Modular Approval
Certification Test Report

FCC ID: SDBR100NA
IC: 2220A-R100NA

FCC Rule Part: CFR 47 Part 24 Subpart D, Part 101 Subpart C
ISED Canada Radio Standards Specification: RSS-119, RSS-134

ACS Report Number: 16-3084.W06.1A

Applicant: Sensus Metering Systems, Inc.
Model: R100NA

Test Begin Date: October 12, 2016
Test End Date: October 27, 2016

Report Issue Date: November 4, 2016

For The Scope of Accreditation Under Certificate Number AT-1921

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

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This report contains 131 pages

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1.0 GENERAL

1.1 Purpose

The purpose of this modular approval report is to demonstrate compliance with Part 2 Subpart J, Part 24 Subpart D and Part 101 Subpart C of the FCC's Code of Federal Regulations, and ISED Canada Radio Standards Specifications RSS-119 and RSS-134.

1.2 Product Description

R100NA is a transceiver module that incorporates a Sensus FLEXNET radio and a GPS receiver, there are areas on the module available for other radio interfaces but they are not populated at this time.

The R100NA is meant as a Remote / Relay state-of-the-art product that allows for both bi-directional Remote traffic to / from endpoints direct to / from an RNI and bi-directional base station Relay mode traffic (buddy / repeat mode via a base station) to / from endpoints. The electronics package is sized such that it is able to be installed indoor and / or outdoor on poles or other structures. This device is able to operate in one of two modes, Remote mode or Relay mode, in order to keep costs low and demand high.

The R100NA is manufactured using any one of three TCXOs (KDS, Taiten, ILSI).

Manufacturer Information:
Sensus Metering Systems, Inc.
639 Davis Drive
Morrisville, NC 27560

Test Sample Serial Numbers:

TCXO Manufacturer	TX Radiated	RF Conducted
ILSI	072*	067
KDS		094
Taitien		116

*Sample 072 was also used for temperature testing.

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology

1.3.1 Configurations and Justification

The EUT was evaluated for radiated and RF conducted measurements for all modulation types. Where applicable, data is provided for the unit having the worst case emissions (where the TCXO is ILSI). Taitien, ILSI, and KDS brands of TCXOs were evaluated.

The evaluation for unintentional emissions is documented separately in a verification report.
The EUT was evaluated in 3 orthogonal planes and the X orientation (flat) being the worst case.
The EUT was tested standalone, and a power supply was used to power it.
The client provided software to exercise the EUT.

The R100NA can be installed into the 53963437000XX host with 2 additional wireless transceivers. Transceiver 1 is a WIFI device and a second is a single cellular modem. Simultaneous transmission is possible with the WIFI (FCC ID: Z64-WL18DBMOD), and cellular radio modem (FCC ID: RI7LE910NA or RI7LE910SV) and the native R100NA Flexnet transmitter. Intermods investigation has been performed and the product meets the requirements.

1.3.2 In-Band Testing Methodology

The EUT is designed to operate in multiple bands under the requirements of CFR 47 Parts 24 and 101. The following is a list of the frequency bands of operation sorted based on the FCC rule parts in which the band is associated.

CFR Title 47 Rule Part	Frequency Band of Operation (MHz)
24D	901.0 - 902.0
24D	930.0 - 931.0
24D	940.0 - 941.0
101	928.85 - 929.0
101	932.0 - 932.5
101	941.0 - 941.5
101	952.0 – 953.0
101	959.85 - 960.0

Based on the requirements set forth in accordance 47 CFR 2.1046-2.1057 as stated above, the methodology in selecting the places to test in the available bands of operation is outlined in the following table.

CFR Title 47 Rule Part	Frequency Band of Operation (MHz)	Location in the Range of Operation	Approx. Test Freq.
24D	901.0 - 902.0	Middle	901.5000
101	928.85 - 929.0	Middle	928.9250
24D	930.0 - 931.0	Middle	930.5000
101	932.0 - 932.5	Middle	932.2500
24D	940.0 - 941.0	1 near top and 1 near bottom	940.0125
101	941.0 - 941.5		941.4875
101	952.0 – 953.0	Middle	952.5000
101	959.85 – 960.0	Middle	959.9250

1.4 Emission Designators

The R100NA transmitter produces fifteen distinct modulation types. The emission designators for the modulation types used by the R100NA transmitter calculated using the baud rate defined in the Theory of Operation are as follows:

EMISSIONS DESIGNATORS

Mode	Emission Designator	Modulation
Normal	9K60F2D	7-FSK
Double Density	9K60F2D	13-FSK
C & I (Half Baud)	4K80F2D	7-FSK
Boost	1K10F2D	7-FSK
Priority	4K80F2D	13-FSK
2SFSK (Half Baud)	5K00F1D	2-SFSK
4SFSK (Half Baud)	5K60F1D	4-SFSK
8SFSK (Half Baud)	5K90F1D	8-SFSK
2SFSK	10K0F1D	2-SFSK
4SFSK	11K3F1D	4-SFSK
8SFSK	11K9F1D	8-SFSK
MPass (5 kbps)	5K90F1D	2-GFSK
MPass (10 kbps)	11K8F1D	2-GFSK
m4Pass (10 kbps)	4K70F1D	4-GFSK
m4Pass (20 kbps)	9K30F1D	4-GFSK

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.
2320 Presidential Dr. Suite 101
Durham NC 27703-8077
Phone: (919) 381-4235
www.acstestlab.com

FCC Registered Test Site Number: 637011
ISED Canada Test Site Registration Number: 20446

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS (Durham) is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board/ANAB accreditation program, and has been issued certificate number AT-1921 in recognition of this accreditation. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of an 18' x 28' x 18' shielded enclosure. The chamber is lined with Samwha Electronics Co. LTD Ferrite Absorber, model number SFA300 (HSN-1). The ferrite tile is 10cm x 10 cm and weighs approximately 1.4lbs. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber. On top of the ferrite tiles is DMAS HT-45 (Dutch Microwave Absorber Solutions) hybrid absorber on all walls except the wall behind the antenna mast which has a shorter DMAS HT-25 absorber.

The turntable is 1.50m in diameter and is located 150cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using short #6 copper wire. The turntable is an aluminum, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the turntable. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane.

Behind the turntable is a 2' x 6' x 1.5' deep shielded pit used for support equipment if necessary. The pit is equipped with 2 - 4" PVC chase from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

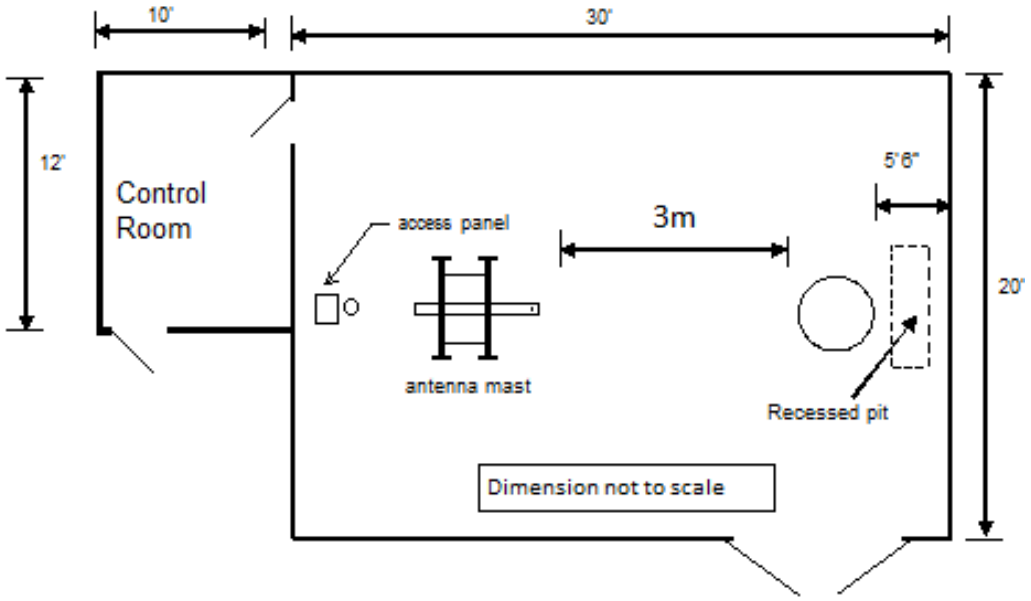

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 10' sheet galvanized steel horizontal ground reference plane (GRP) bonded every 6" to an 8' X 8' aluminum vertical ground plane.

A diagram of the room is shown below in figure 2.3.2-1:

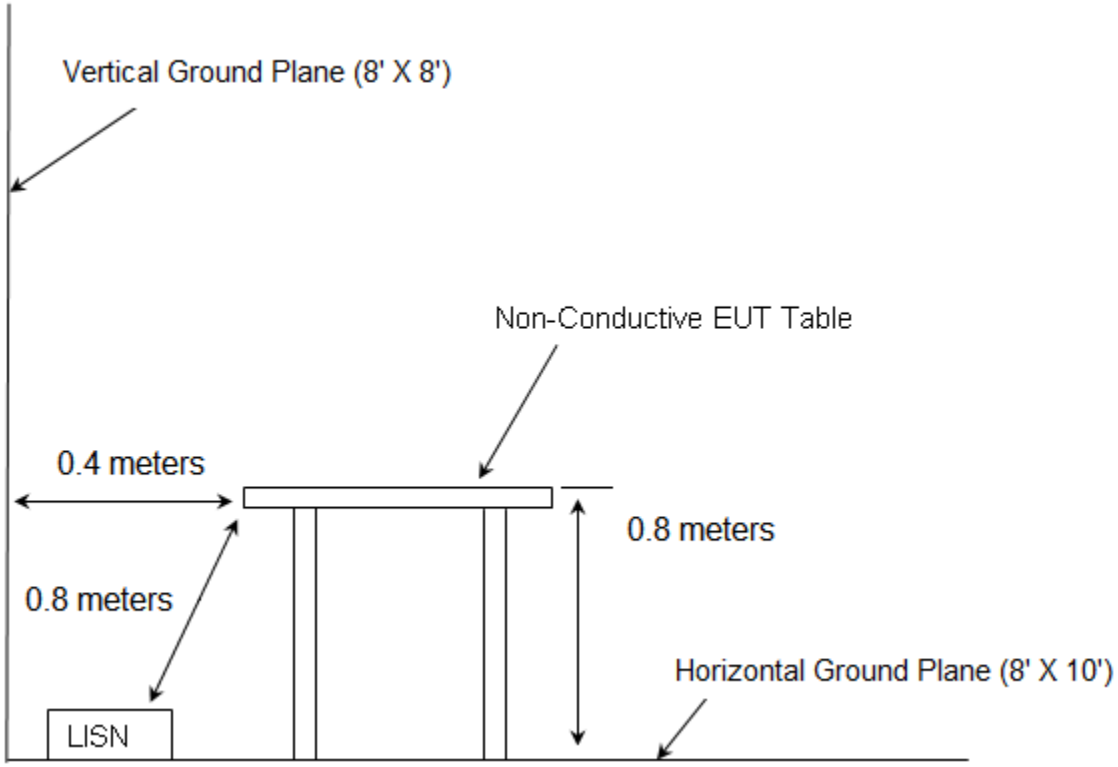

Figure 2.3.2-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2014: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 kHz to 40GHz
- ANSI C63.26-2015: Compliance Testing of Transmitters Used in Licensed Radio Services
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures - 2016
- US Code of Federal Regulations (CFR): Title 47, Part 24, Subpart D: Personal Communications Services – 2016
- US Code of Federal Regulations (CFR): Title 47, Part 101, Subpart C: Fixed Microwave Services -2016
- TIA-603-D: Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards – 2010
- ISED Canada Radio Standards Specification: RSS-119 - Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services in the Frequency Range 27.41-960 MHz, Issue 12, May 2015
- ISED Canada Radio Standards Specification: RSS-134 - 900 MHz Narrow Band Personal Communication Service, Issue 2, February 2016
- ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 2014.

4.0 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

Asset ID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
277	EMCO	93146	Antennas	9904-5199	9/12/2016	9/12/2018
626	EMCO	3110B	Antennas	9411-1945	2/29/2016	2/28/2017
3002	Rohde & Schwarz	ESU40	Receiver	100346	1/8/2016	1/8/2017
3006	Rohde & Schwarz	TS-PR18	Amplifiers	122006	6/29/2015	12/29/2016
3008	Rohde & Schwarz	NRP2	Meter	103131	1/28/2016	1/28/2017
3009	Rohde & Schwarz	NRP-Z81	Meter	102397	1/28/2016	1/28/2017
3012	Rohde & Schwarz	EMC32-EB	Software	100731	8/2/2016	2/2/2017
3013	Agilent	53132A	Meters	MY40007729	7/13/2015	1/13/2017
3014	EMCO	3115	Antennas	9901-5653	2/10/2015	2/10/2017
3016	Fei Teng Wireless Technology	HA-07M18G-NF	Antennas	2013120203	1/26/2016	1/26/2018
3020	Rohde & Schwarz	SMB100A	Signal Generators	175943	7/14/2015	1/14/2017
3029	Micro-Tronics	HPM50108	Filter	134	12/21/2015	12/21/2016
3031	Hasco, Inc.	HLL335-S1-S1-96	Cables	3074	12/30/2015	12/30/2016
3033	Hasco, Inc.	HLL142-S1-S1-36	Cables	1435	1/7/2016	1/7/2017
3038	Florida RF Labs	NMSE-290AW-60.0-NMSE	Cable Set	1448	12/22/2015	12/22/2016
3039	Florida RF Labs	NMSE-290AW-396.0-NMSE	Cable Set	1447	12/22/2015	12/22/2016
3041	Aeroflex Inmet	18N10W-30	Cable Set	1447	1/8/2016	1/8/2017
3042	Aeroflex Inmet	18N10W-10	Cable Set	1444	1/8/2016	1/8/2017
3055	Rohde & Schwarz	3005	Cables	3055	12/30/2015	12/30/2016
3085	Rohde & Schwarz	FSW43	Spectrum Analyzer	103997	8/9/2016	8/9/2017

NCR = No Calibration Required
Asset 3002: Firmware Version: ESU40 is 4.73 SP4
Asset 3012: Software Version: EMC32-B is 9.15
Asset 3085: Firmware Version: 2.41 SP1

5.0 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Sensus Metering Systems, Inc.	R100NA	067, 072, 094, 116
2	Power Supply	Sorensen	QRD-20-4	Asset 0315
3	RF Load	Weinschel	47-20-33	Asset 3060
4	RF Load	ACS	ACS1	Asset 3072

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	Power	2.45 m	No	EUT to Power Supply
B	Power	1.8 m	No	Power Supply to Mains

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

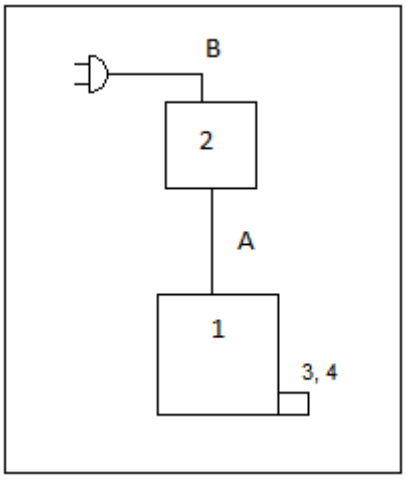

Figure 6-1: EUT Test Setup

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 RF Power Output

7.1.1 Measurement Procedure (ANSI 63.26: 2015 Section 5.2.3.2)

The RF output of the equipment under test was directly connected to the input of a wide band RF power meter through 30 dB of passive attenuation. The results are shown below.

Part 24.132, 101.113 (a), and ISED Canada RSS-134 4.3(a), (b) and RSS-119 5.4 – Power Output

7.1.2 Measurement Results

ILSI

Table 7.1.2-1: Peak Output Power

Frequency (MHz)	FCC Rule Part	Output Power High (dBm)	Output Power High (Watts)	Output Power Low (dBm)	Output Power Low (Watts)
901.5000	24D	35.3	3.39	9.76	0.009
930.5000	24D	35.48	3.53	8.63	0.007
940.0125	24D	35.7	3.72	9.87	0.01
928.9250	101	35.65	3.67	9.69	0.009
932.2500	101	35.52	3.56	8.96	0.008
941.4875	101	35.72	3.73	9.99	0.01
952.5000	101	35.8	3.80	9.6	0.009
959.9250	101	35.71	3.72	7.58	0.006

7.2 Out of Band Unwanted Emissions

7.2.1 Measurement Procedure (ANSI 63.26: 2015 Section 5.7.3)

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through 36.4 dB of passive attenuation for the high power plots and 30.2 dB for the low power plots. The spectrum analyzer resolution and video bandwidths were set to 300 Hz and 3000 Hz respectively. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. Results of the test are shown below for all modes of operation.

7.2.2 Measurement Results – Emission Masks

Part 24.133 a(1), a(2), ISED Canada RSS-134 4.4.1 (a), (b), 4.4.2 (a),(b) – Emission Limits

ILSI
High Power

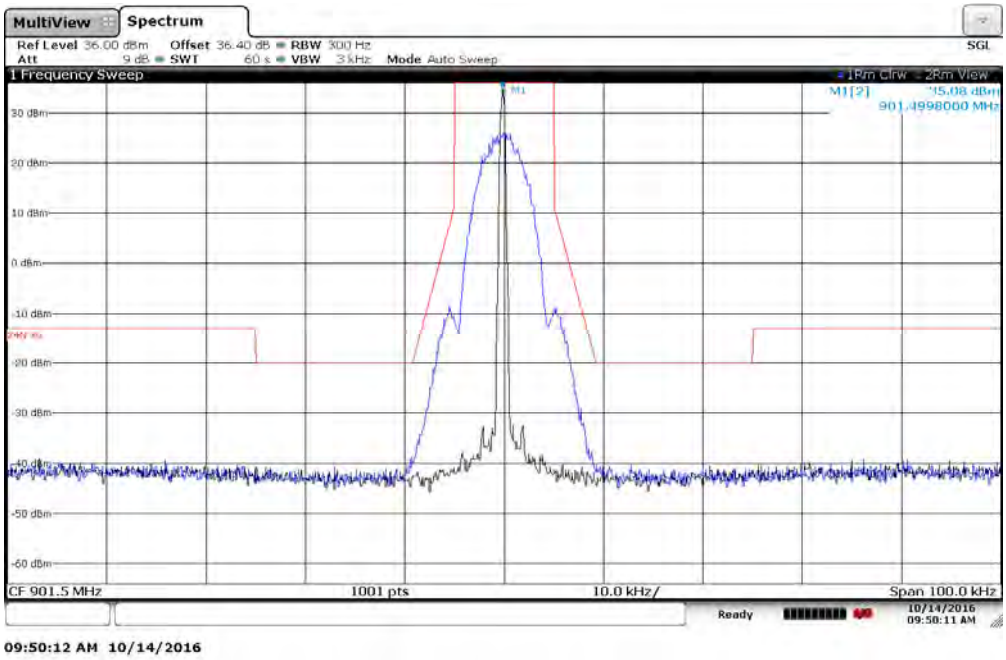

Figure 7.2.2-1: 901.5 MHz – 12.5 kHz Channel Spacing – 2SFSK (Half Baud) Mode

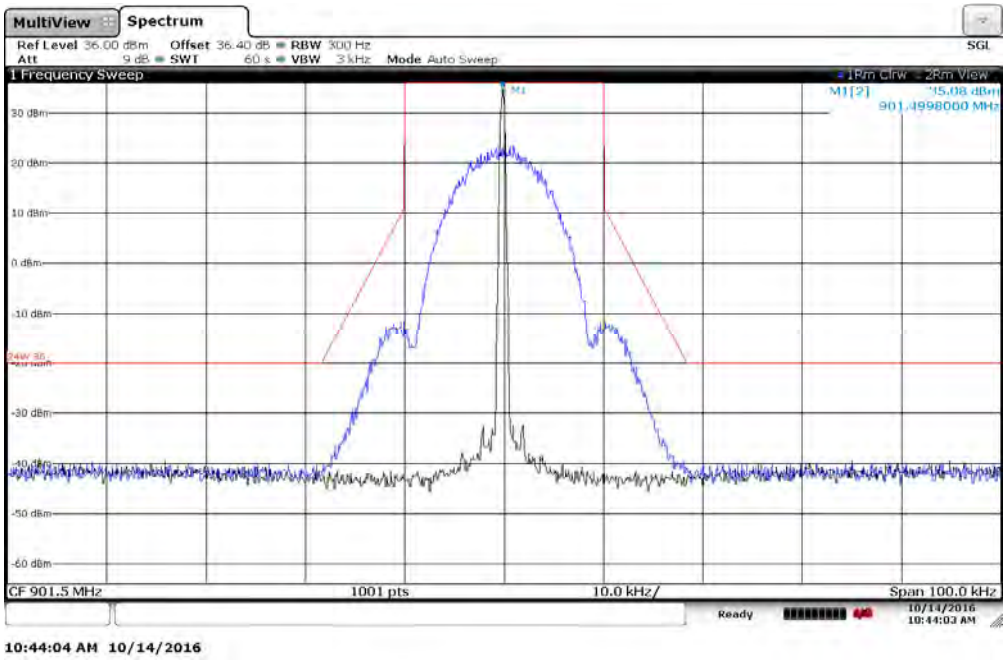

Figure 7.2.2-2: 901.5 MHz – 25 kHz Channel Spacing – 2SFSK Mode

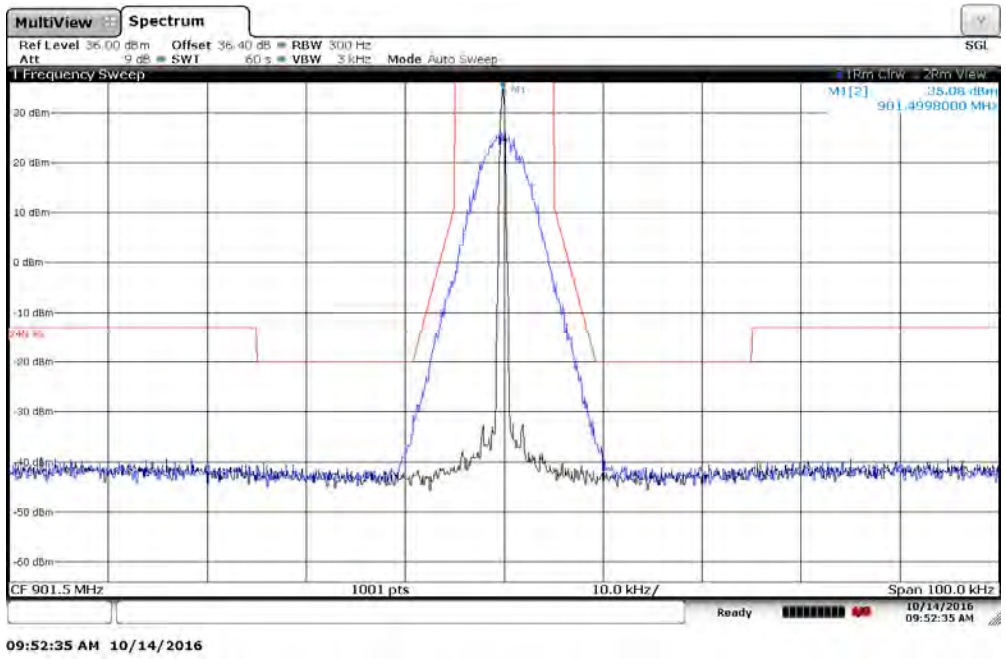

Figure 7.2.2-3: 901.5 MHz – 12.5 kHz Channel Spacing – 4SFSK (Half Baud) Mode

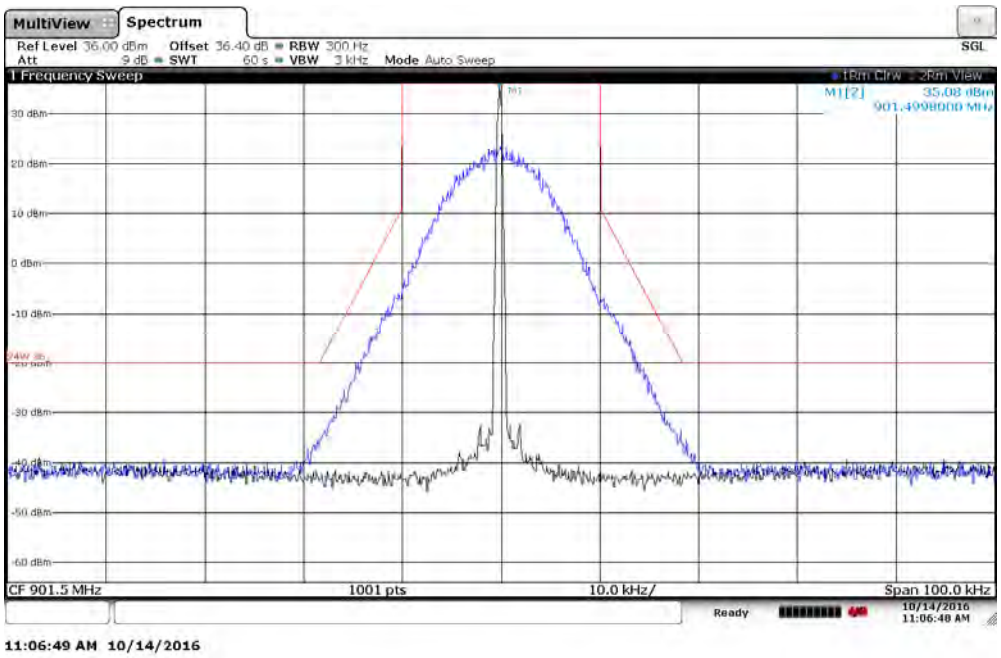

Figure 7.2.2-4: 901.5 MHz – 25 kHz Channel Spacing – 4SFSK Mode

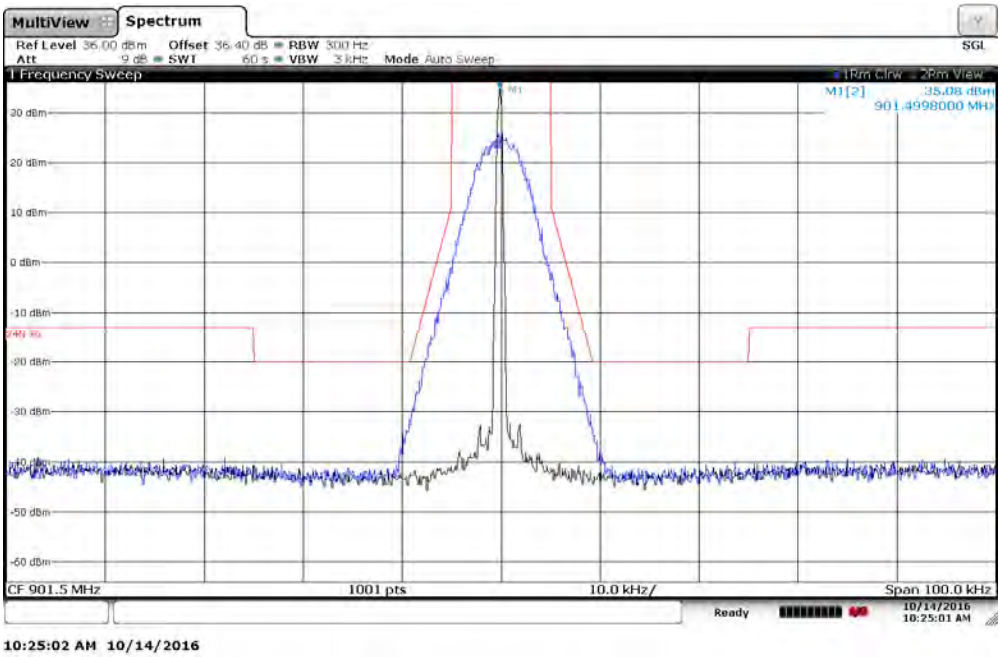

Figure 7.2.2-5: 901.5 MHz – 12.5 kHz Channel Spacing – 8SFSK (Half Baud) Mode

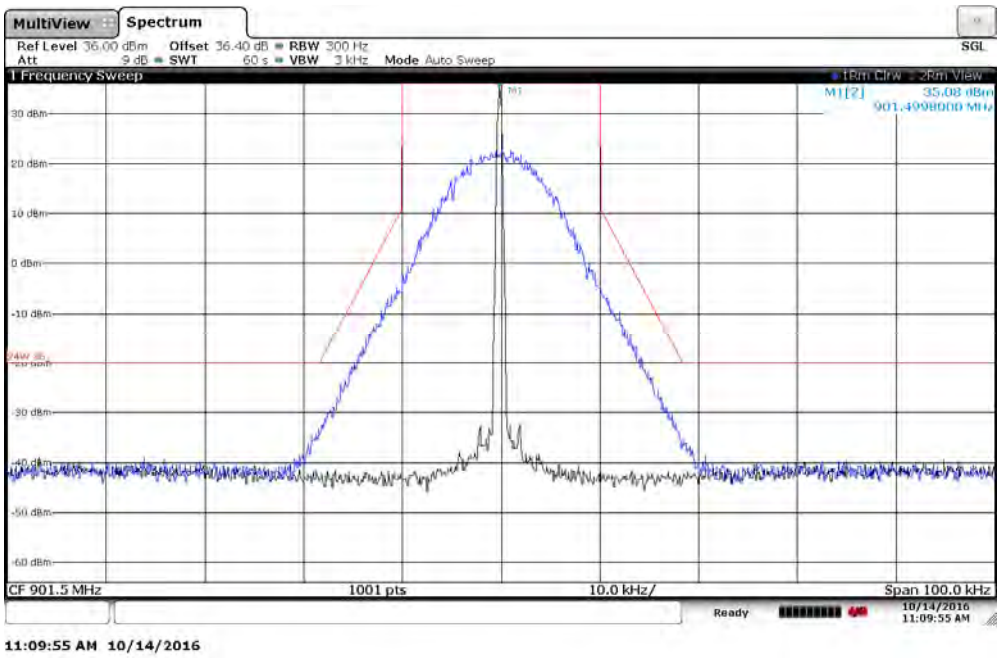

Figure 7.2.2-6: 901.5 MHz – 25 kHz Channel Spacing – 8SFSK Mode

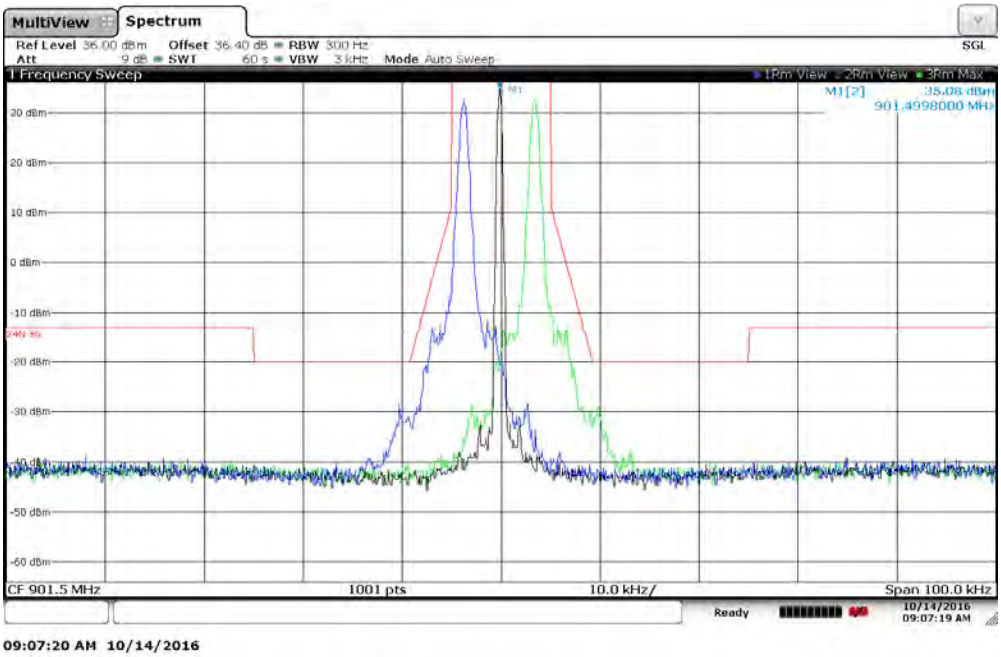

Figure 7.2.2-7: 901.5 MHz – 12.5 kHz Channel Spacing – Boost Mode

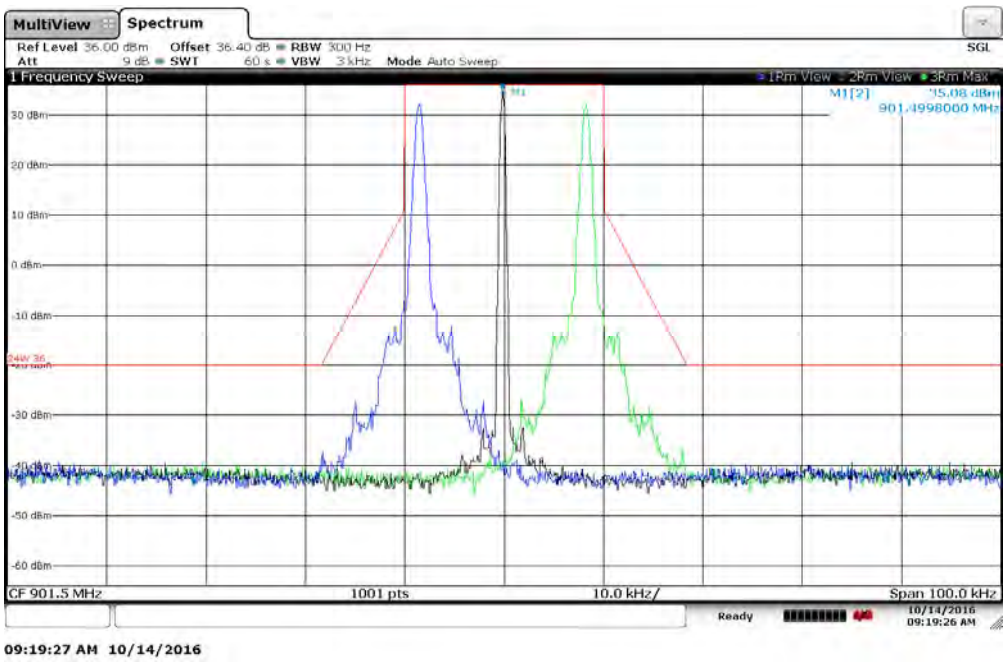

Figure 7.2.2-8: 901.5 MHz – 25 kHz Channel Spacing – Boost Mode

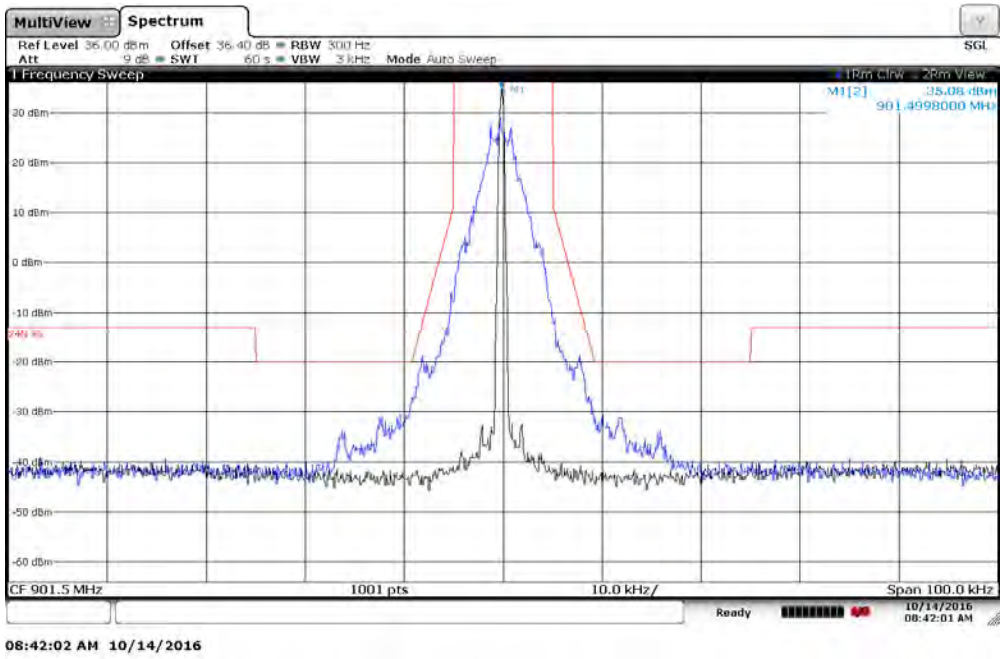

Figure 7.2.2-9: 901.5 MHz – 12.5 kHz Channel Spacing – C&I (Half Baud) Mode

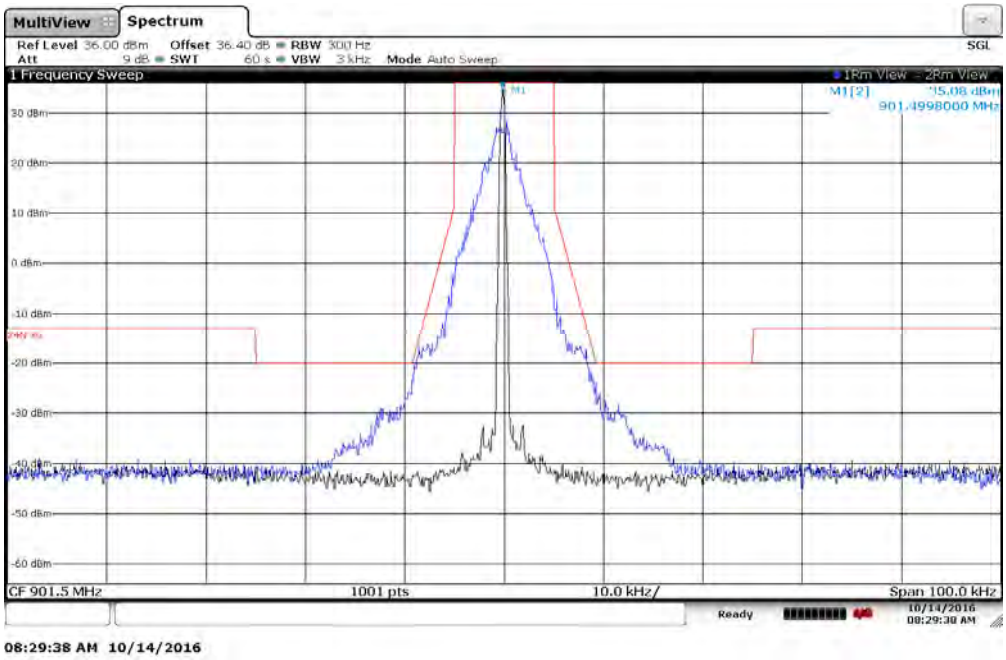

Figure 7.2.2-10: 901.5 MHz – 12.5 kHz Channel Spacing – Priority Mode

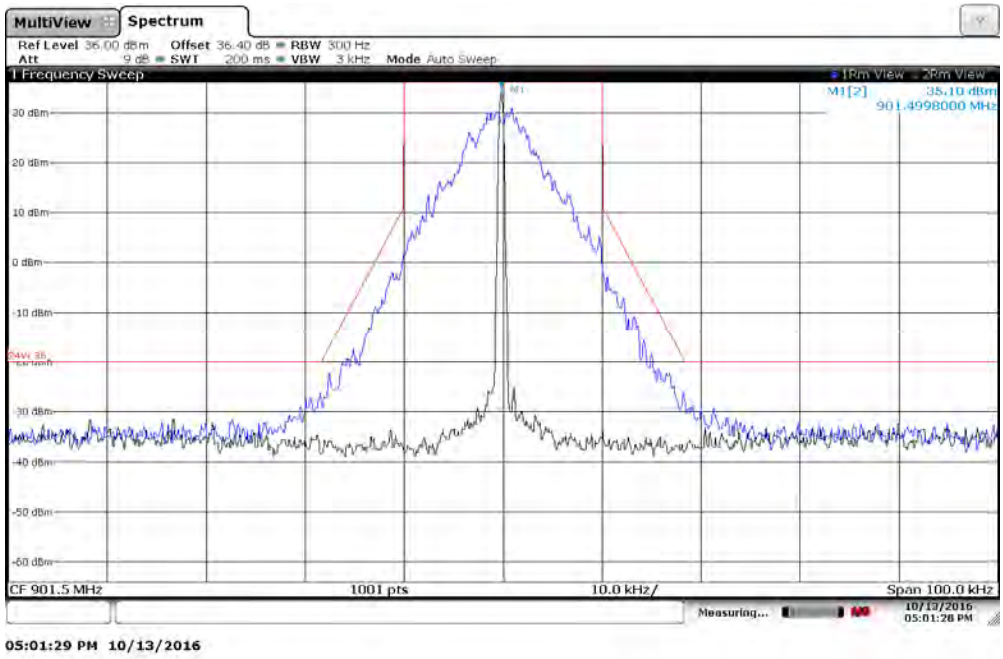

Figure 7.2.2-11: 901.5 MHz – 25 kHz Channel Spacing – Double Density Mode

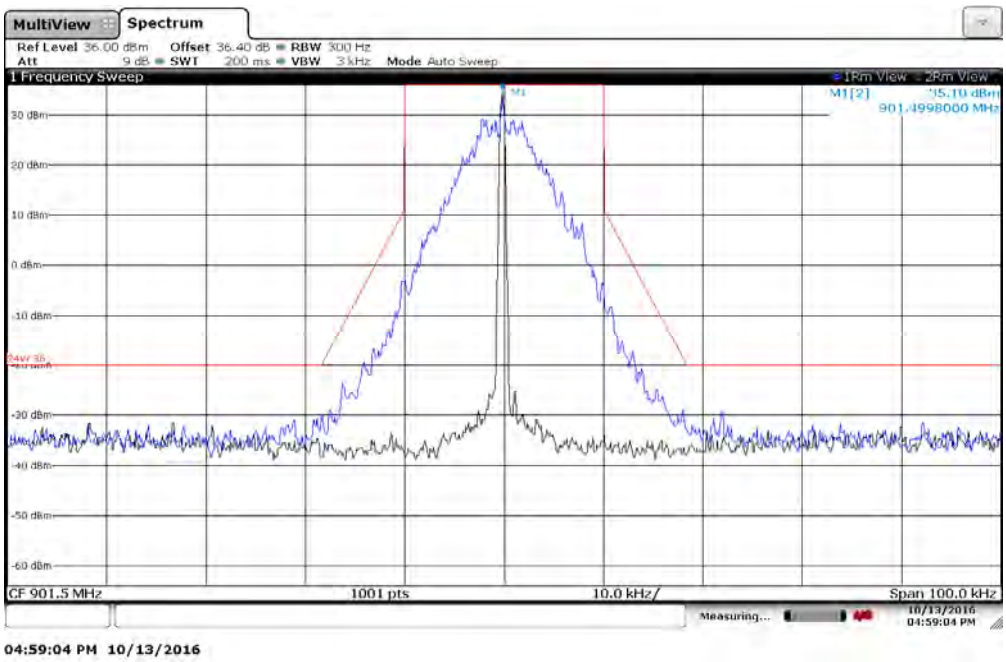

Figure 7.2.2-12: 901.5 MHz – 25 kHz Channel Spacing – Normal Mode

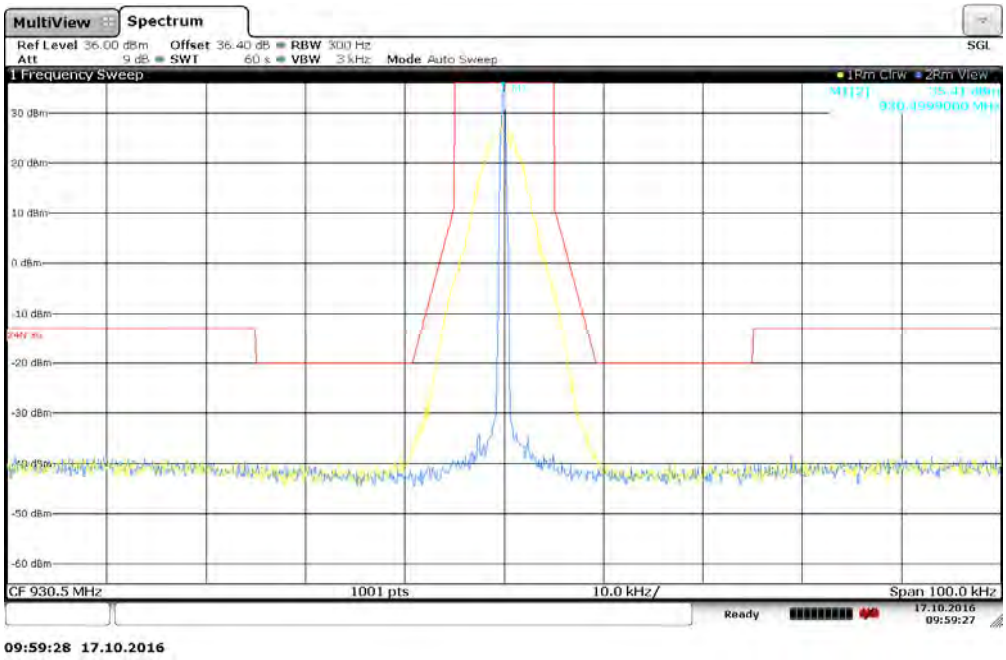

Figure 7.2.2-13: 930.5 MHz - 12.5 kHz Channel Spacing – m4Pass 10k Mode

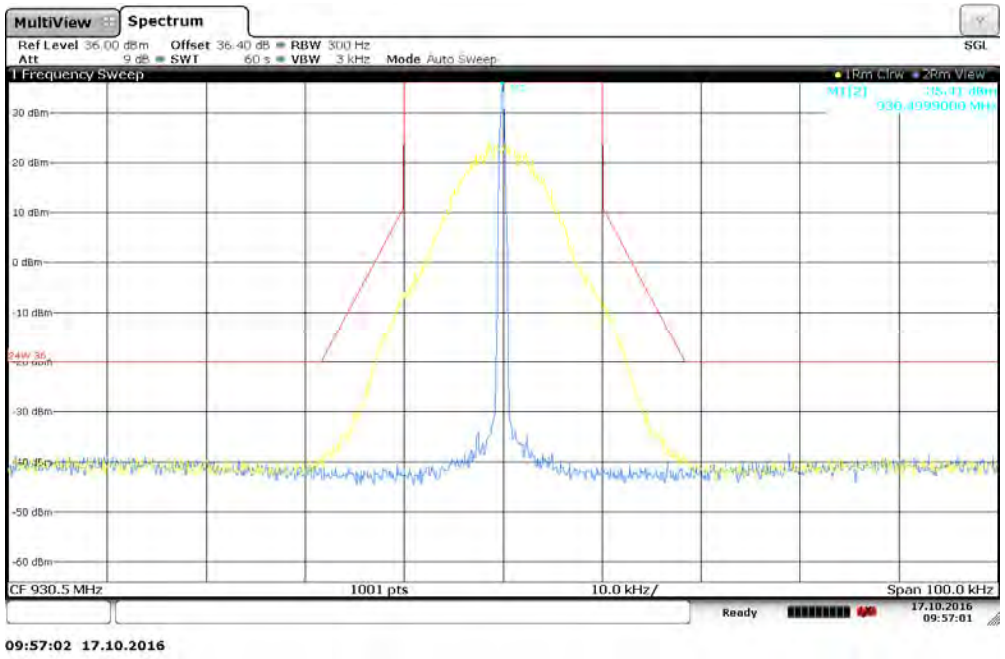

Figure 7.2.2-14: 930.5 MHz – 25 kHz Channel Spacing – m4Pass 20k Mode

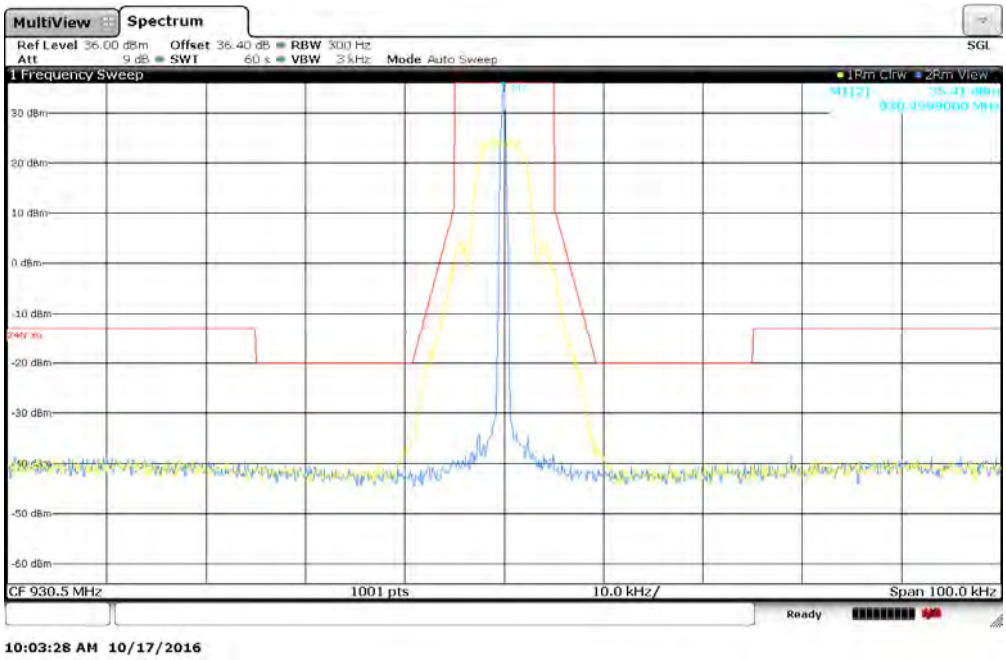

Figure 7.2.2-15: 930.5 MHz – 12.5 kHz Channel Spacing – MPass 5k Mode

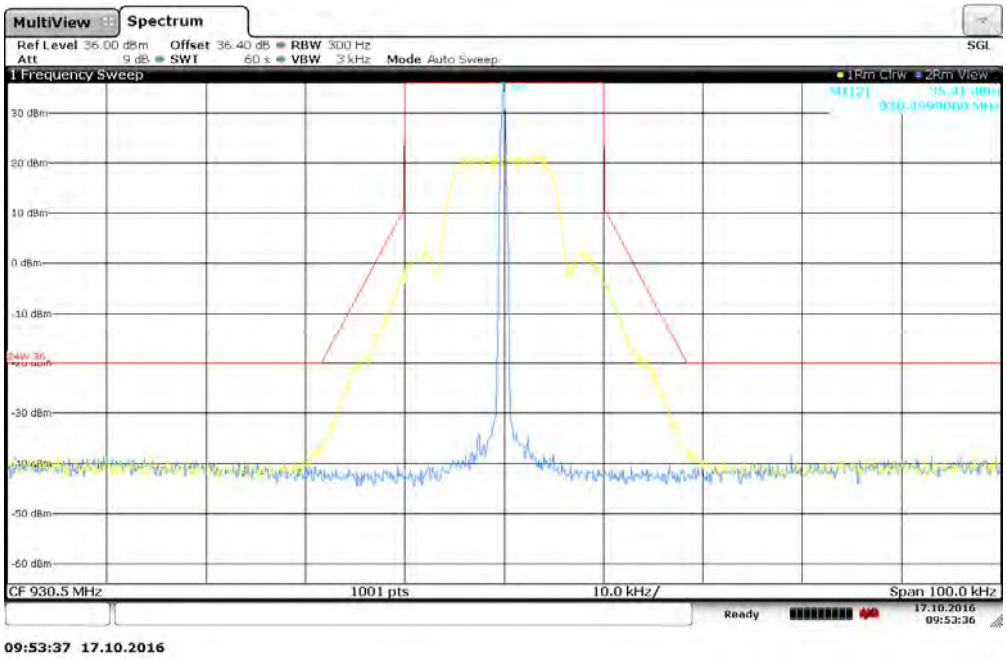

Figure 7.2.2-16: 930.5 MHz – 25 kHz Channel Spacing – MPass 10k Mode

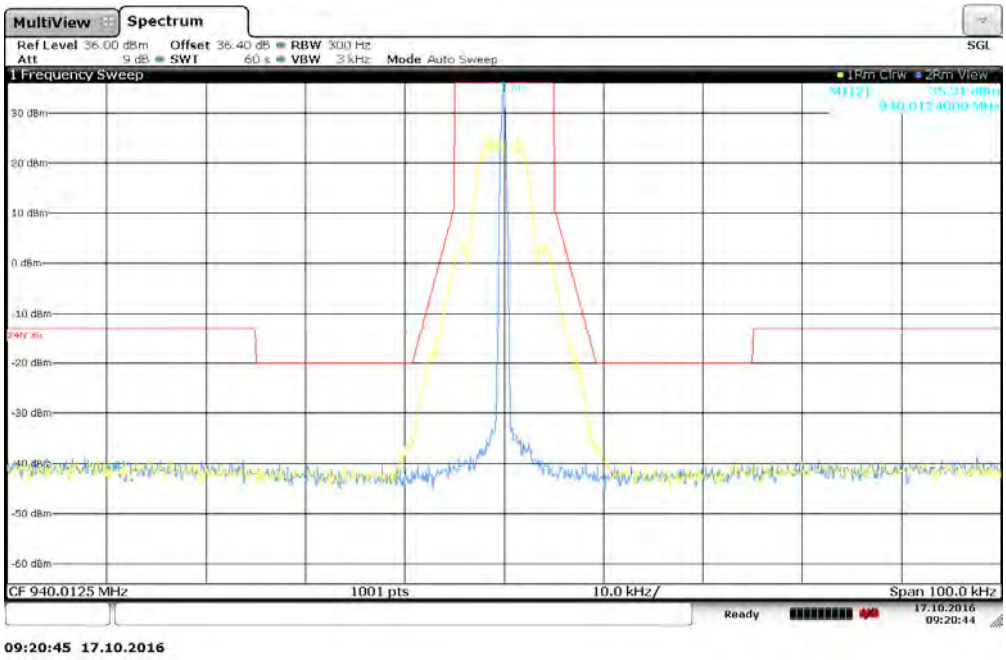

Figure 7.2.2-17: 940.0125 MHz – 12.5 kHz Channel Spacing – mPass 5k Mode

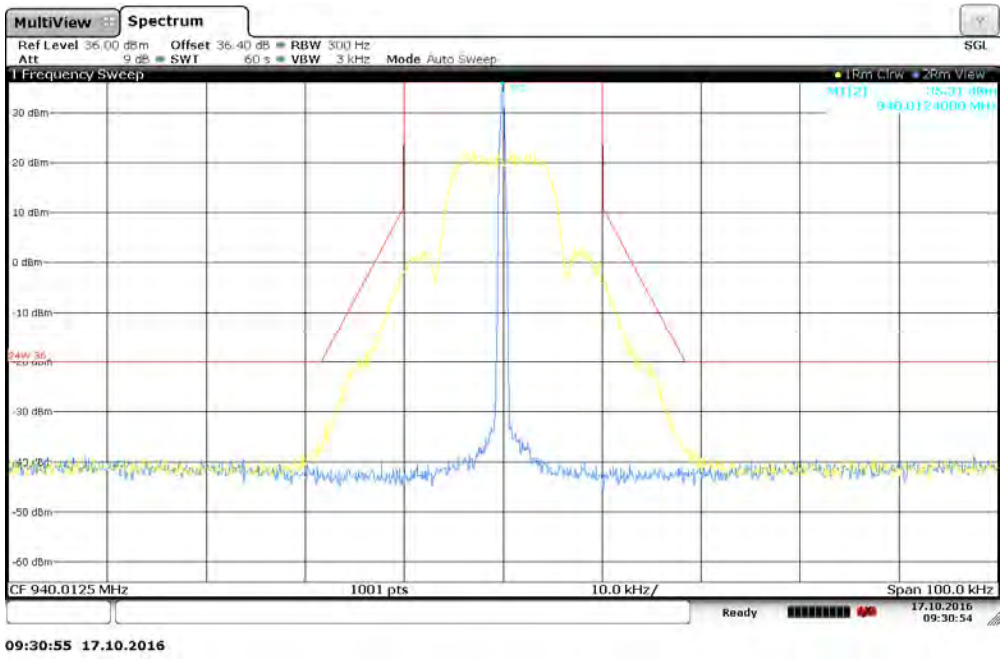

Figure 7.2.2-18: 940.0125 MHz – 25 kHz Channel Spacing – mPass 10k Mode

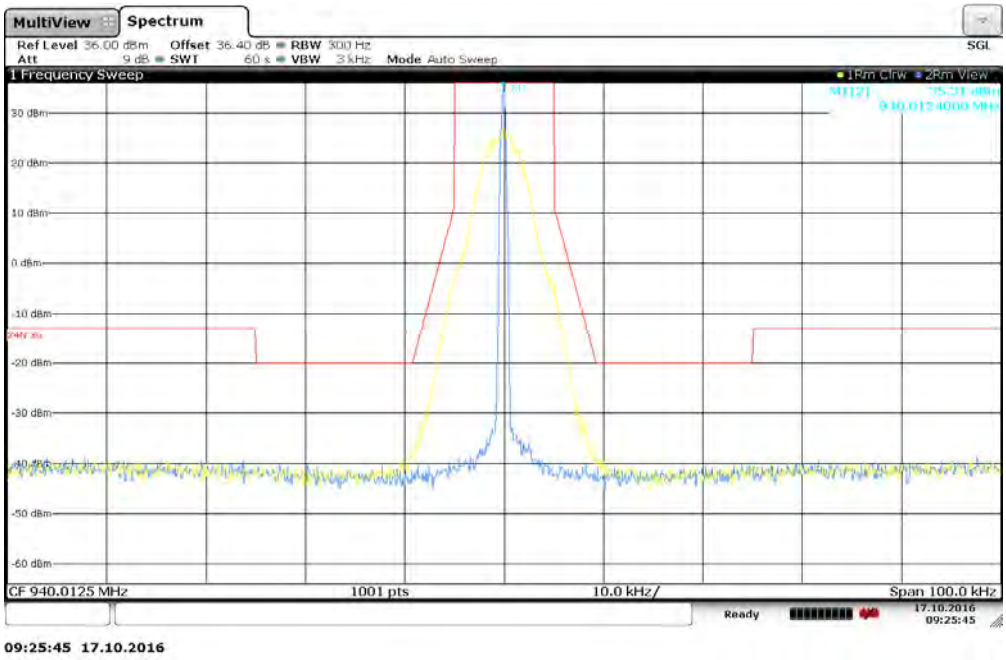

Figure 7.2.2-19: 940.0125 MHz – 12.5 kHz Channel Spacing – m4Pass 10k Mode

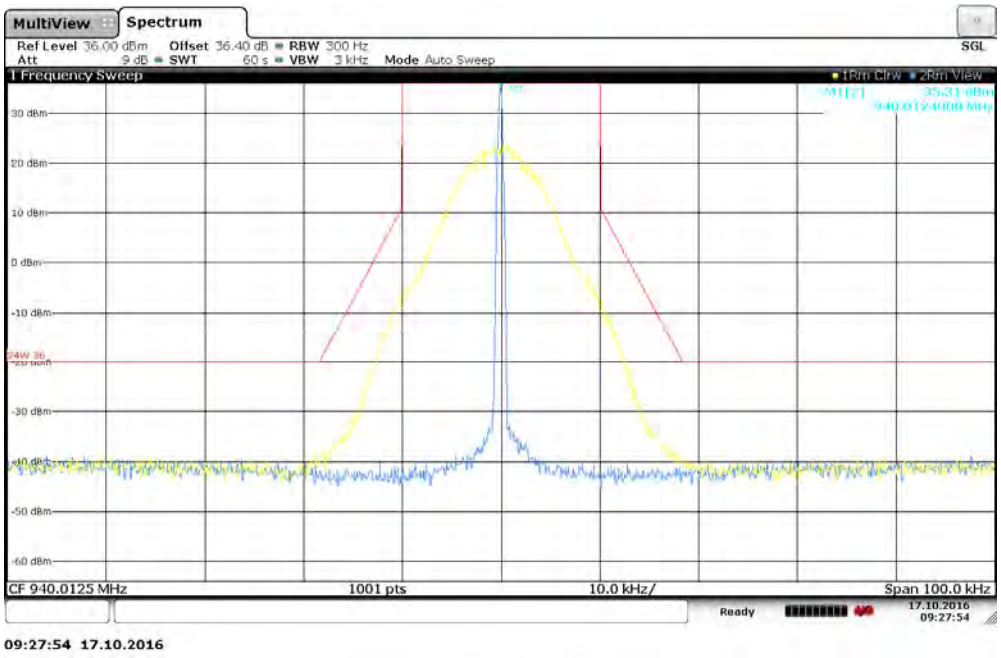

Figure 7.2.2-20: 940.0125 MHz – 25 kHz Channel Spacing – m4Pass 20k Mode

Part 101.111 a(5), a(6), RSS-119 5.8.6 (FCC Part 101.11 a(5) a(6) provides worst case)

