CERTIFICATION TEST REPORT

Report Number. : 13335182-E20V3

Applicant : APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A.

Model : A2342

FCC ID : BCG-E3548A

EUT Description : SMART PHONE

Test Standard : FCC 47 CFR PART 30 MOBILE TRANSMITTER (5G)

Date Of Issue:
September 26, 2020

Prepared by:
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NVLAP LAB CODE 200065-0 (FREMONT)

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	09/21/2020	Initial Issue	GP Chin
V2	09/23/2020	Section 8.3.3: Updated Plot	GP Chin
V3	09/26/2020	Section 6: Updated List	GP Chin

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014,U.S.A
EUT DESCRIPTION:	SMART PHONE
MODEL:	A2342
SERIAL NUMBERS:	G6TD404506PQ G6TD400B06PR
DATE TESTED:	AUGUST 14th – SEPTEMBER 21st, 2020

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 30 Mobile Transmitter (5G)	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Approved & Released For
UL Verification Services Inc. By:

GIA-PIAO (GP) CHIN
SENIOR TEST ENGINEER
UL Verification Services Inc.

Tested By:

STEVE AGUILAR
TEST ENGINEER
UL Verification Services Inc.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 30.
3. ANSI C63.26-2015
4. KDB 842590 D01 Upper Microwave Flexible Use Service v01r01
5. KDB 971168 D01 Power Meas. License Digital Systems v03r01

3. ACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Rd.
☐ Chamber A	☐ Chamber D	☐ Chamber I
☒ Chamber B - Below 18 GHz	☐ Chamber E	☐ Chamber J
☒ Chamber 1 - mmWave	☐ Chamber F	☐ Chamber K
☒ Chamber 2 - mmWave	☐ Chamber G	☐ Chamber L
☒ Chamber 3 - mmWave	☐ Chamber H	☐ Chamber M

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

Chambers 1, 2 and 3 are fully-anechoic chambers dedicated to make measurements to TRP limits from 18-40 GHz, and field strength, EIRP and TRP measurements at and above 40 GHz. The measurement antenna is nominally 1.5 m high in accordance with C63.10-2013, procedures developed by the C63 mmWave Joint Task Group for inclusion in the next editions of C63.10 and C63.26, and applicable FCC KDB documents. The absorber reflectivity fully supports chamber performance over this frequency range. The dimensions of the chambers are approximately 9 m L by 6 m W by 5.2 m H for chamber 1 and 6.8 m L by 3.7 m W by 3.1 m H for chambers 2 and 3.

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4. CALIBRATION AND UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

4.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U_{LAB}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB
Worst Case Radiated Disturbance >40000 MHz	2.85 dB
Temperature	±0.9 °C
Voltages	±0.45 %
Time	±0.02 %

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, 5G, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, NFC and WPT. All models support at least one UICC based SIM. The second SIM is either an UICC based p-SIM (physical SIM) or e-SIM (electronic SIM). The device supports a built-in inductive charging transmitter and receiver. The rechargeable battery is not user accessible.

This test report addresses the 5G NR operational mode on n260 and n261 bands.

Two FR2 RFIC Chipset + Antennas sets are used. Both Chipsets are identical.
Chipset 1 can transmit on antenna M1 or antenna M0. Chipset 2 transmits on antenna M2 only.

Manufacturer declares that antenna M0 transmits approximately 15-16 dB lower power than antenna M1, therefore antenna M1 was used for full measurements on Chipset 1 in this report. Spot-checks on transmit power of antenna M0 were performed with selected modes. Measurements on Chipset 2 were performed with antenna M2 active.

Manufacturer provided the Beam ID settings that yield the highest EIRP for each antenna by the EIRP Simulation tool. These Beam ID settings were used for all tests. All tests were performed in a non-signaling, stand-alone mode of operation.

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5.2. SOFTWARE AND FIRMWARE

EUT Firmware versions:

WiFi: 20_10_619_14
BT: 18.1.148.558
Cell: 0.28.03-1

5.3. WORST CASE ORIENTATION

For all 5G NR FR2 Bands, the worst-case scenario for all measurements is based on the EIRP measurement investigation results, comparing to TRP limit to demonstrate compliance. EIRPs were measured on BPSK, QPSK, 16QAM and 64QAM modulations. It was found that QPSK results were worst case.

The fundamental and radiated spurious emission were investigated in three orthogonal orientations X (landscape) , Y (portrait), Z (flatbed) and Roll, where is applicable. The final optimum position resulting in the highest EIRP for the frequency or band under investigation is placed on an open air fixture allowing no blockage of the signal as measured by the receiving antenna.

5.4. BEAM ID

In all tests, the following Beam ID settings of each antenna were applied for final measurements.

n260 - Peak BID		
Antenna	**BID**	**Paired with**
M0	11	139
M1	24	152
M2	35	163

n261 - Peak BID		
Antenna	**BID**	**Paired with**
M0	17	145
M1	32	160
M2	27	155

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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
LAPTOP + Adapter	Apple	MacBook Pro	HRP046790
Kanzi-USB Adapter	Apple	---	325191
LAPTOP + Adapter	Apple	MacBook Pro	C02VJ0ZZHV2P
Kanzi-USB Adapter	Apple	---	325B8C
LAPTOP + Adapter	Apple	MacBook Pro	C2QP600QG974
Kanzi-USB Adapter	Apple	---	32535E
USB Power Adapter	Apple	A1357	--
LAPTOP + Adapter	Apple	MacBook Pro	HRP046790

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	2	USB Micro	Shielded	0.9 – 2.0	--
2	Data	1	--	Shielded	0.8	--
3	Data	1	--	Shielded	0.06	--
4	DC Power	1	Clip leads	Un-shielded	1.0	--
5	AC Line	1	3-prong	Un-shielded	1.0	--

TEST SETUP

All testing was performed using FTM (Factory Test Mode) software at continuous Tx operation. When implemented out in the field, the EUT will operate with a maximum uplink configuration (i.e., a maximum uplink duty cycle of 100%).

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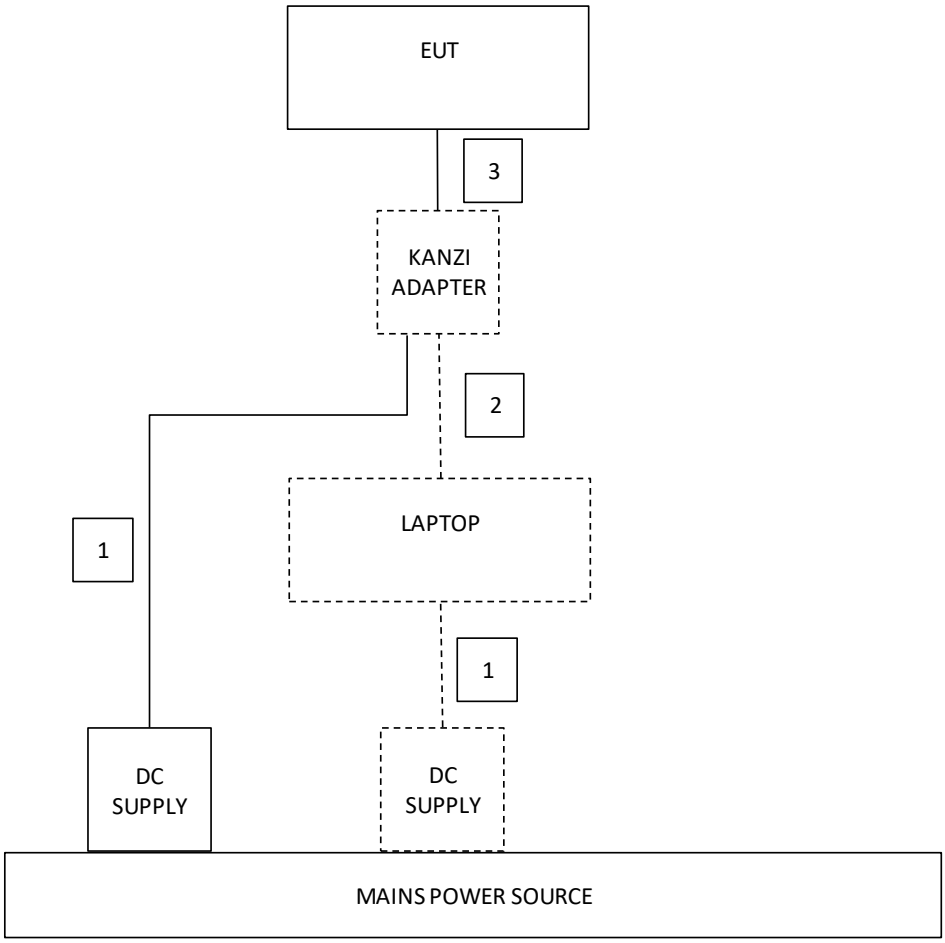
SETUP DIAGRAM FOR TESTS

RF TESTS



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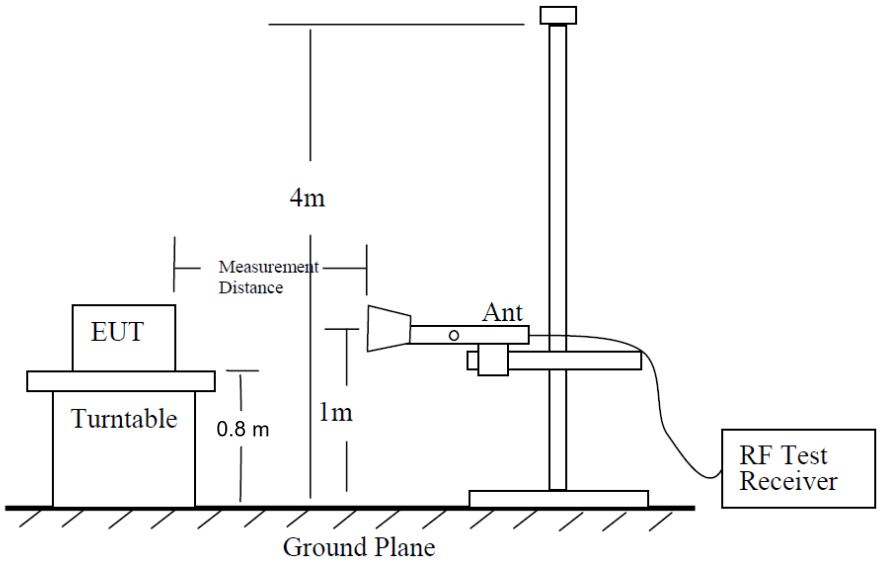
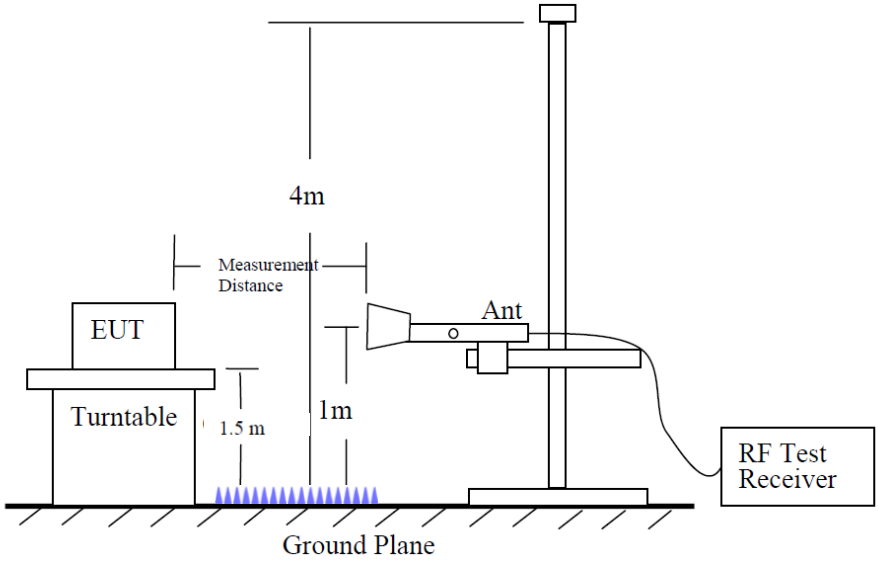
TEST SITE DIAGRAM – Below 1 GHz



TEST SITE DIAGRAM – 1-18 GHz



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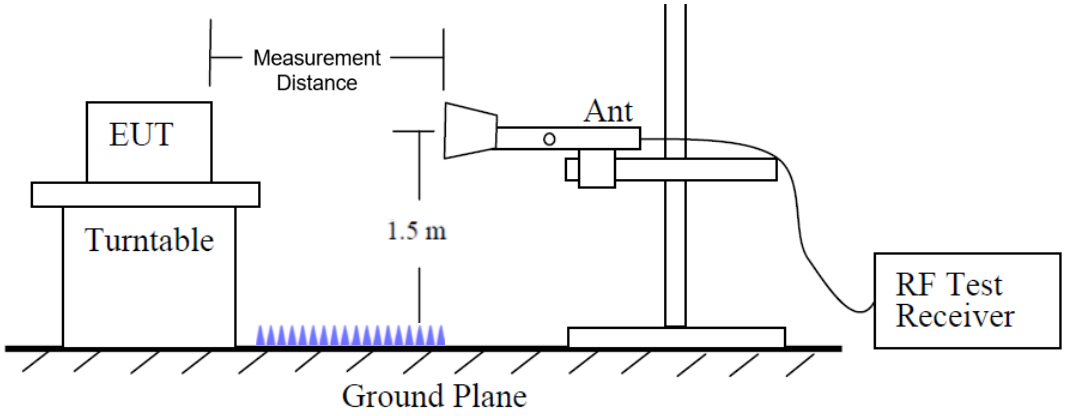
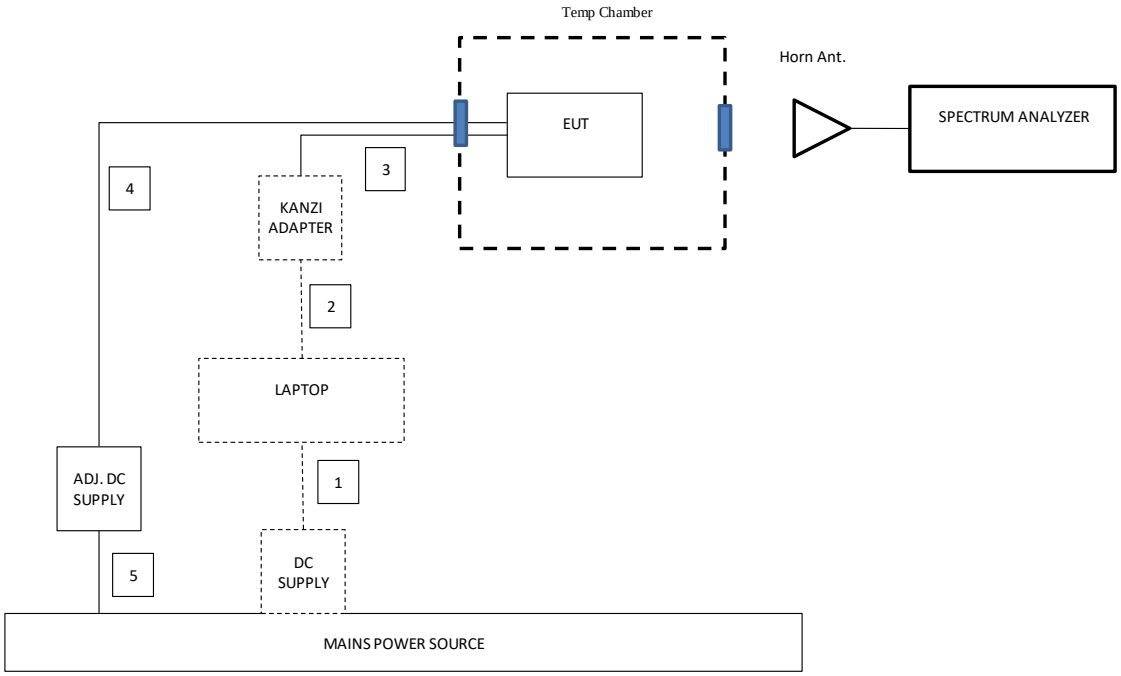
TEST SITE DIAGRAM – Above 18 GHz & mmWave



FREQUENCY STABILITY



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FAR-FIELD DISTANCE AND MEASUREMENT DISTANCE

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable.

The measurement distance is in the far field per formula $2D^2/\lambda$ where D is the larger dimension of the antenna. For fundamental or band edge emissions, the largest far-field distance of either the EUT antenna or measurement antenna shall be used. For above 18 GHz spurious emissions, the far-field distance will be based on the measured antenna. In this case, the measurement antenna has the largest far-field distance. The EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest EIRP reading on the receive spectrum analyzer.

Frequency Range (GHz)	Wavelength (m)	Far Field Distance (m)	Measurement Distance Used (m)
18-26.5	0.0113	3.39	3.50
26.5-40	0.0075	2.67	3.00
40-50	0.0060	1.61	3.00
50-75	0.0040	1.05	1.50
75-110	0.0027	0.70	1.00
110-170	0.0018	0.02	1.00
170-200	0.0015	0.33	0.50

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst case polarization/positioning.

