Nemko Test Report:	10247406_TRF_FCC15C
Applicant:	Long Range Systems, LLC 4550 Excel Pkwy, Suite 200 Addison, TX 75001 USA
Equipment Under Test: (E.U.T.)	TX-13C
In Accordance With:	**FCC Part 15, Subpart C** For Low Power Transmitters Operating Periodically In The Band 40.66 - 40.77 MHz And Above 70 MHz
FCC Identifier:	FCC ID: M74T13C
Tested By:	Nemko USA, Inc. 802 N. Kealy Lewisville, TX 75057-3136

TESTED BY: _____ **DATE:** 19 August 2013
David Light, Senior Wireless Engineer

APPROVED BY: _____ **DATE:** 10 September 2013
Tom Tidwell, Reviewer

Total Number of Pages: 17

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Section 1. Summary of Test Results

Manufacturer: Long Range Systems, LLC

Model No.: TX-13C

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.231. All tests were conducted using measurement procedure ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.
See " Summary of Test Data".

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Summary Of Test Data

Name of Test	Paragraph No.	Results
Transmission Requirements	15.231(a)	Complies
Radiated Emissions	15.231(b)	Complies
Occupied Bandwidth	15.231(c)	Complies
Frequency Tolerance	15.231(d)	NA
Alternate Field Strength Requirements	15.231(e)	NA
Powerline Conducted Emissions	15.207	NA

Footnotes:

1) The device does not operate between 40.66 to 40.70 MHz
2) The device does not operate at a periodic, pre-determined interval.
3) The device is battery powered.

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

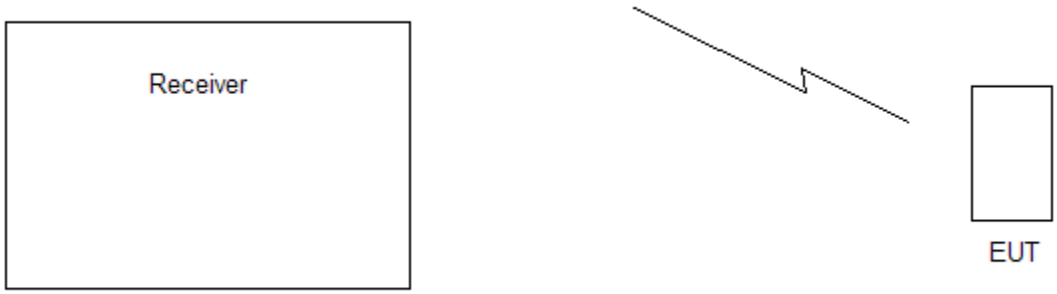
Operating Frequency(ies) of Sample:	448 (fixed) MHz
Type of Emission:	FSK
Supply Power Requirement:	3.6 Vdc NiHM battery

Description of E.U.T.

The Long Range Systems TX-13C is a small handheld device intended to send messages to a receiver. It is intended for use in restaurants to notify the hostess about table status. When in use, it is powered by NiMH batteries.

The transmitter uses a HopeRF RF31B, which is a synthesized RF transmitter. The center frequency is fixed in firmware to 448.0 MHz. The modulation is 2-level FSK with a 4.5 kHz shift.

System Diagram



Section 3. Transmission Requirements

NAME OF TEST: Transmission Requirements	PARA. NO.: 15.231(a)
TESTED BY: David Light	DATE: 19August 2013

Minimum Standard:

15.231(a) Continuous transmissions such as voice, video or data transmissions are not permitted.

15.231(a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds after being released.

15.231(a)(2) A transmitter activated automatically shall cease transmission within 5 seconds of activation.

15.231(a)(3) Periodic transmissions at regular pre-determined intervals are not permitted. However polling or supervisory transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

15.231(a)(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm.

Test Results: Complies.

