ENGINEERING TEST REPORT

Analog FM Video Transmitter
Model No.: FM-TX-4000 MINI
FCC ID: OPH-MINITX4000

Applicant:

K&A Wireless, LLC
2617 Juan Tabo Blvd. NE Suite A
Albuquerque, NM 87112 USA

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, Parts 2 and 90 (Subpart I)

UltraTech's File No.: K&AW-002F90

This Test report is Issued under the Authority of Tri M. Luu, Vice President of Engineering UltraTech Group of Labs Date: March 26, 2013	
Report Prepared by: Dan Huynh Issued Date: March 26, 2013	Tested by: Wei Wu Test Dates: Feb. 13 – Mar. 26, 2013

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

UltraTech Group of Labs

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FCC 91038 | VCCI 1309 | Industry Canada / Industrie Canada Approved Test Facility 46390-2049 | NVLAP LAB CODE 200093-0 | BSMI SL2-IN-E-1119R | Korea KCC-RRL CA2049

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Parts 2 and 90
Title:	Code of Federal Regulations (CFR), Title 47 Telecommunication – Parts 2 & 90
Purpose of Test:	FCC Certification Authorization for Radio operating in the Frequency Band 2450-2483.5 MHz.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with ANSI/TIA-603-D – Land Mobile FM or PM Communications Equipment Measurement and performance Standards.

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2012	Code of Federal Regulations – Telecommunication
ANSI C63.4	2009	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
ANSI/TIA-603-D	2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	K&A Wireless, LLC
Address:	2617 Juan Tabo Blvd. NE Suite A Albuquerque, NM 87112 USA
Contact Person:	Jorge Piovesan Phone #: (505).338-2380 x 714 Fax #: (505).338-2382 Email Address: jpiovesan@ka-wireless.com

MANUFACTURER	
Name:	K&A Wireless, LLC
Address:	2617 Juan Tabo Blvd. NE Suite A Albuquerque, NM 87112 USA
Contact Person:	Jorge Piovesan Phone #: (505).338-2380 x 714 Fax #: (505).338-2382 Email Address: jpiovesan@ka-wireless.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The applicant has supplied the following information (with the exception of the Date of Receipt).

Brand Name:	K&A Wireless, LLC
Product Name:	Analog FM Video Transmitter
Model Name or Number:	FM-TX-4000 MINI
Serial Number:	Test Sample
Type of Equipment:	Licensed Non-Broadcast Station Transmitter
Power Supply Requirement:	5 VDC nominal
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	Video transmission

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile
Intended Operating Environment:	Commercial, Industrial or Business
Power Supply Requirement:	5 VDC nominal
RF Output Power Rating:	0.5 W
Operating Frequency Range:	2458 - 2474 MHz
RF Output Impedance:	50 Ω
Channel Spacing:	16 MHz
Occupied Bandwidth (99%):	5.86 MHz
Emission Designation*:	13M7F3F
Antenna Connector Type:	MMCX

* M = 6.75 MHz, for full resolution D-1 video
D = 100 kHz, for this TX
K = 1, typical
Bn = 2M + 2DK 2(6.75) + 2(0.1)(1) = 13.7 MHz

Emission designator: 13M7F3F

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Shielded/Non-shielded
1	Antenna port	1	MMCX – female	Coaxial
2	Power supply port	1	Wires	26AWG Red and black wires
3	Video input port	1	Wires	26AWG yellow and violet wires
4	Channel select port	1	Wire	26AWG blue wire

2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	NTSC camera
Brand name:	Sony
Model Name or Number:	N/A
Connected to EUT's Port:	Video IN

Ancillary Equipment # 2	
Description:	AC power supply for NTSC camera
Brand name:	I.T.E.
Model Name or Number:	PW118
Connected to EUT's Port:	Connected to NTSC camera

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power Input Source:	5 VDC Nominal

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	N/A
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT is tested with the antenna port terminated to a 50 Ohm RF Load.

Transmitter Test Signals	
Frequency Band(s):	2458 - 2474 MHz
Test Frequencies:	2458 MHz and 2474 MHz
Transmitter Wanted Output Test Signals:	
Transmitter Power (measured maximum output power):	0.556 W High
Normal Test Modulation:	full resolution D-1 video
Modulating signal source:	External

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2014-04-04.

4.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Applicability (Yes/No)
2.1046 & 90.205	RF Power Output	Yes
2.1047(a) & 90.242(b)(8)	Modulation Characteristics - Audio Frequency Response	N/A
2.1047(b) & 90.210	Modulation Characteristics - Modulation Limiting	N/A
2.1049, 90.209 & 90.210	Bandwidth Limitations & Emission Masks	Yes
2.1051, 2.1057 & 90.210	Spurious Emissions at Antenna Terminal	Yes
2.1053, 2.1057 & 90.210	Field Strength of Spurious Emissions	Yes
2.1055 & 90.213	Frequency Stability	Yes
90.214	Transient Frequency Behavior	N/A
2.1091, 1.1307, 1.1310,	RF Exposure Limit	Yes
15.107	AC Power Line Conducted Emissions	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

4.3.1. DEVIATION OF STANDARD TEST PROCEDURES

None.

EXHIBIT 5. MEASUREMENTS DATA

5.1. RF POWER OUTPUT [§§ 2.1046 & 90.205]

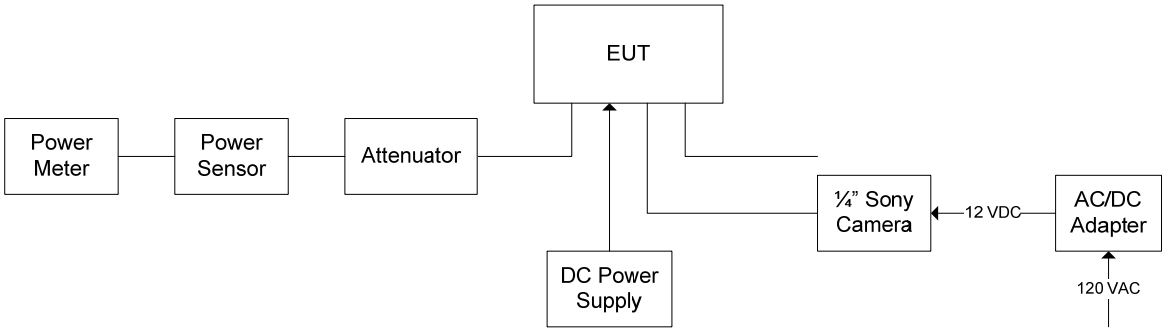
5.1.1. Limit

§ 90.205(o) 2450-2483.5 MHz. The maximum transmitter power is 5 watts.

5.1.2. Method of Measurements

Refer to Section 8.1 (Conducted) and 8.2 (Radiated) of this report for measurement details

5.1.3. Test Arrangement



5.1.4. Test Data

Power Setting	Fundamental Frequency (MHz)	Measured (Average) Power (W)	Power Rating (W)
Hi, 500 mW	2458	0.556	0.5
	2474	0.526	0.5
Low, 10 mW	2458	0.012	0.01
	2474	0.012	0.01

5.2. OCCUPIED BANDWIDTH & EMISSION MASKS [§§ 2.1049, 90.209 & 90.210]

5.2.1. Limits

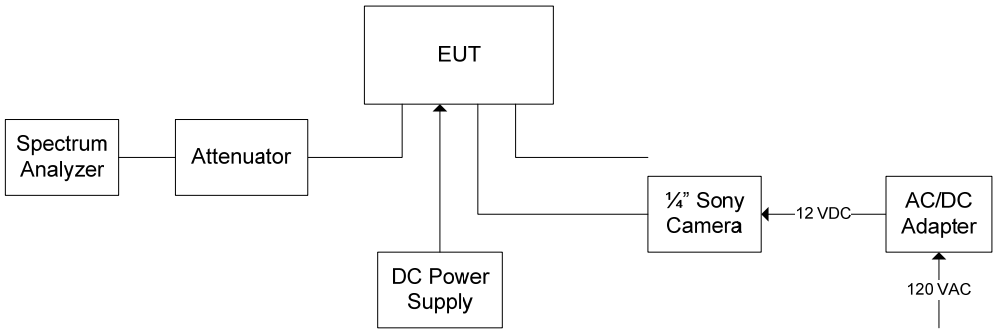
Emissions shall be attenuated below the mean output power of the transmitter as follows:

Frequency band (MHz)	Mask for equipment with Audio low pass filter	Mask for equipment without audio low pass filter
2450-2483.5	B	C

5.2.2. Method of Measurements

47 CFR § 2.1049 and TIA-603-D Section 2.2.11.2

5.2.3. Test Arrangement



5.2.4. Test Data

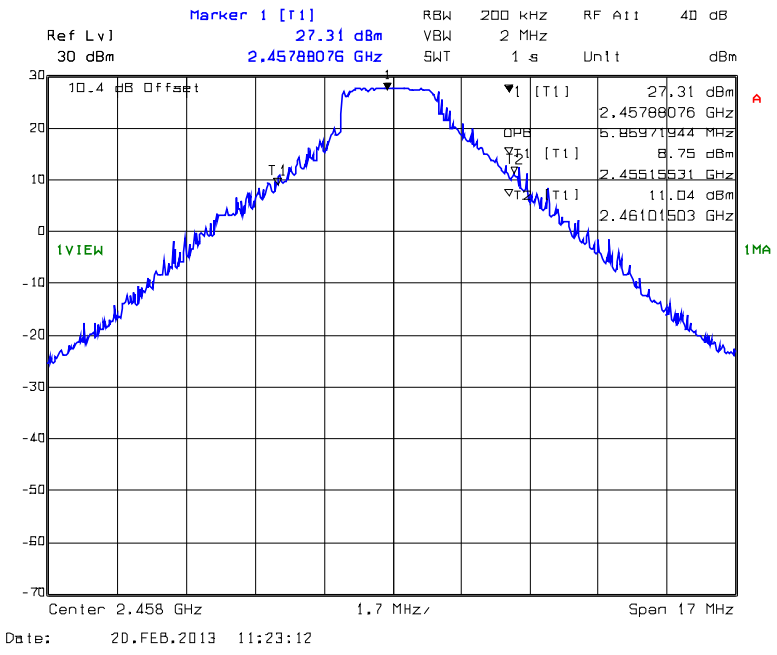
5.2.4.1. 99% Occupied Bandwidth

Frequency (MHz)	*Measured 99% OBW (MHz)	Authorized Bandwidth (MHz)
2458	5.86	13.7
2474	5.48	13.7

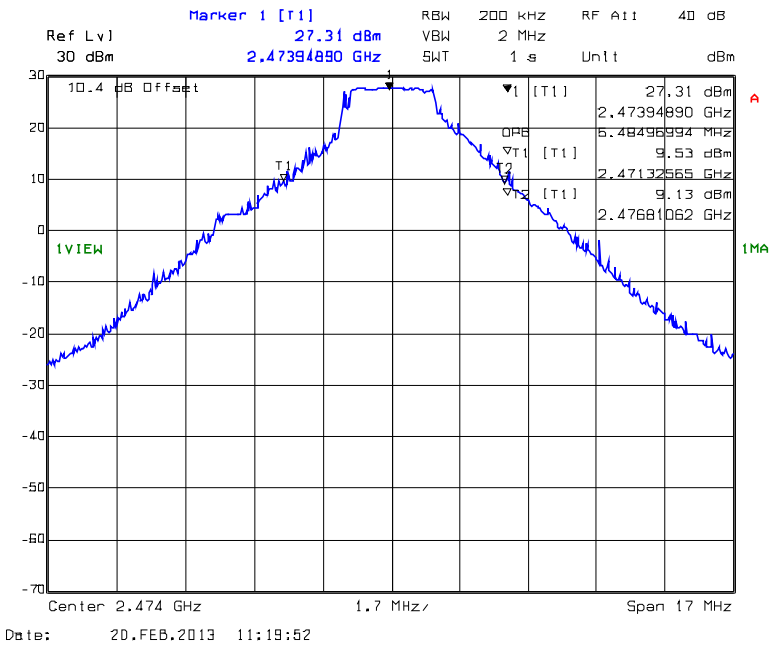
Note: 99% Occupied Bandwidth measurements were performed using the built-in auto function of the spectrum analyzer.

* See the following plots for details of measurements

Plot 5.2.4.1.1. Occupied Bandwidth, 2458 MHz



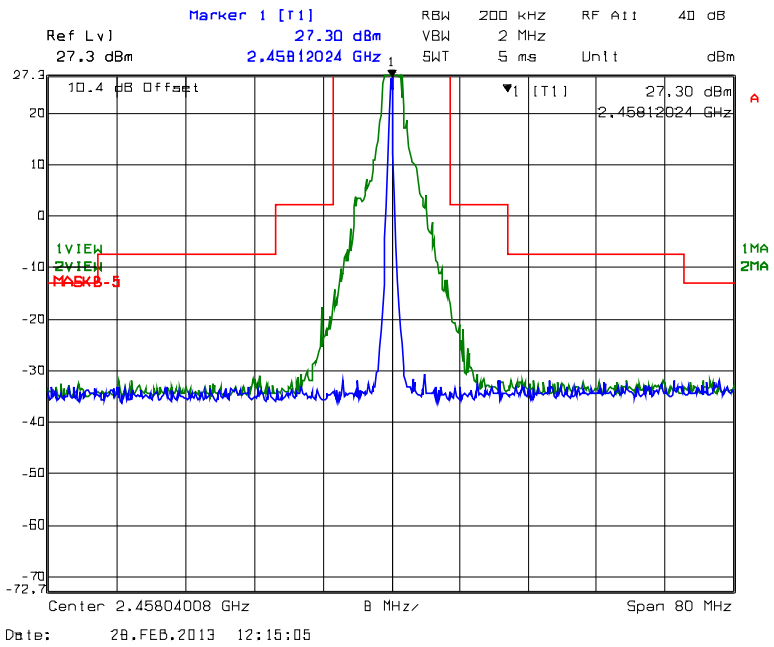
Plot 5.2.4.1.2. Occupied Bandwidth, 2474 MHz



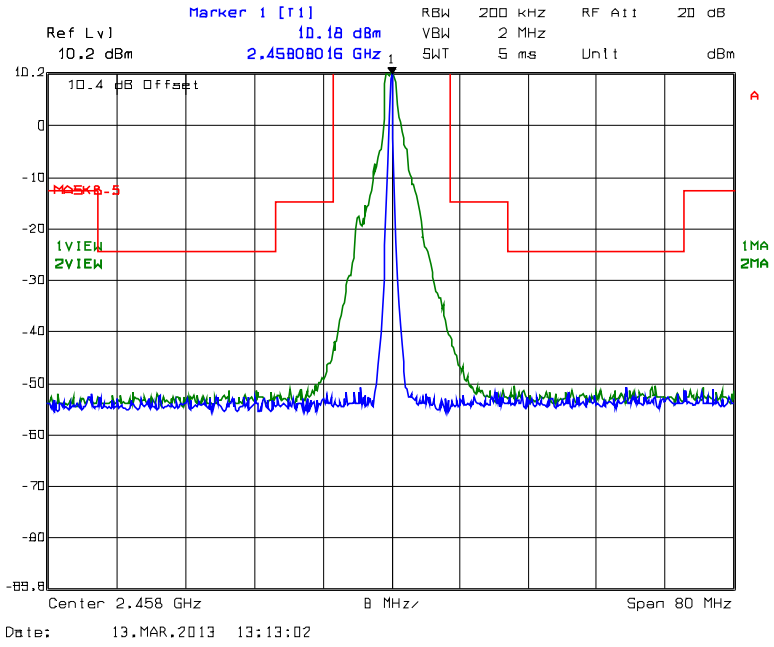
5.2.4.2. Emission Masks

Remark: Mask C is not appropriate as it does not permit the designated bandwidth of the EUT. Alternatively, compliance with Mask B was demonstrated.

