DRAFT EN 305 550 v2.1.0

AS REFERENCED BY TEST PLAN 12511671-TP1V2

TEST REPORT

FOR

MILLIMETER WAVE RADAR SENSOR DEVELOPMENT BOARD

MODELS: IWR6843ISK-ODS,MMWAVEBOOST

REPORT NUMBER: 12927418-E4V4

ISSUE DATE: NOVEMBER 12, 2020

Prepared for
TEXAS INSTRUMENTS
12500 TI BLVD.
DALLAS
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Revision History

Rev.	Issue Date	Revisions	Revised By
V1	08/21/2019	Initial Issue	M.Heckrotte
V2	08/24/2020	Removed duty cycle correction factor from fundamental and OOB measurements in accordance with Test Plan	M.Heckrotte
V3	11/09/2020	Clarified correction factor for Substitution Measurement Procedure in Mean Power Spectral Density, Mean Power and OOB Emissions	M.Heckrotte
V4	11/12/2020	Revised descriptions of EUT and antennas	M.Heckrotte

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	TEXAS INSTRUMENTS 12500 TI BLVD. DALLAS, TEXAS 75243 USA
EUT DESCRIPTION:	MILLIMETER WAVE RADAR SENSOR DEVELOPMENT BOARD
MODELS:	IWR6843ISK-ODS, MMWAVEICBOOST
SERIAL NUMBERS:	5604500275 (IWR6843ISK-ODS) 5498100509 (MMWAVEICBOOST)
DATE TESTED:	JULY 15TH– AUGUST 20th, 2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
DRAFT EN 305 550 v2.1.0 as referenced by Test Plan 12511671-TP1V2	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:

MICHAEL HECKROTTE
PRINCIPAL ENGINEER
UL Verification Services Inc.

Tested By:

STEVE AGUILAR
TEST ENGINEER
UL Verification Services Inc.

1. TEST METHODOLOGY

The tests documented in this report were performed in accordance with EN 303 396.v1.1.1 as referenced by Draft EN 305 550 v2.1.0 as referenced by Test Plan 12511671-TP1V2.

2. FACILITIES 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	☐ Chamber E	☐ Chamber J
☐ Chamber C	☐ Chamber F	☐ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	

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

EN 305 550 v2.1.0 is not within the laboratory's scope of accreditation.

3. CALIBRATION AND UNCERTAINTY

3.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

3.2. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio Frequency	±3.5 x 10^(-8)
Radiated RF power (up to 40 GHz)	±5.3 dB
Radiated RF power (above 40 GHz up to 66 GHz)	±5.1 dB
Radiated RF power (above 66 GHz up to 100 GHz)	±5.4 dB
Radiated RF power (above 100 GHz)	±5.64 dB
Temperature	±0.9 deg C
Humidity	±4.5 % RH
DC and low frequency voltages	±0.45 %

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

4. EQUIPMENT UNDER TEST

4.1. DESCRIPTION OF EUT

See Test Plan 12511671-TP1V2.

The IWR6843ISK-ODS is a 60 to 64 GHz mmWave radar sensor development board with integral short-range (~5 dBi) antennas on the printed circuit board.

The MMWAVEICBOOST is an interface board.

4.2. OUTPUT POWER

The Mean Output Power in the 300 MHz BW mode is 8.51 dBm (7.1 mW) EIRP .

The Mean Output Power in the 1300 MHz BW mode is 10.52 dBm (11.3 mW) EIRP.

The Mean Output Power in the 4000 MHz BW mode is 14.28 dBm (26.8 mW) EIRP.

4.3. SOFTWARE AND FIRMWARE

The software used on the support laptop is mmWave Studio 2.0.0.2 and the DFP package is mmwave_dfp_01.02.00.01 for the xWR6843 series.

Three test scripts with 300 MHz, 1300 MHz and 4000 MHz operating bandwidths, transmitting maximum power were provided and used at all RF tests.

The software used on the support laptop is mmWave Demo Visualizer IWR6843AOP ver 1.0.0. SDK Version 3.2.0.6.AOP. The Out of box (OOB) demo binary found named xwr64xxODS_mmw_demo.bin was downloaded to the device for Receiver Interference Handling tests.

4.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
Laptop	Dell	E7450	713FR72
Laptop Power Supply	Dell	DA130PE-00	CN-OJU012-48661-12E-DYX1-A04
Laptop	Dell	E6420	JQJD5R1
Laptop Power Supply	Dell	PA-1900-02D	CN-09T215-71615-536-1DEE
5VDC 3A Adapter	CUI Japan	EMSA050300	----
5VDC 3A Adapter	Ziumier	WT-24-0503000-U	----
Data Capture Board	TI	DCA1000EVM	----

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	3-prong	Unshielded	0.9	--
2	DC	1	Barrel	Unshielded	1.8	--
3	AC	1	3-prong	Unshielded	-	--
4	DC	1	Barrel	Unshielded	1.5	Ferrite on DC
5	AC	1	3-prong	Unshielded	-	--
6	DC	1	Barrel	Unshielded	1.5	Ferrite on DC
7	60-Pin	1	60-Pin	Flat Ribbon	0.08	--
8	USB	2	USB 2.0 Male - USB mini	Shielded	0.9	--

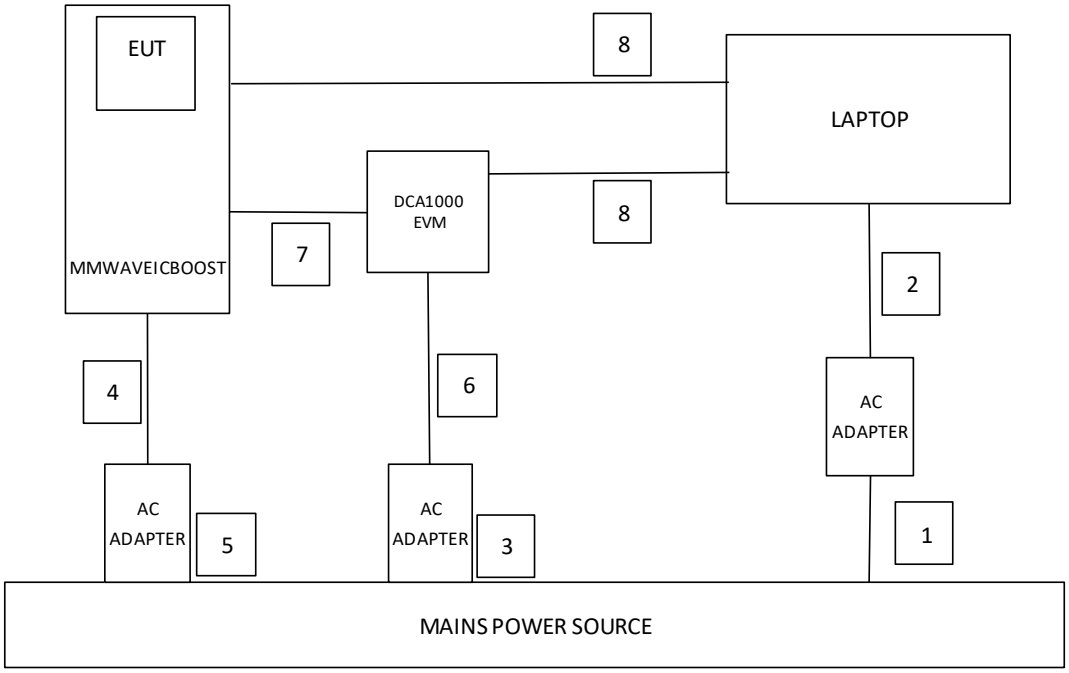
TEST SETUP

The EUT is connected to a laptop computer. Software within the computer is used to configure and exercise the EUT.

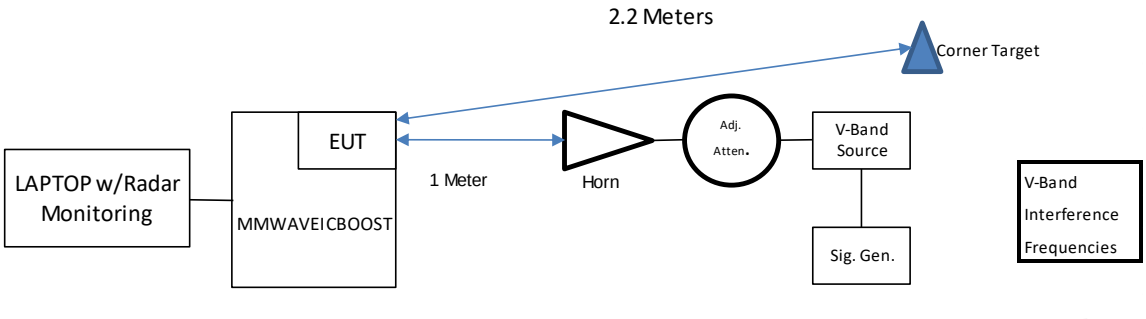
SETUP DIAGRAM FOR TESTS

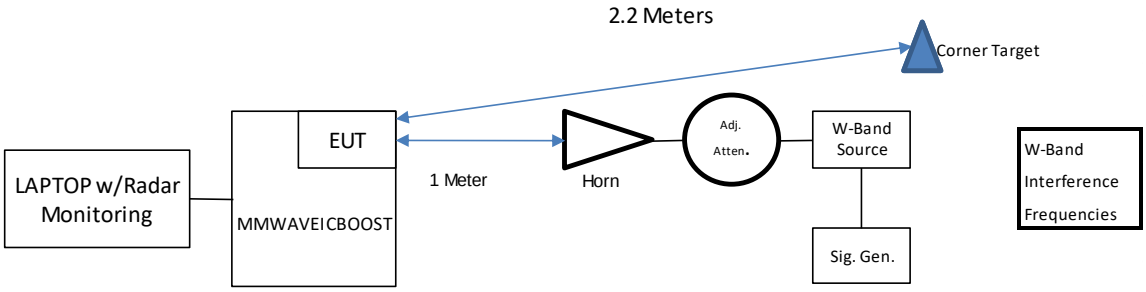
RF TESTS

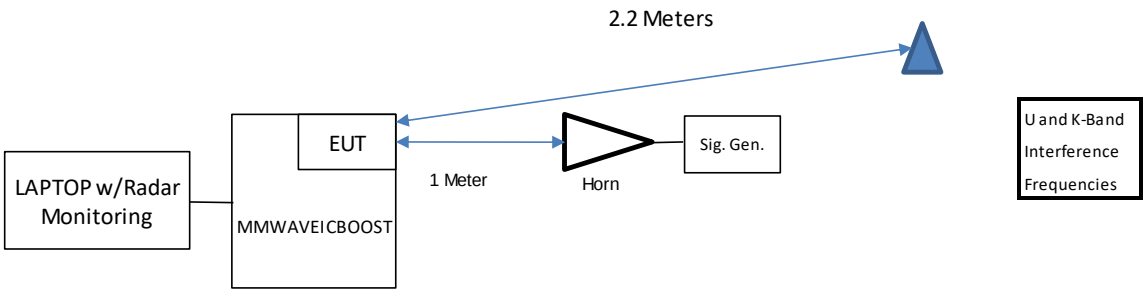
Note: Laptop/USB cables and Laptop power supply were removed for Radiated emissions testing.



RECEIVER IN-BAND, OUT OF BAND AND REMOTE BAND SIGNALS HANDLING







5. 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**	**S/N or Local ID**	**Cal Due**
PXA Signal Analyzer	Agilent	N9030A	T313	1/25/2020
PSG Analog Signal Generator, 250KHz to 50GHz	Keysight	E8257D	PRE0160761	8/13/2019**
50-75 GHz Horn	C M i	HO15R	H15-1	9/20/2019
50-75 GHz Downconverter	OML	C12H1DC01	180530-1	CNR
50-70 GHz Isolator	Mi-Wave	115V/385	1318	CNR
50-75 GHz Diode Detector	Spacek Labs	DV-2P	17A27	CNR
50-75 GHz Horn	C M i	HO15R	H15-1	9/20/2019
Power Sensor, 50-75 GHz	Agilent	V8486A-H02	T433	9/6/2019
P-Series Power Meter	Keysight	N1913A	PRE0078027	1/30/2020
Digital Signal Analyzer, 8 GHz	Agilent	DSA90804A	PRE0079430	8/10/2019**
Low Pass Filter, 10 MHz	Solar Electric Co.	6623-10	T417	9/25/2018
Voltage Amplifier, 200 MHz	FEMTO	HVA-200M-40-B	PRE0184145	CNR
Horn antenna, 33-50 GHz	CMI	HO22R	--	CNR
LNA, 40-50 GHz	Spacek Labs	SL4510-33-4W	14J05	9/24/2019
50-75 GHz Horn	C M i	HO15R	H15-1	9/20/2019
LNA, 50-75 GHz	Vivatech	VTLNA-15-6018-FB	2013051	CNR
50-75 GHz Downconverter	OML	C15H1DC01	PRE0180075	CNR
50-75 GHz Source	OML	S15MS-AG	80708-4	CNR
50-75 GHz Variable Attenuator	Aerowave	15-2220	--	CNR
50-75 GHz Horn	C M i	HO15R	H15-2	9/20/2019
75-110 GHz Horn	C M i	HO10R	H10-1	9/20/2019
LNA, 75-110 GHz	Spacek	SLW-22-5	15J04	CNR
75-110 GHz Downconverter	OML	C10H1DC01	PRE0180076	CNR
110-170 GHz Horn	C M i	HO6R	H06-1	9/20/2019
LNA 110-170 GHz	VivaTech	VTLNA-01S01	2015085	CNR
110-170 GHz Downconverter	Virginia Diode	SAX 228	PRE0175814	CNR
ESW EMI Test Receiver 44 GHz	Rohde & Schwartz	ESW44	PRE0179376	2/19/2020
Hybrid Antenna, 30MHz to 3GHz	SunAR	JB3	PRE0184971	11/13/2019
Amplifier, 9KHz to 1GHz, 32dB	Sonoma Instruments	310	PRE0180175	6/29/2020
Antenna, Horn 1-18GHz	ETS Lingren	3117	T862	6/5/2020
1-18 GHz Filter and Amplifier	UL	---------	PRE0180997	6/29/2020
18-40 GHz Pre-Amp Box	UL	--	PRE0183142	5/1/2020
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	PRE0182188	8/29/2019
Antenna, Horn 26.5 to 40GHz	ARA	MWH-2640/B	PRE0182201	9/4/2019
75-110 GHz Source	VDi	SGX214	PRE0165347	CNR
73.8-110 GHz Adj Attenuator	Flann Microwave	27110	PRE184756	CNR
75-110 GHz Horn	C M i	HO10R	H10-2	9/20/2019
60-90 GHz Source	VDi	SGX213	PRE0165570	CNR
50-75 GHz Horn	C M i	HO15R	HO15R-2	9/20/2019
E-V Band Trasnstion	Mi-Wave	692V-E/385/387	--	CNR
E-Band Attenuator	Flann Microwave	26110	T1686	CNR
Signal Generator 250kHz-40 GHz	Agilent	E8257D	T181	2/7/2020
18-26 GHz Horn	ARA	MWH 1826/B	T39	CNR
Adapter, 1.85mm (F) to V-Band WG Adapter: 50-67 GHz	Agilent	V281A	T989	CNR
33-50 GHz Horn	CMI	HO22R	H22-1	9/20/2019
Adapter, 2.4mm (F) to Q-Band WG Adapter , 33-50 GHz	Agilent	Q281A	T992	CNR
Digital Multimeter	Fluke	87V	PRE0073921	1/23/2020
Thermo Hygrometer	Fisherbrand	14-650-118-15557603	PRE0186414	2/28/2020
UL EMC Radiated Software	Version	Rev.9.5.15 9.5.22		

**Equipment used before calibration due date.

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.

6. APPLICABLE LIMITS AND TEST RESULTS

All Tests were conducted within an environmental range of +15°C to +35°C; 20% to 75% RH per EN 303 396 v1.1.1 clause 4.4.3.1.

6.1. DUTY CYCLE

LIMIT

None, for reporting purposes only.

TEST PROCEDURE

EN 303 396 Clause 6.3.6.3 Oscilloscope method

The total Duty Cycle is calculated as the duty cycle across bursts multiplied by the duty cycle within each burst.

The duty cycle factor is calculated as:

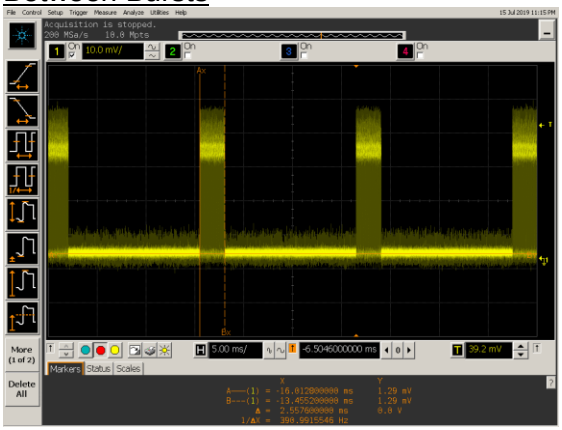
Duty Cycle Factor (dB) = 10 * Log (1 / x)
Where X = Duty Cycle (linear)

RESULTS

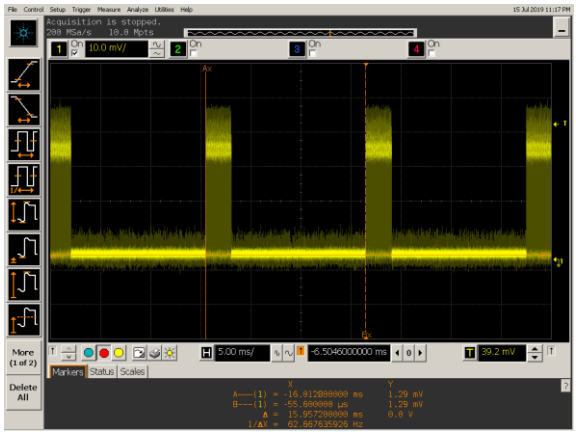
	BETWEEN BURST				WITHIN BURST				TOTAL		
BW Mode	ON Time	Period	Duty Cycle		ON Time	Period	Duty Cycle		Duty Cycle	Duty Cycle	Duty Cycle Correction
(MHz)	(msec)	(msec)	(linear)		(usec)	(usec)	(linear)		(linear)	(%)	(dB)
300	2.56	15.96	0.160		17.00	20.07	0.847		0.14	13.57	8.67
1300	4.33	16.07	0.269		28.75	33.19	0.866		0.23	23.34	6.32
4000	10.00	16.06	0.623		69.27	77.27	0.897		0.56	55.82	2.53

300 MHz BW Mode

Between Bursts

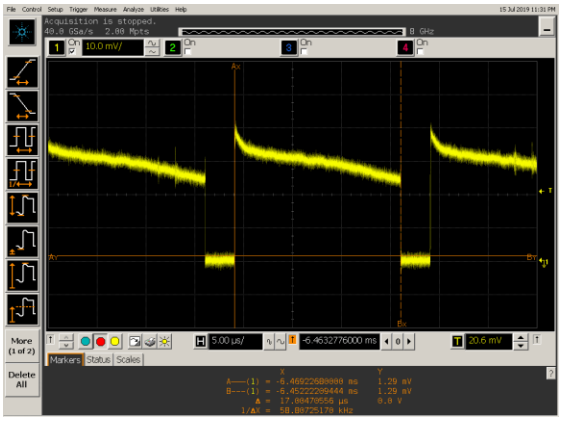


On Time



Period

Within Burst



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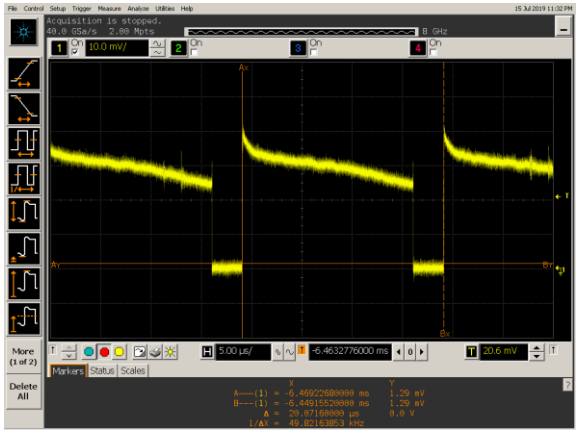
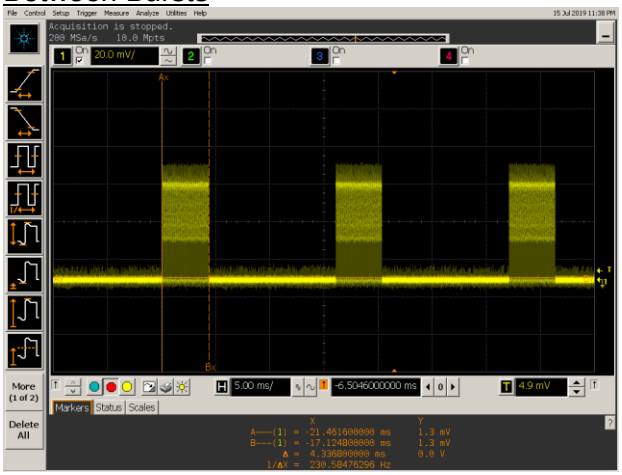


Period

1300 MHz BW Mode

Between Bursts



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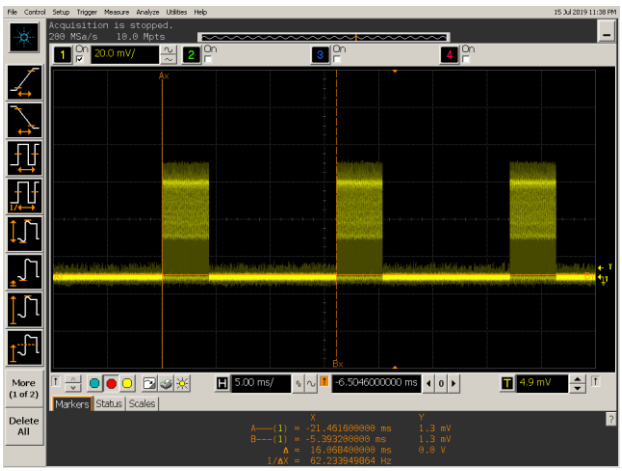
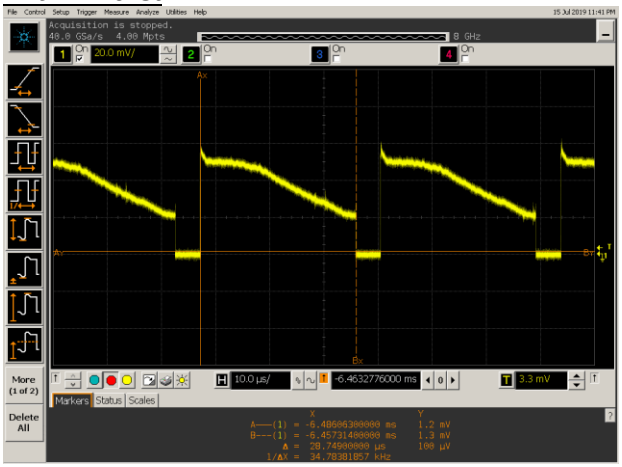


