TIMCO ENGINEERING, Inc.

849 NW State Road 45
Newberry, FL 32669 USA
Ph.: 888.472.2424 or 352.472.5500
Fax: 352.472.2030
Email: info@timcoengr.com
Website: www.timcoengr.com

FCC PART 15.249 & IC RSS-210

UNLICENSED INTENTIONAL RADIATOR

TEST REPORT

Applicant	IRADIMED
Address	1025 WILLA SPRINGS DRIVE
	WINTER SPRINGS FL 32708
FCC ID	**2AKRU-IRM02**
IC	**22312-IRM02**
Model Number	3882
Product Description	MRI WIRELESS SpO oPOD
Date Sample Received	12/8/2016
Final Test Date	03/22/2017
Tested By	Cory Leverett
Approved By	Tim Royer

Report Number	Version Number	Description	Issue Date
2450AUT16TestReport	Rev1	Initial Issue	1/19/2017
	Rev2	Added Bandedge plots pg 11 - 13	3/10/2017
	Rev3	Update Low test freq. pg 10, Update 99%OBW pg 6 - 9	3/22/2017

TABLE OF CONTENTS

GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

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

Tested by:
Name and Title: Cory Leverett, Project Manager/Testing Engineer

Date: 03/22/2017

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

Date: 03/22/2017

GENERAL INFORMATION

EUT Specification

Regulatory Standards	FCC Title 47 CFR Part 15.249 IC RSS-210 Issue 8 A2.9 & RSS-GEN Issue 4		
FCC ID	**2AKRU-IRM02**		
IC	**22312-IRM02**		
Model	3882		
EUT Description	MRI WIRELESS SpO oPOD		
Modulation Types	GFSK		
Operating Frequency	TX: 2414 – 2428 MHz	RX: 2414 – 2428 MHz	
EUT Power Source	☐ 110–120Vac/50– 60Hz		
	☐ DC Power		
	☒ Battery Operated Exclusively 3.7 VDC		
Test Item	☐ Prototype	☐ Pre-Production	☒ Production
Type of Equipment	☐ Fixed	☐ Mobile	☒ Portable
Antenna Connector	None		
Antenna	Integral		
Test Conditions	Temperature: 24-26ºC Relative humidity: 50-65%		
Measurement Standard	ANSI C63.10-2013 ANSI C63.4-2014 (Radiated Site Validation)		

Test Supporting Equipment

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

RESULTS SUMMARY

FCC Rule Part No.	IC Standard Ref.	Requirement	Test Item	Result
2.1049	RSS-GEN 6.6	Occupied Bandwidth	99% Bandwidth	Pass
15.249(a)(c)	RSS-210 § A2.9(a)	Fundamental and Harmonics	Radiated Spurious Emissions	Pass
15.249(d)(e)	RSS-247 § 5.5	Spurious Emissions	Bandedge	Pass
			Radiated Spurious Emissions	Pass
15.207(a)	RSS-GEN § 8.8	AC Conducted Emissions	AC Powerline Conducted Emissions	N/A

Notes:

OCCUPIED BANDWIDTH

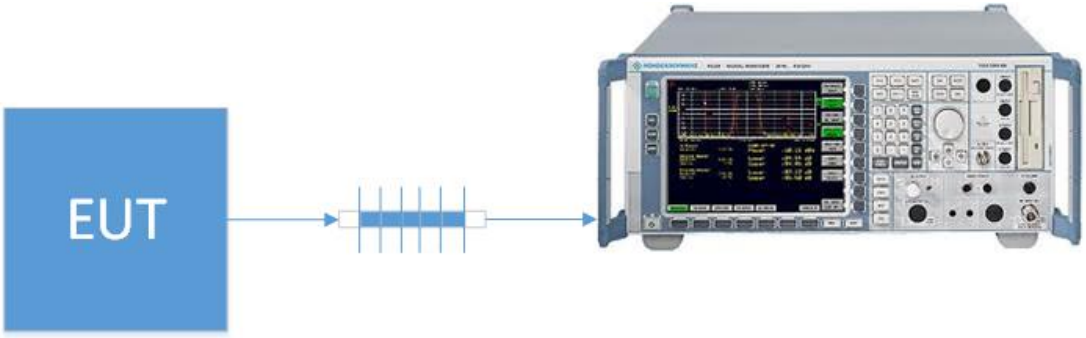
Rules Part No.: FCC 2.1049, IC RSS GEN § 6.6

FCC Requirements: Reporting only

IC Requirements: Reporting Only

Test Method: THE TEST PROCEDURES USED ARE DETAILED IN THE STANDARD LISTED ABOVE.