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6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List					
Description	**Manufacturer**	**Model**	**Local ID**	**Last Cal**	**Cal Due**
Spectrum Analyzer, PXA, 3Hz to 50GHz w/Ext. Mixer	Keysight	N9030A	MY52350427	1/23/2020	1/23/2021
Spectrum Analyzer, PXA, 3Hz to 50GHz w/Ext. Mixer	Keysight	N9030A	PRE0213097	6/29/2020	6/29/2021
EMI Test Receiver	Rohde & Schwarz	FSW50	PRE0211337	4/30/2020	4/30/2021
EMI Test Receiver	Rohde & Schwarz	FSW50	PRE0211887	5/12/2020	5/12/2021
EMI Test Receiver	Rohde & Schwarz	ESW44	PRE0203385	2/22/2020	2/22/2021
Antenna, Horn 18-26.5 GHz	ARA	MWH-1826/B	PRE0079151	11/7/2019	11/7/2020
Antenna, Horn 26.5-40 GHz	ARA	MWH-2640/B	PRE0079317	11/7/2019	11/7/2020
Antenna, Horn 18-26.5 GHz	ARA	MWH-1826/B	PRE0182199	4/27/2019	4/27/2021
Antenna, Horn 26.5-40 GHz	ARA	MWH-2640/B	PRE0182202	5/27/2020	5/27/2021
Antenna, Horn 18-26.5 GHz	ARA	MWH-1826/B	PRE0213446	6/19/2020	6/19/2021
Antenna, Horn 26.5-40 GHz	ARA	MWH-2640/B	PRE0212449	6/25/2020	6/25/2021
Antenna, Horn 18-26.5 GHz	ARA	MWH-1826/B	PRE0212447	6/25/2020	6/25/2021
Antenna, Horn 26.5-40 GHz	ARA	MWH-2640/B	PRE0212448	6/19/2020	6/19/2021
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	PRE0077927	1/22/2020	1/22/2021
Antenna, Double Ridge Guide Horn Antenna 700MHz to 18GHz	A.H. Systems, Inc.	SAS-571	PRE0078352	1/25/2020	1/25/2021
Amplifier, 9KHz to 1GHz, 32dB	Sonoma Instruments	310	PRE0180176	7/14/2020	7/14/2021
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	PRE0077974	5/20/2020	5/20/2021
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25-S-42	PRE0078089	5/11/2020	5/11/2021
Environmental Chamber	Thermotron Industries	SE-600-10-10	PRE0079138	11/20/2020	11/20/2021
Digital Multimeter	Fluke	87V	PRE0073921	1/22/2020	1/22/2021
50V/3A Adj. DC Power Supply	Rigol	DP712	T1746	CNR	CNR
Horn antenna, 33-50 GHz	CMI	HO22R	--	9/13/2019	9/13/2020*
LNA, 40-50 GHz	Spacek Labs	SL4510-33-4W	14J05	9/24/2019	9/24/2020
Filter Low Pass	Spacek Labs	LPF5-50-8-22	T1099	9/24/2019	9/24/2020
50-75 GHz Horn	CMI	HO15R	H15-2	9/13/2019	9/13/2020*
LNA, 50-75 GHz	Vivatech	VTLNA-15-6018-FB	2013051	9/19/2019	9/19/2020*
50-75 GHz Downconverter	VDI	WR15.0SAX	PRE0212243	6/2/2020	6/2/2021
75-110 GHz Horn	CMI	HO10R	H10-1	9/13/2019	9/13/2020*
LNA, 75-110 GHz	Spacek	SLW-22-5	15J04	9/20/2020	9/20/2020*
75-110 GHz Downconverter	VDI	WR10.0SAX	PRE0212453	6/3/2020	6/3/2021
110-170 GHz Horn	CMI	HO6R	H06-1	9/13/2019	9/13/2020*
LNA 110-170 GHz	VivaTech	VTLNA-01S01	2015085	9/23/2019	9/23/2020
110-170 GHz Downconverter	VDI	WR6.5SAX	PRE0209972	4/7/2020	4/7/2021
170-260 GHz Horn	CMI	HO4R	H04-1	9/13/2019	9/13/2020*
170-260 GHz Downconverter	VDI	WR4.3SAX	PRE0212241	5/22/2020	5/22/2021
UL EMC Radiated Software	Version	Rev 9.5.07 Jul 2020			

*Test data presented in the report was captured with equipment covered within the one year calibration period.

All horn antennas at and above the 33-50 GHz band are standard gain horns. In accordance with ANSI C63.10 clause 4.4.3 (a) Standard gain horns need not be periodically recalibrated, unless damage or deterioration is suspected or known to have occurred. If a standard gain horn is not periodically recalibrated, then its critical dimensions (see IEEE Std 1309-2005) shall be verified and documented on an annual basis.

UL measures the critical dimensions on an annual basis and checks for damage and deterioration before each test.

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7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Bandwidth	N/A	Radiated	Compliant
2.1046 30.202	Equivalent Isotropic Radiated Power (EIRP)	+43 dBm	Radiated	Compliant
2.1051 30.203	Out-of-Band Emissions at the Band Edge	-13 dBm/MHz for All out-of-band emissions. -5 dBm/MHz from the band edge up to 10% of the channel BW	Radiated	Compliant
2.1051 30.203	Spurious Emissions	-13 dBm/MHz for all out-of-band emissions	Radiated	Compliant
2.1055	Frequency Stability	N/A	Radiated	Compliant

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8. APPLICABLE LIMITS AND TEST RESULTS

8.1. OCCUPIED BANDWITH

RULE PART

FCC: §2.1049

LIMIT

For reporting purposes only

TEST PROCEDURES

99% bandwidth measurement function of the signal analyzer was used to measure 99% occupied.

- RBW = 1 – 5% of OBW
- VBW ≥ 3 x RBW
- Detector = Peak
- Trace mode = max hold
- Sweep = auto couple
- The trace was allowed to stabilize

KDB 842590 D01 Upper Microwave Flexible Use Service v01 Section 4.3
ANSI C63.26-2015 Clause 5.4.3.

Theoretically, SISO and SISO-Dual configurations yield the same occupied bandwidth and the preliminary bandwidth tests on SISO and SISO-Dual indicated that both configurations yields similar radiated occupied bandwidth. Therefore, all modulations were investigated in SISO-Dual and MIMO to determine worst case configuration. All modes of operations were investigation and results are reported in this section.

RESULTS

See the following pages.

TESTED BY:

Employee IDs: 19296 & 24160, n261 band, Chamber 2
Employee IDs: 19470 & 19437, n260 band, Chamber 3

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8.1.1. OCCUPIED BANDWIDTH n260

RESULTS

n260 ANT M1, Full-RB

Control System	Modulation	Channel	Bandwidth	CCs Active	OBW (MHz)
SISO-DUAL	BPSK	Mid	50	1	46.23
MIMO	BPSK	Mid	100	1	91.86
SISO-DUAL	BPSK	Mid	50	2	95.05
MIMO	BPSK	Mid	100	2	191.18
SISO-DUAL	QPSK	Low	50	1	47.24
SISO-DUAL	QPSK	Mid	50	1	46.23
SISO-DUAL	QPSK	High	50	1	44.97
MIMO	QPSK	Mid	50	1	45.40
SISO-DUAL	QPSK	Low	100	1	91.61
SISO-DUAL	QPSK	Mid	100	1	94.32
SISO-DUAL	QPSK	High	100	1	94.48
MIMO	QPSK	Mid	100	1	91.19
SISO-DUAL	QPSK	Mid	50	2	95.48
MIMO	QPSK	Mid	50	2	95.64
SISO-DUAL	QPSK	Mid	100	2	189.40
MIMO	QPSK	Mid	100	2	192.42
SISO-DUAL	16QAM	Mid	50	1	46.93
MIMO	16QAM	Mid	100	1	91.62
SISO-DUAL	16QAM	Mid	50	2	95.14
MIMO	16QAM	Mid	100	2	191.60
SISO-DUAL	64QAM	Mid	50	1	45.34
MIMO	64QAM	Mid	100	1	92.02
SISO-DUAL	64QAM	Mid	50	2	95.18
MIMO	64QAM	Mid	100	2	193.00

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n260 ANT M2, Full-RB

Control System	Modulation	Channel	Bandwidth	CCs Active	OBW (MHz)
SISO-DUAL	BPSK	Mid	50	1	46.46
MIMO	BPSK	Mid	100	1	93.91
SISO-DUAL	BPSK	Mid	50	2	95.88
MIMO	BPSK	Mid	100	2	192.48
SISO-DUAL	QPSK	Low	50	1	45.44
SISO-DUAL	QPSK	Mid	50	1	46.28
SISO-DUAL	QPSK	High	50	1	46.63
MIMO	QPSK	Mid	50	1	45.19
SISO-DUAL	QPSK	Low	100	1	92.00
SISO-DUAL	QPSK	Mid	100	1	91.16
SISO-DUAL	QPSK	High	100	1	91.58
MIMO	QPSK	Mid	100	1	94.01
SISO-DUAL	QPSK	Mid	50	2	95.27
MIMO	QPSK	Mid	50	2	96.26
SISO-DUAL	QPSK	Mid	100	2	188.86
MIMO	QPSK	Mid	100	2	192.17
SISO-DUAL	16QAM	Mid	50	1	47.22
MIMO	16QAM	Mid	100	1	93.76
SISO-DUAL	16QAM	Mid	50	2	95.26
MIMO	16QAM	Mid	100	2	192.89
SISO-DUAL	64QAM	Mid	50	1	45.32
MIMO	64QAM	Mid	100	1	94.48
SISO-DUAL	64QAM	Mid	50	2	95.81
MIMO	64QAM	Mid	100	2	195.92

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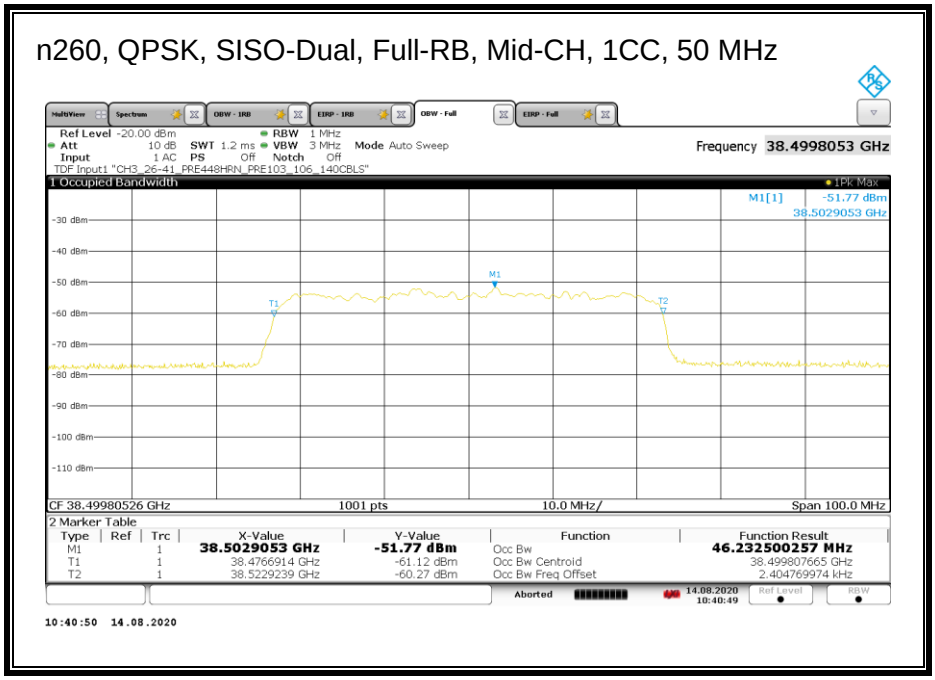
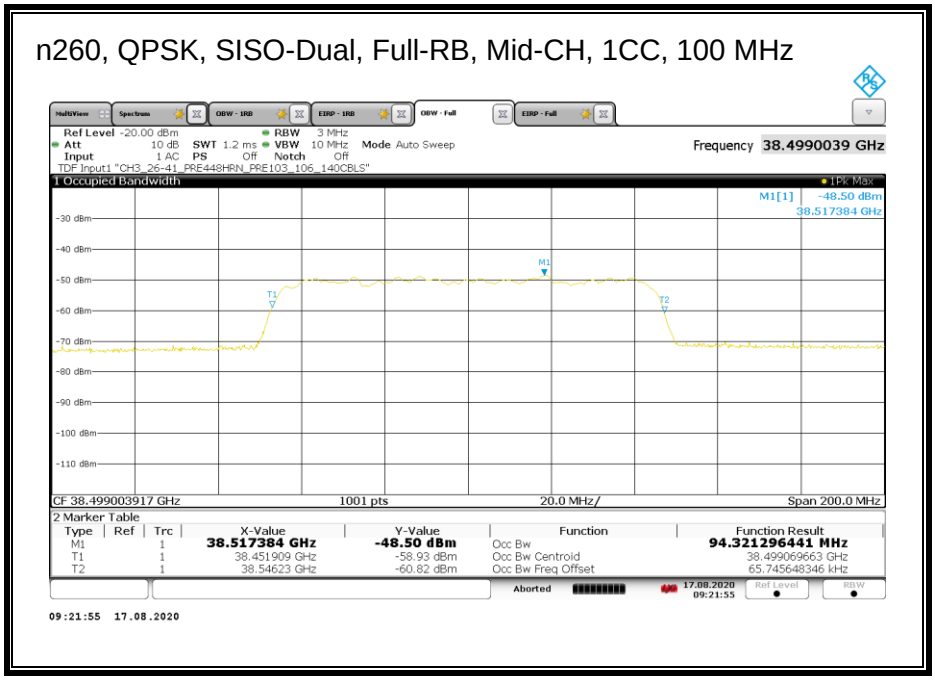
ANT M1





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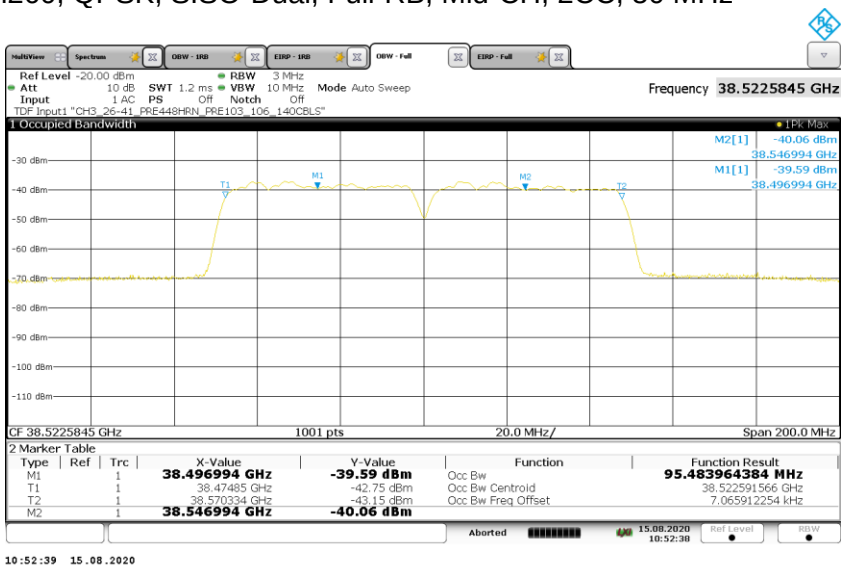
ANT M1

n260, QPSK, SISO-Dual, Full-RB, Mid-CH, 2CC, 50 MHz



n260, QPSK, SISO-Dual, Full-RB, Mid-CH, 2CC, 100 MHz

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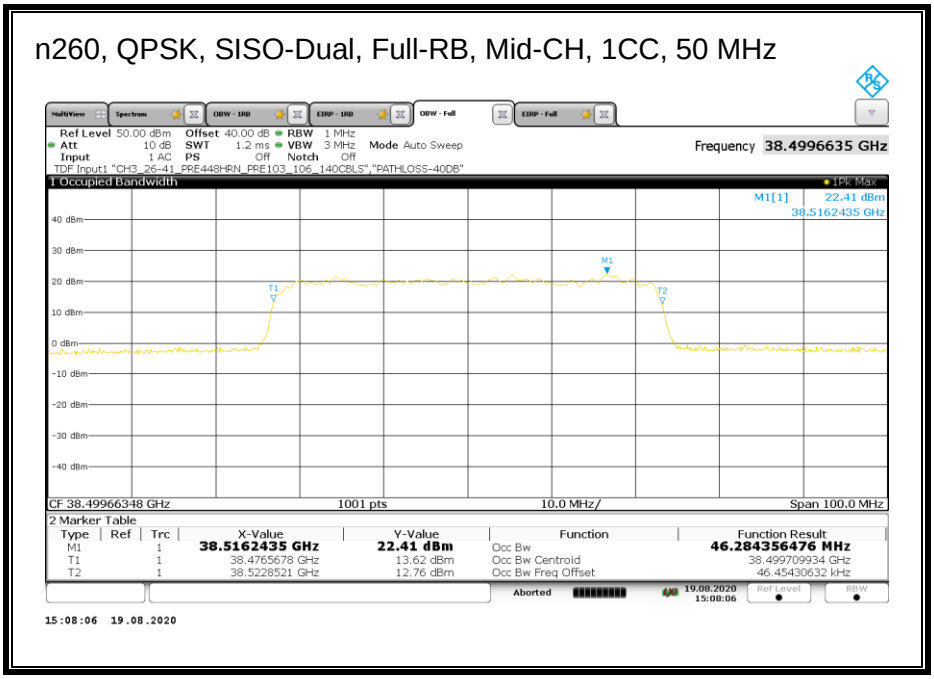
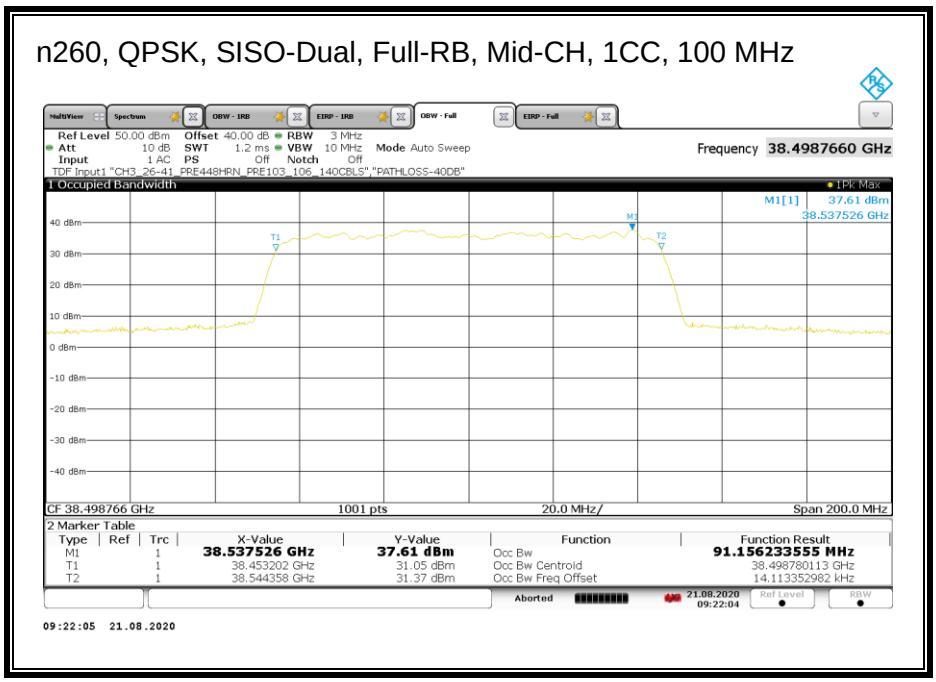
ANT M2