Period

Within Burst



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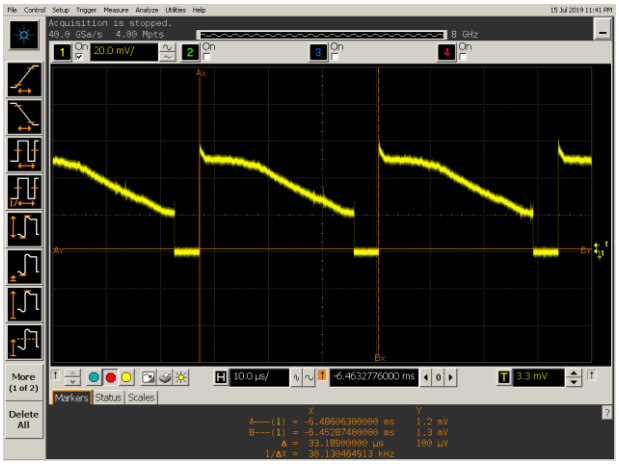
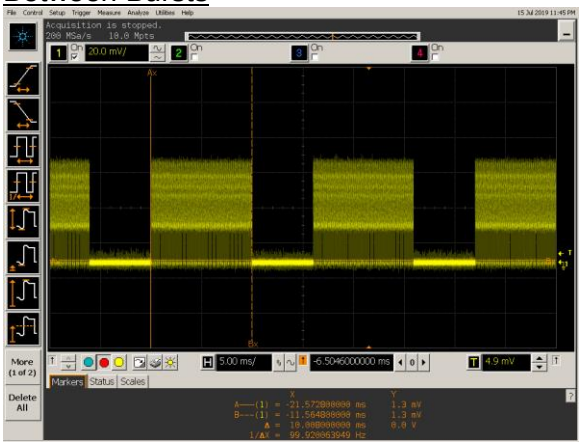


Period

4000 MHz BW Mode

Between Bursts



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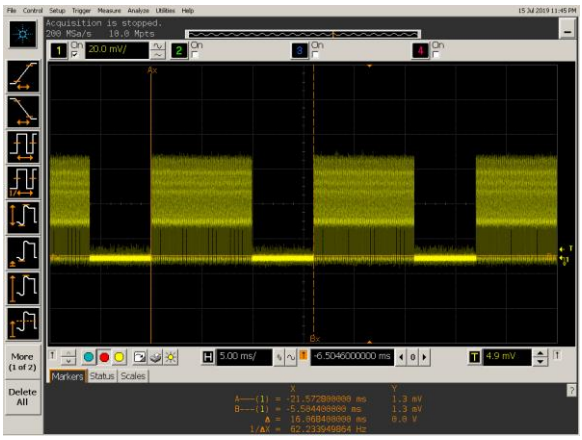
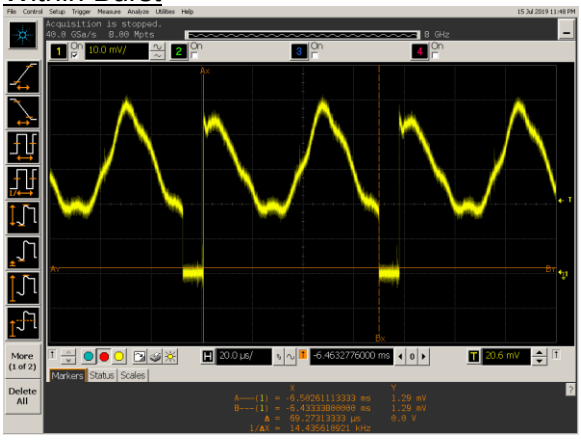
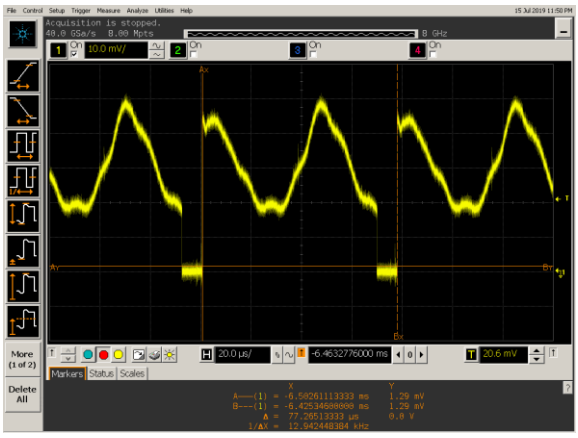


Period

Within Burst



On Time



Period

6.2. MEAN POWER SPECTRAL DENSITY

LIMIT

EN 305-550 Clause 4.3.4.3

Table 4: Mean Power Spectral Density Limit (PSD) (e.i.r.p) [i.1]

Frequency Bands	Power Spectral Density	Application	Notes
57 GHz to 64 GHz	13 dBm/MHz e.i.r.p.	Non-specific SRD	
61,0 GHz to 61,5 GHz	No limit defined	Non-specific SRD	
122 GHz to 122,25 GHz	-48 dBm/MHz > 30° elevation	Non-specific SRD	Notes 1, 2 and 3
122,25 GHz to 123 GHz	No limit defined	Non-specific SRD	
244 GHz to 246 GHz	No limit defined	Non-specific SRD	
NOTE 1: These limits should be measured with an rms detector and an averaging time of 1 ms or less. NOTE 2: The limit of -48 dBm/MHz applies for the normal operation mode of handheld and mobile devices and for fixed installation. NOTE 3: See for declaration requirements, clause 5.2.			

TEST PROCEDURE

EN 303 396 Clause 6.3.5

Test Plan 12511671-TP1V2

The fundamental signal is measured in the far-field of both the EUT and measurement antennas, under Normal environmental conditions.

Substitution testing with a CW source connected to a variable attenuator and standard gain horn is used to determine the EIRP corresponding to an uncorrected measured reference power of 0 dBm. The conducted output power of the Source + Variable Attenuator is measured with a power sensor. The Substitution EIRP is calculated as the conducted output power + TX Antenna Gain.

The difference between Substitution EIRP and 0 dBm is used as the Correction Factor for the EUT measurement.

This Correction Factor inherently consists of the Over-The-Air Path Loss, the RX Measurement Antenna Gain, the Downconverter Conversion Loss and the IF amplifier gain.

This Correction Factor is added to the uncorrected measured EUT power to calculate the EIRP of the signal under test.

FAR FIELD BOUNDARY

The far-field boundary is given as:
$R_{far\ field} = (2 * L^2) / \lambda$
where:
L = Largest Antenna Dimension, in meters
λ = wavelength in meters

Center Frequency (GHz)	Lambda (m)	L EUT Ant (m)	R (Far Field) (m)
60	0.0050	0.0130	0.06760
64	0.0047	0.0130	0.07211

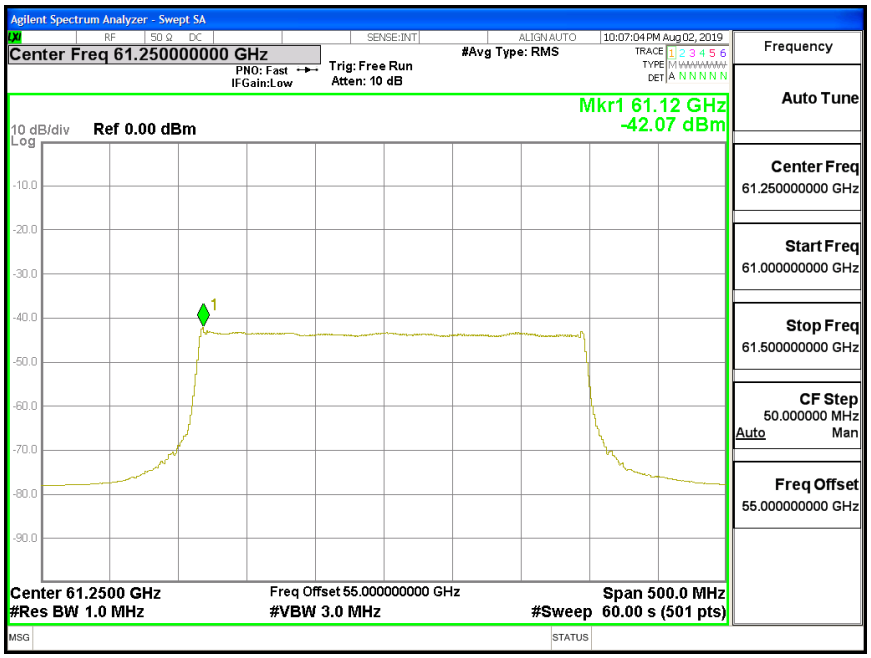
Center Frequency (GHz)	Lambda (m)	L Meas Ant (m)	R (Far Field) (m)
60	0.0050	0.0360	0.51840
64	0.0047	0.0360	0.55296

RESULTS

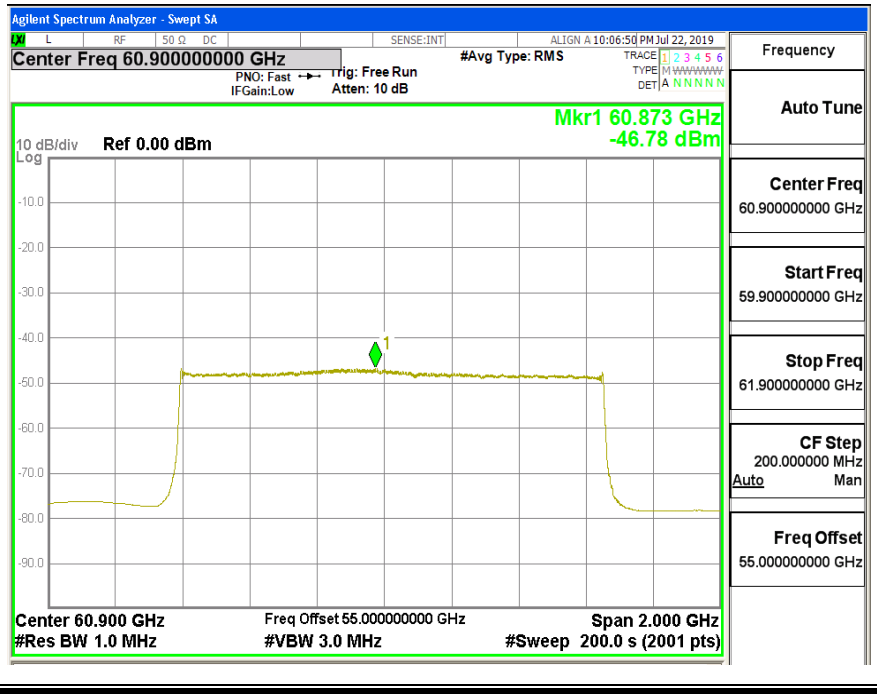
BW Mode	Frequency (GHz)	Meas. Power (dBm)	Meas. Dist. (m)	Correction Factor (dB)	Mean PSD (dBm/MHz EIRP)	Mean PSD Limit (dBm/MHz EIRP)	Margin (dB)
300 MHz	61.257	-42.07	1.5	26.68	-15.39	13	-28.39
1300 MHz	60.919	-46.78	1.5	27.65	-19.13	13	-32.13
4000 MHz	62.121	-48.32	1.5	28.41	-19.91	13	-32.91

NOTE: For the 300 MHz BW mode at 61.257 GHz the limit shown above applies to the 57-64 GHz band, there is no PSD limit in the 61.0-61.5 GHz band.

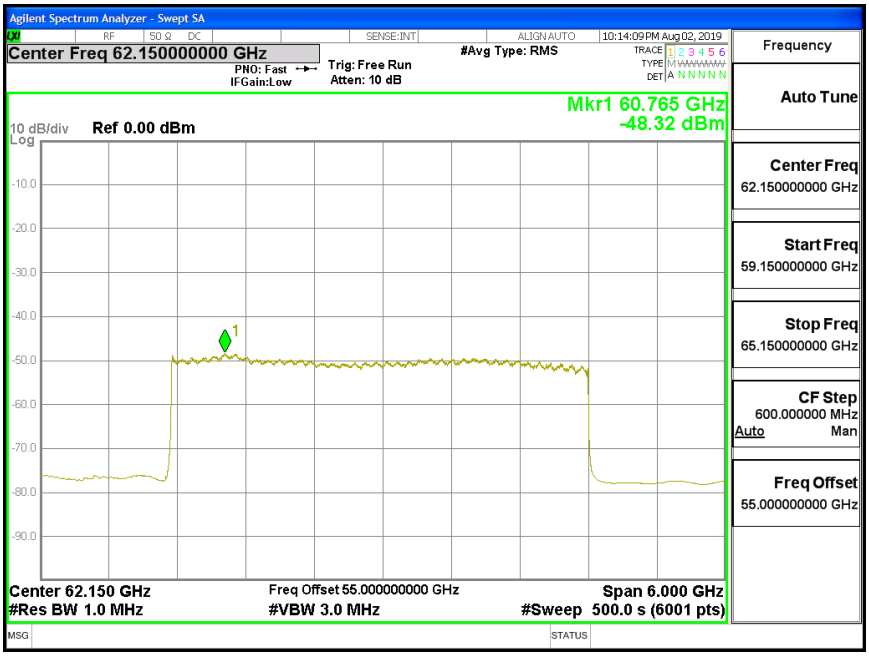
300 MHz Bandwidth Mode



1300 MHz Bandwidth Mode



4000 MHz Bandwidth Mode



6.3. MEAN POWER

LIMIT

EN 305 550 CLAUSE 4.3.3.3

Table 3: RF output power limit [i.1]

Frequency Bands	RF output power	Application	Notes
57 GHz to 64 GHz	100 mW e.i.r.p / 20 dBm e.i.r.p.	Non-specific SRD	Note
61,0 GHz to 61,5 GHz	100 mW e.i.r.p./ 20 dBm e.i.r.p.	Non-specific SRD	
122 GHz to 122,25 GHz	10 dBm e.i.r.p	Non-specific SRD	10 dBm within 250 MHz
122,25 GHz to 123 GHz	100 mW e.i.r.p./ 20 dBm e.i.r.p.	Non-specific SRD	
244 GHz to 246 GHz	100 mW e.i.r.p./ 20 dBm e.i.r.p.	Non-specific SRD	
NOTE: A max transmitter output power of 10 dBm.			

TEST PROCEDURE

EN 303 396 Clause 6.3.4

Test Plan 12511671-TP1V2

The fundamental signal is measured in the far-field of both the EUT and measurement antennas, under Normal environmental conditions.

The far-field boundary is calculated above in Power Density.

Substitution testing with a CW source connected to a variable attenuator and standard gain horn is used to determine the EIRP corresponding to an uncorrected measured reference power of -30 dBm. The conducted output power of the Source + Variable Attenuator is measured with a power sensor. The Substitution EIRP is calculated as the conducted output power + TX Antenna Gain.

The difference between Substitution EIRP and -30 dBm is used as the Correction Factor for the EUT measurement.

This Correction Factor inherently consists of the Over-The-Air Path Loss and the RX Measurement Antenna Gain.

This Correction Factor is added to the uncorrected measured EUT power to calculate the EIRP of the signal under test.

Note: Since the Mean Power measurement does not utilize a Downconverter or IF amplifier, (1) a lower uncorrected reference power is chosen for the Mean Power substitution measurement than for the Power Spectral Density substitution measurement and (2) the correction factors for these two measurements are noticeably different.

RESULTS

BW Mode	Center Freq. (GHz)	Meas. Power (dBm)	Meas. Dist. (m)	Correction Factor (dB)	Mean Power (dBm EIRP)	Power Limit (dBm EIRP)	Margin (dB)	Mean Power (mW EIRP)
300 MHz	61.257	-34.09	1.5	42.60	8.51	20	-11.49	7.1
1300 MHz	60.919	-31.98	1.5	42.50	10.52	20	-9.48	11.3
4000 MHz	62.121	-28.35	1.5	42.63	14.28	20	-5.72	26.8

6.4. PERMITTED RANGE OF OPERATING FREQUENCIES

LIMIT

EN 305 550 4.3.2.3

The upper (f_H) and lower (f_L) limits of the operating frequency range shall meet the conditions in table 2.

Table 2: Limits for f_H and f_L [i.9]

	f_L	f_H
57 GHz to 64 GHz	≥ 57 GHz	≤ 64 GHz
61,0 GHz to 61,5 GHz	≥ 61,0 GHz	≤ 61,5 GHz
122 GHz to 123 GHz	≥ 122 GHz	≤ 123 GHz
244 GHz to 246 GHz	≥ 244 GHz	≤ 246 GHz
NOTE: If the device can work in different modes and different frequency ranges these frequencies should be reported for each mode and frequency range.		

TEST PROCEDURE

Test Plan 12511671-TP1V2

The operating frequency range is measured as the -23 dBc BW under Normal environmental conditions.

RESULTS

-23 dBc Bandwidth

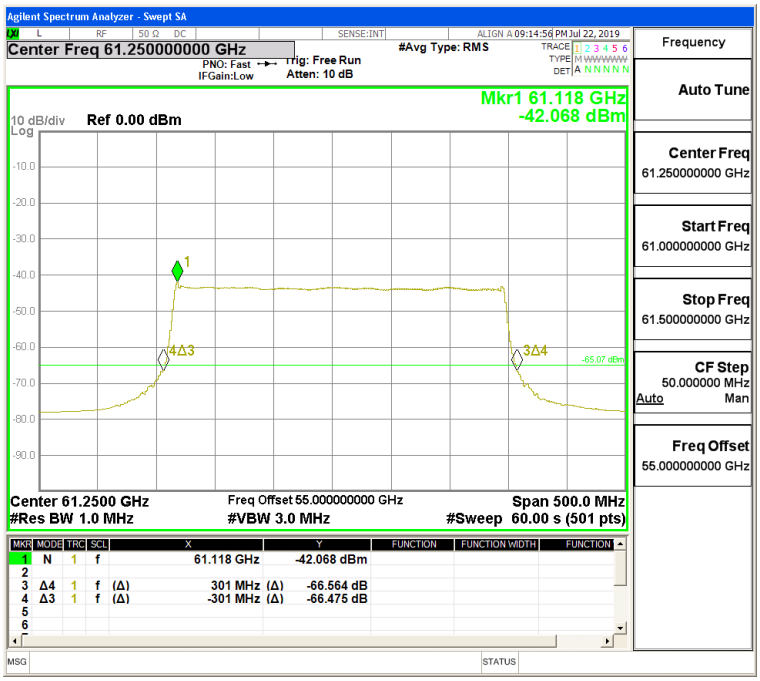
Mode BW	Meas FL (GHz)	FL Limit (GHz)	FL Pass/Fail	Meas FH (GHz)	FL Limit (GHz)	FL Pass/Fail	Center (GHz)	OBW (MHz)
300 MHz	61.106	≥61	Pass	61.407	≤61.5	Pass	61.257	301
1300MHz	60.272	≥57	Pass	61.566	≤64	Pass	60.919	1294
4000MHz	60.279	≥57	Pass	63.962	≤64	Pass	62.121	3683

99% Bandwidth (Reference Only)

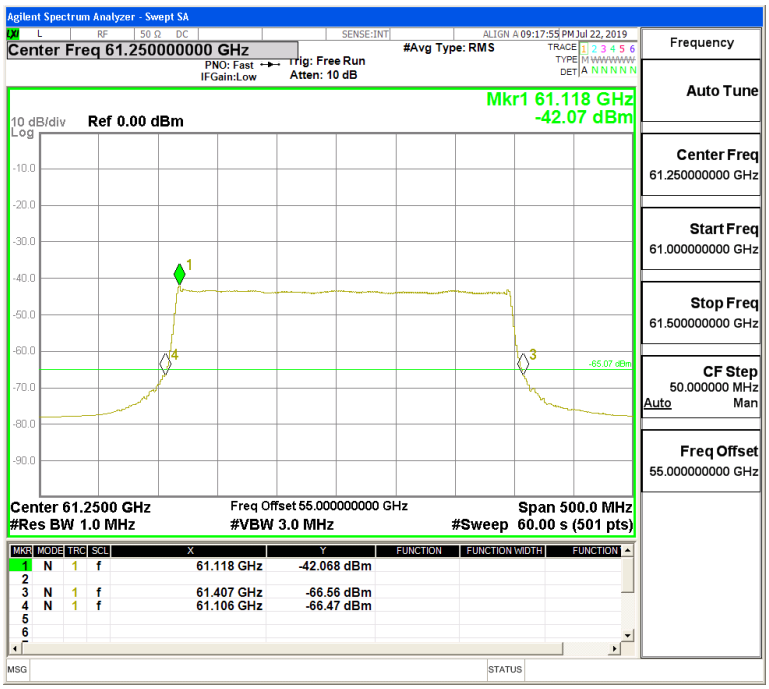
Mode BW	Meas FL (GHz)	Meas FH (GHz)	Center (GHz)	OBW (MHz)
300 MHz	61.115	61.396	61.256	281
1300MHz	60.292	61.544	60.918	1252
4000MHz	60.303	63.918	62.111	3615

