Element Suwon
13, Heungdeok 1-ro, Giheung-gu, Yongin-si,
Gyeonggi-do, 16954 South Korea
Tel. 031.660.7319 / Fax 031.660.7318
http://www.element.com

MEASUREMENT REPORT
FCC Part 15F ULTRA WIDEBAND

Applicant Name:
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
10/5 – 10/17/2023
Test Report Issue Date:
10/20/2023
Test Site/Location:
Element Lab. Yongin-Si, Gyeonggi-do, South Korea
Test Report Serial No.:
1M22308210093-10.A3L

FCC ID:	**A3LSMS928B**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-S928B
Additional Models:	SM-S928B1
EUT Type:	Portable Handset
FCC Classification:	Ultra Wideband (UWB)
FCC Rule Parts(s):	FCC Part 15 Subpart F (15.519, 15.521)
UWB Classification:	Hand-held Communication Device
Test Procedure(s):	ANSI C63.10-2013, KDB 393764 D01

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and has been tested in accordance with the measurement procedures specified in ANSI C63.10-2013 (See Test Report). These measurements were performed with no deviation from the standards. 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.

Prepared by

Reviewed by

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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 and Innovation, Science and Economic Development Canada.

1.2 Element Test Location

These measurement tests were conducted at the Element Suwon Laboratory located at 13, Heungdeok 1-ro, Giheung-gu, Yongin-si, Gyeonggi-do, 16954, South Korea. 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 Element Materials Technology Suwon, Ltd. located in Yongin-si, Gyeonggi-do, 16954, South Korea.

- Element Materials Technology Suwon, Ltd. is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation(A2LA) with Certificate number 2041.04 for Specific Absorption Rate (SAR), and Electromagnetic Compatibility (EMC) & Telecommunications testing for FCC and Innovation, Science, and Economic Development Canada rules.

- Element Materials Technology Suwon, Ltd. facility is accredited, designated, and recognized in accordance with the provision of Radio Wave Act and International Standard ISO/IEC 17025:2017 under the National Radio Research Agency.

  - Designation Number / CABID: KR0169
  - Test Firm Registration Number of FCC: 417945
  - Test Firm Registration Number of ISED: 26168

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMS928B**. The test data contained in this report pertains only to the EUT's ultra-wideband transmitter.

Test Device Serial No.: 1072M

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR (FR1), 802.11b/g/n/ax/be WLAN, 802.11a/n/ac/ax/be UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE), NFC, UWB, Wireless Power Transfer

2.3 Test Configuration

The EUT was tested per the guidance of Section 10 of ANSI C63.10-2013. The EUT setup procedures of ANSI C63.10-2013 were used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Section 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, respectively.

The Equipment Under Test (EUT) was capable of operating on two antennas in two separate modes [HPRF, preamble 27] and [BPRF, preamble 9~12]. Care was taken to ensure the worst-case modes were investigated and reported.

For more information, please see Section 7.0 for test data and the test setup photos document for the test setup photographs.

2.4 EMI Suppression Device(s)/Modifications

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

2.5 Antenna Description

Following antenna was used for the testing.

Frequency [GHz]	Antenna Gain [dBi]
6.5	-5.64
8.0	-5.98

Table 2-1. Maximum Peak Antenna Gain

2.6 Software and Firmware

The test was conducted with firmware version S928BXXU0AWIA installed on the EUT.

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedure described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2014) was used in the measurement of the EUT.

Deviation from measurement procedure…….....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by SY cooperation RF Enclosures. The line-conducted facility is located inside a 7m x 3.66m x 2.7m shielded enclosure. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.7. The EMI Receiver mode of the R&S ESW was used to perform AC line conducted emissions testing. Automated test software was used to perform the AC line conducted emissions testing. Automated measurement software utilized is Rohde & Schwarz EMC32, Version 10.20.01.

3.3 Radiated 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 Clause 5, Figure 5.7 of ANSI C63.4-2014. A raised turntable is used for radiated measurement. It 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. 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. . An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

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 414788 D01 v01r01.

3.4 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

4.0 ANTENNA REQUIREMENTS

Except from §15.203 of the FCC Rules/Regulations:

“An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antenna(s) of the EUT are permanently attached
- There are no provisions for a connection to an external antenna

The EUT complies with the requirements of §15.203.

5.0 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 Disturbance	3.09
Radiated Disturbance (<1GHz)	4.10
Radiated Disturbance (>1GHz)	4.82

6.0 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
Agilent	N9030A	PXA Signal Analyzer	2023-07-06	Annual	2024-07-05	MY48432391
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	2022-10-21	Biennial	2024-10-20	10160045
Huber+Suhner	SF102/11SK/11SK/1500	RF Cable	N/A			SN 804225/2
Huber+Suhner	SF102/11SK/11SK/2000	RF Cable	N/A			SN 804223/2
Mini-Circuits	BW-N10W5+	Attenuator	2023-04-06	Annual	2024-04-05	2106
Mini-Circuits	BW-N10W5+	Attenuator	2023-04-06	Annual	2024-04-05	2106
NARDA	180-442A-KF	Horn Antenna (Small)	2022-11-23	Biennial	2024-11-22	T058701-03
Rohde & Schwarz	TS-PR1840	Preamplifier	2023-07-06	Annual	2024-07-05	100049
Rohde & Schwarz	ENV216	Two-Line V-Network	2023-04-07	Annual	2024-04-06	101319
Rohde & Schwarz	ESW	EMI Test Receiver	2023-07-05	Annual	2024-07-04	101761
Rohde & Schwarz	FSW43	Signal & Spectrum Analyzer	2023-01-13	Annual	2024-01-12	101955
Rohde & Schwarz	TS-SFUNIT-Rx	Shielded Filter Unit	2023-01-13	Annual	2024-01-12	102131
Schwarzbeck	VULB9162	Broadband TRILOG Antenna	2023-06-01	Biennial	2025-05-31	9162-217
Sunol Sciences	DRH-118	Horn Antenna	2023-07-13	Biennial	2025-07-12	A102416-1

Table 6-1.Test Equipment Calibration Schedule

Note:

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.

7.0 TEST DATA

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMS928B

FCC Classification: Ultra-Wideband (UWB)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
§15.503, §15.519 (b)	10dBc Bandwidth	≥ 500MHz	RADIATED	PASS	Section 7.2
§15.519(a)(1)	Cessation Time	Transmission shall cease in less than 10s		PASS	Section 7.3
§15.519(e)	Maximum Peak Power	< 0dBm EIRP in 50MHz BW			Section 7.4
§15.519(c)	Maximum Average Emission in the range of 3100 – 10600 MHz	< -41.3 EIRP in dBm			Section 7.4
§15.519(c)	Radiated Emissions Above 960MHz	See table in 15.519(c) for details			Section 7.4, 7.5
§15.519(d)	Radiated Emissions in the 1164 – 1240Mhz and 1559 – 1610MHz GPS Bands	< -85.3 EIRP in dBm			Section 7.5
§15.519(c), §15.519(a)	Radiate Emissions Below 960MHz	Emissions in restricted bands must meet the radiated limits detailed in 15.209			Section 7.6
§15.207	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen)	LINE CONDUCTED	PASS	Section 7.7

Table 7-1. Summary of Test Results

7.2 10dBc Bandwidth Measurement

§15.503(a), §15.519(b)

Test Overview and Limit

Per the definition of 15.503, the UWB Bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna.

The 10dB bandwidth of the UWB signal must remain fully within the 3100 – 10,600MHz band. The 10dB bandwidth of the UWB signal must also be greater than or equal to 500MHz.

Test Procedures Used

ANSI C63.10-2013 Section 10.1

Test Settings

1. RBW = 1MHz
2. VBW = 3MHz
3. Detector = Peak
4. Span was set wide enough to capture the 10dB points of the signal
5. Trace mode = max hold
6. Sweep = 2s
7. The trace was allowed to stabilize

Test Setup

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

Figure 7-1. Test Instrument and Measurment Setup

Frequency [GHz]	Channel	Preamble ID	Config	Mode	F_M [GHz]	F_L [GHz]	F_H [GHz]	Fc [GHz]	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
6.5	5	9	SP0	BPRF	6.525	6.237	6.770	6.503	532.24	500	Pass
		9	SP1	BPRF	6.525	6.232	6.771	6.502	538.73	500	Pass
		9	SP3	BPRF	6.521	6.228	6.771	6.500	542.72	500	Pass
		10	SP0	BPRF	6.491	6.240	6.746	6.493	505.24	500	Pass
		10	SP1	BPRF	6.491	6.240	6.746	6.493	506.24	500	Pass
		10	SP3	BPRF	6.521	6.208	6.764	6.486	555.22	500	Pass
		11	SP0	BPRF	6.515	6.211	6.768	6.489	556.22	500	Pass
		11	SP1	BPRF	6.518	6.208	6.768	6.488	559.23	500	Pass
		11	SP3	BPRF	6.521	6.208	6.762	6.485	553.72	500	Pass
		12	SP0	BPRF	6.514	6.212	6.767	6.489	554.22	500	Pass
		12	SP1	BPRF	6.514	6.208	6.767	6.487	558.22	500	Pass
		12	SP3	BPRF	6.521	6.208	6.762	6.485	553.72	500	Pass
		27	SP0	HPRF	6.502	6.220	6.759	6.489	539.23	500	Pass
		27	SP1	HPRF	6.502	6.219	6.761	6.490	541.73	500	Pass
		27	SP3	HPRF	6.428	6.218	6.761	6.489	542.73	500	Pass
8.0	9	9	SP0	BPRF	7.831	7.710	8.253	7.981	542.73	500	Pass
		9	SP1	BPRF	7.831	7.710	8.253	7.981	543.23	500	Pass
		9	SP3	BPRF	7.831	7.704	8.268	7.986	564.44	500	Pass
		10	SP0	BPRF	7.832	7.716	8.250	7.983	534.23	500	Pass
		10	SP1	BPRF	7.831	7.717	8.250	7.983	532.73	500	Pass
		10	SP3	BPRF	7.831	7.704	8.269	7.986	564.72	500	Pass
		11	SP0	BPRF	7.821	7.705	8.266	7.985	560.72	500	Pass
		11	SP1	BPRF	7.821	7.705	8.268	7.987	562.72	500	Pass
		11	SP3	BPRF	7.831	7.704	8.269	7.986	564.22	500	Pass
		12	SP0	BPRF	7.839	7.705	8.265	7.985	559.22	500	Pass
		12	SP1	BPRF	7.839	7.705	8.278	7.991	572.22	500	Pass
		12	SP3	BPRF	7.831	7.704	8.269	7.986	564.72	500	Pass
		27	SP0	HPRF	7.750	7.710	8.257	7.983	546.73	500	Pass
		27	SP1	HPRF	7.750	7.710	8.258	7.984	548.23	500	Pass
		27	SP3	HPRF	7.925	7.704	8.263	7.984	558.72	500	Pass

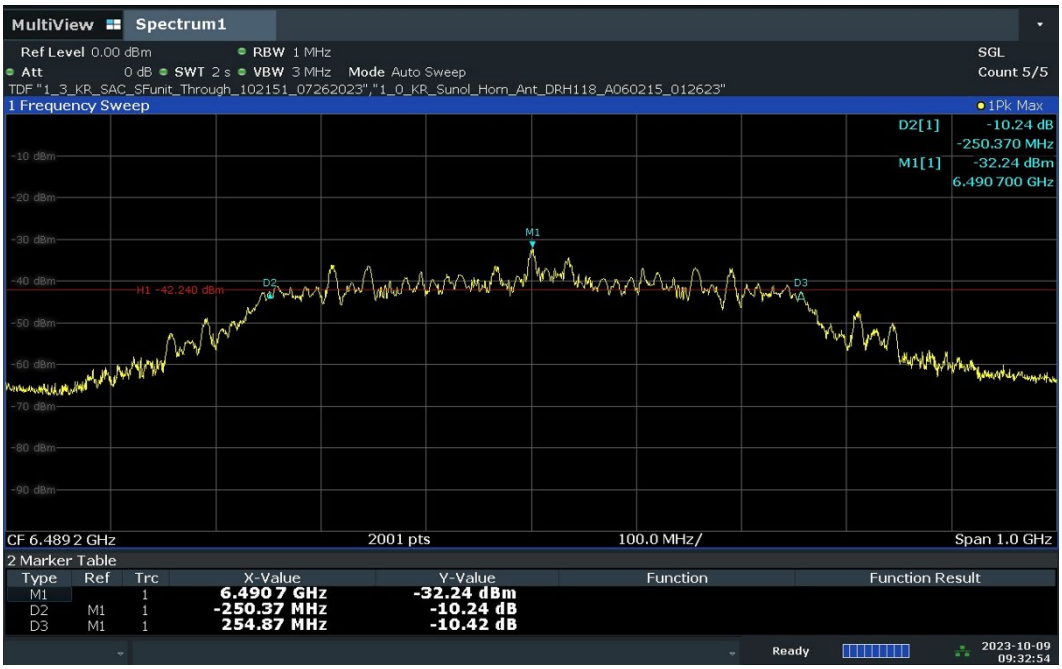
Table 7-2. UWB 10dBc Bandwidth Summary

10dBc Bandwidth Results

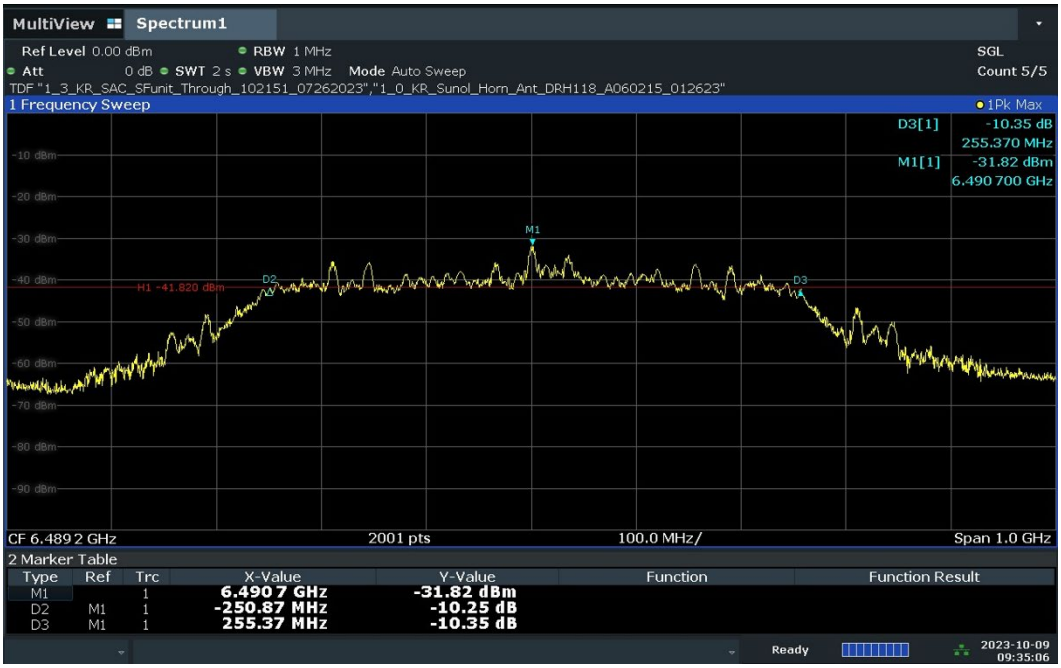
Plot 7-1. 10dBc Bandwidth – CH.5 - SP0 – Preamble 9

