

# FCC Certification Test Report For the REUTECH MSR ESPRIT

# FCC ID: YSD-5840-HG-2000

WLL JOB# 15807-01 Rev 2 December 17, 2018

Prepared for:

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# Abstract

This report has been prepared on behalf of Reutech to support the attached Application for Equipment Authorization. The test report and application are submitted for a Licensed Transmitter under Part 90 of the FCC Rules and Regulations (08/2015). This Certification Test Report documents the test configuration and test results for a Reutech MSR Esprit.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Testing Certificate AT-1448 as an independent FCC test laboratory.

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by the ANSI-ASQ National Accreditation Board/ANAB. Refer to certificate and scope of accreditation AT-1448.

The Testing completed by Washington Laboratories LTD. for the Reutech MSR Esprit complies with the limits for a Licensed Transmitter device under FCC Part 90.

Revision History	Reason	Date
Rev 0	Initial Release	December 17, 2018
Rev 1	Modifications from ACB	January 28, 2019
Rev 2	Modifications from ACB	February 15, 2019

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#### **1.1** Compliance Statement

The Reutech MSR Esprit complies with the limits for a Licensed Transmitter device under FCC Part 90 (08/2015).

#### 1.2 Test Scope

Tests for radiated and conducted (at antenna terminal) emissions were performed. All measurements were performed in accordance with ANSI C63.4, ANSI/TIA/EIA-603D & ANSI C63.26. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

#### **1.3** Contract Information

Customer:	Reutech 35 Electron Avenue Stellenbosch, Capetown, 7600 South Africa
Purchase Order Number:	Deposit Terms
Quotation Number:	70367B
<b>1.4 Test Dates</b> Testing was performed on the following date(s):	11/09/2018-11/13/2018
1.5 Test and Support Personnel	
Washington Laboratories, LTD	John P. Repella
Customer Representative	Leon Nel

#### 1.6 Abbreviations

Α	Ampere
ac	alternating current
AM	Amplitude Modulation
Amps	Amperes
b/s	bits per second
BW	BandWidth
CE	Conducted Emission
cm	centimeter
CW	Continuous Wave
dB	deciBel
dc	direct current
EMI	Electromagnetic Interference
EUT	Equipment Under Test
FM	Frequency Modulation
G	<b>g</b> iga - prefix for 10 <sup>9</sup> multiplier
Hz	Hertz
IF	Intermediate Frequency
k	kilo - prefix for 10 <sup>3</sup> multiplier
LISN	Line Impedance Stabilization Network
Μ	Mega - prefix for $10^6$ multiplier
m	meter
μ	<b>m</b> icro - prefix for 10 <sup>-6</sup> multiplier
NB	Narrowband
QP	Quasi-Peak
RE	Radiated Emissions
RF	Radio Frequency
rms	root-mean-square
SN	Serial Number
S/A	Spectrum Analyzer
V	Volt

# 2 Equipment Under Test

#### 2.1 EUT Identification & Description

The EUT (Radio Frequency Unit - RFU) is the radar unit of the MSR ESPRIT system that performs slope stability monitoring in open pit mines. It does so by generating and transmitting a frequency modulated continuous wave (FMCW) waveform over a bandwidth of 308MHz in the band 9.5 to 9.975GHz through numerous low gain, wide beam patch antennas to cover the entire field of view. The transmit beam is steered electronically by applying phase modulation to the various patch antenna elements. The reflection from the rockface is received by the receiver where it is down converted, filtered, digitized and processed before it goes to the system data processor (external to the RFU)

**2D operation:** In this mode either the 1x2 Horizontally Polarized array left and right or 1x2 Vertically Polarized array left and right are utilized to illuminate the mine slope. The reflections from the mine slope are received via the same receive antenna patch arrays and are processed utilizing the same processing chain hardware for all modes.

**3D operation:** In this mode the 20x2 Horizontally Polarized array left and right are utilized to illuminate the mine slope. Test mode operation: In this mode the test antenna dipole is used to emit a signal that is utilized to test the receive antenna arrays.

ITEM	DESCRIPTION
Manufacturer:	Reutech
FCC ID:	YSD-5840-HG-2000
Model:	MSR Esprit
FCC Rule Parts:	§90.103
Frequency Range:	9.5 to 9.975GHz (operationally 9.567 to 9.875GHz is utilized)
Maximum Output Power:	2.77 W (34.43 dBm) (EIRP in 3D mode)
Modulation:	Frequency Modulated Continuous Wave (FMCW)
Necessary Bandwidth:	308 MHz
Keying:	None
Type of Information:	Data
Number of Channels:	Swept
Power Output Level	Nominal (17dBm)
Antenna Connector	SMA
Antenna Type	MIMO Patch radiators configured in arrays fed separately by microstrip transmission line feed networks. The OEM for the patch antenna arrays is RRS. Each patch element has a theoretical gain of 7.4 dBi
Frequency Tolerance:	±100ppm
Emission Type(s):	F0N
Emissions Designator:	308MF0N
Power Source & Voltage:	24VDC

#### **Table 1: Device Summary**

#### 2.2 Test Configuration

The EUT is mounted on a stand and is powered from an external DC power supply. Communication with the EUT is achieved via an ethernet connection between the laptop hosting the Message Manager application and the EUT. See Figure 1.

Each array transmits in sequence, i.e., not simultaneously.



Figure 1: Test Configuration

Under normal operation, the EUT sweeps a CW signal from 9.5GHz to 9.975GHz. Figures 14 & 15 show plots of the normal operational output of the EUT.

#### 2.3 Testing Algorithm

The MSR Esprit was operated by selecting the operating mode, individual CW frequency or Sweep mode, utilizing the test software provided.

Conducted measurements were taken by connecting the Spectrum Analyzer or power meter to TRX TX ports as shown in Figure 2 with the remaining ports terminated.

The Message Manager was used to set up Primary TX mode and measure the output power at the particular port. An offset was used to compensate for attenuator and cable losses and the power level was recorded. The measurement was conducted at TX frequencies of 9.5GHz, 9.75GHz and 9.975GHz in the Primary 2D mode at TRX TX ports J5 and J6 and. In the Primary 3D mode at TRX TX ports J3 and J4.

Note: Ports 1, 2, 5 and 6 are equivalent in configuration and therefore only ports 5 and 6 were tested for this group.



Figure 2: TRX Ports

#### 2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Testing Certificate AT-1448 as an independent FCC test laboratory.

#### 2.5 Measurements

#### 2.5.1 References

ANSI C63.2 "Specifications for Electromagnetic Noise and Field Strength Instrumentation"

ANSI C63.4 "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"

Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603C)

ANSI C63.26:2015 "American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services"

#### 2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 (R2002) with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

#### **Equation 1: Standard Uncertainty**

$$u_{c} = \pm \sqrt{\frac{a^{2}}{diy^{2}} + \frac{b^{2}}{diy^{2}} + \frac{c^{2}}{diy^{2}} + \dots}$$

Where  $u_c$  = standard uncertainty

Div<sub>a</sub>, <sub>b</sub>, <sub>c</sub>

a, b, c,.. = individual uncertainty elements

= the individual uncertainty element divisor based on the probability distribution

Divisor = 1.732 for rectangular distribution

Divisor = 2 for normal distribution

Divisor = 1.414 for trapezoid distribution

# Equation 2: Expanded Uncertainty I I = k I I

	$C R U_{\ell}$
Where U	= expanded uncertainty
k	= coverage factor
	$k \le 2$ for 95% coverage (ANSI/NCSL Z540-2 Annex G)
uc	= standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is <u>not</u> used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 2 below.

#### Table 2: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty	
Radiated Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	±4.55 dB	

Parameter	Uncertainty	Actual (+/-)
Radio Frequency	±1 x 10 <sup>-7</sup>	±8.64E-08 parts
RF Power conducted (up to 160 W)	±0.75 dB	±0.3dB
Conducted RF Power variations	±0.75 dB	±0.3dB

# 3 Test Equipment

Table 3 shows a list of the test equipment used for measurements along with the calibration information.

Test Name:	Various	Test Date:	
Asset #	Manufacturer/Model	Description	Cal. Due
528	AGILENT/PSA E4446A	SPECTRUM ANALYZER 3Hz-44GHz	12/19/2018
823	AGILENT/EXA 9010A	SPECTRUM ANALYZER 10Hz- 26.5GHz	04/21/2019
425	ARA/DRG-118/A	ANTENNA 1-18GHz	01/03/2020
644	SUNOL SCIENCES/JB1	BICONALOG ANTENNA 26MHz- 1GHz	01/16/2020
559	HP/8447D	PRE-AMPLIFIER 100kHz-1GHz	02/12/2019
522	HP /8449B	PRE-AMPLIFIER 1-26.5GHz	02/12/2019
U90108-2	Oleson Microwave Labs/M19HW	U Band Harmonic Mixer	08/16/2019
E90108-1	Oleson Microwave Labs/M12HW	E Band Harmonic Mixer	08/16/2019
F91210-1	Oleson Microwave Labs/M08HW	F Band Harmonic Mixer	08/16/2019
DPL.26.01	Oleson Microwave Labs/DPL.26	Diplexer	08/16/2019

**Table 3: Test Equipment List** 

# 4 Test Results

#### 4.1 RF Power Output: (FCC Part §2.1046) (C63.26 Section 5.2)

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system.

