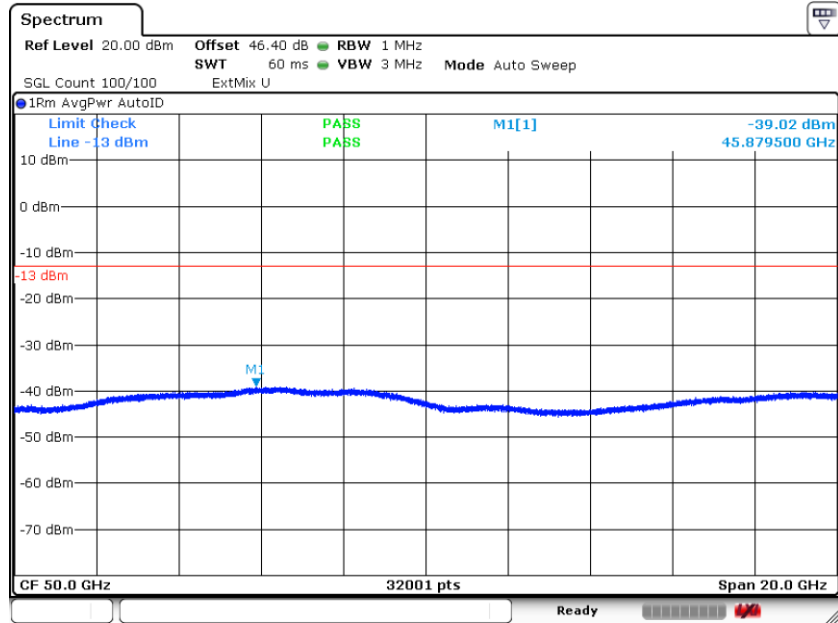




NR Band n261

(40GHz-60GHz)



Date: 24.APR.2021 13:09:12

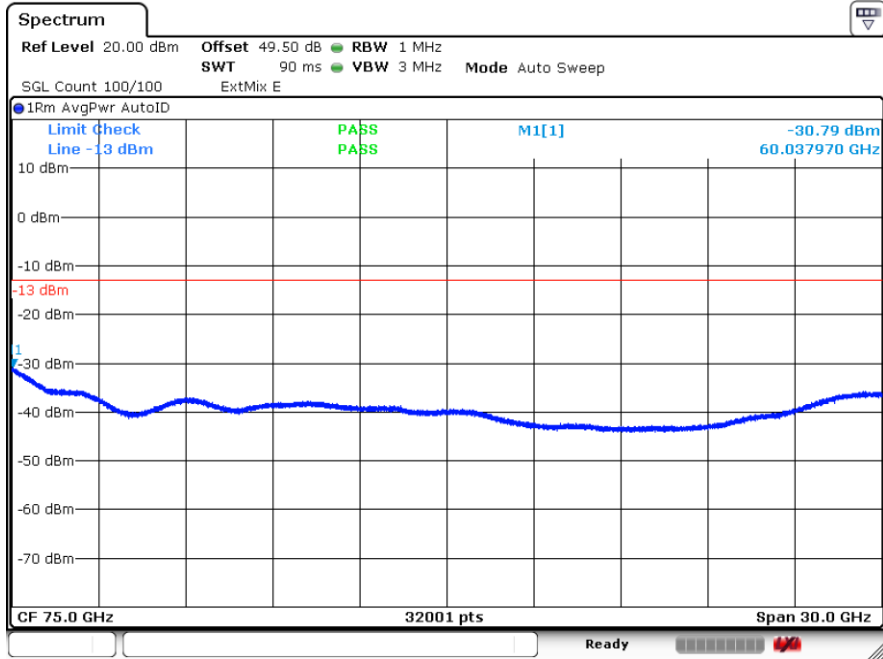
$$\text{Offset} = \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8$$

$$= 42.3 + 0.34 + 107 + 20\log(1.2) - 104.8 = 46.4 \text{ (dB)}$$



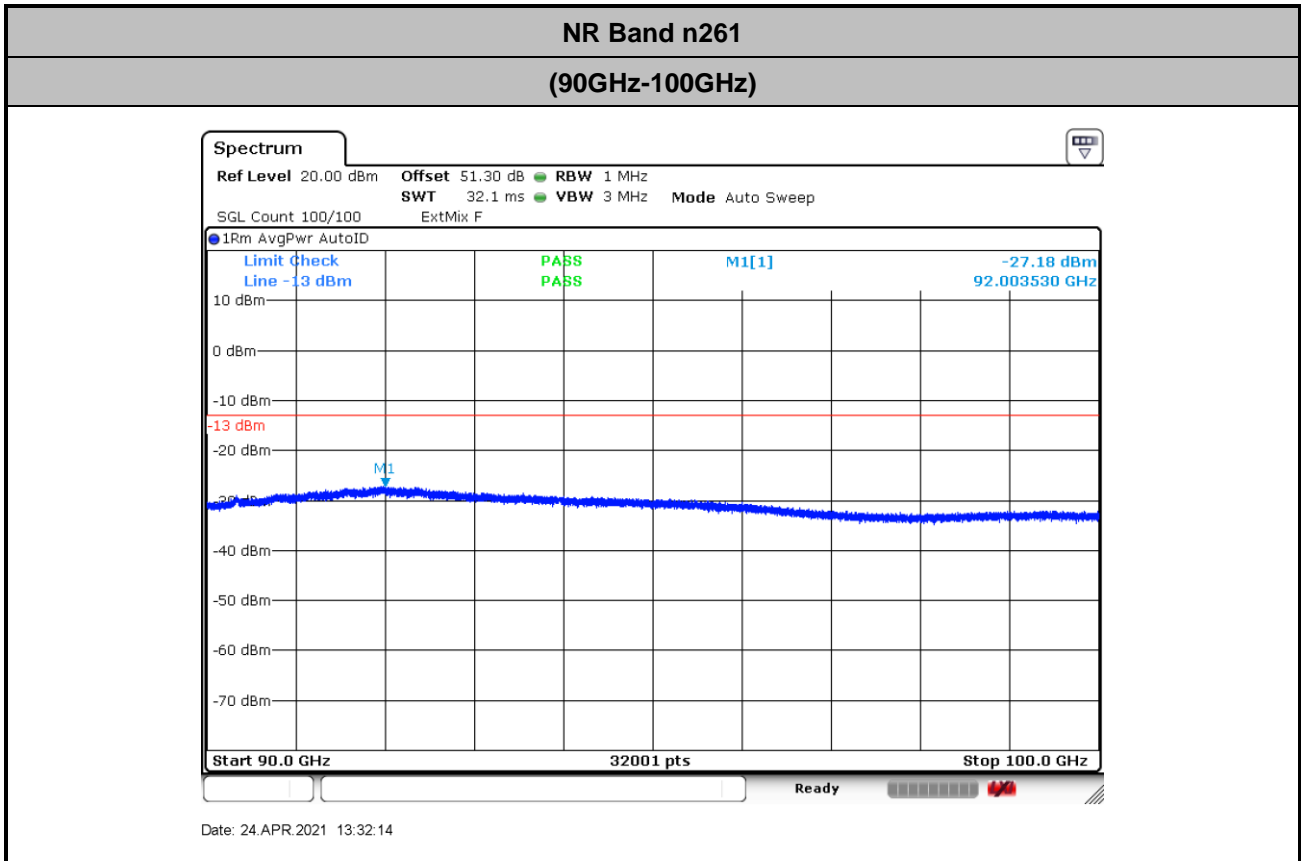
NR Band n261

(60GHz-90GHz)



Date: 24.APR.2021 13:27:12

$$\text{Offset} = \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8$$
$$= 45.4 + 0.34 + 107 + 20\log(1.2) - 104.8 = 49.5 \text{ (dB)}$$



$$\text{Offset} = \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8$$
$$= 47.2 + 0.34 + 107 + 20\log(1.2) - 104.8 = 51.3 \text{ (dB)}$$



### Frequency Stability

Test Conditions		NR Band n261 / Middle Channel			Limit
Temperature (°C)	Voltage (Volt)	CW tone			Note.
		Frequency (GHz)	Deviation (kHz)	Deviation (ppm)	Result
50	120	27.8747572	242.800	8.710	PASS
40	120	27.8747592	240.800	8.639	
30	120	27.875058	-58.000	2.081	
20(Ref.)	120	27.875	0.000	0.000	
10	120	27.875037	-37.000	1.327	
0	120	27.8750839	-83.900	3.010	
-10	120	27.8751119	-111.900	4.014	
-20	120	27.8751119	-111.900	4.014	
-30	120	27.8750589	-58.900	2.113	
20	102	27.874984	16.000	0.574	
20	120	27.875	0.000	0.000	
20	138	27.87499	10.000	0.359	

**Note:** The frequency fundamental emissions stay within the operation band.



## Appendix B.6 Radiated Test: NR Band n261 (Beam ID: 319)

### Occupied Bandwidth

Mode	DFT-s-OFDM NR Band n261 : 99%OBW(MHz)	
BW	100MHz	200MHz
Mod.	QPSK	QPSK
Lowest CH	94.58	188.92
Middle CH	94.70	188.08
Highest CH	94.58	188.42

Mode	CP-OFDM NR Band n261 : 99%OBW(MHz)	
BW	100MHz	200MHz
Mod.	QPSK	QPSK
Lowest CH	94.17	190.96
Middle CH	94.14	190.40
Highest CH	94.19	191.04

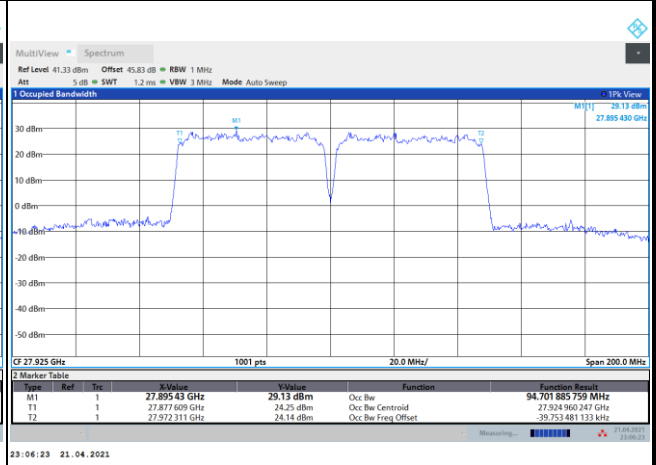
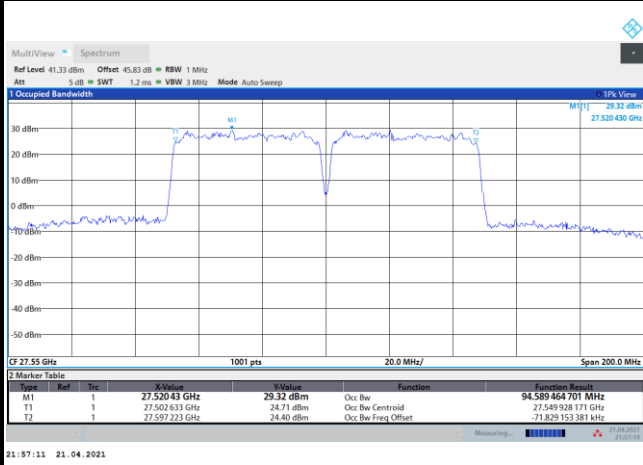


DFT-s-OFDM

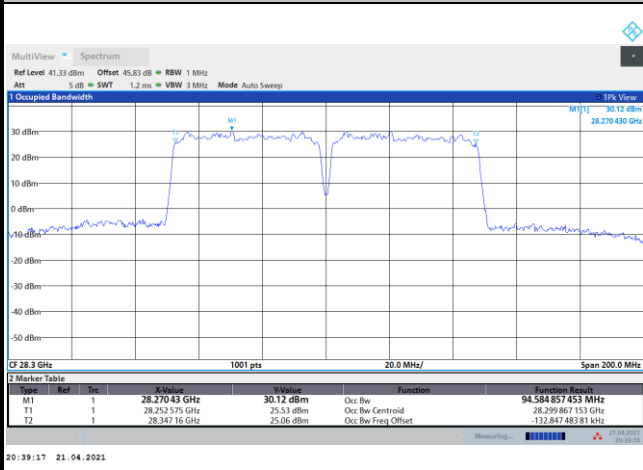
NR Band n261

Lowest Channel / 100MHz / QPSK

Middle Channel / 100MHz / QPSK



Highest Channel / 100MHz / QPSK



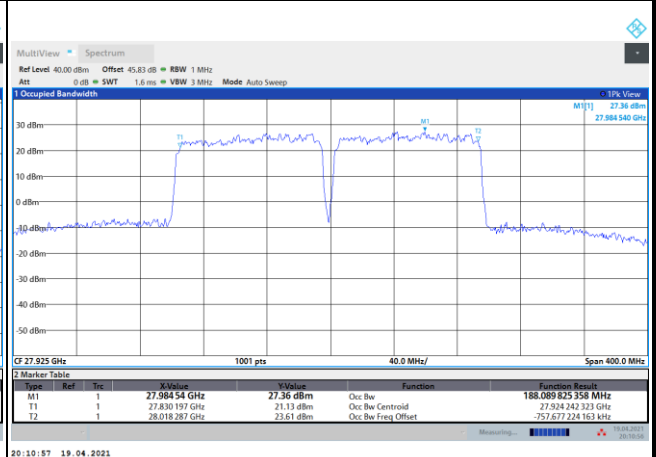
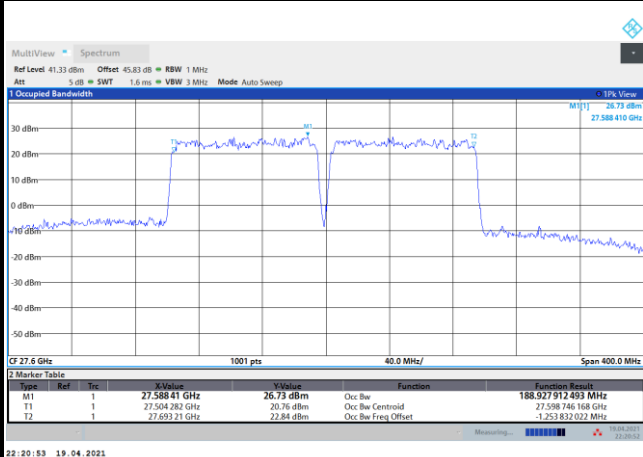