High Power

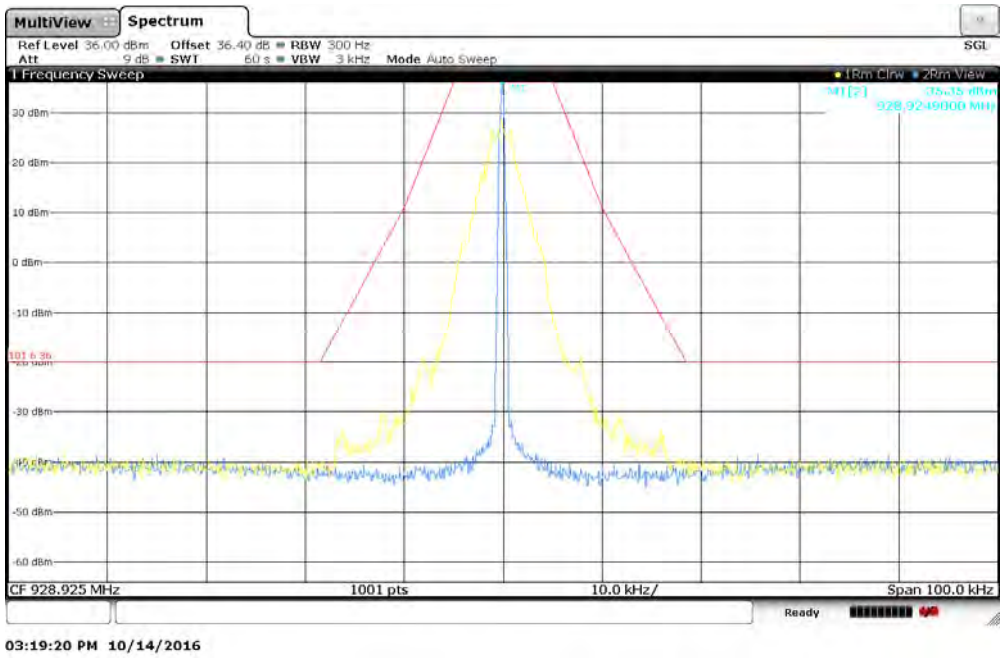

Figure 7.2.2-21: 928.925 MHz – 25 kHz Channel Spacing – C&I Mode

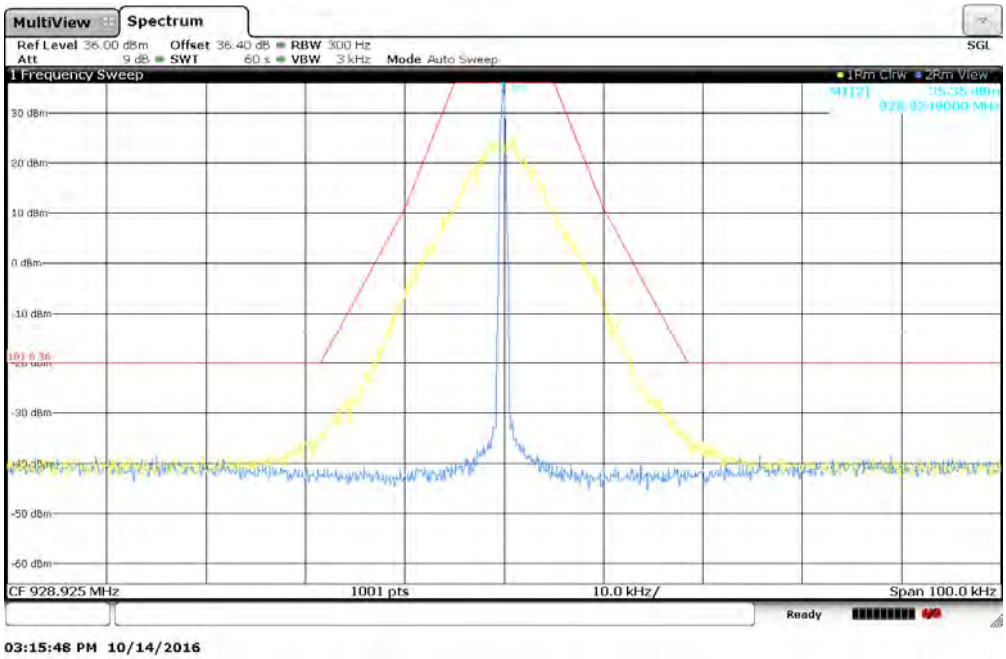

Figure 7.2.2-22: 928.925 MHz – 25 kHz Channel Spacing - Double Density Mode

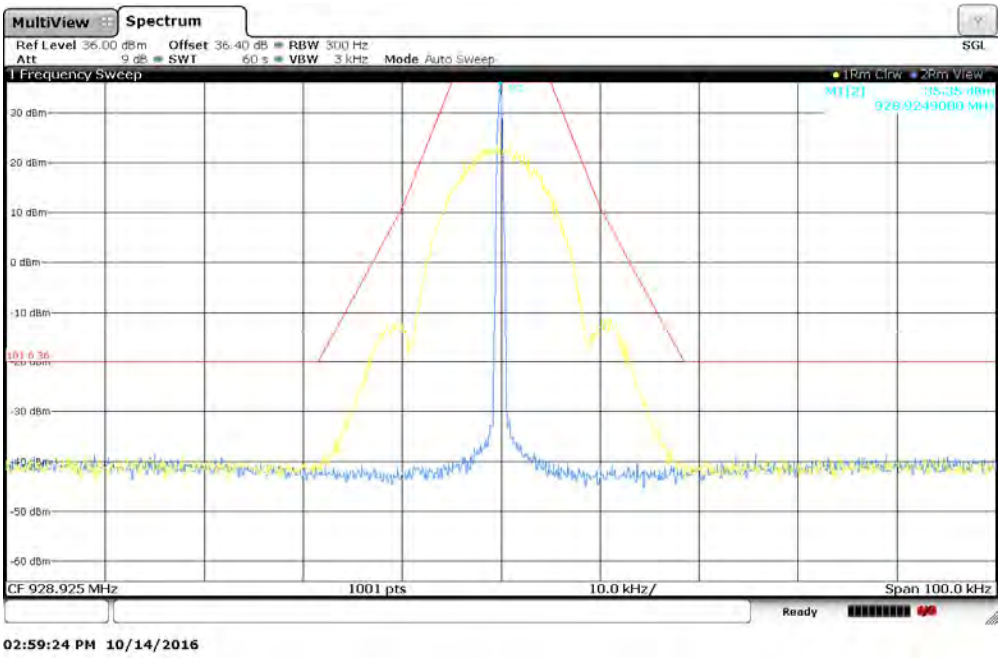

Figure 7.2.2-23: 928.925 MHz – 25 kHz Channel Spacing - 2SFSK Mode

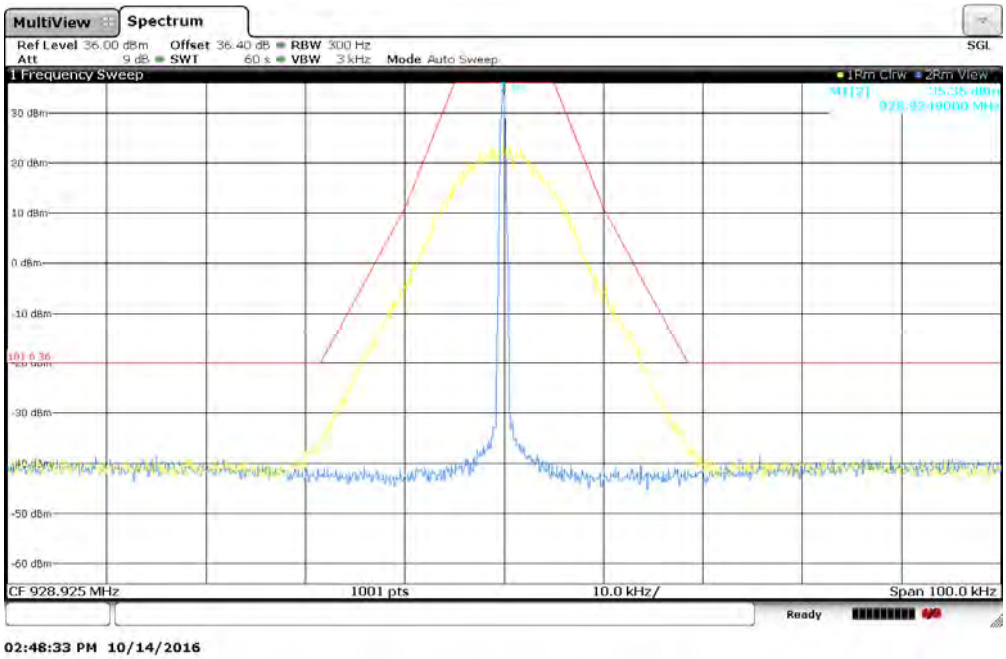

Figure 7.2.2-24: 928.925 MHz – 25 kHz Channel Spacing - 4SFSK Mode

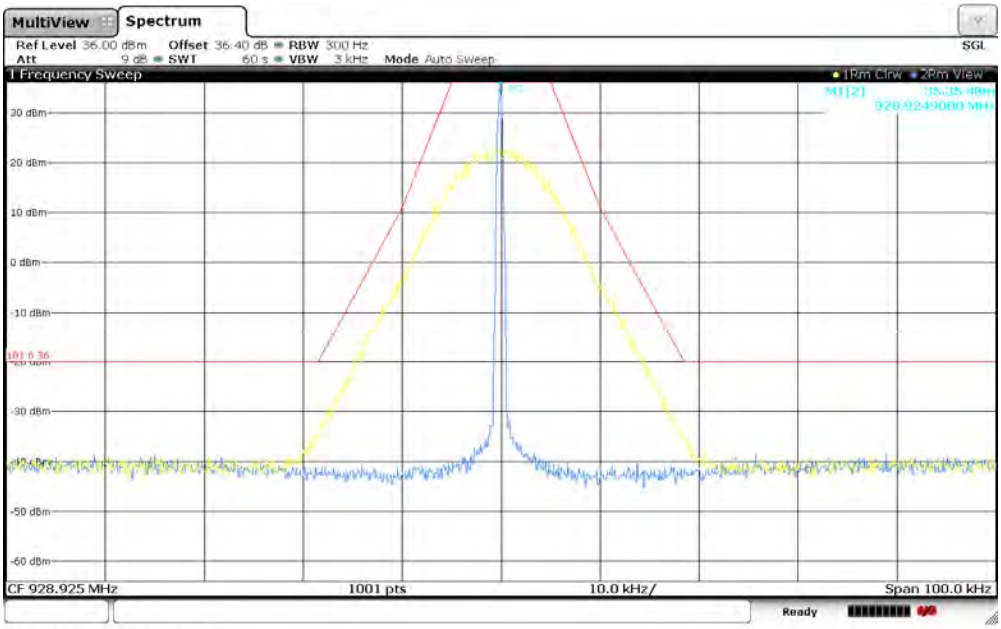

Figure 7.2.2-25: 928.925 MHz – 25 kHz Channel Spacing - 8SFSK Mode

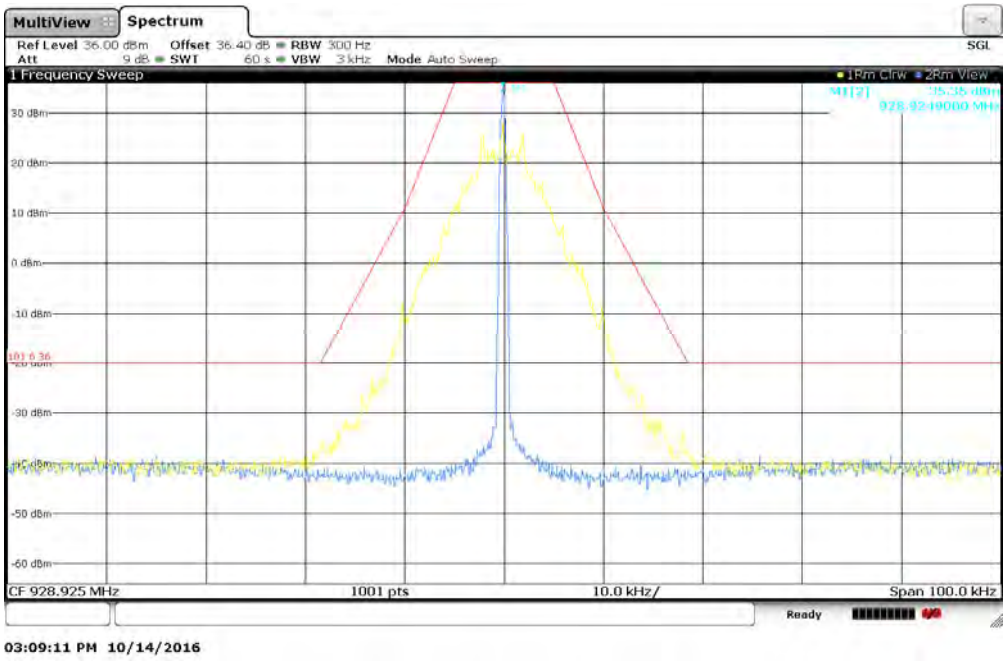

Figure 7.2.2-26: 928.925 MHz – 25 kHz Channel Spacing - Normal Mode

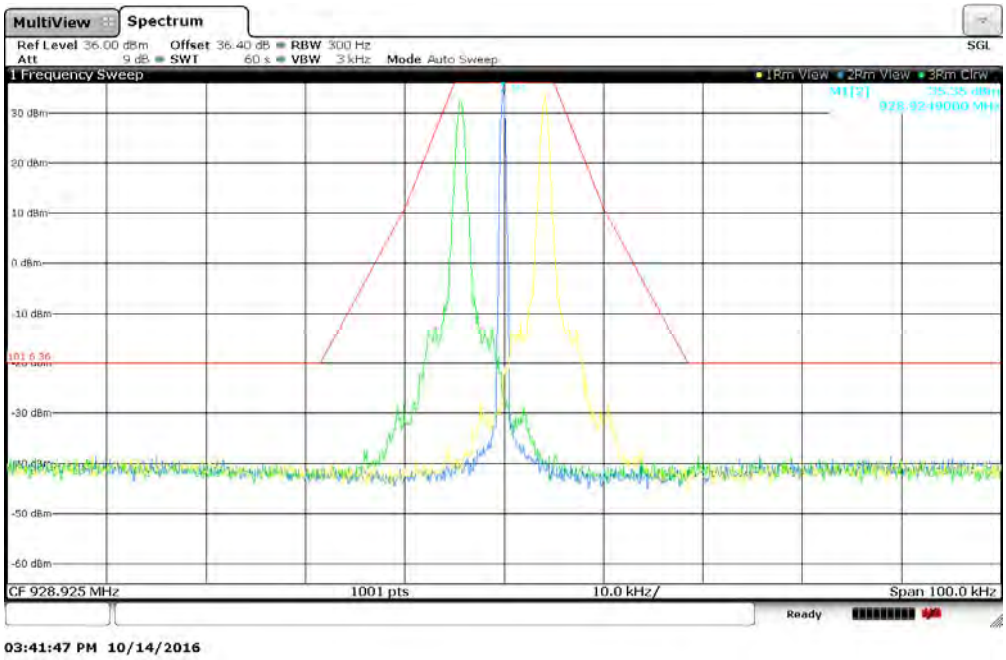

Figure 7.2.2-27: 928.925 MHz – 25 kHz Channel Spacing - Boost Mode

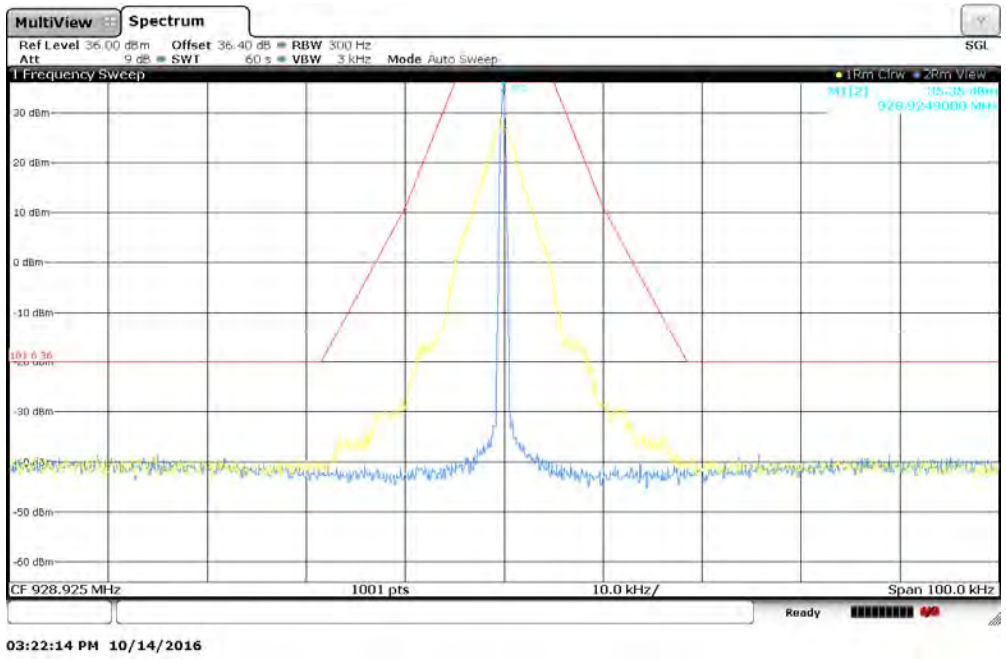

Figure 7.2.2-28: 928.925 MHz –– 25 kHz Channel Spacing - Priority Mode

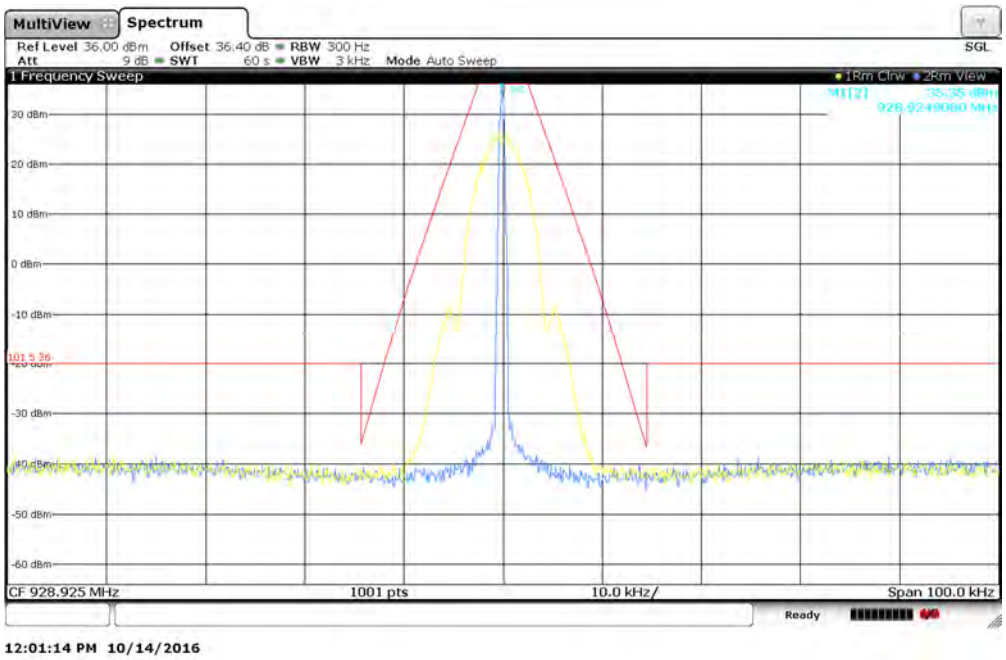

Figure 7.2.2-29: 928.925 MHz –– 12.5 kHz Channel Spacing - 2SFSK (Half Baud) Mode

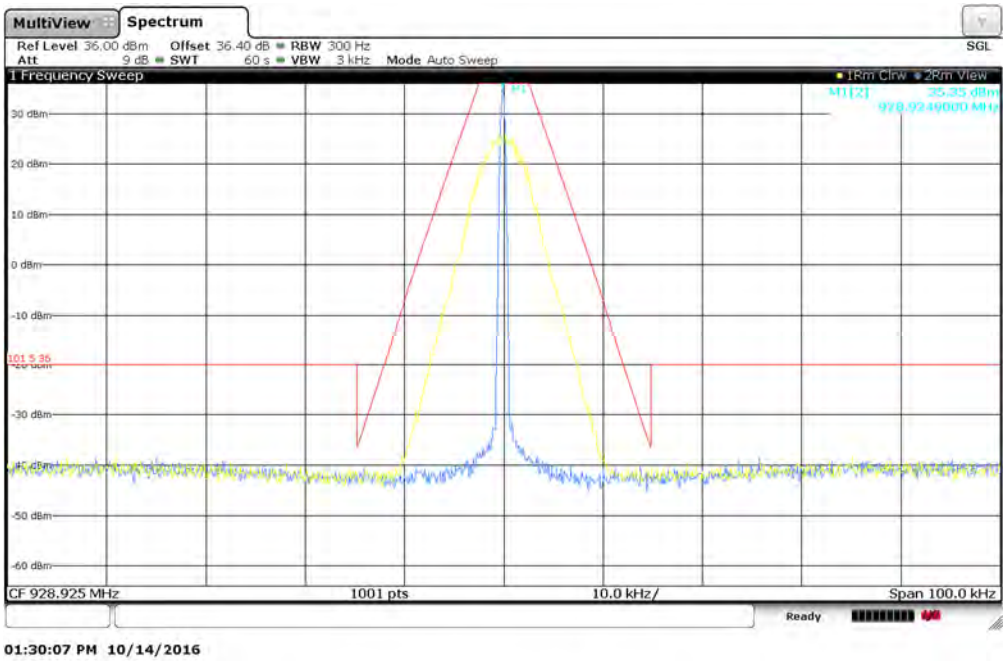

Figure 7.2.2-30: 928.925 MHz –– 12.5 kHz Channel Spacing - 4SFSK (Half Baud) Mode

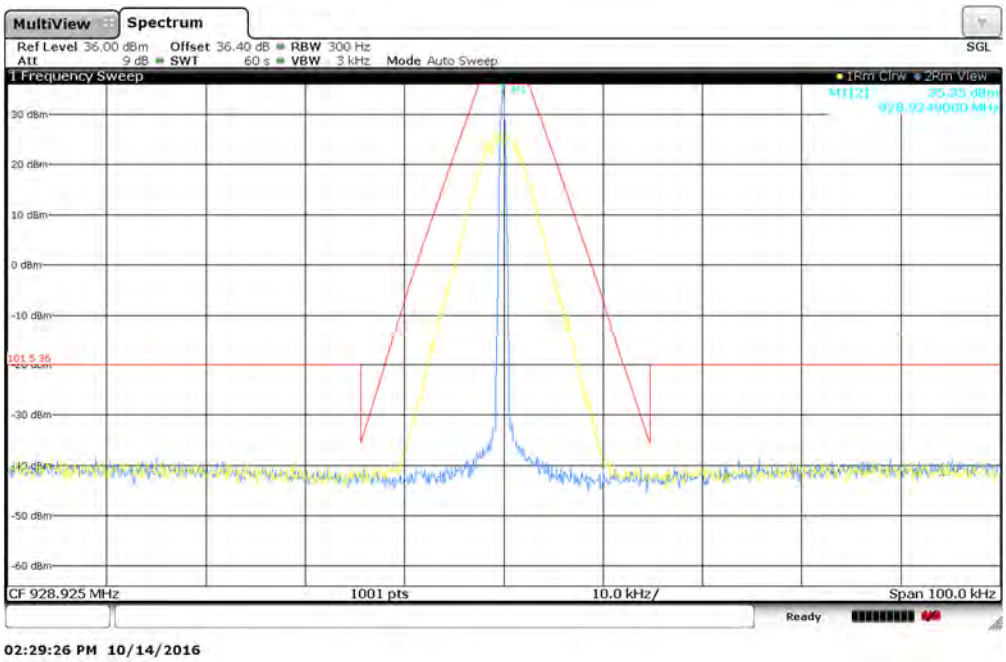

Figure 7.2.2-31: 928.925 MHz –– 12.5 kHz Channel Spacing - 8SFSK (Half Baud) Mode

