



FCC PART 22 and 90


## TEST REPORT

For

**GTS Radio, Inc**

2181 W. California Avenue, Suite 250 Avenue, CA 84104

**FCC ID: Z5VTR2XU1**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Digital Portable Radio
<b>Report Number:</b> RDG161124004-00A	
<b>Report Date:</b> 2017-01-25	
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**Note:** This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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## GENERAL INFORMATION

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

The GTS Radio, Inc's product, model number: TR2X U(1) (*FCC ID: Z5VTR2XU1* ) or the "EUT" in this report was a *Digital Portable Radio*, which was measured approximately: 10.7 cm (L) \* 5.4 cm (W) \*2.8 cm (H), rated input voltage: DC 4.35V rechargeable Li-ion battery or DC 5.0 V from adapter.

#### Adapter Information:

Model: HKA00505010-XA

Input: AC 100-240V, 50/60 Hz, 0.2A

Output: DC 5V, 1.0A

*\* All measurement and test data in this report was gathered from production sample serial number: 161124004 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2016-11-24.*

### Objective

This test report is prepared on behalf of *GTS Radio, Inc* in accordance with Part 2, Part 22 and Part 90 of the Federal Communication Commissions rules.

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

No related submittal.

### Test Methodology

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

Part 22 – Public Mobile Service

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-D.

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

**Measurement Uncertainty**

Item		Uncertainty
AC Power Lines Conducted Emissions		$\pm 3.26$ dB
RF conducted test with spectrum		$\pm 0.9$ dB
RF Output Power with Power meter		$\pm 0.5$ dB
Radiated emission	30MHz~1GHz	$\pm 5.91$ dB
	Above 1G	$\pm 4.92$ dB
Occupied Bandwidth		$\pm 0.5$ kHz
Temperature		$\pm 1.0$ °C
Humidity		$\pm 6\%$

**Test Facility**

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) 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 November 06, 2014. 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.: 815570. 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 which has been done in the factory.

### EUT Exercise Software

No exercise software was used.

### Special Accessories

No special accessory was used.

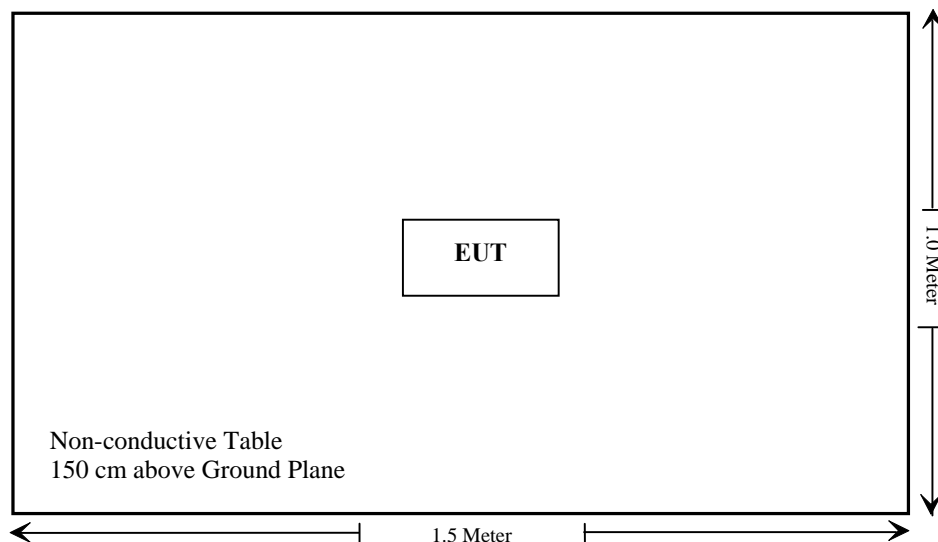
### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
N/A	50 ohm Load	N/A	N/A

### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Results
§1.1307(b), §2.1093	RF Exposure	Compliance
§2.1046; § 22.727; §90.205	RF Output Power	Compliance
§2.1047;§90.207	Modulation Characteristic	Compliance
§2.1049;§22.357;§ 22.731; §90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliance
§2.1051; §22.861;§90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053; §22.861;§90.210	Spurious Radiated Emissions	Compliance
§2.1055; § 22.355;§90.213	Frequency Stability	Compliance
§90.214	Transient Frequency Behavior	Compliance

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emission Test</b>					
Sonoma Instrument	Amplifier	330	171377	2016-09-16	2017-09-16
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Sunol Sciences	Broadband Antenna	JB3	A090314-1	2016-01-09	2019-01-08
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
EMCO	Horn Antenna	3116	9510-2384	2015-11-07	2018-11-06
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-11	2017-11-10
ETS	Horn Antenna	3115	6229	2016-01-11	2017-01-10
ETS	Horn Antenna	3115	9311-4159	2016-01-11	2017-01-10
R&S	Auto test Software	EMC32	V 09.10.0	NCR	NCR
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-15	2016-12-15
Ducommun technologies	RF Cable	104PEA	218124002	2016-04-22	2017-04-22
HP	Signal Generator	E4421B	US38440505	2016-11-11	2017-11-10
<b>RF Conducted test</b>					
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15
WEINSCHL	3dB Attenuator	5326	N/A	2016-06-18	2017-06-18
Rohde & Schwarz	OSP120 BASE UNIT	OSP120	101247	2016-07-04	2017-07-03
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131	2016-09-21	2017-09-21
HEWLETT PACKARD	RF Communications Test SET	8920A	3438A05201	2016-09-21	2017-09-21
HONOVA	Power Splitter	ZFRSC-14-S+	019411452	2016-06-12	2017-06-12
N/A	30dB Attenuator	100W 30dB	N/A	2016-06-18	2017-06-18

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



## **FCC §1.1307(b) & §2.1093 - RF EXPOSURE**

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### **Applicable Standard**

According to FCC §1.1307(b) and §2.1093, portable device operates Part 90 should be subjected to routine environmental evaluation for RF exposure prior or equipment authorization or use.

**Result:** Compliance.

Please refer to SAR Report Number: RDG161124004-20

**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:

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

Spectrum Analyzer Setting:

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

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

<b>Temperature:</b>	23 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Alisa Gao on 2016-12-08.*

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following table.

Mode	Frequency Spacing (kHz)	Frequency (MHz)	Power level	Output (dBm)	Output Power(W)	Note
Analog	12.5	400.0125	High	33.44	2.21	For Federal
			Low	30.31	1.07	
		453.2125	High	33.47	2.22	For Part 90
			Low	30.61	1.15	
		459.5	High	33.52	2.25	For Part 22
			Low	30.50	1.12	
		469.9875	High	33.53	2.25	For Part 90
			Low	30.54	1.13	
Digital	12.5	400.0125	High	33.55	2.26	For Federal
			Low	30.50	1.12	
		453.2125	High	33.51	2.24	For Part 90
			Low	30.74	1.19	
		459.5	High	33.62	2.30	For Part 22
			Low	30.55	1.14	
		469.9875	High	33.63	2.31	For Part 90
			Low	30.66	1.16	

Note: The high rated power is 2W  
The low rated power is 1W.

**FCC §2.1047 & §90.207 - MODULATION CHARACTERISTIC****Applicable Standard**

FCC§2.1047 and §90.207:

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

**Test Procedure**

Test Method: TIA/EIA-603 2.2.3

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

<b>Temperature:</b>	23 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Alisa Gao on 2016-12-08.*

