



# FCC RADIO TEST REPORT

**FCC ID** : SWX-GBE  
**Equipment** : GigaBeam  
**Brand Name** : Ubiquiti  
**Model Name** : GBE  
**Marketing Name** : GigaBeam  
**Applicant** : Ubiquiti Networks, Inc.  
685 Third Avenue, 27th Floor New York, New York 10017 USA  
**Manufacturer** : Ubiquiti Networks, Inc.  
685 Third Avenue, 27th Floor New York, New York 10017 USA  
**Standard** : FCC 47 CFR Part 15.255

The product was received on Jul. 01, 2019 and testing was started from Jul. 01, 2019 and completed on Jul. 11, 2019. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (USA) Inc., the test report shall not be reproduced except in full.

Approved by: Ken Chen

**Sporton International (USA) Inc.**  
1175 Montague Expressway, Milpitas, CA 95035



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## Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Limit	Result (PASS/FAIL)	Remark
3.2	§2.1049 §15.255(e)	Emission Bandwidth	Not Applicable	Reporting only	-
3.3	§15.255(c)	EIRP Power	Peak < 43dBm Average < 40dBm	Pass	-
3.4	§15.255(e)	Peak Conducted Power	< 500mW	Pass	
3.5	§15.255(d)	Transmitter Spurious Emissions	§15.255(d)	Pass	
3.6	§2.1055	Frequency Stability for Temperature & Voltage	Within the band	Pass	-
3.7	§2.1031	RF Exposure	1.0 mW/cm <sup>2</sup>	Pass	-
4	§15.207	AC Power Conducted Emission	§15.207	Pass	-
5	§15.255(a) §15.255(h)	Operation Restriction and Group Installation	-	Pass	

**Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

**Comments and Explanations:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

**Report Producer: Dara Chiu**



# 1 General Description

## 1.1 Product Feature of Equipment Under Test

Wi-Fi 2.4GHz 802.11n, Wi-Fi 5GHz 802.11n/ac, Wi-Fi 60GHz 802.11ad, and GNSS

Product Specification subjective to this standard	
Antenna Type	WLAN 2.4GHz: Internal Antenna WLAN 5GHz: Internal Antenna Wi-Fi 60GHz: Antenna Array (SWL-14 Sector) GPS/Glonass/SBAS: Patch Antenna

## 1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Frequency Range	57-66GHz
The Channel Plans	Channel 1: 58.32GHz Channel 2: 60.48GHz Channel 3: 62.64GHz Channel 4: 64.78GHz
Antenna Info	Gain : 19.4dBi
Type of Modulation	$\pi/2$ -BPSK, $\pi/2$ -QPSK, $\pi/2$ -16QAM

### 1.2.1 Modulation

MCS Index	Modulation	Code Rate	Data Rate (Mbit/s)
0	$\pi/2$ -BPSK	1/2	27.5
1	$\pi/2$ -BPSK	1/2	385
2	$\pi/2$ -BPSK	1/2	770
3	$\pi/2$ -BPSK	5/8	962.5
4	$\pi/2$ -BPSK	3/4	1155
5	$\pi/2$ -BPSK	13/16	1251.25
6	$\pi/2$ -QPSK	1/2	1540
7	$\pi/2$ -QPSK	5/8	1925
8	$\pi/2$ -QPSK	3/4	2310
9	$\pi/2$ -QPSK	13/16	2502.5
10	$\pi/2$ -16QAM	1/2	3080
11	$\pi/2$ -16QAM	5/8	3850
12	$\pi/2$ -16QAM	3/4	4620
Can the transmitter operate un-modulated:		Yes	



### 1.3 Modification of EUT

No modifications are made to the EUT during all test items.

### 1.4 Testing Location

<b>Test Site</b>	Sporton International (USA) Inc.		
<b>Test Site Location</b>	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300		
<b>Test Site No.</b>	<b>Sporton Site No.</b>		
	TH01-CA	03CH01-CA	CO01-CA

**Note:** The test site complies with ANSI C63.4 2014 requirement.

### 1.5 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC 47 CFR Part 2, 15.255
- ♦ ANSI C63.10-2013

**Remark:**

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

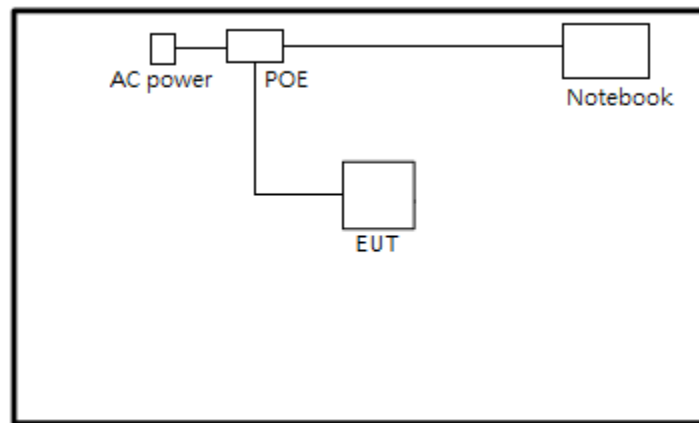
## 2 Test Configuration of Equipment Under Test

### 2.1 Test Mode

For radiated measurement, the pre-scan is performed to find the worst cases EUT position.

Test Channel Frequencies Configuration	
Channel 1	58.32GHz
Channel 2	60.48GHz
Channel 3	62.64GHz
Channel 4	64.78GHz

### 2.2 Connection Diagram of Test System



### 2.3 Support Unit used in test configuration

Item	Equipment	Trade Name	Model No.	Contain FCC ID	Data Cable	Power Cord
1.	Notebook	Toshiba	E45W-C4200X	CJ6UPA5165WB	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m



### 2.4 Far Field Condition for Frequency above 18GHz

Horn Antenna	Frequency (GHz)	Antenna Dimension A (mm)	Wavelength (λ) (m)	Far field R (m) $\geq 2A^2 / \lambda$	Measurement Distance (D) (m)	Distance Factor $20\log(D)$ (dB)
BBHA 9170	18	60	0.0167	0.43	1	0.00
	40	60	0.0075	0.96		
QWH-UPRR00	40	48	0.0075	0.61	1	0.00
	60	48	0.0050	0.92		
QWH-VPRR00	50	38	0.0060	0.48	1	0.00
	75	38	0.0040	0.72		
QWH-EPRR00	60	31	0.0050	0.38	1	0.00
	90	31	0.0033	0.58		
QWH-FPRR00	90	21	0.0033	0.26	1	0.00
	140	21	0.0021	0.41		
QWH-GPRR00	140	14	0.0021	0.18	1	0.00
	220	14	0.0013	0.29		

### 2.5 Frequency List of Low/Middle/High Channels

Test Channel Frequencies Configuration	
Channel 1	58.32GHz
Channel 2	60.48GHz
Channel 3	62.64GHz
Channel 4	64.78GHz





### 3 Radiated Test Items

#### 3.1 Measuring Instruments

See list of measuring instruments of this test report.

#### 3.2 Emission Bandwidth

##### 3.2.1 Description of Emission Bandwidth Measurement

This is for reporting only.

The emission bandwidth (EBW) is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least the specified amount below the maximum level of the modulated carrier.

##### 3.2.2 Test Procedures

The testing follows ANSI C63.10-2013 Section 9.3

6dB Bandwidth

1. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be at least 1.5 times the anticipated OBW.
2. The nominal resolution bandwidth (RBW) shall be 100 kHz, and the VBW shall be at least 3 times the RBW.
3. Set the detection mode to peak, and the trace mode to max hold.

99% Occupied Bandwidth

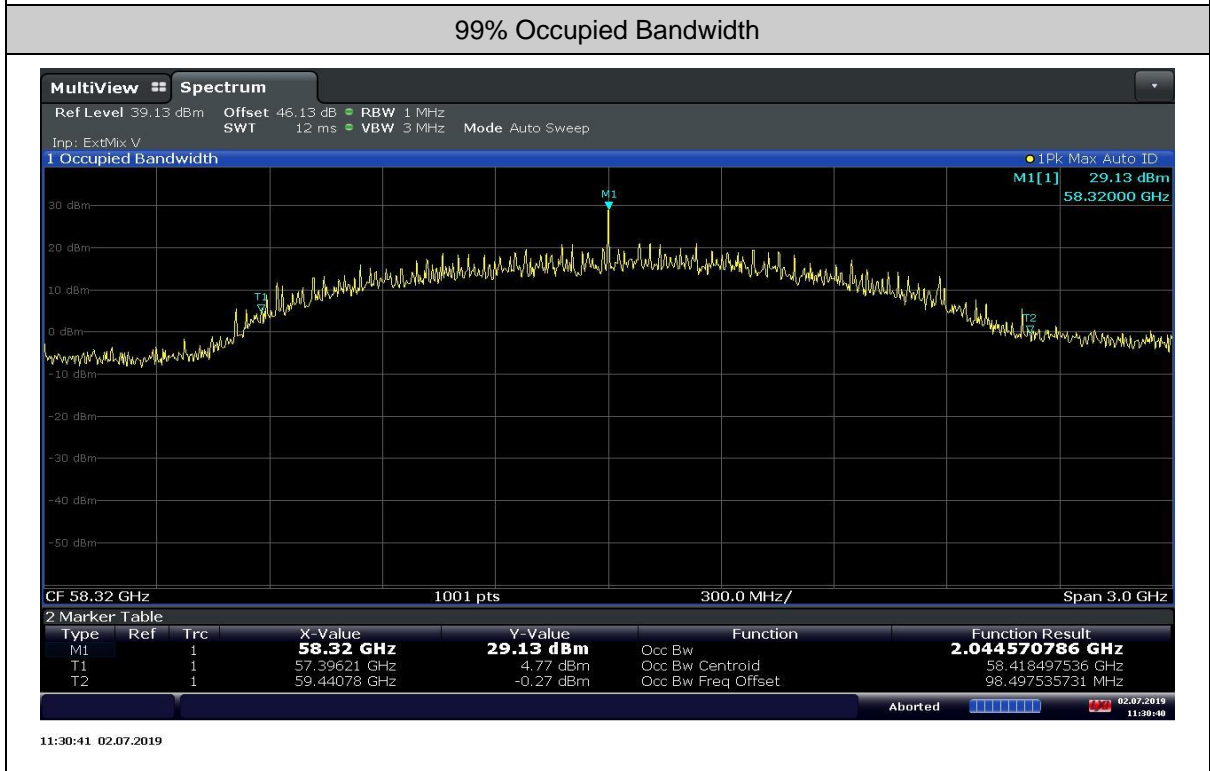
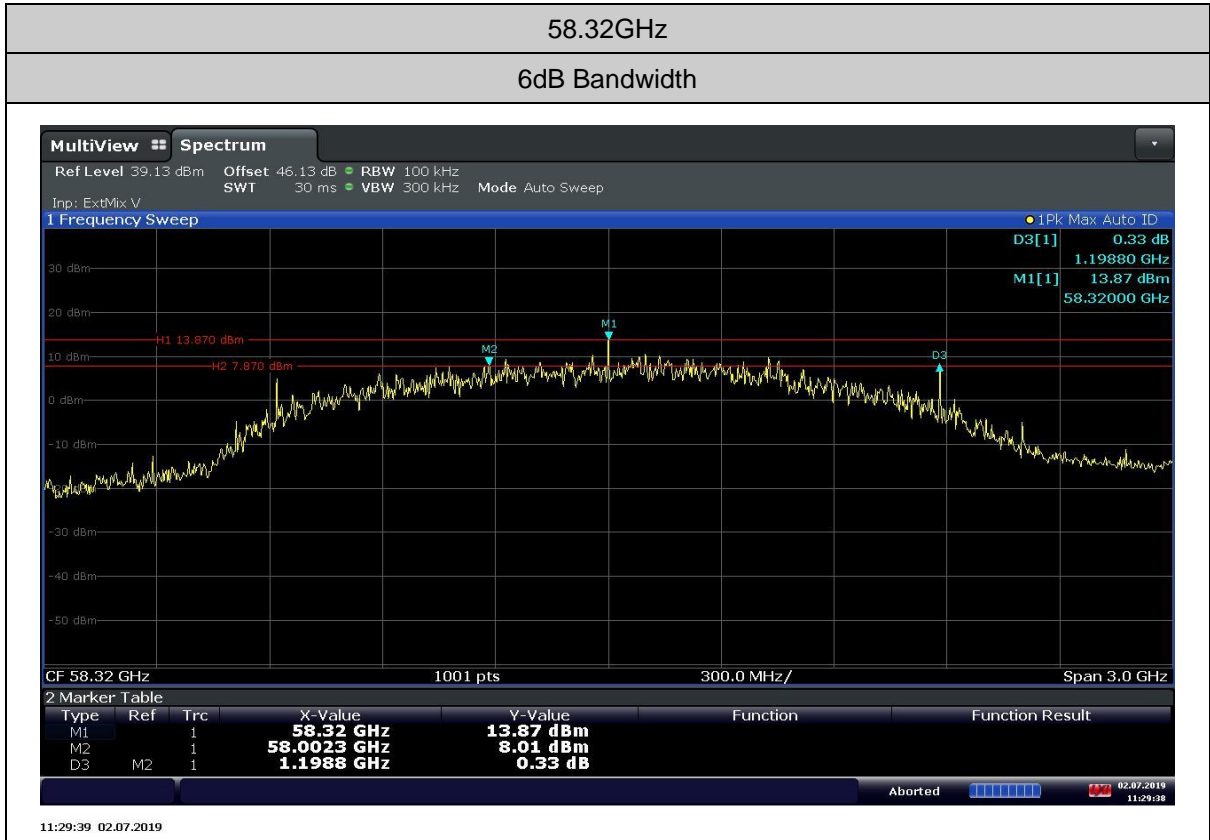
1. Use the 99 % power bandwidth function of the spectrum analyzer
2. The nominal resolution bandwidth (RBW) shall be 1 MHz, and the VBW shall be at least 3 times the RBW.
3. Report the measured bandwidth.

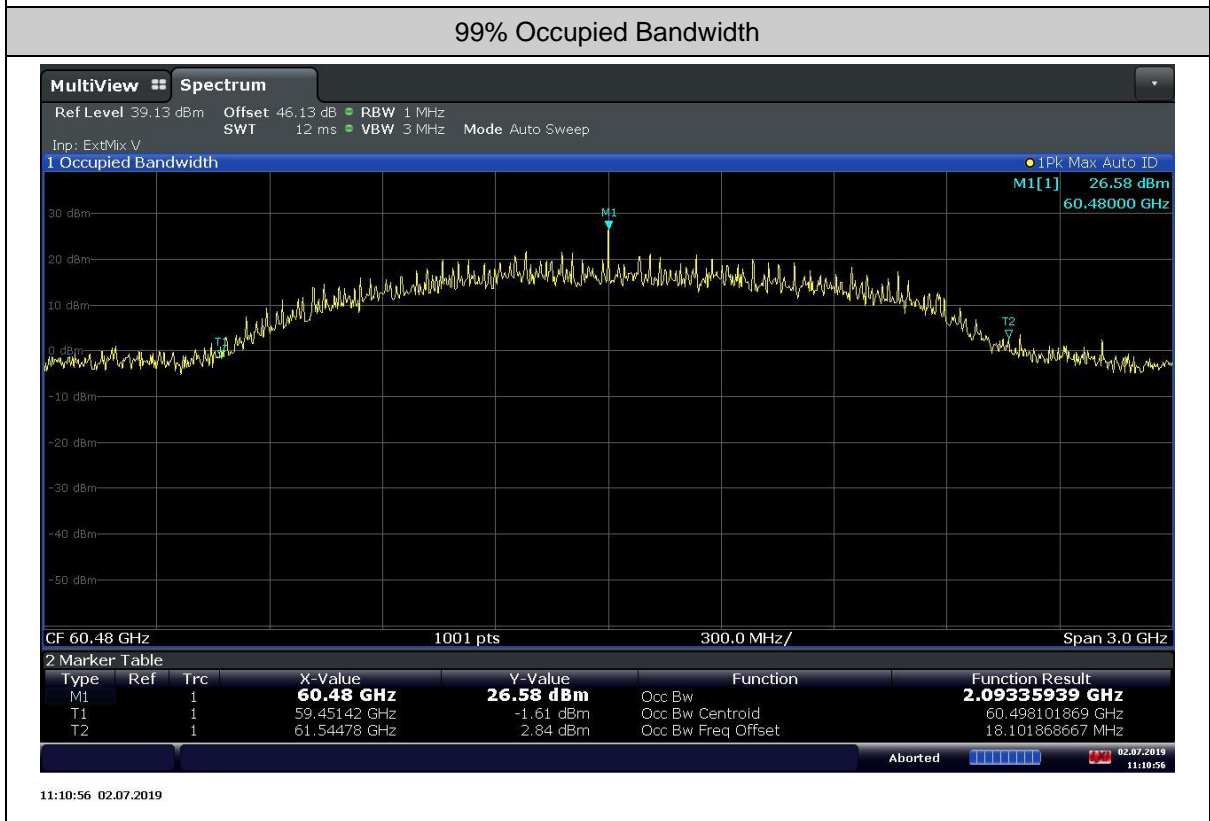
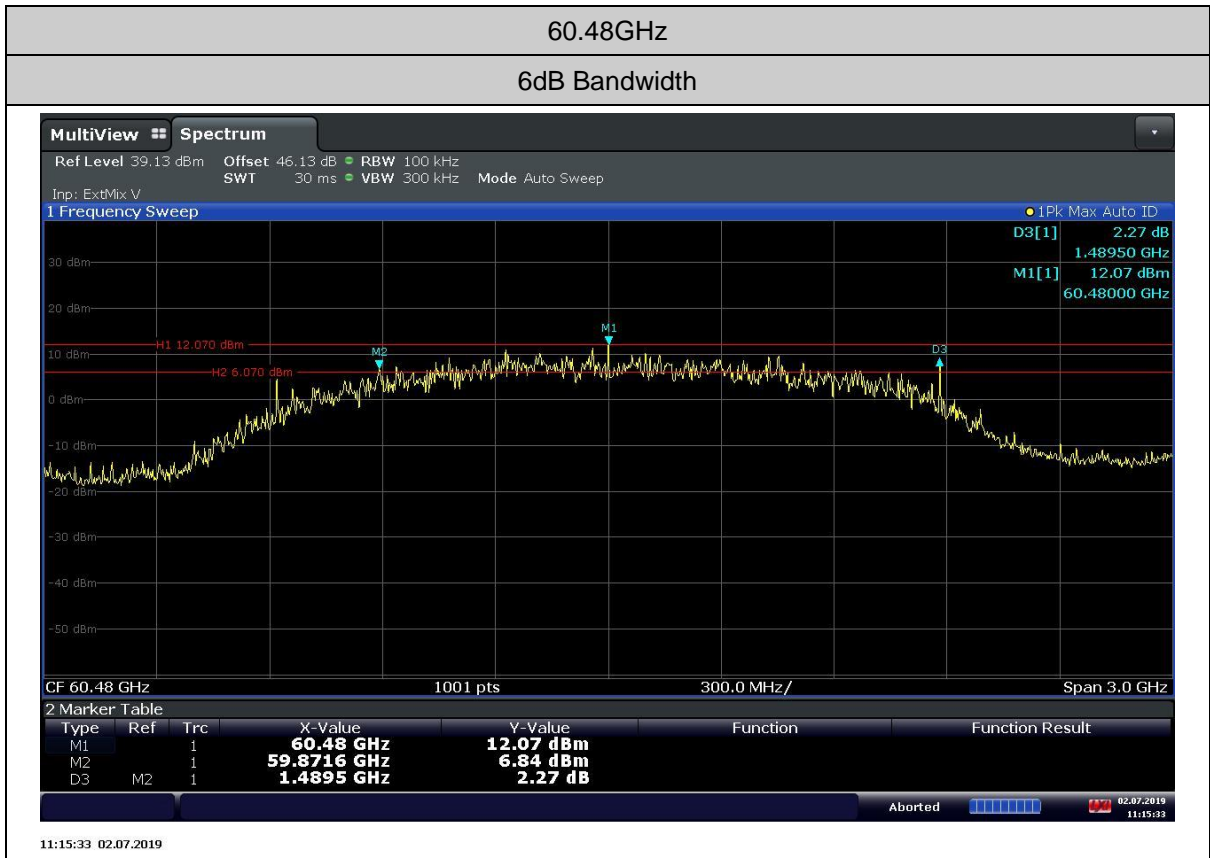
##### 3.2.3 Test Results

