849 NW State Road 45
Newberry, FL 32669 USA
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FCC PART 15.247 & IC RSS-247

2.4 GHz DTS

TEST REPORT

Applicant	**PANDUIT CORP.**
Address	**1819 ATLANTA HWY CUMMING, GA USA 30040**
FCC ID	**2ABED-1167**
IC	**11688B-1167**
Model Number	1167
Product Description	WIRELESS MESH GATEWAY
Date Sample Received	9/14/2017
Final Test Date	9/14/2017
Original Test Date	11/16/2015
Tested By	Tim Royer
Approved By	Franklin Rose

Report Number	Version Number	Description	Issue Date
1659BUT17TestReport	Rev1	Initial Issue	10/17/2017
	Rev2	Updated technical information	12/28/2017
	Rev3	Updated technical information	12/29/2017
	Rev4	Updated technical information	2/1/2018

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GENERAL REMARKS

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Summary

The device under test does:

☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.

☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Sr. EMC Engineer
EMC-003838-NE

Tested by:
Name and Title: Tim Royer, Project Manager/Testing Engineer

Date: 10/17/2017

Reviewed and approved by:
Name and Title: Franklin Rose, Project Manager/Testing Technician

Date: 02/01/2018

GENERAL INFORMATION

EUT Specification

Regulatory Standards	FCC Title 47 CFR Part 15.247 IC RSS-247 Issue 2, February 2017 IC RSS-GEN Issue 4, November 2014		
FCC ID	**2ABED-1167**		
IC	**11688B-1167**		
Model	1167		
EUT Description	WIRELESS MESH GATEWAY		
Modulation Type	QPSK		
Operating Frequency	TX: 2405 – 2480 MHz	RX: 2405 – 2480 MHz	
EUT Power Source	☐ 110–120Vac/50– 60Hz (While in charging Cradle)		
	☒ DC Power		
	☒ Battery Operated		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☒ Fixed	☐ Mobile	☐ Portable
Antenna Connector	SMA		
Antenna	Integral		
Test Facility	**Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.**		
Test Facility 2 (noted in report)	**CKC Laboratories, Inc. located at 5046 Sierra Pines Drive Mariposa, CA 95338 (Designation # US1025)**		
Test Conditions	Temperature: 24-26ºC Relative humidity: 50-65%		
Measurement Standard	ANSI C63.10-2013 (Measurement Procedures) ANSI C63.4-2014 (Radiated Site Validation)		
Test Exercise	The EUT was tested in a continuous transmission mode		

Test Supporting Equipment

Device	Manufacturer	Model	S/N	Supplied By	Used For
N/A					

RESULTS SUMMARY

FCC Rule Part No.	IC Standard Ref.	Requirement	Result
15.247(a)(2)	RSS-247 § 5.2	DTS BANDWIDTH	PASS
15.247(b)(3)	RSS-247 § 5.4	PEAK POWER OUTPUT	PASS
15.247(e)	RSS 247 § 5.2.2	POWER SPECTRAL DENSITY	PASS
---	RSS GEN § 6.6	OCCUPIED BANDWIDTH	PASS
15.247(d)	RSS 247 § 5.5	BANDEDGE	PASS
15.247(d)	RSS-247 § 5.5	UNWANTED EMISSIONS	PASS

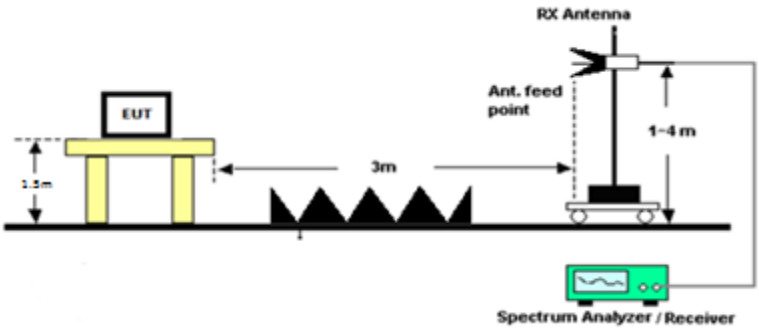
DTS BANDWIDTH

Rules Part No.: FCC 15.247 (a)(2)

Requirements: The minimum 6 dB bandwidth shall be 500 kHz.

Test Method: ANSI C63.10 § 11.8.1 DTS Bandwidth Option 1
ANSI C63.10 § 6.3 Radiated Emissions testing- Common

Setup:



