

FCC PART 95 MEASUREMENT AND TEST REPORT

For

QUANZHOU KAILI ELECTRONICS CO.,LTD.

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City,Fujian Province,China

FCC ID: 2AQX5KD-C51

Report Type: Original Report	Product Type: two way radio
Report Number: RXM190510056-00	
Report Date: 2019-06-10	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

EUT Name:	two way radio
EUT Model:	KD-C51
Multiple Models:	KD-C50, KD-C52, KD-C53, KD-C55, KD-C56
Modulation Type:	FM
Rated Input Voltage:	3.7Vdc from battery
External Dimension:	60mm(L)*21mm(W)*135mm(H)
Serial Number:	190510056
EUT Received Date:	2019.05.14

Note: The series product, models KD-C50, KD-C52, KD-C53, KD-C55, KD-C56 are electrically identical with model KD-C51, we selected KD-C51 for fully testing, the differences details was explained in the declaration letter.

Objective

This report is prepared on behalf of **QUANZHOU KAILI ELECTRONICS CO.,LTD.** in accordance with Part 2 and Part 95, Subpart A and B of the Federal Communication Commissions 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 Part 95 Subpart A and Subpart B of the Federal Communication Commissions rules, and TIA-603-D, Land Mobile FM or PM-Communications Equipment-Measurement and Performance Standards.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

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

Test Facility

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

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218,the FCC Designation No. : CN1220.

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

SYSTEM TEST CONFIGURATION

Description of Test Configuration

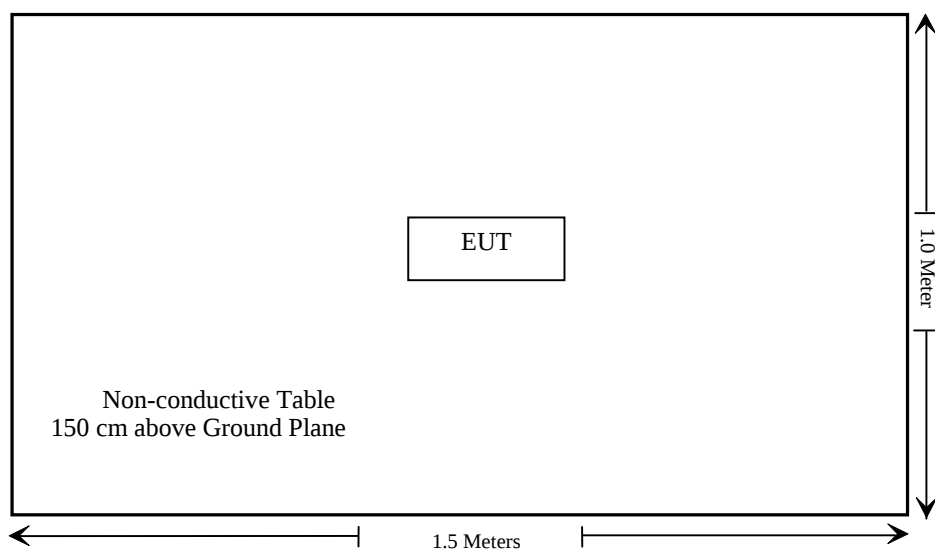
The system was configured for testing in a typical fashion (as normally used by a typical user).

The device uses total 22 FRS channels as below:

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	462.5625	12	467.6625
2	462.5875	13	467.6875
3	462.6125	14	467.7125
4	462.6375	15	462.5500
5	462.6625	16	462.5750
6	462.6875	17	462.6000
7	462.7125	18	462.6250
8	467.5625	19	462.6500
9	467.5875	20	462.6750
10	467.6125	21	462.7000
11	467.6375	22	462.7250

Channel 1-7, 15-22 with high and low power, Channel 8-14 only has one power level

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§2.1093	RF Exposure	Compliance
§95.587(b)	Antenna requirement	Compliance
§2.1046, §95.567	RF Output Power	Compliance
§2.1047, §95.575	Modulation Characteristic	Compliance
§2.1049, §95.573, §95.579	Authorized Bandwidth & Emission Mask	Compliance
§2.1053, §95.579	Spurious Radiated Emissions	Compliance
§2.1055(d), §95.565	Frequency Stability	Compliance

FCC §2.1093 - RF EXPOSURE INFORMATION

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

Test Result

Please refer to SAR Report Number: RXM190510056-20.