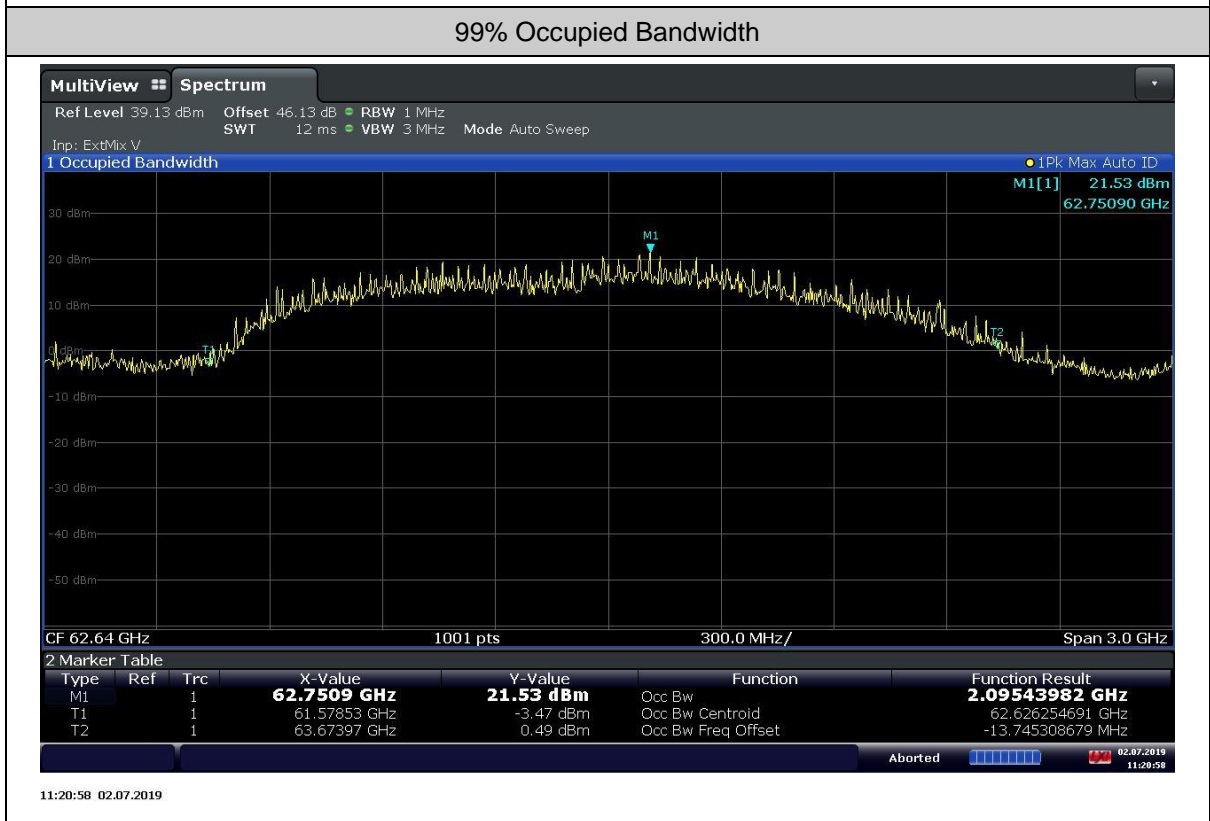
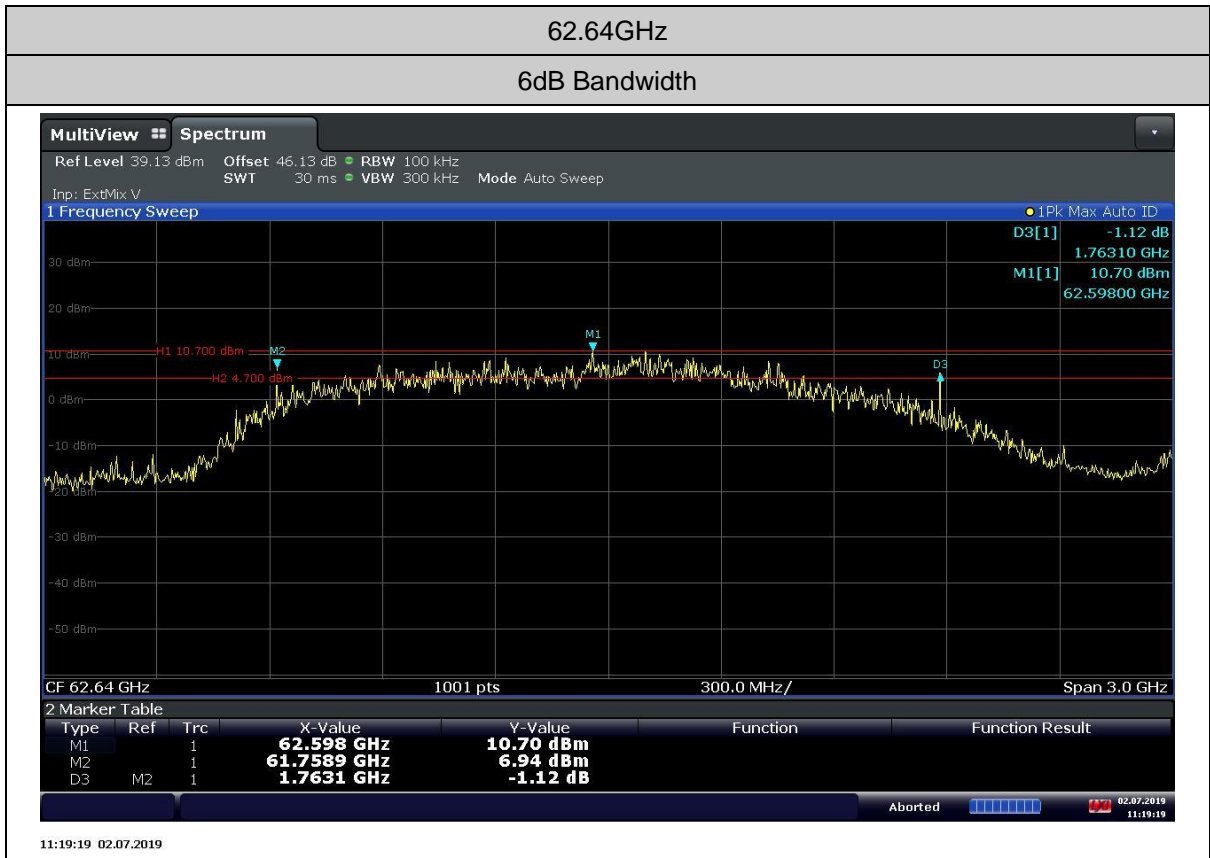
<b>Temperature</b>	22~24°C	<b>Relative Humidity</b>	40~45%
<b>Test Engineer</b>	Leo Liu		
<b>Test Frequency (GHz)</b>	<b>6dB Bandwidth (MHz)</b>	<b>99% Occupied Bandwidth (MHz)</b>	<b>Limit (MHz)</b>
58.32	1198.80	2044.57	Report Only
60.48	1489.50	2093.36	Report Only
62.64	1763.10	2095.44	Report Only
64.78	1549.50	2186.71	Report Only

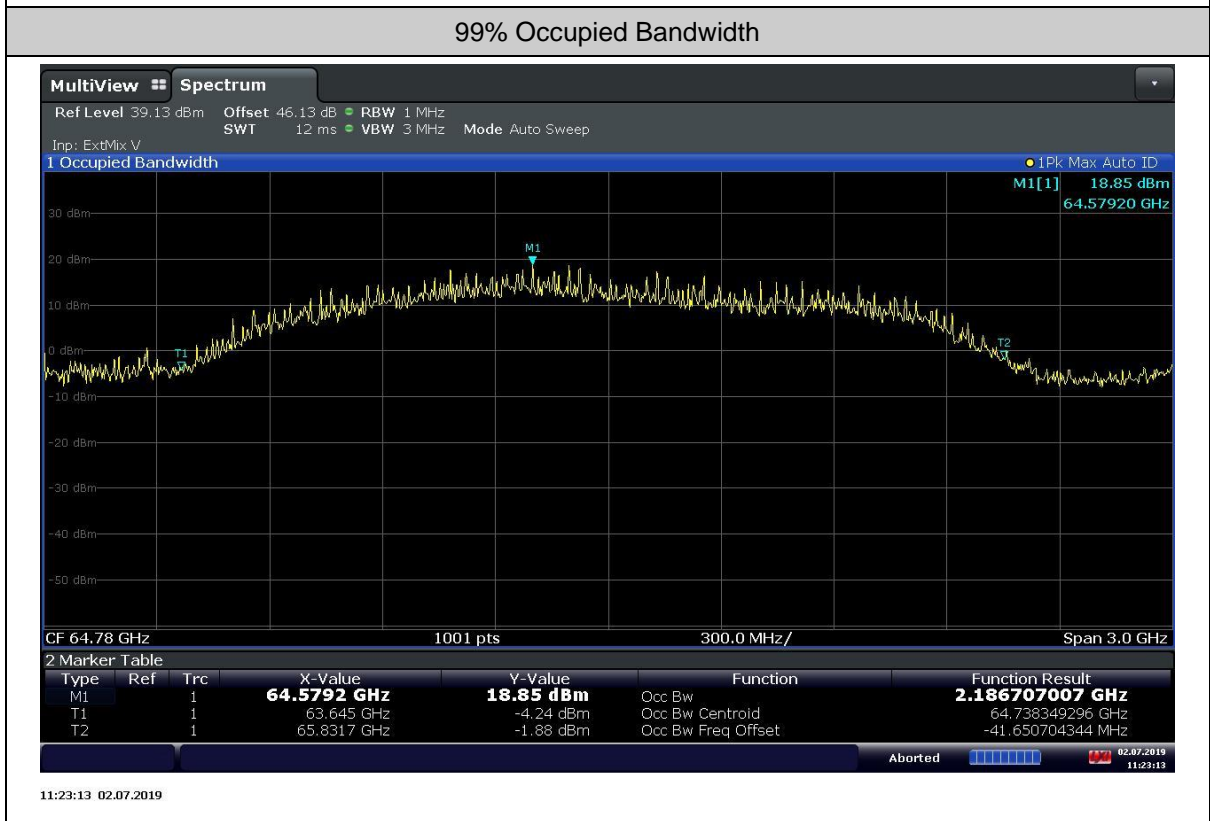
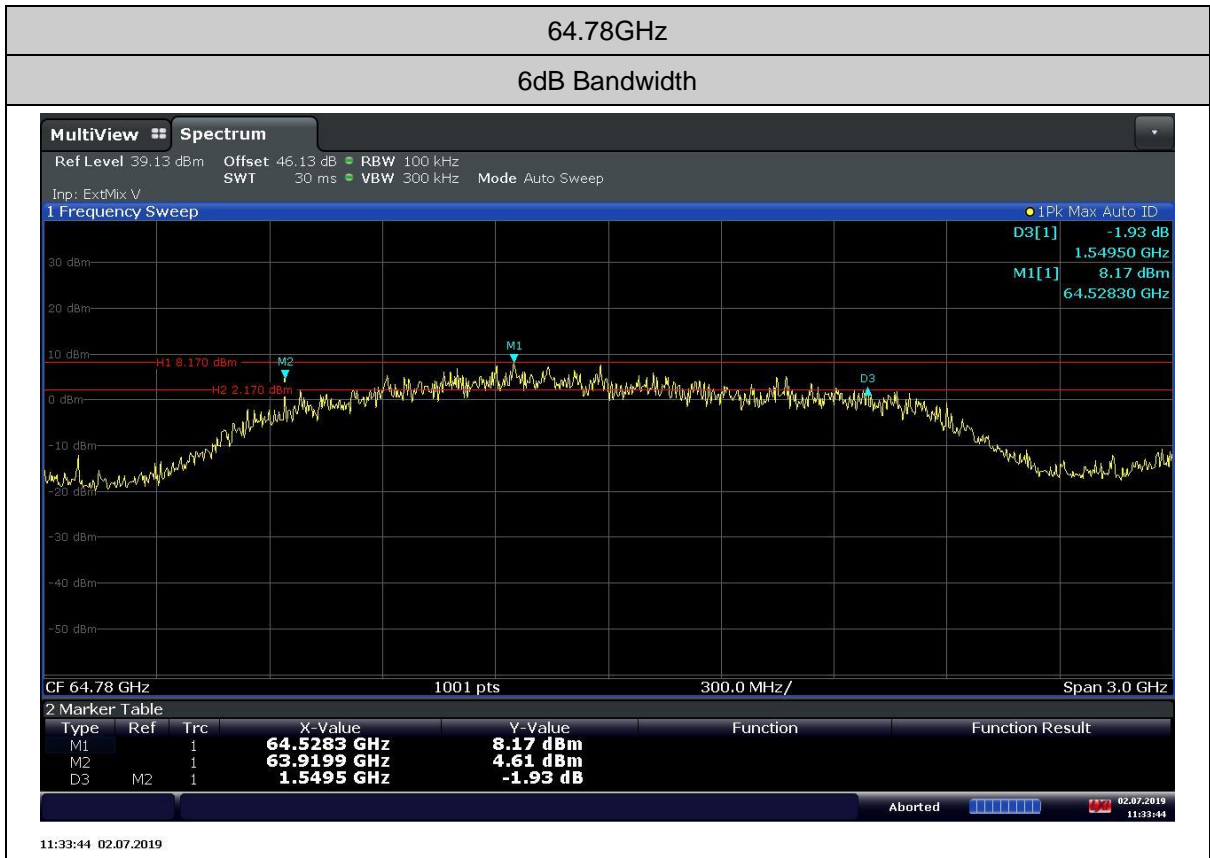


3.2.5 Test Plots











### 3.3 EIRP Power Measurement

#### 3.3.1 Test Limit

Regulation	Product Type (example)	Peak EIRP Power (dBm)	Average Power (dBm)
FCC 15.255 (c) (1) (i)	Except outdoor fixed Point to Point	43	40
FCC 15.255 (c) (1) (ii)	Outdoor fixed Point to Point	85	82
FCC 15.255 (c) (2)	Fixed field disturbance sensors at within the frequency band 61-61.5GHz	43	40
FCC 15.255 (c) (3)	Fixed field disturbance sensors at outside of the band 61-61.5GHz	13	10
	Except fixed field disturbance sensors at 61-61.5GHz	10	-

#### 3.3.2 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013 clause 9.3 and 9.5.



3.3.3 Test Results

Temperature		22~24°C				Relative Humidity				40~45%			
Test Engineer		Leo Liu											
EIRP Power Measurement													
Frequency (GHz)	Measure Dist. (m)	Measure Ant Gain (dBi)	DSO (mV)		Power measured (dBm)		Emeas (dBuV/m)		EIRP (dBm)		EIRP Limit (dBm)		
			P	A	P	A	P	A	P	A	P	A	
58.32	1.00	23.70	118.58	108.75	-10.67	-11.3	142.5	141.9	37.7	37.1	43	40	
60.48	1.00	23.70	147.04	136.21	-9.12	-9.67	144.4	143.8	39.6	39.0	43	40	
62.64	1.00	23.70	129.64	119.73	-10.03	-10.79	143.8	143.0	39.0	38.2	43	40	
64.78	1.00	23.70	3.72	2.69	-30.12	-30.57	124.0	123.5	19.2	18.7	43	40	

For radiated emissions, calculate the field strength (E) in dBµV/meter.

E = 126.8 – 20log(λ) + P – G

where:

E : is the field strength of the emission at the measurement distance, in dBµV/m

P : is the power measured at the output of the test antenna, in dBm

λ: is the wavelength of the emission under investigation [300/fMHz], in m

G : is the gain of the test antenna, in dBi For radiated emissions, calculate the EIRP (dBm). If the measurement was performed in the far field, calculate the EIRP.

EIRP = E-meas +20log(d-meas)-104.7

where:

EIRP : is the equivalent isotopically radiated power, in dBm

E-meas. : is the field strength of the emission at the measurement distance, in dBµV/m

d-meas. : is the measurement distance, in m

NOTE 1: For the applicable limit, see FCC 15.255 (c)

NOTE 2: The comparison method which replaces EUT with a signal generator is used to find the correct conversion factor between “DSO(mV)” & “Power Measured(dBm)”.

Example:

E(dBuV/m) = 126.8 – 20log(λ) + P – G, where f=60GHz, P= -10dBm, G= 24dBi, then E = 138.8 (dBuV/m)

EIRP (dBm) = E(dBuV/m) + 20log (d) – 104.7 = 138.8 (dBuV/m) + 20log(d=1) – 104.7 = 31.4dBm

### 3.4 Peak Conducted Power

#### 3.4.1 Limit of Peak Conducted Power

Peak Conducted Power Limit	
6dB Bandwidth	Peak Conducted Power*
>100MHz	500mW
≤ 100MHz	500mW x (BW/100) **
* For the applicable limit, see FCC 15.255 (c)	
** BW = 6dB emission bandwidth (measured at RBW = 100kHz)	

#### 3.4.2 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013 clause 9.5.

#### 3.4.3 Test Result

Peak Conducted Power					
Frequency (GHz)	EIRP (dBm)	Ant gain (dBi)	Peak Power* (dBm)	Peak Power (mW)	Limit** (mW)
58.32	37.73	19.4	18.33	68.14	500
60.48	39.60	19.4	20.20	104.71	500
62.64	38.99	19.4	19.59	91.09	500
64.78	19.20	19.4	-0.20	0.95	500

\* Because EUT used for the integral antenna without temporary RF connector provided. Therefore peak conducted power is equal to EIRP power subtract the antenna gain.

\*\* For the applicable limit, see FCC 15.255(c)

\*\*\* For radiated emission measurements, calculate conducted transmitter output power P(cond)(dBm)

$$P(\text{cond}) = \text{EIRP} - G(\text{dBi})$$

where:

G(dBi) is gain of EUT antenna.

