Test of: RADWIN JET DUO

To: FCC Part 90 Subpart Z & ISED RSS-197

Test Report Serial No.: RDWN50-U6 Rev B

TEST REPORT

FROM

MiCOM Labs

Test of: RADWIN JET DUO

To: FCC Part 90 Subpart Z & ISED RSS-197

Test Report Serial No.: RDWN50-U6 Rev B

This report supersedes: NONE

Manufacturer: RADWIN Ltd
27 Habarzel Street
Tel Aviv, 6971039
Israel

Product Function: Dual Band 3.x and 5.x GHz Base Station Outdoor Radio with Beamforming Antenna

Copy No: pdf **Issue Date:** 26th February 2018

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
575 Boulder Court
Pleasanton, CA 94566 USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com

A2LA ACCREDITED
TESTING CERT #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

This page has been left intentionally blank

TABLE OF CONTENTS

ACCREDITATION, LISTINGS and RECOGNITION

TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 4th day of February 2016.

President and CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to January 31, 2018
Revised November 22, 2017

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

RECOGNITION

MiCOM Labs, Inc has widely recognized Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA** countries. Our test reports are widely accepted for global type approvals.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.
Phase I - recognition for product testing
Phase II – recognition for both product testing and certification
N/A – Not Applicable

**EU MRA – European Union Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries.

**NB – Notified Body

PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard EN ISO/IEC 17065. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-02.pdf

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Requirements for bodies certifying products, processes and services*. This product certification body also meets the *A2LA R322 – Specific Requirements – Notified Body Accreditation Requirements* and *A2LA R308 - Specific Requirements - ISO-IEC 17065 - Telecommunication Certification Body Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.

Presented this 4th day of February 2016.

President and CEO
For the Accreditation Council
Certificate Number 2381.02
Valid to January 31, 2018
Revised November 22, 2017

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.

United States of America – Telecommunication Certification Body (TCB)
TCB Identifier – US0159

Industry Canada – Certification Body
CAB Identifier – US0159

Europe – Notified Body
Notified Body Identifier - 2280

Japan – Recognized Certification Body (RCB)
RCB Identifier - 210

DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft	30th November 2017	
Draft #2	22nd December 2017	
Rev A	26th December 2017	Initial Release
Rev B	26th February 2018	Updated Normative References to include latest KDB and ANSI C63.26

1. TEST RESULT CERTIFICATE

Manufacturer :	RADWIN Ltd 27 Habarzel Street Tel Aviv, 6971039 Israel	Tested By:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California, 94566 USA
EUT:	Dual Band 3.x and 5.x GHz Base Station Outdoor Radio With Beamforming Antenna	Telephone:	+1 925 462 0304
Model:	RADWIN JET DUO	Fax:	+1 925 462 0306
S/N:	Prototype		
Test Date(s):	25th Oct - 20th Nov 2017	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC Part 90 Subpart Z & ISED RSS-197	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

A2LA ACCREDITED
TESTING CERT #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
I	KDB 971168 D01 v03	Oct. 2017	Measurement Guidance For Certification Of Licensed Digital Transmitters
II	FCC 47 CFR Part 90	2013	Code of Federal Regulations
III	RSS-197	Feb 2010	Wireless Broadband Access Equipment Operating in the Band 3650–3700 MHz
IV	ANSI C63.4	2014	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
V	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
VI	ANSI C63.26	2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
VII	A2LA	August 2017	R105 - Requirement's When Making Reference to A2LA Accreditation Status
VIII	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
IX	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
X	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
XI	CISPR 32	2015	Electromagnetic compatibility of multimedia equipment - Emission requirements
XII	RSS-Gen Issue 4	November 2014	General Requirements and Information for the Certification of Radiocommunication Equipment
XIII	FCC 47 CFR Part 2.1033	2016	FCC requirements and rules regarding photographs and test setup diagrams.

2.2. Test and Uncertainty Procedures

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description
Purpose:	Test of the RADWIN JET DUO to FCC Part 90 Subpart Z & ISED RSS-197 regulations.
Applicant:	RADWIN Ltd 27 Habarzel Street Tel Aviv, 6971039 Israel
Manufacturer:	As Applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton, California 94566 USA
Test report reference number:	RDWN50-U6 Rev B
Date EUT received:	16th October 2017
Dates of test (from - to):	25th Oct - 20th Nov 2017
Standard(s) applied:	FCC Part 90 Subpart Z & ISED RSS-197
No of Units Tested:	1
Type of Equipment:	Dual Band 3.x and 5.x GHz Base Station Outdoor Radio with Beamforming Antenna
Manufacturers Trade Name:	RADWIN
Model(s):	RADWIN JET DUO
Location for use:	Outdoor use only
Declared Frequency Range(s):	Transmit: 3,650 – 3,700 MHz, Receiver: 3,650 – 3,700 MHz
Type of Modulation:	BPSK, QPSK, 16QAM, 64QAM, 256QAM
Operational Bandwidths:	10, 20, 40 MHz
Declared Maximum Output Power:	+37 dBm conducted
ITU Emission Designator:	10M0W7W 20M0W7W 40M0W7W
Transmit/Receive Operation:	Time Division Duplex (TDD)
Rated Input Voltage and Current:	POE: 115Vac 60Hz / +55 Vdc 1.0 A
Operating Temperature Range:	Client declared: -40ºC to +60ºC
Equipment Dimensions:	2.6 / 14.2 / 13.9 in
Weight:	14.0 lb
Primary function of equipment:	Dual Band 3.x and 5.x GHz Base Station Outdoor Radio with Beamforming Antenna

3.2. Scope of Test Program

The scope of the test program was to test the RADWIN JET DUO for compliance against;-

FCC 47 CFR Part 90, Subpart Z & IC RSS-197 regulatory requirements.

The RADWIN JET DUO has three operational bandwidths 10, 20, 40 MHz with 5 modulation schemes BPSK, QPSK, 16QAM, 64QAM, 256QAM in the frequency range 3650 to 3700 MHz.

An investigation was undertaken to identify worst case modulation, see Section APPENDIX A.2 WORST CASE COMPARISON. Modulation states - BPSK, QPSK, 16 QAM, 64QAM, 256QAM.

The following tests were completed to find worst-case condition;

i).. Power Spectral Density (A.2.1)

ii).. Occupied Bandwidth (A.2.2)

Based on the above results BPSK was found to be worst-case. This program therefore focuses on BPSK modulation on low, mid and high channels.

Per Part 90 Subpart Z, 90.1319 & RSS-197 Section 4.2 the RADWIN JET DUO equipment incorporates a contention-based protocol (CBP) therefore this device has access to the full 50 MHz frequency band (3,650 – 3700 MHz).

Compliance with §90.1321(b)(1) - Different Information Transmitted to each Receiver
Manufacturer declared that the product firmware is configured at the factory so that the two streams of the MIMO transmitter emit different information to each receiver at each port under all conditions (modulations and data rates).

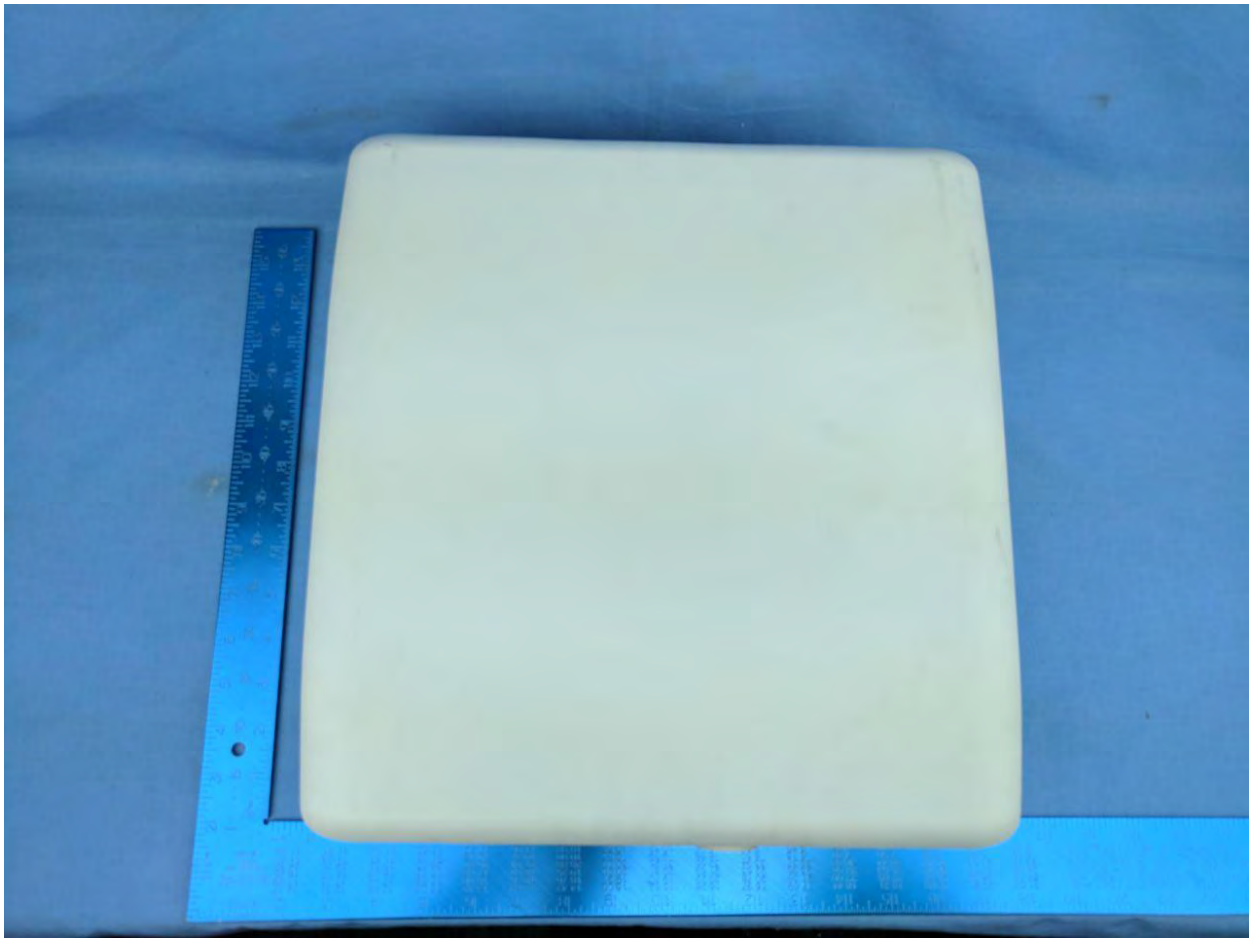
Supporting Information

The RADWIN JET DUO device is manufactured with an integral antenna only (no antenna connectors were available) therefore all measurements were performed radiatively. Antenna gains are declared under Section 3.4 Antenna Details. Device operates with dual polarized transmitters (H+V). Both transmitters were operational during the entire test program and therefore KDB 662911 D01 Multiple Transmitter Output v02r01 was considered during testing. This implies no conducted measurements (i.e., power referenced to the antenna terminals) could be performed.

Co-Location

Co-location testing was performed with the 3.6 GHz and 5 GHz transmitters operating simultaneously, results are on file with MiCOM Labs.

RADWIN JET DUO



RADWIN JET DUO
POE Injector

3.3. Equipment Model(s) and Serial Number(s)

EUT/ Support	Manufacturer	Equipment Description (Including Brand Name)	Model No.	Serial No.
EUT	RADWIN Ltd.	Dual Band 3.x and 5.x GHz Base Station Outdoor Radio with Beamforming Antenna	RADWIN JET DUO	Prototype
EUT	SINPRO	Power Injector for Power Over Ethernet (POE) 100-240V / 50-60Hz: 55 Vdc, 1.0 A	CPU55A-270-1 Rev B	C35473741322
Support	Laptop	Computer		

3.4. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
integral	RADWIN Ltd.	SA0199500	Panel	9.0	8.0	17	Yes	3650-3700
integral	RADWIN Ltd.	SA0199500	Panel	9.0	--	70	Yes	3650-3700

BF Gain - Beamforming Gain
Dir BW - Directional BeamWidth
X-Pol - Cross Polarization

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 2 x 10/100/1000 BT Ethernet

3.6. Test Configurations

Matrix of test configurations

Parameter	Operational Mode	Test Conditions	Bandwidths (MHz)
99% Occupied BW	Modulated - BPSK	Ambient, 55 Vdc (POE)	10, 20, 40
Output power			
Peak Power Spectral Density			
Frequency Stability	Modulated	Temperature (-40°C to +60°C) and Voltage Variations (55, 46.75, 63.25 Vdc)	Carrier Breakthrough
Radiated Spurious Emissions	Modulated	Ambient, 55 Vdc	10
Radiated Band-Edge	Modulated	Ambient, 55 Vdc	10, 20, 40
AC Wireline Emissions	Modulated	Ambient, 55 Vdc	10

BW (MHz)	Modulation		
	BPSK, QPSK, 16QAM, 64QAM, 256QAM		
	Low (MHz)	Mid (MHz)	High (MHz)
10	3656.00	3675.00	3694.00
20	3661.00	3675.00	3689.00
40	3670.00	3675.00	3680.00

3.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

3.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

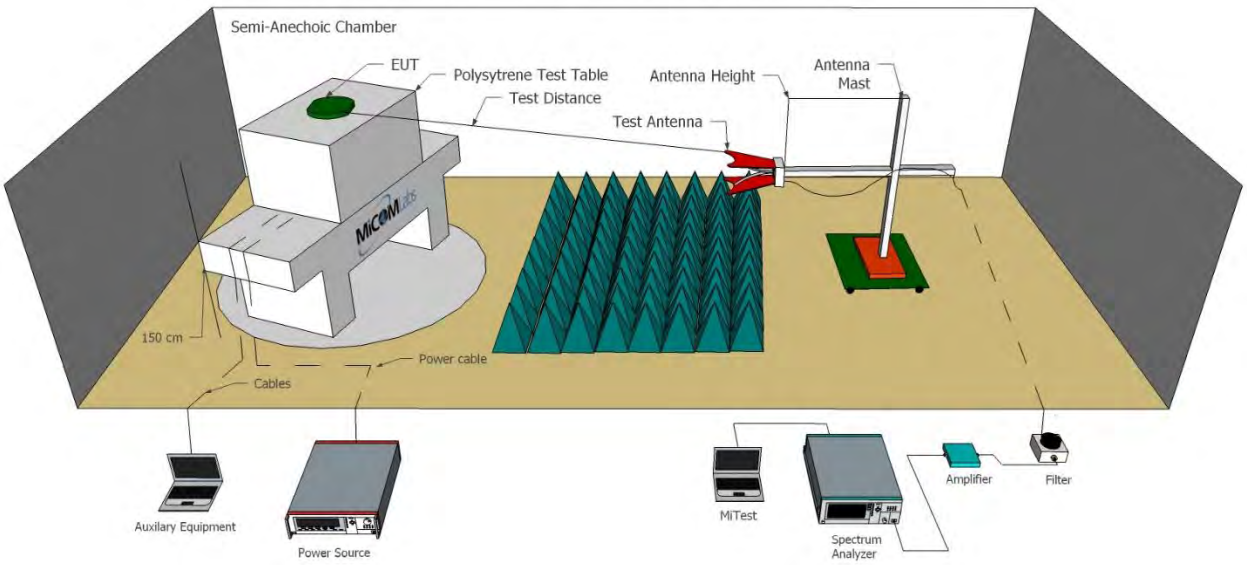
1. NONE

4. TEST EQUIPMENT CONFIGURATIONS

4.1. Radiated Testing

The following tests were performed using the radiated test set-up shown in the diagram below. Radiated emissions above 1GHz.

Radiated Emissions Above 1GHz Test Setup



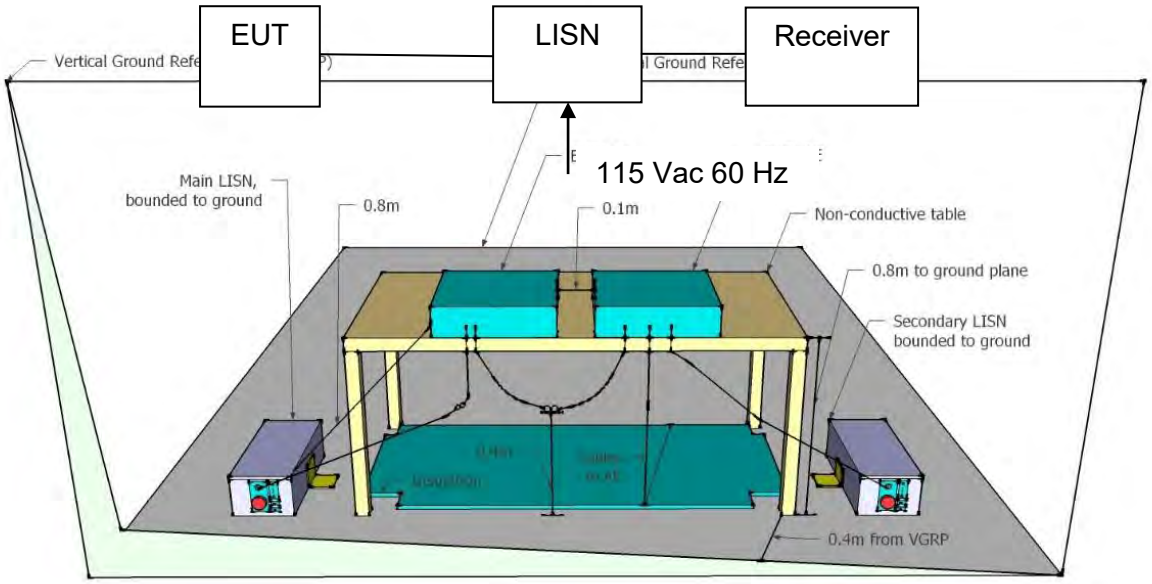
A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	30 Nov 2017
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CU101	04R08507	Not Required
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	2 May 2018
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	5 Oct 2018
373	26III RMS Multimeter	Fluke	Fluke 26 series III	76080720	21 Sep 2018
377	Band Rejection Filter 5150 to 5880MHz	Microtronics	BRM50716	034	6 Oct 2018
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	12 Oct 2018
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	12 Oct 2018
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	12 Oct 2018
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
447	MiTest Rad Emissions Test Software v1.0	MiCOM	Test Software	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	4 Oct 2018
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	4 Oct 2018
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	4 Oct 2018
480	Cable - Bulkhead to Amp	SRC Haverhill	157-3050360	480	6 Oct 2018
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-3050787	481	6 Oct 2018
482	Cable - Amp to Antenna	SRC Haverhill	157-3051574	482	6 Oct 2018

4.2. ac Wireline

The ac Wireline Conducted Emissions test was performed using the conducted test set-up shown in the diagram below.

Test Measurement Set up



Assets Utilized for ac Wireline Emission Testing

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	30 Nov 2017
184	Pulse Limiter	Rhode & Schwarz	ESH3Z2	357.8810.52	6 Oct 2018
190	LISN (two-line V-network)	Rhode & Schwarz	ESH3Z5	836679/006	18 Oct 2018
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	2 May 2018
307	BNC-CABLE	Megaphase	1689 1GVT4	15F50B002	6 Oct 2018
316	Dell desktop computer workstation	Dell	Desktop	WS04	Not Required
372	AC Variable PS	California Instruments	1251P	L06951	Cal when used
388	LISN (3 Phase) 9kHz - 30MHz	Rohde & Schwarz	ESH2-Z5	892107/022	20 Oct 2018
496	MiTest Conducted Emissions test software.	MiCOM	Version 1.0	496	Not Required

5. MEASUREMENT AND PRESENTATION OF TEST DATA

The conducted measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by MiTest. MiTest is an automated test system developed by MiCOM Labs. MiTest is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.

The MiCOM Labs "MiTest" Automated Test System" (Patent Pending)

6. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 90**, **Subpart Z** & RSS-197.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
2.1049 **90.209** **5.2**	99% Occupied Bandwidth	Bandwidth measurement(s)	Radiated	Complies	7.1.1
2.1046; **90.1321 (a)** **5.6**	EIRP Rated Power	Modulated Output Power	Radiated	Complies	7.1.2
2.1046; **90.1321 (a)** **5.6**	Peak EIRP Power Density	Maximum Spectral Density	Radiated	Complies	7.1.3
90.210(b)	Emission Mask	Spectrum Mask	Radiated	Complies	7.1.4
Subpart C **90.1335**	Maximum Permissible Exposure	Exposure to radio frequency energy levels	Radiated	Complies	See MPE report
2.1055(a)(1) **90.213** **5.3**	Frequency Stability	Includes temperature and voltage variations	Radiated	Complies	7.1.5
2.1053; **90.1323** **ANSI/TIA-603** 5.7	Radiated Spurious Emissions	Spurious emissions	Radiated	Complies	7.1.6/ 7.1.7
15.205/ **§15.209** **RSS Gen §8.9, 8.10**	Radiated Digital Emissions	Digital Emissions	Radiated	Complies	7.1.8
	Contention Based Protocol		Declaration	Client Declaration	
15.207 **RSS Gen §8.8**	AC Wireline Conducted	Emissions 150 kHz–30 MHz	Conducted	Complies	7.1.9

Note 1: *Test results reported in this document relate only to the items tested*
Note 2: *The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria*
Note 3: *Section 3.7 'Equipment Modifications' highlight the equipment modifications that were required to bring the product into compliance with the above matrix*

7. TEST RESULTS

7.1.1. Occupied Bandwidth

FCC 47 CFR Part 90.209, Subpart Z; 2.1049,
ISED RSS-197 § 5.2

Test Procedure
The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure the 99% occupied bandwidth. The system highest power setting was selected with modulation ON.

The measurement of channel bandwidth used a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission.

Test Set-up is shown in Section 4.1 Test Equipment Configurations/Radiated Testing

Ambient conditions.
Temperature: 19 to 26 °C Relative humidity: 31 to 57 % Pressure: 999 to 1009 mbar

Equipment Configuration for 26 dB & 99% Occupied Bandwidth			
Variant:	10 MHz	**Duty Cycle (%):**	99.0
Data Rate:	-	**Antenna Gain (dBi):**	9
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 26 dB Bandwidth (MHz) Port(s)				26 dB Bandwidth (MHz)			
MHz	H	V			Highest	Lowest		
3656		11.66		--	11.66	11.66		
3675		11.54		--	11.54	11.54		
3694		11.46		--	11.46	11.46		

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				99% Bandwidth (MHz)			
MHz	H	V			Highest	Lowest		
3656		8.94		--	8.94	8.94		
3675		8.94		--	8.94	8.94		
3694		8.94		--	8.94	8.94		

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Worst case Configuration shown

Equipment Configuration for 26 dB & 99% Occupied Bandwidth			
Variant:	20 MHz	**Duty Cycle (%):**	99.0
Data Rate:	-	**Antenna Gain (dBi):**	9
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 26 dB Bandwidth (MHz) Port(s)				26 dB Bandwidth (MHz)			
MHz	H	V			Highest	Lowest		
3661		22.42		--	22.42	22.42		
3675		22.63		--	22.63	22.63		
3689		22.69		--	22.69	22.69		

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				99% Bandwidth (MHz)			
MHz	H	V			Highest	Lowest		
3661		17.80		--	17.80	17.80		
3675		17.88		--	17.88	17.88		
3689		17.88		--	17.88	17.88		

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Worst case Configuration shown

Equipment Configuration for 26 dB & 99% Occupied Bandwidth

Variant:	40 MHz	**Duty Cycle (%):**	99.0
Data Rate:	-	**Antenna Gain (dBi):**	9
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 26 dB Bandwidth (MHz) Port(s)				26 dB Bandwidth (MHz)			
MHz	**H**	**V**			**Highest**	**Lowest**		
3670	43.69				43.69	43.69		
3675	43.87			--	43.87	43.87		
3680		43.55			43.55	43.55		

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				99% Bandwidth (MHz)			
MHz	**H**	**V**			**Highest**	**Lowest**		
3670	36.55				36.55	36.55		
3675	36.39			--	36.39	36.39		
3680		36.39			36.39	36.39		

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Worst case Configuration shown

7.1.2. Peak Output Power

FCC 47 CFR Part 90, Subpart Z; §90.1321(a),
ISED RSS-197 § 5.6

The following power limits apply to the 3650 – 3675 MHz band.

Base and fixed stations are limited to 25W/25 MHz equivalent isotropically radiated power (EIRP). In any event the peak EIRP power density shall not exceed 1 Watt (+30 dBm) in any one Megahertz slice of spectrum.

EIRP Power Limit 10 MHz Channel Spacing = 40.0 dBm
EIRP Power Limit 20 MHz Channel Spacing = 43.0 dBm
EIRP Power Limit 40 MHz Channel Spacing = 46.0 dBm

Test Procedure
Radiated measurements used for compliance with conducted limits, the following steps are required to ensure that the total emission power is determined for equipment driving cross polarized antennas:

(1) Measure radiated emissions with vertical and horizontal polarizations of the measurement antenna;
(2) Convert each radiated measurement to transmit power based on the antenna gain;

EIRP level to an equivalent electric field strength using the following relationship:
E = EIRP – 20*log (D) + 104.8

Where:
E = electric field strength in dBµV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

(3) Sum the powers across the two polarizations to compare the resultant electric field strength level to the applicable limit.

Calculated Power = A + G + Y+ 10 log (1/x) dBm

A = Total Power [10*Log10 ($10^{a/10}$ + $10^{b/10}$ + $10^{c/10}$ + $10^{d/10}$)]
G = Antenna Gain
Y = Beamforming Gain
x = Duty Cycle (average power measurements only)

Test Set-up is shown in Section 4.1 Test Equipment Configurations/Radiated Testing

Ambient conditions.
Temperature: 19 to 26 °C Relative humidity: 31 to 57 % Pressure: 999 to 1009 mbar

Equipment Configuration for Peak Transmit Power			
Variant:	10 MHz	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	OC
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm) Port(s)				Calculated Total Power	Total EIRP	Limit EIRP	Margin	EUT Power Setting
MHz	H	V			Σ Port(s) dBm	dBm	dBm	dBm	
3656	24.43	25.16	--	--	30.59	39.59	40	-0.41	18.5
3675	23.97	25.63	--	--	30.66	39.66	40	-0.34	21.0
3694	22.75	22.61	--	--	28.46	37.46	40	-2.54	15.0

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

Total EIRP Calculation
Total EIRP = 10 * Log(10^(EIRP Polarity (H/10))+10^(EIRP Polarity (V/10)))

Equipment Configuration for Peak Transmit Power			
Variant:	20 MHz	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	OC
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm) Port(s)				Calculated Total Power	Total EIRP	Limit EIRP	Margin	EUT Power Setting
MHz	H	V			Σ Port(s) dBm	dBm	dBm	dBm	
3661	24.57	24.62	--	--	30.38	39.38	43	-3.63	19.5
3675	27.70	27.75	--	--	33.51	42.51	43	-0.50	20.0
3689	25.1	25.34	--	--	31.00	40.00	43	-3.63	16.5

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

Total EIRP Calculation
Total EIRP = 10 * Log(10^(EIRP Polarity (H/10))+10^(EIRP Polarity (V/10)))

Equipment Configuration for Peak Transmit Power			
Variant:	40 MHz	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	OC
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm) Port(s)				Calculated Total Power	Total EIRP	Limit EIRP	Margin	EUT Power Setting
MHz	H	V			Σ Port(s) dBm	dBm	dBm	dBm	
3670	26.71	26.0	--	--	32.15	41.15	46	-4.87	19.5
3675	31.15	30.87	--	--	36.79	45.79	46	-0.23	24.0
3680	24.7	24.99	--	--	30.63	39.63	46	-6.39	18.0

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

NOTE: the antenna gain shown in the above matrix is different for each of the three antenna chains

Total EIRP Calculation
Total EIRP = 10 * Log(10^(EIRP Polarity (H/10))+10^(EIRP Polarity (V/10)))

7.1.3. Power Spectral Density

FCC 47 CFR Part 90, Subpart Z; §90.1321(a),
ISED RSS-197 § 5.6

The following power limits apply to the 3650 – 3700 MHz band.

Base and fixed stations are limited to 25W/25 MHz equivalent isotropically radiated power (EIRP). In any event the peak EIRP power density shall not exceed 1 Watt (+30 dBm) in any one Megahertz slice of spectrum.

EIRP Power Limit is constant for all channel bandwidths = +30.0 dBm/MHz (137 dBuv/MHz)

Test Procedure
Radiated measurements used for compliance with conducted limits, the following steps are required to ensure that the total emission power s determined for equipment driving cross polarized antennas:

(1) Measure radiated emissions with vertical and horizontal polarizations of the measurement antenna;
(2) Convert each radiated measurement to transmit power based on the antenna gain;

EIRP level to an equivalent electric field strength using the following relationship:
E = EIRP – 20*log (D) + 104.8

Where:
E = electric field strength in dBµV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

(3) Sum the powers or PSDs across the two polarizations to compare the resultant electric field strength level to the applicable limit.

Calculated Power = A + G + Y+ 10 log (1/x) dBm

A = Total Power [10*Log10 ($10^{a/10}$ + $10^{b/10}$ + $10^{c/10}$ + $10^{d/10}$)]
G = Antenna Gain
Y = Beamforming Gain
x = Duty Cycle (average power measurements only)

Test Set-up is shown in Section 4.1 Test Equipment Configurations/Radiated Testing

Ambient conditions.
Temperature: 19 to 26 °C Relative humidity: 31 to 57 % Pressure: 999 to 1009 mbar

Equipment Configuration for Power Spectral Density			
Variant:	10 MHz	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9.00
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/MHz)				Total EIRP	Limit	Margin
MHz	H	V			dBm /MHz	dBm /MHz	dB
3656	5.39	5.18			20.07	30	-9.93
3675	10.71	10.71			25.49	30	-4.51
3694	7.12	6.97			21.83	30	-8.17

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Limit 137 dBuV/MHz = +30 dBm

Total Power Density EIRP Calculation
Total EIRP = 10 * Log(10^(EIRP Polarity (H/10))+10^(EIRP Polarity (V/10)))

Equipment Configuration for Power Spectral Density			
Variant:	20 MHz	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/MHz)				Total EIRP	Limit	Margin
MHz	H	V			dBm /MHz	dBm /MHz	dB
3661	7.36	7.37		--	22.15	30	-7.85
3675	5.72	5.72		--	20.50	30	-9.50
3689	6.29	6.31		--	21.08	30	-8.92

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Limit 137 dBuV/MHz = +30 dBm

Total Power Density EIRP Calculation
Total EIRP = 10 * Log(10^(EIRP Polarity (H/10))+10^(EIRP Polarity (V/10)))

Equipment Configuration for Power Spectral Density			
Variant:	40 MHz	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/MHz)				Total EIRP	Limit	Margin
MHz	H	V			dBm /MHz	dBm /MHz	dB
3670	7.79	7.21			22.29	30	-7.71
3675	7.04	6.88		--	21.74	30	-8.26
3680	6.55	6.78			21.45	30	-8.55

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Limit 137 dBuV/MHz = +30 dBm

Total Power Density EIRP Calculation
Total EIRP = 10 * Log(10^(EIRP Polarity (H/10))+10^(EIRP Polarity (V/10)))

7.1.4. Spectrum Mask

FCC Part 90.210(b),

(b) Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

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

(n) *Other frequency bands.* Transmitters designed for operation under this part on frequencies other than listed in this section must meet the emission mask requirements of Emission Mask B. Equipment operating under this part on frequencies allocated to but shared with the Federal Government, must meet the applicable Federal Government technical standards.

(o) *Instrumentation.* The reference level for showing compliance with the emission mask shall be established, except as indicated in §§90.210 (d), (e), and (k), using standard engineering practices for the modulation characteristic used by the equipment under test. When measuring emissions in the 150-174 MHz and 421-512 MHz bands the following procedures will apply. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For frequencies more than 50 kHz removed from the edge of the authorized bandwidth a resolution of at least 100 kHz must be used for frequencies below 1000 MHz. Above 1000 MHz the resolution bandwidth of the instrumentation must be at least 1 MHz. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, then an alternate procedure may be used provided prior Commission approval is obtained.

Top of mask set with combined radiated power for each frequency and mode.

10 MHz Spectrum Mask Compliance

For the 10 MHz operational bandwidth a resolution bandwidth narrower than 1 MHz was used in order to prove compliance with the spectrum mask. The RBW was scaled to 100 kHz and the spectrum mask adjusted in line with the scaling factor (10 dB).

Per FCC scaling of RBW is appropriate only when the signal is noise like and relatively flat across the spectrum under measurement.

Equipment Configuration for Spectrum Mask			
Variant:	10 MHz	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9.0
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results					
Test Frequency	**Measured Spectrum Mask**				**Complies**
MHz	**H**				**Pass/Fail**
3656	PASS				PASS
3675	PASS				PASS
3694	PASS				PASS

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Spectrum Mask			
Variant:	20 MHz	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9.0
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results					
Test Frequency	**Measured Spectrum Mask**				**Complies**
MHz	**H**				**Pass/Fail**
3661	PASS				PASS
3675	PASS				PASS
3689	PASS				PASS

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Spectrum Mask			
Variant:	40 MHz	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9.0
Modulation:	BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results					
Test Frequency	**Measured Spectrum Mask**				**Complies**
MHz	**H**				**Pass/Fail**
3670	PASS				PASS
3675	PASS				PASS
3680	PASS				PASS

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

7.1.5. Frequency Stability; Temperature Variations, and Voltage Variations

FCC 47 CFR Part 90.213, Subpart Z; 2.1055(a)(1),
ISED RSS-197 § 5.3

Test Procedure
The transmitter output was connected to a spectrum analyzer and the frequency stability was measured in a modulated operational mode as the transmitter could not operate Continuous Wave (CW). Carrier breakthrough was available to provide a measurement point.

Frequency stability was measured through the extremes of temperature on the mid channel and a single operating mode only. Before measurements were taken at each temperature the equipment waited until thermal balance was obtained.

Test Set-up is shown in Section 4.1 Test Equipment Configurations/Radiated Testing

Ambient conditions.
Temperature: 19 to 26 °C Relative humidity: 31 to 57 % Pressure: 999 to 1009 mbar

TABLE OF RESULTS Frequency Stability – Channel Measured 3660.0 MHz

Manufacturers Specification for Frequency Stability

As no apparent frequency stability limits were provided the manufacturer's specification was used ±20 ppm.

7.1.5.1. Frequency Stability; Temperature Variations, and Voltage Variations, FCC

Equipment Configuration for Carrier Frequencies			
Variant:	20 MHz	**Duty Cycle (%):**	99
Data Rate:	Not Applicable	**Antenna Gain (dBi):**	Not Applicable
Modulation:	BPSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	CC
Engineering Test Notes:	Transmitter carrier breakthrough was used for test purposes		

Test Measurement Results

Test frequency	3660 MHz	Measured Frequency	Frequency Error		Limit	Margin
Temperature	**Voltage**	**Hz**	**kHz**	**ppm**	**ppm**	**ppm**
20 °C	**55.0 Vdc**	3599.998577	0.00	0.00	-20 to +20	-20.00
	46.75 Vdc	3599.988675	-9.90	-2.75	-20 to +20	-17.25
	63.25 Vdc	3599.988675	-9.90	-2.75	-20 to +20	-17.25
-40 °C	**55 Vdc**	3599.997532	-1.04	-0.29	-20 to +20	-19.71
-30 °C		3599.996992	-1.58	-0.44	-20 to +20	-19.56
-20 °C		3599.996130	-2.45	-0.68	-20 to +20	-19.32
-10 °C		3599.997203	-1.37	-0.38	-20 to +20	-19.62
0 °C		3599.997436	-1.14	-0.32	-20 to +20	-19.68
10 °C		3599.998389	-0.19	-0.05	-20 to +20	-19.95
30 °C		3599.997555	-1.02	-0.28	-20 to +20	-19.72
40 °C		3599.997143	-1.43	-0.40	-20 to +20	-19.60
50 °C		3599.996393	-2.18	-0.61	-20 to +20	-19.39
60 °C		3599.996146	-2.43	-0.68	-20 to +20	-19.32

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-02 MEASURING FREQUENCY
Measurement Uncertainty:	±0.86 ppm

Note: click the links in the above matrix to view the graphical image (plot).

7.1.5.2. Frequency Stability; Temperature Variations, and Voltage Variations, RSS-197

Per RSS-197 sec 5.3:
The applicant shall ensure frequency stability by showing that fL minus the frequency offset and fH plus the frequency offset shall be within the 3650-3700 MHz band.

Frequency Stability (RSS-197) Band Edge = 3650 MHz					
Frequency (MHz)	**Variant**	**Bandwidth (MHz)**	**Reference Point F_L (MHz)**	**Worst Case Frequency Error (MHz)**	**F_L - Offset**
3656	BPSK	10	3650.16	0.009	3650.15
3661	BPSK	20	3650.08	0.009	3650.07
3670	BPSK	40	3650.06	0.009	3650.05

Frequency Stability (RSS-197) Band Edge = 3700 MHz					
Frequency (MHz)	**Variant**	**Bandwidth (MHz)**	**Reference Point F_H (MHz)**	**Worst Case Frequency Error (MHz)**	**F_H + Offset**
3694	BPSK	10	3699.986	0.009	3699.995
3689	BPSK	20	3699.930	0.009	3699.939
3689	BPSK	20	3699.930	0.009	3699.939

7.1.6. TX Spurious & Restricted Band Emissions

FCC 47 CFR Part 90, Subpart Z; §90.1323, 2.1053;
ISED RSS-197 § 5.7
ANSI/TIA-603

Test Procedure
Measurements were made while EUT was operating in a modulated transmit mode of operation, at the appropriate center frequency. Substitution was performed on any emissions observed.

The measurement equipment was set to measure in peak hold mode. The emissions were measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode.

The highest emissions relative to the limit are listed for each frequency band measured.

Limit
For operation in the 3650 – 3700 band the power of any emission outside the frequency band of operation shall be attenuated below the transmitter power (P) within the licensed band of operation, measured in Watts, by at least 43 + 10*Log (P) = -13dBm.

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'

RADWIN Ltd. SA0199500 17 dBi (9 dBi Gain + 8 dB Beamforming)

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	SA0199500	**Variant:**	10 MHz
Antenna Gain (dBi):	17.00	**Modulation:**	
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	
Channel Frequency (MHz):	3656.00	**Data Rate:**	3.25 Mbit/s
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3657.31	67.21	2.67	33.50	103.03	Fundamental	Horizontal	162	0	--	--	Pass
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	SA0199500	**Variant:**	10 MHz
Antenna Gain (dBi):	17.00	**Modulation:**	
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	
Channel Frequency (MHz):	3675.00	**Data Rate:**	3.25 Mbit/s
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3675.61	70.74	2.71	33.11	106.56	Fundamental	Horizontal	150	0	--	--	Pass
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	SA0199500	**Variant:**	10 MHz
Antenna Gain (dBi):	17.00	**Modulation:**	
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	
Channel Frequency (MHz):	3694.00	**Data Rate:**	3.25 Mbit/s
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3691.38	69.42	2.68	33.22	105.32	Fundamental	Horizontal	162	0	--	--	Pass
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber.												

7.1.7. Restricted Edge & Band Edge Emissions

RESULTS SUMMARY FOR RADIATED BAND-EDGE EMISSIONS

7.1.7.1.1. BPSK:

3650 MHz Radiated Lower Band-Edge Emissions

RADWIN Ltd. SA0199500		Band-Edge Freq	Limit 82.2 dBµV/m	Power Setting
Channel Bandwidth(s)	Operating Frequency (MHz)	MHz	dBµV/m	
10MHz	3656.00	3650.00	80.13	18.5
20MHz	3661.00	3650.00	81.88	19.5
40MHz	3670.00	3650.00	82.04	19.5

3700 MHz Radiated Higher Band-Edge Emissions

RADWIN Ltd. SA0199500		Band-Edge Freq	Limit 82.2 dBµV/m	Power Setting
Channel Bandwidth(s)	Operating Frequency (MHz)	MHz	dBµV/m	
10MHz	3694.00	3700.00	81.95	15.0
20MHz	3689.00	3700.00	81.95	16.5
40MHz	3680.00	3700.00	82.0	18.0

Click on the links to view the data.

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	9 dBi	**Variant:**	10 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3656.00	**Data Rate:**	
Power Setting:	18.5	**Tested By:**	JMH

Test Measurement Results

3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3650.00	44.31	2.73	33.09	80.13	Max Avg	Horizontal	171	5	82.2	-2.1	Pass
#2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	20 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3661.00	**Data Rate:**	
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3650.00	46.06	2.73	33.09	81.88	Max Avg	Horizontal	171	5	82.2	-0.4	Pass
#2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	40 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3670.00	**Data Rate:**	
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3650.00	46.22	2.73	33.09	82.04	Max Avg	Horizontal	171	5	83.2	-0.4	Pass
#2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	9 dBi	**Variant:**	10 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3694.00	**Data Rate:**	
Power Setting:	15.0	**Tested By:**	JMH

Test Measurement Results

3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3700.00	46.03	2.68	33.24	81.95	Max Avg	Horizontal	171	5	82.2	-0.3	Pass
#2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	20 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3689.00	**Data Rate:**	
Power Setting:	16.5	**Tested By:**	JMH

Test Measurement Results

3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3700.00	46.03	2.68	33.24	81.95	Max Avg	Horizontal	171	5	82.2	-0.3	Pass
#2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	40 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3680.00	**Data Rate:**	
Power Setting:	18.0	**Tested By:**	JMH

Test Measurement Results

3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3700.00	46.08	2.68	33.24	82.00	Max Avg	Horizontal	171	5	82.2	-0.2	Pass
#2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

7.1.7.1.2. 64Qam:

3650 MHz Radiated Lower Band-Edge Emissions

RADWIN Ltd. SA0199500		Band-Edge Freq	Limit 82.2 dBµV/m	Power Setting
Channel Bandwidth(s)	Operating Frequency (MHz)	MHz	dBµV/m	
10MHz	3656.00	3650.00	76.93	18.5
20MHz	3661.00	3650.00	80.13	19.5
40MHz	3670.00	3650.00	79.21	19.5

3700 MHz Radiated Higher Band-Edge Emissions

RADWIN Ltd. SA0199500		Band-Edge Freq	Limit 82.2 dBµV/m	Power Setting
Channel Bandwidth(s)	Operating Frequency (MHz)	MHz	dBµV/m	
10MHz	3694.00	3700.00	81.84	16.0
20MHz	3689.00	3700.00	81.95	18.0
40MHz	3680.00	3700.00	82.00	19.5

Click on the links to view the data.

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	10 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	64Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3656.00	**Data Rate:**	
Power Setting:	18.5	**Tested By:**	JMH

Test Measurement Results

3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3650.00	41.11	2.73	33.09	76.93	Max Avg	Horizontal	171	5	82.2	-5.3	Pass
#2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	20 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	64Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3661.00	**Data Rate:**	
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3650.00	44.31	2.73	33.09	80.13	Max Avg	Horizontal	171	5	82.2	-2.3	Pass
#2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	40 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	64Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3670.00	**Data Rate:**	
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3650.00	43.39	2.73	33.09	79.21	Max Avg	Horizontal	171	5	82.2	-3.3	Pass
#2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	10 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	64Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3694.00	**Data Rate:**	
Power Setting:	16.0	**Tested By:**	JMH

Test Measurement Results

3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3700.00	45.92	2.68	33.24	81.84	Max Avg	Horizontal	171	5	82.2	-0.4	Pass
#2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	20 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	64Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3689.00	**Data Rate:**	
Power Setting:	18.0	**Tested By:**	JMH

Test Measurement Results

3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3700.00	46.03	2.68	33.24	81.95	Max Avg	Horizontal	171	5	82.2	-0.3	Pass
#2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	40 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	64Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3680.00	**Data Rate:**	
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3700.00	46.08	2.68	33.24	82.00	Max Avg	Horizontal	171	5	82.2	-0.2	Pass
#2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

7.1.7.1.3. 256Qam:

3650 MHz Radiated Lower Band-Edge Emissions

RADWIN Ltd. SA0199500		Band-Edge Freq	Limit 82.2 dBµV/m	Power Setting
Channel Bandwidth(s)	Operating Frequency (MHz)	MHz	dBµV/m	
10MHz	3656.00	3650.00	76.44	18.5
20MHz	3661.00	3650.00	79.79	19.5
40MHz	3670.00	3650.00	78.99	19.5

3700 MHz Radiated Higher Band-Edge Emissions

RADWIN Ltd. SA0199500		Band-Edge Freq	Limit 82.2 dBµV/m	Power Setting
Channel Bandwidth(s)	Operating Frequency (MHz)	MHz	dBµV/m	
10MHz	3694.00	3700.00	82.00	16.5
20MHz	3689.00	3700.00	82.17	18.0
40MHz	3680.00	3700.00	81.61	19.5

Click on the links to view the data.

