MEASUREMENT REPORT

(FCC : Part 15 Subpart C (15.247) / ANSI C63.4-2003)
Classification : (DTS) Digital Transmission System

Testing Laboratory
1288

Product	:	Transmitter
Trade Name	:	Skytech II, Inc.
Model No.	:	ReMotion TX
Applicant	:	Skytech II, Inc.
Applicant Address	:	9230 Conservation Way Fort Wayne, IN 46809 U.S.A

Report Number	MLT1305P15002
Applicant	Skytech II, Inc.
Product	Transmitter
Sample Received Date	2013/5/15
Sample Tested Date	2013/5/15 ~ 2013/6/28

Report Prepared By	Jesse Tien
Signature	
Date Prepared	2013/6/28

Report Authorized By	Roger Chen
Signature	
Date Authorized	2013/6/28

Test By

Max Light Technology Co., Ltd.
Room 5, 8F, No.125, Section 3 Roosevelt Road,
Taipei, Taiwan., R.O.C.
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History of Test Report

Original Report Issue Date: 2013/6/28

■ No additional attachment

□ additional attachments were issued as in the following record:

Attachment No.	Issue Date	Description
MLT1305P15002	2013/6/28	Original report

CERTIFICATION

We here by verify that :

The test data, data evaluation, test procedures and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4-2003. All test were conducted by
MLT(Max Light Technology Co., Ltd) Room 5, 8F, No.125, Section 3 Roosevelt Road, Taipei, Taiwan, R.O.C Also, we attest to the accuracy of each.

We further submit that the energy emitted by the sample EUT tested as described in the report is in compliance with Class B radiated and conducted emission limit of FCC Rules Part 15 Subpart C (15.247).

Applicant Name	Skytech II, Inc.
Applicant Address	9230 Conservation Way Fort Wayne, IN 46809 U.S.A
Manufacturer Name	FEGO Precision Industrial Co.,Ltd
Manufacturer Address	947 Lin-Sen Rd.Wu-Fong Tai-Chung 413 Taiwan ROC

Equipment	Transmitter
Model No	ReMotion TX
FCC ID	K9LREMOTION

Report Prepared By	Jesse Tien
Signature	

Report Authorized By	Roger Chen
Signature	

1. General

1.1 Introduction

The following measurement report is submitted on behalf of Skytech II, Inc. In support of a Class B Digital Device certification in accordance with Part2 Subpart J and Part 15 Subpart C of the Commission's and Regulations.

1.2 Customer Details

Applicant Name	Skytech II, Inc.
Applicant Address	9230 Conservation Way Fort Wayne, IN 46809 U.S.A
Manufacturer Name	FEGO Precision Industrial Co.,Ltd
Manufacturer Address	947 Lin-Sen Rd.Wu-Fong Tai-Chung 413 Taiwan ROC

1.3 Technical data of EUT

Equipment	Transmitter
Model No	ReMotion TX
FCC ID	K9LREMOTION
Power Type	Battery 6.0V
Type of Modulation	O-QPSK
Carrier Frequency of Each Channel	2415MHz , 2445MHz , 2475MHz
Type of Antenna	PCB Antenna (F Type)

During testing the EUT was operated at Tx mode for each emission measured. This was done in order to ensure that maximum emission levels were attained.

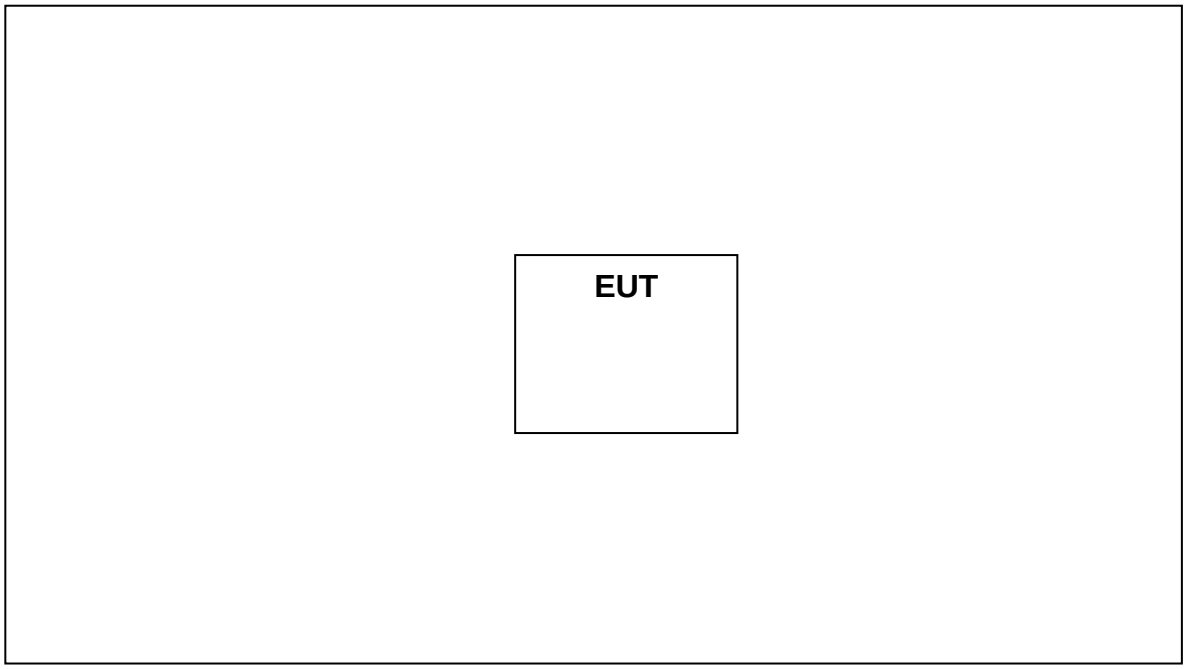
1.4 Summary Of Tests

47 CFR Part 15 Subpart C			
Reference	**Test**	**Results**	**Note**
15.207	Conducted Emission	N/A	Power by Battery
15.209	Radiated Emission	PASS	
15.247(c)	Transmitter Radiated Emissions	PASS	
15.247(b)	Max. Output Power	PASS	
15.247(a)(2)	6dB RF Bandwidth	PASS	
15.247(e)	Max. Power Density	PASS	
15.247(c)	Out of Band Conducted Spurious Emission	PASS	
15.247(d)	Band Edge Measurement	PASS	
15.203	Antenna Requirement	PASS	

1.5 Description of Support Equipment

The EUT itself forms a system. No support equipment is required for its normal operation.

1.6 Configuration of System Under Test



1.7 Test Procedure

All measurements contained in this report were performed according to the techniques described in Measurement procedure ANSI C63.4-2003 followed KDB 558074 v03r01.

1.8 General Test Condition

The conditions under which the EUT operates were varied to determine their effect on the equipment's emission characteristics. The final configuration of the test system and the mode of operation used during these tests were chosen as that which produced the highest emission levels. However, only those conditions which the EUT was considered likely to encounter in normal use were investigated. The systems radiated and conducted emissions were investigated while the computer alternately transferred data to the EUT as well as to the monitor and printer. Using a test program which sent a continuous data and transferred data to and from the EUT was proven to worst case emissions. The system's physical layout and cabling was randomly arranged to ensure that maximum emission levels were attained.

This assessment of the maximum conducted output power tests is base on the minimum transfer rate will produce a maximum output power.

2. Conducted Emissions Requirements

2.1 General & Setup:

The power line conducted emission measurements were performed in a shielded enclosure. The EUT was assembled on a wooden table which is 80 centimeters high, was placed 40 centimeters from the back wall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and EMCO Model 3825/2 Line Impedance Stabilization Networks (LISN). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPER quasi-peak detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

The spectrum was scanned from 150 KHz to 30 MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 2.5.

2.2 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	HP	Spectrum Analyzer	73412A00110	8591EM	2013/03/21	2014/03/21
2.	EMCO	LISN	2658	3825/2	2013/03/01	2014/03/01
3.	TESEQ	ISN	24810	ISN T8	2013/05/22	2014/05/22

2.3 Test condition:

EUT tested in accordance with the specifications given by the manufacturer, and exercised in the most unfavorable manner.

2.4 Conducted Emissions Limits:

FCC Part 15

Frequency range (MHz)	Limits (dBuV)			
	Class A		Class B	
	QP	Avg.	QP	Avg.
0.15 to 0.50	79	66	66 to 56	56 to 46
0.50 to 5.0	73	60	56	46
5.0 to 30	73	60	60	50

2.5 Measurement Data Of Conducted Emissions:

Results: N/A (Powered by battery only)

3. Radiated Emissions Requirements (Below 1GHz)

3.1 General & Setup:

Prior to open-field testing, the EUT was placed in a shielded enclosure and scanned at a close distance to determine its emission characteristics. The physical arrangement of the EUT was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude, directivity, and frequency. The exact system configuration which produced the highest emissions was noted so it could be reproduced later during the open-field tests. This was done to ensure that the final measurements would demonstrate the worst-case interference potential of the EUT. The radiated emissions test is made at a 10 meters open site from 30MHz to 1GHz. The EUT system was placed on a nonconductive turntable which is 0.8 meters height, top surface 1.0 x 1.5 meter. The spectrum was examined from 30 MHz to 1000 MHz using an Hewlett Packard E7403A Spectrum Analyzer, EMCO Biconilog Antenna (Model 3142C) for 30MHz -1GHz. At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization. Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post-detector video filters were used in the test. The spectrum analyzer's 6 dB bandwidth was set to 120 KHz, and the analyzer was operated in the quasi-peak detection mode. The highest emission amplitudes relative to the appropriate limit were measured and recorded in paragraph 3.5.

3.2 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US40240137	E7403A	2013/01/30	2014/01/30
2.	Agilent	Spectrum Analyzer	US39240419	4407B	2013/01/29	2014/01/29
3.	EMCO	Biconilog Antenna	00059739	3142C	2012/09/06	2013/09/06
4.	MLT	Pre Amplifier	20110301	PREAMP6G-02	2013/03/01	2014/03/01
5.	MLT	Pre Amplifier	20110209	PREAMP6G-01	2013/03/01	2014/03/01
6.	EMCO	Biconilog Antenna	00044568	3142C	2012/09/06	2013/09/06

3.3 Test Condition:

EUT tested in accordance with the specifications given by the manufacturer, and exercised in the most unfavorable manner.

