

FCC PART 90

TEST REPORT

For

ADC Telecommunications Inc.

P.O. Box 1101, Minneapolis, Minnesota, United States

FCC ID: NOO-S2195-011

Report Type: Original Report	Product Type: Data InterReach Spectrum
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Report Number: RSZ140122004-00B	
Report Date: 2014-05-06	
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Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *ADC Telecommunications Inc.*'s product, model number: *SPT-S3-8019-22-HP (FCC ID: NOO-S2195-011)* or the "EUT" in this report was a *Data InterReach Spectrum*, which was measured approximately: 27 cm (L) x 21 cm (W) x 8 cm (H), rated with input voltage: DC 54 V.

**All measurement and test data in this report was gathered from production sample serial number: 1401096 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2014-01-22.*

Objective

This test report is prepared on behalf of *ADC Telecommunications Inc.* in accordance with Part 2 and Part 90 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

FCC Part 24E B2I submission with FCC ID: NOO-S2195-011

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. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with radiated emission is 5.91 dB for 30MHz-1GHz.and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) 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 December 06, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. 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 according to TIA-EIA-603-D

The EUT was tested in the normal (native) operating mode to represent worst-case results during the final qualification test.

Equipment Modifications

No modification was made to the EUT tested.

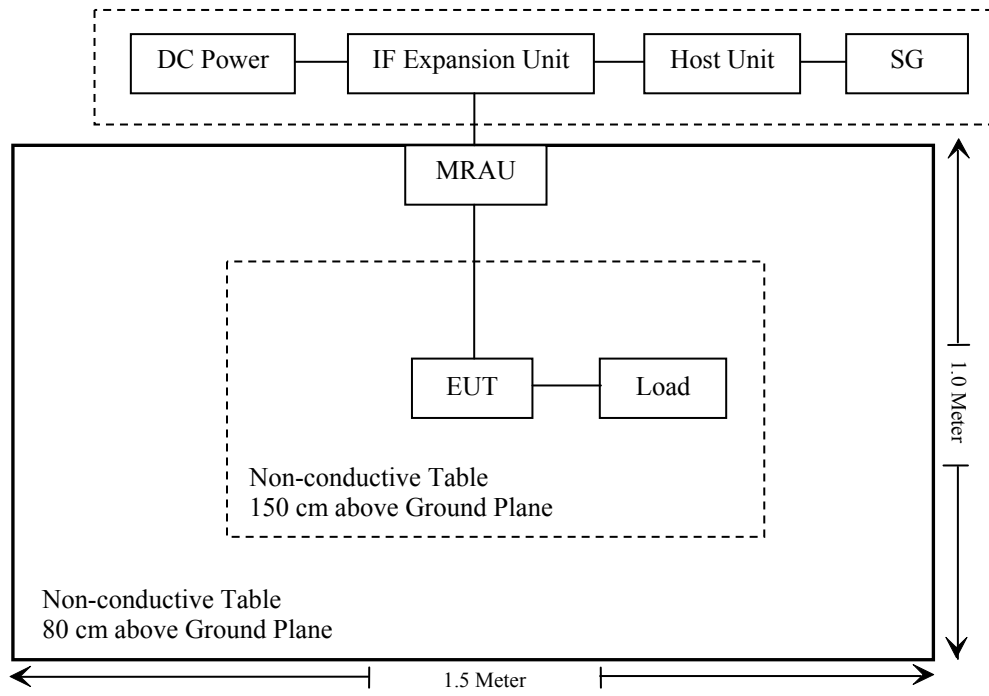
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
ADC Telecommunications Inc.	Host Unit	FWP-0000HUII	MR224BKL
ADC Telecommunications Inc.	Rev Module	SPT-0000000REV-1	MR221NAU
ADC Telecommunications Inc.	Controller Module	SPT-00000MICRO-1	MR221NA3
ADC Telecommunications Inc.	FWD Module	SPT-0000000FWD-1	MR221NA5
ADC Telecommunications Inc.	DC Power	SPT-2400ACDC-1	N/A
ADC Telecommunications Inc.	MRAU	SPT-M3-8519-11-HP	MR226ZW1

External I/O Cable

Cable Description	Length (m)	From/Port	To
Shielding Detachable RF Cable	0.4	EUT	Load
Shielding Detachable RF Cable	1.2*2	EUT	MRAU
Shielding Detachable RF Cable	50*2	MRAU	IF Expansion Unit
Un-shielding Detachable DC Power Cable	1.0	IF Expansion Unit	DC Power
Shielding Detachable RF Cable	1.0	IF Expansion Unit	Host Unit
Shielding Detachable RF Cable	1.4	Host Unit	SG

Block Diagram of Test Setup



Note: IF Expansion Unit contains Rev Module, Controller Module and FWD Module

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§2.1091	Maximum Permissible Exposure (MPE)	Compliance
§2.1046; §90.219(e)(1)	RF Output Power	Compliance
§2.1047	Modulation Characteristic	Not Applicable
§2.1049	Occupied Bandwidth	Compliance
§90.210(h)	Emission Mask	Compliance
§2.1051; §90.210; §90.219(d), (e)(2), (e)(3)	Spurious Emission at Antenna Terminal	Compliance
§2.1053; §90.669	Spurious Radiated Emissions	Compliance
§2.1055; §90.213	Frequency Stability	Compliance
§90.219	Out of Band Rejection	Compliance

FCC §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 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 General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

MPE Prediction

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

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, the power gain factor, is normally numeric gain.

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

Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)			
856.0	3	2.00	26.50	446.68	40	0.0445	0.5707

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 40cm from nearby persons.

Result: Compliance

FCC §2.1046 & 90.219(e)(1) - RF OUTPUT POWER

Applicable Standard

FCC §2.1046 and §90.219(e)(1)

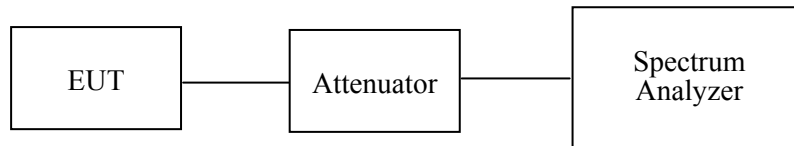
Device Specifications: In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

Test Procedure

Conducted RF Output Power:

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



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12
Agilent	ESG Vector Signal Generator	E4438C	US41461205	2013-11-12	2014-11-12

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

Test Data**Environmental Conditions**

Temperature:	20 ~ 26 °C
Relative Humidity:	20 ~ 56 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2014-03-01 and 2014-03-13.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

APCO 25 C4FM (851-862MHz)

Mode	Channel	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	EIRP (dBm)	ERP (dBm)	Limit (dBm)
APCO 25 C4FM (800 MHz Downlink)	Low	851.1	-18	26.26	29.26	27.11	37
	Middle	856.0	-18	26.50	29.50	27.35	37
	High	861.9	-17	26.22	29.22	27.07	37

Note: The antenna gain is 3 dBi., EIRP=ERP+2.15 dB
5 Watts = 37 dBm.