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	10 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	256Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3656.00	**Data Rate:**	
Power Setting:	18.5	**Tested By:**	JMH

Test Measurement Results

3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3650.00	40.62	2.73	33.09	76.44	Max Avg	Horizontal	171	5	82.2	-5.8	Pass
#2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	20 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	256Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3661.00	**Data Rate:**	
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3650.00	43.97	2.73	33.09	79.79	Max Avg	Horizontal	171	5	82.2	-2.4	Pass
#2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	40 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	256Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3670.00	**Data Rate:**	
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3650.00	43.17	2.73	33.09	78.99	Max Avg	Horizontal	171	5	82.2	-3.2	Pass
#2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3650 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	10 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	256Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3694.00	**Data Rate:**	
Power Setting:	16.0	**Tested By:**	JMH

Test Measurement Results

3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3700.00	46.08	2.68	33.24	82.00	Max Avg	Horizontal	171	5	68.2	-0.2	Pass
#2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3700 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	20 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	256Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3689.00	**Data Rate:**	
Power Setting:	18.0	**Tested By:**	JMH

Test Measurement Results

3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3700.00	46.21	2.68	33.24	82.13	Max Avg	Horizontal	171	5	82.2	-0.1	Pass
#2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

Equipment Configuration for 3700 Radiated Band-Edge Emissions

Antenna:	Not Applicable	**Variant:**	40 MHz
Antenna Gain (dBi):	9.00	**Modulation:**	256Qam
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	3680.00	**Data Rate:**	
Power Setting:	19.5	**Tested By:**	JMH

Test Measurement Results

3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	3700.00	45.69	2.68	33.24	81.61	Max Avg	Horizontal	171	5	82.2	-0.7	Pass
#2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--
Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi												

7.1.8. Digital Emissions (30M-1 GHz)

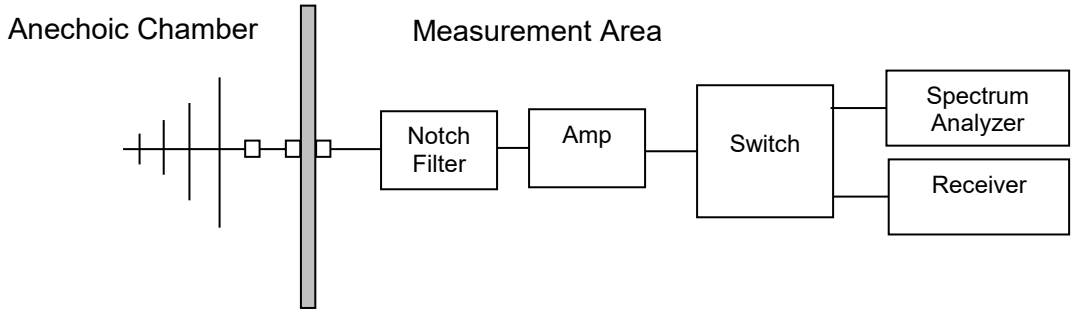
FCC, Part 15 Subpart C §15.205/ §15.209
ISED RSS-Gen § 8.9, 8.10

Test Procedure

Preliminary radiated emissions were measured in the anechoic chamber at a 10-meter distance on every azimuth in both horizontal and vertical polarity. The emissions are recorded with a spectrum analyzer in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 6 Test Set-Up Photographs.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting



Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

FS = Field Strength
R = Measured Receiver Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain

For example:
Given a Receiver input reading of 51.5dBμV; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

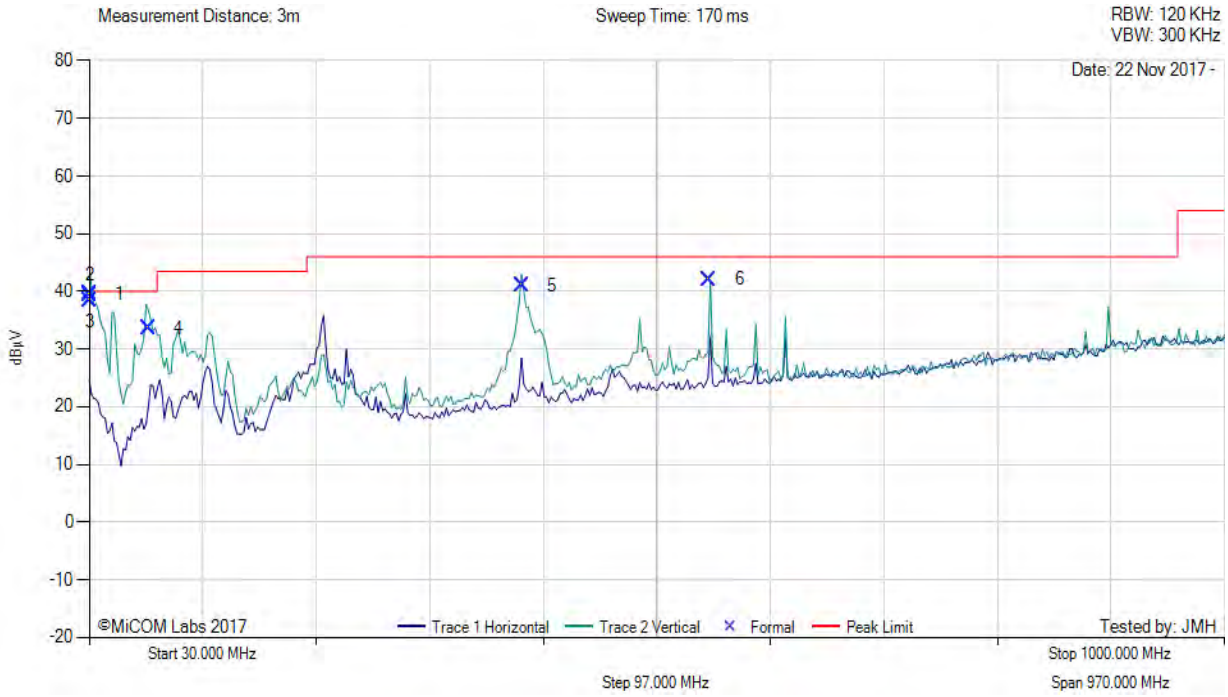
Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100μV/m
48 dBμV/m = 250μV/m

Measurement Results for Spurious Emissions (30 MHz – 1 GHz)

Ambient conditions.
Temperature: 19 to 26 °C Relative humidity: 31 to 57 % Pressure: 999 to 1009 mbar

Variant: Digital Emissions, Test Freq: 3680.00 MHz, Power Setting: 24



30.00 - 1000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	30.01	46.55	3.41	-10.38	39.58	MaxQP	Vertical	101	274	40.0	-0.4	Pass
2	30.48	46.36	3.41	-10.38	39.39	MaxQP	Vertical	100	0	40.0	-0.6	Pass
3	30.87	45.36	3.41	-10.38	38.39	MaxQP	Vertical	120	0	40.0	-1.6	Pass
4	80.40	53.31	3.72	-23.42	33.61	MaxQP	Vertical	109	327	40.0	-6.4	Pass
5	400.02	51.10	4.88	-15.05	40.93	MaxQP	Vertical	118	356	46.0	-5.1	Pass
6	560.00	48.73	5.34	-11.98	42.09	MaxQP	Vertical	169	353	46.0	-3.9	Pass

Test Notes: EUT powered by POE, connected to laptop outside chamber

Specification

Limits

§15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

§15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

§15.209 (a) Limit Matrix

Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'

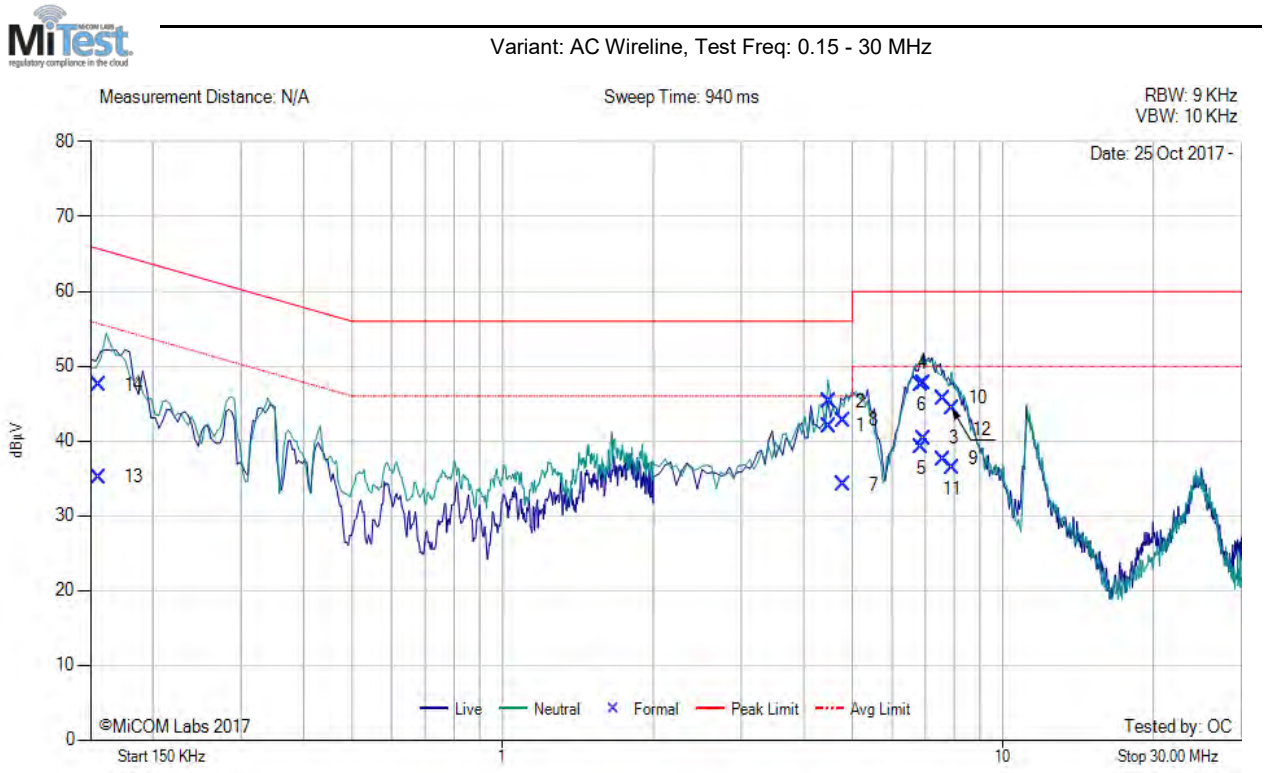
7.1.9. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

FCC, Part 15 Subpart C §15.207
ISED RSS-Gen §8.8

Test Procedure
The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

Test Set-up is shown in Section 4.2 Test Equipment Configurations/ac Wireline Testing

Ambient conditions.
Temperature: 19 to 26 °C Relative humidity: 31 to 57 % Pressure: 999 to 1009 mbar



Num	Frequency MHz	Raw dBµV	Cable Loss dB	Factor dB	Total Correction dBµV	Corrected Value dBµV	Measurement Type	Line	Limit dBµV/m	Margin dB	Pass /Fail
1	4.505	31.73	0.25	10.07	10.32	42.05	Max Avg	Neutral	46.0	-4.0	Pass
2	4.505	34.98	0.25	10.07	10.32	45.30	Max Qp	Neutral	56.0	-10.7	Pass
3	6.933	29.82	0.36	10.17	10.53	40.35	Max Avg	Live	50.0	-9.7	Pass
4	6.933	37.09	0.36	10.17	10.53	47.62	Max Qp	Live	60.0	-12.4	Pass
5	6.886	28.66	0.36	10.17	10.53	39.19	Max Avg	Neutral	50.0	-10.8	Pass
6	6.886	37.05	0.36	10.17	10.53	47.58	Max Qp	Neutral	60.0	-12.4	Pass
7	4.790	23.85	0.26	10.08	10.34	34.19	Max Avg	Live	46.0	-11.8	Pass
8	4.790	32.42	0.26	10.08	10.34	42.76	Max Qp	Live	56.0	-13.2	Pass
9	7.591	27.02	0.41	10.16	10.57	37.59	Max Avg	Live	50.0	-12.4	Pass
10	7.591	35.12	0.41	10.16	10.57	45.69	Max Qp	Live	60.0	-14.3	Pass
11	7.916	25.72	0.43	10.17	10.60	36.32	Max Avg	Neutral	50.0	-13.7	Pass
12	7.916	33.72	0.43	10.17	10.60	44.32	Max Qp	Neutral	60.0	-15.7	Pass
13	0.156	25.20	0.05	9.92	9.97	35.17	Max Avg	Neutral	55.8	-20.7	Pass
14	0.156	37.50	0.05	9.92	9.97	47.47	Max Qp	Neutral	65.8	-18.4	Pass

Test Notes: Model: Jet Duo DB. PoE powered configuration. 120V, 60Hz

Specification

Limit

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μΩ line impedance stabilization network (LISN), see §15.207 (a) matrix below. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

§15.207 (a) Limit Matrix

The lower limit applies at the boundary between frequency ranges

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Laboratory Measurement Uncertainty for Conducted Emissions

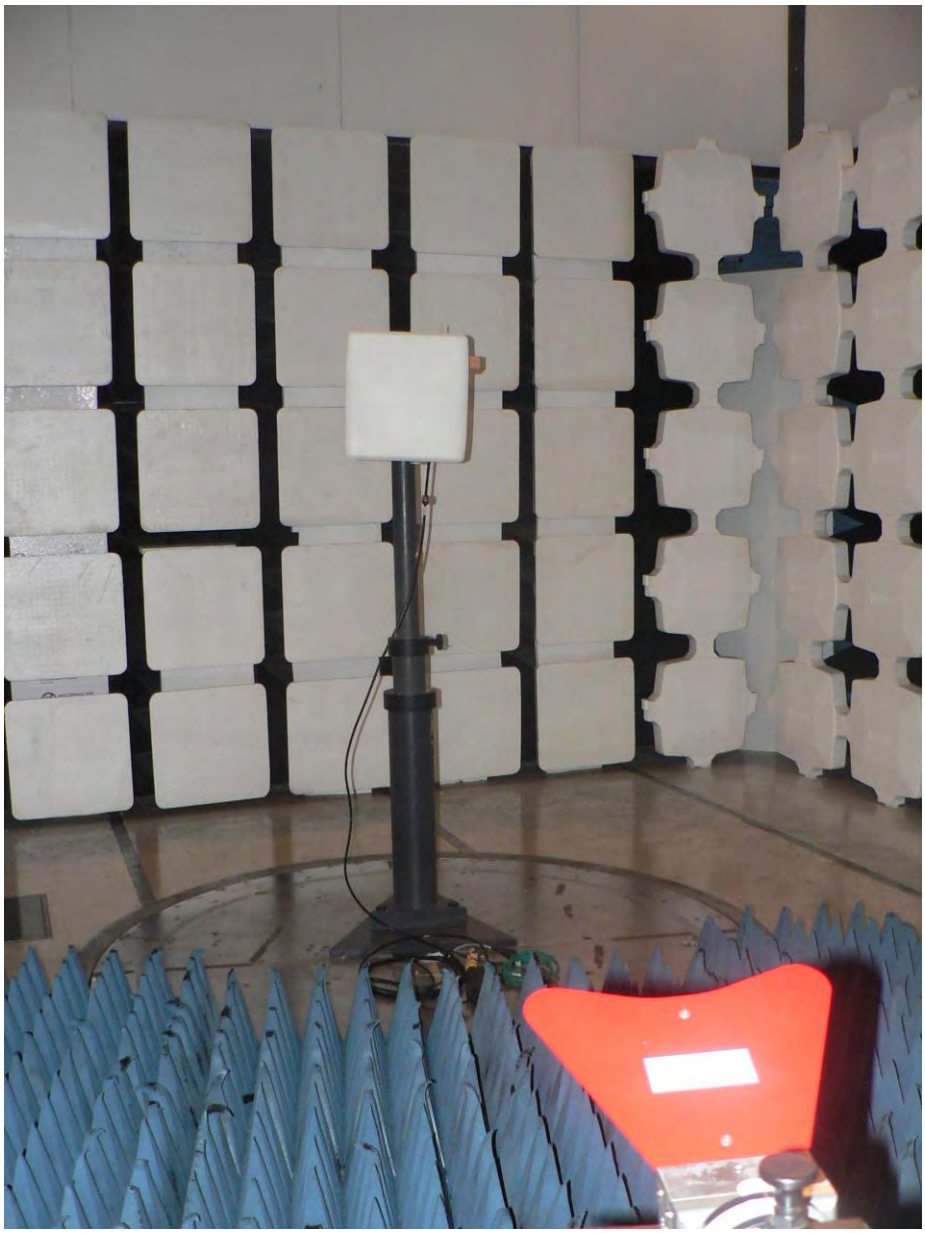
Measurement uncertainty	±2.64 dB

Traceability

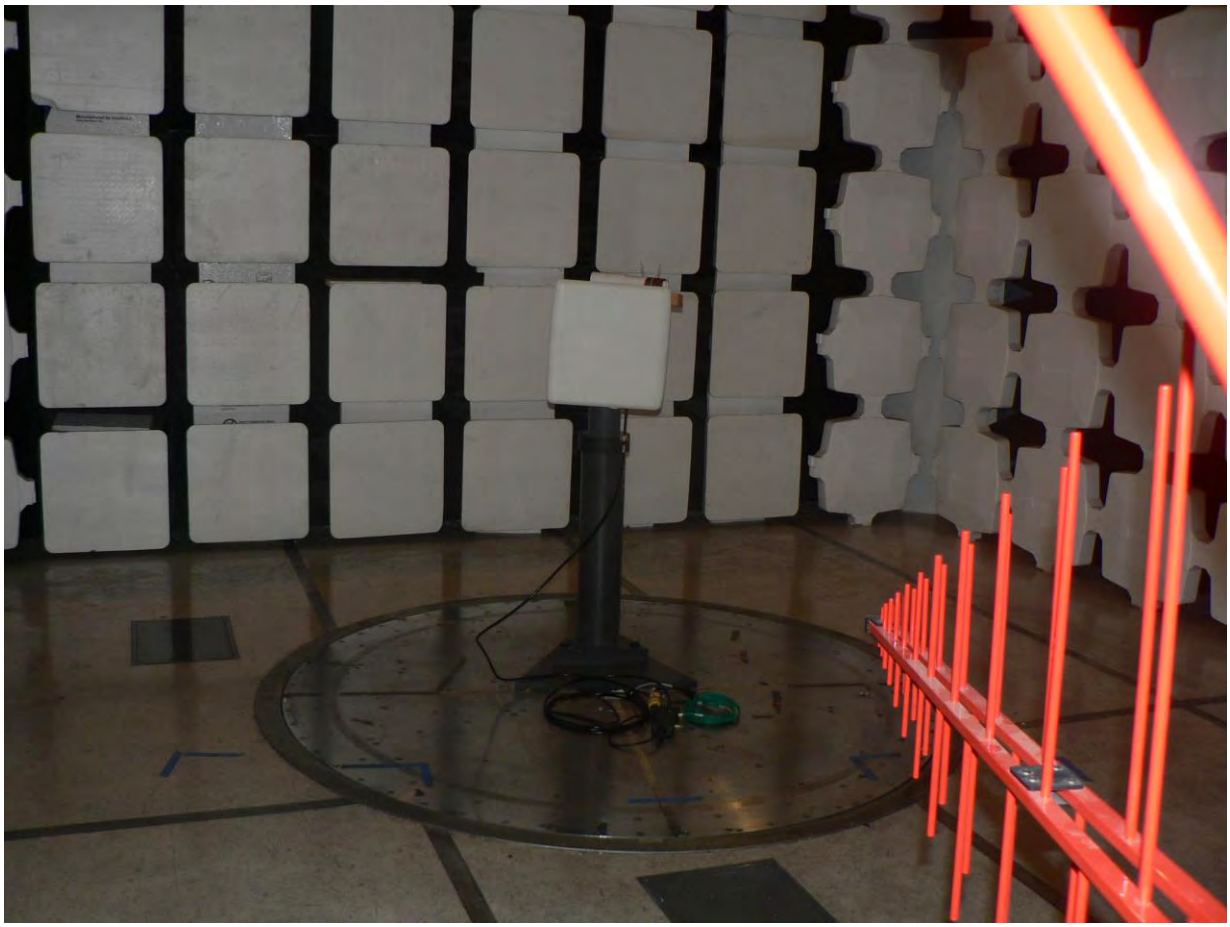
Method
Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions'

8. TEST SET-UP PHOTOGRAPHS

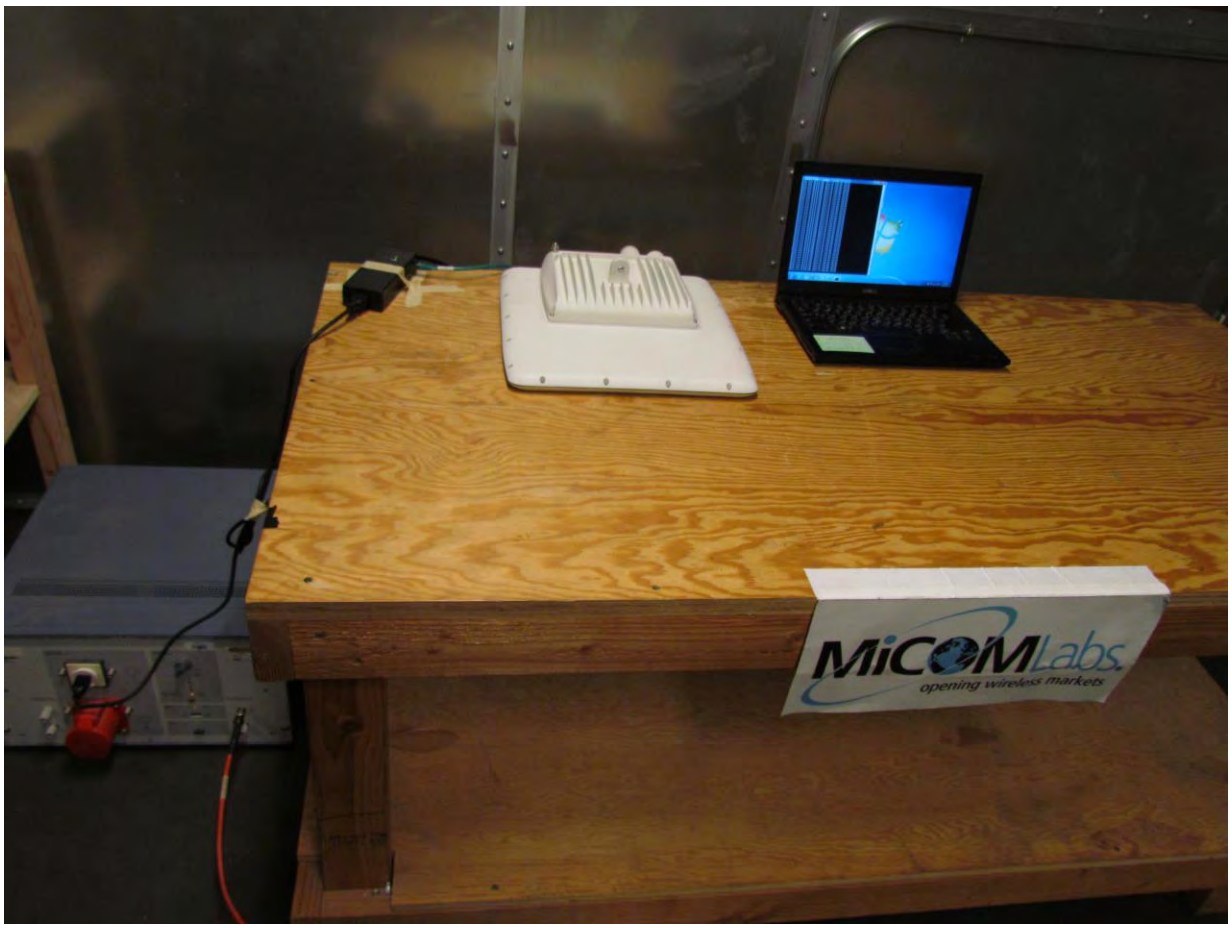
8.1. Radiated Spurious Emissions above 1GHz

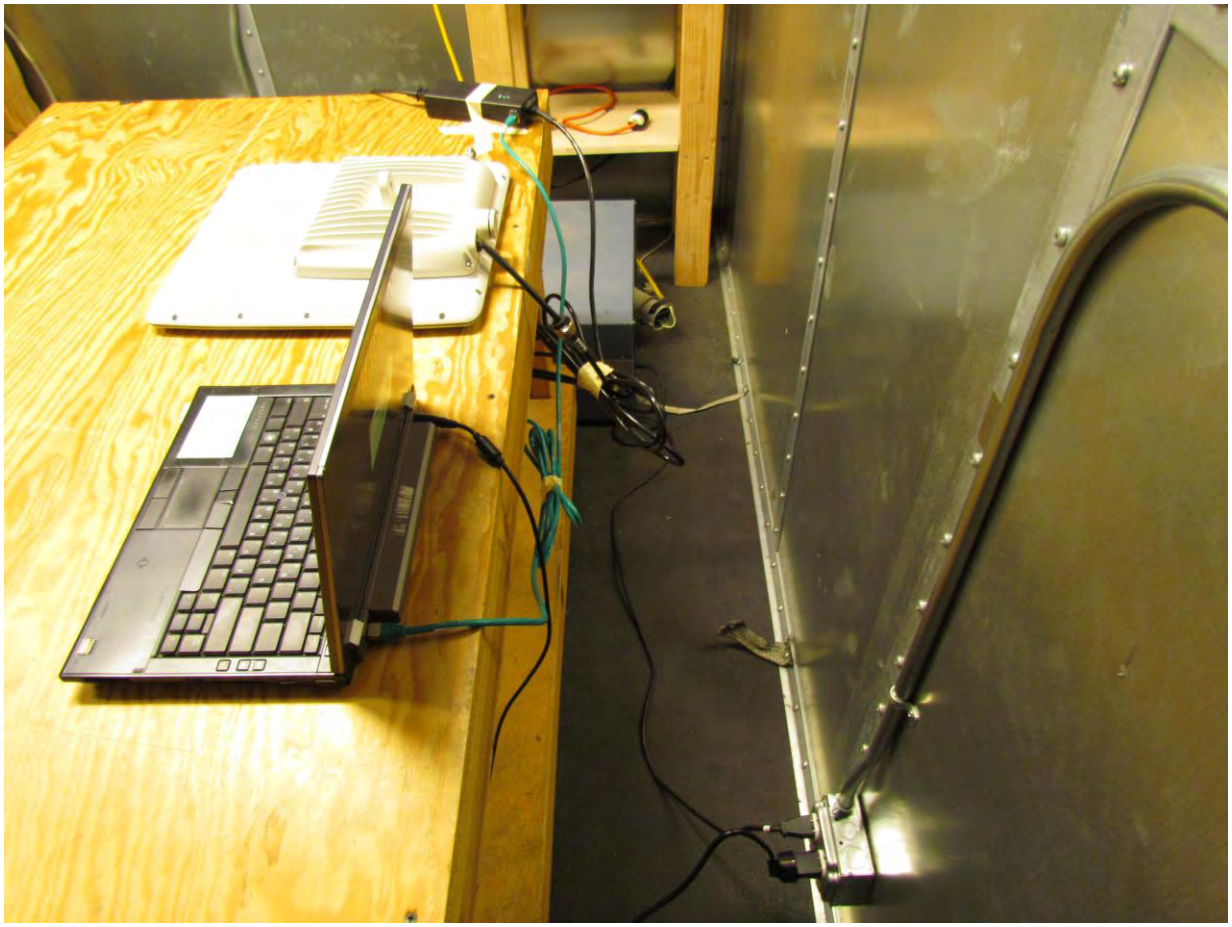


8.2. Digital Emissions (0.03 – 1 GHz)



8.3. ac Wireline Emissions (150 kHz - 30 MHz)

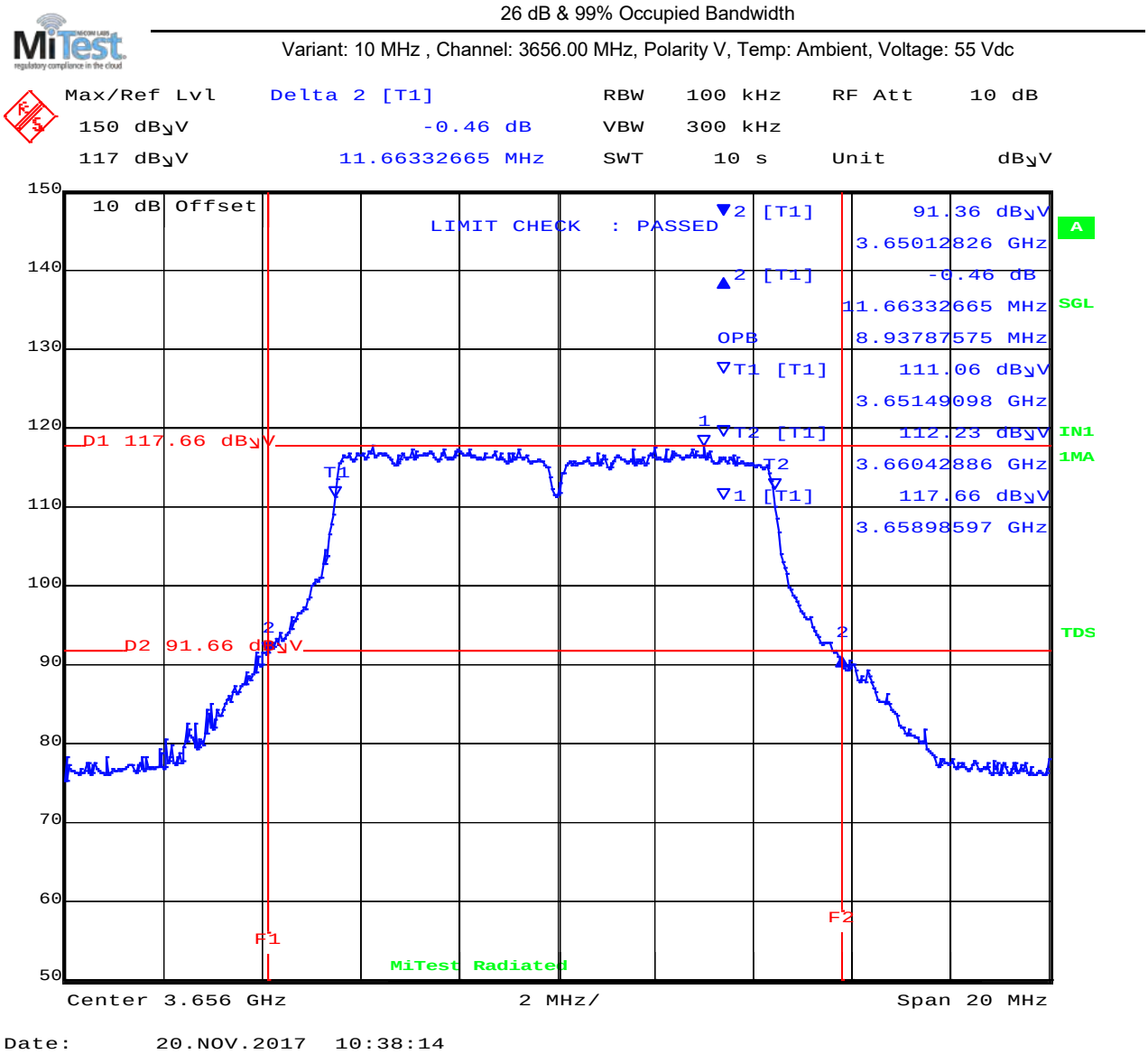




APPENDIX A GRAPHICAL IMAGES

A.1. TEST PLOTS

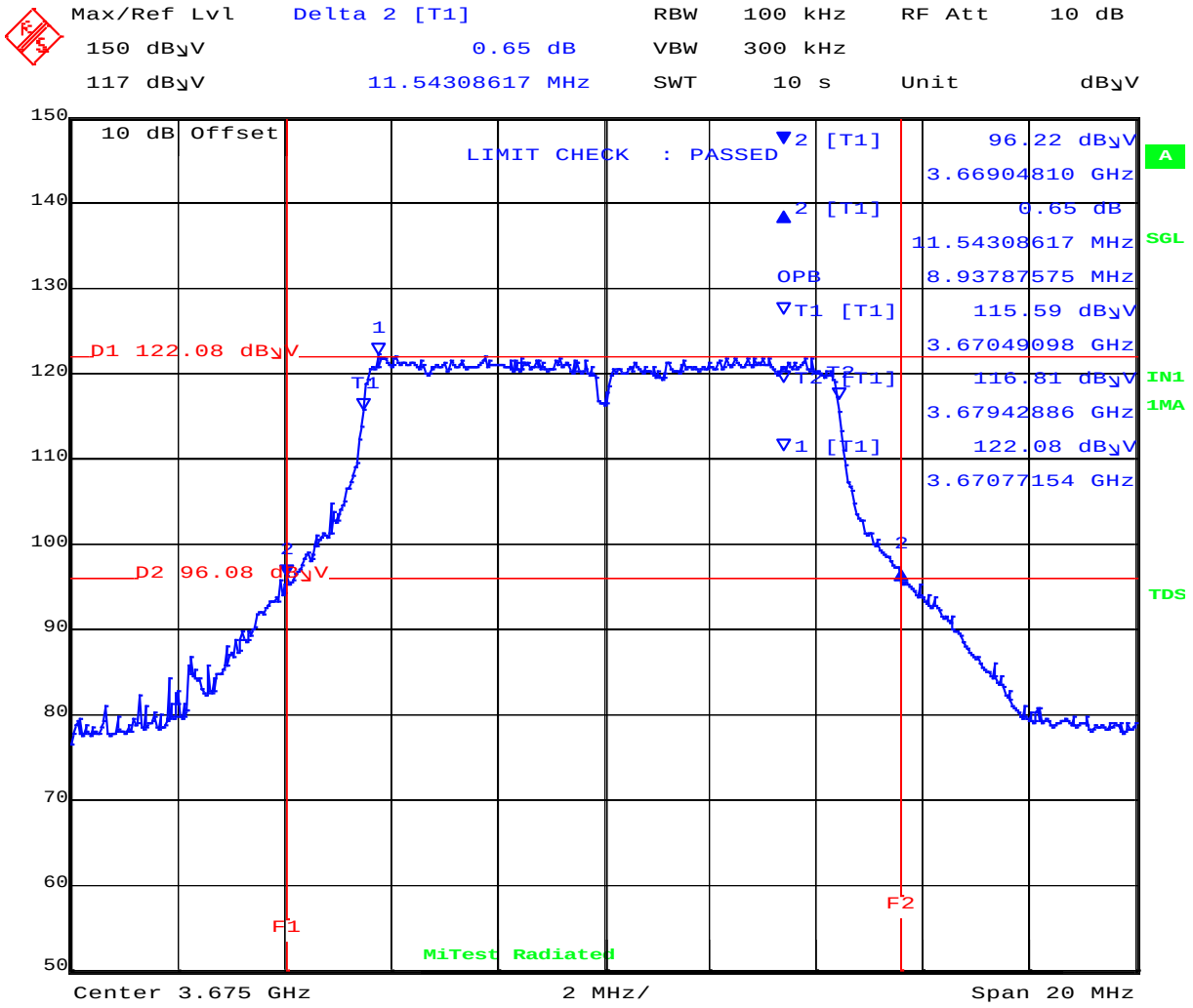
A.1.1. Occupied Bandwidth



Back to Matrix

26 dB & 99% Occupied Bandwidth

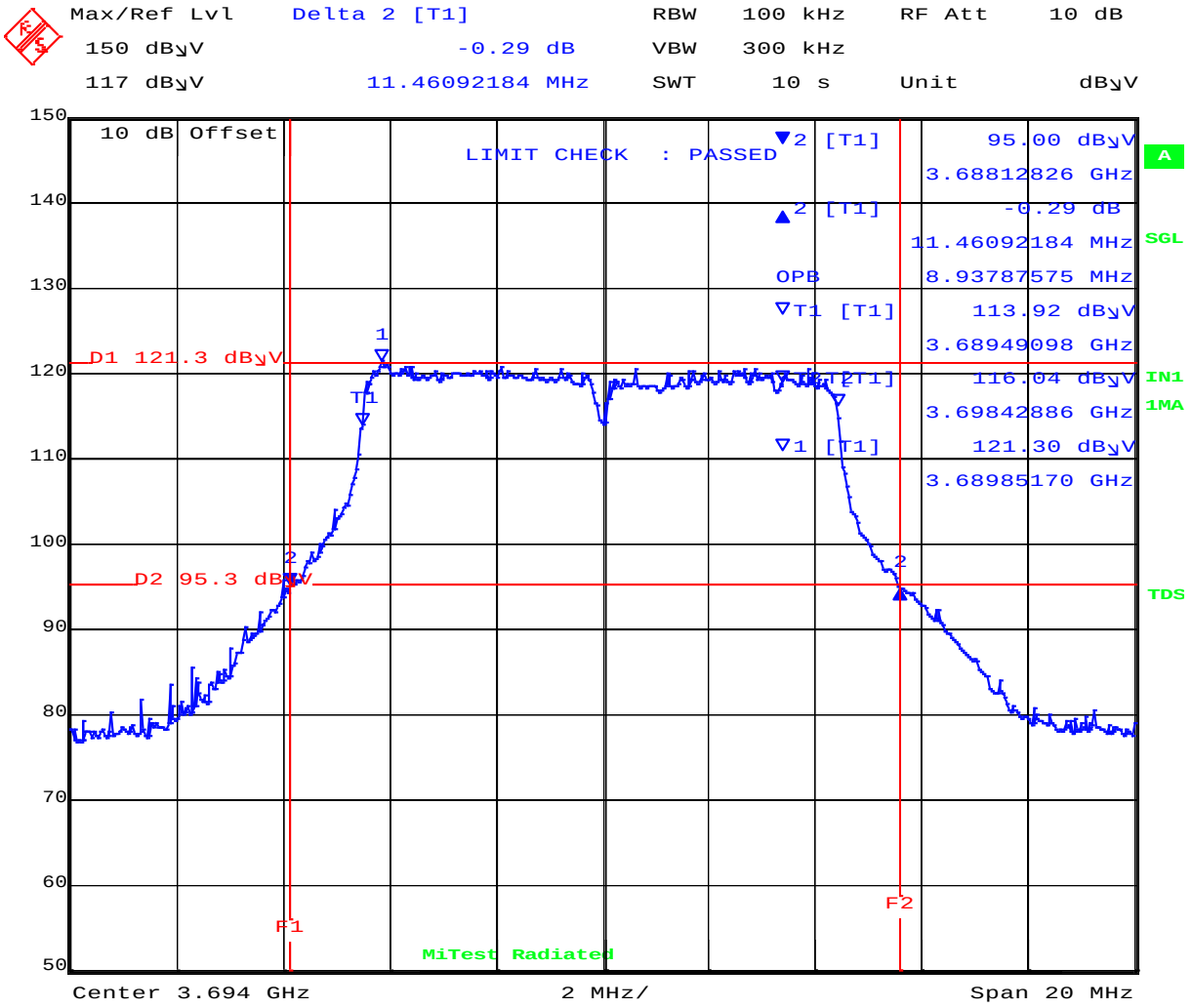
Variant: 10 MHz, Channel: 3675.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

26 dB & 99% Occupied Bandwidth

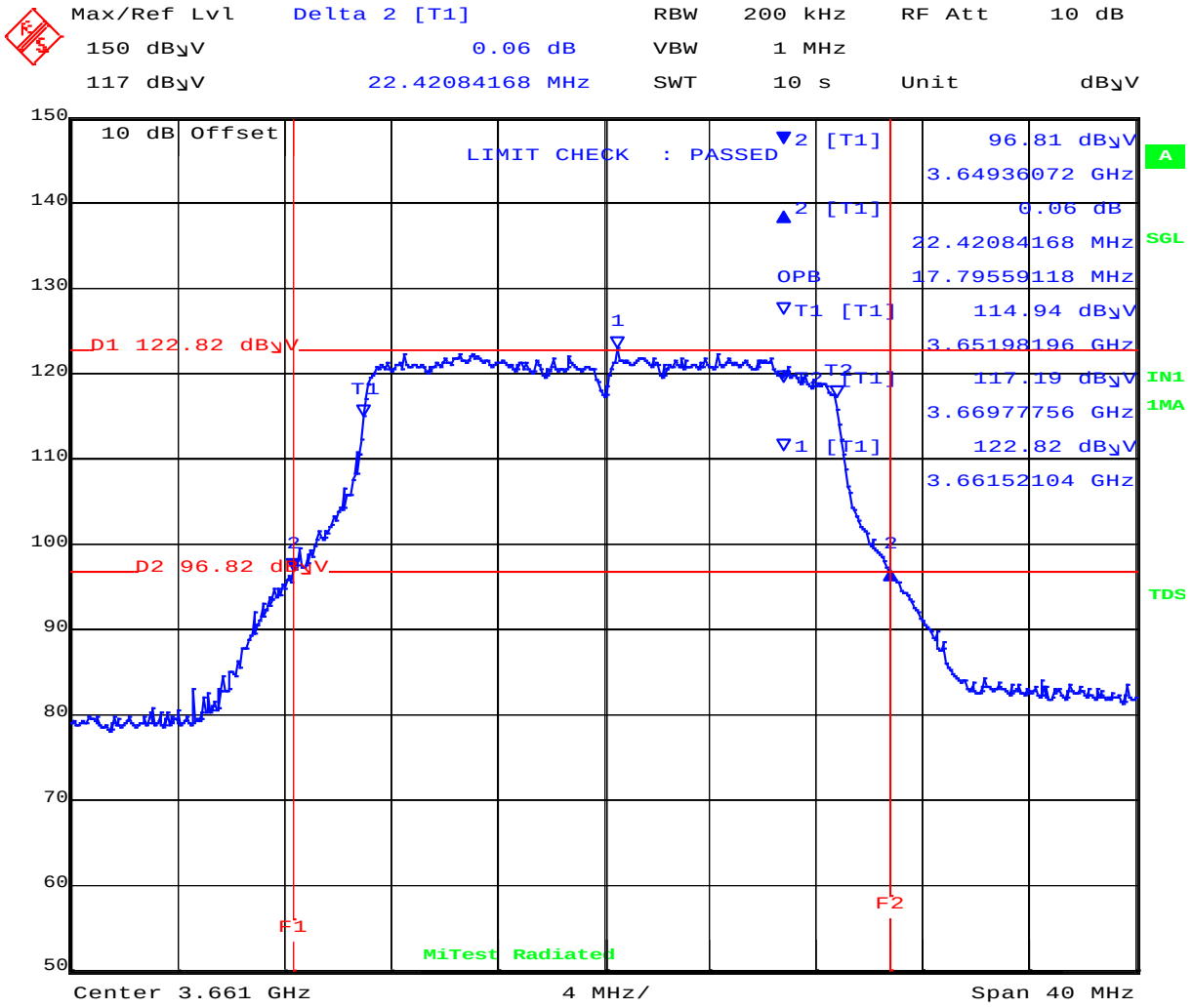
Variant: 10 MHz, Channel: 3694.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

26 dB & 99% Occupied Bandwidth

Variant: 20 MHz, Channel: 3661.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

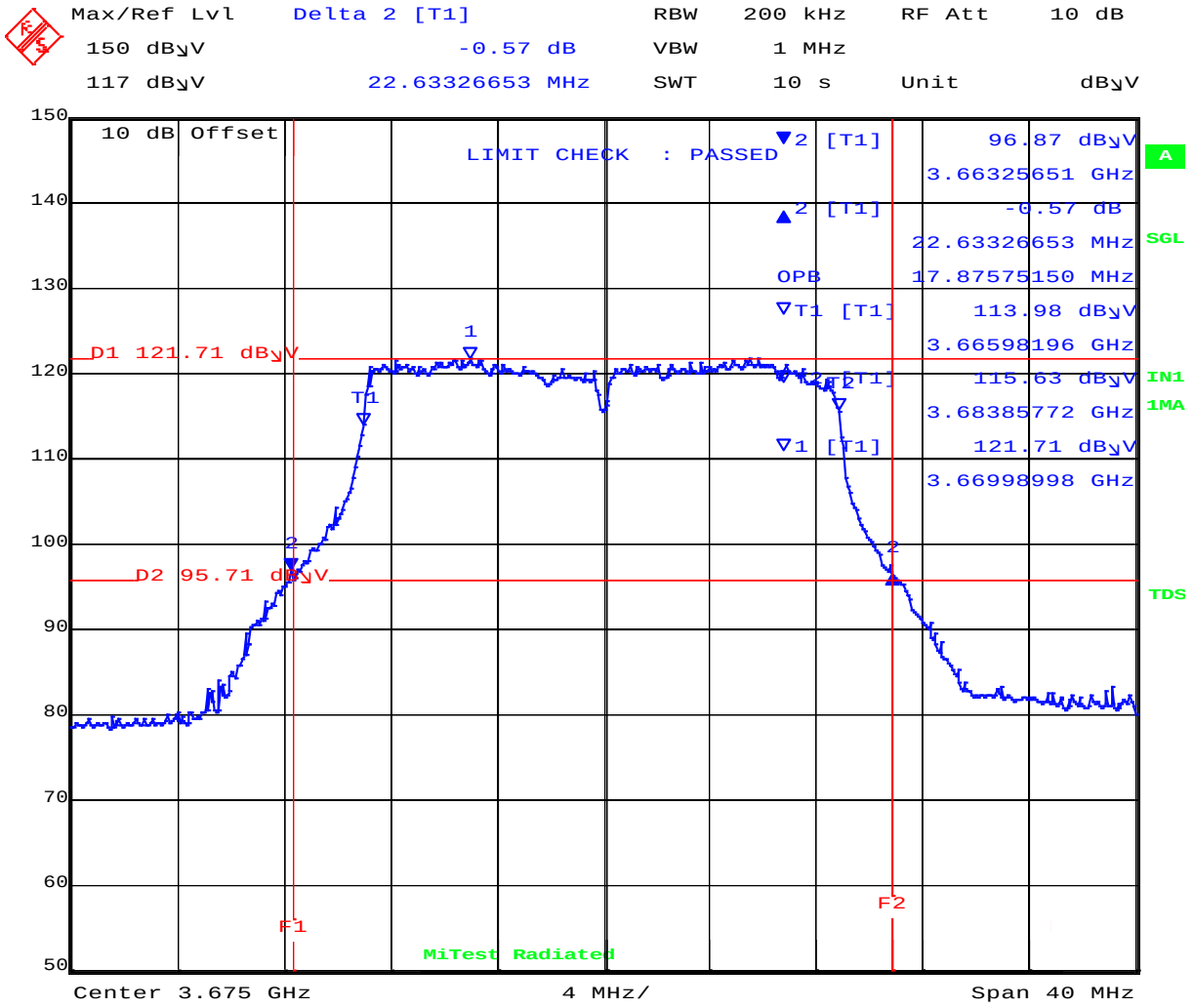


Date: 20.NOV.2017 10:04:19

Back to Matrix

26 dB & 99% Occupied Bandwidth

Variant: 20 MHz, Channel: 3675.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

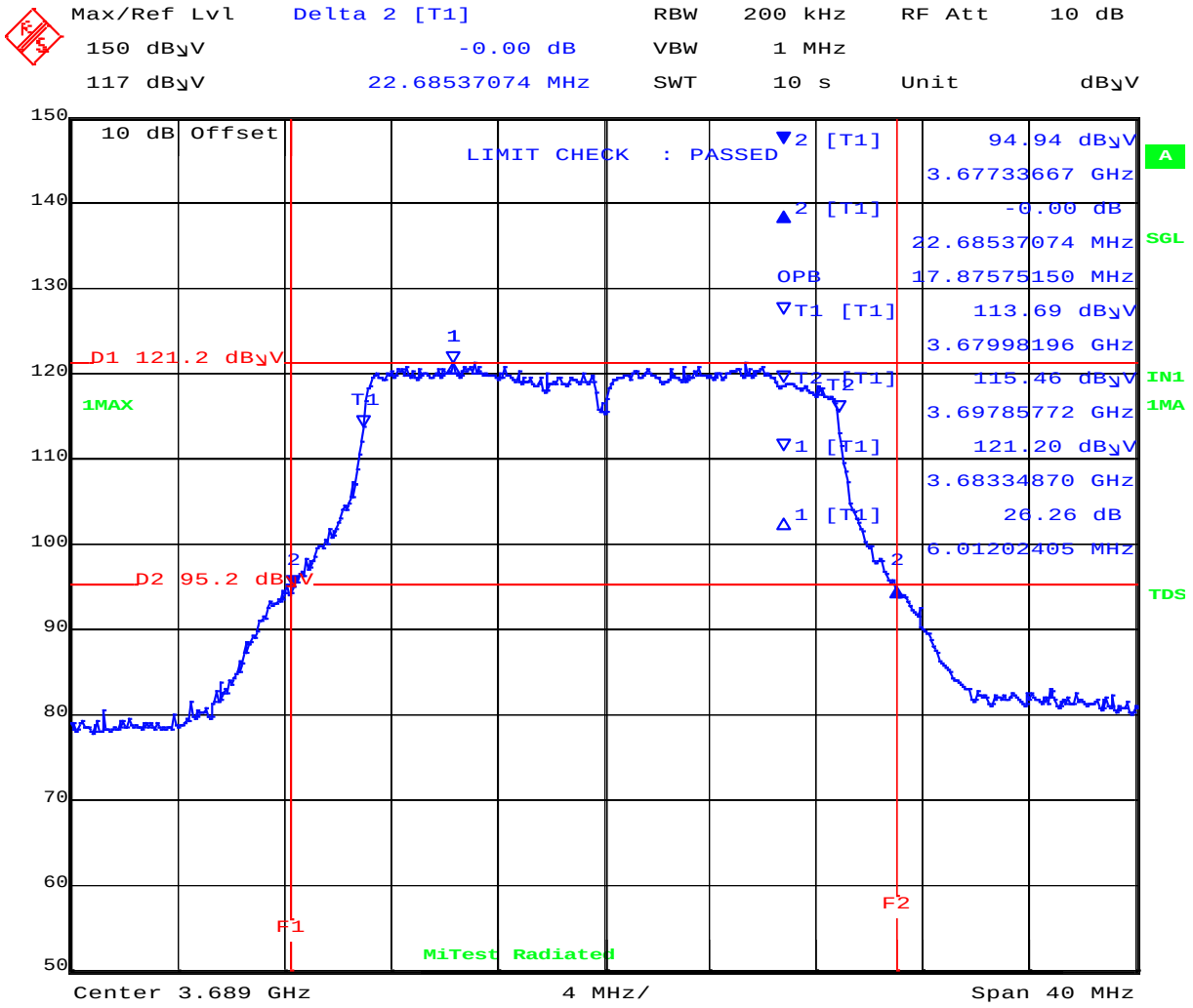


Date: 20.NOV.2017 10:11:50

Back to Matrix

26 dB & 99% Occupied Bandwidth

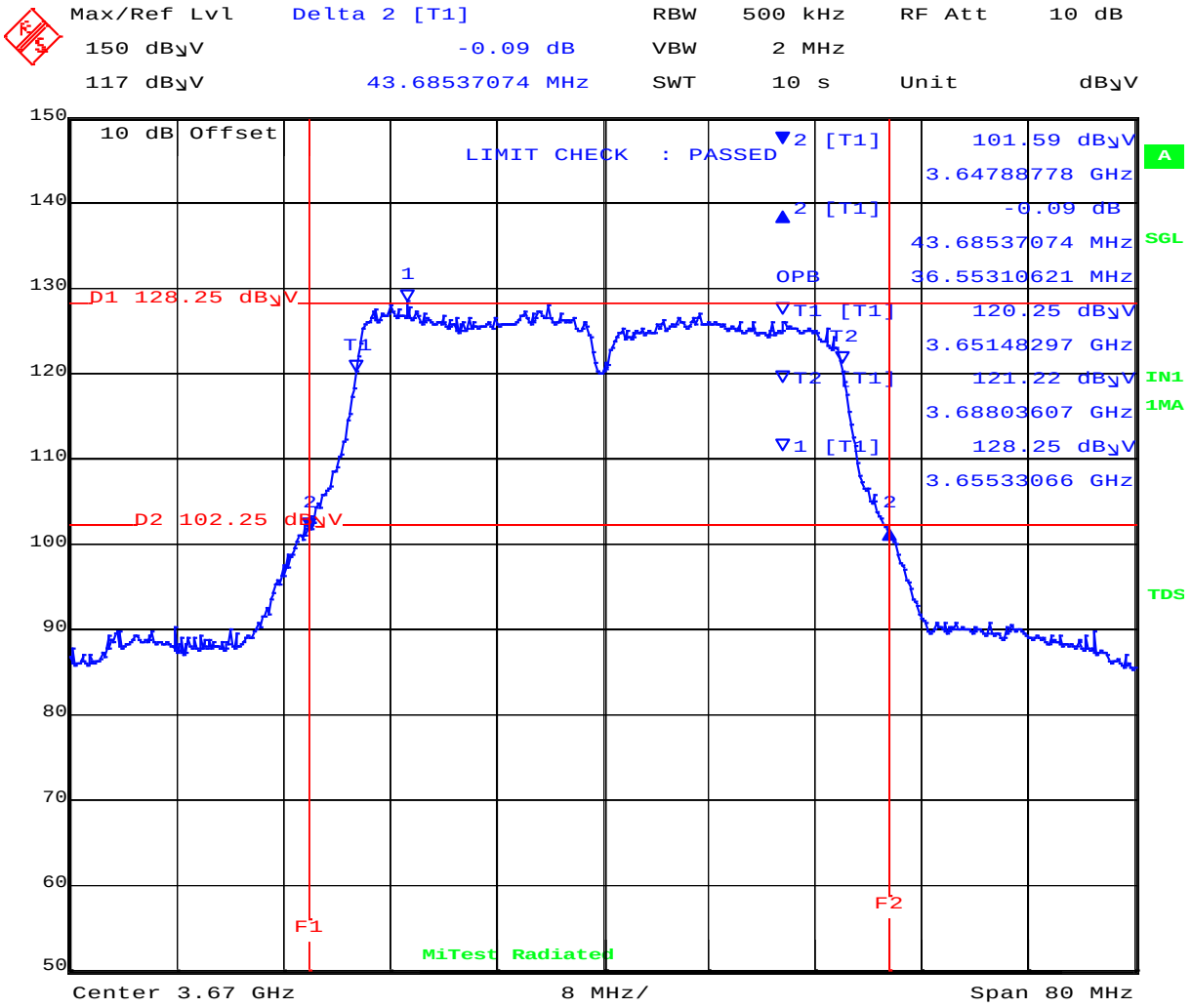
Variant: 20 MHz, Channel: 3689.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

