

FCC PART 90



TEST REPORT

For

SHENZHEN SAMHOO SCI & TECH CO.,LTD.

huaqiangyun Industrial park.n1-1meixiuroad.futian district.shenzhen.china

FCC ID: 2ABUBSPM6040

Report Type: Original Report	Product Type: Digital Two Way Radio
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Report Number: RDG150916001-00	
Report Date: 2015-11-03	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The SHENZHEN SAMHOO SCI & TECH CO.,LTD.'s product, model number:SPM6040 (FCC ID: 2ABUBSPM6040) or the "EUT" in this report was a *Digital Two Way Radio*, which was measured approximately:17.3cm (L)×20.3cm (W)×6.0cm (H), rated with input voltage: DC13.6V.

**All measurement and test data in this report was gathered from production sample serial number: 150916001 (assigned by BACL, Dongguan). The EUT supplied by the applicant was received on 2015-09-17.*

Objective

This test report is prepared on behalf of SHENZHEN SAMHOO SCI & TECH CO.,LTD. in accordance with Part 2, and Part 90 of the Federal Communication Commission rules.

Related Submittal(s)/Grant(s)

N/A

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 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 06, 2015.

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 which has been done in the factory.

EUT Specification:

Operating Frequency Band	400-470 MHz
Modulation Mode	FM/4FSK
Channel Spacing	12.5 kHz
Rated Output Power	High power level: 45W Middle power level: 25W Low power level: 5W

Equipment Modifications

No modifications were made to the unit tested.

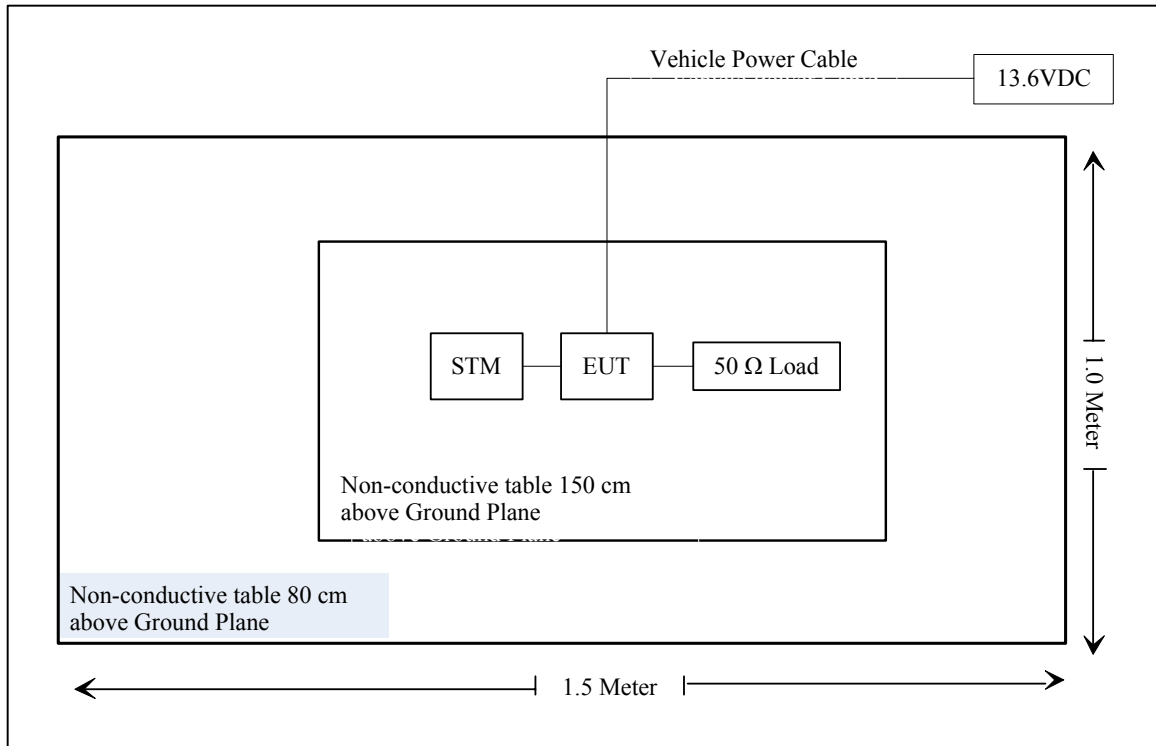
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Pro instrument	DC Power Supply	pps3300	N/A

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
DC Cable	no	no	5.0	Connector	DC power supply

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§2.1091	Maximum Permissible Exposure	Compliance
§2.1046; 90.205	RF Output Power	Compliance
§2.1047;§90.207	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

FCC §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for Maximum Permissible Exposure (MPE)

Limits for Occupational/Controlled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E , H or S (minutes)
0.3- 3.0	614	1.63	(100)*	6
3.0 - 30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6

f = frequency in MHz;

* = Plane-wave equivalent power density;

MPE Calculation

Predication of MPE limit at a given distance

$$S = PG/4\pi R^2$$

Where: S = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Frequency	Tune Up Output Power	Tune Up Output Power	Duty Cycle	Typical Antenna Gain		Distance	Power Density	Limit
				dBi	numeric			
MHz	dBm	mW				cm	mW/cm ²	mW/cm ²
435	47	50119	50%	5.0	3.16	80	0.985	1.45

Radio Exposure Statement:

Using the parameters given in the above calculation, a minimum antenna to person distance of 80 cm is required to meet the limits for occupational/controlled exposure.

Result: Compliant.

FCC §2.1046 & §90.205- RF OUTPUT POWER

Applicable Standard

FCC §2.1046 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:

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	FSP 38	100478	2015-05-09	2016-05-09
AA-MCS	Attenuator(40dB)	CAT-50-40-200-Nm-Nf	0602-010	2015-05-08	2016-05-08
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06
Pasternack	RF Coaxial Cable	RF-01	/	2015-05-06	2016-05-06

* **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:	26.6°C
Relative Humidity:	58 %
ATM Pressure:	100.3 kPa

The testing was performed by Dean Liu on 2015-10-30.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

ModulationMode	Channel Spacing	f _c (MHz)	Conducted Output Power (W)			Note
			High Power Level	Middle Power Level	Low Power Level	
FM	12.5 kHz	400.0125	45.36	25.18	5.18	Not for FCC Review
		435	45.21	25.13	5.21	/
		469.9875	45.16	25.33	5.09	Not for FCC Review
4FSK		400.0125	45.49	25.23	5.14	Not for FCC Review
		435	45.28	25.31	5.19	/
		469.9875	45.19	25.14	5.24	Not for FCC Review

Note: The rated high power is 45W; middle power is 25W; low power is 5W.

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	2015-05-09	2016-05-09
AA-MCS	Attenuator(40dB)	CAT-50-40-200-Nm-Nf	0602-010	2015-05-08	2016-05-08
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06
Pasternack	RF Coaxial Cable	RF-01	/	2015-05-06	2016-05-06

* **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:	26.2 °C
Relative Humidity:	55 %
ATM Pressure:	100.1kPa

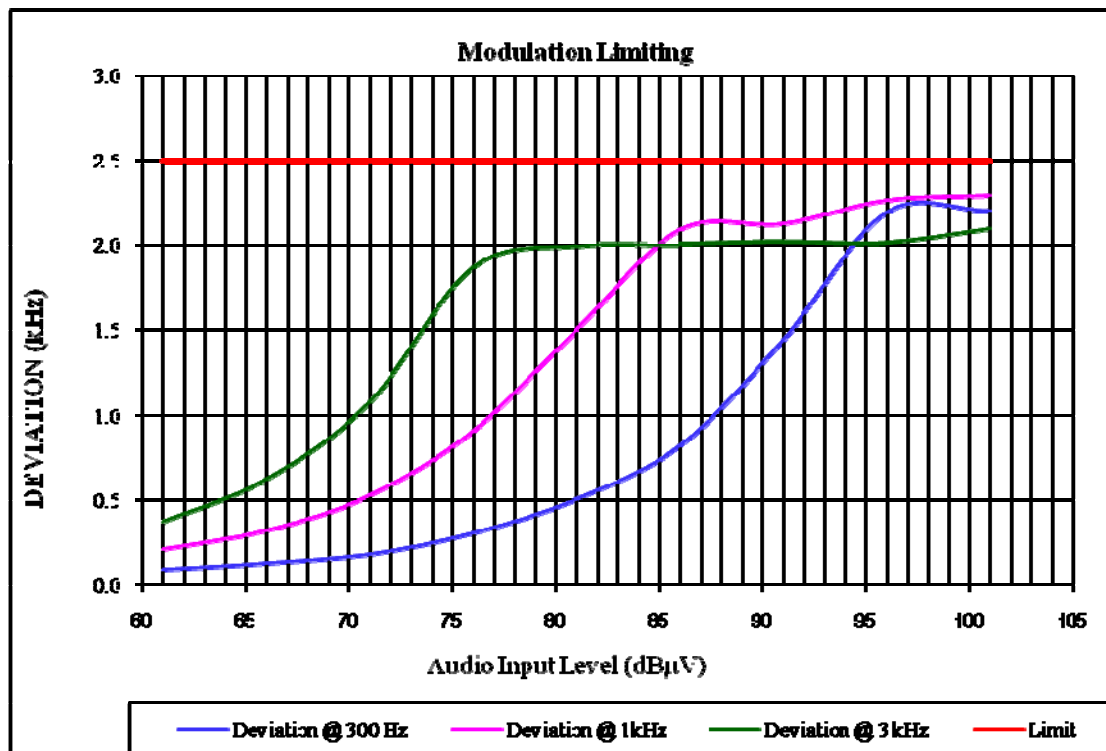
The testing was performed by Dean Liu on 2015-10-30.