DFT-s-OFDM

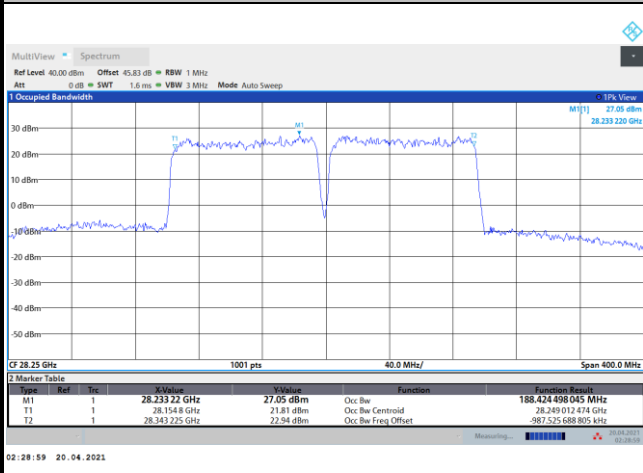
NR Band n261

Lowest Channel / 200MHz / QPSK

Middle Channel / 200MHz / QPSK

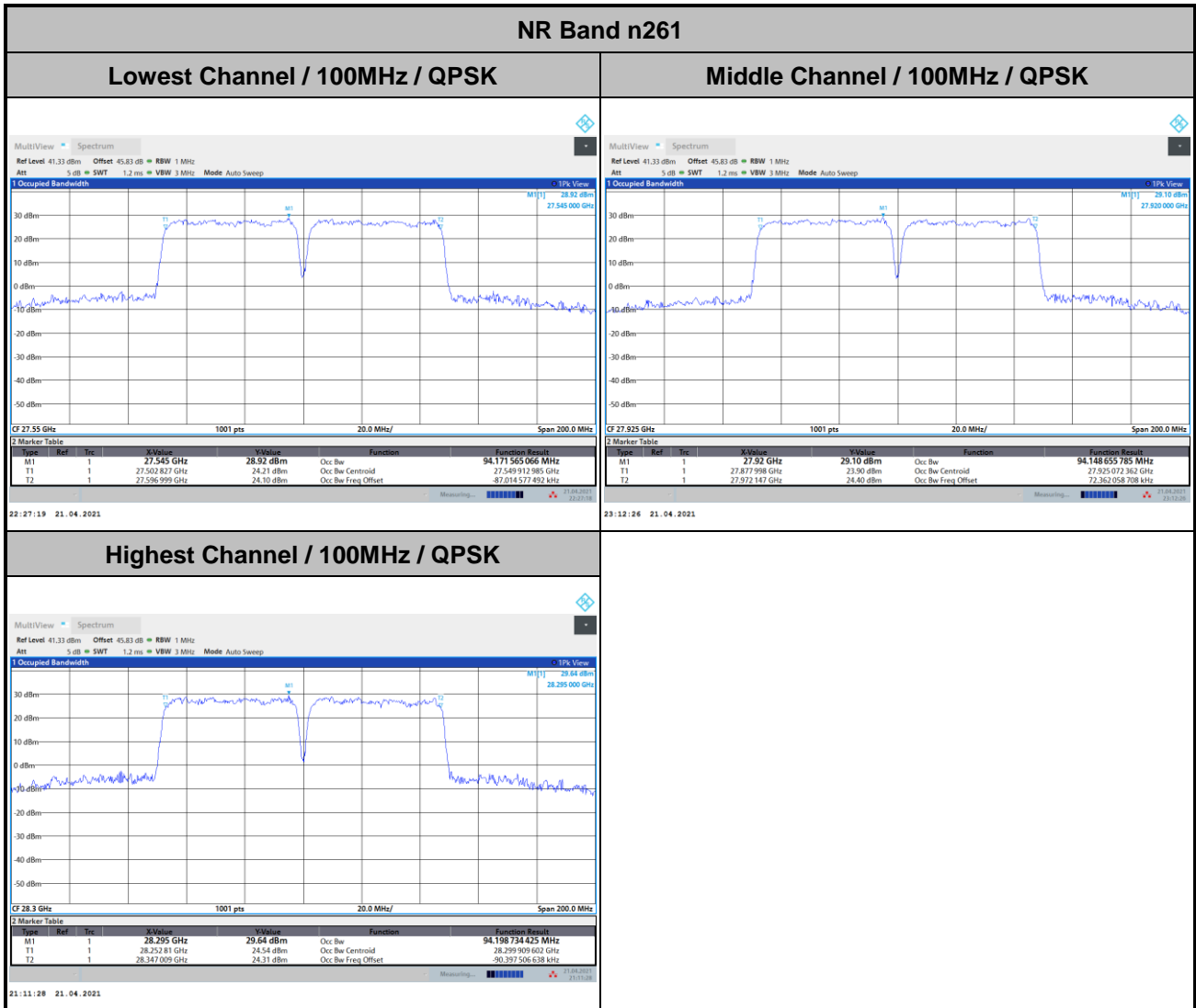


Highest Channel / 200MHz / QPSK





CP-OFDM







CP-OFDM





**Radiated Out of Band Emissions**

**Test Result:**

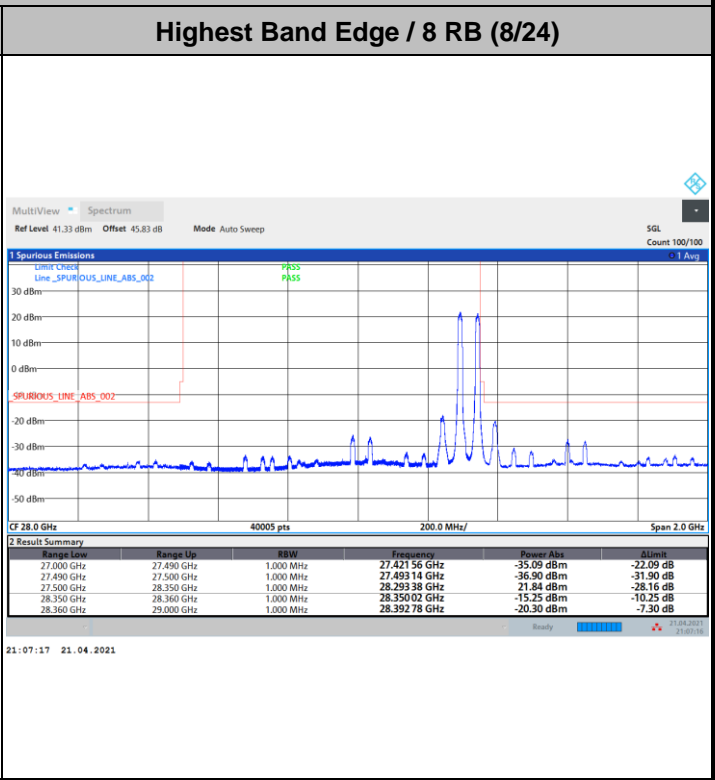
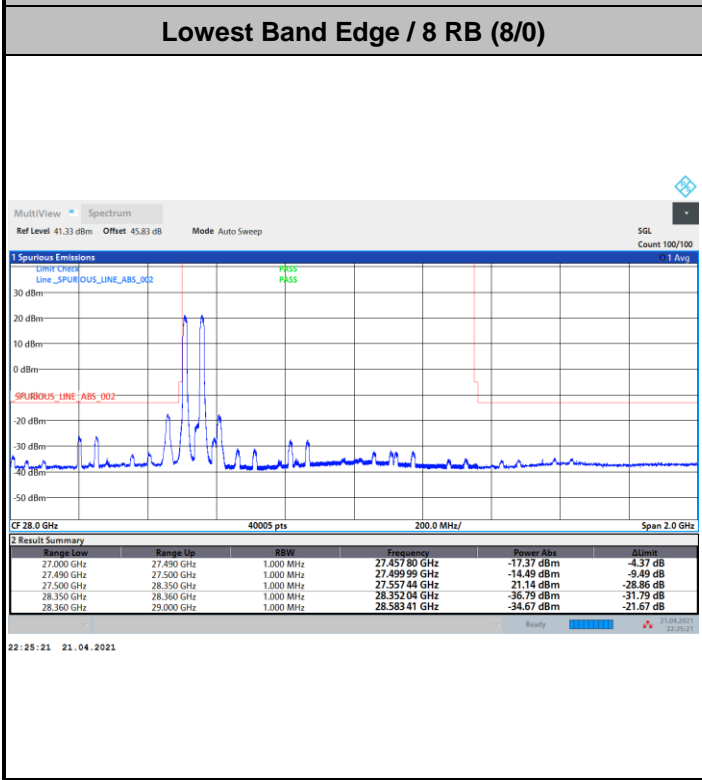
Mode		DFT-s-OFDM NR Band n261							
Channel	BW (MHz)	Modulation	RB Size/ allocation	0 ~ 10 %OB Limit (dBm/MHz)	0 ~ 10 %OB PSD (dBm/MHz)	Result	>10%OB Limit (dBm/MHz)	>10%OB PSD (dBm/MHz)	Result
Low	100	QPSK	32/0	-5	-25.29	Pass	-13	-23.32	Pass
Low	100	BPSK	32/0	-5	-11.26	Pass	-13	-13.29	Pass
Low	100	QPSK	8/0	-5	-14.49	Pass	-13	-17.37	Pass
Low	100	QPSK	10/11	-5	-27.62	Pass	-13	-17.37	Pass
Low	100	BPSK	10/11	-5	-27.68	Pass	-13	-16.09	Pass
High	100	QPSK	32/0	-5	-12.55	Pass	-13	-15.39	Pass
High	100	BPSK	32/0	-5	-12.56	Pass	-13	-15.56	Pass
High	100	QPSK	8/24	-5	-15.25	Pass	-13	-20.3	Pass
High	100	QPSK	10/11	-5	-28.41	Pass	-13	-19.68	Pass
High	100	BPSK	10/11	-5	-28.97	Pass	-13	-18.6	Pass
Low	200	QPSK	64/0	-5	-12.65	Pass	-13	-13.66	Pass
Low	200	BPSK	64/0	-5	-12.34	Pass	-13	-13.64	Pass
Low	200	QPSK	8/0	-5	-16.34	Pass	-13	-18.19	Pass
Low	200	QPSK	20/22	-5	-31.39	Pass	-13	-22.45	Pass
Low	200	BPSK	20/22	-5	-32.62	Pass	-13	-21.66	Pass
High	200	QPSK	64/0	-5	-17.35	Pass	-13	-18.57	Pass
High	200	BPSK	64/0	-5	-16.68	Pass	-13	-18.39	Pass
High	200	QPSK	8/58	-5	-17.82	Pass	-13	-22.18	Pass
High	200	QPSK	20/22	-5	-30.42	Pass	-13	-21.11	Pass
High	200	BPSK	20/22	-5	-30.08	Pass	-13	-20.45	Pass

