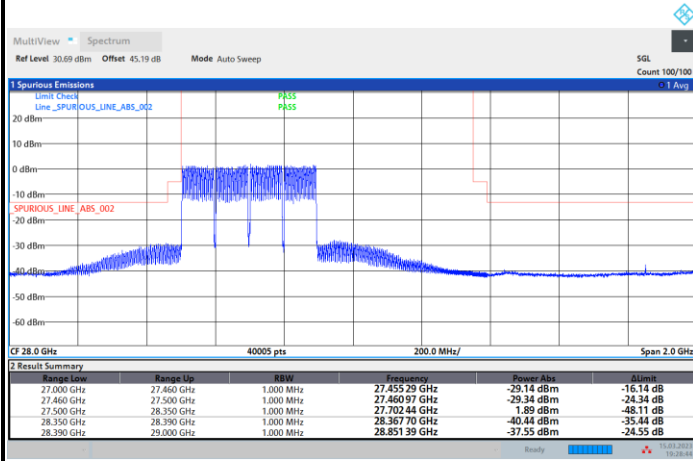




DFT-s-OFDM Module 1

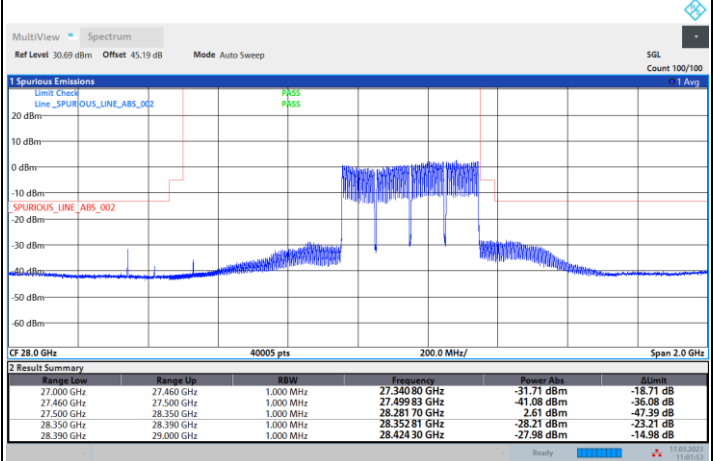
NR Band n261 / 400MHz / 16QAM

Lowest Band Edge / Full RB



19:28:45 15.03.2023

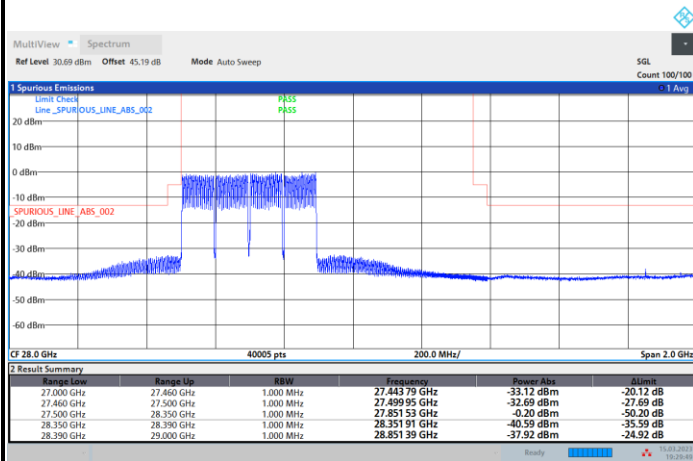
Highest Band Edge / Full RB



11:01:53 17.03.2023

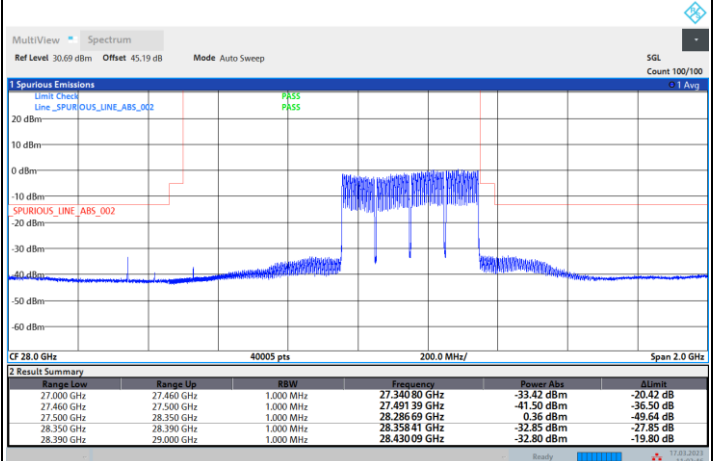
NR Band n261 / 400MHz / 64QAM

Lowest Band Edge / Full RB



19:29:49 15.03.2023

Highest Band Edge / Full RB



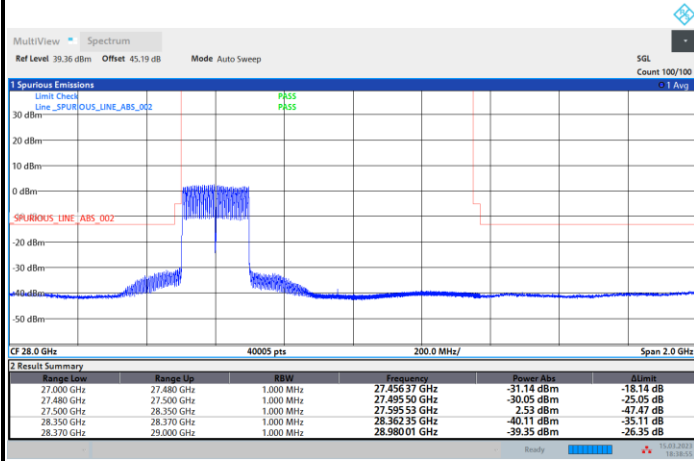
11:02:46 17.03.2023



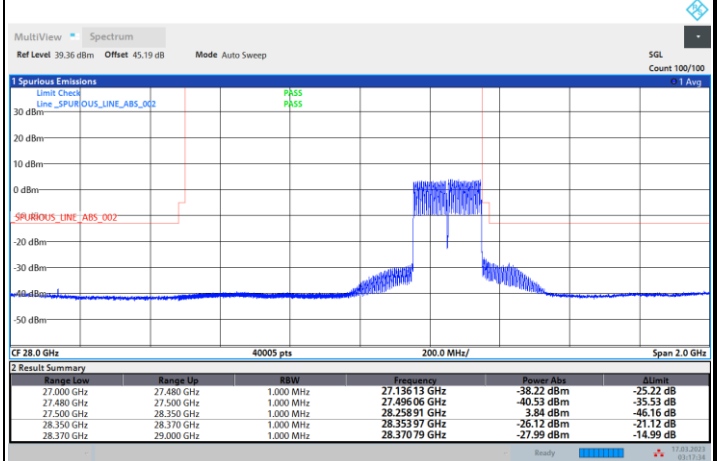
CP-OFDM Module 1

NR Band n261 / 200MHz / QPSK

Lowest Band Edge / Full RB

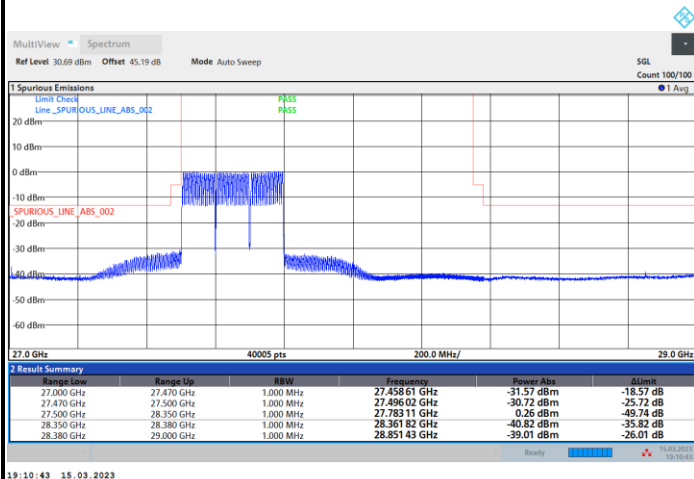


Highest Band Edge / Full RB

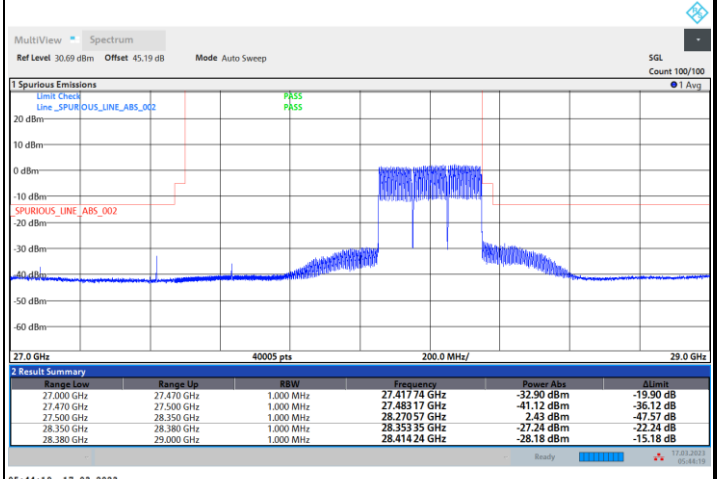


NR Band n261 / 300MHz / QPSK

Lowest Band Edge / Full RB



Highest Band Edge / Full RB



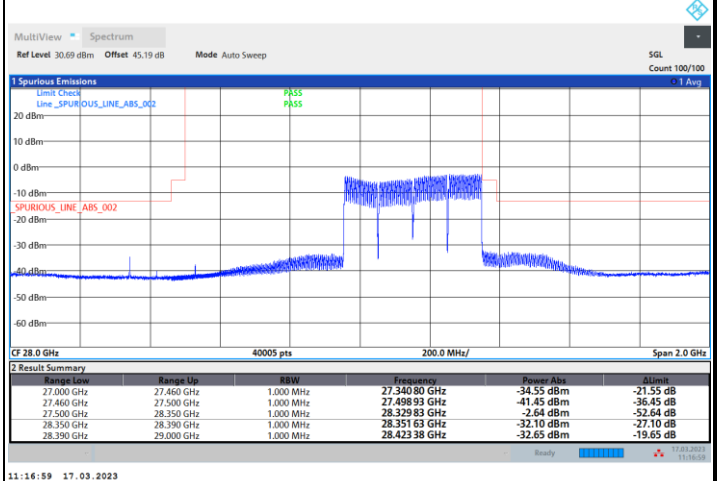
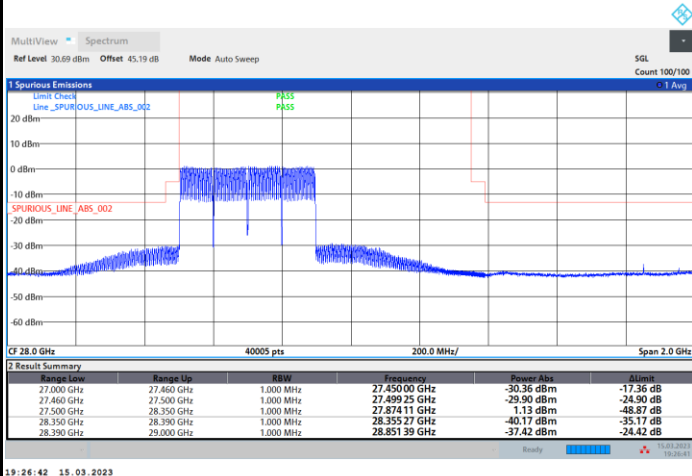


CP-OFDM Module 1

NR Band n261 / 400MHz / QPSK

Lowest Band Edge / Full RB

Highest Band Edge / Full RB

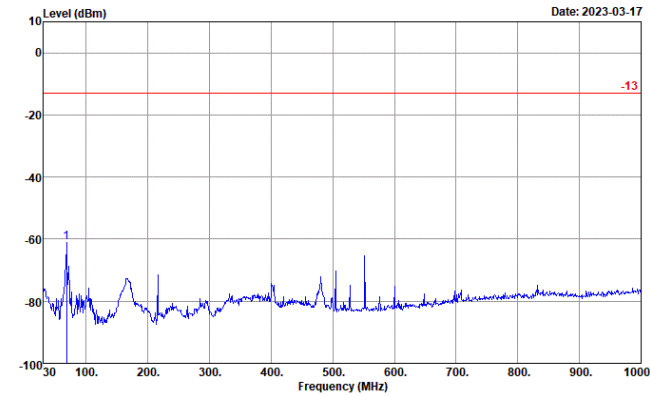




Spurious Emission

NR Band n261 (30MHz-1GHz)