26 dB & 99% Occupied Bandwidth

Variant: 40 MHz, Channel: 3670.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc

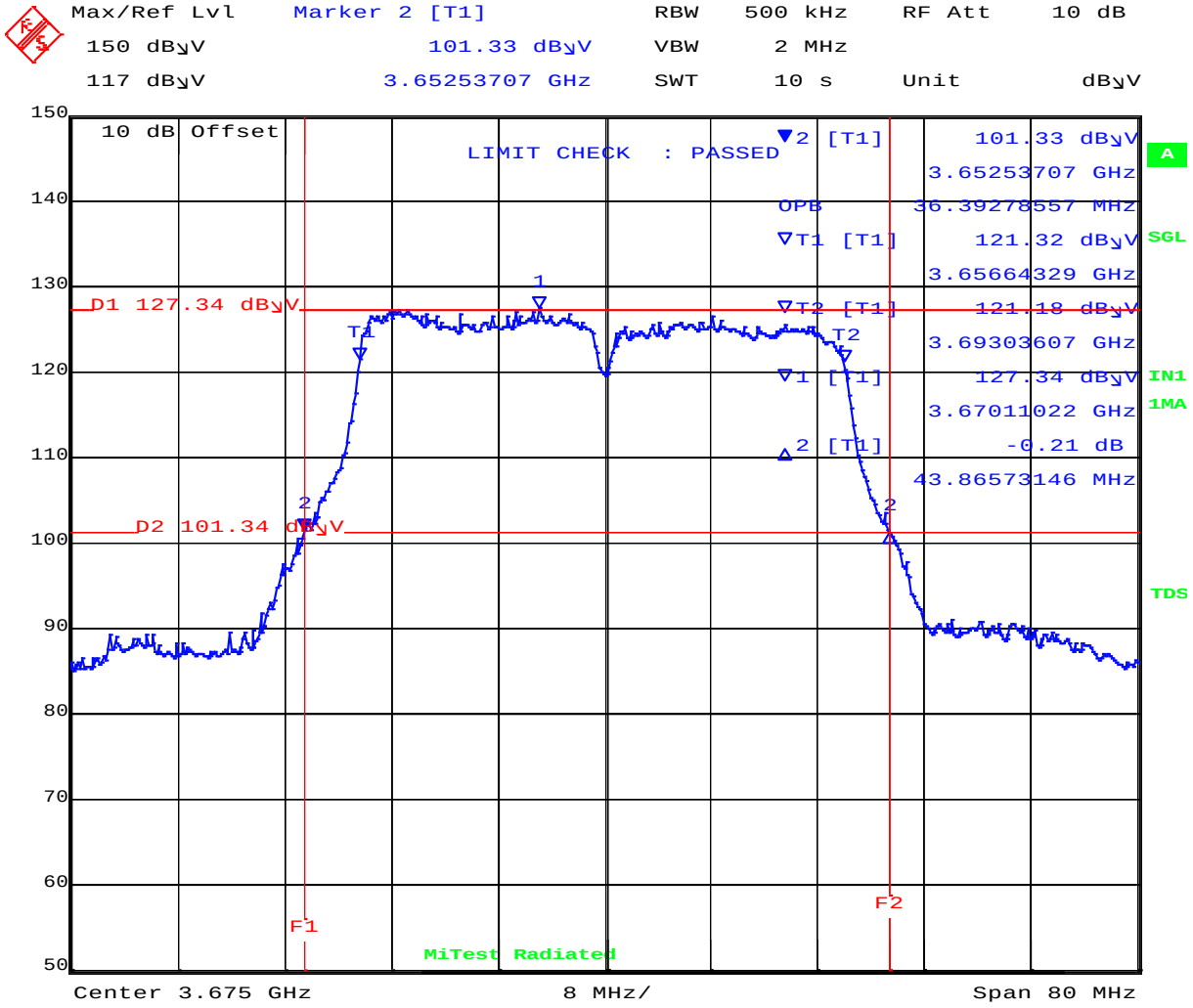


Date: 20.NOV.2017 10:25:22

Back to Matrix

26 dB & 99% Occupied Bandwidth

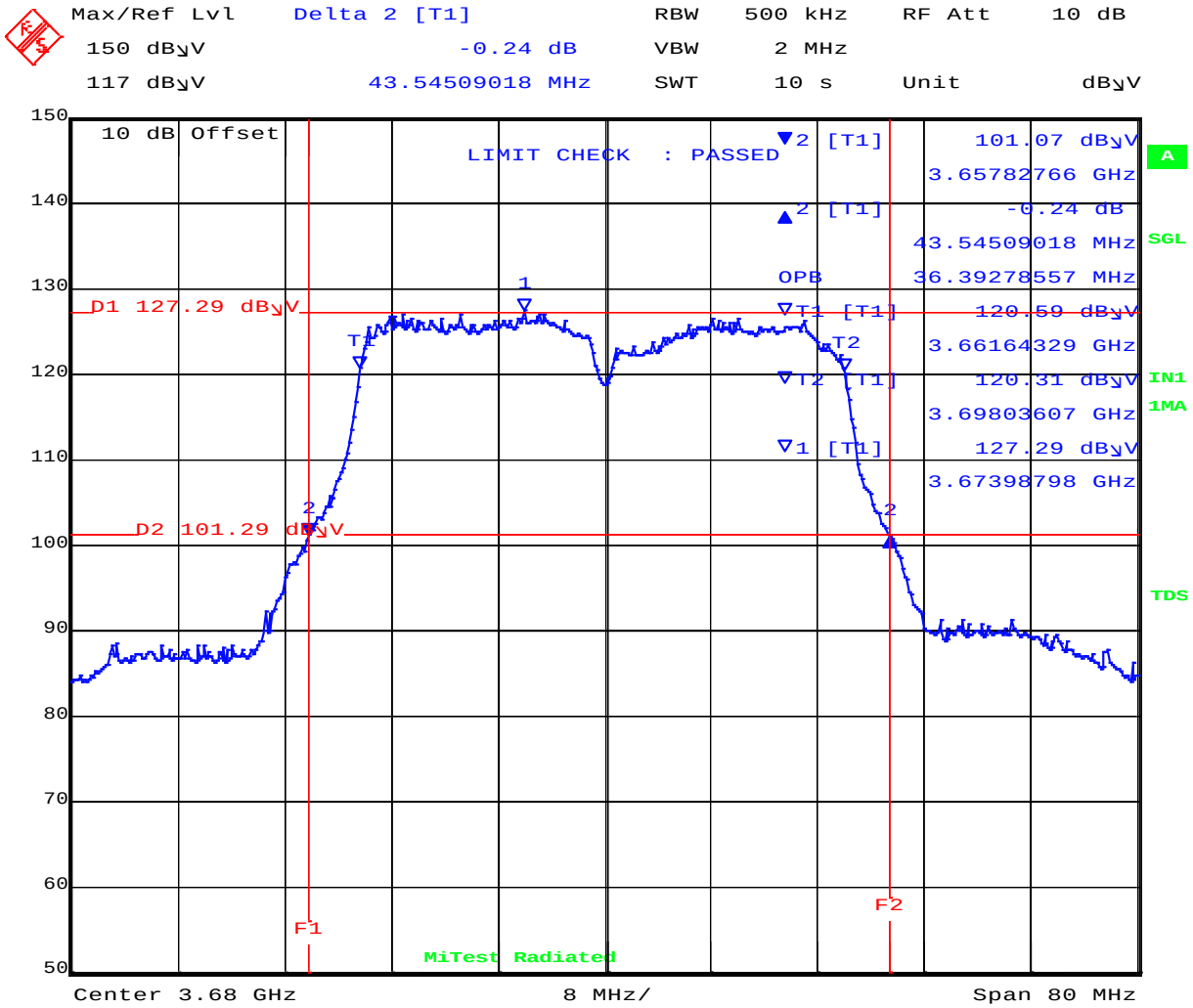
Variant: 40 MHz, Channel: 3675.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

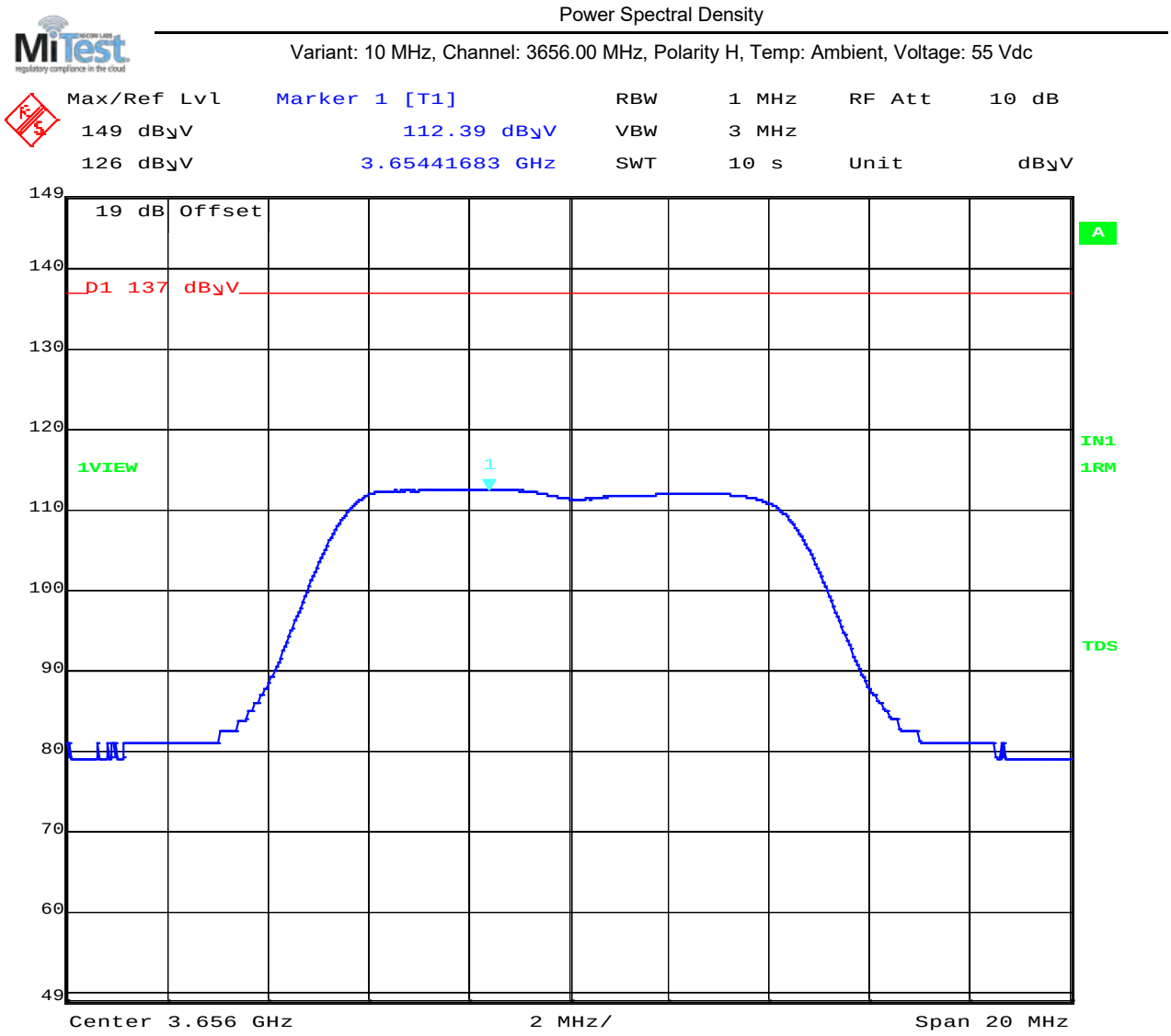
26 dB & 99% Occupied Bandwidth

Variant: 40 MHz, Channel: 3680.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

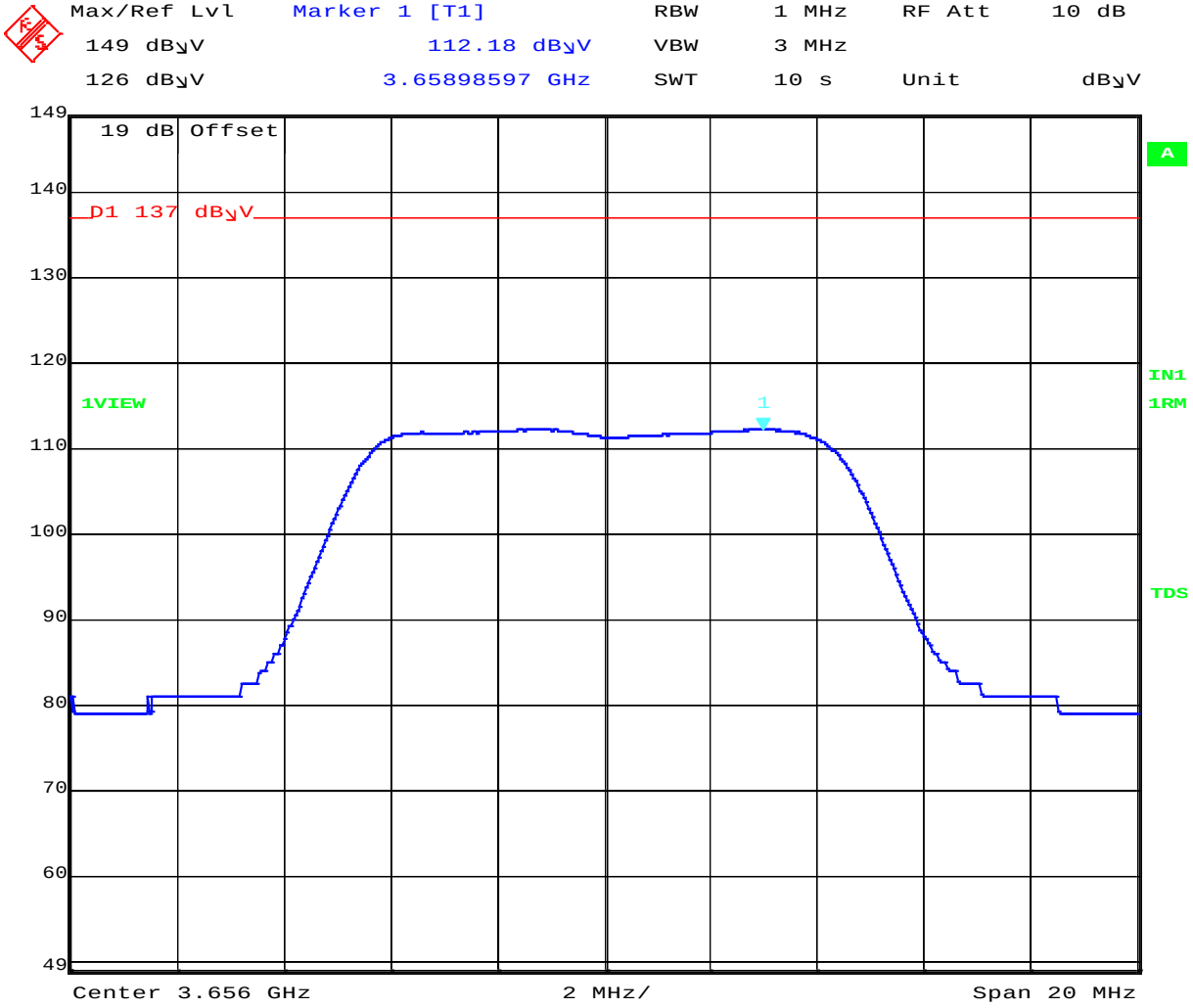
A.1.2. Power Spectral Density



Back to Matrix

Power Spectral Density

Variant: 10 MHz, Channel: 3656.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

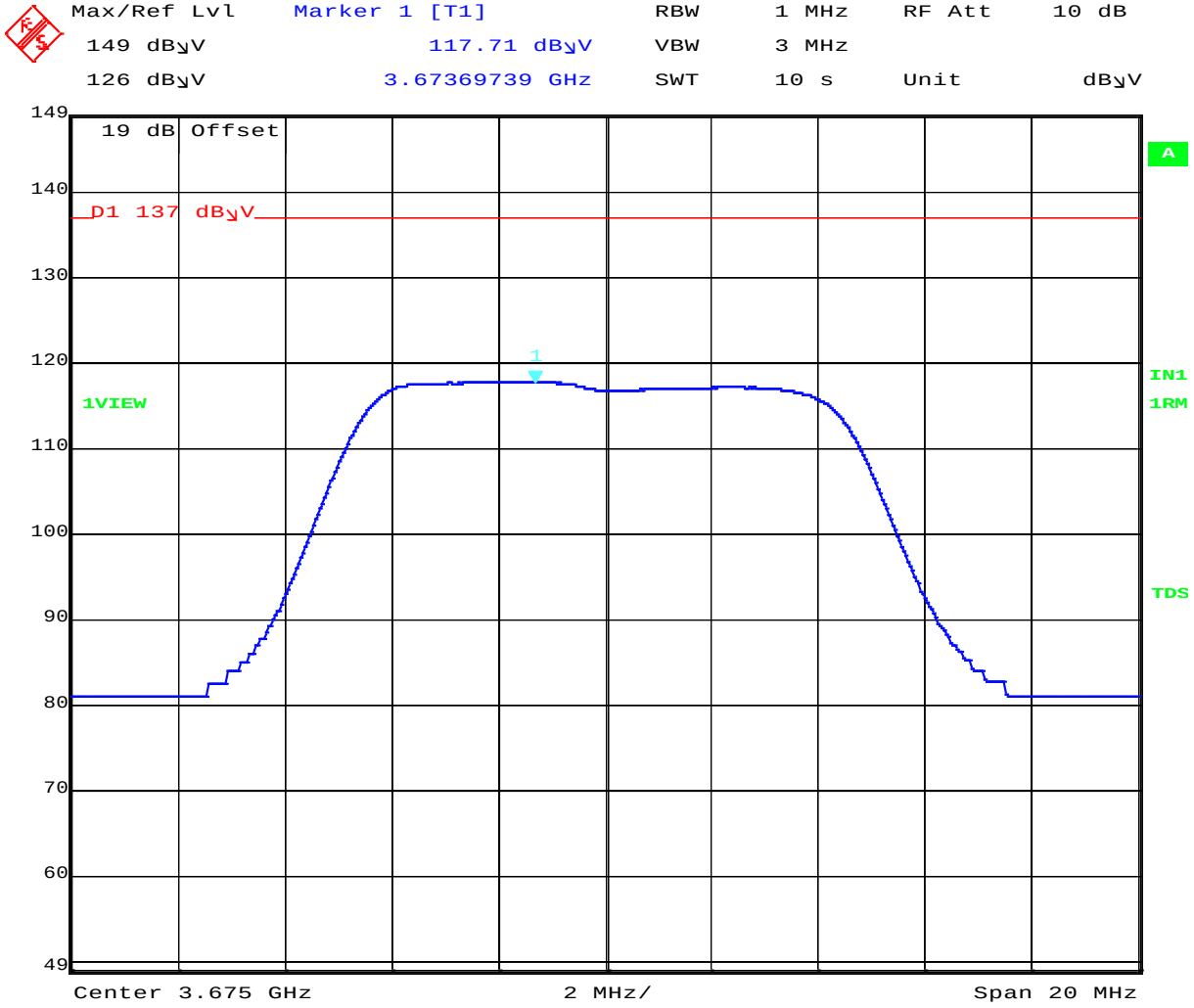


Date: 16.NOV.2017 10:11:41

Back to Matrix

Power Spectral Density

Variant: 10 MHz, Channel: 3675.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc

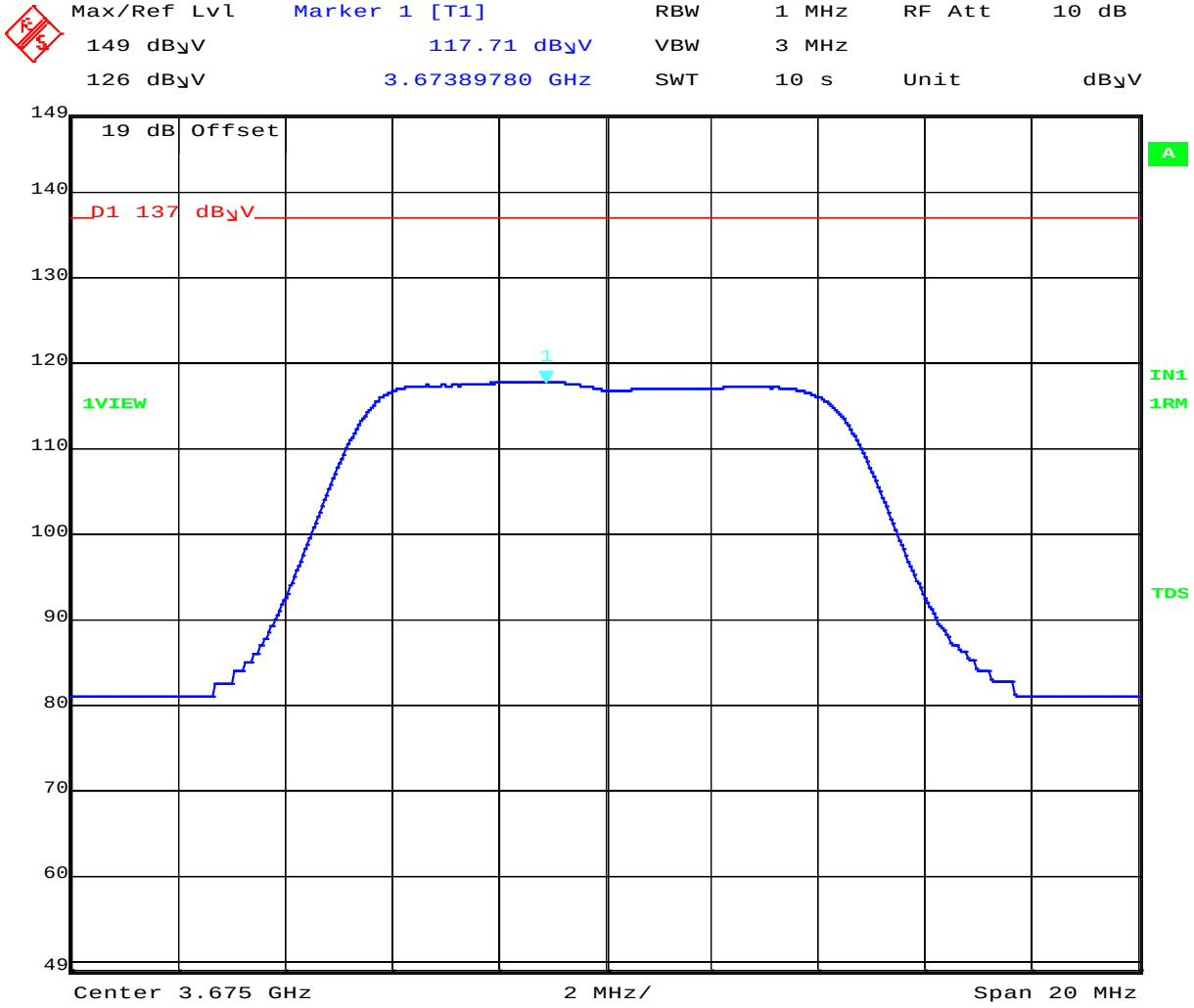


Date: 16.NOV.2017 10:03:46

Back to Matrix

Power Spectral Density

Variant: 10 MHz, Channel: 3675.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

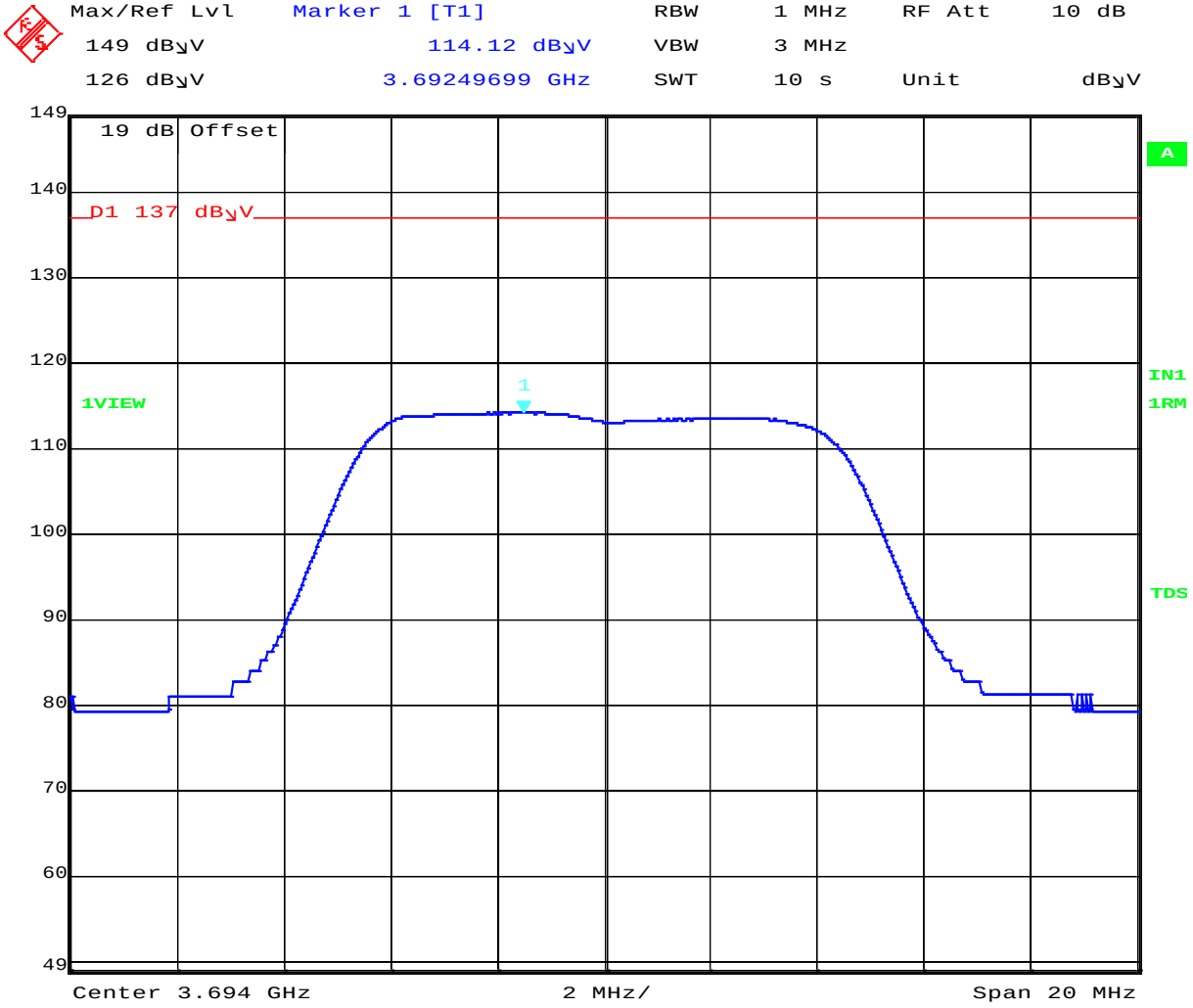


Date: 16.NOV.2017 10:06:29

Back to Matrix

Power Spectral Density

Variant: 10 MHz, Channel: 3694.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc

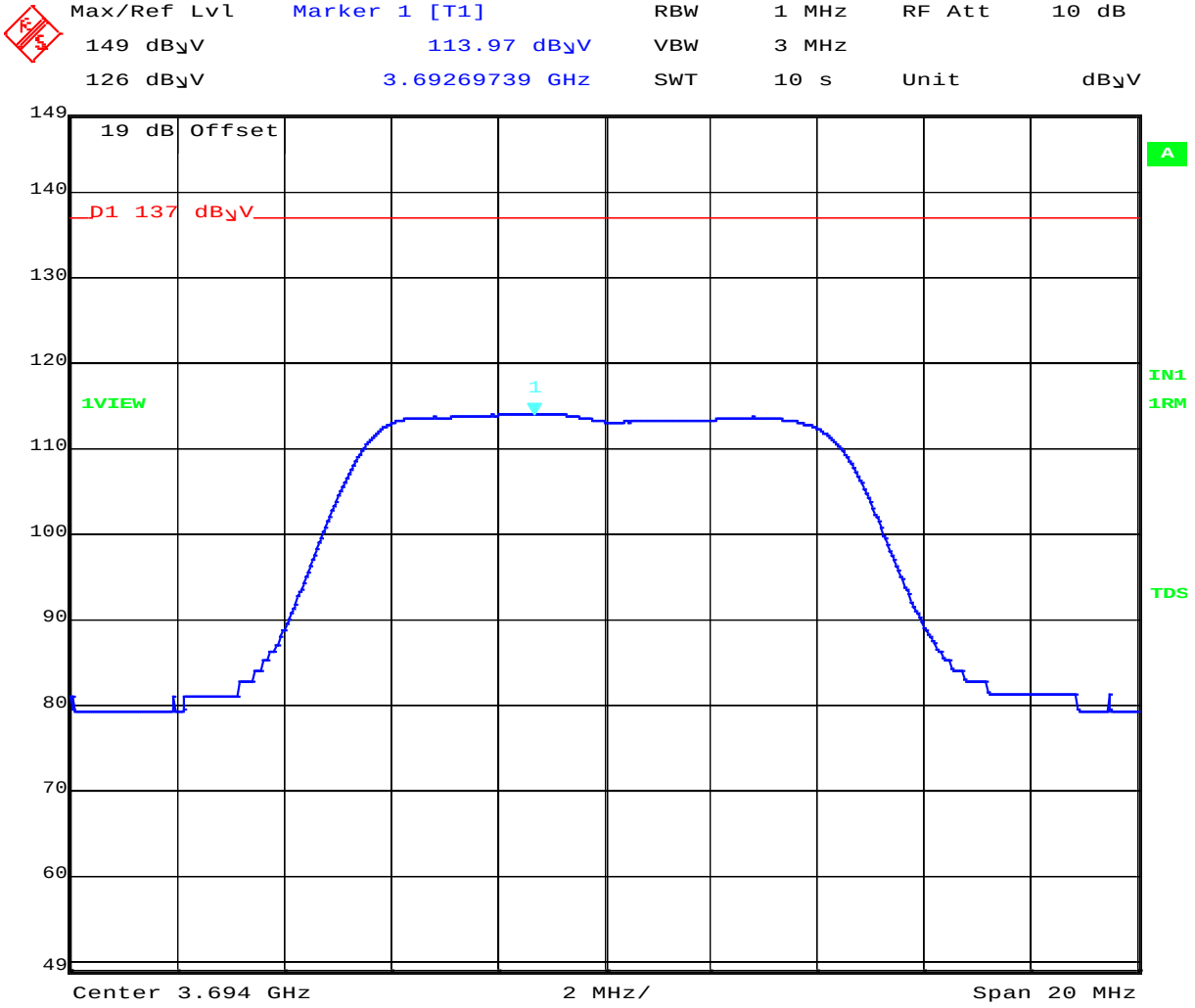


Date: 16.NOV.2017 10:17:32

Back to Matrix

Power Spectral Density

Variant: 10 MHz, Channel: 3694.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

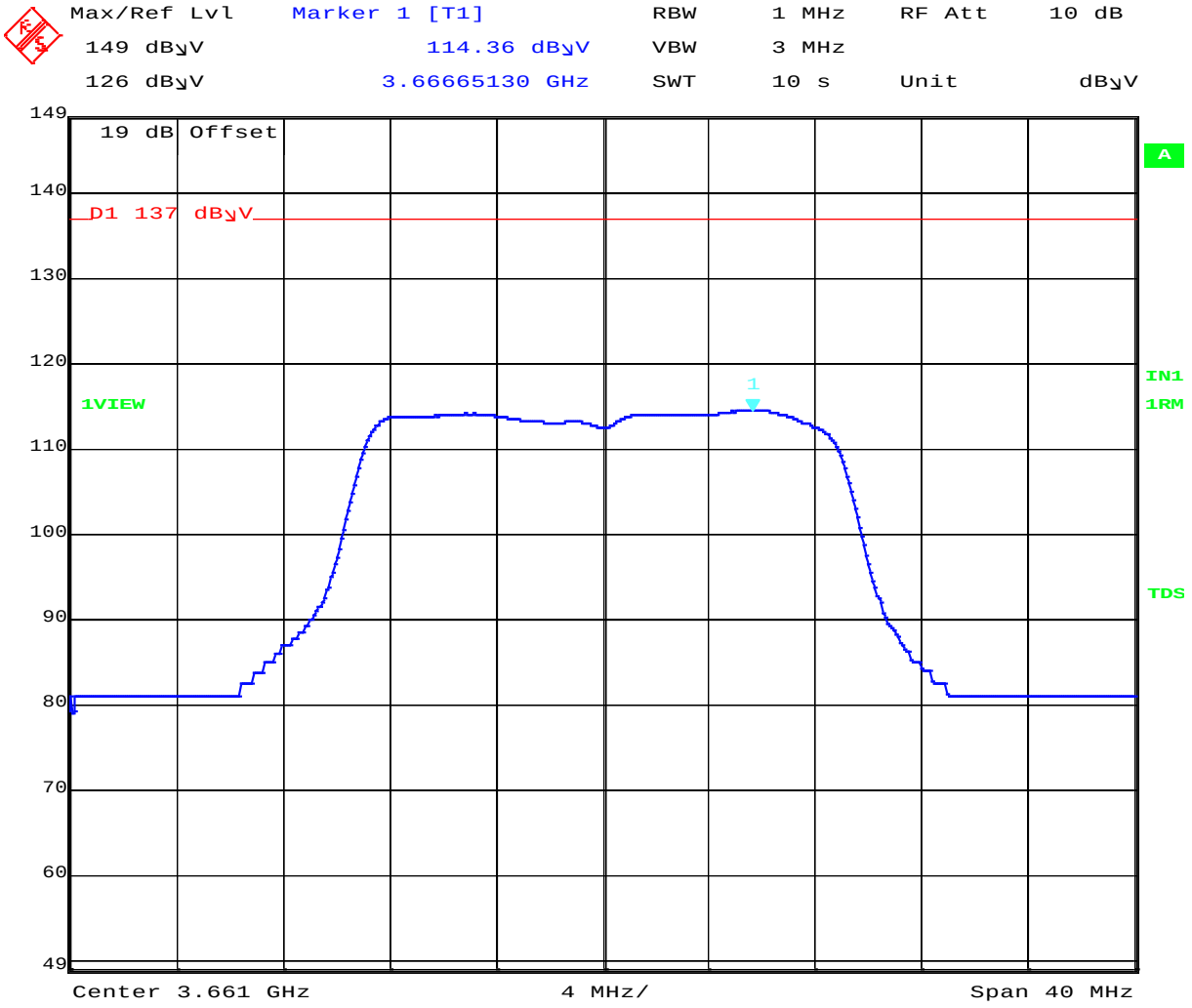


Date: 16.NOV.2017 10:18:55

Back to Matrix

Power Spectral Density

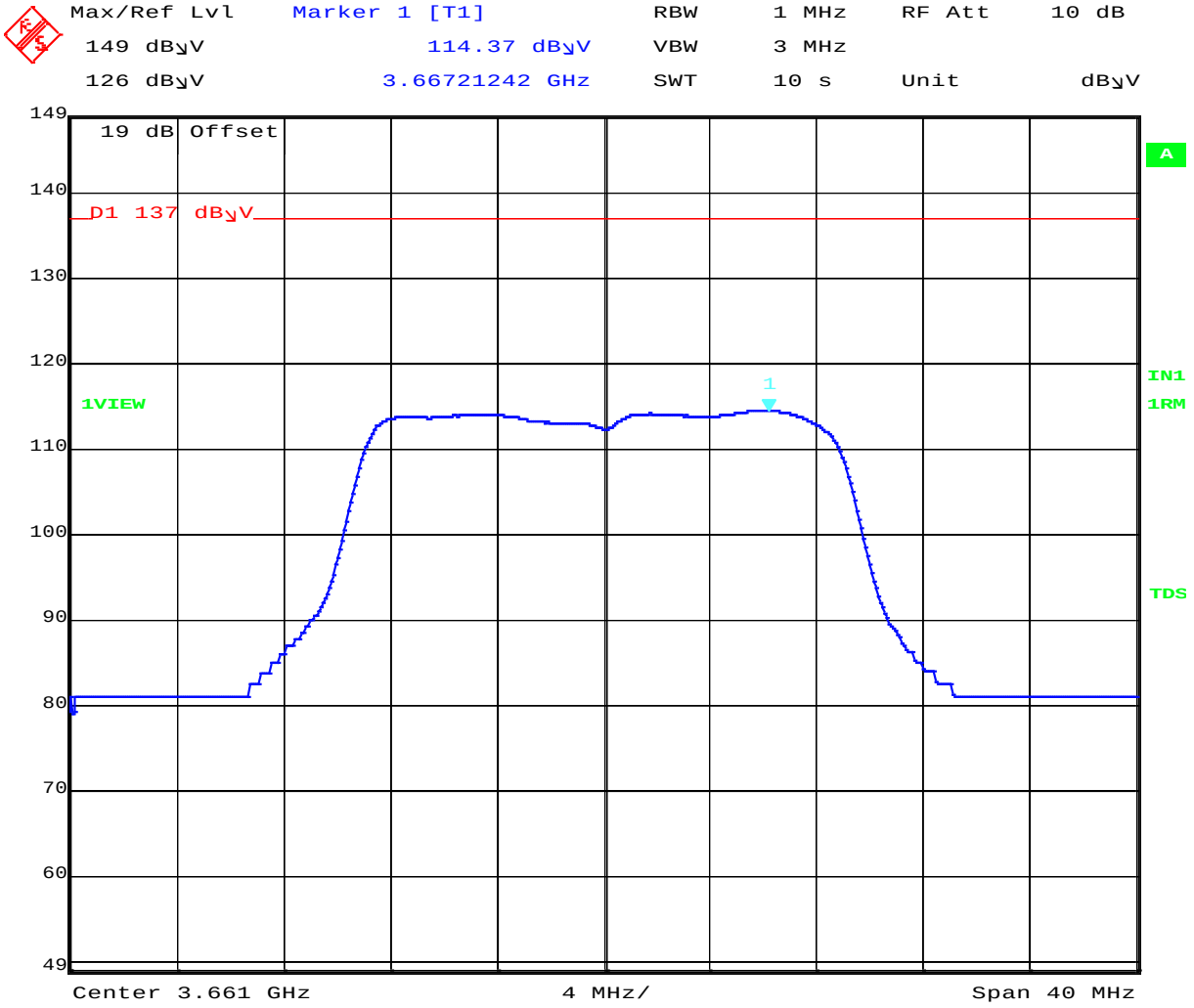
Variant: 20 MHz, Channel: 3661.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

Power Spectral Density

Variant: 20 MHz, Channel: 3661.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

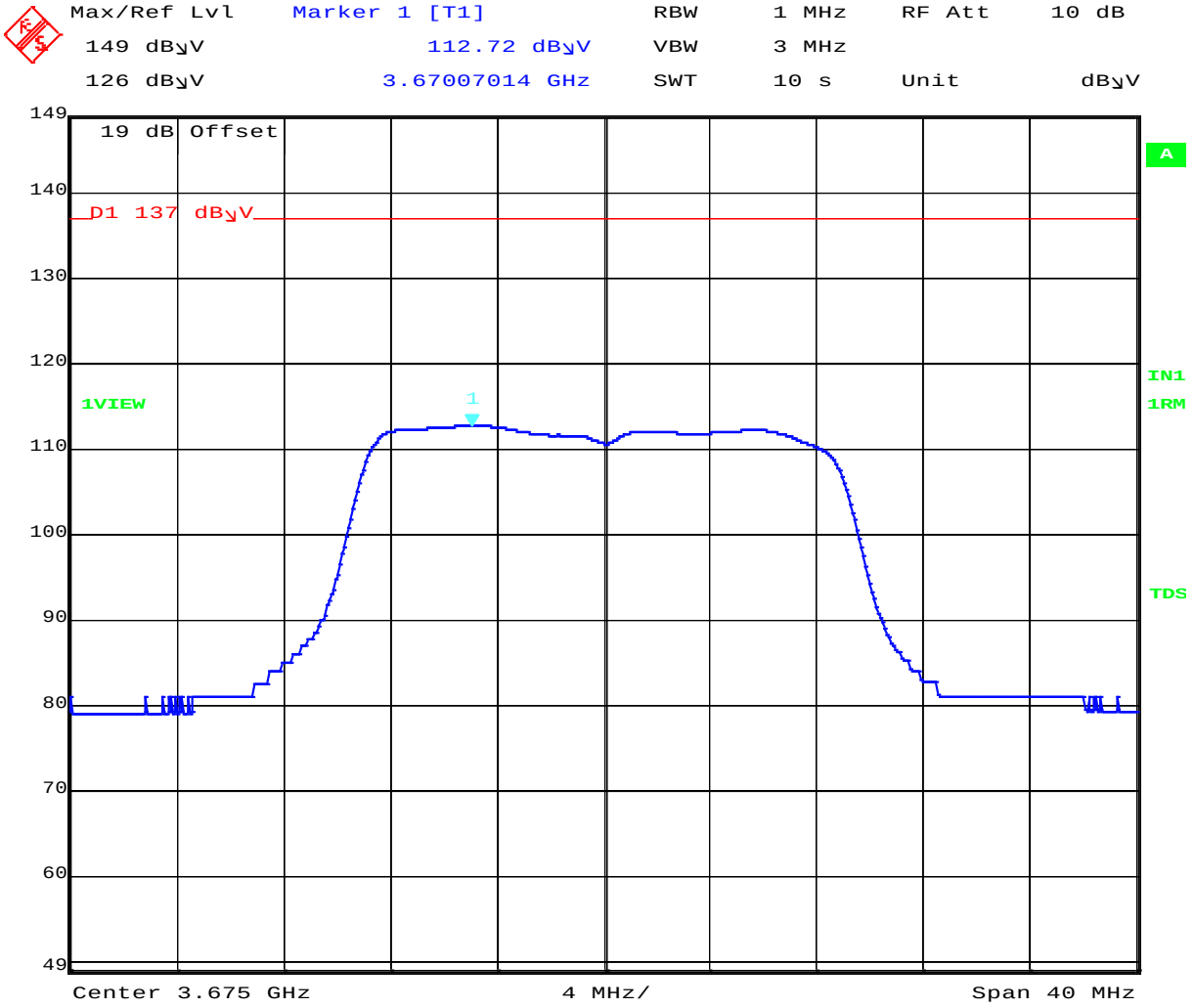


Date: 16.NOV.2017 10:20:16

Back to Matrix

Power Spectral Density

Variant: 20 MHz, Channel: 3675.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc

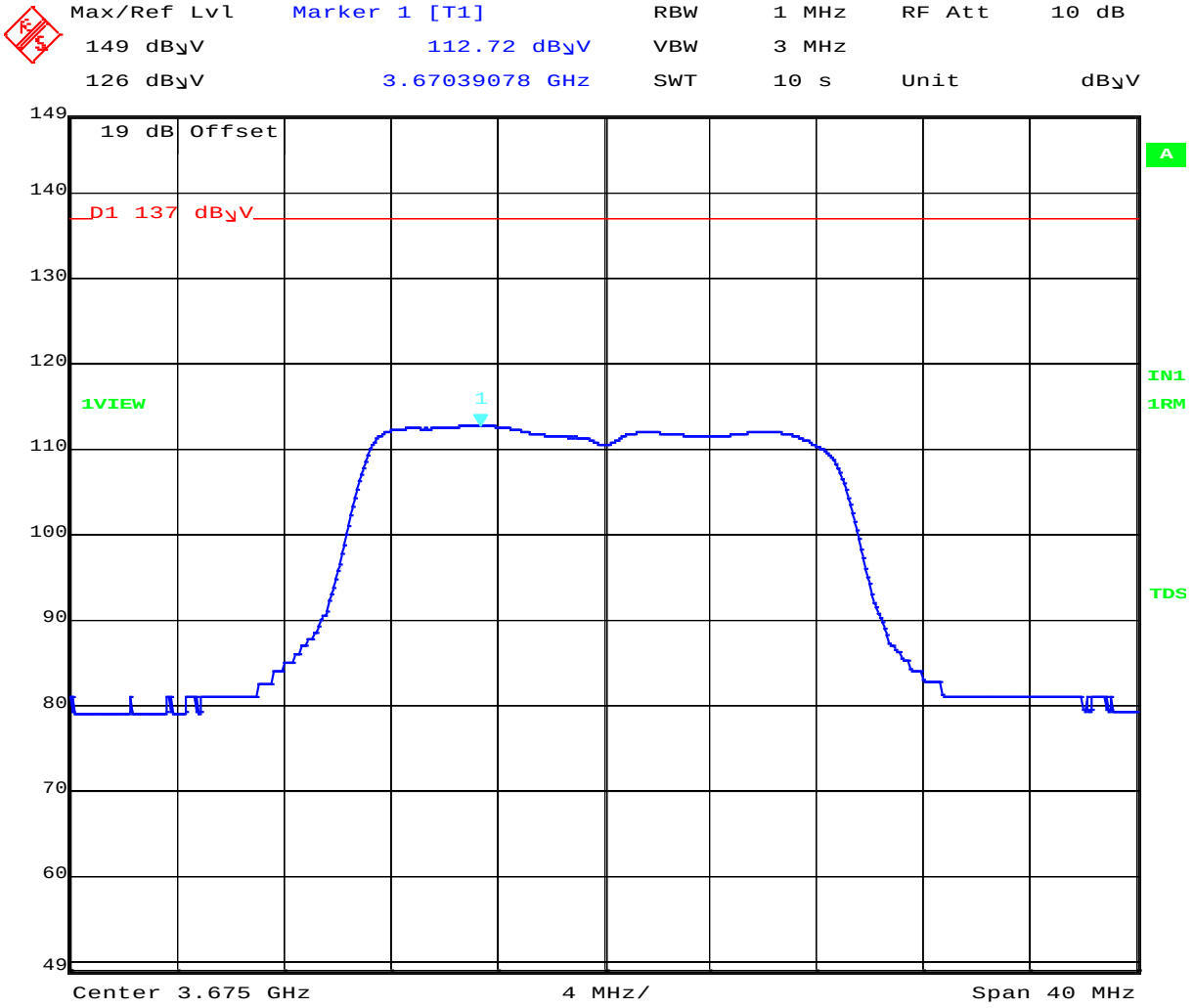


Date: 16.NOV.2017 10:22:54

Back to Matrix

Power Spectral Density

Variant: 20 MHz, Channel: 3675.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