**Note:** Both DFT-s-OFDM and CP-OFDM waveforms are evaluated, and the DFT-s-OFDM is the worst case.

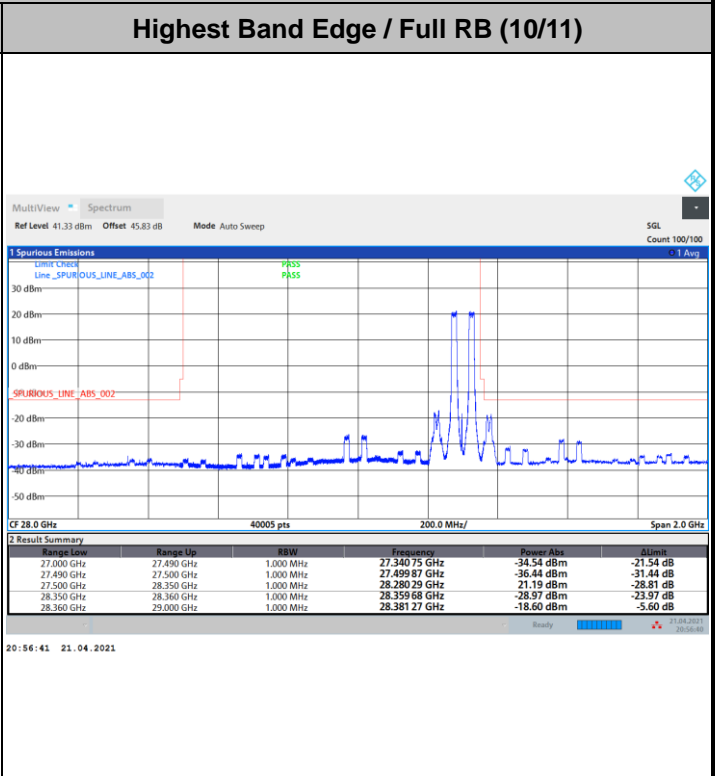
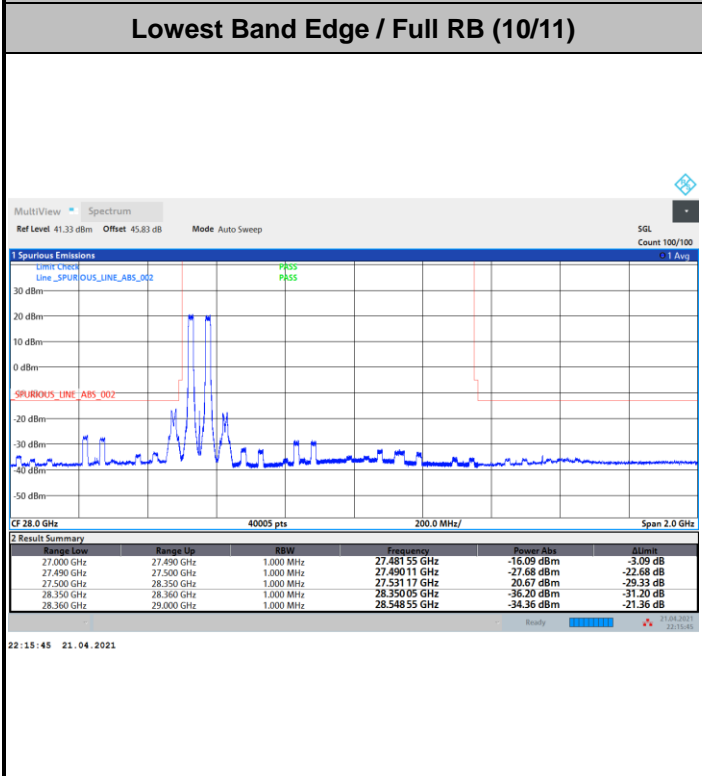


DFT-s-OFDM

NR Band n261 / 100MHz / QPSK



NR Band n261 / 100MHz / BPSK



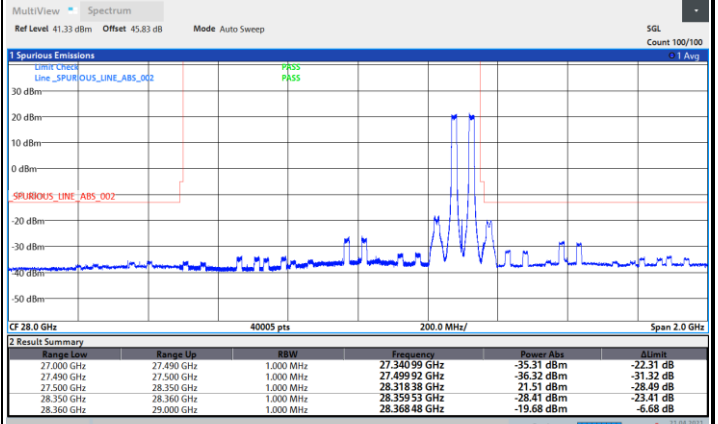
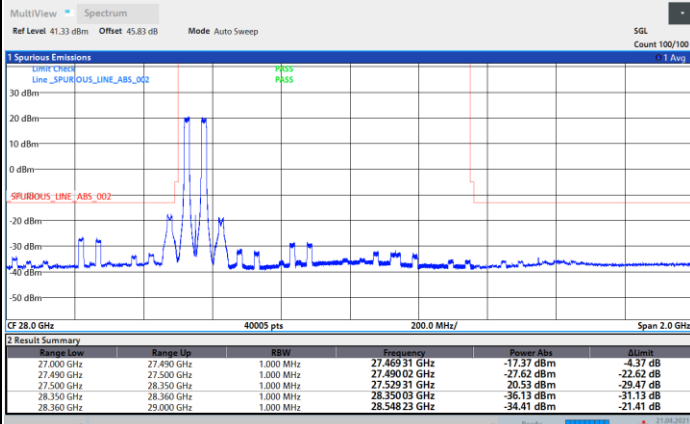


DFT-s-OFDM

NR Band n261 / 100MHz / QPSK

Lowest Band Edge / Full RB (10/11)

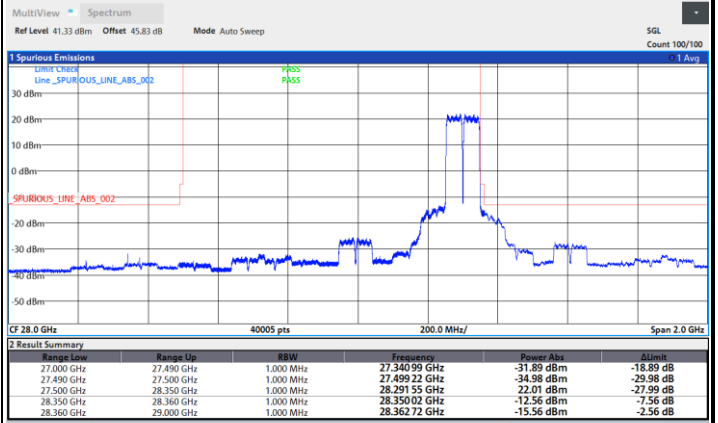
Highest Band Edge / Full RB (10/11)



NR Band n261 / 100MHz / BPSK

Lowest Band Edge / Full RB (32/0)

Highest Band Edge / Full RB (32/0)



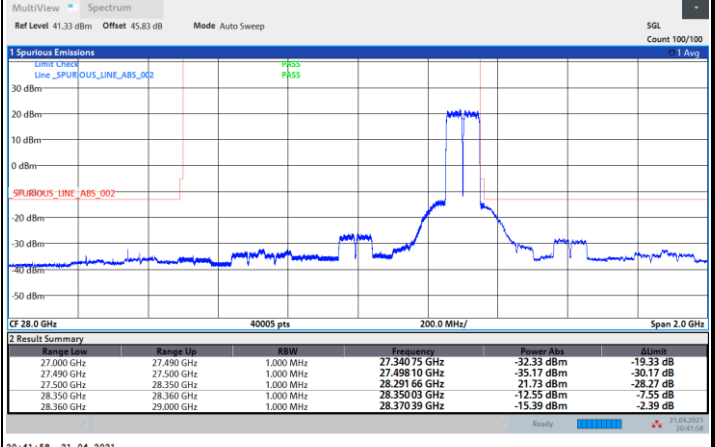
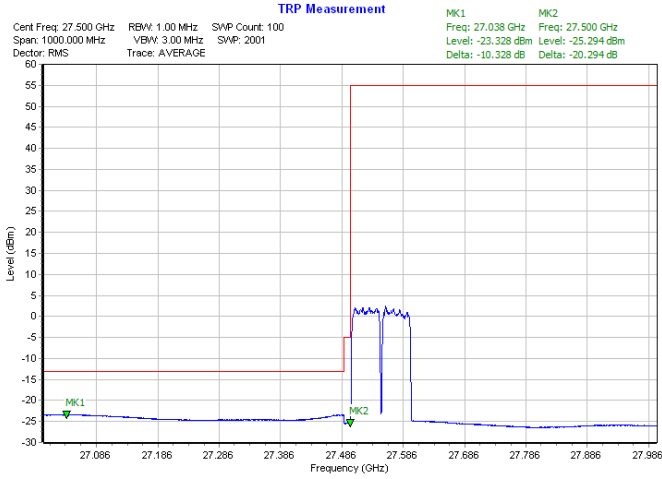


DFT-s-OFDM

NR Band n261 / 100MHz / QPSK

Lowest Band Edge / Full RB (32/0)

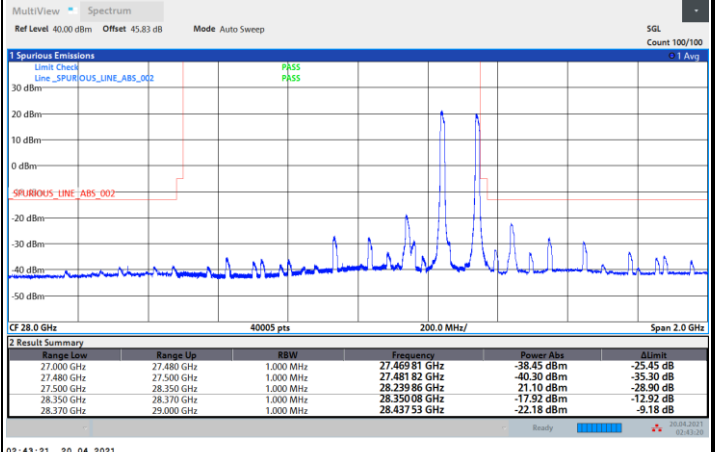
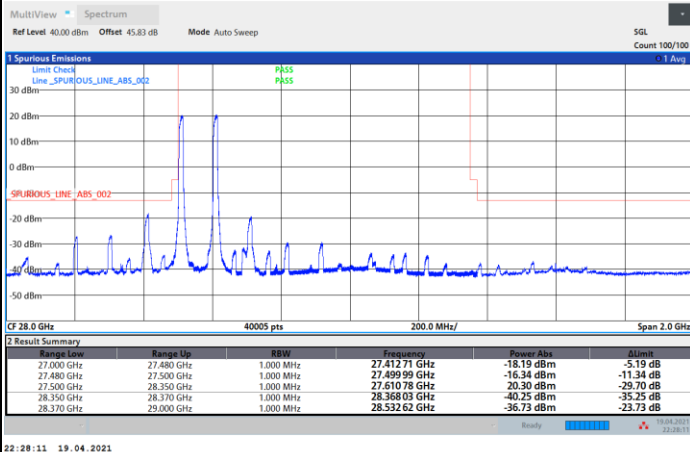
Highest Band Edge / Full RB (32/0)



NR Band n261 / 200MHz / QPSK

Lowest Band Edge / 8 RB (8/0)

Highest Band Edge / 8 RB (8/58)



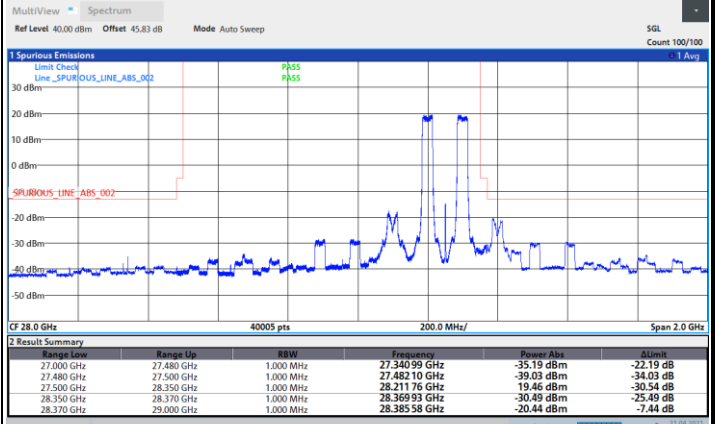
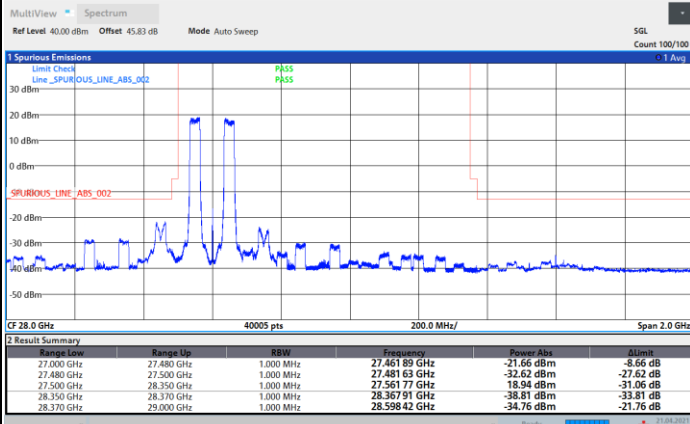


DFT-s-OFDM

NR Band n261 / 200MHz / BPSK

Lowest Band Edge / Full RB (20/22)

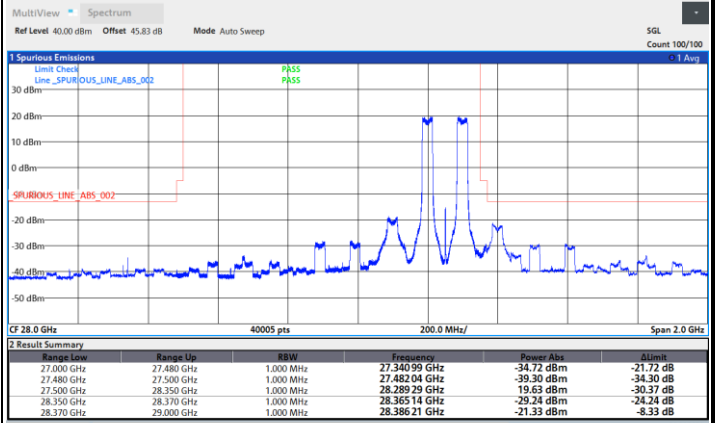
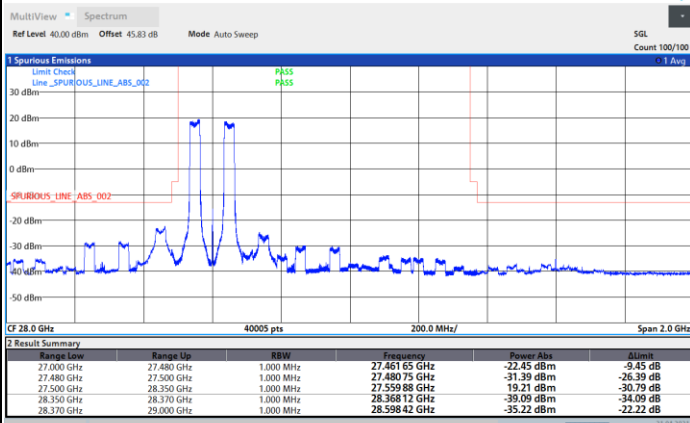
Highest Band Edge / Full RB (20/22)