FCC §95.587 (B)– ANTENNA REQUIREMENT

Applicable Standard

According to FCC §95.587 (b) Antenna.

The antenna of each FRS transmitter type must meet the following requirements.

- (1) The antenna must be a non-removable integral part of the FRS transmitter type.
- (2) The gain of the antenna must not exceed that of a half-wave dipole antenna.
- (3) The antenna must be designed such that the electric field of the emitted waves is vertically polarized when the unit is operated in the normal orientation.

Antenna Connector Construction

The EUT has an integral antenna, the antenna gain is 2.15dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §2.1046, §95.567 - RF OUTPUT POWER**Applicable Standard**

According to FCC §95.567

Each FRS transmitter type must be designed such that the effective radiated power (ERP) on channels 8 through 14 does not exceed 0.5 Watts and the ERP on channels 1 through 7 and 15 through 22 does not exceed 2.0 Watts.

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.

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 emissions were measured by the substitution.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESR3	102453	2018-06-26	2019-06-26
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
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
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2018-09-05	2019-09-05
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05

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

Test Data**Environmental Conditions**

Temperature:	26.8°C
Relative Humidity:	51 %
ATM Pressure:	100.8kPa

The testing was performed by Vern Shen on 2019-05-20

Test Mode: Transmitting

ERP:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd)	Cable Loss (dB)			
Frequency:462.6375MHz High power level								
462.6375	H	94.53	13.20	0.00	0.67	12.53	33.00	20.47
462.6375	V	104.29	25.91	0.00	0.67	25.24	33.00	7.76
Frequency:462.6375MHz Low power level								
462.6375	H	96.24	14.91	0.00	0.67	14.24	33.00	18.76
462.6375	V	98.68	20.30	0.00	0.67	19.63	33.00	13.37
Frequency:467.6375MHz								
467.6375	H	91.00	12.77	0.00	0.68	12.09	27.00	14.91
467.6375	V	99.78	21.55	0.00	0.68	20.87	27.00	6.13

Test Result: Compliance.

FCC §2.1047 & §95.575 - MODULATION CHARACTERISTIC**Applicable Standard**

Per FCC §2.1047 and §95.575:

Each FRS transmitter type must be designed such that the peak frequency deviation does not exceed 2.5 kHz, and the highest audio frequency contributing substantially to modulation must not exceed 3.125 kHz.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
UNI-T	Multimeter	UT39A	M130199938	2019-05-09	2020-05-09
Weinschel	Coaxial Attenuators	53-20-34	LN749	2018-09-05	2019-09-05
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2018-08-31	2019-08-31
HP	RF Communications Test Set	8920A	00 235	2018-07-11	2019-07-11
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/