Plot 7-2. 10dBc Bandwidth – CH.5 – SP1 – Preamble 9

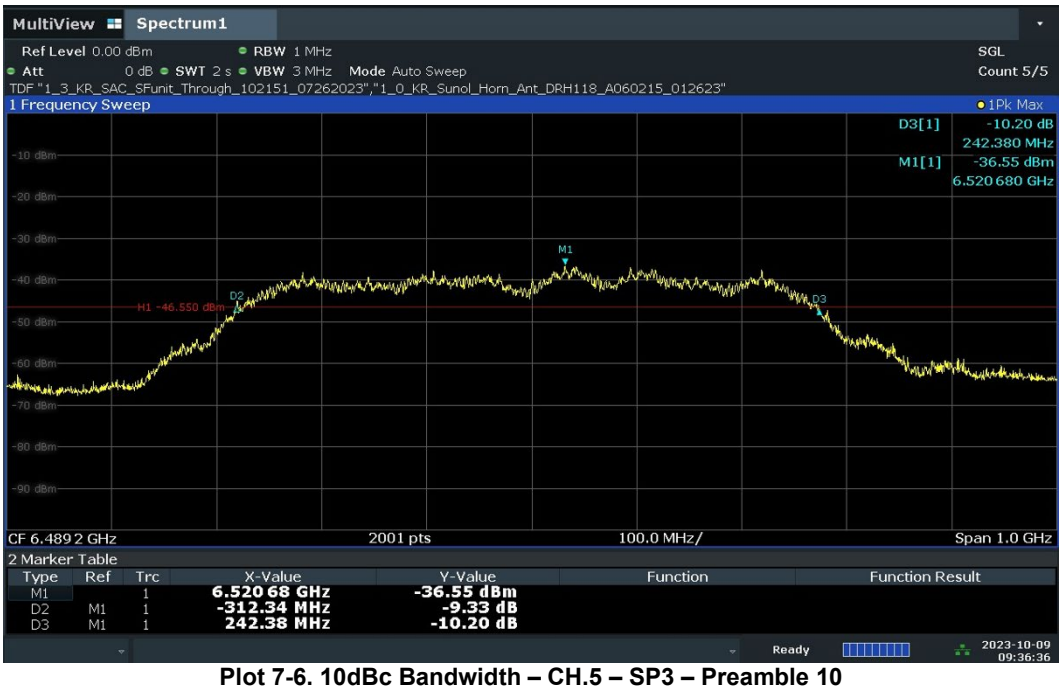
Plot 7-3. 10dBc Bandwidth – CH.5 – SP3 – Preamble 9



Plot 7-4. 10dBc Bandwidth – CH.5 - SP0 – Preamble 10



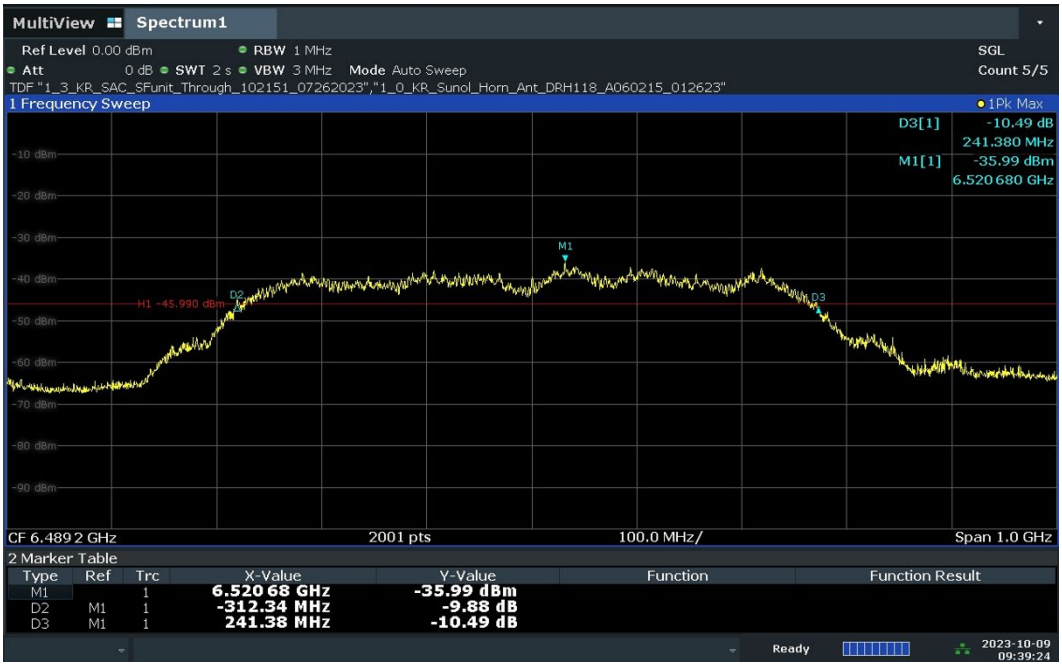
Plot 7-5. 10dBc Bandwidth – CH.5 – SP1 – Preamble 10



Plot 7-6. 10dBc Bandwidth – CH.5 – SP3 – Preamble 10

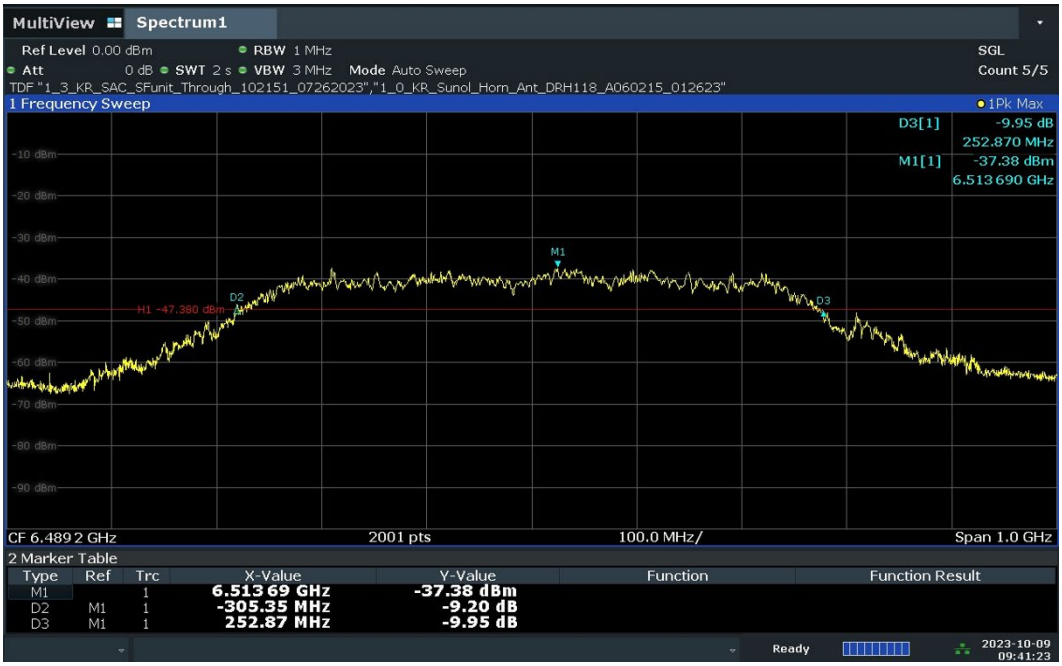
Plot 7-7. 10dBc Bandwidth – CH.5 - SP0 – Preamble 11

Plot 7-8. 10dBc Bandwidth – CH.5 – SP1 – Preamble 11

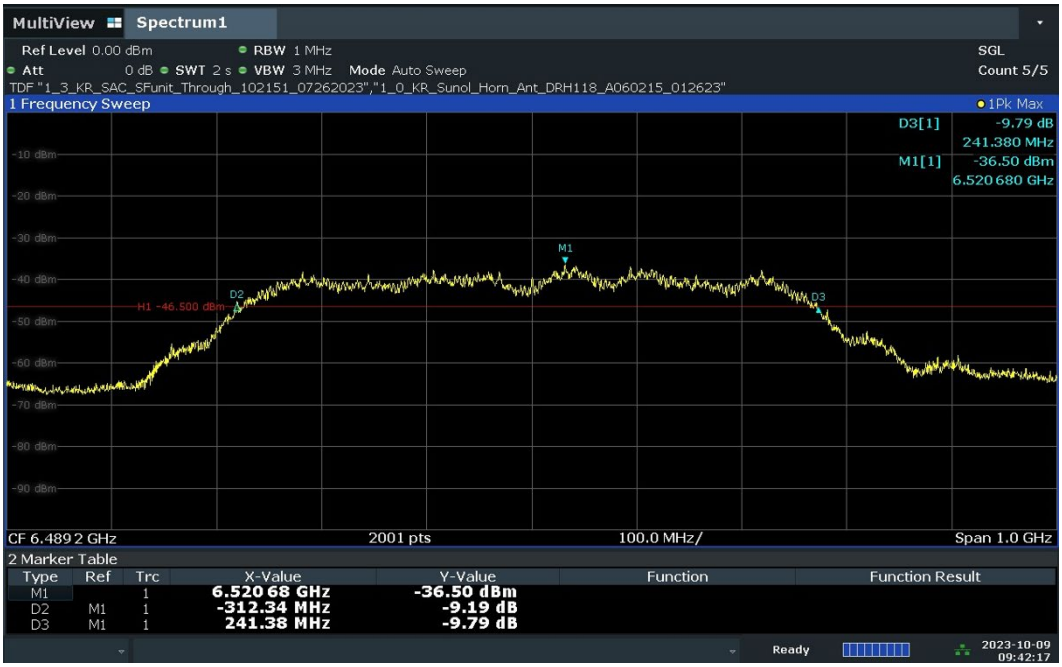


Plot 7-9. 10dBc Bandwidth – CH.5 – SP3 – Preamble 11

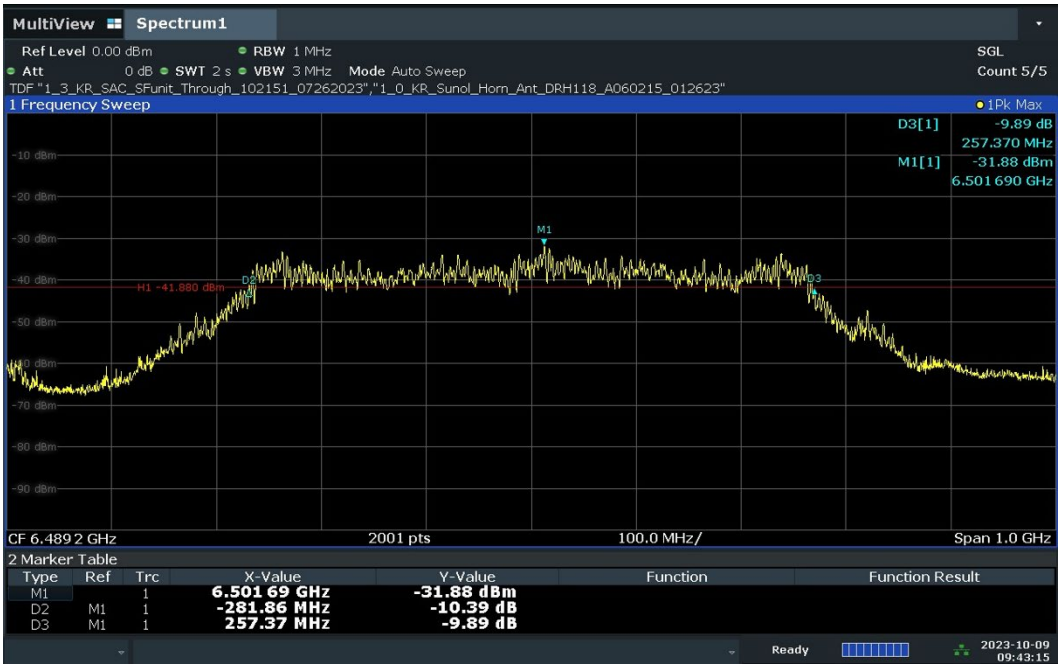
Plot 7-10. 10dBc Bandwidth – CH.5 - SP0 – Preamble 12



Plot 7-11. 10dBc Bandwidth – CH.5 – SP1 – Preamble 12



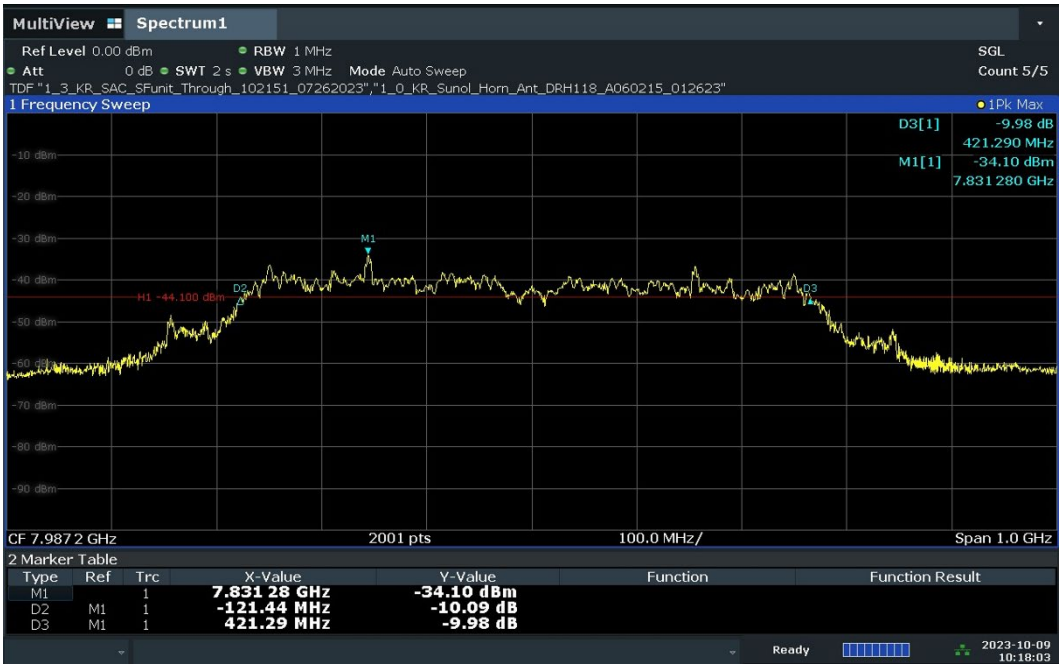
Plot 7-12. 10dBc Bandwidth – CH.5 – SP3 – Preamble 12



Plot 7-13. 10dBc Bandwidth – CH.5 - SP0 – Preamble 27

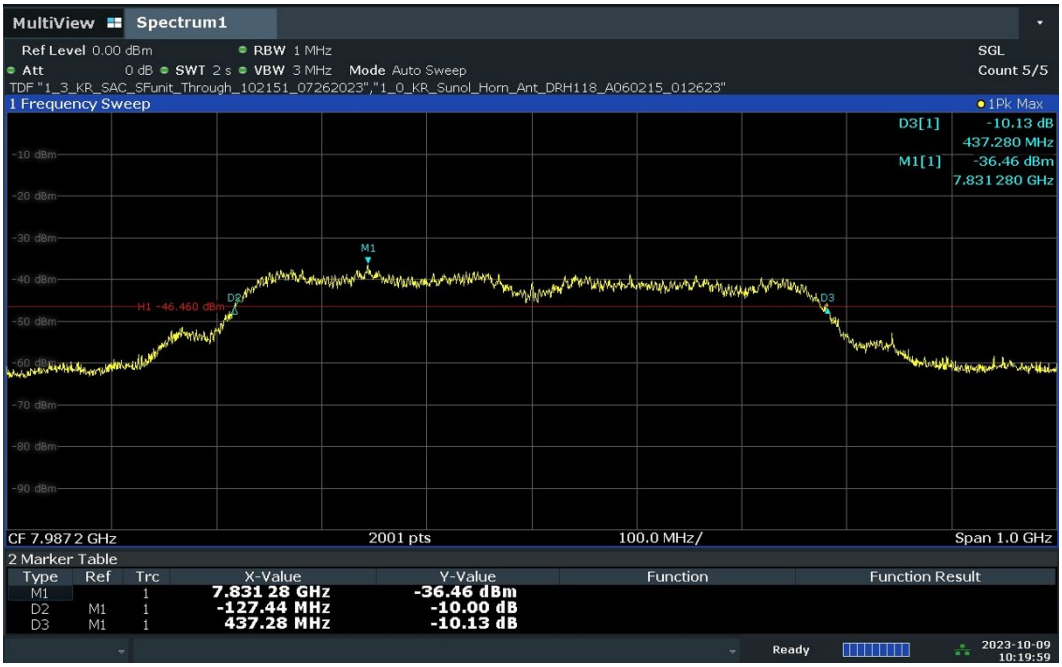
Plot 7-14. 10dBc Bandwidth – CH.5 – SP1 – Preamble 27