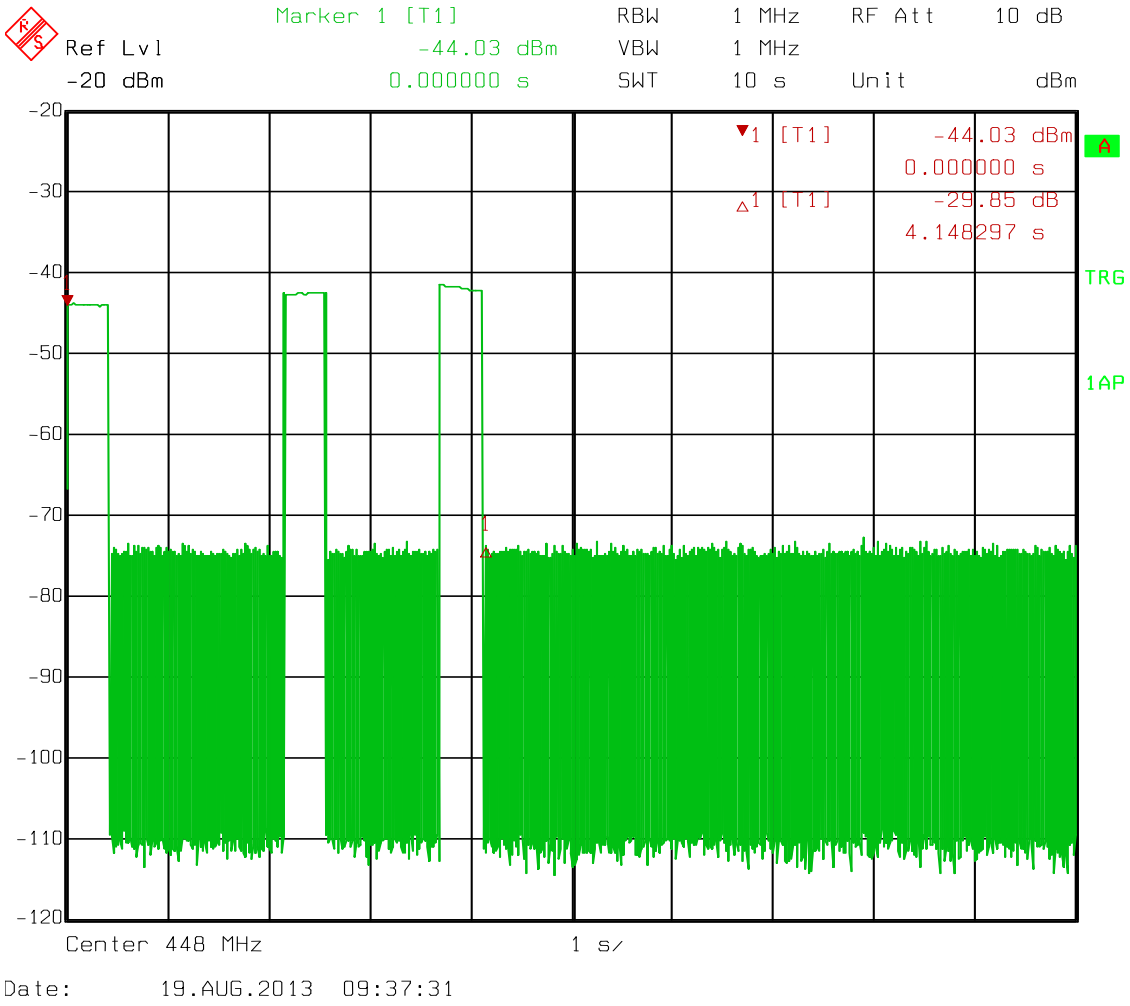
Test Data: Compliance was determined by verification of technical specifications and a functional test on the equipment.