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

Test Procedure

Test Method: TIA/EIA-603-D

Test Data**Environmental Conditions**

Temperature:	26.8°C
Relative Humidity:	51 %
ATM Pressure:	100.8kPa

The testing was performed by Blake Yang on 2019-05-20

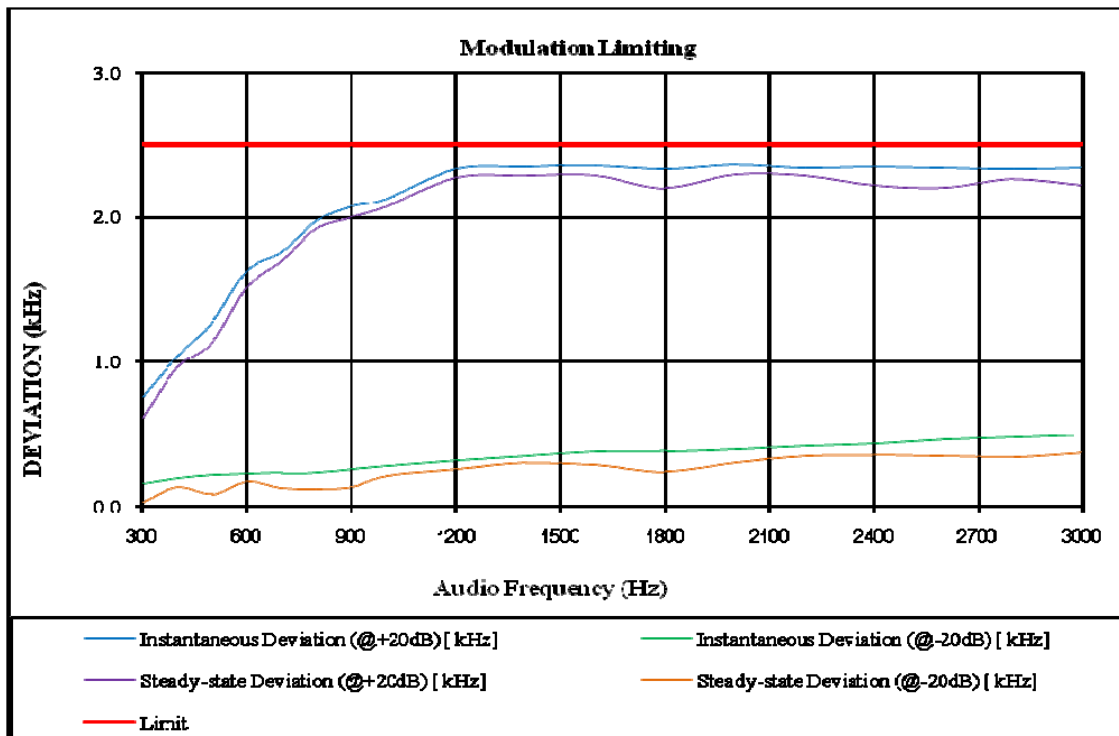
Please refer to the following tables and plots.

Test Mode: Transmitting

MODULATION LIMITING

Carrier Frequency: 462.6375 MHz

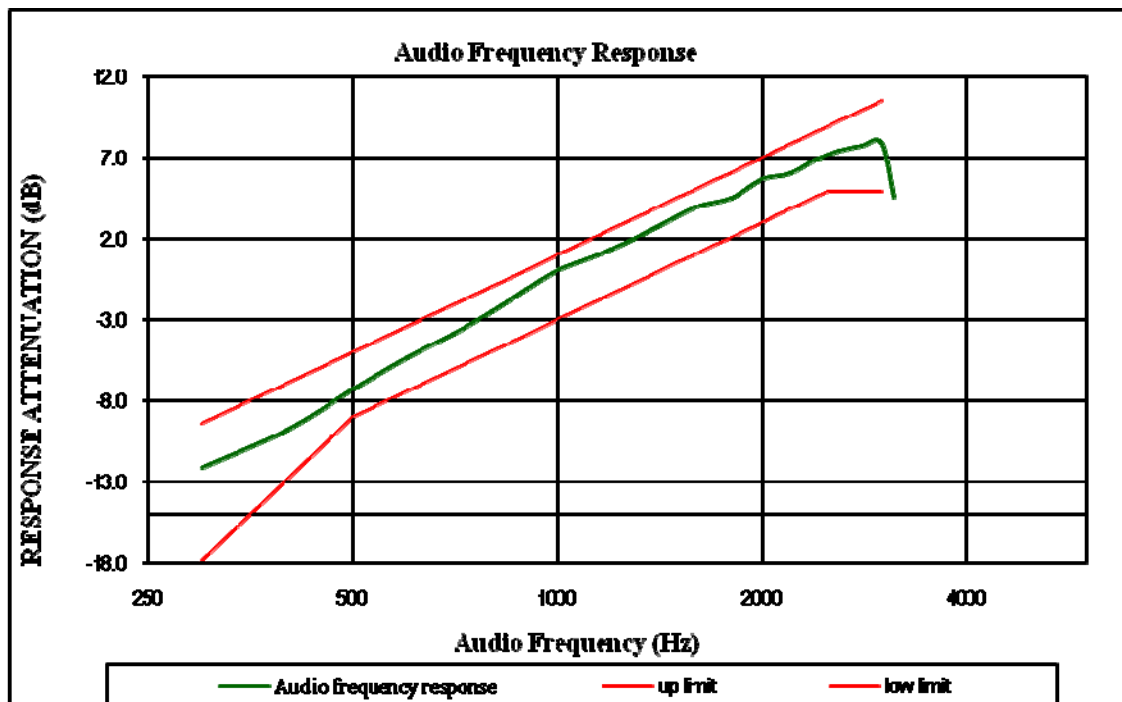
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	
300	0.749	0.154	0.607	0.024	2.5
400	1.035	0.194	0.956	0.127	2.5
500	1.275	0.213	1.130	0.080	2.5
600	1.634	0.224	1.513	0.166	2.5
700	1.763	0.228	1.702	0.122	2.5
800	1.978	0.231	1.920	0.115	2.5
900	2.077	0.256	1.997	0.129	2.5
1000	2.127	0.278	2.077	0.209	2.5
1200	2.338	0.312	2.274	0.255	2.5
1400	2.354	0.347	2.287	0.296	2.5
1600	2.361	0.376	2.290	0.282	2.5
1800	2.337	0.379	2.202	0.236	2.5
2000	2.365	0.394	2.300	0.297	2.5
2200	2.343	0.416	2.291	0.345	2.5
2400	2.352	0.433	2.221	0.351	2.5
2600	2.341	0.462	2.204	0.344	2.5
2800	2.336	0.478	2.263	0.341	2.5
3000	2.345	0.494	2.224	0.365	2.5



