



# **CERTIFICATION TEST REPORT**

**Report Number :** 13415473-E2V2

**Applicant :** Nokia Solutions and Networks US LLC  
6000 Connection Drive  
Irving, Texas 75039, USA

**Product :** 5G AirScale 28 GHz 2T2R n261 mmWave Radio

**Models :** AWEUA / AWEUB / FA3UA

**FCC ID :** 2AD8UASMR28FA3UA

**EUT Description :** Nokia AWEUA/B Airscale mmWave Radio 2T2R 28G + FA3UA Airscale  
mmWave Extension Module 28G

**Test Standard :** 47 CFR FCC PART 30  
§2.1046 RF Power Output, §2.1049 OBW,  
§2.1051 Antenna Spurious (Radiated), §2.1053 Cabinet Spurious

**Date Of Issue:**  
February 05, 2021

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NVLAP LAB CODE 200065-0 (FREMONT)

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	01/27/2021	Initial Issue	Michael Heckrotte
V2	02/05/2021	Updated EUT Description Updated Model Number of Extension Unit on Section 6.1	GP Chin

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Nokia Solutions and Networks US LLC  
6000 Connection Drive  
Irving, Texas 75039, USA

**EUT DESCRIPTION:** Nokia AWEUA/B Aircscale mmWave Radio 2T2R 28G +  
FA3UA Aircscale mmWave Extension Module 28G

**MODELS:** AWEUA / AWEUB / FA3UA

**SERIAL NUMBERS:** AH203301163 (AWEUA)  
AH203500300 & AH203500304 (FA3UA)

**DATE TESTED:** SEPTEMBER 30<sup>th</sup>, 2020 – JANUARY 13<sup>th</sup>, 2021

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
47 CFR FCC PART 30	Complies
As referenced in "SCOPE AND SUMMARY" section below	

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:

Tested By:



MICHAEL HECKROTTE  
PRINCIPAL ENGINEER  
UL Verification Services Inc.



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

## 2. SCOPE AND SUMMARY

47 CFR Clause	Test Description	Test Limit	Test Condition	Test Result
§2.1046 §30.202	RF Power Output	+75 dBm /100 MHz EIRP	Radiated	Complies
§2.1049	Occupied Bandwidth	N/A	Radiated	Complies
§2.1051 §30.203	Antenna Port Spurious Emissions	Limit for OOB emissions from the band edge up to 10% of the channel BW: -5 dBm/MHz TRP	Radiated	Complies
§2.1051 §30.203	Cabinet Spurious Emissions	Limit for all other spurious emissions: -13 dBm/MHz TRP	Radiated	Complies

Other test requirements specified by 47 CFR §2.1033(c)(14) are documented within separate test reports.

## 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following regulations, standards and test methods.

1. FCC CFR 47 Part 30
2. FCC CFR 47 Part 2
3. KDB 842590 D01 Upper Microwave Flexible Use Service v01r01
4. KDB 971168 D01 Power Meas. License Digital Systems v03r01
5. KDB 662911 D01 Multiple Transmitter Output v02r01
6. ANSI C63.26 - 2015
7. ANSI C63.4 - 2014

## 4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company No.	FCC Registration
<input checked="" type="checkbox"/>	Building 1: 47173 Benicia Street, Fremont, California, USA	US0104	2324A	208313
<input type="checkbox"/>	Building 2: 47266 Benicia Street, Fremont, California, USA	US0104	22541	208313
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd, Fremont, California, USA	US0104	2324B	208313

## 5. CALIBRATION AND UNCERTAINTY

### 5.1. 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.

### 5.2. 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.)

### 5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U <sub>LAB</sub>
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%.

## 6. EQUIPMENT UNDER TEST

### 6.1. DESCRIPTION OF EUT

The EUT is an outdoor Radio Transceiver Device operating at 5G NR operational mode on n261 band at 27.5 – 28.35 GHz.

The EUT has the following specifications.

Specification Items	Description
Product	5G AirScale 28 GHz 2T2R n261 mmWave Radio
AC Variant	AWEUA (475166A)
DC Variant	AWEUB (475167A)
Extension Unit	FA3UA (475001A)
Equipment Type	Radio Transceiver Device
Equipment Option	Equipped with Solar Shield
Operating Temperature	-40°C to 55°C
Environment	Outdoor Unit
Operating Frequency Range	27.5 – 28.35 GHz
Power Type	-48 VDC (Nominal); 115 VAC 50/60 Hz (Nominal)
Antenna	Integrated Antenna with ~27 dBi gain, 180 deg coverage with Ext unit. Power per port: 158.5 W (+52 dBm) / Polarization, combined 316 W (+55 dBm) for 2 Arrays (per antenna)
MIMO Mode	2X
Modulation	5G NR LTE-TDD with QPSK, 16QAM, 64QAM, 256QAM
Carrier Configuration	1 to 8 carriers
Carrier Bandwidth	100 MHz
Maximum Rated Conducted RF Power	100 MHz @ 316 W (+55 dBm)
Software Version (Master)	5G19B_7.3800.264
Serial No. (Main)	AH203301163
Serial Nos. (Ext)	AH203500300 & AH203500304



Based on the NRARFCN for n261 band with 100 MHz Carrier, the operating band consists of the following channels and spectrums:

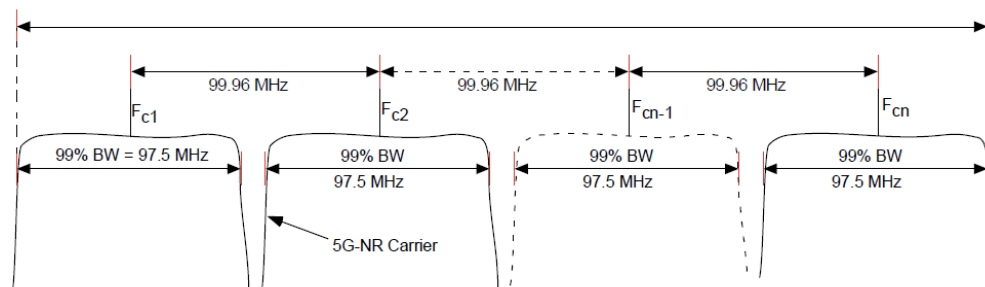
27.50 – 28.30 GHz Range (Left-side Channel)

NRARFCN	TDD Center Reference Frequency (GHz)	Raster Delta (MHz)
2071675	27.55056	99.96
2073341	27.65052	99.96
2075007	27.75048	99.96
2076673	27.85044	99.96
2078339	27.9504	99.96
2080005	28.05036	99.96
2081671	28.15032	99.96
2083337	28.25028	99.96

27.55 – 28.35 GHz Range (Right-side Channel)

NRARFCN	TDD Center Reference Frequency (GHz)	Raster Delta (MHz)
2072503	27.60024	99.96
2074169	27.7002	99.96
2075835	27.80016	99.96
2077501	27.90012	99.96
2079167	28.00008	99.96
2080833	28.10004	99.96
2082499	28.20000	99.96
2084165	28.29996	99.96

The multi-carrier bandwidth of the EUTs is defined as follows. The individual carriers, 98 MHz maximum, are spaced 99.96 MHz apart and do not overlap. The overall signal bandwidth for n adjacent carriers and calculated assessment are shown in the following:



$$\begin{aligned}
 1 \text{ carrier} &= (1-1)(99.96 \text{ MHz}) + 98 \text{ MHz} = 98 \text{ MHz} = 098\text{MG7W} \\
 4 \text{ carrier} &= (4-1)(99.96 \text{ MHz}) + 98 \text{ MHz} = 397.88 \text{ MHz} = 398\text{MG7W} \\
 8 \text{ carrier} &= (8-1)(99.96 \text{ MHz}) + 98 \text{ MHz} = 797.72 \text{ MHz} = 798\text{MG7W}
 \end{aligned}$$

## 6.2. DESCRIPTION OF AVAILABLE ANTENNA

Two Integral antenna arrays are employed for horizontal and vertical transmit beams by EUT. There are no antenna connections. Each antenna assembly is a 12x8 matrix (96 elements) with active 8x8 matrix at transmission and distributes +25 dBm of RF power with an overall gain of 27 dBi. This results in a radiated power of +52 dBm EIRP per antenna assembly for a Total Radiated Power of +55 dBm EIRP (316.25W).

## 6.3. DESCRIPTION OF TEST SETUP

### 6.3.1. EUT AND SUPPORT EQUIPMENT

Use	Product Type	Manufacturer	Models	Comments
EUT	5G AirScale 28 GHz	Nokia of America Corporation LLC	AWEUA	Main Unit
EUT	5G AirScale 28 GHz	Nokia of America Corporation LLC	FA3UA	Extension Unit #1
EUT	5G AirScale 28 GHz	Nokia of America Corporation LLC	FA3UA	Extension Unit #2

Note: EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment, or SIM - Simulator (Not Subjected to Test)

## SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
GPS Antenna	PCTEL	GPS-TMG-26N	3276495
Control Computer	HP	EliteDesk 800 G1 SFF	2UA4460PM6
Baseband Unit (BBU)	Nokia	ABIL	L1190613746
Baseband Unit (BBU)	Nokia	ASIK	L1190909605

### 6.3.2. I/O PORTS

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	Mains	AC	Y	N	None
2	Fiber Optic Cable	TP	Y	N	None
3	Coaxial Cable	N/E	Y	N	For GPS Antenna

\*Note:  
 AC = AC Power Port      DC = DC Power Port      N/E = Non-Electrical  
 I/O = Signal Input or Output Port (Not Involved in Process Control)  
 TP = Telecommunication Ports

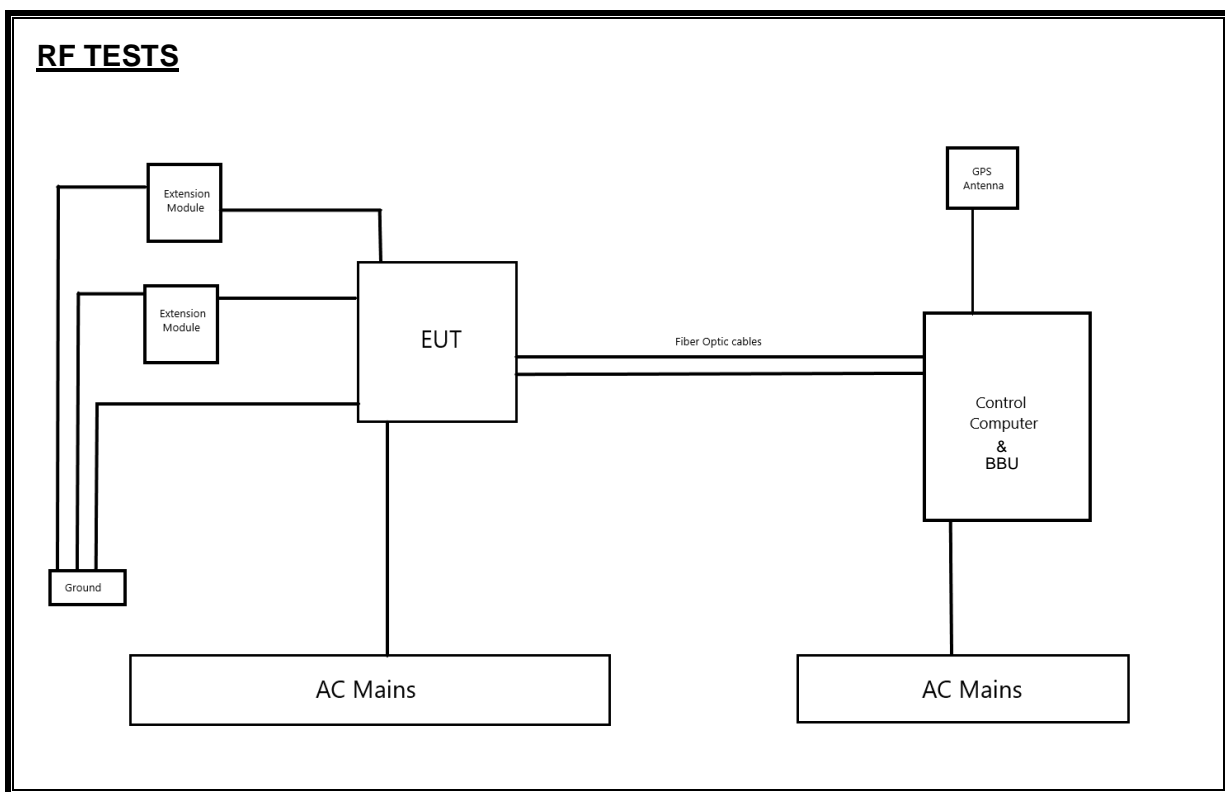
### 6.3.3. TEST SETUP DIAGRAMS

All testing was performed using FTM (Factory Test Mode) software at continuous Tx operation on AC Variant Main and both Extension Units. The Extension Unit is a de-populated version of Main Unit and it does not have the communication and controlled circuitries with the baseband control unit (BBU). All three units were powered on and only a single unit was programmed to transmit desired signal at test.

