Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994

Certificate Number 1-11488382529-1

Model Number	11667A
Manufacturer	Keysight Technologies Inc
Description	DC-18 GHz power splitter, type N, 50 ohm
Serial Number	07045
Customer Asset No.	11667A07045
Options Installed	See Measurement Report

Customer
Keysight Technologies Korea Ltd
25-12 Yeouido-dong
Yeongdeungpo-gu
SEOUL 150-711
Korea, Republic of

Date of Calibration	12 Jul 2019
Procedure	STE-50114535-B.02.06
Temperature	(23 ± 5) °C
Humidity	(50 ± 20) %RH

Location of Calibration
Keysight Technologies Korea Ltd.
Singsong Center Bldg. #57,Yeouinaru-ro,
Youngdeungpo-gu
Seoul 07327
KOREA, REPUBLIC OF

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2005 and ANSI/NCSL Z540.1-1994 (R2002). The quality management system is registered to ISO 9001:2015. This report is NOT an accredited report by Korea Laboratory Accreditation Scheme, a ILAC MRA signatory.

As Received Conditions
The measured values of the equipment were observed in specification at the points tested. Additionally, the expanded measurement uncertainty intervals about the measured values were in specification.

Action Taken
- No corrective actions were necessary.

As Completed Conditions
The measured values of the equipment were observed in specification at the points tested. Additionally, the expanded measurement uncertainty intervals about the measured values were in specification.

Remarks or Special Requirements

This calibration report shall not be reproduced, except in full. The documented results relate to the equipment calibrated only.

The test limits stated in the report correspond to the published specifications of the equipment, at the points tested.
This calibration report may refer to equipment manufactured by HP, Agilent and Keysight as being manufactured by Keysight Technologies.

Based on the customer's request, the next calibration is due on 12 Jul 2020.

Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994

Certificate Number 1-11488382529-1

Traceability Information

Technician ID Number N5241693

Measurements are traceable to the International System of Units (SI) via national metrology institutes (www.keysight.com/find/NMI) that are signatories to the CIPM Mutual Recognition Arrangement.

Calibration Equipment Used

Model Number	Model Description	Equipment ID	Cal Due Date
85054B	Standard mechanical calibration kit, DC to 18 GHz, type-N	85054B00438	22 Nov 2020
N5230A	PNA-L network analyzer	N5230A00214	13 Nov 2019

Traceability Table

	Model	Model Description	Equipment ID	Certificate Number	Trace Value
W,R	85054B	Standard mechanical calibration kit, DC to 18 GHz, type-N	85054B00438	1-11253092369-1-ANAB:AC-1498	Reflection Coefficient Transmission Coefficient
W	N5230A	PNA-L network analyzer	N5230A00214	1-10612086497-1	
R	85056A	Standard mechanical calibration kit, DC to 50 GHz, 2.4 mm	85056A02325	1-10559247677-1-A2LA:2079.01	Reflection Coefficient Transmission Coefficient

Legend

W - Working Standard The calibration equipment used for the calibration of the Model indicated on the first page of the Certificate of calibration.

R - Reference Standard The Reference Standard (Accredited or NMI-calibrated ETE) used to provide traceability to the SI-Units for the calibration parameters listed.

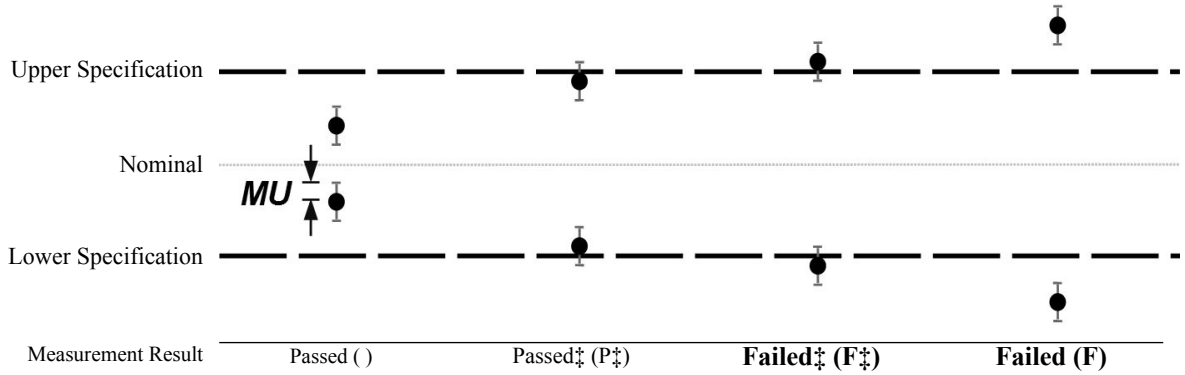
Compliance with Specification

The uncertainty of measurement has been taken into account when determining compliance with specification, as per ILAC-G8:03/2009. If the expanded measurement uncertainty intervals centered about one or more measured values were both in as well as out of specification (upper or lower), it is not possible to state compliance or non-compliance based on a 95% coverage probability for the expanded measurement uncertainty.

