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41039 Boyce Road
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510-578-3500 Phone
510-440-9525 Fax

EMC Test Report

Application for Grant of Equipment Authorization

FCC Part 90.217(b)

Model: TX-7400A

FCC ID:	2AB6OTX7400A
APPLICANT:	Long Range Systems, LLC 4550 Excel Parkway, Suite 200 Addison, TX 75001
TEST SITE(S):	National Technical Systems - Plano 1701 E Plano Pkwy #150 Plano, TX 75074
REPORT DATE:	March 25, 2014
RE-ISSUED:	April 1, 2014
FINAL TEST DATES:	March 19 and 20, 2014
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PROGRAM MGR /
TECHNICAL REVIEWER:

David W. Bare
Chief Engineer

QUALITY ASSURANCE DELEGATE /
FINAL REPORT PREPARER:

David Guidotti
Senior Technical Writer

REVISION HISTORY

Rev#	Date	Comments	Modified By
	March 25, 2014	First release	
1	April 1, 2014	Revised to change the FCC ID	

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SCOPE

An electromagnetic emissions test has been performed on the Long Range Systems model TX-7400A, pursuant to the following rules:

FCC Part 90.217

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in National Technical Systems - Silicon Valley test procedures:

TIA-603-C
FCC Licensed Radio Measurement Guidance KDB 971168

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Long Range Systems model TX-7400A complied with the requirements of the following regulations:

FCC Part 90.217(b)

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Long Range Systems model TX-7400A and therefore apply only to the tested sample. The sample was selected and prepared by Mike Williams of Long Range Systems.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY

FCC Rule Part		Description	Measured Value / Comments	Limit / Requirement	Result
2.1047		Modulation	System uses FSK techniques	Modulation shall be specified	-
2.1049		Occupied Bandwidth	10.5 kHz	12.5 kHz	Complies
2.1046 90.217		Output Power	20.2 dBm (105 mW) EIRP = 166 mW Note 1	120mW	Complies
2.1051 90.217(b)		Antenna Port Spurious Emissions 9 kHz – 5 GHz	All emissions < -30 dBc	< -30dBc	Complies
2.1055 90.217(b)		Frequency Stability	Emission remained within 50 kHz band	< -30dBc outside 50 kHz band	Complies
1.1310		RF Exposure Requirements	Refer to MPE calculations in separate Exhibit, and User Manual statements.	Refer to OET 65, FCC Part 1	Complies
Note 1: EIRP calculated using antenna gain of 2.0 dBi for the highest EIRP system.					

MEASUREMENT UNCERTAINTIES

The measurement of uncertainty is not included with the data in this test report

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Long Range Systems model TX-7400A transmitter operates at 467.75 MHz. The electrical rating of the EUT is 12VDC supplied via an AC/DC Adapter rated at 100-240V, 50/60Hz 1.5A.

The sample was received on March 19, 2014 and tested on March 19 and 20, 2014. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Long Range Systems	TX-7400A	Paging transmitter	None	2AB6OTX7400A
Xing Yuan Electronics Co. Ltd.	XY-1204000UA	AC//DC Adapter	None	-

ANTENNA SYSTEM

The antenna system consists of an omni-directional 2 dBi antenna. The antenna connector is a BNC.

ENCLOSURE

The EUT enclosure measures approximately 9.5 by 19 by 5.7 centimeters. It is primarily constructed of plastic.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at NTS Plano.

SUPPORT EQUIPMENT

No support equipment was used during testing.

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
DC power Port	AC/DC adapter	2 wire	unshielded	1.5

The Mini USB and 3.5 mm audio ports are not functional.

EUT OPERATION

During testing, the EUT was set to continuously transmit at maximum power.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules, construction, calibration, and equipment data has been filed with the Commission.

Site	Designation/Registration Numbers FCC	Location
Chamber 1	US1007	1701 E Plano Pkwy #150, Plano, TX 75074

ANSI C63.4 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.10. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

A spectrum analyzer compliant with CISPR 16-1-1 is used for emissions measurements. The analyzer used can measure over the frequency range of 9 kHz up to 3000 MHz. The analyzer allows both ease of measurement and high accuracy to be achieved. The analyzer has Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The analyzer automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor as specified in ANSI C63.4. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

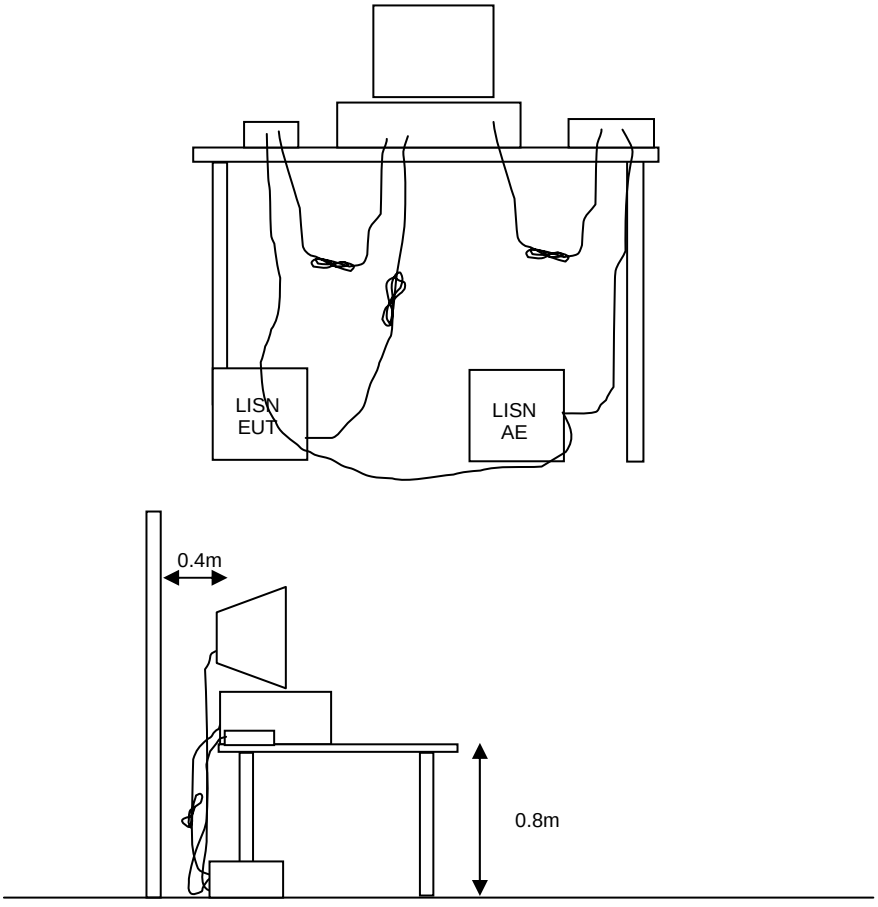


Figure 1 Typical Conducted Emissions Test Configuration

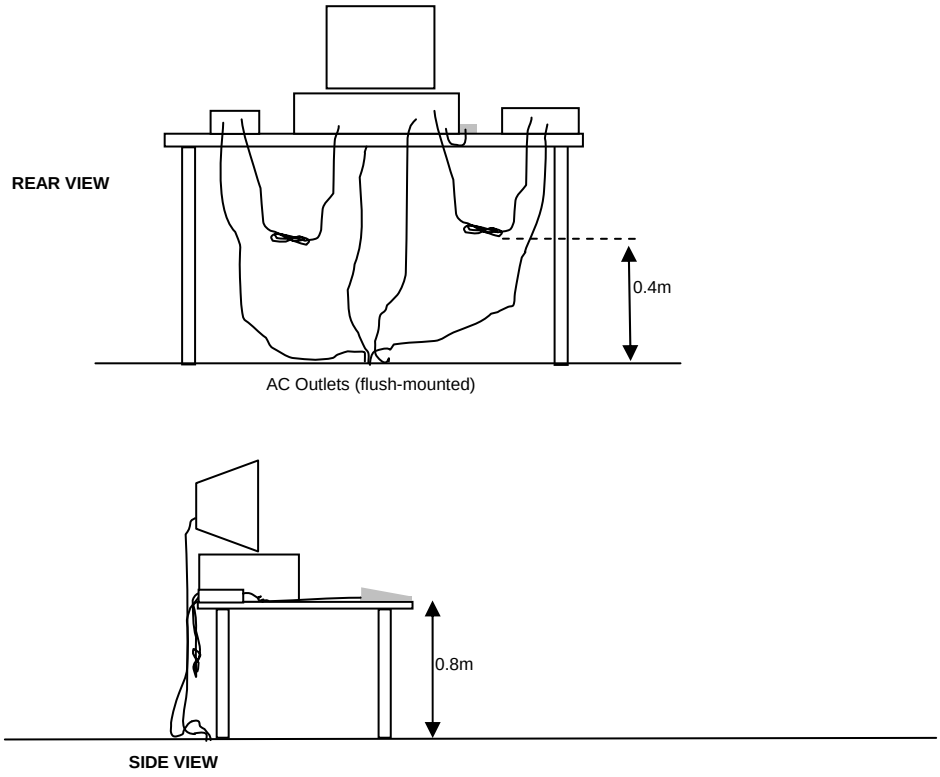
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

