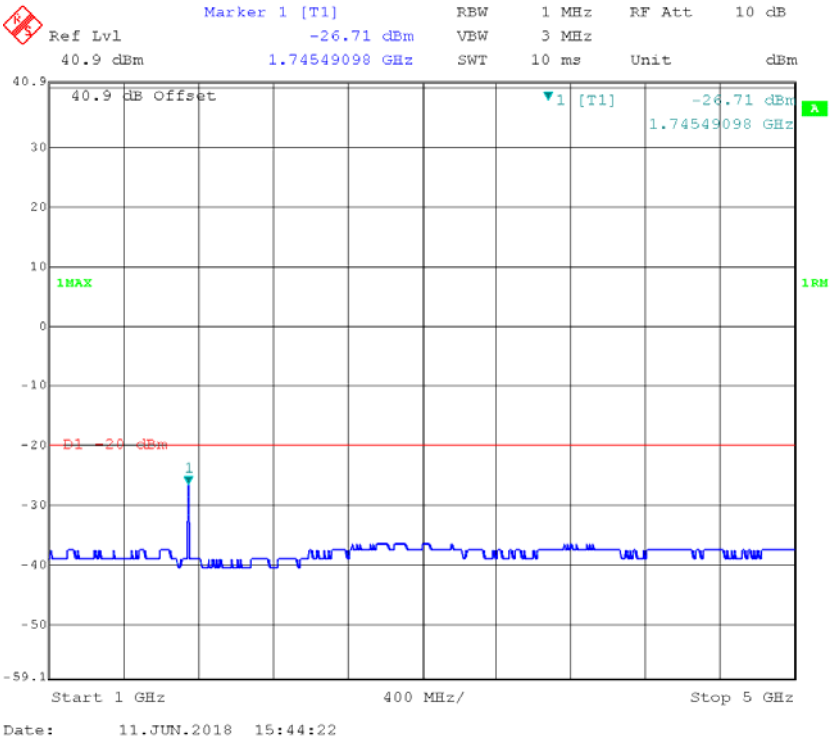
Part 90,
12.5kHz,FM, High power:

30MHz – 1 GHz, Channel Spacing 12.5 kHz, 453.2125 MHz

Fund.test

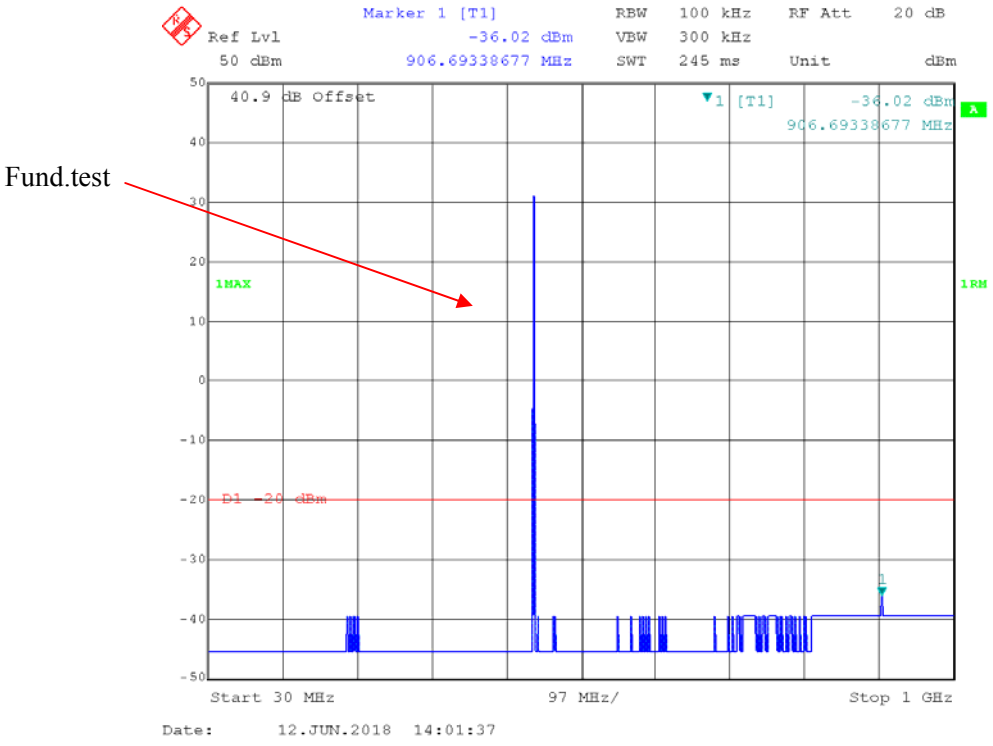


1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 453.2125 MHz



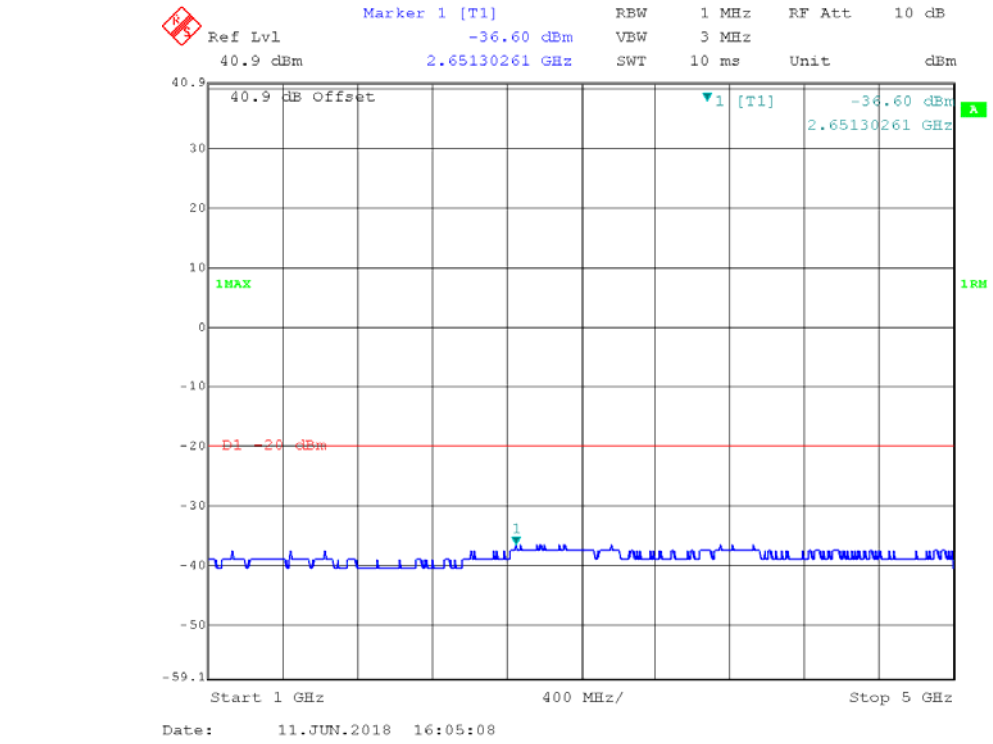
12.5kHz, 4FSK, High power:

30MHz – 1 GHz, Channel Spacing 12.5 kHz, 453.2125 MHz



Fund.test

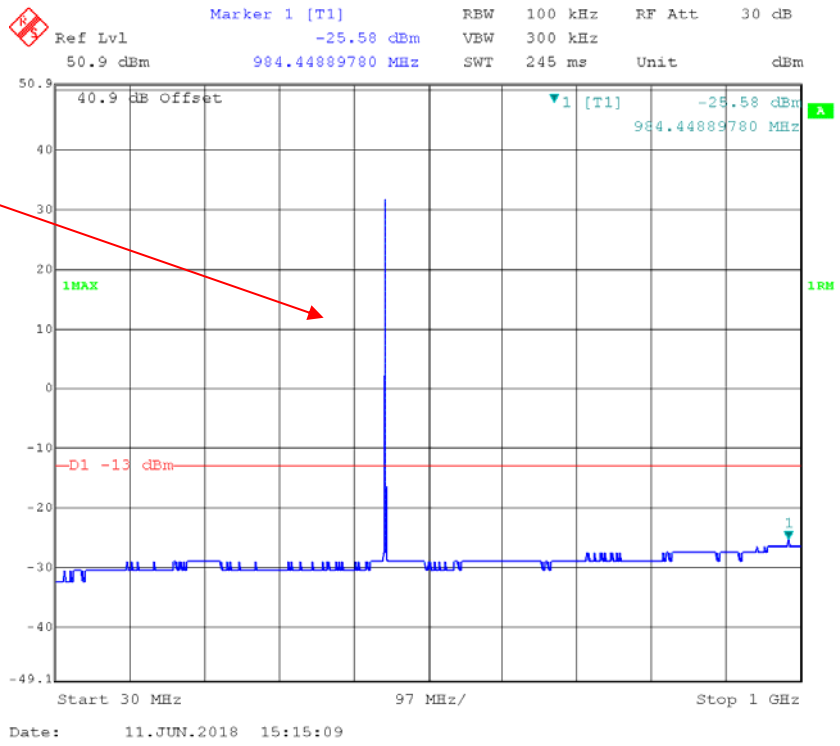
1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 453.2125 MHz



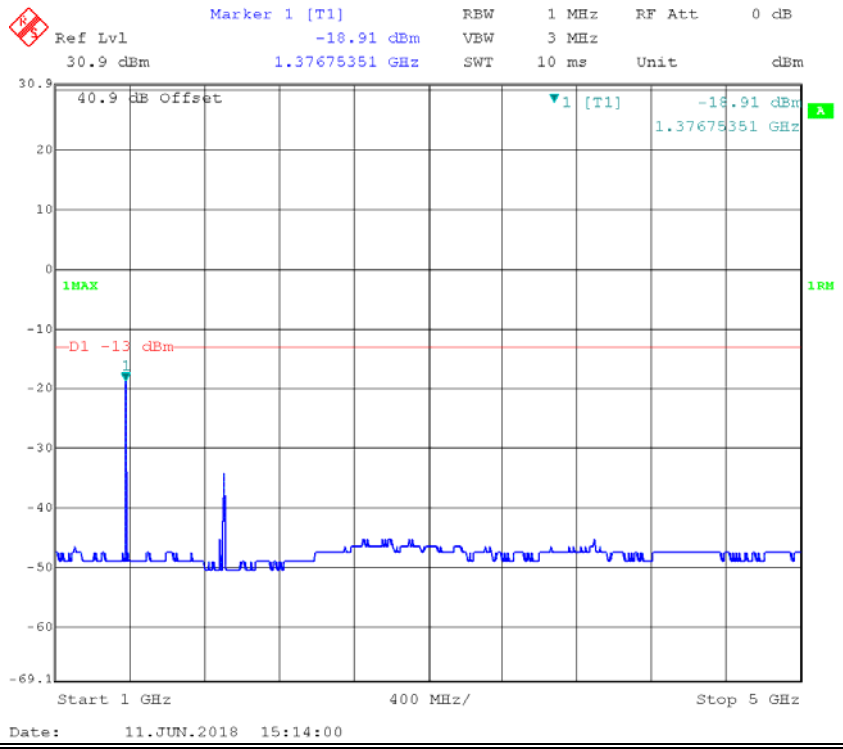
Part 80,
25kHz, FM, High power:

30MHz – 1 GHz, Channel Spacing 25 kHz, 459.9875 MHz

Fund.test

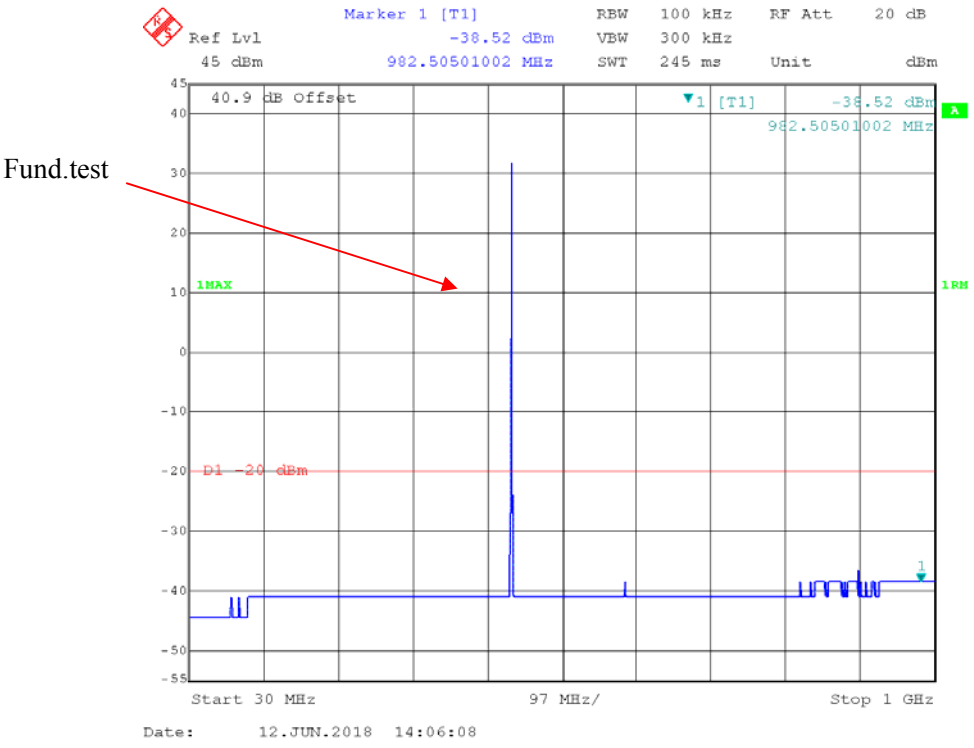


1 GHz – 5 GHz, Channel Spacing 25 kHz, 459.9875 MHz

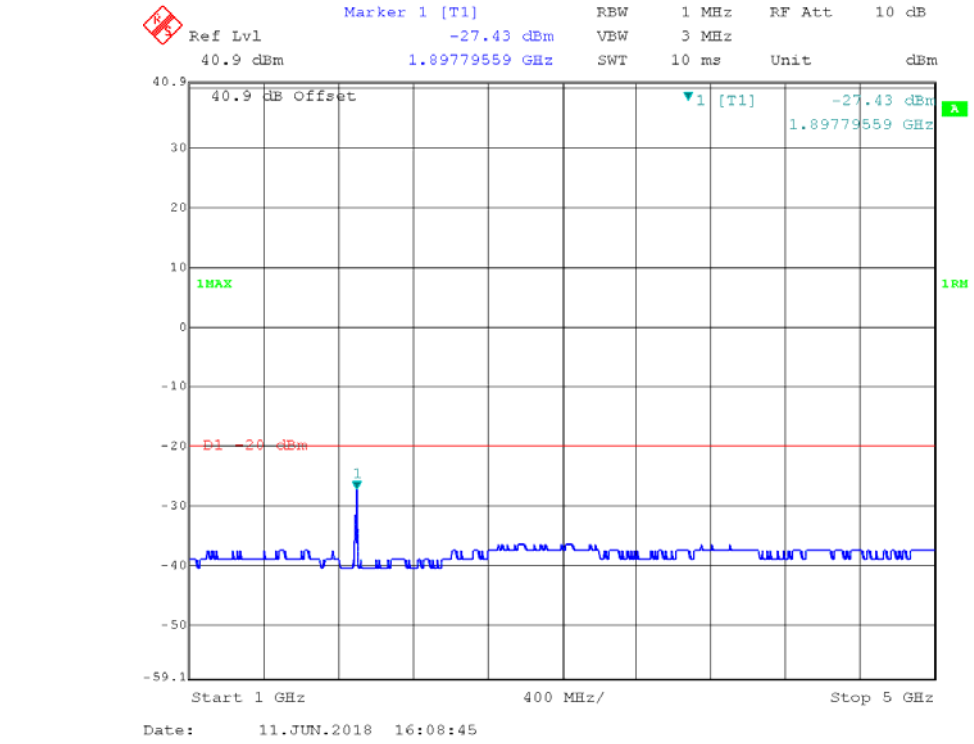


Part 74,
12.5kHz, FM, High power:

30MHz – 1 GHz, Channel Spacing 12.5 kHz, 450.03125 MHz



1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 450.03125 MHz

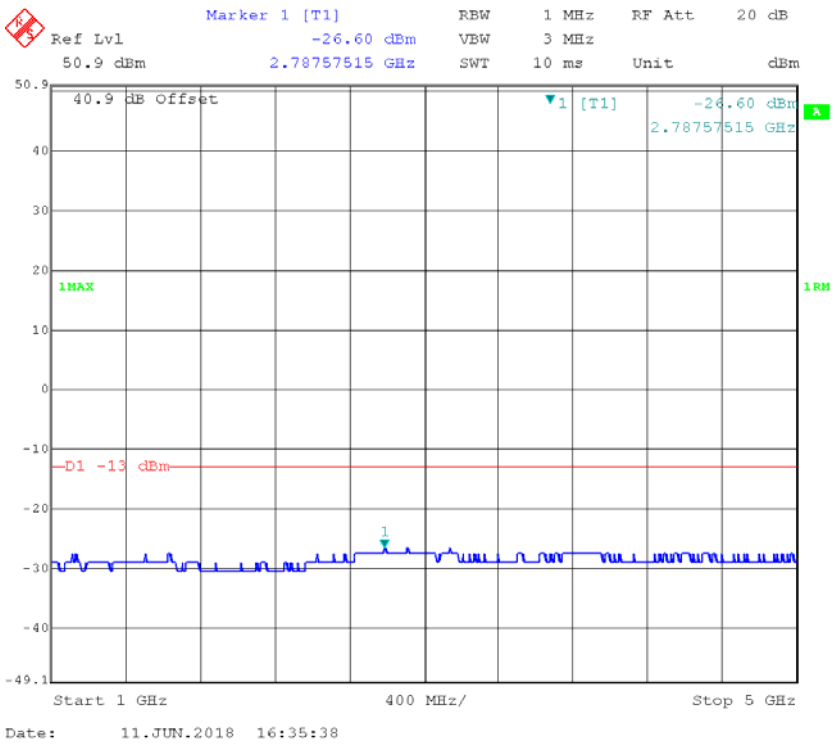


25kHz, FM, High power:

30MHz – 1 GHz, Channel Spacing 25 kHz, 450.03125 MHz

Fund.test

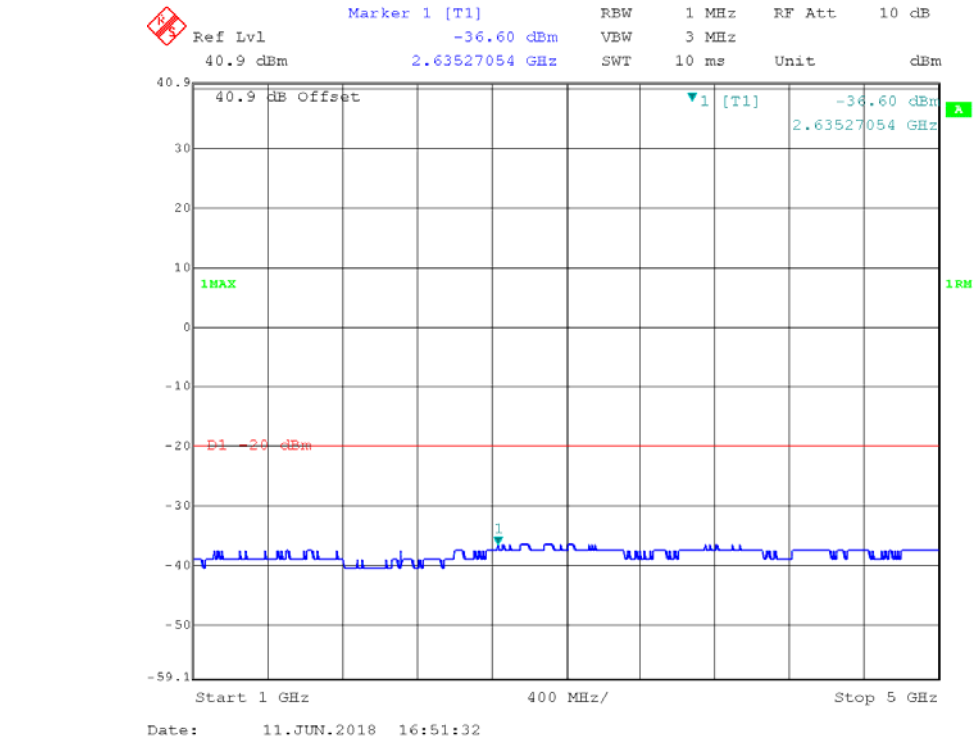
1 GHz – 5 GHz, Channel Spacing 25 kHz, 450.03125 MHz



12.5kHz, 4FSK, High power:

30MHz – 1 GHz, Channel Spacing 12.5 kHz, 450.03125 MHz

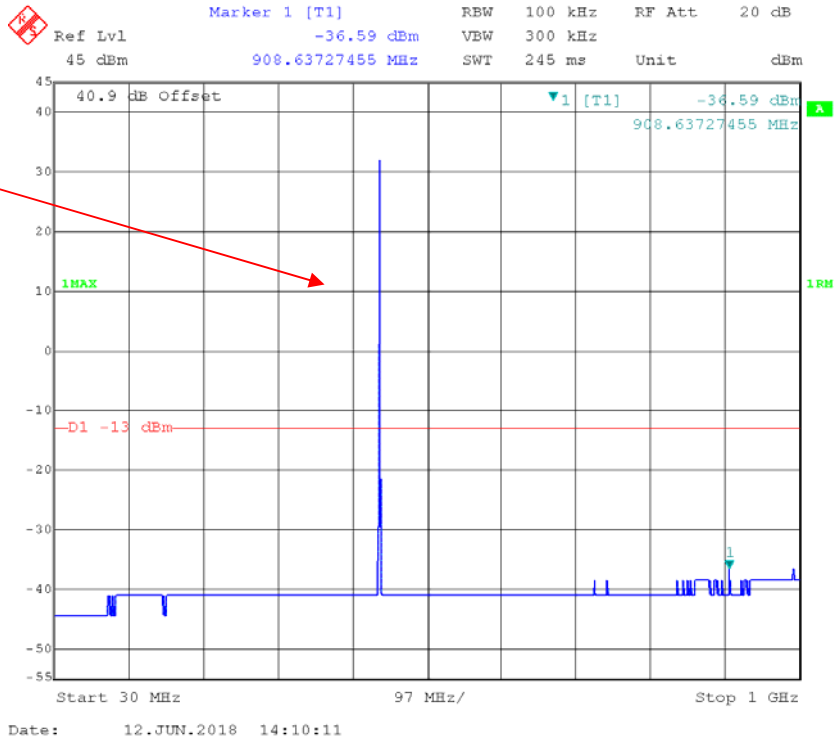
1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 450.03125 MHz