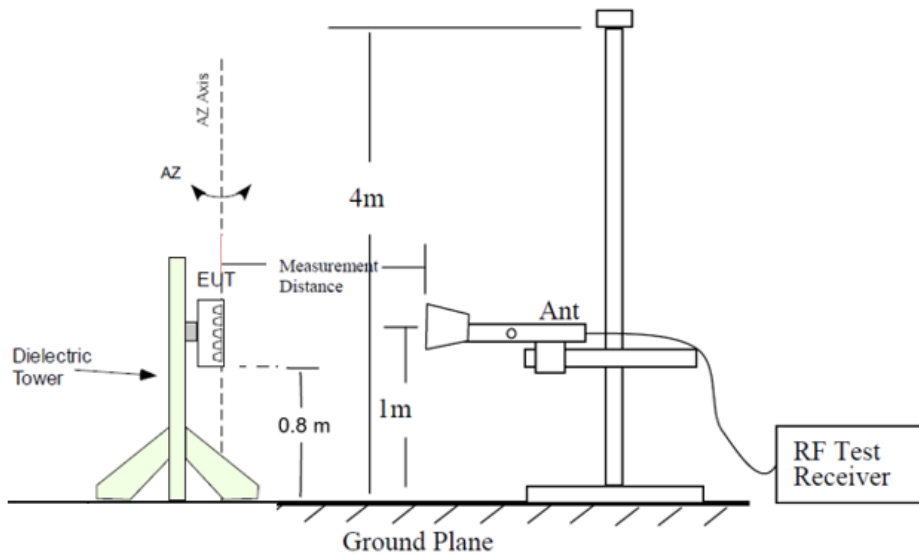
The equipment under test was transmitting while connected to its integral antenna.

The OBW, EIRP and Band Edge measurement were performed on all 8 aggregated carrier configurations, across QPSK, 16QAM and 64QAM modulations. To leverage the performance of Main and Extension Units under test, 1- carrier configuration was measured on both Main and Extension Units. 3-, 5- and 7- carrier configurations were measured on Main Unit and 2-, 4-, 6- and 8- carrier configurations were measured on Extension Unit. These were performed for both the horizontally and vertically polarized beams and for every nominal 100 MHz carrier.

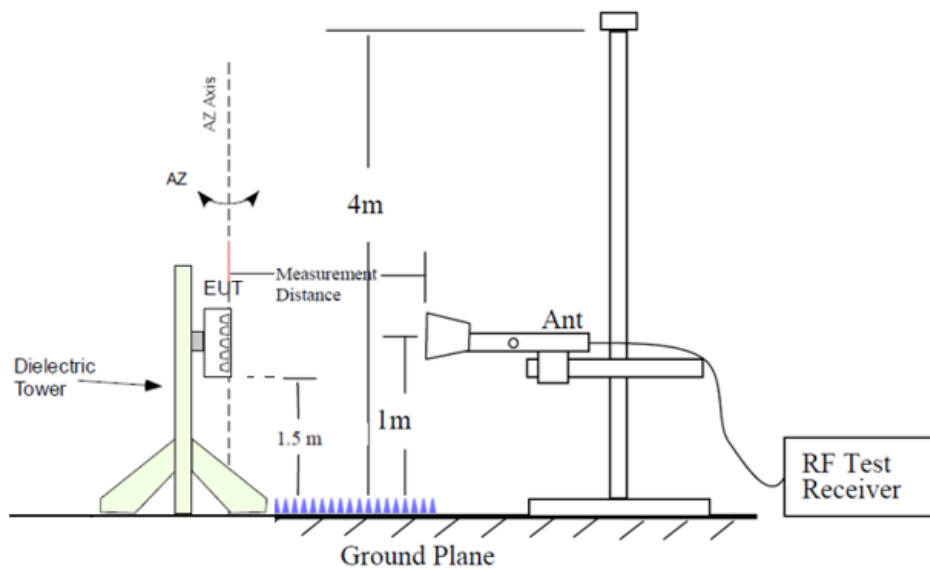
#### SETUP DIAGRAM FOR TESTS



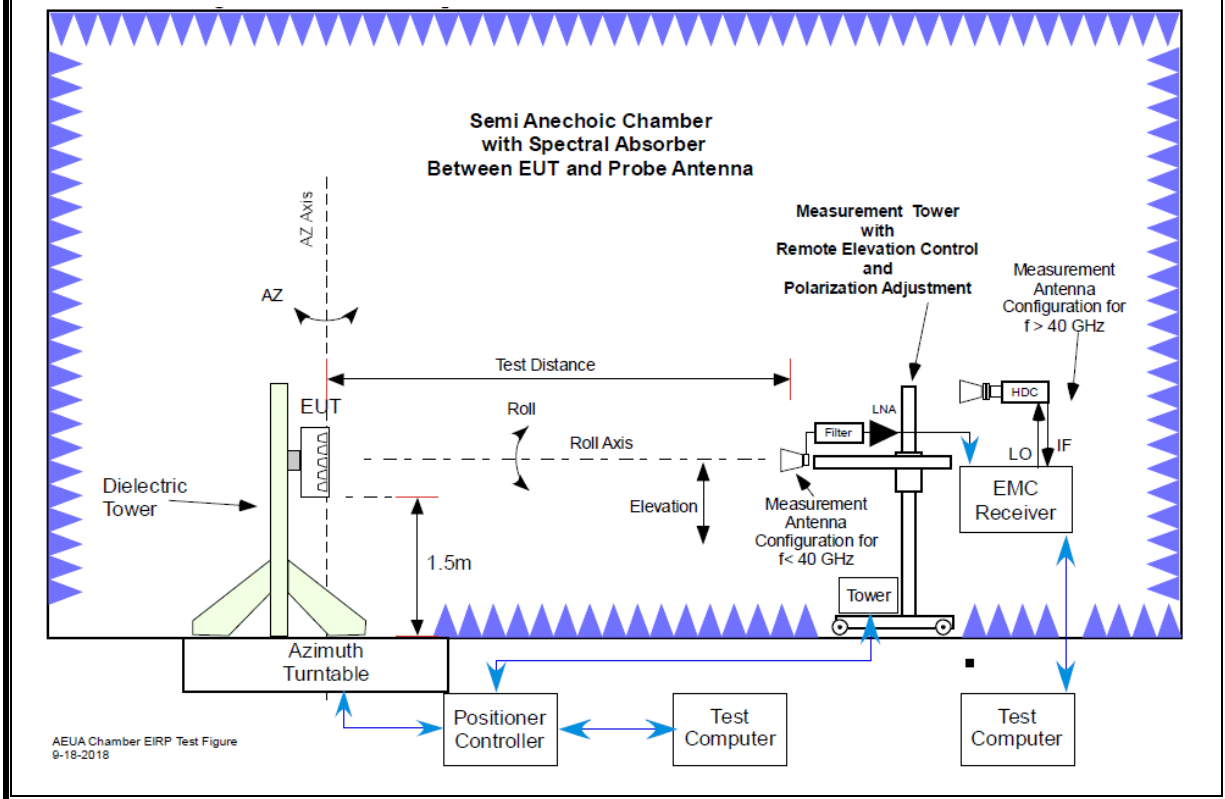
### **TEST SITE DIAGRAM – Below 1 GHz**



### **TEST SITE DIAGRAM – 1 - 18 GHz**



# **TEST SITE DIAGRAM – Above 18 GHz & mmWave**



## **FAR-FIELD BOUNDARY DISTANCE AND MEASUREMENT DISTANCE**

The measurement distance is in the far field per formula  $2D^2/\lambda$  where D is the largest dimension of the antenna

For fundamental or band edge emissions, the largest far-field boundary distance of either the EUT antenna or measurement antenna shall be used. In this case, the measurement antenna has the largest far-field boundary distance. Measurements of fundamental and OOB emissions were made at a distance of 4.5 m.

For spurious emissions, the far-field boundary distance shall be based on the measurement antenna.

<b>Frequency Range (GHz)</b>	<b>Far Field Boundary Distance (m)</b>	<b>Measurement Distance Used (m)</b>
18 - 26.5	3.39	4.00
26.5 - 40	2.67	4.00
40 - 50	1.61	3.00
50 - 75	1.05	1.50
75 - 100	0.70	1.00

## 7. 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*
EMI Test Receiver	Rohde & Schwarz	FSW50	PRE0211337	4/30/2020	4/30/2021
EMI Test Receiver	Rohde & Schwarz	ESW44	PRE0203385	2/22/2020	2/22/2021
Antenna, Horn 26.5-40 GHz	ARA	MWH-2640/B	PRE0079317/T90	11/7/2019	11/7/2020*
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	PRE0212908	9/2/2020	9/2/2021
EMI Test Receiver	Rohde & Schwarz	ESW44	PRE0179375	2/24/2020	2/24/2021
Antenna, Hybrid, 30MHz to 3GHz	Sunoi Science Corp	JB3	PRE0181574	10/21/2020	10/21/2021
Amplifier, 9kHz to 1GHz, 32dB	Sonoma Instrument	310	PRE0180177	4/16/2020	4/16/2021
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T345	5/19/2020	5/19/2021
RF Filter Box, 1-18GHz	UL	N/A	PRE0211790	6/7/2020	6/7/2021
Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	PRE0211790	9/12/2020	9/12/2021
Antenna, Horn 35-50 GHz	CMI	HO22R	--	9/13/2020	9/13/2021
LNA, 40-50 GHz	Eravant	SBL-335033040-2222-E1	PRE0212250	9/28/2020	9/28/2021
Antenna, Horn 50-75 GHz	CMI	HO15R	H15-2	9/13/2020	9/13/2021
LNA, 50-75 GHz	Eravant	SBL-5037533550-1515-E1	PRE0212186	10/5/2020	10/5/2021
50-75 GHz Downconverter	VDI	WR15.0SAX	PRE0212243	6/2/2020	6/2/2021
Antenna, Horn 75-110 GHz	CMI	HO10R	H10-1	9/13/2020	9/13/2021
LNA, 75-110 GHz	Spacek	SLW-22-5	15J04	9/30/2020	9/30/2021
75-110 GHz Downconverter	VDI	WR10.0SAX	PRE0212453	6/3/2020	6/3/2021
UL EMC Radiated Software	Version	Rev 9.5 04 Aug 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 35-50 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.

## 8. APPLICABLE LIMITS AND TEST RESULTS

### 8.1. OCCUPIED BANDWIDTH

#### 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 bandwidth.

- RBW = 1 – 5% of OBW
- VBW  $\geq 3 \times$  RBW
- Detector = Peak, Gated
- 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.

Individual carriers OBW-Signal bandwidths were measured with RBWs of 3 MHz, 5 MHz or 10 MHz, depending on the aggregated carrier configurations and across QPSK, 16QAM and 64QAM modulations.

#### RESULTS

The OBW results for all available carrier configurations and modulations are tabulated in the following pages. To minimize report size, a set of plots on horizontally and vertically polarized beams of each carrier configuration with various RBWs is presented for all other combinations.

