



FCC PART 90 TEST REPORT

For

Kirisun Communications Co., Ltd.

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FCC ID: Q5ETP66002

Report Type: Original Report	Product Type: DMR Two Way Radio
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Report Number: <u>R2DG140702004-00</u>	
Report Date: <u>2014-09-19</u>	
Leon Chen <i>Leon Chen</i>	
Reviewed By: <u>RF Engineer</u>	
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FINAL

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Kirisun Communications Co., Ltd.*'s product, model: *TP660 (FCC ID: Q5ETP66002)* (the "EUT") in this report is a *DMR Two Way Radio*, which was measured approximately: 13.9 cm (H) x 6.0 cm (W) x 3.9 cm (T), rated input voltage: DC 7.4V from lithium battery.

** All measurement and test data in this report was gathered from production sample serial number: 140702004 (Assigned by the BACL, Dongguan). The EUT was received on 2014-07-07.*

Objective

This test report is prepared on behalf of *Kirisun Communications Co., Ltd.* in accordance with Part 2 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 as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-D and ANSI 63.4-2003.

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

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 Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) 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 February 02, 2012. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

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

SYSTEM TEST CONFIGURATION

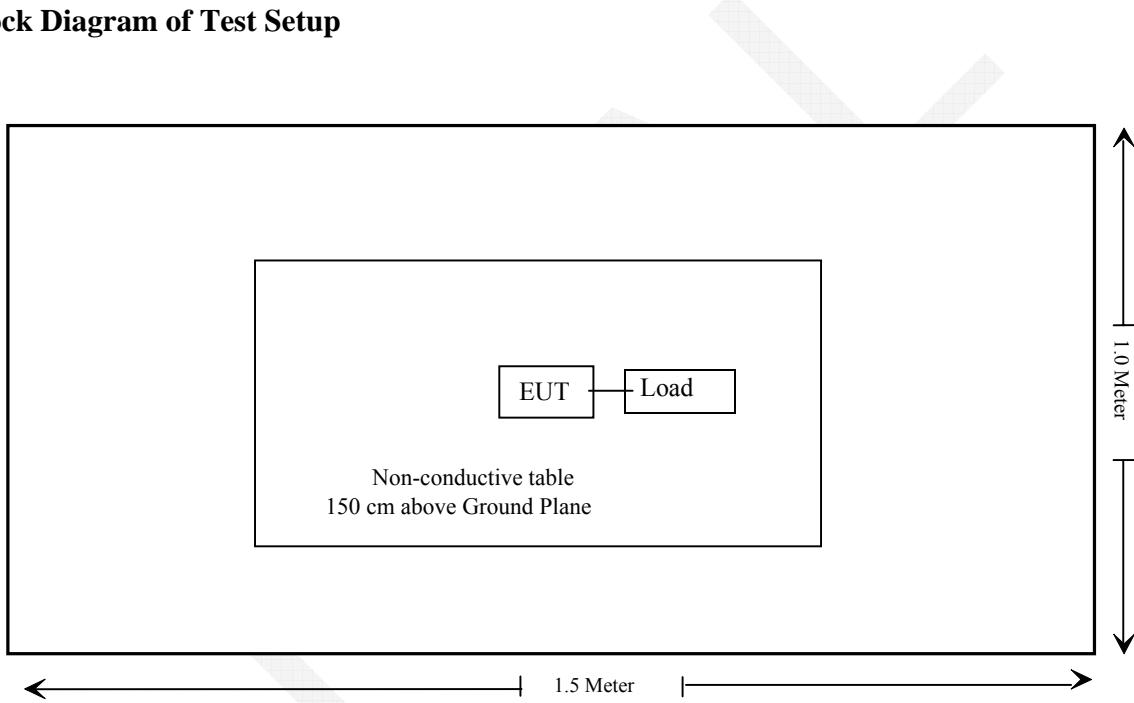
Description of Test Configuration

The system was configured for testing in a test mode.

EUT Specification:

Operating Frequency Band	400-470 MHz
Modulation Mode	FM/4FSK
Channel Separation	12.5 kHz
Rated Output Power	High power level: 4 W Low power level: 1 W

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

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

FCC §1.1310 & §2.1093 - RF EXPOSURE

Applicable Standard

FCC§1.1310 and §2.1093.

Test Result

Compliance, please refer to the SAR report: R2DG140702004-20A.

FINAL

FCC §2.1046 & §90.205- RF OUTPUT POWER

Applicable Standard

FCC §2.1046 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
R&S	Spectrum Analyzer	FSEM	DE31388	2014-05-09	2015-05-09

* **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:	30.8 °C
Relative Humidity:	65 %
ATM Pressure:	99.4 kPa

The testing was performed by Dean Liu on 2014-07-24

Test Result: Compliant. Please refer to following tables.

Modulation mode	Channel Separation	f _c (MHz)	Conducted Output Power (W)		Note
			High	Low	
FM	12.5 kHz	400.025	3.94	1.18	Not for FCC Review
		417.5	4.24	1.22	/
		435	4.13	1.14	/
		452.5	4.30	1.12	/
		469.975	4.30	1.20	/
4FSK	12.5 kHz	400.025	3.89	1.12	Not for FCC Review
		417.5	4.19	1.18	/
		435	4.09	1.22	/
		452.5	4.26	1.14	/
		469.975	4.30	1.28	/

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	00 235	2014-05-09	2015-05-09

*** 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:	30.8 °C
Relative Humidity:	65 %
ATM Pressure:	99.4 kPa

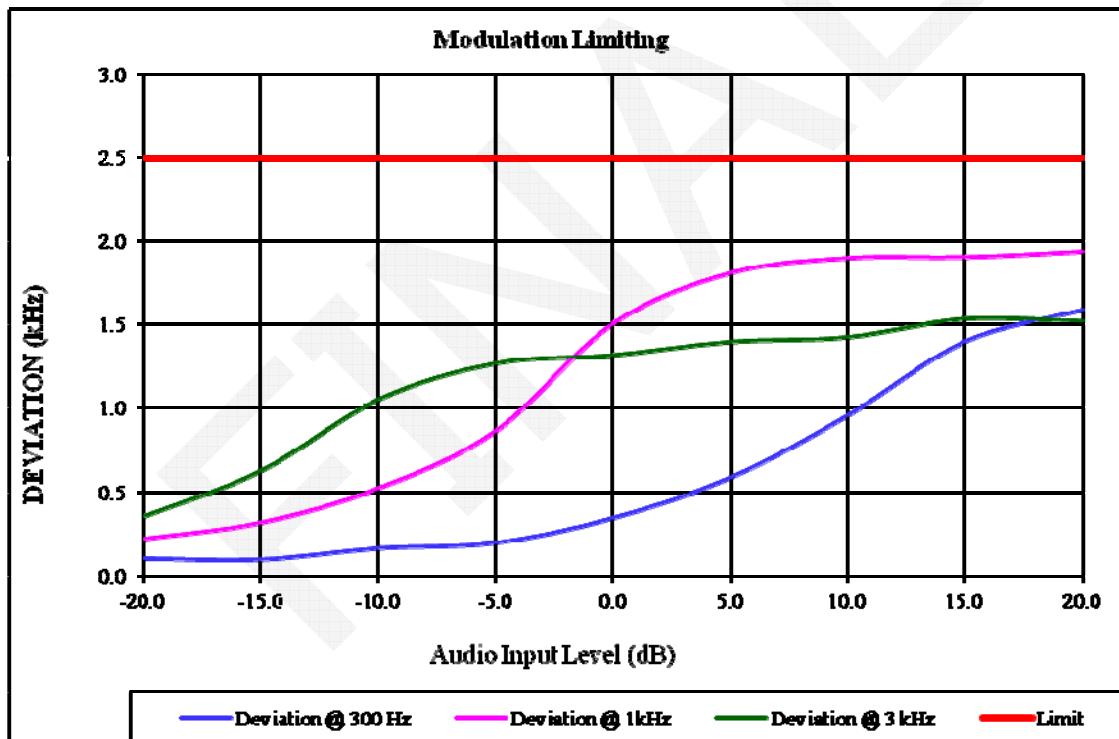
The testing was performed by Dean Liu on 2014-07-24