-23 dBc

300 MHz Bandwidth

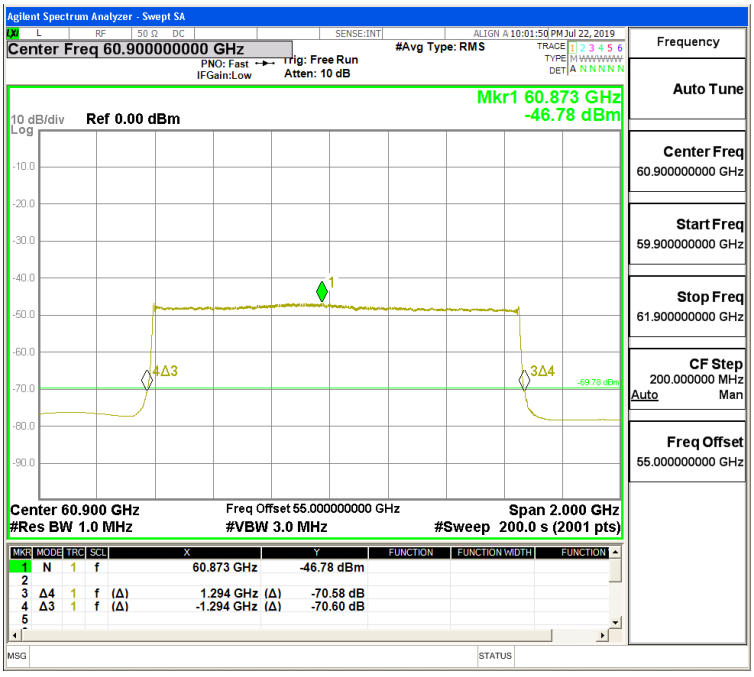


300 MHz FL and FH Markers

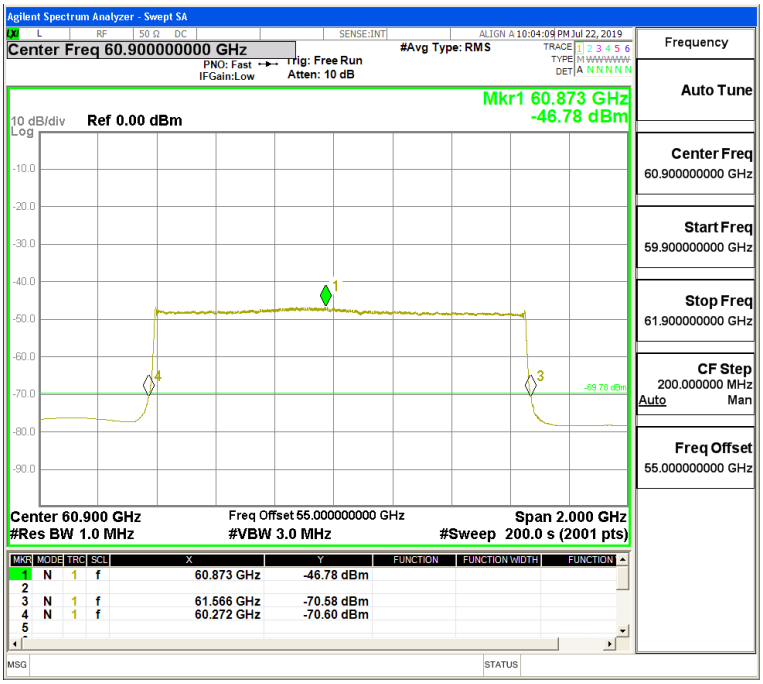


-23 dBc

1300 MHz Bandwidth



1300 MHz FL and FH Markers



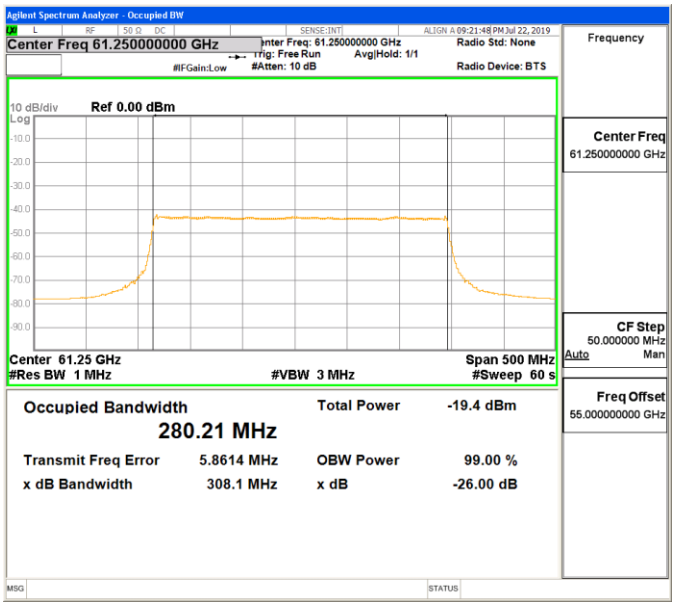
-23 dBc

4000 MHz Bandwidth

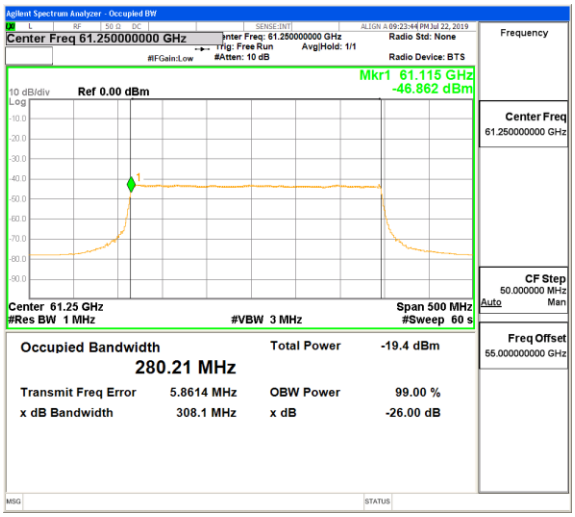
4000 MHz FL and FH Markers

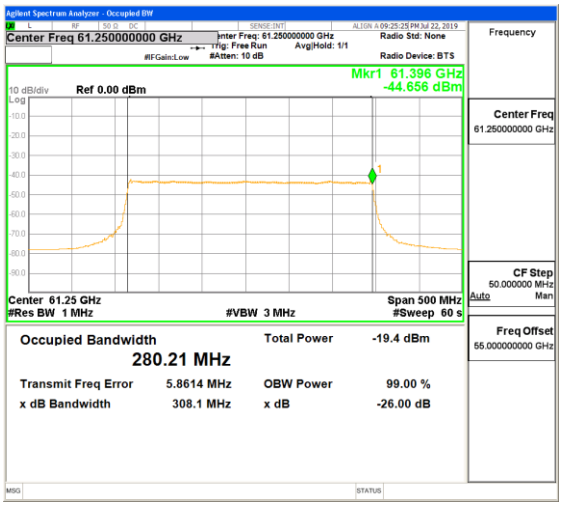
99% BANDWIDTH

300 MHz Bandwidth

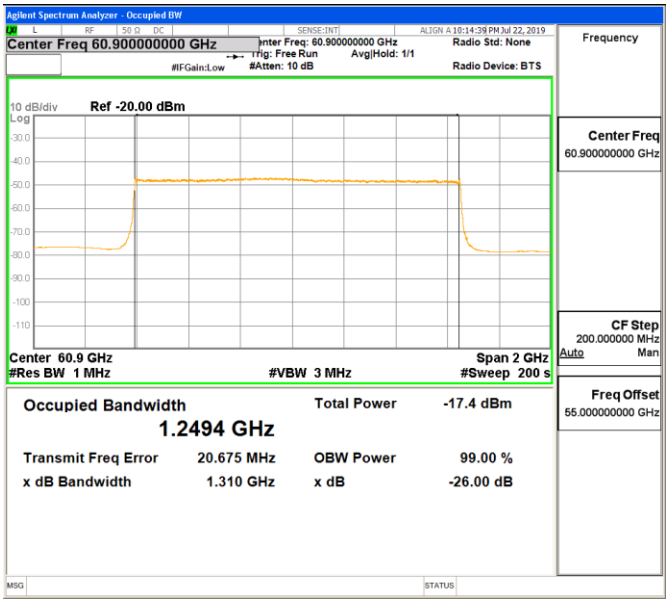


300 MHz Bandwidth 99%FL & FH

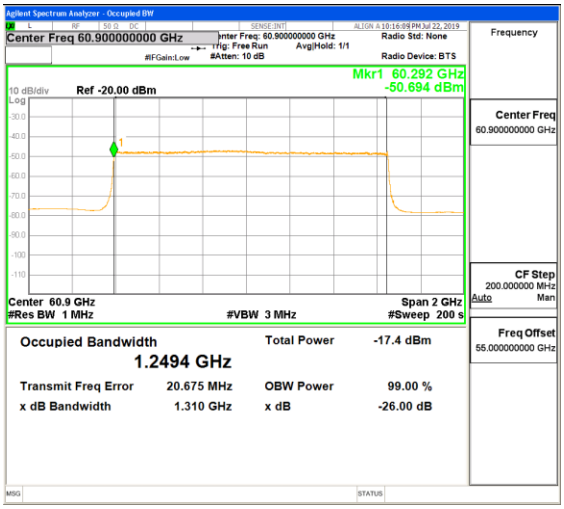


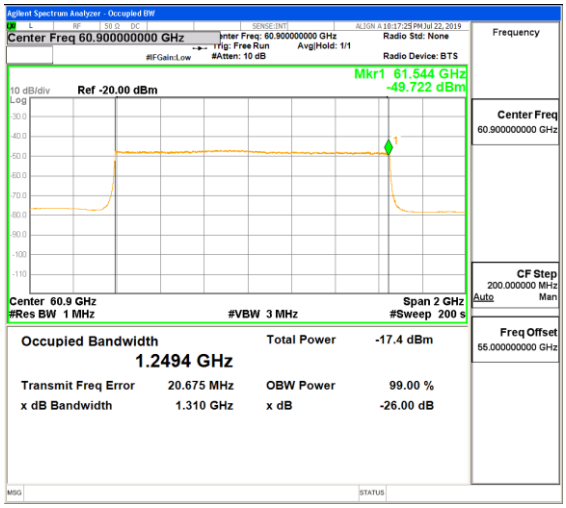


1300 MHz Bandwidth

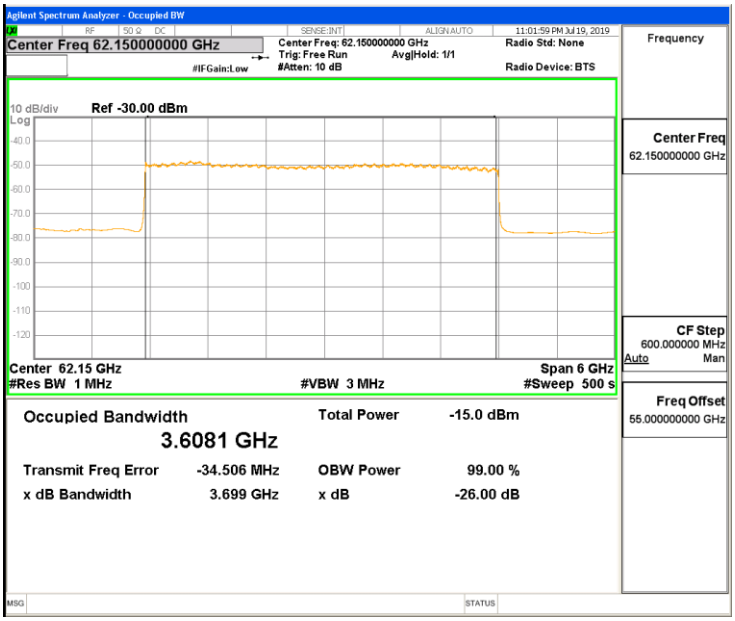


1300 MHz Bandwidth 99%FL & FH

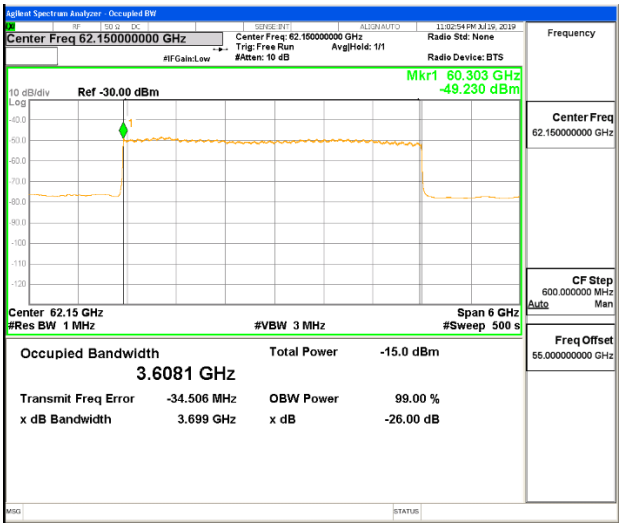


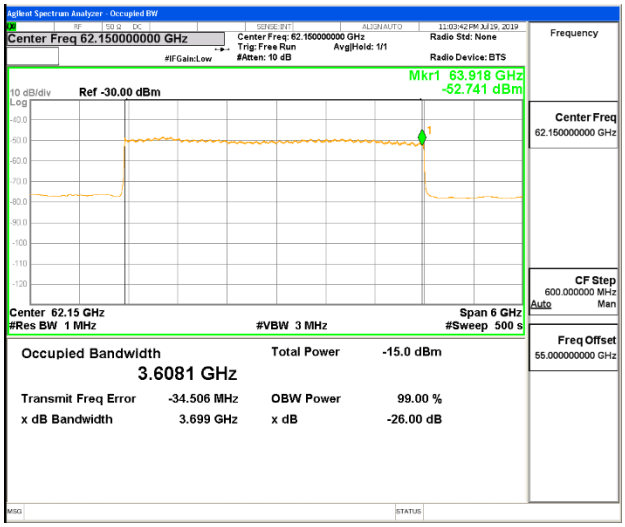


4000 MHz Bandwidth 99% FL & FH



1300 MHz Bandwidth 99%FL & FH





6.5. OUT-OF-BAND EMISSIONS (OOB)

LIMIT

EN 305 550 Clause 4.3.5.3

Table 6: Out-of-band domain

Frequency [GHz]	rms power density [dBm/MHz]
$f_{SL} \leq f < f_L$	See table 7
$f_H < f \leq f_{SH}$	See table 7

Table 7: Limits for out-of-band radiation

Frequency Bands	OOB limit [dBm/MHz]
57 GHz to 64 GHz	-20 dBm/MHz
61,0 GHz to 61,5 GHz	-10 dBm/MHz
122 GHz to 123 GHz	-10 dBm/MHz
244 GHz to 246 GHz	-15 dBm/MHz

The values f_L and f_H are the results of the operating frequency range conformance test, see clause 4.3.2.4.

TEST PROCEDURE

EN 303 396 Clause 6.3.10

Test Plan 12511671-TP1V2

The sidebands of the fundamental signal are measured in the far-field of both the EUT and measurement antennas, under Normal environmental conditions.

The far-field boundary is calculated above in Power Density.

Substitution testing with a CW source connected to a variable attenuator and standard gain horn is used to determine the EIRP corresponding to an uncorrected measured reference power of 0 dBm. The conducted output power of the Source + Variable Attenuator is measured with a power sensor. The Substitution EIRP is calculated as the conducted output power + TX Antenna Gain.

The difference between Substitution EIRP and 0 dBm is used as the Correction Factor for the EUT measurement.

This Correction Factor inherently consists of the Over-The-Air Path Loss, the RX Measurement Antenna Gain, the Downconverter Conversion Loss and the IF amplifier gain.

This Correction Factor is added to the uncorrected measured EUT power to calculate the EIRP of the signal under test.

RESULTS

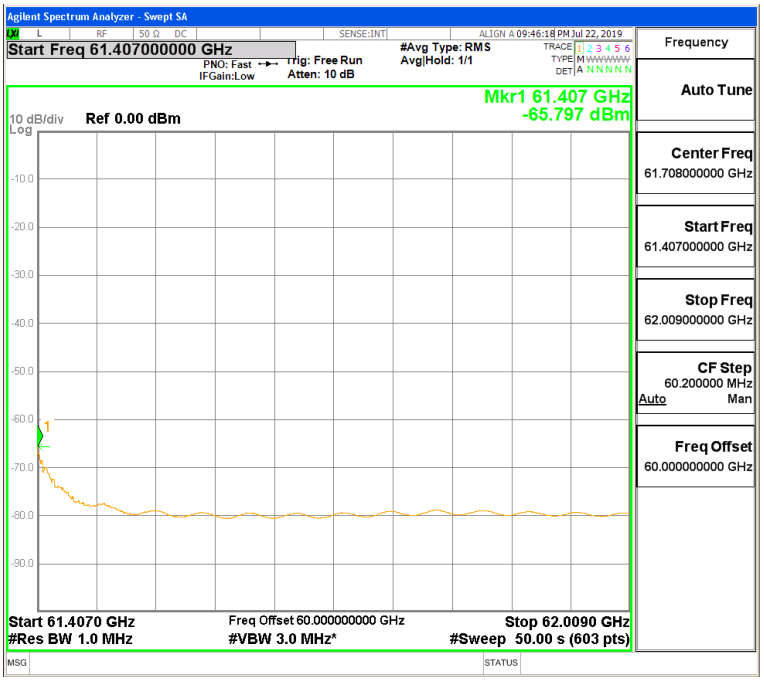
Mode	Boundary of OOB Domain			
	f SL (GHz)	f L (GHz)	F H (GHz)	f SH (GHz)
300 MHz Bandwidth	60.504	61.106	61.407	62.009
1300 MHz Bandwidth	57.704	60.272	61.556	64.124
4000 MHz Bandwidth	52.913	60.279	63.962	71.328

BW Mode	Meas	Frequency (GHz)	Measured Power (dBm)	Meas. Dist. (m)	Correction Factor (dB)	OOB Power (dBm/MHz EIRP)	OOB Limit (dBm/MHz EIRP)	Margin (dB)
300 MHz	OOB LOW	61.104	-66.60	1.5	26.63	-39.97	-10	-29.97
300 MHz	OOB HIGH	61.407	-65.80	1.5	26.73	-39.07	-10	-29.07
1300 MHz	OOB LOW	60.270	-70.84	1.5	26.52	-44.32	-20	-24.32
1300 MHz	OOB HIGH	61.556	-60.47	1.5	27.75	-32.72	-20	-12.72
4 GHz	OOB LOW	60.279	-73.38	1.5	26.51	-46.87	-20	-26.87
4 GHz	OOB HIGH	63.962	-70.55	1.5	28.59	-41.96	-20	-21.96

300 MHz BW Mode

OOB LOW

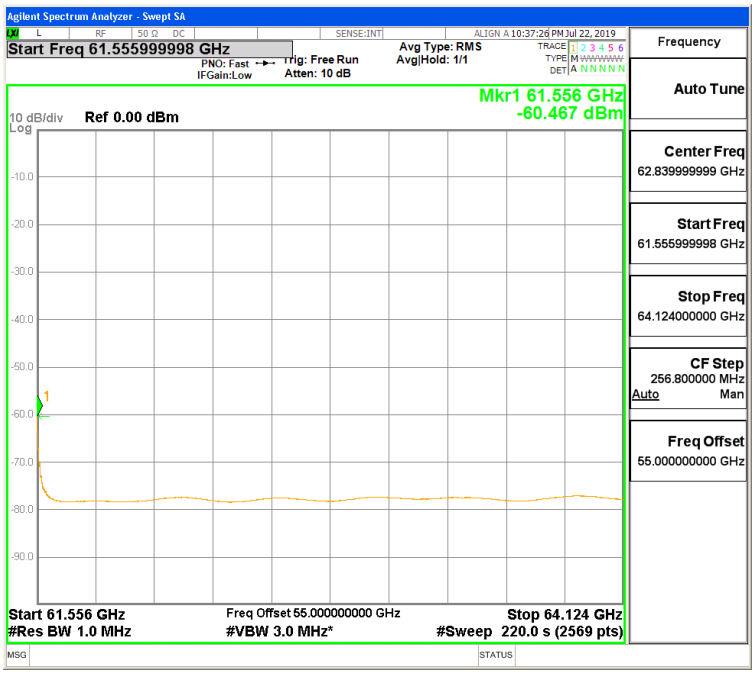
OOB HIGH



1300 MHz BW Mode

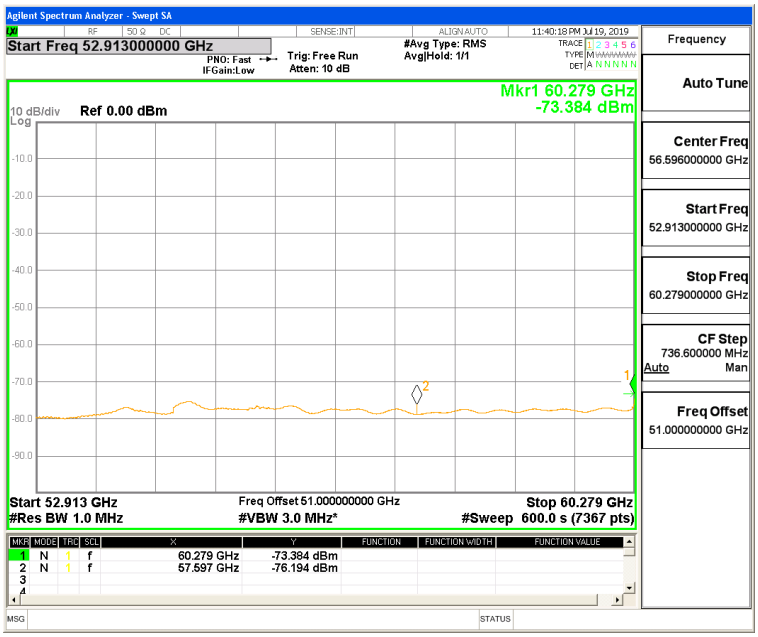
OOB LOW

OOB HIGH

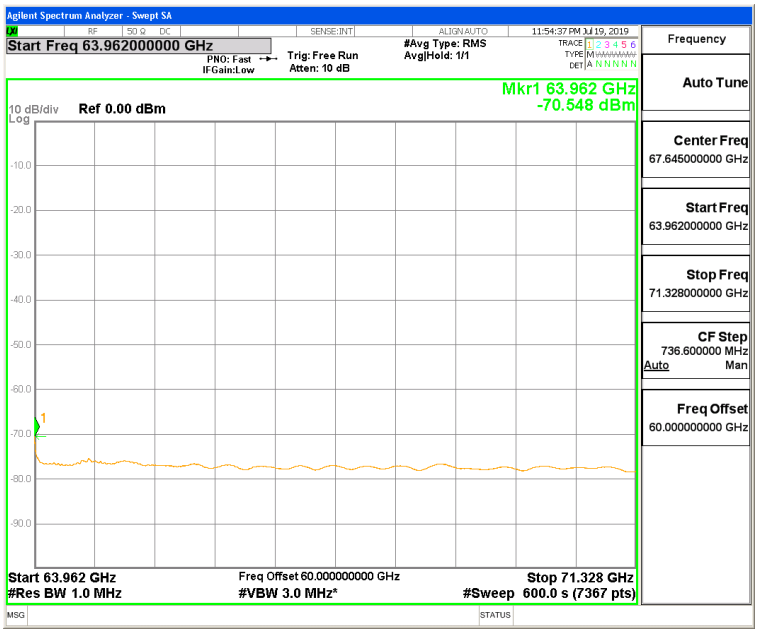


4000 MHz BW Mode

OOB LOW



OOB HIGH



6.6. RADIATED SPURIOUS EMISSIONS

LIMIT

EN 305 550 Clause 4.3.6.3

Frequency range (MHz)	Limit values for spurious radiation	Detector type
47 to 74	-54 dBm e.r.p.	Quasi-Peak
87,5 to 118	-54 dBm e.r.p.	Quasi-Peak
174 to 230	-54 dBm e.r.p.	Quasi-Peak
470 to 862	-54 dBm e.r.p.	Quasi-Peak
otherwise in band 30 to 1 000	-36 dBm e.r.p.	Quasi-Peak
f > 1 000 to 300 000 (note)	-30 dBm e.i.r.p.	RMS
NOTE: According to CEPT/ERC/REC 74-01 [i.3], spurious emission is measured up to the 2nd harmonic of the fundamental frequency.		

TEST PROCEDURE

EN 303 396 Clause 6.3.10

Note: Peak detection used for prescan, identification of emissions, and maximizing signals. Quasi Peak and Average detection used for final measurements.

PROCEDURE FOR 30 MHz TO 50 GHz

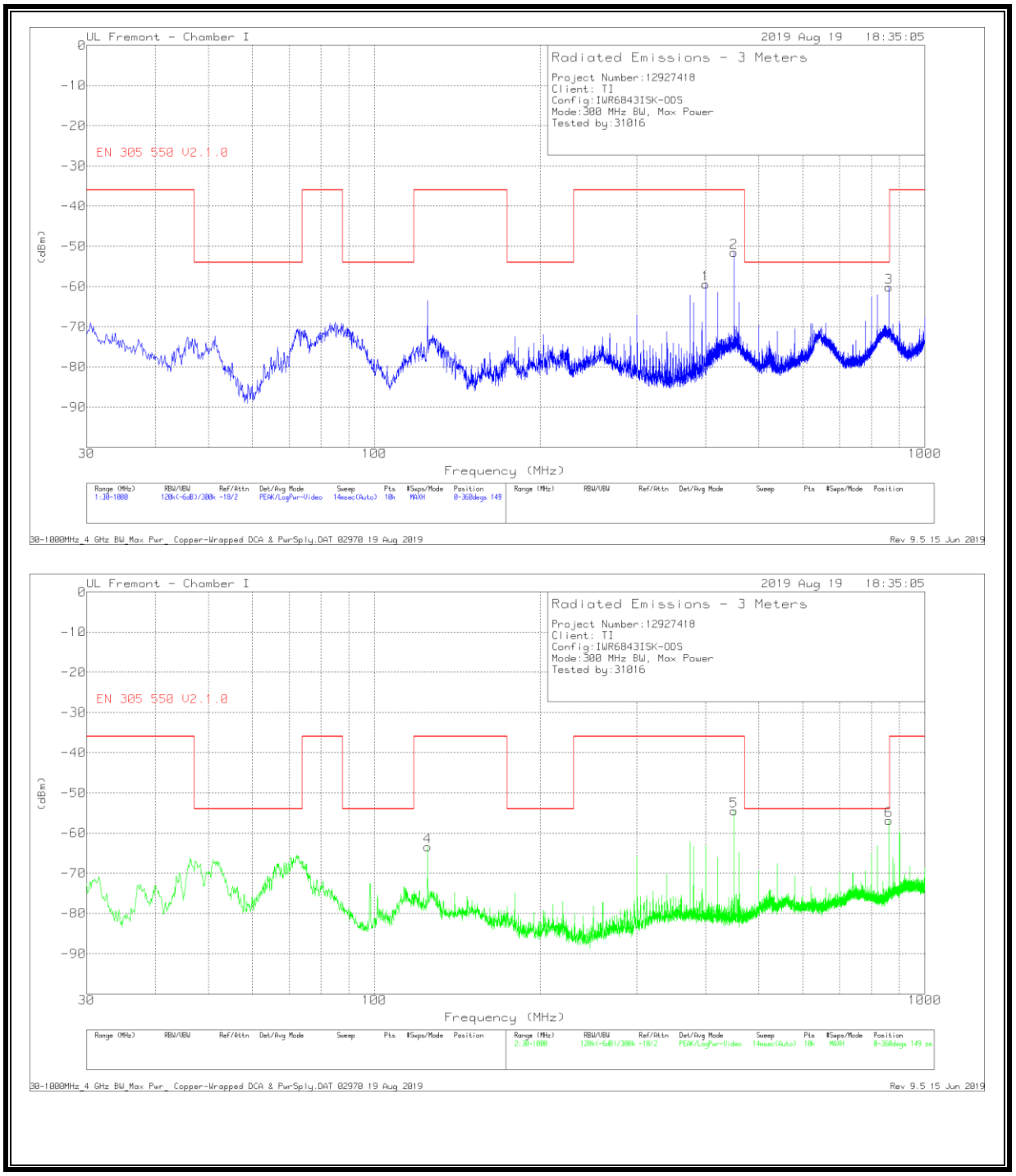
Measurements are made with the antenna feeding a spectrum analyzer via a preamplifier and cables.