Employee IDs: 19296 & 19437  
Location: Chamber 1  
Test Date: 9/30/2020 – 10/6/2020



## RESULTS

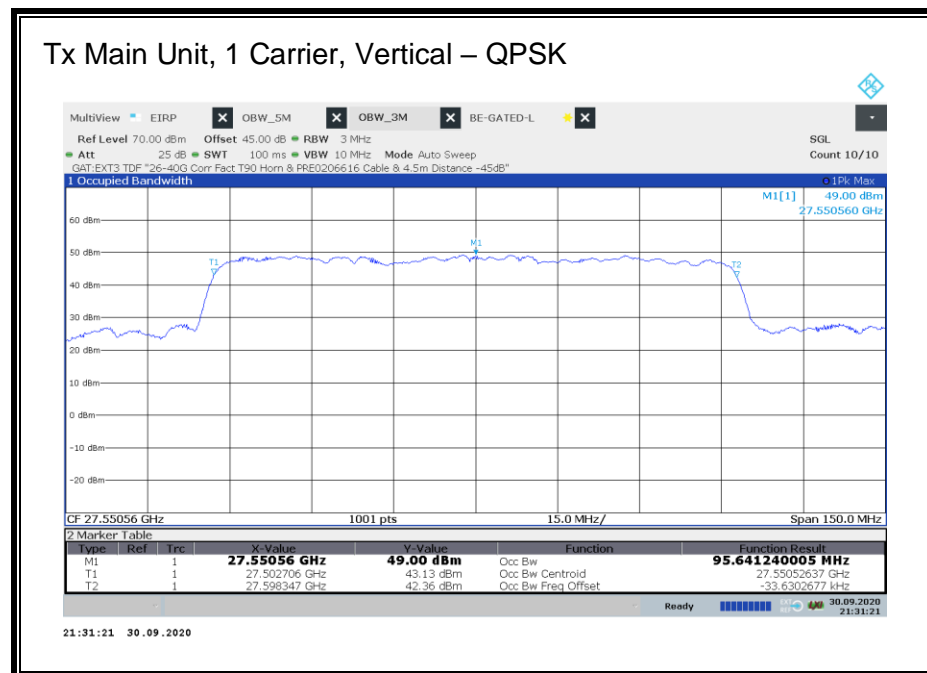
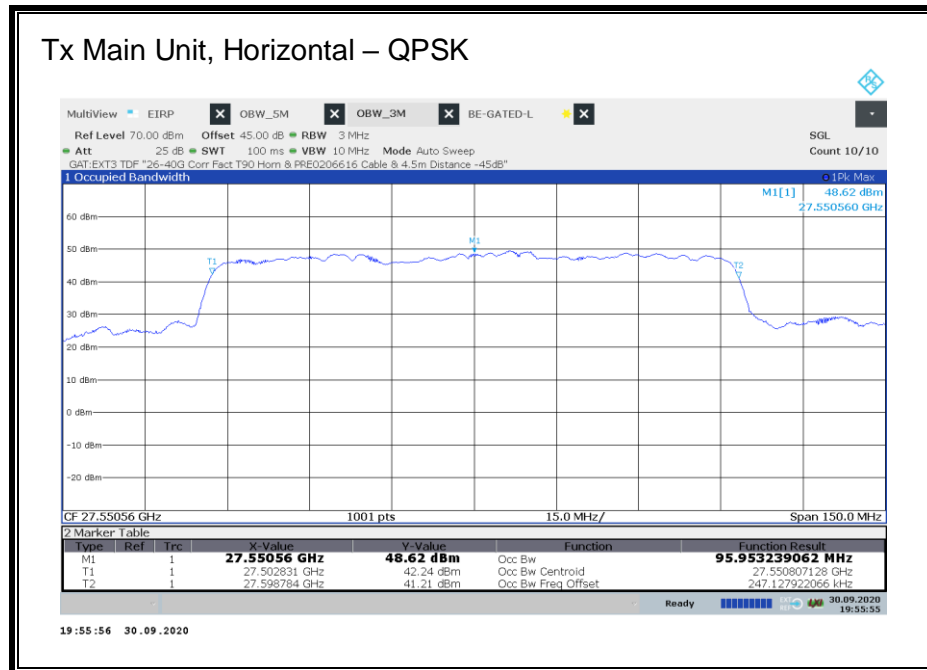
Carrier Location in Band	Tx. Carriers Center Frequency	Tx Unit	Number of Tx. Carriers	Modulation	Measured w/ 3 MHz RBW		Measured w/ 5 MHz RBW	
					Horizontal	Vertical	Horizontal	Vertical
	GHz				MHz	MHz	MHz	MHz
Left	27.55056	Main Unit	1	QPSK	95.95	95.64	96.36	97.34
Left	27.55056	Ext Unit	1	16QAM	94.82	95.35	96.73	97.34
Center	27.9504	Main Unit	1	QPSK	95.57	98.08	95.48	97.66
Center	27.9504	Ext Unit	1	64QAM	96.01	95.89	98.33	98.44
Right	28.29996	Main Unit	1	QPSK	95.35	96.32	97.45	97.61
Right	28.29996	Ext Unit	1	QPSK	96.15	95.34	98.96	96.99

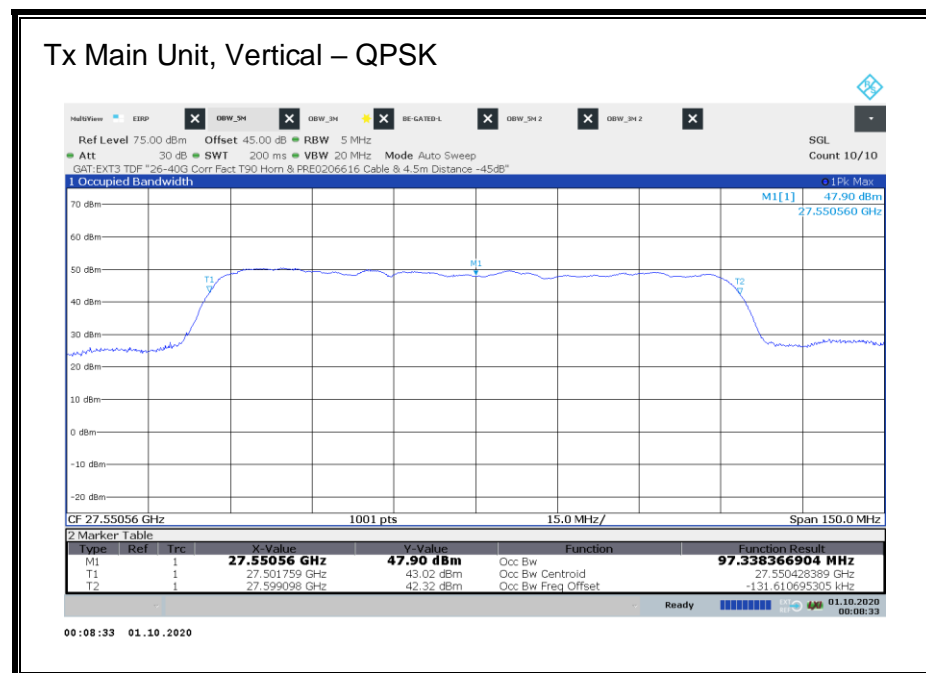
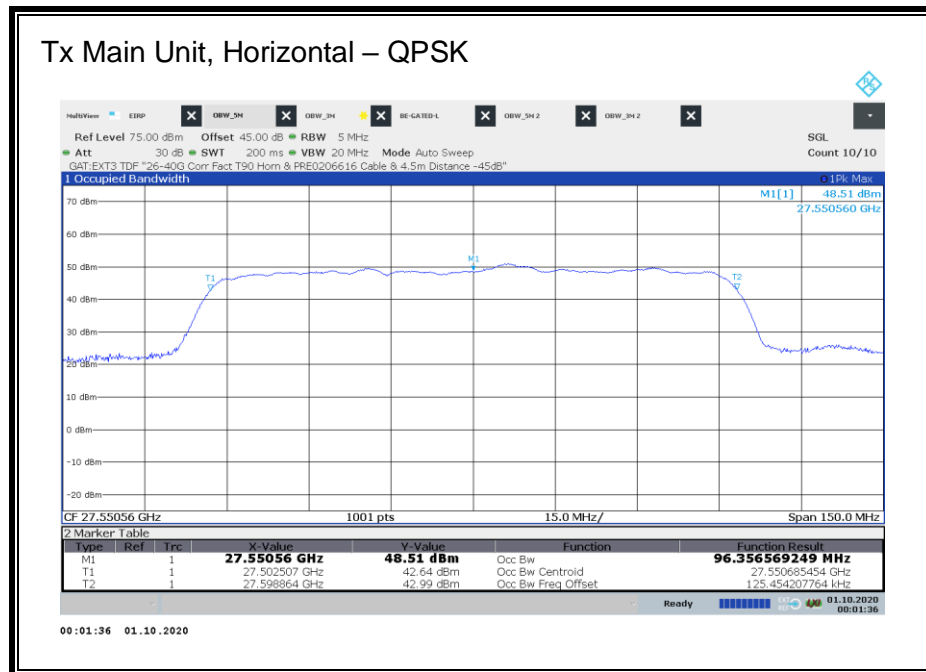
Carrier Location in Band	Tx. Carriers Center Frequency	Tx Unit	Number of Tx. Carriers	Modulation	Measured w/ 5 MHz RBW		Measured w/ 10 MHz RBW	
					Horizontal	Vertical	Horizontal	Vertical
	GHz				MHz	MHz	MHz	MHz
Left	27.55056	Ext Unit	2	QPSK	193.98	194.99	198.02	198.84
	27.65052							
Left	27.55056	Ext Unit	2	64QAM	195.37	194.65	200.42	199.81
	27.65052							
Center	27.9504	Ext Unit	2	QPSK	196.55	195.65	201.59	199.72
	28.05036							
Right	28.2	Ext Unit	2	16QAM	194.66	194.83	198.82	198.91
	28.29996							
Left	27.55056	Main Unit	3	QPSK	293.06	293.81	296.66	297.24
	27.65052							
	27.75048							
Center	27.85044	Main Unit	3	64QAM	293.27	294.05	297.18	298.54
	27.9504							
	28.05036							
Right	28.10004	Main Unit	3	16QAM	293.89	292.84	297.24	295.82
	28.2							
	28.29996							
Left	27.55056	Ext Unit	4	QPSK	390.47	391.22	393.23	394.18
	27.65052							
	27.75048							
	27.85044							
Right	28.00008	Ext Unit	4	16QAM	391.31	392.39	393.26	394.68
	28.10004							
	28.2							
	28.29996							
Left	27.55056	Main Unit	5	QPSK	491.03	491.89	492.66	494.62
	27.65052							
	27.75048							
	27.85044							
	27.9504							
Right	27.90012	Main Unit	5	64QAM	490.92	489.92	493.61	492.13
	28.00008							
	28.10004							
	28.2							
	28.29996							

Carrier Location in Band	Tx. Carriers Center Frequency GHz	Tx Unit	Number of Tx. Carriers	Modulation	Measured w/ 10 MHz RBW	
					Horizontal	Vertical
					MHz	MHz
Left	27.55056	Ext Unit	6	64QAM	590.92	591.84
	27.65052					
	27.75048					
	27.85044					
	27.9504					
	28.05036					
Right	27.80016	Ext Unit	6	QPSK	590.42	591.42
	27.90012					
	28.00008					
	28.10004					
	28.2					
	28.29996					
Left	27.55056	Main Unit	7	QPSK	690.31	691.09
	27.65052					
	27.75048					
	27.85044					
	27.9504					
	28.05036					
Right	28.15032	Main Unit	7	64QAM	692.54	691.37
	27.7002					
	27.80016					
	27.90012					
	28.00008					
	28.10004					
Left	28.2	Ext Unit	8	16QAM	786.85	789.42
	28.29996					
	27.55056					
	27.65052					
	27.75048					
	27.85044					
Right	27.9504	Ext Unit	8	QPSK	787.57	788.64
	28.05036					
	28.15032					
	28.25028					
	27.60024					
	27.7002					
Right	27.80016	Ext Unit	8	64QAM	787.88	789.14
	27.90012					
	28.00008					
	28.10004					
	28.2					
	28.29996					

