LABCODE: 500069-0

FCC PART 22 and 90
TEST REPORT

For

Sepura plc

Radio House, St. Andrews Road, Cambridge CB4 1GR UK

FCC ID: XX6SEM8040H

Report Type:	**Product Type:**
Original Report	DMR Mobile Radio

Test Engineer:	Leon Chen (Leon Chen)
Report Number:	R2DG131112005-00
Report Date:	2014-08-21
Reviewed By:	Jerry Zhang (Jerry Zhang) EMC Manager
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

Sepura plc's product, model number: SEM8040H *(FCC ID: XX6SEM8040H)* the "EUT" in this report is a *DMR Mobile Radio*, which was measured approximately: 17.2 cm (L) x 19.5 cm (W) x 5.8 cm (H), rated input voltage: 13.6 VDC.

** All measurement and test data in this report was gathered from production sample serial number: 7PR131418GD0001. The EUT was received on 2014-07-04.*

Objective

This test report is prepared on behalf of *Sepura plc* in accordance with Part2, Part 22, Part 22 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 22 – Public Mobile Service
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 Communications 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.

Additionally, Bay Area Compliance Laboratories Corp. (Dongguan) is an ISO/IEC 17025 accredited laboratory, and is accredited by National Voluntary Laboratory Accredited Program (Lab Code 500069-0).

The current scope of accreditations can be found at http://ts.nist.gov/standards/scopes/5000690.htm

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a test mode.

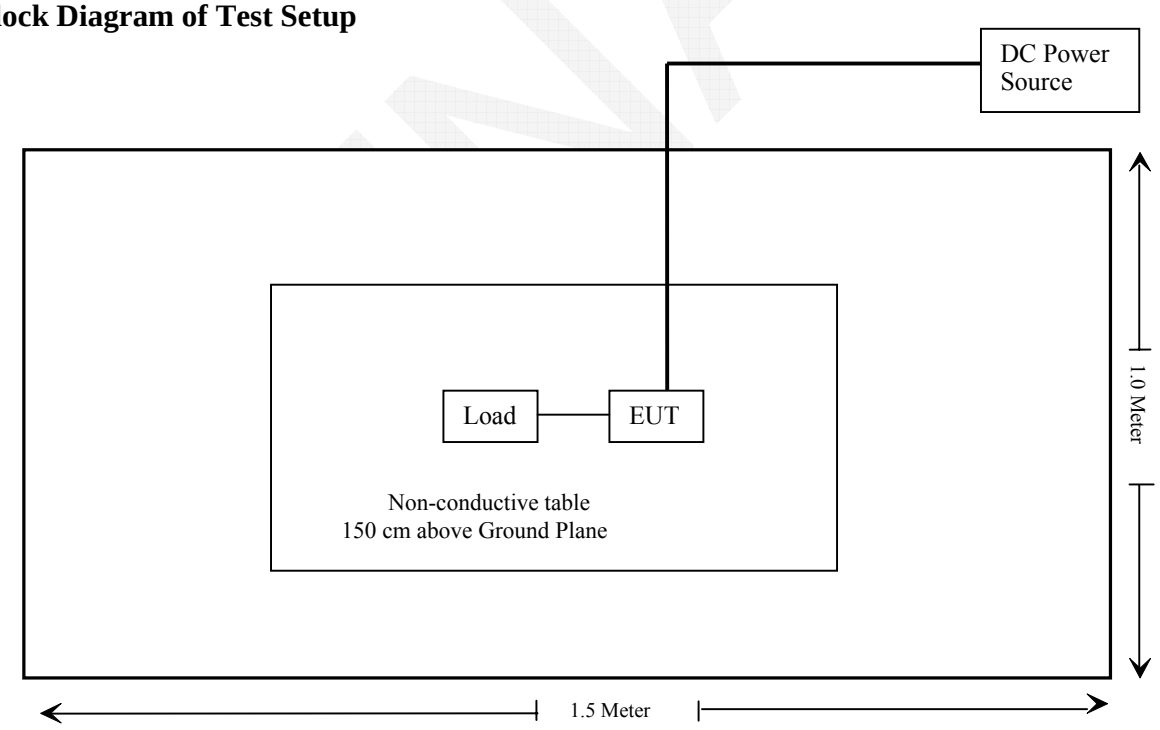
Specification:

Operating Frequency Band	400-470MHz
Modulation Mode	FM/4FSK
Channel separation	12.5 kHz
Conducted Output Power	High power level: 40W Low power level: 25 W

Support Equipment List and Details

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

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
FCC §2.1091	Maximum Permissible Exposure(MPE)	Compliant
§2.1046; § 22.727;§90.205	RF Output Power	Compliant
§2.1047;§90.207	Modulation Characteristic	Compliant
§2.1049;§22.357;§ 22. 731;§90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliant
§2.1051; §22.861;§90.210	Spurious Emission at Antenna Terminal	Compliant
§2.1053; §22.861;§90.210	Spurious Radiated Emissions	Compliant
§2.1055; § 22.355;§90.213	Frequency Stability	Compliant
§90.214	Transient Frequency Behavior	Compliant

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FCC §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to 1.1310, 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 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/cm^2);
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);

Frequency	**Output Power**	**Duty Cycle**	**Cable Loss**		**Typical Antenna**		**Distance**	**Power Density**	**Power Density Limit**
MHz	**mW**		**dB**	**numeric**	**dBi**	**numeric**	cm	mW/m^2	mW/m^2
435	44668	50%	2	1.58	0	1	75	0.2	1.45

Note: the target power is 46dBm +/-0.5dB.

Result: Pass

FCC §2.1046 &§ 22.727 & §90.205- RF OUTPUT POWER

Applicable Standard

FCC §2.1046, § 22.727 and §90.205.

Test Procedure

Conducted RF Output Power:

TIA-603-D section 2.2.1

Radiated method:

TIA 603-D section 2.2.17

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

Spectrum Analyzer setting:

RBW	Video B/W
100kHz	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 in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	18.7 °C
Relative Humidity:	37 %
ATM Pressure:	101.8 kPa

The testing was performed by Leon Chen on 2014-07-22.

Test Mode: Transmitting

Test Result: Compliance.

Please refer to following table.

Modulation Mode	Channel Separation	f_c	High Power Level	Low Power Level	Note
		MHz	W	W	
FM	12.5kHz	400.0125	39.08	25.76	**Not for FCC Review**
		435	41.3	24.77	**For Part 90**
		469.9875	39.81	24.89	
4FSK		400.0125	38.55	25.23	**Not for FCC Review**
		435	41.59	24.04	**For Part 90**
		469.9875	39.36	24.66	
FM		454.5	40.55	25.00	**For Part 22**
		458	40.18	24.89	
4FSK		454.5	40.93	24.77	
		458	40.09	24.89	

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 in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

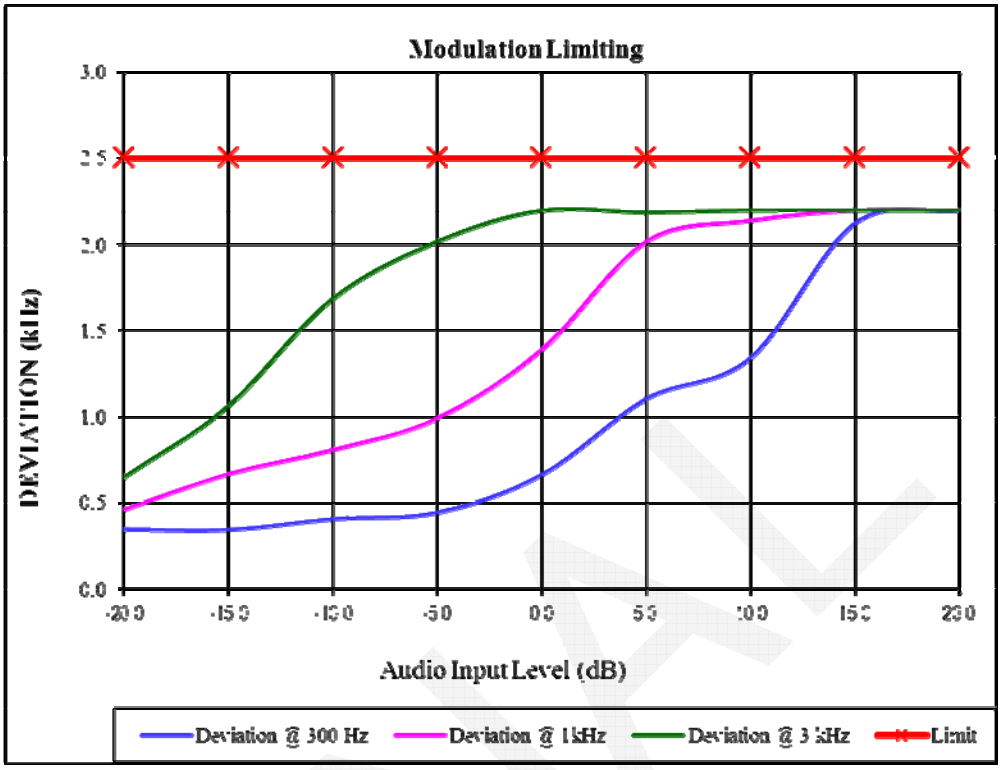
Environmental Conditions

Temperature:	18.7 °C
Relative Humidity:	37%
ATM Pressure:	101.8 kPa

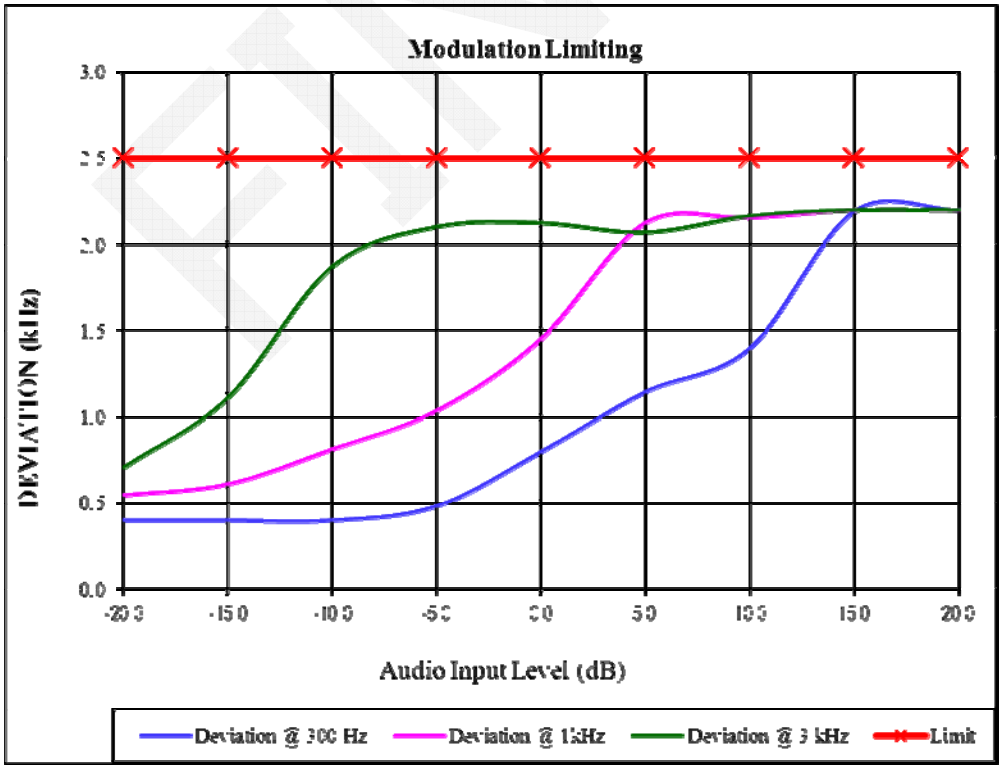
The testing was performed by Leon Chen on 2014-07-18.