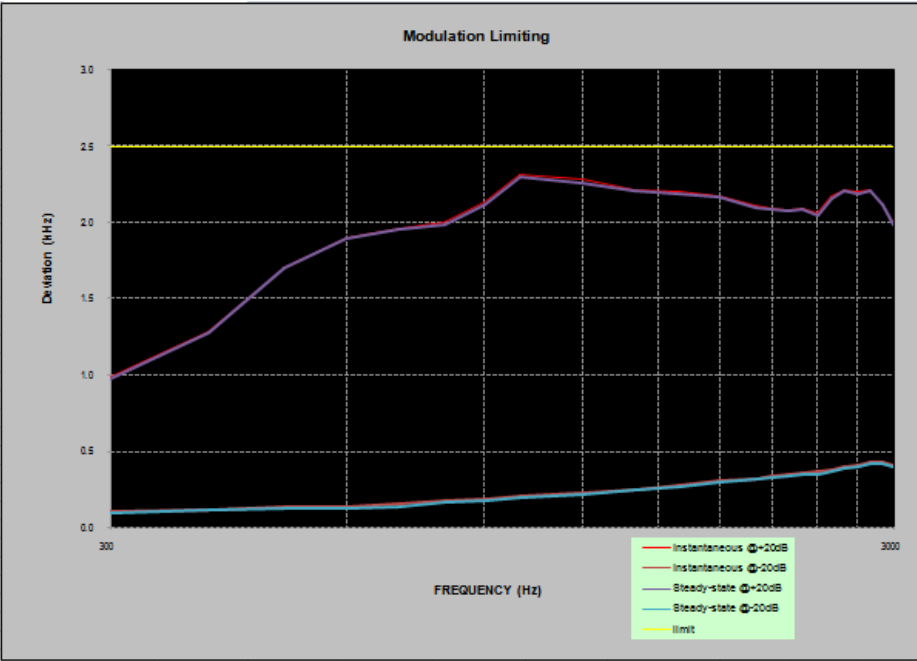
*Test Mode: Transmitting*

**Result:** Compliance.

**Analog Modulation:****MODULATION LIMITING**

Carrier Frequency: 453.2125 MHz, Channel Separation=12.5 kHz

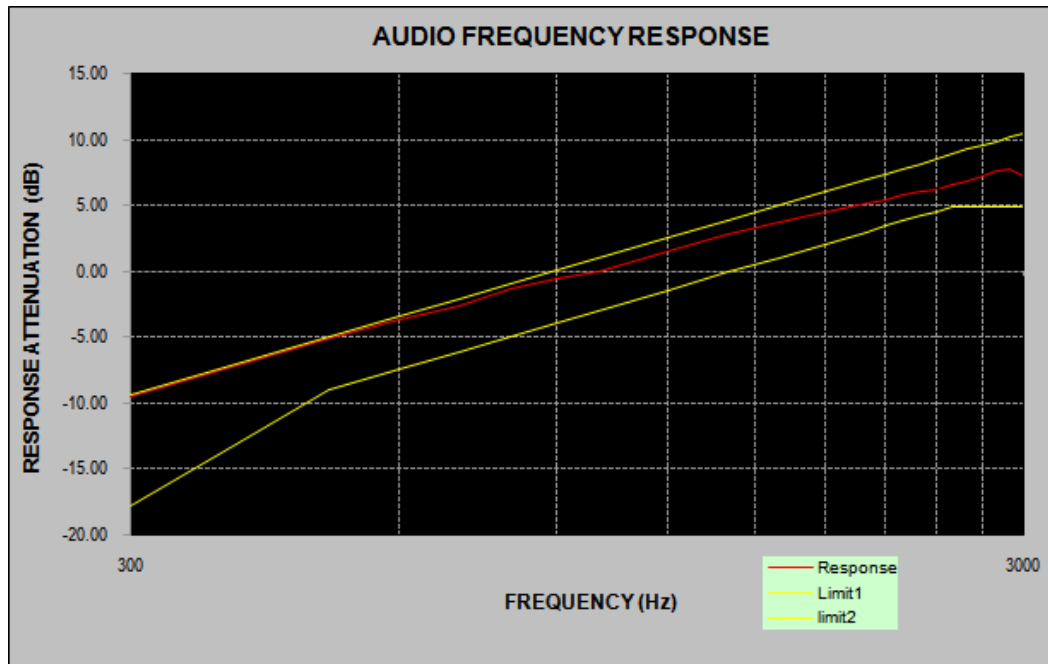
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	0.987	0.102	0.973	0.097	2.500
400	1.283	0.119	1.276	0.110	2.500
500	1.708	0.131	1.703	0.127	2.500
600	1.903	0.137	1.897	0.125	2.500
700	1.961	0.152	1.953	0.138	2.500
800	2.003	0.173	1.987	0.160	2.500
900	2.135	0.184	2.121	0.177	2.500
1000	2.311	0.203	2.301	0.196	2.500
1200	2.281	0.226	2.263	0.213	2.500
1400	2.214	0.249	2.207	0.241	2.500
1600	2.201	0.280	2.187	0.267	2.500
1800	2.169	0.305	2.163	0.292	2.500
2000	2.114	0.321	2.097	0.317	2.500
2100	2.093	0.334	2.084	0.326	2.500
2200	2.083	0.348	2.073	0.336	2.500
2300	2.092	0.361	2.083	0.349	2.500
2400	2.060	0.365	2.041	0.350	2.500
2500	2.177	0.377	2.154	0.363	2.500
2600	2.217	0.395	2.209	0.386	2.500
2700	2.202	0.407	2.187	0.400	2.500
2800	2.213	0.423	2.207	0.415	2.500
2900	2.124	0.427	2.113	0.421	2.500
3000	1.992	0.412	1.987	0.402	2.500



**Audio Frequency Response**

Carrier Frequency: 453.2125 MHz, Channel Separation=12.5 kHz

Audio Frequency (Hz)	Response Attenuation (dB)
300	-9.53
400	-7.01
500	-5.13
600	-3.72
700	-2.62
800	-1.35
900	-0.52
1000	0.00
1200	1.54
1400	2.86
1600	3.78
1800	4.48
2000	5.14
2100	5.40
2200	5.80
2300	6.04
2400	6.23
2500	6.62
2600	6.91
2700	7.21
2800	7.70
2900	7.77
3000	7.29

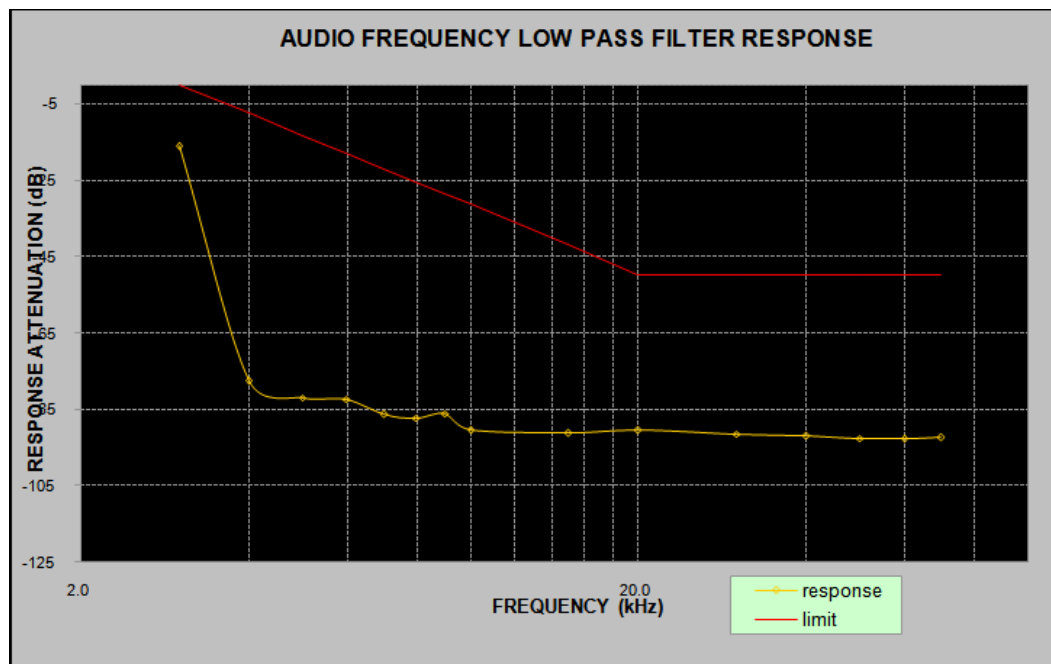




**Audio frequency lows pass filter response**

Carrier Frequency: 453.2125 MHz, Channel Separation=12.5 kHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-16.1	0.0
4.0	-77.6	-7.5
5.0	-81.9	-13.3
6.0	-82.3	-18.1
7.0	-86.4	-22.1
8.0	-87.2	-25.6
9.0	-86.1	-28.6
10.0	-90.5	-31.4
15.0	-91.3	-41.9
20.0	-90.5	-50.0
30.0	-91.5	-50.0
40.0	-92.1	-50.0
50.0	-92.6	-50.0
60.0	-92.8	-50.0
70.0	-92.4	-50.0



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

### **Applicable Standard**

FCC §2.1049, §22.357, § 22.73, §90.209 and §90.210

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

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

### **Test Procedure**

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

The resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the frequency band  $\pm 50$  kHz from the carrier frequency.

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	23 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Alisa Gao on 2016-12-08.*

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)	Note
Analog	12.5	453.2125	High	9.92	10.42	For Part 90
	12.5		Low	9.92	10.32	
	12.5	459.5	High	9.92	10.32	For Part 22
	12.5		Low	9.92	10.32	
Digital	12.5	453.2125	High	7.21	9.42	For Part 90
	12.5		Low	7.31	9.22	
	12.5	459.5	High	7.41	9.42	For Part 22
	12.5		Low	7.41	9.52	

