TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 90

TEST REPORT

For

ABELL INDUSTRIES CO., LTD.

2/F, Bldg. 14, ZhongXing Industrial City,NanShan Dist, ShenZhen, P.R. China

FCC ID: TEY-A720T

Report Type:	**Product Type:**
Original Report	Two way radio

Report Number:	RDG190606008-00A
Report Date:	2019-06-22
Reviewed By:	Jerry Zhang EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		Two way radio
EUT Model:		A720T
Modulation Type:		FM, 4FSK
Channel Spacing:		12.5 kHz
Frequency Range:		400-470 MHz
Rated Output Power: (Conducted)		High Power Level:5W Low Power Level: 1.5 W
Rated Input Voltage:		7.4VDC from battery and DC12V from charger base
Adapter Information	**Model:**	DSA-12PFT-12 FUS 120100
	Input:	100-240V, 50/60Hz, 0.5A
	Output:	$DC12V_{CC}$, 1A
External Dimension:		126mm(L)*53mm(W)*26.5 mm(H)
Serial Number:		190606008
EUT Received Date:		2019/06/06

Objective

This test report is prepared on behalf of *ABELL INDUSTRIES CO., LTD.* in accordance with Part 2, and Part 90 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

No related submittal(s)/grant(s).

Test Methodology

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

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-D.

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

Measurement Uncertainty

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

Test Facility

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

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The frequencies were configured for testing in engineering mode, which was provided by manufacturer.

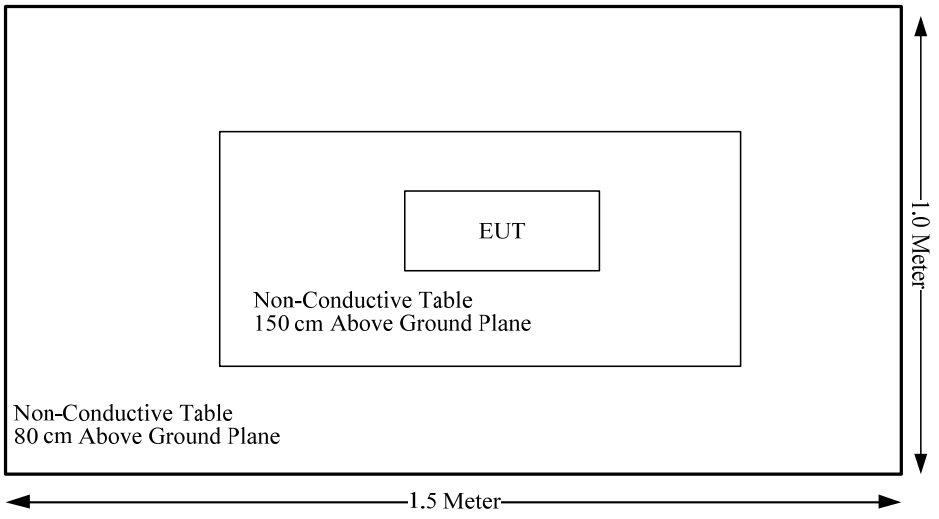
EUT Exercise Software

No EUT exercise software was used in test.

Equipment Modifications

No modification was made to the EUT tested.

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1310 and §2.1093	RF Exposure	Compliance
§2.104;§90.205	RF Output Power	Compliance
§2.1047	Modulation Characteristic	Compliance
§2.1049; §90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliance
§2.1051; §90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053; §90.210	Spurious Radiated Emissions	Compliance
§2.1055; §90.213	Frequency Stability	Compliance
§90.214	Transient Frequency Behavior	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102453	2018-06-26	2019-06-26
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2019-05-06	2020-05-06
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05
R&S	Spectrum Analyzer	FSP 38	100478	2019-05-09	2020-05-09
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2018-09-05	2019-09-05
MICRO-COAX	Coaxial Cable	UFA147-1-2362-100100	64639 231029-001	2019-02-24	2020-02-24
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2018-09-05	2019-09-05
Agilent	Signal Generator	E8247C	MY43321350	2018-12-10	2019-12-10
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2018-08-03	2019-08-03
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	0E01201047	Each time	N/A
Weinschel	Coaxial Attenuators	53-20-34	LN749	Each time	N/A
OuLi	Band Rejector Filter	400-470	003	Each time	N/A
HP	RF Communications Test Set	8920A	3438A05201	2019-01-04	2020-01-04
ESPEC	Constant temperature and humidity Tester	ESX-4CA	018 463	2019-03-26	2020-03-26
UNI-T	Multimeter	UT39A	M130199938	2018-07-24	2019-07-24
Pro instrument	DC Power Supply	pps3300	3300012	N/A	N/A
LEADER	Millivoltmeter	LMV-181A	601788	2018-08-11	2019-08-10

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

FCC §1.1310 & §2.1093 - RF EXPOSURE

Applicable Standard

FCC§1.1310 and §2.1093.

Test Result

Compliance, please refer to the SAR report: RDG190606008-20.

FCC §2.1046 & §90.205 - RF OUTPUT POWER

Applicable Standard

FCC §2.1046, §90.205

Test Procedure

Conducted RF Output Power:

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

Spectrum Analyzer Setting:

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

Test Data

Environmental Conditions

Temperature:	26.4 ℃
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Blake Yang on 2019-06-18.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Modulation Mode	Channel Separation (kHz)	f_c (MHz)	Reading (W)	
			High Power Level	Low Power Level
FM	12.5kHz	400.0125	5.09	1.49
		453.2125	5.13	1.44
		469.9875	4.67	1.47
4FSK	12.5kHz	400.0125	4.89	1.45
		453.2125	5.10	1.47
		469.9875	4.73	1.46

Note: The rated high power level is 5W, and rated low power level is 1.5W.

FCC §2.1047 - MODULATION CHARACTERISTIC

Applicable Standard

FCC §2.1047

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

Test Procedure

Test Method: TIA/EIA-603 2.2.3

Test Data

Environmental Conditions

Temperature:	26.4 ℃
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Blake Yang on 2019-06-18.