MODULATION LIMITING

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

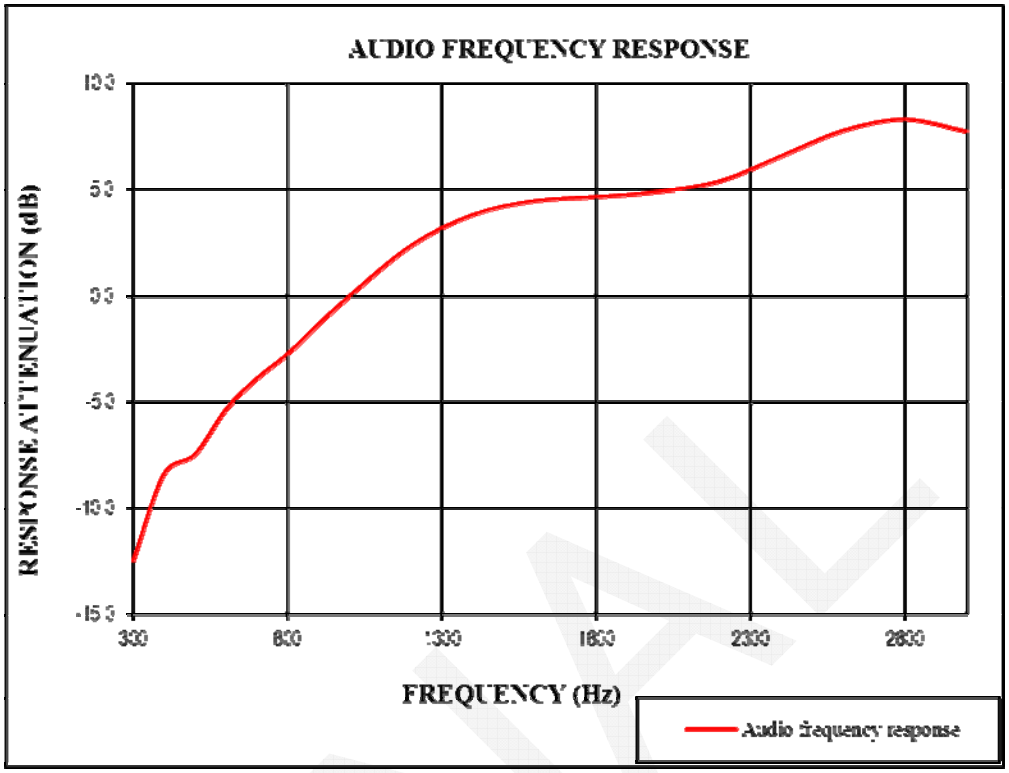


Carrier Frequency: 435 MHz, Channel Separation = 12.5 kHz, low power level

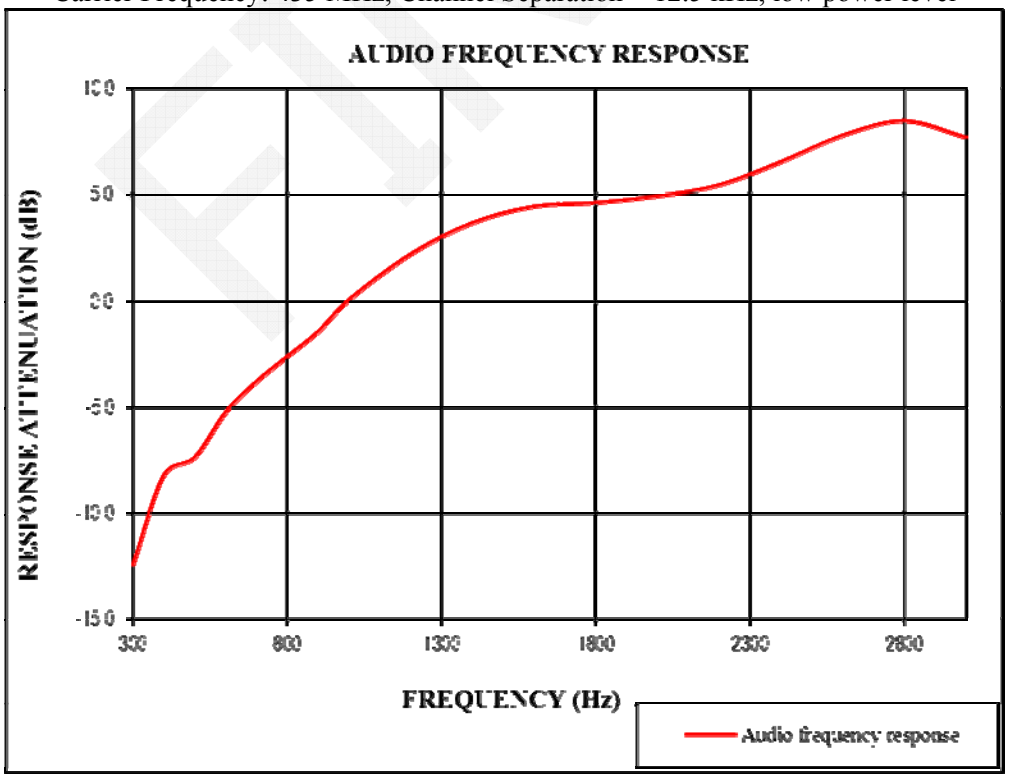


Audio Frequency Response

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



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



Audio Frequency Low Pass Filter Response

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

Applicable Standard

FCC §2.1049, §22.357, § 22.731, §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 f0 to 5.625 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd−2.88 kHz) dB.

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd 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

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, 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:	20.6°C
Relative Humidity:	41 %
ATM Pressure:	101.3 kPa

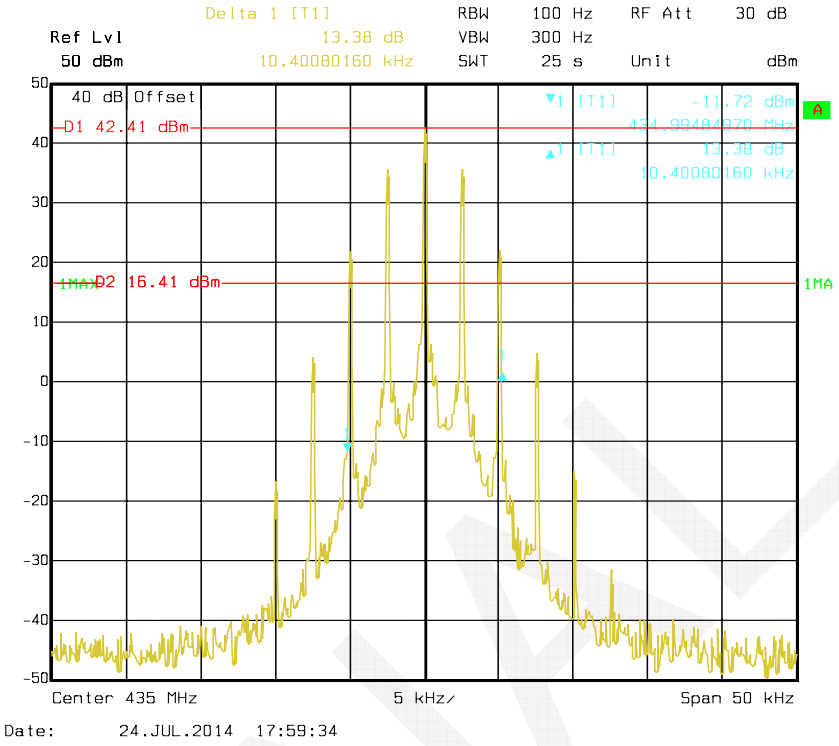
The testing was performed by Leon Chen from 2014-07-24 to 2014-07-30.

Modulation Mode	Channel Separation	f_c MHz	26 dB Bandwidth kHz	Emission Power	Note
FM	12.5kHz	435	10.40	Low Power Level	For Part 90
			10.40	High Power Level	
4FSK			9.50	Low Power Level	
			9.30	High Power Level	
FM		454.5	10.30	Low Power Level	For Part 22
			10.41	High Power Level	
		458	10.40	Low Power Level	
			10.40	High Power Level	
4FSK		454.5	9.60	Low Power Level	
			8.80	High Power Level	
		458	9.20	Low Power Level	
			9.10	High Power Level	

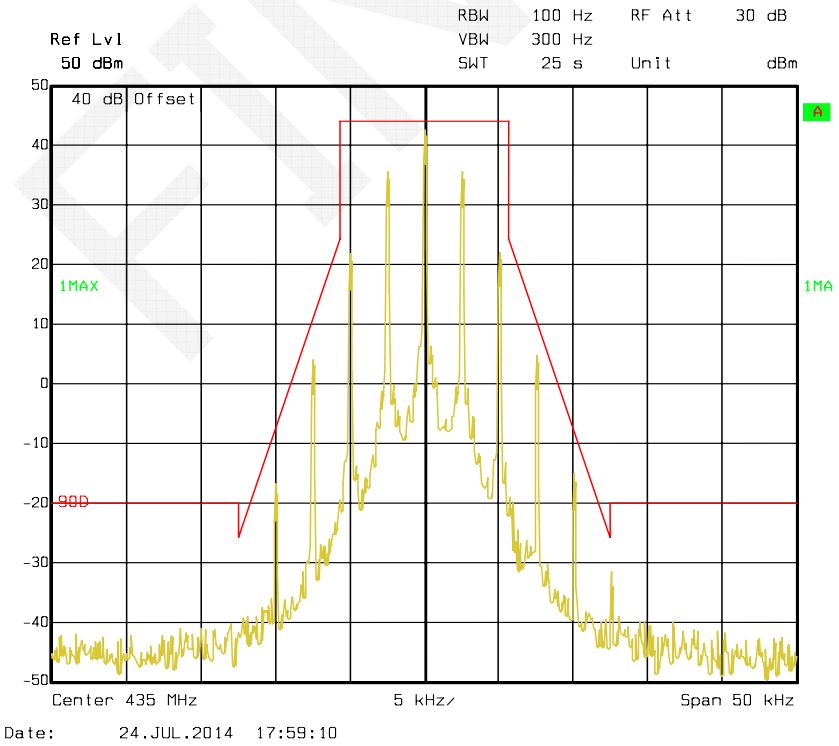
Please refer to the emission mask hereinafter plots.

Part 90 FM Mode:

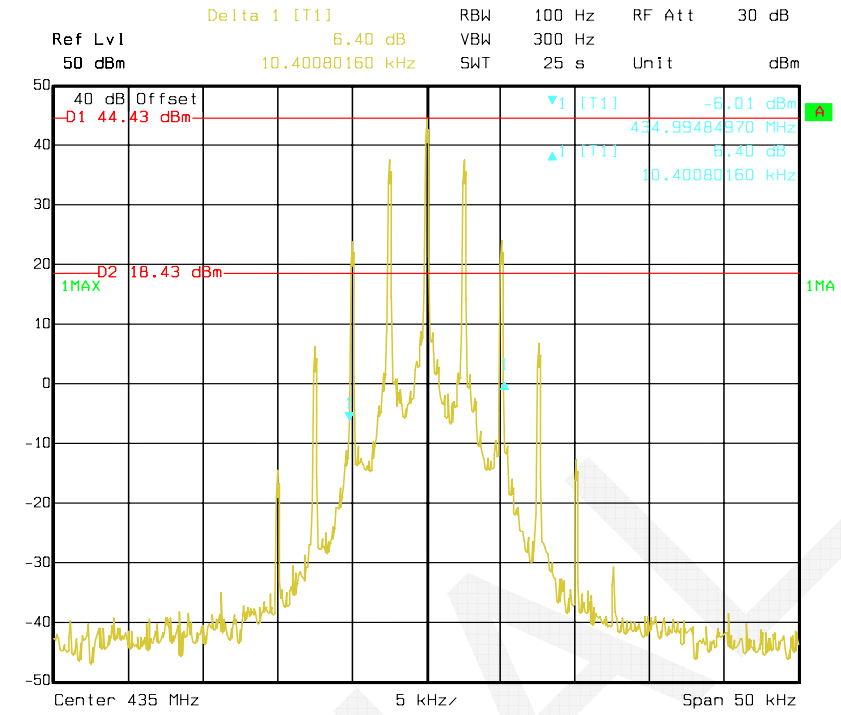
Occupied Bandwidth, 435MHz, Low power level



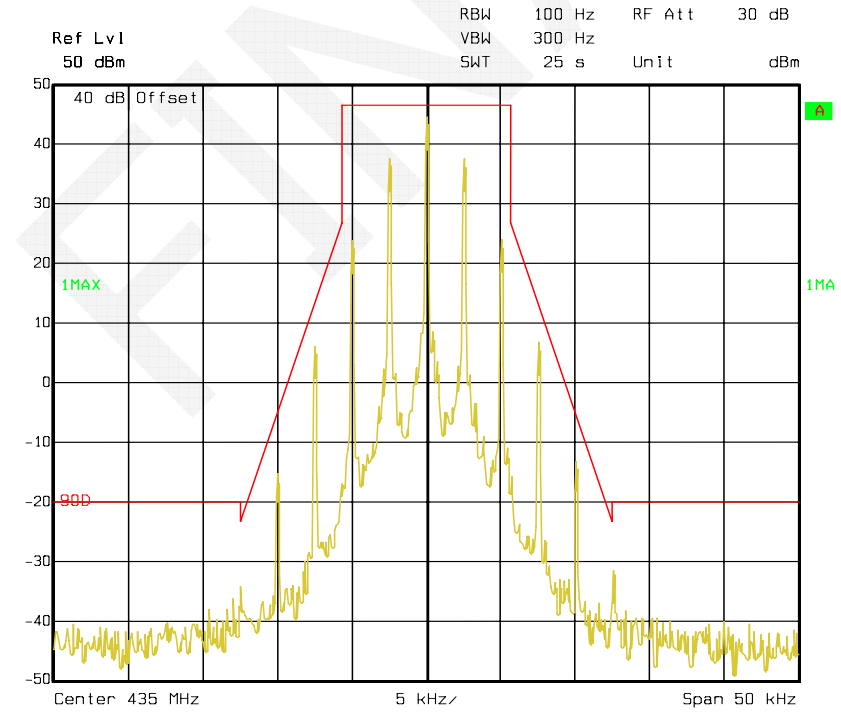
Emission Mask Type D, 435MHz,Low power level



Occupied Bandwidth, 435MHz, High power level

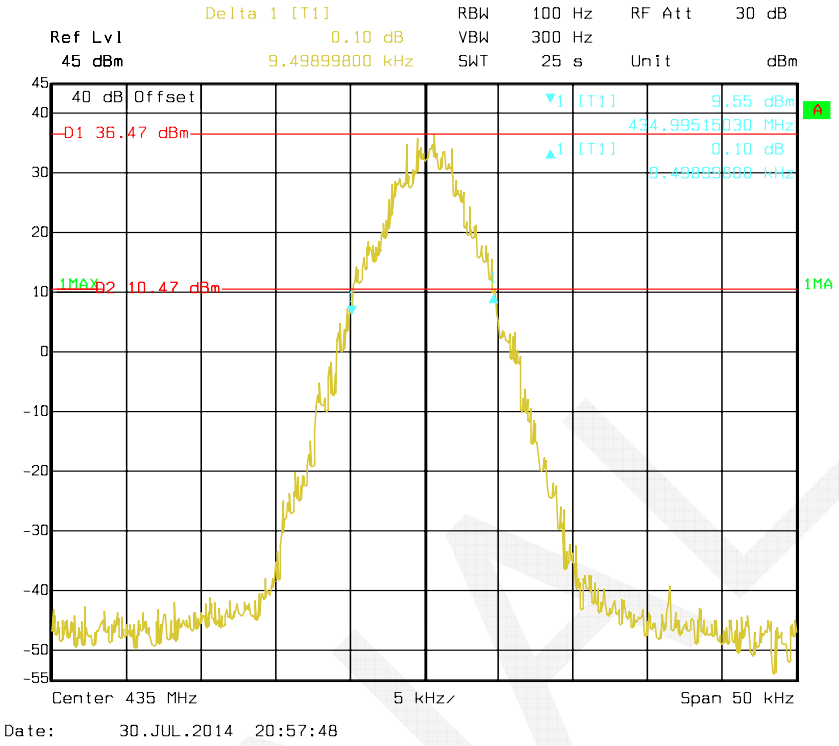


Emission Mask Type D, 435MHz, High power level

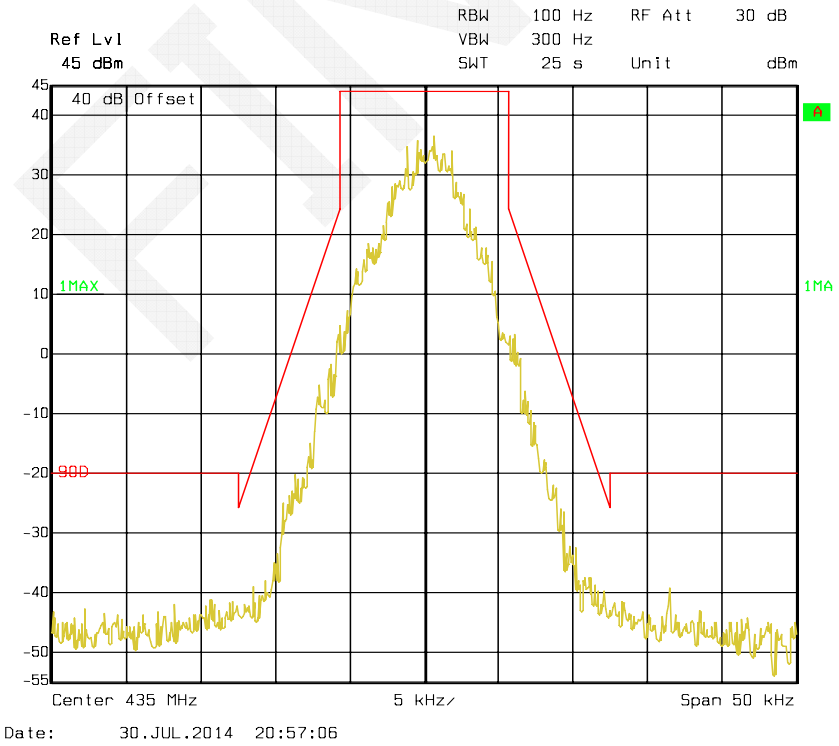


Part 90 4FSK Mode:

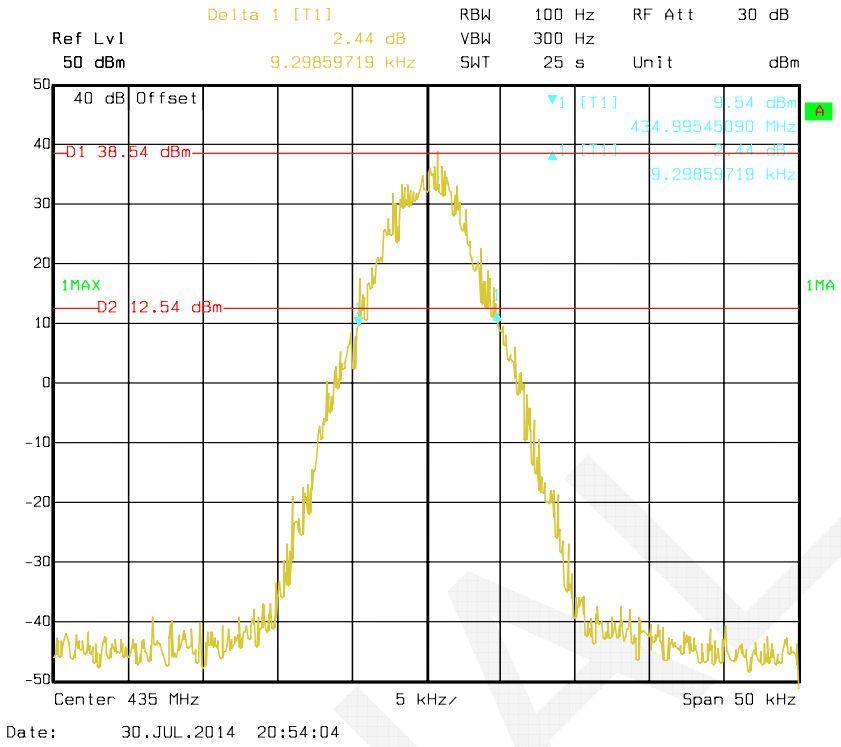
Occupied Bandwidth, 435MHz, Low power level



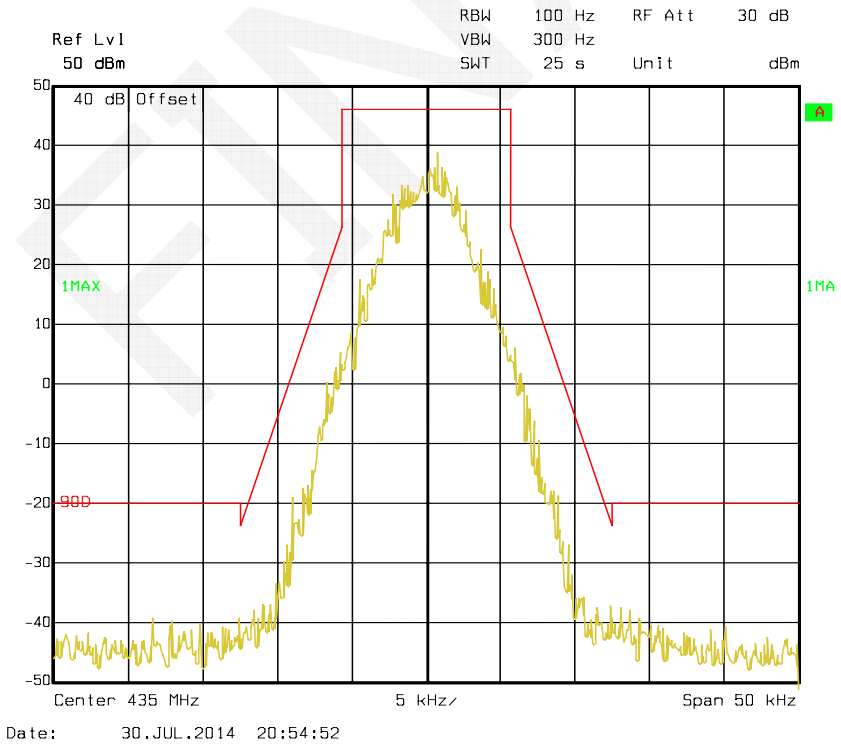
Emission Mask Type D, 435MHz, Low power level



Occupied Bandwidth, 435MHz, High power level

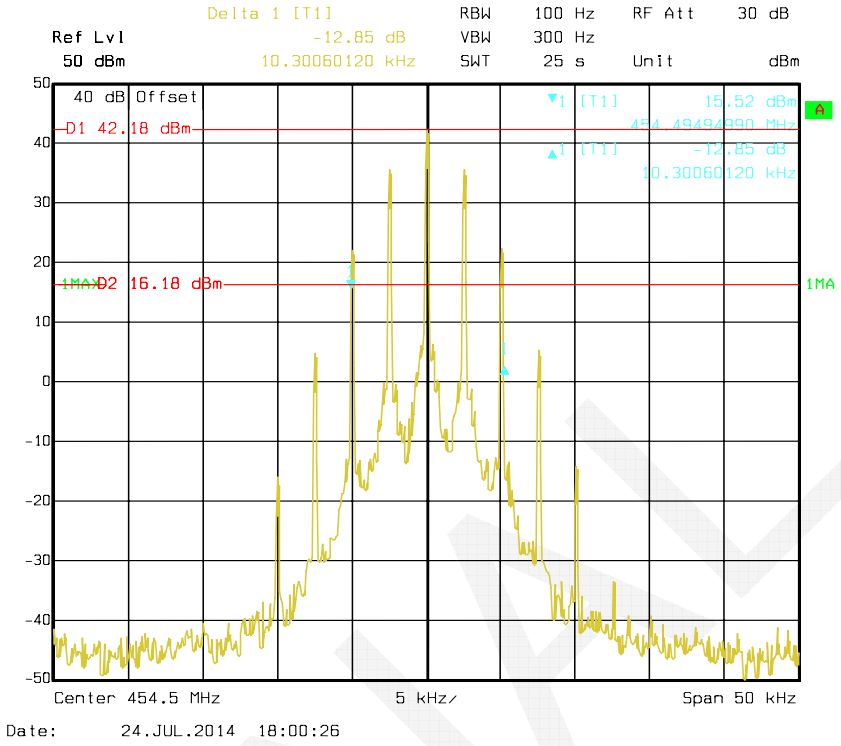


Emission Mask Type D, 435MHz, High power level

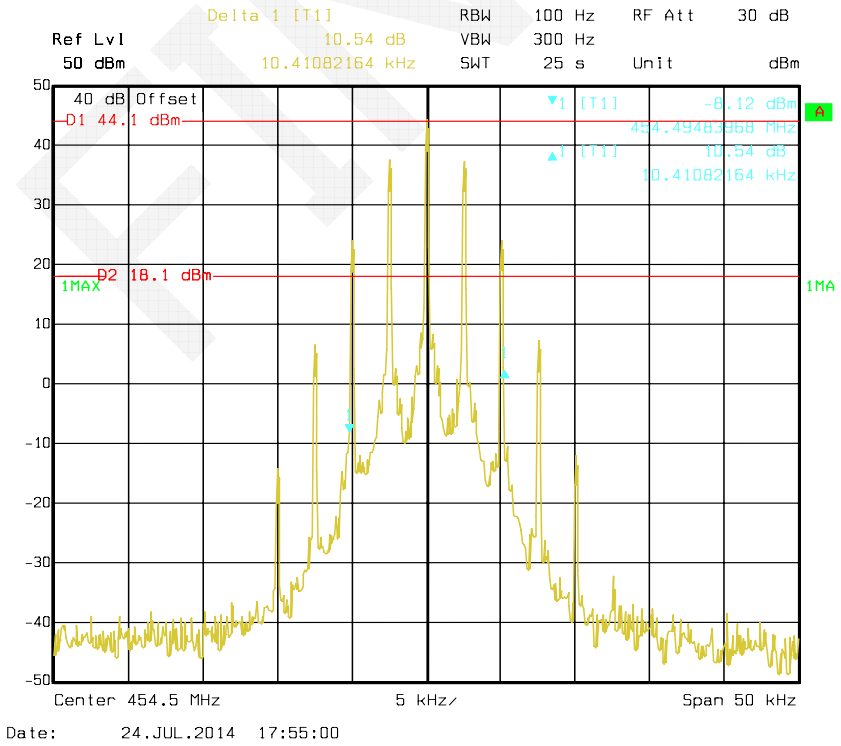


Part 22 FM Mode:

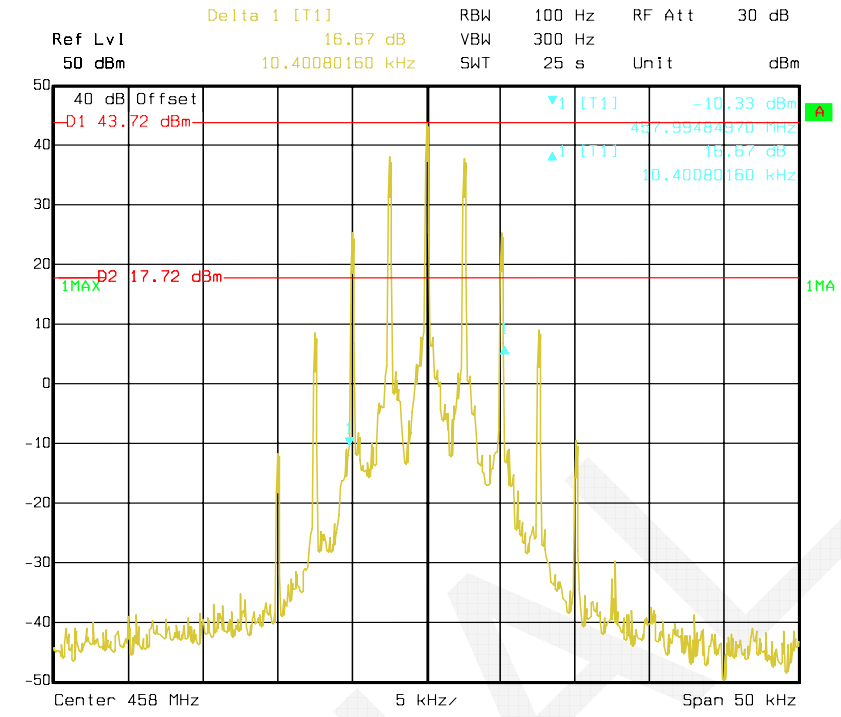
Occupied Bandwidth, 454.5MHz, Low power level



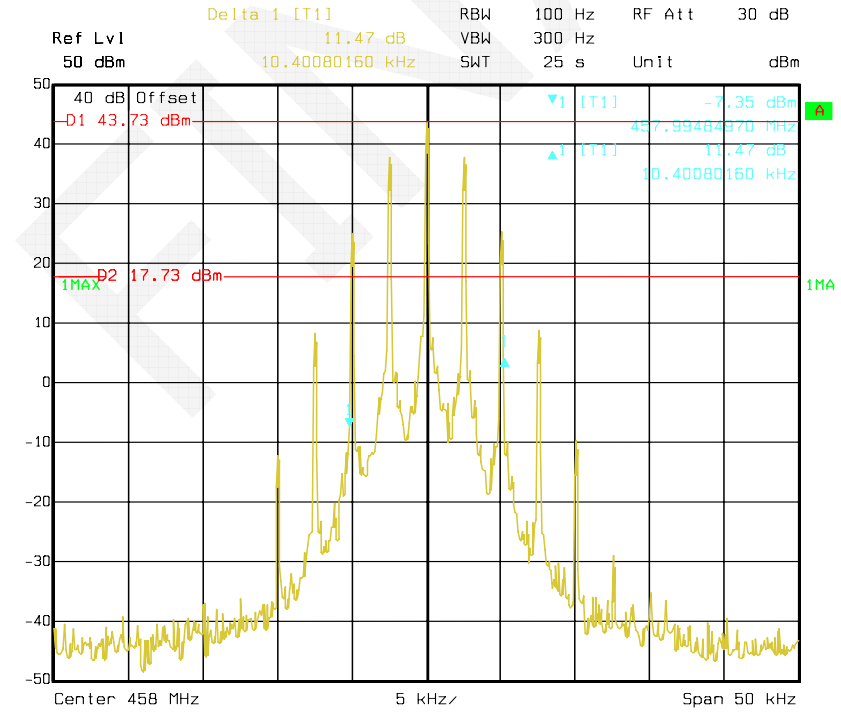
Occupied Bandwidth, 454.5MHz, High power level