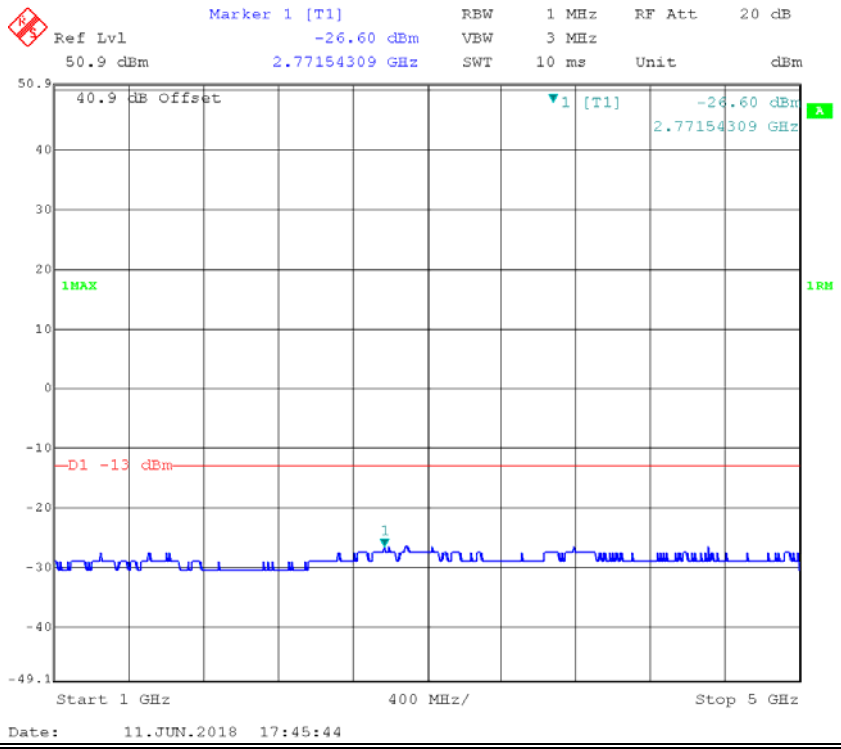
Part 22,
12.5kHz,FM, High power:

30MHz – 1 GHz, Channel Spacing 12.5 kHz, 454.0125 MHz

Fund.test



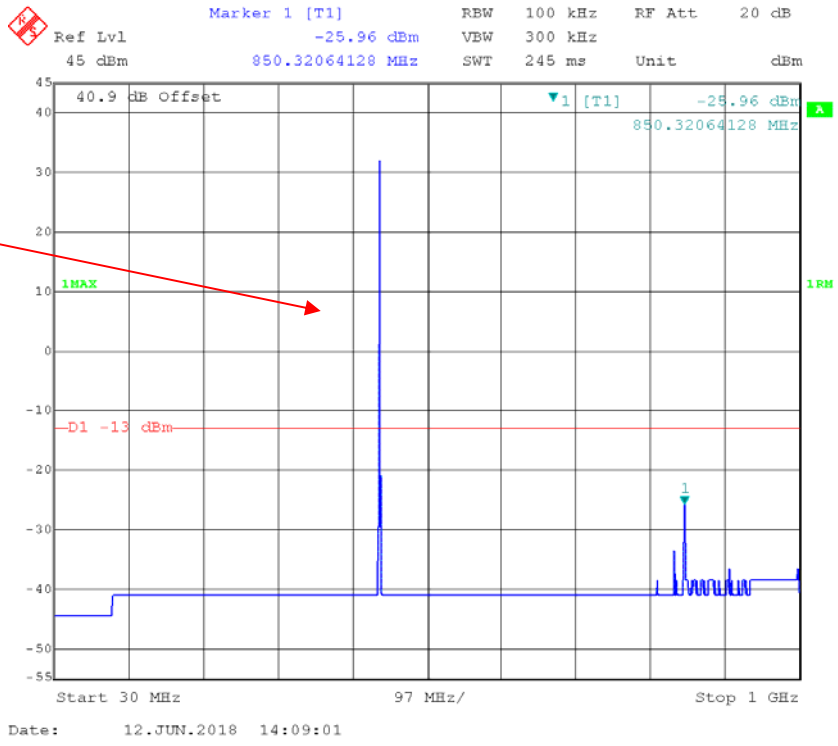
1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 454.0125 MHz



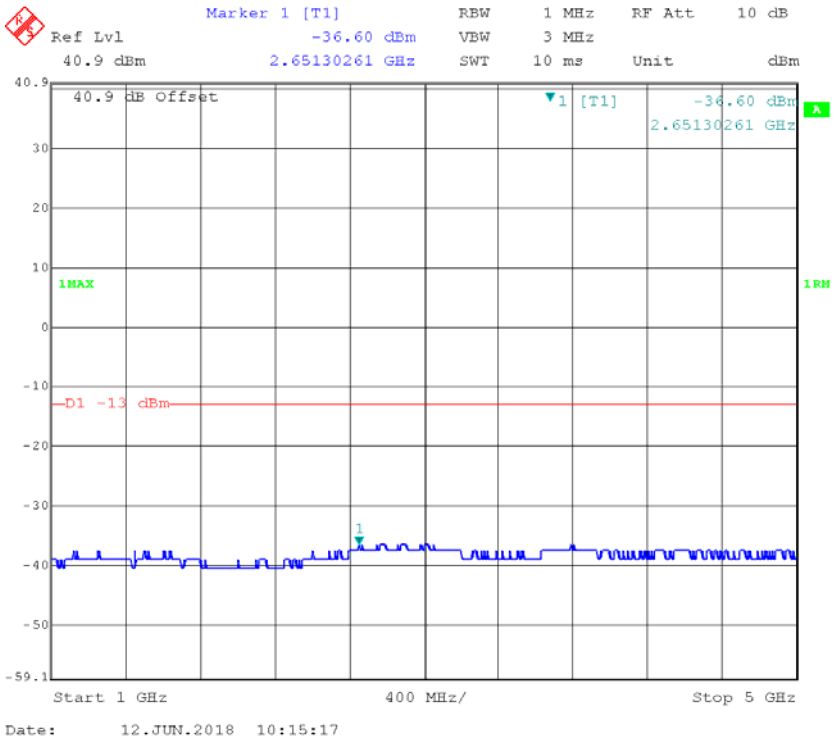
25kHz,FM, High power:

30MHz – 1 GHz, Channel Spacing 25 kHz, 454.0125 MHz

Fund.test



1 GHz – 5 GHz, Channel Spacing 25 kHz, 454.0125 MHz

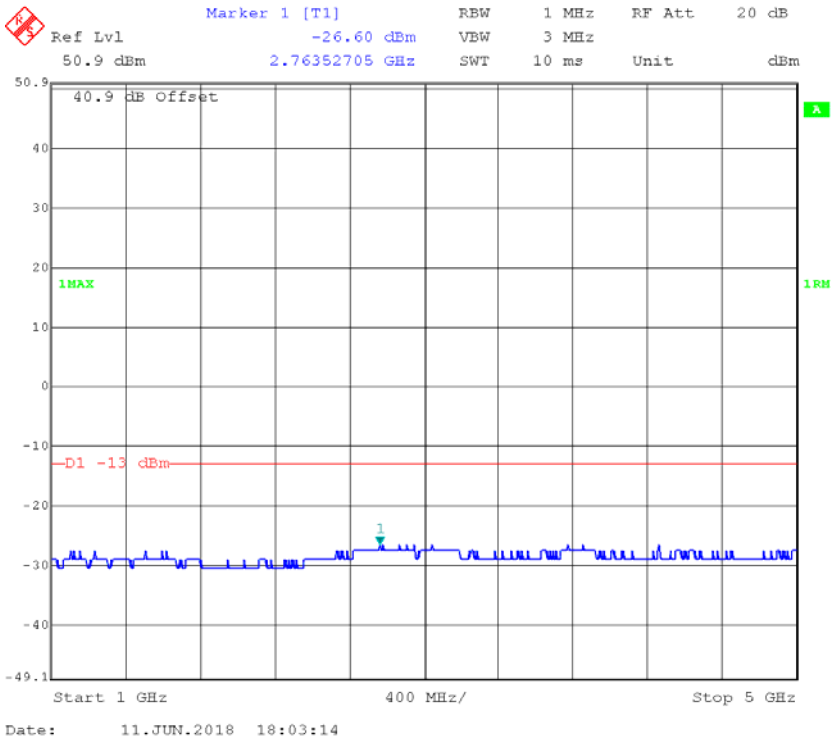


12.5kHz, 4FSK, High power:

30MHz – 1 GHz, Channel Spacing 12.5 kHz, 454.0125 MHz

Fund.test

1 GHz – 5 GHz, Channel Spacing 12.5 kHz, 454.0125 MHz



FCC §2.1053 & §22.861 & §74.462 &§80.211 & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053, §22.861, §74.462, §80.211 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 1g (TXpwr in Watts/0.001)-the absolute level

Test Data

Environmental Conditions

Temperature:	26.3~27.8 ℃
Relative Humidity:	40~45 %
ATM Pressure:	101.9 kPa

The testing was performed by Blake Yang& Vern Shen on 2018-06-08.

Test Mode: Transmitting

30MHz - 5GHz:

Part 90

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM,Frequency: 453.2125MHz-12.5 kHz								
906.425	H	67.58	-29.3	0.0	1	-30.3	-20.0	10.3
906.425	V	56.21	-42.6	0.0	1	-43.6	-20.0	23.6
1359.638	H	52.99	-60.4	8.7	1.2	-52.9	-20.0	32.9
1359.638	V	53.65	-60.4	8.7	1.2	-52.9	-20.0	32.9
1812.850	H	52.72	-61.5	11.2	0.7	-51.0	-20.0	31.0
1812.850	V	53.16	-61.6	11.2	0.7	-51.1	-20.0	31.1
2266.063	H	51.77	-60.5	11.1	1.2	-50.6	-20.0	30.6
2266.063	V	52.01	-60.2	11.1	1.2	-50.3	-20.0	30.3
2719.275	H	46.12	-66.2	13.1	1.3	-54.4	-20.0	34.4
2719.275	V	47.31	-65.1	13.1	1.3	-53.3	-20.0	33.3
3172.488	H	45.65	-64.4	13.5	1.6	-52.5	-20.0	32.5
3172.488	V	46.82	-63.3	13.5	1.6	-51.4	-20.0	31.4
3625.700	H	45.25	-64.7	14.1	1.6	-52.2	-20.0	32.2
3625.700	V	46.17	-63.7	14.1	1.6	-51.2	-20.0	31.2
4FSK,Frequency: 453.2125MHz-12.5 kHz								
906.425	H	67.92	-29	0.0	1	-30.0	-20.0	10.0
906.425	V	55.34	-43.5	0.0	1	-44.5	-20.0	24.5
1359.638	H	54.31	-59.1	8.7	1.2	-51.6	-20.0	31.6
1359.638	V	55.24	-58.8	8.7	1.2	-51.3	-20.0	31.3
1812.850	H	53.12	-61.1	11.2	0.7	-50.6	-20.0	30.6
1812.850	V	54.27	-60.5	11.2	0.7	-50.0	-20.0	30.0
2266.063	H	55.63	-56.6	11.1	1.2	-46.7	-20.0	26.7
2266.063	V	56.73	-55.4	11.1	1.2	-45.5	-20.0	25.5
2719.275	H	51.24	-61	13.1	1.3	-49.2	-20.0	29.2
2719.275	V	51.68	-60.7	13.1	1.3	-48.9	-20.0	28.9
3172.488	H	46.25	-63.8	13.5	1.6	-51.9	-20.0	31.9
3172.488	V	47.11	-63	13.5	1.6	-51.1	-20.0	31.1
3625.700	H	45.32	-64.6	14.1	1.6	-52.1	-20.0	32.1
3625.700	V	46.08	-63.8	14.1	1.6	-51.3	-20.0	31.3

Part 80

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 459.9875MHz-25 kHz								
919.975	H	72.07	-24.2	0.0	1	-25.2	-13.0	12.2
919.975	V	57.46	-40.7	0.0	1	-41.7	-13.0	28.7
1379.963	H	52.36	-60.9	8.9	1.2	-53.2	-13.0	40.2
1379.963	V	53.47	-60.5	8.9	1.2	-52.8	-13.0	39.8
1839.950	H	54.85	-58.9	11.4	0.8	-48.3	-13.0	35.3
1839.950	V	56.73	-57.5	11.4	0.8	-46.9	-13.0	33.9
2299.938	H	58.02	-54.2	11.2	1.2	-44.2	-13.0	31.2
2299.938	V	59.27	-52.8	11.2	1.2	-42.8	-13.0	29.8
2759.925	H	47.35	-64.9	13.1	1.3	-53.1	-13.0	40.1
2759.925	V	48.62	-63.8	13.1	1.3	-52.0	-13.0	39.0
3219.913	H	46.25	-63.7	13.6	1.6	-51.7	-13.0	38.7
3219.913	V	47.11	-62.9	13.6	1.6	-50.9	-13.0	37.9
3679.900	H	45.06	-64.3	14.0	1.8	-52.1	-13.0	39.1
3679.900	V	46.13	-63.2	14.0	1.8	-51.0	-13.0	38.0

Part 74

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 450.03125MHz-12.5 kHz								
900.063	H	64.91	-32.2	0.0	1	-33.2	-20.0	13.2
900.063	V	54.71	-44.4	0.0	1	-45.4	-20.0	25.4
1350.094	H	54.85	-58.5	8.7	1.2	-51.0	-20.0	31.0
1350.094	V	55.21	-58.9	8.7	1.2	-51.4	-20.0	31.4
1800.125	H	52.38	-62	11.1	0.7	-51.6	-20.0	31.6
1800.125	V	53.81	-61.2	11.1	0.7	-50.8	-20.0	30.8
2250.157	H	50.66	-61.6	11.0	1.2	-51.8	-20.0	31.8
2250.157	V	51.74	-60.5	11.0	1.2	-50.7	-20.0	30.7
2700.188	H	46.52	-65.8	13.1	1.3	-54.0	-20.0	34.0
2700.188	V	47.13	-65.3	13.1	1.3	-53.5	-20.0	33.5
3150.219	H	45.68	-64.7	13.4	1.7	-53.0	-20.0	33.0
3150.219	V	46.32	-64.1	13.4	1.7	-52.4	-20.0	32.4
3600.250	H	45.31	-64.9	14.1	1.5	-52.3	-20.0	32.3
3600.250	V	46.28	-63.9	14.1	1.5	-51.3	-20.0	31.3