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

#### For FM Mode (Channel Spacing: 12.5 kHz)

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

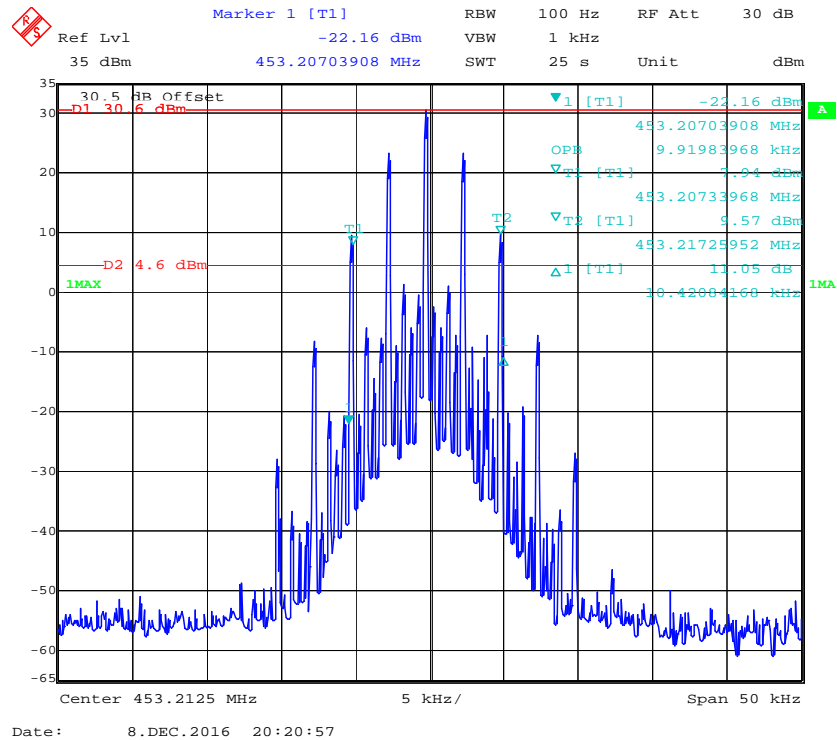
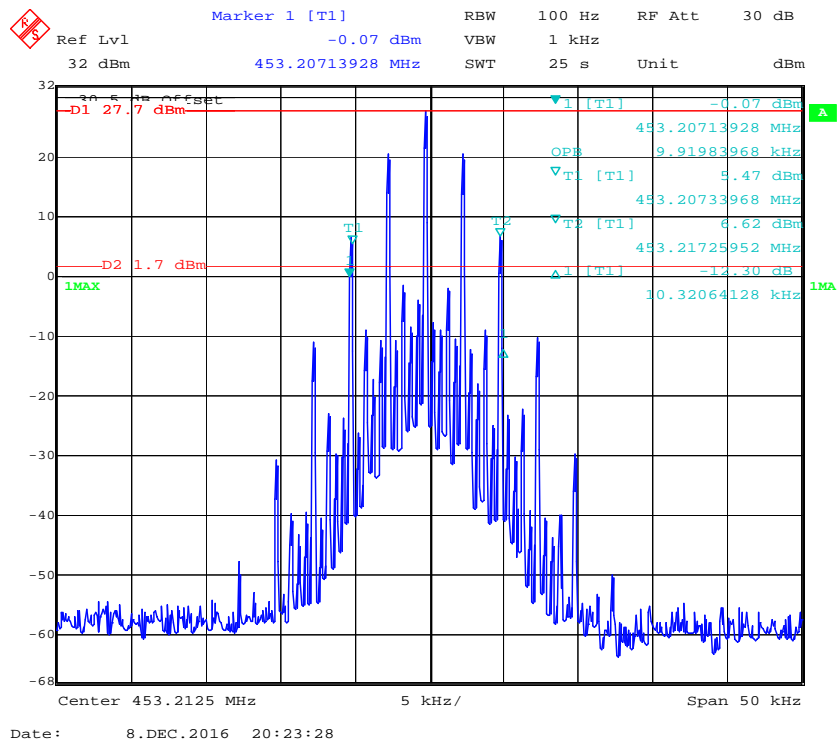
For Digital Mode (Channel Spacing: 12.5 kHz)

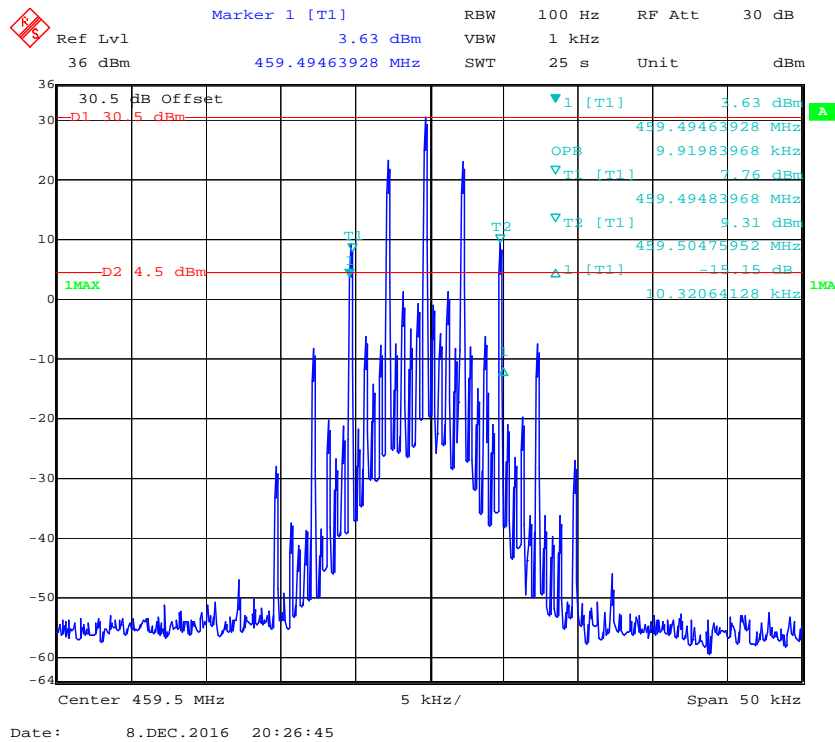
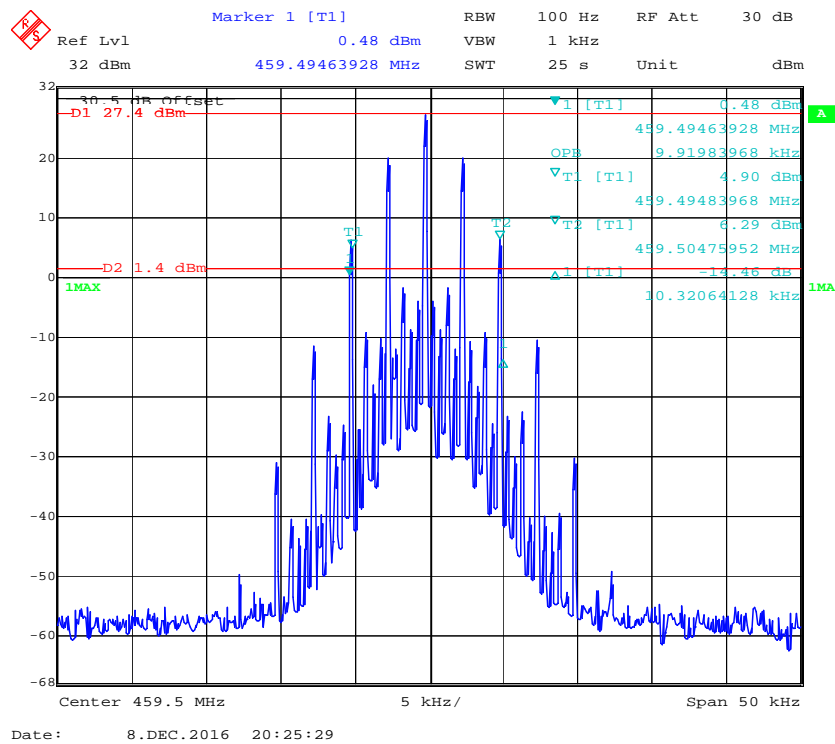
Emission Designator 7K60F1D and 7K60F1E

The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.41 kHz. The emission mask was obtained from 47CFR 90.210(d).

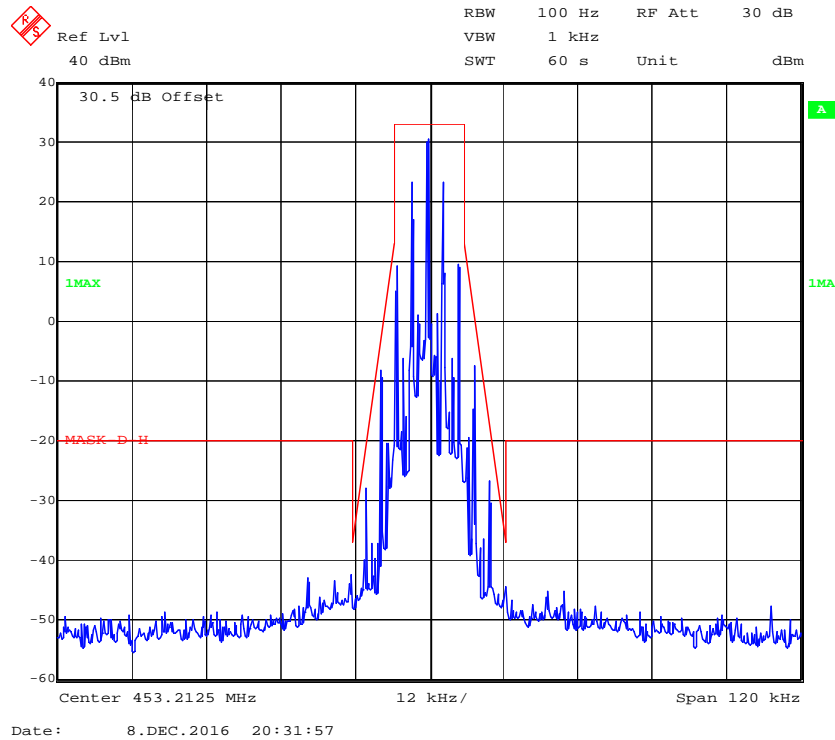
F1D and F1E portion of the designator indicates digital information.