Occupied Bandwidth, 458MHz, Low power level

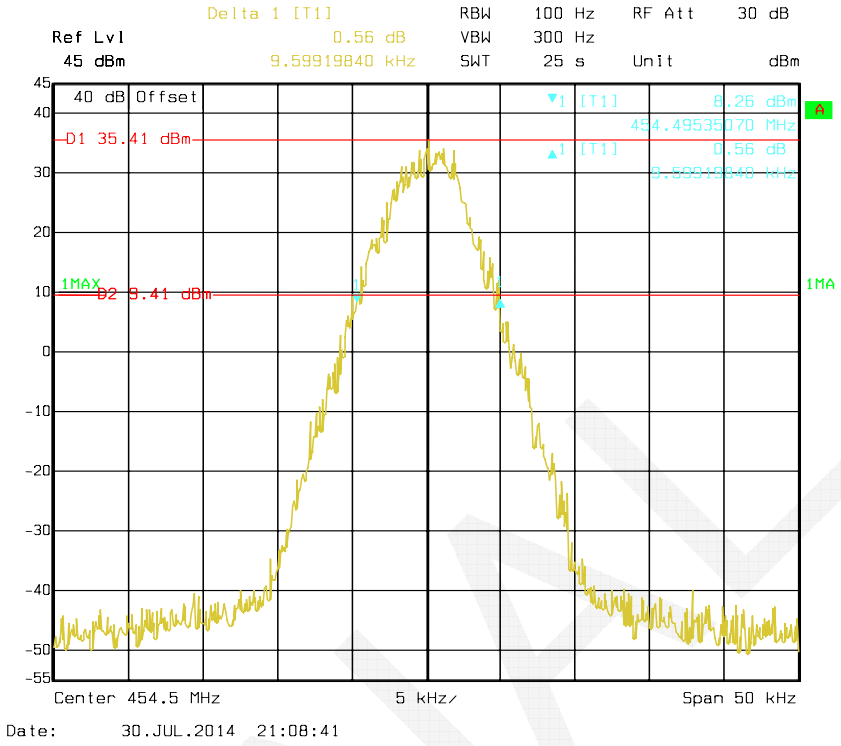


Occupied Bandwidth, 458MHz, High power level

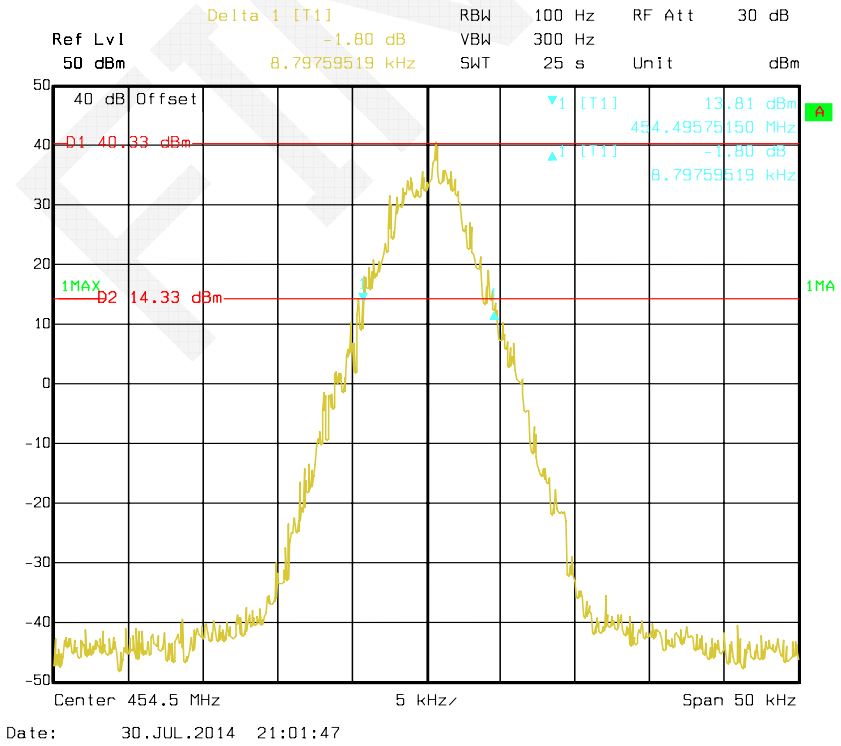


Part 22 4FSK Mode:

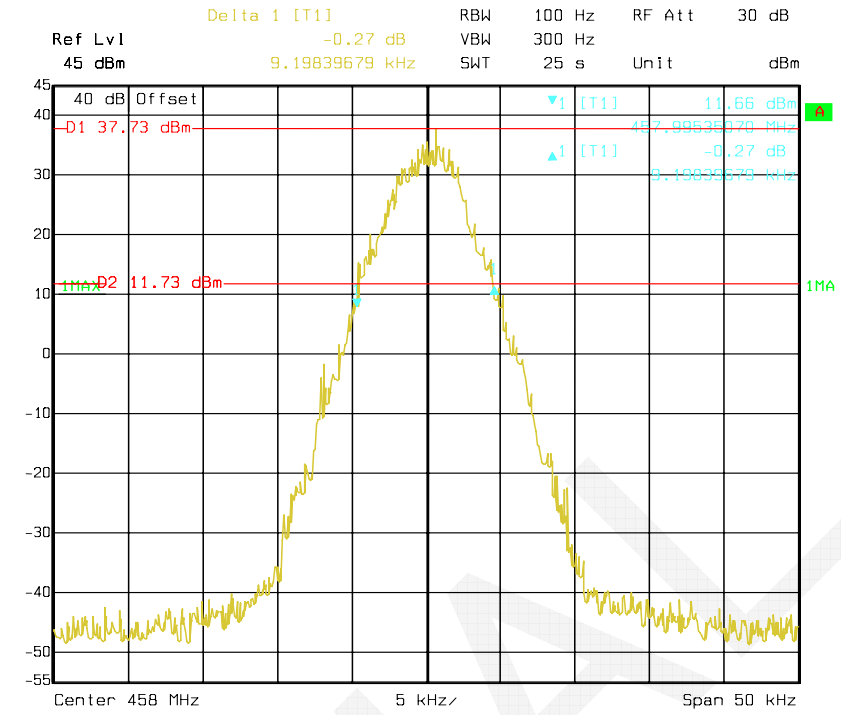
Occupied Bandwidth, 454.5MHz, Low power level



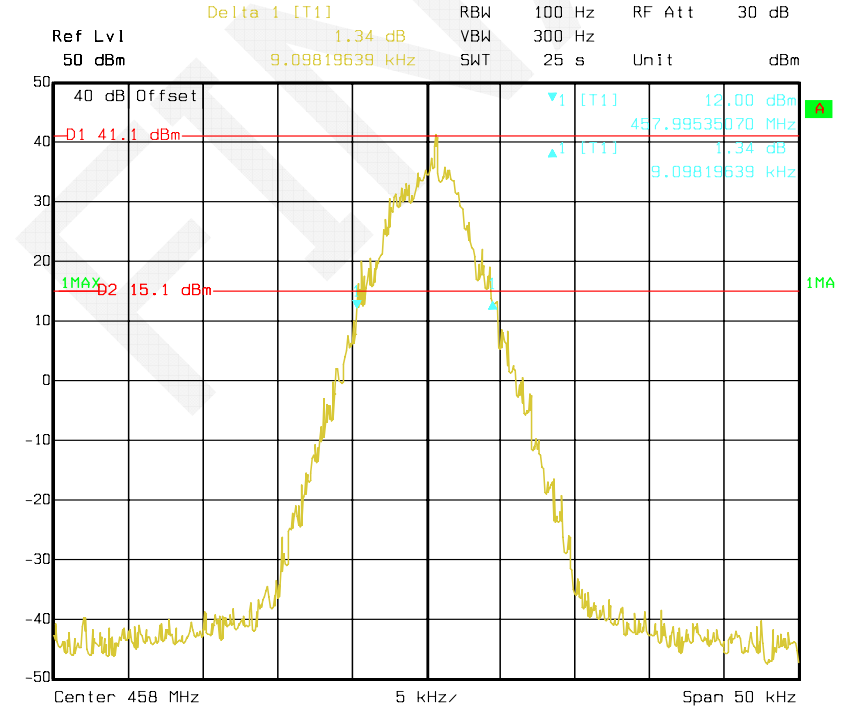
Occupied Bandwidth, 454.5MHz, High power level



Occupied Bandwidth, 458MHz, Low power level



Occupied Bandwidth, 458MHz, High power level



FCC §2.1051 & §22.861 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

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

1) For any frequency removed from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0, 0 dB.

2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 (f_d –2.88 kHz) dB.

3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz at least:

50+10logP=50+10log (P) dB

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 in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

Test Procedure

Spectrum analyzer 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:	39 %
ATM Pressure:	101.2 kPa

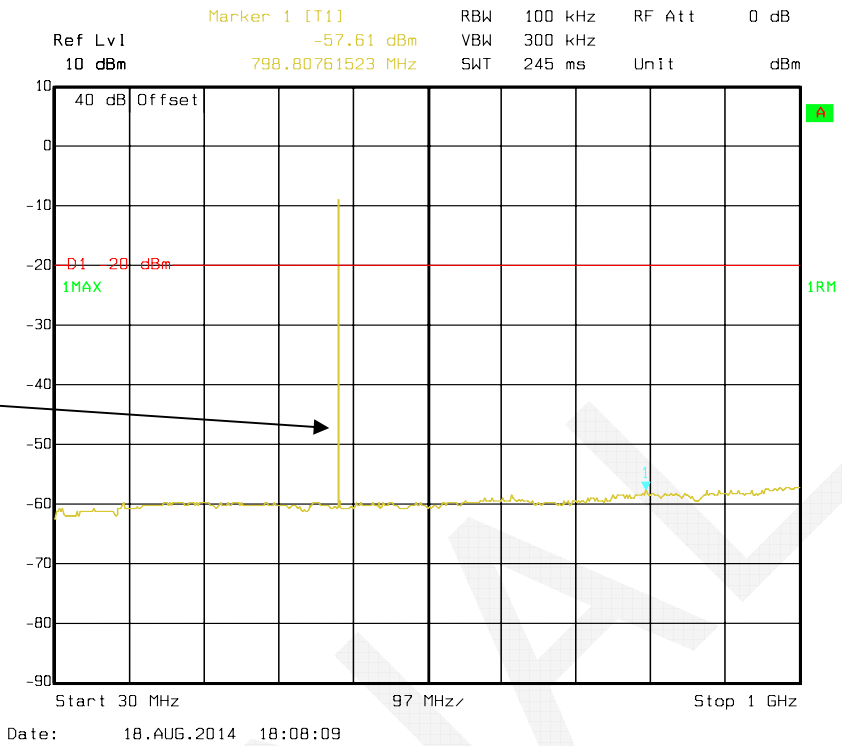
The testing was performed by Leon Chen on 2014-08-18.

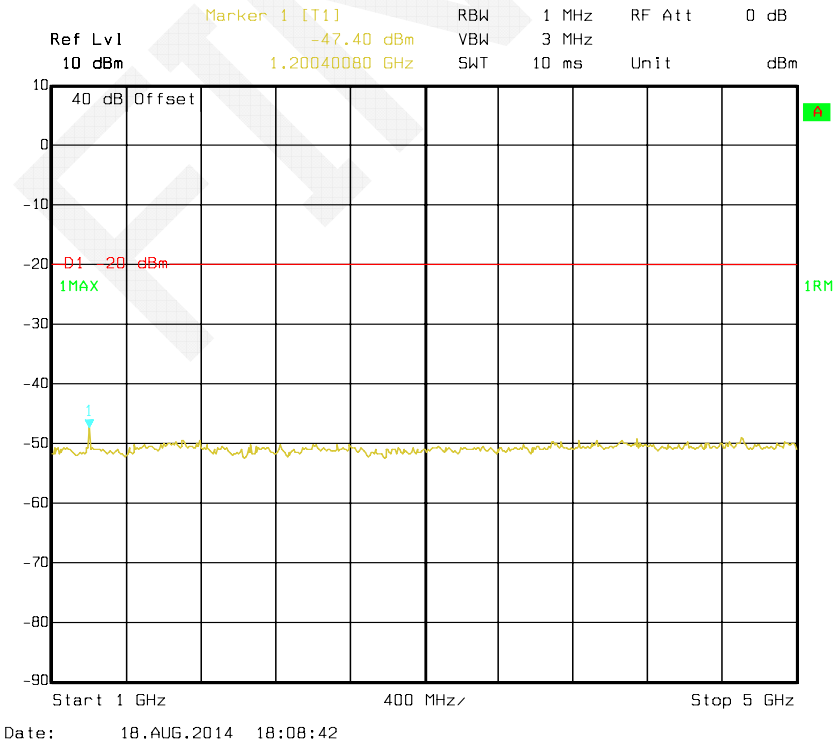
Please refer to the following plots.

