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Detecting AACN Communications During Crash Tests

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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Agency Goals

- Agency goal was to understand how we might objectively evaluate AACN system performance
- NHTSA undertook research to establish a test procedure that could be used for this purpose
- NHTSA defined general system/performance requirements, then established a detailed protocol for evaluation

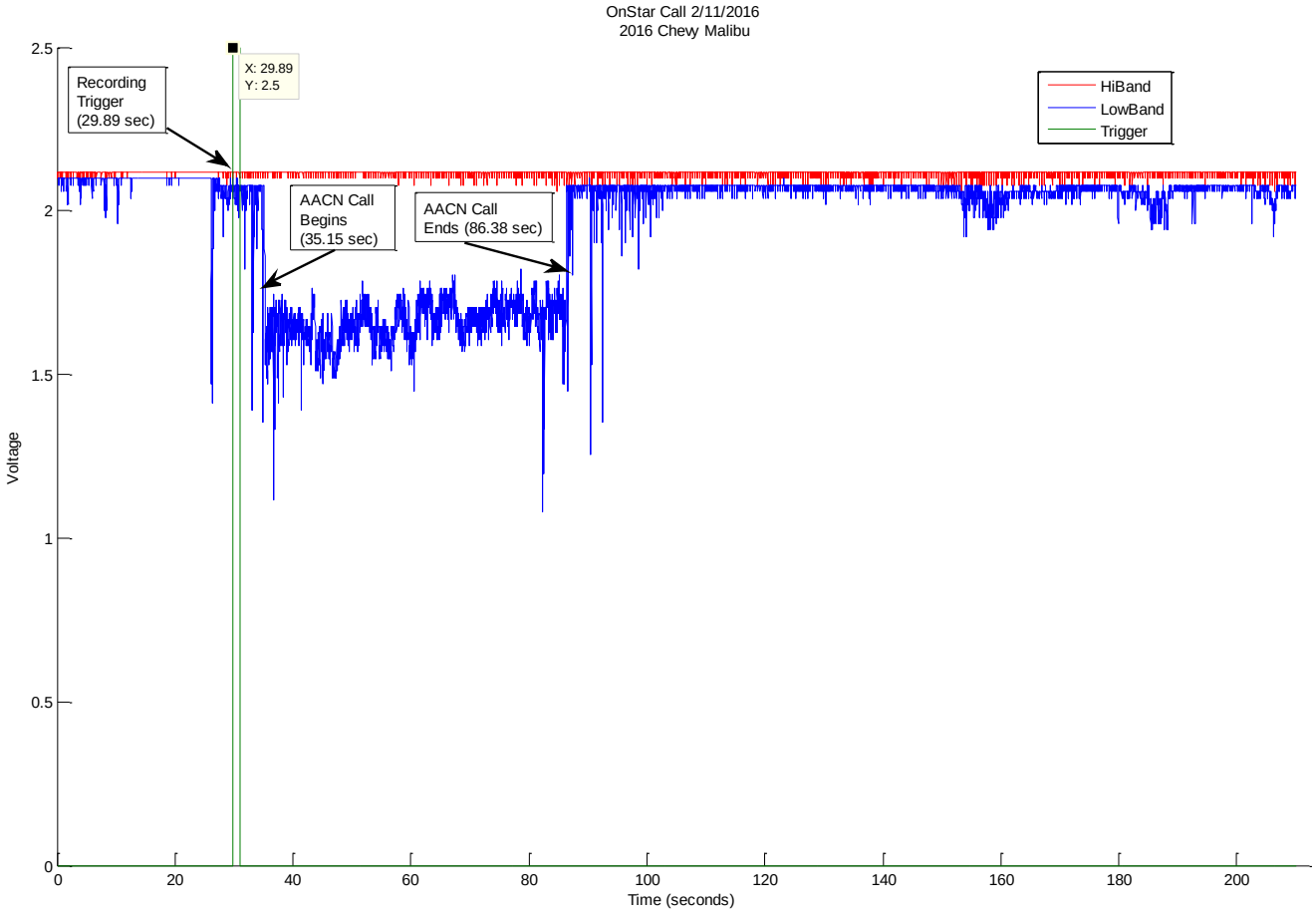
General Requirements

- An AACN equipped vehicle should automatically establish communication with a telematics service provider (TSP) or public safety answering point (PSAP) after a crash test without intervention by an outside agent