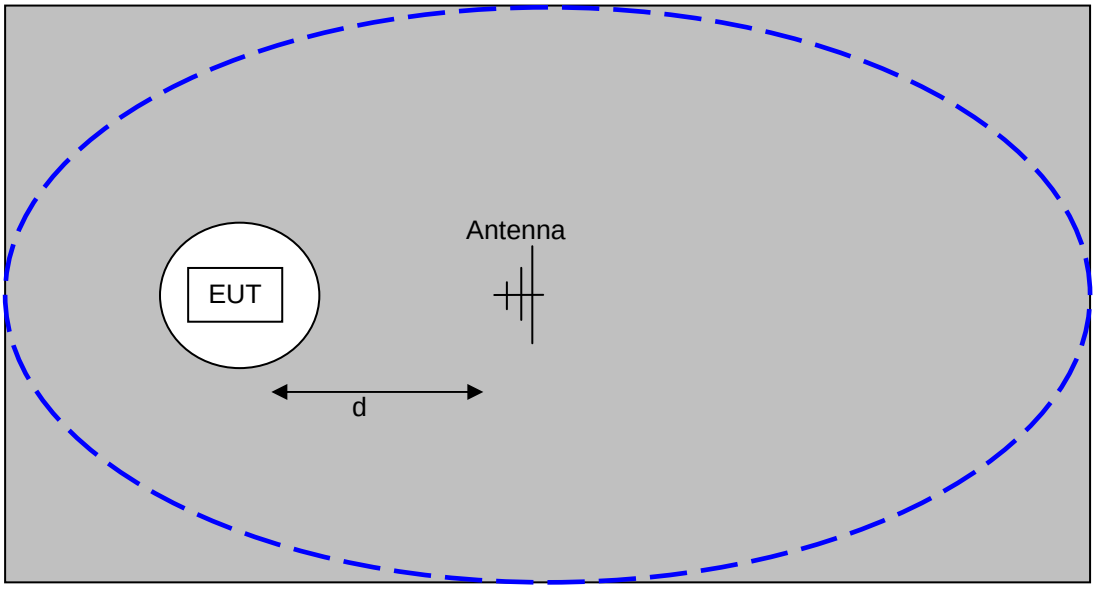
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

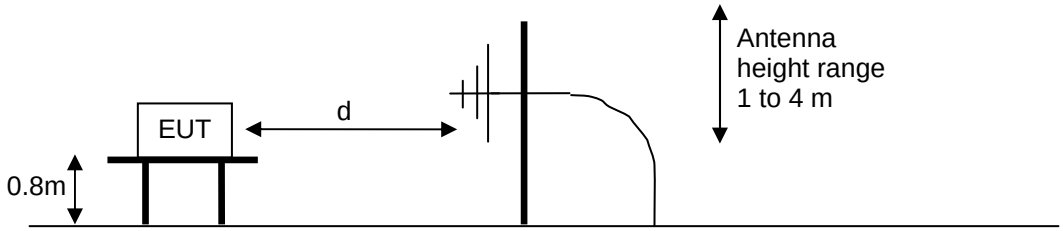
When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.



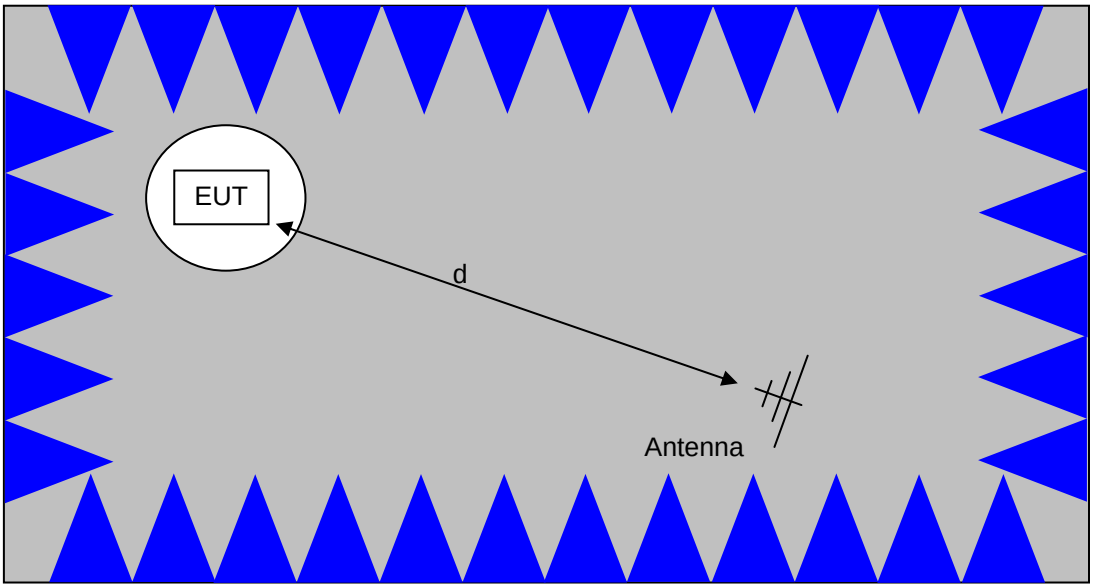
Typical Test Configuration for Radiated Field Strength Measurements



The ground plane extends beyond the ellipse defined in CISPR 16 / CISPR 22 / ANSI C63.4 and is large enough to accommodate test distances (d) of 3m and 10m. Refer to the test data tables for the actual measurement distance.

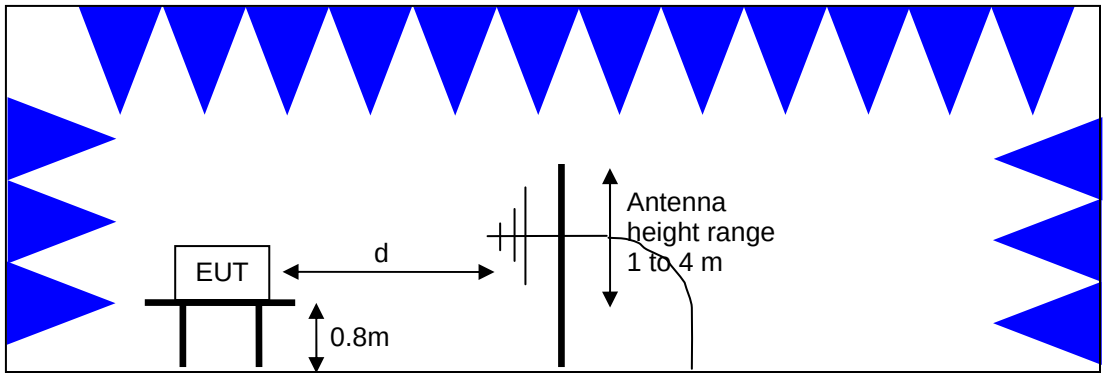


Test Configuration for Radiated Field Strength Measurements
OATS- Plan and Side Views



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

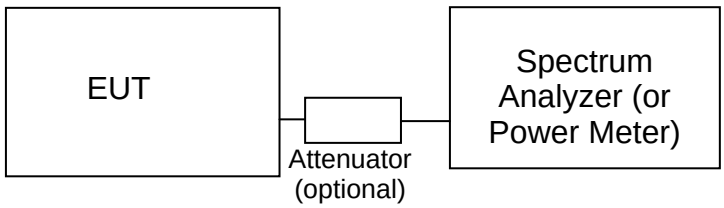
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.