For Part 90:

400.0125 MHz – FM mode

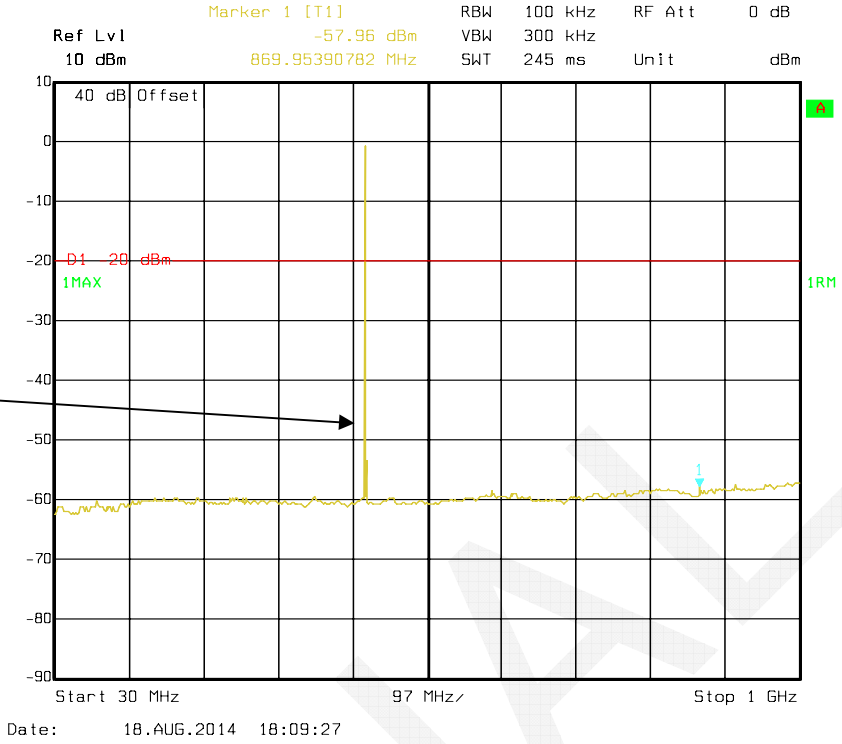
Fundamental test with Band Reject Filter

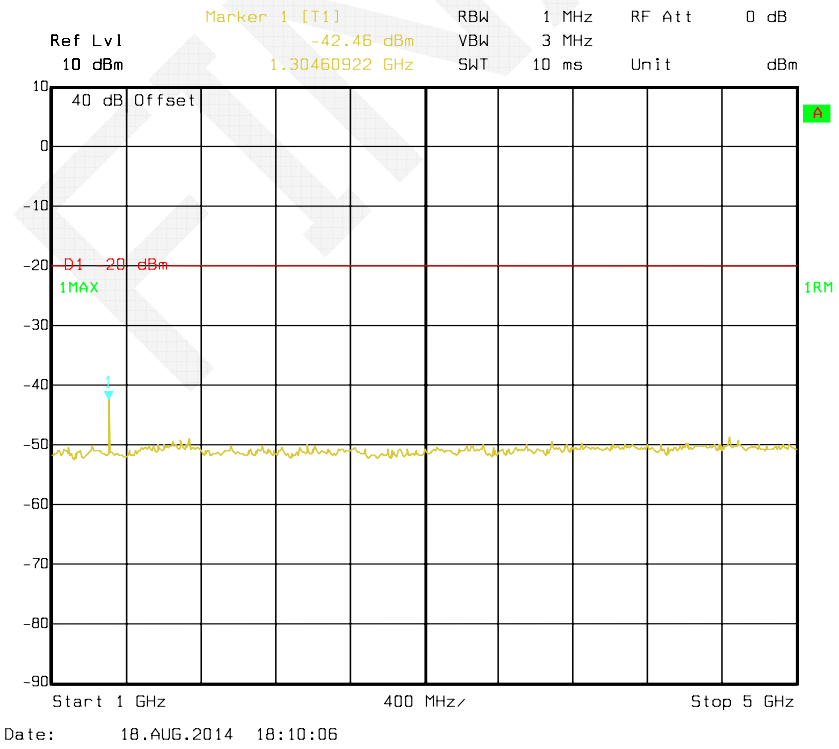




435 MHz – FM mode

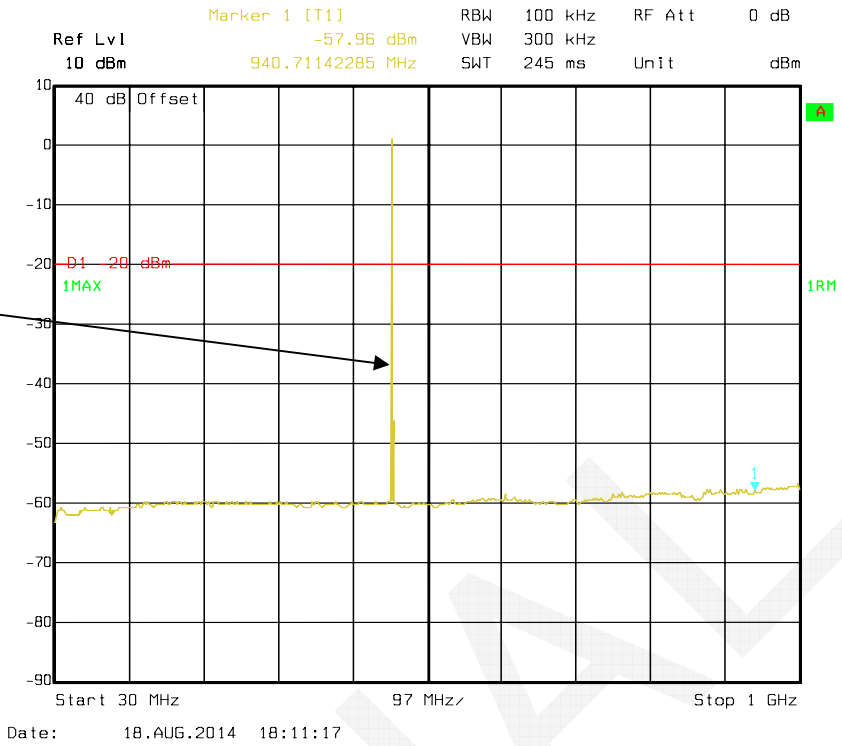
Fundamental test with Band Reject Filter

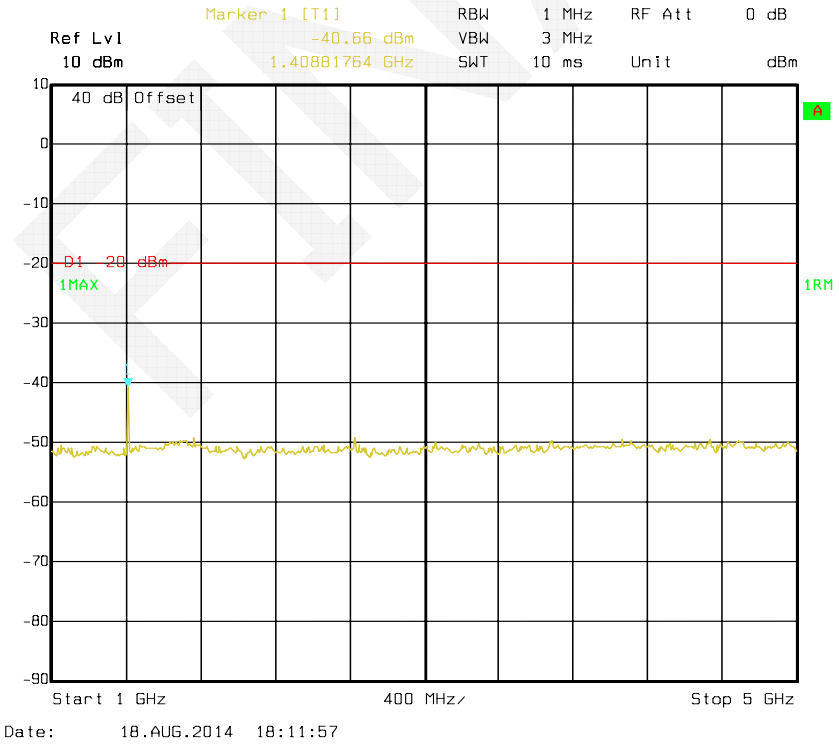




469.9875 MHz – FM mode

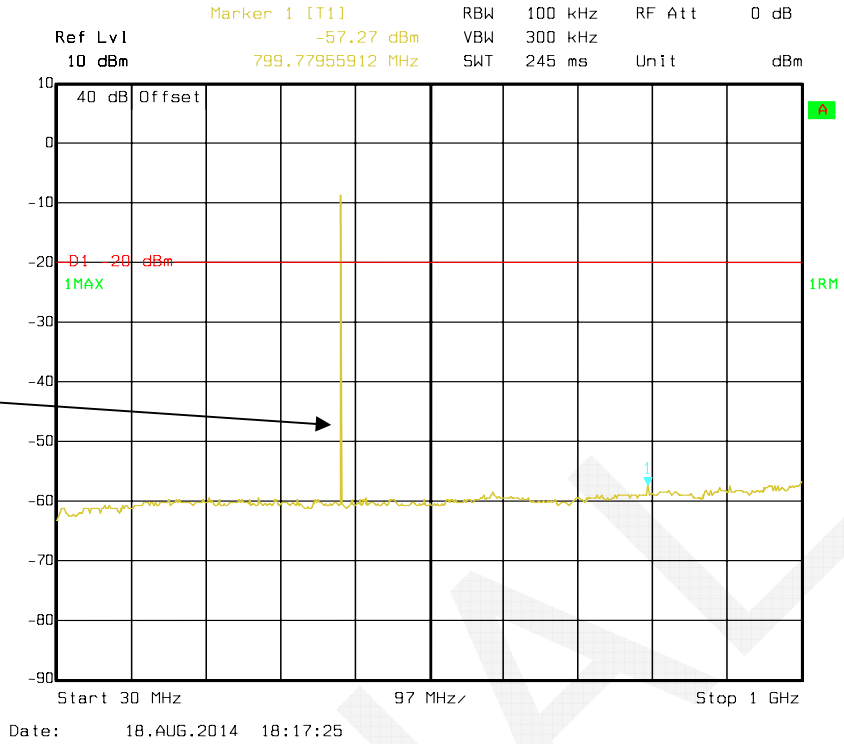
Fundamental test with Band Reject Filter

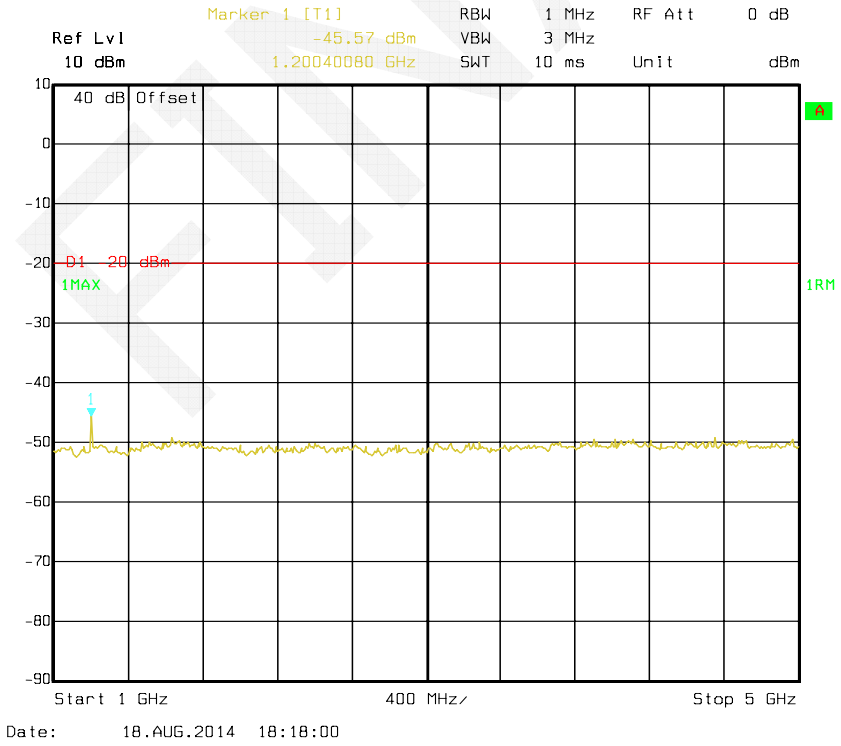




400.0125 MHz – 4FSK mode

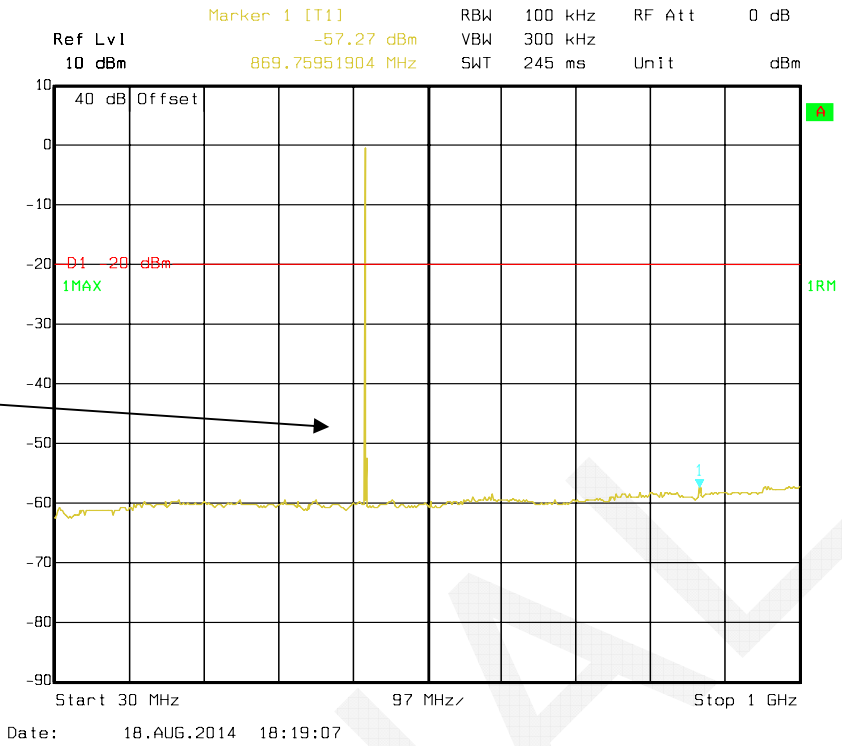
Fundamental test with Band Reject Filter