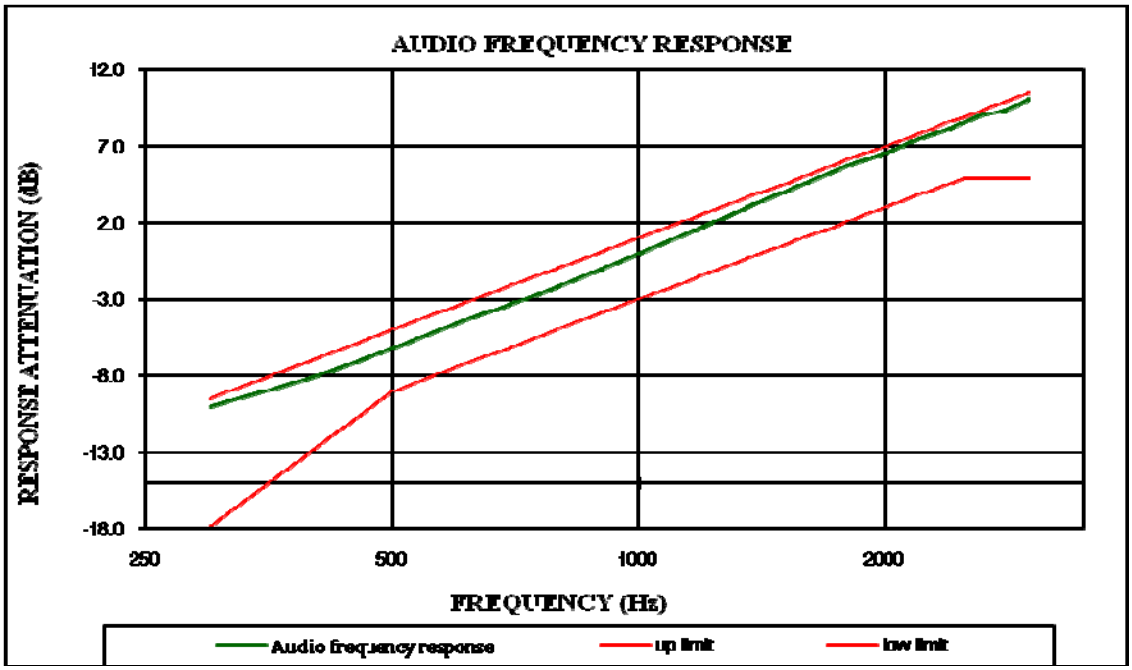
Test Mode: Transmitting

Result: Compliance.

Audio Frequency Response – High Power,12.5kHz

Carrier Frequency: 453.2125 MHz, Channel Separation:12.5kHz

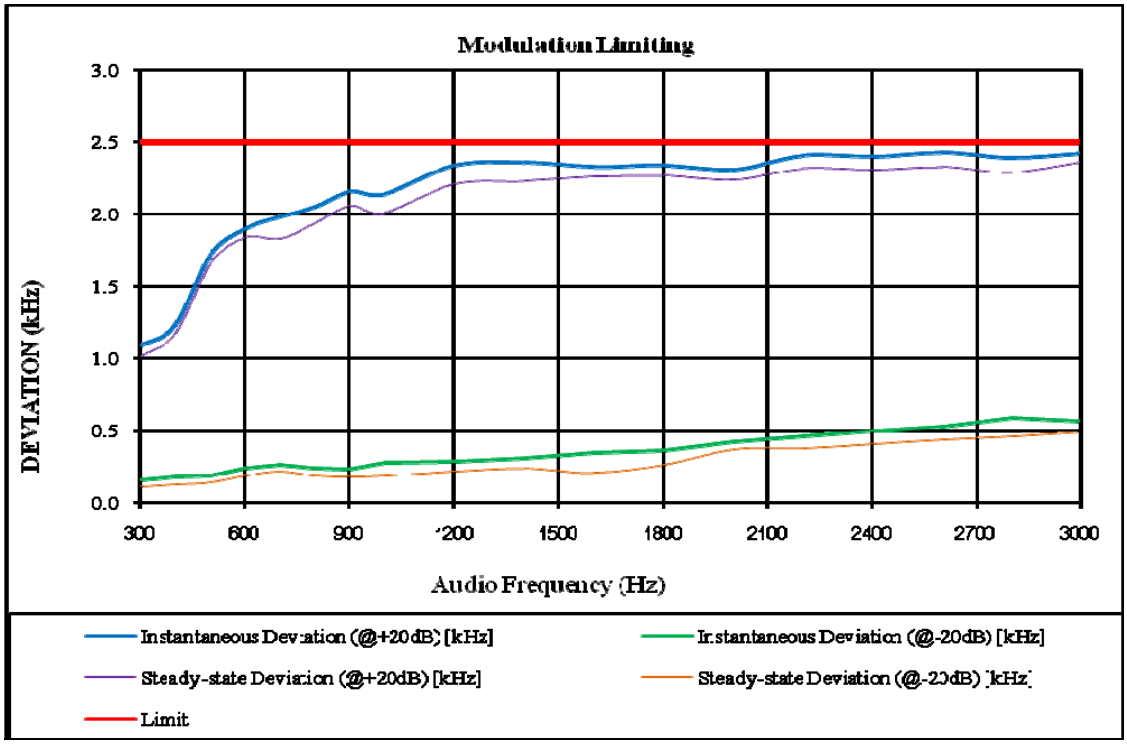
Audio Frequency (Hz)	Response data (dB)
300	-9.96
400	-8.09
500	-6.21
600	-4.56
700	-3.32
800	-2.15
900	-1.01
1000	0.00
1200	1.77
1400	3.31
1600	4.61
1800	5.73
2000	6.54
2200	7.49
2400	8.12
2600	8.94
2800	9.37
3000	10.09