Example:

$$P(\text{cond})(\text{dBm}) = \text{EIRP} (\text{dBm}) - G(\text{dBi}), \text{ where } \text{EIRP} = 38 \text{ dBm}, G = 19\text{dBi}, P(\text{cond}) = 37 - 19 = 18\text{dBm}$$



### 3.5 Transmit Spurious Emission

#### 3.5.1 Limit of Radiated Spurious Emission

Frequency Range	Limit
Below 40GHz	Follow 15.209
Above 40GHz	90 pW/cm <sup>2</sup> @ 3m (equivalent EIRP 102uW, -10dBm)

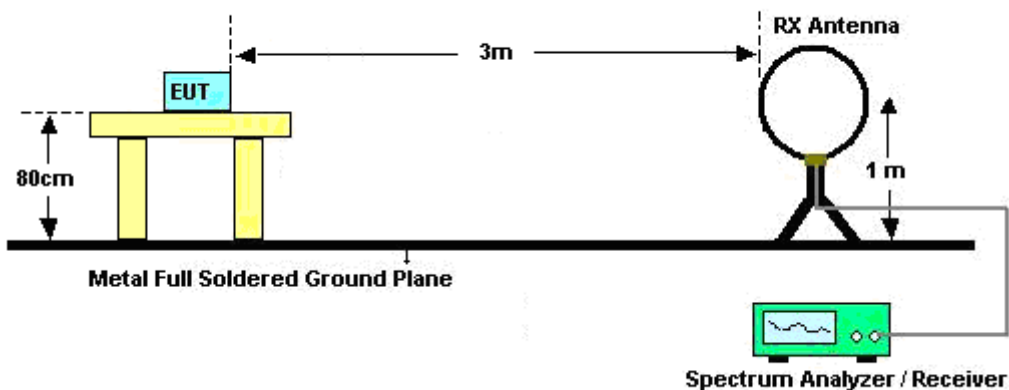
Note 1: For the applicable limit, see FCC 15.255 (d)  
 Note 2: Spurious emissions shall not exceed the level of fundamental emission.

#### 3.5.2 Measuring Instruments

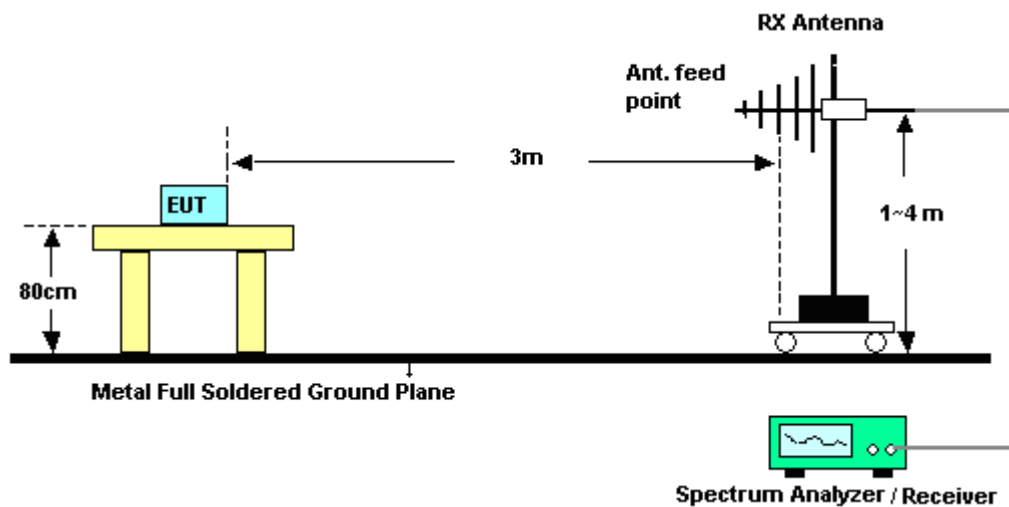
See list of measuring equipment of this test report.

#### 3.5.3 Test Setup

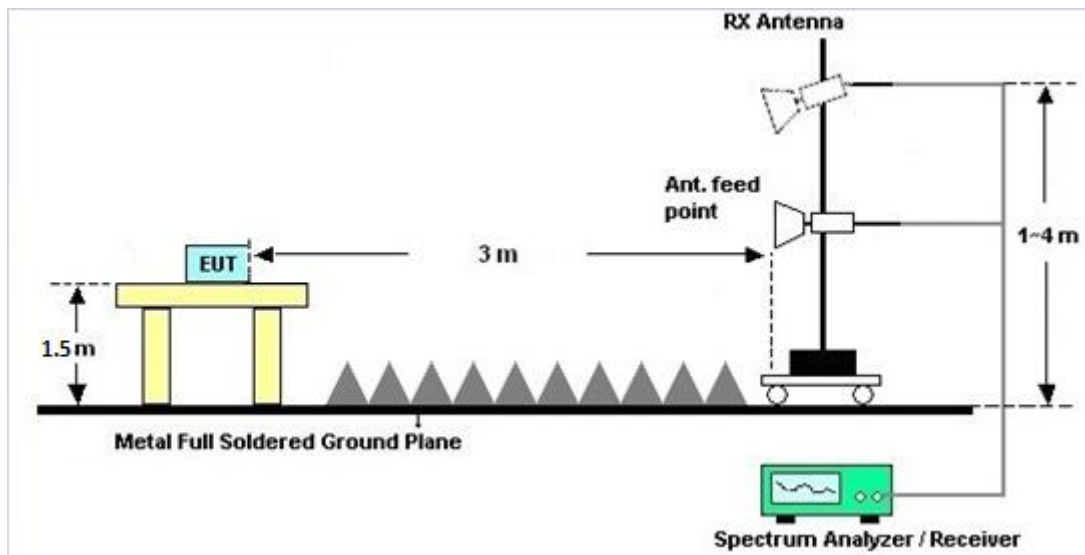
For radiated emissions from 9kHz to 30MHz



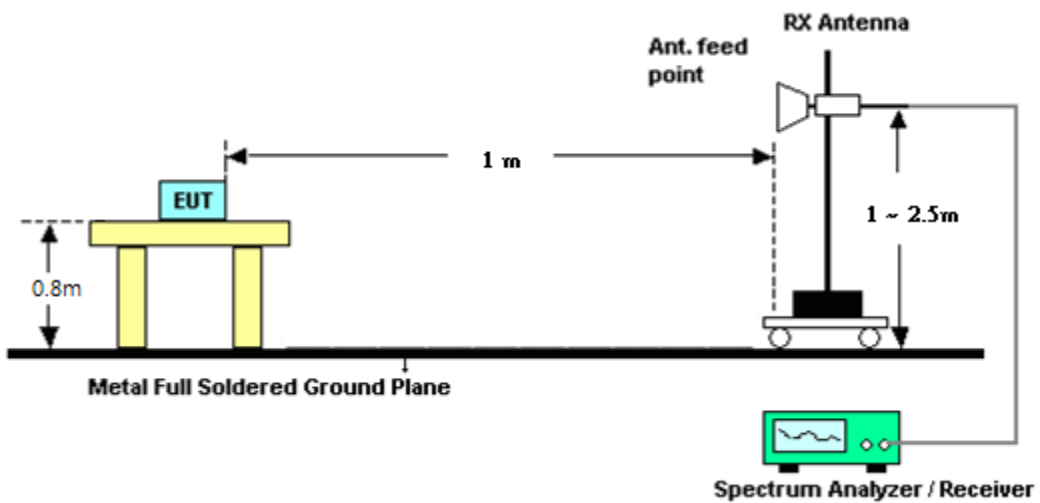
For radiated emissions from 30MHz to 1GHz



For radiated emissions 1GHz to 18GHz



For radiated emissions above 18GHz





### 3.5.4 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013, clause 9.12

$$EIRP \text{ (dBm)} = E(\text{dBuV/m}) + 20\log(D) - 104.7.$$

where D is the measurement distance (in the far field region) in m.

$$E \text{ (dBuV/m)} = \text{Spectrum Reading Level (dBm)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107$$

Hence, the spectrum analyzer *Offset* is derived including RF cable loss and antenna factor.

$$\text{Offset} = \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.7$$

The conversion loss of RF mixer is also included by the mixer table of spectrum analyzer when measurement frequency is above 40GHz.

Example :

$$\begin{aligned} \text{Offset} &= \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.7 \\ &= 40.1 + 2.2 + 107 + 20\log(1) - 104.8 \\ &= 44.5 \text{ (dB)} \end{aligned}$$

### 3.5.5 Test Result

#### 3.5.5.1 Below 30MHz

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

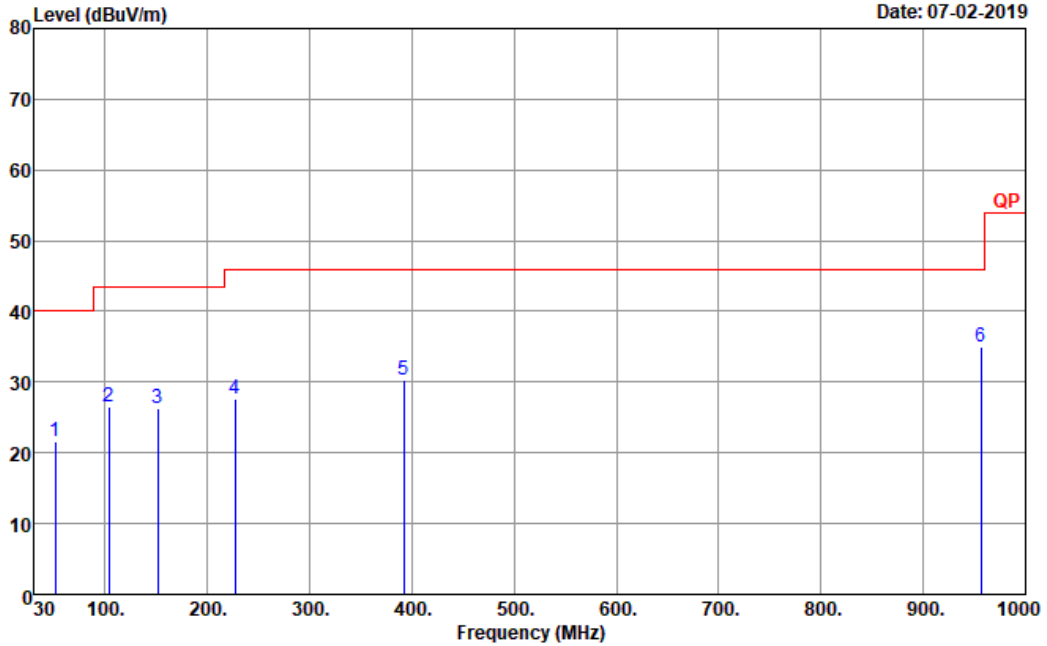
The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10 harmonic or 40 GHz, whichever is appropriate.



3.5.5.2 30MHz to 1GHz

Temperature	20~23°C	Relative Humidity	53~55%
Test Engineer	Leo Liu	Test Distance	3m
Test Range	30MHz to 1GHz	Test Configuration	CTx

Horizontal

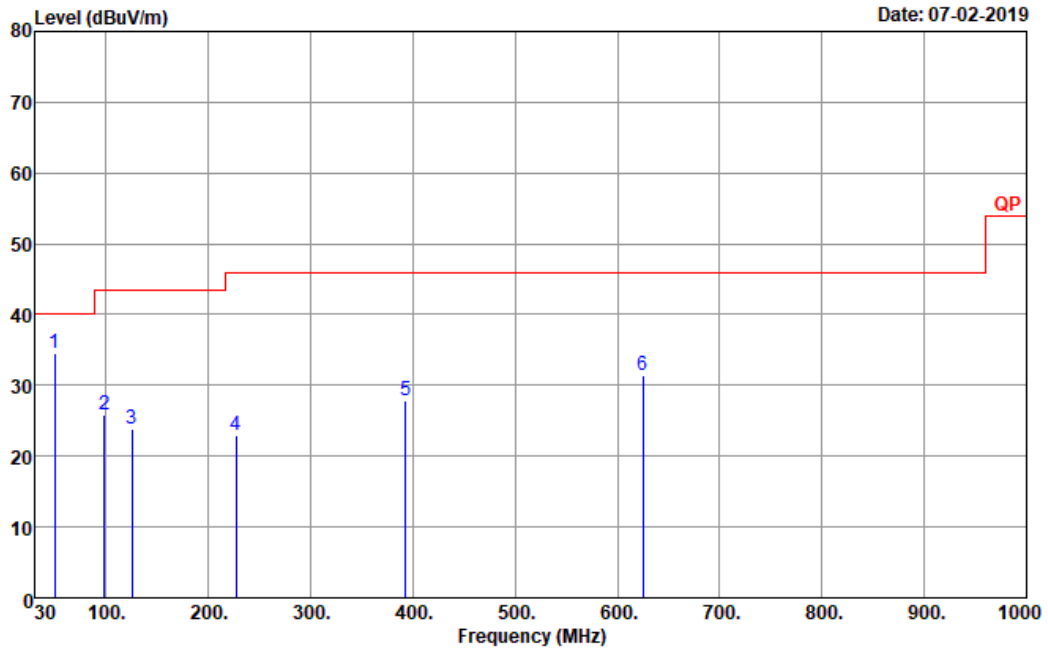


Site : 03CH01-CA  
 Condition : QP 3m BILOG 6111D-LF\_50392 HORIZONTAL  
 Pretest : 190701001  
 Power : AVR 120Vac/60Hz

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	51.34	21.61	-18.39	40.00	38.98	13.56	1.37	32.40	---	---	Peak
2	103.72	26.50	-17.00	43.50	40.64	16.47	1.68	32.35	---	---	Peak
3	151.25	26.27	-17.23	43.50	39.38	17.18	1.96	32.34	---	---	Peak
4	226.91	27.61	-18.39	46.00	41.55	15.89	2.41	32.37	---	---	Peak
5	391.81	30.34	-15.66	46.00	38.12	21.47	3.05	32.48	---	---	Peak
6	956.35	34.97	-11.03	46.00	30.06	30.93	4.65	31.08	100	0	Peak



Vertical



Site : 03CH01-CA  
 Condition : QP 3m BILOG 6111D-LF\_50392 VERTICAL  
 Pretest : 190701001  
 Power : AVR 120Vac/60Hz

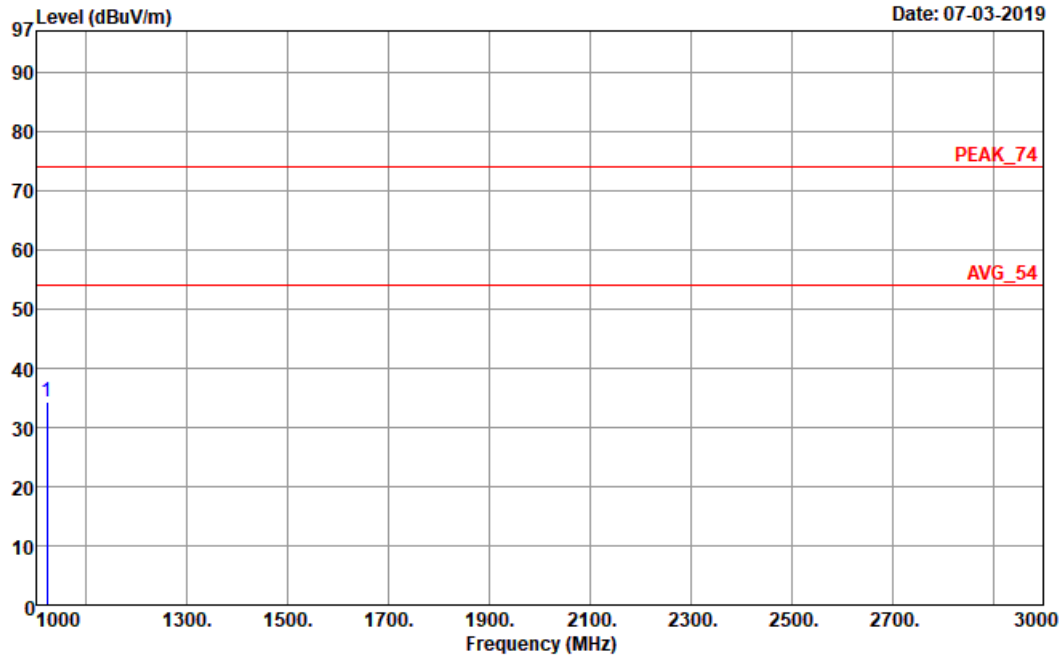
	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	49.40	34.52	-5.48	40.00	50.98	14.50	1.35	32.40	100	0	Peak
2	97.90	25.88	-17.62	43.50	40.73	15.79	1.65	32.35	---	---	Peak
3	125.06	23.91	-19.59	43.50	36.76	17.60	1.81	32.35	---	---	Peak
4	226.91	23.02	-22.98	46.00	36.96	15.89	2.41	32.37	---	---	Peak
5	392.78	27.80	-18.20	46.00	35.54	21.51	3.05	32.48	---	---	Peak
6	624.61	31.48	-14.52	46.00	33.83	26.18	3.86	32.62	---	---	Peak



3.5.5.3 1GHz to 40GHz

Temperature	20~23°C	Relative Humidity	53~55%
Test Engineer	Leo Liu	Test Distance	3m
Test Range	1GHz to 3GHz	Test Configuration	CTx

Horizontal

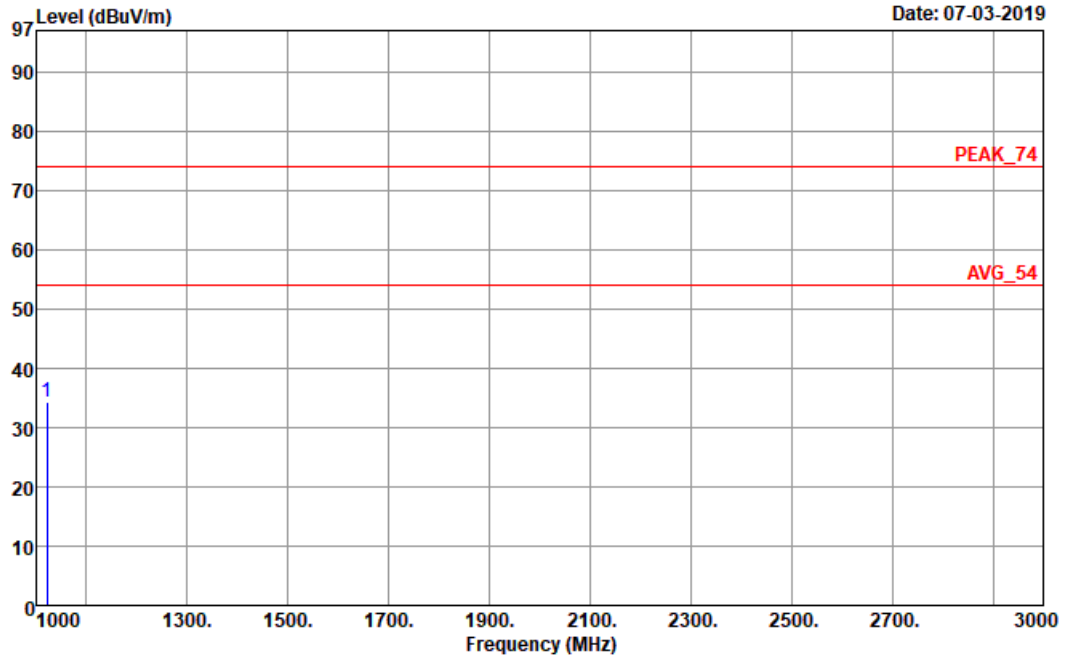


Site : 03CH01-CA  
 Condition : PEAK\_74 3m HORN 9120D-HF\_01894 HORIZONTAL  
 Pretest : 190701001  
 Power : AVR 120Vac/60Hz  
 : Add POE  
 : NB Outside

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	1022.00	34.26	-39.74	74.00	65.94	24.65	4.66	61.33	---	---	Peak