# **1 Carrier Configuration, 3 MHz RBW, Left**

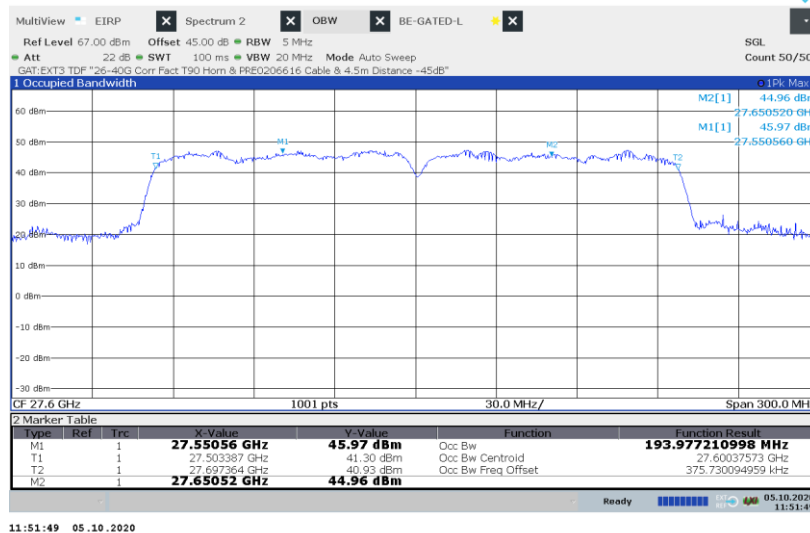


# **1 Carrier Configuration, 5 MHz RBW, Left**

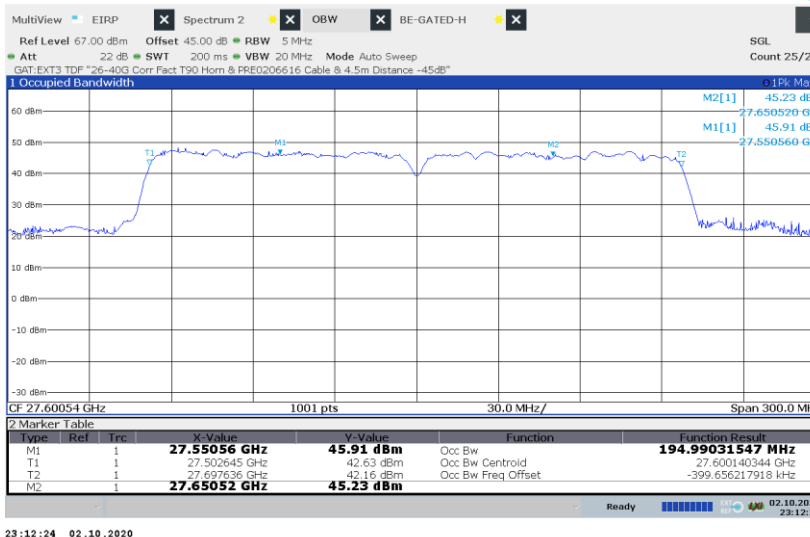


## 2 Carrier Configuration, 5 MHz RBW, Left

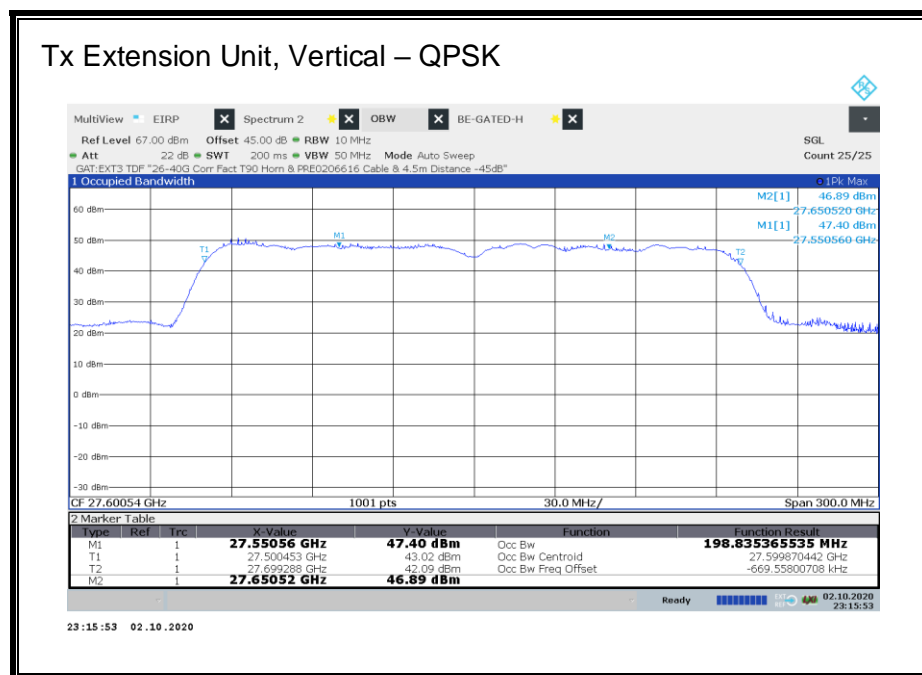
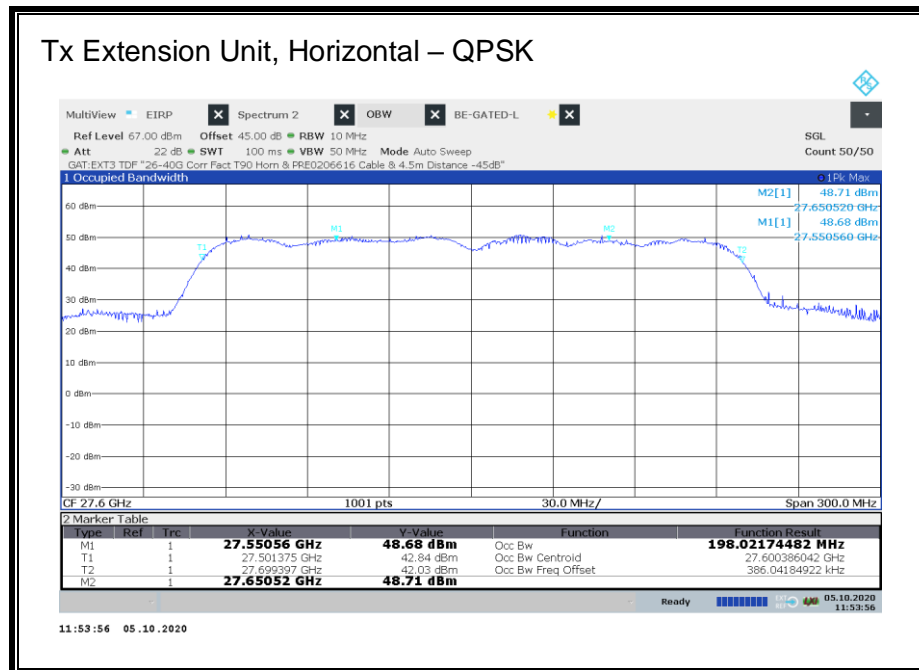
### Tx Extension Unit, Horizontal – QPSK



### Tx Extension Unit, Vertical – QPSK



## 2 Carrier Configuration, 10 MHz RBW, Left



### 3 Carrier Configuration, 5 MHz RBW, Left

#### Tx Main Unit, Horizontal – QPSK

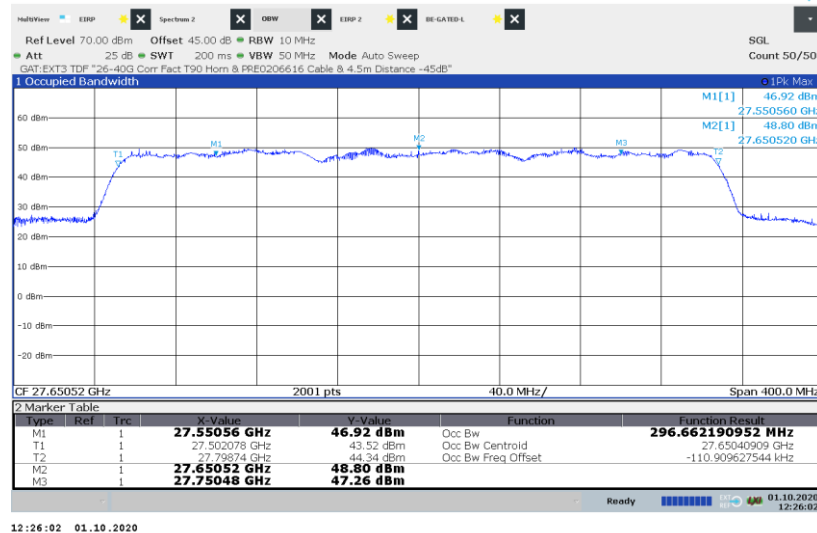


#### Tx Main Unit, Vertical – QPSK

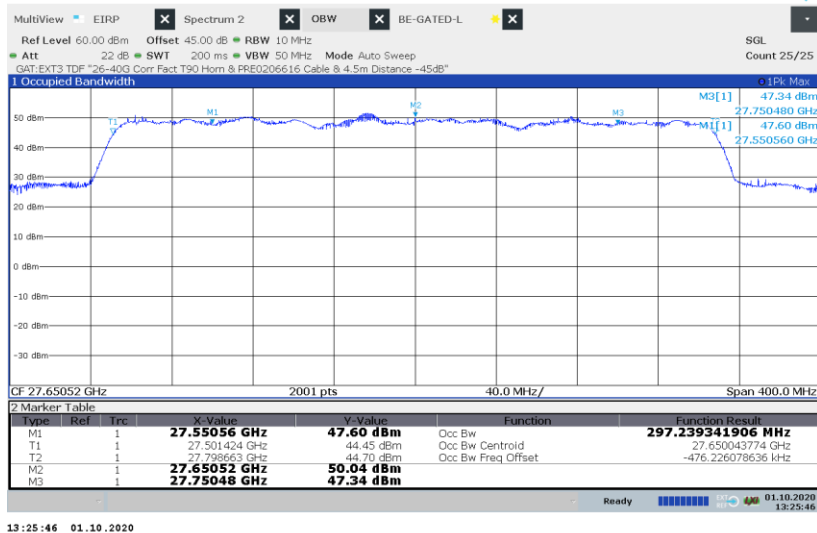


### 3 Carrier Configuration, 10 MHz RBW, Left

#### Tx Main Unit, Horizontal – QPSK

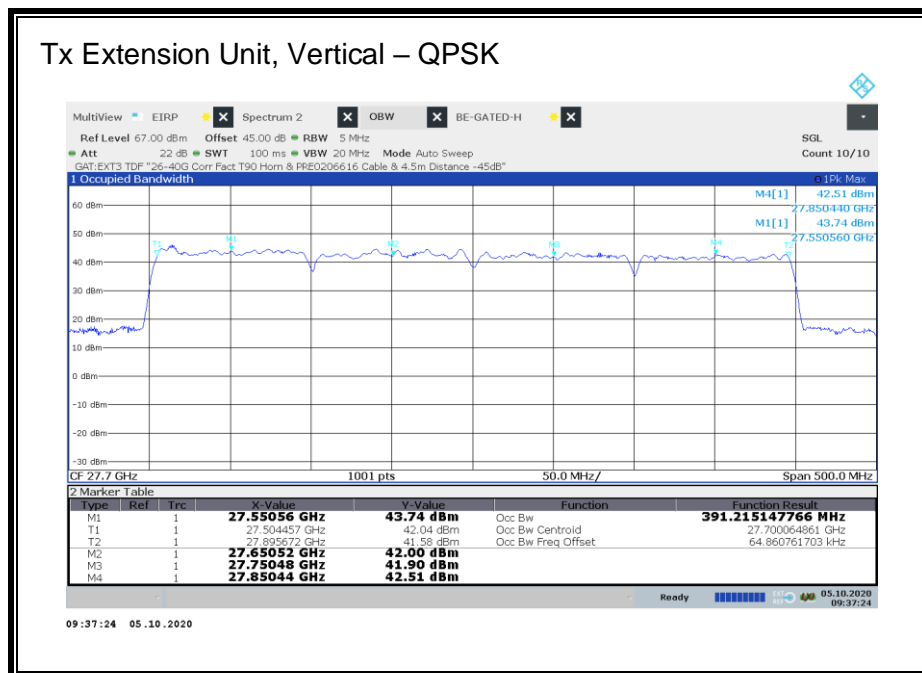
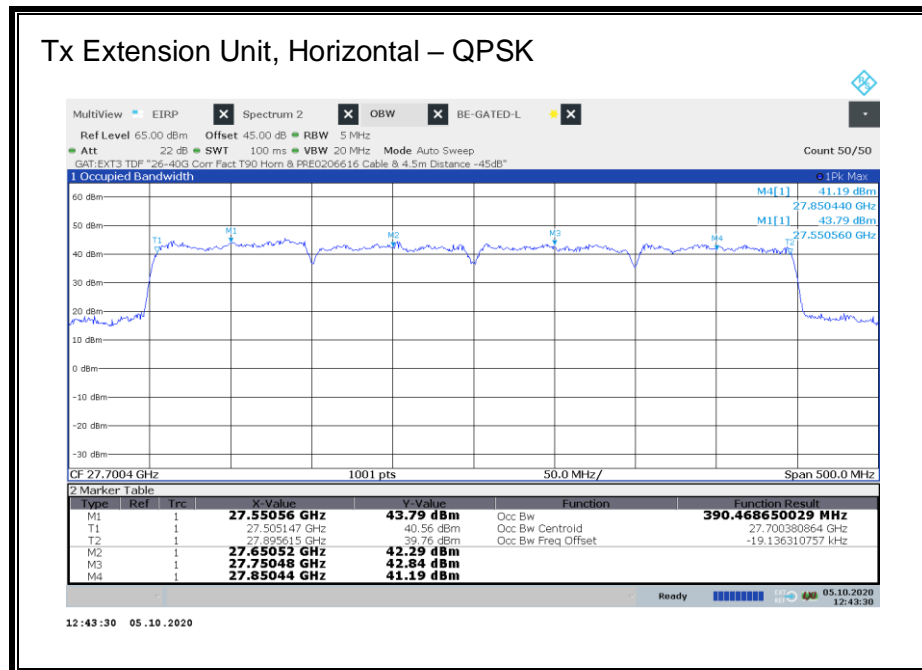