NR Band n261 / 200MHz / QPSK

Lowest Band Edge / Full RB (20/22)

Highest Band Edge / Full RB (20/22)



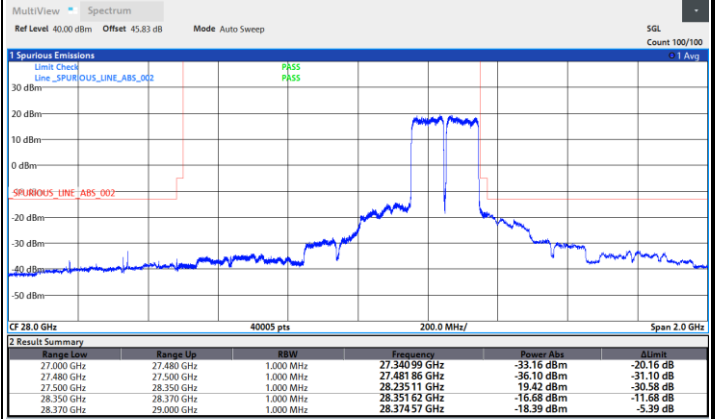
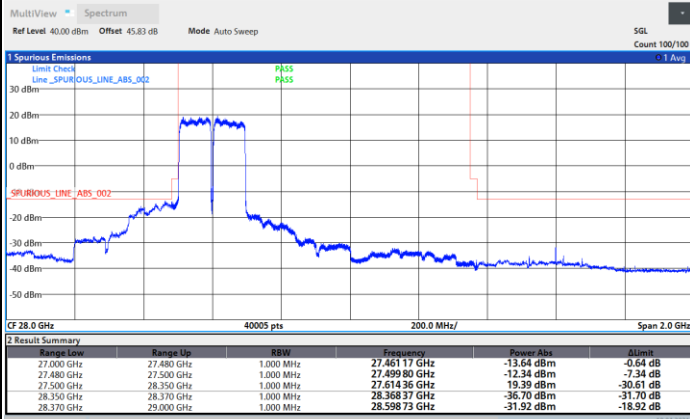


DFT-s-OFDM

NR Band n261 / 200MHz / BPSK

Lowest Band Edge / Full RB (64/0)

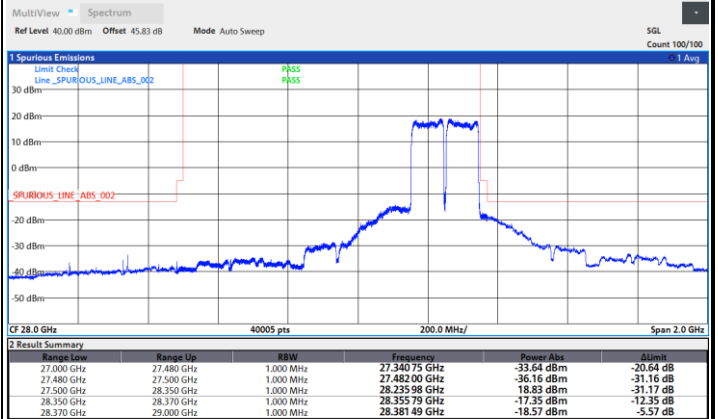
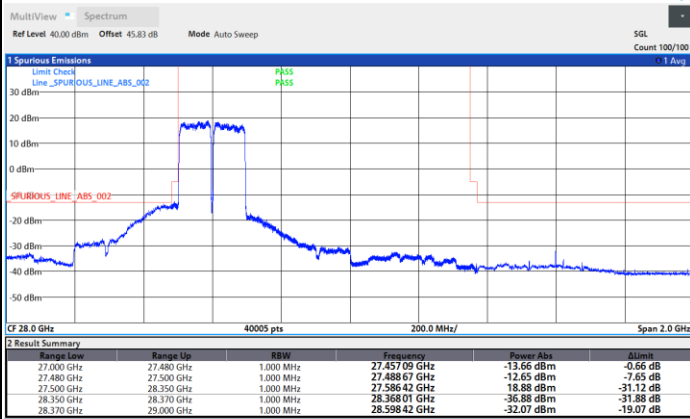
Highest Band Edge / Full RB (64/0)



NR Band n261 / 200MHz / QPSK

Lowest Band Edge / Full RB (64/0)

Highest Band Edge / Full RB (64/0)



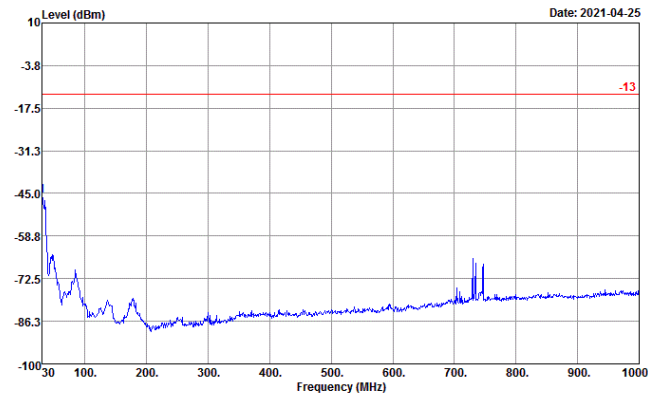


# Spurious Emission

There is no significant spurious emission signal found for frequency started from 30MHz up to 18GHz. Only the noise floor is reported.

## NR Band n261 (30MHz-1GHz)

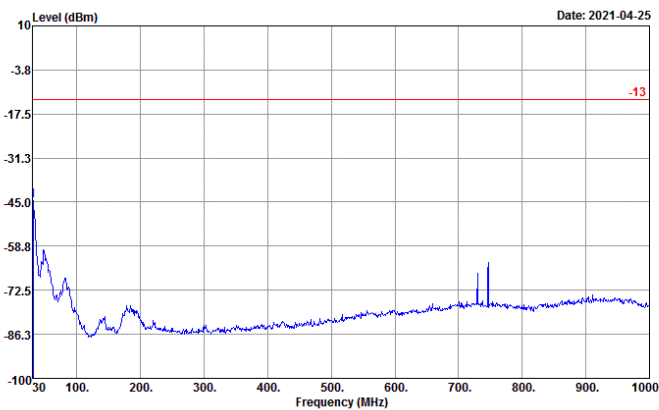
### Horizontal



Site : 03CH10-HY  
Condition : -13 EIRP\_WO HORIZONTAL

: n261 4 Module 2CC				
Freq	Level	Over	Limit	Line
MHz	dBm	dB	dBm	dBm
1	30.00	-45.74	-32.74	-13.00

### Vertical



Site : 03CH10-HY  
Condition : -13 EIRP\_WO VERTICAL

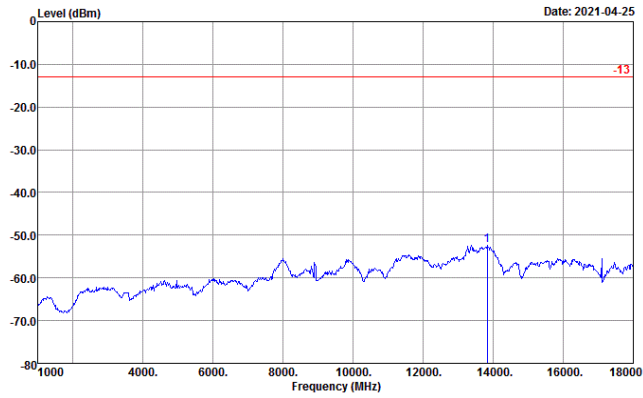
: n261 4 Module 2CC				
Freq	Level	Over	Limit	Line
MHz	dBm	dB	dBm	dBm
1	30.97	-44.60	-31.60	-13.00





NR Band n261 (1GHz-18GHz)

Horizontal

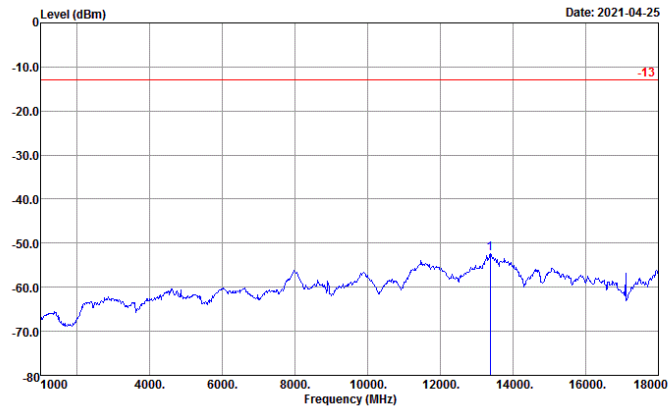


Site : 03CH10-HY  
 Condition : -13 EIRP\_WO HORIZONTAL

: n261 4 Module 2CC

Freq	Level	Over	Limit
MHz	dBm	dB	dBm
1 13835.00	-52.33	-39.33	-13.00

Vertical



Site : 03CH10-HY  
 Condition : -13 EIRP\_WO VERTICAL

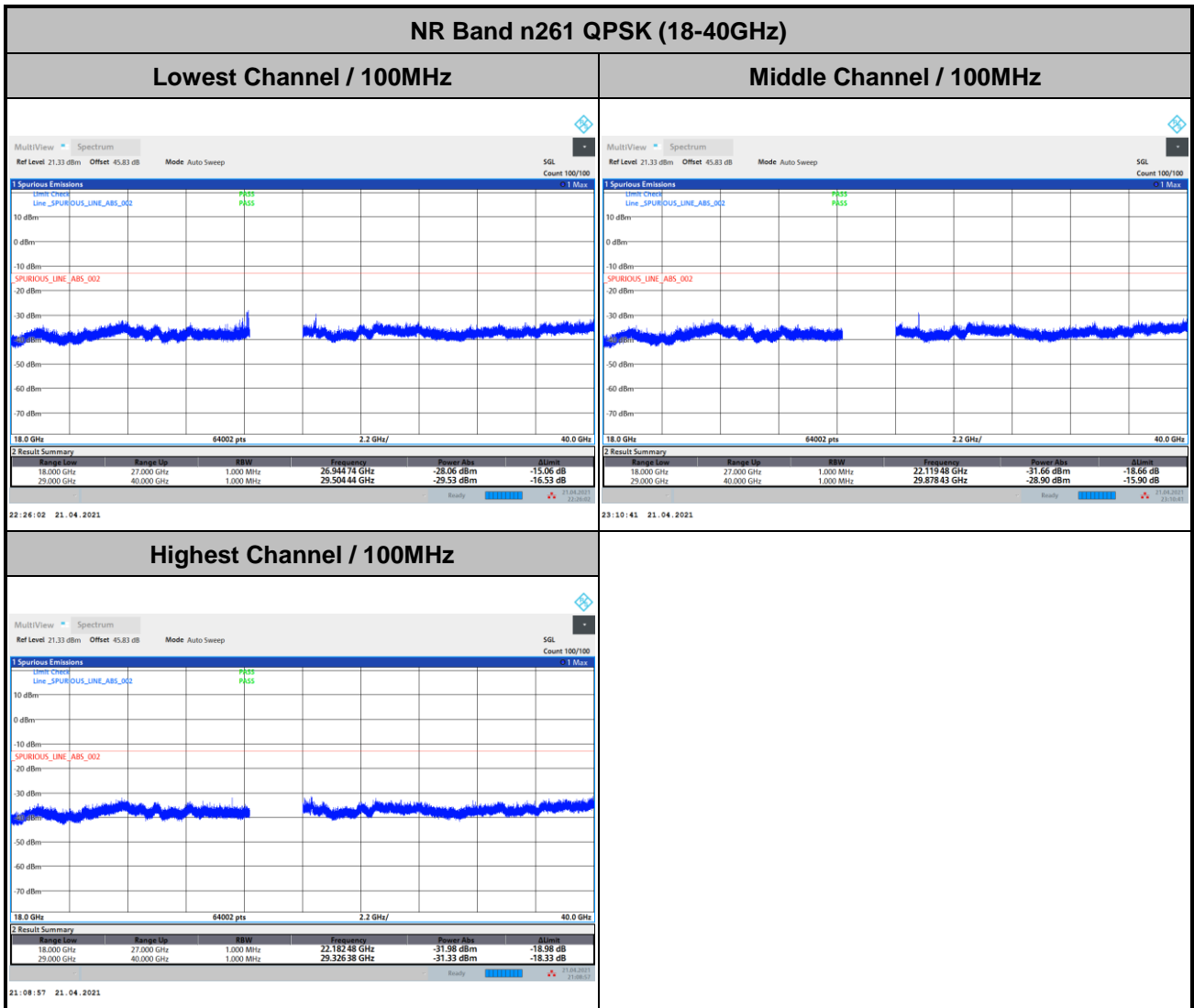
: n261 4 Module 2CC

Freq	Level	Over	Limit
MHz	dBm	dB	dBm
1 13376.00	-52.34	-39.34	-13.00



Spurious emission between 18GHz to 40GHz worst case plot is reported as following.