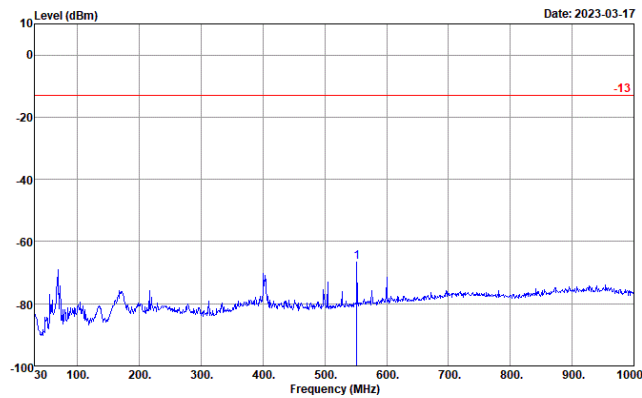
Horizontal



Site : 03CH10-HY
Condition : -13 EIRP_WO HORIZONTAL
Project : 190614-10
: M1

	Freq	Level	Over	Limit	Read
	MHz	dBm	Limit	Line	Level
	MHz	dBm	dB	dBm	dBm
1	67.83	-60.95	-47.95	-13.00	-55.99

Vertical



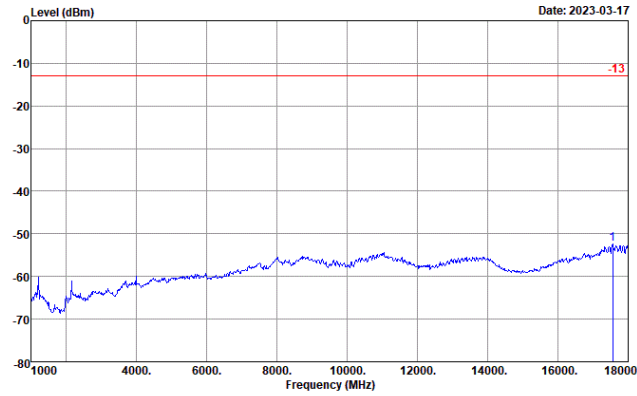
Site : 03CH10-HY
Condition : -13 EIRP_WO VERTICAL
Project : 190614-10
: M1

	Freq	Level	Over	Limit	Read
	MHz	dBm	Limit	Line	Level
	MHz	dBm	dB	dBm	dBm
1	551.86	-66.49	-53.49	-13.00	-70.40



NR Band n261 (1GHz-18GHz)

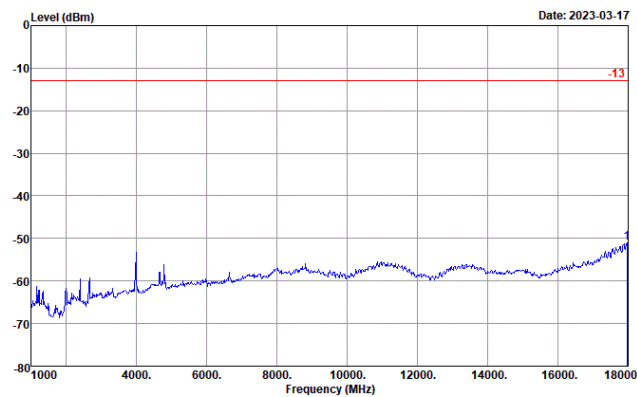
Horizontal



Site : 03CH10-HY
Condition : -13 EIRP_WO HORIZONTAL
Project : 190614-10
: M1

	Freq	Level	Over Limit	Limit Line	Read Level
	MHz	dBm	dB	dBm	dBm
1	17558.00	-52.27	-39.27	-13.00	-66.35

Vertical



Site : 03CH10-HY
Condition : -13 EIRP_WO VERTICAL
Project : 190614-10
: M1

	Freq	Level	Over Limit	Limit Line	Read Level
	MHz	dBm	dB	dBm	dBm
1	17966.00	-50.94	-37.94	-13.00	-68.09



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

DFT-s-OFDM Module 1



Remark: In band and out of band frequencies are omitted.



