Lab Code: 200167-0

FCC PART 90

TEST AND MEASUREMENT REPORT

For

Pacific Crest Corporation

510 Deguigne Drive,
Sunnyvale, CA 94085, USA

FCC ID: KEAADLP

Report Type:	**Product Type:**
Original Report	UHF Transceiver Module

Test Engineers:	Jerry Huang
Report Number:	R1008242-90
Report Date:	2010-12-17
Reviewed By:	Victor Zhang RF Lead
Prepared By: **(84)**	Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732-9164

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1008242-90	Original Report	2010-11-23
1	R1008242-90	Added 390-430 test data	2010-12-17

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report has been prepared on behalf of *Pacific Crest Corporation* and their product, *models: ADLP-1 & ADLP-2, FCC ID: KEAADLP* or the EUT as referred to in the rest of this report. The EUT is a transceiver designed to provide data communication using UHF radio frequencies, operating frequency Band: 390~ 430 MHz, 430~473 MHz. The EUT supports GMSK/4FSK modulation schemes.

Based on the declaration of similarity (Appendix I), the following models are similar.

Models Covered by the Declaration of Similarity
ADL Vantage Pro (ADLP)
TDL 450H

1.2 Technical Summary

No. of Units: Two
Equipment Series Number (Model Number): ADLP-1 & ADLP-2

Power Characteristics: Variable output power form 2 to 35 Watts
Channel Spacing: 25 kHz & 12.5 kHz,
Unit No.1: Frequency Characteristics: 390 to 430 MHz,
Test Frequency: 390.05 MHz, 410 MHz, 429.95 MHz
Serial Number: 211505 & 10370002
Temperature Range:-30° to 60°
Unit No.2: Frequency Characteristics: 430 to 473 MHz,
Test Frequency: 430.05 MHz, 450 MHz, 472.95 MHz
Serial Number: 211598 & 10370005
Temperature Range:-30° to 60°

DC power section: Incoming DC voltage is regulated with a switching DC to DC converter. The externally supplied DC voltage may vary from 9V~30V, If the external voltage is outside this range, it will not be allowed to operate. In following TX & RX testing, we use 12VDC as our external supplied DC voltage.

1.3 Mechanical Description

The EUT measures approximately 150 mm (L) x 103 mm (W) x 85 mm (H) and weighs 1970.5 g.

The test data gathered are from production sample, 390-430MHz: 211505 & 10370002, 430-473MHz: 211598 & 10370005 provided by the manufacturer.

1.4 EUT Photos

ADL Vantage Pro (ADLP)

TDL 450H

Additional photos in Exhibit C

1.5 Objective

This type approval report is prepared on behalf of *Pacific Crest Corporation* in accordance with 47 Part 2 and Part 90 of the Federal Communication Commissions rules.

The objective of the manufacturer is to determine compliance with FCC rules, spurious radiated emissions.

1.6 Related Submittal(s)/Grant(s)

N/A

1.7 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/EIA-603-C, ANSI 63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.8 Test Facility

The Test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at it's facility in Sunnyvale, California, USA.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. 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, Industry Canada, and Voluntary Control Council for Interference have the reports on file and are listed under FCC file 31040/SIT 1300F2, IC registration number: 3062A, and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA/EIA 603-C

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test, the test software was provided by the client.

2.2 EUT Exercise Software

ADLCONF configuration soft ware provided by the customer was used to exercise the system in a mode simulating normal operating conditions.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Local Support Equipment

Manufacturers	Descriptions	Models	Serial Numbers
Dell	Laptop	Latitude	D620

2.5 EUT Internal Configuration Details

Manufacturers	Descriptions	Models	Serial Numbers
Pacific Crest Corporation	PCB Assembly	E00358(ADLP)	24082
Pacific Crest Corporation	PCB Assembly	A02761(ADLP)	-
Pacific Crest Corporation	PCB Assembly	A02761(TDL 450H)	213532
Pacific Crest Corporation	PCB Assembly	A02710(TDL 450H)	240300

2.6 Interface Ports and Cabling

Cable Description	Length (m)	From	To
Data/Power Cable	1	EUT	Laptop[1]

Note[1]: Laptop was used only to program the EUT.

2.7 Power Supply Information

Manufacturer	Description	Model	Serial Number
Mean Well	AC Power Supply, Input: 100-240VAC 50/60Hz 4.0A Output: 12V 15A, 180W	GS220A12-R7B	RB01061550

3 Summary of Test Results

FCC Rules	Description of Tests	Results
§2.1046 §90.205	RF Output Power	Compliant[1]
§2.1047	Modulation Characteristics	N/A
§2.1049 §90.209	Emission mask, Occupied Bandwidth	Compliant[1]
§2.1051 §90.210	Spurious emissions at antenna terminals	Compliant[1]
§2.1053 §90.210	Field strength of spurious radiation	Compliant[1]
§2.1055 §90.213	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
§90.214	Transient Frequency Behavior	Compliant[1]
§2.1091	RF Exposure	Compliant

Note[1]: Tests were completed by Pacific Crest

N/A There is no specific requirement for digital modulation; therefore modulation characteristic is not presented.

4 FCC §2.1091 – RF Exposure Information

4.1 Applicable Standards

According to FCC §2.1091 and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

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)
Limits for General Population/Uncontrolled Exposure				
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

4.2 MPE Prediction

Predication of MPE limit at a given distance

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

Where: S = power density

P = power input to antenna

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

390 ~ 430 MHz Band:

Maximum peak output power at antenna input terminal (dBm):	45.6
Maximum peak output power at antenna input terminal (mW):	36307.805
Duty Cycle:	50%
Maximum Corrected output power at antenna input terminal (mW):	18153.9025
Prediction distance (cm):	120
Prediction frequency (MHz):	390.05
Antenna Gain, typical (dBi):	5.0
Cable loss (dB):	1.0
Maximum Antenna Gain+ Cable Loss (numeric):	2.512
Power density at predication frequency and distance (mW/cm^2):	0.252
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.26

430 ~ 473 MHz Band:

Maximum peak output power at antenna input terminal (dBm):	45
Maximum peak output power at antenna input terminal (mW):	31622.777
Duty Cycle:	50%
Maximum Corrected output power at antenna input terminal (mW):	15811.3885
Prediction distance (cm):	120
Prediction frequency (MHz):	472.95
Antenna Gain, typical (dBi):	5.0
Cable loss (dB):	1.0
Maximum Antenna Gain+ Cable Loss (numeric):	2.512
Power density at predication frequency and distance (mW/cm^2):	0.220
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.3153

4.3 Result

The device is compliant with the requirement MPE limit for uncontrolled exposure. 430-473 MHz maximum power density at the distance of 120 cm is 0.220 mW/cm^2 (Limit 0.315 mW/cm^2). The 390-430 MHz maximum power density at the distance of 120 cm is 0.252 mW/cm^2 (Limit 0.26 mW/cm^2).

5 FCC §2.1046 & §90.205 – RF Output Power

5.1 Applicable Standards

Per FCC §2.1046 and §90.205: maximum ERP is dependent upon the station's antenna HAAT and required service area.

5.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer or a power meter through appropriate attenuator.

5.3 Test Equipment List and Details

Manufacturer	Description	Model	S/N	Cal Date
TekPower	DC power supply	HY3005D	N/A	N/A
HP	Power Sensor	8482A	US37293274	12/23/2009
HP	Power Meter	435B	2235A06162	12/23/2009
Agilent	Spectrum Analyzer	8562EC	3946A00187	12/23/2009

5.4 Test Environment Conditions

Temperature:	21~22 °C
Relative Humidity:	70~75 %
ATM Pressure:	101.2-102.4kPa

The testing was performed by Jacinto Amante on 2010-07-28 & 2010-09-29

5.5 Test Results

390~430 MHz Band:
S/N: 211505

Band (MHz)	Frequency (MHz)	Output Power in dBm
390~430 MHz	390.05	45.6
	410.00	45.5
	429.95	45.5

430~473 MHz Band:
S/N: 211598

Band (MHz)	Frequency (MHz)	Output Power in dBm
430~473 MHz	430.05	44.6
	450.00	44.4
	472.95	45.0

6 FCC §2.1047 & §90.207 - Modulation Characteristic

6.1 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.

6.2 Test Procedure

TIA-603-C §2.2.3

6.3 Test Results

N/A; There is no specific requirement for digital modulation; therefore modulation characteristic is not presented.

7 FCC §2.1049, §90.209 & §90210 – Occupied Bandwidth and Emission Mask

7.1 Applicable Standard

FCC §90.209
Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth.

§2.1049, §90.210
(c) *Emission Mask C.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (f_d/5) dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (f_d^2 /11) dB or 50 dB, whichever is the lesser attenuation;

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

(d) *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 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 to three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emissions 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 (m) 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, then an alternate procedure may be used provided prior Commission approval is obtained.

7.2 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 100 Hz and the spectrum was recorded in the frequency band ±50 KHz or ± 25 kHz from the carrier frequency.

7.3 Test Equipment List and Details

Manufacturer	Description	Model	S/N	Cal Date
Agilent	Spectrum Analyzer	8562EC	3946A00187	12/23/2009
TekPower	DC power supply	HY3005D	N/A	N/A

7.4 Test Environment Conditions

Temperature:	21~22 °C
Relative Humidity:	70~75 %
ATM Pressure:	101.2-102.4kPa

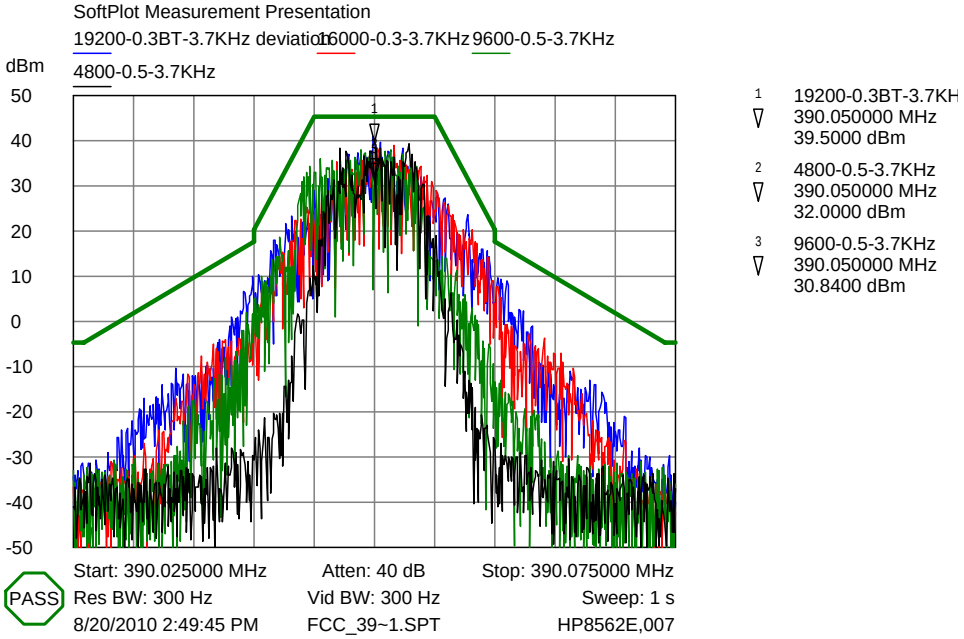
The testing was performed by Hui Chen on 2010-07-26, 2010-08-19, & 2010-08-20

7.5 Test Results

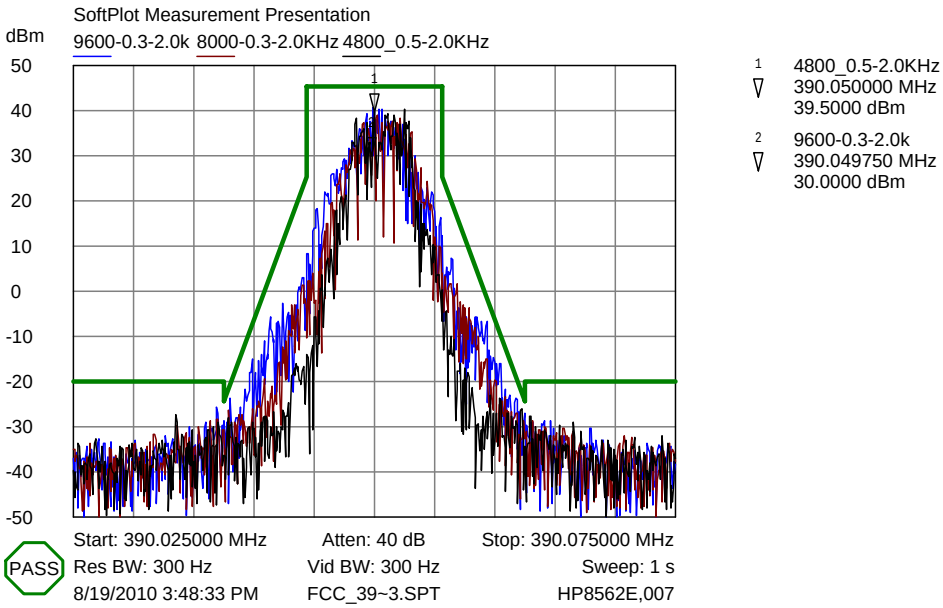
Modulation	Emission C	Result	Emission D	Result
GMSK	19200 bit rate	Compliant	9600 bit rate	Compliant
	16000 bit rate	Compliant	8000 bit rate	Compliant
	9600 bit rate	Compliant	4800 bit rate	Compliant
	4800 bit rate	Complaint	/	/
4 FSK	19200 bit rate	Compliant	9600 bit rate	Compliant

S/N: 211505 (390~430 MHz)