MODULATION LIMITING – High Power

Carrier Frequency: 453.2125 MHz, Channel Separation:12.5kHz

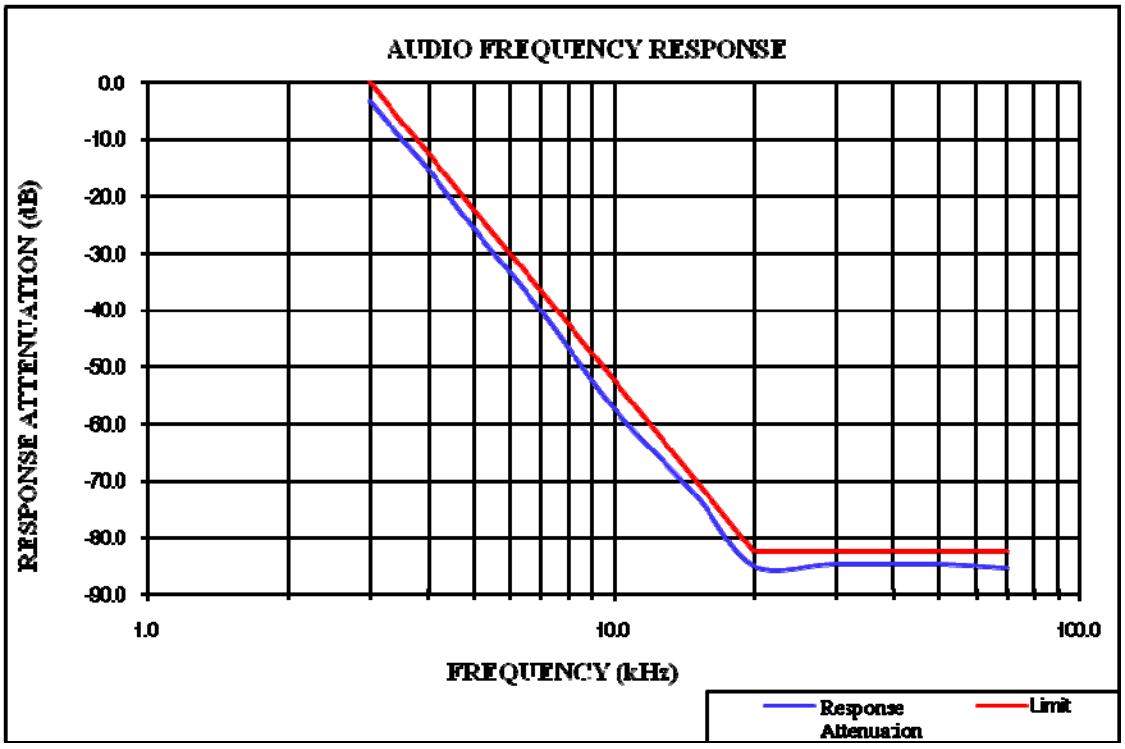
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	
300	1.09	0.16	1.010	0.110	2.5
400	1.23	0.18	1.170	0.130	2.5
500	1.72	0.19	1.660	0.140	2.5
600	1.90	0.24	1.840	0.190	2.5
700	1.98	0.26	1.830	0.220	2.5
800	2.05	0.24	1.940	0.190	2.5
900	2.16	0.23	2.060	0.180	2.5
1000	2.14	0.28	2.010	0.190	2.5
1200	2.34	0.29	2.210	0.220	2.5
1400	2.36	0.31	2.230	0.240	2.5
1600	2.33	0.35	2.260	0.210	2.5
1800	2.34	0.36	2.270	0.260	2.5
2000	2.31	0.42	2.240	0.370	2.5
2200	2.41	0.46	2.320	0.380	2.5
2400	2.40	0.50	2.310	0.410	2.5
2600	2.43	0.53	2.330	0.440	2.5
2800	2.39	0.59	2.290	0.460	2.5
3000	2.42	0.57	2.360	0.490	2.5



Audio Frequency Low Pass Filter Response – High Power

Carrier Frequency: 453.2125 MHz, Channel Spacing = 12.5 kHz

Audio Frequency	Response Attenuation	Limit
kHz	dB	dB
3.0	-3.1	0.0
3.5	-9.7	-6.7
4.0	-15.3	-12.5
5.0	-25.6	-22.2
7.0	-40.3	-36.8
10.0	-57.3	-52.3
15.0	-72.6	-69.9
20.0	-84.9	-82.5
30.0	-84.6	-82.5
50.0	-84.7	-82.5
70.0	-85.3	-82.5



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

Applicable Standard

FCC §2.1049, §90.209 and §90.210

Test Procedure

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

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

Test Data

Environmental Conditions

Temperature:	26.4 ℃
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Blake Yang on 2019-06-18.

Test mode: transimitting

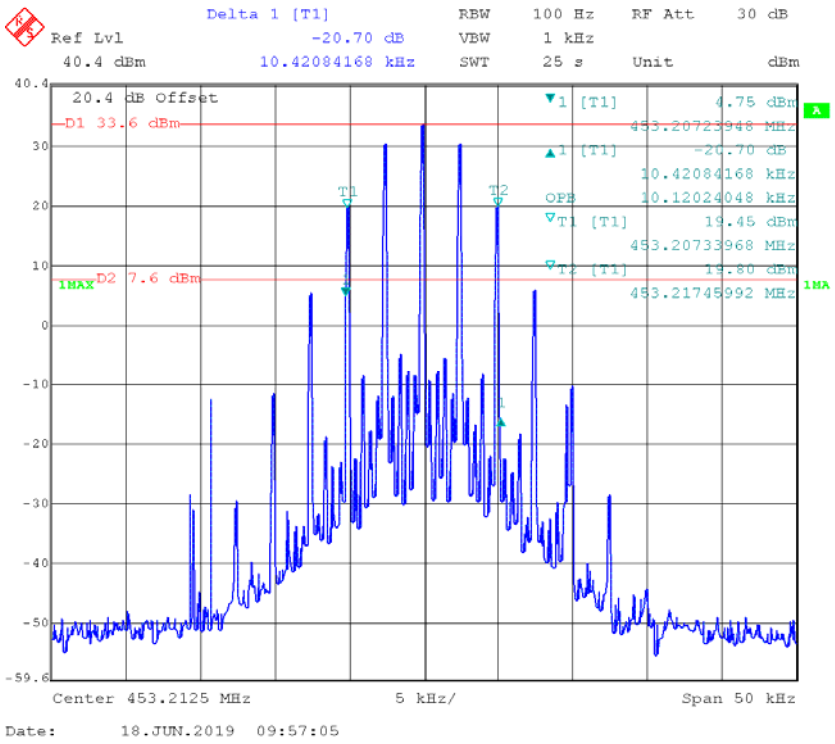
Test Frequency (MHz)	Modulation Mode	Channel Separation	Power Level	99% Occupied Bandwidth (kHz)	26 dB Bandwidth (kHz)
453.2125	FM	12.5kHz	High	10.120	10.421
			Low	10.120	10.421
	4FSK	12.5kHz	High	8.818	12.124
			Low	9.018	12.124