Test Configuration for Antenna Port Measurements

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and NTS Silicon Valley's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

BANDWIDTH MEASUREMENTS

The 6dB, 20dB, 26dB and/or 99% signal bandwidth are measured using the bandwidths recommended by ANSI C63.10 and RSS GEN.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109, RSS 210 Table 2, RSS GEN Table 1 and RSS 310 Table 3. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
902 – 928	1 Watt (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3kHz
5725 – 5850	1 Watt (30 dBm)	8 dBm/3kHz

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_S = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_S)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_S$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_S = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{d} \text{ microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Data and Equipment List

Test Summary

Requirement	Test Procedure	Verdict
RF Power Output CFR 47 §90.217 CFR 47 §2.1046	TIA-603-C FCC KDB 971168 D01 v02r01 Section 5.1.1	PASS
99% Occupied Bandwidth CFR 47 §2.1049	TIA-603-C FCC KDB 971168 D01 v02r01 Section 4.2	PASS
Emission Mask CFR 47 §90.217(b)	TIA-603-C FCC KDB 971168 D01 v02r01 Section 4.2	PASS
Spurious Emissions at the Antenna Terminal CFR 47 §90.217(b) CFR 47 §2.1051	TIA-603-C FCC KDB 971168 D01 v02r01 Section 6.0	PASS
Frequency Stability CFR 47 §90.217(b) CFR 47 §2.1055	TIA-603-C FCC KDB 971168 D01 v02r01 Section 9.0	PASS
Radiofrequency Radiation Exposure Limits CFR 47 §1.1310	N/A	PASS

Mode of Operation:
Device was transmitting continuously with modulation on its single channel during all tests.

Support Equipment Needed:
None

Deviations from test procedures:
None

Modifications to the product:
None

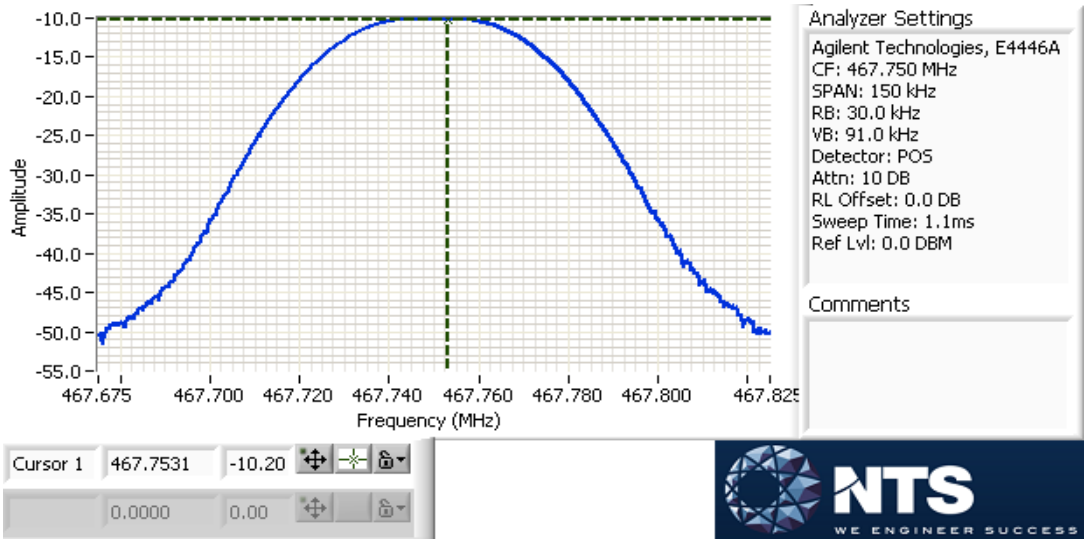
TEST RESULTS

RF Power Output (CFR 47 §90.217, CFR 47 §2.1046)

Date: Mar 19, 2014

Spectrum Analyzer (dBm)	External Attenuator and Cable Loss (dB)	Corrected (dBm)	Corrected (mW)	Limit (mW)	Verdict
-10.2	30.4	20.2	105.0	120.0	Pass

Note: 60s max hold, auto-sweep, 8000 data points across span

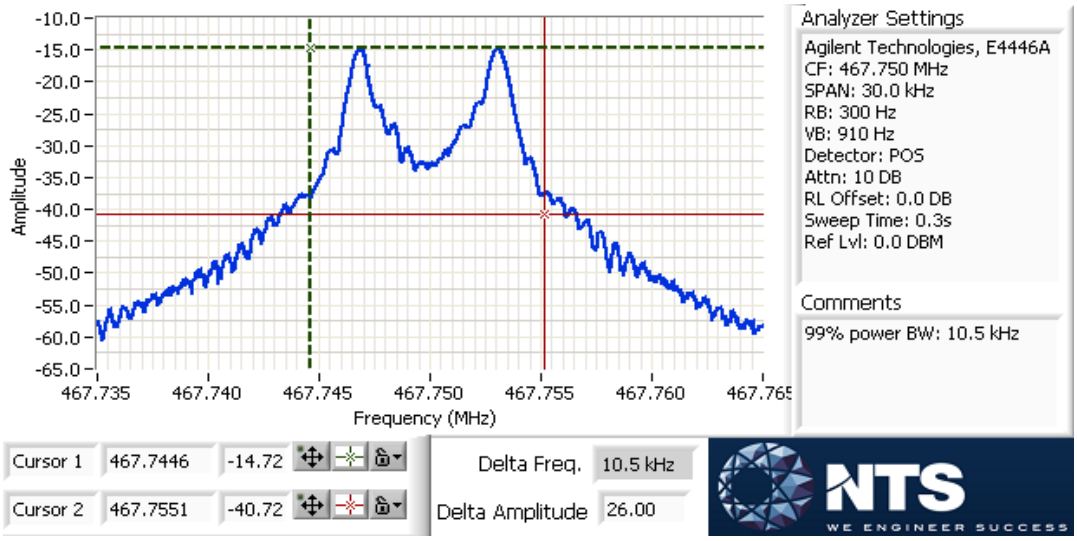


99% Occupied Bandwidth (CFR 47 §2.1049)

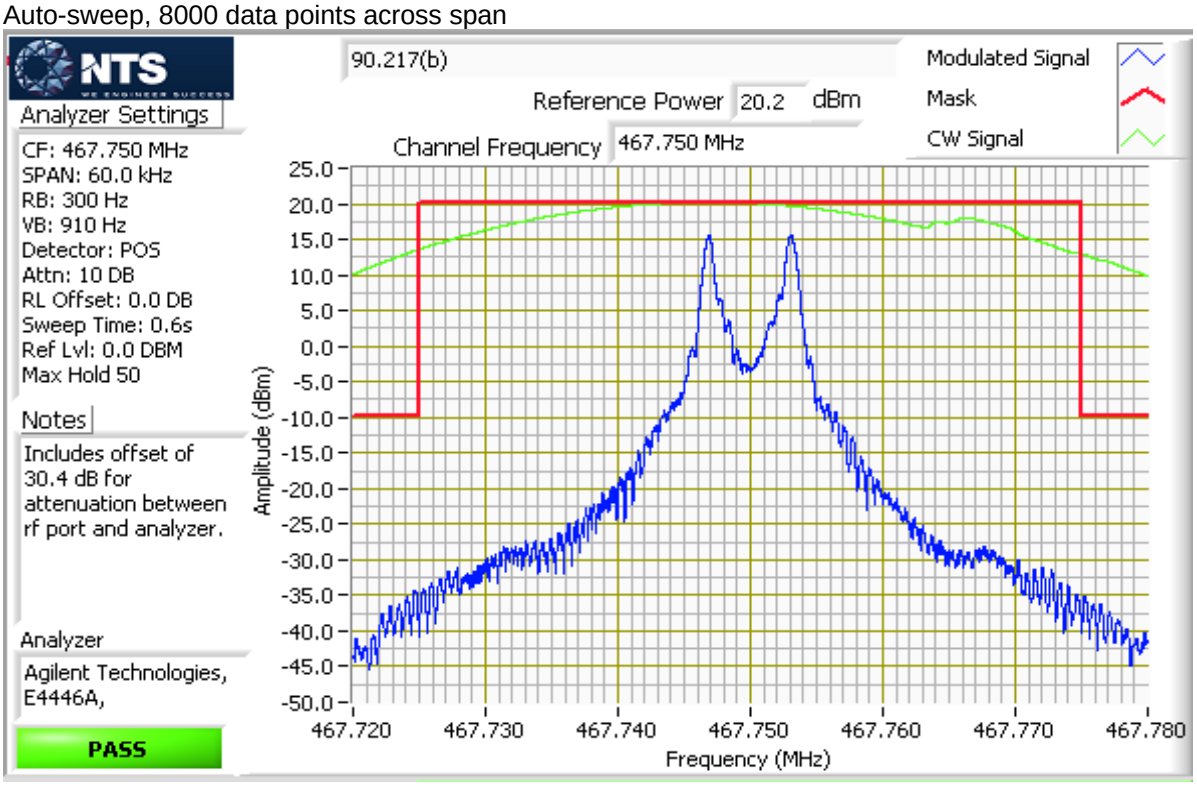
Date: Mar 19, 2014

99% Occupied Bandwidth (kHz)	Limit (kHz)	Verdict
10.5	12.5	Pass

Note: 60s max hold, auto-sweep, 8000 data points across span



Emission Mask (CFR 47 §90.217(b))
Date: Mar 19, 2014
Auto-sweep, 8000 data points across span