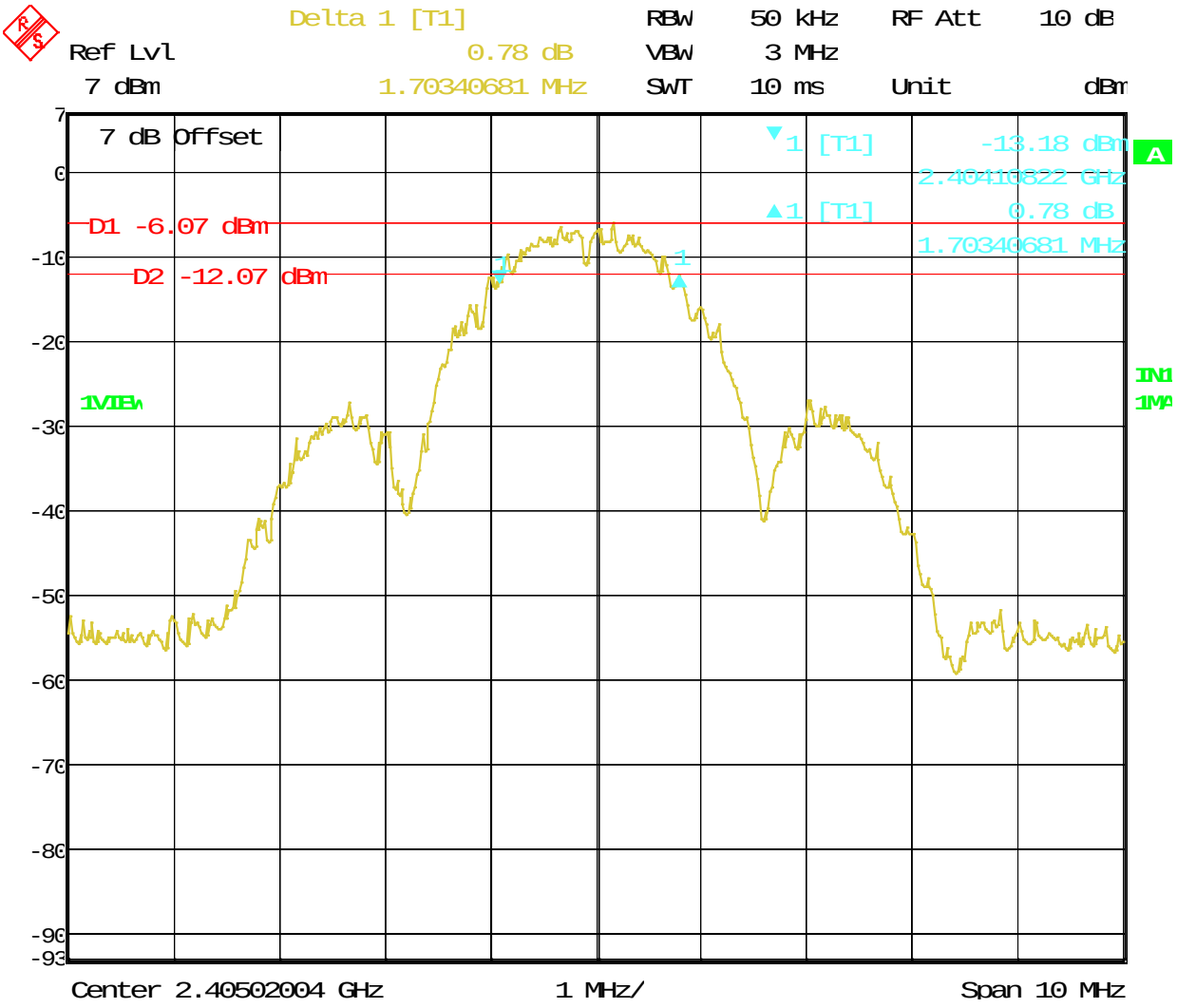
Test Data: **6 dB Occupied Bandwidth Measurement Table**

Tuned Frequency (MHz)	6 dB BW (KHz)	Limit (KHz)	Margin (KHz)
2405	1703	≥ 500	1203
2445	1843	≥ 500	1343
2480	1823	≥ 500	1323