FCC §2.1049 – OCCUPIED BANDWIDTH

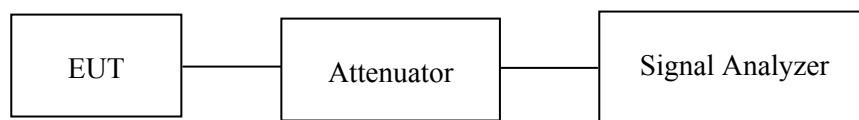
Applicable Standard

FCC §2.1049

Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at 1% of the authorized bandwidth and the 26 dB & 99% bandwidth was recorded.



Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12
Agilent	ESG Vector Signal Generator	E4438C	US41461205	2013-11-12	2014-11-12

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

Test Data

Environmental Conditions

Temperature:	20 ~ 26 °C
Relative Humidity:	20 ~ 56 %
ATM Pressure:	101.0 kPa

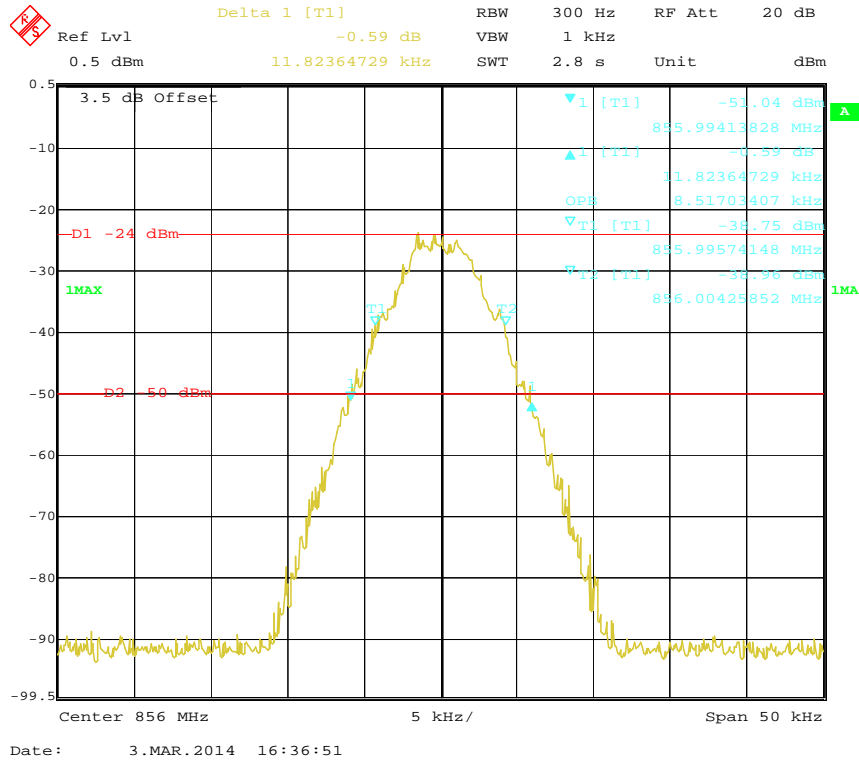
The testing was performed by Rocky Kang on 2014-03-01 to 2014-03-03.

Test Mode: Transmitting

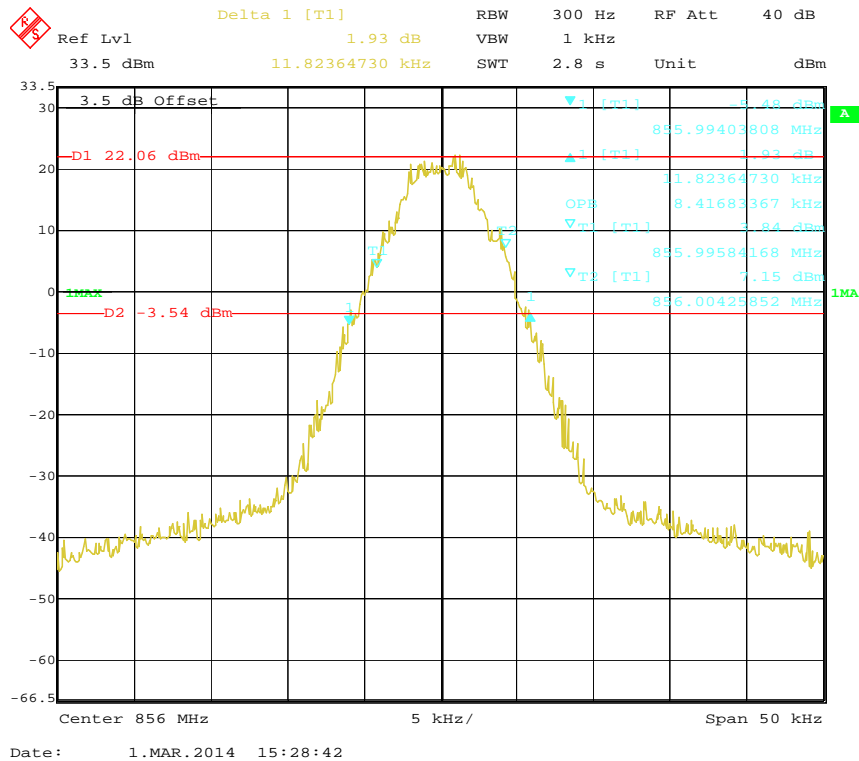
800 MHz Band – Downlink (851-862MHz)

Mode	Frequency (MHz)	Emission Bandwidth Input (kHz)	Emission Bandwidth Output (kHz)
APCO 25 C4FM	856	8.4168	8.4168

APCO 25 C4FM Mode, Input



APCO 25 C4FM Mode, Output



FCC §90.210(h) – EMISSION MASK

Applicable Standard

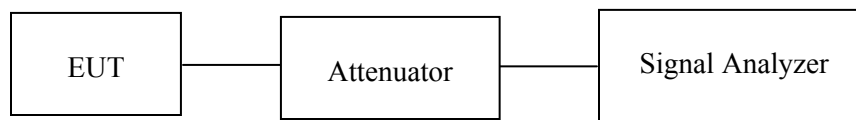
Emission Mask H. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of 4 kHz or less: Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 4 kHz, but no more than 8.5 kHz: At least $107 \log (fd/4)$ dB;
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 8.5 kHz, but no more than 15 kHz: At least $40.5 \log (fd/1.16)$ dB;
- (4) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 15 kHz, but no more than 25 kHz: At least $116 \log (fd/6.1)$ dB;
- (5) On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: At least $43 + \log (P)$ dB.

Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emission up to 10th harmonic.



Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12
Agilent	ESG Vector Signal Generator	E4438C	US41461205	2013-11-12	2014-11-12

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

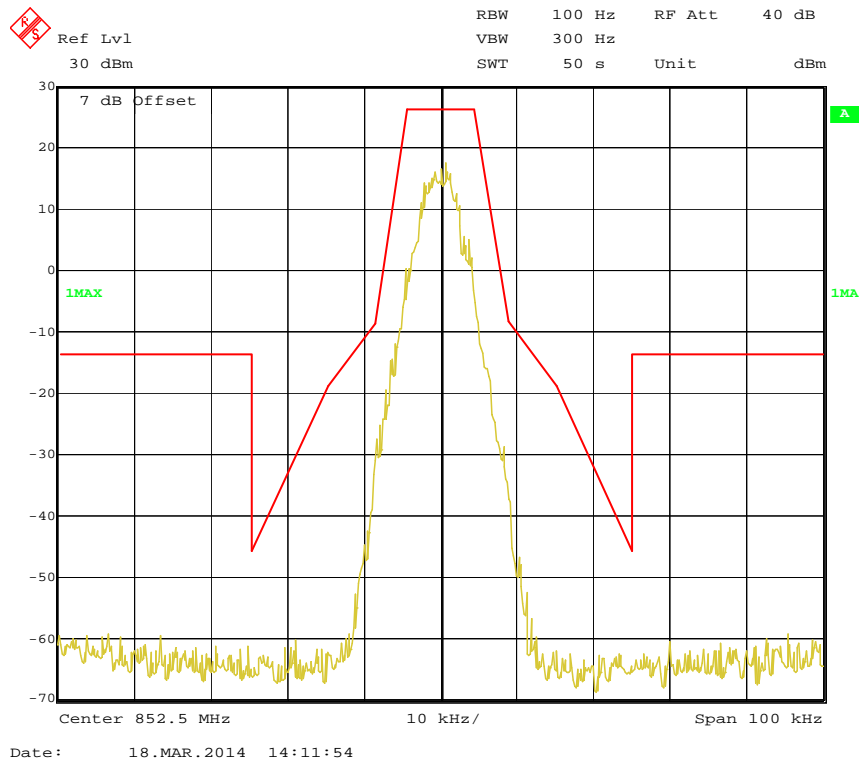
Test Data

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2013-03-18.

Test Mode: Transmitting



FCC §2.1051 & §90.210 & §90.219(d),(e)(2),(e)(3) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

The spectrum shall be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057

Out of band emissions:

Attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB, or -13 dBm.

Good engineering practice must be used in regard to the radiation of intermodulation products and noise, such that interference to licensed communications systems is avoided. In the event of harmful interference caused by any given deployment, the FCC may require additional attenuation or filtering of the emissions and/or noise from signal boosters or signal booster systems, as necessary to eliminate the interference.

In general, the ERP of intermodulation products should not exceed -30 dBm in 10 kHz measurement bandwidth.

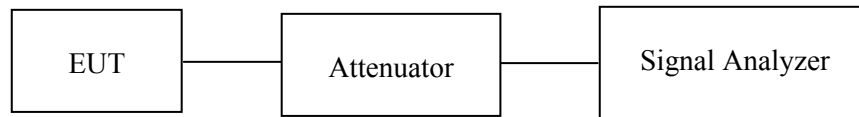
The noise figure of a signal booster must not exceed 9 dB in either direction.

Uplink measurements only required. Uplink signal is received from booster/repeater antenna “over the air”. Downlink signal is NOT “over the air” fed but hardwired via licensed operator basestation which the noise floor is well below -100 dBm/Hz (See Plot Below)

Spurious emissions from a signal booster must not exceed -13 dBm within any 100 kHz measurement bandwidth.

Test Procedure

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



Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12
Agilent	ESG Vector Signal Generator	E4438C	US41461205	2013-11-12	2014-11-12
Rohde & Schwarz	EMI TEST RECEIVER	ESR	N/A	2013-11-12	2014-11-12

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

Test Data**Environmental Conditions**


Temperature:	20 ~ 25 °C
Relative Humidity:	50 ~ 56 %
ATM Pressure:	101.0 kPa

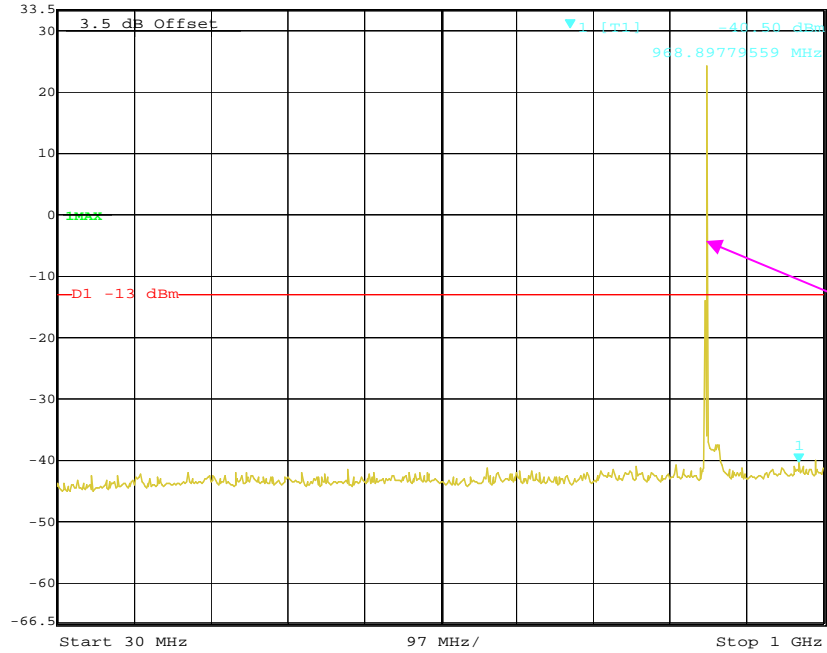
The testing was performed by Rocky Kang from 2014-02-28 to 2014-04-28.

Test Mode: Transmitting

Please refer to the following plots.


30 MHz – 1 GHz, Low Channel

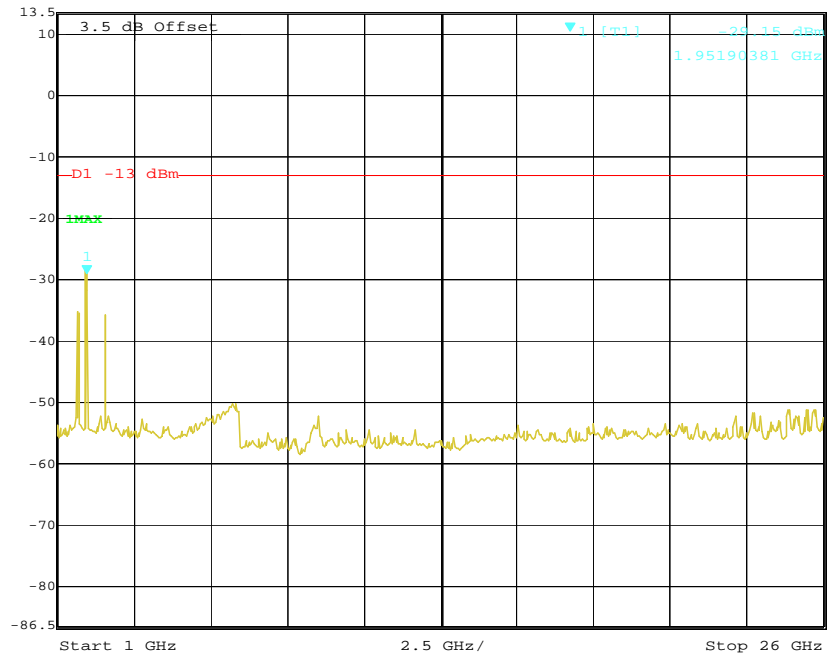
	Ref Lvl	Marker 1 [T1]	RBW	100 kHz	RF Att	40 dB
	33.5 dBm	-40.50 dBm	VBW	300 kHz		
		968.89779559 MHz	SWT	245 ms	Unit	dBm