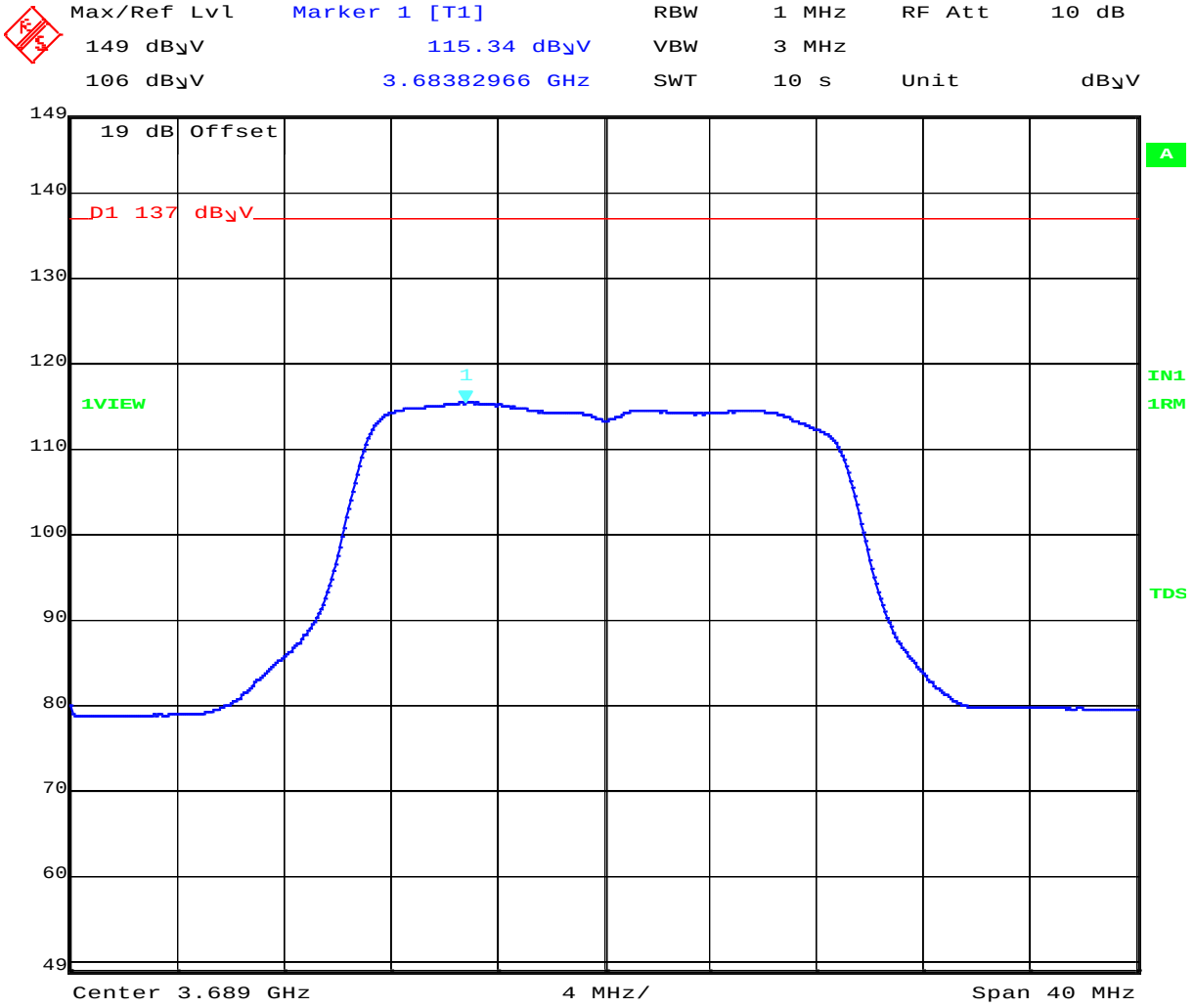


Date: 16.NOV.2017 10:23:46

Back to Matrix

Power Spectral Density

Variant: 20 MHz, Channel: 3689.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc

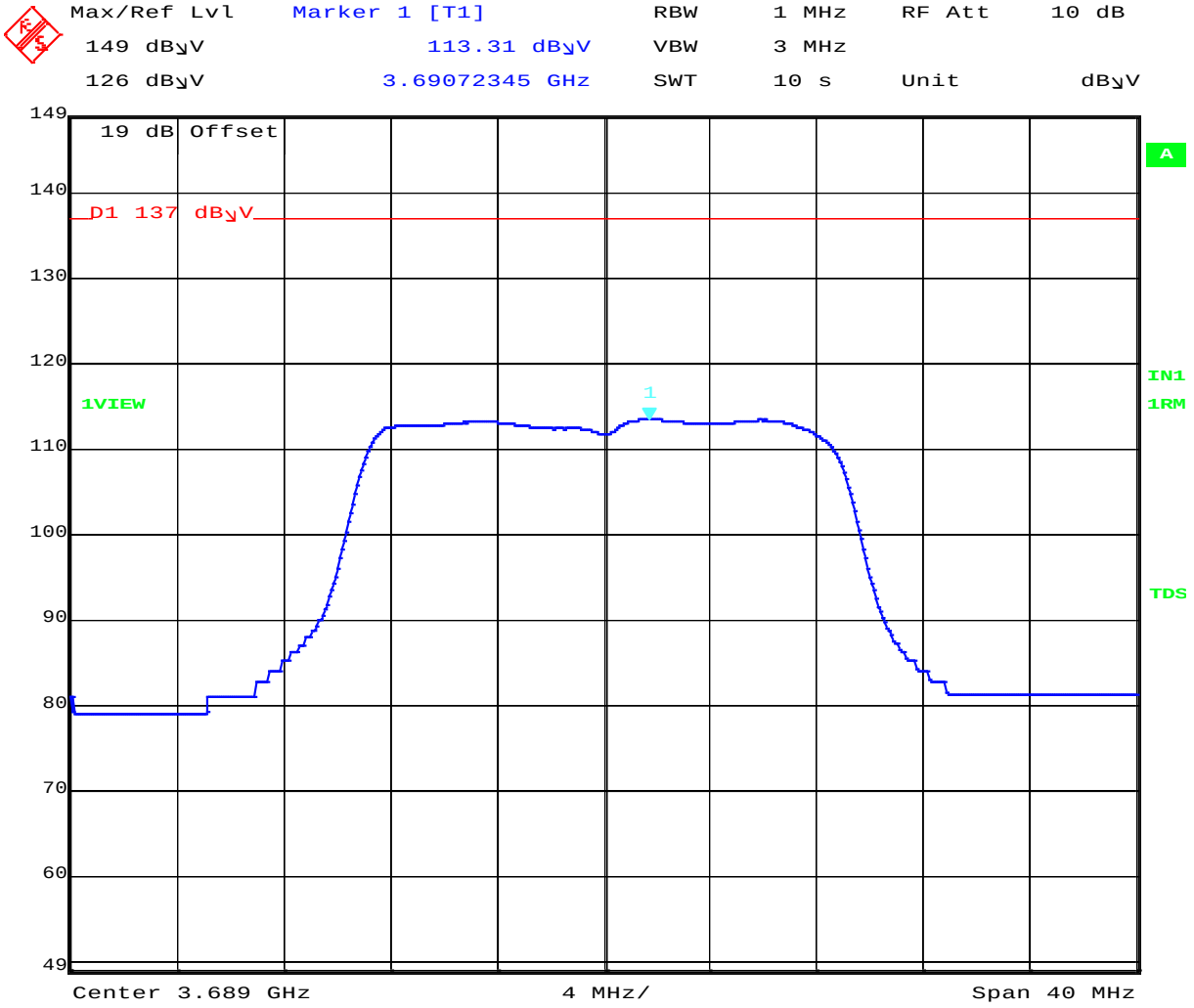


Date: 22.FEB.2018 14:11:14

Back to Matrix

Power Spectral Density

Variant: 20 MHz, Channel: 3689.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

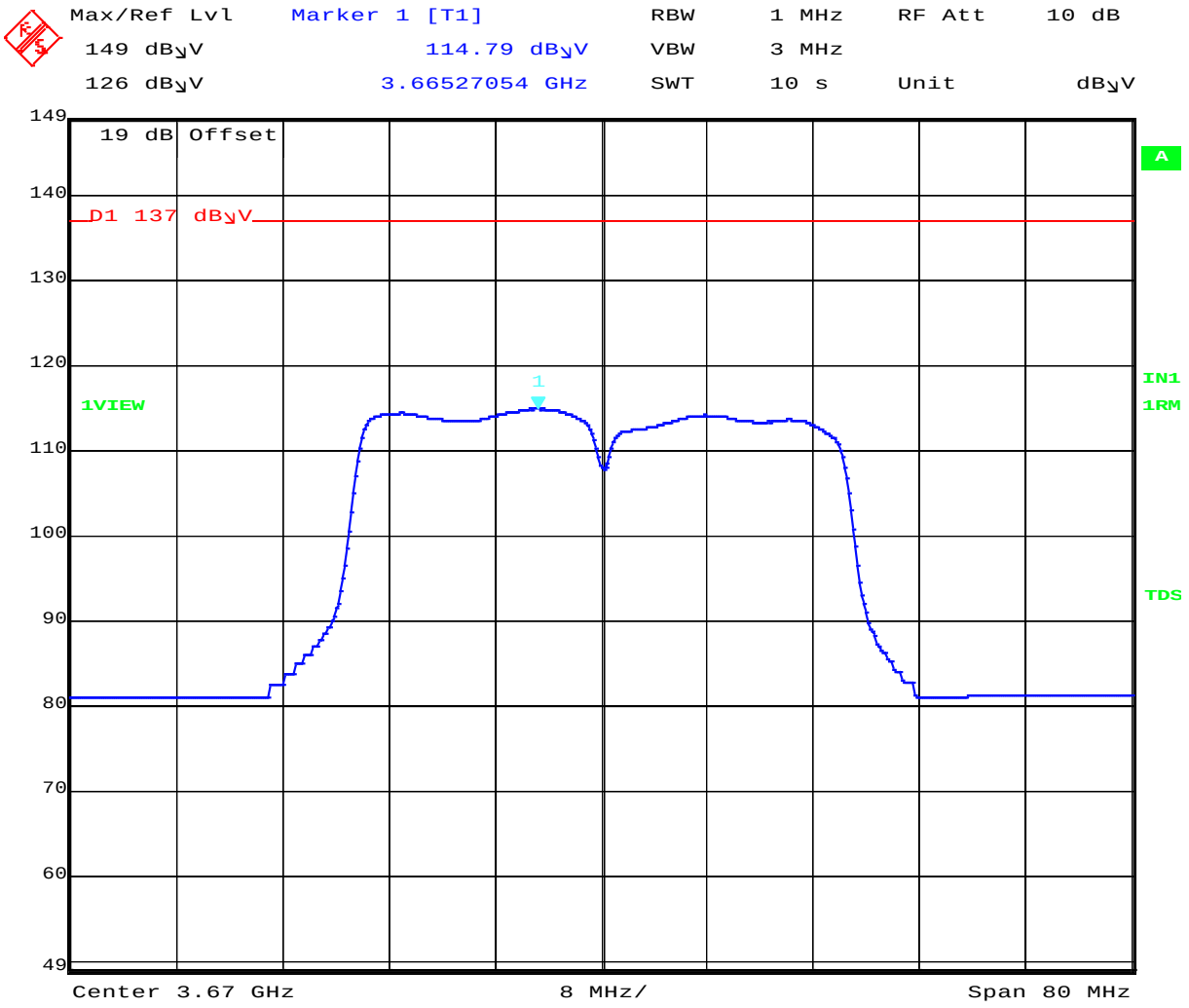


Date: 16.NOV.2017 10:25:23

Back to Matrix

Power Spectral Density

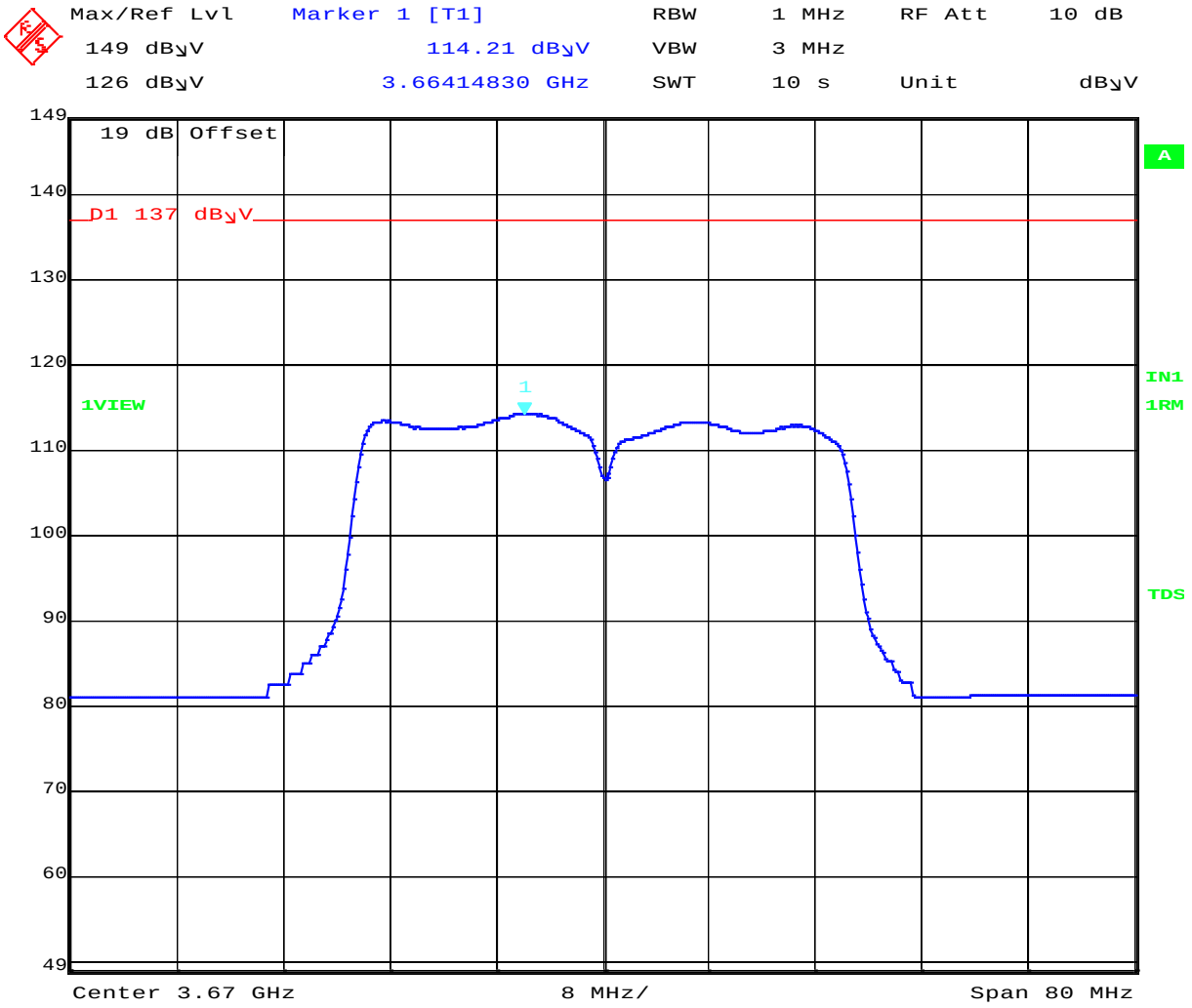
Variant: 40 MHz, Channel: 3670.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

Power Spectral Density

Variant: 40 MHz, Channel: 3670.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

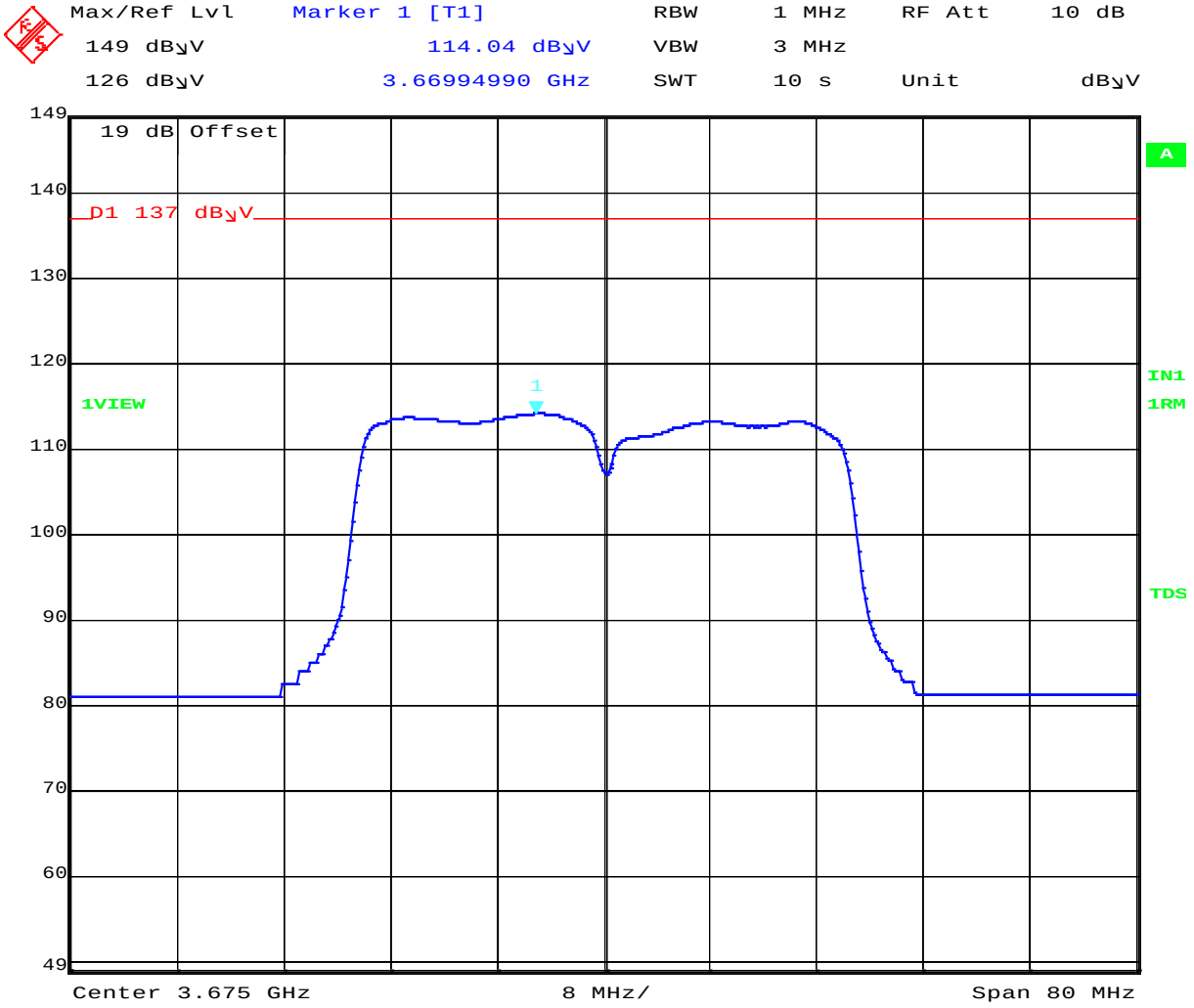


Date: 16.NOV.2017 10:31:00

Back to Matrix

Power Spectral Density

Variant: 40 MHz, Channel: 3675.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc

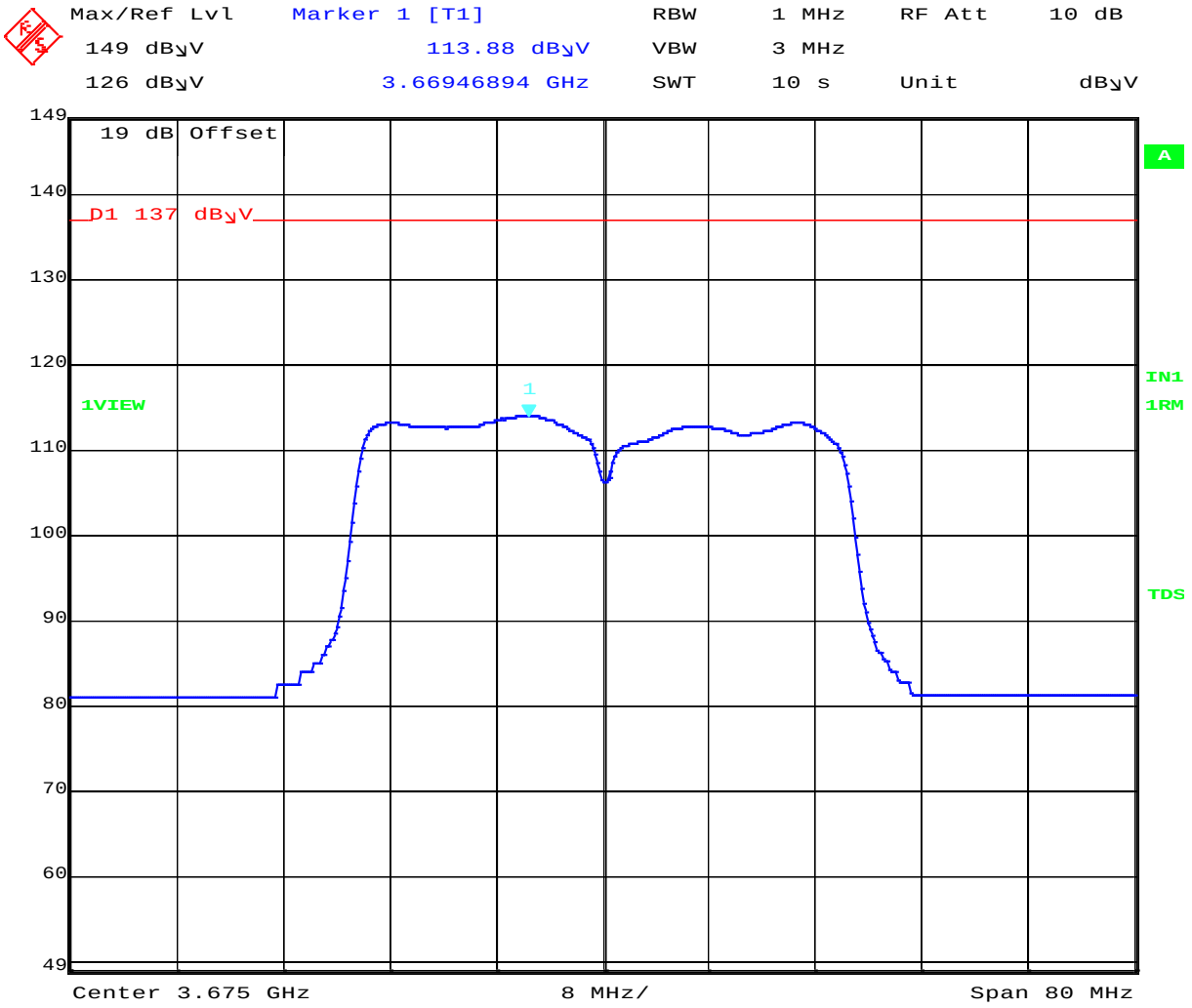


Date: 16.NOV.2017 10:33:06

Back to Matrix

Power Spectral Density

Variant: 40 MHz, Channel: 3675.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

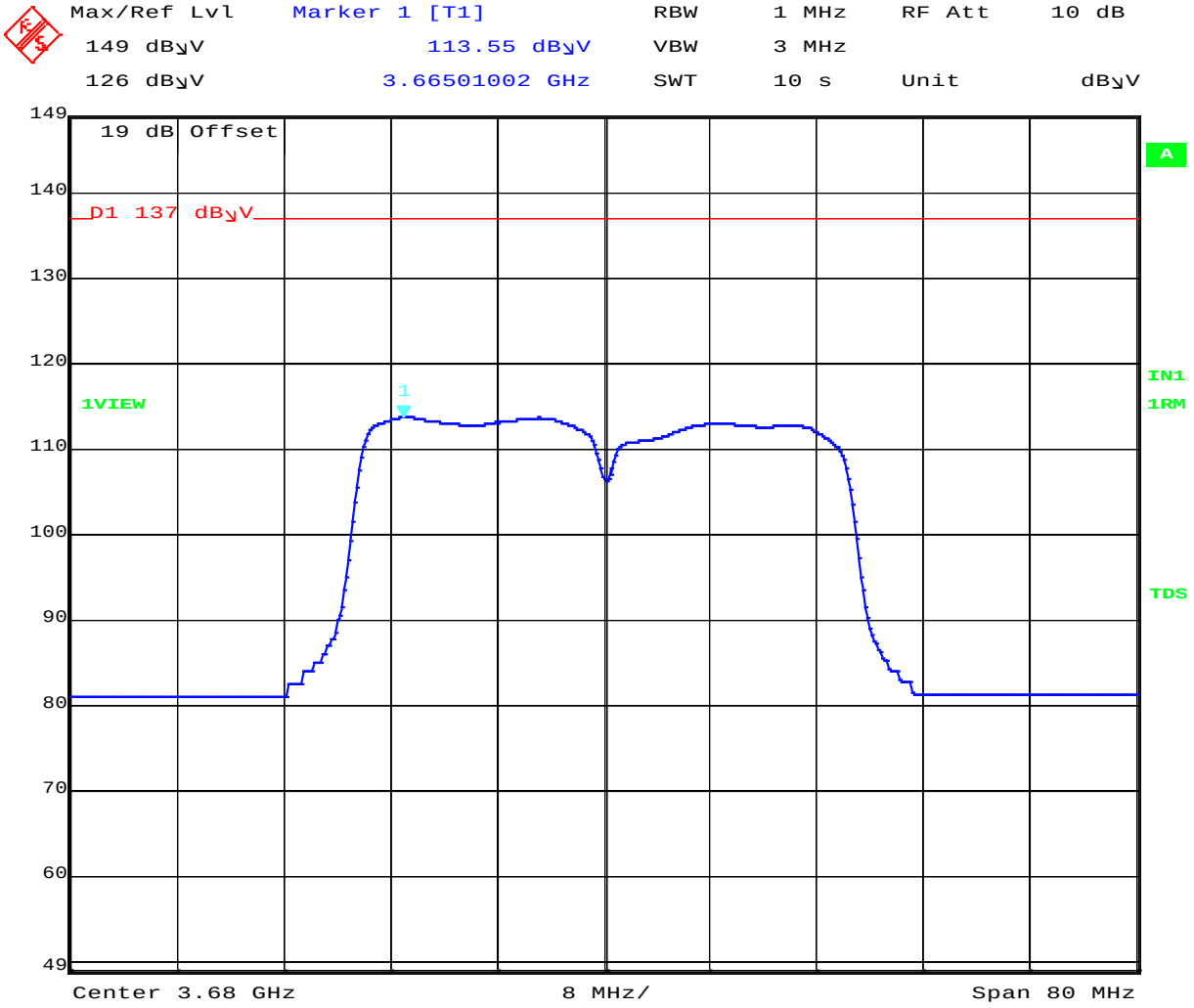


Date: 16.NOV.2017 10:32:09

Back to Matrix

Power Spectral Density

Variant: 40 MHz, Channel: 3680.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc

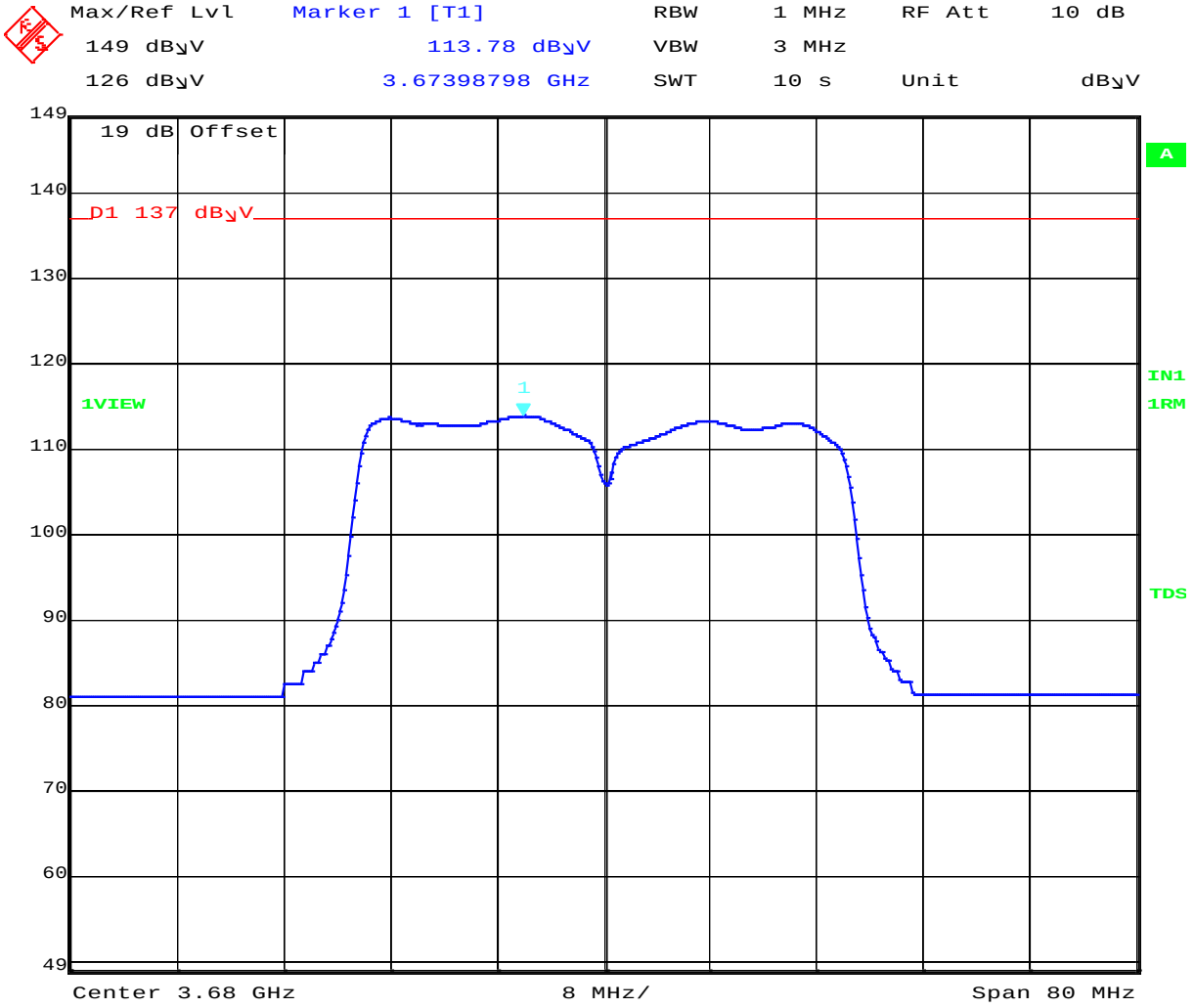


Date: 16.NOV.2017 10:35:40

Back to Matrix

Power Spectral Density

Variant: 40 MHz, Channel: 3680.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc



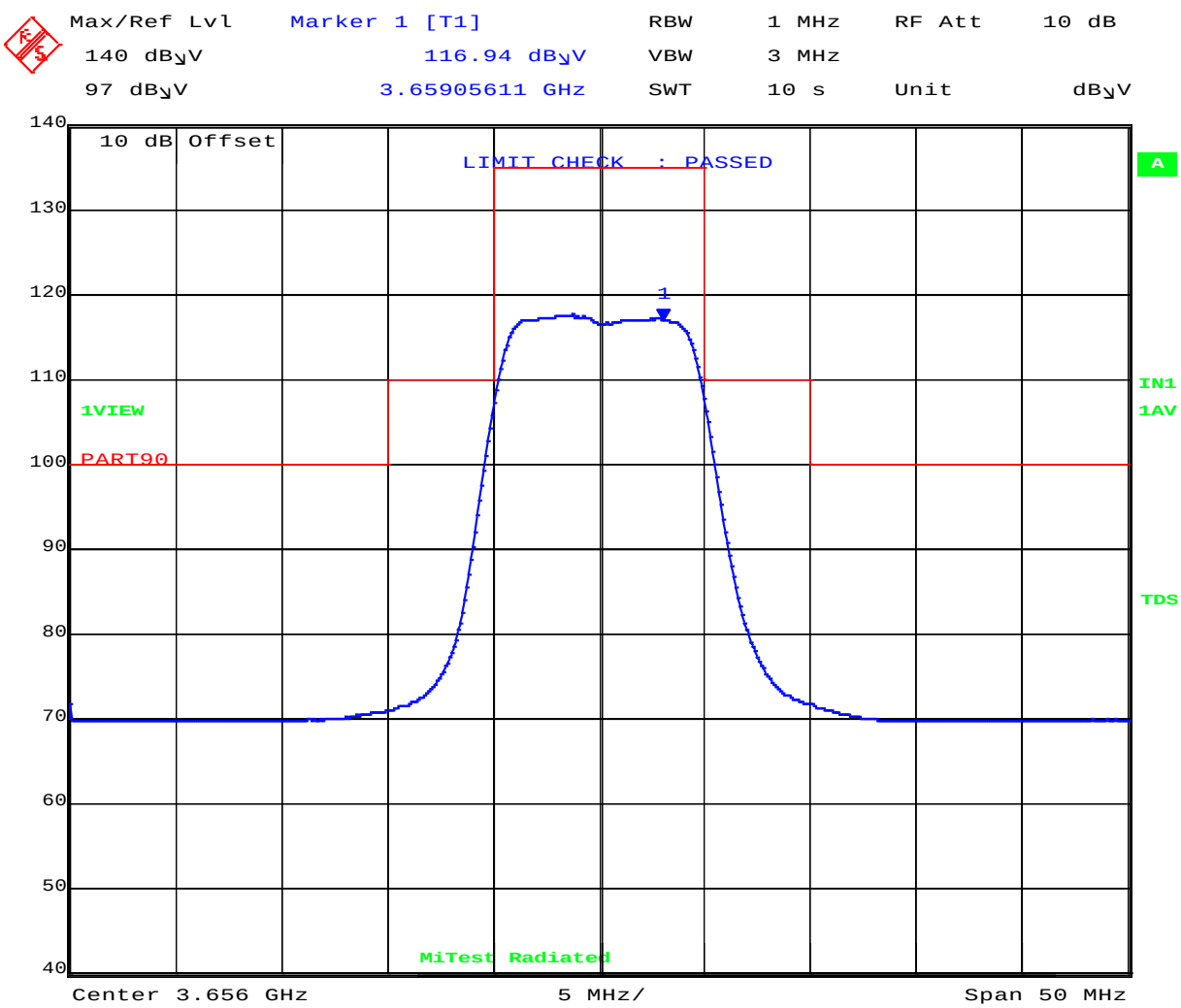
Date: 16.NOV.2017 10:37:56

Back to Matrix

A.1.3. Spectrum Mask

Spectrum Mask

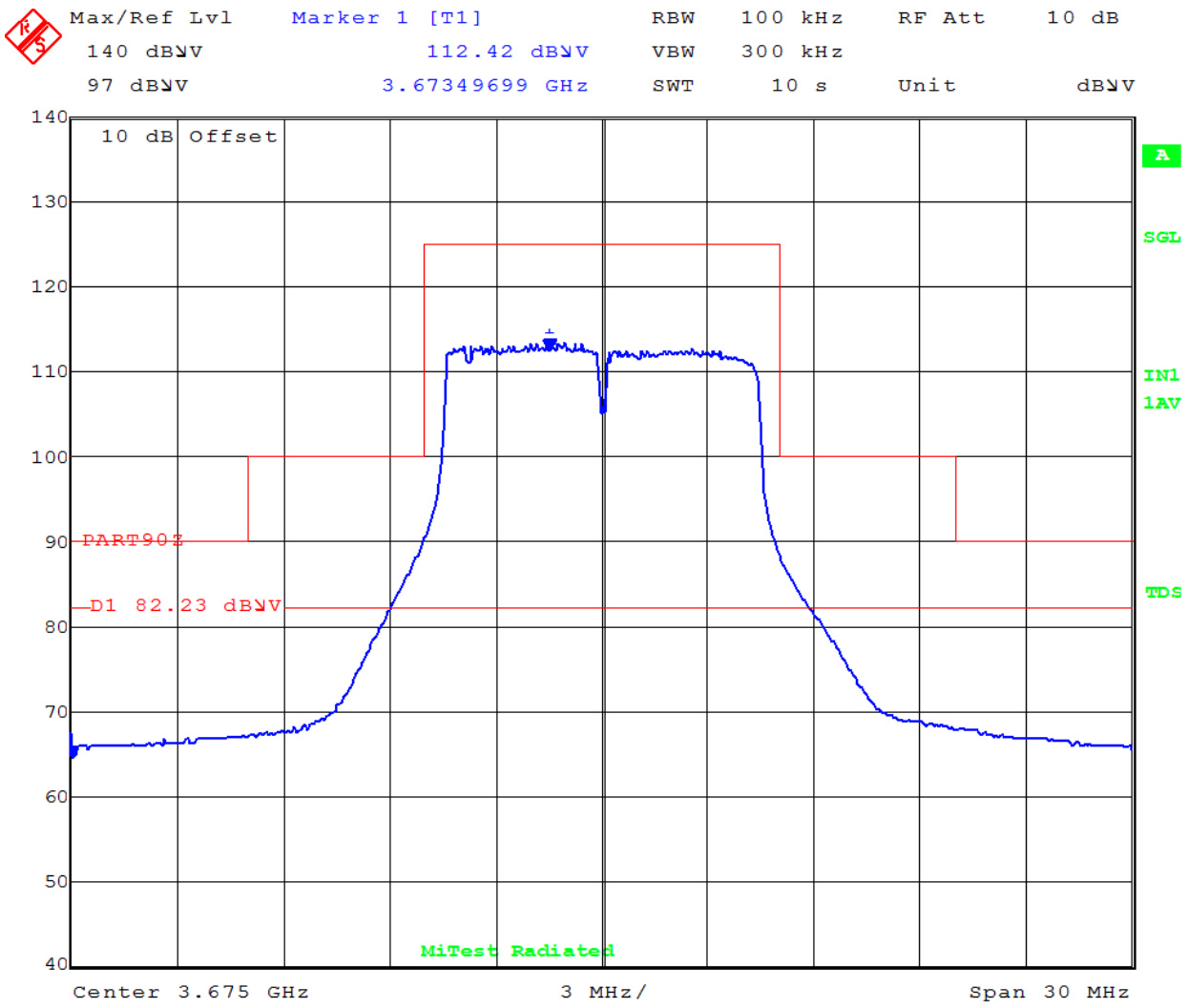
Variant: 10MHz Polarity: H, Channel: 3656.00 MHz, Temp: Ambient, Voltage: 55 Vdc



back to matrix

Spectrum Mask

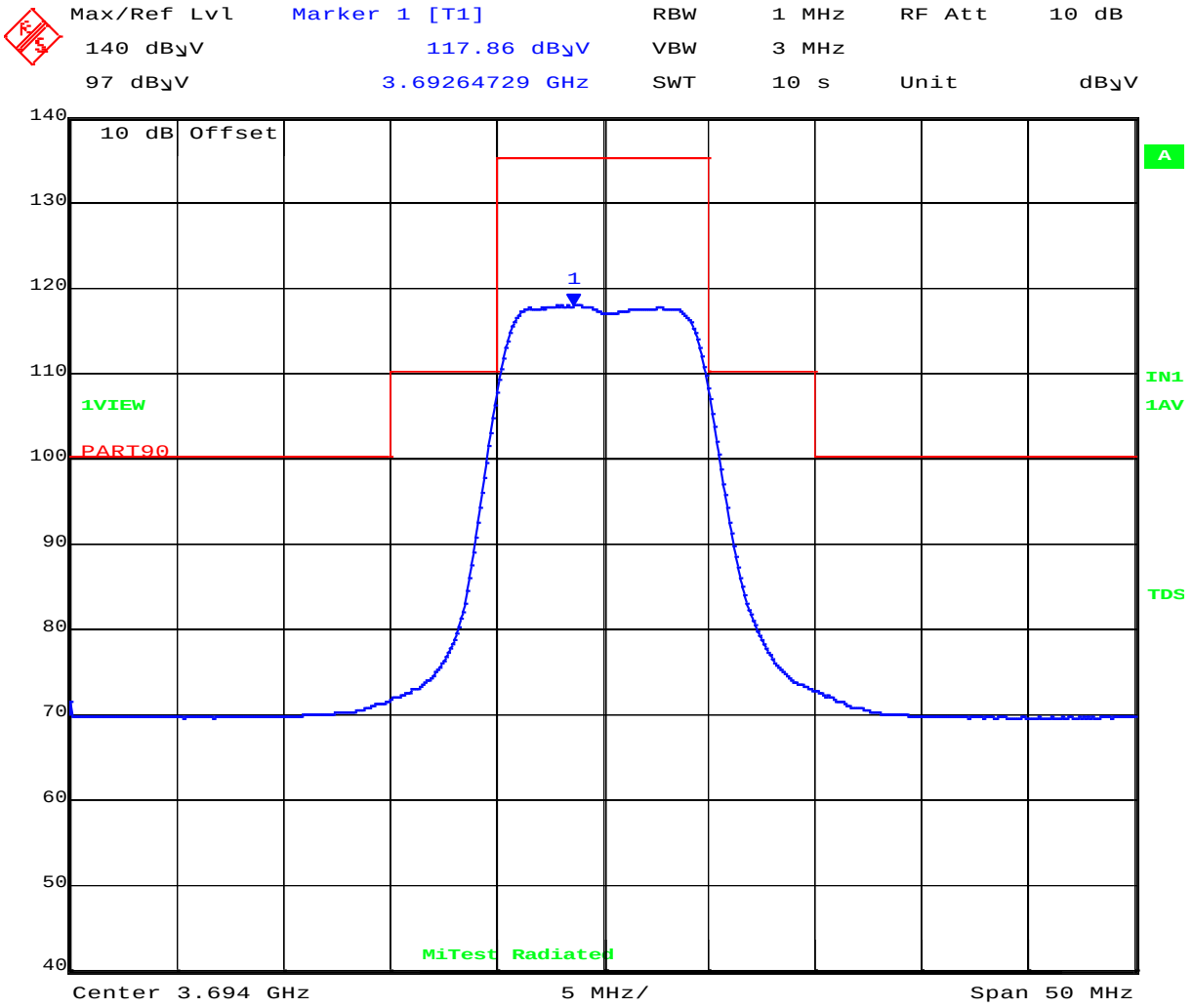
Variant: 10MHz Polarity: H, Channel: 3675.00 MHz, , Temp: Ambient, Voltage: 55 Vdc



back to matrix

Spectrum Mask

Variant: 10MHz Polarity: H, Channel: 3694.00 MHz, , Temp: Ambient, Voltage: 55 Vdc

