



## FCC PART 22 AND PART 90 TEST REPORT

For

### SHENZHEN COVALUE COMMUNICATIONS CO.,LTD.

2/F., Bldg. 24, XiLi Industrial Park, No.119 Xinguang Rd, Xili, Nanshan, Shenzhen, China

**FCC ID: Y4GDR7800-1**

<b>Report Type:</b> Original Report	<b>Product Name:</b> FM TRANSCEIVER
<b>Test Engineer:</b> <u>Kevin Hu</u>	
<b>Report Number:</b> <u>RDG170206002</u>	
<b>Report Date:</b> <u>2017-04-22</u>	
<b>Reviewed By:</b> <u>Henry Ding</u> EMC Leader	
<b>Test Laboratory:</b> Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Hui long wan Plaza, No. 1, Shawan Road, Jinniu District, ChengDu, Sichuan China Tel: 028-65523123, Fax: 028-65525125 <a href="http://www.baclcorp.com">www.baclcorp.com</a>	

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## **TABLE OF CONTENTS**

<b>GENERAL INFORMATION .....</b>	<b>4</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	4
OBJECTIVE .....	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY .....	4
TEST FACILITY.....	5
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>6</b>
DESCRIPTION OF TEST CONFIGURATION .....	6
SUPPORT EQUIPMENT LIST AND DETAILS .....	6
BLOCK DIAGRAM OF TEST SETUP .....	6
<b>SUMMARY OF TEST RESULTS.....</b>	<b>8</b>
<b>FCC §1.1310 &amp; §2.1093 - RF EXPOSURE .....</b>	<b>9</b>
APPLICABLE STANDARD.....	9
TEST RESULT .....	9
<b>FCC §2.1046 &amp; § 22.727&amp;§90.205- RF OUTPUT POWER .....</b>	<b>10</b>
APPLICABLE STANDARD.....	10
TEST PROCEDURE .....	10
TEST EQUIPMENT LIST AND DETAILS .....	10
TEST DATA .....	10
<b>FCC §2.1047 &amp; §90.207 - MODULATION CHARACTERISTIC .....</b>	<b>12</b>
APPLICABLE STANDARD.....	12
TEST PROCEDURE .....	12
TEST EQUIPMENT LIST AND DETAILS .....	12
TEST DATA .....	12
<b>FCC §2.1049&amp; §22.357 &amp; § 22.731 &amp;§90.209 &amp; §90.210 – OCCUPIED BANDWIDTH &amp; EMISSION MASK .....</b>	<b>16</b>
APPLICABLE STANDARD.....	16
TEST EQUIPMENT LIST AND DETAILS .....	17
TEST PROCEDURE .....	17
TEST DATA .....	17
<b>FCC §2.1051&amp; §22.861 &amp; §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS .....</b>	<b>25</b>
APPLICABLE STANDARD.....	25
TEST EQUIPMENT LIST AND DETAILS .....	25
TEST PROCEDURE .....	26
TEST DATA .....	26
<b>FCC §2.1053 &amp; §22.861 &amp; §90.210 - RADIATED SPURIOUS EMISSIONS.....</b>	<b>31</b>
APPLICABLE STANDARD.....	31
TEST EQUIPMENT LIST AND DETAILS .....	31
TEST PROCEDURE .....	32
TEST DATA .....	32
<b>FCC §2.1055 &amp; § 22.355 &amp; §90.213- FREQUENCY STABILITY .....</b>	<b>35</b>
APPLICABLE STANDARD.....	35
TEST EQUIPMENT LIST AND DETAILS .....	35
TEST PROCEDURE .....	35

TEST DATA .....	36
<b>FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR .....</b>	<b>38</b>
APPLICABLE STANDARD .....	38
TEST EQUIPMENT LIST AND DETAILS .....	38
TEST PROCEDURE .....	38
TEST DATA .....	38

## GENERAL INFORMATION

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

The **SHENZHEN COVALUE COMMUNICATIONS CO.,LTD.** 's product, model: **DR7800-1, DR7500-1 (FCC ID: Y4GDR7800-1)** (the "EUT") in this report are **FM TRANSCEIVER**, which were measured approximately: 15.0 cm (L) x 4.5 cm (W) x 5.0 cm (H), rated input voltage: DC7.4V Li-ion battery or DC12V from adapter.

#### Adapter Information:

MODEL: YS02-120100U

INPUT: AC 100-240V, 50/60Hz, 0.32A MAX

OUTPUT: DC 12V, 1000mA

*Note: The series product, model DR7800-1, DR7500-1, DR7810-1, DR7820-1, DR7600-1, DR7610-1, DR7620-1, DR7510-1, DR7520-1 are electrically identical, we selected DR7800-1 for fully testing, and selected DR7500-1 for additional spurious test, the difference between them is explained in the declaration letter.*

*\*All measurement and test data in this report was gathered from final production sample, serial number: 170206002-1(DR7800-1), 170206002-2(DR7500-1), (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-02-06, and EUT conformed to test requirement.*

### Objective

This test report is prepared on behalf of **SHENZHEN COVALUE COMMUNICATIONS CO.,LTD.** in accordance with Part 2, Part 22 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 90 and Part 22.

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 BACL to collect test data is located in the No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, ChengDu, Sichuan China

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on April 24, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in a test mode.

### EUT Specification:

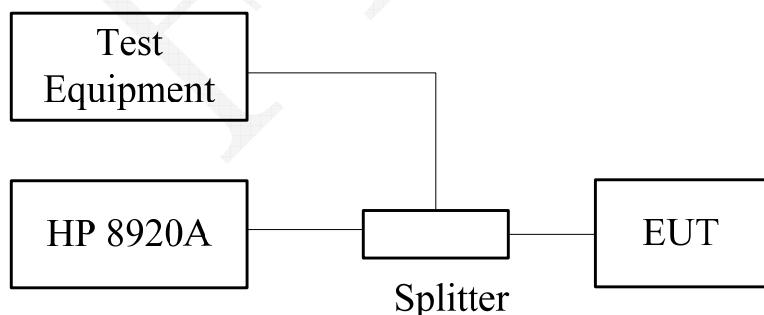
Operating Frequency Band	136-174MHz
Modulation Mode	FM/4FSK
Channel Spacing	12.5 kHz
Rated Output Power	High: 5W Low: 1W

### Support Equipment List and Details

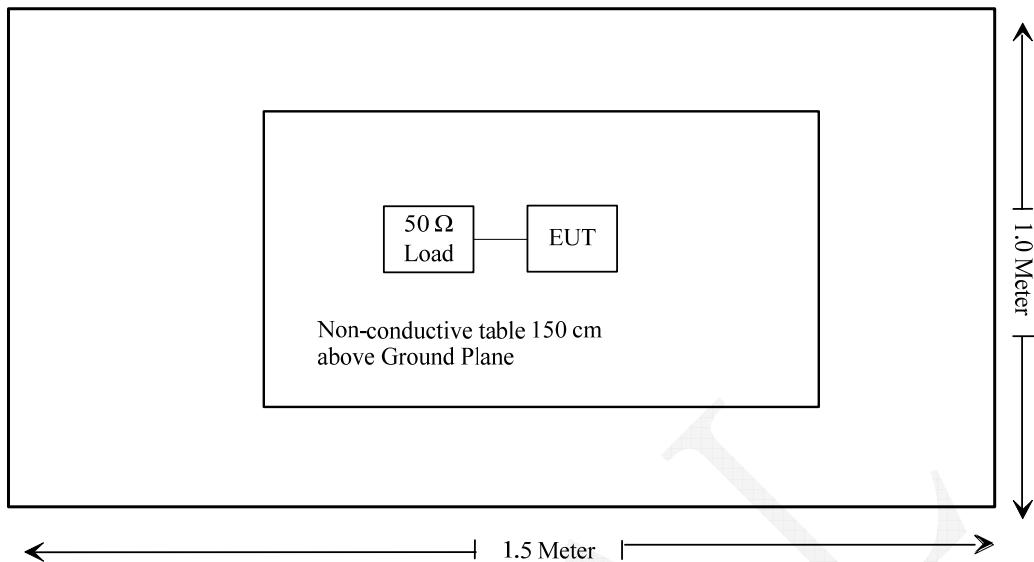
Manufacturer	Description	Model	Serial Number
N/A	Terminal Load (50 Ω)	N/A	N/A
HP	RF Communications Test Set	8920A	00 247
N/A	Splitter	N/A	N/A

### Block Diagram of Test Setup

Conducted:



Radiated:



## SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1310 and §2.1093	RF Exposure	Compliant
§2.1046; § 22.727;§90.205	RF Output Power	Compliant
§2.1047;§90.207	Modulation Characteristic	Compliant
§2.1049;§22.357;§ 2 2.731;§90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliant
§2.1051; §22.861;§90.210	Spurious Emission at Antenna Terminal	Compliant
§2.1053; §22.861;§90.210	Spurious Radiated Emissions	Compliant
§2.1055; § 22.355;§90.213	Frequency Stability	Compliant
§90.214	Transient Frequency Behavior	Compliant

Bay Area Compliance Laboratories Corp. (Chengdu)

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## **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: RDG170206002-20A.

## FCC §2.1046 &§ 22.727&§90.205- RF OUTPUT POWER

### Applicable Standard

FCC §2.1046, § 22.727 and §90.205.

### Test Procedure

Conducted RF Output Power:

TIA-603-D section 2.2.1

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

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
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Attenuator	20dB	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

Temperature:	23.8 °C
Relative Humidity:	42 %
ATM Pressure:	101.6kPa

The testing was performed by Kevin Hu on 2017-02-26.

Test Result: Compliant. Please refer to following tables.

FCC Part 90:

Modulation	Channel Spacing (kHz)	$f_c$ (MHz)	Conducted Output Power (W)		Note
			High	Low	
FM	12.5	136.0125	5.10	1.12	Not for FCC Review
		155.7525	5.12	1.08	/
		173.9875	5.15	1.02	/
4FSK	12.5	136.0125	5.11	1.10	Not for FCC Review
		155.7525	5.17	1.13	/
		173.9875	5.13	1.09	/

FCC Part 22:

Modulation	Channel Spacing (kHz)	$f_c$ (MHz)	Conducted Output Power (W)		Note
			High	Low	
FM	12.5	161.6	5.15	1.06	/
		161.6	5.16	1.03	/

Note: The rated high power is 5W (37 dBm) and low power is 1W (30 dBm).