3.4 Radiated Emissions Limits:

CISPR 22

Frequency range (MHz)	Limits (dBuV)			
	Class A		Class B	
	Distance (Meter)	Limits (dBuV/m)	Distance (Meter)	Limits (dBuV/m)
30 to 230	10	40	10	30
230 to 1000	10	47	10	37

FCC Part 15

Frequency range (MHz)	Limits (dBuV)			
	Class A		Class B	
	Distance (Meter)	Limits (dBuV/m)	Distance (Meter)	Limits (dBuV/m)
30 to 88	10	39	3	40
88 to 216	10	43.5	3	43.5
216 to 960	10	46.5	3	46
960 to 1000	10	49.5	3	54

3.5 Measurement Data Of Radiated Emissions:

3.5.1 Open Field Radiated Emissions (X axis)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : Worst case (X axis)2445MHz

Radiated Emissions (VERTICAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
30.00	54.25	-18.96	100	150	35.29	40	-4.71
38.37	46.66	-23.06	100	170	23.60	40	-16.40
143.67	51.17	-32.09	100	70	19.08	43.5	-24.42
159.87	51.33	-31.41	100	240	19.92	43.5	-23.58
175.80	50.41	-29.61	100	160	20.80	43.5	-22.70
202.80	48.88	-29.60	100	185	19.28	43.5	-24.22
513.50	48.28	-19.18	100	97	29.10	46	-16.90
640.20	49.33	-14.45	100	115	34.88	46	-11.12
751.50	49.41	-18.95	400	190	30.46	46	-15.54

Radiated Emissions (HORIZONTAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
51.87	54.03	-33.08	400	100	20.95	40	-19.05
113.97	55.93	-38.72	400	250	17.21	43.5	-26.29
143.67	55.62	-37.89	400	45	17.73	43.5	-25.77
159.87	56.26	-34.90	400	130	21.36	43.5	-22.14
175.80	52.80	-34.66	400	265	18.14	43.5	-25.36
519.10	48.96	-15.95	320	240	33.01	46	-12.99
645.80	47.66	-14.29	300	320	33.37	46	-12.63
720.00	49.09	-19.77	150	290	29.32	46	-16.68
783.69	50.15	-20.54	100	83	29.61	46	-16.39

Notes : 1.Margin= Amplitude - Limits

2.Distance of Measurement : 3 Meter

3.Height of table for EUT placed: 0.8 Meter.

4.Amplitude= Reading Amplitude –Amplifier gain+ Cable loss + Antenna factor

5.Pre amplifier Gain :38dB to 42dB

3.5.2 Open Field Radiated Emissions (Y axis)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : Worst case (Y axis)2445MHz

Radiated Emissions (VERTICAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
30.00	54.56	-18.96	100	150	35.60	40	-4.40
37.02	48.40	-24.42	100	225	23.98	40	-16.02
128.01	52.55	-31.57	100	76	20.98	43.5	-22.52
143.67	53.75	-32.09	100	250	21.66	43.5	-21.84
159.87	52.43	-31.41	100	165	21.02	43.5	-22.48
175.80	50.56	-29.61	100	150	20.95	43.5	-22.55
513.50	49.80	-19.18	100	84	30.62	46	-15.38
641.60	48.01	-13.86	150	110	34.15	46	-11.85
755.70	49.33	-17.95	390	200	31.38	46	-14.62

Radiated Emissions (HORIZONTAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
51.87	52.32	-33.08	400	110	19.24	40	-20.76
125.31	55.21	-37.91	400	300	17.30	43.5	-26.20
143.67	53.32	-37.89	400	130	15.43	43.5	-28.07
159.87	54.93	-34.90	400	200	20.03	43.5	-23.47
175.80	54.84	-34.66	400	310	20.18	43.5	-23.32
205.77	50.03	-34.55	334	146	15.48	43.5	-28.02
519.10	48.89	-15.95	365	325	32.94	46	-13.06
643.70	49.61	-15.20	150	280	34.41	46	-11.59
751.68	51.17	-21.31	100	65	29.86	46	-16.14

Notes : 1.Margin= Amplitude - Limits

2.Distance of Measurement : 3 Meter

3.Height of table for EUT placed: 0.8 Meter.

4.Amplitude= Reading Amplitude –Amplifier gain+ Cable loss + Antenna factor

5.Pre amplifier Gain :38dB to 42dB

3.5.3 Open Field Radiated Emissions (Z axis)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : Worst case (Z axis)2445MHz

Radiated Emissions (VERTICAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
30.00	54.64	-18.96	100	165	35.68	40	-4.32
38.37	46.43	-23.06	100	106	23.37	40	-16.63
128.01	51.53	-31.57	100	185	19.96	43.5	-23.54
143.67	53.67	-32.09	100	155	21.58	43.5	-21.92
159.87	53.07	-31.41	100	204	21.66	43.5	-21.84
176.07	50.05	-29.60	100	186	20.45	43.5	-23.05
514.20	48.73	-19.16	300	105	29.57	46	-16.43
641.60	49.77	-13.86	350	190	35.91	46	-10.09
783.70	49.68	-17.83	400	225	31.85	46	-14.15

Radiated Emissions (HORIZONTAL)Class B							
Frequency (MHz)	Read (dBuV/m)	Factor	Ant. (cm)	Table (Degree)	Amplitude (dBuV/m)	Limits (dBuV/m)	Margin (dB)
51.87	52.99	-33.08	400	150	19.91	40	-20.09
113.97	56.27	-38.72	400	226	17.55	43.5	-25.95
143.67	52.87	-37.89	400	47	14.98	43.5	-28.52
159.87	53.78	-34.90	400	100	18.88	43.5	-24.62
199.02	50.10	-34.93	350	225	15.17	43.5	-28.33
519.10	48.02	-15.95	330	150	32.07	46	-13.93
592.60	49.60	-22.00	400	285	27.60	46	-18.40
647.20	49.38	-15.12	150	250	34.26	46	-11.74
855.10	50.52	-20.25	145	300	30.27	46	-15.73

Notes : 1.Margin= Amplitude - Limits

2.Distance of Measurement : 3 Meter

3.Height of table for EUT placed: 0.8 Meter.

4.Amplitude= Reading Amplitude –Amplifier gain+ Cable loss + Antenna factor

5.Pre amplifier Gain :38dB to 42dB

4. Maximum Conducted Output Power Requirements

4.1 Test Condition & Setup:

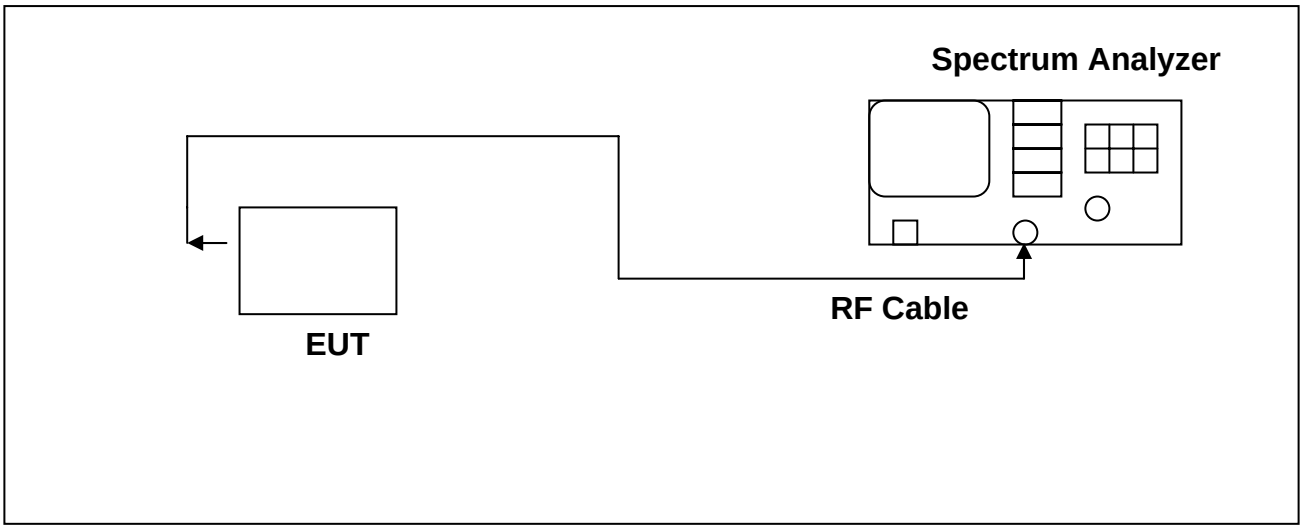
While testing, EUT was set to transmit continuously. Remove the Subjective device's antenna and connect the RF output port to spectrum analyzer. The maximum peak output power shall not exceed 1 watt.

The antenna port of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm). For antennas with gains greater than 6 dBi, transmitter output level must be decreased by an amount equal to (GAIN - 6)/3 dBm.

Measurement procedure is followed KDB 558074 v03r01 (9.1.2 : Integrated band power method)

4.2 Test Instruments Configuration:



4.3 Test Equipment List:

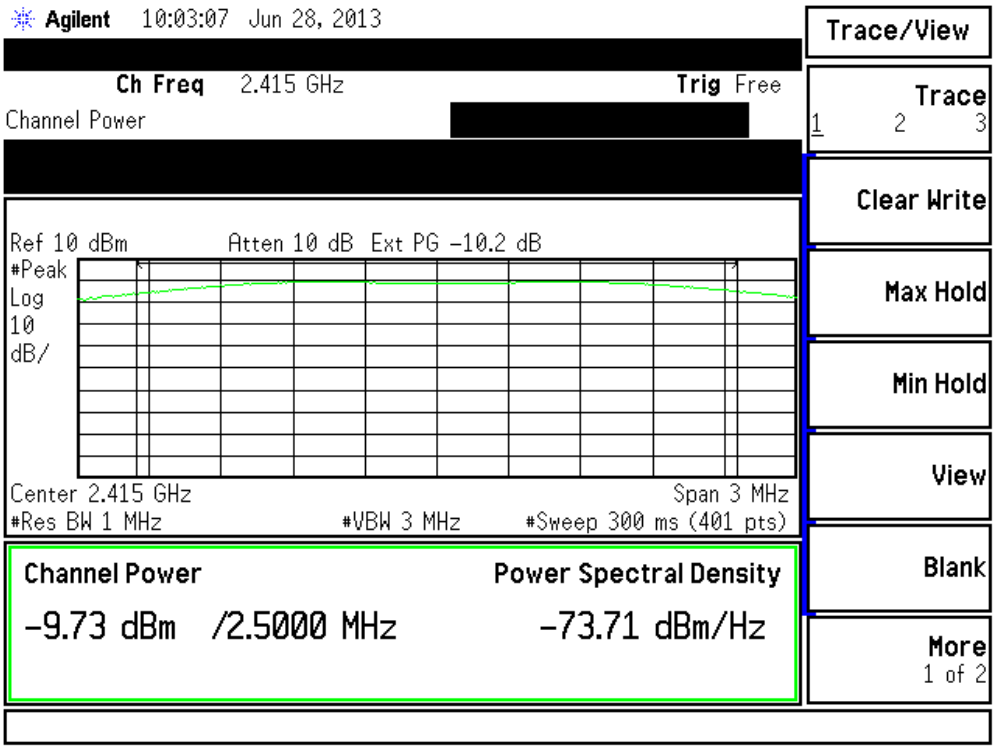
Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US39240419	E4407B	2013/01/29	2014/01/29