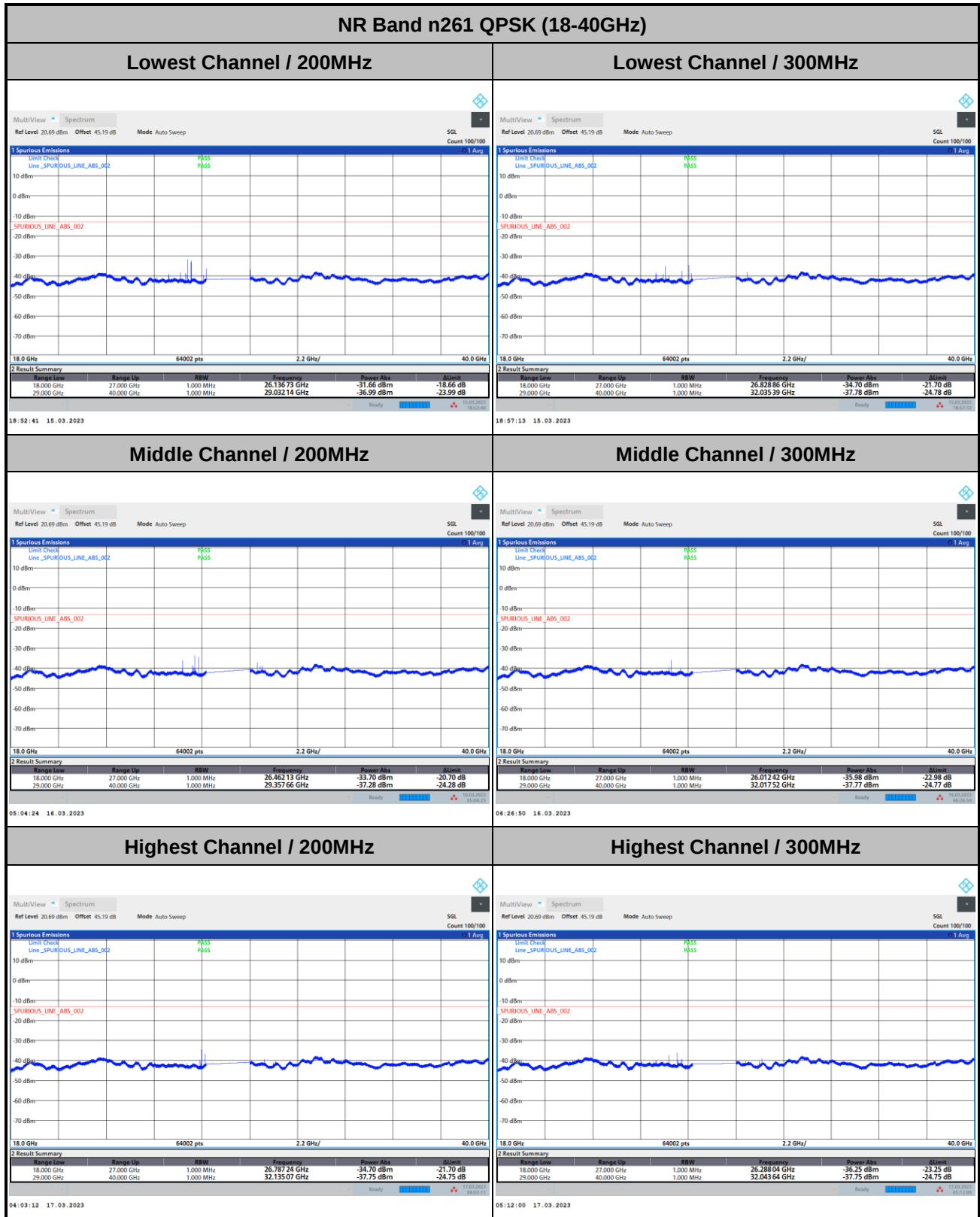
DFT-s-OFDM Module 1

NR Band n261 BPSK (18-40GHz)																		
Lowest Channel / 400MHz																		
MultiView Spectrum Ref Level 20.69 dBm Offset 45.19 dB Mode Auto Sweep SGL Count 100/100 1 Spurious Emissions Limit Check Line SPURIOUS_LINE_ABS_002 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm 18.0 GHz 64002 pts 2.2 GHz/ 40.0 GHz 2 Result Summary <table><tr><th>Range Low</th><th>Range Up</th><th>RBW</th><th>Frequency</th><th>Power Abs</th><th>ΔLimit</th></tr><tr><td>18.000 GHz</td><td>27.000 GHz</td><td>1.000 MHz</td><td>26.828 86 GHz</td><td>-34.55 dBm</td><td>-21.55 dB</td></tr><tr><td>29.000 GHz</td><td>40.000 GHz</td><td>1.000 MHz</td><td>32.042 95 GHz</td><td>-37.89 dBm</td><td>-24.89 dB</td></tr></table> 19:41:28 15.03.2023 intentionally blank	Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit	18.000 GHz	27.000 GHz	1.000 MHz	26.828 86 GHz	-34.55 dBm	-21.55 dB	29.000 GHz	40.000 GHz	1.000 MHz	32.042 95 GHz	-37.89 dBm	-24.89 dB
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit													
18.000 GHz	27.000 GHz	1.000 MHz	26.828 86 GHz	-34.55 dBm	-21.55 dB													
29.000 GHz	40.000 GHz	1.000 MHz	32.042 95 GHz	-37.89 dBm	-24.89 dB													
Middle Channel / 400MHz																		
MultiView Spectrum Ref Level 20.69 dBm Offset 45.19 dB Mode Auto Sweep SGL Count 100/100 1 Spurious Emissions Limit Check Line SPURIOUS_LINE_ABS_002 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm 18.0 GHz 64002 pts 2.2 GHz/ 40.0 GHz 2 Result Summary <table><tr><th>Range Low</th><th>Range Up</th><th>RBW</th><th>Frequency</th><th>Power Abs</th><th>ΔLimit</th></tr><tr><td>18.000 GHz</td><td>27.000 GHz</td><td>1.000 MHz</td><td>22.046 36 GHz</td><td>-38.19 dBm</td><td>-25.19 dB</td></tr><tr><td>29.000 GHz</td><td>40.000 GHz</td><td>1.000 MHz</td><td>32.034 36 GHz</td><td>-37.63 dBm</td><td>-24.63 dB</td></tr></table> 06:37:13 20.03.2023 intentionally blank	Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit	18.000 GHz	27.000 GHz	1.000 MHz	22.046 36 GHz	-38.19 dBm	-25.19 dB	29.000 GHz	40.000 GHz	1.000 MHz	32.034 36 GHz	-37.63 dBm	-24.63 dB
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit													
18.000 GHz	27.000 GHz	1.000 MHz	22.046 36 GHz	-38.19 dBm	-25.19 dB													
29.000 GHz	40.000 GHz	1.000 MHz	32.034 36 GHz	-37.63 dBm	-24.63 dB													
Highest Channel / 400MHz																		
MultiView Spectrum Ref Level 20.69 dBm Offset 45.19 dB Mode Auto Sweep SGL Count 100/100 1 Spurious Emissions Limit Check Line SPURIOUS_LINE_ABS_002 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm 18.0 GHz 64002 pts 2.2 GHz/ 40.0 GHz 2 Result Summary <table><tr><th>Range Low</th><th>Range Up</th><th>RBW</th><th>Frequency</th><th>Power Abs</th><th>ΔLimit</th></tr><tr><td>18.000 GHz</td><td>27.000 GHz</td><td>1.000 MHz</td><td>26.288 04 GHz</td><td>-34.86 dBm</td><td>-21.86 dB</td></tr><tr><td>29.000 GHz</td><td>40.000 GHz</td><td>1.000 MHz</td><td>32.103 79 GHz</td><td>-37.82 dBm</td><td>-24.82 dB</td></tr></table> 11:10:27 17.03.2023 intentionally blank	Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit	18.000 GHz	27.000 GHz	1.000 MHz	26.288 04 GHz	-34.86 dBm	-21.86 dB	29.000 GHz	40.000 GHz	1.000 MHz	32.103 79 GHz	-37.82 dBm	-24.82 dB
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit													
18.000 GHz	27.000 GHz	1.000 MHz	26.288 04 GHz	-34.86 dBm	-21.86 dB													
29.000 GHz	40.000 GHz	1.000 MHz	32.103 79 GHz	-37.82 dBm	-24.82 dB													

Remark: In band and out of band frequencies are omitted.