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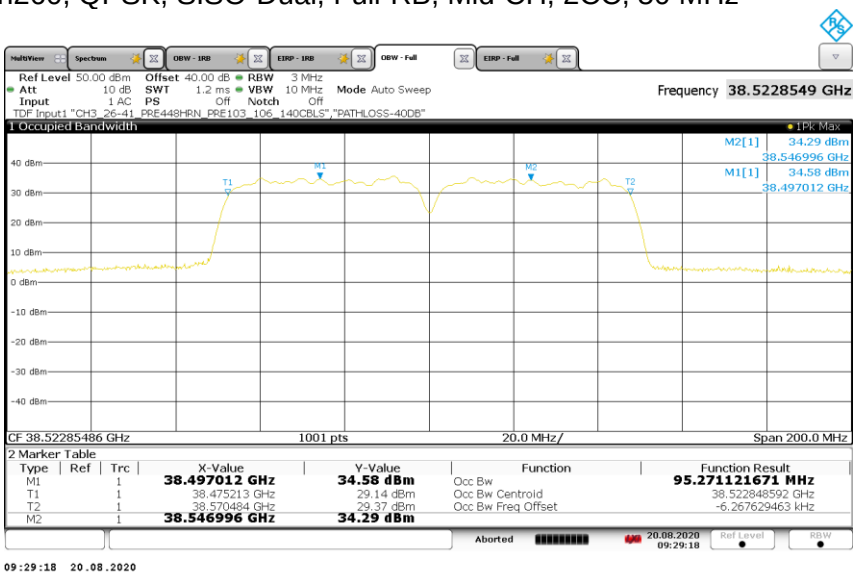
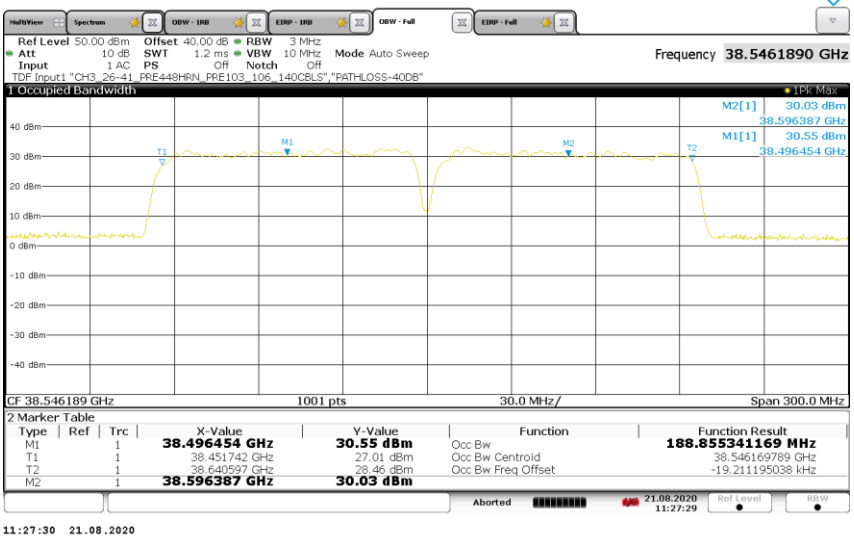
ANT M2

n260, QPSK, SISO-Dual, Full-RB, Mid-CH, 2CC, 50 MHz



n260, QPSK, SISO-Dual, Full-RB, Mid-CH, 2CC, 100 MHz



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8.1.2. OCCUPIED BANDWIDTH n261

RESULTS

n261 ANT M1, Full-RB

Control System	Modulation	Channel	Bandwidth	CCs Active	OBW (MHz)
SISO-DUAL	BPSK	Mid	50	1	45.56
MIMO	BPSK	Mid	100	1	93.30
SISO-DUAL	BPSK	Mid	50	2	98.48
MIMO	BPSK	Mid	100	2	191.61
SISO-DUAL	QPSK	Low	50	1	45.72
SISO-DUAL	QPSK	Mid	50	1	45.43
SISO-DUAL	QPSK	High	50	1	45.48
MIMO	QPSK	Mid	50	1	46.46
SISO-DUAL	QPSK	Low	100	1	92.15
SISO-DUAL	QPSK	Mid	100	1	92.36
SISO-DUAL	QPSK	High	100	1	91.73
MIMO	QPSK	Mid	100	1	93.65
SISO-DUAL	QPSK	Mid	50	2	98.25
MIMO	QPSK	Mid	50	2	95.26
SISO-DUAL	QPSK	Mid	100	2	191.31
MIMO	QPSK	Mid	100	2	191.63
SISO-DUAL	16QAM	Mid	50	1	45.84
MIMO	16QAM	Mid	100	1	93.19
SISO-DUAL	16QAM	Mid	50	2	98.66
MIMO	16QAM	Mid	100	2	191.85
SISO-DUAL	64QAM	Mid	50	1	46.01
MIMO	64QAM	Mid	100	1	93.92
SISO-DUAL	64QAM	Mid	50	2	95.28
MIMO	64QAM	Mid	100	2	191.62

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n261 ANT M2, Full-RB

Control System	Modulation	Channel	Bandwidth	CCs Active	OBW (MHz)
SISO-DUAL	BPSK	Mid	50	1	45.42
MIMO	BPSK	Mid	100	1	93.65
SISO-DUAL	BPSK	Mid	50	2	95.60
MIMO	BPSK	Mid	100	2	191.60
SISO-DUAL	QPSK	Low	50	1	45.36
SISO-DUAL	QPSK	Mid	50	1	45.52
SISO-DUAL	QPSK	High	50	1	45.56
MIMO	QPSK	Mid	50	1	45.33
SISO-DUAL	QPSK	Low	100	1	91.68
SISO-DUAL	QPSK	Mid	100	1	92.02
SISO-DUAL	QPSK	High	100	1	91.66
MIMO	QPSK	Mid	100	1	93.33
SISO-DUAL	QPSK	Mid	50	2	97.79
MIMO	QPSK	Mid	50	2	95.51
SISO-DUAL	QPSK	Mid	100	2	191.02
MIMO	QPSK	Mid	100	2	191.12
SISO-DUAL	16QAM	Mid	50	1	45.47
MIMO	16QAM	Mid	100	1	93.27
SISO-DUAL	16QAM	Mid	50	2	95.18
MIMO	16QAM	Mid	100	2	191.47
SISO-DUAL	64QAM	Mid	50	1	46.00
MIMO	64QAM	Mid	100	1	93.77
SISO-DUAL	64QAM	Mid	50	2	95.13
MIMO	64QAM	Mid	100	2	191.97

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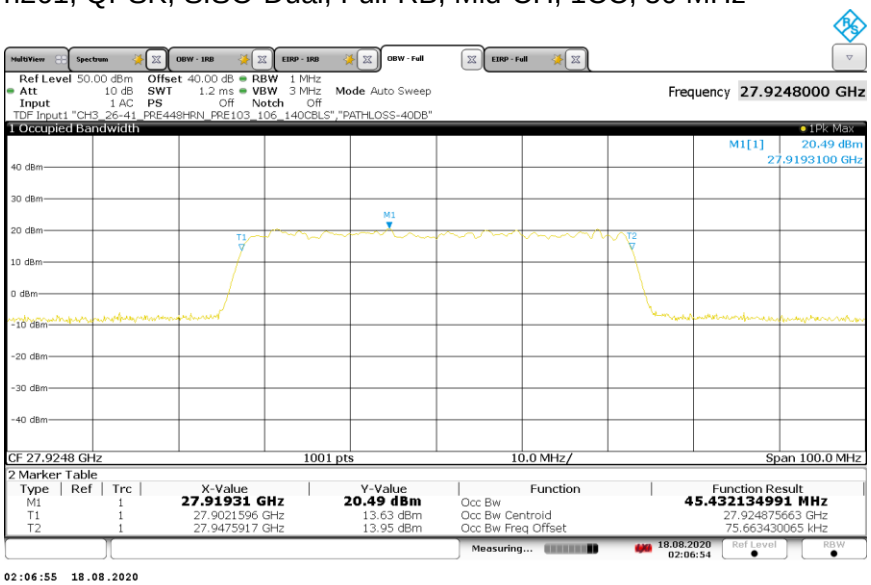
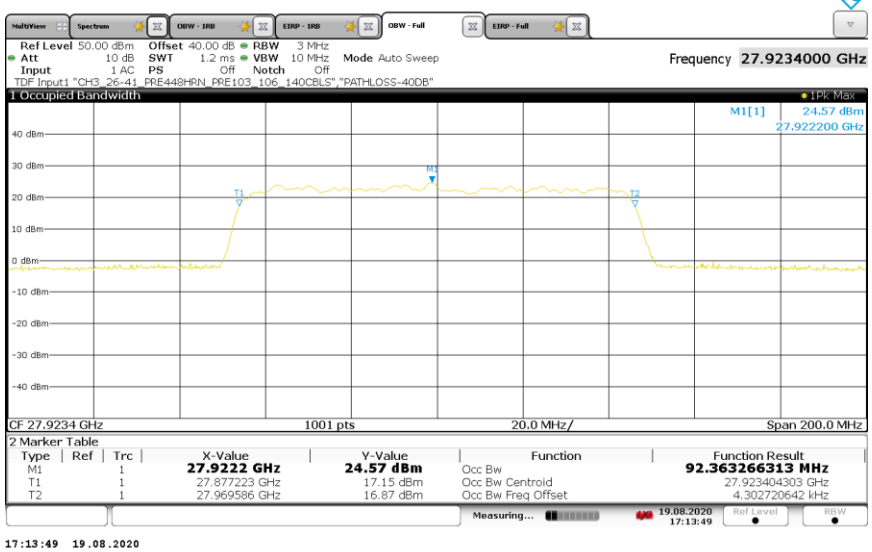
ANT M1

n261, QPSK, SISO-Dual, Full-RB, Mid-CH, 1CC, 50 MHz



n261, QPSK, SISO-Dual, Full-RB, Mid-CH, 1CC, 100 MHz



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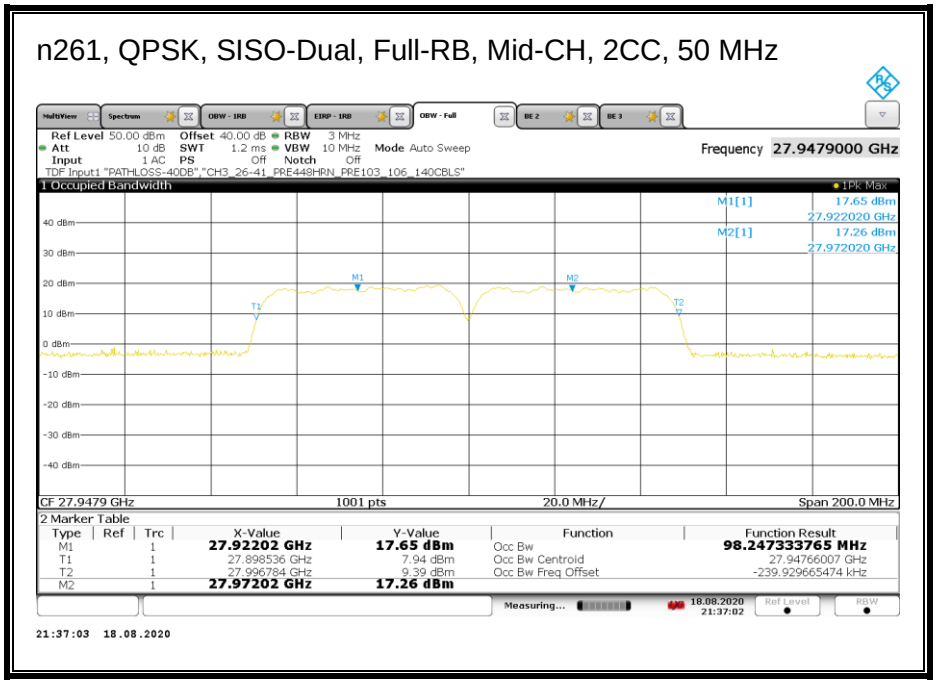
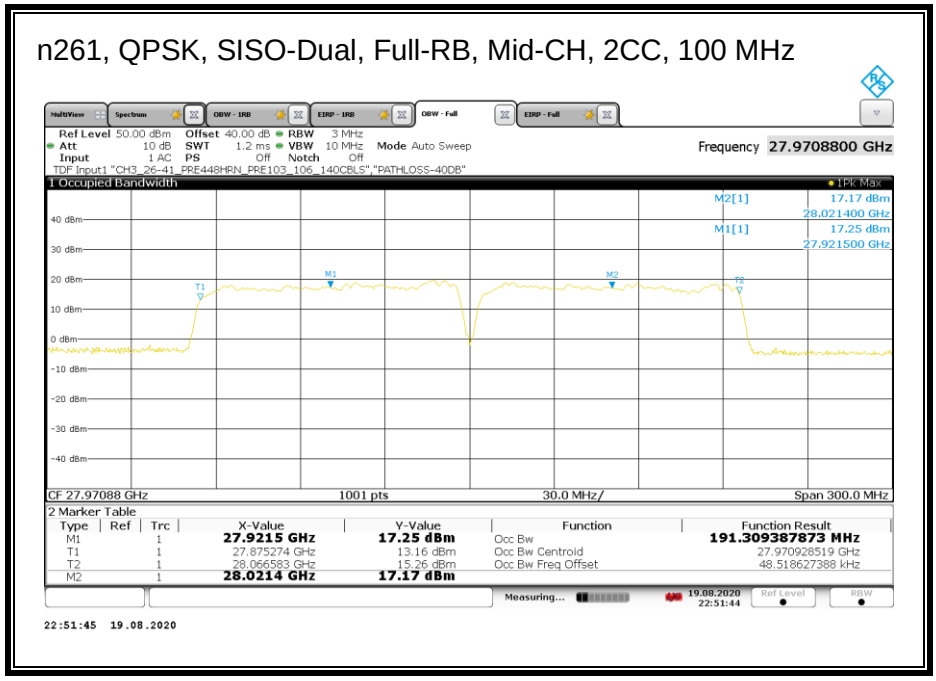
ANT M1