Audio Frequency Response

Carrier Frequency: 462.6375 MHz

Audio Frequency (Hz)	Response Attenuation (dB)
300	-12.14
400	-9.80
500	-7.28
600	-5.32
700	-3.88
800	-2.51
900	-1.15
1000	0.00
1200	1.32
1400	2.76
1600	3.92
1800	4.53
2000	5.68
2200	6.01
2400	6.88
2600	7.41
2800	7.72
3000	7.93
3125	4.56



FCC §2.1049, §95.573, §95.579 - AUTHORIZED BANDWIDTH AND EMISSION MASK

Applicable Standard

According to §95.573

Each FRS transmitter type must be designed such that the occupied bandwidth does not exceed 12.5 kHz.

According to §95.579

Each FRS transmitter type must be designed to satisfy the applicable unwanted emissions limits in this paragraph.

(a) Attenuation requirements. The power of unwanted emissions must be attenuated below the carrier power output in Watts (P) by at least:

- (1) 25 dB (decibels) in the frequency band 6.25 kHz to 12.5 kHz removed from the channel center frequency.
- (2) 35 dB in the frequency band 12.5 kHz to 31.25 kHz removed from the channel center frequency.
- (3) $43 + 10 \log (P)$ dB in any frequency band removed from the channel center frequency by more than 31.25 kHz.

Test Procedure

TIA-603-D, section 2.2.11

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2018-08-31	2019-08-31
Weinschel	Coaxial Attenuators	53-20-34	LN749	2018-09-05	2019-09-05
HP	RF Communications Test Set	8920A	00 235	2018-07-11	2019-07-11
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/

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

Test Data**Environmental Conditions**

Temperature:	26.8°C
Relative Humidity:	51 %
ATM Pressure:	100.8kPa

The testing was performed by Vern Shen&Tyler Pan on 2019-05-20

Test Mode: Transmitting

fc (MHz)	Power level	99% Occupied Bandwidth (kHz)	20 dB Bandwidth (kHz)	Limit (kHz)
462.6375	highest	10.020	10.621	12.50
462.6375	lowest	10.020	10.621	12.50
467.6375	/	10.020	10.621	12.50

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

Emission Designator

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

For FM Mode (Channel Spacing: 12.5 kHz)