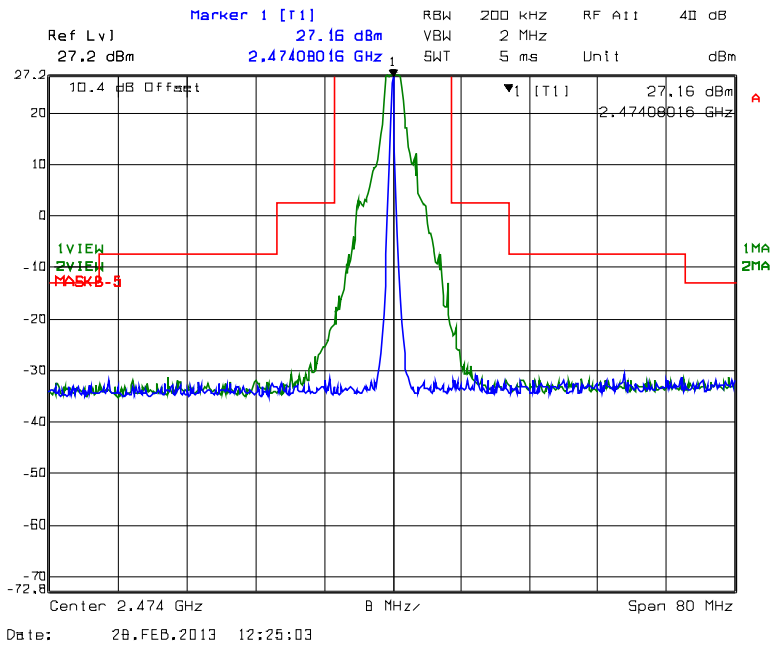
Plot 5.2.4.2.1. Emission Mask B, 2458 MHz, High Power



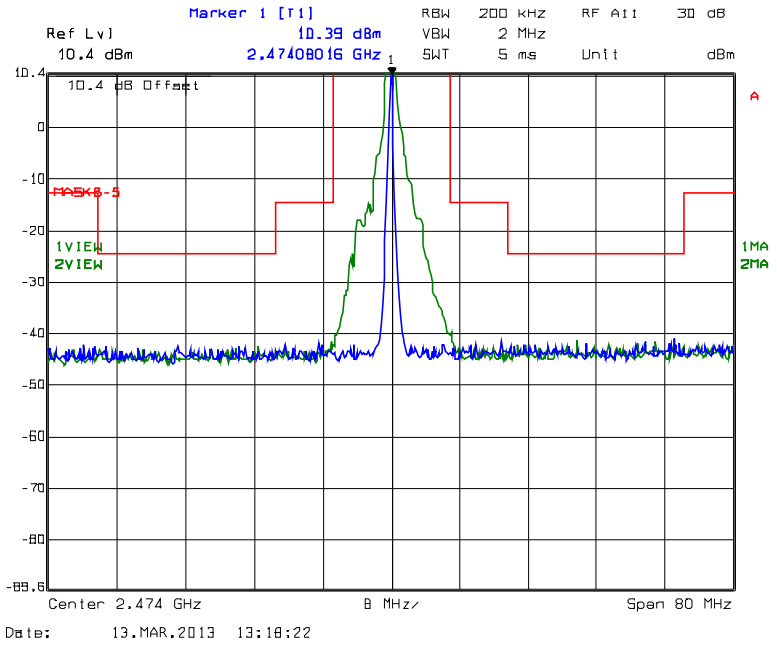
Plot 5.2.4.2.2. Emission Mask B, 2458 MHz, Low Power



Plot 5.2.4.2.3. Emission Mask B, 2474 MHz, High Power



Plot 5.2.4.2.4. Emission Mask B, 2474 MHz, Low Power



5.3. SPURIOUS EMISSIONS AT ANTENNA TERMINAL [§§ 2.1051, 2.1057 & 90.210]

5.3.1. Limits

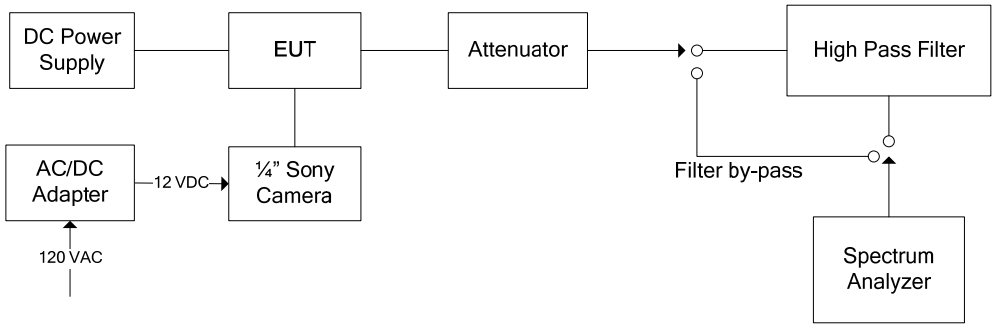
Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Frequency Range	Attenuation Limit (dBc)
§ 90.210(b)	30 MHz or Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	At least 43 + 10 log (P) dB
§ 90.210(c)	30 MHz or Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	At least 43 + 10 log (P) dB