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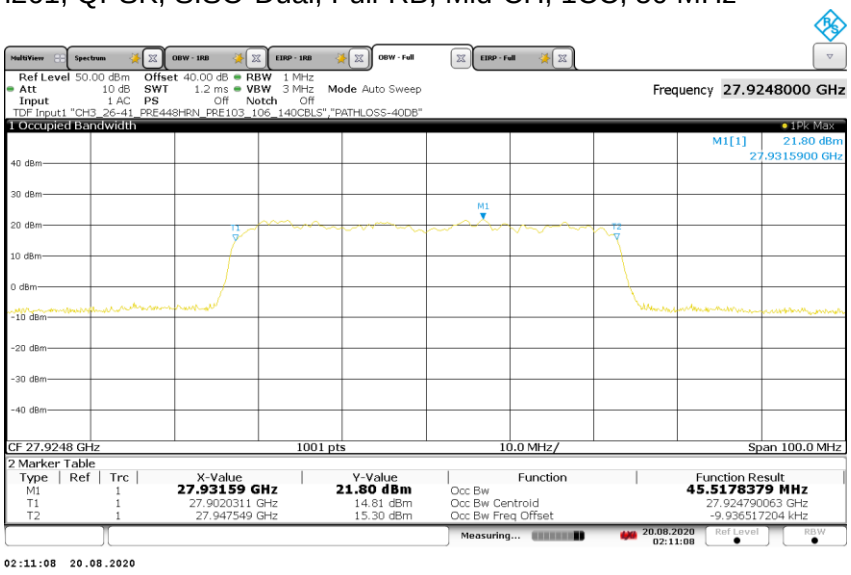
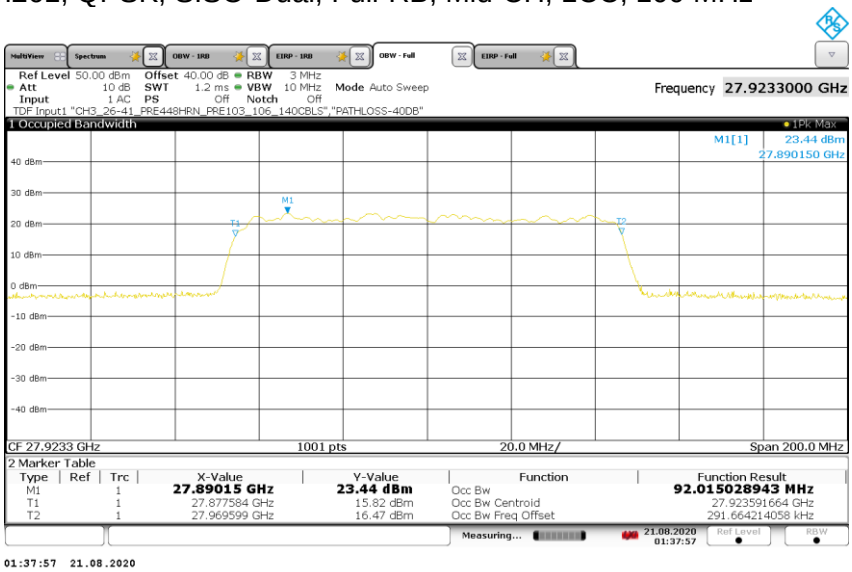
ANT M2

n261, QPSK, SISO-Dual, Full-RB, Mid-CH, 1CC, 50 MHz



n261, QPSK, SISO-Dual, Full-RB, Mid-CH, 1CC, 100 MHz



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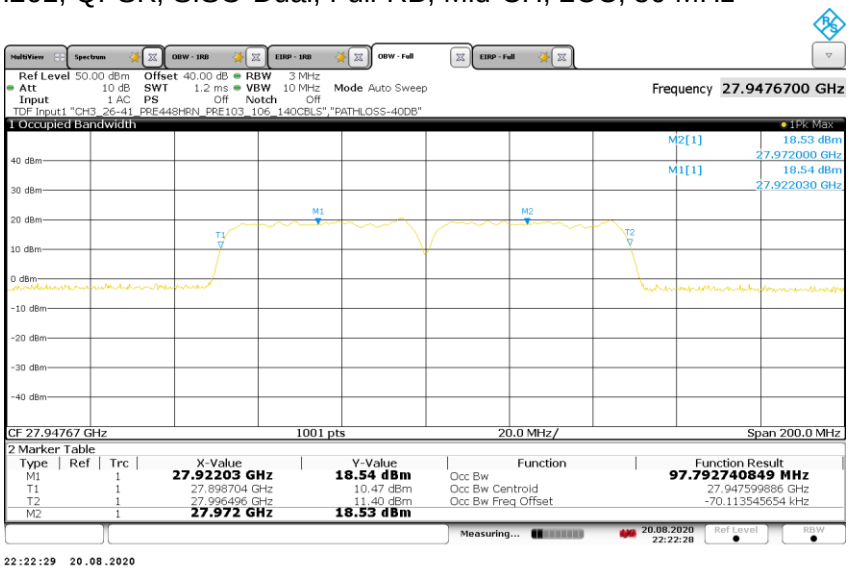
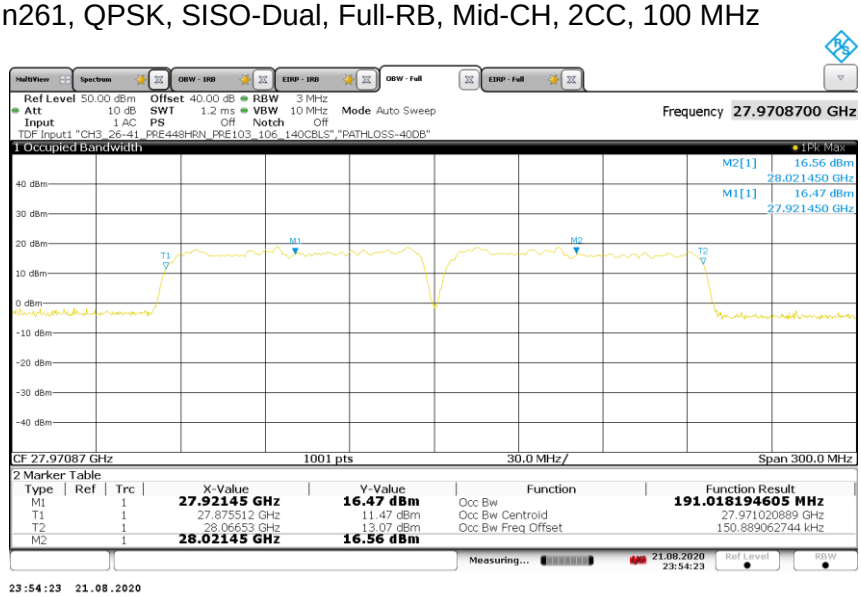
ANT M2

n261, QPSK, SISO-Dual, Full-RB, Mid-CH, 2CC, 50 MHz



n261, QPSK, SISO-Dual, Full-RB, Mid-CH, 2CC, 100 MHz



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8.2. EQUIVALENT ISOTROPIC RADIATED POWER

RULE PART(S)

FCC: §2.1046, §30.202

LIMIT

30.202 (b) - For mobile stations, the average power of the sum of all antenna elements is limited to a maximum EIRP of +43 dBm.

TEST PROCEDURES

Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.

- RBW = 1 – 5% of the OBW, not to exceed 1 MHz
- VBW ≥ 3 x RBW
- Span = 2x to 3x the OBW
- Number of measurement points in sweep > 2 x span / RBW
- Sweep time = auto-couple
- Detector = RMS
- Trace mode = Average over 100 sweeps

KDB 842590 D01 Upper Microwave Flexible Use Service v01 Section 4.2
ANSI C63.26-2015 Clause 5.2, Clause 5.5, Clause 6.4, and Annex C.5.2

EIRP measurements were taken at 3m test distance.

EIRP was calculated using the equations on ANSI C63.26-2015 Annex C.5.2. The total correction factors from 26.5 – 40.2 GHz range of horn antenna gain, cable loss and far-field path loss @ 3m were calculated using equations C.8 and C.9, and pre-loaded into spectrum analyzer.

Sample calculation of EIRP:

Total Correction Factor = Cable Loss (dB) – Horn Ant Gain (dBi) + Path Loss @ 3m (dB)
= 4 - 23 + 71
= 52 dB

EIRP = $P_{measured}$(dBm), where Total Correction Factor preloaded.

In order to properly display of signal level on the plots, the pre-loaded correction factors were intentional lowered by 40 dB and an offset factor of 40 dB was applied on spectrum analyzer to compensate the true correction factors across 26.5 to 40.2 GHz range.

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst case polarization/positioning.

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For antenna M1 and antenna M2, BPSK, QPSK, 16QAM and 64QAM modulations were all investigated in SISO, SISO-Dual and MIMO configurations. The highest power mode is QPSK for the modulations and SISO-Dual antenna configuration. Full data is provided for those combinations. To minimize report size the mid channel data is presented for all other combinations. Single RB (highest power) and full RB allocations were measured.

For antenna M0, only QPSK modulation in SISO-Dual configuration is investigated to verify the manufacture's declaration of lower EIRP comparing to antenna M1. Single RB (highest power) and full RB allocations were measured.

RESULTS

See the following pages.

TESTED BY:

Employee IDs: 19296 & 24160, n261 band, Chamber 2
Employee IDs: 19470 & 19437, n260 band, Chamber 3

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8.2.1. EIRP RESULTS n260 ANT M1 SISO

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	38.4990	50	1	BPSK	1/15	26.74	43	-16.26
Mid	38.4990	50	1	QPSK	1/15	**26.77**	43	-16.23
Mid	38.4998	50	1	QPSK	32/0	25.93	43	-17.07
Mid	38.4990	50	1	16QAM	1/15	24.44	43	-18.56
Mid	38.4990	50	1	64QAM	1/15	22.36	43	-20.64
Mid	38.4990	100	1	BPSK	1/32	26.27	43	-16.73
Mid	38.4990	100	1	QPSK	1/32	26.80	43	-16.20
Mid	38.4984	100	1	QPSK	64/0	26.01	43	-16.99
Mid	38.4990	100	1	16QAM	1/32	23.98	43	-19.02
Mid	38.4981	100	1	64QAM	1/32	22.18	43	-20.82
Mid	38.4970	50	2	BPSK	32/0	22.43	43	-20.57
Mid	38.4970	50	2	QPSK	1/15	19.68	43	-23.32
Mid	38.4970	50	2	QPSK	32/0	22.60	43	-20.40
Mid	38.4970	50	2	16QAM	32/0	21.29	43	-21.71
Mid	38.4965	50	2	64QAM	32/0	21.19	43	-21.81
Mid	38.4965	100	2	BPSK	64/0	22.67	43	-20.33
Mid	38.4965	100	2	QPSK	1/32	19.24	43	-23.76
Mid	38.4965	100	2	QPSK	64/0	22.70	43	-20.30
Mid	38.4965	100	2	16QAM	64/0	21.71	43	-21.29
Mid	38.4965	100	2	64QAM	64/0	21.19	43	-21.81

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8.2.2. EIRP RESULTS n260 ANT M1 SISO-DUAL

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	38.4990	50	1	BPSK	1/15	29.06	43	-13.94
Low	37.0024	50	1	QPSK	1/0	24.81	43	-18.19
Low	37.0240	50	1	QPSK	1/15	26.73	43	-16.27
Low	37.0471	50	1	QPSK	1/31	24.37	43	-18.63
Low	37.0247	50	1	QPSK	32/0	25.58	43	-17.42
Mid	38.4774	50	1	QPSK	1/0	26.46	43	-16.54
Mid	38.4990	50	1	QPSK	1/15	28.81	43	-14.19
Mid	38.5220	50	1	QPSK	1/31	26.90	43	-16.10
Mid	38.4998	50	1	QPSK	32/0	28.57	43	-14.43
High	39.9524	50	1	QPSK	1/0	28.06	43	-14.94
High	39.9740	50	1	QPSK	1/15	28.55	43	-14.45
High	39.9970	50	1	QPSK	1/31	27.04	43	-15.96
High	39.9748	50	1	QPSK	32/0	28.16	43	-14.84
Mid	38.4989	50	1	16QAM	1/15	26.24	43	-16.76
Mid	38.4990	50	1	64QAM	1/15	24.27	43	-18.73
Mid	38.4990	100	1	BPSK	1/32	28.84	43	-14.16
Low	37.0029	100	1	QPSK	1/0	24.61	43	-18.39
Low	37.0490	100	1	QPSK	1/32	26.68	43	-16.32
Low	37.0951	100	1	QPSK	1/64	24.72	43	-18.28
Low	37.0489	100	1	QPSK	64/0	25.62	43	-17.38
Mid	38.4529	100	1	QPSK	1/0	26.00	43	-17.00
Mid	38.4990	100	1	QPSK	1/32	29.14	43	-13.86
Mid	38.5450	100	1	QPSK	1/64	26.09	43	-16.91
Mid	38.4990	100	1	QPSK	64/0	28.08	43	-14.92
High	39.9028	100	1	QPSK	1/0	26.94	43	-16.06
High	39.9489	100	1	QPSK	1/32	**29.52**	43	-13.48
High	39.9951	100	1	QPSK	1/64	27.07	43	-15.93
High	39.9485	100	1	QPSK	64/0	28.06	43	-14.94
Mid	38.4990	100	1	16QAM	1/32	26.95	43	-16.05
Mid	38.4990	100	1	64QAM	1/32	24.16	43	-18.84
Mid	38.4970	50	2	BPSK	32/0	26.35	43	-16.65
Mid	38.4754	50	2	QPSK	1/0	19.78	43	-23.22
Mid	38.4970	50	2	QPSK	1/15	21.75	43	-21.25
Mid	38.5200	50	2	QPSK	1/31	19.78	43	-23.22
Mid	38.4970	50	2	QPSK	32/0	26.28	43	-16.72
Mid	38.4970	50	2	16QAM	32/0	24.74	43	-18.26
Mid	38.4970	50	2	64QAM	32/0	22.47	43	-20.53
Mid	38.4964	100	2	BPSK	64/0	25.91	43	-17.09
Mid	38.4504	100	2	QPSK	1/0	19.14	43	-23.86
Mid	38.4965	100	2	QPSK	1/32	21.35	43	-21.65
Mid	38.5425	100	2	QPSK	1/64	19.34	43	-23.66
Mid	38.4965	100	2	QPSK	64/0	25.74	43	-17.26
Mid	38.4964	100	2	16QAM	64/0	24.66	43	-18.34
Mid	38.4964	100	2	64QAM	64/0	22.54	43	-20.46

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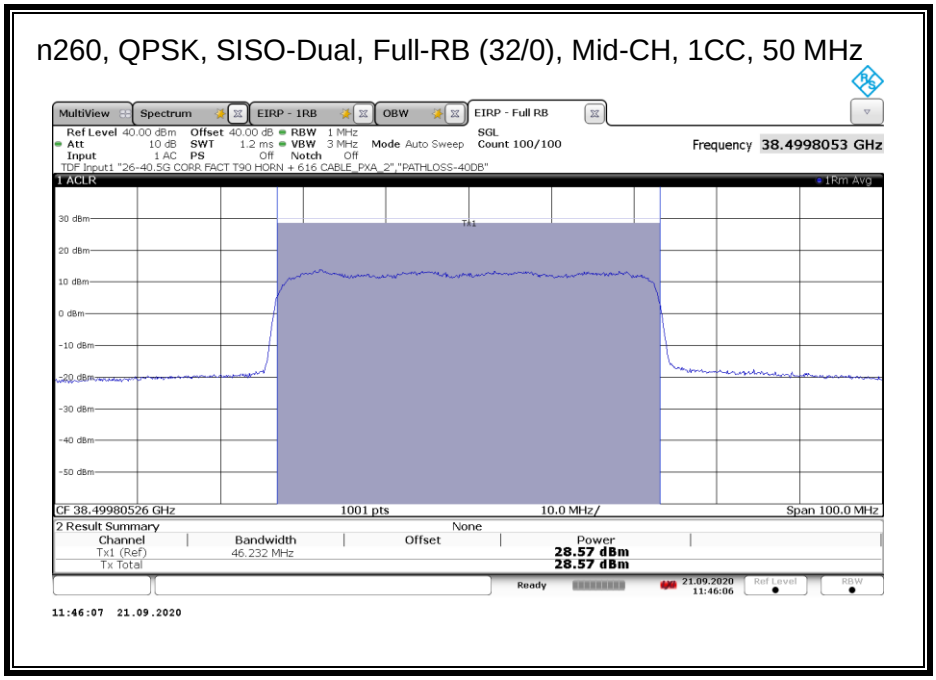
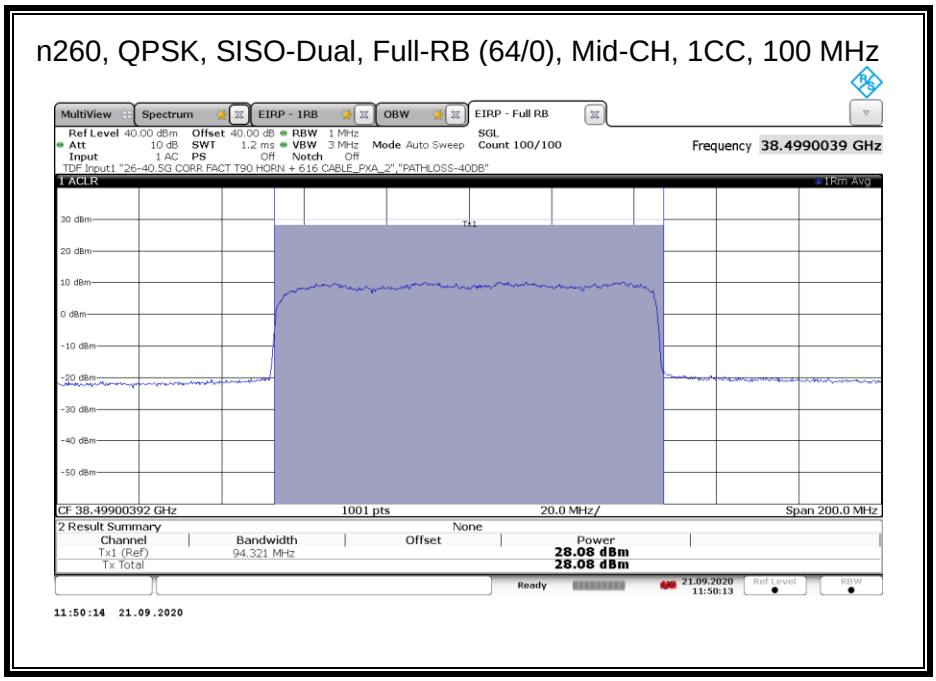
ANT M1



EIRP = $P_{measured}$(dBm) = 28.57 dBm



EIRP = $P_{measured}$(dBm) = 28.08 dBm

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8.2.3. EIRP RESULTS n260 ANT M1 MIMO