Test Result: Compliant. Please refer to following plots.

MODULATION LIMITING

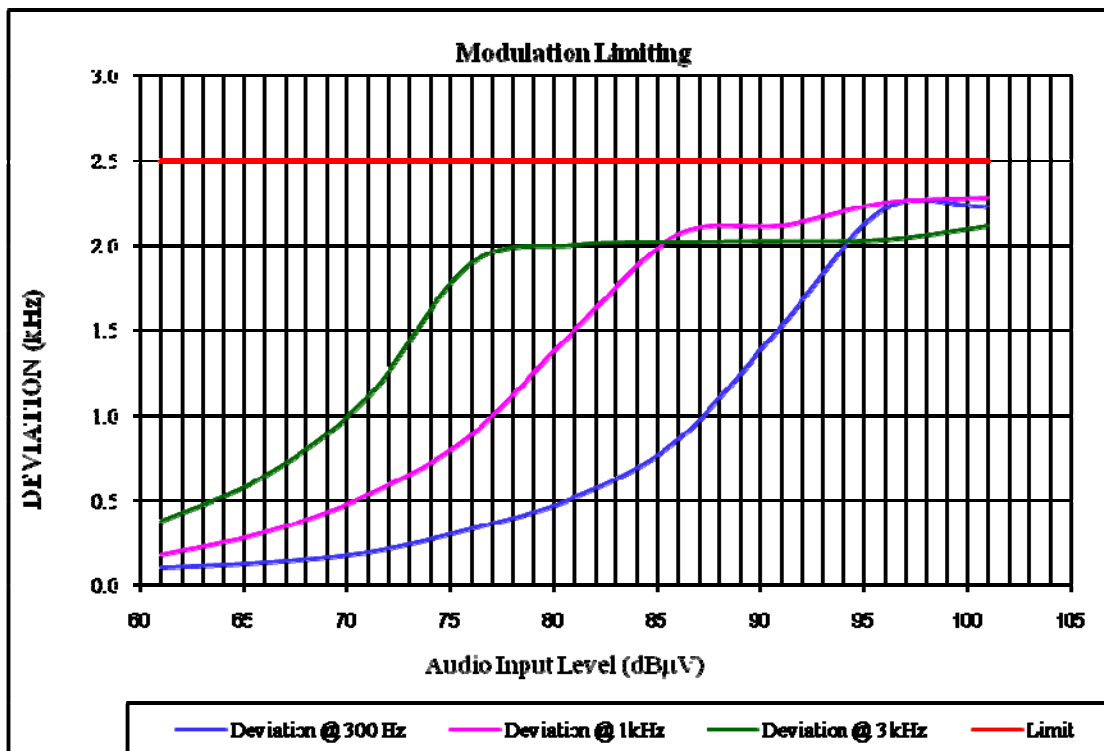
Carrier Frequency: 435MHz, Channel Separation = 12.5 kHz, high power level

AUDIO INPUT LEVEL	DEVIATION (@300Hz)	DEVIATION (@ 1kHz)	DEVIATION (@ 3kHz)	Limit
dBμV	kHz	kHz	kHz	kHz
101	2.202	2.291	2.097	2.5
96	2.191	2.264	2.013	2.5
91	1.441	2.125	2.019	2.5
86	0.820	2.089	2.002	2.5
81	0.503	1.500	1.994	2.5
76	0.305	0.907	1.865	2.5
71	0.183	0.526	1.072	2.5
66	0.126	0.321	0.616	2.5
61	0.091	0.206	0.369	2.5



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

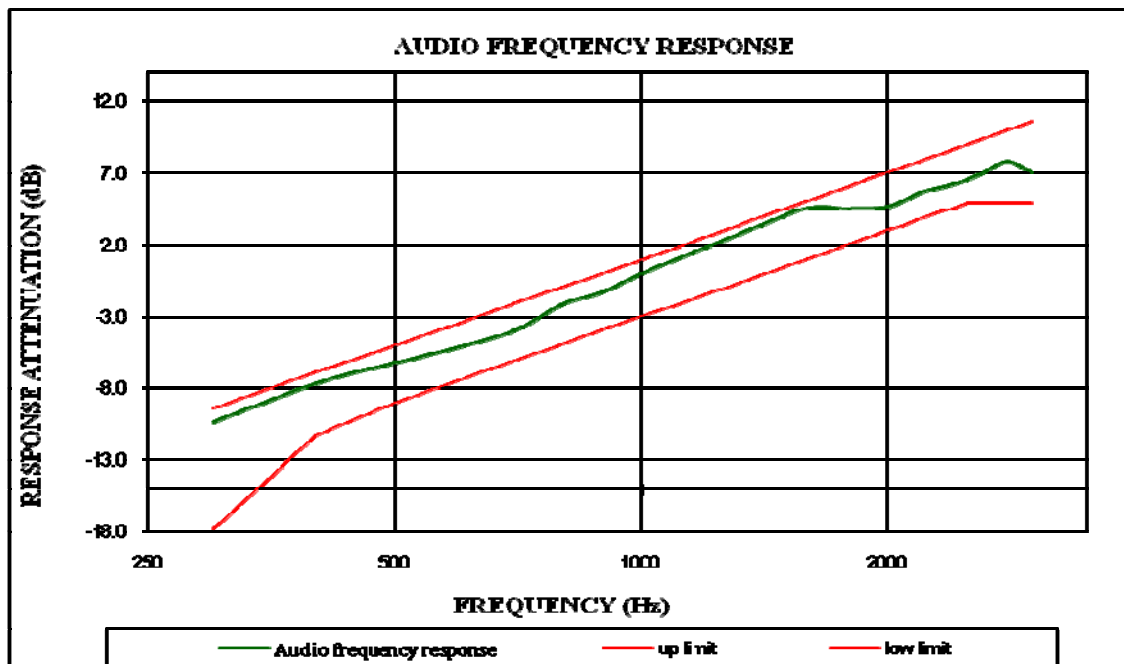
AUDIO INPUT LEVEL	DEVIATION (@300Hz)	DEVIATION (@ 1kHz)	DEVIATION (@ 3kHz)	Limit
dB μ V	kHz	kHz	kHz	kHz
101	2.228	2.285	2.117	2.5
96	2.216	2.255	2.034	2.5
91	1.523	2.119	2.024	2.5
86	0.851	2.063	2.019	2.5
81	0.516	1.500	2.004	2.5
76	0.335	0.882	1.892	2.5
71	0.196	0.530	1.106	2.5
66	0.133	0.312	0.639	2.5
61	0.104	0.181	0.374	2.5