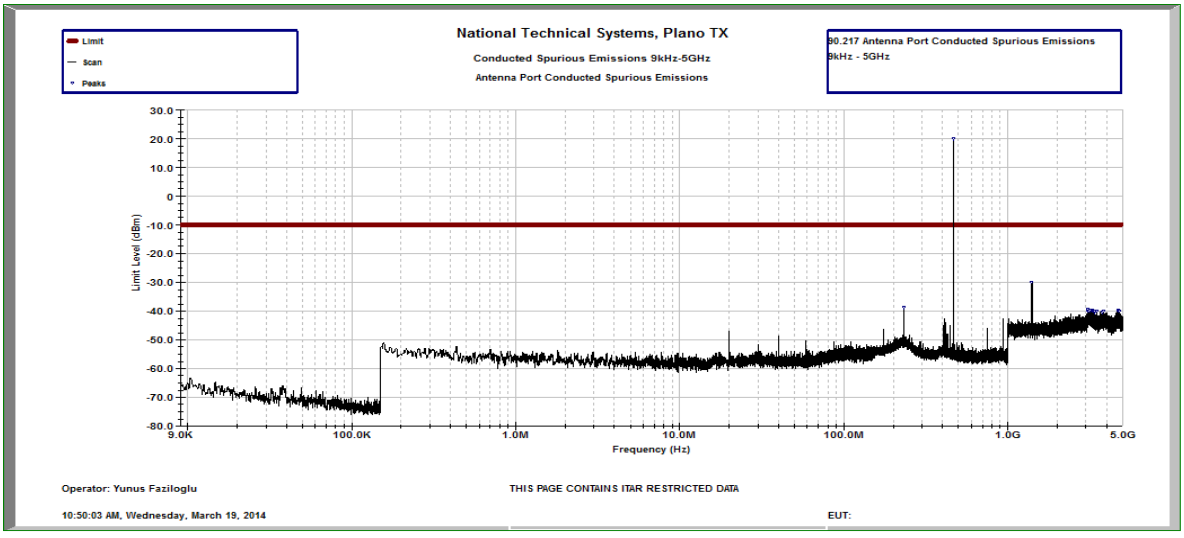


Spurious Emissions at the Antenna Terminal (CFR 47 §90.217(b), CFR 47 §2.1051)

Date: Mar 19, 2014
Frequency Range: 9kHz-5GHz
Instrumentation settings in accordance with CFR 47 §90.210(o).

Frequency Range	RBW	VBW	Number of data points	Divided into	Detector	Sweep Time	Max hold over
9kHz-150kHz	1kHz	3kHz	8000	2 segments	Peak	Auto	50 sweeps
150kHz-1GHz	100kHz	300kHz	8000	2 segments	Peak	Auto	50 sweeps
1GHz-5GHz	1MHz	3MHz	8000	2 segments	Peak	Auto	50 sweeps

Frequency (MHz)	Reading (dBm)	Limit (dBm)	Margin (dB)	Verdict
233.94 MHz	-38.7	-9.88	-28.82	Pass
467.79 MHz	20.12	Reference	N/A	N/A
1.4033 GHz	-29.9	-9.88	-20.02	Pass
3.0561 GHz	-40	-9.88	-30.12	Pass
3.0631 GHz	-40.11	-9.88	-30.23	Pass
3.0788 GHz	-39.31	-9.88	-29.43	Pass
3.1142 GHz	-39.91	-9.88	-30.03	Pass
3.1612 GHz	-39.7	-9.88	-29.82	Pass
3.2558 GHz	-39.99	-9.88	-30.11	Pass
3.2673 GHz	-39.76	-9.88	-29.88	Pass
3.3056 GHz	-39.87	-9.88	-29.99	Pass
3.3206 GHz	-39.92	-9.88	-30.04	Pass
3.3761 GHz	-40.25	-9.88	-30.37	Pass
3.3922 GHz	-40.09	-9.88	-30.21	Pass
3.5142 GHz	-40.18	-9.88	-30.3	Pass
3.7777 GHz	-40.21	-9.88	-30.33	Pass
3.8144 GHz	-40.16	-9.88	-30.28	Pass
4.7011 GHz	-39.63	-9.88	-29.75	Pass
4.7404 GHz	-39.98	-9.88	-30.1	Pass
4.7641 GHz	-40.08	-9.88	-30.2	Pass

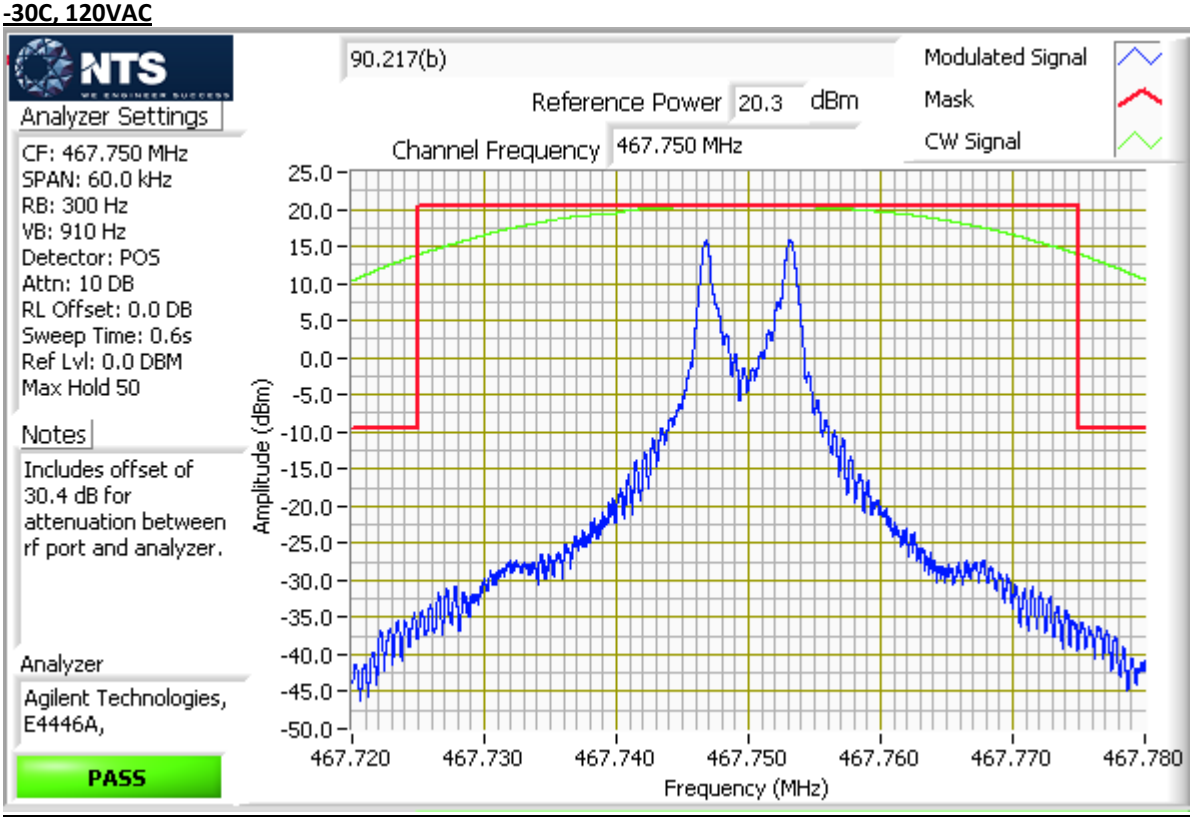


Frequency Stability (CFR 47 §90.217(b), CFR 47 §2.1055)