5.3.2. Method of Measurements

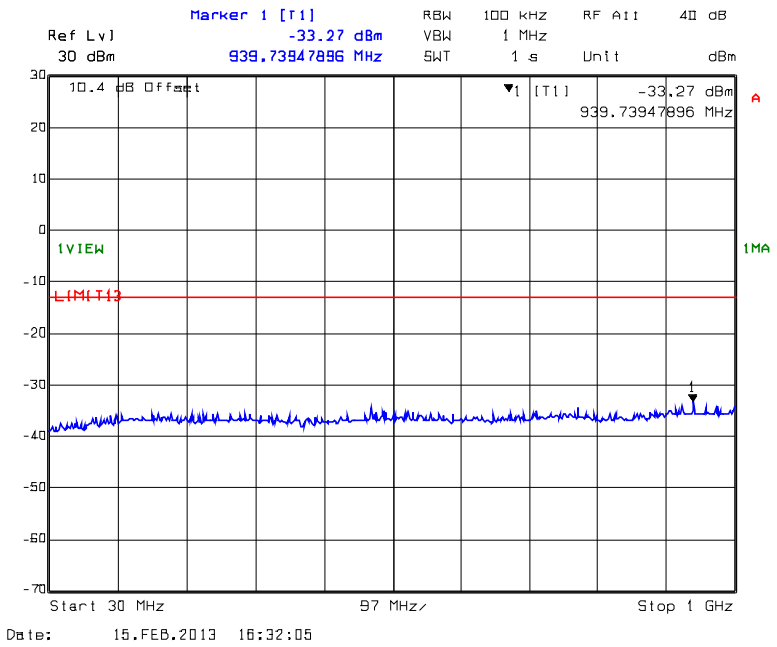
47 CFR §§ 2.1051 and 2.1057

5.3.3. Test Arrangement

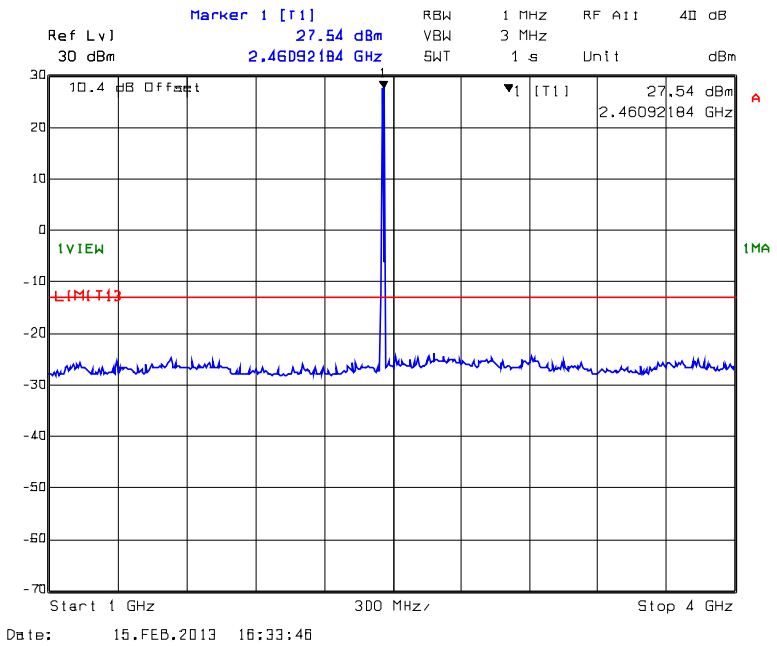


5.3.4. Test Data

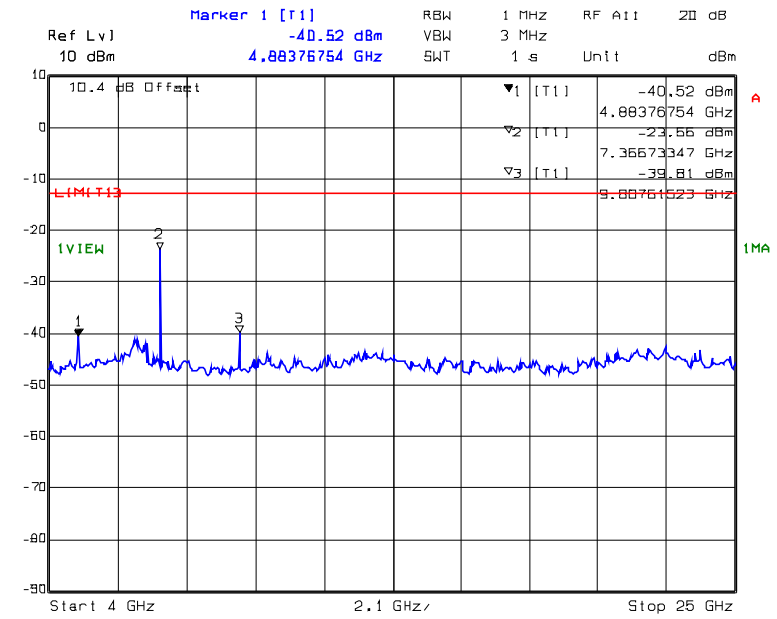
Plot 5.3.4.1. Conducted Transmitter Spurious Emissions, 2458 MHz, High Power, 30 MHz – 1 GHz



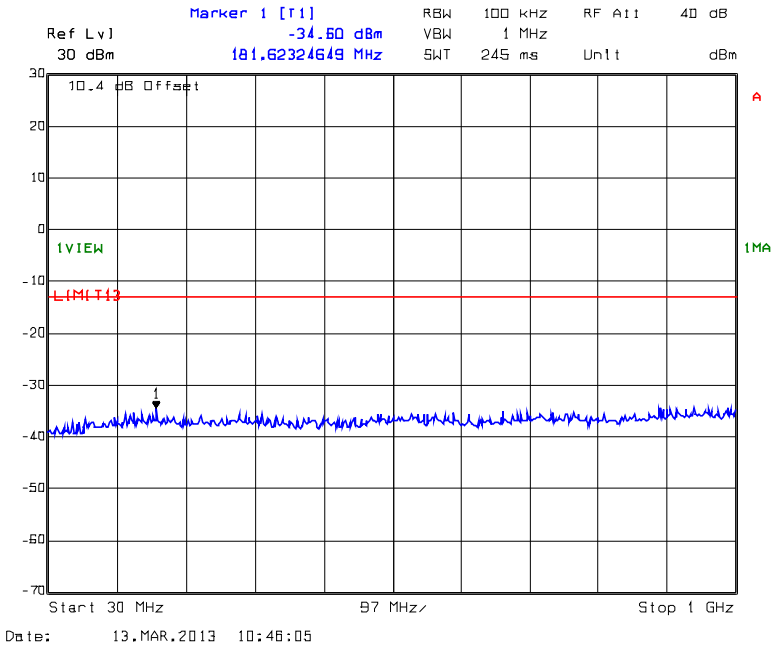
Plot 5.3.4.2. Conducted Transmitter Spurious Emissions, 2458 MHz, High Power, 1 GHz – 4 GHz



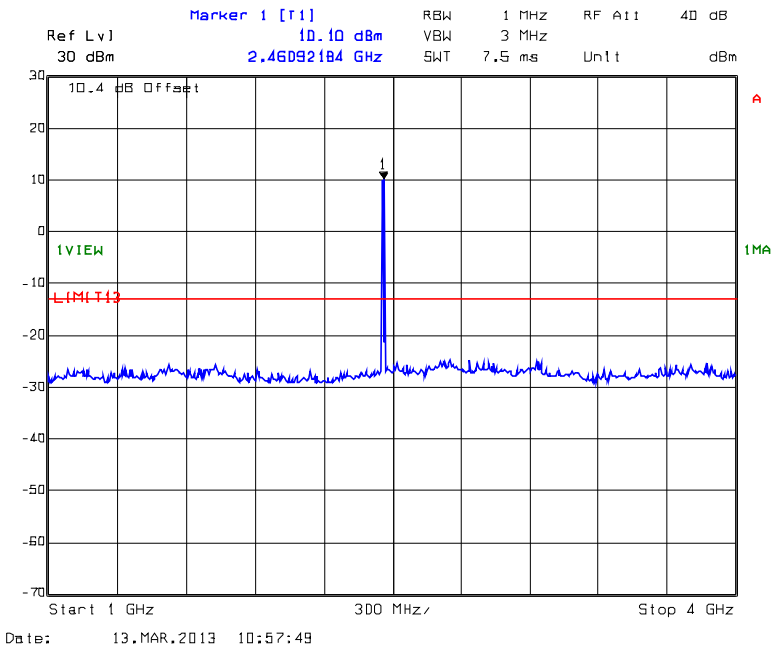
Plot 5.3.4.3. Conducted Transmitter Spurious Emissions, 2458 MHz, High Power, 4 GHz – 25 GHz



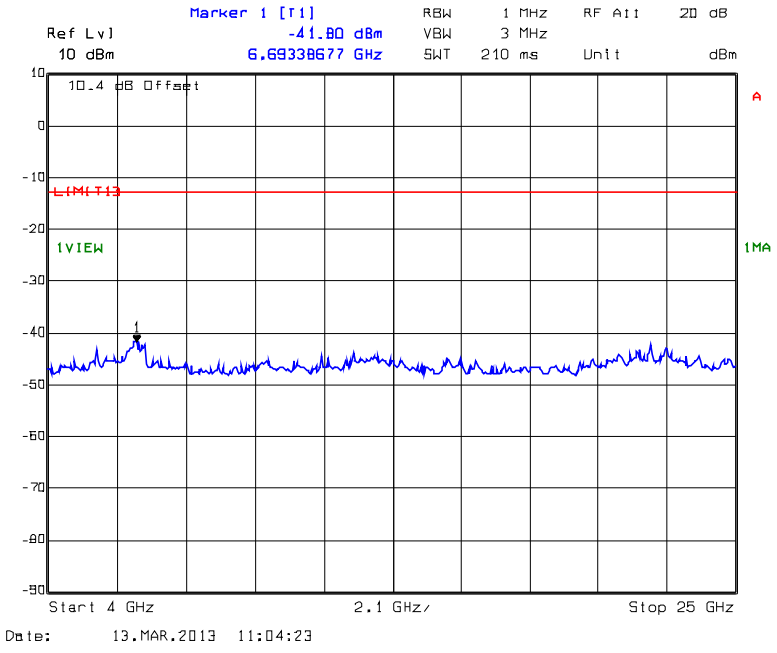
Plot 5.3.4.4. Conducted Transmitter Spurious Emissions, 2458 MHz, Low Power, 30 MHz – 1 GHz