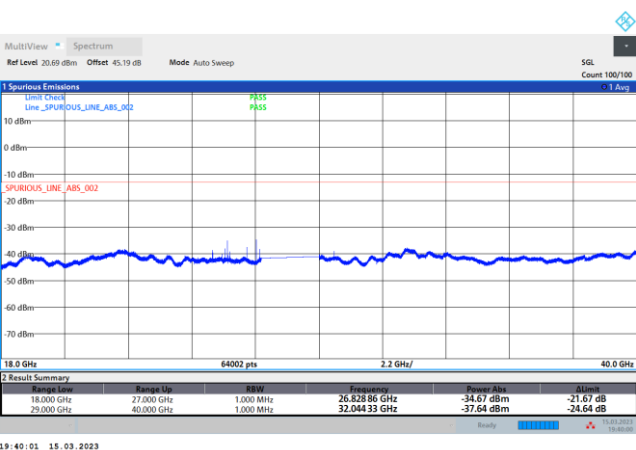
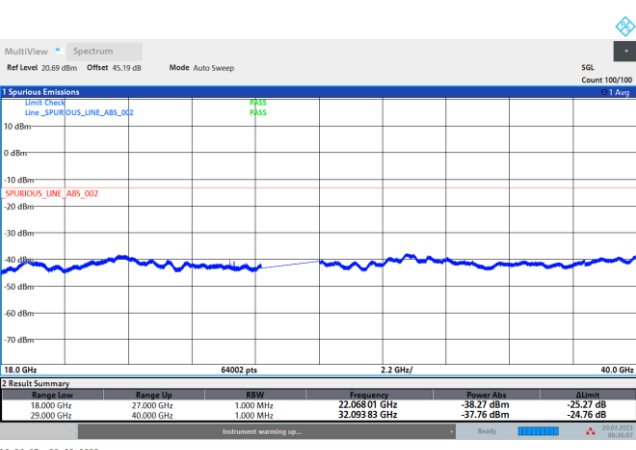
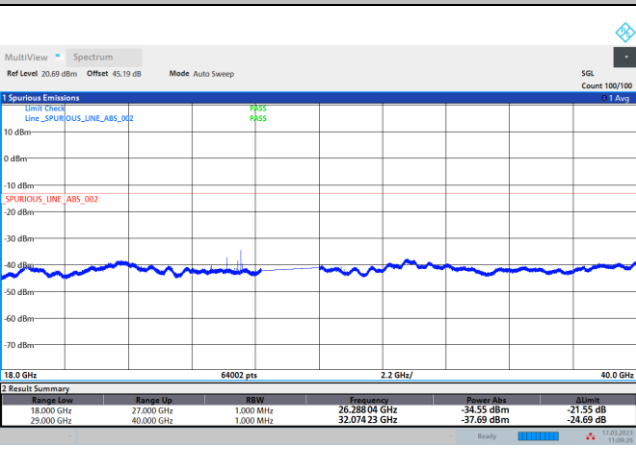
DFT-s-OFDM Module 1



Remark: In band and out of band frequencies are omitted.



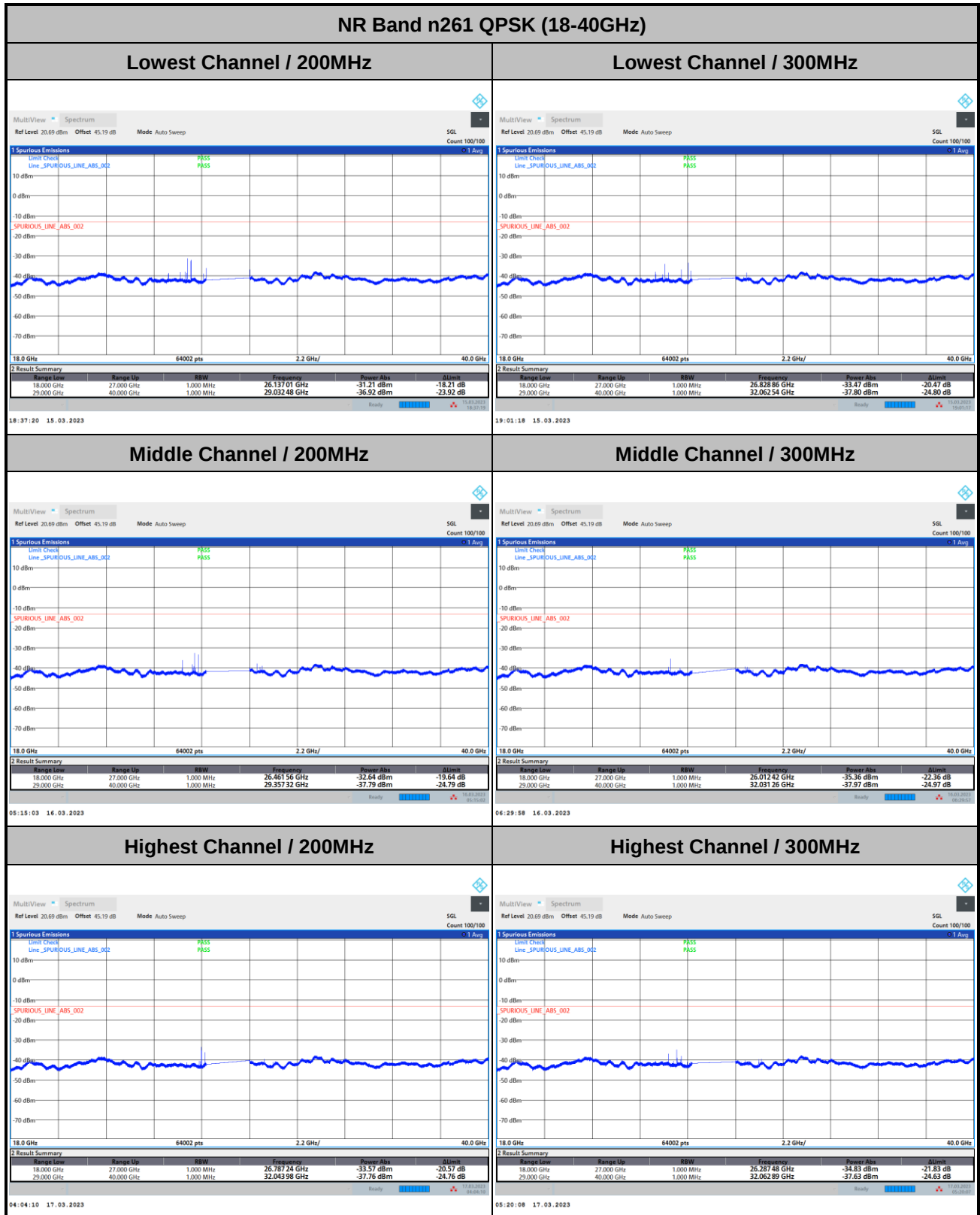
DFT-s-OFDM Module 1

NR Band n261 QPSK (18-40GHz)	
Lowest Channel / 400MHz	
 intentionally blank	
Middle Channel / 400MHz	
 intentionally blank	
Highest Channel / 400MHz	
 intentionally blank	

Remark: In band and out of band frequencies are omitted.