RESULTS: Meets Requirements

DTS BANDWIDTH

Test Data: **6dB Bandwidth Plot Low End of Band**

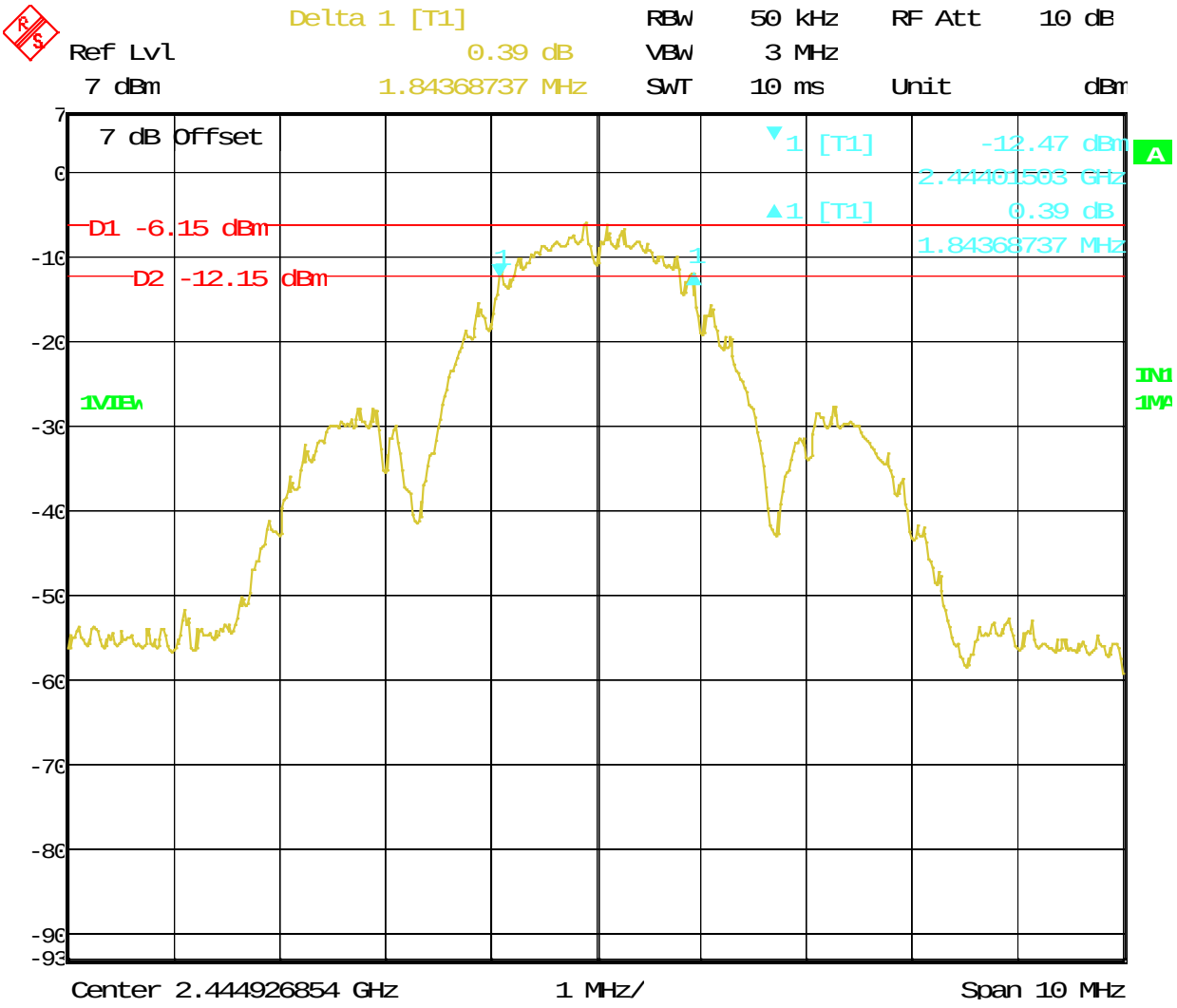


Date: 1.JAN.1997 03:27:37

RESULTS: Meets Requirements

DTS BANDWIDTH

Test Data: **6dB Bandwidth Plot Middle of Band**

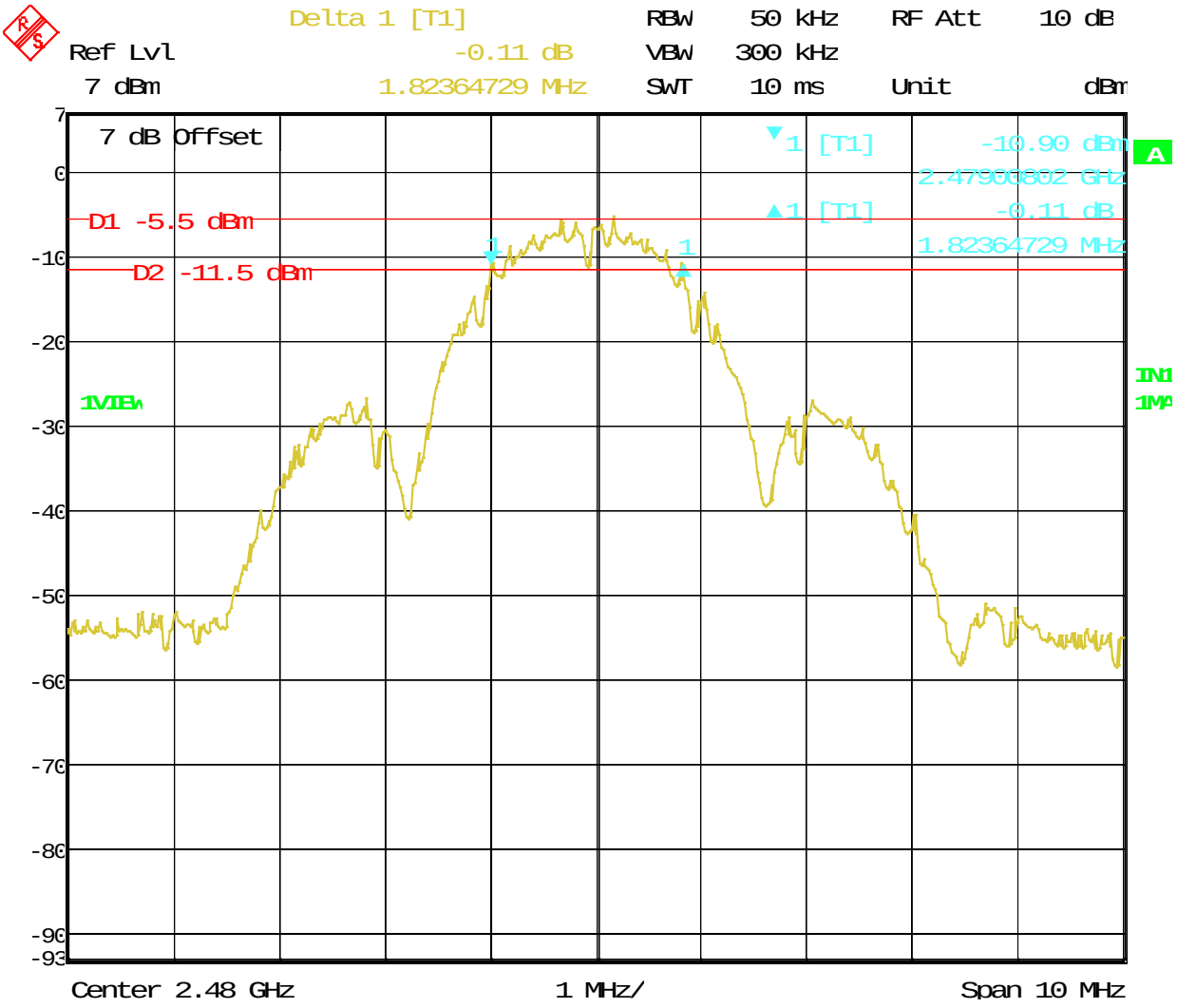


Date: 1.JAN.1997 02:32:44

RESULTS: Meets Requirements

DTS BANDWIDTH

Test Data: **6dB Bandwidth Plot High end of Band**



Date: 1.JAN.1997 07:03:20

RESULTS: Meets Requirements

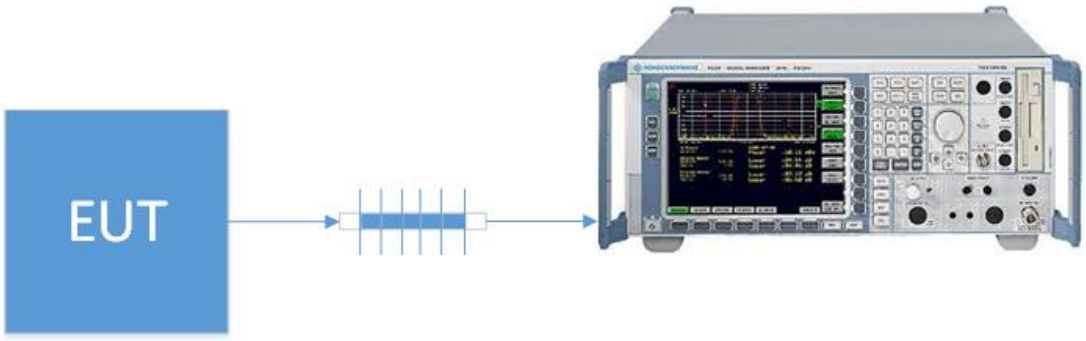
PEAK POWER OUTPUT

Rules Part No.: FCC 15.247(b) (3) (4), IC RSS 247 § 5.4.4

Requirements: Maximum Conducted Peak Power Output shall not exceed 1 Watt
Also the Peak Power Output shall not exceed 4 Watts EIRP

Test Method: ANSI C63.10 § 11.2 Power Limits, definitions, and device configuration
ANSI C63.10 § 11.9.1.1 Fundamental Output Power RBW ≥ DTS Bandwidth
ANSI C63.10 § Annex G Relationship among Field Strength and ERP/EIRP

Setup:



PEAK POWER OUTPUT

Test Data: **Peak Conducted Power Output Measurement Table**

Peak Conducted Power Output Measurement				
Tuned Frequency (MHz)	$P_{Conducted}$ (dBm)	$P_{Conducted}$ (W)	Limit (W)	Margin (W)
2405	0.47	0.00111	1.00	0.99889
2442	0.12	0.00103	1.00	0.99897
2480	-0.42	0.00091	1.00	0.99909

ERP to EIRP Conversion formula: EIRP = ERP + 2 dB

Peak EIRP Power Output Calculation				
Tuned Frequency (MHz)	$P_{Conducted}$ (dBm)	EIRP (W)	Limit (W)	Margin (W)
2405	0.47	0.00177	4.00	3.99823
2442	0.12	0.00163	4.00	3.99837
2480	-0.42	0.00144	4.00	3.99856

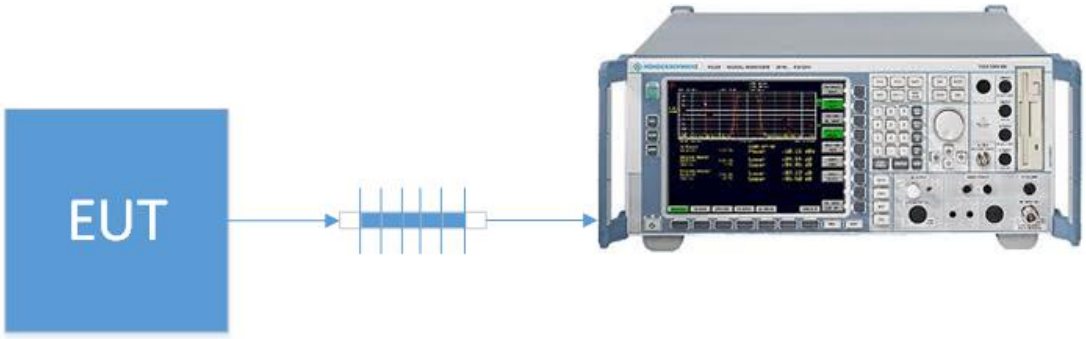
POWER SPECTRAL DENSITY

Rules Part No.: FCC 15.247(e), IC RSS 247 § 5.2.2

Requirements: The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Method: ANSI C63.10 § 11.2 Power Limits, definitions, and device configuration
ANSI C63.10 § 11.10.2 Maximum PSD in the fundamental- Method PKPSD

Setup:



POWER SPECTRAL DENSITY

Test Data: **Power Spectral Density Measurement Table**

Peak Conducted Power Spectral Density		
Tuned Frequency (MHz)	Level (dBm/3KHz)	Limit (dBm/3KHz)
2405	-17.75	8.00
2445	-16.90	8.00
2480	-26.09	8.00

RESULTS: Meets Requirements

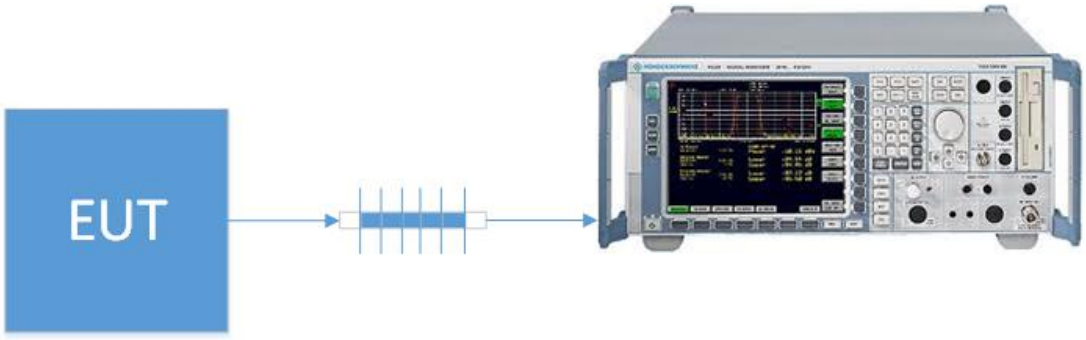
OCCUPIED BANDWIDTH

Rules Part No.: IC RSS GEN § 6.6

Requirements: The 99% Bandwidth is for reporting only.

Test Method: ANSI C63.10 § 6.9.3 Occupied Bandwidth- 99% Power Bandwidth procedure

Setup:



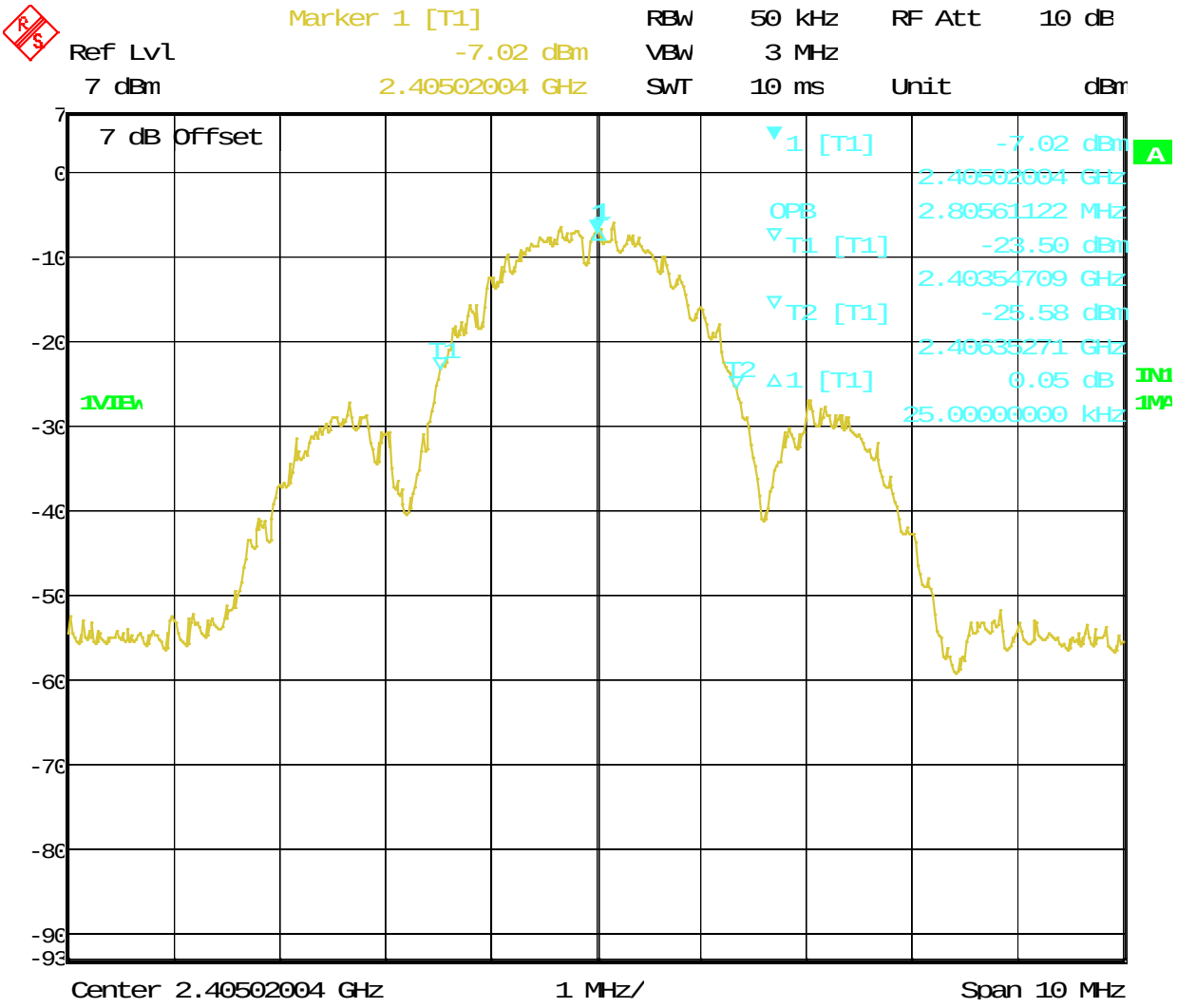
Test Data: **Occupied Bandwidth Measurement Table**

Tuned Frequency (MHz)	99% BW (MHz)
2405	2.80
2445	2.80
2480	2.80

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **99% Bandwidth Plot Low End of Band**

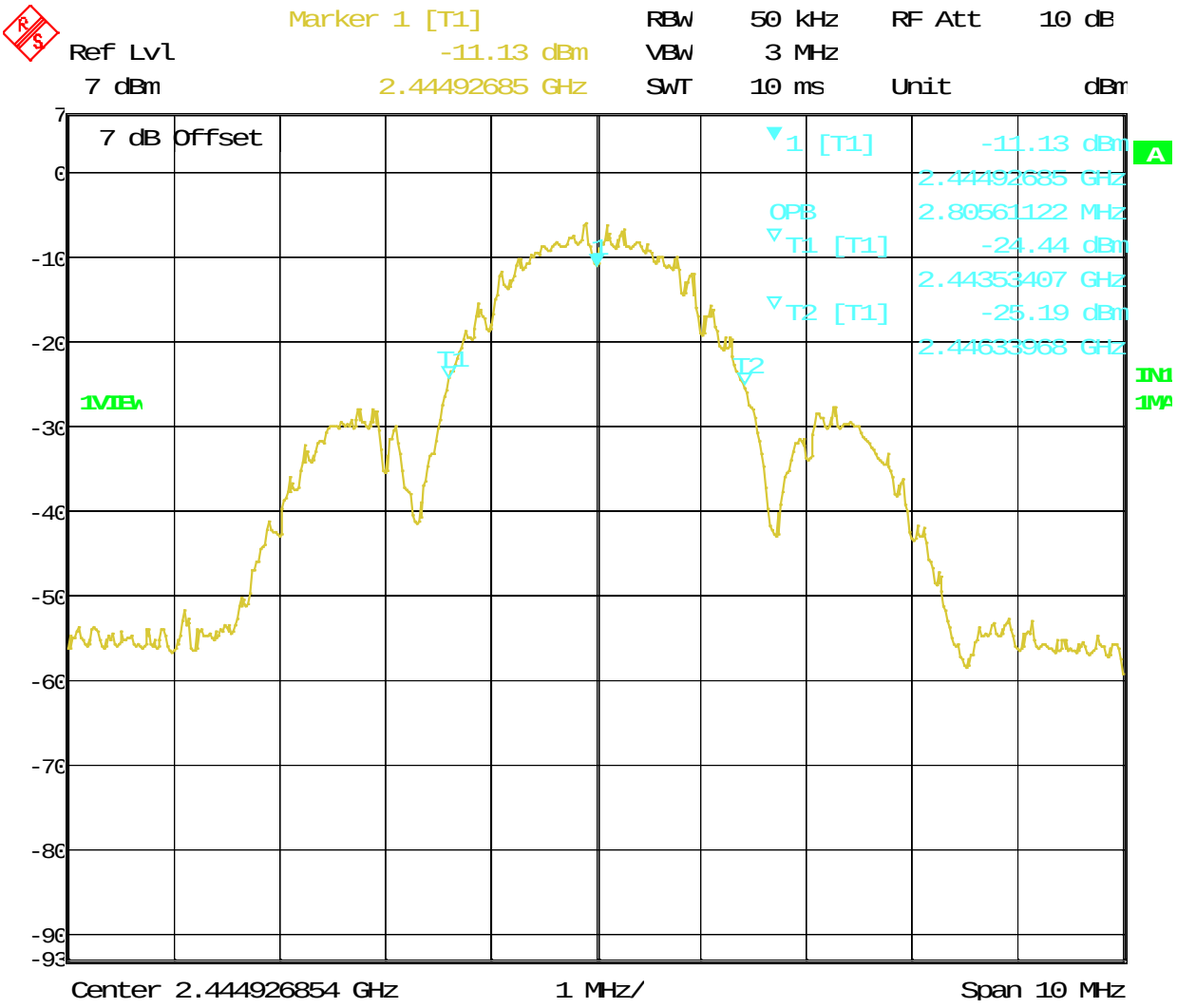


Date: 1.JAN.1997 03:25:47

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **99% Bandwidth Plot Middle of Band**