Date: 28.FEB.2014 11:20:27

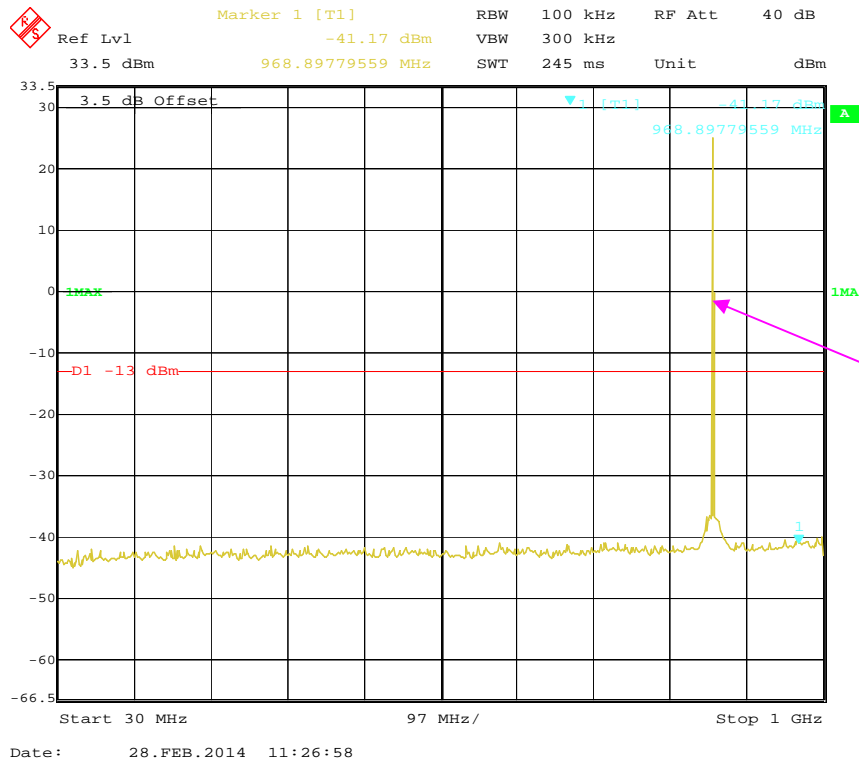
1 GHz – 26 GHz, Low Channel

	Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	20 dB
	13.5 dBm	-29.15 dBm	VBW	3 MHz		
		1.95190381 GHz	SWT	145 ms	Unit	dBm