Vertical



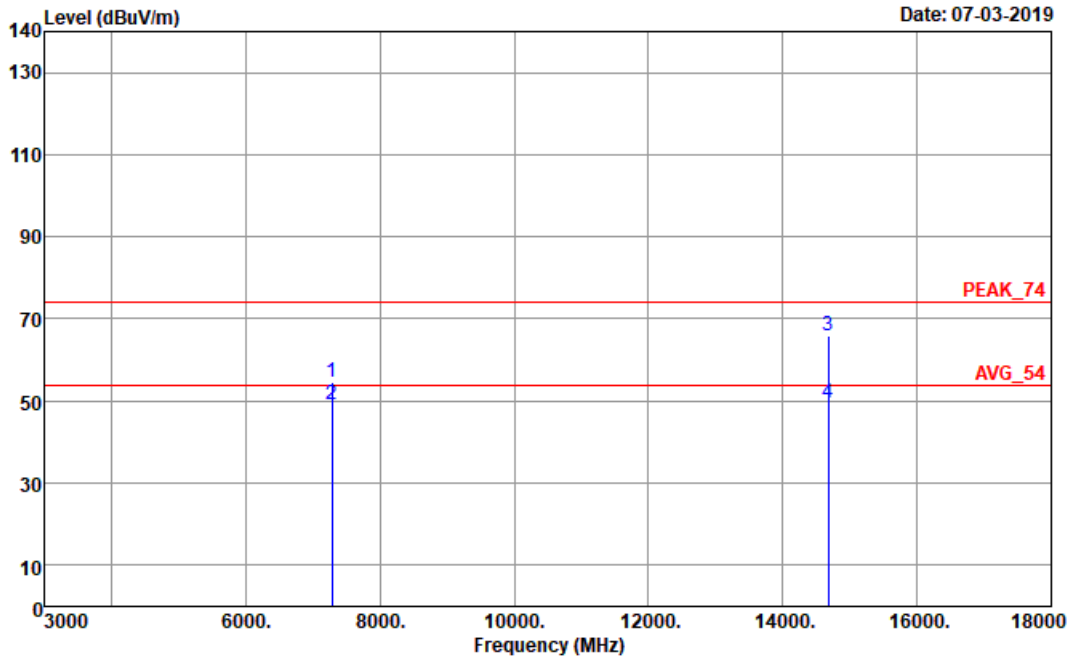
Site : 03CH01-CA  
 Condition : PEAK\_74 3m HORN 9120D-HF\_01894 VERTICAL  
 Pretest : 190701001  
 Power : AVR 120Vac/60Hz  
 : Add POE  
 : NB Outside

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	1022.00	34.26	-39.74	74.00	65.94	24.65	4.66	61.33	---	---	Peak



Temperature	20~23°C	Relative Humidity	53~55%
Test Engineer	Leo Liu	Test Distance	3m
Test Range	3GHz to 18GHz	Test Configuration	CTx

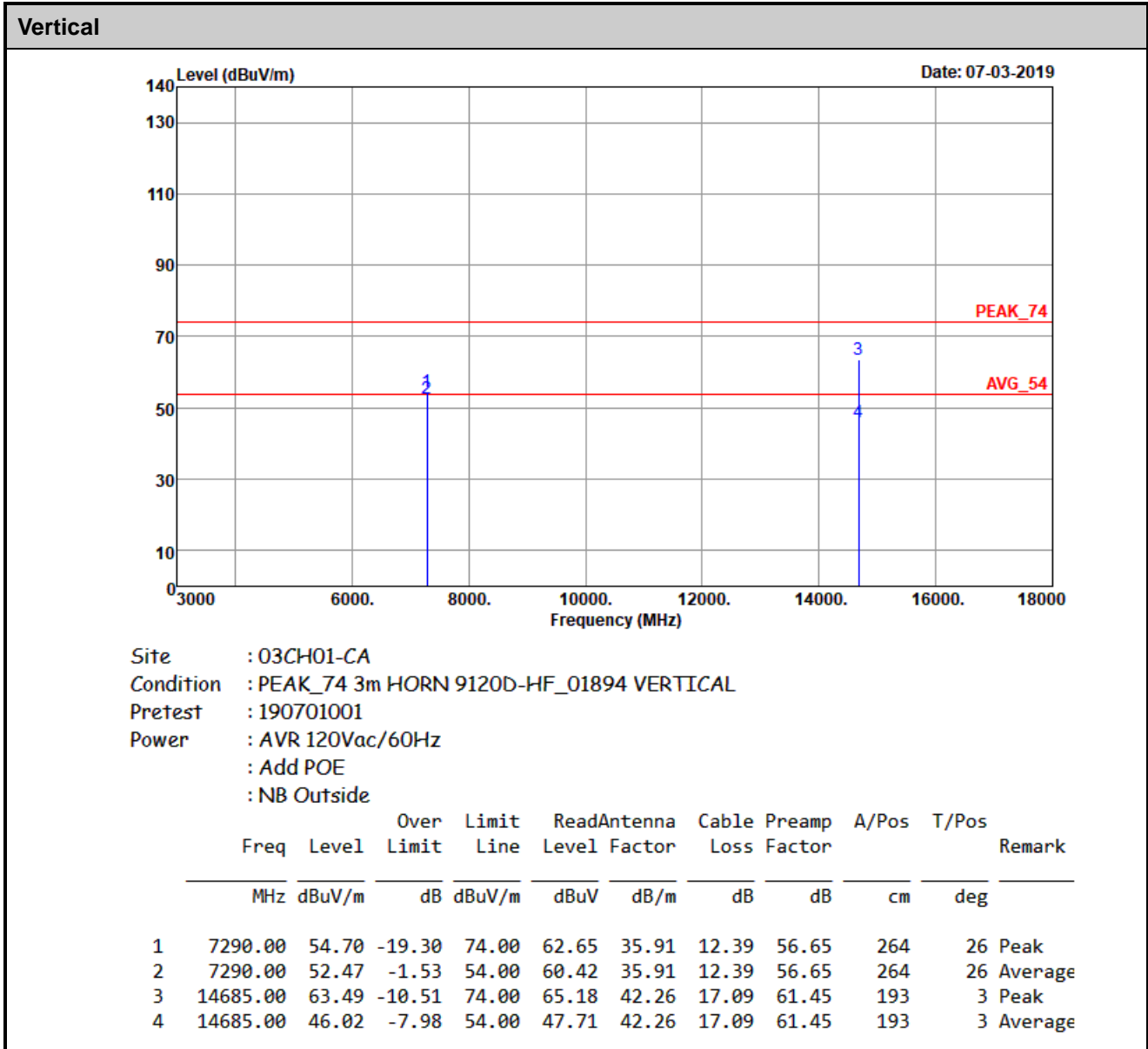
Horizontal



Site : 03CH01-CA  
 Condition : PEAK\_74 3m HORN 9120D-HF\_01894 HORIZONTAL  
 Pretest : 190701001  
 Power : AVR 120Vac/60Hz  
 : Add POE  
 : NB Outside

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	7290.00	54.55	-19.45	74.00	62.50	35.91	12.39	56.65	100	185	Peak
2	7290.00	49.10	-4.90	54.00	57.05	35.91	12.39	56.65	100	185	Average
3	14685.00	65.79	-8.21	74.00	67.48	42.26	17.09	61.45	200	297	Peak
4	14685.00	49.67	-4.33	54.00	51.36	42.26	17.09	61.45	200	297	Average

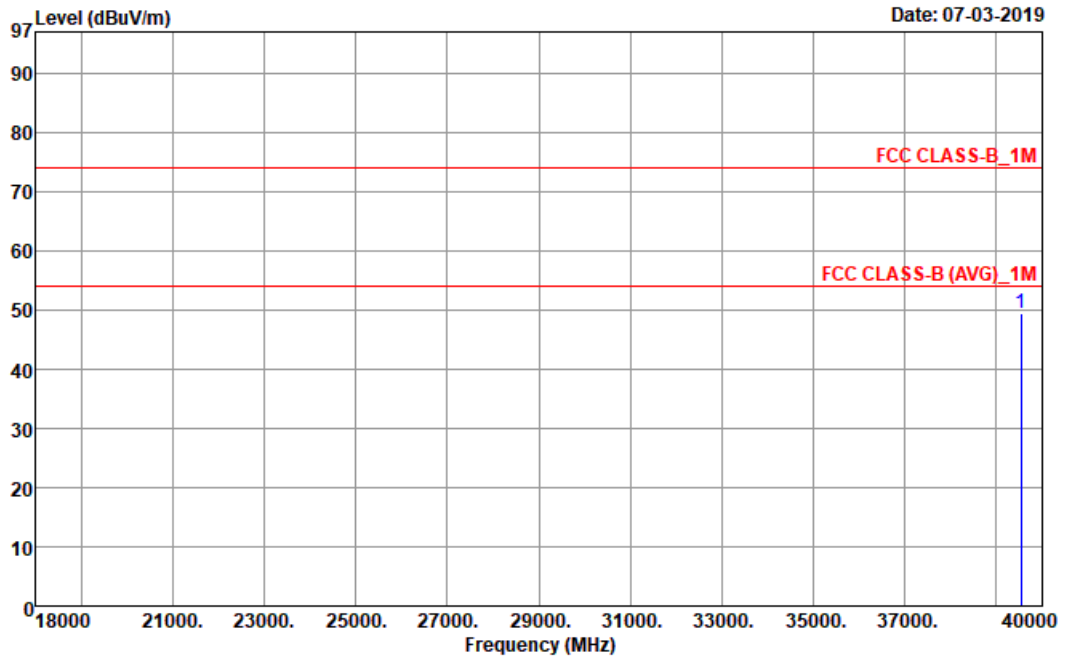






Temperature	20~23°C	Relative Humidity	53~55%
Test Engineer	Leo Liu	Test Distance	1m
Test Range	18GHz to 40GHz	Test Configuration	CTx

Horizontal

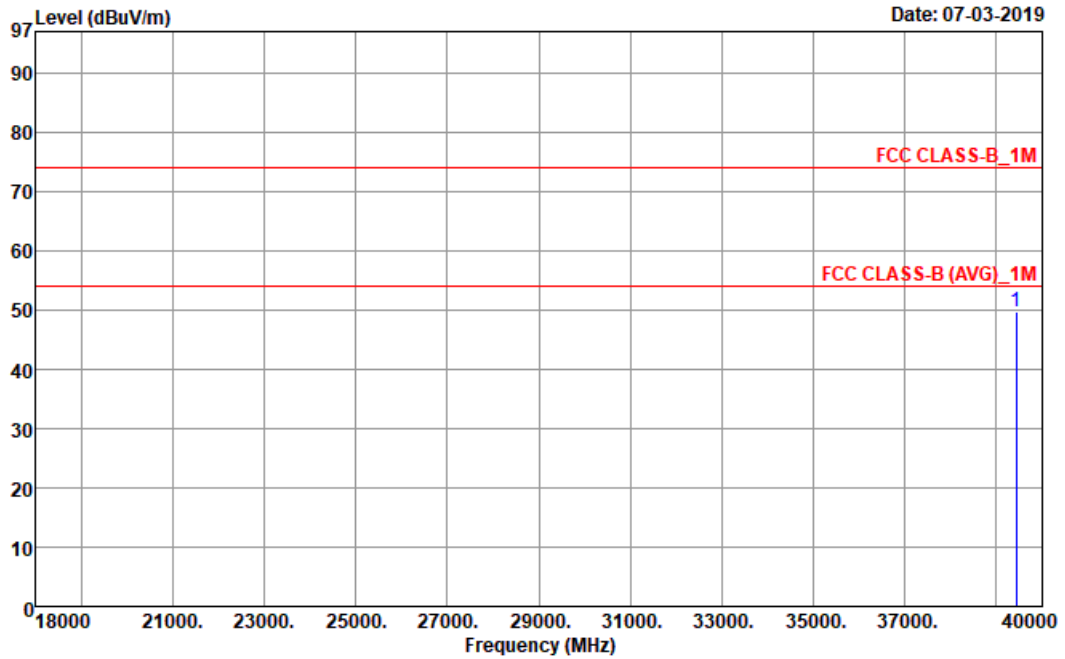


Site : 03CH01-CA  
 Condition : FCC CLASS-B\_1M 1m HORN 9170-SHF\_00841 HORIZONTAL  
 Pretest : 190701001  
 Power : AVR 120Vac/60Hz  
 : Add POE  
 : NB Outside

	Over	Limit	ReadAntenna	Cable	Preamp	A/Pos	T/Pos	Remark	
Freq	Level	Limit	Level	Loss	Loss				
MHz	dBuV/m	dB	dBuV/m	dB	dB	cm	deg		
1	39538.00	49.37	-24.63	74.00	35.99	44.32	32.43	53.83	--- --- Peak



Vertical



Site : 03CH01-CA  
 Condition : FCC CLASS-B\_1M 1m HORN 9170-SHF\_00841 VERTICAL  
 Pretest : 190701001  
 Power : AVR 120Vac/60Hz  
 : Add POE  
 : NB Outside

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	39428.00	49.63	-24.37	74.00	36.47	44.23	32.37	53.90	---	---	Peak



3.5.5.4 40GHz to 200GHz

Temperature	20~23°C	Relative Humidity	53~55%
Test Engineer	Leo Liu	Test Distance	3m
Test Range	30MHz to 1GHz	Test Configuration	CTx

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
58.32	23.5	1	56.56	-56.13
EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm <sup>2</sup> )	Limit (pW/cm <sup>2</sup> )	Test Result
-13.3	3	41.35686655	90	PASS

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
60.48	23.9	1	91.81	-71.59
EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm <sup>2</sup> )	Limit (pW/cm <sup>2</sup> )	Test Result
-22.3	3	5.206521025	90	PASS

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
62.64	23.9	1	91.80	-71.35
EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm <sup>2</sup> )	Limit (pW/cm <sup>2</sup> )	Test Result
-22.06	3	5.502342582	90	PASS

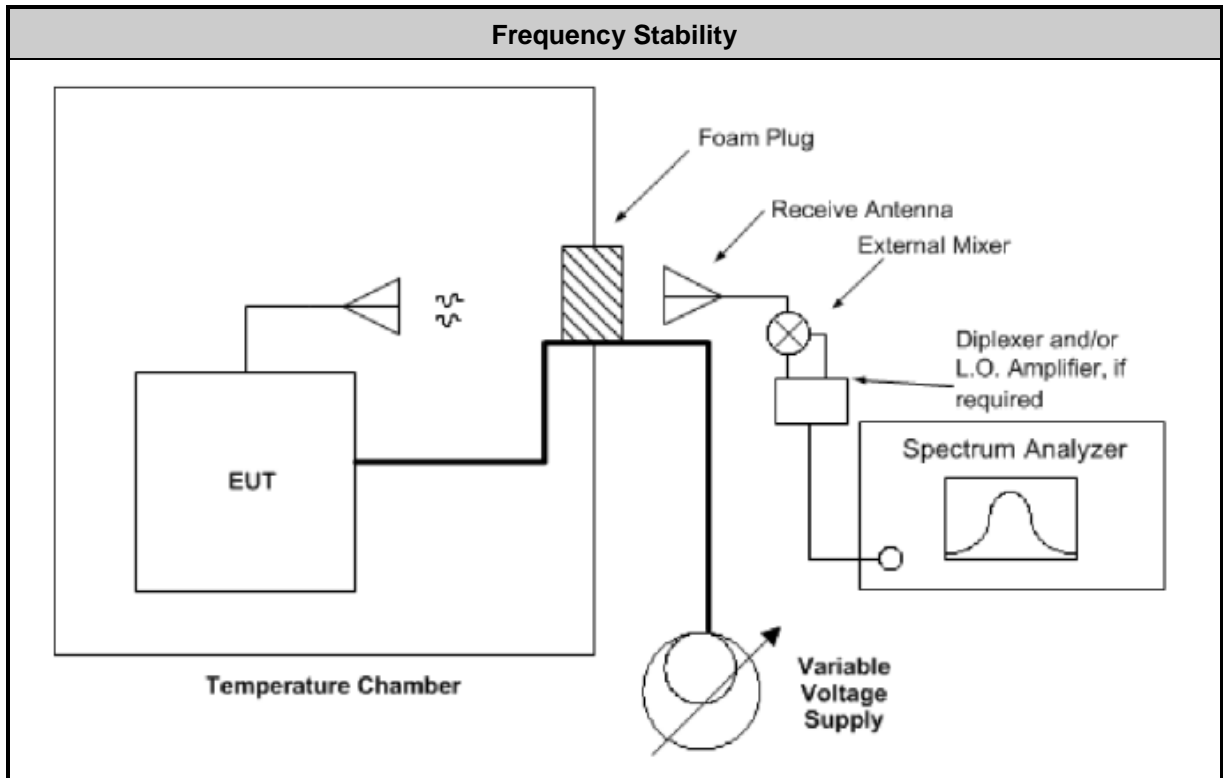
Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
64.78	23.5	1	56.70	-54.35
EIRP(dBm)	Specification Distance (m)	Power Density (pW/cm <sup>2</sup> )	Limit (pW/cm <sup>2</sup> )	Test Result
-11.52	3	62.30854738	90	PASS

### 3.6 Frequency Stability

#### 3.6.1 Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block.

#### 3.6.2 Test Setup





3.6.3 Test Procedures for Temperature Variation

Method of measurement: Refer as ANSI C63.10-2013 clause 9.14

Test Engineer	Jordan Huang			
Test Conditions	Low channel			Limit
Test Temperature (°C)	Voltage (Volt)	Measured Frequency (MHz)	Delta Frequency (±kHz)	Result
70	Normal	58320.172	68	Pass
60	Normal	58319.974	-130	
50	Normal	58319.928	-176	
40	Normal	58319.964	-140	
30	Normal	58320.038	-66	
20	Normal	58320.104	0	
10	Normal	58320.218	114	
0	Normal	58320.292	188	
-10	Normal	58320.312	208	
-20	Normal	58320.292	188	
-30	Normal	58320.262	158	
-40	Normal	58320.274	170	
20	Maximum	Not Performed	Not Performed	
20	Normal	58320.104	0	
20	Minimum	Not Performed	Not Performed	

### 3.7 RF Exposure

#### 3.7.1 Limit

Frequency Range (MHz)	E-field Strength (V/m)	M-field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
(A) Limit for occupational / Controlled Exposure				
0.3 – 3.0	614	1.63	*100	6
3.0 – 30	1842/f	4.89/f	*900/f <sup>2</sup>	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	-	-	f/100	6
1500 – 100000	-	-	5	6
(B) Limit for General Population / Uncontrolled Exposure				
0.3 – 1.34	614	1.63	*100	30
1.34 – 30	824/f	2.19/f	*180/f <sup>2</sup>	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	-	-	f/1500	30
1500 - 100000	-	-	1.0	30

f = frequency in MHz \* = Plane-wave equivalent power density

#### 3.7.2 Equation

Power Density :

$$S = \text{EIRP} / (4 \times \text{Pi} \times D^2)$$

Where:

S = Power density in mW/cm<sup>2</sup>

EIRP = Equivalent Isotropic Radiated Power in mW

D = Separation distance in cm

Distance

Distance is given by:

$$D_{\text{cm}} = \text{SQRT} (\text{EIRP} / (4 \times \text{Pi} \times S))$$

where,

D<sub>cm</sub> = Separation distance in cm

EIRP = Equivalent Isotropic Radiated Power in mW

S = Power density in mW/cm<sup>2</sup>

### 3.7.3 Power Density of Unwanted Emissions

Worse Emission Level from 30MHz to 40GHz						
Frequency Band (MHz)	Limit (dBuV/m @3m)	Limit (dBm)	Limit (mW)	RBW (MHz)	Number (Range/RBW)	Power mW
30 - 88	40	-55.2	3.02E-06	0.1	580	0.002
88 - 216	43.5	-51.7	6.76E-06	0.1	1280	0.009
216 - 960	46	-49.2	1.20E-05	0.1	7440	0.089
960 - 1000	54	-41.2	7.59E-05	0.1	400	0.030
1000 - 40000	54	-41.2	7.59E-05	1	39000	2.958
30 - 40000						3.089

### 3.7.4 Result

The minimum declaration distance is 33cm.

