

FCC and Industry Canada Testing of the
Inmarsat Global Ltd
Model: GSPS Core Module 2.0
In accordance with FCC 47 CFR Part 25, FCC 47
CFR Part 2 and Industry Canada RSS-170 and
Industry Canada RSS-GEN

Prepared for: Inmarsat Global Ltd
99 City Road
London
EC1Y 1AX
United Kingdom

FCC ID: YCT-GSPSCM2
IC: 8944A-GSPSCM2



Product Service

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Date: May 2017
Document Number: 75935242-07 | Issue: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Steven White	04 May 2017	
Authorised Signatory	Matthew Russell	04 May 2017	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 25, FCC 47 CFR Part 2, Industry Canada RSS-170 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Dan Ralley	04 May 2017	
Testing	Graeme Lawler	04 May 2017	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation
IC2932B-1 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be in compliance with FCC 47 CFR Part 25 (2015), FCC 47 CFR Part 2 (2015), Industry Canada RSS-170: Issue 3 (2015) and Industry Canada RSS-GEN : Issue 4 (2014).



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ACCREDITATION

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation. Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

TÜV SÜD Product Service
is a trading name of TÜV SÜD Ltd
Registered in Scotland at East Kilbride,
Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TÜV SÜD Ltd is a
TÜV SÜD Group Company

Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuv-sud.co.uk

TÜV SÜD Product Service
Octagon House
Concorde Way
Fareham
Hampshire PO15 5RL
United Kingdom

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	04 May 2017

Table 1

1.2 Introduction

Applicant	Inmarsat Global Ltd
Manufacturer	Inmarsat Global Ltd
Model Number(s)	GSPS Core Module 2.0
Serial Number(s)	IHG0000198 and IHG0000175
Hardware Version(s)	HWID3203
Software Version(s)	ER-V01.07.00
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 2 (2015) FCC 47 CFR Part 25 (2015) Industry Canada RSS-170: Issue 3 (2015) Industry Canada RSS-GEN: Issue 4 (2014)
Order Number	57-00141-01/1
Date	03-June-2016
Date of Receipt of EUT	10-January-2017
Start of Test	16-January-2017
Finish of Test	16-February-2017
Name of Engineer(s)	Dan Ralley and Graeme Lawler
Related Document(s)	ANSI C63.4 (2014) KDB 971168 D01 v02r02

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 25, FCC 47 CFR Part 2 and Industry Canada RSS-170 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause				Test Description	Result	Comments/Base Standard
	FCC Pt 25	FCC Pt 2	RSS-170	RSS-GEN			
Configuration: Inmarsat Transmitting							
2.1	-	2.1047 (d)	-	-	Modulation Characteristics	Declaration	
2.2	-	2.1049	-	6.6	Occupied Bandwidth	Pass	
2.3	25.202(d)	2.1055	5.2	-	Frequency Tolerance	Pass	
2.4	25.202(f)	2.1051	5.4.3.1	6.13	Spurious Emissions at Antenna Terminals	Pass	
2.5	25.202(f)	2.1053	5.4.3.1	6.13	Radiated Spurious Emissions	Pass	ANSI C63.4 (2014)
2.6	25.204	-	5.3	-	Equivalent Isotropic Radiated Power	Pass	
2.7	25.216	2.1051	5.4.3	-	Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service	Pass	

Table 2



1.4 Declaration of Build Status

Manufacturer	<u>Inmarsat Global Ltd.</u>
Country of origin	<u>Spain</u>
UK Agent	<u>Inmarsat Global Ltd.</u>
Technical Description	<u>Inmarsat GSPS Core Module 2.0</u>
Model No	<u>GSPS Core Module 2.0</u>
Part No	<u>n/a</u>
Serial No	<u>IHG0000198,IHG0000196,IHG0000175,IHG0000137</u>
Drawing Number	<u>57_00141_2v1C_03</u>
Build Status	<u>S3.0</u>
Software Issue	<u>ER-V01.07.00</u>
Hardware Issue	<u>HWID3203</u>
Highest Internally Generated Frequency	<u>3350MHz</u>
FCC ID	<u>YCT-GSPSCM2</u>
Industry Canada ID	<u>8944A-GSPSCM2</u>
Signature	<u>Ari Tastula</u>
Date	<u>12.01.2017</u>
D of B S Serial No	<u></u>

Note: This document has been prepared to enable manufacturers with no mechanism for producing their own Declaration of Build Status, to declare the build state of the equipment submitted for test.

No responsibility will be accepted by TÜV SÜD Product Service as to the accuracy of the information declared in this document by the manufacturer.

1.5 Product Information

1.5.1 Technical Description

GSPS Satellite Phone Core Module for Inmarsat GMR2+ satellite network. Inmarsat GSPS CM v2 is a Satellite Phone Core Module/Modem which will provide satellite telephony, voice mail, text, email messaging and paging services to users within the Inmarsat global satellite network system.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: IHG0000198			
0	As supplied by the customer	Not Applicable	Not Applicable
Serial Number: IHG0000175			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration: Inmarsat Transmitting		
Occupied Bandwidth	Dan Ralley	UKAS
Frequency Tolerance	Dan Ralley	UKAS
Spurious Emissions at Antenna Terminals	Dan Ralley	UKAS
Radiated Spurious Emissions	Graeme Lawler	UKAS
Equivalent Isotropic Radiated Power	Dan Ralley	UKAS
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service	Dan Ralley	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Modulation Characteristics

2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1047 (d)

2.1.2 Declaration

The data below was supplied:

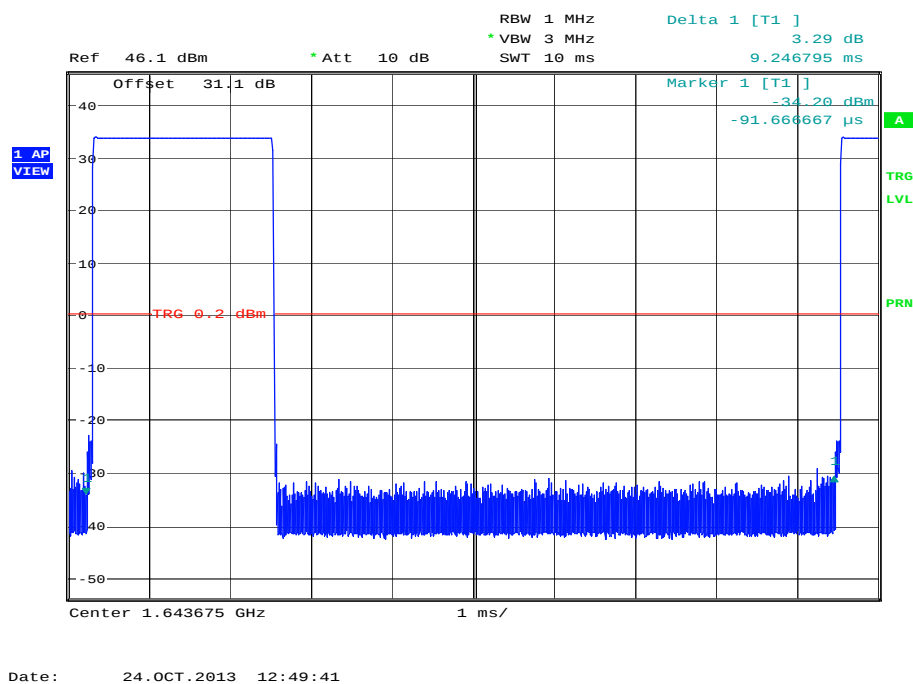


Figure 1 – Transmission Period



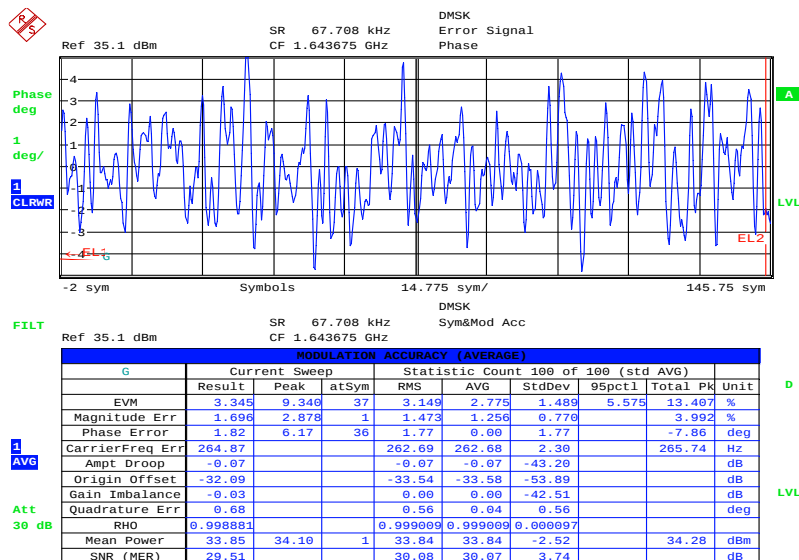
Figure 2 – Transmitter On Time



Figure 3 – Transmission Burst



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Date: 28.OCT.2013 09:03:58

Figure 4 – Modulation Results

FCC 47 CFR Part 2, Limit Clause 2.1047 (d)

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

2.2 Occupied Bandwidth

2.2.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1049
Industry Canada RSS-GEN, Clause 6.6

2.2.2 Equipment Under Test and Modification State

GSPS Core Module 2.0, S/N: IHG0000175 - Modification State 0

2.2.3 Date of Test

16-January-2017

2.2.4 Test Method

This test was performed in accordance with KDB 971168 D01, Clause 4.2.

2.2.5 Environmental Conditions

Ambient Temperature 20.1 °C
Relative Humidity 28.9 %

2.2.6 Test Results

Inmarsat Transmitting

Occupied Bandwidth (kHz)		
1626.675 MHz	1643.675 MHz	1660.475 MHz
60.897	62.821	62.500

Table 5

FCC 47 CFR Part 2, Limit Clause 2.1049

None specified.

Industry Canada RSS-GEN, Limit Clause

None specified.



2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	14-Dec-2017
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	05-Mar-2017
Crystal Detector	Hewlett Packard	8470B	1320	12	08-Jun-2017
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	29-Jan-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Combiner/Splitter	Weinschel	1506A	3877	12	30-Mar-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4510	12	26-May-2017
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	16-Feb-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon

Table 6

O/P Mon – Output Monitored using calibrated equipment

2.3 Frequency Tolerance

2.3.1 Specification Reference

FCC 47 CFR Part 25, Clause 25.202(d)
FCC 47 CFR Part 2, Clause 2.1055
Industry Canada RSS-170, Clause 5.2

2.3.2 Equipment Under Test and Modification State

GPS Core Module 2.0, S/N: IHG0000175 - Modification State 0

2.3.3 Date of Test

18-January-2017 to 25-January-2017

2.3.4 Test Method

The test was performed in accordance with FCC 47 CFR Part 2, Clause 2.1055.

2.3.5 Environmental Conditions

Ambient Temperature 21.1 °C
Relative Humidity 26.1 %

2.3.6 Test Results

Inmarsat Transmitting

Temperature	1643.675 MHz					
	4.8 V DC		5.0 V DC		5.2 V DC	
	Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)
-30.0°C	-0.00004	-0.36504	-0.00026	-2.57959	-0.00006	-0.63273
-20.0°C	0.00006	0.60839	-0.00005	-0.49888	0.00006	0.57189
-10.0°C	-0.00001	-0.13385	0.00004	0.35287	0.00008	0.76657
0.0°C	-0.00016	-1.59399	0.00001	0.13385	-0.00002	-0.19469
+10.0°C	0.00006	0.62056	0.00019	1.92252	-0.00005	-0.52322
+20.0°C	0.00015	1.48448	0.00001	0.08517	-0.00017	-1.66700
+30.0°C	-0.00002	-0.15818	-0.00004	-0.35287	-0.00011	-1.05860
+40.0°C	0.00005	0.51105	0.00000	-0.03650	0.00000	-0.03650
+50.0°C	0.00020	2.01986	0.00015	1.46014	-0.00001	-0.08517

Table 7

FCC 47 CFR Part 25, Limit Clause 25.202(d)

The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent of the reference frequency.

Industry Canada RSS-170, Limit Clause 5.2

For mobile earth station equipment, the carrier frequency shall not depart from the reference frequency by more than ± 10 ppm.

2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	14-Dec-2017
Multimeter	Fluke	79 Series III	611	12	14-Sep-2017
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	05-Mar-2017
Crystal Detector	Hewlett Packard	8470B	1320	12	08-Jun-2017
Thermocouple Thermometer	Fluke	51	3174	12	22-Dec-2017
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	15-Sep-2017
Combiner/Splitter	Weinschel	1506A	3877	12	30-Mar-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	08-Sep-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4510	12	26-May-2017
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	16-Feb-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Oct-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon

Table 8

O/P Mon – Output Monitored using calibrated equipment



2.4 Spurious Emissions at Antenna Terminals

2.4.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 25, Clause 25.202(f)
Industry Canada RSS-170 Clause 5.4.3.1
Industry Canada RSS-GEN, Clause 6.13

2.4.2 Equipment Under Test and Modification State

GSPS Core Module 2.0, S/N: IHG0000175 - Modification State 0

2.4.3 Date of Test

23-January-2017 to 16-February-2017

2.4.4 Test Method

The test was performed in accordance with KDB 971168 D01, Clause 6.