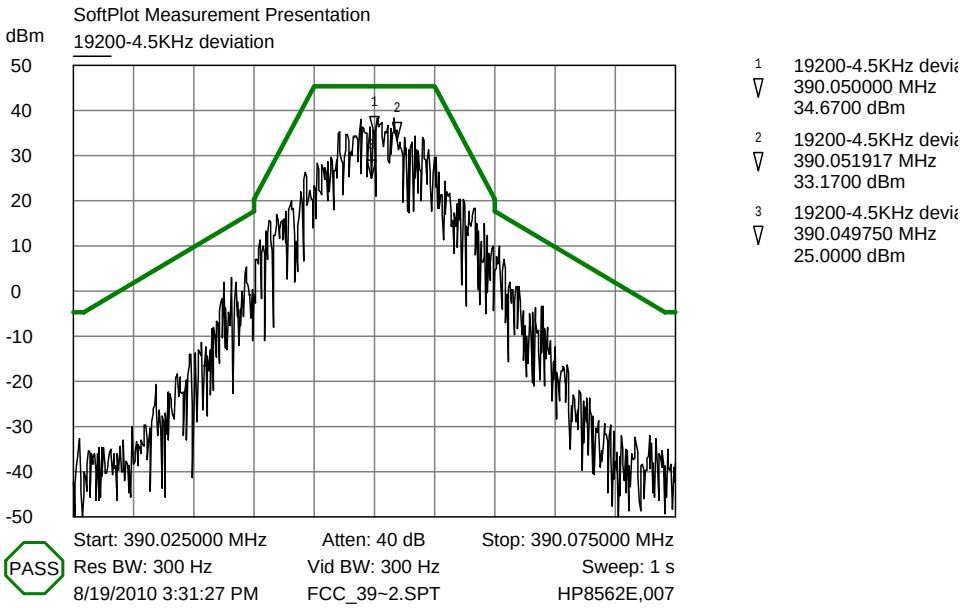
390.05 MHz GMSK Emissions C



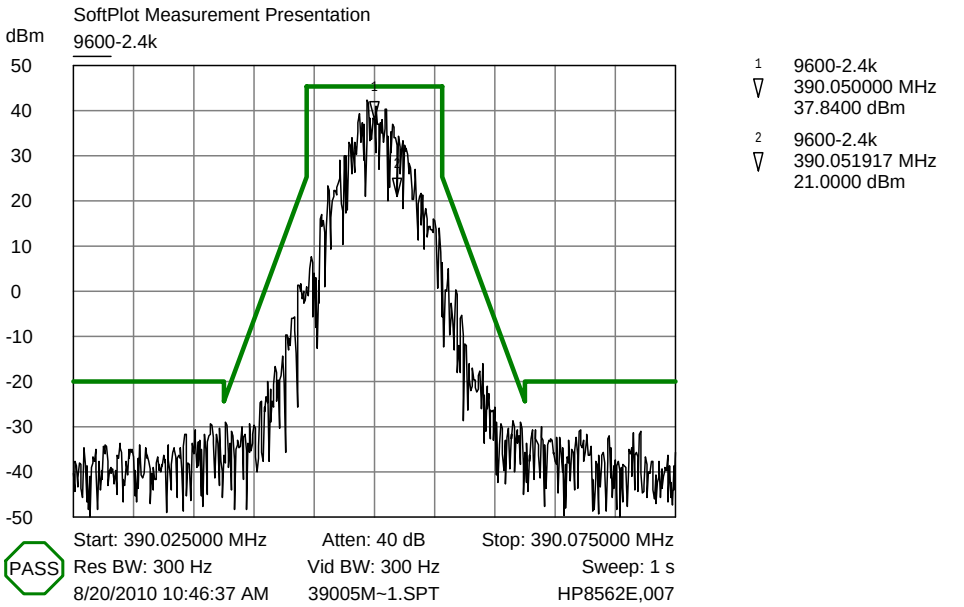
390.05 MHz GMSK Emission D



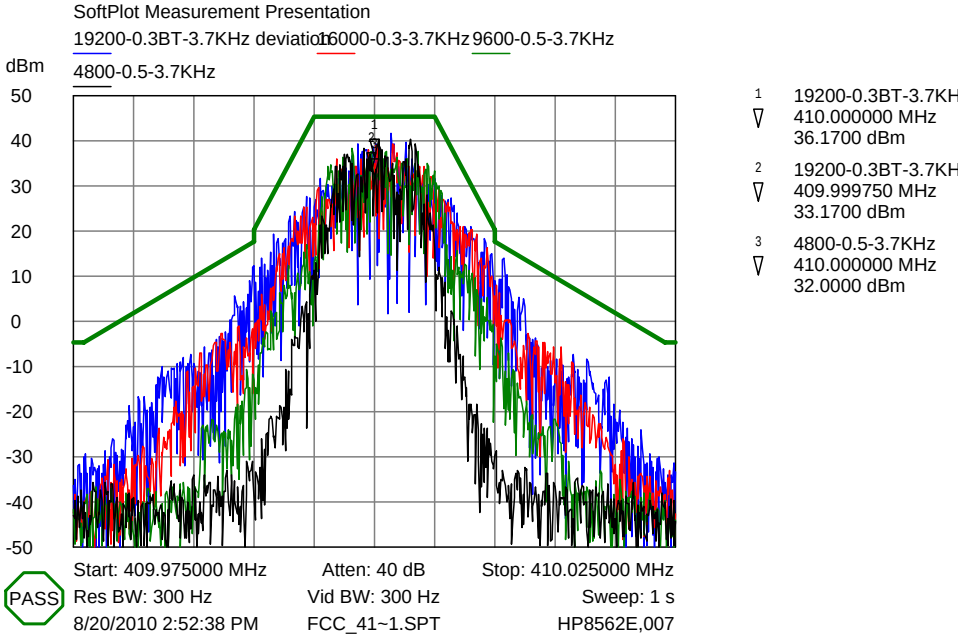
390.05 MHz 4LFSK Emissions C



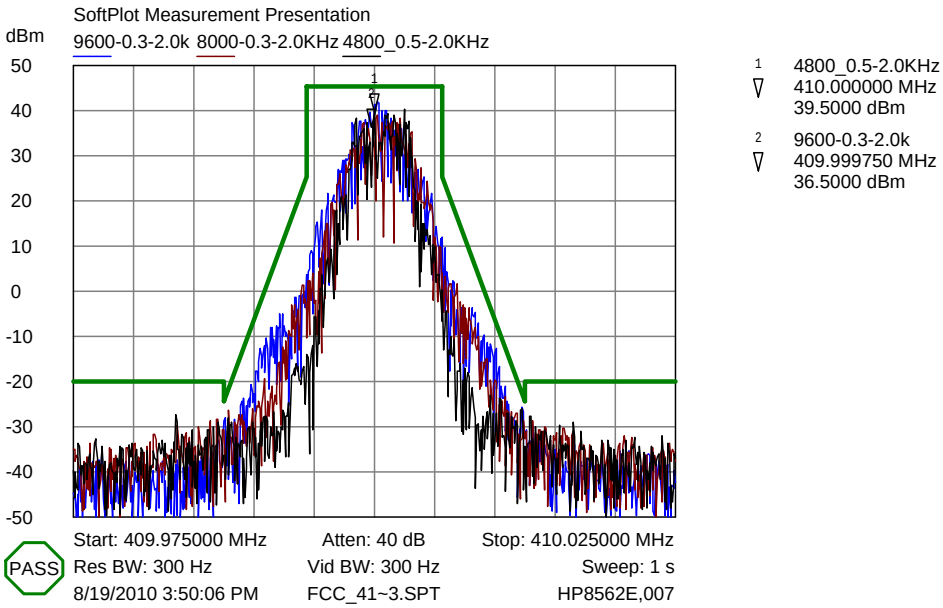
390.05 MHz 4LFSK Emissions D



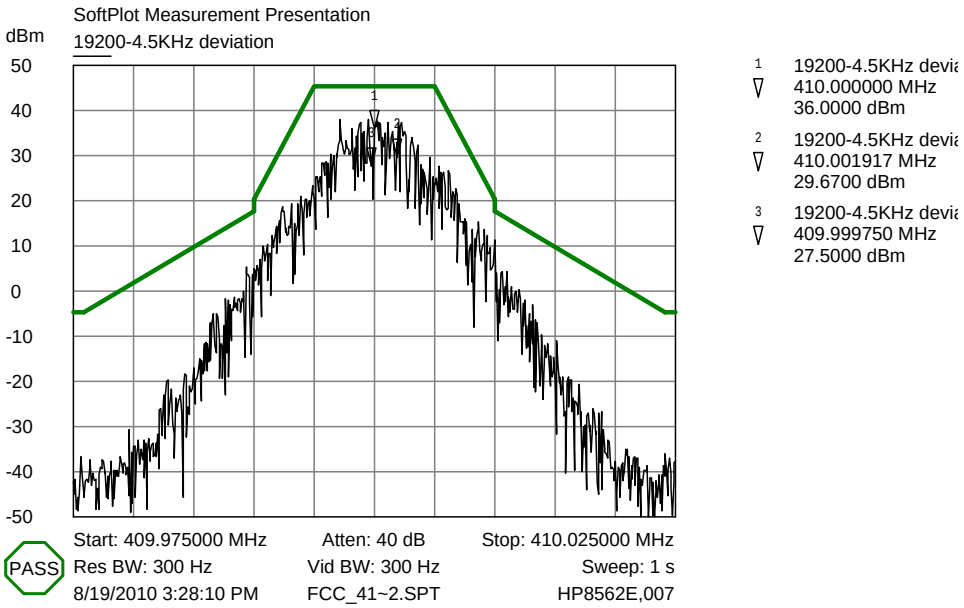
410 MHz GMSK Emissions C



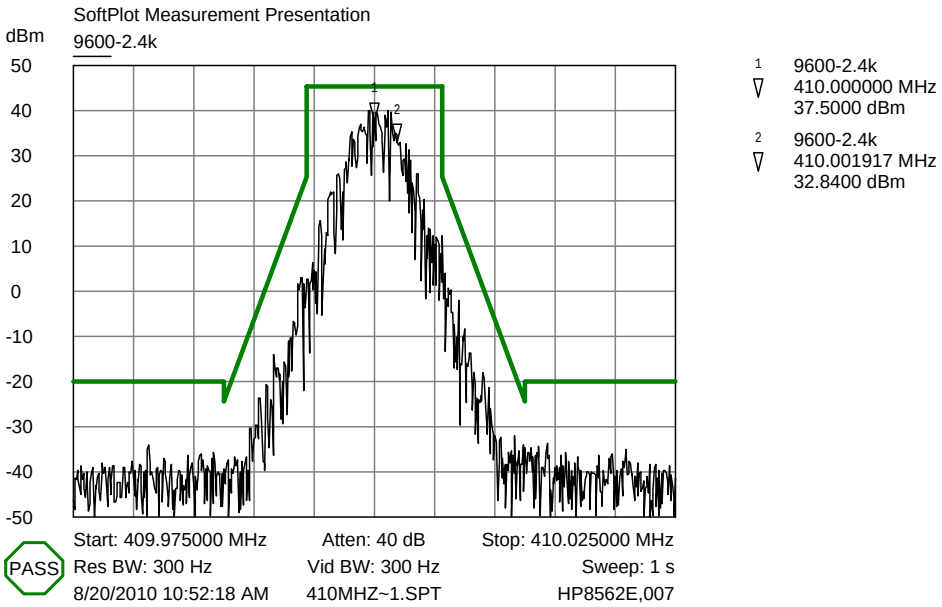
410 MHz GMSK Emission D



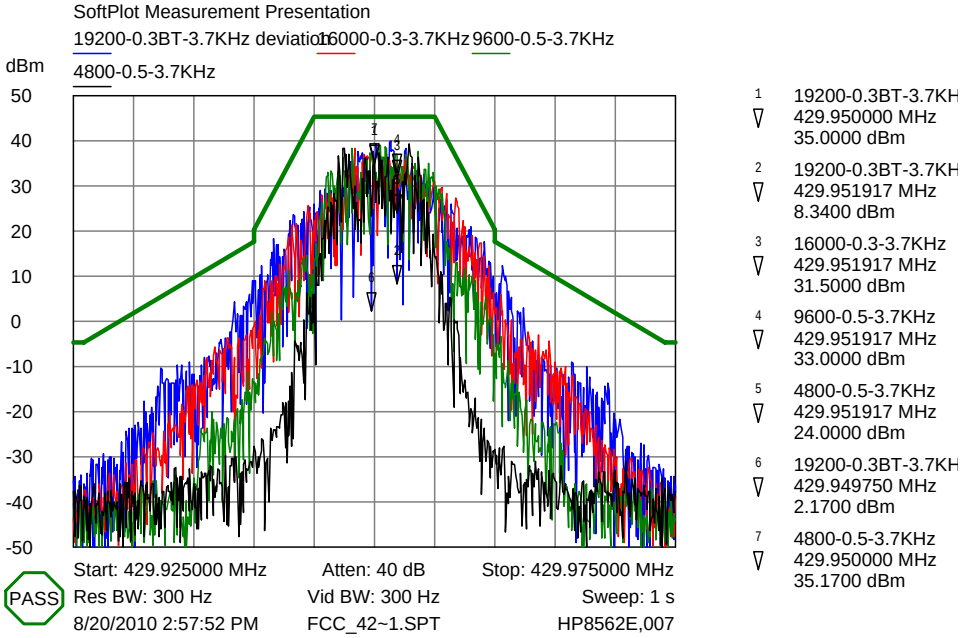
410 MHz 4LFSK Emissions C



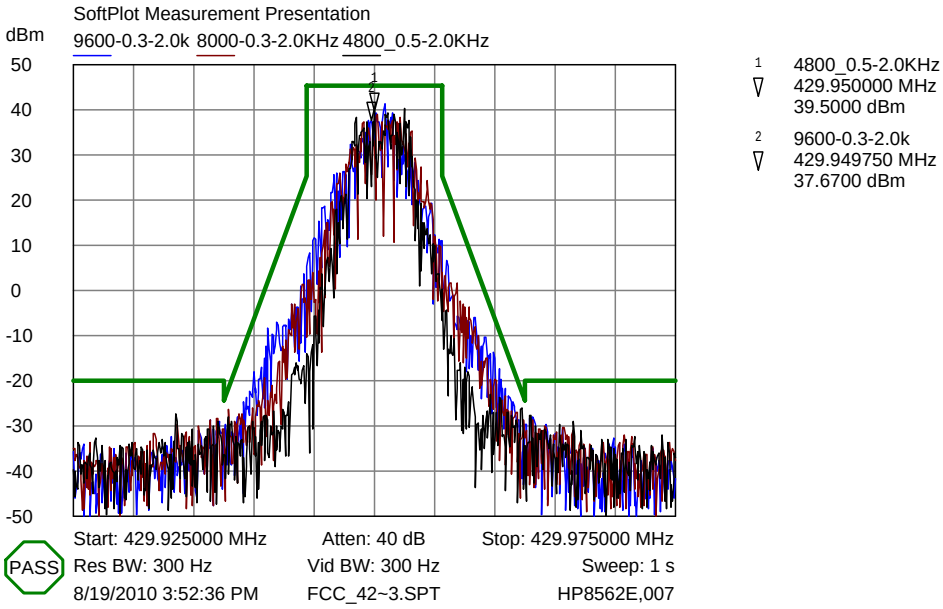
410 MHz 4LFSK Emissions D



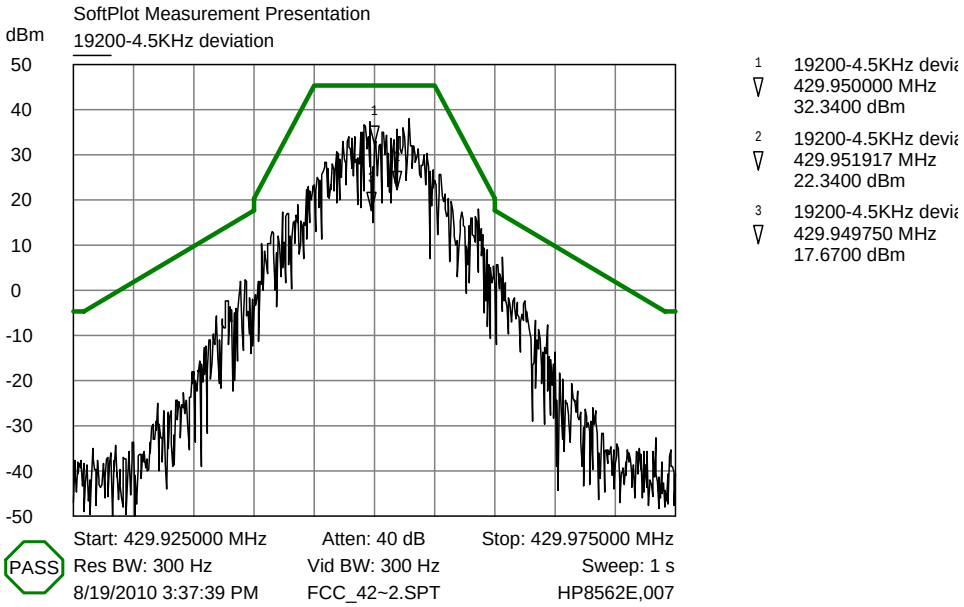
429.95 MHz GMSK Emissions C



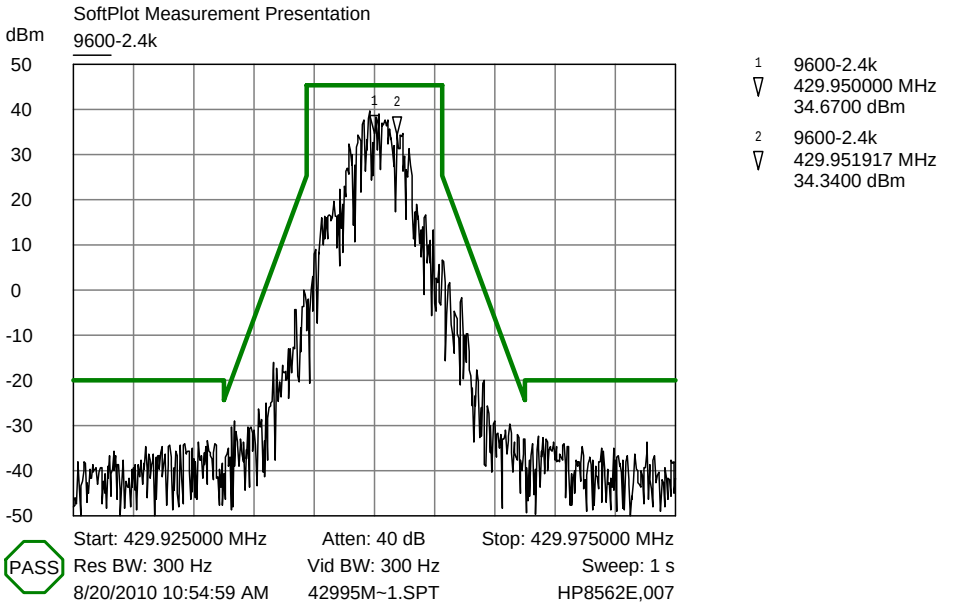
429.95MHz GMSK Emission D



429.95 MHz 4LFSK Emissions C

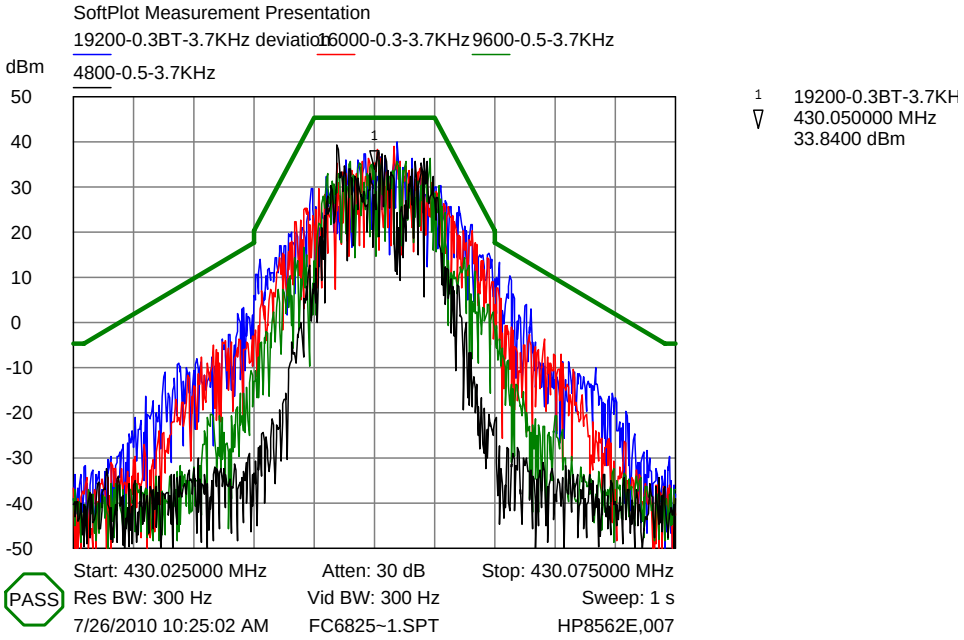


429.95 MHz 4LFSK Emissions D

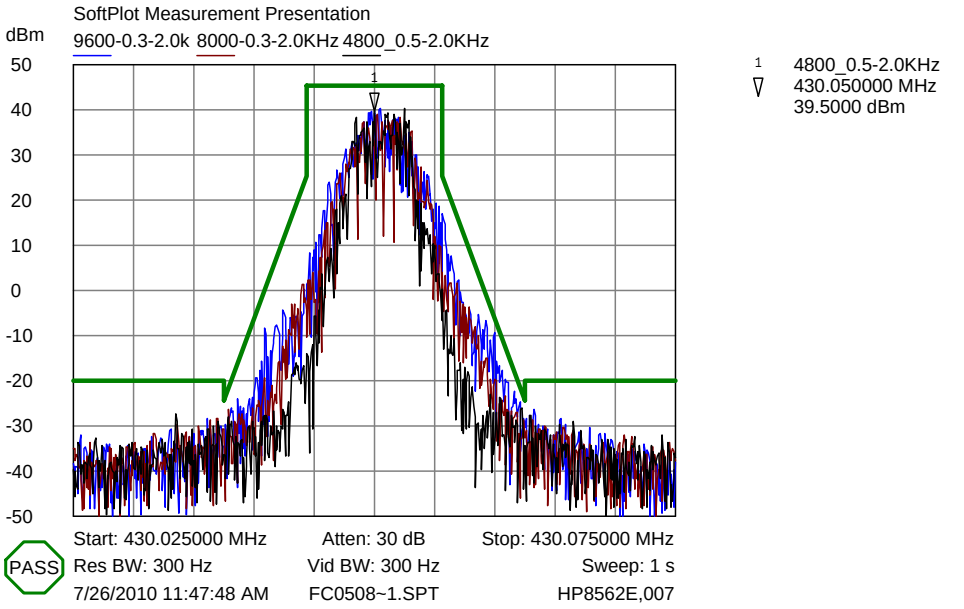


S/N: 211598(430~473MHz)

