Tender No: SAC/HPUR/2018E0735001 **SAC, Ahmedabad**

10th Jan 2019

Corrigendum

Refer our tender no SAC/HPUR/2018E0735001 for Pseudolite Synchronizer Hardware. Consequent to the pre bid conference held on 03/01/2019 as per the tender schedule, the following amendments has been incorporated in the RFP as follows:

Sl No	RFP Details	Earlier	Amend to read as
1	Page No 11, RID .37	Within 1 month after testing	Within 2 months after testing
2	Page No 12, RID .45	Vendor shall quote in slabs of 1-29/30-50/51-100 with and without IP65 complaint	Vendor shall quote in slabs of 1-29/30-50/51-100 with and without (a) IP65 complaint (b) EMI/EMC Certification
3	Page No 21	Table 5: Detailed BOM of RFDC	Table 5: Detailed BOM of RFDC has been modified at rows 42,43,44,45,46,47,48,49,50,51,52

The updated RFP with above amendments incorporated, is available in succeeding pages. The bids will be evaluated as per the revised RFP. There is no change in any other terms and conditions.

Purchase and Stores Officer

SAC/SNGG/RFP/NOV2018/1

REQUEST FOR PROPOSAL

FOR

Development of Pseudolite Synchronizer Hardware

SPACE APPLICATIONS CENTRE

INDIAN SPACE RESEARCH ORGANISATION

AHMEDABAD

2018

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1. Introduction

Space Applications Centre (ISRO) Ahmedabad has initiated development of Pseudolite Synchronizer Hardware in order to meet the requirements of navigation in various fields using indigenous technology. This RFP document provides the details on scope of work involved, responsibilities, specifications of final product etc. Details of work is as given in the section 2.0 'Scope of work'.

2. Scope of work

Line ID	Description
S.1	**Development of Pseudolite Synchronizer Hardware**
1.1.	Vendor has to develop Pseudolite Synchronizer Hardware, consisting of RFDC and Baseband card and Input/output interfaces. Pseudolite Synchronizer Hardware block schematic is given in the Figure 1.
1.2.	Pseudolite Synchronizer Hardware Should comply to specifications as given in the Table 1.
1.3.	Design and fabrication of suitable and compact enclosure for Pseudolite Synchronizer Hardware. Enclosure should provide proper thermal management as per thermal analysis report of PCB provided by SAC/ISRO. It should provide proper RF shielding and EMI performance as given in the Table 1.
1.4.	All IN/OUT ports' names, interface names, Unit name "Pseudolite Synchronizer Hardware", Model number and Unit serial number should be engraved or screen-printed on the enclosure.
1.5.	ISRO/SAC logo and "Space Applications Centre-ISRO, Ahmedabad" should be screen printed on the enclosure.
S.2	**Development of RFDC**
2.1.	SAC/ISRO will provide RFDC Card configuration block schematic, PCB manufacturing design files, Bill of materials. RFDC Card is four-layer PCB on FR-4 material. BOM of the components is provided in the Table 5. Work includes, Bare PCB manufacturing, procurement of all the components as per the BOM(Table-5), component mounting, DC testing of the board.
2.2.	Design and fabrication of cavity type, milled Aluminum alloy metal/ ABS Plastic enclosure for RFDC. It should be compact and should provide proper RF shielding and EMI performance.
2.3.	All IN/OUT ports' names, Unit name "RFDC", Model no and Unit serial no should be engraved or screen-printed on the enclosure.
S.3	**Development of BB Processor Card**

3.1.	SAC/ISRO will provide Baseband card configuration block schematic, PCB Manufacturing design files, BOM, test program file. BB Processor Card is 10-layer PCB on FR-4 material. BOM of the components is provided in the Table 4. Work includes, Bare PCB manufacturing, procurement of all the components, component mounting, DC testing of the board.
3.2.	Vendor shall demonstrate FPGA and ARM processor programming, as per test programs provided by SAC/ISRO.
3.3.	Vendor has to demonstrate the performance of ADC as specified in the test plan.
S.4	**List of Deliverables**
4.1.	(2+28) Pseudolite Synchronizer Hardware units
4.2.	Interface cables, accessories with each Pseudolite Synchronizer Hardware.(mounting screws & screw drivers)
4.3.	Enclosure design, DC test document of both RF and Digital Cards, unit wise test reports, all in hard and soft copies.
S.5	**Refer section 7.0 ' Vendor's Responsibilities' for more details**