2.4.5 Environmental Conditions

Ambient Temperature	21.0 - 23.3 °C
Relative Humidity	25.4 - 34.4 %

2.4.6 Test Results

Inmarsat Transmitting

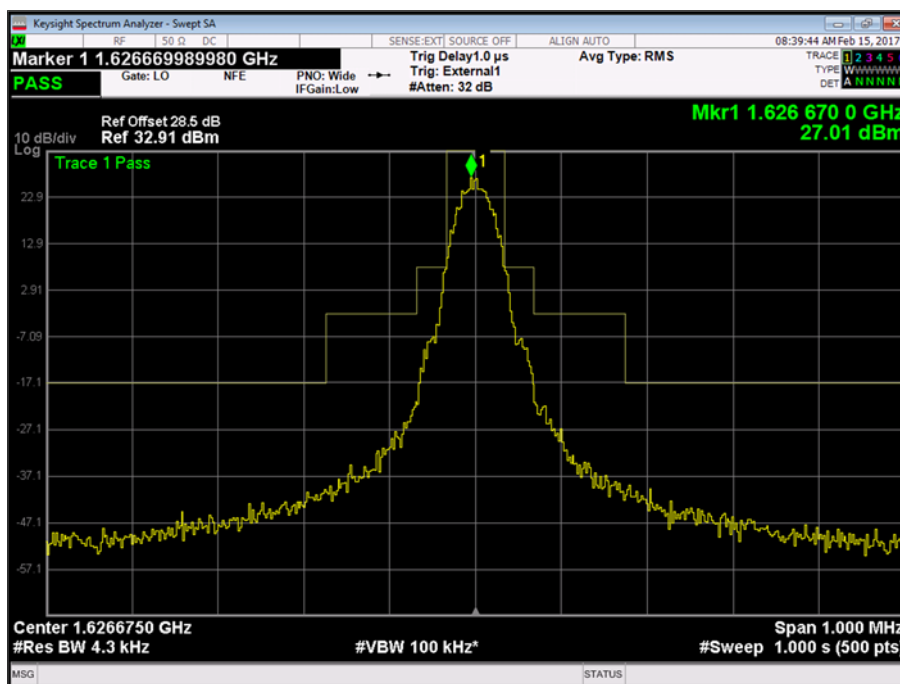


Figure 5 - 1626.675 MHz - Emission Mask

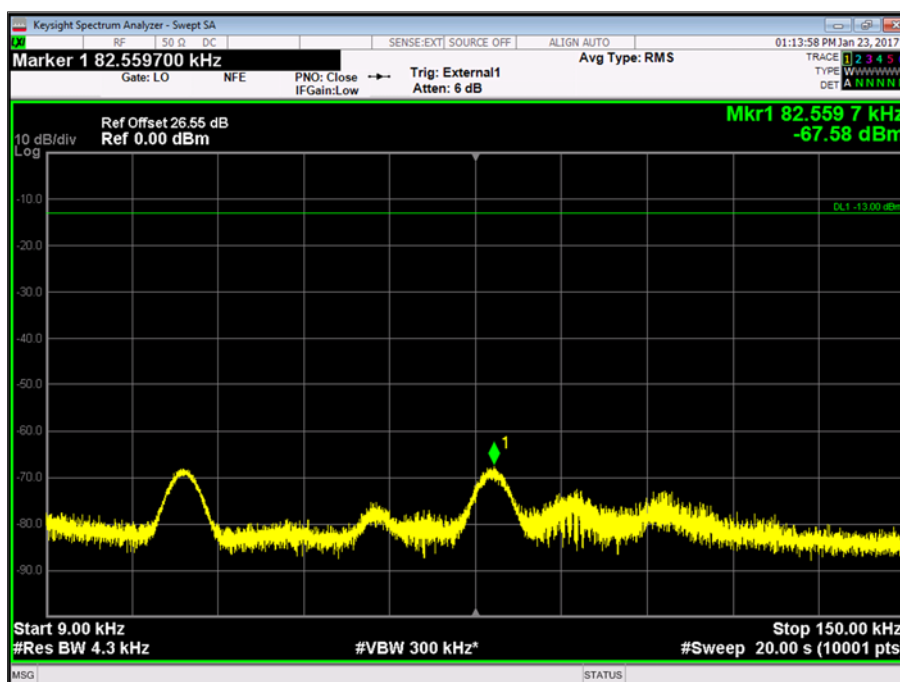


Figure 6 - 1626.675 MHz - 9 kHz to 150 kHz

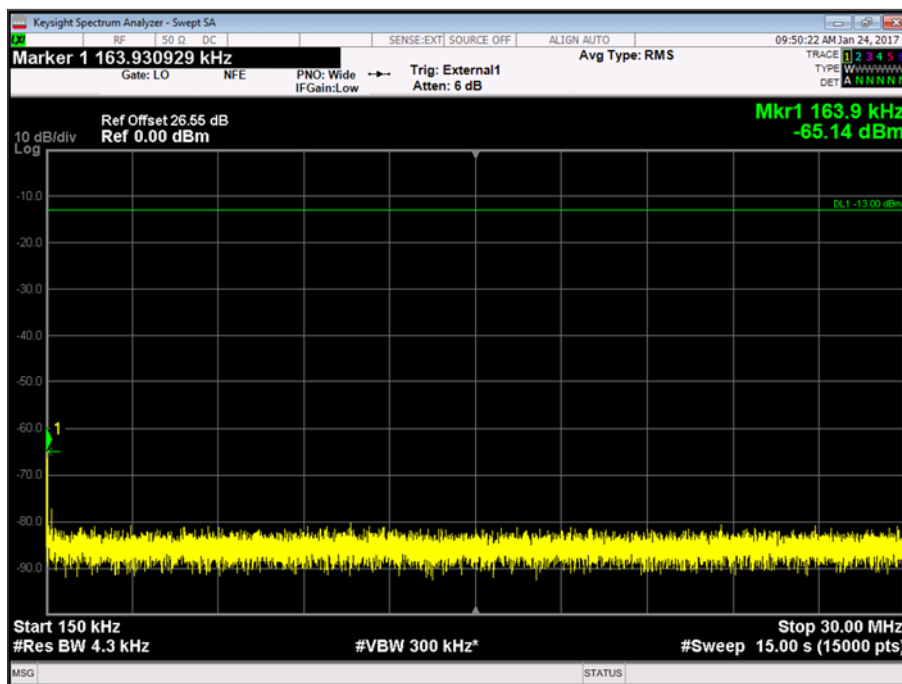


Figure 7 - 1626.675 MHz - 150 kHz to 30 MHz

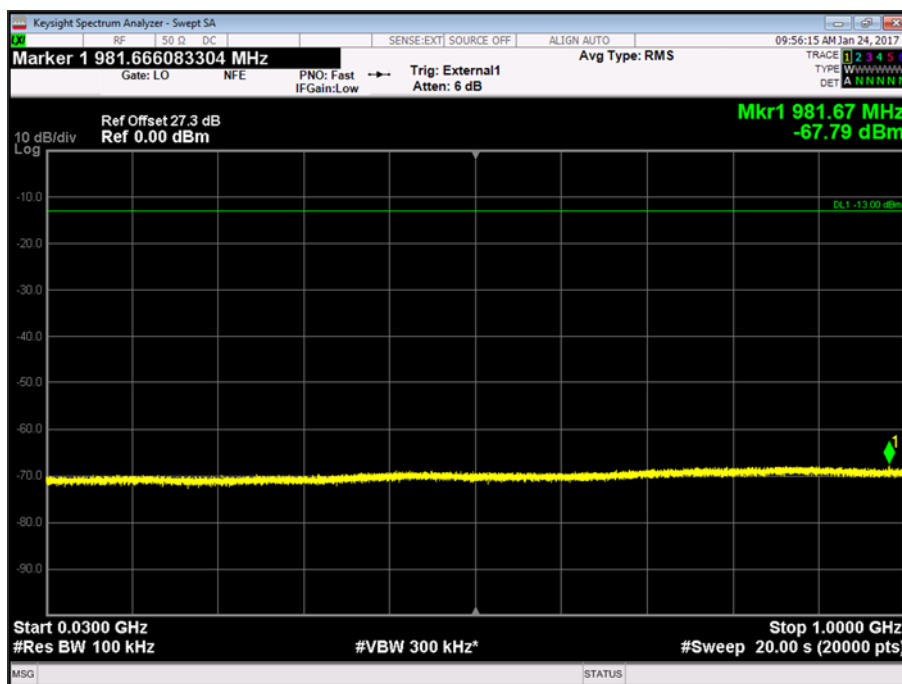


Figure 8 - 1626.675 MHz - 30 MHz to 1 GHz

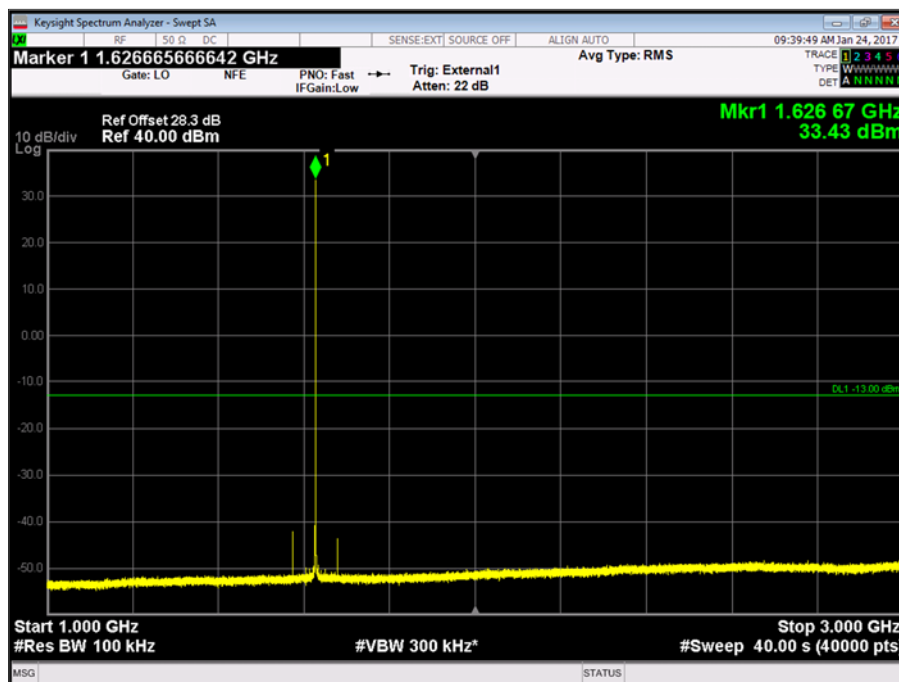


Figure 9 - 1626.675 MHz - 1 GHz to 3 GHz

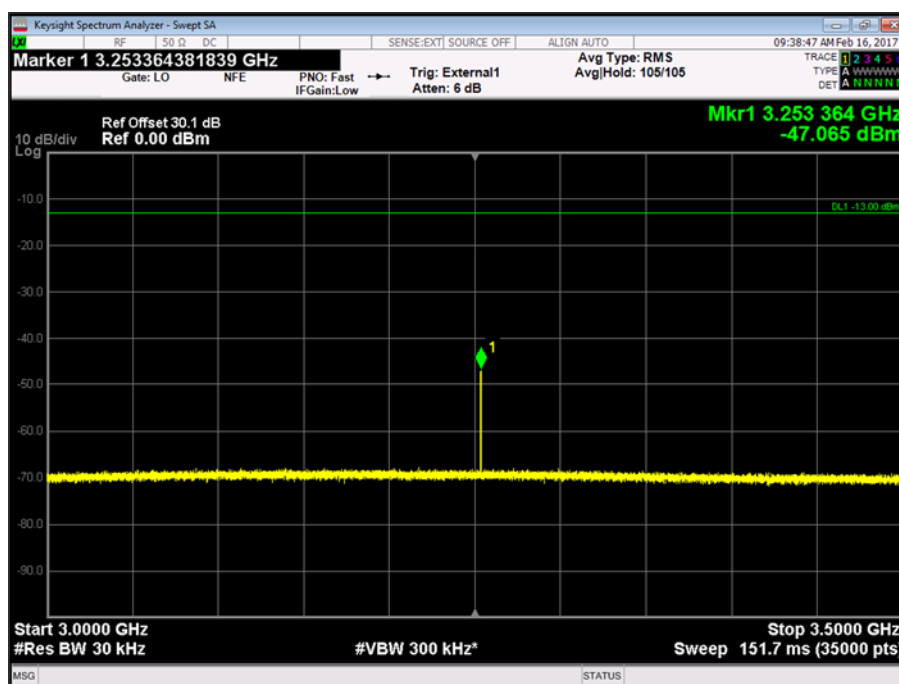


Figure 10 - 1626.675 MHz - 3 GHz to 3.5 GHz

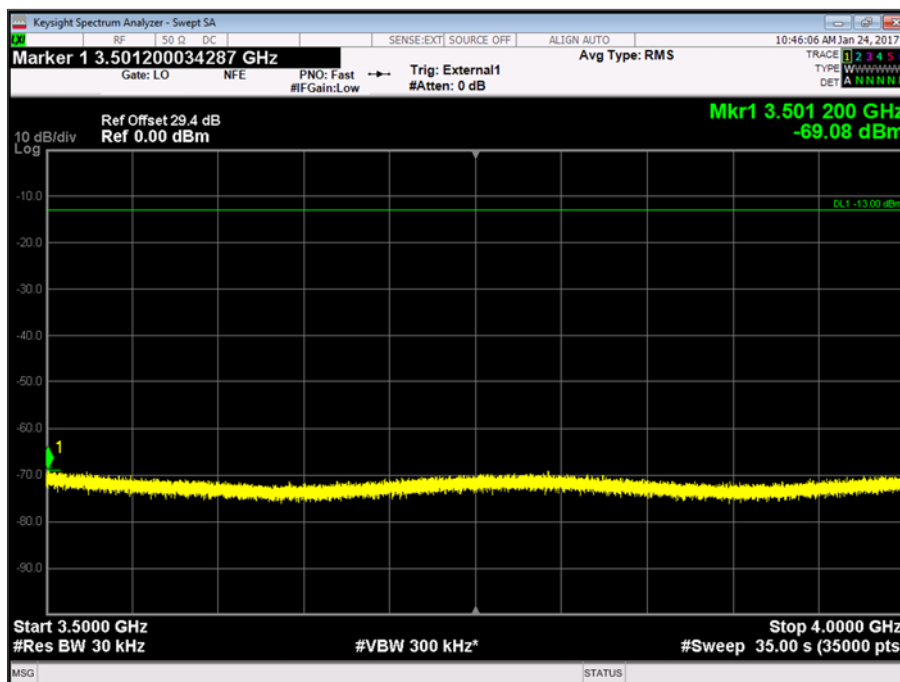


Figure 11 - 1626.675 MHz - 3.5 GHz to 4 GHz