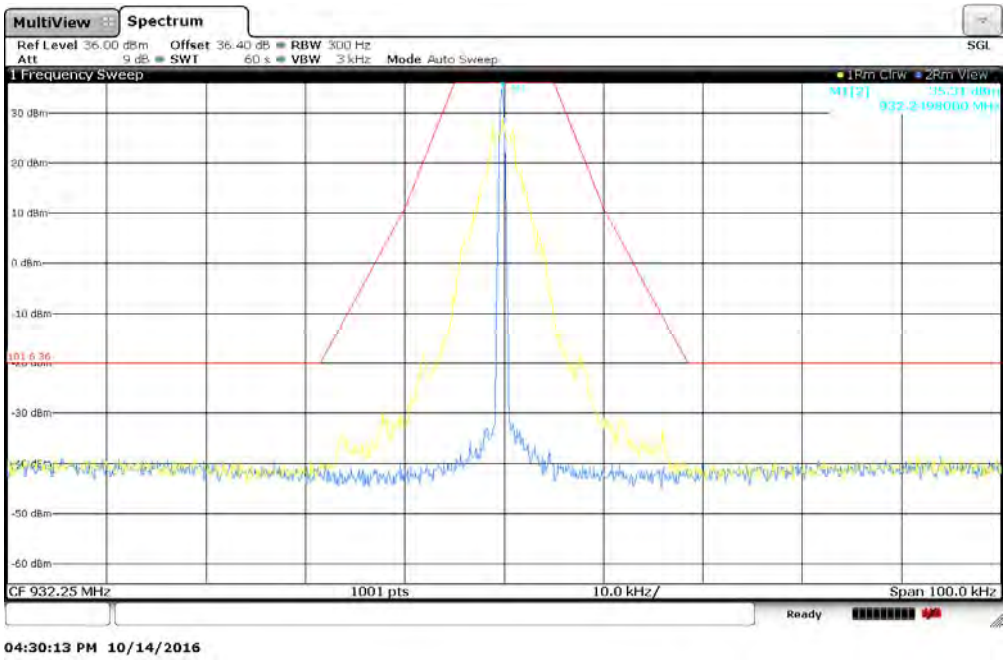

Figure 7.2.2-32: 932.25 MHz – 25 kHz Channel Spacing - C&I Mode

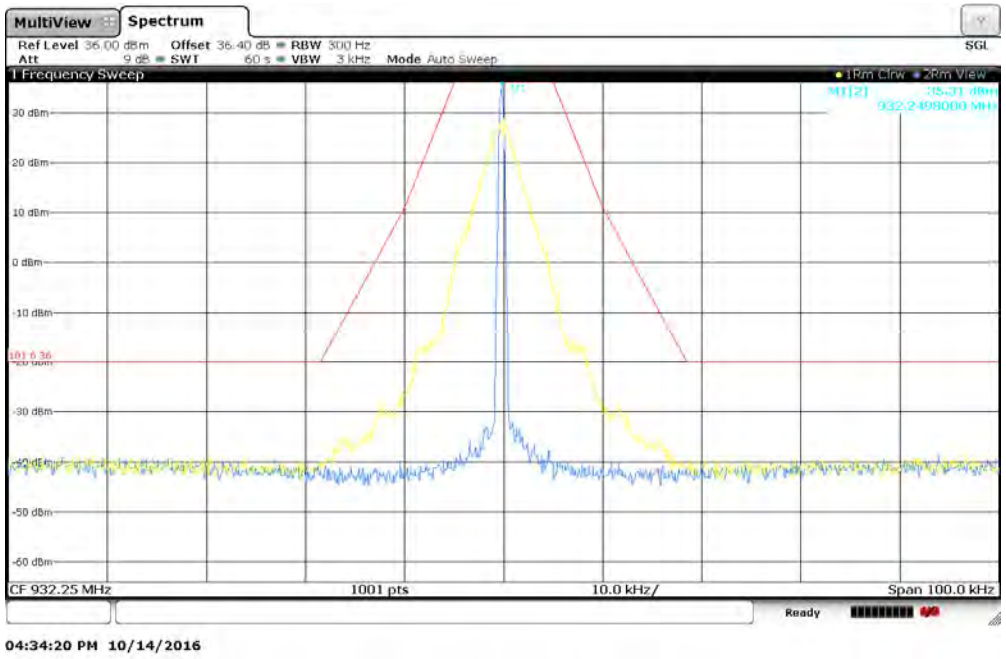

Figure 7.2.2-33: 932.25 MHz –– 25 kHz Channel Spacing - Priority Mode

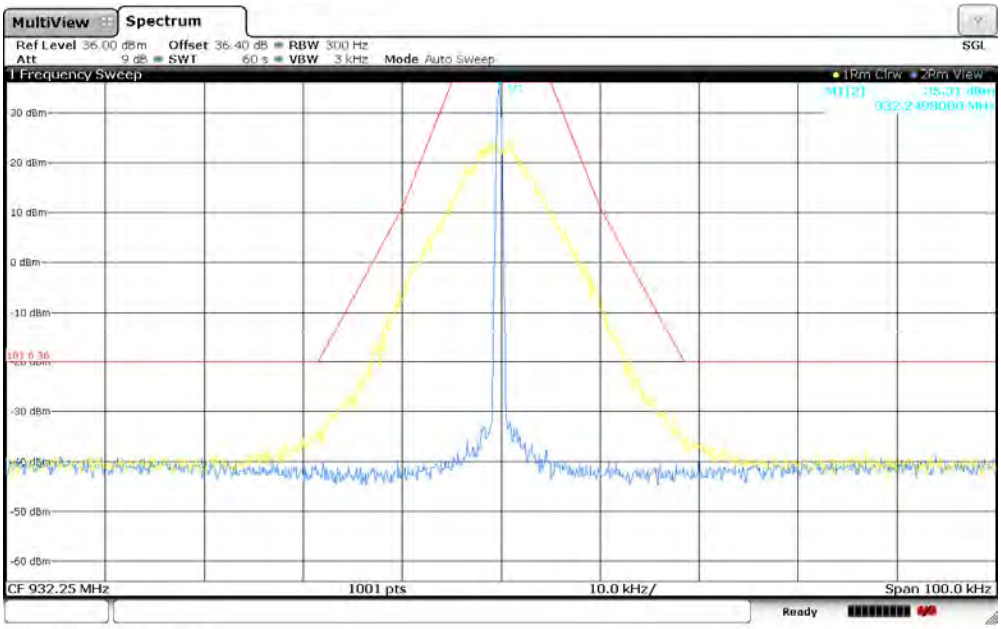

Figure 7.2.2-34: 932.25 MHz – 25 kHz Channel Spacing - Double Density Mode

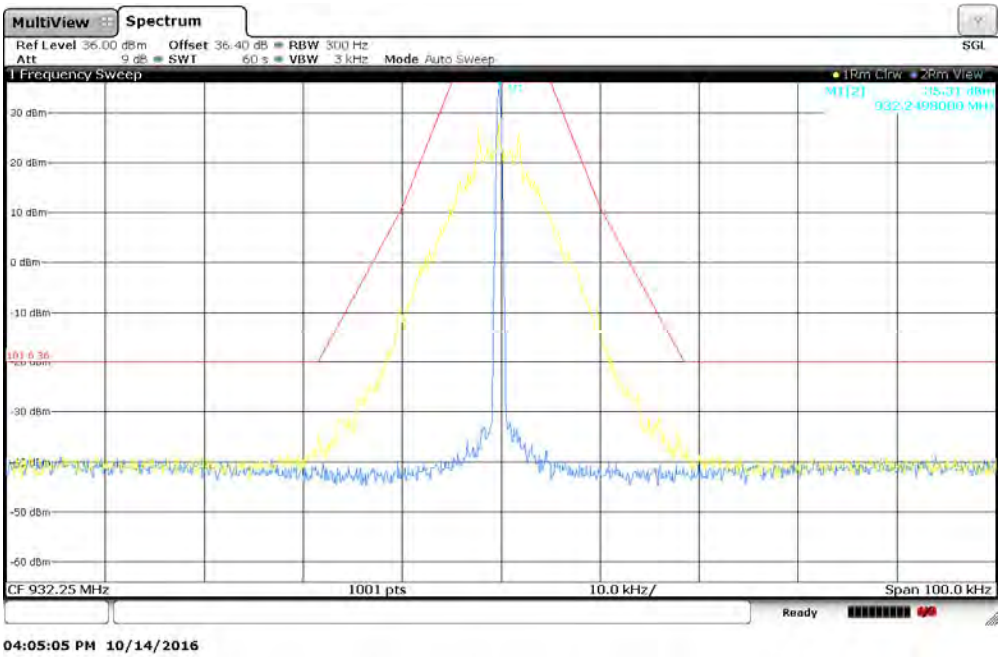

Figure 7.2.2-35: 932.25 MHz – 25 kHz Channel Spacing - Normal Mode

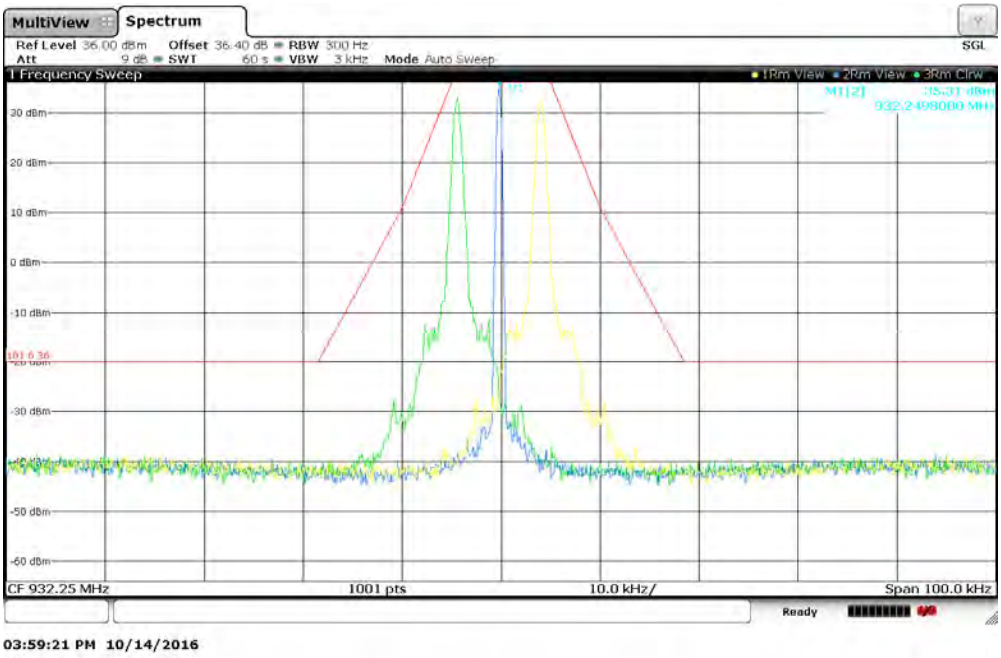

Figure 7.2.2-36: 932.25 MHz – 25 kHz Channel Spacing - Boost Mode

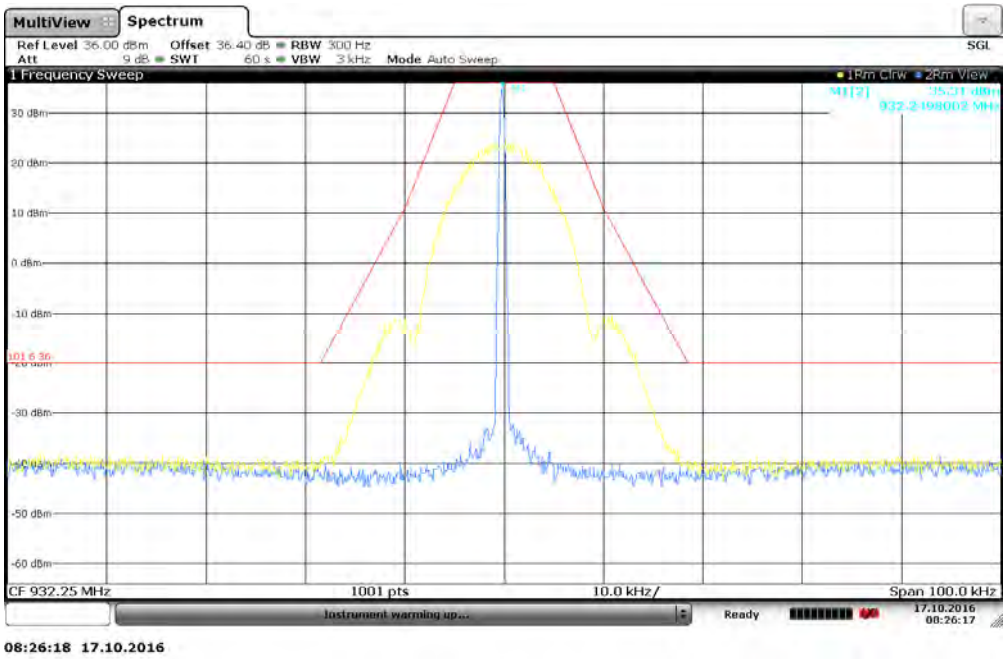

Figure 7.2.2-37: 932.25 MHz –25 kHz Channel Spacing - 2SFSK Mode

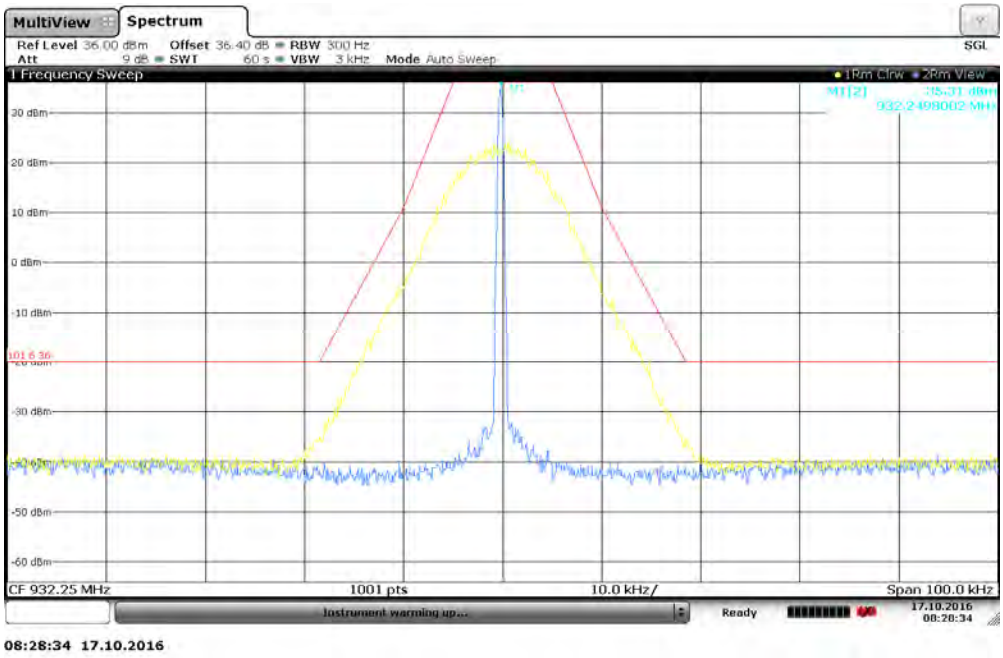

Figure 7.2.2-38: 932.25 MHz – 25 kHz Channel Spacing - 4SFSK Mode

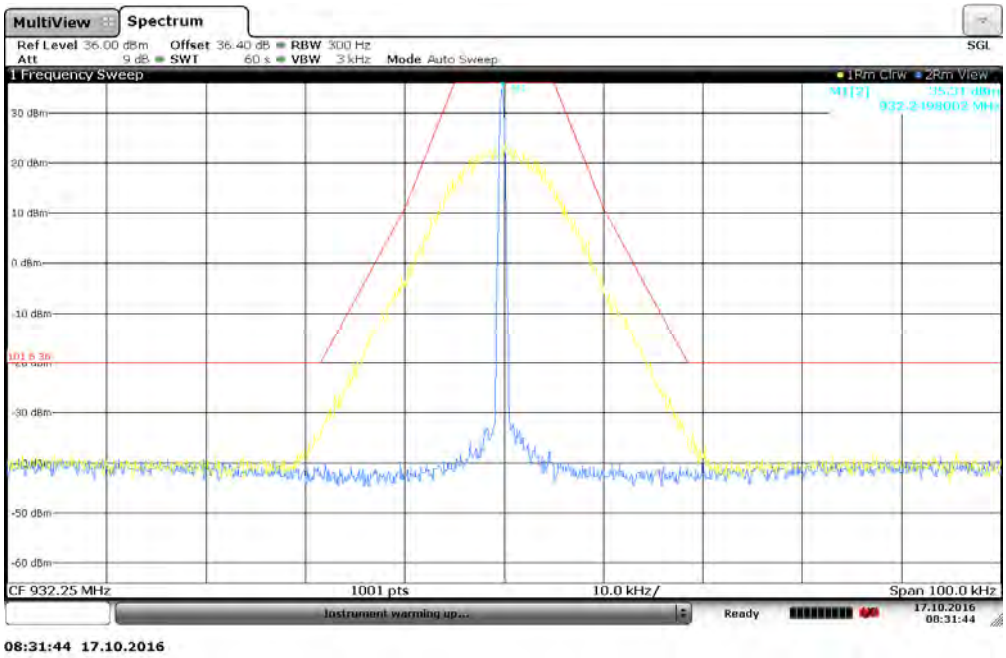

Figure 7.2.2-39: 932.25 MHz – 25 kHz Channel Spacing - 8SFSK Mode

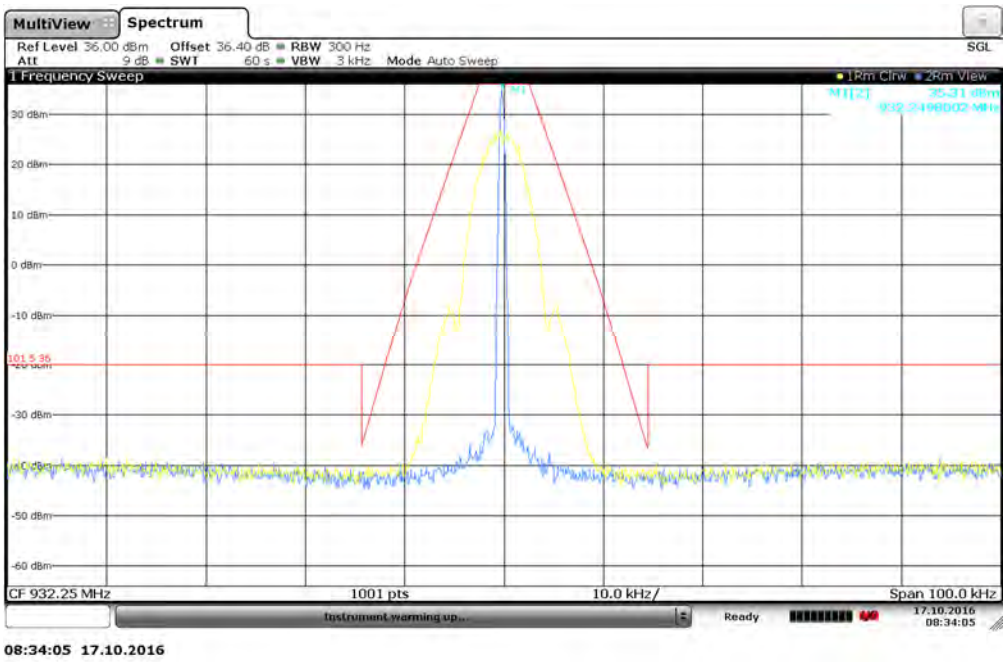

Figure 7.2.2-40: 932.25 MHz –12.5 kHz Channel Spacing - 2SFSK (Half Baud) Mode

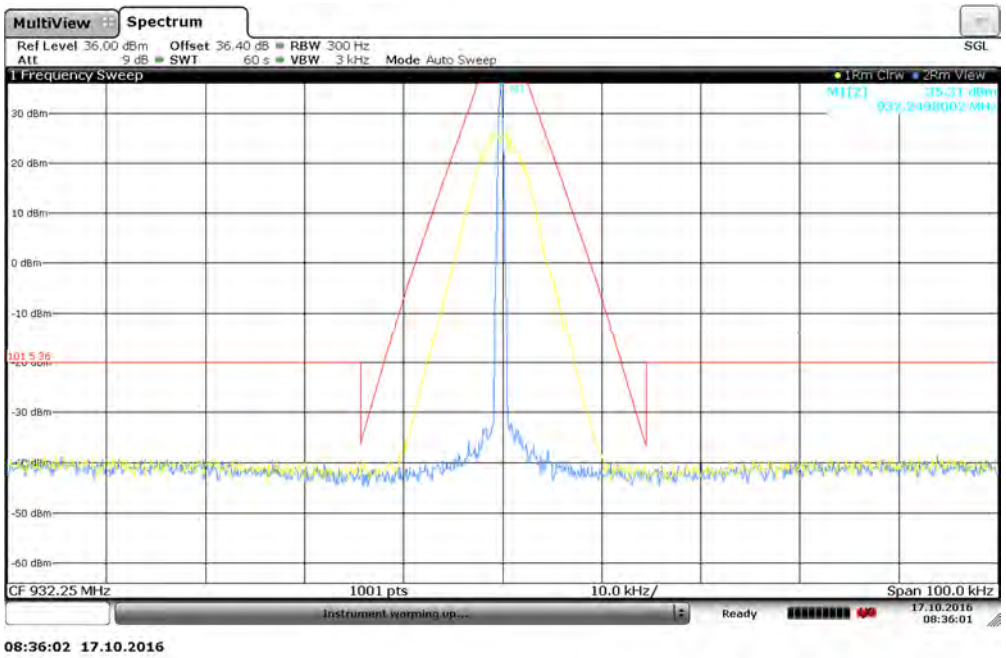

Figure 7.2.2-41: 932.25 MHz – 12.5 kHz Channel Spacing - 4SFSK (Half Baud) Mode

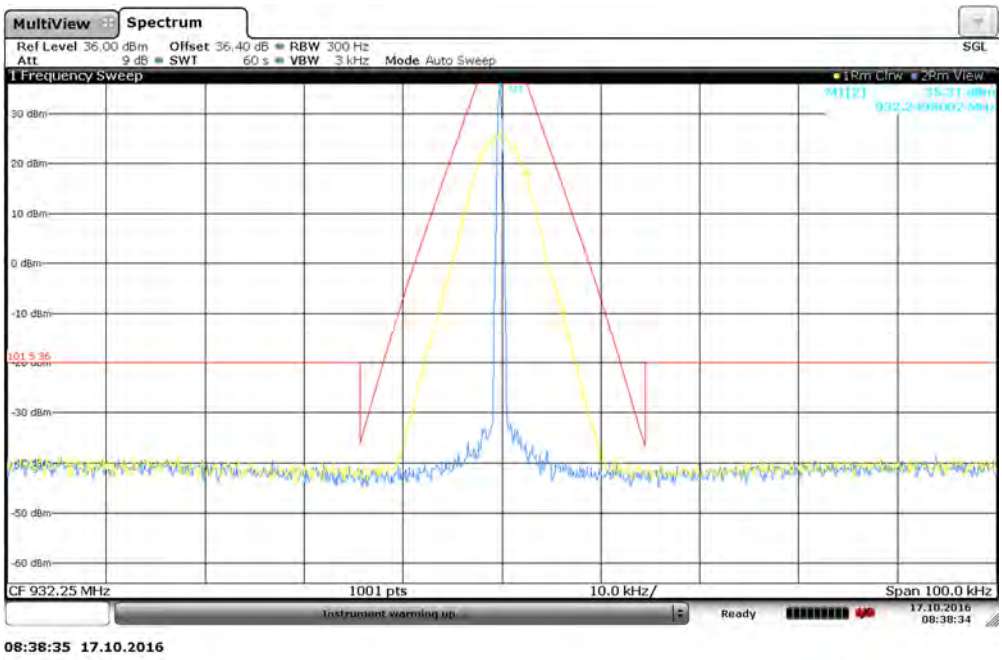

Figure 7.2.2-42: 932.25 MHz – 12.5 kHz Channel Spacing - 8SFSK (Half Baud) Mode

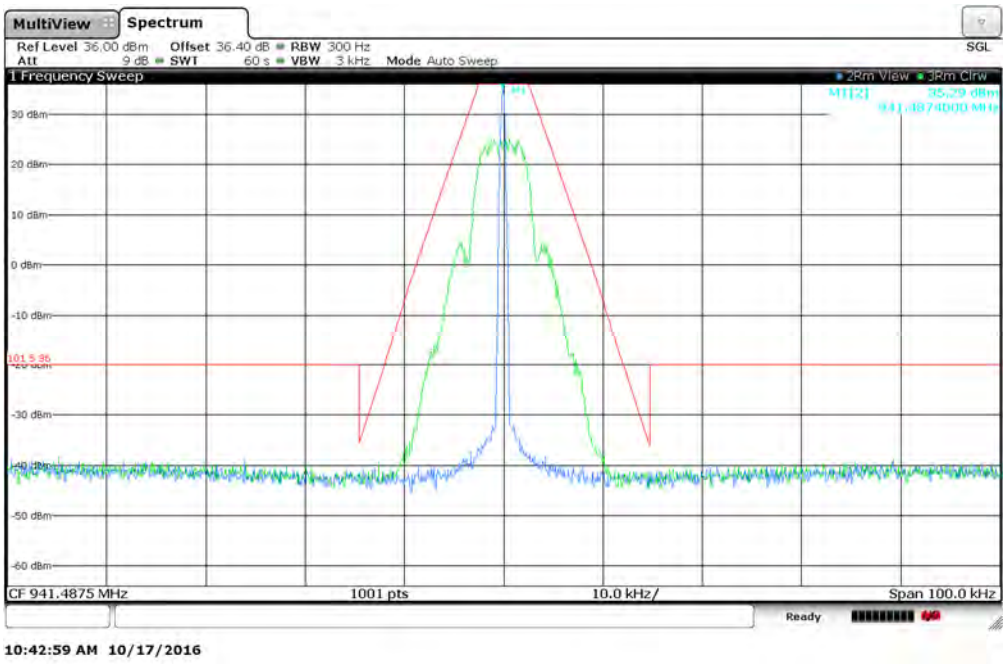

Figure 7.2.2-43: 941.4875 MHz - 12.5 kHz Channel Spacing – mPass 5k Mode

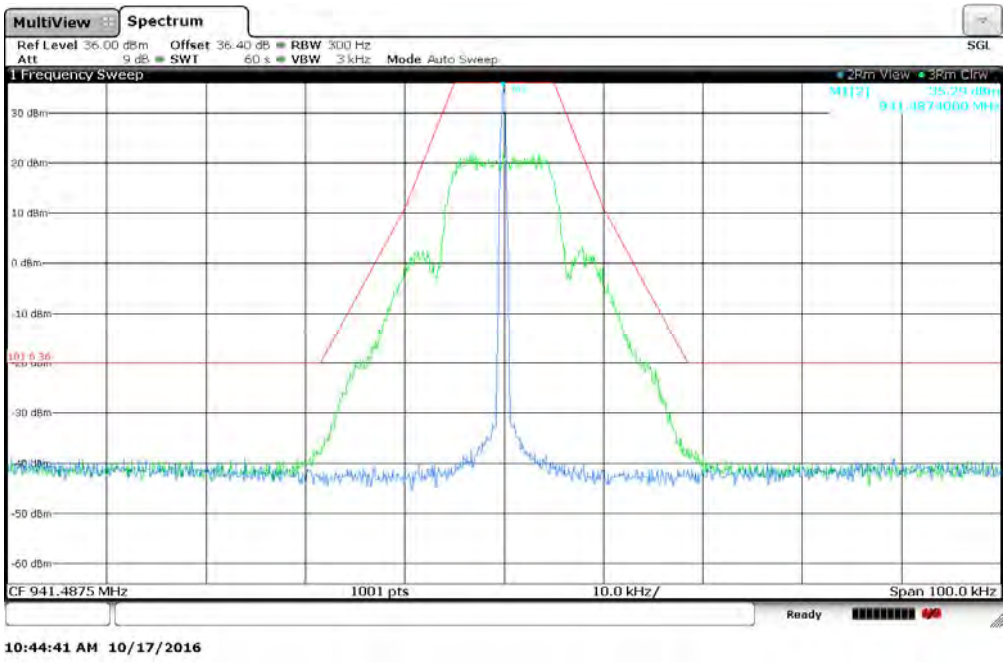

Figure 7.2.2-44: 941.4875 MHz – 25 kHz Channel Spacing – mPass 10k Mode

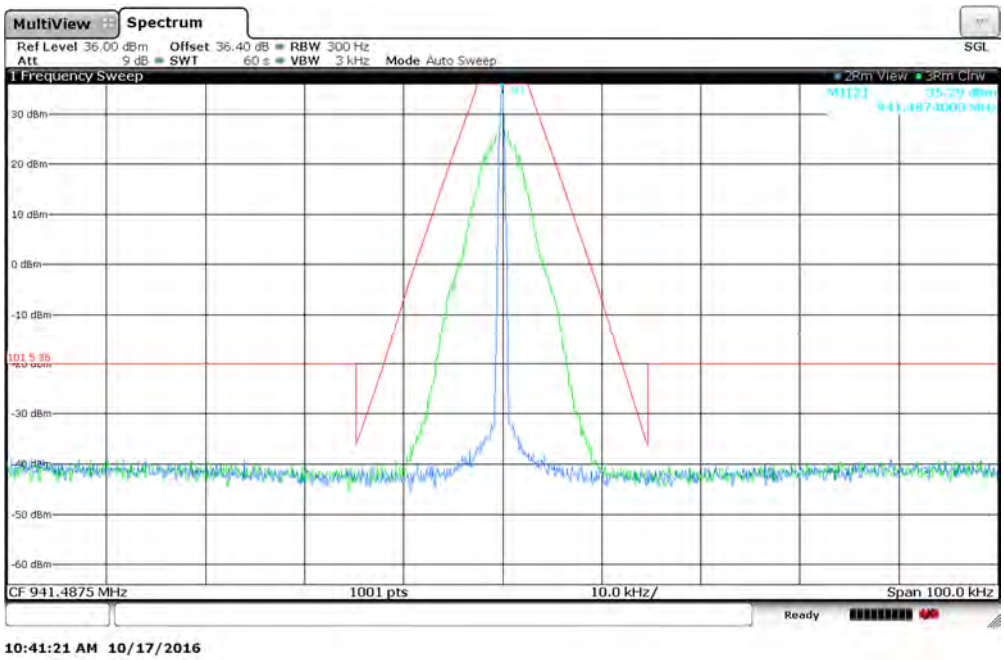

Figure 7.2.2-45: 941.4875 MHz - 12.5 kHz Channel Spacing – m4Pass 10k Mode

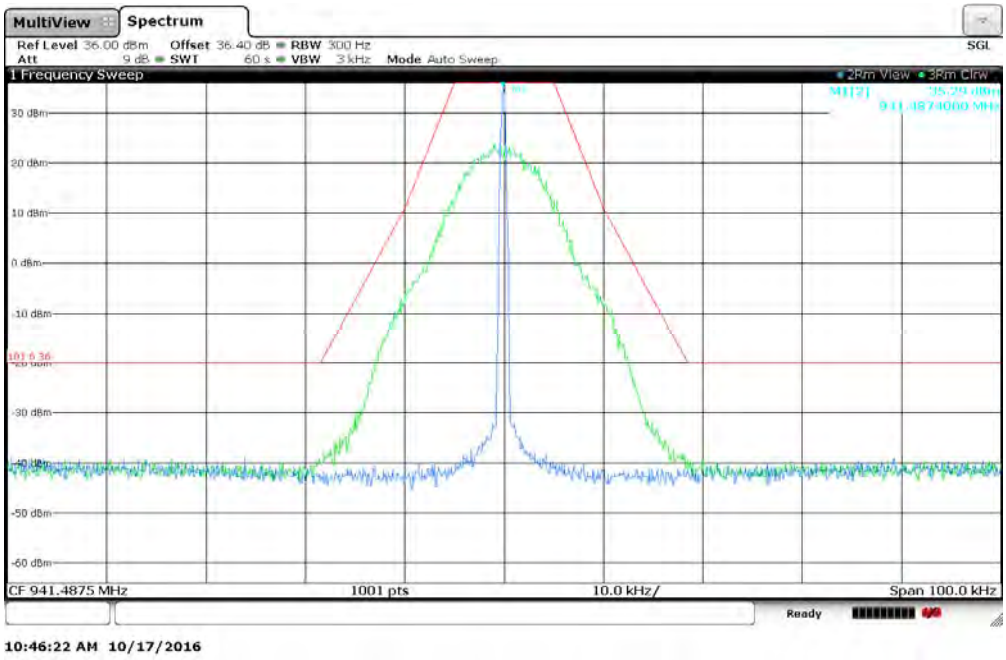

Figure 7.2.2-46: 941.4875 MHz – 25 kHz Channel Spacing – m4Pass 20k Mode

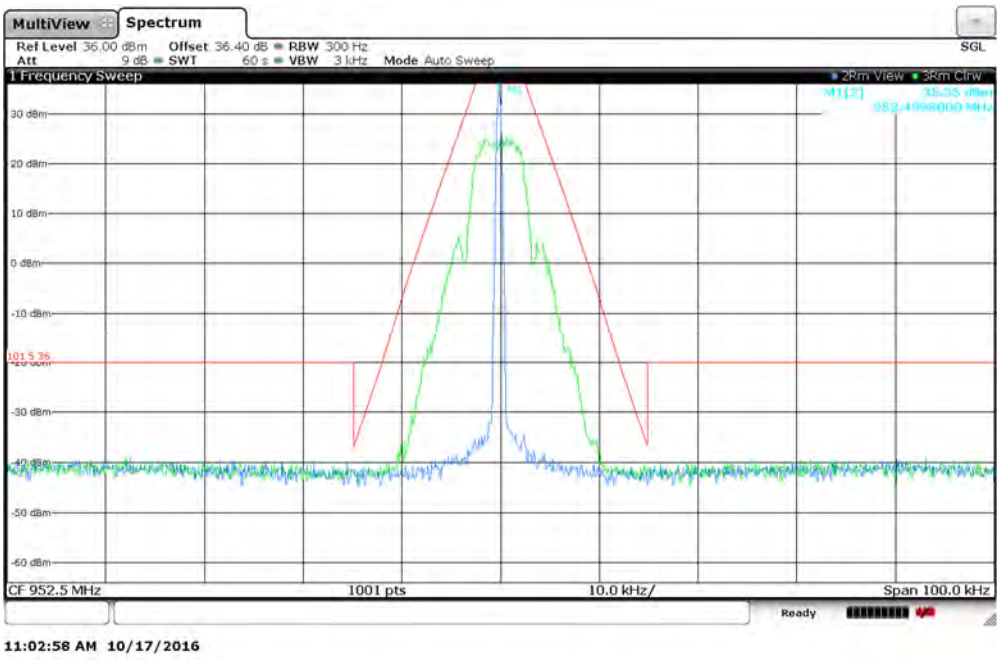

Figure 7.2.2-47: 952.5 MHz - 12.5 kHz Channel Spacing – mPass 5k Mode

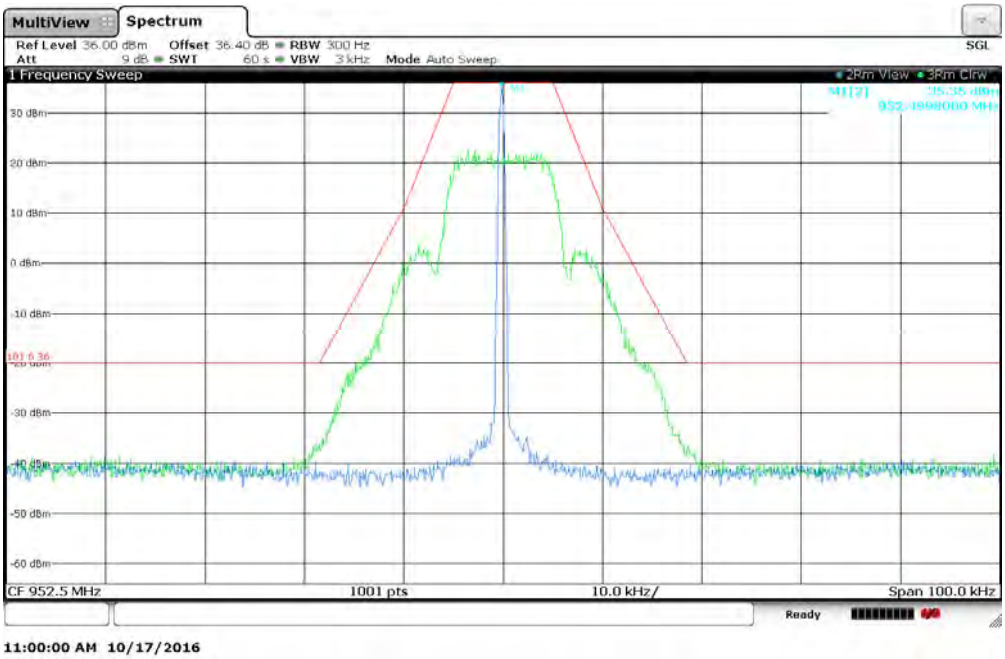

Figure 7.2.2-48: 952.5 MHz – 25 kHz Channel Spacing – mPass 10k Mode

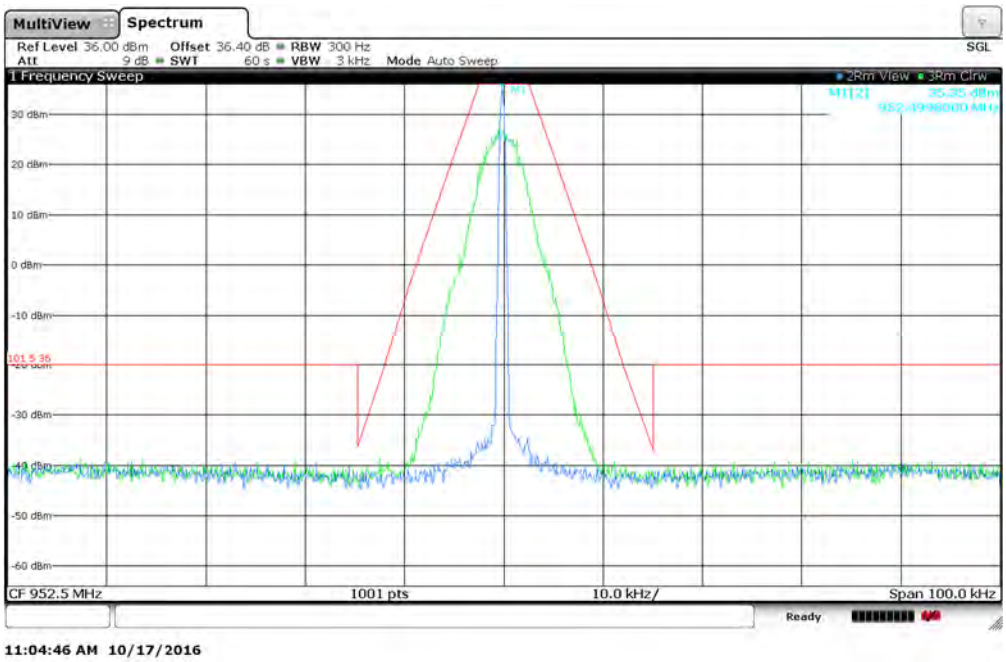

Figure 7.2.2-49: 952.5 MHz - 12.5 kHz Channel Spacing – m4Pass 10k Mode

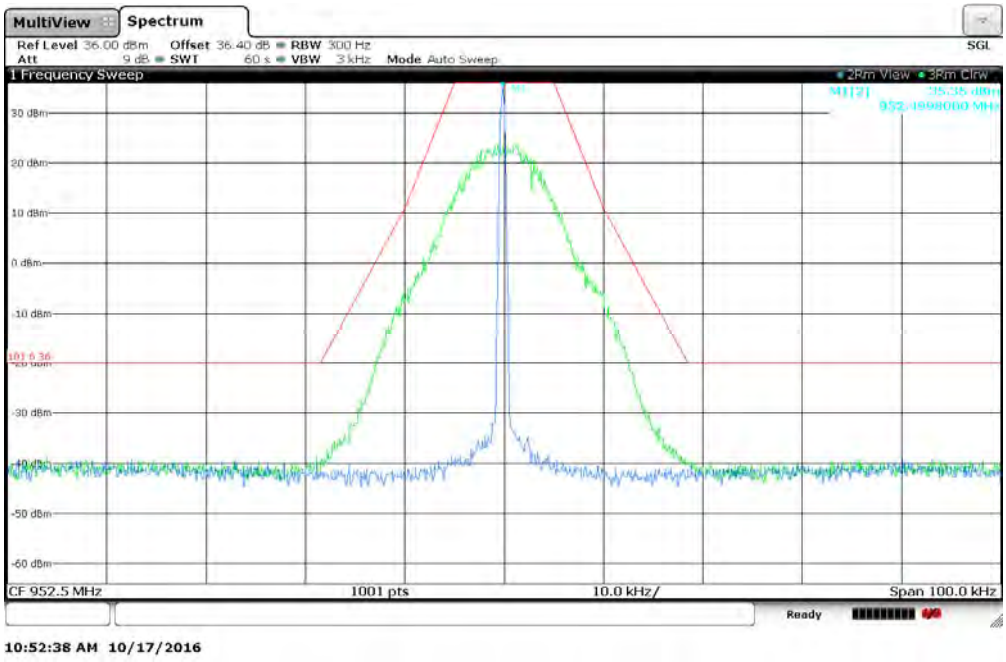

Figure 7.2.2-50: 952.5 MHz – 25 kHz Channel Spacing – m4Pass 20k Mode

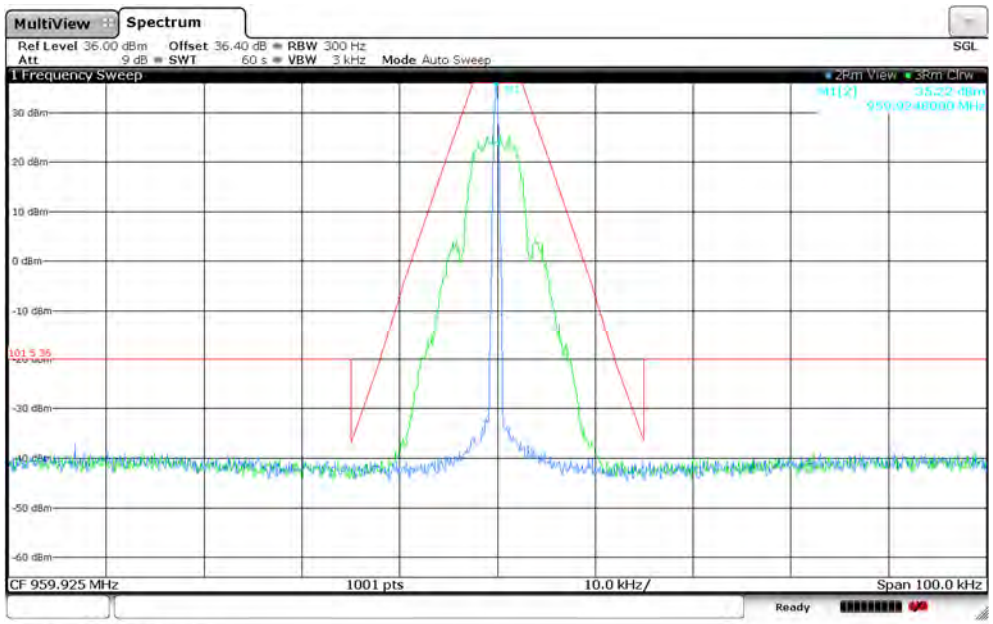

Figure 7.2.2-51: 959.925 MHz - 12.5 kHz Channel Spacing – mPass 5k Mode

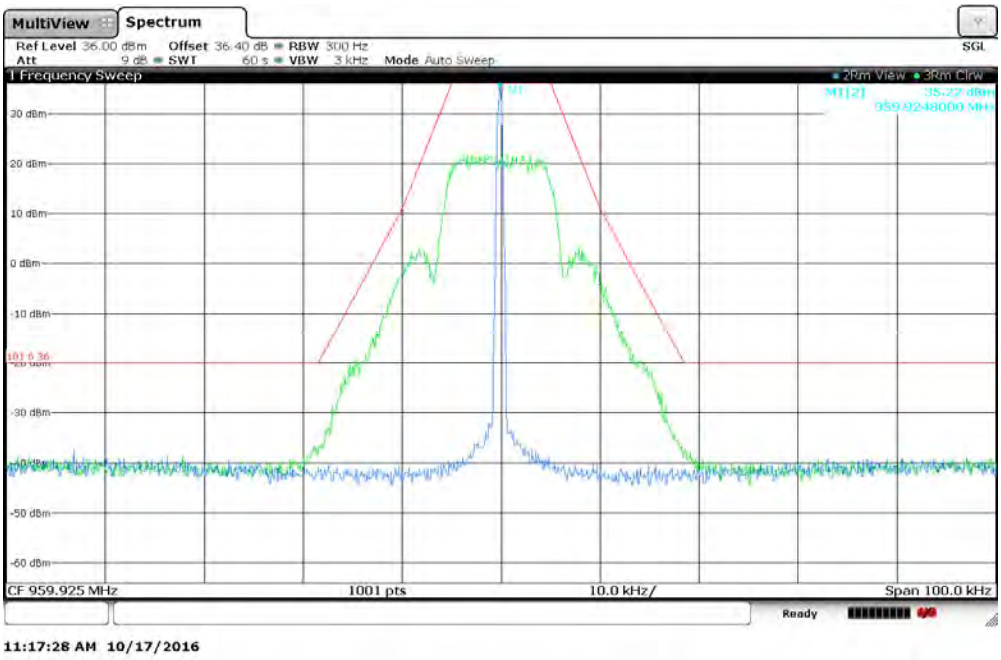

Figure 7.2.2-52: 959.925 MHz – 25 kHz Channel Spacing – mPass 10k Mode

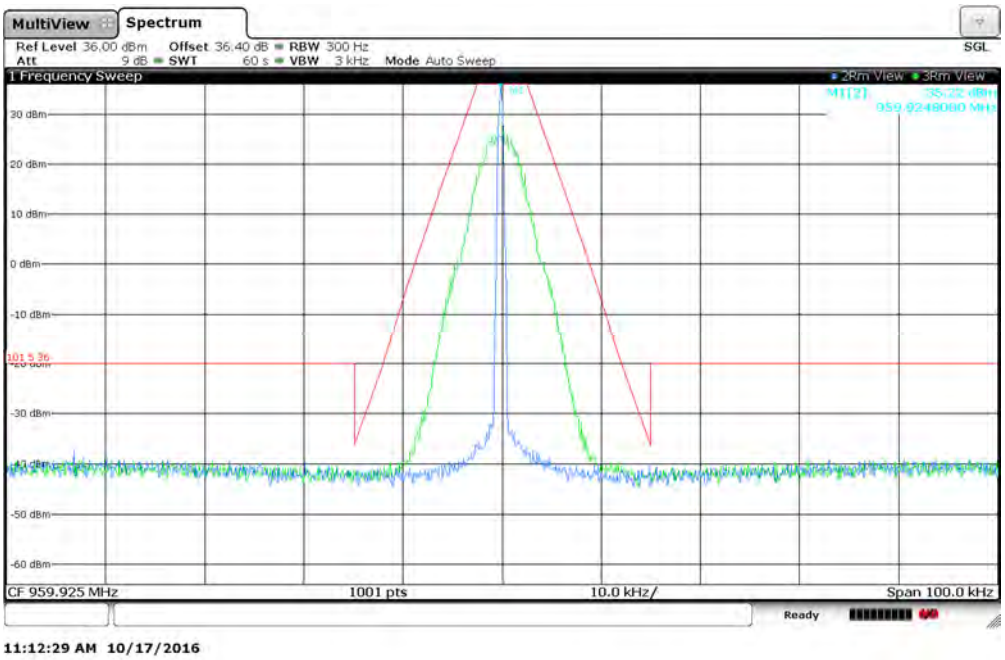

Figure 7.2.2-53: 959.925 MHz - 12.5 kHz Channel Spacing – m4Pass 10k Mode

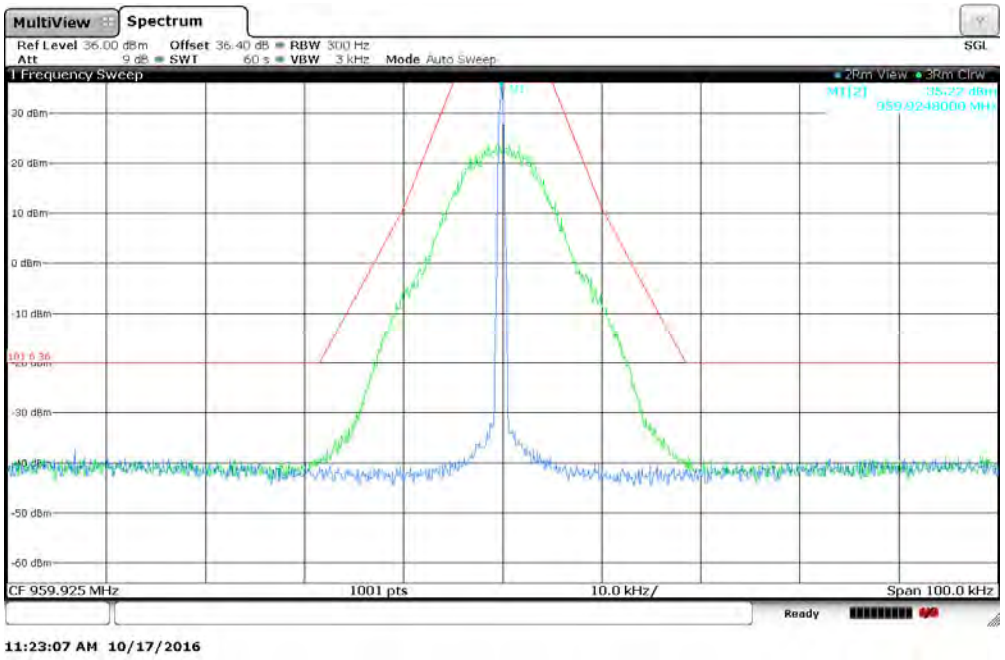

Figure 7.2.2-54: 959.925 MHz – 25 kHz Channel Spacing – m4Pass 20k Mode

Part 24.132, 101.113 (a), and ISED Canada RSS-134 4.3(a), (b) and RSS-119 5.4 – Power Output

ILSI
Low Power

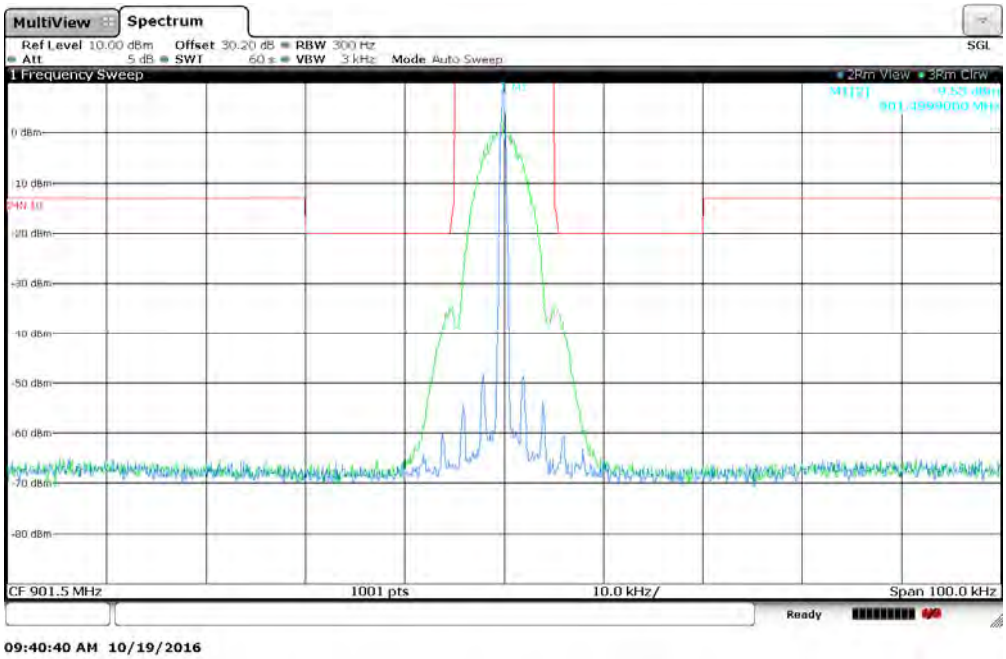

Figure 7.2.2-55: 901.5 MHz – 12.5 kHz Channel Spacing – 2SFSK (Half Baud) Mode

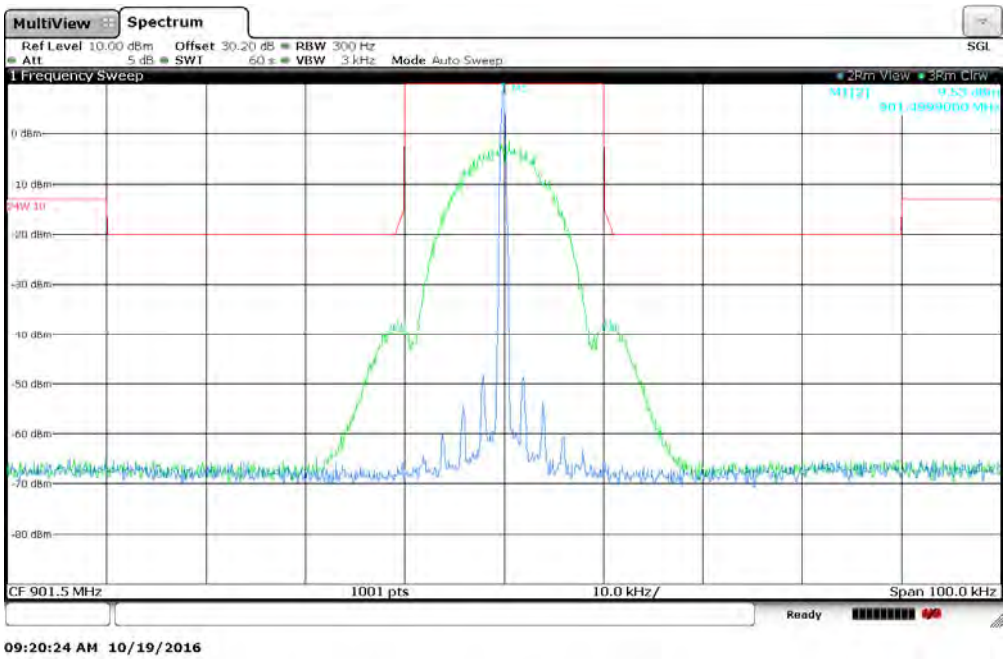

Figure 7.2.2-56: 901.5 MHz – 25 kHz Channel Spacing – 2SFSK Mode

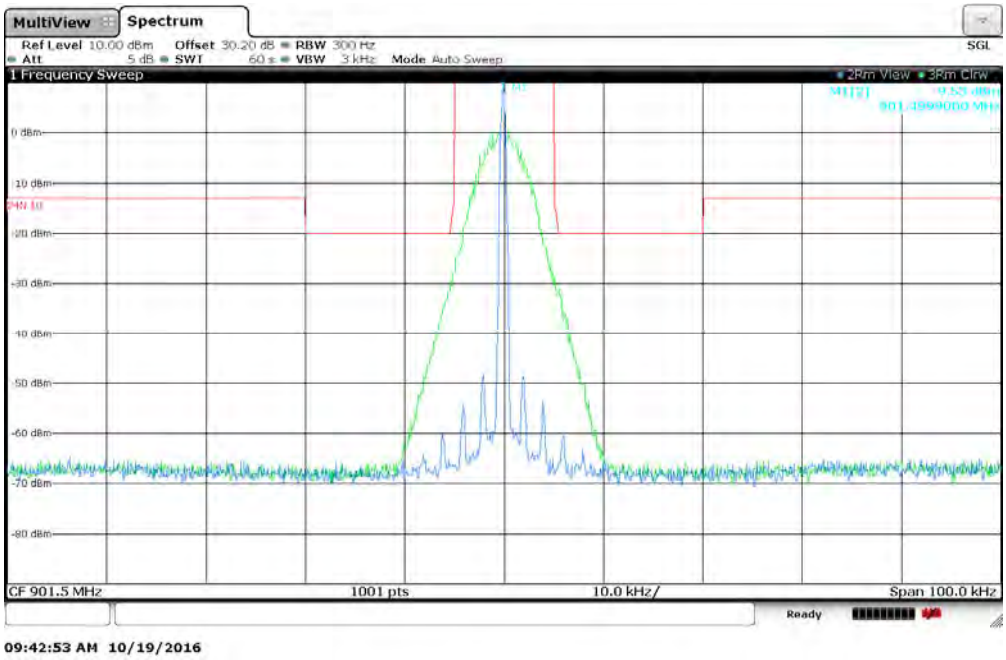

Figure 7.2.2-57: 901.5 MHz – 12.5 kHz Channel Spacing – 4SFSK (Half Baud) Mode

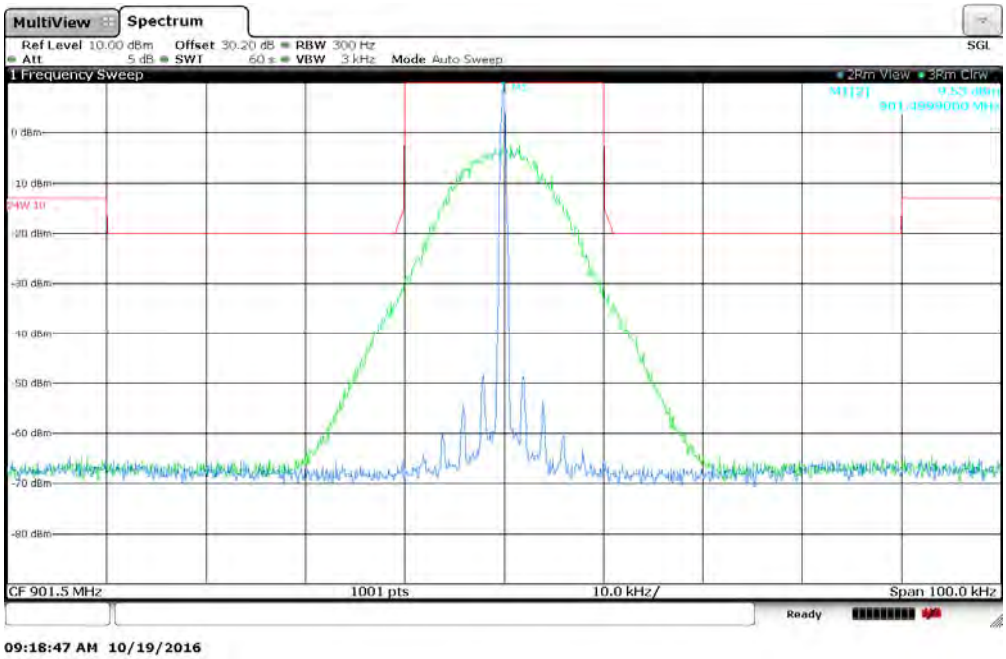

Figure 7.2.2-58: 901.5 MHz – 25 kHz Channel Spacing – 4SFSK Mode

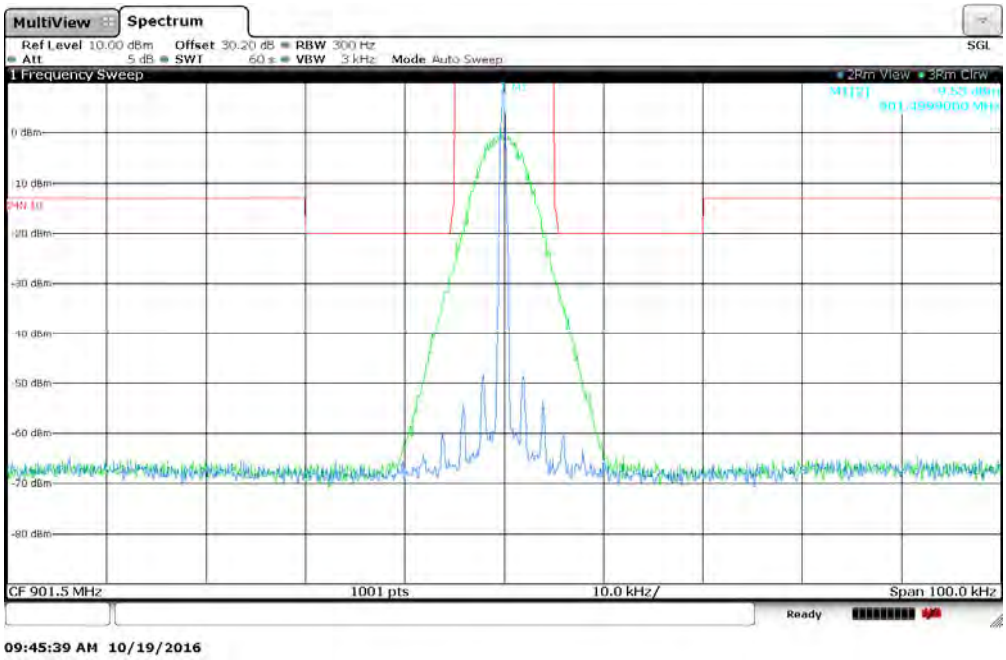

Figure 7.2.2-59: 901.5 MHz – 12.5 kHz Channel Spacing – 8SFSK (Half Baud) Mode

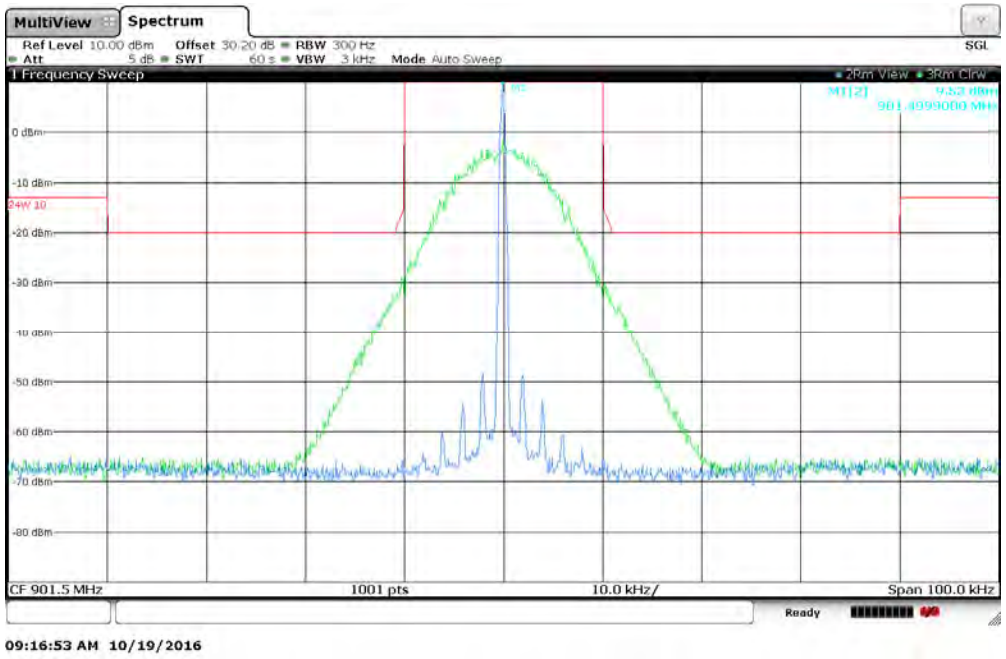

Figure 7.2.2-60: 901.5 MHz – 25 kHz Channel Spacing – 8SFSK Mode

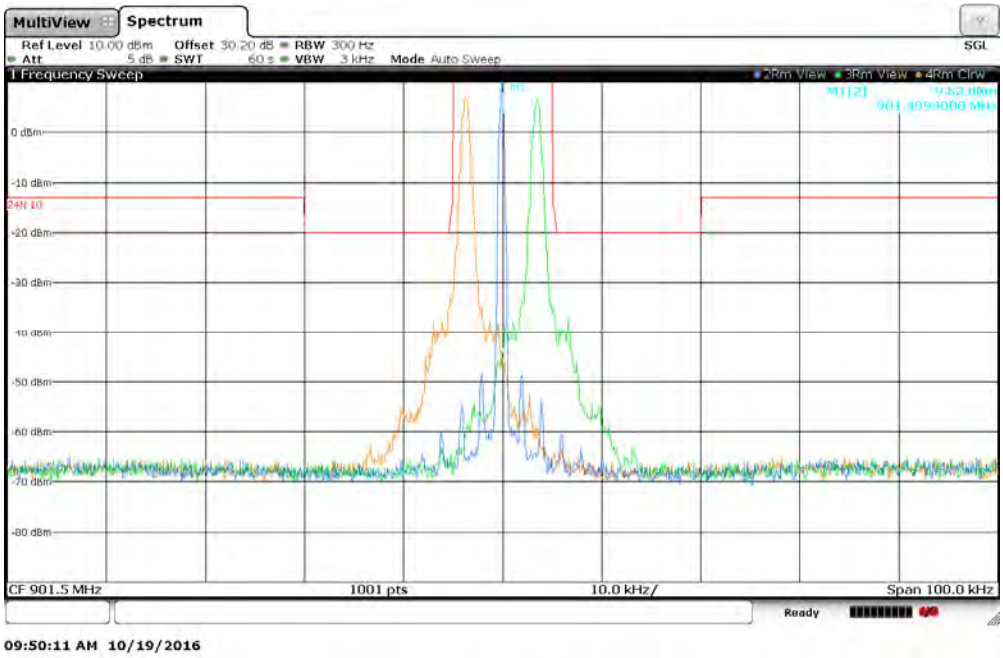

Figure 7.2.2-61: 901.5 MHz – 12.5 kHz Channel Spacing – Boost Mode

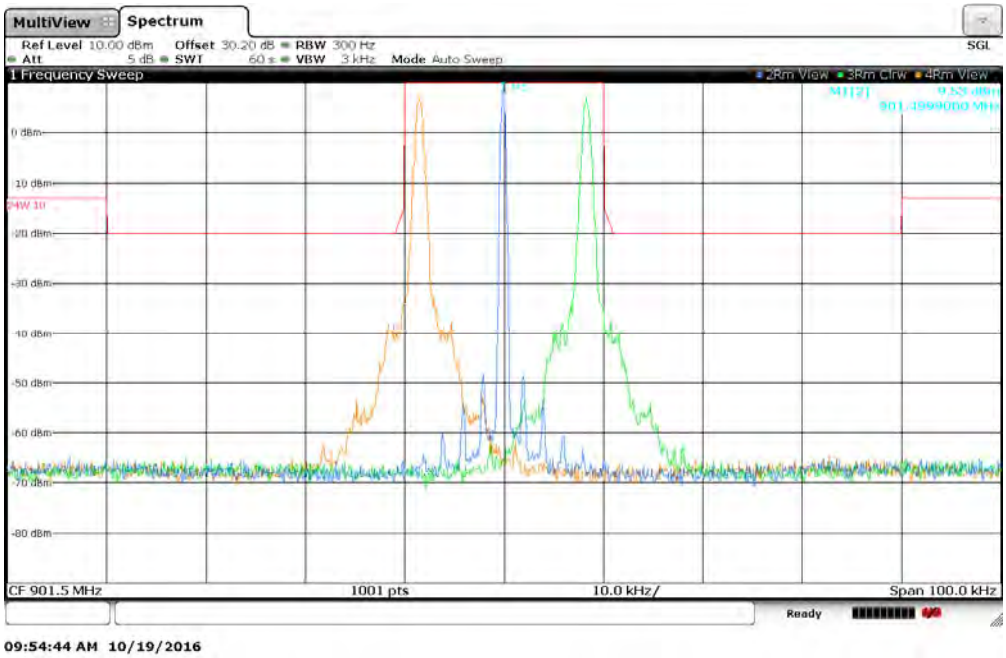

Figure 7.2.2-62: 901.5 MHz – 25 kHz Channel Spacing – Boost Mode

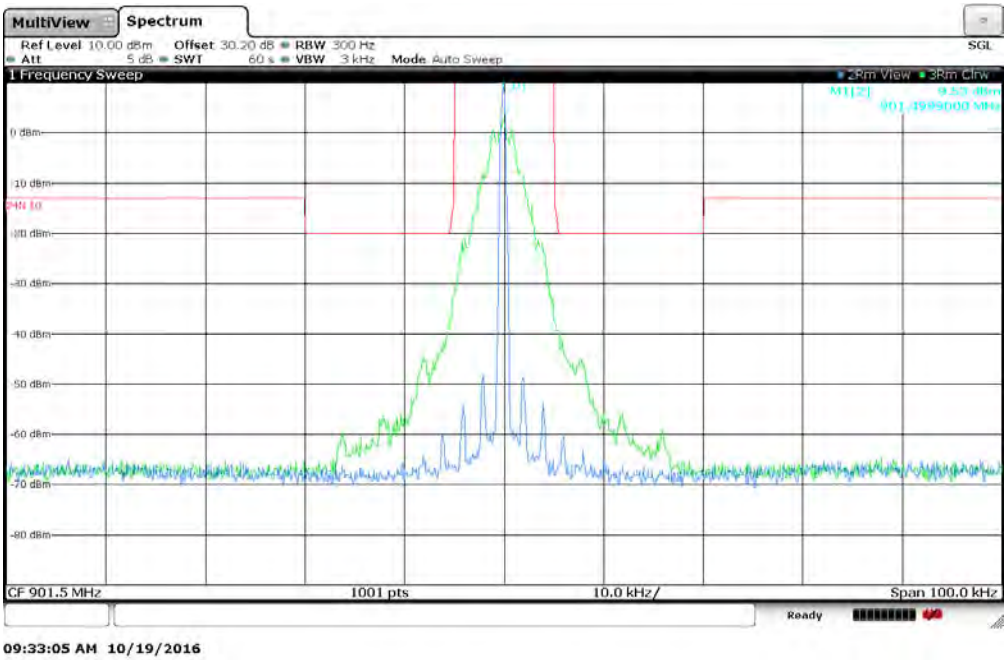

Figure 7.2.2-63: 901.5 MHz – 12.5 kHz Channel Spacing – C&I (Half Baud) Mode

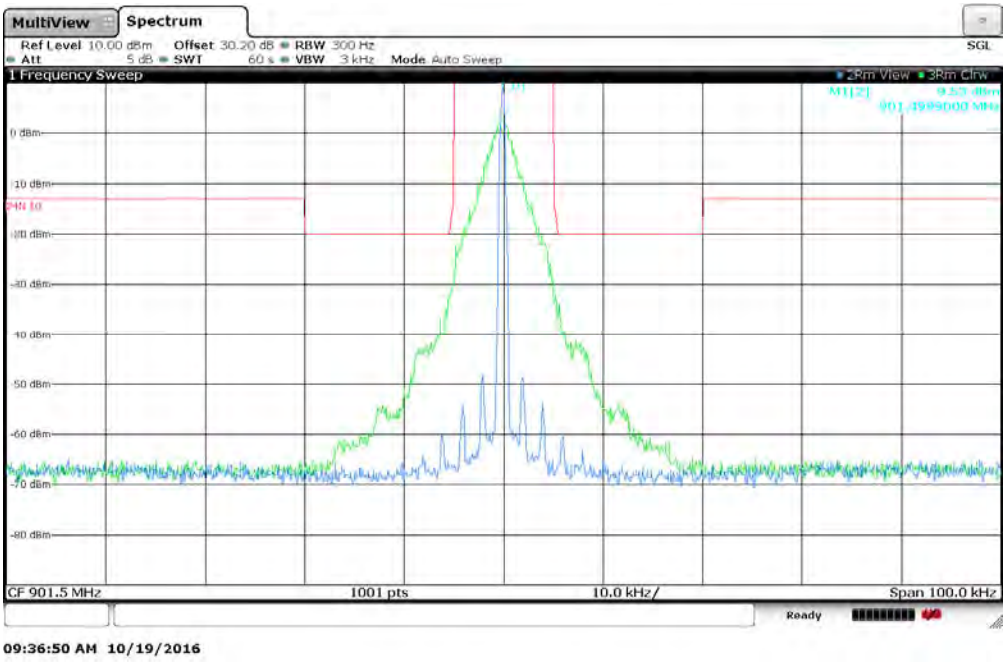

Figure 7.2.2-64: 901.5 MHz – 12.5 kHz Channel Spacing – Priority Mode

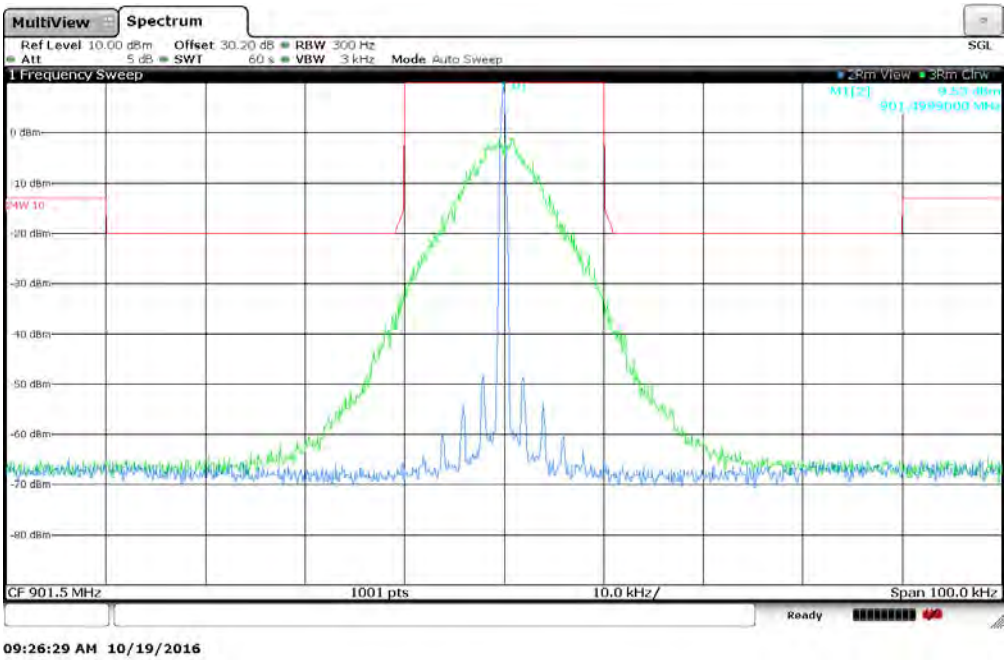

Figure 7.2.2-65: 901.5 MHz – 25 kHz Channel Spacing – Double Density Mode

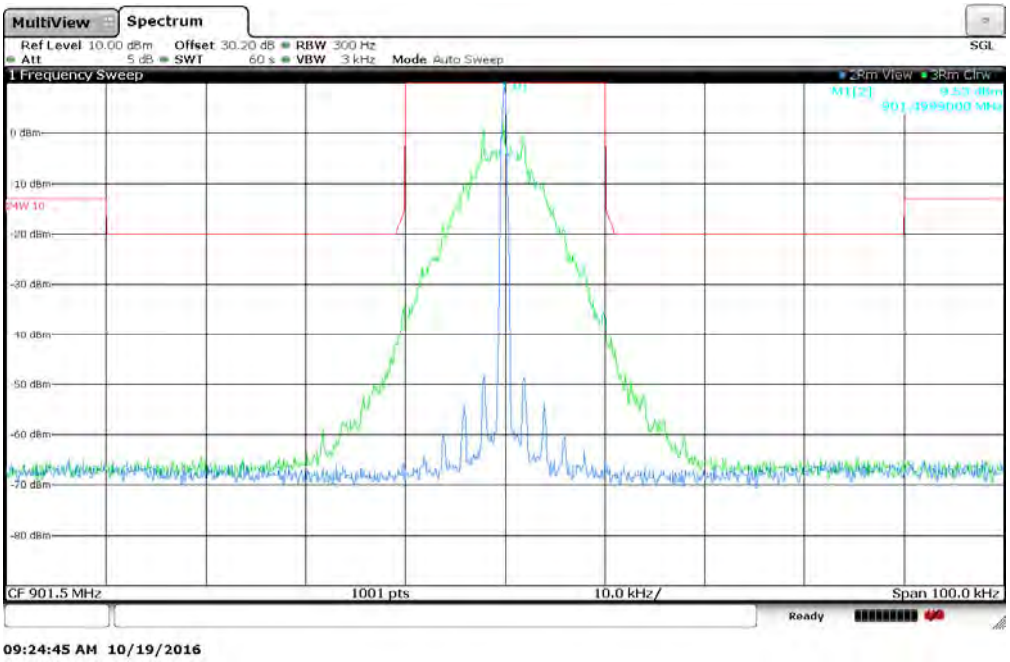

Figure 7.2.2-66: 901.5 MHz – 25 kHz Channel Spacing – Normal Mode

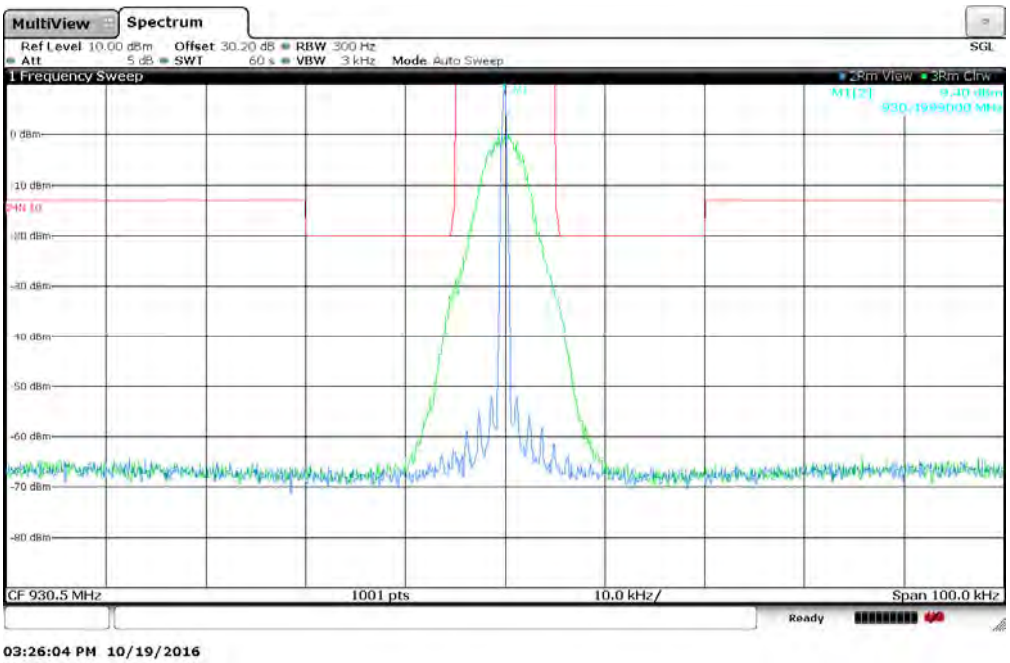

Figure 7.2.2-67: 930.5 MHz - 12.5 kHz Channel Spacing – m4Pass 10k Mode

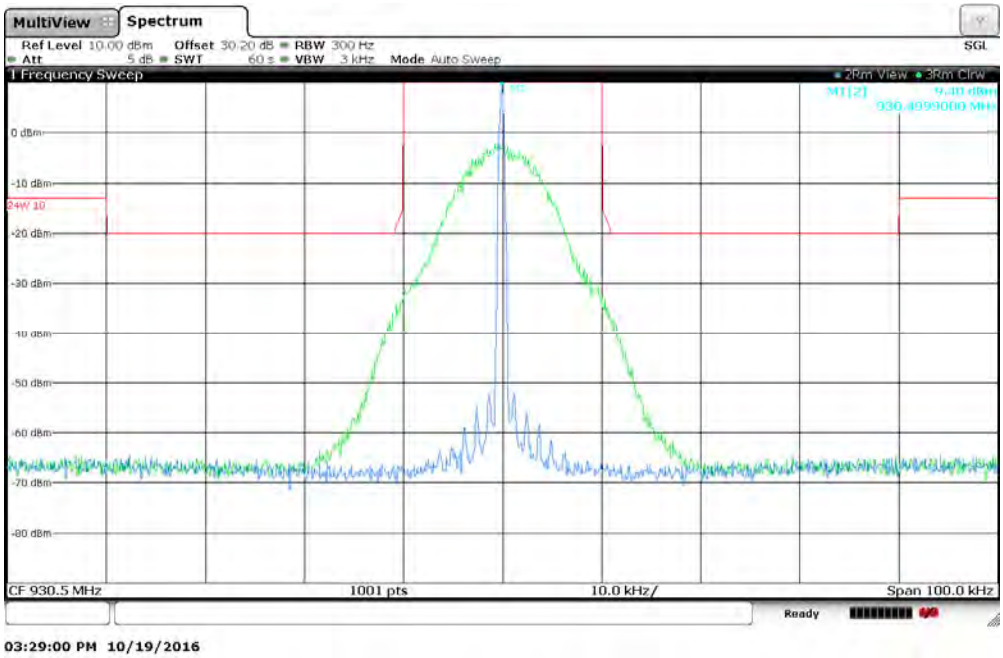

Figure 7.2.2-68: 930.5 MHz – 25 kHz Channel Spacing – m4Pass 20k Mode

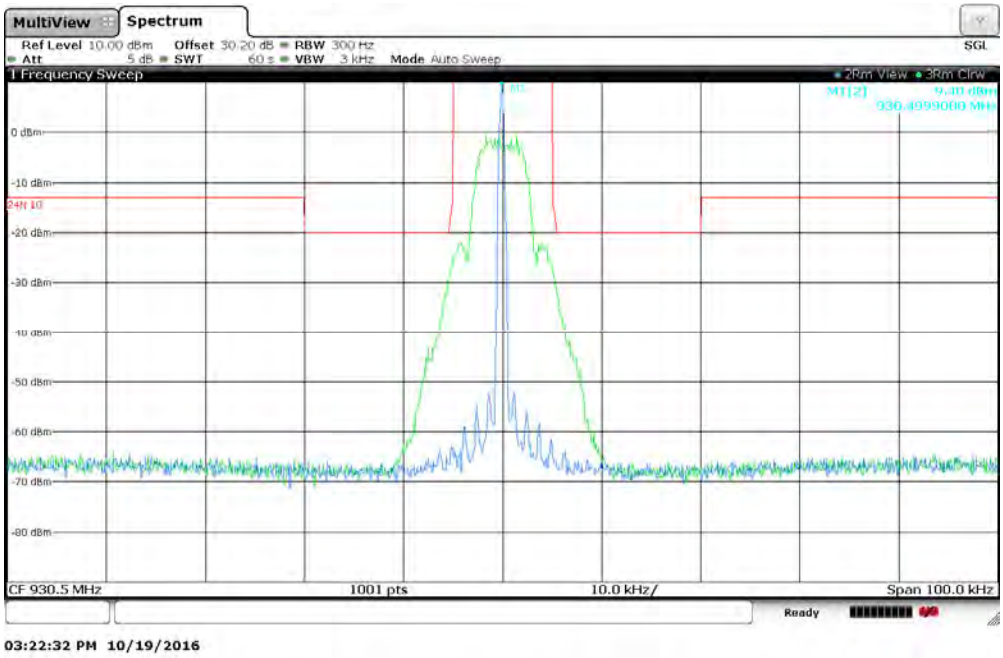

Figure 7.2.2-69: 930.5 MHz – 12.5 kHz Channel Spacing – MPass 5k Mode

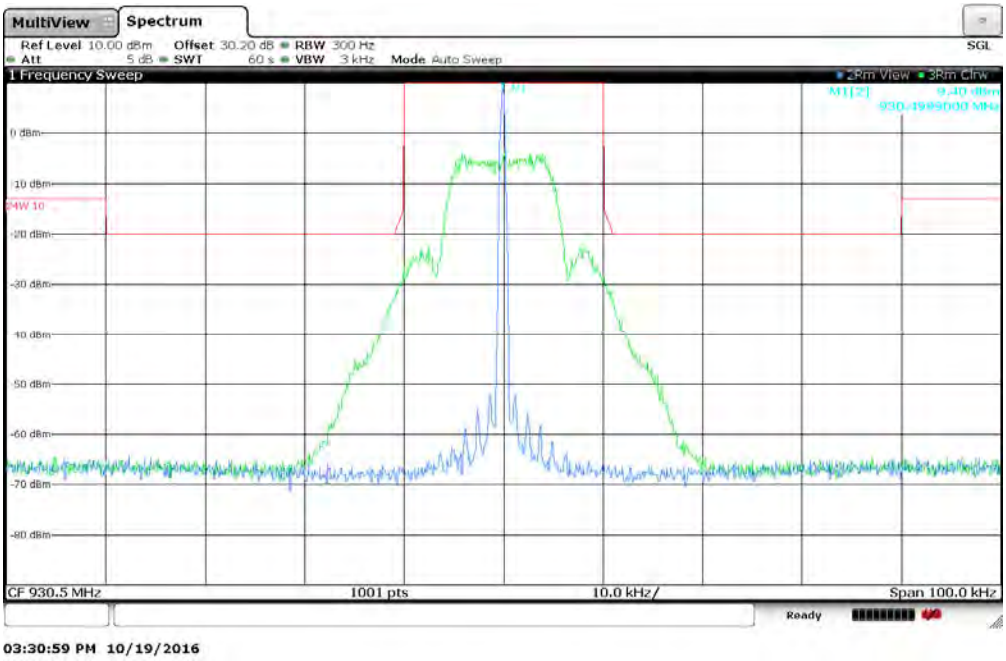

Figure 7.2.2-70: 930.5 MHz – 25 kHz Channel Spacing – MPass 10k Mode

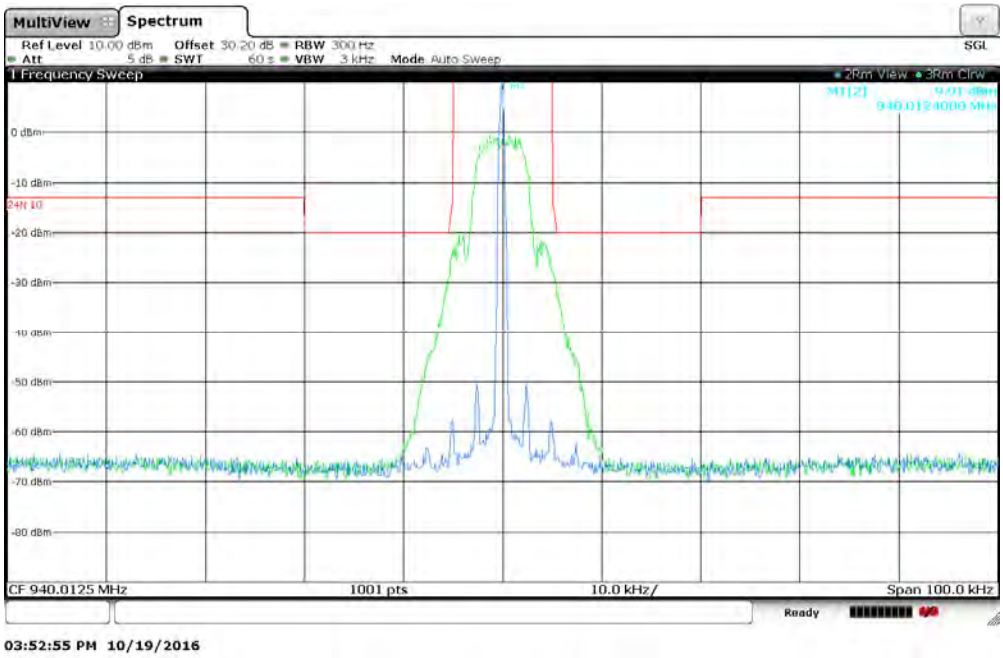

Figure 7.2.2-71: 940.0125 MHz – 12.5 kHz Channel Spacing – mPass 5k Mode

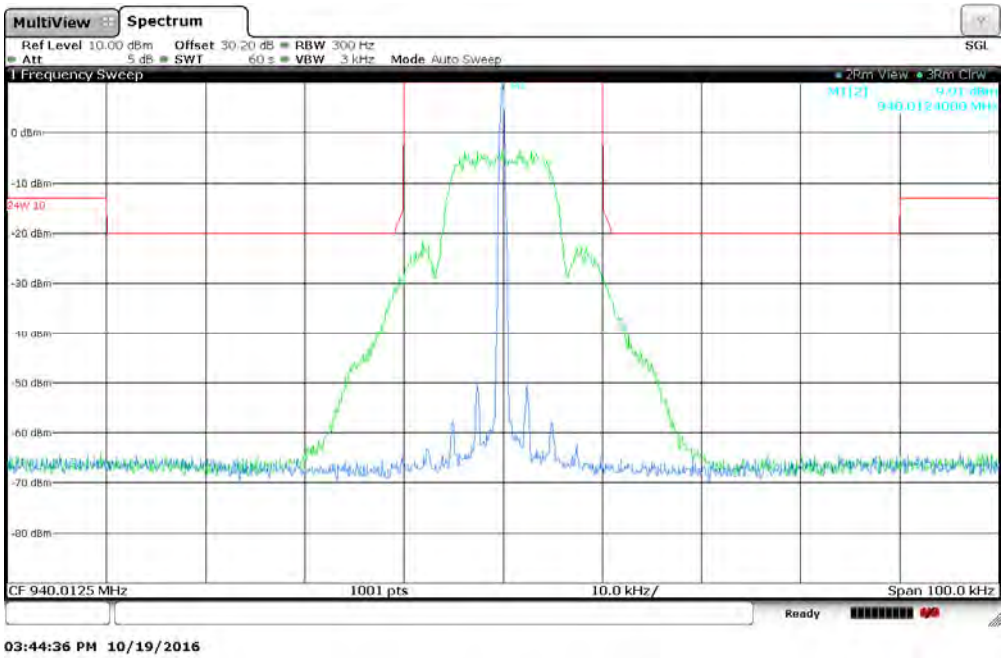

Figure 7.2.2-72: 940.0125 MHz – 25 kHz Channel Spacing – mPass 10k Mode

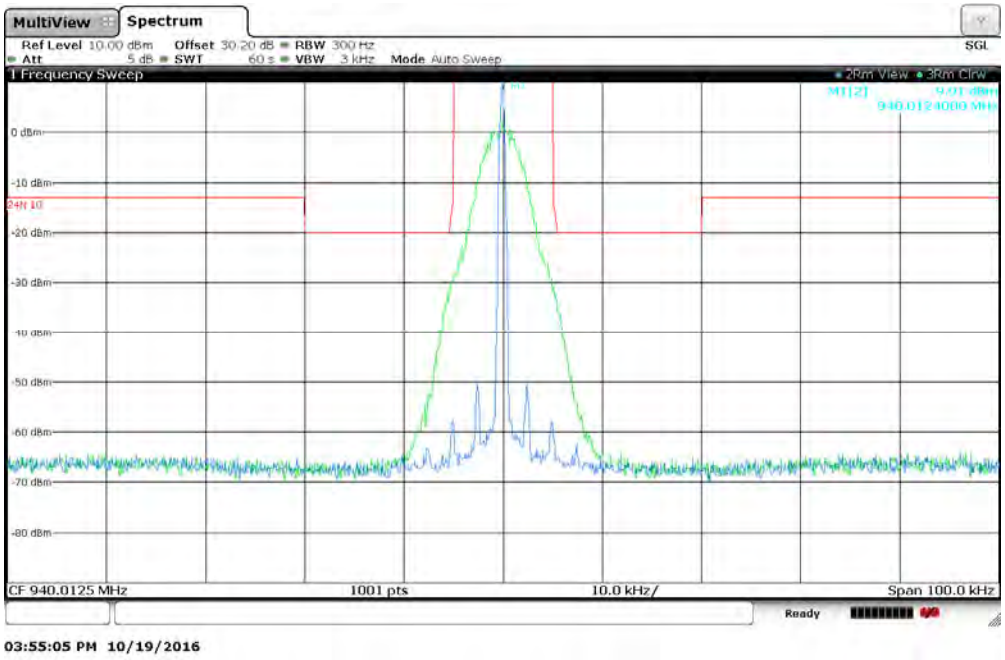

Figure 7.2.2-73: 940.0125 MHz – 12.5 kHz Channel Spacing – m4Pass 10k Mode

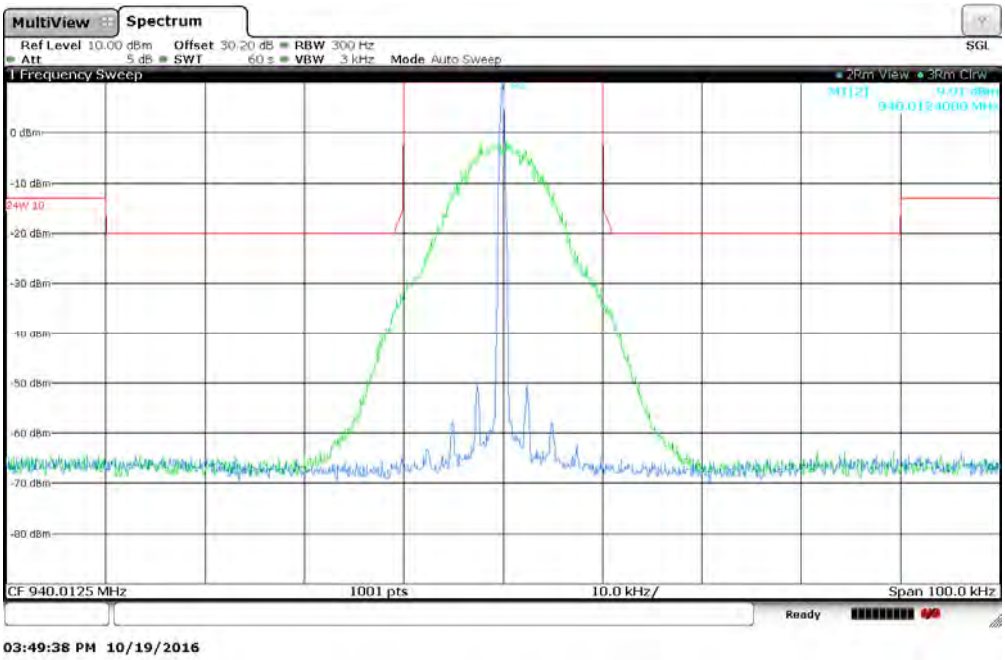

Figure 7.2.2-74: 940.0125 MHz – 25 kHz Channel Spacing – m4Pass 20k Mode

Part 101.111 a(5), a(6), RSS-119 5.8.6 (FCC Part 101.11 a(5) a(6) provides worst case)