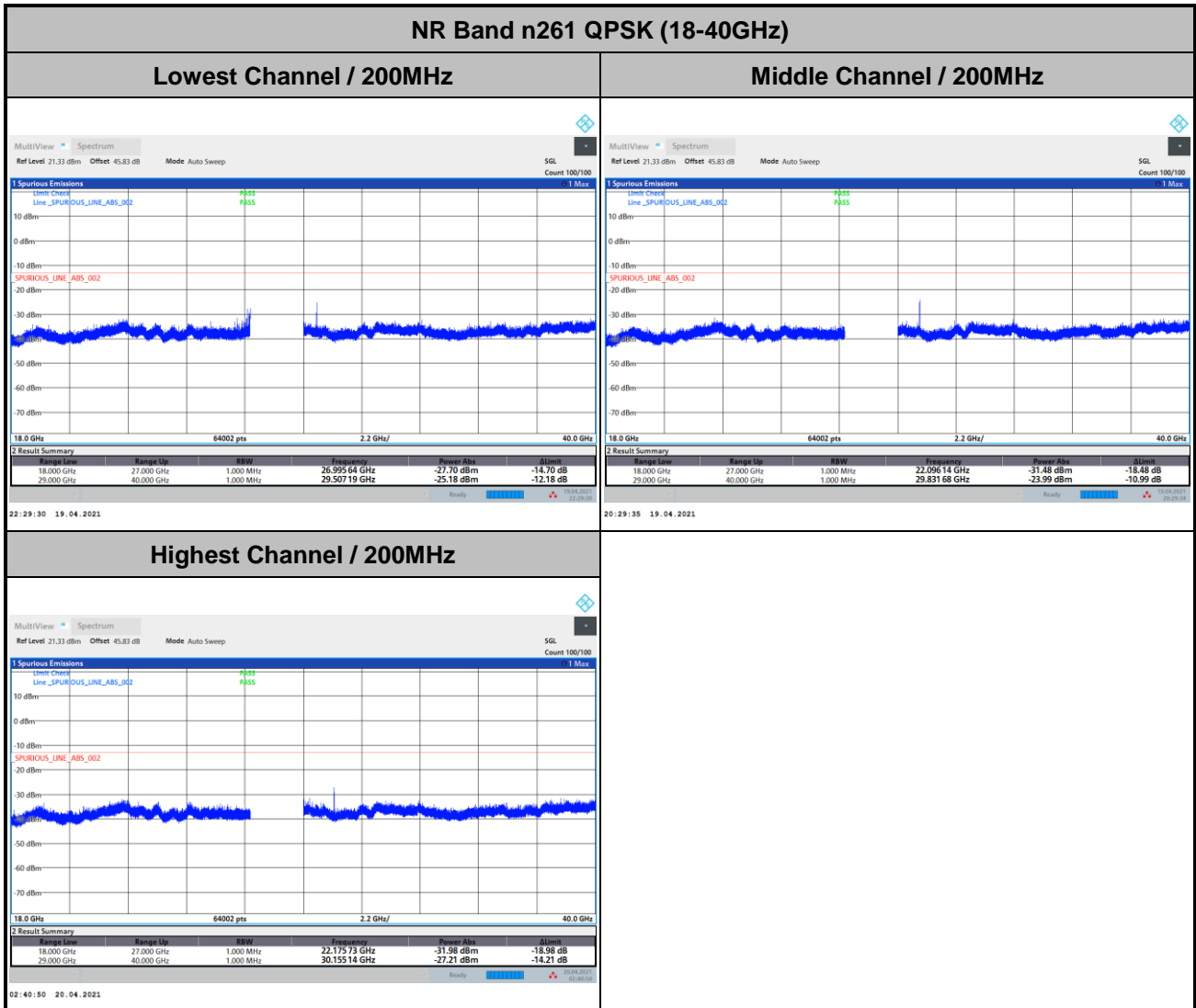
DFT-s-OFDM



**Remark:** Above plots, the spurious emissions were measured from 18GHz to 27GHz and 29GHz to 40GHz. The test results within the omitted frequency 27GHz to 29GHz were measured and reported in the section of Radiated Out of Band Emission with frequency range, 27GHz to 29GHz, and all spurious comply with limits.



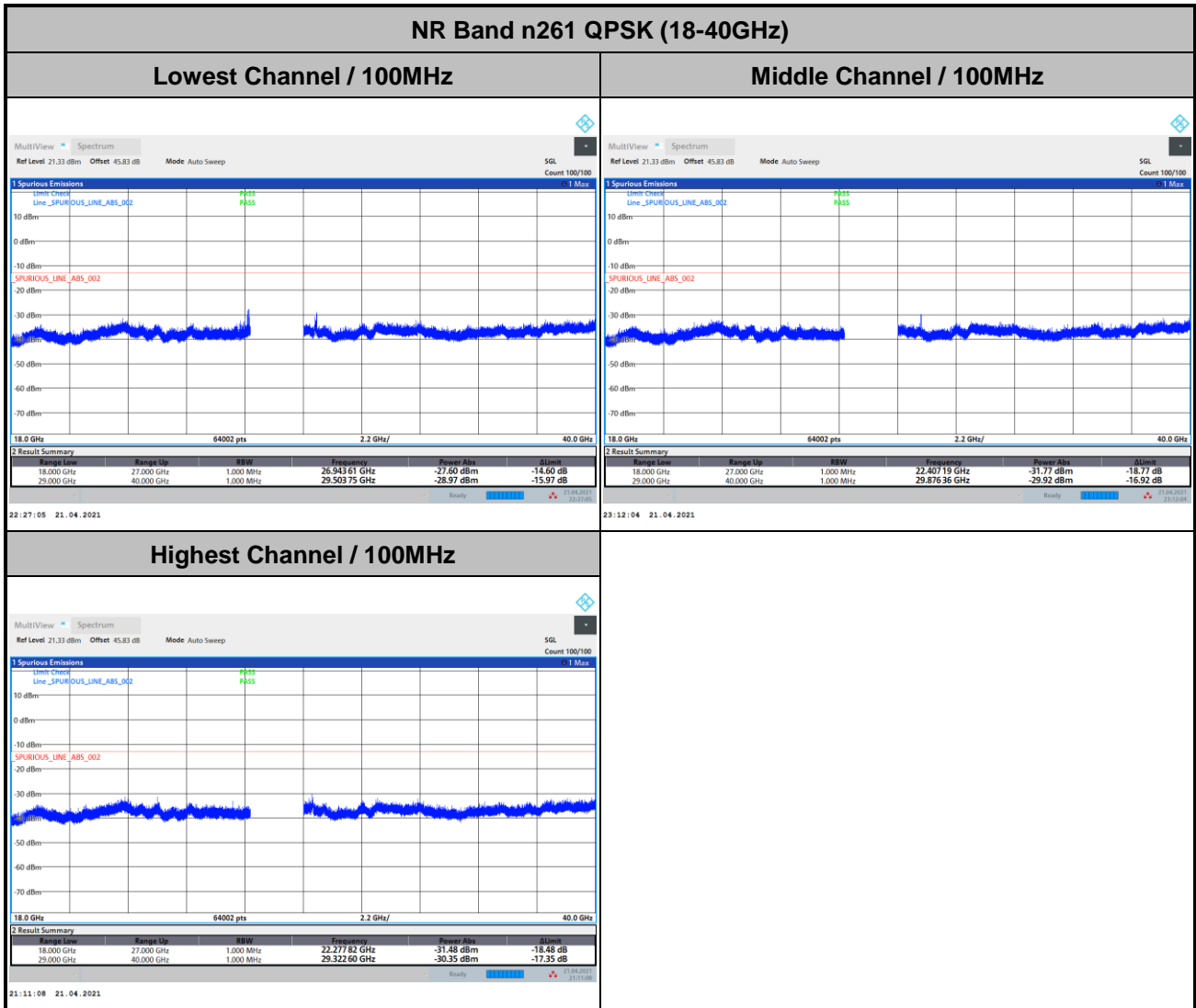
DFT-s-OFDM



**Remark:** Above plots, the spurious emissions were measured from 18GHz to 27GHz and 29GHz to 40GHz. The test results within the omitted frequency 27GHz to 29GHz were measured and reported in the section of Radiated Out of Band Emission with frequency range, 27GHz to 29GHz, and all spurious comply with limits.



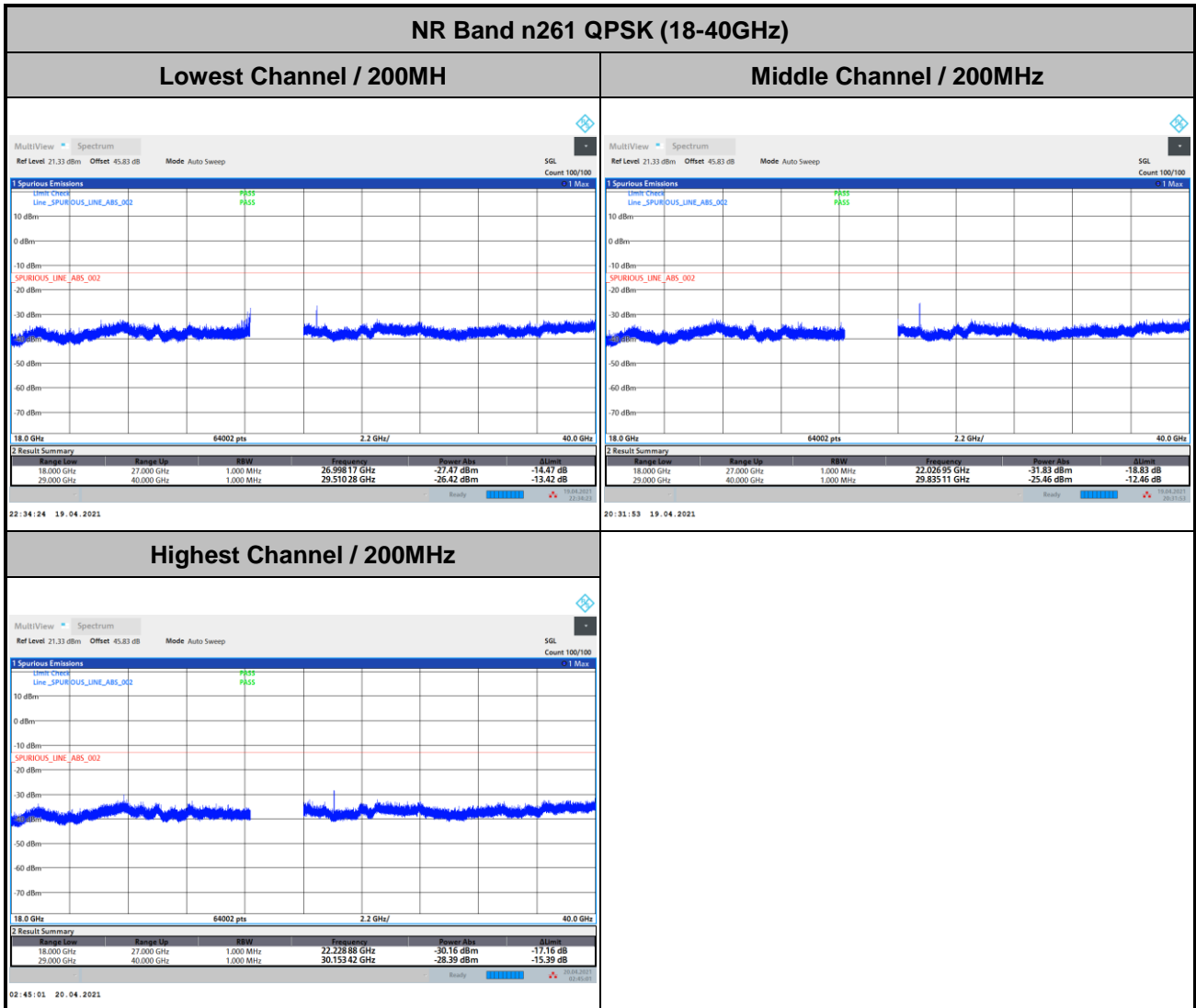
CP-OFDM



**Remark:** Above plots, the spurious emissions were measured from 18GHz to 27GHz and 29GHz to 40GHz. The test results within the omitted frequency 27GHz to 29GHz were measured and reported in the section of Radiated Out of Band Emission with frequency range, 27GHz to 29GHz, and all spurious comply with limits.