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
802	Near Field Probe Set	EMCO	7405	103	N/R	
1036	Spectrum Analyzer	Rohde & Schwartz	FSEK30	830844/006	15-Jul-2013	15-Jul-2015
1082	Cable, 2m	Astrolab	32027-2-29094-72TC		N/R	

Rationale for Compliance with Transmission Requirements

15.231(a)(1) **15.231(a)(2) :**	☒ Manual activation ☐ Automatic activation	TX deactivation time: 4.14 sec
15.231(a)(3) :	☐ Regular, predetermined transmissions ☐ Polling or supervisory transmissions	TX rate and duration: No pre-determined tx
15.231(a)(4) :	☐ Alarm device operating during the pendancy of alarm condition ☒ Non-alarm device	

Test Data – Transmission Requirements



Section 4. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.231(b)
TESTED BY: David Light	DATE: 19 August 2013

Minimum Standard:

Permissible Field Strength Limits (Momentarily Operated Devices

Fundamental Frequency (MHz)	Field Strength of Fundamental Microvolts/Meter at 3 meters; (watts)	Field Strength of Unwanted Emissions Microvolts/Meter at 3 meters; (watts)
40.66 - 40.70	2,250	225
70-130	1, 250	125
130-174	1,250 to 3,750*	125 to 375
174-260 (note 1)	3,750	375
260-470 (note 1)	3,750 to 12,500*	375 to 1,250
Above 470	12,500	1,250

Notes:

# Use quasi-peak or averaging meter.	*For 130 - 174 MHz: FS (microvolts/m) = (56.82 x F) - 6136*
** Linear interpolation with frequency F in MHz*	*For 260 - 470 MHz: FS (microvolts/m) = (41.67 x F) - 7083*

Any emissions that fall within the restricted bands of 15.205 shall not exceed the following limits:

Frequency (MHz)	Field Strength (μV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

Test Results: Complies. The worst-case emission level is 80.0 dBμV/m @ 3m at 448 MHz. This is 1.3 dB below the specification limit.

Test Data: See attached table.

The spectrum was searched from the lowest frequency up to 10 x the highest frequency generated in the device. Below 1 GHz the spectrum analyzer resolution bandwidth was set to 120 kHz and the video bandwidth to 300 kHz, peak detector. The spectrum analyzer resolution bandwidth was set to 1 MHz and video bandwidth was 1 MHz, peak detector.

Test Data - Radiated Emissions

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Det. Atten. (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
448	H	0.0	60.1	17.3	2.6	0.0	80.0	81.3	-1.3	Pass	Carrier
448	V	0.0	55.3	17.3	2.6	0.0	75.2	81.3	-6.1	Pass	Carrier
896	V	0.0	58.6	23.2	3.8	34.4	51.2	91.3	-40.1	Pass	
1344	V	0.0	43.0	24.8	4.7	34.0	38.5	54.0	-15.5	Pass	Noise Floor
1792	V	0.0	41.7	25.6	5.3	34.0	38.6	61.3	-22.7	Pass	Noise Floor
2240	V	0.0	40.1	27.5	6.1	34.0	39.7	54.0	-14.3	Pass	Noise Floor
2688	V	0.0	41.3	29.2	6.6	34.0	43.1	61.3	-18.2	Pass	Noise Floor
3136	V	0.0	44.0	30.6	7.3	34.0	47.9	61.3	-13.4	Pass	
3584	V	0.0	38.3	29.9	8.0	34.0	42.2	61.3	-19.1	Pass	Noise Floor
4032	V	0.0	39.6	31.5	9.1	34.0	46.2	54.0	-7.8	Pass	Noise Floor
4480	V	0.0	39.1	32.3	9.9	34.0	47.3	61.3	-14.0	Pass	Noise Floor
896	H	0.0	62.6	23.2	3.8	34.4	55.2	61.3	-6.1	Pass	
1344	H	0.0	43.0	24.8	4.7	34.0	38.5	54.0	-15.5	Pass	Noise Floor
1792	H	0.0	41.7	25.6	5.3	34.0	38.6	61.3	-22.7	Pass	Noise Floor
2240	H	0.0	40.1	27.5	6.1	34.0	39.7	54.0	-14.3	Pass	Noise Floor
2688	H	0.0	41.3	29.2	6.6	34.0	43.1	61.3	-18.2	Pass	Noise Floor
3136	H	0.0	41.2	30.6	7.3	34.0	45.1	61.3	-16.2	Pass	Noise Floor
3584	H	0.0	38.3	29.9	8.0	34.0	42.2	61.3	-19.1	Pass	Noise Floor
4032	H	0.0	39.6	31.5	9.1	34.0	46.2	54.0	-7.8	Pass	Noise Floor
4480	H	0.0	39.1	32.3	9.9	34.0	47.3	61.3	-14.0	Pass	Noise Floor

The spectrum was searched from 30 MHz to 5 GHz. All emissions are reported.