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
4FSK,Frequency: 450.03125MHz-12.5 kHz								
900.063	H	67.71	-29.4	0.0	1	-30.4	-20.0	10.4
900.063	V	59.67	-39.5	0.0	1	-40.5	-20.0	20.5
1350.094	H	54.31	-59.1	8.7	1.2	-51.6	-20.0	31.6
1350.094	V	55.10	-59	8.7	1.2	-51.5	-20.0	31.5
1800.125	H	51.65	-62.7	11.1	0.7	-52.3	-20.0	32.3
1800.125	V	52.73	-62.3	11.1	0.7	-51.9	-20.0	31.9
2250.157	H	50.21	-62.1	11.0	1.2	-52.3	-20.0	32.3
2250.157	V	51.74	-60.5	11.0	1.2	-50.7	-20.0	30.7
2700.188	H	47.25	-65	13.1	1.3	-53.2	-20.0	33.2
2700.188	V	48.63	-63.8	13.1	1.3	-52.0	-20.0	32.0
3150.219	H	45.27	-65.1	13.4	1.7	-53.4	-20.0	33.4
3150.219	V	46.05	-64.4	13.4	1.7	-52.7	-20.0	32.7
3600.250	H	44.87	-65.3	14.1	1.5	-52.7	-20.0	32.7
3600.250	V	45.13	-65.1	14.1	1.5	-52.5	-20.0	32.5
FM, Frequency: 450.03125MHz-25 kHz								
900.063	H	66.67	-30.5	0.0	1	-31.5	-13.0	18.5
900.063	V	57.03	-42.1	0.0	1	-43.1	-13.0	30.1
1350.094	H	54.63	-58.8	8.7	1.2	-51.3	-13.0	38.3
1350.094	V	55.72	-58.4	8.7	1.2	-50.9	-13.0	37.9
1800.125	H	52.44	-62	11.1	0.7	-51.6	-13.0	38.6
1800.125	V	53.75	-61.2	11.1	0.7	-50.8	-13.0	37.8
2250.157	H	51.52	-60.8	11.0	1.2	-51.0	-13.0	38.0
2250.157	V	52.65	-59.5	11.0	1.2	-49.7	-13.0	36.7
2700.188	H	46.85	-65.4	13.1	1.3	-53.6	-13.0	40.6
2700.188	V	47.24	-65.2	13.1	1.3	-53.4	-13.0	40.4
3150.219	H	45.84	-64.5	13.4	1.7	-52.8	-13.0	39.8
3150.219	V	46.37	-64	13.4	1.7	-52.3	-13.0	39.3
3600.250	H	45.13	-65.1	14.1	1.5	-52.5	-13.0	39.5
3600.250	V	46.41	-63.8	14.1	1.5	-51.2	-13.0	38.2

Part 22

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 454.0125MHz-12.5 kHz								
908.025	H	68.64	-28.2	0.0	1	-29.2	-13.0	16.2
908.025	V	55.97	-42.8	0.0	1	-43.8	-13.0	30.8
1362.038	H	54.03	-59.3	8.7	1.2	-51.8	-13.0	38.8
1362.038	V	55.12	-58.9	8.7	1.2	-51.4	-13.0	38.4
1816.050	H	56.15	-58	11.2	0.7	-47.5	-13.0	34.5
1816.050	V	57.22	-57.5	11.2	0.7	-47.0	-13.0	34.0
2270.063	H	50.91	-61.3	11.1	1.2	-51.4	-13.0	38.4
2270.063	V	51.82	-60.3	11.1	1.2	-50.4	-13.0	37.4
2724.075	H	50.43	-61.8	13.1	1.3	-50.0	-13.0	37.0
2724.075	V	51.21	-61.2	13.1	1.3	-49.4	-13.0	36.4
3178.088	H	47.65	-62.4	13.5	1.6	-50.5	-13.0	37.5
3178.088	V	48.32	-61.8	13.5	1.6	-49.9	-13.0	36.9
3632.100	H	45.13	-64.7	14.1	1.6	-52.2	-13.0	39.2
3632.100	V	46.11	-63.7	14.1	1.6	-51.2	-13.0	38.2
4FSK, Frequency: 454.0125MHz-12.5 kHz								
908.025	H	68.69	-28.1	0.0	1	-29.1	-13.0	16.1
908.025	V	55.25	-43.5	0.0	1	-44.5	-13.0	31.5
1362.038	H	53.41	-59.9	8.7	1.2	-52.4	-13.0	39.4
1362.038	V	54.85	-59.2	8.7	1.2	-51.7	-13.0	38.7
1816.050	H	52.17	-62	11.2	0.7	-51.5	-13.0	38.5
1816.050	V	53.26	-61.4	11.2	0.7	-50.9	-13.0	37.9
2270.063	H	50.54	-61.7	11.1	1.2	-51.8	-13.0	38.8
2270.063	V	51.63	-60.5	11.1	1.2	-50.6	-13.0	37.6
2724.075	H	48.52	-63.8	13.1	1.3	-52.0	-13.0	39.0
2724.075	V	49.73	-62.7	13.1	1.3	-50.9	-13.0	37.9
3178.088	H	46.57	-63.5	13.5	1.6	-51.6	-13.0	38.6
3178.088	V	47.83	-62.2	13.5	1.6	-50.3	-13.0	37.3
3632.100	H	45.52	-64.3	14.1	1.6	-51.8	-13.0	38.8
3632.100	V	46.74	-63.1	14.1	1.6	-50.6	-13.0	37.6

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 454.0125MHz-25 kHz								
908.025	H	68.56	-28.2	0.0	1	-29.2	-13.0	16.2
908.025	V	58.89	-39.9	0.0	1	-40.9	-13.0	27.9
1362.038	H	54.13	-59.2	8.7	1.2	-51.7	-13.0	38.7
1362.038	V	55.62	-58.4	8.7	1.2	-50.9	-13.0	37.9
1816.050	H	52.43	-61.7	11.2	0.7	-51.2	-13.0	38.2
1816.050	V	53.75	-60.9	11.2	0.7	-50.4	-13.0	37.4
2270.063	H	50.61	-61.6	11.1	1.2	-51.7	-13.0	38.7
2270.063	V	51.72	-60.4	11.1	1.2	-50.5	-13.0	37.5
2724.075	H	51.24	-61	13.1	1.3	-49.2	-13.0	36.2
2724.075	V	52.43	-60	13.1	1.3	-48.2	-13.0	35.2
3178.088	H	47.65	-62.4	13.5	1.6	-50.5	-13.0	37.5
3178.088	V	48.72	-61.4	13.5	1.6	-49.5	-13.0	36.5
3632.100	H	45.44	-64.4	14.1	1.6	-51.9	-13.0	38.9
3632.100	V	46.08	-63.8	14.1	1.6	-51.3	-13.0	38.3

Note:
Absolute Level = Substituted Level - Cable loss + Antenna Gain
Margin = Limit- Absolute Level

FCC §2.1055 & § 22.355 & §74.464& §80.209 & §90.213 - FREQUENCY STABILITY

Applicable Standard

FCC §2.1055, § 22.355, §74.464, §80.209 and §90.213

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads 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:	27.1 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

The testing was performed by Andy Huang on 2018-06-13.