Note: Emission bandwidth was based on calculation method instead of measurement.
Emission Designator
Per CFR 47 §2.201& §2.202, BW = 2M + 2D

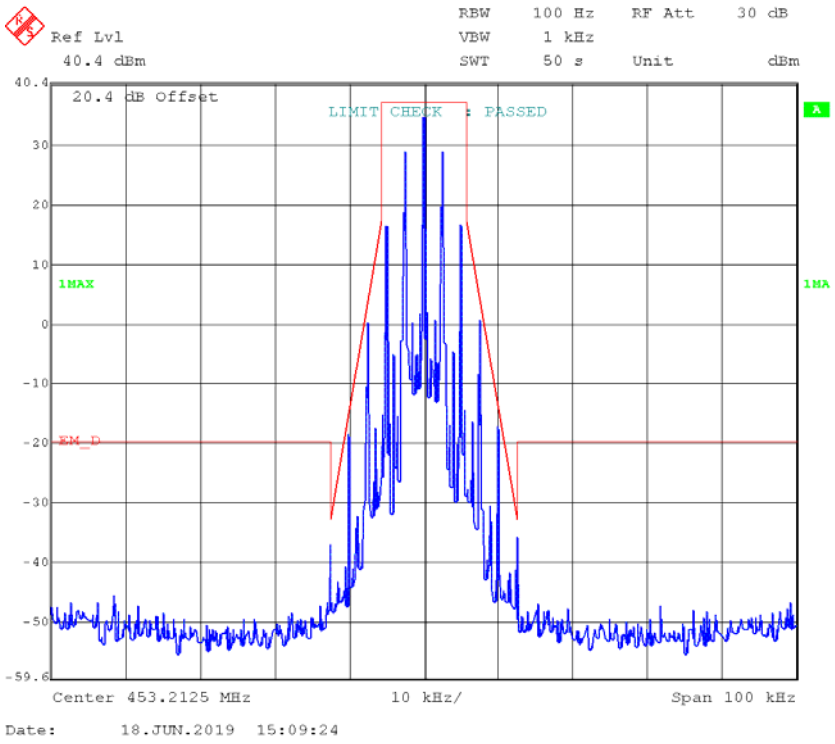
For FM Mode (Channel Spacing: 12.5 kHz)
Emission Designator 11K0F3E
In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.
BW = 2(M+D) = 2*(3.0 kHz + 2.5 kHz) = 11 kHz = 11K0
F3E portion of the designator represents an FM voice transmission
Therefore, the entire designator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

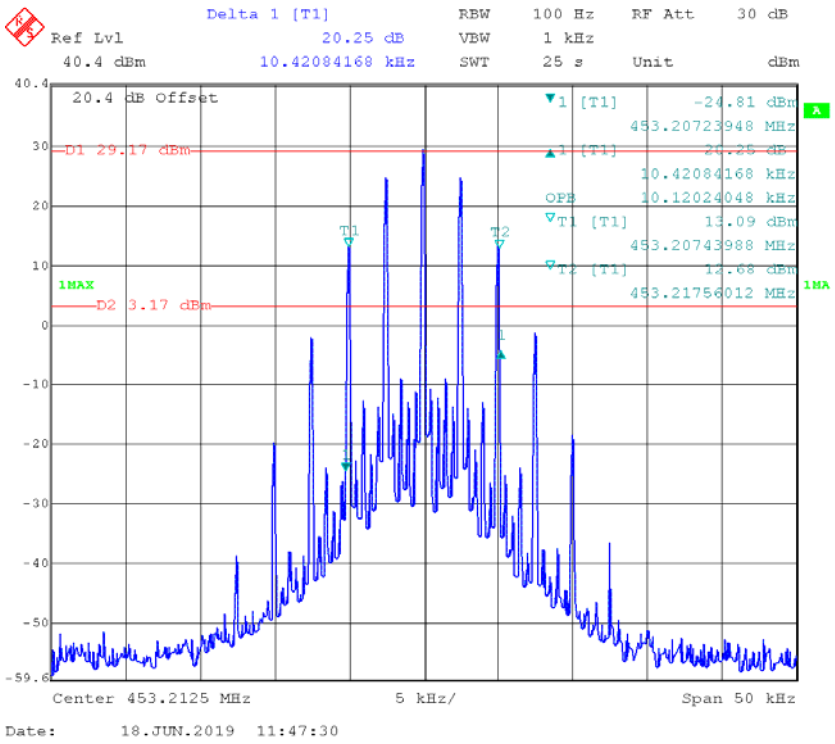
FM,12.5kHz,High Power - Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth



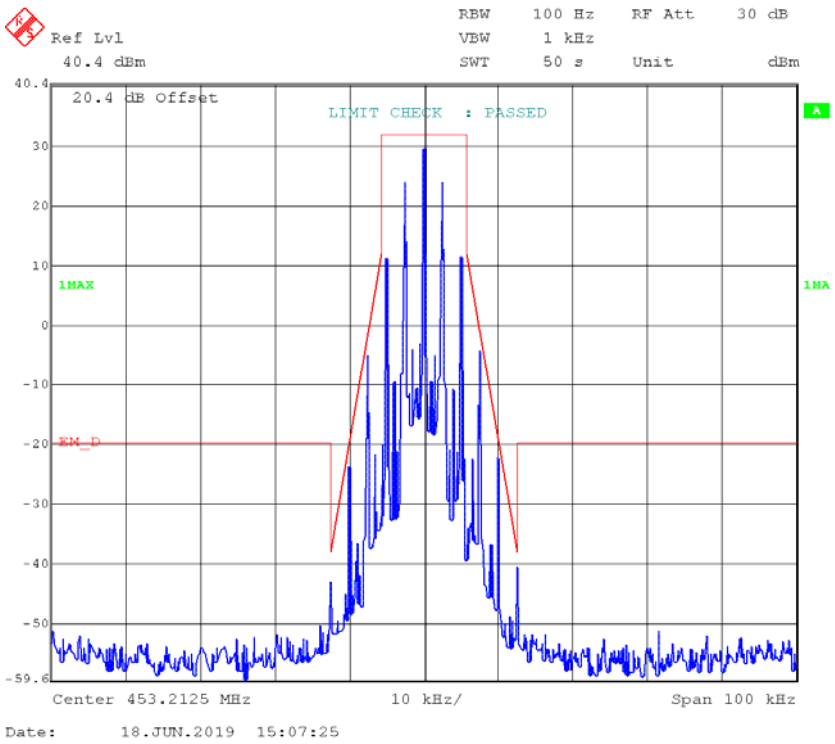
Emission Mask D



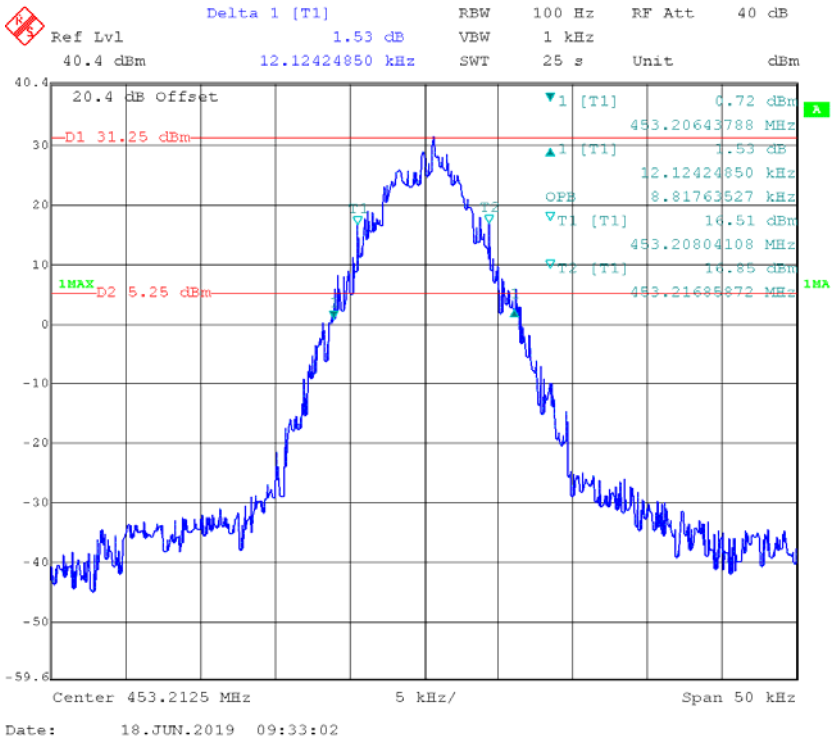
FM,12.5kHz,Low Power - Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth



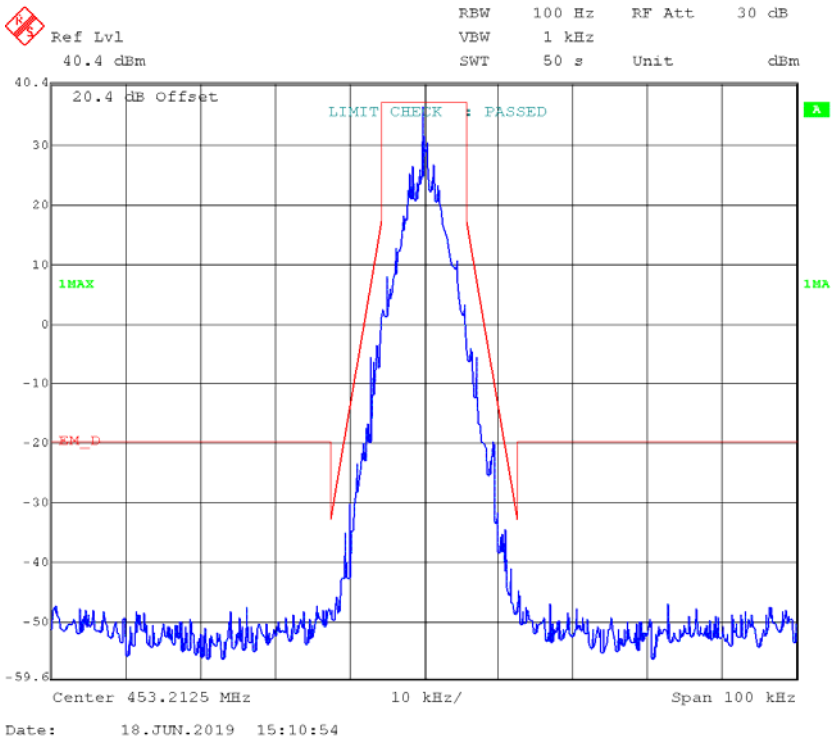
Emission Mask D



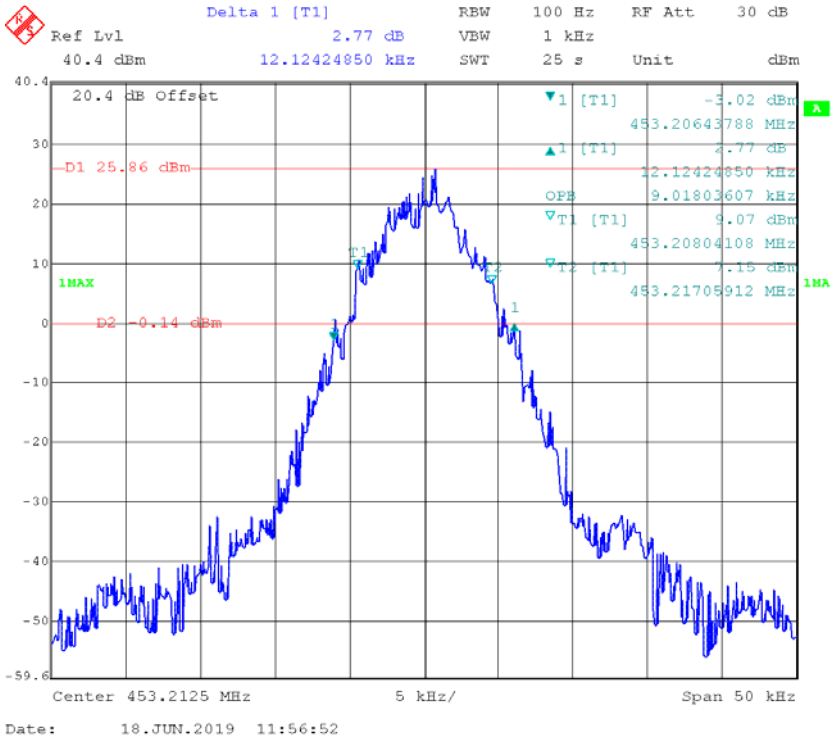
4FSK,12.5kHz,High Power - Frequency 453.2125MHz: 99% Occupied & 26 dB Bandwidth