PROCEDURE FOR 50 TO 132 GHz

External downconverters are utilized.

RESULTS

TX UNWANTED EMISSION 30 TO 1000 MHz



Radiated Emissions

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF PRE0184971 (dB/m)	Amp Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	EN 305 550 V2.1.0	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	859.9907	-68.56	Pk	27.6	-27.8	11.5	-57.26	-54	--	33	135	H
3	859.9907	-69.94	Qp	27.6	-27.8	11.5	-58.64	-54	-4.64	33	135	H
1	399.9944	-57.38	Pk	21.6	-29.6	7.7	-57.68	-36	--	356	127	H
1	399.9944	-59.03	Qp	21.6	-29.6	7.7	-59.33	-36	-23.33	356	127	H
2	449.9899	-48.51	Pk	22.7	-29.3	13.6	-41.51	-36	--	5	112	H
2	449.9899	-49	Qp	22.7	-29.3	13.6	-42	-36	-6	5	112	H
6	859.982	-63.77	Pk	27.6	-27.8	7.6	-56.37	-54	--	265	158	V
6	859.982	-64.72	Qp	27.6	-27.8	7.6	-57.32	-54	-3.32	265	158	V
4	124.996	-64.42	Pk	19.6	-30.6	13.6	-61.82	-36	--	263	187	V
4	124.996	-65.71	Qp	19.6	-30.6	13.6	-63.11	-36	-27.11	263	187	V
5	449.9875	-54.79	Pk	22.7	-29.3	7.1	-54.29	-36	--	67	153	V
5	449.9875	-55.32	Qp	22.7	-29.3	7.1	-54.82	-36	-18.82	67	153	V

Pk - Peak detector
Qp - Quasi-Peak detector

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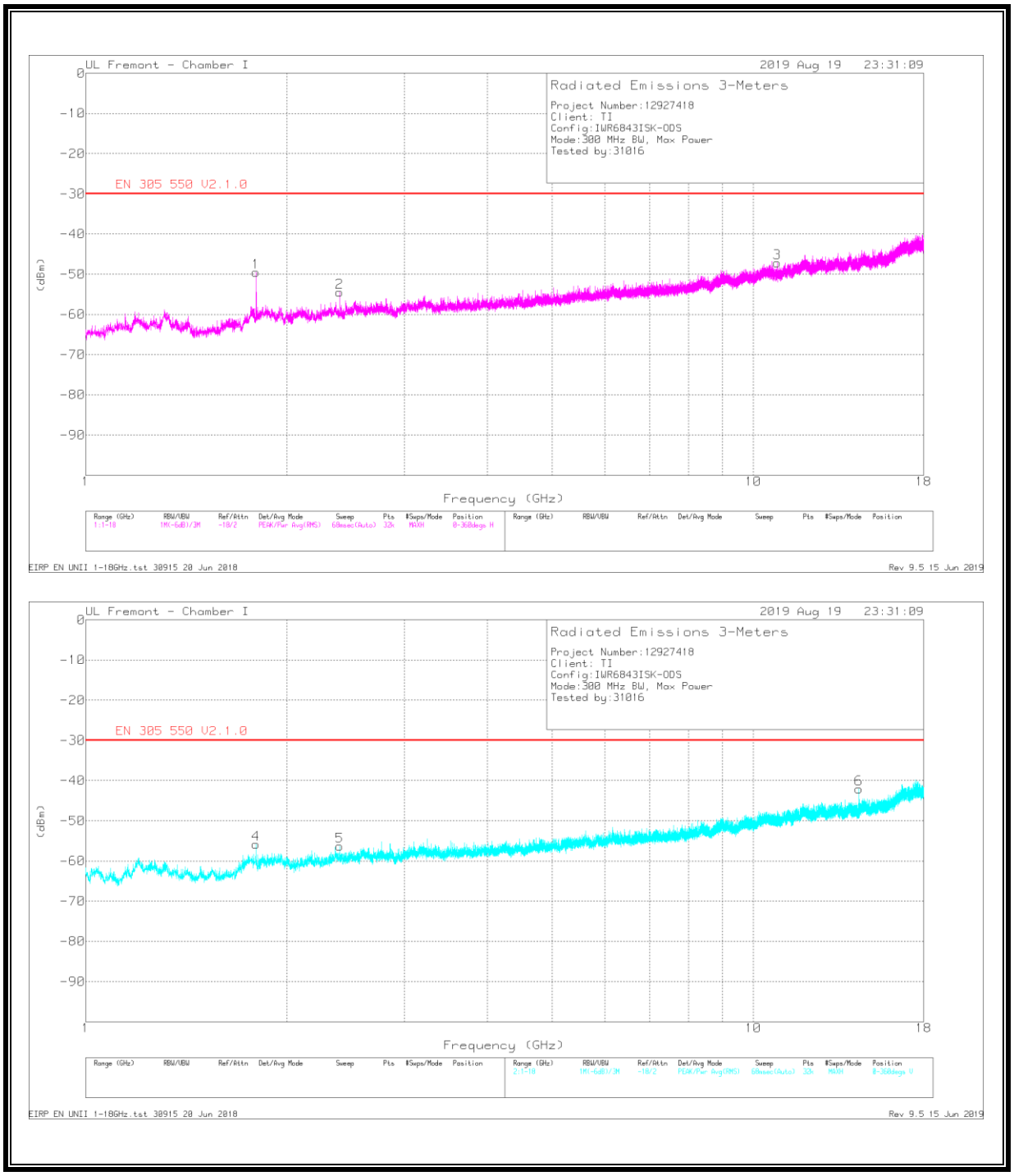
TX UNWANTED EMISSIONS 1 TO 18 GHz:

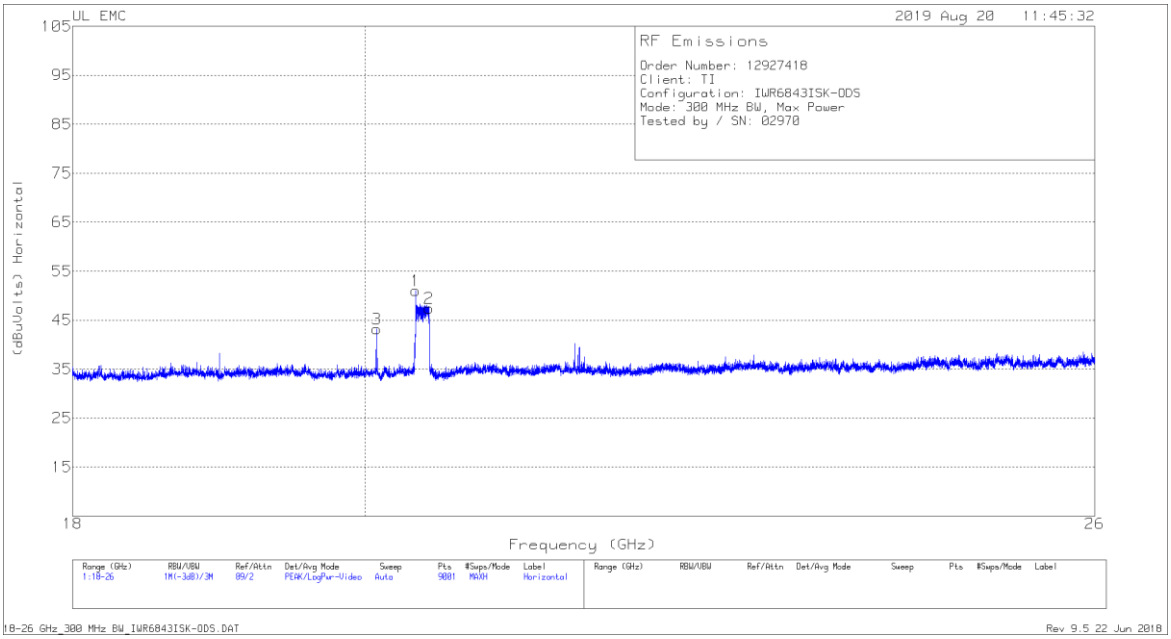


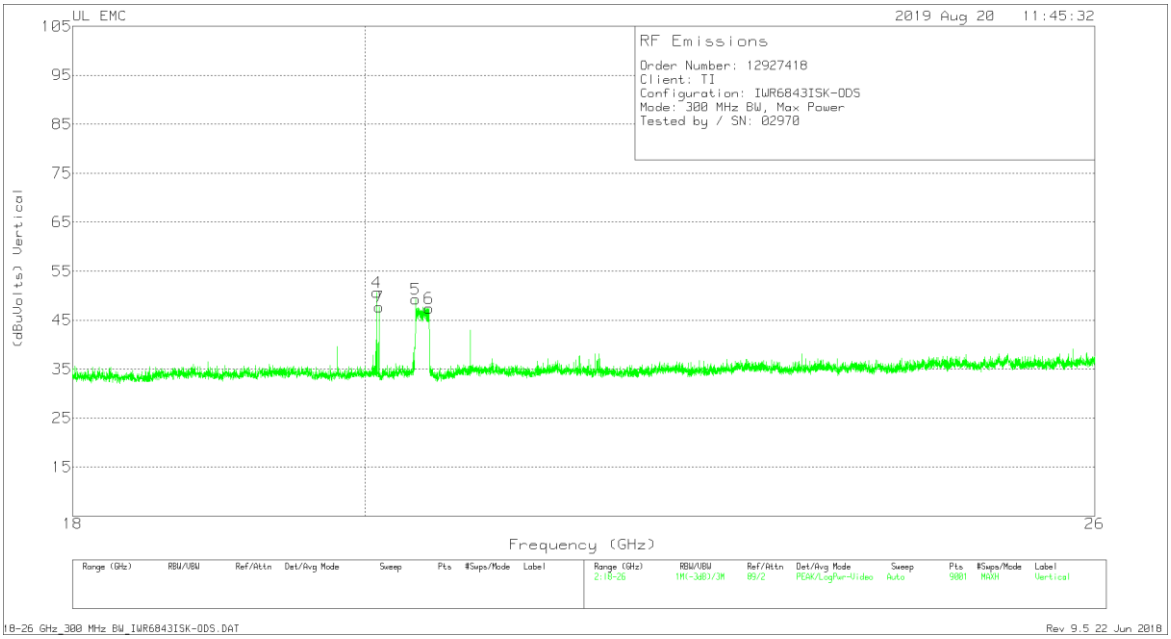
Radiated Emissions

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	EN 305 550 V2.1.0	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.79994	-57.23	Pk	30.5	-33	11.9	-47.83	-	-	347	316	H
1	1.79994	-65.01	Av	30.5	-33	11.9	-55.61	-30	- 25.61	347	316	H
2	2.39991	-62.77	Pk	31.9	-32	11.5	-51.37	-	-	103	261	H
2	2.39991	-69.98	Av	31.9	-32	11.5	-58.58	-30	- 28.58	103	261	H
3	10.85	-73.74	Pk	37.9	-21.5	11.6	-45.74	-	-	243	140	H
3	10.85	-86.73	Av	37.9	-21.5	11.6	-58.73	-30	-28.73	243	140	H
4	1.79993	-61.16	Pk	30.5	-33	12.1	-51.56	-	-	241	381	V
4	1.79993	-71.95	Av	30.5	-33	12.1	-62.35	-30	- 32.35	241	381	V
5	2.40017	-64.94	Pk	31.9	-32	11.9	-53.14	-	-	191	210	V
5	2.40017	-75.73	Av	31.9	-32	11.9	-63.93	-30	- 33.93	191	210	V
6	14.39719	-72.54	Pk	39.6	-22.4	12	-43.34	-	-	253	206	V
6	14.39719	-85.51	Av	39.6	-22.4	12	-56.31	-30	- 26.31	253	206	V

Pk - Peak detector
Av - Average detection
Rev 9.5 15 Jun 2019

TX UNWANTED EMISSIONS 18-26 GHz





Radiated Emissions

Trace Markers
Pre-scan Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0182188 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)
1	20.365	83.94	Pk	33.7	-57.1	-9.5	51.04
2	20.465	79.93	Pk	33.8	-56.8	-9.5	47.43
3	20.083	75.85	Pk	33.2	-56.3	-9.5	43.25
4	20.083	83.24	Pk	33.2	-56.3	-9.5	50.64
5	20.366	82.15	Pk	33.7	-57.1	-9.5	49.25
6	20.464	79.87	Pk	33.8	-56.7	-9.5	47.47
7	20.098	80.66	Pk	33.2	-56.7	-9.5	47.66

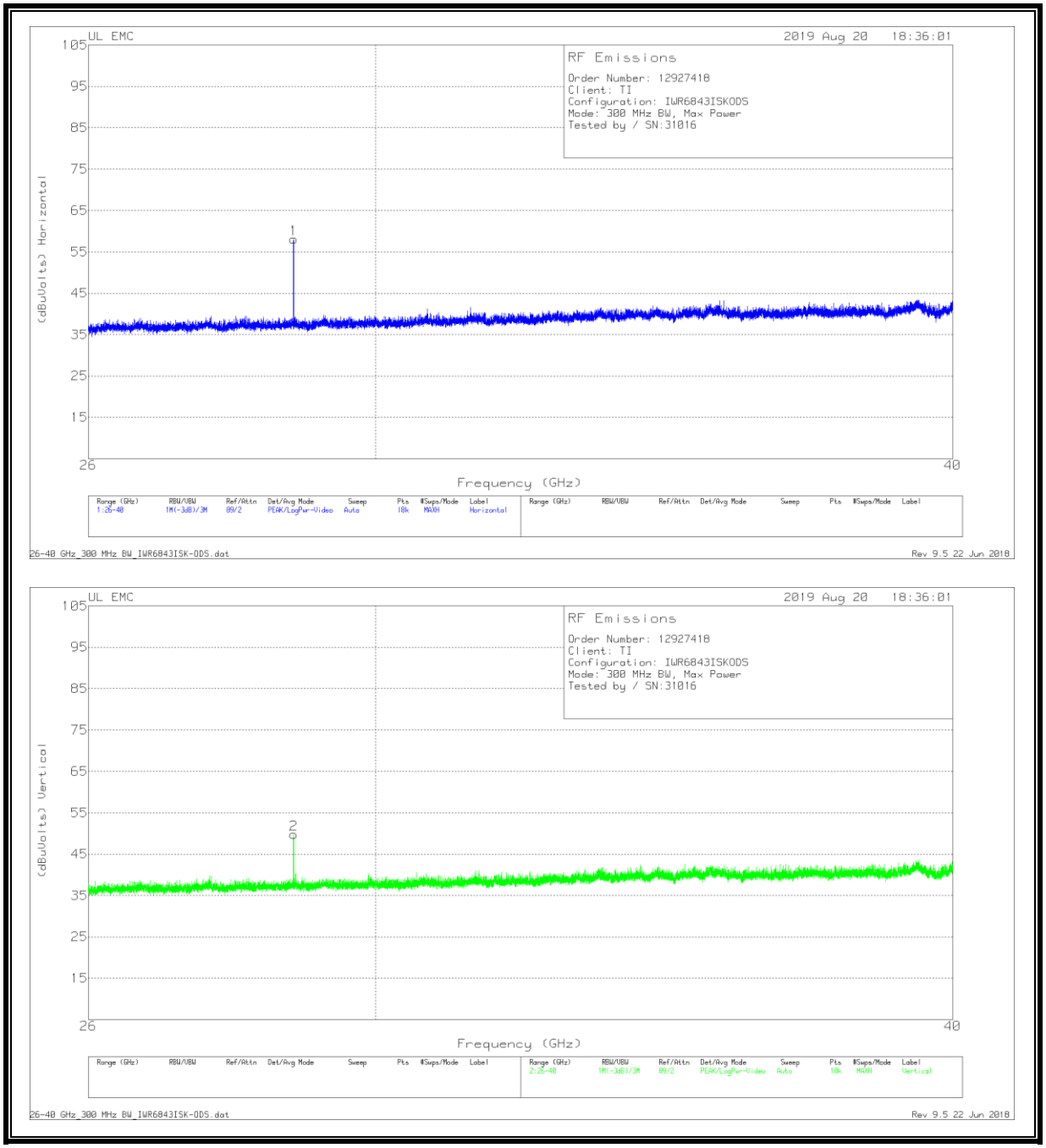
Pk - Peak detector

Final Data

Marker	Freq. (GHz)	Meter Reading (dBuV)	Det	AF PRE0182188	Amp/Cbl (dB)	Dist Corr (dB)	Corr. Reading (dBuV)	F.S. to EIRP Conv. Fact.	Corr. Reading (dBm)	EIRP Limit (dBm)	Margin (dB)	Polarity
1	20.366	47.02	Av	33.7	-57.1	-9.5	14.12	-95.2	-81.08	-30	-51.08	H
2	20.465	46.01	Av	33.8	-56.8	-9.5	13.51	-95.2	-81.69	-30	-51.69	H
3	20.083	54.48	Av	33.2	-56.3	-9.5	21.88	-95.2	-73.32	-30	-43.32	H
4	20.083	54.44	Av	33.2	-56.3	-9.5	21.84	-95.2	-73.36	-30	-43.36	V
5	20.366	55.52	Av	33.7	-57.1	-9.5	22.62	-95.2	-72.58	-30	-42.58	V
6	20.464	54.8	Av	33.8	-56.7	-9.5	22.4	-95.2	-72.8	-30	-42.8	V
7	20.098	54.08	Av	33.2	-56.7	-9.5	21.08	-95.2	-74.12	-30	-44.12	V

Av - Average detection
18-26 GHz_300 MHz BW_IWR6843ISK-ODS.DAT
Rev 9.5 22 Jun 2018

TX UNWANTED EMISSIONS 26-40 GHz: 300 MHz Bandwidth



Radiated Emissions

Trace Markers
Pre-scan

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T90 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)
1	28.799	85.03	Pk	35.8	-53.2	-9.5	58.13
2	28.799	76.67	Pk	35.8	-53.2	-9.5	49.77

Pk - Peak detector

Final Data

Marker	Freq. (GHz)	Meter Reading (dBuV)	Det	AF PRE0182 188	Amp/Cbl (dB)	Dist Corr (dB)	Corr. Reading (dBuV)	F.S. to EIRP Conv. Fact.	Corr. Reading (dBm)	EIRP Limit (dBm)	Margin (dB)	Polarity
1	28.799	84.37	Av	35.8	-53.1	-9.5	57.57	-95.2	-37.63	-30	-7.63	H
2	28.799	76.06	Av	35.8	-53.2	-9.5	49.16	-95.2	-46.04	-30	-16.04	V

Av - Average detection
26-40 GHz_300 MHz BW_IWR6843ISK-ODS.dat
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TX UNWANTED EMISSIONS 40 TO 132 GHz

RESULTS

No unwanted emission above the noise floor of PXA using Average detection on the following bands unless otherwise specified.

Frequency (GHz)	300 MHz Bandwidth	1300 MHz Bandwidth	4000 MHz Bandwidth
40-50	No emissions	No emissions	No emissions
50-60.504	See results	--	--
62.009-75	No emissions	--	--
50-57.704	--	See results	--
64.124-75	--	No emissions	--
50-52.913	--	--	No emissions
71.328-75	--	--	See results
75-90	See results	See results	See results
90-110	No emissions	No emissions	No emissions
110-132	See results	See results	See results

50-75 GHz Band

50-60.504 GHz: 300 MHz BW

Frequency	Measurement Distance (m)	Average Power (dBm)	Total Receiving Gain (dBi)
57.598	1.500	-70.27	36.82
Duty Cycle Factor (dB)	**EIRP (dBm)**	**EIRP (W)**	**Specification Distance (m)**
0	-35.92	0.00000026	3.0
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dBm)**	
-35.92	-30.00	**-5.922**	

50-57.704 GHz: 1300 MHz BW

Frequency	Measurement Distance (m)	Average Power (dBm)	Total Receiving Gain (dBi)
57.598	1.500	-70.15	36.82
Duty Cycle Factor (dB)	**EIRP (dBm)**	**EIRP (W)**	**Specification Distance (m)**
0	-35.80	0.00000026	3.0
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dBm)**	
-35.80	-30.00	**-5.802**	

71.323-75 GHz: 4000 MHz BW

Frequency	Measurement Distance (m)	Average Power (dBm)	Total Receiving Gain (dBi)
71.997	1.500	-71.997	36.09
Duty Cycle Factor (dB)	**EIRP (dBm)**	**EIRP (W)**	**Specification Distance (m)**
0	-34.98	0.00000032	3.0
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dBm)**	
-34.98	-30.00	**-4.981**	

75-90 GHz: 300 MHz BW

Frequency	Measurement Distance (m)	Average Power (dBm)	Total Receiving Gain (dBi)
86.397	1.500	-72.91	38.98
Duty Cycle Factor (dB)	**EIRP (dBm)**	**EIRP (W)**	**Specification Distance (m)**
0	-37.20	0.00000019	3.0
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dBm)**	
-37.20	-30.00	**-7.20**	

75-90 GHz: 1300 MHz BW

Frequency	Measurement Distance (m)	Average Power (dBm)	Total Receiving Gain (dBi)
86.397	1.500	-73.20	38.98
Duty Cycle Factor (dB)	**EIRP (dBm)**	**EIRP (W)**	**Specification Distance (m)**
0	-37.49	0.00000018	3.0
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dBm)**	
-37.49	-30.00	**-7.49**	

75-90 GHz: 4000 MHz BW

Frequency	Measurement Distance (m)	Average Power (dBm)	Total Receiving Gain (dBi)
86.397	1.500	-73.97	38.98
Duty Cycle Factor (dB)	**EIRP (dBm)**	**EIRP (W)**	**Specification Distance (m)**
0	-38.26	0.00000015	3.0
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dBm)**	
-38.26	-30.00	**-8.26**	

110-132 GHz: 300 MHz BW

Frequency	Measurement Distance (m)	Average Power (dBm)	Total Receiving Gain (dBi)
122.196	1.000	-70.76	49.18
Duty Cycle Factor (dB)	**EIRP (dBm)**	**EIRP (W)**	**Specification Distance (m)**
8.67	-37.09	0.00000020	3.0
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dBm)**	
-37.09	-30.00	**-7.09**	

Emission is 2nd harmonic of fundamental.

110-132 GHz: 1300 MHz BW

Frequency	Measurement Distance (m)	Average Power (dBm)	Total Receiving Gain (dBi)
120.49	1.000	-66.00	49.42
Duty Cycle Factor (dB)	**EIRP (dBm)**	**EIRP (W)**	**Specification Distance (m)**
6.31	-35.05	0.00000031	3.0
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dBm)**	
-35.05	-30.00	**-5.05**	

110-132 GHz: 4000 MHz BW

Frequency	Measurement Distance (m)	Average Power (dBm)	Total Receiving Gain (dBi)
120.49	1.000	-59.88	49.42
Duty Cycle Factor (dB)	**EIRP (dBm)**	**EIRP (W)**	**Specification Distance (m)**
2.53	-32.71	0.00000054	3.0
EIRP (dBm)	**EIRP Limit (dBm)**	**Margin (dBm)**	
-32.71	-30.00	**-2.71**	

Emission is 2nd harmonic of fundamental.