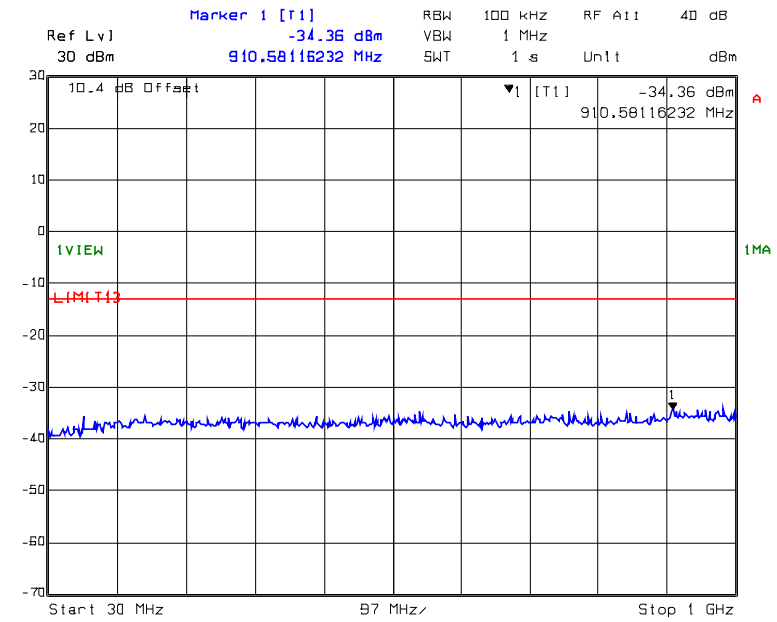
Plot 5.3.4.5. Conducted Transmitter Spurious Emissions, 2458 MHz, Low Power, 1 GHz – 4 GHz



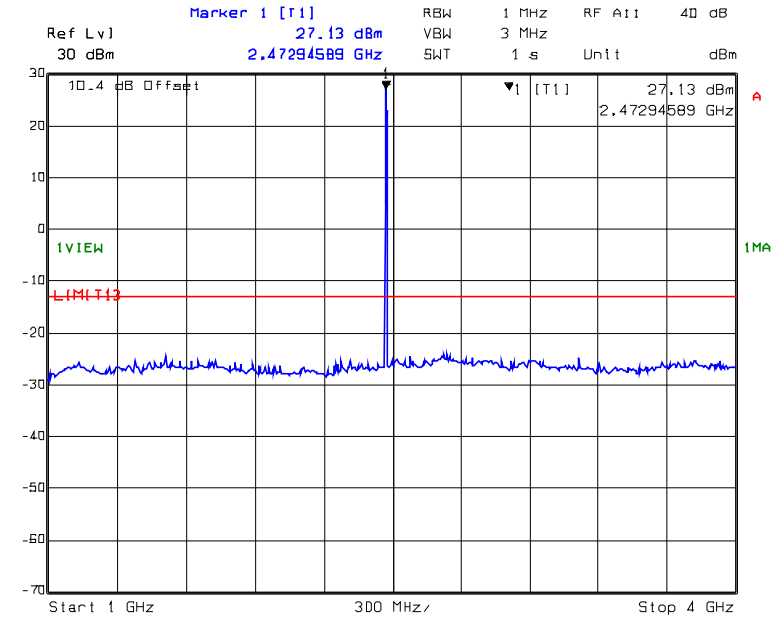
Plot 5.3.4.6. Conducted Transmitter Spurious Emissions, 2458 MHz, Low Power, 4 GHz – 25 GHz



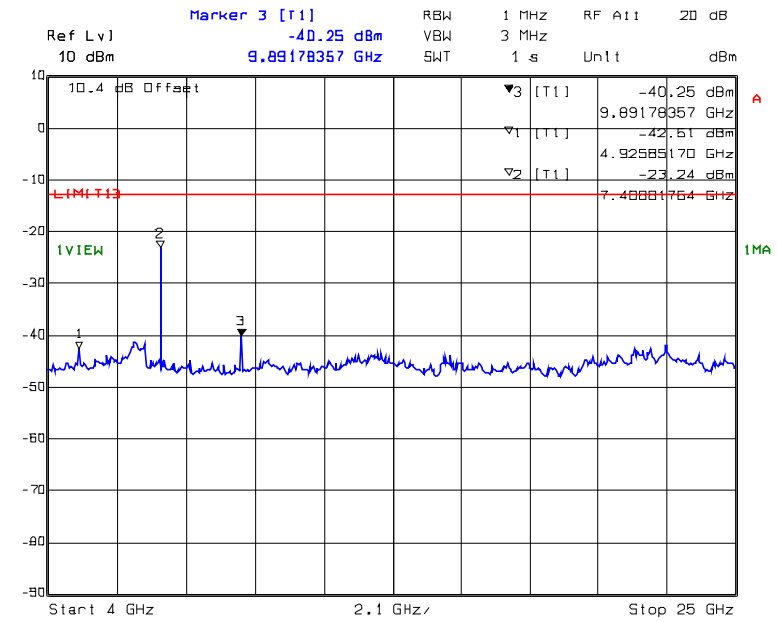
Plot 5.3.4.7. Conducted Transmitter Spurious Emissions, 2474 MHz, High Power, 30 MHz – 1 GHz



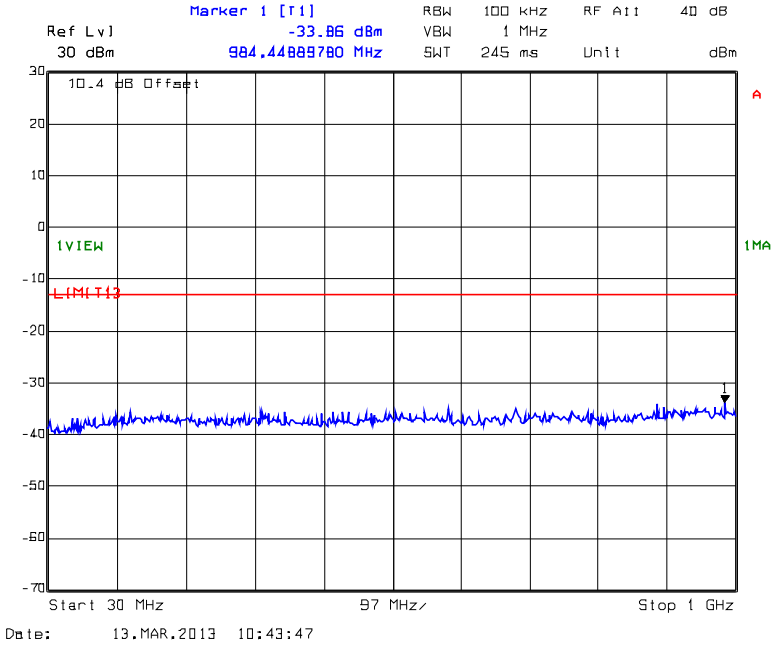
Plot 5.3.4.8. Conducted Transmitter Spurious Emissions, 2474 MHz, High Power, 1 GHz – 4 GHz



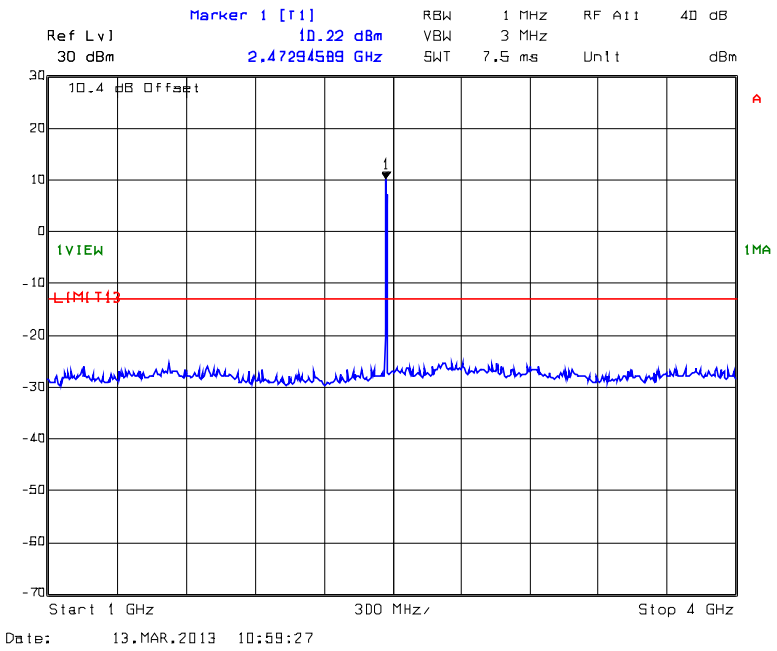
Plot 5.3.4.9. Conducted Transmitter Spurious Emissions, 2474 MHz, High Power, 4 GHz – 25 GHz