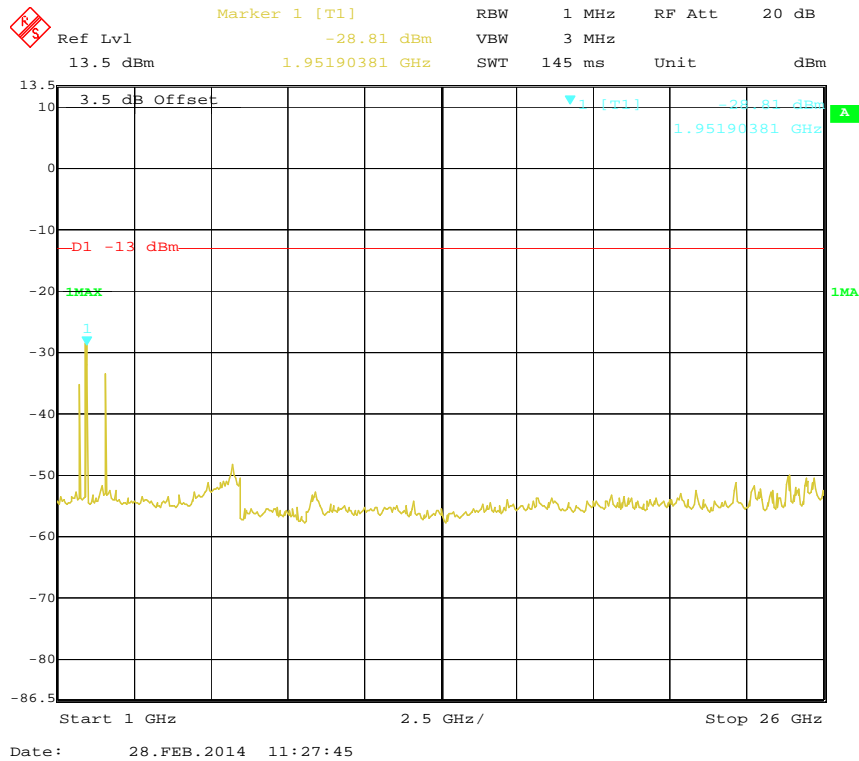
Date: 28.FEB.2014 11:28:10

30 MHz – 1 GHz, Middle Channel

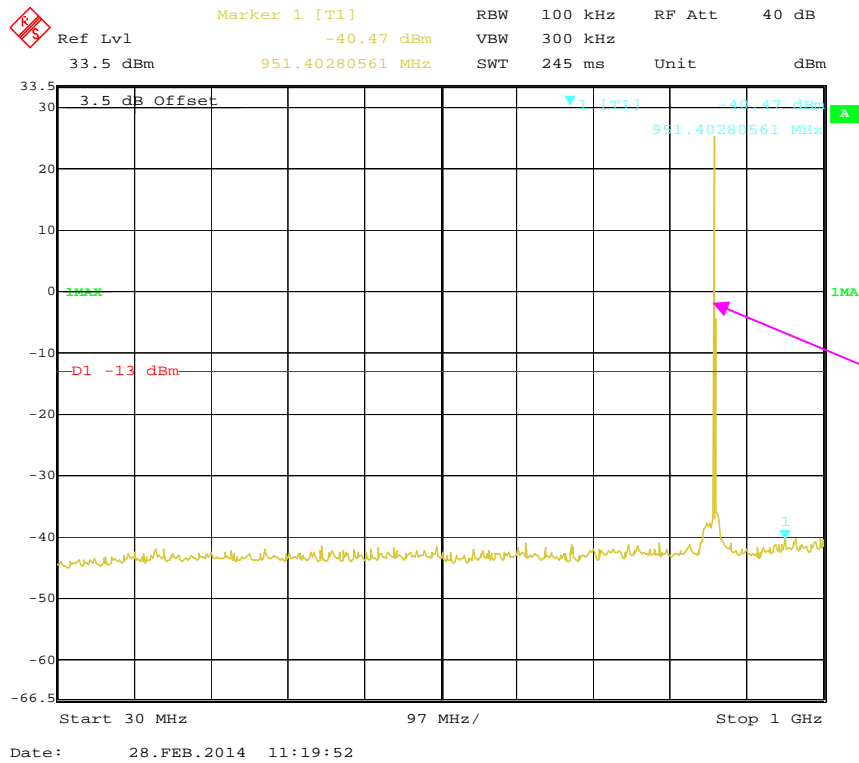


Fund.test with notch filter

1 GHz – 26 GHz, Middle Channel

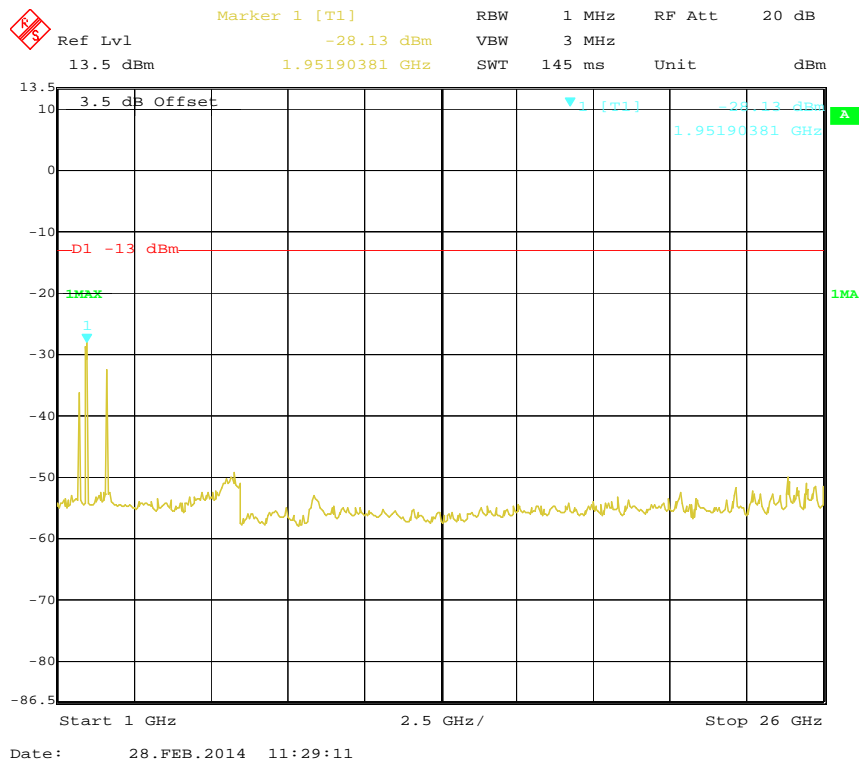


30 MHz – 1 GHz, High Channel



Fund.test with notch filter

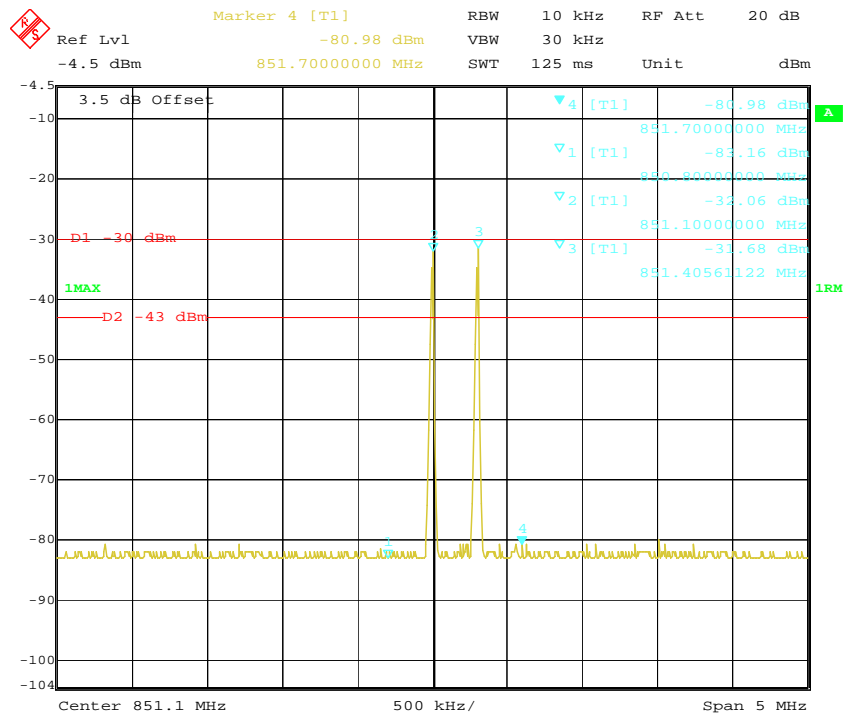
1 GHz – 26 GHz, High Channel



Intermodulation:

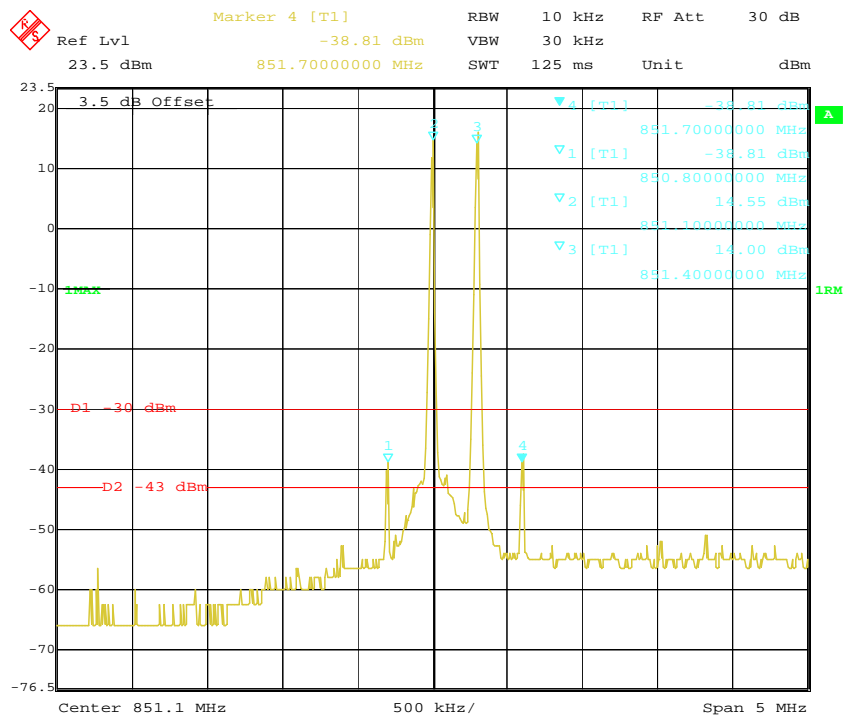
90.219(d)