AACN Information Required from the Test

- Detection of communication between a crash test vehicle and the telematics service provider (TSP)
  - An indication that the crashed vehicle is in communication with the public safety answering point (PSAP) or telematics service provider (TSP) after the crash
  - Independent verification of RF transmission from the vehicle
    - RF detection and recording device
- The contents of the crash data transmitted to the TSP or PSAP
  - An indication of the contents of the crash data transmitted to the TSP PSAP
  - Independently obtaining the contents of this data is not possible, assuming secure communication between the vehicle and the TSP or between the vehicle and the PSAP
    - Ask the TSP or PSAP for the data or a subset of the data they receive, in one example, OnStar did provide information on an NCAP crash test

RF Detector for Crash Tests



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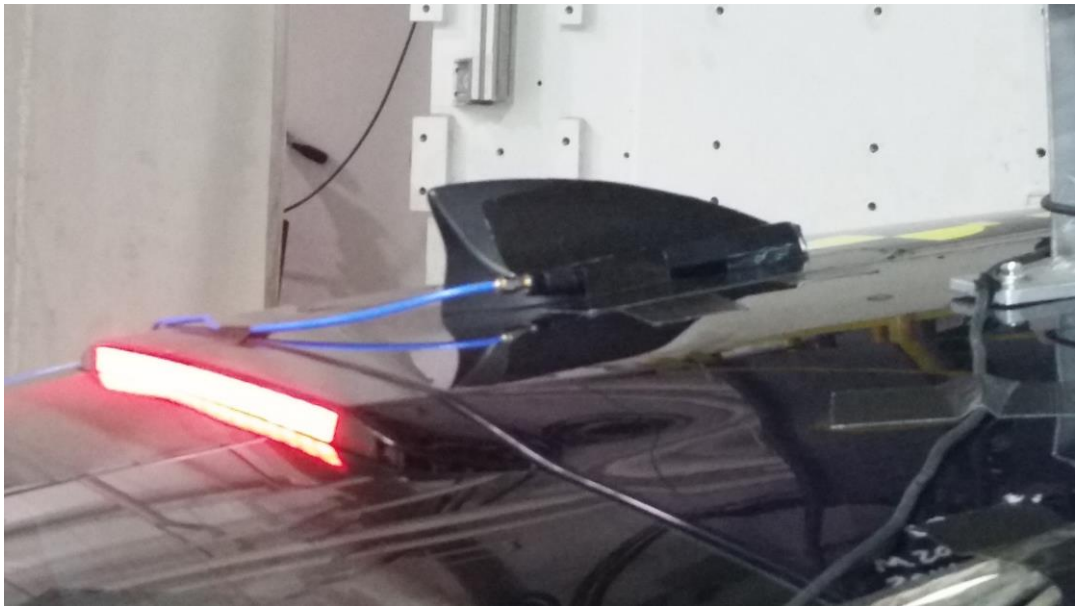
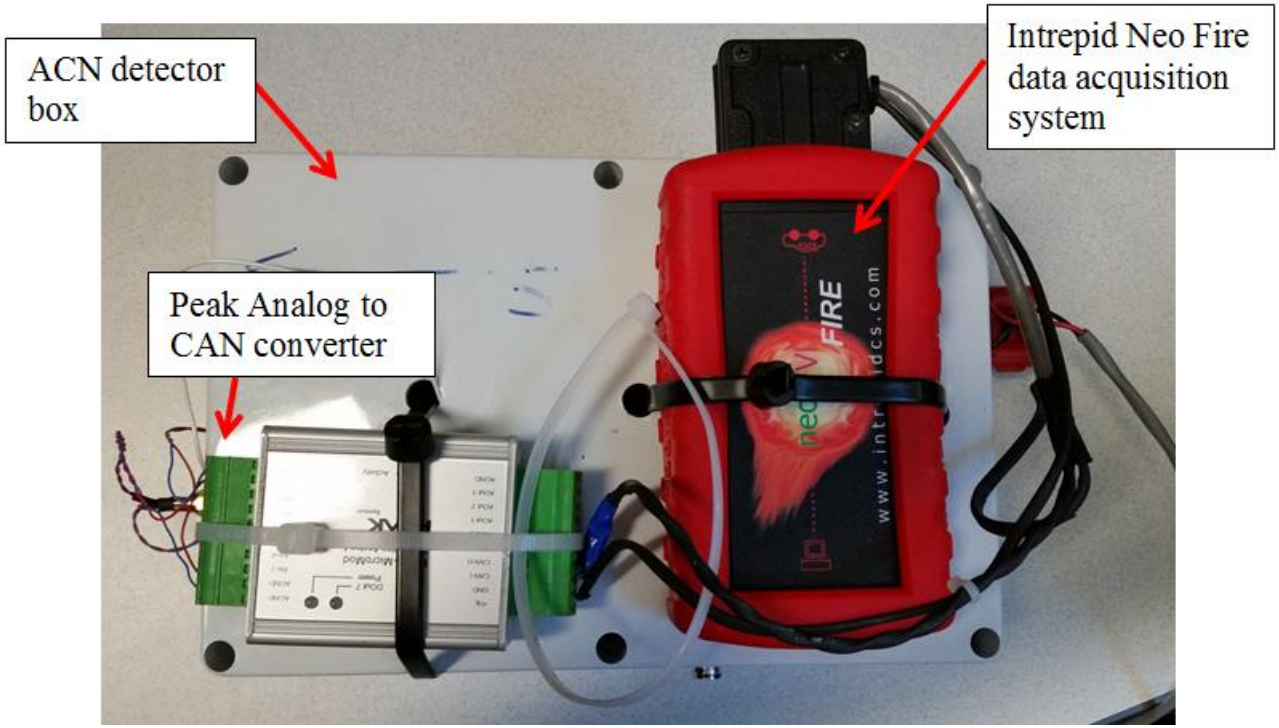
RF Detector for Crash Tests