4.4 Test Result:

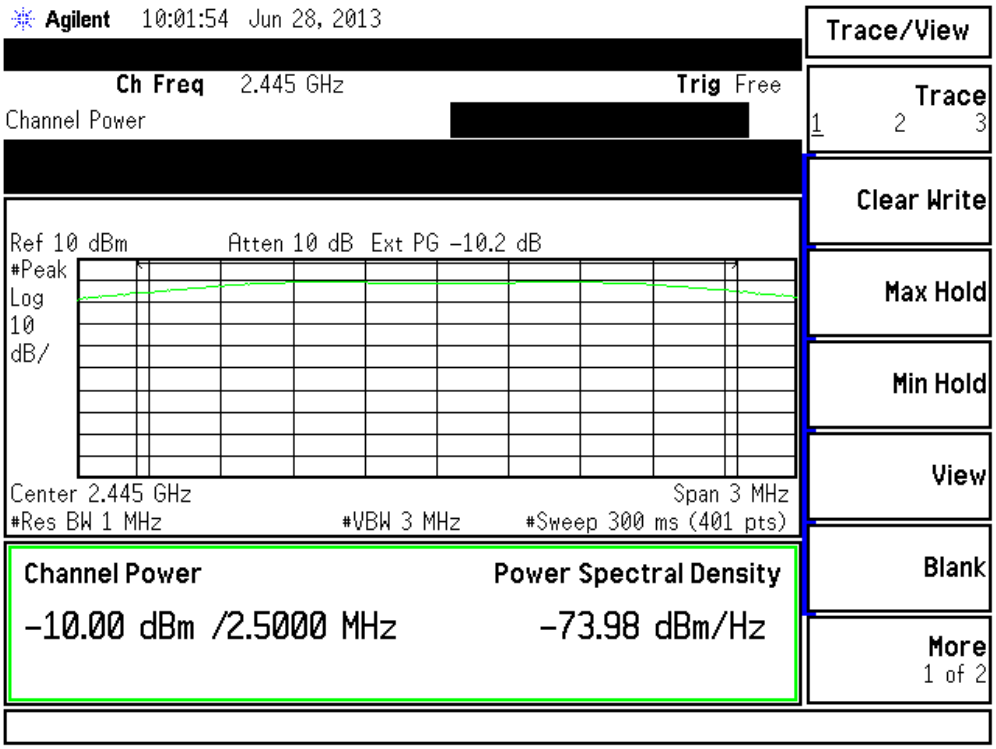
Frequency (MHz)	Output(dBm)	Required Limit
2415	-9.73	<30dBm
2445	-10.00	<30dBm
2475	-10.02	<30dBm

Note : 1. Cable Loss = 10.2dB.
2. Result= Instrument reading value + Cable Loss.

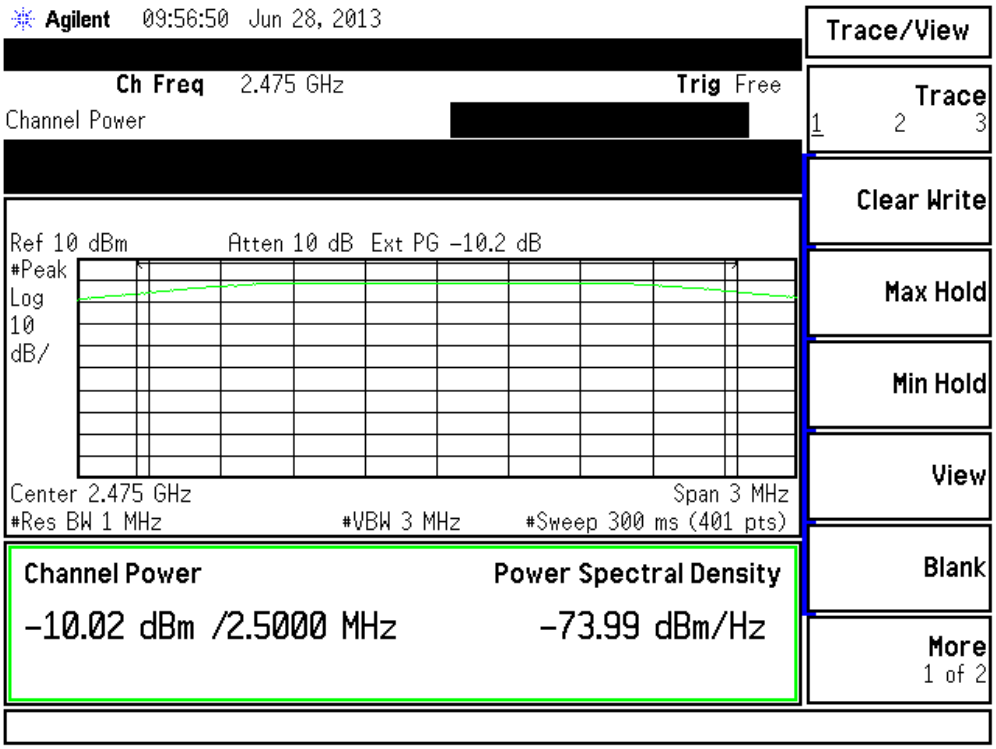
(2415MHz)



(2445MHz)



(2475MHz)



5. Minimum 6dB RF Bandwidth Requirements

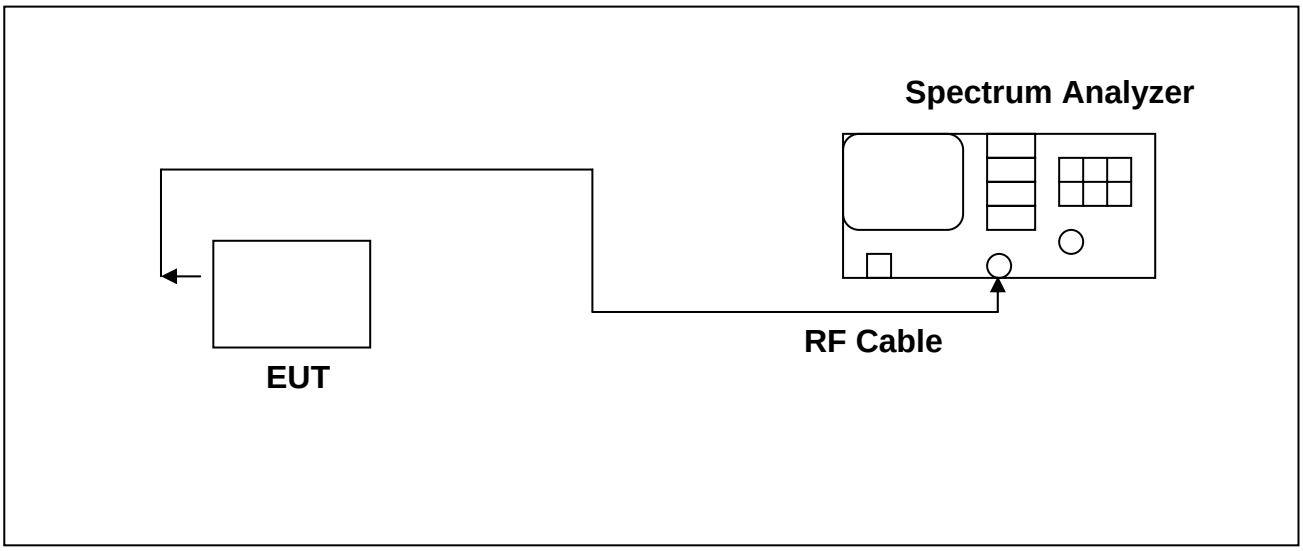
5.1 Test Condition & Setup:

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW set to 100 kHz .VBW set to 300kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

The test was performed at 3 channels.

Measurement procedure is followed KDB 558074 v03r01 (8.1 option 1: DTS bandwidth)

5.2 Test Instruments Configuration:



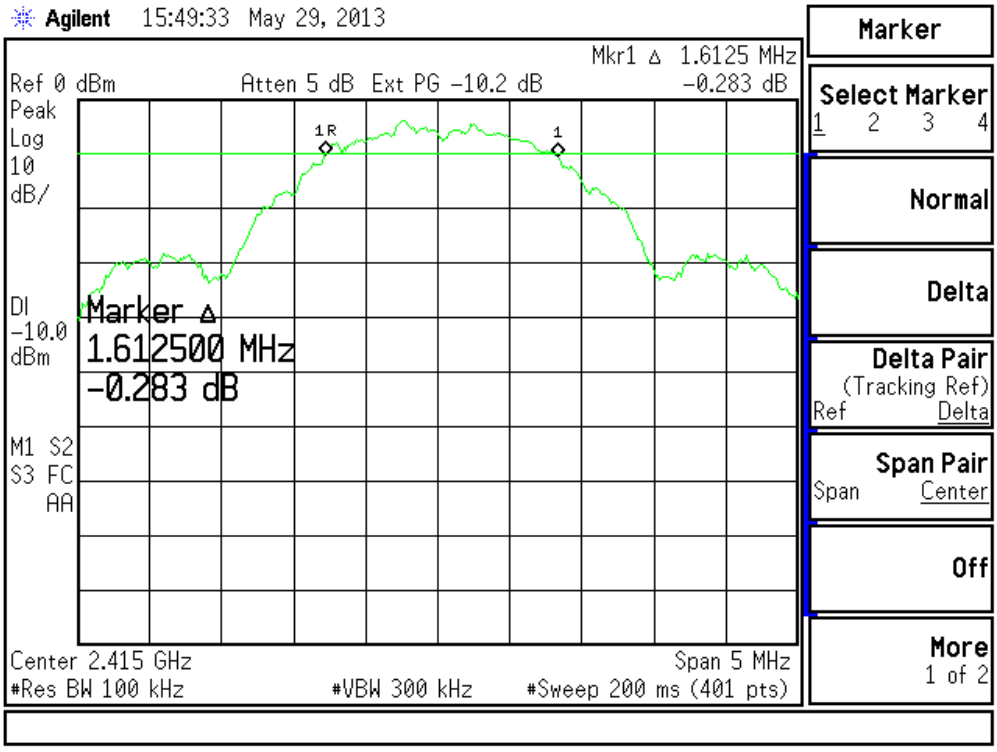
5.3 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US39240419	E4407B	2013/01/29	2014/01/29