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	38.4990	50	1	BPSK	1/15	20.75	43	-22.25
Mid	38.4990	50	1	QPSK	1/15	20.31	43	-22.69
Mid	38.4997	50	1	QPSK	32/0	21.20	43	-21.80
Mid	38.4990	50	1	16QAM	1/15	18.71	43	-24.29
Mid	38.4990	50	1	64QAM	1/15	16.03	43	-26.97
Mid	38.5004	100	1	BPSK	1/33	18.87	43	-24.13
Mid	38.5004	100	1	QPSK	1/33	**21.53**	43	-21.47
Mid	38.4999	100	1	QPSK	66/0	21.44	43	-21.56
Mid	38.5004	100	1	16QAM	1/33	17.78	43	-25.22
Mid	38.5004	100	1	64QAM	1/33	15.02	43	-27.98
Mid	38.4970	50	2	BPSK	32/0	16.90	43	-26.10
Mid	38.4970	50	2	QPSK	1/15	13.21	43	-29.79
Mid	38.4970	50	2	QPSK	32/0	19.10	43	-23.90
Mid	38.4970	50	2	16QAM	32/0	16.47	43	-26.53
Mid	38.4970	50	2	64QAM	32/0	15.10	43	-27.90
Mid	38.4979	100	2	BPSK	66/0	19.24	43	-23.76
Mid	38.4979	100	2	QPSK	1/33	14.22	43	-28.78
Mid	38.4979	100	2	QPSK	66/0	19.55	43	-23.45
Mid	38.4979	100	2	16QAM	66/0	18.54	43	-24.46
Mid	38.4979	100	2	64QAM	66/0	15.44	43	-27.56

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8.2.4. EIRP RESULTS n260 ANT M0 SISO-DUAL

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	38.4990	50	1	QPSK	1/15	16.12	43	-26.88
Mid	38.4997	50	1	QPSK	32/0	15.59	43	-27.41
Mid	38.4990	100	1	QPSK	1/32	**16.79**	43	-26.21
Mid	38.4986	100	1	QPSK	64/0	15.73	43	-27.27

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8.2.5. EIRP RESULTS n260 ANT M2 SISO

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	38.4990	50	1	BPSK	1/15	24.36	43	-18.64
Mid	38.4990	50	1	QPSK	1/15	24.49	43	-18.51
Mid	38.4999	50	1	QPSK	32/0	23.70	43	-19.30
Mid	38.4990	50	1	16QAM	1/15	23.12	43	-19.88
Mid	38.4990	50	1	64QAM	1/15	20.03	43	-22.97
Mid	38.4990	100	1	BPSK	1/32	23.87	43	-19.13
Mid	38.4990	100	1	QPSK	1/32	**24.00**	43	-19.00
Mid	38.4986	100	1	QPSK	64/0	23.56	43	-19.44
Mid	38.4990	100	1	16QAM	1/32	22.98	43	-20.02
Mid	38.4990	100	1	64QAM	1/32	21.99	43	-21.01
Mid	38.4970	50	2	BPSK	32/0	20.43	43	-22.57
Mid	38.4970	50	2	QPSK	1/15	17.55	43	-25.45
Mid	38.4970	50	2	QPSK	32/0	20.52	43	-22.48
Mid	38.4970	50	2	16QAM	32/0	18.48	43	-24.52
Mid	38.4970	50	2	64QAM	32/0	17.93	43	-25.07
Mid	38.4965	100	2	BPSK	64/0	20.41	43	-22.59
Mid	38.4965	100	2	QPSK	1/32	16.98	43	-26.02
Mid	38.4965	100	2	QPSK	64/0	20.44	43	-22.56
Mid	38.4965	100	2	16QAM	64/0	19.41	43	-23.59
Mid	38.4965	100	2	64QAM	64/0	18.94	43	-24.06

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8.2.6. EIRP RESULTS n260 ANT M2 SISO-DUAL

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	38.4990	50	1	BPSK	1/15	27.60	43	-15.40
Low	37.0025	50	1	QPSK	1/0	24.62	43	-18.38
Low	37.0240	50	1	QPSK	1/15	26.79	43	-16.21
Low	37.0471	50	1	QPSK	1/31	23.39	43	-19.61
Low	37.0248	50	1	QPSK	32/0	25.46	43	-17.54
Mid	38.4774	50	1	QPSK	1/0	26.11	43	-16.89
Mid	38.4990	50	1	QPSK	1/15	27.90	43	-15.10
Mid	38.5220	50	1	QPSK	1/31	25.51	43	-17.49
Mid	38.4997	50	1	QPSK	32/0	26.84	43	-16.16
High	39.9524	50	1	QPSK	1/0	25.20	43	-17.80
High	39.9740	50	1	QPSK	1/15	27.46	43	-15.54
High	39.9970	50	1	QPSK	1/31	25.01	43	-17.99
High	39.9749	50	1	QPSK	32/0	26.08	43	-16.92
Mid	38.4990	50	1	16QAM	1/15	25.32	43	-17.68
Mid	38.4990	50	1	64QAM	1/15	23.33	43	-19.67
Mid	38.4990	100	1	BPSK	1/32	27.43	43	-15.57
Low	37.0029	100	1	QPSK	1/0	24.74	43	-18.26
Low	37.0490	100	1	QPSK	1/32	26.99	43	-16.01
Low	37.0951	100	1	QPSK	1/64	24.22	43	-18.78
Low	37.0484	100	1	QPSK	64/0	25.41	43	-17.59
Mid	38.4529	100	1	QPSK	1/0	25.48	43	-17.52
Mid	38.4990	100	1	QPSK	1/32	**28.16**	43	-14.84
Mid	38.5450	100	1	QPSK	1/64	25.37	43	-17.63
Mid	38.4988	100	1	QPSK	64/0	26.73	43	-16.27
High	39.9028	100	1	QPSK	1/0	24.61	43	-18.39
High	39.9489	100	1	QPSK	1/32	27.11	43	-15.89
High	39.9950	100	1	QPSK	1/64	24.85	43	-18.15
High	39.9488	100	1	QPSK	64/0	26.07	43	-16.93
Mid	38.4990	100	1	16QAM	1/32	25.68	43	-17.32
Mid	38.4990	100	1	64QAM	1/32	23.04	43	-19.96
Mid	38.5200	50	2	BPSK	32/0	18.16	43	-24.84
Mid	38.4754	50	2	QPSK	1/0	18.97	43	-24.03
Mid	38.4970	50	2	QPSK	1/15	20.80	43	-22.20
Mid	38.5200	50	2	QPSK	1/31	18.58	43	-24.42
Mid	38.4970	50	2	QPSK	32/0	24.84	43	-18.16
Mid	38.4970	50	2	16QAM	32/0	23.41	43	-19.59
Mid	38.4970	50	2	64QAM	32/0	20.69	43	-22.31
Mid	38.4964	100	2	BPSK	64/0	24.76	43	-18.24
Mid	38.4504	100	2	QPSK	1/0	18.38	43	-24.62
Mid	38.4965	100	2	QPSK	1/32	20.35	43	-22.65
Mid	38.5425	100	2	QPSK	1/64	18.56	43	-24.44
Mid	38.4965	100	2	QPSK	64/0	24.78	43	-18.22
Mid	38.4965	100	2	16QAM	64/0	23.56	43	-19.44
Mid	38.4965	100	2	64QAM	64/0	20.92	43	-22.08

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8.2.7. EIRP RESULTS n260 ANT M2 MIMO

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	38.4990	50	1	BPSK	1/15	18.95	43	-24.05
Mid	38.4990	50	1	QPSK	1/15	19.05	43	-23.95
Mid	38.4997	50	1	QPSK	32/0	**19.76**	43	-23.24
Mid	38.4990	50	1	16QAM	1/15	16.78	43	-26.22
Mid	38.4991	50	1	64QAM	1/15	15.32	43	-27.68
Mid	38.5004	100	1	BPSK	1/33	18.14	43	-24.86
Mid	38.5004	100	1	QPSK	1/33	18.33	43	-24.67
Mid	38.4998	100	1	QPSK	66/0	19.79	43	-23.21
Mid	38.5004	100	1	16QAM	1/33	16.94	43	-26.06
Mid	38.5004	100	1	64QAM	1/33	14.97	43	-28.03
Mid	38.4970	50	2	BPSK	32/0	16.71	43	-26.29
Mid	38.4970	50	2	QPSK	1/15	11.78	43	-31.22
Mid	38.4970	50	2	QPSK	32/0	17.23	43	-25.77
Mid	38.4970	50	2	16QAM	32/0	16.07	43	-26.93
Mid	38.4970	50	2	64QAM	32/0	14.30	43	-28.70
Mid	38.4979	100	2	BPSK	66/0	16.72	43	-26.28
Mid	38.4979	100	2	QPSK	1/33	10.87	43	-32.13
Mid	38.4979	100	2	QPSK	66/0	17.55	43	-25.45
Mid	38.4979	100	2	16QAM	66/0	16.76	43	-26.24
Mid	38.4979	100	2	64QAM	66/0	12.94	43	-30.06

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8.2.8. EIRP RESULTS n261 ANT M1 SISO

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	27.9240	50	1	BPSK	1/15	26.20	43	-16.80
Mid	27.9240	50	1	QPSK	1/15	26.58	43	-16.42
Mid	27.9247	50	1	QPSK	32/0	25.56	43	-17.44
Mid	27.9240	50	1	16QAM	1/15	23.60	43	-19.40
Mid	27.9240	50	1	64QAM	1/15	21.21	43	-21.79
Mid	27.9240	100	1	BPSK	1/32	25.68	43	-17.32
Mid	27.9240	100	1	QPSK	1/32	**26.27**	43	-16.73
Mid	27.9241	100	1	QPSK	64/0	25.43	43	-17.57
Mid	27.9240	100	1	16QAM	1/32	22.50	43	-20.50
Mid	27.9240	100	1	64QAM	1/32	20.87	43	-22.13
Mid	27.9220	50	2	BPSK	32/0	21.54	43	-21.46
Mid	27.9220	50	2	QPSK	1/15	19.40	43	-23.60
Mid	27.9220	50	2	QPSK	32/0	21.53	43	-21.47
Mid	27.9220	50	2	16QAM	32/0	20.13	43	-22.87
Mid	27.9220	50	2	64QAM	32/0	17.55	43	-25.45
Mid	27.9215	100	2	BPSK	64/0	22.84	43	-20.16
Mid	27.9215	100	2	QPSK	1/32	18.67	43	-24.33
Mid	27.9215	100	2	QPSK	64/0	22.91	43	-20.09
Mid	27.9215	100	2	16QAM	64/0	21.40	43	-21.60
Mid	27.9215	100	2	64QAM	64/0	19.14	43	-23.86

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8.2.9. EIRP RESULTS n261 ANT M1 SISO-DUAL

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	27.9240	50	1	BPSK	1/15	26.02	43	-16.98
Low	27.5245	50	1	QPSK	1/0	24.59	43	-18.41
Low	27.5240	50	1	QPSK	1/15	26.77	43	-16.23
Low	27.5471	50	1	QPSK	1/31	24.45	43	-18.55
Low	27.5247	50	1	QPSK	32/0	26.32	43	-16.68
Mid	27.9024	50	1	QPSK	1/0	25.14	43	-17.86
Mid	27.9240	50	1	QPSK	1/15	26.60	43	-16.40
Mid	27.9471	50	1	QPSK	1/31	24.28	43	-18.72
Mid	27.9248	50	1	QPSK	32/0	25.95	43	-17.05
High	28.3024	50	1	QPSK	1/0	24.70	43	-18.30
High	28.3240	50	1	QPSK	1/15	26.03	43	-16.97
High	28.3470	50	1	QPSK	1/31	23.85	43	-19.15
High	28.3245	50	1	QPSK	32/0	25.40	43	-17.60
Mid	27.9240	50	1	16QAM	1/15	24.18	43	-18.82
Mid	27.9240	50	1	64QAM	1/15	22.06	43	-20.94
Mid	27.9240	100	1	BPSK	1/32	27.43	43	-15.57
Low	27.5031	100	1	QPSK	1/0	26.64	43	-16.36
Low	27.5491	100	1	QPSK	1/32	28.33	43	-14.67
Low	27.5952	100	1	QPSK	1/64	25.81	43	-17.19
Low	27.5485	100	1	QPSK	64/0	27.06	43	-15.94
Mid	27.8779	100	1	QPSK	1/0	26.02	43	-16.98
Mid	27.9240	100	1	QPSK	1/32	**28.43**	43	-14.57
Mid	27.9701	100	1	QPSK	1/64	25.37	43	-17.63
Mid	27.9234	100	1	QPSK	64/0	27.23	43	-15.77
High	28.2529	100	1	QPSK	1/0	25.70	43	-17.30
High	28.2990	100	1	QPSK	1/32	27.63	43	-15.37
High	28.3451	100	1	QPSK	1/64	26.22	43	-16.78
High	28.2983	100	1	QPSK	64/0	26.88	43	-16.12
Mid	27.9240	100	1	16QAM	1/32	25.31	43	-17.69
Mid	27.9240	100	1	64QAM	1/32	23.83	43	-19.17
Mid	27.9221	50	2	BPSK	32/0	22.95	43	-20.05
Mid	27.9004	50	2	QPSK	1/0	18.11	43	-24.89
Mid	27.9221	50	2	QPSK	1/15	19.81	43	-23.19
Mid	27.9451	50	2	QPSK	1/31	17.35	43	-25.65
Mid	27.9221	50	2	QPSK	32/0	23.16	43	-19.84
Mid	27.9450	50	2	16QAM	32/0	21.66	43	-21.34
Mid	27.9221	50	2	64QAM	32/0	19.52	43	-23.48
Mid	27.9215	100	2	BPSK	64/0	25.03	43	-17.97
Mid	27.8754	100	2	QPSK	1/0	19.10	43	-23.90
Mid	27.9215	100	2	QPSK	1/32	20.85	43	-22.15
Mid	27.9676	100	2	QPSK	1/64	18.19	43	-24.81
Mid	27.9215	100	2	QPSK	64/0	25.09	43	-17.91
Mid	27.9215	100	2	16QAM	64/0	23.05	43	-19.95
Mid	27.9215	100	2	64QAM	64/0	21.10	43	-21.90

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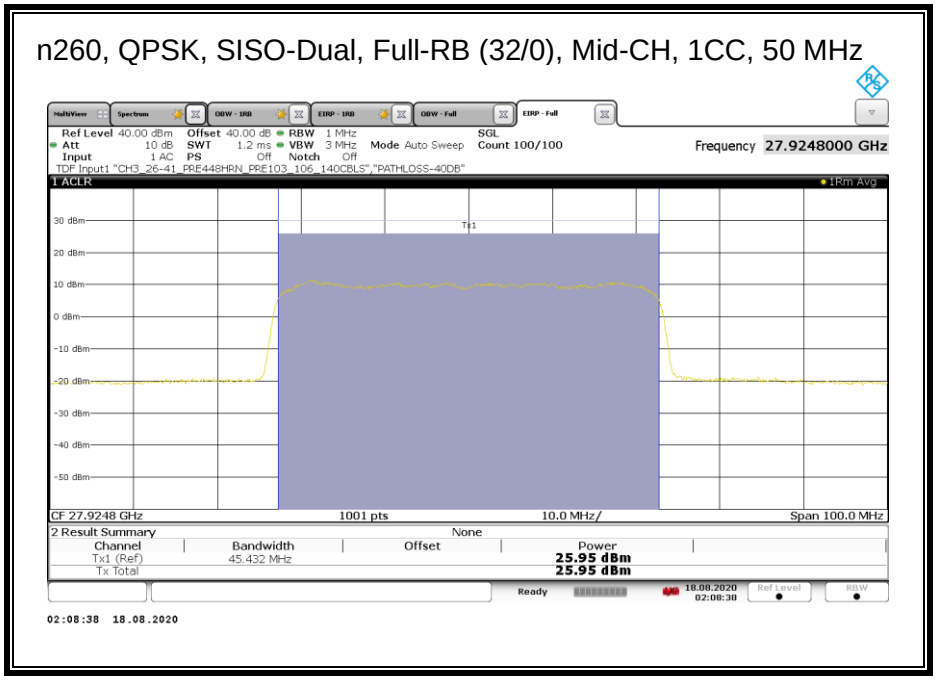
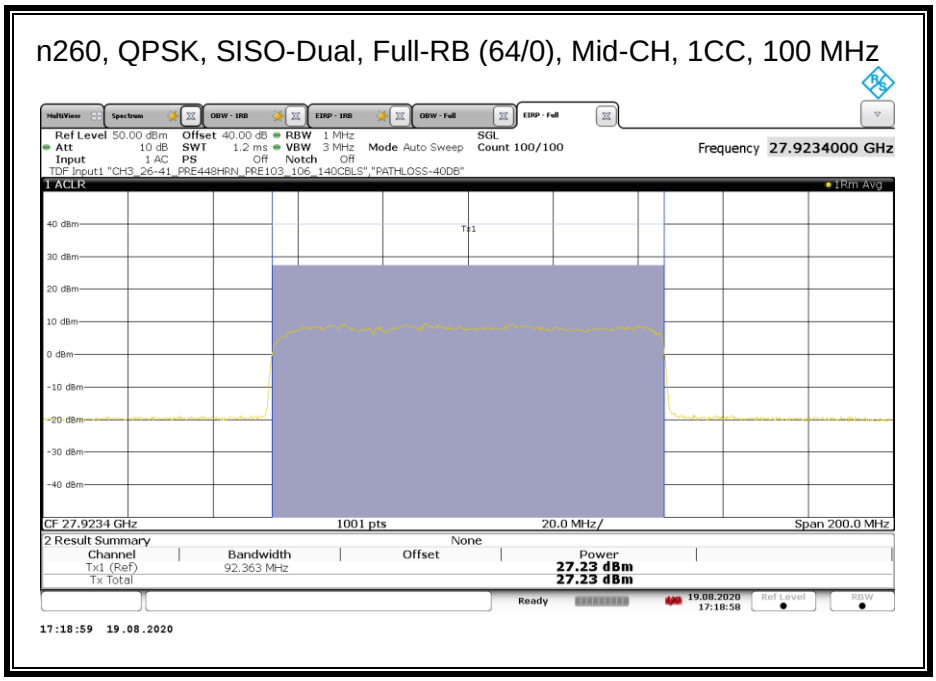
ANT M1