Test Result: Compliant. Please refer to following plots.

MODULATION LIMITING

Carrier Frequency: 435MHz, Channel Separation = 12.5 kHz, high power level

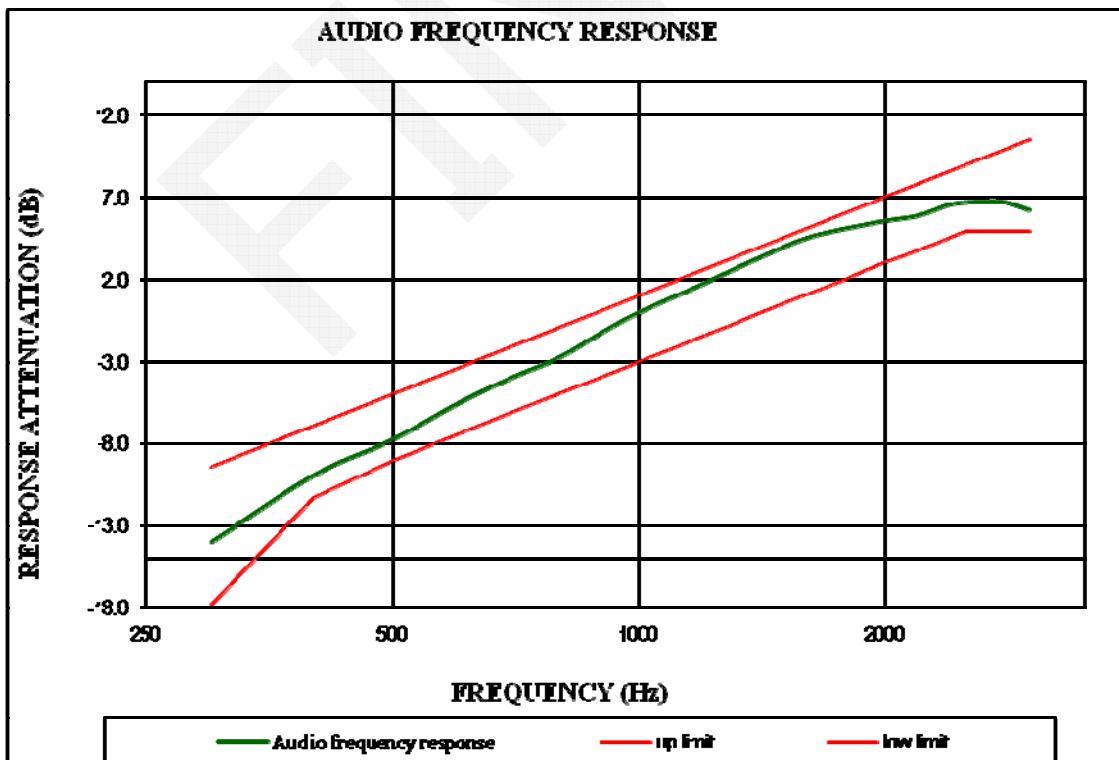
Audio Input Level [dB]	Frequency Deviation (kHz)			FCC Limit [kHz]
	@ 300 Hz	@ 1kHz	@ 3 kHz	
20.0	1.589	1.940	1.524	2.5
15.0	1.399	1.907	1.539	2.5
10.0	0.955	1.902	1.428	2.5
5.0	0.582	1.810	1.400	2.5
0.0	0.341	1.506	1.319	2.5
-5.0	0.191	0.862	1.270	2.5
-10.0	0.158	0.519	1.051	2.5
-15.0	0.090	0.313	0.623	2.5
-20.0	0.096	0.215	0.348	2.5



Audio Frequency Response

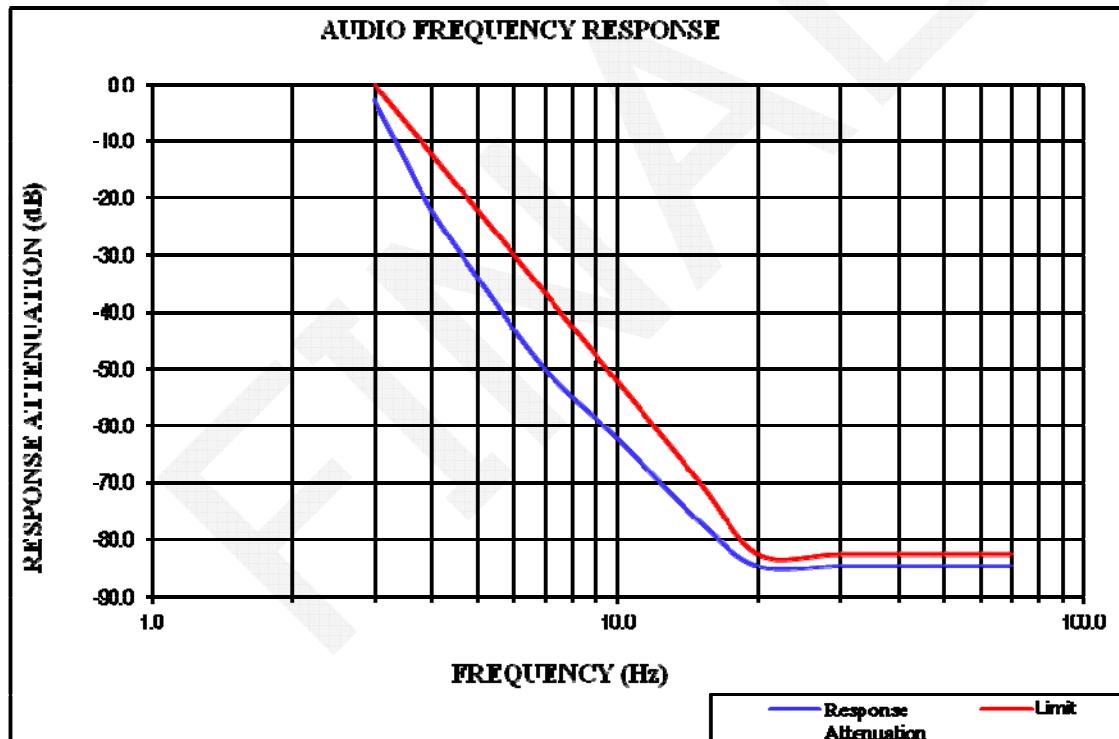
Carrier Frequency: 435 MHz, Channel Separation = 12.5 kHz, high power level