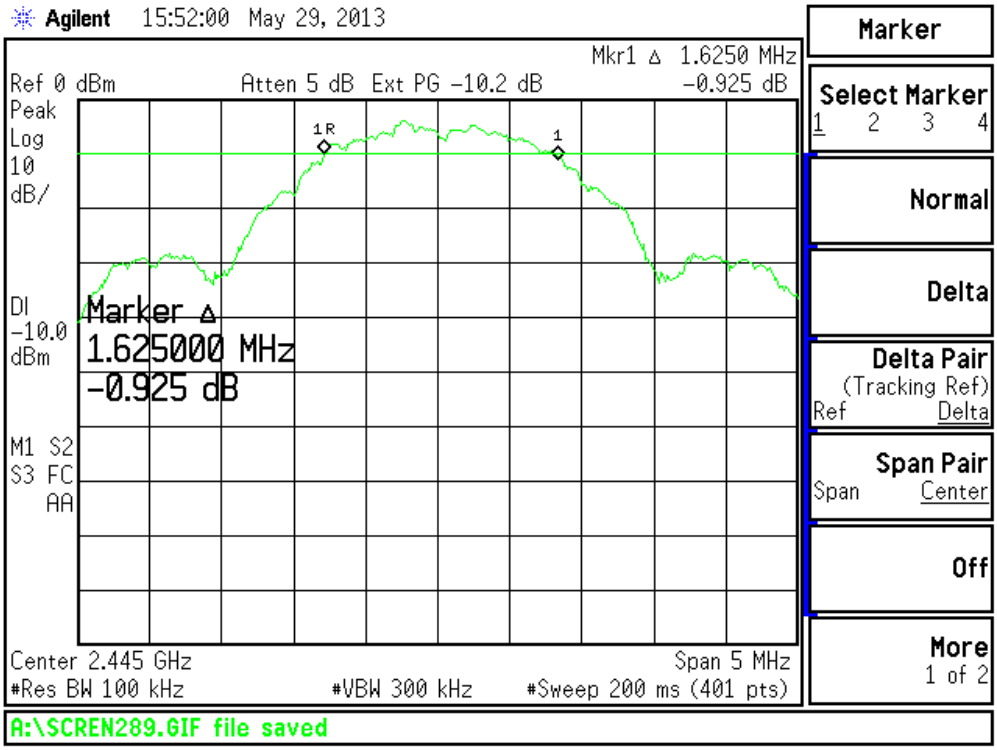
5.4 Test Result:

Frequency (MHz)	Min. 6dB Bandwidth (MHz)	Required Limit
2415	1.6125	>500KHz
2445	1.6250	>500KHz
2475	1.6250	>500KHz

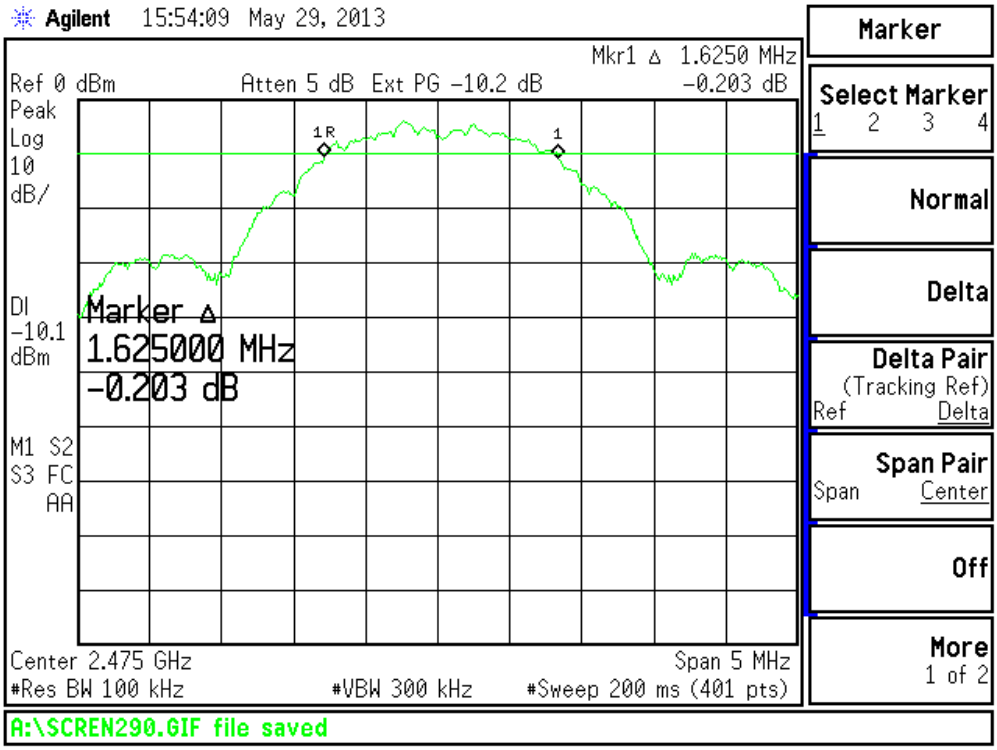
(2415MHz)



(2445MHz)



(2475MHz)



6. Maximum Power Density Requirements

6.1 Test Condition & Setup:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RBW =100kHz , VBW=300kHz ,

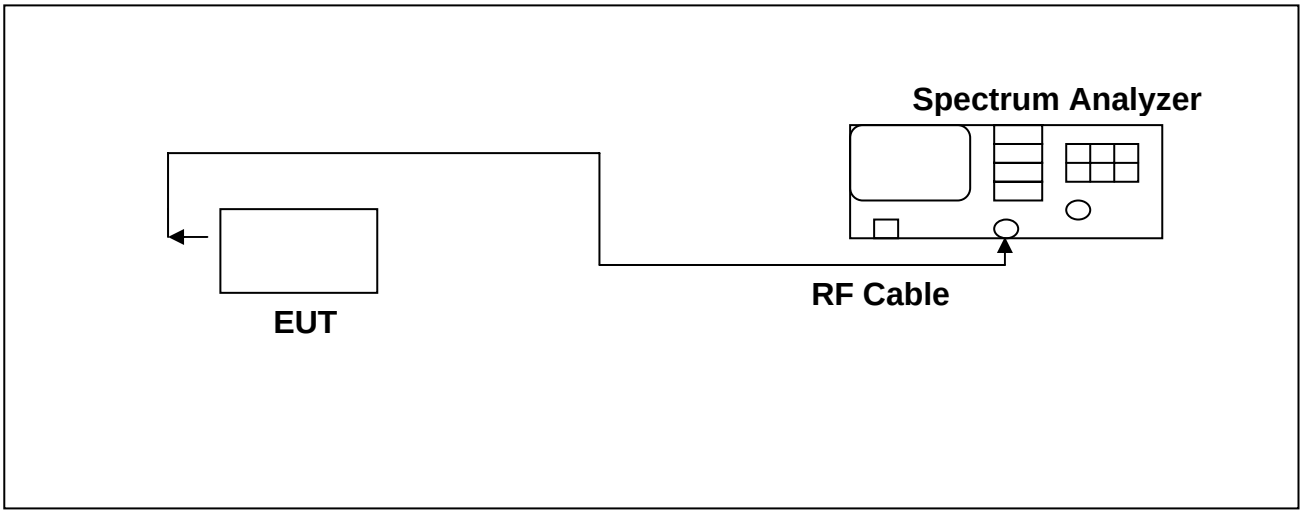
Detector = peak , Sweep time = auto couple , Trace Mode = max hold , Allow trace to fully stabilize. Use the peak marker function to determine the maximum amplitude level in any 100kHz band segment within the fundamental EBW.

Scale the observed power level to an equivalent value in 3kHz by adjusting.

Bandwidth correction factor = 10log(3kHz / 100kHz) == -15.2dB

Measurement procedure is followed KDB 558074 v03r01 (10.2 Method PKPSD (peak PSD)

6.2 Test Instruments Configuration:



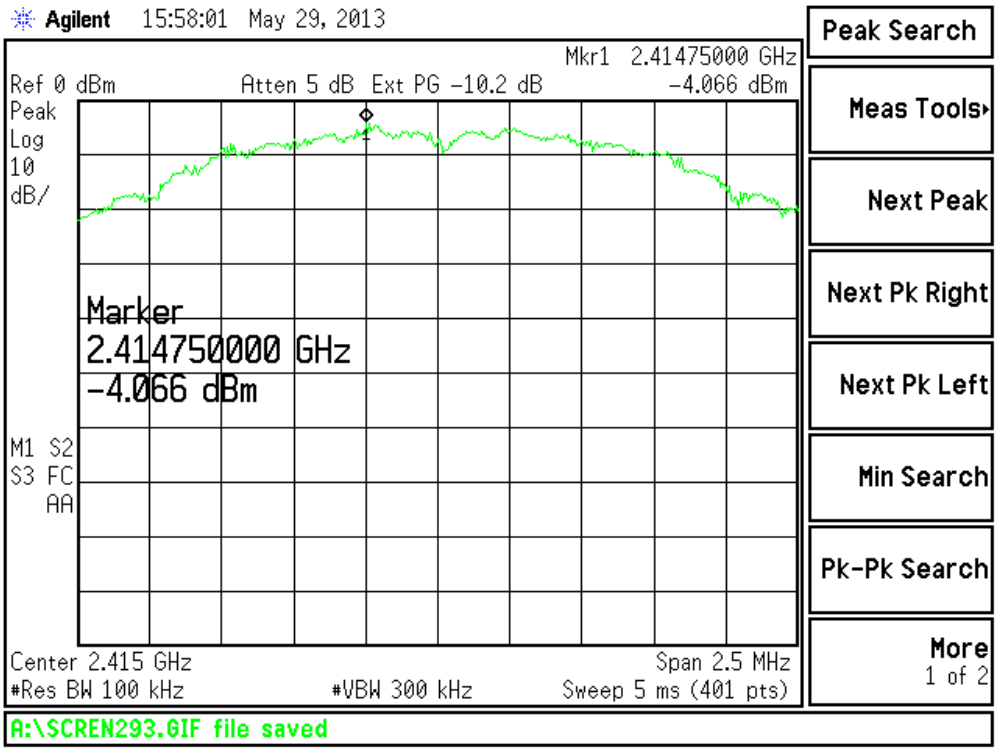
6.3 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US39240419	E4407B	2013/01/29	2014/01/29