An overall statement of compliance for all tests performed as received, and as completed (if any adjustments / repairs were performed) is included at the beginning of this report. Statements of compliance apply only to warranted specifications. When functional verification tests are performed, results are reported in the “Functional Test” section, and do not affect these statements of compliance.
The status summaries relate to the tested item only. A final decision about whether the item's performance actually satisfies requirements of the user can only be made by the user.

Measurement results are reported as:

- Passed ( ) - The measured values of the equipment were observed in specification at the points tested. Additionally, the expanded measurement uncertainty intervals about the measured values were in specification.
- Passed‡ (P‡) - The measured values of the equipment were observed in specification at the points tested. However, a portion of the expanded measurement uncertainty intervals about one or more measured values exceeded specification. Consequently, compliance with specification cannot be declared based on the stated coverage probability.
- Failed‡ (F‡) - One or more measured values of the equipment were observed out of specification at the points tested. However, a portion of the expanded measurement uncertainty intervals about one or more measured values were in specification. Consequently, non-compliance with specification cannot be declared based on the stated coverage probability.
- Failed (F) - One or more measured values of the equipment were observed out of specification at the points tested. Additionally, the expanded measurement uncertainty intervals about one or more measured values were entirely outside the specification.



( ) This result is indicated on the measurement report as a blank space in the column labeled “Status” or “Sts”.
MU = 95% expanded measurement uncertainty.

Uncertainty of Measurement

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%. This probability corresponds to a coverage factor of k=2 for a normal distribution.

Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994

Certificate Number 1-11488382529-1

Calibration Test Results Summary

Test Name	As Received Status
INPUT REFL COEF	Passed
PORT2 INSERTION LOSS	Done
PORT3 INSERTION LOSS	Done
PORT2 to PORT3 TRACKING	Passed
EQUIVALENT SOURCE MATCH	Passed

Tested Configuration

Tested Options	001
(As Rec)	001

INPUT REFL COEF

Passed

The PHASE(deg) column is the measured PHASE.
The MAG column is the measured MAGNITUDE.
The MAXIMUM column is the spec for MAGNITUDE.
The UNCERT column is the uncertainty for MAGNITUDE.

TEST COND	PHASE	MAG	MAXIMUM	UNCERT.	Status
50 MHz	84.4°	0.001	0.070	0.0041	
100 MHz	42°	0.003	0.070	0.0041	
500 MHz	−24.5°	0.005	0.070	0.0042	
1000 MHz	−114.7°	0.003	0.070	0.0042	
1500 MHz	134.8°	0.002	0.070	0.0043	
2000 MHz	−0.3°	0.005	0.070	0.0044	
2500 MHz	−89.9°	0.008	0.070	0.0049	
3000 MHz	−174.5°	0.013	0.070	0.0050	
3500 MHz	121.9°	0.018	0.070	0.0063	
4000 MHz	75.5°	0.023	0.070	0.0064	
4500 MHz	29.2°	0.028	0.111	0.0065	
5000 MHz	−24.8°	0.029	0.111	0.0066	
5500 MHz	−86.3°	0.024	0.111	0.0067	
6000 MHz	−160.1°	0.015	0.111	0.0067	
6500 MHz	109.8°	0.016	0.111	0.022	
7000 MHz	10.3°	0.013	0.111	0.022	
7500 MHz	−99.6°	0.005	0.111	0.022	
8000 MHz	94.2°	0.016	0.111	0.022	
8500 MHz	28.4°	0.032	0.184	0.023	
9000 MHz	−33.5°	0.042	0.184	0.023	
9500 MHz	−94°	0.040	0.184	0.023	
10000 MHz	−157.5°	0.030	0.184	0.023	
10500 MHz	142.3°	0.018	0.184	0.023	
11000 MHz	91°	0.022	0.184	0.023	
11500 MHz	19.5°	0.037	0.184	0.023	
12000 MHz	−55.6°	0.049	0.184	0.023	
12500 MHz	−128.6°	0.050	0.184	0.023	
13000 MHz	159.7°	0.049	0.184	0.023	
13500 MHz	88.2°	0.052	0.184	0.024	
14000 MHz	21.1°	0.062	0.184	0.024	
14500 MHz	−56.5°	0.056	0.184	0.024	
15000 MHz	−112.6°	0.021	0.184	0.024	
15500 MHz	−80.7°	0.030	0.184	0.024	
16000 MHz	−144.6°	0.046	0.184	0.024	
16500 MHz	148.2°	0.035	0.184	0.024	
17000 MHz	116.7°	0.042	0.184	0.024	
17500 MHz	52.4°	0.077	0.184	0.024	
18000 MHz	−18.4°	0.110	0.184	0.025	