Audio Frequency (Hz)	Response Attenuation (dB)
300	-13.96
400	-9.89
500	-7.72
600	-5.53
700	-3.93
800	-2.72
900	-1.22
1000	0.01
1200	1.77
1400	3.31
1600	4.52
1800	5.13
2000	5.57
2200	5.90
2400	6.57
2600	6.74
2800	6.71
3000	6.23



Audio Frequency Low Pass Filter Response

Audio Frequency	Response Attenuation	Limit
kHz	dB	dB
3.0	-2.8	0.0
3.5	-13.4	-6.7
4.0	-22.5	-12.5
5.0	-33.9	-22.2
7.0	-50.2	-36.8
10.0	-62.3	-52.3
15.0	-76.8	-69.9
20.0	-84.6	-82.5
30.0	-84.6	-82.5
50.0	-84.6	-82.5
70.0	-84.6	-82.5



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

Applicable Standard

FCC §2.1049, §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 (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

Test Equipment List and Details(ESPI)

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	DE31388	2014-05-09	2015-05-09
HP	RF Communications Test Set	8920A	00 235	2014-05-09	2015-05-09

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

Test Procedure

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

Test Data

Environmental Conditions

Temperature:	30.8 °C
Relative Humidity:	65 %
ATM Pressure:	99.4 kPa

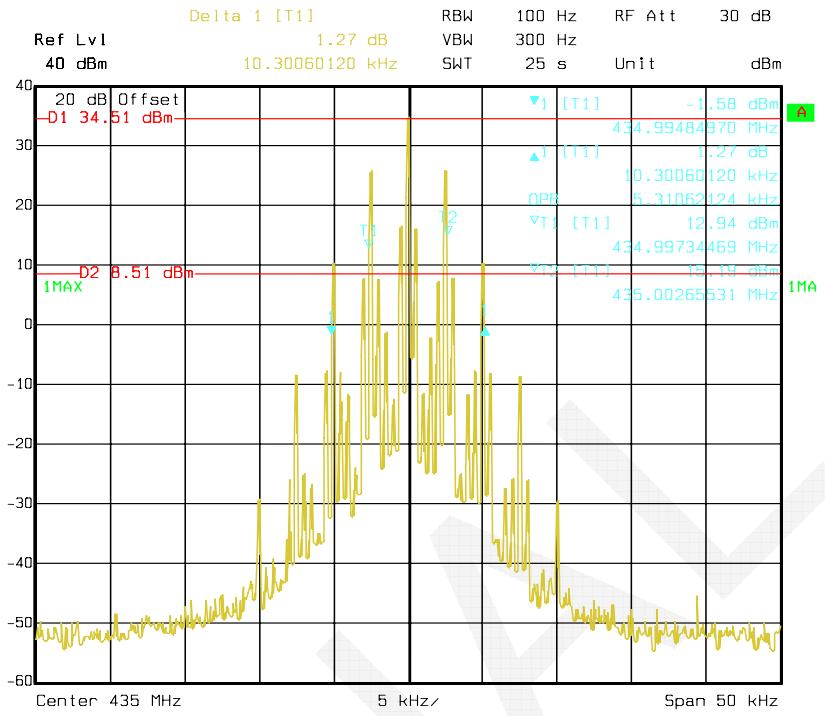
The testing was performed by Dean Liu on 2014-07-24

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

Modulation Mode	Channel Separation		f _c	26 dB Bandwidth	Power Level
	kHz	MHz			
FM	12.5	435	10.30	10.10	High
4FSK			10.30		
FM			9.80	9.80	Low
4FSK			9.80		

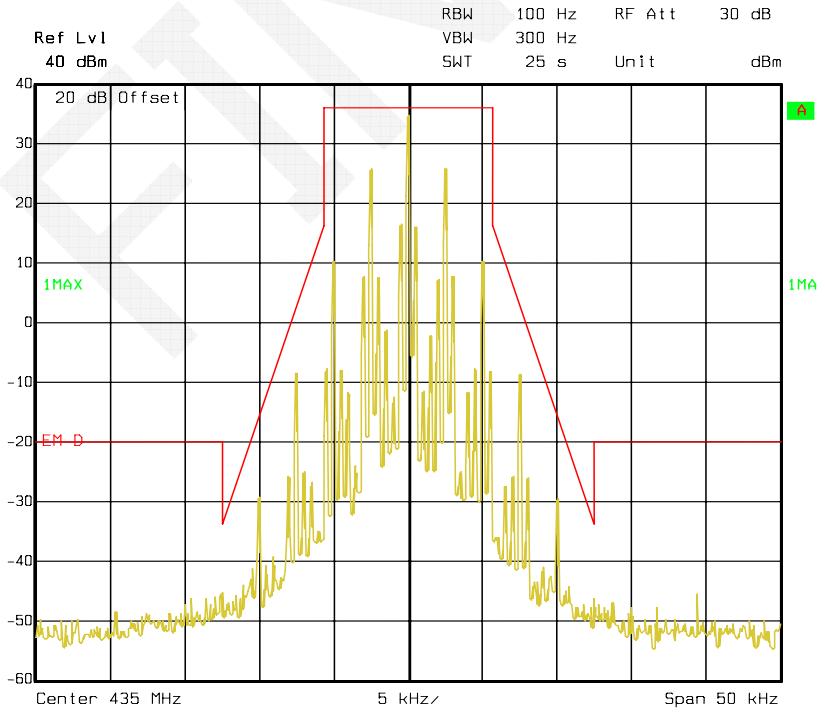
Part 90:

Occupied Bandwidth – FM, 435 MHz, High Power Level



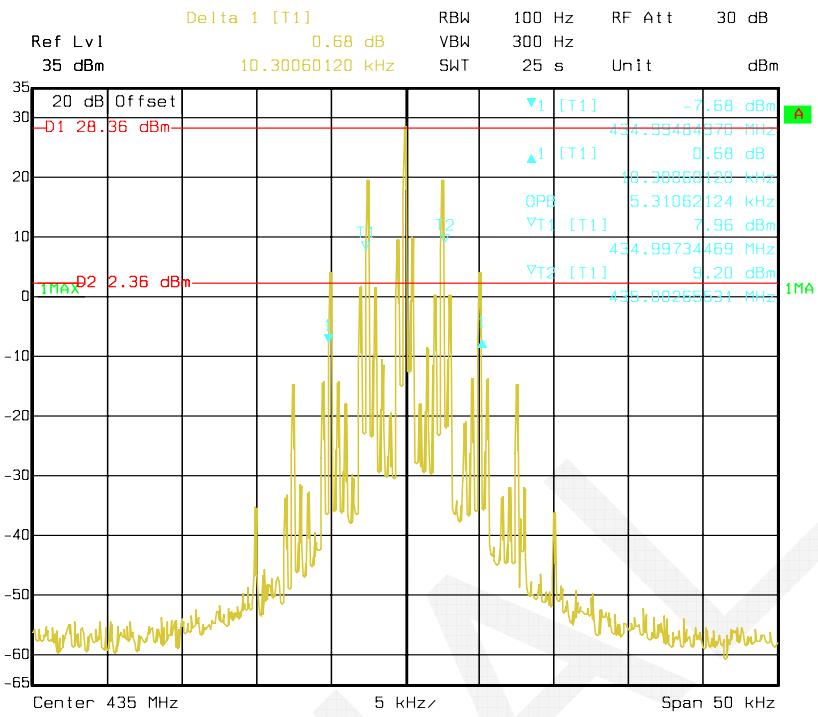
Date: 24.JUL.2014 15:27:10

Emission Mask - Type D



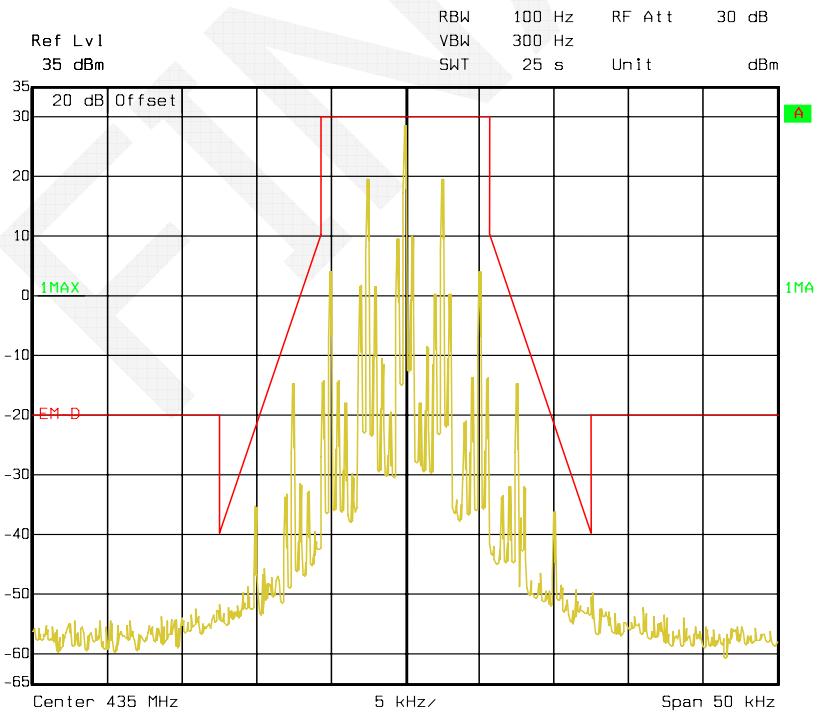
Date: 24.JUL.2014 15:28:05

Occupied Bandwidth – FM, 435 MHz, Low Power Level

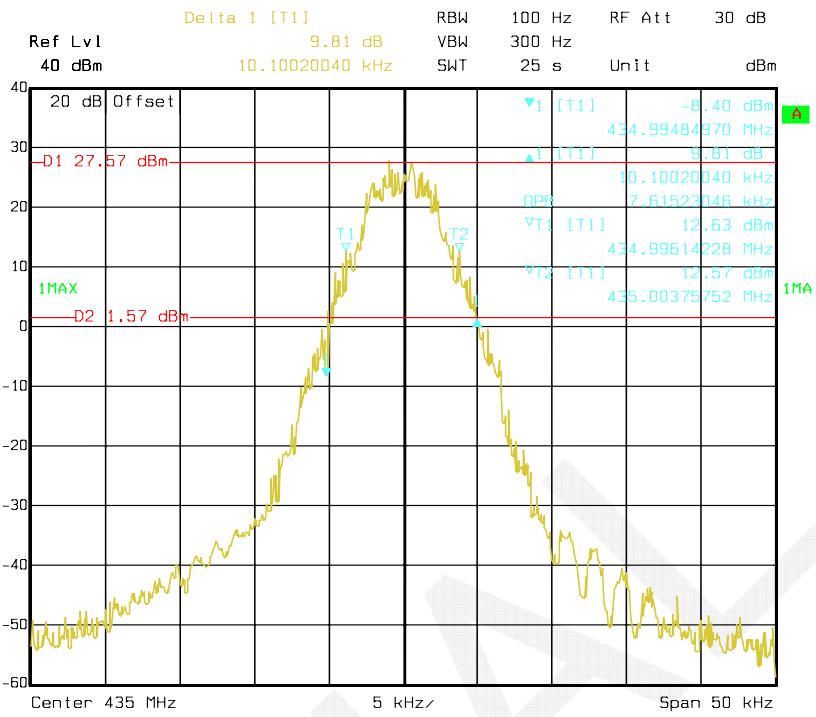


Date: 24.JUL.2014 15:35:44

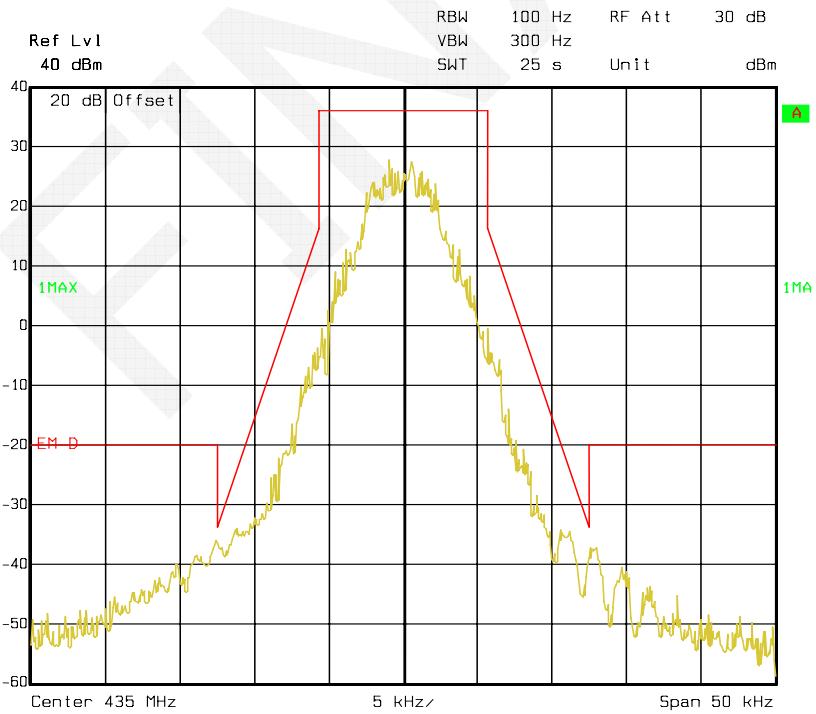
Emission Mask - Type D



Date: 24.JUL.2014 15:35:58

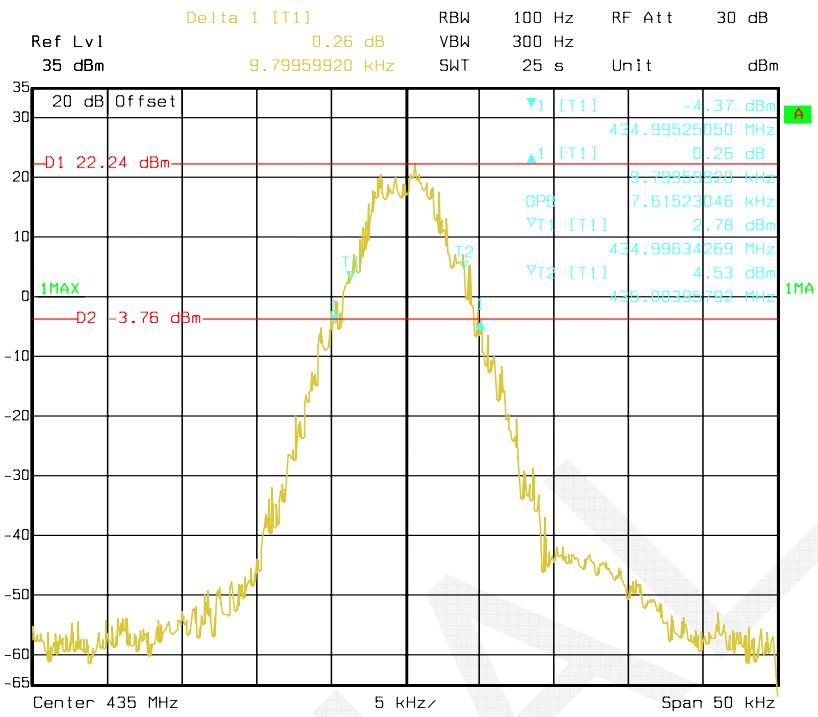
Occupied Bandwidth -4FSK, 435 MHz, High Power Level