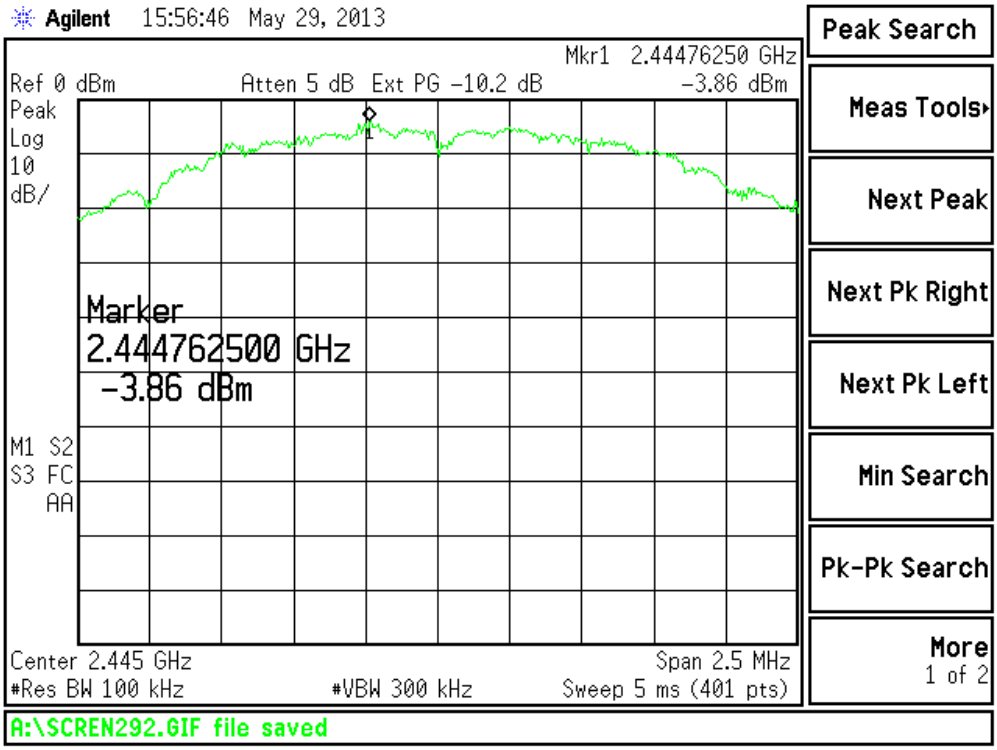
6.4 Test Result:

Frequency (MHz)	Power Density (dBm)	Results PSD/3kHz(dBm)	Required Limit
2415	-4.066	-19.266	<8dBm
2445	-3.860	-19.060	<8dBm
2475	-4.414	-19.614	<8dBm

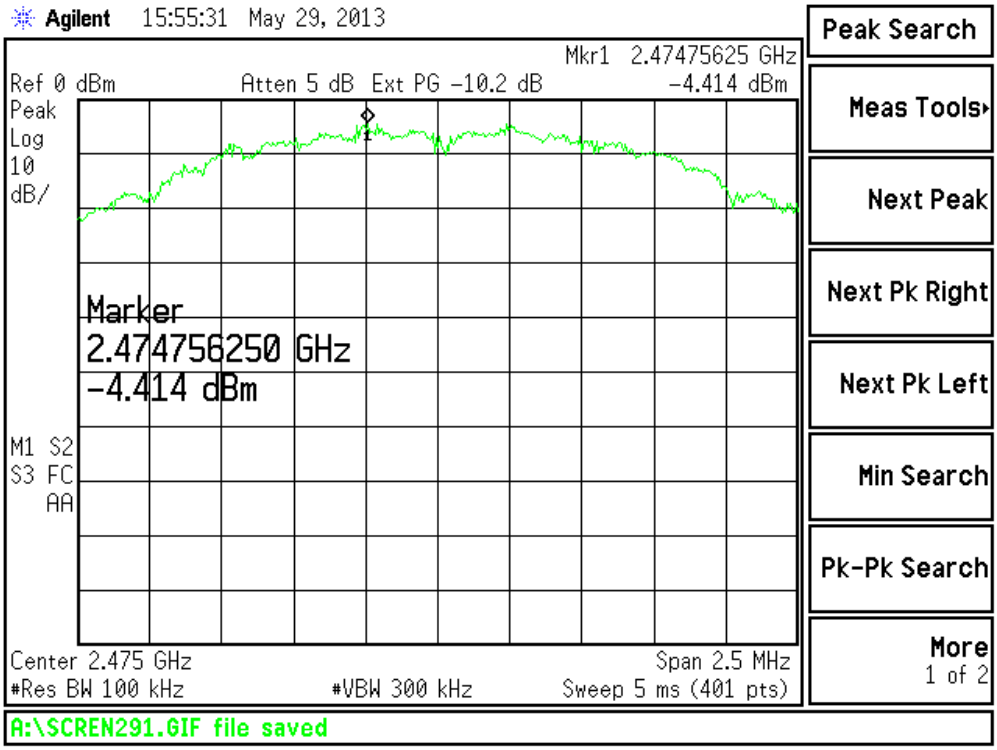
(2415MHz)



(2445MHz)



(2475MHz)



7. Out of Band Conducted Spurious Emissions Requirements

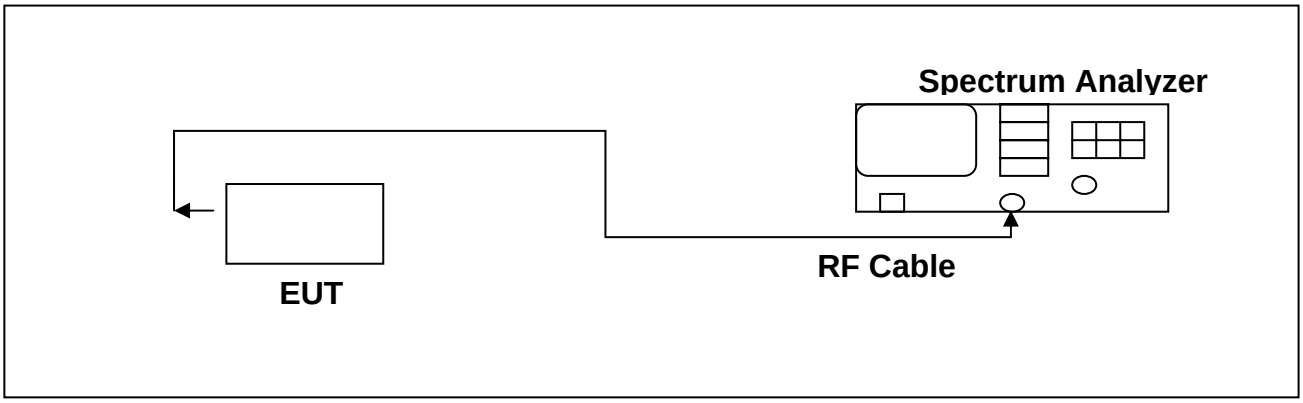
7.1 Test Condition & Setup:

In any 100 kHz bandwidth outside the EUT pass band, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the pass band. The test was performed at 3 channels.

Measurement procedure is followed KDB 558074 v03r01 (11.3 Emission level measurement)

7.2 Test Instruments Configuration:



7.3 Test Equipment List:

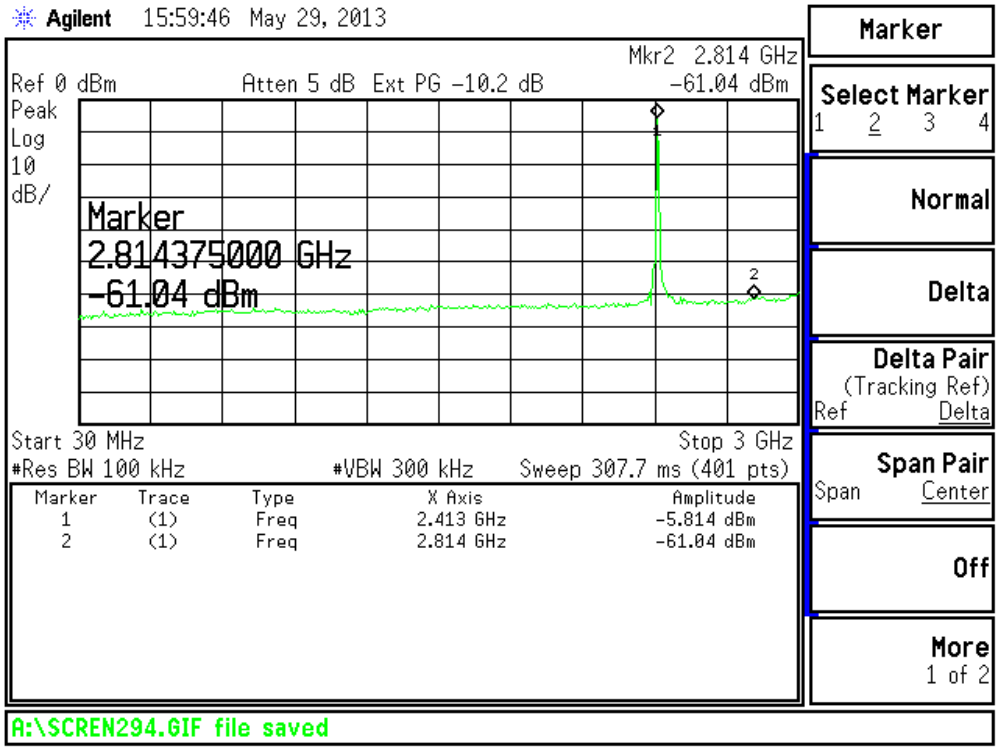
Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US39240419	E4407B	2013/01/29	2014/01/29

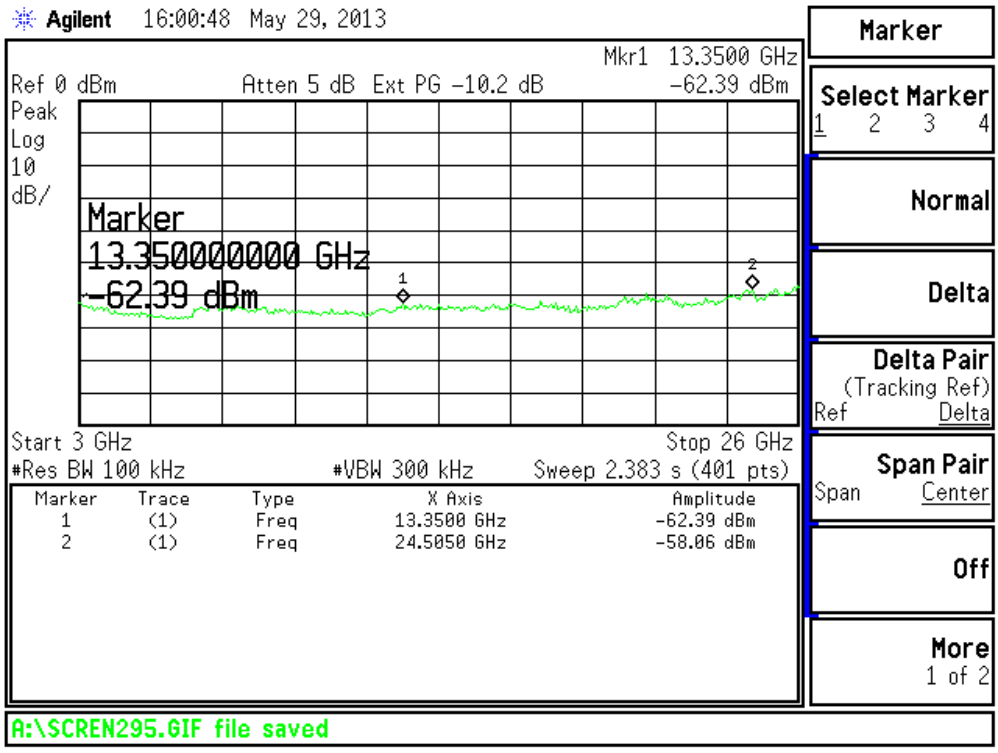
7.4 Test Result:

Refer to attached data sheets. Data shows out of band emissions are suppressed well below the -20 dBc minimum required by the Rules.