APCO 25 C4FM Mode, Input, Low Channel



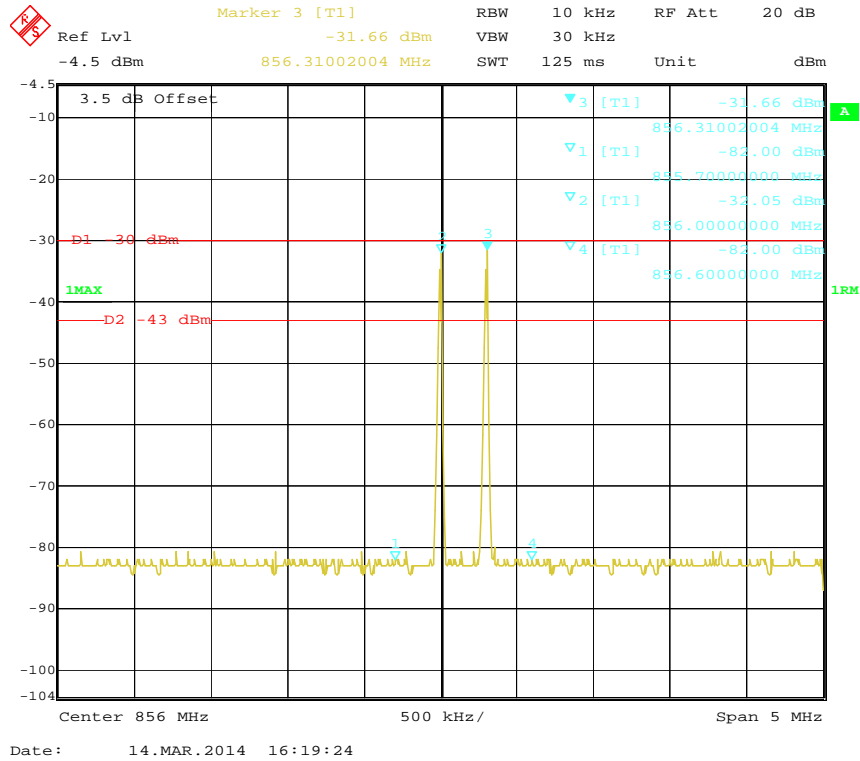
Date: 14.MAR.2014 16:17:09

APCO 25 C4FM Mode, Output, Low Channel

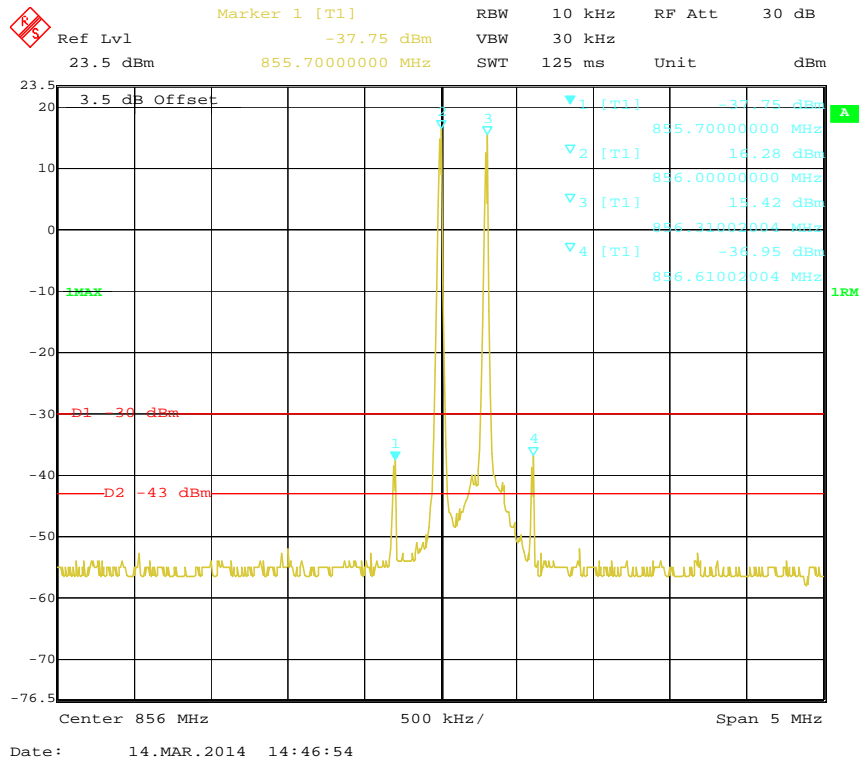


Date: 14.MAR.2014 14:44:18

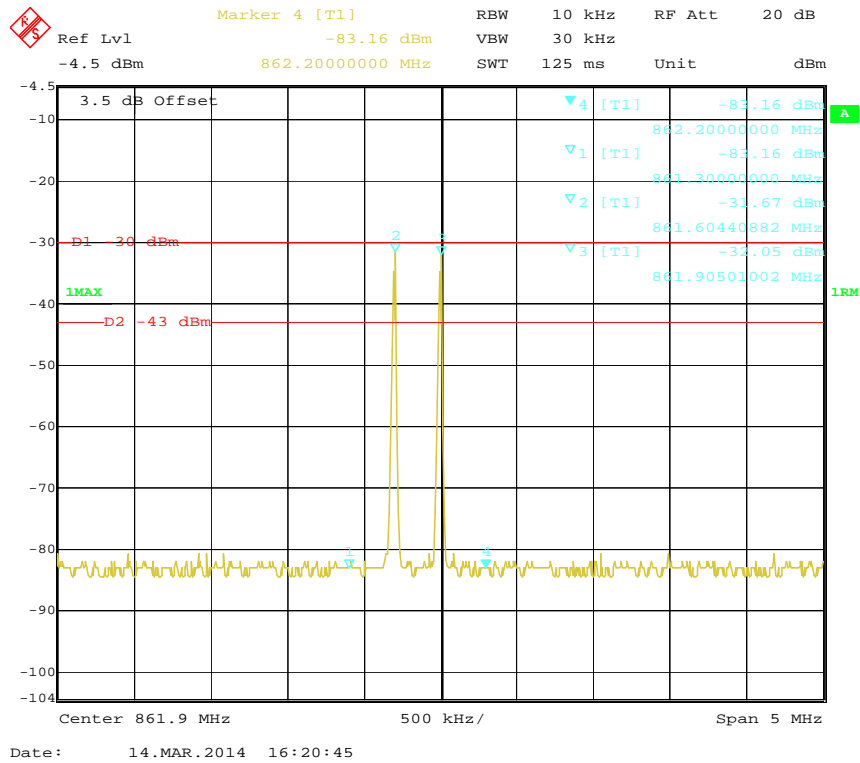
APCO 25 C4FM Mode, Input, Middle Channel



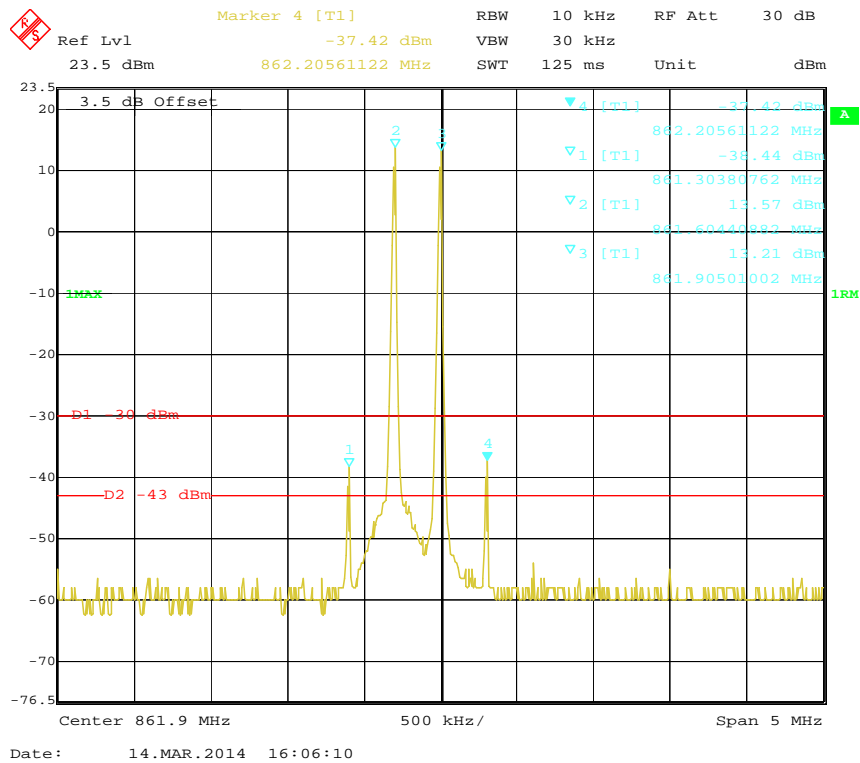
APCO 25 C4FM Mode, Output, Middle Channel