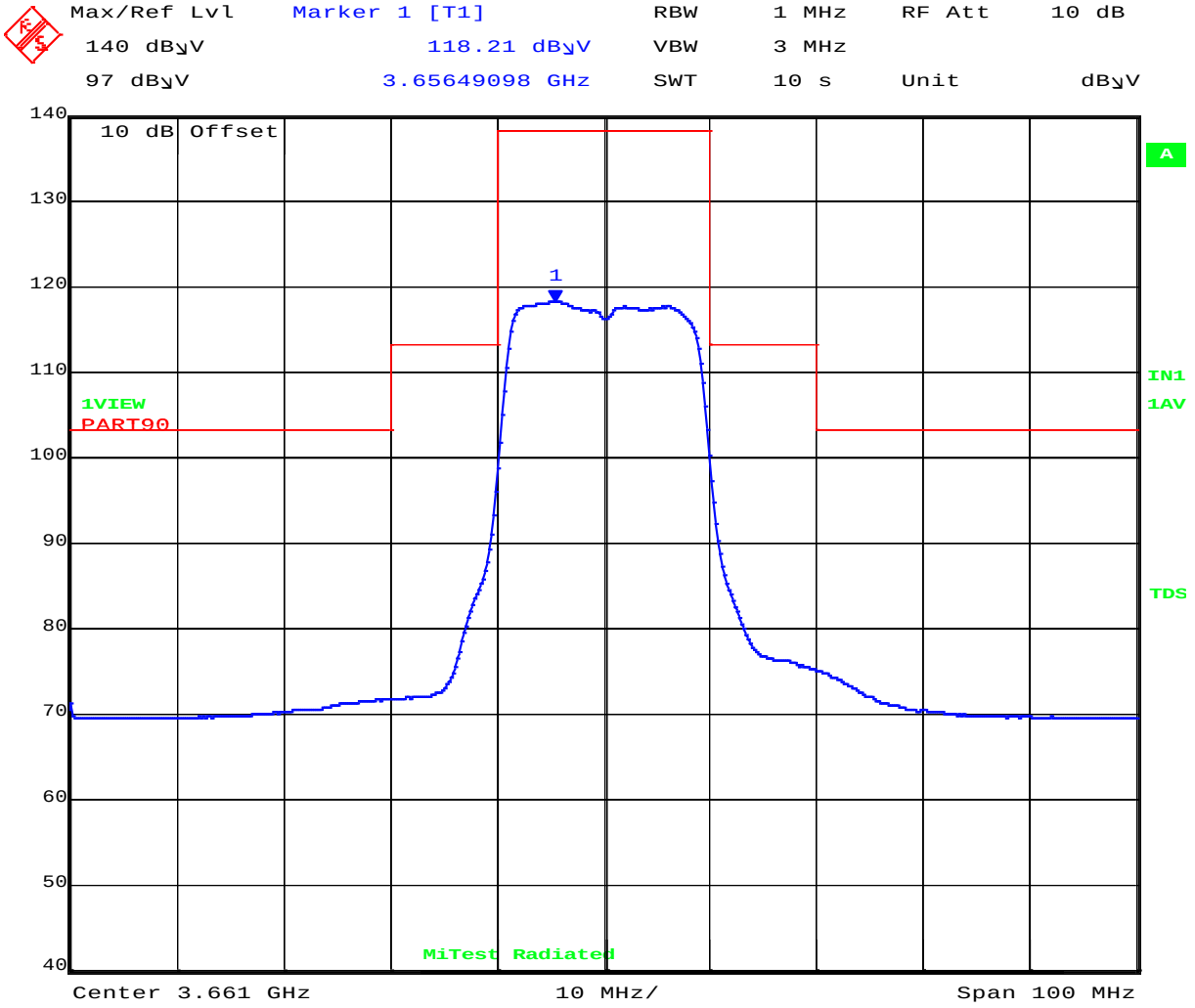


Date: 22.NOV.2017 13:39:43

back to matrix

Spectrum Mask

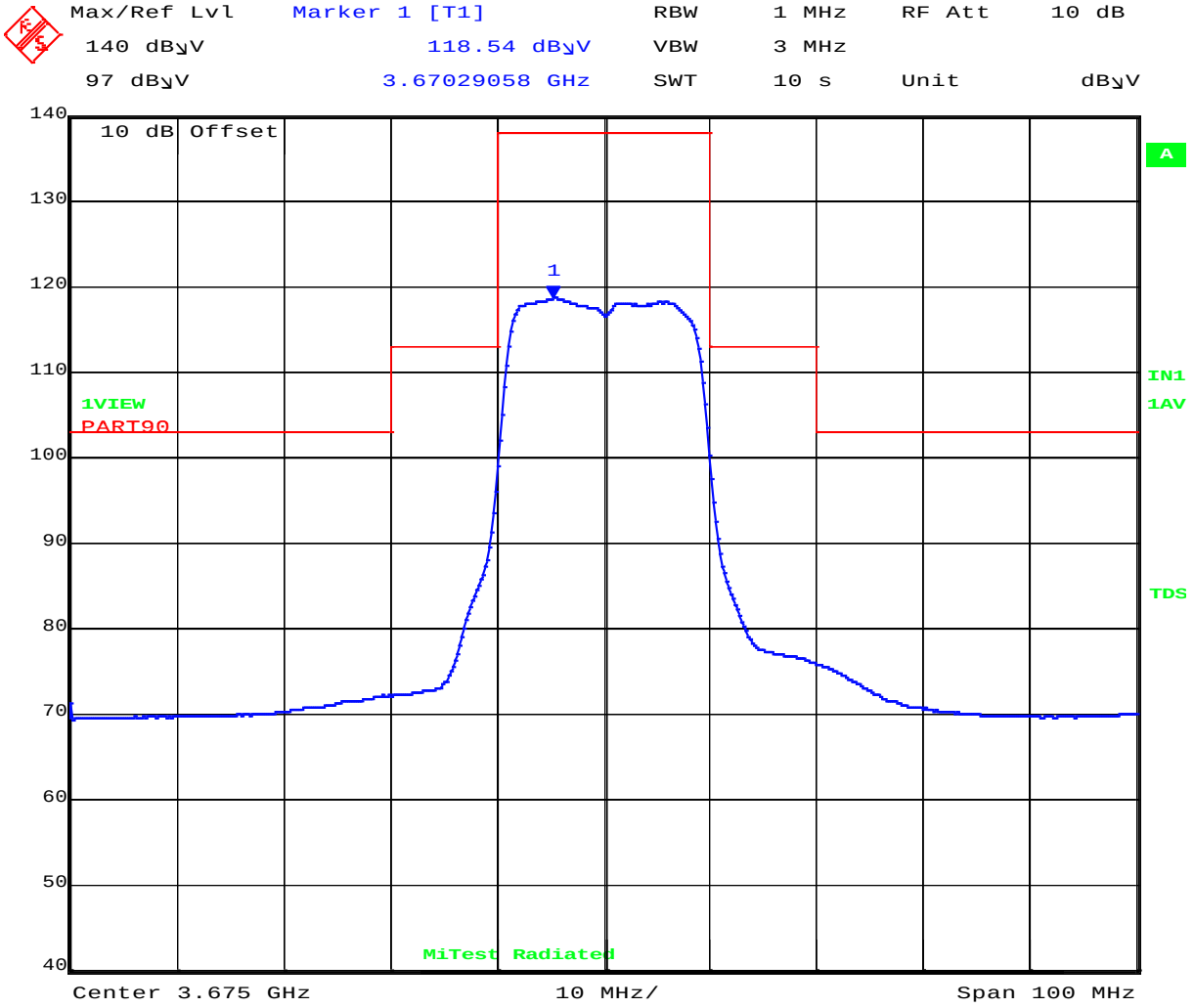
Variant: 20MHz Polarity: H, Channel: 3661.00 MHz, , Temp: Ambient, Voltage: 55 Vdc



back to matrix

Spectrum Mask

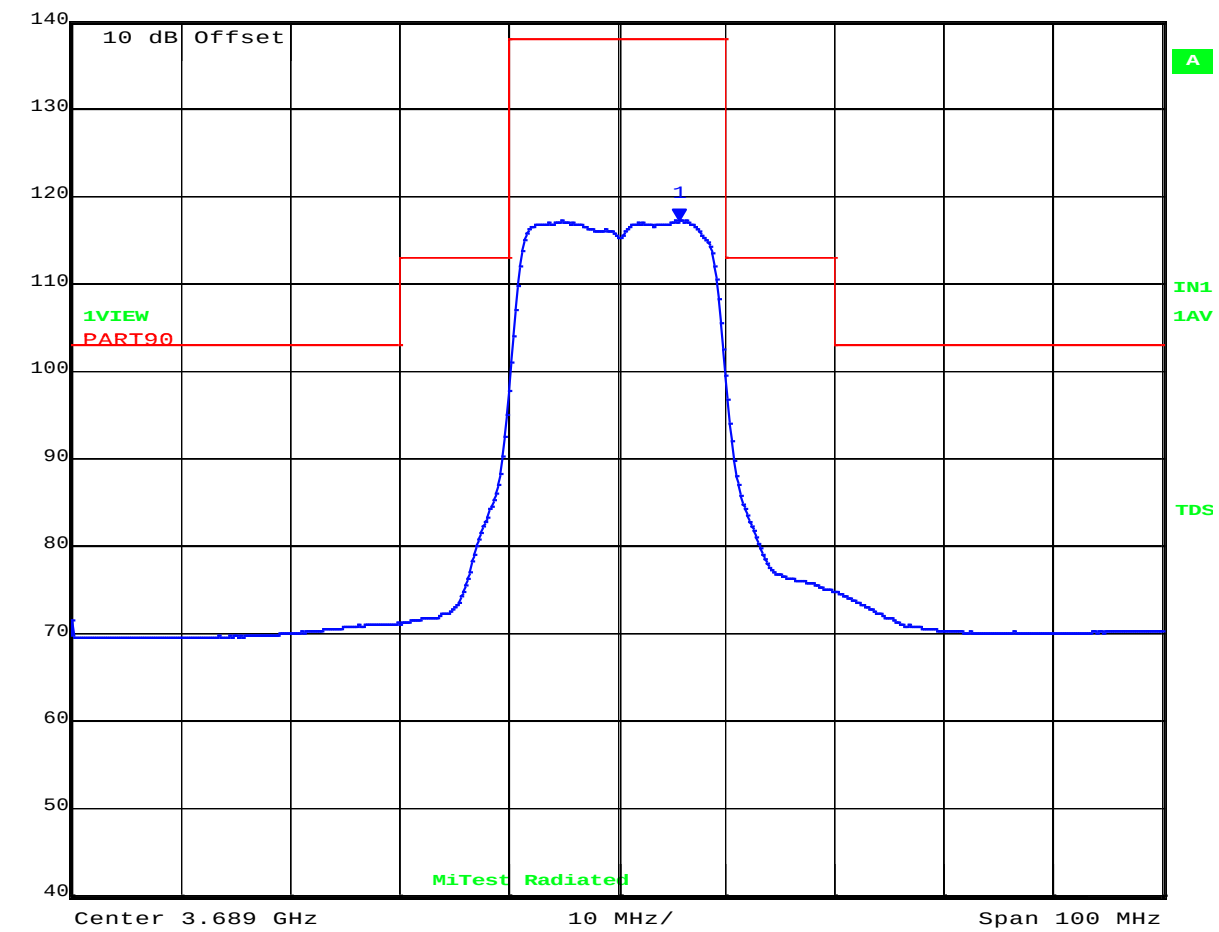
Variant: 20MHz Polarity: H, Channel: 3675.00 MHz, , Temp: Ambient, Voltage: 55 Vdc



back to matrix

Spectrum Mask

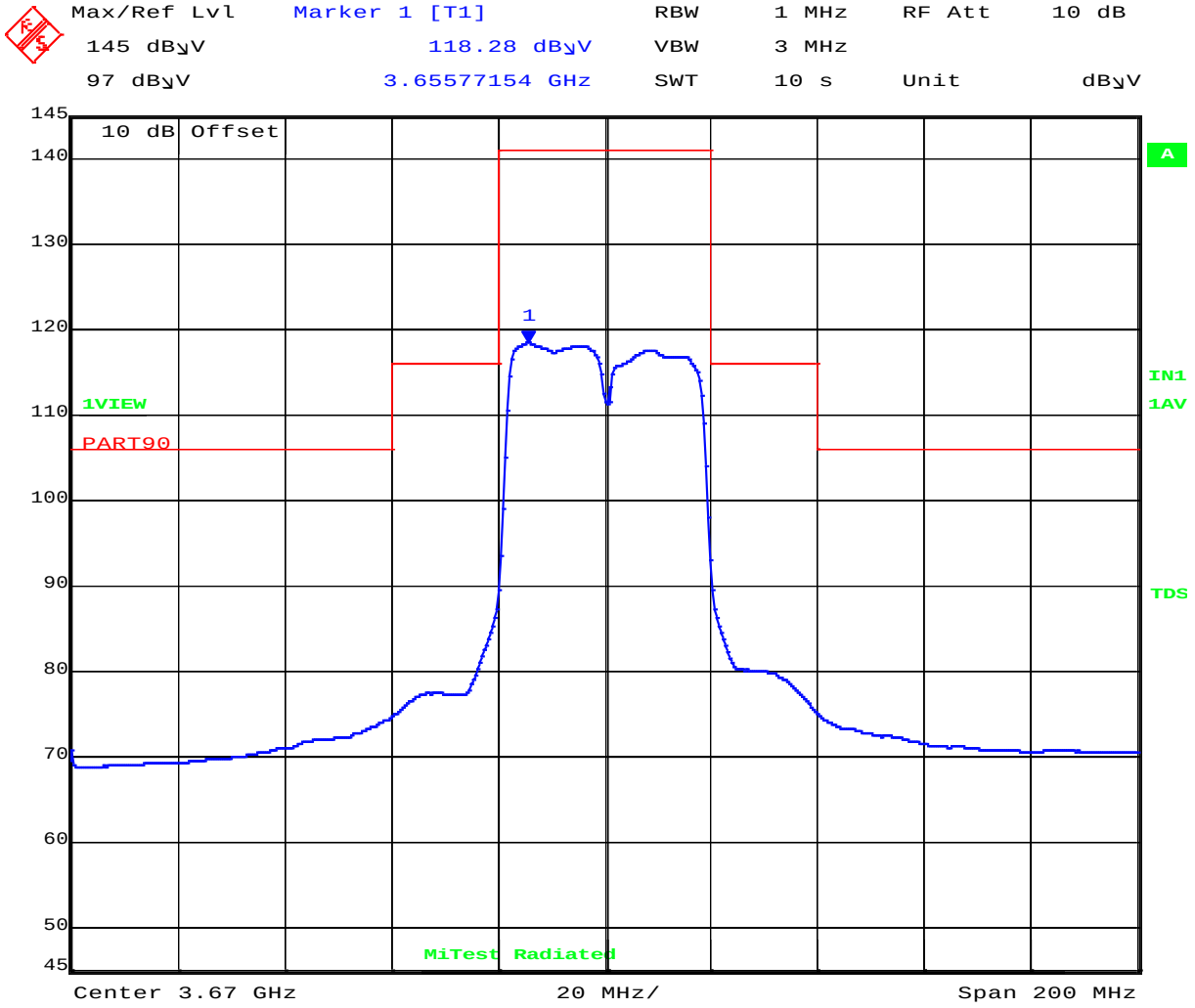
Variant: 20MHz Polarity: H, Channel: 3689.00 MHz, , Temp: Ambient, Voltage: 55 Vdc



back to matrix

Spectrum Mask

Variant: 40MHz Polarity: H, Channel: 3670.00 MHz, , Temp: Ambient, Voltage: 55 Vdc

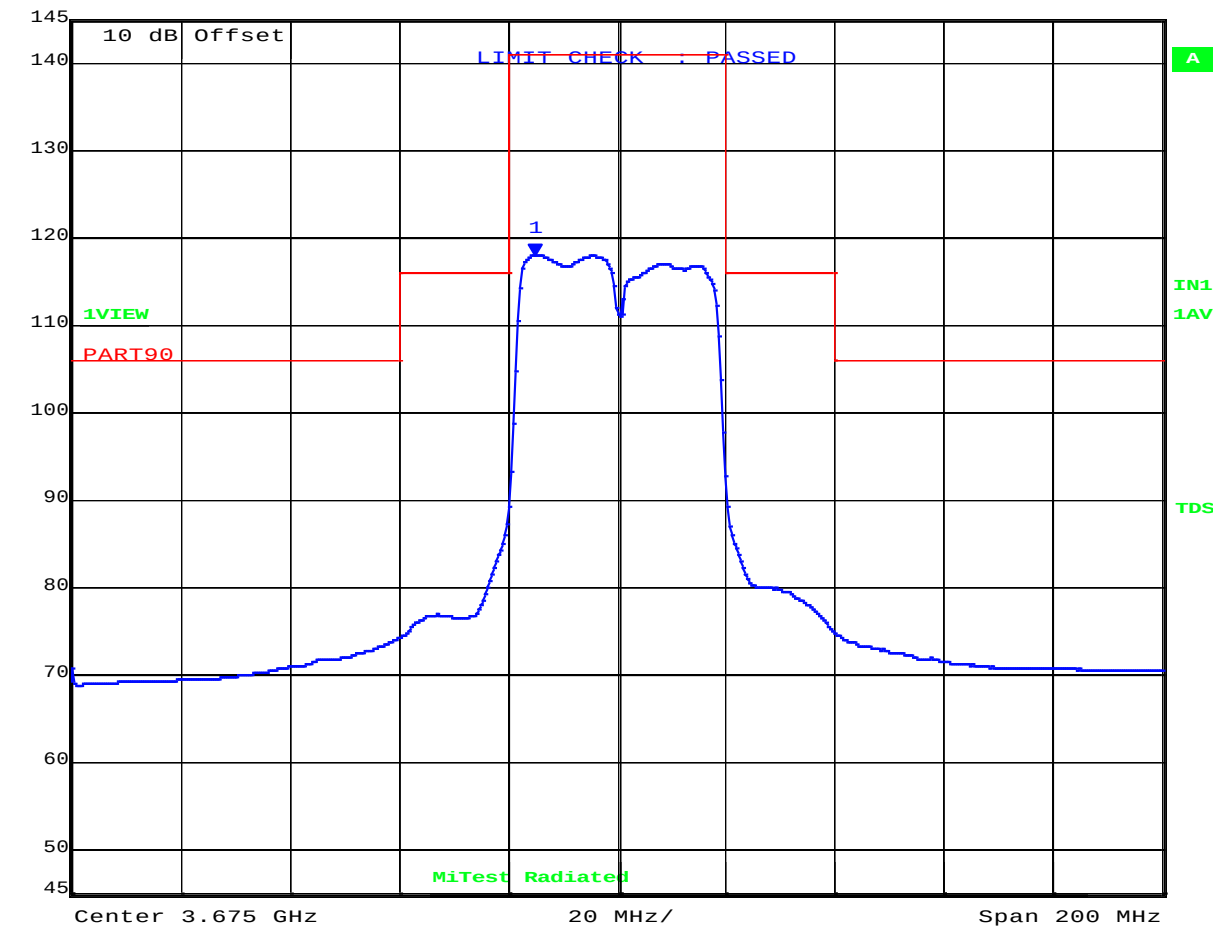


Date: 22.NOV.2017 14:13:28

back to matrix

Spectrum Mask

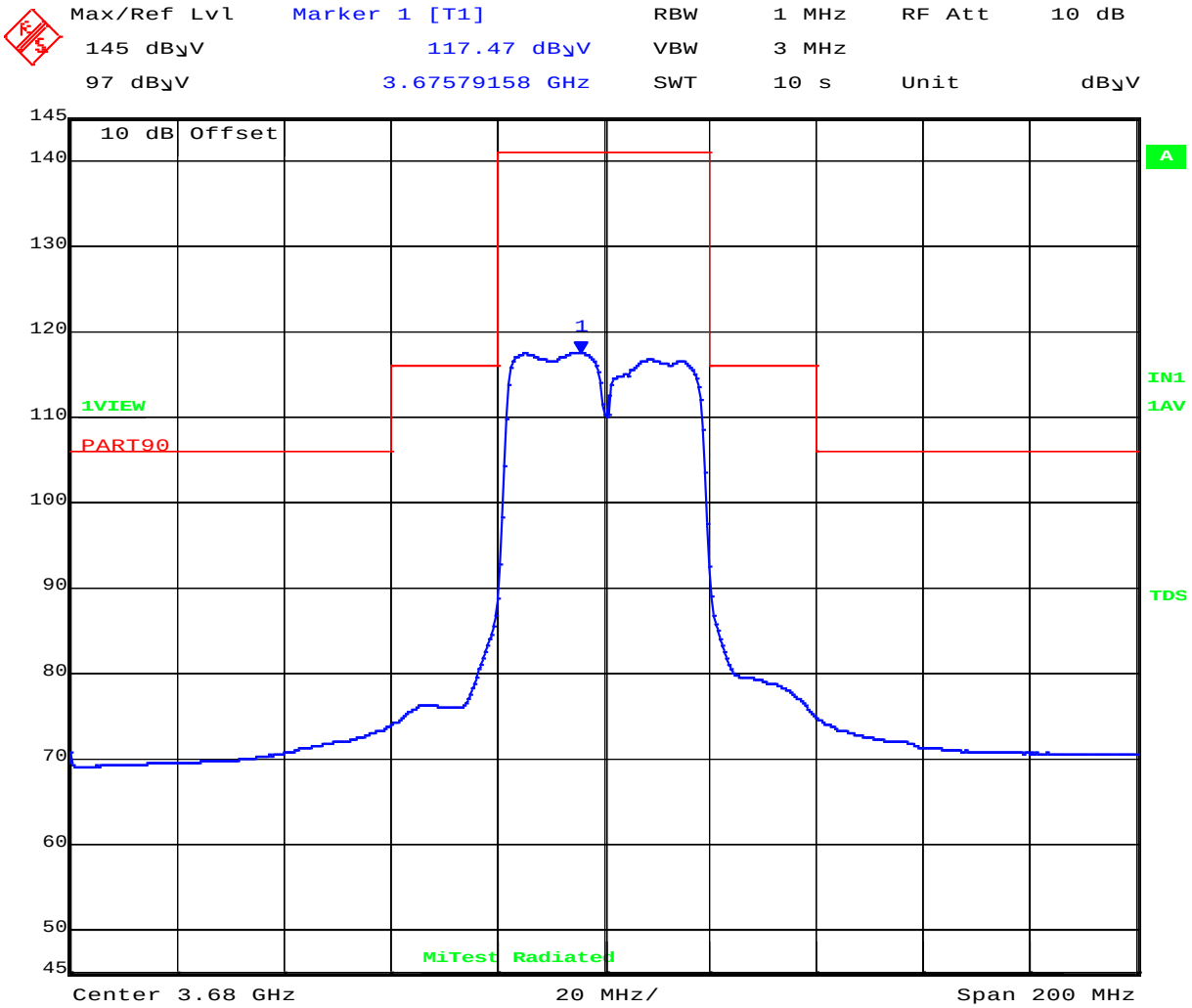
Variant: 40MHz Polarity: H, Channel: 3675.00 MHz, , Temp: Ambient, Voltage: 55 Vdc



back to matrix

Spectrum Mask

Variant: 40MHz Polarity: H, Channel: 3680.00 MHz, , Temp: Ambient, Voltage: 55 Vdc

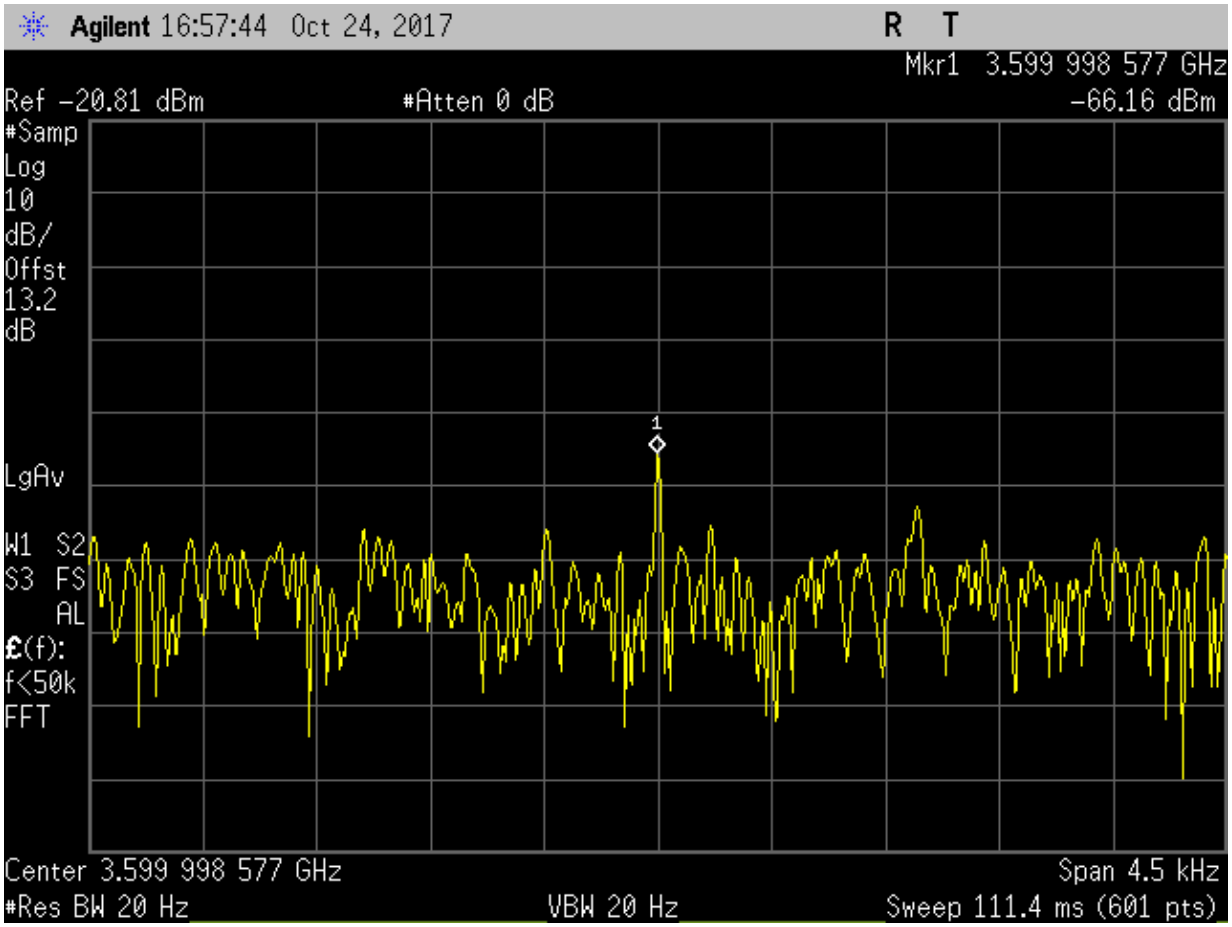


back to matrix

A.1.4. Frequency Stability

Carrier Frequencies 20 °C

Variant: , Channel: 3660.00 MHz, , Temp: nom, Voltage: 55 Vdc

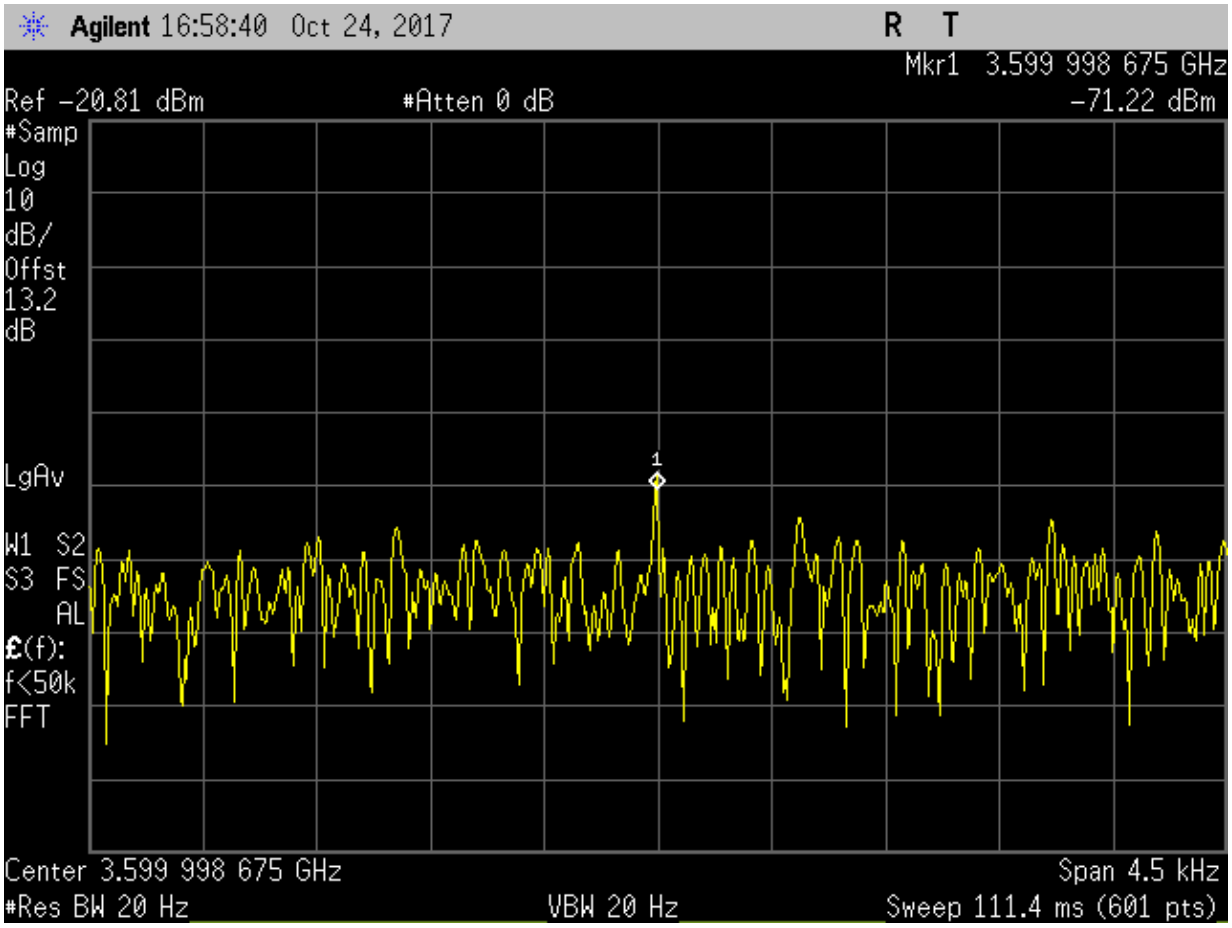


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 0 Trace Mode = CLR/WRITE	M1 : 3599.998 MHz : -66.16 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies 20 °C

Variant: , Channel: 3660.00 MHz, , Temp: nom, Voltage: 46.75 Vdc

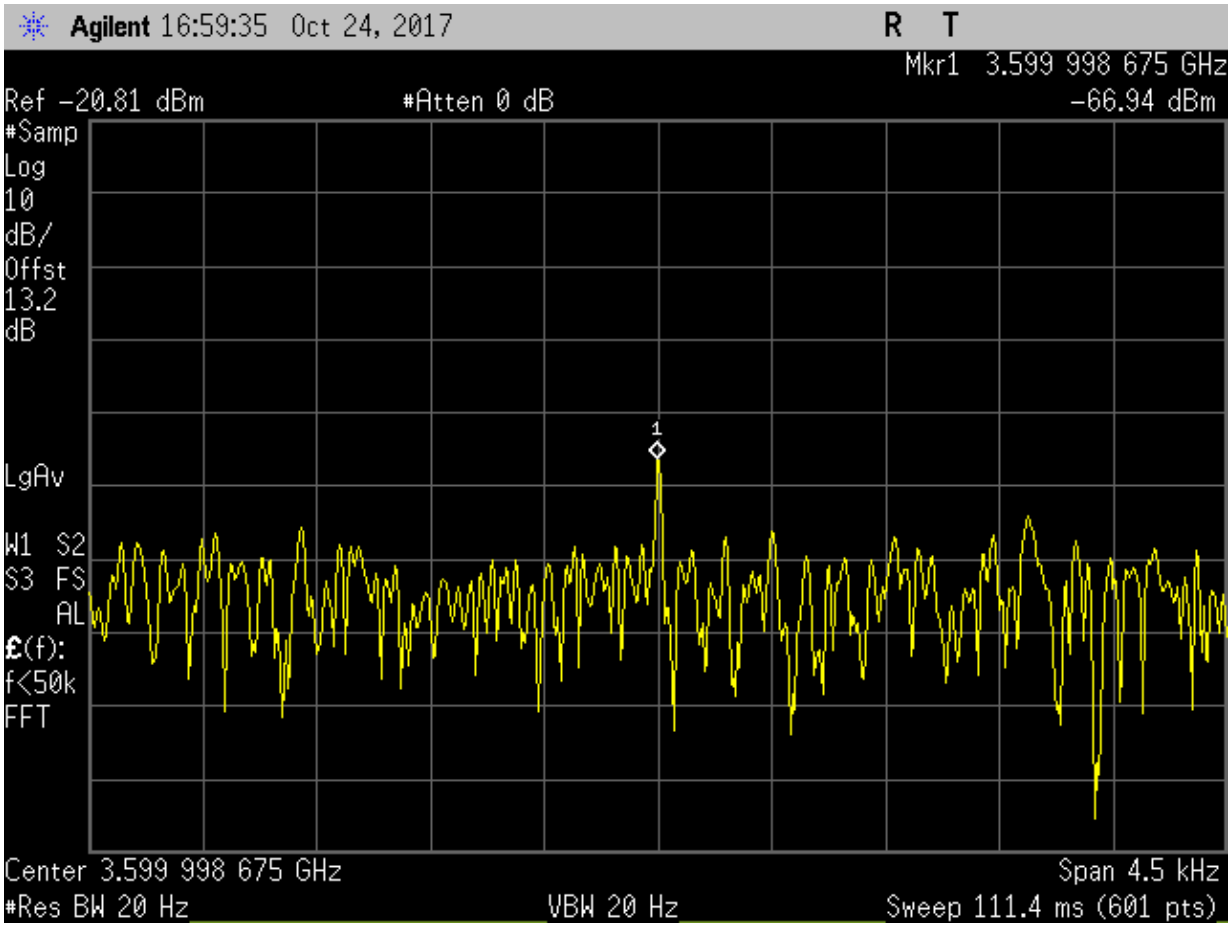


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 0 Trace Mode = CLR/WRITE	M1 : 3599.998 MHz : -71.22 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies 20 °C

Variant: , Channel: 3660.00 MHz, , Temp: Ambient, Voltage: 63.25 Vdc

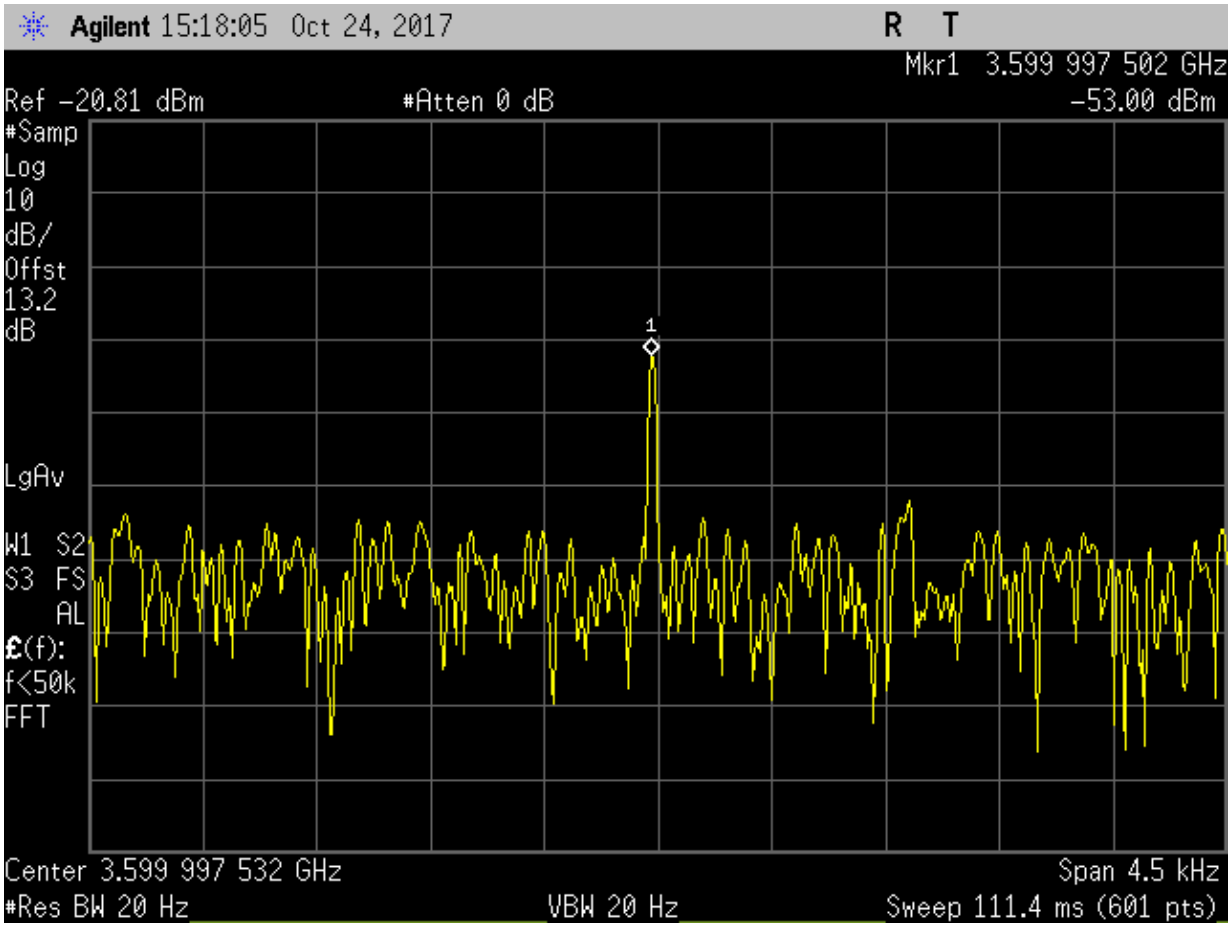


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = CLR/WRITE	M1 : 3599.998 MHz : -66.94 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies -40 °C

Variant: , Channel: 3660.00 MHz, , Temp: , Voltage: nom Vdc

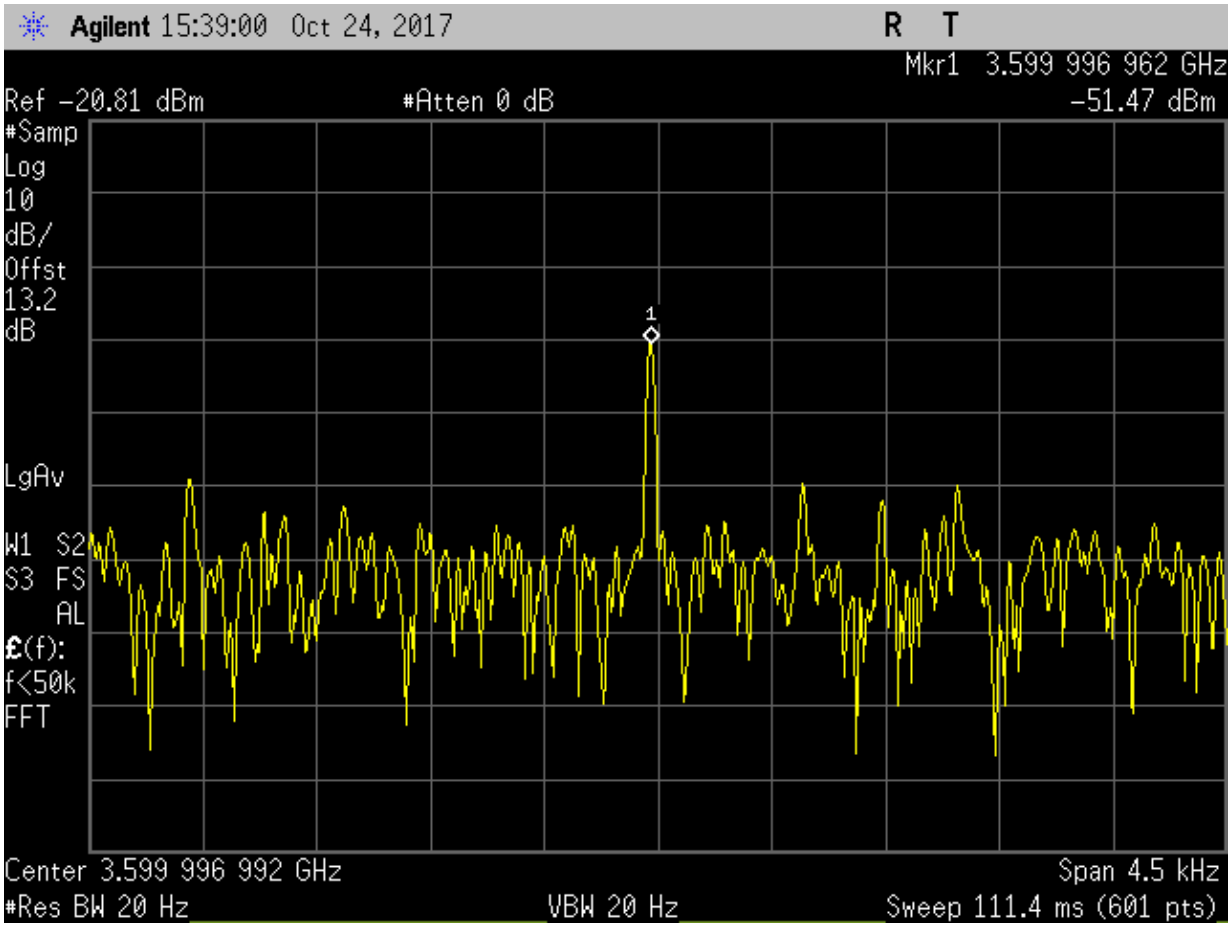


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 3599.998 MHz : -53.00 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies -30 °C

Variant: , Channel: 3660.00 MHz, , Temp: , Voltage: nom Vdc

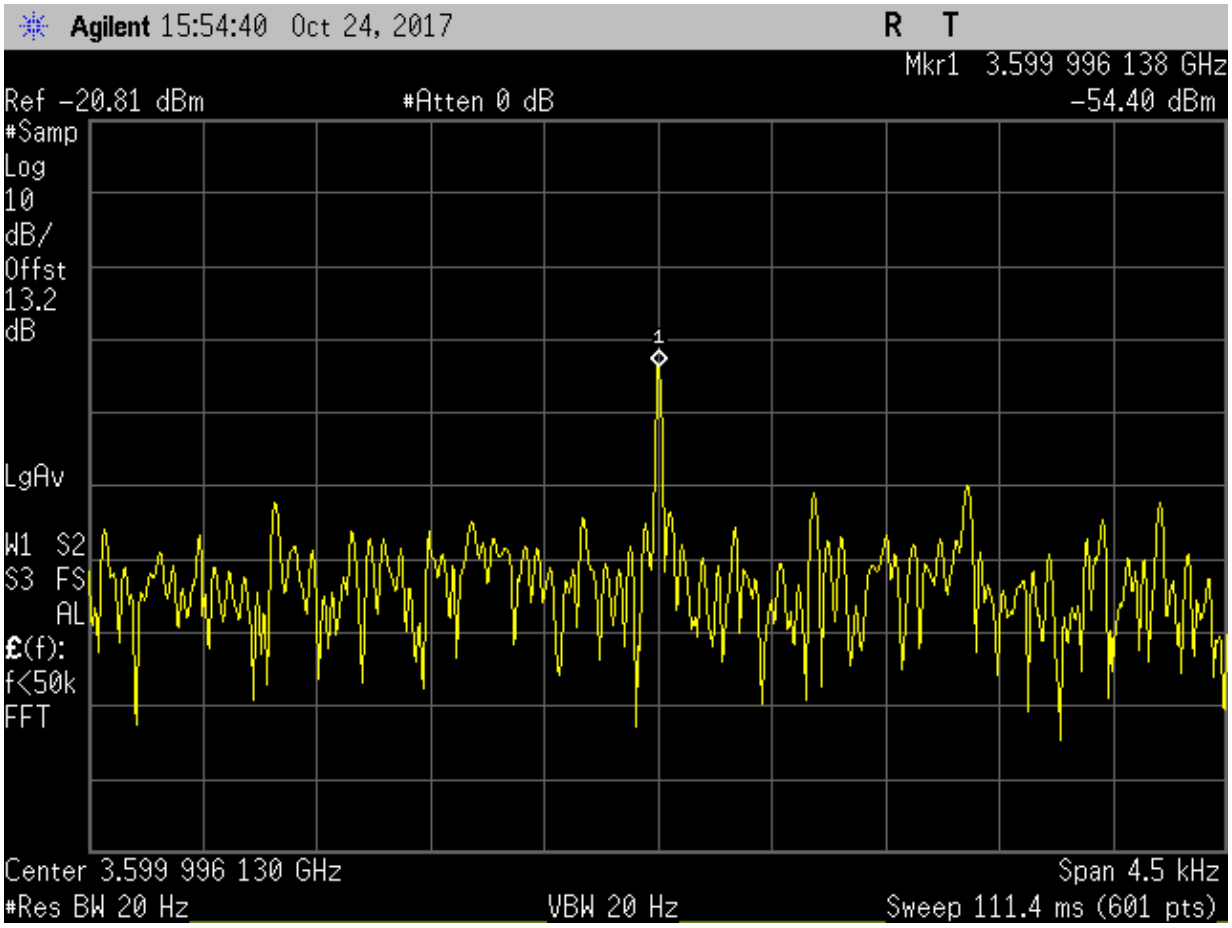


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 3599.997 MHz : -51.47 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies -20 °C

Variant: , Channel: 3660.00 MHz, , Temp: , Voltage: nom Vdc

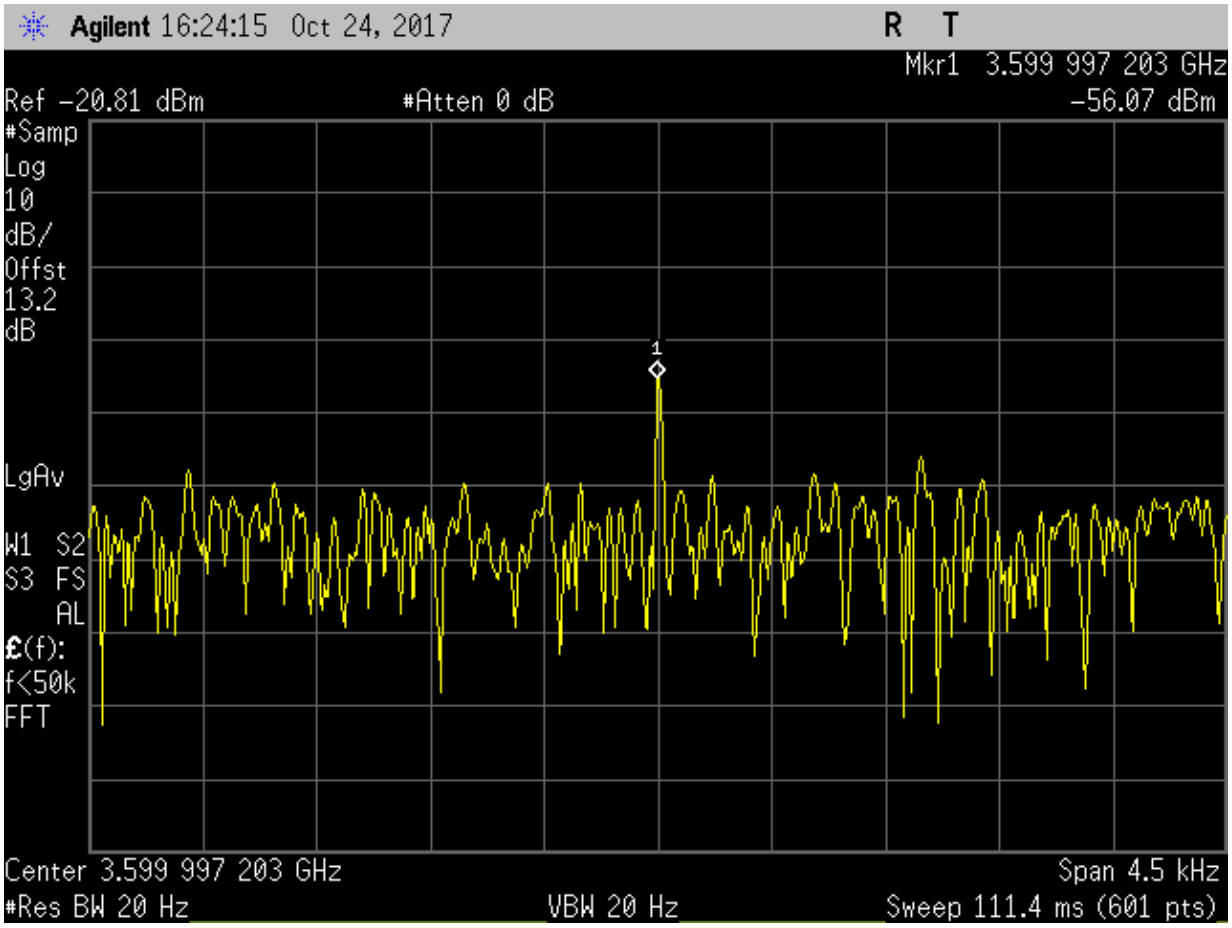


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = CLR/WRITE	M1 : 3599.996 MHz : -54.40 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies -5 °C