- Goal is to deliver an indication of a transmitted signal's power to a data acquisition system
- Must be able to survive a crash test



RF Detector for Crash Tests

- Earlier version

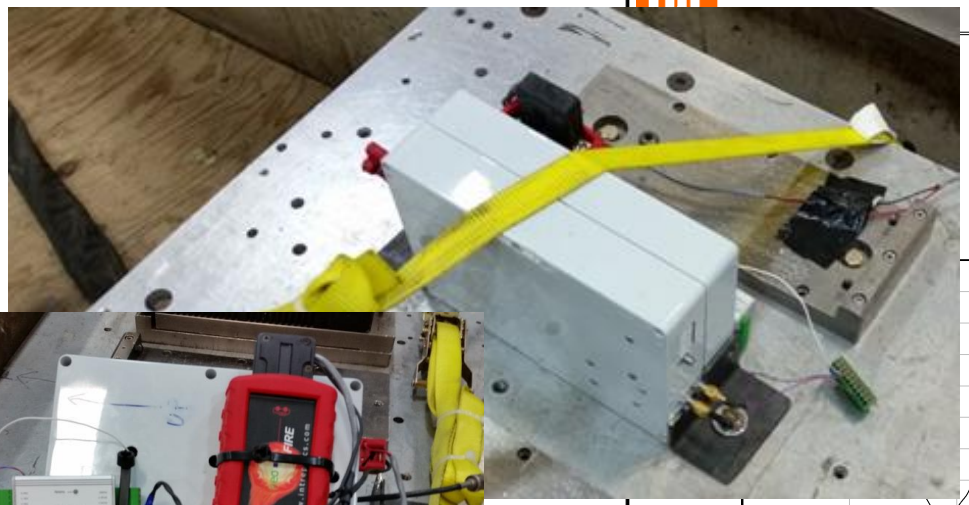


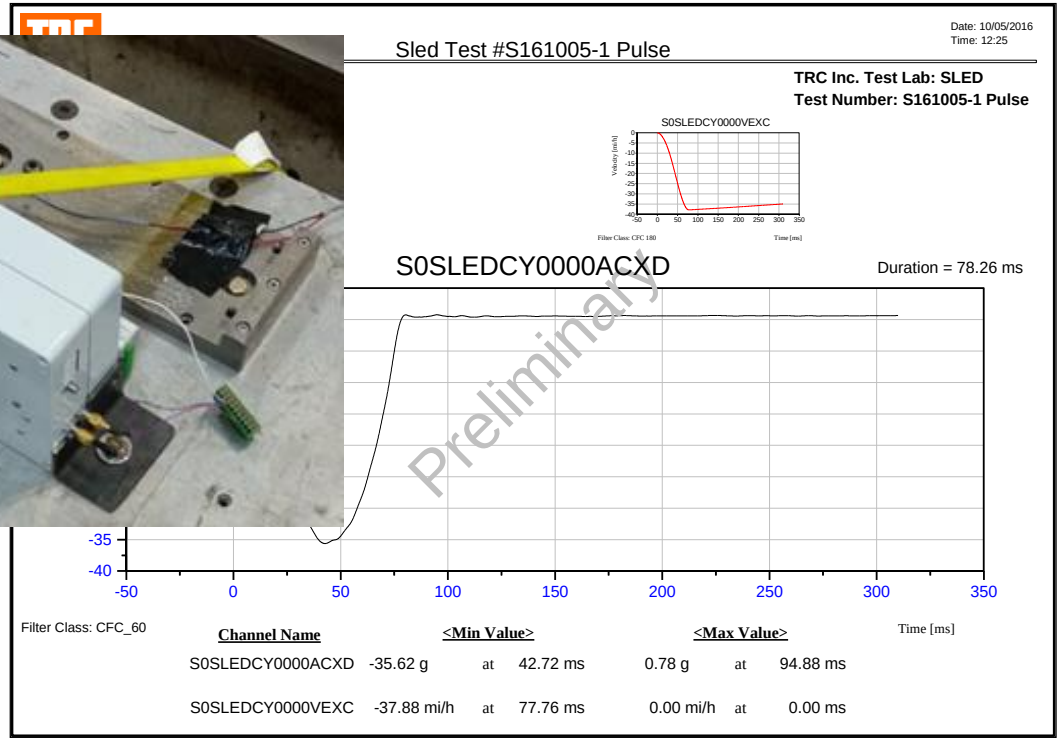
RF Detector for Crash Tests

- Piggy-backed NCAP tests revealed weak voltage regulation circuitry
  - Two frontal, one side
- One failure to take data for reasons unknown
- Frequency of actual crash tests not high enough for verification purposes