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

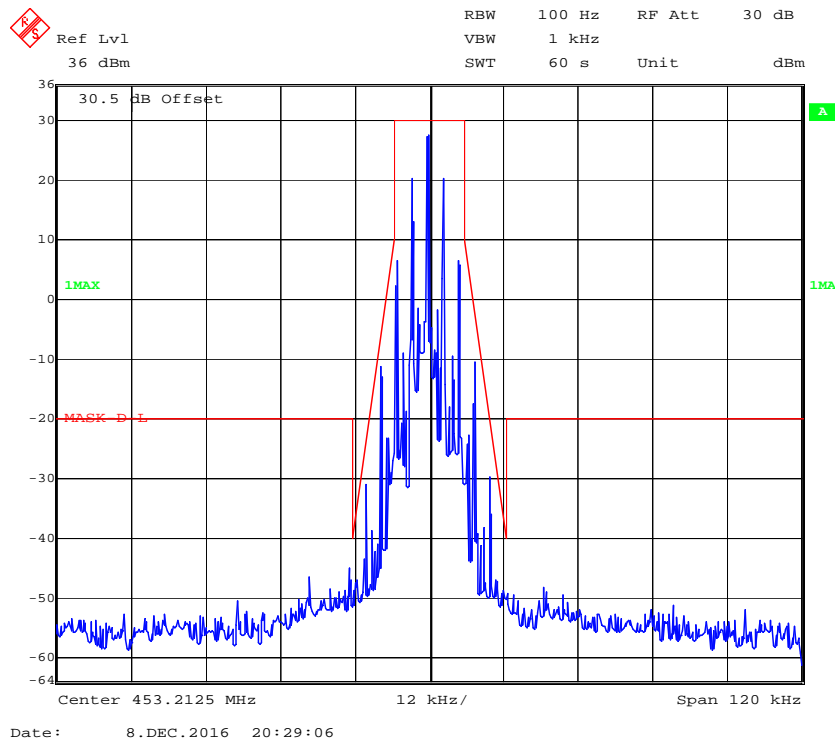
**Analog Modulation:****Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, High Power****Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**

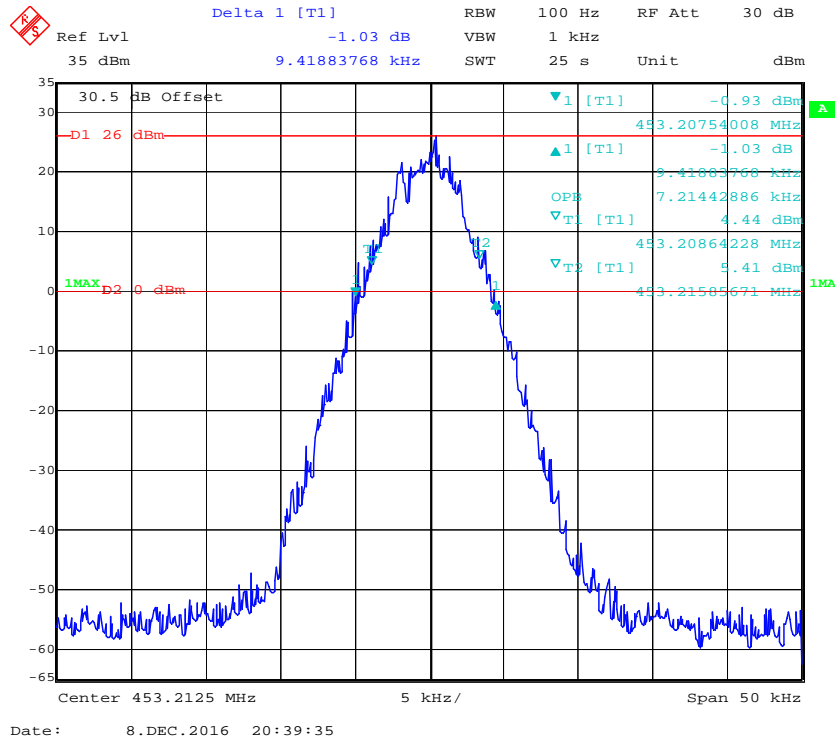
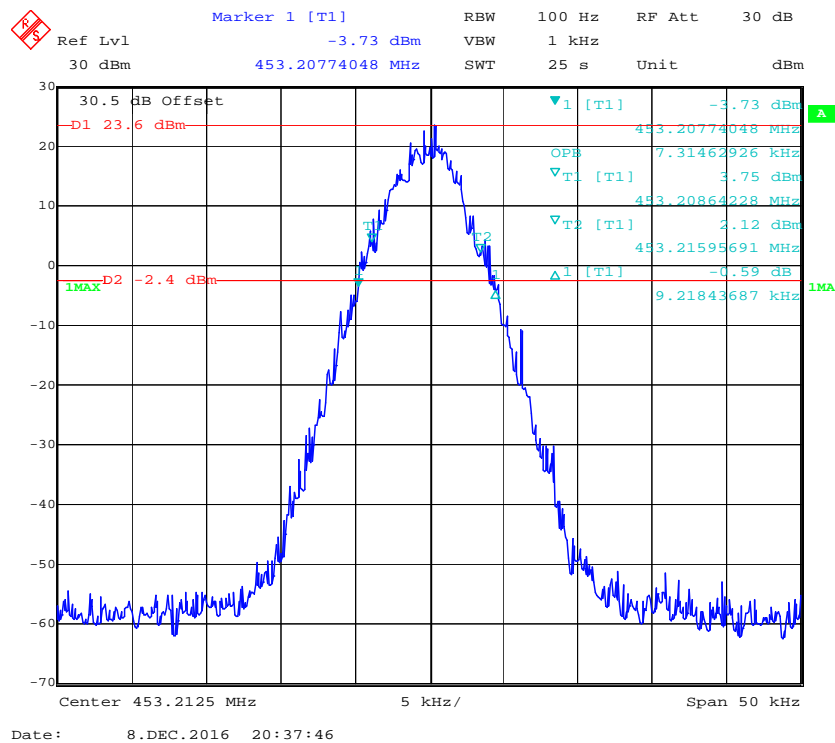
**Frequency 459.5 MHz: 99% Occupied & 26 dB Bandwidth, High Power****Frequency 459.5 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**

### Frequency 453.2125 MHz: Emission Mask, High Power

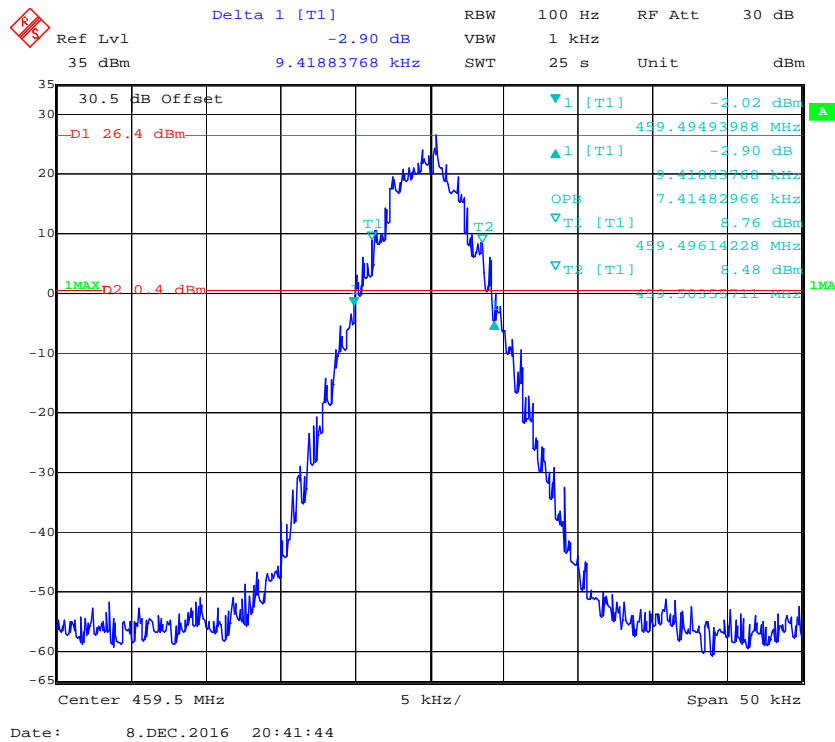


### Frequency 453.2125 MHz: Emission Mask, Low Power

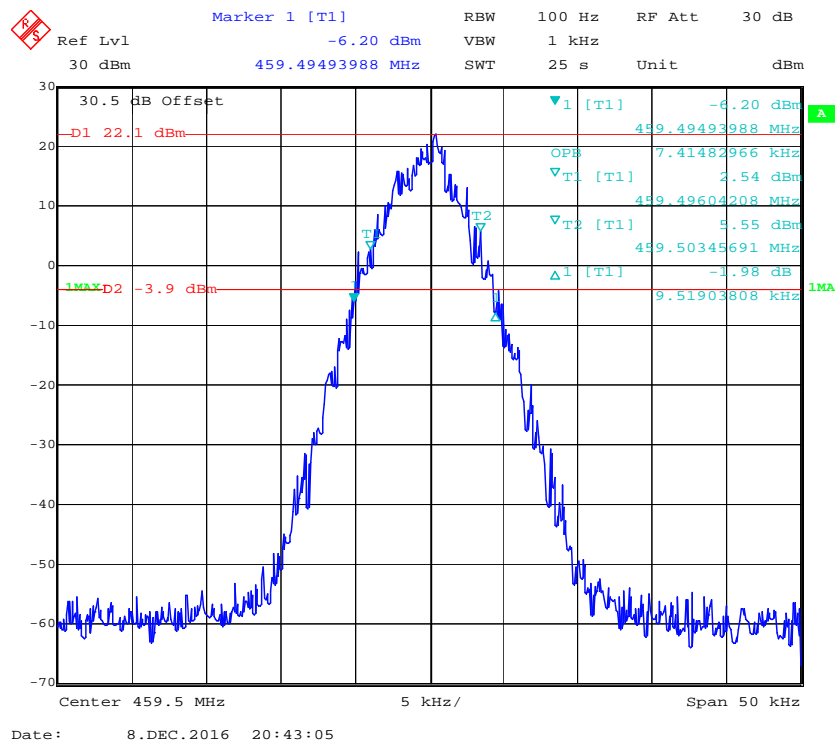


**Digital Modulation:****Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, High Power****Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth with Low Power**