Date: 24.JUL.2014 15:30:32

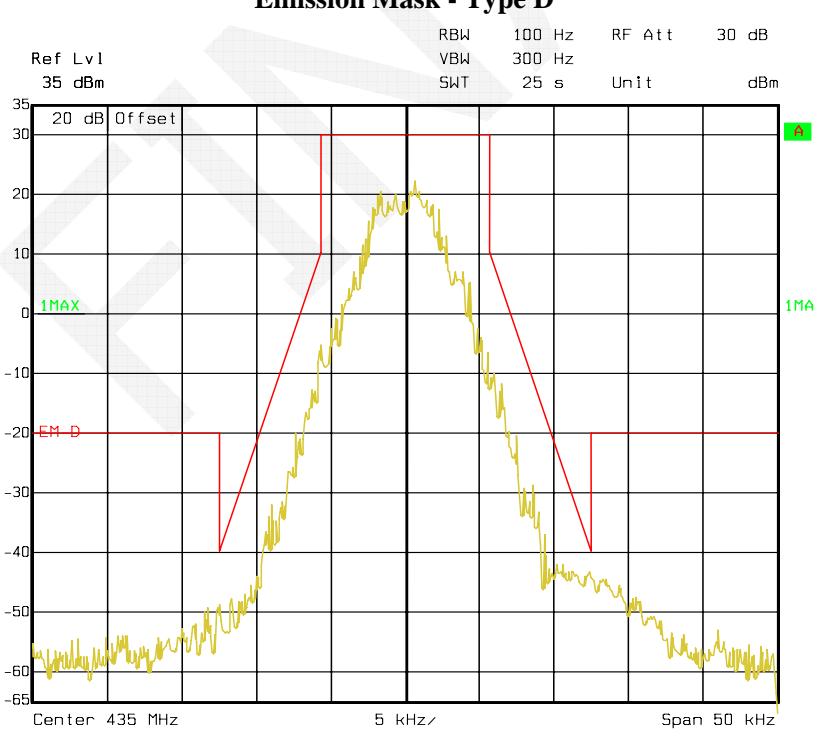
Emission Mask - Type D

Date: 24.JUL.2014 15:29:55

Occupied Bandwidth – 4FSK, 435 MHz, Low Power Level



Emission Mask - Type D



FCC §2.1051&§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 (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	DE31388	2014-05-09	2015-05-09
HP	RF Communications Test Set	8920A	00 235	2014-05-09	2015-05-09

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

Test Procedure

Adjust the spectrum analyzer for the following settings:

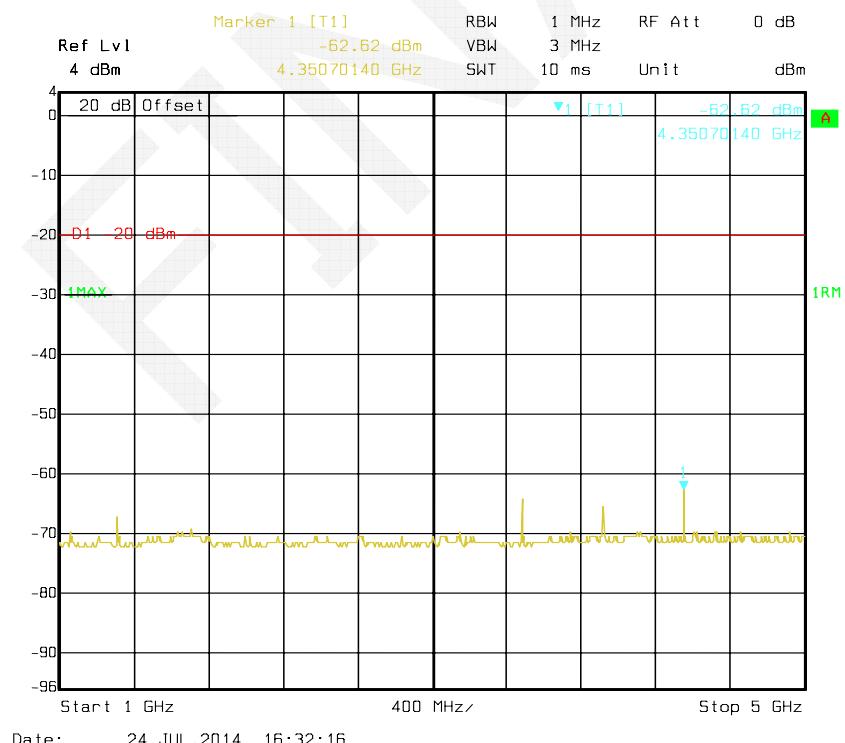
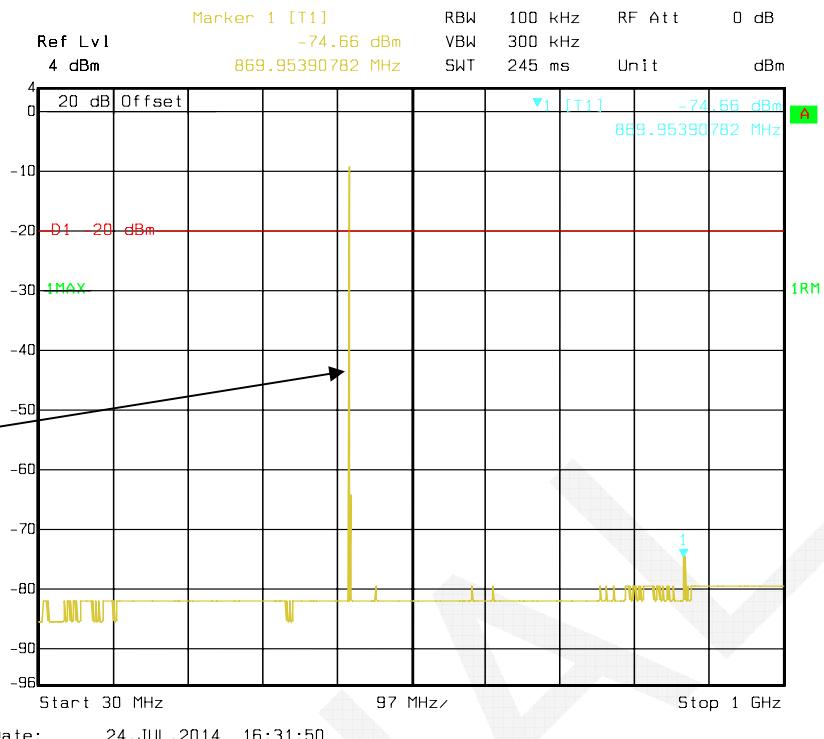
- 1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
- 2) Video Bandwidth ≥ 3 times the resolution bandwidth.
- 3) Sweep Speed ≤ 2000 Hz per second.
- 4) Detector Mode = mean or average power.

Test Data

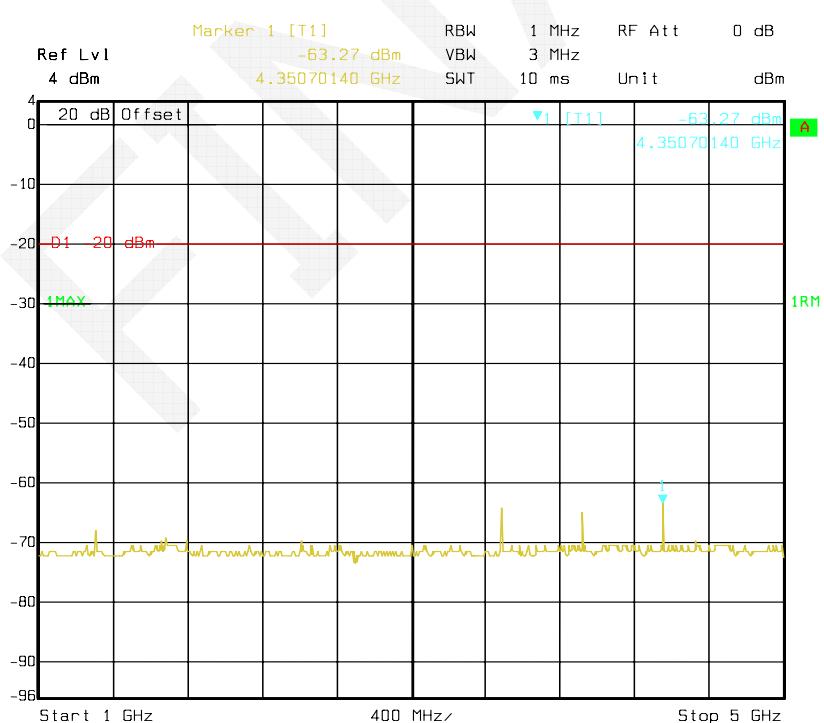
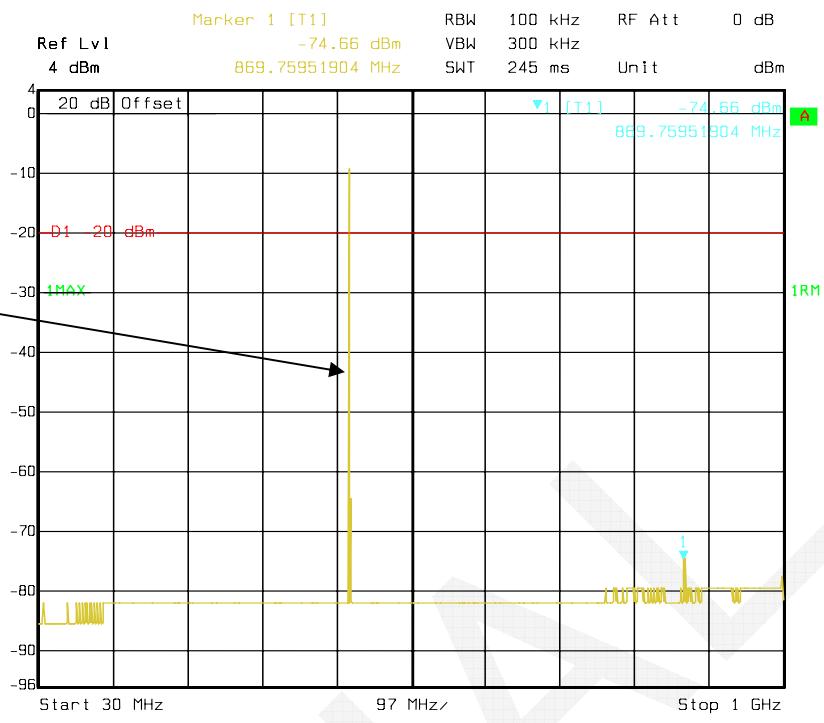
Environmental Conditions

Temperature:	30.8 °C
Relative Humidity:	65 %
ATM Pressure:	99.4 kPa

The testing was performed by Dean Liu on 2014-07-24

435 MHz – FM Mode, High Power

435 MHz -4FSK Mode, High Power



FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053 and §90.210

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
HP	Signal Generator	8648A	3426A00831	2013-11-06	2014-11-06
Sunol Sciences	Antenna	JB3	A060611-1	2011-09-06	2014-09-05
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
HP	Amplifier	8447E	2434A02181	2013-09-06	2014-09-06
R&S	EMI Test Receiver	ESCI	100224	2014-05-09	2015-05-09
Agilent	Signal Generator	E8247C	MY43321350	2012-10-15	2014-10-15
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2014-02-19	2015-02-19
TDK RF	Horn Antenna	HRN-0118	130 084	2012-09-06	2015-09-06
ETS LINDGREN	Horn Antenna	3115	000 527 35	2012-09-06	2015-09-06
R&S	Spectrum Analyzer	FSEM	DE31388	2014-05-09	2015-05-09

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

Test Procedure

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

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

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

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

For part 90:

Spurious emissions in dB = $10 \log_{10} (\text{TXpwr in Watts} / 0.001)$ - 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.