ILSI
Low Power

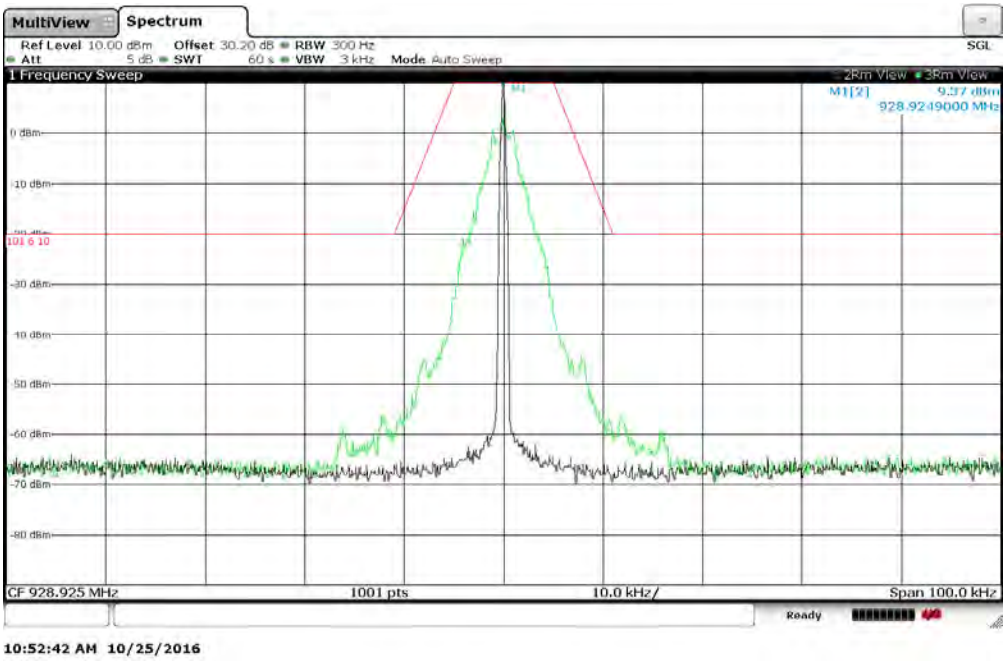

Figure 7.2.2-75: 928.925 MHz – 25 kHz Channel Spacing - C&I Mode

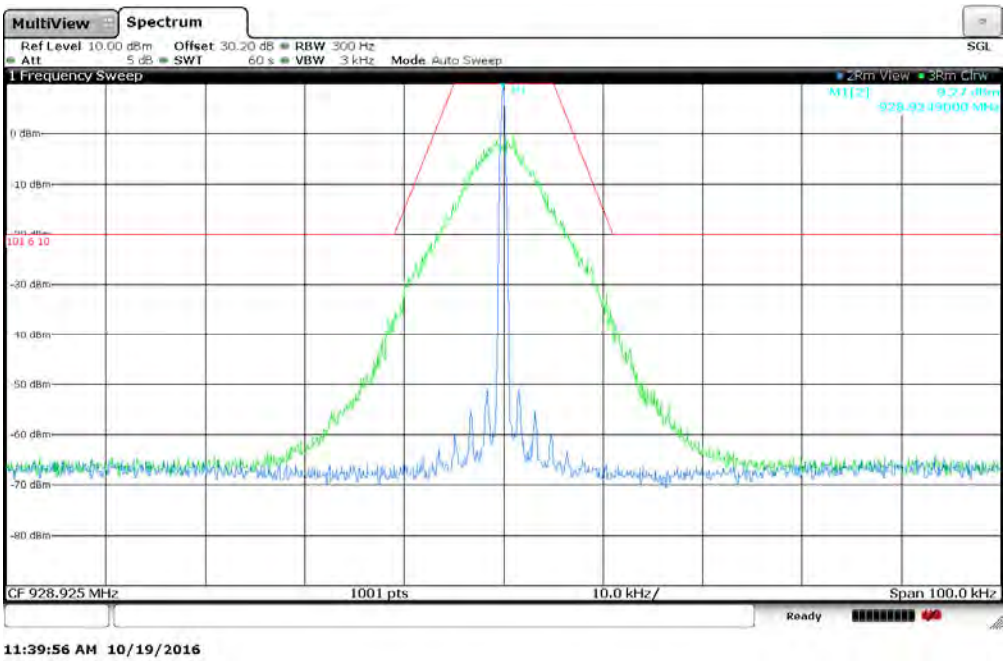

Figure 7.2.2-76: 928.925 MHz – 25 kHz Channel Spacing - Double Density Mode

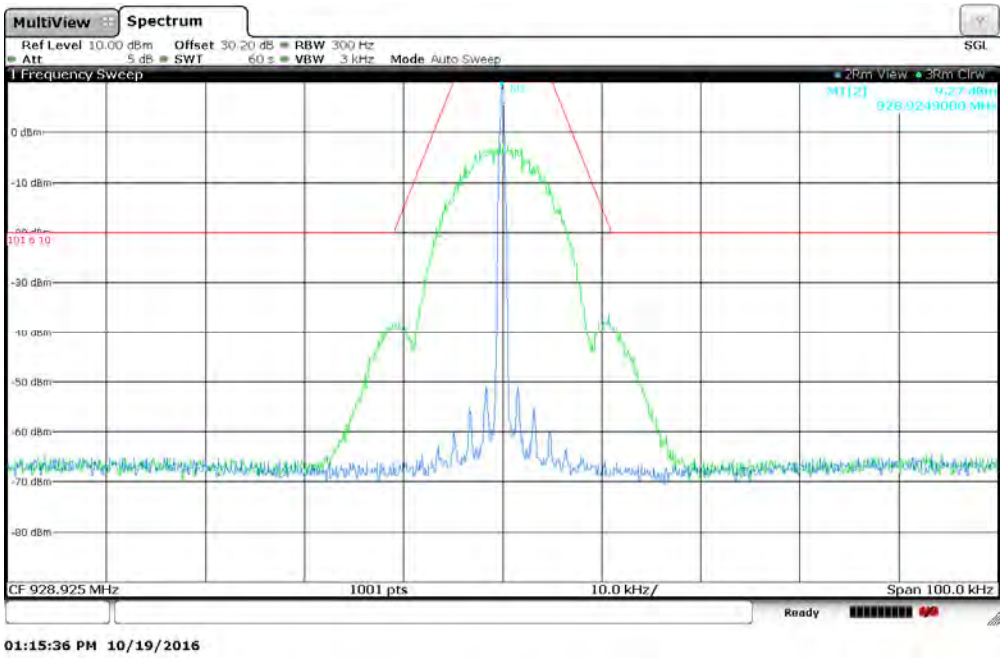

Figure 7.2.2-77: 928.925 MHz – 25 kHz Channel Spacing - 2SFSK Mode

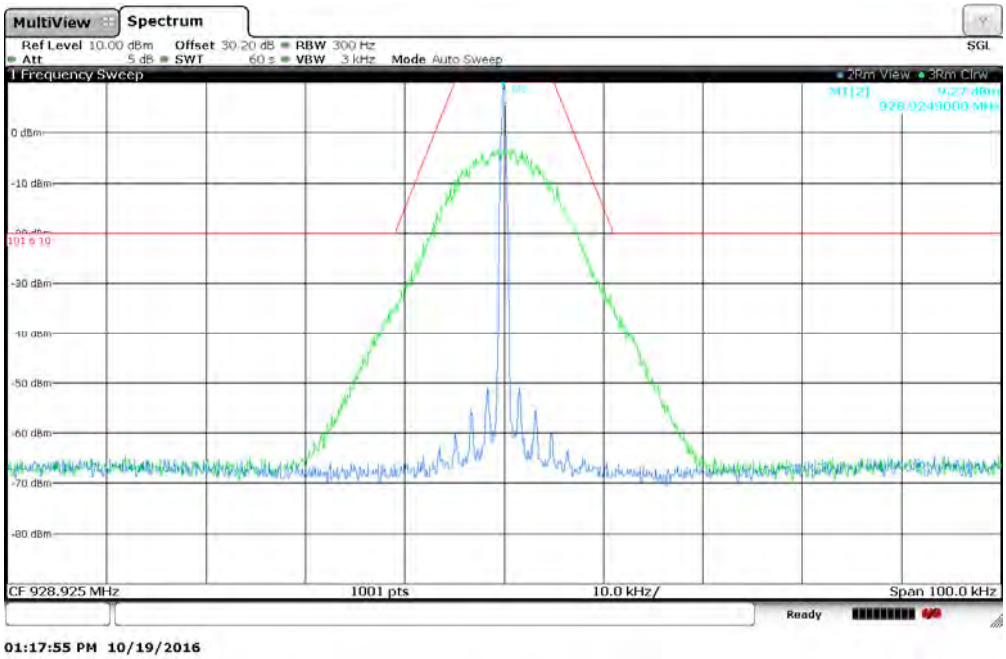

Figure 7.2.2-78: 928.925 MHz – 25 kHz Channel Spacing - 4SFSK Mode

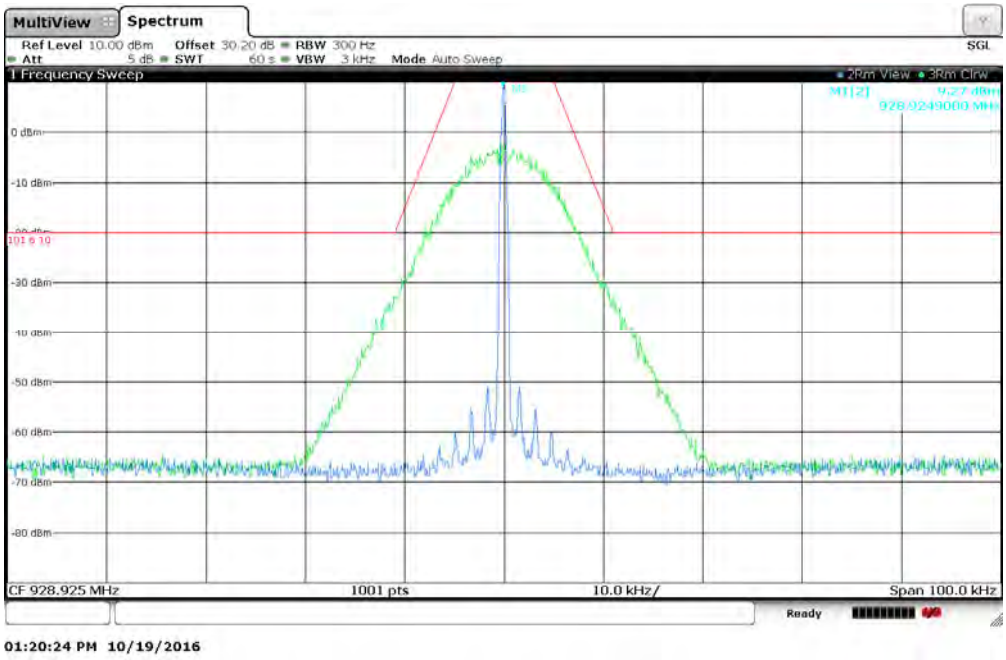

Figure 7.2.2-79: 928.925 MHz – 25 kHz Channel Spacing - 8SFSK Mode

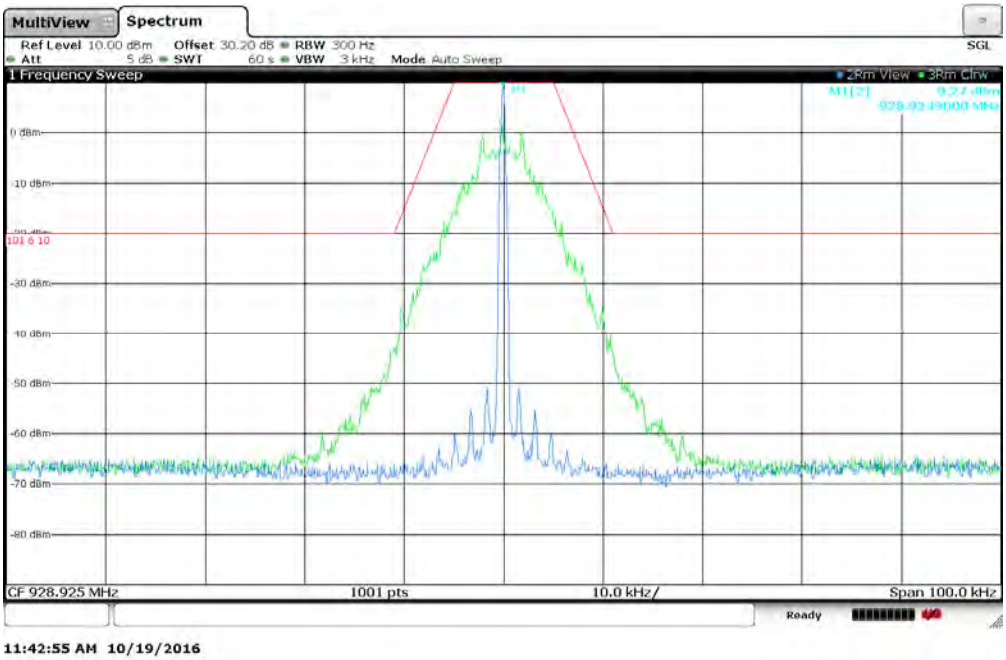

Figure 7.2.2-80: 928.925 MHz – 25 kHz Channel Spacing - Normal Mode

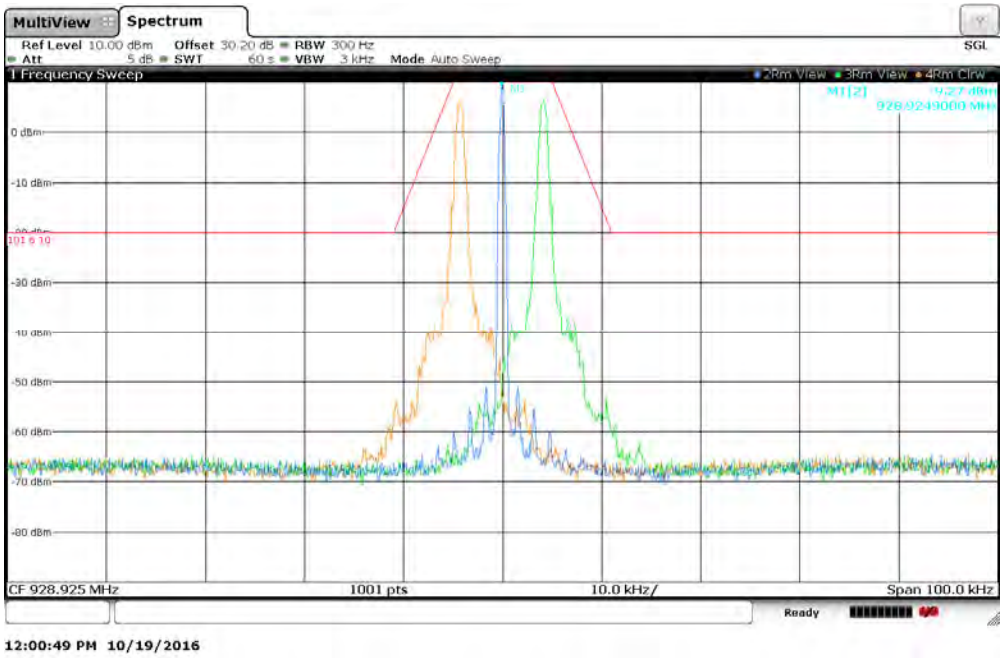

Figure 7.2.2-81: 928.925 MHz – 25 kHz Channel Spacing - Boost Mode

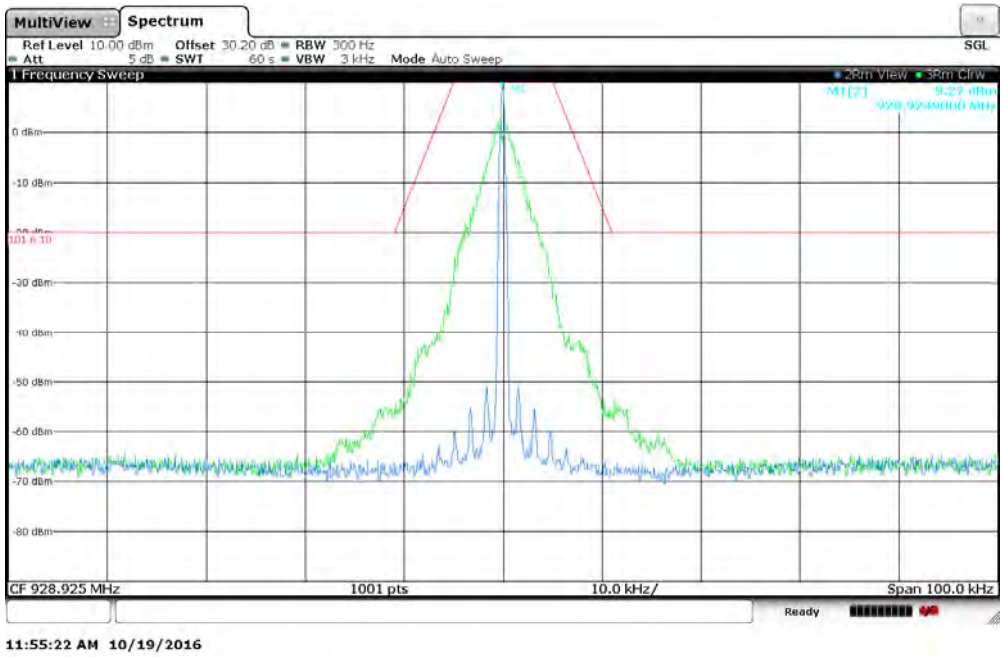

Figure 7.2.2-82: 928.925 MHz –– 25 kHz Channel Spacing - Priority Mode

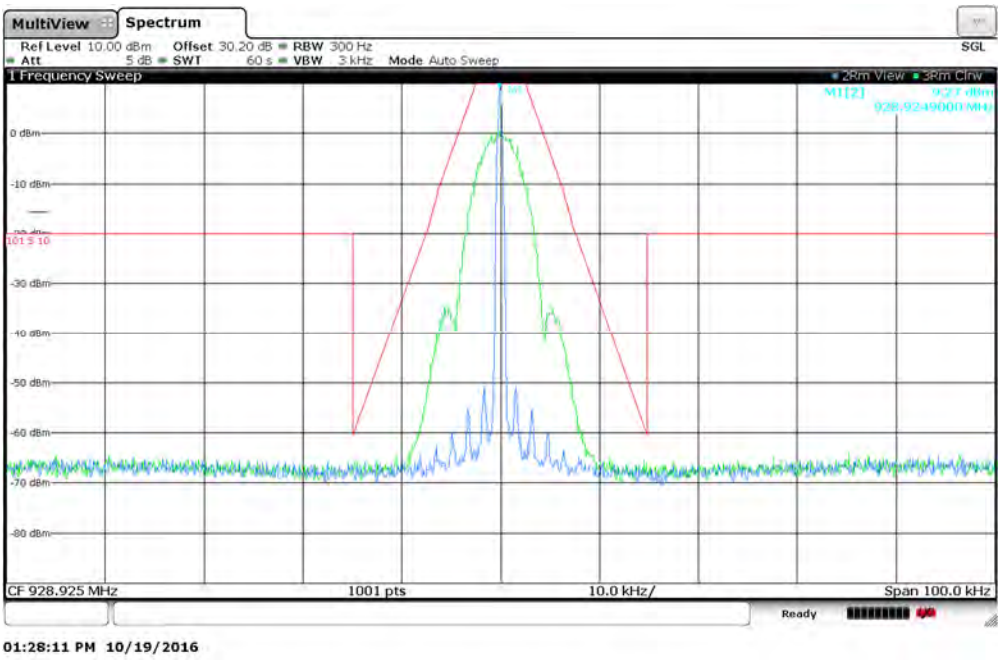

Figure 7.2.2-83: 928.925 MHz –– 12.5 kHz Channel Spacing - 2SFSK (Half Baud) Mode

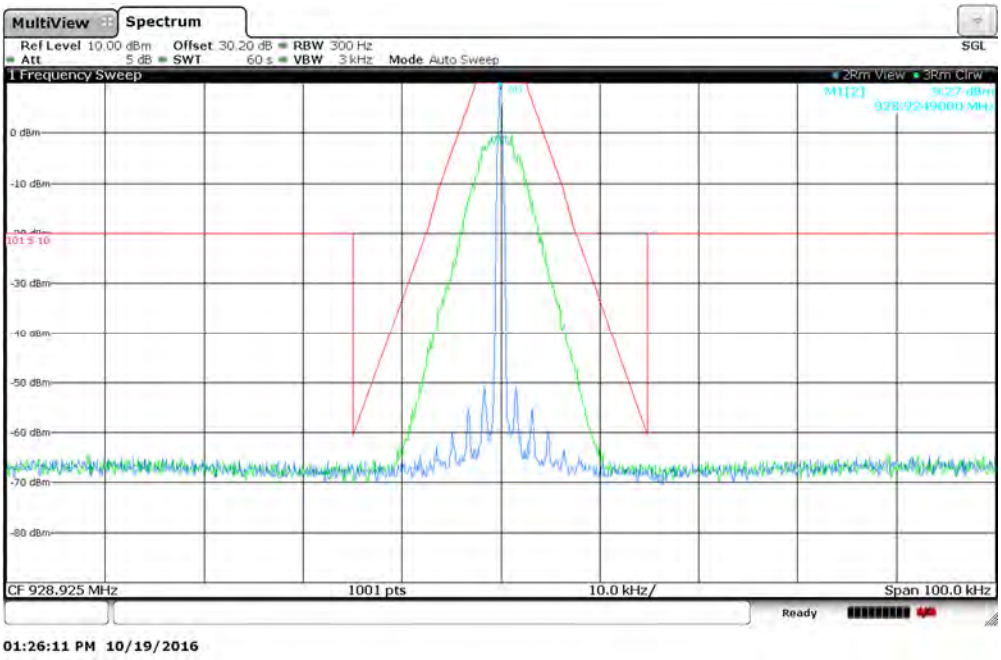

Figure 7.2.2-84: 928.925 MHz –– 12.5 kHz Channel Spacing - 4SFSK (Half Baud) Mode

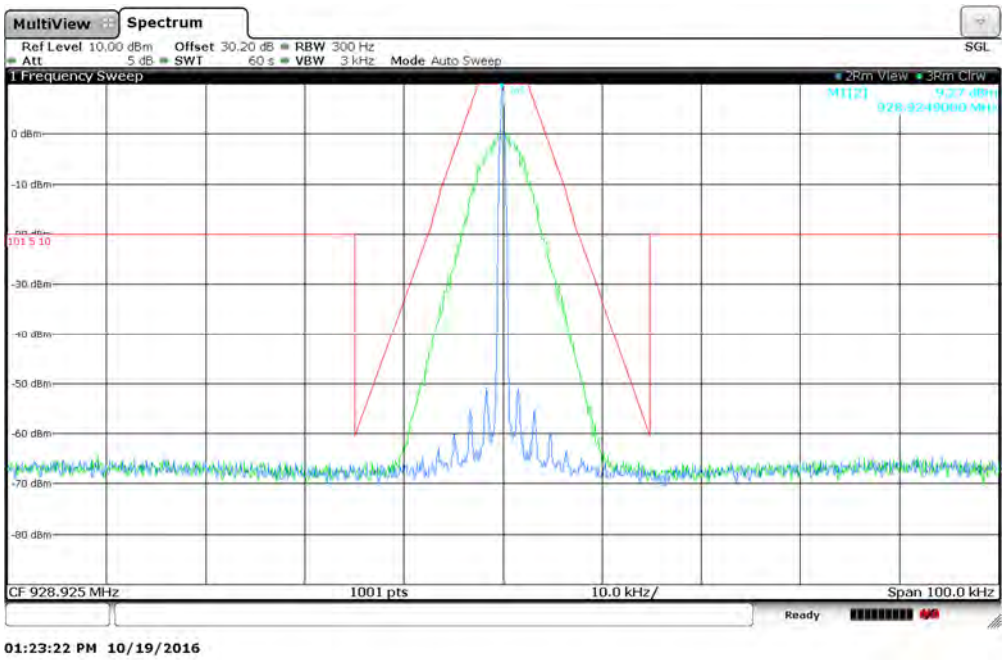

Figure 7.2.2-85: 928.925 MHz –– 12.5 kHz Channel Spacing - 8SFSK (Half Baud) Mode

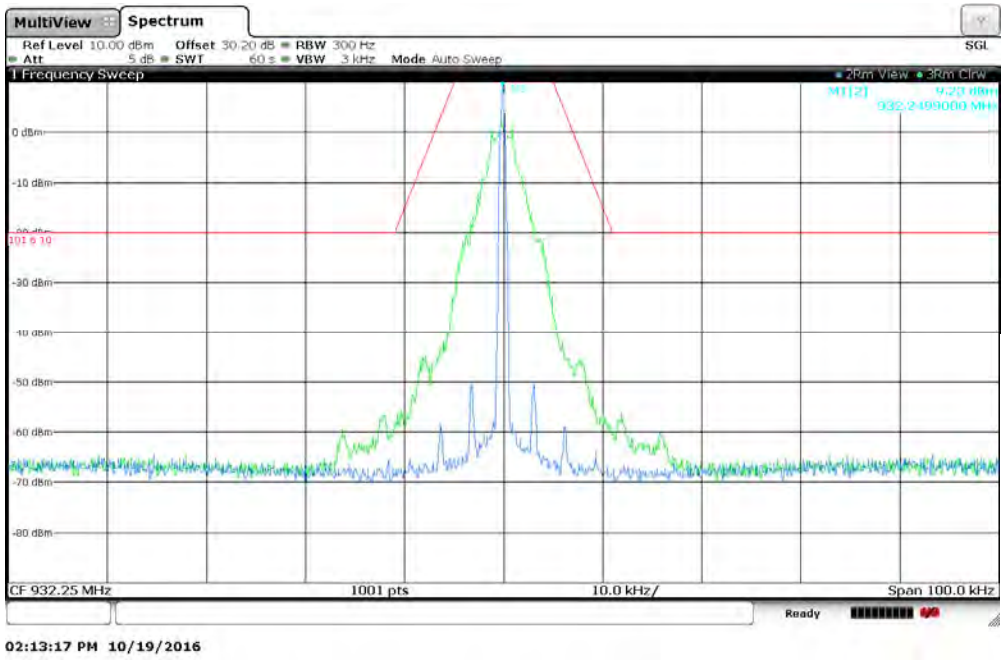

Figure 7.2.2-86: 932.25 MHz – 25 kHz Channel Spacing - C&I Mode

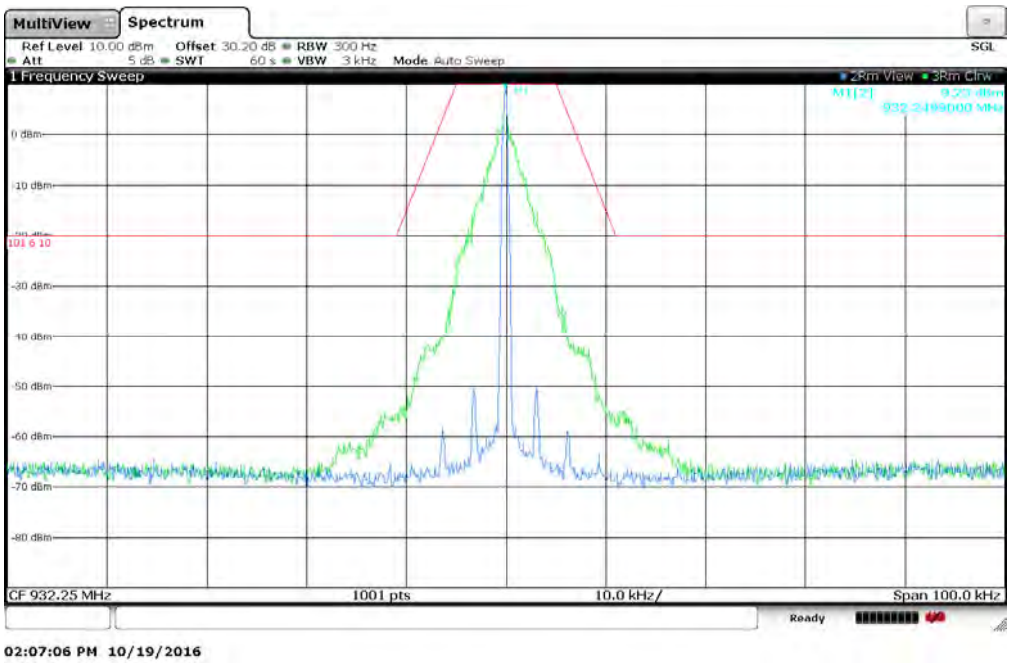

Figure 7.2.2-87: 932.25 MHz –– 25 kHz Channel Spacing - Priority Mode

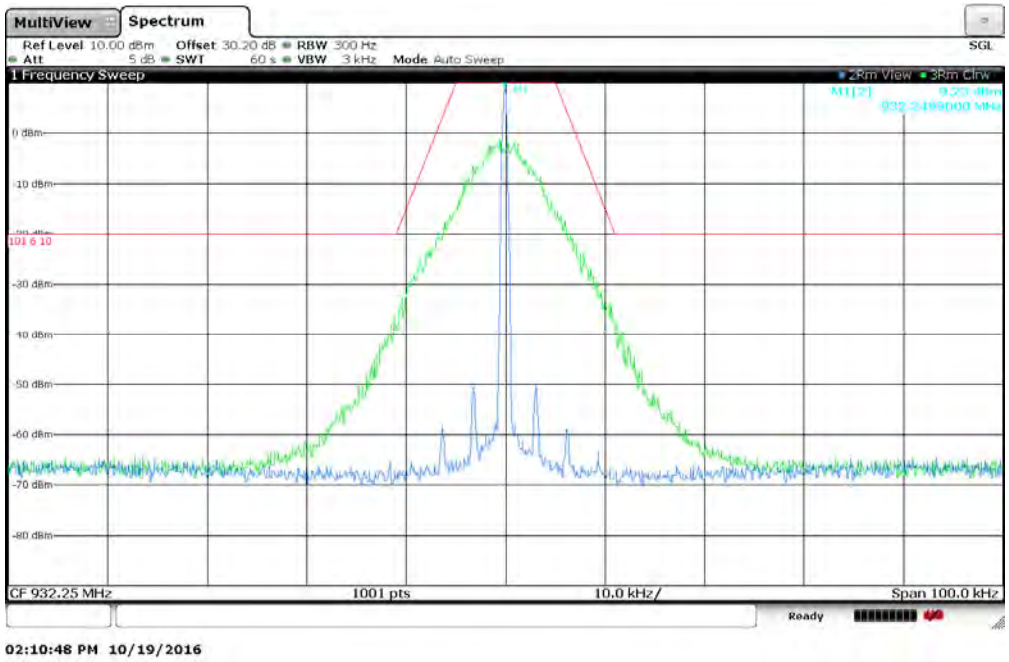

Figure 7.2.2-88: 932.25 MHz – 25 kHz Channel Spacing - Double Density Mode

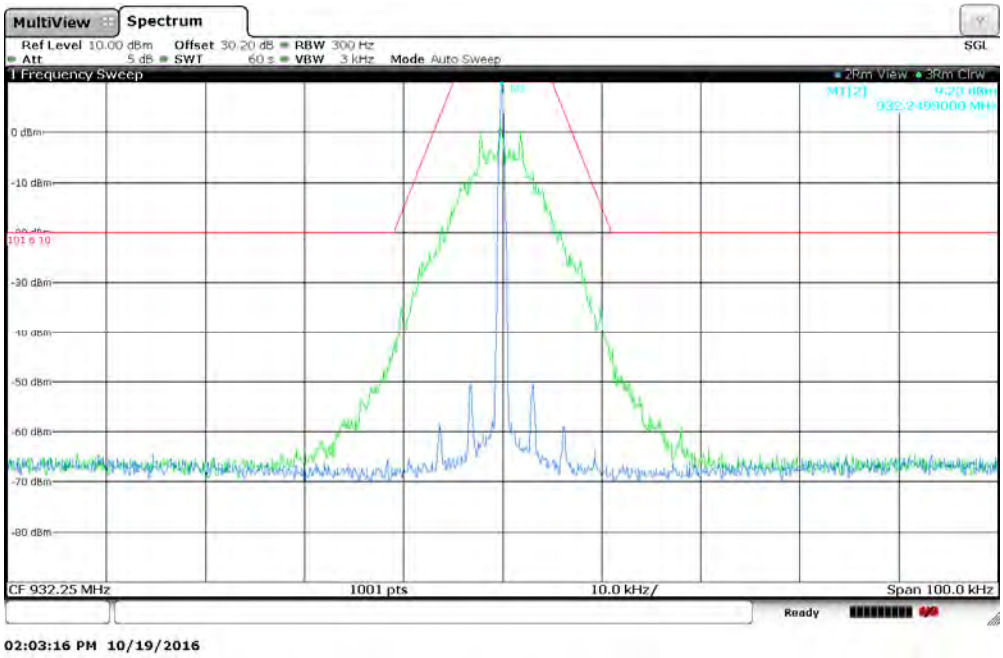

Figure 7.2.2-89: 932.25 MHz – 25 kHz Channel Spacing - Normal Mode

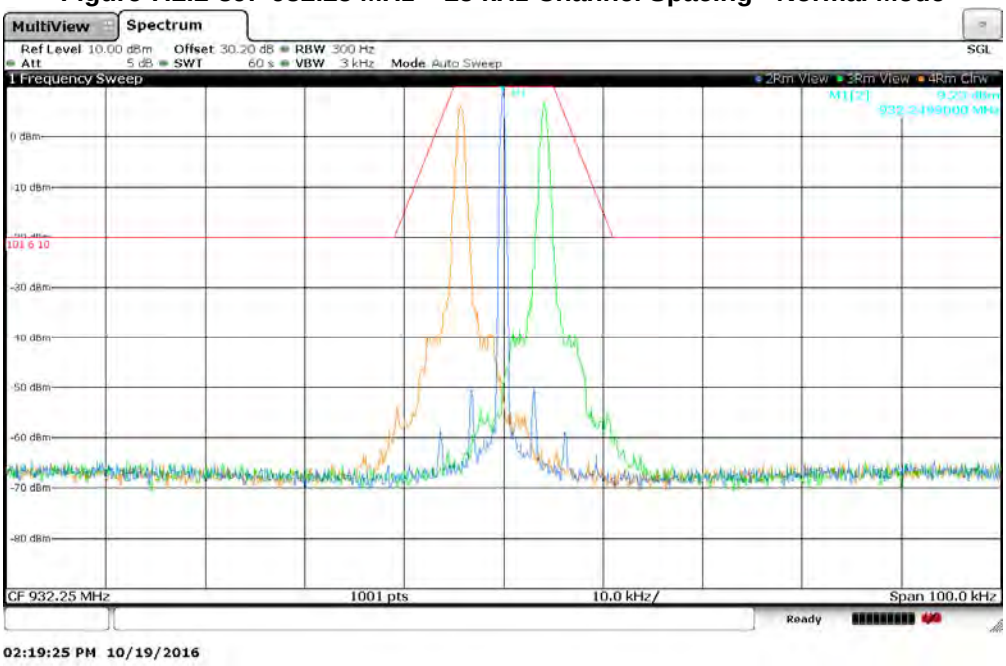

Figure 7.2.2-90: 932.25 MHz – 25 kHz Channel Spacing - Boost Mode

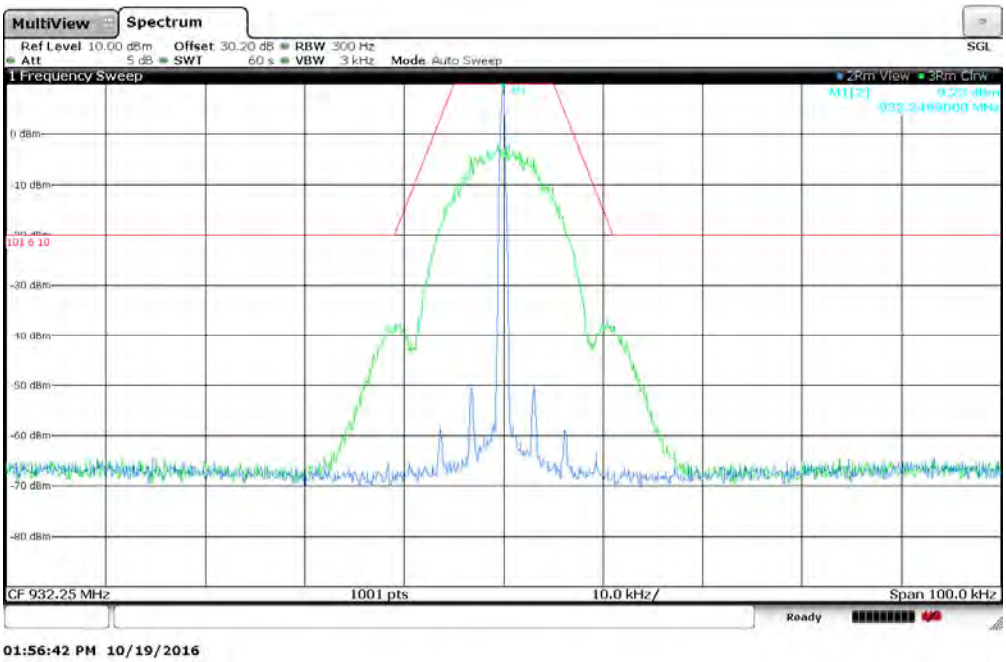

Figure 7.2.2-91: 932.25 MHz –25 kHz Channel Spacing - 2SFSK Mode

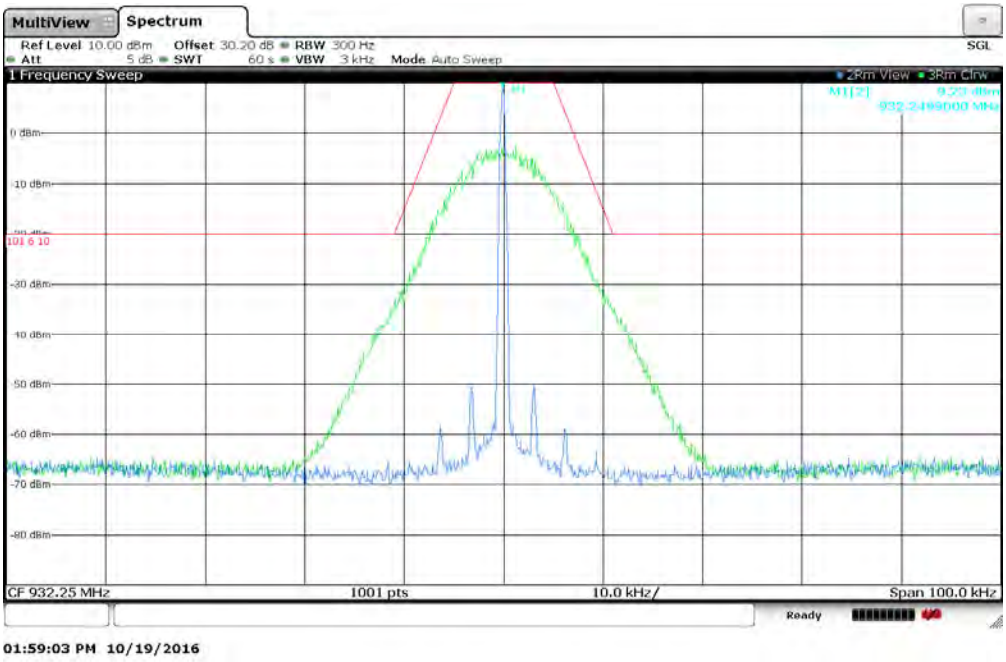

Figure 7.2.2-92: 932.25 MHz – 25 kHz Channel Spacing - 4SFSK Mode

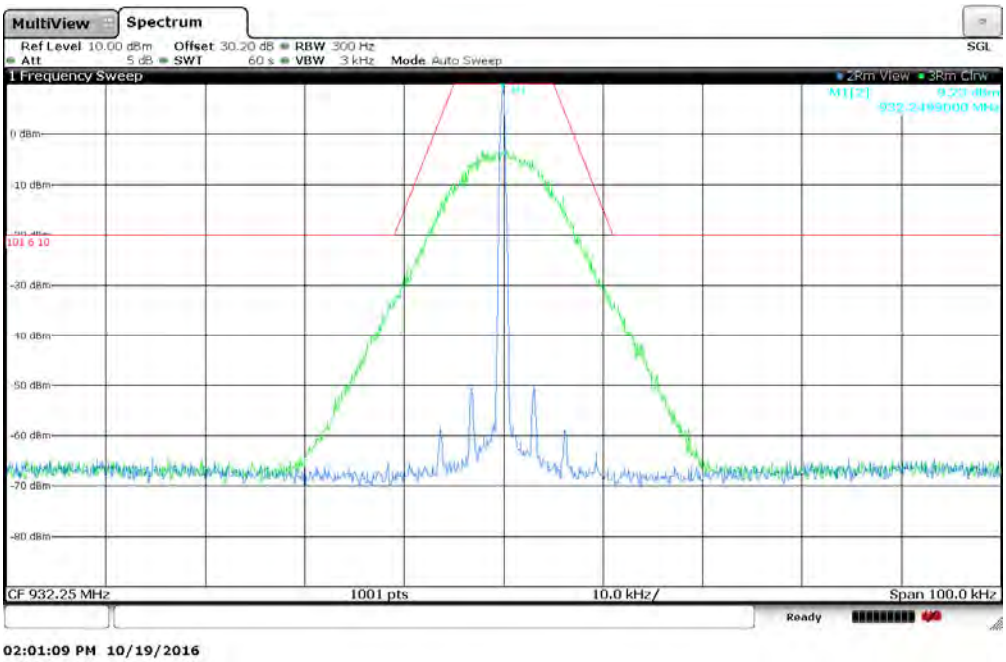

Figure 7.2.2-93: 932.25 MHz – 25 kHz Channel Spacing - 8SFSK Mode

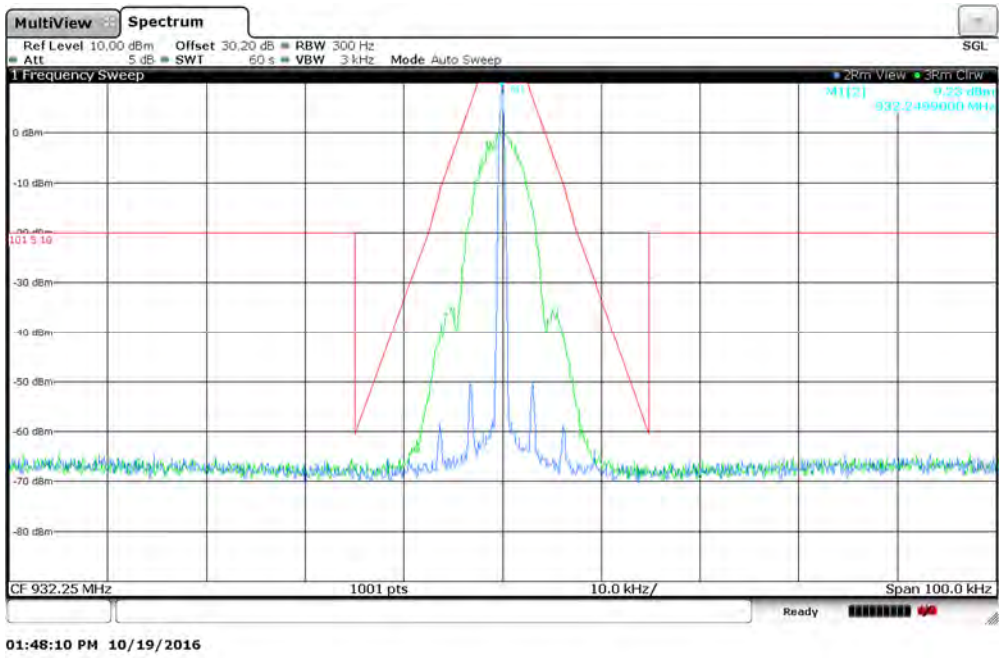

Figure 7.2.2-94: 932.25 MHz –12.5 kHz Channel Spacing - 2SFSK (Half Baud) Mode

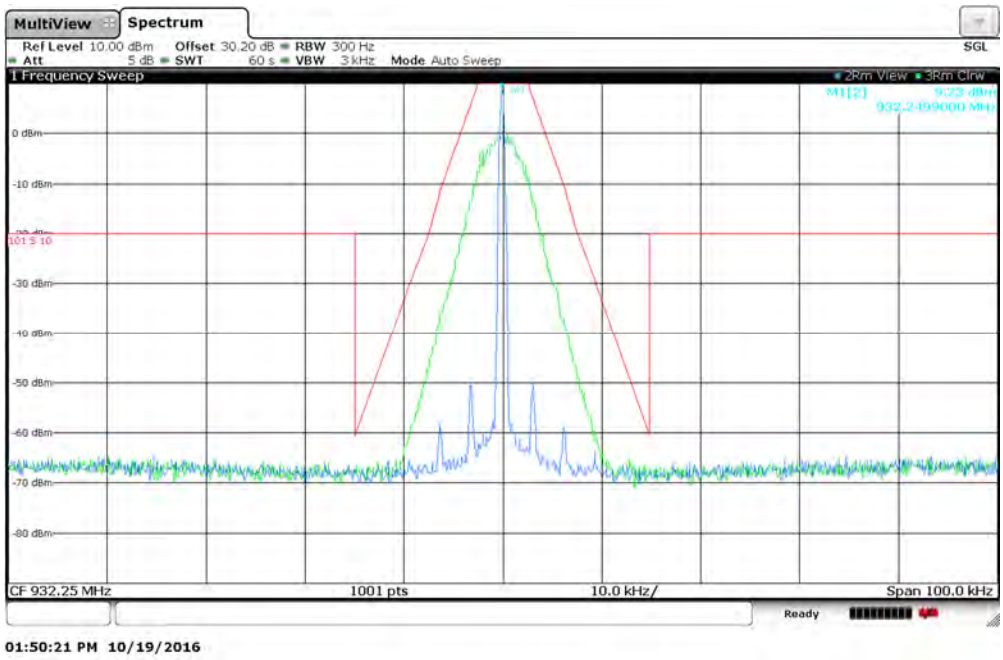

Figure 7.2.2-95: 932.25 MHz – 12.5 kHz Channel Spacing - 4SFSK (Half Baud) Mode

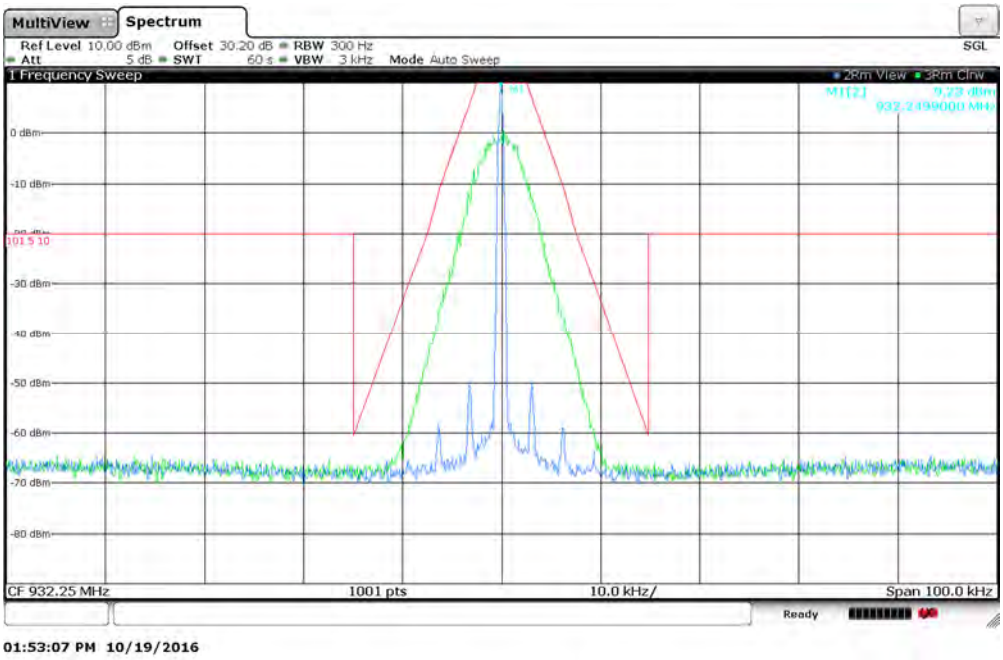

Figure 7.2.2-96: 932.25 MHz – 12.5 kHz Channel Spacing - 8SFSK (Half Baud) Mode

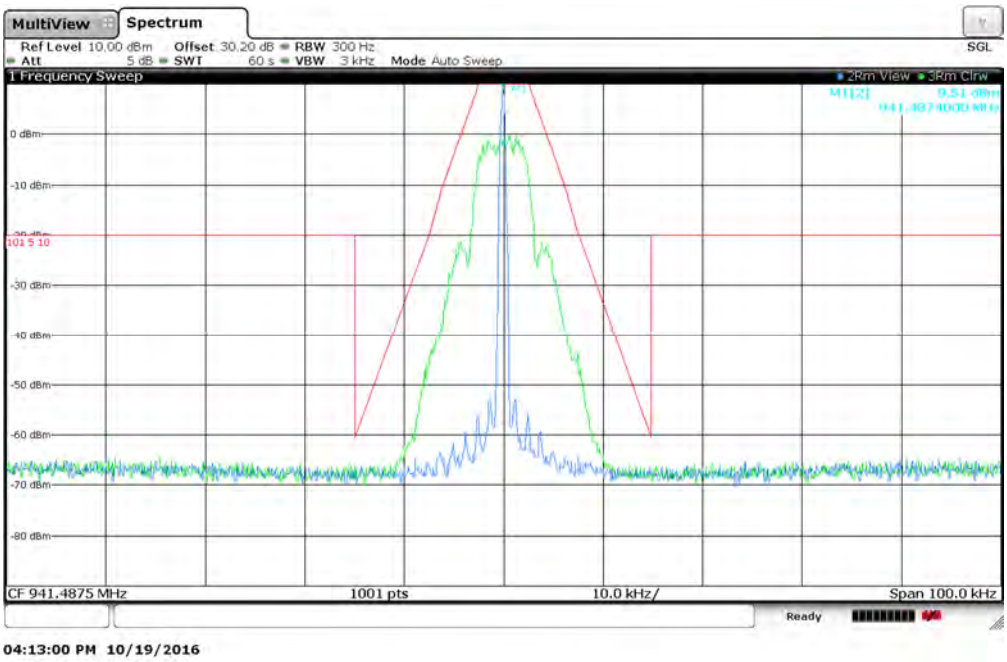

Figure 7.2.2-97: 941.4875 MHz - 12.5 kHz Channel Spacing – mPass 5k Mode

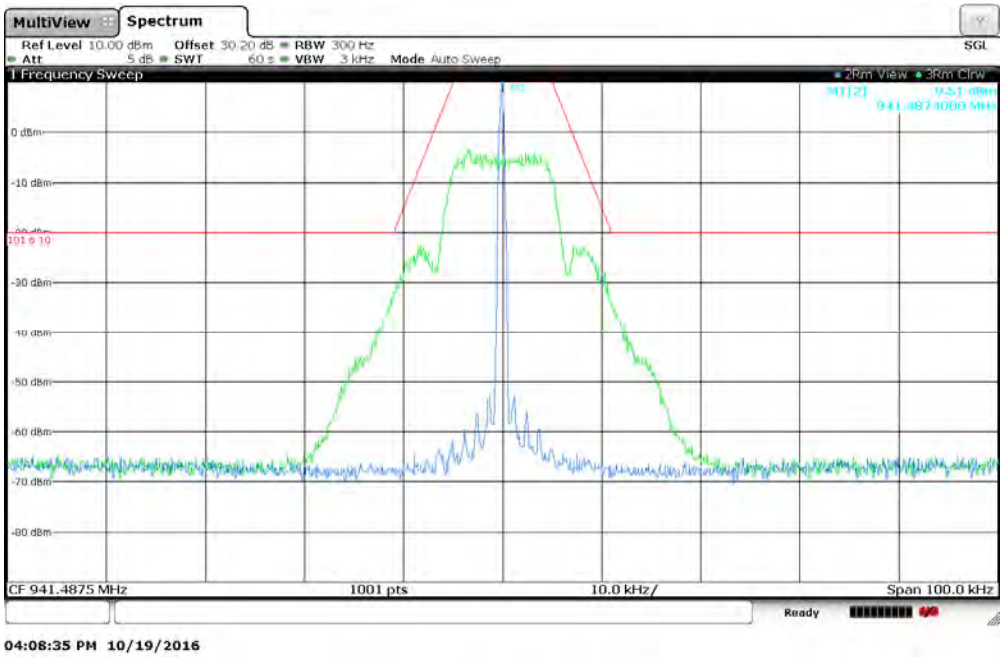

Figure 7.2.2-98: 941.4875 MHz – 25 kHz Channel Spacing – mPass 10k Mode

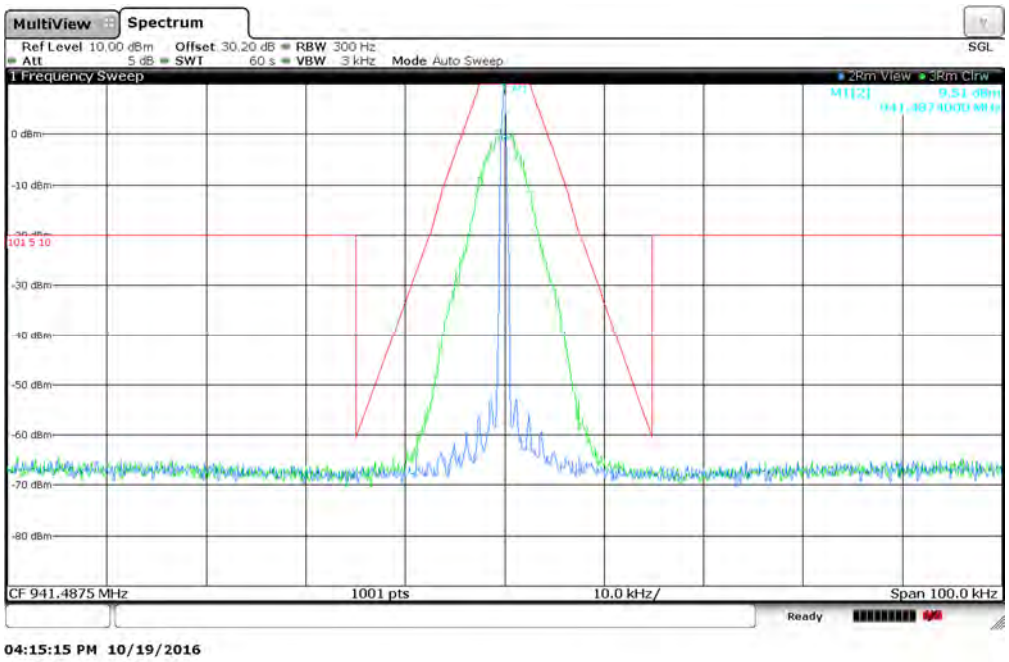

Figure 7.2.2-99: 941.4875 MHz - 12.5 kHz Channel Spacing – m4Pass 10k Mode

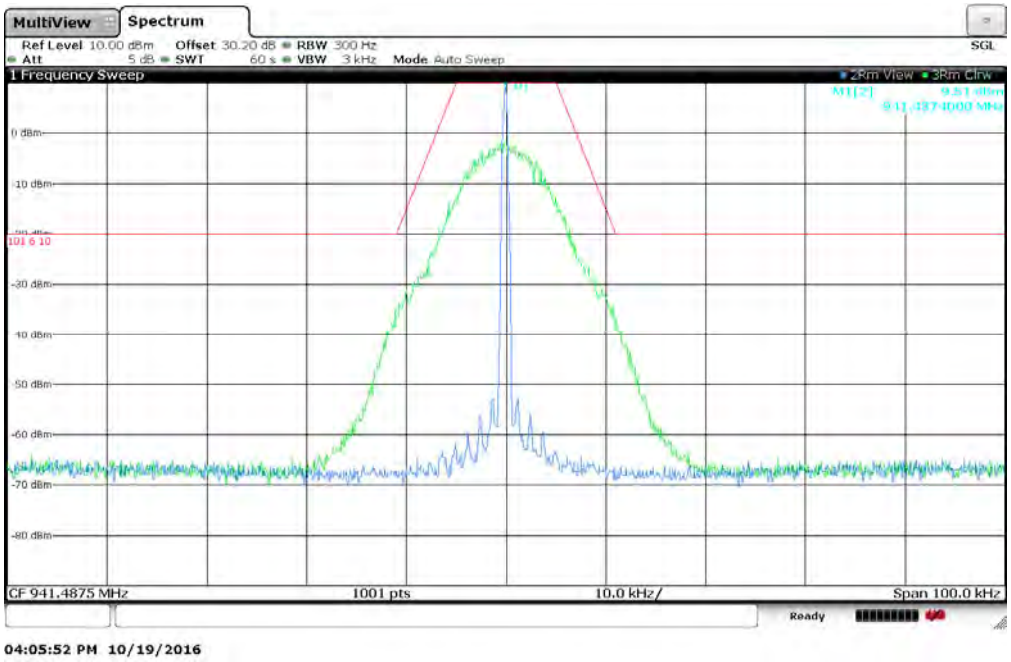

Figure 7.2.2-100: 941.4875 MHz – 25 kHz Channel Spacing – m4Pass 20k Mode

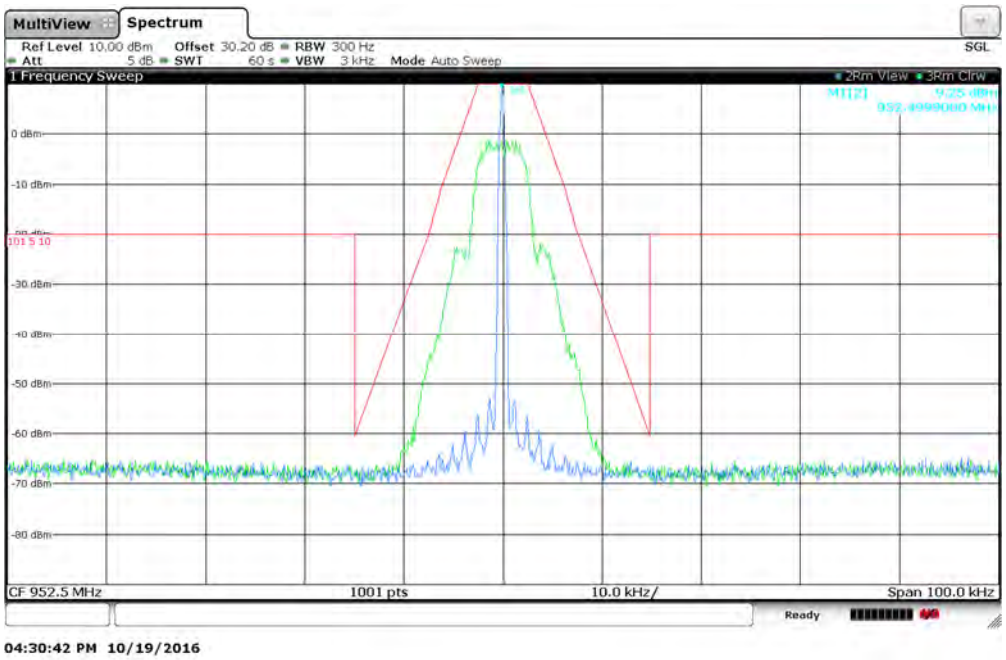

Figure 7.2.2-101: 952.5 MHz - 12.5 kHz Channel Spacing – mPass 5k Mode

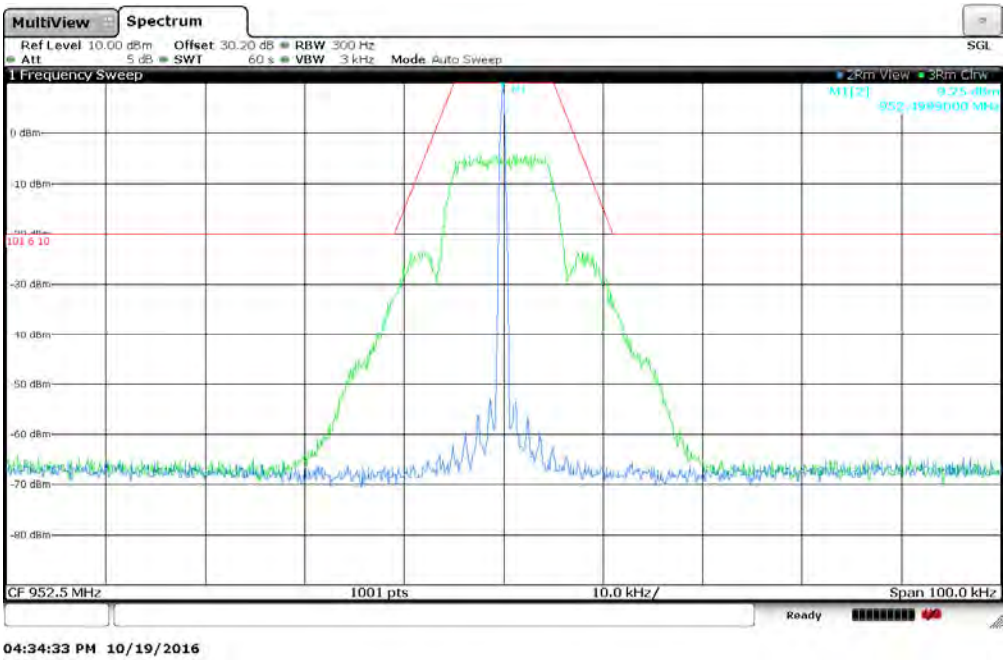

Figure 7.2.2-102: 952.5 MHz – 25 kHz Channel Spacing – mPass 10k Mode

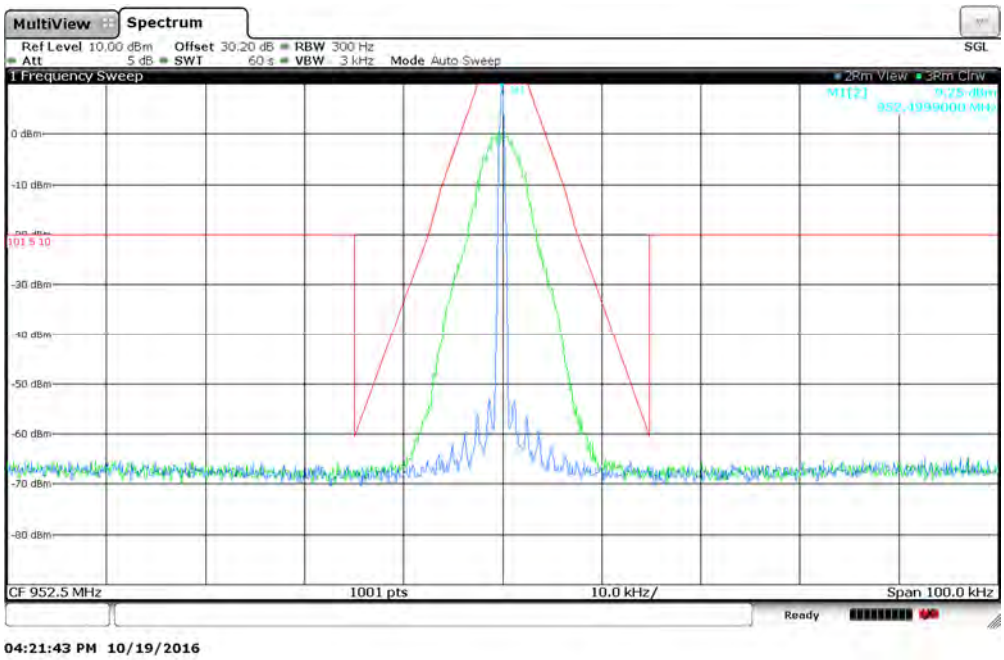

Figure 7.2.2-103: 952.5 MHz - 12.5 kHz Channel Spacing – m4Pass 10k Mode

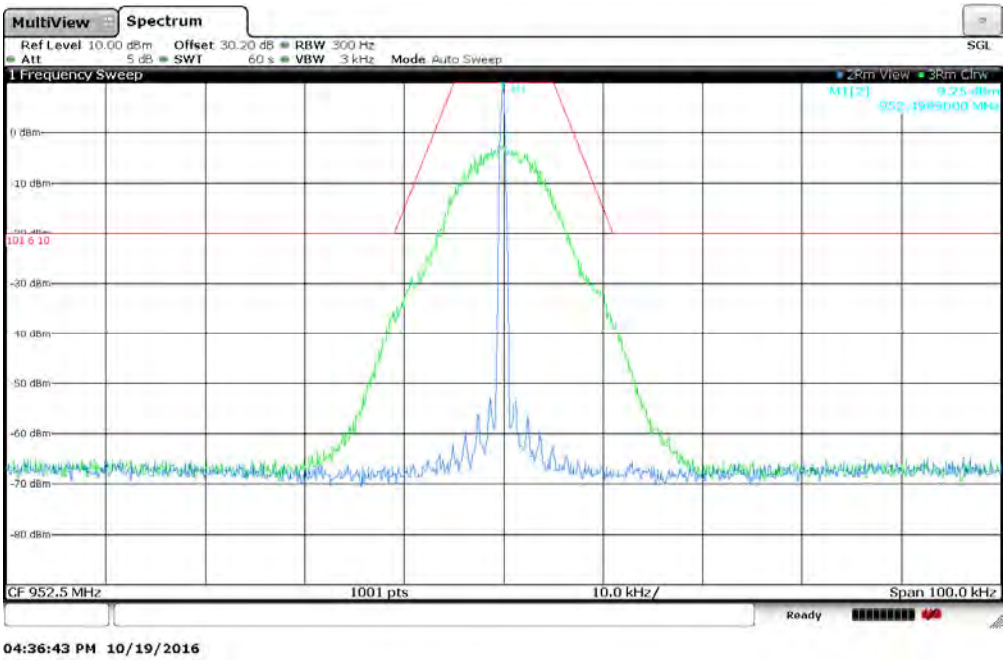

Figure 7.2.2-104: 952.5 MHz – 25 kHz Channel Spacing – m4Pass 20k Mode

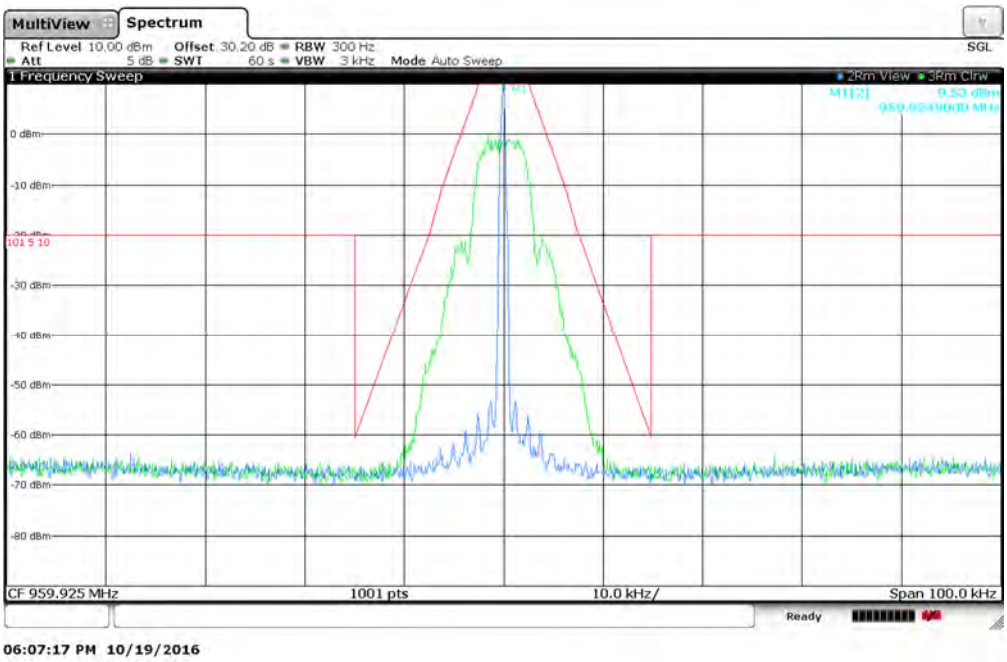

Figure 7.2.2-105: 959.925 MHz - 12.5 kHz Channel Spacing – mPass 5k Mode

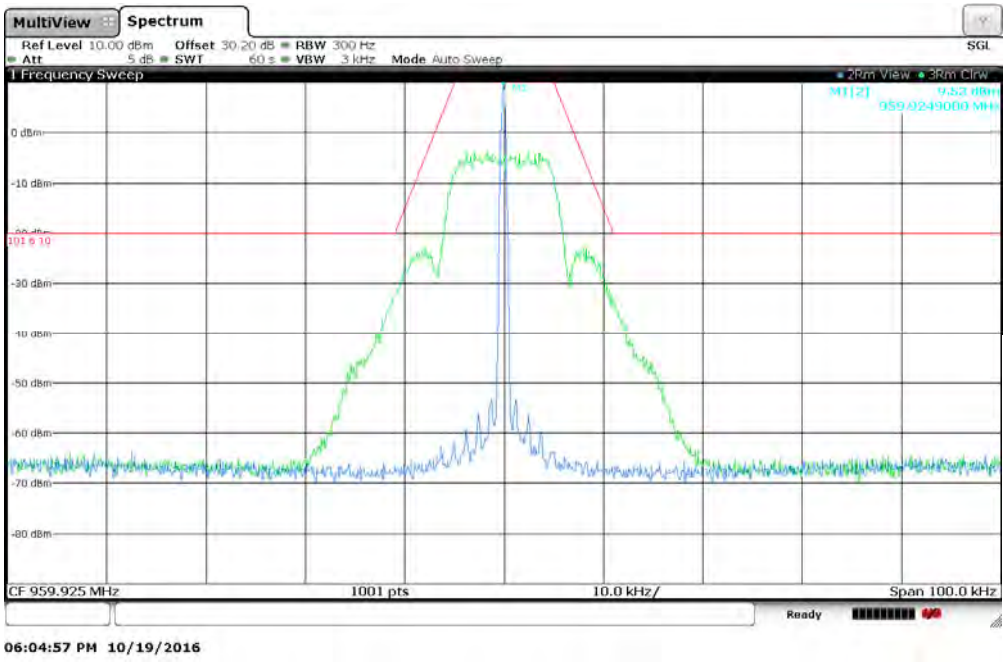

Figure 7.2.2-106: 959.925 MHz – 25 kHz Channel Spacing – mPass 10k Mode

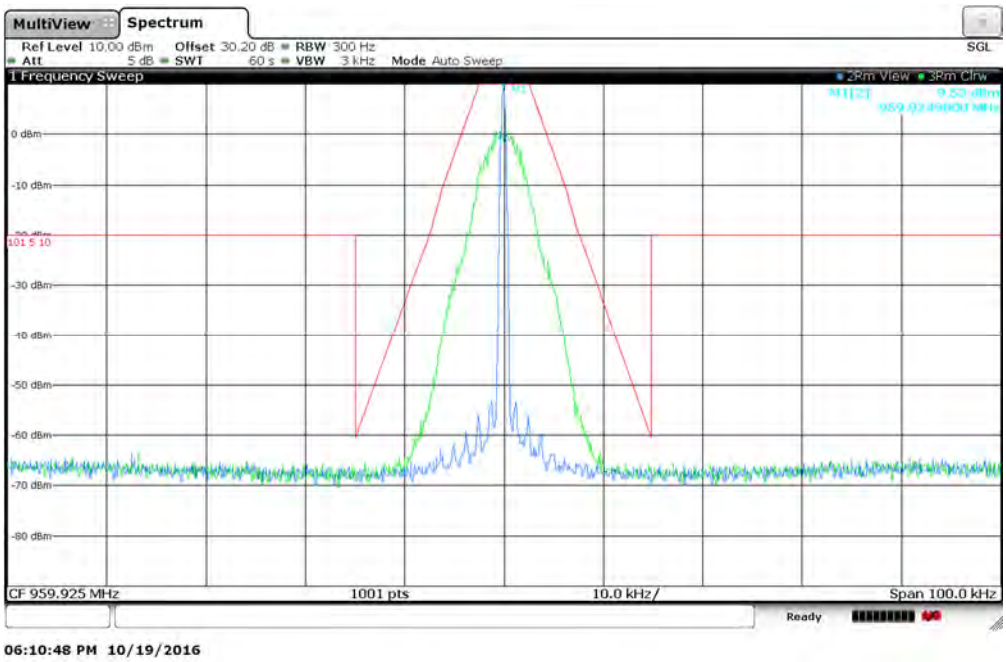

Figure 7.2.2-107: 959.925 MHz - 12.5 kHz Channel Spacing – m4Pass 10k Mode

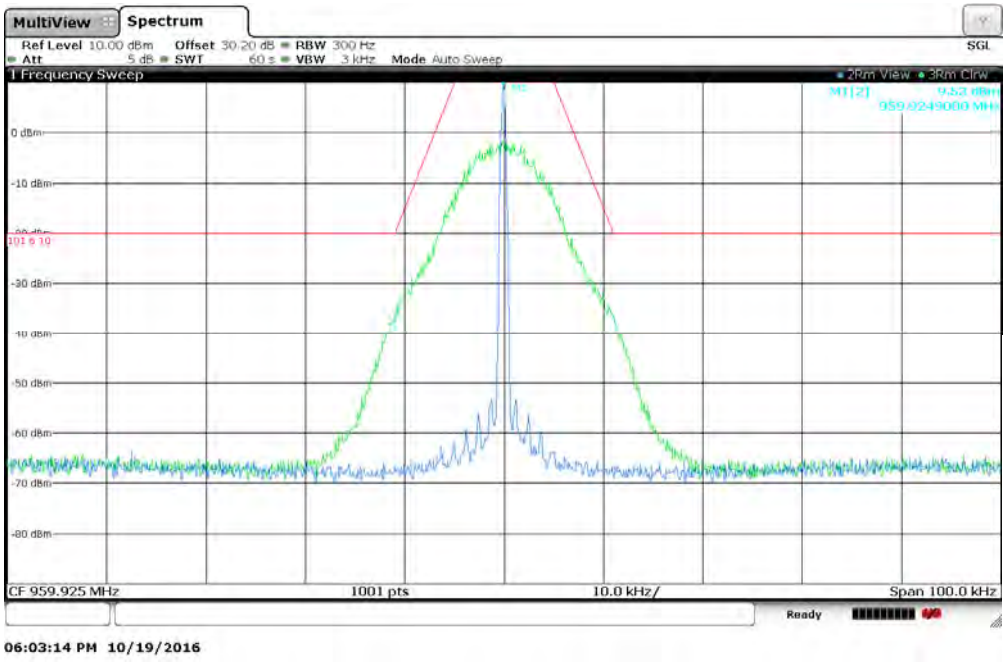

Figure 7.2.2-108: 959.925 MHz – 25 kHz Channel Spacing – m4Pass 20k Mode

7.3 99% Bandwidth

7.3.1 Measurement Procedure (ANSI 63.26: 2015 Section 5.4.4)

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through 40 dB of passive attenuation. The internal correction factors of the spectrum analyzer were employed to correct for any cable and attenuator losses.

The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts. The nominal IF filter 3 dB bandwidth (RBW) is in the range of 1% to 5% of the OBW, and the VBW was set ≥ 3 × RBW. The reference level was set to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. The measurements were made using the spectrum analyzer's 99% BW function.

7.3.2 Measurement Results

Frequency (MHz)	ISED Canada Rule Part	Mode of Operation	99% Bandwidth (kHz)
901.5000	RSS-134	2SFSK	11.8855
901.5000	RSS-134	4SFSK	14.3339
901.5000	RSS-134	8SFSK	14.6888
901.5000	RSS-134	2SFSK (Half Baud)	6.0109
901.5000	RSS-134	4SFSK (Half Baud)	6.9261
901.5000	RSS-134	8SFSK (Half Baud)	7.2065
901.5000	RSS-134	Boost	1.3474
901.5000	RSS-134	C&I (Half-Baud)	5.8888
901.5000	RSS-134	Double Density	13.6097
901.5000	RSS-134	Normal	12.0110
901.5000	RSS-134	Priority	6.5276
930.5000	RSS-134	m4Pass 10k	6.0733
930.5000	RSS-134	m4Pass 20k	12.1278
930.5000	RSS-134	MPass 5k	5.7177
930.5000	RSS-134	MPass 10k	12.1237
940.0125	RSS-134	m4Pass 10k	6.0330
940.0125	RSS-134	m4Pass 20k	12.1127
940.0125	RSS-134	MPass 5k	5.8060
940.0125	RSS-134	MPass 10k	12.0323
928.9250	RSS-119	2SFSK	11.8182
928.9250	RSS-119	4SFSK	14.1868
928.9250	RSS-119	8SFSK	14.4406
928.9250	RSS-119	2SFSK (Half Baud)	6.0152
928.9250	RSS-119	4SFSK (Half Baud)	7.1421
928.9250	RSS-119	8SFSK (Half Baud)	7.1863
928.9250	RSS-119	Boost	1.3635
928.9250	RSS-119	C&I (Half-Baud)	6.0098

Frequency (MHz)	ISED Canada Rule Part	Mode of Operation	99% Bandwidth (kHz)
928.9250	RSS-119	Double Density	13.2016
928.9250	RSS-119	Normal	11.3530
928.9250	RSS-119	Priority	6.6181
932.2500	RSS-119	2SFSK	11.9896
932.2500	RSS-119	4SFSK	14.1086
932.2500	RSS-119	8SFSK	14.4734
932.2500	RSS-119	2SFSK (Half Baud)	5.9124
932.2500	RSS-119	4SFSK (Half Baud)	6.9201
932.2500	RSS-119	8SFSK (Half Baud)	7.2239
932.2500	RSS-119	Boost	1.3492
932.2500	RSS-119	C&I (Half-Baud)	6.0491
932.2500	RSS-119	Double Density	13.4553
932.2500	RSS-119	Normal	11.7553
932.2500	RSS-119	Priority	7.0748
941.4875	RSS-119	m4Pass 10k	6.0748
941.4875	RSS-119	m4Pass 20k	12.0291
941.4875	RSS-119	MPass 5k	5.7897
941.4875	RSS-119	MPass 10k	11.8000
952.5000	RSS-119	m4Pass 10k	6.1949
952.5000	RSS-119	m4Pass 20k	12.1447
952.5000	RSS-119	MPass 5k	5.8773
952.5000	RSS-119	MPass 10k	11.8811

ISED Canada RSS-GEN 6.6, ISED Canada RSS-134

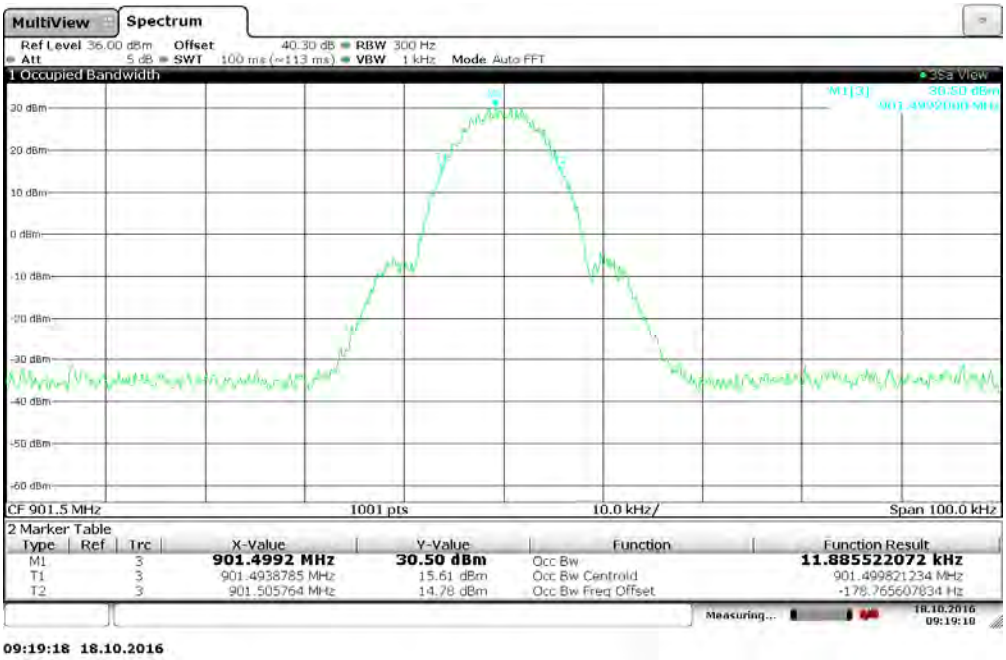

Figure 7.3.2-1: 901.5 MHz – 2SFSK Mode

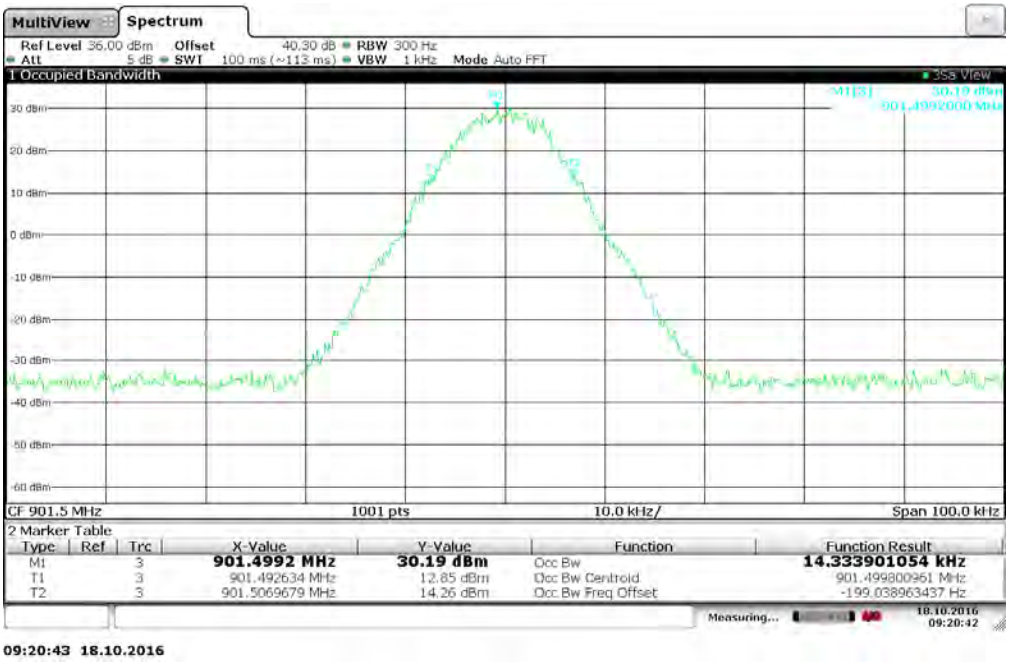

Figure 7.3.2-2: 901.5 MHz – 4SFSK Mode

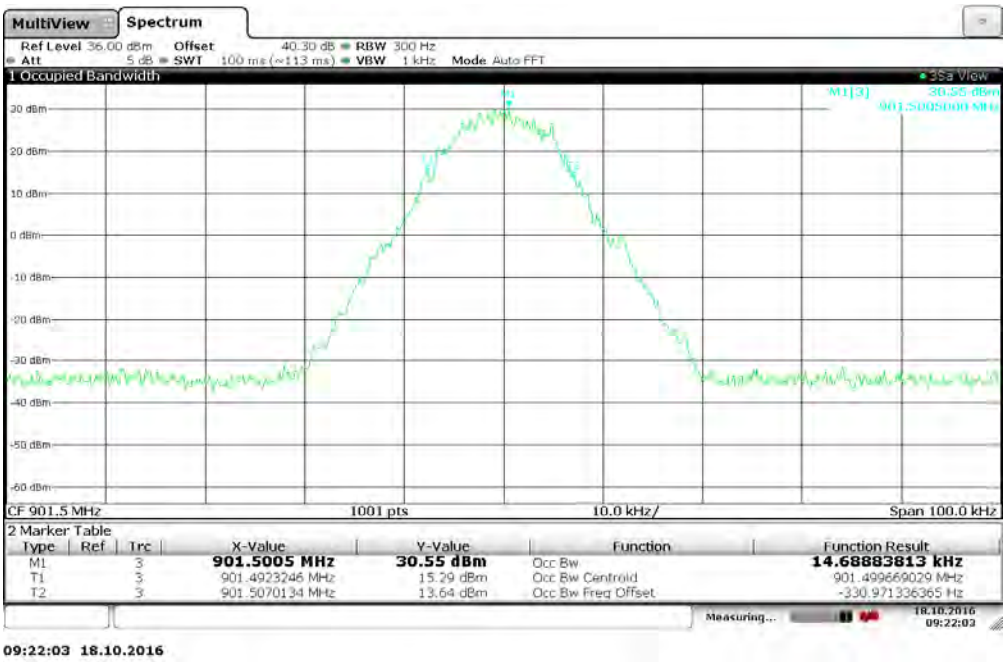

Figure 7.3.2-3: 901.5 MHz – 8SFSK Mode

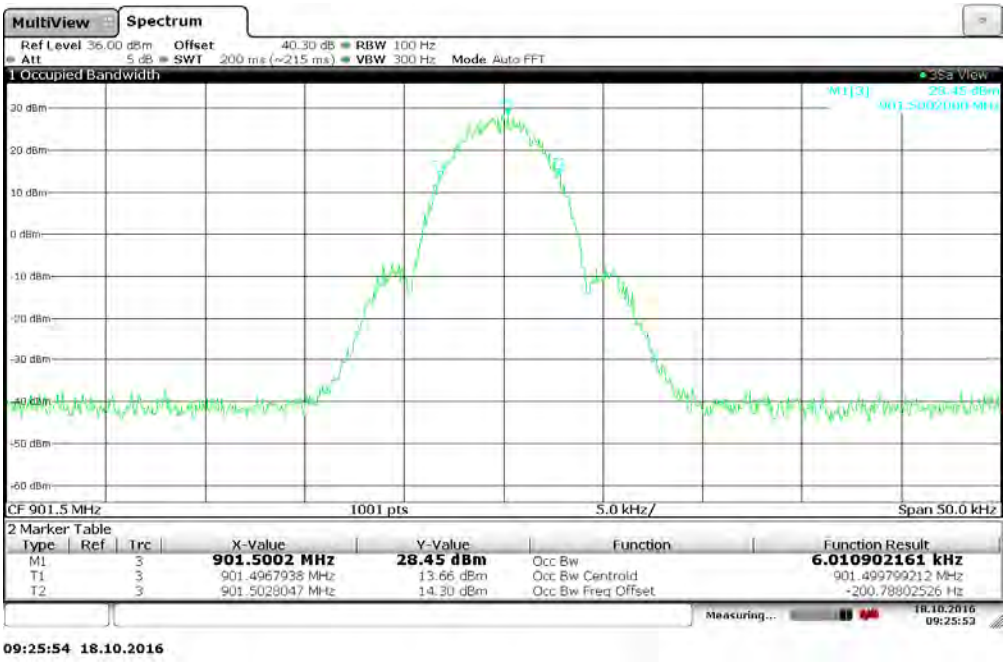

Figure 7.3.2-4: 901.5 MHz – 2SFSK (Half Baud) Mode

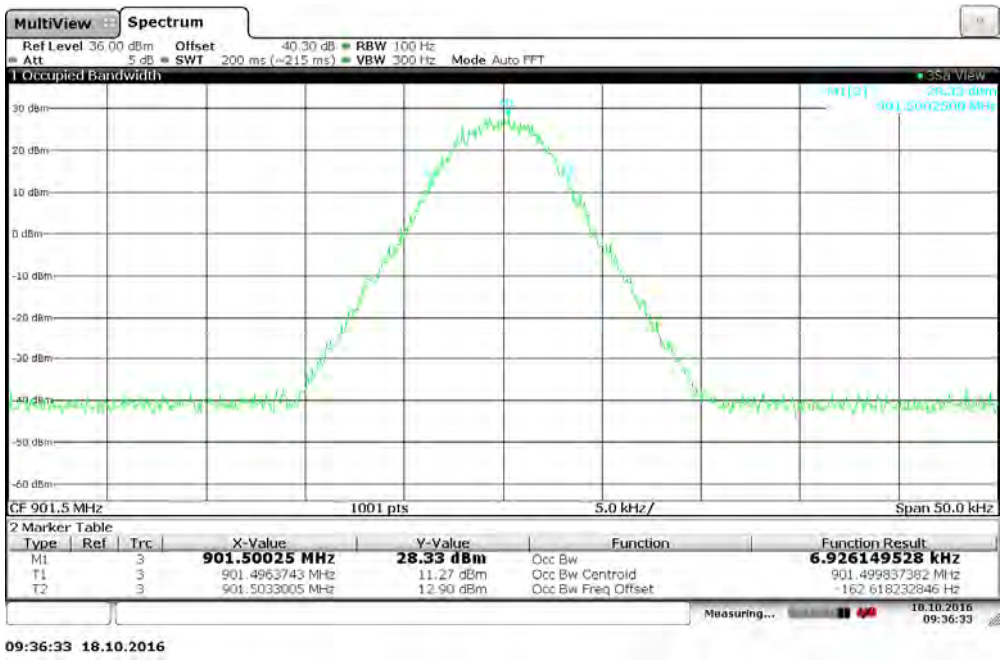

Figure 7.3.2-5: 901.5 MHz – 4SFSK (Half Baud) Mode

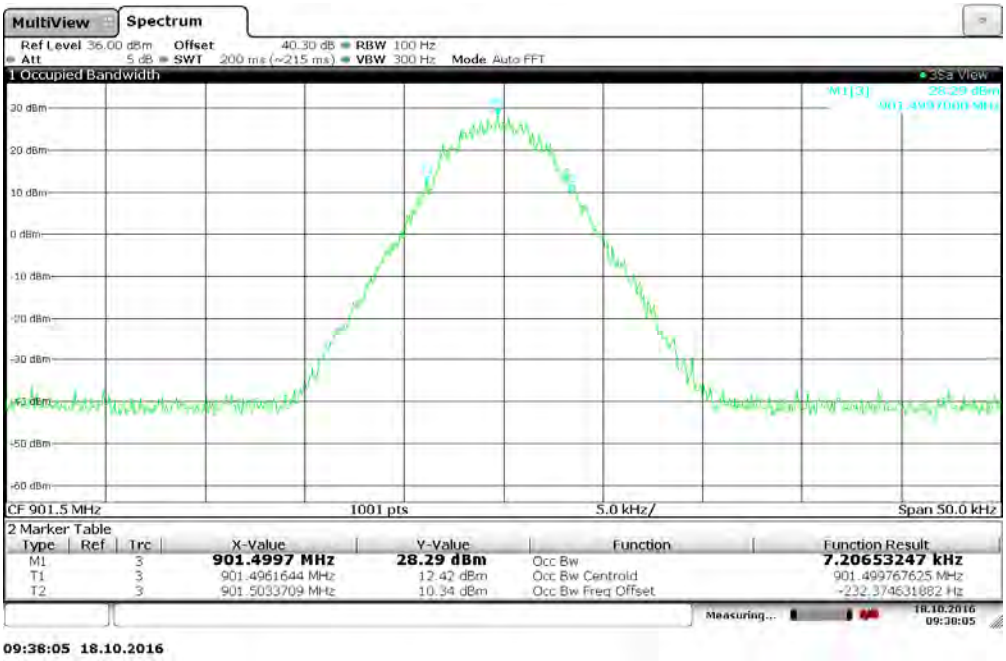

Figure 7.3.2-6: 901.5 MHz – 8 SFSK (Half Baud) Mode

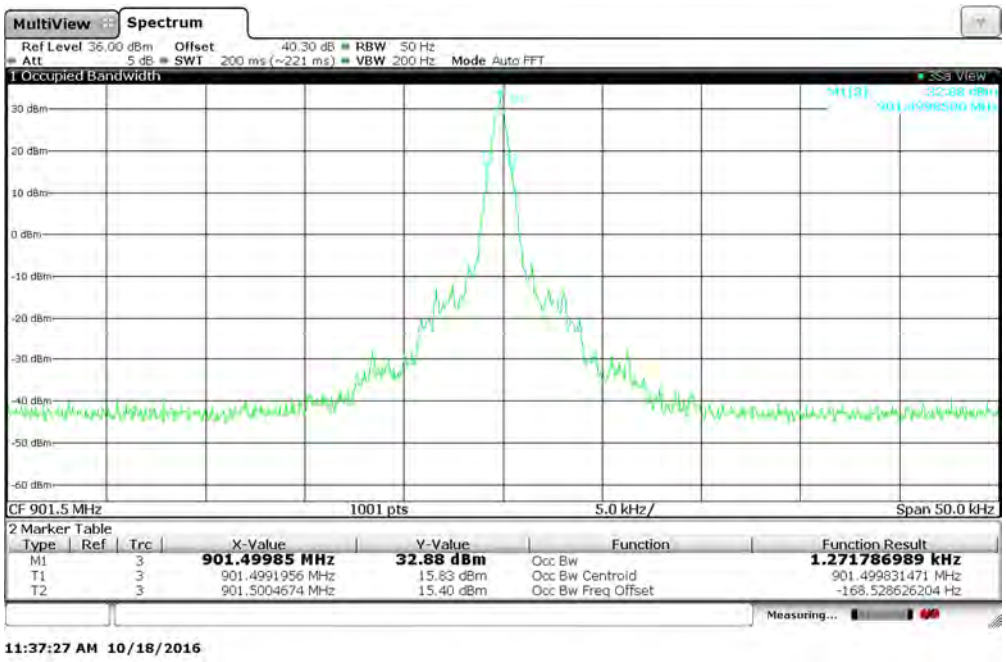

Figure 7.3.2-7: 901.5 MHz – Boost Mode

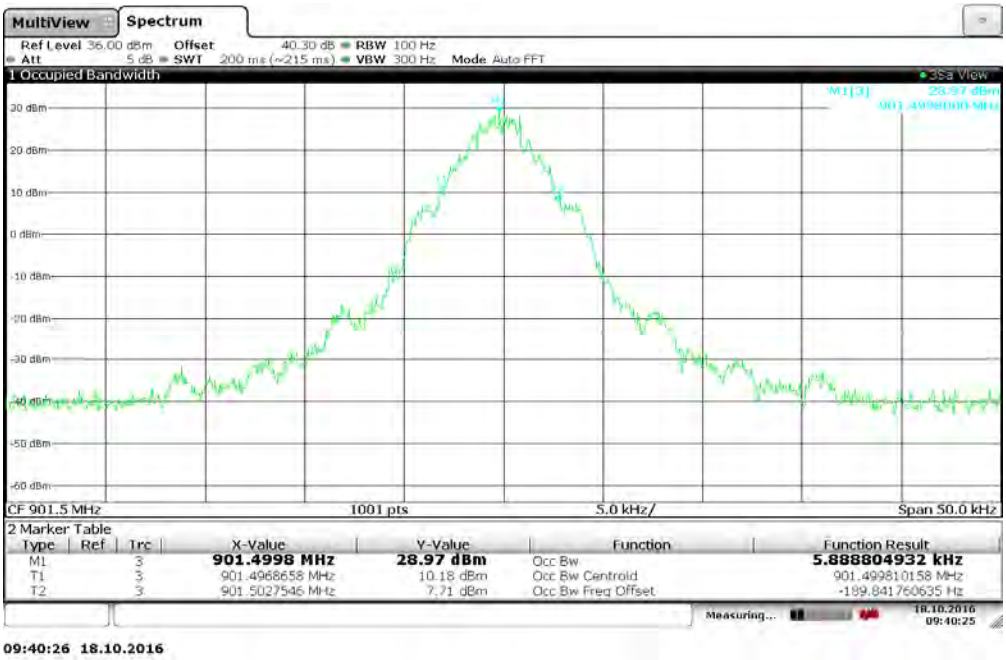

Figure 7.3.2-8: 901.5 MHz – C&I (Half Baud) Mode

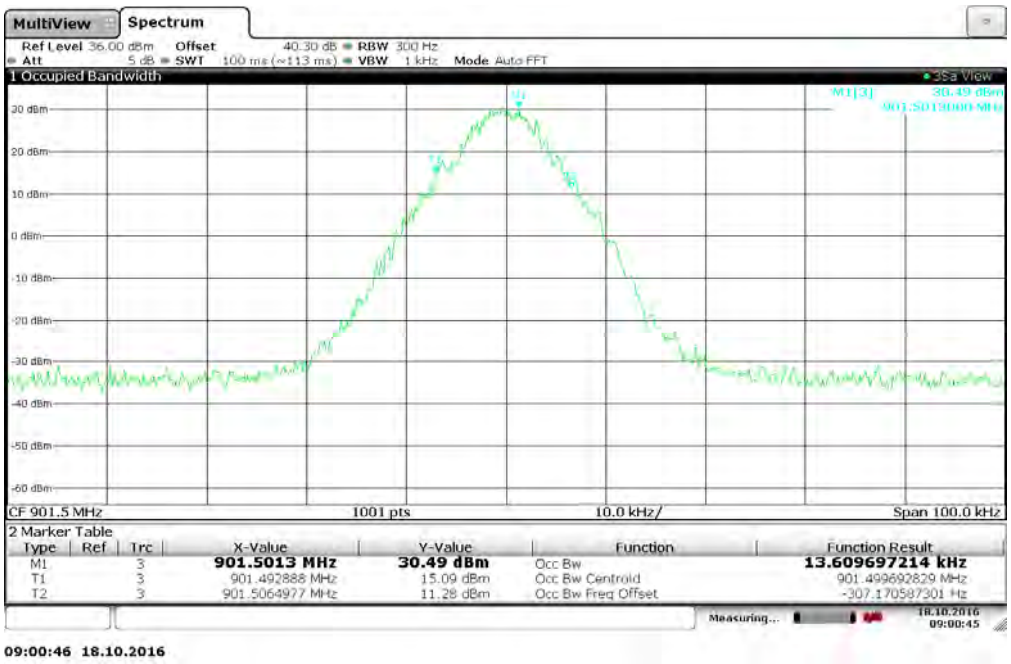

Figure 7.3.2-9: 901.5 MHz – Double Density Mode

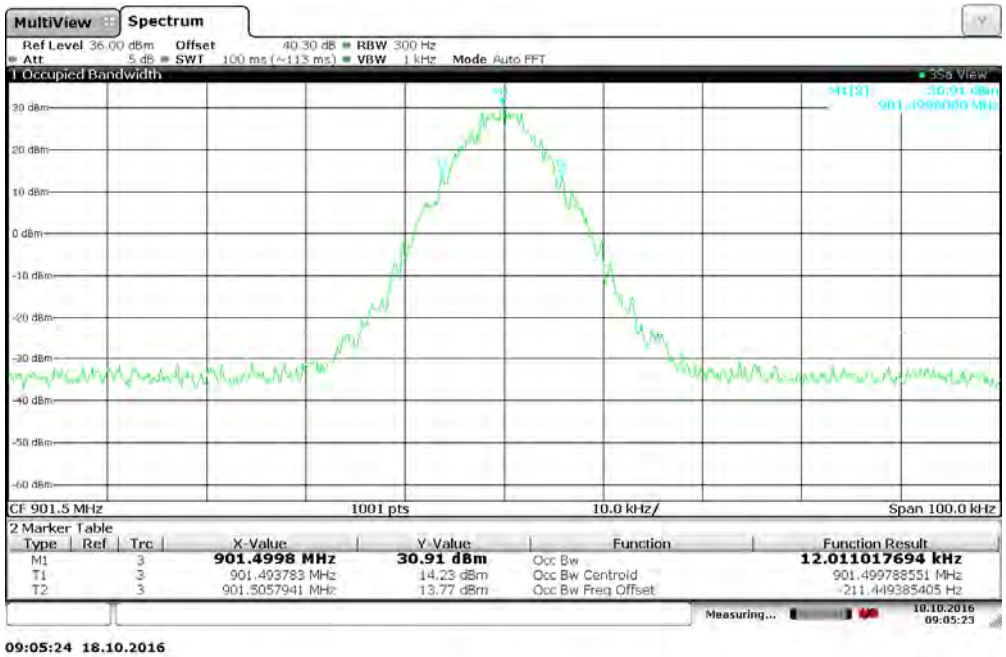

Figure 7.3.2-10: 901.5 MHz – Normal Mode

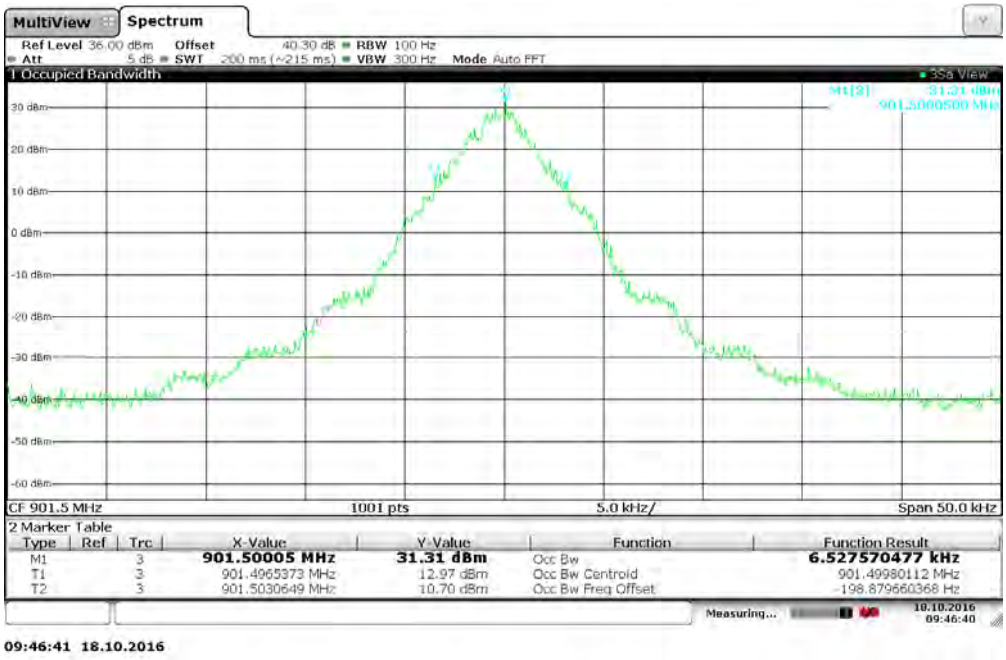

Figure 7.3.2-11: 901.5 MHz – Priority Mode

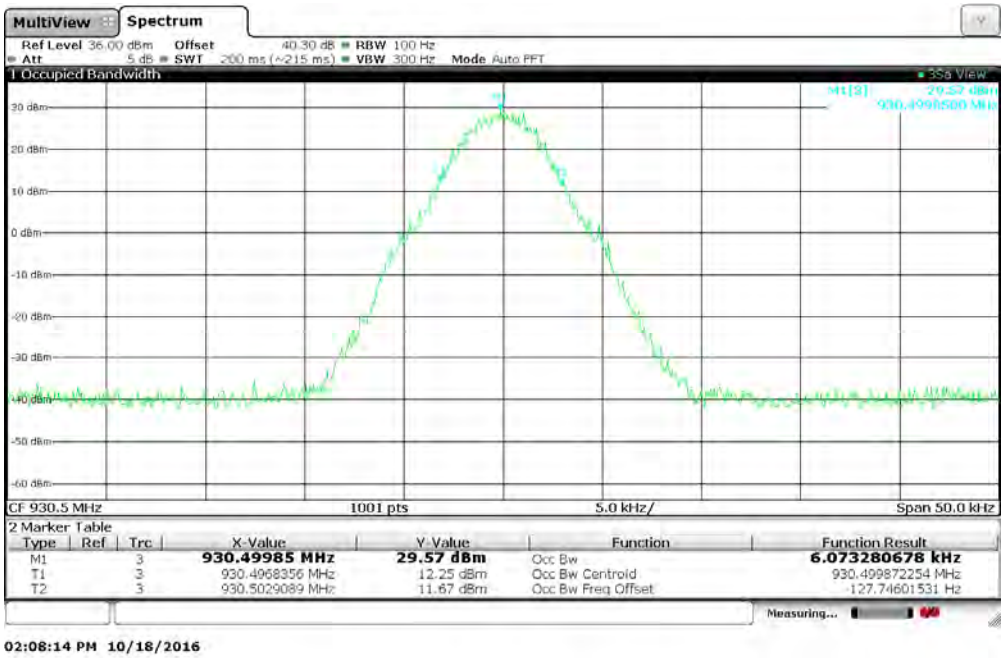

Figure 7.3.2-12: 930.5 MHz – m4Pass 10k Mode

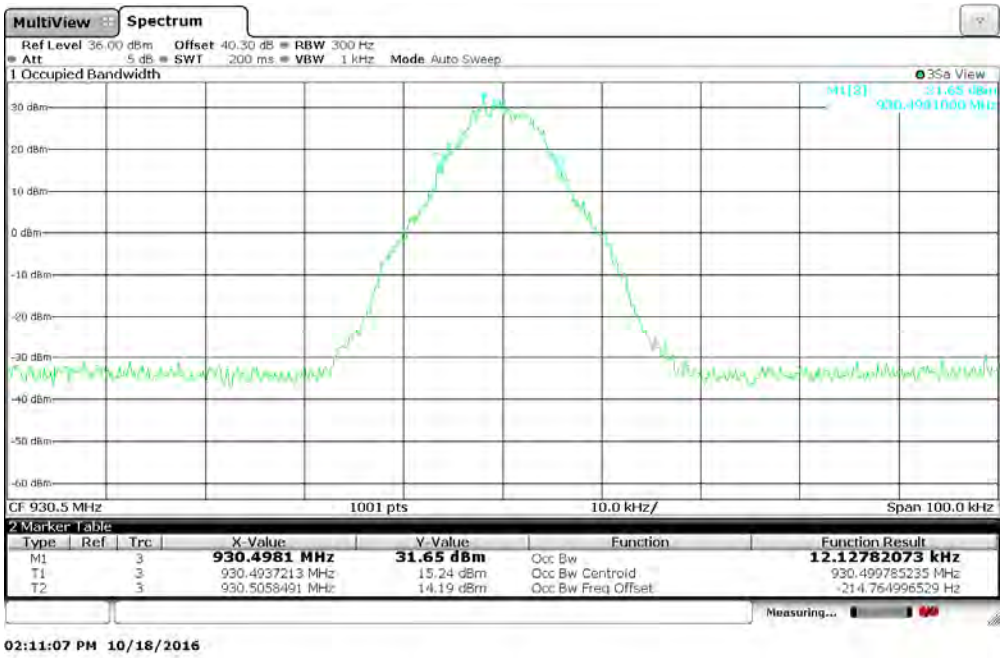

Figure 7.3.2-13: 930.5 MHz – m4Pass 20k Mode

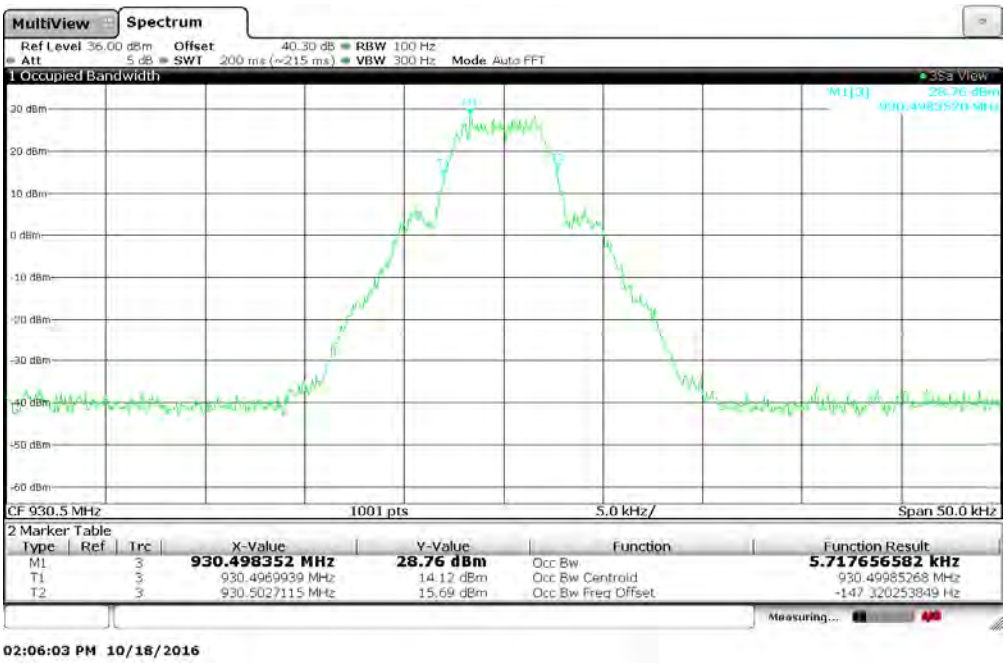

Figure 7.3.2-14: 930.5 MHz – MPass 5k Mode

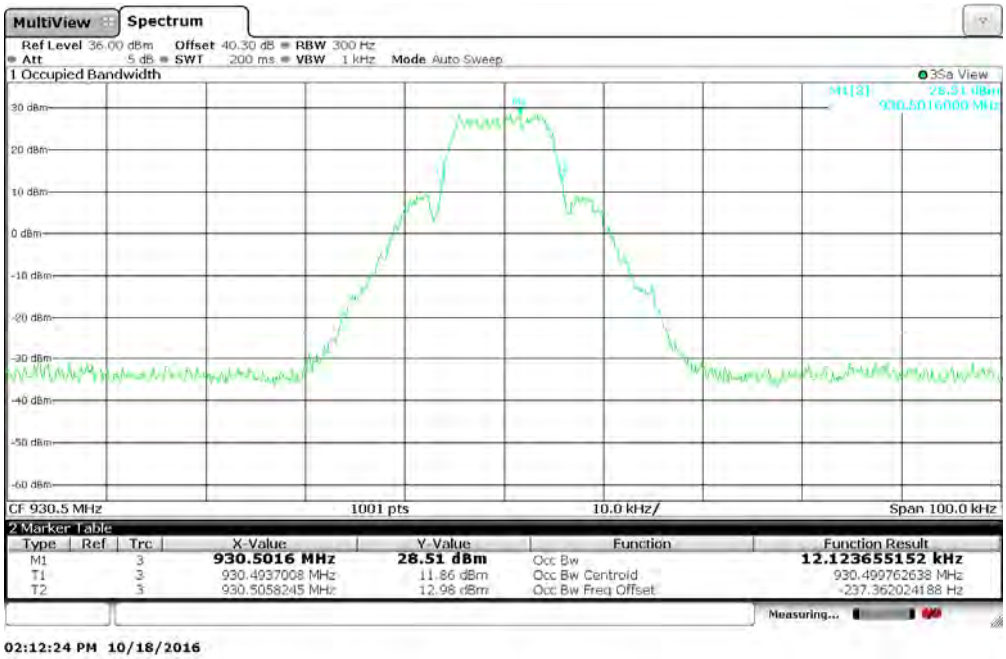

Figure 7.3.2-15: 930.5 MHz – MPass 10k Mode

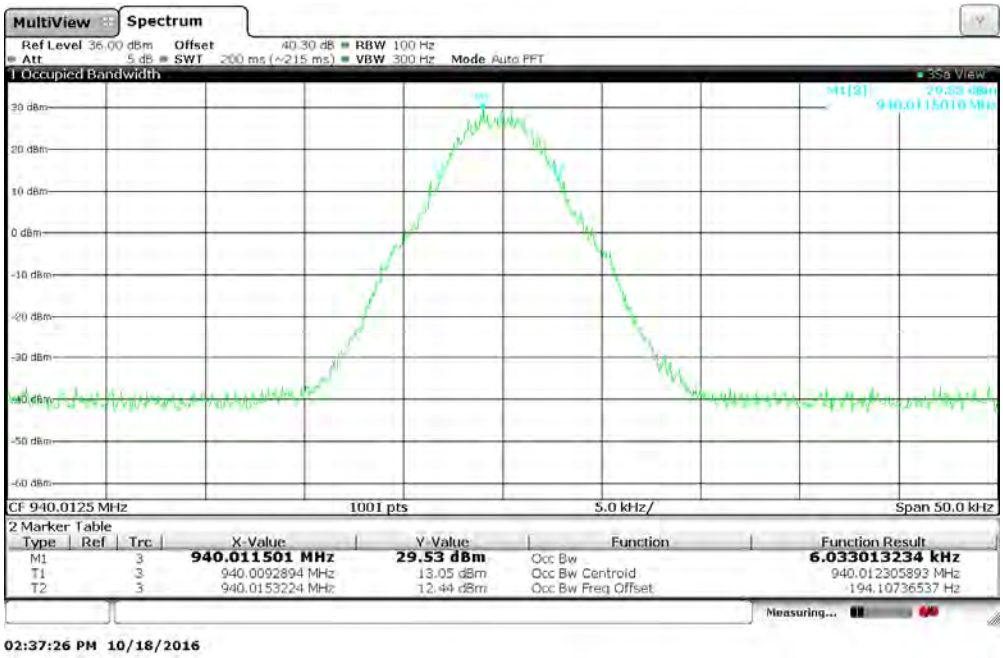

Figure 7.3.2-16: 940.0125 MHz – m4Pass 10k Mode

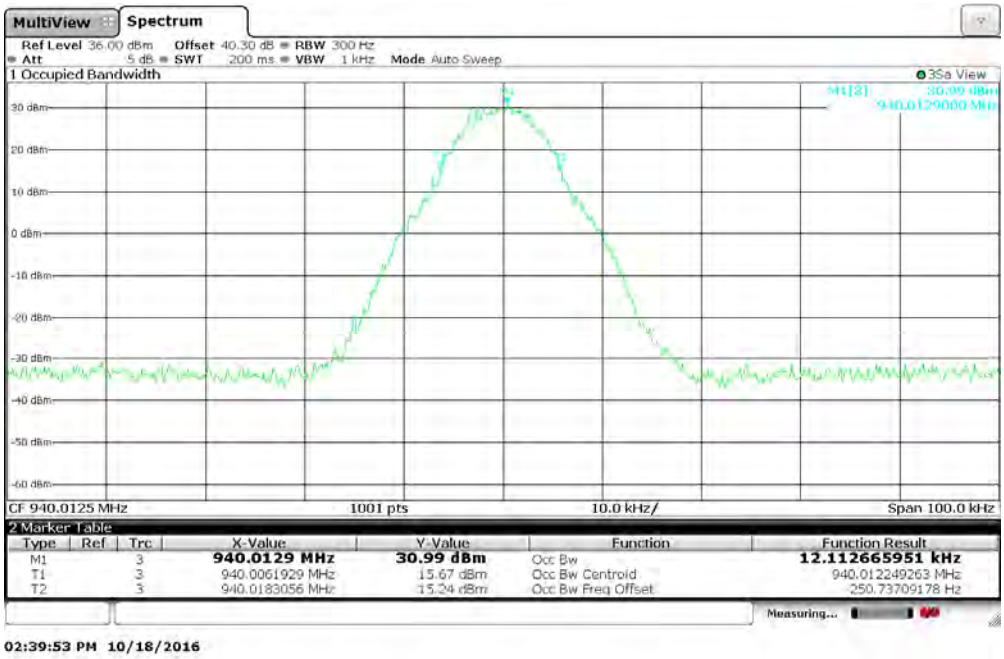

Figure 7.3.2-17: 940.0125 MHz – m4Pass 20k Mode

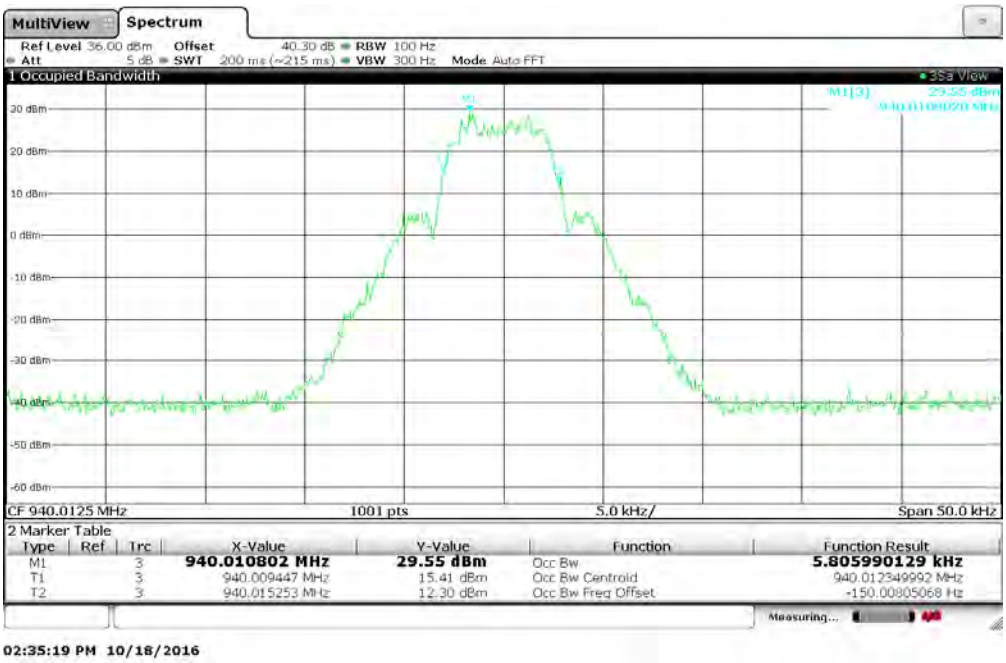

Figure 7.3.2-18: 940.0125 MHz – MPass 5k Mode

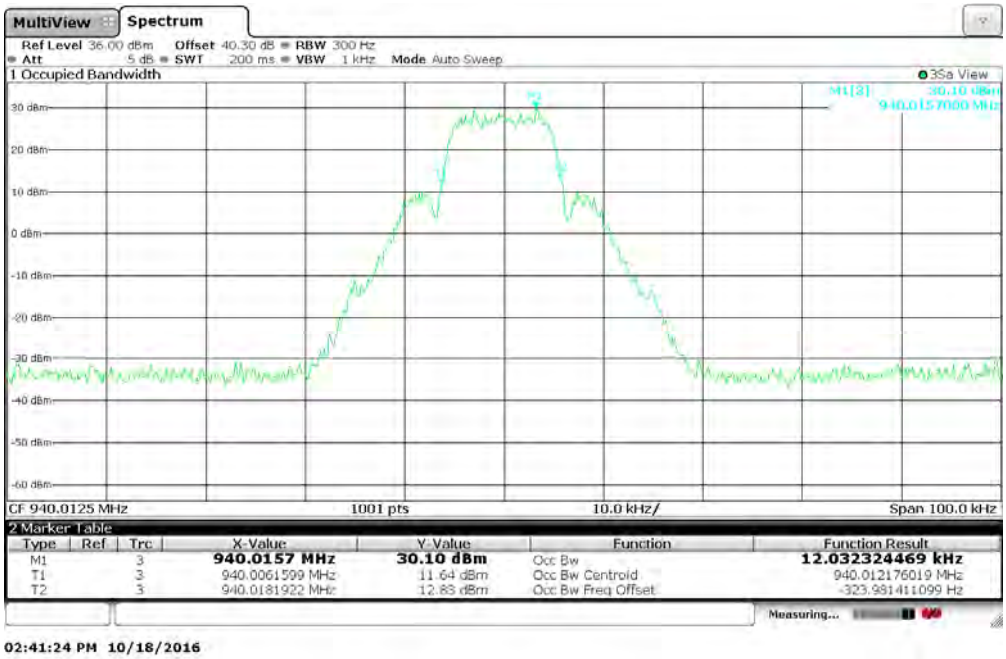

Figure 7.3.2-19: 940.0125 MHz – MPass 10k Mode

ISED Canada RSS-GEN 6.6, ISED Canada RSS-119

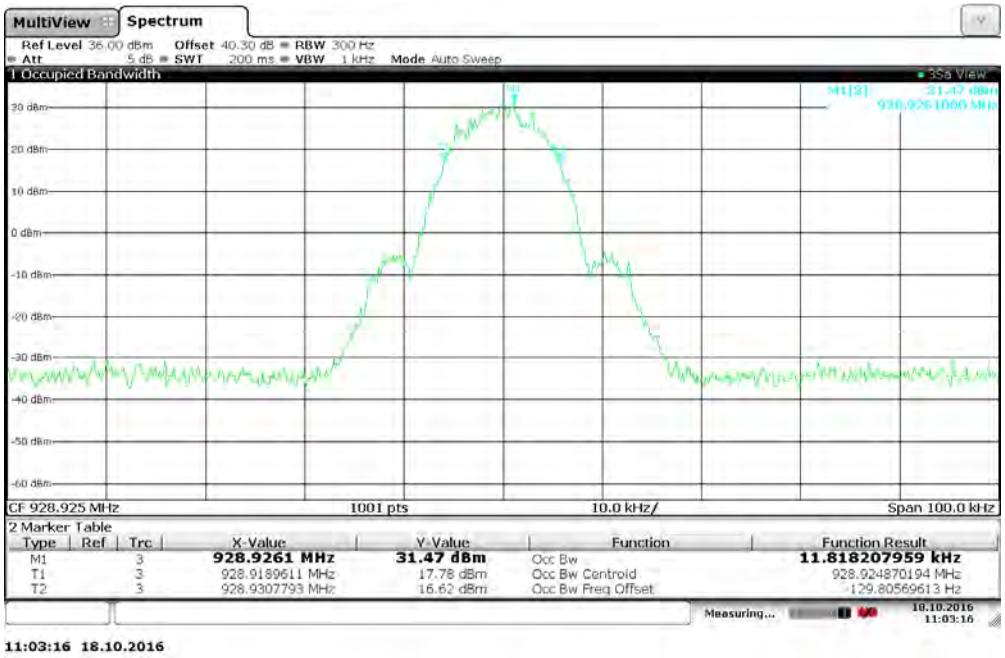

Figure 7.3.2-20: 928.925 MHz – 2SFSK Mode

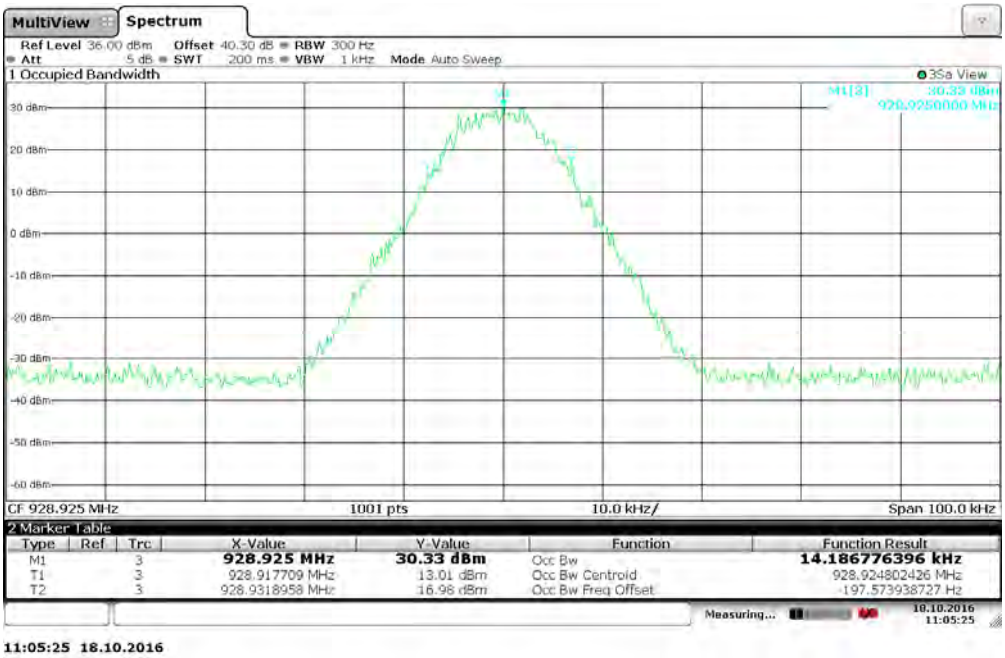

Figure 7.3.2-21: 928.925 MHz – 4SFSK Mode

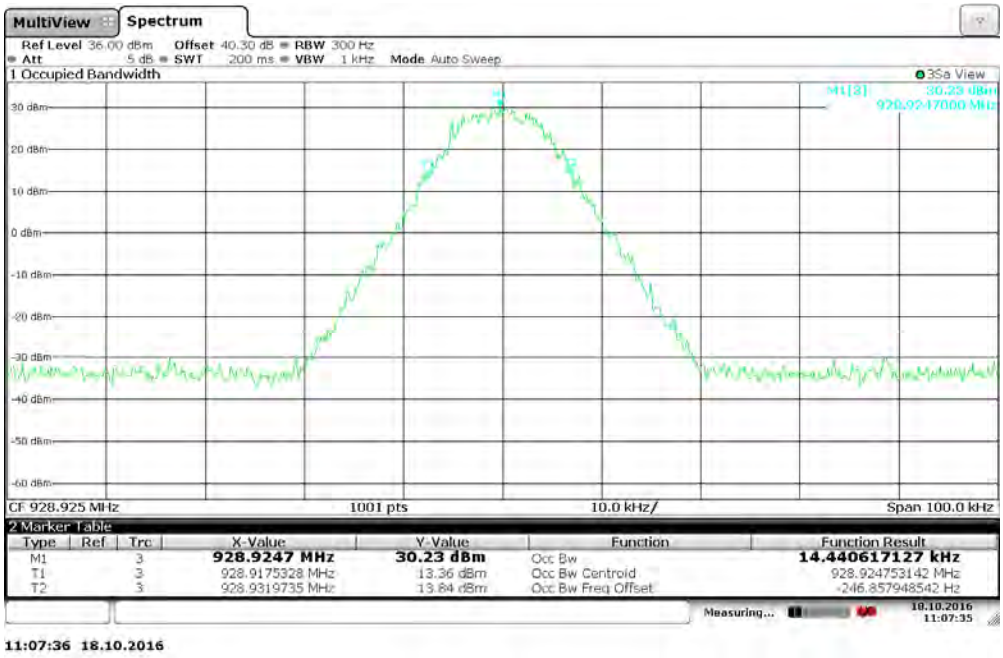

Figure 7.3.2-22: 928.925 MHz – 8SFSK Mode

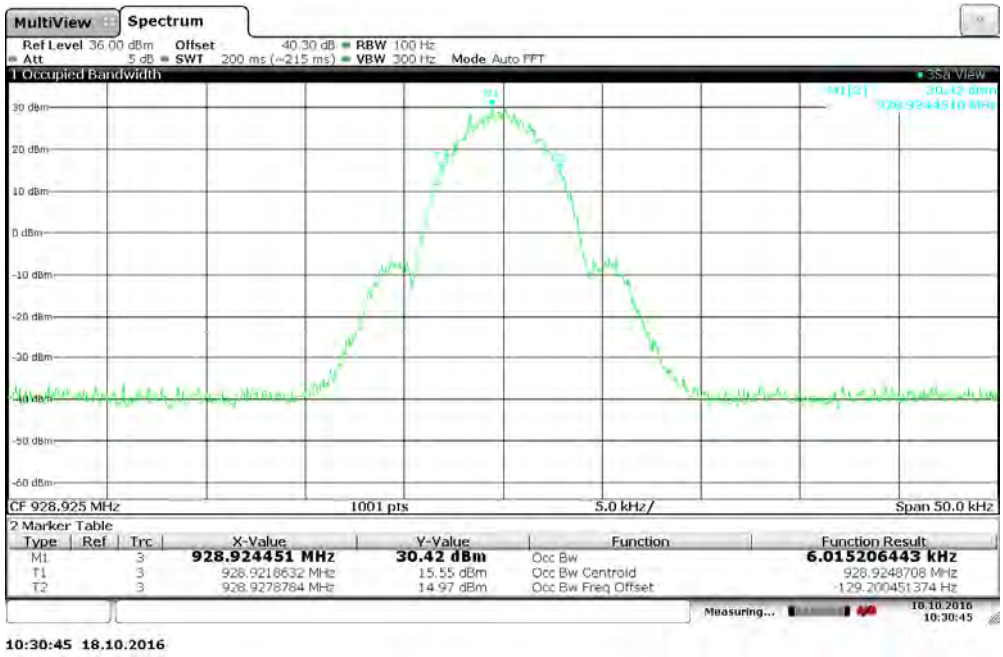

Figure 7.3.2-23: 928.925 MHz – 2SFSK (Half Baud) Mode

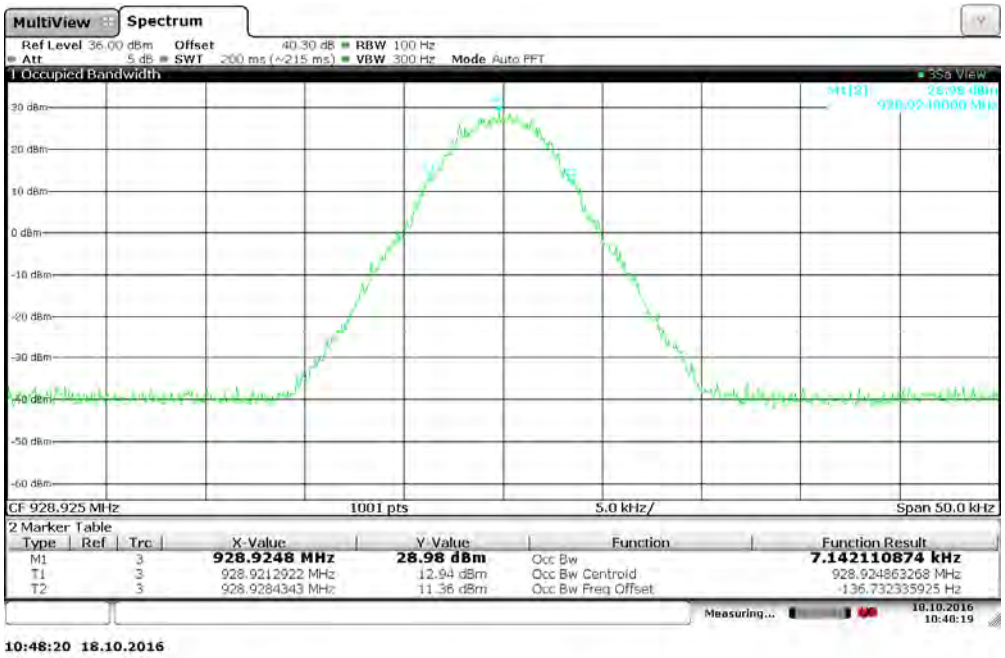

Figure 7.3.2-24: 928.925 MHz – 4SFSK (Half Baud) Mode

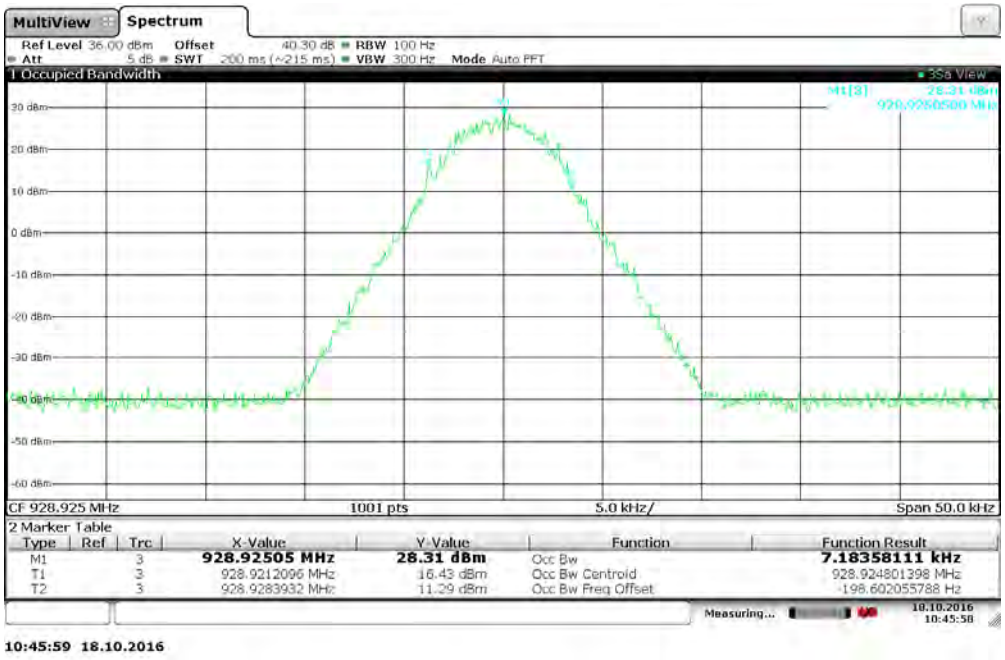

Figure 7.3.2-25: 928.925 MHz – 8SFSK (Half Baud) Mode

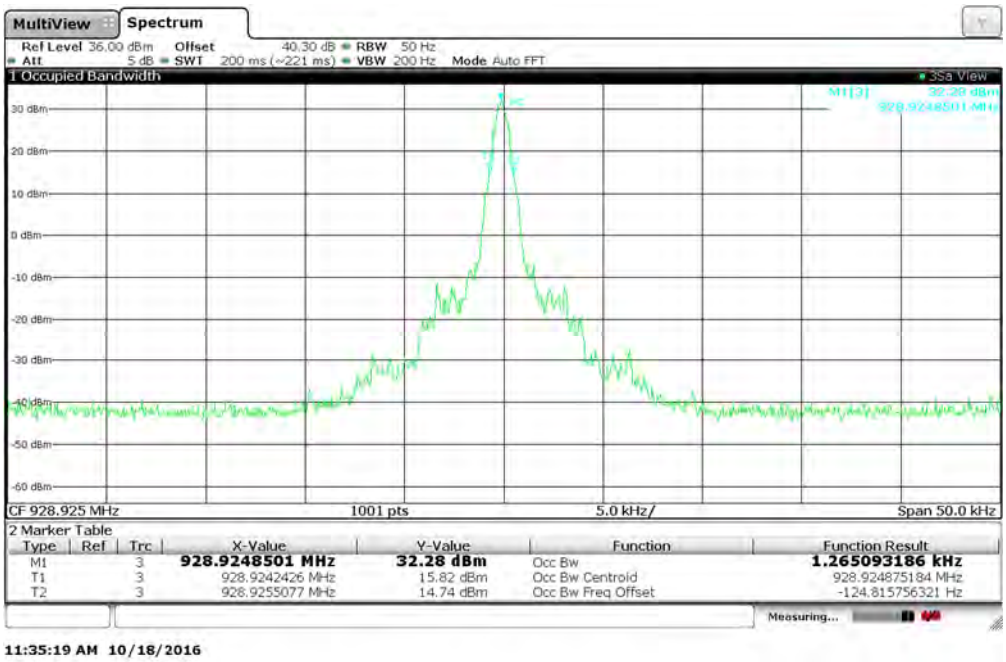

Figure 7.3.2-26: 928.925 MHz – Boost Mode

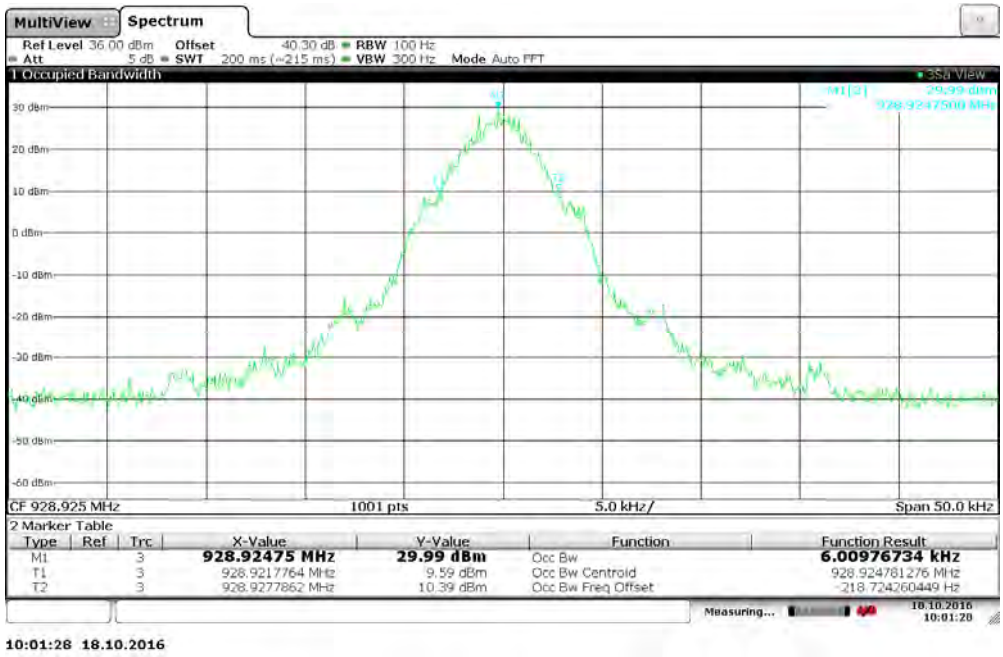

Figure 7.3.2-27: 928.925 MHz – C&I (Half Baud) Mode

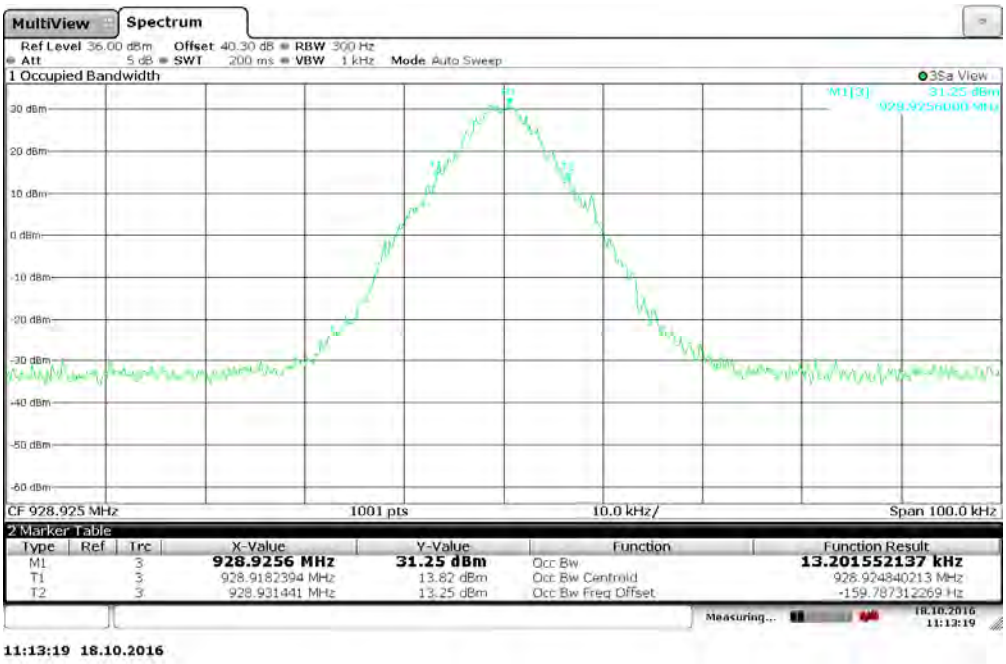

Figure 7.3.2-28: 928.925 MHz – Double Density Mode

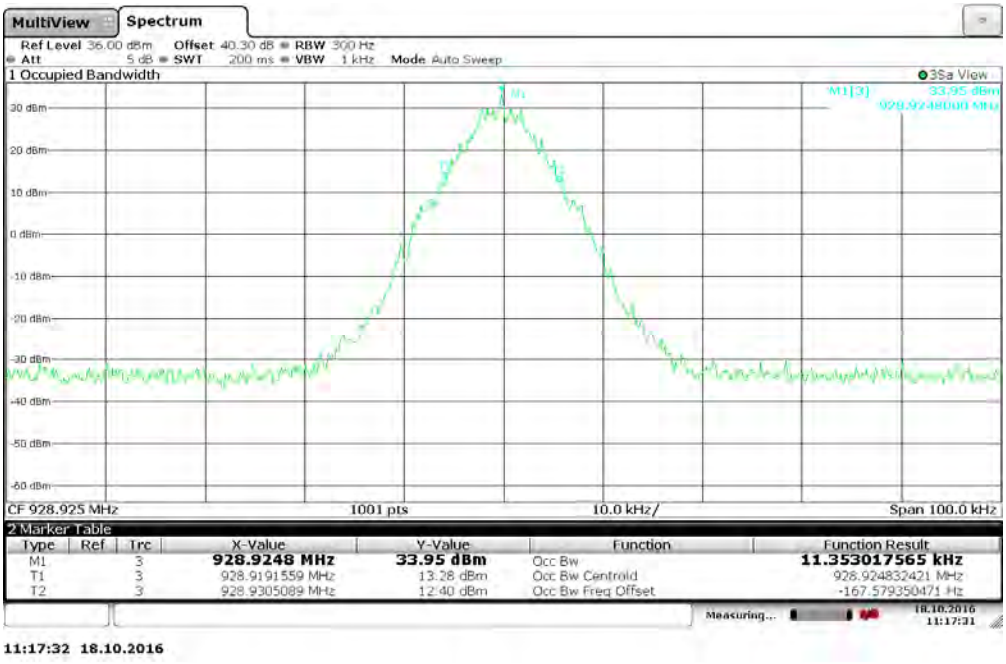

Figure 7.3.2-29: 928.925 MHz – Normal Mode

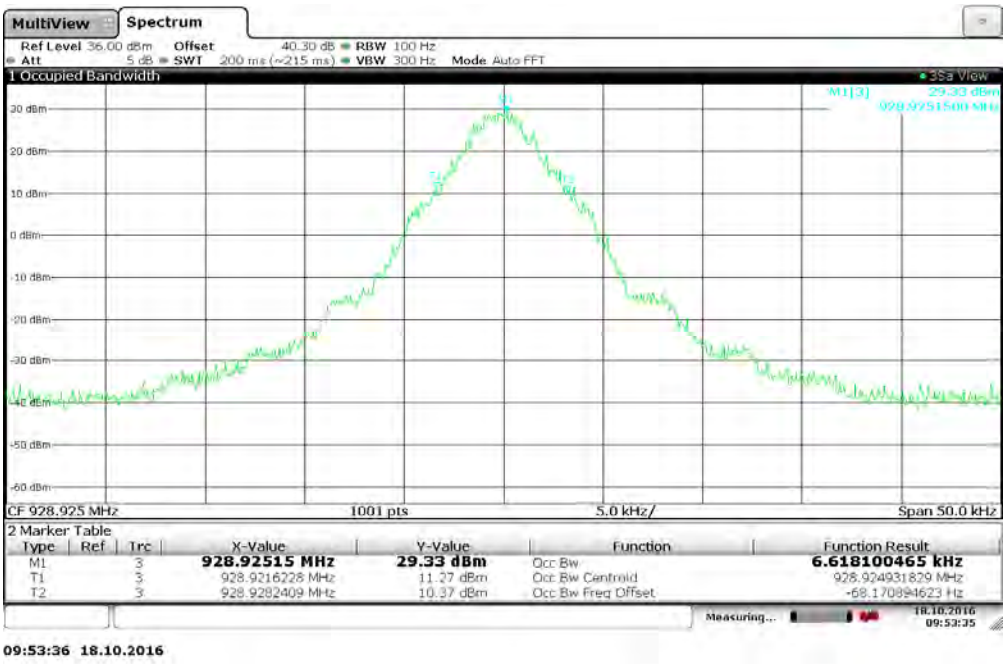

Figure 7.3.2-30: 928.925 MHz – Priority Mode

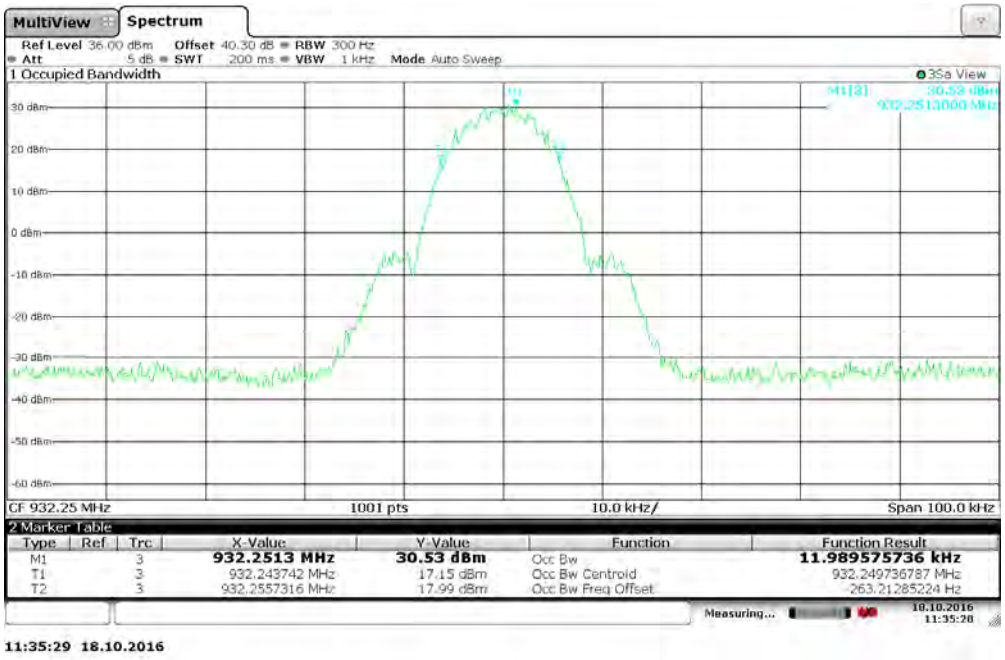

Figure 7.3.2-31: 932.25 MHz – 2SFSK Mode

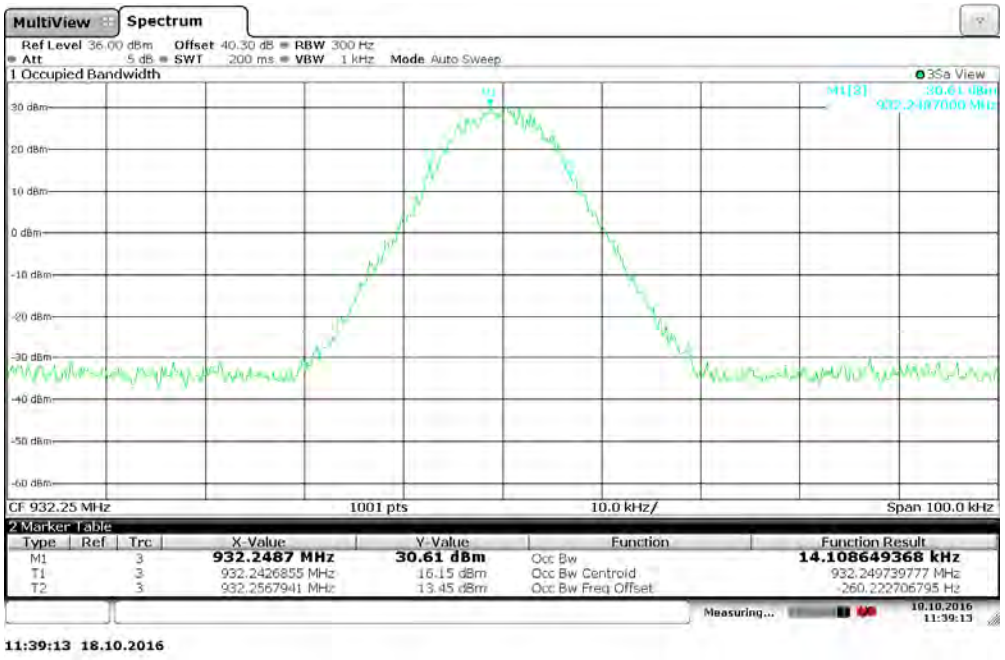

Figure 7.3.2-32: 932.25 MHz – 4SFSK Mode

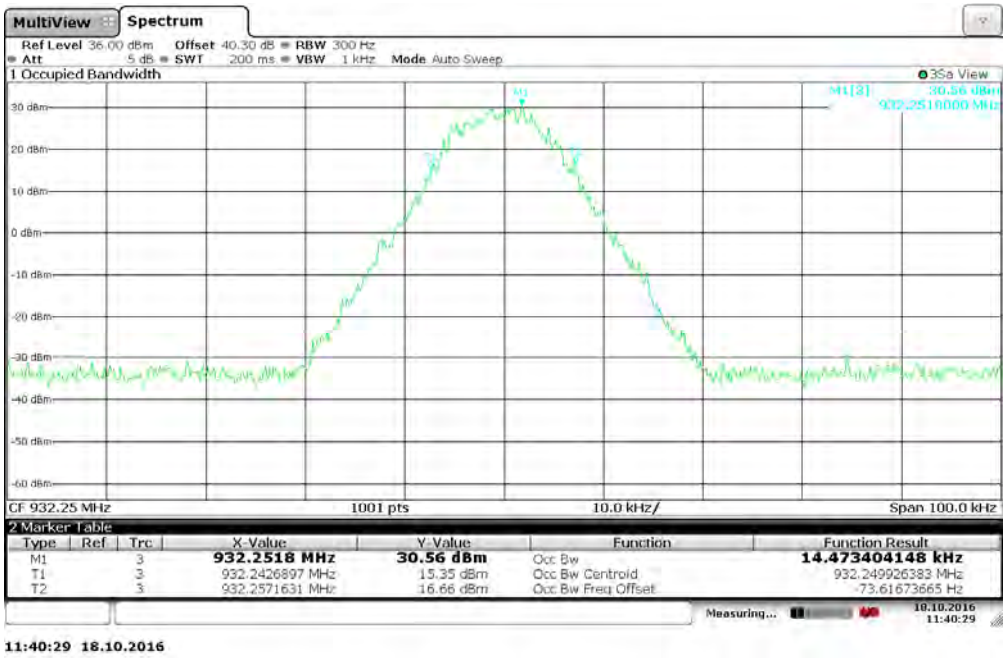

Figure 7.3.2-33: 932.25 MHz – 8SFSK Mode

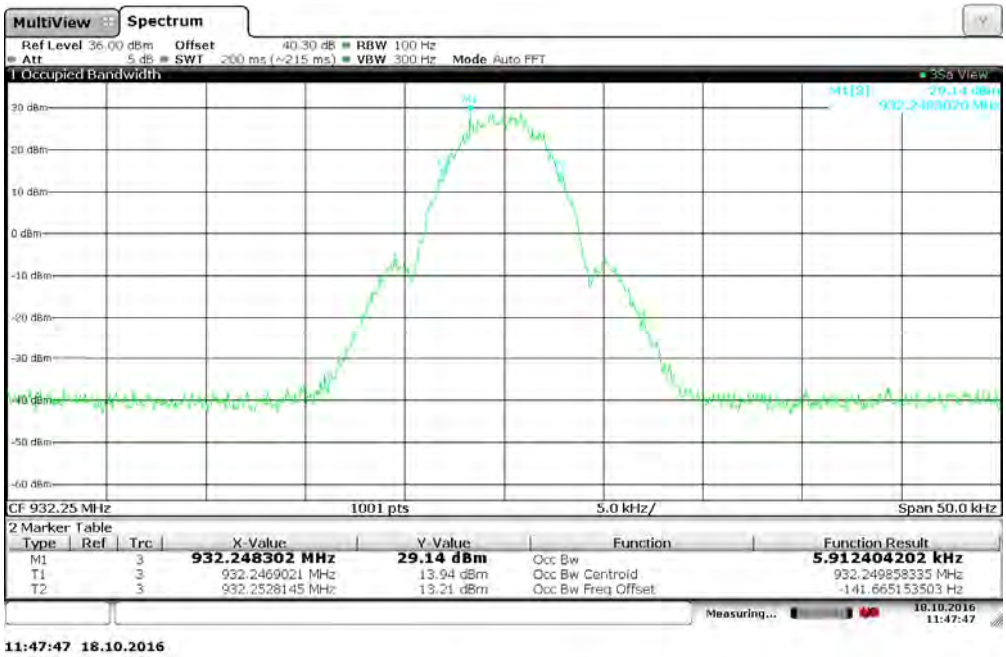

Figure 7.3.2-34: 932.25 MHz – 2SFSK (Half Baud) Mode

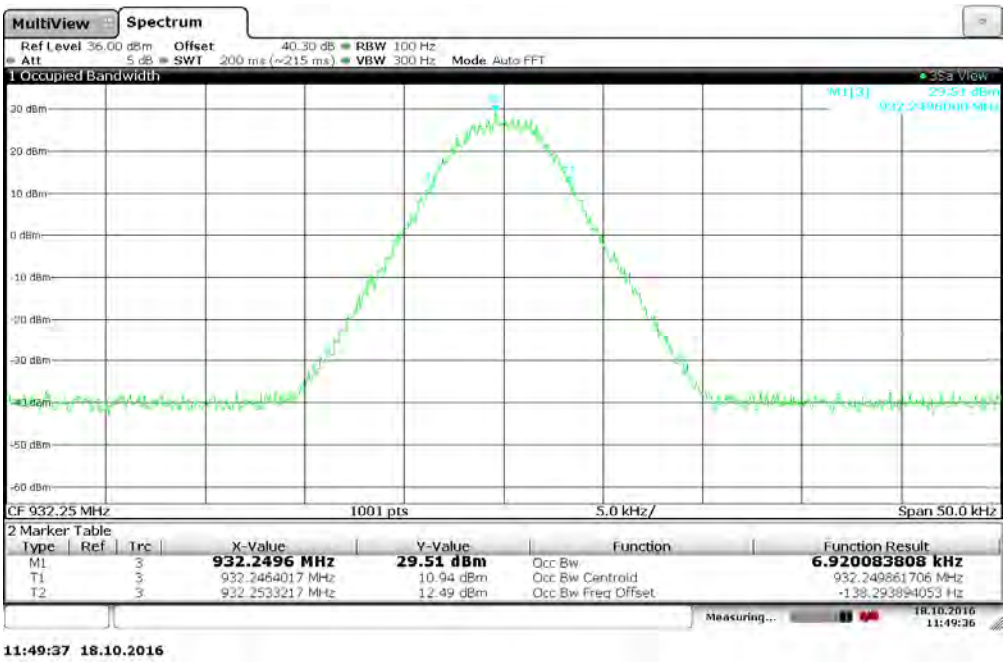

Figure 7.3.2-35: 932.25 MHz – 4SFSK (Half Baud) Mode

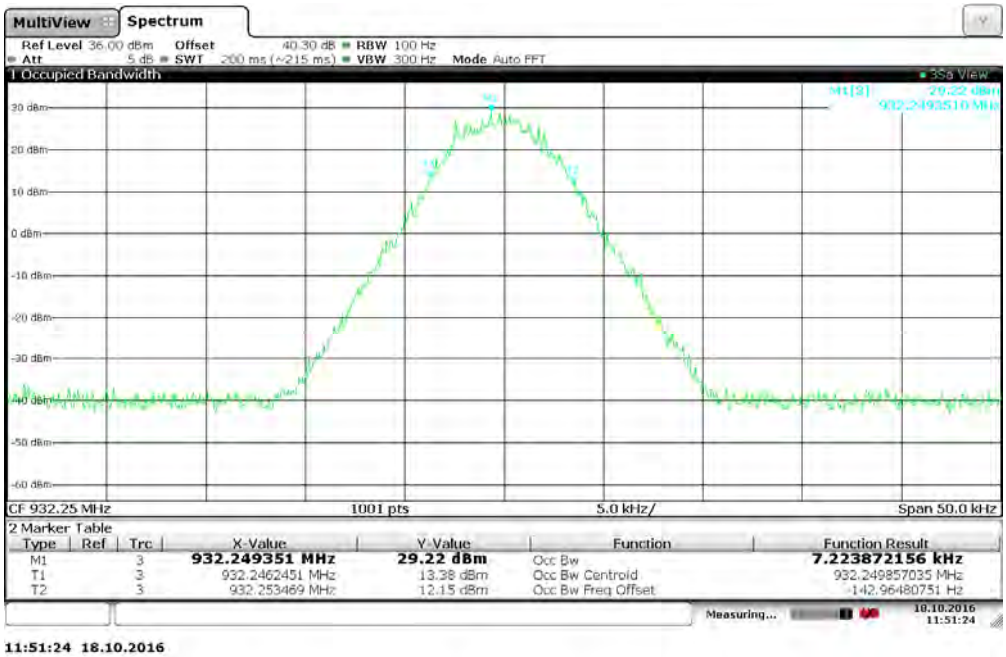

Figure 7.3.2-36: 932.25 MHz – 8SFSK (Half Baud) Mode

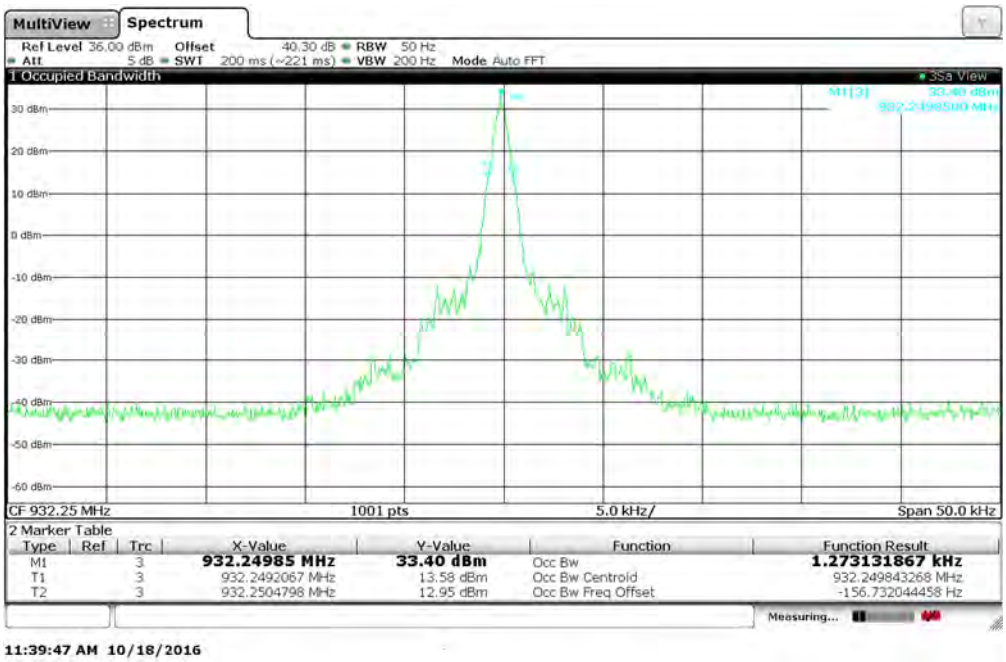

Figure 7.3.2-37: 932.25 MHz – Boost Mode

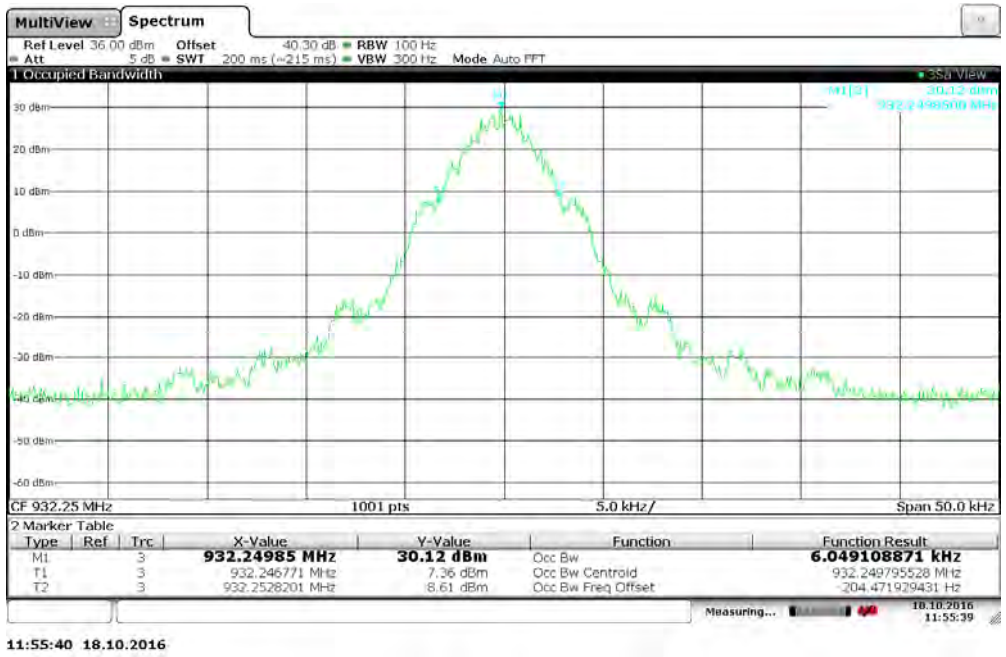

Figure 7.3.2-38: 932.25 MHz – C&I (Half Baud) Mode

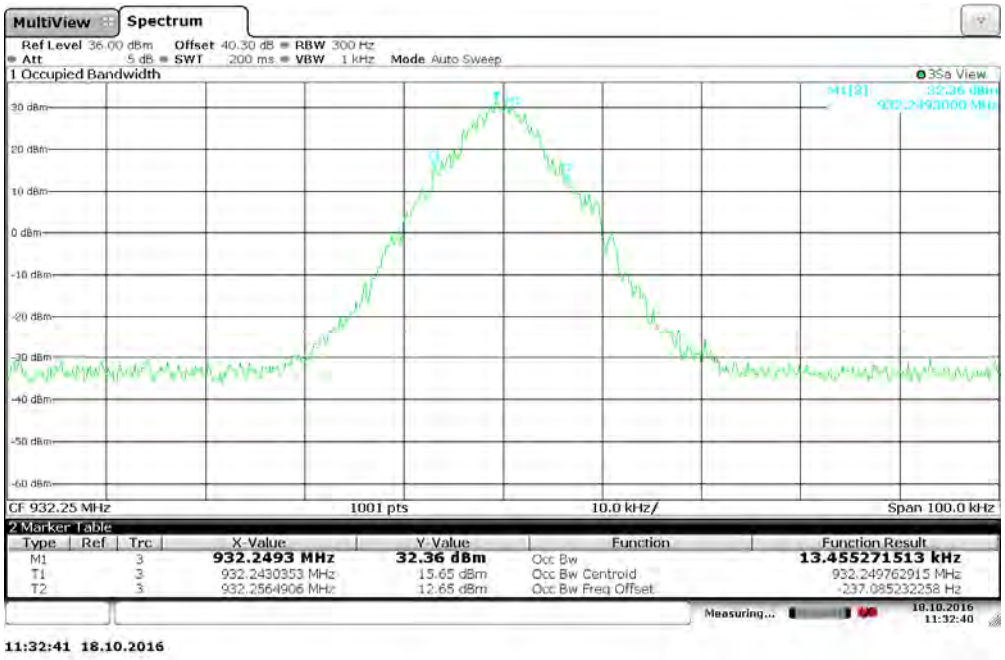

Figure 7.3.2-39: 932.25 MHz – Double Density Mode

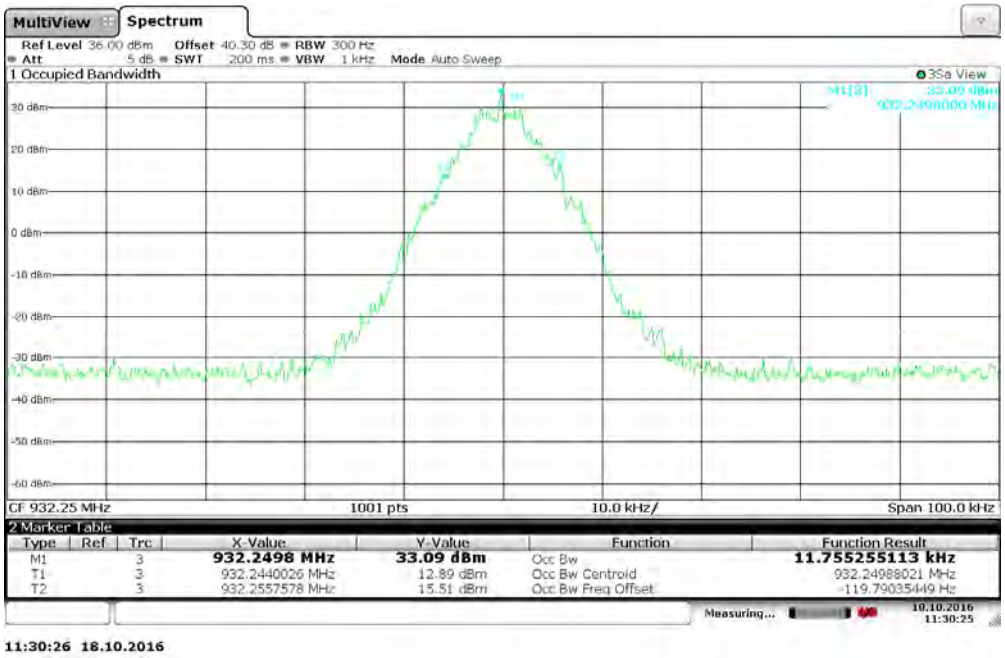

Figure 7.3.2-40: 932.25 MHz – Normal Mode

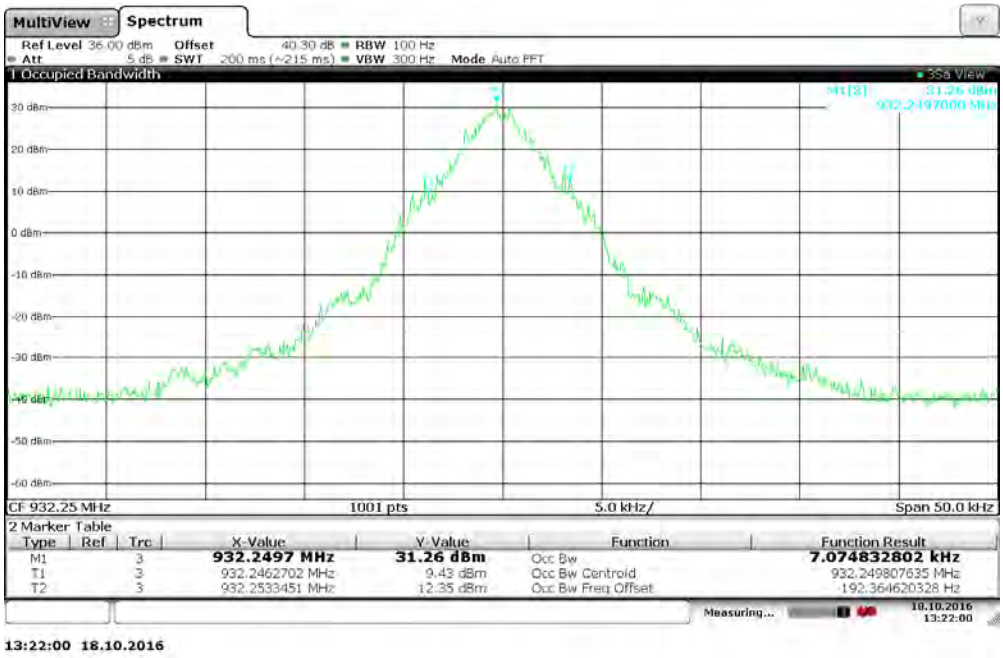

Figure 7.3.2-41: 932.25 MHz –– Priority Mode

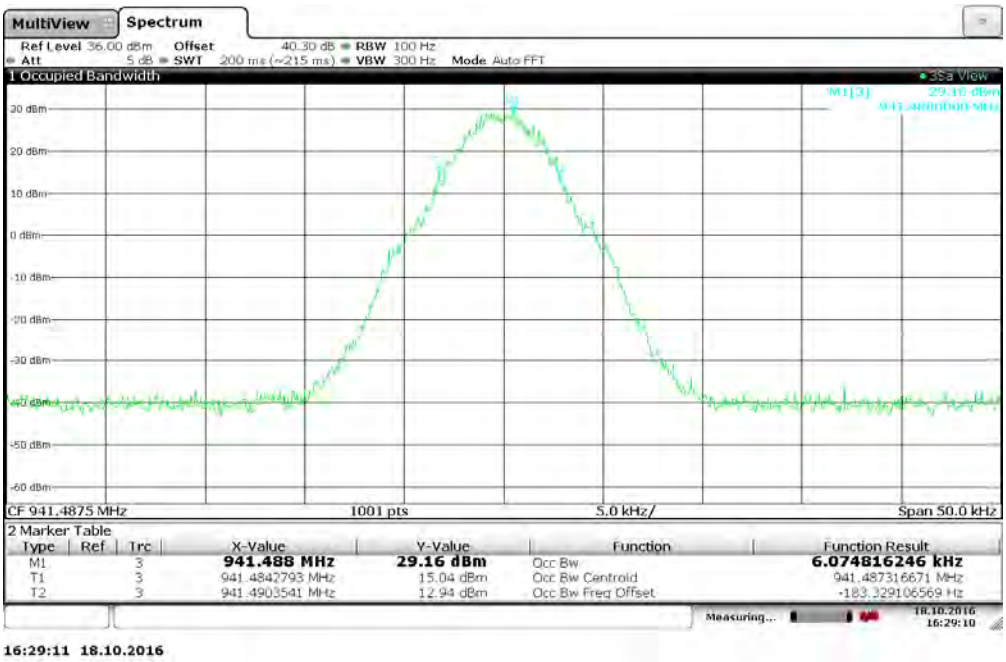

Figure 7.3.2-42: 941.4875 MHz – m4Pass 10k Mode

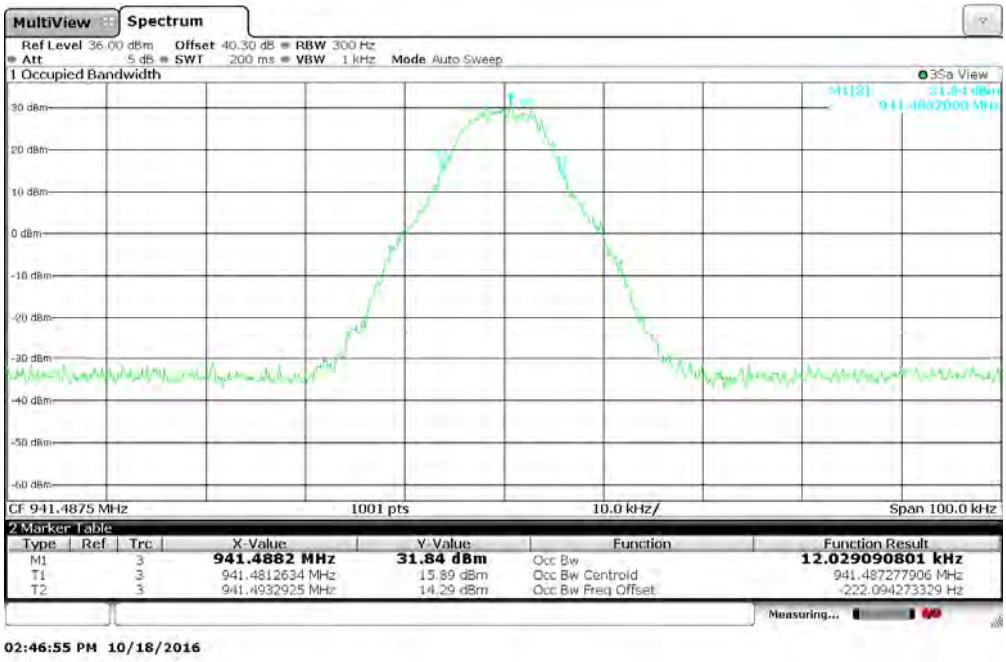

Figure 7.3.2-43: 941.4875 MHz – m4Pass 20k Mode

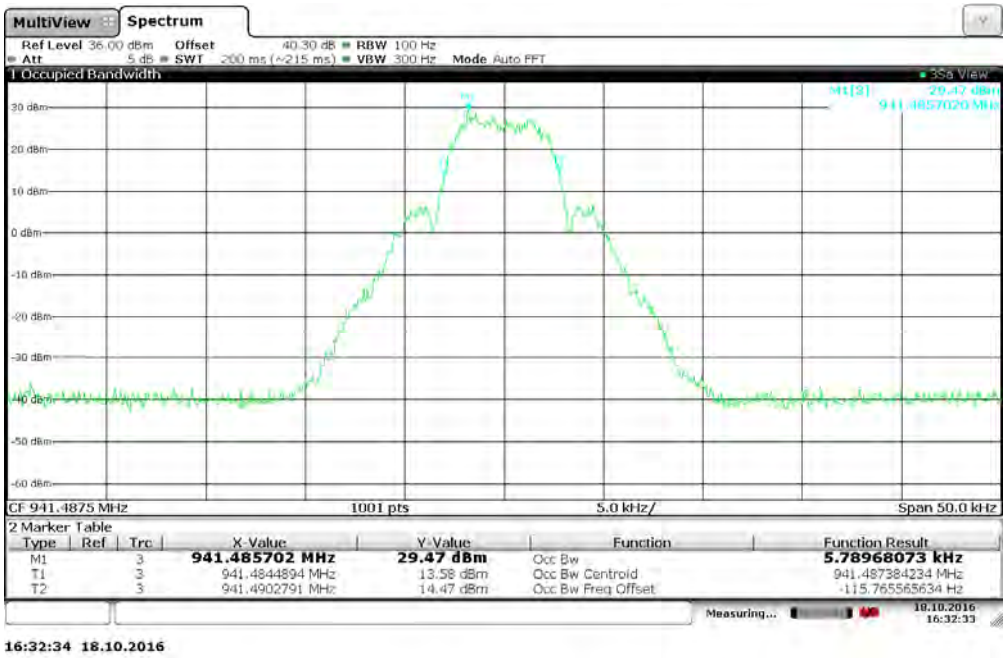

Figure 7.3.2-44: 941.4875 MHz – MPass 5k Mode

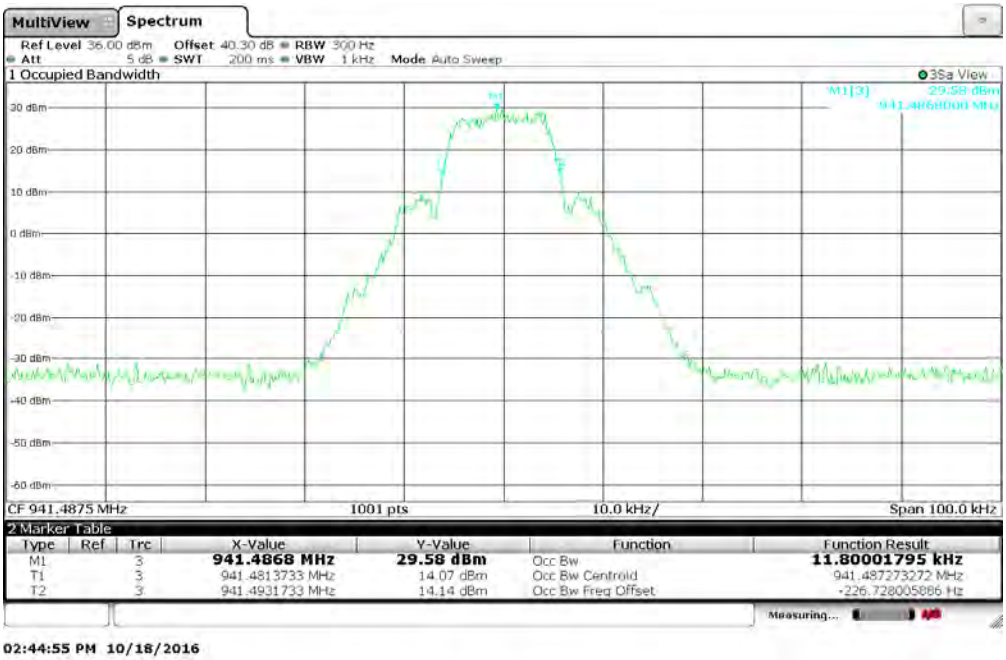

Figure 7.3.2-45: 941.4875 MHz – MPass 10k Mode

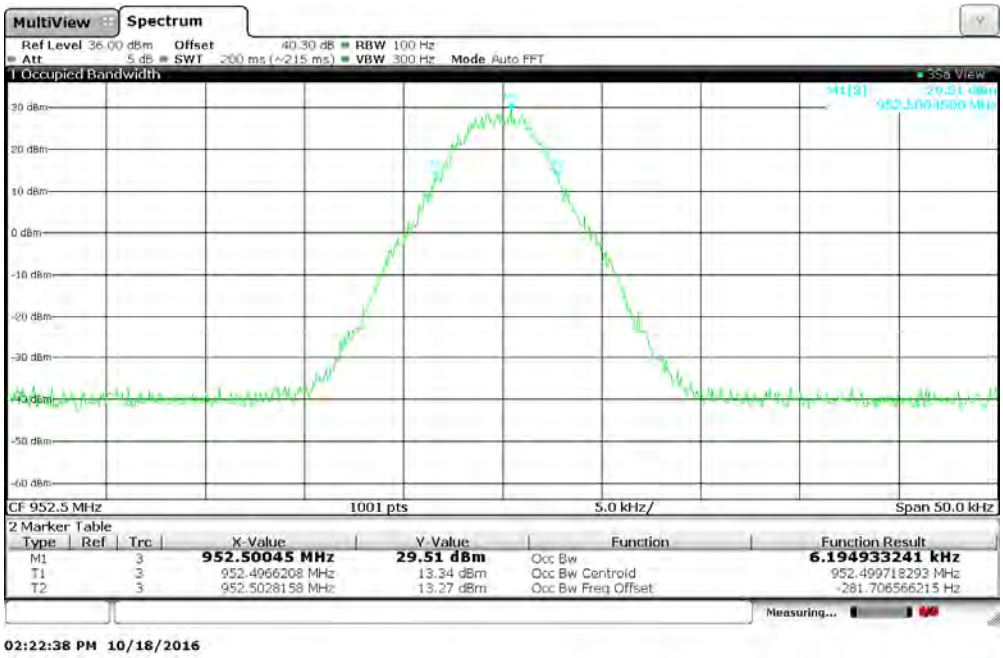

Figure 7.3.2-46: 952.5 MHz – m4Pass 10k Mode

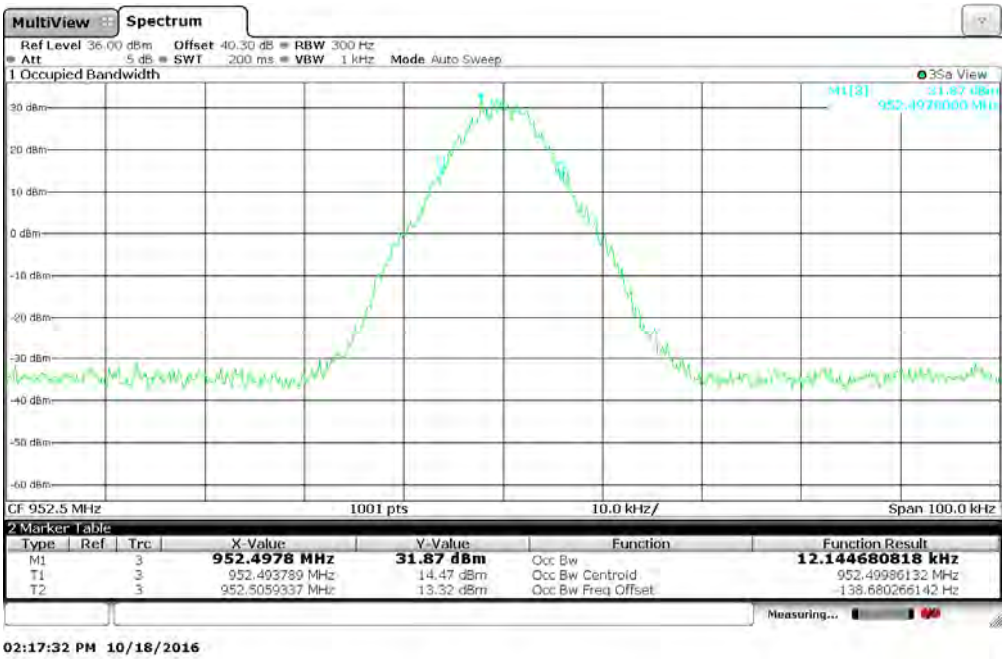

Figure 7.3.2-47: 952.5 MHz – m4Pass 20k Mode

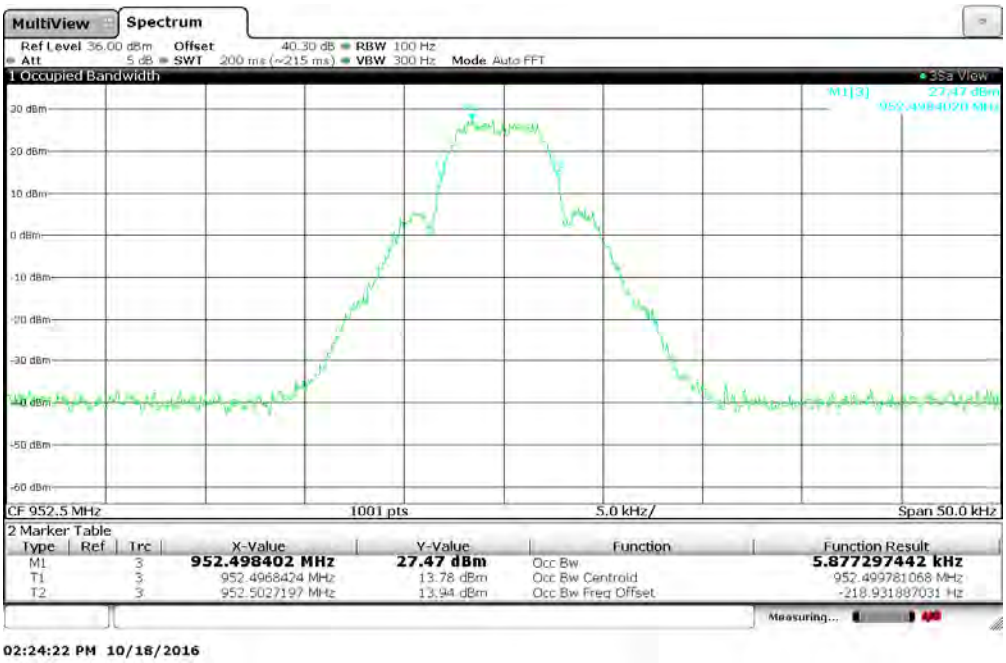

Figure 7.3.2-48: 952.5 MHz – MPass 5k Mode

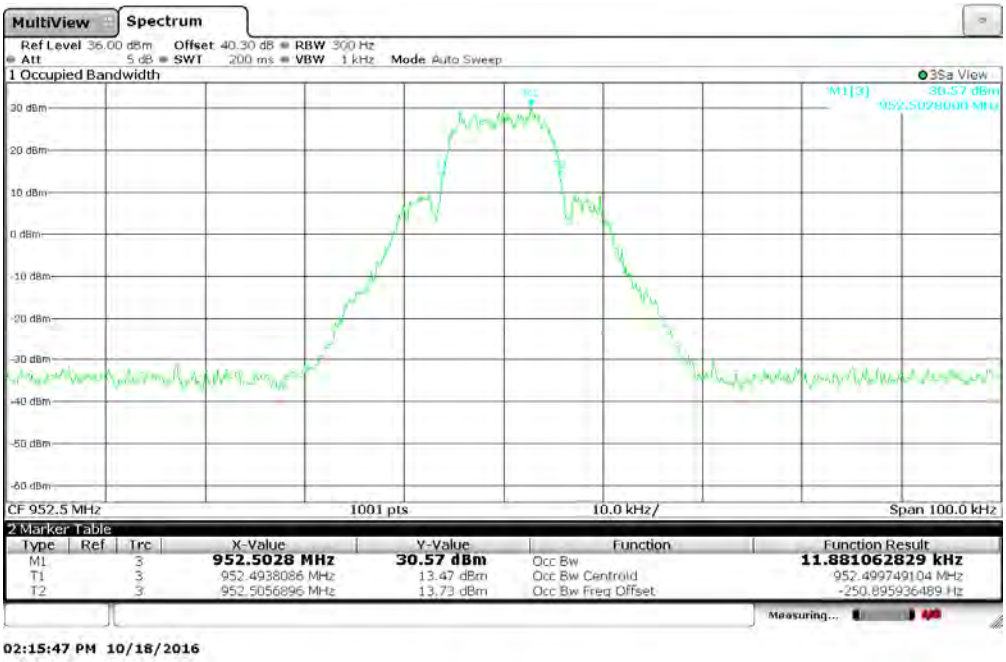

Figure 7.3.2-49: 952.5 MHz – MPass 10k Mode

7.4 Spurious Emissions at Antenna Terminals

7.4.1 Measurement Procedure (ANSI 63.26: 2015 Section 5.7.4)

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through 40.2 dB of passive attenuation for the high power plots and 30.2 dB for the low power plots.. The spectrum analyzer resolution bandwidth was set to 100 kHz below 1000 MHz and 1 MHz above 1000 MHz. The internal correction factors of the spectrum analyzer were employed to correct for any cable, attenuator or filter losses. The spectrum was investigated in accordance to CFR 47 Part 2.1057. There were no significant emissions from 9 kHz or lowest frequency generated to 30 MHz. Results are shown below.

7.4.2 Measurement Results

Part 24.133 a(1), a(2), ISED Canada RSS-134 4.4.1 (a), (b), 4.4.2 (a), (b)

ILSI

High Power

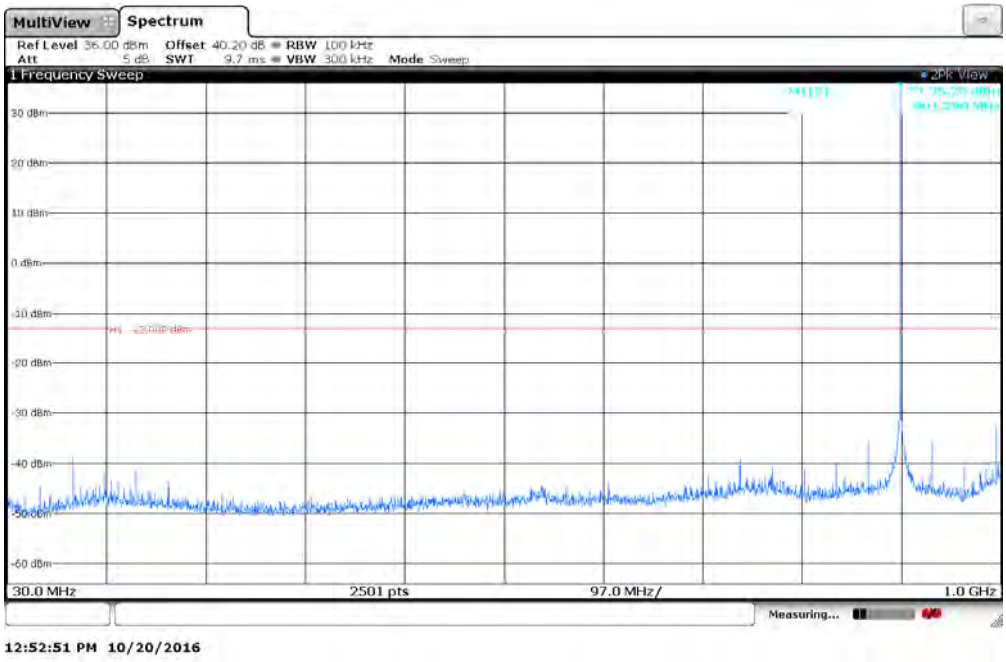

Figure 7.4.2-1: 901.5 MHz – 30MHz to 1GHz – Normal mode

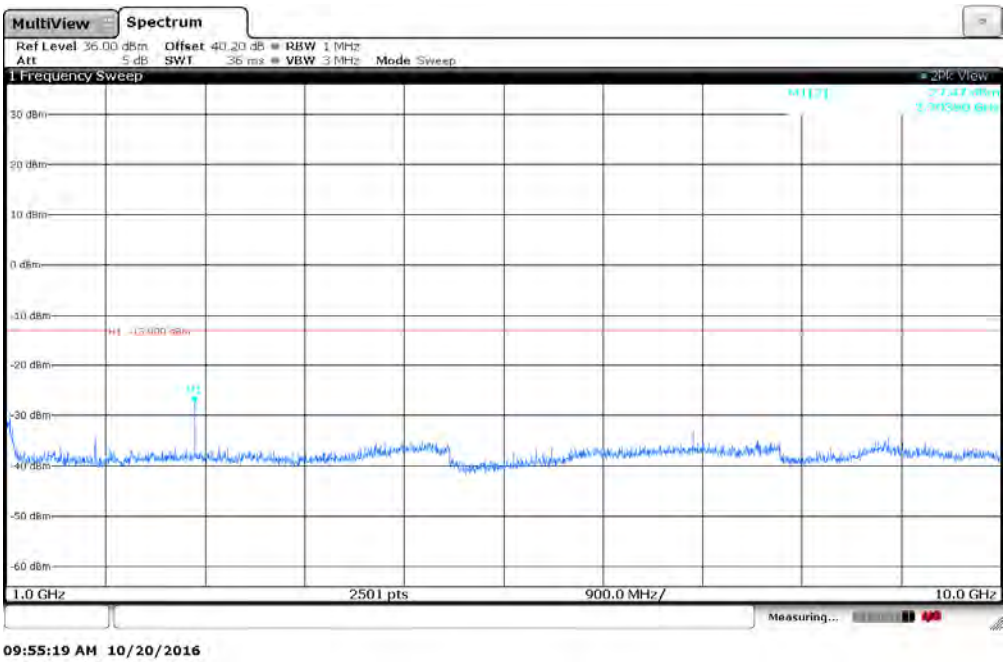

Figure 7.4.2-2: 901.5 MHz – 1GHz to 10GHz – Normal mode

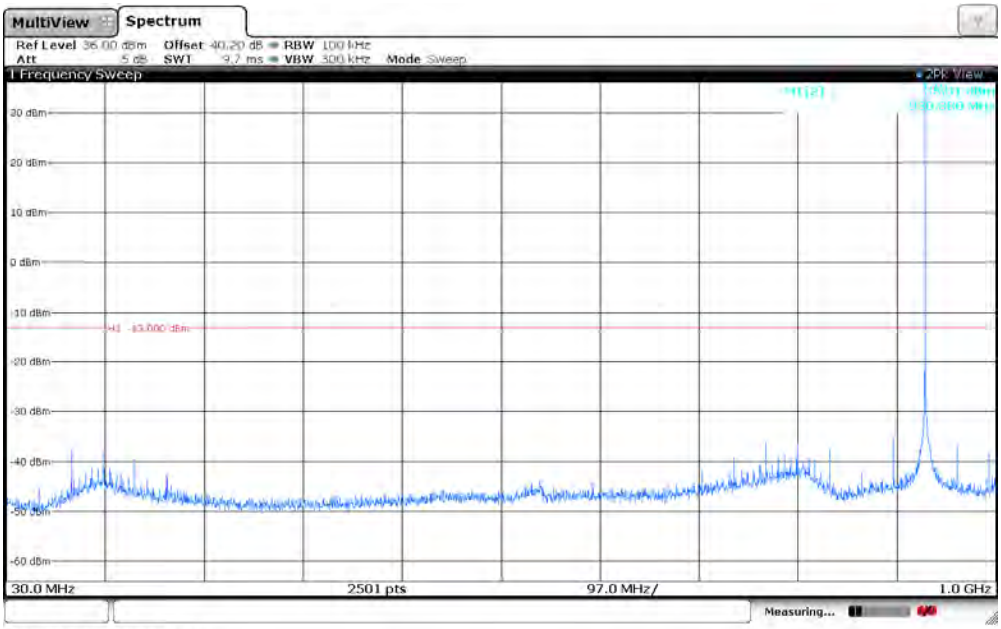

Figure 7.4.2-3: 930.5 MHz – 30MHz to 1GHz – Mpass5k mode

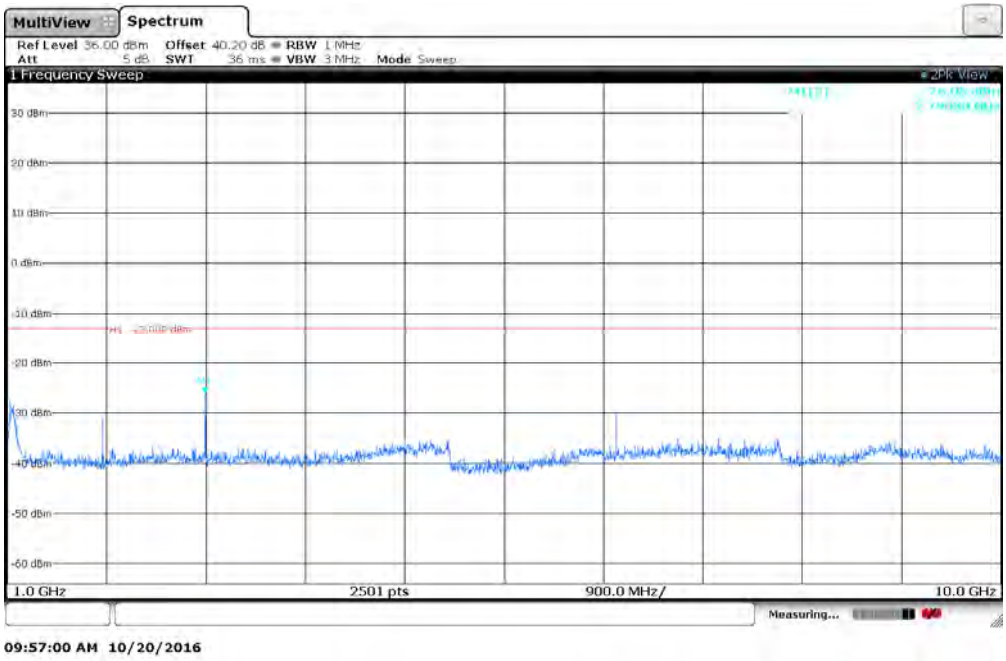

Figure 7.4.2-4: 930.5 MHz – 1GHz to 10GHz – Mpass 5k mode

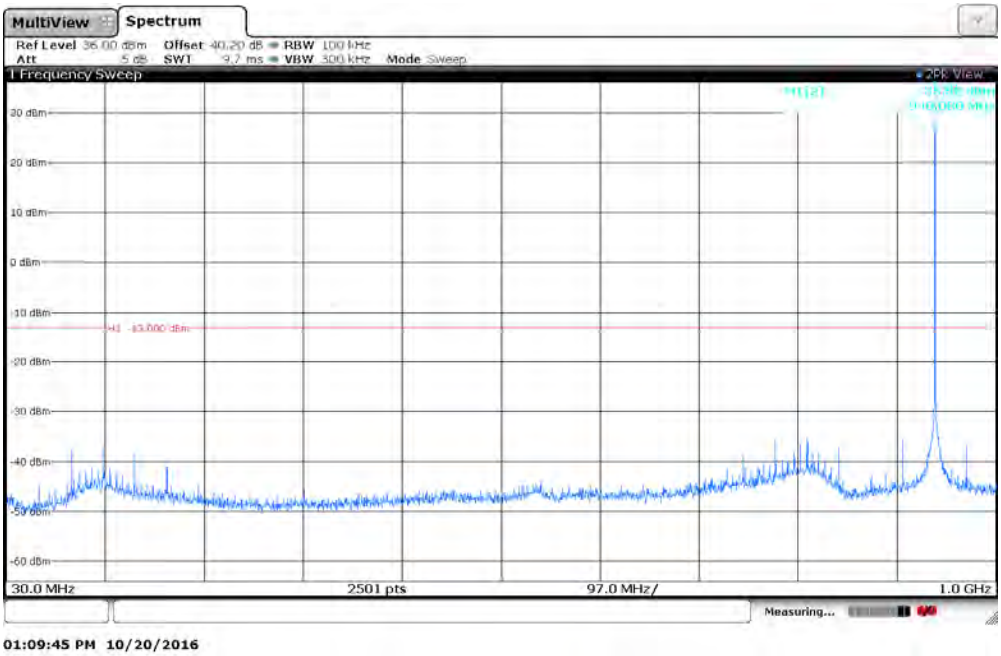

Figure 7.4.2-5: 940.0125 MHz – 30MHz to 1GHz – Mpass5k mode

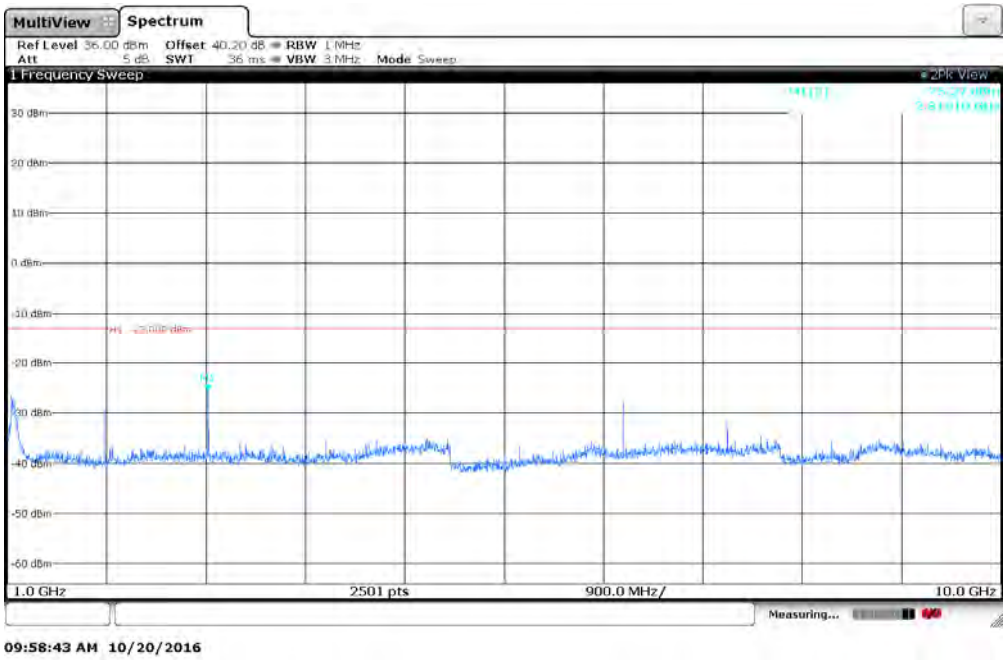

Figure 7.4.2-6: 940.0125 MHz – 1GHz to 10GHz – Mpass5k mode

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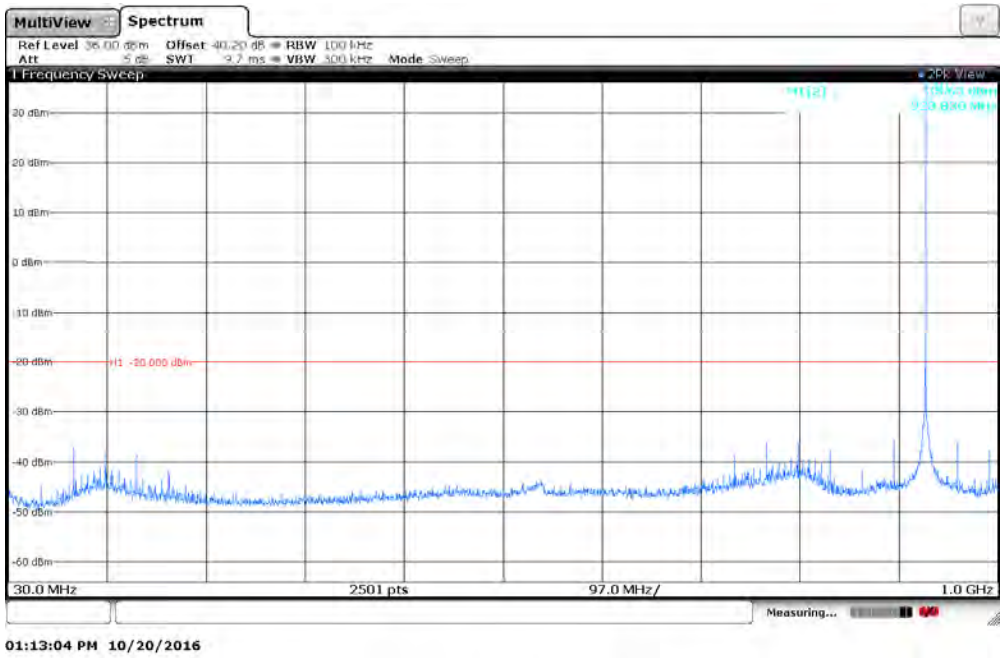

Figure 7.4.2-7: 928.925 MHz – 30MHz to 1GHz – Normal mode

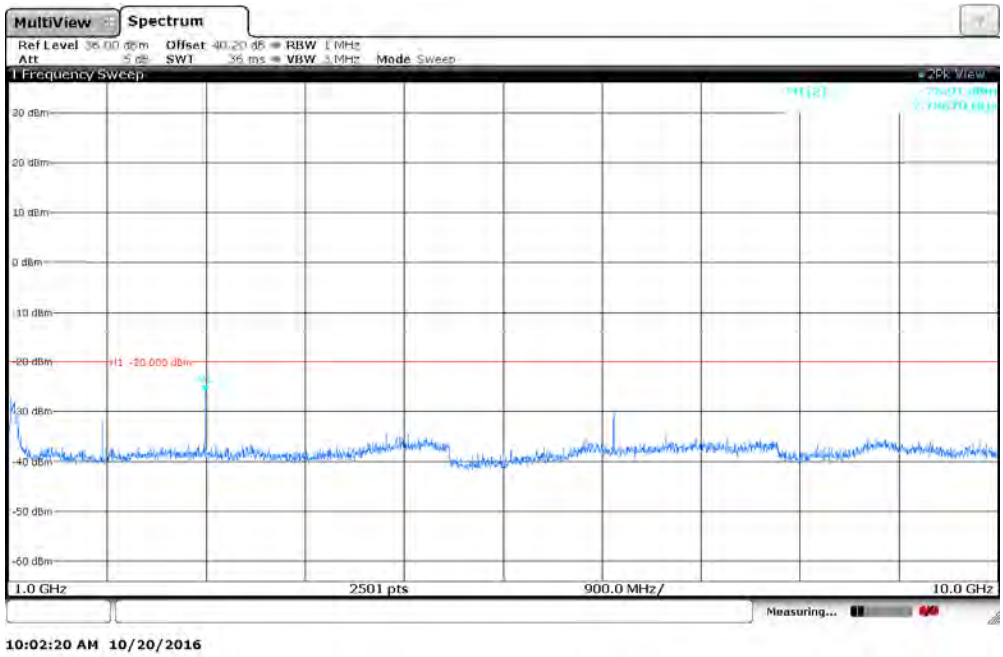

Figure 7.4.2-8: 928.925 MHz – 1GHz to 10GHz – Normal mode

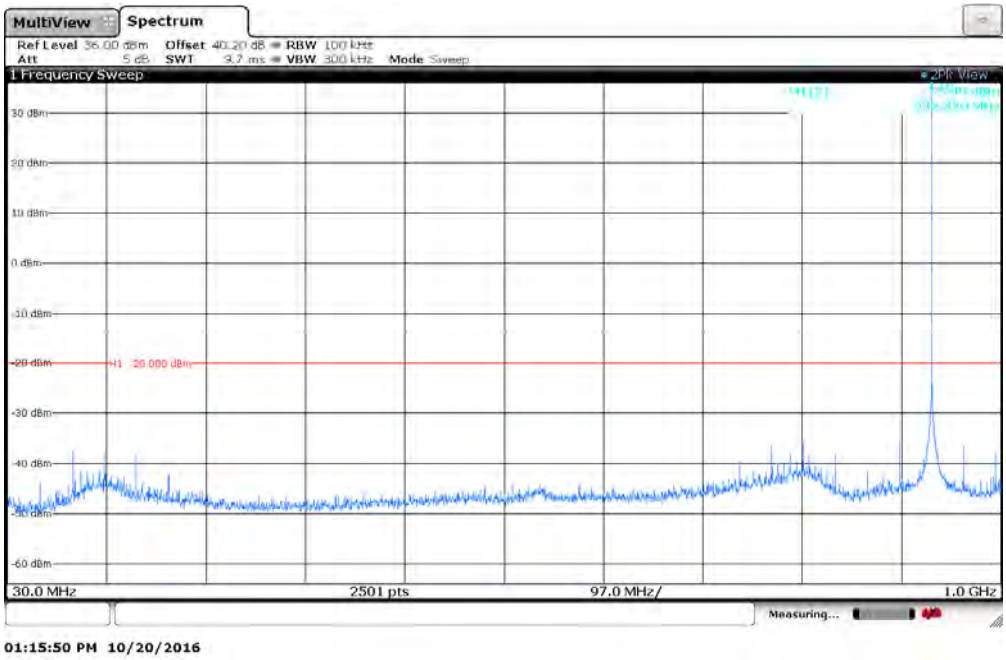

Figure 7.4.2-9: 932.25 MHz – 30MHz to 1GHz – Normal mode

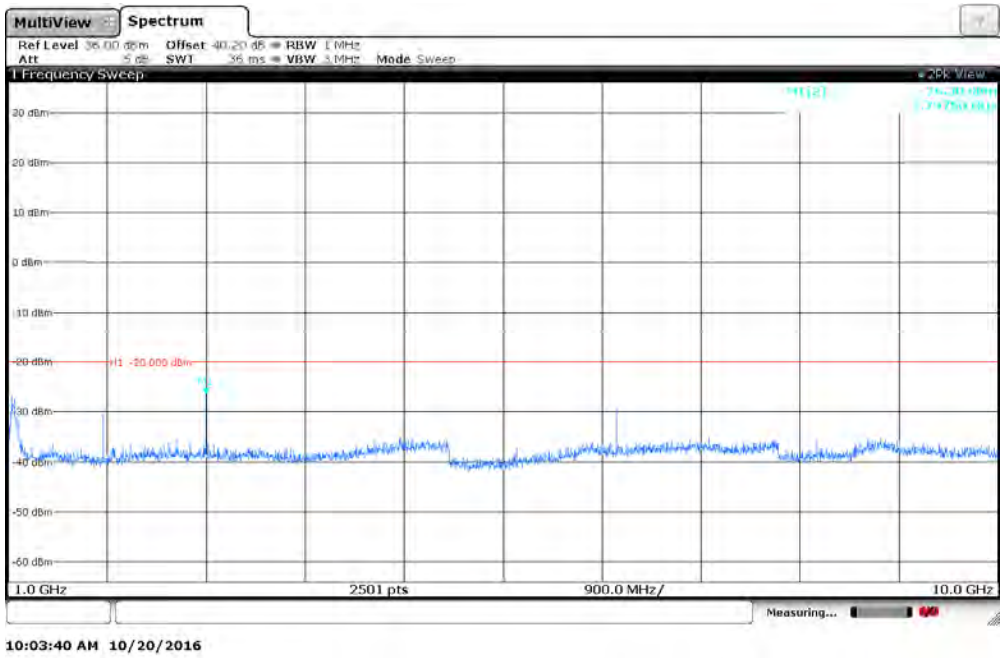

Figure 7.4.2-10: 932.25 MHz – 1GHz to 10GHz – Normal mode

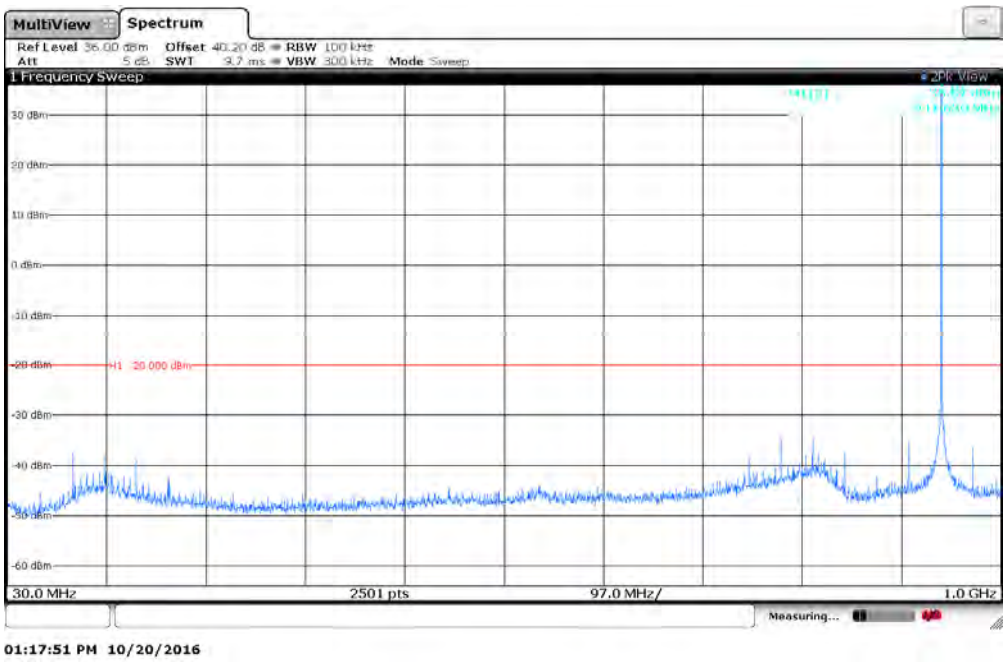

Figure 7.4.2-11: 941.4875 MHz – 30MHz to 1GHz – Mpass5k mode

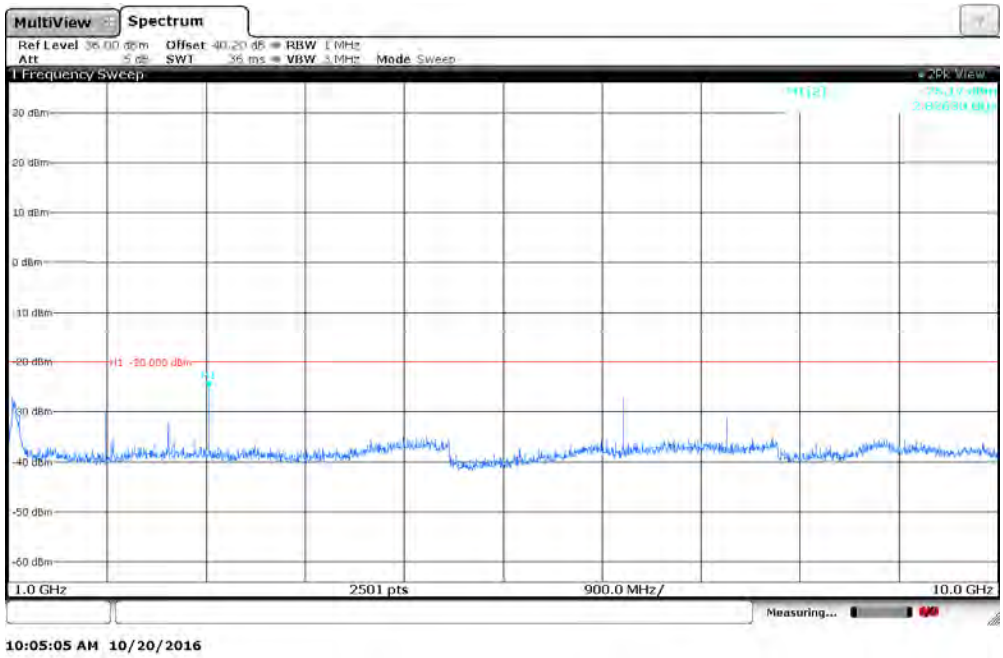

Figure 7.4.2-12: 941.4875 MHz – 1GHz to 10GHz – Mpass5k mode

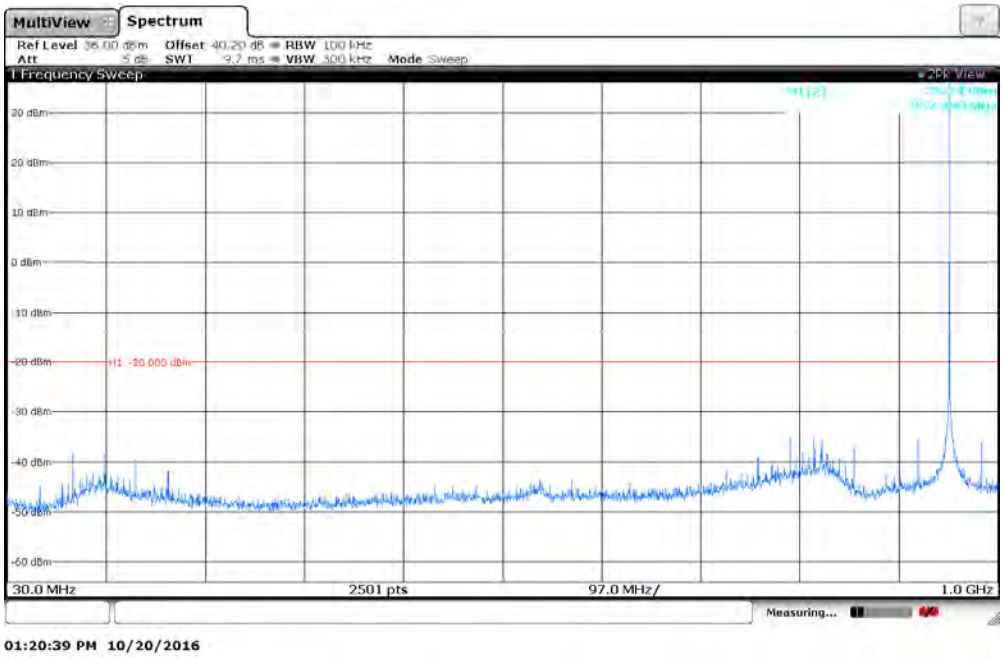

Figure 7.4.2-13: 952.5 MHz – 30MHz to 1GHz – Mpass5k mode

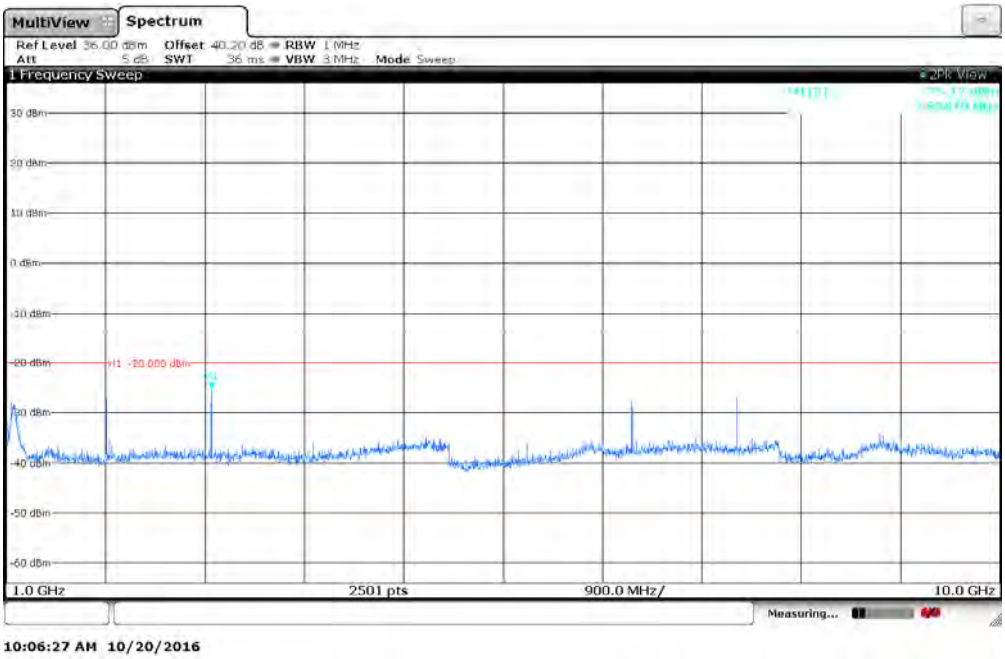

Figure 7.4.2-14: 952.5 MHz – 1GHz to 10GHz – Mpass5k mode

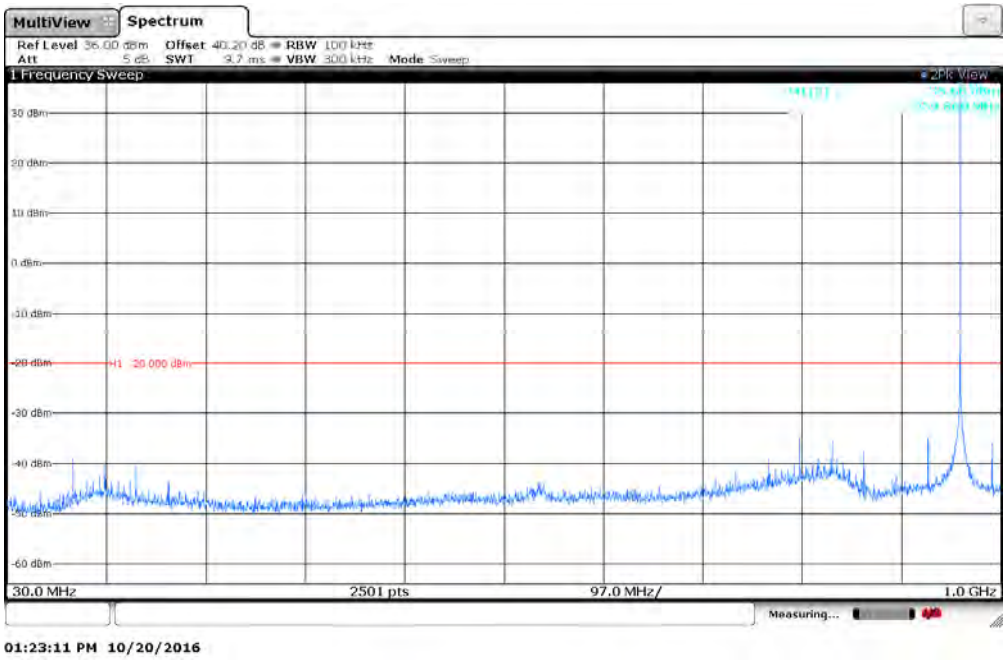

Figure 7.4.2-15: 959.925 MHz – 30MHz to 1GHz – Mpass5k mode

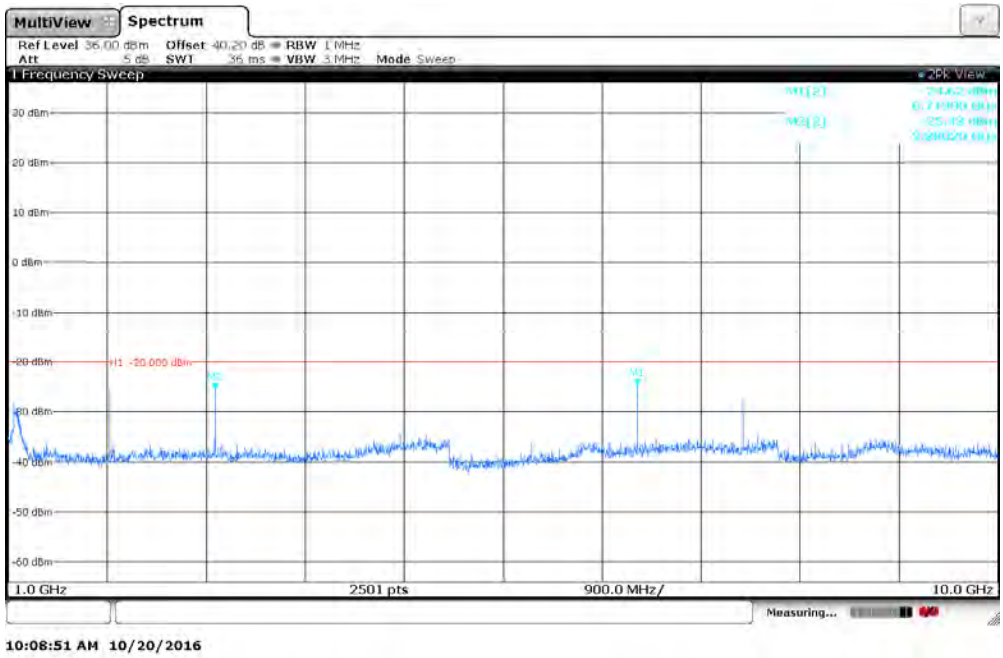

Figure 7.4.2-16: 959.925 MHz – 1GHz to 10GHz – Mpass5k mode

Part 24.133 a(1), a(2), ISED Canada RSS-134 4.4.1 (a), (b), 4.4.2 (a), (b)

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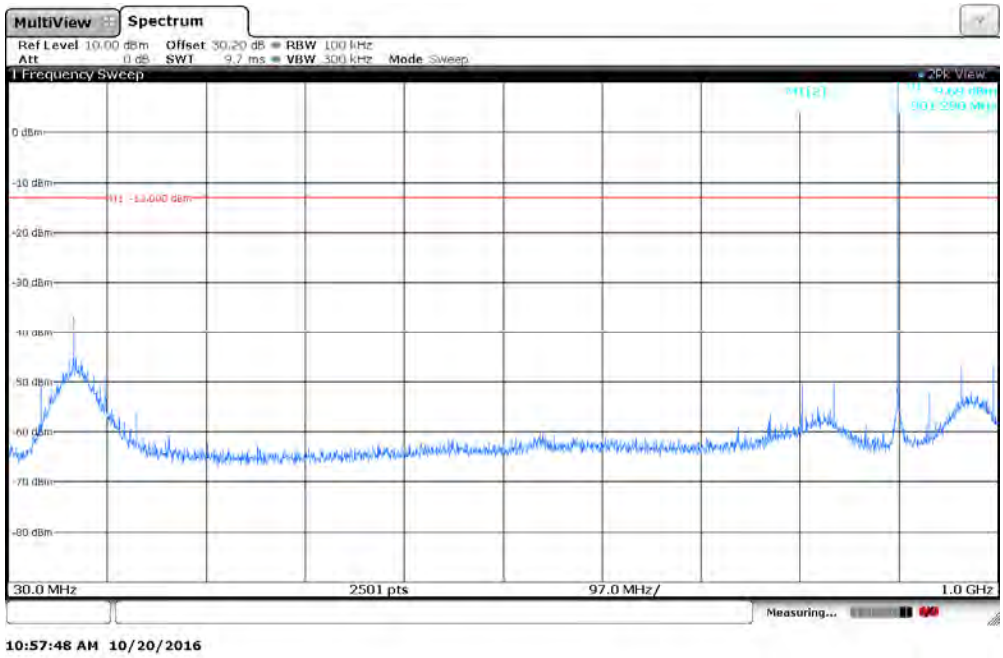

Figure 7.4.2-17: 901.5 MHz – 30MHz to 1GHz

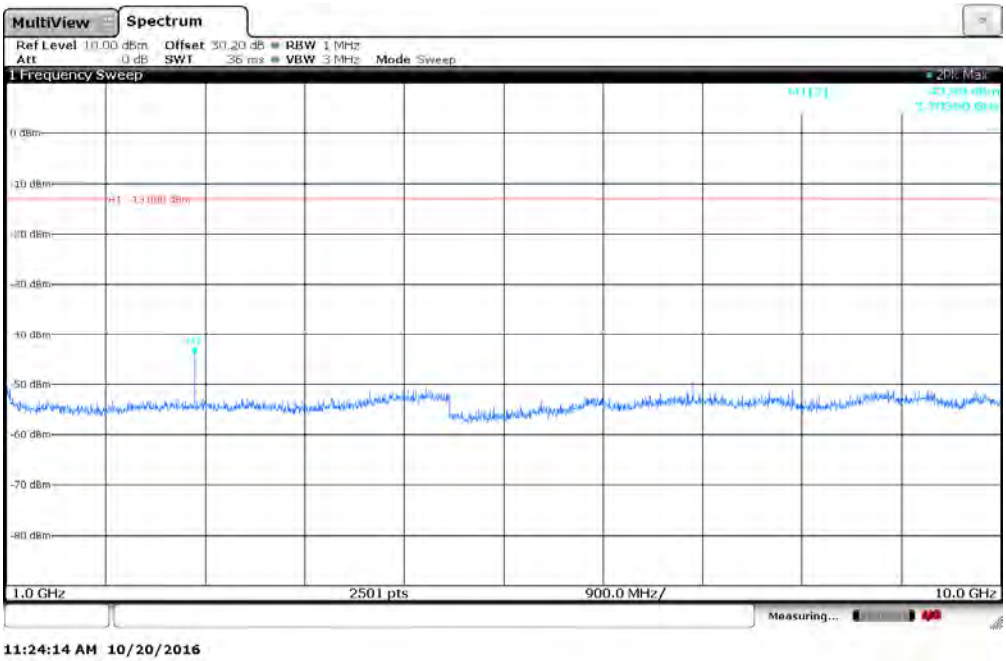

Figure 7.4.2-18: 901.5 MHz – 1GHz to 10GHz

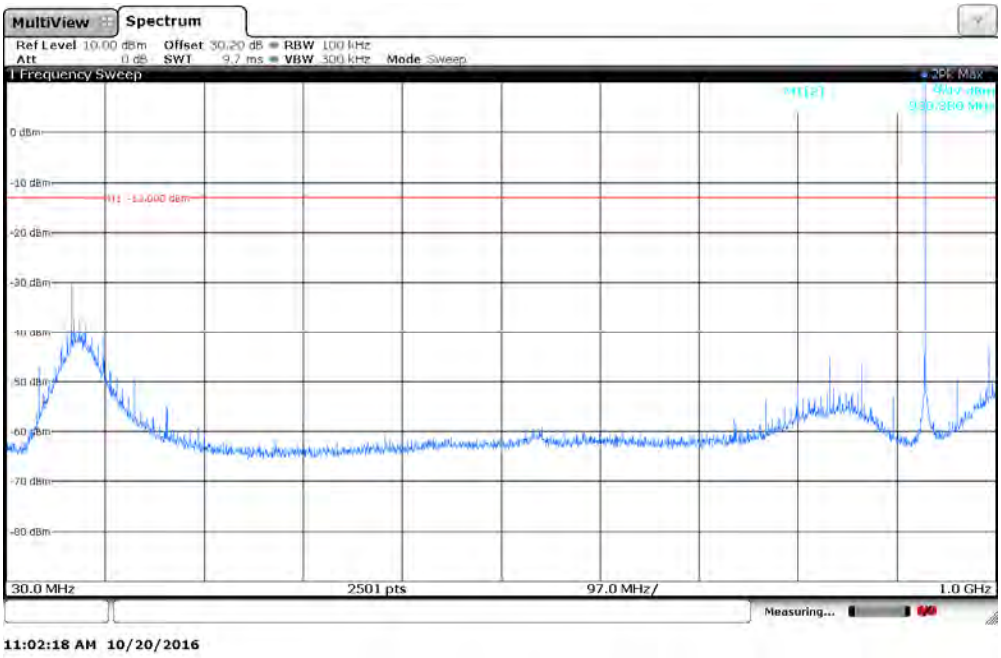

Figure 7.4.2-19: 930.5 MHz – 30MHz to 1GHz

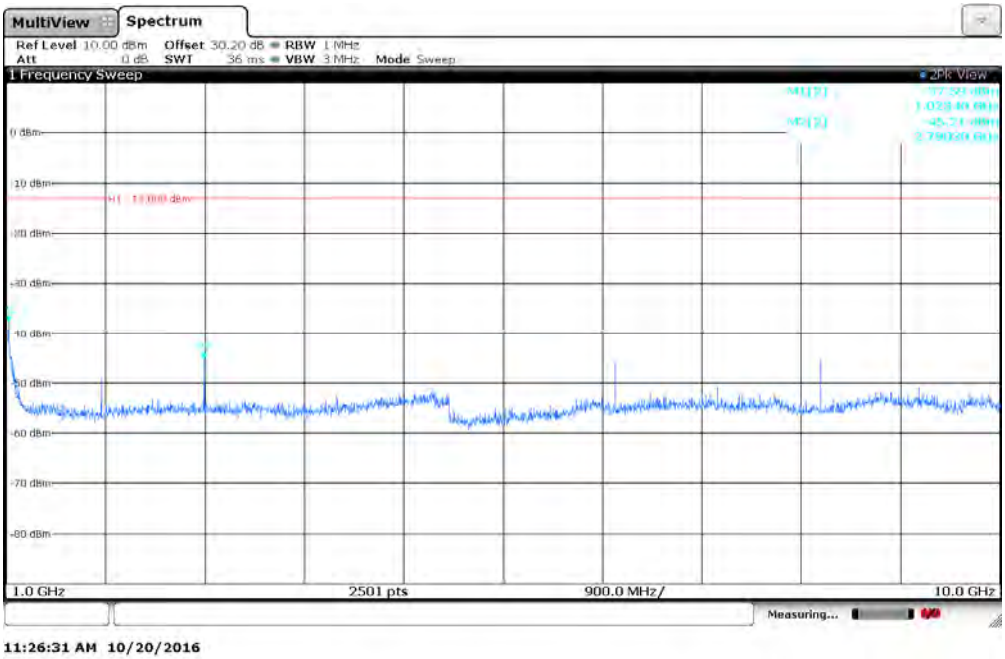

Figure 7.4.2-20: 930.5 MHz – 1GHz to 10GHz

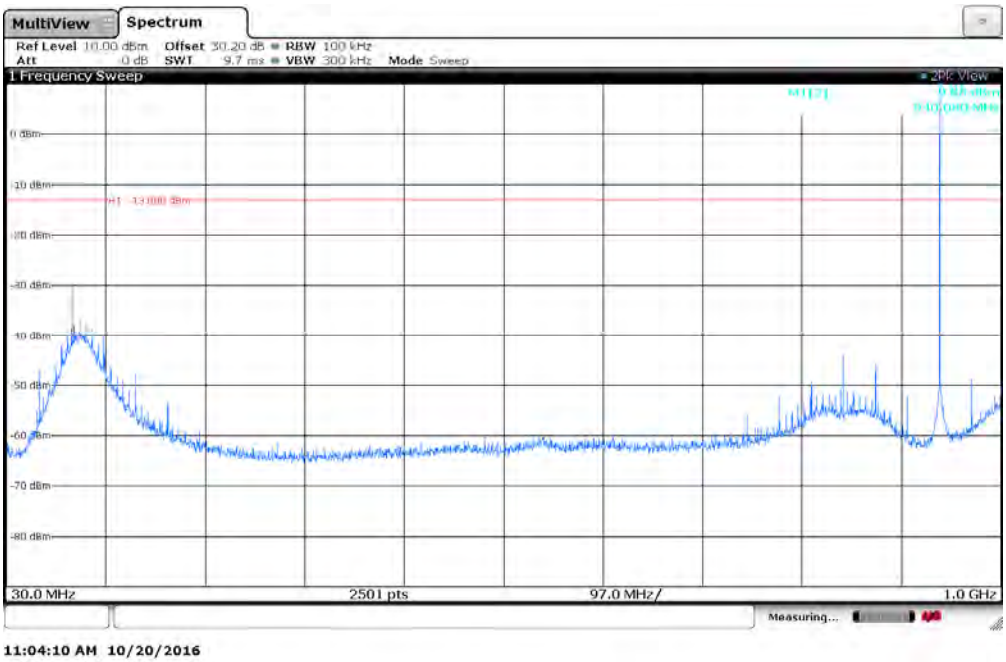

Figure 7.4.2-21: 940.0125 MHz – 30MHz to 1GHz

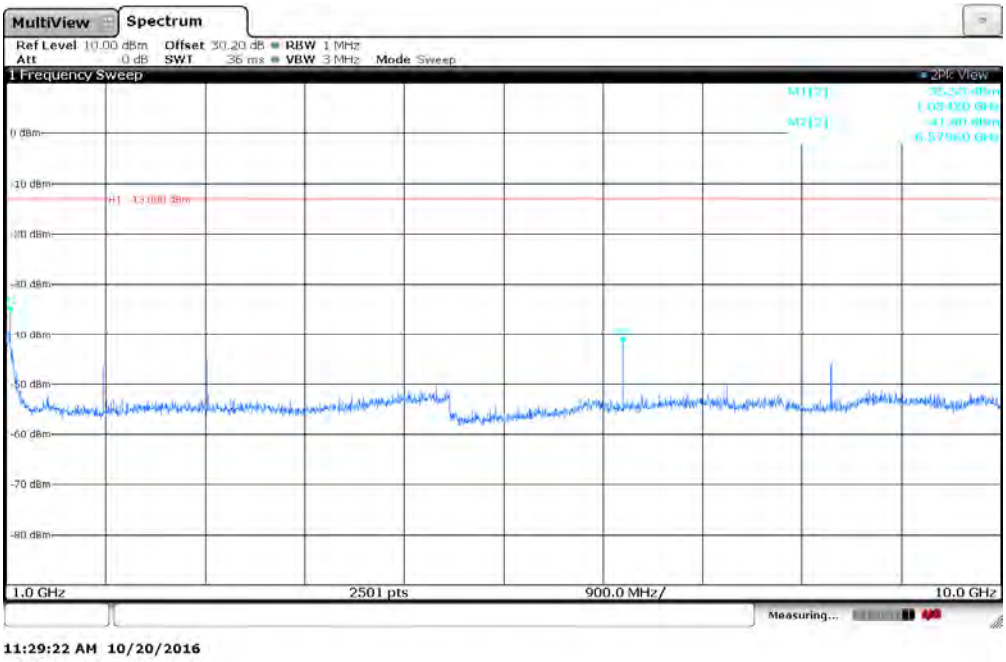

Figure 7.4.2-22: 940.0125 MHz – 1GHz to 10GHz

Part 101.111 a(6), RSS-119 5.8.6

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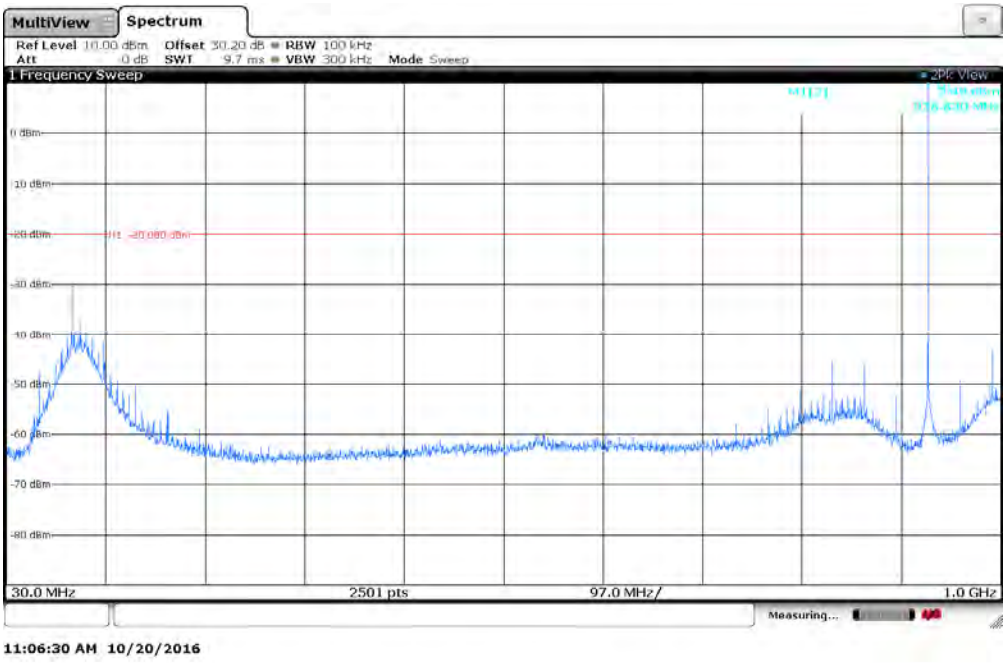