- Series of sled tests

RF Detector Sled Testing

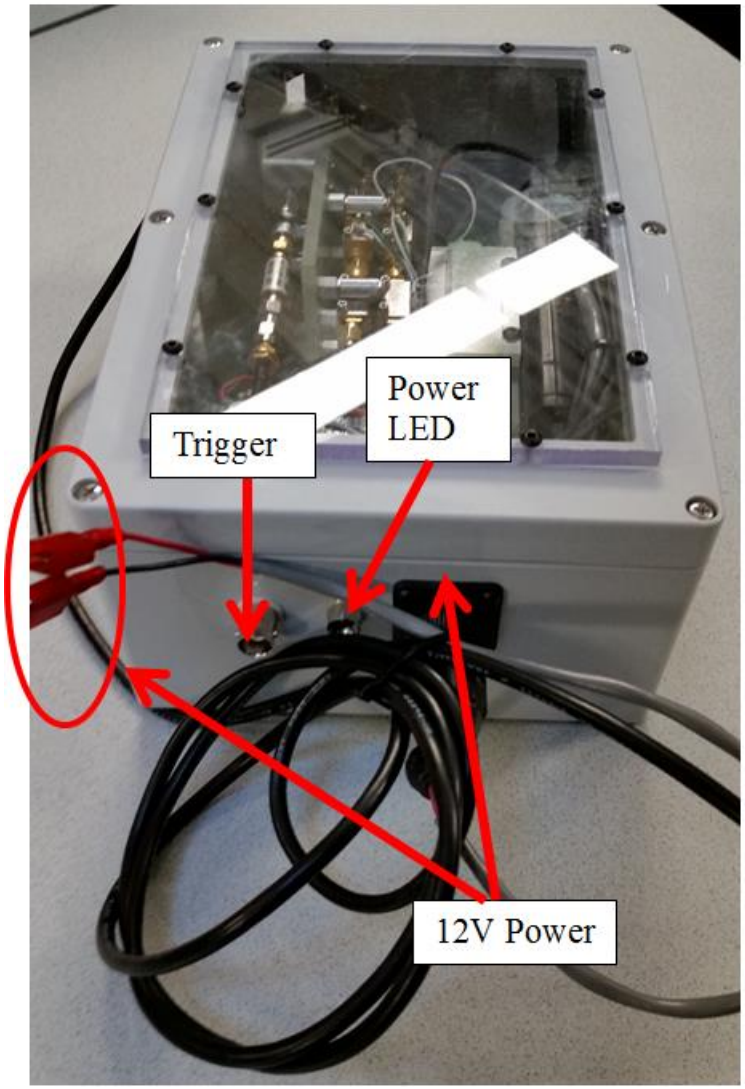
Out of five 35 G, 38mph sled tests with a variety of orientations, two minor failures, no structural failures of circuitry





RF Detector for Crash Tests

- Later version shown here
- Developed in conjunction with TRC, but MGA Research Corporation and Calspan are building similar RF detectors using the draft AACN test procedure… lessons learned will be wrapped back into the AACN test procedure