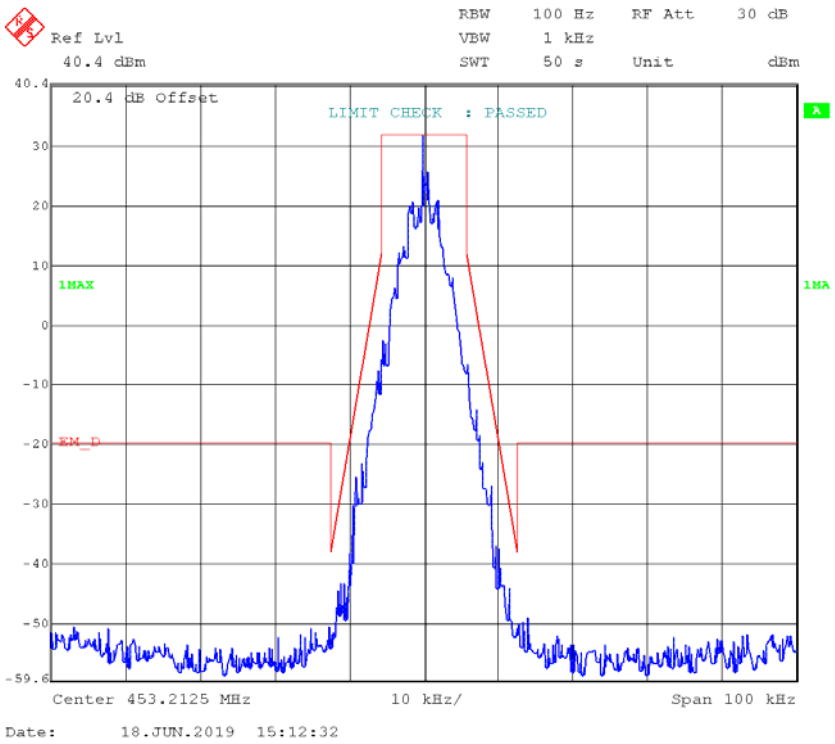
Emission Mask D



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



Emission Mask D



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

Applicable Standard

FCC §2.1051, §90.210

Test Procedure

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

Test Data

Environmental Conditions

Temperature:	26.4 ℃
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

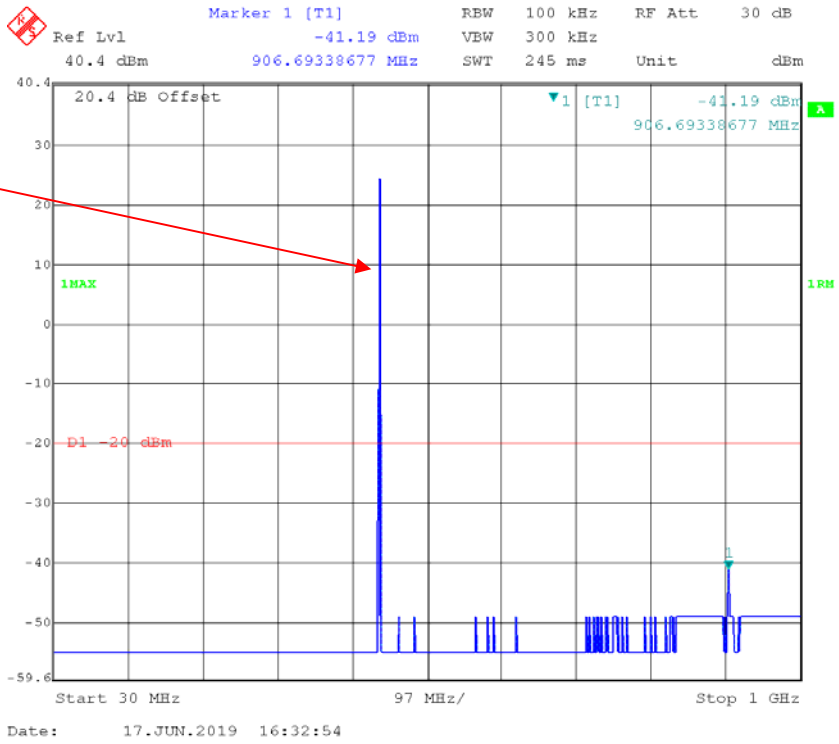
The testing was performed by Blake Yang on 2019-06-17.

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

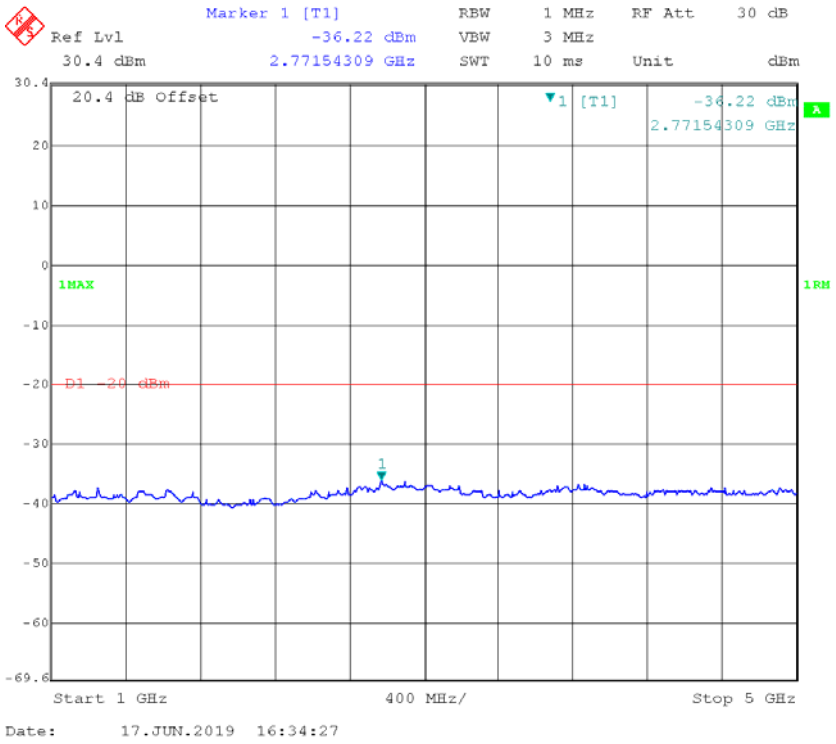
FM, High power:

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

Fund.test with Filter



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

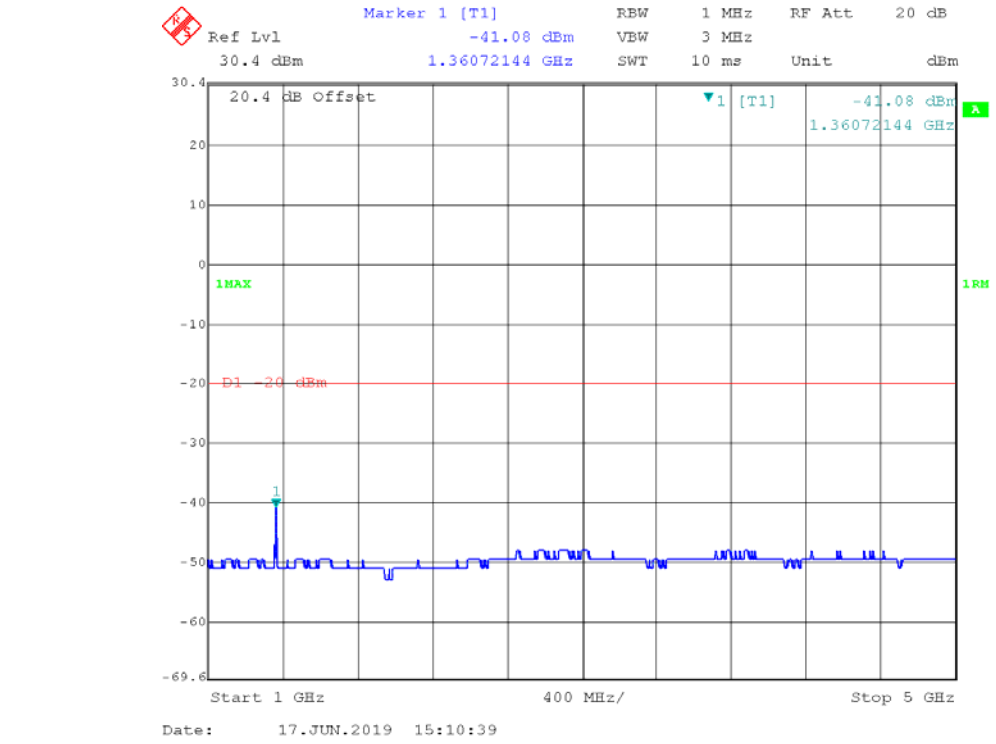


12.5kHz, 4FSK, High power:

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

Fund.test with Filter

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



FCC §2.1053 §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053, §90.210

Test Procedure

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

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

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

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

Spurious emissions in dB =10 1g (TXpwr in Watts/0.001)-the absolute level

Test Data

Environmental Conditions

Temperature:	26.1 °C
Relative Humidity:	61%
ATM Pressure:	101.1kPa

** The testing was performed by Vern Shen &Lucy Lu on 2019-06-12*

Test Mode: Transmitting

30MHz - 5GHz:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM,Frequency: 453.2125MHz-12.5 kHz								
906.4250	H	40.65	-56.22	0.00	1.03	-57.25	-20.00	37.25
906.4250	V	42.54	-56.30	0.00	1.03	-57.33	-20.00	37.33
1359.64	H	56.12	-47.33	9.41	1.18	-39.10	-20.00	19.10
1359.64	V	53.64	-49.97	9.41	1.18	-41.74	-20.00	21.74
1812.85	H	52.04	-52.19	10.94	1.21	-42.46	-20.00	22.46
1812.85	V	49.17	-55.00	10.94	1.21	-45.27	-20.00	25.27
2266.06	H	51.79	-51.58	11.87	1.19	-40.90	-20.00	20.90
2266.06	V	53.54	-50.56	11.87	1.19	-39.88	-20.00	19.88
2719.28	H	41.63	-60.74	12.29	1.35	-49.80	-20.00	29.80
2719.28	V	47.35	-55.77	12.29	1.35	-44.83	-20.00	24.83
3172.488	H	48.55	-52.97	12.33	1.54	-42.18	-20.00	22.18
3172.488	V	54.68	-46.25	12.33	1.54	-35.46	-20.00	15.46
3625.700	H	46.91	-53.66	12.23	1.57	-43.00	-20.00	23.00
3625.700	V	48.72	-50.93	12.23	1.57	-40.27	-20.00	20.27
4FSK,Frequency: 453.2125MHz-12.5 kHz								
906.43	H	41.66	-55.21	0.00	1.03	-56.24	-20.00	36.24
906.43	V	43.19	-55.65	0.00	1.03	-56.68	-20.00	36.68
1359.64	H	53.34	-50.11	9.41	1.18	-41.88	-20.00	21.88
1359.64	V	55.79	-47.82	9.41	1.18	-39.59	-20.00	19.59
1812.85	H	44.46	-59.77	10.94	1.21	-50.04	-20.00	30.04
1812.85	V	45.69	-58.48	10.94	1.21	-48.75	-20.00	28.75
2266.06	H	50.97	-52.40	11.87	1.19	-41.72	-20.00	21.72
2266.06	V	53.16	-50.94	11.87	1.19	-40.26	-20.00	20.26
2719.28	H	40.99	-61.38	12.29	1.35	-50.44	-20.00	30.44
2719.28	V	48.36	-54.76	12.29	1.35	-43.82	-20.00	23.82
3172.49	H	40.87	-60.65	12.33	1.54	-49.86	-20.00	29.86
3172.49	V	47.21	-53.72	12.33	1.54	-42.93	-20.00	22.93
3625.70	H	45.67	-54.90	12.23	1.57	-44.24	-20.00	24.24
3625.70	V	53.79	-45.86	12.23	1.57	-35.20	-20.00	15.20

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

FCC §2.1055 & §90.213 - FREQUENCY STABILITY

Applicable Standard

FCC §2.1055, §90.213

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external 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 leads and RF output cable exited the chamber through an opening made for the purpose.