System Notes:

All RF signals in the ESPRIT Radar Sensor are generated in the Transceiver (TRX). The TRX also contains all the RF amplifiers for the Transmit (TX) signals. The TRX has seven TX ports, six of which have the same output level of 17 dBm and are connected to four Transmit Antenna PCB's via coaxial cables. The four TX Antenna PCB's are actually two sets of similar PCB's. In the first set each PCB contains a 1 x 2 array of vertically polarized patch radiators and a 1 x 2 array of horizontally polarized patch radiators. These arrays are fed separately by microstrip transmission lines. In the second set each PCB contains a 20 x 2 array of horizontally polarized patch radiators. The arrays are again fed by microstrip transmission line feed networks. **Per section 90.205(r), there is no power limit at the fundamental emissions frequencies.** 

Frequency (GHz)	Level(dBm)	Limit
9.500	16.390	N/A
9.750	17.081	N/A
9.975	17.157	N/A

Table 4: RF Power Output 2D\_A J5

Table 5: RF Power Output 2D\_B J6

Frequency (GHz)	Level(dBm)	Limit
9.500	17.023	N/A
9.750	16.906	N/A
9.975	15.635	N/A

#### Table 6: RF Power Output 3D\_B J3

Frequency (GHz)	Level(dBm)	Limit
9.500	18.928	N/A
9.750	18.120	N/A
9.975	17.973	N/A

Frequency (GHz)	Level(dBm)	Limit
9.500	18.397	N/A
9.750	18.043	N/A
9.975	17.929	N/A

Table 7: RF P	ower Output	3D_A J4
---------------	-------------	---------



Figure 3: RF Peak Power, 2D\_A J5 Low Channel

Agilent S	pectrum An	alyzer - Swept SA	l.						
LXI	RF	50 Ω AC			SENSE:INT	ALIGNAUTO		12:07:05	5 PM Nov 12, 2018
Marke	er 1 9.74	199266500	00 GHz	PNO: Fast 😱 FGain:Low	Trig: Free Run Atten: 30 dB	ar Avg Ho	/pe: Log-Pwr ld:>100/100	1F	TYPE MWWWWW DET PNNNNN
10 dB/c	Ref div <b>Re</b> f	Offset 4 dB f 23.00 dBm	1				Mkr1	9.749 92 17.	6 65 GHz 081 dBm
3									
13.0 —									
3.00									
-7.00 —									
-17.0 —									
-27.0 —									
-37.0 —									
-47.0									
41.0									
-57.0 —									
-67.0 —									
Cente	r 0 7400	28 GH7						Snan	2 000 MHz
#Res	BW 1.0 I	MHz		VBW	( 50 MHz		Swee	p 2.67 ms	(40001 pts)
MSG						STATUS			

Figure 4: RF Peak Power, 2D\_A J5 Mid Channel

Agilent Spect	rum Analyzer - Swept SA					
IXI	RF 50 Ω AC	CORREC	SENSE:INT	ALIGN AUTO		06:59:45 AMNov 13, 2018
Center F	req 9.974932500	) GHZ PNO: Fast IFGain:Low	⊃ Trig: Free Run Atten: 40 dB	Avg Tyj Avg Hol	d:>100/100	TYPE MWWWWW DET P N N N N N
10 dB/div	Ref 23.00 dBm				Mkr1	9.974 932 50 GHz 17.157 dBm
Log			1			
13.0						
3.00						
-7.00						
-17.0						
-27.0						
-37.0						
-47.0						
-57.0						
-67.0						
Center 9. #Res BW	974933 GHz 1.0 MHz	VBI	N 50 MHz	1	Sweer	Span 2.000 MHz 2.67 ms (40001 pts)
MSG				STATUS		(····· <b>/····</b> /

Figure 5: RF Peak Power, 2D\_A J5 High Channel

Agilent Spectr	rum Analyzer - Swept SA						
LXI	RF 50 Ω AC		ENSE:INT	ALIGN AUTO		01:44:35 PM Nov 12, 2	018
Marker 1	9.499927950000 G	Hz PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 30 dB	#Avg Type: Avg Hold:>1	Log-Pwr 100/100	TRACE 1 2 3 4 TYPE M WWW DET P N N N	56 ///// NN
10 dB/div	Ref Offset 4 dB Ref 23.00 dBm				Mkr1	9.499 927 95 GH 17.023 dB	−lz m
LUG			1				
13.0							-
3.00							-
-7.00							_
-17.0							_
-27.0							_
-37.0							_
-47.0							_
-57.0							
-67.0							
Center 9.4 #Res BW	499941 GHz 1.0 MHz	#VB\	N 50 MHz		Sweep	Span 2.000 Mi 2.67 ms (40001 p	Hz ts)
MSG				STATUS			

Figure 6: RF Peak Power, 2D J6 Low Channel

Agilent Spect	trum Analyzer - Swept SA								
LXI	RF 50Ω AC			SENSE:INT	ALIGN		L D	01:55:02	2 PM Nov 12, 2018
Marker '	1 9.7499123500	00 GHZ	PNO: Fast 😱 -Gain:Low	Trig: Free F Atten: 40 d	Run . B	#Avg Type: Avg Hold:>	100/100		DET P N N N N N
10 dB/div	Ref Offset 4 dB Ref 27.00 dBm						Mkr1	9.749 91: 16.	2 35 GHz 906 dBm
1.08					1				
17.0									
7.00									
-3.00									
-13.0									
-23.0									
-33.0									
-43.0									
-53.0									
-63.0									
Center 9 #Res BW	.749920 GHz / 1.0 MHz		#VBI	W 1.0 MHz			Sweer	Span 2.67 ms	2.000 MHz (40001 pts)
MSG	· · · · · · · · · · · · · · · · · · ·					STATUS			(

Figure 7: RF Peak Power, 2D\_B J6 Mid Channel



Figure 8: RF Peak Power, 2D\_B J6 High Channel

Agilent Spect	rum Analyzer -	Swept SA					
IXI	RF 50	Ω AC CORREC		SENSE:INT	ALIGNAUTO	L Down	09:08:07 AMNov 13, 2018
Marker 1	9.499918	380000 GHZ	PNO: Fast 😱 IFGain:Low	) Trig: Free Run Atten: 40 dB	Avg Typ Avg Hold	e: Log-Pwr i:>100/100	TYPE MWWWWW DET P N N N N N
10 dB/div	Ref 23.00	) dBm				Mkr1	9.499 918 38 GHz 18.928 dBm
				<b></b> 1			
13.0							
3.00							
-7.00							
-17.0							
-27.0							
-37.0							
-47.0							
-57.0							
67.0							
-07.0							
Center 9. #Res BW	499928 GH 1.0 MHz	Iz	VBW	V 50 MHz	I	Sweep	Span 2.000 MHz 2.67 ms (40001 pts)
MSG					STATUS		、 <b>·</b> ,

Figure 9: RF Peak Power, 3D\_B J3 Low Channel

Agilent Spect	rum Analyzer - Swe	ept SA					
<mark>) X</mark> .	RF 50 Ω	AC CORREC	9	ENSE:INT	ALIGN AUTO		09:52:17 AMNov 13, 2018
Marker 1	9.7499183	50000 GHz	PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 40 dB	Avg Type: Avg Hold:>	Log-Pwr 10/10	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N
						Mkr1	9.749 918 35 GHz
10 dB/div	Ref 23.00 c	lBm					18.120 dBm
				1			
13.0							
3.00							
-7.00							
17.0							
-17.0							
-27.0							
-37.0							
-47.0							
-57.0							
-67.0							
Center 9.	749918 GHz		I	I	1	1	Span 2.000 MHz
#Res BW	1.0 MHz		VBW	50 MHz		Swee	p 2.67 ms (40001 pts)
мsg 횢 File	<3D_J3_CCPW	'R.png> saved			STATUS		

Figure 10: RF Peak Power, 3D\_B J3 Mid Channel

Agilent S	pectrum Ar	nalyzer - Swept S/	A							
LXI	RF	= 50Ω AC	CORREC		SENSE:INT	AL	IGNAUTO		12:42:0	5 PMNov 13, 2018
Span	2.0000	0000 MHz		PNO: Fast 🕞 IFGain:Low	⊃ Trig: Free F Atten: 40 d	lun B	Avg Type: Avg Hold:>	Log-Pwr 10/10	I	TYPE M WWWWW DET P N N N N N
10 dB/d	liv Re	f 23.00 dBm	ı					Mkr1	9.974 92 17	3 18 GHz .973 dBm
						1				
13.0 —										
3.00										
7.00										
-7.00										
-17.0 —										
-27.0 —										
-37.0 —										
-47.0 —										
-57.0 —										
-67.0 —										
Center #Res E	r 9.9749 3W 1.0	)23 GHz MHz		VBN	W 50 MHz			Swee	Spar p 2.67 ms	1 2.000 MHz (40001 pts)
MSG							STATUS			

Figure 11: RF Peak Power, 3D\_B J3 High Channel



Figure 12: RF Peak Power, 3D\_A J4 Low Channel

Agilent Spect	rum Analyzer - Swept SA	1						
I <mark>XI</mark>	RF 50 Ω AC	CORREC	S	ENSE:INT	ALIGN AUTO		01:07:26	PMNov 13, 2018
Marker 1	9.7498990700	00 GHz Pi IFC	NO: Fast 😱 Gain:Low	Trig: Free Run Atten: 40 dB	Avg Ty Avg Hol	pe: Log-Pwr  d:>10/10	1	ACE 1 2 3 4 5 6 IYPE M WWWWW DET P N N N N N
10 dB/div	Ref 23.00 dBm	1				Mkr1	9.749 89 18.	9 07 GHz 043 dBm
				<b></b> 1				
13.0								
10.0								
3.00								
7.00								
-7.00								
-17.0								
-27.0								
-37.0								
17.0								
-47.0								
-57.0								
-67.0								
	740024 011-						0	2 000 MIL-
#Res BW	749924 GHZ 1.0 MHz		VBW	50 MHz		Swee	span p 2.67 ms	2.000 WHZ (40001 pts)
MSG					STATUS			/

Figure 13: RF Peak Power, 3D\_A J4 Mid Channel

Agilent Spectr	um Analyzer - Swept SA								
LXI	RF 50 Ω AC	CORREC	s	ENSE:INT	ALIGN	AUTO		01:42:05	PMNov 13, 2018
Span 2.0	0000000 MHz	PN	IO: Fast 😱 Jain:Low	Trig: Free R Atten: 40 dE	un A }	Avg Type: L Avg Hold:>10	og-Pwr )/10	TR 1	ACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N
10 dB/div	Ref 23.00 dBm						Mkr1	9.974 92 17.	3 18 GHz 929 dBm
					1				
13.0									
3.00									
-7.00									
-17.0									
-27.0									
-37.0									
-47.0									
-57.0									
-67.0									
Center 9.9 #Res BW	)74923 GHz 1.0 MHz		VBW	50 MHz			Sweep	Span 2.67 ms (	2.000 MHz (40001 pts)
MSG						STATUS			

Figure 14: RF Peak Power, 3D\_A J4 High Channel

#### 4.2 Radiated EIRP Measurements (C63.26 Section 5.5.3)

Radiated measurements using a standard OATS test arrangement. Direct field strength measurements of the maximum emission amplitude level (maximized as described previously), a signal generator and transmit antenna are substituted in place of the EUT. The output power of the signal generator is adjusted to replicate the maximized signal amplitude measured in the direct field strength measurement. The signal generator power setting is then used to determine the EIRP of the EUT spurious emission(s).