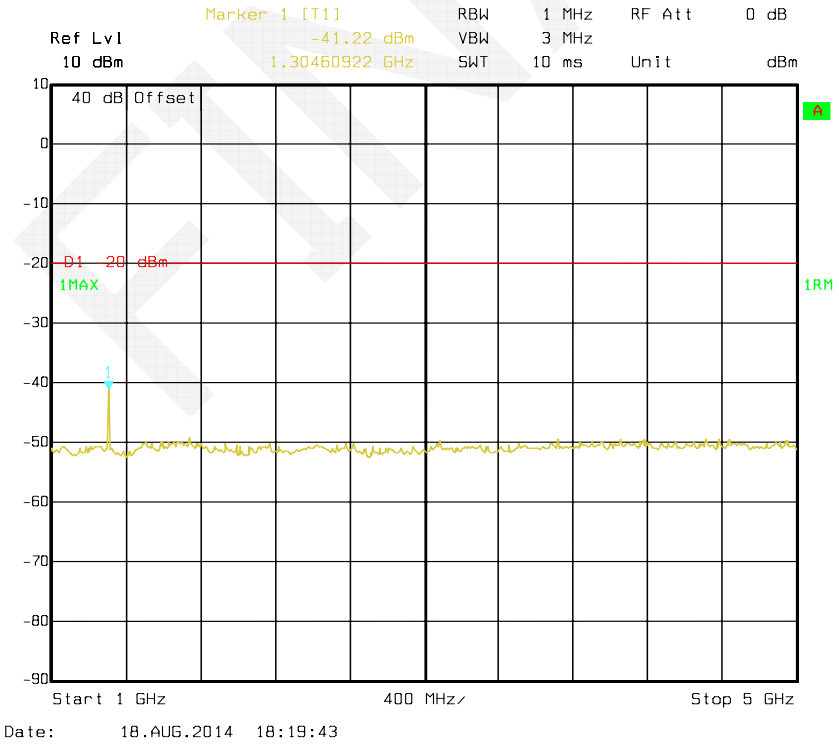




435 MHz – 4FSK mode

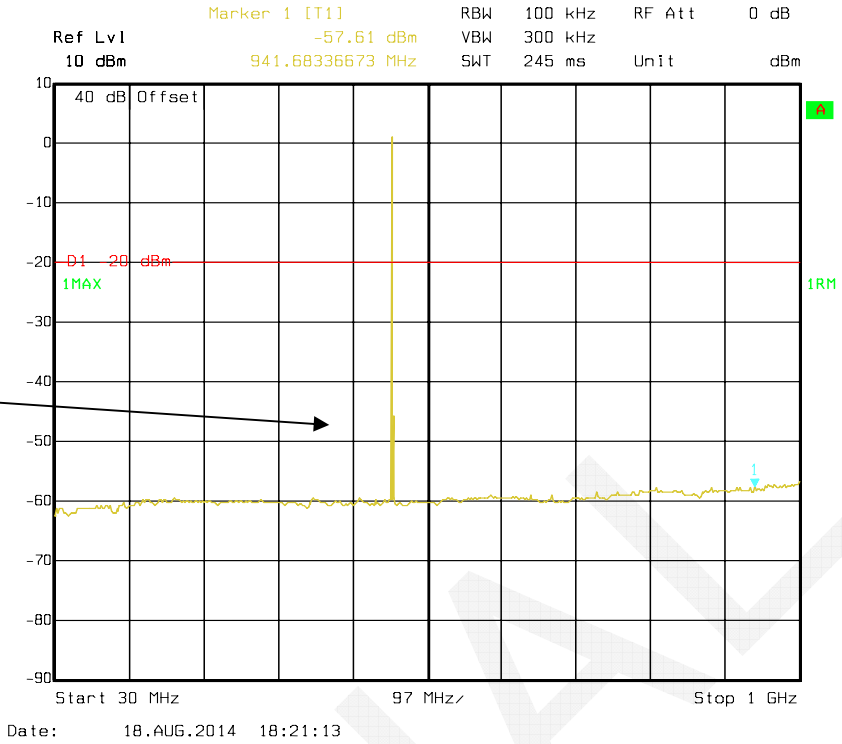
Fundamental test with Band Reject Filter

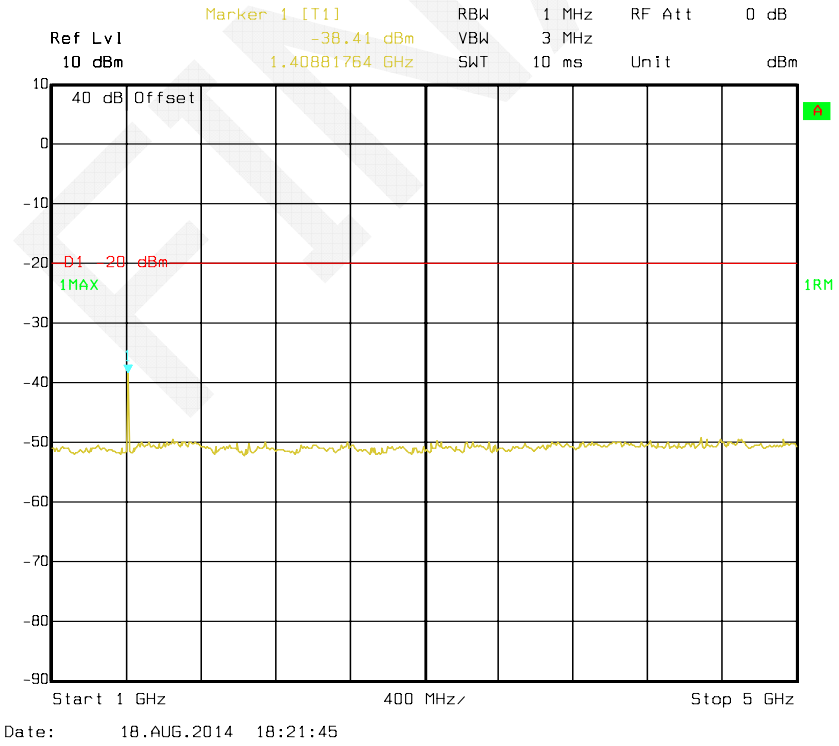




469.9875 MHz – 4FSK mode

Fundamental test with Band Reject Filter

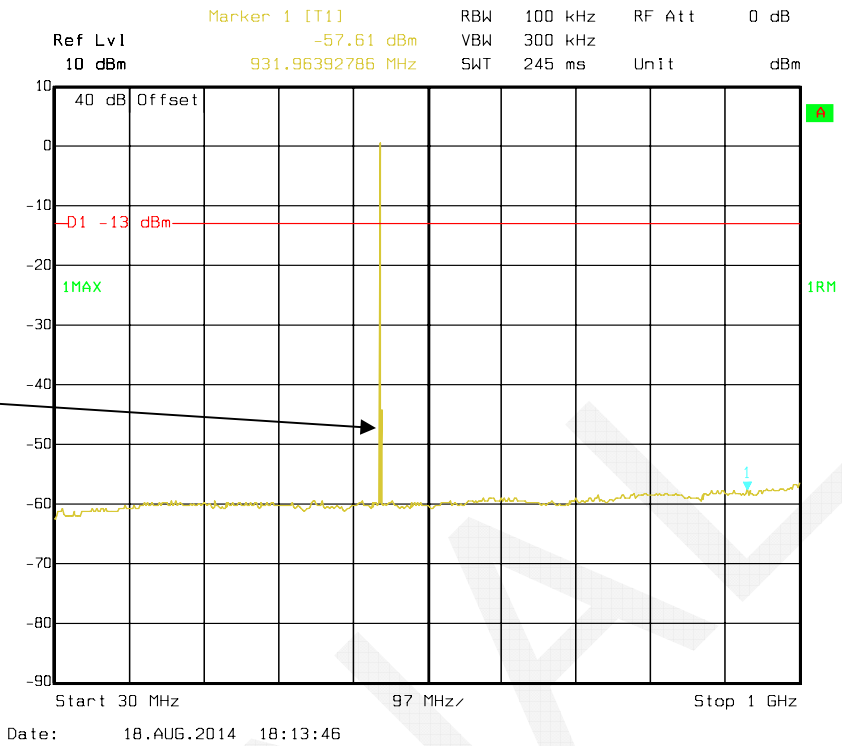


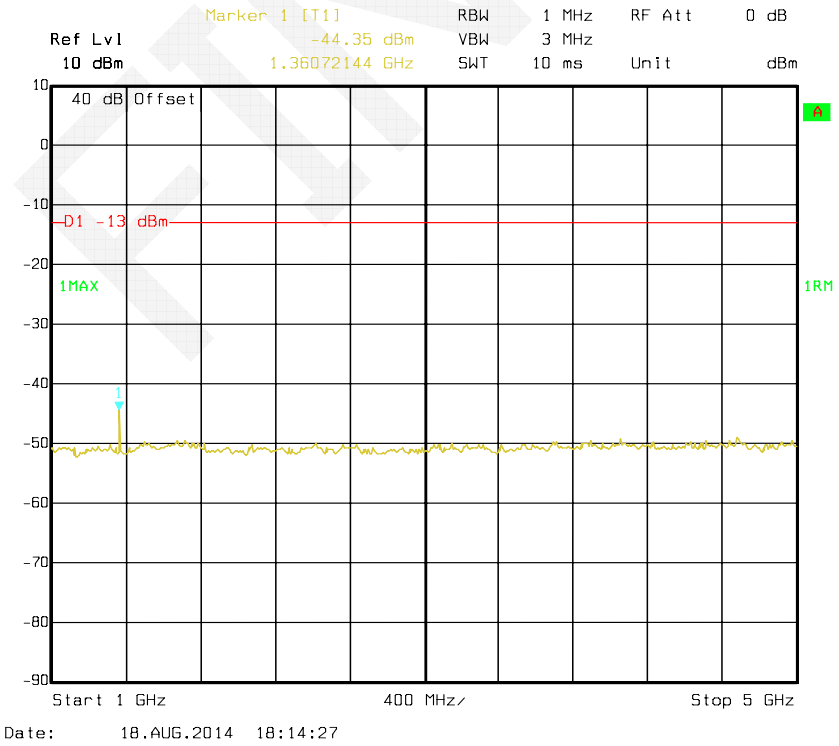


For Part 22:

454.5 MHz – FM mode

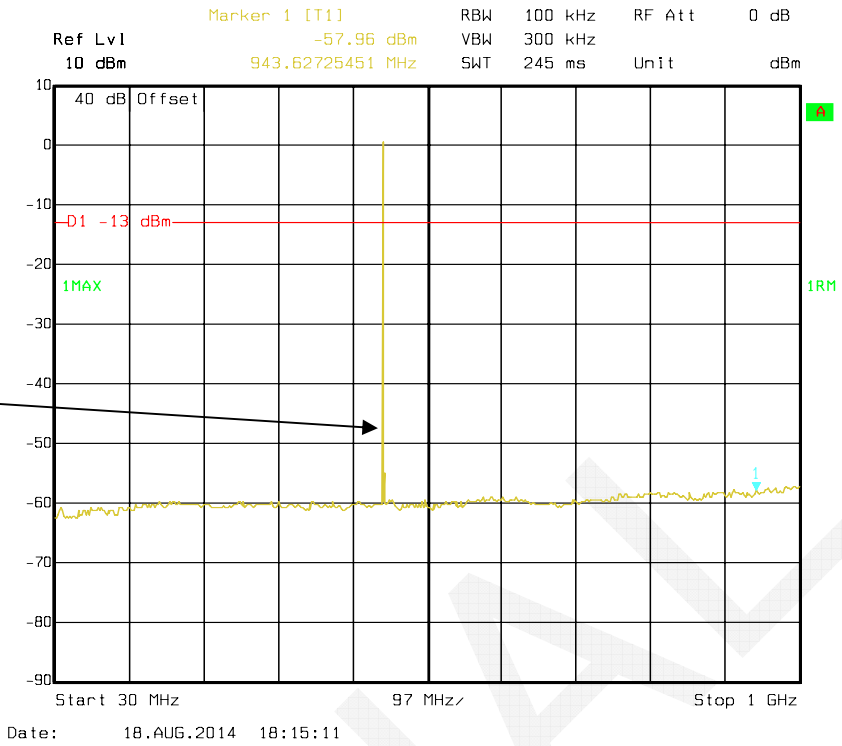
Fundamental test with Band Reject Filter

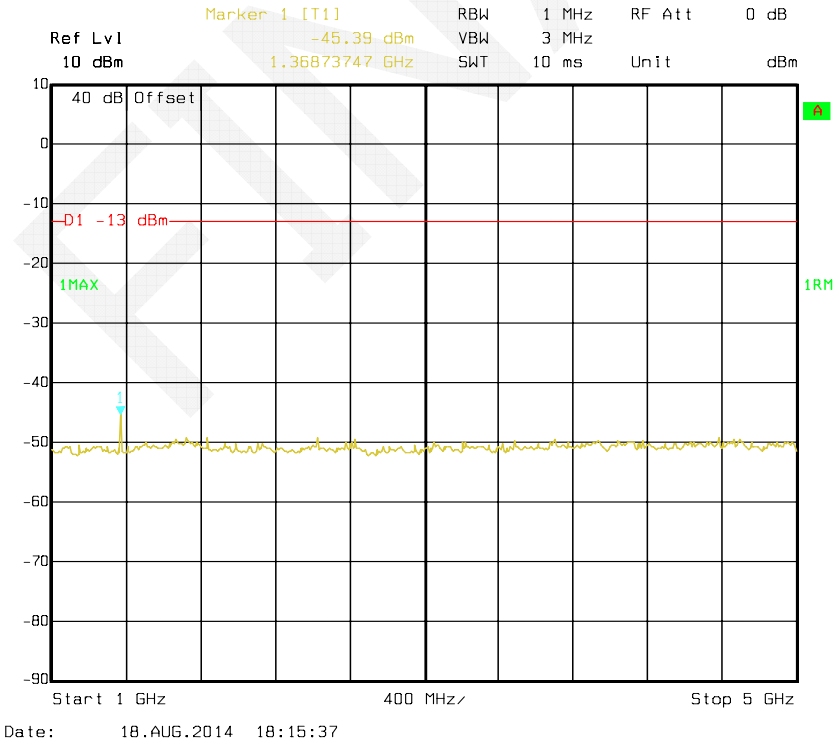




458 MHz – FM mode

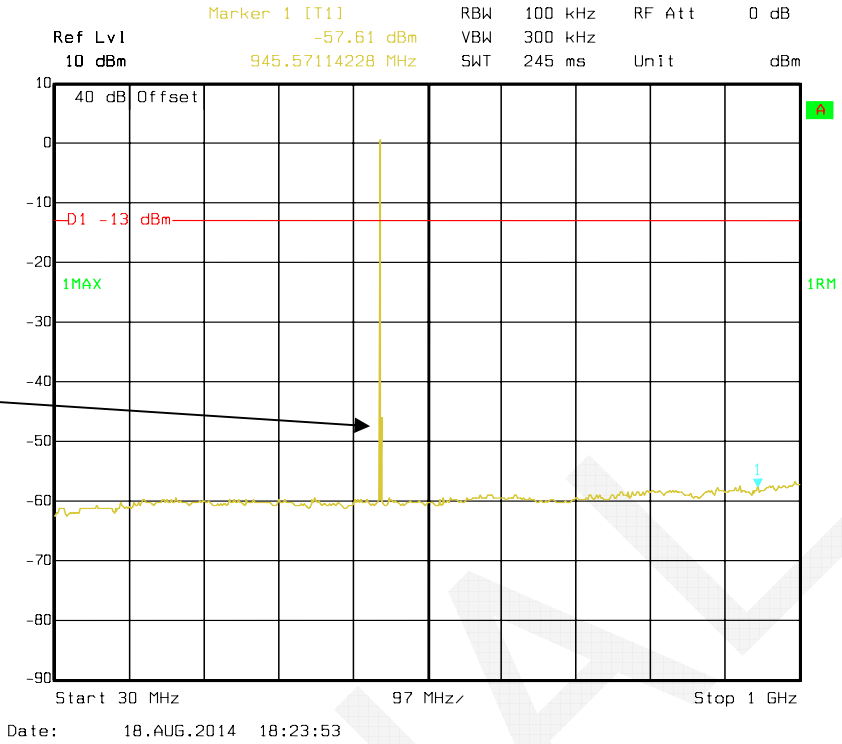
Fundamental test with Band Reject Filter