## **FCC §2.1047 & §90.207 - MODULATION CHARACTERISTIC**

### **Applicable Standard**

FCC§2.1047 & §90.207:

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

### **Test Procedure**

Test Method: 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	00 247	2016-08-10	2017-08-09
LEADER	Millivoltmeter	LMV-181A	601561	2016-08-10	2017-08-09
N/A	RF Attenuator	20dB	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### **Test Data**

#### **Environmental Conditions**

Temperature:	23.8 °C
Relative Humidity:	42 %
ATM Pressure:	101.6 kPa

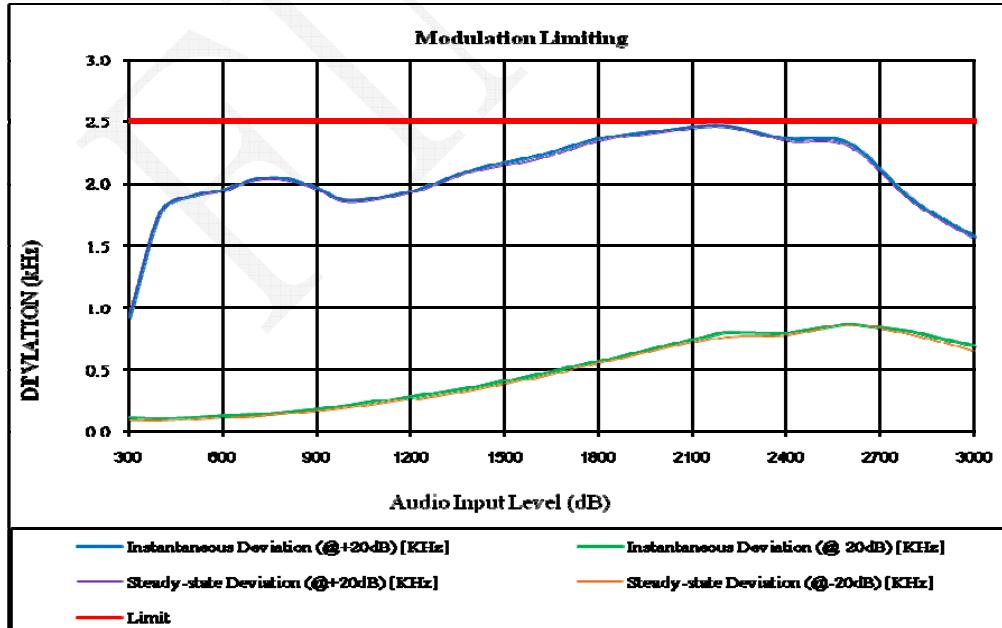
*The testing was performed by Kevin Hu on 2017-02-26.*

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

## MODULATION LIMITING

Carrier Frequency: 155.7525 MHz, Channel Spacing = 12.5 kHz

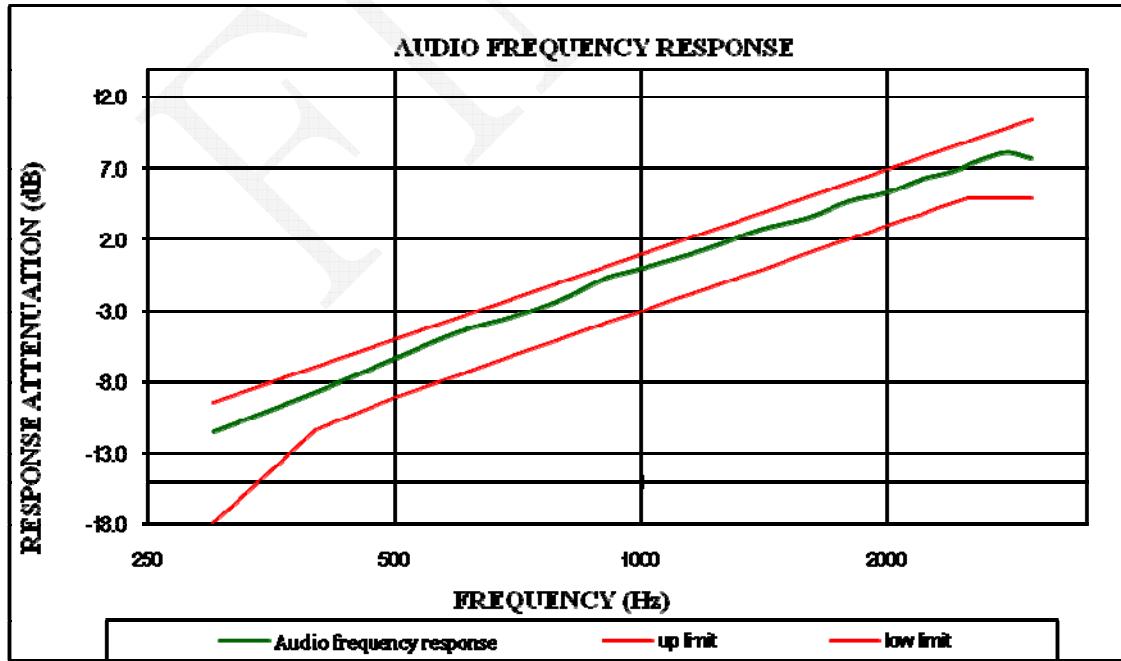
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	
300	0.922	0.112	0.933	0.095	2.5
400	1.77	0.108	1.763	0.092	2.5
500	1.896	0.115	1.892	0.104	2.5
600	1.946	0.128	1.935	0.121	2.5
700	2.031	0.141	2.024	0.133	2.5
800	2.038	0.16	2.022	0.153	2.5
900	1.961	0.182	1.95	0.175	2.5
1000	1.861	0.213	1.852	0.201	2.5
1200	1.934	0.285	1.925	0.266	2.5
1400	2.112	0.355	2.097	0.342	2.5
1600	2.22	0.458	2.191	0.442	2.5
1800	2.36	0.567	2.341	0.554	2.5
2000	2.425	0.68	2.413	0.671	2.5
2200	2.463	0.797	2.46	0.764	2.5
2400	2.361	0.791	2.342	0.781	2.5
2600	2.323	0.865	2.298	0.861	2.5
2800	1.87	0.805	1.852	0.783	2.5
3000	1.575	0.691	1.555	0.653	2.5



### Audio Frequency Response

Carrier Frequency: 155.7525 MHz, Channel Spacing = 12.5 kHz

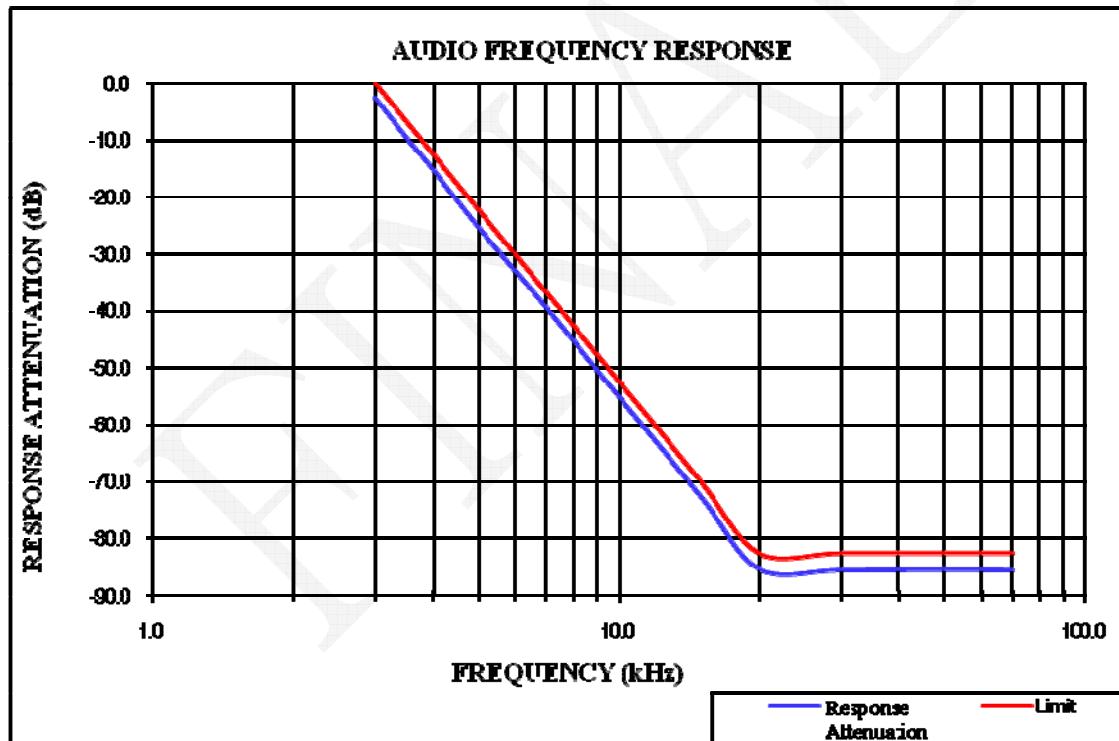
Audio Frequency	Response Attenuation
Hz	dB
300	-11.47
400	-8.69
500	-6.33
600	-4.44
700	-3.35
800	-2.18
900	-0.72
1000	0.00
1200	1.36
1400	2.78
1600	3.59
1800	4.78
2000	5.36
2200	6.29
2400	6.84
2600	7.63
2800	8.16
3000	7.75



### Audio Frequency Low Pass Filter Response

Carrier Frequency: 155.7525 MHz, Channel Spacing = 12.5 kHz

Audio Frequency	Response Attenuation	Limit
kHz	dB	dB
3.0	-2.6	0.0
3.5	-9.5	-6.7
4.0	-15.2	-12.5
5.0	-25.3	-22.2
7.0	-39.5	-36.8
10.0	-55.1	-52.3
15.0	-72.6	-69.9
20.0	-85.4	-82.5
30.0	-85.6	-82.5
50.0	-85.5	-82.5
70.0	-85.6	-82.5



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

### Applicable Standard

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

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 ( $fd$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27(fd - 2.88 \text{ kHz})$  dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $fd$  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.