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
993	Antenna, Horn	A.H. Systems	SAS-200/571	162	22-Sep-2011	22-Sep-2013
1763	Antenna, Bilog	Schaffner	CBL 6111D	22926	07-Mar-2013	07-Mar-2014
1767	Receiver	Rohde & Schwartz	ESIB26	837491/0002	19-Dec-2012	19-Dec-2013
1783	Cable Assy, 3m Chamber	Nemko	Chamber		26-Sep-2012	26-Sep-2013
1785	Preamplifier	A.H. Systems	PAM-0126	143	09-Jan-2013	09-Jan-2014

Section 5. Occupied Bandwidth

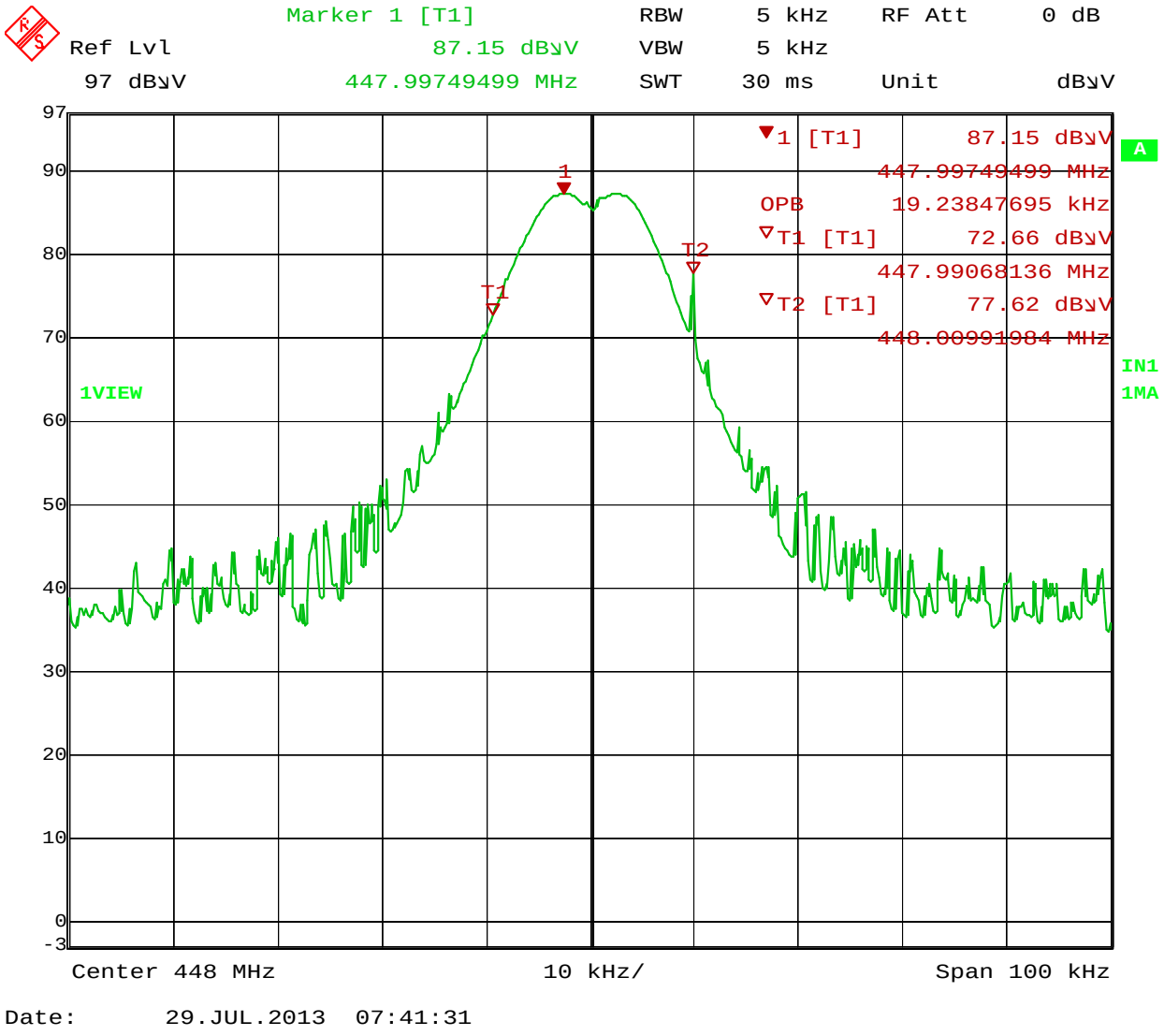
NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.231(c)
TESTED BY: David Light	DATE: 29 July 2013