EIRP = $P_{measured}$(dBm) = 25.95 dBm



EIRP = $P_{measured}$(dBm) = 27.23 dBm

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8.2.10. EIRP RESULTS n261 ANT M1 MIMO

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	27.9240	50	1	BPSK	1/15	19.80	43	-23.20
Mid	27.9240	50	1	QPSK	1/15	19.58	43	-23.42
Mid	27.9247	50	1	QPSK	32/0	20.26	43	-22.74
Mid	27.9240	50	1	16QAM	1/15	17.73	43	-25.27
Mid	27.9240	50	1	64QAM	1/15	15.51	43	-27.49
Mid	27.9255	100	1	BPSK	1/33	19.49	43	-23.51
Mid	27.9255	100	1	QPSK	1/33	19.89	43	-23.11
Mid	27.9248	100	1	QPSK	66/0	**20.99**	43	-22.01
Mid	27.9255	100	1	16QAM	1/33	17.76	43	-25.24
Mid	27.9255	100	1	64QAM	1/33	16.77	43	-26.23
Mid	27.9220	50	2	BPSK	32/0	16.72	43	-26.28
Mid	27.9220	50	2	QPSK	1/15	12.73	43	-30.27
Mid	27.9220	50	2	QPSK	32/0	17.82	43	-25.18
Mid	27.9220	50	2	16QAM	32/0	17.77	43	-25.23
Mid	27.9220	50	2	64QAM	32/0	13.48	43	-29.52
Mid	27.9229	100	2	BPSK	66/0	18.54	43	-24.46
Mid	27.9229	100	2	QPSK	1/33	12.82	43	-30.18
Mid	27.9229	100	2	QPSK	66/0	18.51	43	-24.49
Mid	27.9229	100	2	16QAM	66/0	17.60	43	-25.40
Mid	27.9229	100	2	64QAM	66/0	15.98	43	-27.02

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8.2.11. EIRP RESULTS n261 ANT M0 SISO-DUAL

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	27.9240	50	1	QPSK	1/15	13.27	43	-29.73
Mid	27.9247	50	1	QPSK	32/0	12.30	43	-30.70
Mid	27.9240	100	1	QPSK	1/32	**13.66**	43	-29.34
Mid	27.9235	100	1	QPSK	64/0	12.40	43	-30.60

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8.2.12. EIRP RESULTS n261 ANT M2 SISO

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	27.9240	50	1	BPSK	1/15	24.78	43	-18.22
Mid	27.9240	50	1	QPSK	1/15	**25.52**	43	-17.48
Mid	27.9249	50	1	QPSK	32/0	24.20	43	-18.80
Mid	27.9240	50	1	16QAM	1/15	22.36	43	-20.64
Mid	27.9240	50	1	64QAM	1/15	20.60	43	-22.40
Mid	27.9241	100	1	BPSK	1/32	24.35	43	-18.65
Mid	27.9241	100	1	QPSK	1/32	25.28	43	-17.72
Mid	27.9236	100	1	QPSK	64/0	24.28	43	-18.72
Mid	27.9241	100	1	16QAM	1/32	22.48	43	-20.52
Mid	27.9241	100	1	64QAM	1/32	19.90	43	-23.10
Mid	27.9220	50	2	BPSK	32/0	21.05	43	-21.95
Mid	27.9220	50	2	QPSK	1/15	17.54	43	-25.46
Mid	27.9220	50	2	QPSK	32/0	21.82	43	-21.18
Mid	27.9220	50	2	16QAM	32/0	19.66	43	-23.34
Mid	27.9220	50	2	64QAM	32/0	17.20	43	-25.80
Mid	27.9215	100	2	BPSK	64/0	21.82	43	-21.18
Mid	27.9215	100	2	QPSK	1/32	17.70	43	-25.30
Mid	27.9215	100	2	QPSK	64/0	21.74	43	-21.26
Mid	27.9215	100	2	16QAM	64/0	20.10	43	-22.90
Mid	27.9215	100	2	64QAM	64/0	17.80	43	-25.20

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8.2.13. EIRP RESULTS n261 ANT M2 SISO-DUAL

Channel	Frequency (GHz)	Bandwidth (MHz)	CCs	Modulation	RB (Size/Offset)	Avg EIRP (dBm)	Limit (dBm)	Margin (dB)
Mid	27.9240	50	1	BPSK	1/15	27.25	43	-15.75
Low	27.5024	50	1	QPSK	1/0	25.07	43	-17.93
Low	27.5241	50	1	QPSK	1/15	27.31	43	-15.69
Low	27.5471	50	1	QPSK	1/31	25.25	43	-17.75
Low	27.5247	50	1	QPSK	32/0	26.35	43	-16.65
Mid	27.9024	50	1	QPSK	1/0	25.49	43	-17.51
Mid	27.9240	50	1	QPSK	1/15	27.81	43	-15.19
Mid	27.9471	50	1	QPSK	1/31	25.49	43	-17.51
Mid	27.9248	50	1	QPSK	32/0	26.52	43	-16.48
High	28.3024	50	1	QPSK	1/0	25.85	43	-17.15
High	28.3240	50	1	QPSK	1/15	27.07	43	-15.93
High	28.3470	50	1	QPSK	1/31	25.34	43	-17.66
High	28.3247	50	1	QPSK	32/0	26.61	43	-16.39
Mid	27.9240	50	1	16QAM	1/15	25.12	43	-17.88
Mid	27.9240	50	1	64QAM	1/15	22.92	43	-20.08
Mid	27.9240	100	1	BPSK	1/32	27.34	43	-15.66
Low	27.5031	100	1	QPSK	1/0	25.99	43	-17.01
Low	27.5492	100	1	QPSK	1/32	27.95	43	-15.05
Low	27.5952	100	1	QPSK	1/64	26.22	43	-16.78
Low	27.5485	100	1	QPSK	64/0	26.79	43	-16.21
Mid	27.8779	100	1	QPSK	1/0	25.46	43	-17.54
Mid	27.9240	100	1	QPSK	1/32	27.50	43	-15.50
Mid	27.9701	100	1	QPSK	1/64	25.44	43	-17.56
Mid	27.9233	100	1	QPSK	64/0	26.59	43	-16.41
High	28.2530	100	1	QPSK	1/0	25.91	43	-17.09
High	28.2990	100	1	QPSK	1/32	**28.42**	43	-14.58
High	28.3451	100	1	QPSK	1/64	25.55	43	-17.45
High	28.2986	100	1	QPSK	64/0	27.05	43	-15.95
Mid	27.9240	100	1	16QAM	1/32	24.92	43	-18.08
Mid	27.9240	100	1	64QAM	1/32	23.36	43	-19.64
Mid	27.9220	50	2	BPSK	32/0	23.85	43	-19.15
Mid	27.9005	50	2	QPSK	1/0	18.68	43	-24.32
Mid	27.9220	50	2	QPSK	1/15	20.72	43	-22.28
Mid	27.9450	50	2	QPSK	1/31	18.50	43	-24.50
Mid	27.9220	50	2	QPSK	32/0	23.90	43	-19.10
Mid	27.9220	50	2	16QAM	32/0	22.34	43	-20.66
Mid	27.9220	50	2	64QAM	32/0	20.10	43	-22.90
Mid	27.9215	100	2	BPSK	64/0	24.47	43	-18.53
Mid	27.8754	100	2	QPSK	1/0	18.72	43	-24.28
Mid	27.9215	100	2	QPSK	1/32	20.32	43	-22.68
Mid	27.9675	100	2	QPSK	1/64	18.22	43	-24.78
Mid	27.9215	100	2	QPSK	64/0	24.56	43	-18.44
Mid	27.9215	100	2	16QAM	64/0	22.53	43	-20.47
Mid	27.9215	100	2	64QAM	64/0	20.47	43	-22.53

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8.2.14. EIRP RESULTS n261 ANT M2 MIMO

Channel	Frequency	Bandwidth	CCs	Modulation	RB	Avg EIRP	Limit	Margin
	(GHz)	(MHz)			(Size/Offset)	(dBm)	(dBm)	(dB)
Mid	27.9240	50	1	BPSK	1/15	19.08	43	-23.92
Mid	27.9240	50	1	QPSK	1/15	**20.41**	43	-22.59
Mid	27.9247	50	1	QPSK	32/0	19.95	43	-23.05
Mid	27.9240	50	1	16QAM	1/15	17.92	43	-25.08
Mid	27.9240	50	1	64QAM	1/15	16.67	43	-26.33
Mid	27.9255	100	1	BPSK	1/33	18.52	43	-24.48
Mid	27.9255	100	1	QPSK	1/33	19.97	43	-23.03
Mid	27.9246	100	1	QPSK	66/0	19.71	43	-23.29
Mid	27.9255	100	1	16QAM	1/33	17.64	43	-25.36
Mid	27.9255	100	1	64QAM	1/33	16.68	43	-26.32
Mid	27.9221	50	2	BPSK	32/0	16.46	43	-26.54
Mid	27.9221	50	2	QPSK	1/15	13.00	43	-30.00
Mid	27.9221	50	2	QPSK	32/0	17.44	43	-25.56
Mid	27.9221	50	2	16QAM	32/0	15.71	43	-27.29
Mid	27.9221	50	2	64QAM	32/0	13.41	43	-29.59
Mid	27.9229	100	2	BPSK	66/0	16.84	43	-26.16
Mid	27.9229	100	2	QPSK	1/33	11.81	43	-31.19
Mid	27.9229	100	2	QPSK	66/0	17.28	43	-25.72
Mid	27.9229	100	2	16QAM	66/0	16.27	43	-26.73
Mid	27.9229	100	2	64QAM	66/0	14.16	43	-28.84

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8.3. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §2.1051, §30.203

LIMITS

30.203 (a) - The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

TEST PROCEDURE

- RBW = 1 MHz
- VBW ≥ 3 x RBW
- Number of measurement points in sweep > 2 x span / RBW
- Sweep time = auto-couple
- Detector = RMS
- Trace mode = Average

KDB 842590 D01 Upper Microwave Flexible Use Service v01 Section 4.2
ANSI C63.26-2015 Clause 5.2, Clause 5.5, Clause 6.4, and Annex C.5.2

Band Edge measurements were measured as EIRP for direct comparison to the 30.203 TRP limit to demonstrate compliance.

The appropriate far field test distance at 3m, listed on Section 5, was used at test.

EIRP was calculated using the equations on ANSI C63.26-2015 Annex C.5.2. The total correction factors from 26.5 – 40.2 GHz range of horn antenna gain, cable loss and far-field path loss @ 3m were calculated using equations C.8 and C.9, and pre-loaded into spectrum analyzer.

Sample calculation of EIRP:

Total Correction Factor = Cable Loss (dB) – Horn Ant Gain (dBi) + Path Loss @ 3m (dB)
= 4 - 23 + 71
= 52 dB

EIRP = $P_{measured}$(dBm), where Total Correction Factor preloaded.

In order to properly display of signal level on the plots, the pre-loaded correction factors were intentional lowered by 40 dB and an offset factor of 40 dB was applied on spectrum analyzer to compensate the true correction factors across 26.5 to 40.2 GHz range.

Preliminary testing on BPSK, QPSK, 16QAM and 64QAM modulations for SISO, SISO-Dual and MIMO configurations determined that the highest band edge emissions were for the SISO-Dual antenna configuration with QPSK modulation, consistent with this also being the configuration with the highest EIRP. The SISO-Dual configuration was, therefore, used for the final band-

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edge measurements with QPSK modulation for both single RB and full RB allocations. Additional measurements were made on the MIMO configuration, which has as a wider occupied bandwidth than the SISO-DUAL configuration, with the single RB allocation to verify that SISO-Dual was worst case. The Pass/Fail indicator from spectrum analyzer was applied on all plots.

Band edge measurements for multi-carrier (2CC) operations were limited to single RB in each carrier in the (50 MHz + 50 MHz) and (100 MHz + 100 MHz) modes. Note that inter-modulation products which can be seen in the band edge plots are evaluated as part of the radiated spurious emission measurements.

Verified through preliminary testing across other modulations and antenna configurations, there was no significant change of spectrum pattern at band edges on 1CC Full RB and 2CC Full RB, therefore no further investigation was performed on 2CC Full RB operation.

RESULTS

See the following pages.

TESTED BY :

Employee ID: 19459, n261 & n260 bands, Chamber 1

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8.3.1. BAND EDGE RESULTS n260 SISO-DUAL 1CC

ANT M1, 50 MHz, SISO-DUAL, 1CC, QPSK

Low-side, Single RB

Low-side, Full RB

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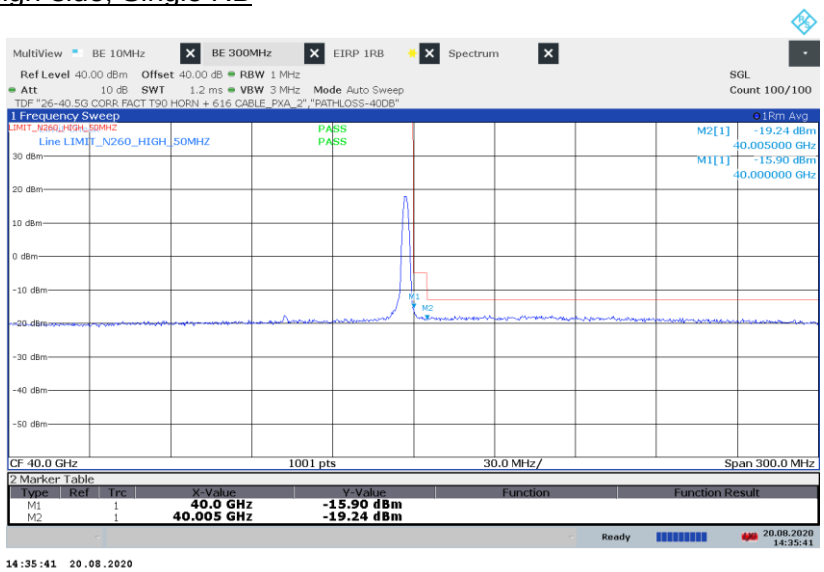
ANT M1, 50 MHz, SISO-DUAL, 1CC, QPSK

High-side, Single RB



High-side, Full RB

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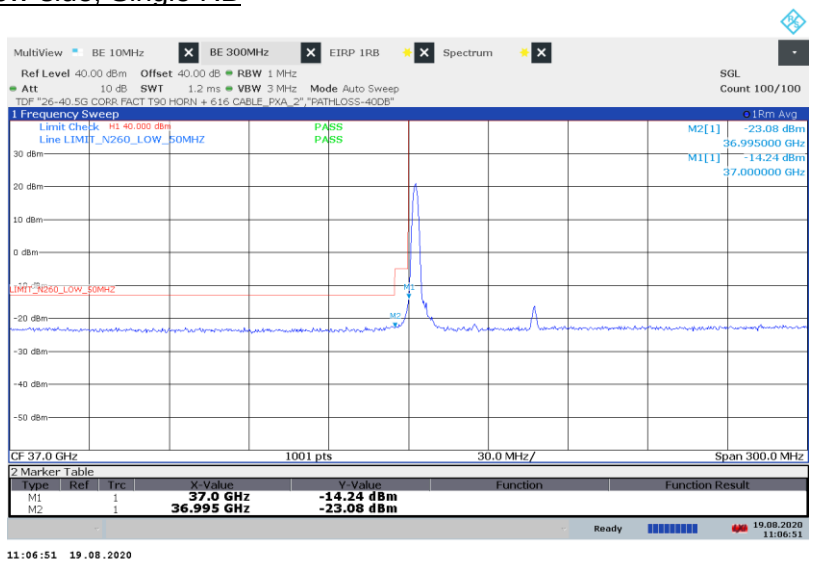
ANT M2, 50 MHz, SISO-DUAL, 1CC, QPSK

Low-side, Single RB



Low-side, Full RB

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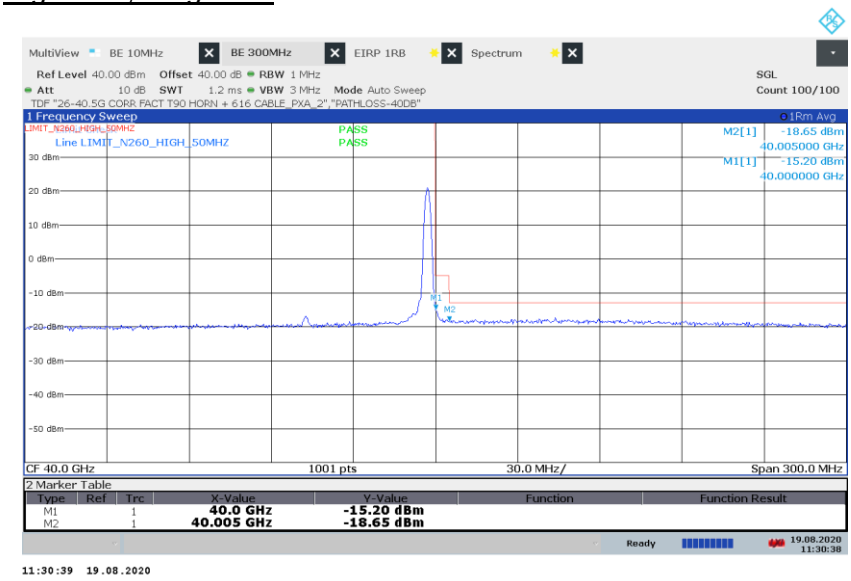
ANT M2, 50 MHz, SISO-DUAL, 1CC, QPSK