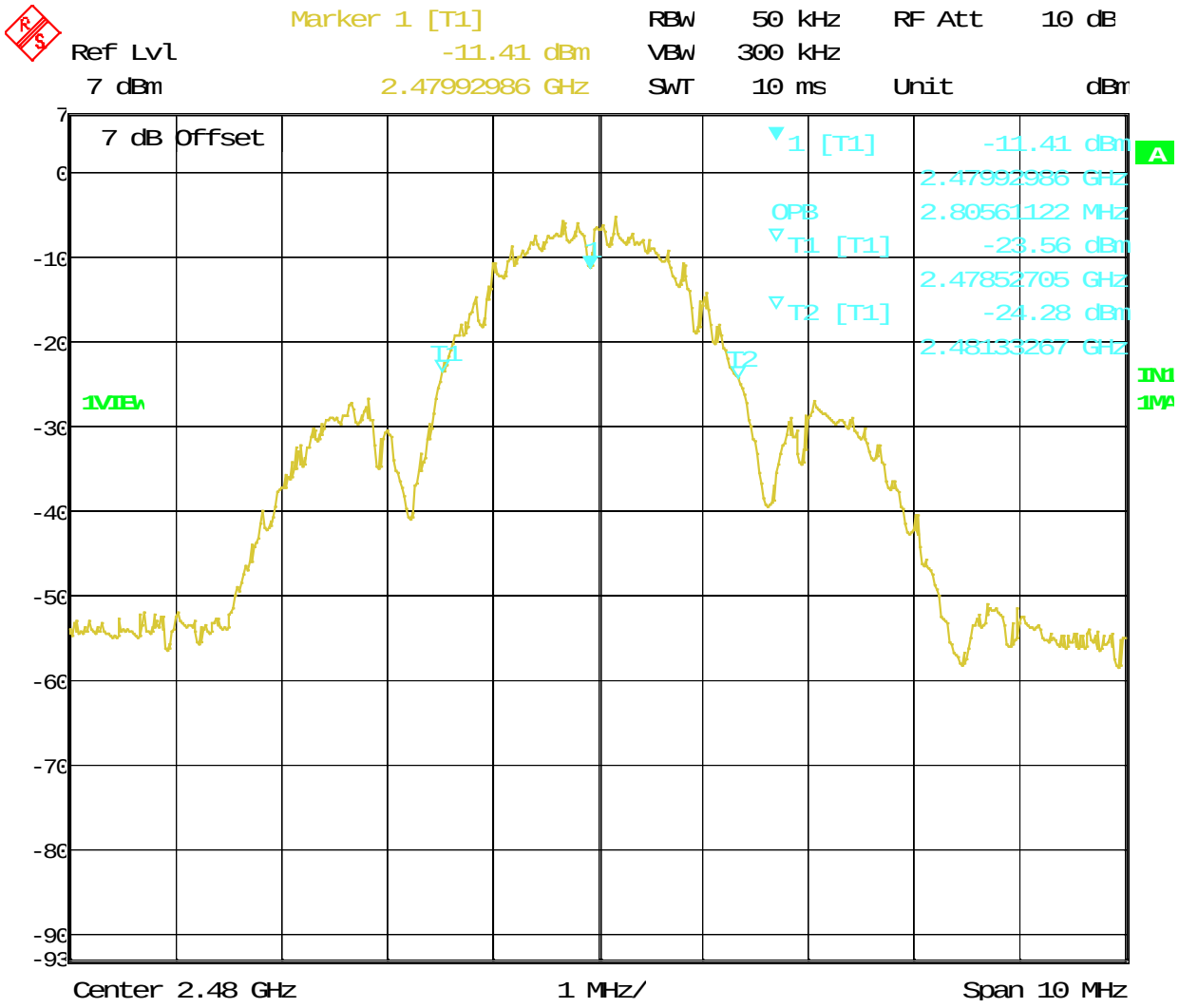


Date: 1.JAN.1997 02:31:10

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **99% Bandwidth Plot High end of Band**



Date: 1.JAN.1997 07:01:06

RESULTS: Meets Requirements

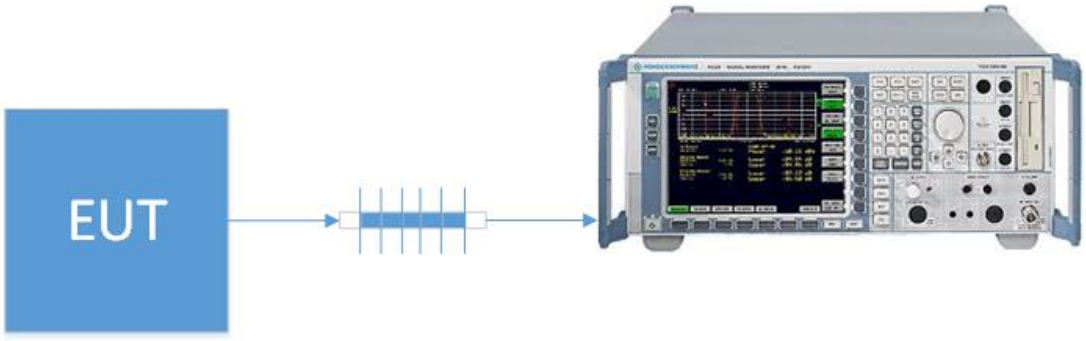
BANDEDGE

Rule Part No.: FCC 15.247(d), IC RSS 247 § 5.5

Requirements: Emissions must be at least 20dB down from the highest emission level Within the authorized band as measured with a 100 kHz RBW.