Variant: , Channel: 3660.00 MHz, , Temp: , Voltage: nom Vdc

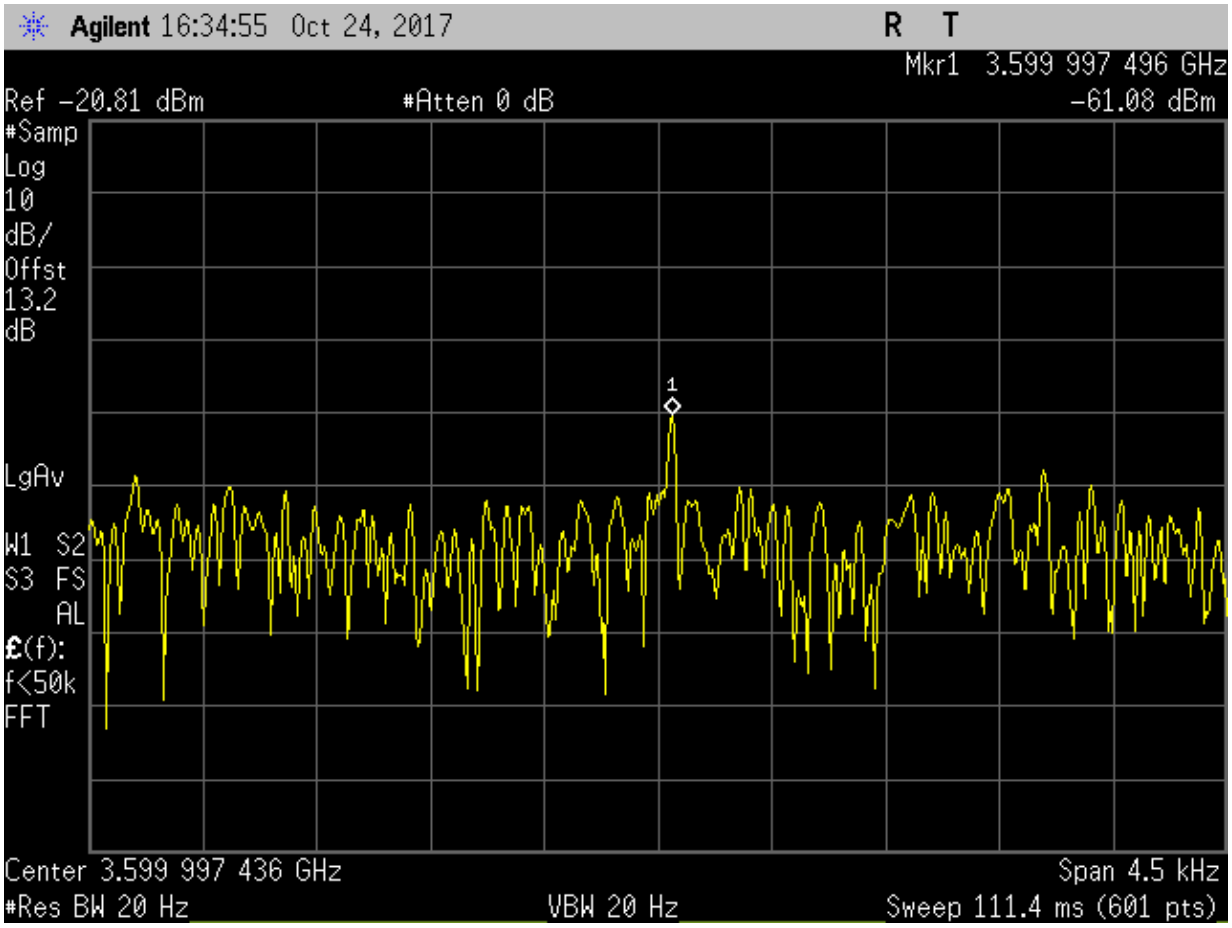


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 3599.997MHz : -56.07 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies 0 °C

Variant: , Channel: 3660.00 MHz, , Temp: , Voltage: nom Vdc

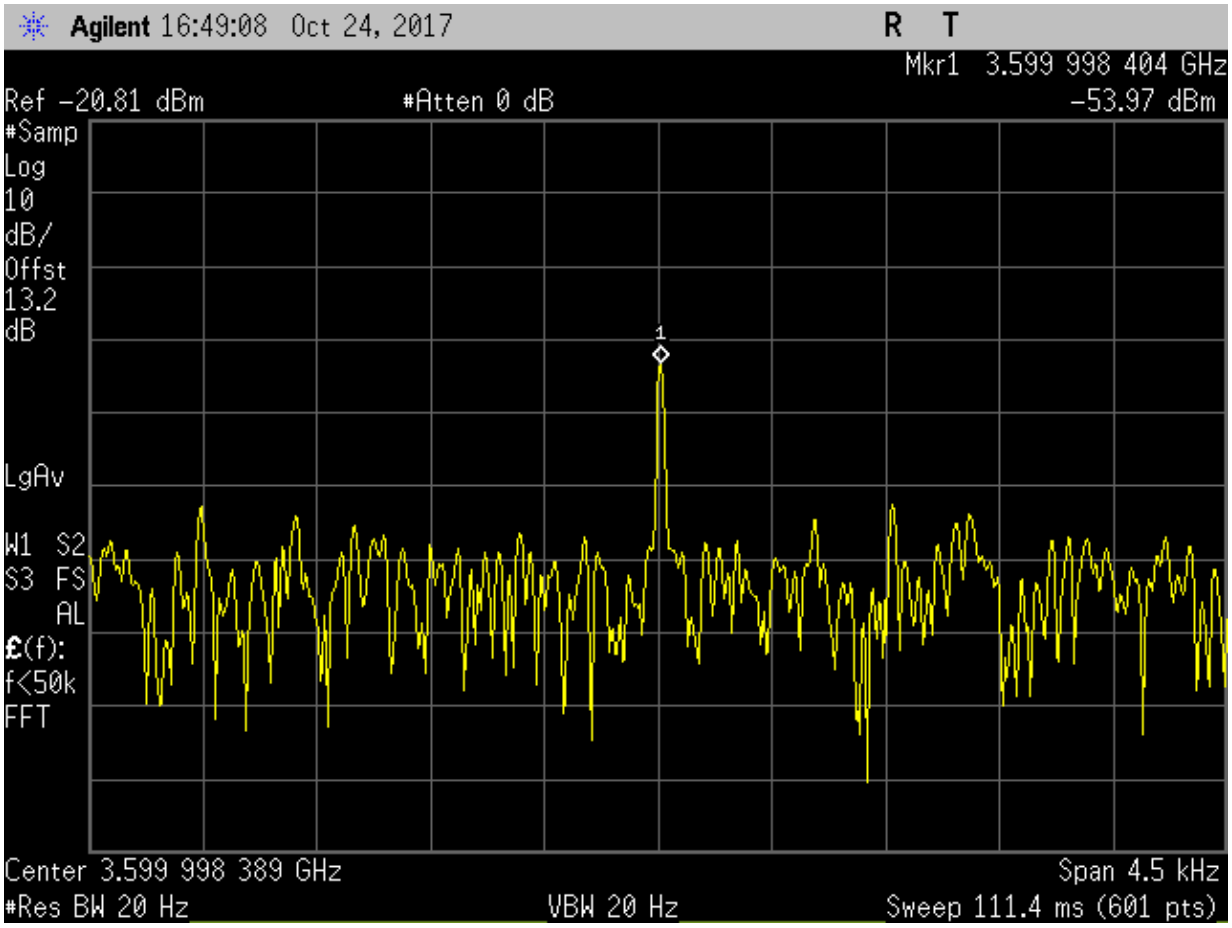


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 3599.997 MHz : -61.08 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies 10 °C

Variant: , Channel: 3660.00 MHz, , Temp: , Voltage: nom Vdc

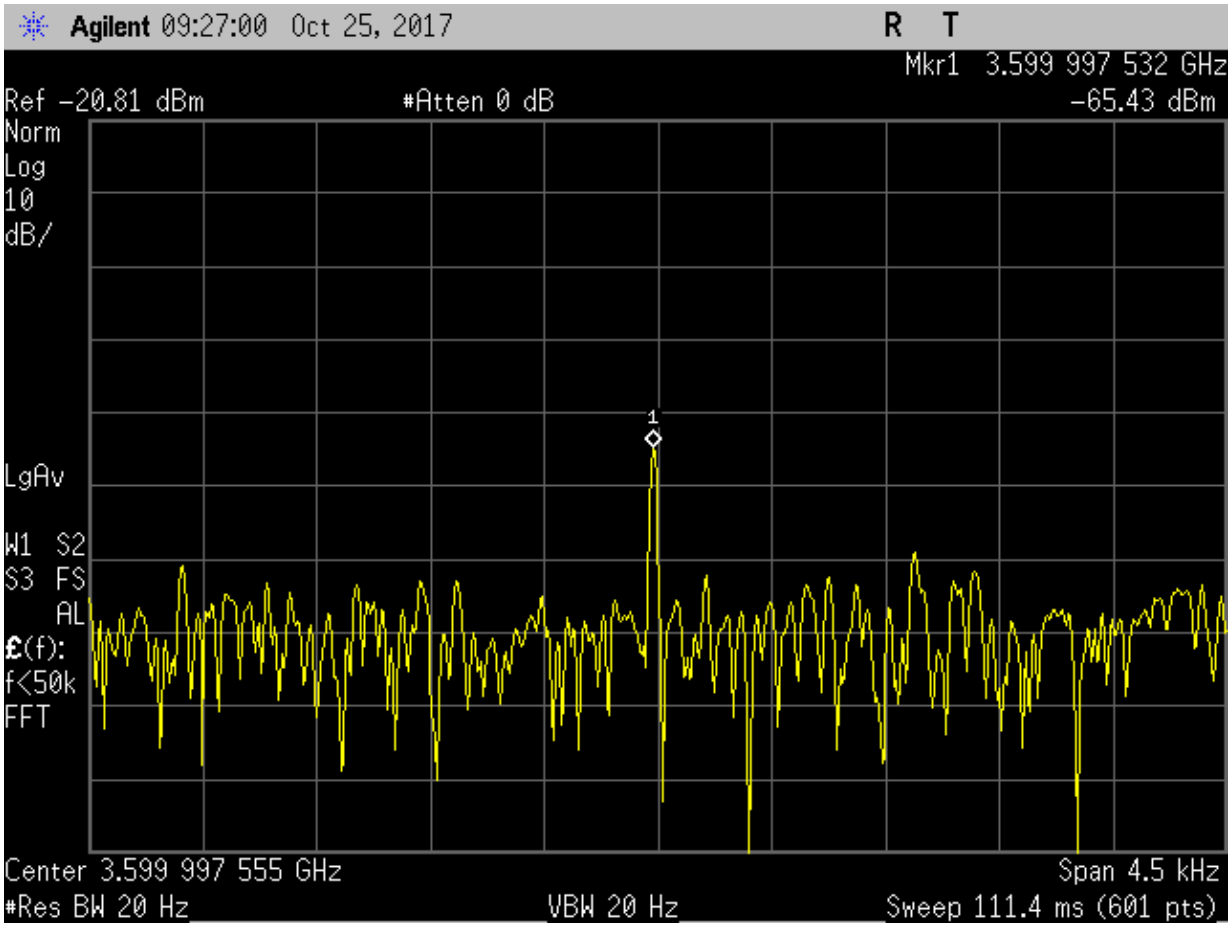


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 3599.998 MHz : -53.97 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies 30 °C

Variant: , Channel: 3660.00 MHz, , Temp: , Voltage: nom Vdc

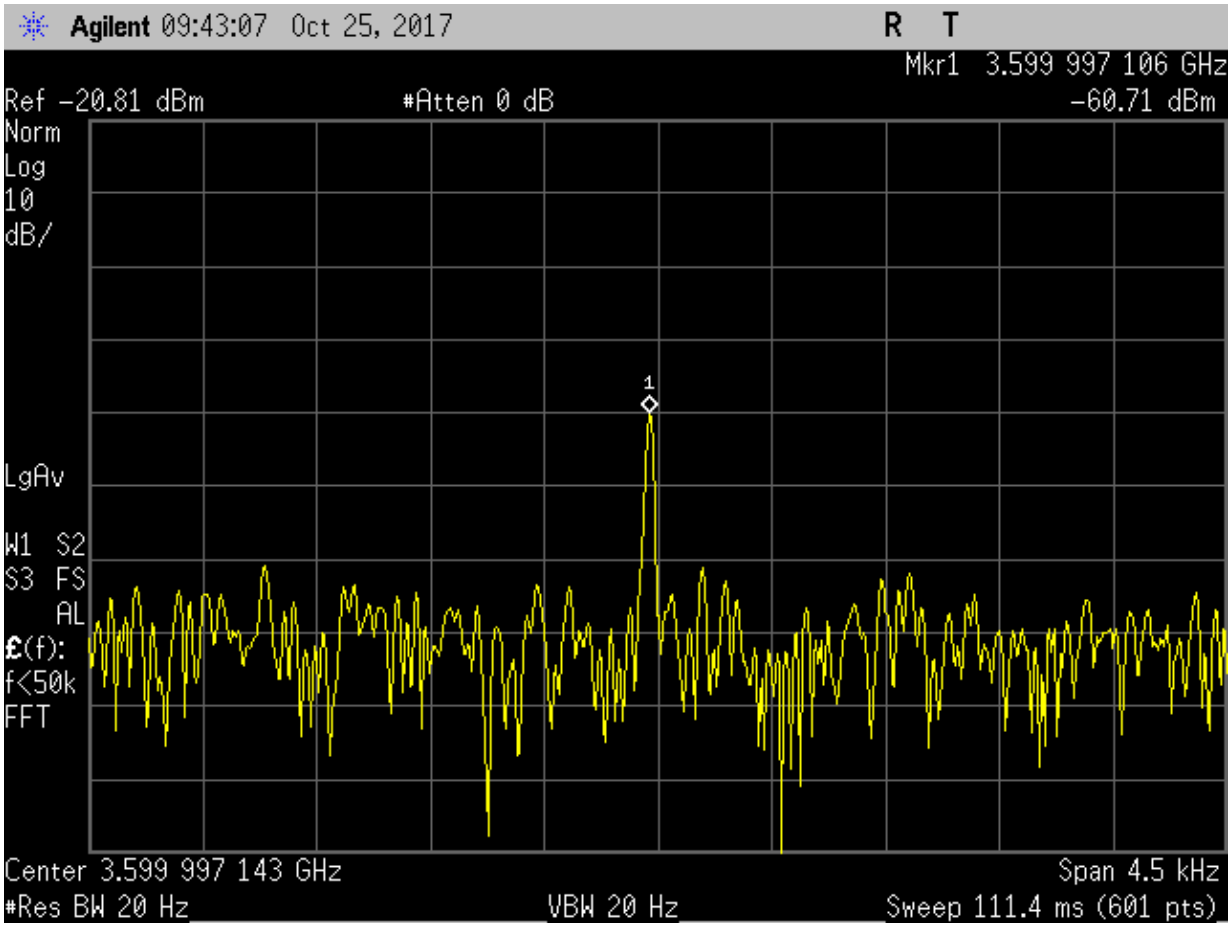


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = CLR/WRITE	M1 : 3599.997 MHz : -65.43 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies 40 °C

Variant: , Channel: 3660.00 MHz, , Temp: , Voltage: nom Vdc

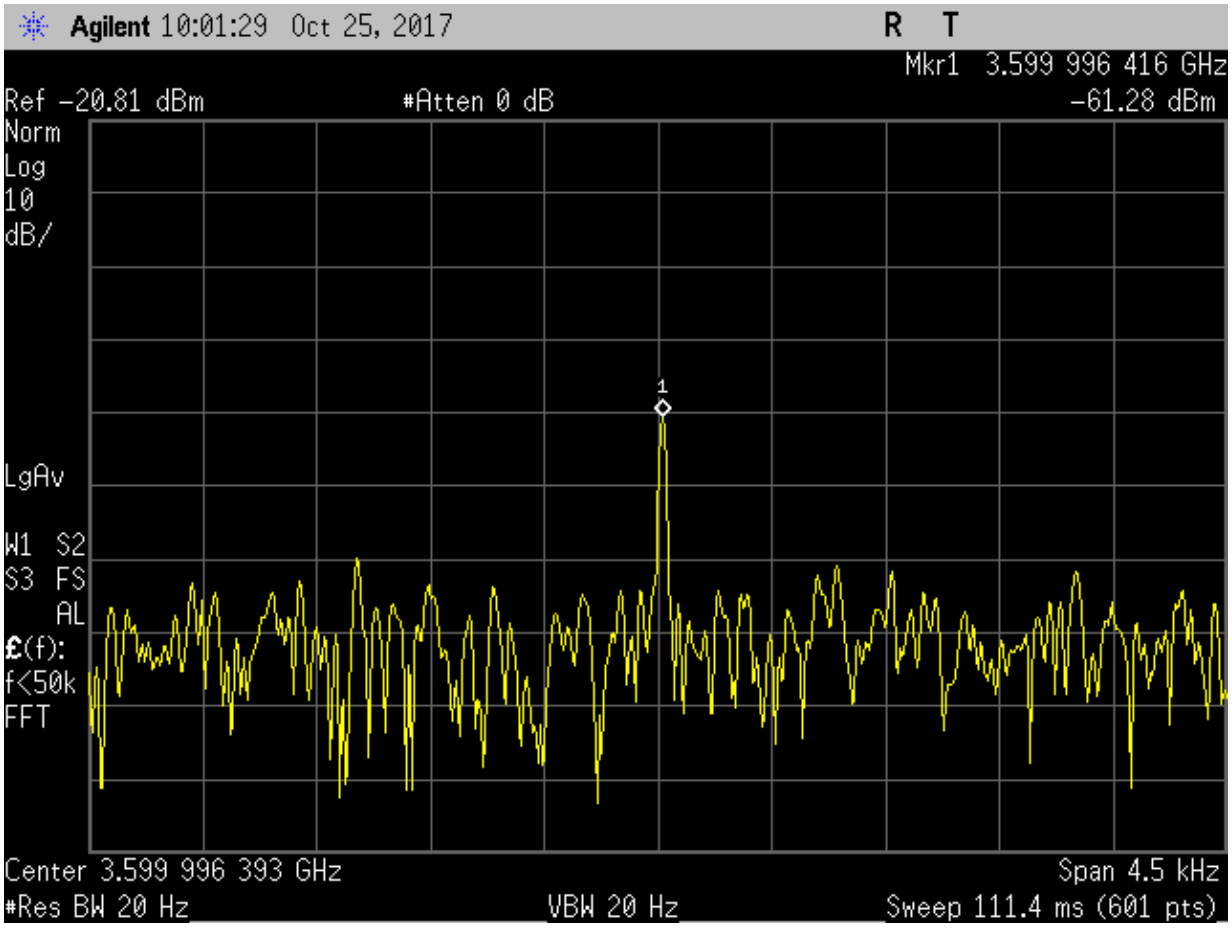


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = CLR/WRITE	M1 : 3599.997 MHz : -60.71 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies 55 °C

Variant: , Channel: 3660.00 MHz, , Temp: , Voltage: nom Vdc

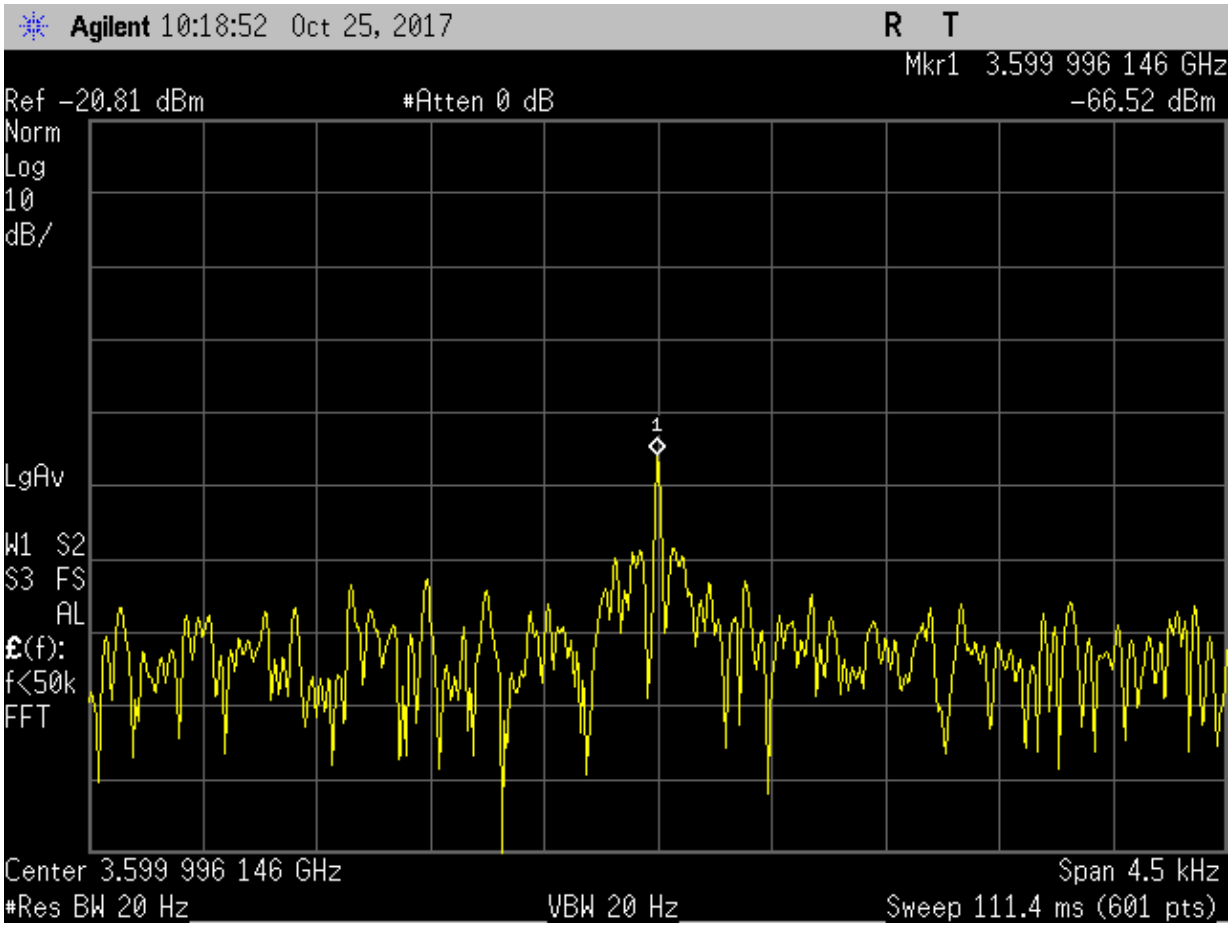


Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = CLR/WRITE	M1 : 3599.996 MHz : -60.28 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

Carrier Frequencies 60 **°C**

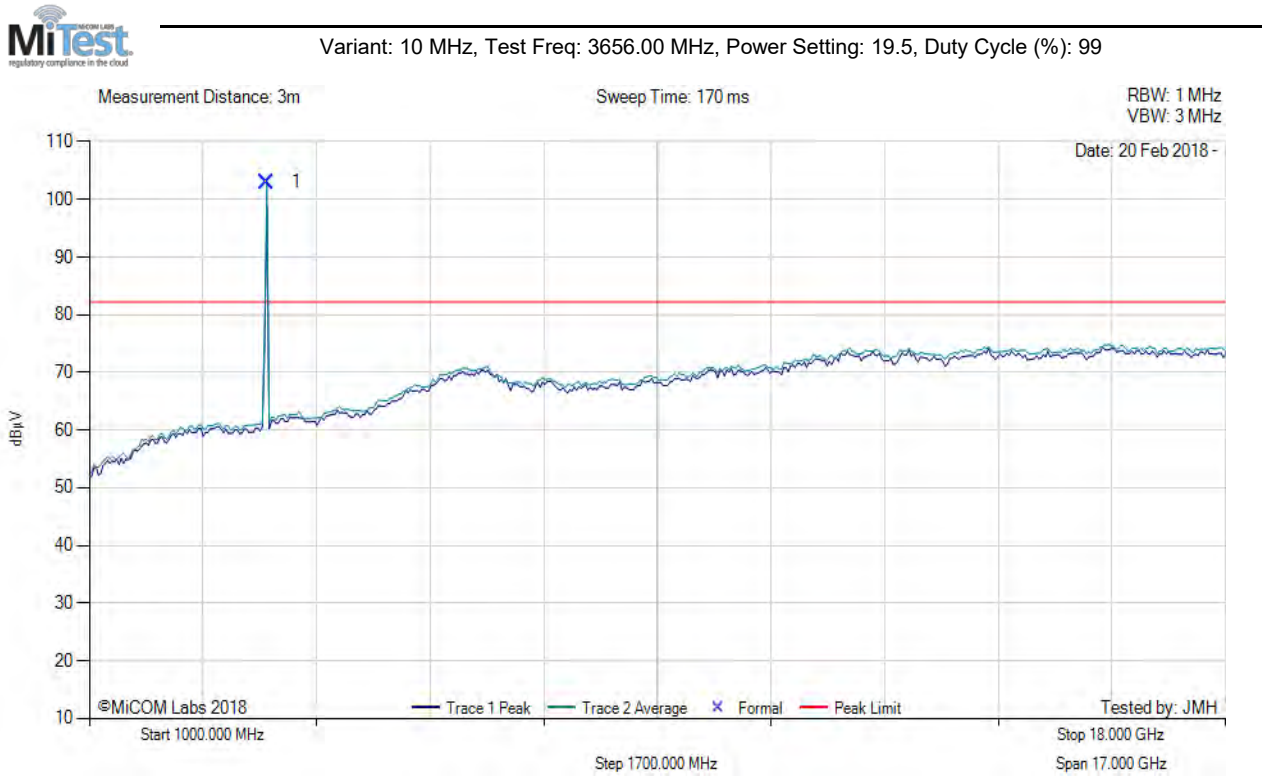
Variant: , Channel: 3660.00 MHz, , Temp: , Voltage: nom Vdc



Analyser Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = CLR/WRITE	M1 : 3599.996MHz : -66.52 dBm	Channel Frequency: 3660.00 MHz

Back to Matrix

A.1.5. TX Spurious and Restricted Band Emissions

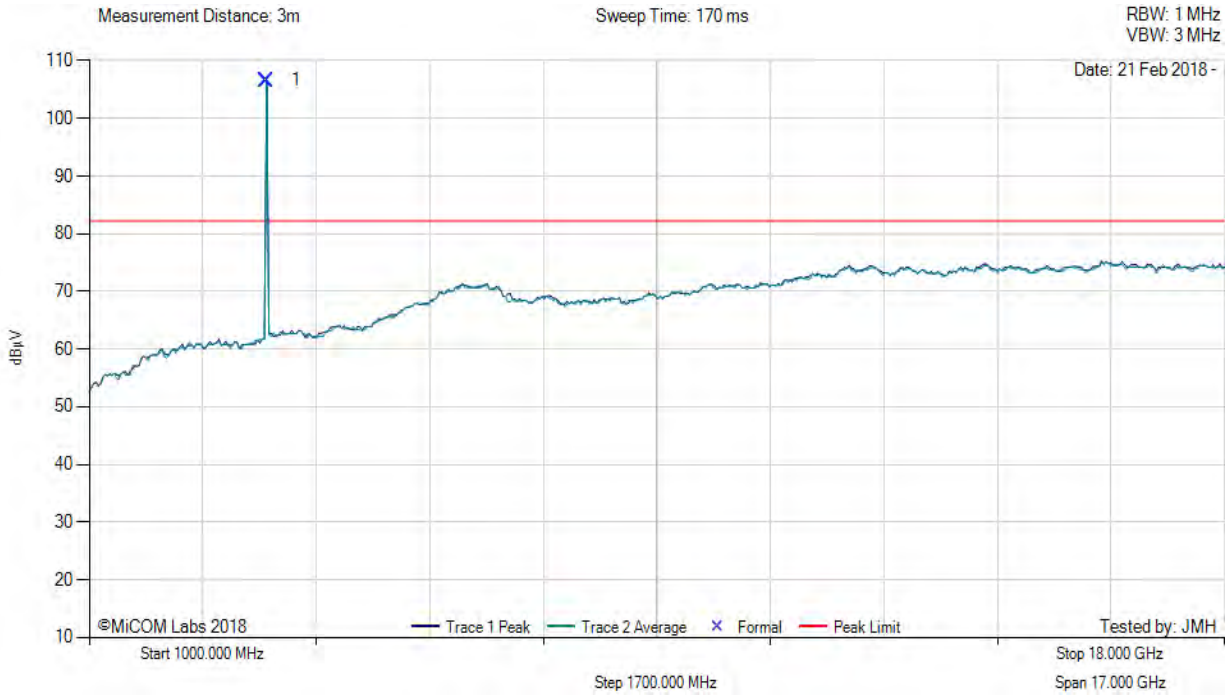


1000.00 - 18000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3656.66	67.21	2.67	33.50	103.38	Fundamental	Horizontal	150	0	--	--	Pass

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber.

back to matrix

Variant: 10 MHz, Test Freq: 3675.00 MHz, Power Setting: 19.5, Duty Cycle (%): 99

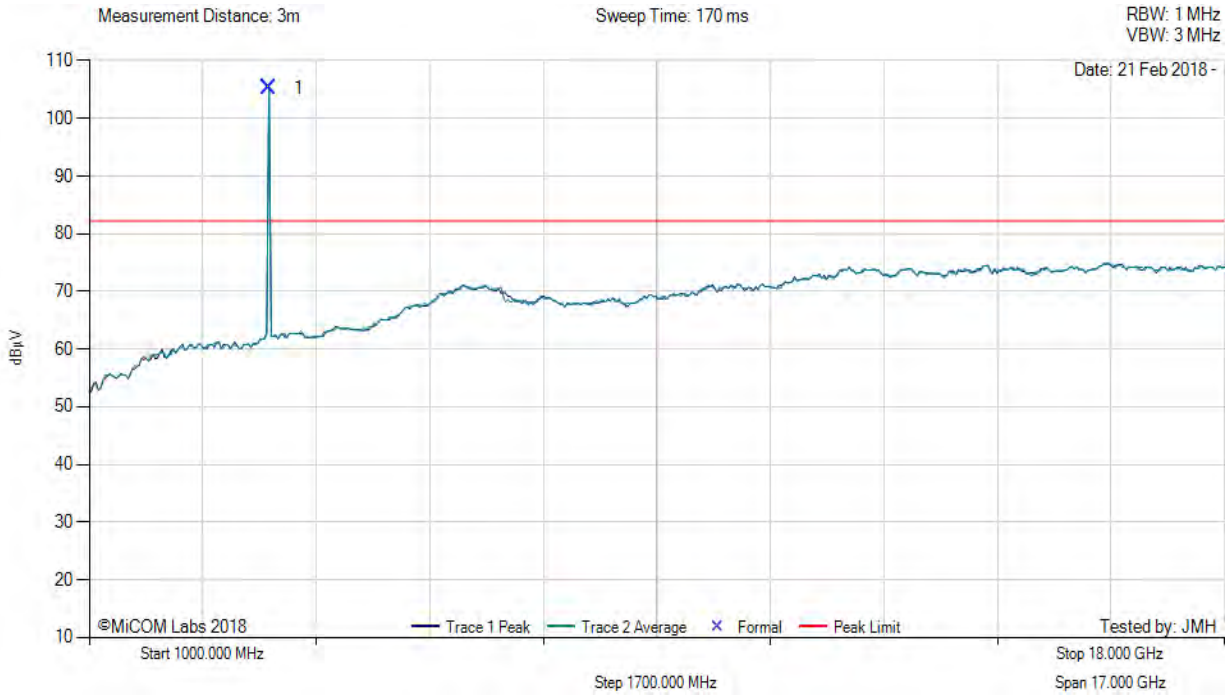


1000.00 - 18000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3675.61	70.74	2.71	33.11	106.56	Fundamental	Horizontal	150	0	--	--	Pass

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber.

back to matrix

Variant: 10 MHz, Test Freq: 3694.00 MHz, Power Setting: 19.5, Duty Cycle (%): 99



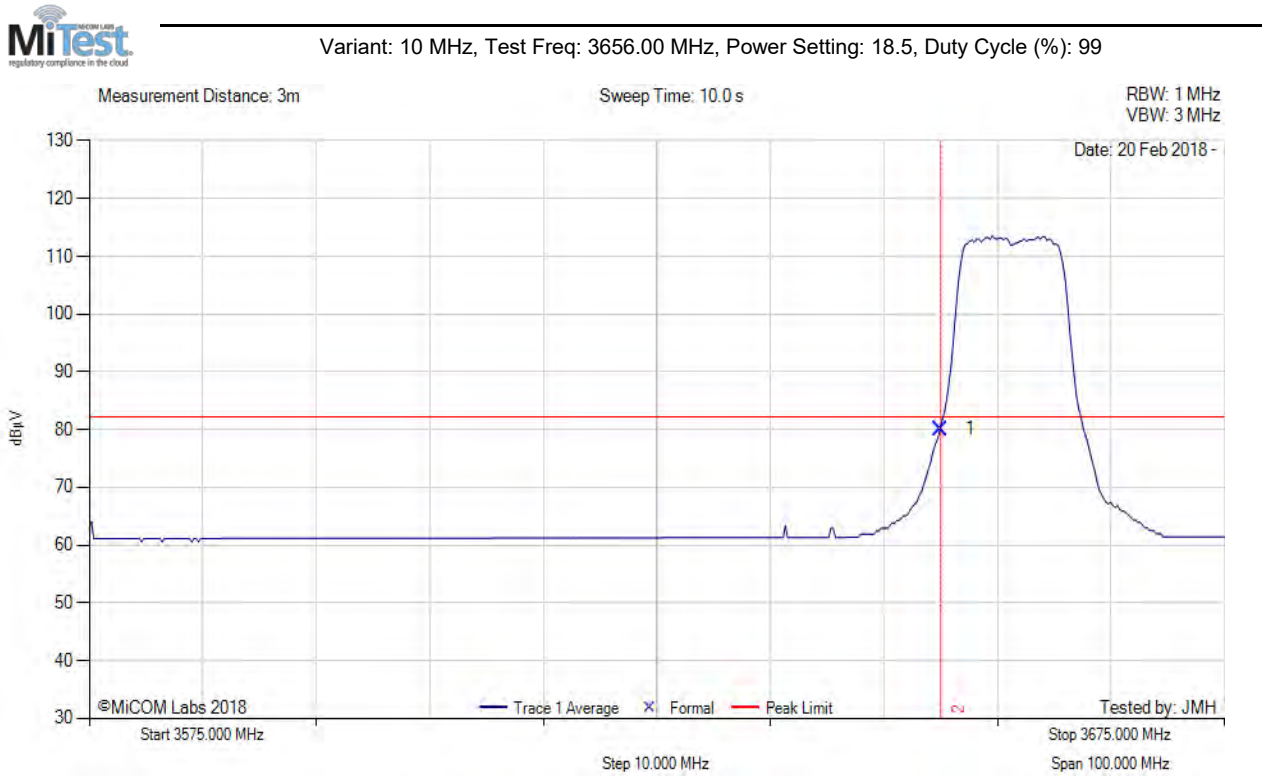
1000.00 - 18000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3691.38	69.42	2.68	33.22	105.32	Fundamental	Horizontal	162	0	--	--	Pass

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber

back to matrix

A.1.6. Restricted Edge & Band Edge Emissions

BPSK:

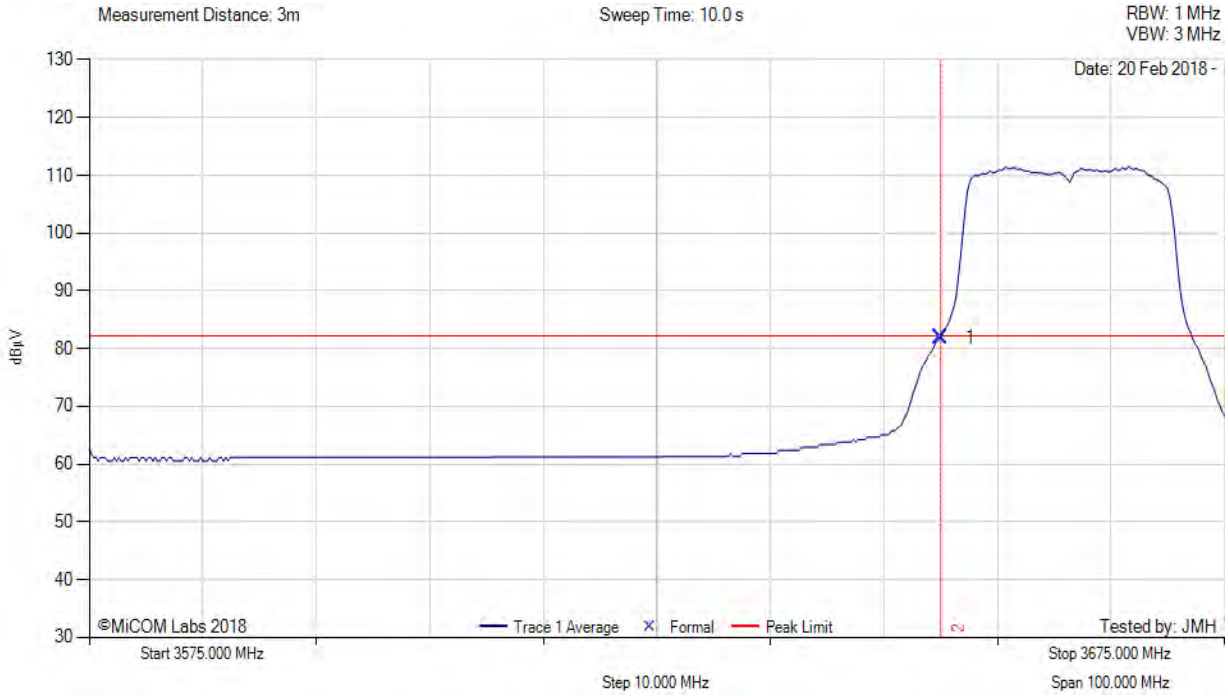


3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3650.00	44.31	2.73	33.09	80.13	Max Avg	Horizontal	171	5	82.2	-2.1	Pass
2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 20 MHz, Test Freq: 3661.00 MHz, Power Setting: 19.5, Duty Cycle (%): 99

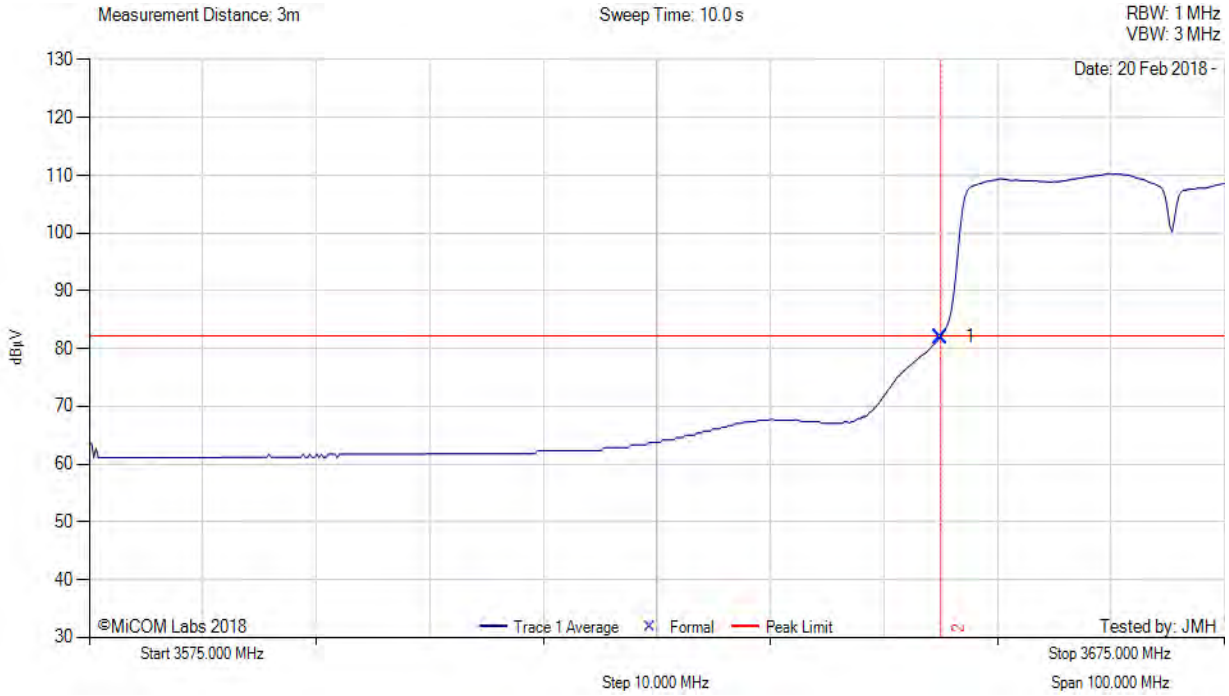


3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3650.00	46.06	2.73	33.09	81.88	Max Avg	Horizontal	171	5	82.2	-0.4	Pass
2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 40 MHz, Test Freq: 3670.00 MHz, Power Setting: 19.5, Duty Cycle (%): 99

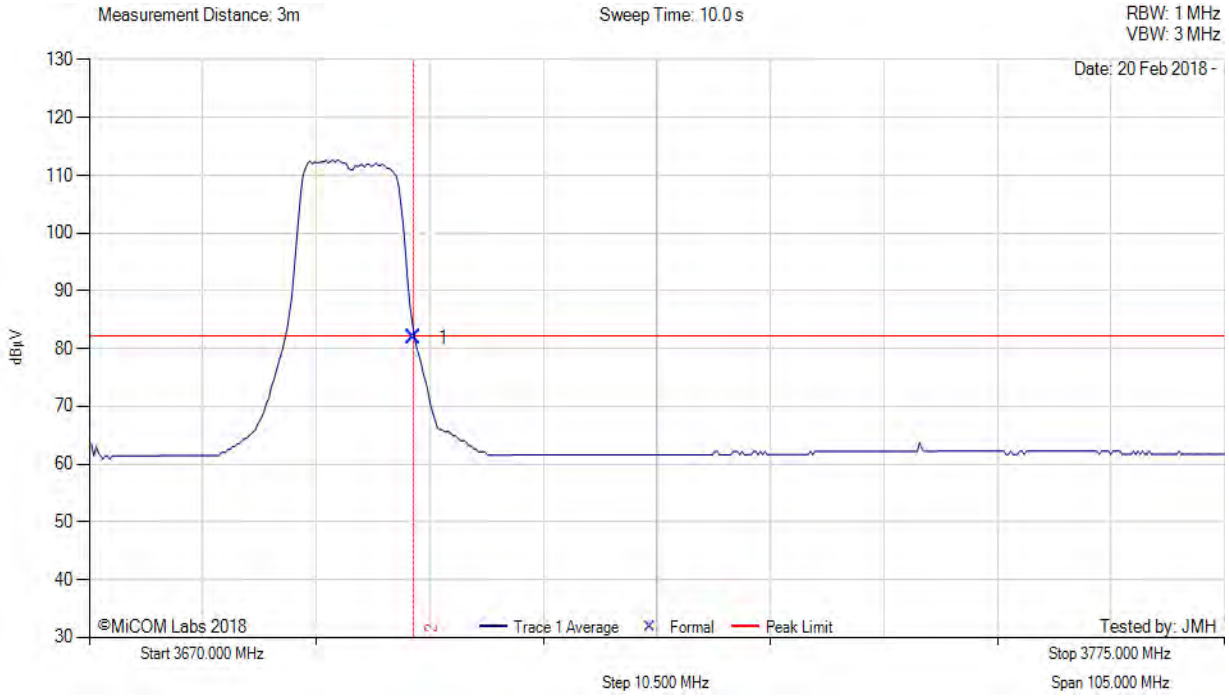


3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3650.00	46.22	2.73	33.09	82.04	Max Avg	Horizontal	171	5	83.2	-0.4	Pass
2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 10 MHz, Test Freq: 3694.00 MHz, Antenna: 9 dBi, Power Setting: 15.0, Duty Cycle (%): 99

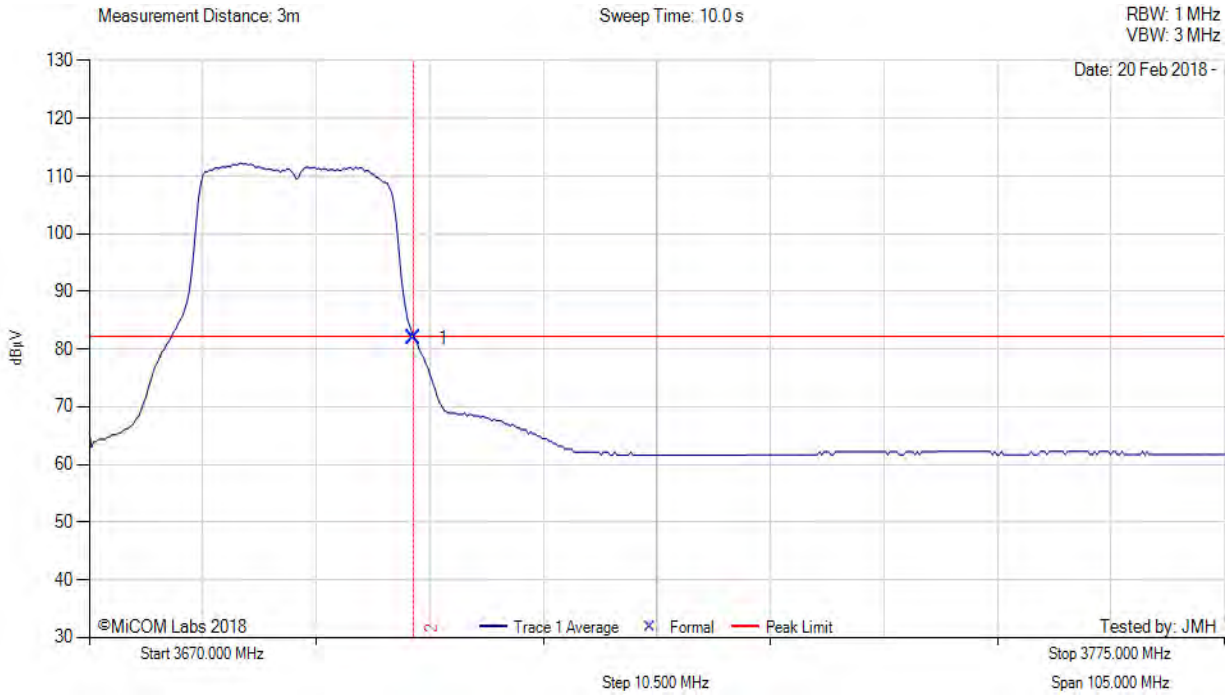


3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3700.00	46.03	2.68	33.24	81.95	Max Avg	Horizontal	171	5	82.2	-0.3	Pass
2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 20 MHz, Test Freq: 3689.00 MHz, Power Setting: 16.5, Duty Cycle (%): 99

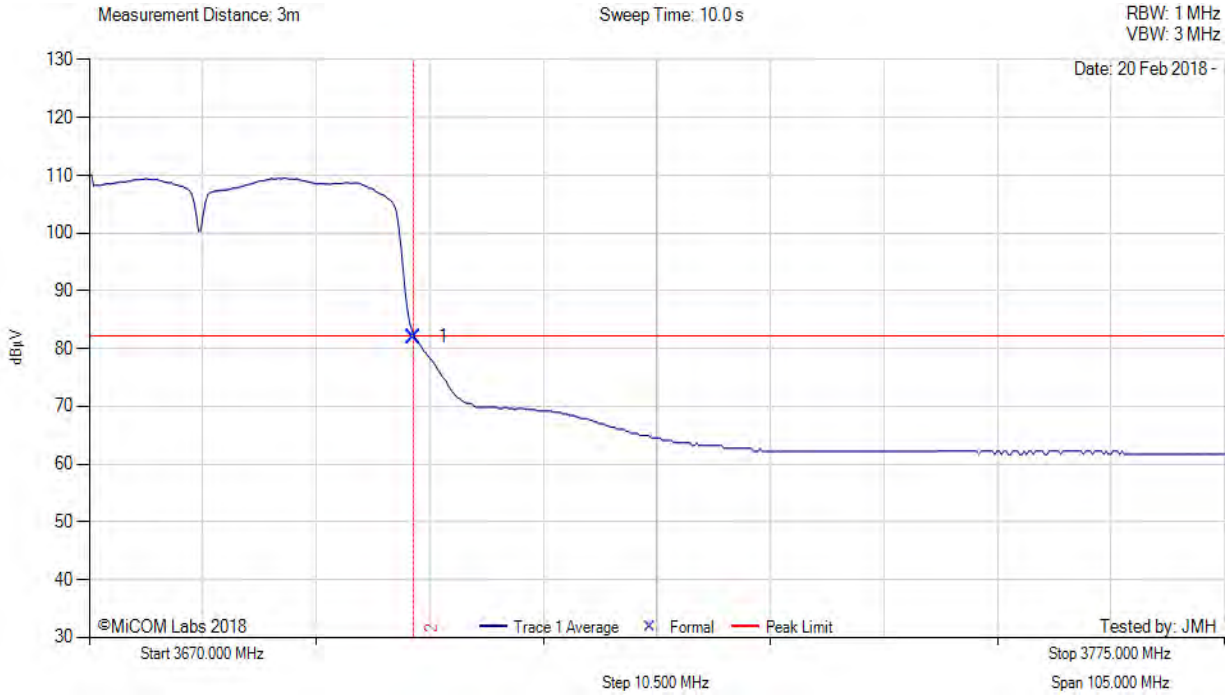


3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3700.00	46.03	2.68	33.24	81.95	Max Avg	Horizontal	171	5	82.2	-0.3	Pass
2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 40 MHz, Test Freq: 3680.00 MHz, Power Setting: 18.0, Duty Cycle (%): 99