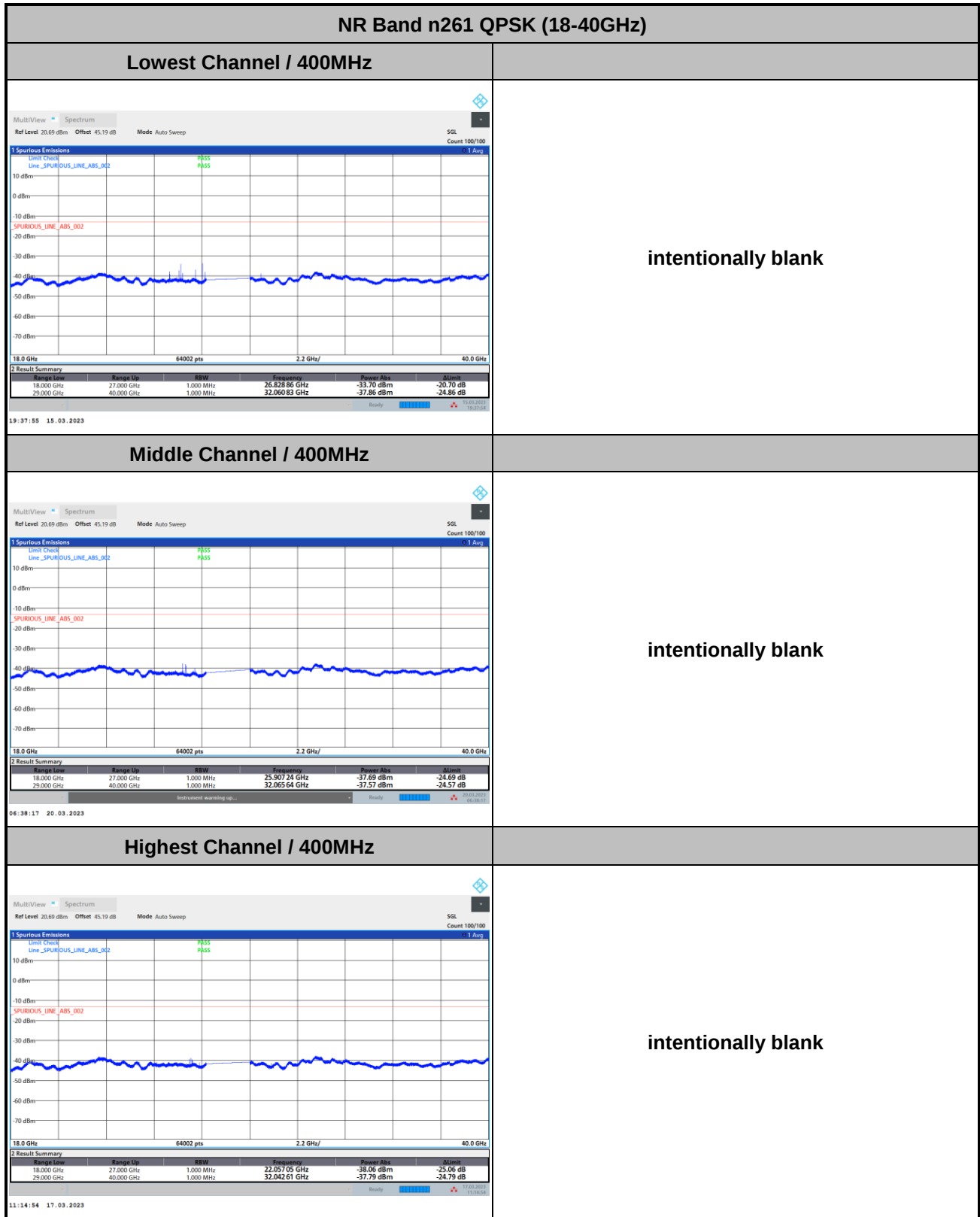
CP-OFDM Module 1



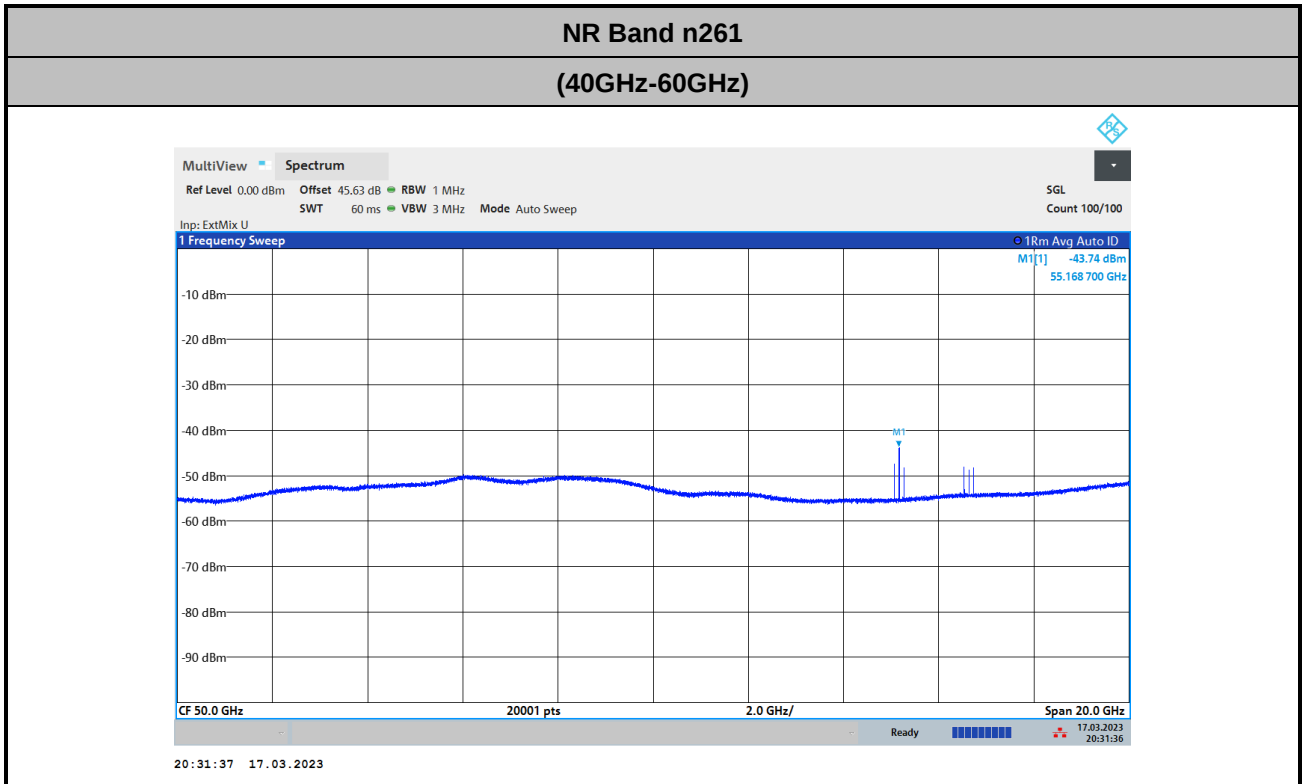
Remark: In band and out of band frequencies are omitted.



