

# FCC PART 22, PART 74 AND PART 90 TEST REPORT

For

## Tait Limited

535 Wairakei Rd 1645 Christchurch New Zealand

**FCC ID: CASTPEHGD**

<b>Report Type:</b> Original Report	<b>Product Name:</b> Two way radio
<b>Report Number:</b>	RDG170810002-00A
<b>Report Date:</b>	2017-11-30
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**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.(Dongguan).

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## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The *Tait Limited*'s product, model number: *T03-00302-GCAA*, Type Code: *TPEHGD* (FCC ID: CASTPEHGD,) (the "EUT") in this report was a **Two way radio**, which was measured approximately: 6.6 cm (L) x 3.6 cm (W) x 14.5 cm (H), rated input voltage: DC7.4V from rechargeable Li-ion battery or DC 12V from adapter.

#### Adapter Information:

MODEL: ICP30-120-2000

INPUT: AC 100 ~ 240V, 50/60Hz, 0.8A

OUTPUT: DC 12V, 2000mA

*Note: The series product, model T03-00302-GCAA, T03-00302-GBAA, T03-00302-GAAA are electrically identical, we selected T03-00302-GCAA for fully testing, and all models for radiated test, the details was explained in the attached declaration letter.*

*All measurement and test data in this report was gathered from production sample serial number: 170810002 (Assigned by BACL). The EUT was received on 2017-08-10*

### Objective

This test report is prepared on behalf of **Tait Limited** in accordance with Part 2, Part 22, part 74 and Part 90 of the Federal Communications Commission rules.

### Related Submittal(s)/Grant(s)

No related submittal(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, Part 22, Part 74 and Part 90.

Applicable Standards: TIA-603-D.

The uncertainty of any RF tests which use conducted method measurement is  $\pm 0.5$  dB, the uncertainty of any radiation on emissions measurement is:

30M~200MHz:  $\pm 4.7$  dB;

200M~1GHz:  $\pm 6.0$  dB;

1G-6GHz:  $\pm 5.13$ dB;

6G~25GHz:  $\pm 5.47$ dB;

And the uncertainty will not be taken into consideration for all test data recorded in the report.

## **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.

Bay Area Compliance Laboratories Corp. (Dongguan) has been accredited to ISO/IEC 17025 by CNAS(Lab code: L5662). And accredited to ISO/IEC 17025 by NVLAP(Test Laboratory Accreditation Certificate Number 500069-0), the FCC Designation No. CN5002 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Dongguan) was 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 was provided by manufacturer. In the test mode, the software: `CPS` provided by manufacturer can change the test modulation, channels, and power level.

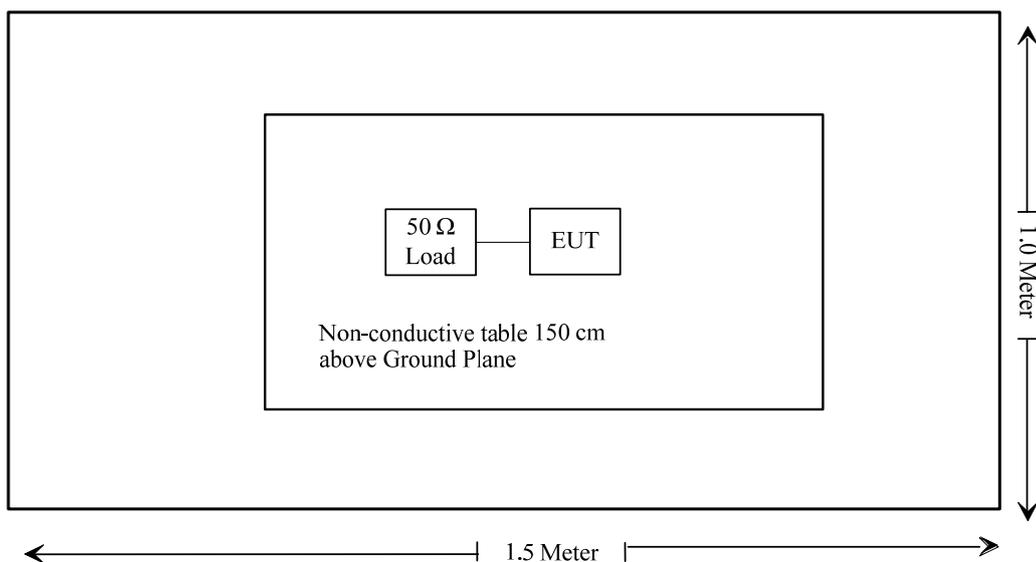
### EUT Specification:

Operating Frequency Band	400-480MHz
Modulation Mode	FM/4FSK
Channel Spacing	12.5/25kHz
Rated Output Power	High: 4W Low: 1W

### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
N/A	Terminal Load (50 Ω)	N/A	N/A
HP	RF Communications Test Set	8920A	00 247

### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Results</b>
§1.1310 and §2.1093	RF Exposure	Compliant
§ 2.1046 & § 22.727 & § 74.461 & § 90.205	RF Output Power	Compliant
§ 2.1047	Modulation Characteristic	Compliant
§ 2.1049 & § 22.357 & § 22.731 & § 90.209 & § 90.210 & § 74.462	Occupied Bandwidth & Emission Mask	Compliant
§ 2.1051 & § 22.861 & § 90.210 & § 74.462	Spurious Emission at Antenna Terminal	Compliant
§ 2.1053 & § 22.861 & § 90.210 & § 74.462	Spurious Radiated Emissions	Compliant
§ 2.1055 & § 22.355 & § 90.213 & § 74.464	Frequency Stability	Compliant
§ 90.214	Transient Frequency Behavior	Compliant

## **FCC §1.1310 & §2.1093 - RF EXPOSURE**

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### **Applicable Standard**

FCC§1.1310 and §2.1093.

### **Test Result**

Compliant, please refer to the SAR report: RDG170810002-20A.

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

**Applicable Standard**

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

**Test Procedure**

Conducted RF Output Power:

TIA-603-D section 2.2.1

The RF output power of the transmitter(SMA port) was connected to the input of the spectrum analyzer through sufficient attenuation and SMA cable.

Spectrum Analyzer setting:

RBW	VBW
100 kHz	300 kHz

**Test Equipment List and Details**

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	831259/019	2017-07-18	2018-07-18
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	Each Time	/
E-Microwave	RF Attenuator	20dB	20dB-1	Each Time	/
E-Microwave	RF Attenuator	20dB	20dB-2	Each Time	/
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/

**\* 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).

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	26.5°C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	100.5 kPa

The testing was performed by Pean Zhu on 2017-08-29.

Test Result: Compliant. Please refer to following tables.

FCC Part 90:

Modulation	Channel Spacing (kHz)	f <sub>c</sub> (MHz)	Conducted Output Power (W)	
			High	Low
FM	12.5	400.0125 <sup>Note 1</sup>	4.28	1.08
		453.2125	4.32	1.09
		479.9875	4.27	1.10
4FSK		400.0125 <sup>Note 1</sup>	4.10	1.09
		453.2125	4.29	1.03
		479.9875	4.23	1.08

FCC Part 22:

Modulation	Channel Spacing (kHz)	f <sub>c</sub> (MHz)	Conducted Output Power (W)	
			High	Low
FM	12.5	454.0125	4.22	1.05
4FSK		454.0125	4.19	1.02
FM	25	454.2125	4.17	1.03

FCC Part 74:

Modulation	Channel Spacing (kHz)	f <sub>c</sub> (MHz)	Conducted Output Power (W)	
			High	Low
FM	12.5	455.0125	4.13	1.01
	25	455.6625	4.32	1.02
4FSK	12.5	455.0125	4.24	1.02

Note:

The rated high power is 4W (36 dBm) and low power is 1W (30 dBm).

Note 1: Not for FCC Review

## FCC §2.1047 - MODULATION CHARACTERISTIC

### Applicable Standard

FCC§2.1047

### Test Procedure

Test Method: TIA/EIA-603 2.2.3

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
HP	RF Communications Test Set	8920A	00 235	2017-07-11	2018-07-11
LEADER	Millivoltmeter	LMV-181A	601788	2017-08-11	2018-08-10
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	Each Time	/
E-Microwave	RF Attenuator	20dB	20dB-1	Each Time	/
E-Microwave	RF Attenuator	20dB	20dB-2	Each Time	/
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/

\* **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).

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	26.5 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	100.5 kPa

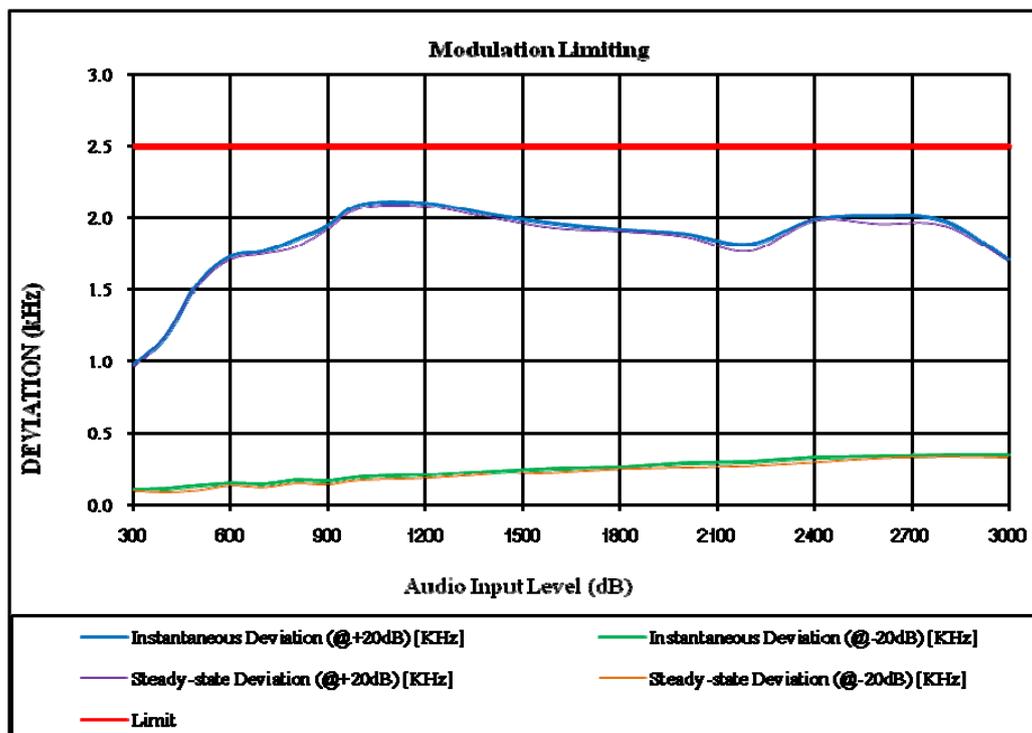
The testing was performed by Pean Zhu on 2017-08-29.

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

**MODULATION LIMITING**

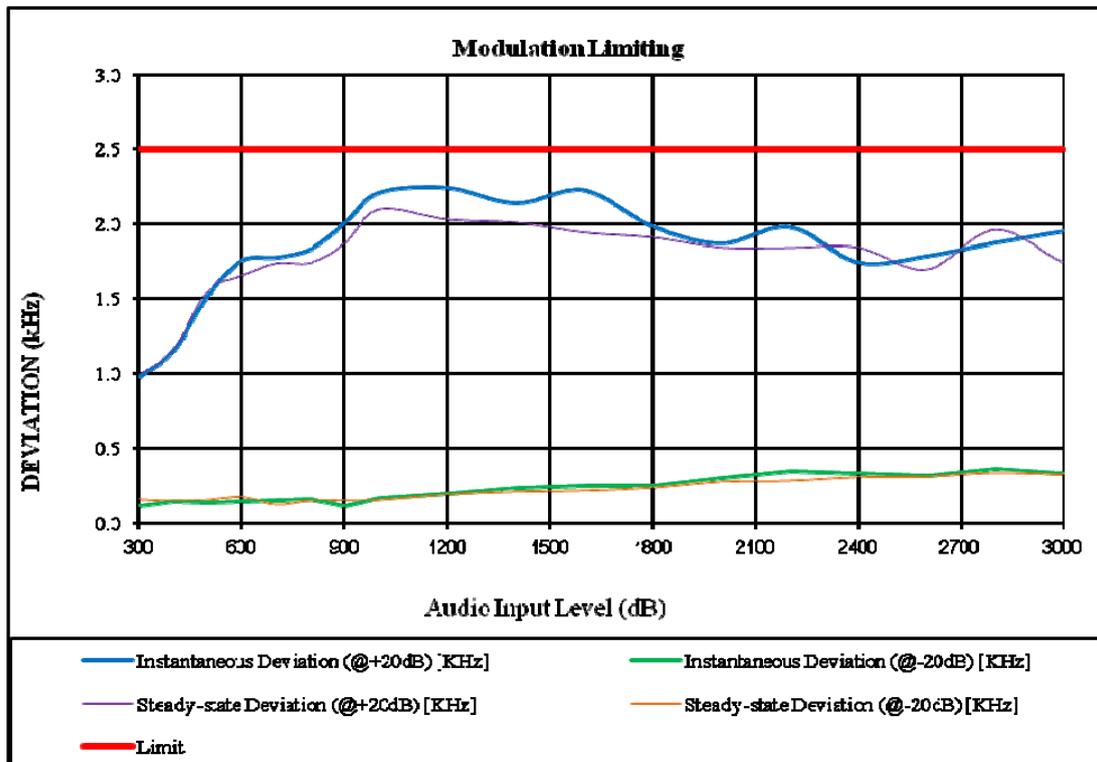
Part 90: Carrier Frequency: 453.2125 MHz, Channel Spacing = 12.5 kHz

Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	
300	0.979	0.106	0.96	0.1	2.5
400	1.185	0.113	1.18	0.09	2.5
500	1.553	0.138	1.543	0.103	2.5
600	1.734	0.149	1.717	0.134	2.5
700	1.768	0.145	1.755	0.123	2.5
800	1.852	0.17	1.803	0.15	2.5
900	1.949	0.169	1.931	0.143	2.5
1000	2.093	0.192	2.074	0.173	2.5
1200	2.103	0.214	2.087	0.187	2.5
1400	2.025	0.231	2.008	0.216	2.5
1600	1.961	0.258	1.933	0.23	2.5
1800	1.919	0.266	1.912	0.254	2.5
2000	1.889	0.291	1.875	0.264	2.5
2200	1.818	0.297	1.774	0.275	2.5
2400	1.986	0.328	1.983	0.299	2.5
2600	2.012	0.338	1.961	0.327	2.5
2800	1.979	0.345	1.949	0.338	2.5
3000	1.711	0.343	1.709	0.332	2.5



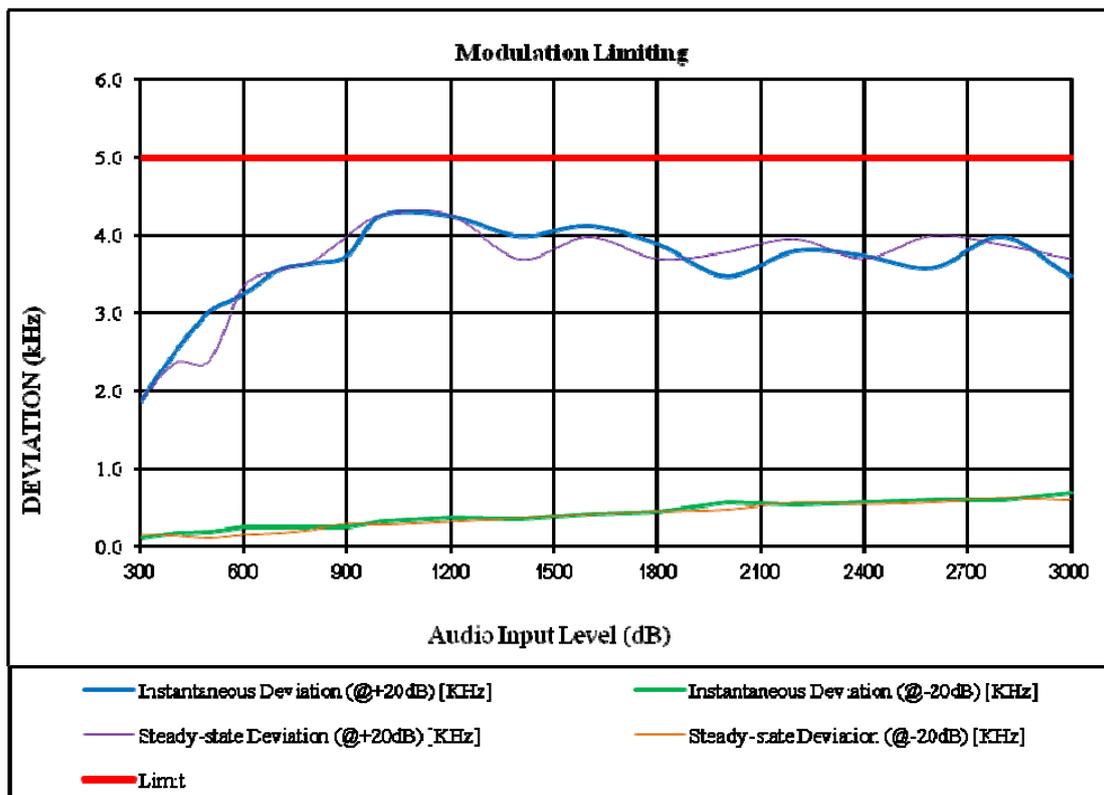
Part 22: Carrier Frequency: 454.0125 MHz, Channel Spacing = 12.5 kHz

Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	
300	0.977	0.114	0.987	0.158	2.5
400	1.158	0.142	1.158	0.148	2.5
500	1.525	0.136	1.554	0.156	2.5
600	1.76	0.145	1.658	0.174	2.5
700	1.78	0.147	1.741	0.125	2.5
800	1.836	0.156	1.745	0.15	2.5
900	2.01	0.114	1.874	0.151	2.5
1000	2.214	0.168	2.103	0.155	2.5
1200	2.247	0.198	2.036	0.192	2.5
1400	2.145	0.232	2.014	0.211	2.5
1600	2.231	0.247	1.947	0.218	2.5
1800	1.987	0.245	1.915	0.238	2.5
2000	1.874	0.298	1.847	0.278	2.5
2200	1.984	0.347	1.845	0.285	2.5
2400	1.748	0.332	1.847	0.309	2.5
2600	1.789	0.314	1.699	0.313	2.5
2800	1.878	0.365	1.965	0.338	2.5
3000	1.955	0.334	1.745	0.326	2.5



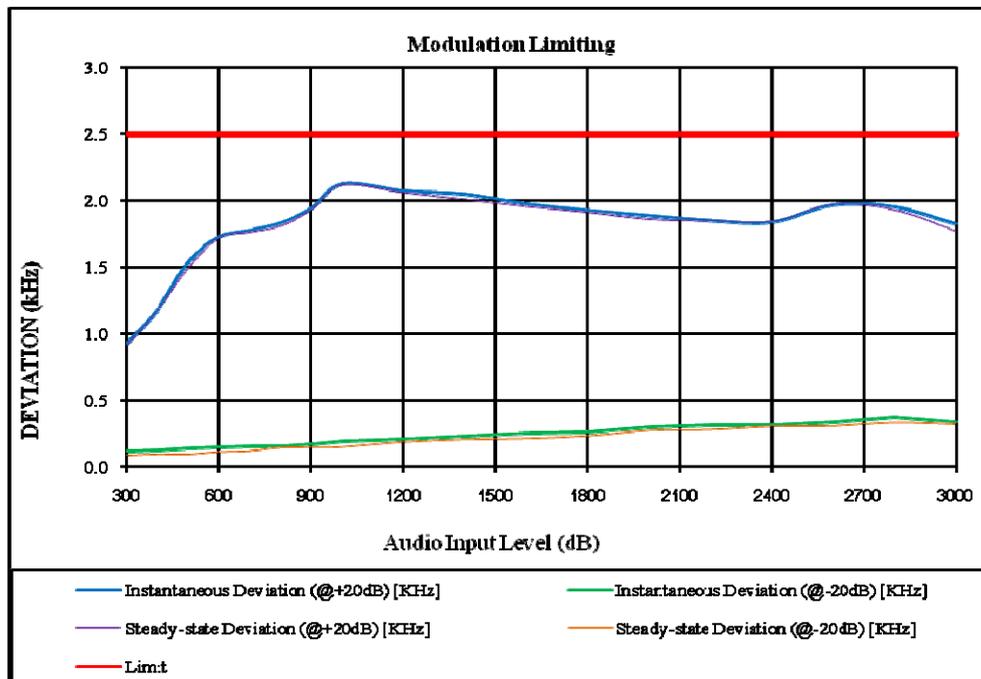
Part 22: Carrier Frequency: 454.2125 MHz, Channel Spacing = 25 kHz

Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	
300	1.878	0.125	1.875	0.158	5.0
400	2.504	0.174	2.366	0.145	5.0
500	3.025	0.189	2.394	0.117	5.0
600	3.25	0.258	3.345	0.158	5.0
700	3.558	0.247	3.542	0.178	5.0
800	3.647	0.259	3.665	0.221	5.0
900	3.745	0.258	3.987	0.298	5.0
1000	4.265	0.324	4.258	0.285	5.0
1200	4.256	0.369	4.258	0.326	5.0
1400	3.997	0.367	3.69	0.37	5.0
1600	4.125	0.415	3.977	0.417	5.0
1800	3.895	0.458	3.695	0.458	5.0
2000	3.478	0.568	3.778	0.484	5.0
2200	3.805	0.547	3.95	0.574	5.0
2400	3.745	0.575	3.697	0.553	5.0
2600	3.585	0.596	3.998	0.578	5.0
2800	3.987	0.599	3.875	0.633	5.0
3000	3.478	0.687	3.696	0.607	5.0



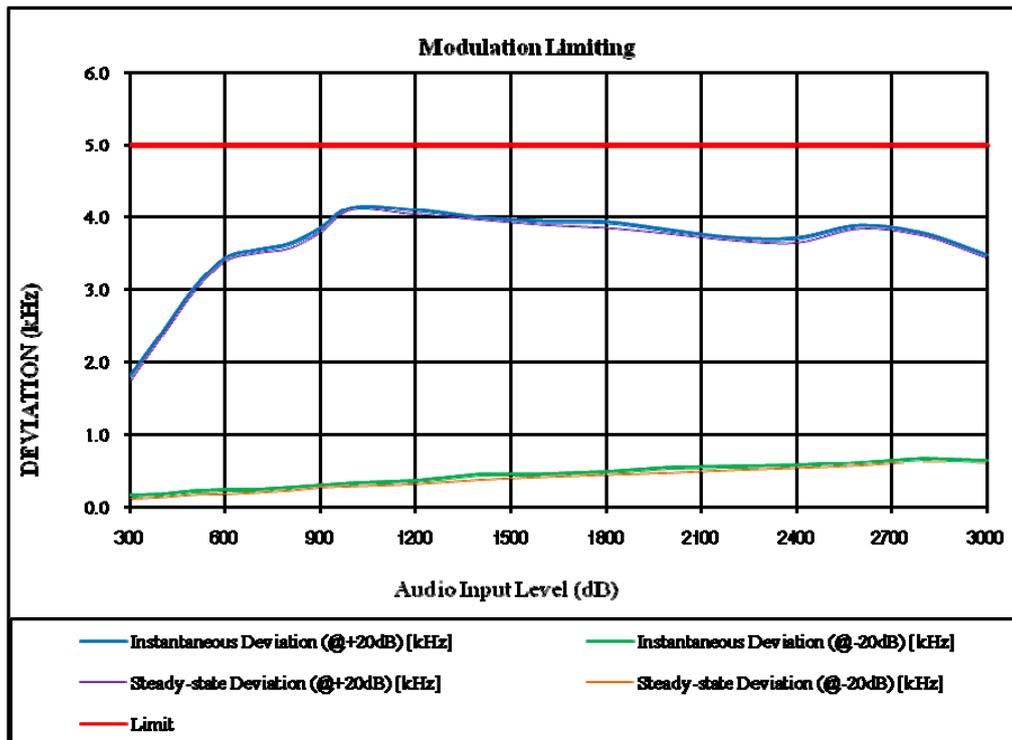
Part 74:Carrier Frequency: 455.0125 MHz, Channel Spacing = 12.5 kHz

Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	
300	0.927	0.116	0.917	0.091	2.5
400	1.185	0.124	1.183	0.101	2.5
500	1.544	0.136	1.505	0.1	2.5
600	1.73	0.143	1.724	0.118	2.5
700	1.78	0.152	1.765	0.125	2.5
800	1.836	0.154	1.813	0.15	2.5
900	1.946	0.168	1.934	0.151	2.5
1000	2.131	0.191	2.12	0.155	2.5
1200	2.078	0.21	2.062	0.192	2.5
1400	2.053	0.229	2.011	0.211	2.5
1600	1.979	0.257	1.958	0.218	2.5
1800	1.931	0.263	1.915	0.238	2.5
2000	1.891	0.298	1.863	0.278	2.5
2200	1.854	0.312	1.851	0.285	2.5
2400	1.842	0.313	1.843	0.309	2.5
2600	1.973	0.336	1.973	0.313	2.5
2800	1.957	0.377	1.933	0.338	2.5
3000	1.828	0.342	1.774	0.326	2.5



Part 74: Carrier Frequency: 455.6625 MHz, Channel Spacing = 25 kHz

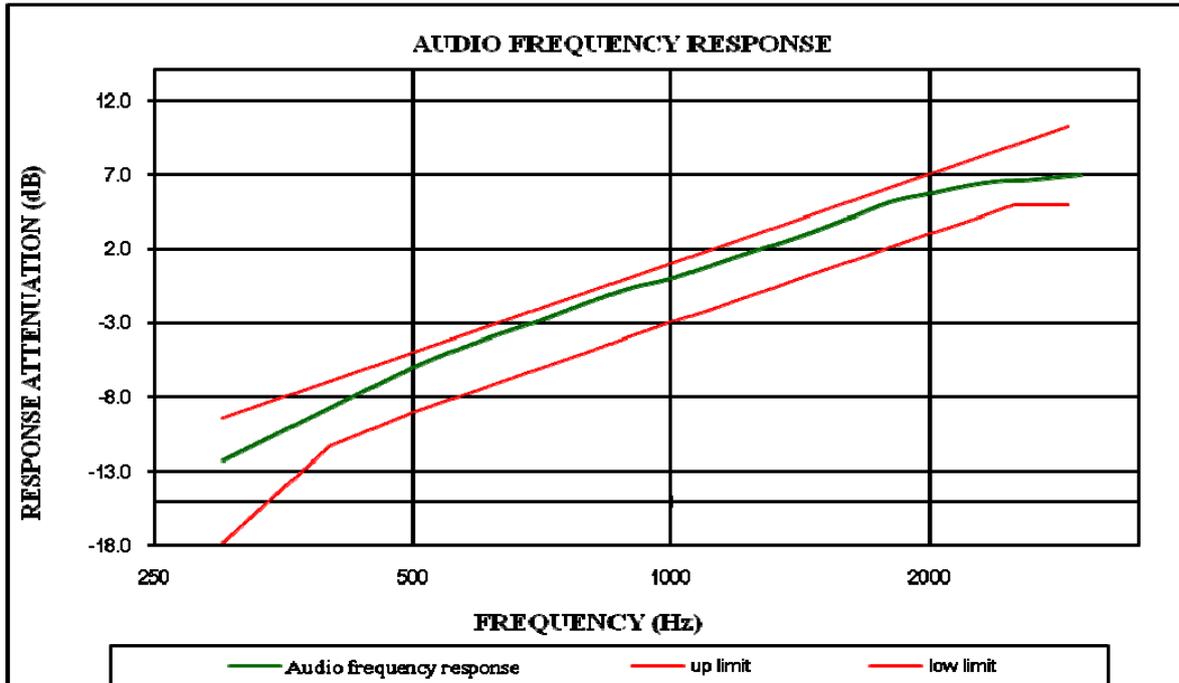
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	
300	1.808	0.158	1.754	0.12	5.0
400	2.402	0.173	2.367	0.141	5.0
500	3.007	0.218	2.968	0.176	5.0
600	3.437	0.234	3.399	0.184	5.0
700	3.551	0.242	3.51	0.204	5.0
800	3.635	0.262	3.575	0.231	5.0
900	3.851	0.293	3.796	0.273	5.0
1000	4.137	0.333	4.107	0.291	5.0
1200	4.104	0.356	4.043	0.321	5.0
1400	3.995	0.454	3.969	0.377	5.0
1600	3.944	0.453	3.898	0.416	5.0
1800	3.934	0.478	3.855	0.446	5.0
2000	3.823	0.542	3.775	0.472	5.0
2200	3.719	0.557	3.686	0.508	5.0
2400	3.714	0.584	3.651	0.538	5.0
2600	3.885	0.621	3.843	0.573	5.0
2800	3.78	0.686	3.75	0.627	5.0
3000	3.483	0.652	3.45	0.611	5.0



**Audio Frequency Response**

Part 90: Carrier Frequency: 453.2125 MHz, Channel Spacing = 12.5 kHz

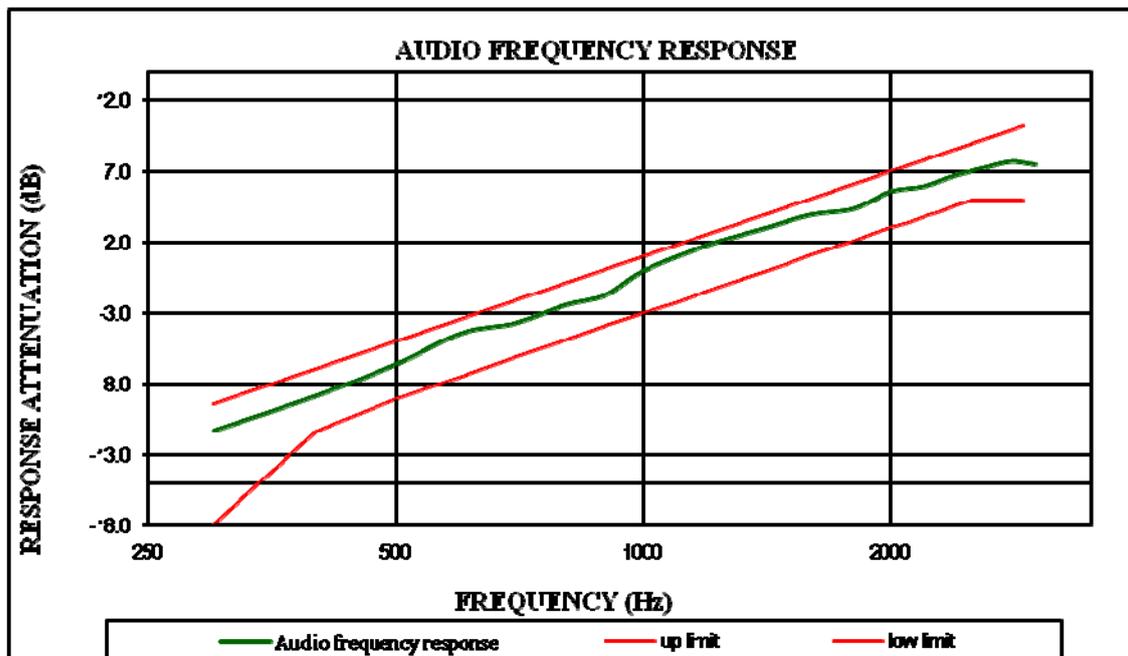
Audio Frequency	Response Attenuation
Hz	dB
300	-12.26
400	-8.73
500	-5.99
600	-4.18
700	-2.88
800	-1.62
900	-0.62
1000	0.00
1200	1.53
1400	2.77
1600	4.00
1800	5.15
2000	5.70
2200	6.21
2400	6.53
2600	6.60
2800	6.79
3000	6.95



**Audio Frequency Response**

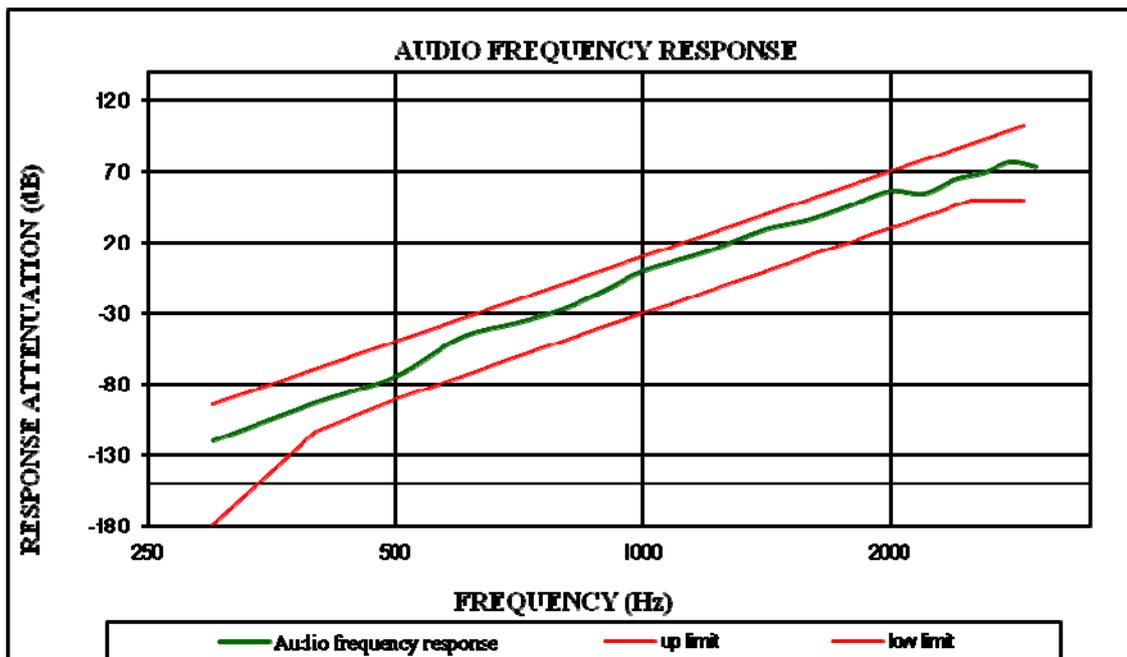
Part 22:Carrier Frequency: 454.0125 MHz, Channel Spacing = 12.5 kHz

Audio Frequency	Response Attenuation
Hz	dB
300	-11.25
400	-8.78
500	-6.58
600	-4.39
700	-3.67
800	-2.44
900	-1.69
1000	0.00
1200	1.84
1400	2.97
1600	3.96
1800	4.36
2000	5.58
2200	5.96
2400	6.74
2600	7.25
2800	7.69
3000	7.48



Part 22: Carrier Frequency: 454.2125 MHz, Channel Spacing = 25 kHz

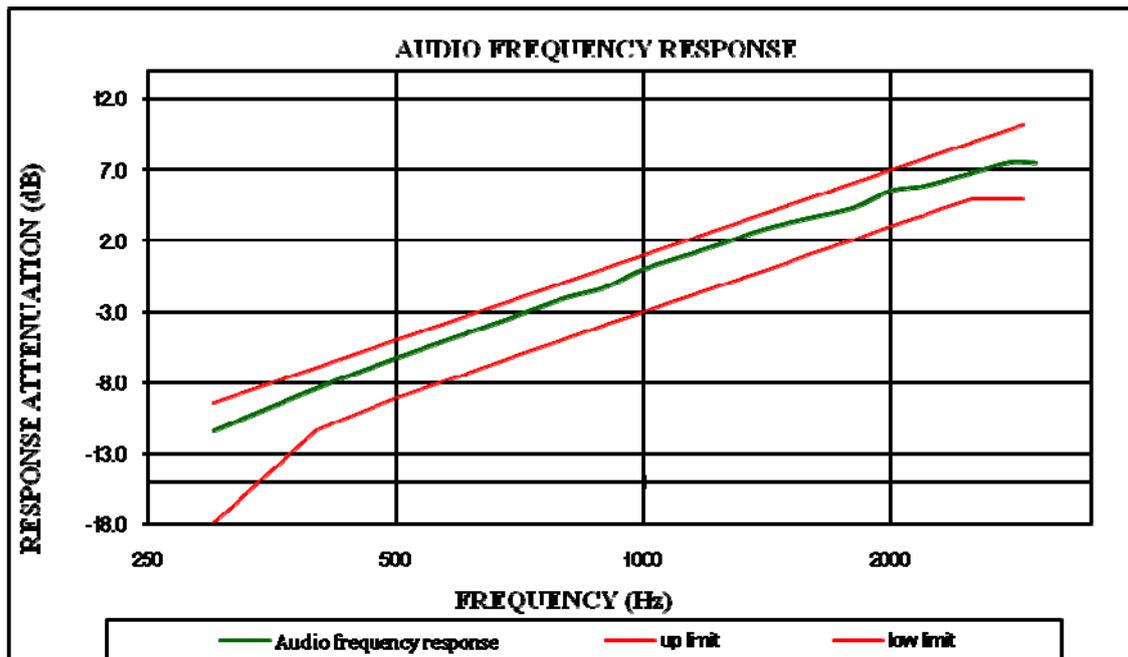
Audio Frequency Hz	Response Attenuation dB
300	-11.98
400	-9.28
500	-7.44
600	-4.68
700	-3.68
800	-2.69
900	-1.33
1000	0.00
1200	1.40
1400	2.89
1600	3.64
1800	4.69
2000	5.64
2200	5.47
2400	6.46
2600	6.91
2800	7.67
3000	7.34



**Audio Frequency Response**

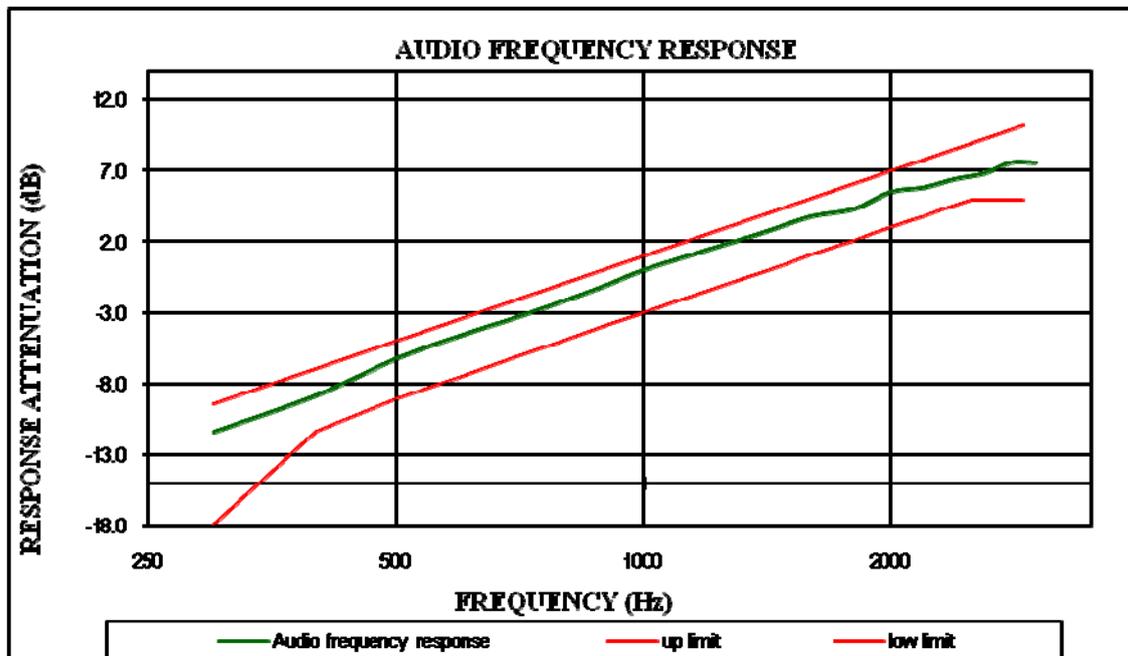
Part 74:Carrier Frequency: 455.0125 MHz, Channel Spacing = 12.5 kHz

Audio Frequency	Response Attenuation
Hz	dB
300	-11.36
400	-8.36
500	-6.25
600	-4.64
700	-3.27
800	-2.05
900	-1.26
1000	0.00
1200	1.48
1400	2.80
1600	3.62
1800	4.30
2000	5.52
2200	5.85
2400	6.45
2600	7.01
2800	7.51
3000	7.46



Part 74: Carrier Frequency: 455.6625 MHz, Channel Spacing = 25 kHz

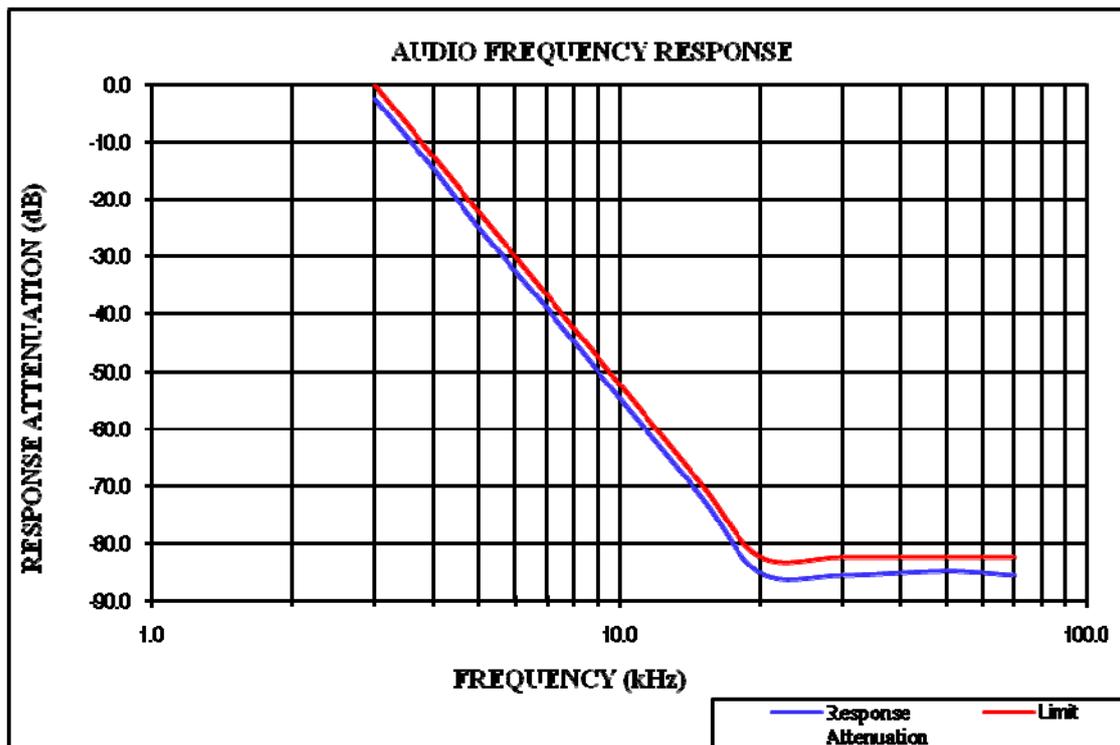
Audio Frequency Hz	Response Attenuation dB
300	-11.35
400	-8.78
500	-6.21
600	-4.57
700	-3.32
800	-2.16
900	-1.07
1000	0.00
1200	1.45
1400	2.65
1600	3.77
1800	4.27
2000	5.48
2200	5.81
2400	6.41
2600	6.78
2800	7.55
3000	7.54



**Audio Frequency Low Pass Filter Response**

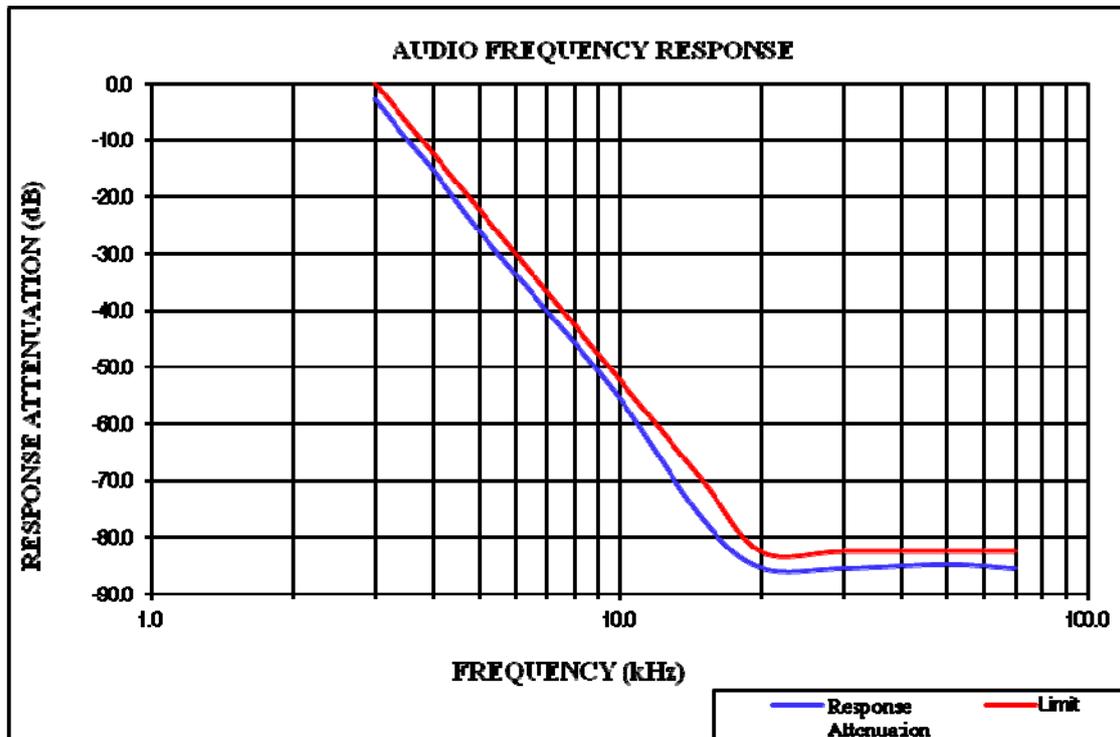
Part 90: Carrier Frequency: 453.2125 MHz, Channel Spacing = 12.5 kHz

Audio Frequency	Response Attenuation	Limit
kHz	dB	dB
3.0	-2.5	0.0
3.5	-9.1	-6.7
4.0	-14.7	-12.5
5.0	-25.0	-22.2
7.0	-39.1	-36.8
10.0	-54.7	-52.3
15.0	-72.0	-69.9
20.0	-85.2	-82.5
30.0	-85.6	-82.5
50.0	-84.9	-82.5
70.0	-85.6	-82.5



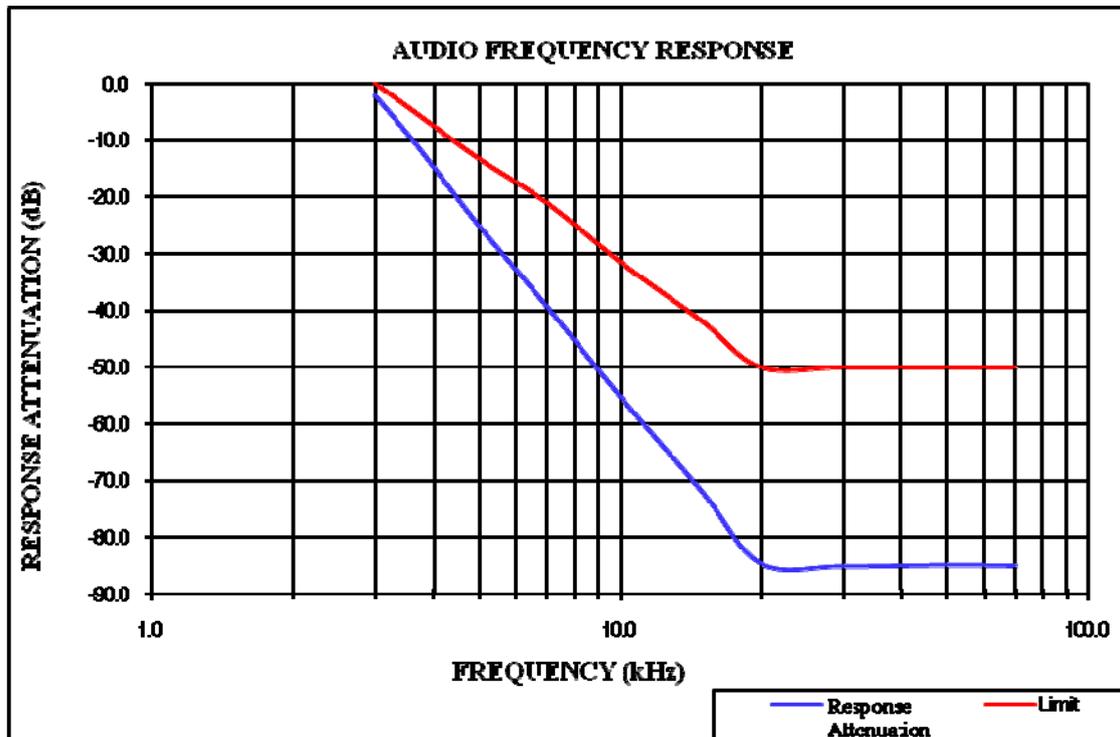
Part 22:Carrier Frequency: 454.0125 MHz, Channel Spacing = 12.5 kHz

Audio Frequency	Response Attenuation	Limit
kHz	dB	dB
3.0	-2.8	0.0
3.5	-9.7	-6.7
4.0	-15.4	-12.5
5.0	-26.0	-22.2
7.0	-40.2	-36.8
10.0	-55.6	-52.3
15.0	-76.8	-69.9
20.0	-85.5	-82.5
30.0	-85.6	-82.5
50.0	-84.9	-82.5
70.0	-85.6	-82.5



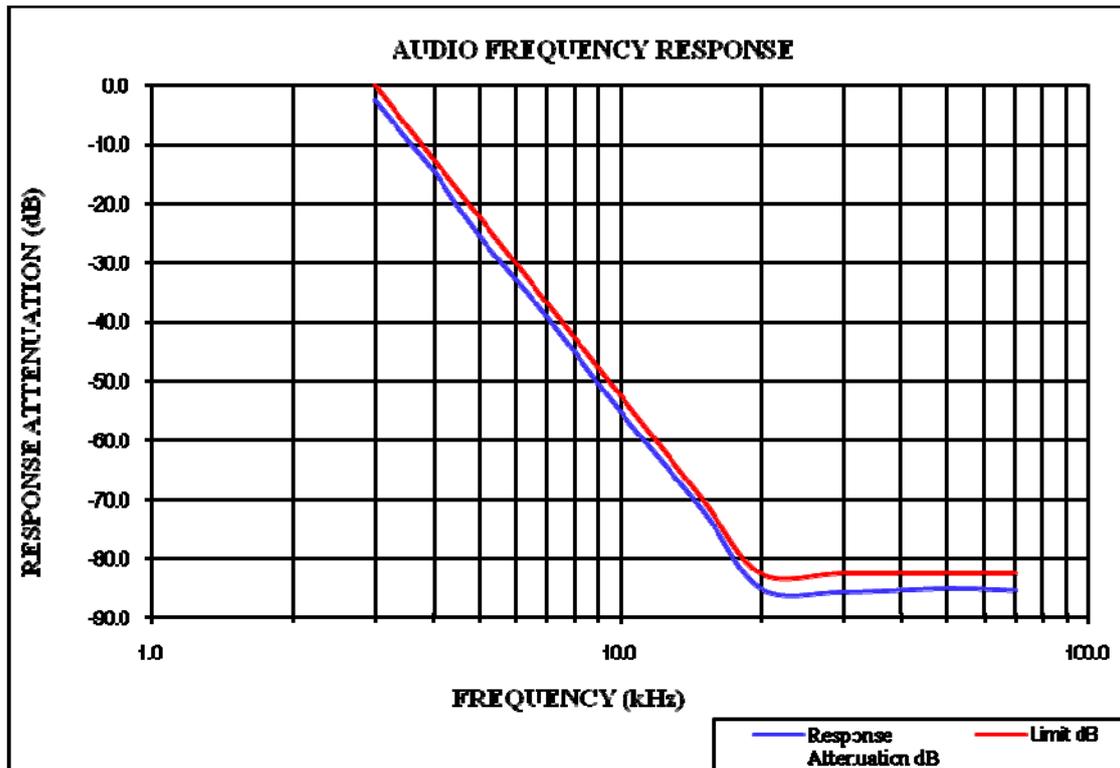
Part 22: Carrier Frequency: 454.2125 MHz, Channel Spacing = 25 kHz

Audio Frequency	Response Attenuation	Limit
kHz	dB	dB
3.0	-3.0	0.0
3.5	-10.9	-4.0
4.0	-16.8	-7.5
5.0	-27.0	-13.3
7.0	-41.3	-21.1
10.0	-56.0	-31.4
15.0	-73.0	-41.9
20.0	-85.7	-50.0
30.0	-85.2	-50.0
50.0	-85.0	-50.0
70.0	-85.1	-50.0



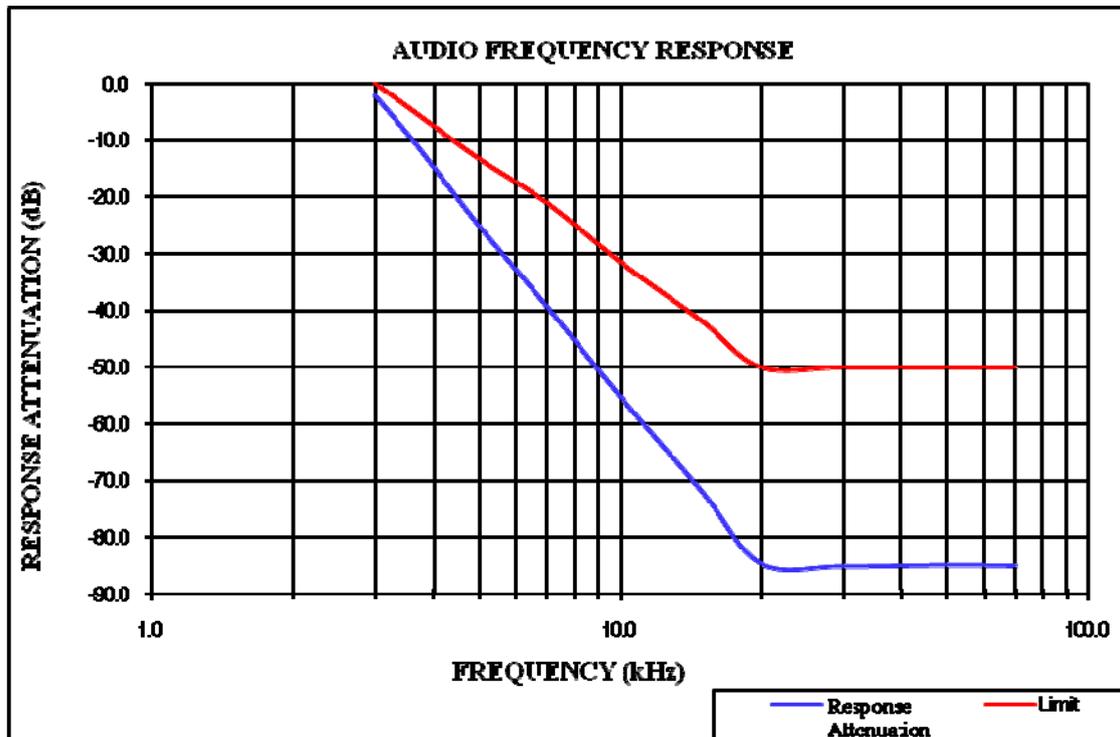
Part 74:Carrier Frequency: 455.0125 MHz, Channel Spacing = 12.5 kHz

Audio Frequency	Response Attenuation	Limit
kHz	dB	dB
3.0	-2.4	0.0
3.5	-8.9	-6.7
4.0	-14.4	-12.5
5.0	-25.3	-22.2
7.0	-39.1	-36.8
10.0	-55.0	-52.3
15.0	-71.7	-69.9
20.0	-85.0	-82.5
30.0	-85.6	-82.5
50.0	-85.0	-82.5
70.0	-85.3	-82.5



Part 74: Carrier Frequency: 455.6625 MHz, Channel Spacing = 25 kHz

Audio Frequency	Response Attenuation	Limit
kHz	dB	dB
3.0	-2.0	0.0
3.5	-8.5	-4.0
4.0	-14.6	-7.5
5.0	-25.0	-13.3
7.0	-39.3	-21.1
10.0	-55.1	-31.4
15.0	-72.0	-41.9
20.0	-84.7	-50.0
30.0	-85.2	-50.0
50.0	-85.0	-50.0
70.0	-85.1	-50.0



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

**Applicable Standard**

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

Applicable Emission Masks

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25	A or B	A or C
25-50	B	C
72-76	B	C
150-174	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854	B	H
809-824/854-869	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M
5850-5925		
All other bands	B	C

**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) On any frequency from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27(f_d - 2.88 \text{ kHz})$  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.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

**Test Equipment List and Details**

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	831259/019	2017-07-18	2018-07-18
HP	RF Communications Test Set	8920A	00 235	2017-07-11	2018-07-11
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	Each Time	/
E-Microwave	RF Attenuator	20dB	20dB-1	Each Time	/
E-Microwave	RF Attenuator	20dB	20dB-2	Each Time	/
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/

\* **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).

**Test Procedure**

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

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	24.9 ~ 27.5 °C
<b>Relative Humidity:</b>	52 ~ 58 %
<b>ATM Pressure:</b>	100 ~100.5 kPa

*The testing was performed by Pean Zhu from 2017-08-24 to 2017-11-27.*

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

*FCC Part 90:*

Modulation Mode	Channel Spacing	$f_c$	26 dB Bandwidth	99% Occupied Bandwidth	Power Level
		MHz	kHz	kHz	
FM	12.5 kHz	453.2125	10.321	9.920	High
			10.321	9.920	Low
4FSK	12.5 kHz		9.319	7.715	High
			9.319	7.816	Low

FCC Part 22:

Modulation Mode	Channel Spacing	$f_c$	26 dB Bandwidth	99% Occupied Bandwidth	Power Level
		MHz	kHz	kHz	
FM	12.5 kHz	454.0125	10.321	9.920	High
			10.321	9.920	Low
4FSK			8.417	5.812	High
			8.417	5.812	Low
FM	25 kHz	454.2125	15.78	14.78	High
			15.78	14.78	Low

FCC Part 74:

Modulation Mode	Channel Spacing	$f_c$	26 dB Bandwidth	99% Occupied Bandwidth	Power Level
		MHz	kHz	kHz	
FM	12.5 kHz	455.0125	10.421	10.020	High
			10.421	10.020	Low
	25 kHz		16.032	15.281	High
			16.032	15.281	Low
4FSK	12.5 kHz	455.0125	9.118	7.515	High
			9.519	7.114	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.

$$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 2.5 \text{ kHz}) = 11 \text{ kHz} = 11K0$$

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.

$$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 5.0 \text{ kHz}) = 16 \text{ kHz} = 16K0$$

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

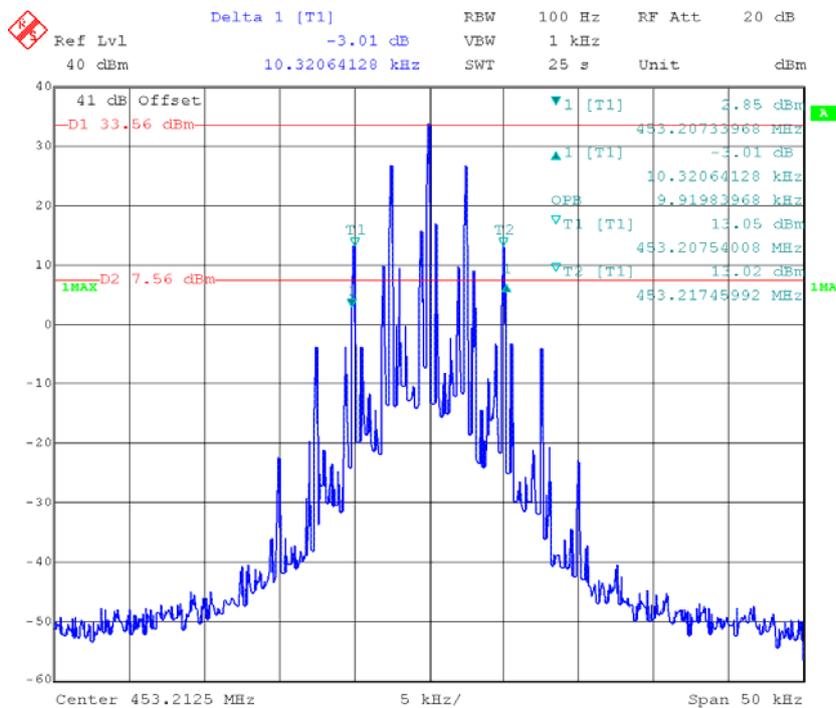
The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz. The emission mask was obtained from 47CFR 90.210(d).

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.

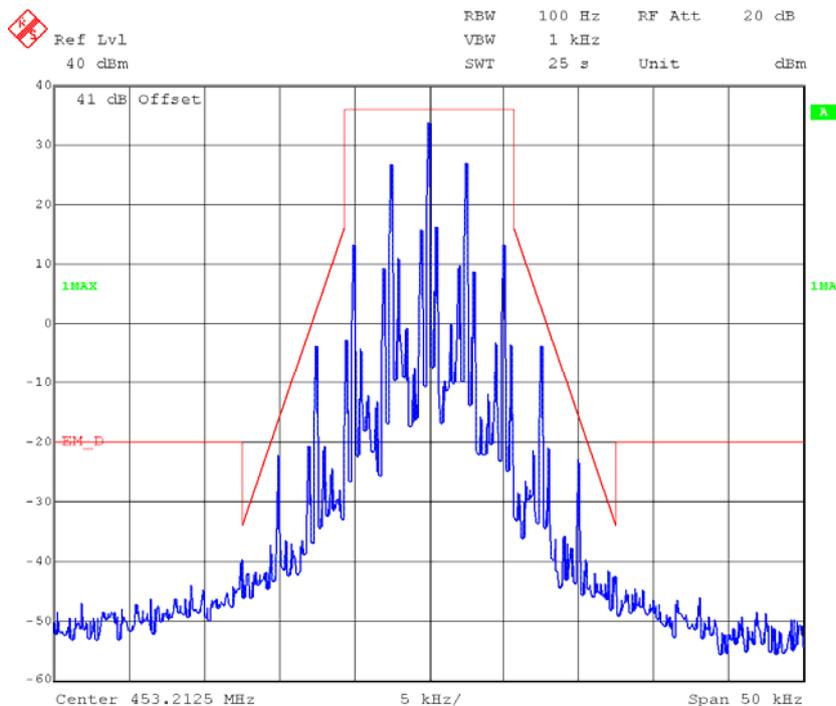
Part 90:

### Bandwidth – FM, 453.2125 MHz, High Power Level



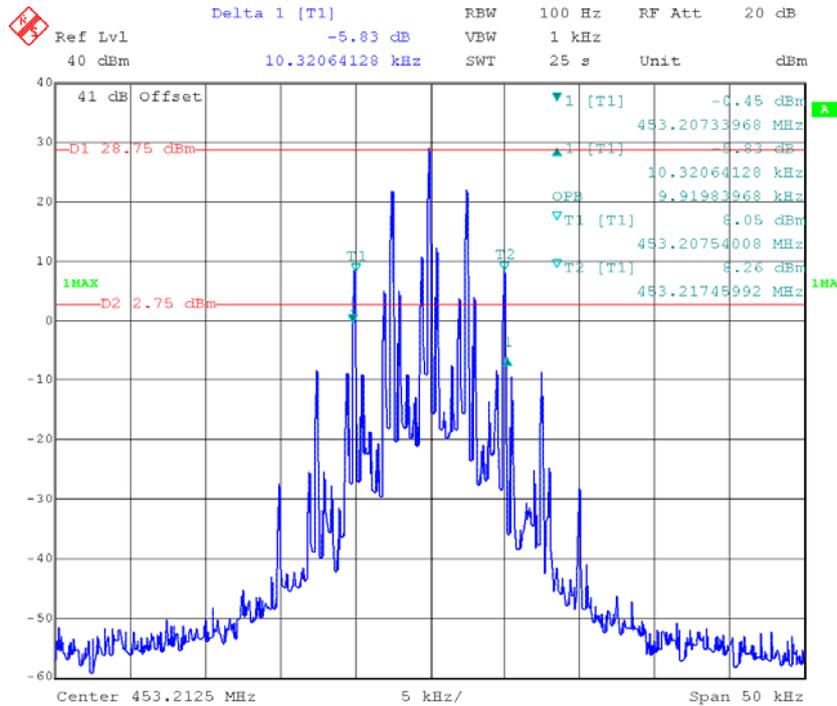
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### Emission Mask - Type D

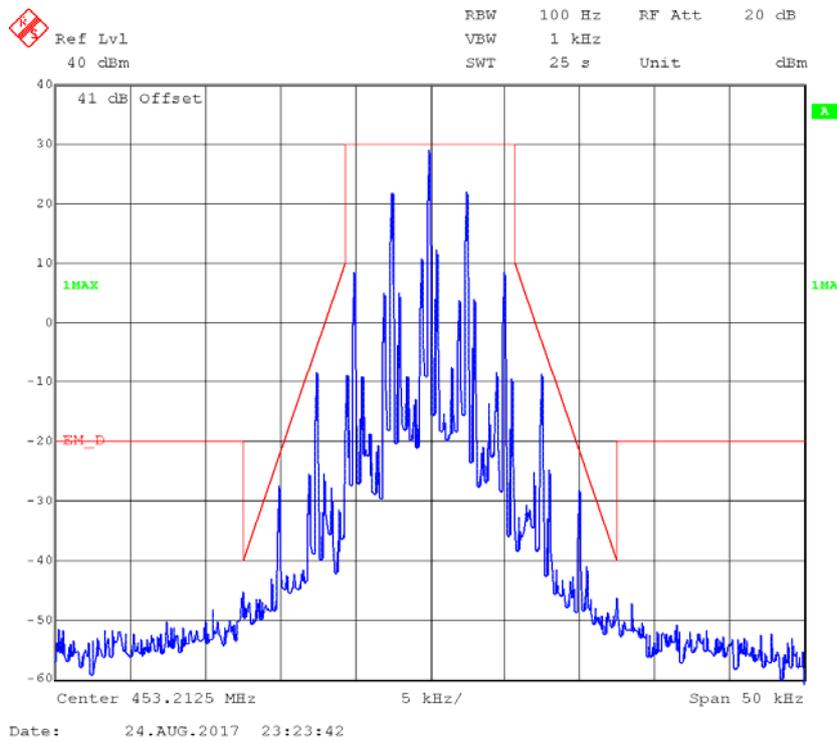


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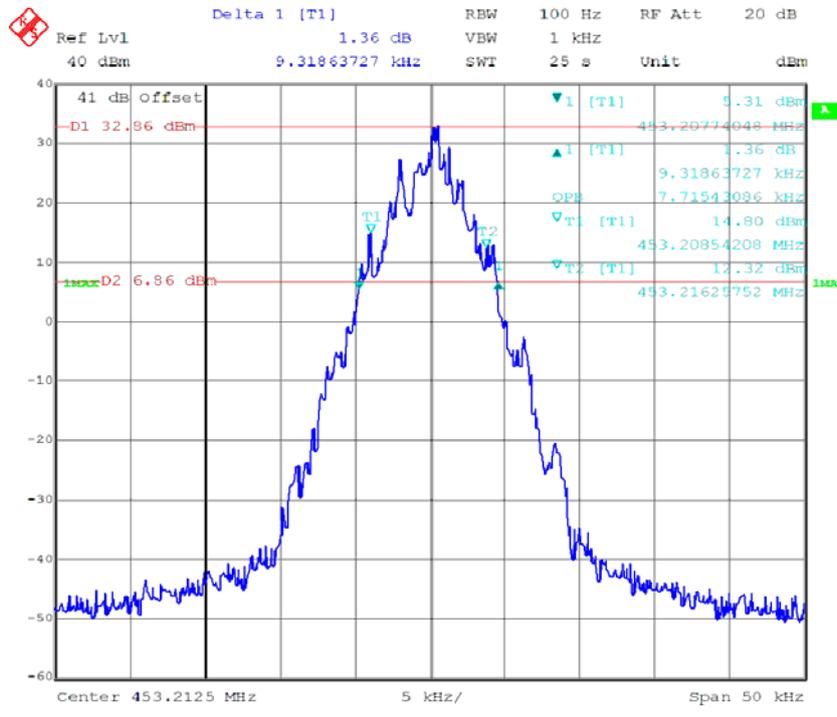
**Bandwidth – FM, 453.2125 MHz, Low Power Level**



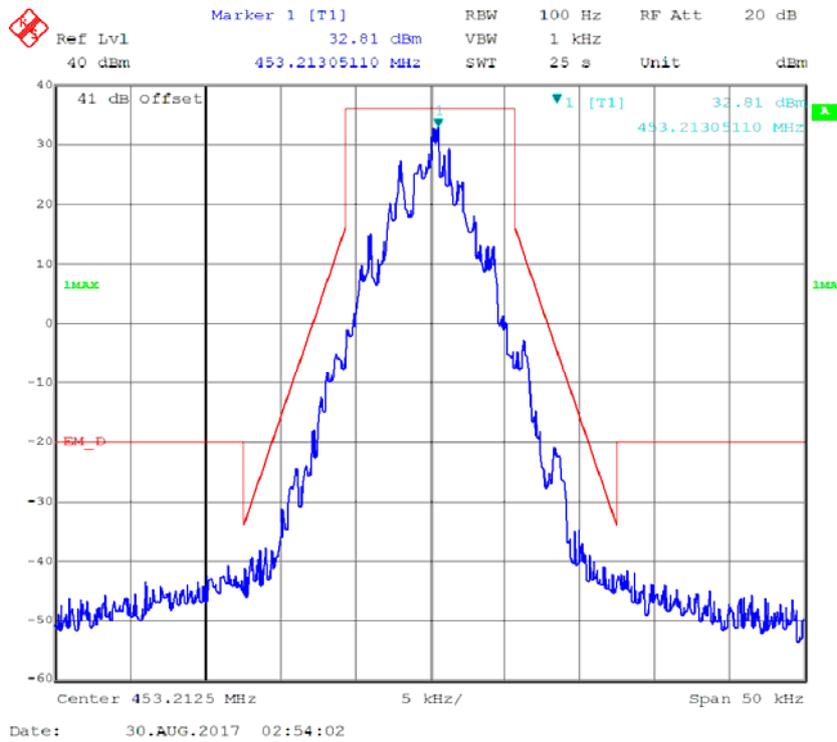
**Emission Mask - Type D**



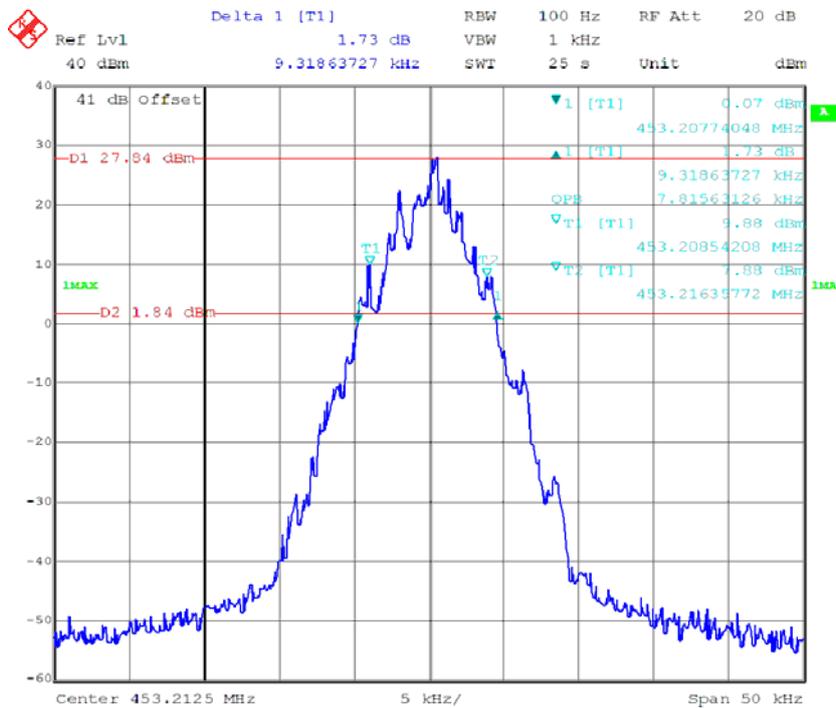
### Bandwidth – 4FSK, 453.2125 MHz, High Power Level



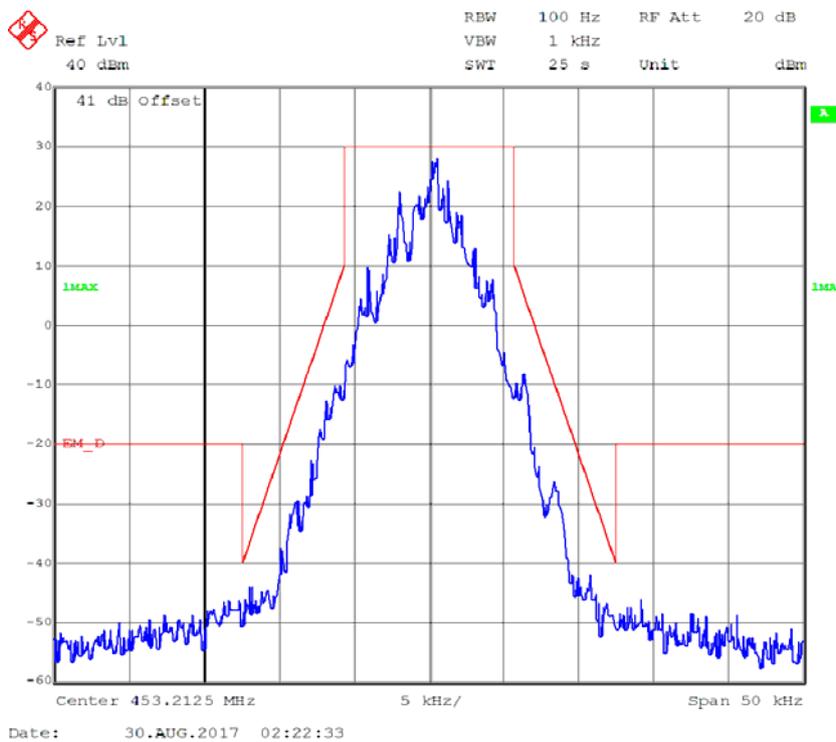
### Emission Mask - Type D



### Bandwidth – 4FSK, 453.2125 MHz, Low Power Level

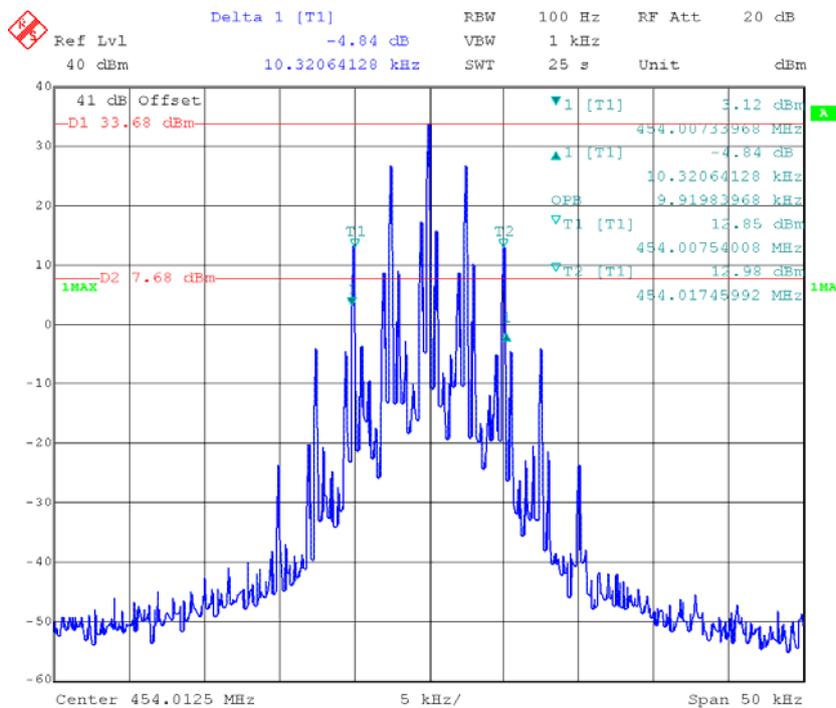


### Emission Mask - Type D



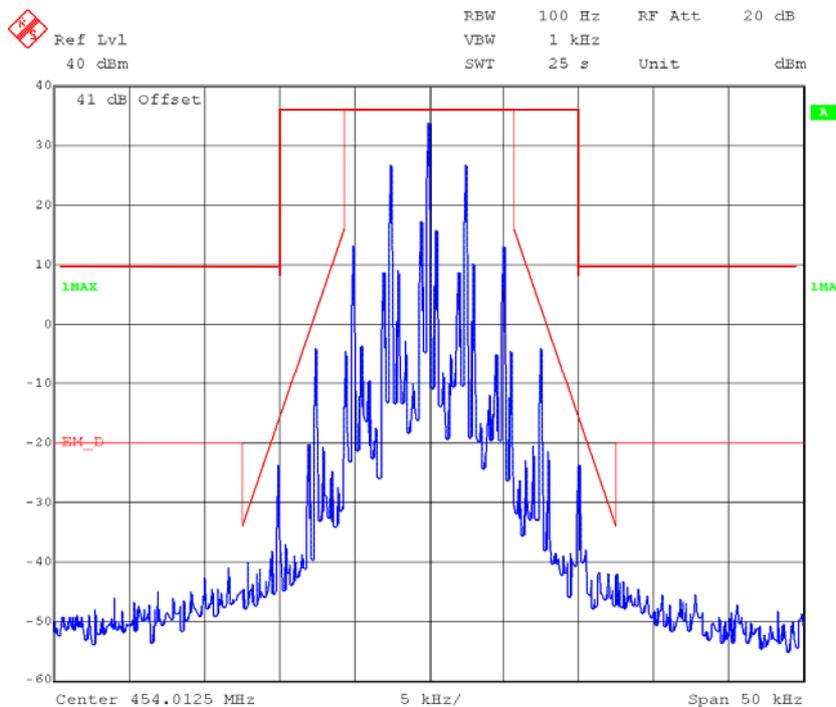
Part 22.359:

**Bandwidth – FM, 12.5kHz, 454.0125 MHz, High Power Level**



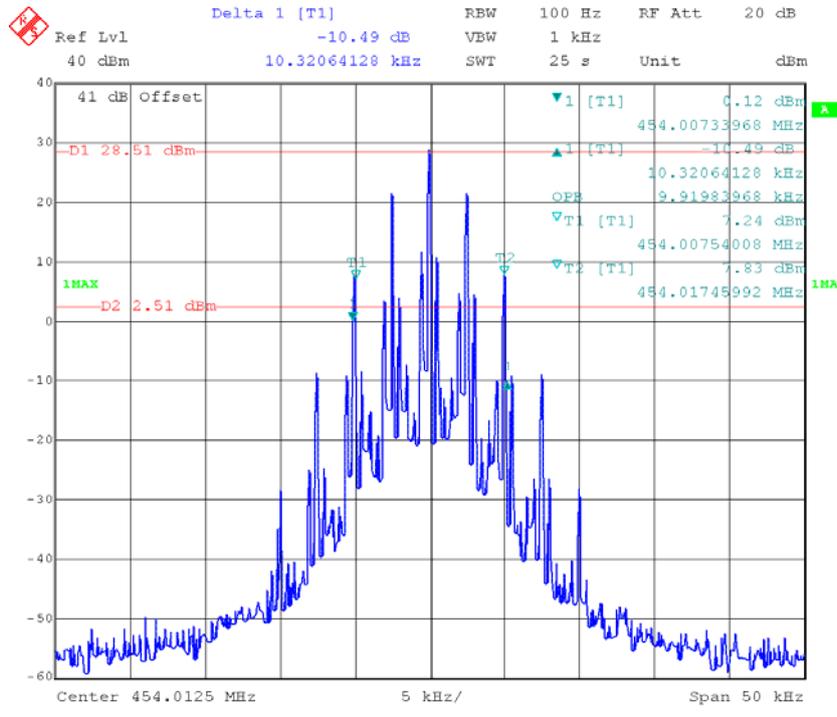
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**Emission Mask ,FCC part 22.359**

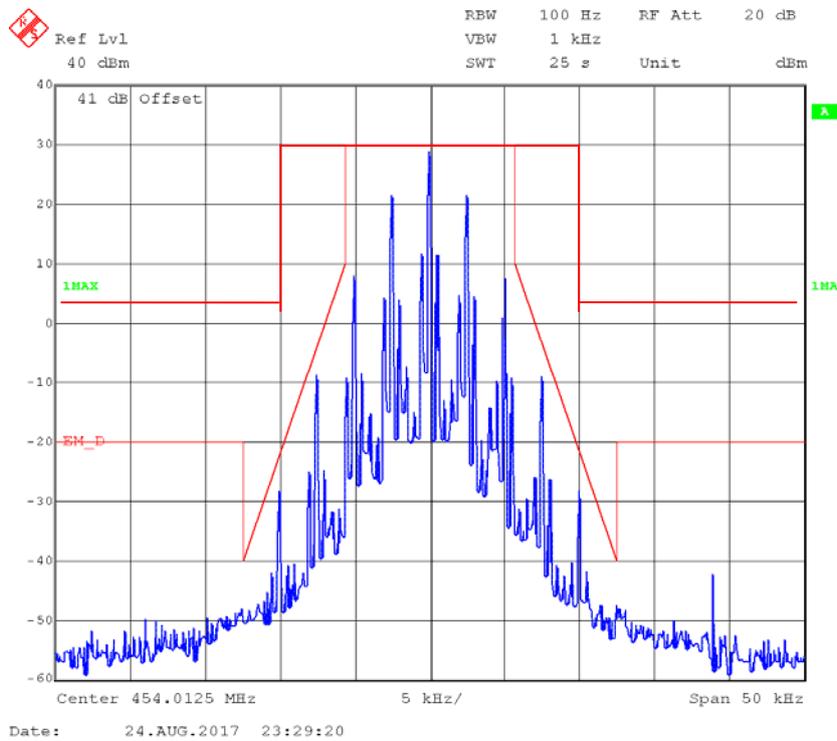


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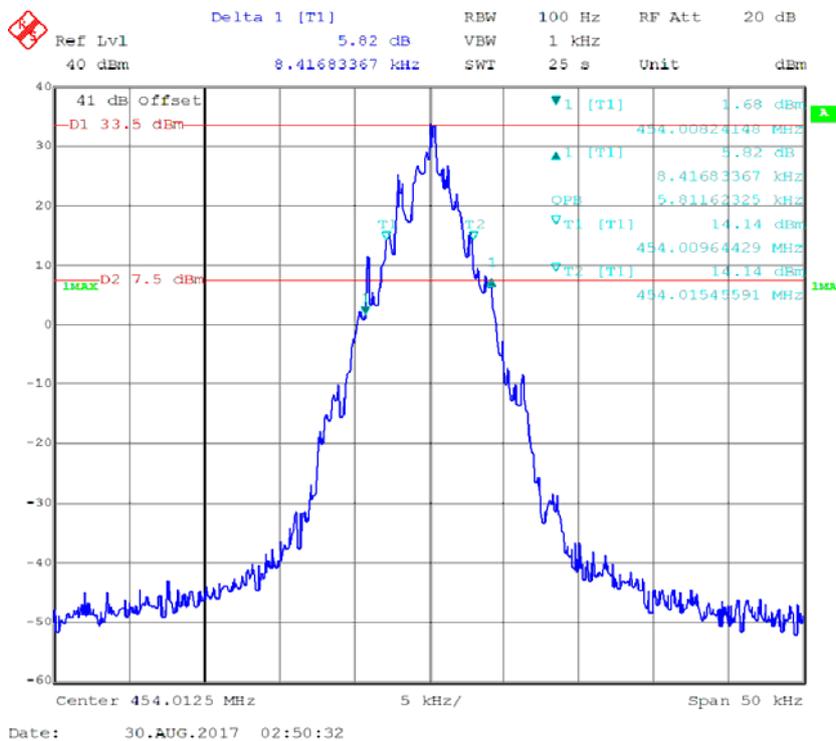
**Bandwidth – FM, 12.5kHz, 454.0125 MHz, Low Power Level**



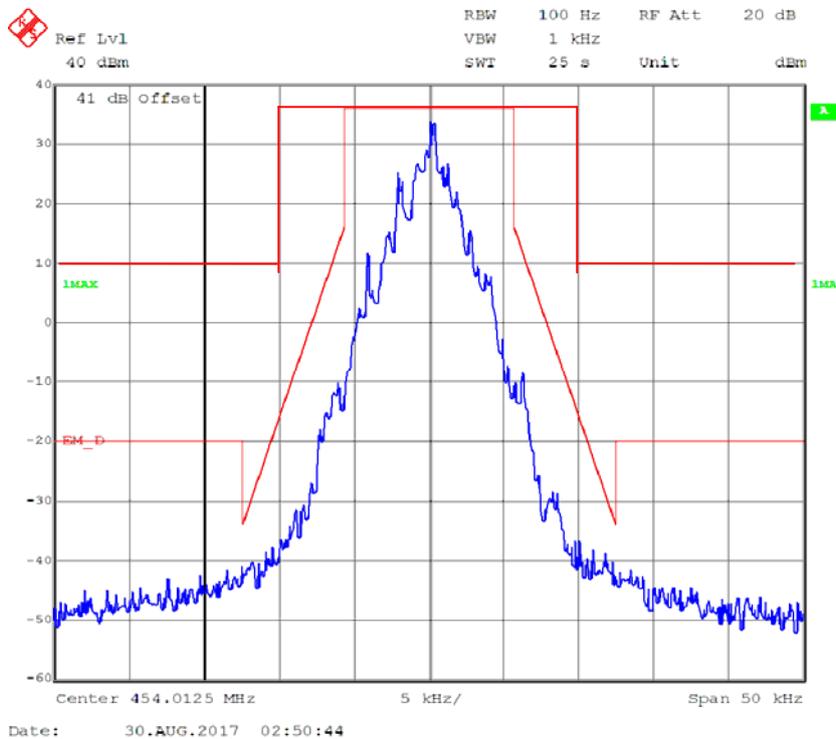
**Emission Mask ,FCC part 22.359**



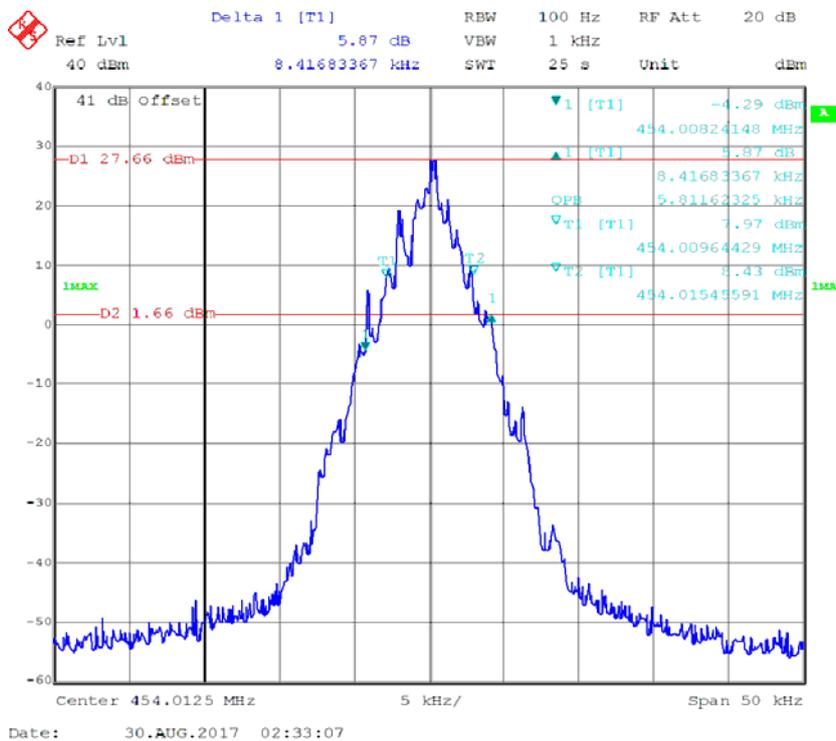
**Bandwidth – 4FSK, 12.5kHz,454.0125 MHz, High Power Level**



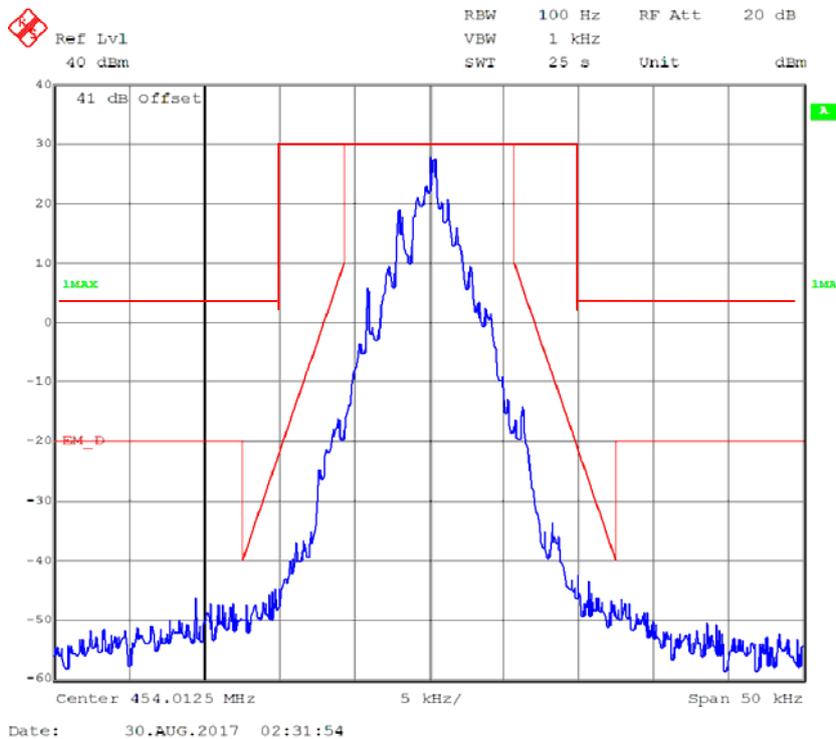
**Emission Mask ,FCC part 22.359**



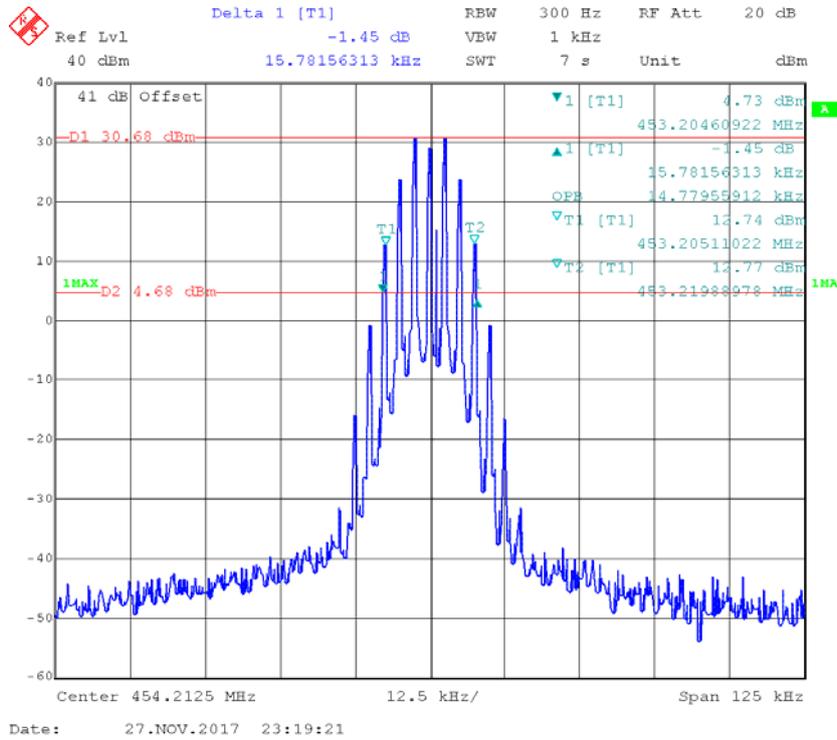
**Bandwidth – 4FSK, 12.5kHz, 454.0125 MHz, Low Power Level**



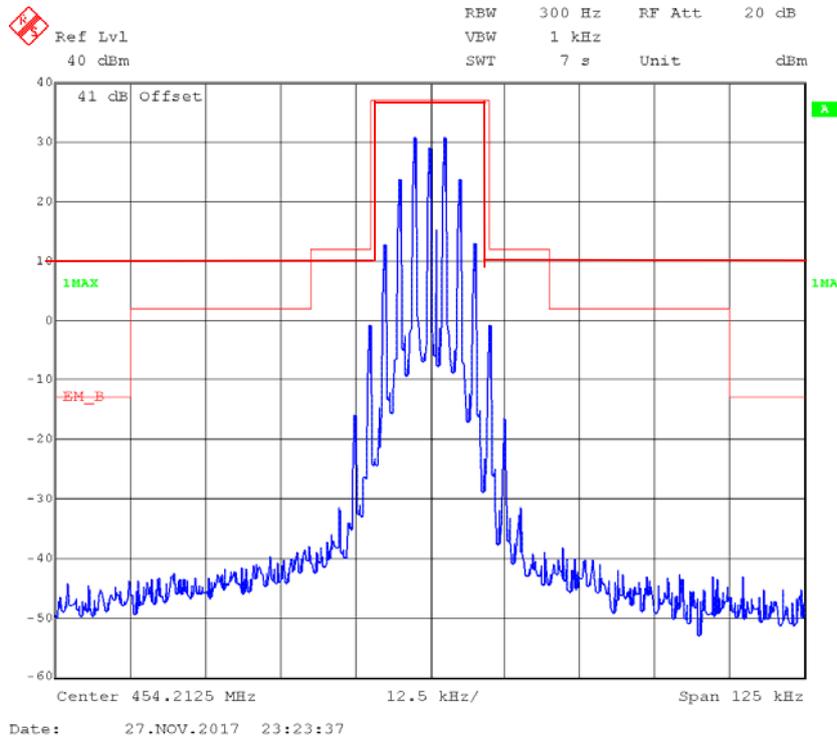
**Emission Mask ,FCC part 22.359**



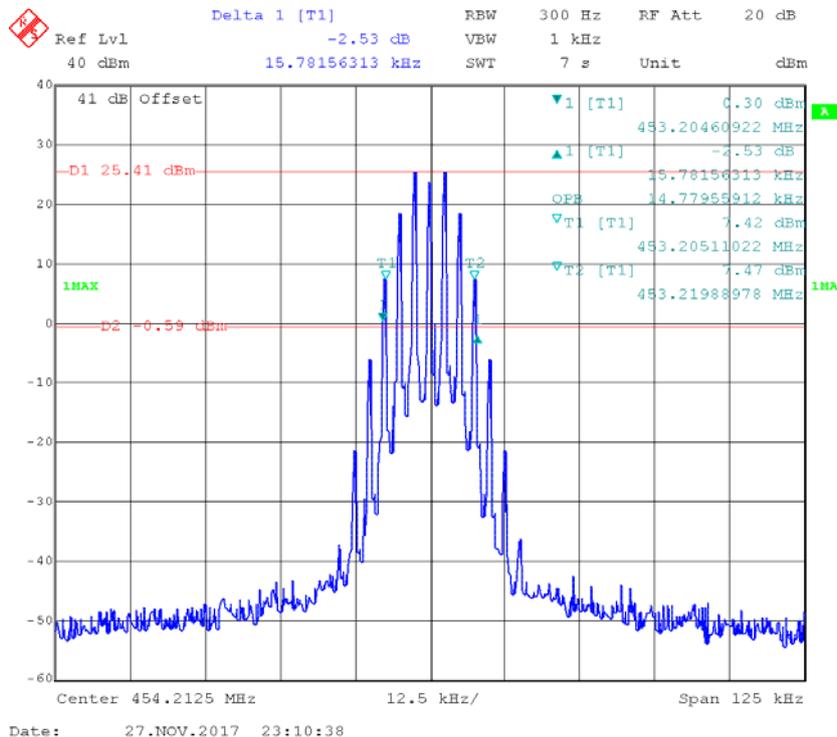
**Bandwidth – FM, 25kHz, 454.2125 MHz, High Power Level**



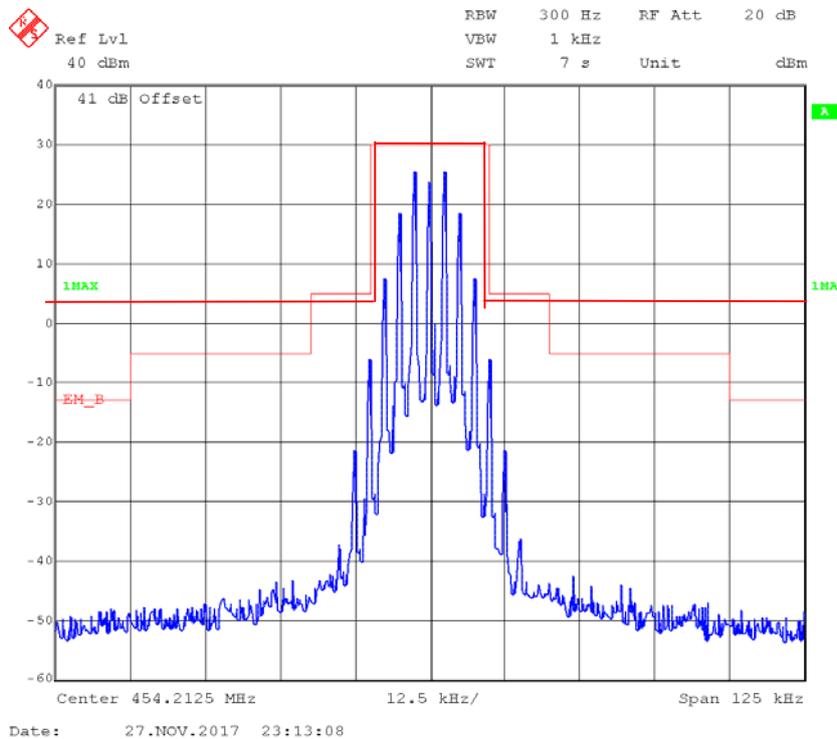
**Emission Mask ,FCC part 22.359**



**Bandwidth – FM, 25kHz, 454.2125 MHz, Low Power Level**

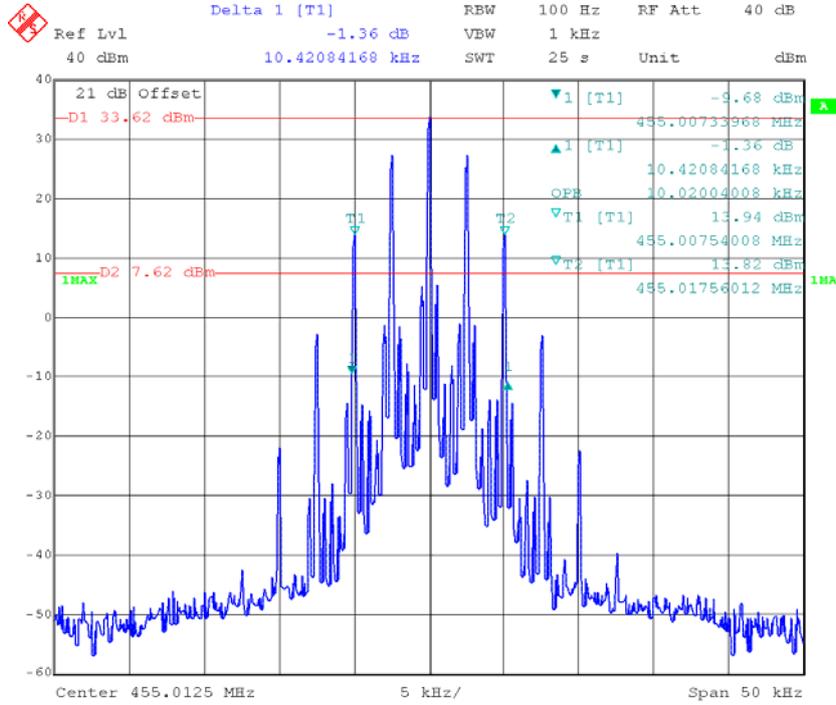


**Emission Mask ,FCC part 22.359**



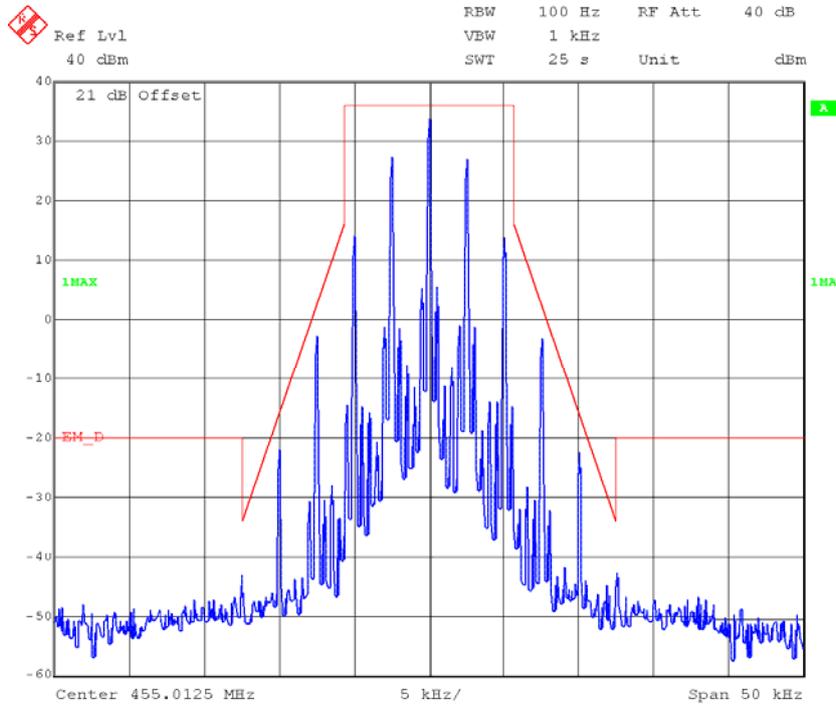
Part 74

Bandwidth – FM, 455.0125 MHz, High Power Level



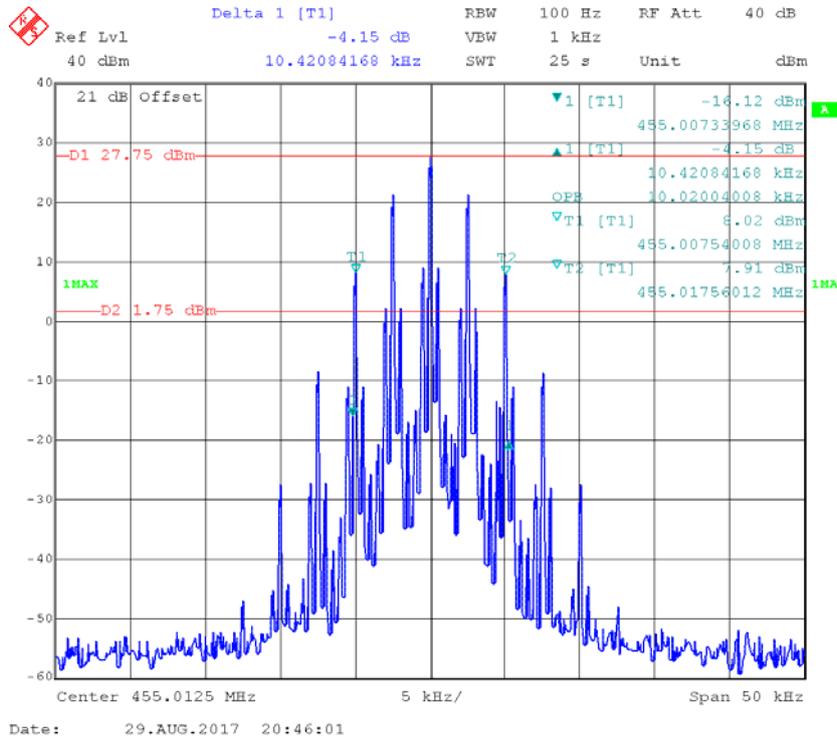
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Emission Mask - Type D

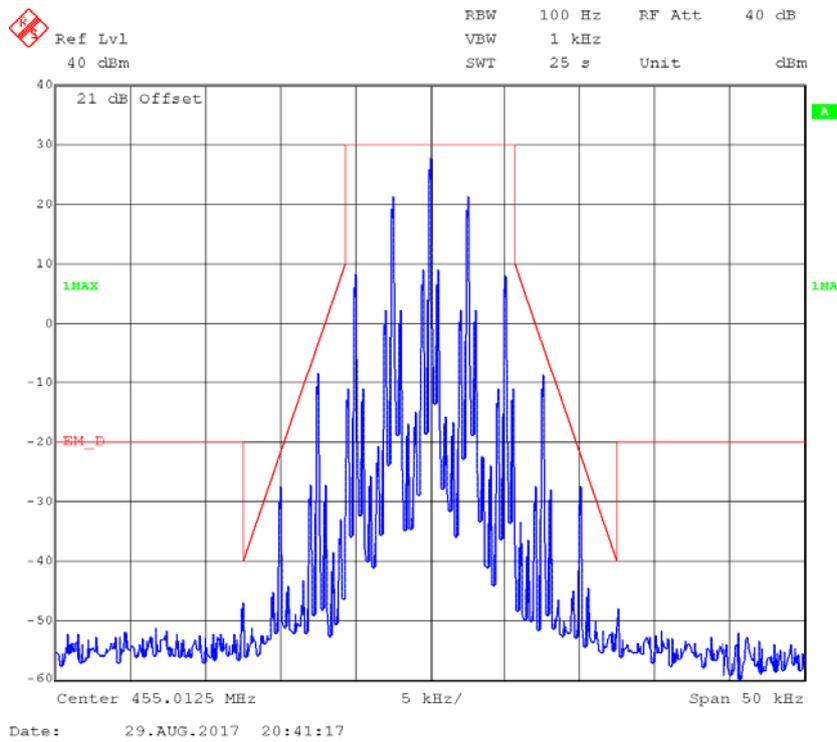


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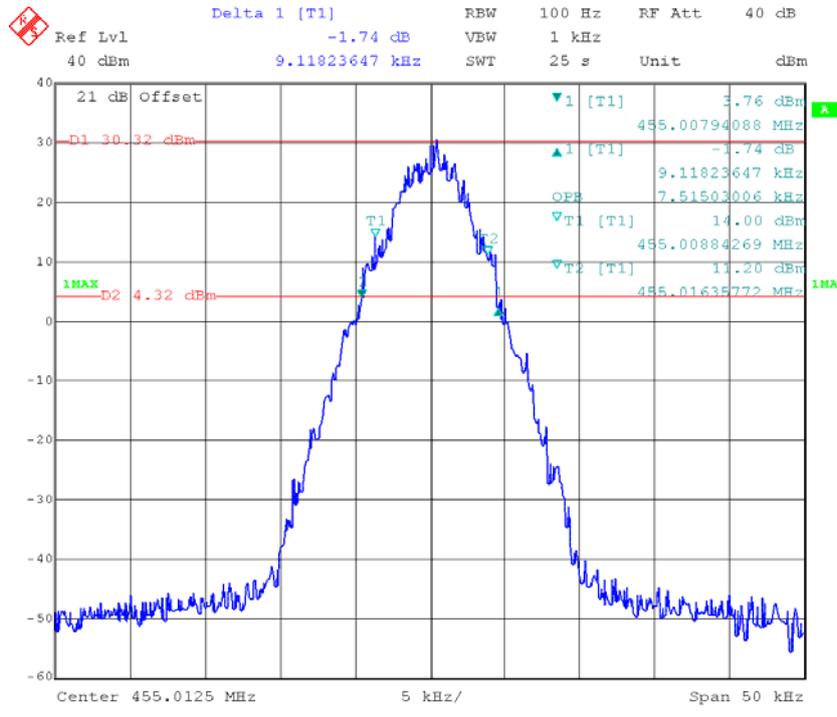
### Bandwidth – FM, 455.0125 MHz, Low Power Level



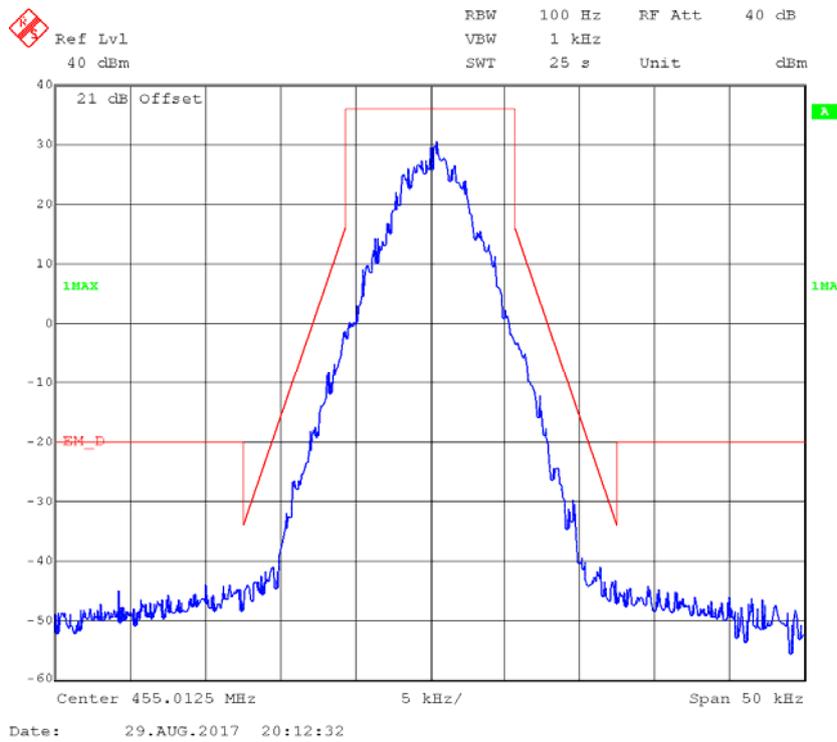
### Emission Mask - Type D



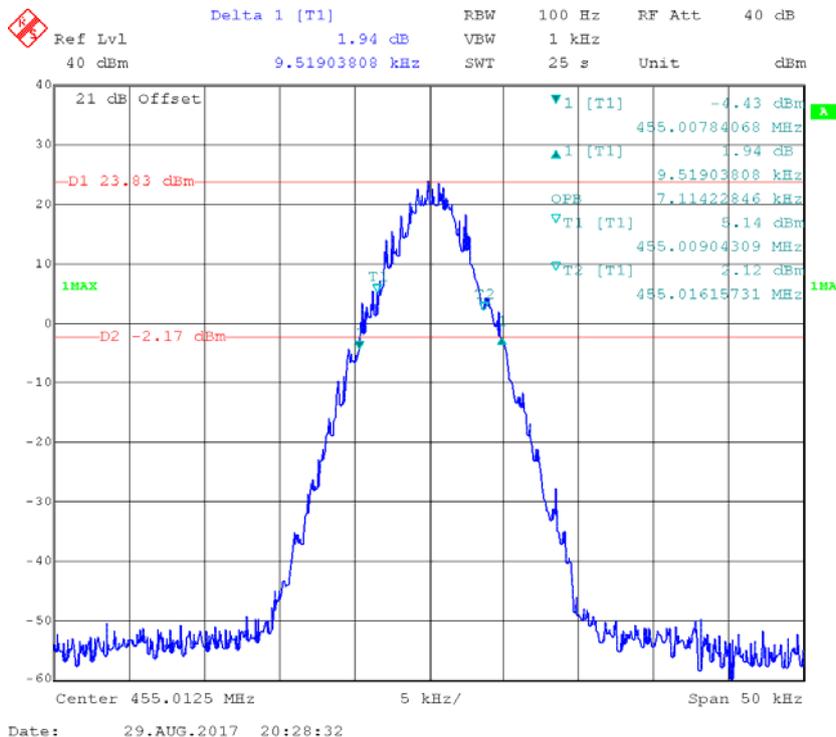
**Bandwidth – 4FSK, 455.0125 MHz, High Power Level**



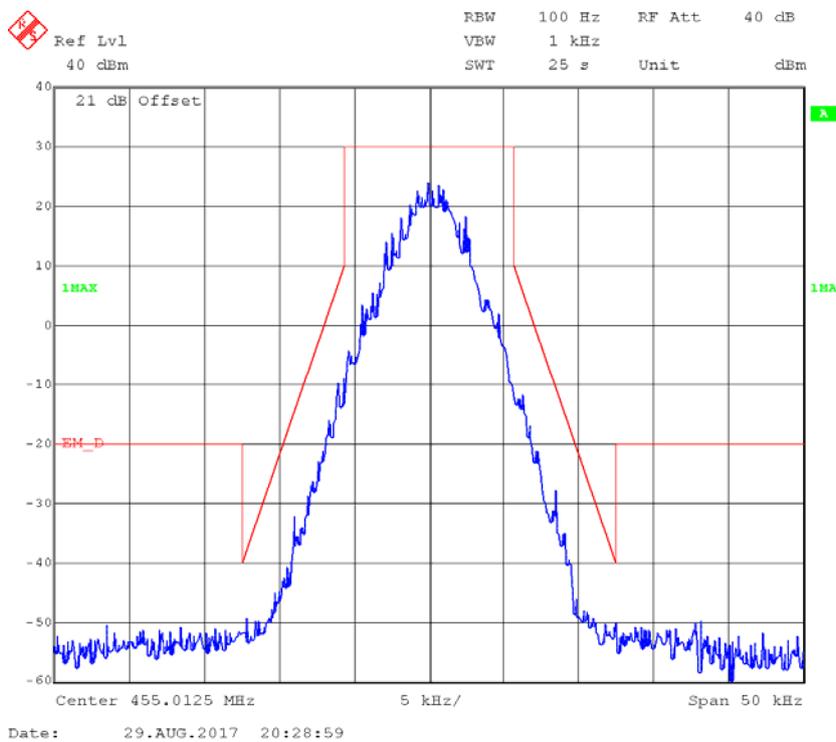
**Emission Mask - Type D**



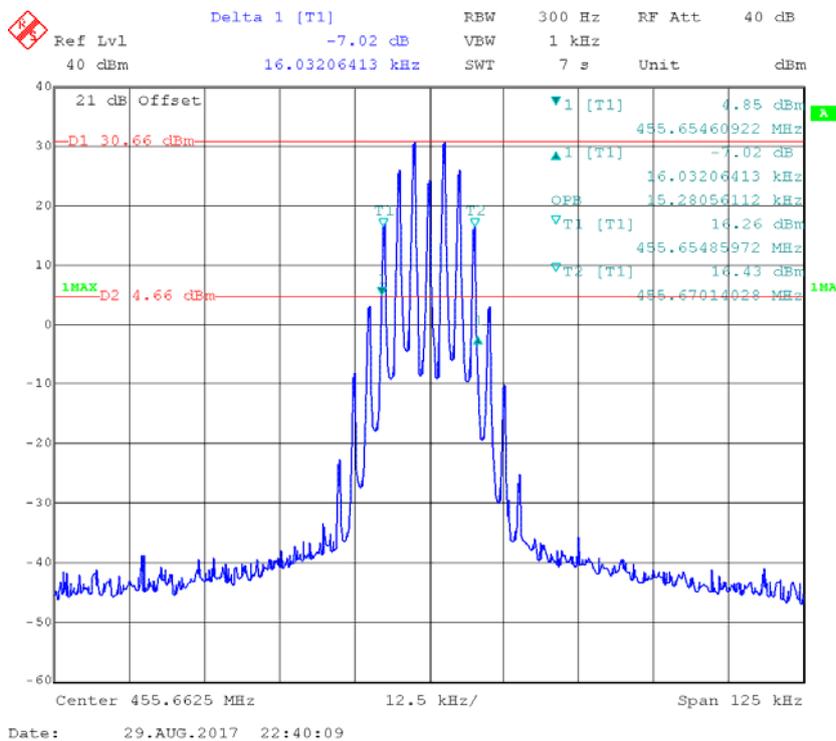
### Bandwidth – 4FSK, 455.0125 MHz, Low Power Level



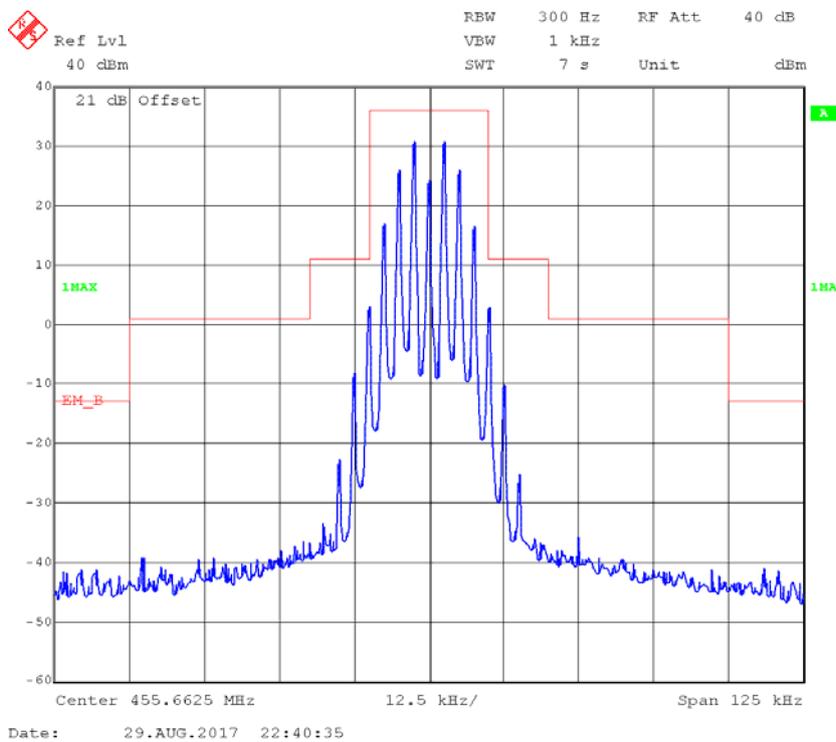
### Emission Mask - Type D



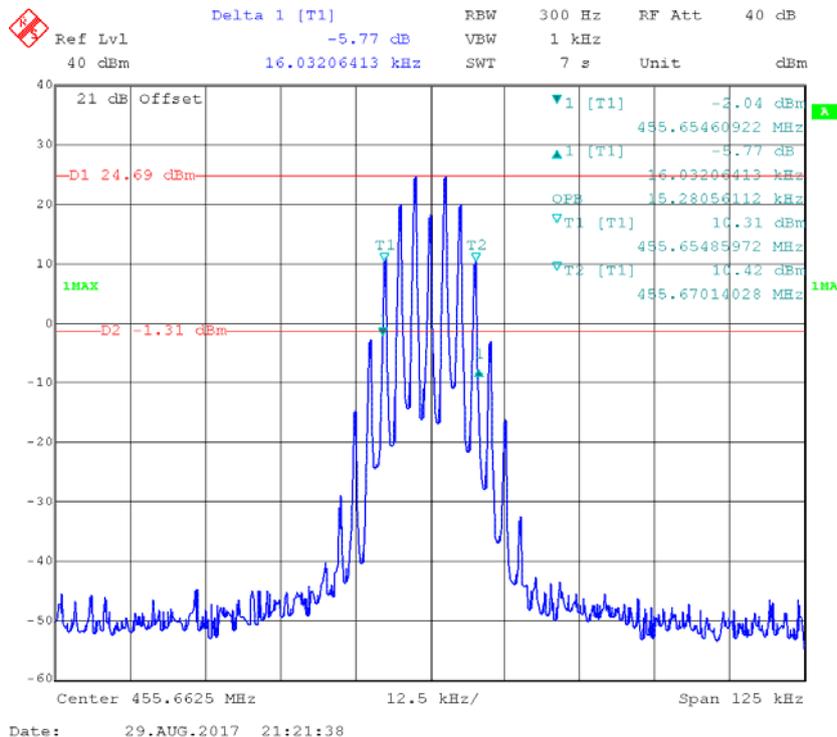
### Bandwidth – FM, 25kHz, 455.6625 MHz, High Power Level



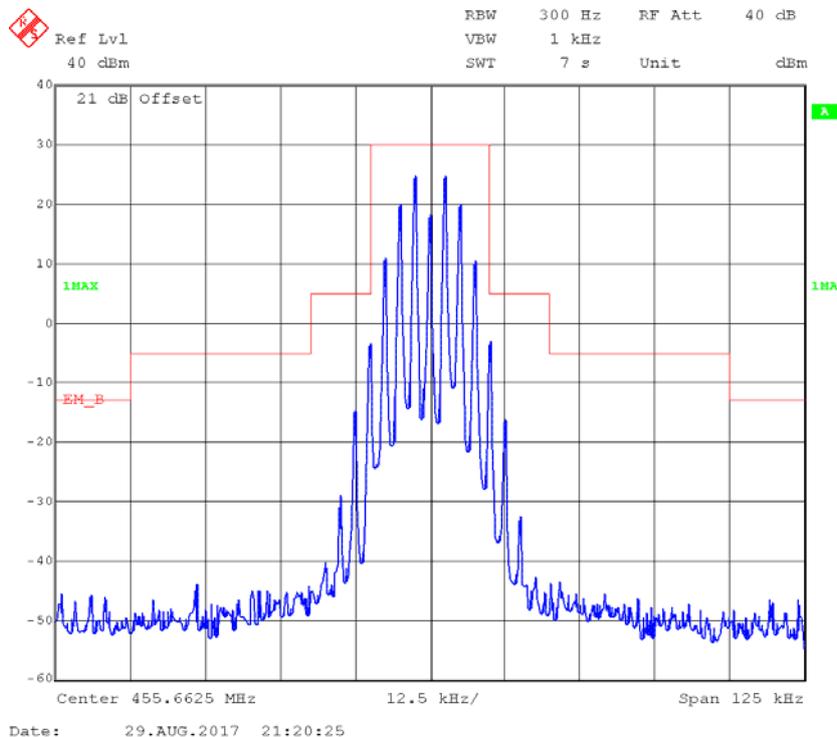
### Emission Mask - Type B



**Bandwidth – FM, 25kHz, 455.6625 MHz, Low Power Level**



**Emission Mask - Type B**



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

### Applicable Standard

§90.210 Emission limitations:

**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) On any frequency from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27(f_d - 2.88 \text{ kHz})$  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.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

§22.861 Emission limitations:

- (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

§74.462 Emission limitations:

(c) For emissions on frequencies above 25 MHz with authorized bandwidths up to 30 kHz, the emissions shall comply with the emission mask and transient frequency behavior requirements of §§90.210 and 90.214 of this chapter. For all other emissions, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- (1) On any frequency removed from the assignment frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;
- (2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;
- (3) On any frequency removed from the assigned frequency by more than 250 percent on the authorized bandwidth; at least  $43 \text{ plus } 10 \log^{10}$  (mean output power, in watts) dB.

(d) In the event a station's emissions outside its authorized channel cause harmful interference, the Commission may, at its discretion, require the licensee to take such further steps as may be necessary to eliminate the interference.

**Test Equipment List and Details**

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	831259/019	2017-07-18	2018-07-18
HP	RF Communications Test Set	8920A	00 235	2017-07-11	2018-07-11
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2017-05-06	2018-05-06
E-Microwave	RF Attenuator	20dB	20dB-1	Each Time	/
E-Microwave	RF Attenuator	20dB	20dB-2	Each Time	/
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/

\* **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).

**Test Procedure**

Adjust the spectrum analyzer for the following settings:

- 1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
- 2) Video Bandwidth  $\geq 3$  times the resolution bandwidth.
- 3) Sweep Speed  $\leq 2000$  Hz per second.
- 4) Detector Mode = peak.

**Test Data****Environmental Conditions**

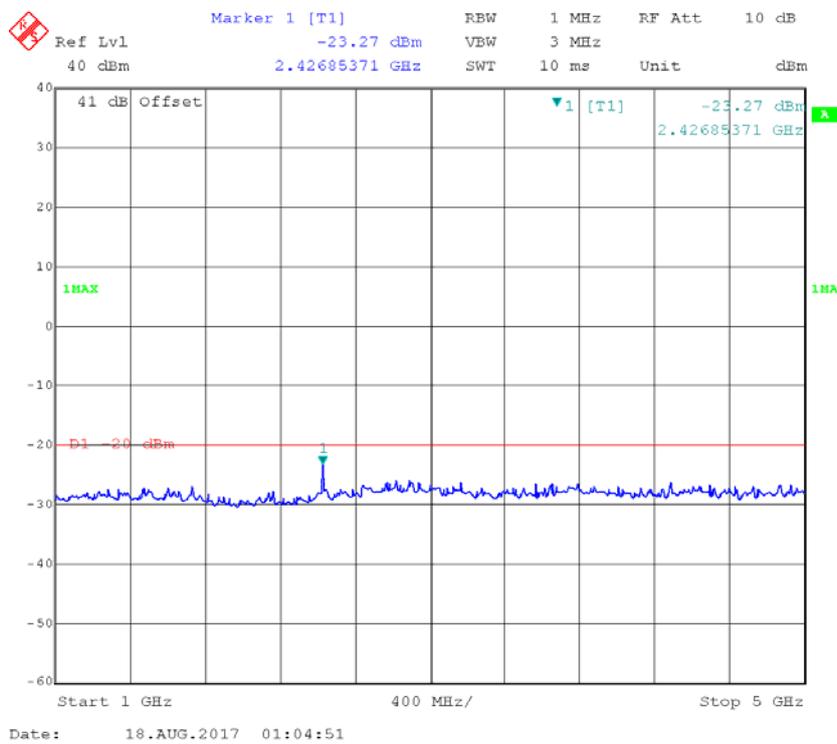
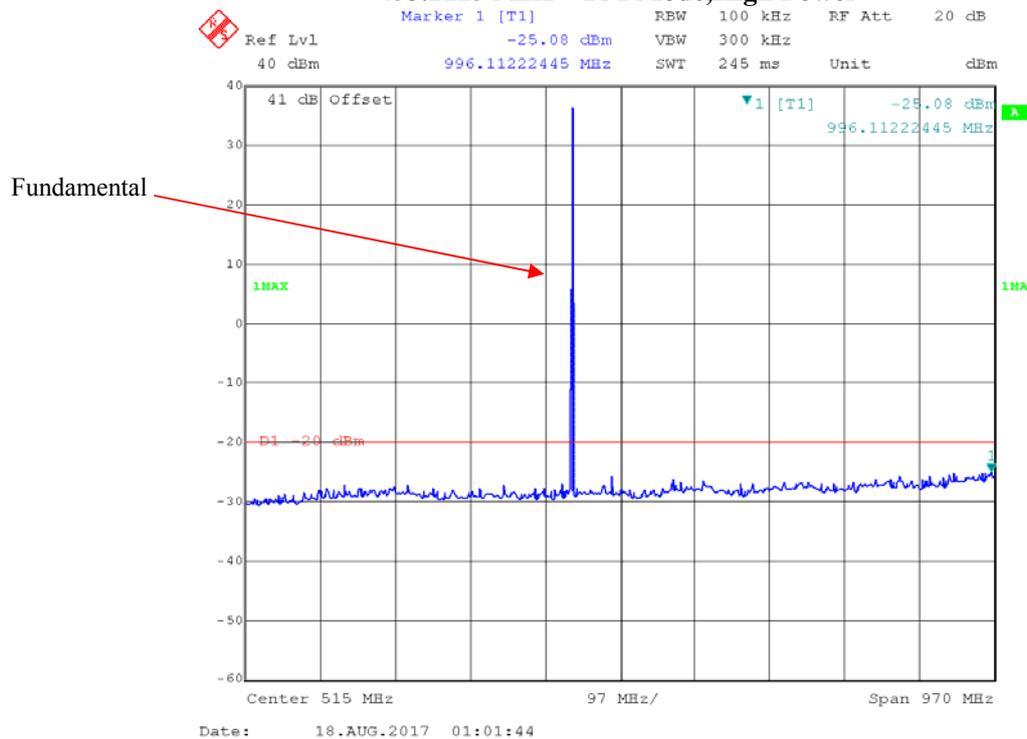
<b>Temperature:</b>	24.6 ~ 27.6 °C
<b>Relative Humidity:</b>	47 ~ 58 %
<b>ATM Pressure:</b>	98.9 ~ 100.5 kPa

*The testing was performed by Pean Zhu from 2017-08-17 to 2017-08-29.*

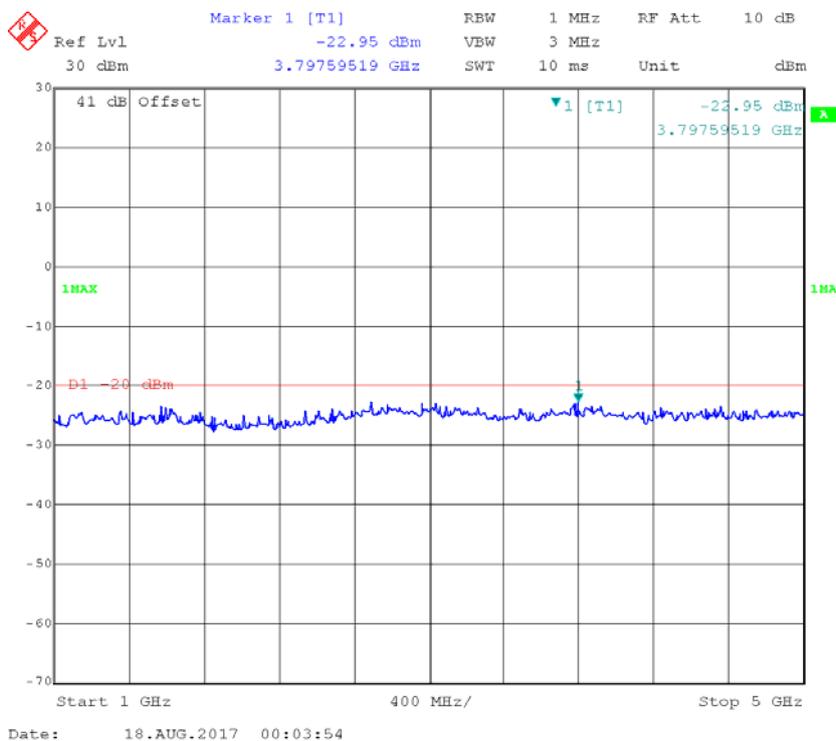
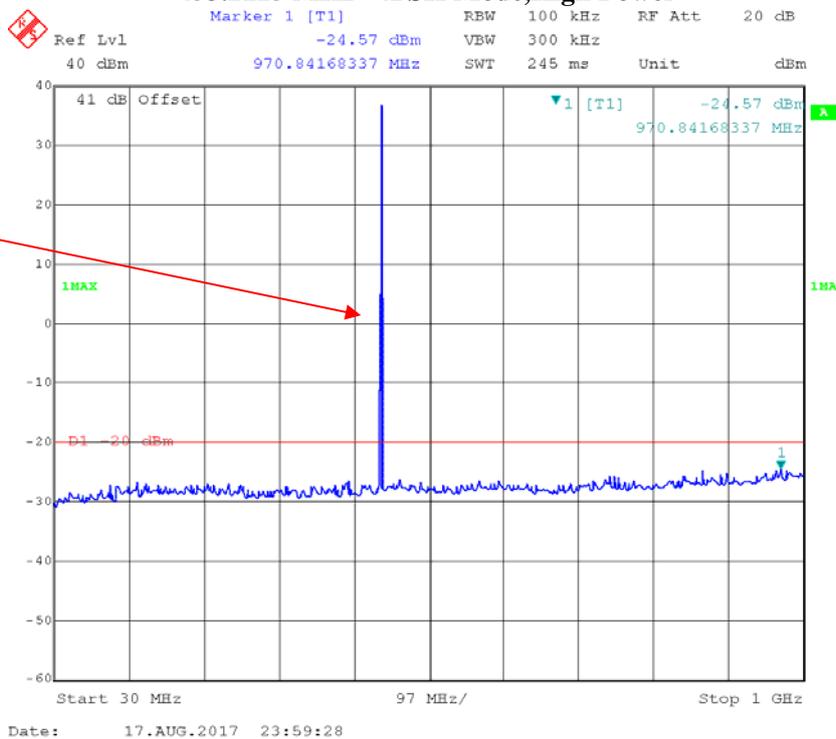
*Test Mode: Transmitting(High power was the worst)*

*Test Result: Compliant. Please refer to the following plots.*

### FCC PART 90 453.2125 MHz – FM Mode, High Power

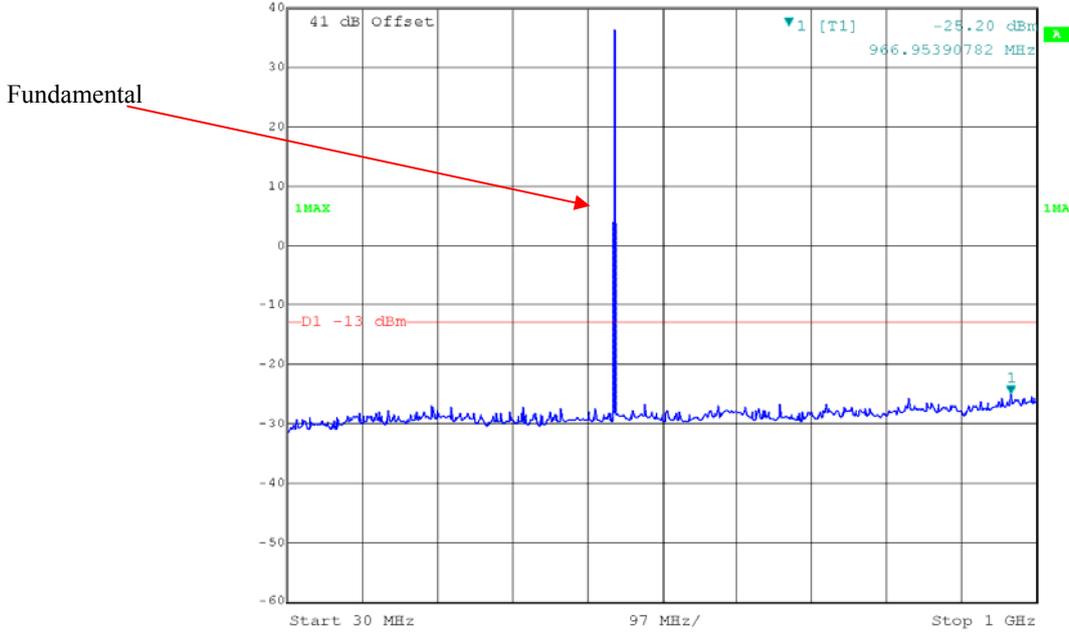


### FCC PART 90 453.2125 MHz -4FSK Mode,High Power



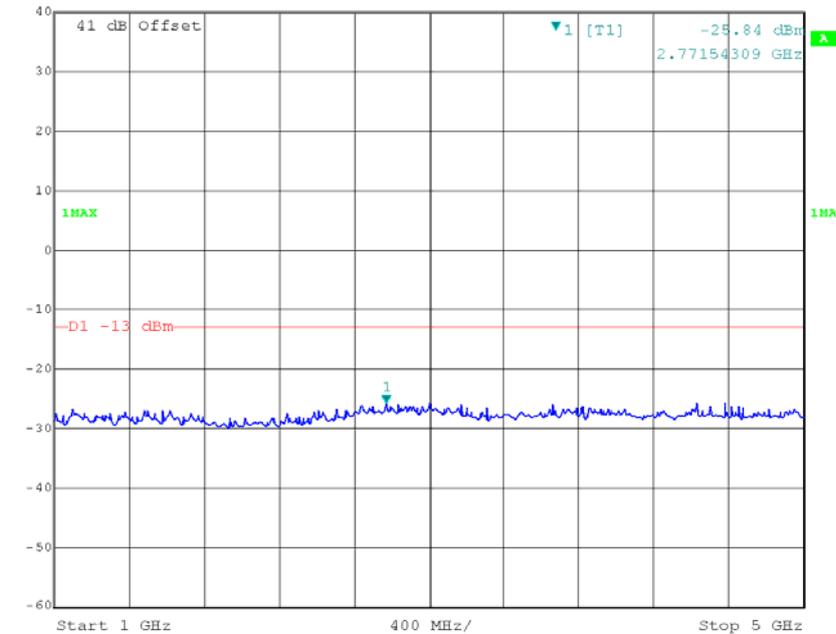
FCC PART 22  
454.0125 MHz –FM Mode(12.5kHz was the worst),High Power

Marker 1 [T1] RBW 100 kHz RF Att 20 dB  
Ref Lvl -25.20 dBm VBW 300 kHz  
40 dBm 966.95390782 MHz SWT 245 ms Unit dBm



Date: 18.AUG.2017 01:02:13

Marker 1 [T1] RBW 1 MHz RF Att 10 dB  
Ref Lvl -25.84 dBm VBW 3 MHz  
40 dBm 2.77154309 GHz SWT 10 ms Unit dBm

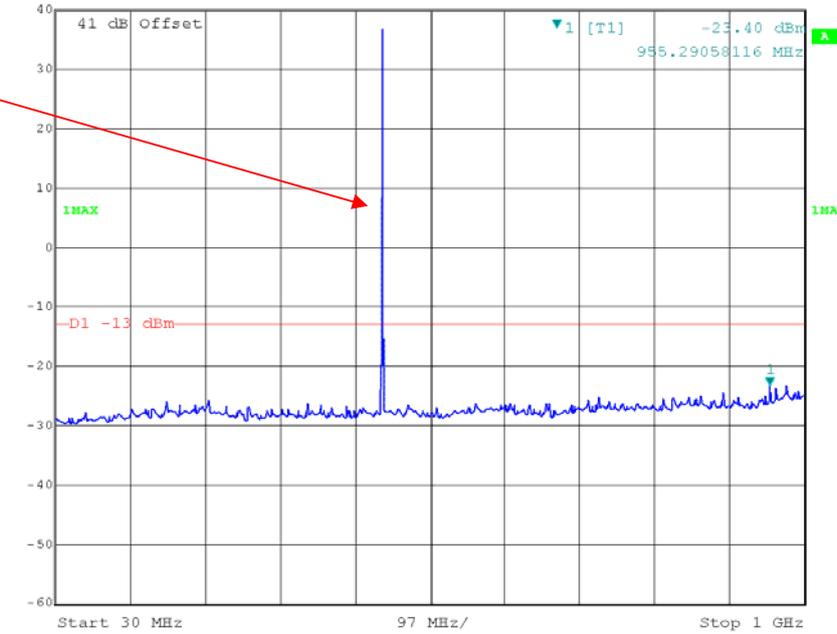


Date: 18.AUG.2017 01:05:16

### FCC PART 22 454.0125 MHz – 4FSK Mode, High Power

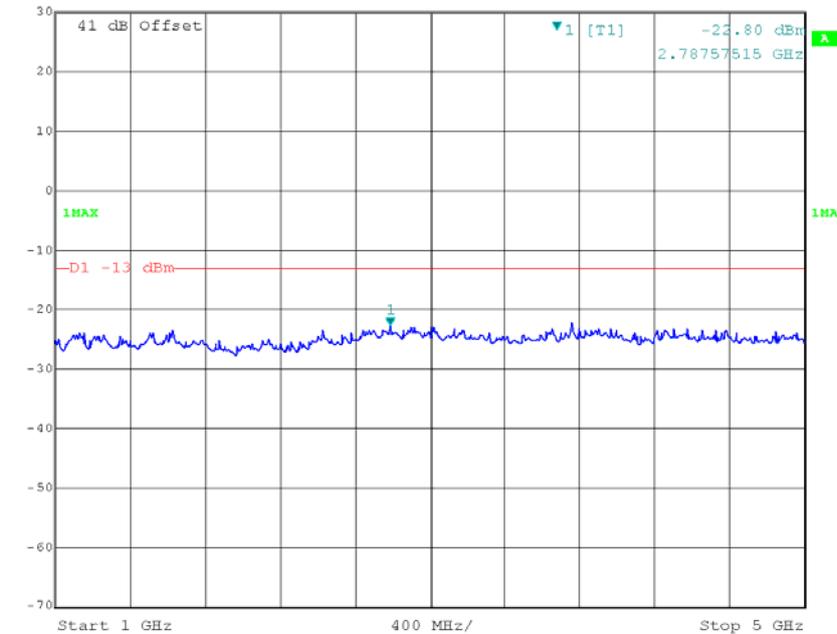
Marker 1 [T1] RBW 100 kHz RF Att 20 dB  
Ref Lvl 40 dBm -23.40 dBm VBW 300 kHz  
955.29058116 MHz SWT 245 ms Unit dBm

Fundamental



Date: 17.AUG.2017 23:56:33

Marker 1 [T1] RBW 1 MHz RF Att 10 dB  
Ref Lvl 30 dBm -22.80 dBm VBW 3 MHz  
2.78757515 GHz SWT 10 ms Unit dBm

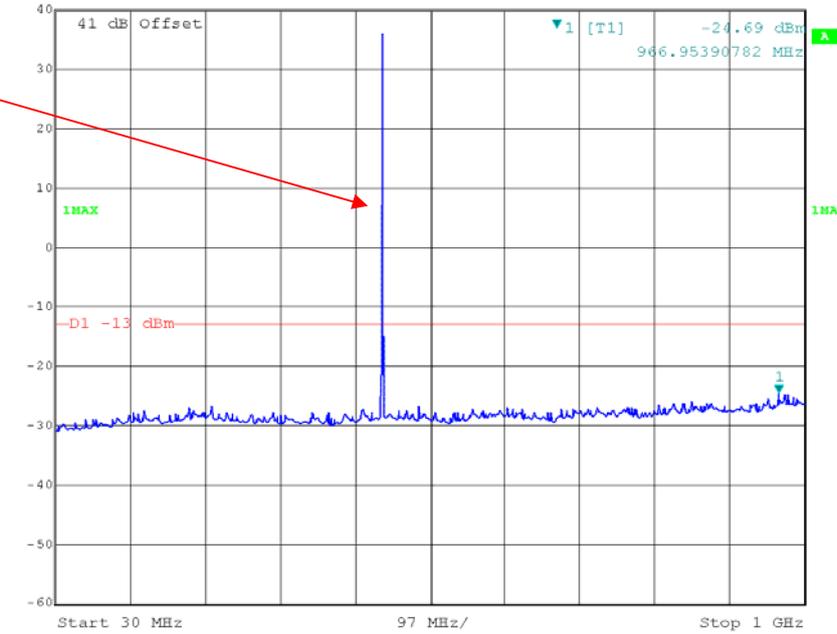


Date: 18.AUG.2017 00:04:13

### FCC PART 74 455.0125 MHz – FM Mode(12.5kHz mode was worst),High Power

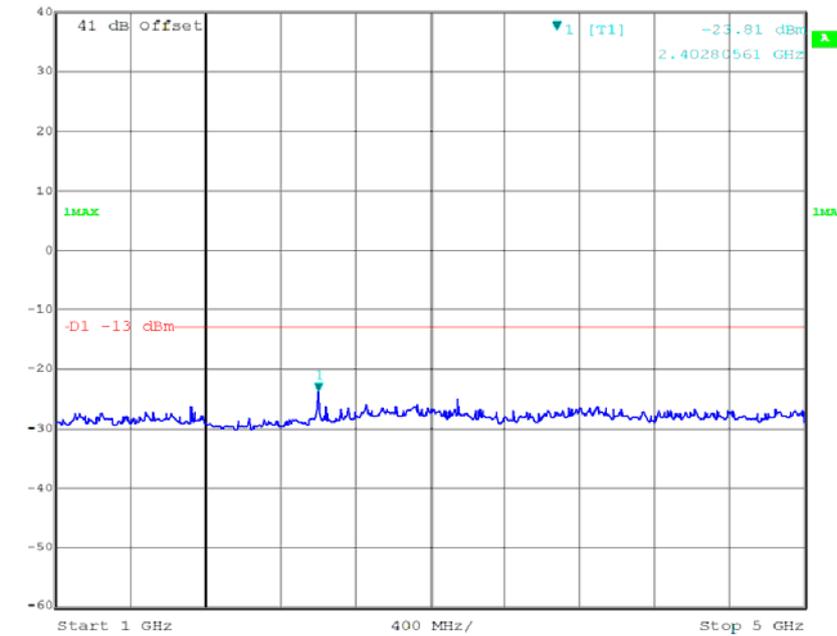
Marker 1 [T1] RBW 100 kHz RF Att 20 dB  
Ref Lvl 40 dBm -24.69 dBm VBW 300 kHz  
40 dBm 966.95390782 MHz SWT 245 ms Unit dBm

Fundamental



Date: 29.AUG.2017 21:39:20

Marker 1 [T1] RBW 1 MHz RF Att 10 dB  
Ref Lvl 40 dBm -23.81 dBm VBW 3 MHz  
40 dBm 2.40280561 GHz SWT 10 ms Unit dBm

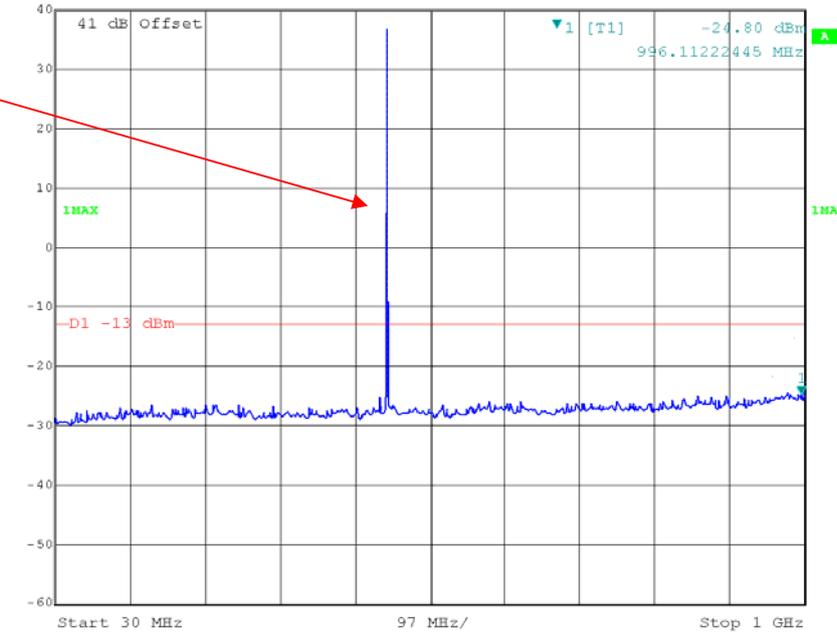


Date: 29.AUG.2017 21:38:42

### FCC PART 74 455.0125 MHz – 4FSK Mode, High Power

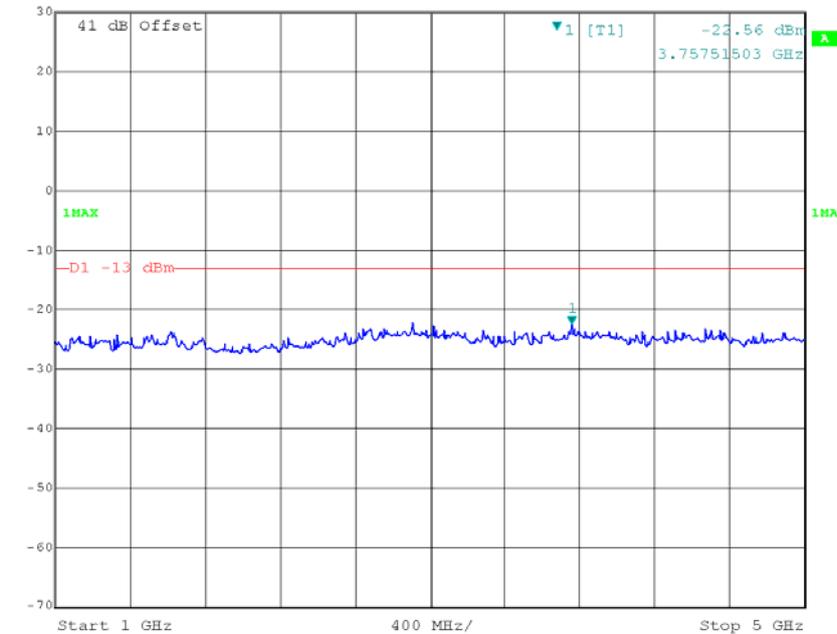
Marker 1 [T1] RBW 100 kHz RF Att 20 dB  
Ref Lvl 40 dBm -24.80 dBm VBW 300 kHz  
996.11222445 MHz SWT 245 ms Unit dBm

Fundamental



Date: 18.AUG.2017 02:15:42

Marker 1 [T1] RBW 1 MHz RF Att 10 dB  
Ref Lvl 30 dBm -22.56 dBm VBW 3 MHz  
3.75751503 GHz SWT 10 ms Unit dBm



Date: 18.AUG.2017 02:23:02

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

### Applicable Standard

FCC §2.1053 and §22.861 and §90.210 & §74.462

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Signal Generator	E8247C	MY43321350	2016-09-23	2017-09-22
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-1	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2016-09-01	2017-09-01
R&S	EMI Test Receiver	ESCI	100224	2016-09-01	2017-08-31
N/A	Coaxial Cable	4m	N/A	2016-09-01	2017-09-01
N/A	Coaxial Cable	0.75m	N/A	2016-09-01	2017-09-01
N/A	Coaxial Cable	10m	N/A	2016-09-01	2017-09-01
N/A	Coaxial Cable	8m	N/A	2016-09-01	2017-09-01
Mini-Circuit	Amplifier	ZVA-213-S+	SN054201245	2017-02-19	2018-02-19
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	2016-12-08	2017-12-08
HP	Signal Generator	1026	320408	2016-12-08	2017-12-08

\* **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).

## 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.

For part 90:

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

Spurious attenuation limit in dB = 50 + 10 Log<sub>10</sub> (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

For part 22:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

For part 74:

On any frequency removed from the assigned frequency by more than 250 percent on the authorized bandwidth; at least 43 plus 10 log<sup>10</sup> (mean output power, in watts) dB.

## Test Data

### Environmental Conditions

<b>Temperature:</b>	26.5 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	100.5 kPa

*The testing was performed by Pean Zhu on 2017-08-29.*

**Test Mode:** *Transmitting(T03-00302-GCAA was the worst)*

*FM mode, high power level:*

Frequency	Polar	S.A. Reading	S.G. Level	Antenna Gain	Cable Loss	Absolute Level	Limit	Margin
MHz	H/V	dBµV	dBm	dBd/dBi	dB	dBm	dBm	dB
<b>Frequency: 453.2125 MHz, for FCC PART 90</b>								
906.425	H	33.47	-40.8	0.0	1.1	-41.9	-20.0	21.9
906.425	V	36.78	-34.2	0.0	1.1	-35.3	-20.0	15.3
1359.638	H	53.57	-59.8	8.7	1.2	-52.3	-20.0	32.3
1359.638	V	57.33	-56.8	8.7	1.2	-49.3	-20.0	29.3
1812.850	H	50.23	-64	11.1	0.7	-53.6	-20.0	33.6
1812.850	V	52.15	-62.6	11.1	0.7	-52.2	-20.0	32.2
2266.063	H	46.25	-66	11.1	1.2	-56.1	-20.0	36.1
2266.063	V	48.34	-63.8	11.1	1.2	-53.9	-20.0	33.9
2719.275	H	55.23	-57.1	13.1	1.3	-45.3	-20.0	25.3
2719.275	V	55.59	-56.8	13.1	1.3	-45.0	-20.0	25.0
3172.488	H	47.88	-62.2	13.5	1.6	-50.3	-20.0	30.3
3172.488	V	49.03	-61.1	13.5	1.6	-49.2	-20.0	29.2
3625.700	H	44.94	-65	14.1	1.6	-52.5	-20.0	32.5
3625.700	V	45.42	-64.5	14.1	1.6	-52.0	-20.0	32.0
<b>Frequency: 454.0125 MHz, for FCC PART 22(12.5kHz was the worst)</b>								
908.025	H	32.28	-41.9	0.0	1.1	-43.0	-13.0	30.0
908.025	V	36.91	-34	0.0	1.1	-35.1	-13.0	22.1
1362.038	H	54.17	-59.2	8.7	1.2	-51.7	-13.0	38.7
1362.038	V	56.88	-57.2	8.7	1.2	-49.7	-13.0	36.7
1816.050	H	49.75	-64.4	11.2	0.7	-53.9	-13.0	40.9
1816.050	V	51.93	-62.7	11.2	0.7	-52.2	-13.0	39.2
2270.063	H	46.30	-66	11.1	1.2	-56.1	-13.0	43.1
2270.063	V	48.96	-63.2	11.1	1.2	-53.3	-13.0	40.3
2724.075	H	54.60	-57.7	13.1	1.3	-45.9	-13.0	32.9
2724.075	V	55.09	-57.3	13.1	1.3	-45.5	-13.0	32.5
3178.088	H	48.50	-61.5	13.5	1.6	-49.6	-13.0	36.6
3178.088	V	49.13	-60.9	13.5	1.6	-49.0	-13.0	36.0
3632.100	H	46.79	-63.1	14.1	1.6	-50.6	-13.0	37.6
3632.100	V	46.03	-63.8	14.1	1.6	-51.3	-13.0	38.3

**4FSK mode, high power level:**

Frequency	Polar	S.A. Reading	S.G. Level	Antenna Gain	Cable Loss	Absolute Level	Limit	Margin
MHz	H/V	dBµV	dBm	dBd/dBi	dB	dBm	dBm	dB
<b>Frequency: 453.2125 MHz, for FCC PART 90</b>								
906.425	H	31.41	-42.8	0.0	1.1	-43.9	-20.0	23.9
906.425	V	36.23	-34.7	0.0	1.1	-35.8	-20.0	15.8
1359.638	H	53.07	-60.3	8.7	1.2	-52.8	-20.0	32.8
1359.638	V	56.21	-57.9	8.7	1.2	-50.4	-20.0	30.4
1812.850	H	48.65	-65.5	11.1	0.7	-55.1	-20.0	35.1
1812.850	V	51.30	-63.4	11.1	0.7	-53.0	-20.0	33.0
2266.063	H	45.53	-66.7	11.1	1.2	-56.8	-20.0	36.8
2266.063	V	47.66	-64.5	11.1	1.2	-54.6	-20.0	34.6
2719.275	H	53.46	-58.8	13.1	1.3	-47.0	-20.0	27.0
2719.275	V	54.45	-58	13.1	1.3	-46.2	-20.0	26.2
3172.488	H	47.41	-62.7	13.5	1.6	-50.8	-20.0	30.8
3172.488	V	48.02	-62.1	13.5	1.6	-50.2	-20.0	30.2
3625.700	H	44.11	-65.8	14.1	1.6	-53.3	-20.0	33.3
3625.700	V	45.38	-64.5	14.1	1.6	-52.0	-20.0	32.0
<b>Frequency: 454.0125 MHz, for FCC PART 22</b>								
908.025	H	30.21	-44	0.0	1.1	-45.1	-13.0	32.1
908.025	V	36.00	-34.9	0.0	1.1	-36.0	-13.0	23.0
1362.038	H	53.01	-60.3	8.7	1.2	-52.8	-13.0	39.8
1362.038	V	56.21	-57.9	8.7	1.2	-50.4	-13.0	37.4
1816.050	H	48.79	-65.3	11.2	0.7	-54.8	-13.0	41.8
1816.050	V	51.01	-63.7	11.2	0.7	-53.2	-13.0	40.2
2270.063	H	45.67	-66.6	11.1	1.2	-56.7	-13.0	43.7
2270.063	V	47.87	-64.3	11.1	1.2	-54.4	-13.0	41.4
2724.075	H	53.97	-58.3	13.1	1.3	-46.5	-13.0	33.5
2724.075	V	54.56	-57.8	13.1	1.3	-46.0	-13.0	33.0
3178.088	H	47.42	-62.6	13.5	1.6	-50.7	-13.0	37.7
3178.088	V	48.52	-61.6	13.5	1.6	-49.7	-13.0	36.7
3632.100	H	46.14	-63.7	14.1	1.6	-51.2	-13.0	38.2
3632.100	V	44.59	-65.3	14.1	1.6	-52.8	-13.0	39.8

*FM mode(12.5kHz was worst), high power level:*

Frequency	Polar	S.A. Reading	S.G. Level	Antenna Gain	Cable Loss	Absolute Level	Limit	Margin
MHz	H/V	dB $\mu$ V	dBm	dBd/dBi	dB	dBm	dBm	dB
<b>Frequency: 455.0125 MHz, for FCC PART 74</b>								
910.025	H	33.14	-41	0.0	1.1	-42.1	-13.0	29.1
910.025	V	36.43	-34.4	0.0	1.1	-35.5	-13.0	22.5
1365.038	H	53.62	-59.7	8.7	1.2	-52.2	-13.0	39.2
1365.038	V	56.34	-57.7	8.7	1.2	-50.2	-13.0	37.2
1820.050	H	49.16	-64.9	11.2	0.7	-54.4	-13.0	41.4
1820.050	V	51.27	-63.3	11.2	0.7	-52.8	-13.0	39.8
2275.063	H	45.80	-66.4	11.1	1.2	-56.5	-13.0	43.5
2275.063	V	48.44	-63.7	11.1	1.2	-53.8	-13.0	40.8

*4FSK mode, high power level:*

Frequency	Polar	S.A. Reading	S.G. Level	Antenna Gain	Cable Loss	Absolute Level	Limit	Margin
MHz	H/V	dB $\mu$ V	dBm	dBd/dBi	dB	dBm	dBm	dB
<b>Frequency: 455.0125 MHz, for FCC PART 74</b>								
910.025	H	32.45	-41.7	0.0	1.1	-42.8	-13.0	29.8
910.025	V	35.26	-35.6	0.0	1.1	-36.7	-13.0	23.7
1365.038	H	52.14	-61.2	8.7	1.2	-53.7	-13.0	40.7
1365.038	V	54.26	-59.8	8.7	1.2	-52.3	-13.0	39.3
1820.050	H	47.62	-66.4	11.2	0.7	-55.9	-13.0	42.9
1820.050	V	50.77	-63.8	11.2	0.7	-53.3	-13.0	40.3
2275.063	H	44.26	-68	11.1	1.2	-58.1	-13.0	45.1
2275.063	V	45.96	-66.2	11.1	1.2	-56.3	-13.0	43.3

**Note:**

- 1) The unit of Antenna Gain is dBd for frequency below 1GHz, and the unit of Antenna Gain is dBi for frequency above 1GHz.
- 2) Absolute Level = SG Level - Cable loss + Antenna Gain
- 3) Margin = Limit-Absolute Level

**FCC §2.1055 & § 22.355 & §90.213&§74.464- FREQUENCY STABILITY****Applicable Standard**

FCC §2.1055, § 22.355, §90.213, §74.464

**Test Equipment List and Details**

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	831259/019	2017-07-18	2018-07-18
Dongzhixu	High Temperature Test Chamber	DP1000	201105083-4	2016-09-10	2017-09-09
UNI-T	Multimeter	UT39A	M130199938	2017-04-10	2018-04-10
HP	RF Communications Test Set	8920A	00 235	2017-07-11	2018-07-11
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2017-05-06	2018-05-06
E-Microwave	RF Attenuator	20dB	20dB-1	Each Time	/
E-Microwave	RF Attenuator	20dB	20dB-2	Each Time	/
Pro instrument	DC Power Supply	pps3300	N/A	N/A	N/A
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/

\* **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).

**Test Procedure**

Frequency Stability vs. Temperature: The equipment under test was connected to 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 power 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.

The frequency stability shall be measured with variation of primary supply voltage as follows:

- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value.
- (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	26.5 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	100.5 kPa

The testing was performed by Pean Zhu on 2017-08-29.

Test Mode: Transmitting

FCC PART 90:

<b>FM mode, Reference Frequency: 453.2125 MHz, Limit: 2.5 ppm</b>			
<b>Temperature</b>	<b>Voltage</b>	<b>Measured</b>	<b>Frequency Error</b>
<b>°C</b>	<b>V<sub>DC</sub></b>	<b>MHz</b>	<b>ppm</b>
-30	7.4	453.212446	-0.12
-20		453.212431	-0.15
-10		453.212443	-0.13
0		453.212474	-0.06
10		453.212431	-0.15
20		453.212443	-0.13
30		453.212426	-0.16
40		453.212447	-0.12
50		453.212439	-0.13
25		6.8	453.212429
25	8.4	453.212444	-0.12

FCC PART 22:

<b>FM mode, Reference Frequency: 454.0125 MHz, Limit: 2.5 ppm</b>			
<b>Temperature</b>	<b>Voltage</b>	<b>Measured</b>	<b>Frequency Error</b>
<b>°C</b>	<b>V<sub>DC</sub></b>	<b>MHz</b>	<b>ppm</b>
-30	7.4	454.012436	-0.14
-20		454.012437	-0.14
-10		454.012450	-0.11
0		454.012464	-0.08
10		454.012447	-0.12
20		454.012420	-0.18
30		454.012450	-0.11
40		454.012464	-0.08
50		454.012425	-0.17
25		6.8	454.012418
25	8.4	454.012424	-0.17

FCC PART 74:

<b>FM,12.5kHz, Reference Frequency: 455.0125 MHz, Limit:2.5 ppm</b>			
<b>Temperature</b>	<b>Voltage</b>	<b>Measured</b>	<b>Frequency Error</b>
<b>°C</b>	<b>V<sub>DC</sub></b>	<b>MHz</b>	<b>ppm</b>
-30	7.4	455.012389	-0.24
-20		455.012374	-0.27
-10		455.012430	-0.15
0		455.012429	-0.15
10		455.012374	-0.27
20		455.012430	-0.15
30		455.012405	-0.21
40		455.012425	-0.16
50		455.012411	-0.19
25		6.8	455.012373
25	8.4	455.012417	-0.18

## FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

### Applicable Standard

FCC §90.214

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	831259/019	2017-07-18	2018-07-18
HP	RF Communications Test Set	8920A	00 235	2017-07-11	2018-07-11
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2017-05-06	2018-05-06
E-Microwave	RF Attenuator	20dB	20dB-1	Each Time	/
E-Microwave	RF Attenuator	20dB	20dB-2	Each Time	/
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/

\* **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).

### Test Procedure

The tests and measurements indicated in TIA-603-D §2.2.19.2.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	24.6 ~ 27.6 °C
<b>Relative Humidity:</b>	47 ~ 58 %
<b>ATM Pressure:</b>	98.9 ~ 100.5 kPa

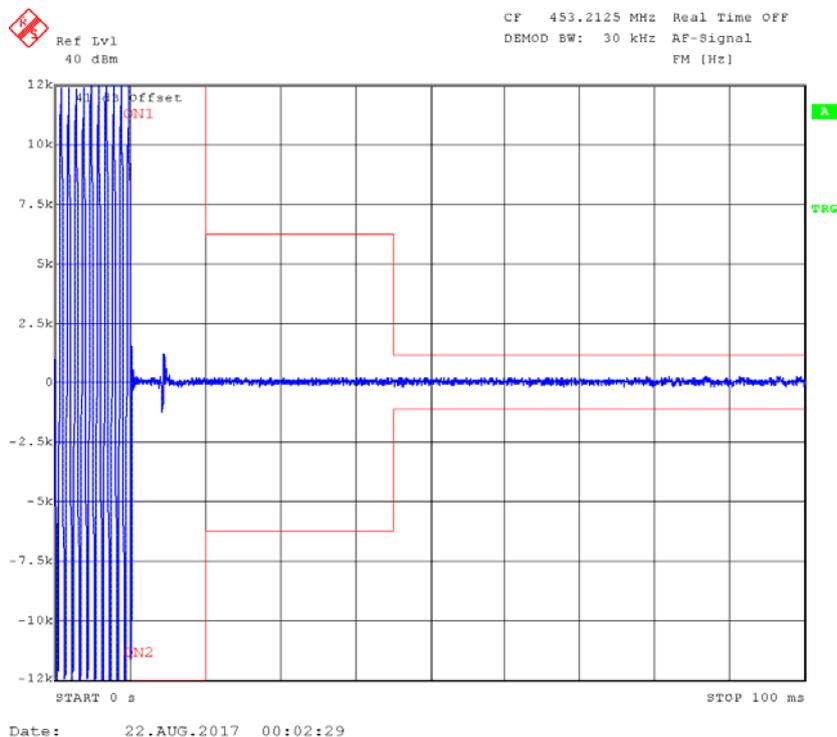
The testing was performed by Pean Zhu from 2017-08-22 to 2017-08-29.

Channel Spacing (kHz)	Transient Period (ms)	Transient Frequency	Result
12.5	<10(t <sub>1</sub> )	±12.5 kHz	Pass
	<25(t <sub>2</sub> )	±6.25 kHz	
	<10(t <sub>3</sub> )	±12.5 kHz	

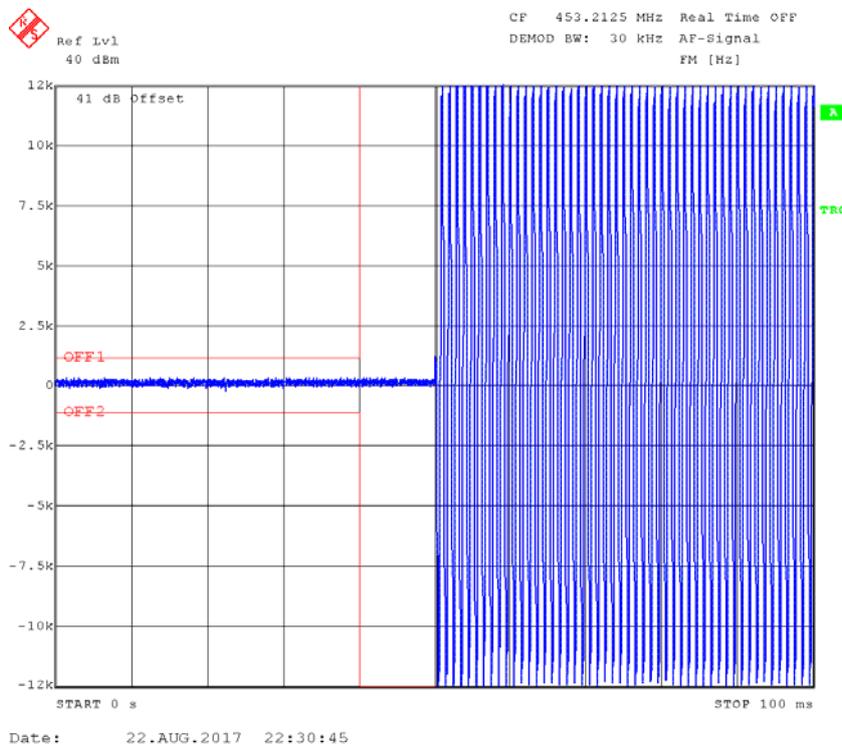
Please refer to the following plots.

**Part 90, FM Mode:**

**Turn on – 453.2125 MHz, High power level**



**Turn off – 453.2125 MHz, High power level**



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