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Thank You

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Backup Slides

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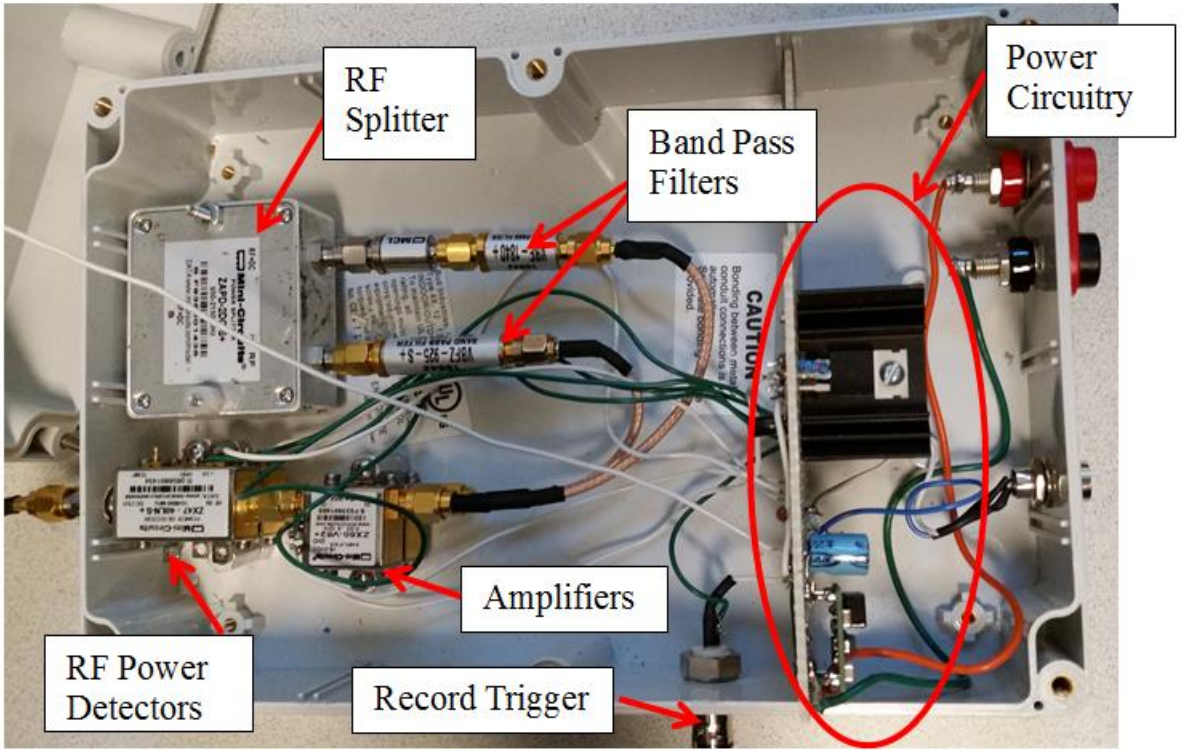
RF Detector for Crash Tests

- RF Detection Circuit Internals



RF Detector for Crash Tests

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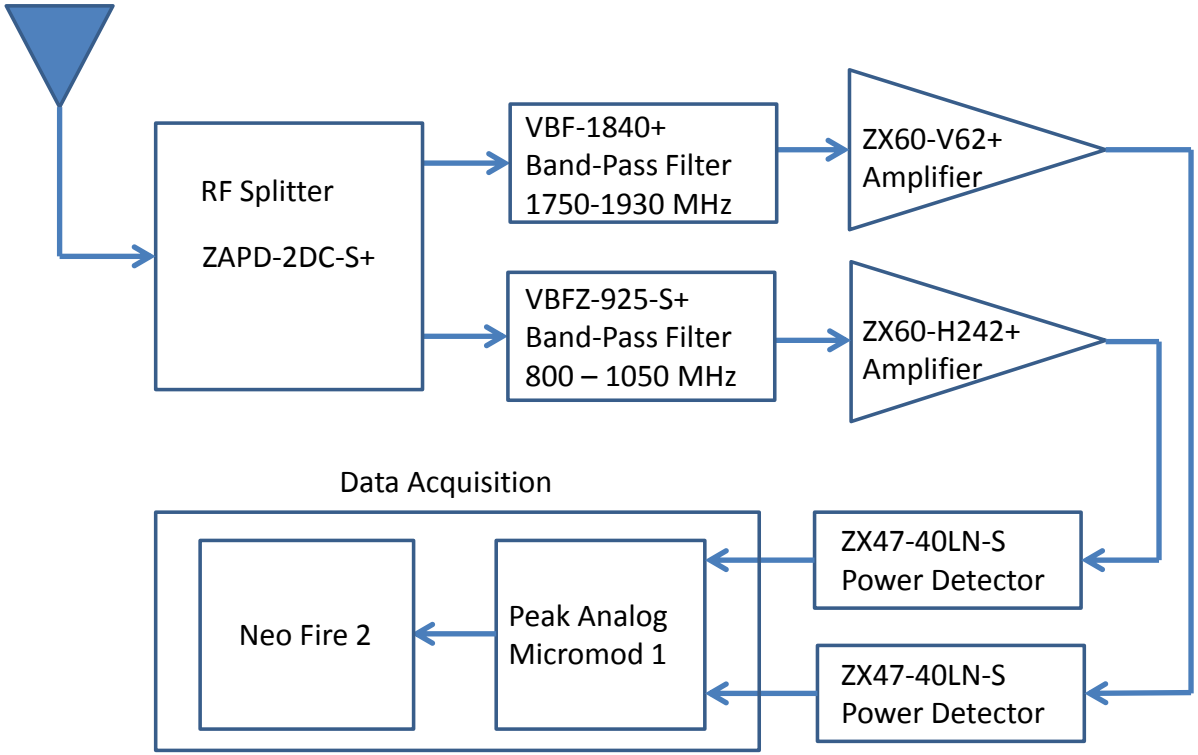