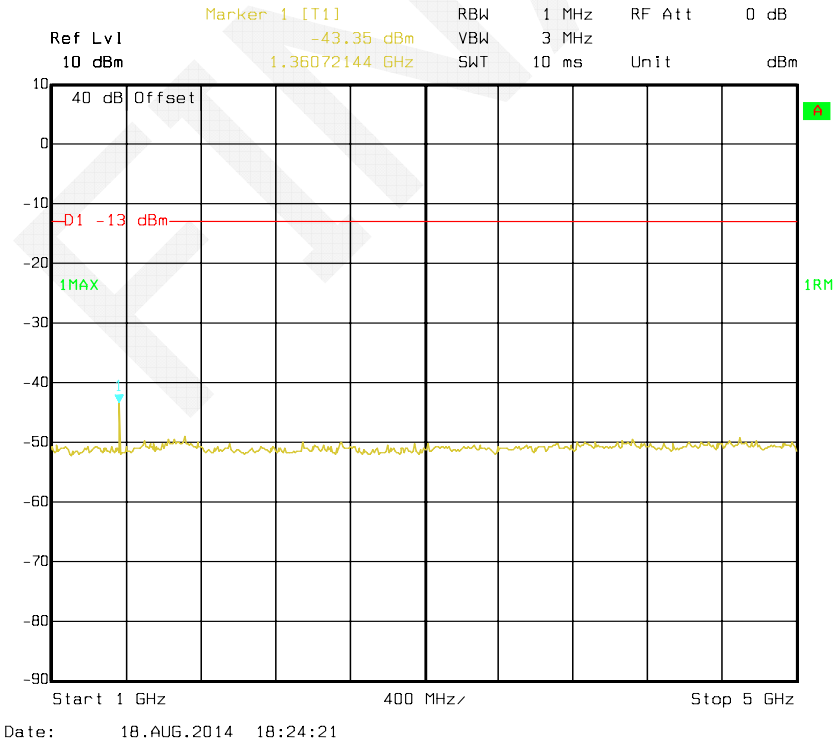




454.5 MHz – 4FSK mode

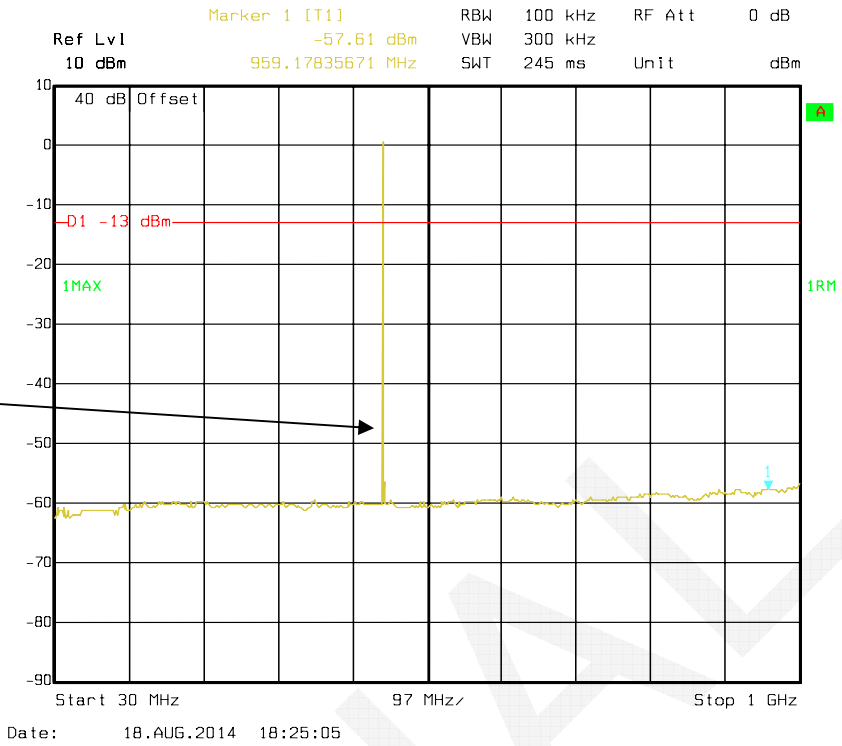
Fundamental test with Band Reject Filter

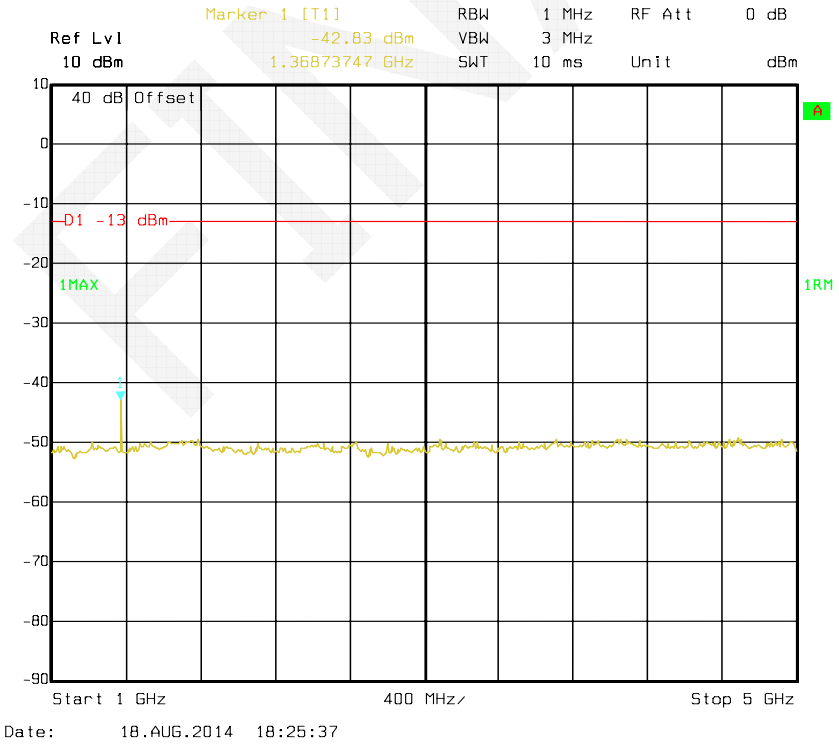




458 MHz – 4FSK mode

Fundamental test with Band Reject Filter





FCC §2.1053 & §22.861 & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053 and §22.861 and §90.210

Test Equipment List and Details

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

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, 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.

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

Spurious attenuation limit in dB =50+10 Log_{10} (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

Test Data

Environmental Conditions

Temperature:	24.8 °C
Relative Humidity:	39 %
ATM Pressure:	101.2 kPa

The testing was performed by Leon Chen on 2014-08-18.

For Part 90:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	PART 90	
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)		Limit (dBm)	Margin (dB)
operation frequency: 400.0125 **MHz, FM mode**								
800.0250	H	48.43	-43.4	0.0	0.9	-44.3	-20.0	24.3
800.0250	V	47.26	-42.1	0.0	0.9	-43.0	-20.0	23.0
1200.0375	H	43.51	-57.2	7.3	1	-50.9	-20.0	30.9
1200.0375	V	44.53	-55.9	7.3	1	-49.6	-20.0	29.6
1600.0500	H	44.86	-56.3	10.1	1.4	-47.6	-20.0	27.6
1600.0500	V	47.42	-54.6	10.1	1.4	-45.9	-20.0	25.9
2000.0625	H	48.65	-49.7	12.0	1.3	-39.0	-20.0	19.0
2000.0625	V	52.58	-44.4	12.0	1.3	-33.7	-20.0	13.7
Frequency:435.000 **MHz, FM mode**								
870.0000	H	45.70	-46.3	0.0	1	-47.3	-20.0	27.3
870.0000	V	45.45	-43.2	0.0	1	-44.2	-20.0	24.2
1305.0000	H	41.08	-58.7	8.3	1.1	-51.5	-20.0	31.5
1305.0000	V	43.10	-57.2	8.3	1.1	-50.0	-20.0	30.0
1740.0000	H	43.02	-57.7	10.9	1.5	-48.3	-20.0	28.3
1740.0000	V	46.17	-54.8	10.9	1.5	-45.4	-20.0	25.4
2175.0000	H	46.65	-49.1	10.9	1.5	-39.7	-20.0	19.7
2175.0000	V	50.09	-45.3	10.9	1.5	-35.9	-20.0	15.9
Frequency: 469.9875 **MHz, FM mode**								
939.9750	H	43.32	-44.8	0.0	1	-45.8	-20.0	25.8
939.9750	V	44.01	-41.4	0.0	1	-42.4	-20.0	22.4
1409.9625	H	40.66	-60.1	9.0	1.3	-52.4	-20.0	32.4
1409.9625	V	38.64	-61.8	9.0	1.3	-54.1	-20.0	34.1
1879.9500	H	42.95	-56.4	11.7	1.4	-46.1	-20.0	26.1
1879.9500	V	44.70	-54.3	11.7	1.4	-44.0	-20.0	24.0
2349.9375	H	45.79	-50.8	11.8	2	-41.0	-20.0	21.0
2349.9375	V	46.80	-49	11.8	2	-39.2	-20.0	19.2

For Part 90:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	PART 90	
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)		Limit (dBm)	Margin (dB)
operation frequency: 400.0125 **MHz, 4FSK mode**								
800.0250	H	48.22	-43.6	0.0	0.9	-44.5	-20.0	24.5
800.0250	V	47.64	-41.7	0.0	0.9	-42.6	-20.0	22.6
1200.0375	H	43.15	-57.5	7.3	1	-51.2	-20.0	31.2
1200.0375	V	44.74	-55.7	7.3	1	-49.4	-20.0	29.4
1600.0500	H	44.46	-56.7	10.1	1.4	-48.0	-20.0	28.0
1600.0500	V	47.90	-54.1	10.1	1.4	-45.4	-20.0	25.4
2000.0625	H	48.65	-49.7	12.0	1.3	-39.0	-20.0	19.0
2000.0625	V	52.82	-44.1	12.0	1.3	-33.4	-20.0	13.4
Frequency:435.000 **MHz, 4FSK mode**								
870.0000	H	45.29	-46.7	0.0	1	-47.7	-20.0	27.7
870.0000	V	45.85	-42.8	0.0	1	-43.8	-20.0	23.8
1305.0000	H	41.49	-58.3	8.3	1.1	-51.1	-20.0	31.1
1305.0000	V	43.24	-57.1	8.3	1.1	-49.9	-20.0	29.9
1740.0000	H	43.27	-57.4	10.9	1.5	-48.0	-20.0	28.0
1740.0000	V	46.54	-54.4	10.9	1.5	-45.0	-20.0	25.0
2175.0000	H	46.69	-49.1	10.9	1.5	-39.7	-20.0	19.7
2175.0000	V	49.96	-45.4	10.9	1.5	-36.0	-20.0	16.0
Frequency: 469.9875 **MHz, 4FSK mode**								
939.9750	H	42.84	-45.3	0.0	1	-46.3	-20.0	26.3
939.9750	V	43.99	-41.4	0.0	1	-42.4	-20.0	22.4
1409.9625	H	40.52	-60.3	9.0	1.3	-52.6	-20.0	32.6
1409.9625	V	38.62	-61.9	9.0	1.3	-54.2	-20.0	34.2
1879.9500	H	43.05	-56.3	11.7	1.4	-46.0	-20.0	26.0
1879.9500	V	44.37	-54.6	11.7	1.4	-44.3	-20.0	24.3
2349.9375	H	46.03	-50.6	11.8	2	-40.8	-20.0	20.8
2349.9375	V	46.96	-48.9	11.8	2	-39.1	-20.0	19.1