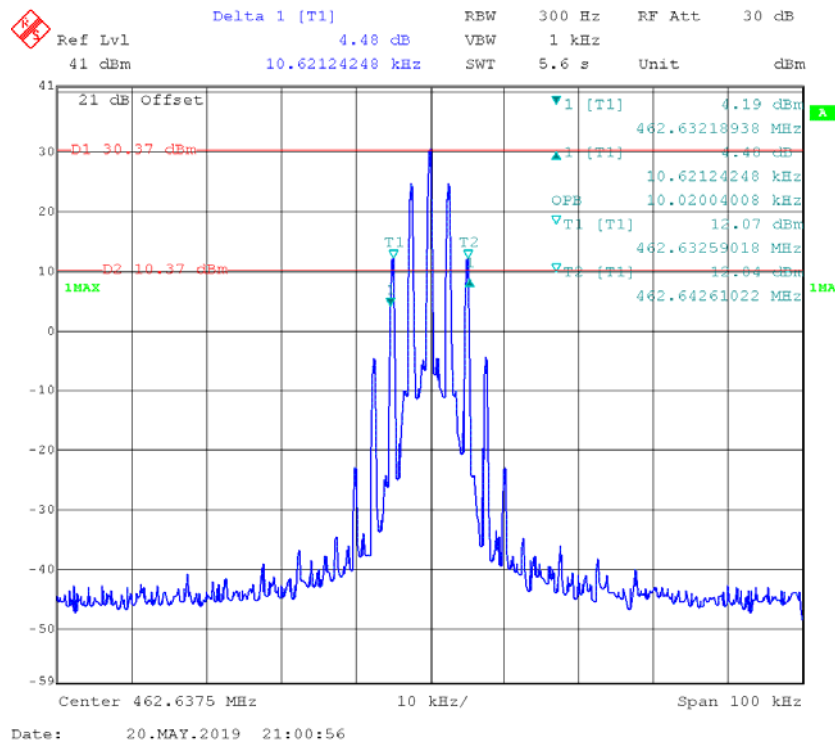
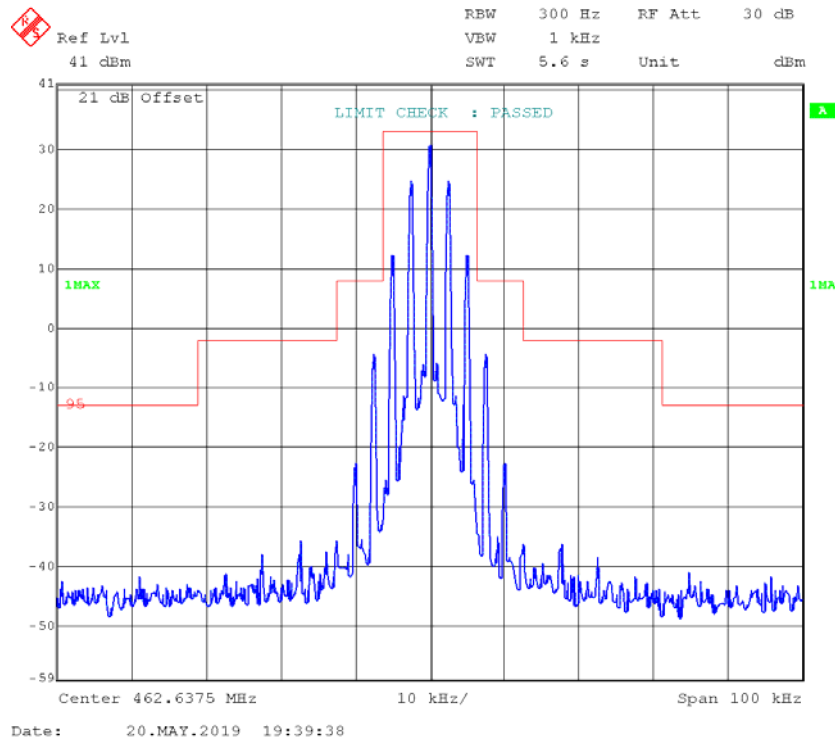
Emission Designator 11K0F3E