6.7. RECEIVER SPURIOUS

Not applicable Per Test Plan 12511671-TP1V2

6.8. RECEIVER INTERFERENCE SIGNAL HANDLING

LIMIT

EN 305 550 Clause 4.4.3.3

Table 11: For EUT operating within 57 GHz to 64 GHz

	In-band signal	OOB signal	Remote-band signal
Frequency	Centre frequency (f_c) of the EUT modulated signal (see clause 4.3.1)	$f = f_c \pm OBW$	$f = f_c \pm 10 \times OBW$
Signal level field strength at the EUT	55 mV/m	173 mV/m	173 mV/m
Equivalent EIRP at 10 m	10 dBm	20 dBm	20 dBm

Table 12: For EUT operating within 61,0 GHz to 61,5 GHz

	In-band signal	OOB signal	Remote-band signal
Frequency	Centre frequency (f_c) of the EUT modulated signal (see clause 4.3.1)	$f = f_c \pm OBW$	$f = f_c \pm 10 \times OBW$
Signal level field strength at the EUT	55 mV/m	173 mV/m	173 mV/m
Equivalent EIRP at 10 m	10 dBm	20 dBm	20 dBm

TEST SETUP AND PROCEDURE

EN 303 396 Clause 6.3.12

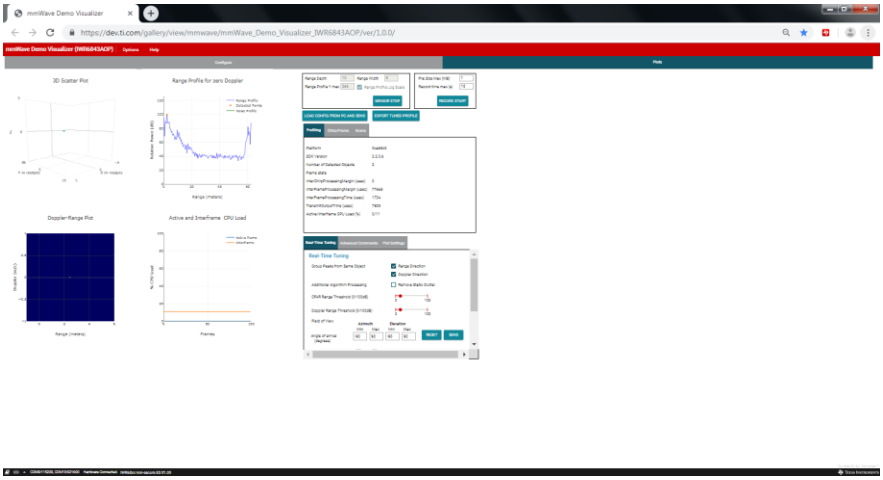
Test Plan 12511671-TP1V2

RESULTS

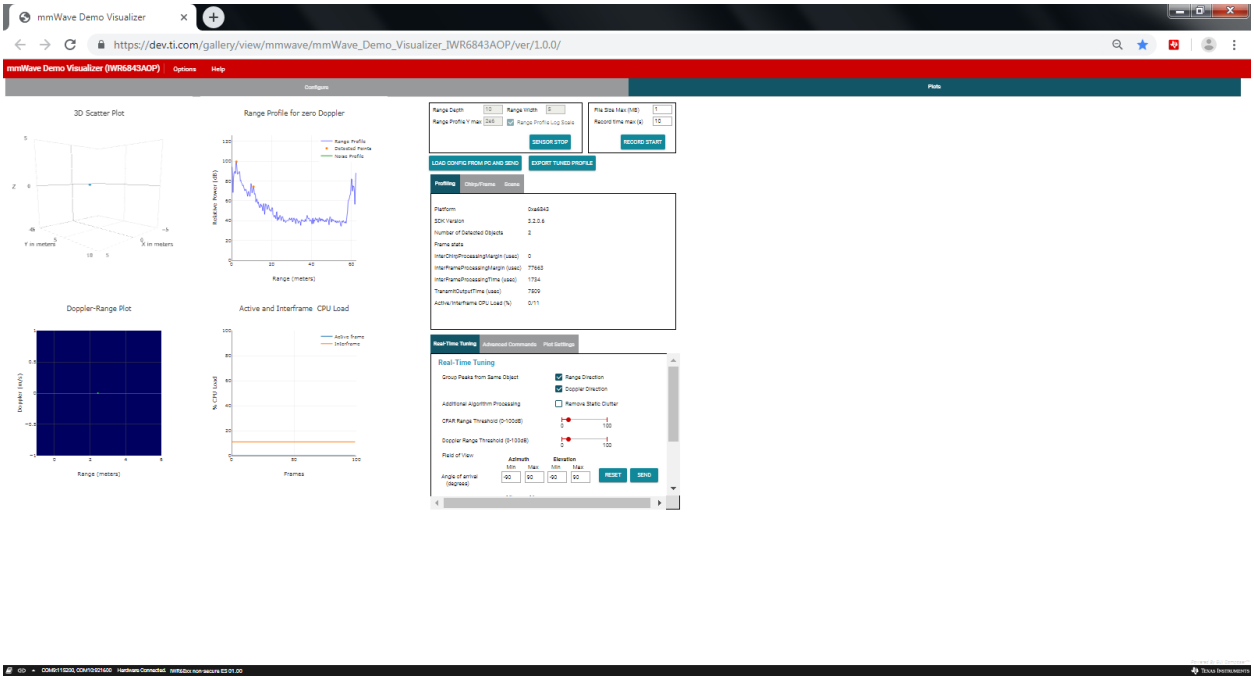
No changes in the Range Profile, Scatter Plot or Doppler Range Plot were observed during the application of the unwanted signals in the chart below, relative to the corresponding indications with no interference signal present.

Signal	Band Width Mode (MHz)	Antenna Mode	Unwanted Frequency (GHz)	+10 dBm EIRP Results	+20 dBm EIRP Results
In-Band	300	2TX	60.40	Pass	--
Remote +	300	2TX	63.21	--	Pass
OOB +	300	2TX	60.68	--	Pass
OOB -	300	2TX	60.12	--	Pass
Remote -	300	2TX	57.60	--	Pass
In-Band	1300	2TX	60.90	Pass	--
Remote +	1300	2TX	73.42	--	Pass
OOB +	1300	2TX	62.15	--	Pass
OOB -	1300	2TX	59.65	--	Pass
Remote -	1300	2TX	48.40	--	Pass
In-Band	4000	2TX	62.50	Pass	--
Remote +	4000	2TX	98.30	--	Pass
OOB +	4000	2TX	65.80	--	Pass
OOB -	4000	2TX	58.60	--	Pass
Remote -	4000	2TX	26.10	--	Pass
In-Band	300	3TX	60.40	Pass	--
Remote +	300	3TX	63.21	--	Pass
OOB +	300	3TX	60.68	--	Pass
OOB -	300	3TX	60.12	--	Pass
Remote -	300	3TX	57.60	--	Pass
In-Band	1300	3TX	60.90	Pass	--
Remote +	1300	3TX	73.42	--	Pass
OOB +	1300	3TX	62.15	--	Pass
OOB -	1300	3TX	59.65	--	Pass
Remote -	1300	3TX	48.40	--	Pass
In-Band	4000	3TX	62.50	Pass	--
Remote +	4000	3TX	98.30	--	Pass
OOB +	4000	3TX	65.80	--	Pass
OOB -	4000	3TX	58.60	--	Pass
Remote -	4000	3TX	26.10	--	Pass

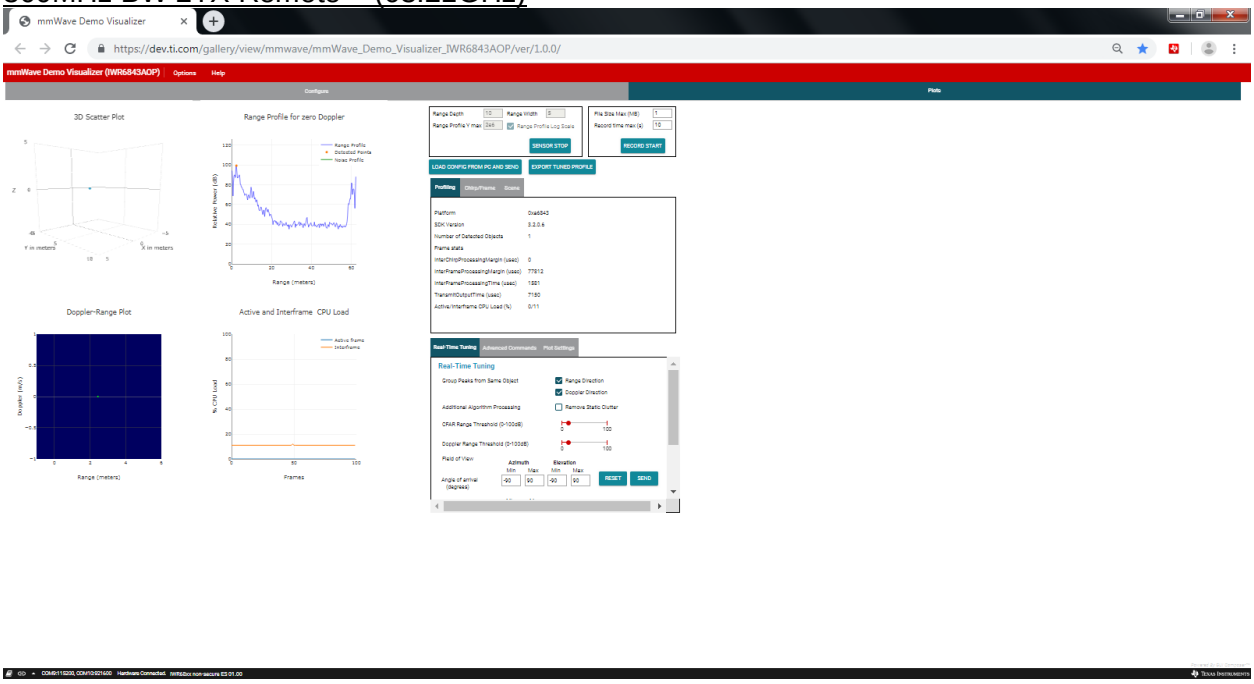
300MHz BW 2TX No Interference



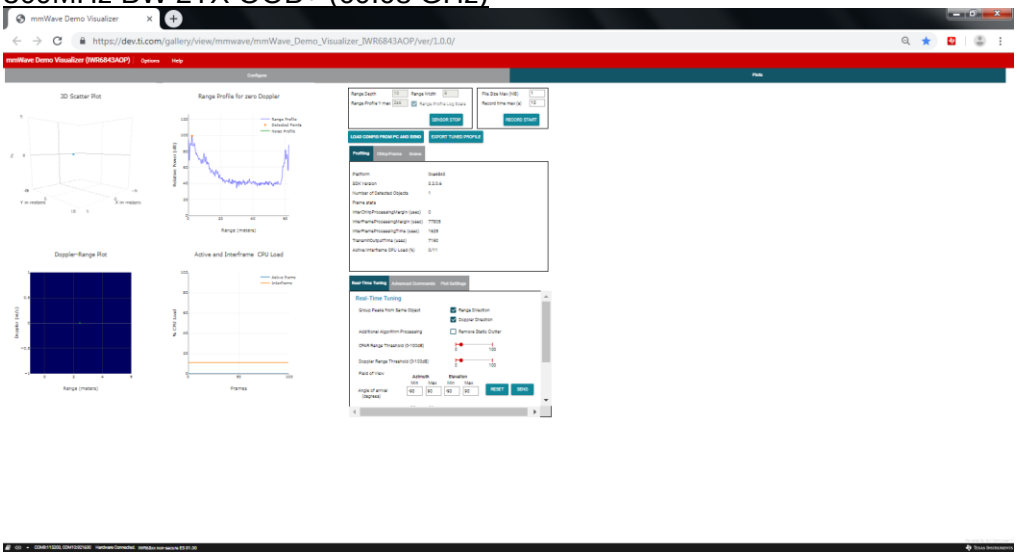
300MHz BW 2TX In-Band (60.4 GHz)



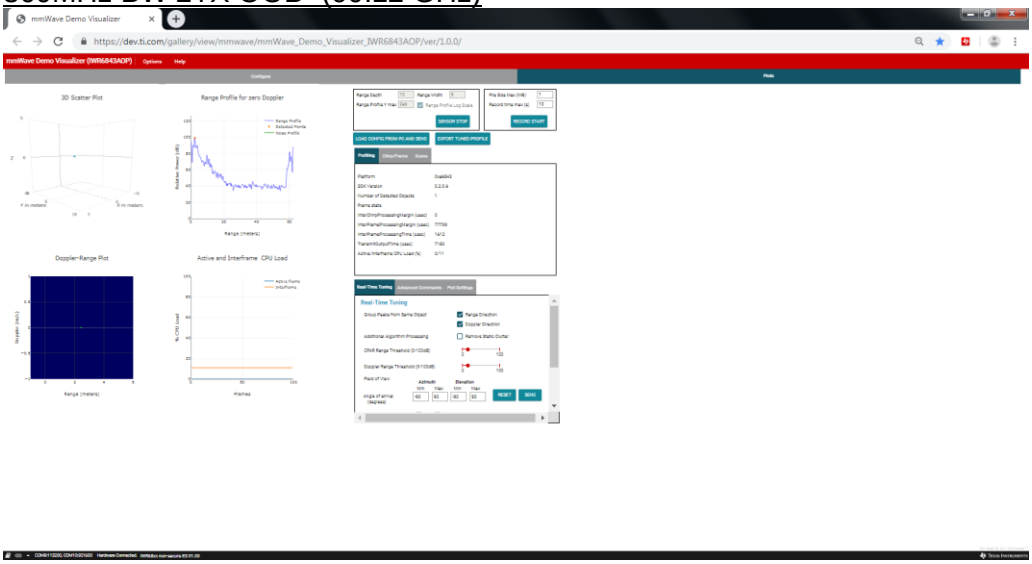
300MHz BW 2TX Remote + (63.21GHz)



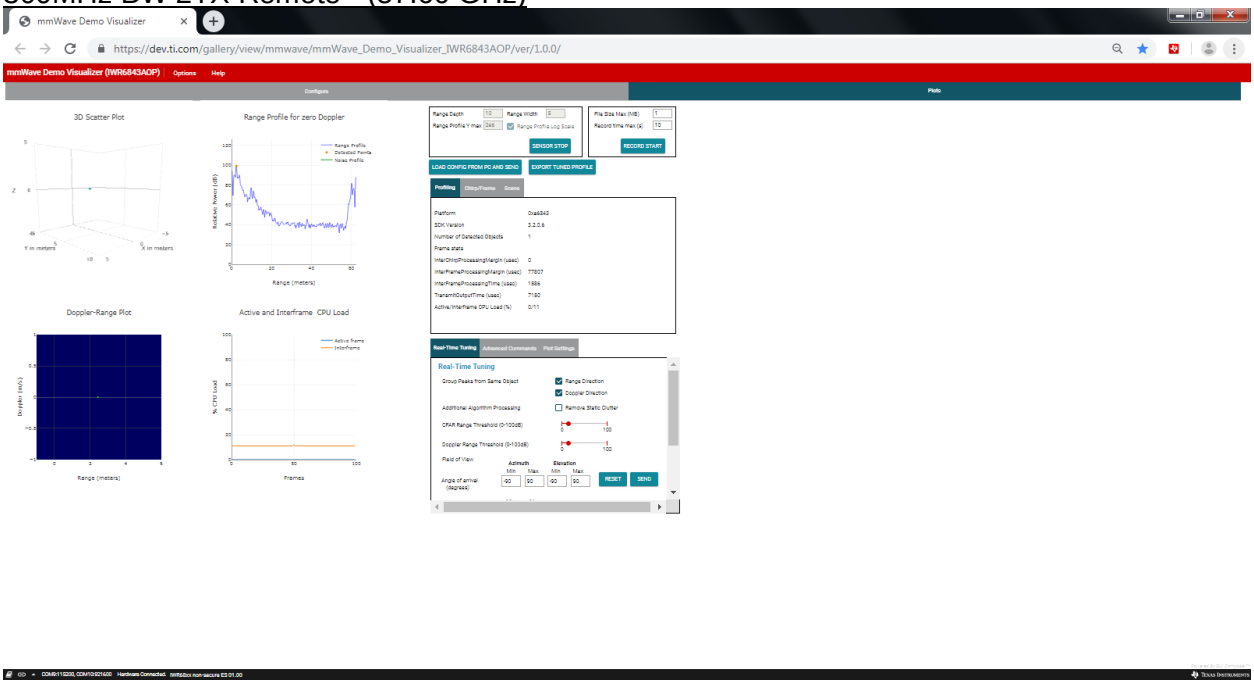
300MHz BW 2TX OOB+ (60.68 GHz)



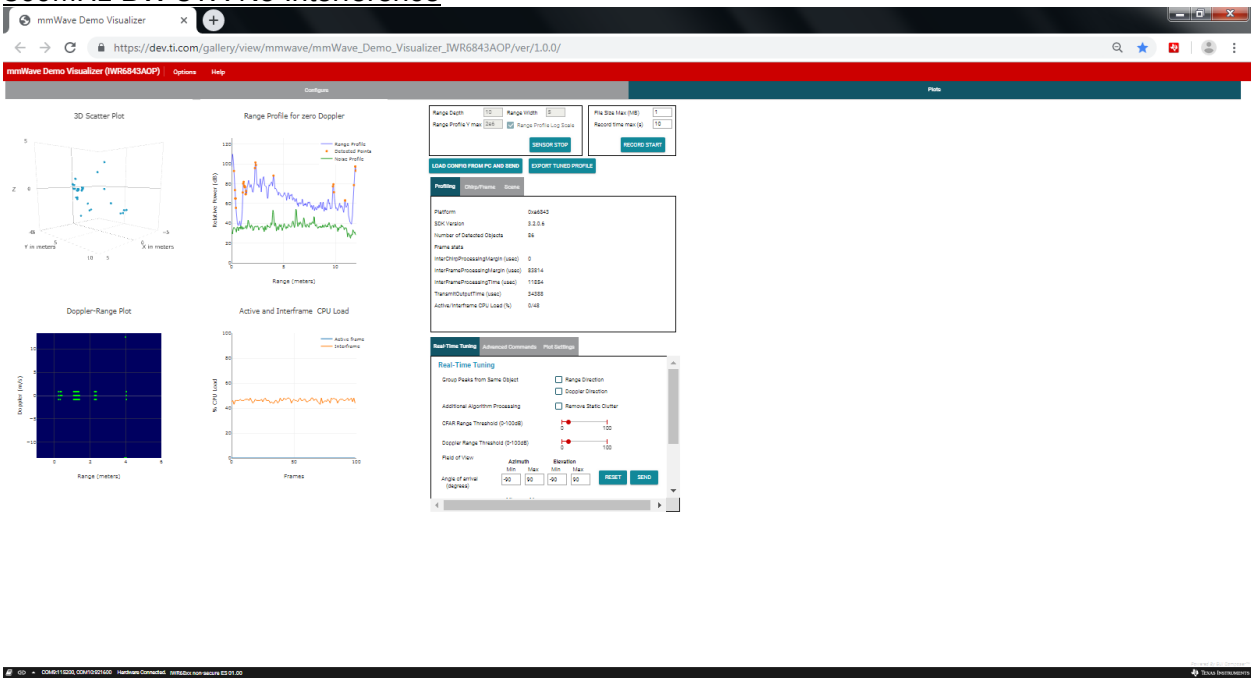
300MHz BW 2TX OOB- (60.12 GHz)



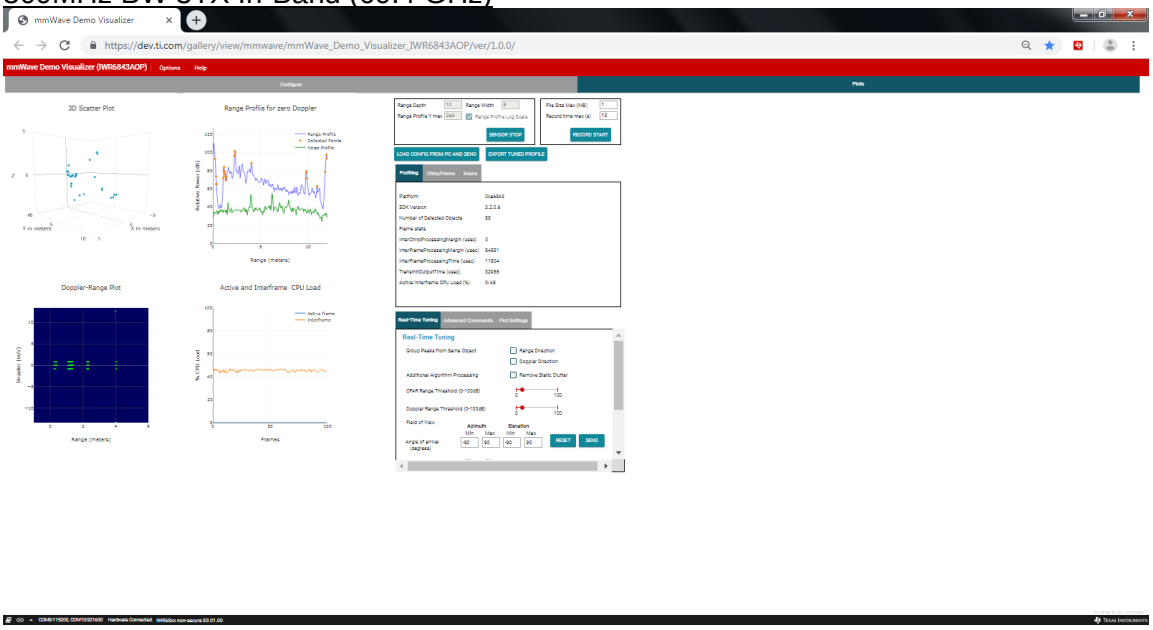
300MHz BW 2TX Remote - (57.60 GHz)