APCO 25 C4FM Mode, Input, High Channel

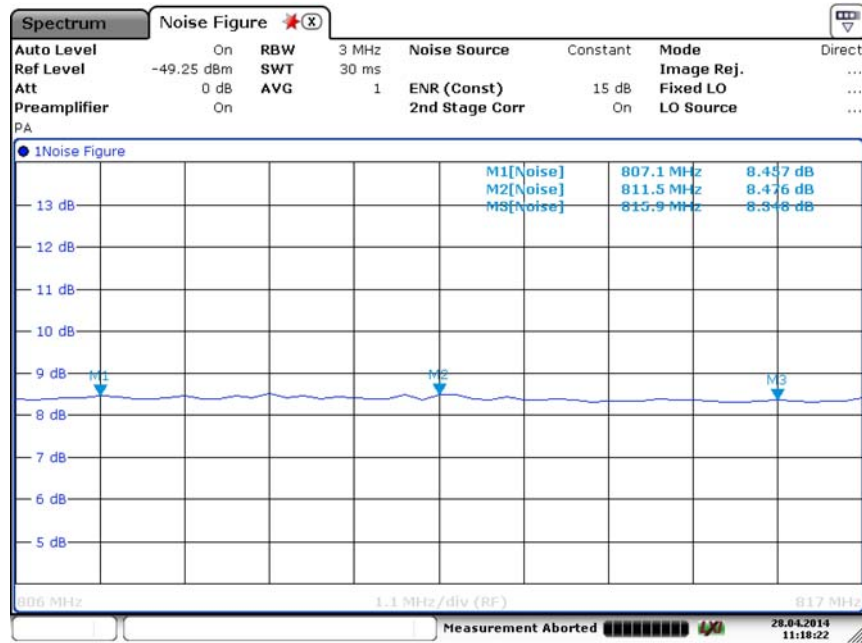


APCO 25 C4FM Mode, Output, High Channel



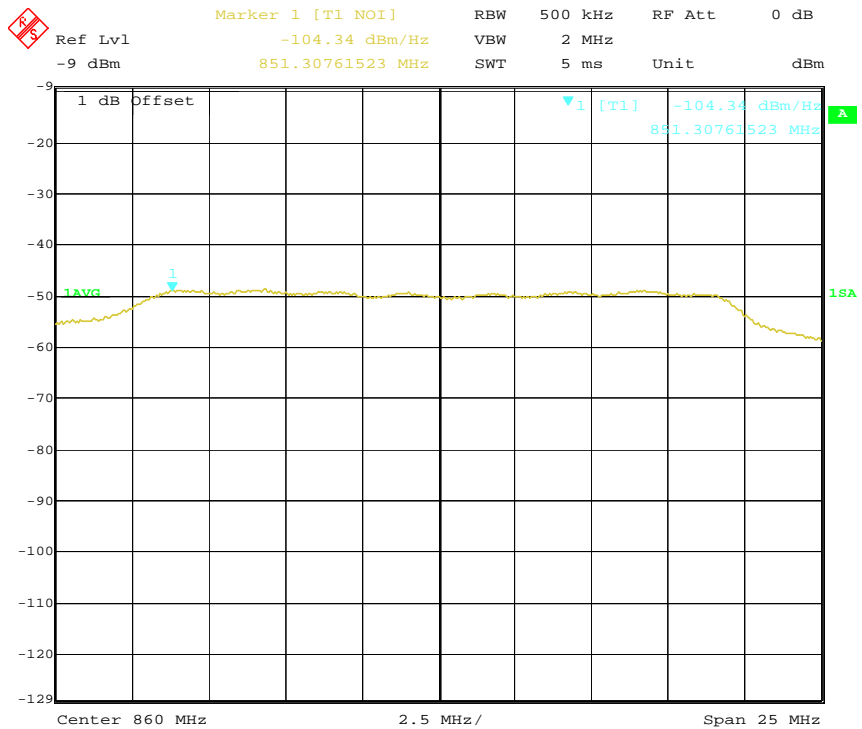
90.219 (e) (2) – Noise Figure

Uplink



Date: 28.APR.2014 11:18:23

Downlink



Date: 25.APR.2014 11:41:43

FCC §2.1053 & §90.669 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053 and §90.669

Test Procedure

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

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

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

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

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

Spurious attenuation limit in dB = 43 + 10 Log₁₀ (power out in Watts)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2013-09-25	2014-09-25
HP	Amplifier	8447E	1937A01046	2013-09-30	2014-09-30
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2011-11-28	2014-11-27
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12
Sunol Sciences	Horn Antenna	DRH-118	A052304	2011-12-01	2014-11-30
HP	Synthesized Sweeper	8341B	2624A00116	2013-05-09	2014-05-09
Mini-Circuits	Amplifier	ZVA-183-S+	5969001149	2013-04-13	2014-04-13
A.H. System	Horn Antenna	SAS-200/571	135	2012-02-11	2015-02-10
COM POWER	Dipole Antenna	AD-100	041000	NCR	NCR

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

Test Data**Environmental Conditions**

Temperature:	23 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2014-03-14.

Test Mode: Transmitting

30 MHz – 9 GHz:

Frequency (MHz)	Receiver Reading (dB μ V)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 90	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
851.1 MHz										
470.1	43.51	122	1.6	H	-54.0	0.47	0	-54.47	-13	41.47
470.1	40.15	142	1.3	V	-57.4	0.47	0	-57.87	-13	44.87
1702.6	48.96	203	2.4	H	-54.1	0.97	9.4	-45.67	-13	32.67
1702.6	55.87	325	1.5	V	-44.5	0.97	9.4	-36.07	-13	23.07
860 MHz										
470.3	44.62	89	1.5	H	-52.9	0.47	0	-53.37	-13	40.37
470.3	41.18	58	1.6	V	-56.3	0.47	0	-56.77	-13	43.77
1720.0	51.54	297	2.4	H	-51.5	0.97	9.4	-43.07	-13	30.07
1720.0	54.33	284	2.4	V	-46.1	0.97	9.4	-37.67	-13	24.67

Note:

Absolute Level = SG Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

FCC §2.1055 & §90.213 - FREQUENCY STABILITY

Applicable Standard

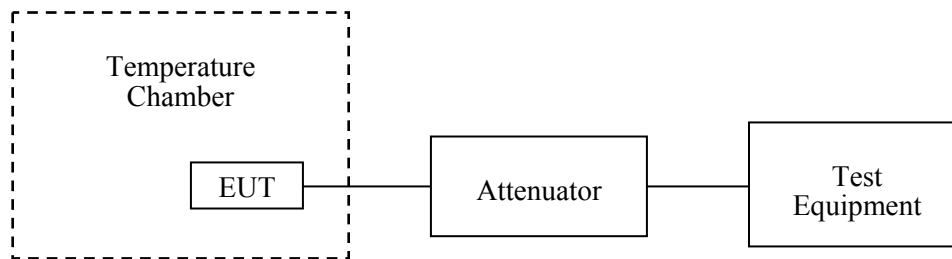
FCC §2.1055 and §90.213

Test Procedure

Frequency Stability vs. Temperature: The equipment is varied from -30°C to + 50°C using an environmental chamber

Frequency Stability vs. Voltage: the primary supply voltage is varied from battery end point to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification – the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.



Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12
Agilent	ESG Vector Signal Generator	E4438C	US41461205	2013-11-12	2014-11-12
ESPEC	Temperature & Humidity Chamber	EL-10KA	09107726	2013-11-01	2014-11-01

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

Test Data

Environmental Conditions

Temperature:	22 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2014-02-24.

Test Mode: Transmitting

851-862MHz

Test Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (ppm)	Limited (ppm)
Power Supplied (V _{DC})	Temperature (°C)				
Frequency vs. Temperature					
54	45	856	856.00055	0.64	±1.5
	35	856	856.00085	0.99	±1.5
	25	856	856.00044	0.51	±1.5
	15	856	856.00074	0.86	±1.5
	5	856	856.00077	0.90	±1.5
	-5	856	856.00054	0.63	±1.5
	-15	856	856.00078	0.91	±1.5
	-25	856	856.00047	0.55	±1.5
Frequency vs. Voltage					
51	25	856	856.00032	0.37	±1.5
57	25	856	856.00017	0.20	±1.5

FCC §90.219 - OUT OF BAND REJECTION

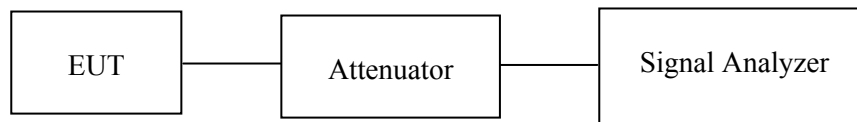
Applicable Standard

FCC § 90.219

Test Procedure

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

The center of the spectrum analyzer was set to block edge frequency



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12
Agilent	ESG Vector Signal Generator	E4438C	US41461205	2013-11-12	2014-11-12

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

Test Data

Environmental Conditions

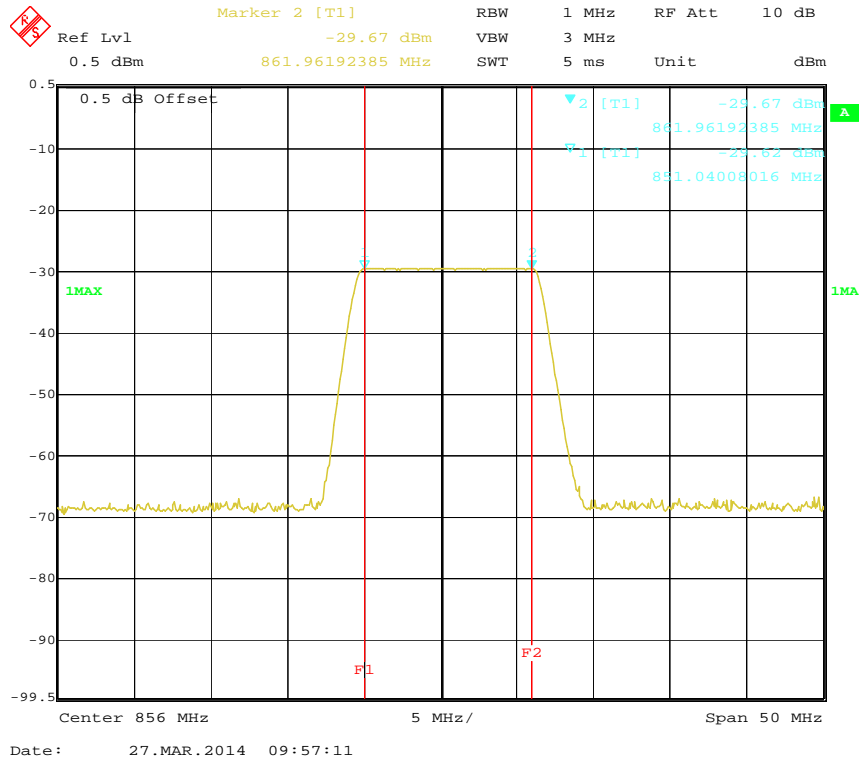
Temperature:	20 ~ 25 °C
Relative Humidity:	50 ~ 56 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang from 2014-03-14 to 2014-03-27.

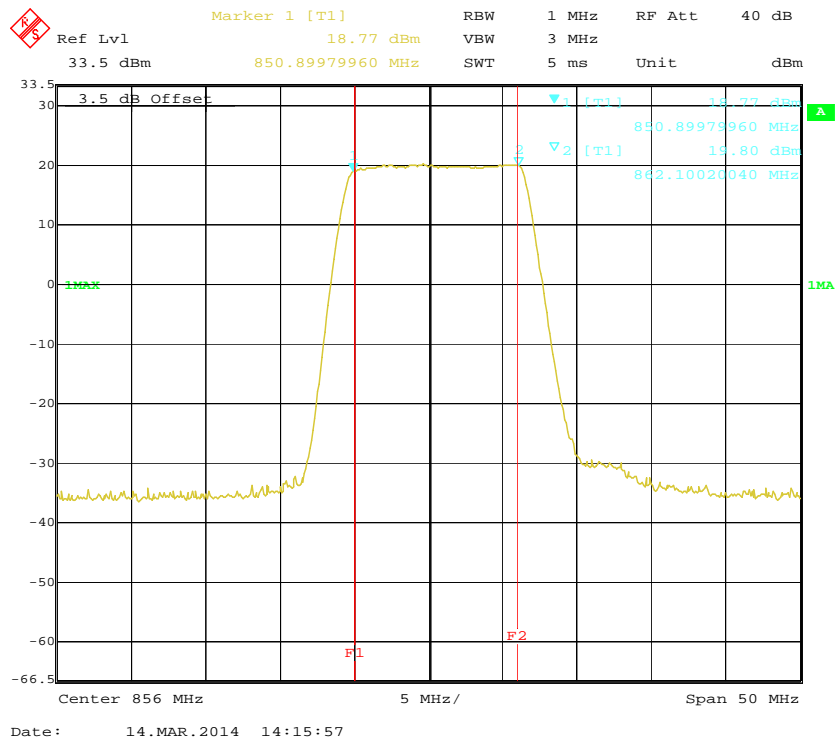
EUT operation mode: Transmitting

Test Result: Compliance. Please refer to the following plots.

851 MHz ~ 862 MHz, Input



851 MHz ~ 862 MHz, Output



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