Audio Frequency Response

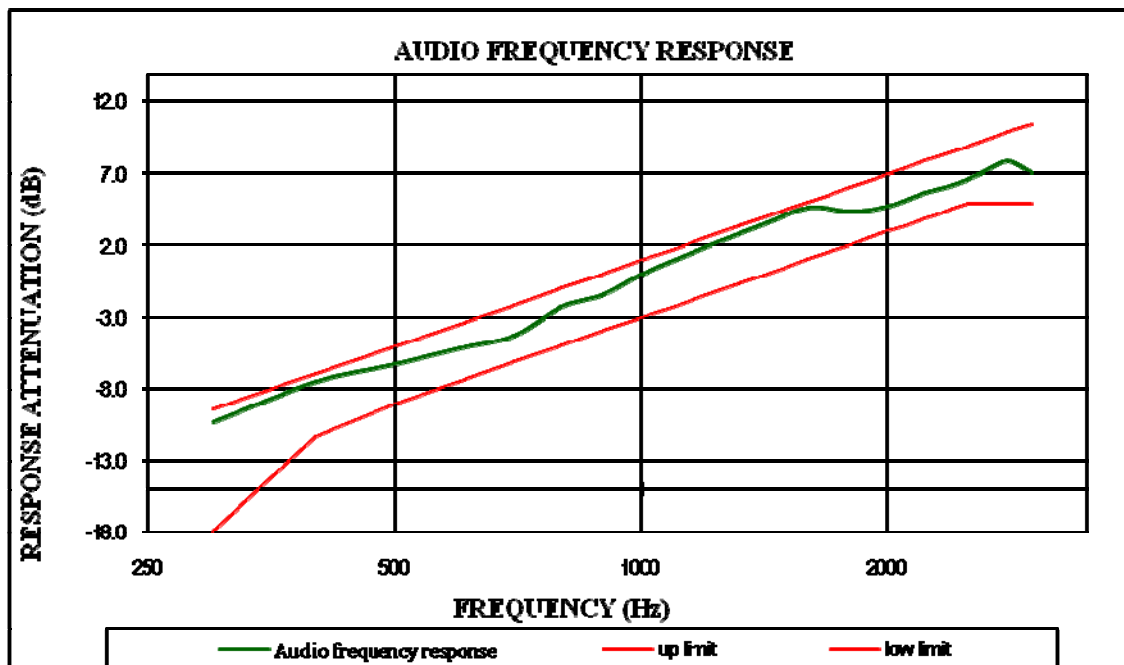
Carrier Frequency: 435 MHz, Channel Separation = 12.5 kHz, high power level

Audio Frequency Hz	Response Attenuation dB
300	-10.35
400	-7.67
500	-6.29
600	-5.11
700	-4.01
800	-2.18
900	-1.28
1000	0.00
1200	1.82
1400	3.38
1600	4.58
1800	4.54
2000	4.66
2200	5.62
2400	6.14
2600	6.84
2800	7.75
3000	6.98



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

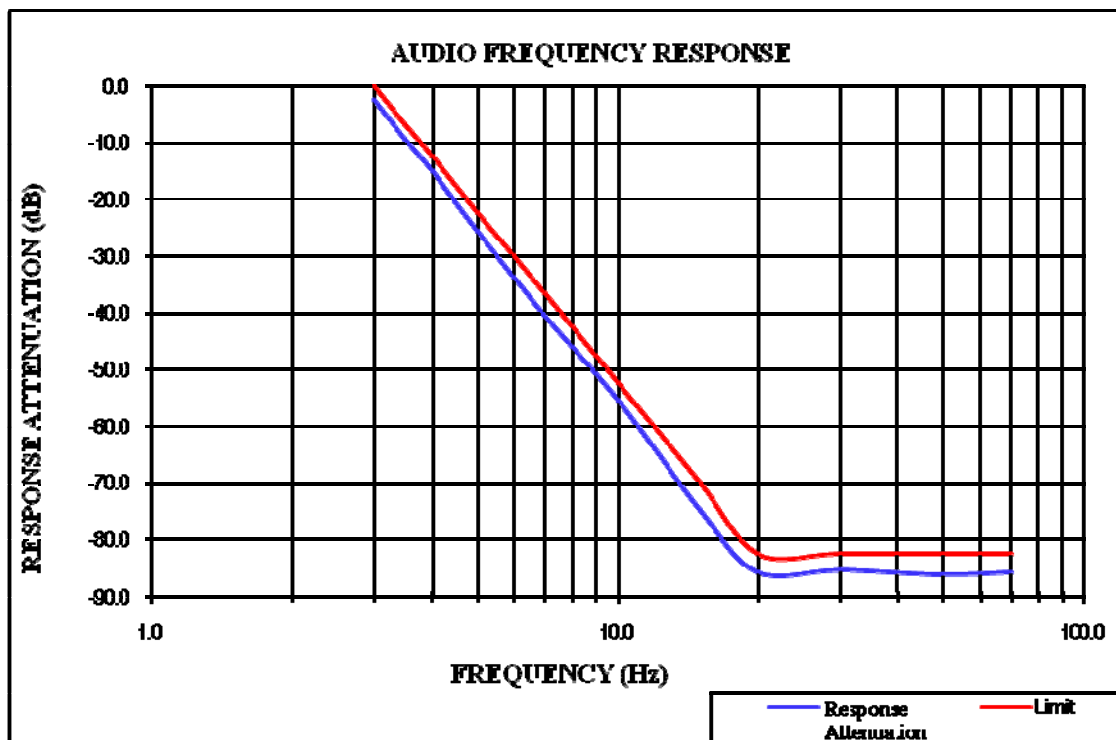
Audio Frequency Hz	Response Attenuation dB
300	-10.28
400	-7.51
500	-6.25
600	-5.17
700	-4.25
800	-2.23
900	-1.36
1000	0.00
1200	1.97
1400	3.43
1600	4.68
1800	4.41
2000	4.78
2200	5.65
2400	6.22
2600	7.01
2800	7.87
3000	7.08



Audio Frequency Low Pass Filter Response

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

Audio Frequency	Response Attenuation	Limit
kHz	dB	dB
3.0	-2.4	0.0
3.5	-9.3	-6.7
4.0	-15.1	-12.5
5.0	-25.6	-22.2
7.0	-40.7	-36.8
10.0	-55.4	-52.3
15.0	-74.8	-69.9
20.0	-85.7	-82.5
30.0	-85.4	-82.5
50.0	-86.1	-82.5
70.0	-85.8	-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

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
HP	RF Communications Test Set	8920A	00 235	2015-05-09	2016-05-09
AA-MCS	Attenuator(40dB)	CAT-50-40-200-Nm-Nf	0602-010	2015-05-08	2016-05-08
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06
Pasternack	RF Coaxial Cable	RF-01	/	2015-05-06	2016-05-06

*** 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

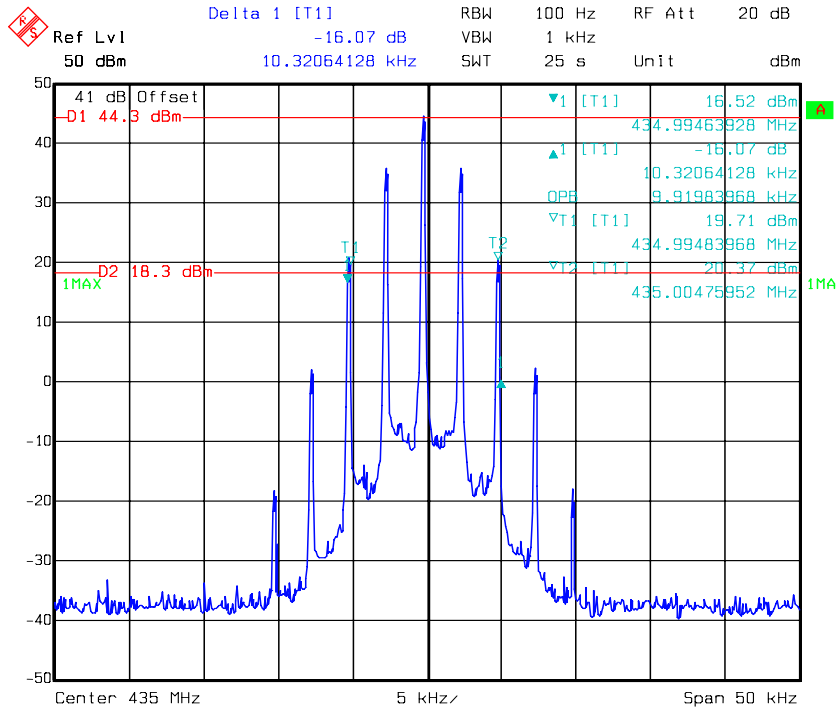
Environmental Conditions

Temperature:	26.3~26.9°C
Relative Humidity:	51-56 %
ATM Pressure:	99.7 -100.5 kPa