Figure 7.4.2-23: 928.925 MHz – 30MHz to 1GHz

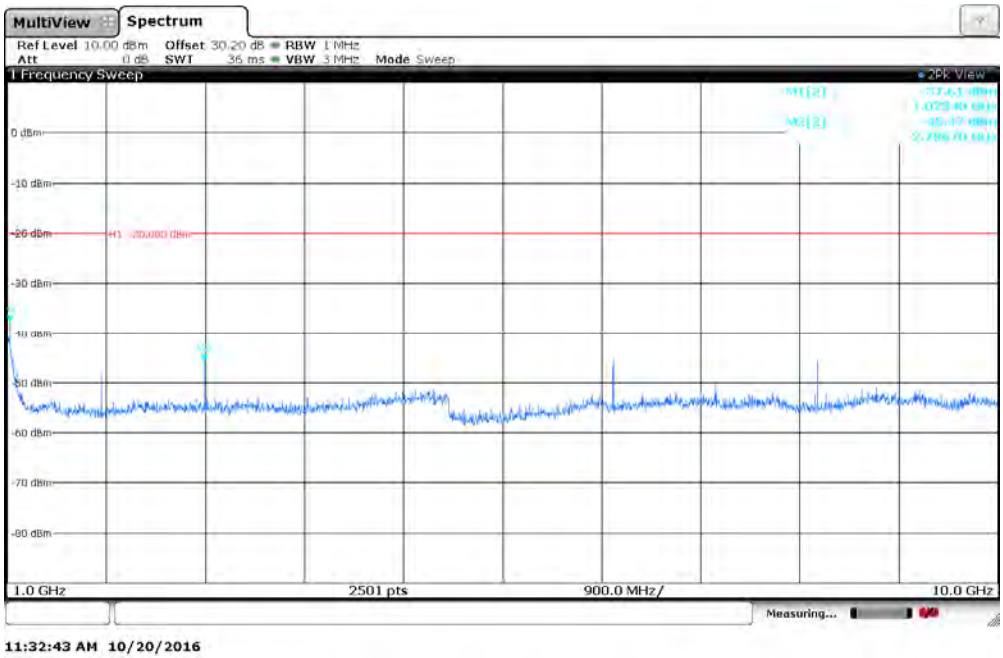

Figure 7.4.2-24: 928.925 MHz – 1GHz to 10GHz

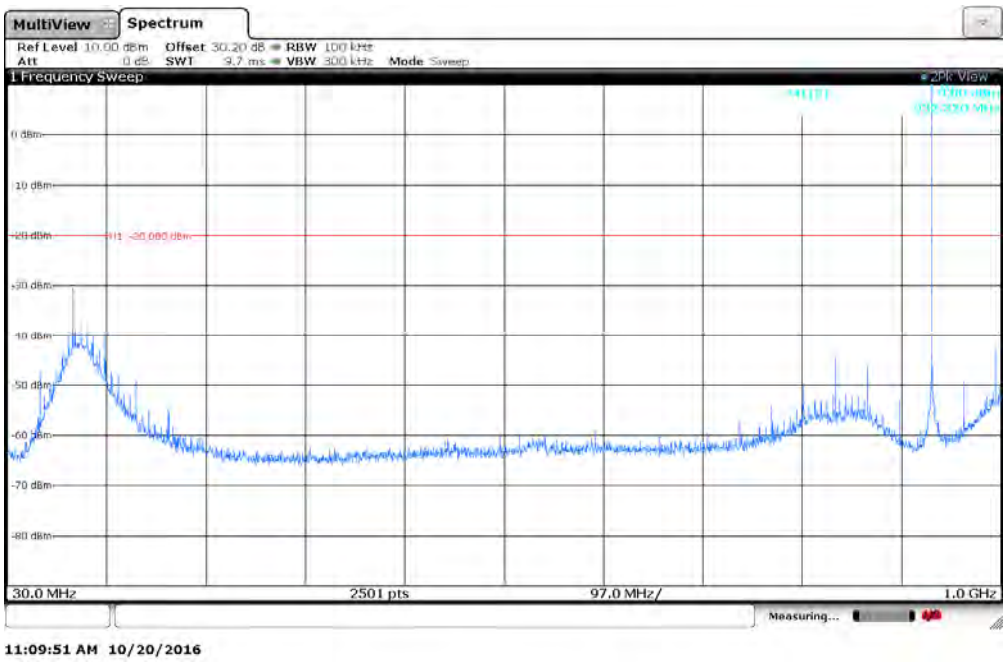

Figure 7.4.2-25: 932.25 MHz – 30MHz to 1GHz

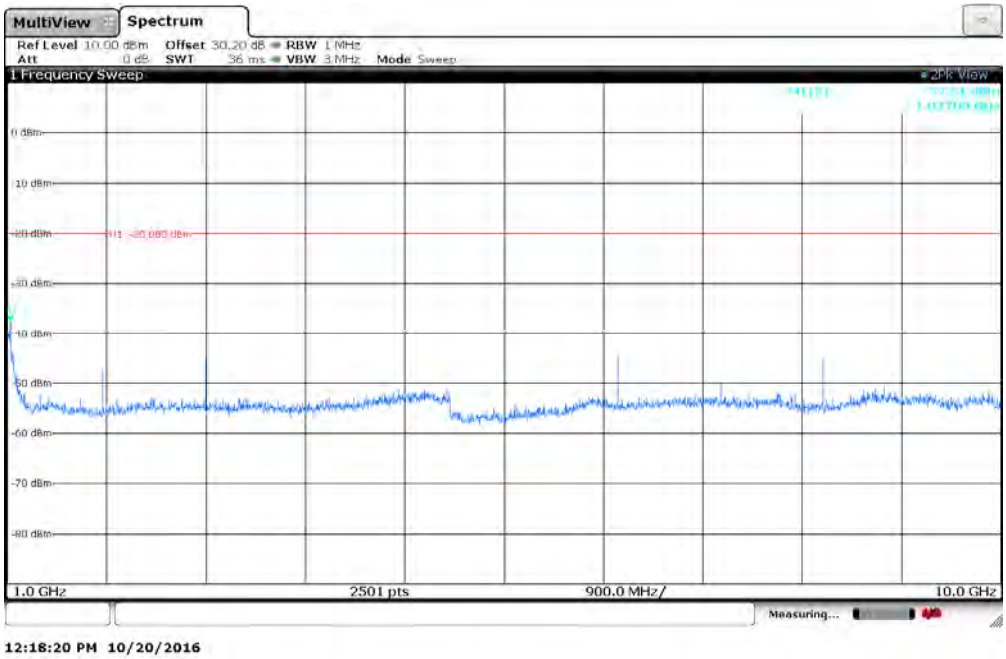

Figure 7.4.2-26: 932.25 MHz – 1GHz to 10GHz

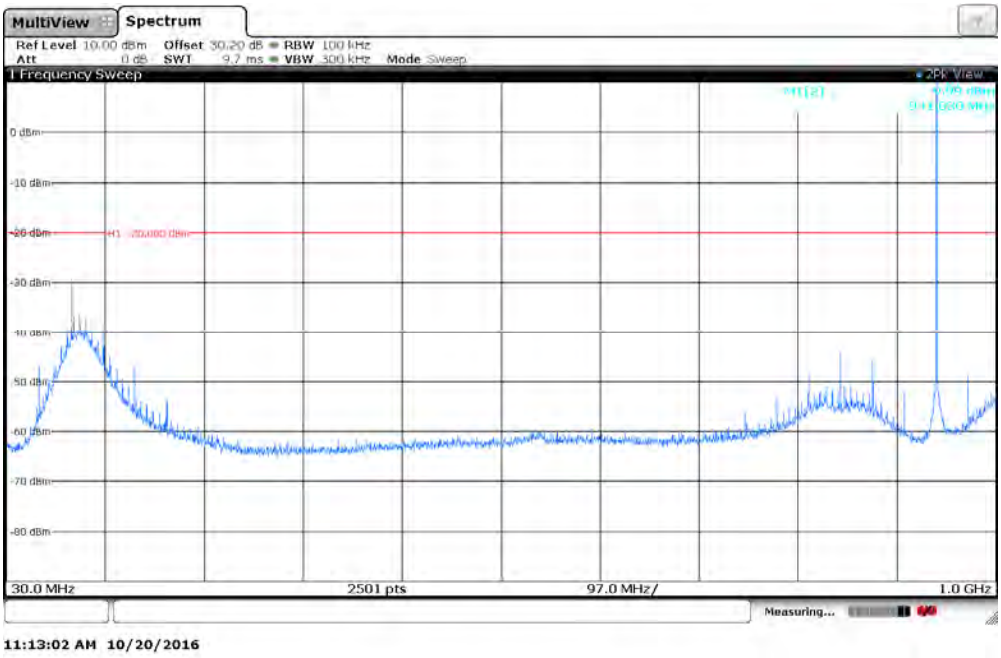

Figure 7.4.2-27: 941.4875 MHz – 30MHz to 1GHz

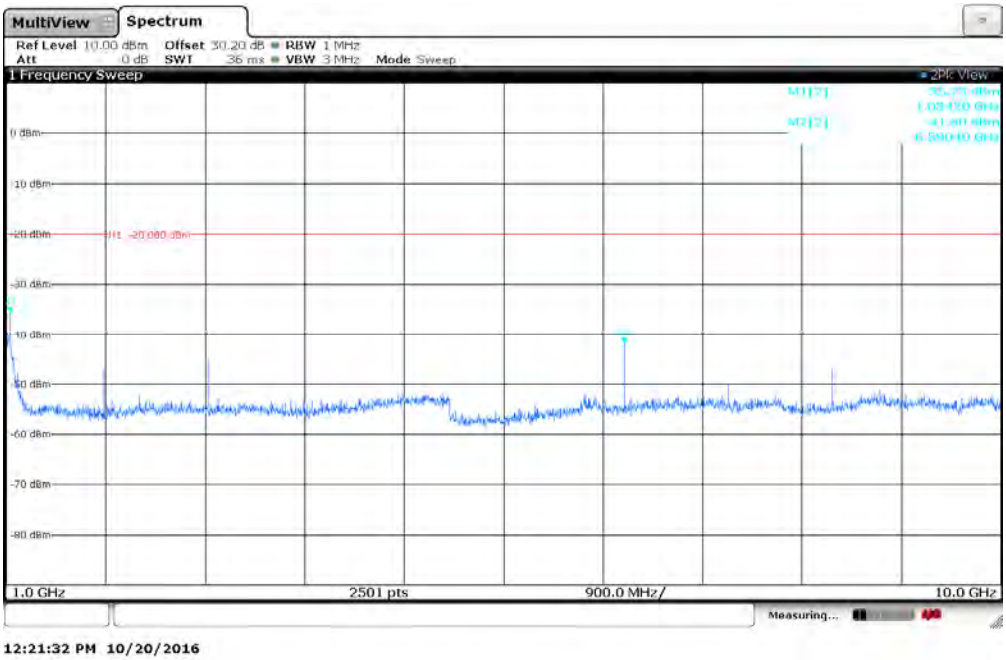

Figure 7.4.2-28: 941.4875 MHz – 1GHz to 10GHz

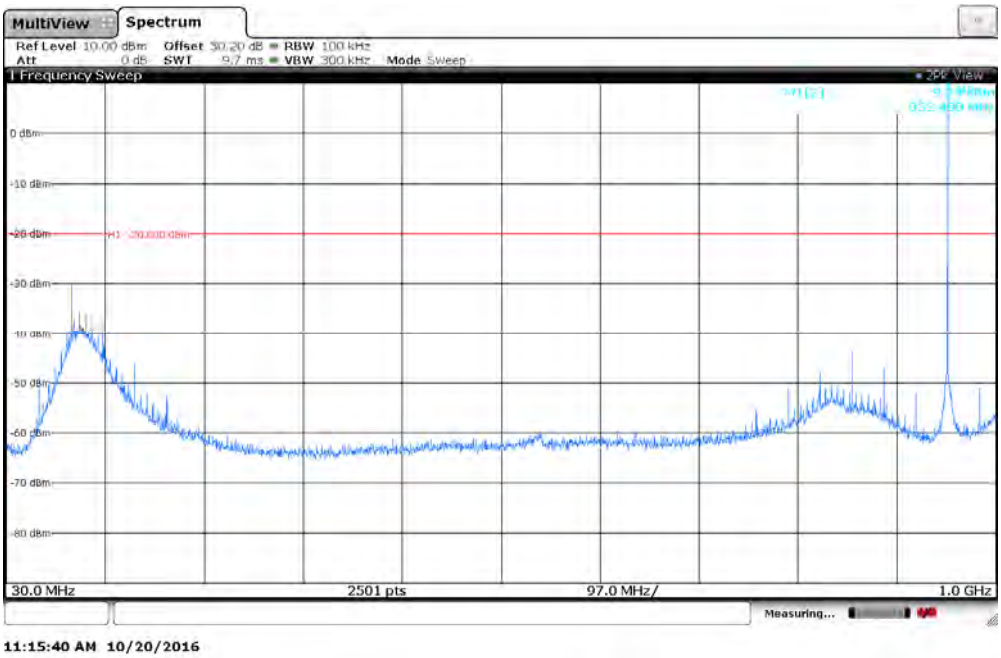

Figure 7.4.2-29: 952.5 MHz – 30MHz to 1GHz

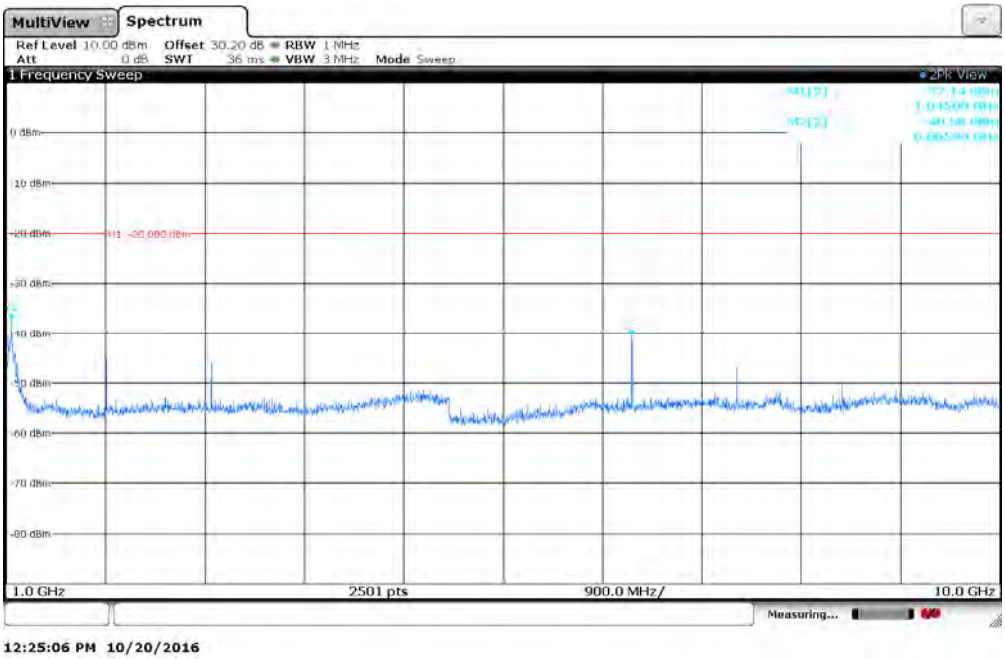

Figure 7.4.2-30: 952.5 MHz – 1GHz to 10GHz

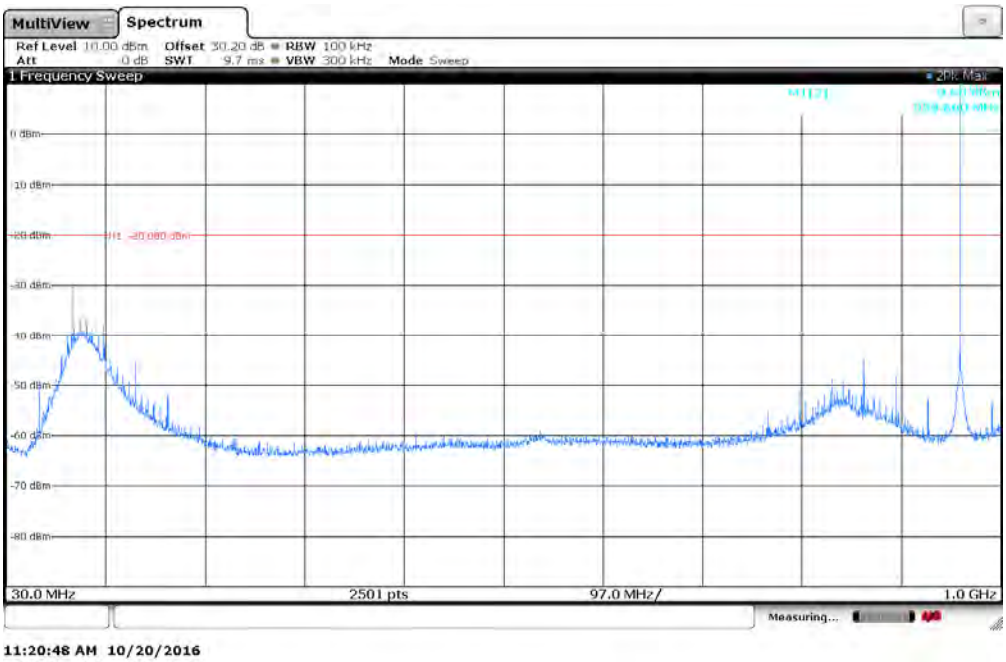

Figure 7.4.2-31: 959.925 MHz – 30MHz to 1GHz

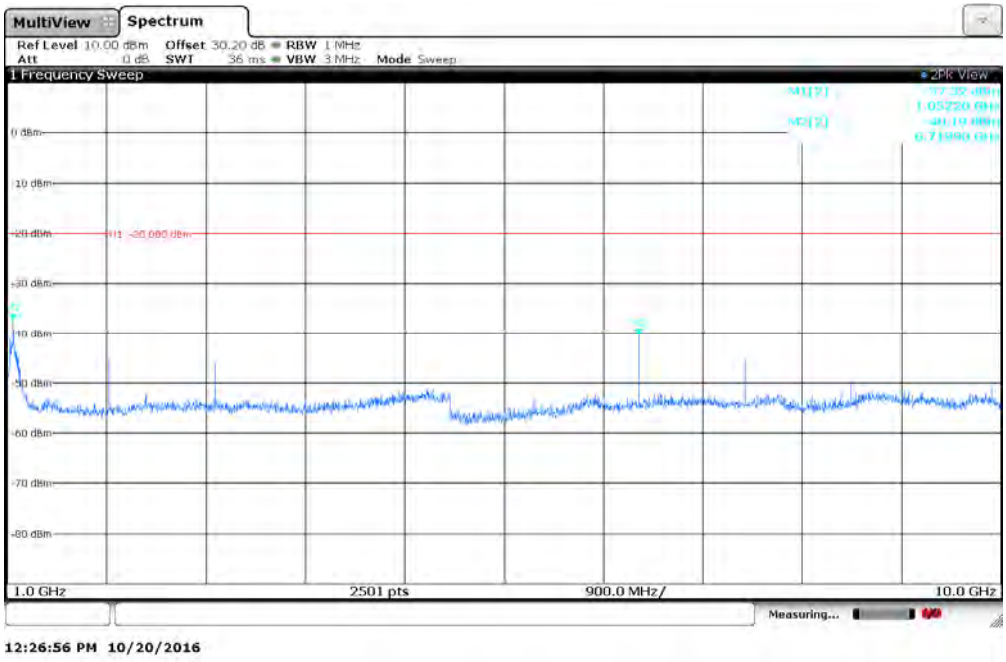

Figure 7.4.2-32: 959.925 MHz – 1GHz to 10GHz

7.5 Field Strength of Spurious Emissions

7.5.1 Measurement Procedure (ANSI 63.26: 2015 Section 5.5.2.3.1)

The equipment under test is placed in the Semi-Anechoic Chamber (described in section 2.3.1) on a table at the turntable center. Below 1 GHz the table height was 80cm and above 1 GHz the table height was 1.5m. For each spurious emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º and the maximum reading on the spectrum analyzer is recorded. This was repeated for both horizontal and vertical polarizations of the receive antenna.

The equipment under test is then replaced with a substitution antenna fed by a signal generator. The signal generator's frequency is set to that of the spurious emission recorded from the equipment under test. The antenna mast is raised and lowered from one (1) to four (4) meters to obtain a maximum reading on the spectrum analyzer. The output of the signal generator is then adjusted until the reading on the spectrum analyzer matches that obtained from the equipment under test. The signal generator level is recorded. The power in dBm of each spurious emission is calculated by correcting the signal generator level for the cable loss and gain of the substitution antenna referenced to a dipole. The spectrum was investigated in accordance to CFR 47 Part 2.1057.

The magnitude of all spurious emissions not reported were attenuated below the noise floor of the measurement system and therefore not specified in this report. Results are shown below.

7.5.2 Measurement Results

Part 24.133 a(1), a(2), RSS-134 4.4.1 (a), (b), 4.4.2 (a), (b)

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Table 7.5.2-1: Field Strength of Spurious Emissions – 901.5 MHz – Normal Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1803	56.60	H	-46.10	-13.00	33.10
1803	63.3	V	-38.10	-13.00	25.10
2704.5	47.8	H	-51.30	-13.00	38.30
2704.5	61.2	V	-38.30	-13.00	25.30
3606	53.2	H	-42.79	-13.00	29.79
3606	53.4	V	-44.49	-13.00	31.49
4507.5	58.9	H	-35.10	-13.00	22.10
4507.5	56.6	V	-38.90	-13.00	25.90

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-2: Field Strength of Spurious Emissions – 930.5 MHz – mPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1861	59.20	H	-44.08	-13.00	31.08
1861	65.4	V	-36.78	-13.00	23.78
2791.5	53.3	H	-45.65	-13.00	32.65
2791.5	66.6	V	-32.65	-13.00	19.65
3722	55.6	H	-38.92	-13.00	25.92
3722	66.2	V	-30.32	-13.00	17.32
4652.5	48.4	H	-45.34	-13.00	32.34
4652.5	44.6	V	-50.94	-13.00	37.94

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-3: Field Strength of Spurious Emissions – 940.0125 MHz – mPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1880.025	58.60	H	-44.88	-20.00	24.88
1880.025	60.7	V	-41.28	-20.00	21.28
2820.0375	54.3	H	-44.74	-20.00	24.74
2820.0375	63.2	V	-35.84	-20.00	15.84
3760.05	48.2	H	-46.30	-20.00	26.30
3760.05	53.8	V	-42.60	-20.00	22.60
4700.0625	43.2	H	-49.51	-20.00	29.51
4700.0625	44.5	V	-50.21	-20.00	30.21

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Part 101.111 a(5) & (6), RSS-119 5.8.6

Table 7.5.2-4: Field Strength of Spurious Emissions – 928.925 MHz – Normal Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1857.85	58.10	H	-44.89	-20.00	24.89
1857.85	65.5	V	-36.49	-20.00	16.49
2786.775	53.6	H	-45.36	-20.00	25.36
2786.775	67.5	V	-31.76	-20.00	11.76
3715.7	55.9	H	-38.53	-20.00	18.53
3715.7	71	V	-25.53	-20.00	5.53
4644.625	50.7	H	-42.62	-20.00	22.62
4644.625	47.4	V	-47.82	-20.00	27.82

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-5: Field Strength of Spurious Emissions – 932.25 MHz – Normal Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1864.5	55.60	H	-47.68	-20.00	27.68
1864.5	61.5	V	-40.28	-20.00	20.28
2796.75	49.4	H	-49.35	-20.00	29.35
2796.75	57.5	V	-41.55	-20.00	21.55
3729	46.3	H	-48.22	-20.00	28.22
3729	51.85	V	-44.82	-20.00	24.82
4661.25	44.4	H	-49.25	-20.00	29.25
4661.25	47.4	V	-48.05	-20.00	28.05

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-6: Field Strength of Spurious Emissions – 941.4875 MHz – mPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1882.975	58.80	H	-44.48	-20.00	24.48
1882.975	63.4	V	-38.68	-20.00	18.68
2824.4625	55.6	H	-43.53	-20.00	23.53
2824.4625	63.8	V	-35.33	-20.00	15.33
3765.95	49	H	-45.80	-20.00	25.80
3765.95	50.5	V	-46.20	-20.00	26.20
4707.4375	44.7	H	-48.22	-20.00	28.22
4707.4375	42.6	V	-52.02	-20.00	32.02

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-7: Field Strength of Spurious Emissions – 952.5 MHz – mPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1905	59.00	H	-43.18	-20.00	23.18
1905	65.3	V	-35.88	-20.00	15.88
2857.5	55.3	H	-43.72	-20.00	23.72
2857.5	66.5	V	-32.52	-20.00	12.52
3810	58.4	H	-36.07	-20.00	16.07
3810	68.7	V	-27.27	-20.00	7.27
4762.5	52.6	H	-40.21	-20.00	20.21
4762.5	55.8	V	-39.11	-20.00	19.11
7620	55.8	V	-34.86	-20.00	14.86

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-8: Field Strength of Spurious Emissions – 959.925 MHz – mPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1919.85	61.60	H	-40.67	-20.00	20.67
1919.85	65.7	V	-35.67	-20.00	15.67
2879.775	55.8	H	-43.40	-20.00	23.40
2879.775	63.8	V	-35.20	-20.00	15.20
3839.7	46.4	H	-47.56	-20.00	27.56
3839.7	49.5	V	-46.76	-20.00	26.76
4799.625	48.9	H	-43.97	-20.00	23.97
4799.625	48.9	V	-45.77	-20.00	25.77
7679.4	50.8	H	-39.66	-20.00	19.66
7679.4	52.2	V	-38.66	-20.00	18.66

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Part 24.133 a(1), a(2), RSS-134 4.4.1 (a), (b), 4.4.2 (a), (b)

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Table 7.5.2-9: Field Strength of Spurious Emissions – 901.5 MHz – Normal Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1803	44.40	H	-58.40	-13.00	45.40
1803	43.4	V	-58.00	-13.00	45.00
2704.5	46.3	V	-53.20	-13.00	40.20
3606	43.8	V	-54.09	-13.00	41.09
4507.5	42.6	H	-51.30	-13.00	38.30
4507.5	43.8	V	-51.80	-13.00	38.80

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-10: Field Strength of Spurious Emissions – 930.5 MHz – mPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1861	42.80	H	-60.78	-13.00	47.78
1861	44.7	V	-57.48	-13.00	44.48
2791.5	41.4	H	-57.55	-13.00	44.55
2791.5	44.9	V	-54.35	-13.00	41.35
5583	45.5	H	-46.47	-13.00	33.47
5583	49.6	V	-44.07	-13.00	31.07

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-11: Field Strength of Spurious Emissions – 940.0125 MHz – mPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1880.025	43.70	H	-60.18	-20.00	40.18
1880.025	48.1	V	-54.18	-20.00	34.18
2820.0375	44.5	H	-54.64	-20.00	34.64
2820.0375	47.2	V	-51.84	-20.00	31.84
3760.05	44.6	V	-51.70	-20.00	31.70
4700.0625	42.6	V	-52.11	-20.00	32.11

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Part 101.111 a (5) & (6), RSS-119 5.8.6

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ILSI

Table 7.5.2-12: Field Strength of Spurious Emissions – 928.925 MHz – Normal Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1857.85	42.90	H	-60.29	-20.00	40.29
1857.85	45.4	V	-56.69	-20.00	36.69
2786.775	42	H	-57.06	-20.00	37.06
2786.775	45.6	V	-53.66	-20.00	33.66
5573.55	44.3	H	-47.69	-20.00	27.69
5573.55	44.4	V	-49.49	-20.00	29.49

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-13: Field Strength of Spurious Emissions – 932.25 MHz – Normal Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1864.5	42.50	H	-60.68	-20.00	40.68
1864.5	45.1	V	-56.78	-20.00	36.78
2796.75	40.8	H	-58.05	-20.00	38.05
2796.75	45.1	V	-54.05	-20.00	34.05
3729	43.4	V	-53.62	-20.00	33.62
5593.5	40.8	H	-51.25	-20.00	31.25
5593.5	45.6	V	-48.15	-20.00	28.15

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-14: Field Strength of Spurious Emissions – 941.4875 MHz – mPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1882.975	40.00	H	-63.68	-20.00	43.68
1882.975	47.4	V	-54.58	-20.00	34.58
2824.4625	43.4	H	-55.63	-20.00	35.63
2824.4625	45.6	V	-53.53	-20.00	33.53
3765.95	42	V	-54.70	-20.00	34.70

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-15: Field Strength of Spurious Emissions – 952.5 MHz – mPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBµV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1905	41.50	H	-60.68	-20.00	40.68
1905	49.5	V	-51.78	-20.00	31.78
2857.5	43.8	H	-55.12	-20.00	35.12
2857.5	45.6	V	-53.42	-20.00	33.42

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

Table 7.5.2-16: Field Strength of Spurious Emissions – 959.925 MHz – mPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1919.85	40.60	H	-61.67	-20.00	41.67
1919.85	46.8	V	-54.17	-20.00	34.17
2879.775	42.4	H	-56.80	-20.00	36.80
2879.775	44.4	V	-54.60	-20.00	34.60

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

7.6 Frequency Stability

7.6.1 Measurement Procedure (ANSI C63.26 Section 5.6.3)

The equipment under test is placed inside an environmental chamber. The RF output is directly coupled to the input of the measurement equipment and a power supply is attached to the primary supply voltage.

Frequency measurements were made at the extremes of the of temperature range -30º C to +50º C and at intervals of 10º C at normal supply voltage. A period of time sufficient to stabilize all components of the equipment was allowed at each frequency measurement. The equipment operates at 12 Vdc. Measurements were made to the equipment under test at a temperature of 20º C and at +/- 15% of 12Vdc. The maximum variation of frequency was recorded.

At the clients request data for all 3 TCXO manufacturers are included in the results below.

7.6.2 Measurement Results

Part 24.135, RSS-134 (4.5)

Frequency Stability

16-3084	**Frequency (MHz):**	901.5	
KDS	**Deviation Limit (PPM):**	1.0ppm	
94			

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**901.499907**	**-0.103**	100%	12.00
-20 C	**901.499717**	**-0.314**	100%	12.00
-10 C	**901.499678**	**-0.357**	100%	12.00
0 C	**901.499700**	**-0.333**	100%	12.00
10 C	**901.499810**	**-0.211**	100%	12.00
20 C	**901.499930**	**-0.078**	100%	12.00
30 C	**901.499965**	**-0.039**	100%	12.00
40 C	**901.500060**	**0.067**	100%	12.00
50 C	**901.500125**	**0.139**	100%	12.00
20 C	**901.499860**	**-0.155**	85%	10.20
20 C	**901.499920**	**-0.089**	115%	13.80

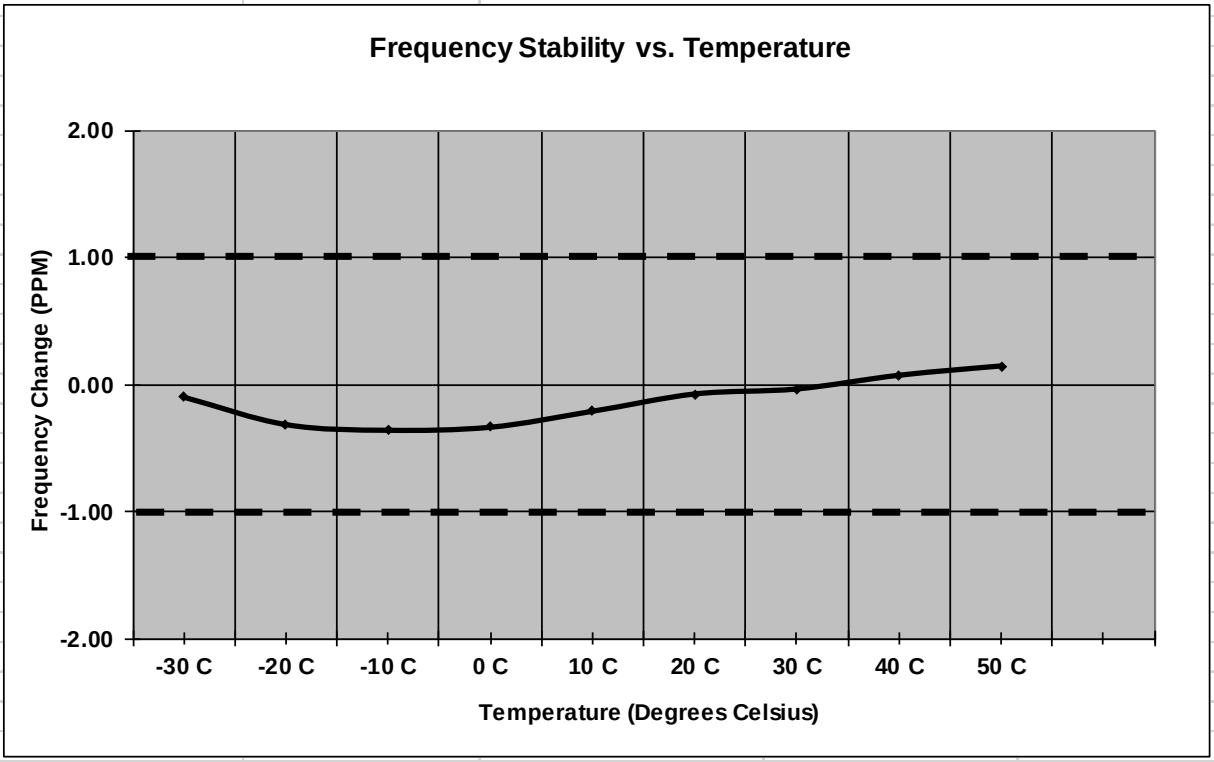

Figure 7.6.2-1: Frequency Stability – 901.5 MHz - KDS

Part 24.135, RSS-134 (4.5)

Frequency Stability

16-3084	**Frequency (MHz):**	930.5	
KDS	**Deviation Limit (PPM):**	1.0ppm	
94			

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**930.499898**	**-0.110**	100%	12.00
-20 C	**930.499712**	**-0.310**	100%	12.00
-10 C	**930.499694**	**-0.329**	100%	12.00
0 C	**930.499660**	**-0.365**	100%	12.00
10 C	**930.499820**	**-0.193**	100%	12.00
20 C	**930.499902**	**-0.105**	100%	12.00
30 C	**930.499976**	**-0.026**	100%	12.00
40 C	**930.500050**	**0.054**	100%	12.00
50 C	**930.500100**	**0.107**	100%	12.00
20 C	**930.499930**	**-0.075**	85%	10.20
20 C	**930.499910**	**-0.097**	115%	13.80

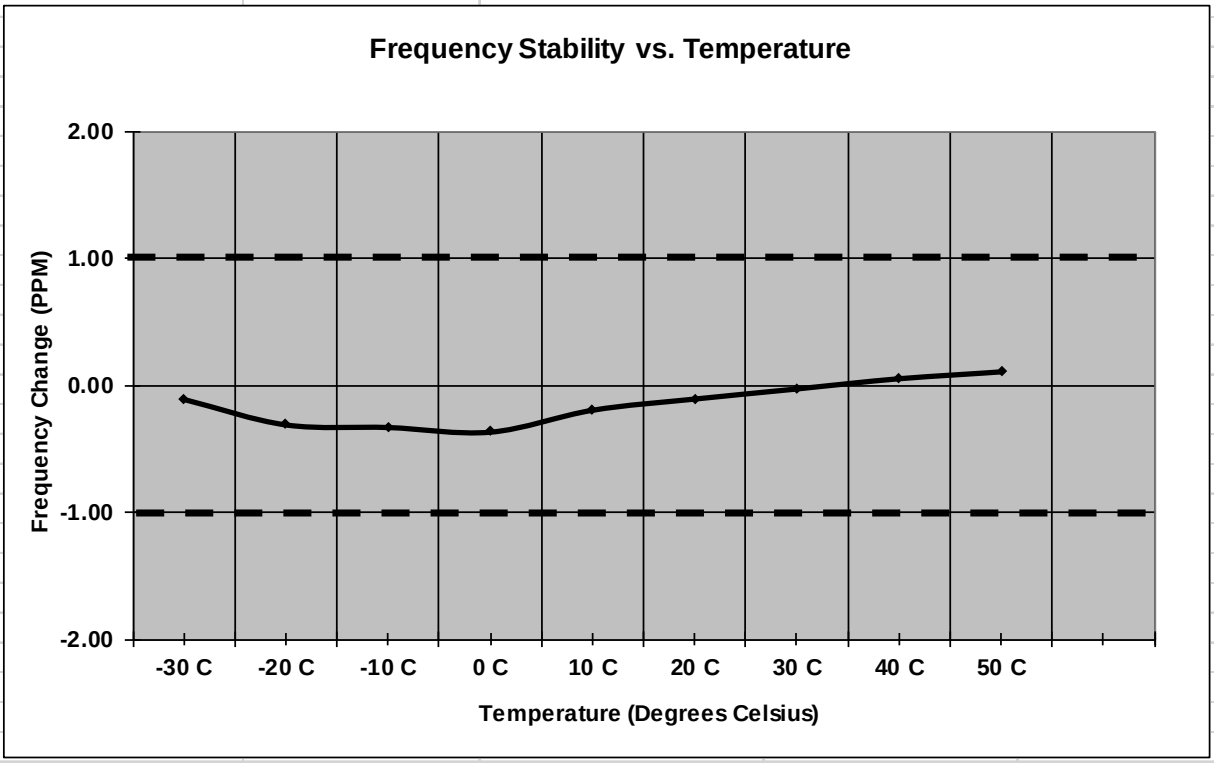

Figure 7.6.2-2: Frequency Stability – 930.5 MHz - KDS

Part 101.107, RSS-119 5.3

Frequency Stability

16-3084	**Frequency (MHz):**	959.925	
KDS	**Deviation Limit (PPM):**	1.0ppm	
94			

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**959.924875**	**-0.130**	100%	12.00
-20 C	**959.924715**	**-0.297**	100%	12.00
-10 C	**959.924687**	**-0.326**	100%	12.00
0 C	**959.924610**	**-0.406**	100%	12.00
10 C	**959.924790**	**-0.219**	100%	12.00
20 C	**959.924910**	**-0.094**	100%	12.00
30 C	**959.924970**	**-0.031**	100%	12.00
40 C	**959.925030**	**0.031**	100%	12.00
50 C	**959.925100**	**0.104**	100%	12.00
20 C	**959.924910**	**-0.094**	85%	10.20
20 C	**959.924900**	**-0.104**	115%	13.80

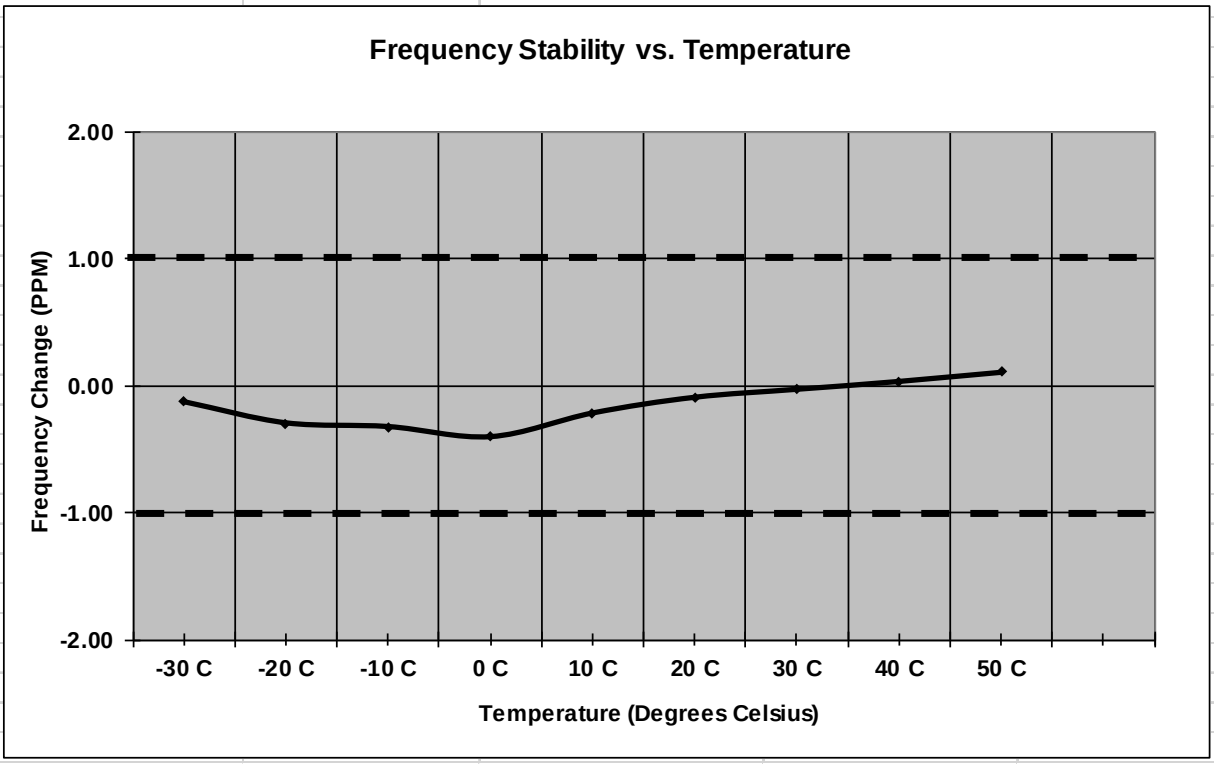

Figure 7.6.2-3: Frequency Stability – 959.925 MHz - KDS

Part 24.135, RSS-134 (4.5)

Frequency Stability

16-3084	**Frequency (MHz):**	901.5	
ILSI	**Deviation Limit (PPM):**	1.0ppm	
72			

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**901.499230**	**-0.854**	100%	12.00
-20 C	**901.499610**	**-0.433**	100%	12.00
-10 C	**901.499832**	**-0.186**	100%	12.00
0 C	**901.499980**	**-0.022**	100%	12.00
10 C	**901.500067**	**0.074**	100%	12.00
20 C	**901.500080**	**0.089**	100%	12.00
30 C	**901.500001**	**0.001**	100%	12.00
40 C	**901.499982**	**-0.020**	100%	12.00
50 C	**901.499990**	**-0.011**	100%	12.00
20 C	**901.500080**	**0.089**	85%	10.20
20 C	**901.500090**	**0.100**	115%	13.80

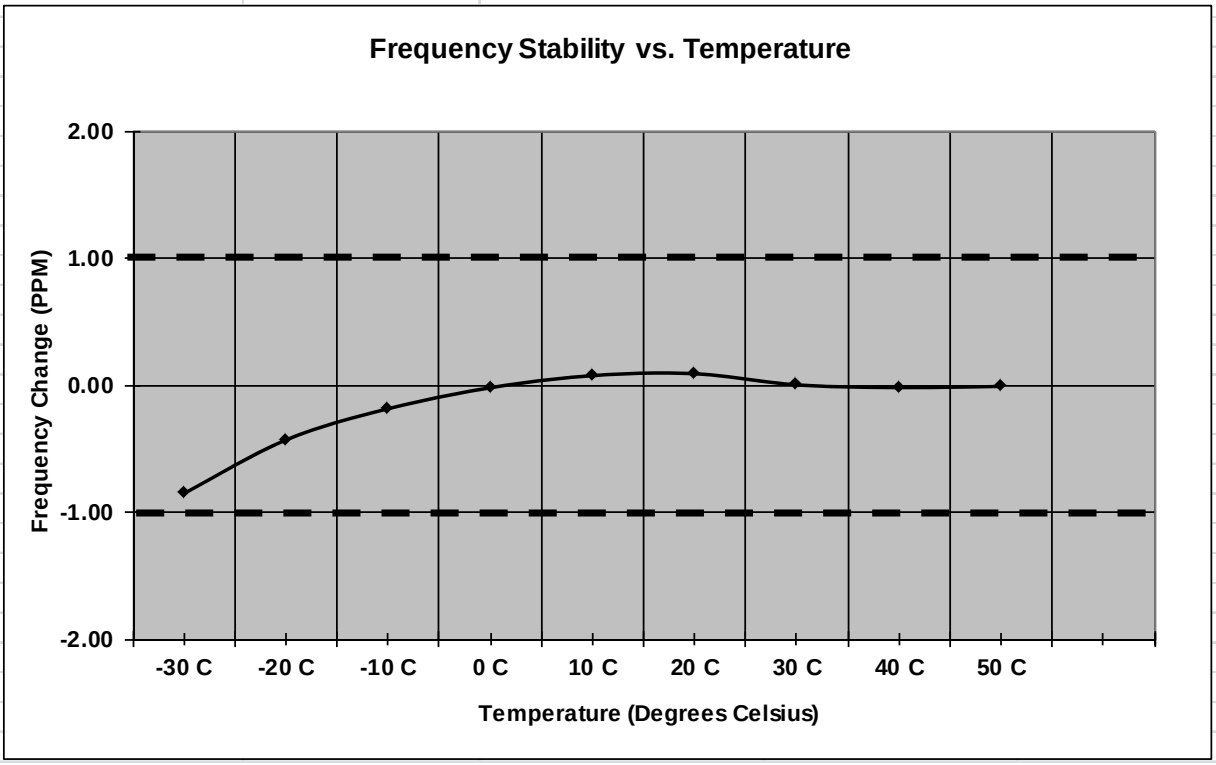

Figure 7.6.2-4: Frequency Stability – 901.5 MHz - ILSI

Part 24.135, RSS-134 (4.5)

Frequency Stability

16-3084	**Frequency (MHz):**	930.5	
ILSI	**Deviation Limit (PPM):**	1.0ppm	
72			

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**930.499340**	**-0.709**	100%	12.00
-20 C	**930.499675**	**-0.349**	100%	12.00
-10 C	**930.499895**	**-0.113**	100%	12.00
0 C	**930.500070**	**0.075**	100%	12.00
10 C	**930.500140**	**0.150**	100%	12.00
20 C	**930.500108**	**0.116**	100%	12.00
30 C	**930.500047**	**0.051**	100%	12.00
40 C	**930.499980**	**-0.021**	100%	12.00
50 C	**930.499950**	**-0.054**	100%	12.00
20 C	**930.500113**	**0.121**	85%	10.20
20 C	**930.500108**	**0.116**	115%	13.80

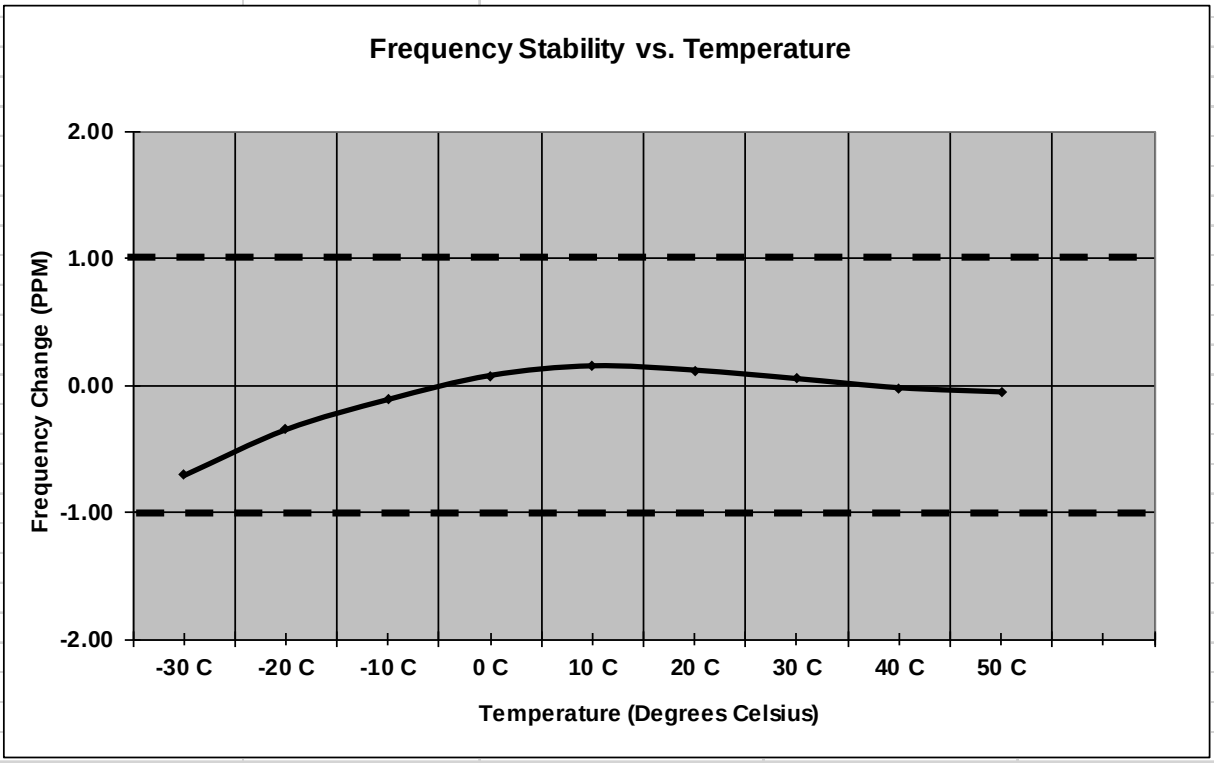

Figure 7.6.2-5: Frequency Stability – 930.5 MHz - ILSI

Part 101.107, RSS-119 5.3

Frequency Stability

16-3084	**Frequency (MHz):**	959.925	
ILSI	**Deviation Limit (PPM):**	1.0ppm	
72			

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**959.924405**	**-0.620**	100%	12.00
-20 C	**959.924630**	**-0.385**	100%	12.00
-10 C	**959.924901**	**-0.103**	100%	12.00
0 C	**959.925030**	**0.031**	100%	12.00
10 C	**959.925155**	**0.161**	100%	12.00
20 C	**959.925127**	**0.132**	100%	12.00
30 C	**959.925065**	**0.068**	100%	12.00
40 C	**959.924960**	**-0.042**	100%	12.00
50 C	**959.924925**	**-0.078**	100%	12.00
20 C	**959.925120**	**0.125**	85%	10.20
20 C	**959.925138**	**0.144**	115%	13.80

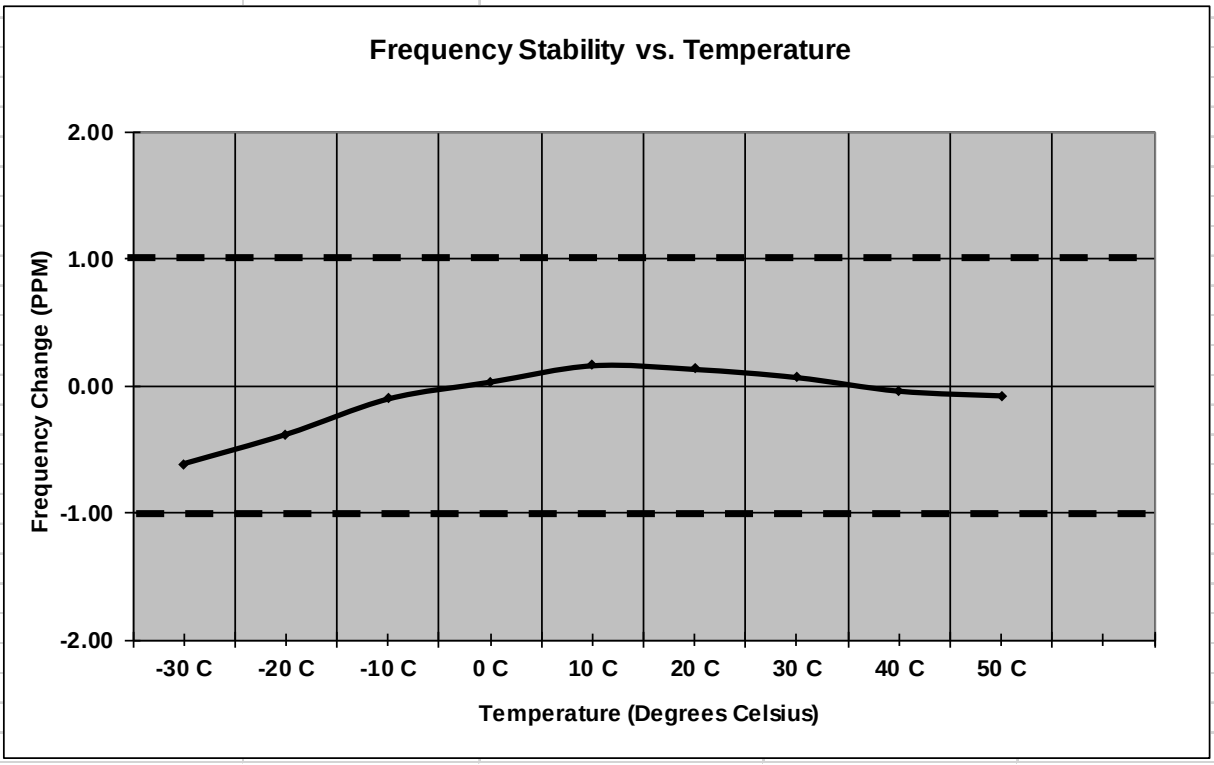

Figure 7.6.2-6: Frequency Stability – 959.925 MHz - ILSI

Part 24.135, RSS-134 (4.5)

Frequency Stability

16-3084	**Frequency (MHz):**	901.5	
Taitien	**Deviation Limit (PPM):**	1.0ppm	
116			

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**901.500425**	**0.471**	100%	12.00
-20 C	**901.500390**	**0.433**	100%	12.00
-10 C	**901.500220**	**0.244**	100%	12.00
0 C	**901.500160**	**0.177**	100%	12.00
10 C	**901.500190**	**0.211**	100%	12.00
20 C	**901.500080**	**0.089**	100%	12.00
30 C	**901.499972**	**-0.031**	100%	12.00
40 C	**901.500069**	**0.076**	100%	12.00
50 C	**901.499770**	**-0.255**	100%	12.00
20 C	**901.500080**	**0.089**	85%	10.20
20 C	**901.500080**	**0.089**	115%	13.80

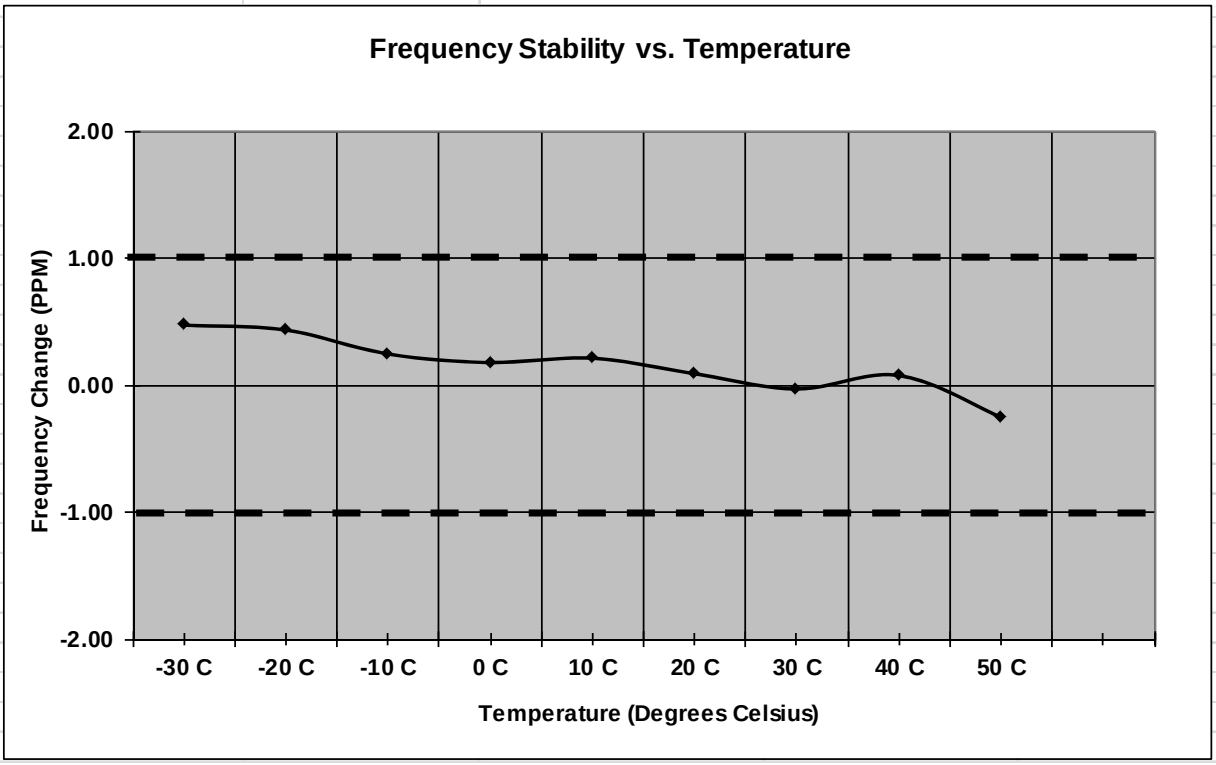

Figure 7.6.2-7: Frequency Stability – 901.5 MHz - Taitien

Part 24.135, RSS-134 (4.5)

Frequency Stability

16-3084	**Frequency (MHz):**	930.5	
Taitien	**Deviation Limit (PPM):**	1.0ppm	
116			

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**930.500440**	**0.473**	100%	12.00
-20 C	**930.500420**	**0.451**	100%	12.00
-10 C	**930.500245**	**0.263**	100%	12.00
0 C	**930.500173**	**0.186**	100%	12.00
10 C	**930.500216**	**0.232**	100%	12.00
20 C	**930.500093**	**0.100**	100%	12.00
30 C	**930.499988**	**-0.013**	100%	12.00
40 C	**930.499881**	**-0.128**	100%	12.00
50 C	**930.499775**	**-0.242**	100%	12.00
20 C	**930.500092**	**0.099**	85%	10.20
20 C	**930.500090**	**0.097**	115%	13.80

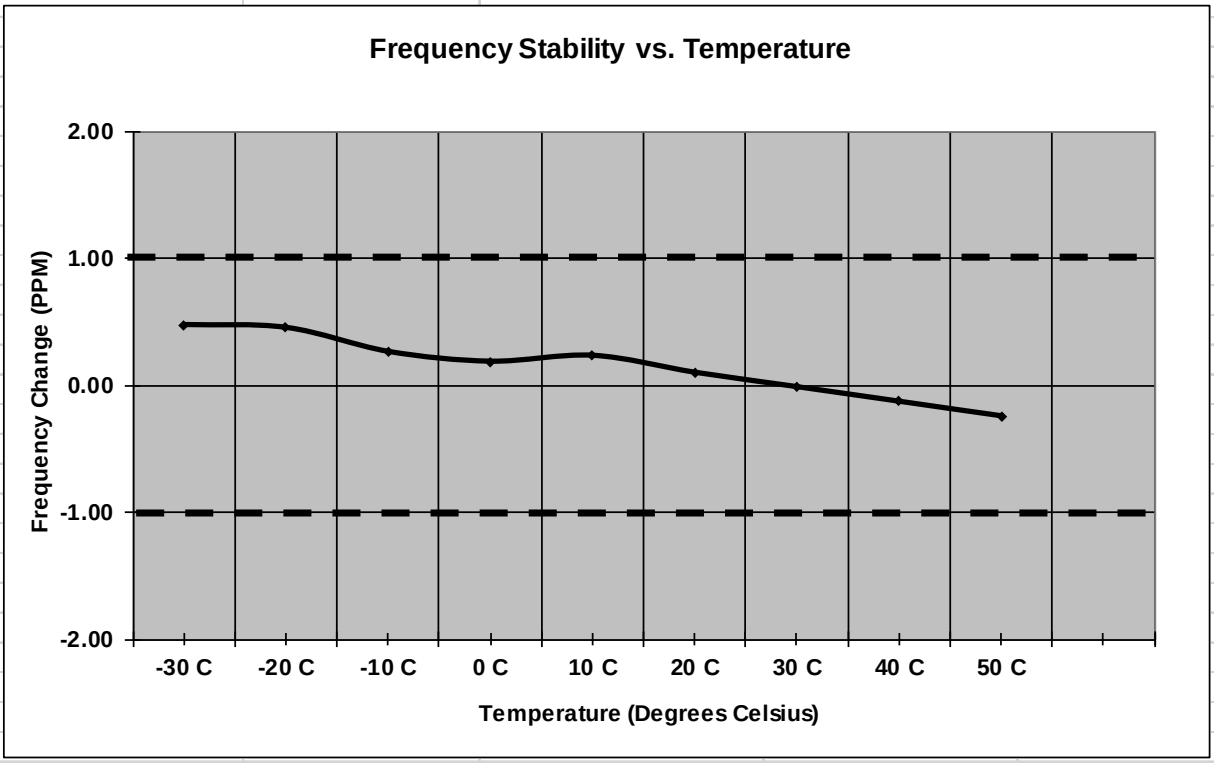

Figure 7.6.2-8: Frequency Stability – 930.5 MHz - Taitien

Part 101.107, RSS-119 5.3

Frequency Stability

16-3084	**Frequency (MHz):**	959.925	
Taitien	**Deviation Limit (PPM):**	1.0ppm	
116			

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**959.925430**	**0.448**	100%	12.00
-20 C	**959.925432**	**0.450**	100%	12.00
-10 C	**959.925180**	**0.188**	100%	12.00
0 C	**959.925163**	**0.170**	100%	12.00
10 C	**959.925221**	**0.230**	100%	12.00
20 C	**959.925090**	**0.094**	100%	12.00
30 C	**959.924980**	**-0.021**	100%	12.00
40 C	**959.924875**	**-0.130**	100%	12.00
50 C	**959.924760**	**-0.250**	100%	12.00
20 C	**959.925092**	**0.096**	85%	10.20
20 C	**959.925090**	**0.094**	115%	13.80

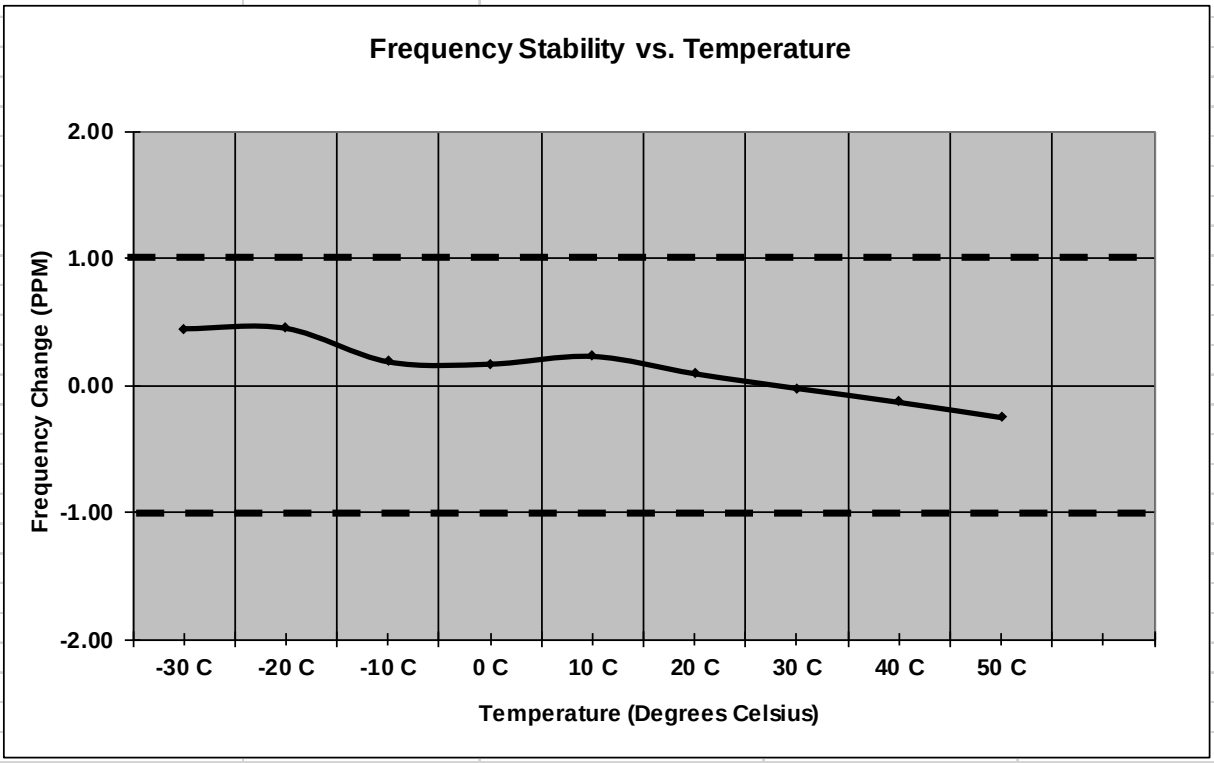

Figure 7.6.2-9: Frequency Stability – 959.925 MHz - Taitien

8.0 CONCLUSION

In the opinion of ACS, Inc. the model R100NA, manufactured by Sensus Metering Systems, Inc., meets all the requirements of FCC Part 24D and Part 101 as well as ISED Canada RSS-119 and RSS-134 where applicable.

End Report