CP-OFDM

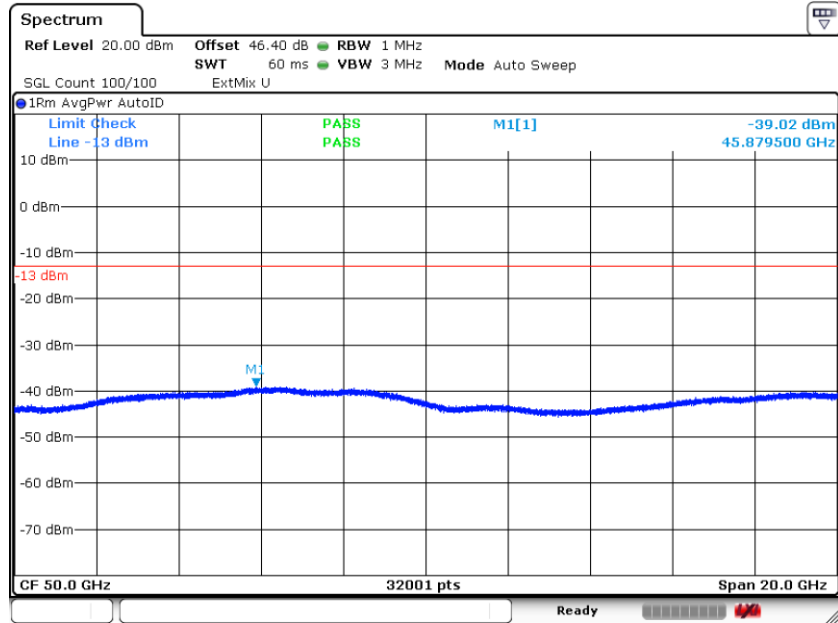


**Remark:** Above plots, the spurious emissions were measured from 18GHz to 27GHz and 29GHz to 40GHz. The test results within the omitted frequency 27GHz to 29GHz were measured and reported in the section of Radiated Out of Band Emission with frequency range, 27GHz to 29GHz, and all spurious comply with limits.



NR Band n261

(40GHz-60GHz)



Date: 24.APR.2021 13:09:12

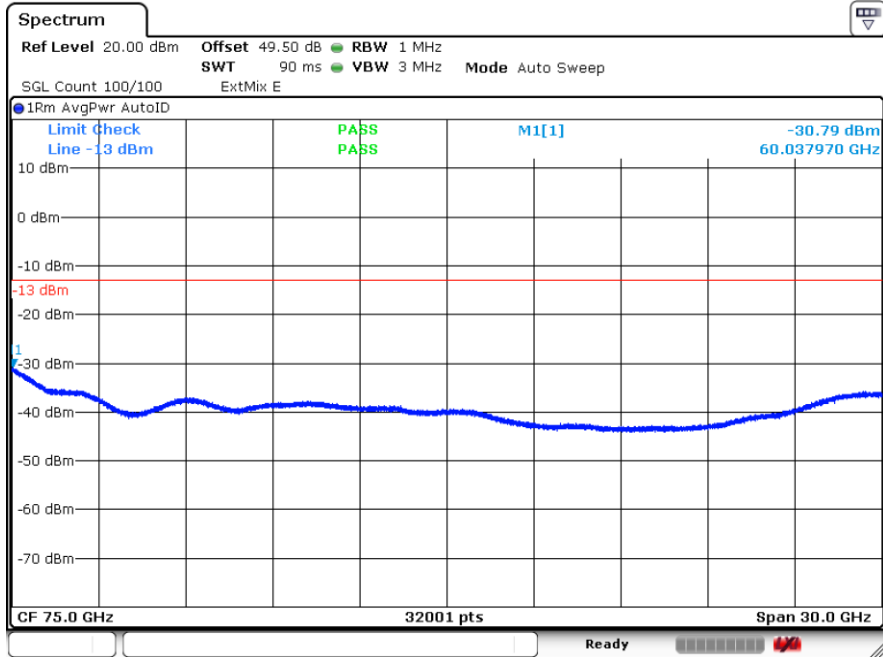
$$\text{Offset} = \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8$$

$$= 42.3 + 0.34 + 107 + 20\log(1.2) - 104.8 = 46.4 \text{ (dB)}$$



NR Band n261

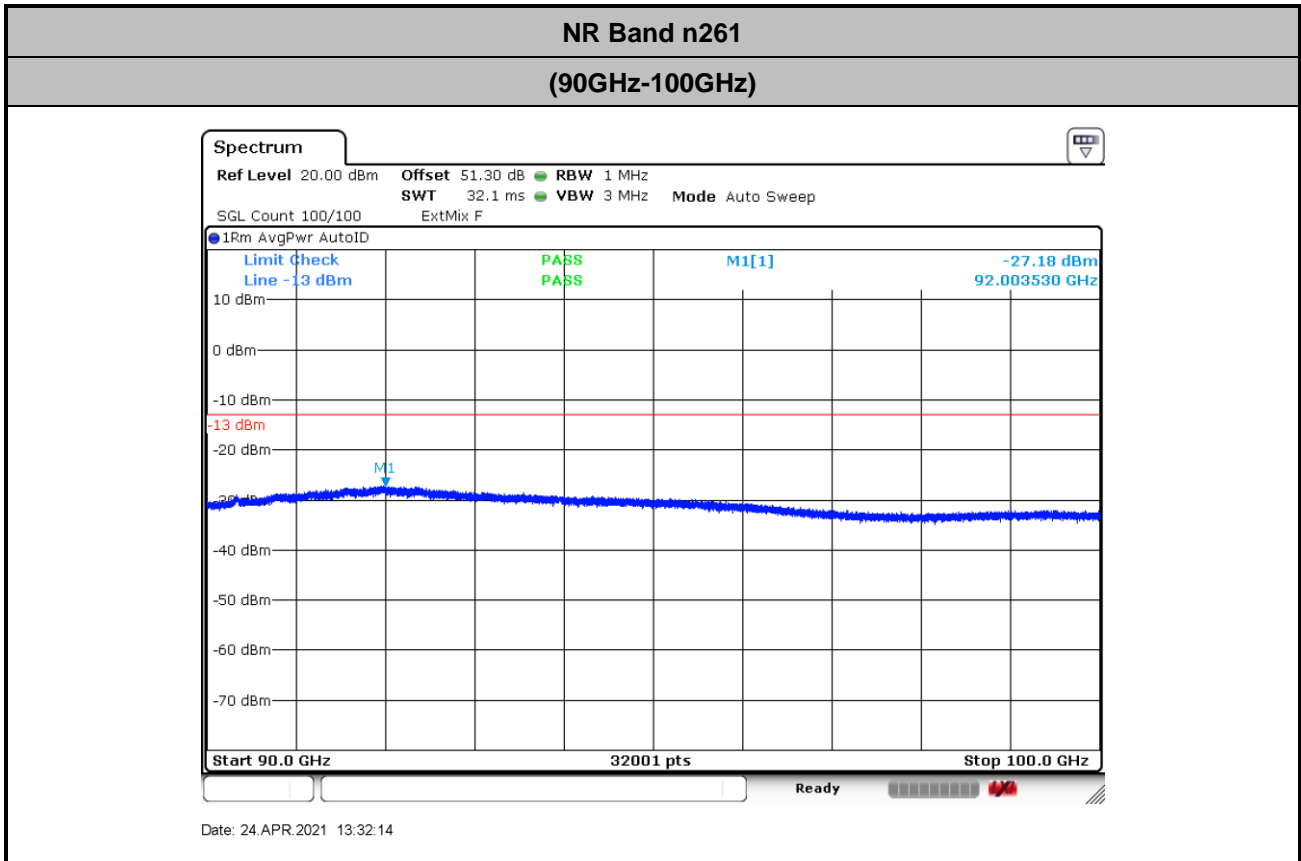
(60GHz-90GHz)



Date: 24.APR.2021 13:27:12

$$\text{Offset} = \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8$$

$$= 45.4 + 0.34 + 107 + 20\log(1.2) - 104.8 = 49.5 \text{ (dB)}$$



$$\begin{aligned} \text{Offset} &= \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8 \\ &= 47.2 + 0.34 + 107 + 20\log(1.2) - 104.8 = 51.3 \text{ (dB)} \end{aligned}$$





Frequency Stability

Test Conditions		NR Band n261 / Middle Channel			Limit
Temperature (°C)	Voltage (Volt)	CW tone			Note.
		Frequency (GHz)	Deviation (kHz)	Deviation (ppm)	Result
50	120	27.8747572	242.800	8.710	PASS
40	120	27.8747592	240.800	8.639	
30	120	27.875058	-58.000	2.081	
20(Ref.)	120	27.875	0.000	0.000	
10	120	27.875037	-37.000	1.327	
0	120	27.8750839	-83.900	3.010	
-10	120	27.8751119	-111.900	4.014	
-20	120	27.8751119	-111.900	4.014	
-30	120	27.8750589	-58.900	2.113	
20	102	27.874984	16.000	0.574	
20	120	27.875	0.000	0.000	
20	138	27.87499	10.000	0.359	

Note: The frequency fundamental emissions stay within the operation band.

—THE END—



## Appendix C. R&S Mixer Certificate



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® ZVA40	100103	0001-300467129	2021-06-13
Powersensor	R&S® NRP-Z55	140091	509915_D-K-15195-01-01_2019-05	2020-05-22
Powersensor	R&S® NRP-Z57	101423	508173_D-K-15195-01-01_2019-05	2020-05-07

**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

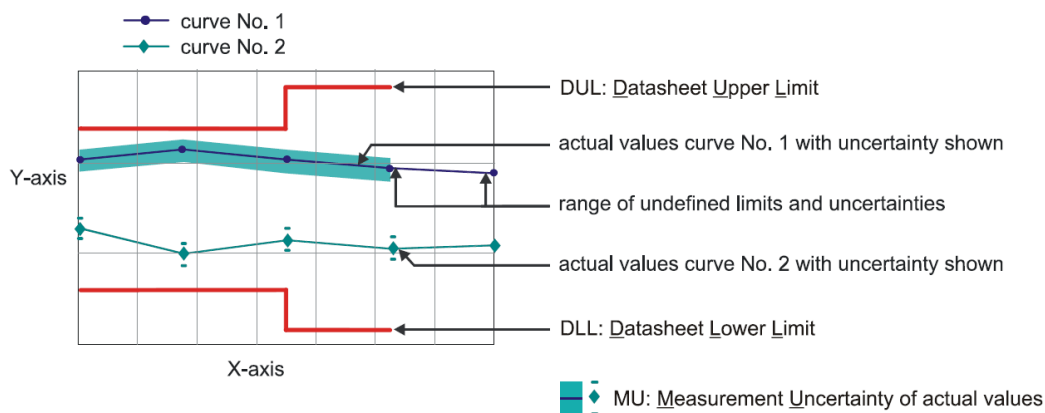
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is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

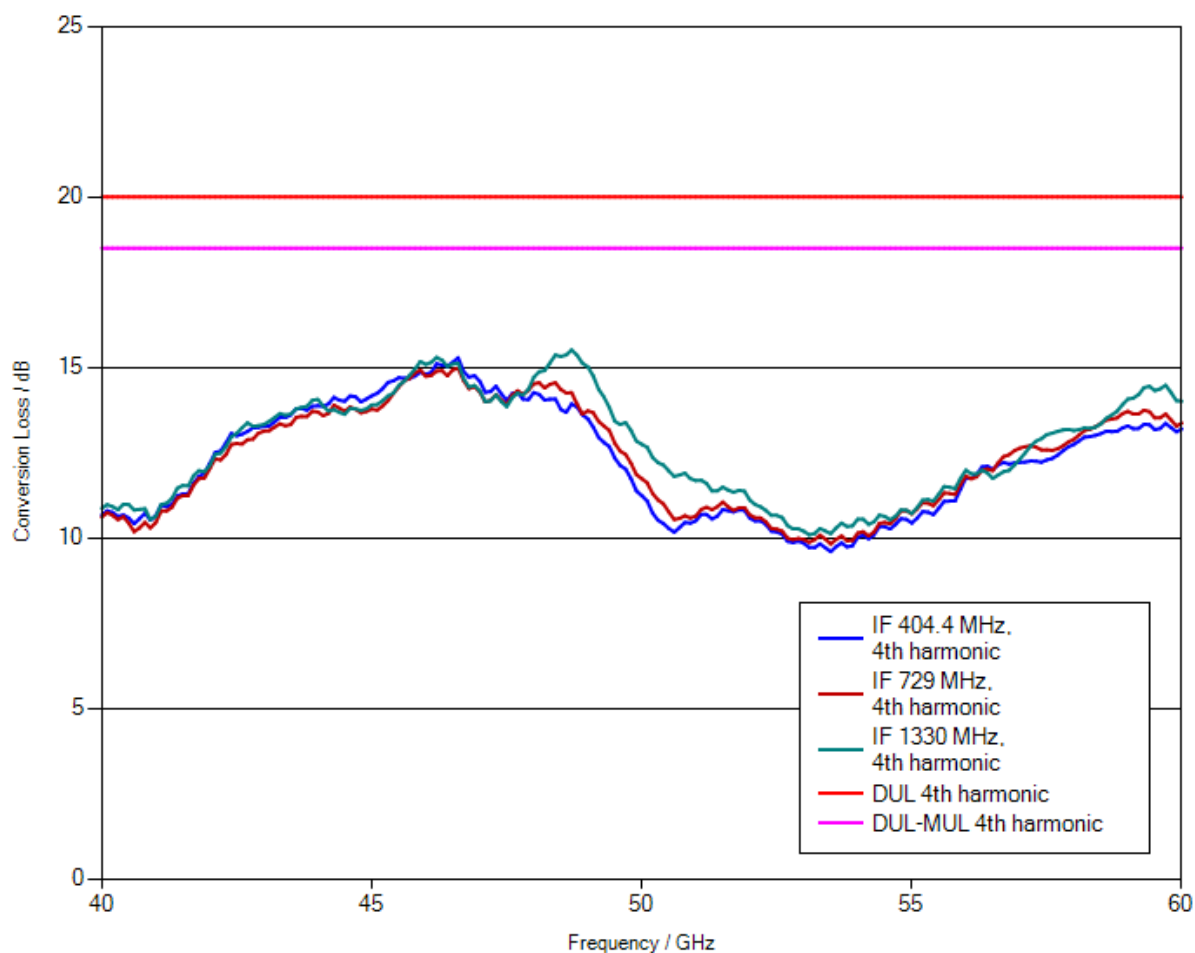
2013  
7\_13

**Remark**

## 1.1 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.**

## 1.2 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 4th harmonic	4 dB	2.16 dB	PASS
IF = 729 MHz, 4th harmonic	4 dB	2.04 dB	PASS
IF = 1330 MHz, 4th harmonic	4 dB	2.19 dB	PASS



# Calibration Certificate

**Certificate Number 24-0090-101811-01**
**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 **101811**

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, 2018-07-16**

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 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.