#### Tx Main Unit, Vertical – QPSK

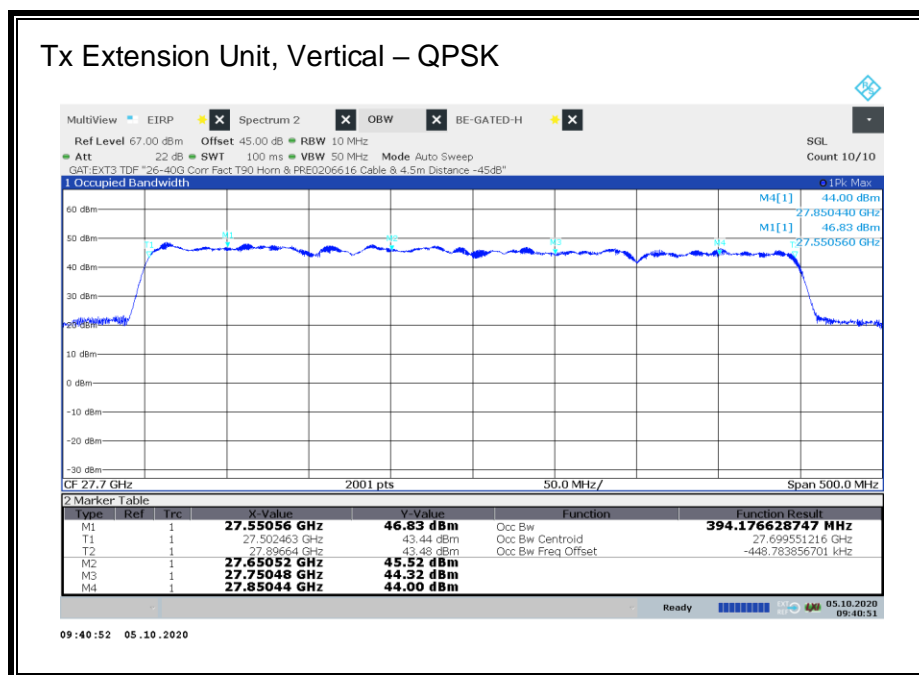
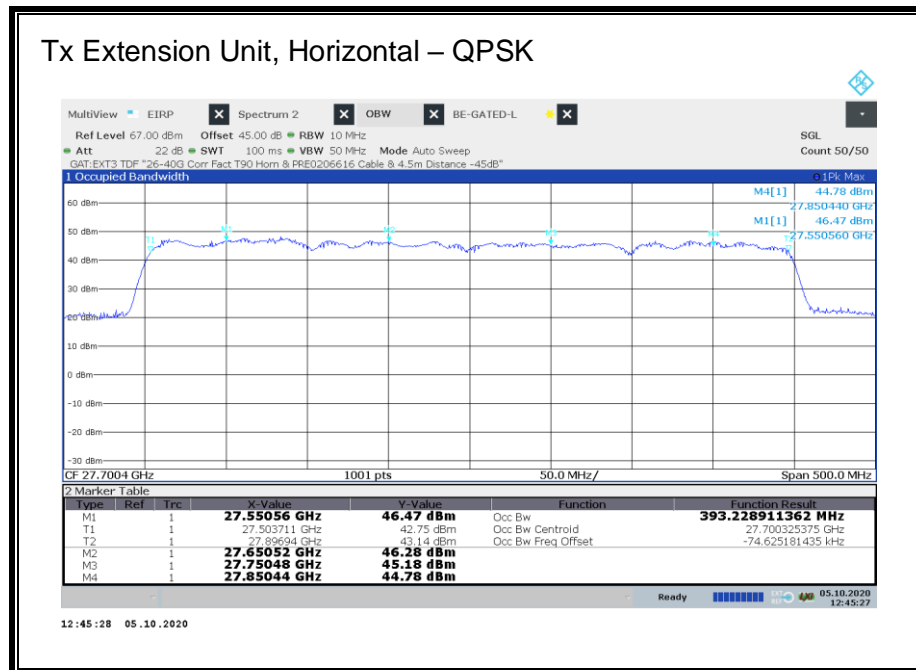




#### 4 Carrier Configuration, 5 MHz RBW, Left

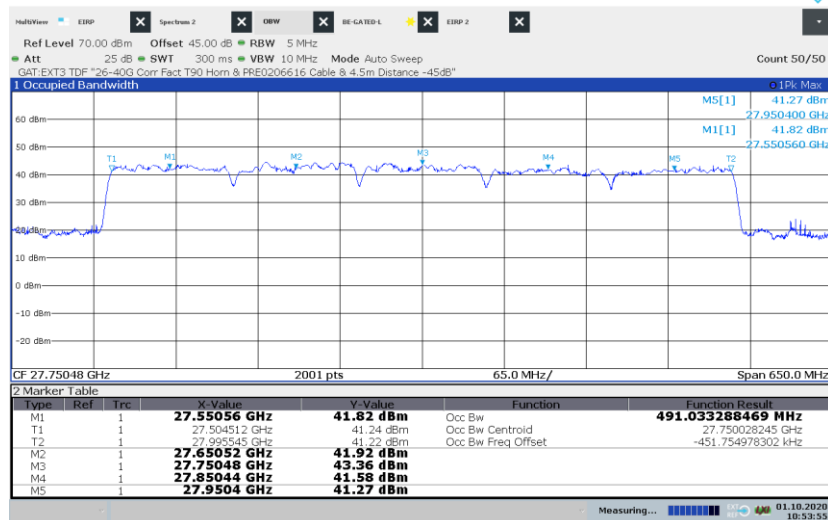


#### 4 Carrier Configuration, 10 MHz RBW, Left



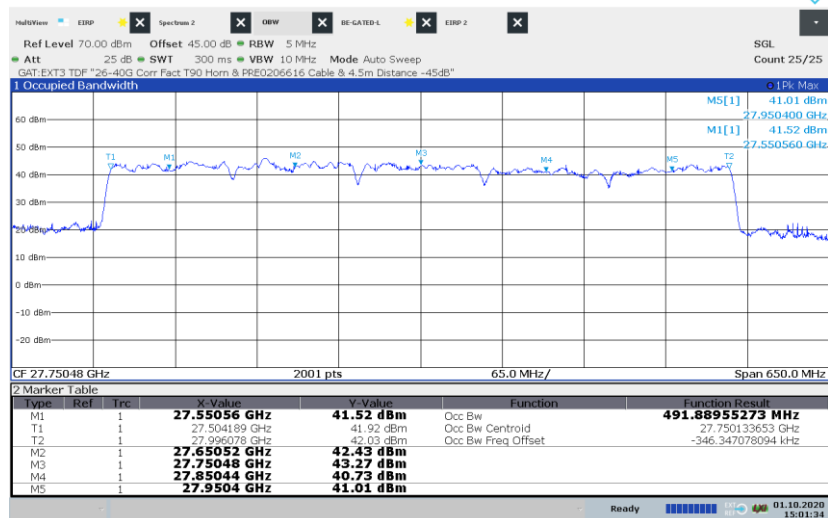
## 5 Carrier Configuration, 5 MHz RBW, Left