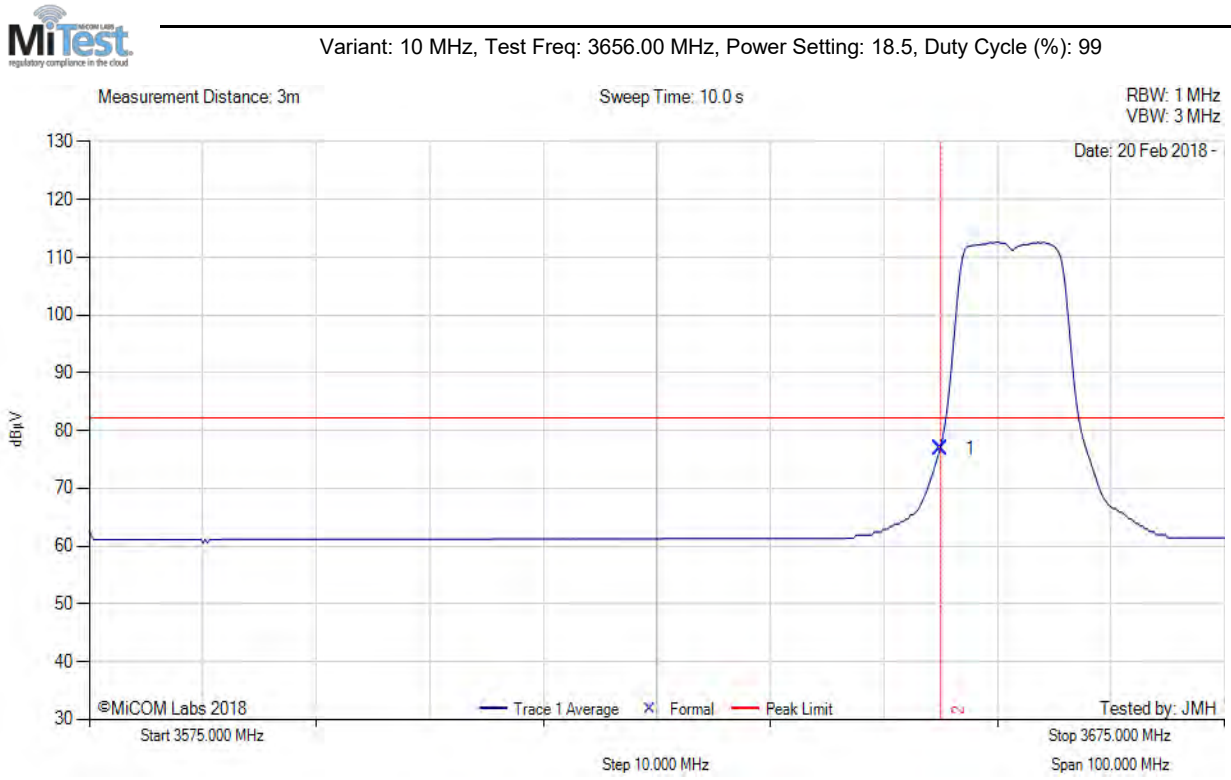


3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3700.00	46.08	2.68	33.24	82.00	Max Avg	Horizontal	171	5	82.2	-0.2	Pass
2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

64 Qam

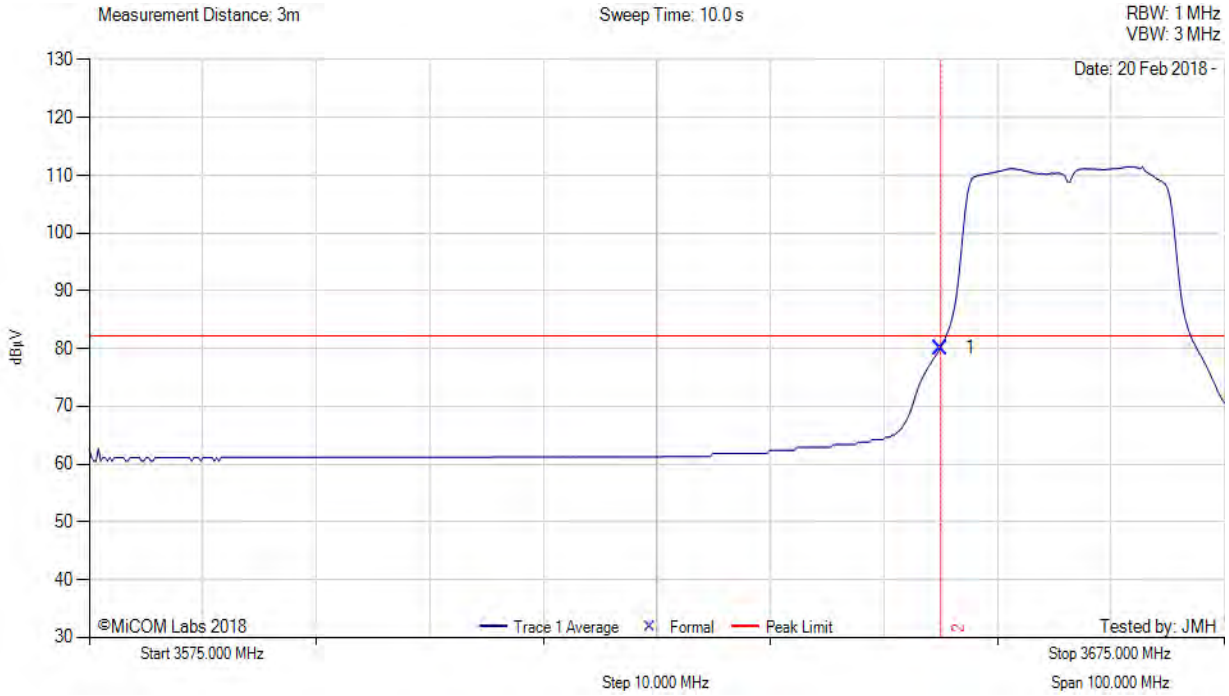


3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3650.00	41.11	2.73	33.09	76.93	Max Avg	Horizontal	171	5	82.2	-5.3	Pass
2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 20 MHz, Test Freq: 3661.00 MHz, Power Setting: 19.5, Duty Cycle (%): 99

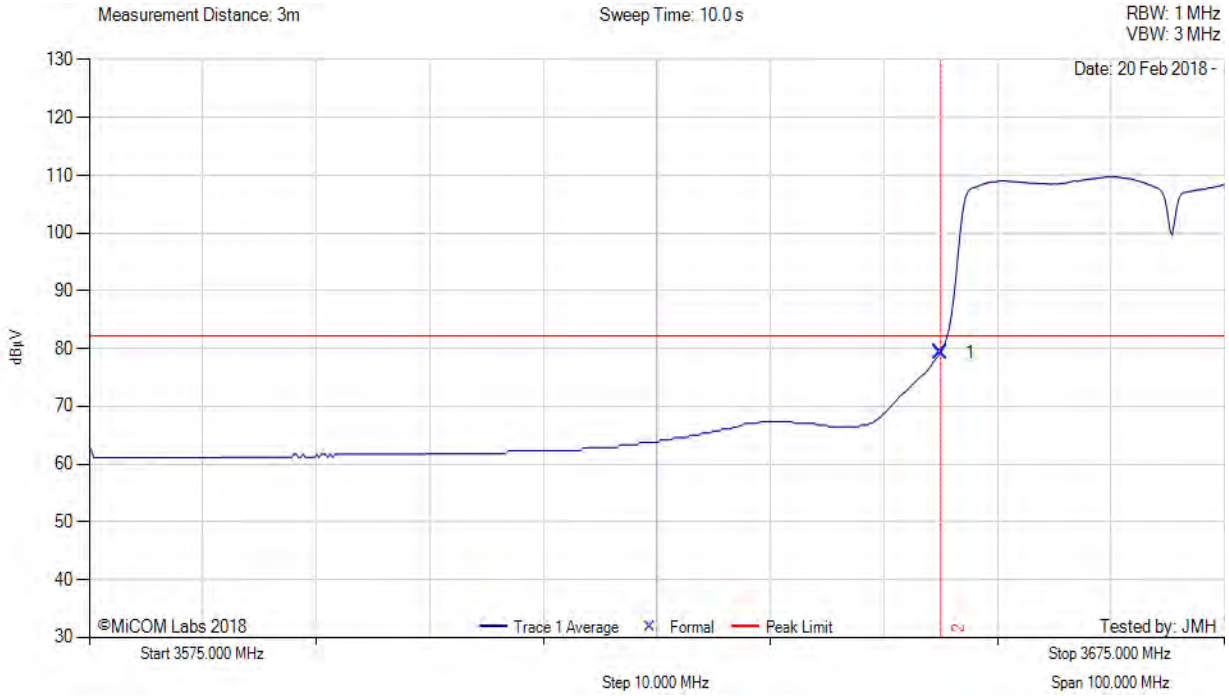


3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3650.00	44.31	2.73	33.09	80.13	Max Avg	Horizontal	171	5	82.2	-2.3	Pass
2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 40 MHz, Test Freq: 3670.00 MHz, Power Setting: 19.5, Duty Cycle (%): 99

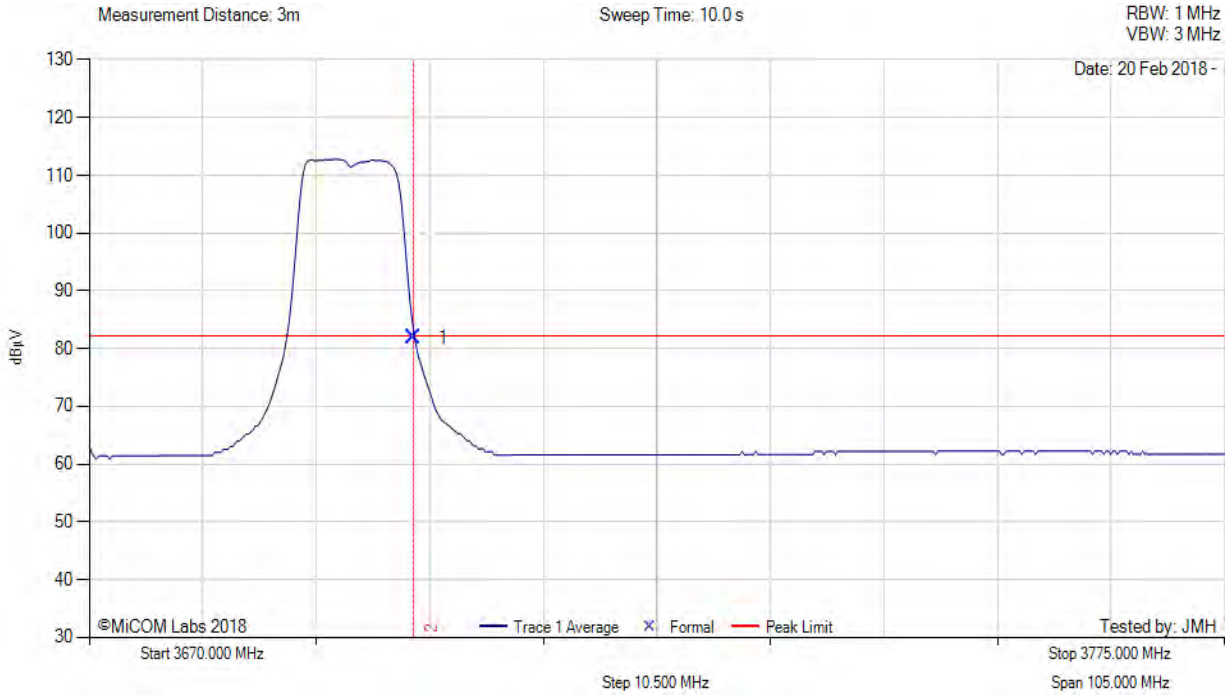


3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3650.00	43.39	2.73	33.09	79.21	Max Avg	Horizontal	171	5	82.2	-3.3	Pass
2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 10 MHz, Test Freq: 3694.00 MHz, Power Setting: 16.0, Duty Cycle (%): 99

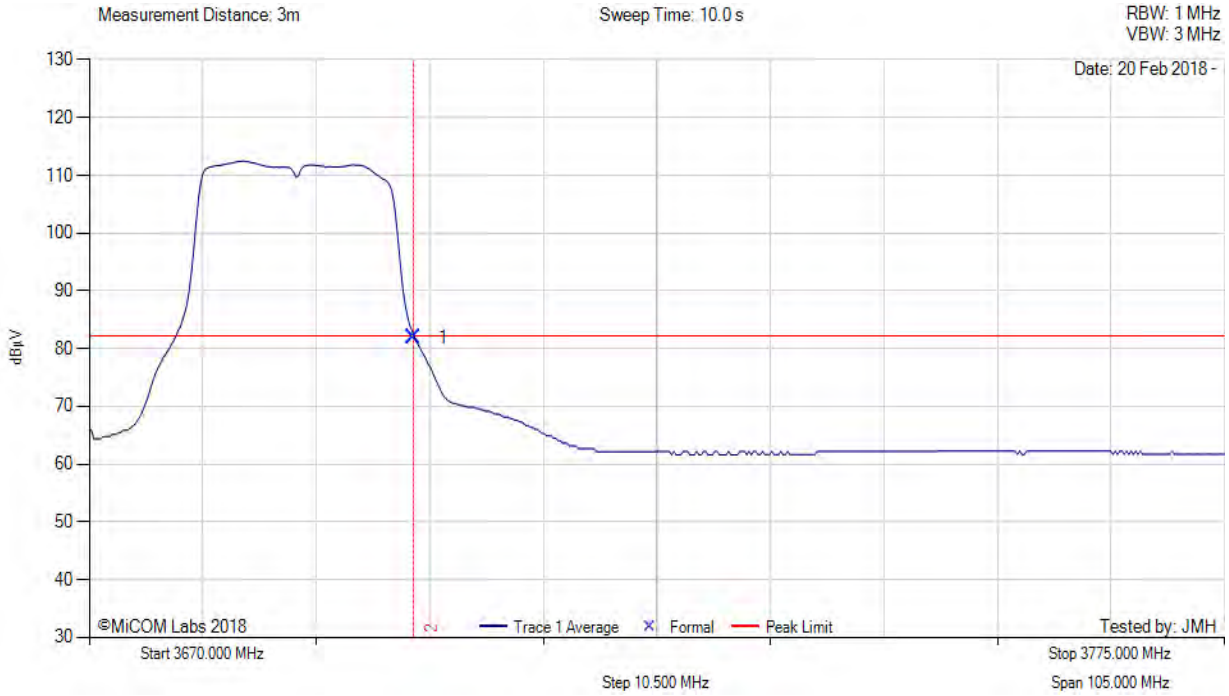


3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3700.00	45.92	2.68	33.24	81.84	Max Avg	Horizontal	171	5	82.2	-0.4	Pass
2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 20 MHz, Test Freq: 3689.00 MHz, Power Setting: 18.0, Duty Cycle (%): 99

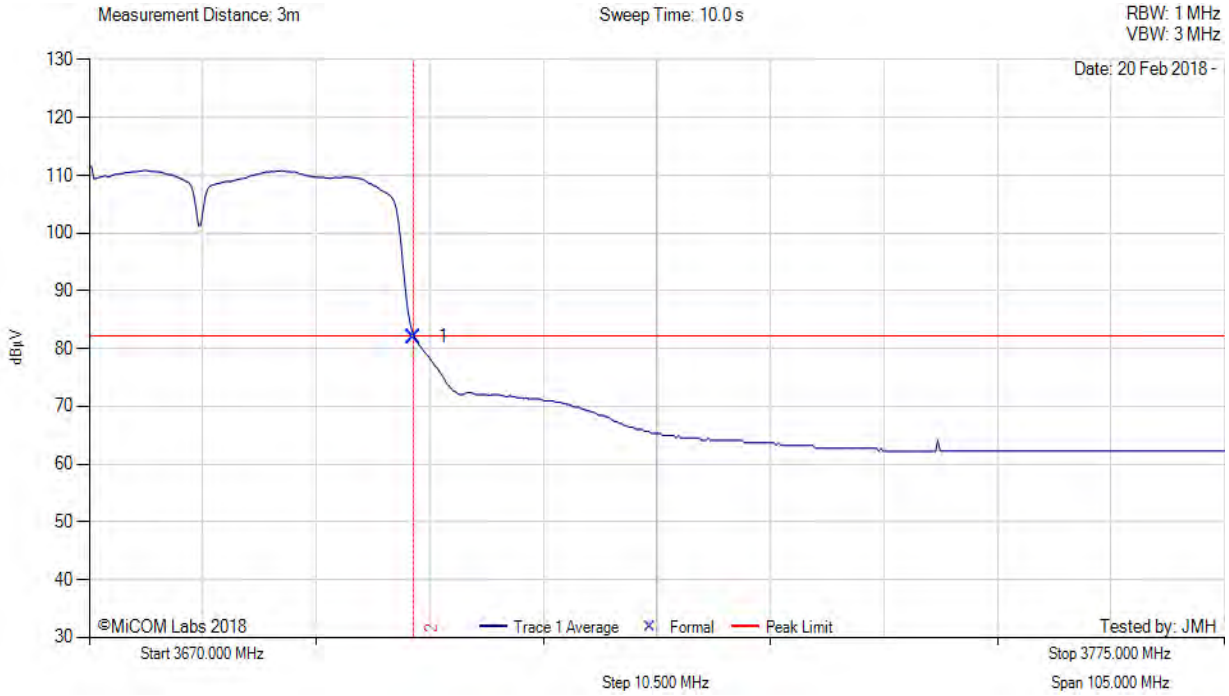


3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3700.00	46.03	2.68	33.24	81.95	Max Avg	Horizontal	171	5	82.2	-0.3	Pass
2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 40 MHz, Test Freq: 3680.00 MHz, Power Setting: 19.5, Duty Cycle (%): 99

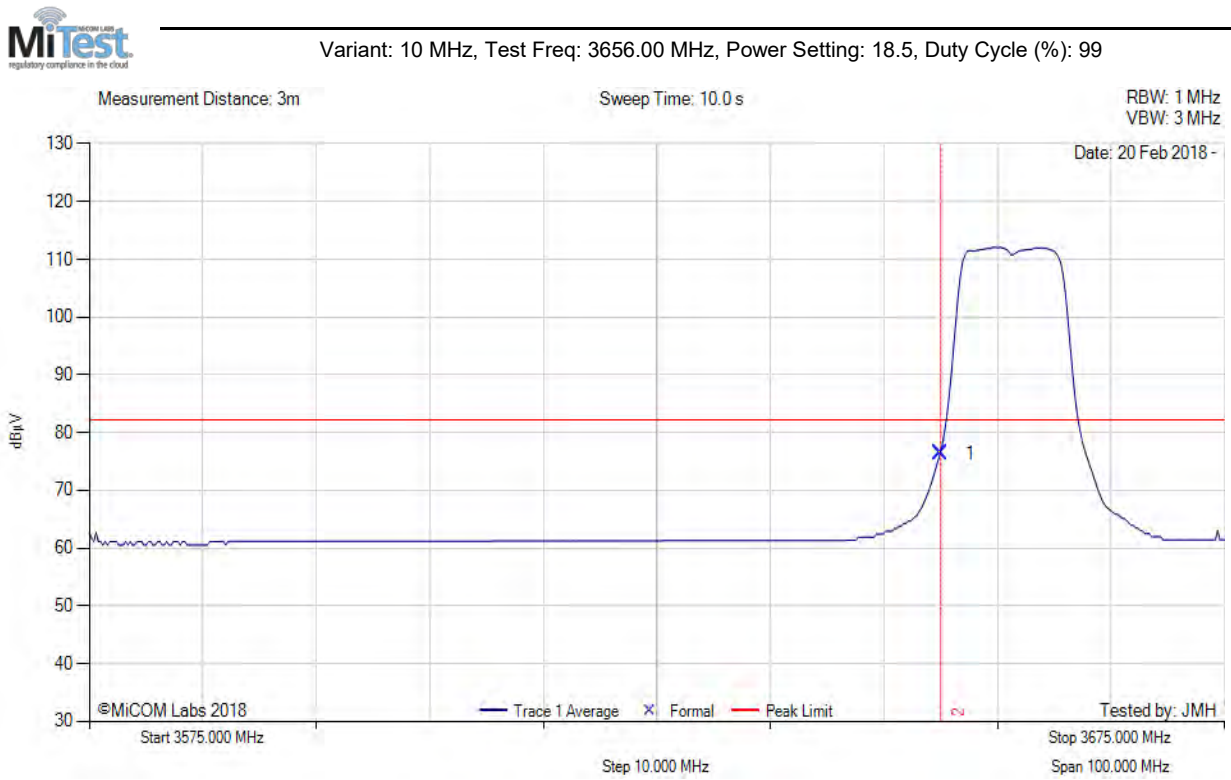


3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3700.00	46.08	2.68	33.24	82.00	Max Avg	Horizontal	171	5	82.2	-0.2	Pass
2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

256 Qam

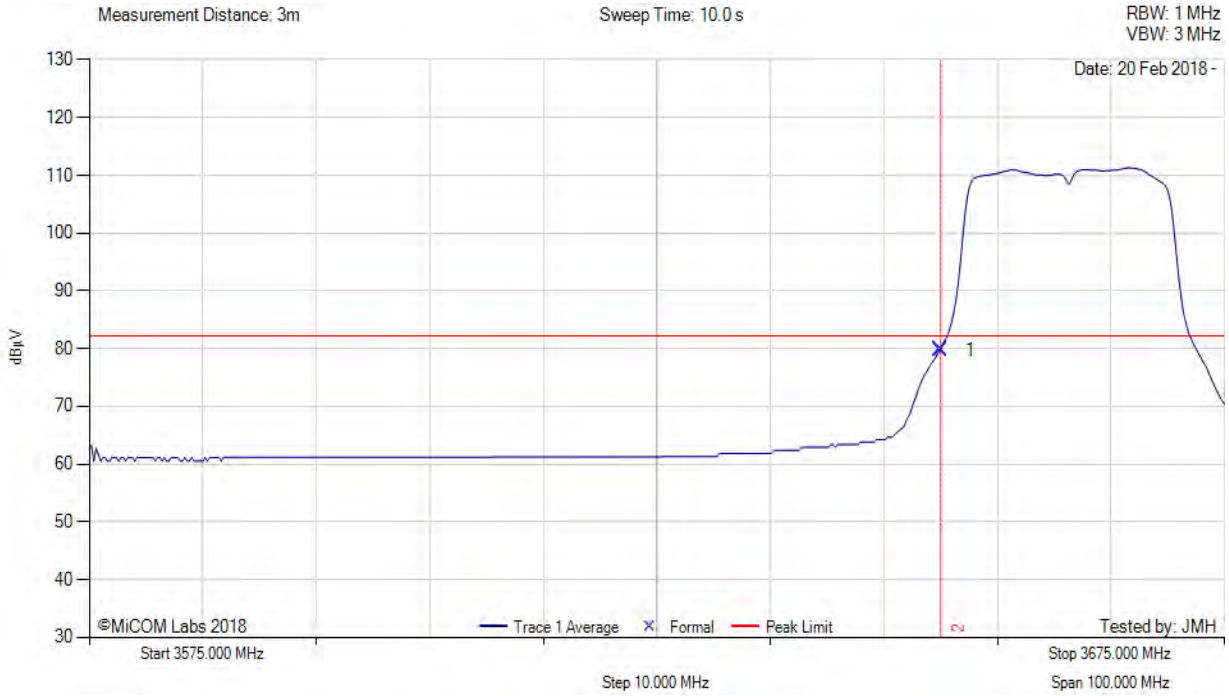


3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3650.00	40.62	2.73	33.09	76.44	Max Avg	Horizontal	171	5	82.2	-5.8	Pass
2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 20 MHz, Test Freq: 3661.00 MHz, Power Setting: 19.5, Duty Cycle (%): 99

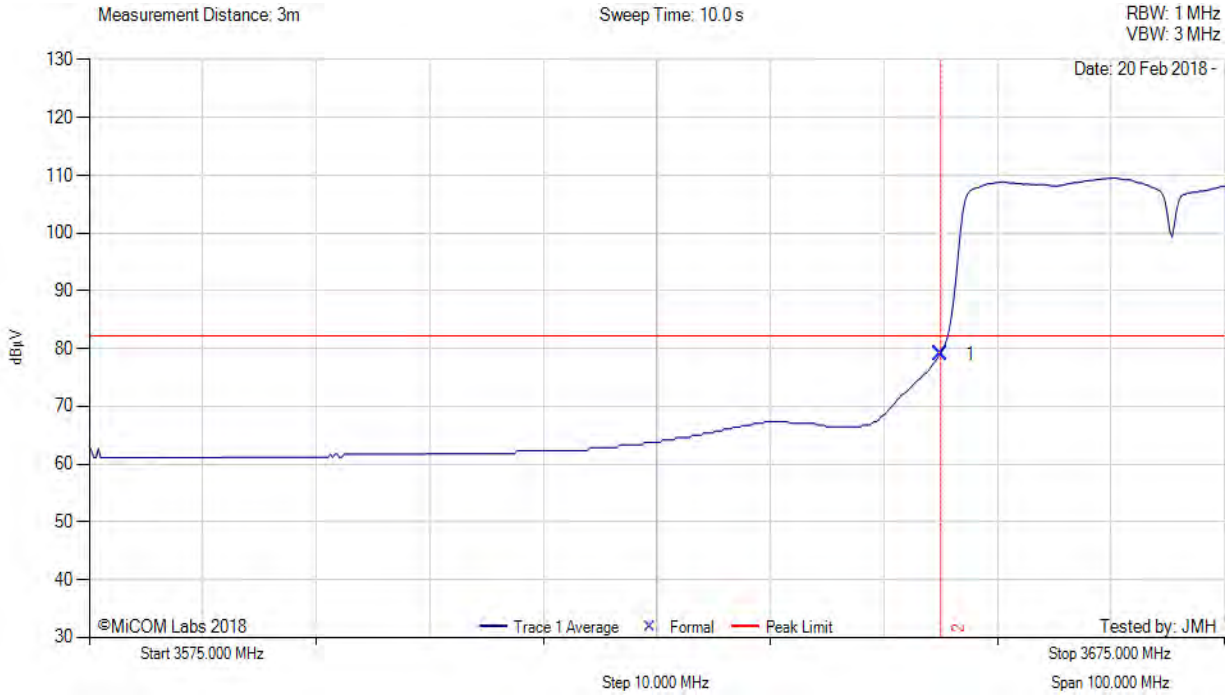


3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3650.00	43.97	2.73	33.09	79.79	Max Avg	Horizontal	171	5	82.2	-2.4	Pass
2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 40 MHz, Test Freq: 3670.00 MHz, Power Setting: 19.5, Duty Cycle (%): 99

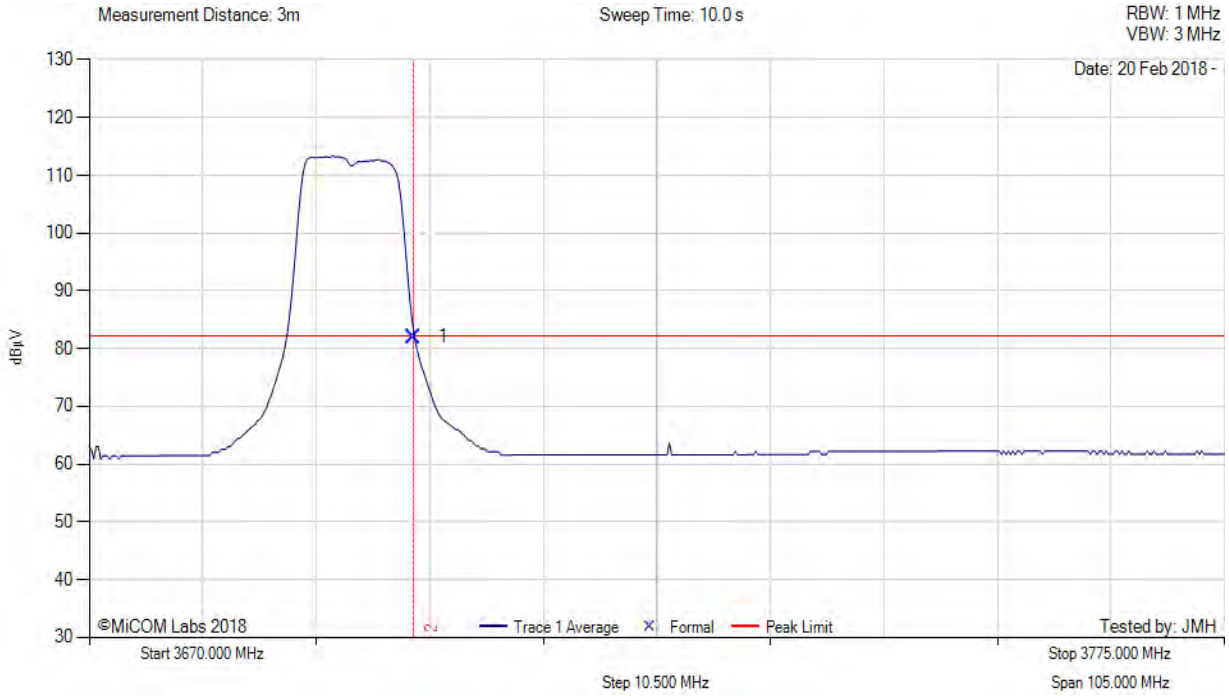


3575.00 - 3675.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3650.00	43.17	2.73	33.09	78.99	Max Avg	Horizontal	171	5	82.2	-3.2	Pass
2	3650.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 10 MHz, Test Freq: 3694.00 MHz, Power Setting: 16.5, Duty Cycle (%): 99

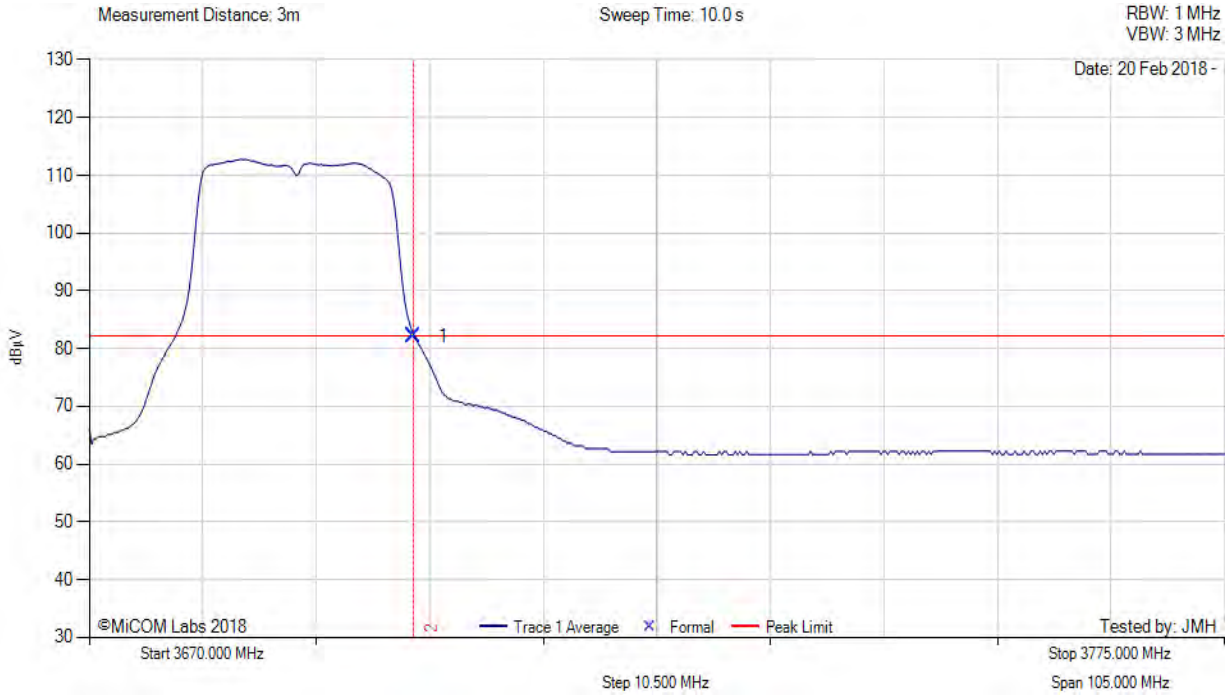


3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3700.00	46.08	2.68	33.24	82.00	Max Avg	Horizontal	171	5	68.2	-0.2	Pass
2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 20 MHz, Test Freq: 3689.00 MHz, Power Setting: 18.0, Duty Cycle (%): 99

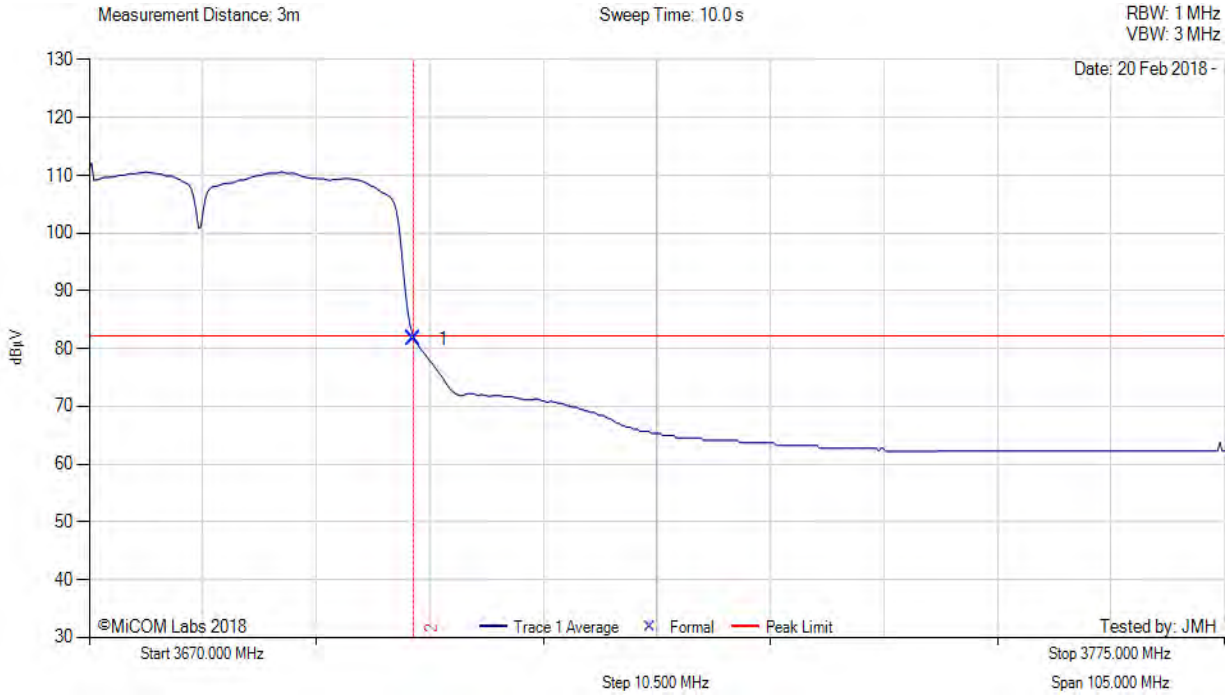


3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3700.00	46.25	2.68	33.24	82.17	Max Avg	Horizontal	171	5	82.2	-0.3	Pass
2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

Variant: 40 MHz, Test Freq: 3680.00 MHz, Power Setting: 19.5, Duty Cycle (%): 99



3670.00 - 3775.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3700.00	45.69	2.68	33.24	81.61	Max Avg	Horizontal	171	5	82.2	-0.7	Pass
2	3700.00	--	--	--	--	Band-Edge	--	--	--	--	--	--

Test Notes: EUT Powered by POE, Controlled by laptop outside chamber. 9 dBi

back to matrix

A.2. WORST CASE COMPARISON

An investigation was undertaken to identify worst case modulation. Modulation states - BPSK, QPSK, 16 QAM, 64QAM, 256QAM.

The following tests were completed in order to find the worst-case state;

i).. Power Spectral Density
ii) Occupied Bandwidth

Based on the above results BPSK was found to be worst-case. This program focuses on BPSK modulation

A.2.1. Power Spectral Density

Equipment Configuration for Power Spectral Density			
Variant:	10 MHz	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9.00
Modulation:	Varies	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:	All Modes tested with power setting of 18.5		

Test Measurement Results							
Test Frequency	**Measured Power Spectral Density (dBm/MHz)**						
Modulation	**H**	**V**					
BPSK	**9.91**	**9.63**					
QPSK	9.71	9.54					
16 Qam	9.58	9.46					
64 Qam	9.19	9.04					
256 Qam	9.01	8.91					

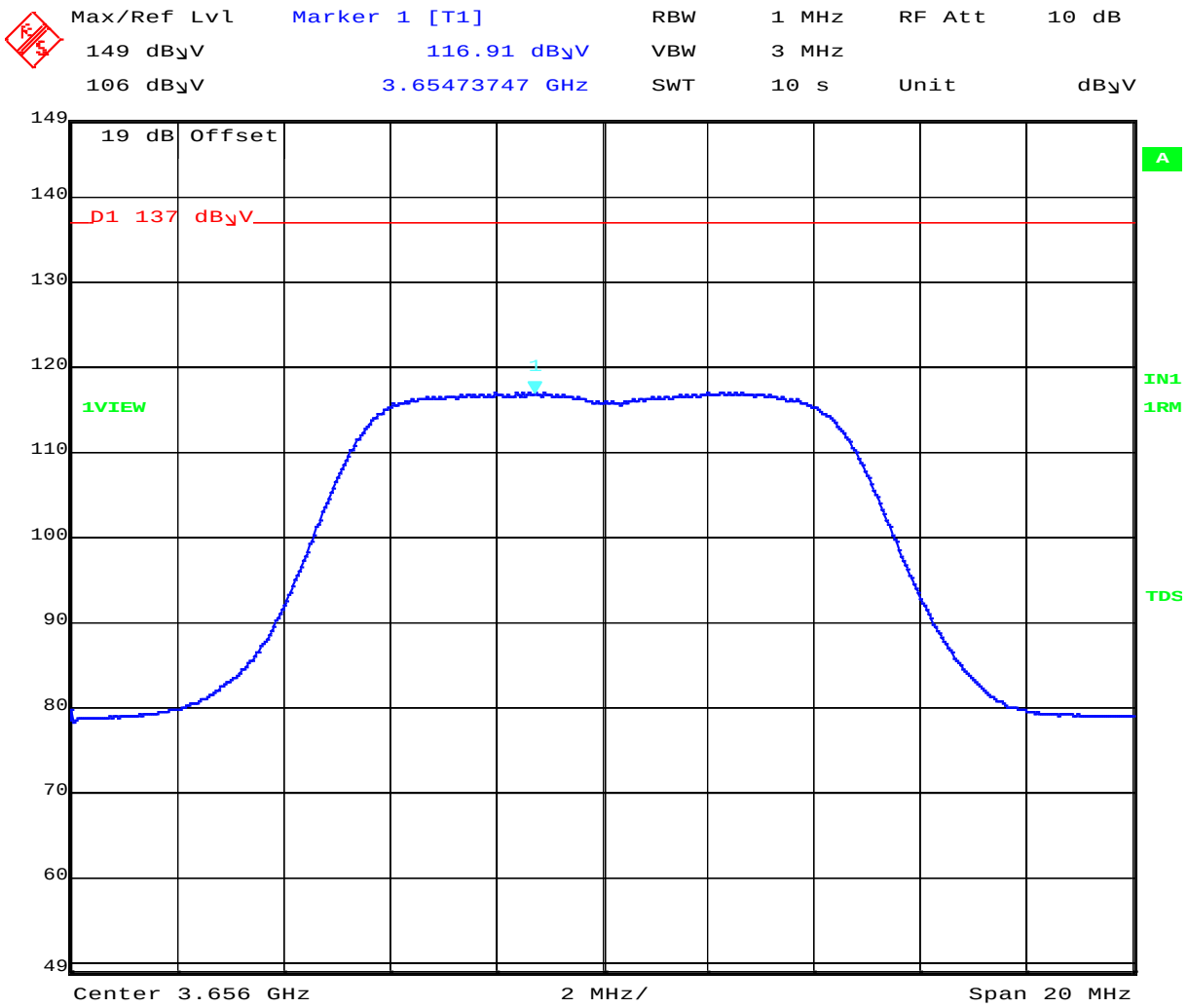
Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

BPSK Power Spectral Density = 116.91 dBuV/m = Worst Case

Power Spectral Density

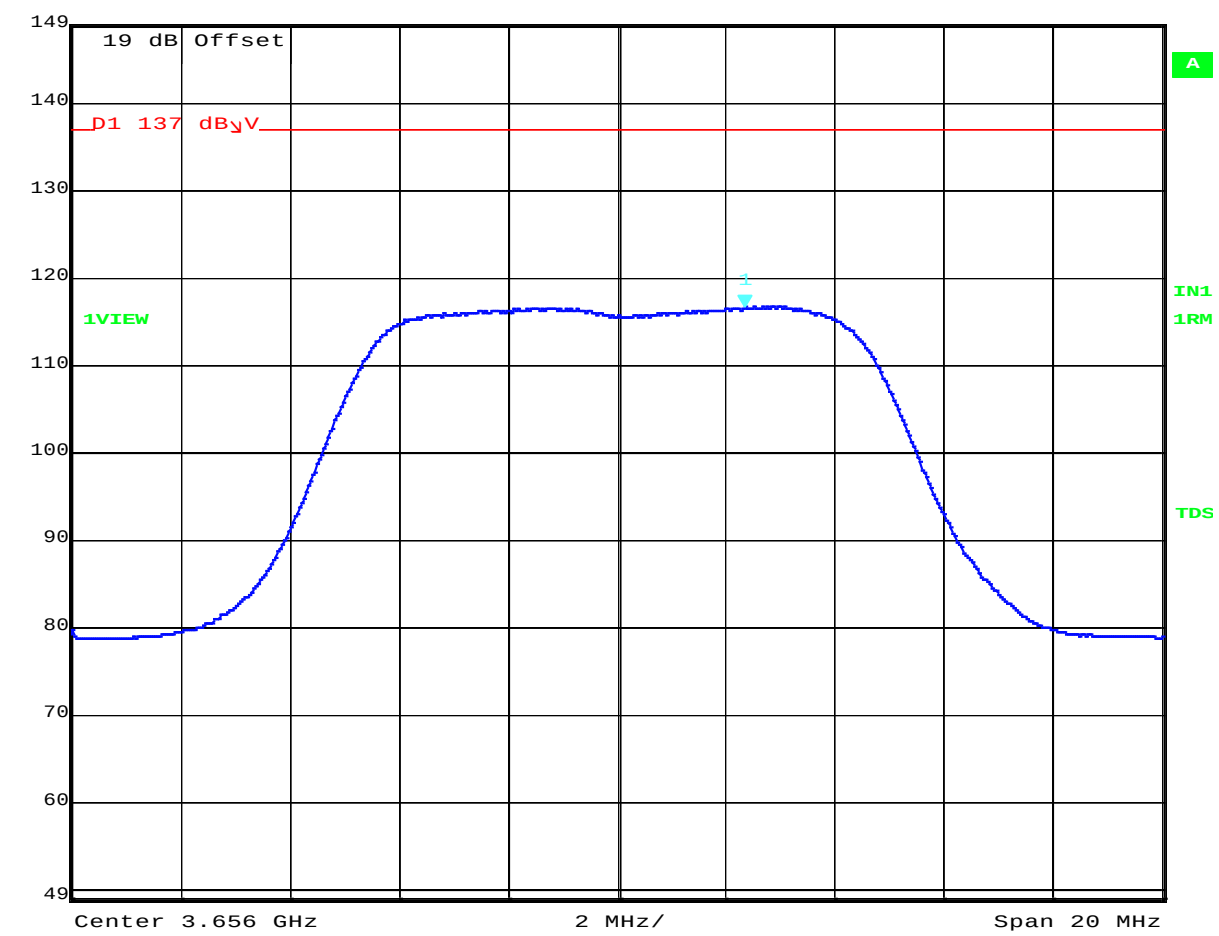
Mode: BPSK Variant: 10 MHz, Channel: 3656.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

Power Spectral Density

Mode: BPSK Variant: 10 MHz, Channel: 3656.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

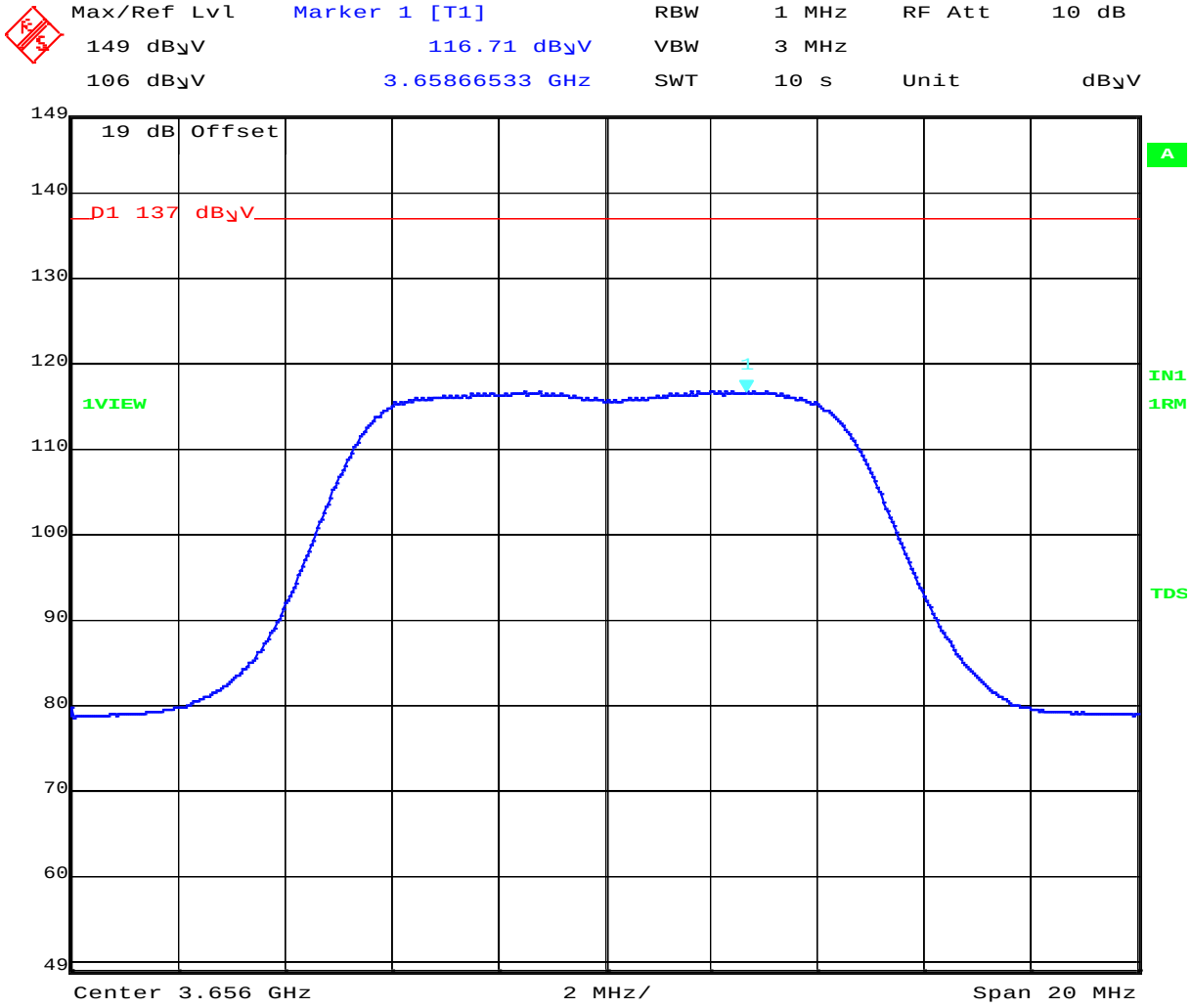


Date: 22.FEB.2018 13:08:22

Back to Matrix

Power Spectral Density

Mode: QPSK Variant: 10 MHz, Channel: 3656.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc

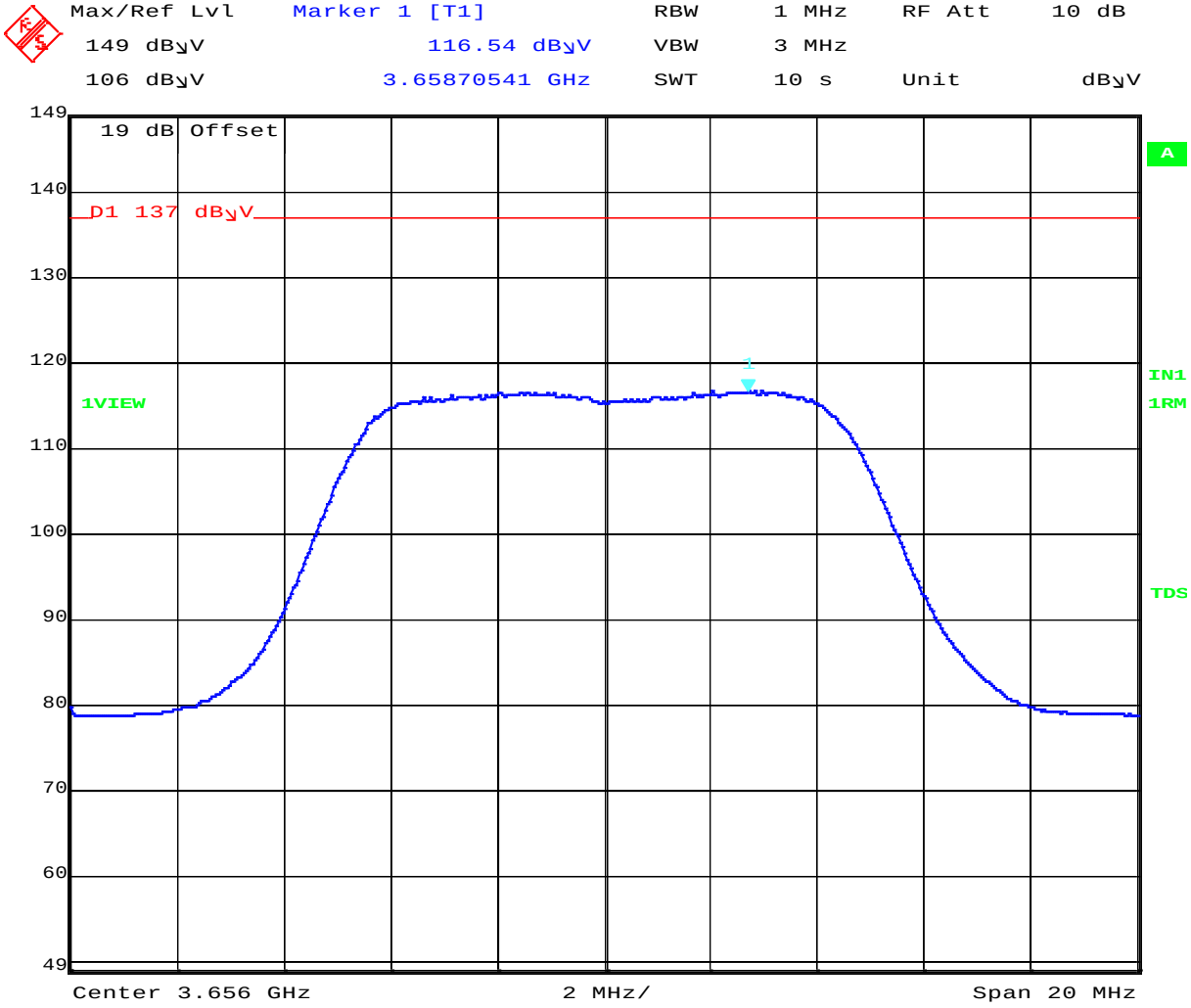


Date: 22.FEB.2018 13:09:58

Back to Matrix

Power Spectral Density

Mode: QPSK Variant: 10 MHz, Channel: 3656.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

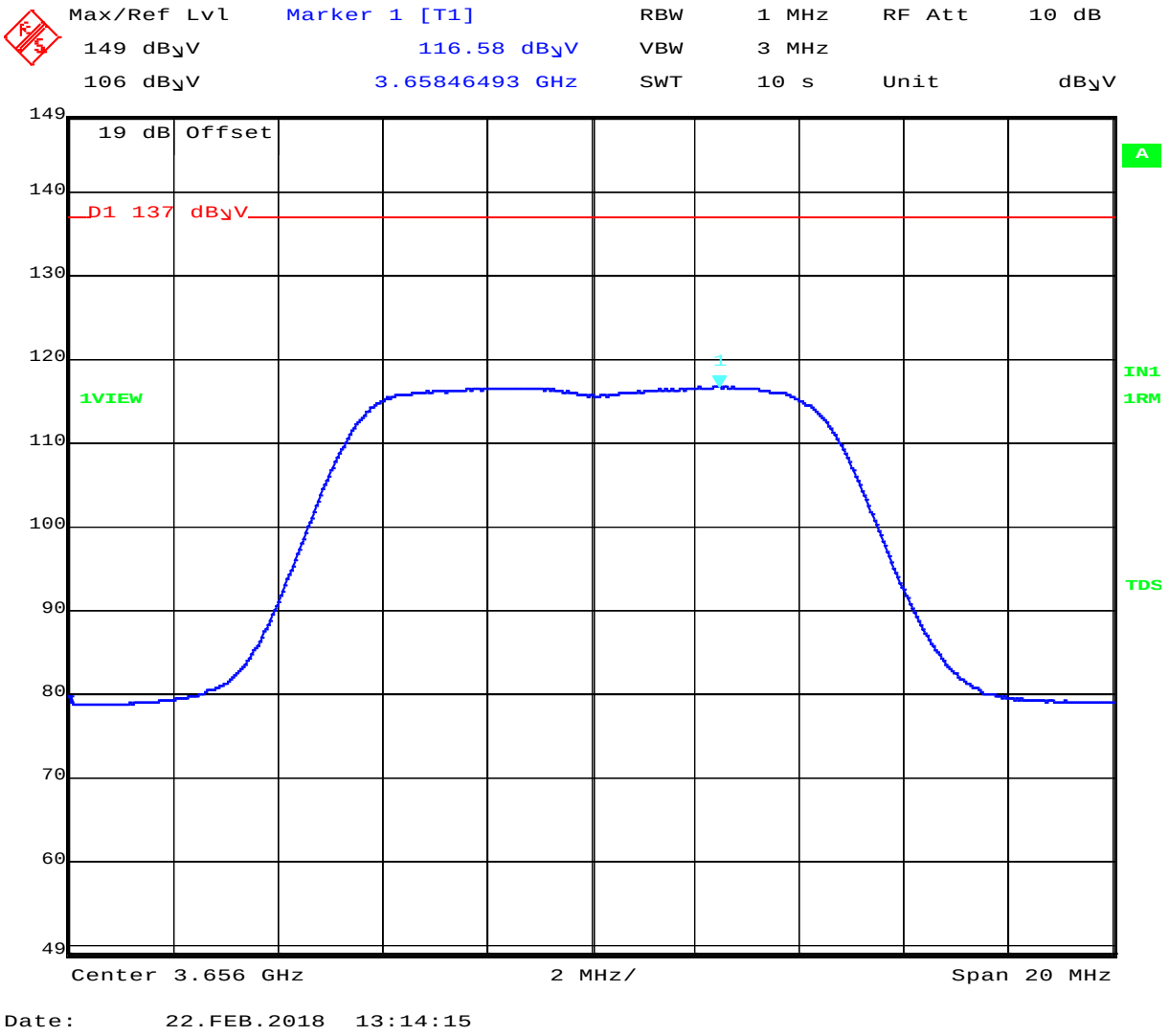


Date: 22.FEB.2018 13:11:47

Back to Matrix

Power Spectral Density

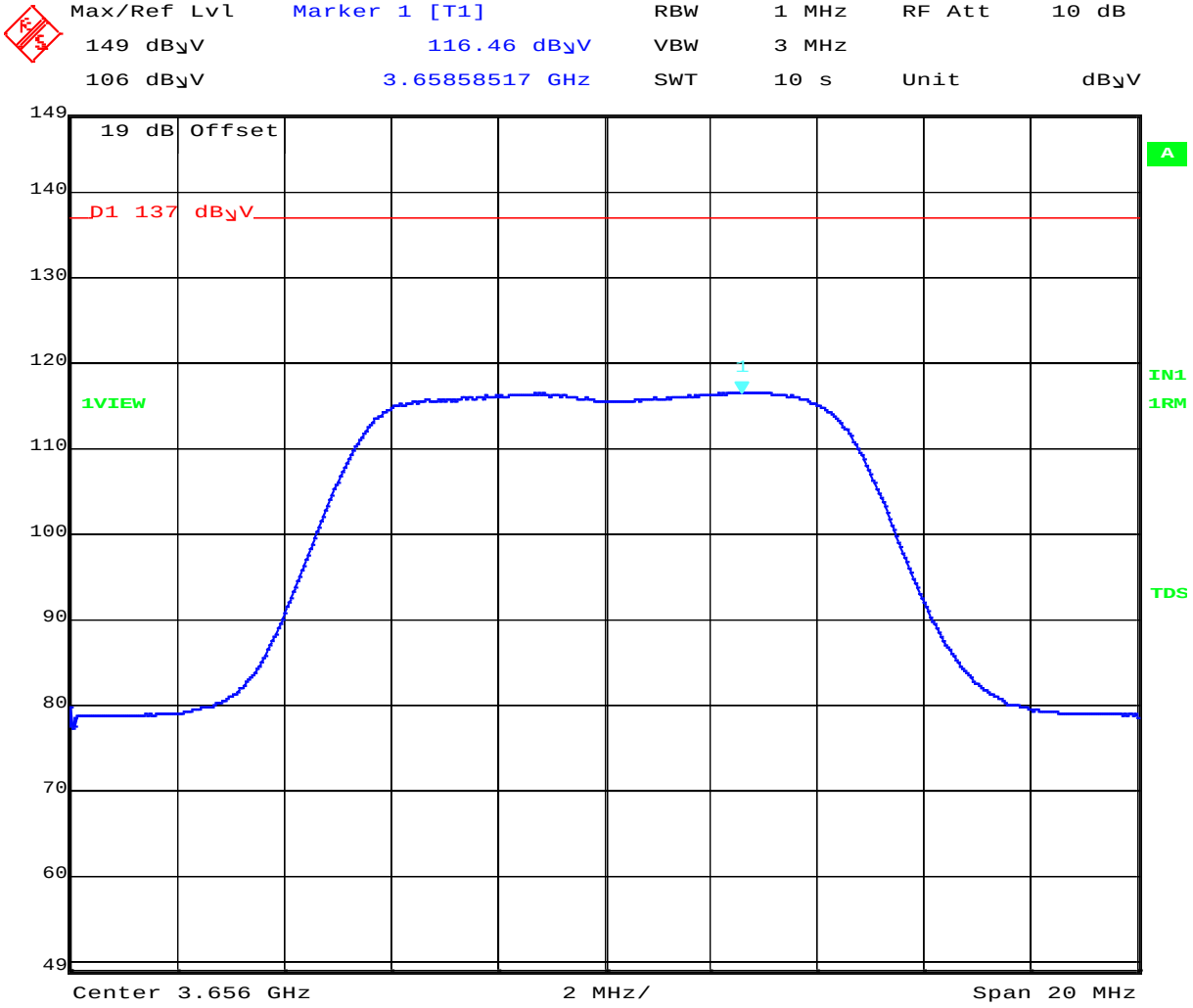
Mode: 16 Qam Variant: 10 MHz, Channel: 3656.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

Power Spectral Density

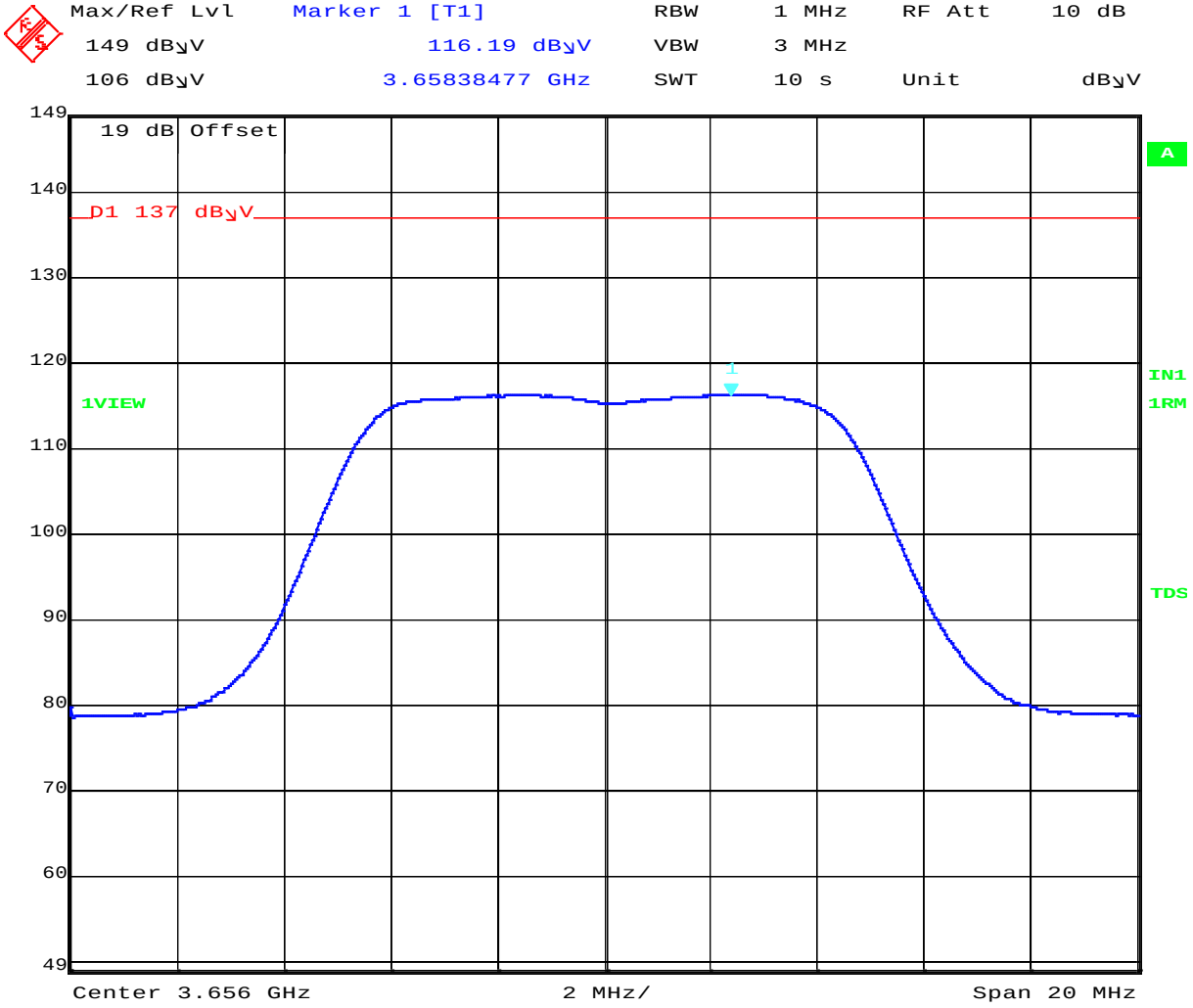
Mode: 16 Qam Variant: 10 MHz, Channel: 3656.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

Power Spectral Density

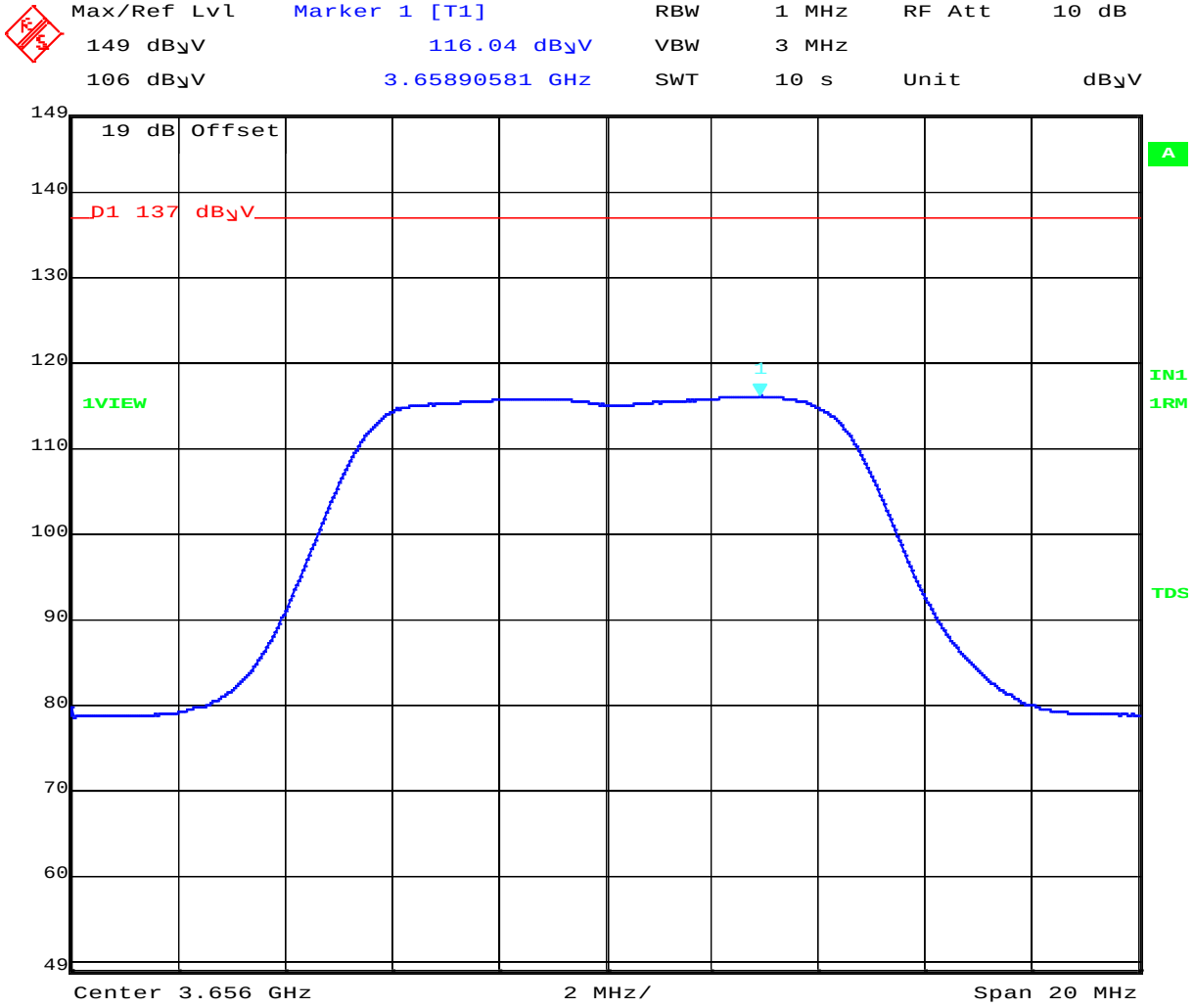
Mode: 64 Qam Variant: 10 MHz, Channel: 3656.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

Power Spectral Density

Mode: 64 Qam Variant: 10 MHz, Channel: 3656.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

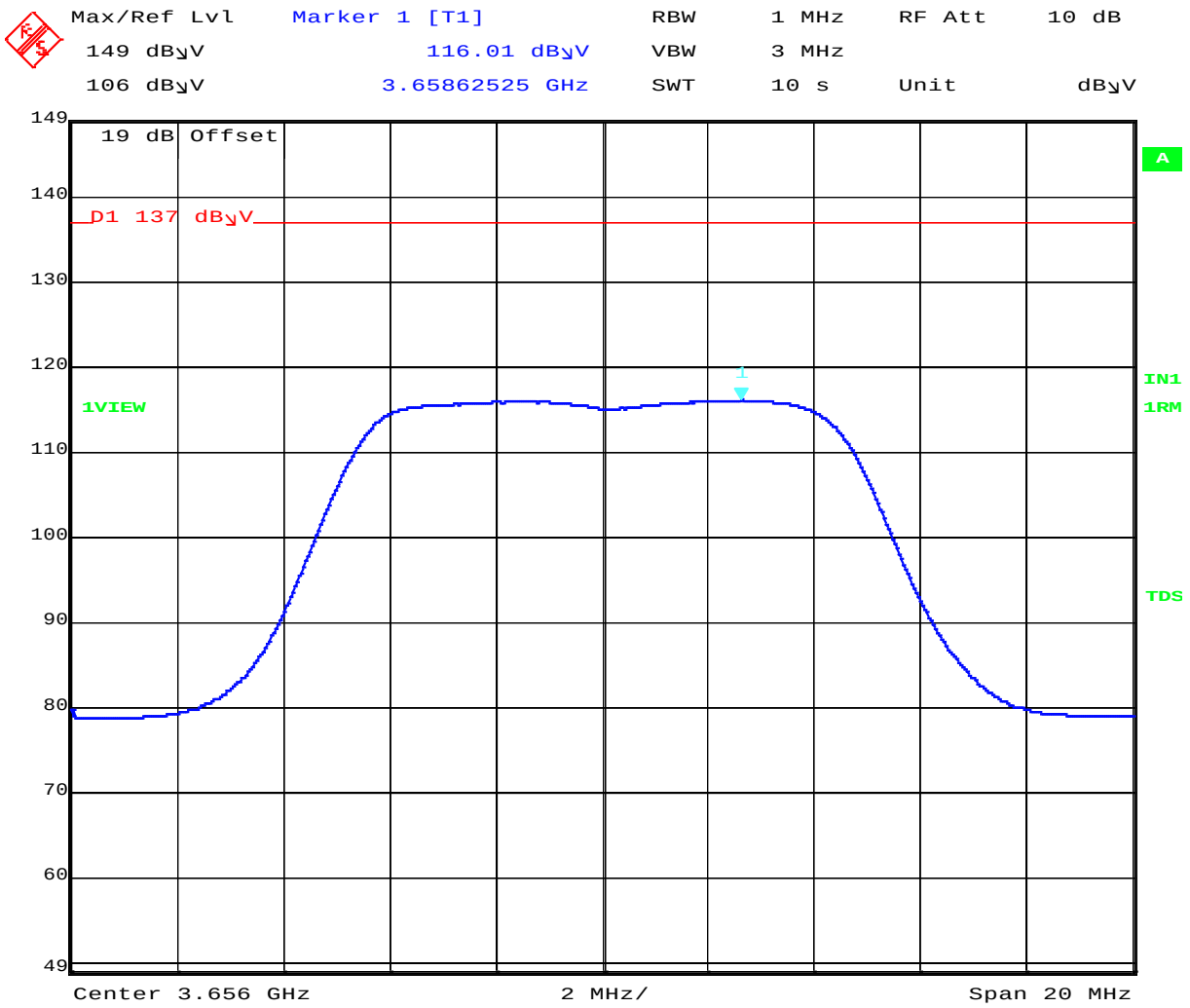


Date: 22.FEB.2018 13:21:21

Back to Matrix

Power Spectral Density

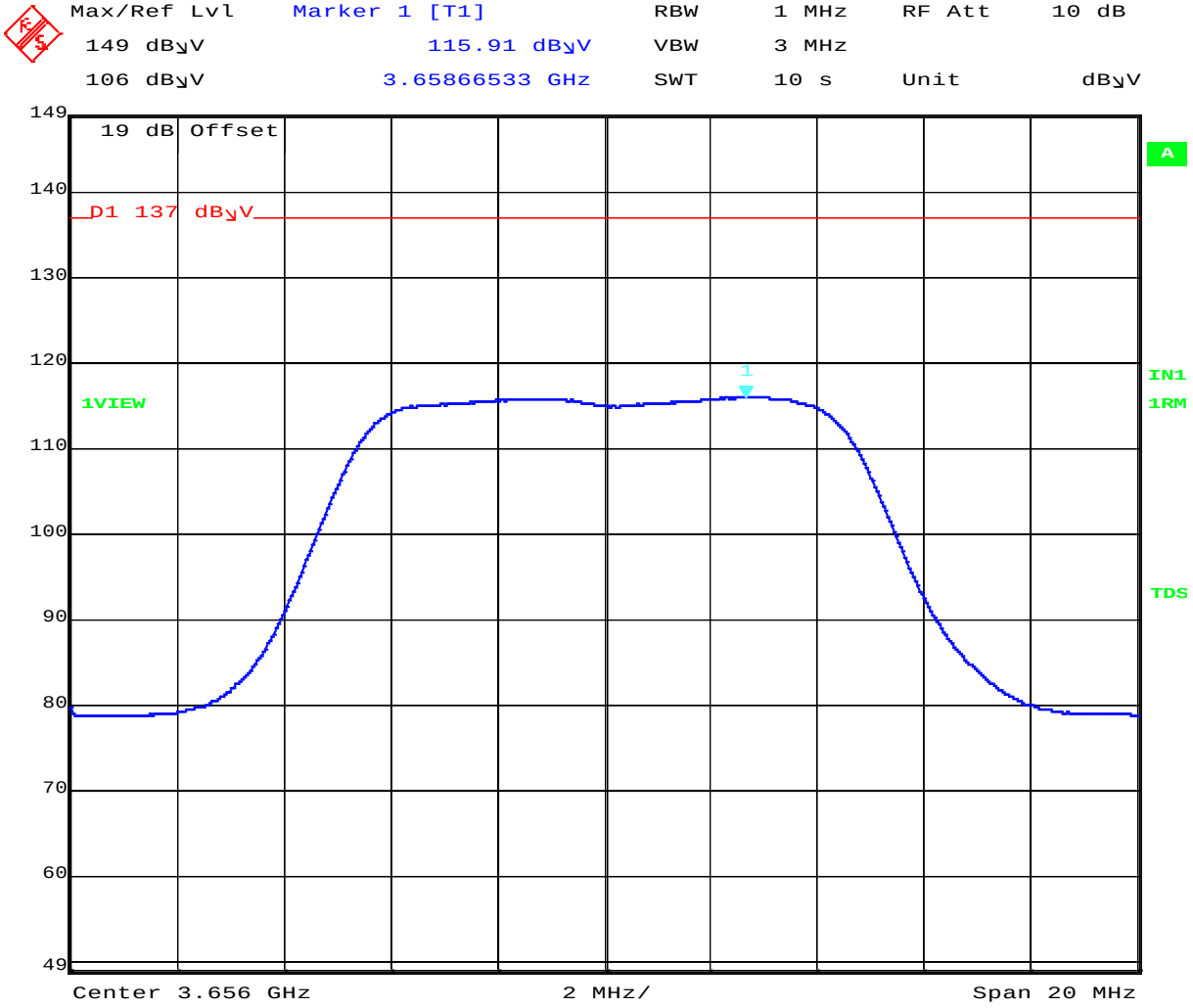
Mode: 256 Qam Variant: 10 MHz, Channel: 3656.00 MHz, Polarity H, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

Power Spectral Density

Mode: 256 Qam Variant: 10 MHz, Channel: 3656.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc



Back to Matrix

A.2.2. Occupied Bandwidth

Equipment Configuration for 26 dB & 99% Occupied Bandwidth

Variant:	10 MHz	**Duty Cycle (%):**	99.0
Data Rate:	-	**Antenna Gain (dBi):**	9
Modulation:	Varies	**Beam Forming Gain (Y)(dB):**	
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 26 dB Bandwidth (MHz) Port(s)				26 dB Bandwidth (MHz)			
3656 MHz	**H**	**V**			**Highest**			
BPSK		12.18		--	12.18			
QPSK		11.38			11.38			
16 Qam		11.14			11.14			
64 Qam		11.50		--	11.50			
256 Qam		11.42		--	11.42			

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				99% Bandwidth (MHz)			
3656 MHz	**H**	**V**			**Highest**	**Lowest**		
BPSK		8.89		--	8.89			
QPSK		8.89			8.89			
16 Qam		8.89			8.89			
64 Qam		8.93		--	8.94			
256 Qam		8.93		--	8.94			

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

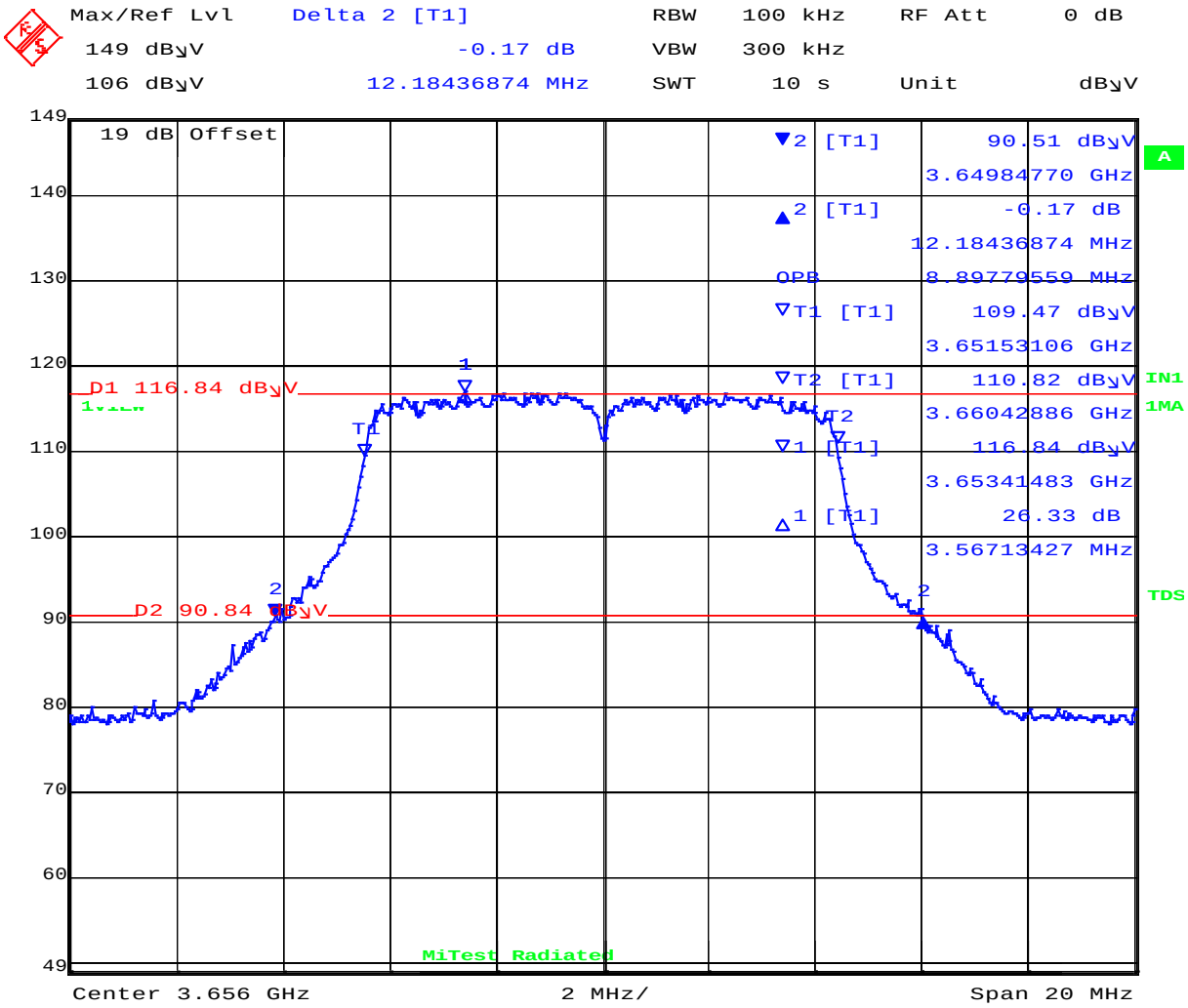
Note: click the links in the above matrix to view the graphical image (plot).

BPSK was found to have the widest 26dB bandwidth (worst case)

Occupied Bandwidth BPSK:

26 dB & 99% Occupied Bandwidth

Mode: BPSK Variant: 10 MHz , Channel: 3656.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc



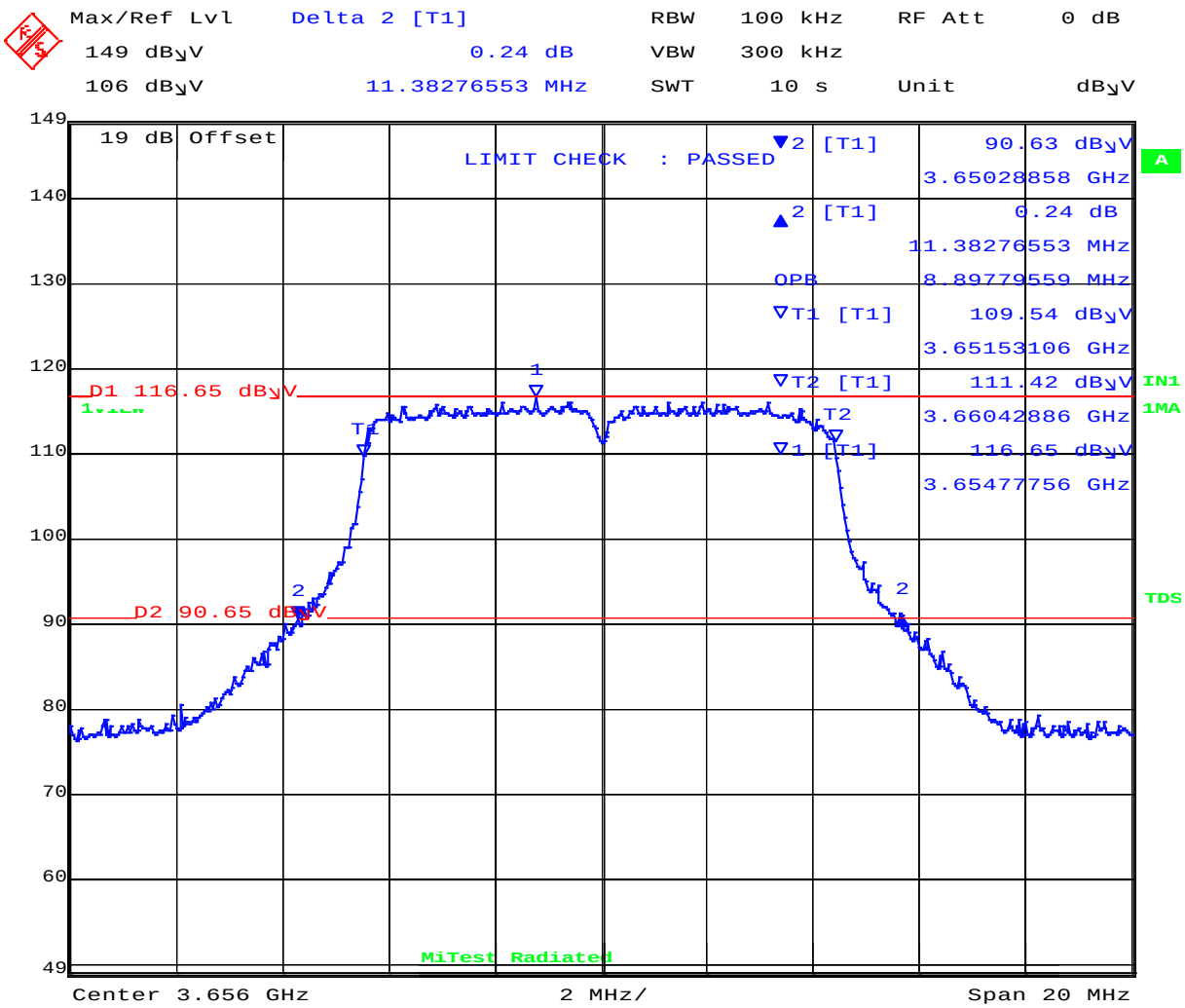
Date: 27.FEB.2018 09:55:21

Back to Matrix

Occupied Bandwidth QPSK:

26 dB & 99% Occupied Bandwidth

Mode: QPSK Variant: 10 MHz , Channel: 3656.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc

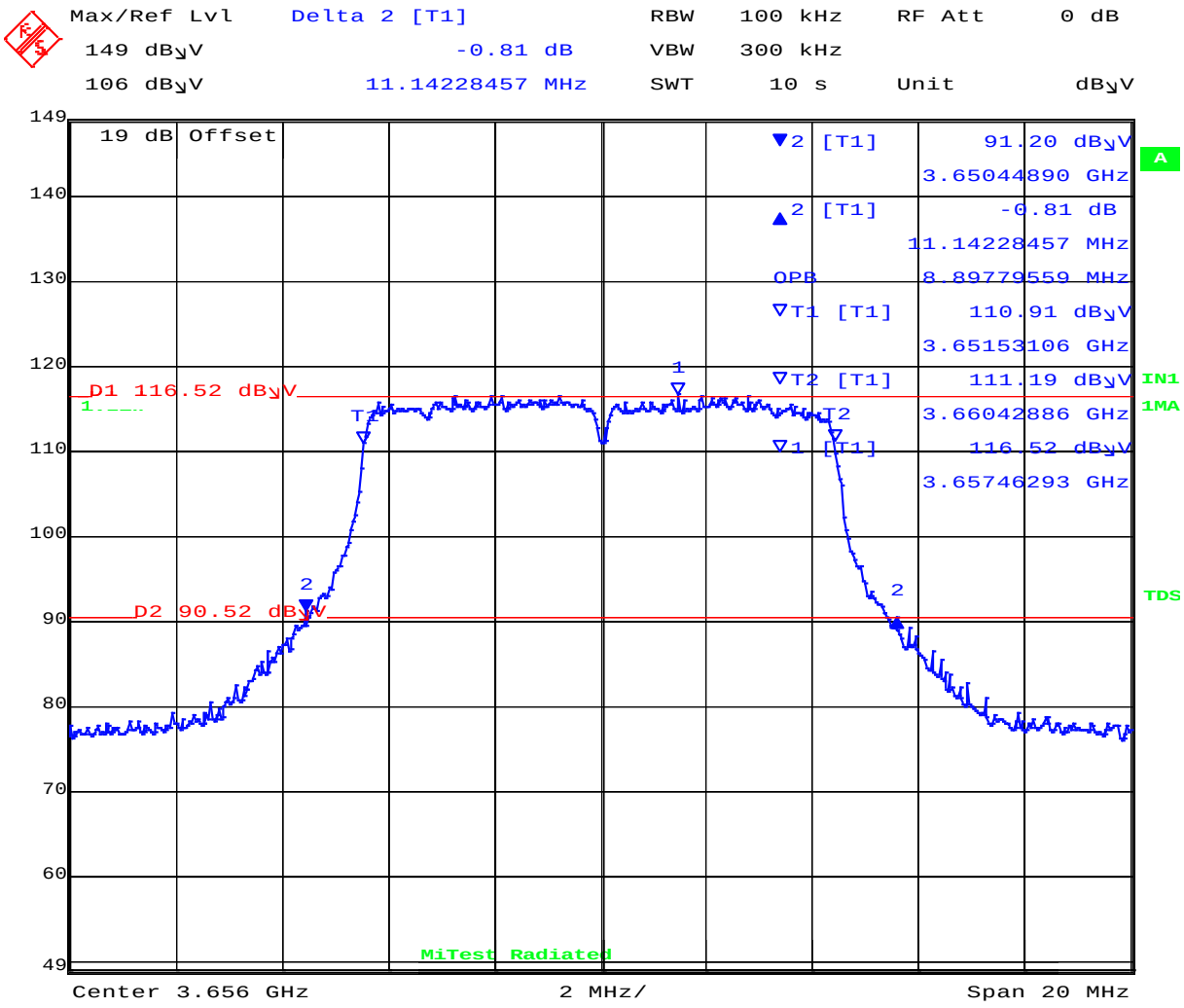


Back to Matrix

Occupied Bandwidth 16 Qam:

26 dB & 99% Occupied Bandwidth

Mode: 16 Qam Variant: 10 MHz , Channel: 3656.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc



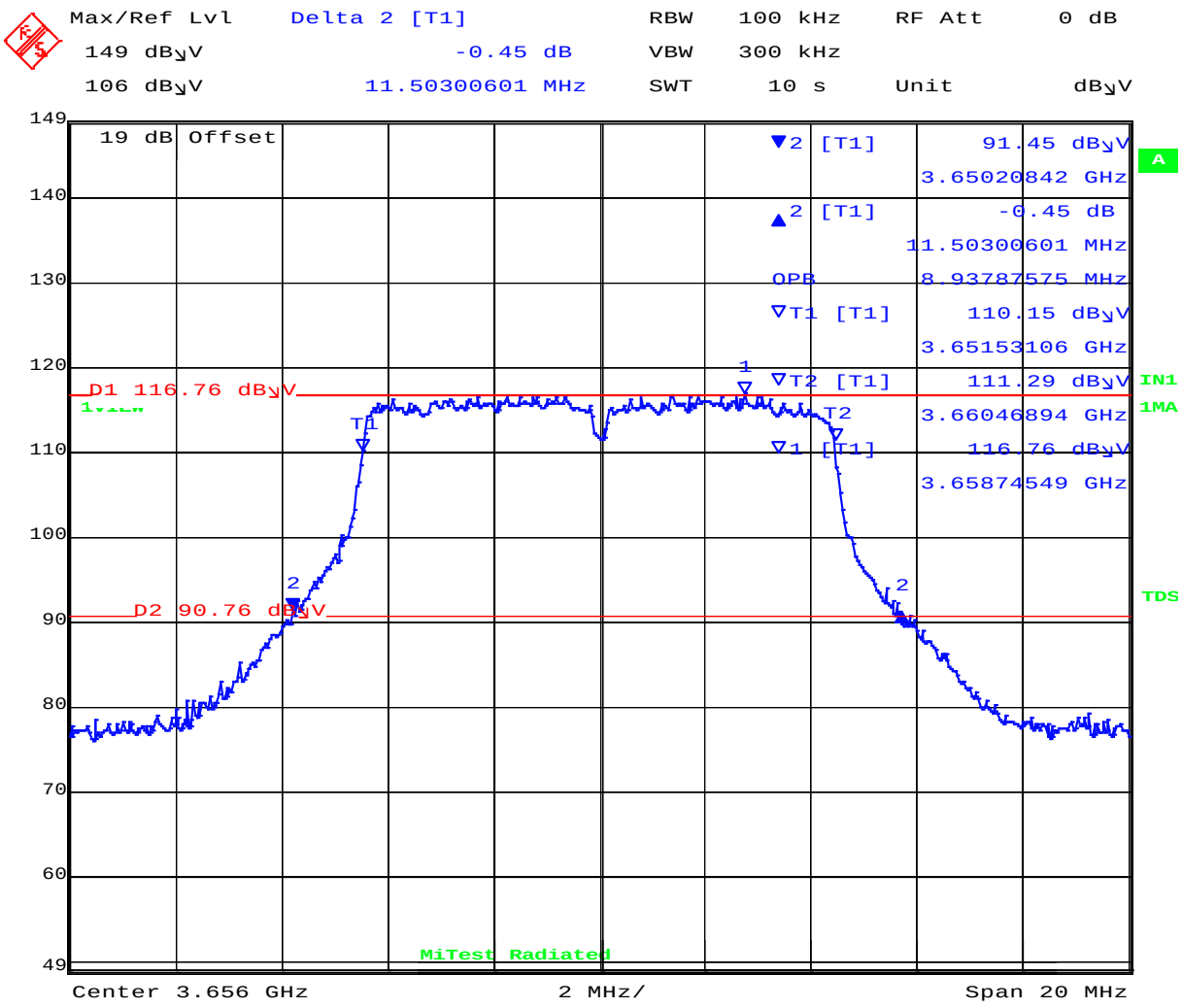
Date: 27.FEB.2018 10:06:05

Back to Matrix

Occupied Bandwidth 64 Qam:

26 dB & 99% Occupied Bandwidth

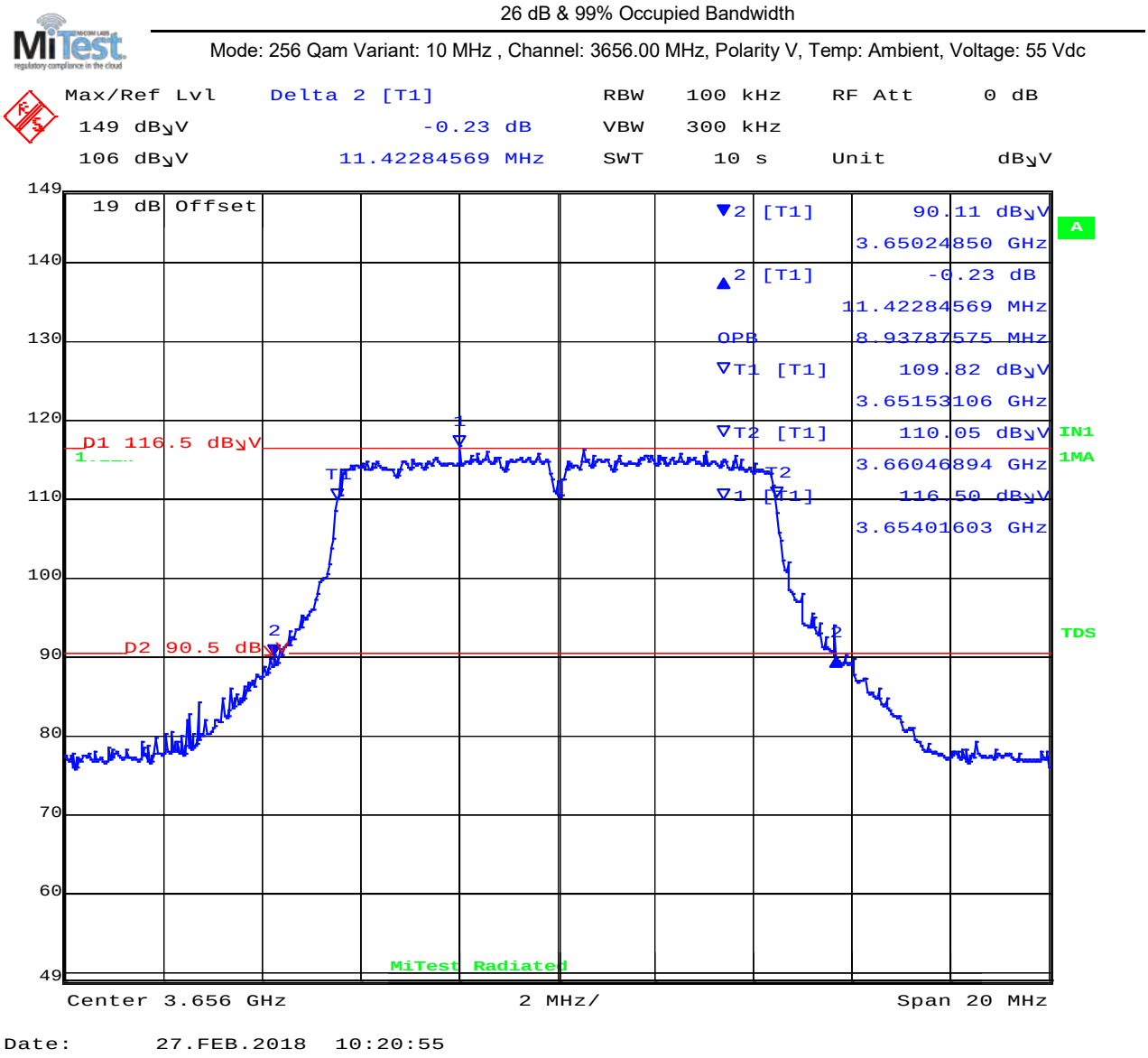
Mode: 64 Qam Variant: 10 MHz , Channel: 3656.00 MHz, Polarity V, Temp: Ambient, Voltage: 55 Vdc



Date: 27.FEB.2018 10:09:58

Back to Matrix

Occupied Bandwidth 256 Qam:



Back to Matrix

575 Boulder Court
Pleasanton, California 94566, USA
Tel: 1.925.462.0304
Fax: 1.925.462.0306
www.micomlabs.com