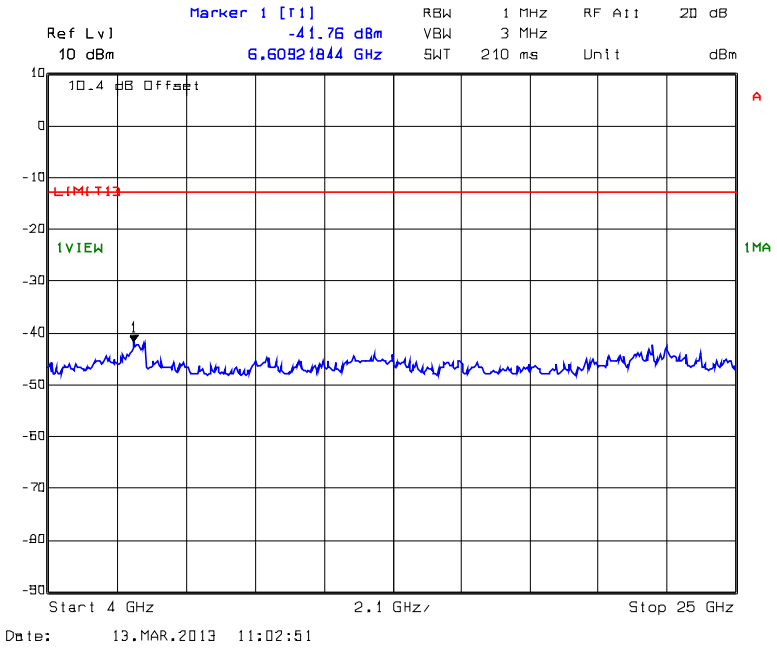
Plot 5.3.4.10. Conducted Transmitter Spurious Emissions, 2474 MHz, Low Power, 30 MHz – 1 GHz



Plot 5.3.4.11. Conducted Transmitter Spurious Emissions, 2474 MHz, Low Power, 1 GHz – 4 GHz



Plot 5.3.4.12. Conducted Transmitter Spurious Emissions, 2474 MHz, Low Power, 4 GHz – 25 GHz



5.4. FIELD STRENGTH OF SPURIOUS EMISSIONS [§§ 2.1053, 2.1057 & 90.210]

5.4.1. Limits

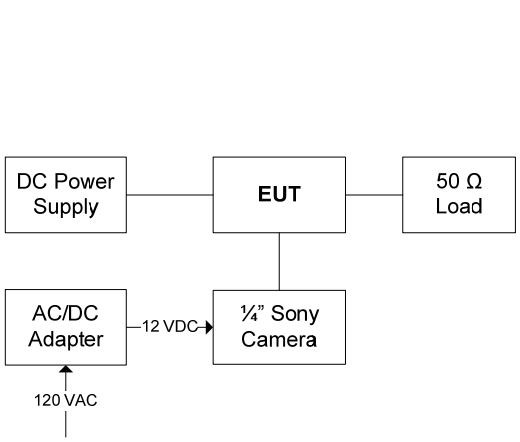
Emissions shall be attenuated below the mean output power of the transmitter as follows:

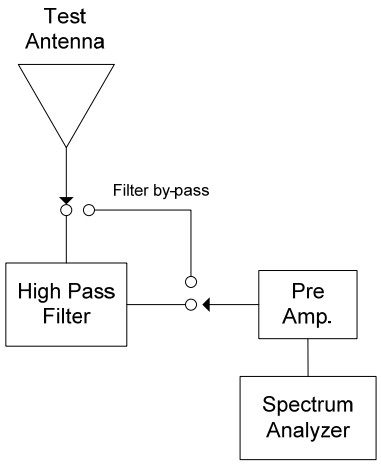
FCC Rules	Frequency Range	Attenuation Limit (dBc)
§ 90.210(b)	30 MHz or Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	At least 43 + 10 log (P) dB
§ 90.210(c)	30 MHz or Lowest frequency of the radio to 10th harmonic of the highest frequency of the radio	At least 43 + 10 log (P) dB

5.4.2. Method of Measurements

47 CFR §§ 2.1053, 2.1057 and the substitution method specified in Section 8.2 of this report was used to measure the spurious emissions.

5.4.3. Test Arrangement





5.4.4. Test Data

Remarks:

- The radiated emissions were performed with high power setting at 3 m distance to represents the worst-case test configuration.
- The emissions were scanned from 30 MHz to 10th harmonics; all spurious emissions that are in excess of 20dB below the specified limit shall be recorded.

Test Frequency (MHz):	2458					
Power $_{conducted}$ (dBm):	27					
Limit (dBm):	-13					
Frequency (MHz)	**E-Field (dBµV/m)**	**EMI Detector (Peak/QP)**	**Antenna Polarization (H/V)**	**ERP measured (dBm)**	**Limit (dBm)**	**Margin (dB)**
7374	78.53	Peak	V	-21.28	-13	-8.28
7374	75.93	Peak	H	-23.88	-13	-10.88
9832	70.18	Peak	V	-30.63	-13	-17.63
12290	70.82	Peak	V	-30.10	-13	-17.10
12290	73.62	Peak	H	-27.30	-13	-14.30

Test Frequency (MHz):	2474					
Power $_{conducted}$ (dBm):	27					
Limit (dBm):	-13					
Frequency (MHz)	**E-Field (dBµV/m)**	**EMI Detector (Peak/QP)**	**Antenna Polarization (H/V)**	**ERP measured (dBm)**	**Limit (dBm)**	**Margin (dB)**
7422	78.84	Peak	V	-20.82	-13	-7.82
7422	76.90	Peak	H	-22.76	-13	-9.76
12370	71.03	Peak	V	-29.35	-13	-16.35
12370	73.28	Peak	H	-27.10	-13	-14.10

5.5. FREQUENCY STABILITY [§§ 2.1055 & 90.213]

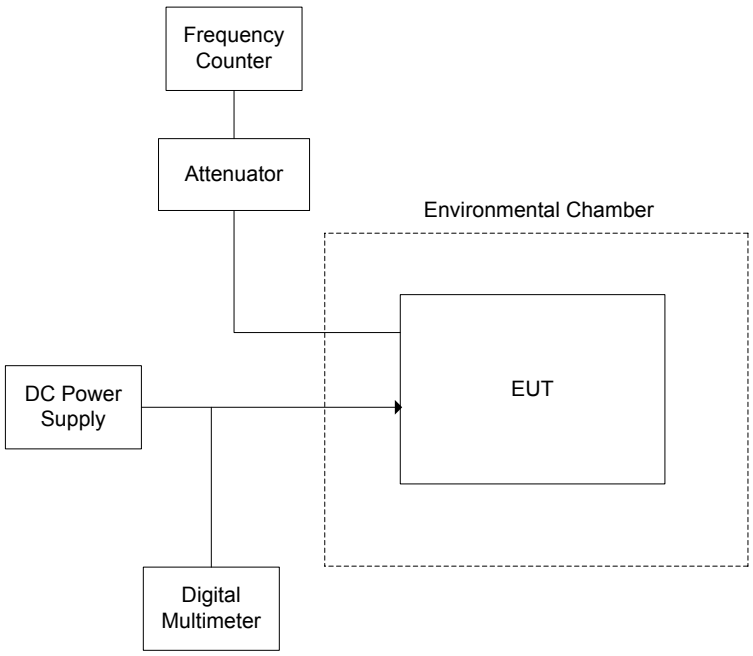
5.5.1. Limits

The frequency stability is to be specified in the station authorization.