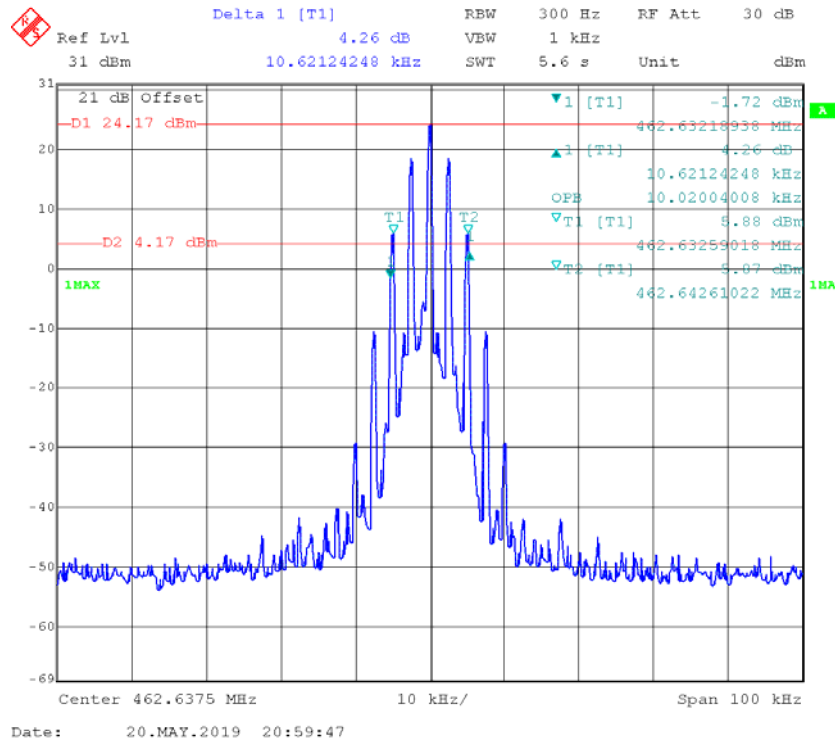
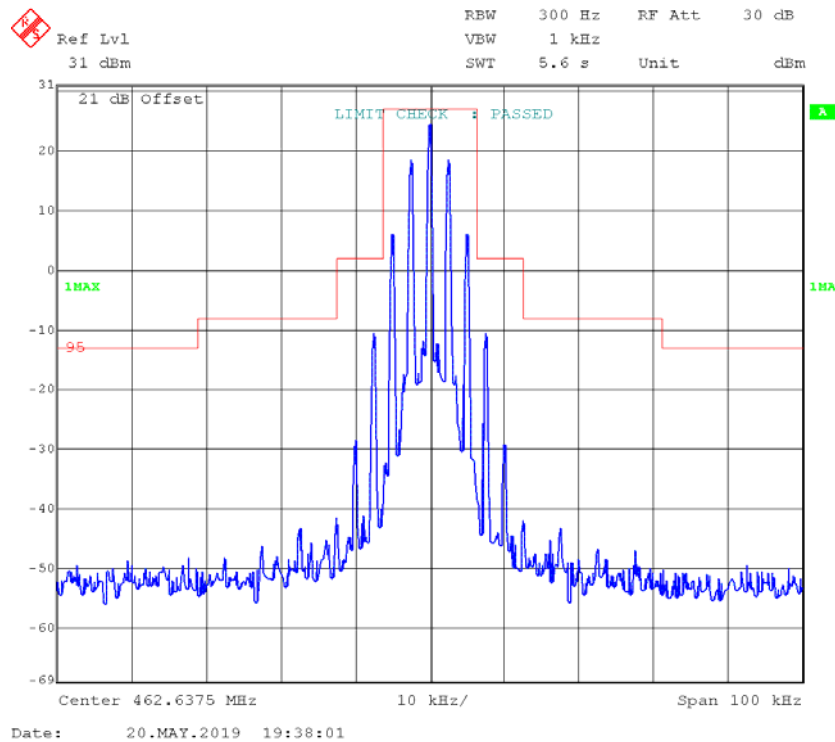
In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.

