Laboratory	**SAC (ISRO)-TIMCD-Calibration Laboratory, Space Applications Centre, Department of Space, Government of India, Ambawadi Vistar Post Office, Jodhpur Tekra, Ahmedabad, Gujarat**		
Accreditation Standard	**ISO/IEC 17025: 2005**		
Discipline	**Electro-Technical Calibration**	**Issue Date**	**20.10.2014**
Certificate Number	**C-0556**	**Valid Until**	**19.10.2016**
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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
SOURCE			
1. DC VOLTAGE$	10 V	4.0 µV	Using DC Reference Standard Fluke /734A(732B) By Direct Method
	100 mV to 1V	0.66 µV to 4 µV	Using Calibrator Fluke/5720A By Direct Method
	1V to 10V	4 µV to 35 µV	
	10V to 100V	35 µV to 0.5 mV	
	100 V to 1000 V	0.5 mV to 5 mV	
2. AC VOLTAGE$	**100 Hz to 1 kHz**		
	100 mV to 1 V	10 µV to 50 µV	Using Calibrator Fluke/5720A By Direct Method
	1 V to 10 V	50 µV to 0.50mV	
	10 V to 100 V	0.50 mV to 10 mV	
	100 V to 1000 V	10 mV to 0.16 V	
	1 kHz to 20 kHz		
	500 V to 1000 V	10 mV to 0.16 V	Using Calibrator Fluke/5720A with Fluke / 5725A Amplifier By Direct Method
	1 kHz to 100 kHz		
	100 mV to 1V	12 µV to 0.13 mV	Using Calibrator Fluke/5720A with Fluke / 5725A Amplifier By Direct Method
	1 V to 10 V	0.13 mV to 1.2 mV	
	10 V to 100 V	1.2 mV to 12 mV	
	100 V to 500 V	12 mV to 0.19 V	
	100 kHz to 300 kHz		
	1 V to 10 V	0.13 mV to 5 mV	Using Calibrator Fluke/5720A By Direct Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
3. DC CURRENT[$]	100 µA to 1 mA 1 mA to 1 A 1 A to 10 A	5 nA to 30 nA 30 nA to 50 µA 50 µA to 0.8 mA	Using Calibrator Fluke/5720A with Fluke / 5725A Amplifier By Direct Method
4. AC CURRENT[$]	**100 Hz to 1kHz**		
	100 µA to 1 mA 1 mA to 100 mA 100 mA to 1 A 1 A to 10 A	31 nA to 0.15 µA 0.15 µA to 15 µA 15 µA to 0.2 mA 0.2 mA to 3 mA	Using Calibrator Fluke/5720A with Fluke/ 5725A Amplifier By Direct Method
	1 kHz to10 kHz		
	1 mA to 100 mA 100 mA to 10 A	0.60 µA to 60 µA 60 µA to 4 mA	
5. DC RESISTANCE[$]			
	1 Ω	3 µΩ	Using Tinsley/5685A, Standard By Direct Method
	10 kΩ	23.7 mΩ	Using Resistor Guildline /9330, Standard. By Direct Method
	1 GΩ	0.37 MΩ	Using Resistor Fluke/ 8508A-7000K Standard Resistor By Direct Method
	1 Ω & 1.9 Ω 10 Ω & 19 Ω 100 Ω & 190 Ω 1k Ω & 1.9 kΩ 10 kΩ & 19 kΩ 100 kΩ & 190 kΩ 1 MΩ & 1.9 MΩ 10 MΩ & 19 MΩ 100 MΩ	50 µΩ & 60 µΩ 70 µΩ & 0.1 mΩ 0.5 mΩ & 0.6 mΩ 5 mΩ & 6 mΩ 50 mΩ & 60 mΩ 0.3 Ω & 0.5 Ω 10 Ω & 15 Ω 0.22 kΩ & 0.5 kΩ 16 kΩ	Using Calibrator Fluke/5720A By Direct Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
6. FREQUENCY$	10 MHz	5×10^{-12}	Using Cesium Beam Frequency Standard,Oscilloquartz/5585 By Direct Method
	1-2-2.5-5- 10 MHz	2×10^{-12}	Using Frequency Difference Multiplier Adert / 4110A By Direct Method
	50 Hz to 1MHz 1 MHz to 10MHz	0.01 mHz to 2mHz 2 mHz to 20 mHz	Using AWG Wavetek/39 By Direct Method
	10 MHz to1 GHz 1 GHz to 40 GHz	0.6 Hz to 1.5 Hz 1.5 Hz to 23 Hz	Using 5PSG CW Signal Gen,Agilent / E8247C By Direct Method
7. RF POWER$	**10 MHz to 40GHz** 1 pW to 20 mW (-90 dBm to +13 dBm)	7 % to 10 %	Using PSG CW Signal Gen; Agilent/ E8247C By Direct Method
8. CAL FACTOR$ (CF)	**10 MHz to 26.5 GHz @ 1 mW** 0.85 to 1	4%	Using Sensor Cal System Tegam/1806A, F1135A & DMM Keithley 2000 By Direct Method
	26.5 GHz to 40 GHz @ 1 mW 0.85 to 1	5%	Using Sensor Cal System Tegam/1806A, 1107-08 & DMM Keithley 2000 By Direct Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
9. OSCILLOSCOPE$			
1) Voltage (Amplitude)			
a. DC Signal (1MΩ)	2 mV to 220 V	2 µV to 0.12 mV	Using Oscilloscope Calibrator / Wavetek (Fluke) / 9500B with 9530/ 9560 Active Head By Direct Comparison Substitution Method
b. DC Signal (50Ω)	2 mV to 5 V	2 µV to 1.2 mV	
c. Square Wave (1MΩ)	2 mV to 220 Vp-p	10 µV to 75 mVp-p	
d. Square Wave (50Ω)	2 mV to 5 Vp-p	10 µV to 1.5 mVp-p	
2) Time Base	3.3 ns to 10 ms	60 fs to 0.8 µs	
3) Bandwidth	3.2 GHz	3.2 %	
	6.4 GHz	5 %	
MEASURE			
1. DC VOLTAGE$	100 mV to 1V	0.6 µV to 4 µV	Using 8 ½ Multimeter Fluke/8508A By Direct Method
	1 V to 10 V	4 µV to 35µV	
	10 V to 100V	35 µV to 0.5 mV	
	100 V to 1000 V	0.5 mV to 5 mV	
2. AC VOLTAGE$	**100 Hz to 20 kHz**		
	100 mV to 1 V	10 µV to 50 µV	Using 8 ½ Multimeter Fluke/8508A By Direct Method
	1 V to 10 V	50 µV to 0.4 mV	
	10 V to 100 V	0.4 mV to 10 mV	
	100 V to 1000 V	10 mV to 0.15 V	
	20 kHz to 100 kHz		
	100 mV to 1 V	10 µV to 0.12mV	
	1 V to 10 V	0.12mV to 1.1mV	
	10 V to 100 V	1.1 mV to 12 mV	
	1 V	1.1 mV	
3. DC CURRENT$	100 µA to 1 mA	2 nA to 20 nA	Using 8 ½ Multimeter Fluke/8508A By Direct Method
	1 mA to 1 A	20 nA to 40 µA	
	1 A to 10 A	40 µA to 1 mA	

	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
4.	**AC CURRENT[$]**	**100 Hz to 1 kHz**		
		100 µA to 1 mA	20 nA to 0.15 µA	Using 8 ½ Multimeter Fluke/8508A By Direct Method
		1 mA to 100 mA	0.15 µA to 10 µA	
		100 mA to 1 A	10 µA to 0.15 mA	
		1 A to 10 A	0.15 mA to 2 mA	
		1 kHz to 10 kHz		
		10 mA to 1 A	1 µA to 0.2 mA	
		1 A to 10 A	0.2 mA to 2 mA	
5.	**DC RESISTANCE[$]**	1Ω to 100 Ω	8 Ω to 0.5 mΩ	Using 8 ½ Multimeter Fluke/8508A By Direct Method
		100 V to 10 kΩ	0.5 mΩ to 50 mΩ	
		10 kΩ to 1 MΩ	50 mΩ to 10 Ω	
		1 MΩ to 10 MΩ	10 Ω to 200 Ω	
		10 MΩ to 100 MΩ	0.2 kΩ to 15 kΩ	
		100 M Ω to 1 GΩ	15 kΩ to 0.3 MΩ	
6.	**FREQUENCY[$]**	1 Hz to 300 MHz	0.1 mHz to 1.5 Hz	Using Timer/Counter Pendulum CNT-90 By Direct Method
		10 Hz to 40 GHz	0.6 Hz to 25 Hz	Using Frequency Counter Agilent/53152A By Direct Method
7.	**RF POWER[$]**	**10 MHz to 26.5 GHz**		
		10 µW to 25 mW (-20 dBm to +14 dBm)	4 %	Using Sensor Cal System Tegam 1806A & M1135A By Direct Method

	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
		10 MHz to 40 GHz 1 nW to 100 mW (-60 dBm to +20 dBm)	5 % to 8 %	Using RF Power meter Agilent N1914A with N8487A/ 8487D / N8485A By Direct Method
		10 MHz to 40 GHz 100 pW to 10 nW (-70 dBm to -50 dBm)	6 % to 9 %	Using Spectrum analyzer R&S FSU67/ Agilent E4446A By Direct Method
		10 MHz to 40 GHz 1 pW to 100 pW (-90 dBm to -70 dBm)	7 % to 12 %	
8.	**AMPLITUDE MODULATION$ (AM)**	Mod.Depth: 5 % to 99% (Fc: 100 kHz to 2 GHz Fm: 100 Hz to 10 kHz)	0.5 % to 2 %	Using Modulation Analyzer Boonton / 8201
9.	**FREQUENCY MODULATION$ (FM)**	Deviation: 10 kHz to 199 kHz (Fc: 100 kHz to 2 GHz Fm: 100 Hz to 10 kHz)	0.20 kHz to 4 kHz	Using Modulation Analyzer Boonton / 8201 By Direct Method
10.	**REFLECTION CO-EFFICIENT$**	Frequency: 10 MHz to 40 GHz 0.002 to 0.33	0.04 to 0.11	Using Vector Network Analyzer, Anritsu / MS4644A By Direct Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
11. ATTENUATION[$]	Frequency: 10MHz to 40GHz 0 dB to 50 dB (Lin: 1 to 0.00316)	1.6 % to 6 %	Using Vector Network Analyzer, Anritsu / MS4644A By Direct Method

*** Measurement Capability is expressed as an uncertainty (±) at a confidence probability of 95%**
[$]Only in Permanent Laboratory

Shally Sharma
Convenor

Avijit Das
Program Manager