§22.357 Emission types.

Any authorized station in the Public Mobile Services may transmit emissions of any type(s) that comply with the applicable emission rule, i.e. §22.359, §22.861 or §22.917

§22.731 Emission limitations.

Upon application for multichannel operation, the FCC may authorize emission bandwidths wider than those specified in §22.357, provided that spectrum utilization is equal to or better than that achieved by single channel operation.

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
HP	RF Communications Test Set	8920A	00 247	2016-08-10	2017-08-09
N/A	RF Attenuator	20dB	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested 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

Temperature:	24.3 ~ 27.1 °C
Relative Humidity:	38 ~ 54 %
ATM Pressure:	101 ~101.8 kPa

*The testing was performed by Kevin Hu from 2017-02-22 to 2017-02-26.*

*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		
FM	12.5 kHz	155.7525	10.321	9.92	High	
			10.321	9.92	Low	
	12.5 kHz		10.200	7.715	High	
			9.749	7.114	Low	

FCC Part 22:

Modulation Mode	Channel Spacing	$f_c$	26 dB Bandwidth	99% Occupied Bandwidth	Power Level
			MHz	kHz	
FM	12.5 kHz	161.6	10.321	5.21	High
			10.321	5.21	Low
			9.900	7.7154	High
			10.000	7.515	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 Digital Mode (Channel Spacing: 12.5 kHz)

Emission Designator 7K60F1D and 7K60F1E

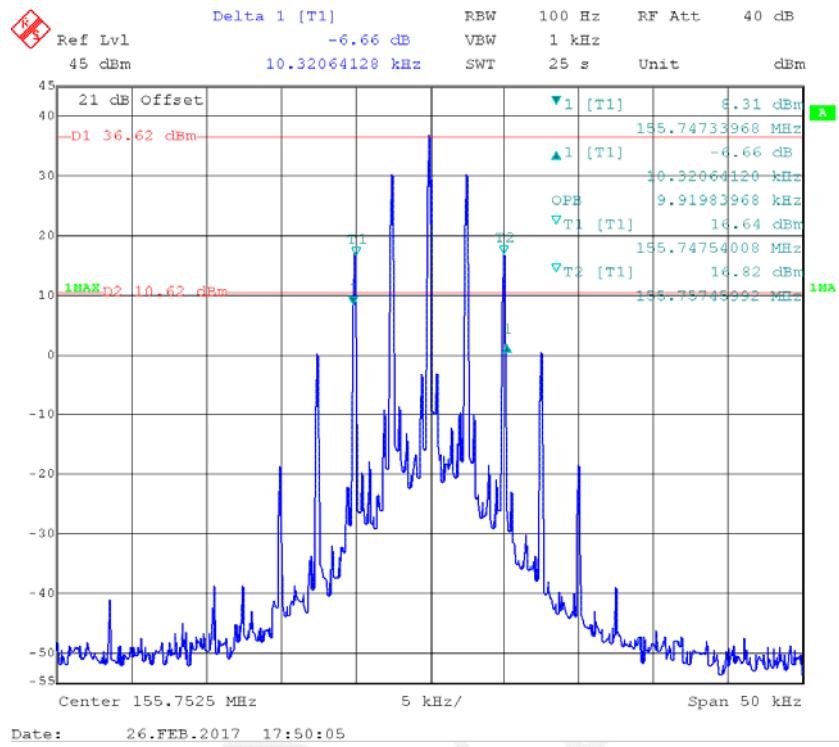
The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz. The emission mask was obtained from 47CFR 90.210(d).

F1D and F1E portion of the designator indicates digital information.

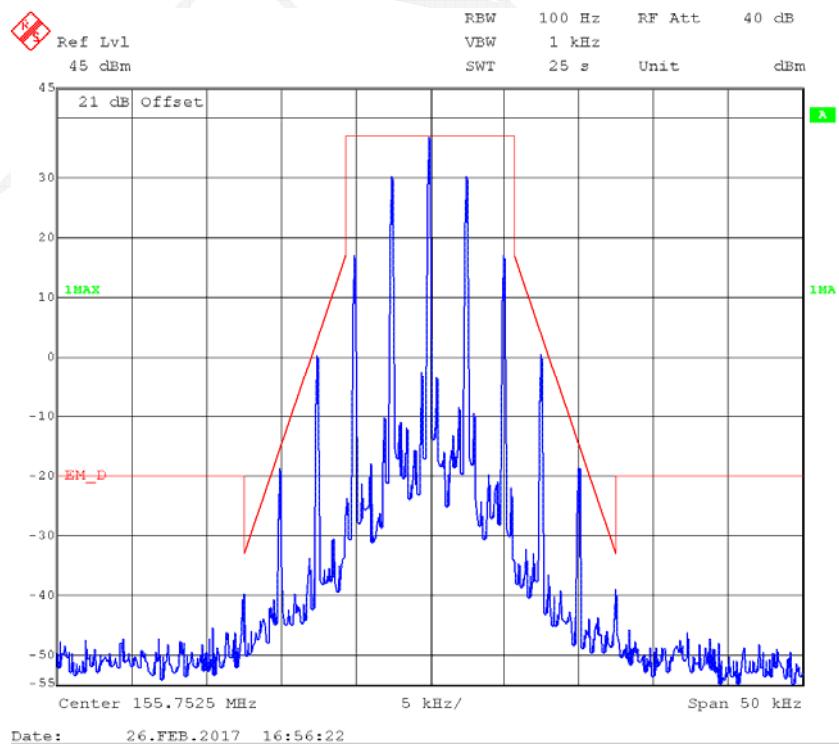
Therefore, the entire designator for 12.5 kHz channel spacing digital mode is 7K60F1D and 7K60F1E.

### *Part 90:*

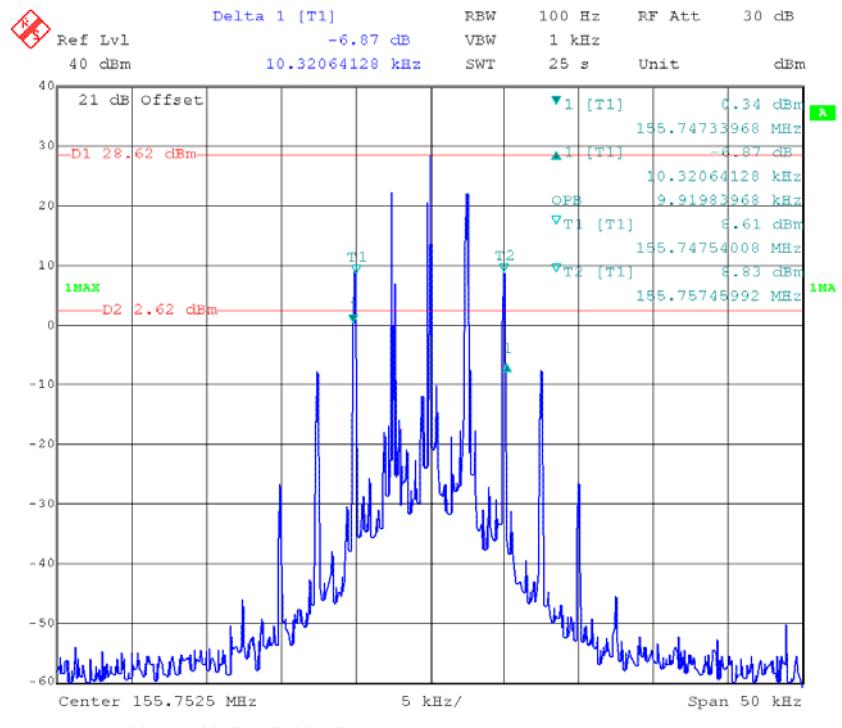
## Bandwidth – FM, 155.7525 MHz, High Power Level