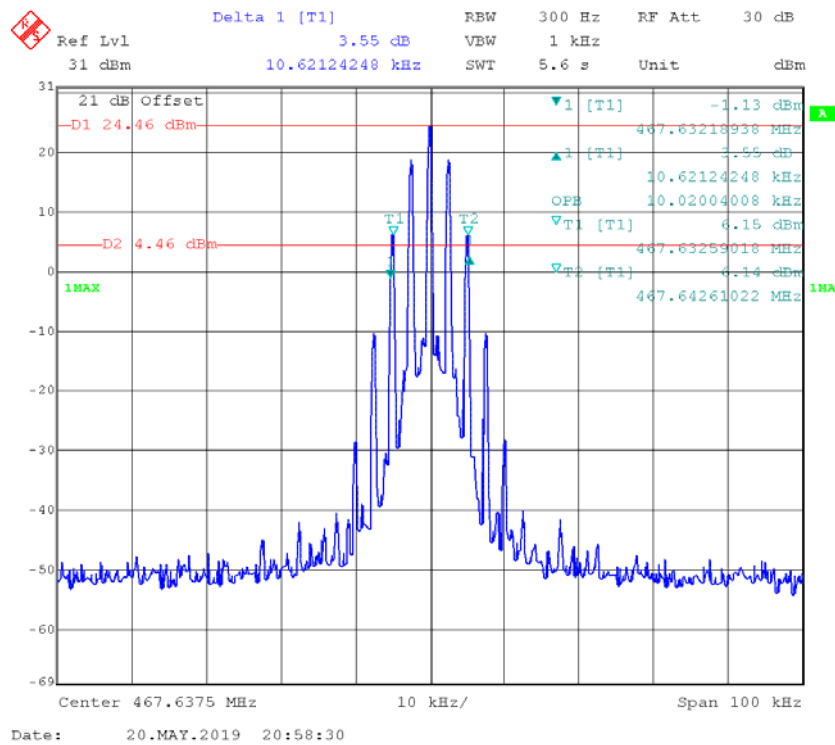
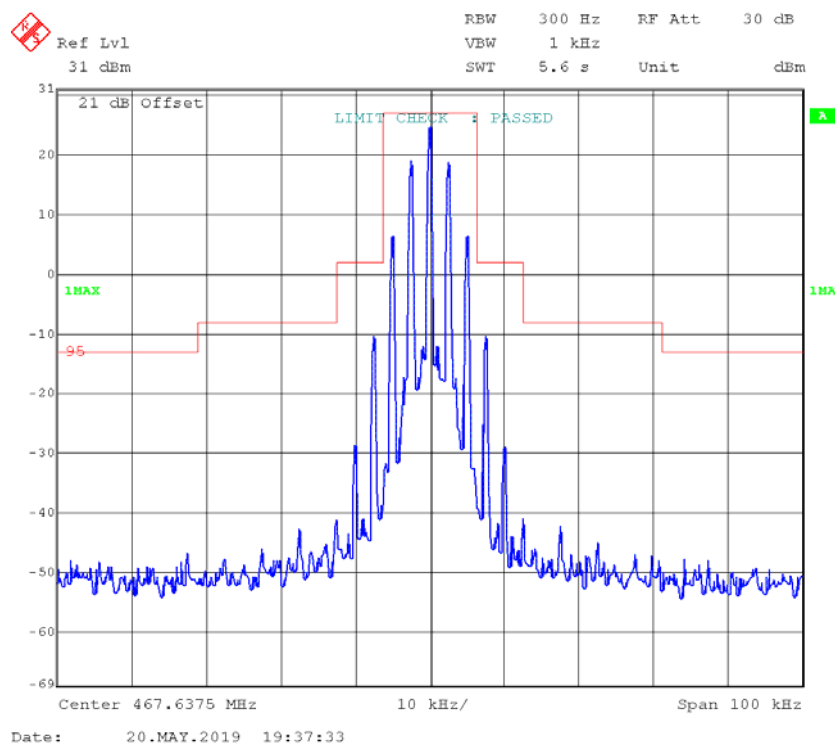
$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 2.5 \text{ kHz}) = 11 \text{ kHz} = 11K0$

F3E portion of the designator represents an FM voice transmission

Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

High Power - 462.6375 MHz 99% Occupied & 26 dB Bandwidth**Emission Mask D**

Low Power - 462.6375 MHz 99% Occupied & 26 dB Bandwidth**Emission Mask D**

467.6375 MHz 99% Occupied & 26 dB Bandwidth**Emission Mask D**

FCC §2.1053 & §95.579 - RADIATED SPURIOUS EMISSION

Applicable Standard

FCC §2.1053 and §95.579

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 tenth 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 = 43+10 Log₁₀ (power out in Watts)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESR3	102453	2018-06-26	2019-06-26
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
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
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2018-09-05	2019-09-05
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05
Agilent	Signal Generator	E8247C	MY43321350	2018-12-10	2019-12-10
R&S	Spectrum Analyzer	FSP 38	100478	2018-12-10	2019-12-10
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

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

Test Data**Environmental Conditions**

Temperature:	26.8°C
Relative Humidity:	51 %
ATM Pressure:	100.8kPa

The testing was performed by Blake Yang on 2019-05-20

Test Mode: Transmitting (462.6375MHz high power level is the worst case)