Plot 7-15. 10dBc Bandwidth – CH.5 – SP3 – Preamble 27

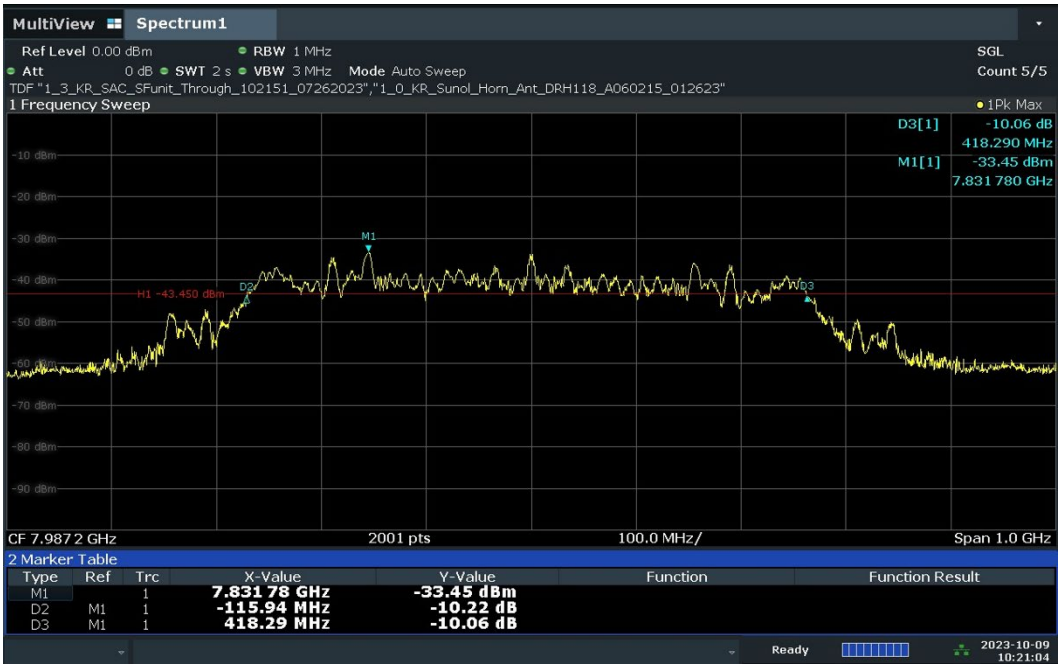


Plot 7-16. 10dBc Bandwidth – CH.9 - SP0 – Preamble 9

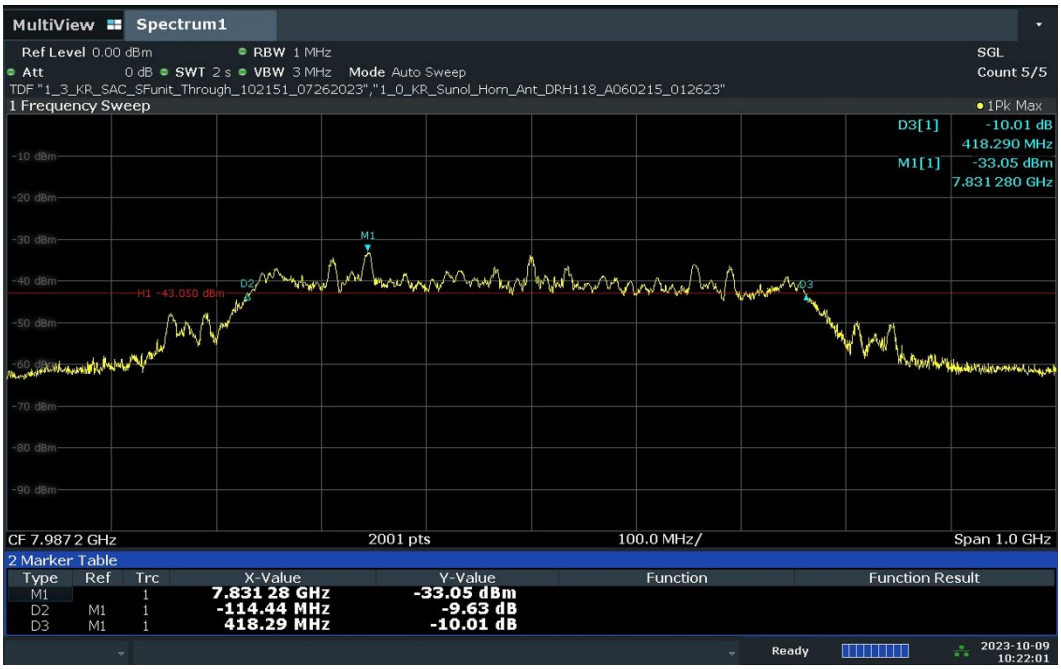
Plot 7-17. 10dBc Bandwidth – CH.9 – SP1 – Preamble 9



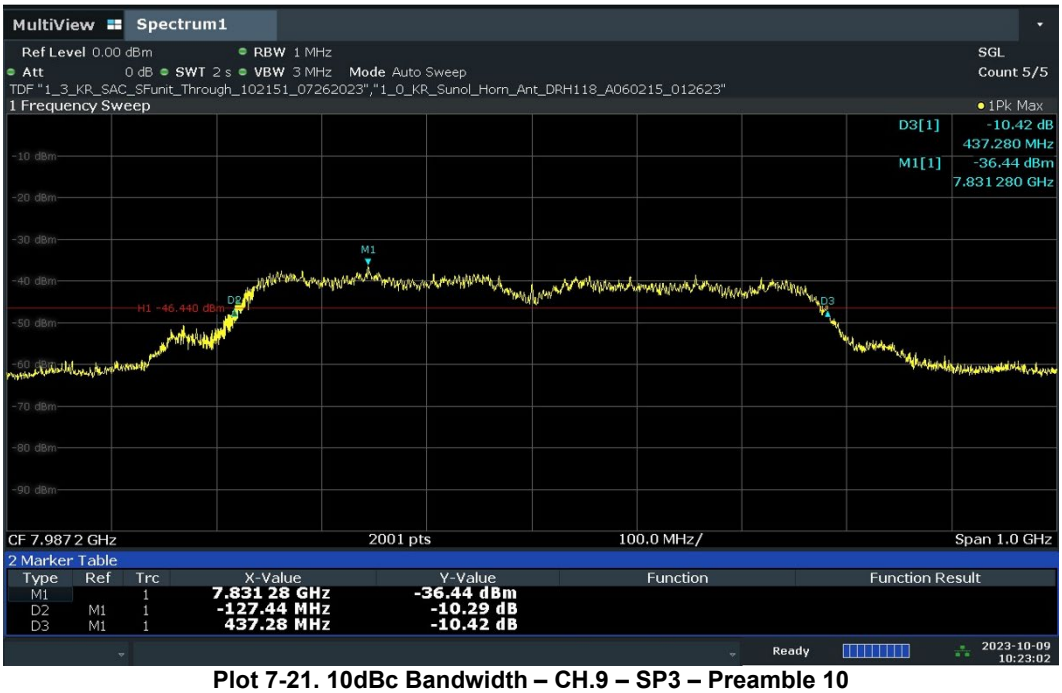
Plot 7-18. 10dBc Bandwidth – CH.9 – SP3 – Preamble 9



Plot 7-19. 10dBc Bandwidth – CH.9 - SP0 – Preamble 10



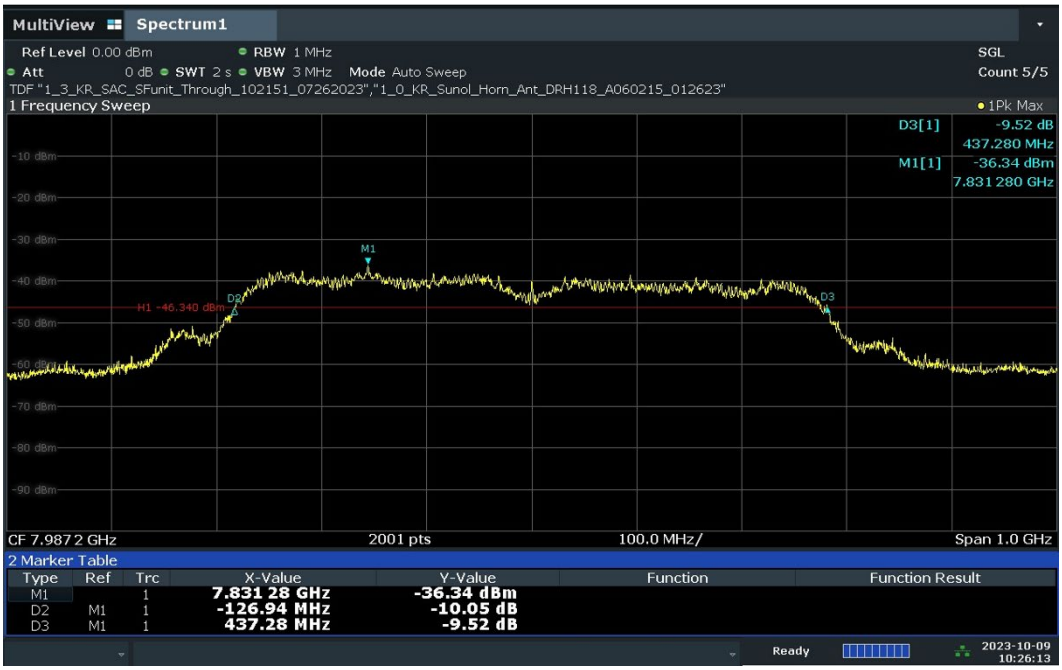
Plot 7-20. 10dBc Bandwidth – CH.9 – SP1 – Preamble 10



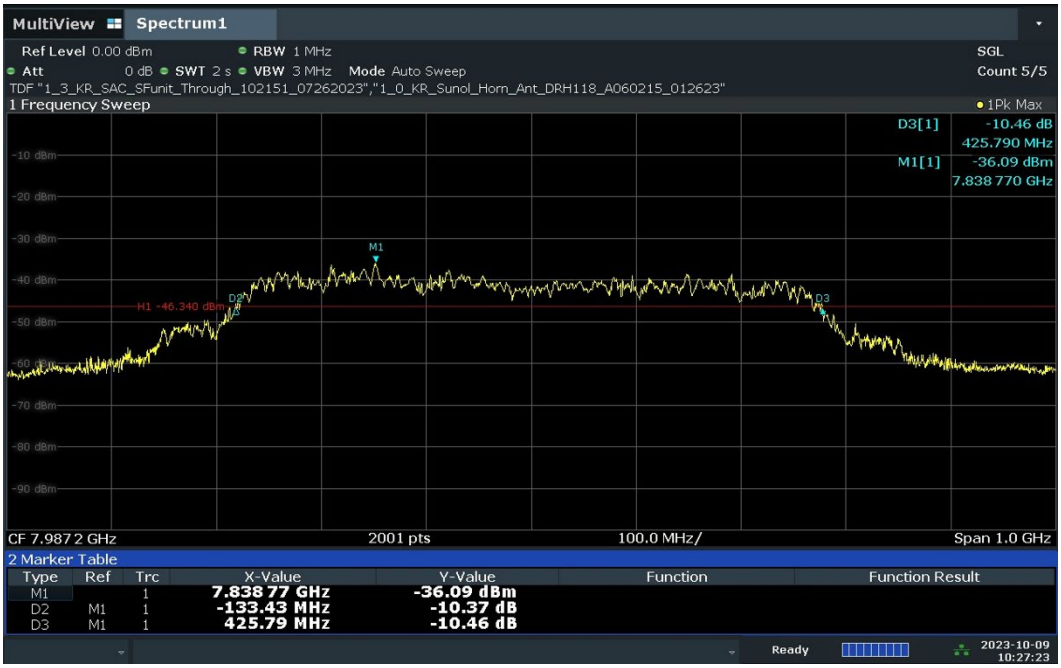
Plot 7-21. 10dBc Bandwidth – CH.9 – SP3 – Preamble 10