**Radiometer Physics GmbH; Meckenheim**

Date of Issue  
Ausstellungsdatum

**2018-07-19**

Head of Laboratory  
Laborleitung

**Ceru**

Person Responsible  
Bearbeiter

**Grossmindorf**

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

Material Number 1048.0371.02

Serial Number 101811

Certificate Number 24-0090-101811-01

Calibration Method  
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity 20 % - 80 %  
Relative LuftfeuchteAmbient Temperature  
Umgebungstemperatur(23 <sup>+7</sup><sub>-3</sub>) °CWorking 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	20-611482	2018-07-21
Calibration kit	WR12	E10001	RPG-PAQA-TN-2014-005	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

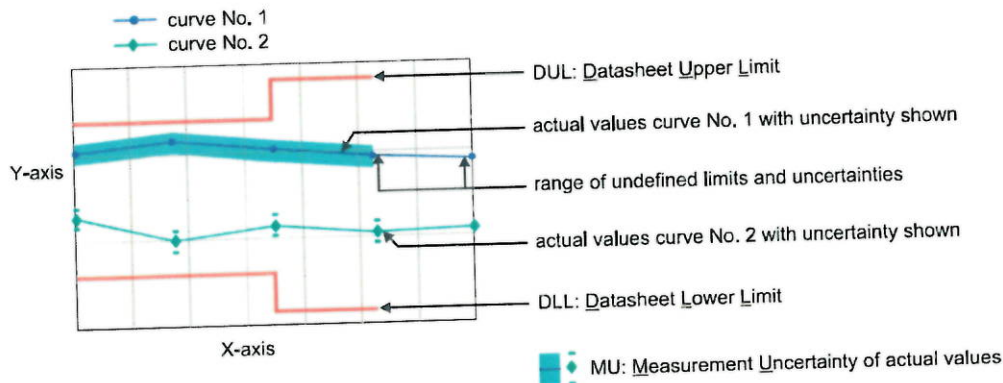
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is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



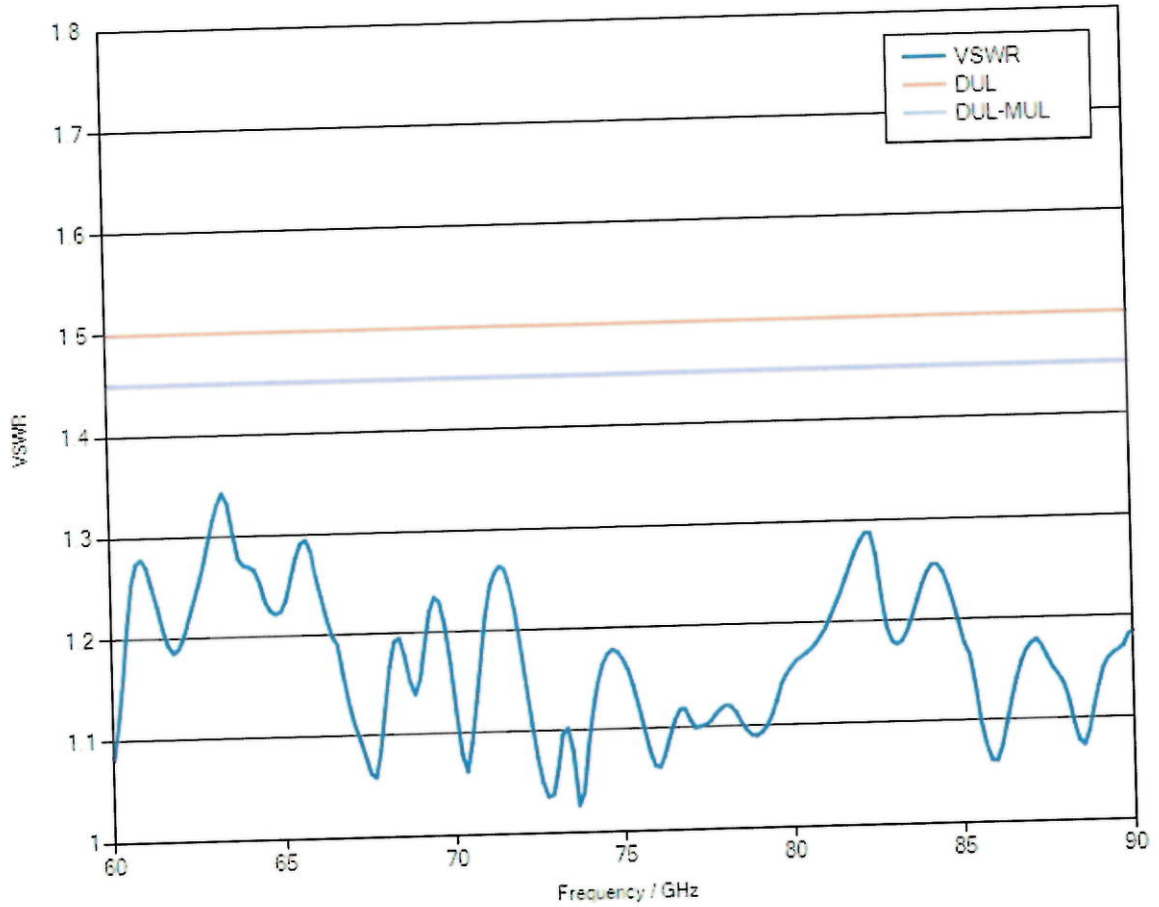
Software used for measurement  
Item Type  
Measurement Studio Professional Edition  
MixerCertification

Version  
2013  
7\_08

Remark

### 1.1 RF Input – VSWR

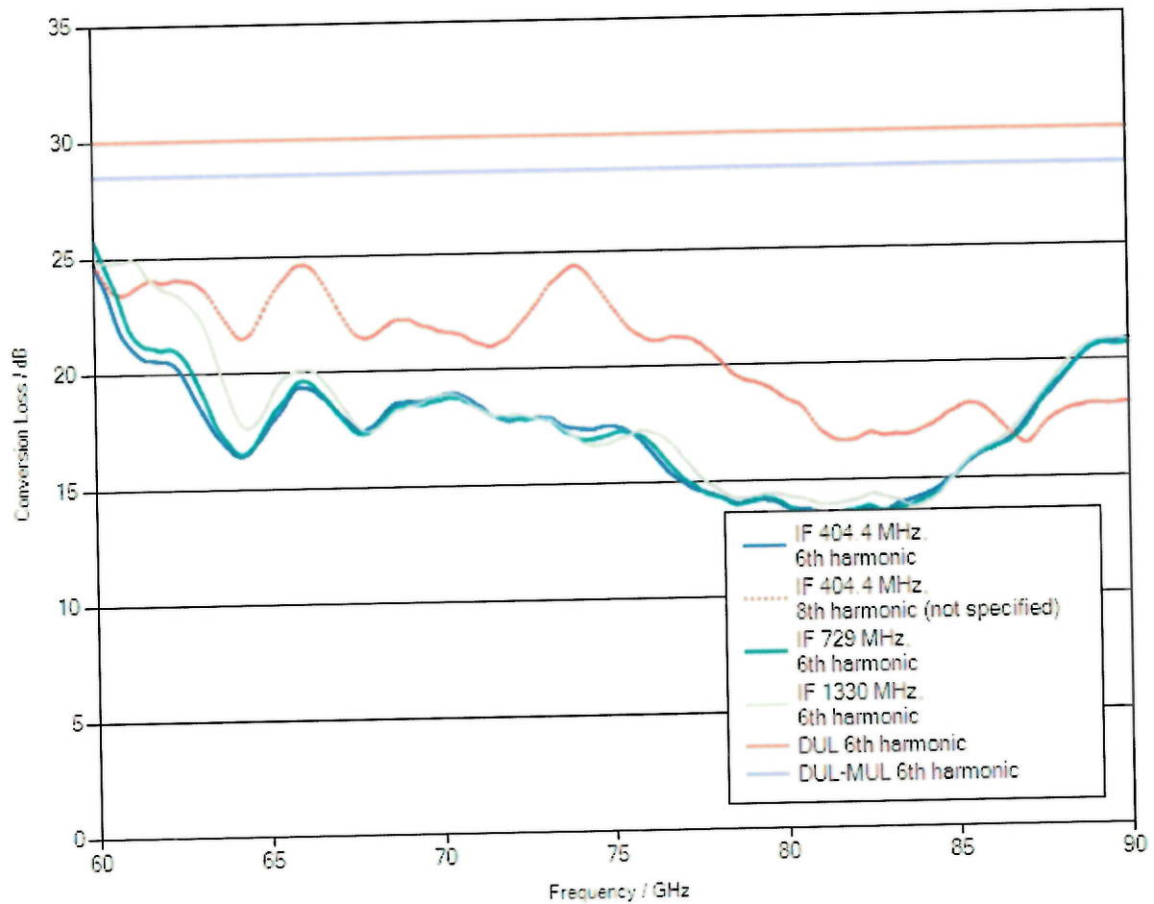
Measurement uncertainty: 0.05 (VSWR)



## 1.2 Conversion loss

LO level                    +14 dBm nominal  
Bias                        0 A

Measurement uncertainty:    1.5 dB



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, 6th harmonic	6 dB	3.29 dB	PASS
IF = 404.4 MHz, 8th harmonic	not specified	2.25 dB	not specified
IF = 729 MHz, 6th harmonic	6 dB	3.47 dB	PASS
IF = 1330 MHz, 6th harmonic	6 dB	3.84 dB	PASS





# Calibration Certificate

Kalibrierschein

Certificate Number **24-0140-101128-02**

Zertifikatsnummer

## Unit Data

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

**Manufacturer** RPG Radiometer-Physics GmbH  
Hersteller

**Type** RPG FS-Z140  
Typ

**Material Number** 3622.0708.02    **Serial Number** 101128  
Materialnummer                      Seriennummer

**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** Sporton International Inc.  
Auftraggeber  
**No. 106 6F., Sec. 1, Hsin Tai Wu Rd., Xizhi Dist., 000000 NEW TAIPEI CITY-000000 221- TAIWAN**

**Order Number** 8800003072  
Bestellnummer

**Date of Receipt** 2020-10-06  
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, 2020-10-26**

**Scope of Calibration**  
Umfang der Kalibrierung

**Standard Calibration**

**Statement of Compliance (Incoming)**  
Konformitätsaussage (Anlieferung)

**Defective.**

**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  
4 pages Outgoing Results**

## RPG Radiometer-Physics GmbH; Meckenheim

**Date of Issue**  
Ausstellungsdatum

**2020-10-27**

**Head of Laboratory**  
Laborleitung

Schulze

**Person Responsible**  
Bearbeiter

Gottbehüt

**Page (Seite) 1/2**  
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® ZVA40	100103	0001-300467129	2021-06-13
Powersensor	R&S® NRP-Z55	140093	509916_D-K-15195-01-01_2019-05	2021-05-22

**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

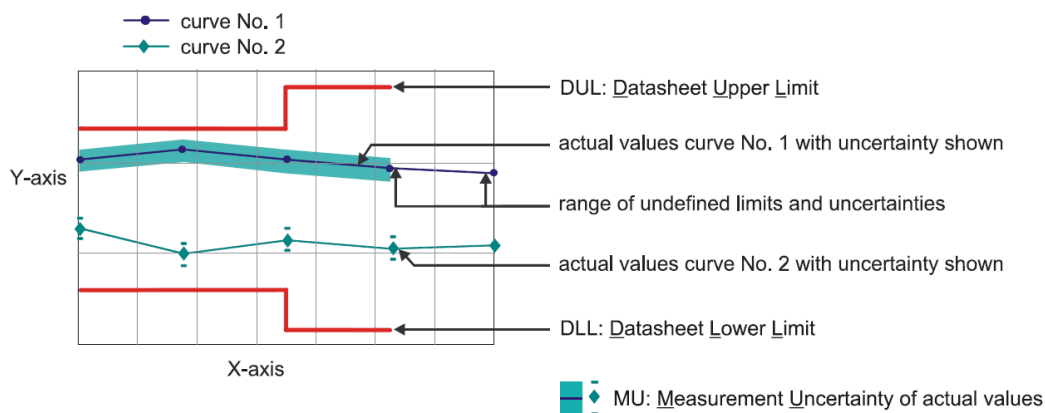
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is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