Test Mode: Transmitting

FCC Part 90:

FM,12.5kHz, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	120	453.212561	0.13
-20	120	453.212533	0.07
-10	120	453.212519	0.04
0	120	453.212509	0.02
10	120	453.212522	0.05
20	120	453.212510	0.02
30	120	453.212537	0.08
40	120	453.212578	0.17
50	120	453.212533	0.07
60	120	453.212871	0.82
25	102	453.212514	0.03
25	138	453.212525	0.06

4FSK, 12.5kHz, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	120	453.212480	-0.04
-20	120	453.212590	0.20
-10	120	453.212580	0.18
0	120	453.212570	0.15
10	120	453.212570	0.15
20	120	453.212480	-0.04
30	120	453.212570	0.15
40	120	453.212610	0.24
50	120	453.212570	0.15
60	120	453.212790	0.64
25	102	453.212590	0.20
25	138	453.212470	-0.07

FM,12.5kHz, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	13.6	453.212562	0.14
-20	13.6	453.212527	0.06
-10	13.6	453.212515	0.03
0	13.6	453.212507	0.02
10	13.6	453.212524	0.05
20	13.6	453.212511	0.02
30	13.6	453.212536	0.08
40	13.6	453.212583	0.18
50	13.6	453.212531	0.07
60	13.6	453.212867	0.81
25	10.8	453.212513	0.03
25	16	453.212533	0.07

4FSK, 12.5kHz, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	13.6	453.212475	-0.06
-20	13.6	453.212597	0.21
-10	13.6	453.212579	0.17
0	13.6	453.212579	0.17
10	13.6	453.212560	0.13
20	13.6	453.212472	-0.06
30	13.6	453.212568	0.15
40	13.6	453.212608	0.24
50	13.6	453.212574	0.16
60	13.6	453.212780	0.62
25	10.8	453.212581	0.18
25	16	453.212463	-0.08

FCC Part 80:

FM,25kHz, Reference Frequency: 459.9875 MHz,Limit: ±5.0 ppm			
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	120	459.987461	-0.08
-20	120	459.987466	-0.07
-10	120	459.987434	-0.14
0	120	459.987413	-0.19
10	120	459.987483	-0.04
20	120	459.987400	-0.22
30	120	459.987442	-0.13
40	120	459.987460	-0.09
50	120	459.987453	-0.10
60	120	459.987436	-0.14
25	102	459.987451	-0.11
25	138	459.987412	-0.19

FM,25kHz, Reference Frequency: 459.9875 MHz,Limit: ±5.0 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	13.6	459.987468	-0.07
-20	13.6	459.987563	0.14
-10	13.6	459.987535	0.08
0	13.6	459.987503	0.01
10	13.6	459.987492	-0.02
20	13.6	459.987404	-0.21
30	13.6	459.987535	0.08
40	13.6	459.987561	0.13
50	13.6	459.987556	0.12
60	13.6	459.987528	0.06
25	10.8	459.987561	0.13
25	16	459.987402	-0.21

FCC Part 74:

FM, 12.5kHz, Reference Frequency: 450.03125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	120	450.031352	0.23
-20	120	450.031328	0.17
-10	120	450.031367	0.26
0	120	450.031359	0.24
10	120	450.031378	0.28
20	120	450.031310	0.13
30	120	450.031324	0.16
40	120	450.031366	0.26
50	120	450.031327	0.17
60	120	450.031329	0.18
25	102	450.031347	0.22
25	138	450.031319	0.15

4FSK, 12.5kHz, Reference Frequency: 450.03125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	120	450.031330	0.18
-20	120	450.031270	0.04
-10	120	450.031370	0.27
0	120	450.031320	0.16
10	120	450.031340	0.20
20	120	450.031390	0.31
30	120	450.031350	0.22
40	120	450.031430	0.40
50	120	450.031230	-0.04
60	120	450.031270	0.04
25	102	450.031400	0.33
25	138	450.031350	0.22

FM, 25kHz, Reference Frequency: 450.03125 MHz, Limit: ±5.0 ppm			
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	120	450.031300	0.11
-20	120	450.031420	0.38
-10	120	450.031350	0.22
0	120	450.031460	0.47
10	120	450.031360	0.24
20	120	450.031380	0.29
30	120	450.031420	0.38
40	120	450.031300	0.11
50	120	450.031400	0.33
60	120	450.031350	0.22
25	102	450.031290	0.09
25	138	450.031290	0.09

FM, 12.5kHz, Reference Frequency: 450.03125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	13.6	450.031356	0.24
-20	13.6	450.031322	0.16
-10	13.6	450.031374	0.28
0	13.6	450.031357	0.24
10	13.6	450.031388	0.31
20	13.6	450.031316	0.15
30	13.6	450.031333	0.18
40	13.6	450.031367	0.26
50	13.6	450.031329	0.18
60	13.6	450.031319	0.15
25	10.8	450.031349	0.22
25	16	450.031314	0.14

4FSK, 12.5kHz, Reference Frequency: 450.03125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	13.6	450.031320	0.16
-20	13.6	450.031261	0.02
-10	13.6	450.031370	0.27
0	13.6	450.031310	0.13
10	13.6	450.031332	0.18
20	13.6	450.031383	0.30
30	13.6	450.031353	0.23
40	13.6	450.031430	0.40
50	13.6	450.031240	-0.02
60	13.6	450.031266	0.04
25	13.45	450.031401	0.34
25	13.75	450.031350	0.22

FM, 25kHz, Reference Frequency: 450.03125 MHz, Limit: ±5.0 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	13.6	450.031303	0.12
-20	13.6	450.031428	0.40
-10	13.6	450.031358	0.24
0	13.6	450.031465	0.48
10	13.6	450.031358	0.24
20	13.6	450.031398	0.33
30	13.6	450.031426	0.39
40	13.6	450.031292	0.09
50	13.6	450.031410	0.36
60	13.6	450.031361	0.25
25	10.8	450.031275	0.06
25	16	450.031291	0.09

FCC Part 22:

FM, 12.5kHz, Reference Frequency: 454.0125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	120	454.012523	0.05
-20	120	454.012520	0.04
-10	120	454.012573	0.16
0	120	454.012535	0.08
10	120	454.012540	0.09
20	120	454.012510	0.02
30	120	454.012516	0.04
40	120	454.012563	0.14
50	120	454.012532	0.07
60	120	454.012527	0.06
25	102	454.012558	0.13
25	138	454.012517	0.04

4FSK,12.5kHz, Reference Frequency: 454.0125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	120	454.012620	0.26
-20	120	454.012590	0.20
-10	120	454.012670	0.37
0	120	454.012640	0.31
10	120	454.012530	0.07
20	120	454.012440	-0.13
30	120	454.012440	-0.13
40	120	454.012520	0.04
50	120	454.012530	0.07
60	120	454.012460	-0.09
25	102	454.012530	0.07
25	138	454.012610	0.24

FM, 25kHz, Reference Frequency: 454.0125 MHz, Limit: ±5 ppm			
Temperature (℃)	**Voltage Supplied (V_{AC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	120	454.012450	-0.11
-20	120	454.012440	-0.13
-10	120	454.012540	0.09
0	120	454.012460	-0.09
10	120	454.012470	-0.07
20	120	454.012470	-0.07
30	120	454.012480	-0.04
40	120	454.012460	-0.09
50	120	454.012430	-0.15
60	120	454.012530	0.07
25	102	454.012600	0.22
25	138	454.012470	-0.07

