

Item	QTY	Brd	#Brds	Board	Reference	Value	Tolerance	Description	Manufacturer	Manufacturer PN
1	35		1	MMC	C1,C2,C3,C4,C5,C6,C7,C8,C9,C10,C12,C13,C17,C22,C30,C41,C42,C43,C44,C49,C50,C52,C54,C55,C56,C57,C65,C67,C68,C69,C71,C76,C82,C84,C87	0.1uF	10%	CAP CER .1UF 16V X5R 0402	Murata Electronics	GRM155R6C1C04KA88D
2	2		1	MMC	C11,C59	1nF	10%	CAP CER 1000PF 50V 10% X7R 0402	Murata Electronics	GRM155R71H102KA01D
3	2		1	MMC	C15,C61	0.47uF	20%	CAP CER .47UF 25V Y5V 0603	Murata Electronics	GRM188F51E474ZA01D
4	2		1	MMC	C16,C63	4.7uF	20%	CAP CER 4.7UF 25V X5R 0805	Murata Electronics	GRM21BR61E475MA12L
5	13		1	MMC	C18,C24,C25,C26,C28,C29,C31,C33,C66,C72,C75,C81,C83	100pF	5%	CAP CER 100PF 50V 5% COG 0402	Murata Electronics	GRM1555C1H101J201D
6	2		1	MMC	C19,C64	0.1uF	10%	CAP CER .1UF 50V 10% X7R 0805	Murata Electronics	GRM21BR71H104KA01L
7	2		1	MMC	C20,C60	470pF	10%	CAP CER 470PF 50V 10% X7R 0402	Murata Electronics	GRM155R71H471KA01D
8	2		1	MMC	C21,C62	47uF	20%	CAP CER 47UF 10V X5R 1210	Kemet	C1210C476M8PACTU
9	1		1	MMC	C34	10nF	10%	CAP CER 10000PF 16V 10% X7R 0402	Murata Electronics	GRM155R71C103KA01D
10	2		1	MMC	C37,C85	22pF	5%	CAP CER 22PF 50V 5% COG 0402	Murata Electronics	GRM1555C1H220J201D
11	1		1	MMC	C38	8.2pF	0.25pF	CAP CER 8.2PF 50V 5 0402 UHI Q	Johanson Tech	500R0758R2CV4T
12	1		1	MMC	C39	6.8pF	0.25pF	CAP CERAMIC 6.8PF 50V COG 0402	Murata Electronics	GJM1555C1H68R8C01D
13	1		1	MMC	C40	3.3pF	0.25pF	CAP CERAMIC 3.3PF 50V COG 0402	Murata Electronics	GJM1555C1H3R3C01D
14	2		1	MMC	C51,C53	1uF	10%	CAP CER 1UF 25V X5R 0603	Murata Electronics	GRM188R61E105KA12D
15	2		1	MMC	C88,C89	10uF	10%	CAP CER 10UF 35V X5R 10% 1206	Taiyo Yuden	GMK316B106KL-T
16	2		1	MMC	DA1,DA2	SMS05T1G		TVS ARRAY QUAD 350V SC74-6	On semiconductor	SMS05T1G
17	1		1	MMC	D1	B340A		DIODE SCHOTTKY 3A 40V SMA	Diodes Inc	B340A-13-F
18	2		1	MMC	D2,D8	DFLS240L		DIODE SCHOTTKY 2A 40V PWRDI 123	Diodes Inc	DFLS240L-7
19	3		1	MMC	D3,D4,D6	HLMP-3507-D00B2		LED 5MM GAP GRN RA HOUSING TH	Avago	HLMP-3507-D00B2
20	2		1	MMC	D5,D7	HLMP-3301-F00B2		LED 5MM GAP RED RT ANGLE HOUSING	Avago	HLMP-3301-F00B2
21	2		1	MMC	D10,D12	LG L29K-G2J1-24-Z		LED SMARTLED GREEN 570NM 0603	Osram	LG L29K-G2J1-24-Z
22	2		1	MMC	J1,J4	JTAG		CONN HEADER LPROPO STR 14POS GOLD	TE Connectivity	5103308-2
23	2		1	MMC	J2,J12	CON2		TERMINAL BLOCK 5.08MM 2POS PCB	On Shore Tech	ED2250/2
24	2		1	MMC	J3,J15	SMA Straight		CONN SOCKET SMA STR DIE CAST PCB	TE Connectivity	5-1814832-1
25	4		1	MMC	J5,J6,J7,J8	MMCX_SM		CONN JACK MMCX 50 OHM EDGE MOUNT	Molex	73415-0961
26	1		1	MMC	J9	CONN PCB 8x2-P		CONN HEADER 16POS 2MM GOLD SMD	Hirose electric	A3A-16PA-25V(71)
27	1		1	MMC	J10	CONN PCB 10x2-S		CONN RECEPT 20POS 2MM GOLD SMD	Hirose electric	A3A-20DA-25V(71)
28	2		1	MMC	J11,J13	USB_B		CONN RCPT USB TYPE B R/A PCB	FCI	61729-0010BLF
29	1		1	MMC	J17	CON3		CONN HEADER VH TOP 3POS 3.96MM	JST Sales	83P-VH(LF)(SN)
30	2		1	MMC	L1,L2	6.8uH	20%	INDUCTOR SHIELD PWR 6.8UH SMD	Coiltronics	DR73-6R8-R
31	2		1	MMC	L3,L10	100nH	5%	INDUCTOR 100NH 220MA 0603	Murata Electronics	LQW18ANR10J00D
32	1		1	MMC	L5	22nH	5%	INDUCTOR 22NH 310MA 0402	Murata Electronics	LQW15AN22NJ00D
33	1		1	MMC	L6	2.7nH	0.5nH	INDUCTOR 2.7NH 850MA 0402	Murata Electronics	LQW15AN27ND00D
34	2		1	MMC	L7,L8	5.6nH	0.2nH	Power Inductors 5.6 NH +- .2NH	Murata Electronics	LQW15AN56NC10D
35	1		1	MMC	L9	MCF182CN102M04AK		FILTER EMI 3-TERM 25V 4A 0603	Rohm	MCF182CN102M04AK