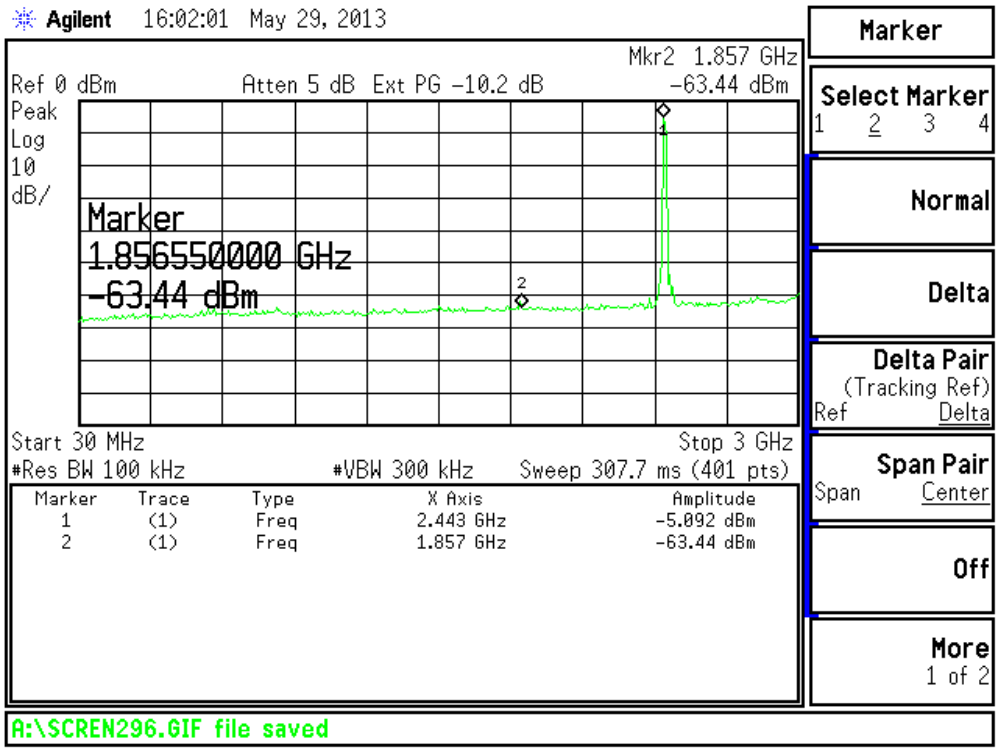
For the result, if the spurious emission of two antennas have the same frequency, we choice the worst one and add 3dB to be the final result, otherwise, use the graph to represent it.

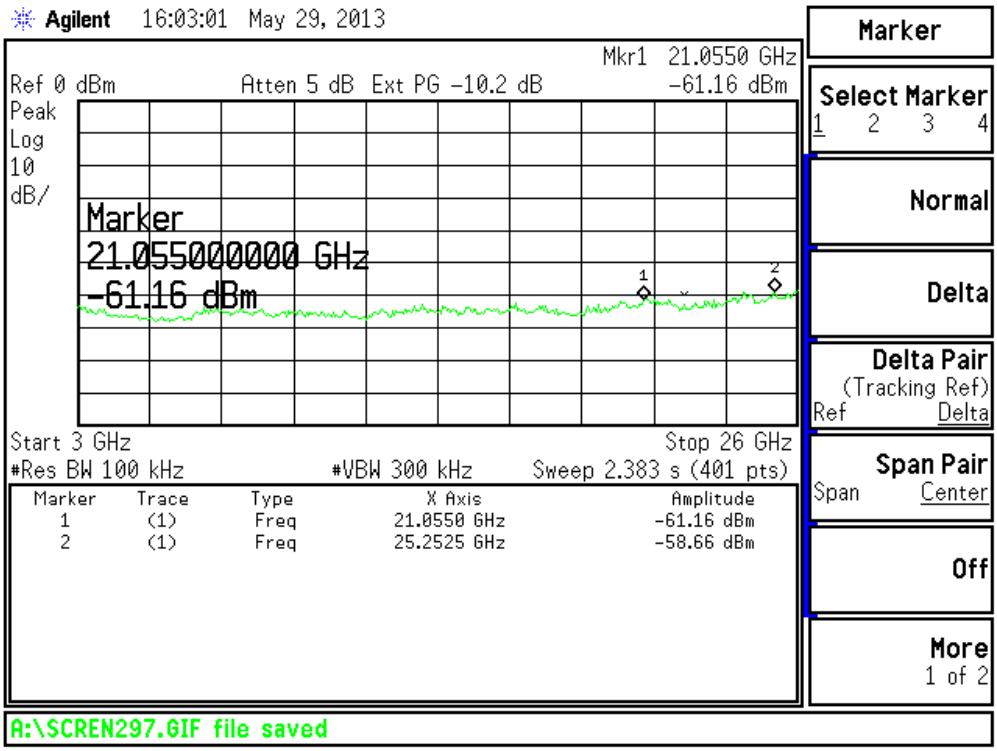
(2415MHz)



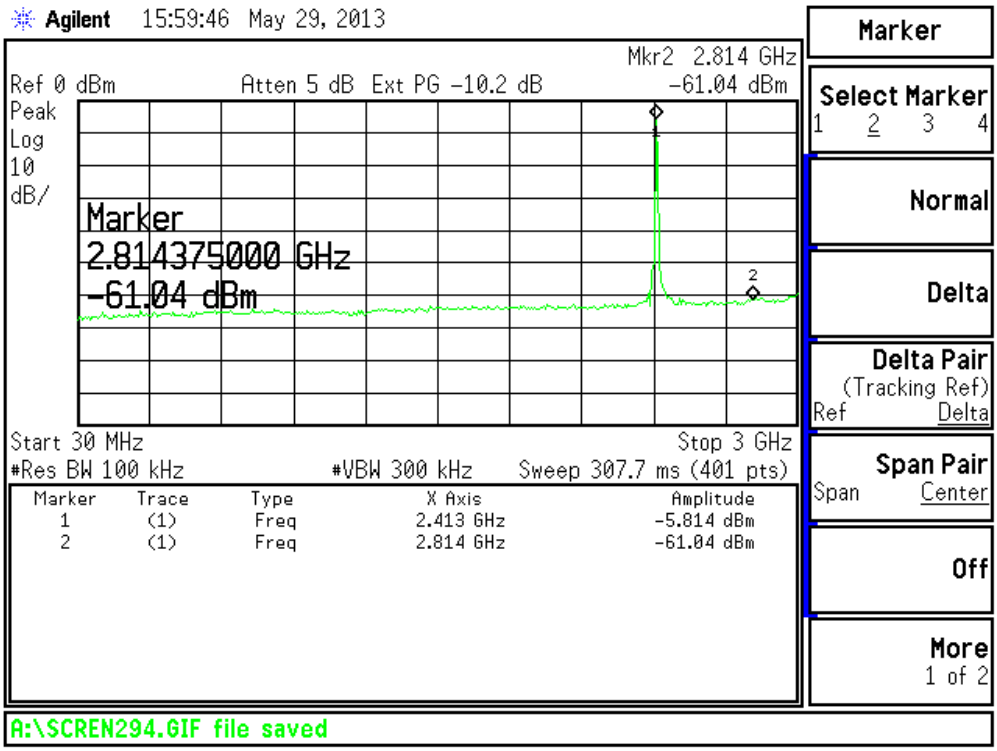

Agilent 16:00:48 May 29, 2013
Mkr1 13.3500 GHz
Ref 0 dBm
Atten 5 dB Ext PG -10.2 dB
-62.39 dBm
Peak
Log
10
dB/
Marker
13.350000000 GHz
-62.39 dBm
Start 3 GHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.383 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 13.3500 GHz -62.39 dBm
2 (1) Freq 24.5050 GHz -58.06 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2
A:\SCREN295.GIF file saved

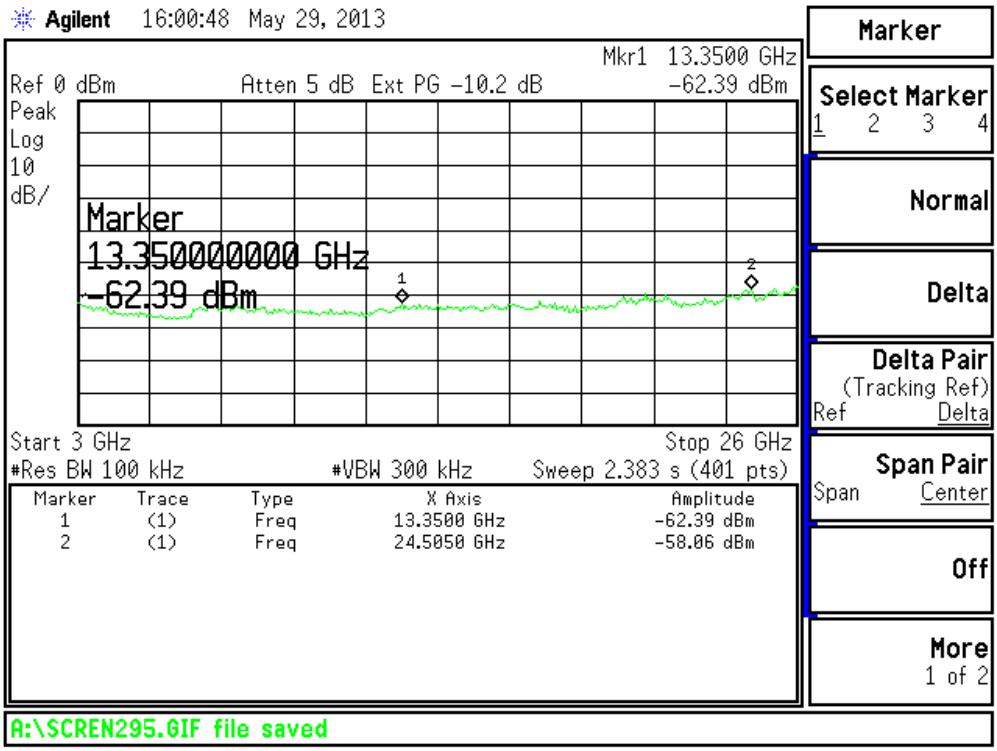
(2445MHz)