### Frequency 459.5 MHz: 99% Occupied & 26 dB Bandwidth, High Power

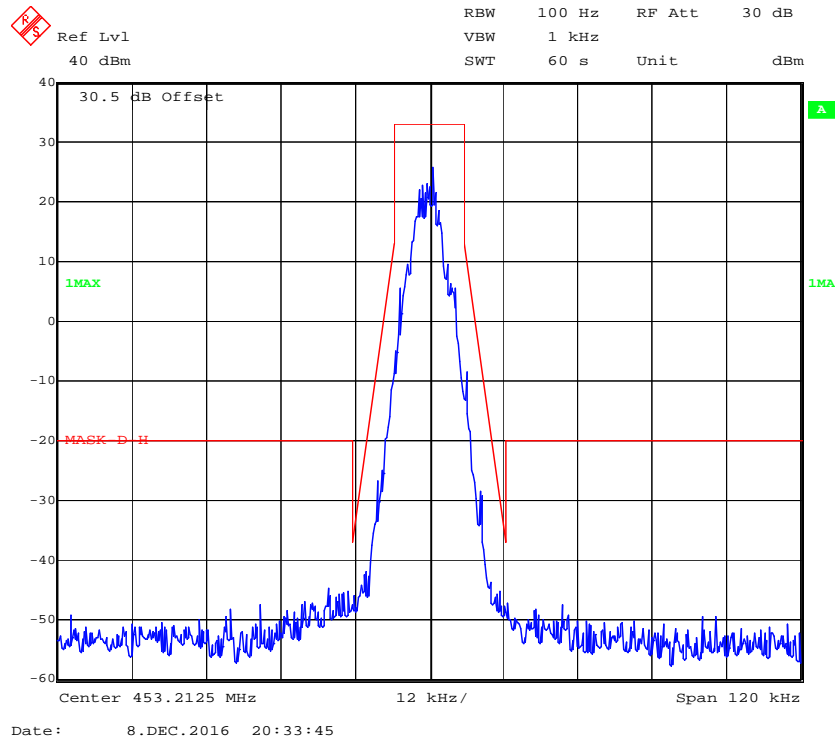


### Frequency 459.5 MHz: 99% Occupied & 26 dB Bandwidth with Low Power

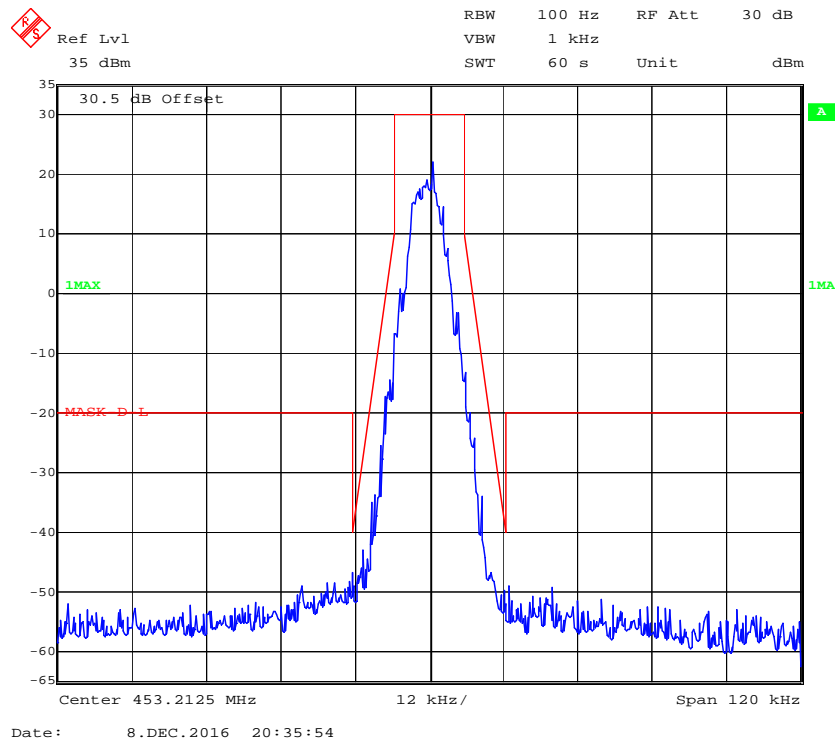




### Frequency 453.2125 MHz: Emission Mask, High Power



### Frequency 453.2125 MHz: Emission Mask, Low Power



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

### Test Procedure

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

### Test Data

#### Environmental Conditions

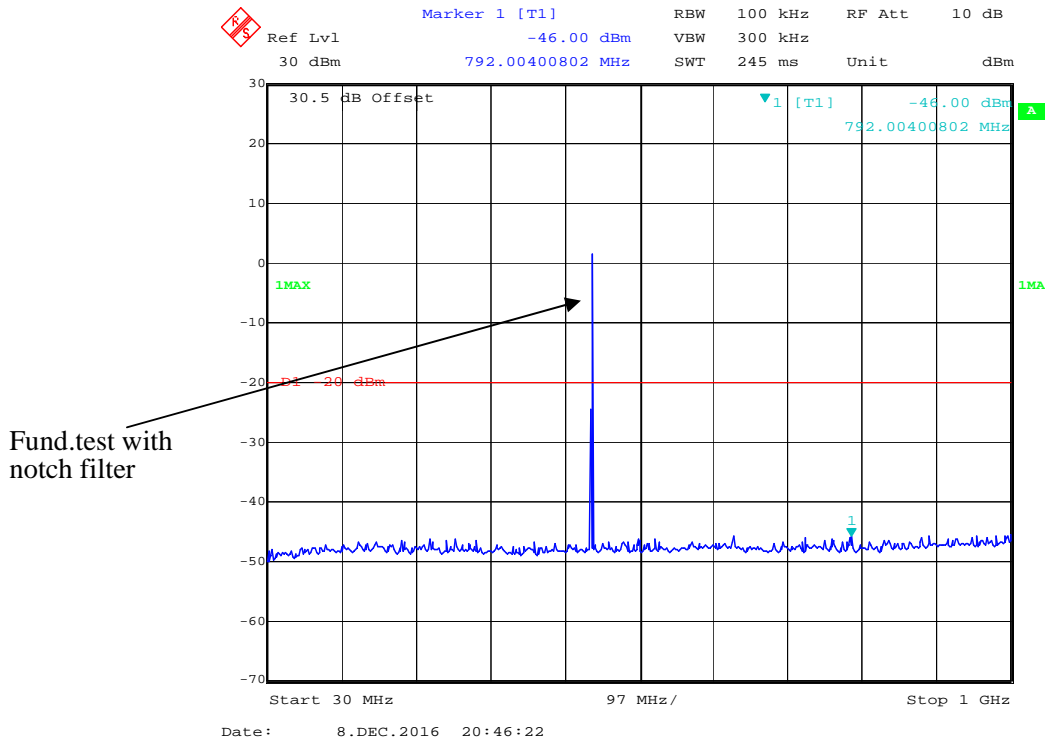
Temperature:	23~24 °C
Relative Humidity:	50~54 %
ATM Pressure:	100.0~101.0 kPa

*The testing was performed by Alisa Gao on 2016-12-08 and 2016-12-19.*

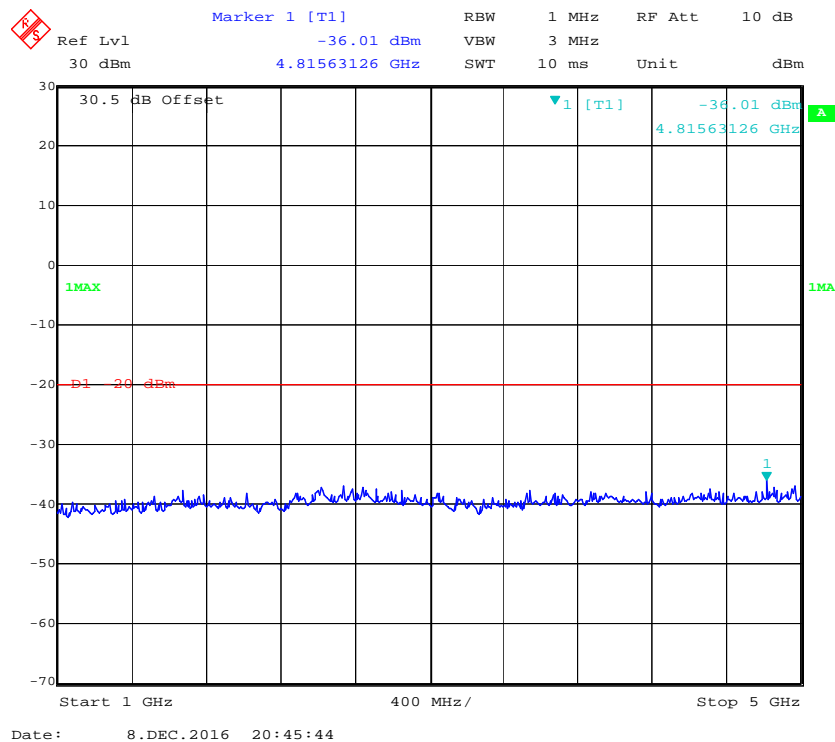
*Test Mode: Transmitting, please refer to the following plots.*