To calculate the emissions power the following equation is used:

Pe = Ps(dBm) - cable loss (dB) + antenna gain (dBd)

Where:

Pe = equivalent emission power in dBm

Ps = source (signal generator) power in dBm

#### Manufacturer's Calculated Parameters

	TX Set 1 1x2 H-pol left and right	TX Set 2 1x2 V- pol left and right	TX Set 3 20x2 H- pol left and right
Gain (dBi)	6.3	6.3	6.3
Number of Antenna Elements			
(N)	4	4	80
TX Cable Loss(dB)	1.8	1.8	1.8
Microstrip Feed Loss(dB)	3.5	3.5	4.3
Phase Modulator Loss(dB)	3.5	3.5	3.5
Total Power Gain(dB)	3.5	3.5	15.8

	TX Set 1 1x2 H- pol left and right	TX Set 2 1x2 V- pol left and right	TX Set 3 20x2 H- pol left and right
Conducted PWR (dBm)	17.8	17.8	17.6
Directive Gain (dB)	3.5	3.5	15.8
EIRP (dBm)	21.3	21.3	33.4
EIPR(W)	0.14	0.14	2.2

Frequency (MHz)	Polarity (H/V)	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors(dB)	Corr. Level (dBuV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Comments
9500.00	V	0.0	1.0	61.2	50.8	112.0	16.7	N/A	N/A	2D
9500.00	V	0.0	1.0	67.0	50.8	117.7	22.5	N/A	N/A	3D
9750.00	V	0.0	1.0	61.4	51.2	112.6	17.3	N/A	N/A	2D
9750.00	V	0.0	1.0	64.0	51.2	115.2	19.9	N/A	N/A	3D
9975.00	V	0.0	1.0	63.5	51.9	115.4	20.1	N/A	N/A	2D
9975.00	V	0.0	1.0	67.0	51.9	118.9	23.6	N/A	N/A	3D
9500.00	Н	0.0	1.6	65.2	50.8	116.0	20.7	N/A	N/A	2D
9500.00	Н	0.0	1.6	77.2	50.8	128.0	32.7	N/A	N/A	3D
9750.00	Н	0.0	1.6	65.3	51.2	116.5	21.3	N/A	N/A	2D
9750.00	Н	0.0	1.6	77.4	51.2	128.6	33.4	N/A	N/A	3D
9975.00	Н	0.0	1.6	63.5	51.9	115.4	20.1	N/A	N/A	2D
9975.00	Н	0.0	1.6	76.8	51.9	128.7	33.4	N/A	N/A	3D

#### Table 8: Radiated EIRP Measurements

#### 4.3 Occupied Bandwidth & Emissions Mask:

Emissions bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer. The mask was determined using the criteria specified in FCC Part §90.210(c).

#### 4.3.1 Occupied Bandwidth

Under normal operation, the EUT sweeps a CW signal from 9.5GHz to 9.975GHz. Figures 14 & 15 show plots of the normal operational output of the EUT at the 2D and 3D ports.

The occupied bandwidth of the fundamental carrier is immeasurable as it is a CW carrier.

Ж А	gilent 14:	55:10 Oc	ct 26, 20	18						
								Μ	kr3 9.63	4 40 GHz
Ref 30	dBm		#A1	ten 40 di	В				18	3.80 dBm
#Peak			1R		3			1		
LOG 10			) ř		Y.	·······		Ŷ		
dBZ										
a,										
	و الله مراجع في والله و.	at a libert of a second of	La					h and ha mail		5.515
1										
LAUA										
M1 S2										
Center	9.650 00	0 GHz							Span	700 MHz
#Res B	W 1 MHz				VBW 8 MH	łz	S	weep 1.6	38 ms (8	192 pts)
Mark	er Tra	ce T	ype	X	Axis		Amplitu	ıde		
	(1	) H \ F	req Troa	9.491 K 311 Ø	00 GHZ 32 MH⇒		17.75 c _0 10	4B 1Bm		
3	(1	, У Б	req Treq	9.634	40 GHz		18.80 0	iBm		

Figure 15: Occupied Bandwidth, 2D

Agilent	Spectr	um Ana	lyzer - Swep	t SA													
LXI		RF	50 Ω	AC	CORREC		_	S	ENSE:INT		β	LIGN A	ло			09:04:4	1 AMNov 13, 2018
Mark	ter 1	Δ 30	1.75000	0000	00 MHz	PNO: IFGair	Fast n:Low	Ţ	Trig: Free Atten: 40	Run dB		Av Av	/g Type: g Hold:>	Log-Pwr 100/100		T	RACE 1 2 3 4 5 6 TYPE MWWWWW DET PNNNNN
10 dB	/div	Ref	23.00 d <b>i</b>	Зm											∆Mk	r1 301. -	.750 MHz 1.027 dB
						1	X						<mark>∫1∆2</mark>				
13.0 -								4									
3.00 -								'									
-7.00 -																	
-17.0 -																	
-27 በ																	
27.0	n al april a	re verste vive	de la statistique estate	llugi	and a state of the state of the								g kalf kas plice	a a daglada dag	Laudadouro	nderskiller Herberger fo	tang ang situ ng salatil.
-37.0	antenne fra fra fra		n Bandhillig an de san an an Ann	al de la des	And provide the physical lines of	too too'sd	1						, and a state of a state				
-47.0 -				_		_											
-57.0 -																	
-67.0 -																	
Cent #Res	er 9.6 BW	650 ( 300 k	GHz :Hz				V	вw	3.0 MHz					Sw	eep '	Span 10.7 ms	1.000 GHz (40001 pts)
MSG 🧕	File <	3D_S	weep_Por	t_J3.	png> save	ed						s	TATUS				

Figure	16.	Occupied	Randwidth	<b>3</b> D
rigure	10:	Occupieu	. Danuwium,	SD

#### 4.3.2 Emissions Mask

For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

#### Mask C

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (fd/5) dB;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd 2/11) dB or 50 dB, whichever is the lesser attenuation;
- (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

The Emissions bandwidth was measured as shown below:



Figure 17: Emissions Bandwidth, 2D\_B J5, Low Channel



Figure 18: Emissions Bandwidth, 2D\_B J5, Mid Channel



Figure 19: Emissions Bandwidth, 2D\_B J5, High Channel



Figure 20: Emissions Bandwidth, 2D\_A J6, Low Channel


Figure 21: Emissions Bandwidth, 2D\_A J6, Mid Channel



Figure 22: Emissions Bandwidth, 2D\_A J6, High Channel



Figure 23: Emissions Bandwidth, 3D\_B J3, Low Channel



Figure 24: Emissions Bandwidth, 3D\_B J3, Mid Channel



Figure 25: Emissions Bandwidth, 3D\_B J3, High Channel



Figure 26: Emissions Bandwidth, 3D\_A J4, Low Channel



Figure 27: Emissions Bandwidth, 3D\_A J4, Mid Channel



Figure 28: Emissions Bandwidth, 3D\_A J4, High Channel

Table 9 provides a summary of the Emissions Bandwidth Results. There is no limit per 90.2099(b)(5).

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel	-	None	Pass
Mid Channel	-	None	Pass
High Channel	-	None	Pass

### Table 9: Emissions Mask Results

### Table 10: Emissions Mask Results

Frequency	Bandwidth	Limit	Pass/Fail		
Low Channel	-	None	Pass		
Mid Channel	-	None	Pass		
High Channel	-	None	Pass		

### Table 11: Emissions Mask Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel	-	None	Pass
Mid Channel	-	None	Pass
High Channel	-	None	Pass

## Table 12: Emissions Mask Results

Frequency	Bandwidth	Limit	Pass/Fail		
Low Channel	-	None	Pass		
Mid Channel	-	None	Pass		
High Channel	-	None	Pass		

## 4.4 Conducted Spurious Emissions at Antenna Terminals (FCC Part §2.1051)

FCC Part §90.210(c) states:

For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (fd/5) dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd 2/11) dB or 50 dB, whichever is the lesser attenuation;

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P) dB$ .

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 10dB attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator and cables. The spectrum analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 1MHz. The amplitude of the EUT carrier frequency was measured to determine the emissions limit. The emissions outside of the allocated frequency band were then scanned from 30 MHz up to the tenth harmonic of the carrier (100GHz).

The following are plots of the conducted spurious emissions data.

### 2D\_A J5

Agilen	gilent Spectrum Analyzer - Swept SA										
X		RF	50 Ω AC			SENSE:INT	AL		Les Dum	12:27:27	7 PM Nov 12, 2018
Stop PAS	o Freq S	1.0	00000000	GHZ	PNO: Fast	Trig: Free l	Run	#Avg type:	Log-Pwr	1	
				11	-Galu:Low	Atten: 00 t			Mkr	1 26 287	125 GHz
10 dE	3/div	Ref ( Ref	0ffset 4 dB 23.00 dBm	1						1 20.207	dBm
3	Trace	1 Pa	ss								
13.0											
3.00											
-7.00											
-17.0											
-27.0											
-37.0											1
-47.0											
-57.0	un an	helden	mplaataeembarda	estel familients (19 m	le de la fisiona des	an a	handa, ndestarda, da jugar	n se sa higo ga giba baha	na ann an Arthreadach	na gipi kan kada pi	Denerfellebygenerelpede
-07.0	ig the life in the second s	նութներ	and not the plastic static property	Matalogica	all in the local line of the second second	and a subger press	Within the second second second	and the second second	and marked have donal	and and the second second	and a state of the state of the
-67.0											
Star	t 30.0 I	ИНz								Stop 1	.0000 GHz
#Res	5 BW 1	00 k	Hz		VBW	V 100 kHz			Sweep	90.7 ms	(40001 pts)
MSG								STATUS			

Figure 29: Conducted Spurious Emissions, Center Channel 30 - 1000MHz

Agilen	t Spectru	m Anal	yzer - Swept SA	l.								
LXI		RF	50 Ω AC			SENSE:INT	AL		L	12:29:34	PMNov 12, 3	2018
Mar	ker 1 4	1.87	00000000	00 GHz	BNO: Fast	Tria: Free	Run	#Avg Type:	Log-Pwr		ACE <u>1</u> 2 3 4 IYPE M <del>WWW</del>	156 WWW
PAS	S			I	FGain:Low	Atten: 30 d	1B				DET P N N N	N N N
10 dE Log i	3/div	Ref 0 Ref 2	ffset 4 dB 23.00 dBm							Mkr1 4.8 -26.	75 0 G 260 dE	Hz 3m
	Trace	1 Pa	SS									
13.0												-
3.00												_
-7.00												
-17.0												
-27.0												<mark>)</mark> 1
-37.U												
-47.0	ha	يال ادر	n ta ta an ta ailt itu a n	House, he has stickers when	and the part of the last	nathlandhangan	and the second strategy	ուրբեպունիերինների	Man de petro choro de com	والمراجع والمراجع والمراجع	La Halanda Jahar	utertiti
-57.0	n	ante de la calendaria de l La contra calendaria de la c	national and for the part of	والمتعمد والمتعادية الملا	and the individual of the	in the second second	a falling the fallen of the party of the	d planta phila a tria interiora	la di bia la la che la constanza la c	a house of the state of the state of the	al <u>y pak an</u> dan di	a apat
-67.0	Ideadar on cor	p										
0.10												
Star #Res	t 1.000 s BW 1	GHz 00 k	Hz		VBV	V 100 kHz			Swee	Stop p 371 ms	5.000 G (40001 p	iHz ots)
MSG								STATUS				