RF Detector for Crash Tests

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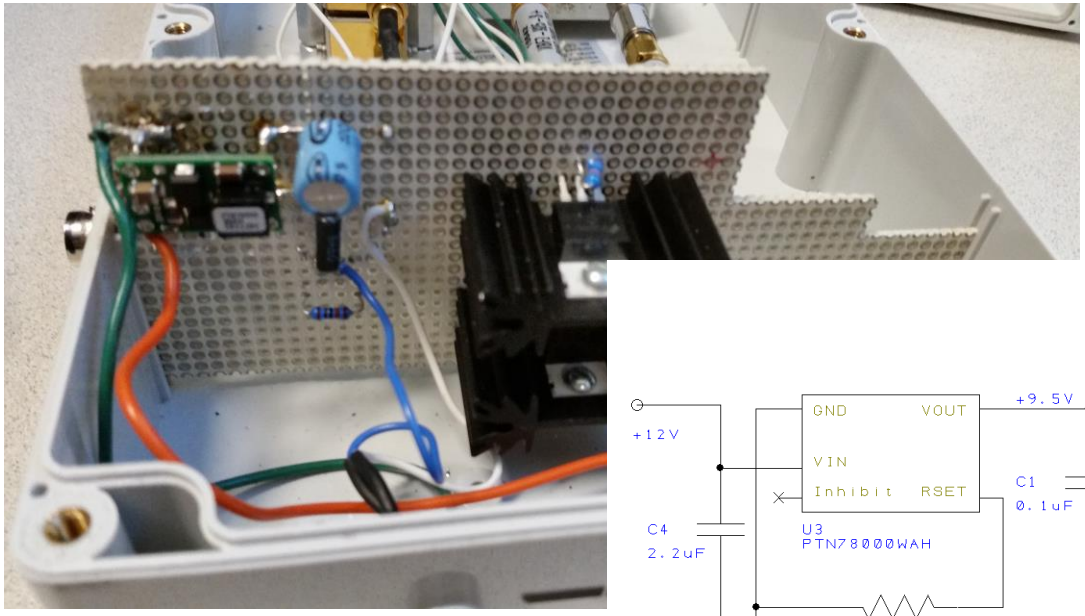