Frequency (GHz)	Fundamental EIRP (dBm)	Fundamental EIRP (mW)	Separation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )
58.32	37.10	5128.614	33	0.375	1.0
60.48	39.00	7943.282	33	0.580	1.0
62.64	38.20	6606.934	33	0.483	1.0
64.78	18.70	74.13102	33	0.005	1.0



## 4 AC conducted Emission Test Items

### 4.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

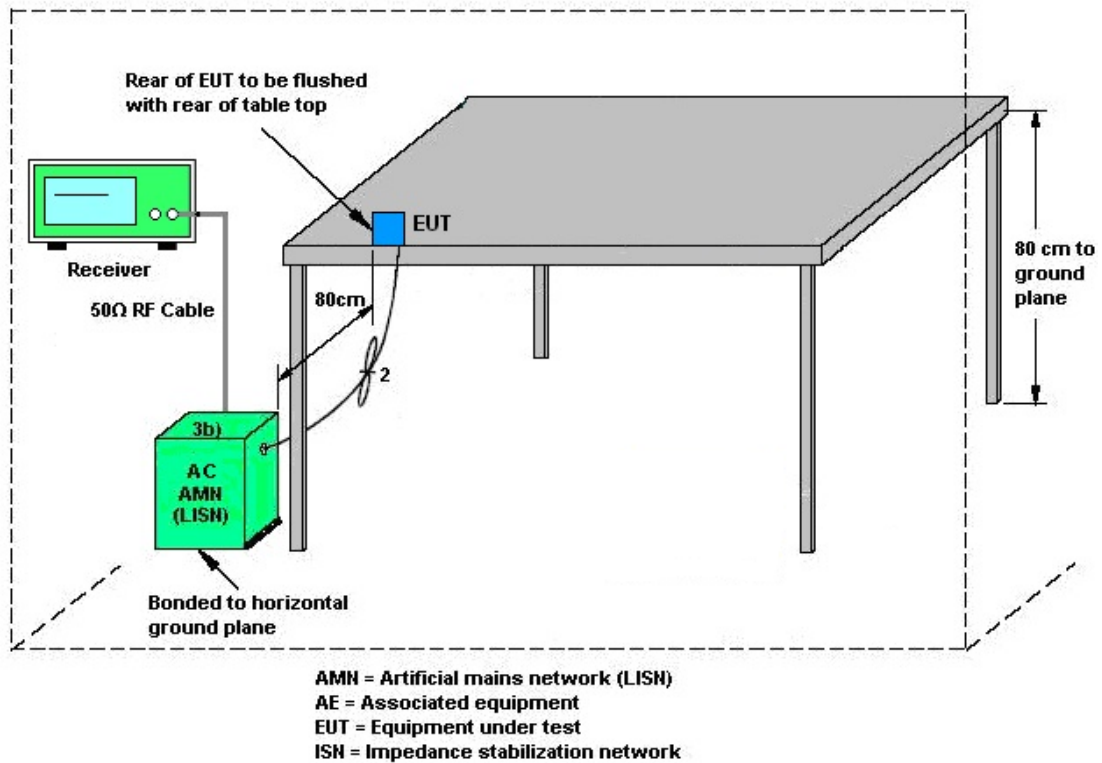
### 4.2 Measuring Instruments

See list of measuring equipment of this test report.

### 4.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

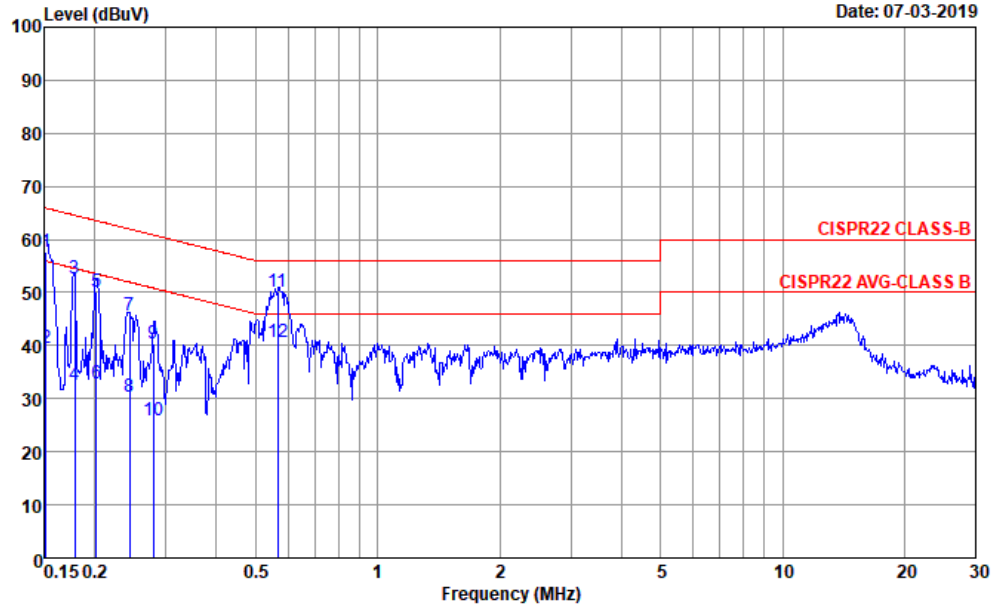
### 4.4 Test Setup





### 4.5 Test Result of AC Conducted Emission Measurement

Test Engineer :	Leo Liu	Temperature :	20~23°C
		Relative Humidity :	47~50%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	60GHZTx + WLAN Tx + PoE		

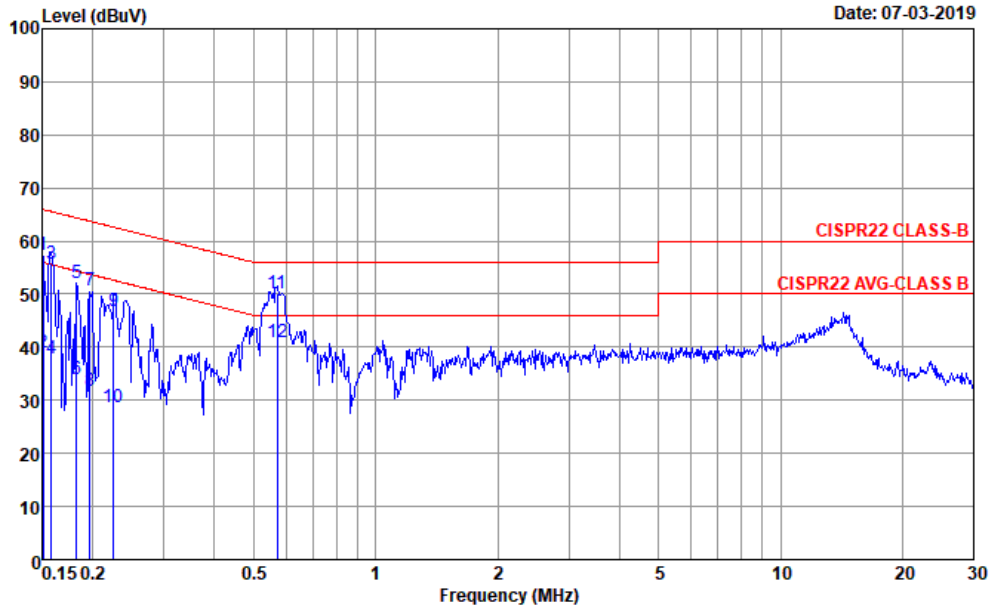


Site : CO01-CA  
 Condition : CISPR22 CLASS-B NNB51\_N\_USA407 NEUTRAL  
 Pretest : 190701001  
 Power : AVR 120Vac/60Hz  
 EUT : 60GHz AP

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Aux Factor	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	dB		
1	0.15	57.58	-8.33	65.91	37.60	9.86	0.06	10.06	QP	NEUTRAL
2	0.15	39.58	-26.33	65.91	19.60	9.86	0.06	10.06	Average	NEUTRAL
3	0.18	52.59	-11.96	64.55	32.60	9.86	0.07	10.06	QP	NEUTRAL
4	0.18	32.69	-31.86	64.55	12.70	9.86	0.07	10.06	Average	NEUTRAL
5	0.20	50.19	-13.35	63.54	30.20	9.86	0.07	10.06	QP	NEUTRAL
6	0.20	32.99	-30.55	63.54	13.00	9.86	0.07	10.06	Average	NEUTRAL
7	0.24	45.59	-16.36	61.95	25.60	9.86	0.07	10.06	QP	NEUTRAL
8	0.24	30.29	-31.66	61.95	10.30	9.86	0.07	10.06	Average	NEUTRAL
9	0.28	40.30	-20.55	60.85	20.30	9.86	0.07	10.07	QP	NEUTRAL
10	0.28	25.90	-34.95	60.85	5.90	9.86	0.07	10.07	Average	NEUTRAL
11	0.57	50.03	-5.97	56.00	30.01	9.87	0.07	10.08	QP	NEUTRAL
12	0.57	40.63	-15.37	56.00	20.61	9.87	0.07	10.08	Average	NEUTRAL



Test Engineer :	Leo Liu	Temperature :	22~24°C
		Relative Humidity :	47~50%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	60GHZTx + WLAN Tx + PoE		



Site : CO01-CA  
 Condition : CISPR22 CLASS-B NNB51\_L1\_USA407 LINE  
 Pretest : 190701001  
 Power : AVR 120Vac/60Hz  
 EUT : 60GHz AP

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Aux Factor	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	dB		
1	0.15	57.26	-8.70	65.96	37.30	9.84	0.06	10.06	QP	LINE
2	0.15	39.06	-26.94	66.00	19.10	9.84	0.06	10.06	Average	LINE
3	0.16	55.76	-9.80	65.56	35.80	9.84	0.06	10.06	QP	LINE
4	0.16	37.76	-28.24	66.00	17.80	9.84	0.06	10.06	Average	LINE
5	0.18	52.17	-12.20	64.37	32.20	9.84	0.07	10.06	QP	LINE
6	0.18	34.07	-31.93	66.00	14.10	9.84	0.07	10.06	Average	LINE
7	0.20	50.57	-13.19	63.76	30.60	9.84	0.07	10.06	QP	LINE
8	0.20	31.67	-34.33	66.00	11.70	9.84	0.07	10.06	Average	LINE
9	0.23	46.68	-15.93	62.61	26.70	9.85	0.07	10.06	QP	LINE
10	0.23	28.58	-37.42	66.00	8.60	9.85	0.07	10.06	Average	LINE
11	0.57	50.22	-5.78	56.00	30.21	9.86	0.07	10.08	QP	LINE
12	0.57	41.02	-18.98	60.00	21.01	9.86	0.07	10.08	Average	LINE



## 5 Operation Restriction and Group Installation

### 5.1 Limit of Operation Restriction and Group Installation

Item	Limit
<b>Operation Restriction</b>	Operation is not permitted for the following products: - Equipment used on aircraft or satellites. (Refer as FCC 15.255 (a)) - Field disturbance sensors, including vehicle radar systems, unless the field disturbance sensors are employed for fixed operation. (Refer as FCC 15.255 (a))
<b>Group Installation</b>	Operation is not permitted for the following products: - External phase-locking (Refer as FCC 15.255 (h))

### 5.2 Result of Operation Restriction

EUT is a wireless video area network (WVAN) for the connection of consumer electronic (CE) audio and video devices.

### 5.3 Result of Group Installation

The frequency, amplitude and phase of the transmit signal are set within the EUT. There are no external phase-locking inputs or any other means of combining two or more units together to realize a beam-forming array.



## 6 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	6111D	50392	30MHz~1GHz	May 15, 2019	Jul. 01, 2019 ~ Jul. 11, 2019	May 14, 2020	Radiation (03CH01-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	01894	1GHz~18GHz	Jul. 30, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Jul. 29, 2019	Radiation (03CH01-CA)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	BBHA917000841	18GHz~40GHz	Jul. 31, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Jul. 30, 2019	Radiation (03CH01-CA)
Preamplifier	EMEC	EMC18G40G	060725	18GHz~40GHz	Jul. 27, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Jul. 26, 2019	Radiation (03CH01-CA)
Amplifier	SONOMA	310N	372241	N/A	Aug. 02, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 01, 2019	Radiation (03CH01-CA)
Preamplifier	Keysight	83017A	MY53270321	1GHz~26.5GHz	Sep. 27, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Sep. 26, 2019	Radiation (03CH01-CA)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800055000	1GHz~18GHz	Jul. 31, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Jul. 30, 2019	Radiation (03CH01-CA)
EMI Test Receiver	R&S	ESU26	100049	20Hz~26.5GHz	Aug. 23, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 22, 2019	Radiation (03CH01-CA)
Filter	Wainwright	WLK12-1200-1272-11000-40SS	SN1	1.2G Low Pass	Aug. 03, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 02, 2019	Radiation (03CH01-CA)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN9	3G High pass	Aug. 03, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 02, 2019	Radiation (03CH01-CA)
Notch Filter	Wainwright	WRCJV10-2375-2400-2483-2508-40SS	SN4	Notch Filter	Aug. 03, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 02, 2019	Radiation (03CH01-CA)
Hygrometer	TESEO	608-H1	45142559	N/A	Aug. 07, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 06, 2019	Radiation (03CH01-CA)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Jul. 01, 2019 ~ Jul. 11, 2019	N/A	Radiation (03CH01-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jul. 01, 2019 ~ Jul. 11, 2019	N/A	Radiation (03CH01-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jul. 01, 2019 ~ Jul. 11, 2019	N/A	Radiation (03CH01-CA)
*Mixer	Rohde&Schwarz	FSZ60	100994	40~60GHz	Dec. 05, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Dec. 04, 2021	Radiation (03CH01-CA)
*Mixer	Rohde&Schwarz	FSZ75	101562	50~75GHz	Feb. 26, 2019	Jul. 01, 2019 ~ Jul. 11, 2019	Feb. 25, 2021	Radiation (03CH01-CA)
*Mixer	Rohde&Schwarz	FSZ90	101130	60~90GHz	Sep. 06, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Sep. 05, 2021	Radiation (03CH01-CA)
*Mixer	Rohde&Schwarz	FSZ140	101867	90~140GHz	Jan. 11, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Jan. 10, 2021	Radiation (03CH01-CA)
*Mixer	Rohde&Schwarz	FSZ220	101008	140~220GHz	Apr. 04, 2019	Jul. 01, 2019 ~ Jul. 11, 2019	Apr. 03, 2022	Radiation (03CH01-CA)
Standard Horn Antenna	Quinstar	QWH-UPRR00	923600006	40~60G	Aug. 17, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 16, 2021	Radiation (03CH01-CA)
Standard Horn Antenna	Quinstar	QWH-UPRR00	923700008	50~75G	Aug. 17, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 16, 2021	Radiation (03CH01-CA)
Standard Horn Antenna	Quinstar	QWH-UPRR00	784600035	60~90G	Aug. 17, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 16, 2021	Radiation (03CH01-CA)
Standard Horn Antenna	Quinstar	QWH-UPRR00	923800009	90~140G	Aug. 17, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 16, 2021	Radiation (03CH01-CA)
Standard Horn Antenna	Quinstar	QWH-UPRR00	923900002	140~220G	Aug. 17, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Aug. 16, 2021	Radiation (03CH01-CA)
Spectrum Analyzer	Rohde&Schwarz	FSW43	104042	9KHz~40Ghz	Sep. 26, 2018	Jul. 01, 2019 ~ Jul. 11, 2019	Sep. 25, 2019	Radiation (03CH01-CA)
Loop Antenna	Rohde&Schwarz	HFH2-Z2	100840	9KHz~30Mhz	Apr. 03, 2019	Jul. 01, 2019 ~ Jul. 11, 2019	Apr. 02, 2020	Radiation (03CH01-CA)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
LISN	TESEQ	NNB51	47407	N/A	Jun. 26, 2019	Jul. 03, 2019	Jun. 25, 2020	Conduction (CO01-CA)
EMI Test Receiver	R&S	ESU26	100123	20Hz~26.5GHz	Aug. 28, 2018	Jul. 03, 2019	Aug. 27, 2019	Conduction (CO01-CA)
Pulse limiter with 10dB attenuation	R&S	VTSD 9561-F N	9561-F- N00412	N/A	Jun. 11, 2019	Jul. 03, 2019	Jun. 10, 2020	Conduction (CO01-CA)
Temperature and Humidity chamber	ESPEC	SH-642	93012171	N/A	Apr. 12, 2019	Jul. 01, 2019 ~ Jul. 11, 2019	Apr. 13, 2020	Conducted (TH01-CA)

**Note:**

(\*) Equipment manufacturer's Calibration Certificate.

## 7 Uncertainty of Evaluation

### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	1.7
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### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.4
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### Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	6.5
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### Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.9
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### Uncertainty of Radiated Emission Measurement (40 GHz ~ 220 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	7.0
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## **Appendix A. R&S Mixer Certificate**



**Radiometer Physics**  
A Rohde & Schwarz Company

**RPG Radiometer-Physics GmbH**  
Werner-von-Siemens-Str. 4  
D-53340 Meckenheim  
Telefon 02225-99981-0  
Fax 02225-99981-99  
www.radiometer-physics.de


Radiometer Physics, Werner-von-Siemens-Str. 4, D-53340 Meckenheim  
Rohde & Schwarz Messgerätebau GmbH  
Riedbachstr. 37  
87700 Memmingen

Ansprechpartner: Frank Marvin Gottbehüt  
Abteilung: 1RP-IM

Telefon 02225-99981-0  
Fax 02225-99981-99  
mm-wave-service@radiometer-physics.de

Meckenheim, 2019-04-04

## Servicebericht

Allgemeine Daten			
<b>Bauteilbezeichnung</b>	FS-Z220		
<b>RMA Nummer</b>	4425	<b>Artikelnr. /Materialnr.</b>	3593.3250.02
<b>Eingangsdatum</b>	2019-04-03	<b>Seriennummer (SN)</b>	101008
Die folgenden Arbeiten wurden am Gerät durchgeführt:			
<input checked="" type="checkbox"/>	Überprüfung	<input type="checkbox"/>	Nachrüstung
<input type="checkbox"/>	Reparatur	<input type="checkbox"/>	Umrüstung
<input checked="" type="checkbox"/>	Kalibrierung	<input type="checkbox"/>	Austausch
<input type="checkbox"/>	Justierung	<input type="checkbox"/>	Gerät gereinigt
<input type="checkbox"/>	Sonderkalibrierung	<input type="checkbox"/>	Elektrischer Sicherheitstest
<input type="checkbox"/>	Performance Check	<input type="checkbox"/>	Sonstiges (Siehe Bericht)
<b>Bericht:</b>			
2019-04-04 Datum	Frank Marvin Gottbehüt Name		Unterschrift 

Seite 1 von 1



# Calibration Certificate

Certificate Number **24-0220-101008-02**

Kalibrierschein

Zertifikatsnummer

## Unit Data

Item  
Gegenstand **Harmonic Mixer, 140 GHz to 220 GHz**

Manufacturer  
Hersteller **RPG Radiometer-Physics GmbH**

Type  
Typ **RPG FS-Z220**

Material Number  
Materialnummer **3593.3250.02**      Serial Number  
Seriennummer **101008**

Asset Number  
Inventarnummer

This calibration certificate documents, that the named item is tested and measured against defined specifications. Measurement results are located usually in the corresponding interval with a probability of approx. 95% (coverage factor  $k = 2$ ). Calibration is performed with test equipment and standards directly or indirectly traceable by means of approved calibration techniques to the PTB/DKD or other national/international standards, which realize the physical units of measurement according to the International System of Units (SI). In all cases where no standards are available, measurements are referenced to standards of the R&S laboratories. Principles and methods of calibration correspond with EN ISO/IEC 17025. This calibration certificate may not be reproduced other than in full. Calibration certificates without signatures are not valid. The user is obliged to have the object recalibrated at appropriate intervals.