The PHASE uncertainty is Arcsin(UNCERT/MAG) degree,
except where MAG is less than UNCERT, in which case
PHASE uncertainty is +/- 180 degree.

PORT2 INSERTION LOSS

Done

TEST COND	PHASE	MAG	UNCERT.
NO SPECS FOR THIS PARAMETER			
50 MHz	−5.2°	6.03 dB	0.040 dB
100 MHz	−10.4°	6.04 dB	0.040 dB
500 MHz	−51.6°	6.06 dB	0.058 dB
1000 MHz	−103°	6.08 dB	0.043 dB
1500 MHz	−154.5°	6.11 dB	0.043 dB
2000 MHz	154.1°	6.14 dB	0.043 dB
2500 MHz	102.8°	6.18 dB	0.067 dB
3000 MHz	51.6°	6.22 dB	0.067 dB
3500 MHz	0.4°	6.25 dB	0.078 dB
4000 MHz	−50.8°	6.25 dB	0.078 dB
4500 MHz	−102.1°	6.27 dB	0.078 dB
5000 MHz	−153.4°	6.29 dB	0.079 dB
5500 MHz	155.2°	6.32 dB	0.079 dB
6000 MHz	103.8°	6.38 dB	0.079 dB
6500 MHz	52.9°	6.46 dB	0.22 dB
7000 MHz	2°	6.48 dB	0.22 dB
7500 MHz	−48.8°	6.47 dB	0.22 dB
8000 MHz	−99.7°	6.43 dB	0.22 dB
8500 MHz	−150.9°	6.38 dB	0.24 dB
9000 MHz	157.8°	6.30 dB	0.24 dB
9500 MHz	106°	6.21 dB	0.24 dB
10000 MHz	54°	6.22 dB	0.24 dB
10500 MHz	2.1°	6.31 dB	0.24 dB
11000 MHz	−48.9°	6.40 dB	0.24 dB
11500 MHz	−99.8°	6.40 dB	0.24 dB
12000 MHz	−150.9°	6.33 dB	0.24 dB
12500 MHz	157.5°	6.23 dB	0.24 dB
13000 MHz	105.8°	6.19 dB	0.24 dB
13500 MHz	53.9°	6.07 dB	0.24 dB
14000 MHz	1°	6.01 dB	0.24 dB
14500 MHz	−51.5°	6.10 dB	0.24 dB
15000 MHz	−103.8°	6.19 dB	0.25 dB
15500 MHz	−155.7°	6.34 dB	0.25 dB
16000 MHz	153.5°	6.40 dB	0.25 dB
16500 MHz	101.2°	6.17 dB	0.25 dB
17000 MHz	47.8°	6.26 dB	0.25 dB
17500 MHz	−5.3°	6.46 dB	0.25 dB
18000 MHz	−56.9°	6.81 dB	0.26 dB

PORT3 INSERTION LOSS

Done

TEST COND	PHASE	MAG	UNCERT.
NO SPECS FOR THIS PARAMETER			
50 MHz	−5.2°	6.01 dB	0.040 dB
100 MHz	−10.4°	6.02 dB	0.040 dB

PORT3 INSERTION LOSS (cont.)