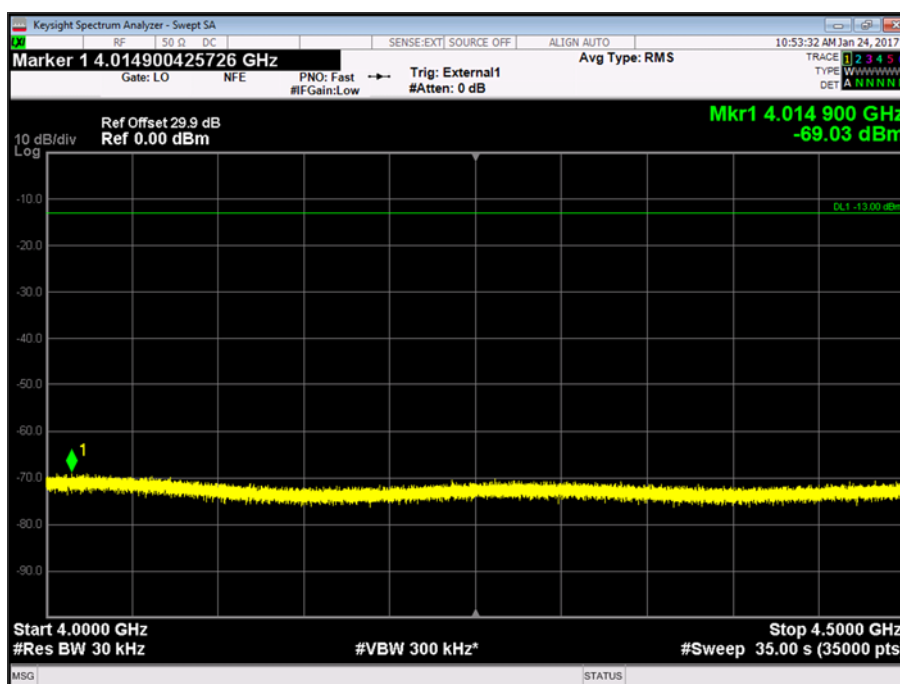


Figure 12 - 1626.675 MHz - 4 GHz to 4.5 GHz

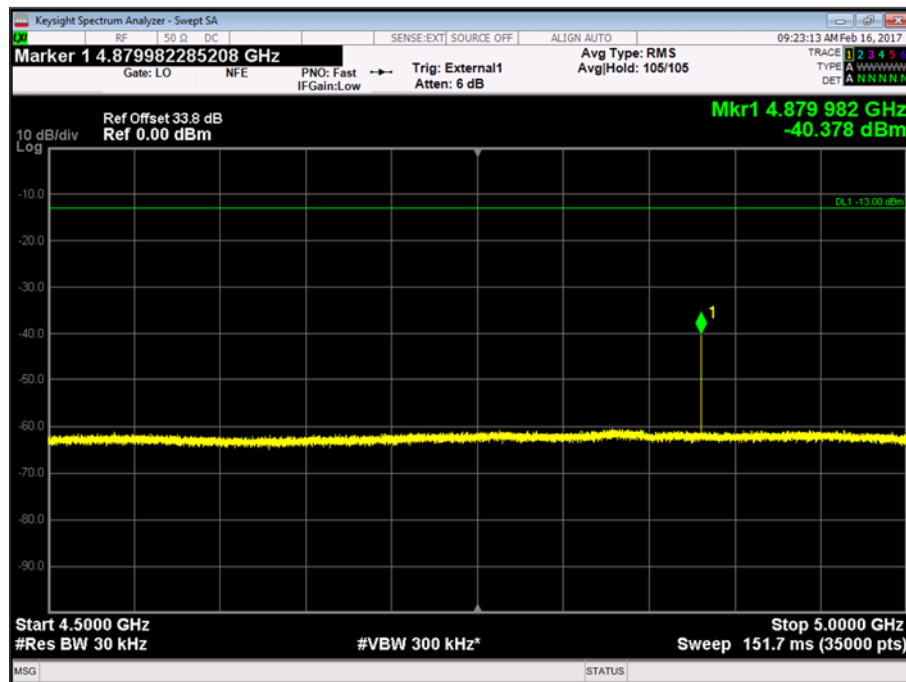


Figure 13 - 1626.675 MHz - 4.5 GHz to 5 GHz

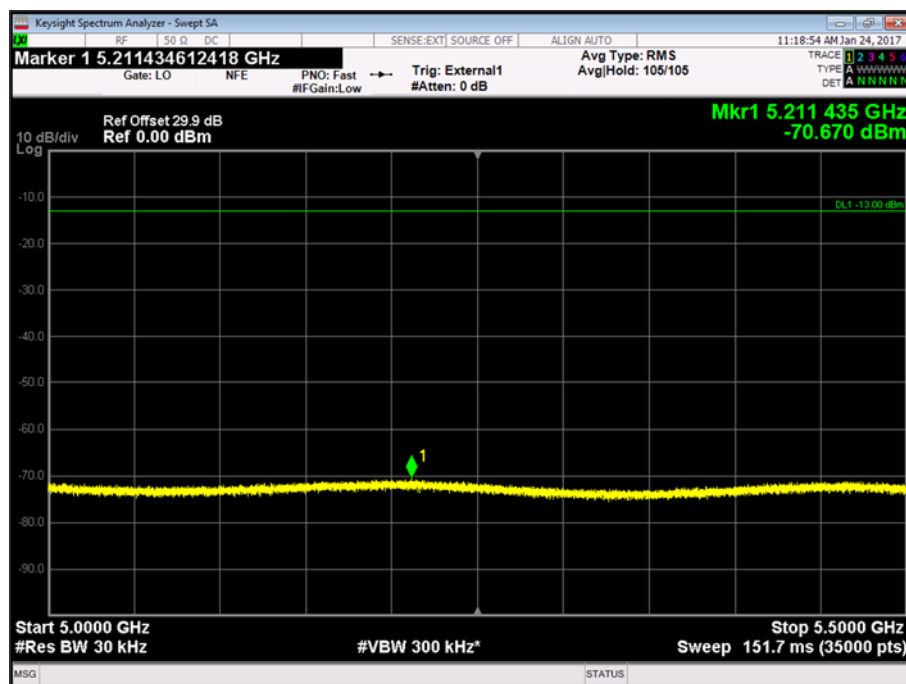


Figure 14 - 1626.675 MHz - 5 GHz to 5.5 GHz

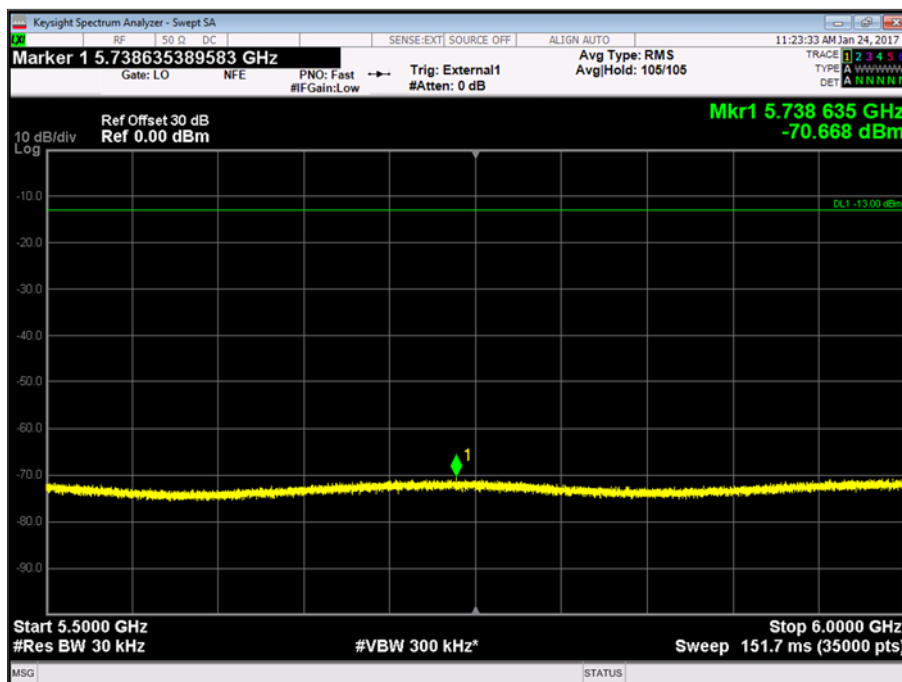


Figure 15 - 1626.675 MHz - 5.5 GHz to 6 GHz

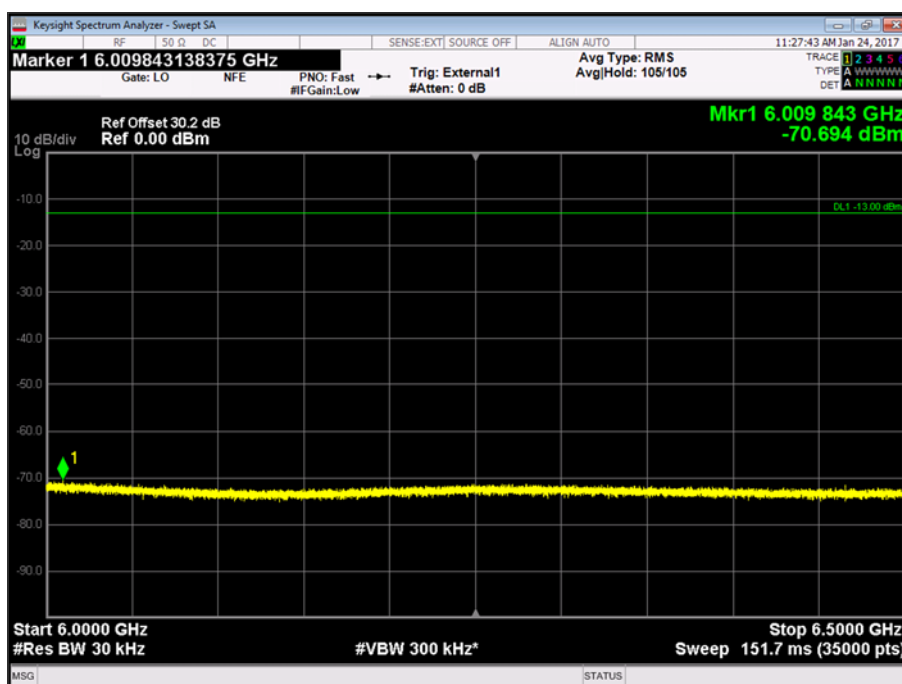


Figure 16 - 1626.675 MHz - 6 GHz to 6.5 GHz

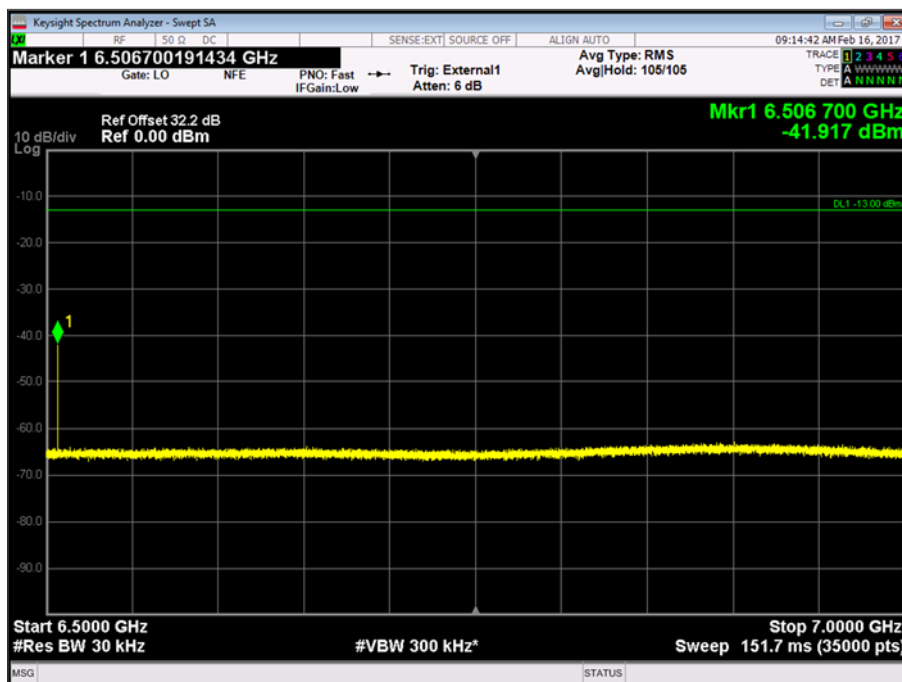


Figure 17 - 1626.675 MHz - 6.5 GHz to 7 GHz

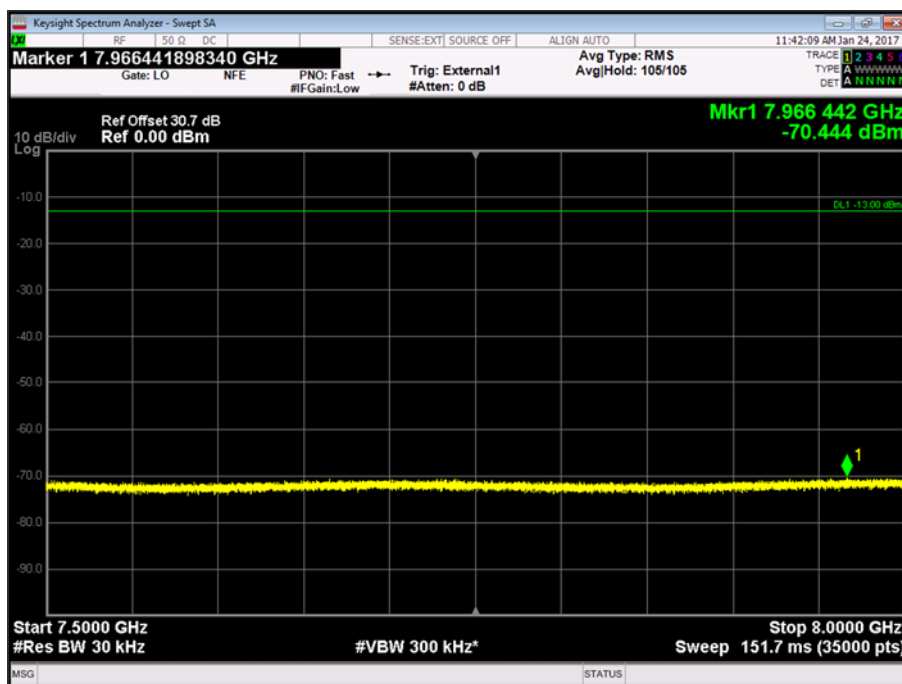


Figure 18 - 1626.675 MHz - 7.5 GHz to 8 GHz



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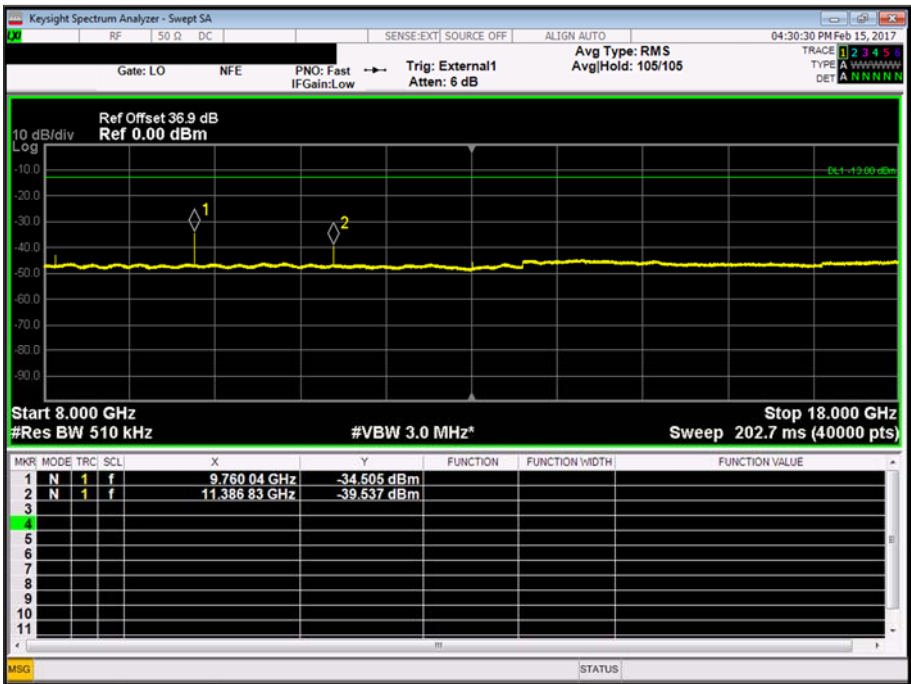