Plot 7-22. 10dBc Bandwidth – CH.9 - SP0 – Preamble 11

Plot 7-23. 10dBc Bandwidth – CH.9 – SP1 – Preamble 11

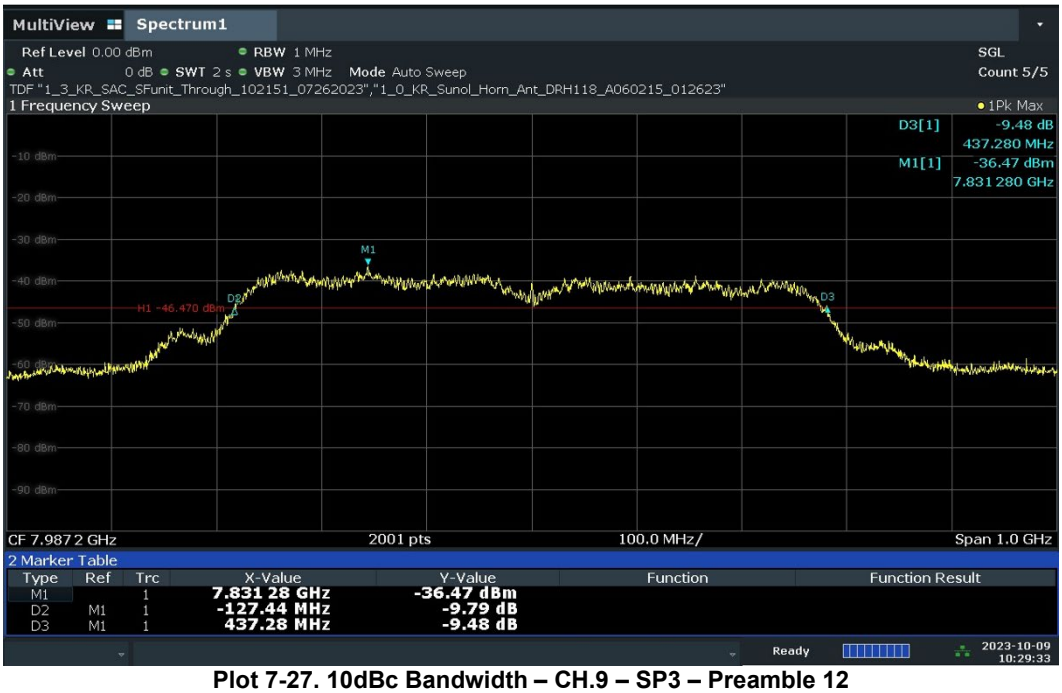


Plot 7-24. 10dBc Bandwidth – CH.9 – SP3 – Preamble 11

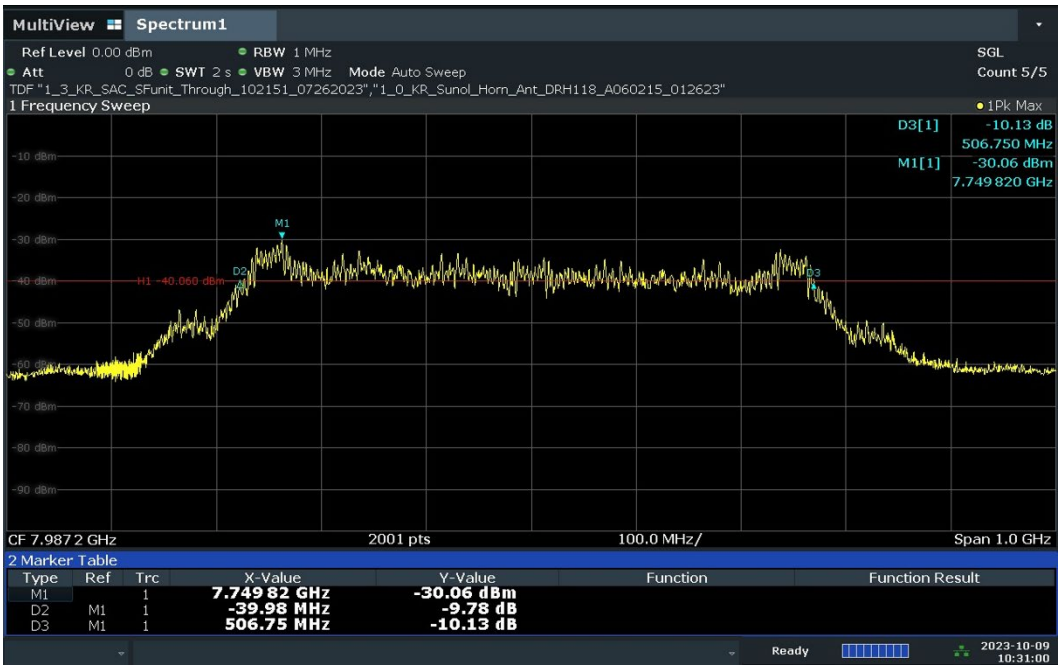


Plot 7-25. 10dBc Bandwidth – CH.9 - SP0 – Preamble 12

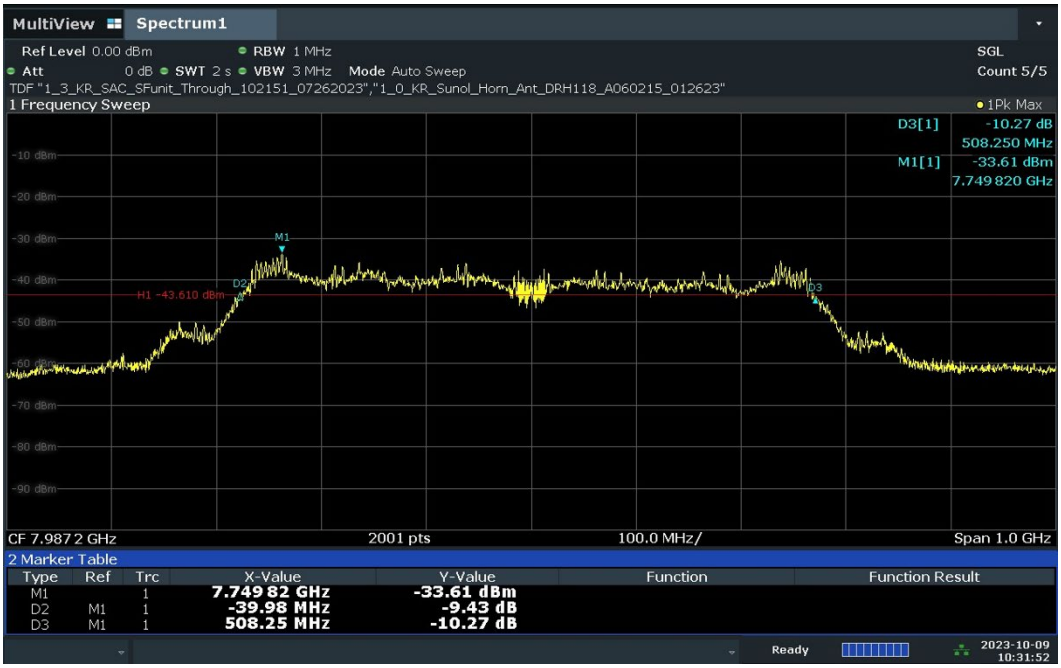
Plot 7-26. 10dBc Bandwidth – CH.9 – SP1 – Preamble 12



Plot 7-27. 10dBc Bandwidth – CH.9 – SP3 – Preamble 12



Plot 7-28. 10dBc Bandwidth – CH.9 - SP0 – Preamble 27



Plot 7-29. 10dBc Bandwidth – CH.9 – SP1 – Preamble 27

Plot 7-30. 10dBc Bandwidth – CH.9 – SP3 – Preamble 27

7.3 Cessation Time

§15.519(a)(1)

Test Overview and Limit

§15.519(a)(1) A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgment from the associated receiver that its transmission is being received an acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

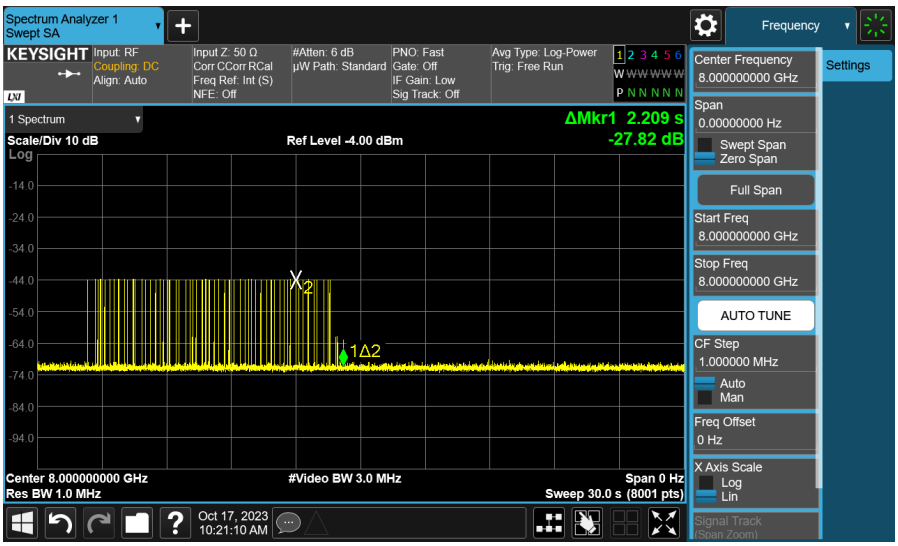
Test Settings

1. RBW = 1MHz
2. VBW = 3MHz
3. Span = 0 Span Mode
4. Sweep time shall be sufficient to demonstrate EUTs compliance with the rule part.

Test Setup

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

Figure 7-2. Test Instrument and Measurement Setup



Plot 7-31. Cessation Time Plot

Test Note

X2 represents the EUT for UWB stop receiving, and 1Δ2 shows the EUT for UWB cease transmitting.

7.4 Peak Power and Maximum Average Emissions

§15.519(e), §15.519(c)

Test Overview and Limit

15.519 (e) There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fM. That limit is 0 dBm EIRP.

15.519 (c) The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
3100 - 10600	-41.3

Table 7-3. Average EIRP Limit

Test Procedures Used

ANSI C63.10-2013

Test Settings

Peak:

1. Analyzer frequency set to the frequency of the radiated spurious emission of interest
2. RBW = 50MHz, VBW = 80MHz
3. Detector = Peak
4. Sweep time = auto coupled
5. Trace mode = max hold
6. Trace was allowed to stabilize

Average:

1. Analyzer frequency set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz, VBW = 3MHz
3. Detector = Average (RMS)
4. Sweep time = No more than 1ms integration period over measurement bin
5. Trace mode = max hold
6. Trace was allowed to stabilize

Test Note

All combinations of HPRF/BPRF, power mode, and preamble are investigated for average and peak EIRP measurements. Only the worst case combinations are reported for each channel and each antenna.

RESULTS – BPRF

CH	MODE	Preamble	Meas. Ant.	Peak Power (dBm/50MHz)	Peak Limit (dBm/50MHz)	Margin [dB]
5	SP0	10	H	-1.65	0	-1.65
9	SP1	10	H	-1.52	0	-1.52

Table 7-4. BPRF Highest Peak Power Results

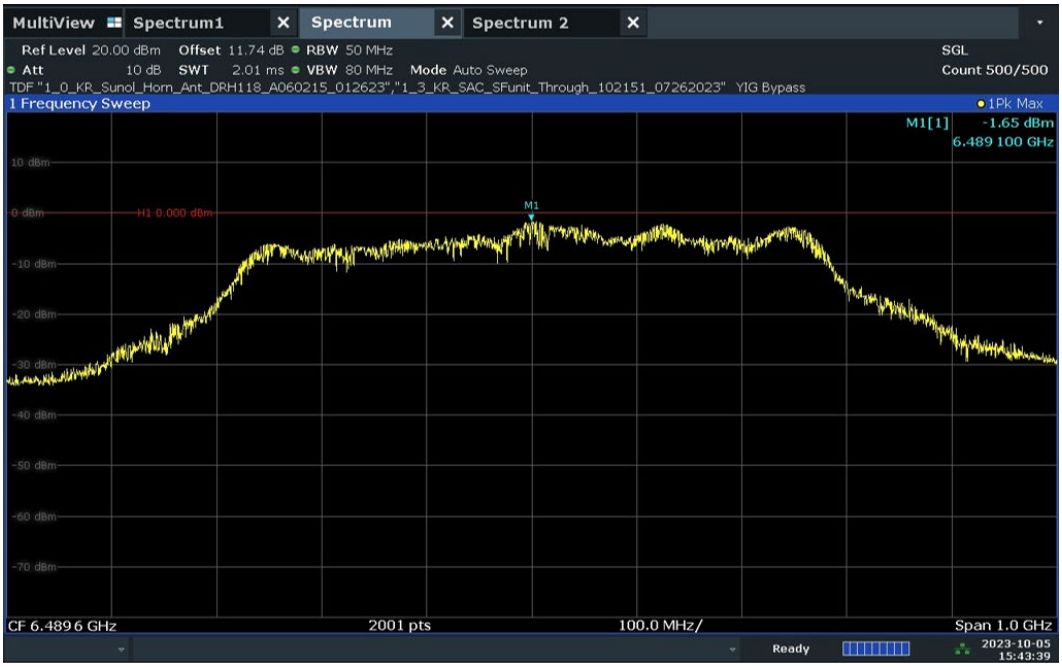
CH	MODE	Preamble	Meas. Ant.	Average Power (dBm)	Average Limit (dBm)	Margin [dB]
5	SP3	10	H	-42.90	-41.3	-1.60
9	SP3	10	H	-42.86	-41.3	-1.56

Table 7-5. BPRF Highest Average Power Results

Sample Calculation:

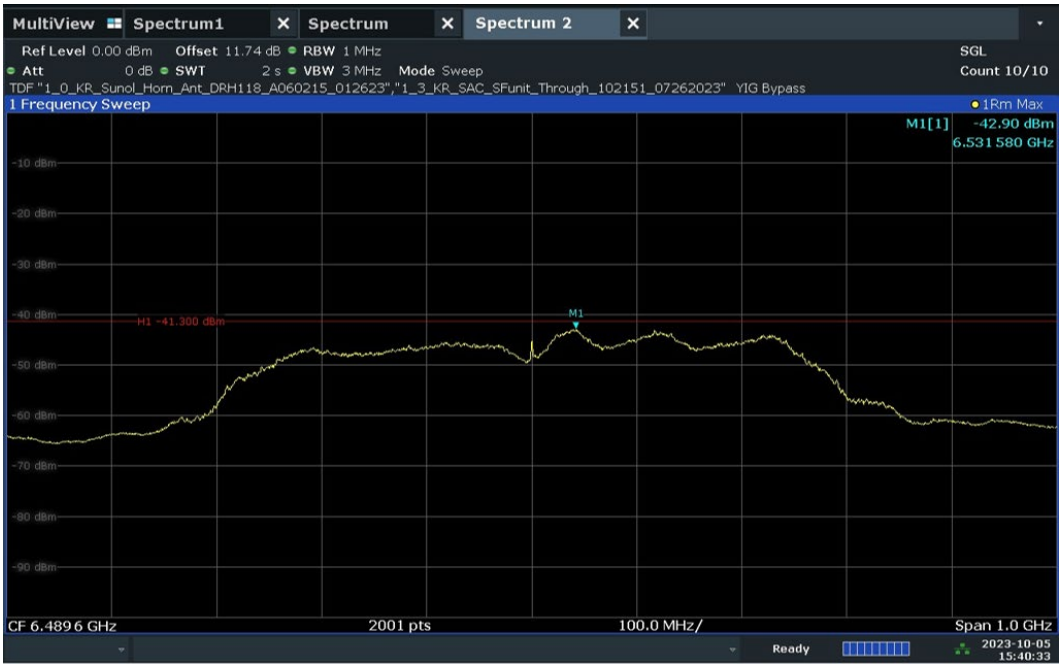
The raw radiated spurious level is converted to field strength in dBuV/m. Then, the EIRP level is calculated by applying the additional factors shown below for a test distance of 3 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8

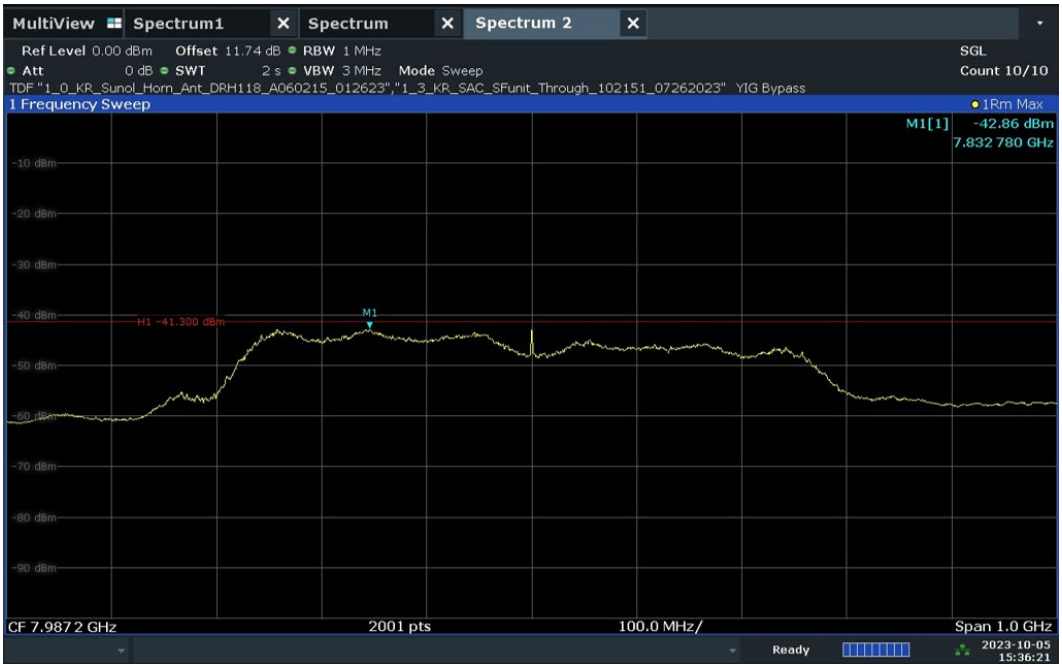


Plot 7-32. UWB Peak Power Measurement - CH.5 – BPRF

Plot 7-33. UWB Peak Power Measurement - CH.9 – BPRF



Plot 7-34. UWB Average Power Measurement - CH.5 – BPRF



Plot 7-35. UWB Average Power Measurement - CH.9 – BPRF

RESULTS – HPRF

CH	MODE	Preamble	Meas. Ant.	Peak Power (dBm/50MHz)	Peak Limit (dBm/50MHz)	Margin [dB]
5	SP0	27	H	-6.54	0	-6.54
9	SP0	27	H	-5.50	0	-5.50