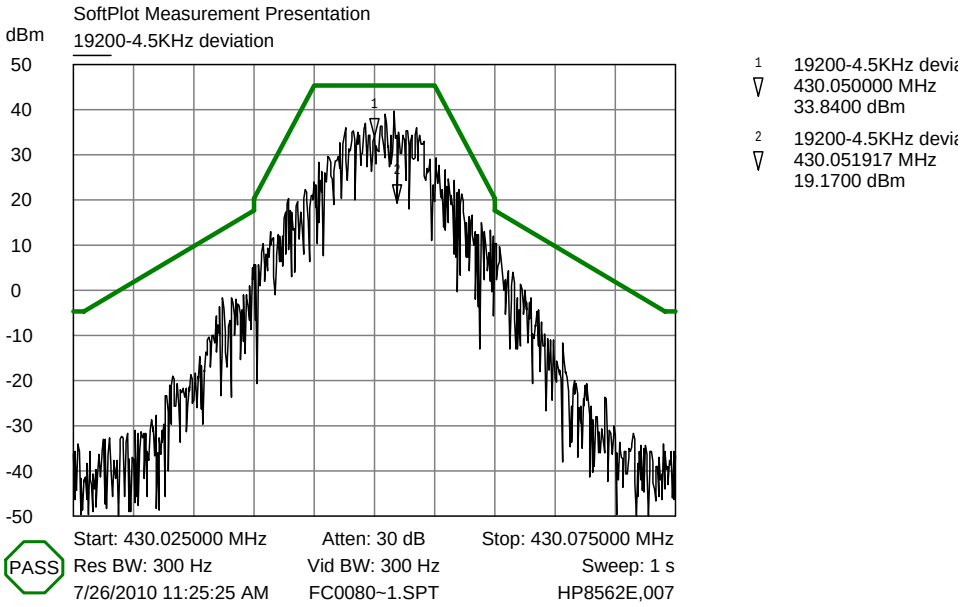
430.05MHz_GMSK Emission C



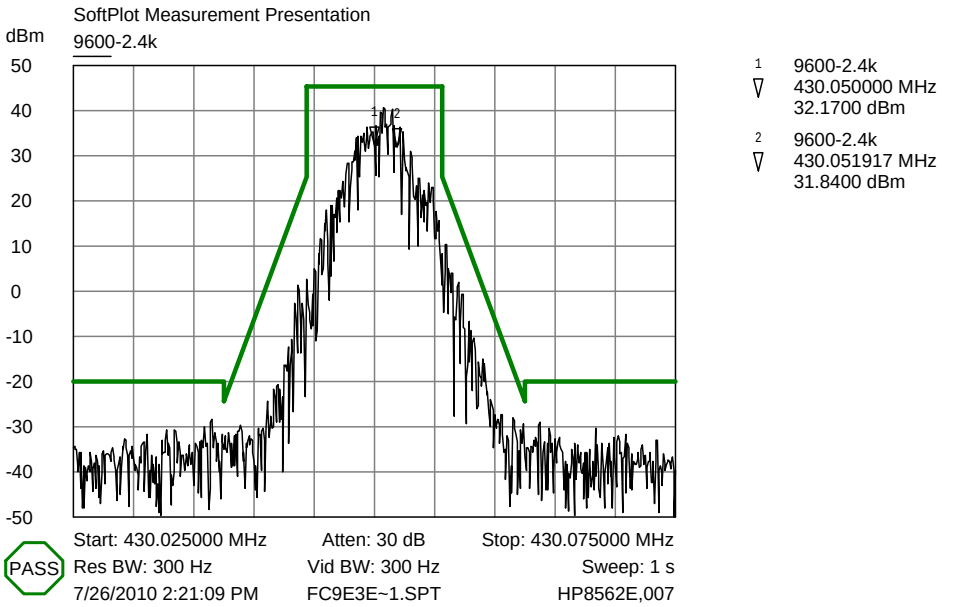
430.050 GMSK Emission D



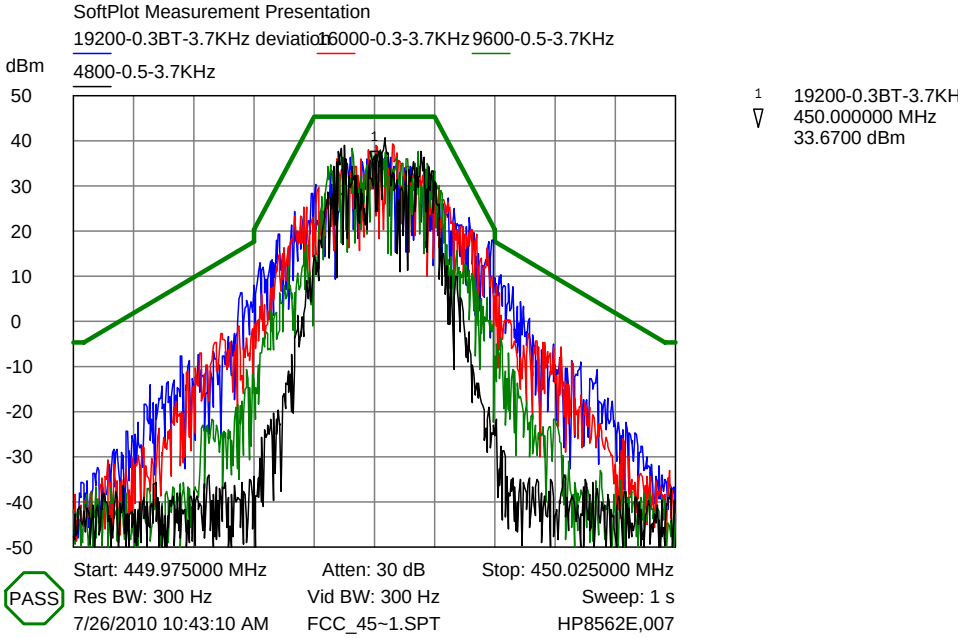
430.05 MHz 4LFSK Emissions C



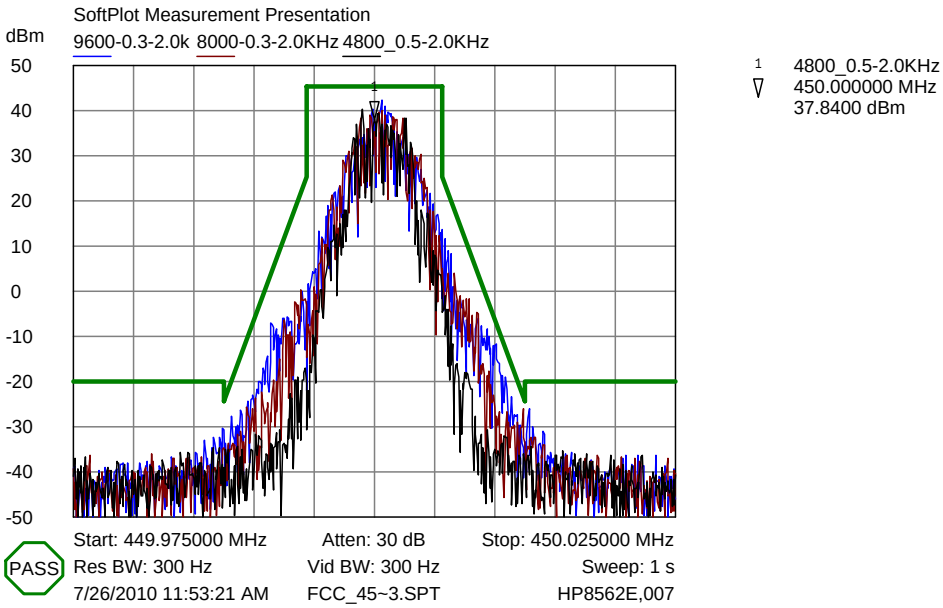
430.05 MHz 4LFSK Emissions D



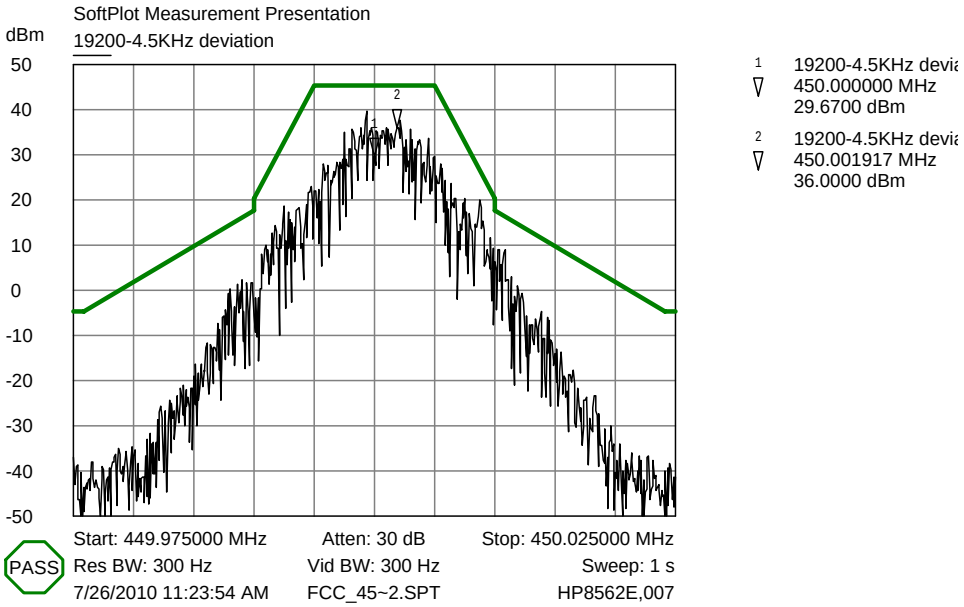
450 MHz GMSK Emissions C



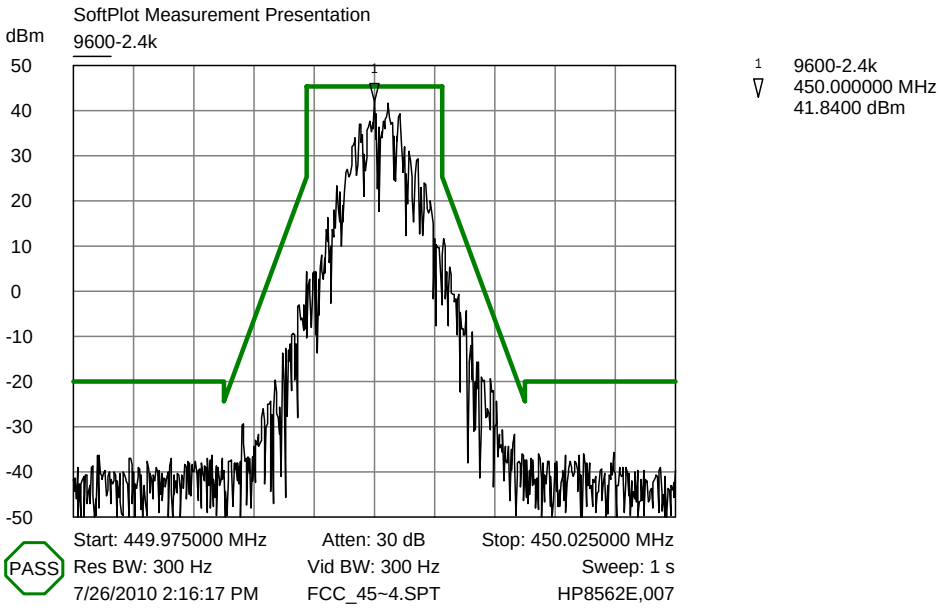
450MHz GMSK Emission D



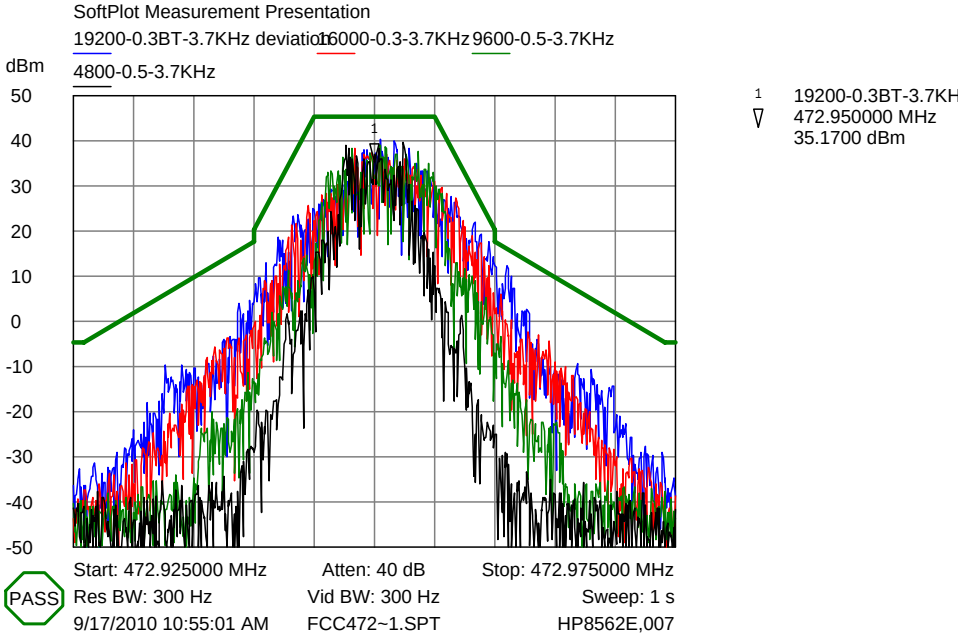
450 MHz 4LFSK Emissions C



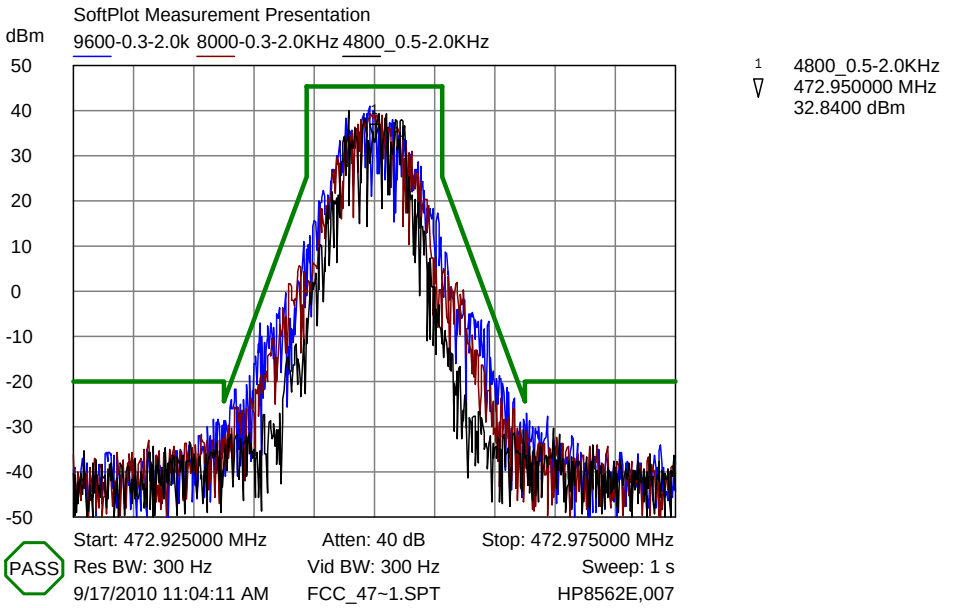
450 MHz 4LFSK Emissions D



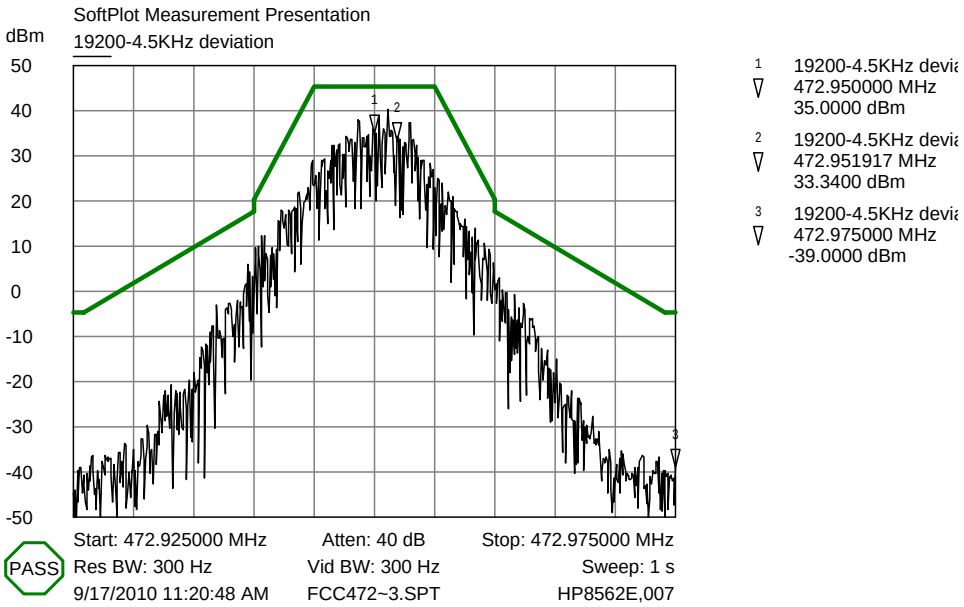
472.95 MHz GMSK Emissions C



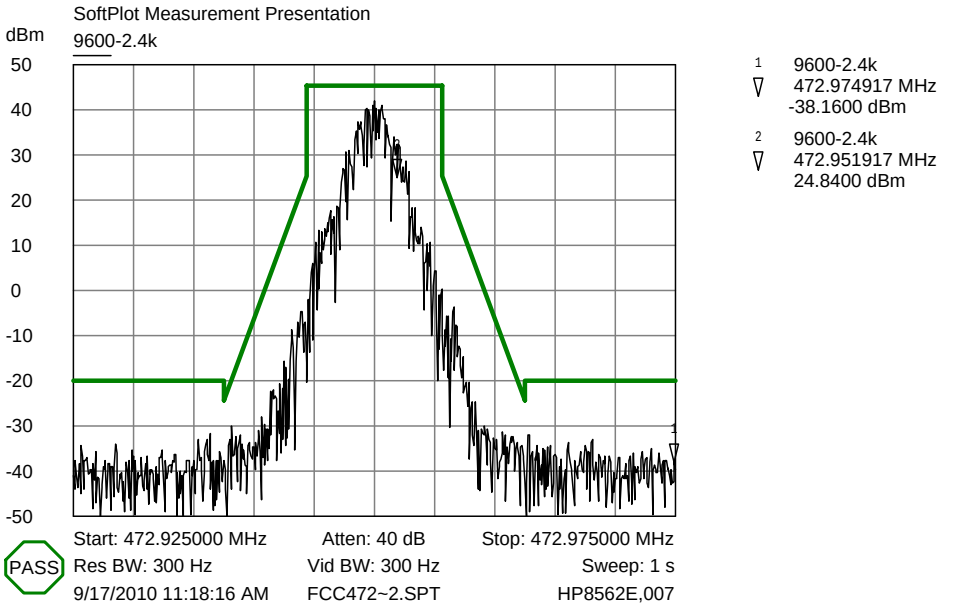
472.95 MHz GMSK Emission D



472.95 MHz 4LFSK Emissions C



472.95 MHz 4LFSK Emissions D



8 FCC §2.1051 & §90.210 – Spurious Emissions at Antenna Terminals

8.1 Applicable Standard

FCC §2.1051 and §90.210.
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 or 70 dB

On any frequency removed from the center of the assigned channel by more than 250 percent at least:
43+10log (P)

8.2 Test Procedure

TIA-603-C §2.2.13

8.3 Test Equipment List and Details

Manufacturer	Description	Model	S/N	Cal Date
Agilent	Spectrum Analyzer	8562EC	3946A00288	12/22/2009
TekPower	DC power supply	HY3005D	N/A	N/A

8.4 Test Environment Conditions

Temperature:	21~22 °C
Relative Humidity:	70~75 %
ATM Pressure:	101.2-102.4kPa

The testing was performed by Hui Chen on 2010-07-21~ 2010-09-01

8.5 Test Results

390~430 MHz(S/N: 211505)

	TX Operation		TX Standby		TX Operation		TX Standby	
	Freq. (MHz)	Output Power (dBm)	Freq. (MHz)	Output Power (dBm)	Freq. (MHz)	Output Power (dBm)	Freq. (MHz)	Output Power (dBm)
Fundamental	390.05	44.8	444.5	-75.2	410.00	45.1	464.45	-72.1
2nd Harmonic	780.1	-57.2	889	-87.2	820.00	-58.2	928.90	-82.5
3rd Harmonic	1170.15	-45.5	1333.5	-67.4	1230.00	-60.2	1393.35	-75.0
4th Harmonic	1560.2	<-60	1778	<-70	1640.00	<-60	1857.80	<-70
5th Harmonic	1950.25	<-60	2222.5	<-70	2050.00	<-60	2322.25	<-70
6th Harmonic	2340.3	<-60	2667	<-70	2460.00	<-60	2786.70	<-70
7th Harmonic	2730.35	<-60	3111.5	<-70	2870.00	<-60	3251.15	<-60
8th Harmonic	3120.4	<-60	3556	<-70	3280.00	<-60	3715.60	<-70
9th Harmonic	3510.45	<-60	4000.5	<-70	3690.00	<-60	4180.05	<-70
10th Harmonic	3900.5	<-60	4445	<-70	4100.00	<-60	4644.50	<-70

390~430 MHz(S/N: 211505)

	TX Operation		TX Standby	
	Freq. (MHz)	Output Power (dBm)	Freq. (MHz)	Output Power (dBm)
Fundamental	429.95	45.1	484.4	-70
2nd Harmonic	859.9	-61	968.8	-86
3rd Harmonic	1289.85	-65	1453.2	-70
4th Harmonic	1719.8	<-70	1937.6	<-70
5th Harmonic	2149.75	<-70	2422	<-70
6th Harmonic	2579.7	<-70	2906.4	<-70
7th Harmonic	3009.65	<-70	3390.8	-50
8th Harmonic	3439.6	<-70	3875.2	<-70
9th Harmonic	3869.55	<-70	4359.6	<-70
10th Harmonic	4299.5	<-70	4844	<-70

430~473 MHz(S/N: 211598)

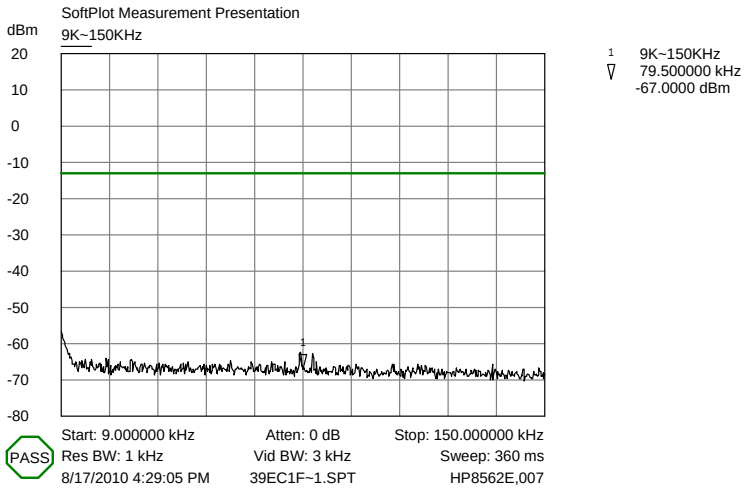
	TX Operation		TX Standby		TX Operation		TX Standby	
	Freq. (MHz)	**Output Power (dBm)**	**Freq. (MHz)**	**Output Power (dBm)**	**Freq. (MHz)**	**Output Power (dBm)**	**Freq. (MHz)**	**Output Power (dBm)**
Fundamental	430.05	45.4	484.5	-75	450.0	45.3	504.45	-71
2nd Harmonic	860.1	-64	969	-87	900.0	-64	1008.9	-91
3rd Harmonic	1290.15	-54	1453.5	-67	1350.0	-58	1513.35	-76
4th Harmonic	1720.2	<-60	1938	<-70	1800.0	<-60	2017.8	<-70
5th Harmonic	2150.25	<-60	2422.5	<-70	2250.0	<-60	2522.25	<-70
6th Harmonic	2580.3	<-60	2907	<-70	2700.0	<-60	3026.7	<-70
7th Harmonic	3010.35	<-60	3391.5	-62	3150.0	<-60	3531.15	-57
8th Harmonic	3440.4	<-60	3876	<-70	3600.0	<-60	4035.6	<-70
9th Harmonic	3870.45	<-60	4360.5	<-70	4050.0	<-60	4540.05	<-70
10th Harmonic	43000.5	<-60	4845.0	<-70	4500.0	<-60	5044.5	<-70

430~473 MHz(S/N: 211598)