Figure 30: Conducted Spurious Emissions, Center Channel 1 – 5GHz



Figure 31: Conducted Spurious Emissions, Center Channel 5 – 9.748GHz



Figure 32: Conducted Spurious Emissions, Center Channel 9.748 – 9.755GHz

Agilen	gilent Spectrum Analyzer - Swept SA										
<mark>I XI</mark>		RF	50 Ω AC			SENSE:INT	AL		1 o a Dua	12:23:01	L PM Nov 12, 2018
Mar PAS	Ker 1 ' S	14.9	01580375	000 GHZ	PNO: Fast 🕞 -Gain:Low	) Trig: Free Atten: 30 d	Run 18	#Avg Type.	Log-F wi	1	
10 dE Log I	3/div	Ref ( Ref	Offset 4 dB 23.00 dBm			1			MI	kr1 14.96 -45	1 58 GHz 5.62 dBm
13.0	Irace	1 Pa	SS								
3.00											
7.00											
-7.00											
-17.0											
-27.0											
-37.0											1
-47.0	يال بالكر الله	للم معاليان	and databased to an	وتفتاك وتربا والفرواط التقريمة باري	Internet and the second second	and the state of the second	aller and a streng all a strength of the stren	nda barpapaallaa	para dina dia dalara da ina dia dia dia dia dia dia dia dia dia di	al constation of the sector	
-57.0	hand the fair for the	the state		inansiai <b>j</b> irinaa da	ده شاه بالادر بطعر مر شر <mark>ار</mark> در .	ana jana ang kana ang kanang kanan	a particular bilinear ab the part	ى زارلىيەر رويىن <sub>1</sub> مەرەر يىلىم بارو يەرىيەن.	and the contract of the second second	ka adala dan basar karaka	and the state of t
-67.0											
Star	t 9.755	GH	2							Stop 1	5.000 GHz
#Res	s BW 1	00 k	Hz		VBW	V 100 kHz			Swee	p 485 ms	(40001 pts)
MSG								STATUS			

Figure 33: Conducted Spurious Emissions, Center Channel 9.755 - 15GHz

Agilen	t Spectru	m Anal	lyzer - Swep	ot SA									
IXI Mari	(or 1 /	RF	50 Ω	AC			SENS	E:INT	Al		Log-Pwr	12:24:52 TB	2 PMNov 12, 2018
PAS	S	19.43	990750	0000		PNO: Fast FGain:Low	<b>.</b> .	Frig: Free Atten: 30 d	Run 18	ming type.	2091 8		
10 dE	3/div	Ref C Ref	)ffset 4 dE 23.00 dI	3 Bm							Mkı	1 19.499 -38	875 GHz 8.29 dBm
LUG	Trace	1 Pa	SS										
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3.00													
-7.00													
-17.0													
-27.0													
-37.0													1
47.0	فقطاري ورواق	alla la stat	իրունը հետ գետ են	In the second second	-	u hanna ceilteanach	որելուներ	Helen of the line of the	والمراجع المراجع المراجع	المراجع والمراجع والمراجع والمراجع	al an an fam and the	antilization diplot ou	a cal al a factor film and
-47.0	a and the flat	(males)	nt phone phone in	(Marine Paul	ulut di ancadi <sup>l</sup> ut	enderste jaarde	an a	han an the particular	dan padapat la padara	n an	Hard Annaly and the standard	hadin salaanii (ki	nillen der seiter
-57.0													
-67.0													
Stari #Res	t 15.00 5 BW 1	0 GH 00 k	lz Hz			VI	BW 10	00 kHz			Swee	Stop 2 p−464 ms ⊧	0.000 GHz (40001 pts)
MSG										STATUS			

Figure 34: Conducted Spurious Emissions, Center Channel 15 - 20GHz



Figure 35: Conducted Spurious Emissions, Center Channel 20 – 26.5GHz

🔆 Agi	<b>ilent</b> 06:40:05_0c	t 26, 201	.8						
		_		_			M	kr1 26.6	06 8 GHz
Ref 20 (	dBm	At	ten 30 di	3	1		-36	.43 dBm	
#reak									
10									
dB/									
DI F									
-13.0									
dBm									
LgAv  _	4								
M1 \$2		lant and the				. և աշեկես		tan linda hara sa ta	an alian induction in a
S3 FC									
A AA									
<b>£</b> (f):	Marker								
FTun [		രര വ							
Swp 🖌		לאט שש	Z						
-	-36.43 dBm								
Start 26	.500 0 GHz						S	top 30.00	000GHz
#Res BW	1 MHz			VBW 8 MH	Ηz	S	weep 18.	02 ms (81	.92 pts)

Figure 36: Conducted Spurious Emissions, Center Channel 26.5 – 30GHz

Ж А	gilent 06:4	10:34 <u>Oc</u>	t 26, 201	.8						
								M	kr1 33.5	08 7 GHz
Ref 20	dBm		At	itten 30 dB					-28	.44 dBm
#Peak										
LOG										
10 487										
ub7										
DI										
-13.0										
dBm								1		
LgAv							L. Helsenheitet	and the state of		
44 00	1	يديدون او الراري	and a second s	lange di Marangan.	in depute dissipli an analysis in the state	and and the second s	A Design of the state of the	and the second second		angesterne der ge
MI 32 83 EC					4 5 1					
93 FU A AA										
<b>f</b> (f)										
FTun	Marke	r								
Swp	33.50	37000	00 GH:	Ζ						
	-28 4	4 dRm								
	- 20.4									
Start 3	0.000 0 (	GHz				1		S	top 35.00	00 0 GHz
#Res B	W 1 MHz			VBW 8 MHz Sweep 25.12 ms (8192 p						.92 pts)

Figure 37: Conducted Spurious Emissions, Center Channel 30 – 35GHz

→¥ A	gilent 06:41:23 Oc	t 26,201:	.8						
							M	kr1 38.3	12 8 GHz
Ref 10	dBm	At	ten 20 di	3		-31	.55 dBm		
#Peak									
Log									
ab/									
DI									
-13.0						1			
dBm			1 Inis	ال جامل میں	and the second second	and here the second	national de la des	for the state	the second
LgAv	under alle des dette beste dette des deber	In the second	A LINE AND A LONG BODY	and the state of t					
M1 S2									
53 FU									
н нн <b>с</b> (т)•									
ETun	Marker								
Swn	38.3128000	00 GH	7						
Jo		00 0							
	-31.33 UDIII								
Start 3	5.000 0 GHz						S	ton 40.00	10 0 GHz
#Res B	W 1 MHz			VBW 8 MH	łz	weep 25.	12 ms (81	92 pts)	

Figure 38: Conducted Spurious Emissions, Center Channel 35 – 40GHz

🧩 A	<b>gilent</b> 06:47	7 <b>:</b> 47 Oc	t 26, 201	.8							
							onte tog 1, tog 1, tog 1, tog 1, tog 1, t	M	kr1 40.0	85 5 GHz	
Ref -1	0 dBm			Ext Mix					-42.13		
#Peak											
Log											
ar\											
	1										
DI	Tilles Includes and	date			م م الم ال	Linder I					
-13.0		AND TRACE	na ann an Airth an Airth an Airth	the state of the s		destriction of participation				البريل مح والرو	
dBm											
LgAv											
44 00											
MI 32 82 EC											
53 FU 0 00											
п пп <b>с</b> (1)•											
ETun	Marker										
Swn	40 085	Saaai	aa gh	7							
~"P	12 1 2	D		-							
	-42.13	udili									
Start 4	0.000 0 G	Hz						S	top 50.00	00 0 GHz	
#Res B	W 1 MHz			VBW 8 MHz Swe				weep 50.	24 ms (81	192 pts)	

Figure 39: Conducted Spurious Emissions, Center Channel 40 – 50GHz

🔆 A	gilent 06:48:29 00	st 26, 201	.8						
							М	kr1 58.8	03 6 GHz
Ref -1	0 dBm		Ext Mix	{				-42	2.90 dBm
#Peak									
Log									
10									
ar\									
								1_	
ם ו					. San Land				La. B
-13.0	and he was a set of the set of the set								
dBm									
LgAv									
M1 S2									
S3 FC									
	Marker								
riun Swn	58 8036000	iaa ch-	7						
210	42.00.0000		<u>~</u>						
	-42.90 aBm								
Start 5	0 000 0 GHz						<u>ا</u>	: ton 60.00	)0 0 GH-
#Res B	W 1 MHz			VBW 8 MH	Ηz	S	weep 50.	24 ms (8	192 nts)

Figure 40: Conducted Spurious Emissions, Center Channel 50 – 60GHz

🔆 🕺	<b>gilent</b> 06:5	54:43 <u>O</u> c	t 26,201	.8						
								M	kr1 69.9	31 6 GHz
Ref -1	0 dBm			Ext Mix	1				-33	.27 dBm
#Peak			***************							
Log										
10										
dB/										1
										Ŷ
	LUN AND	ال يتعلمان	المعادي المعاد	مريل المعالم	- Lunation	for the second		all a subschedungen	An I I Constitute of	
n I	and a set of a set of the line	Contraction of the second		and and the second s	1-111					
-13.0										
dBm										
LaAv										
M1 S2										
S3 FC										
A AA										
<b>£</b> (f):	Marko	-								
Flun		10000	00 CU.							
Swp	09.93	LDOOD	00 GH	Z						
	-33.2	7 dBm								
Start 6	0.000 0 (	GHz				-		S	top 70.00	00 0 GHz
#Res B	W 1 MHz				VBW 8 MF	lz	S	weep 50.	24 ms (81	l92 pts)_