**Analog Modulation:**

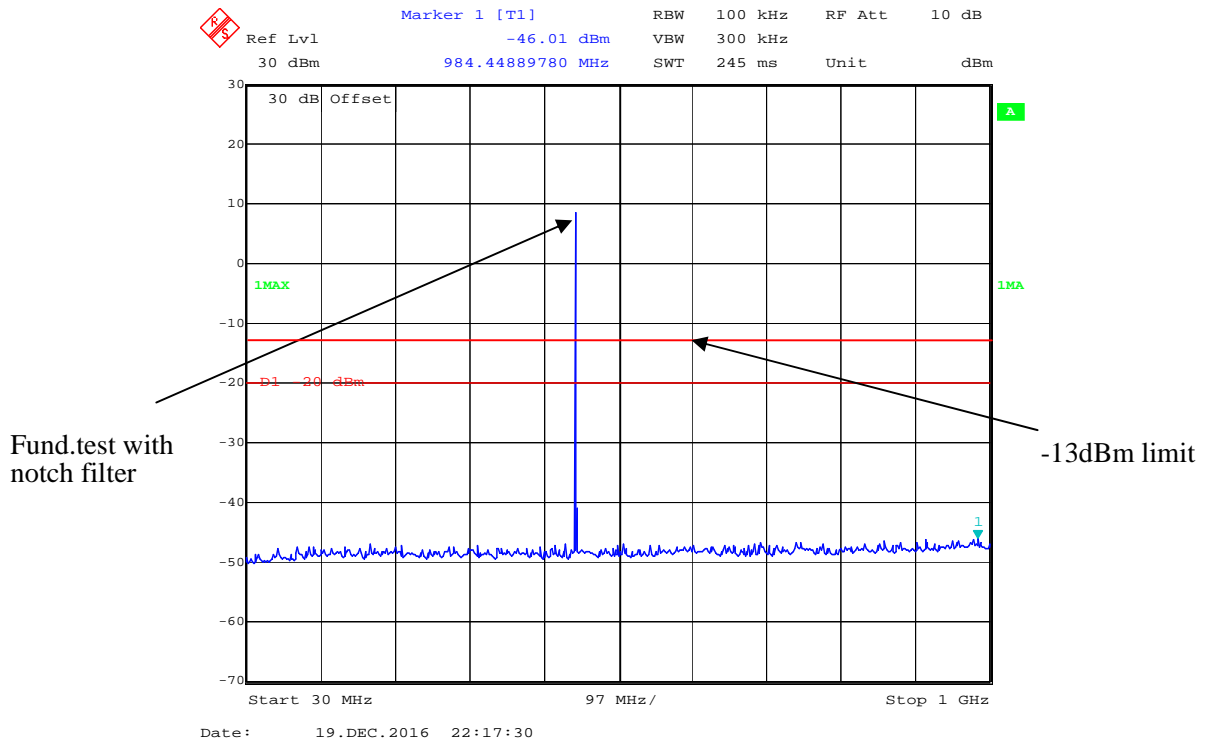
**30MHz – 1 GHz, Spacing Channel 12.5 kHz, 453.2125 MHz--- Part 90**



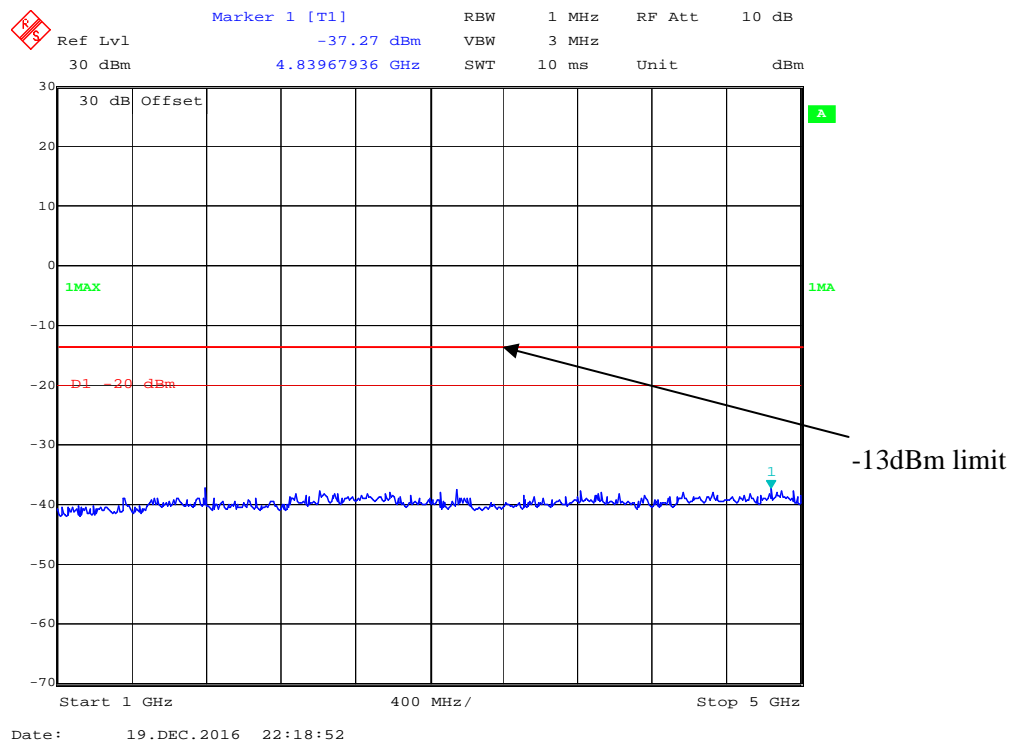
**1 GHz – 5 GHz, Spacing Channel 12.5 kHz, 453.2125 MHz --- Part 90**