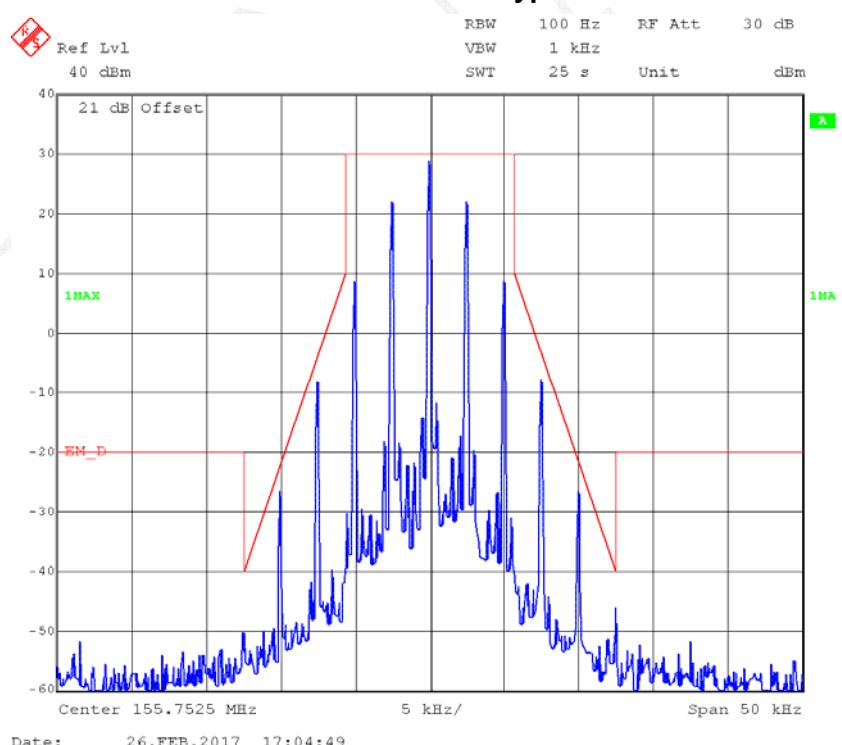
## Emission Mask - Type D



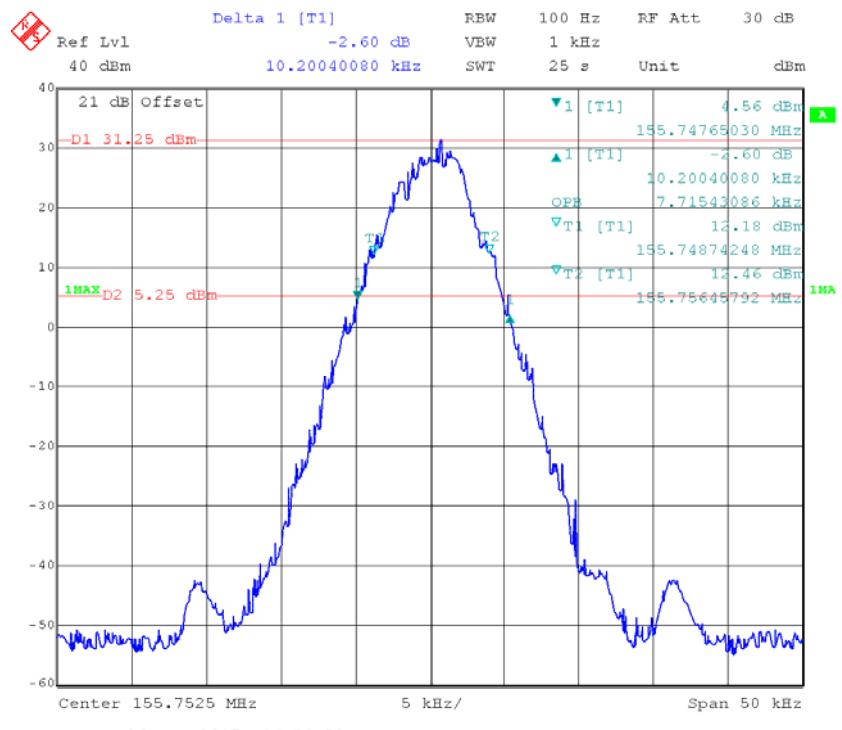
## Bandwidth – FM, 155.7525 MHz, Low Power Level



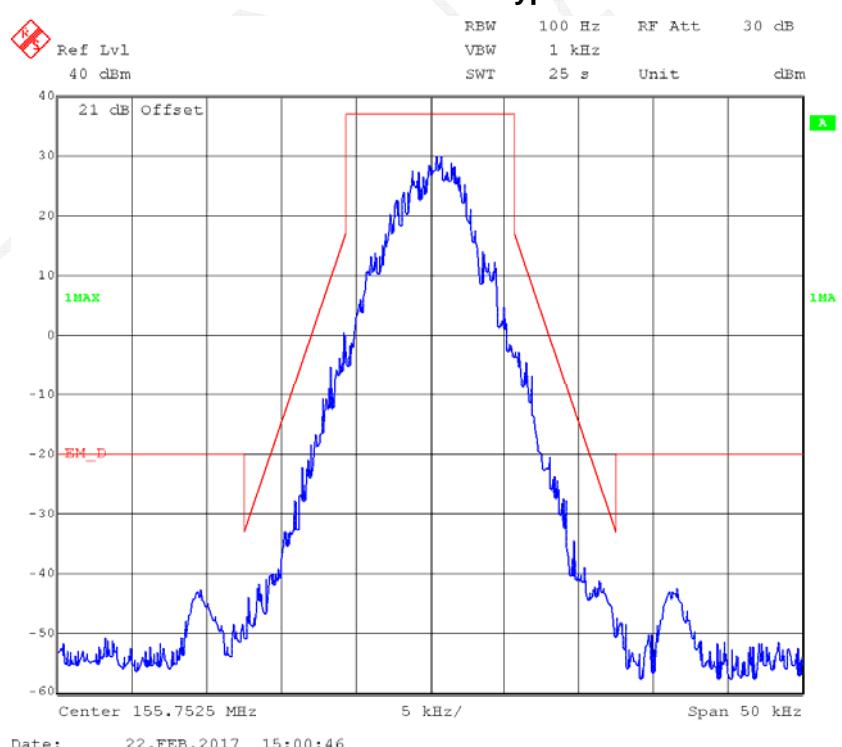
## Emission Mask - Type D



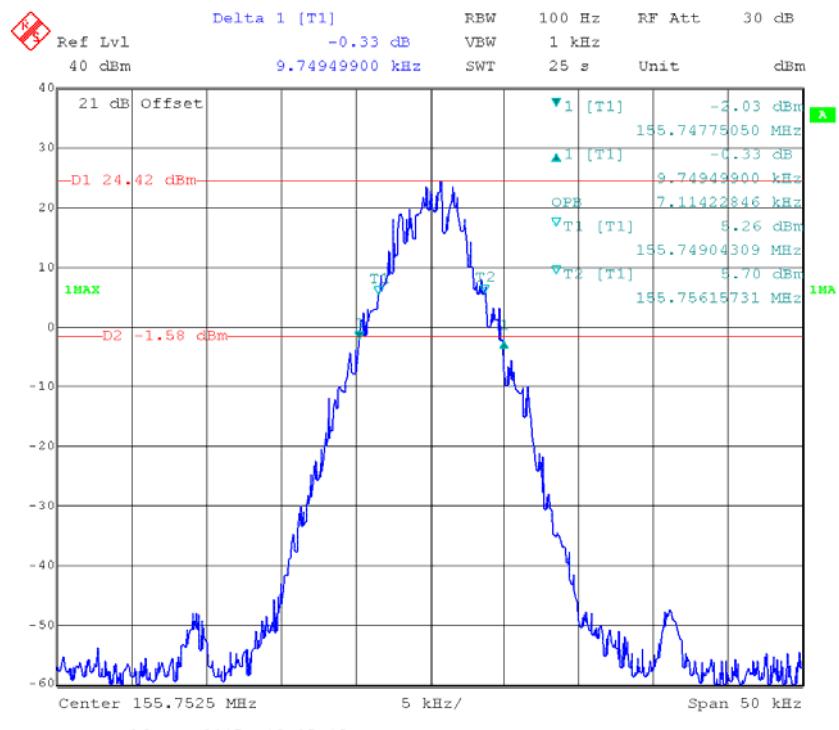
**Bandwidth – 4FSK, 155.7525 MHz, High Power Level**