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

Test Data

Environmental Conditions

Temperature:	26.4 ℃
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

The testing was performed by Blake Yang on 2019-06-18

Test Mode: Transmitting

FM,12.5kHz, Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	7.4	453.211812	-1.52
-20		453.211808	-1.53
-10		453.211804	-1.54
0		453.211809	-1.53
10		453.211801	-1.54
20		453.211809	-1.52
30		453.211805	-1.53
40		453.211817	-1.51
50		453.211824	-1.49
20	6.3	453.211811	-1.52
20	8.4	453.211816	-1.51

4FSK, 12.5kHz, Reference Frequency:453.2125 MHz, Limit: ±2.5 ppm			
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
-30	7.4	453.211811	-1.52
-20		453.211809	-1.52
-10		453.211801	-1.54
0		453.211816	-1.51
10		453.211809	-1.52
20		453.211801	-1.54
30		453.211807	-1.53
40		453.211815	-1.51
50		453.211821	-1.50
20	6.3	453.211815	-1.51
20	8.4	453.211811	-1.52

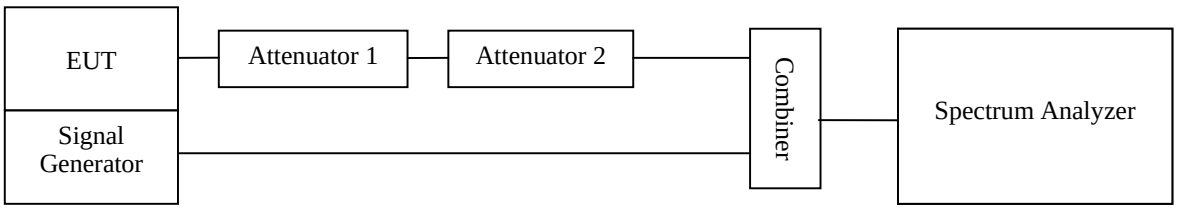
FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

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

Test Procedure

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



Test Data

Environmental Conditions

Temperature:	26.4 ℃
Relative Humidity:	56 %
ATM Pressure:	100.9 kPa

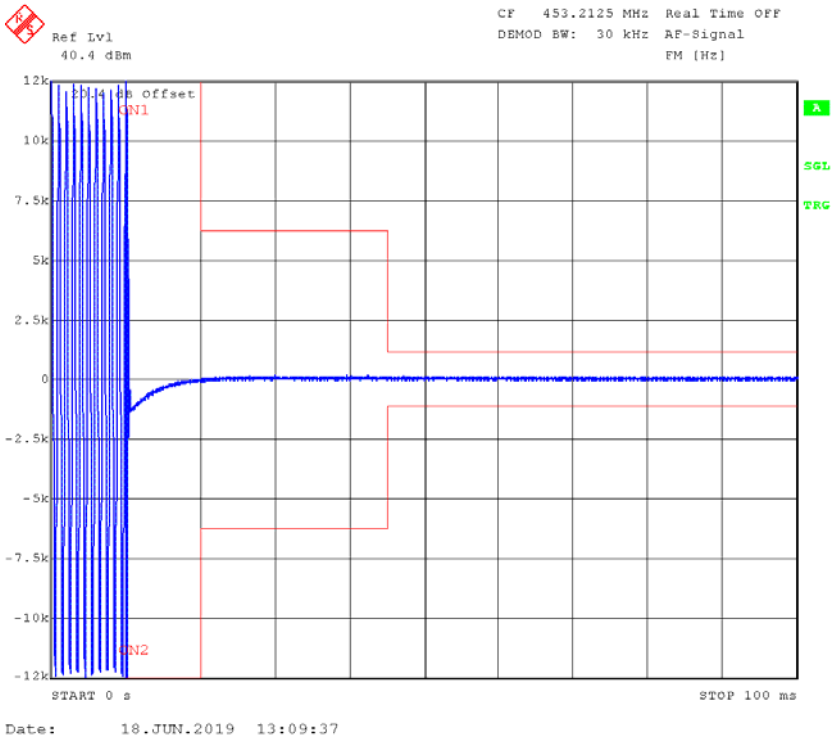
The testing was performed by Blake Yang on 2019-06-18.

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

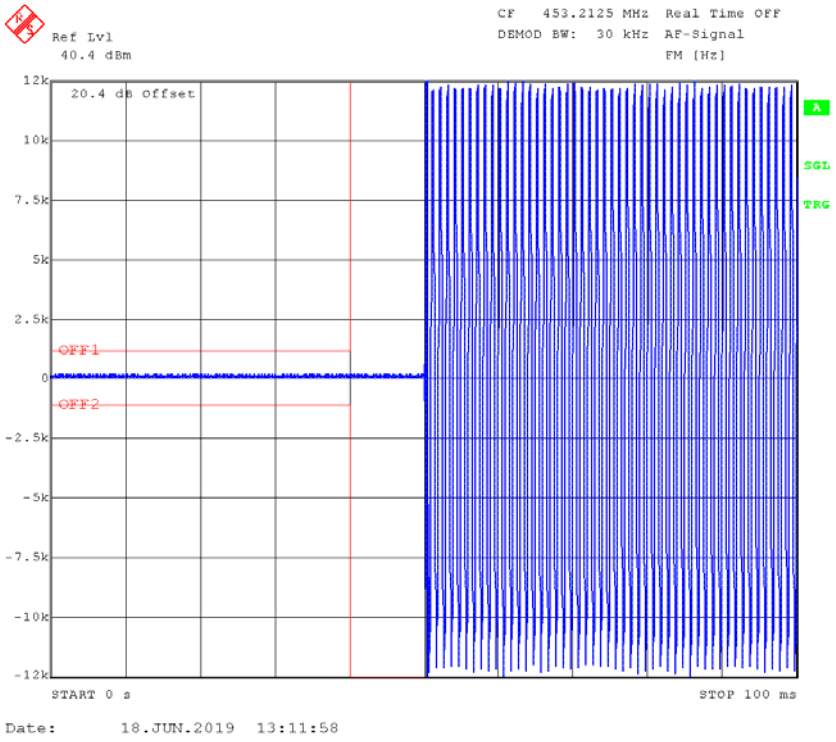
Please refer to the following plots.

FM, High Power Channel: 453.2125 MHz, 12.5kHz

Turn on



Turn off



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