36	1		1	MMC	P1	CONNECTOR DB9		CONN D-SUB PLUG R/A 9POS GOLD/FL	TE Connectivity	1734352-1
37	4		1	MMC	Q2,Q3,Q4,Q5	DMP2160U		MOSFET P-CH 20V 3.2A SOT-23	Diodes Inc	DMP2160U-7
38	16		1	MMC	R1,R2,R6,R9,R10,R11,R18,R19,R20,R48,R49,R50,R53,R54,R61,R63	100R	5%	RES 100 OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ101X
39	2		1	MMC	R3,R46	4.7K	5%	RES 4.7K OHM 1/16W 5% 0402 SMD	Vishay/Dale	CRCW04024K70JNED
40	3		1	MMC	R5,R52,R69	47K	5%	RES 47K OHM 1/16W 5% 0402 SMD	Vishay/Dale	CRCW040247K0JNED
41	2		1	MMC	R12,R60	0.68R	5%	RES .68 OHM 1/8W 5% 0805 SMD	Panasonic	ERJ-6RQJ68V
42	2		1	MMC	R13,R58	20K	1%	RES 22.0K OHM 1/16W 1% 0402 SMD	Vishay/Dale	CRCW040222K0FKED
43	2		1	MMC	R14,R59	316K	1%	RES 316K OHM 1/16W 1% 0402 SMD	Vishay/Dale	CRCW0402316KFKED
44	3		1	MMC	R15,R57,R95	68.1K	1%	RES 68.1K OHM 1/16W 1% 0402 SMD	Vishay/Dale	CRCW0402681KFKED
45	6		1	MMC	R16,R21,R22,R55,R56,R62	100K	1%	RES 100K OHM 1/16W 1% 0402 SMD	Yageo	RC0402FR-07100KL
46	16		1	MMC	R35,R36,R37,R38,R39,R40,R41,R42,R43,R51,R64,R68,R70,R71,R87,R92,R96	OR		RES 0.0 OHM 1/16W 0402 SMD	Vishay/Dale	CRCW04020000Z0ED
47	1		1	MMC	R67	820R	5%	RES 100 OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ101X
48	6		1	MMC	R44,R45,R91,R94,R97,R98	10K	1%	RES 10.0K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1002X
49	1		1	MMC	R99	1.5K	1%	RES 1.50K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1501X
50	1		1	MMC	U1	MAX3223		IC DRVR/RCVR MULTCH RS232 20SSOP	TI	MAX3223IDBR
51	2		1	MMC	U2,U11	CP2102-GM		IC USB-TO-UART BRIDGE 28VQFN	Silicon Laboratories	CP2102-GM
52	2		1	MMC	U3,U15	MSP430F248		IC MCU 16BIT 48K FLASH 64-LQFP	TI	MSP430F248PMR
53	2		1	MMC	U4,U17	LT1912		IC REG SW 2A STEP-DOWN 10-DFN	Linear Technology	LT1912EDD#PBF
54	2		1	MMC	U5,U7	SPF-5043Z		GaAs pHEMT LOW NOISE MMIC AMPLIFIER	RFMD	SPF-5043Z
55	1		1	MMC	U8	WP4C+		4 way RF power splitter	Mimicircuits	WP4C+
56	1		1	MMC	U9	SX1231		IC 433/868/915MHZ TXRX 24-QFN	Semtech	SX1231MLTRT
57	2		1	MMC	U12,U13	LTC1694-1		IC ACCEL SMBUS DUAL TSOT23-5	Linear Technology	LT1694-1IS5#TRMPBF
58	1		1	MMC	U16	RF3858		900MHz RF PA	RFMD	RF3858
59	1		1	MMC	U18	0915LP15B026		FILTER LOWPASS GSM/CDMA 915MHZ	Johanson Tech	0915LP15B026E
60	1		1	MMC	U19	LY35A		FILTER SAW ISM 915MHZ SMD	Epcos	LY35A
61	1		1	MMC	U20	B3726		FILTER BANDPASS 915MHZ	Epcos	B3726
62	1		1	MMC	U21	MCP6001		IC OPAMP 1.8V 1MHZ SNGL SOT23-5	Microchip	MCP6001T-I/OT
63	1		1	MMC	U22	LT1764A		IC LDO LO NOISE 3A ADJ DDPAK-5	Linear Technology	LT1764AEQ#PBF
64	1		1	MMC	U23	SWR348-32.000	1ppm	TCXO	Suntzu Frequency control	SWR348-32.000MHZ
65	1		1	MMC	X1	32MHz	15ppm	CRYSTAL 32.000000 MHZ SMD 8PF	NDK	NX32255A-32.000000MHZ
66	2		1	MMC	X2,X3	CRYSTAL_32768		CRYSTAL 32.768 KHZ 6.0 PF SMD	Abracom	ABS25-32.768KHZ-6-1-T
67	81		4	Radio	C1,C4,C5,C6,C8,C12,C15,C16,C17,C20,C23,C26,C27,C28,C32,C34,C37,C38,C39,C42,C45,C48,C49,C50,C53,C56,C59,C60,C61,C65,C67,C70,C71,C72,C75,C78,C81,C82,C83,C86,C89,C92,C93,C94,C96,C100,C103,C104,C105,C108,C111,C114,C115,C116,C120,C122,C125,C126,C127,C131,C133,C136,C137,C138,C141,C144,C147,C148,C149,C152,C155,C158,C159,C160,C164,C166,C169,C170,C171,C174,C177	0.1uF	10%	CAP CER .1UF 16V X5R 0402	Murata Electronics	GRM155R6C1C04KA88D
68	16		4	Radio	C3,C14,C25,C36,C47,C58,C69,C80,C91,C102,C113,C124,C135,C146,C157,C168	6.8pF	0.25pF	CAP CER 6.8PF 50V 5 0402 UHI Q	Johanson Technology	500R0756R8CV4T