Test Method: ANSI C63.10 § 6.10.4 Authorized band-edge relative method (non-restricted)
ANSI C63.10 § 6.10.6 Marker Delta Method (restricted band edge)

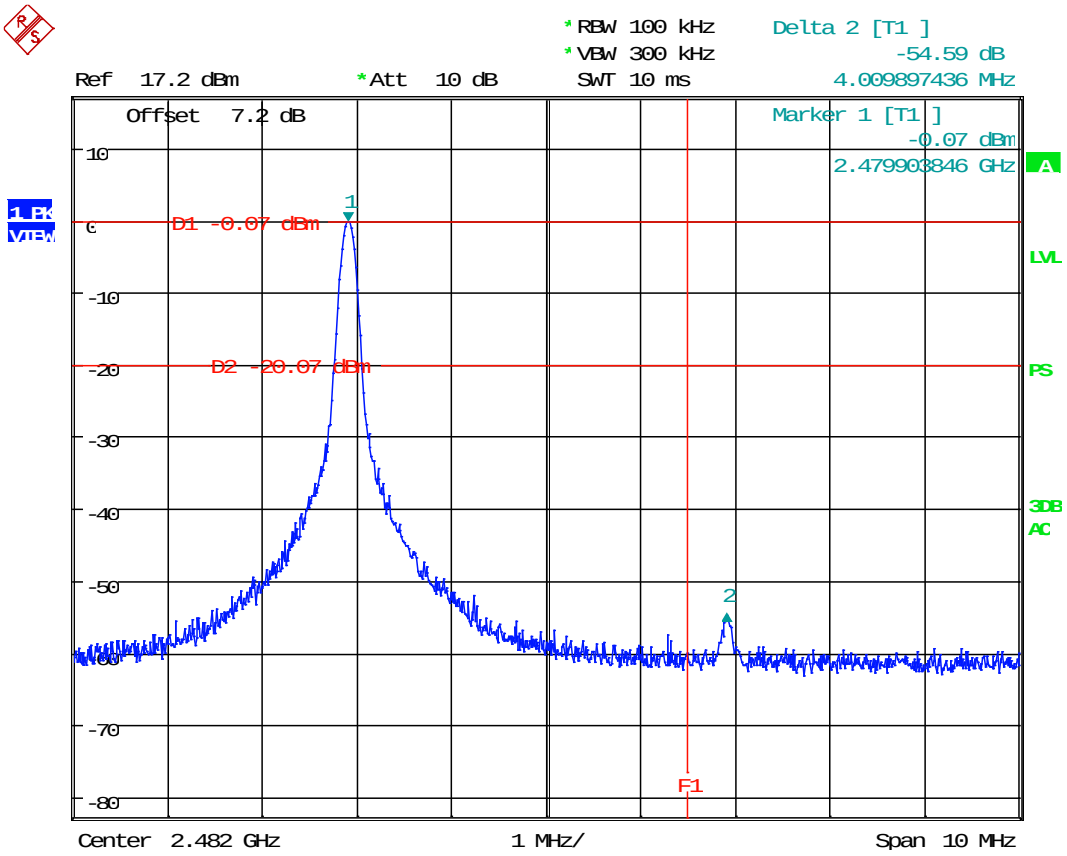
Setup:



BANDEDGE

Test Data: **Upper Band Edge Plot**

Peak / Average	Field Strength of Carrier (dBuV/m)	Emission Level Below Carrier (dB)	Field Strength of Emission (dBuV/m)	Emission Limit (dBuV/m)	Margin (dB)
Peak	94.72	54.59	40.13	74	33.87
Average	73.8	54.59	19.21	54	34.79

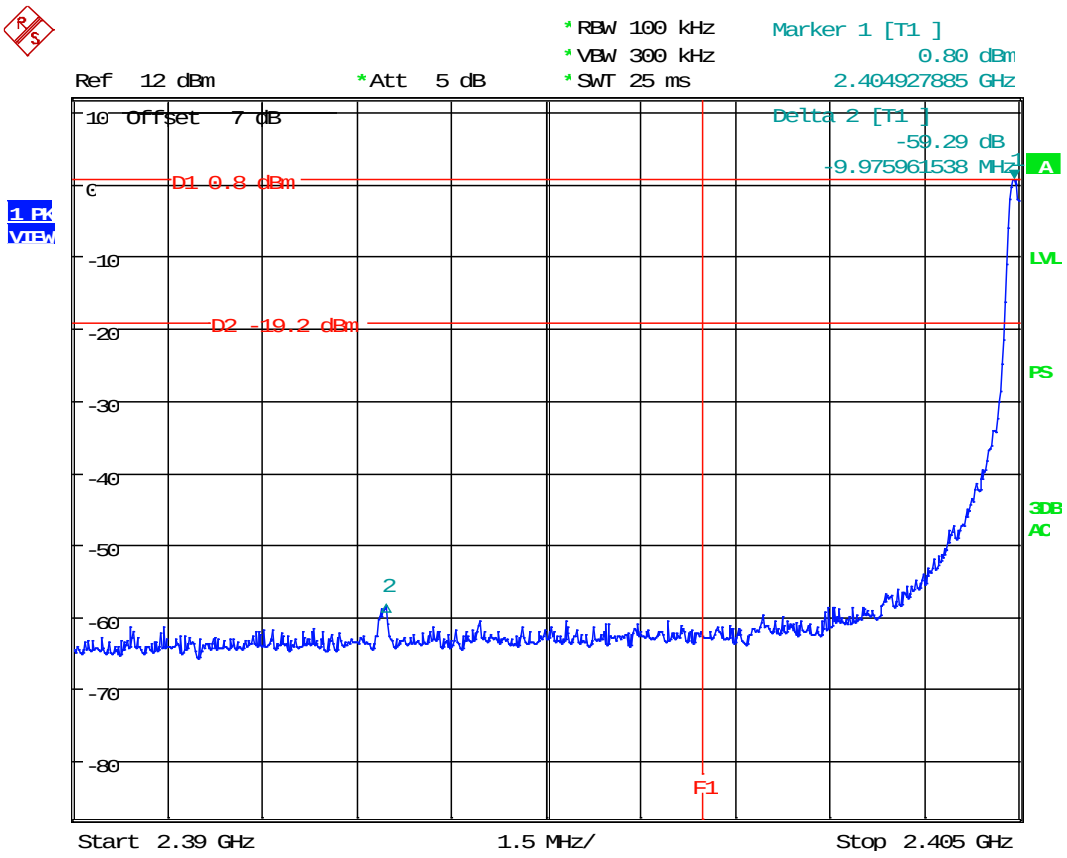


Date: 14.SEP.2017 11:24:48

RESULTS: Meets Requirements

BANDEDGE

Test Data: **Lower Band Edge Plot**



Date: 14.SEP.2017 11:13:23

RESULTS: Meets Requirements

RADIATED SPURIOUS EMISSIONS

Rules Part No.: FCC part 15.247 (d) & 15.209, IC RSS 247 § 5.5 & RSS GEN § 8.9

Requirements: Emissions found in restricted bands the levels must comply with the general limits found in FCC part 15.209