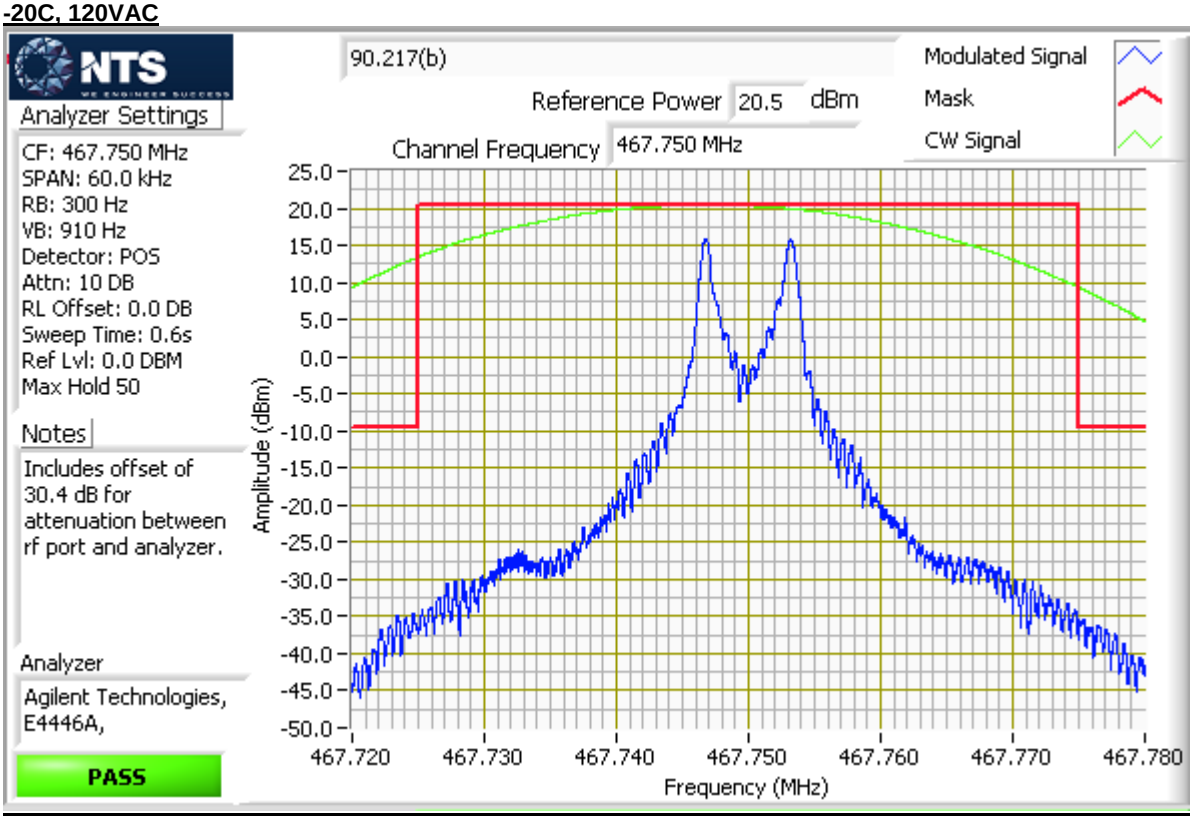
Date: Mar 20, 2014
90.217(b) requires the emission to stay within the defined mask over extreme temperatures and voltages. Emission mask measurements were repeated under the following voltages and temperatures and plots presented below.

Temperature (C)	AC Voltage (V)	Verdict
-30	120	Pass
-20	120	Pass
-10	120	Pass
0	120	Pass
10	120	Pass
20	102 (85% of 120)	Pass
20	120	Pass
20	138 (115% of 120)	Pass
30	120	Pass
40	120	Pass
50	120	Pass