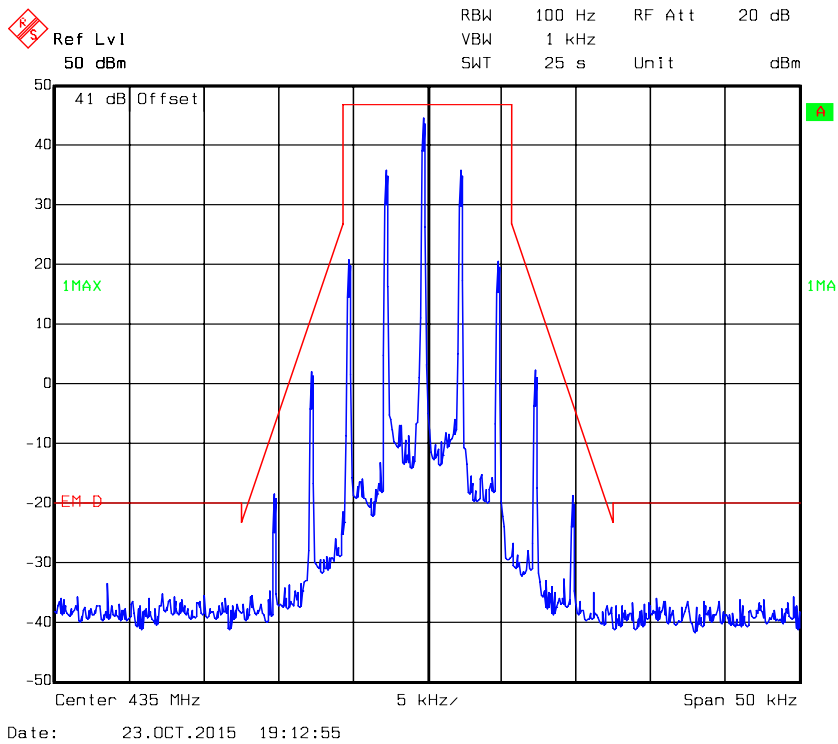
The testing was performed by Dean Liu from 2015-10-23 to 2015-10-28.

ModulationMode	Channel Spacing	f _c (MHz)	99% Occupied Bandwidth	26 dB Bandwidth	Power Level
			kHz	kHz	
FM	12.5	435	9.92	10.32	High
4FSK			7.31	9.72	
FM			10.02	10.42	Middle
4FSK			7.21	9.32	
FM			9.92	10.32	Low
4FSK			7.11	9.12	

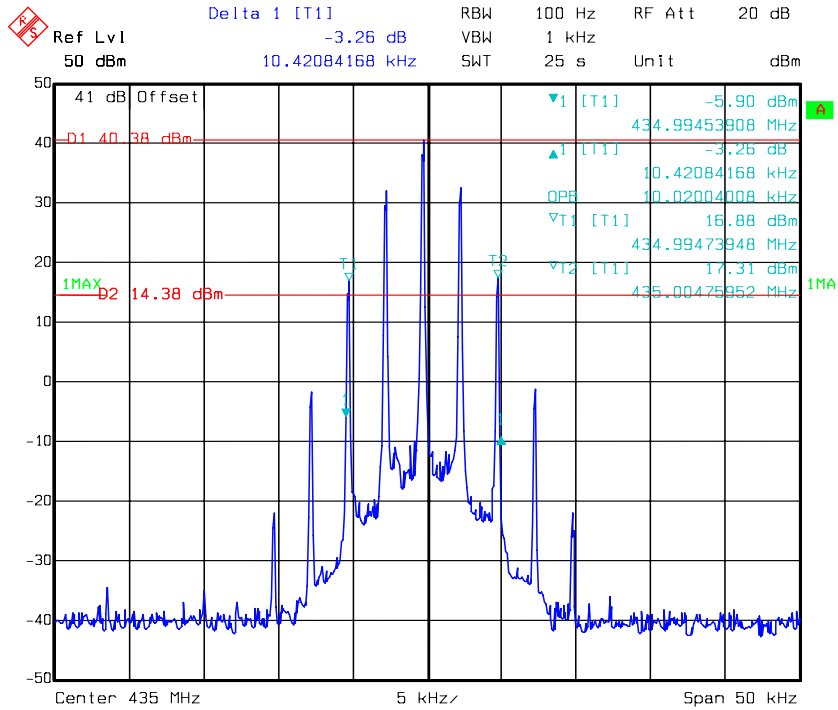
Occupied Bandwidth – FM, 435 MHz, High Power Level



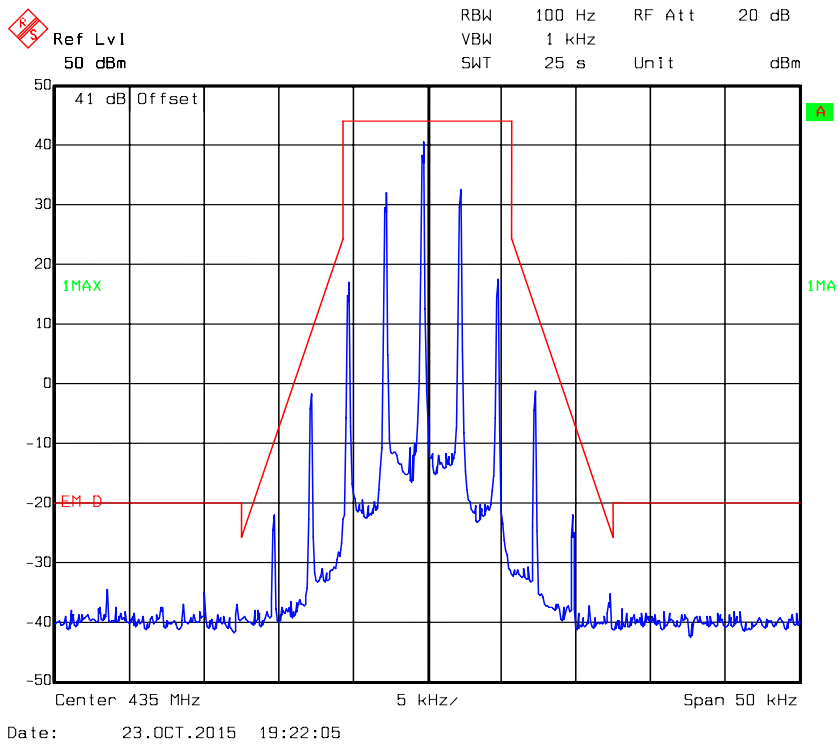
Emission Mask - Type D



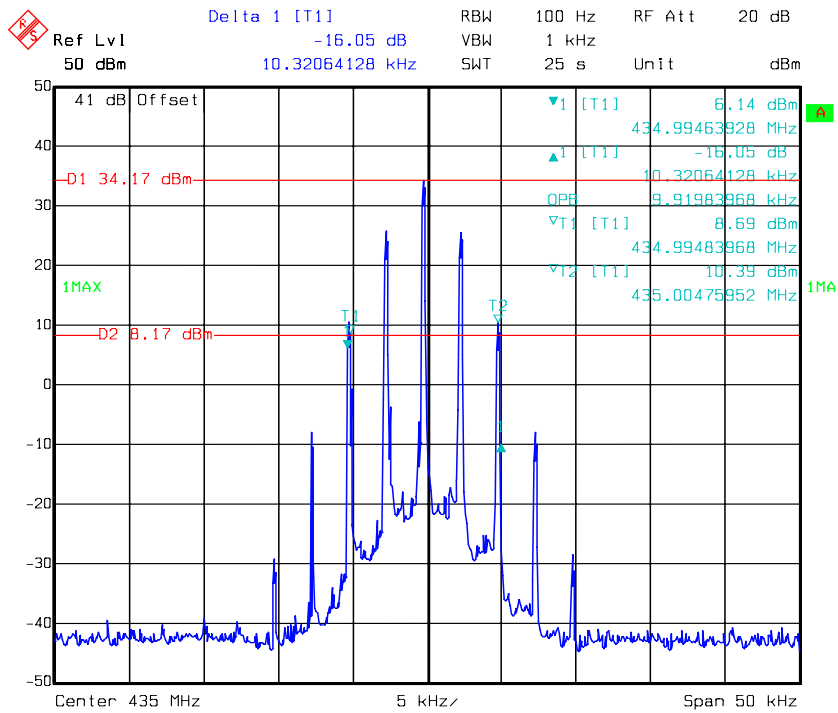
Occupied Bandwidth – FM, 435 MHz, Middle Power Level