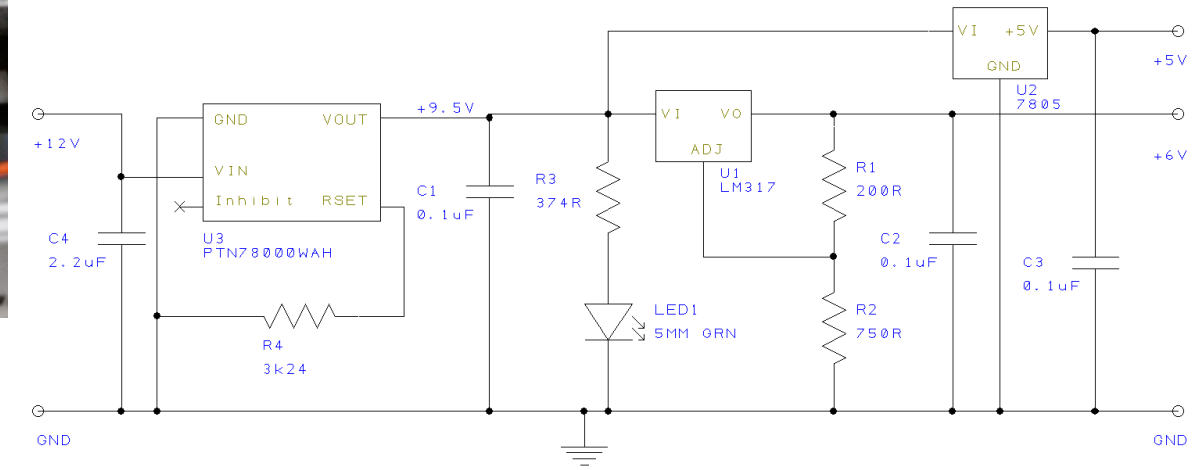

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RF Detector for Crash Tests

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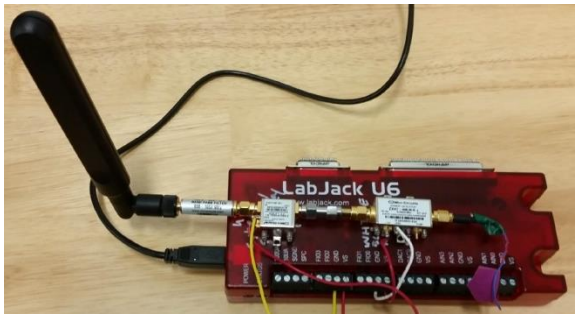
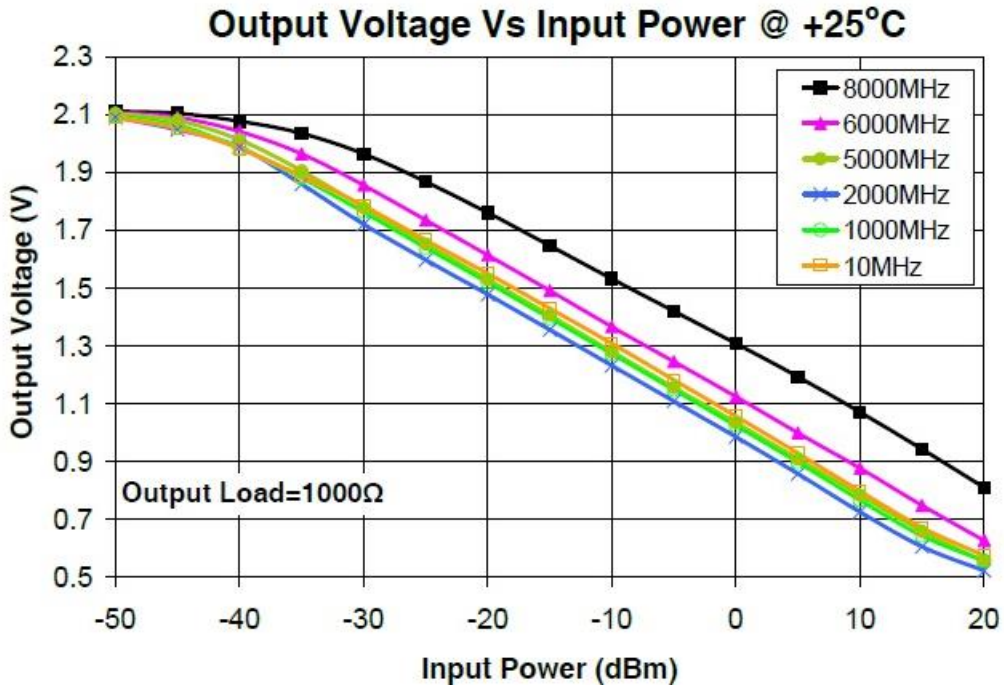