Figure 41: Conducted Spurious Emissions, Center Channel 60 – 70GHz

₩ А	gilent 06:5	55:21 Oc	t 26, 201	.8						
								M	kr1 75.1	06 8 GHz
Ref -1	0 dBm			Ext Mix					-31	.51 dBm
#Peak										
LOG										
ub/						1 <b>0</b>				
	- Bullatile	م العالية بيوارين					all and the case	والمعاقبة والمراجع والم	Appendia to alla	
								and the second second		
DI										
-13.0										
dBm										
LgAv										
M1 00										
MI 32 83 EC										
A AA										
<b>£</b> (f):	<b>1</b> 4 1									
FTun	Marke	r								
Swp	75.10	68000	00 GH:	Z						
	-31 5	1 dRm								
	- 01.0									
Start 7	70.000 0	GHz						S	top 80.00	00 0 GHz
#Res B	W 1 MHz				VBW 8 MH	lz	S	weep 50.	24 ms (81	l92 pts)

Figure 42: Conducted Spurious Emissions, Center Channel 70 – 80GHz

₩ А	<b>gilent</b> 06:56:0	0 Oct	26, 201	8						
								M	kr1 80.5	48 2 GHz
Ref -1	ØdBm			Ext Mix					-33	.60 dBm
≢геак Год										
109 10										
dBZ										
ч <i>с</i> ,	1									
	إذالين الري درائيم إمرا			and the second	al form to all the Microsoft	a and sub-	والمعارج والمراجع	والمتعادية والمتعادية		فاستعاده والمع
						1.10		and the property is a second		
DI										
-13.0 dBm										
LGHV										
M1 S2										
S3 FC										
A AA										
<b>£</b> (f):	Markor									
FTun		0000								
Swp	80.5482	0000	U GHZ	Z						
	33.60 c	dBm _								
Start 8	30.000 0 GHZ					1_	~	5	top 90.00	00 0 GHZ
#ĸes B	WIMHZ				ARM & WH	1Z	5	weeр 50.	24 ms (8]	L9Z pts)

Figure 43: Conducted Spurious Emissions, Center Channel 80 – 90GHz

💥 A	gilent 06:0	35 <b>:</b> 44_0c	t 26, 201	.8							
								M	kr1 97.1	74 9 GHz	
Ref -1	0 dBm			Ext Mix	{				-30	.58 dBm	
#Peak											
Log											
10											
aR/											
	Maril man bent	and the street	inter land	و سار و در و او در ال	likely have a second de	الألباء والمتعارجة المتع	the dead in the state	all and a ball of the	and the same same	Address of the second second	
	and the second se					and the second second					
n											
-13.0											
dBm											
LgAv											
M1 S2											
S3 FC											
A AA											
£(f):	Marke	r									
Flun	-07 17	10000	രര പ								
Swb	31.11	43000	רוס שש.	2							
	L-30.5	8 dBm									
Start S	30.000 0 1	GHz						St	op 100.00	10 0 GHz	
#Res B	es BW 1 MHz				VBM 8 MF	lz	S	Sweep 50.24 ms (8192 pts)			

Figure 44: Conducted Spurious Emissions, Center Channel 90 – 100GHz

# 2D\_B J6

Agilen	t Spectru	m Ana	lyzer - Swept SA	l							
		RF	50 Ω AC			SENSE:INT	AL		Law Down	03:07:2:	1 PM Nov 12, 2018
Stop PAS	o Freq S	<u>1.0</u>	00000000	GHz I	PNO: Fast 🖵 -Gain:Low	) Trig: Free Atten: 40 d	Run 1B	#Avgilype: Avg Hold:4	Log-Pwr 9/100	۲۲	ACE         1         2         3         4         5         6           TYPE         M WWWWWW         M         <
10 dE	3/div	Ref ( <b>Ref</b>	Offset 4 dB 27.00 dBm	I					M	kr2 9.749	926 GHz dBm
3	Trace	1 Pa	ISS								2
17.0											<b></b>
7.00											
-3.00											
-13.0											
-23.0	n falliski si s		a helatat ana ara-tat	an is in the trai		Windows all the effective	allo Marcana Inc ad talana hika		ana, <mark>alla as makala and</mark>	Anna gara ta barlata	deall and have dealed of
-33.0	entresenter Antesenter	and a la	ndin an na sang dina kanang sa	langer pe fergetyse er spendi I men helden se konstruktion	<sup>n</sup> nithini an containi I	ata da la tata di biblarija	Matellin (ministration)	la al martial de la contraction de contraction de la contraction de contraction de contraction de contraction de	n staak hiji si si saasi sa ku si si sa si	nagastili alaştik adılarıştı	and the state of the
-43.0											
-53.0											
-63.0											
Star Res	t 30.0 I BW 3.0	MHz 0 MH	łz		VBV	V 50 MHz			Swee	Stop 1 p 2.67 ms	.0000 GHz (40001 pts)
MSG								STATUS			

Figure 45: Conducted Spurious Emissions, Center Channel 30 - 1000MHz



Figure 46: Conducted Spurious Emissions, Center Channel 1 – 5GHz



Figure 47: Conducted Spurious Emissions, Center Channel 5 – 9.74GHz



Figure 48: Conducted Spurious Emissions, Center Channel 9.74 – 9.76GHz

Agilen	t Spectru	m Anal	yzer - Sv	vept SA									
LXI		RF	50 \$	2 AC			SEN	SE:INT	AL	IGN AUTO		03:12:18	3 PM Nov 12, 2018
Stop PAS	o Freq S	10.0	00000	0000	) GHz	PNO: Fast IEGain:Low	Ţ,	Trig: Free I #Atten: 20 (	Run dB	#Avg Type: Avg Hold:2	Log-Pwr 0/100	۱۲	ACE 1 2 3 4 5 6 TYPE M WWWWWW DET P N N N N N
10 dE	3/div	Ref C Ref	)ffset 4 <b>14.00</b>	<sup>dB</sup> dBm							М	(r2 9.749	926 GHz dBm
	2 <sup>-</sup> race	1 Pa	SS										
4.00													
-6.00													
-16.0													
-26.0													
-36.0													
-46.0													
-56.0	16 1		1			h l				1			4.4.1
-66.0	MAN AN					MAN MANY PARA						http://www.war	
-76.0													
Start #Res	t 9.760 s BW 3	0 GH 00 k	lz Hz			#	VBW	3.0 MHz			Swee	Stop 10 2.67 ms	.0000 GHz (40001 pts)
MSG										STATUS			

Figure 49: Conducted Spurious Emissions, Center Channel 9.76 - 10GHz

Agilen	t Spectru	m Ana	lyzer - Swept SA								
<b>Z</b>		RF	50 Ω AC			SENSE:INT	AL		<b>D</b>	03:12:3	3 PM Nov 12, 2018
Stop PAS	S Freq	20.	00000000	0 GHz	PNO: Fast 🖵	Trig: Free l	Run	#Avg Type: Avg Hold:1	0/100		
1 45	<u> </u>	ļ		IF	-Gain:Low	#Atten: 20	ав				DEIT
10 dE	3/div	Ref ( <b>Ref</b>	Dffset 4 dB <b>14.00 dBm</b>	I					IV	1kr2 9.74	9 93 GHz dBm
LUG	2 <sup>-</sup> race	1 Pa	ss								
4.00											
-6.00											
-16.0											
-26.0											
-36.0											
-46.0									1		
				من من استادات	col to to card teacter.	n an	popular application	en anderen de la para la	ballin lipstropic	And all the states of the second	nd market to bit applet
-5b.U	and the second	<b>Marilly</b>	I STATE AND A STATE OF A STATE	स्वत्र स्वतः का विद्यु स्वत्र	ala kalendar kalendar. Markala Markala kalendar dari sara	and some the state	terit kehetek herbit direkt	nich senting a diffectivitäteitä	<sup>ninde</sup> r (der besteunder b	and all the set of the set of the	anger an
-66.0	Adaptation p.	ykana la	station, provident	ni pilanta finikili, dahadada biy		he with a second					
-76.U											
Star #Res	t 10.00 s BW 3	0 Gł 00 k	Hz Hz	1	#VB	W 3.0 MHz	1		Swee	Stop 2 p 104 ms	20.000 GHz (40001 pts)
MSG								STATUS			

Figure 50: Conducted Spurious Emissions, Center Channel 10 - 20GHz

Agilent	Spectru	n Anal	yzer - Swept SA	l.							
X		RF	50 Ω AC			SENSE:INT	AL	IGNAUTO		03:13:0:	3 PM Nov 12, 2018
Stop PAS	Freq S	26.	50000000	0 GHz	PNO: Fast 🖵 IFGain:Low	) #Atten: 20	Run dB	#Avgilype: Avg Hold:1	Log-Pwr 2/100	lh	ACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N
10 dB	/div	Ref C <b>Ref</b>	offset 4 dB 14.00 dBm	ı					N	1kr2 9.74	9 93 GHz dBm
	<sup>2</sup> <sup>-</sup> race	1 Pa	ss								
4.00 -											
-6.00 -											
-16.0 -											
-26.0 -											
-36.0 -											
-46.0 -				III TO THE OWNER OF	Marina da	and a faith and a start of a star	n ing katalan para para para	li ana desta se ithere i		land Anna Athleteller	
50.0	nder alle services. Inder alle services die services d	n an ailte	us and have been been a first the party of the	ngadalalik beter bereine	al data addition to an or other	an et daalent bereist detet	Propositional distal lands and a particular	distanti della	, hild half a la serie a serie a	a da antes en este este este este este este es	and the second second
-30.0	and the second	<b>P1111111111111</b>									
-66.0 -											
-76.0 -											
Start #Res	20.00 BW 3	0 GH 00 k	lz Hz		#VB	W 3.0 MHz			Swee	Stop 2 p 66.7 ms	26.500 GHz (40001 pts)
MSG								STATUS			

Figure 51: Conducted Spurious Emissions, Center Channel 20 – 26.5GHz

🔆 🔆 Agilent 12	:52:35 Oc	t 26, 201:	18						
							М	kr1 29.2	28 3 GHz
Ref 10 dBm		At	ten 20 dl	В				-46	6.25 dBm
#Peak									
Log									
ab/									
DI									
-13.0									
dBm									
LgAv									
M1 S2		1	وجواديا والمرجوعة الألي	a the dillering		an she bits in the	ور والماركين الم		lin helt en bienels parte privileitettettette
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	er								
Sun 29 22	מממראי	и сн	7						
		00 011	<u>_</u>						
-40.2	,s abm								
Start 26 500 0	 СН-2							1 1	30 0 CH→
	0112			VBM 8 M	17	S	ween 18	ир 50.00 И2 ms (8	192 nts)