Minimum Standard: 15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Results: Complies. See attached graph.

Test Data: See attached graph.

Test Data – Occupied Bandwidth

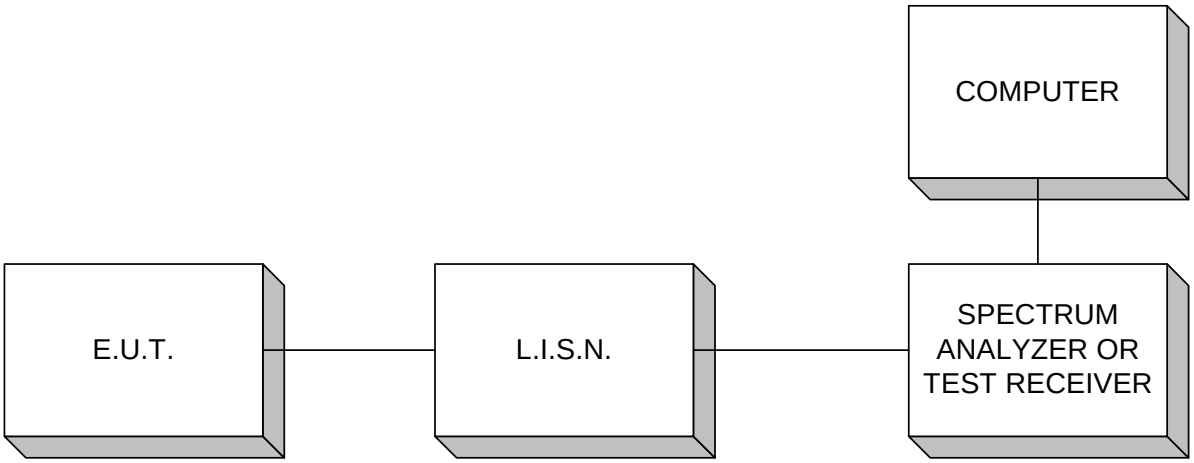


Limit = 1.12 MHz

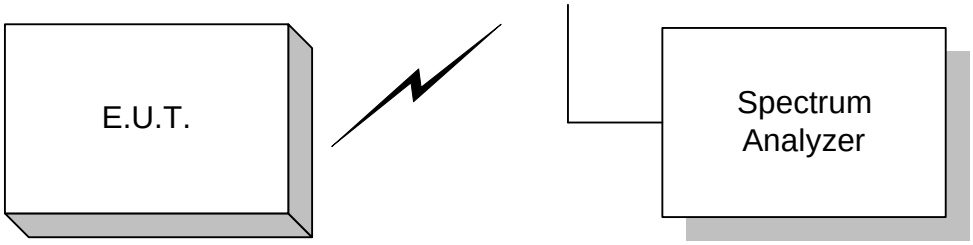
Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
802	Near Field Probe Set	EMCO	7405	103	N/R	
1082	Cable, 2m	Astrolab	32027-2-29094-72TC		N/R	
1767	Receiver	Rohde & Schwartz	ESIB26	837491/0002	19-Dec-2012	19-Dec-2013