Test Data

Environmental Conditions

Temperature:	27.1 °C
Relative Humidity:	53 %
ATM Pressure:	99.8 kPa

The testing was performed by Dean Liu on 2014-07-31.

Test Mode: Transmitting

Frequency	Polar	S.A. Reading	S.G. Level	Antenna Gain	Cable Loss	Absolute Level	Limit	Margin
MHz	H/V	dB μ V	dBm	dBd/dBi	dB	dBm	dBm	dB
Frequency:435MHz, FM, High Power Level								
870.000	V	34.89	-36.6	0.0	1	-37.6	-20.0	17.6
870.000	H	38.57	-36.1	0.0	1	-37.1	-20.0	17.1
1305.000	V	34.08	-38.9	8.3	1.1	-31.7	-20.0	11.7
1305.000	H	32.60	-39.5	8.3	1.1	-32.3	-20.0	12.3
1740.000	V	16.72	-56.5	10.9	1.5	-47.1	-20.0	27.1
1740.000	H	20.98	-52	10.9	1.5	-42.6	-20.0	22.6
Frequency: 435MHz, 4FSK, High Power Level								
870.000	V	34.35	-37.1	0.0	1	-38.1	-20.0	18.1
870.000	H	38.45	-36.2	0.0	1	-37.2	-20.0	17.2
1305.000	V	33.23	-39.7	8.3	1.1	-32.5	-20.0	12.5
1305.000	H	33.13	-39	8.3	1.1	-31.8	-20.0	11.8
1740.000	V	16.21	-57.1	10.9	1.5	-47.7	-20.0	27.7
1740.000	H	21.86	-51.1	10.9	1.5	-41.7	-20.0	21.7

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 & §90.213- FREQUENCY STABILITY

Applicable Standard

FCC §2.1055, §90.213

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	DE31388	2014-05-09	2015-05-09
Dongzhixu	High Temperature Test Chamber	DP1000	201105083-3	2013-08-01	2014-08-01

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

Test Procedure

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

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

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

- (1) 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

Temperature:	30.8 °C
Relative Humidity:	65 %
ATM Pressure:	99.4 kPa

The testing was performed by Dean Liu on 2014-07-24

Test Mode: Transmitting

Reference Frequency: 435 MHz, Limit: 2.5 ppm			
Temerature	Voltage	Reading	Frequency Error
°C	V _{DC}	MHz	ppm
-30	7.4	434.999982	-0.004
-20	7.4	434.999979	-0.005
-10	7.4	434.999977	-0.005
0	7.4	434.999981	-0.004
10	7.4	434.999978	-0.005
20	7.4	434.999975	-0.006
30	7.4	434.999962	-0.009
40	7.4	434.999974	-0.006
50	7.4	434.999968	-0.007
60	7.4	434.999966	-0.008
25	6.3	434.999971	-0.007

FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

Regulations: FCC §90.214

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

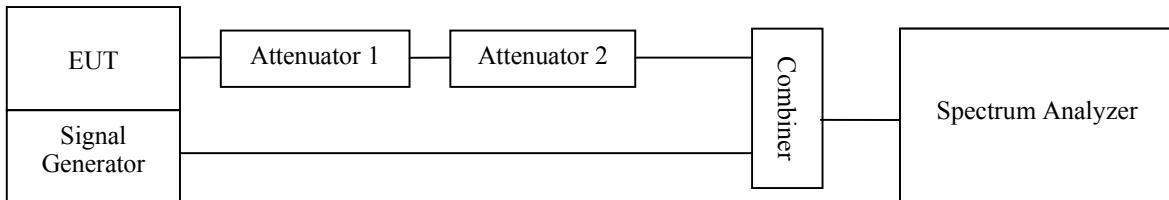
Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	DE31388	2014-05-09	2015-05-09
HP	Signal Generator	8648A	3426A00831	2013-11-06	2014-11-06

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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 .



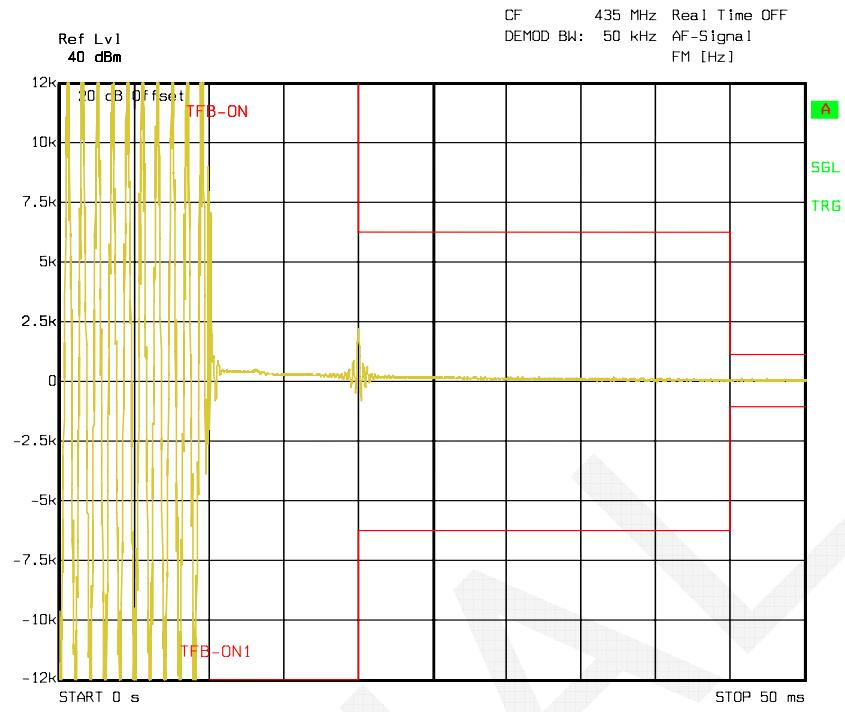
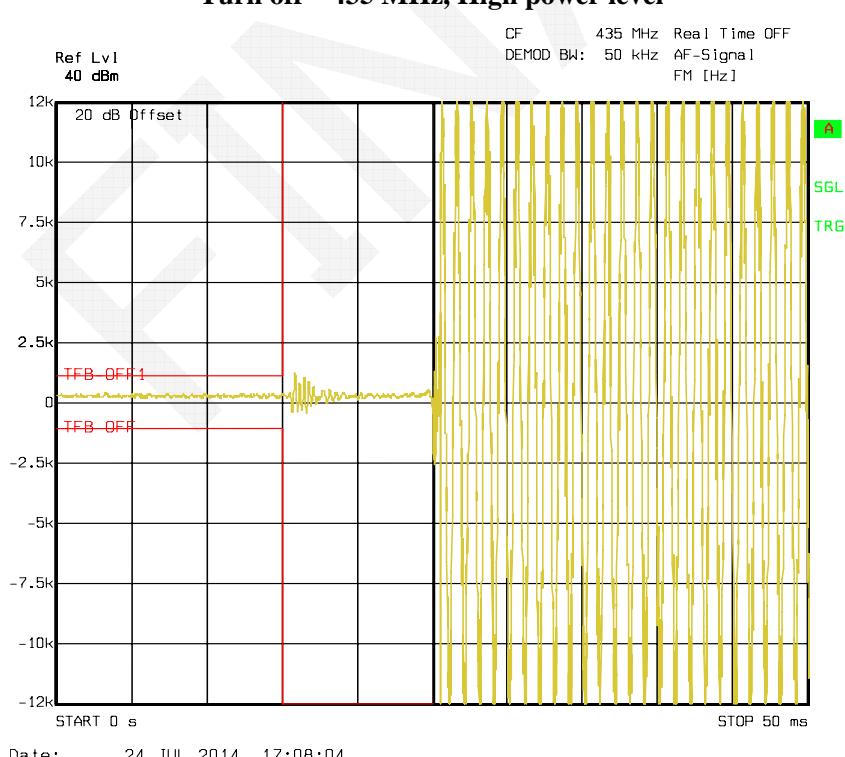
Test Data**Environmental Conditions**