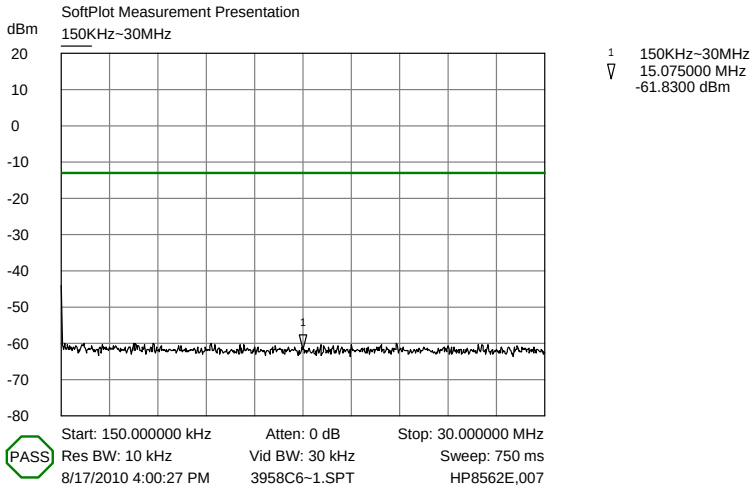
	TX Operation		TX Standby	
	Freq. (MHz)	**Output Power (dBm)**	**Freq. (MHz)**	**Output Power (dBm)**
Fundamental	472.95	45.1	527.4	-70
2nd Harmonic	945.9	-64	1054.8	-86
3rd Harmonic	1418.85	-58	1582.2	-70
4th Harmonic	1891.8	<-60	2109.6	<-70
5th Harmonic	2364.75	<-60	2637	<-70
6th Harmonic	2837.7	<-60	3164.4	<-70
7th Harmonic	3310.65	<-60	3691.8	-50
8th Harmonic	3783.6	<-60	4219.2	<-70
9th Harmonic	4256.55	<-60	4746.6	<-70
10th Harmonic	4729.5	<-60	5274	<-70

S/N: 211505(390~430 MHz)

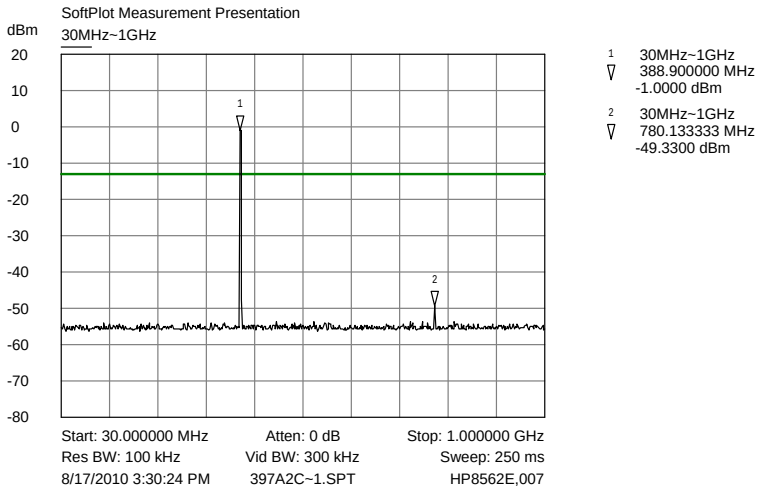
390.05 MHz TX emission: 9~150 kHz



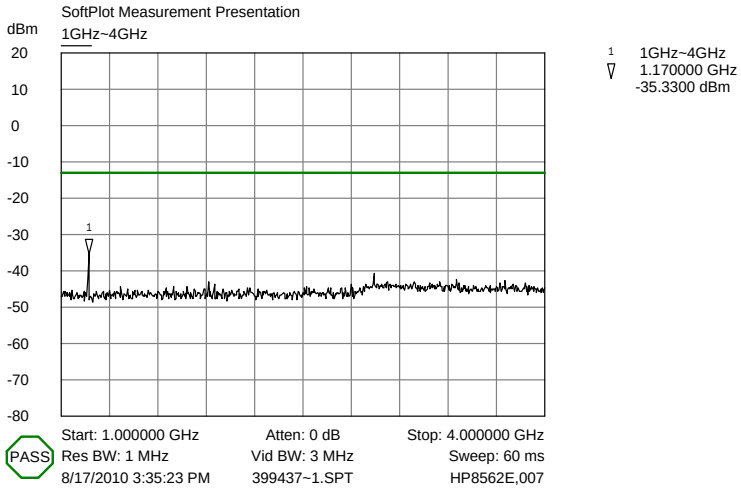
390.05 MHz TX emission: 150 kHz~30 MHz



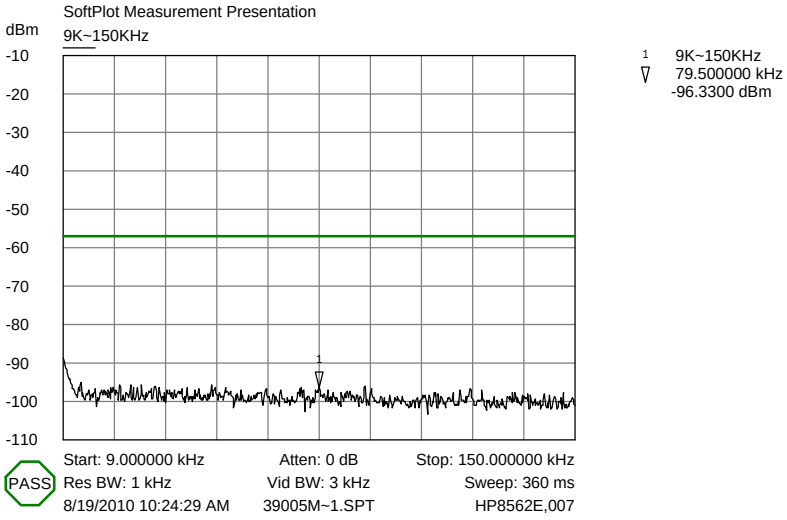
390.05 MHz TX emission: 30 MHz~1 GHz (Notch filter is needed to reject carrier)