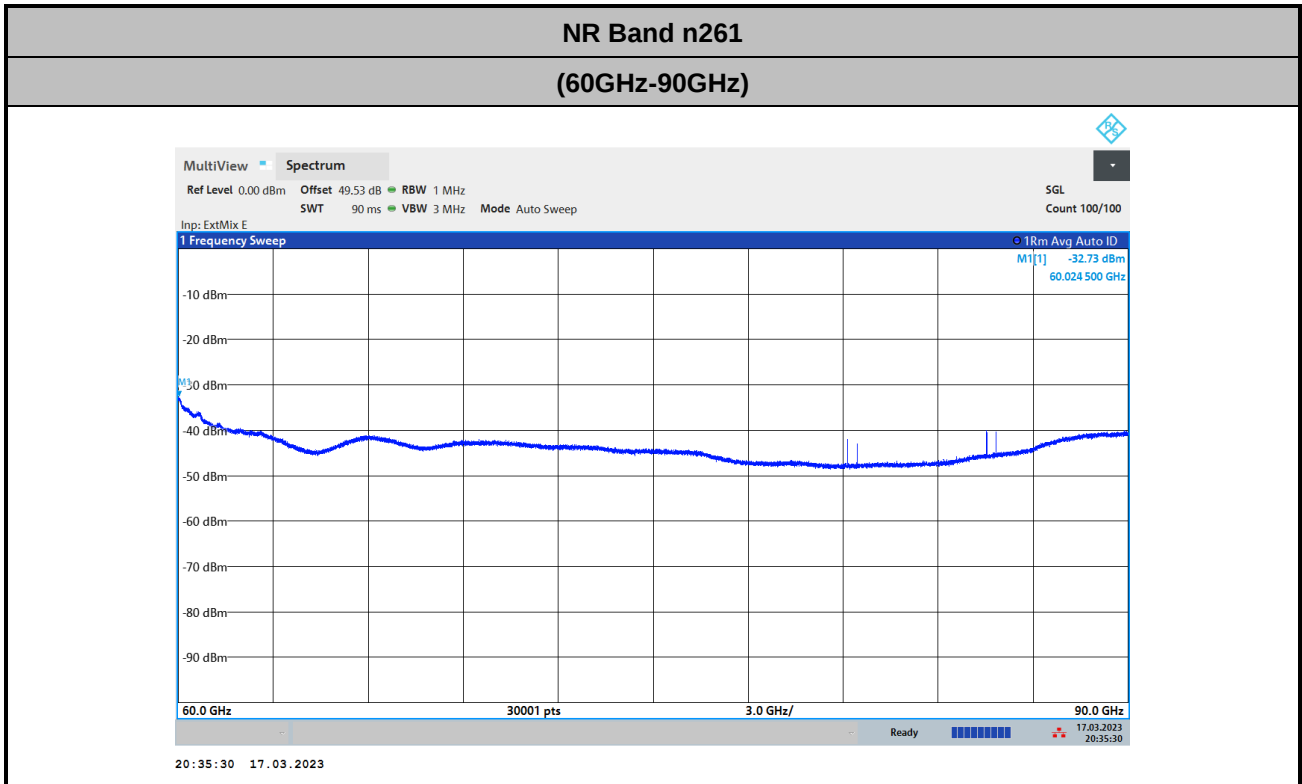
CP-OFDM Module 1



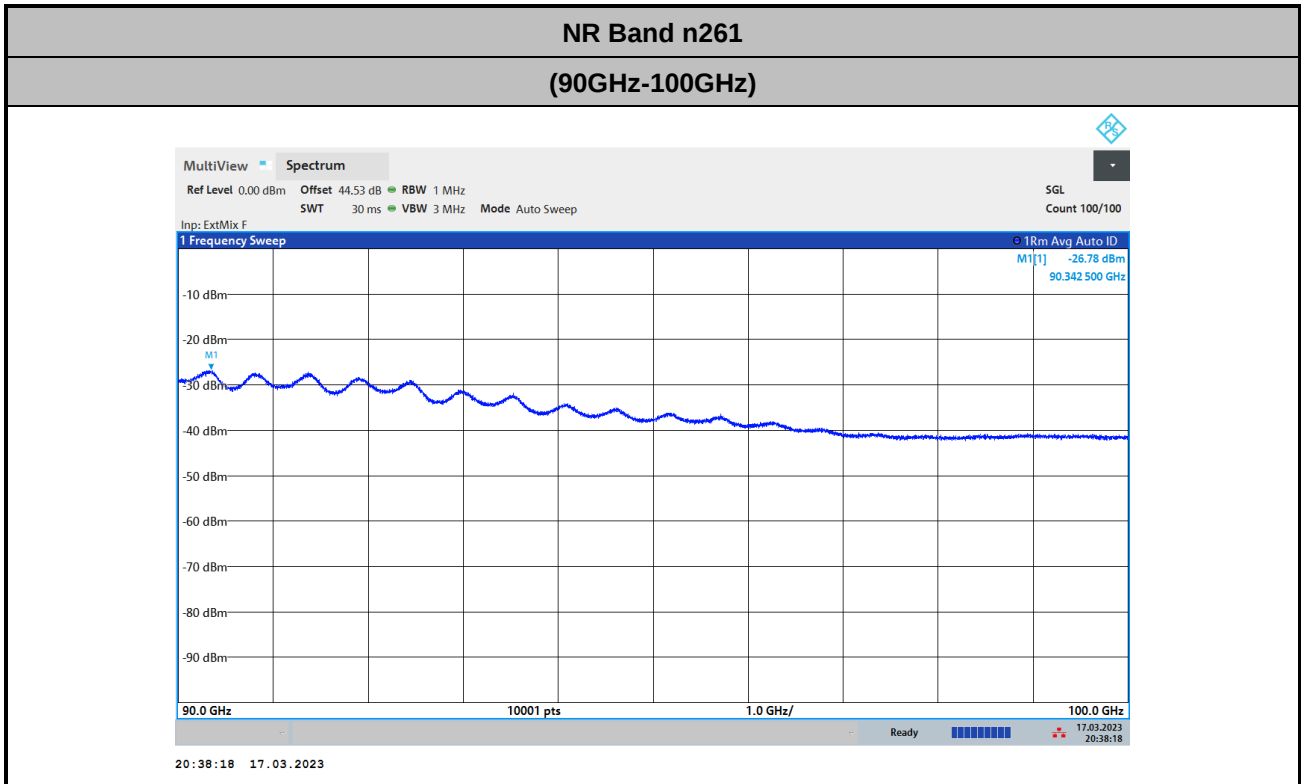
Remark: In band and out of band frequencies are omitted.



$$\begin{aligned} \text{Offset} &= \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8 \\ &= 43 + 0.43 + 107 + 20\log(1) - 104.8 = 45.63 \text{ (dB)} \end{aligned}$$



$$\begin{aligned} \text{Offset} &= \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8 \\ &= 46.9 + 0.43 + 107 + 20\log(1) - 104.8 = 49.53 \text{ (dB)} \end{aligned}$$



$$\begin{aligned} \text{Offset} &= \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8 \\ &= 47.92 + 0.43 + 107 + 20\log(0.5) - 104.8 = 44.53 \text{ (dB)} \end{aligned}$$

Frequency Stability

Test Conditions		NR Band n261 / Middle Channel			Limit
Temperature (°C)	Voltage (Volt)	CW tone			Note 2.
		Frequency (GHz)	Deviation (kHz)	Deviation (ppm)	Result
50	Normal Voltage	27.924989	11.000	0.394	PASS
40	Normal Voltage	27.924976	24.000	0.859	
30	Normal Voltage	27.924988	12.000	0.430	
20(Ref.)	Normal Voltage	27.925	0.000	0.000	
10	Normal Voltage	27.925009	-9.000	0.322	
0	Normal Voltage	27.9250599	-59.900	2.145	
-10	Normal Voltage	27.9251289	-128.900	4.616	
-20	Normal Voltage	27.9251618	-161.800	5.794	
-30	Normal Voltage	27.9252243	-224.300	8.032	
20	Maximum Voltage	27.924991	9.000	0.322	
20	Normal Voltage	27.924998	2.000	0.072	
20	Battery End Point	27.925001	-1.000	0.036	

Note:

1. Normal Voltage =3.85 V. ; Battery End Point (BEP) =3.4 V. ; Maximum Voltage =4.4 V.
2. The frequency fundamental emissions stay within the operation band.



Appendix B. R&S Mixer and Horn Antenna Calibration Reports

akkreditiert durch die / *accredited by the*

Deutsche Akkreditierungsstelle GmbH

als Kalibrierlaboratorium im / *as calibration laboratory in the*



Deutsche
Akkreditierungsstelle
D-K-15195-01-00

Deutschen Kalibrierdienst



Kalibrierschein

Calibration certificate

Kalibrierzeichen

Calibration mark

593876

D-K-
15195-01-00

2021-04

Gegenstand
Object **FS-Z60 HARMONIC MIXER 40-60GHZ**

Hersteller
Manufacturer **ROHDE & SCHWARZ**

Typ
Type **FS-Z60**

Fabrikat/Serien-Nr.
Serial number **100986**

Auftraggeber
Customer **Sporton International Inc.**

**6F., Sec. 1, Hsin Tai Wu Rd., No. 106
221 New Taipei City
TW**

Auftragsnummer
Order No. **311002157**

Anzahl der Seiten des Kalibrierscheines
Number of pages of the certificate **3 Certificate
5 Outgoing Results
5 Incoming Results**

Datum der Kalibrierung
Date of calibration **2021-04-09**

Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).

Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).

The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.

The user is obliged to have the object recalibrated at appropriate intervals.

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine sind bei Nennung des für die Freigabe Verantwortlichen in Klarschrift auch ohne Unterschrift gültig.

This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates with the full name of the approval responsible person are valid without signature.

Datum der Ausstellung
Date of issue

2021-04-09

Freigabe des Kalibrierscheins durch
Approval of the calibration certificate by

Dr. Gerhard Rösel

Leiter des Kalibrierlaboratoriums
Head of the calibration laboratory

Johannes Negele

Bearbeiter
Person in charge

Object FS-Z60 HARMONIC MIXER 40-60GHZ
Type FS-Z60 **Serial No.** 100986
Date 2021-04-09 **Material No.** 1048.0171.02
Page 2 / 3

593876
D-K- 15195-01-00
2021-04



Place of Calibration

87700 Memmingen, Rohde-und-Schwarz-Str. 1

Calibration Procedure

The measuring object is an RF harmonic mixer, which converts an RF signal at one frequency into a signal at another frequency (here: IF). The conversion loss was measured using a vector network analyzer. The RF output power as well as the IF input power of the corresponding ports of the VNA were traced back to a power sensor. The conversion loss is defined as the ratio of the power at the IF frequency to the power at the RF frequency with a given LO power. (IF: Intermediate frequency; LO: Local Oscillator)

The traceability is represented in the table Working Standards used.

Calibration Method See first page of Outgoing Results

Statement of Compliance

Incoming: All measured values are within the data sheet specifications.

Outgoing: All measured values are within the data sheet specifications.