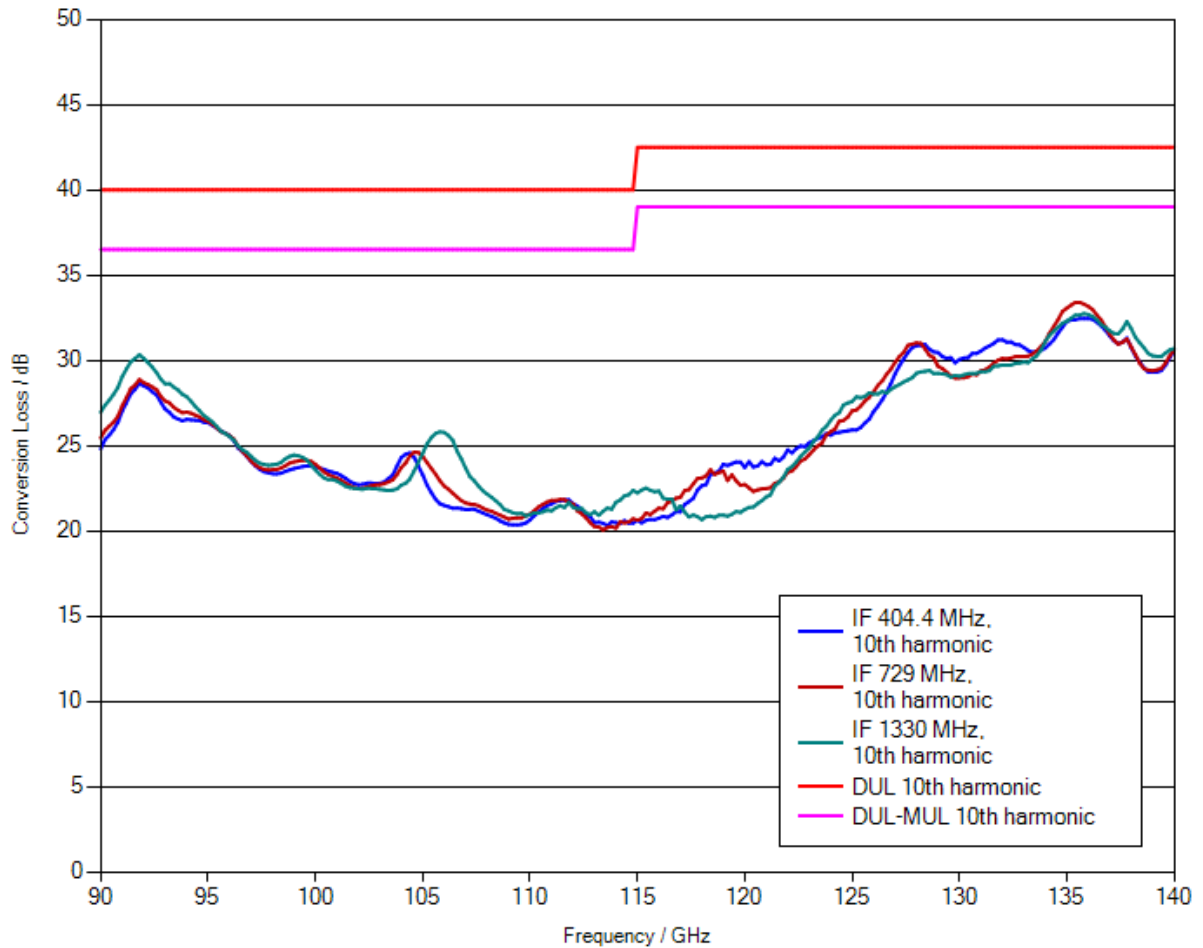
2013  
7\_14

**Remark**

## 1.1 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.

## 1.2 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 10th harmonic	6 dB	2.1 dB	PASS
IF = 729 MHz, 10th harmonic	6 dB	1.96 dB	PASS
IF = 1330 MHz, 10th harmonic	6 dB	2.13 dB	PASS



# Calibration Certificate

Certificate Number **24-0220-101014-01**

Kalibrierschein

Zertifikatsnummer

## Unit Data

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

Manufacturer  
Hersteller **RPG**

Type  
Typ **RPG FS-Z220**

Material Number  
Materialnummer **3593.3250.02**      Serial Number  
Seriennummer **101014**

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. 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, 2018-08-27**

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

**2018-08-28**

Head of Laboratory  
Laborleitung

Schulze

Person Responsible  
Bearbeiter

Heinze

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

Calibration Method  
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity 20 % - 80 %  
Relative LuftfeuchteAmbient 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

**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

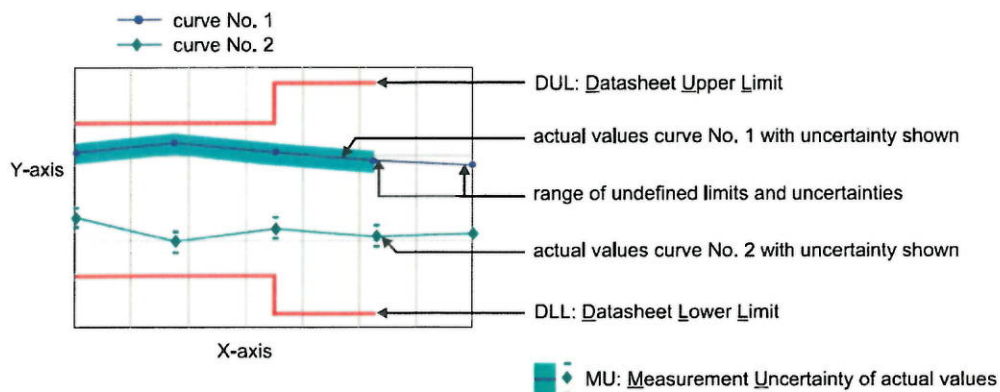
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is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

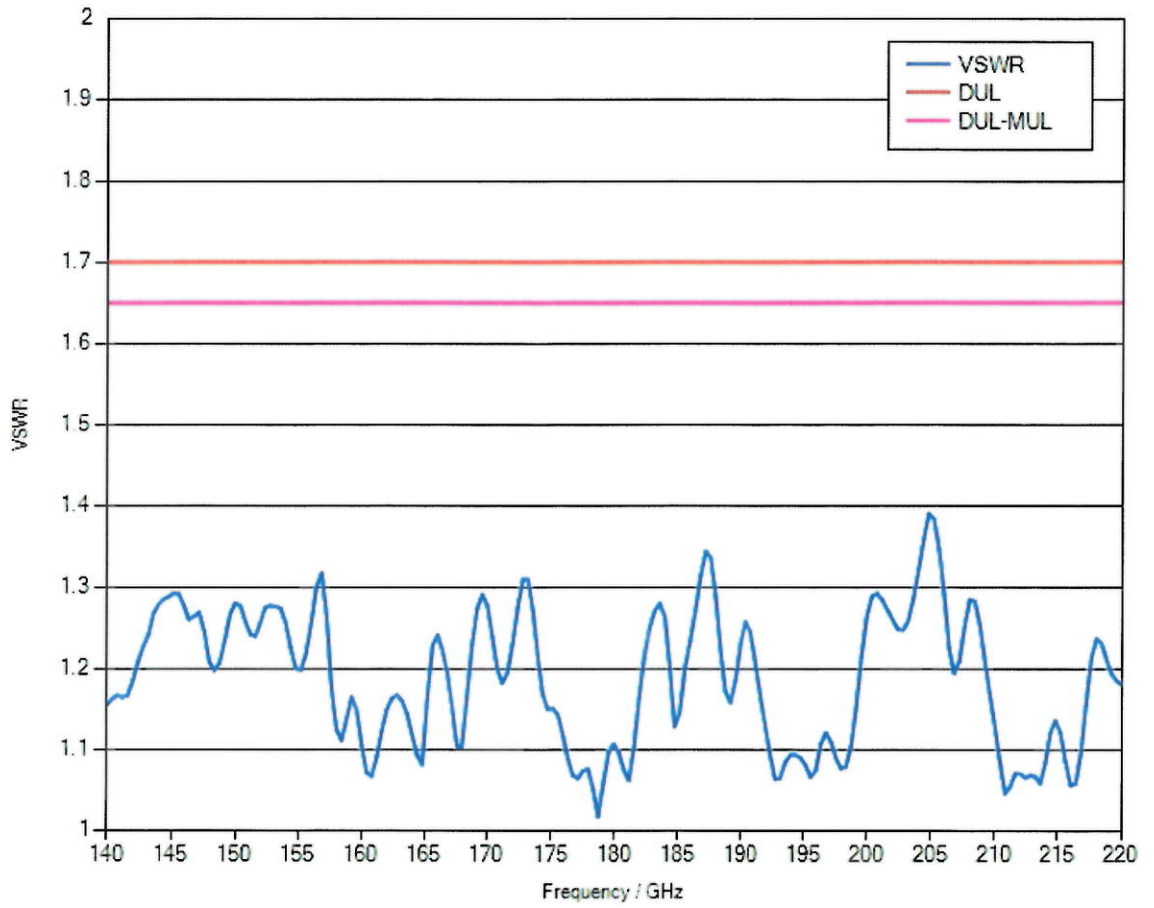
**Version**

2013  
7\_09

**Remark**

### 1.1 RF Input – VSWR

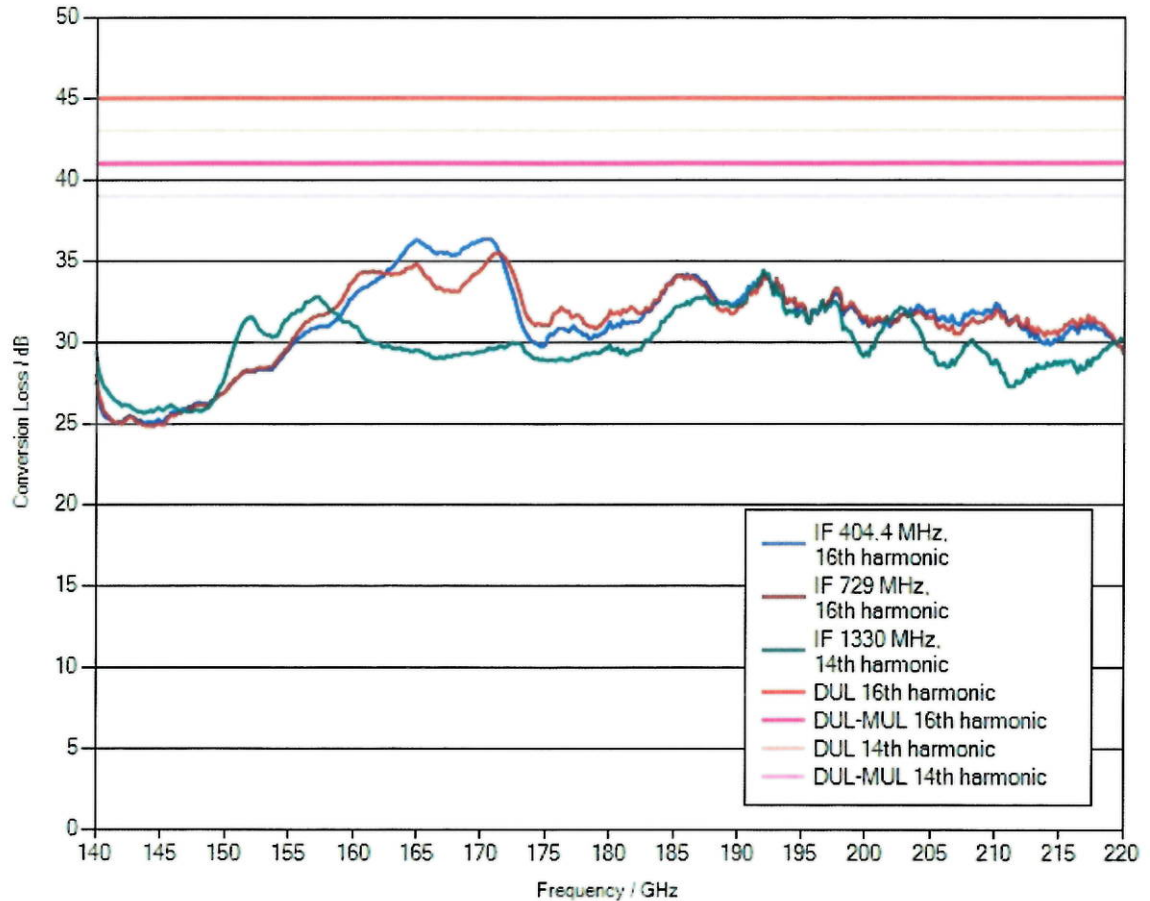
Measurement uncertainty: 0.05 (VSWR)



## 1.2 Conversion loss

LO level                    +13 dBm nominal  
Bias                        0 A

Measurement uncertainty:    4 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, 16th harmonic	6 dB	2.71 dB	PASS
IF = 729 MHz, 16th harmonic	6 dB	2.61 dB	PASS
IF = 1330 MHz, 14th harmonic	6 dB	2.61 dB	PASS



## **Appendix D. Calibration Certificate of Standard Gain Horn**

### **Antennas**









# Calibration certificate

ISO 17025  
ACCREDITED LABORATORY



Accreditation certificate No. № BY/112 02.5.0.0065 of 09.01.2015

Certificate number 25-18 Date when calibrated 08/17/2018 Page 1 of 2

**Item calibrated**

Antenna QWH-UPRR00 # 923600007

Description of measurement standard / measuring instrument / identification

**Customer**

Sporton International Inc.  
No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District,  
TaoYuan City 333, Taiwan, R.O.C.

Name of the customer, address

**Method of calibration**

GOST 20271.1, MK KL 8.2-16

Name of the method / identification

*All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. This certificate shall not be reproduced, except in full. Any publication extracts from the calibration certificate requires written permission of the issuing calibration laboratory of microwave measuring equipment.*

**Authorising signature**



M. Svirid/ Technical manager

Name and position

Date of issue 08/17/2018