Figure 52: Conducted Spurious Emissions, Center Channel 26.5 – 30GHz

💥 A	gilent 12:56:	42 Oc	t 26,201	.8						
								M	kr1 33.4	22 0 GHz
Ref 10	dBm		Att	ten 20 di	В				-35	.55 dBm
#Peak		1						*****		
Log										
10										
dB/										
<u> </u>										
-13.0 48m							1			
							Ŷ			
LgHV			وفرع محفاه أمالت	يعريبك ألكار ادائك عسره	والم والمتلحي والم وم وما والح ال	Repaired in the second			a tha sha ba ka a tal	alation bland <sup>al</sup> ter
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MI 32 02 FC										
<b>£</b> (£)·										
ETun	Marker									
Swn	33 4220	innai	70 GH	7						
~"P		HD		-						
	-32.22	apw								
S										
Start 3	50.000 0 GH:	Z					~		top 35.00 גרא גרא	0 0 GHZ
#Kes B	W I MHZ				ARM & WE	1Z	S	weep 25.	12 ms (81	เษ2 pts)_

Figure 53: Conducted Spurious Emissions, Center Channel 30 – 35GHz

<u>ж</u> А	gilent 12:58:50	) Oct 26, 201	.8						
							M	kr1 38.9	72 7 GHz
Ref 10	dBm	At	ten 20 di	Β				-31	.16 dBm
#Peak									
Log									
аБ7									
DI									
-13.0									
dBm				I was seen as			alah sebiat dara di Alah sebiat di kara di		Debil and and a set
LgAv									
M1 S2									
53 FU									
н нн <b>с</b> (f)•									
ETun	Marker								
Swn	38.97270	100'00 GH:	7						
0.10	-21 16 4	Dm							
	-31.10 u								
Start 3	5.000 0 GHz	I		1		1	S	ton 40.00	10 0 GHz
#Res B	W 1 MHz			VBW 8 MH	łz	S	weep 25.	12 ms (81	192 pts)

Figure 54: Conducted Spurious Emissions, Center Channel 35 – 40GHz


Figure 55: Conducted Spurious Emissions, Center Channel 40 – 50GHz

💥 А	gilent 13:0	07:53 Oc	t 26, 201	.8						
			11111111111111111111111111111111111111					М	kr1 59.1	43 0 GHz
Ref -1	0 dBm			Ext Mix	{				-43	8.06 dBm
#Peak			***************	****						
Log										
10										
dB/										
										1
n I								al a seal	a., Jeanslau	
-13.0	أأديم ويعتدا بالالا	deskipers hat bla	adam katagan s	A CONTRACTOR OF					Charge and Charge and	and the second second
dBm	and the second									
LgAv										
M1 S2										
S3 FC										
A AA										
£(†):	Marke	r								
Flun		ററററ	രെ പ							
swp	35.14	20000	נחט שש	2						
	-43.0	p qRw								
	0.000.0	0.11								
Start 5	0.000 0	5Hz					~	5	top 60.00	00 0 GHz
#Kes B	W 1 MHz_				ARM & WE	1Z	S	weeр 50.	24 ms (81	192 pts)_

Figure 56: Conducted Spurious Emissions, Center Channel 50 – 60GHz



Figure 57: Conducted Spurious Emissions, Center Channel 60 – 70GHz

💥 А	<b>gilent</b> 13:15:3	1 Oct	26,201	8						
								M	kr1 76.2	39 8 GHz
Ref -1	0 dBm			Ext Mix					-31	.18 dBm
#Peak										
Log										
10 10										
ab7										
	Mand and Million and Million	وي والداني بي ال	a state of the second second					and the second second		
DI										
-13.0										
dBm										
LgAv										
M1 00										
MI 32 63 EC										
<b>£</b> (f):										
FTun	Marker									
Swp	76.2398	2000	0 GHz	2						
	-31 18 6	-lRm								
Start 7	0.000 0 GHz							S	top 80.00	00 0 GHz
#Res B	W 1 MHz				VBW 8 MH	lz	S	weep 50.	24 ms (81	l92 pts)_

Figure 58: Conducted Spurious Emissions, Center Channel 70 – 80GHz

🔆 Agilent 13	8:16:28_0c	t 26, 201:	.8						
							M	kr1 81.9	66 8 GHz
Ref —10 dBm			Ext Mix	{				-33	.17 dBm
#Peak									
Log									
10									
dR1	1								
بالماسعين أقريع	الم المراب بالألبير الس		adda an an da and	المعدر والملاحظ	م روقا حاري ورو	la set e se		L	
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DI									
-13.0									
dBm									
LgAv									
M1 S2									
S3 FC									
H HH									
Mark	er								
		ממ בם-	7						
PMb 01.3			2						
	Ti qRw								
Start 80 000 0	1 GHz							ton 90.00	10 0 GH-
#Res BW 1 MHz	2			VBW 8 MH	łz	S	.weep 50	24 ms (81	92 pts)

Figure 59: Conducted Spurious Emissions, Center Channel 80 – 90GHz

🔆 👫	gilent 13:22	2:46 Oc	t 26, 201	.8						
								M	kr1 92.2	97 6 GHz
Ref -1	0 dBm			Ext Mix	:				-30	.89 dBm
#Peak			*******							
Log										
10										
dR/			1							
	ار استعماد اردامه	and a second second		والبراني ويتعاط	اللبين واللبوم	المراجع والمراجع	أسقيل والمتكفية	يرو و واد ا داد ا	ومتراجع والم	وعلامت والمعادة
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DI -13.0										
dBm										
laAv										
M1 S2										
\$3 FC										
A AA										
£(f): FTun	Marker									
Swp	92.297	6000	00 GH:	z						
	20 00	dPm								
	-30.03	ubili								
Start 9	10.000 0 G	Hz				1	1	St	on 100.00	10 0 GHz
#Res B	W 1 MHz				VBW 8 MF	łz	S	weep 50.	24 ms (81	192 pts)

Figure 60: Conducted Spurious Emissions, Center Channel 90 – 100GHz

## 3D\_B J3

Agilen	t Spectru	ım Ana	lyzer	- Swept S	A												
X		RF	000	50Ω AC		IORREC		_		SENSE:INT		ALI	IGN AUTO	. La n Dum		10:00:3	5 AMNov 13, 2018
Mari PAS	ker 1 S	<u>823.</u>	338	375000	OM	Hz	PNO IFGai	: Fast n:Low	Ģ	Trig: Free Atten: 40 d	Run 1B		Avg Type Avg Hold:	: Log-Pwr >10/10			DET P N N N N N
10 dE	3/div	Ref	23.	00 dBn	1										IV	1kr1 823. -43.	339 MHz 942 dBm
3	Trace	1 Pa	ss														
13.0							_								-		
3.00															_		
-7.00															_		
-17.0																	
-27.0																	
-37.0																• <sup>1</sup>	
-47.0	dila") materi	ר <sup>ייינ</sup> יימקו <del>ירי</del> ן		all and a star		detel transf	Hall Hard	and the second	(eser) Jacos		loge flyfarily. Deforingen	eles della	nalenskykalistalis enskarkasiskasis		rie-le le	and a later state to an and some	and an
-57.0		ر ( منهمین ار العد				and an only of the later.											
-67.0																	
Star #Res	t 30.0 s BW 1	MHz 100 k	Hz					v	'ΒW	/ 1.0 MHz				Swe	eep	Stop 1 90.7 ms	.0000 GHz (40001 pts)
MSG													STATUS				

Figure 61: Conducted Spurious Emissions, Center Channel 30 - 1000MHz



Figure 62: Conducted Spurious Emissions, Center Channel 1 – 5GHz



Figure 63: Conducted Spurious Emissions, Center Channel 5 – 9.75GHz



Figure 64: Conducted Spurious Emissions, Center Channel 9.75 – 9.76GHz



Figure 65: Conducted Spurious Emissions, Center Channel 9.75 - 10GHz



Figure 66: Conducted Spurious Emissions, Center Channel 10 - 55GHz



Figure 67: Conducted Spurious Emissions, Center Channel 15 – 20GHz



Figure 68: Conducted Spurious Emissions, Center Channel 20 – 25GHz



Figure 69: Conducted Spurious Emissions, Center Channel 25 – 26.5GHz

🔆 🕺	<b>gilent</b> 05:02:25 Oc	t 26, 201:	.8						
							M	kr1 29.7	06 0 GHz
Ref -1	0 dBm	At	ten 10 di	В				-56	.92 dBm
#Peak		******	*******						
Log									
10									
dB/									
DI									
-13.0 JD									
apm									$\diamond$
LgHv			الموجلة المرجولية الم	من المانية الك <sup>اني</sup> والعربي . منه من المانية الكانية من الماني من الم	ير ارو الله ورار المراكلي ومن من المراجع المراجع				
M1 00									
MI 32 82 EC									
n nn <b>r</b> (f)									
ETun	Marker								
Swn	29 7060000	aa ch	7						
2np		00 011	_						
	-20.92 aBW								
A									
Start 2	0.500 0 GHZ						5	top 30.00	00 0 GHZ
#Kes B	W I MHZ			ARM & WE	1Z	S	weep 18.	02 ms (81	192 pts)

Figure 70: Conducted Spurious Emissions, Center Channel 26.5 – 30GHz

)∦⊱ А	gilent 05:0	03 <b>:</b> 22 Oc	t 26, 201:	.8						
							oon,	М	kr1 33.4	43 4 GHz
Ref -1	0 dBm		At	ten 10 di	3				-49	.56 dBm
#Peak										
Log										
10										
aB/										
n										
-13.0										
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S3 FC										
A AA										
<b>£</b> (f):	Marke	r								
Flun	-22 11	຺ ຉຑຉຉຉ	രെ വ							
Swp	33.44	34000	חט שש.	Z						
	-49.5	6 dBm								
			1							
Start 3	30.000 0	GHz						S	itop 35.00	00 0 GHz

Figure 71: Conducted Spurious Emissions, Center Channel 30 – 35GHz

Ж А	gilent 05:0	)3 <b>:</b> 59_0c	t 26, 201:	.8						
								M	kr1 38.3	40 9 GHz
Ref -1	0 dBm		At	ten 10 di	В				-43	.28 dBm
#Peak										
Log										
10 dB/										
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-13.0			المعادية والمعادية	Letter and his d		dates and the		a fa dha gallanna an		
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п пп <b>f</b> (f)•										
FTun	Marke	r								
Swp	38.34	09000	00 GH:	z						
	_13.20									
	-43.20	JUDIII								
Start 3	35.000 0 (	GHz			1	1	1	S	top 40.00	00 0 GHz
#Res B	W 1 MHz				VBW 8 MH	Ηz	S	weep 25.	12 ms (81	192 pts)