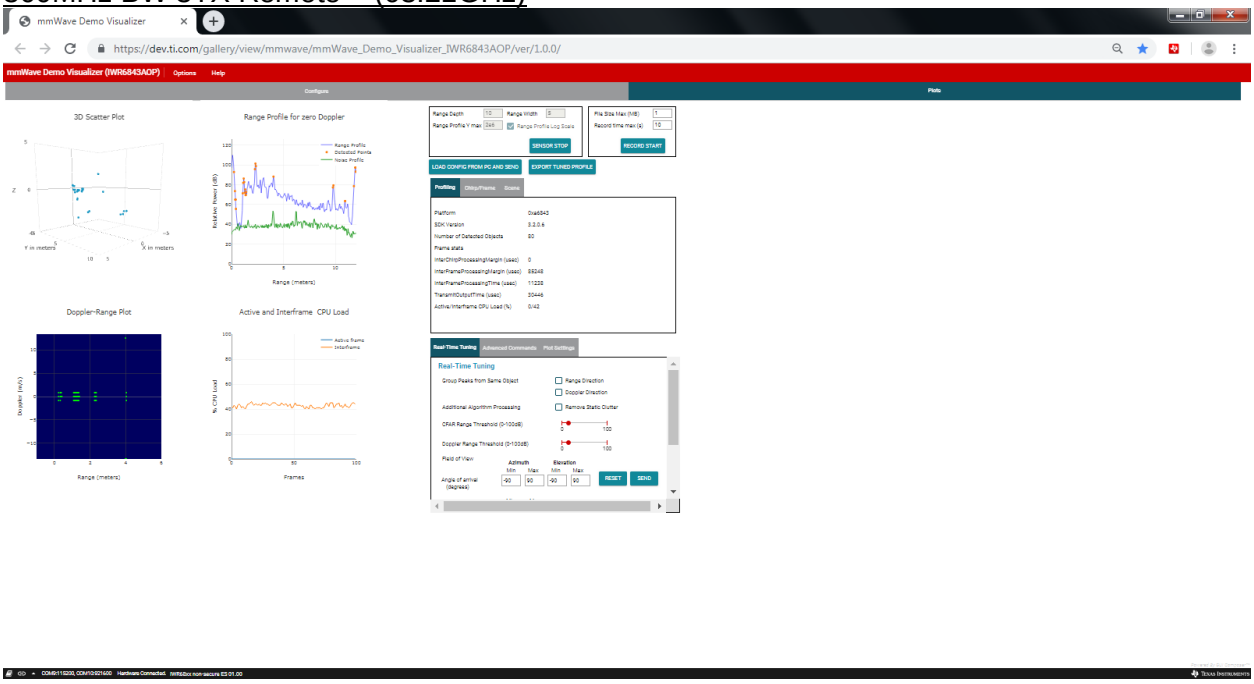
300MHz BW 3TX No Interference



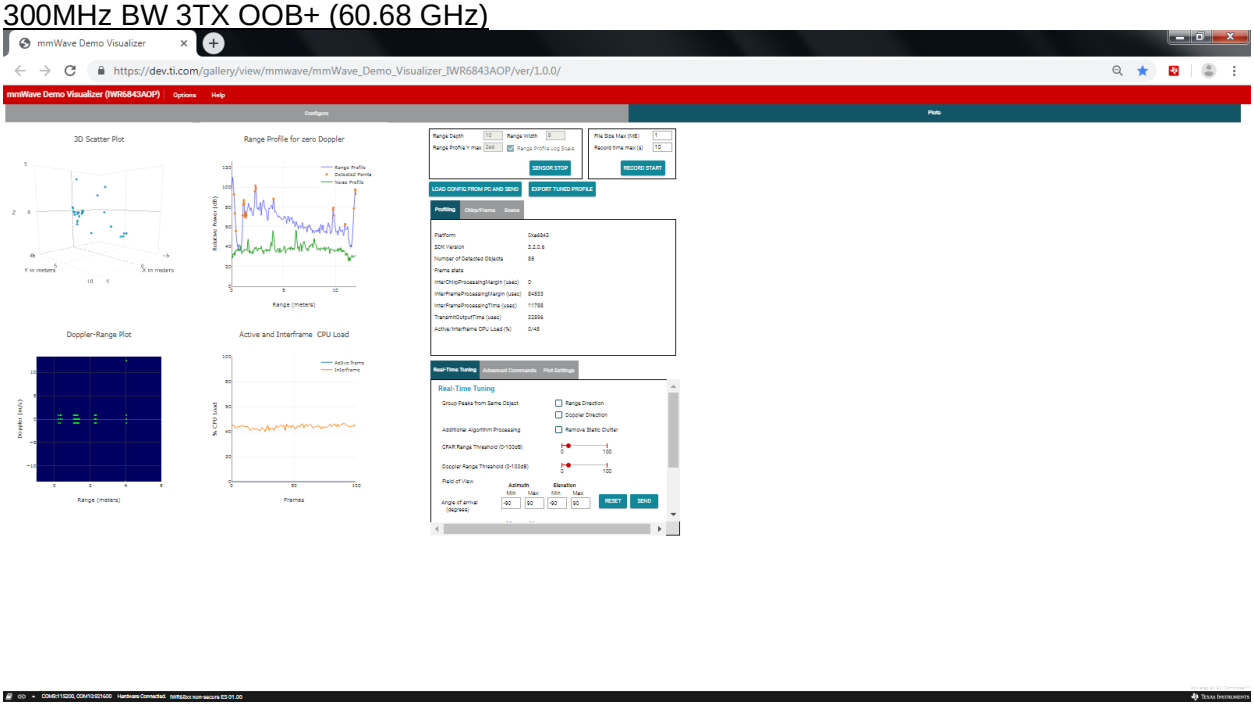
300MHz BW 3TX In-Band (60.4 GHz)



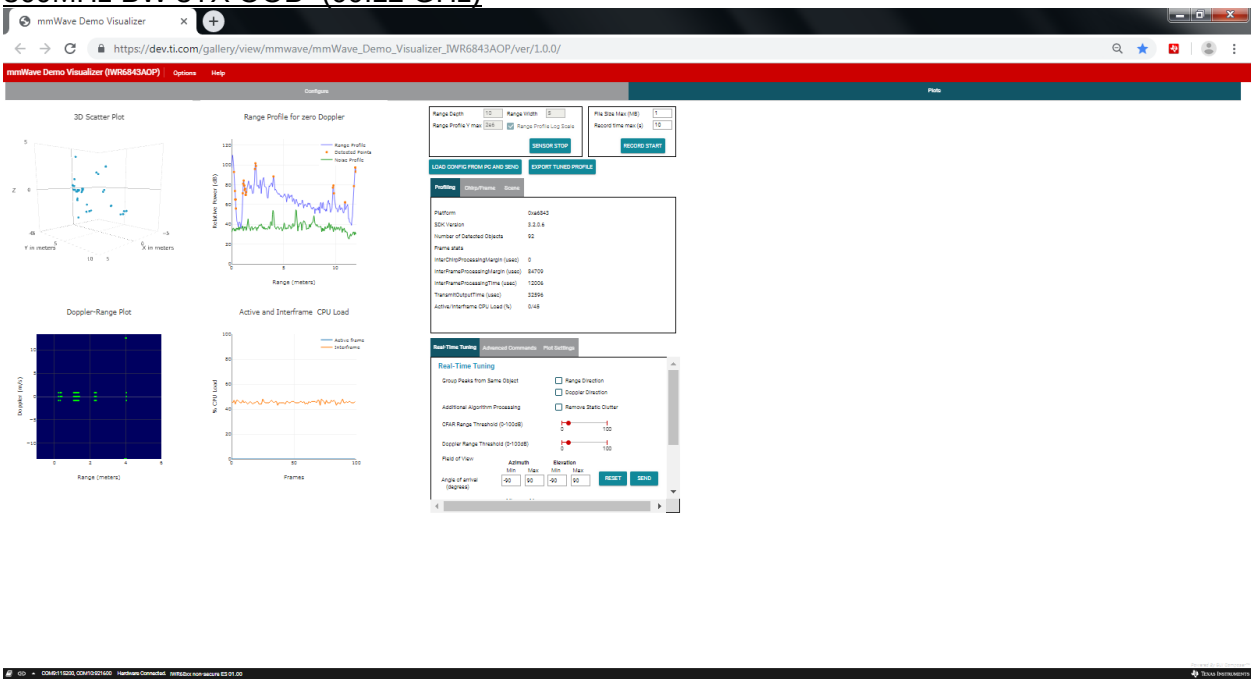
300MHz BW 3TX Remote + (63.21GHz)



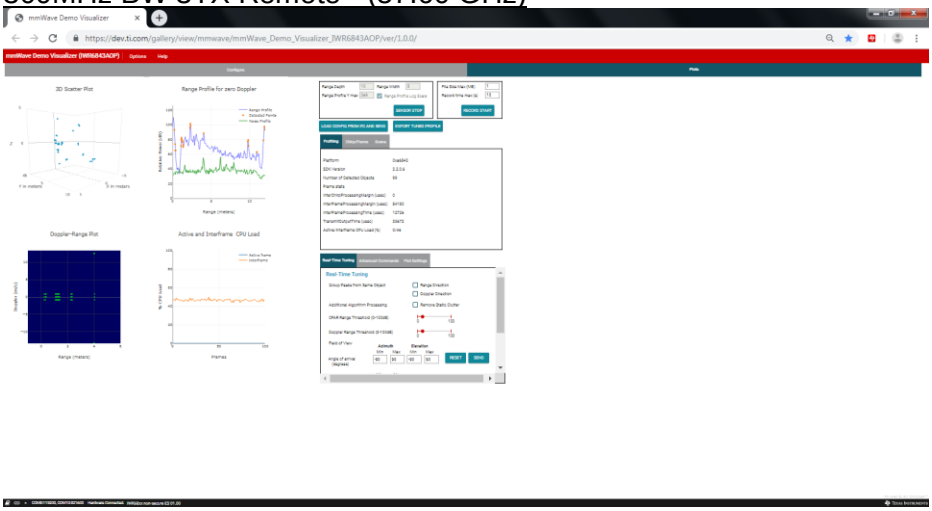
300MHz BW 3TX OOB+ (60.68 GHz)



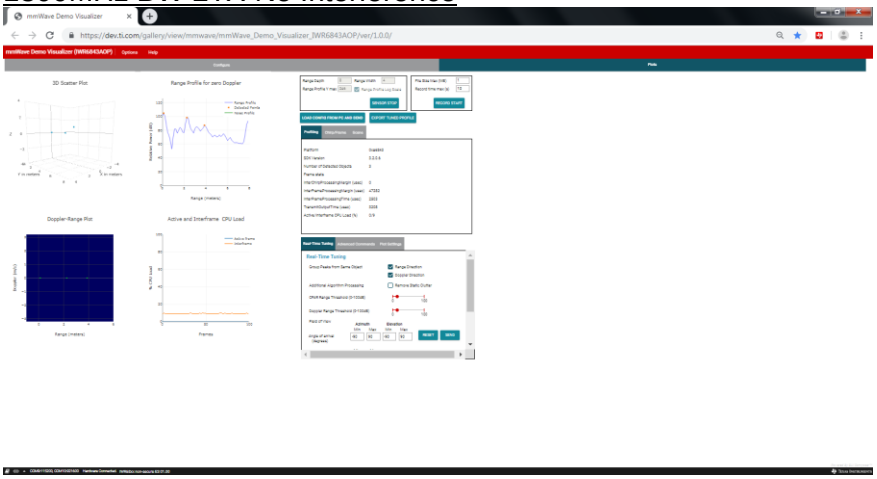
300MHz BW 3TX OOB- (60.12 GHz)



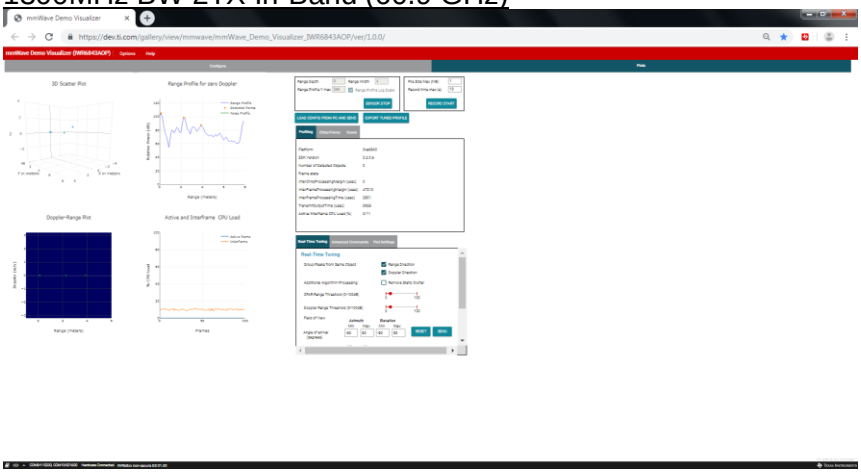
300MHz BW 3TX Remote - (57.60 GHz)



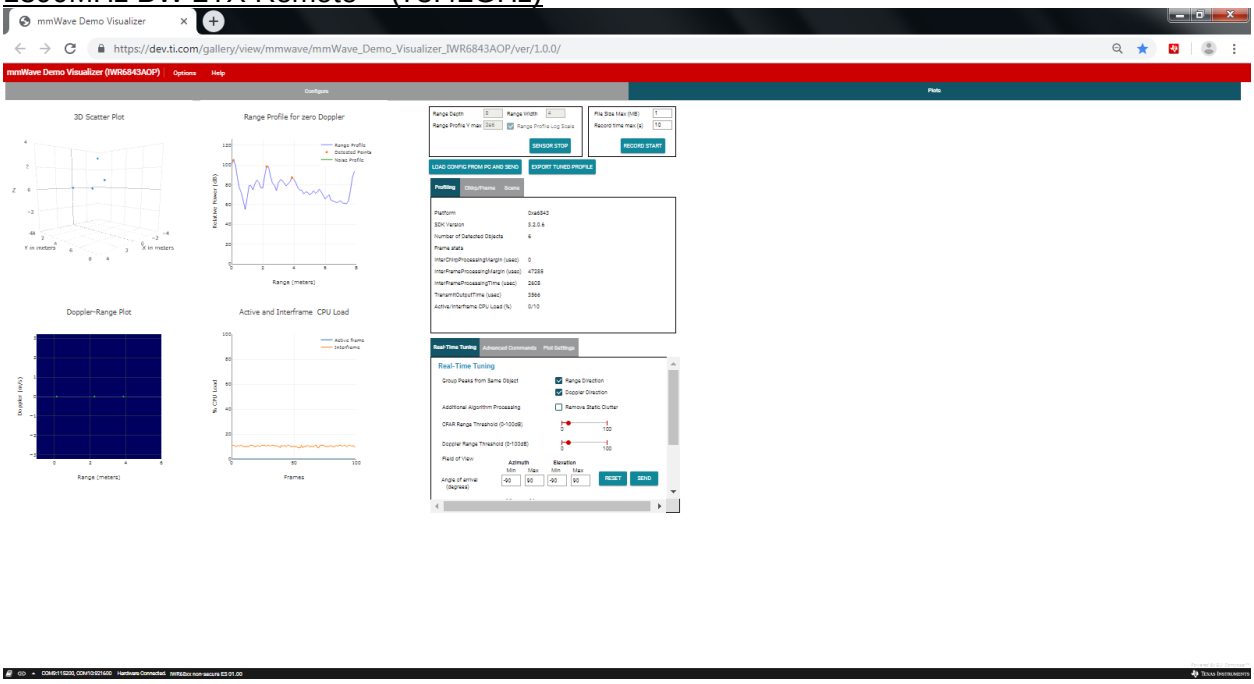
1300MHz BW 2TX No Interference



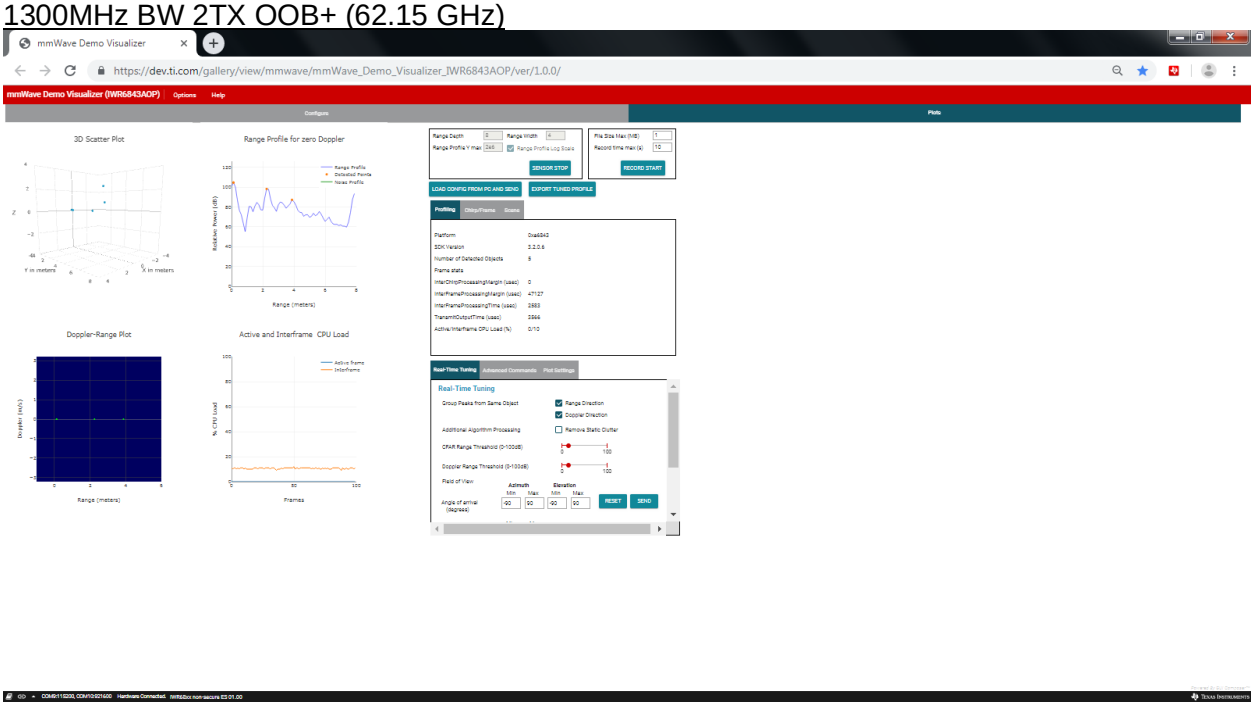
1300MHz BW 2TX In-Band (60.9 GHz)



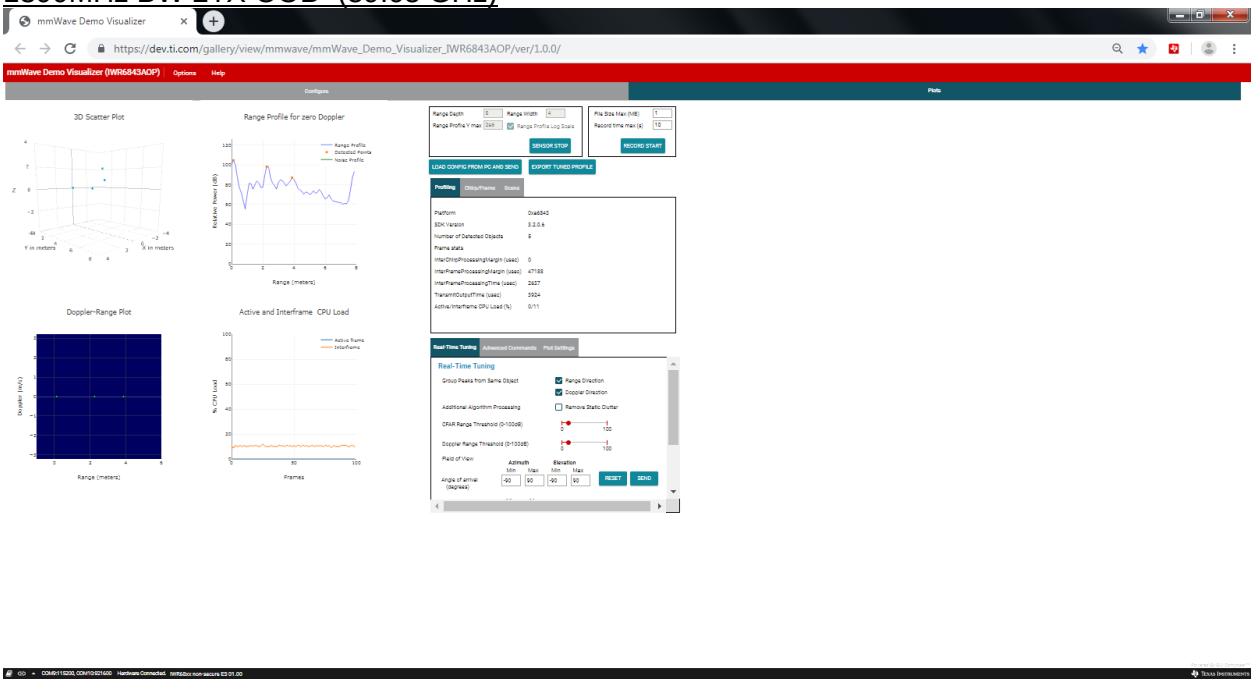
1300MHz BW 2TX Remote + (73.42GHz)



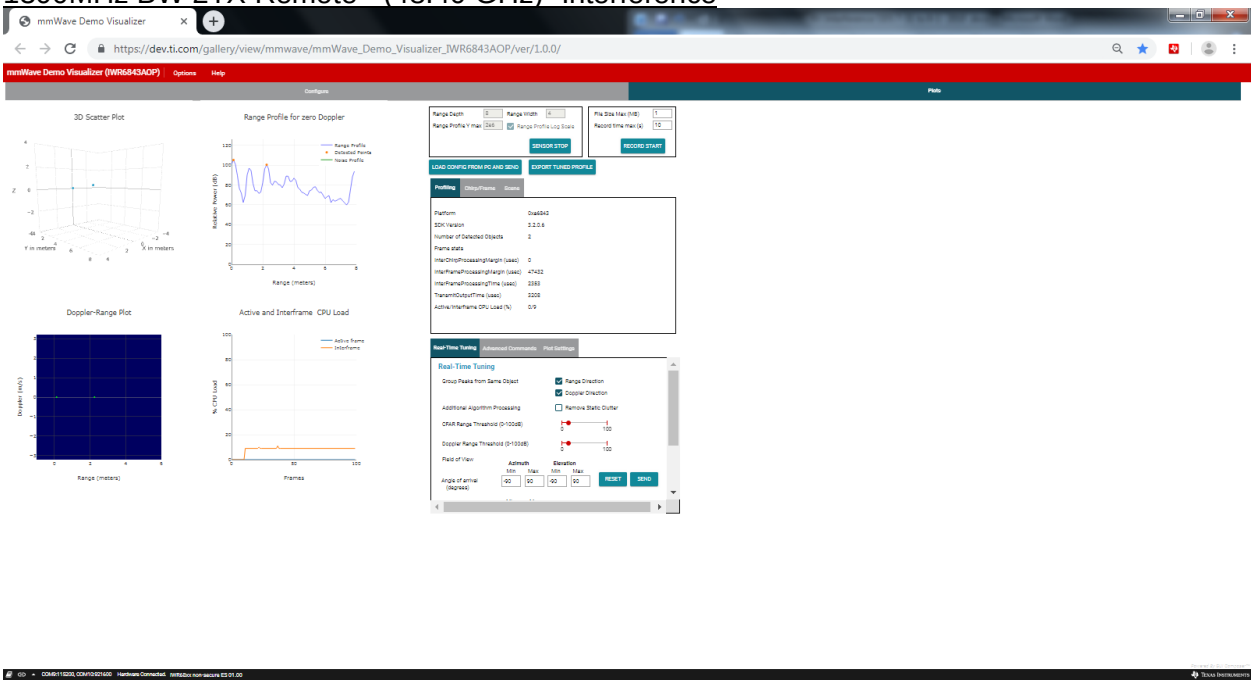
1300MHz BW 2TX OOB+ (62.15 GHz)



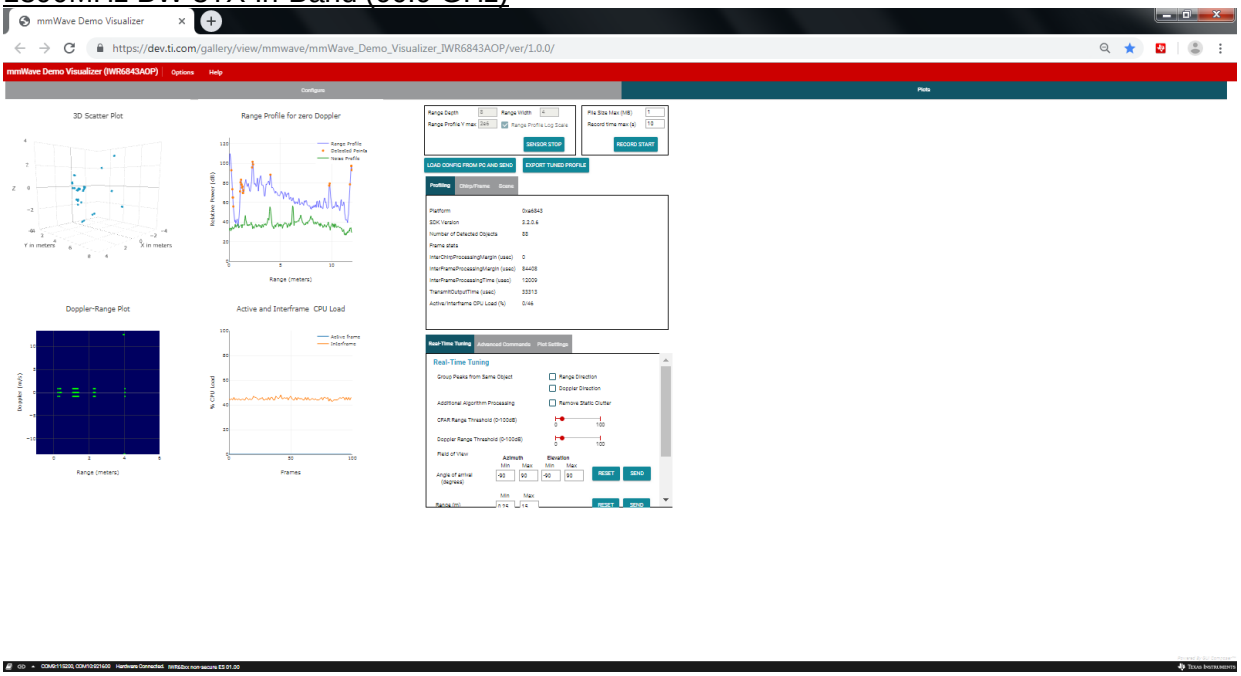
1300MHz BW 2TX OOB- (59.65 GHz)