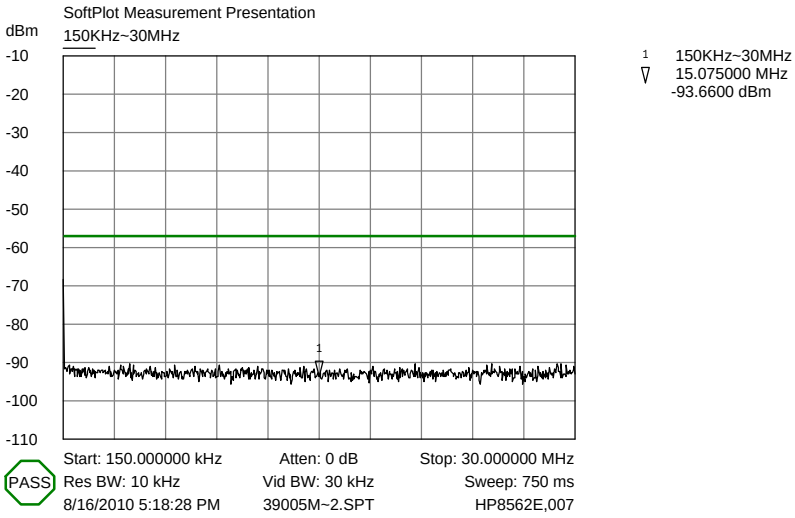
390.05 MHz TX emission: 1 GHz~4 GHz



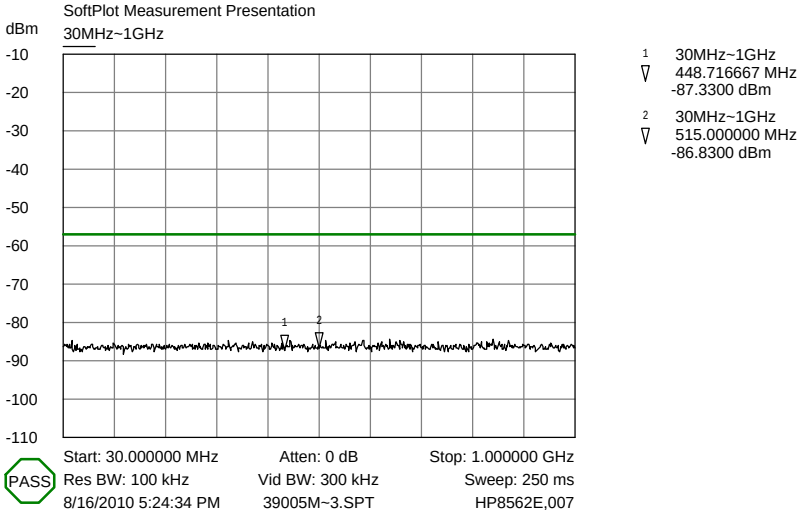
390.05 MHz RX emission: 9~150 kHz



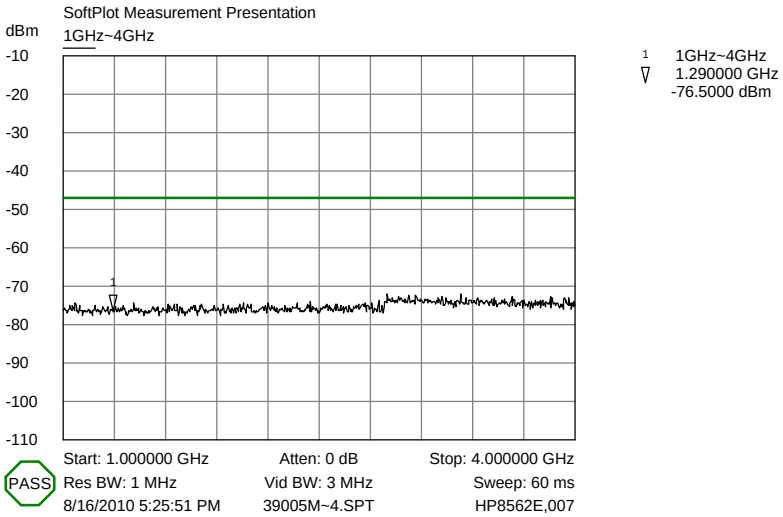
390.05 MHz RX emission: 150 kHz~30 MHz



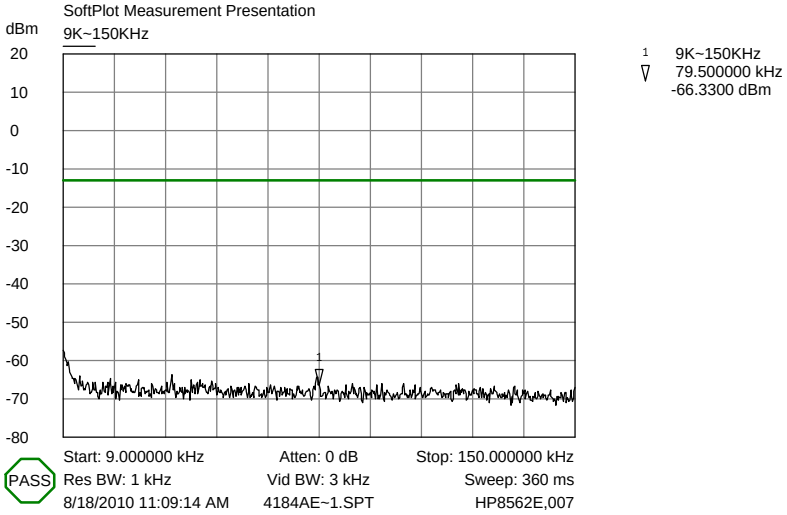
390.05 MHz RX emission: 30 MHz~1 GHz



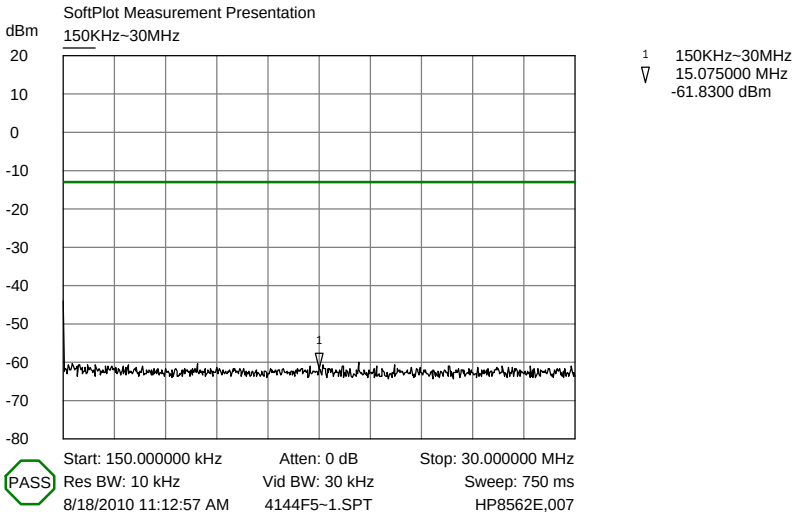
390.05 MHz RX emission: 1 GHz~4 GHz



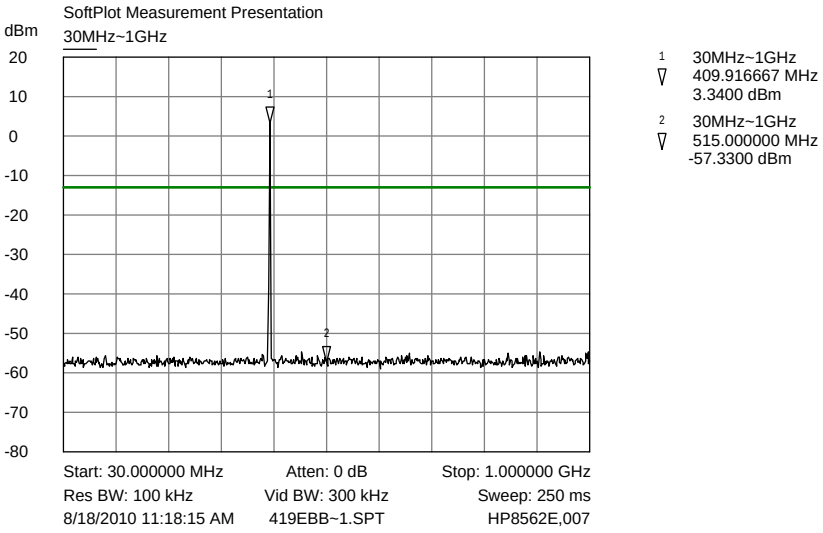
410 MHz TX emission: 9~150 kHz



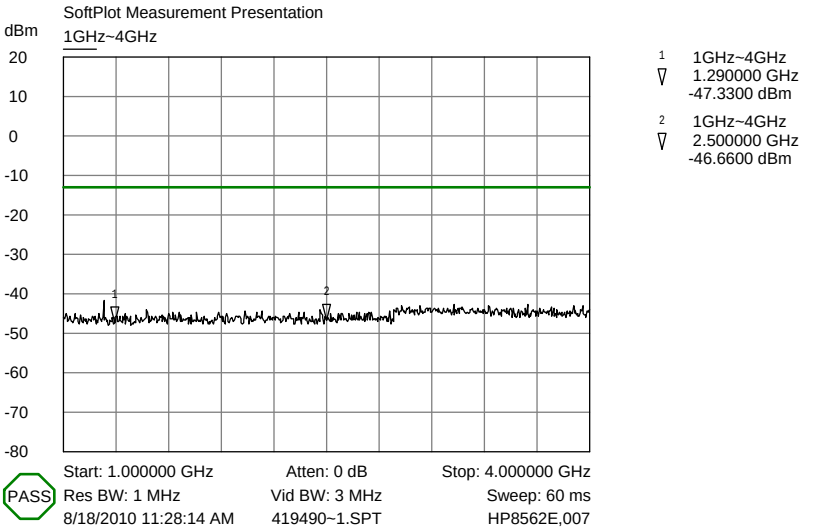
410 MHz TX emission: 150 kHz~30 MHz



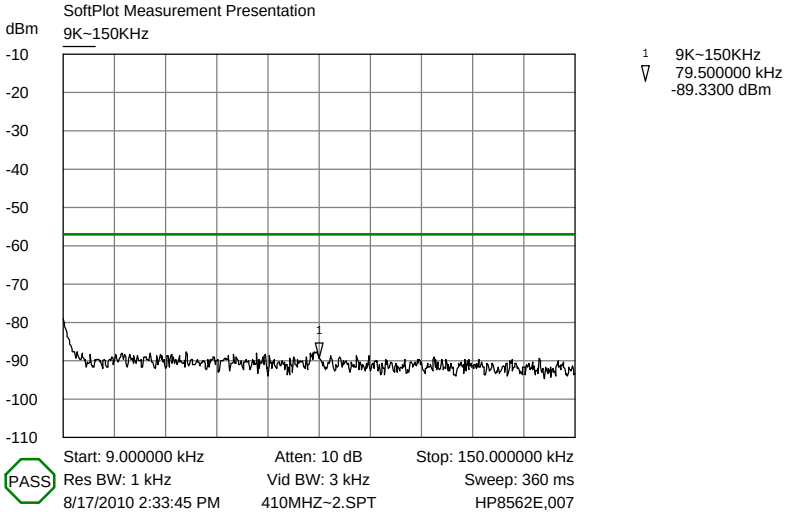
410 MHz TX emission: 30 MHz~1 GHz



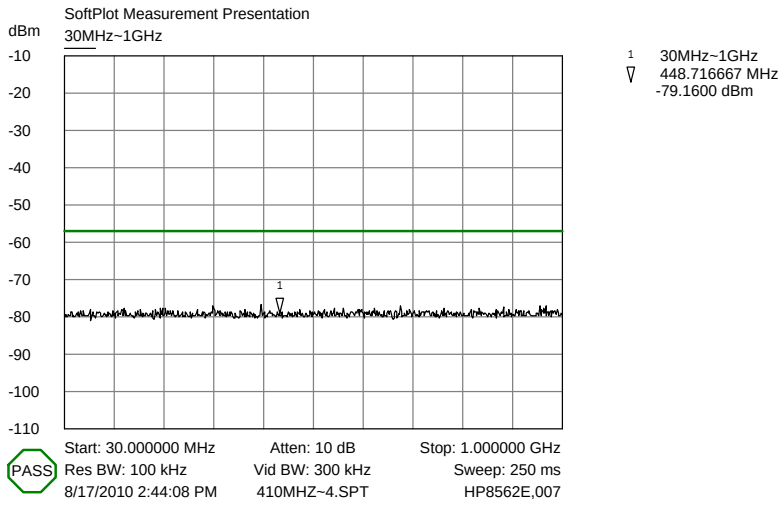
410 MHz TX emission: 1 GHz~4 GHz



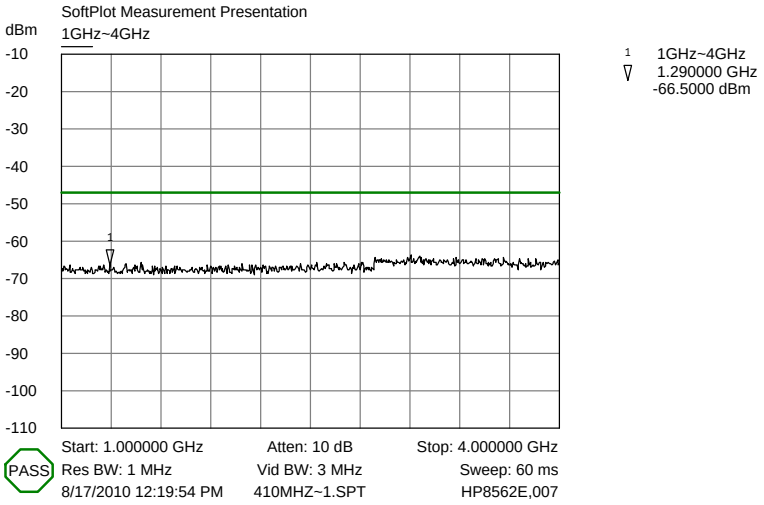
410 MHz RX emission: 9~150 kHz



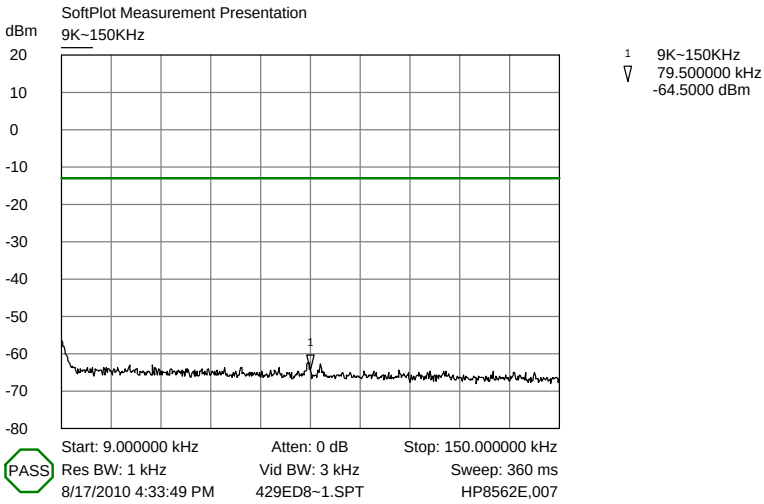
410 MHz RX emission: 150 kHz~30 MHz



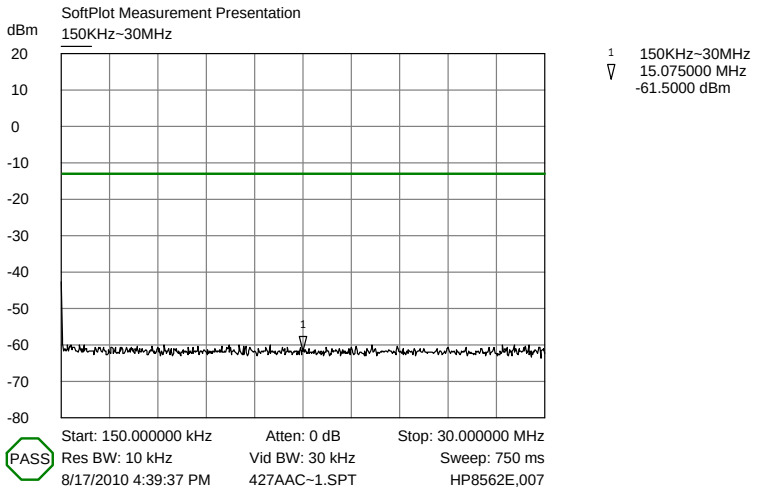
410 MHz RX emission: 1 GHz~4 GHz



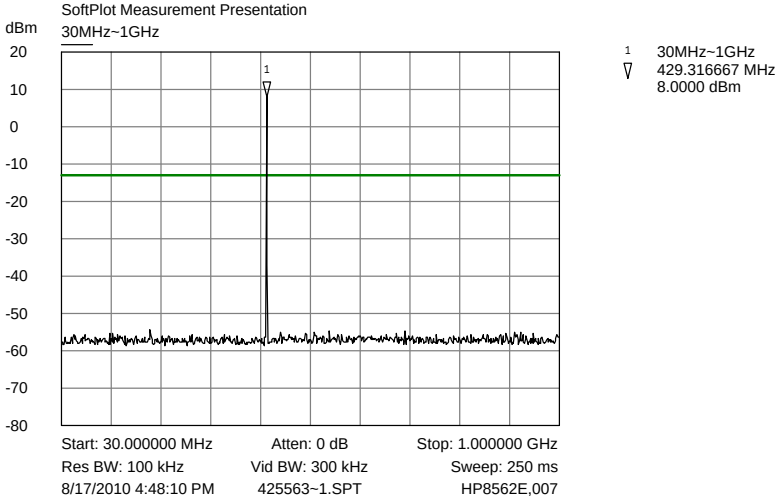
429.95 MHz TX emission: 9~150 kHz



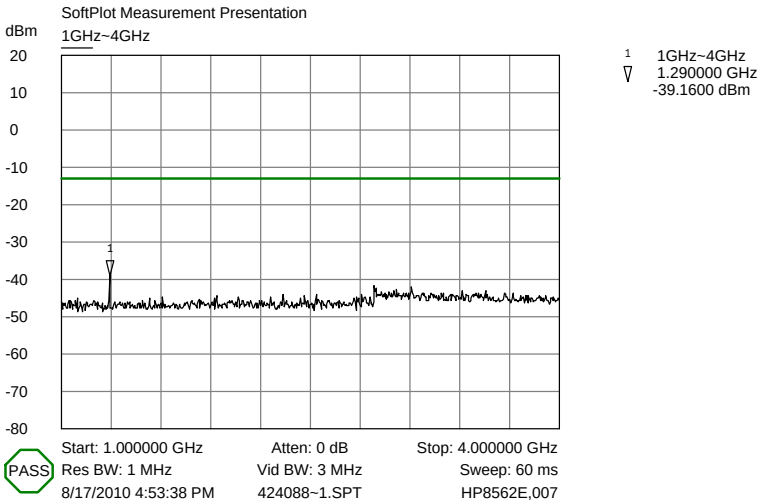
429.95 MHz TX emission: 150 kHz~30 MHz



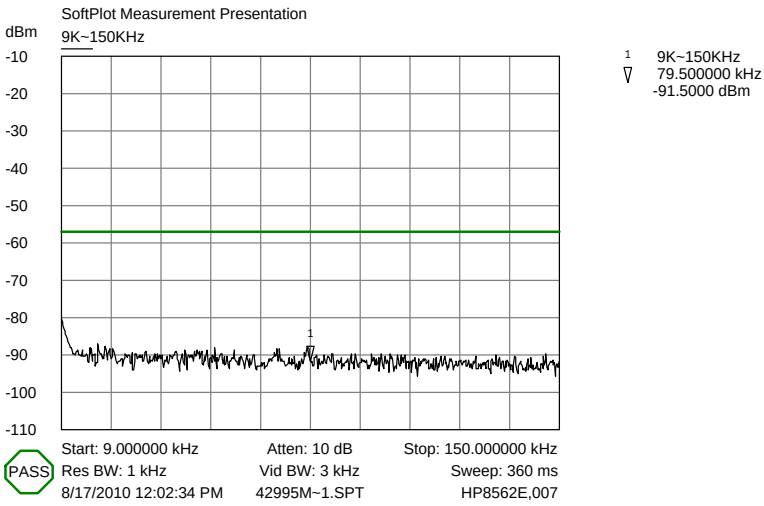
429.95 MHz TX emission: 30 MHz~1 GHz



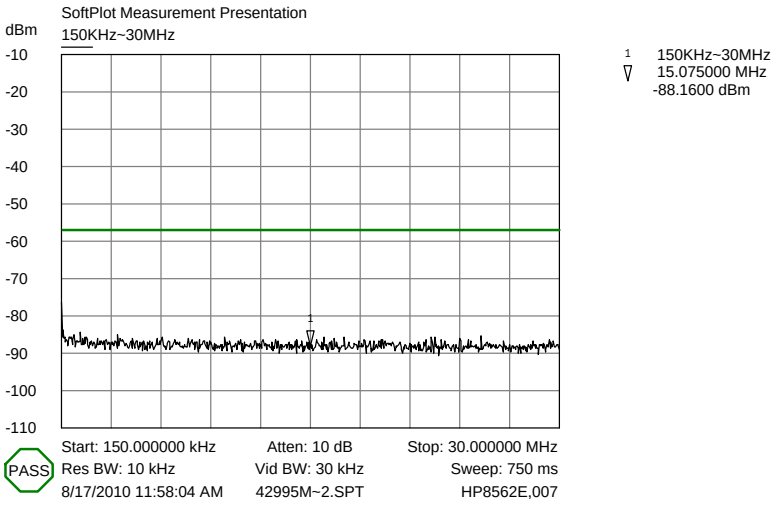
429.95 MHz TX emission: 1 GHz~4 GHz



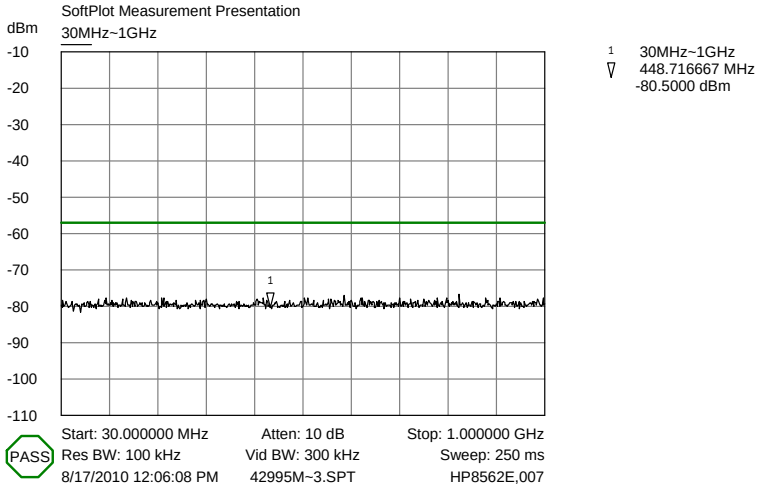
429.05 MHz RX emission: 9~150 kHz



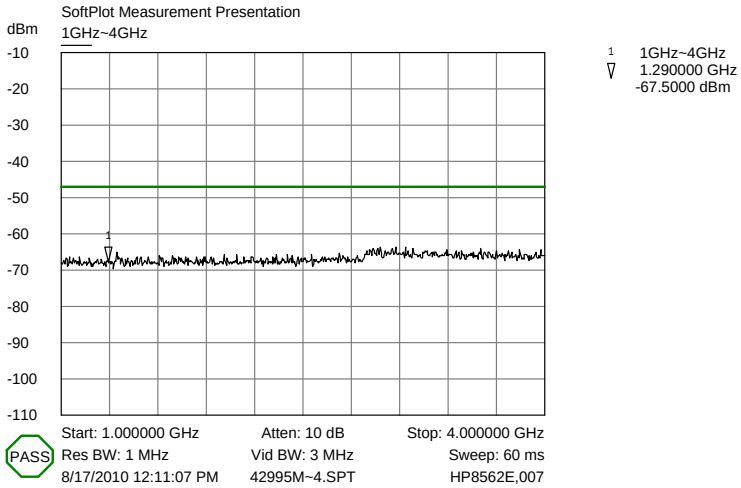
429.05 MHz RX emission: 150 kHz~30 MHz



429.95 MHz RX emission: 30 MHz~1 GHz

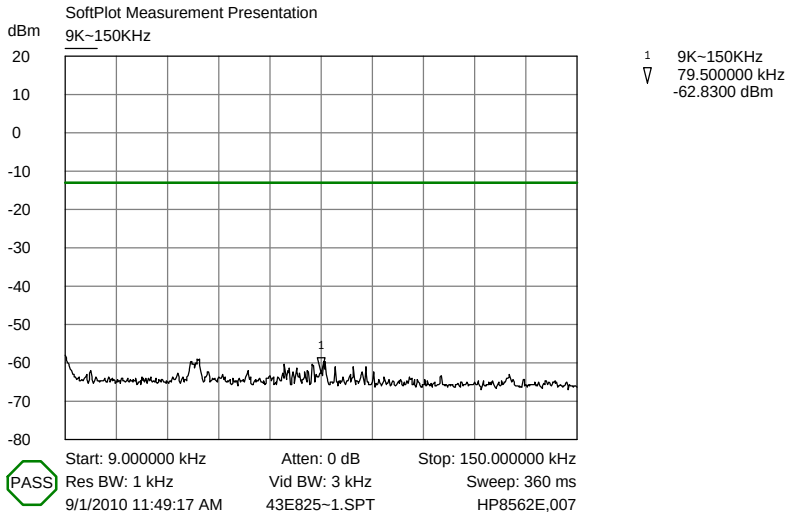


429.95 MHz RX emission: 1 GHz~4 GHz

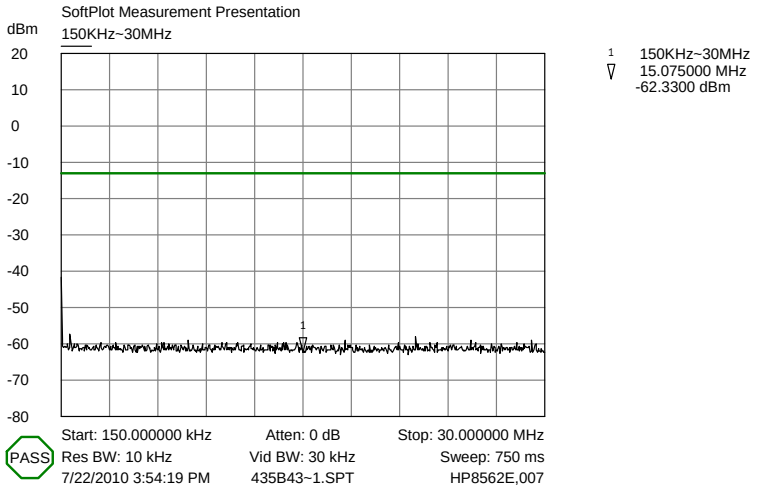


S/N: 211598 (430~473MHz)

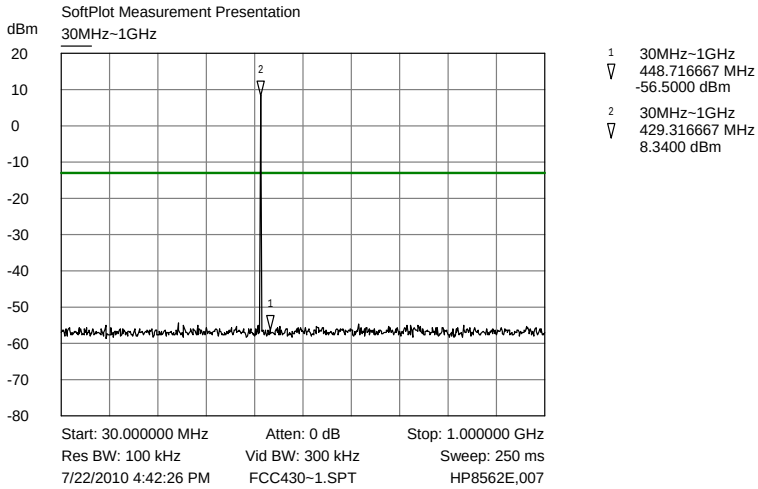
430.05 MHz TX emissions: 9 kHz~150 kHz



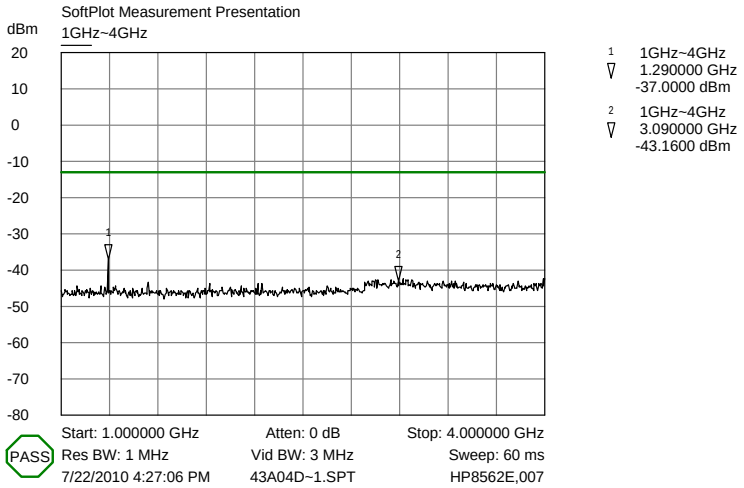
430.05 MHz TX emission: 150 kHz~30 MHz



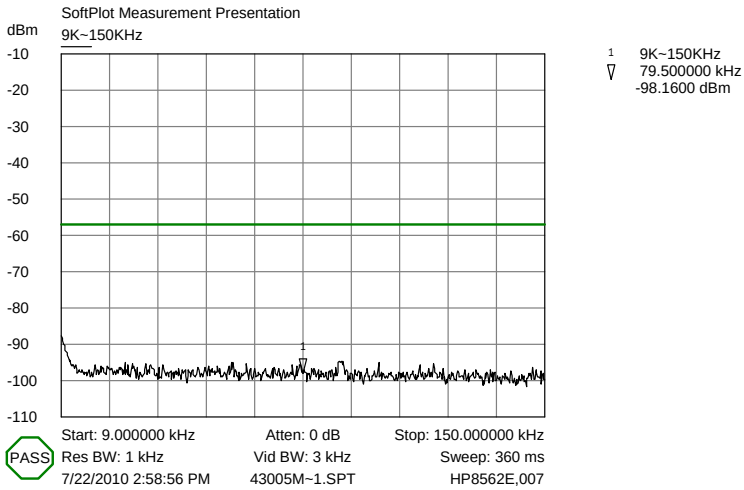
430.05 MHz TX emission: 30 MHz~1 GHz (Notch filter is needed to reject carrier)