Setup:



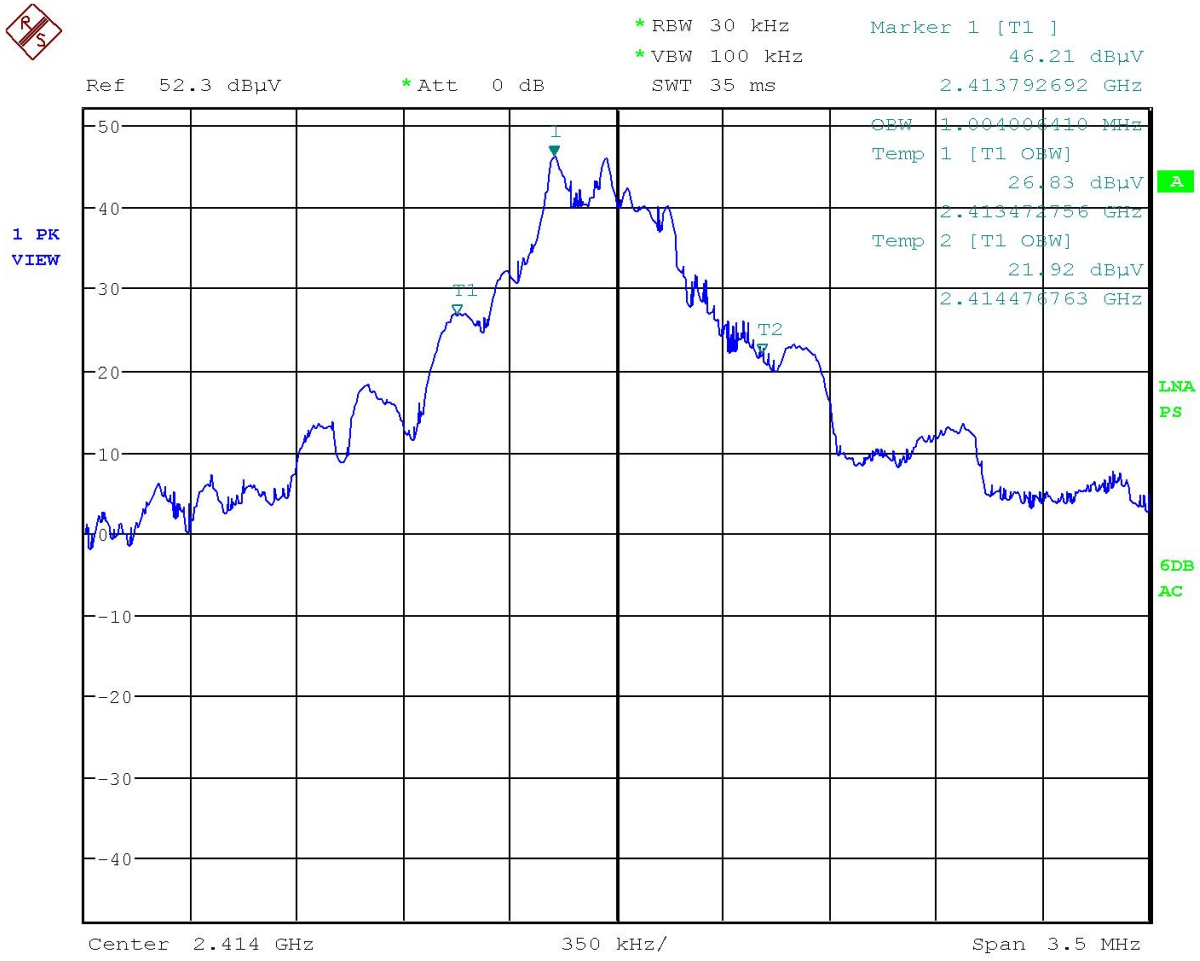
Test Data: **Measurement Table**

Tuned Frequency (MHz)	BW (KHz)
2414	1004.00
2420	998.39
2428	964.74

RESULTS:

OCCUPIED BANDWIDTH

Test Data: **Low end of band Plot**

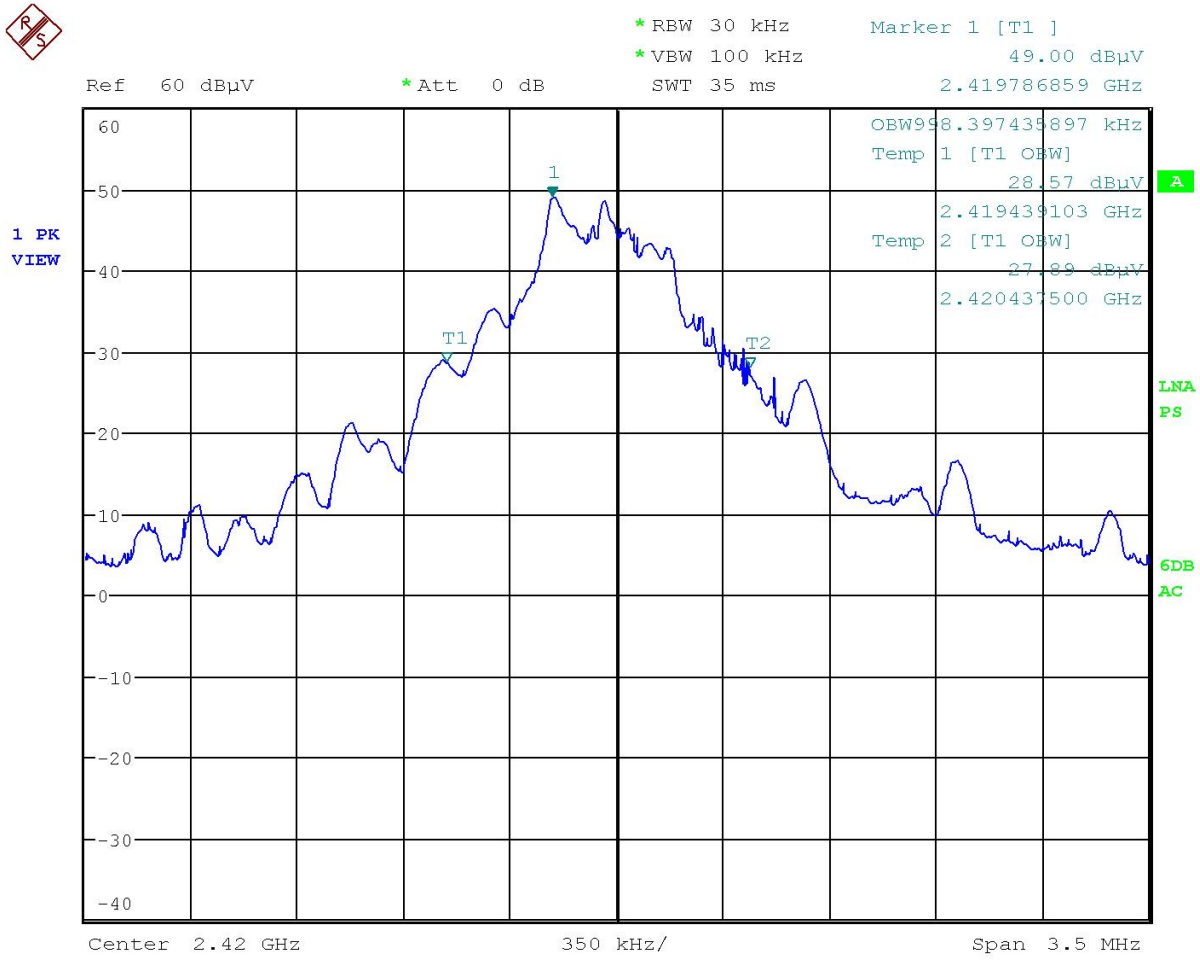


Date: 22.MAR.2017 08:47:45

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **Middle of band Plot**

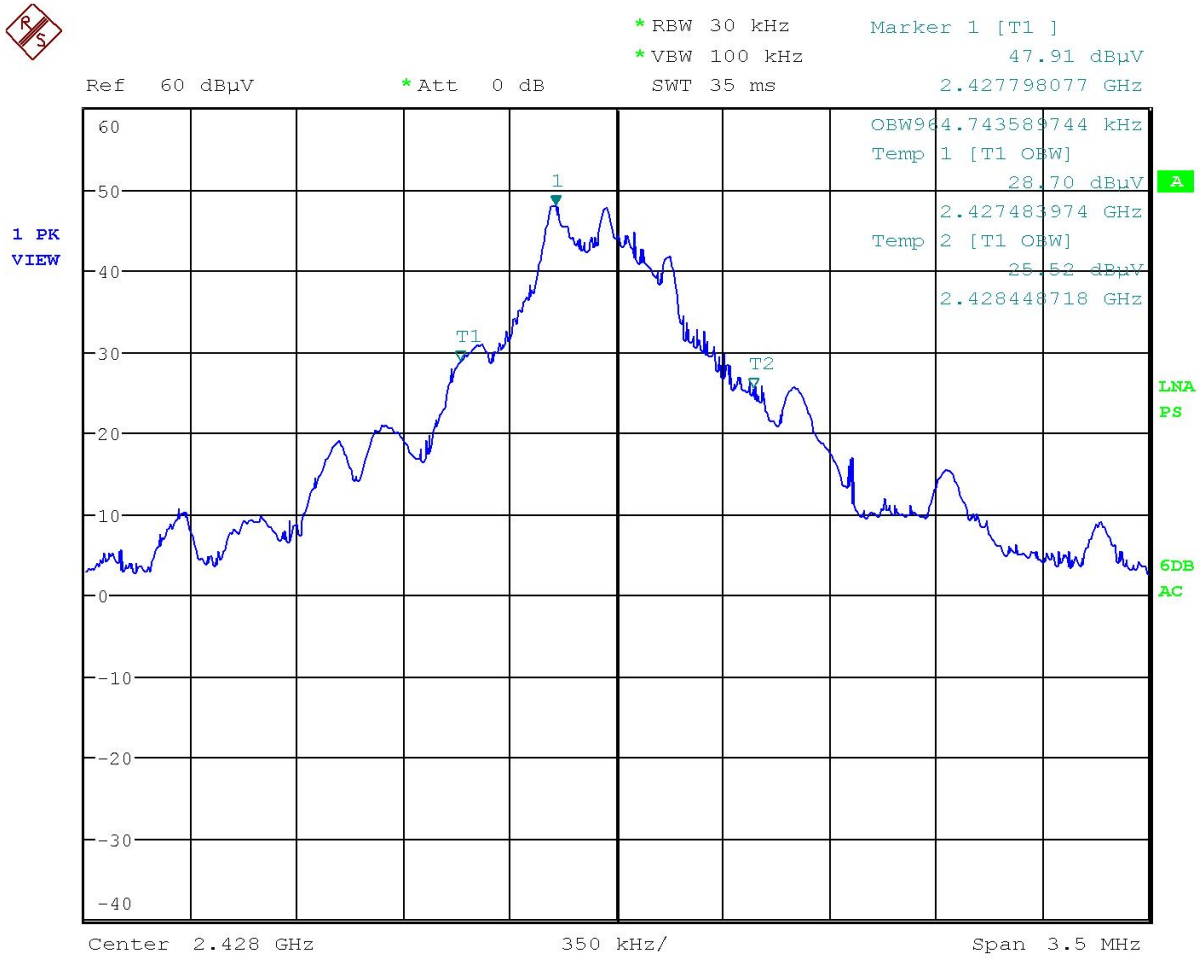


Date: 22.MAR.2017 08:52:21

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **High end of band Plot**



Date: 22.MAR.2017 08:57:03

RESULTS: Meets Requirements

BANDEDGE