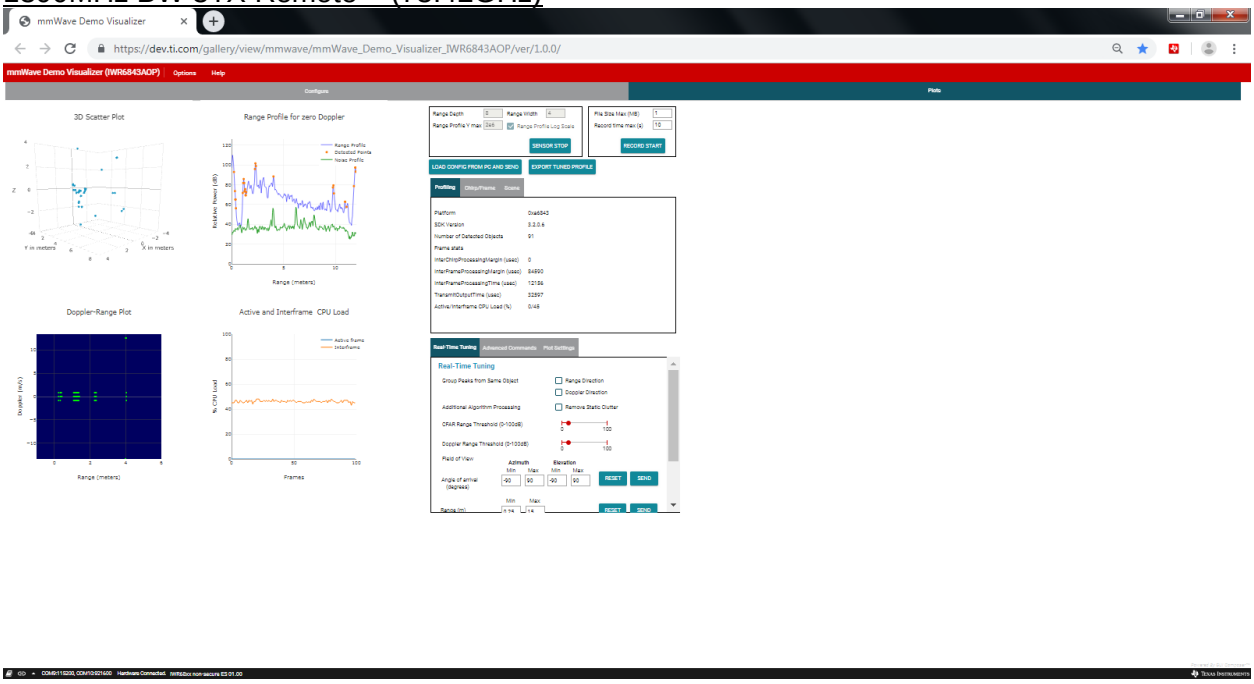
1300MHz BW 2TX Remote - (48.40 GHz)- Interference



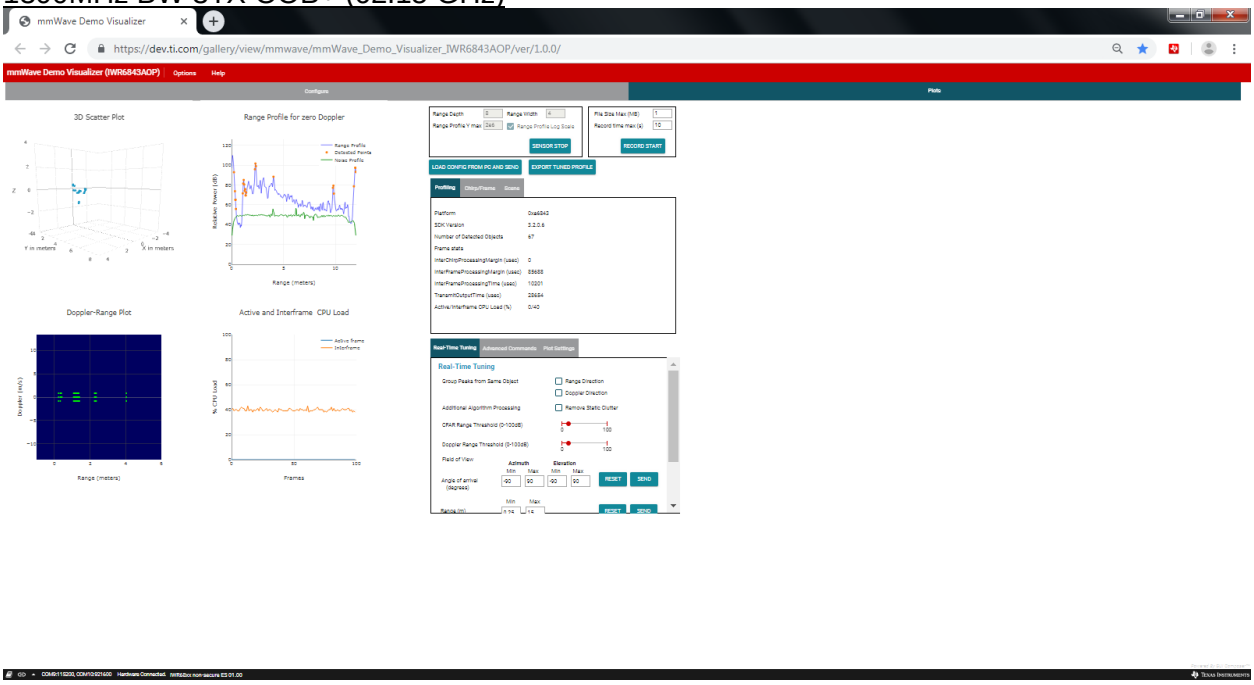
1300MHz BW 3TX In-Band (60.9 GHz)



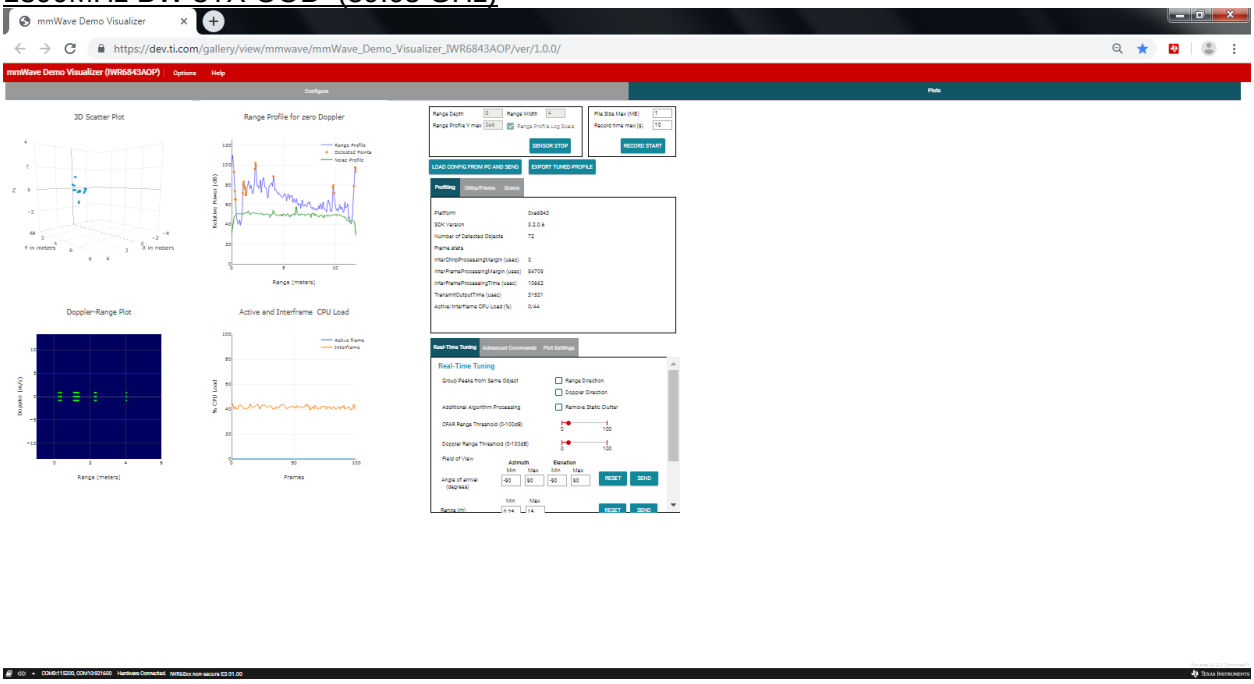
1300MHz BW 3TX Remote + (73.42GHz)



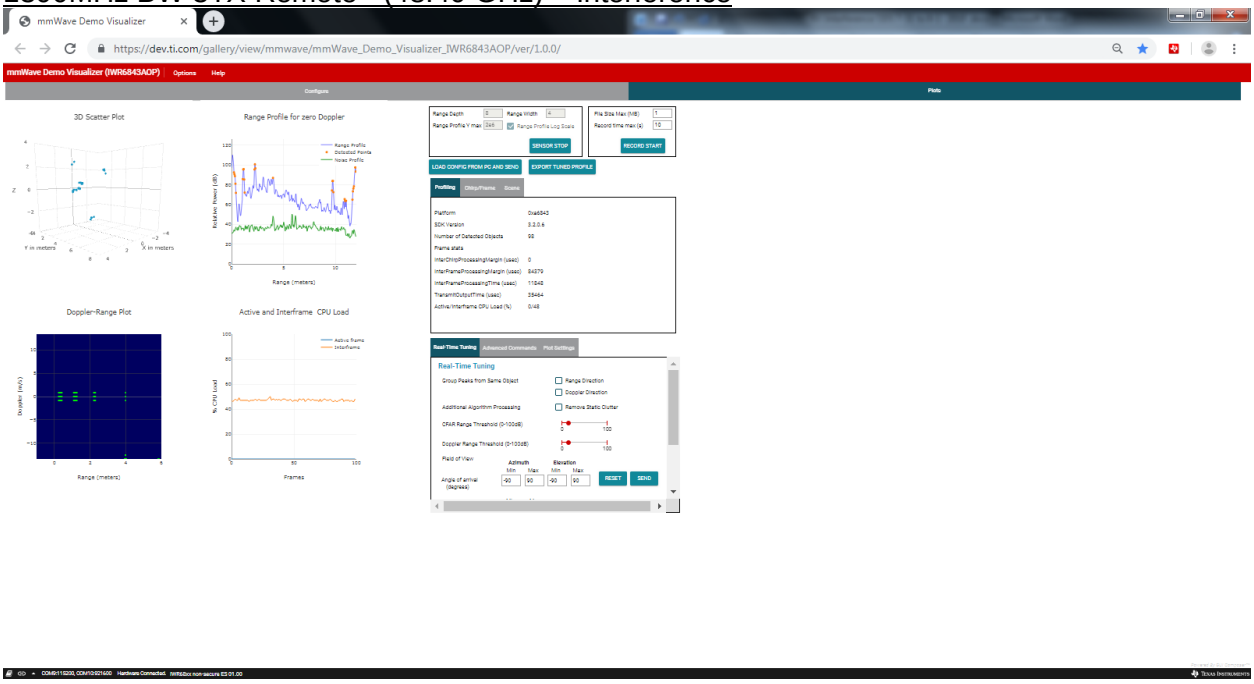
1300MHz BW 3TX OOB+ (62.15 GHz)



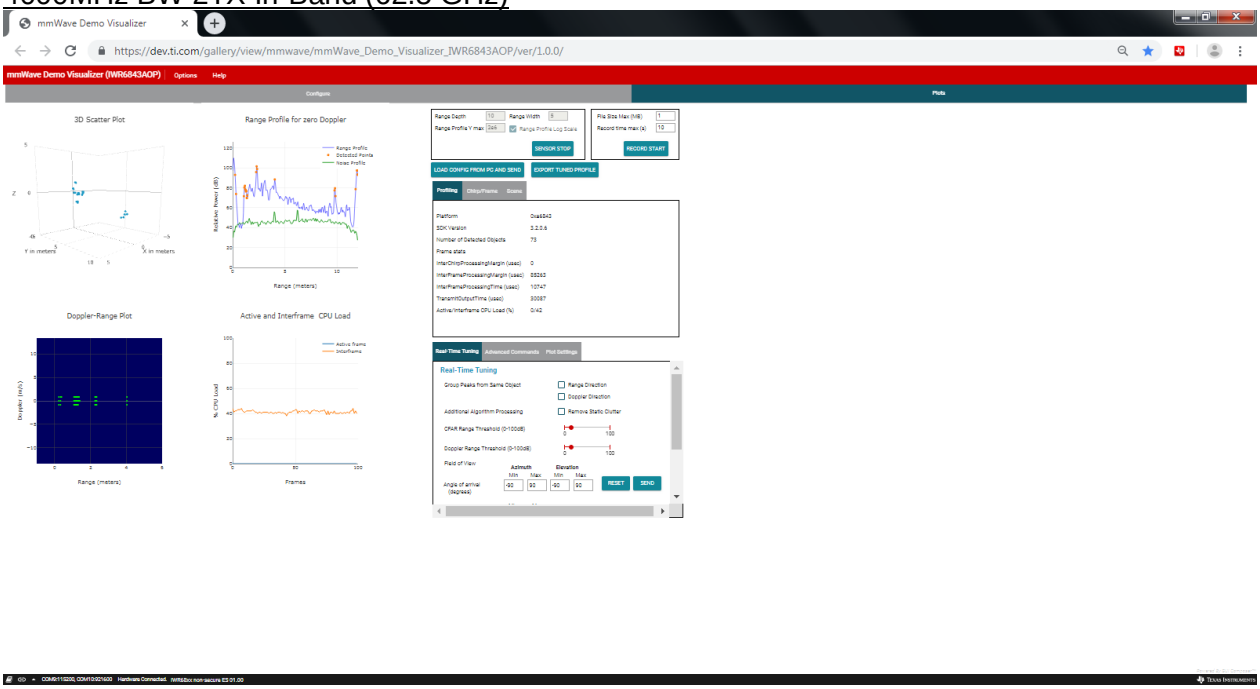
1300MHz BW 3TX OOB- (59.65 GHz)



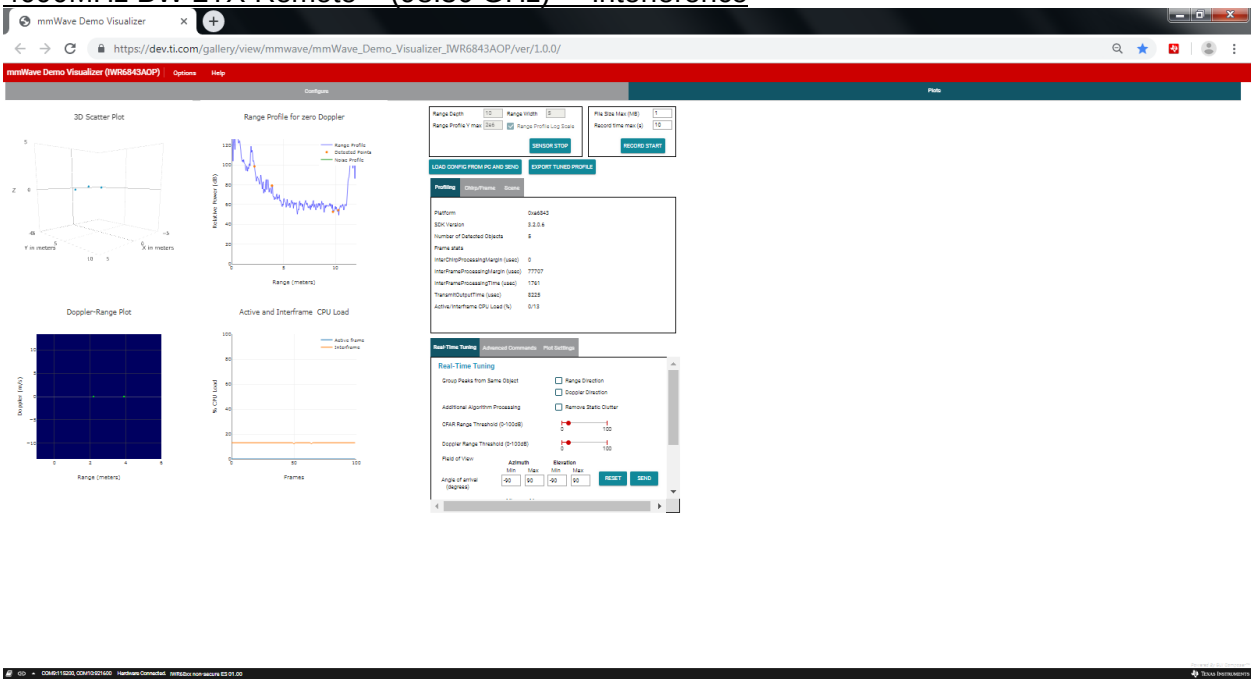
1300MHz BW 3TX Remote - (48.40 GHz) – Interference



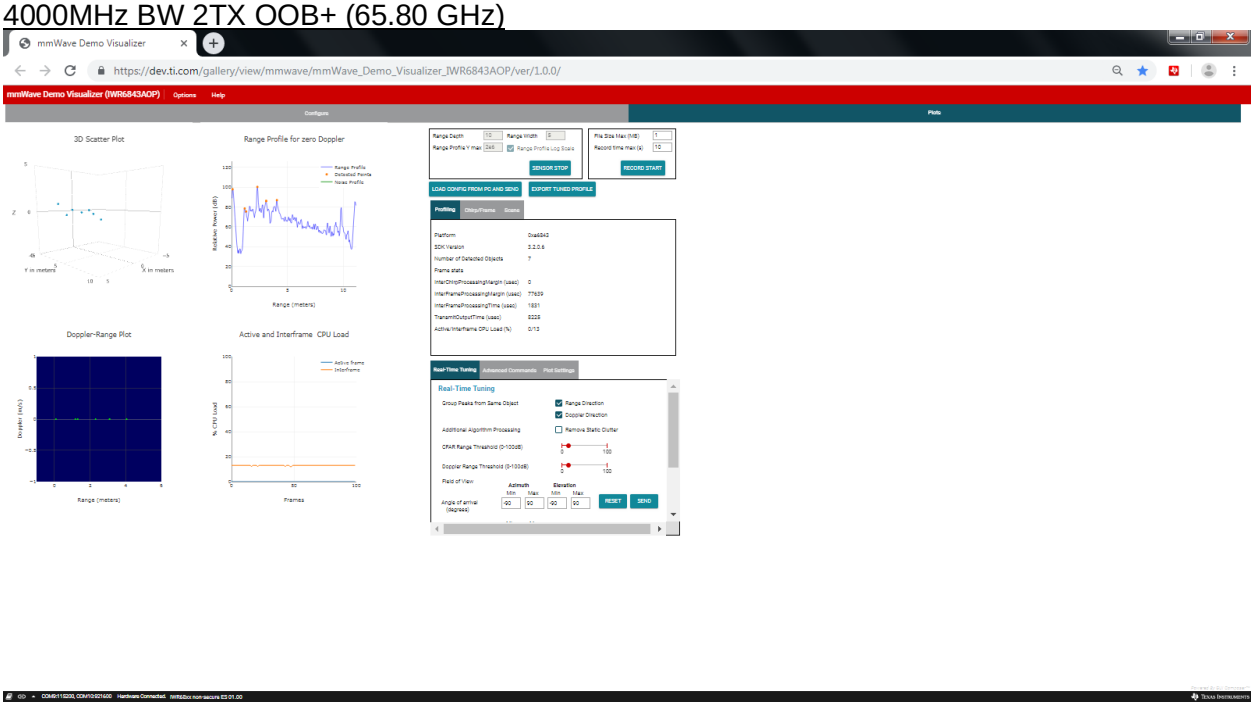
4000MHz BW 2TX In-Band (62.5 GHz)



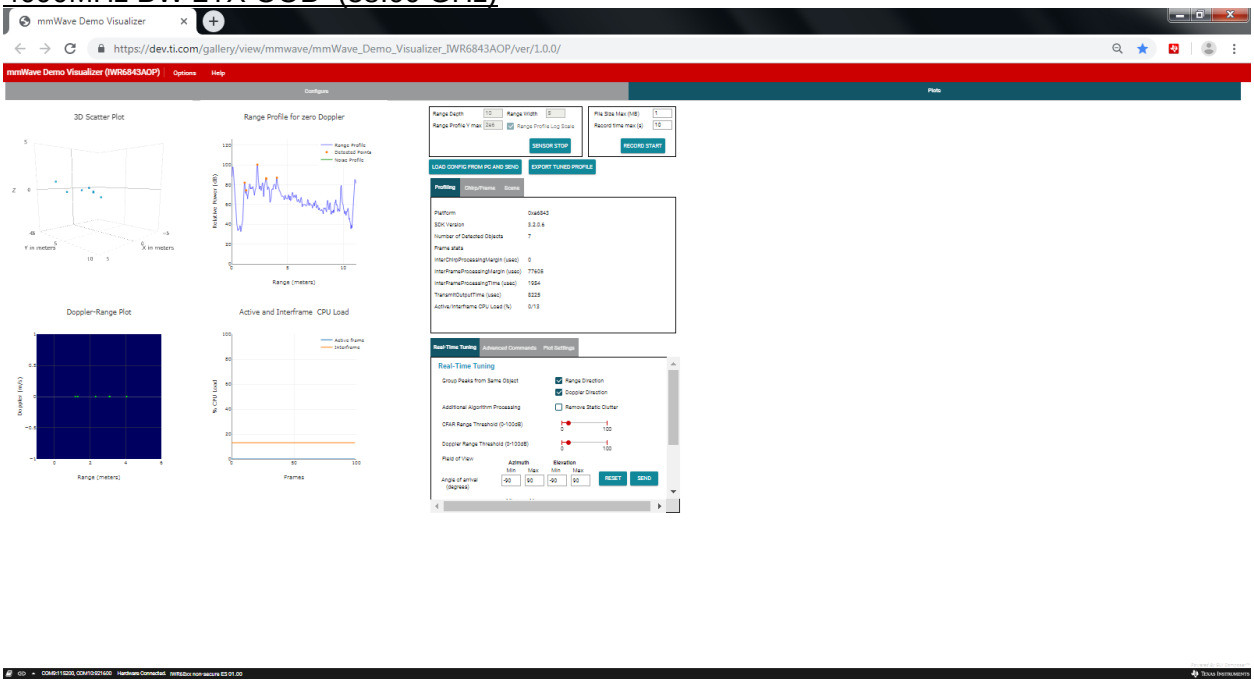
4000MHz BW 2TX Remote + (98.30 GHz) – Interference