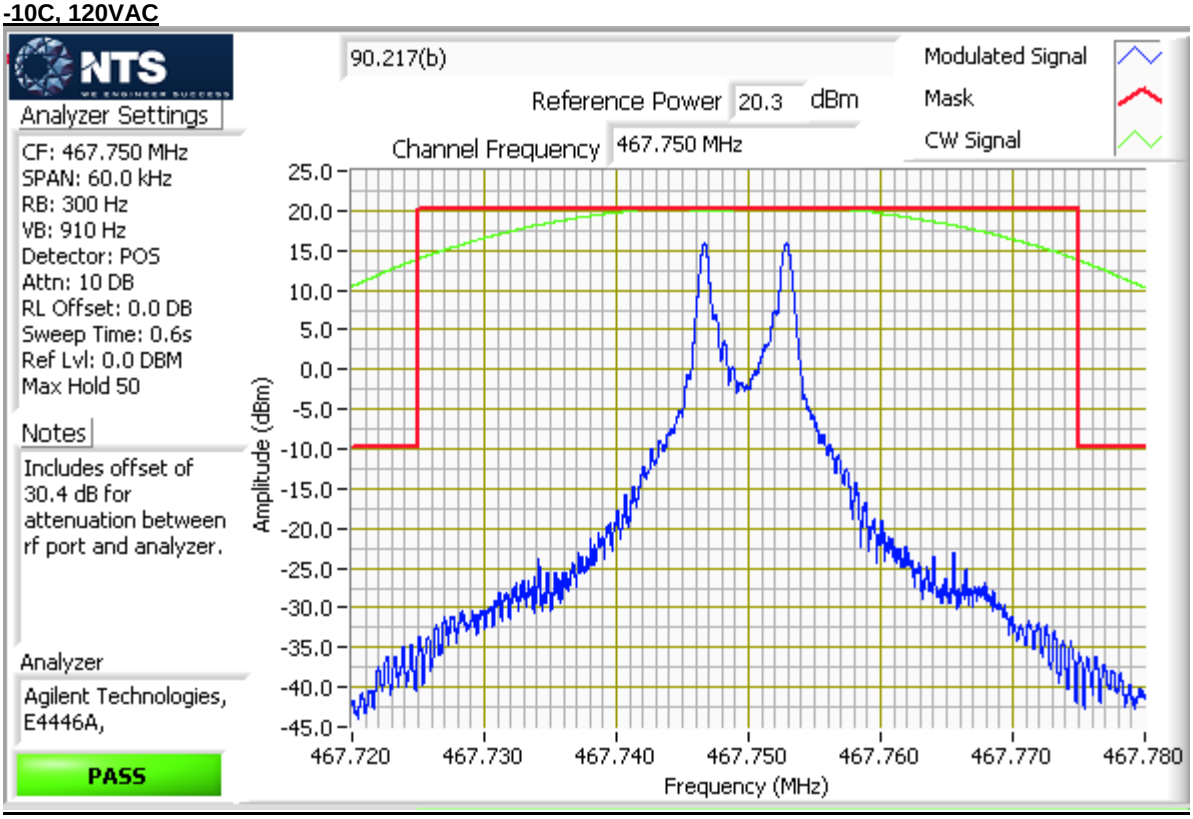
-30C, 120VAC



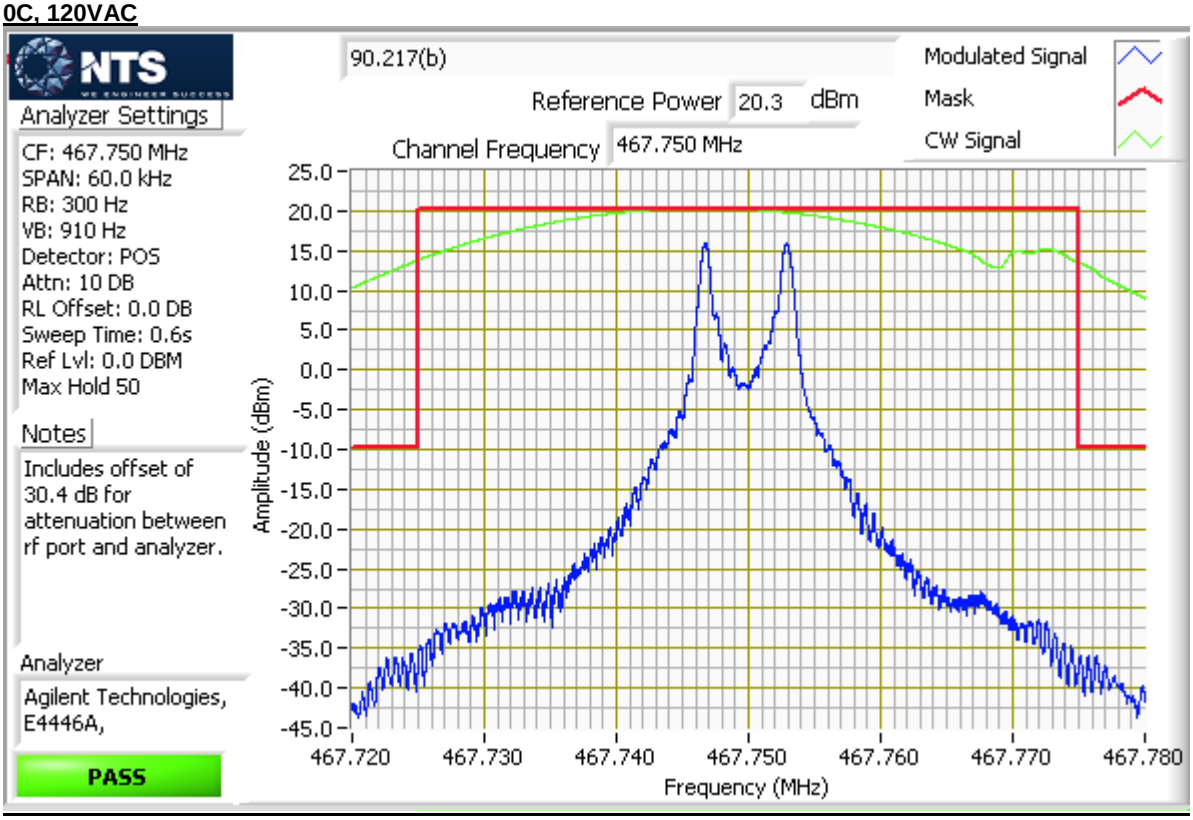
-20C, 120VAC



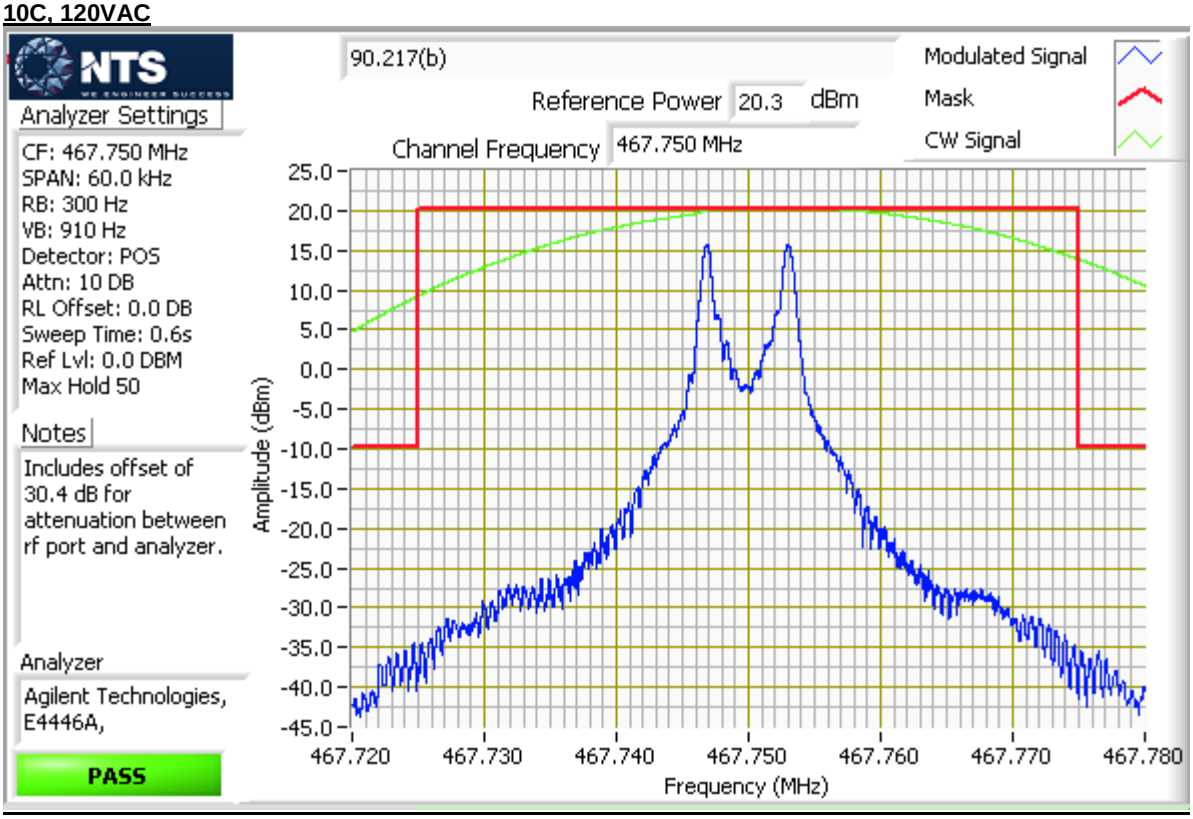
-10C, 120VAC



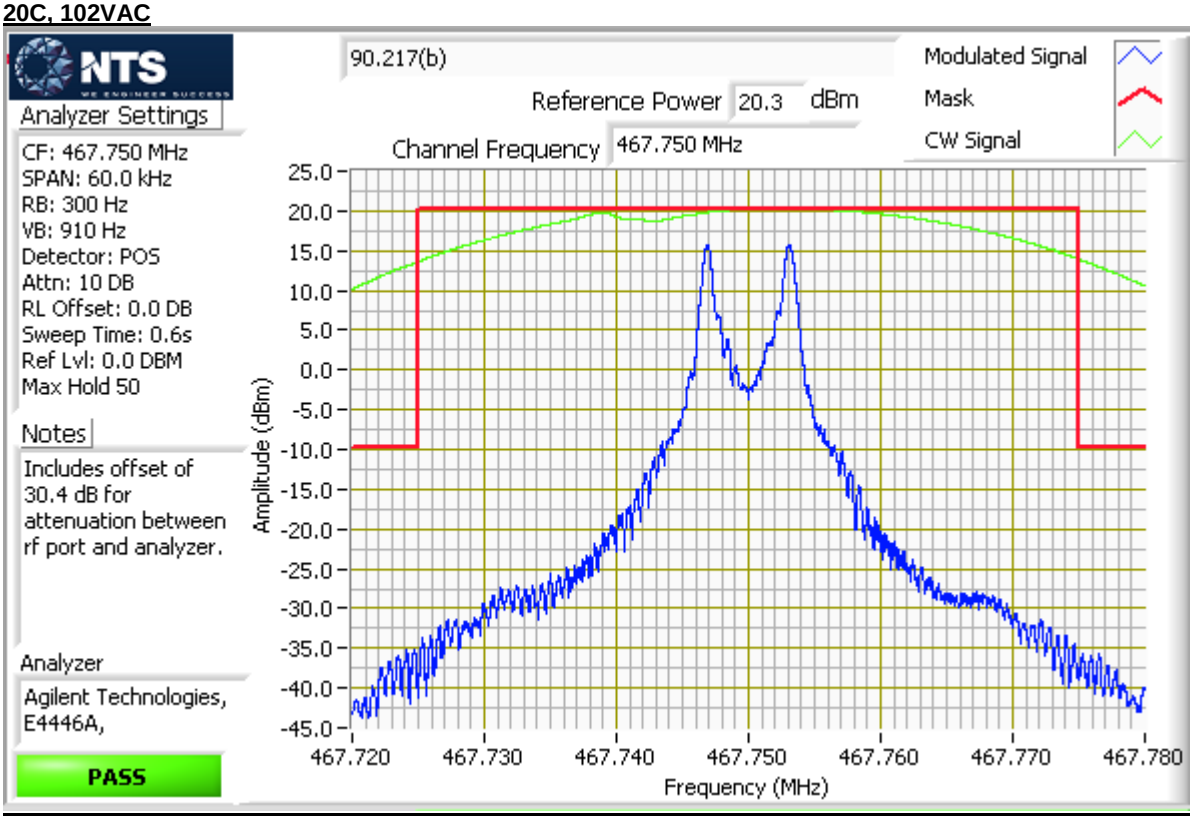
0C, 120VAC



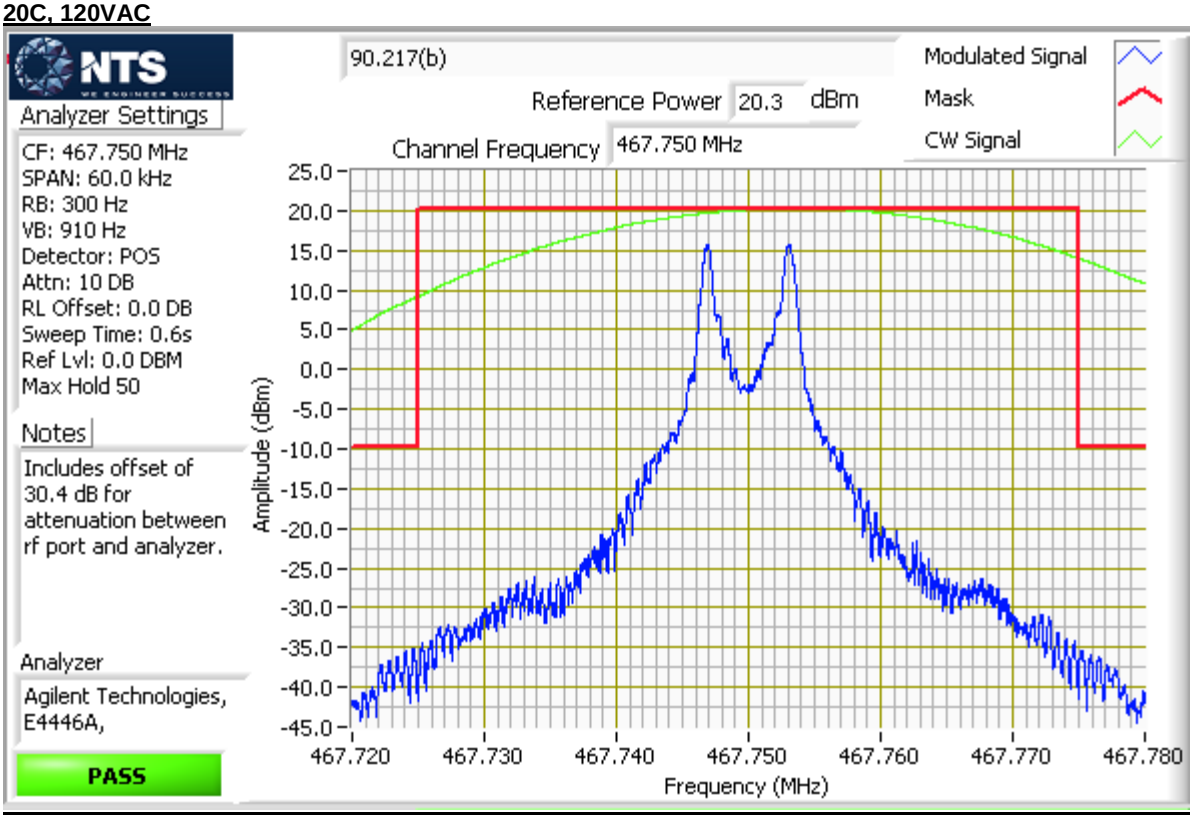
10C, 120VAC



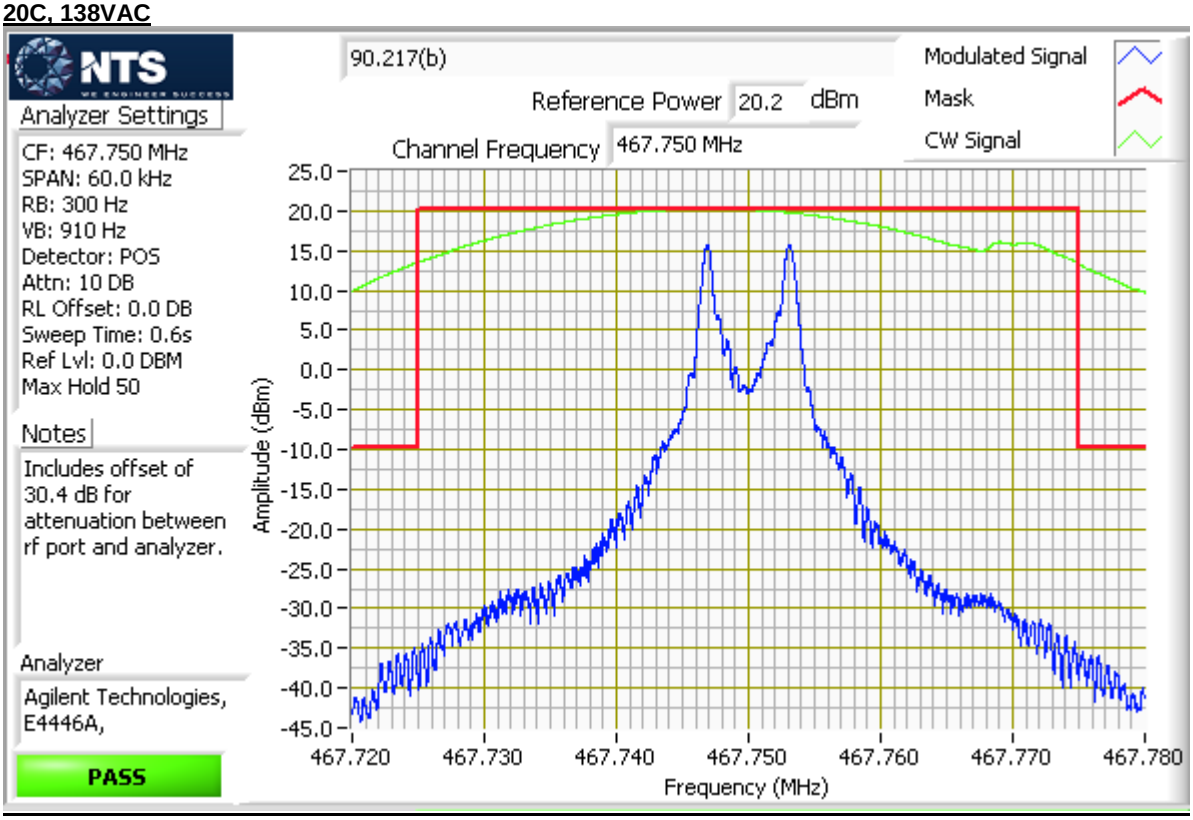