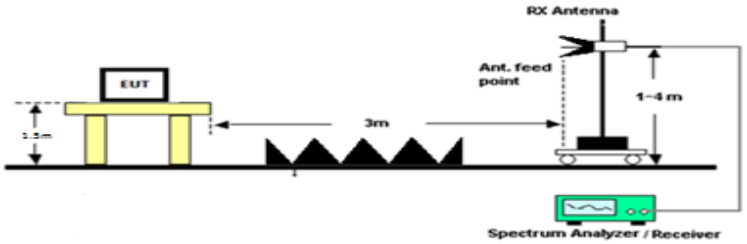
Rule Part No.: FCC 15.249(d), IC RSS 210 § A2.9(b)

Requirements: Emissions must be at least 50 dB down from the highest emission level Within the authorized band as measured with a 100 kHz RBW, or to the limits of 15.209.

Test Method: THE TEST PROCEDURES USED ARE DETAILED IN THE STANDARD LISTED ABOVE.

Setup:

Emissions above 1 GHz



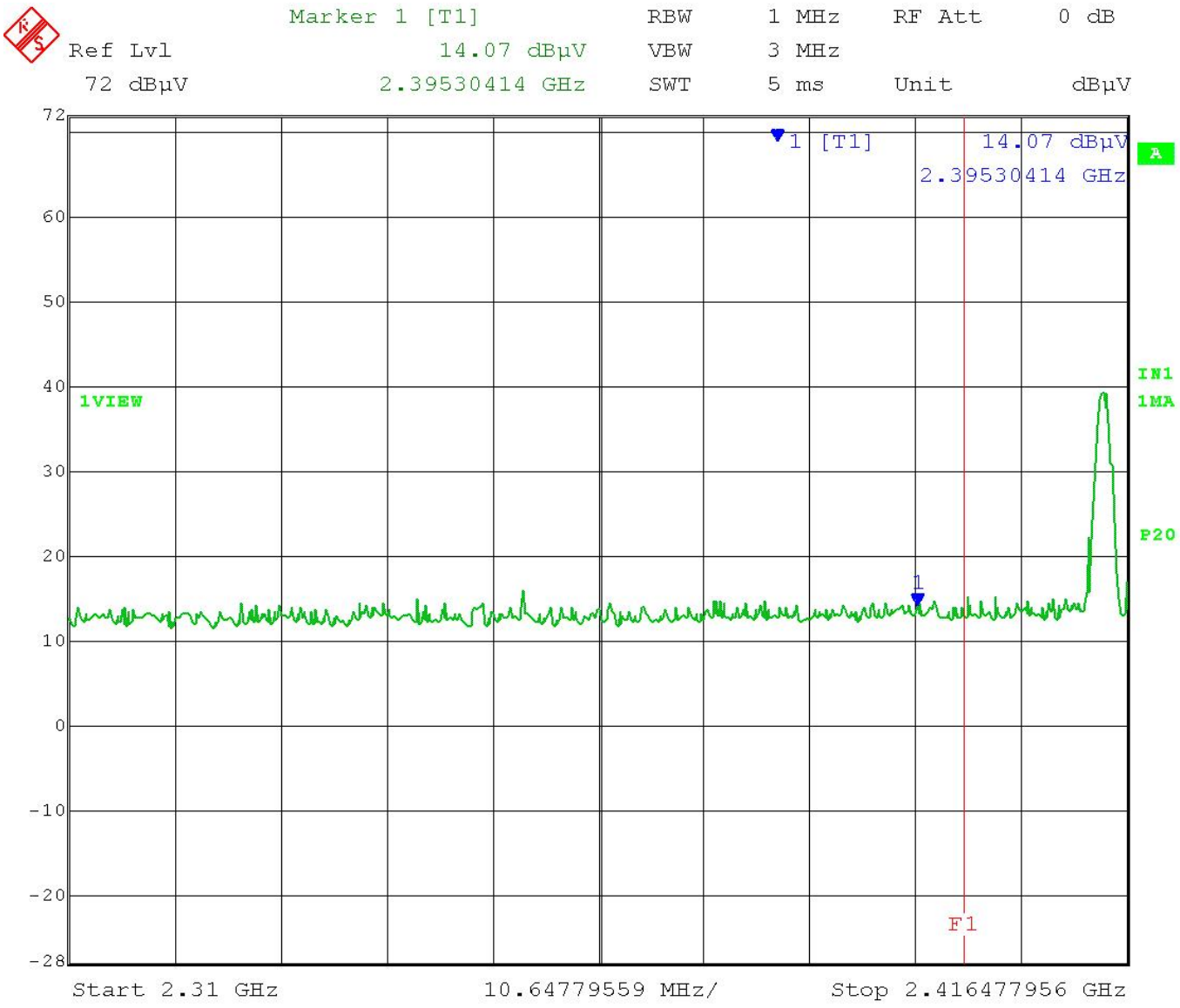
Test Data: **Bandedge Measurement Table**