Table 7-6. HPRF Highest Peak Power Results

CH	MODE	Preamble	Meas. Ant.	Average Power (dBm)	Average Limit (dBm)	Margin [dB]
5	SP0	27	H	-43.22	-41.3	-1.92
9	SP0	27	H	-43.00	-41.3	-1.70

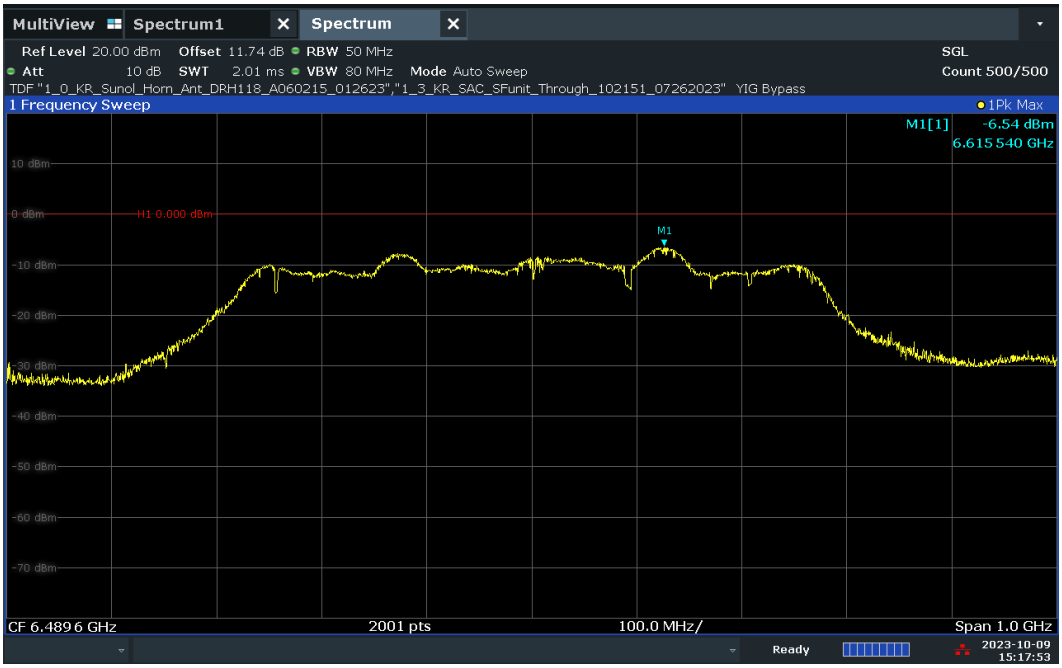
Table 7-7. HPRF Highest Average Power Results

Sample Calculation

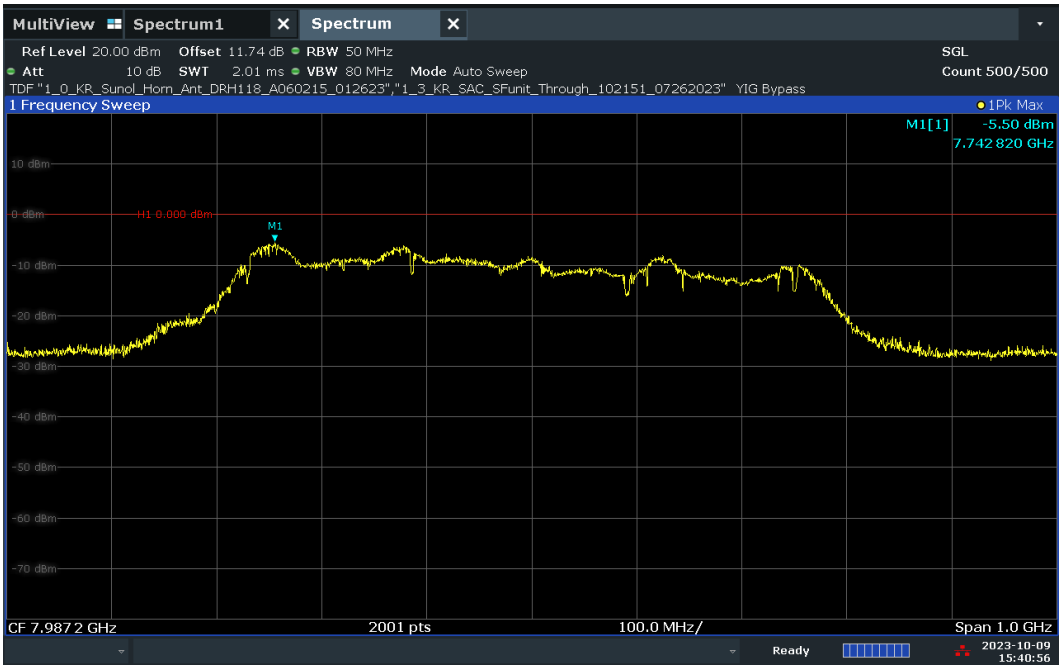
The raw radiated spurious level is converted to field strength in dBuV/m. Then, the EIRP level is calculated by applying the additional factors shown below for a test distance of 3 meter

.

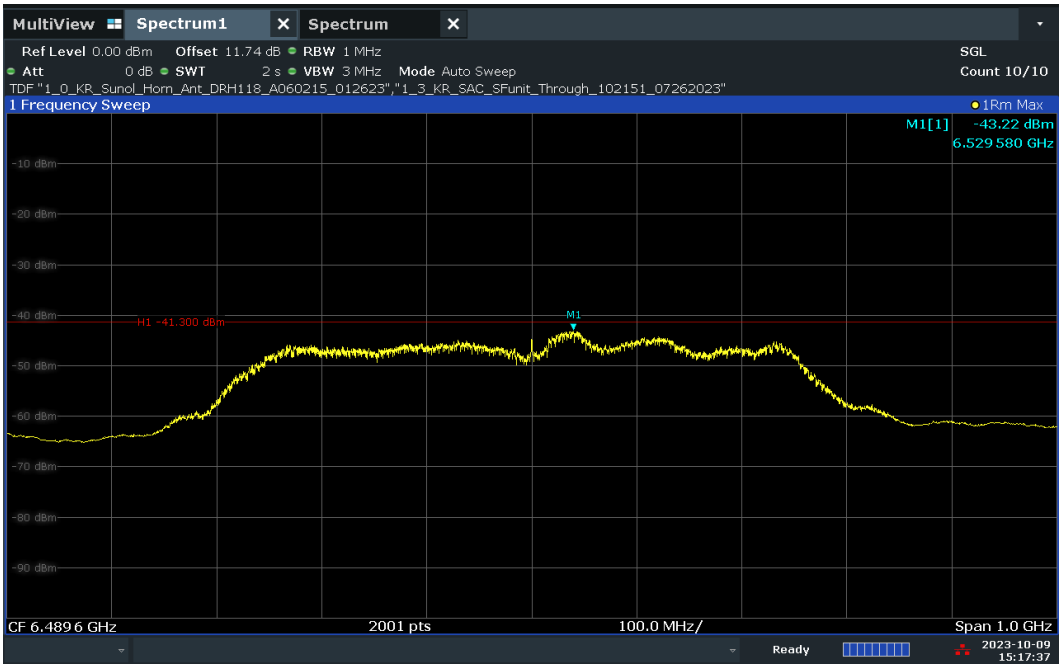
RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8



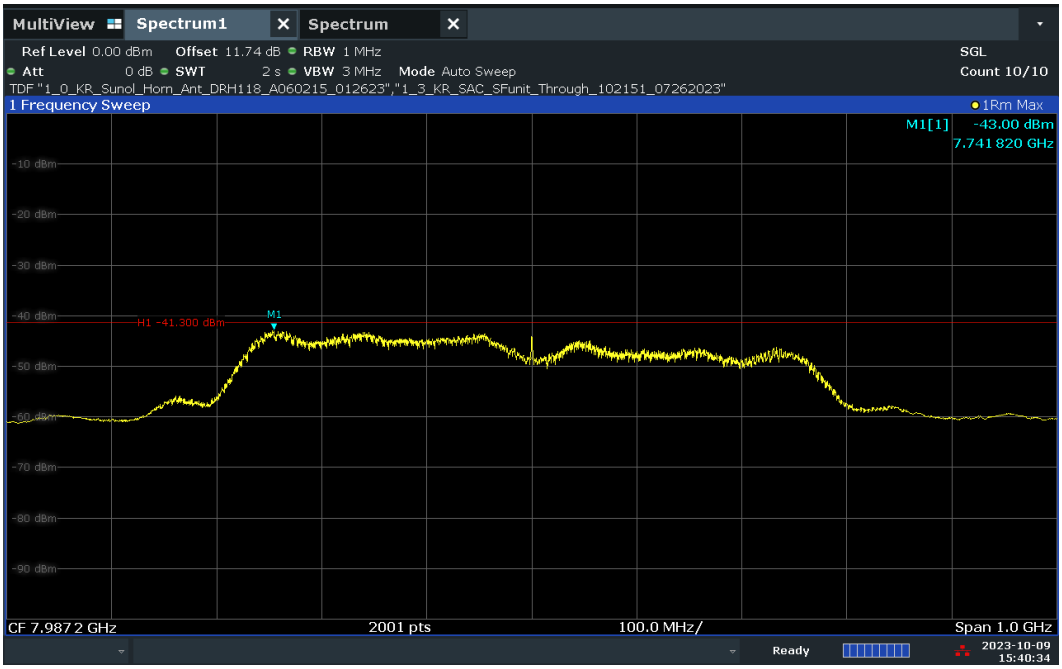
Plot 7-36. UWB Peak Power Measurement - CH.5 – HPRF



Plot 7-37. UWB Peak Power Measurement - CH.9 – HPRF



Plot 7-38. UWB Average Power Measurement - CH.5 – HPRF



Plot 7-39. UWB Average Power Measurement - CH.9 – HPRF

7.5 Radiated Measurement Data above 960MHz

§15.519 (c), §15.519(d)

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at maximum power and at the appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

§15.519(c)

Frequency in MHz	EIRP in dBm
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

Table 7-8. Above 960MHz Average Limits

§15.519(d)

Frequency in MHz	EIRP in dBm
1164-1240	-85.3
1559-1610	-85.3

Table 7-9. Above 960MHz Average Limits

Test Procedures Used

ANSI C63.10-2013

Test Settings

Average EIRP Measurements

1. Analyzer frequency set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz (30kHz for emissions in the GPS bands)
3. VBW = 3MHz (100kHz for the emissions in the GPS bands)
4. Detector = RMS
5. Sweep time = No more than 1ms integration period over each measurement bin
6. Trace mode = Max hold
7. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown test setup photos provided.

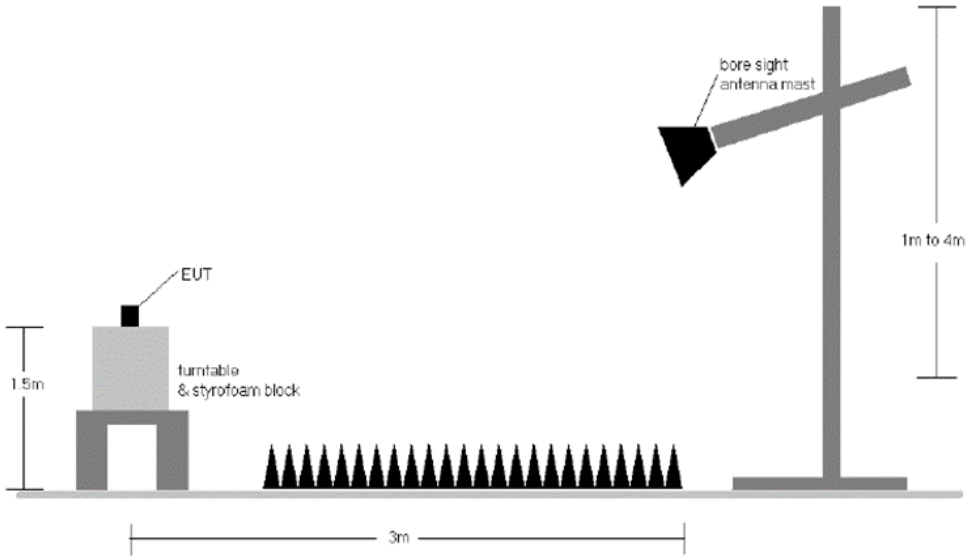


Figure 7-3. Radiated Test Setup > 1GHz

Test Notes

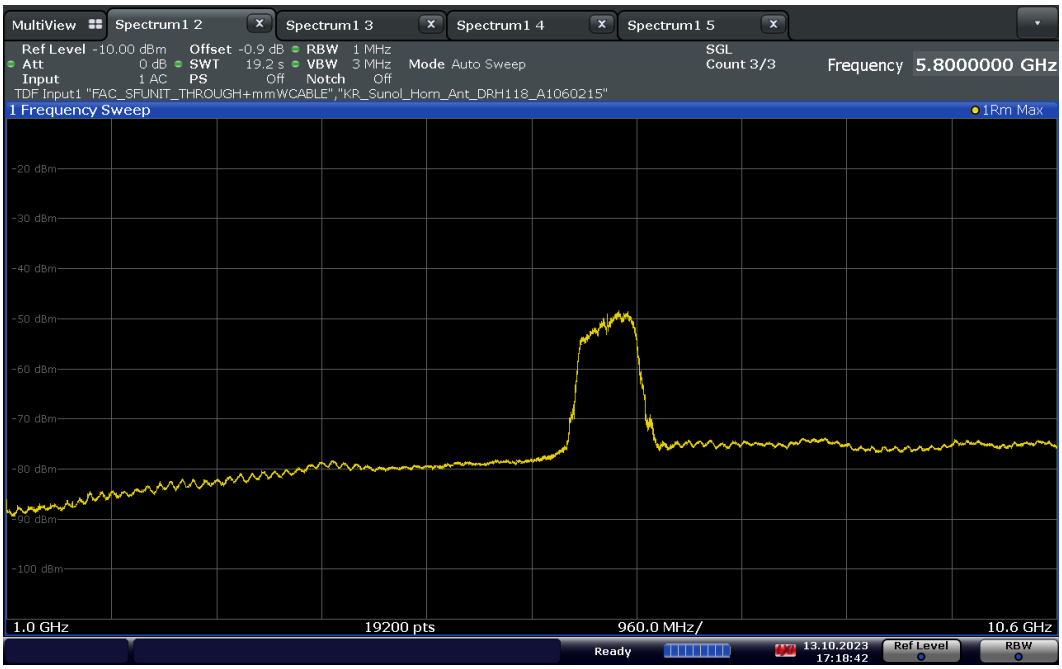
1. All modes of operation and settings (Preamble, Packet Type, etc) were investigated and the worst-case emissions are reported.
2. The RBW for measurements in the GPS Bands were reduced to 30kHz in order to prove compliance.
3. 1000 ~ 18000 MHz and above 18000 MHz pre-scan plots were conducted at 0.7 and 0.6 meter respectively. The plots are only for the purpose of spurious emission identification.
4. All final measurements were made at 0.7 and 0.6 meters respectively.
5. All readings are calibrated by a signal generator with accuracy traceable to the National Institute of Standards and Technology (NIST).
6. AFCL (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)

Sample Calculation

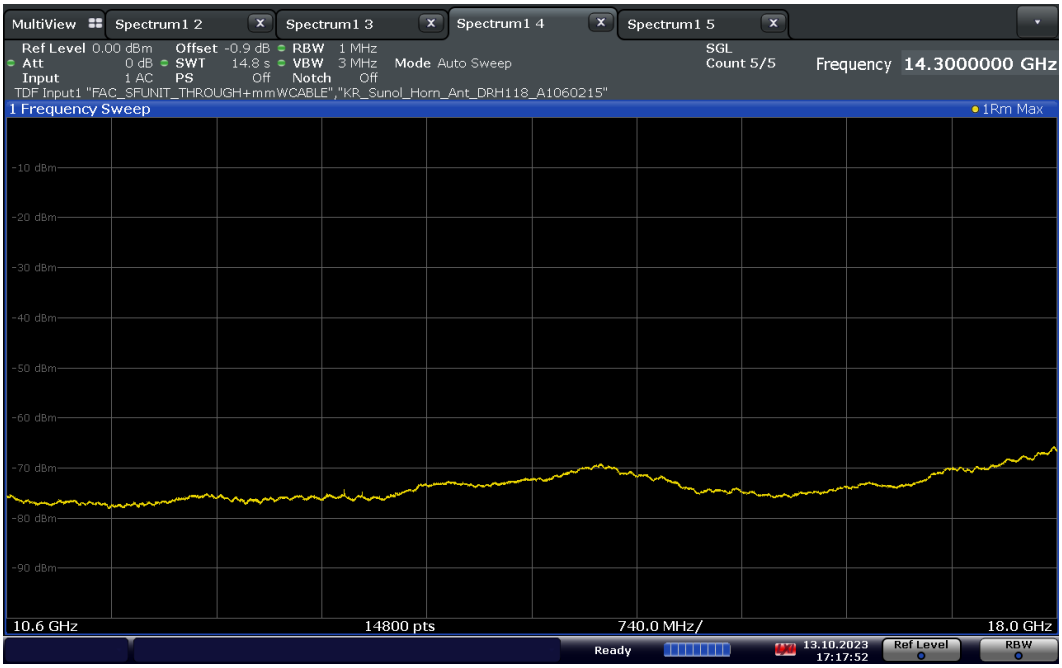
The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE level is calculated by applying the additional factors shown below for a test distance of 3 meter.

Spurious Emission Level (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8

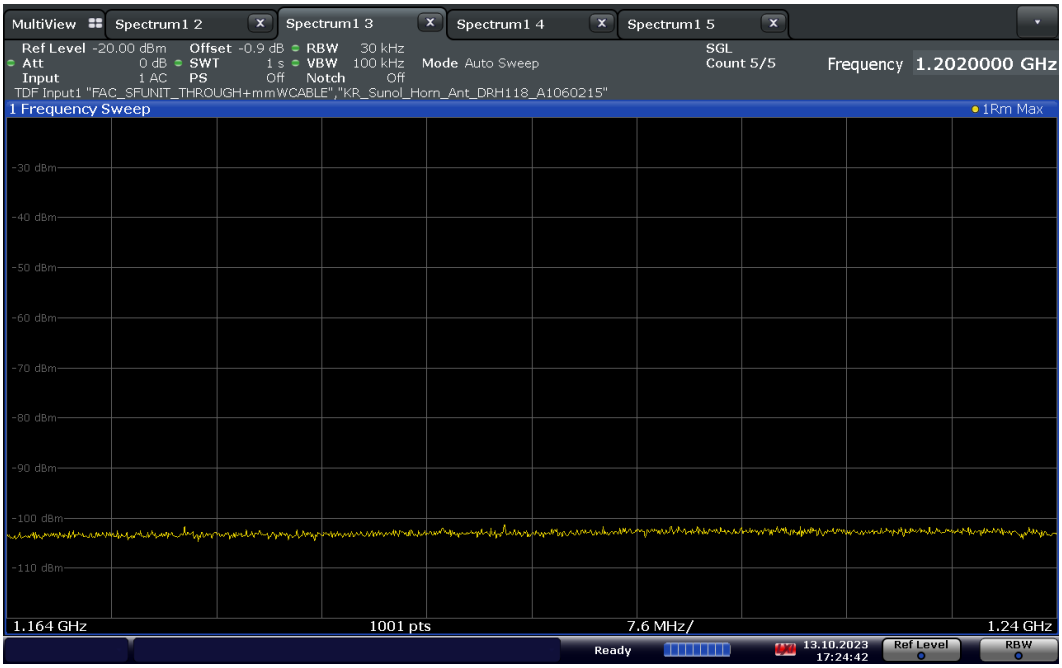
Channel 5



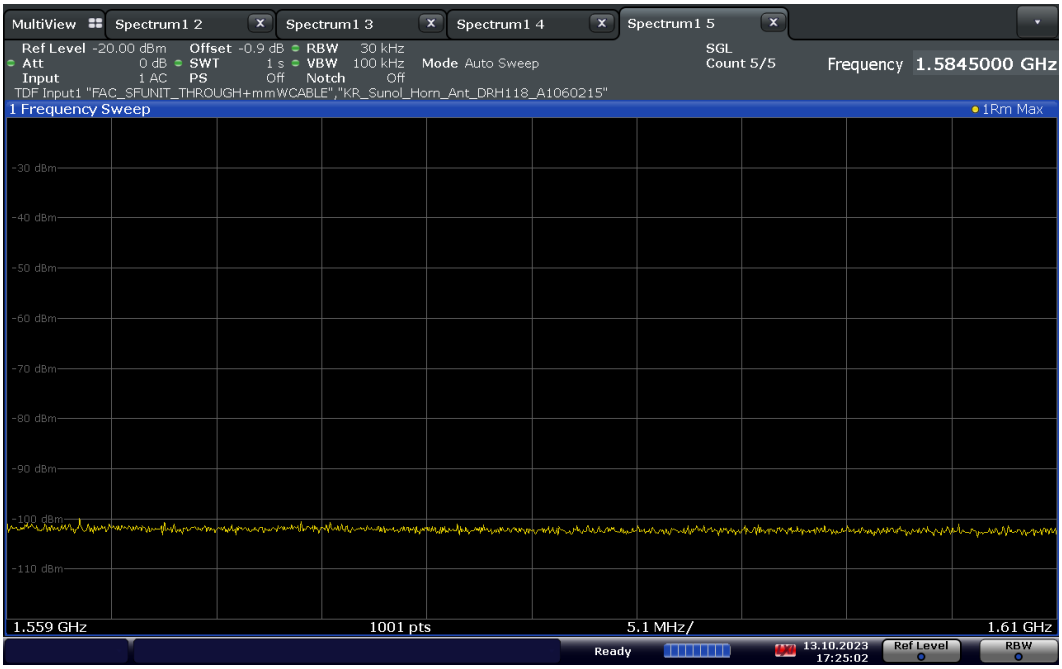
Plot 7-40. Radiated Spurious Pre-Scan 1000 - 10600 MHz - CH.5



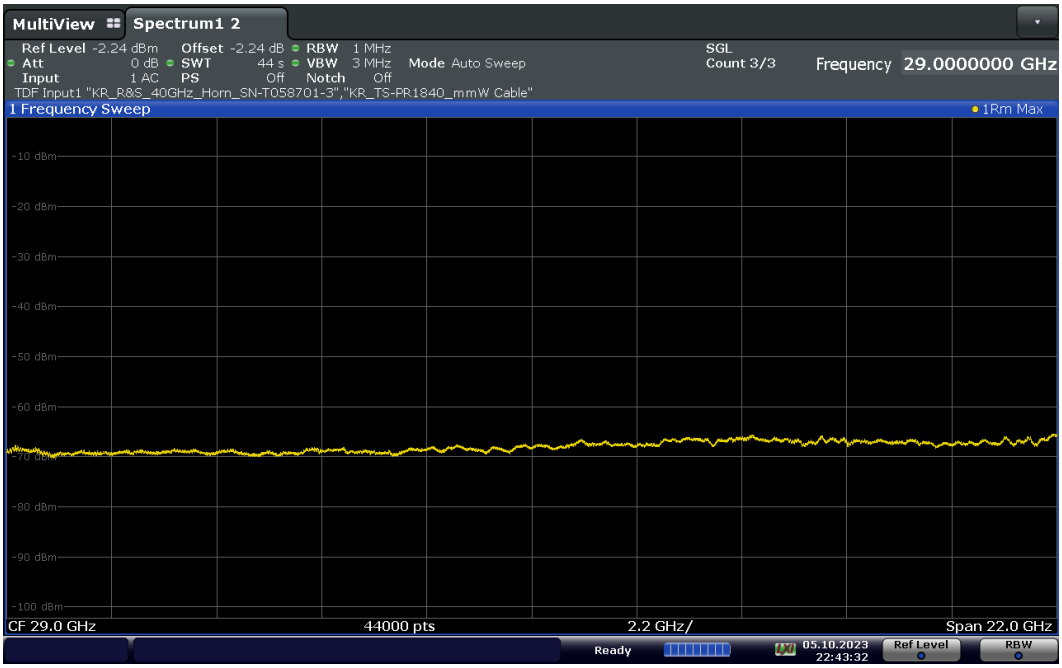
Plot 7-41. Radiated Spurious Pre-Scan 10600 - 18000 MHz - CH.5



Plot 7-42. Radiated Spurious Pre-Scan 1164 - 1240 MHz - CH.5 – GPS band



Plot 7-43. Radiated Spurious Pre-Scan 1559 - 1610 MHz - CH.5 – GPS band



Plot 7-44. Radiated Spurious Pre-Scan 18 – 40 GHz - CH.5

Channel:	5
Frequency (MHz):	6489.6
Preamble ID	10
Config	SP3

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Spurious Emission Level[dBm]	Limit [dBm]	Margin [dB]
1603	RMS	H	-	-	-87.77	-75.30	-12.47
1983	RMS	H	-	-	-84.23	-63.30	-20.93
3084	RMS	H	-	-	-82.26	-61.30	-20.96
10523	RMS	H	-	-	-75.25	-41.30	-33.95
17832	RMS	H	-	-	-66.72	-61.30	-5.42
39117	RMS	H	-	-	-66.12	-61.30	-4.82

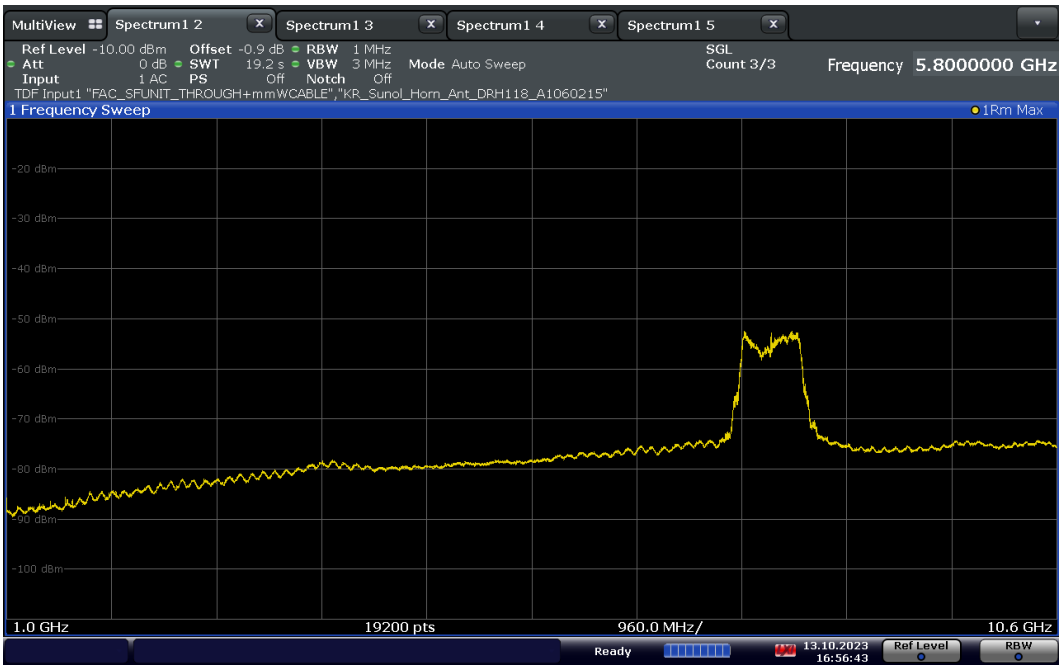
Table 7-10. Radiated Spurious Emissions CH. 5

Channel:	5
Frequency (MHz):	6489.6
Preamble ID	10
Config	SP3

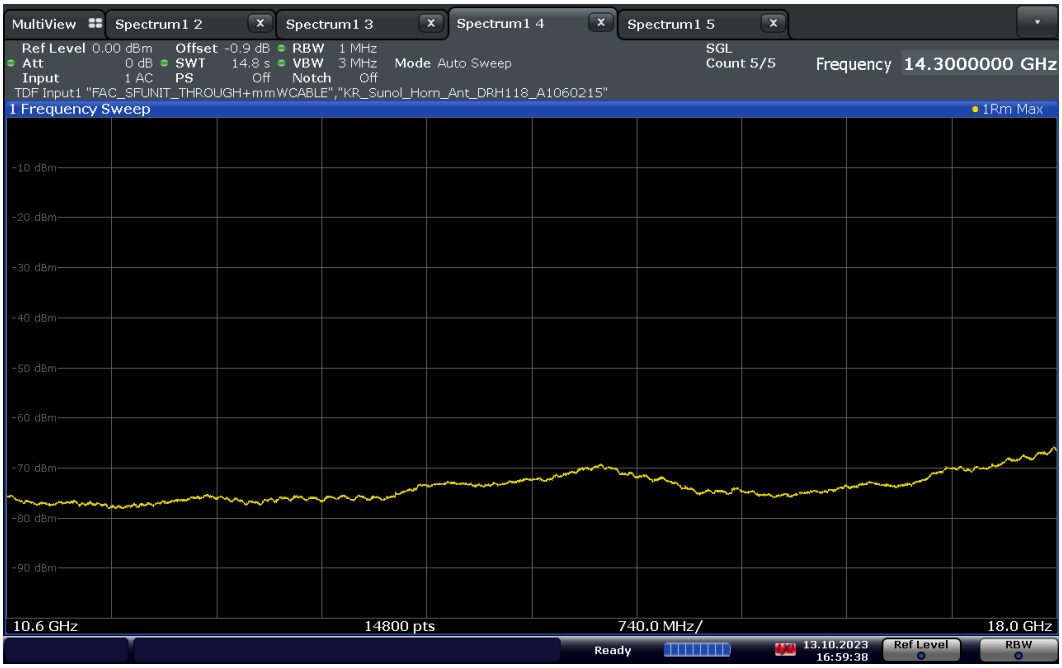
Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Spurious Emission Level[dBm]	Limit [dBm]	Margin [dB]
1198.3	RMS	H	-	-	-101.26	-85.30	-15.96
1564.2	RMS	H	-	-	-99.81	-85.30	-14.51

Table 7-11. Radiated Spurious Emissions CH. 5 – GPS BANDs

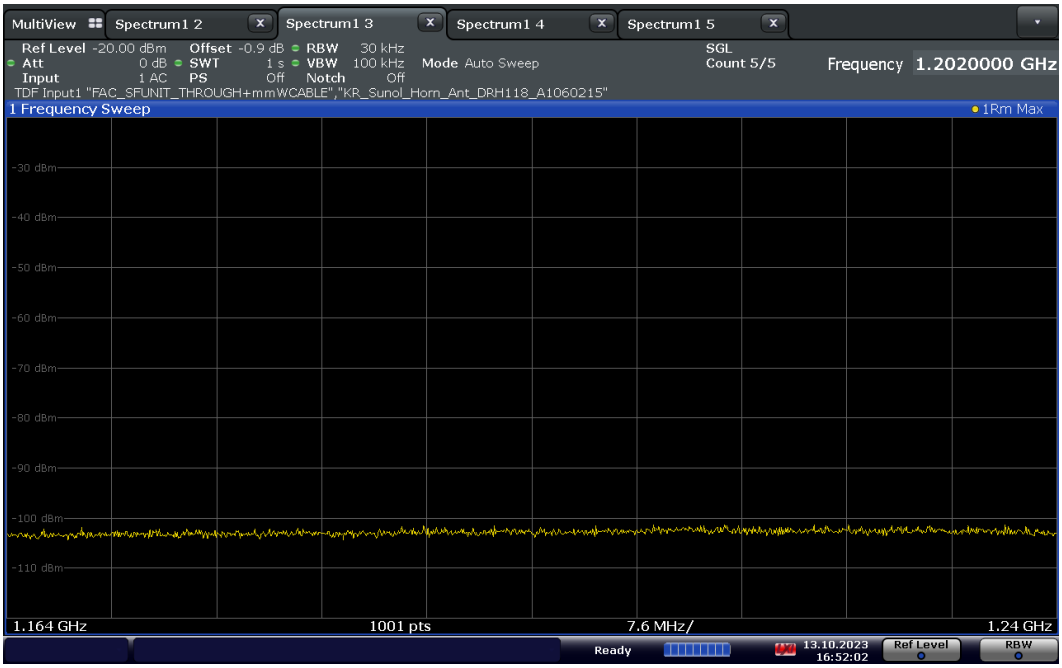
Channel 9



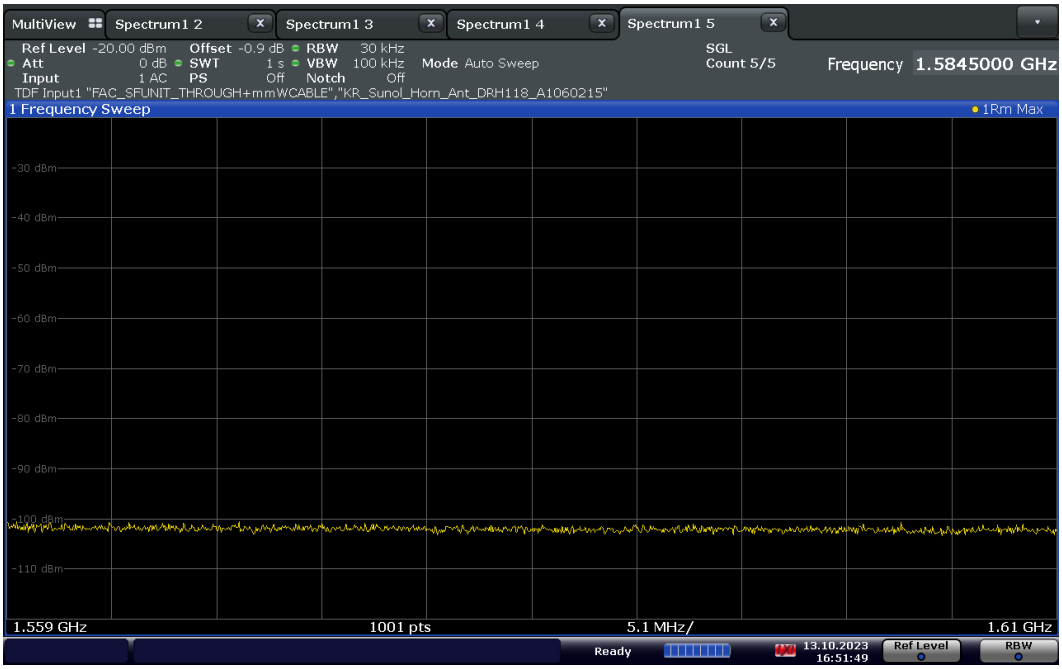
Plot 7-45. Radiated Spurious Pre-Scan 1000 - 10600 MHz - CH.9



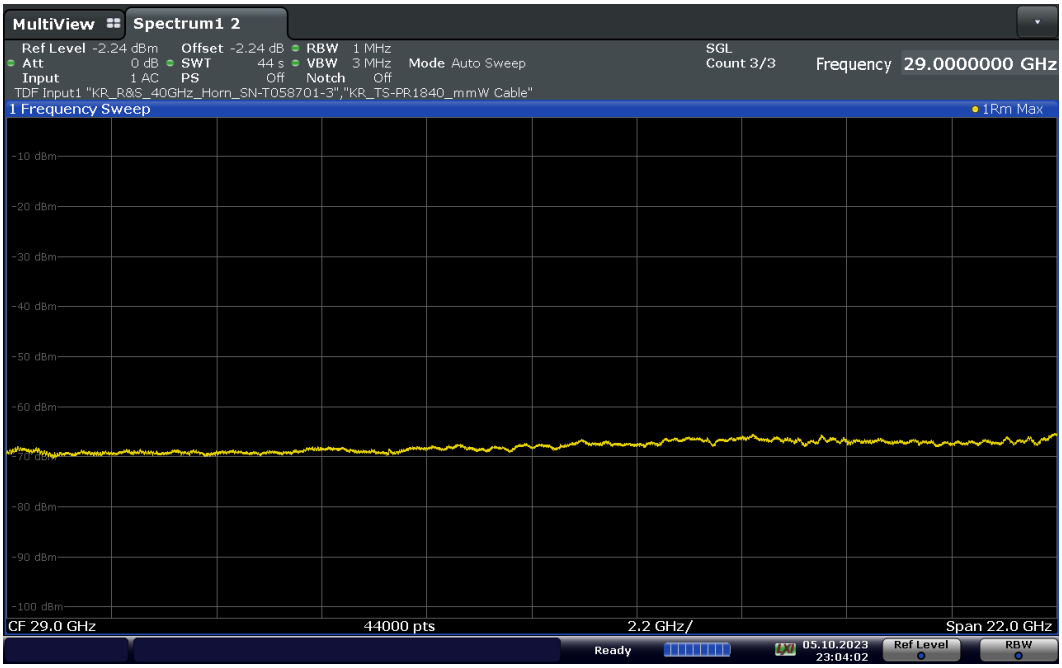
Plot 7-46. Radiated Spurious Pre-Scan 10600 - 18000 MHz - CH.9



Plot 7-47. Radiated Spurious Pre-Scan 1164 - 1240 MHz - CH.9 – GPS band



Plot 7-48. Radiated Spurious Pre-Scan 1559 - 1610 MHz - CH.9 – GPS band



Plot 7-49. Radiated Spurious Pre-Scan 18 – 40 GHz - CH.9

Channel:	9
Frequency (MHz):	7987.2
Preamble ID	10
Config	SP3

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Spurious Emission Level[dBm]	Limit [dBm]	Margin [dB]
1596	RMS	H	-	-	-88.02	-75.30	-12.72
1926	RMS	H	-	-	-84.63	-63.30	-21.33
3054	RMS	H	-	-	-83.17	-61.30	-21.87
10508	RMS	H	-	-	-75.88	-41.30	-34.58
17829	RMS	H	-	-	-65.89	-61.30	-4.59
39664	RMS	H	-	-	-66.03	-61.30	-4.73

Table 7-12. Radiated Spurious Emissions CH. 9

Channel:	9
Frequency (MHz):	7987.2
Preamble ID	10
Config	SP3

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Spurious Emission Level[dBm]	Limit [dBm]	Margin [dB]
1206.8	RMS	H	-	-	-102.18	-85.30	-16.88
1571.2	RMS	H	-	-	-100.24	-85.30	-14.94

Table 7-13. Radiated Spurious Emissions CH. 9 – GPS BANDs

7.6 Radiated Spurious Emissions Measurements – Below 1GHz

§15.209(a), §15.519(c); RSS-Gen [8.9]

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 6 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-19 per Section 15.209 and RSS-Gen (8.9).

Frequency	Field Strength [µV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-14. Radiated Limits

Test Procedures Used

ANSI C63.10-2013

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Test Setup

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

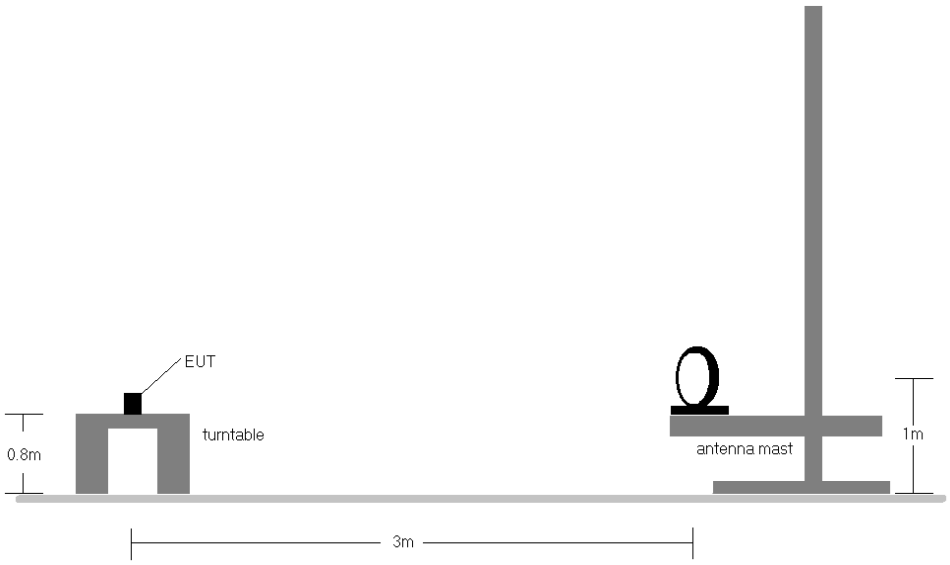


Figure 7-4. Radiated Test Setup < 30Mhz

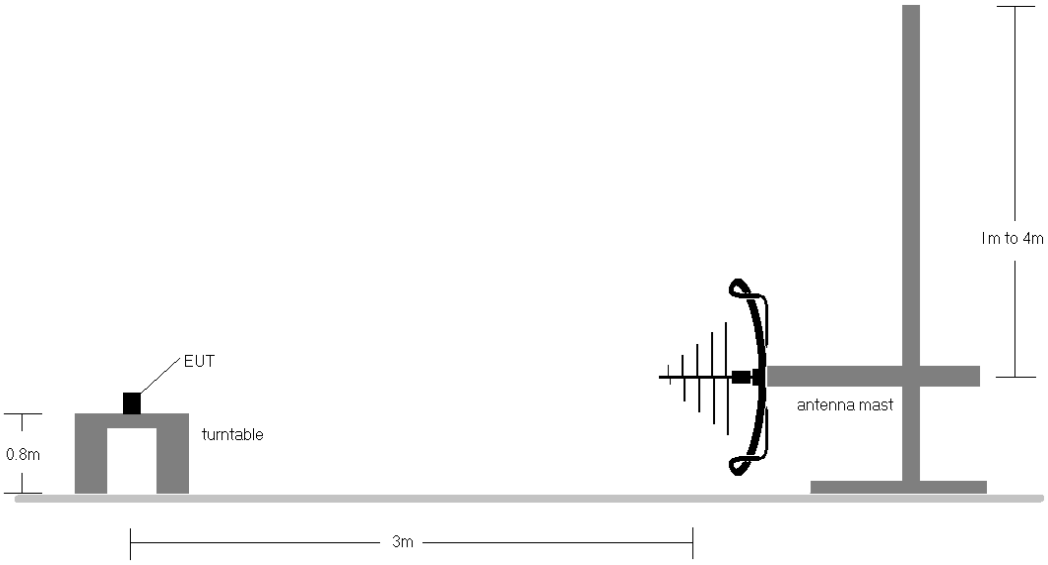
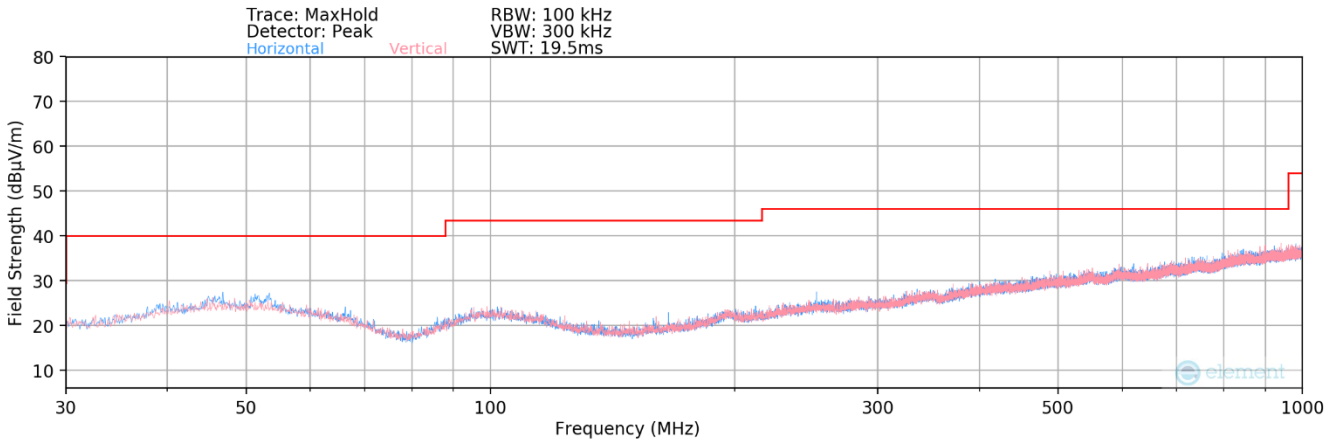


Figure 7-5. Radiated Test Setup < 1GHz

Test Notes

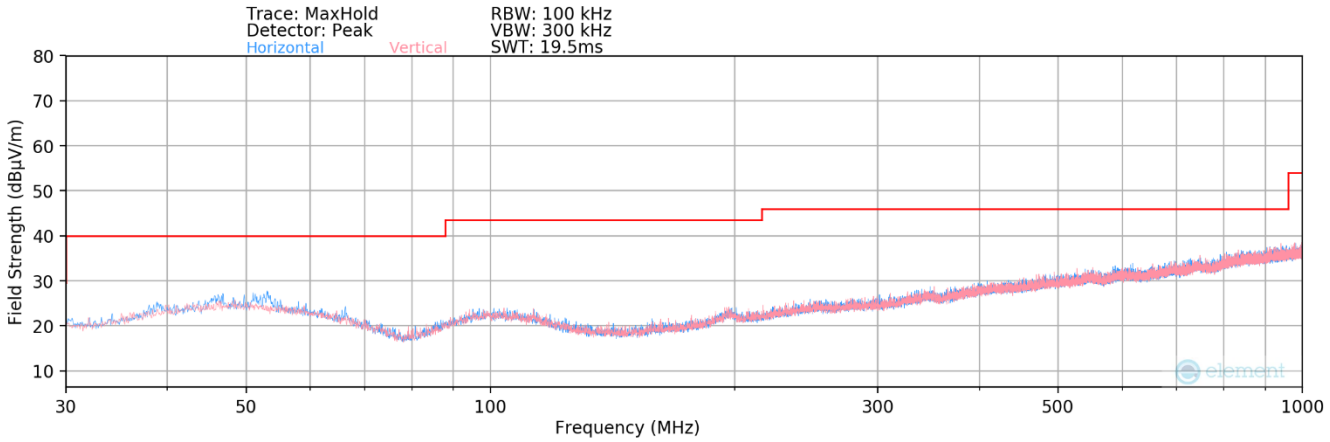
1. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
2. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
3. Emissions were measured at a 3 meter test distance.
4. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
5. No spurious emissions were detected within 20dB of the limit below 30MHz.
6. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.
7. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. There were no emissions detected in the 30MHz – 1GHz frequency range, as shown in the subsequent plots.