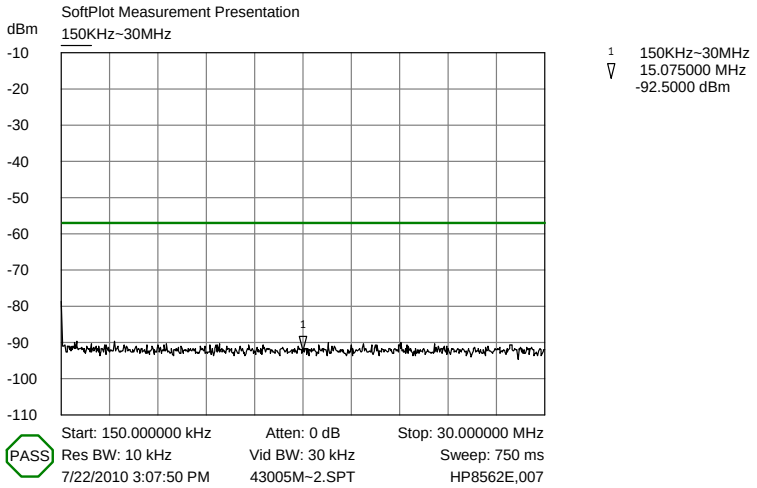
430.05 MHz TX emission: 1 GHz~4 GHz



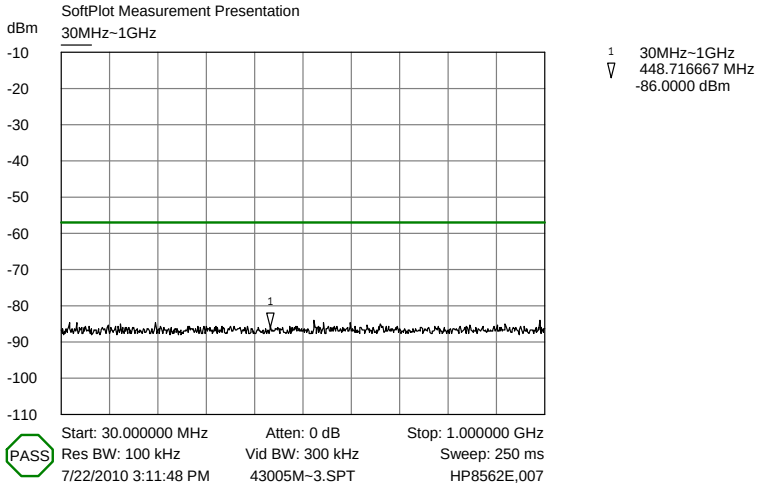
430.05 MHz RX emission: 9 kHz~150 kHz



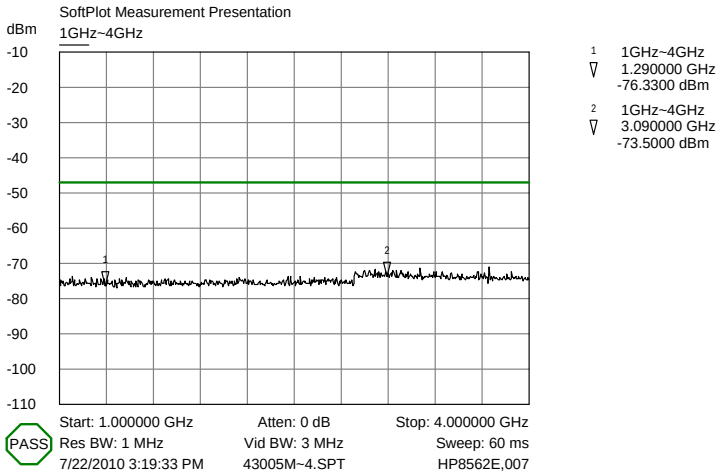
430.05 MHz RX emission: 150 kHz~30 MHz



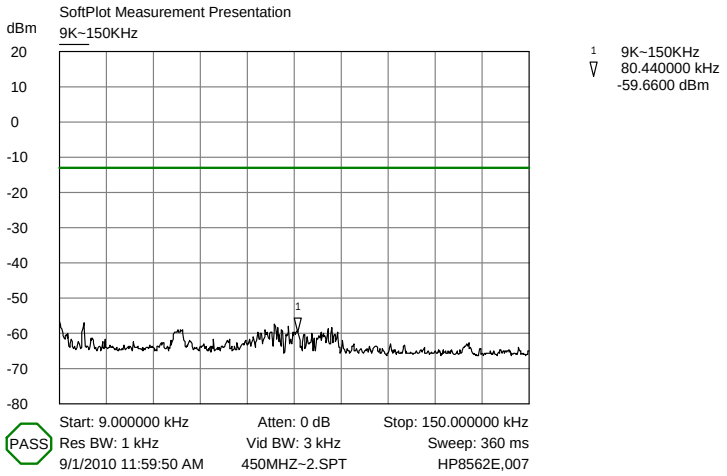
430.05 MHz RX emission: 30 MHz~1 GHz



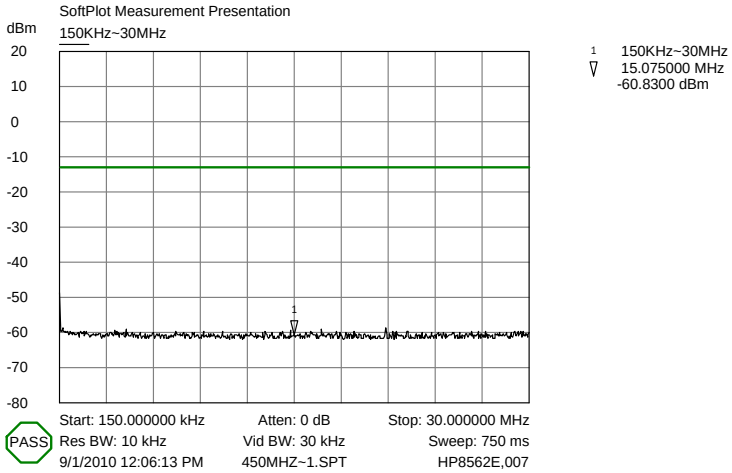
430.05 MHz RX emission: 1 GHz~4 GHz



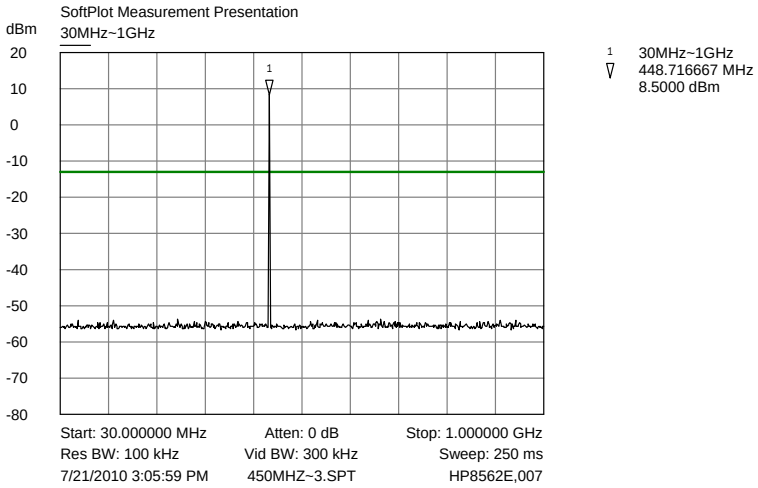
450 MHz TX emissions: 9 kHz~150 kHz



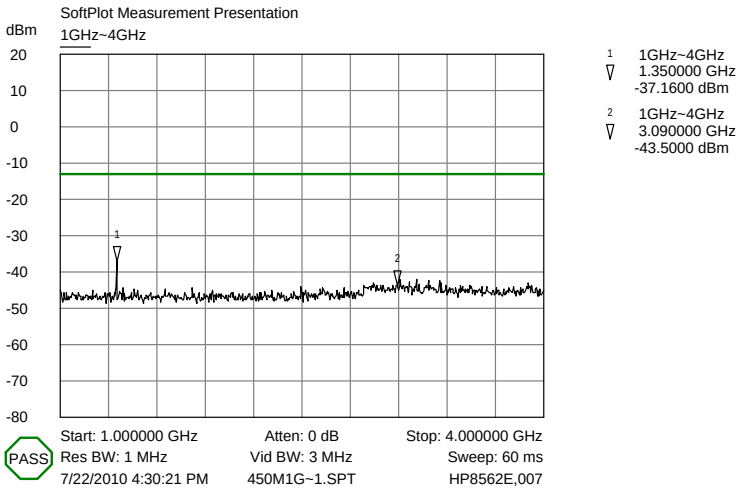
450 MHz TX emission: 150 kHz~30 MHz



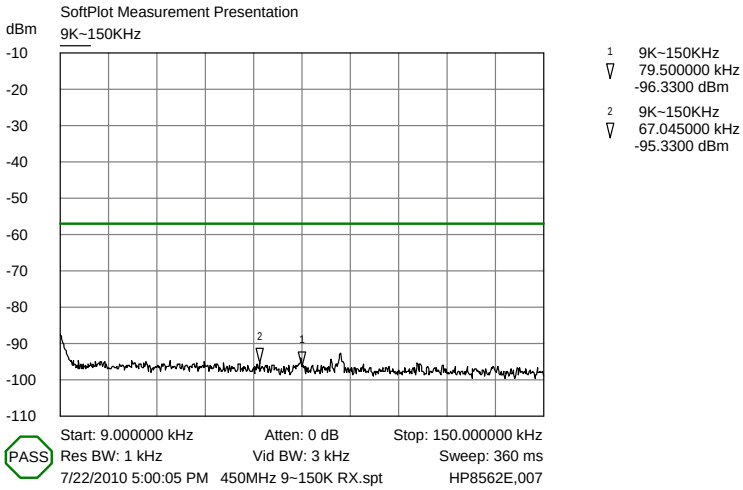
450 MHz TX emission: 30 MHz~1 GHz (Notch filter is needed to reject carrier)



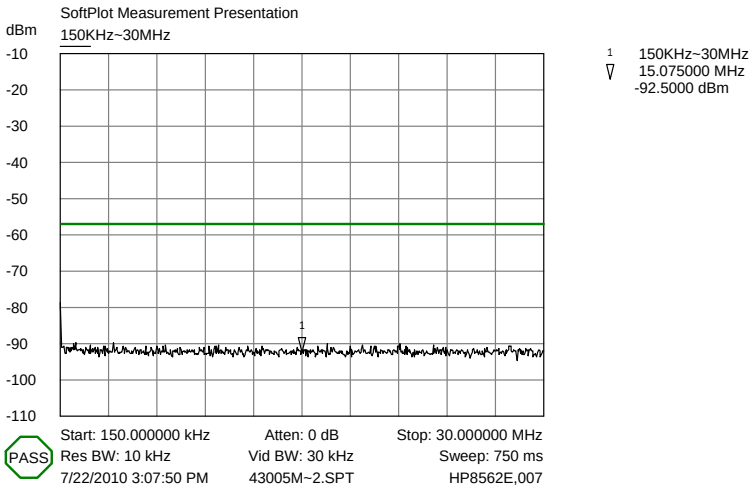
450 MHz TX emission: 1 GHz~4 GHz



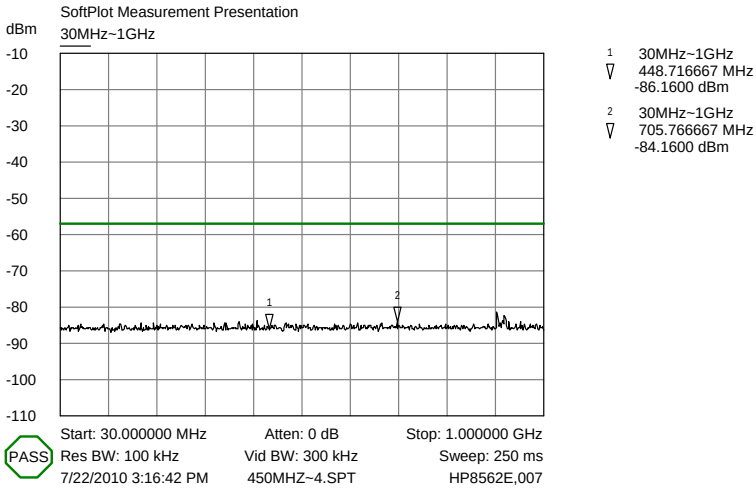
450 MHz RX emission: 9 kHz~150 kHz



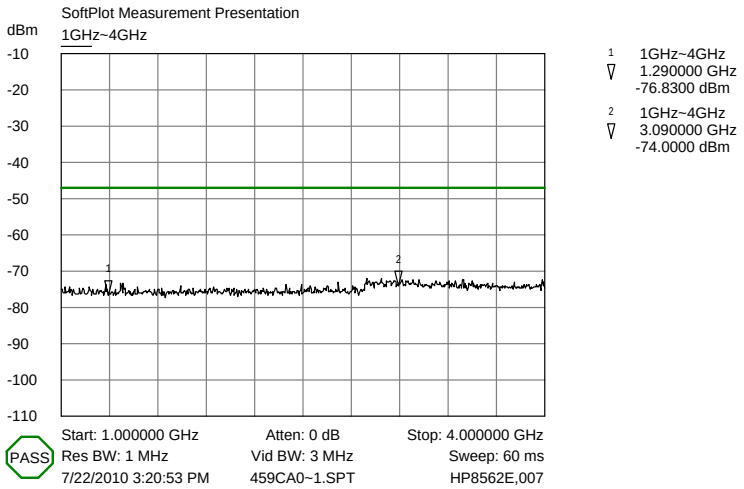
450 MHz RX emission: 150 kHz~30 MHz



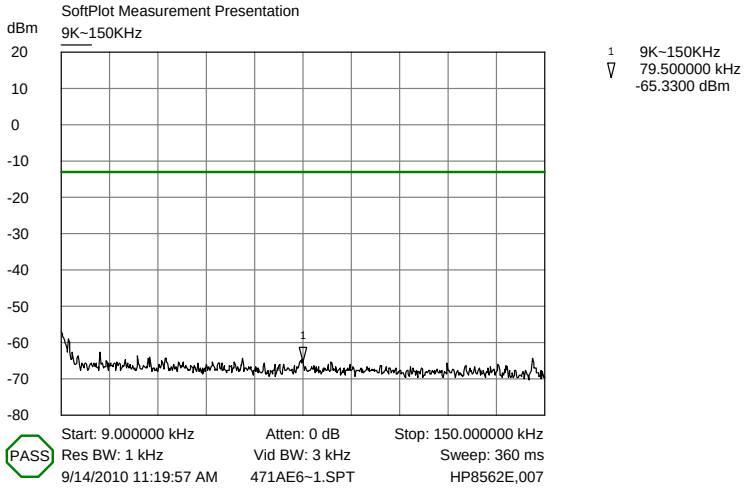
450 MHz RX emission: 30 MHz~1 GHz



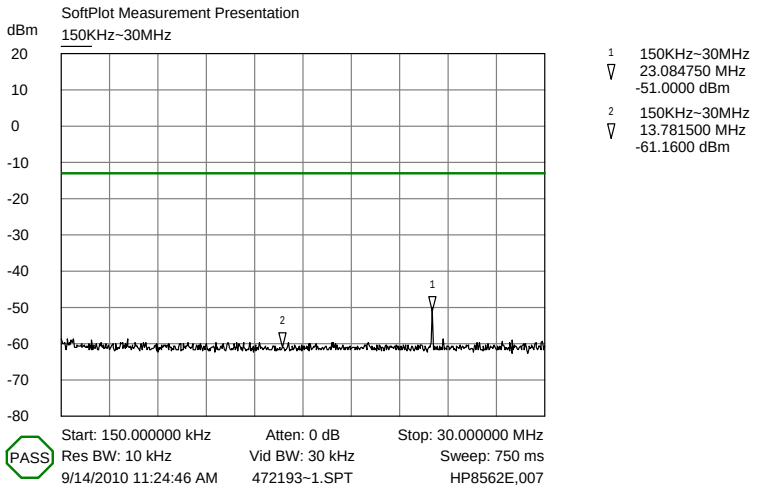
450 MHz RX emission: 1 GHz~4 GHz



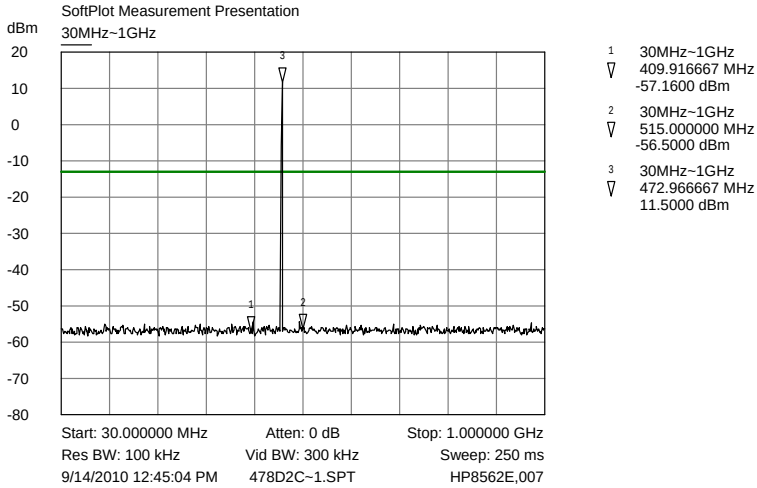
472.95 MHz TX emissions: 9 kHz~150 kHz



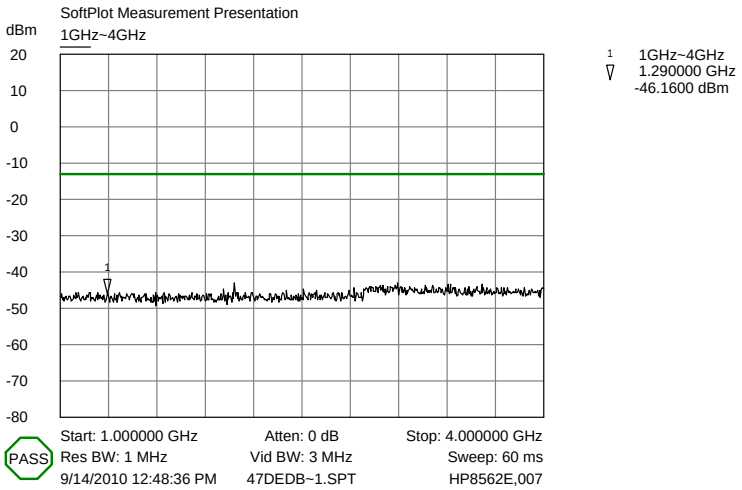
472.95 MHz TX emission: 150 kHz~30 MHz



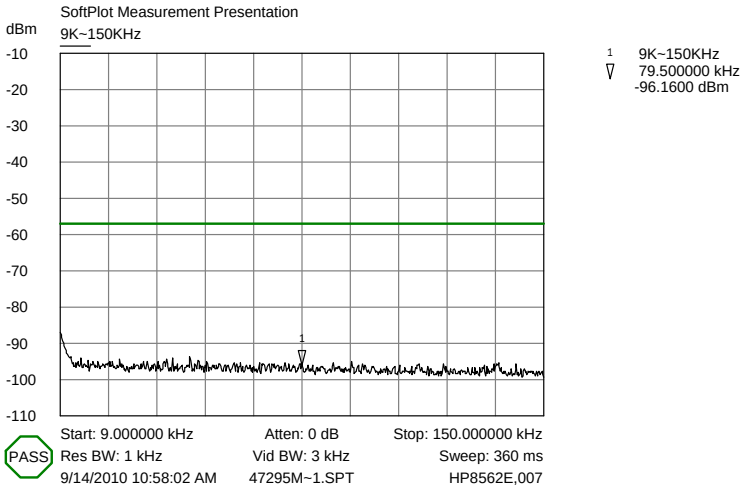
472.95 MHz TX emission: 30 MHz~1 GHz (Notch filter is needed to reject carrier)



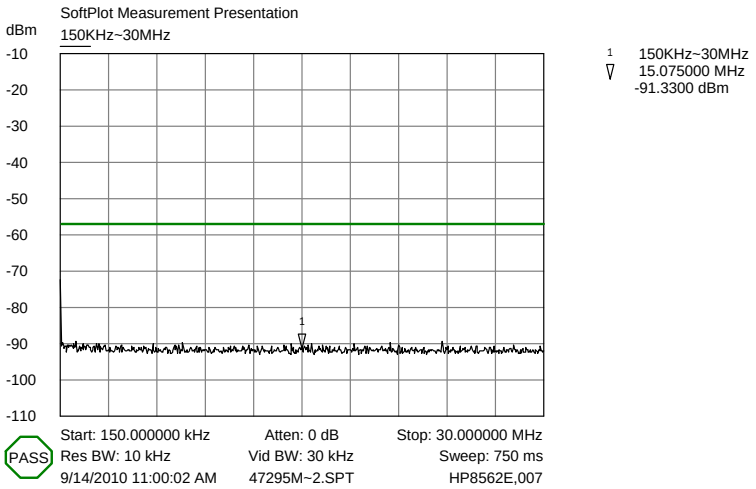
472.95 MHz TX emission: 1 GHz~4 GHz



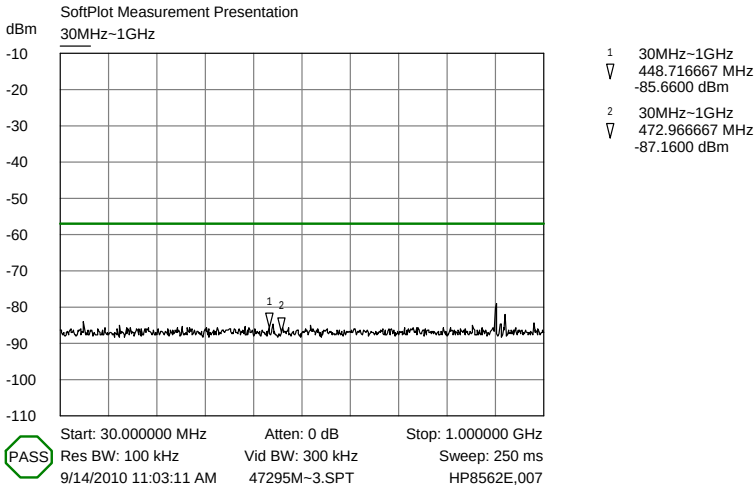
472.95 MHz RX emission: 9 kHz~150 kHz



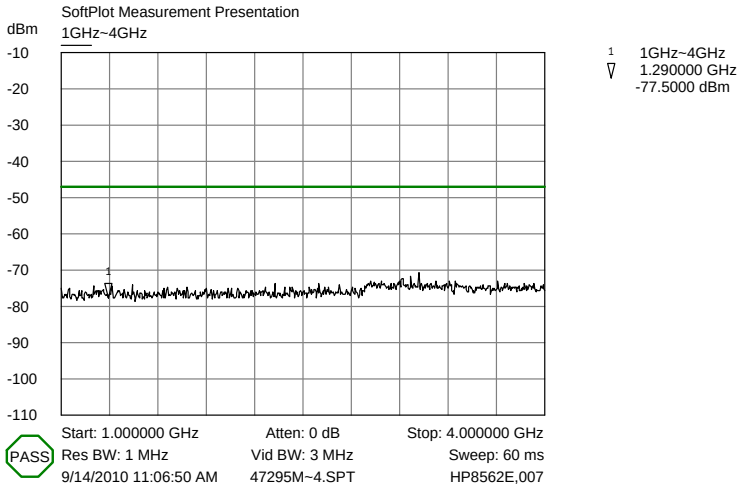
472.95 MHz RX emission: 150 kHz~30 MHz



472.95 MHz RX emission: 30 MHz~1 GHz



472.95 MHz RX emission: 1 GHz~4 GHz



9 FCC §2.1053 & §90.210 - Radiated Spurious Emissions

9.1 Applicable Standard

FCC §2.1053 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate and §90.210(b),(d): Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

9.2 Test Procedure

TIA-603-C §2.2.12

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 log (TX power in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts) for EUT with a 25 KHz channel bandwidth.