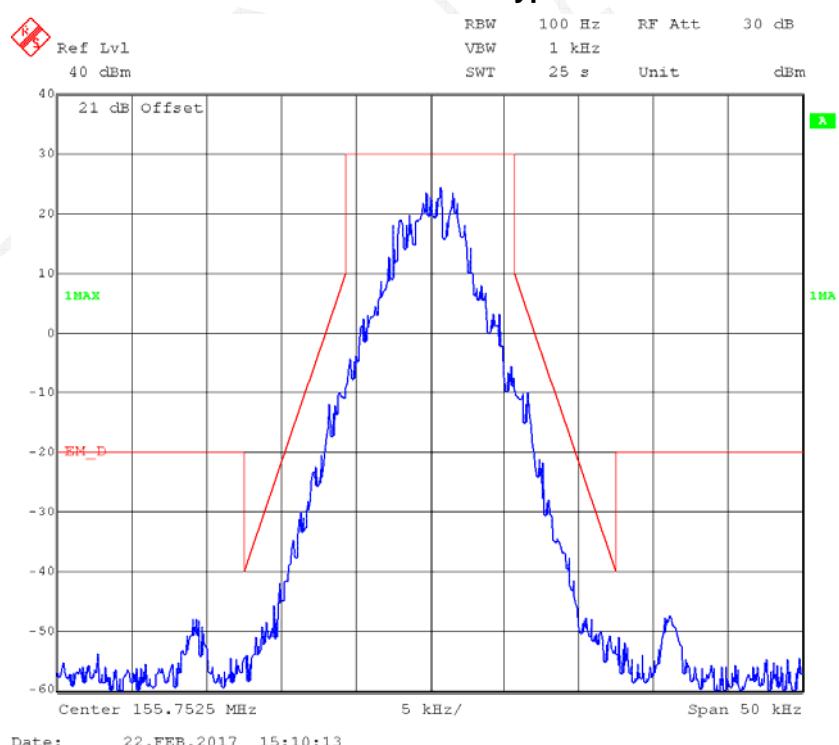
**Emission Mask - Type D**



**Bandwidth – 4FSK, 155.7525 MHz, Low Power Level**

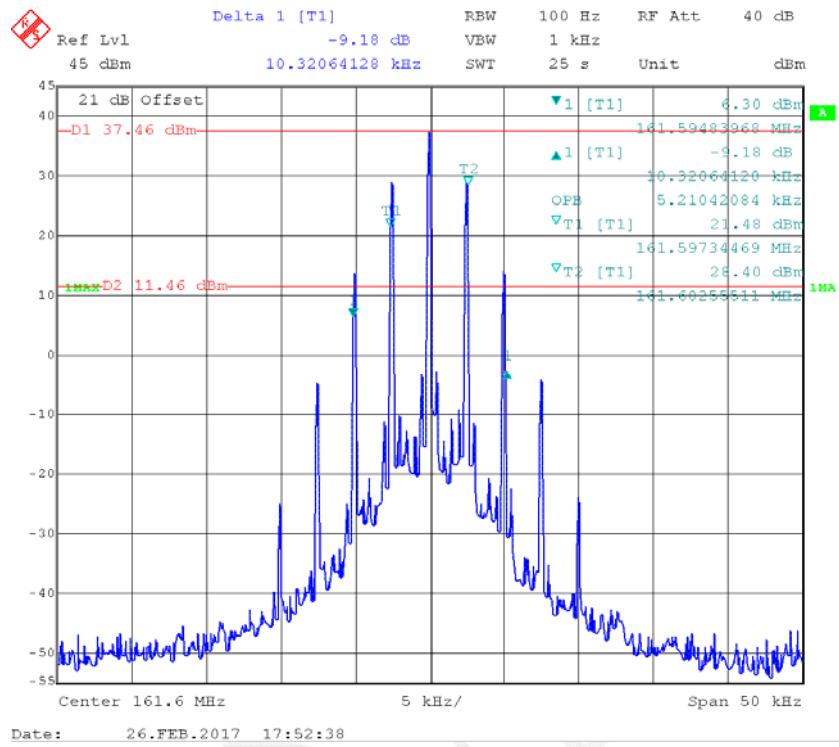


**Emission Mask - Type D**

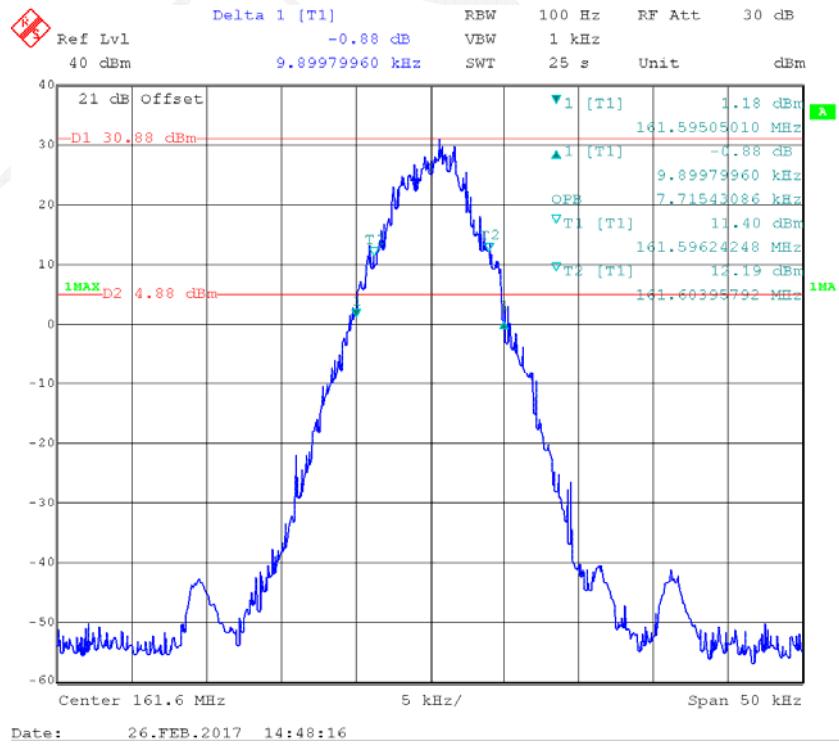


Part 22:

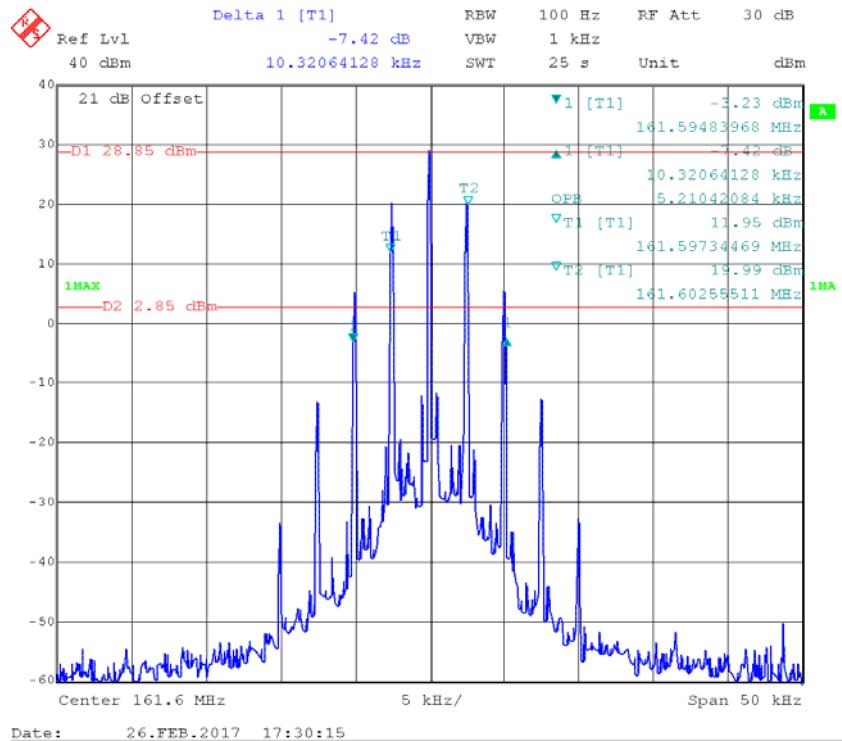
**Bandwidth – FM, 161.6 MHz, High Power Level**



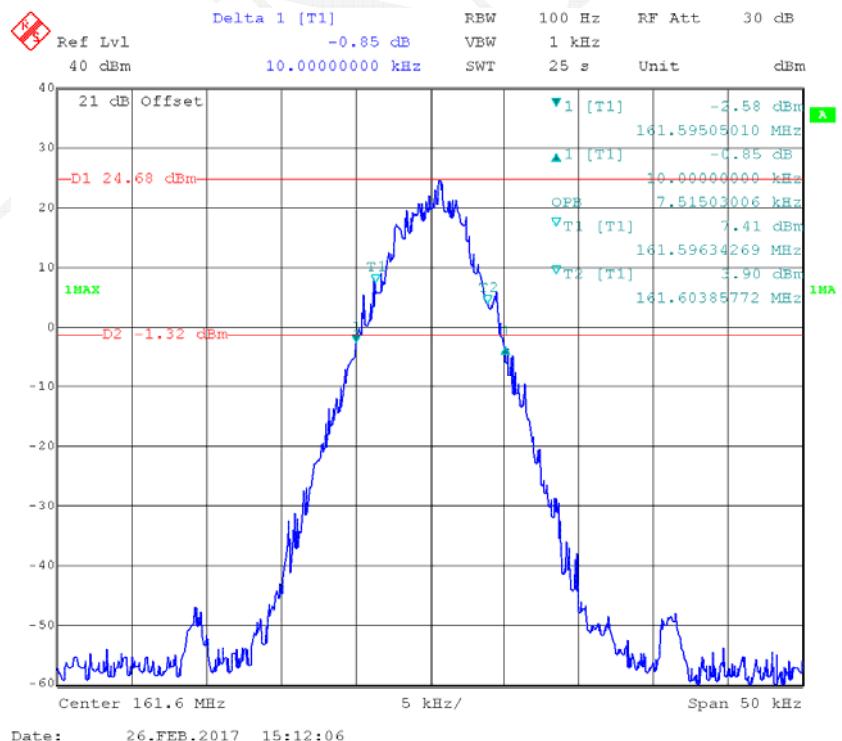
**Bandwidth – 4FSK, 161.6 MHz, High Power Level**



**Bandwidth – FM, 161.6 MHz, Low Power Level**



**Bandwidth – 4FSK, 161.6 MHz, Low Power Level**



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

### Applicable Standard

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

- (1) 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 ( $fd$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27(fd - 2.88)$  dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $fd$  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.

### Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
Oulitong	band rejection filter	136-174	201	Each Time	/
N/A	RF Attenuator	20dB	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested 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.