For Part 22:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	PART 22	
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)		Limit (dBm)	Margin (dB)
operation frequency: 454.5000 **MHz, FM mode**								
909.0000	H	43.87	-47.3	0.0	1	-48.3	-13.0	35.3
909.0000	V	44.60	-43.1	0.0	1	-44.1	-13.0	31.1
1363.5000	H	40.36	-60	8.7	1.2	-52.5	-13.0	39.5
1363.5000	V	42.73	-57.6	8.7	1.2	-50.1	-13.0	37.1
1818.0000	H	41.96	-58	11.2	1.4	-48.2	-13.0	35.2
1818.0000	V	45.90	-54.3	11.2	1.4	-44.5	-13.0	31.5
2272.5000	H	45.96	-50.1	11.1	1.8	-40.8	-13.0	27.8
2272.5000	V	48.87	-46.9	11.1	1.8	-37.6	-13.0	24.6
Frequency: 458.0000 **MHz, FM mode**								
916.0000	H	45.26	-45.2	0.0	1	-46.2	-13.0	33.2
916.0000	V	45.96	-41.3	0.0	1	-42.3	-13.0	29.3
1374.0000	H	43.00	-57.5	8.8	1.2	-49.9	-13.0	36.9
1374.0000	V	42.66	-57.7	8.8	1.2	-50.1	-13.0	37.1
1832.0000	H	42.56	-57.3	11.3	1.4	-47.4	-13.0	34.4
1832.0000	V	47.86	-52.1	11.3	1.4	-42.2	-13.0	29.2
2290.0000	H	46.93	-49.2	11.2	1.8	-39.8	-13.0	26.8
2290.0000	V	49.48	-46.3	11.2	1.8	-36.9	-13.0	23.9

For Part 22:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	PART 22	
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)		Limit (dBm)	Margin (dB)
operation frequency: 454.5000 **MHz, 4FSK mode**								
909.0000	H	43.10	-48.1	0.0	1	-49.1	-13.0	36.1
909.0000	V	44.17	-43.6	0.0	1	-44.6	-13.0	31.6
1363.5000	H	41.24	-59.1	8.7	1.2	-51.6	-13.0	38.6
1363.5000	V	41.90	-58.4	8.7	1.2	-50.9	-13.0	37.9
1818.0000	H	41.49	-58.5	11.2	1.4	-48.7	-13.0	35.7
1818.0000	V	45.97	-54.3	11.2	1.4	-44.5	-13.0	31.5
2272.5000	H	46.07	-50	11.1	1.8	-40.7	-13.0	27.7
2272.5000	V	48.79	-47	11.1	1.8	-37.7	-13.0	24.7
Frequency: 458.0000 **MHz, 4FSK mode**								
916.0000	H	44.28	-46.2	0.0	1	-47.2	-13.0	34.2
916.0000	V	45.82	-41.4	0.0	1	-42.4	-13.0	29.4
1374.0000	H	43.99	-56.5	8.8	1.2	-48.9	-13.0	35.9
1374.0000	V	43.60	-56.7	8.8	1.2	-49.1	-13.0	36.1
1832.0000	H	42.92	-56.9	11.3	1.4	-47.0	-13.0	34.0
1832.0000	V	48.76	-51.2	11.3	1.4	-41.3	-13.0	28.3
2290.0000	H	47.15	-49	11.2	1.8	-39.6	-13.0	26.6
2290.0000	V	50.42	-45.4	11.2	1.8	-36.0	-13.0	23.0

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

Applicable Standard

FCC §2.1055, § 22.355, §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
Pro instrument	DC power supply	PPS3300	/	/	/
UNI-T	Multimeter	UT39A	M130199938	2014-04-10	2015-04-10

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

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an AC/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.

Test Data

Environmental Conditions

Temperature:	23.8°C
Relative Humidity:	40 %
ATM Pressure:	101.2 kPa

The testing was performed by Leon Chen on 2014-07-22.

Test Mode: Transmitting

Part 90:

Reference Frequency: 435 MHz				
Temperature	**Voltage**	**Reading**	**Frequency Error**	**Limit**
℃	**V_{DC}**	**MHz**	**ppm**	**ppm**
-30	13.6	435.000019	0.04	2.5
-20	13.6	435.000035	0.08	
-10	13.6	435.000047	0.11	
0	13.6	435.000039	0.09	
10	13.6	435.000045	0.10	
20	13.6	435.000076	0.17	
30	13.6	435.000078	0.18	
40	13.6	435.000096	0.22	
50	13.6	435.000085	0.20	
60	13.6	435.000092	0.21	
25	15.6	435.000083	0.19	
25	10.8	435.000101	0.23	

Part 22:

Reference Frequency: 454.5 MHz				
Temperature	**Voltage**	**Reading**	**Frequency Error**	**Limit**
℃	**V_{DC}**	**MHz**	**ppm**	**ppm**
-30	13.6	454.500128	0.28	2.5
-20	13.6	454.500135	0.30	
-10	13.6	454.500120	0.27	
0	13.6	454.500094	0.21	
10	13.6	454.500106	0.23	
20	13.6	454.500088	0.19	
30	13.6	454.500079	0.17	
40	13.6	454.500108	0.24	
50	13.6	454.500129	0.28	
60	13.6	454.500134	0.30	
25	15.6	454.500154	0.34	
25	10.8	454.500161	0.35	

FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

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

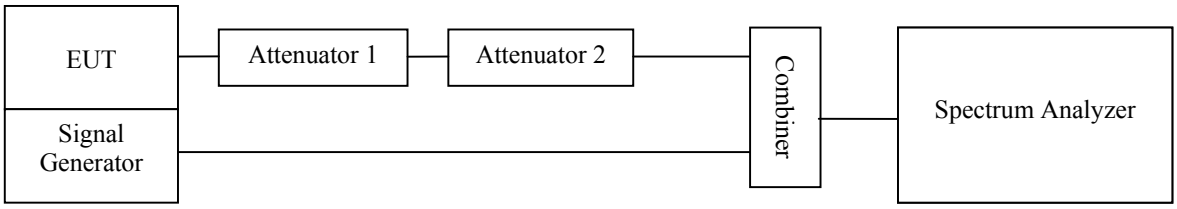
Test Equipment List and Details

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

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, 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 "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

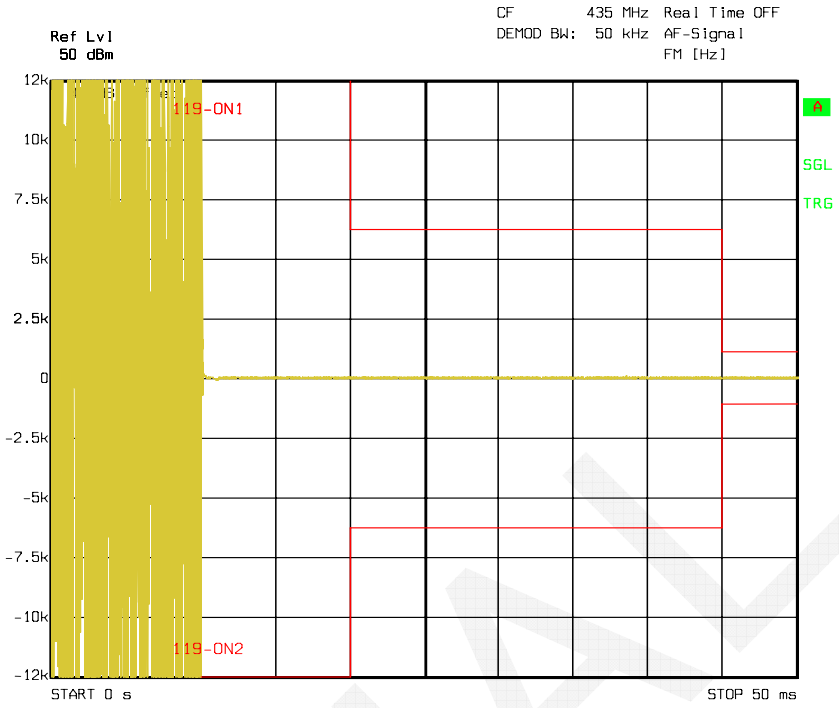
Temperature:	23.9°C
Relative Humidity:	42 %
ATM Pressure:	101.2 kPa

The testing was performed by Leon Chen on 2014-07-24.

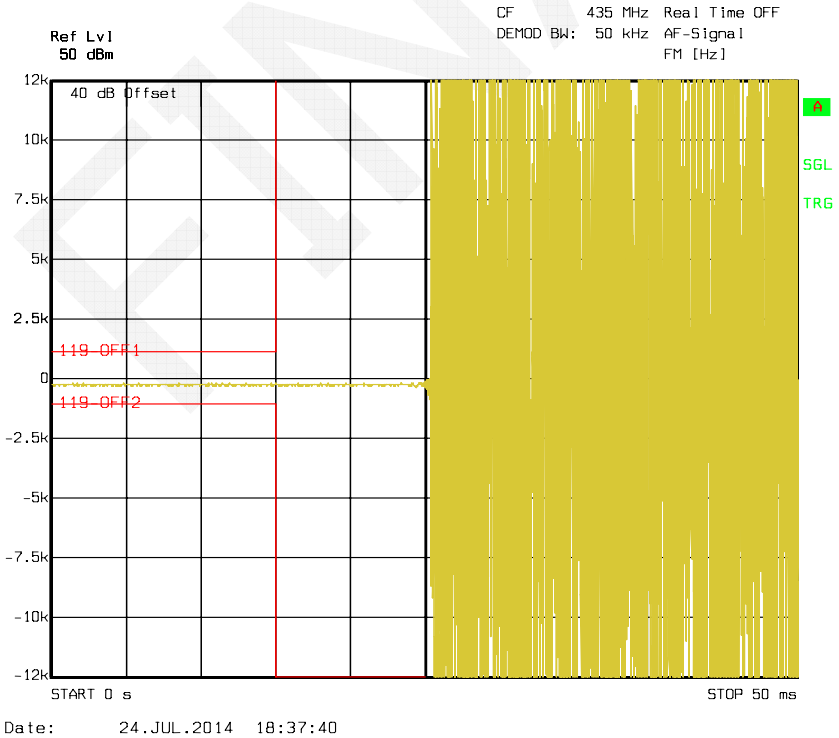
Channel Separation (kHz)	Period (ms)	Maximum frequency difference	Result
12.5	<10 (t1)	±12.5 kHz	Pass
	<25 (t2)	±6.25 kHz	
	<10 (t3)	±12.5 kHz	

Please refer to the following plots.

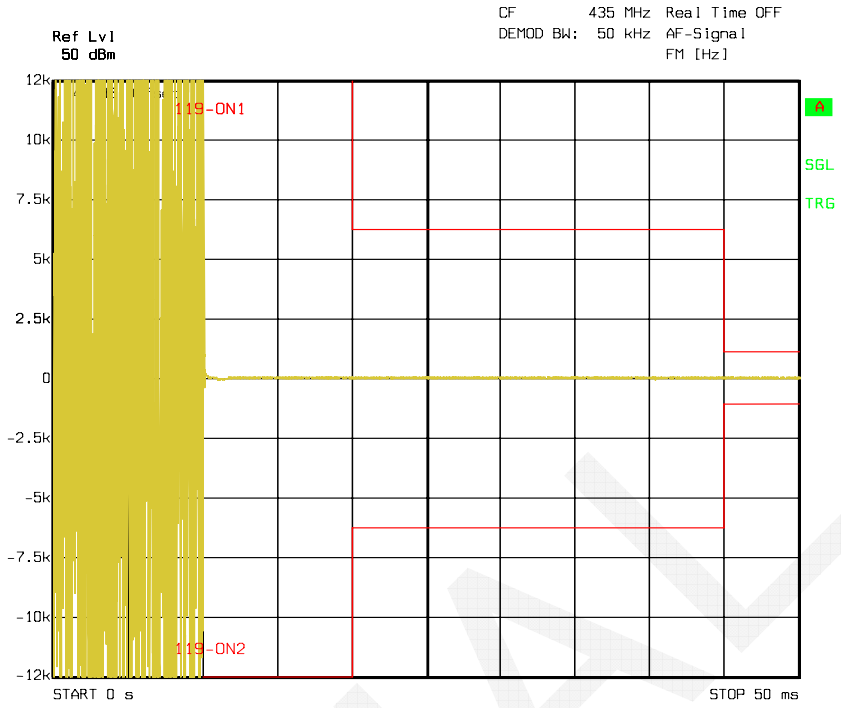
Turn on, 435MHz, Low power level



Turn off, 435MHz, Low power level

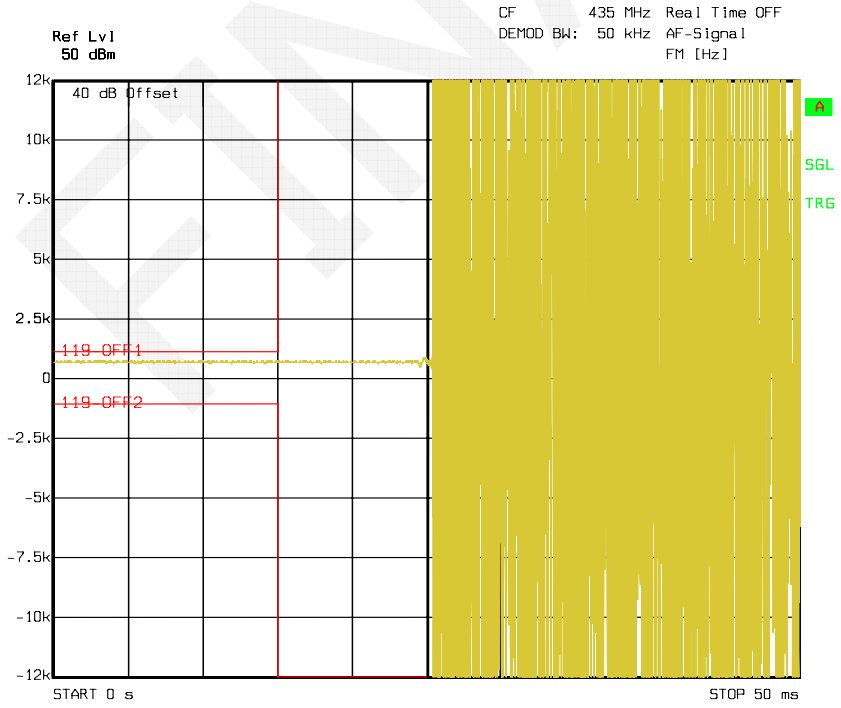


Turn on, 435MHz, High power level



Date: 24.JUL.2014 18:36:29

Turn off, 435MHz, High power level



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