69	16	4	Radio	C7,C18,C29,C40,C51,C62,C73,C84,C95,C106,C117,C128,C139,C150,C161,C172	1nF	10%	CAP CER 1000PF 50V 10% X7R 0402	Murata Electronics	GRM155R71H102KA01D
70	32	4	Radio	C9,C10,C19,C21,C30,C31,C41,C43,C52,C54,C63,C64,C74,C76,C85,C87,C97,C98,C107,C109,C118,C119,C129,C130,C140,C142,C151,C153,C162,C163,C173,C175	12pF	5%	CAP CER 12PF 50V 5 0402 UHI Q	Johanson Technology	500R075120JV4T
71	16	4	Radio	C11,C22,C33,C44,C55,C66,C77,C88,C99,C110,C121,C132,C143,C154,C165,C176	0.1uF	10%	CAP CER .1UF 16V X5R 0402	Murata Electronics	GRM155R61C104KA88D
72	1	4	Radio	C178	10uF	10%	CAP CER 10UF 16V X5R 0805	Murata Electronics	GRM21BR61C106KE15L
73	6	4	Radio	C179,C180,C181,C182,C183,C184	100pF	5%	CAP CER 100PF 50V 5% COG 0402	Murata Electronics	GRM1555C1H101J201D
74	16	4	Radio	J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16	CON3		CONN HEADER 3POS 2MM R/A SMD	Tyco Electronics	1775469-3
75	1	4	Radio	J17	CONN PCB 8x2-P		CONN HEADER 16POS 2MM GOLD SMD	Hirose Electric	A3A-16PA-25V(71)
76	1	4	Radio	J18	MMCX_SM		CONN JACK MMCX 50 OHM EDGE MOUNT	Molex	73415-0961
77	1	4	Radio	J19	CONN PCB 10x2-S		CONN RECEPT 20POS 2MM GOLD SMD	Hirose Electric	A3A-20DA-25V(71)
78	1	4	Radio	J20	Jumper x 3		CONN HEADER R/A 6POS GOLD SMD	3M	961206-5500-AR-PR
79	16	4	Radio	L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,L14,L15,L16	6.8nH	5%	CER INDUCTOR 6.8NH 0402	Johanson Technology	L-07C6N8JV6T
80	1	4	Radio	L17	FB		FERRITE CHIP 70 OHM 0402	Murata Electronics	BLM15AX7005N1D
81	16	4	Radio	R1,R6,R11,R16,R21,R26,R31,R36,R41,R46,R51,R56,R61,R66,R71,R76	47k	5%	RES 47K OHM 1/16W 5% 0402 SMD	Vishay/Dale	CRCW040247K0JNED
82	32	4	Radio	R2,R3,R4,R5,R7,R8,R9,R12,R13,R15,R18,R19,R22,R23,R25,R27,R29,R32,R35,R38,R42,R44,R45,R49,R50,R53,R55,R59,R64,R65,R68,R72	100R	5%	RES 100 OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ101X
83	32	4	Radio	R10,R14,R17,R20,R24,R28,R30,R33,R34,R37,R39,R40,R43,R47,R48,R52,R54,R57,R58,R60,R62,R63,R67,R69,R70,R73,R74,R75,R77,R78,R79,R80	100R	5%	RES 100 OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ101X
84	16	4	Radio	U1,U3,U5,U7,U9,U11,U13,U15,U17,U19,U21,U23,U25,U27,U29,U31	MSP430F2122		IC MCU 16BIT 4K FLASH 32-QFN	TI	MSP430F2122IRHBR
85	16	4	Radio	U2,U4,U6,U8,U10,U12,U14,U16,U18,U20,U22,U24,U26,U28,U30,U32	SX1231		IC 433/868/915MHZ TXRX 24-QFN	Semtech	SX1231IMLTRT
86	5	4	Radio	U33,U34,U35,U36,U37	WP4C+		4 way RF power splitter	Minicircuits	WP4C+
87	16	4	Radio	X1,X2,X3,X4,X5,X6,X7,X8,X9,X10,X11,X12,X13,X14,X15,X16	32MHz	15ppm	CRYSTAL 32.000000 MHZ SMD 8PF	NDK	NX3225SA-32.000000MHZ
88	1	1	Chassis				CABLE RG174/U 50 OHM COAXIAL	Alpha Wire	9174 BK005
89	1	1	Chassis				Master MCU PCB	Amitron Corporation	
90	4	1	Chassis				Radioboard PCB	Amitron Corporation	