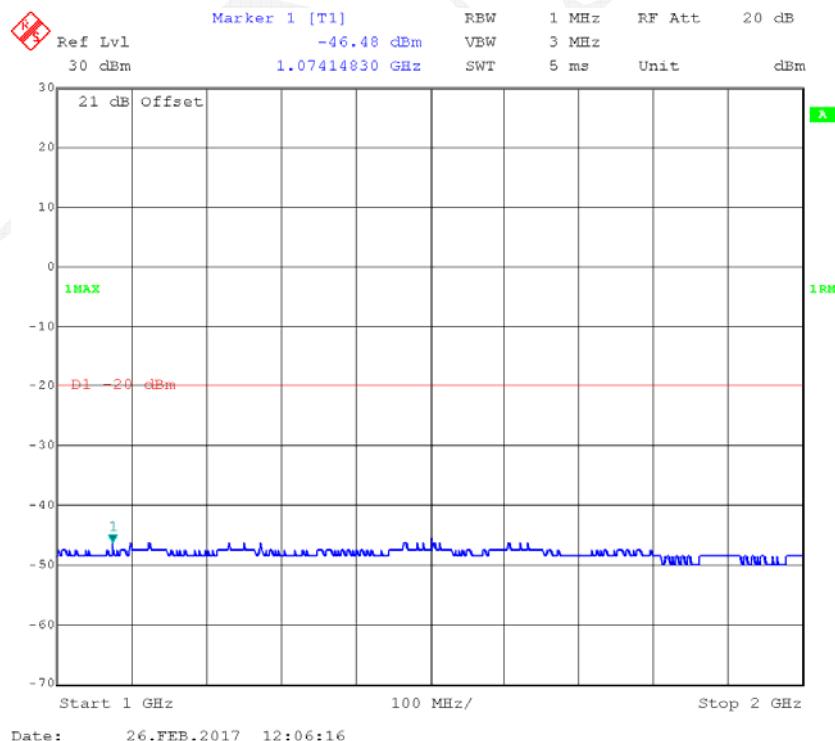
## Test Data

### Environmental Conditions

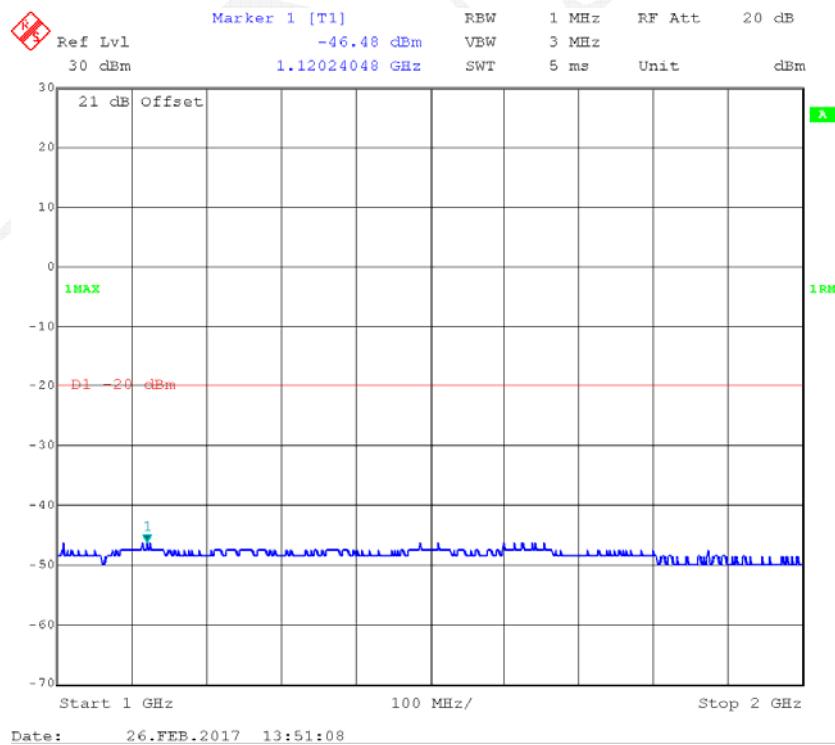
<b>Temperature:</b>	23.7 ~25.1 °C
<b>Relative Humidity:</b>	37 ~42 %
<b>ATM Pressure:</b>	101.2 ~ 101.6 kPa

*The testing was performed by Kevin Hu from 2017-02-26 to 2017-03-02.*

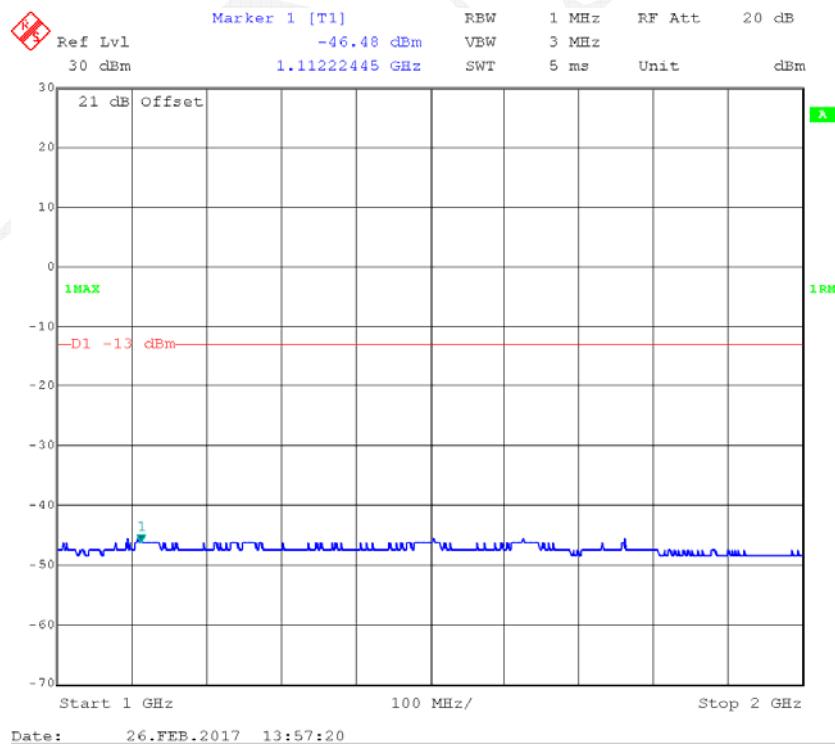
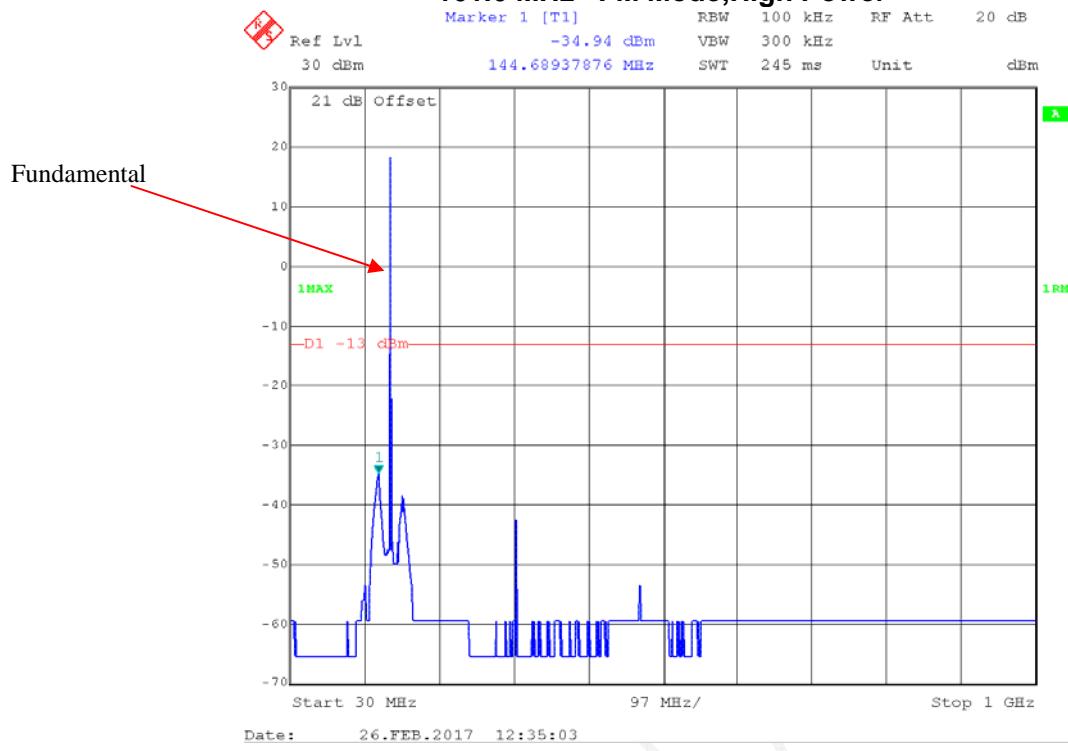
**FCC PART 90**  
**155.7525 MHz – FM Mode,High Power**



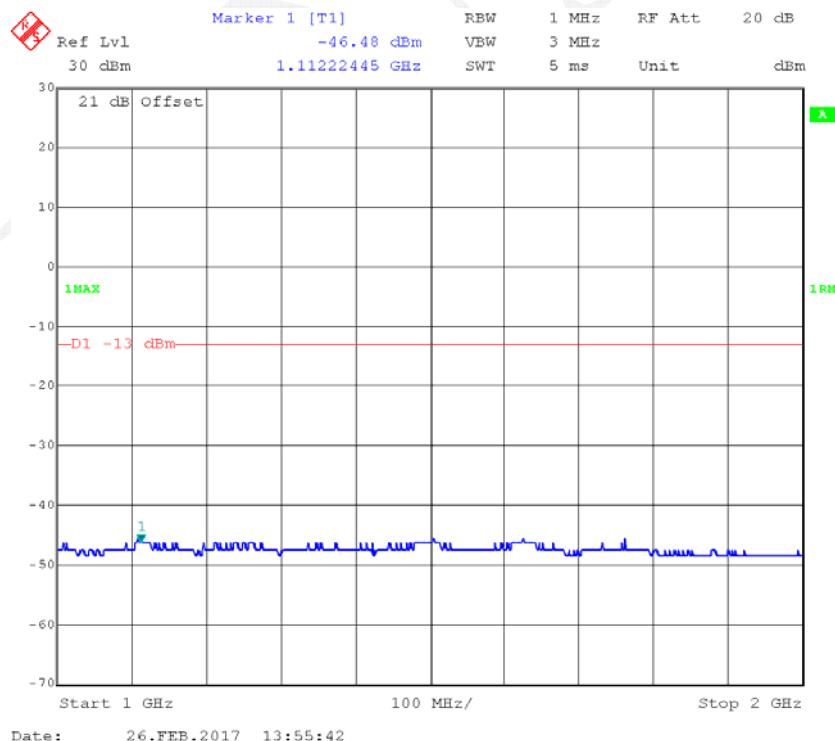
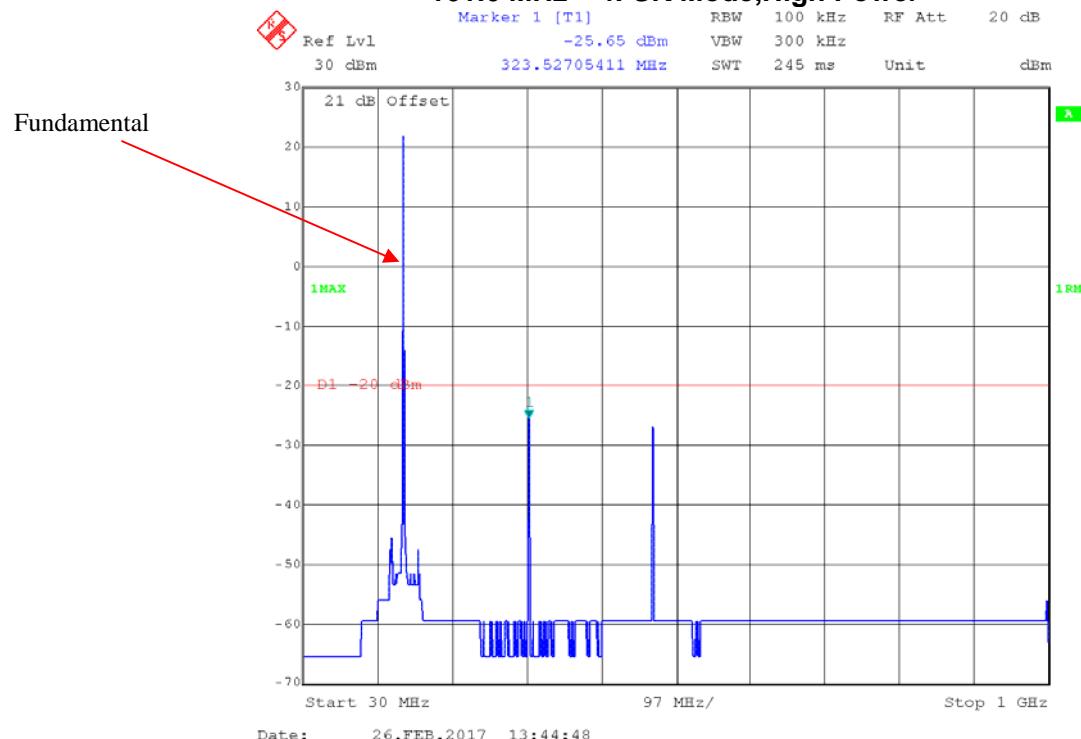
**FCC PART 90**  
**155.7525 MHz –4FSK Mode,High Power**