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:462.6375MHz								
925.2750	H	65.68	-30.41	0.00	0.97	-31.38	-13.00	18.38
925.2750	V	65.50	-32.42	0.00	0.97	-33.39	-13.00	20.39
1387.91	H	60.73	-42.94	9.53	1.21	-34.62	-13.00	21.62
1387.91	V	58.86	-44.92	9.53	1.21	-36.60	-13.00	23.60
1850.55	H	63.39	-40.81	11.05	1.20	-30.96	-13.00	17.96
1850.55	V	61.05	-43.08	11.05	1.20	-33.23	-13.00	20.23
2313.19	H	50.84	-52.42	11.94	1.20	-41.68	-13.00	28.68
2313.19	V	51.83	-52.29	11.94	1.20	-41.55	-13.00	28.55
2775.83	H	53.94	-48.33	12.31	1.38	-37.40	-13.00	24.40
2775.83	V	49.77	-53.07	12.31	1.38	-42.14	-13.00	29.14
3238.46	H	51.15	-50.24	12.30	1.55	-39.49	-13.00	26.49
3238.46	V	53.39	-47.23	12.30	1.55	-36.48	-13.00	23.48
3701.10	H	51.60	-48.77	12.24	1.55	-38.08	-13.00	25.08
3701.10	V	48.96	-50.83	12.24	1.55	-40.14	-13.00	27.14
FM, frequency:467.6375MHz								
935.2750	H	64.97	-30.70	0.00	0.94	-31.64	-13.00	18.64
935.2750	V	68.00	-29.43	0.00	0.94	-30.37	-13.00	17.37
1402.91	H	63.42	-40.37	9.59	1.23	-32.01	-13.00	19.01
1402.91	V	59.85	-44.03	9.59	1.23	-35.67	-13.00	22.67
1870.55	H	64.60	-39.57	11.11	1.19	-29.65	-13.00	16.65
1870.55	V	61.42	-42.69	11.11	1.19	-32.77	-13.00	19.77
2338.19	H	54.77	-48.42	11.97	1.20	-37.65	-13.00	24.65
2338.19	V	52.53	-51.61	11.97	1.20	-40.84	-13.00	27.84
2805.83	H	45.68	-56.53	12.32	1.40	-45.61	-13.00	32.61
2805.83	V	47.83	-54.86	12.32	1.40	-43.94	-13.00	30.94
3273.46	H	55.26	-46.07	12.29	1.56	-35.34	-13.00	22.34
3273.46	V	55.72	-44.74	12.29	1.56	-34.01	-13.00	21.01
3741.10	H	51.68	-48.58	12.25	1.53	-37.86	-13.00	24.86
3741.10	V	48.39	-51.48	12.25	1.53	-40.76	-13.00	27.76

FCC§2.1055 (d), §95.565- FREQUENCY STABILITY**Applicable Standard**

According to FCC §2.1055(a) (1),

The frequency stability shall be measured with variation of ambient temperature from -30°C to $+50^{\circ}\text{C}$, and according to FCC 2.1055(d) (2), the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.

According to FCC §95.565

Each FRS transmitter type must be designed such that the carrier frequencies remain within ± 2.5 parts-per-million of the channel center frequencies specified in § 95.563 during normal operating conditions.

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 Frequency Counter.

Frequency Stability vs. Voltage:

1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

The output frequency was recorded for each voltage.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
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	N/A	N/A	N/A
Weinschel	Coaxial Attenuators	53-20-34	LN749	2018-09-05	2019-09-05
HP	RF Communications Test Set	8920A	3438A05201	2019-01-04	2020-01-04
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	/

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

Test Data**Environmental Conditions**

Temperature:	26.8℃
Relative Humidity:	51 %
ATM Pressure:	100.8kPa

The testing was performed by Blake Yang on 2019-05-20

Test Mode: Transmitting

Reference Frequency: 462.6375 MHz				
Temperature	Voltage	Reading	Frequency Error	Limit
℃	Vdc	MHz	ppm	ppm
-30	3.7	462.637337	-0.35	2.5
-20		462.637352	-0.32	
-10		462.637376	-0.27	
0		462.637405	-0.21	
10		462.637410	-0.19	
20		462.637470	-0.06	
30		462.637346	-0.33	
40		462.637416	-0.18	
50		462.637336	-0.35	
20	3.5	462.637413	-0.19	2.5
20	4.2	462.637420	-0.17	2.5

Reference Frequency: 467.6375 MHz				
Temperature	Voltage	Reading	Frequency Error	Limit
℃	Vdc	MHz	ppm	ppm
-30	3.7	467.637396	-0.22	2.5
-20		467.637389	-0.24	
-10		467.637404	-0.21	
0		467.637390	-0.24	
10		467.637407	-0.20	
20		467.637470	-0.06	
30		467.637379	-0.26	
40		467.637387	-0.24	
50		467.637335	-0.35	
20	3.5	467.637336	-0.35	2.5
20	4.2	467.637352	-0.32	2.5

Note: The extreme voltage was declared by applicant.

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