High-side, Single RB



High-side, Full RB

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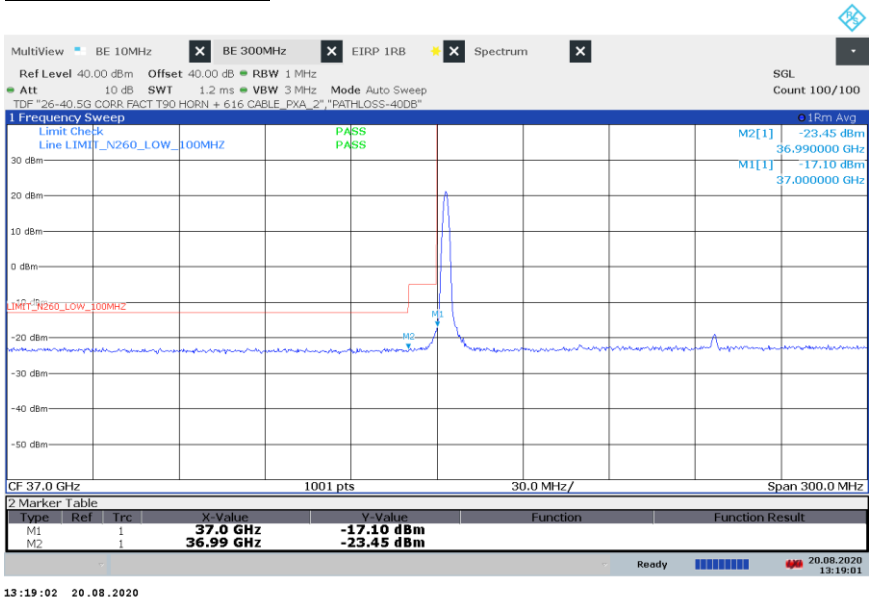
ANT M1, 100 MHz, SISO-DUAL, 1CC, QPSK

Low-side, Single RB



Low-side, Full RB

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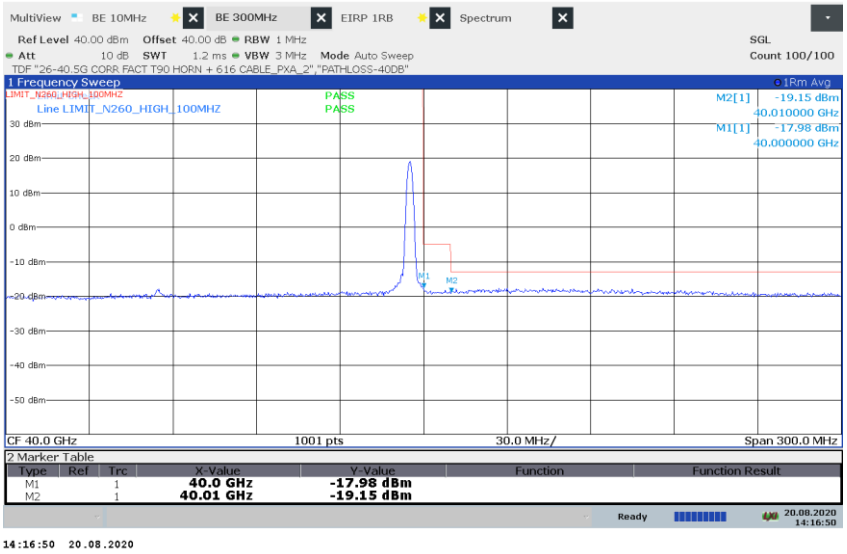
ANT M1, 100 MHz, SISO-DUAL, 1CC, QPSK

High-side, Single RB



High-side, Full RB

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ANT M2, 100 MHz, SISO-DUAL, 1CC, QPSK

Low-side, Single RB

Low-side, Full RB

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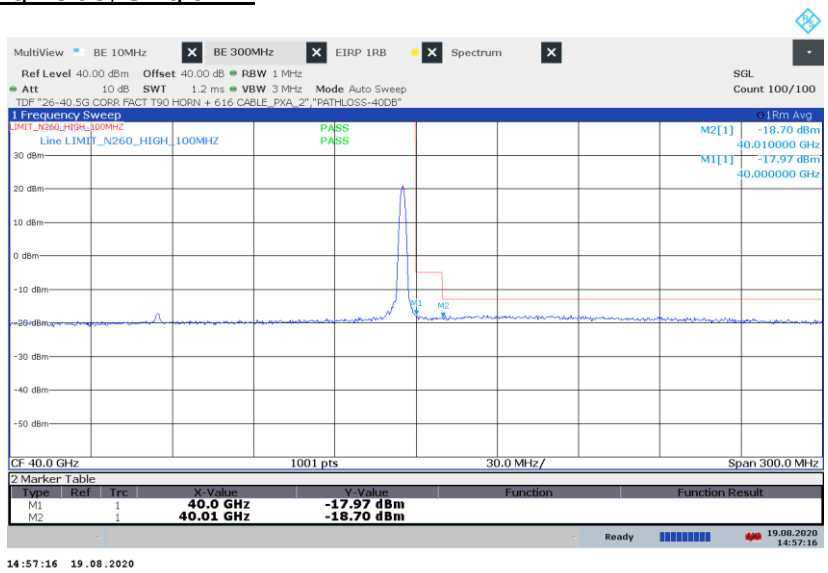
ANT M2, 100 MHz, SISO-DUAL, 1CC, QPSK

High-side, Single RB



High-side, Full RB

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8.3.2. BAND EDGE RESULTS n260 SISO-DUAL 2CC

ANT M1, 50 MHz, SISO-DUAL, 2CC, QPSK

Low-side, Single RB

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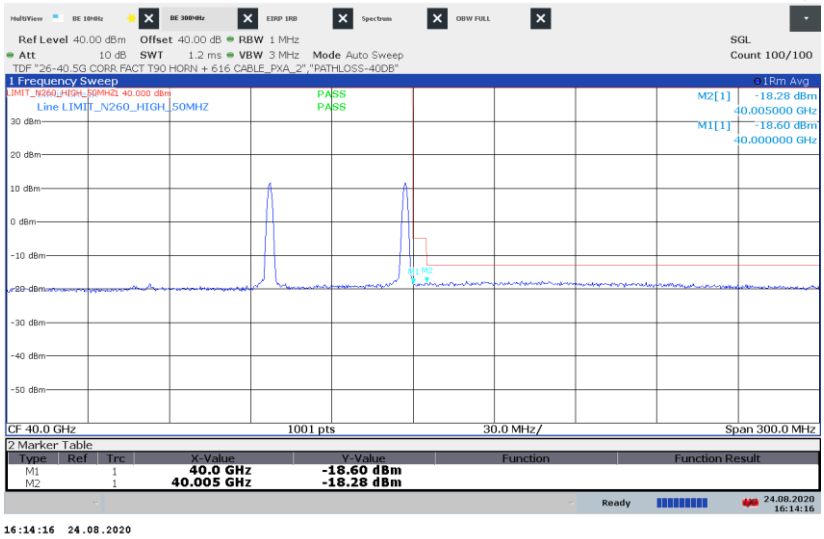
ANT M1, 50 MHz, SISO-DUAL, 2CC, QPSK

High-side, Single RB



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ANT M2, 50 MHz, SISO-DUAL, 2CC, QPSK

Low-side, Single RB

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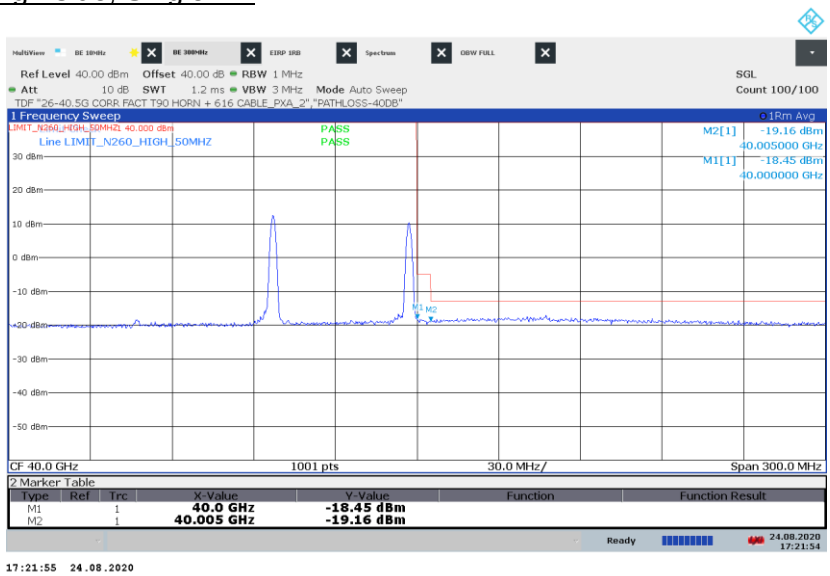
ANT M2, 50 MHz, SISO-DUAL, 2CC, QPSK

High-side, Single RB



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ANT M1, 100 MHz, SISO-DUAL, 2CC, QPSK

Low-side, Single RB

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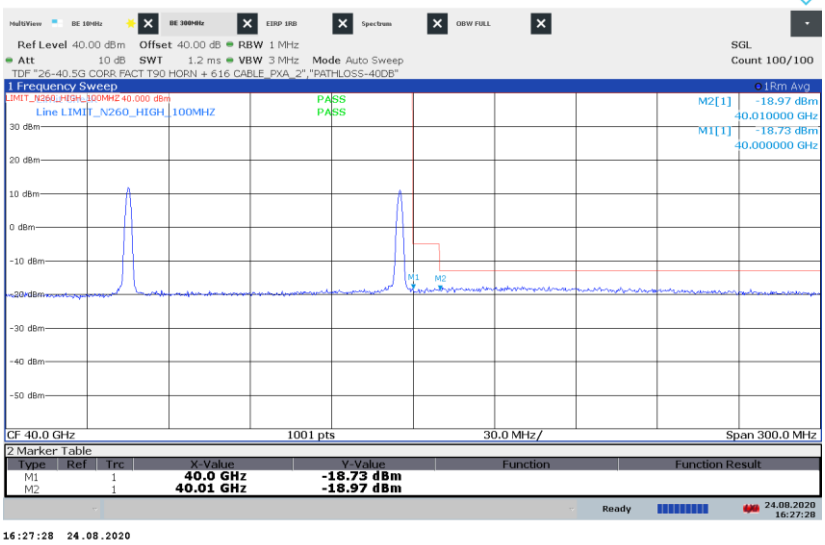
ANT M1, 100 MHz, SISO-DUAL, 2CC, QPSK

High-side, Single RB



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ANT M2, 100 MHz, SISO-DUAL, 2CC, QPSK

Low-side, Single RB

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ANT M2, 100 MHz, SISO-DUAL, 2CC, QPSK

High-side, Single RB

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8.3.3. BAND EDGE RESULTS n260 MIMO 1CC

ANT M1, 50 MHz, MIMO, 1CC, QPSK

Low-side, Single RB

Low-side, Full RB

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ANT M1, 50 MHz, MIMO, 1CC, QPSK

High-side, Single RB

High-side, Full RB

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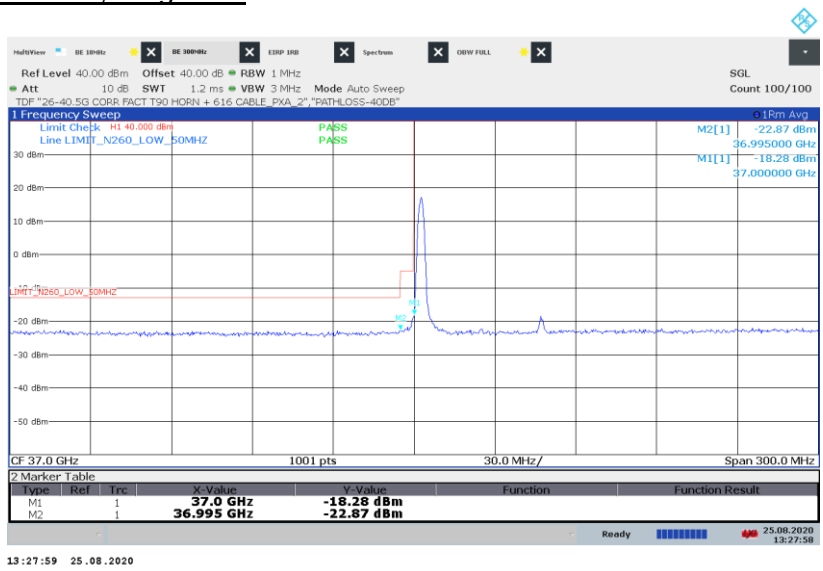
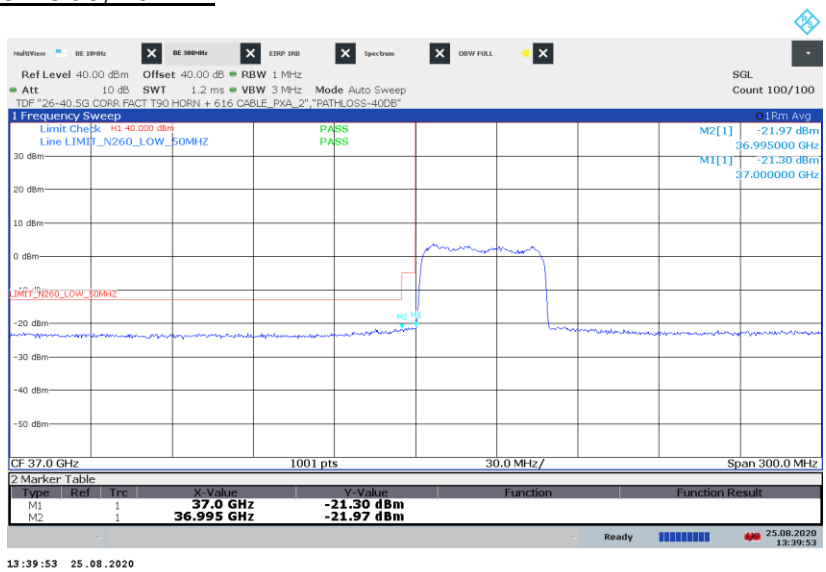
ANT M2, 50 MHz, MIMO, 1CC, QPSK

Low-side, Single RB



Low-side, Full RB



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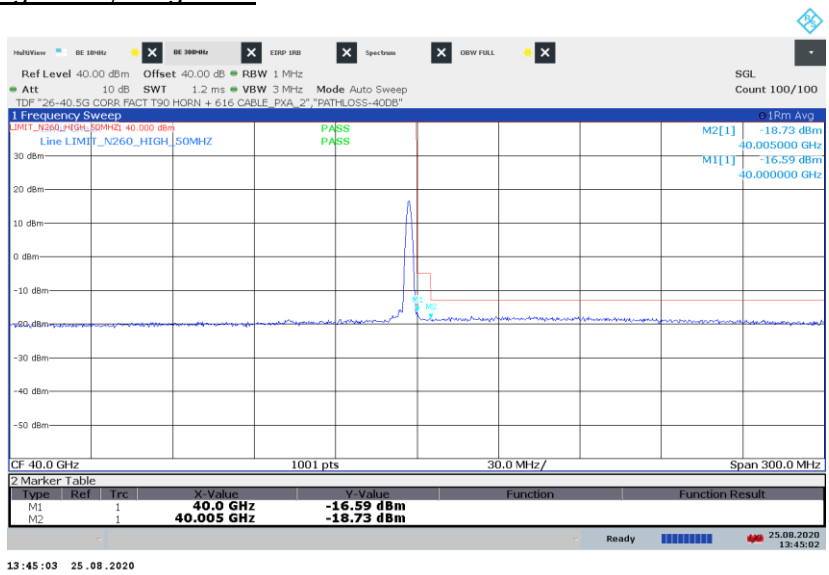
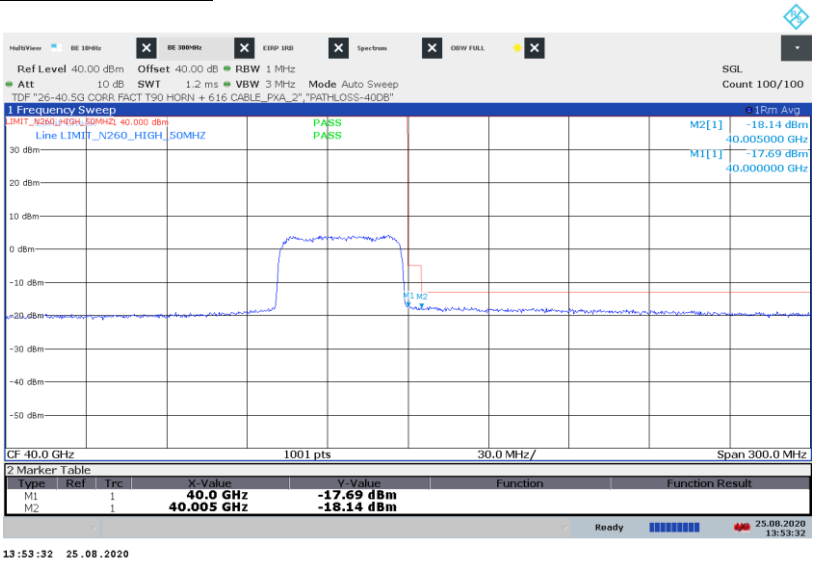
ANT M2, 50 MHz, MIMO, 1CC, QPSK

High-side, Single RB



High-side, Full RB



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ANT M1, 100 MHz, MIMO, 1CC, QPSK