TEST COND	PHASE	MAG	UNCERT.
500 MHz	−51.5°	6.04 dB	0.058 dB
1000 MHz	−102.9°	6.06 dB	0.043 dB
1500 MHz	−154.2°	6.08 dB	0.043 dB
2000 MHz	154.4°	6.10 dB	0.043 dB
2500 MHz	103.1°	6.13 dB	0.067 dB
3000 MHz	51.9°	6.16 dB	0.067 dB
3500 MHz	0.8°	6.19 dB	0.078 dB
4000 MHz	−50.5°	6.20 dB	0.078 dB
4500 MHz	−101.7°	6.23 dB	0.078 dB
5000 MHz	−153°	6.25 dB	0.078 dB
5500 MHz	155.7°	6.29 dB	0.079 dB
6000 MHz	104.5°	6.37 dB	0.079 dB
6500 MHz	53.8°	6.43 dB	0.22 dB
7000 MHz	2.8°	6.44 dB	0.22 dB
7500 MHz	−48°	6.45 dB	0.22 dB
8000 MHz	−98.9°	6.42 dB	0.22 dB
8500 MHz	−149.9°	6.36 dB	0.24 dB
9000 MHz	158.9°	6.29 dB	0.24 dB
9500 MHz	107.1°	6.19 dB	0.24 dB
10000 MHz	55.1°	6.20 dB	0.24 dB
10500 MHz	3.4°	6.31 dB	0.24 dB
11000 MHz	−47.5°	6.40 dB	0.24 dB
11500 MHz	−98.3°	6.39 dB	0.24 dB
12000 MHz	−149.3°	6.31 dB	0.24 dB
12500 MHz	159.1°	6.21 dB	0.24 dB
13000 MHz	107.5°	6.17 dB	0.24 dB
13500 MHz	55.8°	6.04 dB	0.24 dB
14000 MHz	2.9°	5.98 dB	0.24 dB
14500 MHz	−49.5°	6.04 dB	0.24 dB
15000 MHz	−102°	6.15 dB	0.25 dB
15500 MHz	−153.7°	6.32 dB	0.25 dB
16000 MHz	155.6°	6.37 dB	0.25 dB
16500 MHz	103.3°	6.15 dB	0.25 dB
17000 MHz	50.1°	6.26 dB	0.25 dB
17500 MHz	−2.6°	6.49 dB	0.25 dB
18000 MHz	−53.7°	6.70 dB	0.26 dB

PORT2 to PORT3 TRACKING

Passed

PORT2 is the right hand port and PORT3 is the left hand port,as seen reading the model number label.

The PHASE(deg) column is the measured PHASE.
The MAG column is the measured MAGNITUDE.
The MINIMUM and MAXIMUM columns are specs for MAGNITUDE.
The UNCERT column is the uncertainty for MAGNITUDE.

TEST COND	PHASE	MINIMUM	MAG	MAXIMUM	UNCERT.	Status
50 MHz	0°	−0.150 dB	−0.023 dB	0.150 dB	0.046 dB	

PORT2 to PORT3 TRACKING (cont.)