Figure 19 - 1626.675 MHz - 8 GHz to 18 GHz

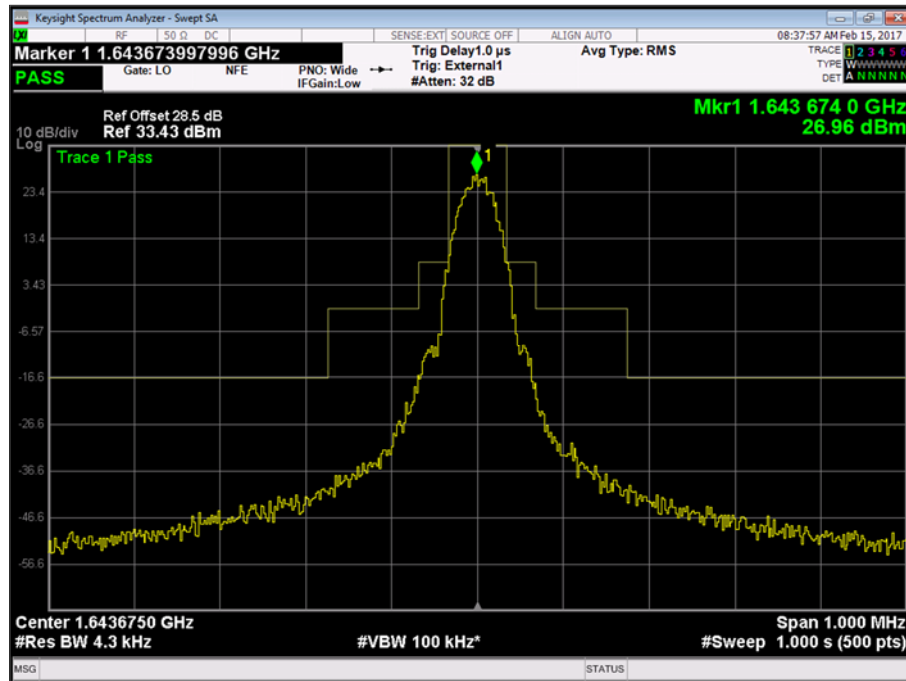


Figure 20 - 1643.675 MHz - Emission Mask

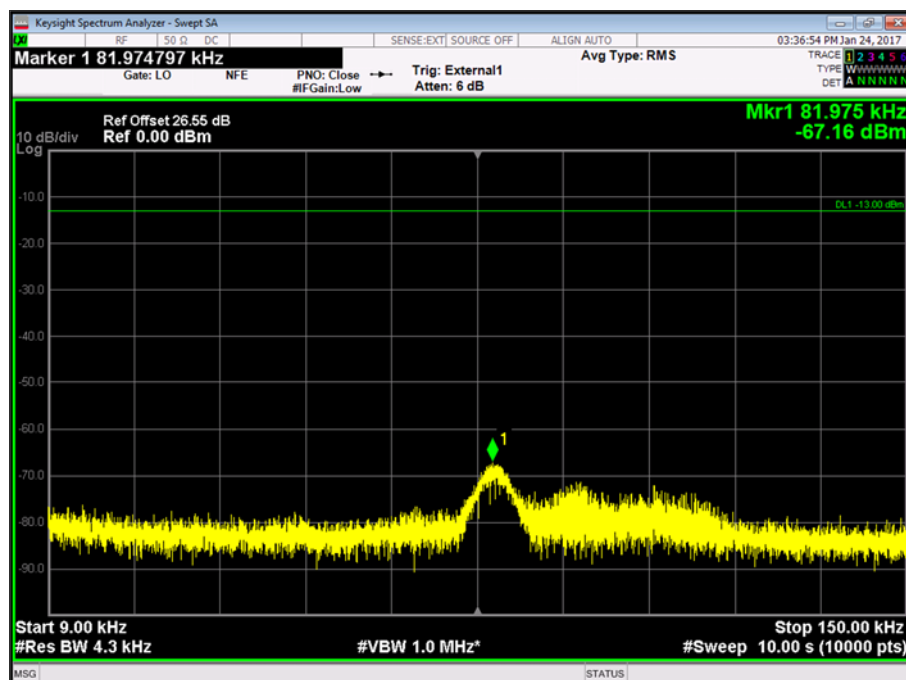


Figure 21 - 1643.675 MHz - 9 kHz to 150 kHz

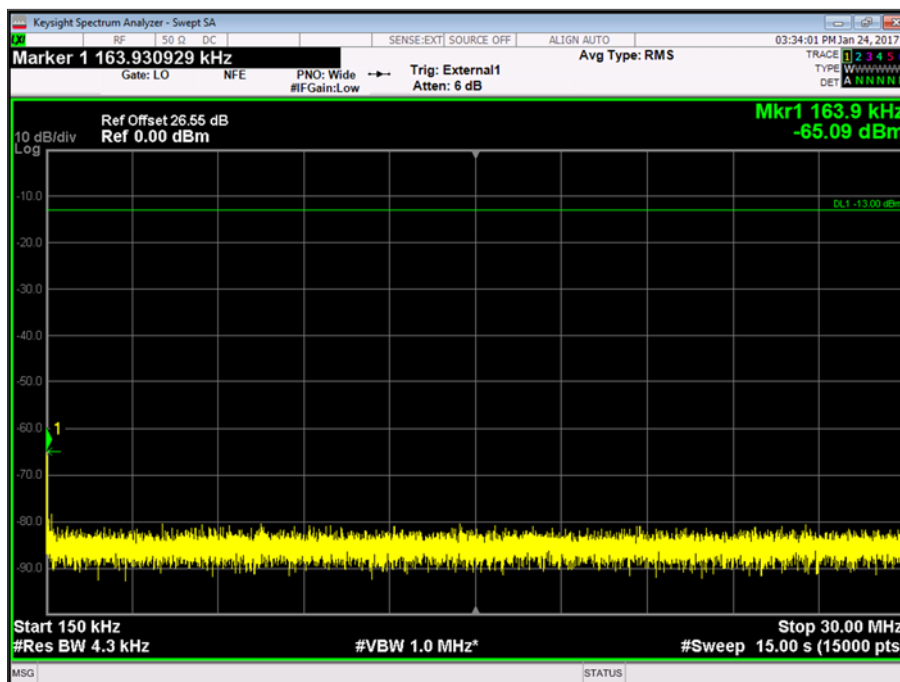


Figure 22 - 1643.675 MHz - 150 kHz to 30 MHz

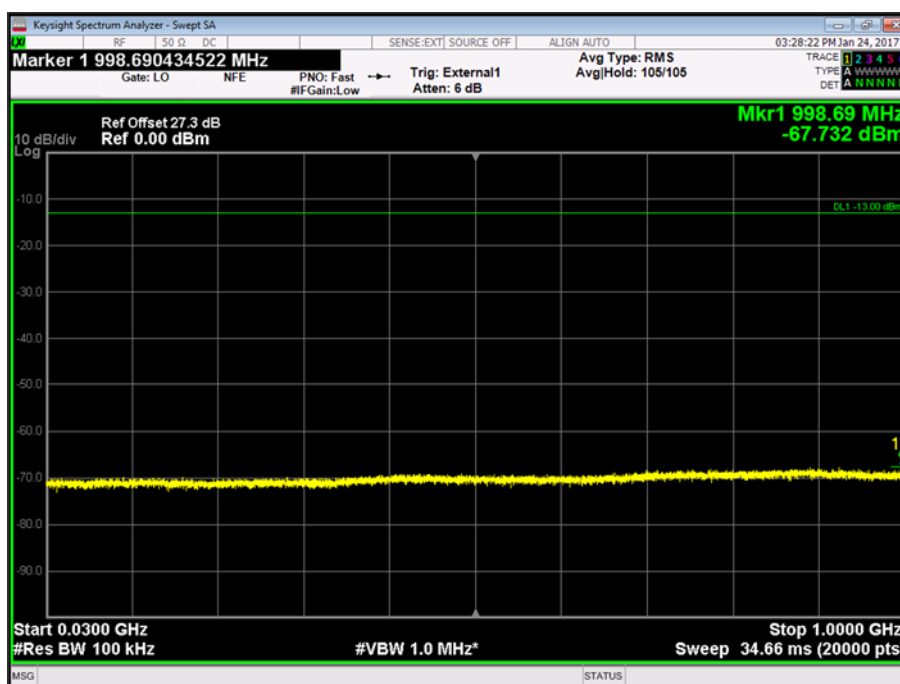


Figure 23 - 1643.675 MHz - 30 MHz to 1 GHz

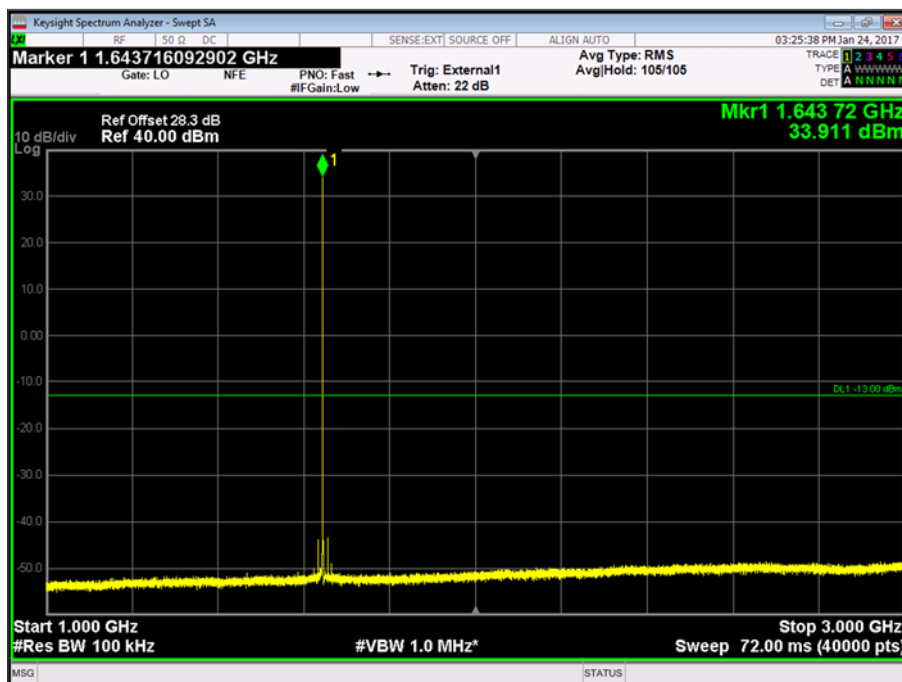


Figure 24 - 1643.675 MHz - 1 GHz to 3 GHz

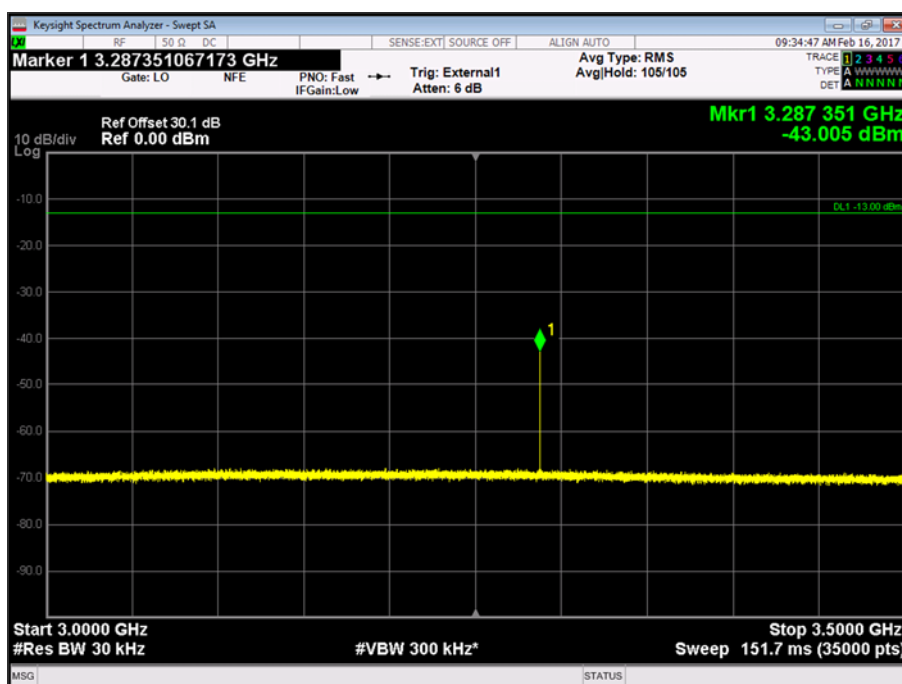


Figure 25 - 1643.675 MHz - 3 GHz to 3.5 GHz

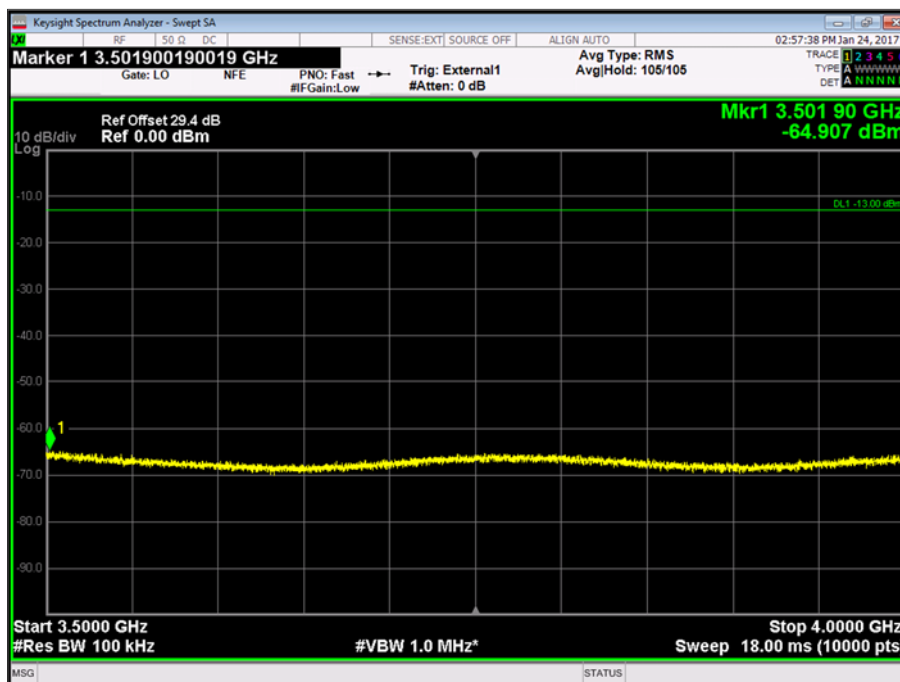


Figure 26 - 1643.675 MHz - 3.5 GHz to 4 GHz

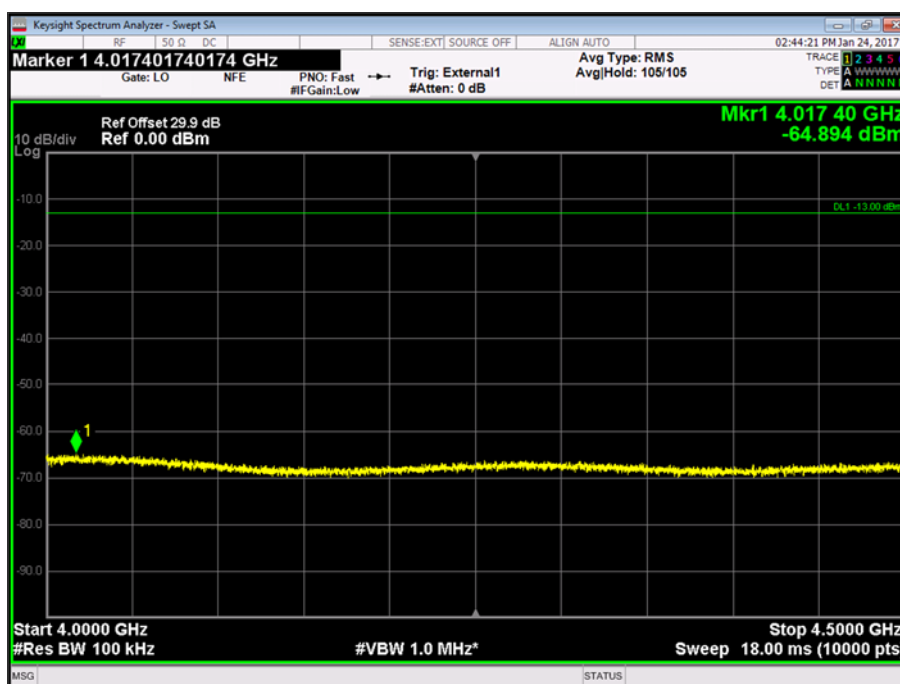


Figure 27 - 1643.675 MHz - 4 GHz to 4.5 GHz

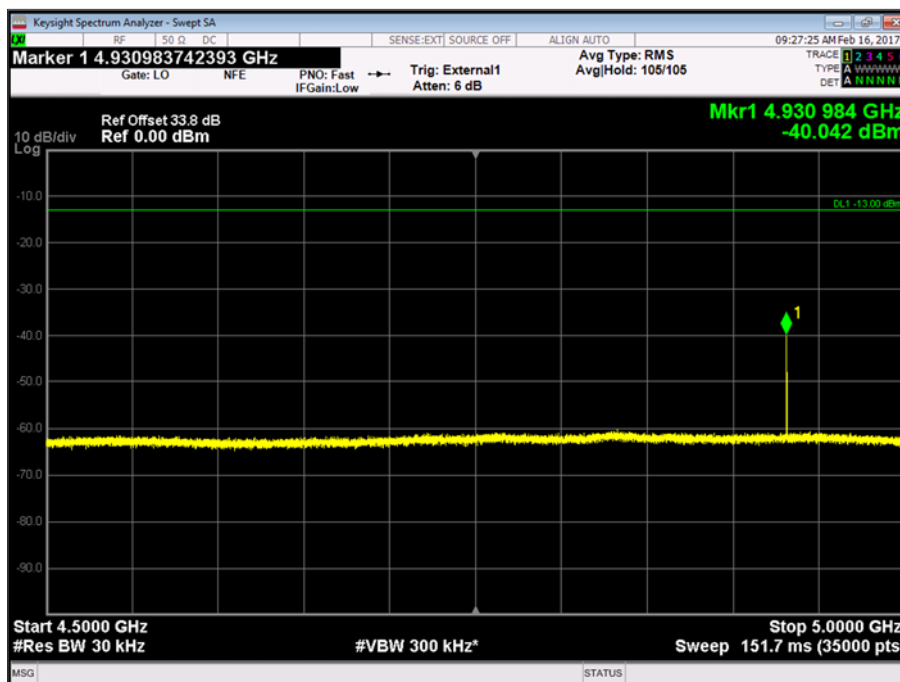


Figure 28 - 1643.675 MHz - 4.5 GHz to 5 GHz

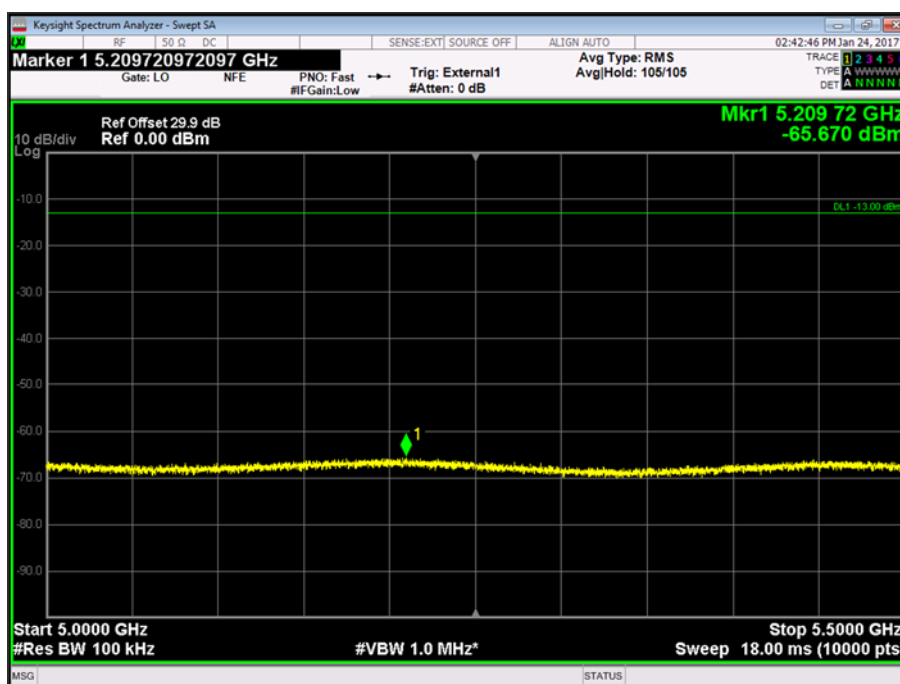


Figure 29 - 1643.675 MHz - 5 GHz to 5.5 GHz

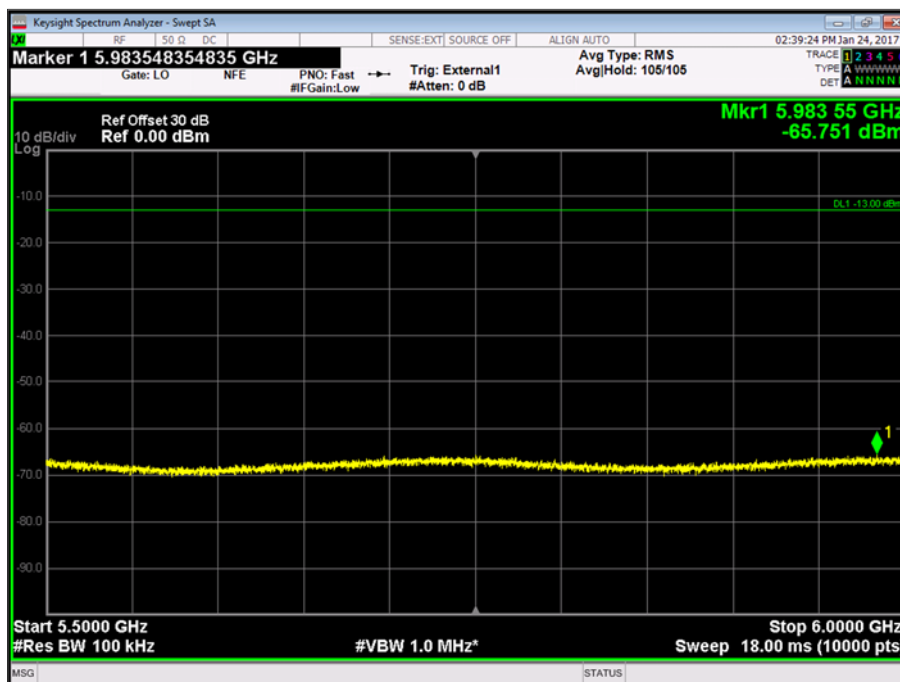


Figure 30 - 1643.675 MHz - 5.5 GHz to 6 GHz

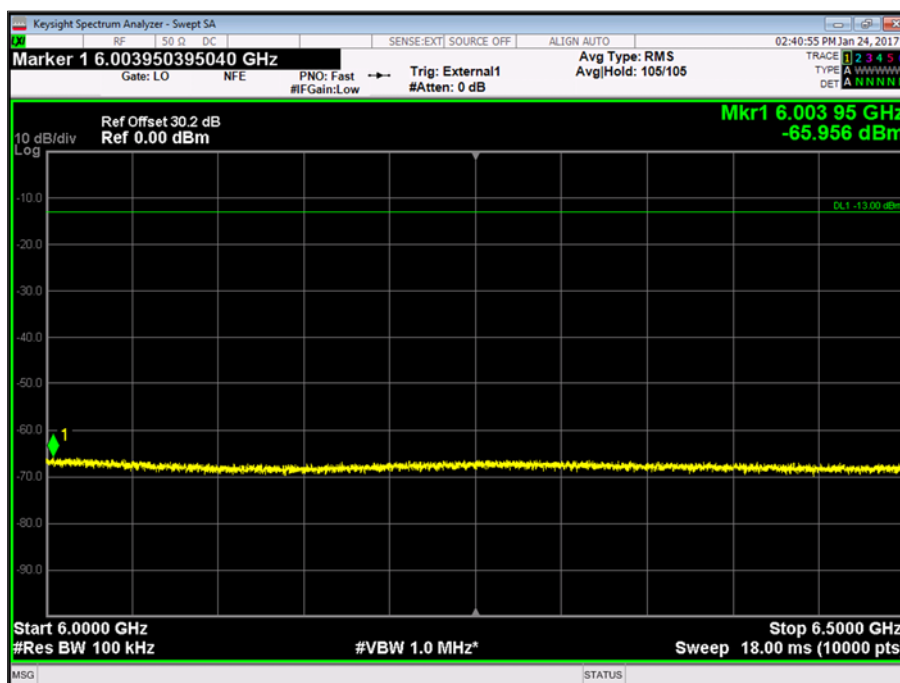


Figure 30 - 1643.675 MHz - 6 GHz to 6.5 GHz

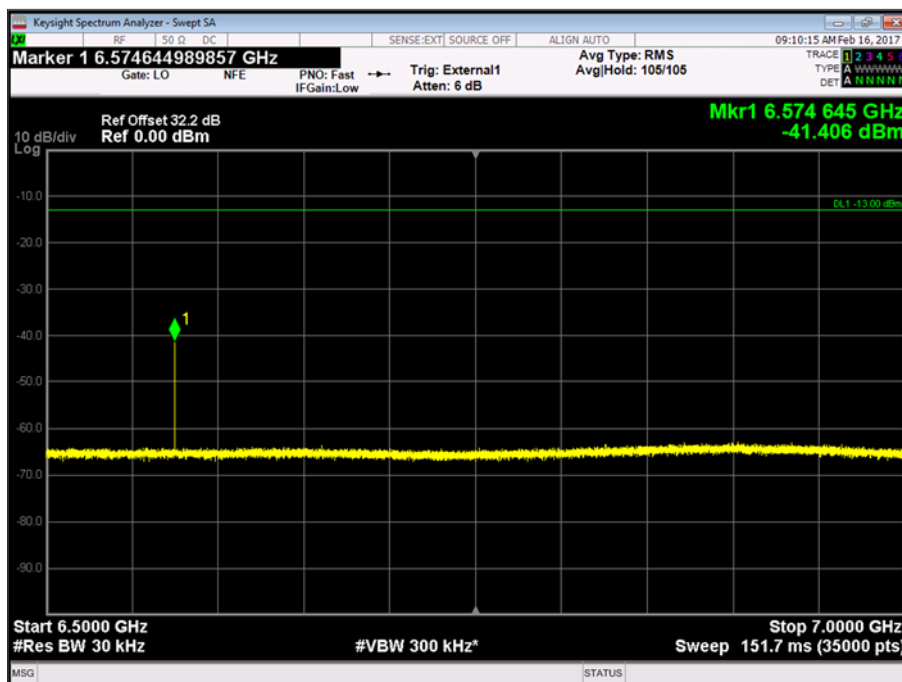


Figure 31 - 1643.675 MHz - 6.5 GHz to 7 GHz

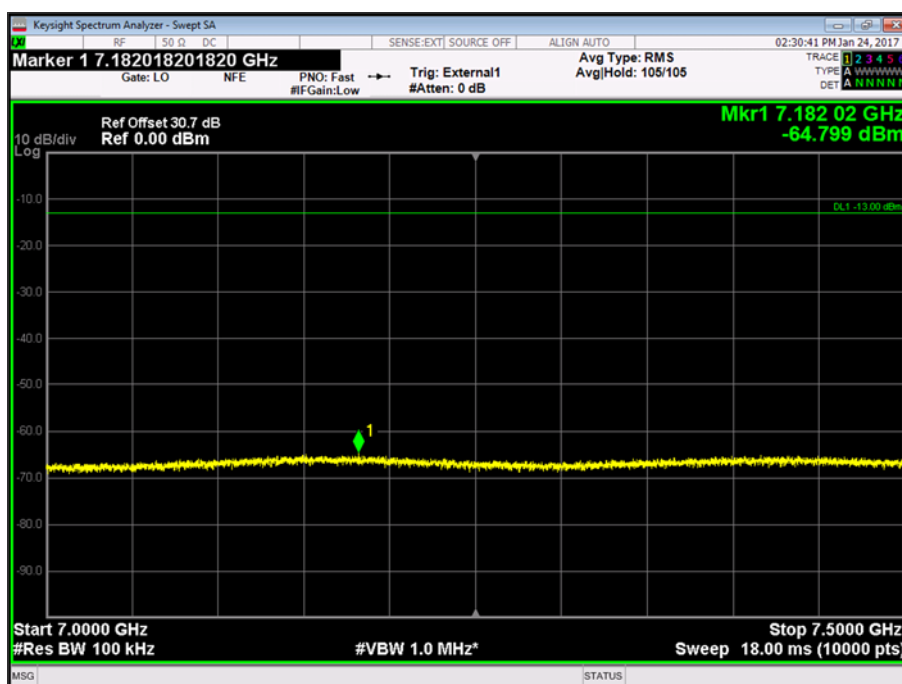


Figure 32 - 1643.675 MHz - 7 GHz to 7.5 GHz



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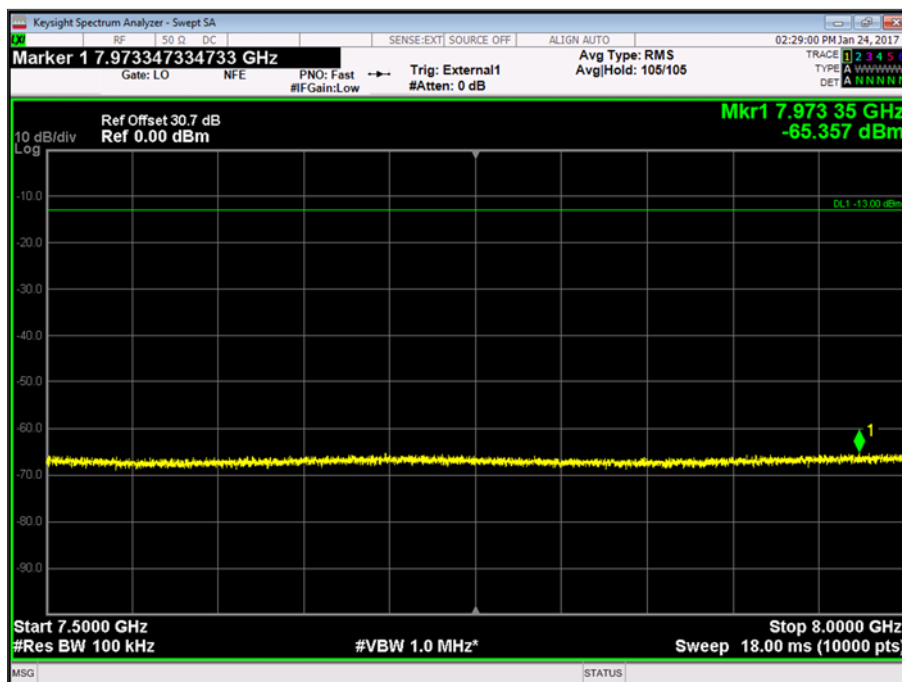