Agilent 16:02:01 May 29, 2013
Mkr2 1.857 GHz
Ref 0 dBm
Atten 5 dB Ext PG -10.2 dB
-63.44 dBm
Peak
Log
10
dB/
Marker
1.856550000 GHz
-63.44 dBm
Start 30 MHz
Stop 3 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 307.7 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.443 GHz -5.092 dBm
2 (1) Freq 1.857 GHz -63.44 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2
A:\SCREN296.GIF file saved


Agilent 16:03:01 May 29, 2013
Mkr1 21.0550 GHz
Ref 0 dBm
Atten 5 dB Ext PG -10.2 dB
-61.16 dBm
Peak
Log
10
dB/
Marker
21.055000000 GHz
-61.16 dBm
Start 3 GHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.383 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 21.0550 GHz -61.16 dBm
2 (1) Freq 25.2525 GHz -58.66 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2
A:\SCREN297.GIF file saved

(2475MHz)


Agilent 15:59:46 May 29, 2013
Mkr2 2.814 GHz
Ref 0 dBm
Atten 5 dB Ext PG -10.2 dB
-61.04 dBm
Peak
Log
10
dB/
Marker
2.814375000 GHz
-61.04 dBm
Start 30 MHz
Stop 3 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 307.7 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.413 GHz -5.814 dBm
2 (1) Freq 2.814 GHz -61.04 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2
A:\SCREN294.GIF file saved


Agilent 16:00:48 May 29, 2013
Mkr1 13.3500 GHz
Ref 0 dBm
Atten 5 dB Ext PG -10.2 dB
-62.39 dBm
Peak
Log
10
dB/
Marker
13.350000000 GHz
-62.39 dBm
Start 3 GHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.383 s (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 13.3500 GHz -62.39 dBm
2 (1) Freq 24.5050 GHz -58.06 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2
A:\SCREN295.GIF file saved

8. Band Edges Requirements

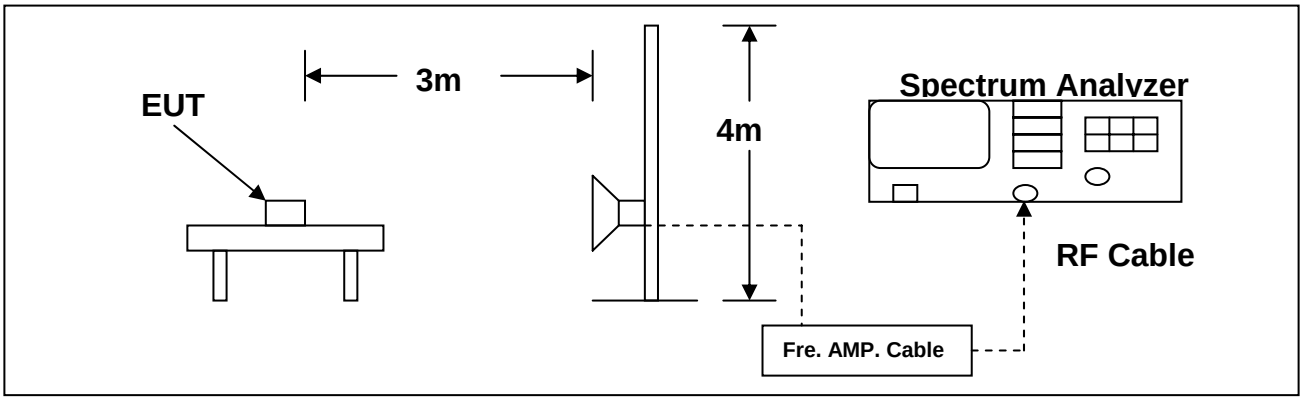
8.1 Test Condition & Setup:

The emissions on the harmonics frequencies, the limits, and the margin of compliance are presented. These tests were made when the transmitter was in full radiated power. The additional test was performed to show compliance with the requirement at the band edge frequency 2400 MHz and up to 2483.5 MHz.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Measurement procedure followed KDB 558074 v03r01 (13.3.1 Peak Detection)

8.2 Test Instruments Configuration:



8.3 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US44300422	E4446A	2012/12/14	2013/12/14
2.	TA	Pre Amplifier	RF01	0.10~19.1GHz 60dBm	2012/08/24	2013/08/24
3.	SCHWARZBECK	Horn Antenna	304	BBHA 9120 D	2012/10/15	2013/10/15
4.	Agilent	Spectrum Analyzer	US39240419	E4407B	2013/01/29	2014/01/29
5.	MLT	Pre Amplifier	20110209	PREAMP6G-01	2013/03/01	2014/03/01

8.4 Test Result:

8.4.1 Test mode : X-Axis

Radiated Emissions (HORIZONTAL) 2415MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2399.6	47.4 (PK)	1	95	0	74.0(PK)	-26.6
2399.6	46.2 (AV)	1	95	0	54.0(AV)	-7.8

Radiated Emissions (VERTICAL) 2415MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2397.2	46.8 (PK)	1	130	0	74.0(PK)	-27.2
2397.2	45.6 (AV)	1	130	0	54.0(AV)	-8.4

Radiated Emissions (HORIZONTAL) 2475MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2485.0	50.9 (PK)	1	115	0	74.0(PK)	-23.1
2485.0	49.4 (AV)	1	115	0	54.0(AV)	-4.6

Radiated Emissions (VERTICAL) 2475MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2485.8	51.9 (PK)	1	126	0	74.0(PK)	-22.1
2485.8	50.4 (AV)	1	126	0	54.0(AV)	-3.6

Notes : 1.Margin= Amplitude - Limits

2. Height of table for EUT placed: 0.8 Meter.
3. ANT= Antenna height.
4. Duty= Duty cycle correction factor.
5. Amplitude= Reading Amplitude – Amplifier gain+ Cable loss+ Antenna factor (Auto calculate in spectrum analyzer)

8.4.2 Test mode : Y-Axis

Radiated Emissions (HORIZONTAL) 2415MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2397.3	49.0 (PK)	1	87	0	74.0(PK)	-25.0
2397.3	47.8 (AV)	1	87	0	54.0(AV)	-6.2

Radiated Emissions (VERTICAL) 2415MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2398.3	50.5 (PK)	1	115	0	74.0(PK)	-23.5
2398.3	49.3 (AV)	1	115	0	54.0(AV)	-4.7

Radiated Emissions (HORIZONTAL) 2475MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2485.1	48.3 (PK)	1	95	0	74.0(PK)	-25.7
2485.1	46.9 (AV)	1	95	0	54.0(AV)	-7.1

Radiated Emissions (VERTICAL) 2475MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2485.4	52.4 (PK)	1	130	0	74.0(PK)	-21.6
2485.4	51.0 (AV)	1	130	0	54.0(AV)	-3.0

Notes : 1.Margin= Amplitude - Limits

2. Height of table for EUT placed: 0.8 Meter.
3. ANT= Antenna height.
4. Duty= Duty cycle correction factor.
5. Amplitude= Reading Amplitude – Amplifier gain+ Cable loss+ Antenna factor (Auto calculate in spectrum analyzer)

8.4.3 Test mode : Z-Axis

Radiated Emissions (HORIZONTAL) 2415MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2399.2	52.0 (PK)	1	153	0	74.0(PK)	-22.0
2399.2	50.8 (AV)	1	153	0	54.0(AV)	-3.2

Radiated Emissions (VERTICAL) 2415MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2397.8	47.9 (PK)	1	140	0	74.0(PK)	-26.1
2397.8	46.7 (AV)	1	140	0	54.0(AV)	-7.3

Radiated Emissions (HORIZONTAL) 2475MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2484.3	54.4 (PK)	1	145	0	74.0(PK)	-19.6
2484.3	53.0 (AV)	1	145	0	54.0(AV)	-1.0

Radiated Emissions (VERTICAL) 2475MHz						
Frequency (MHz)	Amplitude (dBuV/m)	Ant. (m)	Table (Degree)	Duty (dB)	Limit (dBuV/m)	Margin (dB)
2485.8	50.9 (PK)	1	125	0	74.0(PK)	-23.1
2485.8	49.4 (AV)	1	125	0	54.0(AV)	-4.6

Notes : 1.Margin= Amplitude - Limits

2. Height of table for EUT placed: 0.8 Meter.
3. ANT= Antenna height.
4. Duty= Duty cycle correction factor.
5. Amplitude= Reading Amplitude – Amplifier gain+ Cable loss+ Antenna factor (Auto calculate in spectrum analyzer)

9. Radiated Emissions Requirements (Above 1GHz)

9.1 General and setup:

Prior to open-field testing, the EUT was placed in a shielded enclosure and scanned at a close distance to determine its emission characteristics. The physical arrangement of the EUT was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude, directivity, and frequency. The exact system configuration which produced the highest emissions was noted so it could be reproduced later during the open field tests. This was done to ensure that the final measurements would demonstrate the worst-case interference potential of the EUT.

Final radiation measurements were made on a three-meter, open-field test site. The EUT system was placed on a nonconductive turntable which was 0.8 meters height, top surface 1.0 x 1.5 meter. During the test, EUT was set to transmit continuously & measurements spectrum range from 30 MHz to 26.5 GHz is investigated.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

A nonconductive material surrounded the EUT to supporting the EUT for standing on tree orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer’s 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvlt (dBuV) into field intensity in microvolts pre meter(uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in microcolts per meter (dBuV/m).

The actual field is intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

Amplitude (dBuV/m)= FI(dBuV)+AF(dBuV)+CL(dBuV)-Gain(dB)

FI= Reading of the field intensity.
AF= Antenna factor.
CL= Cable loss.

P.S Amplitude is auto calculate in spectrum analyzer.