Figure 72: Conducted Spurious Emissions, Center Channel 35 – 40GHz

🧩 A	<b>gilent</b> 04:32	:08 Oc	t 26,201	.8						
								M	kr1 40.3	13 8 GHz
Ref -1	0 dBm			Ext Mix	{				-40	.74 dBm
#Peak				******						
Log										
10										
dB/										
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						Mind and and a	the second second second	ALL LANDA	والمحمد والمحاطية	
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MI 32 82 EC										
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	-40.74	apw								
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#кеs В	WIMHZ _				ARM & WE	1Z	5	weeр 50.	24 ms (8]	נשב pts)_

Figure 73: Conducted Spurious Emissions, Center Channel 40 – 50GHz

💥 А	gilent 04::	33 <b>:</b> 03 Oc	t 26, 201:	.8						
							onte toe te toerte toerte toerte t	M	kr1 59.2	34 5 GHz
Ref -1	0 dBm			Ext Mix	{				-43	.30 dBm
#Peak										
Log										
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dB/										
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-13.0	فيبار اطليق وبال	وبالترور ويتعادد	بالم والمحر بالرقار	All market						the state of the s
dBm										
LgAv										
M1 S2										
S3 FC										
A AA										
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Swp	33.23	43000	חס שש.	2						
	-43.3	0 dBm								
Start 5	0.000 0 1	GHz						S	top 60.00	10 0 GHz
#Res B	W 1 MHz				VBM 8 MF	lz	S	weep 50.	24 ms (8:	192 pts)_

Figure 74: Conducted Spurious Emissions, Center Channel 50 – 60GHz

💥 A	<b>gilent</b> 04:54:36_0c	t 26,201	.8						
							M	kr1 69.9	60 9 GHz
Ref -1	0 dBm		Ext Mix	:				-33	.26 dBm
#Peak							******		
Log									
10									
dB/									1
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-13.0									
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M1 S2									
S3 FC									
A AA									
<b>£</b> (f):	Markor								
FTun									
Swp	69.9603000	00 GH:	Z						
	-33.26 dBm								
Start 6	60.000 0 GHz						S	top 70.00	00 0 GHz
#Res B	W 1 MHz			VBW 8 MH	lz	S	weep 50.	24 ms (81	l92 pts)_

Figure 75: Conducted Spurious Emissions, Center Channel 60 – 70GHz



Figure 76: Conducted Spurious Emissions, Center Channel 70 – 80GHz

₩ А	gilent 04:5	5 <b>5:</b> 56 Oc	t 26, 201	.8						
								M	kr1 82.1	51 1 GHz
Ref -1	0 dBm			Ext Mix	{				-32	.39 dBm
#Peak										
Log										
10 10										
uD7			1							
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		(manufacture) and	alt at a second	Contractor of the state	a bearing the states					
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-13.0										
dBm										
LgAv										
M1 S2										
S3 EC										
Ă ĂĂ										
<b>£</b> (f):	Marka	_								
FTun	marke									
Swp	82.15	11000	00 GH:	Z						
	-32.3	9 dBm								
Start 8	30.000 0 (	GHz						S	top 90.00	)0 0 GHz
#Res B	W 1 MHz				VBW 8 MH	łz	S	weep 50.	24 ms (81	.92 pts)_

Figure 77: Conducted Spurious Emissions, Center Channel 80 – 90GHz

🧩 A	gilent 04:10	):48 Oc	t 26, 201	.8						
								M	kr1 91.9	96 1 GHz
Ref -1	0 dBm			Ext Mix				-30	.72 dBm	
#Peak										
Log										
10										
aR/		1	\$							
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DI										
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LgAv										
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<b>t</b> .(†): ET.us	Marker									
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οπþ	21.000	1000		2						
	-30.72	arw								
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Figure 78: Conducted Spurious Emissions, Center Channel 90 – 100GHz

## 3D\_A J4

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Figure 79: Conducted Spurious Emissions, Center Channel 30 - 1000MHz



Figure 80: Conducted Spurious Emissions, Center Channel 1 – 5GHz



Figure 81: Conducted Spurious Emissions, Center Channel 5 – 9.749GHz



Figure 82: Conducted Spurious Emissions, Center Channel 9.749 – 9.750GHz



Figure 83: Conducted Spurious Emissions, Center Channel 9.75 - 10GHz



Figure 84: Conducted Spurious Emissions, Center Channel 10 - 15GHz



Figure 85: Conducted Spurious Emissions, Center Channel 15 – 20GHz



Figure 86: Conducted Spurious Emissions, Center Channel 20 – 25GHz



Figure 87: Conducted Spurious Emissions, Center Channel 25 – 26.5GHz

💥 А	gilent 21:30	:52 Oc	t 25,201	.8						
								M	kr1 26.6	11 1 GHz
Ref 11	dBm		At	ten 30 dl	3		-46.19 dBm			
Peak										
LOG										
10 10										
uD7										
DI										
-13.0										
dBm										
LgAv										
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FTun	marker									
Swp	26.611	1000	00 GH:	Z						
	-46.19	dBm								
	- ·									
Start 2	26.500 0 GH	lz						S	top 30.00	00 0 GHz
#Res BW 100 kHz				VBW 1 MHz Sweep 323.3 ms (8192					l92 pts)	

Figure 88: Conducted Spurious Emissions, Center Channel 26.5 – 30GHz

💥 A	gilent 21:31:36 0	ct 25, 201	.8							
							M	kr1 33.5	75 9 GHz	
Ref 11	dBm	At	Atten 30 dB -39.03 d							
Peak										
Log										
аБ7										
DI										
-13.0										
dBm							1			
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0 00										
<b>f</b> (f)										
FTun	Marker									
Swp	33.5759000	00 GH:	z							
	-39 03 dBm									
	55.65 00									
Start 3	0.000 0 GHz						S	top 35.00	00 0 GHz	
#Res B	W 100 kHz			VBW 1 MH	lz		Sweep 4	62 ms (81	92 pts)	

Figure 89: Conducted Spurious Emissions, Center Channel 30 – 35GHz

🔆 Agilent 21:32:32 Oct 25, 2018										
								M	kr1 38.6	20 4 GHz
Ref 11	dBm		At	ten 30 di	Β			-31	.29 dBm	
Peak										
LOG										
DI										
-13.0								1		
авт				ياس با ا		Julius marshall	ار والمطلقين المحمولي ويحمد المطلقية محمد المر		define a special se	all strategy and the state
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FTun	Marke									
Swp	38.620	04000	00 GH:	Z						
	-31.29	A dRm								
Start 3	35.000 0 (	GHz						S	top 40.00	00 0 GHz
#Res BW 100 kHz				VBW 1 MH	łz		Sweep 4	62 ms (81	.92 pts)_	

Figure 90: Conducted Spurious Emissions, Center Channel 35 – 40GHz
🔆 A	gilent 01:05:57 00	ct 26, 201	.8						
							М	kr1 40.1	36 7 GHz
Ref -1	0 dBm		Ext Mix	{				-42	.02 dBm
#Peak									
Log									
dB/									
	1								
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Ă AA									
<b>£</b> (f):	Marker								
Flun	-10 1007000								
Swp	40.1307000	חט ששי.	2						
	42.02 dBm								
Start 4	0.000 0 GHz						S	top 50.00	00 0 GHz
#Res B	W 1 MHz			VBW 8 MH	Ηz	S	weep 50.	24 ms (8:	192 pts)

Figure 91: Conducted Spurious Emissions, Center Channel 40 – 50GHz

💥 А	gilent 01:	06:33 Oc	t 26,201:	.8						
								M	kr1 59.2	76 0 GHz
Ref -1	0 dBm			Ext Mix	{				-43	.33 dBm
#Peak										
Log										
10										
dB/										
										4
ы										<b>\$</b>
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Lau										
M1 S2										
S3 FC										
A AA										
<b>£</b> (f):	Maulia	-								
FTun	marke	Г 								
Swp	59.27	60000	00 GH:	Z						
	-433	3 dRm								
	- 10.0									
Start 5	0.000 0	GHz			1			S	top 60.00	00 0 GHz
#Res B	#Res BW 1 MHz				VBW 8 MH	łz	S	weep 50.	24 ms (81	l92 pts)

Figure 92: Conducted Spurious Emissions, Center Channel 50 – 60GHz

🔆 🕹	gilent 01::	17:36 Oc	t 26, 201:	.8						
								M	kr1 69.7	79 0 GHz
Ref -1	0 dBm			Ext Mix					-34	.57 dBm
#Peak		****************	*****************							
Log	g 🛛									
10										
dB/										
										1
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LgHv										
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n nn <b>r</b> (1)										
ETun	Marke	r								
Sup	69 77	annan	NN GH	7						
Jub	245	7 10	00 011	<b>~</b>						
	-34.5	/ dBm								
Start 6	60.000 0	GHz					_	S	top 70.00	00 0 GHz
#Res B	W 1 MHz				VBW 8 MF	lz	S	weep 50.	24 ms (81	l92 pts)_

Figure 93: Conducted Spurious Emissions, Center Channel 60 – 70GHz

🔆 A	gilent 01:1	.8 <b>:</b> 23 <u>O</u> c	t 26, 201	.8						
								M	kr1 74.9	50 6 GHz
Ref -1	0 dBm			Ext Mix					-31	.62 dBm
#Peak										
Log										
ab/					1					
	and a star of the last	A CALL AND A STATE	L	a lan an a that			and the class	ومتأول وليرو	a deal and the second	
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-13.0										
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FTun	Markei	-								
Swp	74.950	76000	00 GH:	Z						
	-21 61									
Start 7	'0.000 0 (	Hz						S	ton 80.00	10 0 GHz
#Res B	W 1 MHz				VBW 8 MH	łz	S	weep 50	24 ms (81	192 pts)

Figure 94: Conducted Spurious Emissions, Center Channel 70 – 80GHz

🔆 A	gilent 01:1	19:05 Oc	t 26, 201	.8								
								M	kr1 82.4	94 2 GHz		
Ref -1	0 dBm			Ext Mix	Ext Mix -32.71 dBm							
#Peak			****************									
Log												
aR/			1									
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-13.0 JP												
LgHv												
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Ă AA												
<b>£</b> (f):	<b>M</b> 1											
FTun	marke	r										
Swp	82.49	42000	00 GH:	Z								
	-327	1 dRm										
Start 8	0.000 0 1	GHz						S	top 90.00	00 0 GHz		
#Res B	W 1 MHz				VBW 8 MH	lz	S	weep 50.	24 ms (81	l92 pts)		

Figure 95: Conducted Spurious Emissions, Center Channel 80 – 90GHz

🔆 A	gilent 01:3	0:41 Oc	t 26,201	.8						
								M	kr1 92.1	73 1 GHz
Ref -1	0 dBm			Ext Mix					-30	.63 dBm
#Peak										
LOG										
10 10										
ub/			\$							
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						Contraction of the second s				
DI -13.0										
dBm										
LgAv										
M1 S2										
S3 FC										
A AA										
<b>£</b> (f): FTun	Marker									
Swp	92.173	1000	00 GH:	Z						
	-30.63	dBm								
Start 9	0.000 0 G	Hz						St	op 100.00	00 0 GHz
#Res BW 1 MHz					VBW 8 MH	lz	S	weep 50.	24 ms (81	l92 pts)

Figure 96: Conducted Spurious Emissions, Center Channel 90 – 100GHz

## 4.5 Radiated Spurious Emissions: (FCC Part §2.1053) (C63.26 Section 5.5.3)

The EUT must comply with the requirements for radiated spurious emissions. These emissions must meet the limits specified in §90.210 (c) for peak measurements.