Low-side, Single RB

Low-side, Full RB

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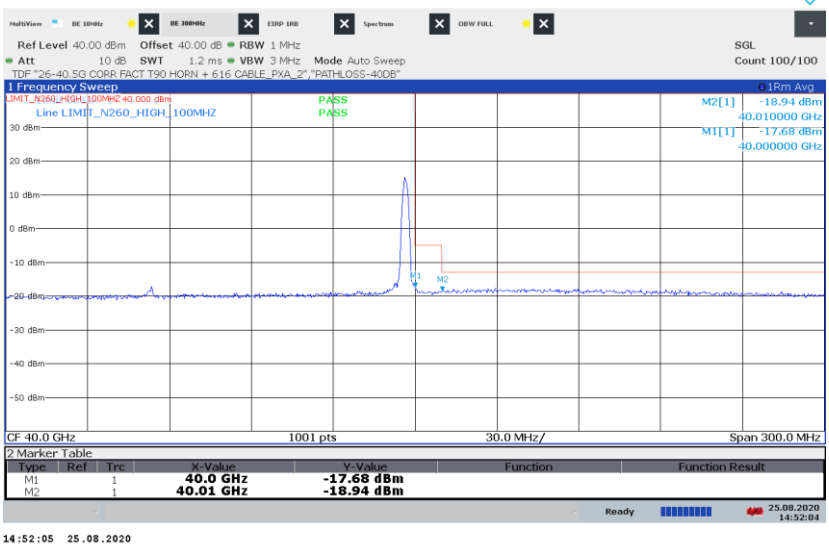
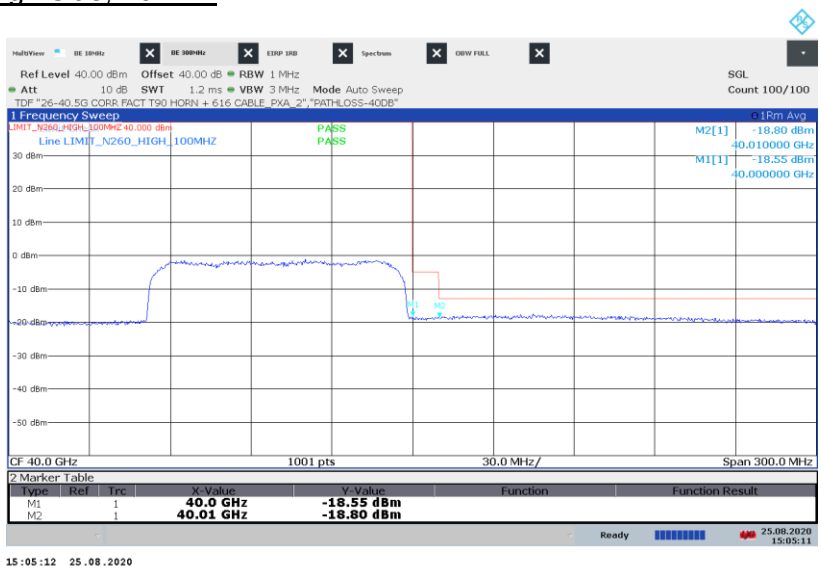
ANT M1, 100 MHz, MIMO, 1CC, QPSK

High-side, Single RB



High-side, Full RB



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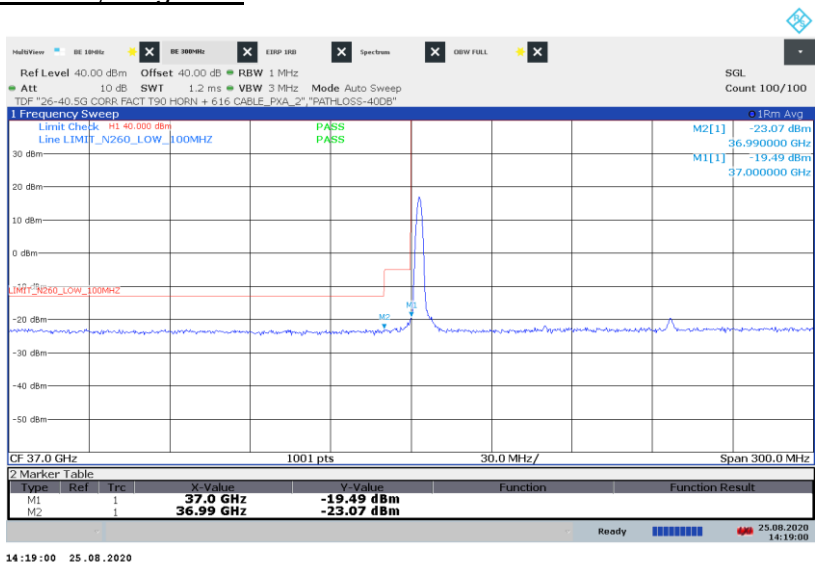
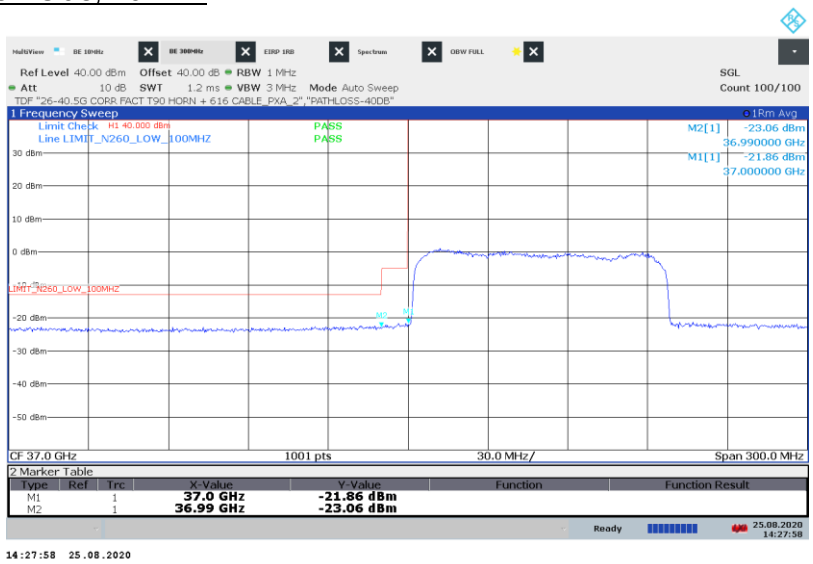
ANT M2, 100 MHz, MIMO, 1CC, QPSK

Low-side, Single RB



Low-side, Full RB



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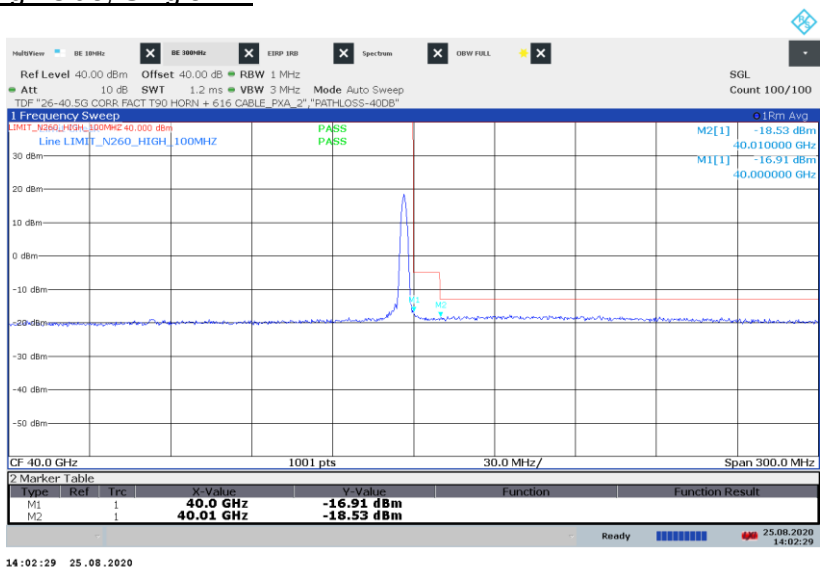
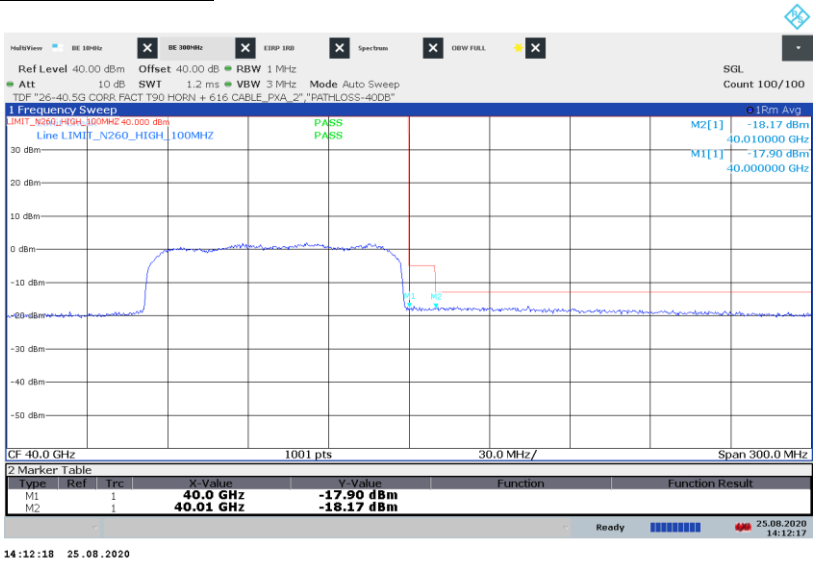
ANT M2, 100 MHz, MIMO, 1CC, QPSK

High-side, Single RB



High-side, Full RB



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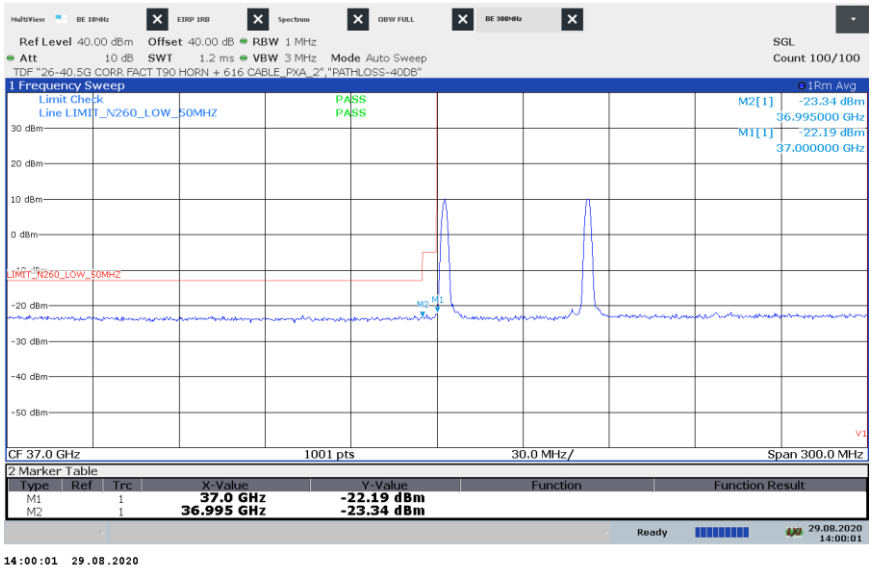
8.3.4. BAND EDGE RESULTS n260 MIMO 2CC

ANT M1, 50 MHz, MIMO, 2CC, QPSK

Low-side, Single RB



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ANT M1, 50 MHz, MIMO, 2CC, QPSK

High-side, Single RB

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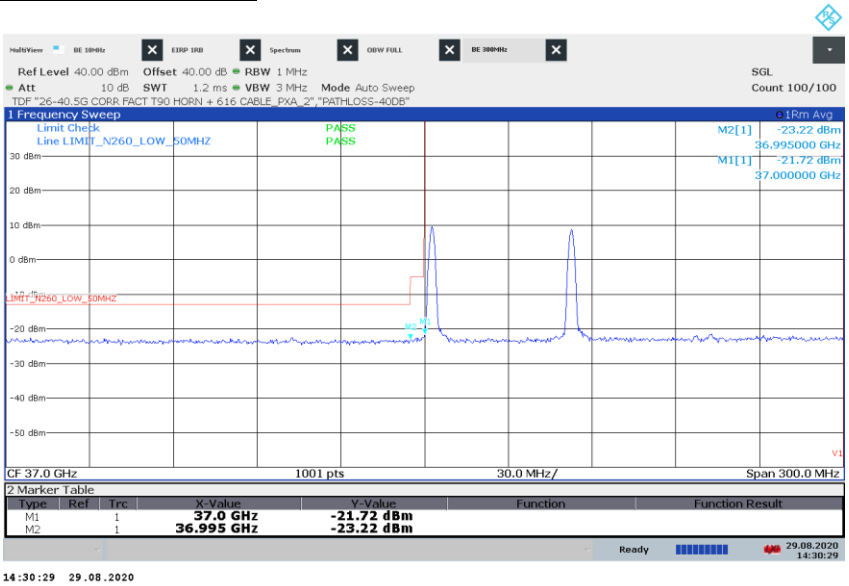
ANT M2, 50 MHz, MIMO, 2CC, QPSK

Low-side, Single RB



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ANT M2, 50 MHz, MIMO, 2CC, QPSK

High-side, Single RB

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ANT M1, 100 MHz, MIMO, 2CC, QPSK

Low-side, Single RB

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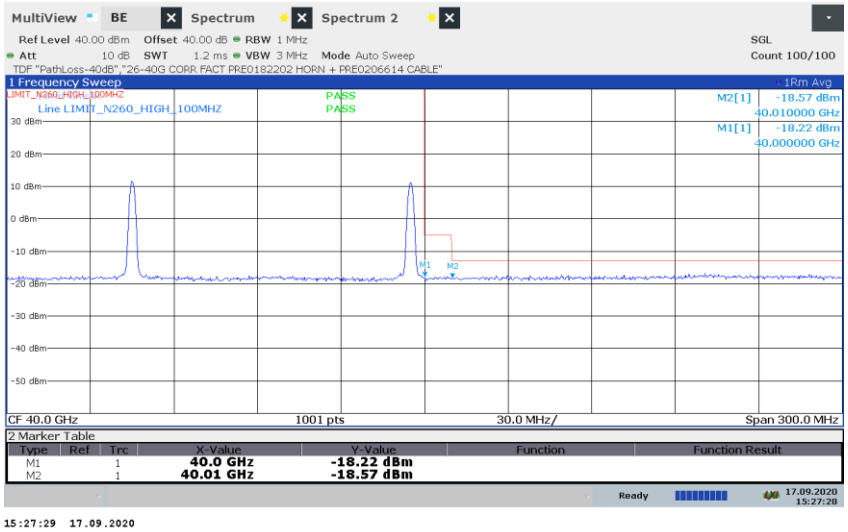
ANT M1, 100 MHz, MIMO, 2CC, QPSK

High-side, Single RB



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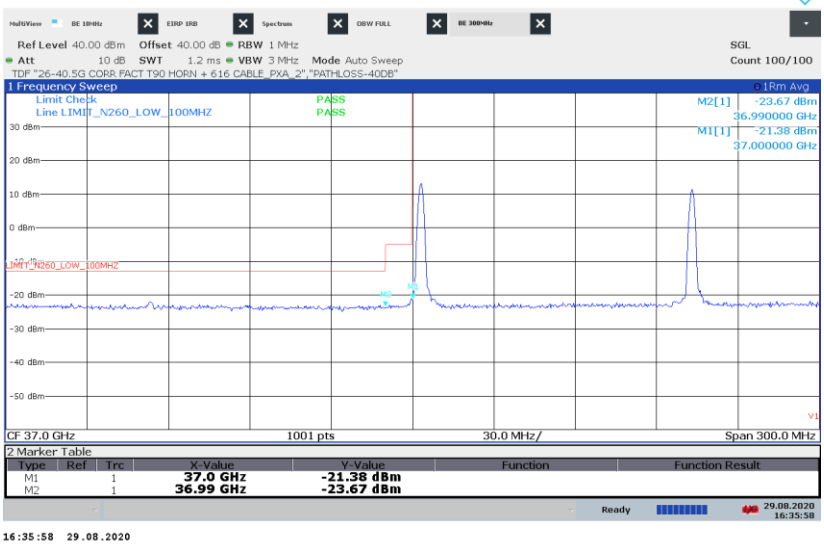
ANT M2, 100 MHz, MIMO, 2CC, QPSK

Low-side, Single RB



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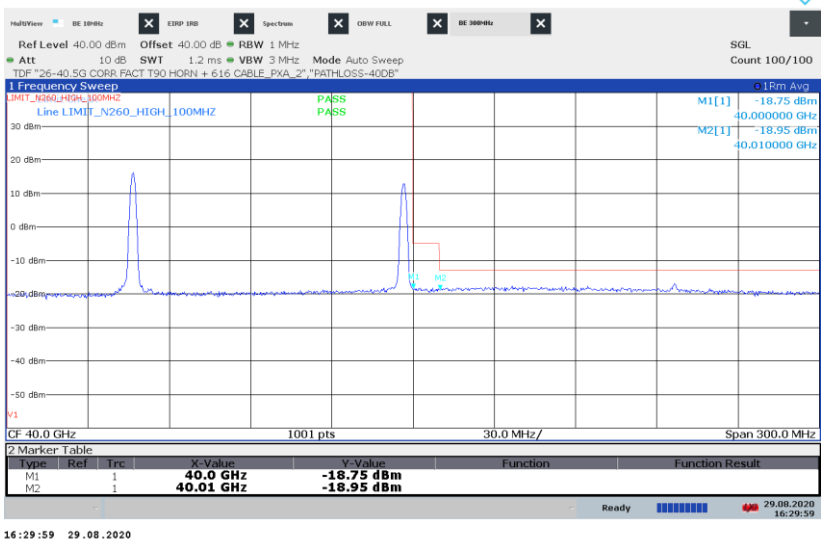
ANT M2, 100 MHz, MIMO, 2CC, QPSK

High-side, Single RB



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