Section 6. Block Diagrams

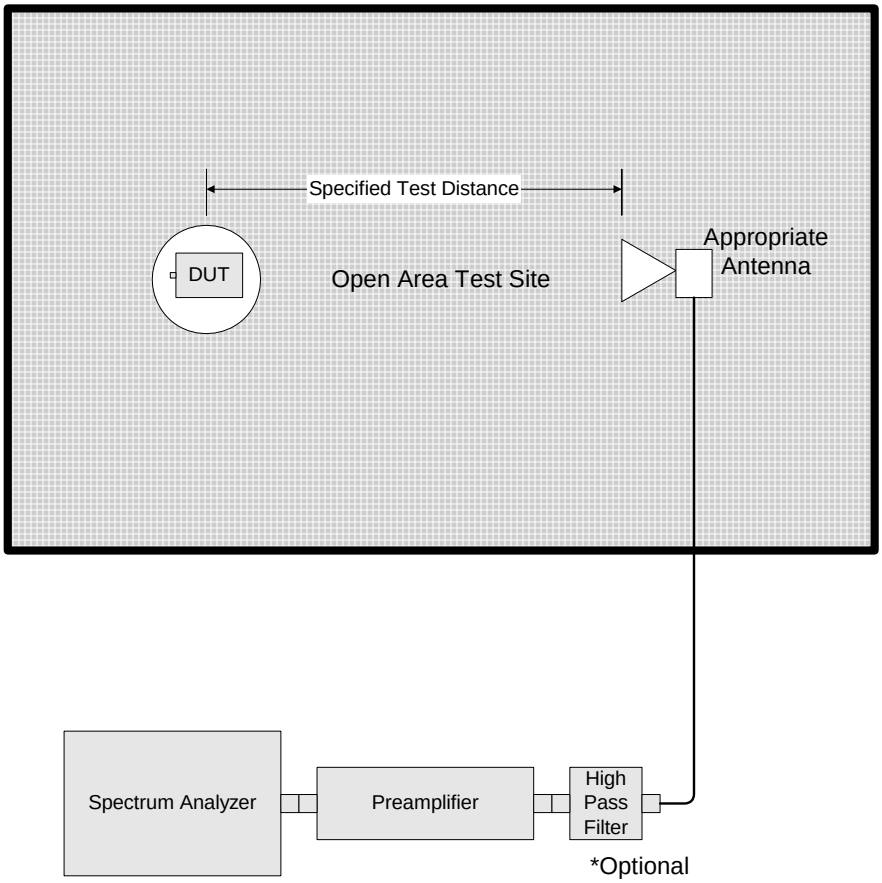
Conducted Emissions



Occupied Bandwidth, Duty Cycle

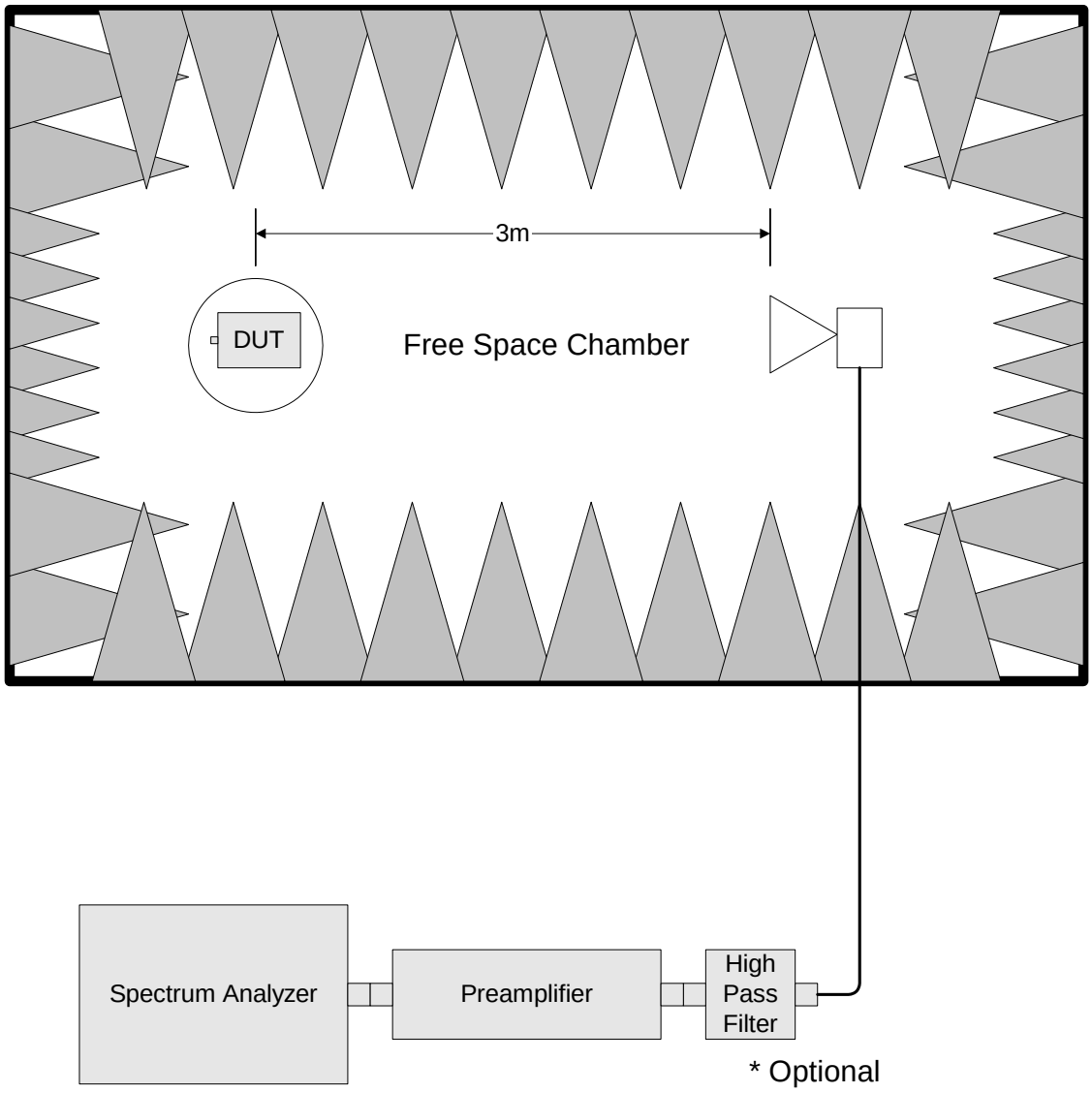


Outdoor Test Site For Radiated Emissions



Radiated Emissions 30 MHz - 1 GHz

The spectrum was searched up to the 10th harmonic of the fundamental frequency of operation.



Radiated Emissions above 1 GHz

ANNEX A - RESTRICTED BANDS

Annex A Restricted Bands of Operation

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.49 - 0.51	16.69475-16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425-16.80475	960-1240	7.25-7.75
3.020 - 3.026	25.5-25.67	1300-1427	8.025-8.5
4.125 - 4.128	37.5-38.25	1435-1626.6	9.0-9.2
4.17725 - 4.17775	73-74.6	1645.5-1646.5	9.3-9.5
4.20725 - 4.20775	74.8-75.2	1660-1710	10.6-12.7
6.215 - 6.218	108-121.94	1718.8-1722.2	13.25-13.4
6.31175 - 6.31225	123-138	2220-2300	14.47-14.5
8.291 - 8.294	149.9-150.05	2310-2390	15.35-16.2
8.362 - 8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625 - 8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425 - 8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29 - 12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975 - 12.52025	240-285	3345.8-3358	36.43-36.5
12.57675 - 12.57725	322-335.4	3600-4400	Above 38.6
13.36 - 13.41			