3. Pseudolite Synchronizer Hardware Functional Description

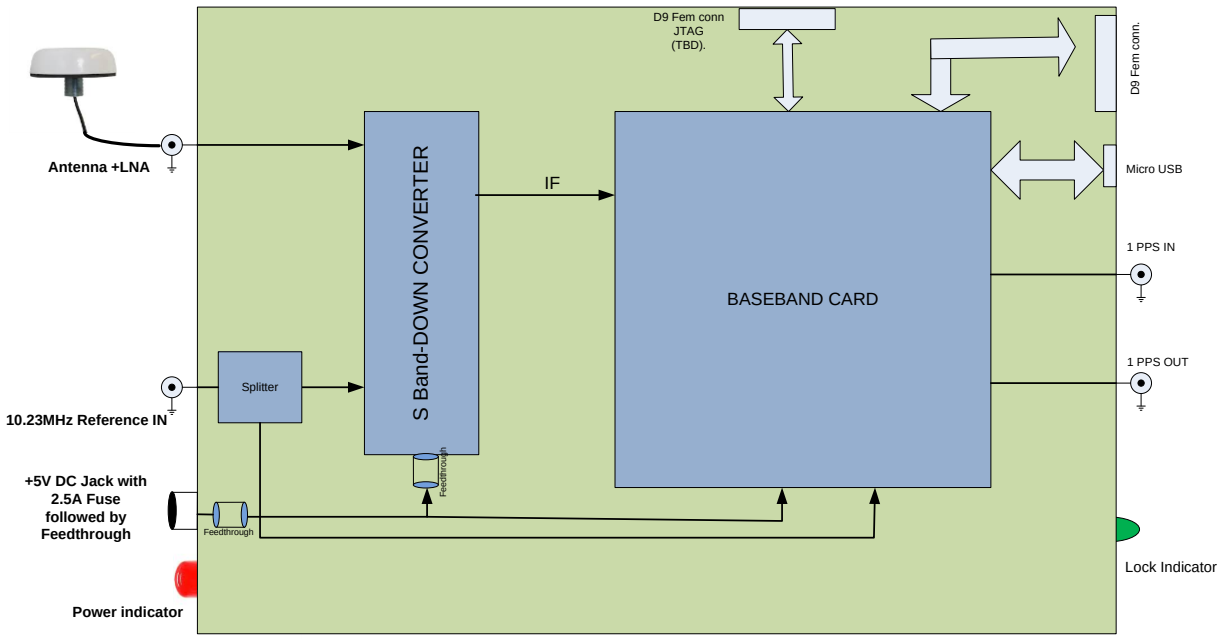

Figure 1: Pseudolite Synchronizer Hardware

Pseudolite Synchronizer Hardware consists of S-Band-RF downconverter(RFDC) and Baseband card. Functional description of RFDC and BB card is given in para 4 and para5 of this RFP respectively and specifications of RFDC, Baseband card are given in table 2 and table 3 respectively. Block schematic is given in the figure 1. Detail specifications of Pseudolite Synchronizer Hardware are given in the **Table 1.**

Table 1: Pseudolite Synchronizer Hardware Specification

Requirement ID	Parameter	Specification
Input Signals		
RID.1	RF Input Signals	
1.1.	Center Frequency and BW	S-band 2414.28 MHz in 20.46 MHz BW
1.2.	Input Noise Power Range	- 60 to -100 dBm in 20.46 MHz BW in band
1.3.	Noise Figure	< 2 dB
1.4.	Input Impedance	50 Ω
1.5.	Input Connector	SMA-F to SMA-F Panel receptacle
RID.2	External Reference Signal IN	
2.1.	10.23 MHz Reference IN	10.23 MHz Sine wave , connected to input port of splitter.
2.2.	Stability	10^{-10} /Sec
2.3.	Level	+0 dBm to + 3 dBm, @ 50 Ω
2.4.	Input Connector	SMA-F to SMA-F Panel receptacle
RID.3	1 PPS IN signal	
3.1.	Level	LV TTL
3.2.	Connector	SMA-F to SMA-F Panel receptacle , @ 50 Ω
RID.4	Power Supply	Total Pseudolite Synchronizer Hardware shall operate on single DC supply. All essential voltages for internal operations of RFDC, BB card must be derived from single DC input to IDU. The card should also have an option to connect to battery.
4.1.	Voltage	5V ± 3%
4.2.	Current	Max current 2A @5V
4.3.	Noise Rejection	EMI filter attached to the enclosure
4.4.	Connector	D9 female
Output Signals		

RID.5	1PPS OUT	
5.1.	Level	LV TTL
5.2.	Connector	SMA-F to SMA-F Panel receptacle, @ 50 Ω
RID.6	Interfaces	
6.1.	USB to UART	1 Nos., Suitable interface cable to be provided by vendor
6.2.	D9 Female Connector	3.3V LVTTL ,Connected with J16 of Baseband card
6.3.	D9 Female Connector(TBD)	3.3V LVTTL ,Connected with J9 of Baseband card
RID.7	Indicators and switches	
7.1.	Switch	Toggle switch for Power ON/OFF with 2.5A fuse with holder .
7.2.	LED Indicators(RED)	The LED indication should be provided for power ON.
7.3.	LED Indicator (GREEN)	The LED indication be provided for proper functionality connected with J17 of Baseband card.
RID.8	Enclosure	Proper heat dissipation of Baseband card should be taken care depending upon PCB thermal analysis report provided by SAC/ISRO.
RID.9	Operating Ambient Temperature Range	0 ° to + 50 ° C
RID.10	EMI/EMC	(RS 103 ,RE 102)*
RID.11	Weather Proof Package	IP65 Standard (Optional)
RID.12	Dimensions& Weight	Not more than 100 x 200 x 50 mm.(WxBxH), < 1000 gm (preferable)

*Note: Exact parameter for 2414.28Mhz Frequency will be given later.

4. RF Down Converter (RFDC) Functional Description

RF Down Converter receives (through RF IN Port of IDU) composite RF signal as described in the specifications RID.1 in the Table 1. RF Downconverter translates input S-band signal to 70 MHz IF. S band Down Converter chain has independently tunable active RF Down Converter -synthesizer chip. Total gain from RF input port to AGC I/P at IF will be approximately 70 dB. AGC should provide at least 30 dB range with nominal constant output of -4 dBm at IF OUT ports. Detailed specifications of RF Down Converter are given in **Table-2**

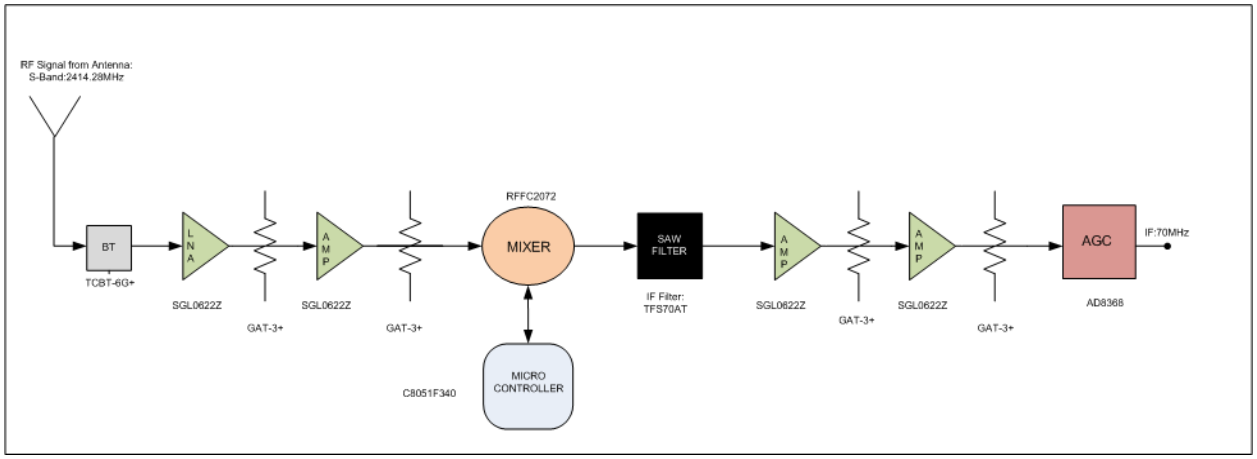

Figure 2: RF Down Converter

Table 2: RF Down Converter Interface Specifications

Requirement ID	Parameter	Specification
RID.13	RF input and BW	RF Frequency 2414.28 MHz with 1dB filter BW 24 MHz
13.1.	Input Connector(P2)	SMA-F Panel receptacle, single connector connected to Pseudolite Synchronizer Hardware front panel, using flexible low loss RF cable.
RID.14	External Reference Signal IN	
14.1.	10.23 MHz Reference IN	10.23 MHz Sine, connected with OUT port of the Splitter.
14.2.	Input Connector (P1)	SMA-F Panel receptacle
14.3.	Level	+0 dBm to + 3 dBm, @ 50 Ω
14.4.	Stability	10^{-10} /Sec
RID.15	DC Input	
15.1.	Voltage Range	5V ± 3%
15.2.	Current	0.5A(With external LNA of active antenna)
15.3.	DC Input Connector	Feed through connector connected with J3
RID.16	Output Signals	

16.1.	Down Converter IF O/P Signal	70 MHz
16.2.	1 dB IF BW @ IF O/P	24 MHz two sided
16.3.	IF levels	- 10 dBm± 3 dB across 50 Ω.
16.4.	IF connector (P3)	SMA-F Panel receptacle
RID.17	Interfaces	
17.1.	Inter connection with Baseband card	Suitable, preferably SMA flexible cable to connect IF Signals.
17.2.	RF Down Converter Enclosure	Made of Aluminum alloy with proper grounding and shielding, shall meet EMI/EMC specifications.

5. Base Band Card Functional Description

The design of the Baseband card is based on the Xilinx Zynq-7000 all Programmable SoC with required configuration memory and other required peripherals. It has two ADCs to take two IF inputs. It also has a clock synthesizer section to provide phased locked clocks and a power supply section. 10.23 MHz sine wave fed on Reference Signal port is used as reference signal to Clock generation. Clock generation block shall generate output clocks in the range of 10 to 100 MHz. Block diagram of Baseband card is shown in the **Figure 3**. Detail specifications are given in the **Table 3**. BOM of critical components is given in the **Table 4**.

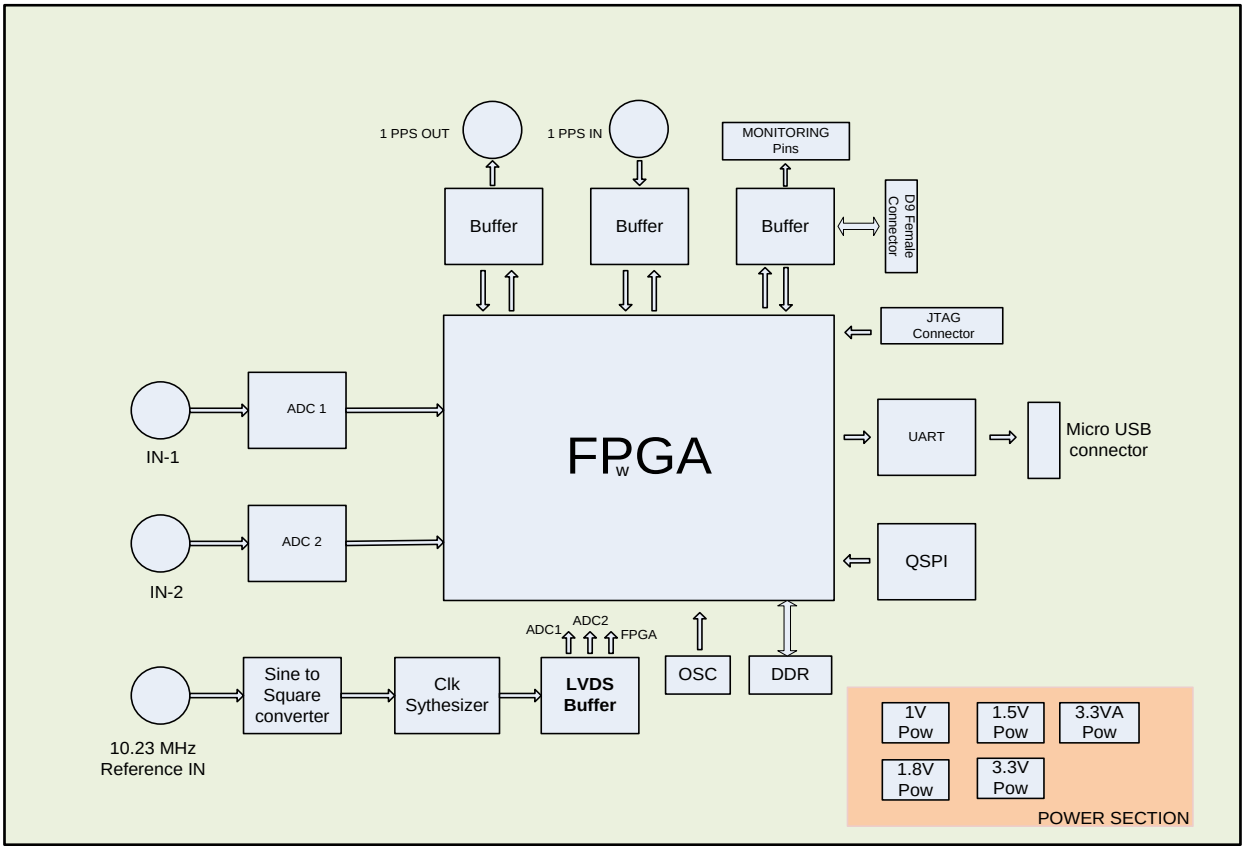

Figure 3: Baseband card block design

Table 3: Baseband Card Interface Specification

Requirement ID	Parameter	Specification
RID.18	IF frequency	70MHz
18.1.	Input connector (K1)	SMA-F(PCB –through hole right angle jack) , connected with RFDC (P3)
18.2.	Level	-10dBm±3dBm , @ 50 Ω
RID.19	External Reference Signal IN	10.23 MHz Sine wave
19.1.	10.23 MHz Reference IN(J20)	SMA-F(PCB –through hole right angle jack) connector via splitter
19.2.	Level	+0 dBm to + 3 dBm @ 50 Ω
RID.20	Input / Output Signals	
20.1.	D9 Female Connector	3.3V LVTTL, Control signals for external transmitter. Connected with 2,3,4,6 pin of J16

20.2.	GPIO(J17)	GPIO lines from FPGA on berg strip for monitoring and future use
20.3.	1 PPS IN (K3)	LV TTL , SMA-F (PCB –through hole right angle jack) @ 50 Ω
20.4.	1 PPS OUT (K2)	LV TTL , SMA-F(PCB –through hole right angle jack) @ 50 Ω
RID.21	User Interfaces	
21.1.	UART (J10)	Mini USB cable to be provided.
21.2.	Programming (J9)	JTAG
RID.22	Size	9.3cm x 8.5cm.
RID.23	DC Input	
23.1.	Voltage Range	5V ± 10%
23.2.	Current	1.1A@5V
23.3.	Connector (J1)	Berg strip

6. SAC/ISRO's Responsibilities

Requirement ID	Description
RID.24	SAC/ISRO shall provide detailed RFDC PCB manufacturing design files, BOM for RFDC card, DC test program and detail specifications.
RID.25	SAC/ISRO shall provide Baseband Card PCB Design manufacturing files, PCB thermal analysis report, BOM for Baseband card, DC test program and detail specifications.
RID.26	Test programs for Baseband card and RFDC will be provided by SAC/ISRO.
RID.27	SAC will review Enclosure design, test details before delivery of DVM units.
RID.28	SAC shall verify performance of vendor developed unit, porting SAC developed HDL software on Baseband cards as per SAC defined test plan.
RID.29	SAC will provide acceptance test plan and carry out T&E of DVM units and will provide clearance for production after successful completion of T&E.
RID.30	Remaining units will be accepted after SAT(site acceptance plan).

7. Vendor's Responsibilities

Requirement ID	Description	Vendor's Compliance
RID.31	Vendor shall fabricate RFDC and Baseband card as per PCB manufacturing design files given by SAC/ISRO. Vendor shall provide complete enclosed unit consisting of RFDC and Base-band card with proper interfaces.	
RID.32	Vendor's responsibility for above work includes design of enclosure, procurement of components, manufacturing of Bare PCBs for RFDC and Baseband Card, component mounting , hardware DC testing.	
RID.33	Vendor shall integrate and test hardware unit with DC performance.	
RID.34	Vendor shall submit DC Test Report and enclosure design approach. In case of IP65 complaint enclosure design , IP65 certification is required.	
RID.35	For any deviation in the performance of DVM unit, with respect to specifications, vendor shall incorporate necessary modifications in the DVM unit, without cost to SAC. Resubmit the modified DVM unit for acceptance test.	
RID.36	Any minor change in the design to be supported by the vendor without any extra cost.	
RID.37	Vendor shall maintain following time line and comply to all specifications. Delivery of 2 prototype (DVM) unit to SAC, Within 3 months of PO. After acceptance of DVM units, vendor has to deliver remaining units in 2 or 3 parts within 2 month after testing .	
RID.38	Remaining units will be accepted after SAT(site acceptance plan).	
RID.39	Vendor shall deliver units, after acceptance, to SAC store. All expenses for the same shall be borne by Vendor. .	
RID.40	SAC shall own IP rights of all the designs of enclosures for RFDC and Baseband card, prepared by vendor under this contract. Vendor shall submit these IP documents along with DVM to SAC.	
RID.41	Units should be **warranted for One-year warranty**. During	

	warranty period, vendor shall collect faulty unit(s) from SAC/ISRO, whenever intimated, repair at their service center and return to SAC/ISRO within 15 days of intimation from SAC/ISRO.	
RID.42	All the expenses/charges, during warranty period, for packaging, forwarding, back and forth transportation from SAC/ISRO to factory/service center, repairing, re-packing, delivery at SAC/ISRO, shall be borne by vendor.	
RID.43	Vendor must supply similar units to SAC/ISRO at a rate not exceeding the price of the unit i.e. without NRE charges and development cost, up to two years after the delivery and acceptance of units.	
RID.44	Vendor has to sign Non-Disclosure Agreement (NDA) Document and should strictly comply with the legal agreements of the contract, terms and conditions laid down by ISRO, for maintaining secrecy of all the technical & non-technical documents, material's details, correspondence, hardware/ software details.	
RID.45	Vendor shall quote in slabs of 1-29/30-50/51-100 with and without A) IP65 complaint. B) EMI/EMC certification.	

8.Vendor's Selection Criteria.

RID.46	Vendor should give point-by-point Compliance in Vendor's Responsibilities section (RID No. 31 to 45).
RID.47	Vendor should have executed similar assembly and fabrication work before with SAC/ISRO and completed work in time. Vendor must attach P.O. copies of the completed works at the time of quotation.

9.Detailed Bill of Materials.

Table 4: Detailed BOM of Baseband card

Sl. No.	Qty	Reference	Manufacturer Part No.	Manufacturer	Procurement	Value	Package

					Specification		
1.	28	C2,C259,C260,C282,C283,C295,C299,C301,C302,C303,C308,C310,C311,C312,C313,C316,C318,C320,C321,C323,C333,C334,C348,C355,C357,C359,C360,C361		AVX/Kemet/TDK/Murata/Vishay	Industrial Grade	0.01uF/16V	SMD0402
2.	44	C5,C224,C226,C227,C228,C231,C232,C234,C235,C236,C237,C238,C257,C270,C272,C273,C274,C280,C281,C300,C304,C306,C307,C309,C314,C317,C319,C322,C324,C331,C332,C336,C337,C339,C344,C345,C346,C347,C349,C351,C352,C353,C356,C358		AVX/Kemet/TDK/Murata/Vishay	Industrial Grade	0.1UF/16V	SMD0402
3.	8	C9,C10,C229,C230,C275,C276,C277,C279		AVX/Kemet/TDK/Murata/Vishay	Industrial Grade	2.2uF/16V	SMD0402
4.	10	C135,C225,C271,C288,C292,C296,C325,C335,C340,C284		AVX/Kemet/TDK/Murata/Vishay	Industrial Grade	10uF/16V	SMD0402
5.	16	C136,C137,C138,C151,C160,C166,C178,C187,C196,C211,C217,C265,C266,C267,C327,C328		AVX/Kemet/TDK/Murata/Vishay	Industrial Grade	100uF/16V	SMD1210
6.	26	C139,C152,C153,C154,C161,C162,C167,C168,C169,C175,C179,C180,C181,C188,C189,C190,C197,C212,C213,C218,C261,C262,C263,C264,C329,C330		AVX/Kemet/TDK/Murata/Vishay	Industrial Grade	4.7uF/16V	SMD0402

7.	41	C144,C145,C146,C147, C148,C149,C150,C155, C156,C157,C158,C163, C164,C165,C170,C171, C172,C173,C176,C177, C182,C183,C184,C185, C186,C191,C192,C193, C194,C195,C198,C199, C214,C215,C216,C219, C220,C221,C222,C223, C338		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	0.47uF/ 16V	SMD0402
8.	8	C233,C278,C159,C174, C305,C315,C350,C354		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	47uF/16V	SMD0805
9.	1	C239		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	1uF/16V	SMD0402
10	2	C252,C253		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	33PF/16V	SMD0402
11	5	C286,C289,C294,C298, C341		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	22UF/16V	SMD0805
12	5	C287,C293,C297,C342, C285		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	0.0033 UF/16 V	SMD0402
13	1	C326		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	0.22UF /16V	SMD0402
14	4	D3,D4,D6,D7	SML-D12M1WT86	ROHM	Industrial Grade	LED	SMD0603
15	1	J1	P9305-02-4-1-1	PROTECTRON	Industrial Grade	Power Jack	THR 2Pin
16	1	J9	87331-1420	MOLEX, LLC	Industrial Grade	Xilinx Parallel IV connector	CONN HEADER 14POS 2MM

							VERT OLD
17	1	J10	UX60SC-MB-5ST	Hirose Electric Co Ltd.	Industrial Grade	USB_MINI_RECEP	SMD
18	1	J16	P9413-A-6--21	PROTECTRON	Industrial Grade	SPI JUMPER	THR
19	1	J17	P9305-08-4-1-1	PROTECTRON	Industrial Grade	MONITOR	THR 8Pin
20	2	J18,J19	P9305-03-4-1-1	PROTECTRON	Industrial Grade	CON3	THR 3Pin
21	1	J20	72970	Pomona Electronics	Industrial Grade	SMA_L5 IN	THR
22	1	J21	P9101-03-A3H-1	PROTECTRON	Industrial Grade	JUMPER	THR 3Pin
23	1	J22	P9101-02-12-1	PROTECTRON	Industrial Grade	P9101-02-12-1	THR
24	4	K1,K2,K3,K6	72970	Pomona Electronics	Industrial Grade	SMA	THR
25	1	L7	BLM21BB201SN1D	Murata	Industrial Grade	200ohm(Impedance at 100 MHz), 200mA	SMD0805
26	1	L11	Resistor	Murata	Industrial Grade	0E Resistor	SMD0805
27	1	L16	SRN 8040-2R2Y	BOURNS.Inc	Industrial Grade	2.2UH, 300MA	SMD
28	4	L17,L18,L19,L21	SRN 3015-1R0Y	BOURNS.Inc	Industrial Grade	1UH,2350MA	SMD
29	2	L20,L22	BLM21BB201SN1D	Murata	Industrial Grade	200ohm, 200mA	

30	2	R1,R145	RC0402FR-0749R9L	Yageo	Industrial Grade	49.9E 1/16W	SMD0402
31	2	R2,R146	RC0402FR-073K74L	Yageo	Industrial Grade	3.74K 1/10W	SMD0402
32	16	R3,R78,R79,R80,R81,R84,R87,R88,R158,R179,R180,R201,R202,R203,R204,R205	9C04021A0R00JLHF3	Yageo	Industrial Grade	0E	SMD0402
33	2	R4,R157	-	Yageo	Industrial Grade	NC	SMD0402
34	7	R38,R39,R140,R141,R143,R167,R182	RC0402FR-0780R6L	Yageo	Industrial Grade	80.6E	SMD0402
35	7	R40,R45,R166,R178,R190,R191,R200	RC0402FR-07240RL	Yageo	Industrial Grade	240E	SMD0402
36	3	R41,R42,R162	RC0402FR-0720KL	Yageo	Industrial Grade	20K	SMD0402
37	5	R43,R44,R105,R106,R107	RC0402FR-071KL	Yageo	Industrial Grade	1K	SMD0402
38	25	R46,R131,R132,R133,R134,R135,R136,R137,R138,R139,R181,R183,R184,R185,R186,R187,R188,R189,R193,R194,R195,R196,R197,R198,R199	RC0402FR-0740R2L	Yageo	Industrial Grade	40.2E	SMD0402
39	14	R47,R48,R49,R50,R51,R52,R53,R77,R89,R108,R151,R153,R156,R173	RC0402FR-074K7L	Yageo	Industrial Grade	4.7K	SMD0402
40	1	R82	RC0402FR-0739RL	Yageo	Industrial Grade	39E	SMD0402
41	5	R83,R130,R144,R159,R192	RC0402FR-0710KL	Yageo	Industrial Grade	10K	SMD0402
42	12	R85,R127,R129,R142,R148,R150,R152,R154,R160,R163,R170,R175	RC0402FR-07100KL	Yageo	Industrial Grade	100K	SMD0402
43	2	R86,R174	-	Yageo	Industrial Grade	NC	SMD0402

44	1	R104	RC0402FR-071ML	Yageo	Industrial Grade	1M	SMD0402
45	4	R111,R128,R147,R155	RC0402FR-0733RL	Yageo	Industrial Grade	33E	SMD0402
46	1	R125	9C04021A0R00JLHF3	Yageo	Industrial Grade	0E	SMD0402
47	1	R149	RC0402FR-0749R9L	Yageo	Industrial Grade	49.9E	SMD0402
48	1	R161	RC0402FR-074K99L	Yageo	Industrial Grade	4.99K	SMD0402
49	1	R164	RC0402FR-0713KL	Yageo	Industrial Grade	13K	SMD0402
50	2	R165,R169	RC0402FR-0715KL	Yageo	Industrial Grade	15K	SMD0402
51	1	R168	RC0402FR-0718K7L	Yageo	Industrial Grade	18.7K	SMD0402
52	2	R171,R176	RC0402FR-0756K2L	Yageo	Industrial Grade	56.2K	SMD0402
53	2	R172,R177	RC0402FR-0718K2L	Yageo	Industrial Grade	18.2K	SMD0402
54	1	SW1	7914J-1-000E	BOURNS.Inc	Industrial Grade	SW DIP-2	SMD
55	3	TP1,TP2,TP3				Test Point	THR 1mm
56	2	TP4,TP5				Test Point	SMD 1mm
57	2	T3,T4	ADT1-1WT	Mini Circuits	Industrial Grade	ADT1-1WT	SMD
58	2	U1,U40	AD9480BSUZ-250	Analog Devices Inc.	Industrial Grade	AD9480BSUZ-250	44-Lead TQFP
59	3	U3,U47,U49	74LCX244MTCX	ON Semiconductor	Industrial Grade	74LCX244	TSSOP

60	1	U19	XC7Z020-2CLG400I	Xilinx Inc.	Industrial Grade	zynq7020	CLG400 Package
61	1	U22	DSC1001DI1-033.3333T	Microchip Technology	Industrial Grade	33MHZ_OSC	4-Pin QFN
62	1	U23	USBLC6-2SC6	STMicroelectronics	Industrial Grade	USBLC6-2	SOT23-6L
63	1	U24	CP2102-GM	Silicon Labs	Industrial Grade	CP2102-GM	28-Pin MLP
64	1	U29	SI5351C-B-GM	Silicon Labs	Industrial Grade	clock synthesizer	20-Pin QFN
65	2	U34,U35	MT41K256M16TW-107 IT:P TR	Micron	Industrial Grade	DDR	96 Ball FBGA - 96 ball X 16 (0.8 pitch)
66	1	U36	TPS51206DSQR	Texas Instruments	Industrial Grade	TPS51206	WSON (10)
67	1	U39	S25FL128SAGMFI010	Cypress Semiconductor	Industrial Grade	QSPI Flash	16-Pin SOIC
68	1	U41	LTC6957HMS-3#PBF	Linear Technology	Industrial Grade	LTC6957-3	12-Pin MSOP/DFN
69	5	U42,U43,U46,U48,U50	TLV62130RGTR	Texas Instruments	Industrial Grade	REGULATOR TLV62130RGTR	VQFN (16)
70	1	U45	SNJ55LVDS31W	Texas Instruments	Industrial Grade	LVDS BUFFER	16-Pin CPF
71	1	U51	MAX232DWR	Texas Instruments	Industrial Grade	RS232 IC	SOIC-16
72	1	Xc1	ABM7-25.000MHZ-	Abracon LLC	industrial	25MHZ_OSC	

			D2Y-T		Grade	Crystal	
73	1	Y1	ECS-3225S33-500 FNT	ECS INC International	industrial Grade	50MHz Oscillator	3.2x2.5x0.9 mm