Figure 33 - 1643.675 MHz - 7.5 GHz to 8 GHz

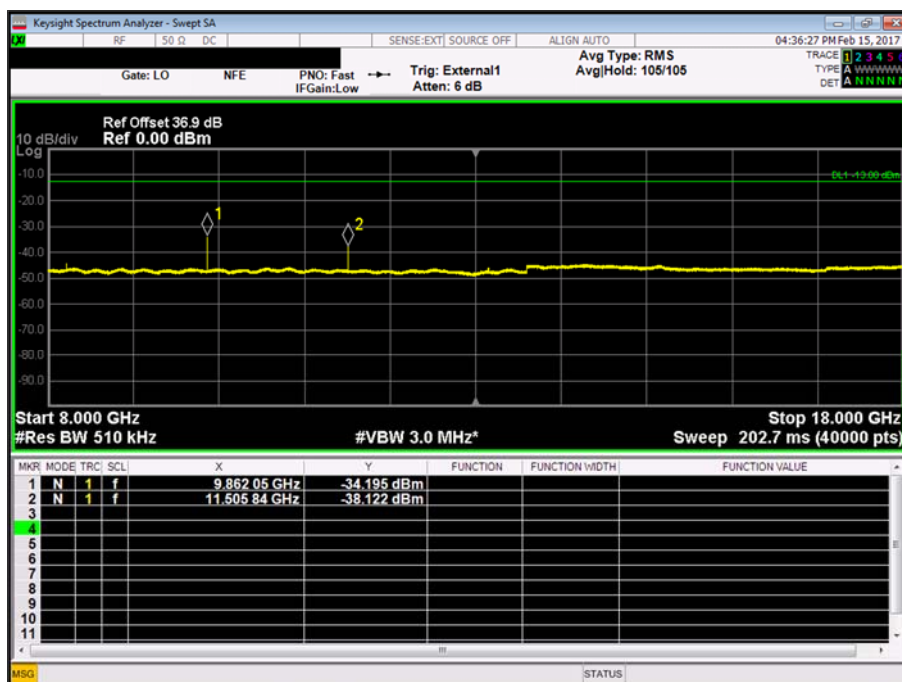


Figure 34 - 1643.675 MHz - 8 GHz to 18 GHz

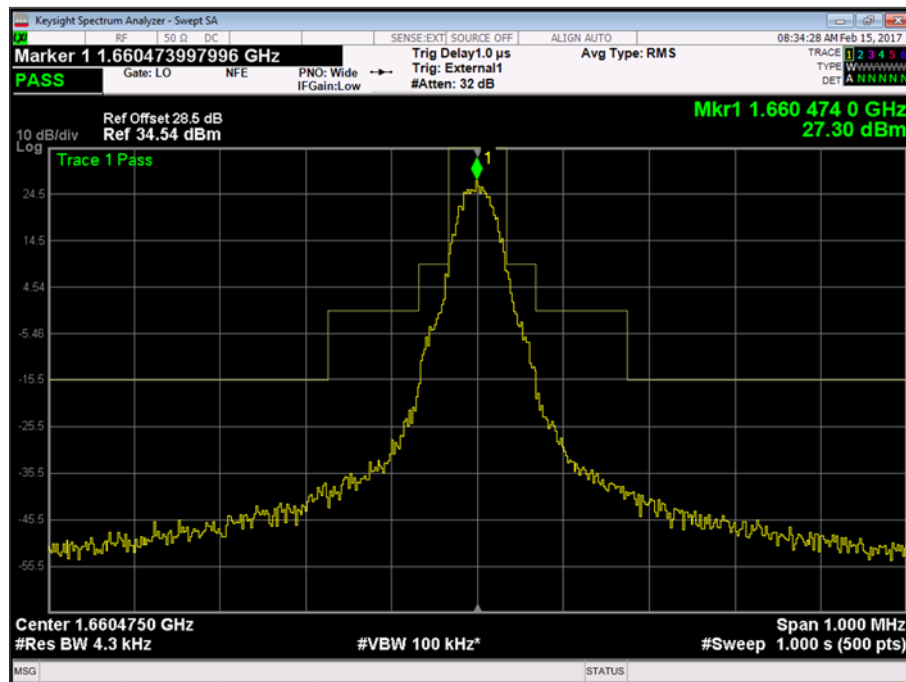


Figure 35 - 1660.475 MHz - Emission Mask

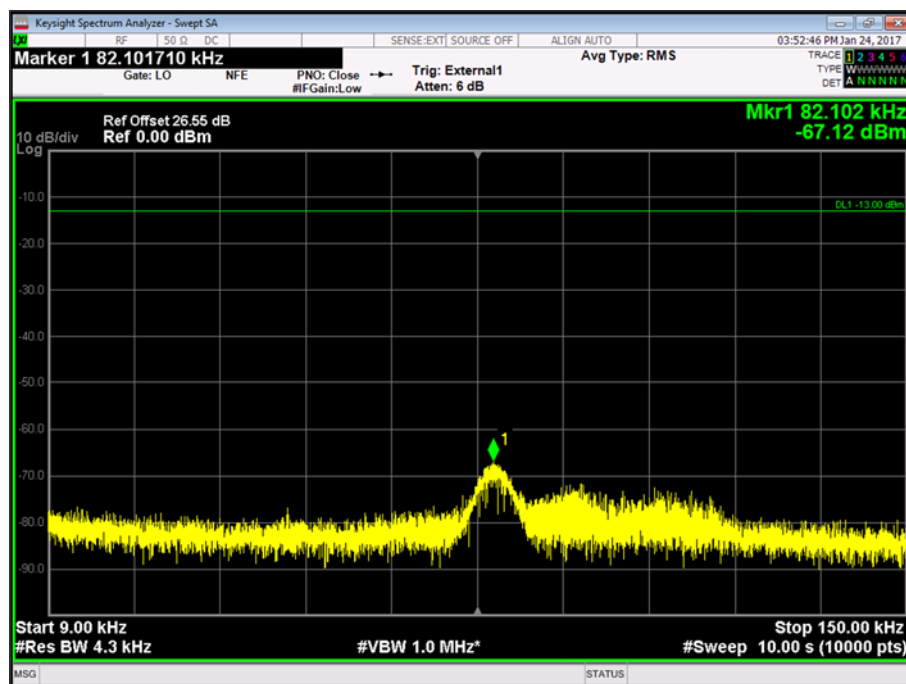


Figure 36 - 1660.475 MHz - 9 kHz to 150 kHz

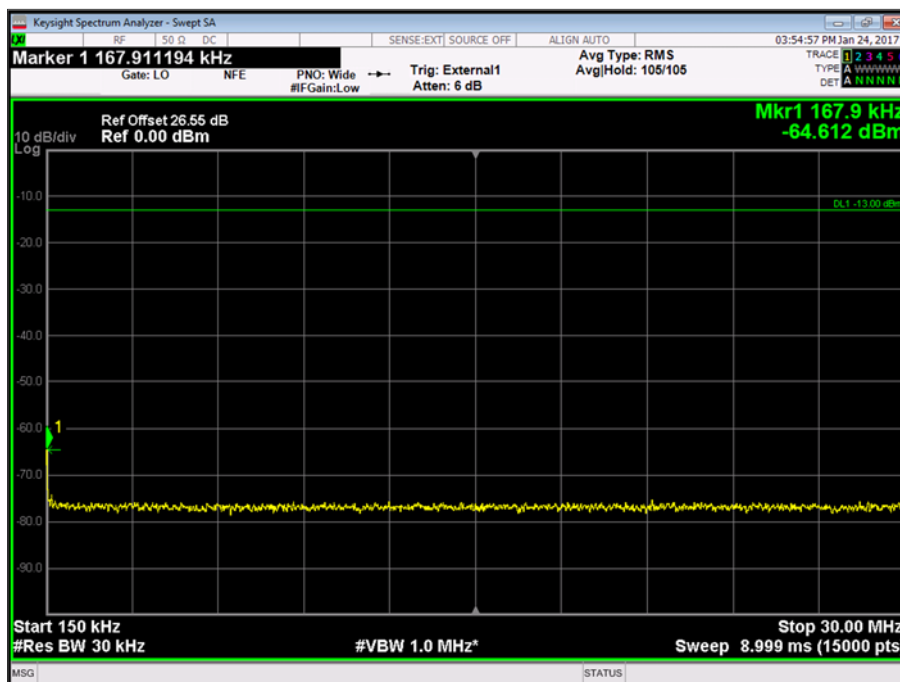


Figure 37 - 1660.475 MHz - 150 kHz to 30 MHz

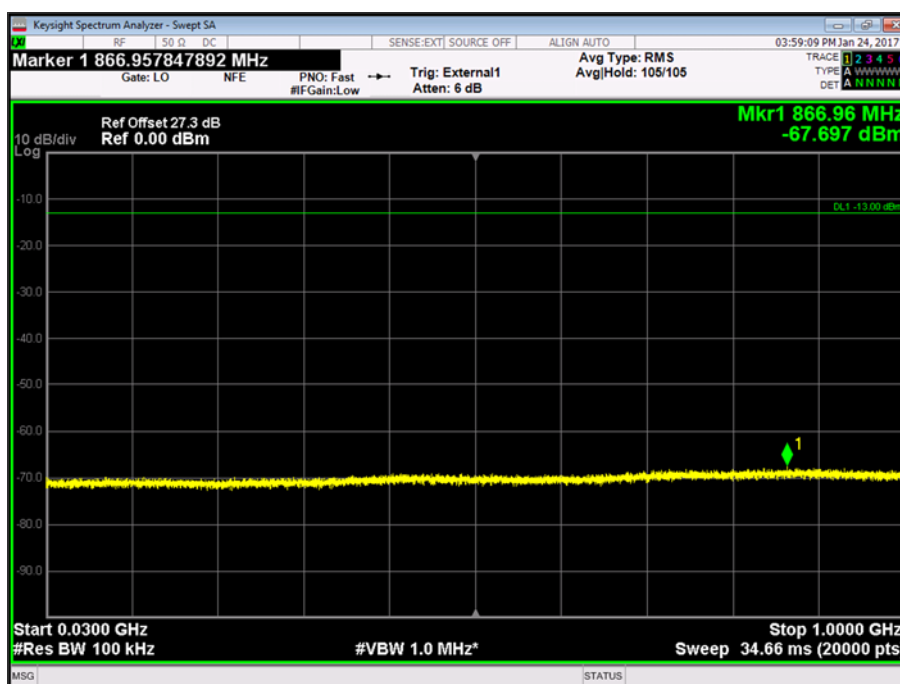


Figure 38 - 1660.475 MHz - 30 MHz to 1 GHz

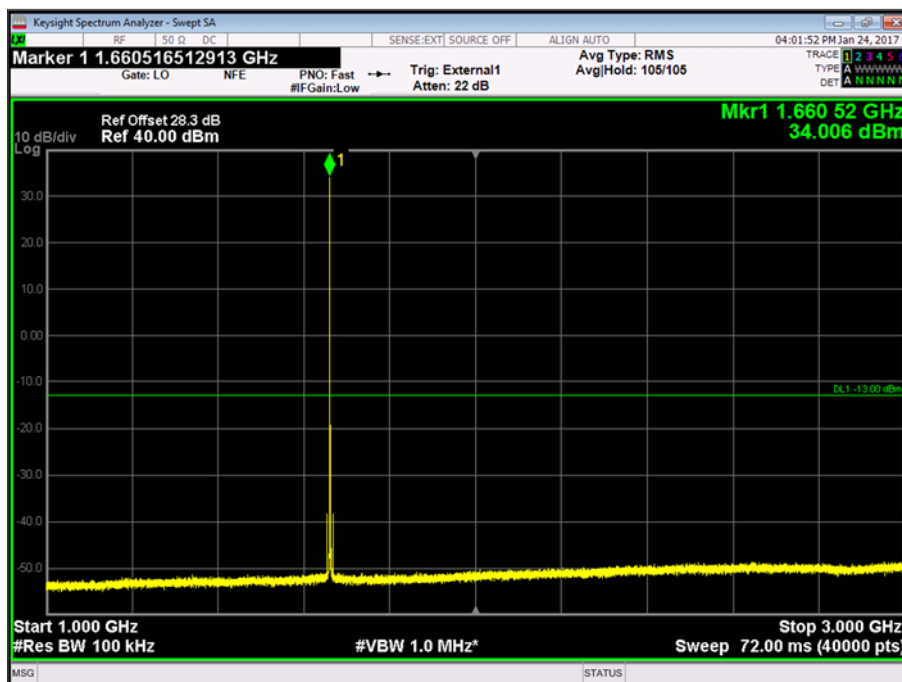


Figure 39 - 1660.475 MHz - 1 GHz to 3 GHz

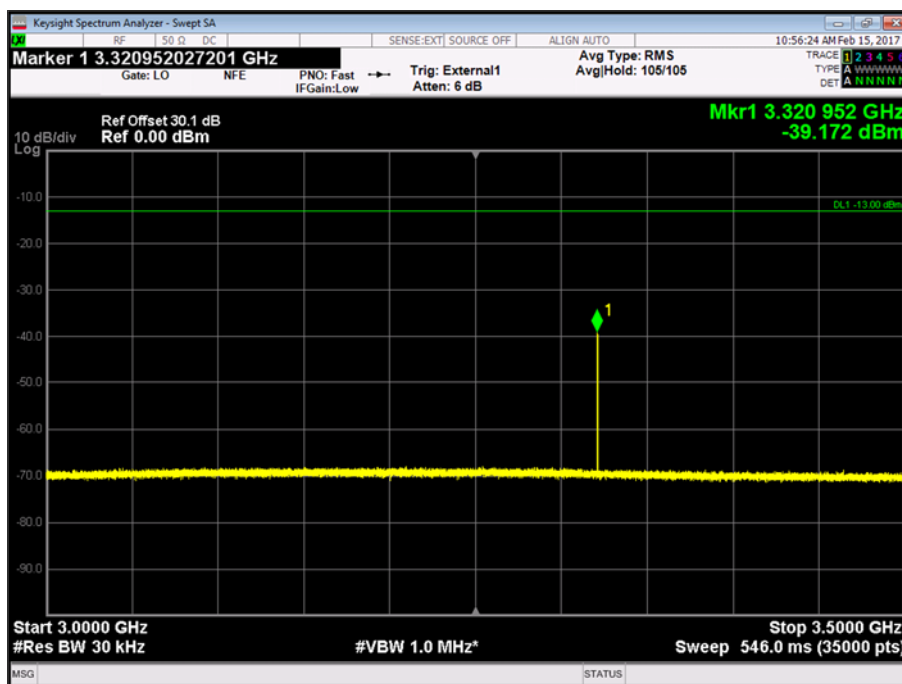


Figure 40 - 1660.475 MHz - 3 GHz to 3.5 GHz

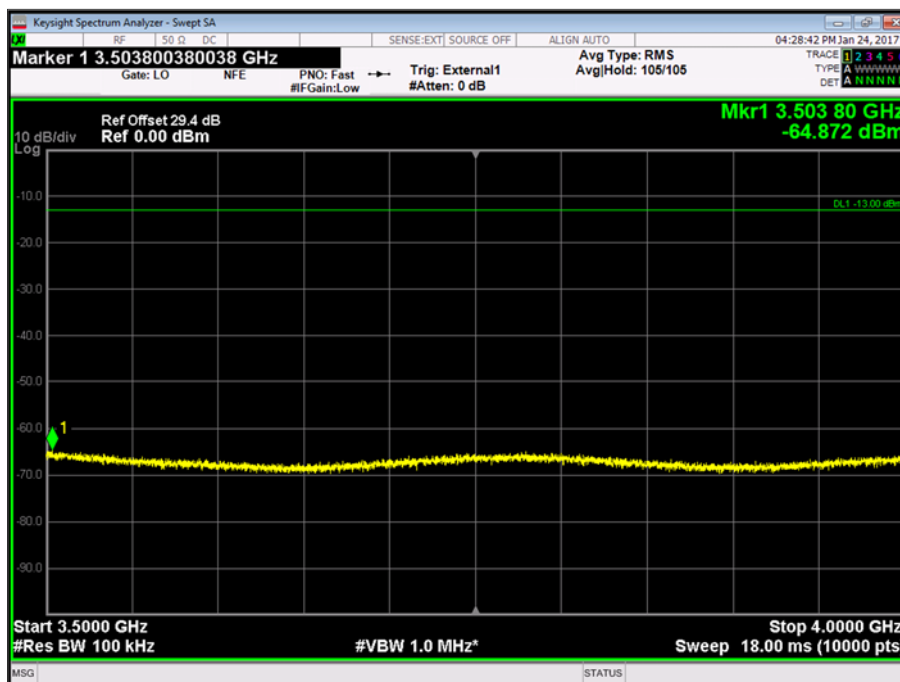


Figure 41 - 1660.475 MHz - 3.5 GHz to 4 GHz

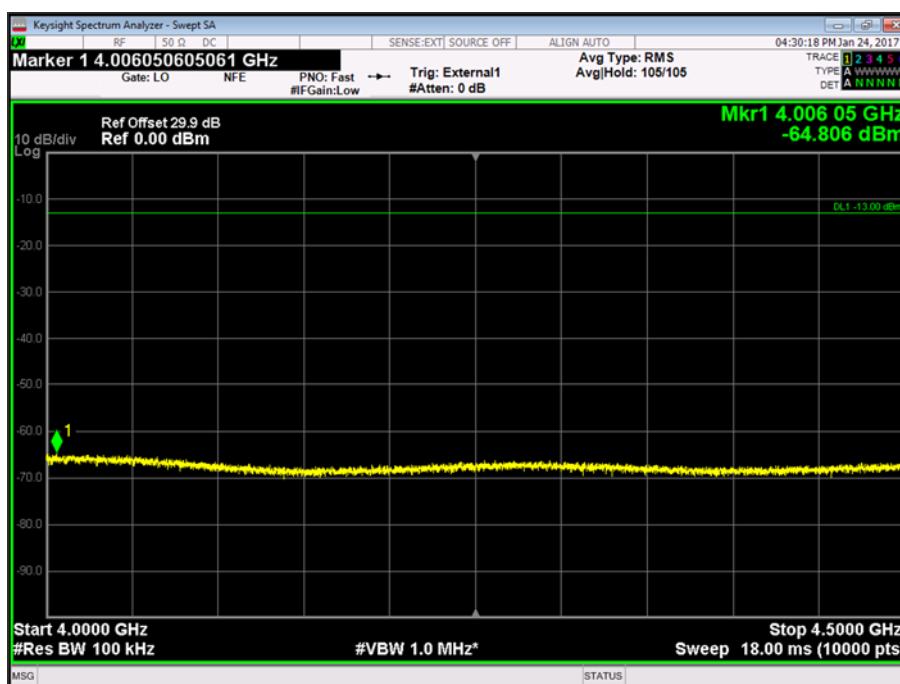


Figure 42 - 1660.475 MHz - 4 GHz to 4.5 GHz

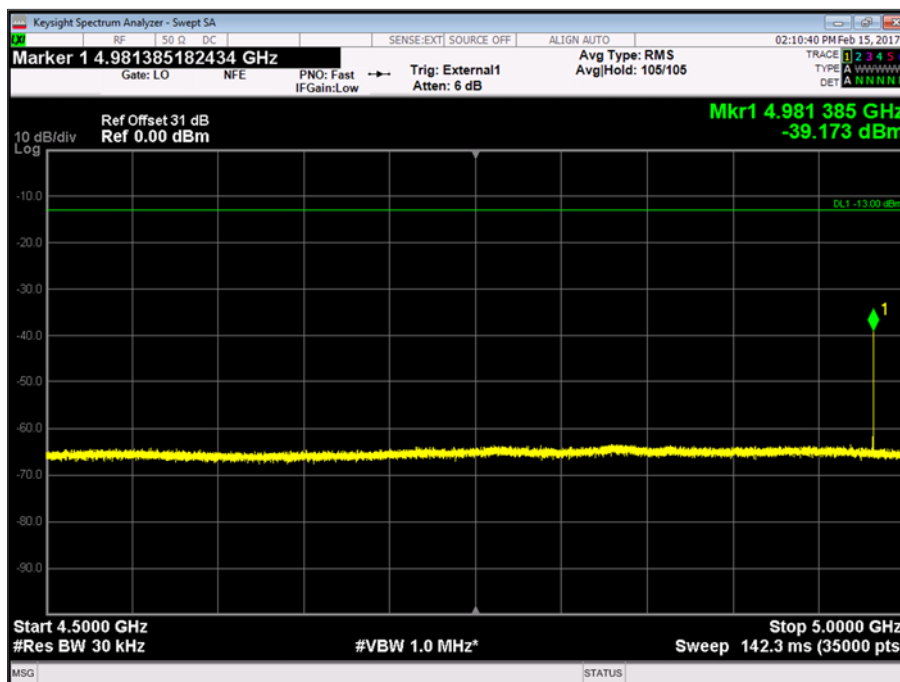


Figure 43 - 1660.475 MHz - 4.5 GHz to 5 GHz

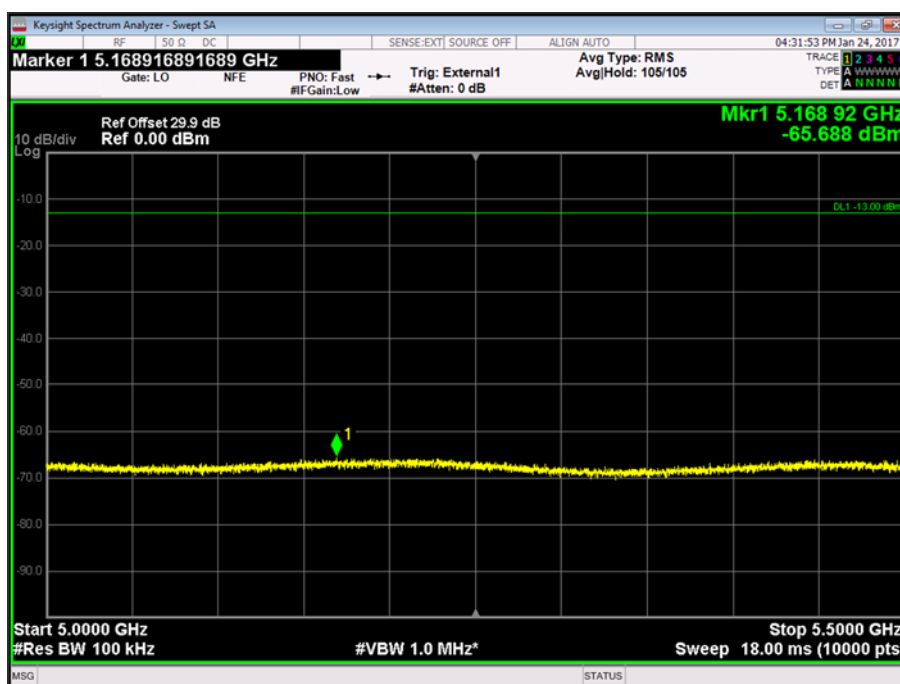


Figure 44 - 1660.475 MHz - 5 GHz to 5.5 GHz

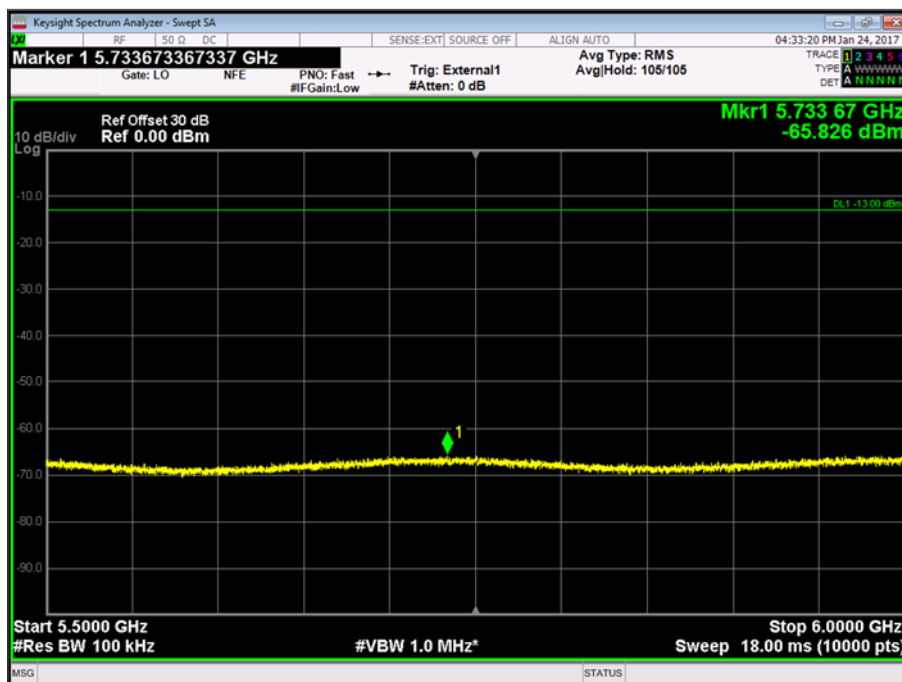


Figure 45 - 1660.475 MHz - 5.5 GHz to 6 GHz

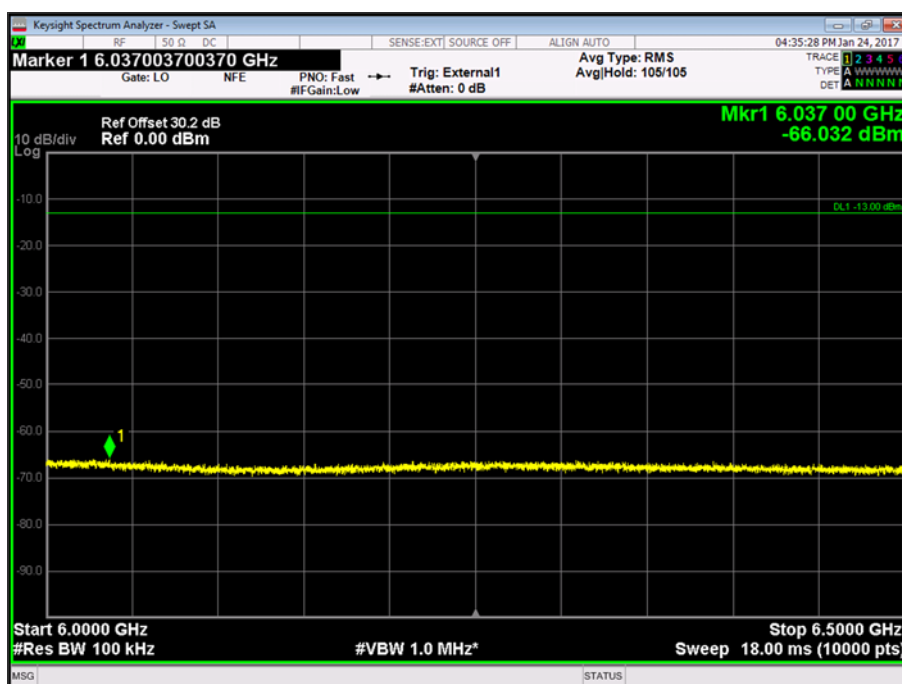


Figure 46 - 1660.475 MHz - 6 GHz to 6.5 GHz



Product Service

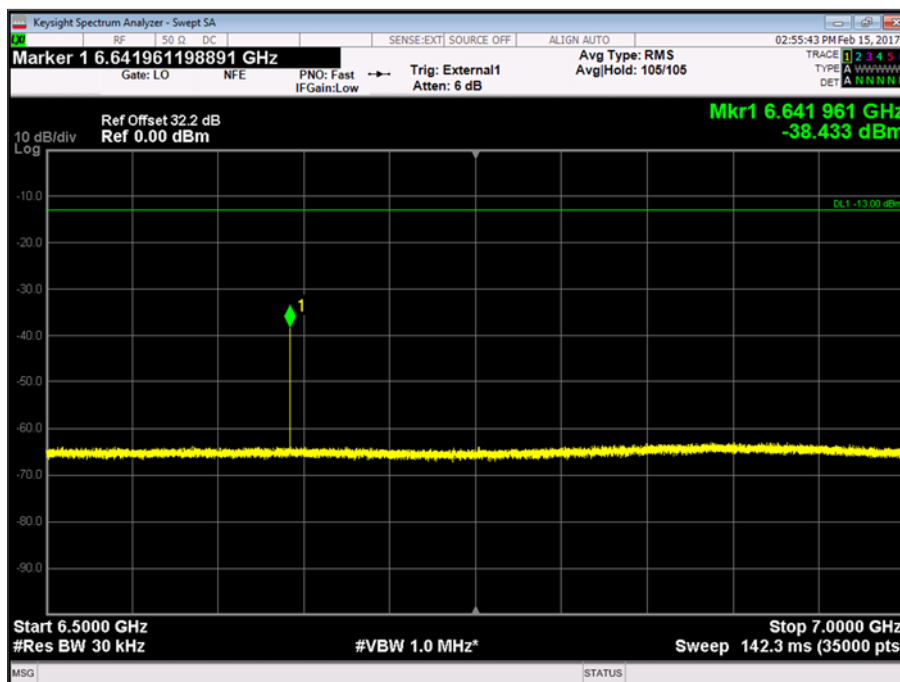


Figure 47 - 1660.475 MHz - 6.5 GHz to 7 GHz

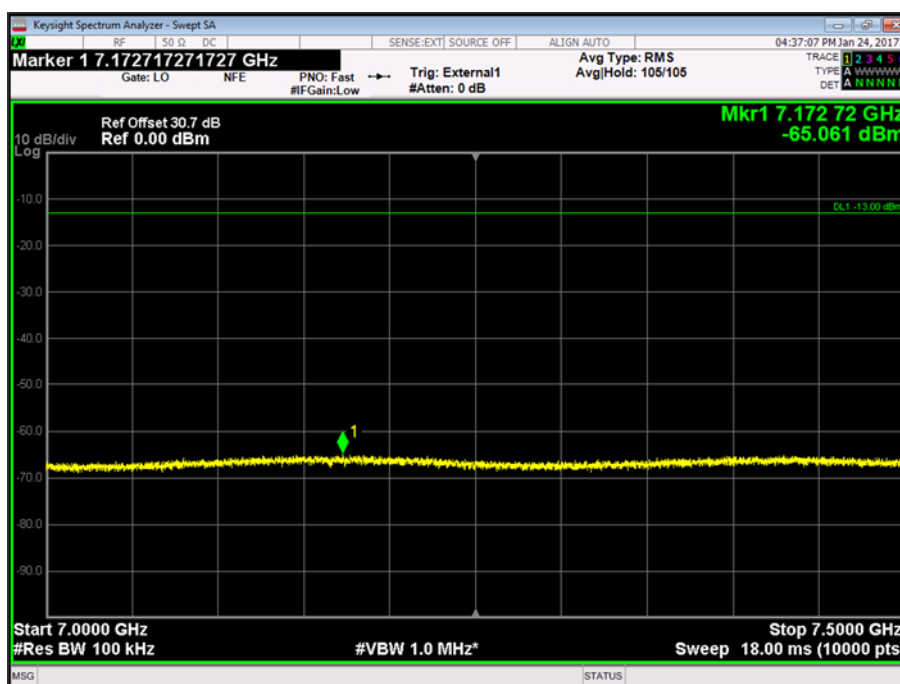


Figure 48 - 1660.475 MHz - 7 GHz to 7.5 GHz



Product Service

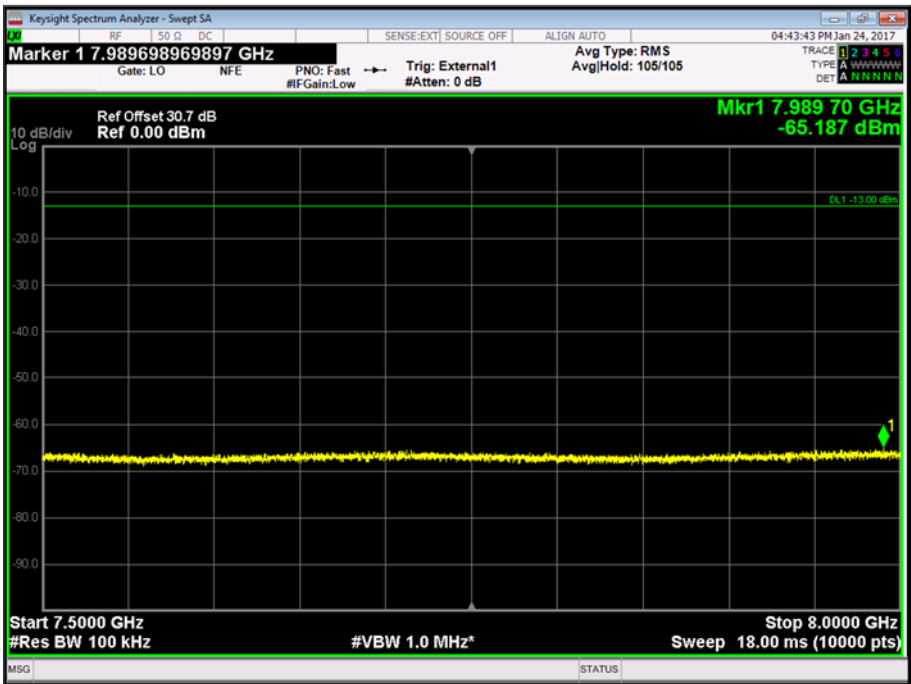


Figure 49 - 1660.475 MHz - 7.5 GHz to 8 GHz

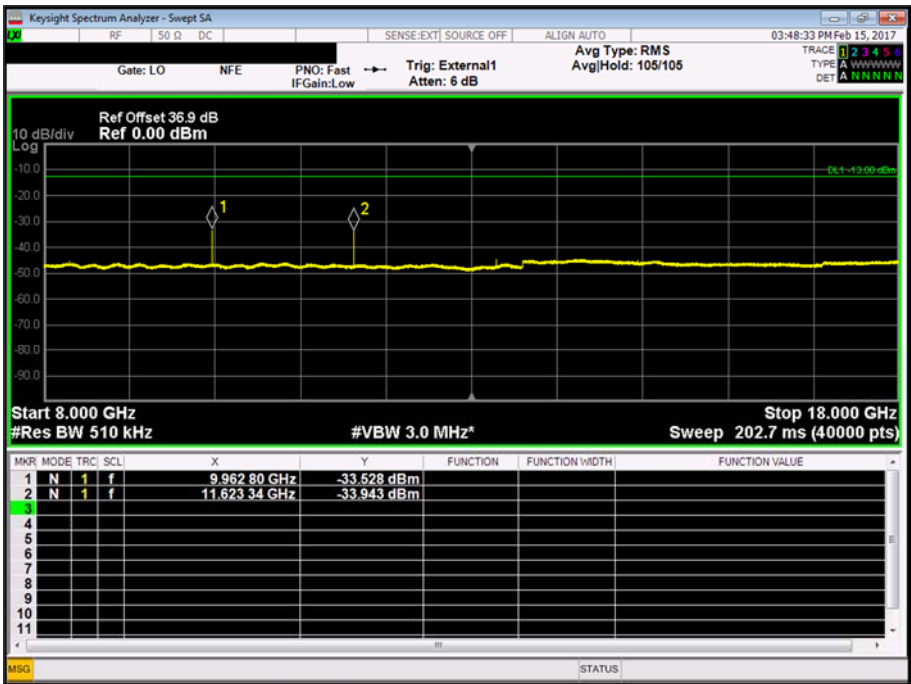


Figure 50 - 1660.475 MHz - 8 GHz to 18 GHz

Remarks

The authorized channel bandwidth was declared by the manufacturer as 70 kHz.

FCC 47 CFR Part 2, Limit Clause 25.202(f)

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

- 1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the authorised bandwidth;
- 2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the authorised bandwidth;
- 3) $43 + 10 \log p$ (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the authorised bandwidth.

Industry Canada RSS-170, Limit Clause 5.4.3.1

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

- 1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the occupied bandwidth or necessary bandwidth, whichever is greater