### 30MHz – 1 GHz, Spacing Channel 12.5 kHz, 459.5 MHz--- Part 22

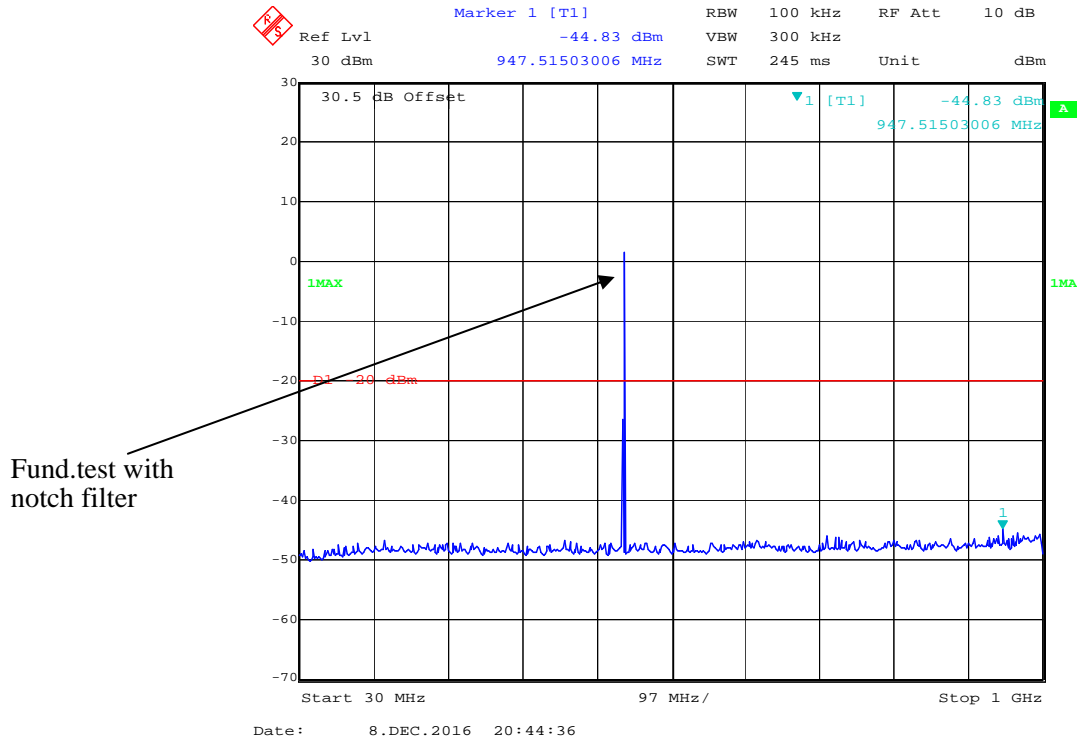


### 1 GHz – 5GHz, Spacing Channel 12.5 kHz, 459.5 MHz--- Part 22

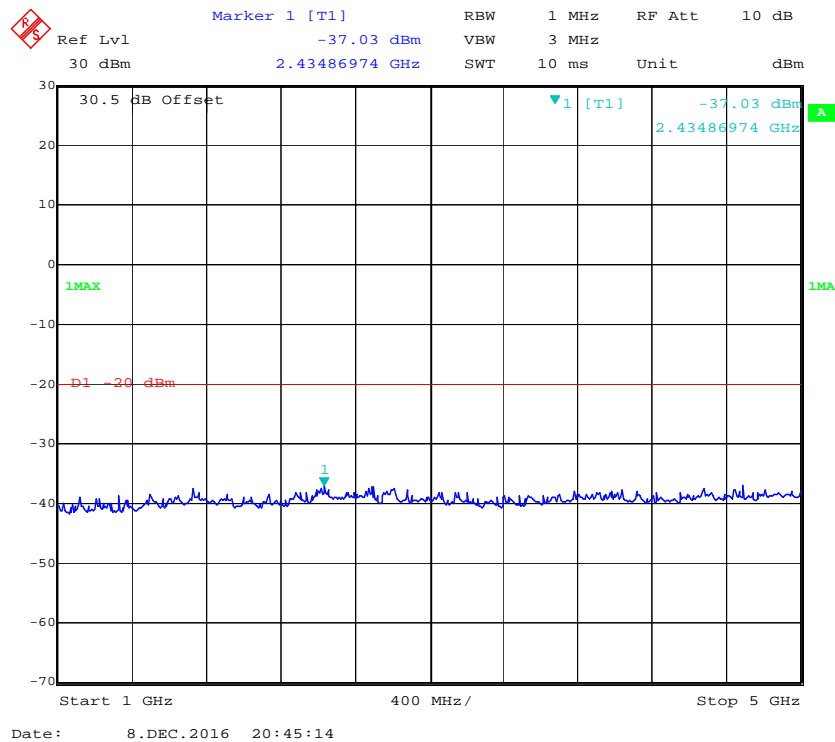


**Digital Modulation:**

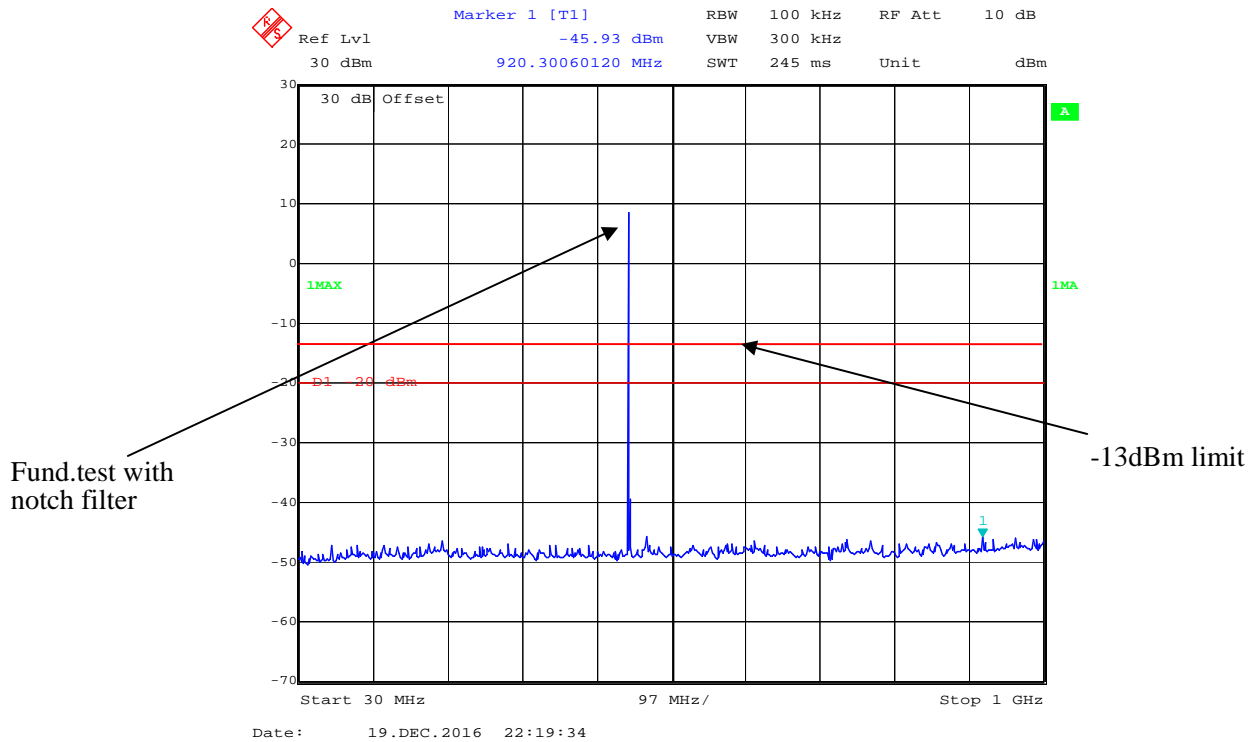
**30MHz - 1 GHz, 453.2125MHz--- Part 90**



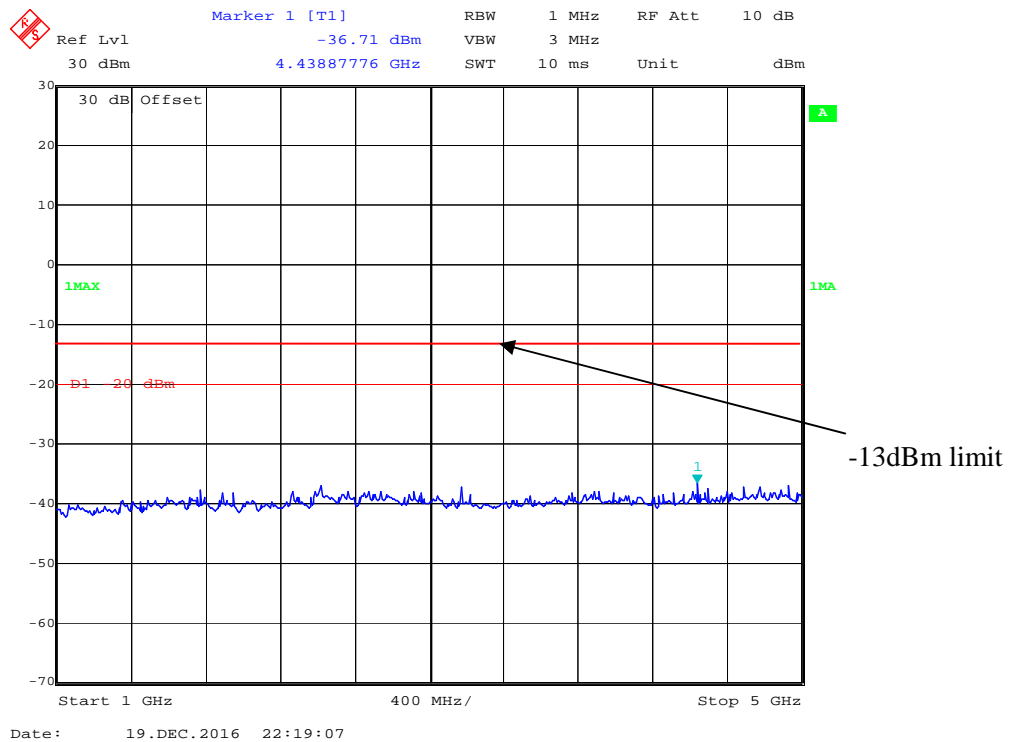
**1 GHz – 5 GHz, 453.2125MHz --- Part 90**



### 30MHz - 1 GHz, 459.5 MHz--- Part 22



### 1 GHz – 5 GHz, 459.5 MHz --- Part 22



**FCC §2.1053 & §22.861 & §90.210 - RADIATED SPURIOUS EMISSIONS****Applicable Standard**

FCC §2.1053, §22.861 and §90.210

**Test Procedure**

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

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

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

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

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

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

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

<b>Temperature:</b>	23 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Layne Li on 2016-12-08.*

*Test Mode: Transmitting***30MHz - 5GHz:**

Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)			
Analog Modulation 453.2125 MHz- for FCC part 90										
906.43	62.83	181	1.6	H	-30.9	0.45	5.05	-26.30	-20	6.30
906.43	61.07	243	1.4	V	-33.6	0.45	5.05	-29.00	-20	9.00
1359.64	70.19	29	1.6	H	-31.8	0.27	7.75	-24.32	-20	4.32
1359.64	73.62	183	1.9	V	-34.0	0.27	7.75	-26.52	-20	6.52
Analog Modulation 459.5 MHz - for FCC part 22										
919.00	63.43	156	2.1	H	-30.4	0.45	5.05	-25.80	-13	12.80
919.00	61.35	227	2.1	V	-33.3	0.45	5.05	-28.70	-13	15.70
1408.50	66.32	19	1.3	H	-35.0	0.34	7.92	-27.42	-13	14.42
1408.50	63.65	214	2.2	V	-43.2	0.34	7.92	-35.62	-13	22.62



Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)			
Digital Modulation 453.2125MHz- for FCC part 90										
906.43	63.45	29	2.1	H	-30.3	0.45	5.05	-25.70	-20	5.70
906.43	61.92	172	1.5	V	-32.8	0.45	5.05	-28.20	-20	8.20
1359.64	70.19	159	1.5	H	-31.8	0.27	7.75	-24.32	-20	4.32
1359.64	73.52	35	1.8	V	-34.1	0.27	7.75	-26.62	-20	6.62
Digital Modulation 459.5 MHz- for FCC part 22										
919.00	62.77	43	2.0	H	-31.0	0.45	5.05	-26.40	-13	13.40
919.00	61.61	139	1.9	V	-33.1	0.45	5.05	-28.50	-13	15.50
1408.50	67.11	130	2.0	H	-34.5	0.34	7.92	-26.92	-13	13.92
1408.50	64.97	20	1.7	V	-43.1	0.34	7.92	-35.52	-13	22.52