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector (PK/AV)	Read Level (dBuV)	Polarity	Coax Loss (dB)	ACF (dB)	Field Strength (dBuV/M)	Limit (dBuV/M)	Margin (dB)
2414	2395.30	Peak	14.07	V	5.68	31.91	51.66	74	22.34
2414	2395.30	Average	1.78	V	5.68	31.91	39.37	54	14.63
2428	2484.50	Peak	15.10	V	5.78	32.66	53.56	74	20.44
2428	2484.50	Average	1.55	V	5.78	32.66	40.01	54	13.99

Results Meet Requirements

BANDEDGE

Test Data: **Lower Bandege Peak Plot**

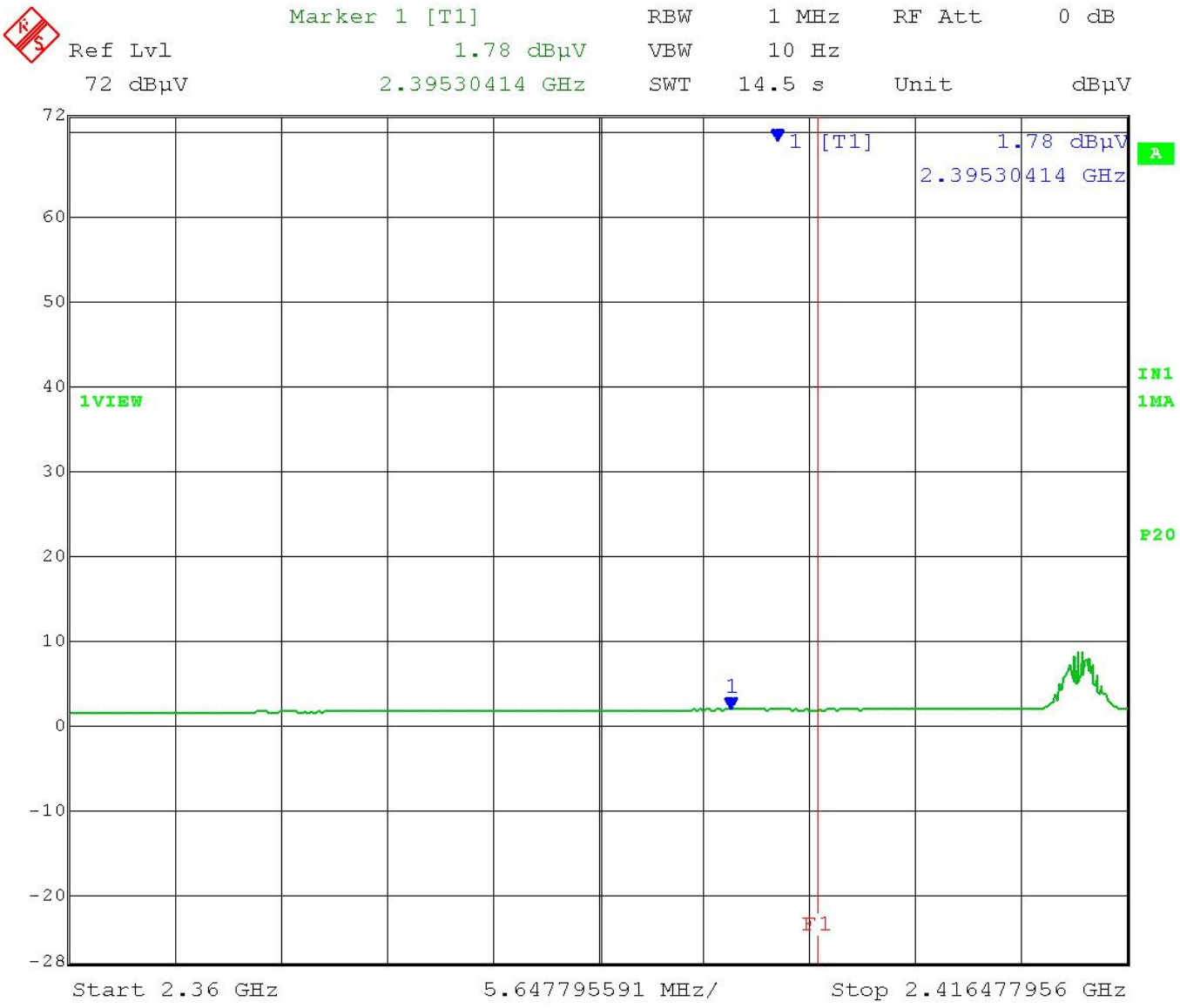


Date: 10.MAR.2017 10:58:09

RESULTS: Meets Requirements

BANDEDGE