### Tx Main Unit, Horizontal – QPSK



10:53:56 01.10.2020

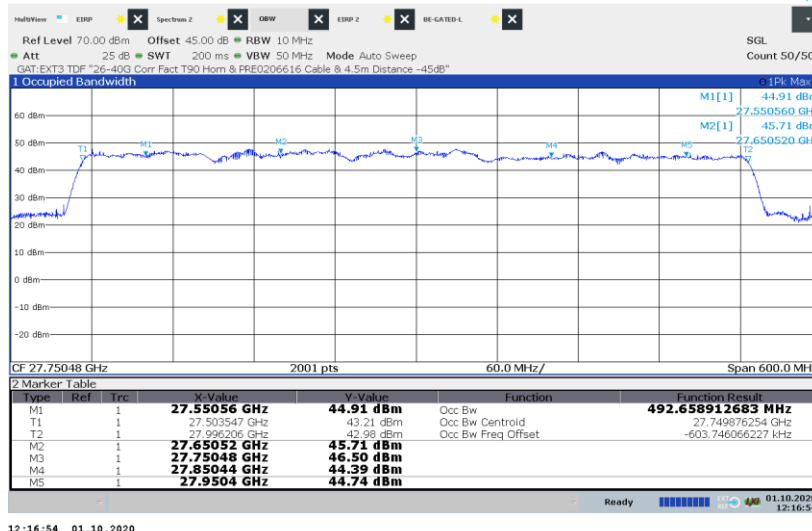
### Tx Main Unit, Vertical – QPSK



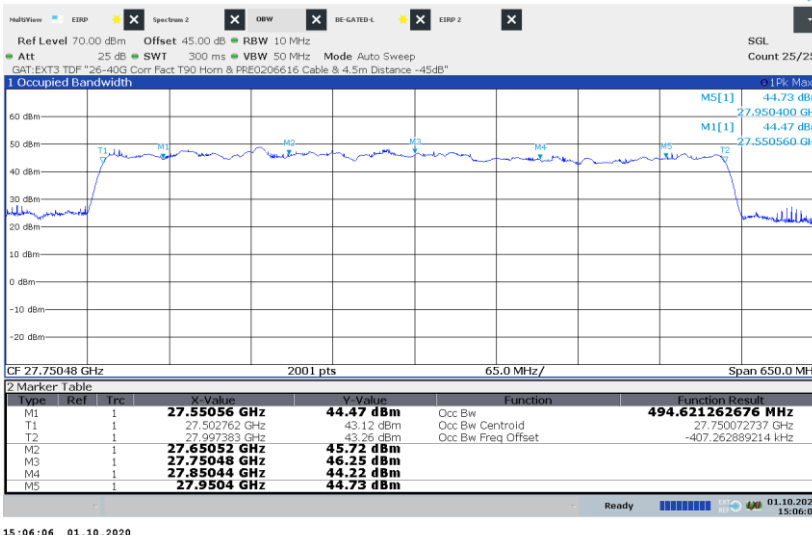
15:01:34 01.10.2020

## 5 Carrier Configuration, 10 MHz RBW, Left

### Tx Main Unit, Horizontal – QPSK

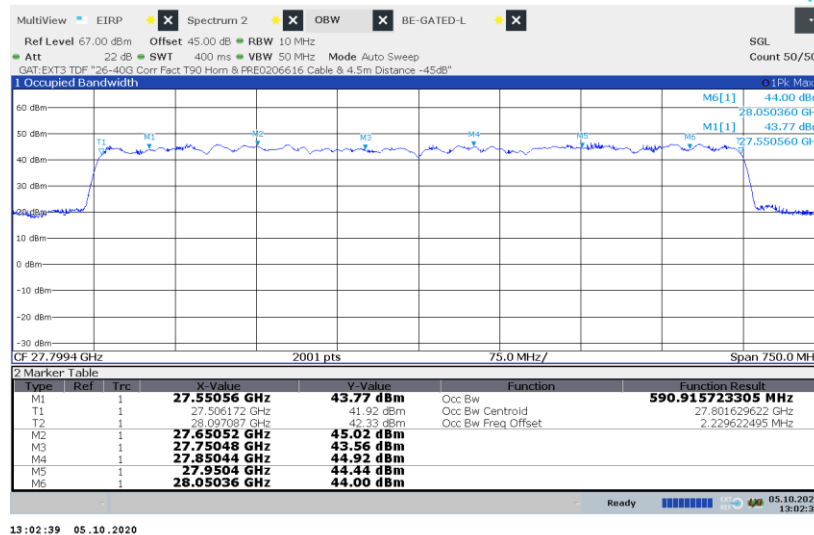


### Tx Main Unit, Vertical – QPSK

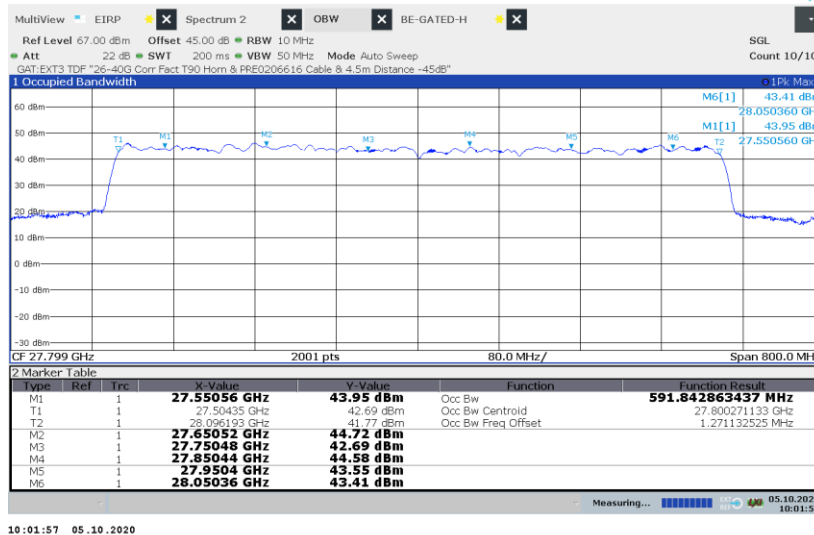


## 6 Carrier Configuration, 10 MHz RBW, Left

### Tx Extension Unit, Horizontal – 64QAM

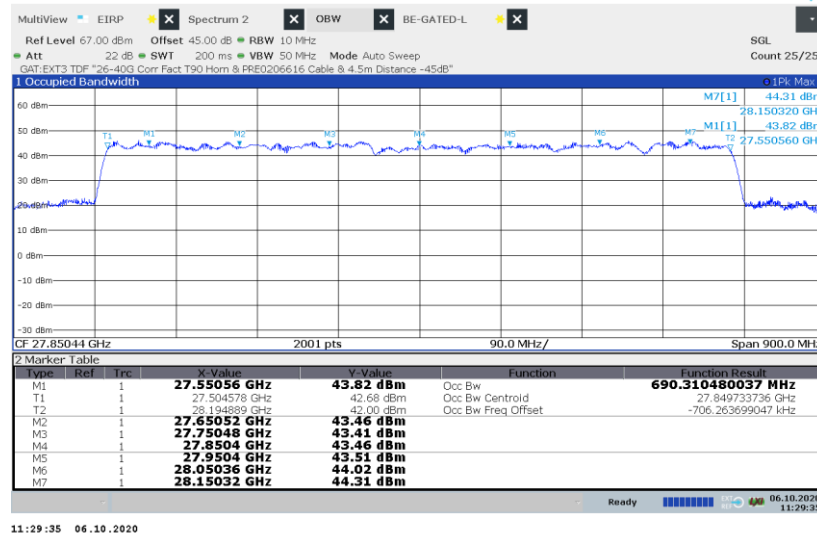


### Tx Extension Unit, Vertical – 64QAM

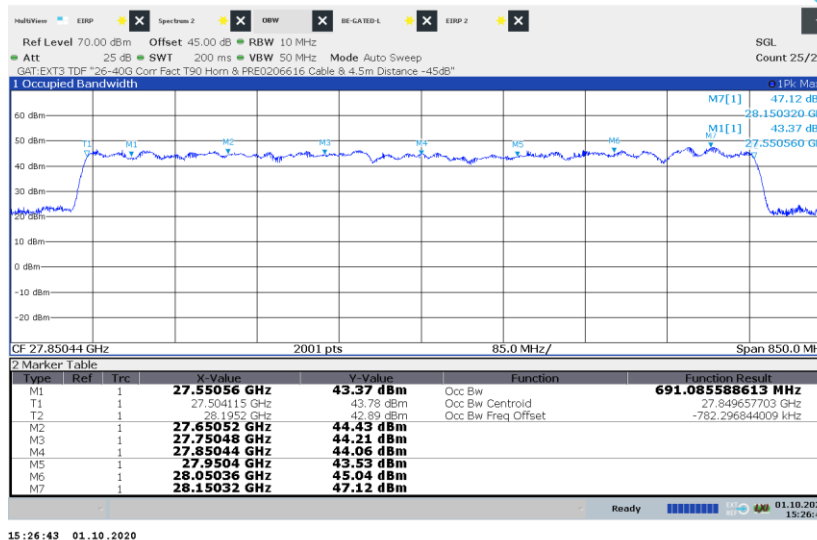


## 7 Carrier Configuration, 10 MHz RBW, Left

### Tx Main Unit, Horizontal – 64QAM

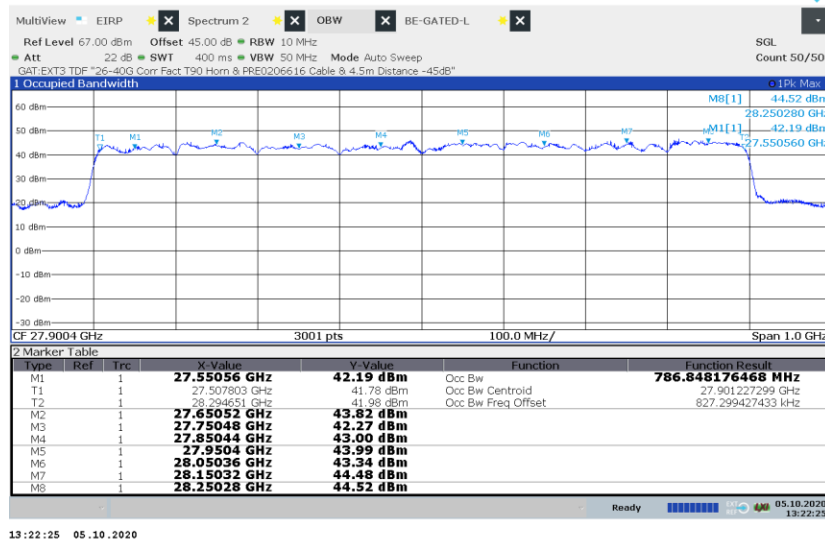


### Tx Main Unit, Vertical – 64QAM

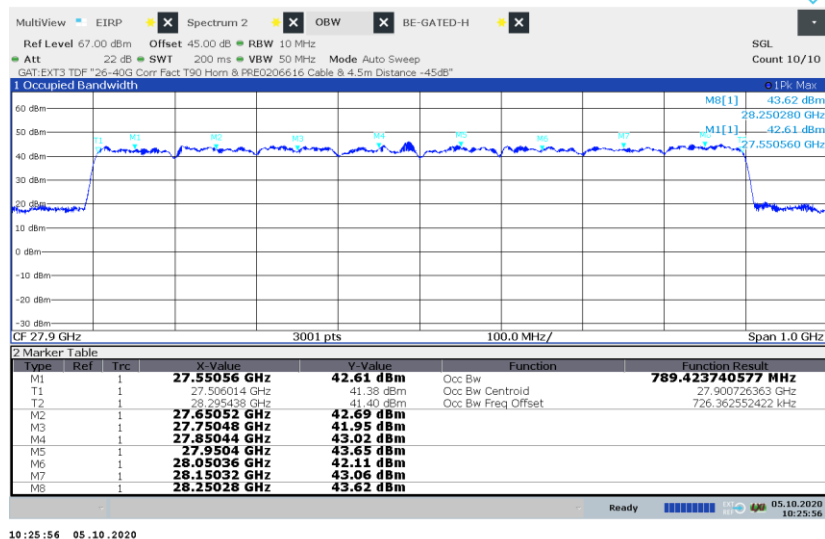


## 8 Carrier Configuration, 10 MHz RBW, Left

### Tx Extension Unit, Horizontal – 16QAM



### Tx Extension Unit, Vertical – 16QAM



## 8.2. RF POWER OUTPUT

### RULE PART(S)

FCC: §2.1046, §30.202

### LIMIT

30.202 (a) For fixed and base stations operating in connection with mobile systems, the average power of the sum of all antenna elements is limited to an equivalent isotopically radiated power (EIRP) density of +75 dBm/100 MHz. For channel bandwidths less than 100 megahertz the EIRP must be reduced proportionally and linearly based on the bandwidth relative to 100 megahertz.

### TEST PROCEDURES

Radiated power measurements were 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  $\geq 3 \times$  RBW
- Span = 2x to 3x the OBW
- Number of measurement points in sweep  $> 2 \times$  span / RBW
- Sweep time = auto-couple
- Detector = RMS, Gated
- Trace mode = Average over 10 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 performed at 4.5 m test distance.

EIRP was calculated using the equations on ANSI C63.26-2015 Annex C.5.2. The total correction factors from the receive horn antenna gain ranging 26 – 40 GHz, cable loss and far-field path loss @ 4.5 m were calculated using equations C.8 and C.9, and pre-loaded into spectrum analyzer.

Sample calculation of EIRP:

$$\begin{aligned}\text{Total Correction Factor} &= \text{Cbl Loss (dB)} - \text{Horn Ant Gain (dBi)} + \text{Path Loss @ 4.5m (dB)} \\ &= 4 - 23 + 74.5 \\ &= 55.5 \text{ dB}\end{aligned}$$

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

In order to properly display of signal level on the plots, the pre-loaded correction factors were intentional lowered by 45 dB and an offset factor of 45 dB was applied on spectrum analyzer to compensate the true correction factors across 26 to 40 GHz frequency range.



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

## **RESULTS**

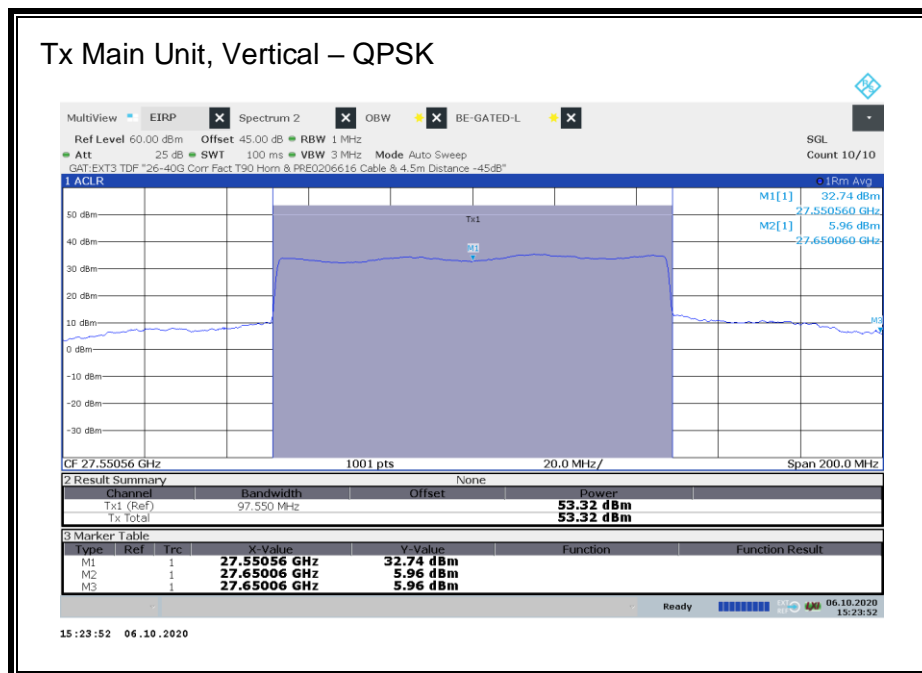
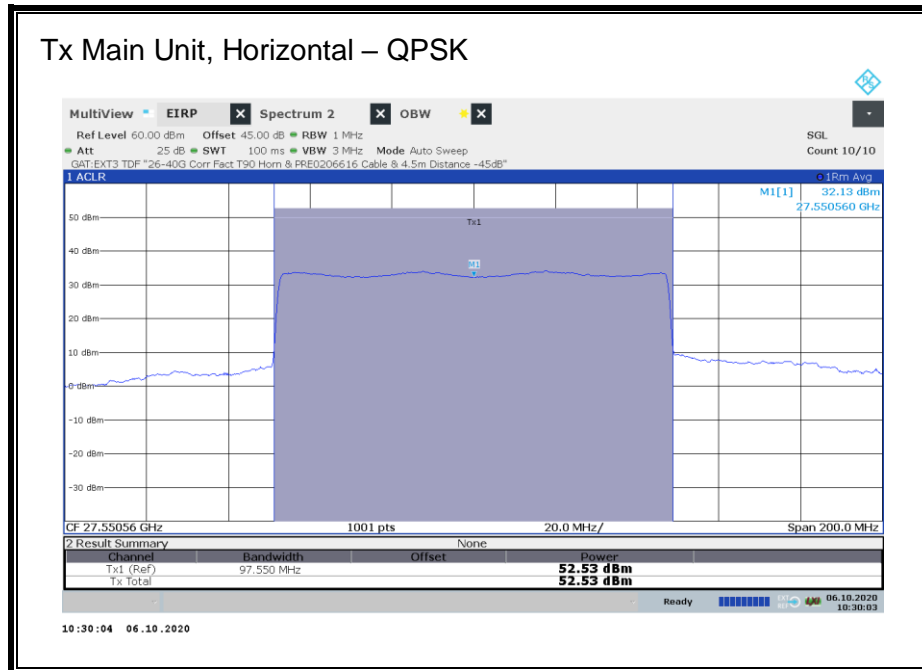
The EIRP results for all available carrier configurations and modulations are tabulated in the following pages. To minimize report size, a set of plots on horizontally and vertically polarized beams of each carrier configuration is presented for all other combinations.