FM, 12.5kHz, Reference Frequency: 454.0125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	13.6	454.012530	0.07
-20	13.6	454.012520	0.04
-10	13.6	454.012581	0.18
0	13.6	454.012535	0.08
10	13.6	454.012541	0.09
20	13.6	454.012503	0.01
30	13.6	454.012524	0.05
40	13.6	454.012565	0.14
50	13.6	454.012522	0.05
60	13.6	454.012520	0.04
25	10.8	454.012559	0.13
25	16	454.012520	0.04

4FSK,12.5kHz, Reference Frequency: 454.0125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	13.6	454.012619	0.26
-20	13.6	454.012583	0.18
-10	13.6	454.012679	0.39
0	13.6	454.012632	0.29
10	13.6	454.012525	0.06
20	13.6	454.012446	-0.12
30	13.6	454.012444	-0.12
40	13.6	454.012528	0.06
50	13.6	454.012539	0.09
60	13.6	454.012465	-0.08
25	10.8	454.012529	0.06
25	16	454.012619	0.26

FM, 25kHz, Reference Frequency: 454.0125 MHz, Limit: ±5 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	13.6	454.012450	-0.11
-20	13.6	454.012435	-0.14
-10	13.6	454.012538	0.08
0	13.6	454.012458	-0.09
10	13.6	454.012461	-0.09
20	13.6	454.012473	-0.06
30	13.6	454.012471	-0.06
40	13.6	454.012462	-0.08
50	13.6	454.012438	-0.14
60	13.6	454.012527	0.06
25	10.8	454.012593	0.20
25	16	454.012467	-0.07

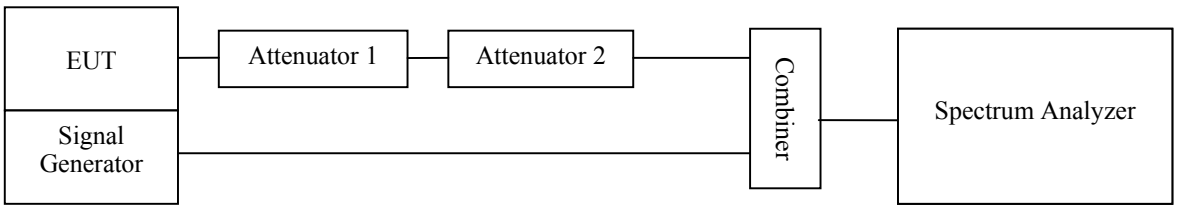
FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

Regulations: FCC §90.214
Test method: ANSI/TIA-603-D 2010, section 2.2.19.3

Test Procedure

a) Connect the EUT and test equipment as shown on the following block diagram.
b) Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
c) 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.
d) Turn on the transmitter.
e) 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.
f) Turn off the transmitter.
g) 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.
h) Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
i) 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 "tiger offset" to -10ms for turn on and -15ms for turn off.
j) 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.
k) 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:	27.1 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

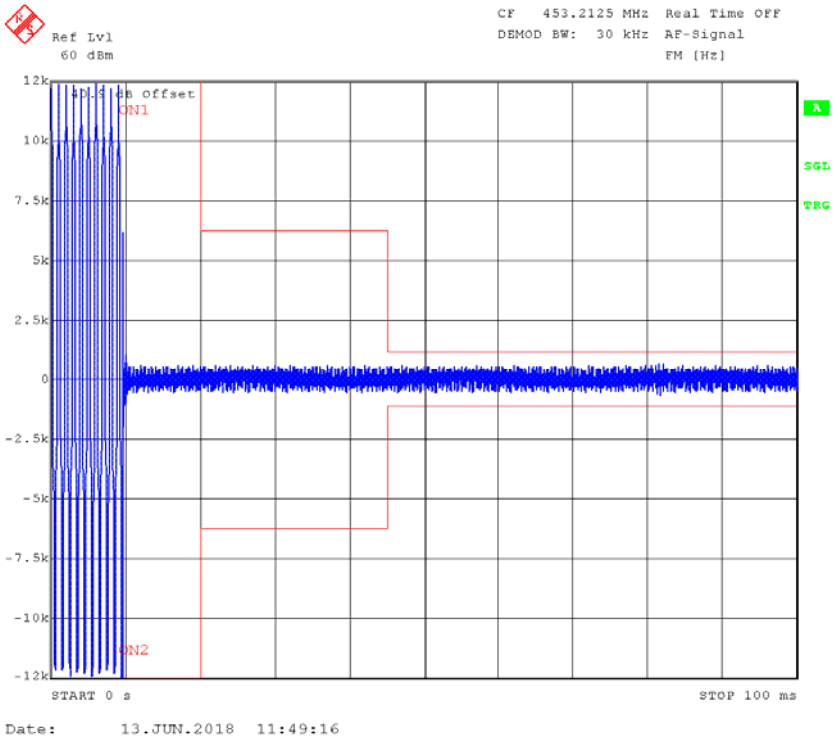
The testing was performed by Andy Huang on 2018-06-13.

Channel Spacing (kHz)	Transient Period (ms)	Transient Frequency	Result
12.5	<10(t_1)	±12.5 kHz	Pass
	<25(t_2)	±6.25 kHz	
	<10(t_3)	±12.5 kHz	

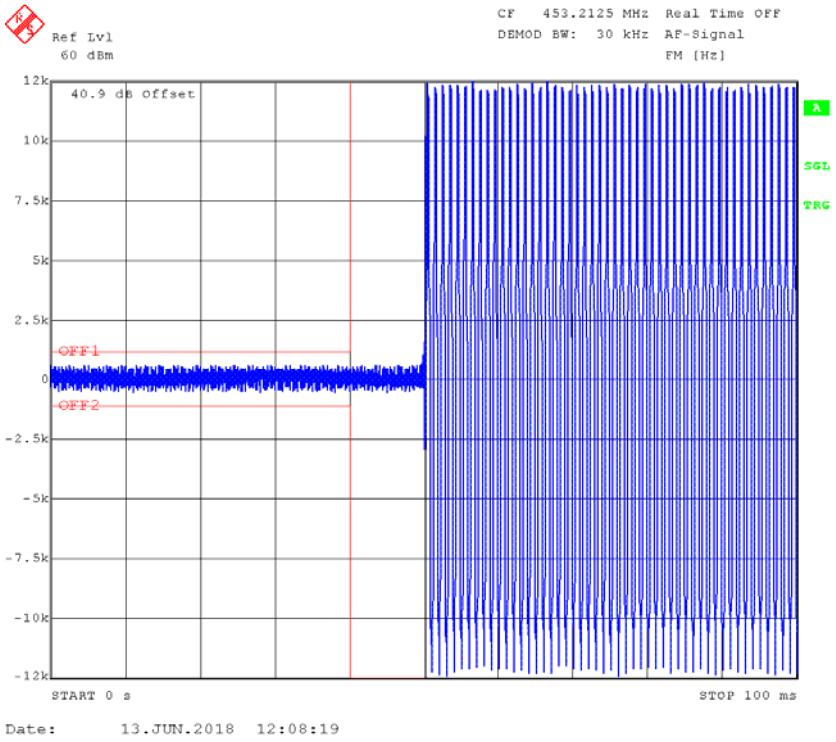
Please refer to the following plots.

High Power Channel: 453.2125 MHz

Turn on



Turn off



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