- 2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the occupied bandwidth or necessary bandwidth, whichever is greater
- 3) $43 + 10 \log p$ (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the occupied bandwidth or necessary bandwidth, whichever is greater.

2.4.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	14-Dec-2017
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	05-Mar-2017
Crystal Detector	Hewlett Packard	8470B	1320	12	08-Jun-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Combiner/Splitter	Weinschel	1506A	3877	12	30-Mar-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4510	12	26-May-2017
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	16-Feb-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Oct-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon

Table 9

O/P Mon – Output Monitored using calibrated equipment



2.5 Radiated Spurious Emissions

2.5.1 Specification Reference

FCC 47 CFR Part 25, Clause 25.202(f)
FCC 47 CFR Part 2, Clause 2.1051
Industry Canada RSS-170, Clause 5.4.3.1
Industry Canada RSS-GEN, Clause 6.13

2.5.2 Equipment Under Test and Modification State

GPS Core Module 2.0, S/N: IHG0000198 - Modification State 0

2.5.3 Date of Test

18-January-2017 to 22-January-2017

2.5.4 Test Method

The test was performed in accordance with KDB 971168 D01, Clause 7.

2.5.5 Environmental Conditions

Ambient Temperature 18.9 - 19.9 °C
Relative Humidity 24.0 - 25.0 %

2.5.6 Test Results

Inmarsat Transmitting

Frequency (MHz)	Result (dBm)
*	

Table 10 - 1626.675 MHz - 30 MHz to 1 GHz Emissions Results

*No emissions were found within 20 dB of the limit.

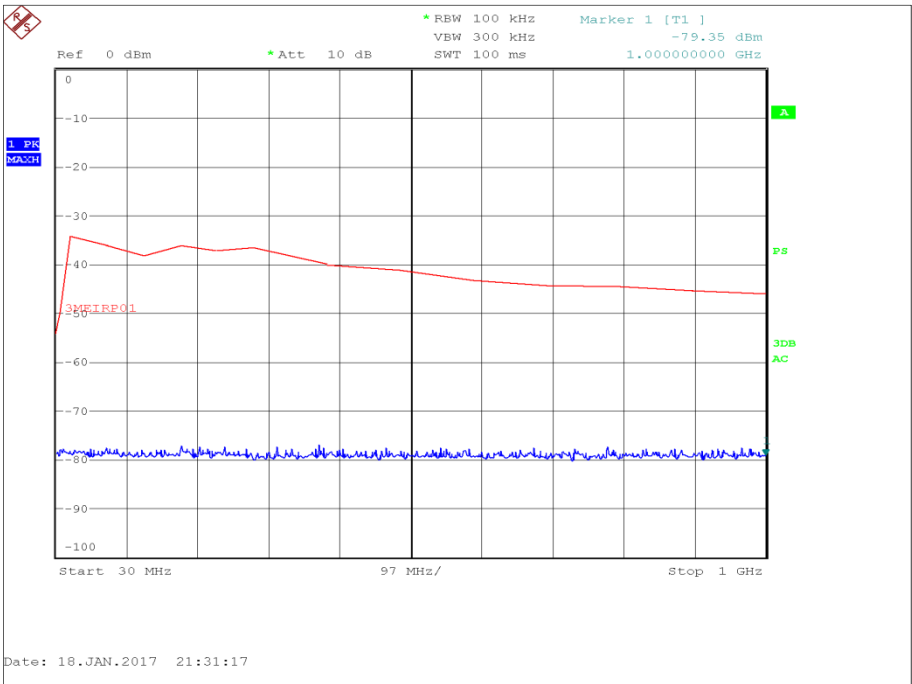


Figure 51 - 1626.675 MHz - 30 MHz to 1 GHz

Frequency (MHz)	Result (dBm)
*	

Table 11 - 1626.675 MHz - 1 GHz to 18 GHz Emissions Results

*No emissions were found within 20 dB of the limit.

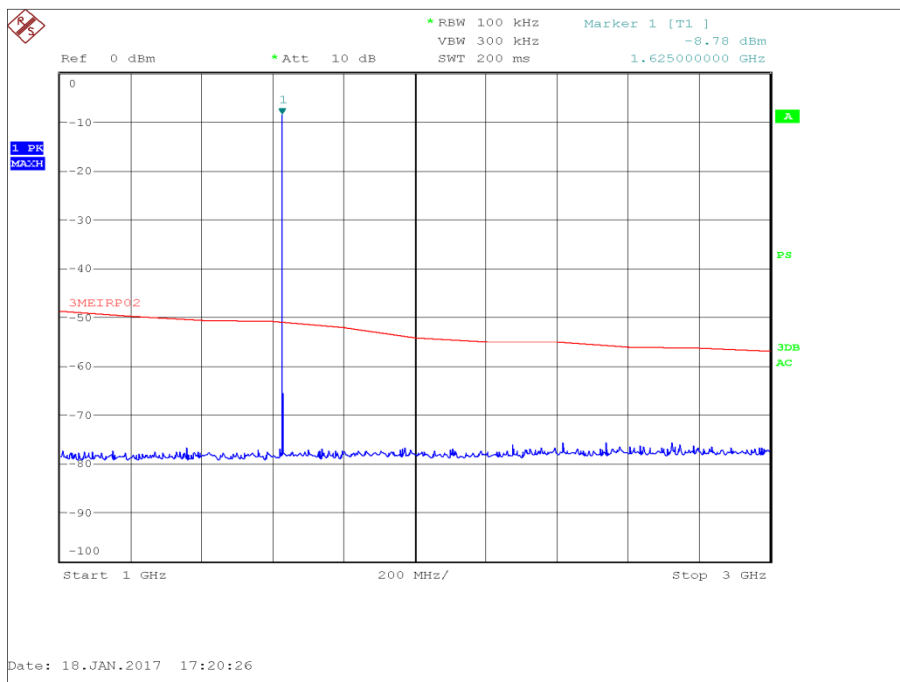


Figure 52 - 1626.675 MHz - 1 GHz to 3 GHz

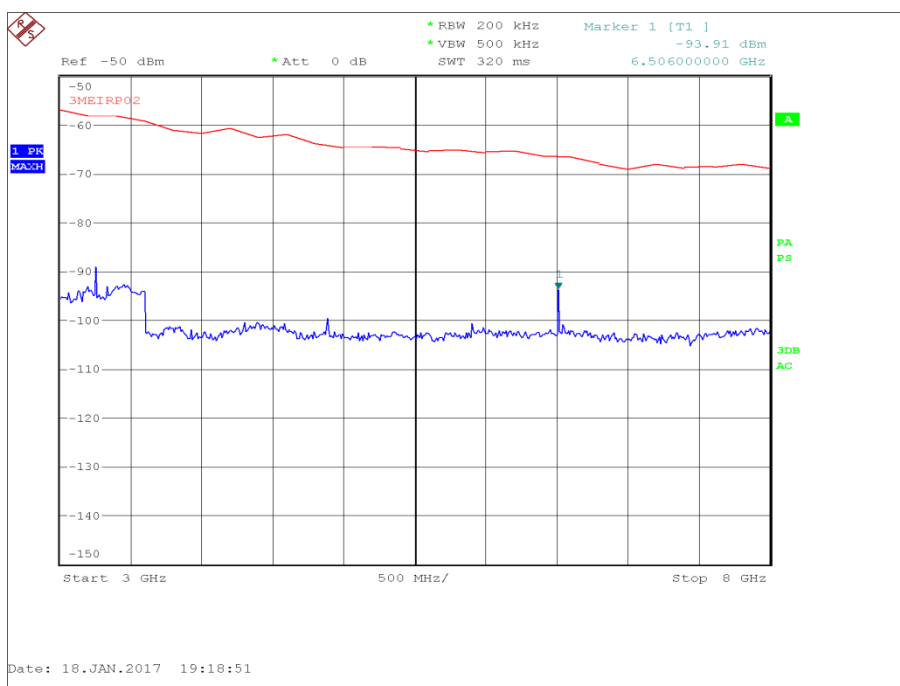


Figure 53 - 1626.675 MHz - 3 GHz to 8 GHz



Product Service

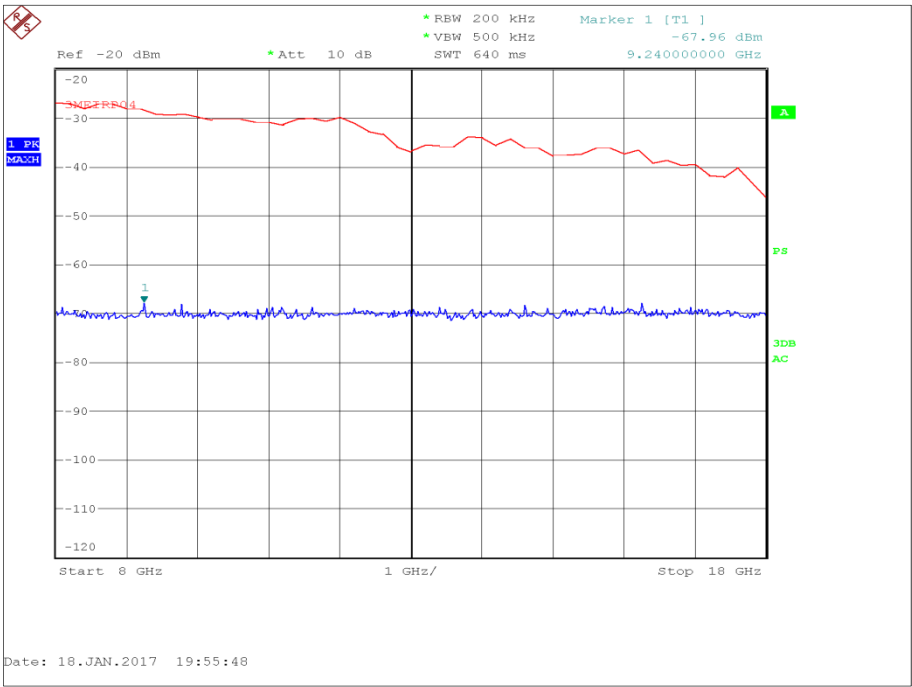


Figure 54 - 1626.675 MHz - 8 GHz to 18 GHz



Frequency (MHz)	Result (dBm)
*	

Table 12 - 1643.675 MHz - 30 MHz to 1 GHz Emissions Results

*No emissions were found within 20 dB of the limit.