Test Data: **Lower Bandedge Average Plot**

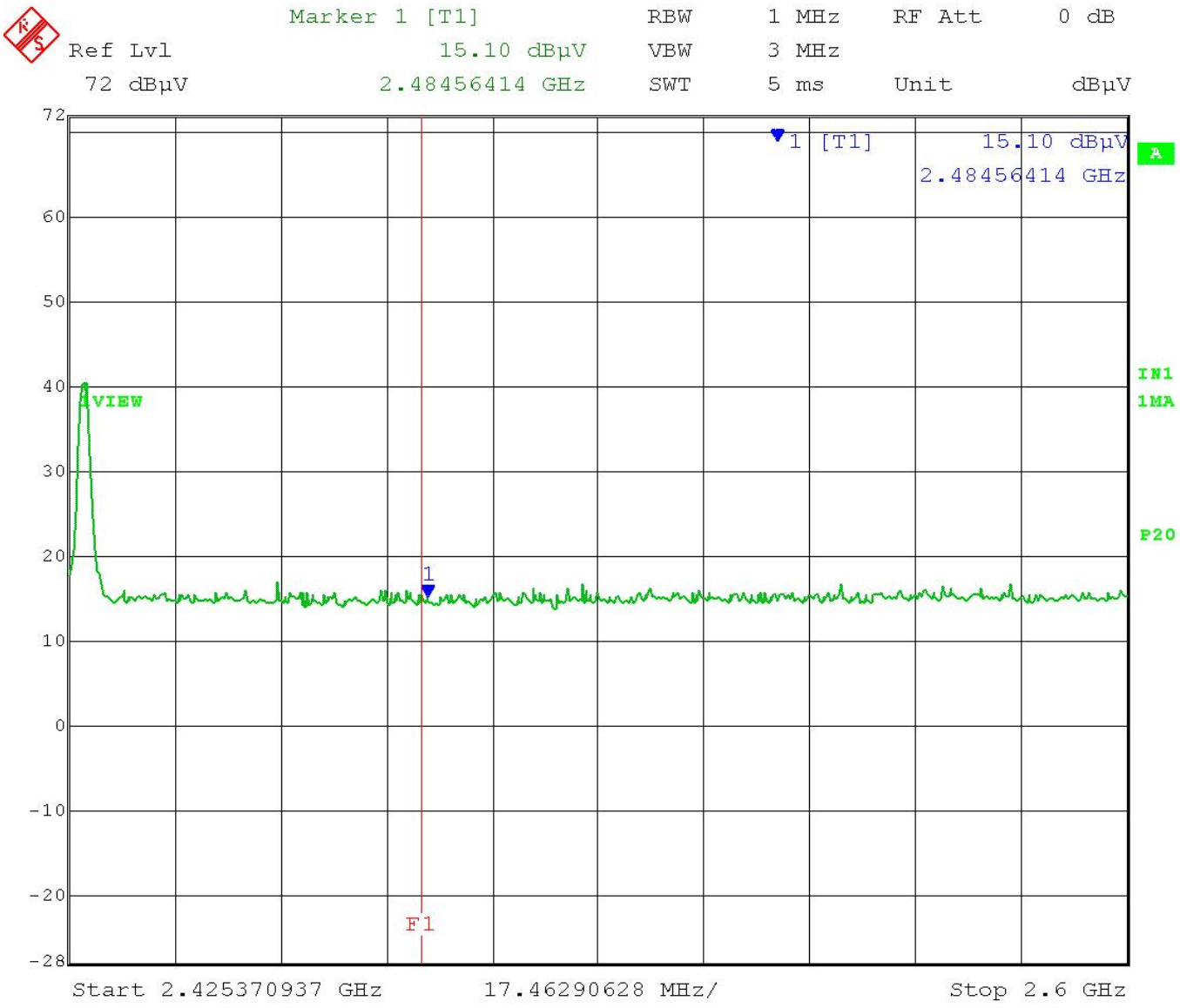


Date: 10.MAR.2017 10:58:59

RESULTS: Meets Requirements

BANDEDGE

Test Data: **Upper Bandege Band Peak Plot**

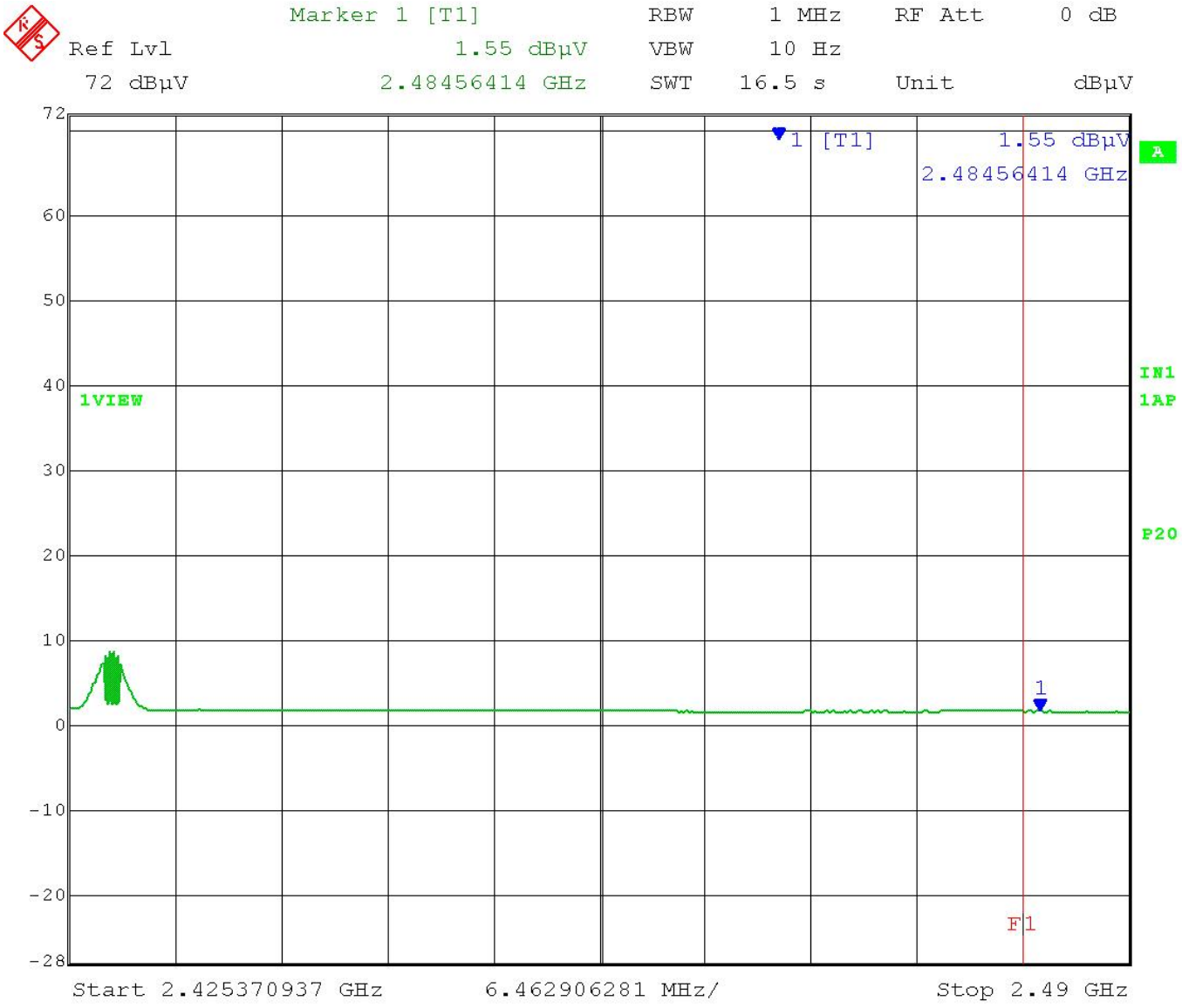


Date: 10.MAR.2017 10:48:55

RESULTS: Meets Requirements

BANDEDGE

Test Data: **Upper Bandedge Average Plot**



Date: 10.MAR.2017 10:50:47

RESULTS: Meets Requirements

RADIATED SPURIOUS EMISSIONS

Rules Part No.: FCC part 15.249 (a)(c)(d)(e)

Requirements: the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation

Field strength limits are specified at a distance of 3 meters

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Frequency	Limits
Part 15.209	
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
Part 15.249	
Fundamental 902 – 928 MHz	94.0 dBµV/m @ 3 meters
Fundamental 2.4 – 2.4835 GHz	94.0 dBµV/m @ 3 meters
Harmonics	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.

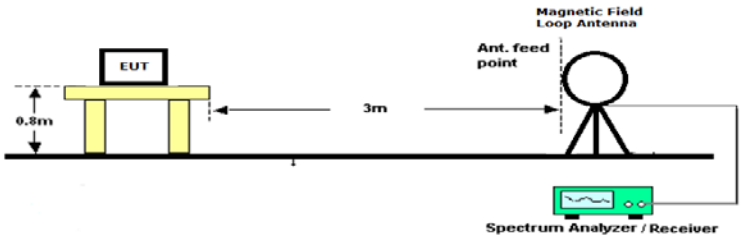
Example:

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

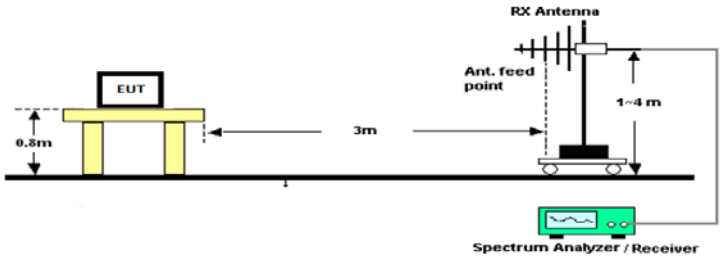
RADIATED SPURIOUS EMISSIONS

Setup:

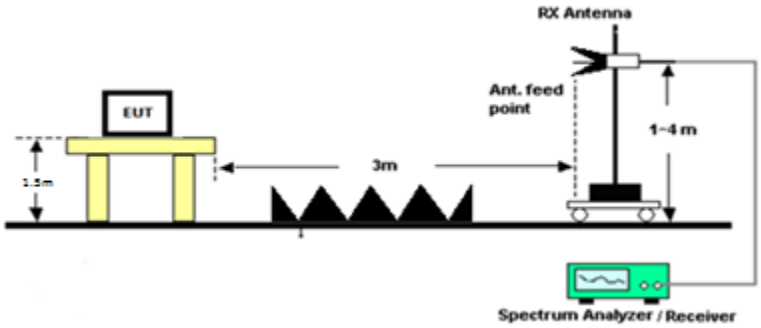
Emissions below 30 MHz



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.

Only emissions within 20dB of the limit are reported.

The spectrum was measured from 9 KHz to 25 GHz

Test Data: **Measurement Table**

Tuned Freq (MHz)	Emission Frequency (MHz)	Detector (QP/PK/AV)	Meter Reading (dBuV)	Antenna Polarity (H/V)	Coax Loss (dB)	Correction Factor (dB/M)	Field Strength (dBuV/M)	Limit (dBuV/M)	Margin (dB)
2414.00	282.05	22.24	PK	V	1.97	15.17	39.38	46.00	6.62
2414.00	306.41	16.67	PK	H	2.05	13.20	31.92	46.00	14.08
2414.00	633.33	21.13	PK	V	2.90	19.10	43.13	46.00	2.87
2414.00	741.02	18.16	PK	H	3.14	20.78	42.08	46.00	3.92
2414.00	2329.59	13.62	PK	H	5.60	32.05	51.27	54.00	2.73
2414.00	2391.50	13.84	PK	V	5.63	32.16	51.63	54.00	2.37
2414.00	2414.00	43.62	PK	V	5.71	32.44	81.77	94.00	12.23
2414.00	4828.00	0.83	PK	H	8.09	33.97	42.89	54.00	11.11
2414.00	7242.00	-0.63	PK	V	9.94	35.48	44.79	54.00	9.21
2414.00	9656.00	-1.07	PK	H	11.45	36.91	47.29	54.00	6.71
2420.00	289.74	19.11	PK	V	1.99	13.75	34.85	46.00	11.15
2420.00	371.79	20.98	PK	H	2.21	14.64	37.83	46.00	8.17
2420.00	712.82	21.02	PK	H	3.08	20.40	44.50	46.00	1.50
2420.00	826.92	19.84	PK	V	3.30	21.79	44.93	46.00	1.07
2420.00	2420.00	48.83	PK	V	5.71	32.46	87.00	94.00	7.00
2420.00	2840.00	1.60	PK	V	6.17	32.32	40.09	54.00	13.91
2420.00	7260.00	-1.47	PK	H	9.96	35.52	44.01	54.00	9.99
2420.00	9680.00	-1.87	PK	H	11.47	36.96	46.56	54.00	7.44
2428.00	262.82	21.89	PK	H	1.90	12.67	36.46	46.00	9.54
2428.00	394.87	22.69	PK	V	2.27	15.19	40.15	46.00	5.85
2428.00	529.48	21.96	PK	H	2.66	17.48	42.10	46.00	3.90
2428.00	806.41	17.42	PK	V	3.26	20.46	41.14	46.00	4.86
2428.00	2428.00	51.13	PK	V	5.72	32.48	89.33	94.00	4.67
2428.00	2485.90	13.04	PK	H	5.78	32.66	51.48	54.00	2.52
2428.00	2486.12	13.13	PK	V	5.78	32.66	51.57	54.00	2.43
2428.00	4856.00	-0.86	PK	V	8.11	33.94	41.19	54.00	12.81
2428.00	7274.00	-1.80	PK	V	9.97	35.55	43.72	54.00	10.28
2428.00	9712.00	-2.33	PK	V	11.49	37.01	46.17	54.00	7.83

Results: Meets Requirements

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconical 1096 Chamber	Eaton	94455-1	1096	07/14/15	07/14/17
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/14/15	07/14/17
Antenna: Standard Gain Horn 18.0-26.3 GHz	Systron Donner	DBE-520-20	Not Serialized	NA	NA
Antenna: Standard Gain Horn 12.4-18.0 GHz	ATM	62-442-6	D262108-01	NA	NA
CHAMBER	Panashield	3M	N/A	04/25/16	12/31/17
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren Chamber	3117	00035923	01/30/17	01/30/19
Software: Field Strength Program	Timco	N/A	Version 4.0	NA	NA
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	11/18/17
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	08/08/16	08/08/18
Pre-amp	RF-LAMBDA	RNLA00M45GA	NA	01/04/16	01/04/18
Band Reject Filter 2.4 GHz	Micro-Tronics	BRM50702-02	-G042	9/27/16	9/27/18
High Pass Filter 18GHz	Micro-Tronics	HPS18771	-002	9/27/16	9/27/18
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	NA	NA

***EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT