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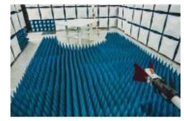

MEASUREMENT REPORT
LTE Band 8 (NB-IoT)

Applicant Name:
Telit Communications S.p.A
Viale Stazione di Prosecco 5/b
34010, Trieste, Italy

Date of Testing:
03/11 - 04/14/2021
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2104010024-01-R1.RI7

FCC ID:	**RI7ME910G1WW**
Applicant:	**Telit Communications S.p.A**

Application Type:	Class II Permissive Change
Model:	ME910G1-WW
EUT Type:	Data Terminal Module
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	Part 27 Subpart P
Test Procedure(s):	ANSI C63.26-2015, KDB 971168 D01 v03r01
Class II Permissive Change:	Adding LTE Band 8 Frequencies
Original Grant Date:	03/24/2020

Note: This revised Test Report (S/N: 1M2104010024-01-R1.RI7) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Randy Ortanez
President

CERT #2041.01

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Telit Data Terminal Module FCC ID: RI7ME910G1WW.** This device operates using NB-IoT & CAT-M1 LTE.

The test data contained in this report pertains only to the emissions due to the EUT's NB-IoT LTE licensed transmitter.

Test Device Serial No.: 79260

2.2 Device Capabilities

This device contains the following capabilities:

Band 2, 4, 5, 8 (NB-IoT & CAT-M1), 12, 13, 25, 26, 66, 71 and 85
GPRS/EDGE GSM850 and PCS 1900 Bands

2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 3.2 of this test report for a description of the radiated and antenna port conducted emissions tests.

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

2.5 Software and Firmware

The test was conducted with firmware version M0C.400002 and AT#BNDOPTIONS includes B8_39d installed on the EUT.

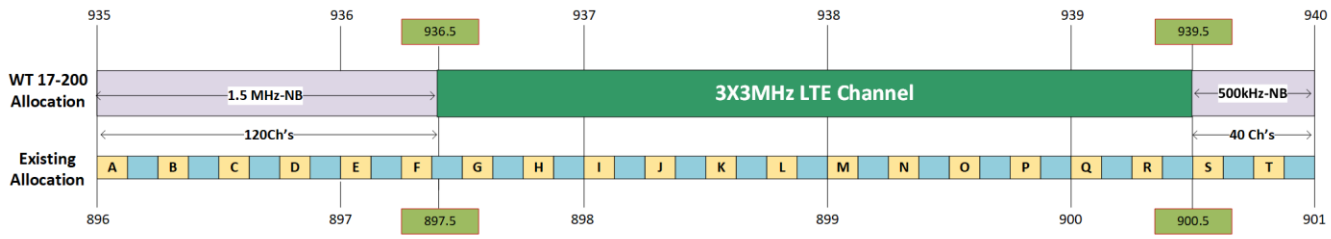
3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the document titled “Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards” (ANSI/TIA-603-E-2016) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

3.2 Broadband Frequency Assignment

The spectrum for this band is allocated as shown below.



Note:

Device can operate in the following range: 897.5MHz- 900.5MHz (Uplink) and this range 936.5- 939.5MHz (Downlink).

3.3 Radiated Power and Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

For radiated power measurements, substitution method is used per the guidance of ANSI/TIA-603-E-2016. A halfwave dipole is substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_{d\ [dBm]} = P_{g\ [dBm]} - \text{cable loss}_{\ [dB]} + \text{antenna gain}_{\ [dBd/dBi]};$$

where Pd is the dipole equivalent power, Pg is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to $P_{g\ [dBm]}$ – cable loss $_{[dB]}$.

For radiated spurious emissions measurements and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. Field Strength (EIRP) is calculated using the following formulas:

$$E_{[dB\mu V/m]} = \text{Measured amplitude level}_{[dBm]} + 107 + \text{Cable Loss}_{[dB]} + \text{Antenna Factor}_{[dB/m]}$$

And

$$EIRP_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8;$$ where D is the measurement distance in meters.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 474788 D01.

Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI/TIA-603-E-2016.

4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	LTx2	Licensed Transmitter Cable Set	9/16/2020	Annual	9/16/2021	LTx2
Emco	3115	Horn Antenna (1-18GHz)	6/18/2020	Biennial	6/18/2022	9704-5182
Keysight Technologies	N9030A	PXA Signal Analyzer	9/2/2020	Annual	9/2/2021	MY55410501
Rohde & Schwarz	ESU 40	EMI Test Reciever (40GHz)	9/9/2020	Annual	9/9/2021	100384
Rohde & Schwarz	AP1	EMC Cable and Switch System	9/10/2020	Annual	9/10/2021	AP1
Rohde & Schwarz	AP1-002	EMC Cable and Switch System	3/9/2021	Annual	3/9/2022	AP1-002
Rohde & Schwarz	CMW500	Radio Communication Tester	11/5/2020	Annual	11/5/2021	112347

Table 5-1. Summary of Test Results

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

2. Equipment with a calibration date of “N/A” shown in this list was not used to make direct calibrated measurements.

6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

LTE BW = 8.62 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 8M45W7D

LTE BW = 8.45 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

Spurious Radiated Emission – LTE Band

Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80).

7.0 TEST RESULTS

7.1 Summary

Company Name: Telit Communications S.p.A

Model: ME910G1-WW

Mode(s): LTE Band 8 NB-IoT & CAT-M1

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Report Reference
CONDUCTED	Transmitter Conducted Output Power/ Effective Radiated Power	2.1046, 27.1507(a)(3)	10W ERP	PASS	Section 7.2
	Occupied Bandwidth	2.1049, 27.1506	N/A	PASS	Section 7.3
	Conducted Band Edge / Spurious Emissions	2.1051, 27.1509(a)	Attenuation > 43 + 10 $\log_{10}$ (P[Watts]) for all out-of-band emissions	PASS	Section 7.4, 7.5
	Peak-Average Ratio	2.1051, 27.1507(d)	< 13dB	PASS	Section 7.6
	Frequency Stability	2.1055	Fundamental emissions stay within authorized frequency block	PASS	Section 7.8
RADIATED	Radiated Spurious Emissions	2.1051, 27.1509(a)	Attenuation > 43 + 10 $\log_{10}$ (P[Watts]) for all out-of-band emissions	PASS	Section 7.7

Table 7-1. Summary of Test Results

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized is LTE Automation Version 5.3
5) For Conducted Band Edge, both Stand-alone and In-band mode of operation were investigated to determine compliance. Test result in this section represents the worst case mode of operation.

7.2 Transmitter Conducted Output Power/ Effective Radiated Power

Test Overview

The transmitter conducted ouput power is a measure of the total average power contained within a 3MHz channel as defined in §27.1506. All modes of operation were investigated and the worst case configuration results are reported in this section.
Effective Radiated Power (ERP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedure Used

ANSI C63.26-2015 – Section 5.2.4.2

Test Settings

All conducted powers were measured using the R&S CMW500's Channel Measurement function.

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None

LTE Band 8 3MHz Bandwidth (3.75kHz SCS)								
Modulation	Subcarrier Spacing (kHz)	Number of Subcarriers	SC Offset	Low Channel		Mid Channel		High Channel
				21626 (897.6MHz)	21627 (897.7MHz)	21640 (899.0 MHz)	21653 (900.3MHz)	21654 (900.4MHz)
				Conducted Power [dBm]	Conducted Power [dBm]	Conducted Power [dBm]	Conducted Power [dBm]	Conducted Power [dBm]
BPSK (MCS=0)	3.75	1	0	5.83	24.44	24.60	24.37	5.97
		1	24	5.90	24.30	24.32	24.31	6.03
		1	47	5.81	24.42	24.34	24.35	5.96
QPSK (MCS=3)		1	0	5.89	24.49	24.50	24.49	6.04
		1	24	5.96	24.35	24.37	24.47	6.07
		1	47	5.85	24.34	24.35	24.31	5.97

Table 7-2. Transmitter Conducted Output Power Measurements (3.75kHz SCS)

LTE Band 8 3MHz Bandwidth (15kHz SCS)								
Modulation	Subcarrier Spacing (kHz)	Number of Subcarriers	SC Offset	Low Channel		Mid Channel		High Channel
				21626 (897.6MHz)	21627 (897.7MHz)	21640 (899.0 MHz)	21653 (900.3MHz)	21654 (900.4MHz)
				Conducted Power [dBm]	Conducted Power [dBm]	Conducted Power [dBm]	Conducted Power [dBm]	Conducted Power [dBm]
BPSK (MCS=0)	15	1	0	6.14	24.77	24.68	24.81	6.13
		1	6	6.18	24.79	24.69	24.74	6.14
		1	11	6.02	24.73	24.59	24.69	6.01
QPSK (MCS=0)		3	0	6.05	24.68	24.59	24.69	6.02
		3	3	6.12	24.73	24.62	24.74	6.09
		3	9	6.02	24.66	24.54	24.70	6.05
		6	0	6.17	24.73	24.64	24.75	6.11
		6	6	6.14	24.60	24.51	24.63	6.10
		12	0	6.33	24.65	24.51	24.68	6.23

Table 7-3. Transmitter Conducted Output Power Measurements (15kHz SCS)

Frequency Band [MHz]	Maximum Conducted Power [dBm]	Maximum ERP [dBm]	Maximum Antenna Gain [dBi]
899	25	40	17.15

Table 7-4. ERP Data (LTE Band 8)

Note:

The 17.15dBi antenna gain shown in the table above is the maximum theoretical antenna gain that can be used by this device in order to reach the 10W ERP limit (42.15dBm EIRP) for operation in this band. An actual antenna was not used for testing to determine ERP compliance.

7.3 Occupied Bandwidth

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

ANSI C63.26-2015 – Section 5.4.4

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

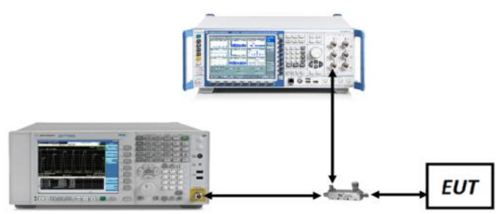


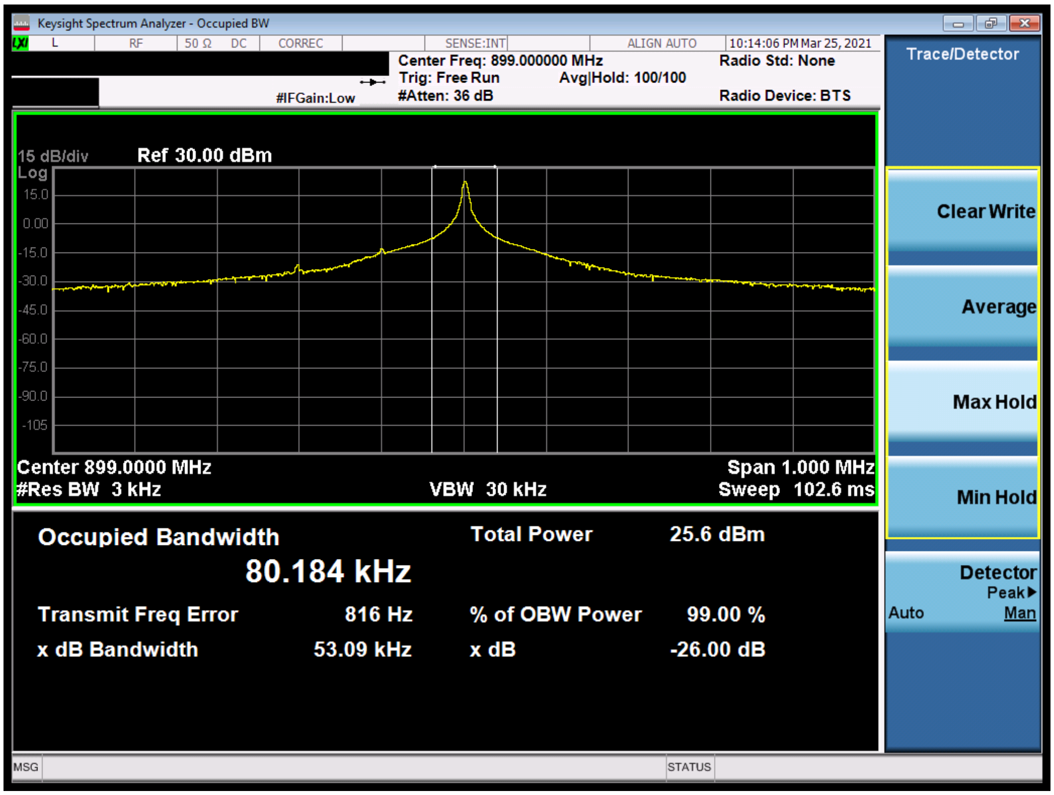
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

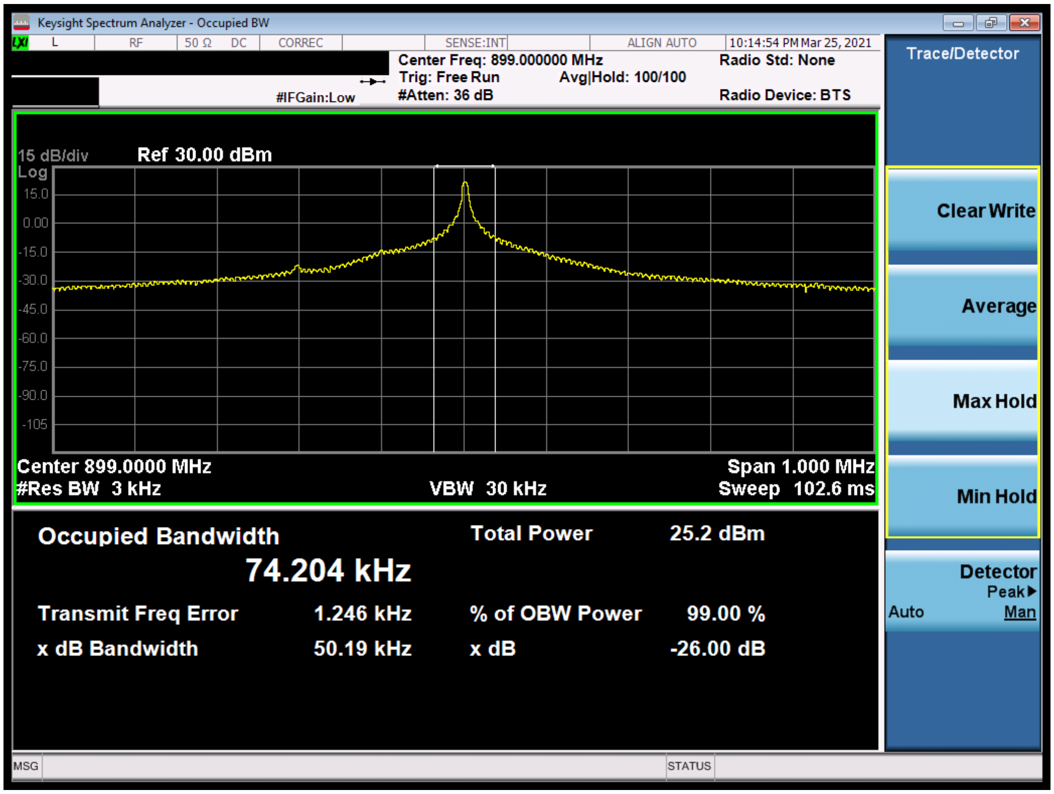
None

Mode	Channel Bandwidth (MHz)	Channel/ Frequency	Modulation	Subcarrier Spacing	Number of Subcarrier	SC Offset	Occupied BW (kHz)
NB-IoT (Standalone)	3	CH21640 - 899.0MHz	BPSK	3.75	1	24	80.184
NB-IoT (Standalone)	3	CH21640 - 899.0MHz	QPSK	3.75	1	24	74.204
NB-IoT (Standalone)	3	CH21640 - 899.0MHz	BPSK	15	1	6	133.81
NB-IoT (Standalone)	3	CH21640 - 899.0MHz	QPSK	15	12	0	192.51

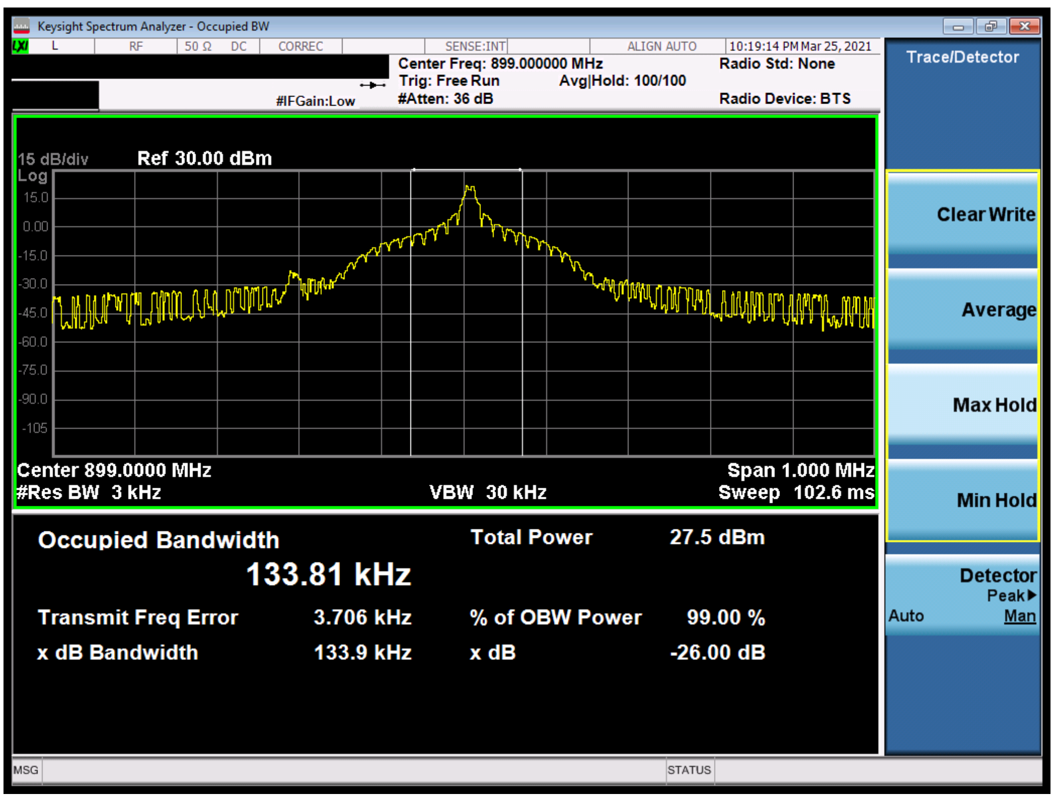
Table 7-5. Occupied Bandwidth Measurements



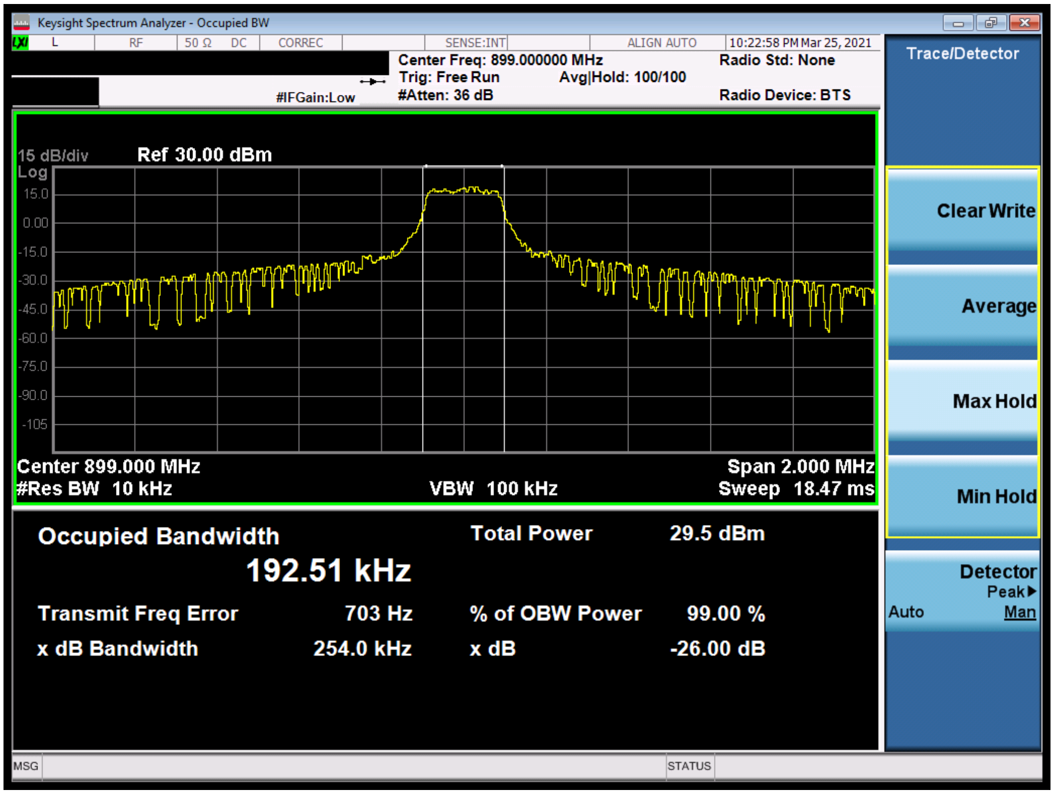
Plot 7-1. Occupied Bandwidth Plot (3.75kHz SCS, BPSK, 1SC, SC Offset 24)



Plot 7-2. Occupied Bandwidth Plot (3.75kHz SCS, QPSK, 1SC, SC Offset 24)



Plot 7-3. Occupied Bandwidth Plot (15kHz SCS, BPSK, 1SC, SC Offset 6)



Plot 7-4. Occupied Bandwidth Plot (15kHz SCS, QPSK, 12SC, SC Offset 0)

7.4 Band Edge Emissions at Antenna Terminal

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. Several modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + 10 log$_{10}$(P$_{[Watts]}$), where P is the transmitter power in Watts.

Test Procedure Used

ANSI C63.26-2015 – Section 5.7.3

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average for continuous emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

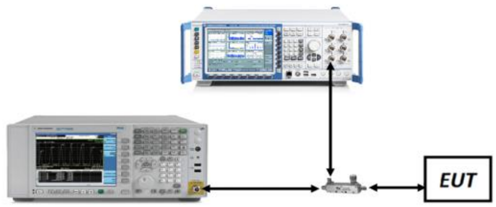


Figure 7-3. Test Instrument & Measurement Setup

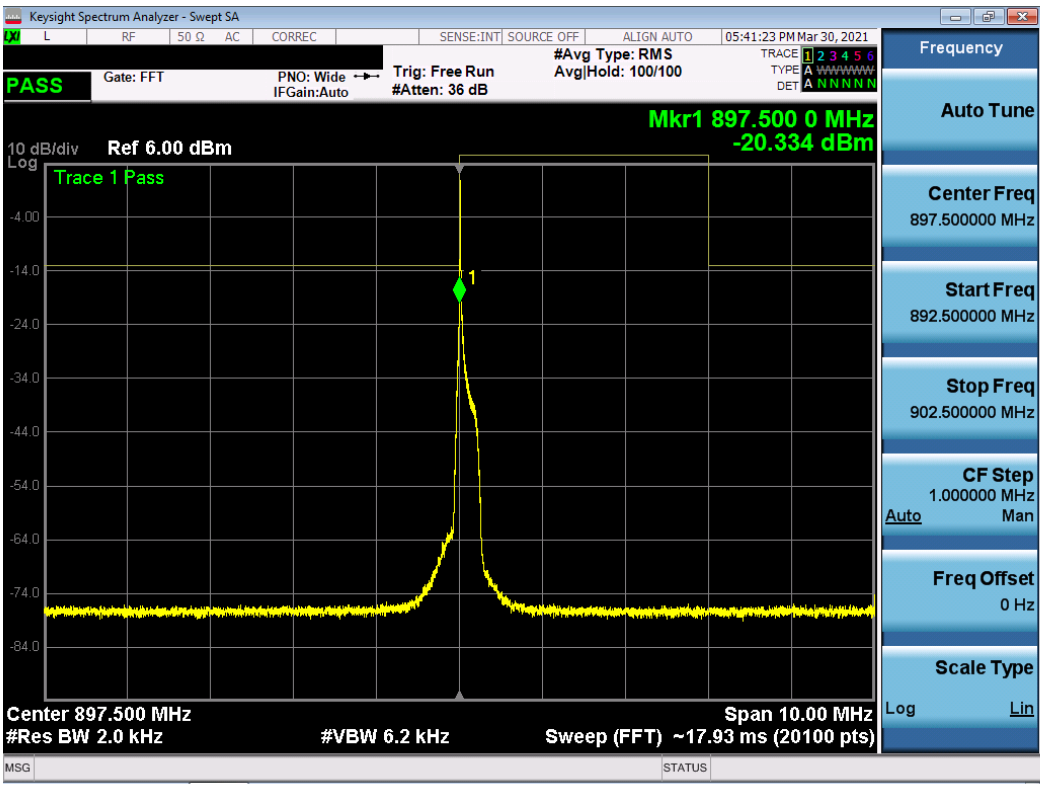
Test Notes

1. Per §27.1509(c), in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.
2. This section shows non-compliant band edge emissions. The emissions were measured with the required 100kHz RBW and they were also investigated with a RBW greater than or equal to 1% of the channel emission bandwidth, as allowed by the rule

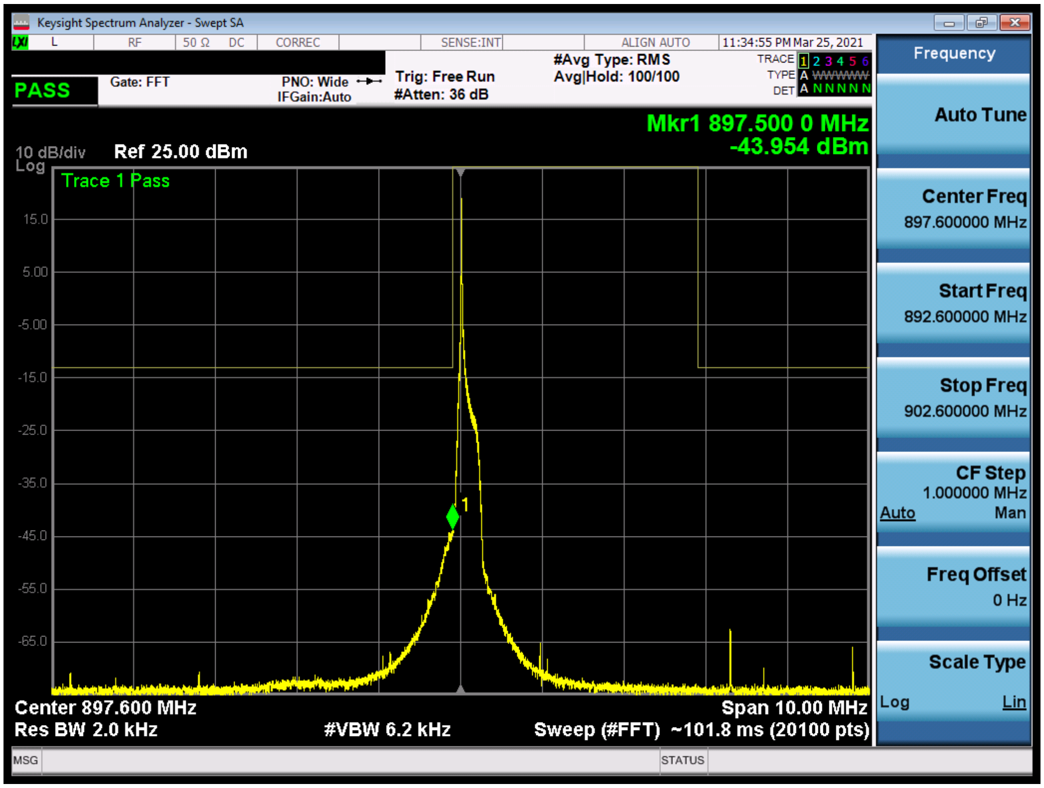
Mode	Channel Bandwidth [MHz]	Channel/ Frequency	Modulation	Subcarrier Spacing	Number of Subcarriers	SC Offset	Band Edge Level [dBm]	Limit [dBm]	Margin [dB]
NB-IoT (Standalone)	3	CH21626 - 897.6MHz	BPSK	3.75	1	0	-20.334	-13	-7.33
NB-IoT (Standalone)	3	CH21627 - 897.7MHz	BPSK	3.75	1	0	-43.954	-13	-30.95
NB-IoT (Standalone)	3	CH21653 - 900.3MHz	BPSK	3.75	1	47	-42.532	-13	-29.53
NB-IoT (Standalone)	3	CH21654 - 900.4MHz	BPSK	3.75	1	47	-19.84	-13	-6.84
NB-IoT (Standalone)	3	CH21626 - 897.6MHz	QPSK	15	12	0	-24.969	-13	-11.97
NB-IoT (Standalone)	3	CH21627 - 897.7MHz	QPSK	15	12	0	-38.99	-13	-25.99
NB-IoT (Standalone)	3	CH21653 - 900.3MHz	QPSK	15	12	0	-37.532	-13	-24.53
NB-IoT (Standalone)	3	CH21654 - 900.4MHz	QPSK	15	12	0	-27.266	-13	-14.27

Table 7-6. Band Edge Measurements

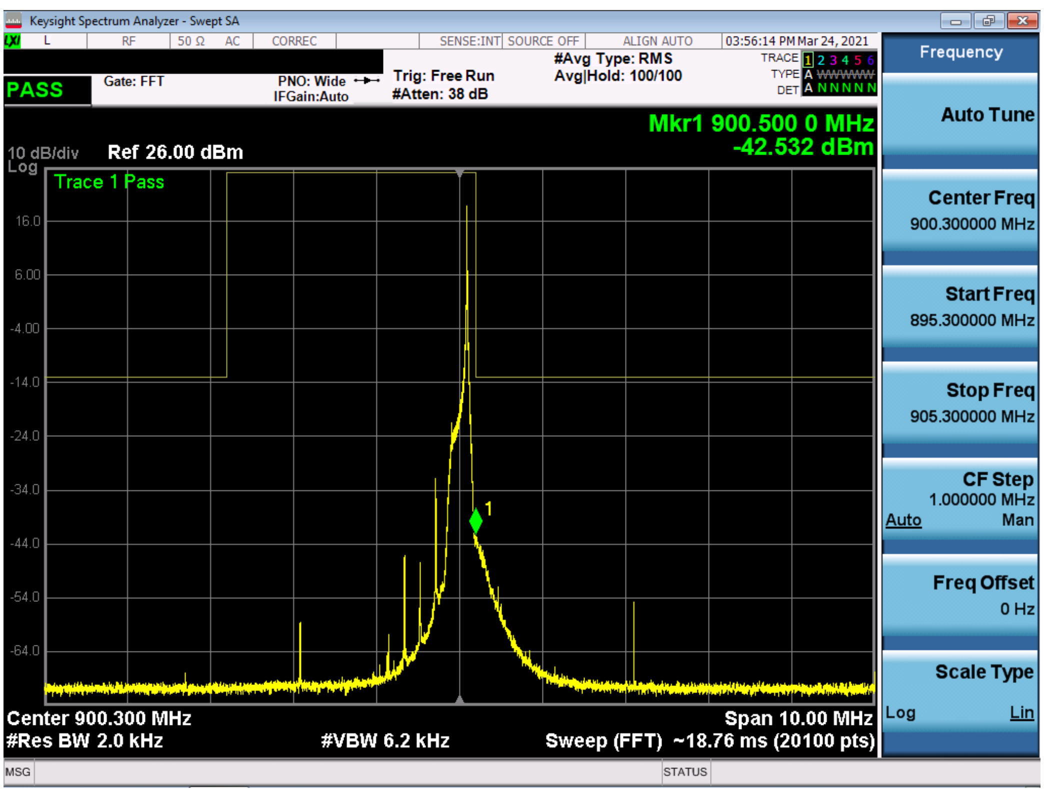
Standalone Mode



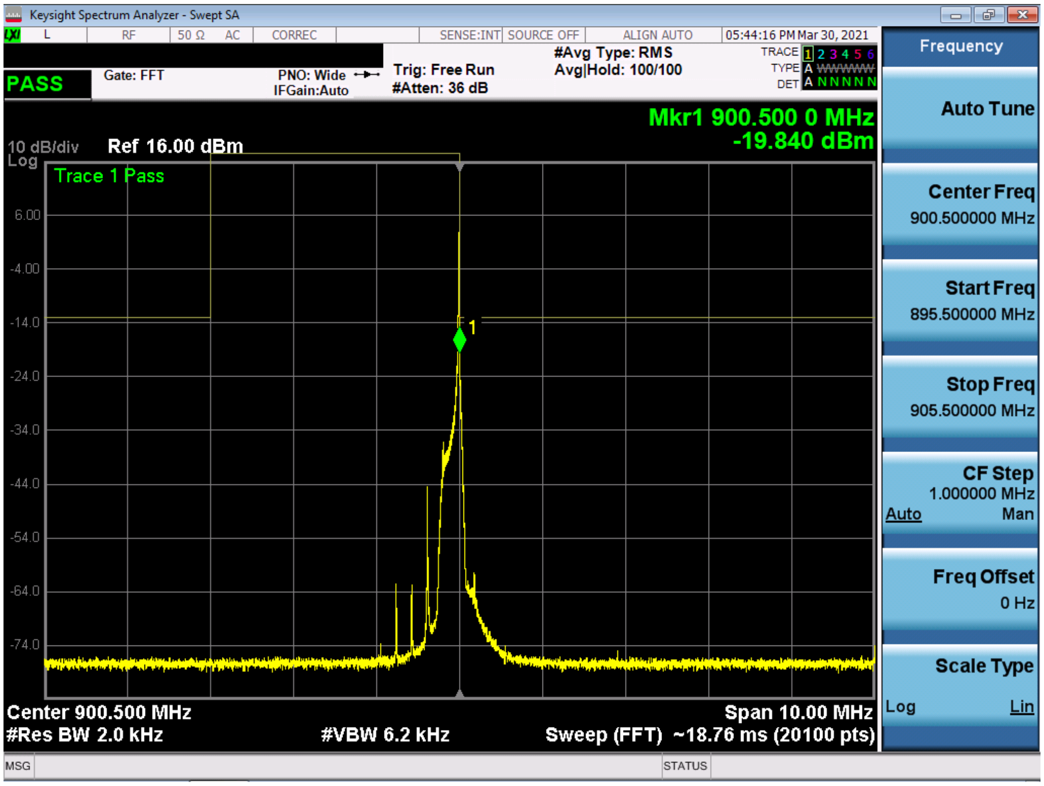
Plot 7-5. Lower Band Edge Plot (3.75kHz SCS, BPSK, 1SC, SC Offset 0, 2kHz RBW) _CH21626



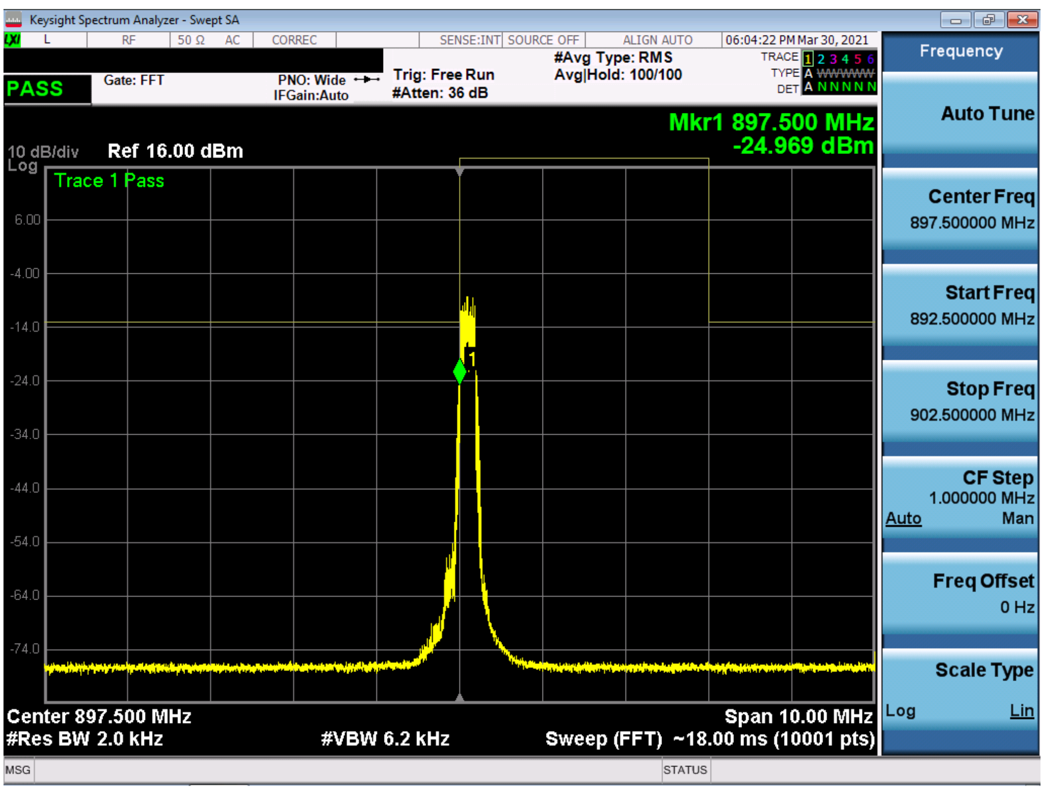
Plot 7-6. Lower Band Edge Plot (3.75kHz SCS, BPSK, 1SC, SC Offset 0, 2kHz RBW) _CH21627



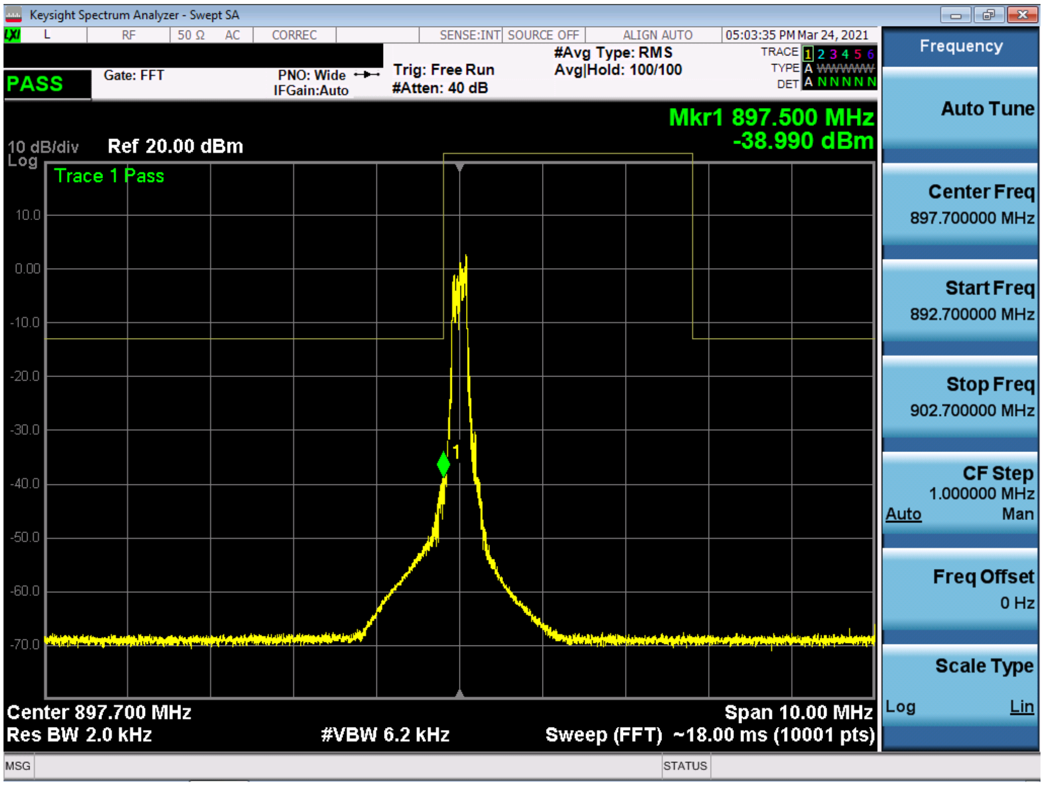
Plot 7-7. Upper Band Edge Plot (3.75kHz SCS, BPSK, 1SC, SC Offset 47, 2kHz RBW) _CH21653



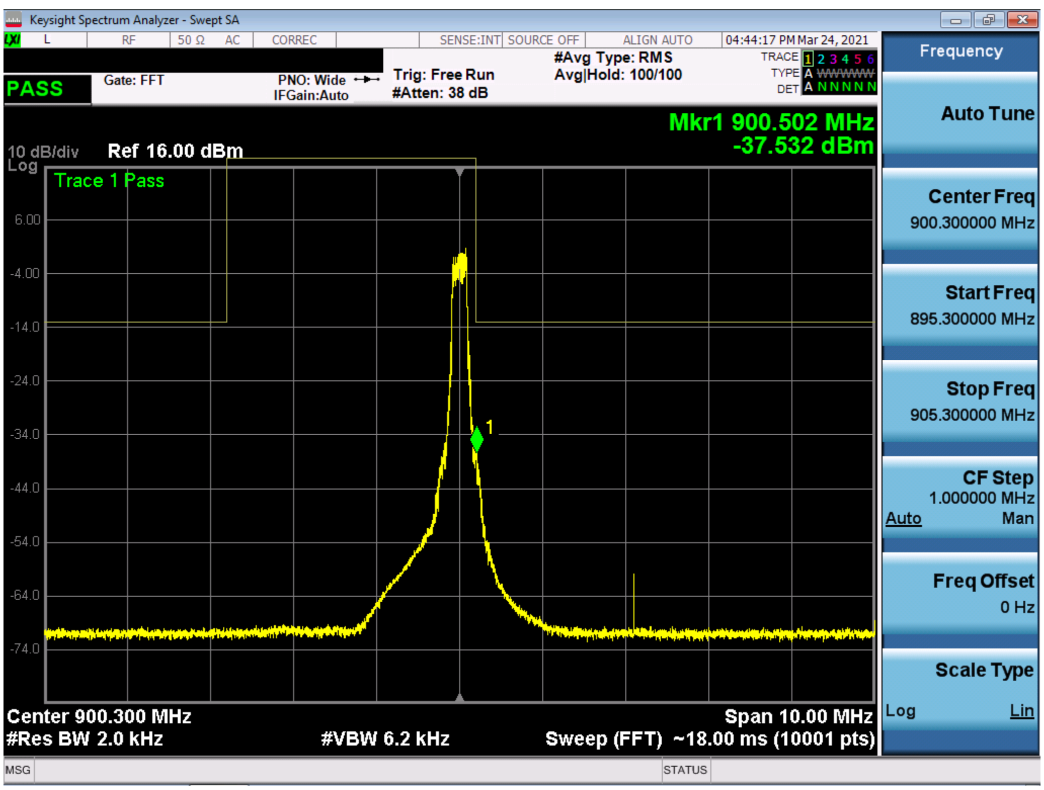
Plot 7-8. Upper Band Edge Plot (3.75kHz SCS, BPSK, 1SC, SC Offset 47, 2kHz RBW) _CH21654



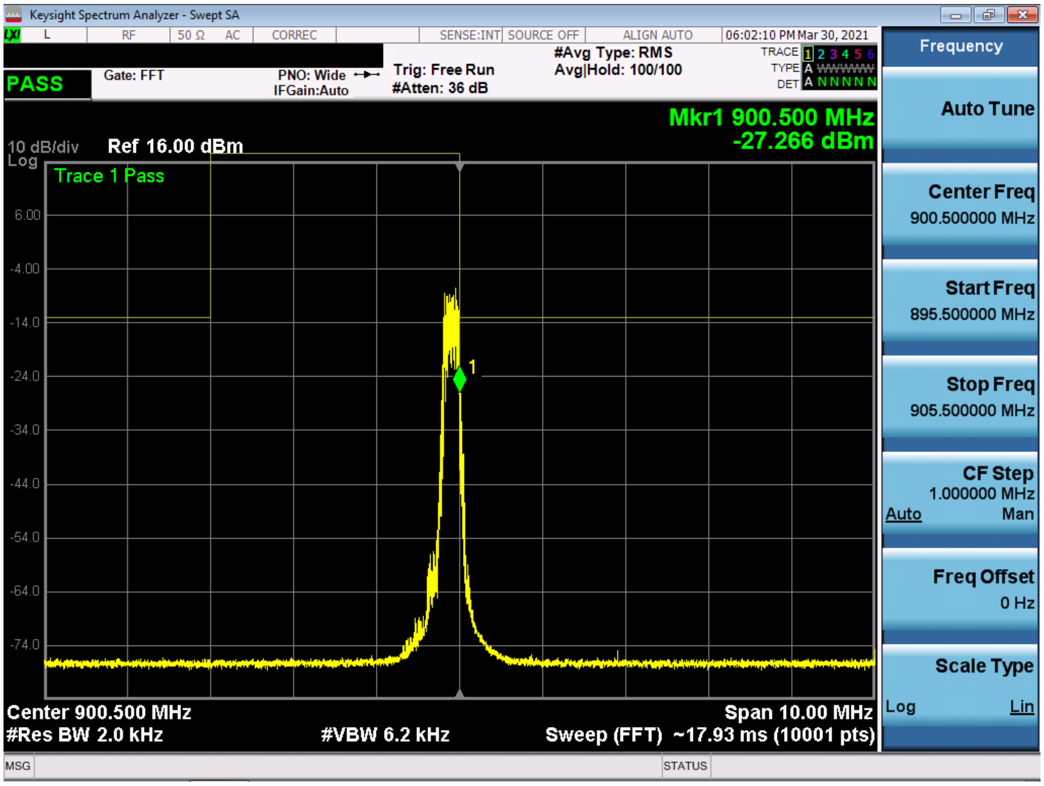
Plot 7-9. Lower Band Edge Plot (15kHz SCS, BPSK, 12SC, SC Offset 0, 2kHz RBW) _ CH21626



Plot 7-10. Lower Band Edge Plot (15kHz SCS, BPSK, 12SC, SC Offset 0, 2kHz RBW) _ CH21627



Plot 7-11. Upper Band Edge Plot (15kHz SCS, BPSK, 12SC, SC Offset 0, 2kHz RBW) _CH21653



Plot 7-12. Upper Band Edge Plot (15kHz SCS, BPSK, 12SC, SC Offset 0, 2kHz RBW) _CH21654

7.5 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. Several modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + 10log $_{10}$***(P*** $_{[Watts]}$***), where P is the transmitter power in Watts.***

Test Procedure Used

ANSI C63.26-2015 – Section 5.7.4

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz for Cell, 20GHz for AWS, 20GHz for PCS (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

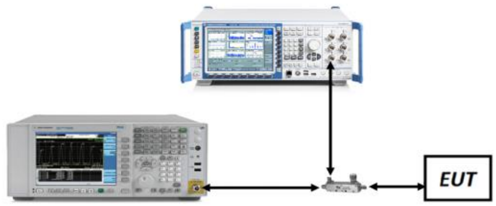


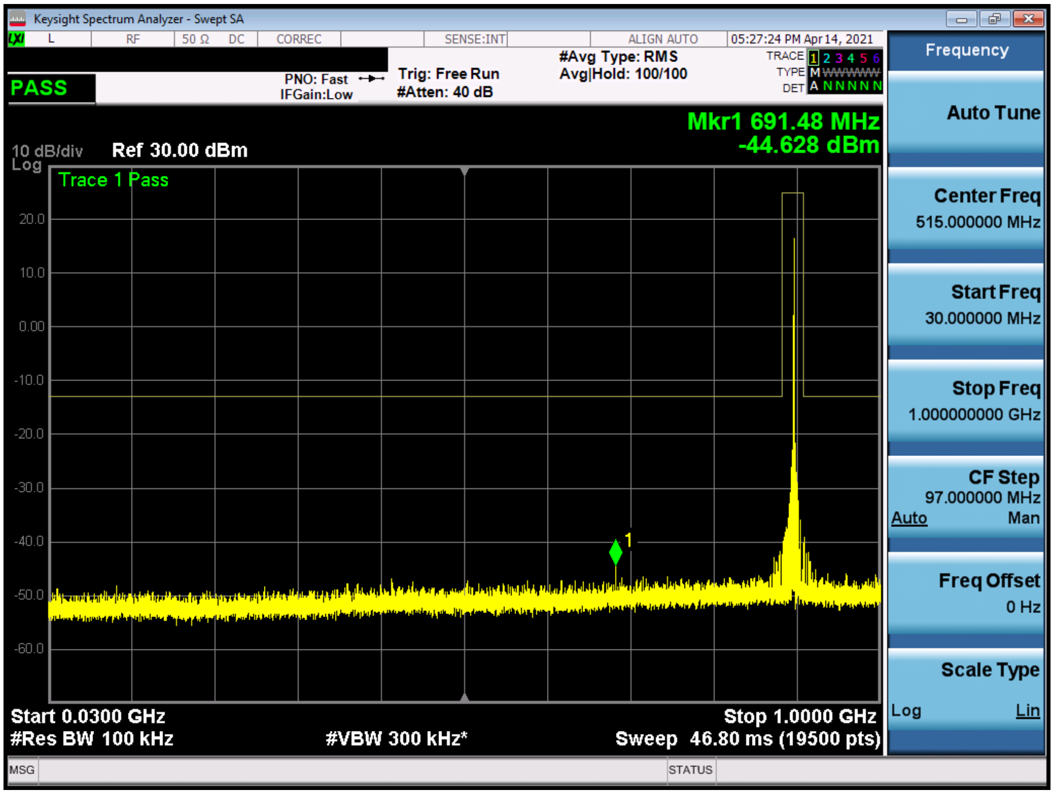
Figure 7-4. Test Instrument & Measurement Setup

Test Notes

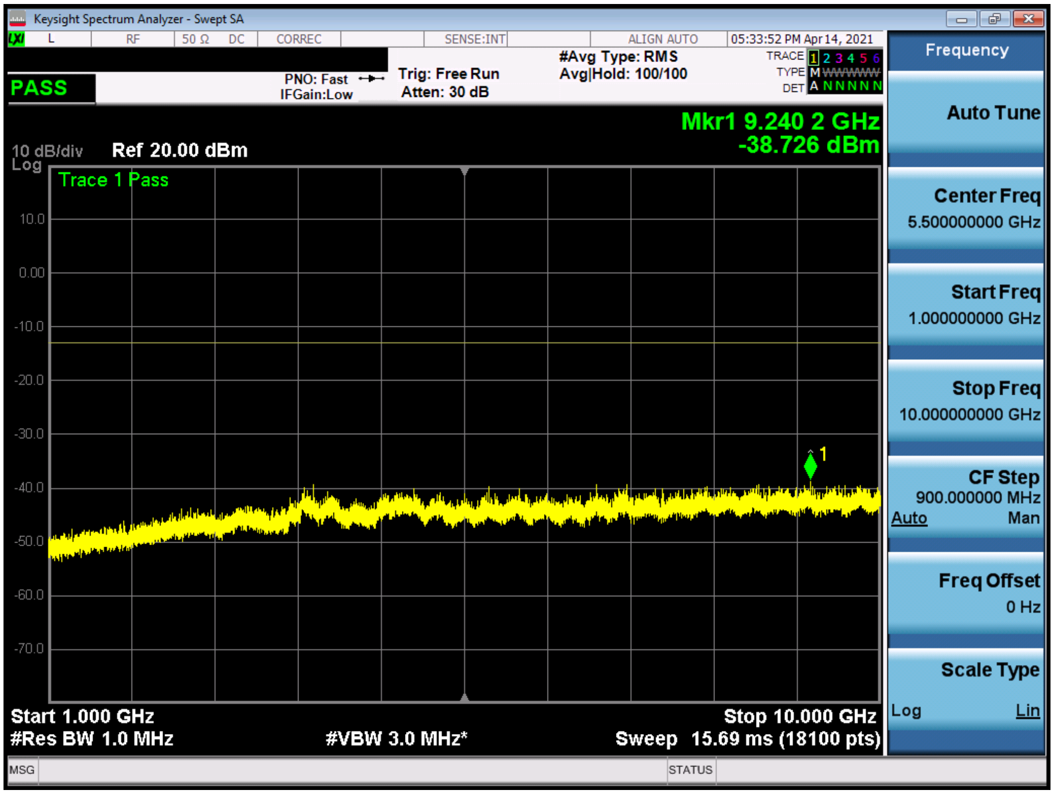
Per 27.1509(a), compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

Mode	Channel Bandwidth [MHz]	Channel/ Frequency	Modulation	Subcarrier Spacing	Number of Subcarriers	SC Offset	Worst Case CSE [dBm]	Limit [dBm]	Margin [dB]
NB-IoT (Standalone)	3	CH21627 - 897.7MHz	QPSK	3.75	1	24	-38.726	-13	-25.73
NB-IoT (Standalone)	3	CH21627 - 897.7MHz	QPSK	15	1	6	-38.838	-13	-25.84
NB-IoT (Standalone)	3	CH21627 - 897.7MHz	QPSK	15	12	0	-36.200	-13	-23.20
NB-IoT (Standalone)	3	CH21640 - 899.0MHz	QPSK	3.75	1	24	-34.525	-13	-21.53
NB-IoT (Standalone)	3	CH21640 - 899.0MHz	QPSK	15	1	6	-34.583	-13	-21.58
NB-IoT (Standalone)	3	CH21640 - 899.0MHz	QPSK	15	12	0	-34.063	-13	-21.06
NB-IoT (Standalone)	3	CH21653 - 900.3MHz	QPSK	3.75	1	24	-37.552	-13	-24.55
NB-IoT (Standalone)	3	CH21653 - 900.3MHz	QPSK	15	1	6	-38.297	-13	-25.30
NB-IoT (Standalone)	3	CH21653 - 900.3MHz	QPSK	15	12	0	-38.725	-13	-25.73

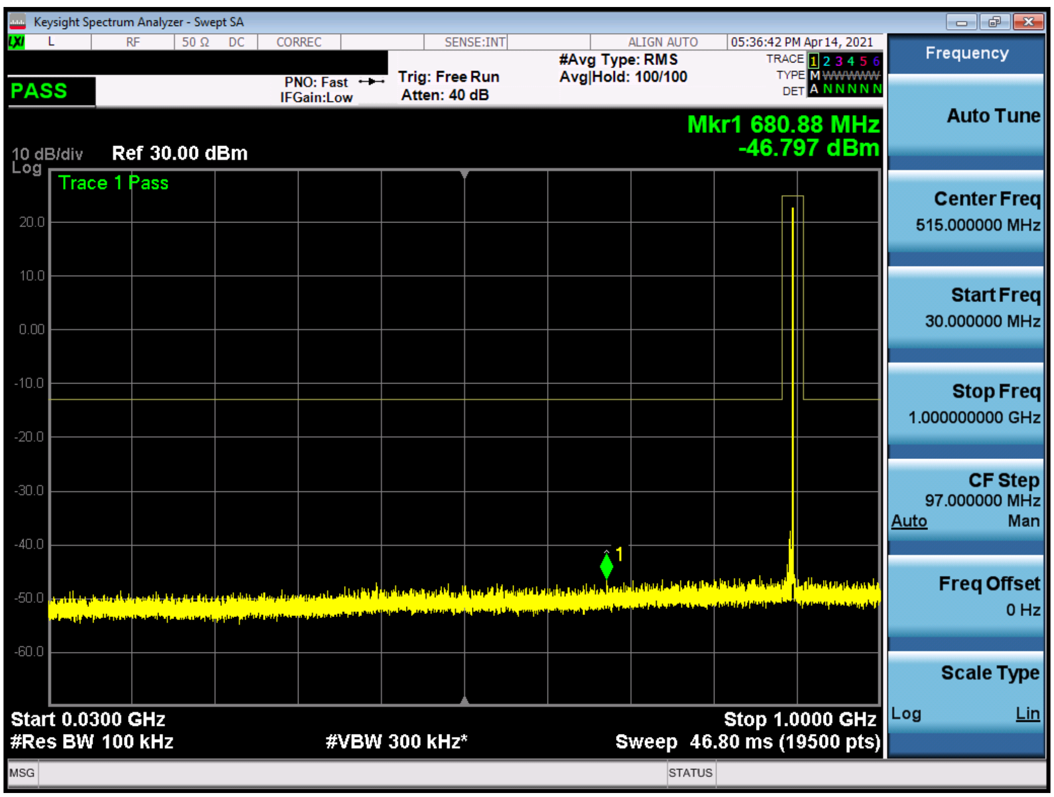
Table 7-7. Spurious Emission Measurements



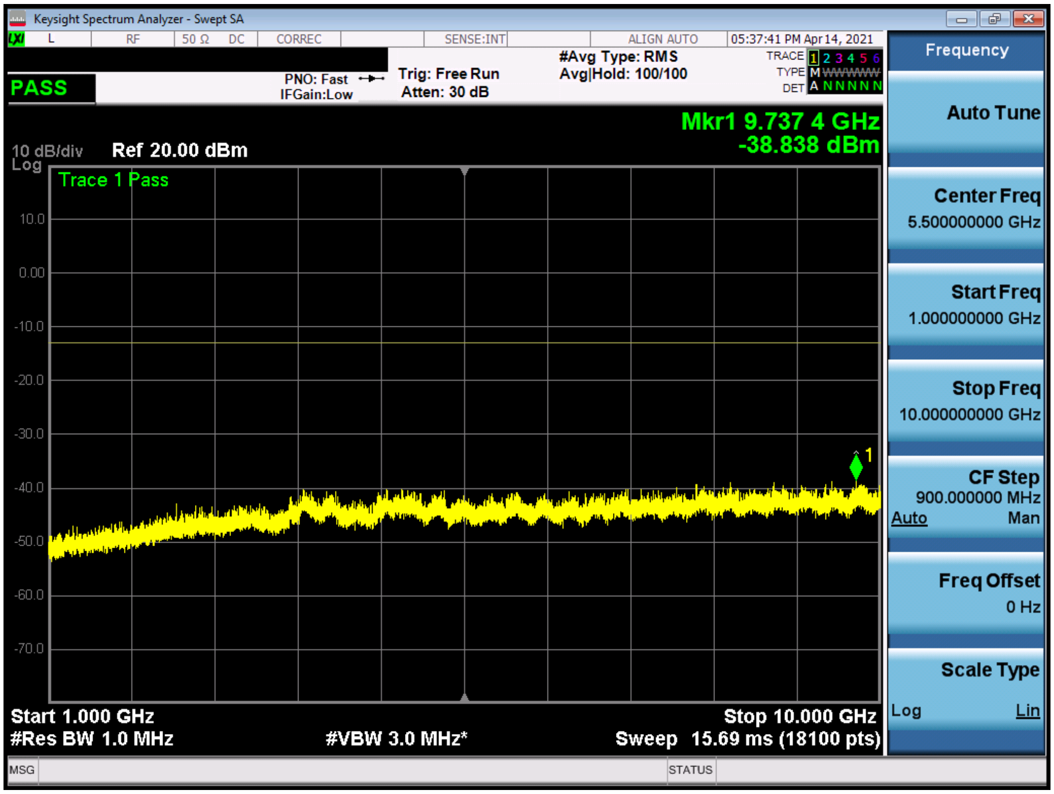
Plot 7-13. Conducted Spurious Plot – Low Channel (3.75kHz SCS, BPSK, 1SC, SC Offset 24) _CH21627



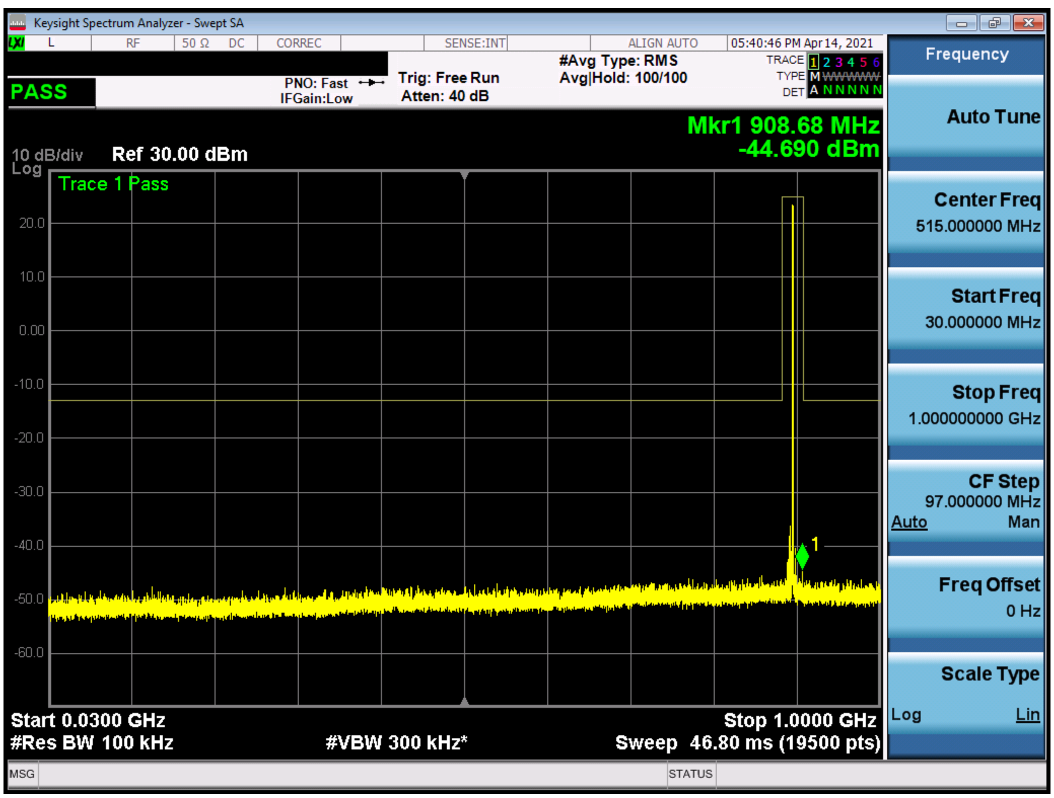
Plot 7-14. Conducted Spurious Plot- Low Channel (3.75kHz SCS, BPSK, 1SC, SC Offset 24) _CH21627



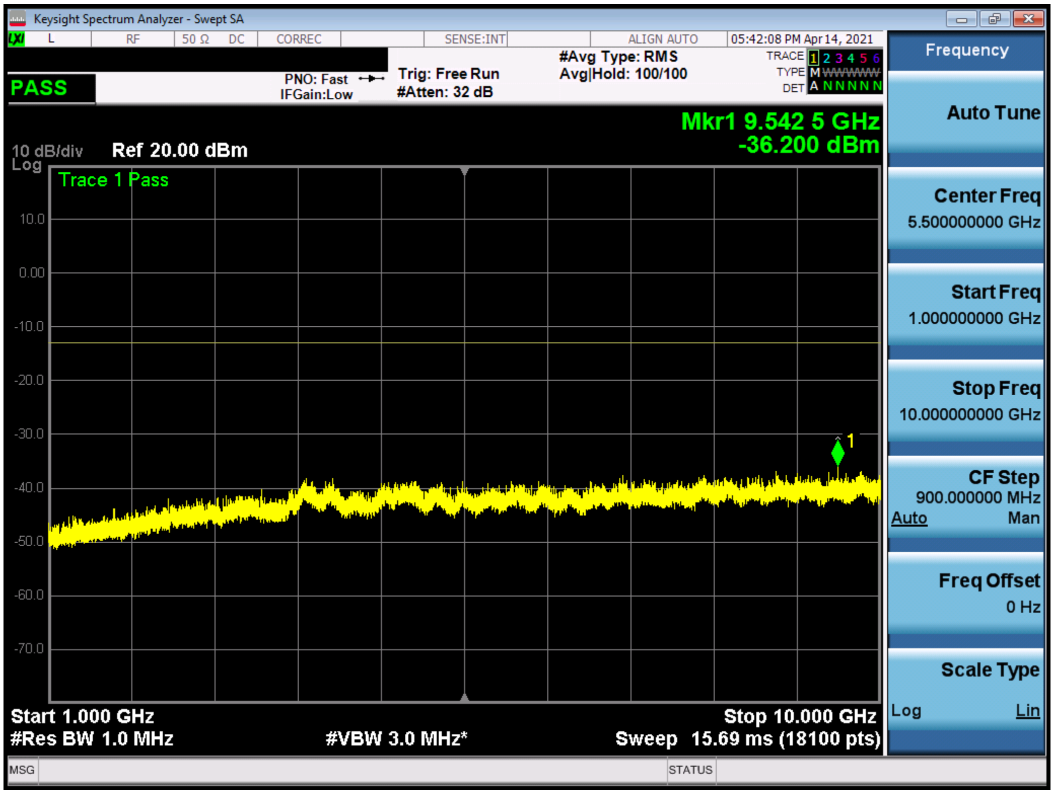
Plot 7-15. Conducted Spurious Plot – Low Channel (15kHz SCS, BPSK, 1SC, SC Offset 6) _CH21627



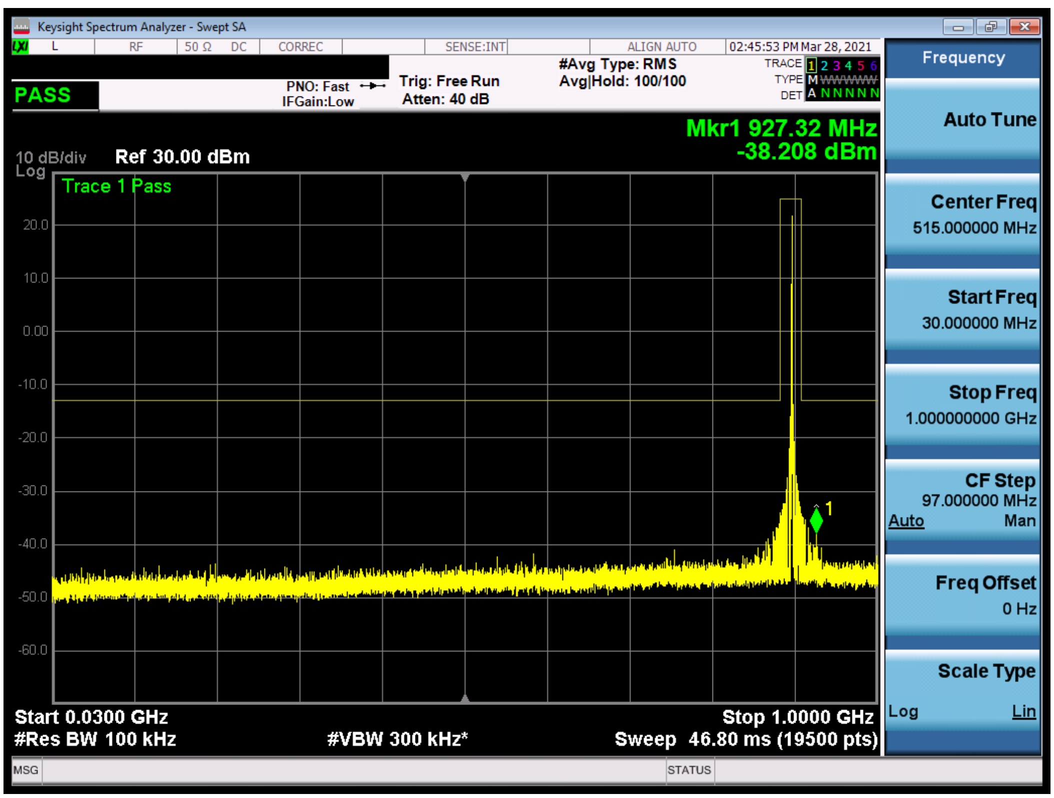
Plot 7-16. Conducted Spurious Plot – Low Channel (15kHz SCS, BPSK, 1SC, SC Offset 6) _CH21627



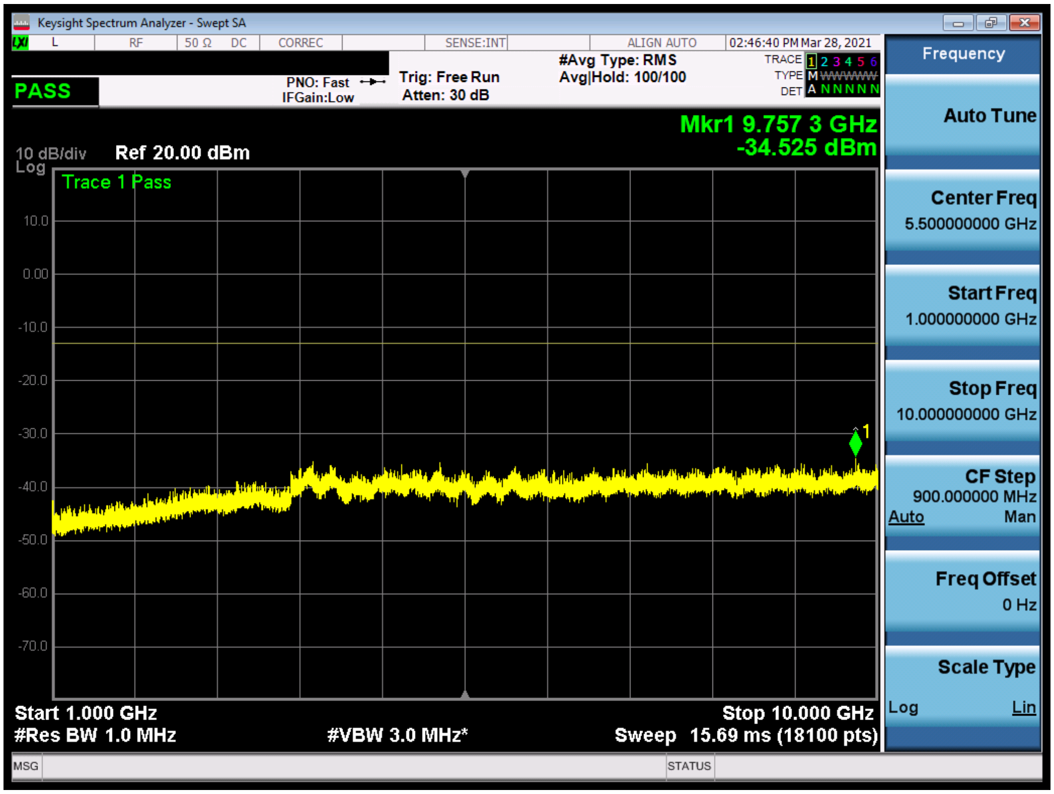
Plot 7-17. Conducted Spurious Plot – Low Channel (15kHz SCS, QPSK, 12SC, SC Offset 0) _CH21627



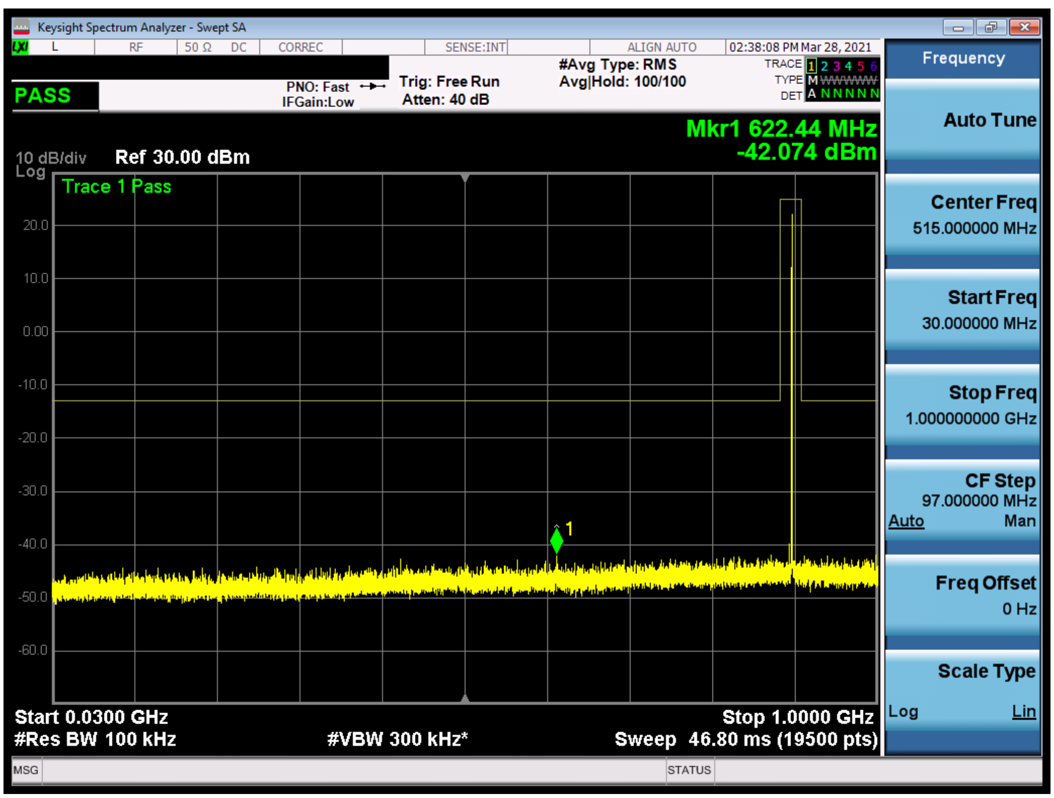
Plot 7-18. Conducted Spurious Plot- Low Channel (15kHz SCS, QPSK, 12SC, SC Offset 0) _CH21627



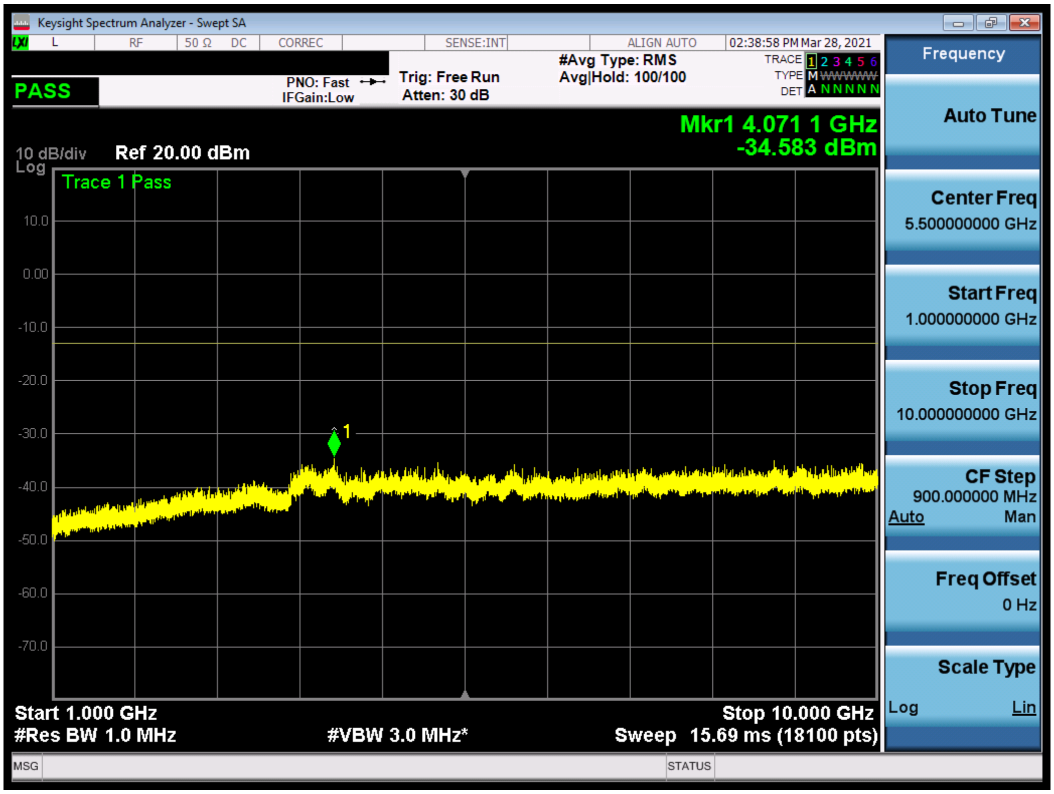
Plot 7-19. Conducted Spurious Plot – Mid Channel (3.75kHz SCS, BPSK, 1SC, SC Offset 24) _CH21640



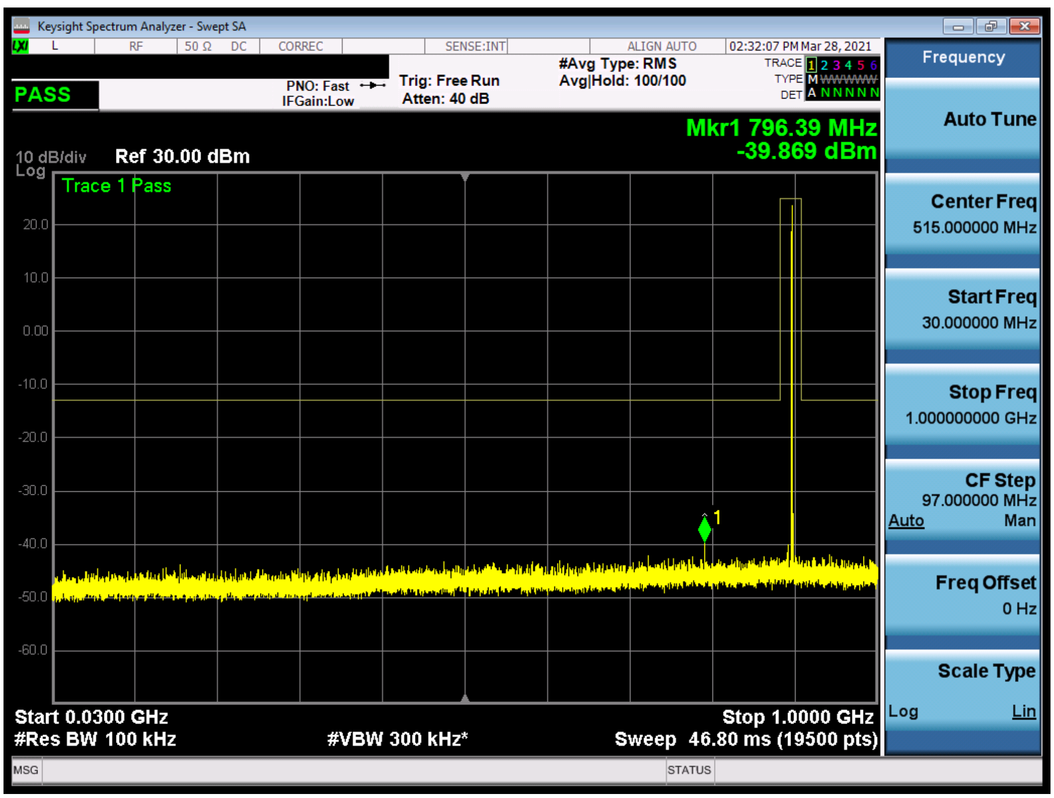
Plot 7-20. Conducted Spurious Plot – Mid Channel (3.75kHz SCS, BPSK, 1SC, SC Offset 24) _CH21640



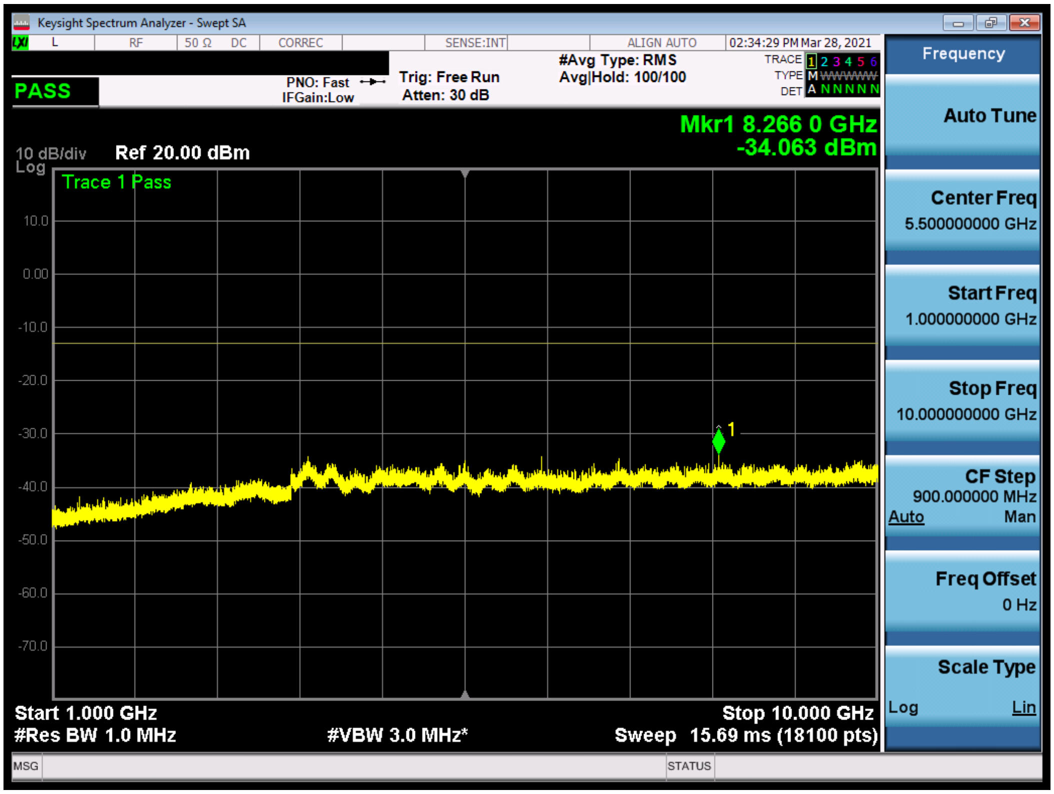
Plot 7-21. Conducted Spurious Plot- Mid Channel (15kHz SCS, BPSK, 1SC, SC Offset 6) _CH21640



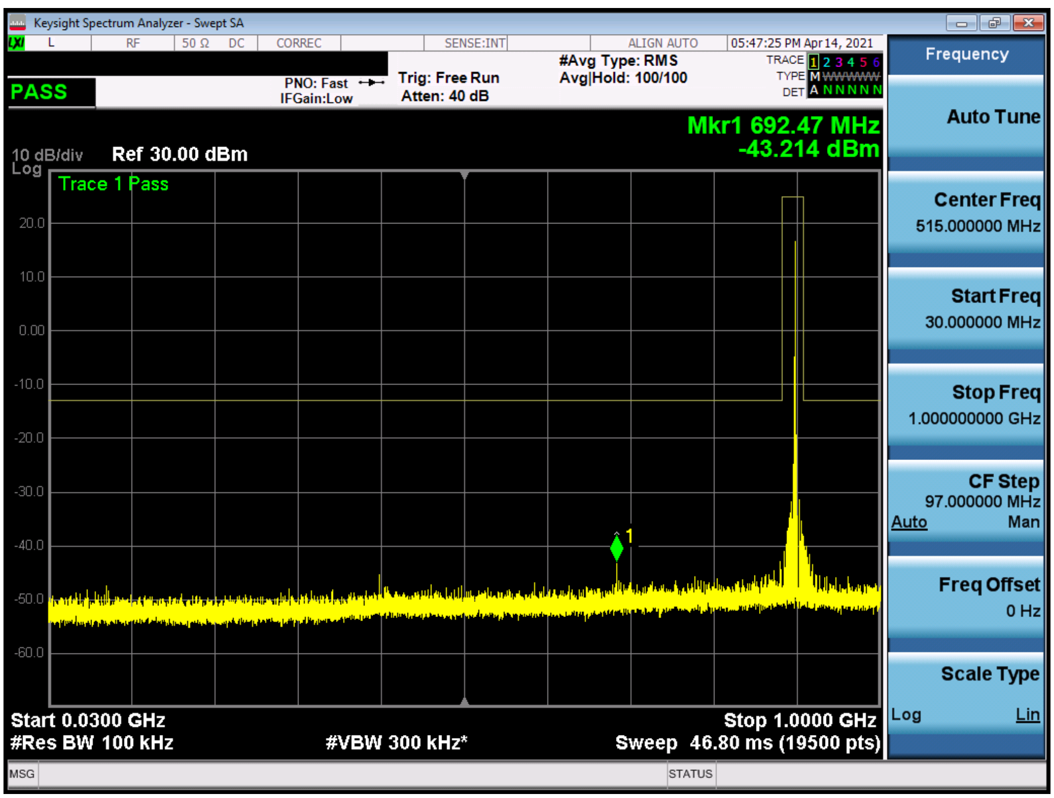
Plot 7-22. Conducted Spurious Plot – Mid Channel (15kHz SCS, BPSK, 1SC, SC Offset 6) _CH21640



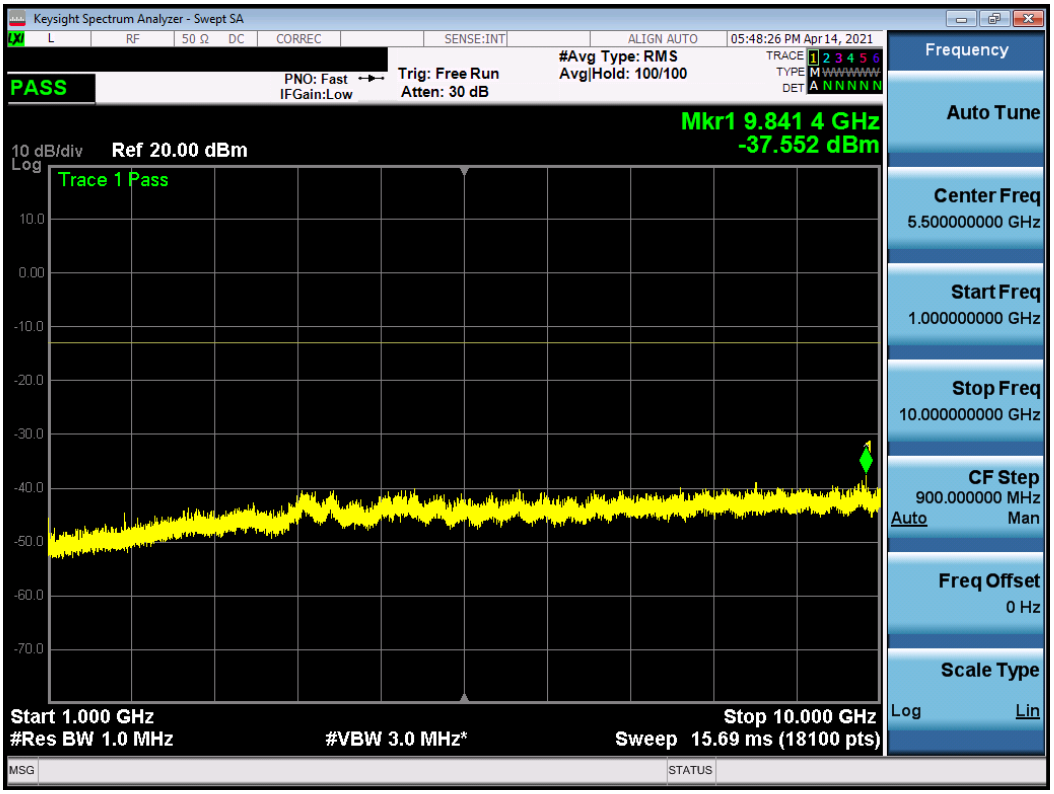
Plot 7-23. Conducted Spurious Plot – Mid Channel (15kHz SCS, QPSK, 12SC, SC Offset 0) _CH21640



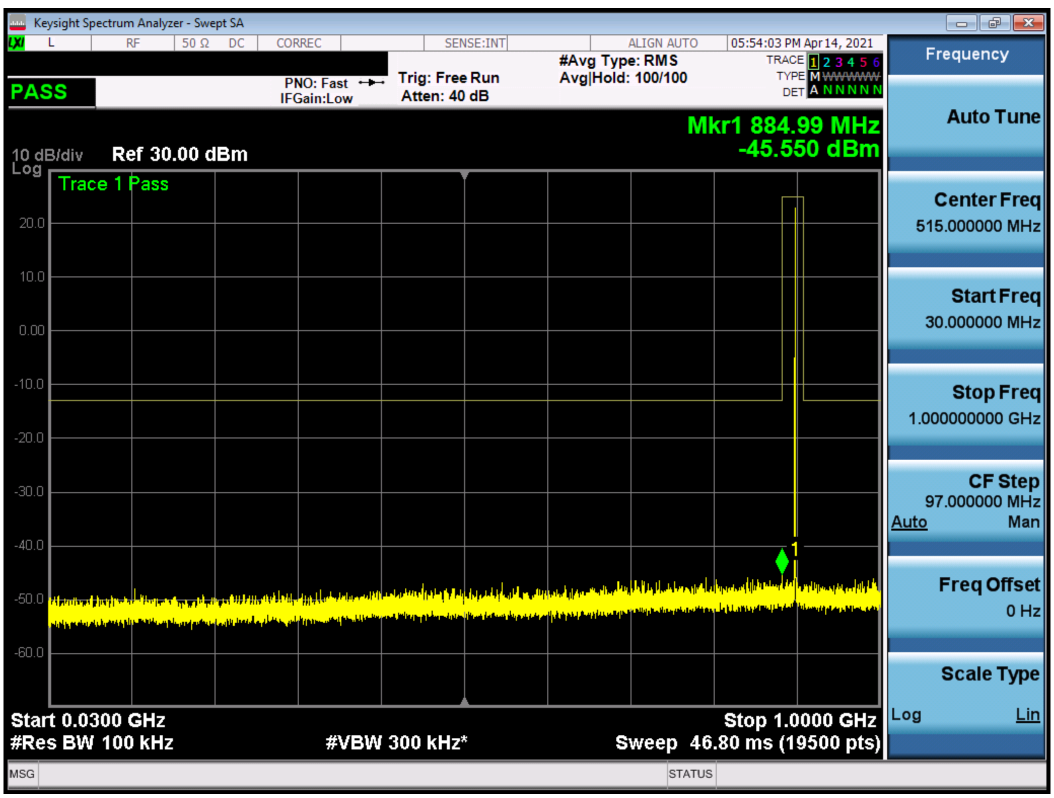
Plot 7-24. Conducted Spurious Plot – Mid Channel (15kHz SCS, QPSK, 12SC, SC Offset 0) _CH21640



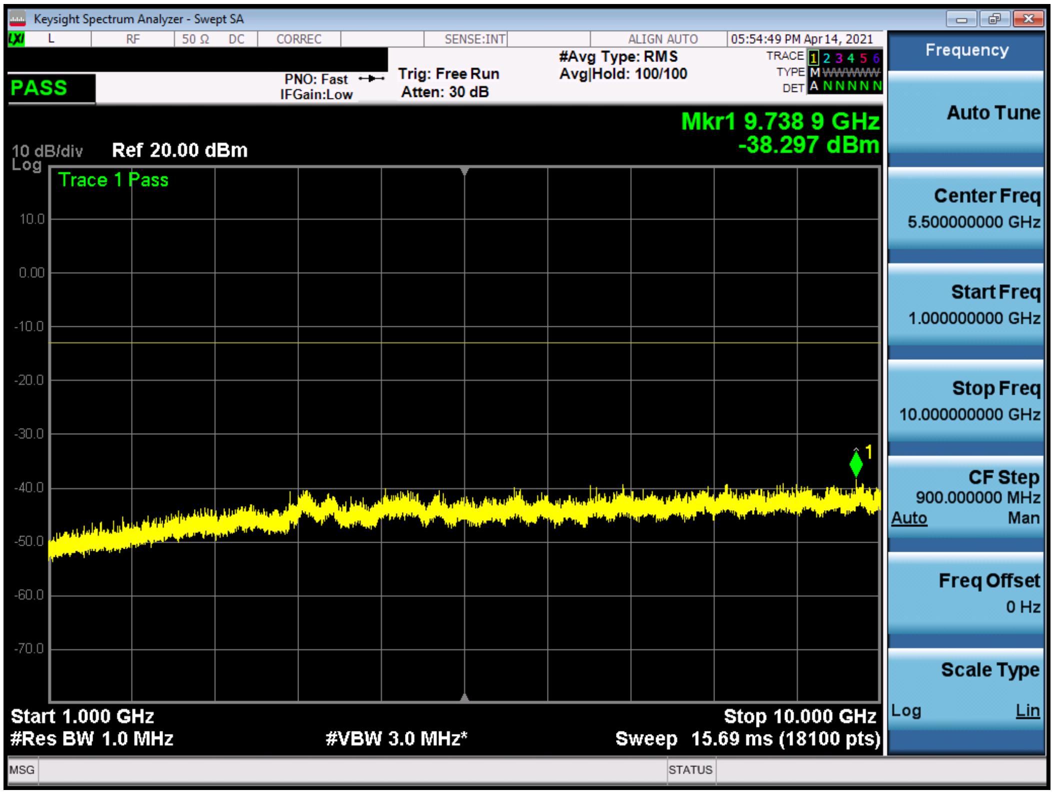
Plot 7-25. Conducted Spurious Plot – High Channel (3.75kHz SCS, BPSK, 1SC, SC Offset 24) _CH21653



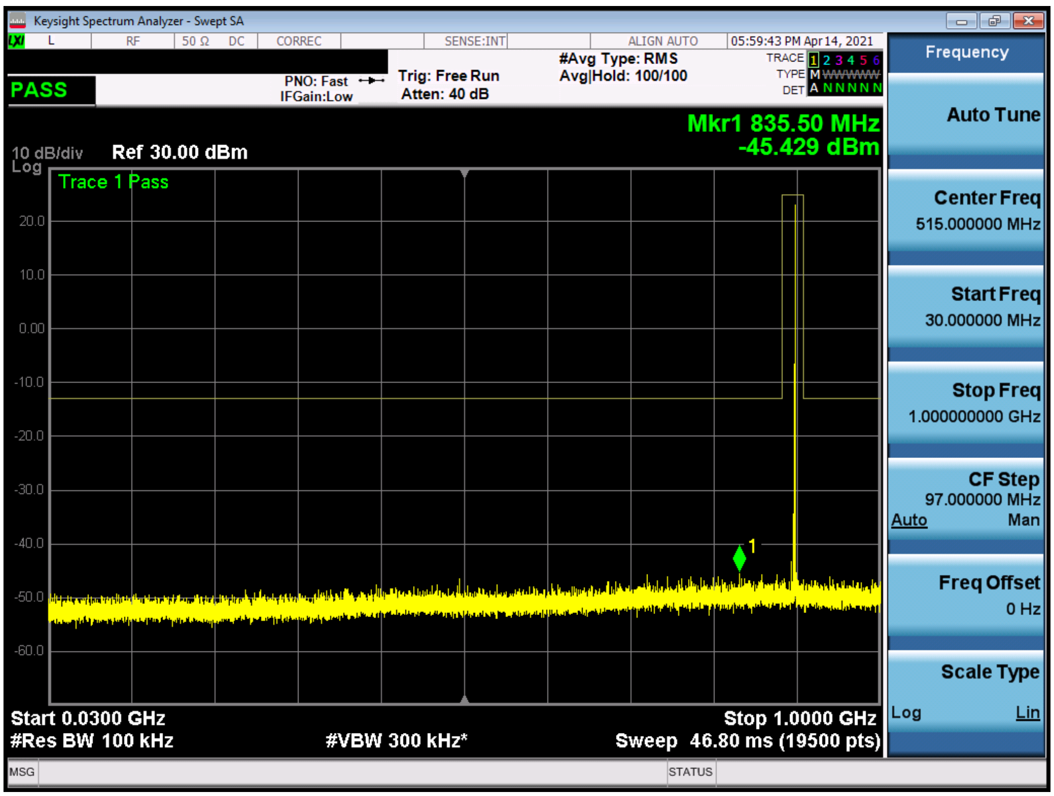
Plot 7-26. Conducted Spurious Plot- High Channel (3.75kHz SCS, BPSK, 1SC, SC Offset 24) _CH21653



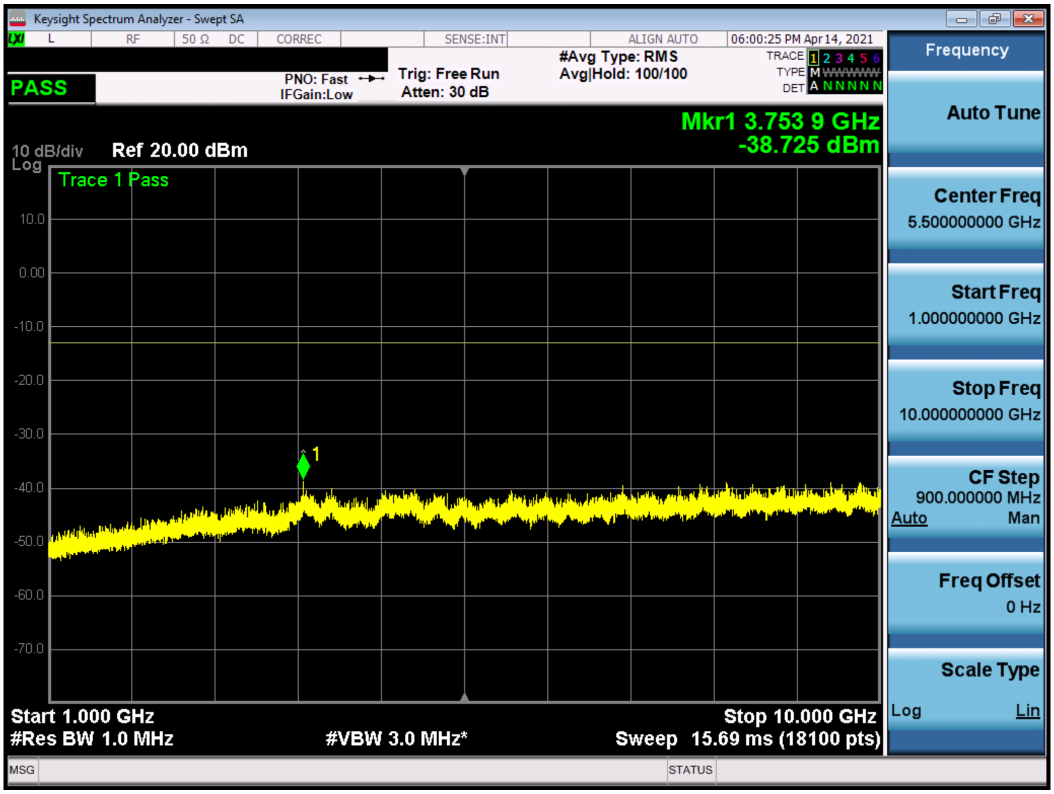
Plot 7-27. Conducted Spurious Plot – High Channel (15kHz SCS, BPSK, 1SC, SC Offset 6) _CH21653



Plot 7-28. Conducted Spurious Plot – High Channel (15kHz SCS, BPSK, 1SC, SC Offset 6) _CH21653



Plot 7-29. Conducted Spurious Plot – High Channel (15kHz SCS, QPSK, 12SC, SC Offset 0) _CH21653



Plot 7-30. Conducted Spurious Plot- High Channel (15kHz SCS, QPSK, 12SC, SC Offset 0) _CH21653

7.6 Peak-Average Ratio

Test Overview

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 5.7.1

Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW ≥ OBW or specified reference bandwidth
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

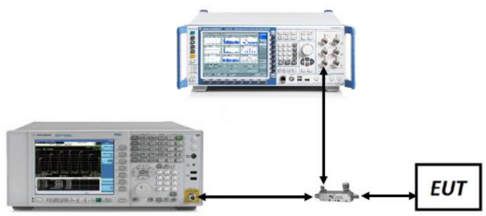
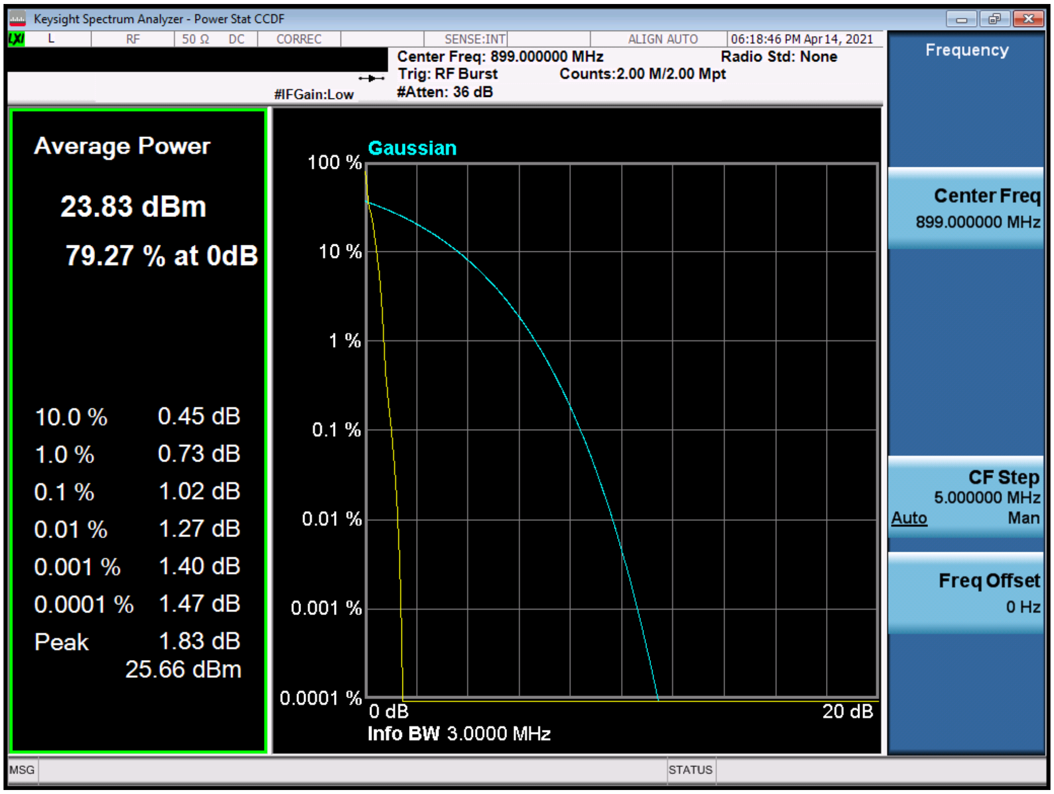


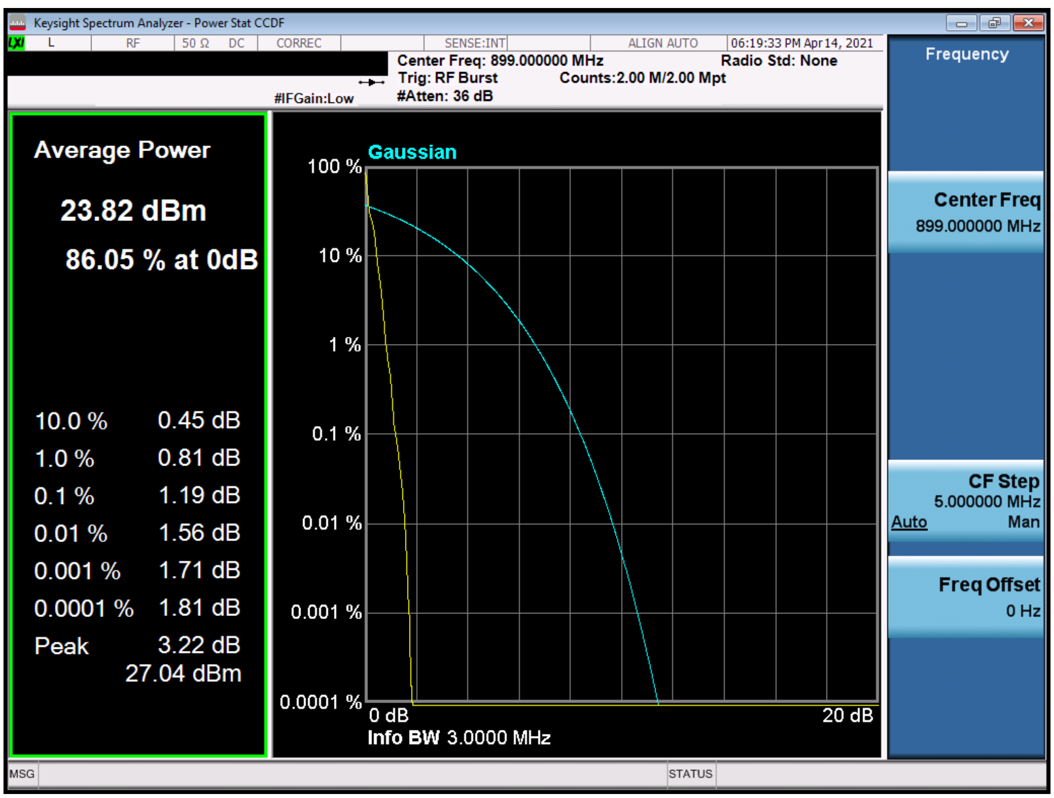
Figure 7-5. Test Instrument & Measurement Setup

Test Notes

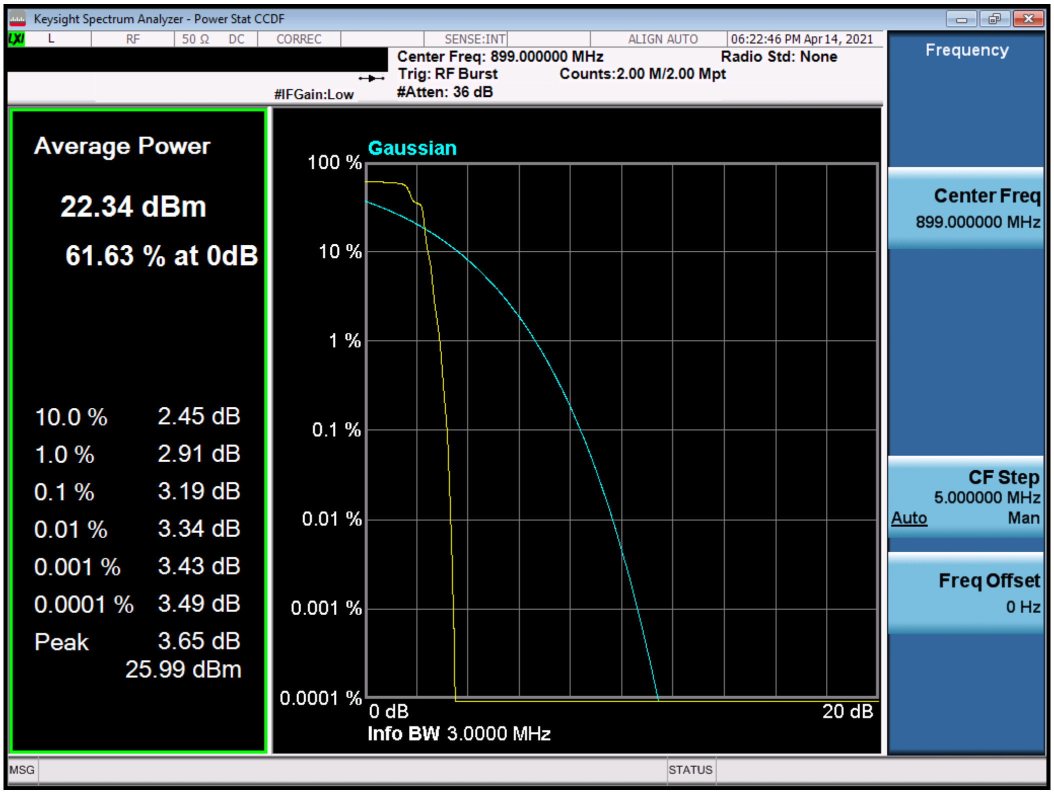
None.



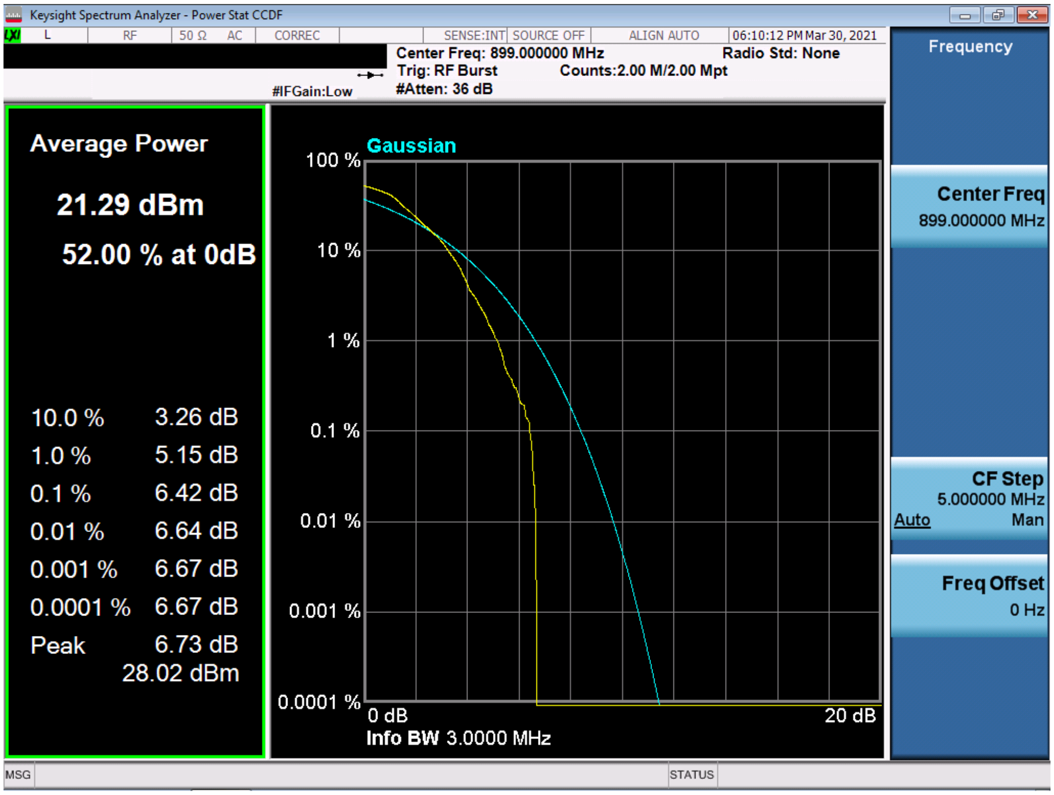
Plot 7-31. Peak to Average Ratio (3.75kHz SCS, BPSK, 1SC, SC Offset 24)



Plot 7-32. Peak to Average Ratio (3.75kHz SCS, QPSK, 1SC, SC Offset 24)



Plot 7-33. Peak to Average Ratio (15kHz SCS, BPSK, 1SC, SC Offset 6)



Plot 7-34. Peak to Average Ratio (15kHz SCS, QPSK, 12SC, SC Offset 0)

7.7 Radiated Spurious Emissions Measurements

Test Overview

Radiated spurious emissions measurements are performed using the direct field strength conversion method described in KDB 971168 with the EUT transmitting into a 50Ω termination. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

ANSI/TIA-603-E-2016 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

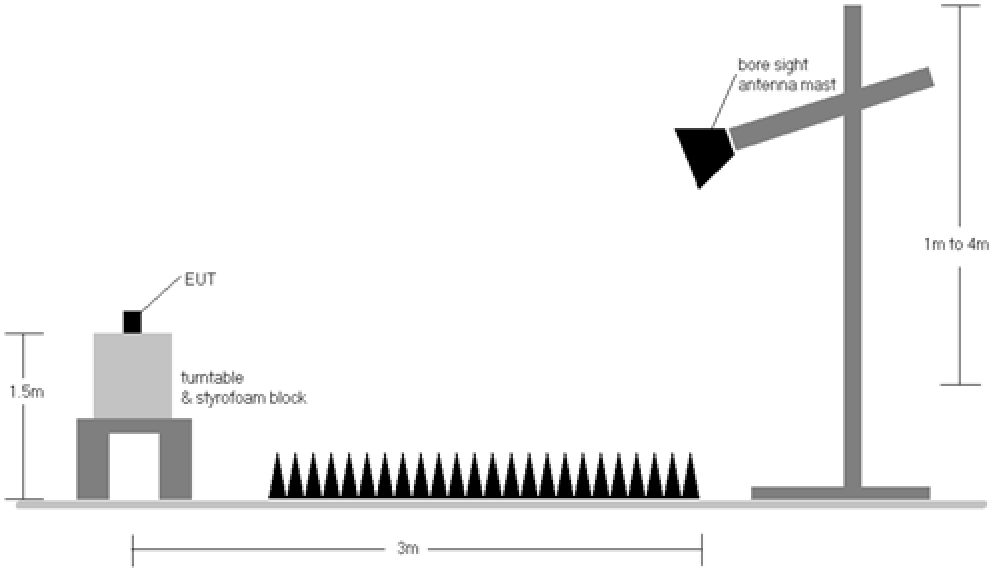


Figure 7-6. Test Instrument & Measurement Setup

Test Notes

1) Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
   b) E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
   d) EIRP (dBm) = E(dBµV/m) + 20logD – 104.8; where D is the measurement distance in meters.

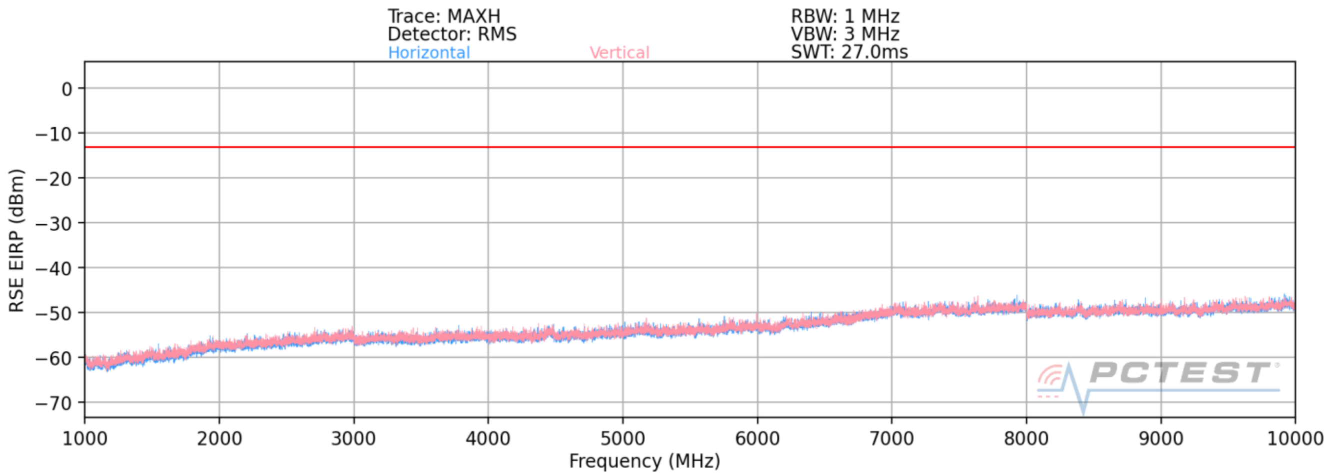
2) The EUT was investigated using all Subcarrier spacings and offsets. The worst case emissions are reported with the EUT positioning, modulations for 3.75kHz and 15kHz Subcarrier spacing.

3) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.

4) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

5) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.

6) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

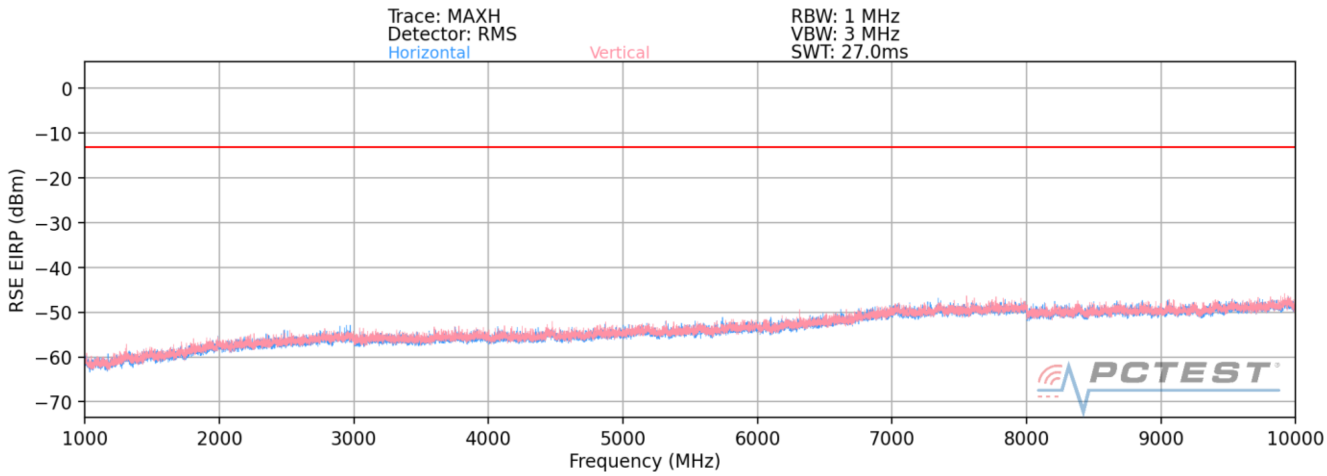


Plot 7-35. Radiated Spurious Plot (LTE Band 8- 3.75kHz SCS)

Bandwidth (MHz):	3
Frequency (MHz):	899.0
SCS / SC Offset:	1 / 24
Detector / Trace Mode:	RMS / Maxhold
RBW / VBW:	1MHz / 3MHz

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1798.0	V	312	28	-68.51	0.87	39.36	-55.90	-13.00	-42.90
2697.0	V	-	-	-69.42	3.77	41.35	-53.91	-13.00	-40.91
3596.0	V	-	-	-70.45	5.08	41.63	-53.62	-13.00	-40.62
4495.0	V	-	-	-71.20	6.36	42.16	-53.10	-13.00	-40.10

Table 7-8. Radiated Spurious Data (LTE Band 8- 3.75kHz SCS)



Plot 7-36. Radiated Spurious Plot (LTE Band 8- 15kHz SCS)

Bandwidth (MHz):	3
Frequency (MHz):	899.0
SCS / SC Offset:	1 / 6
Detector / Trace Mode:	RMS / Maxhold
RBW / VBW:	1MHz / 3MHz

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1798.00	V	342	13	-68.52	0.87	39.35	-55.91	-13.00	-42.91
2409.00	V	400	267	-68.96	3.56	41.60	-53.66	-13.00	-40.66
3596.00	V	-	-	-70.90	5.08	41.18	-54.07	-13.00	-41.07
4495.00	V	-	-	-71.45	6.36	41.91	-53.35	-13.00	-40.35
5394.00	V	-	-	-71.45	7.61	43.16	-52.10	-13.00	-39.10

Table 7-9. Radiated Spurious Data (LTE Band 8- 15kHz SCS)

7.8 Frequency Stability / Temperature Variation

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Test Procedure Used

ANSI/TIA-603-E-2016

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

Test Notes

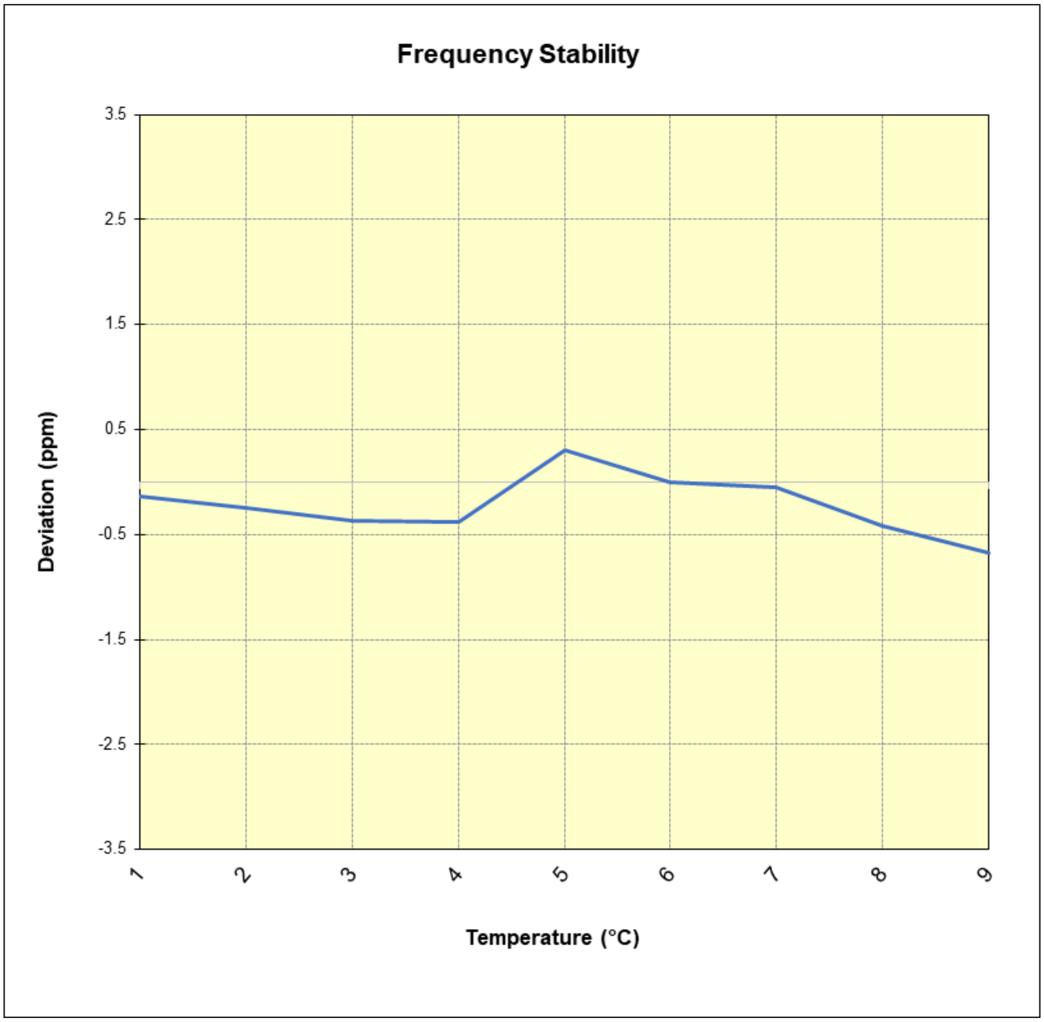
None

Frequency Stability / Temperature Variation

Operating Frequency (Hz):	899,000,000
Ref. Voltage (VDC):	3.80

Voltage (%)	Power (VDC)	Temp (^{o}C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	899,073,548	-119	-0.0000132
		- 20	899,073,444	-223	-0.0000248
		- 10	899,073,340	-327	-0.0000364
		0	899,073,321	-346	-0.0000385
		+ 10	899,073,941	274	0.0000305
		+ 20 (Ref)	899,073,667	0	0.0000000
		+ 30	899,073,621	-46	-0.0000051
		+ 40	899,073,297	-370	-0.0000412
		+ 50	899,073,064	-603	-0.0000671
85 %	3.20	+ 20	899,073,485	-182	-0.0000202
115 %	4.30	+ 20	899,073,329	-338	-0.0000376

Table 7-10. LTE Band 8 NB-IoT Frequency Stability Data



Plot 7-37. LTE Band 8 NB-IoT Frequency Stability Chart

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Telit Data Terminal Module FCC ID: RI7ME910G1WW** complies with all requirements specified in FCC Part 27 Subpart P of the FCC Rules for LTE NB-IoT operation.