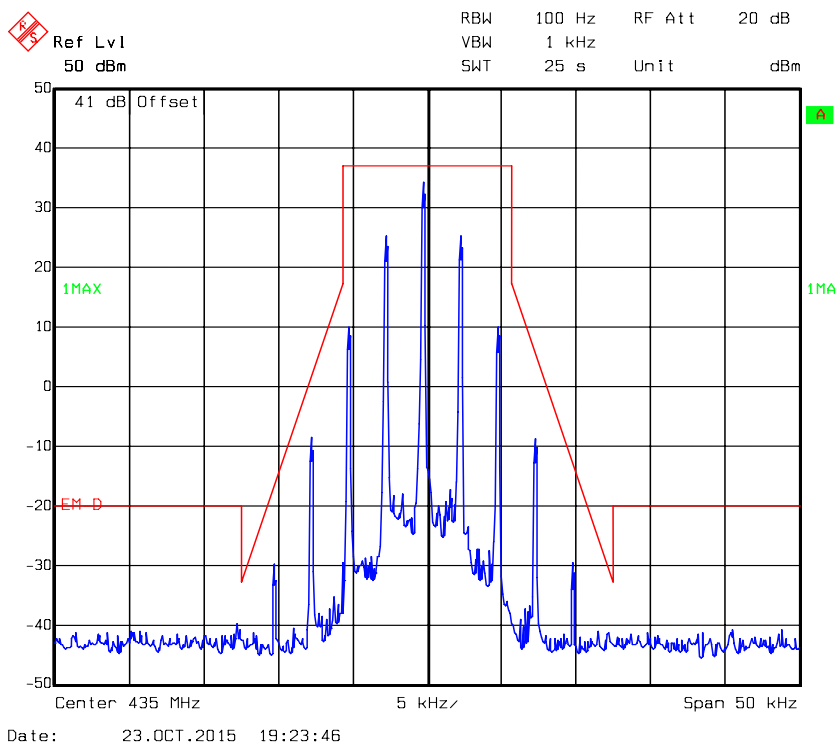
Emission Mask - Type D



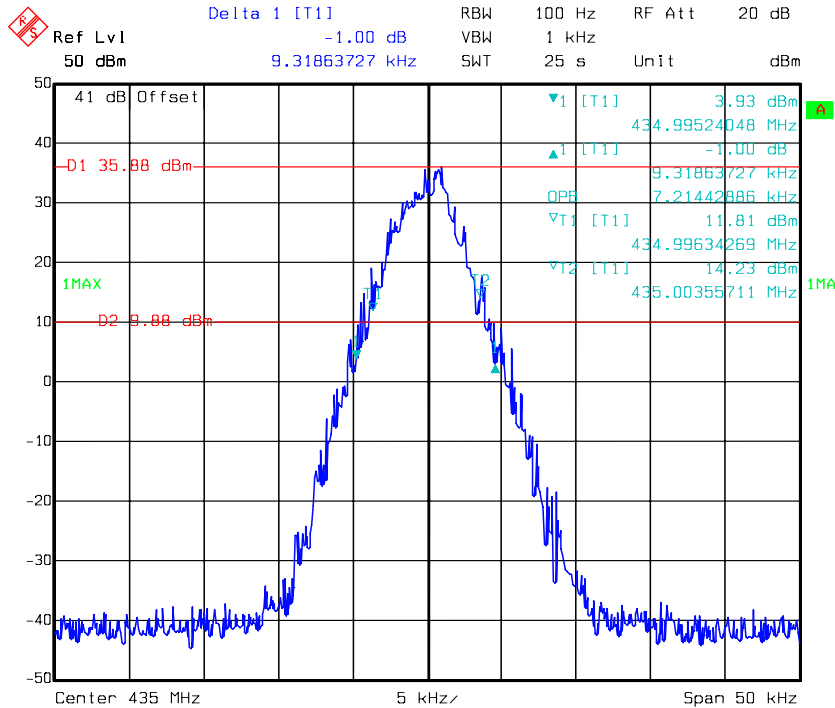
Occupied Bandwidth – FM, 435 MHz, Low Power Level



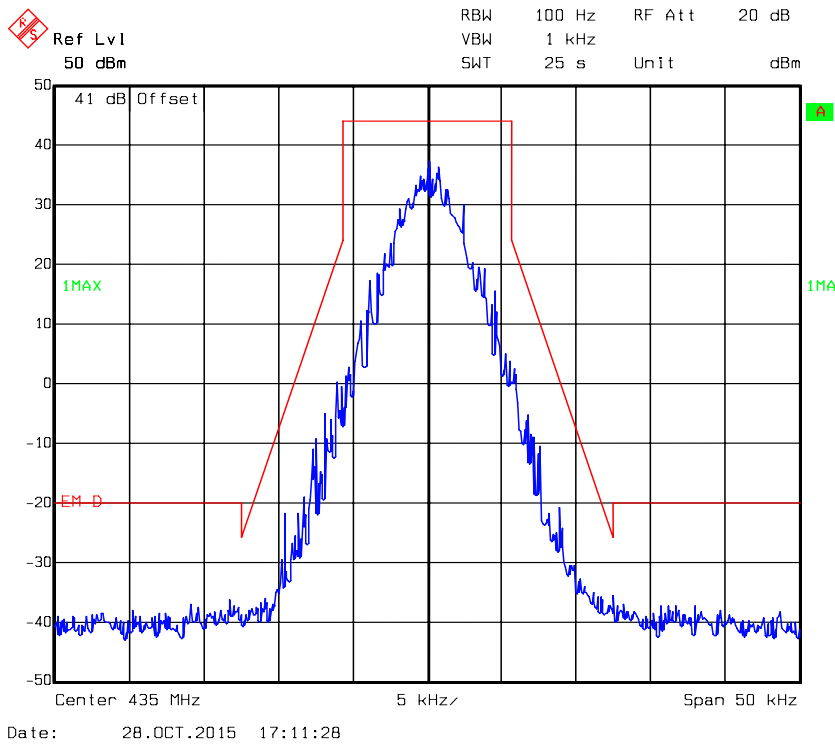
Emission Mask - Type D



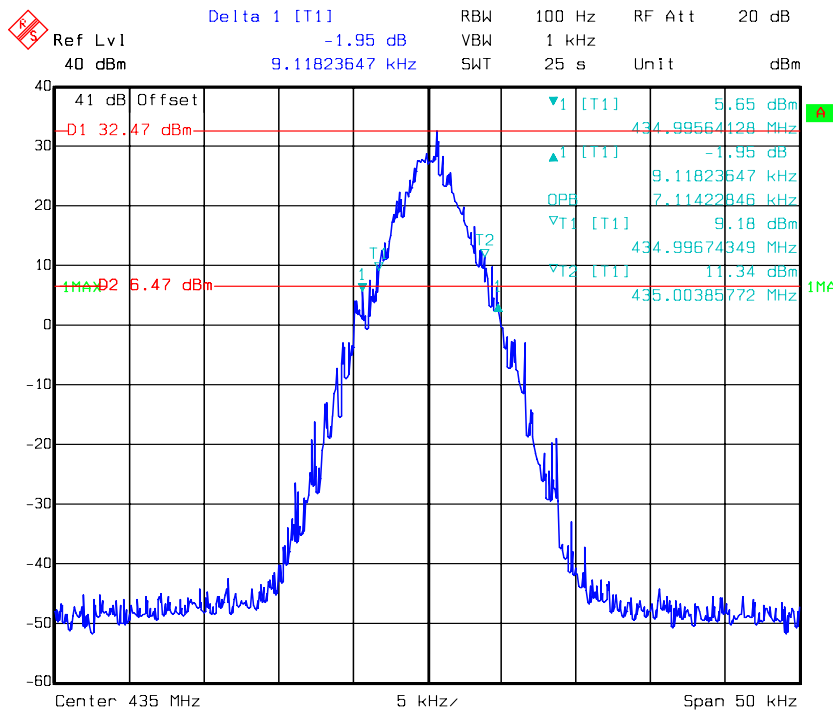
Occupied Bandwidth -4FSK, 435 MHz, Middle Power Level