TEST COND	PHASE	MINIMUM	MAG	MAXIMUM	UNCERT.	Status
100 MHz	0°	−0.150 dB	−0.016 dB	0.150 dB	0.046 dB	
500 MHz	0°	−0.150 dB	−0.026 dB	0.150 dB	0.051 dB	
1000 MHz	−0.1°	−0.150 dB	−0.022 dB	0.150 dB	0.049 dB	
1500 MHz	−0.1°	−0.150 dB	−0.029 dB	0.150 dB	0.049 dB	
2000 MHz	−0.1°	−0.150 dB	−0.023 dB	0.150 dB	0.050 dB	
2500 MHz	−0.1°	−0.150 dB	−0.010 dB	0.150 dB	0.055 dB	
3000 MHz	−0.2°	−0.150 dB	−0.019 dB	0.150 dB	0.053 dB	
3500 MHz	−0.2°	−0.150 dB	−0.020 dB	0.150 dB	0.060 dB	
4000 MHz	−0.3°	−0.150 dB	−0.020 dB	0.150 dB	0.056 dB	
4500 MHz	−0.4°	−0.200 dB	−0.009 dB	0.200 dB	0.061 dB	
5000 MHz	−0.4°	−0.200 dB	−0.011 dB	0.200 dB	0.063 dB	
5500 MHz	−0.4°	−0.200 dB	−0.010 dB	0.200 dB	0.062 dB	
6000 MHz	−0.6°	−0.200 dB	0.007 dB	0.200 dB	0.072 dB	
6500 MHz	−0.7°	−0.200 dB	0.048 dB	0.200 dB	0.067 dB	
7000 MHz	−0.7°	−0.200 dB	−0.001 dB	0.200 dB	0.079 dB	
7500 MHz	−0.8°	−0.200 dB	0.016 dB	0.200 dB	0.075 dB	
8000 MHz	−1.1°	−0.200 dB	0.024 dB	0.200 dB	0.078 dB	
8500 MHz	−1.5°	−0.250 dB	0.002 dB	0.250 dB	0.080 dB	
9000 MHz	−1.6°	−0.250 dB	−0.076 dB	0.250 dB	0.071 dB	
9500 MHz	−0.7°	−0.250 dB	−0.098 dB	0.250 dB	0.082 dB	
10000 MHz	−0.9°	−0.250 dB	−0.014 dB	0.250 dB	0.074 dB	
10500 MHz	−1.2°	−0.250 dB	0.001 dB	0.250 dB	0.085 dB	
11000 MHz	−1.4°	−0.250 dB	−0.006 dB	0.250 dB	0.083 dB	
11500 MHz	−1.4°	−0.250 dB	−0.015 dB	0.250 dB	0.087 dB	
12000 MHz	−1.5°	−0.250 dB	−0.023 dB	0.250 dB	0.095 dB	
12500 MHz	−1.6°	−0.250 dB	−0.032 dB	0.250 dB	0.083 dB	
13000 MHz	−1.5°	−0.250 dB	−0.032 dB	0.250 dB	0.092 dB	
13500 MHz	−1.6°	−0.250 dB	−0.007 dB	0.250 dB	0.074 dB	
14000 MHz	−1.6°	−0.250 dB	−0.002 dB	0.250 dB	0.082 dB	
14500 MHz	−1.4°	−0.250 dB	0.090 dB	0.250 dB	0.080 dB	
15000 MHz	−2.3°	−0.250 dB	0.078 dB	0.250 dB	0.079 dB	
15500 MHz	−2.4°	−0.250 dB	0.021 dB	0.250 dB	0.094 dB	
16000 MHz	−2.5°	−0.250 dB	0.004 dB	0.250 dB	0.091 dB	
16500 MHz	−2.5°	−0.250 dB	0.015 dB	0.250 dB	0.10 dB	
17000 MHz	−2.5°	−0.250 dB	−0.003 dB	0.250 dB	0.099 dB	
17500 MHz	−2.6°	−0.250 dB	0.015 dB	0.250 dB	0.10 dB	
18000 MHz	−3°	−0.250 dB	−0.087 dB	0.250 dB	0.12 dB	

The PHASE uncertainty is Arcsin(Lin_Mu/Lin_Mag) degree,
except where Lin_Mag is less than Lin_Mu, in which case
PHASE uncertainty is +/- 180 degree.
Lin_Mu & Lin_Mag are linear mode of UNCERT & MAG, which
can be calculated by:

Lin_Mag= 10^(MAG /20)
Lin_Mu = 10^(UNCERT /20)

EQUIVALENT SOURCE MATCH — Passed

PORT2 is the right hand port and PORT3 is the left hand port,as seen reading the model number label.

The PHASE(deg) column is the measured PHASE.
The MAG column is the measured MAGNITUDE.
The MAXIMUM column is the specs for MAGNITUDE.
The UNCERT column is the uncertainty for MAGNITUDE.