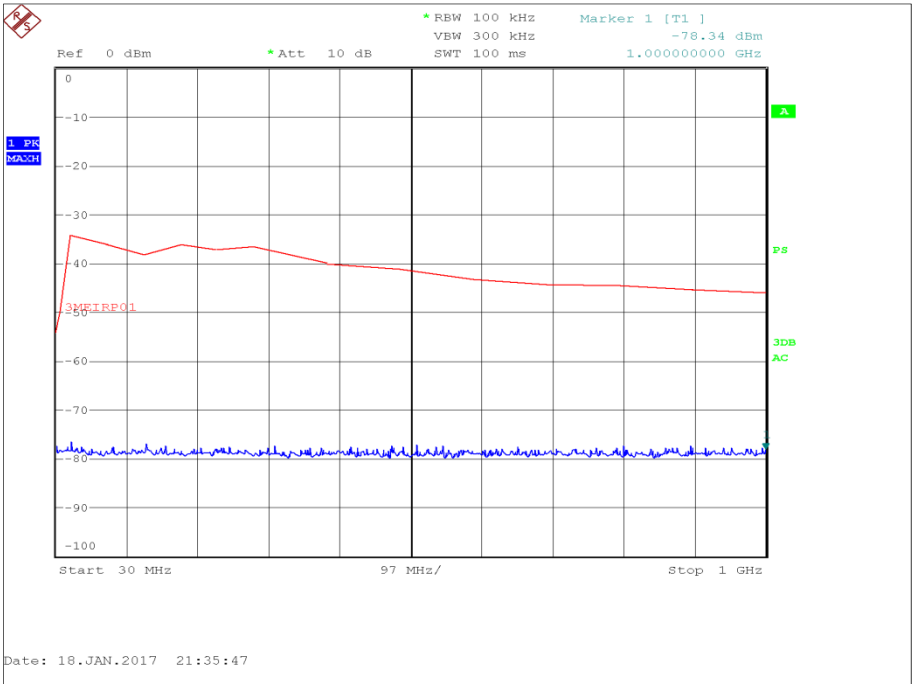


Figure 55 - 1643.675 MHz - 30 MHz to 1 GHz



Frequency (MHz)	Result (dBm)
*	

Table 13 - 1643.675 MHz - 1 GHz to 18 GHz Emissions Results

*No emissions were found within 20 dB of the limit.

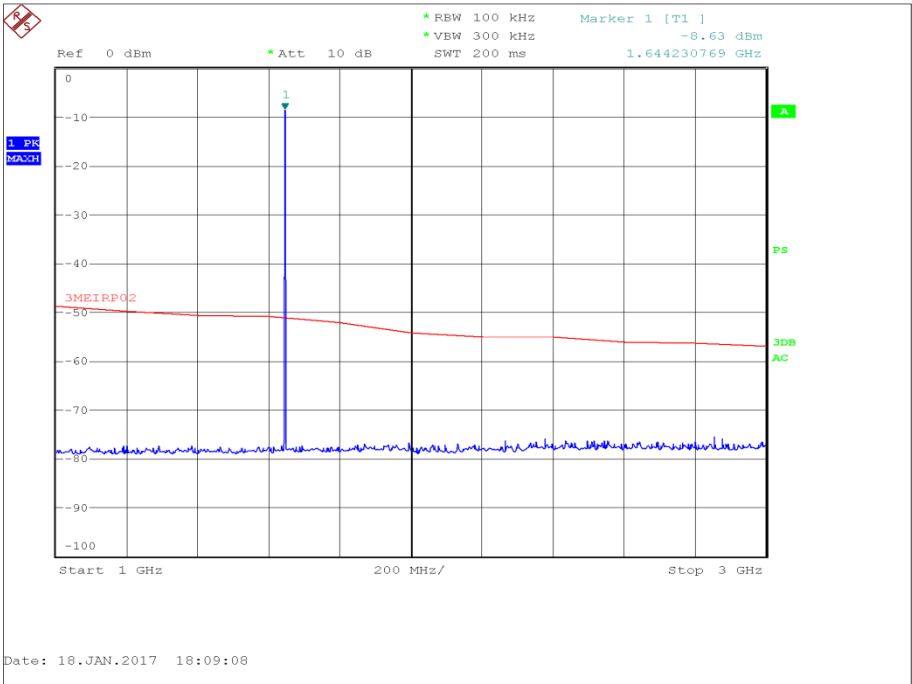


Figure 56 - 1643.675 MHz - 1 GHz to 3 GHz



Product Service

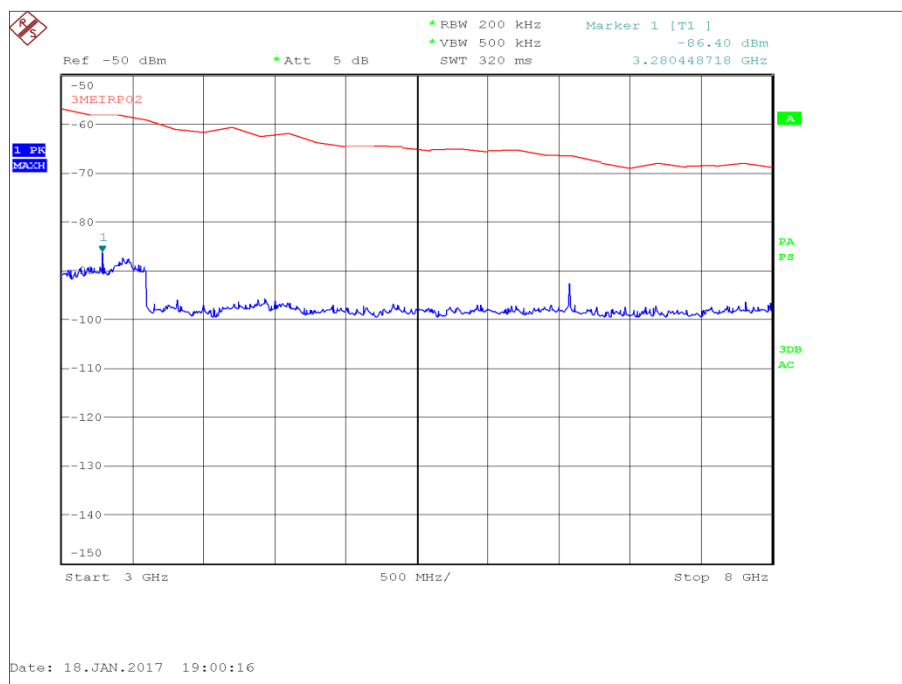


Figure 57 - 1643.675 MHz - 3 GHz to 8 GHz

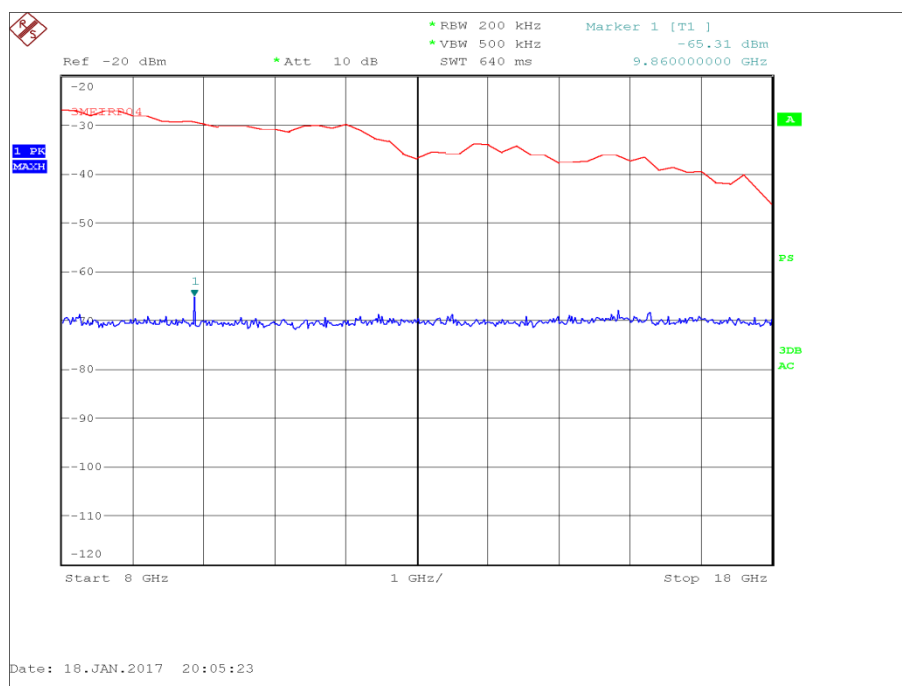


Figure 58 - 1643.675 MHz - 8 GHz to 18 GHz



Frequency (MHz)	Result (dBm)
*	

Table 14 - 1660.475 MHz - 30 MHz to 1 GHz Emissions Results

*No emissions were found within 20 dB of the limit.

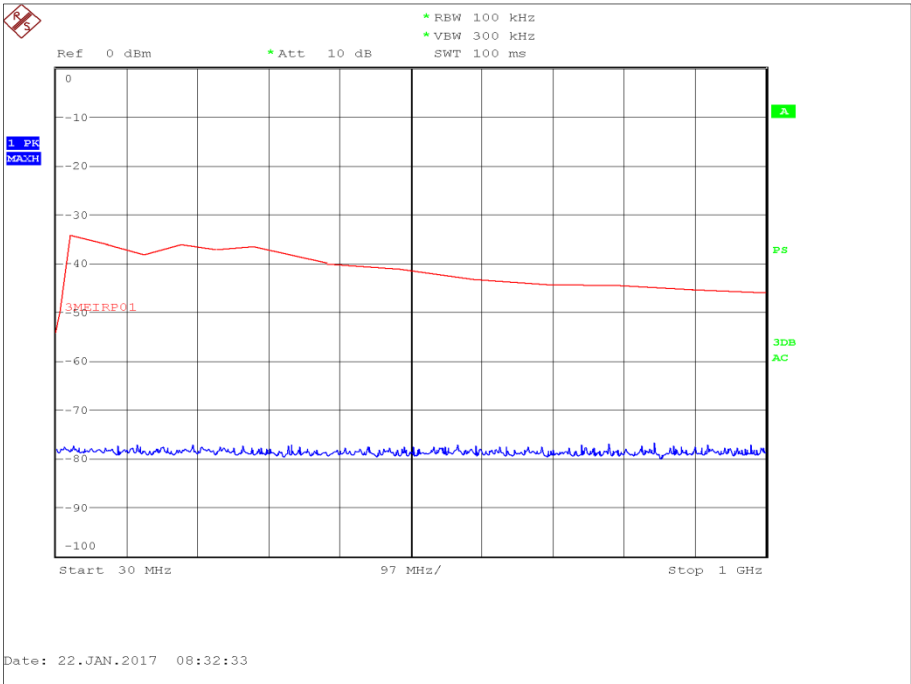


Figure 59 - 1660.475 MHz - 30 MHz to 1 GHz

Frequency (MHz)	Result (dBm)
*	

Table 15 - 1660.475 MHz - 1 GHz to 18 GHz Emissions Results

*No emissions were found within 20 dB of the limit.



Product Service

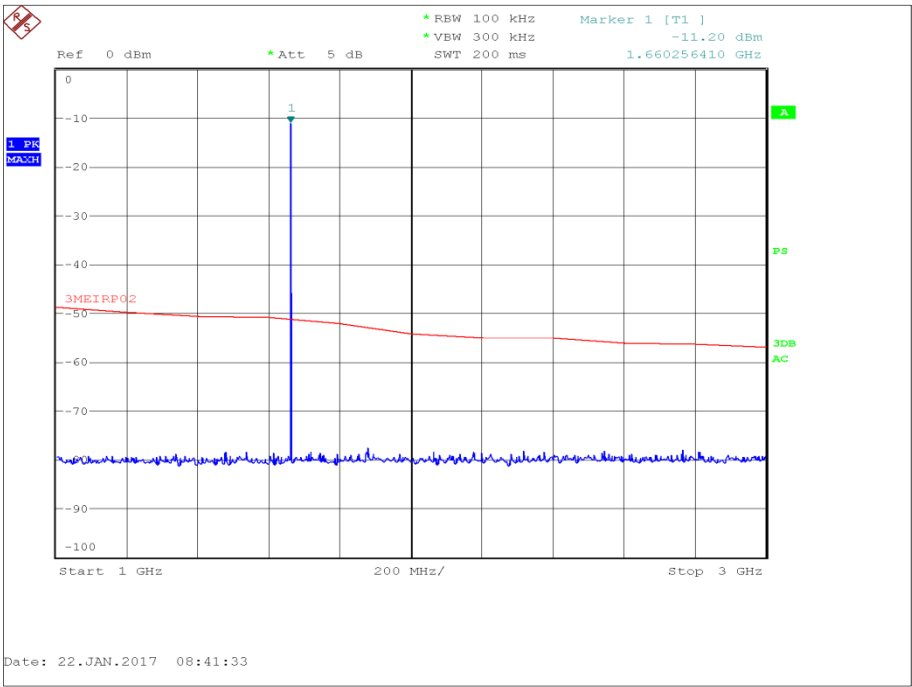


Figure 60 - 1660.475 MHz - 1 GHz to 3 GHz

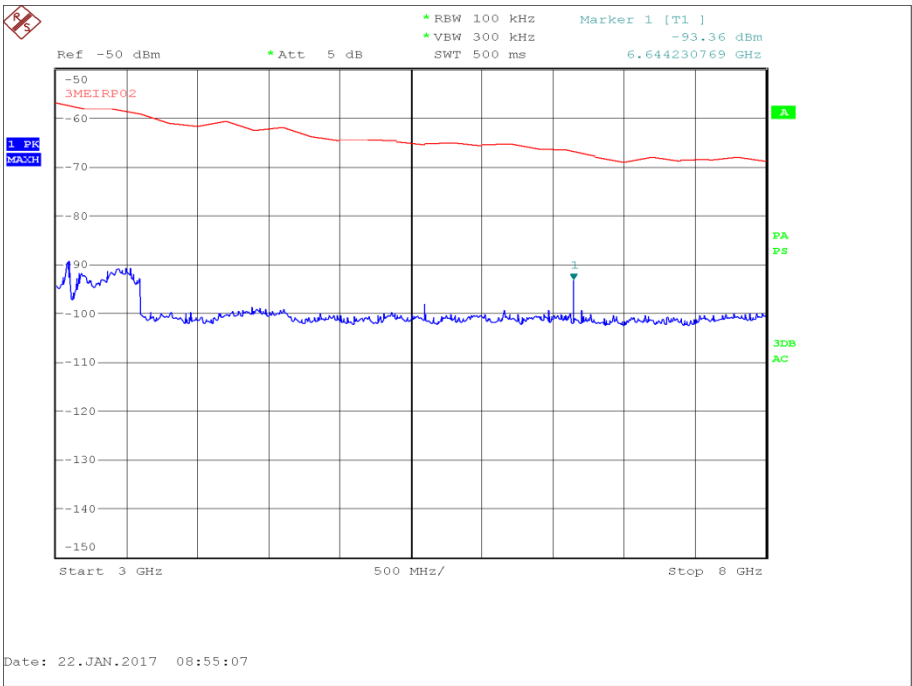


Figure 61 - 1660.475 MHz -: 3 GHz to 8 GHz

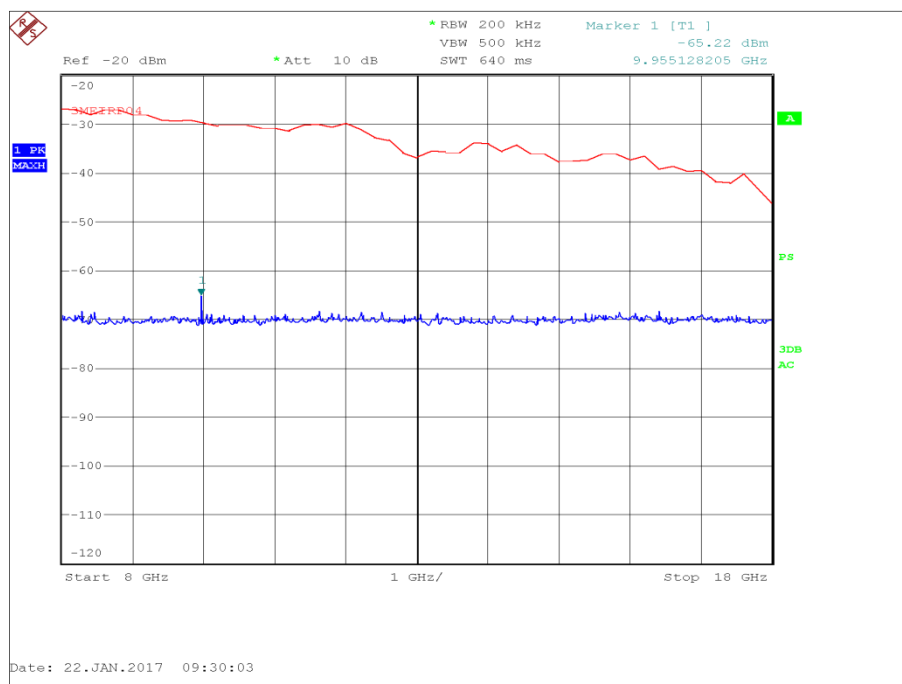


Figure 62 - 1660.475 MHz - 8 GHz to 18 GHz

Remarks

The authorized channel bandwidth was declared by the manufacturer as 70 kHz.

FCC 47 CFR Part 2, Limit Clause 25.202(f)

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

- 1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the authorised bandwidth;
- 2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the authorised bandwidth;
- 3) $43 + 10 \log p$ (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the authorised bandwidth.

Industry Canada RSS-170, Limit Clause 5.4.3.1

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

- 1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the occupied bandwidth or necessary bandwidth, whichever is greater;
- 2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the occupied bandwidth or necessary bandwidth, whichever is greater;
- 3) $43 + 10 \log p$ (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the occupied bandwidth or necessary bandwidth, whichever is greater.

2.5.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Pre-Amplifier	Phase One	PS04-0086	1533	12	29-Jul-2017
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	HYGROPALM 1	2338	12	21-Sep-2017
Multimeter	Iso-tech	IDM101	2417	12	30-Sep-2017
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	12-Nov-2017
Tilt Antenna Mast	mature GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	mature GmbH	NCD	3917	-	TU
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4412	12	23-Mar-2017
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	6	O/P Mon
Cable (Rx, SMAM-SMAM 0.5m)	Scott Cables	SLSLL18-SMSM-00.50M	4528	6	03-Feb-2017
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	27-Feb-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon

Table 16

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

2.6 Equivalent Isotropic Radiated Power

2.6.1 Specification Reference

FCC 47 CFR Part 25, Clause 25.204
Industry Canada RSS-170, Clause 5.3

2.6.2 Equipment Under Test and Modification State

GSPS Core Module 2.0, S/N: IHG0000175 - Modification State 0

2.6.3 Date of Test

13-February-2017

2.6.4 Test Method

The test was performed in accordance with KDB 971168, clause 5.4.1.

2.6.5 Environmental Conditions

Ambient Temperature 22.5 °C
Relative Humidity 27.8 %

2.6.6 Test Results

Inmarsat Transmitting

EIRP (dBm)		
1626.675 MHz	1643.675 MHz	1660.475 MHz
28.596	28.260	28.342

Table 17

FCC 47 CFR Part 25, Limit Clause 25.204

+40 dBW in any 4 kHz band for $\theta \leq 0^\circ$

+40 + 3 θ dBW in any 4 kHz band for $0^\circ < \theta \leq 5^\circ$

For angles of elevation of the horizon greater than 5° there shall be no restriction as to the equivalent isotropically radiated power transmitted by an earth station towards the horizon.

Industry Canada RSS-170, Limit Clause 5.3

The application for MES certification shall state the MES e.i.r.p. that is necessary for satisfactory communication. The maximum permissible e.i.r.p. will be the stated necessary e.i.r.p. plus a 2 dB margin. If a detachable antenna is used, the certification application shall state the recommended antenna type and manufacturer, the antenna gain and the maximum transmitter output power at the antenna terminal.

2.6.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	14-Dec-2017
Multimeter	Fluke	79 Series III	611	12	14-Sep-2017
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	05-Mar-2017
Crystal Detector	Hewlett Packard	8470B	1320	12	08-Jun-2017
Signal Generator (250kHz to 4GHz)	Agilent Technologies	E4433B	2893	12	18-Aug-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	13-Dec-2017
Combiner/Splitter	Weinschel	1506A	3877	12	30-Mar-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4514	12	16-Feb-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Oct-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon

Table 18

O/P Mon – Output Monitored using calibrated equipment



2.7 Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service

2.7.1 Specification Reference

FCC 47 CFR Part 25, Clause 25.216
Industry Canada RSS-170, Clause 5.4.3

2.7.2 Equipment Under Test and Modification State

GPS Core Module 2.0, S/N: IHG0000175 - Modification State 0

2.7.3 Date of Test

13-February-2017

2.7.4 Test Method

The test was performed in accordance with KDB 971168 D01, Clause 6, FCC CFR 47 Part 25, Clause 25.216 and Industry Canada RSS-170, Clause 5.4.3.