Working Standards used

Item	Type	Serial Number	Calibration Certificate Number	Cal. Due
Therm.Power Sensor DC-40GHz	NRP-Z55	130179	585760 D-K-15195-01-00 2021-01	2023-01-31
Thermal Power Sensor	NRP67T	100977	515392 D-K-15195-01-01 2019-07	2022-07-31
Vect. Netw. Analyzer 4PORT	ZVA67	101175	0023 D-K-15195-01-00 2021-03	2022-03-31

Object FS-Z60 HARMONIC MIXER 40-60GHZ
Type FS-Z60 **Serial No.** 100986
Date 2021-04-09 **Material No.** 1048.0171.02
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593876
D-K- 15195-01-00
2021-04



Measurement Uncertainty

The expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$.

It was determined in accordance with EA-4/02 M:2013. The true value is located in the corresponding interval with a probability of 95 %.

Environmental Conditions

Ambient Temperature $(23 \pm 1) ^\circ\text{C}$ Relative Humidity 20%-60%

Ancillary Functional Measurements

In addition to the calibration results, the calibration certificate includes functional measurements that might have an influence on the measurement uncertainty of the calibration results. The functional measurement results are marked and are not intended to be used to support the further dissemination of metrological traceability. They are intended to verify the requirements on the measurement object according to manufacturer specifications and technical standards.

Comments on Measurement Results

The measurement results in the test report stated below have been tested for compliance with the given specifications and marked if necessary. The associated uncertainty of measurement has been taken into account. Measurement results that are not covered by the DAkkS accreditation are marked with ¹.

Ref.: ILAC G8:09/2019 'Guidelines on Decision Rules and Statements of Conformity'.

Outgoing Results

Designation:	HARMONIC MIXER
Type:	FS-Z60
Material No.:	1048.0171.02
Serial No.:	100986
Certificate No.:	593876 D-K-15195-01-00 2021-04
Referring to Test Documentation:	5038.8581.01-PB-02.00

Test Department:	3MME3
Name:	Johannes Negele
Date:	2021-04-09



Table of contents

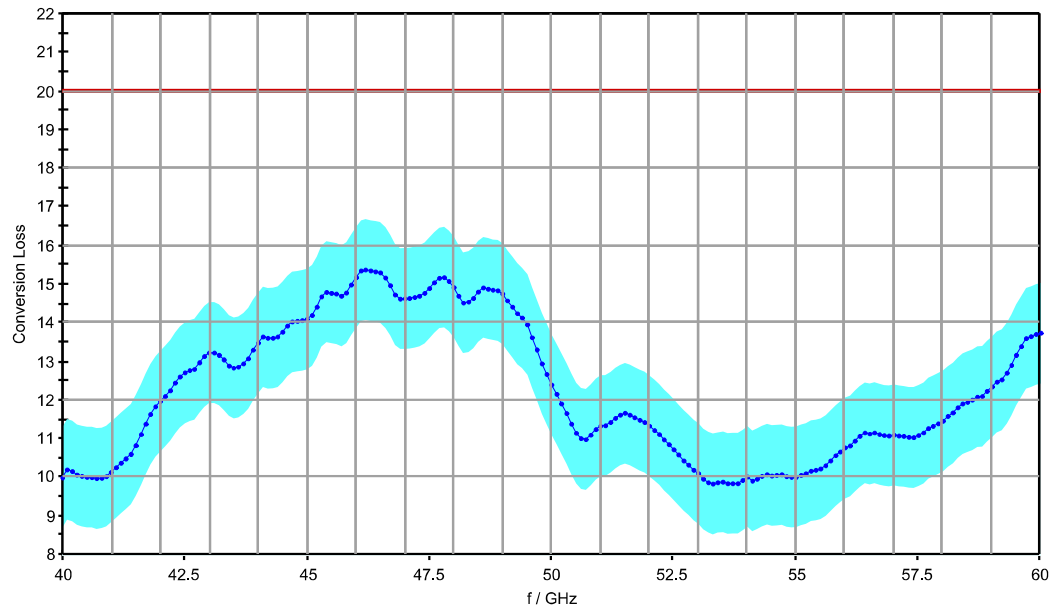
Software used for measurement	3
1. Conversion Loss (4. Harmonic)	4
1.1 Conversion Loss (IF = 404.4 MHz)	4
1.2 Conversion Loss (IF = 729 MHz)	4
1.3 Conversion Loss (IF = 1330 MHz)	5
1.4 Continuity response within 1 GHz	5

Software used for measurement			
Item	Type	Version	Remark
Suite	Setup	V12.10.02	Test Management Software G5
Test Program (7012.8706.00_)	Component	V01.05	

1. Conversion Loss (4. Harmonic)

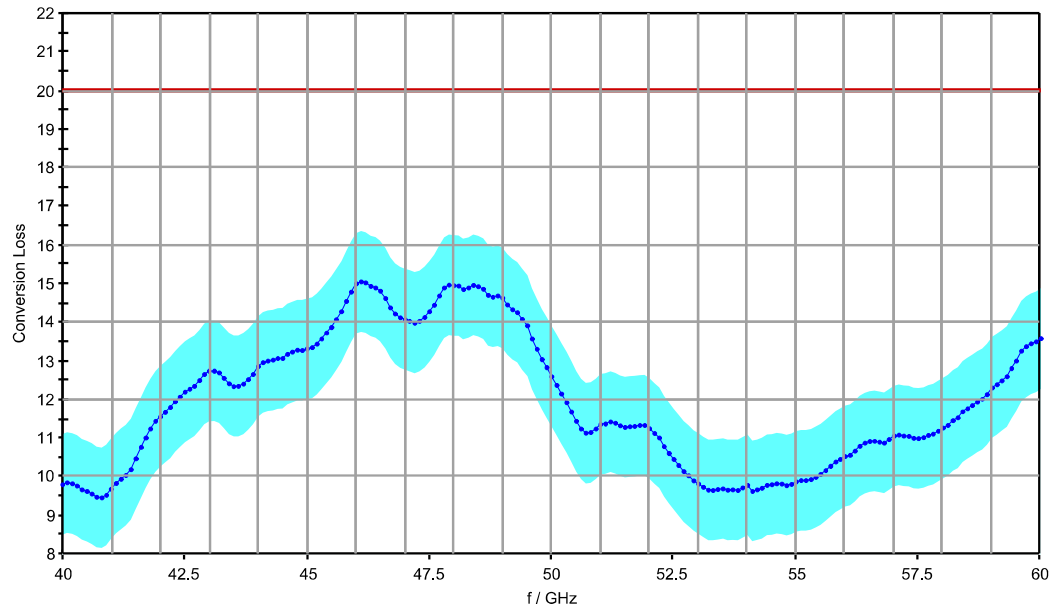
1.1 Conversion Loss (IF = 404.4 MHz)

IF = 404.4 MHz, 4. Harmonic



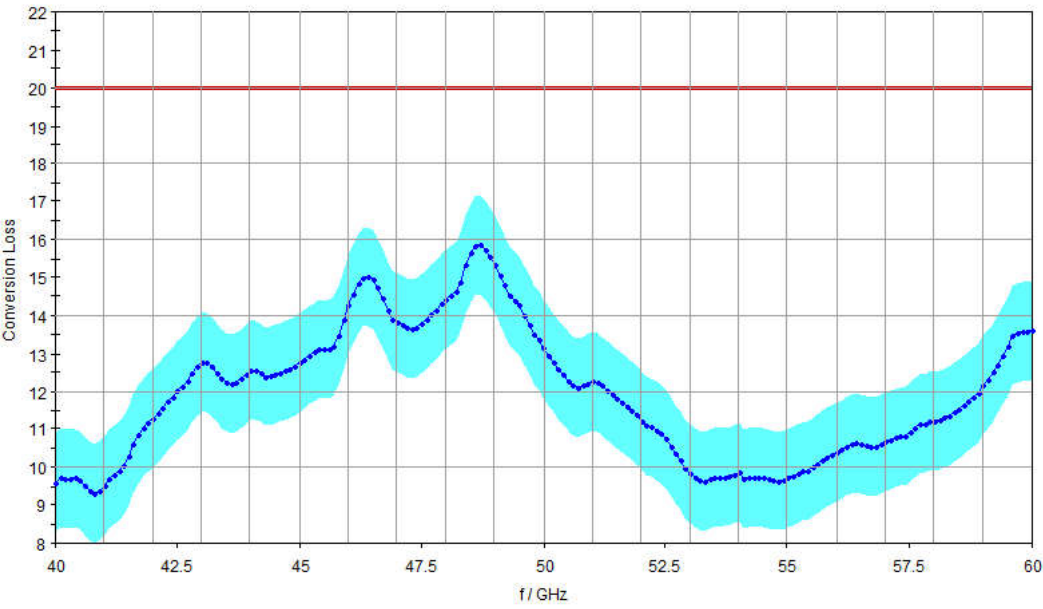
1.2 Conversion Loss (IF = 729 MHz)