TEST COND	PHASE	MAG	MAXIMUM	UNCERT.	Status
PORT2 EQUIVALENT SOURCE MATCH:					
50 MHz	163.6°	0.003	0.048	0.0034	
100 MHz	153°	0.002	0.048	0.0036	
500 MHz	83.5°	0.001	0.048	0.0055	
1000 MHz	103.8°	0.002	0.048	0.0041	
1500 MHz	102.8°	0.003	0.048	0.0048	
2000 MHz	86.5°	0.005	0.048	0.0052	
2500 MHz	60.3°	0.008	0.048	0.0042	
3000 MHz	41.3°	0.009	0.048	0.0063	
3500 MHz	13.1°	0.009	0.048	0.0041	
4000 MHz	−18.3°	0.010	0.048	0.0062	
4500 MHz	−57°	0.011	0.091	0.0054	
5000 MHz	−86.3°	0.015	0.091	0.0052	
5500 MHz	−110.3°	0.020	0.091	0.0066	
6000 MHz	−127.2°	0.024	0.091	0.0045	
6500 MHz	−131.4°	0.028	0.091	0.0072	
7000 MHz	−156°	0.040	0.091	0.0051	
7500 MHz	−170°	0.042	0.091	0.0070	
8000 MHz	176.1°	0.044	0.091	0.0064	
8500 MHz	159.7°	0.044	0.142	0.0061	
9000 MHz	140.1°	0.041	0.142	0.0075	
9500 MHz	117.8°	0.033	0.142	0.0052	
10000 MHz	81.1°	0.023	0.142	0.0083	
10500 MHz	24.1°	0.019	0.142	0.0059	
11000 MHz	−30.2°	0.028	0.142	0.0077	
11500 MHz	−62.4°	0.042	0.142	0.0074	
12000 MHz	−86.5°	0.056	0.142	0.0068	
12500 MHz	−105.6°	0.066	0.142	0.0088	
13000 MHz	−123.7°	0.072	0.142	0.0057	
13500 MHz	−140°	0.076	0.142	0.0088	
14000 MHz	−156°	0.071	0.142	0.0064	
14500 MHz	−171.4°	0.065	0.142	0.0081	
15000 MHz	173°	0.058	0.142	0.0085	
15500 MHz	153.4°	0.051	0.142	0.0068	
16000 MHz	130.9°	0.045	0.142	0.011	
16500 MHz	104.6°	0.048	0.142	0.0067	
17000 MHz	76.1°	0.057	0.142	0.010	
17500 MHz	45.6°	0.070	0.142	0.0088	
18000 MHz	28.2°	0.081	0.142	0.0099	

EQUIVALENT SOURCE MATCH (cont.)

TEST COND	PHASE	MAG	MAXIMUM	UNCERT.	Status
PORT3 EQUIVALENT SOURCE MATCH:					
50 MHz	172.9°	0.005	0.048	0.0034	
100 MHz	163.8°	0.005	0.048	0.0036	
500 MHz	107.8°	0.003	0.048	0.0055	
1000 MHz	111°	0.006	0.048	0.0042	
1500 MHz	81.3°	0.005	0.048	0.0049	
2000 MHz	82.2°	0.008	0.048	0.0053	
2500 MHz	60.3°	0.009	0.048	0.0043	
3000 MHz	48.8°	0.009	0.048	0.0064	
3500 MHz	31.6°	0.008	0.048	0.0042	
4000 MHz	9.4°	0.006	0.048	0.0061	
4500 MHz	−28.5°	0.006	0.091	0.0055	
5000 MHz	−60.9°	0.007	0.091	0.0053	
5500 MHz	−86.2°	0.009	0.091	0.0066	
6000 MHz	−100.9°	0.015	0.091	0.0045	
6500 MHz	−111.6°	0.025	0.091	0.0071	
7000 MHz	−133.5°	0.030	0.091	0.0050	
7500 MHz	−146.3°	0.035	0.091	0.0069	
8000 MHz	−158.6°	0.043	0.091	0.0063	
8500 MHz	−171.9°	0.045	0.142	0.0061	
9000 MHz	170.7°	0.057	0.142	0.0074	
9500 MHz	131.1°	0.052	0.142	0.0052	
10000 MHz	97°	0.033	0.142	0.0083	
10500 MHz	48.7°	0.022	0.142	0.0058	
11000 MHz	−12.5°	0.024	0.142	0.0076	
11500 MHz	−52.9°	0.036	0.142	0.0073	
12000 MHz	−78°	0.049	0.142	0.0068	
12500 MHz	−97.7°	0.060	0.142	0.0088	
13000 MHz	−114.6°	0.066	0.142	0.0056	
13500 MHz	−129.6°	0.066	0.142	0.0088	
14000 MHz	−143.5°	0.070	0.142	0.0065	
14500 MHz	−176.4°	0.050	0.142	0.0081	
15000 MHz	−165.1°	0.037	0.142	0.0086	
15500 MHz	−174.4°	0.035	0.142	0.0067	
16000 MHz	171.4°	0.032	0.142	0.011	
16500 MHz	151.2°	0.029	0.142	0.0065	
17000 MHz	109°	0.048	0.142	0.010	
17500 MHz	66.6°	0.061	0.142	0.0085	
18000 MHz	28.7°	0.078	0.142	0.0097	

The PHASE uncertainty is Arcsin(UNCERT/MAG) degree,
except where MAG is less than UNCERT, in which case
PHASE uncertainty is +/- 180 degree.