2.7.5 Environmental Conditions

Ambient Temperature 22.3 °C
Relative Humidity 37.6 %

2.7.6 Test Results

Inmarsat Transmitting

Frequency (MHz)	Level (dBW)
1574.731	-72.32

Table 19 - 1626.675 MHz - Broadband Emission Results

No other emissions were detected within 10 dB of the limit.



Product Service

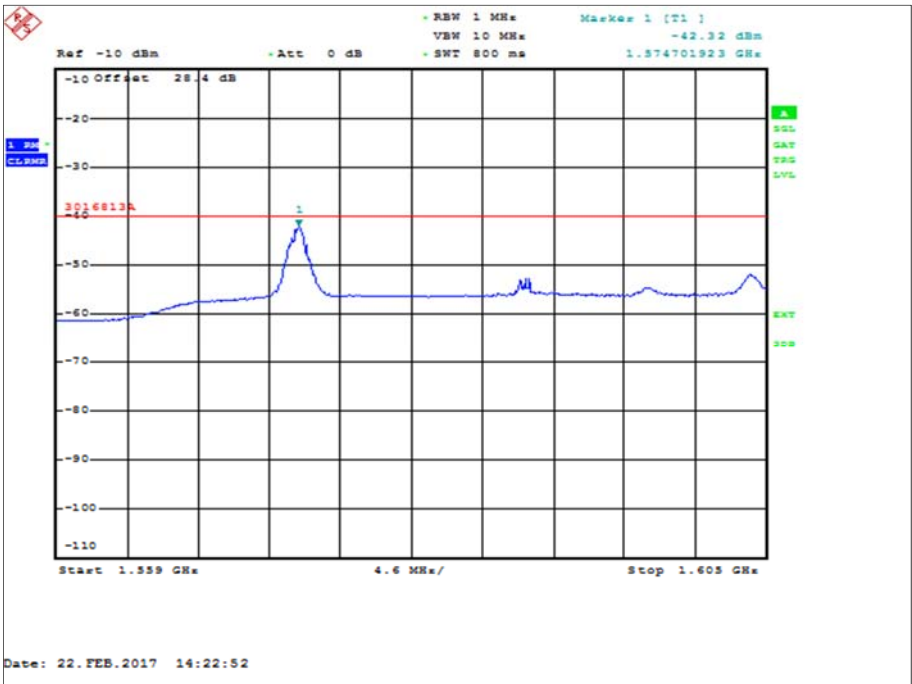


Figure 63 - 1626.675 MHz – Broadband Emissions



Frequency (MHz)	Level (dBW)
*	

Table 20 - 1626.675 MHz - Discrete Emission Results

*No emissions were detected within 6 dB of the limit.

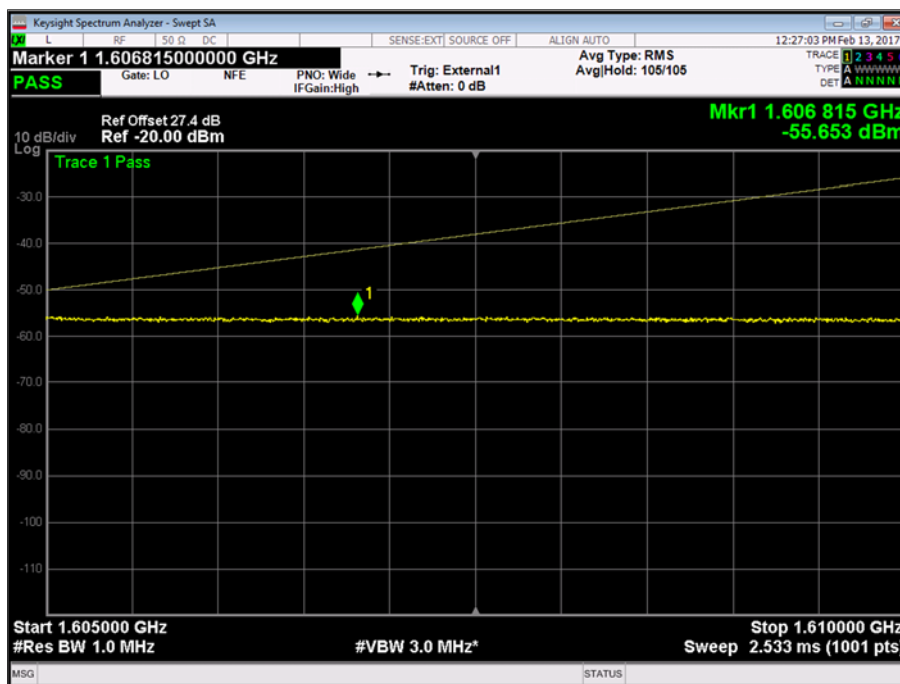


Figure 64 - 1626.675 MHz - Discrete Emissions



Product Service

Frequency (MHz)	Level (dBW)
*	

Table 21 - 1643.675 MHz - Broadband Emission Results

*No emissions were detected within 6 dB of the limit.

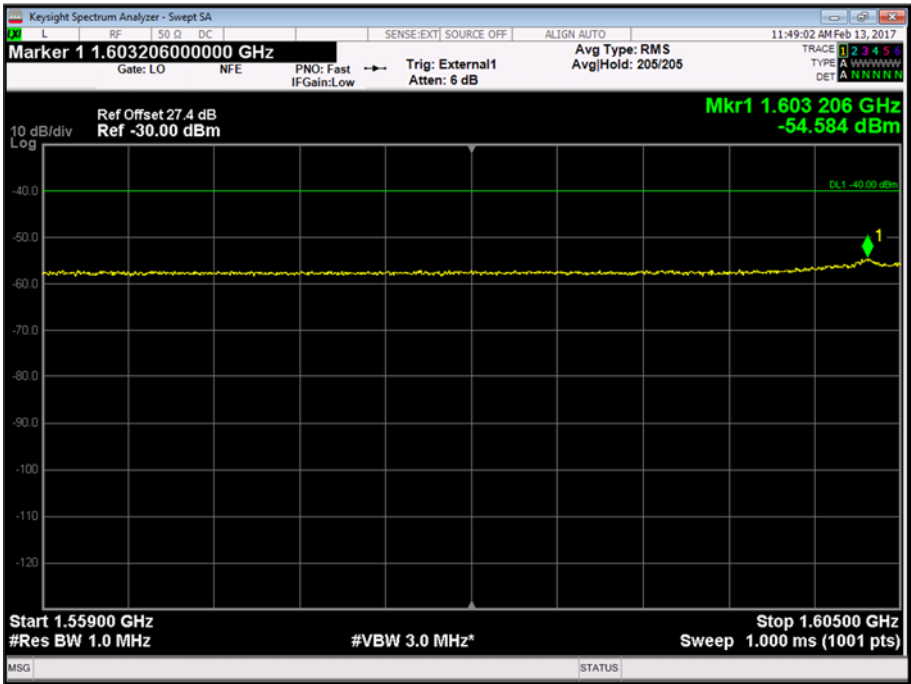


Figure 65 - 1643.675 MHz - Broadband Emissions



Frequency (MHz)	Level (dBW)
*	

Table 22 - 1643.675 MHz - Discrete Emission Results

*No emissions were detected within 6 dB of the limit.

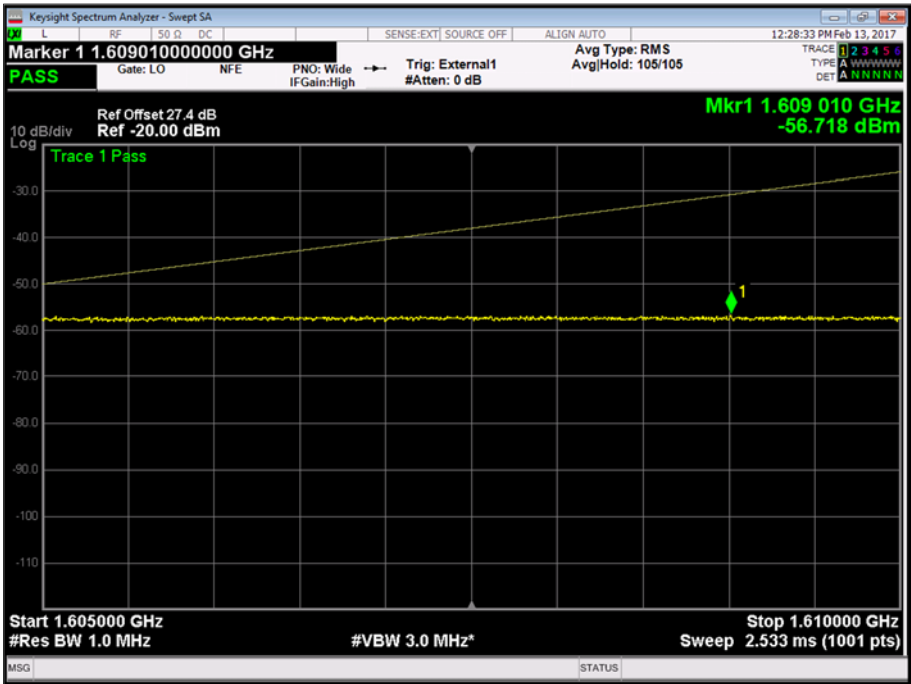


Figure 66 - 1643.675 MHz - Discrete Emissions



Frequency (MHz)	Level (dBW)
*	

Table 23 - 1660.475 MHz - Broadband Emission Results

*No emissions were detected within 10 dB of the limit.

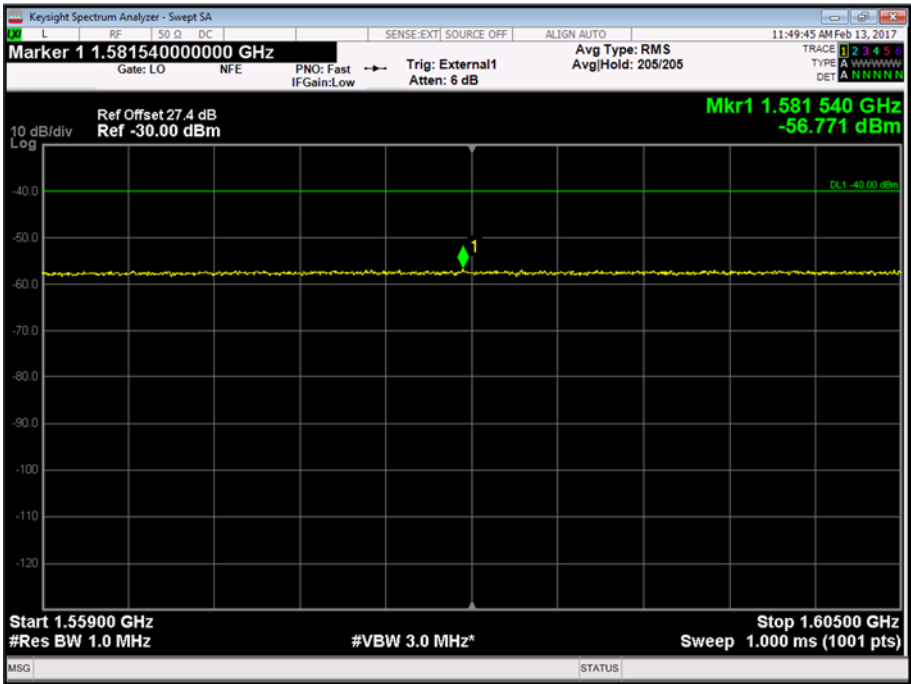


Figure 67 - 1660.475 MHz - Broadband Emissions



Frequency (MHz)	Level (dBW)
*	

Table 24 - 1660.475 MHz - Discrete Emission Results

*No emissions were detected within 10 dB of the limit.

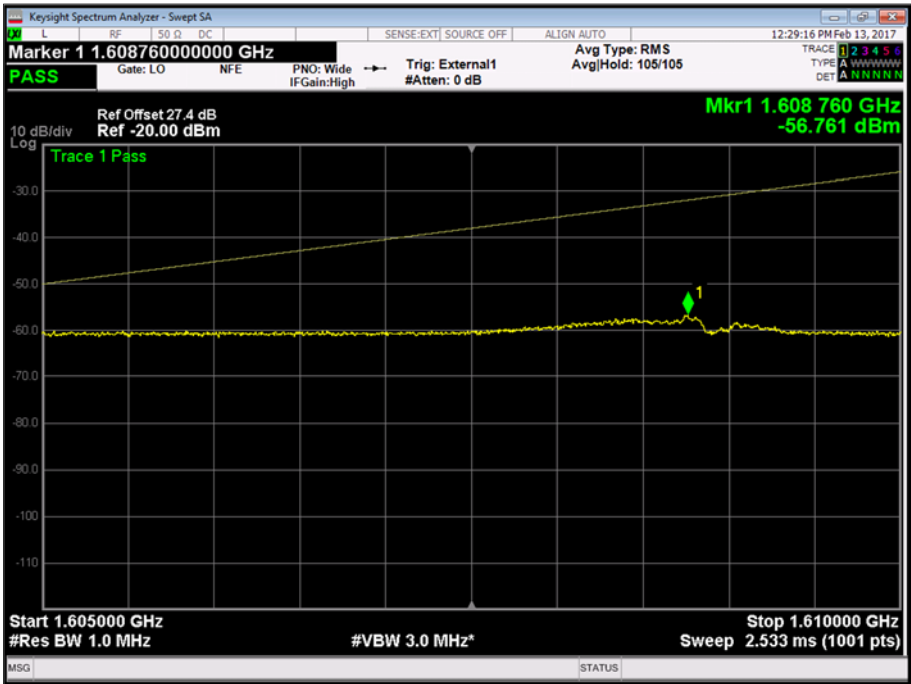


Figure 68 - 1660.475 MHz - Discrete Emissions



Frequency (MHz)	Level (dBW)
*	

Table 25 Carrier-off - Broadband Emission Results

*No emissions were detected within 10 dB of the limit.

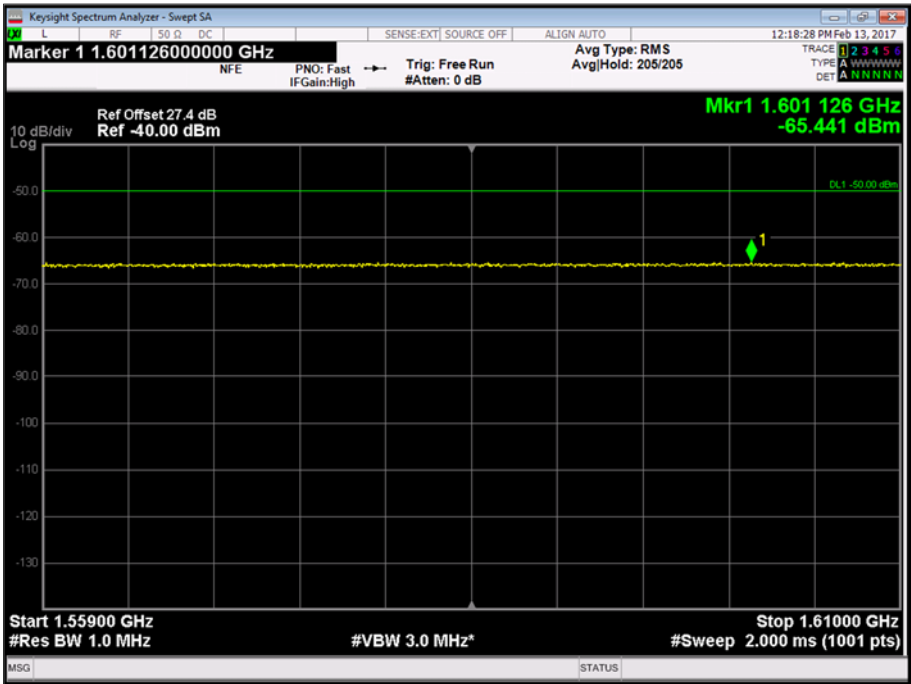


Figure 69 - Carrier-off - Broadband Emissions

Frequency (MHz)	Level (dBW)
*	

Table 26 - Carrier-off - Discrete Emission Results

*No emissions were detected within 10 dB of the limit.

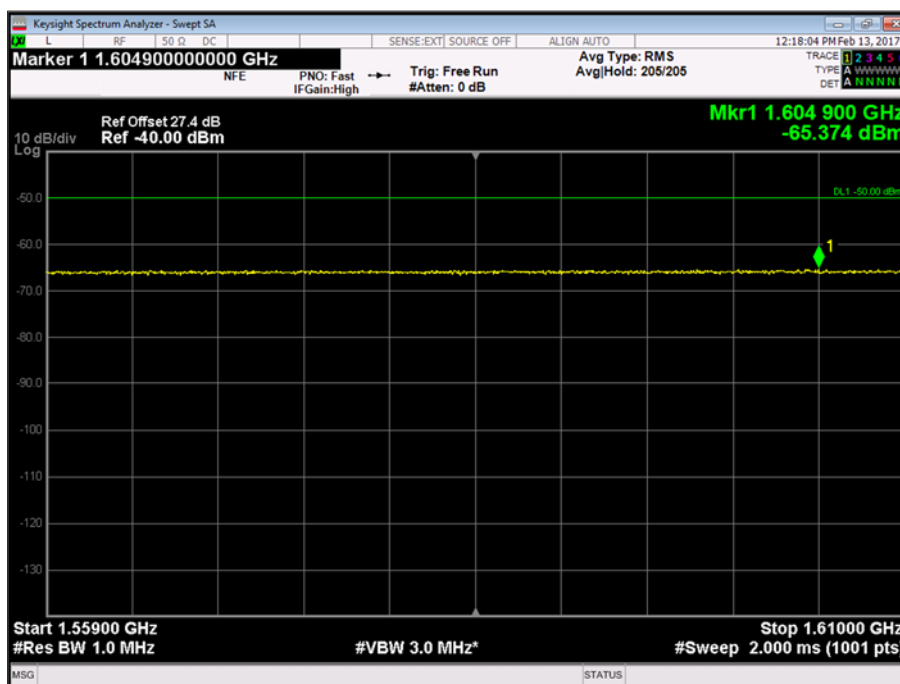


Figure 70 - Carrier-off - Discrete Emissions

FCC 47 CFR Part 25, Limit Clause 25.216

25.216(c) The e.i.r.p. density of emissions from mobile earth stations placed in service after July 21, 2002 with assigned uplink frequencies between 1610 MHz and 1660.5 MHz shall not exceed -70 dBW/MHz, averaged over any 2 millisecond active transmission interval, in the band 1559–1605 MHz. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed -80 dBW, averaged over any 2 millisecond active transmission interval, in the 1559–1605 MHz band.

25.216(g) Mobile earth stations manufactured more than six months after FEDERAL REGISTER publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies in the 1610–1626.5 MHz band shall suppress the power density of emissions in the 1605–1610 MHz band-segment to an extent determined by linear interpolation from -70 dBW/MHz at 1605 MHz to -10 dBW/MHz at 1610 MHz averaged over any 2 millisecond active transmission interval. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed a level determined by linear interpolation from -80 dBW at 1605 MHz to -20 dBW at 1610 MHz, averaged over any 2 millisecond active transmission interval.

25.216(i) The e.i.r.p. density of carrier-off state emissions from mobile earth stations manufactured more than six months after FEDERAL REGISTER publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies between 1 and 3 GHz shall not exceed -80 dBW/MHz in the 1559–1610 MHz band averaged over any two millisecond interval.

2.7.7 Test Location and Test Equipment Used

This test was carried out in RF Chamber 8 and RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	14-Dec-2017
Multimeter	Fluke	79 Series III	611	12	14-Sep-2017
Crystal Detector	Hewlett Packard	8470B	1320	12	08-Jun-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	09-Sep-2017
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	15-Sep-2017
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	13-Dec-2017
Combiner/Splitter	Weinschel	1506A	3877	12	30-Mar-2017
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	25-Oct-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	08-Sep-2017
DC to TTL Converter	TUV SUD Product Service	GSPS CORE MODULE 2.0	4378	-	TU
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4514	12	16-Feb-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	12-Jan-2018
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Oct-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon
2 metre SMA Cable	IW Microwave	3PS-1806LC-788-3PS	4829	12	24-Jan-2018

Table 27

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Modulation Characteristics	-
Occupied Bandwidth	± 1.87 kHz
Frequency Tolerance	± 3.54 Hz
Spurious Emissions at Antenna Terminals	± 3.08 dB
Radiated Spurious Emissions	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 18 GHz: ± 6.3 dB
Equivalent Isotropic Radiated Power	Conducted: ± 0.7 dB Radiated: 1 GHz to 18 GHz: ± 6.3 dB
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service	Conducted: ± 3.45 dB Radiated: ± 6.3 dB

Table 28