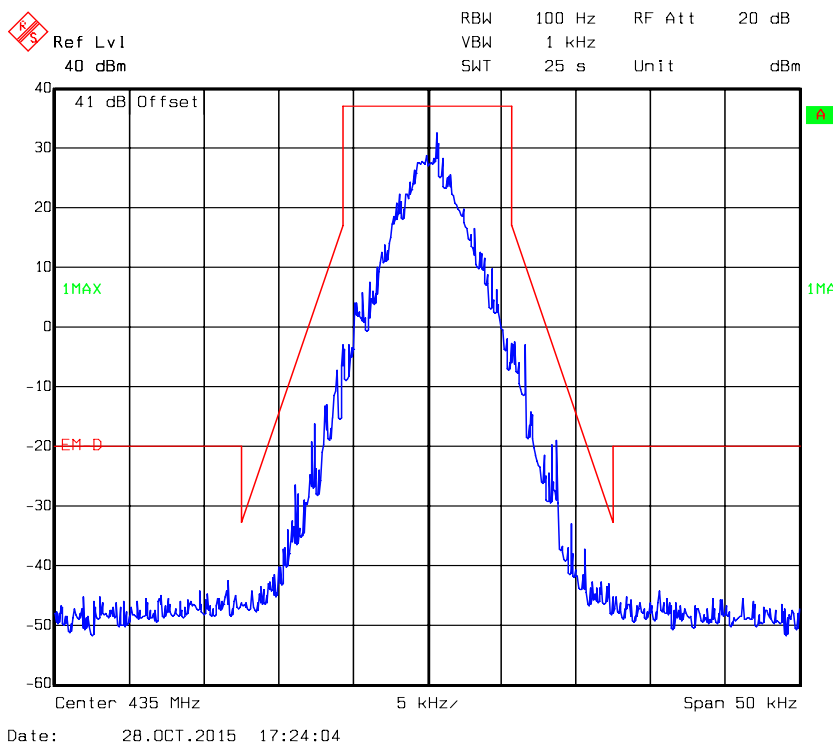
Emission Mask - Type D



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	FSP 38	100478	2015-05-09	2016-05-09
HP	RF Communications Test Set	8920A	00 235	2015-05-09	2016-05-09
AA-MCS	Attenuator(40dB)	CAT-50-40-200-Nm-Nf	0602-010	2015-05-08	2016-05-08
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06
Mini-Circuits	HIGH PASS FILTER	BHP-550+	YZU15801121	2015-05-06	2016-05-06
Pasternack	RF Coaxial Cable	RF-01	/	2015-05-06	2016-05-06

* **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.

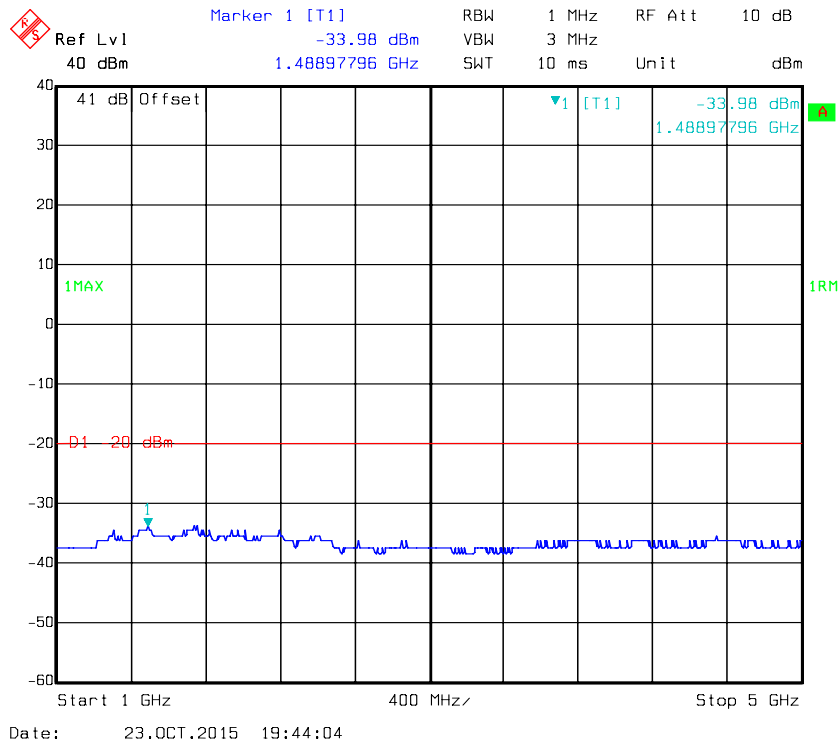
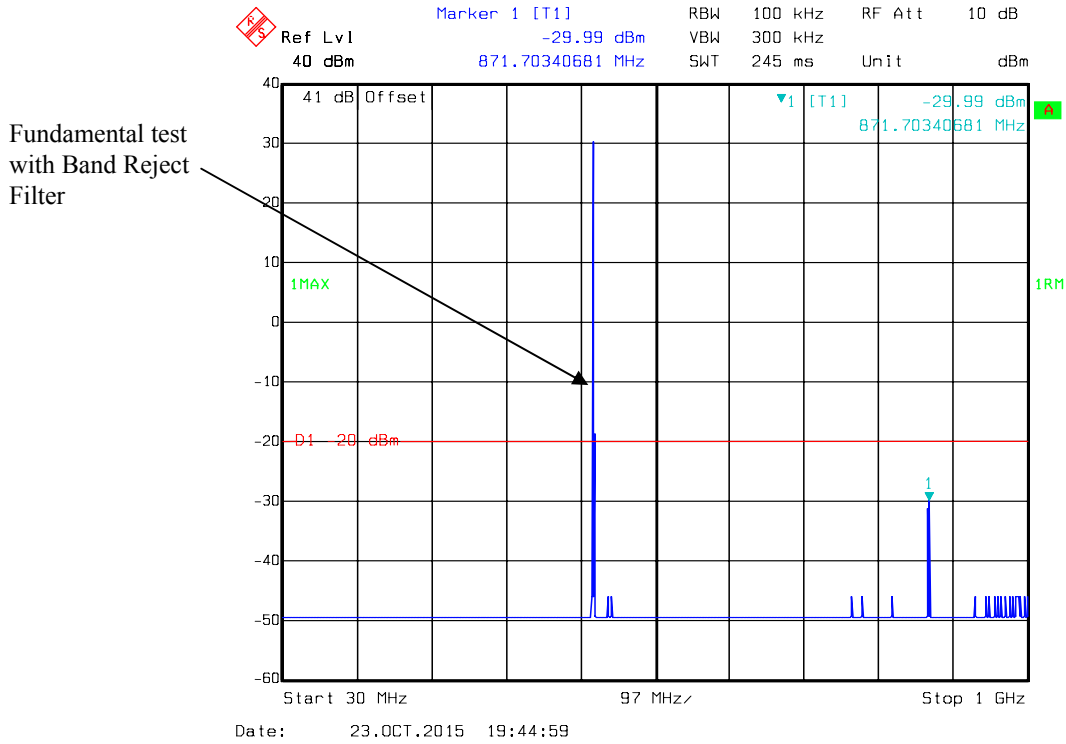
Test Data**Environmental Conditions**