Plot 7-50. 30MHz - 1 GHz Pre-Scan Plots – CH 5

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBuV/m]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
52.38	Quasi-Peak	H	-	-	1.65	20.37	22.02	40.00	-17.98
957.32	Quasi-Peak	H	-	-	2.17	30.67	32.84	46.02	-13.18
952.58	Quasi-Peak	V	-	-	2.28	30.62	32.90	46.02	-13.12

Table 7-15. Radiated Spurious Emissions Below 1GHz – CH5



Plot 7-51. 30MHz - 1 GHz Pre-Scan Plots – CH 9

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBuV/m]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
52.54	Quasi-Peak	H	-	-	1.58	20.35	21.93	40.00	-18.07
956.29	Quasi-Peak	H	-	-	2.22	30.67	32.89	46.02	-13.13
958.35	Quasi-Peak	V	-	-	2.31	30.67	32.98	46.02	-13.04

Table 7-16. Radiated Spurious Emissions Below 1GHz – CH9

7.7 Line Conducted Measurement Data

§15.207

Test Overview and Limit

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

All emissions must not exceed the limits shown in Table 7-20 per FCC 15.207 and RSS-Gen (8.8).

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

Table 7-17. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.4-2014

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = RMS
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the test setup photos provided.

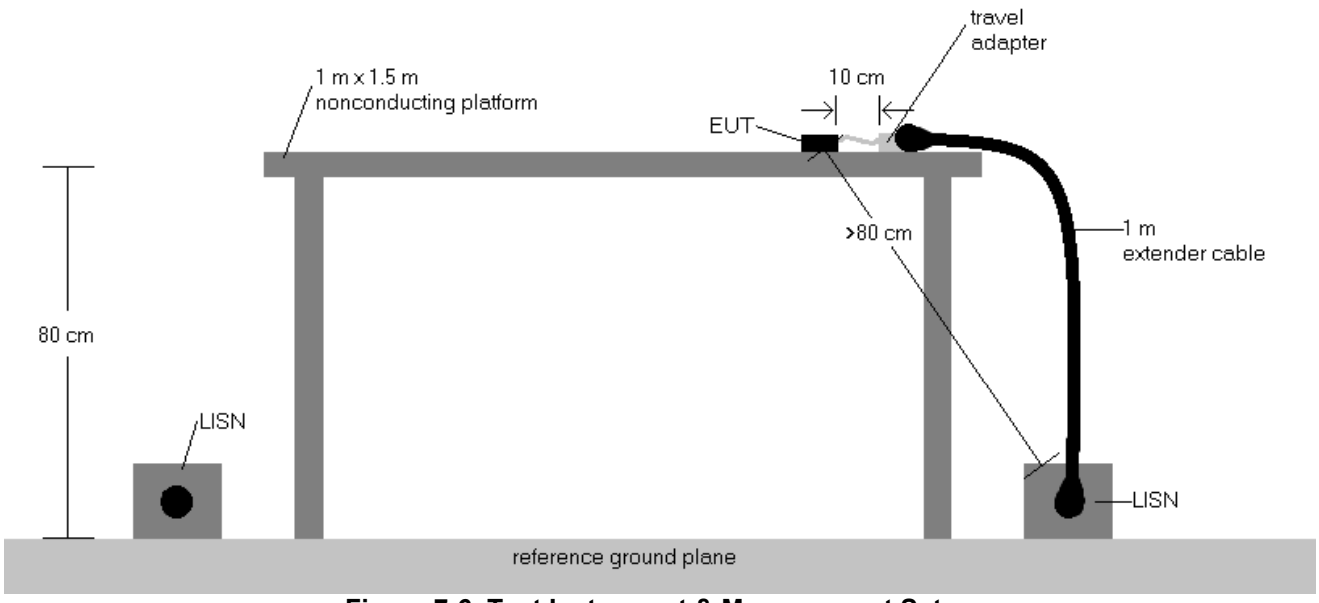
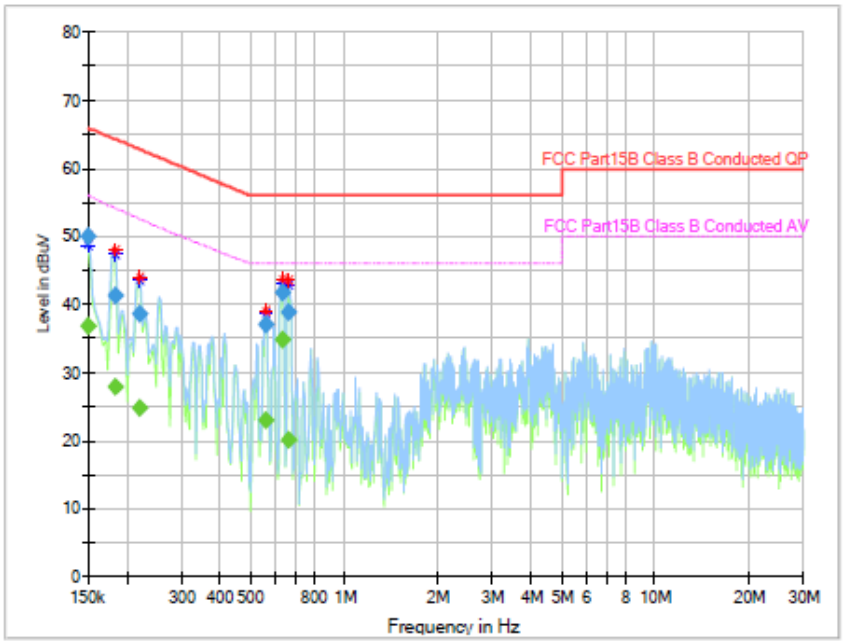


Figure 7-6. Test Instrument & Measurement Setup

Test Notes

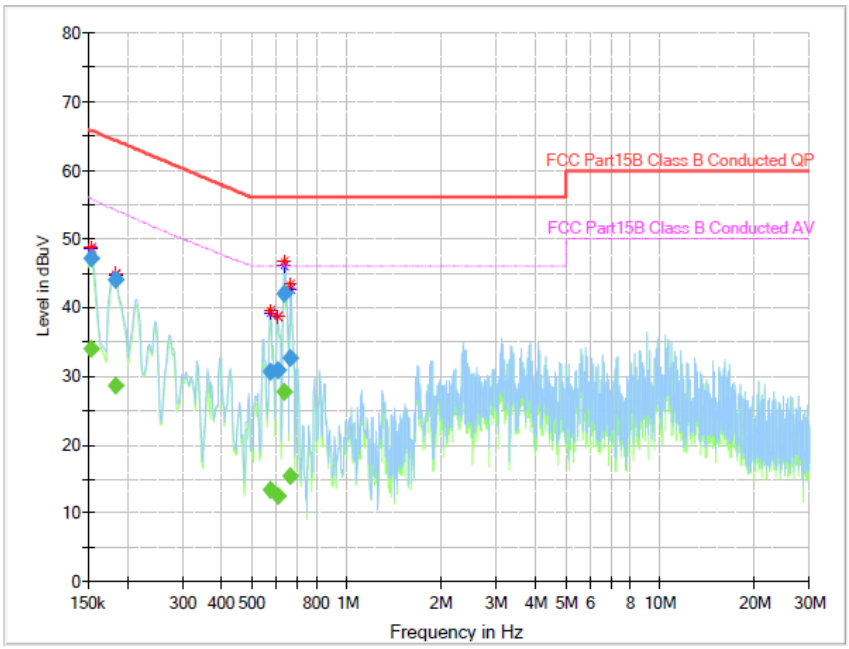
1. All Modes of operation were investigated and the worst-case emissions are reported.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in Section 15.207 and RSS-Gen.
3. L1 = Phase; N = Neutral
4. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
5. QP/AV Level (dBµV) = QP/AV Reading (dBµV) + Factor (dB)
6. Margin (dB) = QP/AV Limit (dBµV) – QP/AV Level (dBµV)
7. Traces shown in plot are made using a peak detector.
8. Deviations to the Specifications: None.



Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	---	36.95	56.00	19.05	1000.0	9.000	L1	9.8
0.150000	50.17	---	66.00	15.83	1000.0	9.000	L1	9.8
0.182835	---	27.93	54.22	26.29	1000.0	9.000	L1	10.0
0.182835	41.24	---	64.36	23.12	1000.0	9.000	L1	10.0
0.218655	---	24.76	52.66	27.90	1000.0	9.000	L1	9.8
0.218655	38.69	---	62.87	24.18	1000.0	9.000	L1	9.8
0.558945	---	23.06	46.00	22.94	1000.0	9.000	L1	9.9
0.558945	37.12	---	56.00	18.88	1000.0	9.000	L1	9.9
0.633570	---	34.79	46.00	11.21	1000.0	9.000	L1	9.9
0.633570	41.77	---	56.00	14.23	1000.0	9.000	L1	9.9
0.660435	---	20.02	46.00	25.98	1000.0	9.000	L1	9.9
0.660435	38.81	---	56.00	17.19	1000.0	9.000	L1	9.9

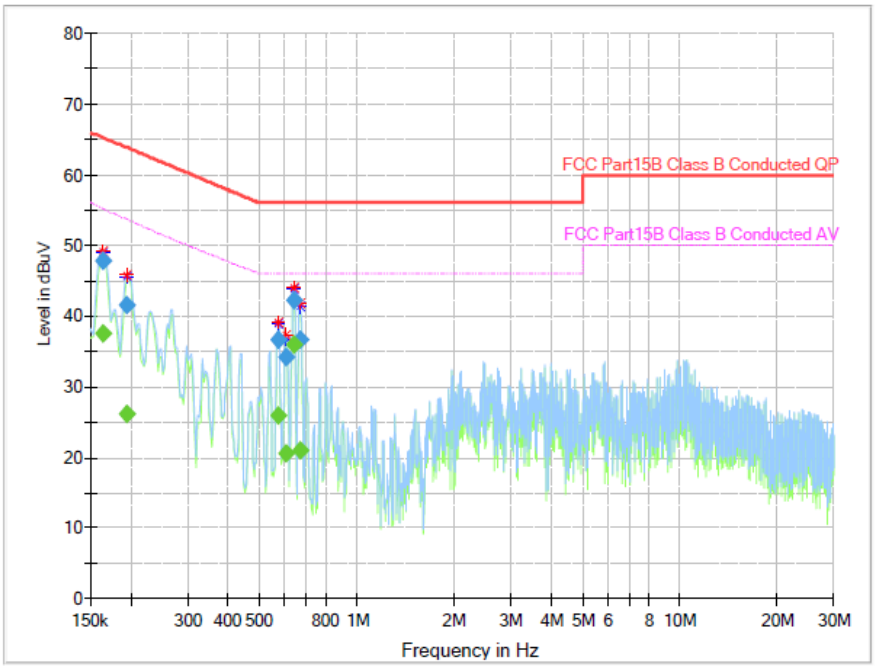
Plot 7-52. Line Conducted Plot (L1) – CH 5



Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.152985	---	33.87	55.82	21.95	1000.0	9.000	N	9.8
0.152985	47.22	---	65.84	18.62	1000.0	9.000	N	9.8
0.182835	---	28.68	54.22	25.54	1000.0	9.000	N	10.0
0.182835	44.11	---	64.36	20.24	1000.0	9.000	N	10.0
0.573870	---	13.31	46.00	32.69	1000.0	9.000	N	9.9
0.573870	30.56	---	56.00	25.44	1000.0	9.000	N	9.9
0.603720	---	12.53	46.00	33.47	1000.0	9.000	N	9.9
0.603720	30.74	---	56.00	25.26	1000.0	9.000	N	9.9
0.636555	---	27.81	46.00	18.19	1000.0	9.000	N	9.9
0.636555	42.07	---	56.00	13.93	1000.0	9.000	N	9.9
0.663420	---	15.37	46.00	30.63	1000.0	9.000	N	9.9
0.663420	32.70	---	56.00	23.30	1000.0	9.000	N	9.9

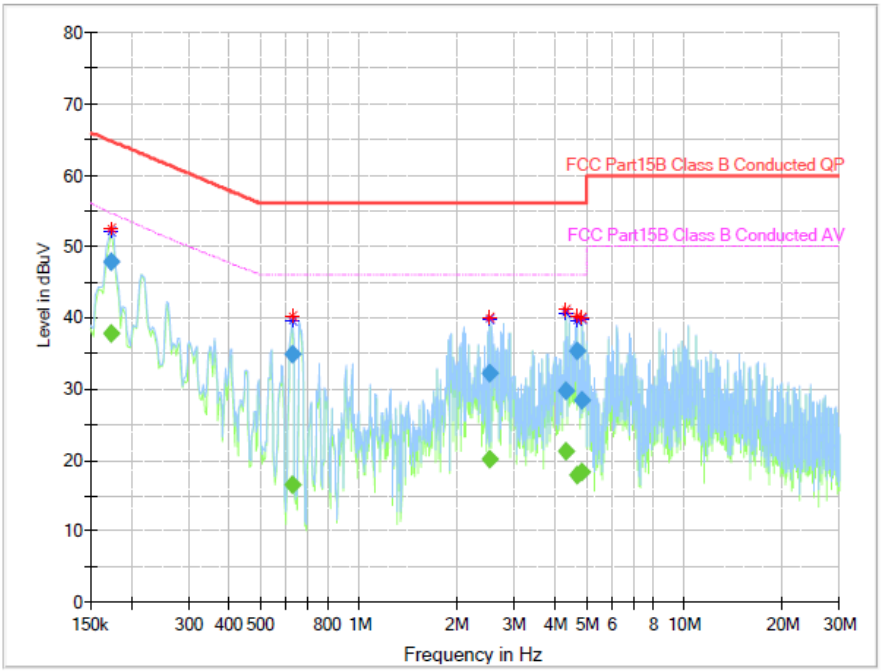
Plot 7-53. Line Conducted Plot (N) – CH 5



Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.164925	---	37.46	55.14	17.68	1000.0	9.000	L1	9.9
0.164925	47.82	---	65.21	17.40	1000.0	9.000	L1	9.9
0.194775	---	26.09	53.66	27.57	1000.0	9.000	L1	9.9
0.194775	41.64	---	63.83	22.19	1000.0	9.000	L1	9.9
0.573870	---	25.99	46.00	20.01	1000.0	9.000	L1	9.9
0.573870	36.76	---	56.00	19.24	1000.0	9.000	L1	9.9
0.603720	---	20.50	46.00	25.50	1000.0	9.000	L1	9.9
0.603720	34.30	---	56.00	21.70	1000.0	9.000	L1	9.9
0.639540	---	35.98	46.00	10.02	1000.0	9.000	L1	9.9
0.639540	42.19	---	56.00	13.81	1000.0	9.000	L1	9.9
0.666405	---	21.07	46.00	24.93	1000.0	9.000	L1	9.9
0.666405	36.70	---	56.00	19.30	1000.0	9.000	L1	9.9

Plot 7-54. Line Conducted Plot (L1) – CH 9



Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.173880	---	37.73	54.67	16.94	1000.0	9.000	N	10.0
0.173880	47.83	---	64.77	16.95	1000.0	9.000	N	10.0
0.624615	---	16.44	46.00	29.56	1000.0	9.000	N	9.9
0.624615	34.96	---	56.00	21.04	1000.0	9.000	N	9.9
2.529045	---	20.17	46.00	25.83	1000.0	9.000	N	9.8
2.529045	32.17	---	56.00	23.83	1000.0	9.000	N	9.8
4.317060	---	21.29	46.00	24.71	1000.0	9.000	N	9.9
4.317060	29.78	---	56.00	26.22	1000.0	9.000	N	9.9
4.663320	---	17.95	46.00	28.05	1000.0	9.000	N	9.9
4.663320	35.20	---	56.00	20.80	1000.0	9.000	N	9.9
4.872270	---	18.22	46.00	27.78	1000.0	9.000	N	9.9
4.872270	28.32	---	56.00	27.68	1000.0	9.000	N	9.9

Plot 7-55. Line Conducted Plot (N) – CH 9

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMS928B** has been tested to comply with the requirements specified in §15.519 and §15.521 of the FCC rules.