Frequency	Limits
FCC Part 15.209, IC RSS-GEN 8.9	
9 to 490 kHz	2400/F (kHz) µV/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) µV/m @ 30 meters
1705 kHz to 30 MHz	29.54 dBµV/m @ 30 meters
30 – 88	40.0 dBµV/m @ 3 meters
80 – 216	43.5 dBµV/m @ 3 meters
216 – 960	46.0 dBµV/m @ 3 meters
Above 960	54.0 dBµV/m @ 3 meters

Test Method: ANSI C63.4 § Annex D Validation of radiated emissions standard test sites
ANSI C63.10 § 6.3 Common requirements radiated emissions
ANSI C63.10 § 6.4 Emissions below 30 MHz
ANSI C63.10 § 6.5 Emissions between 30 & 1000 MHz
ANSI C63.10 § 6.6 Emissions above 1 GHz

Field Strength Calculation:

The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBµV) to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

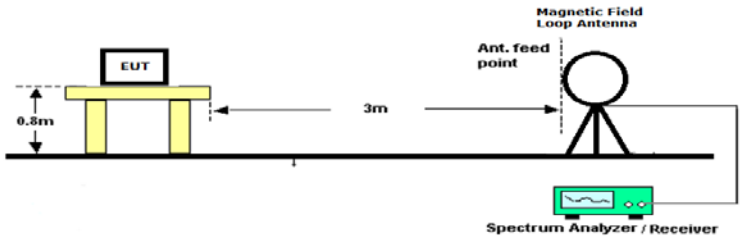
Example:			
Freq (MHz)	Meter Reading	+ ACF	+ CL = FS
33	20 dBµV	+ 10.36 dB	+ 0.5 = 30.86 dBµV/m @ 3m

Notes: Only emissions within 20dB of the limit are reported from 9 KHz to 25 GHz

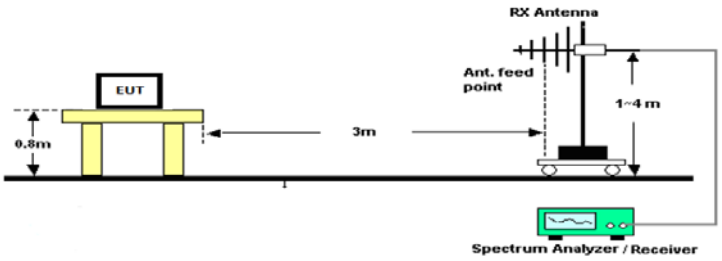
RADIATED SPURIOUS EMISSIONS

Setup:

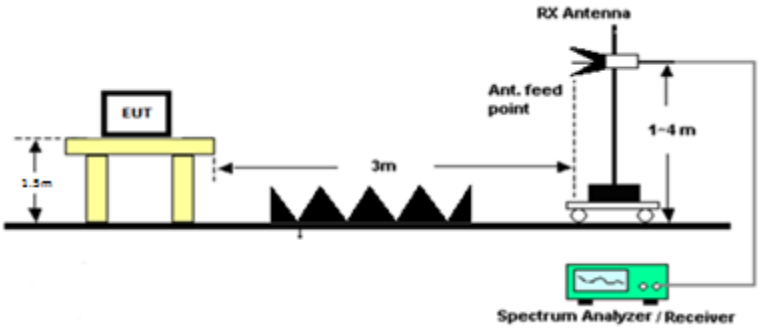
Emissions below 30 MHz



Emissions 30 – 1000 MHz



Emissions above 1 GHz



RADIATED SPURIOUS EMISSIONS

Notes: The EUT was checked in three orthogonal planes as required, a setup photo is provided to show the orientation of the worst case position.

The spectrum was measured from 9 KHz to 25 GHz, emissions discovered in bands listed in part 15.205 were compared with limit of 15.209 and only emissions found within 20 dB from limit are reported

Test Data: **Restricted Band Emissions Field Strength table**

Emission Frequency MHz	Meter Reading dBu V	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
250.00	31.80	H	1.89	12.00	45.69	0.31
250.00	28.50	V	1.89	12.00	42.39	3.61
191.00	11.30	V	1.59	14.20	27.09	47.63
375.00	23.90	V	2.23	15.00	41.13	33.60
375.00	26.00	H	2.23	15.00	43.22	31.50
660.00	8.40	H	3.00	19.80	31.20	43.52
2340.00	14.10	H	5.79	32.07	51.96	2.04
2342.00	6.90	V	5.79	32.05	44.74	9.26
2343.50	8.50	V	5.80	32.04	46.34	7.66

Results Meet Requirements

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Attenuator K 6dB 2W DC-40G	Narda	4768-6	1044-1	N/A	N/A
Attenuator K 6dB 2W DC-40G	Narda	4768-6	1044-3	N/A	N/A
DC Power Supply	HP	6286A	1744A03842	N/A	N/A
Antenna: Biconical 1096	Eaton	94455-1	1096	08/01/17	08/01/19
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/26/17	07/26/19
CHAMBER	Panashield	3M	N/A	04/25/16	03/31/18
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	03/01/17	03/01/19
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Antenna: Active Loop	ETS-Lindgren	6502	00062529	N/A	N/A
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	Chamber 3 cable set (Primary)	KMKM-0244-01; KMKM-0670-00; KFKF-0198-01	08/09/16	08/09/18
Band Reject Filter 2.4 GHz	Micro-Tronics	BRM50702-02	-G042	09/27/16	09/27/18

STATE OF THE MEASUREMENT UC

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: "Uncertainty in EMC Measurements" and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.
Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
RF Frequency Accuracy	± 49.5 Hz	(1)
RF Conducted Power	±0.93dB	(1)
Conducted spurious emission of transmitter valid up to 40GHz	±1.86dB	
Occupied Bandwidth	±2.65%	
Audio Frequency Response	±1.86dB	
Modulation limiting	±1.88%	
Radiated RF Power	±1.4dB	
Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq. Within 6kHz and 25kHz of audio Freq.	 ±1.88% ±2.04%	
Rad Emissions Sub Meth up to 26.5GHz	±2.14dB	
Adjacent channel power	±1.47dB	(1)
Transient Frequency Response	±1.88%	
Temperature	±1.0°C	(1)
Humidity	±5.0%	

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

END OF REPORT