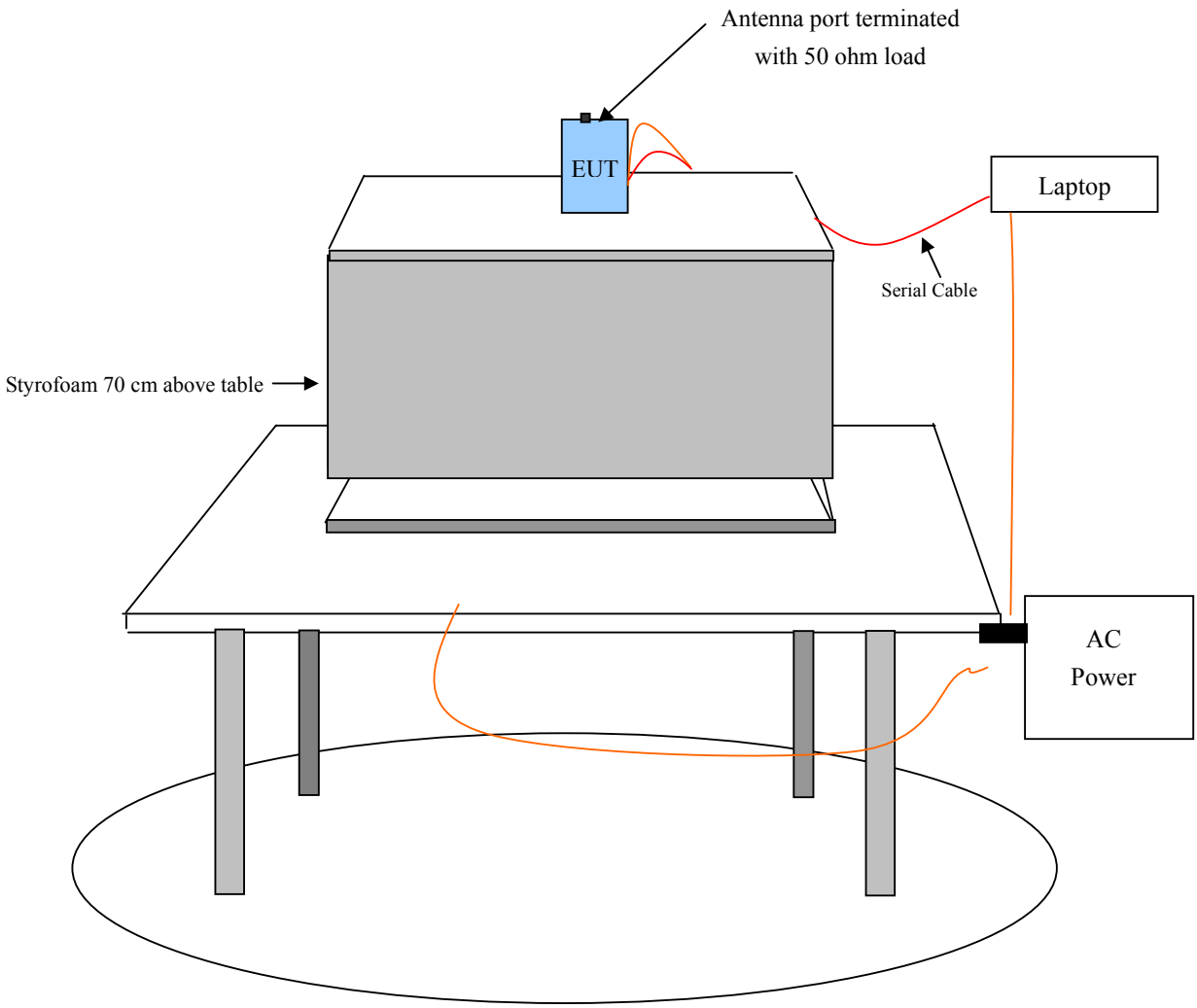
Spurious attenuation limit in dB = 50 + 10 Log_{10} (power out in Watts) for EUT with a 12.5 KHz channel bandwidth.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2010-03-24
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A0020106-2	2010-08-06
Hewlett Packard	Pre amplifier	8447D	2944A06639	2010-06-18
A.R.A Inc	Horn antenna	DRG-1181A	1132	2009-10-27
Mini-Circuits	Pre Amplifier	ZVA-183-S	570400946	2010-05-10

Statement of Traceability: BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

9.4 Test Setup



9.5 Test Environmental Conditions

Temperature:	19~25 °C
Relative Humidity:	50~54 %
ATM Pressure:	100.9~101.2kPa

The testing was performed by Jerry Huang on 2010-10-11~2010-10-14

9.6 Test Result

390-430 MHz Band SN: 10370002

Middle Channel (Channel spacing 12.5 kHz)

Indicated		Azimuth (degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (cm)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
819.7	42.37	219	175	H	819.7	-39.71	0	0.66	-40.37	-20	-20.37
819.7	41.73	184	196	V	819.7	-38.69	0	0.66	-39.35	-20	-19.35
1229.55	64.86	121	149	V	1229.55	-38.31	6.522	0.83	-32.618	-20	-12.618
1229.55	66.15	258	147	H	1229.55	-37.02	6.522	0.83	-31.328	-20	-11.328
1639.4	53.54	269	151	H	1639.4	-49.09	8.749	1	-41.341	-20	-21.341
1639.4	49.97	84	127	V	1639.4	-51.97	8.749	1	-44.221	-20	-24.221
2049.25	62.47	148	153	H	2049.25	-39.23	8.606	1.32	-31.944	-20	-11.944
2049.25	63.51	194	149	V	2049.25	-38.19	8.606	1.32	-30.904	-20	-10.904
2459.1	48.95	112	238	H	2459.1	-49.05	9.356	1.34	-41.034	-20	-21.034
2459.1	50.48	277	149	V	2459.1	-47.13	9.356	1.34	-39.114	-20	-19.114
2868.95	51	216	180	H	2868.95	-45.6	10.332	1.34	-36.608	-20	-16.608
2868.95	55.7	183	142	V	2868.95	-41.09	10.332	1.34	-32.098	-20	-12.098
3278.8	54.45	248	109	H	3278.8	-42.02	9.846	1.32	-33.494	-20	-13.494
3278.8	52.27	218	172	V	3278.8	-43.93	9.846	1.32	-35.404	-20	-15.404
4098.5	46.99	224	166	H	4098.5	-49.31	10.62	1.83	-40.52	-20	-20.52
4098.5	48.39	215	131	V	4098.5	-47.73	10.62	1.83	-38.94	-20	-18.94

Middle Channel (Channel spacing 25 kHz)

Indicated		Azimuth (degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (cm)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
819.7	41.56	216	129	H	819.7	-40.52	0	0.66	-41.18	-13	-28.18
819.7	41.85	186	195	V	819.7	-38.57	0	0.66	-39.23	-13	-26.23
1229.55	64.72	130	143	H	1229.55	-37.48	6.522	1	-31.958	-13	-18.958
1229.55	66.99	134	158	V	1229.55	-36.15	6.522	1	-30.628	-13	-17.628
1639.4	51.39	264	150	H	1639.4	-50.04	8.749	1	-42.291	-13	-29.291
1639.4	52.41	177	254	V	1639.4	-49.57	8.749	1	-41.821	-13	-28.821
2049.25	63.35	254	147	H	2049.25	-38.01	8.606	1.32	-30.724	-13	-17.724
2049.25	64.02	186	146	V	2049.25	-37.6	8.606	1.32	-30.314	-13	-17.314
2459.1	44.58	107	150	H	2459.1	-51.8	9.356	1.34	-43.784	-13	-30.784
2459.1	47.87	269	157	V	2459.1	-48.24	9.356	1.34	-40.224	-13	-27.224
2868.95	53.21	199	192	H	2868.95	-43.96	10.332	1.66	-35.288	-13	-22.288
2868.95	53.63	158	224	V	2868.95	-43.93	10.332	1.66	-35.258	-13	-22.258
3278.8	49.18	99	180	H	3278.8	-45.81	9.846	1.32	-37.284	-13	-24.284
3278.8	49.05	302	182	V	3278.8	-46.27	9.846	1.32	-37.744	-13	-24.744
4098.5	43.01	170	151	H	4098.5	-50.94	10.62	1.66	-41.98	-13	-28.98
4098.5	44.97	212	155	V	4098.5	-49.6	10.62	1.66	-40.64	-13	-27.64

430~ 473 MHz Band SN: 10370005

Middle Channel (Channel spacing 12.5 kHz)

Indicated		Azimuth (degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (cm)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
432.6	37.92	262	139	H	432.6	-65.9	0	0.66	-66.56	-20	-46.56
432.6	35.84	176	150	V	432.6	-65.12	0	0.66	-65.78	-20	-45.78
899.7	41.33	278	169	H	899.7	-52.98	0	0.66	-53.64	-20	-33.64
899.7	38.37	280	177	V	899.7	-53.9	0	0.66	-54.56	-20	-34.56
1349.55	67.53	133	147	H	1349.55	-41.88	7.625	0.83	-35.085	-20	-15.085
1349.55	71.56	172	221	V	1349.55	-37.48	7.625	0.83	-30.685	-20	-10.685
1799.4	64.21	232	162	H	1799.4	-44.77	9.583	1	-36.187	-20	-16.187
1799.4	66.69	4	206	V	1799.4	-42.23	9.583	1	-33.647	-20	-13.647
2249.25	64.43	330	148	H	2249.25	-43.03	9.06	1	-34.97	-20	-14.97
2249.25	65.33	266	152	V	2249.25	-41.64	9.06	1	-33.58	-20	-13.58
2699.1	59.32	51	183	H	2699.1	-45.59	9.272	1.34	-37.658	-20	-17.658
2699.1	62.95	199	119	V	2699.1	-41.58	9.272	1.34	-33.648	-20	-13.648
3148.95	56.38	127	148	H	3148.95	-47.27	9.476	1.32	-39.114	-20	-19.114
3148.95	59.21	203	107	V	3148.95	-44.24	9.476	1.32	-36.084	-20	-16.084
3598.8	48.72	252	267	H	3598.8	-52.67	10.082	1.83	-44.418	-20	-24.418
3598.8	50.15	299	131	V	3598.8	-51.78	10.082	1.83	-43.528	-20	-23.528

Middle Channel (Channel spacing 25 kHz)

Indicated		Azimuth (degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (cm)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
899.7	39.89	318	161	H	899.7	-54.42	0	0.66	-55.08	-13	-42.08
899.7	40.77	178	131	V	899.7	-51.5	0	0.66	-52.16	-13	-39.16
1349.55	70.66	316	232	H	1349.55	-38.75	7.625	0.83	-31.955	-13	-18.955
1349.55	71.83	131	156	V	1349.55	-37.21	7.625	0.83	-30.415	-13	-17.415
1799.4	62.28	21	148	H	1799.4	-46.7	9.583	1	-38.117	-13	-25.117
1799.4	66.11	206	153	V	1799.4	-42.81	9.583	1	-34.227	-13	-21.227
2249.25	67.13	0	152	H	2249.25	-40.33	9.06	1	-32.27	-13	-19.27
2249.25	66.45	243	150	V	2249.25	-40.52	9.06	1	-32.46	-13	-19.46
2699.1	59.4	53	145	H	2699.1	-45.51	9.272	1.34	-37.578	-13	-24.578
2699.1	63.72	220	174	V	2699.1	-40.81	9.272	1.34	-32.878	-13	-19.878
3148.95	55.87	201	152	H	3148.95	-47.78	9.476	1.32	-39.624	-13	-26.624
3148.95	56.34	174	183	V	3148.95	-47.11	9.476	1.32	-38.954	-13	-25.954
3598.8	47.81	257	160	H	3598.8	-53.58	10.082	1.83	-45.328	-13	-32.328
3598.8	47.86	81	200	V	3598.8	-54.07	10.082	1.83	-45.818	-13	-32.818

10 FCC §2.1055 & §90.213- Frequency Stability

10.1 Applicable Standard

FCC §2.1055 and §90.213 for output power > 2 watts, the limit is 5.0ppm, mobile stations designed to operate with a 12.5 KHz channel bandwidth must have a frequency stability of 2.5 ppm.

10.2 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 (or spectrum analyzer) 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.

Frequency Stability vs. Voltage: An external variable DC power supply was connected to the equipment under test. The voltage was set from 85% to 115% of the nominal value. The output frequency was recorded for each voltage.

10.3 Test Equipment List and Details

Manufacturer	Description	Model	S/N	Cal Date
Agilent	Spectrum Analyzer	8562EC	3946A00288	12/22/2009
Tenney	Temperature Oven	Series 942	CL5CHAMBERS	N/A
TekPower	DC power supply	HY3005D	N/A	N/A

10.4 Test Environment Conditions

Temperature:	20~22 °C
Relative Humidity:	70~75 %
ATM Pressure:	100.9~101.2kPa

The testing was performed by Jacinto Amante on 2010-07-27, 2010-09-27

10.5 Test Results

S/N: 211505 (390~430 MHz)

Reference Frequency 390.05 MHz				
Test Condition		**Frequency Measure with Time Elapsed**		
Temperature (^{O}C)	**Power Supply(Vdc)**	**Freq Error (KHz)**	**ppm Error**	**Result**
Frequency vs. Temperature				
60	12	0.21	0.54	Compliant
50	12	0.14	0.36	Compliant
40	12	0.05	0.13	Compliant
30	12	0.07	0.18	Compliant
20	12	0.004	0.001	Complaint
10	12	-0.11	-0.28	Compliant
0	12	-0.18	-0.46	Compliant
-10	12	-0.06	-0.15	Compliant
-20	12	-0.008	-0.019	Compliant
-30	12	0.20	0.53	Compliant
Frequency vs. Voltage				
20	10.2	0.004	0.001	Compliant
20	13.8	0.004	0.001	Compliant

Reference Frequency 410 MHz				
Test Condition		**Frequency Measure with Time Elapsed**		
Temperature (^{O}C)	**Power Supply(Vdc)**	**Freq Error (KHz)**	**ppm Error**	**Result**
Frequency vs. Temperature				
60	12	0.21	0.50	Compliant
50	12	0.14	0.34	Compliant
40	12	0.07	0.16	Compliant
30	12	0.07	0.16	Compliant
20	12	0.005	0.001	Complaint
10	12	-0.11	-0.27	Compliant
0	12	-0.18	-0.45	Compliant
-10	12	-0.06	-0.14	Compliant
-20	12	-0.008	-0.017	Compliant
-30	12	0.15	0.36	Compliant
Frequency vs. Voltage				
20	10.2	0.005	0.001	Compliant
20	13.8	0.005	0.001	Compliant

Reference Frequency 429.95 MHz				
Test Condition		**Frequency Measure with Time Elapsed**		
Temperature (^{O}C)	**Power Supply(Vdc)**	**Freq Error (KHz)**	**ppm Error**	**Result**
Frequency vs. Temperature				
60	12	0.24	0.56	Compliant
50	12	0.18	0.42	Compliant
40	12	0.09	0.21	Compliant
30	12	0.08	0.20	Compliant
20	12	0.048	0.11	Complaint
10	12	-0.15	-0.35	Compliant
0	12	-0.20	-0.47	Compliant
-10	12	-0.04	-0.09	Compliant
-20	12	-0.03	-0.08	Compliant
-30	12	0.17	0.41	Compliant
Frequency vs. Voltage				
20	10.2	0.048	0.11	Compliant
20	13.8	0.048	0.11	Compliant

S/N: 211598 (430~473 MHz)

Reference Frequency 430.05 MHz				
Test Condition		**Frequency Measure with Time Elapsed**		
Temperature (^{O}C)	**Power Supply(Vdc)**	**Freq Error (KHz)**	**ppm Error**	**Result**
Frequency vs. Temperature				
60	12	-0.17	-0.39	Compliant
50	12	-0.15	-0.34	Compliant
40	12	-0.14	-0.32	Compliant
30	12	-0.08	-0.18	Compliant
20	12	0.025	0.05	Complaint
10	12	0.046	0.10	Compliant
0	12	0.14	0.32	Compliant
-10	12	0.20	0.46	Compliant
-20	12	0.22	0.51	Compliant
-30	12	0.32	0.74	Compliant
Frequency vs. Voltage				
20	10.2	0.025	0.05	Compliant
20	13.8	0.025	0.05	Compliant

Reference Frequency 450 MHz				
Test Condition		**Frequency Measure with Time Elapsed**		
Temperature (^{O}C)	**Power Supply(Vdc)**	**Freq Error (KHz)**	**ppm Error**	**Result**
Frequency vs. Temperature				
60	12	-0.14	-0.31	Compliant
50	12	-0.15	-0.33	Compliant
40	12	-0.15	-0.33	Compliant
30	12	-0.09	-0.20	Compliant
20	12	0.024	0.05	Complaint
10	12	0.06	0.13	Compliant
0	12	0.13	0.29	Compliant
-10	12	0.19	0.42	Compliant
-20	12	0.25	0.56	Compliant
-30	12	0.30	0.67	Compliant
Frequency vs. Voltage				
20	10.2	0.024	0.05	Compliant
20	13.8	0.024	0.05	Compliant

Reference Frequency 472.95 MHz				
Test Condition		**Frequency Measure with Time Elapsed**		
Temperature (^{O}C)	**Power Supply(Vdc)**	**Freq Error (KHz)**	**ppm Error**	**Result**
Frequency vs. Temperature				
60	12	-0.18	-0.38	Compliant
50	12	-0.15	-0.32	Compliant
40	12	-0.15	-0.32	Compliant
30	12	-0.039	-0.08	Compliant
20	12	0.035	0.07	Complaint
10	12	0.08	0.17	Compliant
0	12	0.19	0.40	Compliant
-10	12	0.27	0.57	Compliant
-20	12	0.21	0.45	Compliant
-30	12	0.40	0.85	Compliant
Frequency vs. Voltage				
20	10.2	0.035	0.07	Compliant
20	13.8	0.035	0.07	Compliant

11 FCC §90.214 – Transient Frequency Behavior

11.1 Standard Applicable

FCC §90.214, Transmitters designed to operate in the 150–174 MHz and 421–512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits.

11.2 Test Method

TIA/EIA-603 2.2.19

11.3 Test Equipment List and Details

Manufacturer	Description	Model	S/N	Cal Date
Agilent	Spectrum Analyzer	8562EC	3946A00288	12/22/2009
TekPower	DC power supply	HY3005D	N/A	N/A
HP	RF Communications Test Set	8920A	274652140	12/23/2009
Tectronix	Scope	TDS 220	B067544	12/23/2009
HP	Signal Generator	8648A	3426A00120	12/23/2009

11.4 Test Environment Conditions

Temperature:	20~22 °C
Relative Humidity:	70~75 %
ATM Pressure:	100.9~101.2kPa

The testing was performed by Hui Chen on 2010-07-29, 2010-08-05

11.5 Test Results

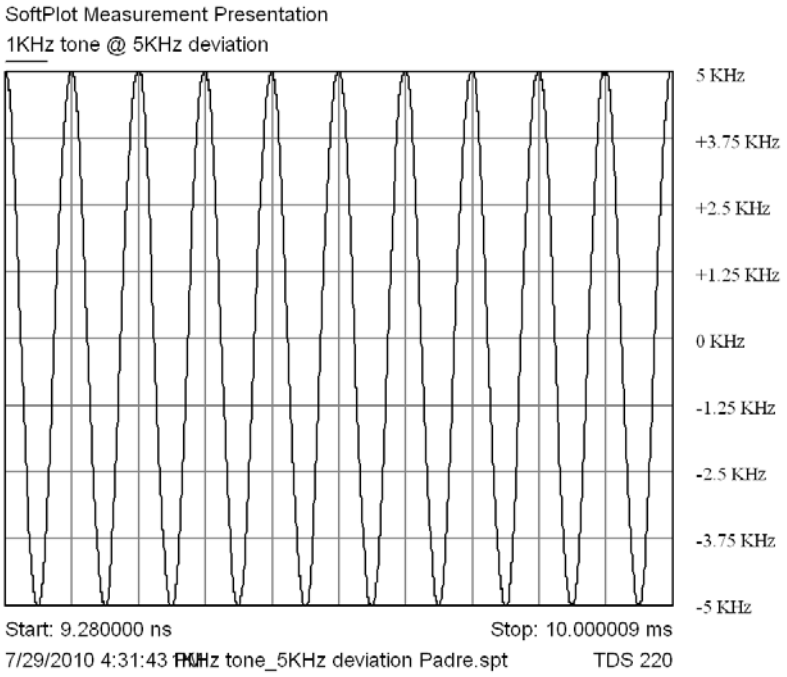
Transmitter designed to operate in 421-512MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time Intervals	Maximum frequency difference		421 to 512 MHz
Transient frequency behavior for equipment designed to operate on 25 kHz channels			
	Limit	Test Result(for all testing frequencies)	Time Intervals
T1	+/- 25 kHz	< +/- 1.25 kHz	10.0 ms
T2	+/-12.5 kHz	< +/- 1.25 kHz	25.0 ms
T3	+/-25 kHz	< +/- 1.25 kHz	10.0 ms
Transient frequency behavior for equipment designed to operate on 12.5 kHz channels			
	Limit	Test Result	
T1	+/-12.5 kHz	< +/- 1.25 kHz	10.0 ms
T2	+/-6.25 kHz	< +/- 1.25 kHz	25.0 ms
T3	+/-12.5 kHz	< +/- 1.25 kHz	10.0 ms

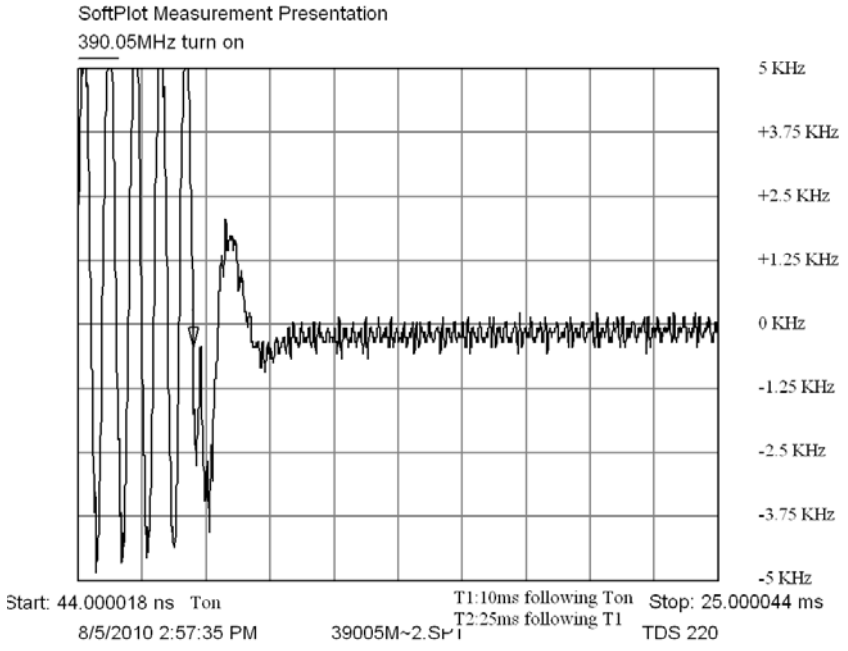
Ton is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
T1 is the time period immediately following ton.
T2 is the time period immediately following t1.
T3 is the time period from the instant when the transmitter is turned off until toff.
Toff is the instant when the 1 kHz testing signal starts to rise.
During the time from the end of t2 to the beginning of t3, the frequency difference must not exceed the limits specified in § 90.213. The allowed limit is equal to the transmitter frequency times its FCC frequency tolerance times+/- 4 display divisions divided by 25 kHz.