Approved Operating Frequencies

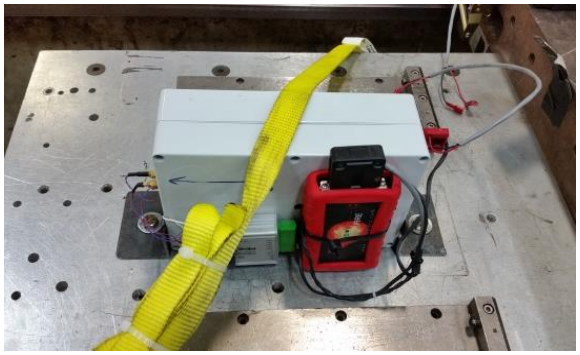
App # (Line Item)	Lower Frequency	Upper Frequency	Power Output	Tolerance	Emission Designator	Rule Parts	Grant Notes
1 (1)	2412	2462	0.148			15C	CC
1 (2)	5745	5825	0.073			15C	CC
1 (3)	2402	2480	0.005			15C	CC
2 (1)	5180.00000000	5240.00000000	0.0150000			15E	CC
3 (1)	2402.00000000	2480.00000000	0.0050000			15C	CC
4 (1)	1850.2	1909.8	0.392	2.5ppm	245KG7W	24E	
4 (11)	1852.4	1907.6	0.228	2.5ppm	4M16F9W	24E	
4 (12)	1851.25	1908.75	0.293	2.5ppm	1M29F9W	24E	
4 (13)	1852.5	1907.5	0.206	2.5ppm	4M51G7D	24E	
4 (14)	1852.5	1907.5	0.166	2.5ppm	4M48W7D	24E	
4 (15)	1855.5	1905.5	0.212	2.5ppm	8M99G7D	24E	
4 (16)	1855.5	1905.5	0.169	2.5ppm	8M97W7D	24E	
4 (17)	1712.4	1752.6	0.231	2.5ppm	4M16F9W	27	
4 (18)	706.5	713.5	0.204	2.5ppm	4M51G7D	27	
4 (19)	706.5	713.5	0.163	2.5ppm	4M50W7D	27	
4 (2)	709	711	0.202	2.5ppm	8M98G7D	27	
4 (21)	709	711	0.16	2.5ppm	8M97W7D	27	
4 (22)	782	782	0.189	2.5ppm	9M00G7D	27	
4 (23)	782	782	0.136	2.5ppm	9M00G7D	27	
4 (24)	1712.5	1852.5	0.209	2.5ppm	4M50G7D	27	
4 (25)	1712.5	1852.5	0.158	2.5ppm	4M49W7D	27	
4 (26)	1715	1750	0.209	2.5ppm	8M98G7D	27	
4 (27)	1715	1750	0.165	2.5ppm	8M98W7D	27	
4 (3)	826.4	846.6	0.244	2.5ppm	4M16F9W	22H	
4 (4)	824.7	848.31	0.303	2.5ppm	1M28F9W	22H	
4 (5)	826.5	846.5	0.201	2.5ppm	4M47G7D	22H	
4 (6)	826.5	846.5	0.158	2.5ppm	4M47W7D	22H	
4 (7)	829	844	0.199	2.5ppm	8M97G7D	22H	
4 (8)	829	844	0.158	2.5ppm	8M95W7D	22H	
4 (9)	1850.2	1909.8	1.057	2.5ppm	246KGXW	24E	

CHANNEL NUMBER	LOWER FREQUENCY MHZ	CENTER FREQUENCY MHZ	UPPER FREQUENCY MHZ
1	2401	2412	2423
2	2404	2417	2428
3	2411	2422	2433
4	2416	2427	2438
5	2421	2432	2443
6	2426	2437	2448
7	2431	2442	2453
8	2436	2447	2458
9	2441	2452	2463
10	2451	2457	2468
11	2451	2462	2473
12	2456	2467	2478
13	2461	2472	2483
14	2473	2484	2495

Part Number	Description	Manufacturer
VBF-1840+	Band-Pass Filter	Mini-Circuits
VBFZ-925-S+	Band-Pass Filter	Mini-Circuits
ZX60-V62+	RF Amplifier	Mini-Circuits
ZX60-H242+	RF Amplifier	Mini-Circuits
ZX47-40LN-S	RF Power Detector	Mini-Circuits
ZAPD-2DC-S+	RF Power Splitter	Mini-Circuits
LM317	Voltage Regulator	Various
LM7805C	Voltage Regulator	Various
TG.10.0113	Cellular Antenna	Taoglas Antenna Solutions
Neo VI Fire	CAN Logger	Intrepid Controls Systems Inc.
MicroMod Analog 1	Analog to CAN Converter	Peak-System


Output Voltage Vs Input Power @ +25°C
Output Voltage (V)
2.3
2.1
1.9
1.7
1.5
1.3
1.1
0.9
0.7
0.5
-50
-40
-30
-20
-10
0
10
20
Input Power (dBm)
Output Load=1000Ω
8000MHz
6000MHz
5000MHz
2000MHz
1000MHz
10MHz

Sled Test Device Orientations



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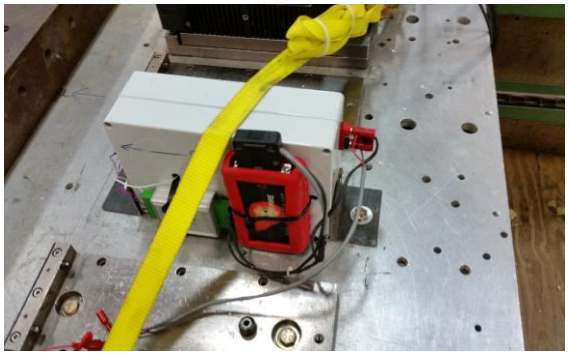

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