**Note:**

Absolute Level = SG Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

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**FCC §2.1055 & § 22.355 & §90.213 - FREQUENCY STABILITY**

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**Applicable Standard**

FCC §2.1055, § 22.355 and §90.213

**Test Procedure**

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

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

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

<b>Temperature:</b>	23 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Alisa Gao on 2016-12-08.*

*Test Mode: Transmitting*

**For Analog Modulation**

Reference Frequency: 453.2125MHz, Limit: $\pm 5$ ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Measured Frequency error (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	4.35	453.212210	-0.6399
40	4.35	453.212201	-0.6597
30	4.35	453.212205	-0.6509
20	4.35	453.212207	-0.6465
10	4.35	453.212211	-0.6377
0	4.35	453.212198	-0.6664
-10	4.35	453.212203	-0.6553
-20	4.35	453.212213	-0.6333
-30	4.35	453.212206	-0.6487
Frequency Stability versus Input Voltage			
20	4.00	453.212213	-0.6333

Reference Frequency: 459.5 MHz, Limit: $\pm 2.5$ ppm, 12.5 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Measured Frequency error (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	4.35	459.499704	-0.6442
40	4.35	459.499712	-0.6268
30	4.35	459.499703	-0.6464
20	4.35	459.499708	-0.6355
10	4.35	459.499697	-0.6594
0	4.35	459.499706	-0.6398
-10	4.35	459.499702	-0.6485
-20	4.35	459.499695	-0.6638
-30	4.35	459.499705	-0.6420
Frequency Stability versus Input Voltage			
20	4.00	459.499698	-0.6572

**For Digital Modulation**

Reference Frequency: 453.2125 MHz, Limit: $\pm 5$ ppm, 12.5 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	4.35	453.212191	-0.6818
40	4.35	453.212205	-0.6509
30	4.35	453.212207	-0.6465
20	4.35	453.212201	-0.6597
10	4.35	453.212196	-0.6708
0	4.35	453.212204	-0.6531
-10	4.35	453.212212	-0.6355
-20	4.35	453.212196	-0.6708
-30	4.35	453.212206	-0.6487
Frequency Stability versus Input Voltage			
20	4.00	453.212209	-0.6421

Reference Frequency: 459.5 MHz, Limit: $\pm 2.5$ ppm, 12.5 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	4.35	459.499702	-0.6485
40	4.35	459.499707	-0.6376
30	4.35	459.499713	-0.6246
20	4.35	459.499695	-0.6638
10	4.35	459.499710	-0.6311
0	4.35	459.499709	-0.6333
-10	4.35	459.499705	-0.6420
-20	4.35	459.499712	-0.6268
-30	4.35	459.499696	-0.6616
Frequency Stability versus Input Voltage			
20	4.00	459.499701	-0.6507

Note: End point voltage is 4.0 V

## FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

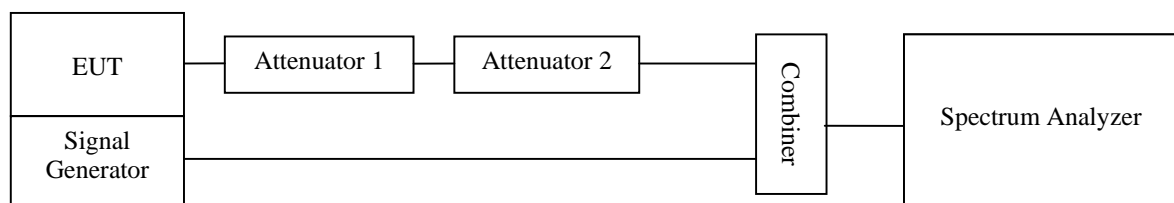
### Applicable Standard

Regulations: FCC §90.214

Test method: ANSI/TIA-603-D 2010, section 2.2.19.3

### Test Procedure

- a) Connect the EUT and test equipment as shown on the following block diagram.
- b) Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
- c) Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at  $\pm 12.5$  kHz deviation and set its output level to -100dBm.
- d) Turn on the transmitter.
- e) Supply sufficient attenuation via the RF attenuator to provide an input level to the Spectrum Analyzer that is 40 dB below the maximum allowed input power when the transmitter is operating at its rated power level. Note this power level on the Spectrum Analyzer as  $P_0$ .
- f) Turn off the transmitter.
- g) Adjust the RF level of the signal generator to provide RF power equal to  $P_0$ . This signal generator RF level shall be maintained throughout the rest of the measurement.
- h) Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
- i) Adjust the vertical amplitude control of the spectrum analyzer to display the 1000 Hz at  $\pm 4$  divisions vertically centered on the display. Set trigger mode of the Spectrum Analyzer to "Video", and tune the "trigger level" on suitable level. Then set the "trigger offset" to -10ms for turn on and -15ms for turn off.
- j) Turn on the transmitter and the transient wave will be captured on the screen of Spectrum Analyzer. Observe the stored display. The instant when the 1 kHz test signal is completely suppressed is considered to be  $t_{on}$ . The trace should be maintained within the allowed divisions during the period  $t_1$  and  $t_2$ .
- k) Then turn off the transmitter, and another transient wave will be captured on the screen of Spectrum Analyzer. The trace should be maintained within the allowed divisions during the period  $t_3$ .



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

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

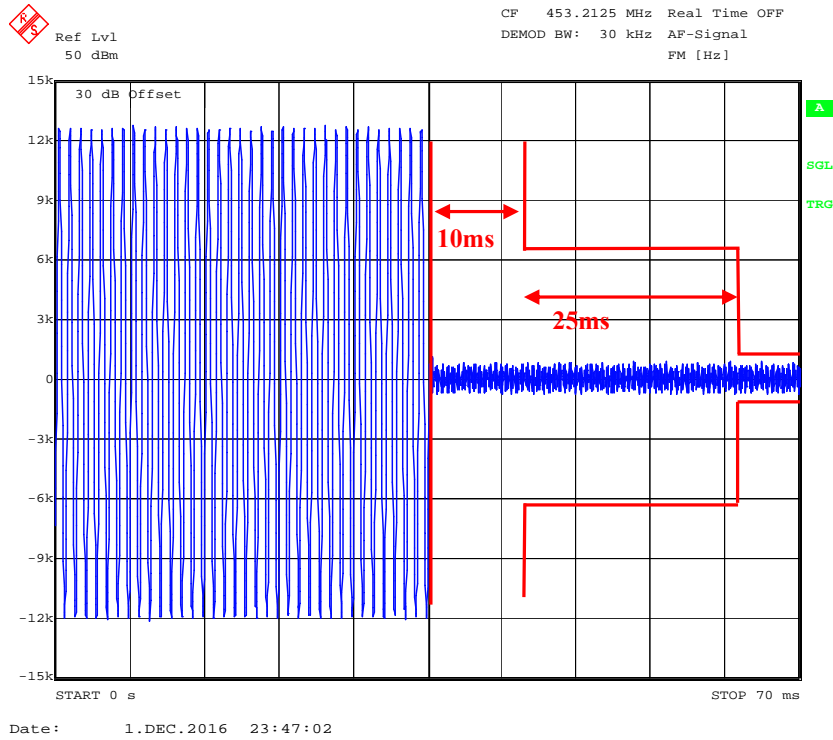
*The testing was performed by Alisa Gao on 2016-12-01.*

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

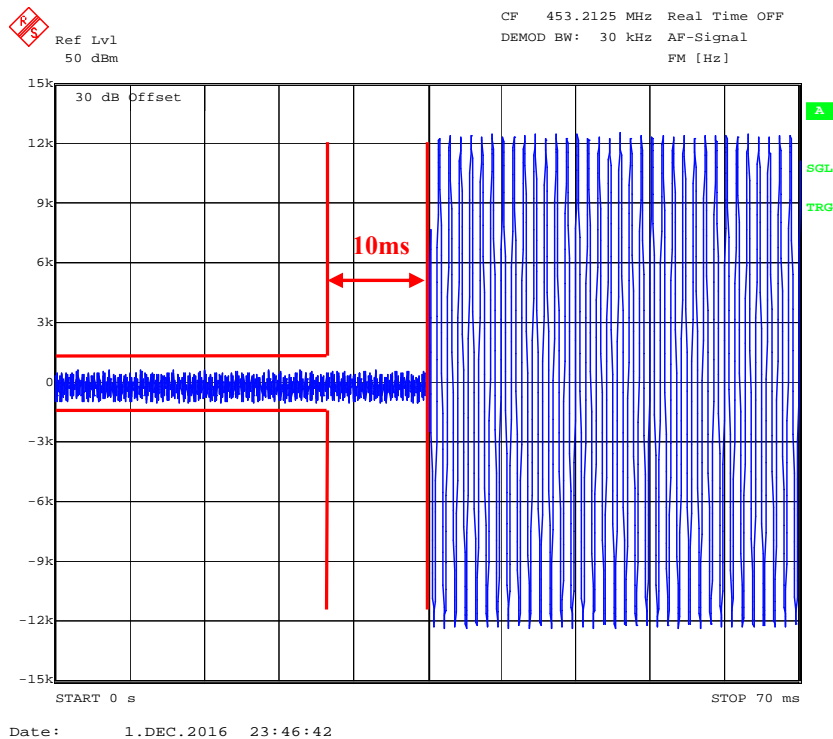
Please refer to the following plots.

# Channel Spacing 12.5 kHz

## Turn on



## Turn off



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