5.5.2. Method of Measurements

47 CFR §§ 2.1055 and TIA-603-D, Section 2.2.2.2

5.5.3. Test Arrangement



5.5.4. Test Data

Test Frequency:	2458 MHz
Full Power Level:	27 dBm
Frequency Tolerance Limit:	± 50 ppm or ± 122900 Hz
Max. Frequency Tolerance Measured:	-36505 Hz or 14.9 ppm
Input Voltage Rating:	5 VDC (nominal)

Ambient Temperature (°C)	**Frequency Drift (Hz)**		
	Supply Voltage (Nominal) 5 VDC	**Supply Voltage (Shutdown Voltage) 3.2 VDC**	**Supply Voltage (115% of the nominal) 5.75 VDC**
-30	+19085	--	-
-20	+17506	--	--
-10	+17573	--	--
0	+14779	--	--
+10	+8915	--	--
+20	-16990	-9802	-21029
+30	-26981	--	--
+40	-27350	--	--
+50	-32355	--	--
+60	-36505	--	--

5.6. RF EXPOSURE REQUIREMENTS [§§ 1.1310 & 2.1091]

5.6.1. Limits

§ **1.1310:** The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) 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

Note 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

5.6.2. Method of Measurements

Calculation Method of RF Safety Distance:

$$S = \frac{PG}{4\pi \cdot r^2} = \frac{EIRP}{4\pi \cdot r^2}$$

Where, P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

$$r = \sqrt{\frac{PG}{4\pi \cdot S}} = \sqrt{\frac{EIRP}{4\pi \cdot S}}$$

5.6.3. Evaluation of RF Exposure Compliance Requirements

Maximum RF Power conducted, **$P_{conducted}$[dBm]:**	27.45
Maximum Antenna Gain, **G[dBi]**:	15
Maximum EIRP, **P_{EIRP}[dBm]**:	42.45
MPE Limit for Occupational/Controlled Exposure, **$S_{controlled}$[mW/cm^2]**:	5
Calculated RF Safety Distance for Occupational/Controlled Exposure, **$r_{safety\_controlled}$[cm]**:	16.73

5.7. POWER LINE CONDUCTED EMISSIONS [§ 15.107(a)]

5.7.1. Limits

The equipment shall meet the limits of the following table:

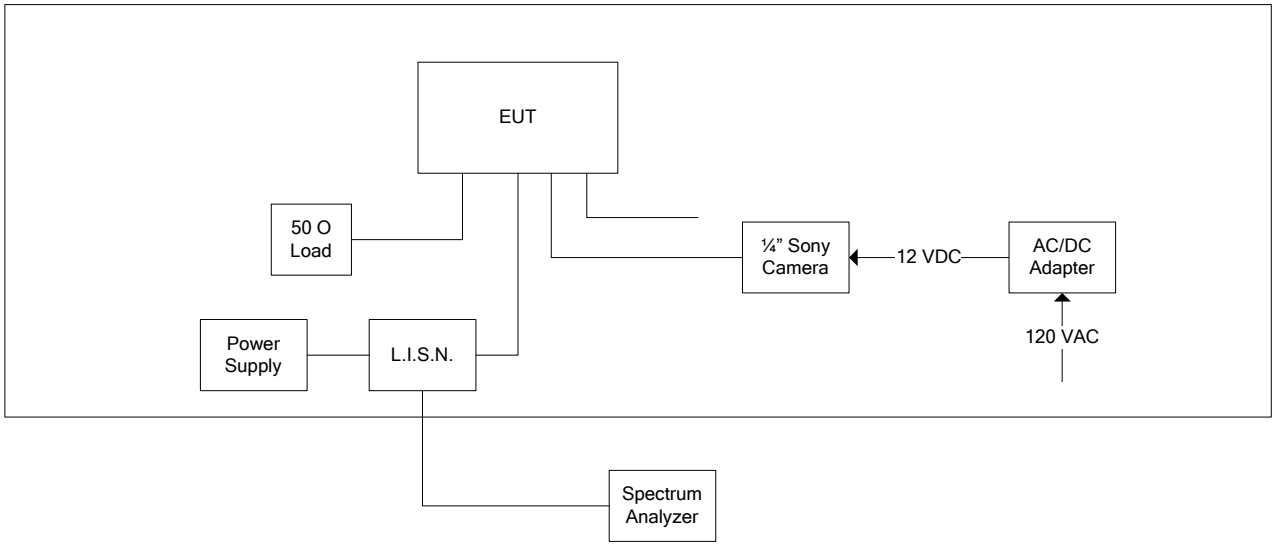
Frequency of emission (MHz)	Conducted Limits (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

5.7.1.1. Method of Measurements

Refer to Ultratech Test Procedures ULTR-P001-2004 & ANSI C63.4-2009 for method of measurements.

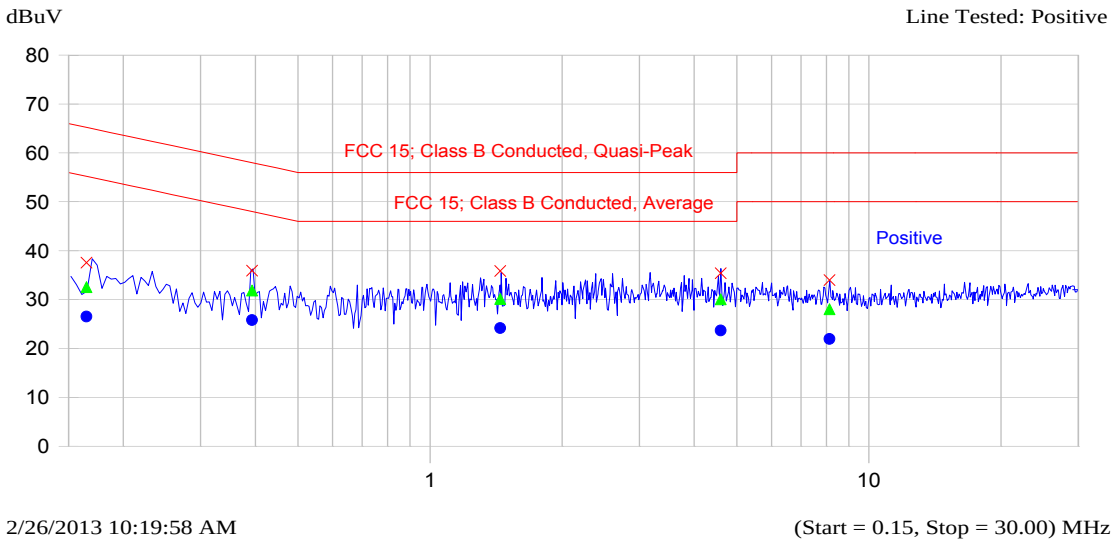
5.7.2. Test Arrangement



5.7.3. Test Data

Plot 5.7.3.1. Power Line Conducted Emissions
Line Voltage: 5 VDC; Line Tested: Positive

Current Graph

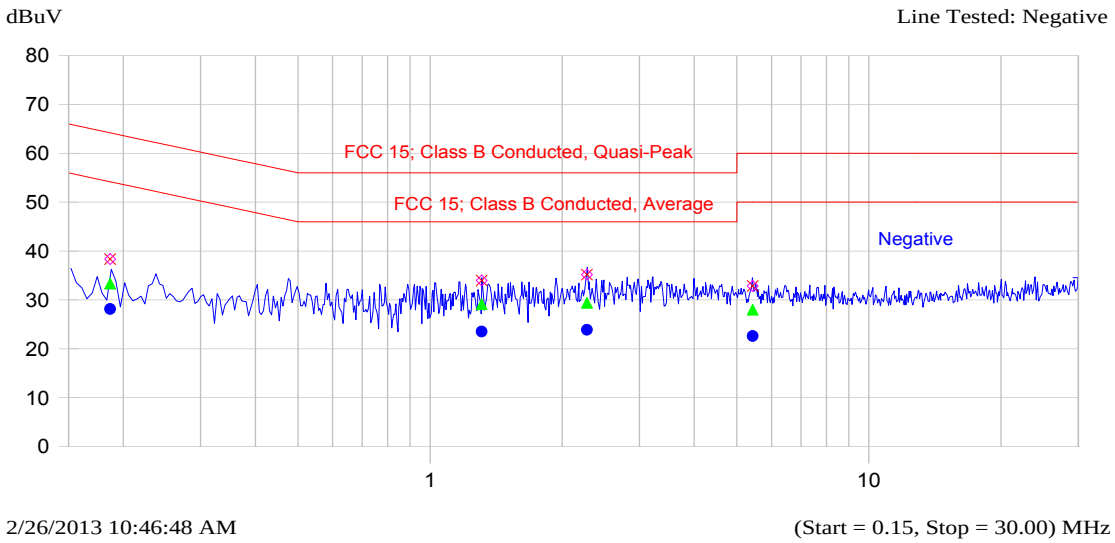


Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.165	37.6	32.6	-33.0	26.5	-29.1	Positive
0.393	35.9	31.8	-27.1	25.8	-23.2	Positive
1.445	35.8	30.1	-25.9	24.2	-21.8	Positive
4.595	35.4	30.1	-25.9	23.7	-22.3	Positive
8.136	34.0	28.0	-32.0	22.0	-28.0	Positive