Table 5 : Detailed BOM of RFDC

S. No	Qty.	Reference	Manufacturer Part No.	Manufacturer	Procurement Specification	Value	Package
1.	1	C1		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	10pF/50V	SMD0402
2.	16	C2,C8,C9,C15,C16,C17,C18,C35,C38,C44,C45,C50,C53,C60,C61,C62		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	100pF/50v	SMD0402
3.	1	C3		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	180pF/50v	SMD0402
4.	5	C4,C7,C64,C68,C70		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	10uF/50v	SMD0805
5.	2	C5,C6		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	330pF/50v	SMD0402
6.	13	C10,C11,C12,C13,C14,C19,C24,C25,C28,C29,C30,C31,C71		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	33pF/50v	SMD0402
7.	8	C20,C23,C26,C27,C46,C47,C56,C63		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	10nF/50v	SMD0402
8.	7	C21,C32,C42,C49,C57,C66,C69		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	0.1uF/50v	SMD0402
9.	8	C22,C33,C37,C40,C52,C55,C65,C67		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	1uF/50v	SMD0402
10.	3	C34,C41,C48		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	1nF/50v	SMD0402

11.	5	C36,C39,C43,C51,C54		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	1200pF/50v	SMD0402
12.	1	C58		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	680pF/50v	SMD0402
13.	1	C59		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	56pF/50v	SMD0402
14.	1	D1		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	LED	SMD0402
15.	1	JP1		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	3-pin BERG Strip	3 pin Male Berg 2.54 mm pitch
16.	1	J1		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	6-pin BERG Strip	6 pin Male Berg 2.54 mm pitch
17.	1	J2		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	10-pin BERG Strip	10 pin Male Berg 2.54 mm pitch
18.	1	J3		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	2-pin BERG Strip	2 pin Male Berg 2.54 mm pitch
19.	4	L1,L2,L4,L5		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	68nH/50v	SMD0402
20.	1	L3		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	10nH/50v	SMD0402
21.	1	L6		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	100nH/50v	SMD0402
22.	2	L7,L8		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	82nH/50v	SMD0402
23.	3	P1,P2,P3		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	SMA Connector	SMA-F PCB Mount
24.	1	R1		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	22k/62.5mW	SMD0402
25.	5	R2,R3,R6,R17,R18		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	0E/62.5mW	SMD0402
26.	2	R4,R5		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	470E/62.5mW	SMD0402
27.	1	R7		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	100K/62.5mW	SMD0402
28.	2	R8,R12		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	220E/62.5mW	SMD0402

29.	1	R9		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	51K/62.5mW	SMD0402
30.	2	R10,R11		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	1K/62.5mW	SMD0402
31.	1	R13		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	105E/62.5mW	SMD0402
32.	1	R14		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	180E/62.5mW	SMD0402
33.	2	R15,R16		AVX/Kemet/TDK/ Murata/Vishay	Industrial Grade	10K/62.5mW	SMD0402
34.	1	T1	RFXF6553	Mini-Circuits	Industrial Grade	Transformer	S20
35.	1	T2	RFXF9503	Mini-Circuits	Industrial Grade	Transformer	S20
36.	1	T3	TCBT-6G+	Mini-Circuits	Industrial Grade	Bias Tee	Surface mount
37.	1	U1	C8051F340	Silicon Labs	Industrial Grade	Microcontroller	TQFP
38.	1	U2	RFFC2071	RFMD	Industrial Grade	Mixer	QFN
39.	1	U3	AD8368	Analog Devices	Industrial Grade	AGC	LFCSP
40.	4	U4,U5,U7,U8	SGL0622Z	RFMD	Industrial Grade	LNA	QFN
41.	1	U6	TFS70AT	Vectron International	Industrial Grade	IF Filter	SAW FILTER
42.	2	U9,U10	TPS73630DBVT	Texas Instruments	Industrial Grade	3 V Regulator	SOT-23
43.	1	U11	TPS73633DBVT	Texas Instruments	Industrial Grade	3.3 V Regulator	SOT-23
44.	1	U12	NT1065	NTLAB	Industrial Grade	RFASIC	QFN
45.	1	U14	TA0675	TAI-SAW	Industrial Grade	L5 SAW Filter	SMD
46.	1	U15	MBP-6R6-2414BP-26M	MiSO Ltd	Industrial Grade	S Ceramic Filter	SMD
47.	1	U16	ULP-30+	Mini-Circuits	Industrial Grade	Low Pass Filter	SMD
48.	1	U17	ADT-4-6T+	Mini-Circuits	Industrial Grade	Transformer	SMD
49.	1	U18	TCM1-43X+	Mini-Circuits	Industrial Grade	Transformer	SMD
50.	5	Z1,Z2,Z3,Z4,Z5	GAT-3+	Mini-Circuits	Industrial Grade	Attenuator	MCLP
51.	1	Splitter	ZFSC-2-1W-S+	Mini-Circuits	Industrial Grade	ZFSC-2-1W-S+	Modular
52.	2	Feed through	SFP 040 1026	Eurofarad	MIL Grade	100 V DC Screw Type Pi Filter	