Employee IDs: 19296 & 19437  
Location: Chamber 1  
Test Date: 10/2/2020 – 10/6/2020

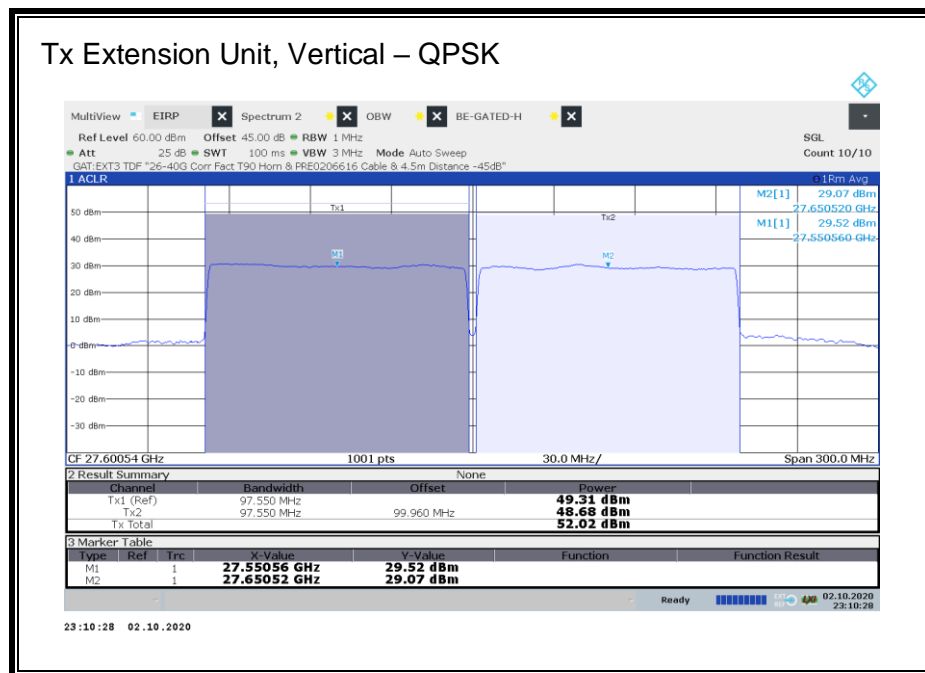
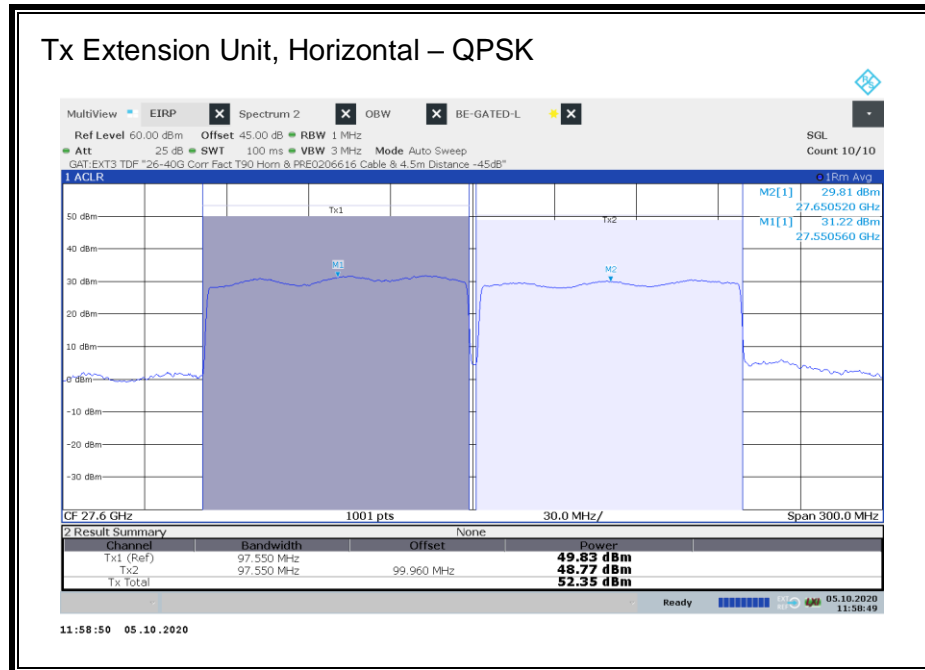
Carrier Location in Band	Tx. Carriers Center Frequency GHz	Tx Unit	Number of Tx. Carriers	Modulation	Total Measured Avg EIRP		Combined Avg EIRP Both Pols dBm/100MHz	Part 30 Limit dBm/100MHz	Limit Margin dB	Pass or Fail
					Horizontal dBm/100MHz	Vertical dBm/100MHz				
Left	27.55056	Main Unit	1	QPSK	52.53	53.32	55.95	75	-19.05	Pass
Left	27.55056	Ext Unit	1	16QAM	52.5	52.56	55.54	75	-19.46	Pass
Center	27.9504	Main Unit	1	QPSK	52.58	52.97	55.79	75	-19.21	Pass
Center	27.9504	Ext Unit	1	64QAM	52.42	52.14	55.29	75	-19.71	Pass
Right	28.29996	Main Unit	1	QPSK	52.7	53.27	56.00	75	-19.00	Pass
Right	28.29996	Ext Unit	1	QPSK	52.99	52.41	55.72	75	-19.28	Pass
Left	27.55056	Ext Unit	2	QPSK	52.35	52.02	55.20	75	-19.80	Pass
	27.65052									
Left	27.55056	Ext Unit	2	64QAM	52.23	52.44	55.35	75	-19.65	Pass
	27.65052									
Center	27.9504	Ext Unit	2	QPSK	52.92	52.43	55.69	75	-19.31	Pass
	28.05036									
Right	28.2	Ext Unit	2	16QAM	53.08	52.22	55.68	75	-19.32	Pass
	28.29996									
Left	27.55056	Main Unit	3	QPSK	52.59	53.48	56.07	75	-18.93	Pass
	27.65052									
	27.75048									
Center	27.85044	Main Unit	3	64QAM	52.38	52.8	55.61	75	-19.39	Pass
	27.9504									
	28.05036									
Right	28.10004	Main Unit	3	16QAM	52.38	53.21	55.83	75	-19.17	Pass
	28.2									
	28.29996									
Left	27.55056	Ext Unit	4	QPSK	52.23	52.22	55.24	75	-19.76	Pass
	27.65052									
	27.75048									
	27.85044									
Right	28.00008	Ext Unit	4	16QAM	52.7	52.91	55.82	75	-19.18	Pass
	28.10004									
	28.2									
	28.29996									
Left	27.55056	Main Unit	5	QPSK	52.31	52.83	55.59	75	-19.41	Pass
	27.65052									
	27.75048									
	27.85044									
	27.9504									
Right	27.90012	Main Unit	5	64QAM	52.89	52.59	55.75	75	-19.25	Pass
	28.00008									
	28.10004									
	28.2									
	28.29996									

Carrier Location in Band	Tx. Carriers Center Frequency GHz	Tx Unit	Number of Tx. Carriers	Modulation	Total Measured Avg EIRP		Combined Avg EIRP	Part 30	Limit	Pass
					Horizontal	Vertical	Both Pols	Limit	Margin	or
					dBm/100MHz	dBm/100MHz	dBm/100MHz	dBm/100MHz	dB	Fail
Left	27.55056	Ext Unit	6	64QAM	52.04	52.18	55.12	75	-19.17	Pass
	27.65052									
	27.75048									
	27.85044									
	27.9504									
	28.05036									
Right	27.80016	Ext Unit	6	QPSK	52.22	52.89	55.58	75	-19.17	Pass
	27.90012									
	28.00008									
	28.10004									
	28.2									
	28.29996									
Left	27.55056	Main Unit	7	QPSK	52.25	52.85	55.57	75	-19.43	Pass
	27.65052									
	27.75048									
	27.85044									
	27.9504									
	28.05036									
Right	28.15032	Main Unit	7	64QAM	52.3	53.29	55.83	75	-19.17	Pass
	27.7002									
	27.80016									
	27.90012									
	28.00008									
	28.10004									
Left	28.2	Ext Unit	8	16QAM	52.56	52.3	55.44	75	-19.56	Pass
	28.29996									
	27.55056									
	27.65052									
	27.75048									
	27.85044									
Right	27.9504	Ext Unit	8	QPSK	52.15	52.59	55.39	75	-19.61	Pass
	28.05036									
	28.15032									
	28.25028									
	27.60024									
	27.7002									
Right	27.80016	Ext Unit	8	64QAM	52.39	52.78	55.60	75	-19.40	Pass
	27.90012									
	28.00008									
	28.10004									
	28.2									
	28.29996									

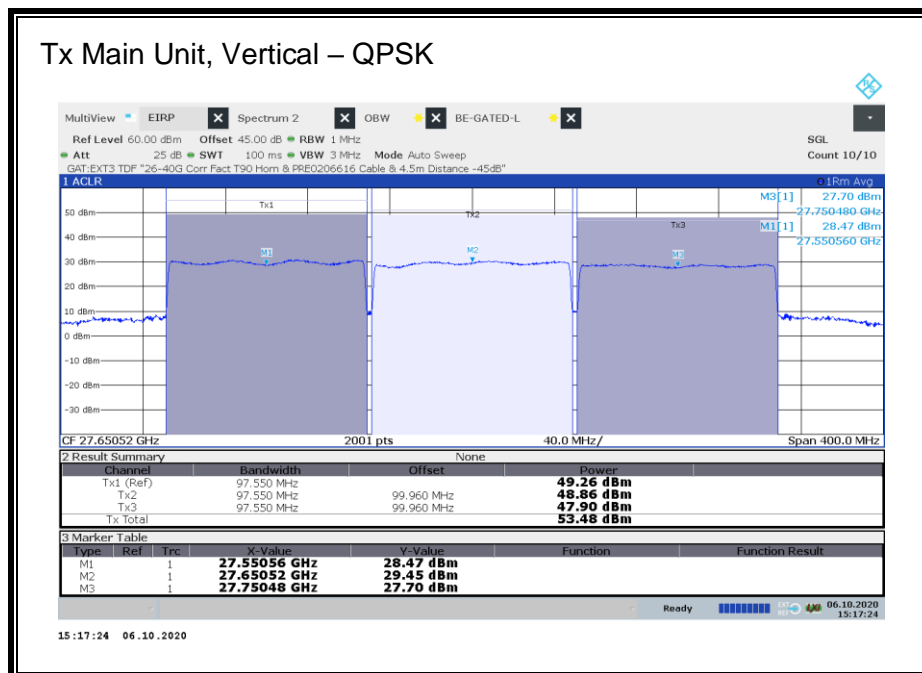
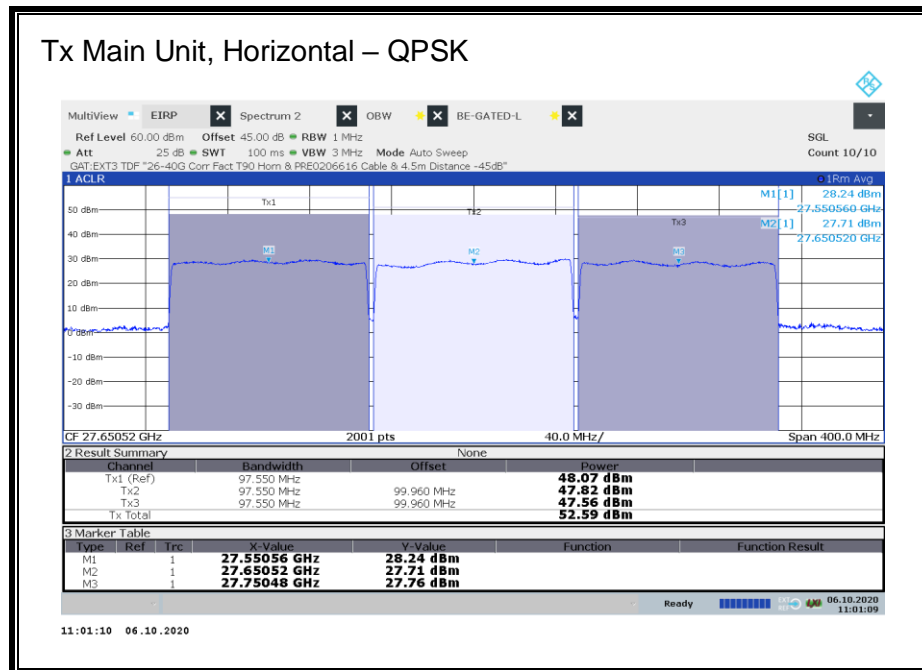
## 1 Carrier Configuration, Left