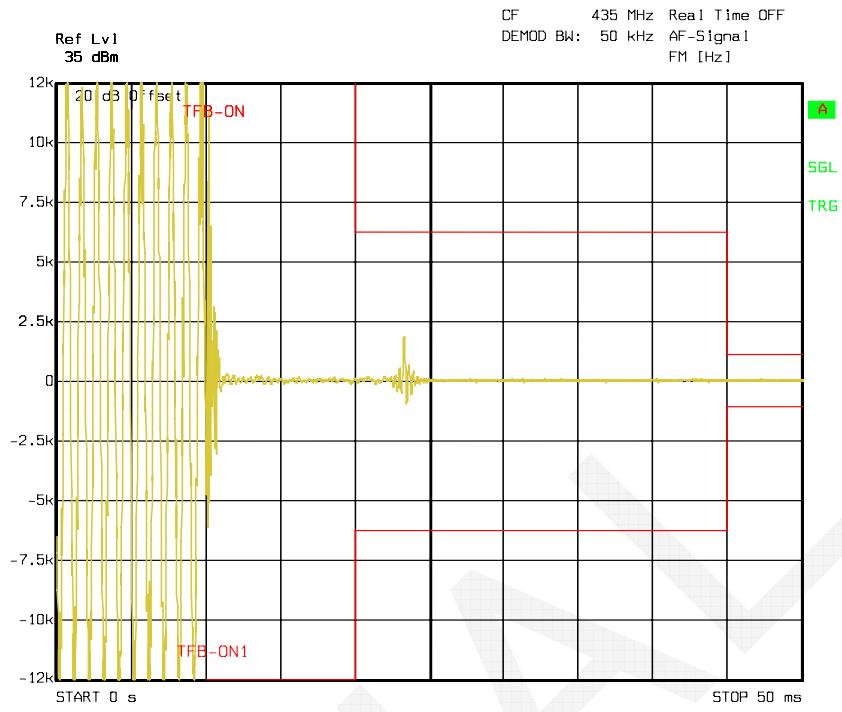
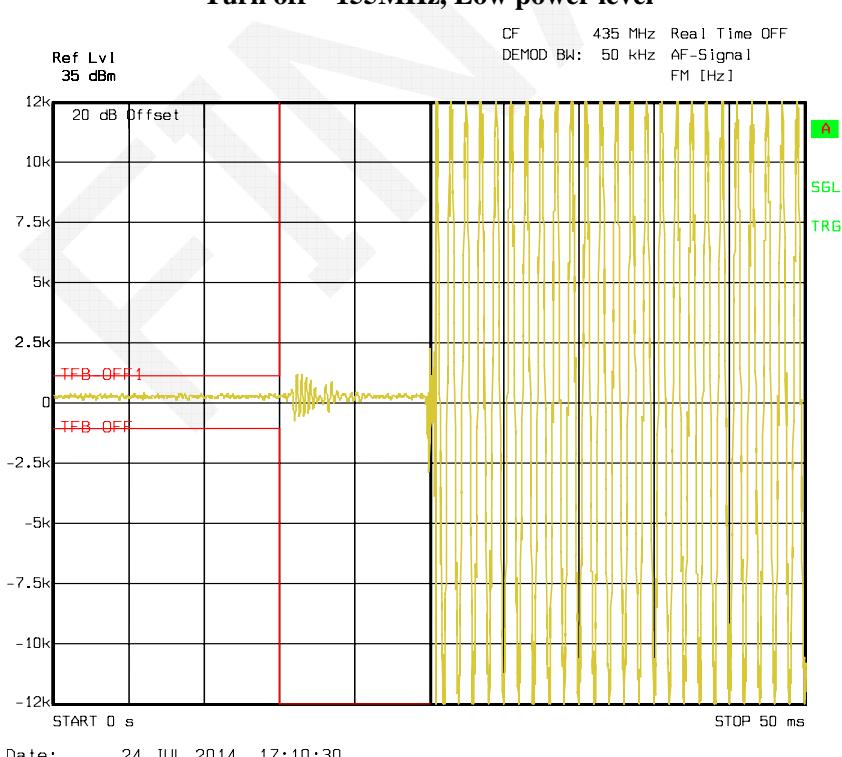
Temperature:	30.8 °C
Relative Humidity:	65 %
ATM Pressure:	99.4 kPa

The testing was performed by Dean Liu on 2014-07-24

Channel Separation (kHz)	Transient Period (ms)	Maximum frequency difference	Result
12.5	<5(t_1)	± 12.5 kHz	Pass
	<20(t_2)	± 6.25 kHz	
	<5(t_3)	± 12.5 kHz	

Please refer to the following plots.

Turn on – 435 MHz, High power level**Turn off – 435 MHz, High power level**

Turn on – 435 MHz, Low power level**Turn off – 155MHz, Low power level**

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