91	1	1	Chassis				CONN SMA PLUG RG 174/316/LMR 100	Amphenol Connex	132114
92	17	1	Chassis				NUT HEX 4-40 ZINC PLATED	B&F Fastener Supply	HN2440
93	4	1	Chassis				NUT HEX 6-32 STAINLESS STEEL	B&F Fastener Supply	HNS5632
94	5	1	Chassis				SCREW MACHINE PHIL 4-40X1/4 SS	B&F Fastener Supply	PMSSS 440 0025 PH
95	5	1	Chassis				SCREW MACHINE PHIL 4-40X5/16 SS	B&F Fastener Supply	PMSSS 440 0031 PH
96	8	1	Chassis				SCREW MACHINE PHIL 4-40X3/8 SS	B&F Fastener Supply	PMSSS 440 0038 PH
97	4	1	Chassis				SCREW MACHINE PHIL 4-40X5/8 SS	B&F Fastener Supply	PMSSS 440 0063 PH
98	4	1	Chassis				SCREW MACHINE PHIL 6-32X5/8 SS	B&F Fastener Supply	PMSSS 632 0063 PH
99	17	1	Chassis				WASHER LOCK INT TOOTH #4 ZINC	B&F Fastener Supply	INT LWZ 004
100	4	1	Chassis				WASHER LOCK INT TOOTH #6 ZINC	B&F Fastener Supply	INT LWZ 006
101	17	1	Chassis				WASHER LOCK METRIC M 3 ZINC	B&F Fastener Supply	MLWZ 003
102	1	1	Chassis				Enclosures	BuckEye Shape Forms	DII-35-4-10 BLK
103	1	1	Chassis				1ft DB9 M/F Extension Cable - Black	CablesToGo	25211
104	1	1	Chassis				Delta Model # U5534, Rev. D, Wireless Diplexer	Delta Microwave	U5534
105	3	1	Chassis				ADAPTER SMA M/F RA BRASS	Fairview Microwave	SM7567
106	3	1	Chassis				Flexible Cable SMA M/M 8 in	Fairview Microwave	SCA49316DS-08
107	1	1	Chassis				Flexible Cable SMA M/M 15 in	Fairview Microwave	SCA49316DS-15
108	1	1	Chassis				TNC Male to TNC Male RF cable, 12in	Fairview Microwave	SCB15922-12
109	2	1	Chassis				Adapter SMA/F-TNC/F FLNG 18GHz	Fairview Microwave	SM4754
110	1	1	Chassis				BLK-STRANDED-HOOKUP WIRE 18 AWG	General Cable/Carol Brand	C2064A.12.01
111	1	1	Chassis				WHITE STRANDED-HOOKUP WIRE 18AWG	General Cable/Carol Brand	C2064A.12.02
112	1	1	Chassis				RED STRANDED-HOOKUP WIRE 18 AWG	General Cable/Carol Brand	C2064A.12.03
113	1	1	Chassis				CABLE 2 COND SHIELD PVC 18 AWG	General Cable/Carol Brand	C2534A-12-10
114	1	1	Chassis				CONN HOUSING VH 3POS 3.96MM WHT	JST Sales	VHR-3N
115	3	1	Chassis				CONN TERM CRIMP VH/NV 18-22AWG	JST Sales	SVH-21T-P1.1
116	5	1	Chassis				STANDOFF M/F HEX 4-40 .750"L BRS	Keystone Electronics	1946
117	20	1	Chassis				STDOFF HEX M/F 4-40 .250"L BRS	Keystone Electronics	8713
118	4	1	Chassis				SPACER ROUND #6 SCRW .250"L BR	Keystone Electronics	1457A
119	8	1	Chassis				CONN MMCX MALE R/A CRIMP RG-174	Linx Technologies	CONMMCX012
120	1	1	Chassis				CORD COIL CIG 5A FUSE W/DC PLUG	MPD	ZA5074-2.5
121	1	1	Chassis				RFH0947 - RF power amplifier with 15 dB gain	RFHIC	RFH0947
122	5	1	Chassis				ADHESIVE KWIK KLIP 5/16 - 13/32	Richco Plastic CO	AKKL-3140A-RT
123	2	1	Chassis				CONN PLUG MINI PWR 2COND LOCKING	Switchcraft Inc	761K
124	2	1	Chassis				CONN POWERJACK LONG BUSHING	Switchcraft Inc	L712A
125	1	1	Chassis				Magnetic Antennas	Tessco	69068 & 39629