## Order Data

Customer  
Auftraggeber

Order Number  
Bestellnummer **4703008458**

Date of Receipt  
Eingangsdatum **2019-04-03**

Dieser Kalibrierschein dokumentiert, dass der genannte Gegenstand nach festgelegten Vorgaben geprüft und gemessen wurde. Die Messwerte lagen im Regelfall mit einer Wahrscheinlichkeit von annähernd 95% im zugeordneten Wertintervall (Erweiterte Messunsicherheit mit  $k = 2$ ). Die Kalibrierung erfolgte mit Messmitteln und Normalen, die direkt oder indirekt durch Ableitung mittels anerkannter Kalibriertechniken rückgeführt sind auf Normale der PTB/DKD oder anderer nationaler/internationaler Standards zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem internationalen Einheitensystem (SI). Wenn keine Normale existieren, erfolgt die Rückführung auf Bezugsnormale der R&S-Laboratorien. Grundsätze und Verfahren der Kalibrierung beziehen sich auf EN ISO/IEC 17025. Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Kalibrierscheine ohne Unterschriften sind ungültig. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

## Performance

Place and Date of Calibration  
Ort und Datum der Kalibrierung

**Meckenheim, 2019-04-04**

Scope of Calibration  
Umfang der Kalibrierung

**Standard Calibration**

Statement of Compliance  
(Incoming)  
Konformitätsaussage  
(Anlieferung)

**All measured values are within the data sheet specifications.**

Statement of Compliance  
(Outgoing)  
Konformitätsaussage  
(Auslieferung)

**All measured values are within the data sheet specifications.**

Extend of Calibration Documents  
Umfang des Kalibrierdokuments

**2 pages Calibration Certificate  
5 pages Outgoing Results  
3 pages Incoming Results**

**Radiometer Physics GmbH; Meckenheim**

Date of Issue  
Ausstellungsdatum

**2019-04-04**

Head of Laboratory  
Laborleitung

Schulze

Person Responsible  
Bearbeiter

Gottbehuet

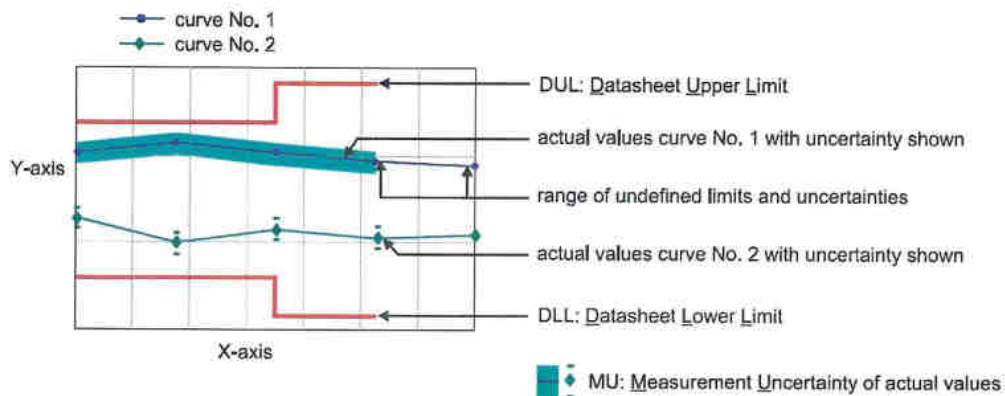
Page (Seite) 1/2  
Vers2010-05-05/  
RPG2014-02-28

## Outgoing Results

The following abbreviations may be used in this document

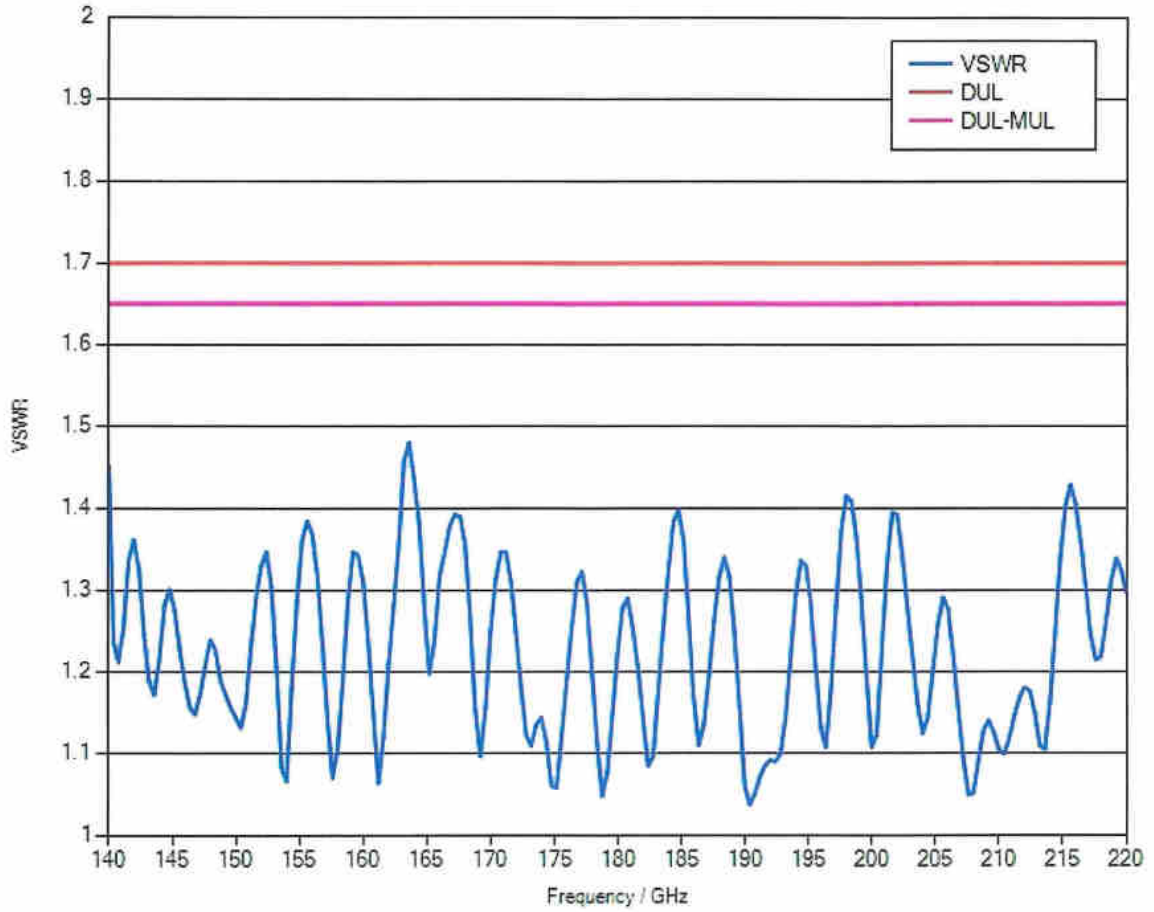
{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
{b}	The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
{c}	Functional test, therefore no measurement uncertainty is stated.
{d}	Typical value, refer to performance test.
{e}	The measurement uncertainty is taken into account when setting the measuring system.
DL or DT	Data Limit for symmetrical tolerance limits
DLL	Datasheet Lower Limit
DUL	Datasheet Upper Limit
MU	Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
Act.	Actual Value
UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	Measurement results marked as UGB1 show conformity with a probability of >50 % and <95 %.
UGB2	Measurement results marked as UGB2 show non-conformity with a probability of >50 % and <95 %.
DU	Datasheet Uncertainty

### Explanation of charts



### 1.1 RF Input – VSWR

Measurement uncertainty: 0.05 (VSWR)



### 1.3 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 16th harmonic	6 dB	1.83 dB	PASS
IF = 729 MHz, 16th harmonic	6 dB	1.88 dB	PASS
IF = 1330 MHz, 14th harmonic	6 dB	2.64 dB	PASS

Material Number 3593.3250.02

Serial Number 101008

Certificate Number 24-0220-101008-02

(Incoming)

**Software used for measurement**

**Item Type**

Measurement Studio Professional Edition  
MixerCertification

**Version**

2013  
7\_12

**Remark**

Incoming Report



# Calibration Certificate

Certificate Number **24-0075-101562-01**

Kalibrierschein

Zertifikatsnummer

## Unit Data

Item  
Gegenstand **Harmonic Mixer, 50 GHz to 75 GHz**

Manufacturer  
Hersteller **RPG**

Type  
Typ **RPG FS-Z75**

Material Number  
Materialnummer **3638.2240.02**    Serial Number  
Seriennummer **101562**

Asset Number  
Inventarnummer

This calibration certificate documents, that the named item is tested and measured against defined specifications. Measurement results are located usually in the corresponding interval with a probability of approx. 95% (coverage factor  $k = 2$ ). Calibration is performed with test equipment and standards directly or indirectly traceable by means of approved calibration techniques to the PTB/DKD or other national/international standards, which realize the physical units of measurement according to the International System of Units (SI). In all cases where no standards are available, measurements are referenced to standards of the R&S laboratories. Principles and methods of calibration correspond with EN ISO/IEC 17025. This calibration certificate may not be reproduced other than in full. Calibration certificates without signatures are not valid. The user is obliged to have the object recalibrated at appropriate intervals.

## Order Data

Customer  
Auftraggeber

Order Number  
Bestellnummer

Date of Receipt  
Eingangsdatum

Dieser Kalibrierschein dokumentiert, dass der genannte Gegenstand nach festgelegten Vorgaben geprüft und gemessen wurde. Die Messwerte lagen im Regelfall mit einer Wahrscheinlichkeit von annähernd 95% im zugeordneten Wertintervall (Erweiterte Messunsicherheit mit  $k = 2$ ). Die Kalibrierung erfolgte mit Messmitteln und Normalen, die direkt oder indirekt durch Ableitung mittels anerkannter Kalibriertechniken rückgeführt sind auf Normale der PTB/DKD oder anderer nationaler/internationaler Standards zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Wenn keine Normale existieren, erfolgt die Rückführung auf Bezugsnormale der R&S-Laboratorien. Grundsätze und Verfahren der Kalibrierung beziehen sich auf EN ISO/IEC 17025. Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Kalibriertechniken ohne Unterschriften sind ungültig. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

## Performance

Place and Date of Calibration  
Ort und Datum der Kalibrierung

**Meckenheim, 2019-01-24**

Scope of Calibration  
Umfang der Kalibrierung

**Standard Calibration**

Statement of Compliance  
(Incoming)  
Konformitätsaussage  
(Anlieferung)

**New device**

Statement of Compliance  
(Outgoing)  
Konformitätsaussage  
(Auslieferung)

Extend of Calibration Documents  
Umfang des Kalibrierdokuments

**All measured values are within the data sheet specifications.**

**2 pages Calibration Certificate  
4 pages Outgoing Results**

## Radiometer Physics GmbH; Meckenheim

Date of Issue  
Ausstellungsdatum

**2019-01-25**

Head of Laboratory  
Laborleitung

Schulze

Person Responsible  
Bearbeiter

*D. Heinze*

Heinze

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RPG2014-02-28



Calibration Method  
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity 20 % - 80 %  
Relative LuftfeuchteAmbient Temperature  
Umgebungstemperatur(23  $\begin{smallmatrix} +7 \\ -3 \end{smallmatrix}$ ) °C

Working standards used (having a significant effect on the accuracy) Verwendete Gebrauchsnormale (mit signifikantem Einfluss auf die Genauigkeit)				
Item Gegenstand	Type Typ	Serial Number Seriennummer	Calibration Certificate Number Kalibrierscheinnummer	Cal. Due Kalibr. bis
Vector Network Analyzer	R&S® ZVA67	101097	20-300432406	2020-07-21
Powersensor	R&S® NRP-Z55	140093	20-300426315	2019-05-17
Powersensor	R&S® NRP-Z58	101065	0001-300474488	2019-08-03

**UGB1** A compliance statement may be possible where a confidence level of less than 95 % is acceptable.  
Die Bestätigung der Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

**UGB2** A non-compliance statement may be possible where a confidence level of less than 95 % is acceptable.  
Die Bestätigung der Nicht-Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

Ref.: ILAC-G8:03/2009 'Guidelines on the Reporting of Compliance with Specification'.

**Notes**

## Anmerkungen

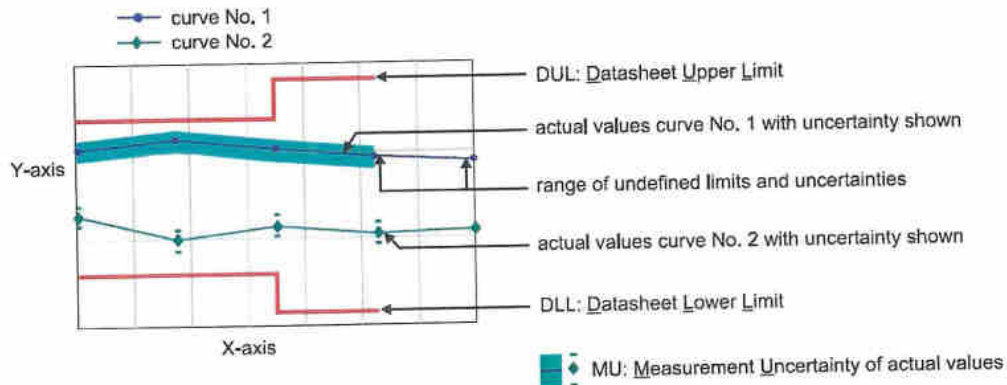
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is actually put into operation.

# Outgoing Results

The following abbreviations may be used in this document

- {a) No measurement uncertainty stated because the errors always add together.  
So it is sure that a measurement result evaluated as "PASS" is pass.
- {b) The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
- {c) Functional test, therefore no measurement uncertainty is stated.
- {d) Typical value, refer to performance test.
- {e) The measurement uncertainty is taken into account when setting the measuring system.
- DL or DT Data Limit for symmetrical tolerance limits
- DLL Datasheet Lower Limit
- DUL Datasheet Upper Limit
- MU Measurement Uncertainty
- MLL or MLV Measurement Uncertainty Lower Value
- MUL or MUV Measurement Uncertainty Upper Value
- Nom. Nominal Value
- Dev. Deviation
- MErr. Measurement Error
- Act. Actual Value
- UGB Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
- UGB1 Measurement results marked as UGB1 show conformity with a probability of >50 % and <95 %.
- UGB2 Measurement results marked as UGB2 show non-conformity with a probability of >50 % and <95 %.
- DU Datasheet Uncertainty

## Explanation of charts



**Software used for measurement**

**Item Type**  
Measurement Studio Professional Edition  
MixerCertification

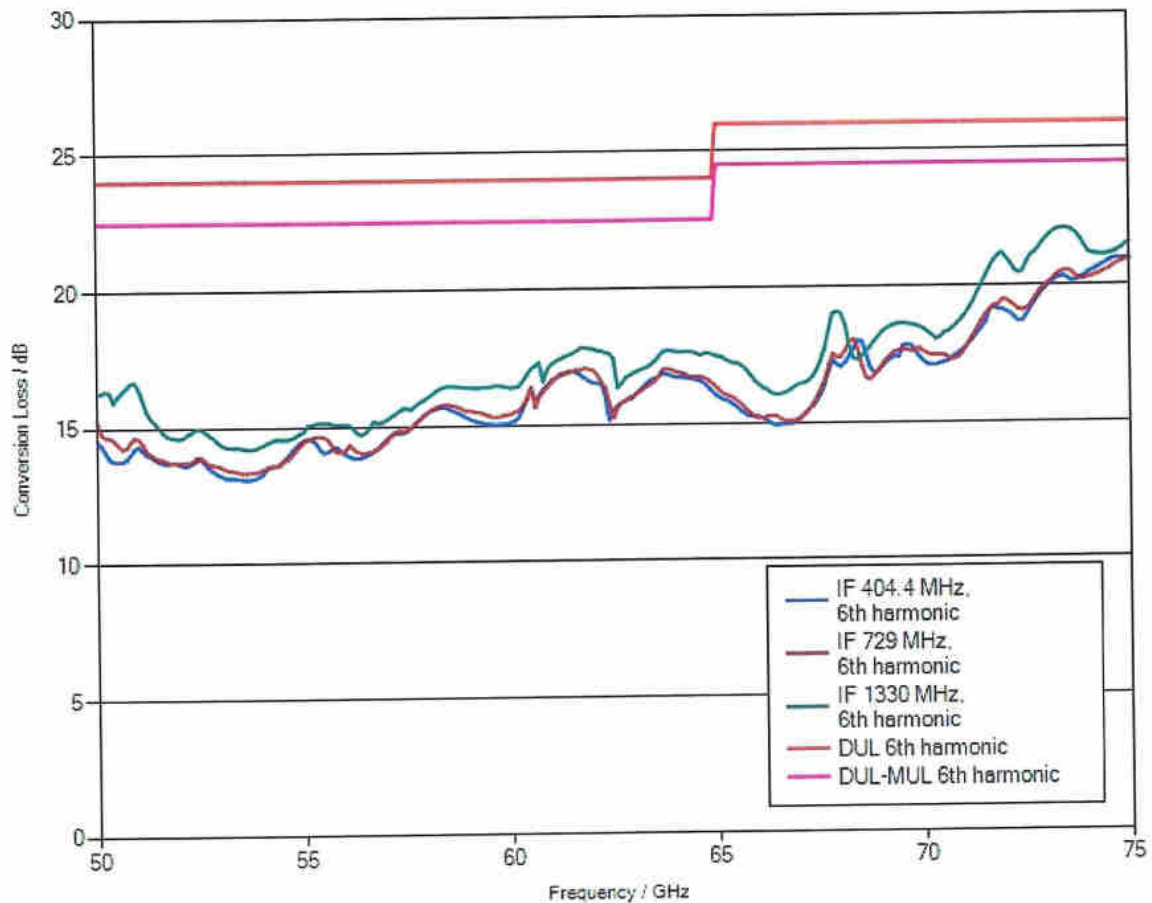
**Version**  
2013  
\_B5G

**Remark**

## 1.1 Conversion loss

LO level            +14 dBm nominal  
Bias                0 A

Measurement uncertainty:    1.5 dB



**Note:** Numeric calibration data can be found attached to the PDF file of the calibration certificate. Click the "paper clip" symbol to display the file.

The file has been renamed for safety reasons.  
When downloading the file onto your PC, please delete the ".file" extension and unzip the data.

## 1.2 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 6th harmonic	6 dB	2.26 dB	PASS
IF = 729 MHz, 6th harmonic	6 dB	2.42 dB	PASS
IF = 1330 MHz, 6th harmonic	6 dB	2.63 dB	PASS



# Calibration Certificate

Kalibrierschein

Certificate Number **24-0140-101130-01**

Zertifikatsnummer

## Unit Data

Item  
Gegenstand **Harmonic Mixer, 90 GHz to 140 GHz**

Manufacturer  
Hersteller **RPG**

Type  
Typ **RPG FS-Z140**

Material Number  
Materialnummer **3622.0708.02**      Serial Number  
Seriennummer **101130**

Asset Number  
Inventarnummer

This calibration certificate documents, that the named item is tested and measured against defined specifications. Measurement results are located usually in the corresponding interval with a probability of approx. 95% (coverage factor  $k = 2$ ). Calibration is performed with test equipment and standards directly or indirectly traceable by means of approved calibration techniques to the PTB/DKD or other national/international standards, which realize the physical units of measurement according to the International System of Units (SI). In all cases where no standards are available, measurements are referenced to standards of the R&S laboratories. Principles and methods of calibration correspond with EN ISO/IEC 17025. This calibration certificate may not be reproduced other than in full. Calibration certificates without signatures are not valid. The user is obliged to have the object recalibrated at appropriate intervals.

## Order Data

Customer  
Auftraggeber

Order Number  
Bestellnummer

Date of Receipt  
Eingangsdatum

Dieser Kalibrierschein dokumentiert, dass der genannte Gegenstand nach festgelegten Vorgaben geprüft und gemessen wurde. Die Messwerte lagen im Regelfall mit einer Wahrscheinlichkeit von annähernd 95% im zugeordneten Wertintervall (Erweiterte Messunsicherheit mit  $k = 2$ ). Die Kalibrierung erfolgte mit Messmitteln und Normalen, die direkt oder indirekt durch Ableitung mittels anerkannter Kalibriertechniken rückgeführt sind auf Normale der PTB/DKD oder anderer nationaler/internationaler Standards zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Wenn keine Normale existieren, erfolgt die Rückführung auf Bezugsnormale der R&S-Laboratorien. Grundsätze und Verfahren der Kalibrierung beziehen sich auf EN ISO/IEC 17025. Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Kalibrierscheine ohne Unterschriften sind ungültig. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

## Performance

Place and Date of Calibration  
Ort und Datum der Kalibrierung

**Meckenheim, 2018-09-04**

Scope of Calibration  
Umfang der Kalibrierung

**Standard Calibration**

Statement of Compliance  
(Incoming)  
Konformitätsaussage  
(Anlieferung)

**New device**

Statement of Compliance  
(Outgoing)  
Konformitätsaussage  
(Auslieferung)

**All measured values are within the data sheet specifications.**

Extend of Calibration Documents  
Umfang des Kalibrierdokuments

**2 pages Calibration Certificate  
5 pages Outgoing Results**

## Radiometer Physics GmbH; Meckenheim

Date of Issue  
Ausstellungsdatum

**2018-09-06**

Head of Laboratory  
Laborleitung

Schulze

Person Responsible  
Bearbeiter

Dick

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RPG2014-02-28

Calibration Method  
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity 20 % - 80 %  
Relative LuftfeuchteAmbient Temperature  
Umgebungstemperatur(23 <sup>+7</sup>  
-3) °C

Working standards used (having a significant effect on the accuracy) Verwendete Gebrauchsnormale (mit signifikantem Einfluss auf die Genauigkeit)				
Item Gegenstand	Type Typ	Serial Number Seriennummer	Calibration Certificate Number Kalibrierscheinnummer	Cal. Due Kalibr. bis
Vector Network Analyzer	R&S® ZVA67	101097	20-300432406	2020-07-21
Powersensor	R&S® NRP-Z55	140093	20-300426315	2019-05-17

**UGB1** A compliance statement may be possible where a confidence level of less than 95 % is acceptable.  
Die Bestätigung der Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

**UGB2** A non-compliance statement may be possible where a confidence level of less than 95 % is acceptable.  
Die Bestätigung der Nicht-Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

Ref.: ILAC-G8:03/2009 'Guidelines on the Reporting of Compliance with Specification'.

**Notes**  
Anmerkungen

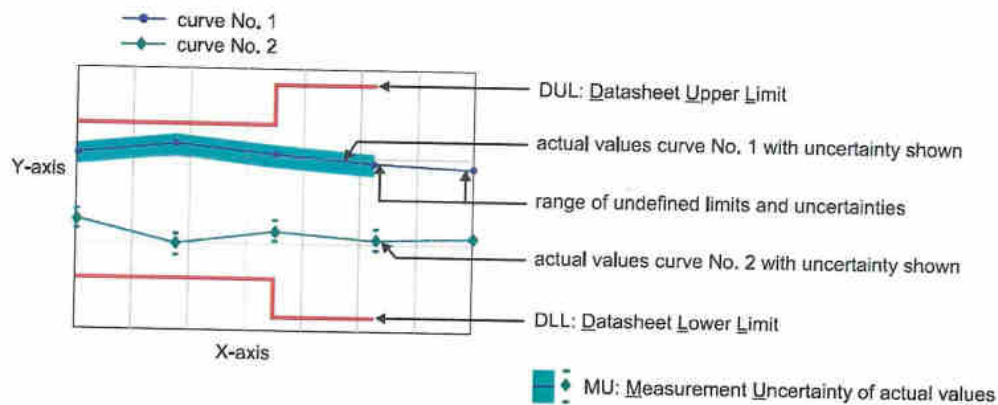
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is actually put into operation.

# Outgoing Results

The following abbreviations may be used in this document

{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
{b}	The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
{c}	Functional test, therefore no measurement uncertainty is stated.
{d}	Typical value, refer to performance test.
{e}	The measurement uncertainty is taken into account when setting the measuring system.
DL or DT	Data Limit for symmetrical tolerance limits
DLL	Datasheet Lower Limit
DUL	Datasheet Upper Limit
MU	Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
Act.	Actual Value
UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	Measurement results marked as UGB1 show conformity with a probability of >50 % and <95 %.
UGB2	Measurement results marked as UGB2 show non-conformity with a probability of >50 % and <95 %.
DU	Datasheet Uncertainty

## Explanation of charts





**Software used for measurement**

**Item Type**

Measurement Studio Professional Edition  
MixerCertification

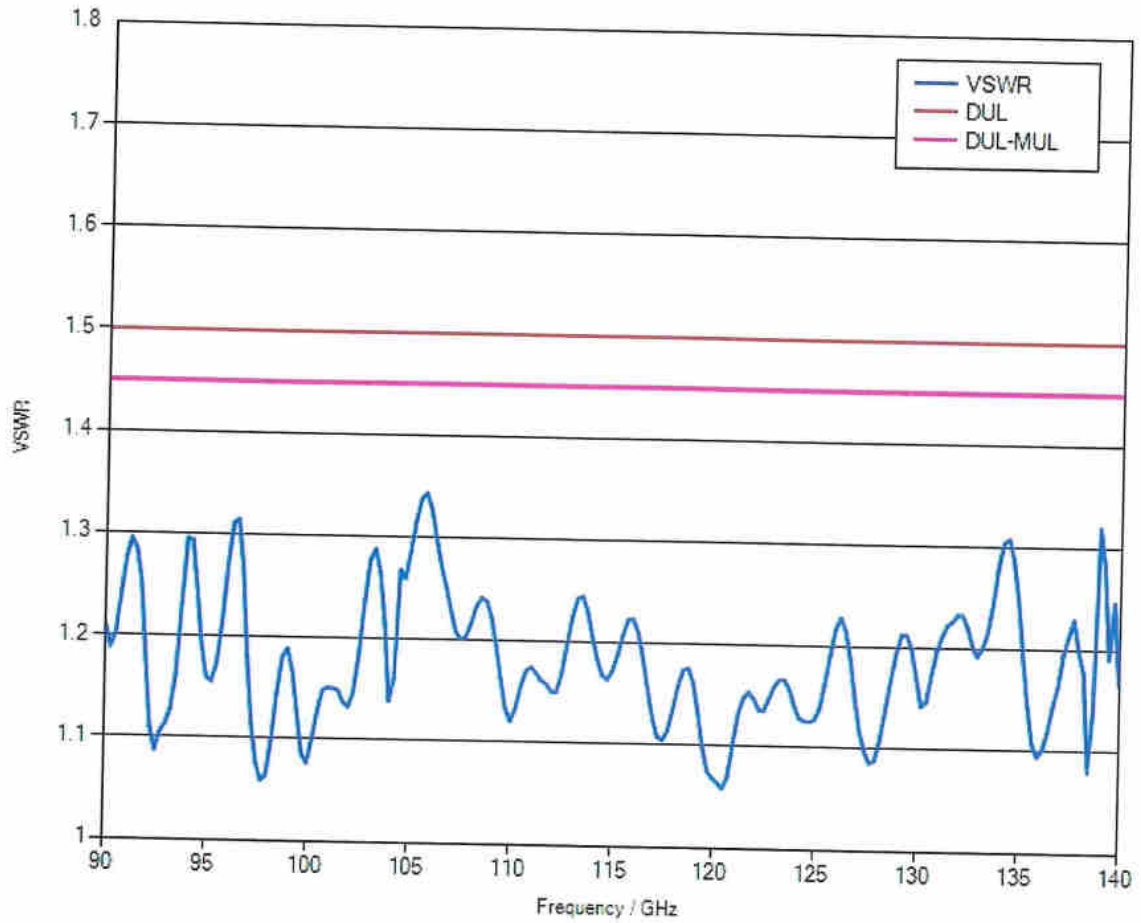
**Version**

2013  
7\_09

**Remark**

### 1.1 RF Input – VSWR

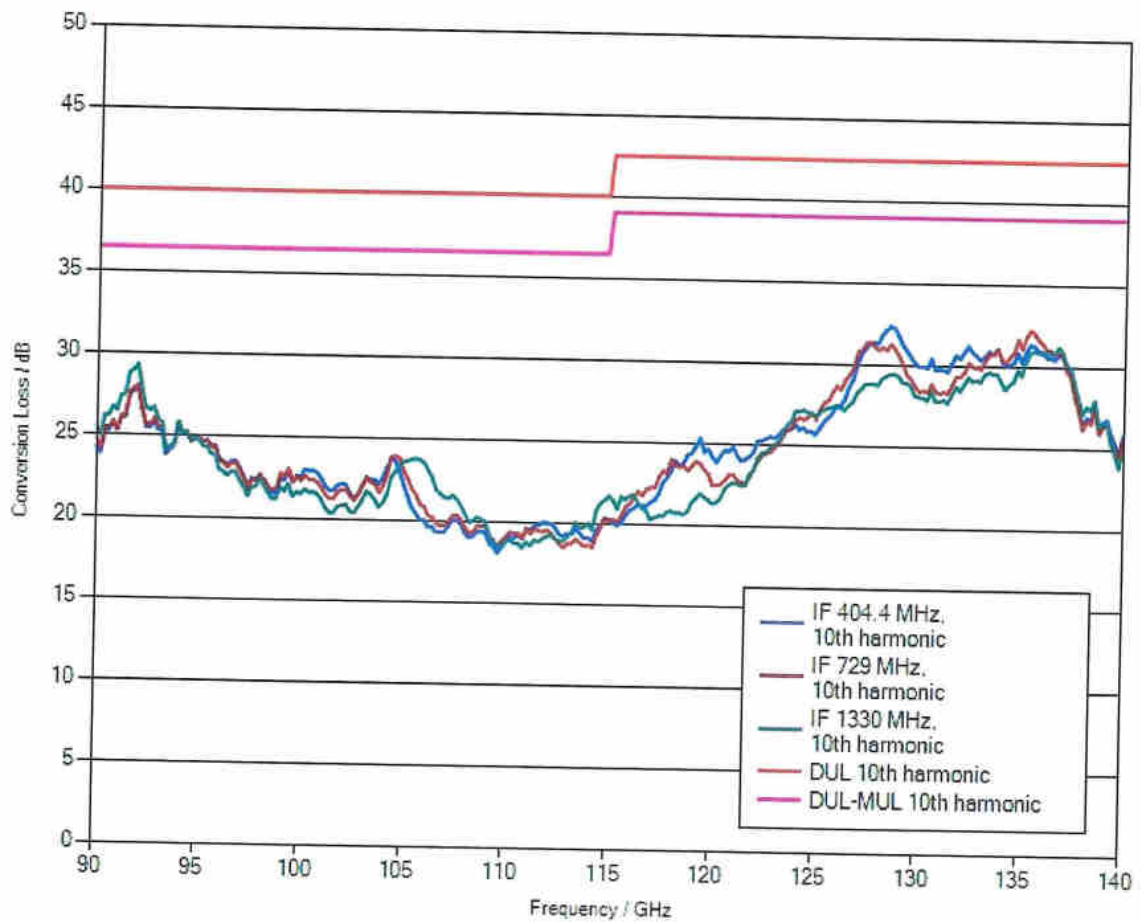
Measurement uncertainty: 0.05 (VSWR)



## 1.2 Conversion loss

LO level            +14 dBm nominal  
Bias                0 A

Measurement uncertainty:    3.5 dB



**Note:** Numeric calibration data can be found attached to the PDF file of the calibration certificate. Click the "paper clip" symbol to display the file.

The file has been renamed for safety reasons.

When downloading the file onto your PC, please delete the ".file" extension and unzip the data.

### 1.3 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 10th harmonic	6 dB	3.43 dB	PASS
IF = 729 MHz, 10th harmonic	6 dB	3.52 dB	PASS
IF = 1330 MHz, 10th harmonic	6 dB	2.96 dB	PASS



# Calibration Certificate

Certificate Number **24-0060-100994-01**

Kalibrierschein

Zertifikatsnummer

## Unit Data

Item Gegenstand **Harmonic Mixer, 40 GHz to 60 GHz**

Manufacturer Hersteller **RPG**

Type Typ **RPG FS-Z60**

Material Number Materialnummer **1048.0171.02** Serial Number Seriennummer **100994**

Asset Number Inventarnummer

This calibration certificate documents, that the named item is tested and measured against defined specifications. Measurement results are located usually in the corresponding interval with a probability of approx. 95% (coverage factor  $k = 2$ ). Calibration is performed with test equipment and standards directly or indirectly traceable by means of approved calibration techniques to the PTB/DKD or other national/international standards, which realize the physical units of measurement according to the International System of Units (SI). In all cases where no standards are available, measurements are referenced to standards of the R&S laboratories. Principles and methods of calibration correspond with EN ISO/IEC 17025. This calibration certificate may not be reproduced other than in full. Calibration certificates without signatures are not valid. The user is obliged to have the object recalibrated at appropriate intervals.

## Order Data

Customer Auftraggeber

Order Number Bestellnummer

Date of Receipt Eingangsdatum

Dieser Kalibrierschein dokumentiert, dass der genannte Gegenstand nach festgelegten Vorgaben geprüft und gemessen wurde. Die Messwerte lagen im Regelfall mit einer Wahrscheinlichkeit von annähernd 95% im zugeordneten Werteintervall (Erweiterte Messunsicherheit mit  $k = 2$ ). Die Kalibrierung erfolgte mit Messmitteln und Normalen, die direkt oder indirekt durch Ableitung mittels anerkannter Kalibriertechniken rückgeführt sind auf Normale der PTB/DKD oder anderer nationaler/internationaler Standards zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Wenn keine Normale existieren, erfolgt die Rückführung auf Bezugsnormale der R&S-Laboratorien. Grundsätze und Verfahren der Kalibrierung beziehen sich auf EN ISO/IEC 17025. Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Kalibrierscheine ohne Unterschriften sind ungültig. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

## Performance

Place and Date of Calibration Ort und Datum der Kalibrierung

**Meckenheim, 2018-12-04**

Scope of Calibration Umfang der Kalibrierung

**Standard Calibration**

Statement of Compliance (Incoming) Konformitätsaussage (Anlieferung)

**New device**

Statement of Compliance (Outgoing) Konformitätsaussage (Auslieferung)

**All measured values are within the data sheet specifications.**

Extend of Calibration Documents Umfang des Kalibrierdokuments

**2 pages Calibration Certificate  
5 pages Outgoing Results**

## Radiometer Physics GmbH; Meckenheim

Date of Issue Ausstellungsdatum

Head of Laboratory Laborleitung

Person Responsible Bearbeiter

**2018-12-05**

Schulze

Grossmindorf

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RPG2014-02-28

Calibration Method  
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity 20 % - 80 %  
Relative LuftfeuchteAmbient Temperature  
Umgebungstemperatur(23  $\pm$  0.3) °C

Working standards used (having a significant effect on the accuracy) Verwendete Gebrauchsnormale (mit signifikantem Einfluss auf die Genauigkeit)				
Item Gegenstand	Type Typ	Serial Number Seriennummer	Calibration Certificate Number Kalibrierscheinnummer	Cal. Due Kalibr. bis
Vector Network Analyzer	R&S® ZVA67	101097	20-300432406	2020-07-21
Powersensor	R&S® NRP-Z55	140093	20-300426315	2019-05-17
Powersensor	R&S® NRP-Z57	101423	20-541799	2019-04-27
Calibration Kit	WR19	U10001	24-0060-U10001-01	2019-02-01

**UGB1** A compliance statement may be possible where a confidence level of less than 95 % is acceptable.  
Die Bestätigung der Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

**UGB2** A non-compliance statement may be possible where a confidence level of less than 95 % is acceptable.  
Die Bestätigung der Nicht-Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

Ref.: ILAC-G8:03/2009 'Guidelines on the Reporting of Compliance with Specification'.

**Notes**  
Anmerkungen

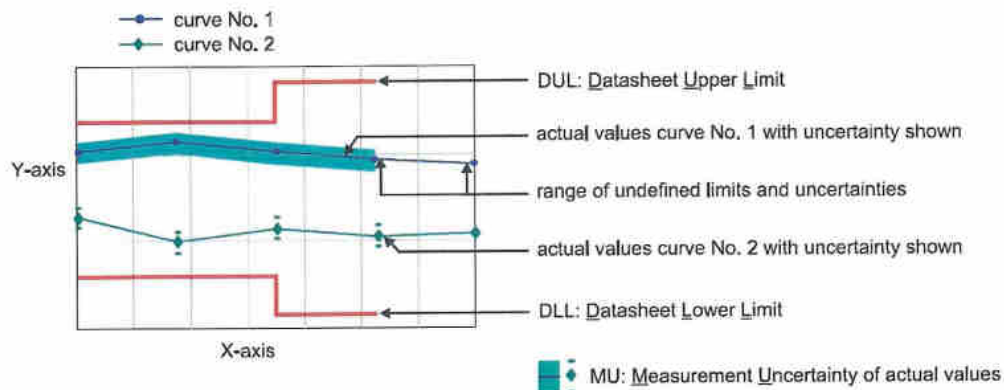
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is actually put into operation.