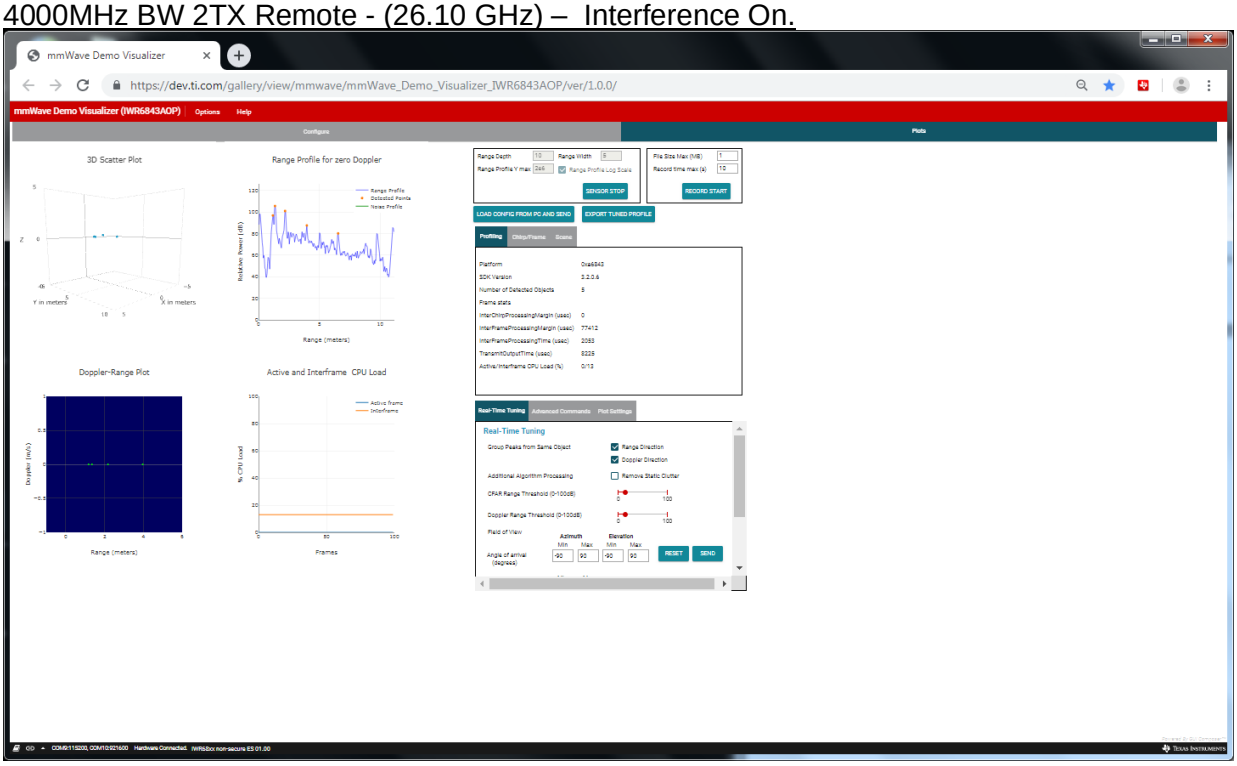
4000MHz BW 2TX OOB+ (65.80 GHz)



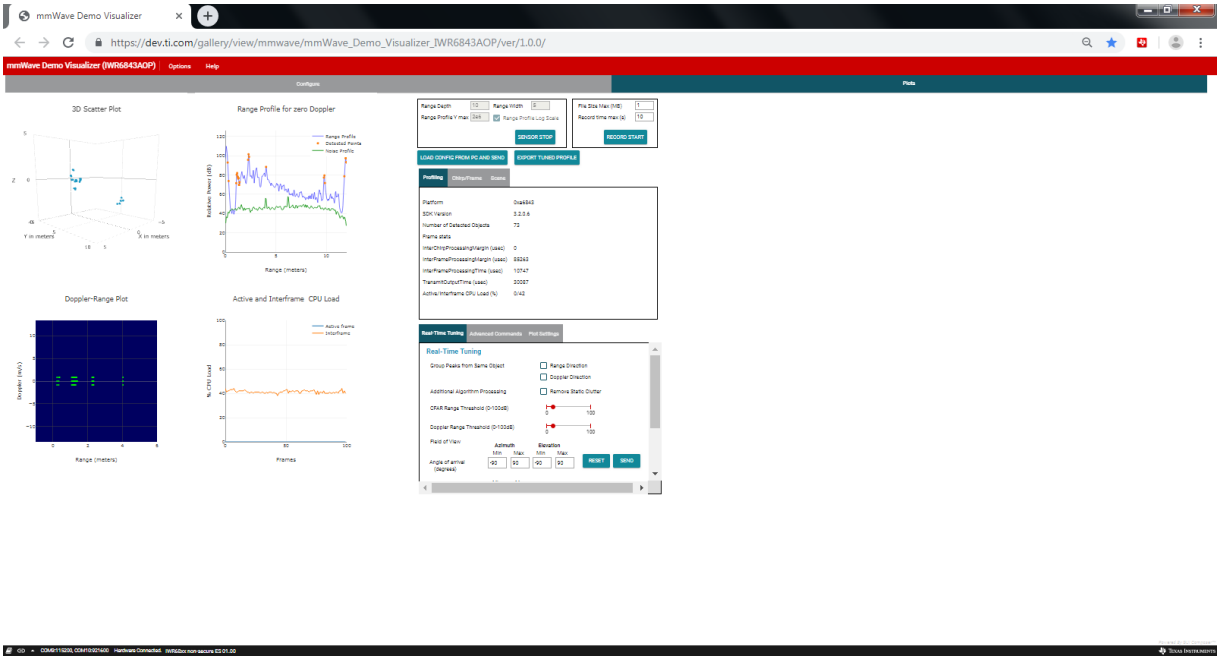
4000MHz BW 2TX OOB- (58.60 GHz)



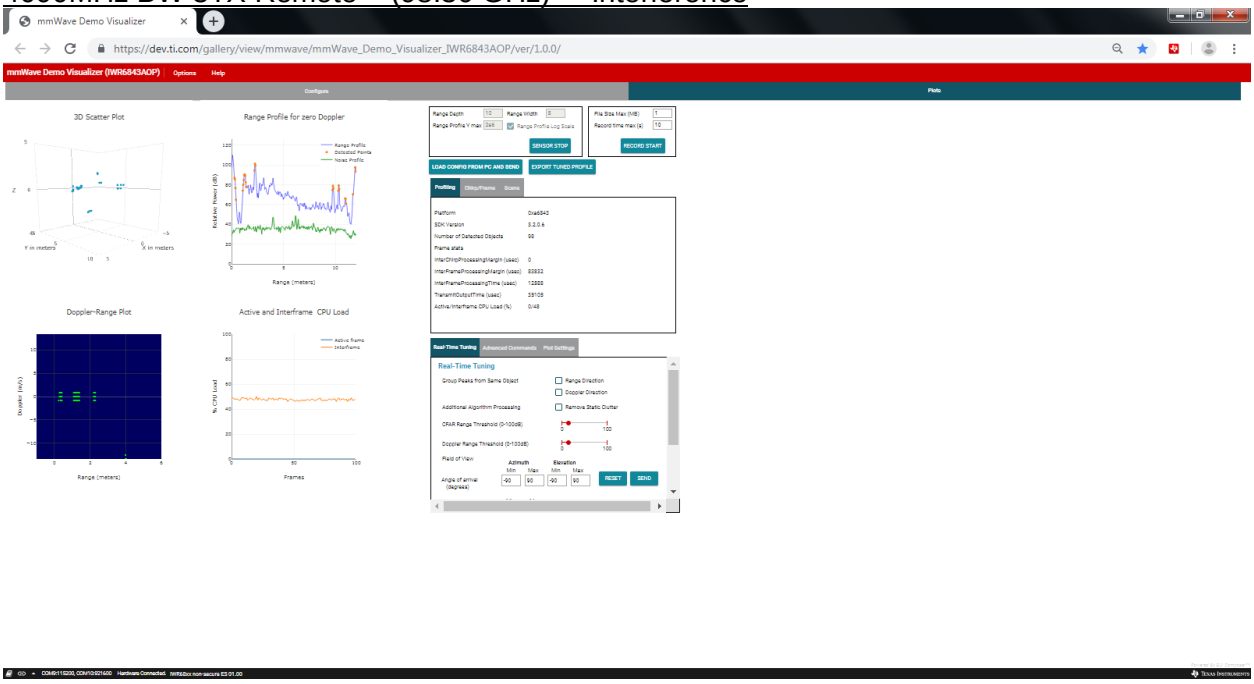
4000MHz BW 2TX Remote - (26.10 GHz) – Interference On.



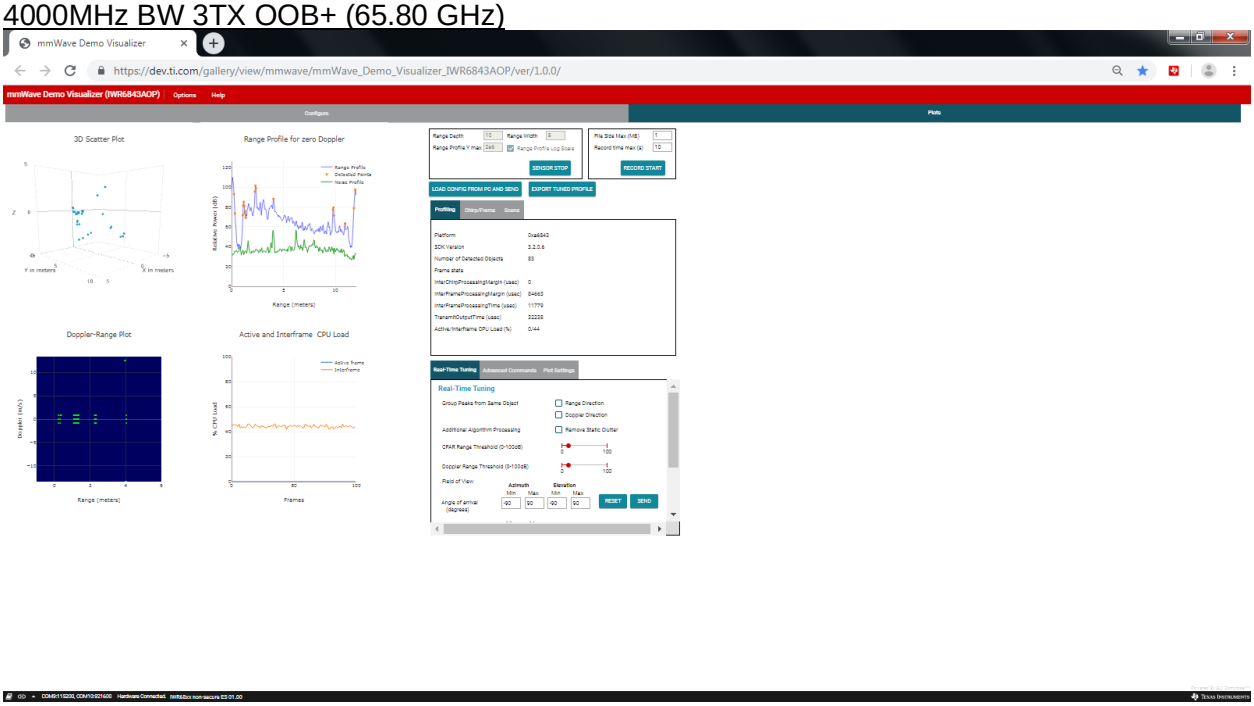
4000MHz BW 3TX In-Band (62.5 GHz)



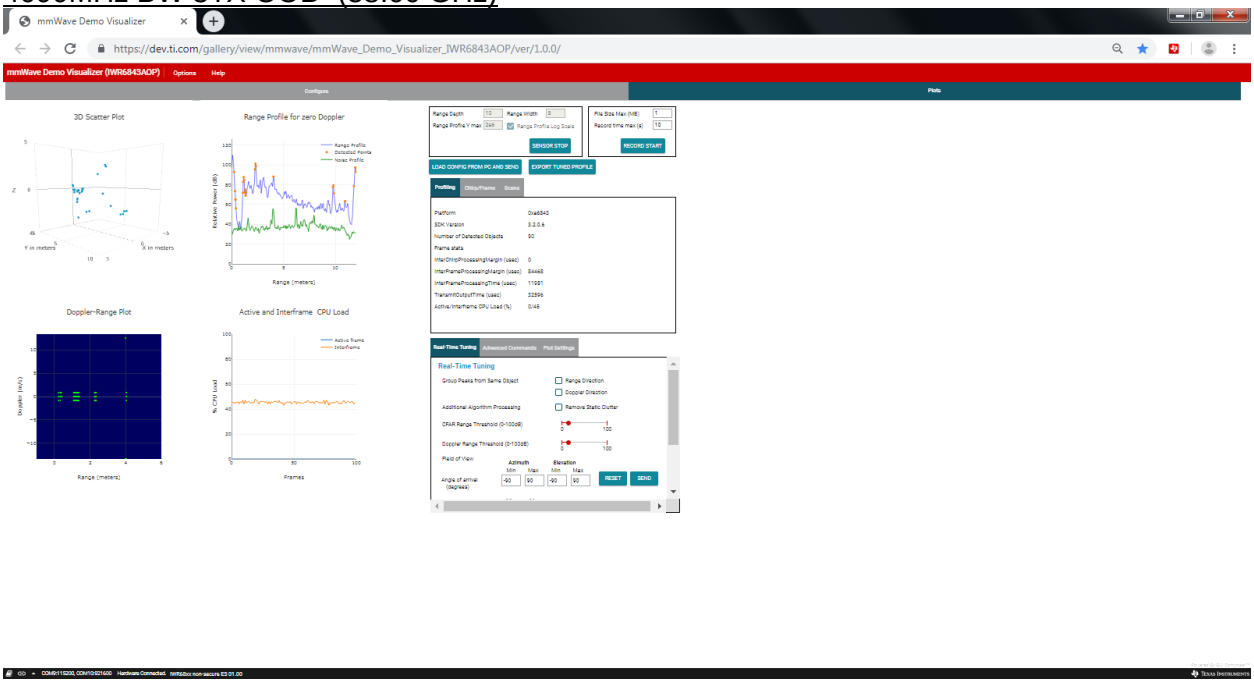
4000MHz BW 3TX Remote + (98.30 GHz) – Interference



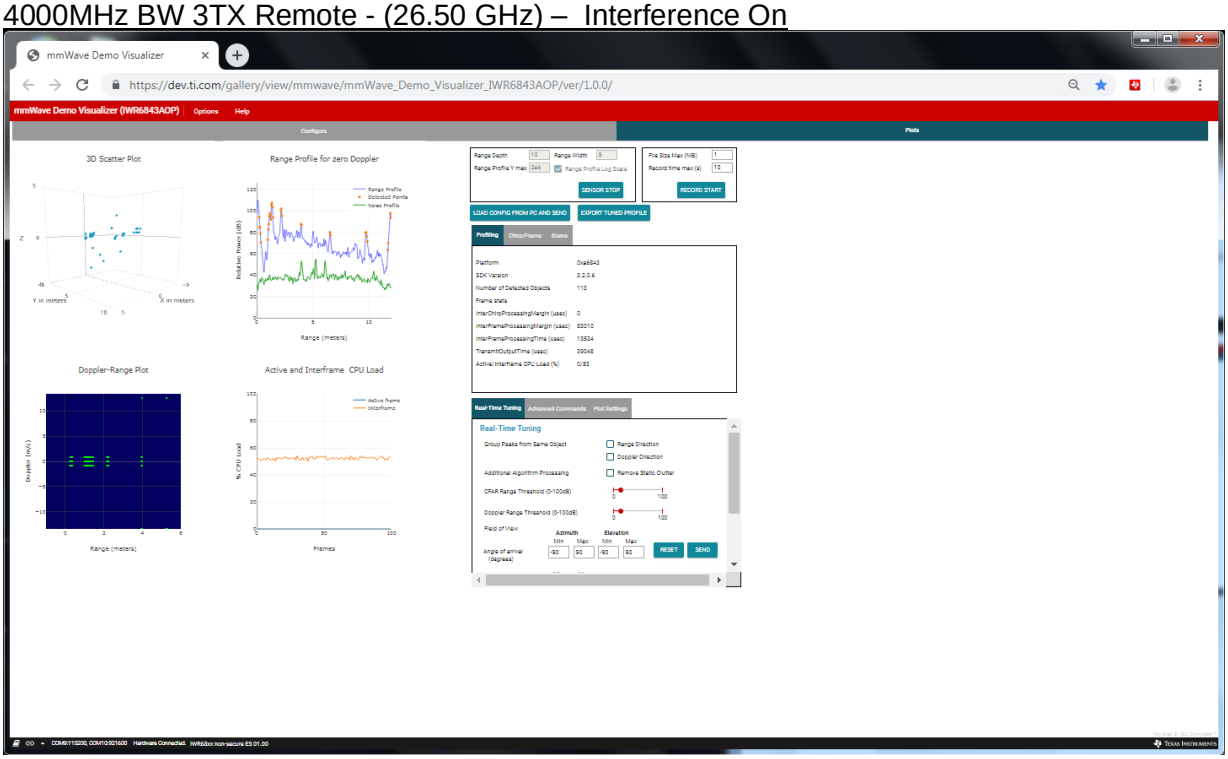
4000MHz BW 3TX OOB+ (65.80 GHz)



4000MHz BW 3TX OOB- (58.60 GHz)



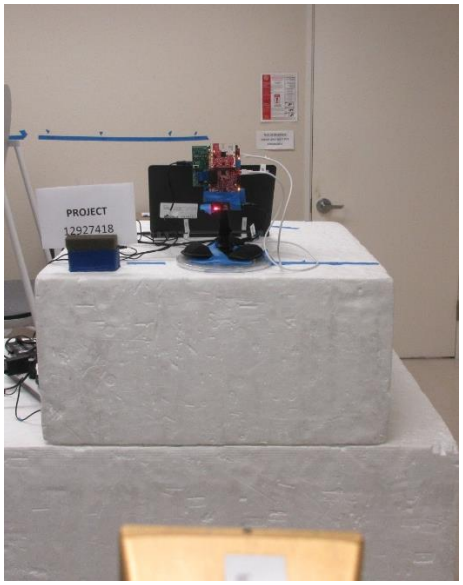
4000MHz BW 3TX Remote - (26.50 GHz) – Interference On



7. SETUP PHOTOS

RADIATED RF MEASUREMENT SETUP

FRONT PHOTO

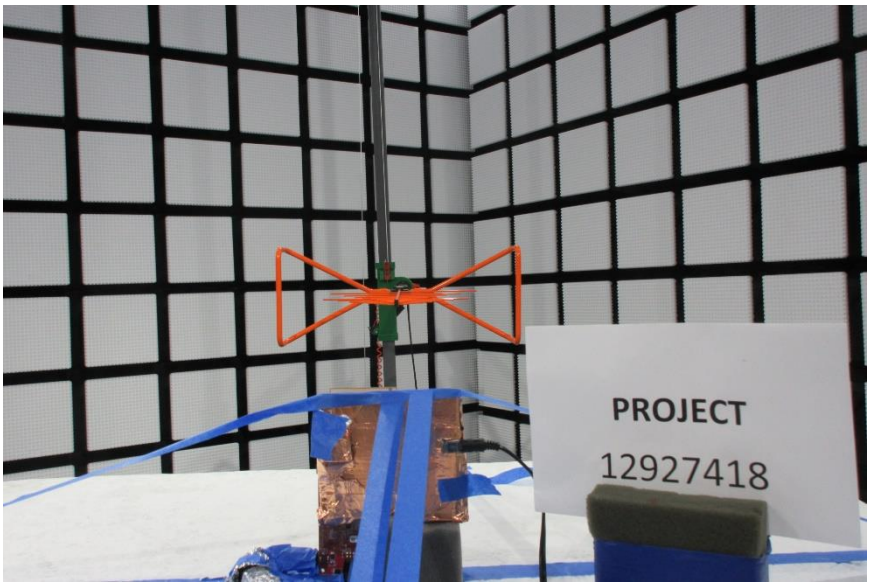


BACK PHOTO

RADIATED RF MEASUREMENT SETUP (Below 1GHz)

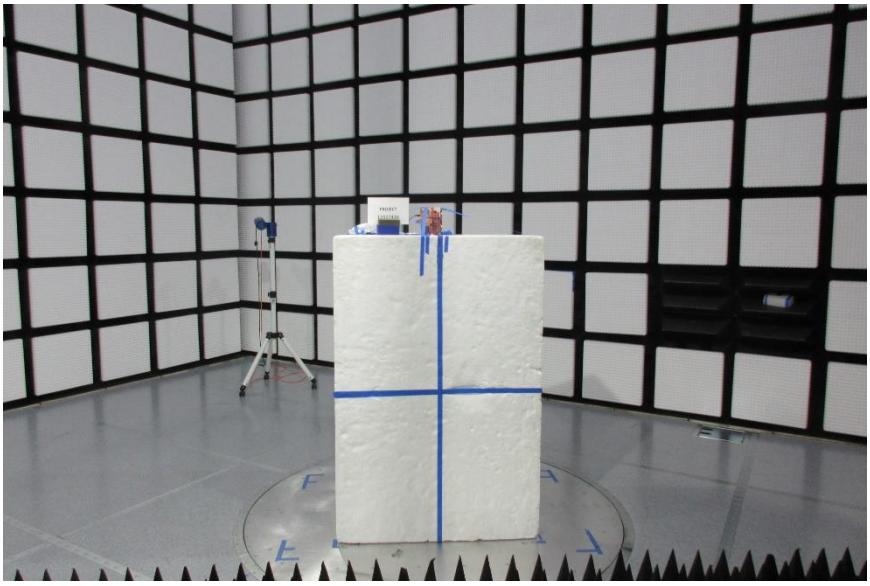
FRONT PHOTO

BACK PHOTO

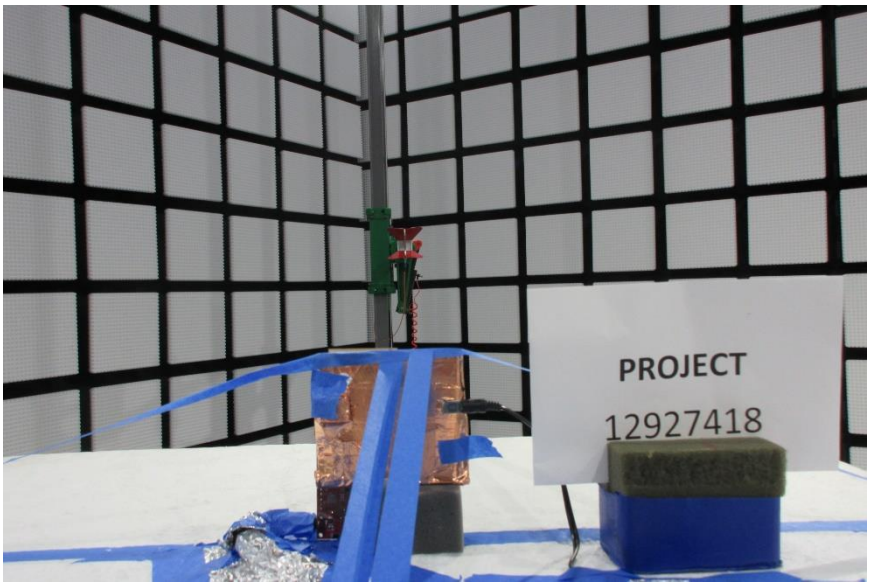


RADIATED RF MEASUREMENT SETUP (1-40 GHz)

FRONT PHOTO



BACK PHOTO



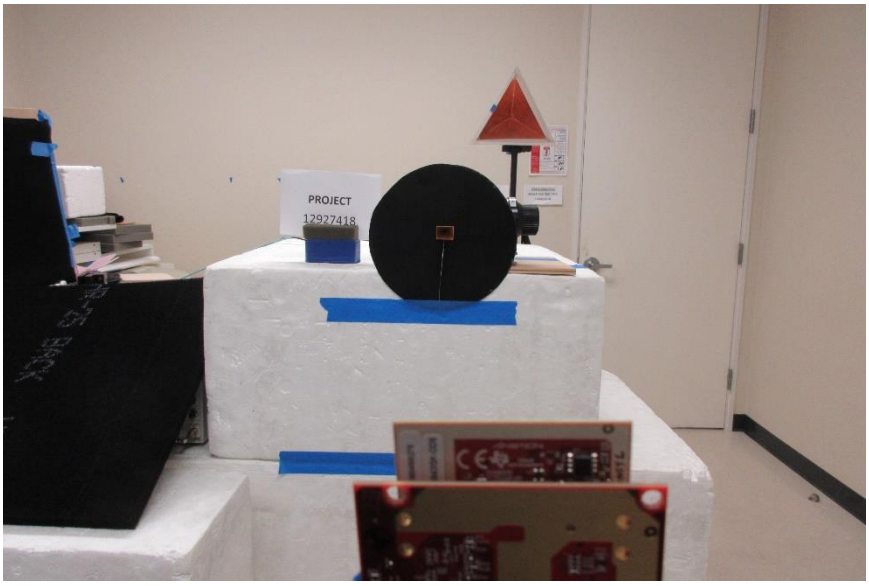
RADIATED RF MEASUREMENT SETUP >40 GHz

FRONT PHOTO

BACK PHOTO

RECEIVER INTERFERENCE HANDLING

FRONT PHOTO



BACK PHOTO

END OF REPORT