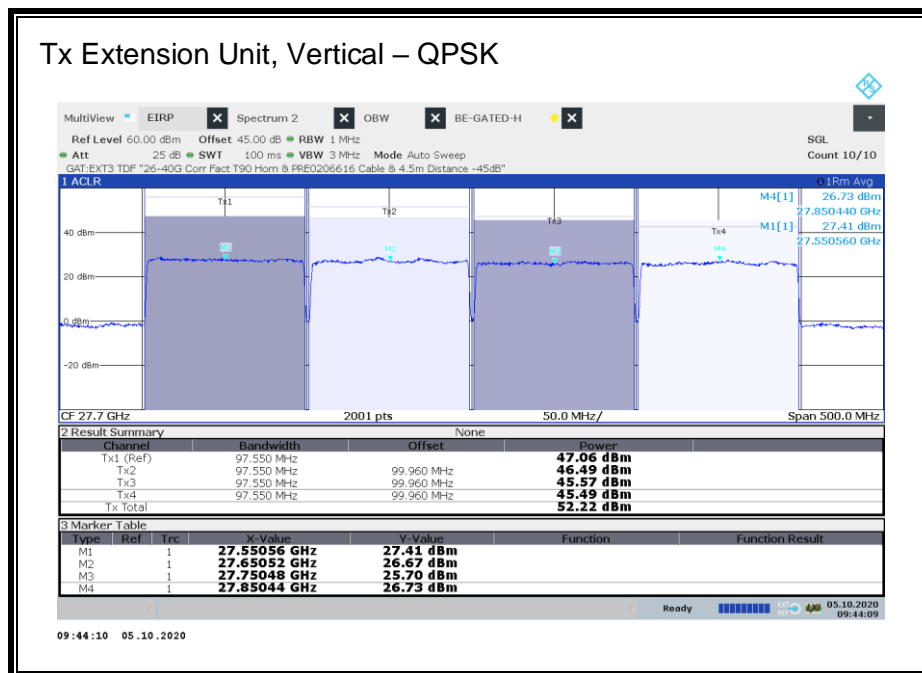
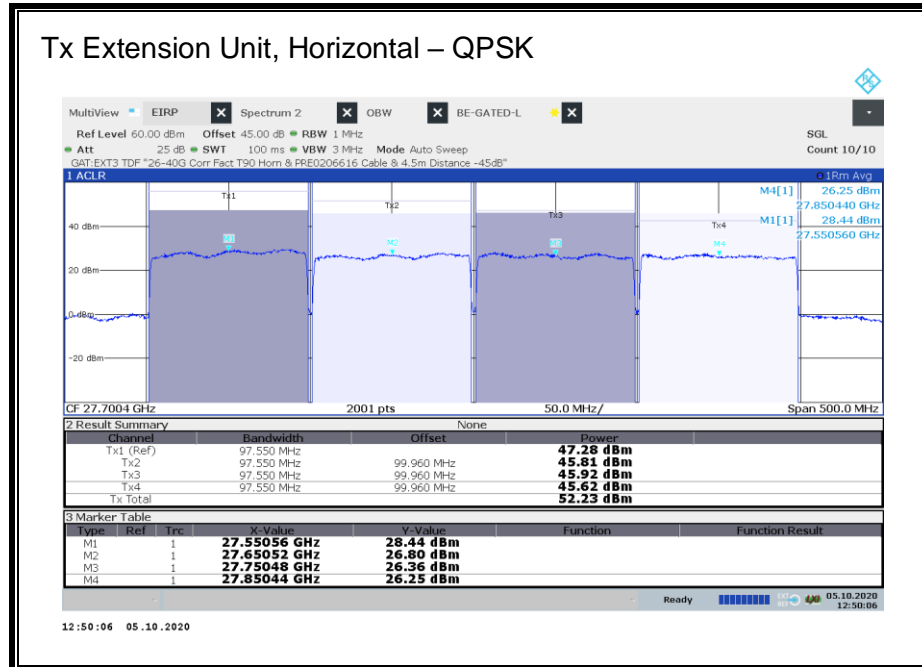
## 2 Carrier Configuration, Left



### 3 Carrier Configuration, Left

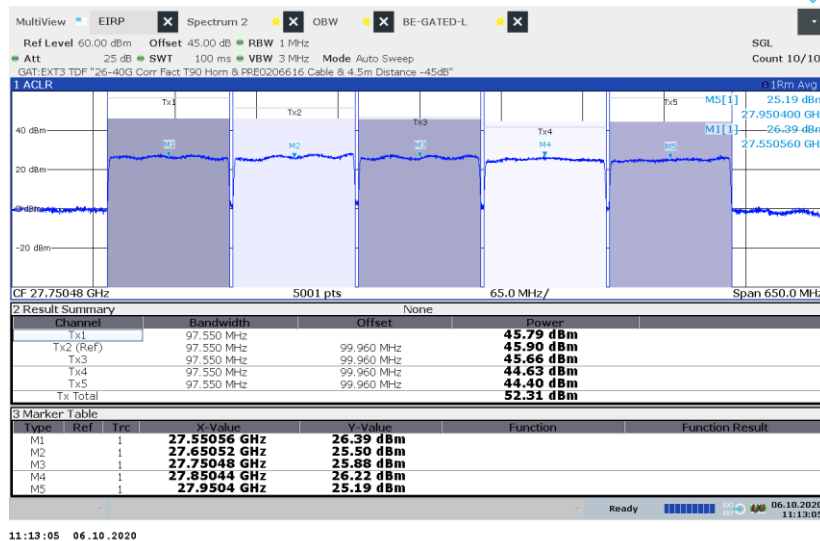


#### 4 Carrier Configuration, Left

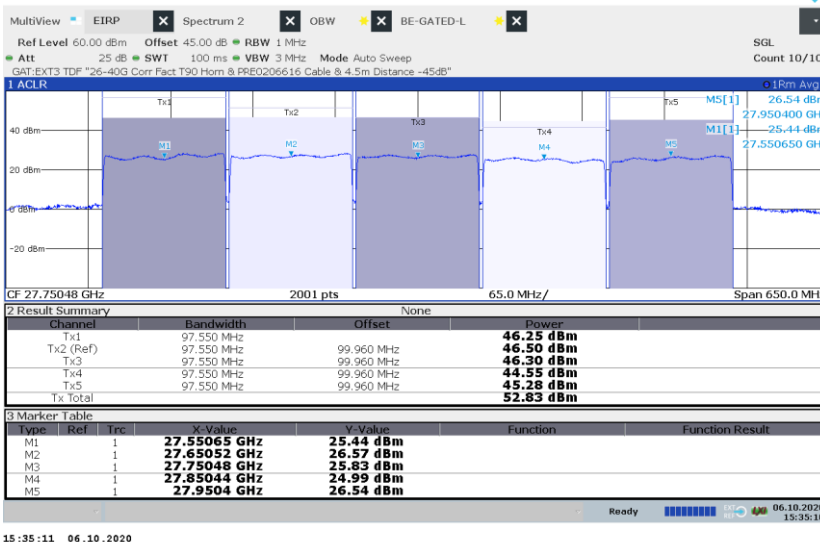


## 5 Carrier Configuration, Left

### Tx Main Unit, Horizontal – QPSK



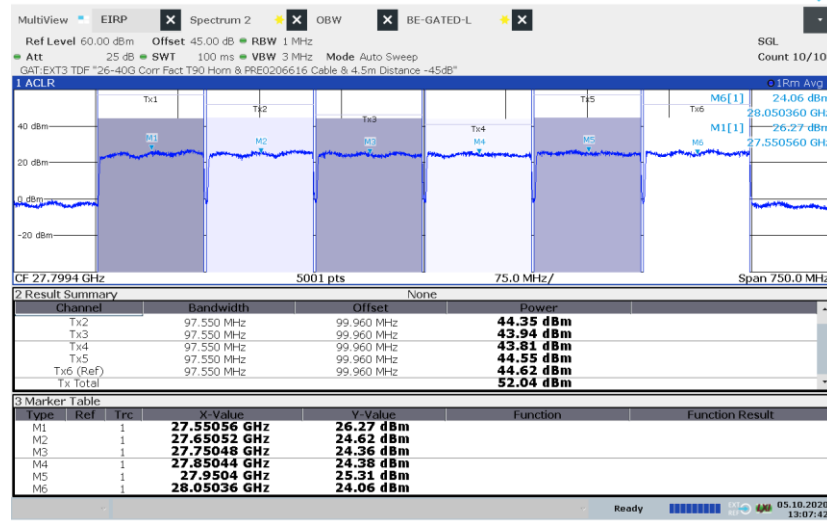
### Tx Main Unit, Vertical – QPSK



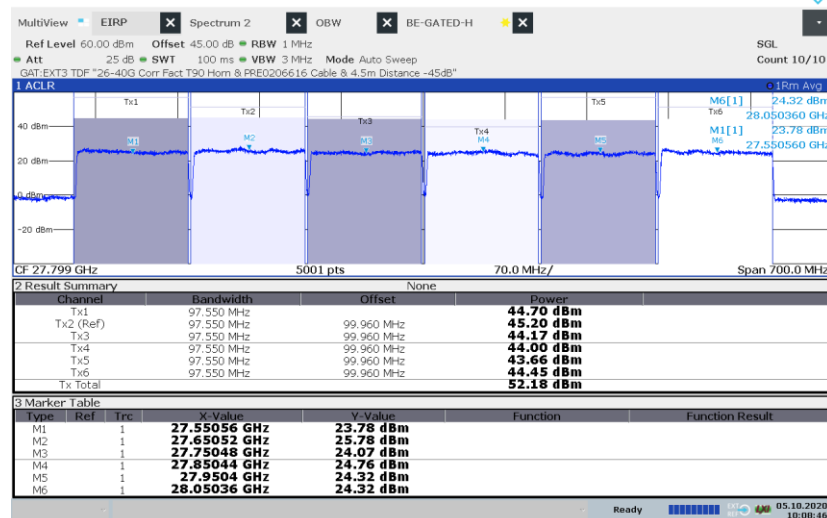


## 6 Carrier Configuration, Left

### Tx Extension Unit, Horizontal – 64QAM

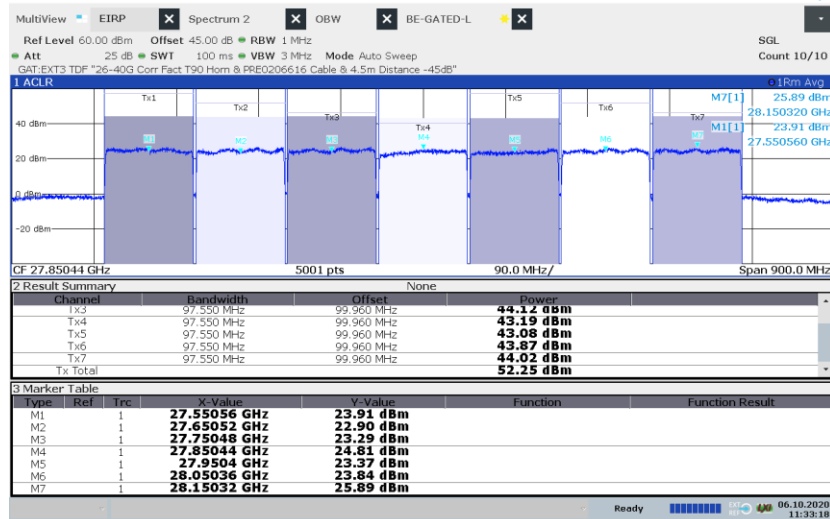


### Tx Extension Unit, Vertical – 64QAM

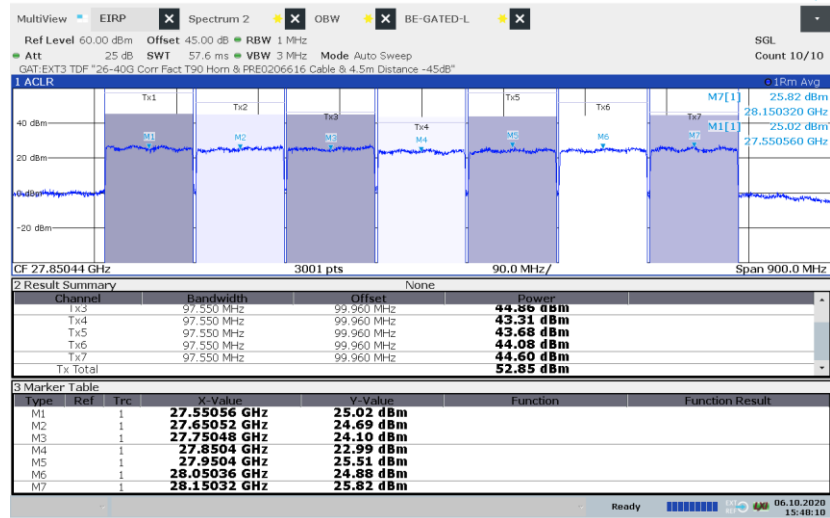


## 7 Carrier Configuration, Left

### Tx Main Unit, Horizontal – QPSK

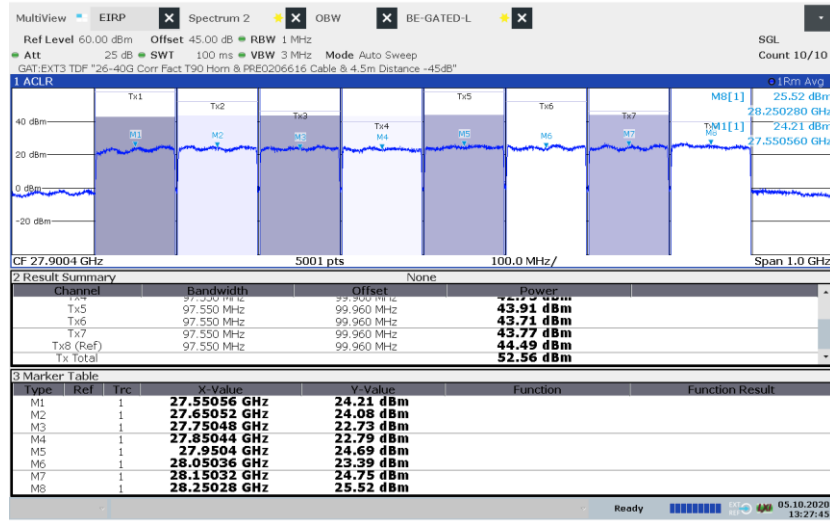


### Tx Main Unit, Vertical – QPSK



## 8 Carrier Configuration, Left

### Tx Extension Unit, Horizontal – 16QAM



### Tx Extension Unit, Vertical – 16QAM