## Outgoing Results

The following abbreviations may be used in this document

{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
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DL or DT	Data Limit for symmetrical tolerance limits
DLL	Datasheet Lower Limit
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MU	Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
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Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
Act.	Actual Value
UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	Measurement results marked as UGB1 show conformity with a probability of >50 % and <95 %.
UGB2	Measurement results marked as UGB2 show non-conformity with a probability of >50 % and <95 %.
DU	Datasheet Uncertainty

### Explanation of charts



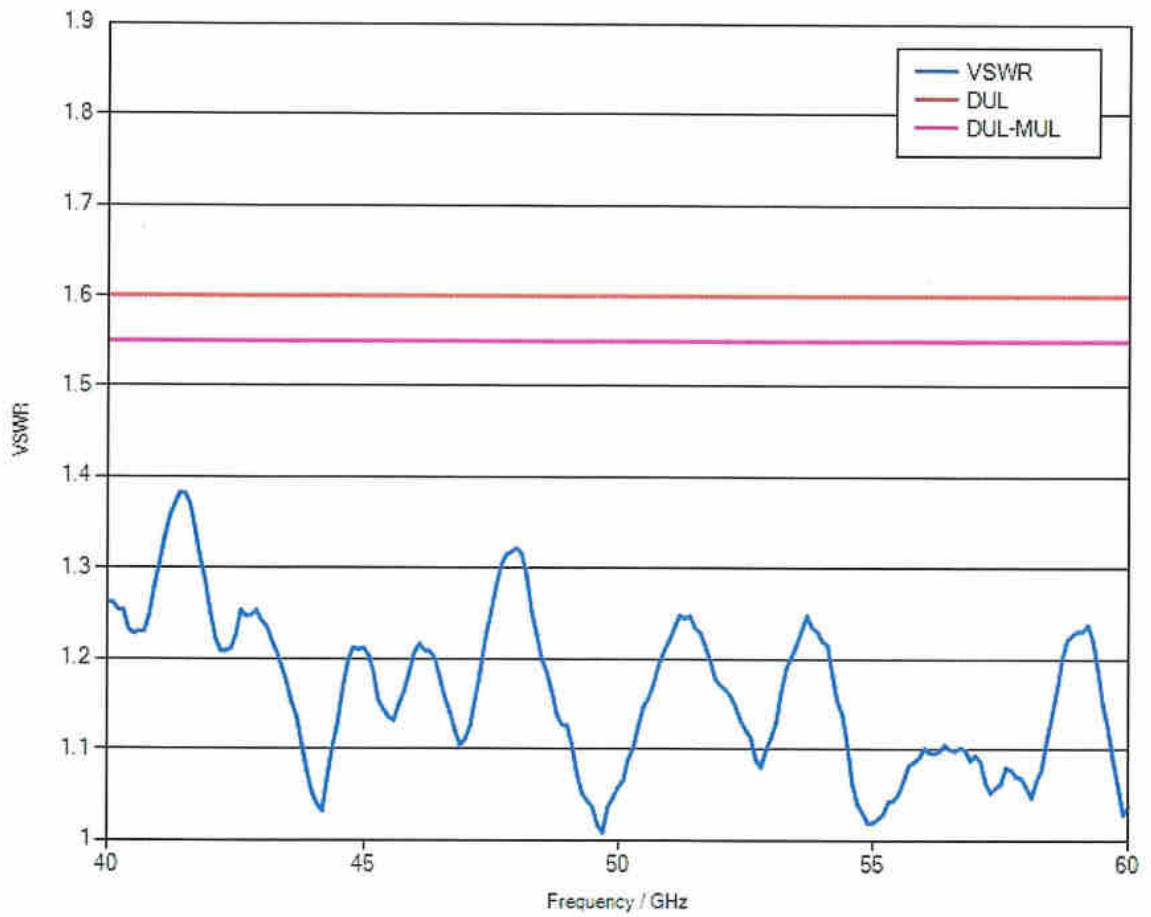
**Software used for measurement**

Item Type	Version	Remark
Measurement Studio Professional Edition	2013	
MixerCertification	7_09	



### 1.1 RF Input – VSWR

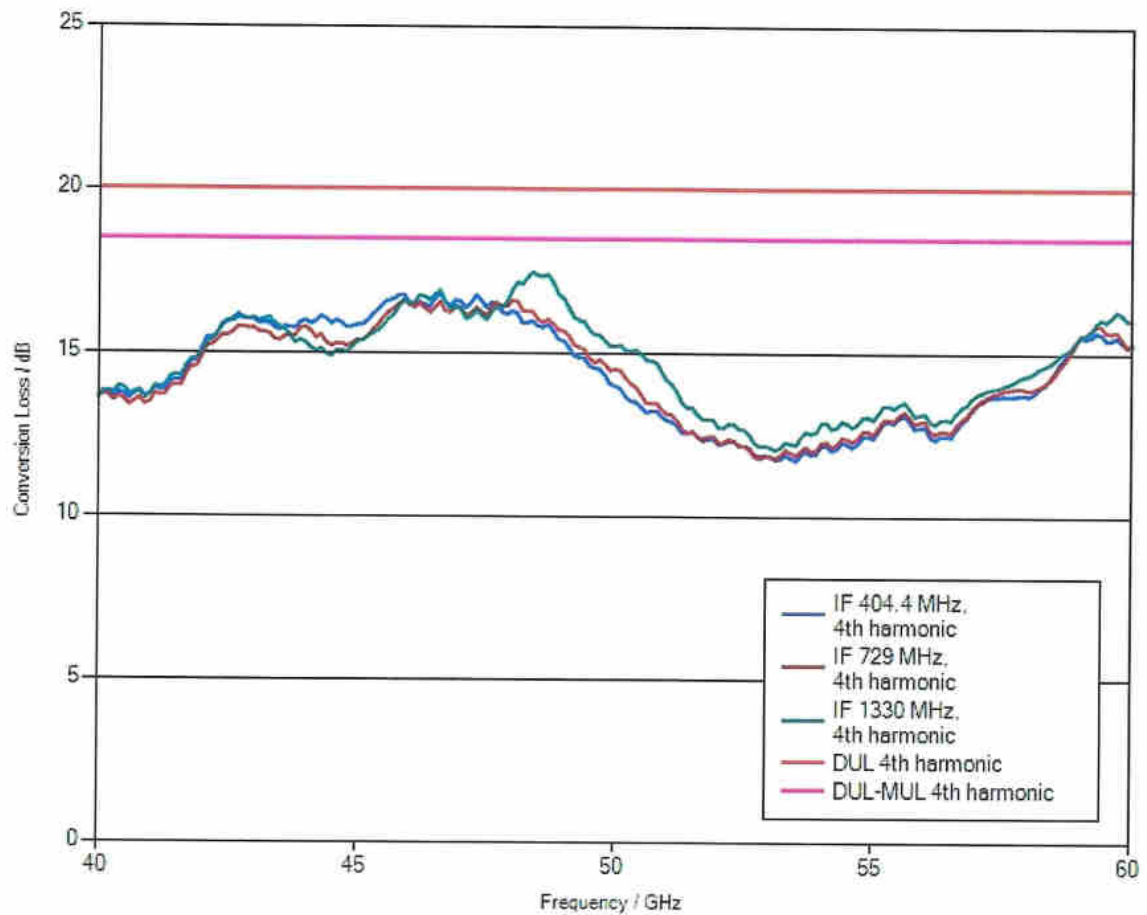
Measurement uncertainty: 0.05 (VSWR)



## 1.2 Conversion loss

LO level                    +13 dBm nominal  
Bias                        0 A

Measurement uncertainty:    1.5 dB



**Note:** Numeric calibration data can be found attached to the PDF file of the calibration certificate. Click the "paper clip" symbol to display the file.

The file has been renamed for safety reasons.  
When downloading the file onto your PC, please delete the ".file" extension and unzip the data.

### 1.3 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 4th harmonic	4 dB	1.82 dB	PASS
IF = 729 MHz, 4th harmonic	4 dB	1.68 dB	PASS
IF = 1330 MHz, 4th harmonic	4 dB	1.82 dB	PASS



## Calibration Certificate

Certificate Number 24-0090-101867-01

Kalibrierschein

Zertifikatsnummer

### Unit Data

Item  
Gegenstand **Harmonic Mixer, 60 GHz to 90 GHz**

Manufacturer  
Hersteller **ROHDE & SCHWARZ**

Type  
Typ **R&S® FS-Z90**

Material Number  
Materialnummer **1048.0371.02**      Serial Number  
Seriennummer **101867**

Asset Number  
Inventarnummer

This calibration certificate documents, that the named item is tested and measured against defined specifications. Measurement results are located usually in the corresponding interval with a probability of approx. 95% (coverage factor  $k = 2$ ). Calibration is performed with test equipment and standards directly or indirectly traceable by means of approved calibration techniques to the PTB/DKD or other national/international standards, which realize the physical units of measurement according to the International System of Units (SI). In all cases where no standards are available, measurements are referenced to standards of the R&S laboratories. Principles and methods of calibration correspond with EN ISO/IEC 17025. This calibration certificate may not be reproduced other than in full. Calibration certificates without signatures are not valid. The user is obliged to have the object recalibrated at appropriate intervals.

### Order Data

Customer  
Auftraggeber

Order Number  
Bestellnummer

Date of Receipt  
Eingangsdatum

### Performance

Place and Date of Calibration  
Ort und Datum der Kalibrierung

**Meckenheim, 2019-01-10**

Scope of Calibration  
Umfang der Kalibrierung

**Standard Calibration**

Statement of Compliance  
(Incoming)  
Konformitätsaussage  
(Anlieferung)

**New device**

Statement of Compliance  
(Outgoing)  
Konformitätsaussage  
(Auslieferung)

**All measured values are within the data sheet specifications.**

Extend of Calibration Documents  
Umfang des Kalibrierdokuments

**2 pages Calibration Certificate  
5 pages Outgoing Results**

Dieser Kalibrierschein dokumentiert, dass der genannte Gegenstand nach festgelegten Vorgaben geprüft und gemessen wurde. Die Messwerte lagen im Regelfall mit einer Wahrscheinlichkeit von annähernd 95% im zugeordneten Werteintervall (Erweiterte Messunsicherheit mit  $k = 2$ ). Die Kalibrierung erfolgte mit Messmitteln und Normalen, die direkt oder indirekt durch Ableitung mittels anerkannter Kalibriertechniken rückgeführt sind auf Normale der PTB/DKD oder anderer nationaler/internationaler Standards zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Wenn keine Normale existieren, erfolgt die Rückführung auf Bezugsnormale der R&S-Laboratorien. Grundsätze und Verfahren der Kalibrierung beziehen sich auf EN ISO/IEC 17025. Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Kalibrierscheine ohne Unterschriften sind ungültig. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

### Radiometer Physics GmbH; Meckenheim

Date of Issue  
Ausstellungsdatum

**2019-01-11**

Head of Laboratory  
Laborleitung

Schulze

Person Responsible  
Bearbeiter

Heinze

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Vers2010-05-05/  
RPG2014-02-28

Calibration Method  
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity 20 % - 80 %  
Relative Luftfeuchte

Ambient Temperature  
Umgebungstemperatur

(23 <sup>+7</sup><sub>-3</sub>) °C

Working standards used (having a significant effect on the accuracy) Verwendete Gebrauchsnormale (mit signifikantem Einfluss auf die Genauigkeit)				
Item Gegenstand	Type Typ	Serial Number Seriennummer	Calibration Certificate Number Kalibrierscheinnummer	Cal. Due Kalibr. bis
Vector Network Analyzer	R&S® ZVA67	101097	20-300432406	2020-07-21
Powersensor	R&S® NRP-Z55	140093	20-300426315	2019-05-17
Powersensor	R&S® NRP-Z58	101063	0001-300474490	2019-08-06
Calibration kit	WR12	E10001	RPG-PAQA-TN-2014-005	2019-02-01

<b>UGB1</b>	<b>A compliance statement may be possible where a confidence level of less than 95 % is acceptable.</b> Die Bestätigung der Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.
<b>UGB2</b>	<b>A non-compliance statement may be possible where a confidence level of less than 95 % is acceptable.</b> Die Bestätigung der Nicht-Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.
Ref.: ILAC-G8:03/2009 'Guidelines on the Reporting of Compliance with Specification'.	

**Notes**  
Anmerkungen

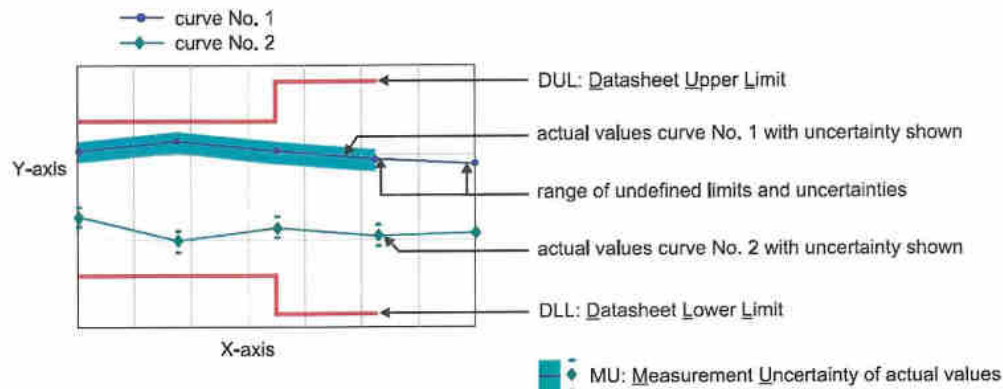
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is actually put into operation.

## Outgoing Results

### The following abbreviations may be used in this document

{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
{b}	The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
{c}	Functional test, therefore no measurement uncertainty is stated.
{d}	Typical value, refer to performance test.
{e}	The measurement uncertainty is taken into account when setting the measuring system.
DL or DT	Data Limit for symmetrical tolerance limits
DLL	Datasheet Lower Limit
DUL	Datasheet Upper Limit
MU	Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
Act.	Actual Value
UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	Measurement results marked as UGB1 show conformity with a probability of >50 % and <95 %.
UGB2	Measurement results marked as UGB2 show non-conformity with a probability of >50 % and <95 %.
DU	Datasheet Uncertainty

### Explanation of charts



**Software used for measurement**

**Item Type**

Measurement Studio Professional Edition  
MixerCertification

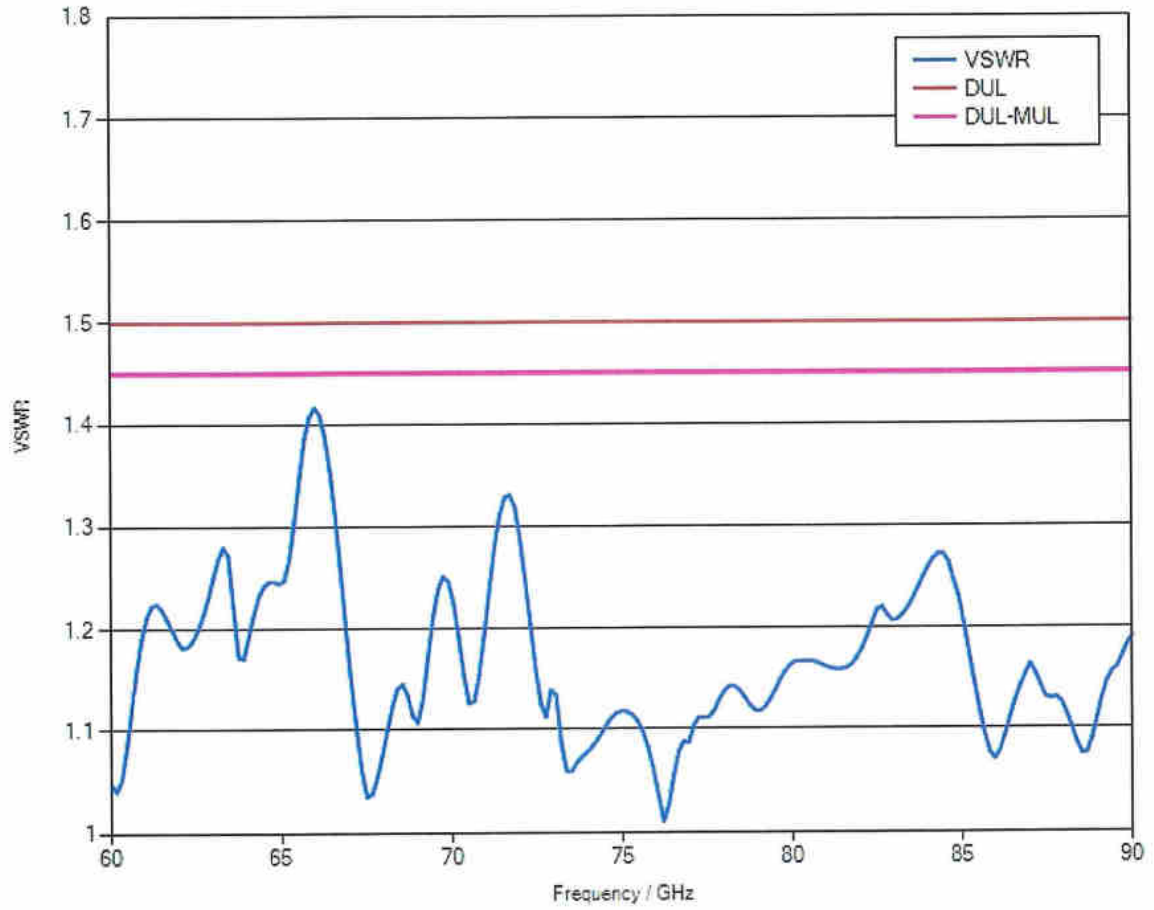
**Version**

2013  
7\_09

**Remark**

### 1.1 RF Input – VSWR

Measurement uncertainty: 0.05 (VSWR)

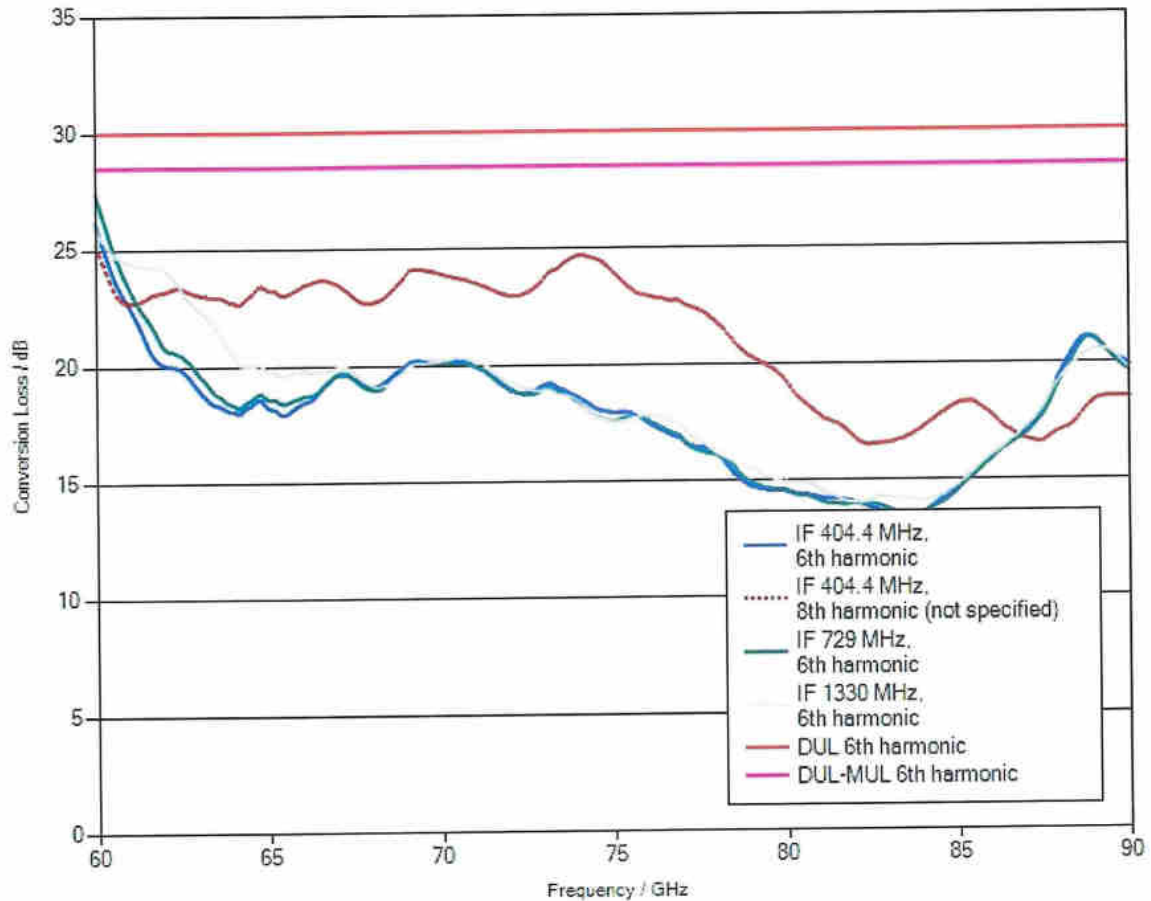




## 1.2 Conversion loss

LO level            +14 dBm nominal  
Bias                0 A

Measurement uncertainty:    1.5 dB



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### 1.3 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 6th harmonic	6 dB	3.42 dB	PASS
IF = 404.4 MHz, 8th harmonic	not specified	2.49 dB	not specified
IF = 729 MHz, 6th harmonic	6 dB	3.85 dB	PASS
IF = 1330 MHz, 6th harmonic	6 dB	2.01 dB	PASS