Temperature:	24.8°C
Relative Humidity:	49 %
ATM Pressure:	100.2 kPa

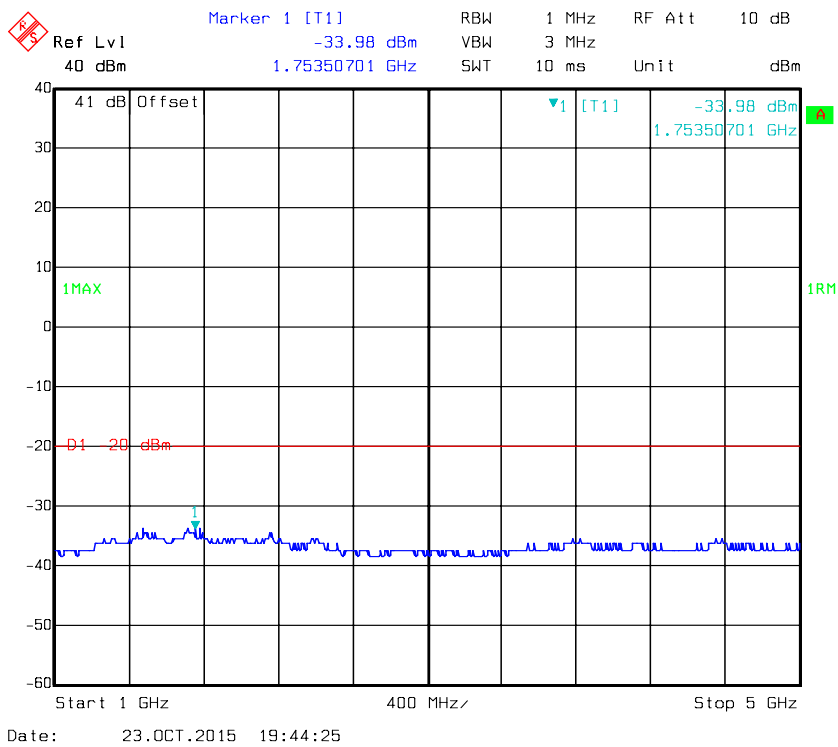
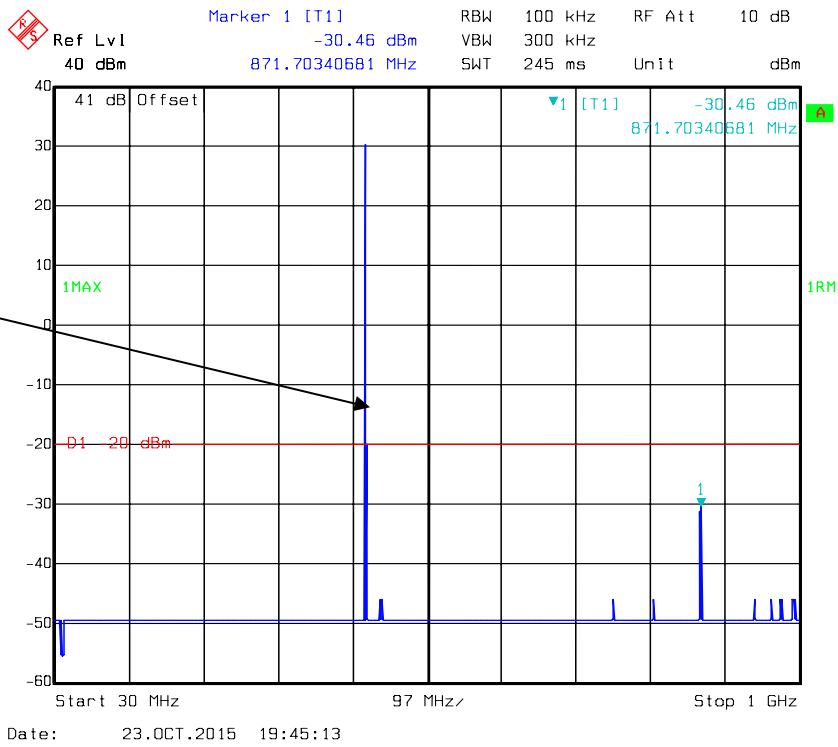
The testing was performed by Dean Liu on 2015-10-23.

Test Mode: Transmitting

435 MHz – FM Mode



435 MHz -4FSK Mode



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 lg (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB = 43 + 10 Log₁₀ (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
HP	Signal Generator	8648A	3426A00831	2014-11-06	2015-11-06
Sunol Sciences	Antenna	JB3	A060611-1	2014-09-06	2017-09-05
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
HP	Amplifier	8447E	2434A02181	2015-09-06	2016-09-06
R&S	EMI Test Receiver	ESCI	100224	2015-05-09	2016-05-09
Agilent	Signal Generator	E8247C	MY43321350	2015-10-15	2016-10-15
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2015-02-19	2016-02-19
TDK RF	Horn Antenna	HRN-0118	130 084	2015-09-06	2018-09-06
ETS LINDGREN	Horn Antenna	3115	000 527 35	2015-09-06	2018-09-06
R&S	Spectrum Analyzer	FSEM	DE31388	2015-05-09	2016-05-09
N/A	Coaxial Cable	14m	N/A	2015-05-06	2016-05-06
N/A	Coaxial Cable	8m	N/A	2015-05-06	2016-05-06
Weinschel Corp	Terminal Load(100W)	1440-3	MD447	/	/

* **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:	27.7°C
Relative Humidity:	55 %
ATM Pressure:	100.6 kPa

The testing was performed by Dean Liu on 2015-10-20.

Test Mode: Transmitting(FM mode,high power)

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
Frequency:435.000 MHz								
870.000	H	32.72	-41.9	0.0	1	-42.9	-20.0	22.9
870.000	V	33.45	-38	0.0	1	-39.0	-20.0	19
1305.000	H	57.26	-42.6	6.7	1.3	-37.2	-20.0	17.2
1305.000	V	58.63	-41.7	6.7	1.3	-36.3	-20.0	16.3
1740.000	H	34.98	-65.7	8.1	1.4	-59.0	-20.0	39
1740.000	V	35.42	-65.5	8.1	1.4	-58.8	-20.0	38.8
2175.000	H	40.58	-55.2	9.0	1.9	-48.1	-20.0	28.1
2175.000	V	41.17	-54.2	9.0	1.9	-47.1	-20.0	27.1

Test Mode: Transmitting(4FSK mode,high power)

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
Frequency:435.000 MHz								
870.000	H	31.84	-42.8	0.0	1	-43.8	-20.0	23.8
870.000	V	32.17	-39.3	0.0	1	-40.3	-20.0	20.3
1305.000	H	56.70	-43.1	6.7	1.3	-37.7	-20.0	17.7
1305.000	V	57.92	-42.4	6.7	1.3	-37.0	-20.0	17
1740.000	H	34.61	-66.1	8.1	1.4	-59.4	-20.0	39.4
1740.000	V	35.18	-65.8	8.1	1.4	-59.1	-20.0	39.1
2175.000	H	39.32	-56.4	9.0	1.9	-49.3	-20.0	29.3
2175.000	V	40.64	-54.8	9.0	1.9	-47.7	-20.0	27.7

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 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 Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
Dongzhixu	High Temperature Test Chamber	DP1000	201105083-4	2015-08-11	2016-08-11
UNI-T	Multimeter	UT39A	M130199938	2015-04-10	2016-04-10
AA-MCS	Attenuator(40dB)	CAT-50-40-200-Nm-Nf	0602-010	2015-05-06	2016-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06
Pasternack	RF Coaxial Cable	RF-01	/	2015-05-06	2016-05-06

* **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:	26.9 °C
Relative Humidity:	58 %
ATM Pressure:	100.3 kPa

The testing was performed by Dean Liu on 2015-10-30.

Test Mode: Transmitting

Reference Frequency: 435 MHz, Limit: 2.5 ppm			
Temperature	Voltage	Reading	Frequency Error
°C	V_{DC}	MHz	ppm
-30	13.6	435.000150	0.34
-20	13.6	435.000137	0.31
-10	13.6	435.000156	0.36
0	13.6	435.000142	0.33
10	13.6	435.000139	0.32
20	13.6	435.000140	0.32
30	13.6	435.000128	0.29
40	13.6	435.000172	0.40
50	13.6	435.000124	0.29
25	10.8	435.000144	0.33
	15.6	435.000159	0.37

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

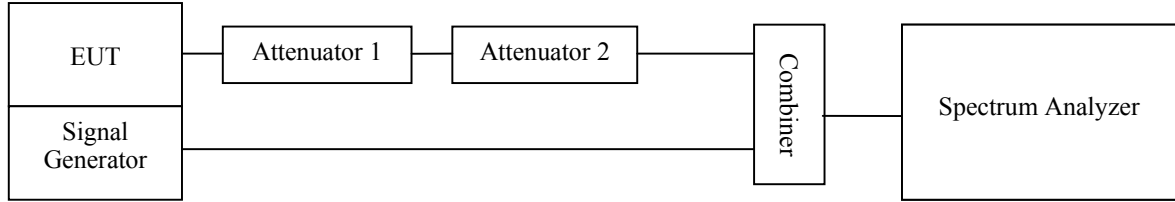
Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	DE31388	2015-05-09	2016-05-09
HP	Signal Generator	8648A	3426A00831	2014-11-06	2015-11-06
AA-MCS	Attenuator(40dB)	CAT-50-40-200-Nm-Nf	0602-010	2015-05-06	2016-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06
Pasternack	RF Coaxial Cable	RF-01	/	2015-05-06	2016-05-06
Pasternack	RF Coaxial Cable	RF-02	/	2015-05-06	2016-05-06

* **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

- 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 "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**