20C, 102VAC



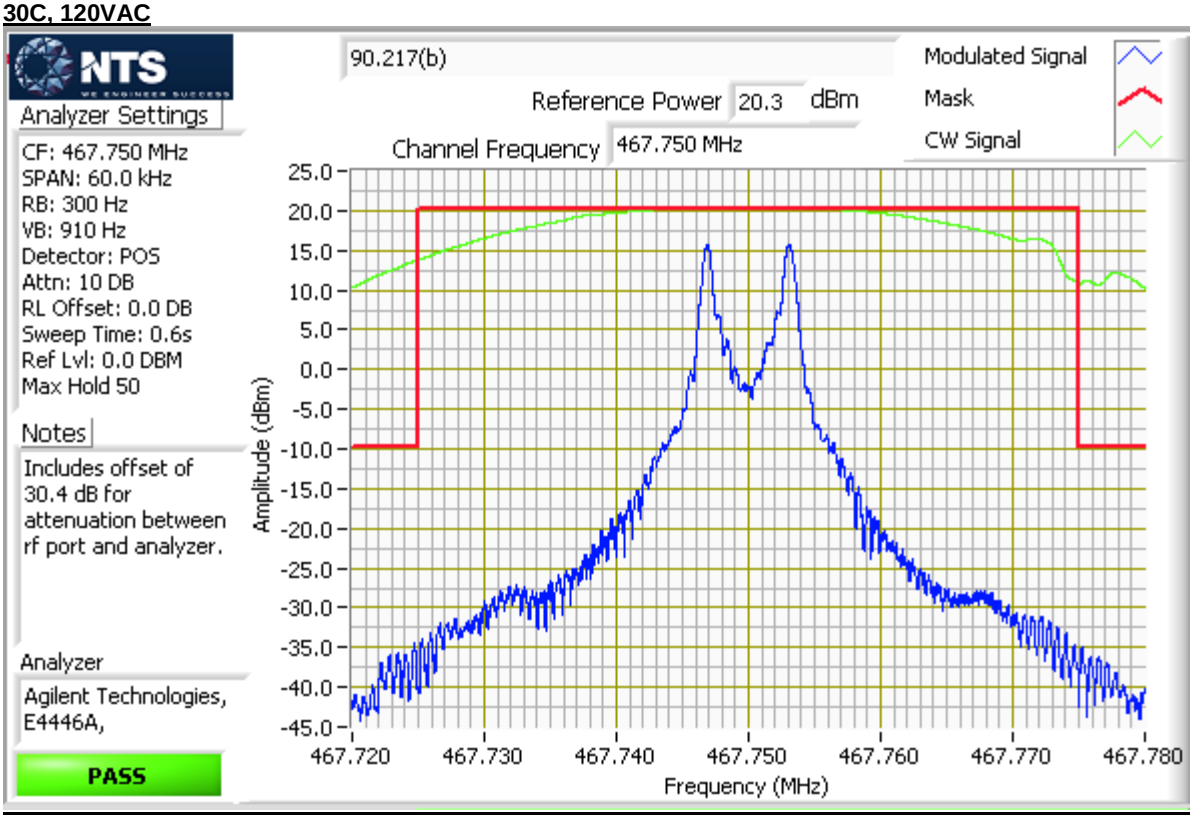
20C, 120VAC



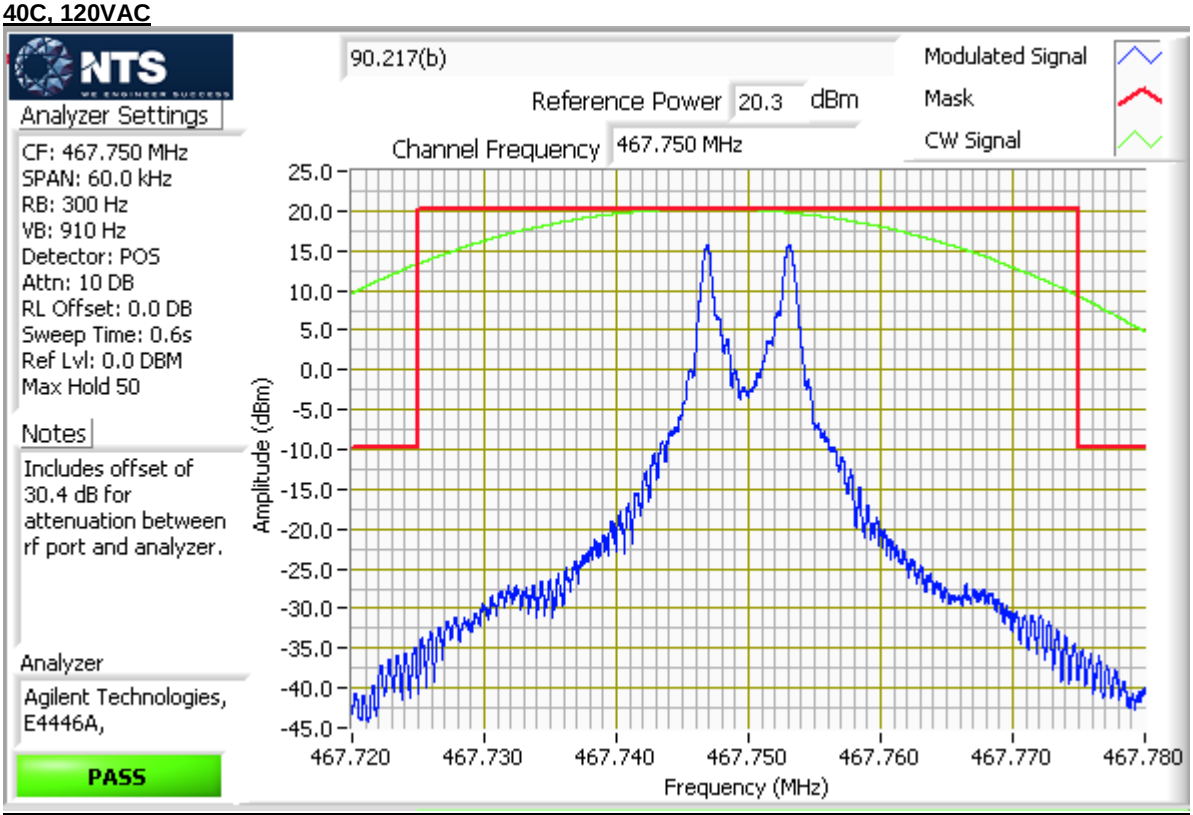
20C, 138VAC



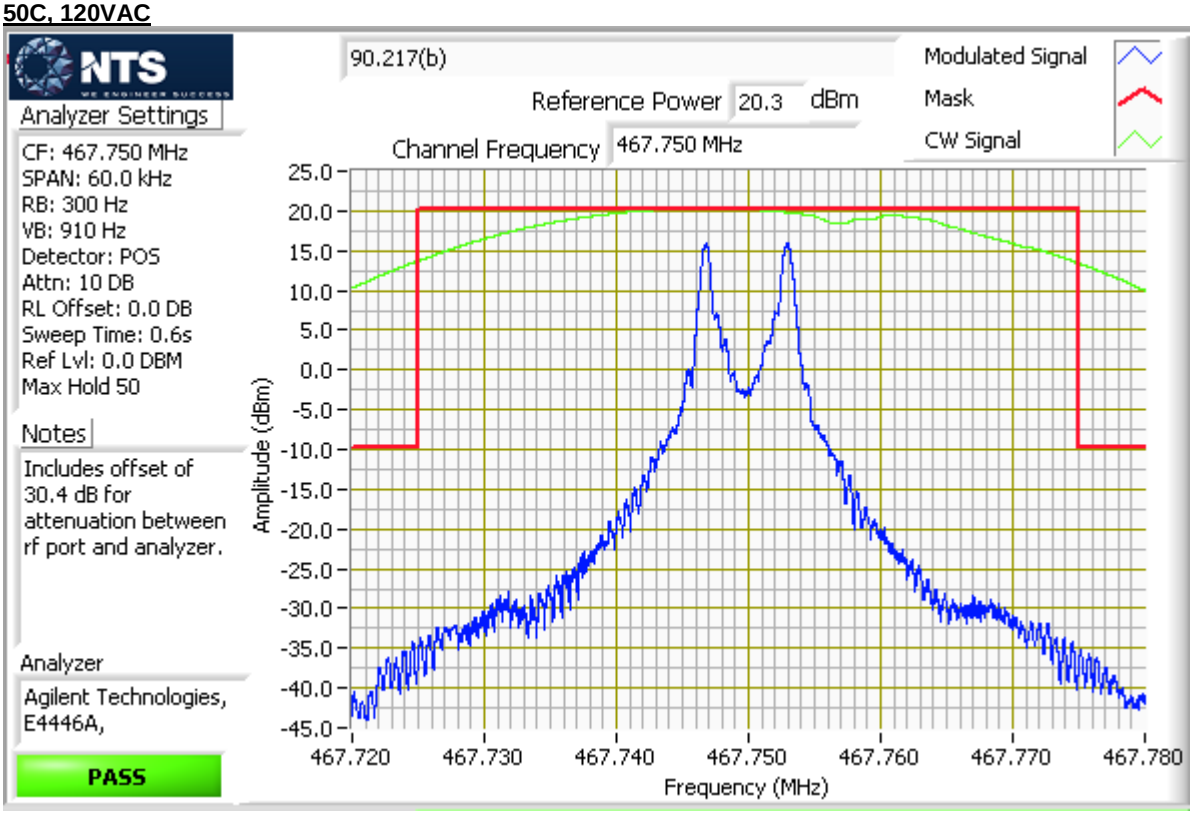
30C, 120VAC



40C, 120VAC



50C, 120VAC



TEST EQUIPMENT

NTS ID#	Description	Duration	Calibration Due
E1529P	Spectrum Analyzer Agilent E4446A	12 months	2/14/2015
ENV1195P	Chamber Thermotron	N/A	No Calibration
ENV1384P	Data Acq/Switch Unit Agilent 34970A	12 months	2/24/2015
E1086P	Power Supply Elgar SW1750AE	N/A	No Calibration
E1390P	RMS Voltmeter Fluke 87V	12 months	1/31/2015

End of Report

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