The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:

(1) For fundamental frequency : Transmitter Output < +30dBm

(2) For spurious frequency : Spurious emission limits = fundamental emission limit /10

9.2 Test Equipment List:

Item	Mfr/Brand	Instruments	Serial No.	Model/Type No.	Calibrated Date	Next Cal. Date
1.	Agilent	Spectrum Analyzer	US44300422	E4446A	2012/12/14	2013/12/14
2.	TA	Pre Amplifier	RF01	0.10~19.1GHz 60dBm	2012/08/24	2013/08/24
3.	Herotek	Pre Amplifier	30690	A402-417	2012/11/02	2013/11/02
4.	SCHWARZBECK	Horn Antenna	181	BBHA 9170	2012/11/18	2013/11/18
5.	SCHWARZBECK	Horn Antenna	304	BBHA 9120 D	2012/10/15	2013/10/15
6.	Agilent	Spectrum Analyzer	US39240419	E4407B	2013/01/29	2014/01/29
7.	MLT	Pre Amplifier	TA010-190-30	RF03	2012/07/20	2013/07/20

9.3 Test Condition:

EUT tested in accordance with the specifications given by the manufacturer, and exercised in the most unfavorable manner.

Peak Measurement RBW set to 1MHz , VBW set to 3MHz

Average Measurement RBW set to 1MHz , VBW set to 10Hz

The X axial at Pre-test procedure is the worst case, the final result shown on this report is based on this condition.

9.4 Radiated Emissions Limits:

Frequency range (MHz)	Peak (dBuV/m)	Average (dBuV/m)
Above 1000	74	54

9.5 Measurement Data Of Radiated Emissions:

9.5.1 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : Worst case (X axis) 2415MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
2896.0	39.12	31.28	1.53	36.65	32.81	74.00	54.00	-37.35	-21.19
14550.0	55.24	41.83	-11.65	43.59	30.18	74.00	54.00	-30.41	-23.82
17895.0	50.66	37.56	-2.52	48.14	35.04	74.00	54.00	-25.86	-18.96

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
10515.0	60.31	48.73	-12.22	48.09	36.51	74.00	54.00	-25.91	-17.49
13770.0	54.20	41.32	-10.81	43.39	30.51	74.00	54.00	-30.61	-23.49
17895.0	51.35	39.54	-2.52	48.83	37.02	74.00	54.00	-25.17	-16.98

Notes : 1.Margin= Amplitude - Limits

2.Distance of Measurement : 3 Meter

3.Height of table for EUT placed: 0.8 Meter.

4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor (Auto calculate in spectrum analyzer)

5.The other emission levels were very low against the limit.

6. Pre Amplifier (RF01) Gain :63dB to 69dB

7. Pre Amplifier (30690) Gain :38dB to 50dB

9.5.2 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : Worst case (Y axis) 2415MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
10515.0	59.54	46.17	-12.22	47.32	33.95	74.00	54.00	-26.68	-20.05
14715.0	55.24	42.06	-11.73	43.51	30.33	74.00	54.00	-30.49	-23.67
17895.0	50.80	39.85	-2.52	48.28	37.33	74.00	54.00	-25.72	-16.67

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
10515.0	63.34	50.79	-12.22	51.12	38.57	74.00	54.00	-22.88	-15.43
14520.0	54.36	40.94	-11.40	42.96	29.54	74.00	54.00	-31.04	-24.46
17925.0	51.26	43.18	-2.31	48.95	40.87	74.00	54.00	-25.05	-13.13

Notes : 1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor
(Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

9.5.3 Open Field Radiated Emissions (Subpart C)

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following

Test Mode : Worst case (Z axis) 2415MHz

Radiated Emissions (VERTICAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
8820.0	59.24	47.27	-16.65	42.59	30.62	74.00	54.00	-31.41	-23.38
10515.0	55.83	45.83	-12.22	43.61	33.61	74.00	54.00	-30.39	-20.39
17910.0	50.50	39.03	-2.41	48.09	36.62	74.00	54.00	-25.91	-17.38

Radiated Emissions (HORIZONTAL)									
Frequency (MHz)	Read (dBuV/m)		Factor	Amplitude (dBuV/m)		Limits (dBuV/m)		Margin (dB)	
	PK	AV		PK	AV	PK	AV	PK	AV
10515.0	60.90	31.54	-12.22	48.68	33.26	74.00	54.00	-25.32	-20.74
14700.0	54.87	57.56	-11.59	43.28	45.34	74.00	54.00	-30.72	-8.66
17745.0	50.96	47.22	-3.36	47.60	35.53	74.00	54.00	-26.40	-18.47

Notes : 1.Margin= Amplitude - Limits
2.Distance of Measurement : 3 Meter
3.Height of table for EUT placed: 0.8 Meter.
4.Amplitude= Reading Amplitude – Amplifier gain + Cable loss + Antenna factor
(Auto calculate in spectrum analyzer)
5.The other emission levels were very low against the limit.
6. Pre Amplifier (RF01) Gain :63dB to 69dB
7. Pre Amplifier (30690) Gain :38dB to 50dB

10. Antenna Requirements

10.1 Standard Applicable:

For intentional device, according to 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

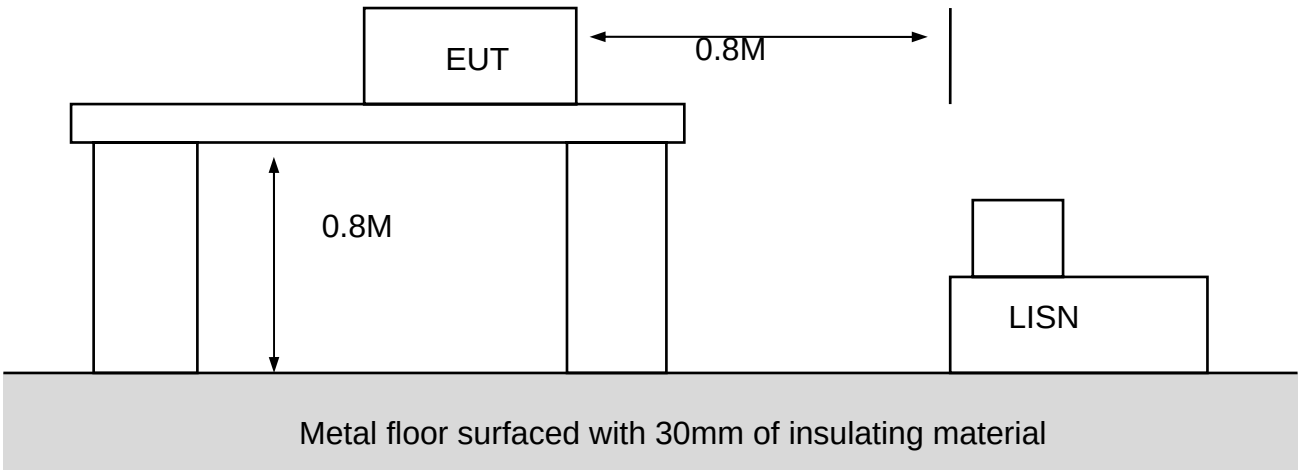
And According to 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

10.2 Antenna Construction:

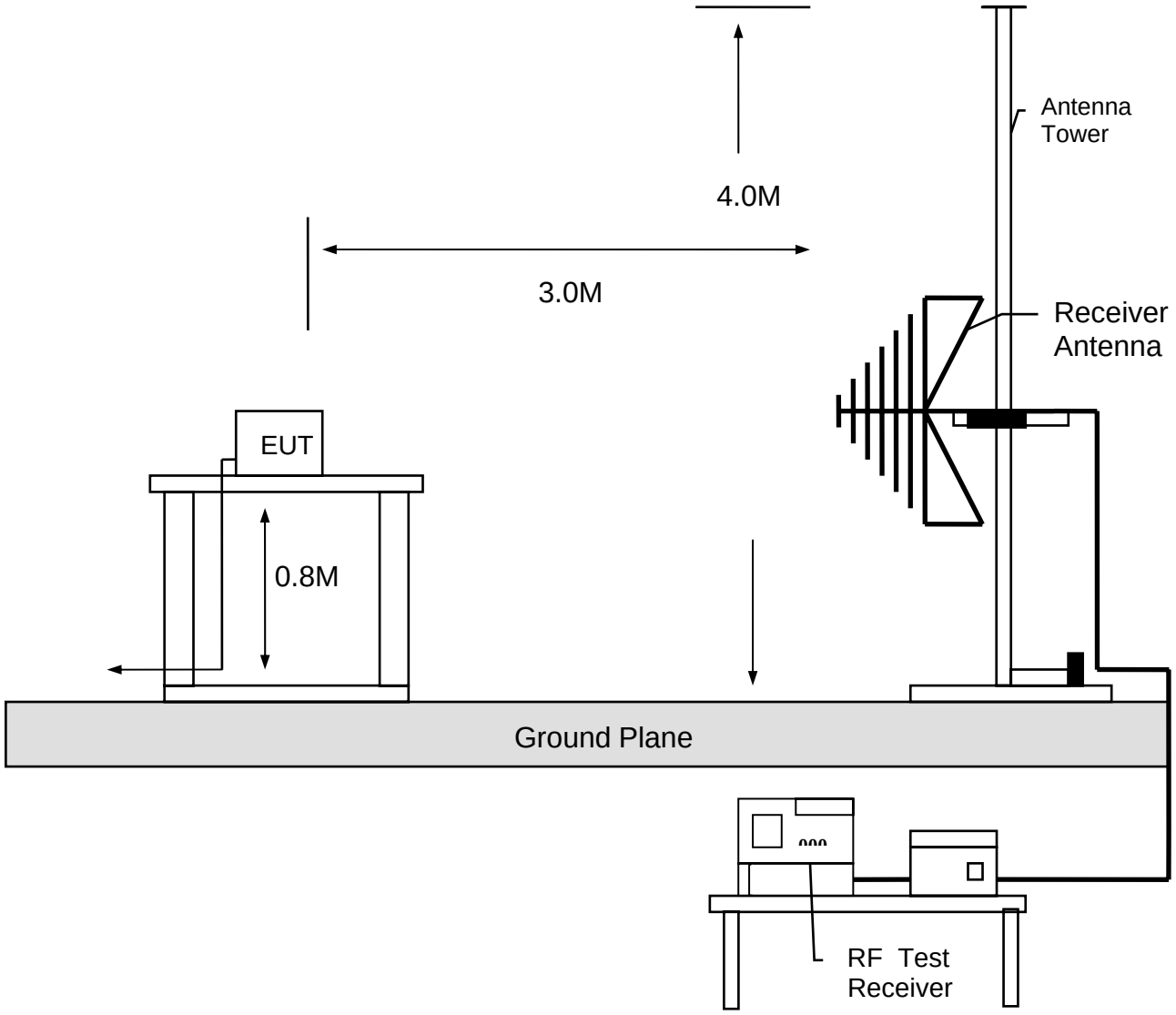
Ant. Type	Gain	type of connector
F Type	2.2 dBi	PCB

Appendix I - EUT Test Setup

MEASUREMENT OF POWER LINE CONDUCTED RFI VOLTAGE



MEASUREMENT OF RADIATED EMISSION



Appendix II - Brand / Trade Name & Model No. Multiple Listee

Model No.	Trade Name