Temperature:	26.8~27.1 °C
Relative Humidity:	57~59 %
ATM Pressure:	100.1~100.3 kPa

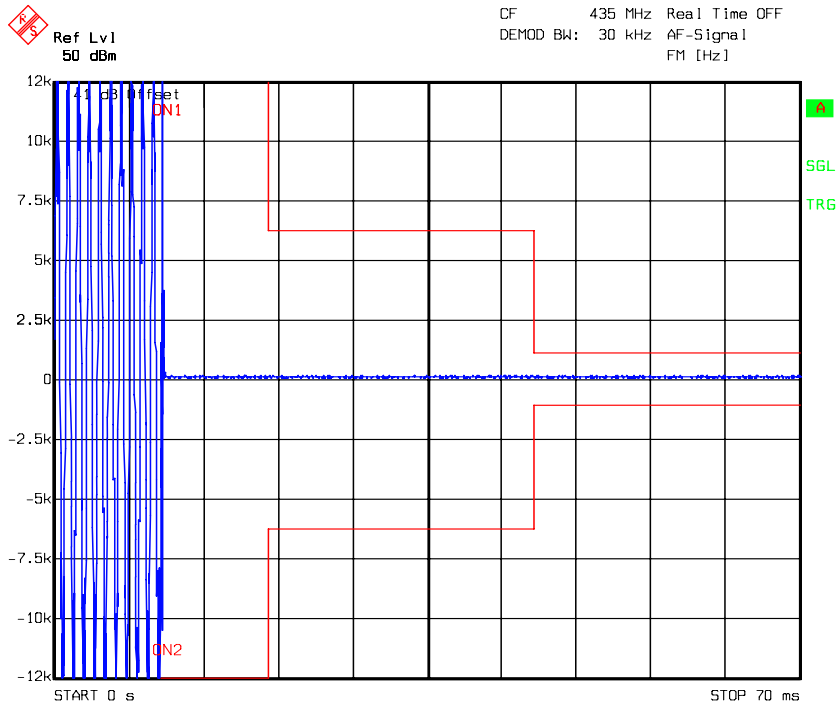
The testing was performed by Dean Liu on 2015-10-28 and 2015-11-04.

Test Mode: Transmitting

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

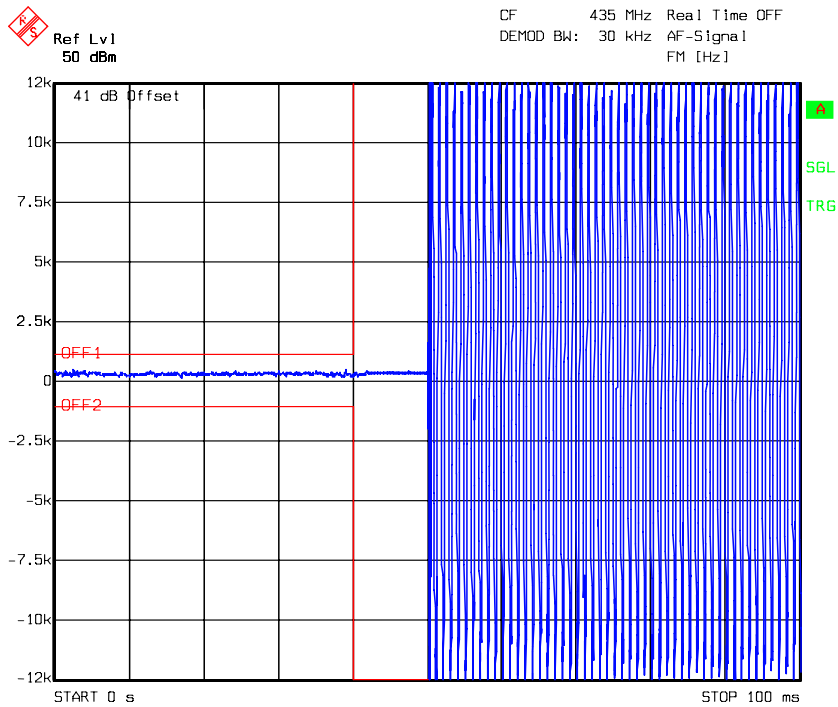
Please refer to the following plots.

Turn on – 435 MHz, FM Mode, High power level



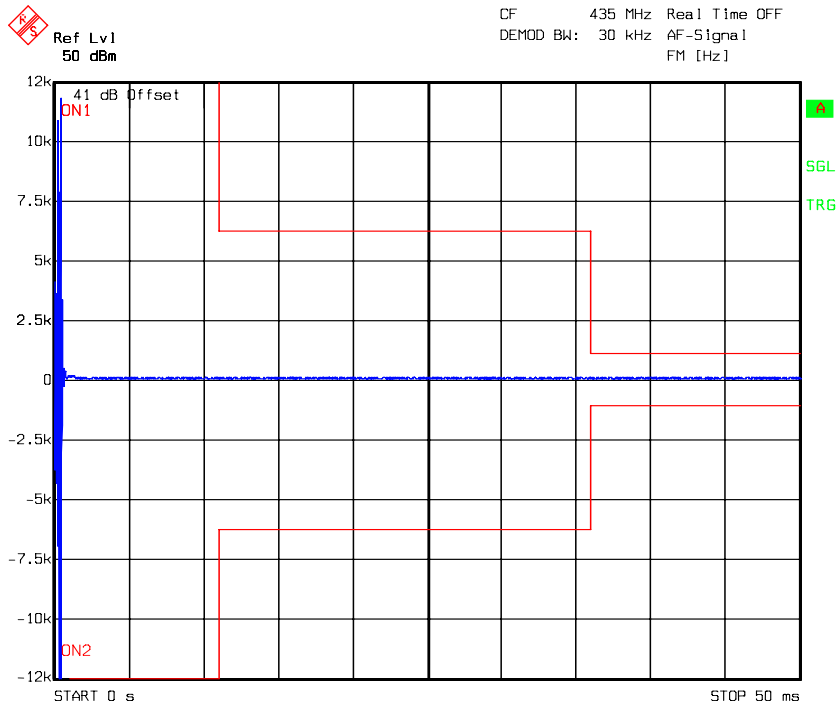
Date: 28.OCT.2015 19:57:25

Turn off – 435 MHz, FM Mode, High power level



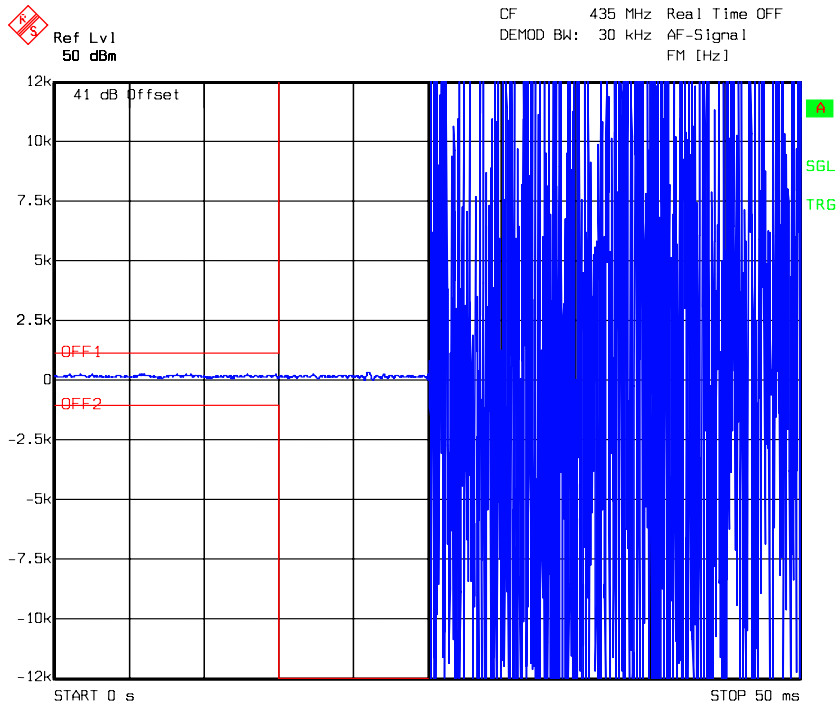
Date: 28.OCT.2015 20:05:41

Turn on – 435 MHz, 4FSK Mode, High power level



Date: 04.NOV.2015 22:32:09

Turn off – 435 MHz, 4FSK Mode, High power level



Date: 04.NOV.2015 22:41:16

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