S/N: 211505(390~430 MHz)

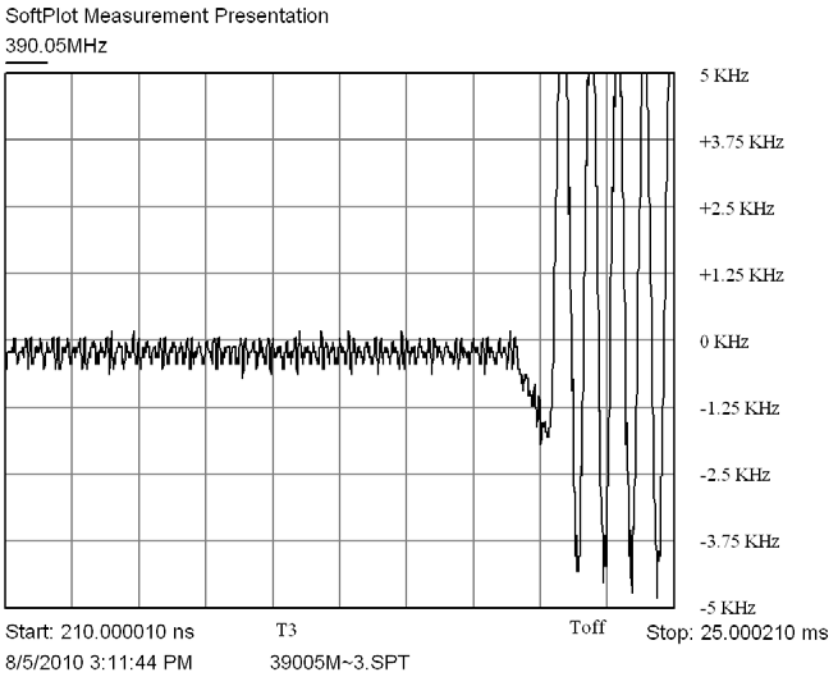
1 kHz tone at +/-5 kHz deviation



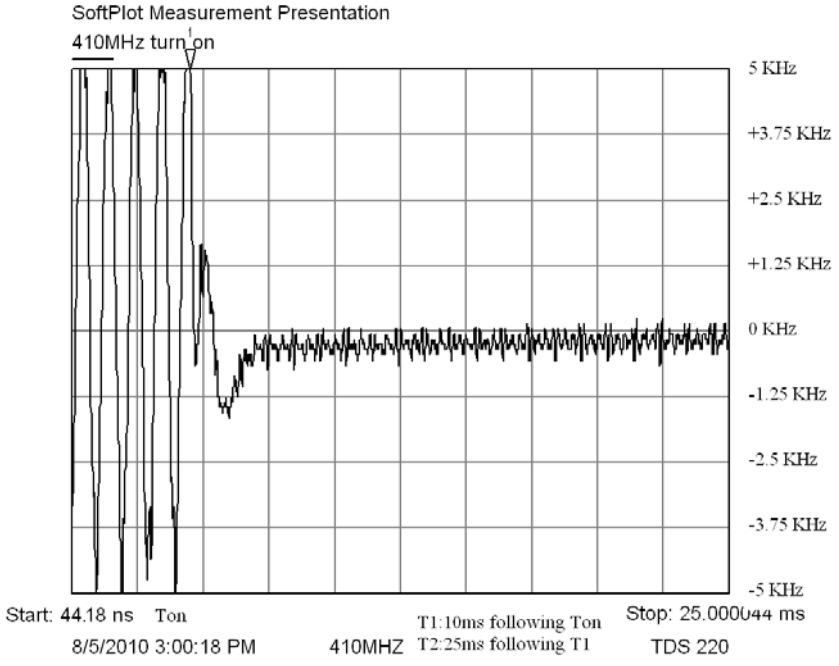
390.05 MHz turn on transient frequency



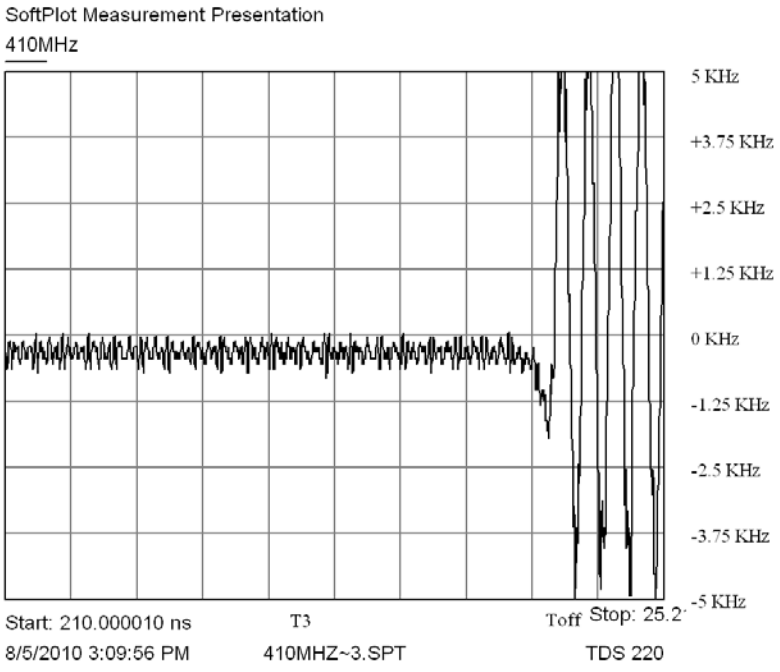
390.05 MHz turn off transient frequency



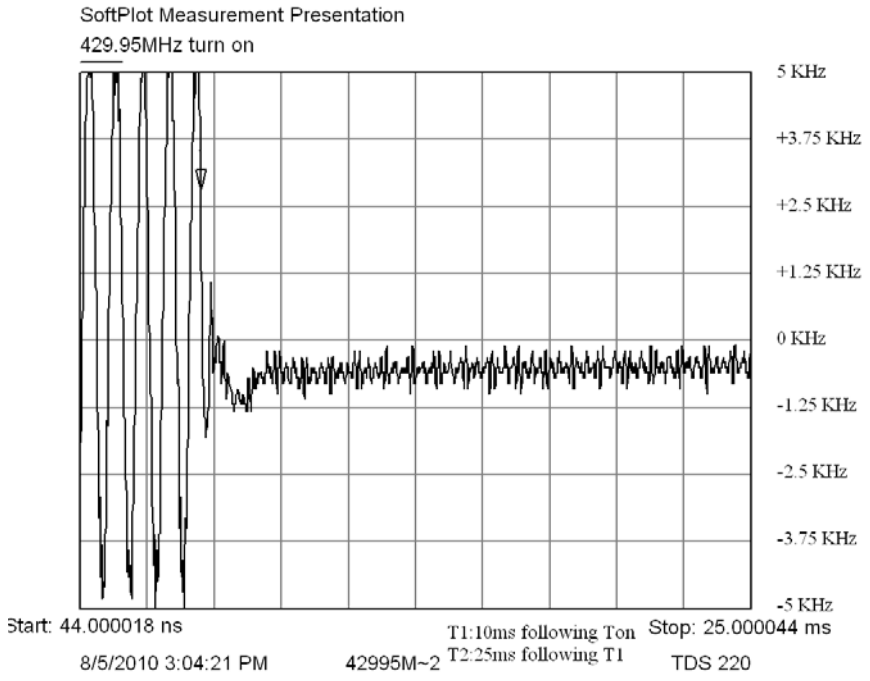
410 MHz turn on transient frequency



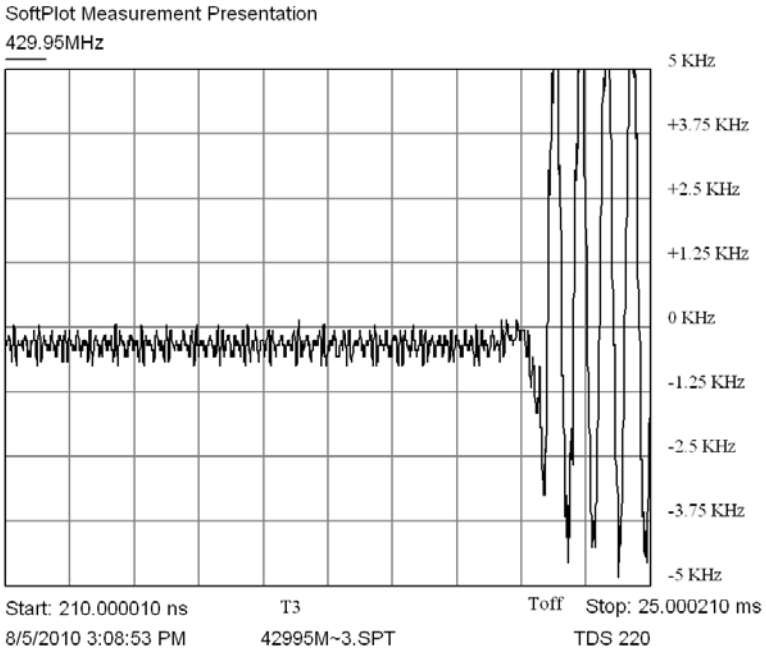
410 MHz turn off transient frequency



429.95 MHz turn on transient frequency

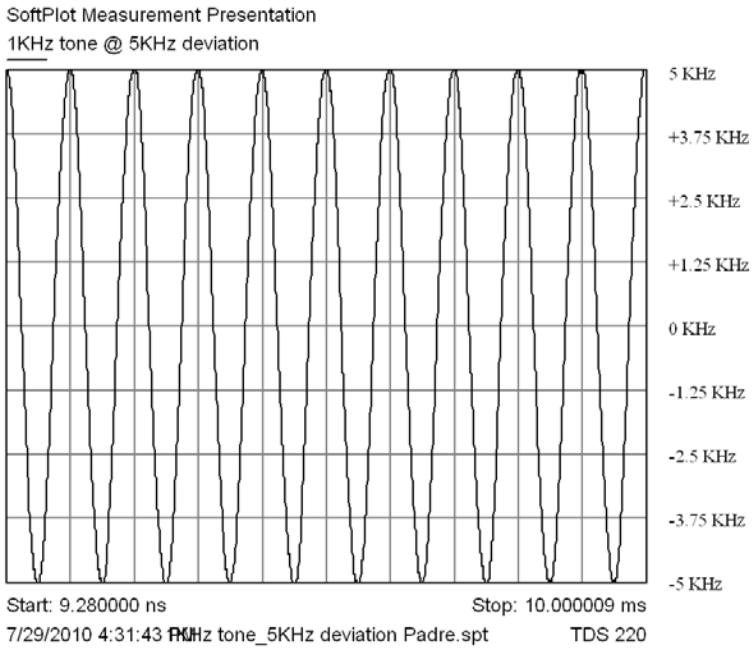


429.85 MHz turn off transient frequency

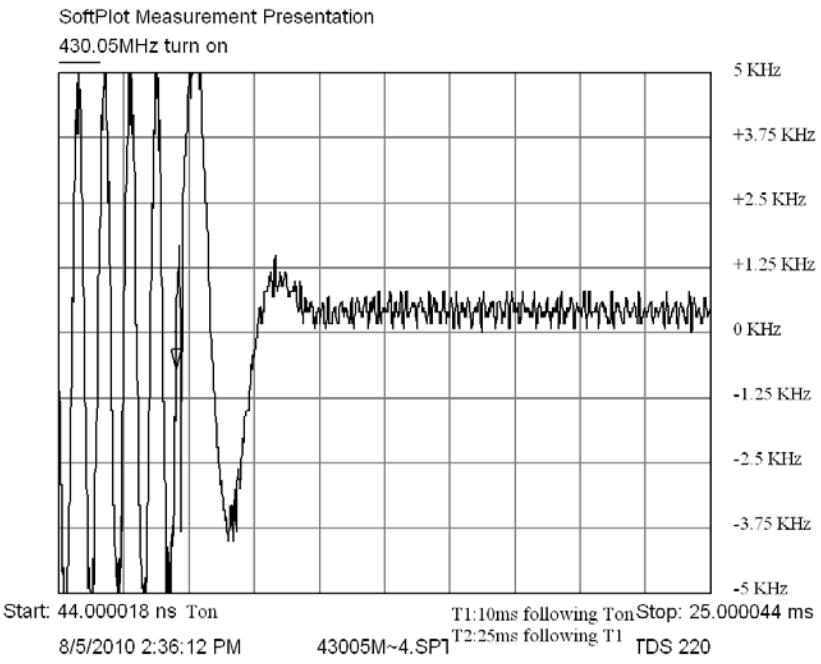


S/N: 211598(430~473 MHz)

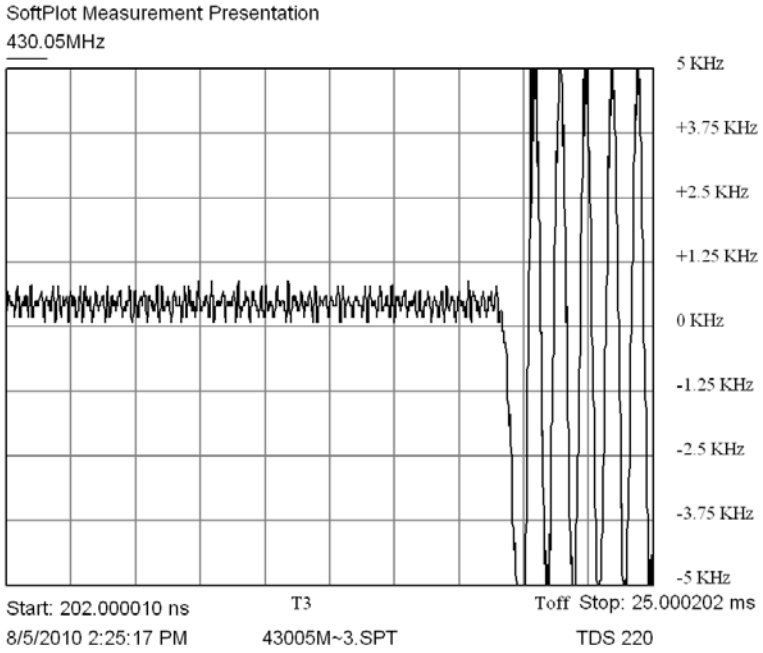
1 kHz tone at +/-5 kHz deviation



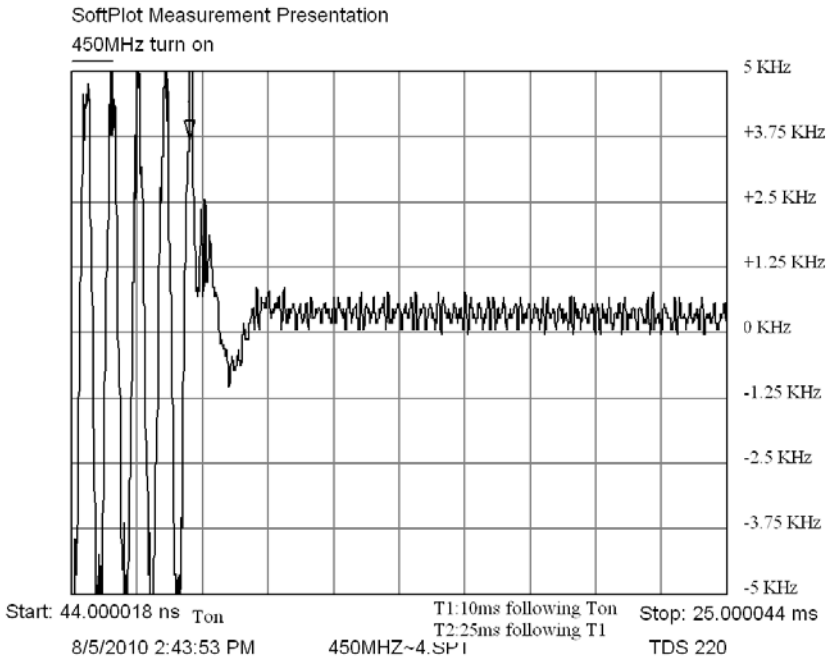
430.05 MHz turn on transient frequency



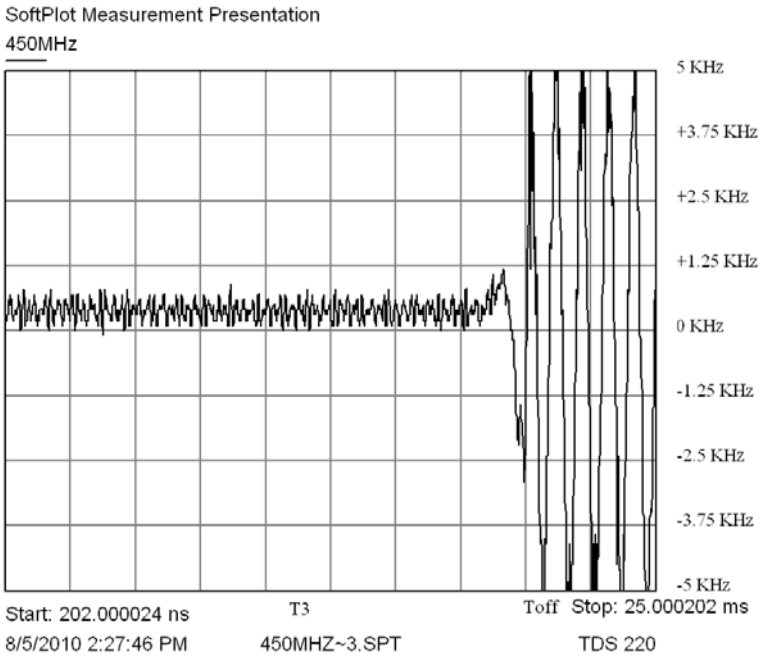
430.05 MHz turn off transient frequency



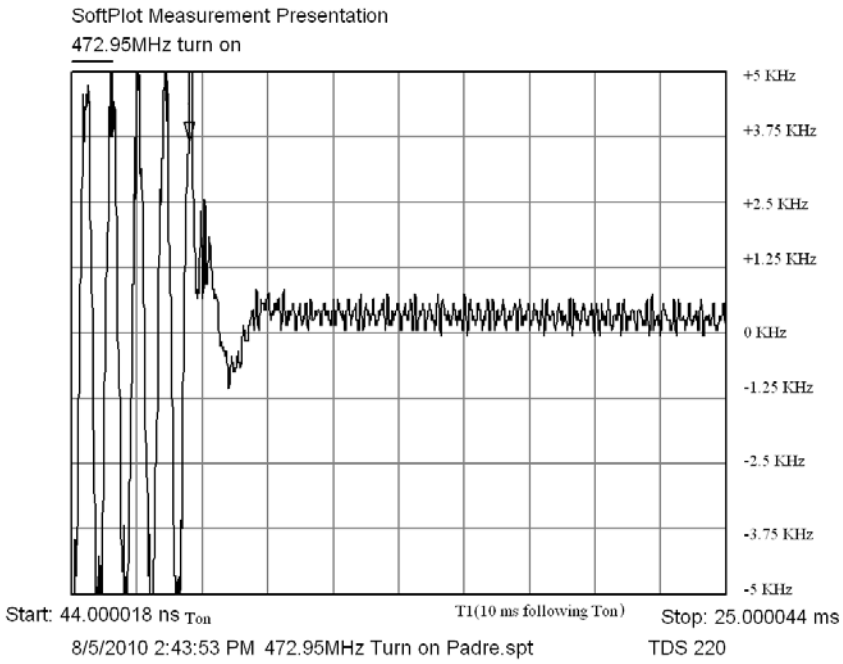
450 MHz turn on transient frequency



450 MHz turn off transient frequency



472.95 MHz turn on transient frequency



472.95 MHz turn off transient frequency