Final testing was performed with the unit on a non-conducted 1.5 m high support.

## 4.5.1 Test Procedure

Radiated measurements using a standard OATS test arrangement. Direct field strength measurements of the maximum emission amplitude level (maximized as described previously), a signal generator and transmit antenna are substituted in place of the EUT. The output power of the signal generator is adjusted to replicate the maximized signal amplitude measured in the direct field strength measurement. The signal generator power setting is then used to determine the EIRP of the EUT spurious emission(s). The EIRP results were then compared to the limit of -13dBm. Test results are tabulated in Table 13 & Table 14.

Frequency (MHz)	Polarity	Azimuth	Ant. Height (m)	Spurious Level (dBuV)	Sub. Sig. Gen. Level	Sub. Power Level	Sub. Ant. Factor (dB)	Sub. Ant. Gain (dB)	EIRP Level (dBm)	Limit (dBm)	Margin (dB)
					(dBm)	(dBm)					
50.00	V	180.0	1.0	52.0	-29.5	-30.5	8.0	-3.8	-34.4	-13	-21.4
62.02	V	180.0	1.0	45.9	-37.9	-39.1	7.8	-1.7	-40.8	-13	-27.8
109.39	V	90.0	1.0	39.0	-38.7	-40.3	13.0	-2.0	-42.4	-13	-29.4
110.11	V	180.0	1.0	39.1	-38.5	-40.1	13.1	-2.1	-42.2	-13	-29.2
124.99	V	180.0	1.0	35.7	-40.2	-41.9	14.1	-2.0	-43.9	-13	-30.9
249.98	V	180.0	1.5	35.4	-50.2	-52.4	11.4	6.8	-45.6	-13	-32.6
319.61	V	180.0	1.5	29.7	-52.6	-55.0	13.9	6.4	-48.6	-13	-35.6
326.64	V	180.0	1.5	27.7	-54.6	-57.0	14.0	6.5	-50.5	-13	-37.5
332.17	V	180.0	1.5	26.5	-55.9	-58.3	14.0	6.6	-51.7	-13	-38.7
343.24	V	180.0	1.5	27.9	-54.2	-56.6	14.1	6.8	-49.8	-13	-36.8
375.01	V	135.0	1.8	37.8	-54.2	-56.7	15.0	6.7	-50.0	-13	-37.0
39.42	Н	180.0	4.0	45.7	-21.4	-22.3	14.5	-12.3	-34.6	-13	-21.6
50.00	Н	180.0	4.0	39.9	-41.8	-42.8	8.0	-3.8	-46.7	-13	-33.7
62.02	Н	180.0	4.0	41.4	-42.3	-43.5	7.8	-1.7	-45.2	-13	-32.2
70.22	Н	180.0	4.0	46.0	-37.5	-38.8	8.3	-1.2	-40.0	-13	-27.0
109.70	Н	135.0	4.0	39.6	-37.5	-39.1	13.1	-2.1	-41.2	-13	-28.2
110.58	Н	180.0	4.0	44.4	-32.6	-34.2	13.2	-2.1	-36.3	-13	-23.3
124.99	Н	180.0	4.0	43.3	-32.6	-34.3	14.1	-2.0	-36.3	-13	-23.3
249.98	Н	180.0	3.0	41.8	-44.1	-46.3	11.4	6.8	-39.5	-13	-26.5
319.61	Н	270.0	2.0	27.8	-54.4	-56.8	13.9	6.4	-50.4	-13	-37.4
326.64	Н	270.0	2.0	26.1	-56.1	-58.5	14.0	6.5	-52.0	-13	-39.0
332.17	Н	270.0	2.0	28.3	-53.9	-56.3	14.0	6.6	-49.7	-13	-36.7
343.28	Н	135.0	2.0	28.8	-53.4	-55.8	14.1	6.8	-49.0	-13	-36.0
375.01	Н	225.0	2.0	39.6	-41.4	-43.9	15.0	6.7	-37.2	-13	-24.2
400.00	Н	90.0	2.0	39.7	-41.7	-44.2	15.0	7.3	-37.0	-13	-24.0

Table 13: Radiated Emission Test Data < 1GHz

Frequency	Polarity	Azimuth	Ant.	Spurious	Sub. Sig.	Sub.	Sub. Ant.	Sub. Ant.	EIRP	Limit	Margin
(MHz)			Height	Level	Gen.	Power	Factor(dB)	Gain(dB)	Level	(dBm)	(dB)
			(m)	(dBuV)	Level	Level			(dBm)		
					(dBm)	(dBm)					
1374.99	V	0.0	1.0	47.9	-57.8	-62.8	25.3	7.7	-55.2	-13	-42.2
1625.07	V	45.0	1.0	46.7	-59.4	-64.9	25.2	9.2	-55.7	-13	-42.7
1875.00	V	45.0	1.0	47.1	-56.7	-62.7	26.5	9.2	-53.5	-13	-40.5
2325.58	V	180.0	1.0	53.7	-47.1	-53.9	28.2	9.3	-44.5	-13	-31.5
1374.99	Н	0.0	1.5	49.0	-56.6	-61.6	25.3	7.7	-54.0	-13	-41.0
1625.07	Н	45.0	1.5	47.0	-59.1	-64.6	25.2	9.2	-55.4	-13	-42.4
1875.00	Н	45.0	1.5	47.5	-56.3	-62.3	26.5	9.2	-53.1	-13	-40.1
2325.58	Н	180.0	1.6	54.2	-46.6	-53.4	28.2	9.3	-44.0	-13	-31.0

Table 14: Radiated Emissions Test Data > 1GHz

Radiated spurious emissions were scanned to 40GHz.

## 4.6 Frequency Stability: (FCC Part §2.1055) (C63.26 Section 5.6)

Frequency as a function of temperature and voltage variation shall be maintained within the FCC-prescribed tolerances.

The temperature stability was measured with the unit in an environmental chamber used to vary the temperature of the sample. The sample was held at each temperature step to allow the temperature of the sample to stabilize.

The radio circuitry has several supplies. 24VDC is supplied to the System Data Processor card, which provides the 1GHz clock to the Up Converter/Receiver module. The Up converter/Receiver is powered via 12VDC. To demonstrate the frequency stability of the system due to voltage variations, both power supplies were varied using an external adjustable power supply to 85% of the normal input voltage and 115% of the normal voltage. The frequency of the Center channel was measured and recorded at each voltage setting. Results are found in Table 16.

The frequency stability of the transmitter was examined for the temperature range of  $-30^{\circ}$ C to  $+50^{\circ}$ C. The carrier frequency was measured while the EUT was in the temperature chamber. The reference frequency of the EUT was measured at the ambient room temperature with the spectrum analyzer. The results are found in Table 15 & Table 16.

Temperature (C)	Frequency (MHz)	Deviation (Hz)	Limit (+/- Hz)1	Pass/Fail
22(ambient)	9749.923356	0	-	NA
-30	9749.961122	37766	-	Pass
-20	9749.961899	38543	-	Pass
-10	9749.962544	39188	-	Pass
0	9749.964735	41379	-	Pass
10	9749.964855	41499	-	Pass
20	9749.923368	12	-	Pass
30	9749.908969	-14387	-	Pass
40	9749.902568	-20788	-	Pass
50	9749.877004	-46352	-	Pass

Table 15: Frequency Deviation as a Function of Temperature (2D\_A J5)

<sup>1</sup> Per FCC 90.213(a) the required tolerance is determined during licensing.

	1		8 ( =	/
Voltage	Frequency (MHz)	Deviation (Hz)	Limit (+/Hz)	Pass/Fail
Nominal Voltage	9749.923356	0	None	NA
110% of Nominal Voltage (26.4Vdc)	9749.922899	-457	None	Pass
85% of Nominal Voltage (20.6Vdc)	9749.923555	199	None	Pass

 Table 16: Frequency Deviation as a Function of Voltage (2D\_A J5)

Table 17: Frequency Deviation as a Function of Temperature (3D\_A J4)

Temperature(C)	Frequency (MHz)	Deviation (Hz)	Limit	Pass/Fail
20(ambient)	9749.922896	0	None	NA
-30	9749.961441	38545	None	Pass
-20	9749.962566	39670	None	Pass
-10	9749.963251	40355	None	Pass
0	9749.964780	41884	None	Pass
10	9749.943987	21091	None	Pass
20	9749.922934	38	None	Pass
30	9749.911158	-11738	None	Pass
40	9749.899811	-23085	None	Pass
50	9749.875190	-47706	None	Pass

Voltage	Frequency (MHz)	Deviation (Hz)	Limit (+/- Hz)	Pass/Fail
Nominal Voltage	9749.922896	0	974992	NA
110% of Nominal Voltage (26.4Vdc)	9749.923658	762	974992	Pass
85% of Nominal Voltage (20.4Vdc)	9749.922998	102	974992	Pass

Table 18: Frequency	<b>Deviation as a Function of</b>	Voltage (3D A J4)
rubic rot requency	Deviation us a r unction of	