Theory of Operations

UWMR

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1. Introduction

This document describes the theory of operation of the UWMR.

2. Operations Overview

2.1 Receiver

The RF signal from the antenna connector is filtered through the duplexer and through BPF1 band-pass filter, passed through the first LNA, further filtered by the second band-pass filter BPF2 and amplified by the second LNA after which the signal is split and delivered to the RF Acquisition boards. The system supports up to 4 RF Acquisition boards. The input of the board is matched to 50 ohm.

Each RF Acquisition board contains 16 independent radios and will be programmed to receive on various channels/modulations. The total number of radios for the entire system is up to 64, which means that the system can receive simultaneously up to 64 messages on different channels.

2.2 Transmitter

The transmitter outputs a fixed continuous unmodulated signal with better than 1ppm temperature stability that is factory programmed between 952MHz and 960MHz to the driver amplifier. The driver is amplitude modulated with a single tone between 25Hz and 60Hz and feeds a separate power amplifier that outputs a +36dBm signal through a duplexer to the antenna.

3. Control

The Master microcontroller will poll each radio from RF Acquisition boards for received messages and will deliver the messages to the laptop using a USB port. The entire system is powered by 12 V/3A max. The input is fused and it is reverse polarity protected using a series diode.

4. Antenna attachment

The antenna for the transmitter module is connected to unit through a front panel TNC connector.

5. Tune-up Procedure

The tune up procedure is done automatically by our board test station. The test station uses a spectrum analyzer to measure output power and frequency of the RF signal. Units that fall outside of the test limits fail the testing and are not shipped until they have been repaired and retested.

The test station performs other tests such as Receiver sensitivity, current draw, as well as other board specific functions not related to the RF performance.

During the board test process, each board is programmed with a serial number, date of manufacture, manufacturer ID, and part number.