**FCC PART 22**  
**161.6 MHz -FM Mode,High Power**



**FCC PART 22**  
**161.6 MHz – 4FSK Mode,High Power**



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

### Applicable Standard

FCC §2.1053 and §22.861 and §90.210

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Amplifier	8447D	2944A10442	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A101808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-6-16	2017-6-15
EMCO	Adjustable Dipole Antenna	3121C	9109-258	N/A	N/A
HP	Signal Generator	8648C	3623A04150	2016-5-23	2017-5-22
WILTRON	SWEPT FREQUENCY SYNTHESIZER	6737	213001	2016-5-23	2017-5-22
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2016-05-20	2017-05-19
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2016-11-10	2017-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2016-11-10	2017-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2016-11-10	2017-11-09

\* **Statement of Traceability:** BACL (Chengdu) attested 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 =  $10 \log_{10} (\text{TXpwr in Watts}/0.001)$  - the absolute level

Spurious attenuation limit in dB =  $50 + 10 \log_{10} (\text{power out in Watts})$  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.

## Test Data

### Environmental Conditions

Temperature:	24.3 °C
Relative Humidity:	48 %
ATM Pressure:	101.2 kPa

The testing was performed by Kevin Hu on 2017-03-02.

**Test Mode: Transmitting** (per retest, the DR7800-1 was test 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	dB $\mu$ V	dBm	dBd/dBi	dB	dBm	dBm	dB
<b>Frequency: 155.7525 MHz, for FCC PART 90</b>								
311.505	H	52.670	-32	0.0	0.5	-32.5	-20.0	12.5
311.505	V	42.330	-40.5	0.0	0.5	-41.0	-20.0	21.0
467.258	H	30.820	-32	0.0	0.7	-32.7	-20.0	12.7
467.258	V	32.410	-40.5	0.0	0.7	-41.2	-20.0	21.2
623.010	H	48.470	-30.5	0.0	0.8	-31.3	-20.0	11.3
623.010	V	35.870	-32	0.0	0.8	-32.8	-20.0	12.8
778.763	H	33.630	-40.5	0.0	0.9	-41.4	-20.0	21.4
778.763	V	29.250	-32	0.0	0.9	-32.9	-20.0	12.9
934.515	H	37.180	-40.5	0.0	1	-41.5	-20.0	21.5
934.515	V	36.580	-30.5	0.0	1	-31.5	-20.0	11.5
1090.268	H	38.89	-61.1	7.5	1.4	-55.0	-20.0	35.0
1090.268	V	36.23	-64.1	7.5	1.4	-58.0	-20.0	38.0
1246.020	H	36.78	-63.5	7.8	1.3	-57.0	-20.0	37.0
1246.020	V	34.69	-65.7	7.8	1.3	-59.2	-20.0	39.2
1401.773	H	35.63	-65.1	9.0	1.5	-57.6	-20.0	37.6
1401.773	V	33.84	-66.5	9.0	1.5	-59.0	-20.0	39.0
1557.525	H	34.56	-66.8	9.9	1.2	-58.1	-20.0	38.1
1557.525	V	33.37	-68.6	9.9	1.2	-59.9	-20.0	39.9
<b>Frequency: 161.6 MHz, for FCC PART 22</b>								
323.200	H	51.910	-32.5	0.0	0.5	-33.0	-13.0	20.0
323.200	V	42.870	-39.7	0.0	0.5	-40.2	-13.0	27.2
484.800	H	37.660	-43.1	0.0	0.7	-43.8	-13.0	30.8
484.800	V	32.850	-44.8	0.0	0.7	-45.5	-13.0	32.5
646.400	H	53.110	-25.3	0.0	0.8	-26.1	-13.0	13.1
646.400	V	44.670	-31.3	0.0	0.8	-32.1	-13.0	19.1
808.000	H	30.020	-45.1	0.0	0.9	-46.0	-13.0	33.0
808.000	V	31.250	-40.8	0.0	0.9	-41.7	-13.0	28.7
969.600	H	38.630	-33.8	0.0	1	-34.8	-13.0	21.8
969.600	V	36.850	-32.3	0.0	1	-33.3	-13.0	20.3
1131.200	H	38.42	-61.7	7.4	1.4	-55.7	-13.0	42.7
1131.200	V	36.57	-63.7	7.4	1.4	-57.7	-13.0	44.7
1292.800	H	36.34	-63.5	8.2	1.3	-56.6	-13.0	43.6
1292.800	V	34.95	-65.4	8.2	1.3	-58.5	-13.0	45.5
1454.400	H	35.26	-65.9	9.3	1.3	-57.9	-13.0	44.9
1454.400	V	34.18	-67	9.3	1.3	-59.0	-13.0	46.0
1616.000	H	34.44	-66.7	10.2	1.2	-57.7	-13.0	44.7
1616.000	V	32.78	-69.1	10.2	1.2	-60.1	-13.0	47.1

**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: 155.7525 MHz, for FCC PART 90</b>								
311.506	H	51.840	-32.8	0.0	0.5	-33.3	-20.0	13.3
311.506	V	42.170	-40.7	0.0	0.5	-41.2	-20.0	21.2
467.259	H	32.610	-32.8	0.0	0.7	-33.5	-20.0	13.5
467.259	V	31.990	-40.7	0.0	0.7	-41.4	-20.0	21.4
623.012	H	46.850	-32.2	0.0	0.8	-33.0	-20.0	13.0
623.012	V	35.660	-32.8	0.0	0.8	-33.6	-20.0	13.6
778.765	H	34.010	-40.7	0.0	0.9	-41.6	-20.0	21.6
778.765	V	27.690	-32.8	0.0	0.9	-33.7	-20.0	13.7
934.518	H	36.520	-40.7	0.0	1	-41.7	-20.0	21.7
934.518	V	38.890	-32.2	0.0	1	-33.2	-20.0	13.2
1090.268	H	38.71	-61.2	7.5	1.4	-55.1	-20.0	35.1
1090.268	V	36.58	-63.7	7.5	1.4	-57.6	-20.0	37.6
1246.020	H	36.37	-63.9	7.8	1.3	-57.4	-20.0	37.4
1246.020	V	35.08	-65.3	7.8	1.3	-58.8	-20.0	38.8
1401.773	H	35.54	-65.2	9.0	1.5	-57.7	-20.0	37.7
1401.773	V	34.45	-65.9	9.0	1.5	-58.4	-20.0	38.4
1557.525	H	34.10	-67.2	9.9	1.2	-58.5	-20.0	38.5
1557.525	V	33.05	-68.9	9.9	1.2	-60.2	-20.0	40.2
<b>Frequency: 161.6 MHz, for FCC PART 22</b>								
323.200	H	51.930	-32.5	0.0	0.5	-33.0	-13.0	20.0
323.200	V	43.180	-39.3	0.0	0.5	-39.8	-13.0	26.8
484.800	H	37.550	-43.2	0.0	0.7	-43.9	-13.0	30.9
484.800	V	33.180	-44.5	0.0	0.7	-45.2	-13.0	32.2
646.400	H	53.110	-25.3	0.0	0.8	-26.1	-13.0	13.1
646.400	V	44.630	-31.3	0.0	0.8	-32.1	-13.0	19.1
808.000	H	30.130	-45	0.0	0.9	-45.9	-13.0	32.9
808.000	V	31.220	-40.9	0.0	0.9	-41.8	-13.0	28.8
969.600	H	38.630	-33.8	0.0	1	-34.8	-13.0	21.8
969.600	V	40.010	-29.1	0.0	1	-30.1	-13.0	17.1
1131.200	H	38.72	-61.4	7.4	1.4	-55.4	-13.0	42.4
1131.200	V	37.25	-63.1	7.4	1.4	-57.1	-13.0	44.1
1292.800	H	37.13	-62.7	8.2	1.3	-55.8	-13.0	42.8
1292.800	V	35.24	-65.1	8.2	1.3	-58.2	-13.0	45.2
1454.400	H	35.28	-65.9	9.3	1.3	-57.9	-13.0	44.9
1454.400	V	34.09	-67.1	9.3	1.3	-59.1	-13.0	46.1
1616.000	H	34.80	-66.4	10.2	1.2	-57.4	-13.0	44.4
1616.000	V	32.51	-69.3	10.2	1.2	-60.3	-13.0	47.3

**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- FREQUENCY STABILITY**

### **Applicable Standard**

FCC §2.1055, § 22.355, §90.213

### **Test Equipment List and Details**

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
BACL	High Temperature Test Chamber	BTH-150	30024	2016-12-2	2017-12-1
FLUKE	Multimeter	1587	27870099	2016-12-30	2017-12-29
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Attenuator	20dB	N/A	Each Time	/

**\* Statement of Traceability:** BACL (Chengdu) attested 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>	25.1 °C
<b>Relative Humidity:</b>	37 %
<b>ATM Pressure:</b>	101.2kPa

The testing was performed by Kevin Hu on 2017-03-02.