IF = 729 MHz, 4. Harmonic



1.3 Conversion Loss (IF = 1330 MHz)

IF = 1330 MHz, 4. Harmonic



1.4 Continuity response within 1 GHz

Continuity response within any 1 GHz Band, 4. Harmonic

	DUL /dB	Continuity /dB
max. at IF = 404.4 MHz:	6.0	2.80
max. at IF = 729 MHz:	6.0	2.47
max. at IF = 1330 MHz:	6.0	2.22

Incoming Results

Designation:	HARMONIC MIXER
Type:	FS-Z60
Material No.:	1048.0171.02
Serial No.:	100986
Certificate No.:	593876 D-K-15195-01-00 2021-04
Referring to Test Documentation:	5038.8581.01-PB-02.00

Test Department:	3MME3
Name:	Johannes Negele
Date:	2021-04-09



Table of contents

Software used for measurement	3
1. Conversion Loss (4. Harmonic)	4
1.1 Conversion Loss (IF = 404.4 MHz)	4
1.2 Conversion Loss (IF = 729 MHz)	4
1.3 Conversion Loss (IF = 1330 MHz)	5
1.4 Continuity response within 1 GHz	5

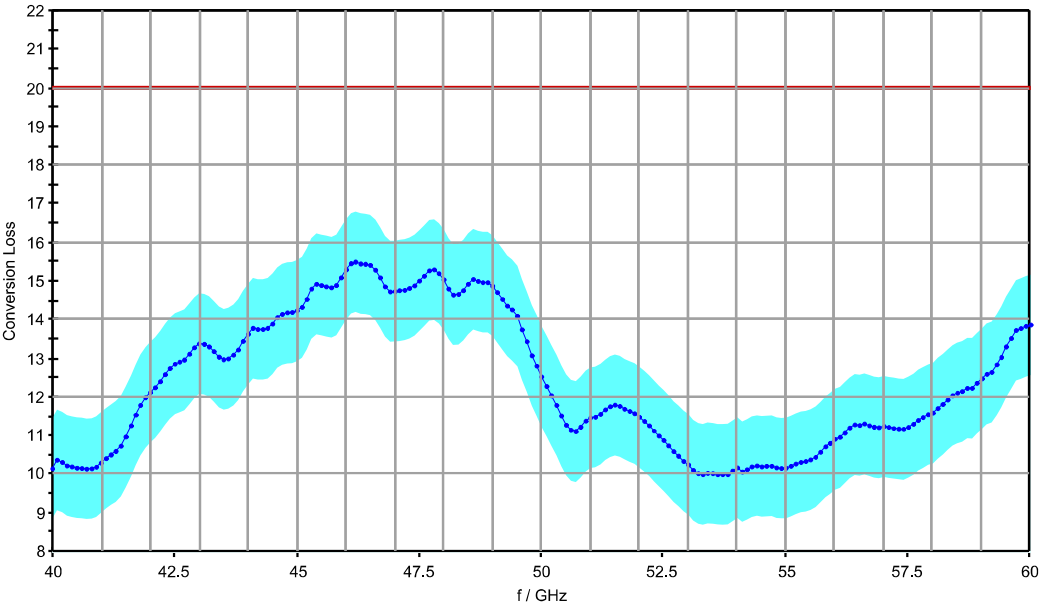
Incoming Results

Software used for measurement			
Item	Type	Version	Remark
Suite	Setup	V12.10.02	Test Management Software G5
Test Program (7012.8706.00_)	Component	V01.05	

1. Conversion Loss (4. Harmonic)

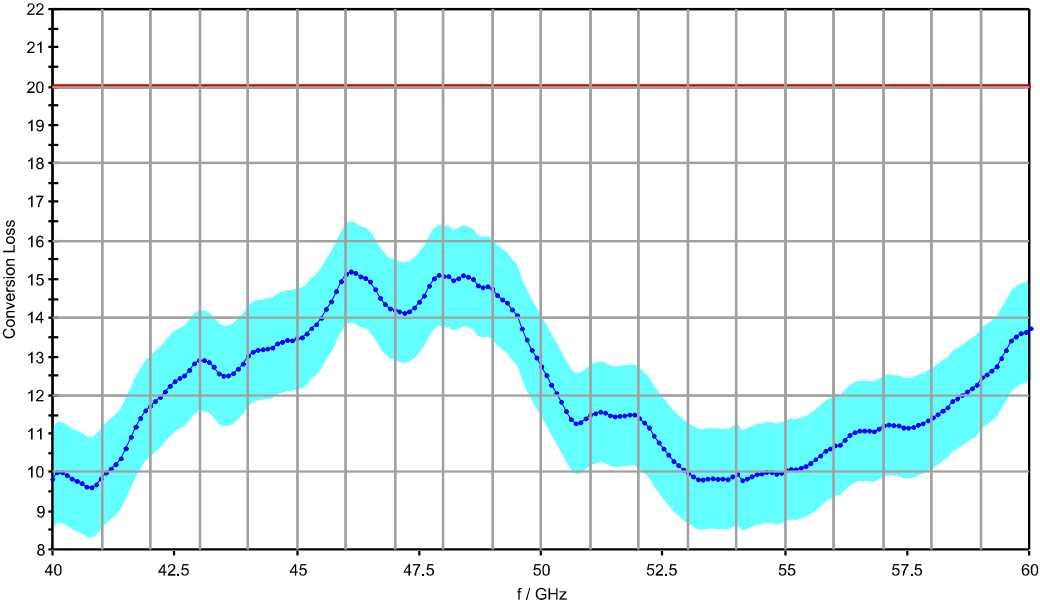
1.1 Conversion Loss (IF = 404.4 MHz)

IF = 404.4 MHz, 4. Harmonic



1.2 Conversion Loss (IF = 729 MHz)

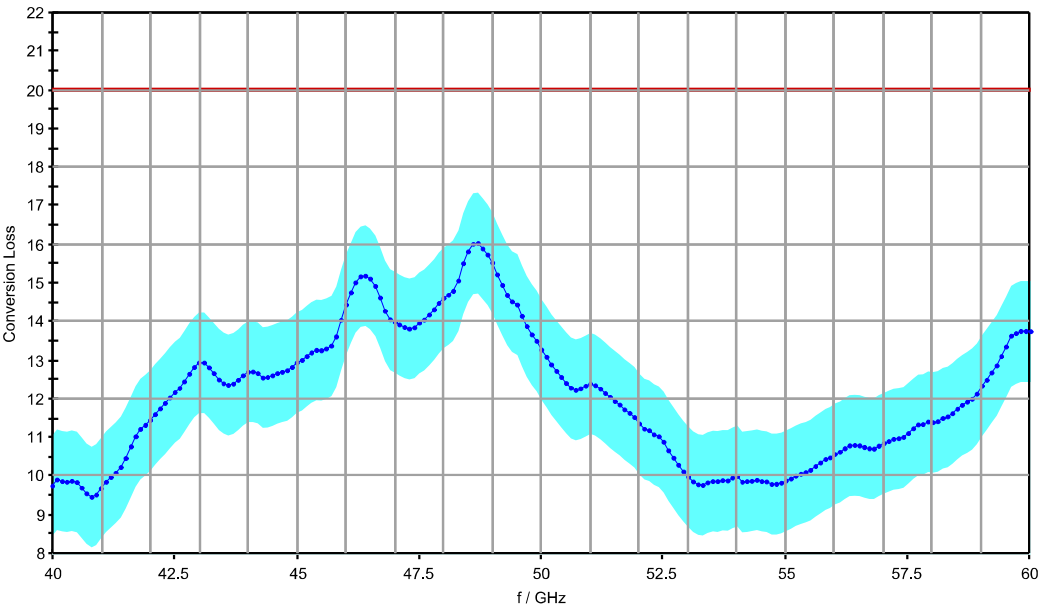
IF = 729 MHz, 4. Harmonic



Incoming Results

1.3 Conversion Loss (IF = 1330 MHz)

IF = 1330 MHz, 4. Harmonic



1.4 Continuity response within 1 GHz

Continuity response within any 1 GHz Band, 4. Harmonic

	DUL /dB	Continuity /dB
max. at IF = 404.4 MHz:	6.0	2.81
max. at IF = 729 MHz:	6.0	2.48
max. at IF = 1330 MHz:	6.0	2.24

Incoming Results