Plot 5.7.3.2. Power Line Conducted Emissions
Line Voltage: 5 VDC; Line Tested: Negative

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.187	38.4	33.4	-31.6	28.1	-26.8	Negative
1.311	34.0	29.1	-26.9	23.5	-22.5	Negative
2.277	35.2	29.4	-26.6	23.9	-22.1	Negative
5.436	32.9	28.0	-32.0	22.6	-27.4	Negative

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	R/S	FSEK20	834157/005	9KHz-40GHz	30 Jul 2013
Attenuator (10dB)	Aeroflex/Weinschel	46-10-34	BS4336	DC-18 GHz	Cal. on use
Frequency Counter	EIP	545A	2683	10Hz - 18 GHz	25 Mar 2014
Environmental Chamber	Envirotronics	SSH32C	11994847-S-11059	-60 to 177 °C	16 Aug 2013
RF Synthesized signal Generator	HP	8648C	3343U00391	100K-3200M Hz AM/ FM/ PM	03 Jan 2014
Power supply	Tenma	72-7295	490300297	1-40V DC 5A	Cal. on use
FFT Digital Spectrum Analyzer	Advantest	R9211E	8202336	10mHz--100KHz	25 Jan 2014
Horn antenna	ETS-LINDGREN	3117	119425	1-18GHz	02 Apr 2013
Preamplifier	Hewlett Packard	8449B	3008A00769	1-26.5GHz	06 Aug 2013
High Pass Filter	K&L	11SH10-4000T12000-C0	4	Cut off 4.0GHz	Cal. on use
Attenuator	Aeroflex/Weinschel	23-20-34	BH7876	DC-18 GHz	Cal. on use
Antenna	ETS	93148	1101	200-2000 MHz	22 Mar 2013*
Antenna	EMCO	3142C	26873	26-3000MHz	04 May 2013
EMI Receiver	R/S	ESU 40	100037	20 Hz-40 GHz	19 Mar 2013*
Preamplifier	AH System	PAM-0118	225	20MHz-18GHz	16 Mar 2013*
Power Meter	Hewlett Packard	436A	2101A11242	100K--50G sensor dependent	23 Jan 2014
Power Sensor	Hewlett Packard	8482A	US37295943	0.1 - 4GHz	13 Jan 2014
Antenna+adaptor	ETS	3160-09	118385	18GHz-26.5GHz	30 Jul 2014
Pre-amplifier	Spacer Labs	SLKKa-30-6	6D26	18GHz-40.0GHz	30 Jul 2014
Spectrum Analyzer	Agilent	E7401A	US40240432	9 kHz–1.5 GHz	01 May 2013
Attenuator	Pasternack	PE7010-20	-	DC–2 GHz	Cal. On use
L.I.S.N	EMCO	3825/2	8907-1531	10 kHz -100 MHz	05 Apr 2013

* The equipment was used during the test period of Feb. 13 – Mar. 1, 2013.

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (150 kHz – 30 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 1.57**	**± 1.8**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.14**	**± 3.6**

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 2.15**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.30**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.78**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 1.87**	**Under consideration**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.75**	**Under consideration**

EXHIBIT 8. MEASUREMENT METHODS

8.1. CONDUCTED POWER MEASUREMENTS

- The following shall be applied to the combination(s) of the radio device and its intended antenna(e).
- I f the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.
- The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
- The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

Step 1: Duty Cycle measurements if the transmitter's transmission is transient

- Using a EMI Receiver with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with 0<x<1, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

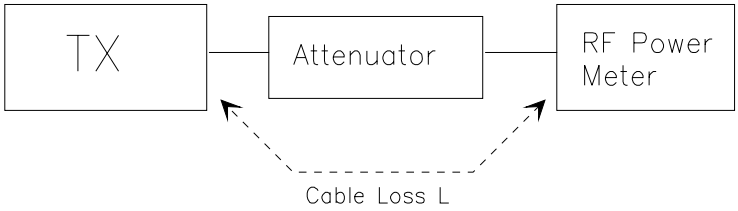
Step 2: Calculation of Average EIRP. See Figure 1

- The average output power of the transmitter shall be determined using a wideband, calibrated RF average power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

EIRP = A + G + 10log(1/x)

{X = 1 for continuous transmission => 10log(1/x) = 0 dB}

Figure 1.



8.2. RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD

8.2.1. Maximizing RF Emission Level (E-Field)

(a) The measurements were performed with full rf output power and modulation.
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
(e) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBμV/m) = Reading (dBμV) + Total Correction Factor (dB/m)

(f) Set the EMI Receiver and #2 as follows:

Center Frequency:	test frequency
Resolution BW:	100 KHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(h) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
(l) Repeat for all different test signal frequencies.

8.2.2. Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method

(a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

Center Frequency:	equal to the signal source
Resolution BW:	100 KHz
Video BW:	VBW > RBW
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(c) Select the frequency and E-field levels obtained in the Section 8.2.1 for ERP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):
- DIPOLE antenna for frequency from 30-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

(e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
(f) Use one of the following antenna as a receiving antenna:
- DIPOLE antenna for frequency from 30-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

(g) If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
(h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
(i) Tune the EMI Receivers to the test frequency.
(j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(k) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
(n) Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:

P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1
EIRP = P + G1 = P3 + L2 - L1 + A + G1
ERP = EIRP – 2.15 dB
Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1

Where:	P:	Actual RF Power fed into the substitution antenna port after corrected.
	P1:	Power output from the signal generator
	P2:	Power measured at attenuator A input
	P3:	Power reading on the Average Power Meter
	EIRP:	EIRP after correction
	ERP:	ERP after correction

(o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

Figure 2

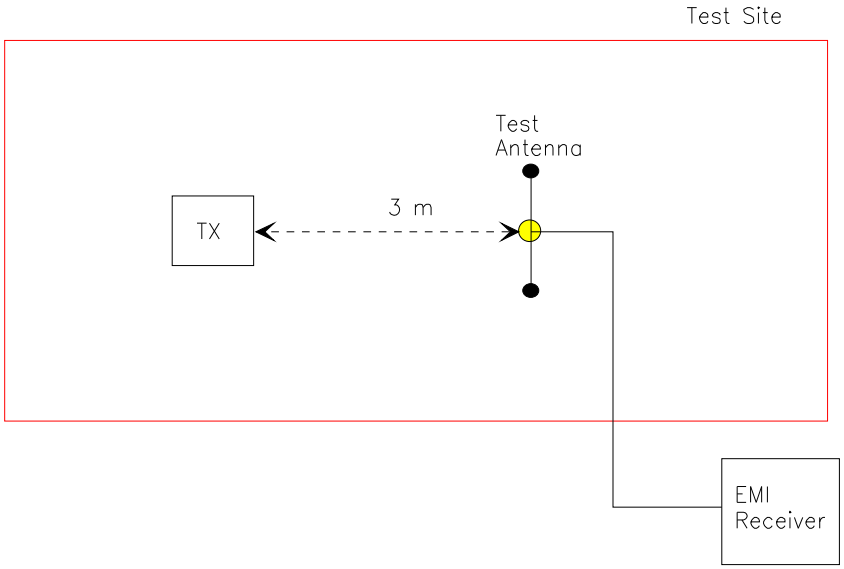


Figure 3