Test Mode: Transmitting

FCC PART 90:

Reference Frequency: 155.7525 MHz, Limit: 5 ppm			
Temerature	Voltage	Measured	Frequency Error
°C	V <sub>DC</sub>	MHz	ppm
-30	7.4	155.752464	-0.23
-20		155.752466	-0.22
-10		155.752471	-0.18
0		155.752470	-0.19
10		155.752469	-0.20
20		155.752470	-0.19
30		155.752470	-0.19
40		155.752468	-0.21
50		155.752466	-0.22
60		155.752466	-0.22
25	6.7	155.752469	-0.20
25	7.4	155.752468	-0.21

FCC PART 22:

Reference Frequency: 161.6 MHz, Limit: 5 ppm			
Temerature	Voltage	Measured	Frequency Error
°C	V <sub>DC</sub>	MHz	ppm
-30	7.4	161.599967	-0.21
-20		161.599977	-0.15
-10		161.599972	-0.17
0		161.599976	-0.15
10		161.599974	-0.16
20		161.599973	-0.17
30		161.599962	-0.23
40		161.599963	-0.23
50		161.599968	-0.20
60		161.599970	-0.19
25	6.7	161.599965	-0.22
25	7.4	161.599964	-0.22

Note: The extreme voltage is declared by the manufacturer.

## 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
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
HP	RF Communications Test Set	8920A	00 247	2016-08-10	2017-08-10
N/A	RF Attenuator	20dB	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested 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

Temperature:	24.3~24.5°C
Relative Humidity:	41~42 %
ATM Pressure:	101.4~101.5 kPa

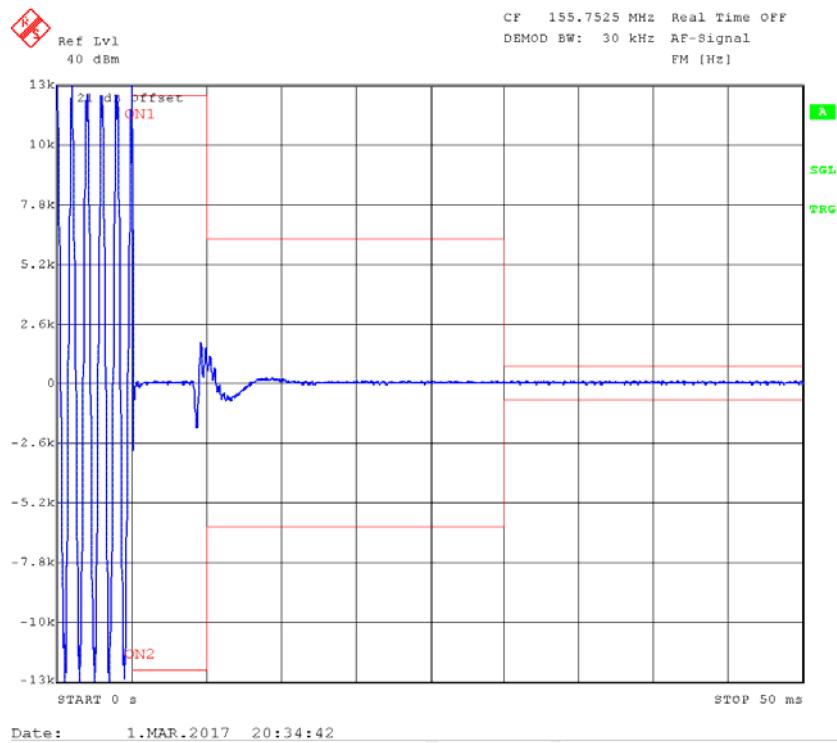
The testing was performed by Kevin Hu from 2017-03-01 to 2017-04-22.

Channel Spacing (kHz)	Transient Period (ms)	Maximum frequency difference	Result
12.5	<5 (t <sub>1</sub> )	±12.5 kHz	Pass
	<20(t <sub>2</sub> )	±6.25 kHz	
	<5(t <sub>3</sub> )	±12.5 kHz	

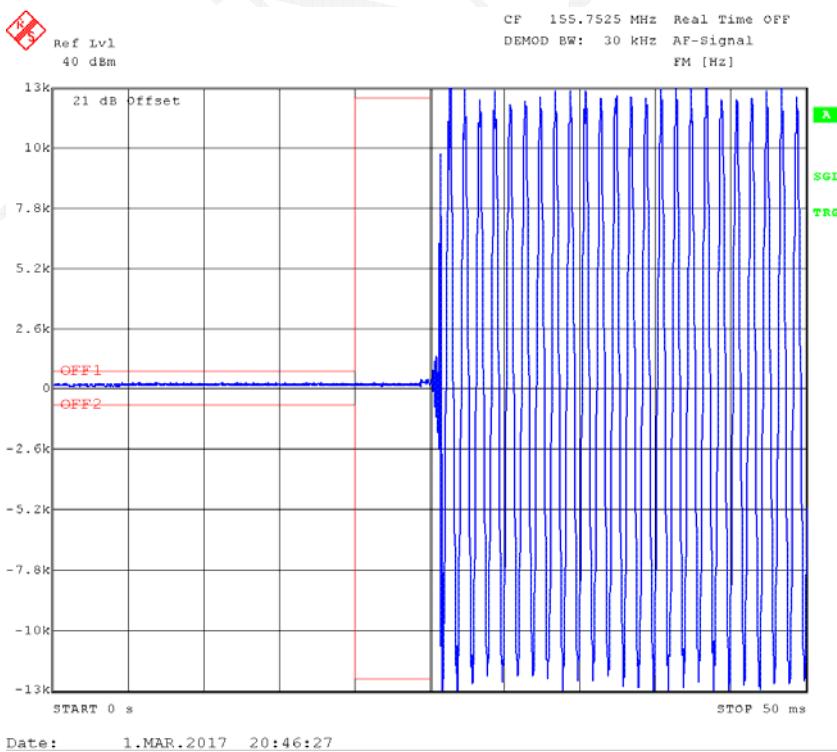
Please refer to the following plots.

**FM Mode:**

**Turn on – 155.7525 MHz, High power level**

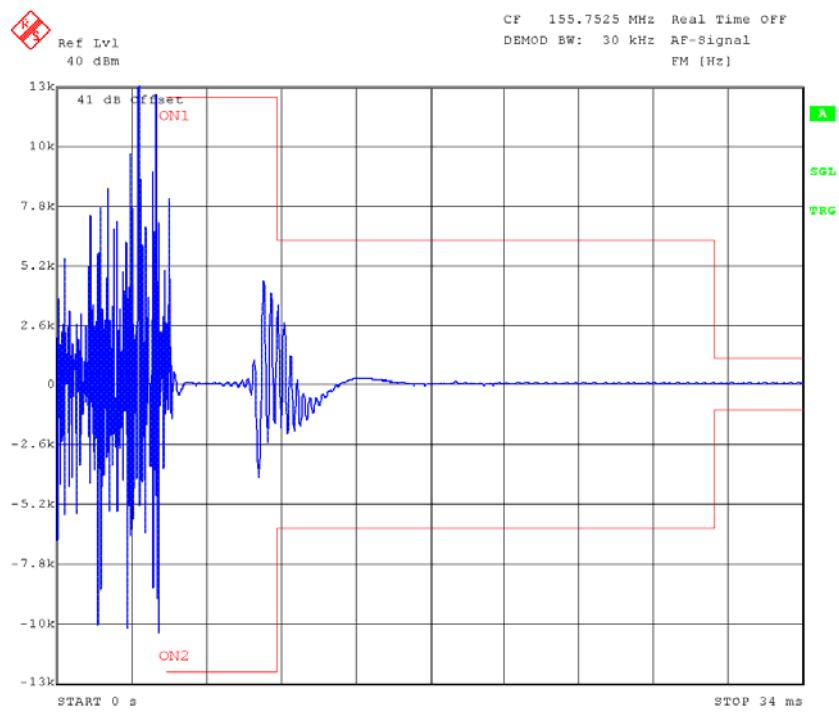


**Turn off – 155.7525 MHz, High power level**

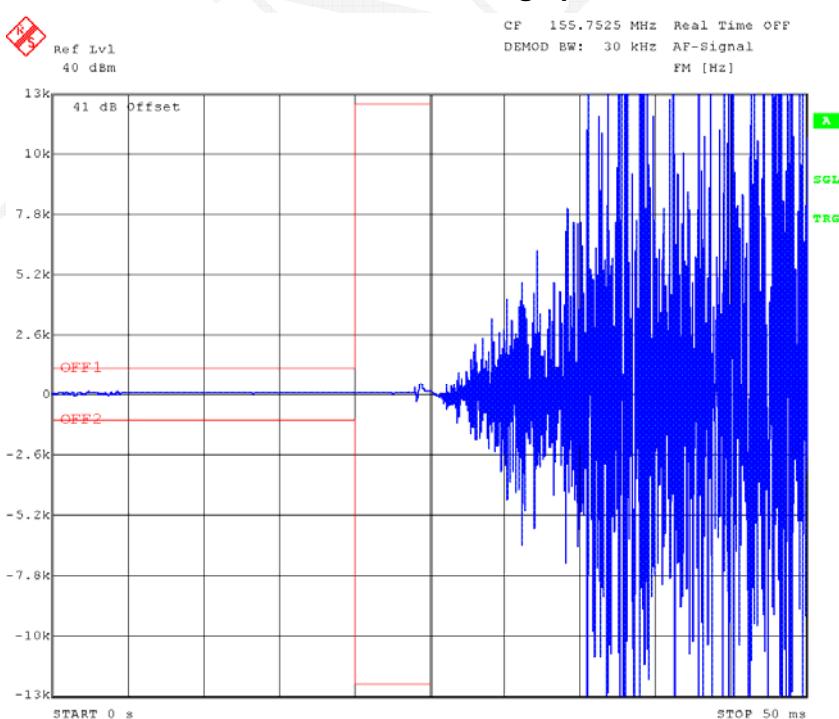


**4FSK Mode:**

**Turn on – 155.7525 MHz, High power level**



**Turn off – 155.7525 MHz, High power level**



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