

**FCC LISTED, REGISTRATION
NUMBER: 720267**

**ISED LISTED REGISTRATION
NUMBER IC 4621A-2**

Test report No:

NIE: 54931RRF.001

Test report

REFERENCE STANDARD: USA FCC Part 90 CANADA IC RSS-119

Identificación del objeto ensayado.....:	RF Transceiver / Base Station Repeater		
Identification of item tested			
Marca	PowerTrunk		
Trade			
Modelo y/o referencia tipo	BSR75 -N		
Model and /or type reference			
Other identification of the product	D138N61PT FCC ID: WT7PTBSR75800B IC: 8624A-PTBSR75800B		
HW version	CCP: 1.02.34.33.35		
SW version	CCP: 1.02.34.33.35		
Características	<u>Power supply:</u> Nominal voltage: 27.4 VDC Operational voltage range: [21.6 - 28.0 VDC] <u>Frequency band:</u> - TX: 851-870 MHz / RX: 806-825 MHz <u>RF output power (nominal):</u> - TETRA: 48.75 dBm (75 W) / TI D-LMR: 48.75 dBm (75 W) See full details on pages 4 and 5		
Features			
Solicitante	TELTRONIC, S.A.U.		
Applicant	Polígono Malpica, Calle C/F-Oeste (50016). Zaragoza (SPAIN).		
Método de ensayo solicitado, norma.....:	USA FCC Part 90 10-01-16 Edition. CANADA IC RSS-119 Issue 12, May 2015. ANSI C63.26-2015. ANSI/TIA-603-E: 2016.		
Test method requested, standard			
Resultado	IN COMPLIANCE		
Summary			
Aprobado por (nombre / cargo y firma)	A. Llamas RF Lab. Manager		
Approved by (name / position & signature)			
Fecha de realización	2018-03-14		
Date of issue			Firmado digitalmente por ALEJANDRO LLAMAS RODRIGUEZ Fecha: 2018.03.14 10:31:49 +01'00'
Formato de informe No.	FDT08_20		
Report template No			

Index

Competences and guarantees.....3

General conditions.....3

Uncertainty3

Usage of samples.....4

Test sample description4

Identification of the client5

Testing period.....5

Environmental conditions.....5

Remarks and comments.....6

Testing verdicts7

Appendix A – Test results8

Competences and guarantees

DEKRA Testing and Certification is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

DEKRA Testing and Certification is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: ISED 4621A-2.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification at the time of performance of the test.

DEKRA Testing and Certification is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Usage of samples

Samples undergoing test have been selected by: **the client**.

Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial number	Reception date
54931C/001	RF Transceiver / Base Station Repeater	BSR75 -N	915867	2017-10-03

1. Sample S/01 has undergone the test(s).

All tests indicated in appendix A.

Test sample description

The BSR75 (Base Station Repeater) is a digital RF transceiver aimed at providing the PowerTrunk-T Infrastructure with a TETRA carrier. It has been conceived as a module to be integrated in a PowerTrunk-T Cabinet with an SBS configuration (Site Base Station). The BSR75 -N operates in the frequency band 806-870 MHz and provides an RF output power of 75 W in the subband 851-870 MHz.

Features:

Power Supply:

Nominal voltage: 27.4 VDC

Operational voltage range: [21.6 - 28.0 VDC]

Access scheme:

TDMA with 4 physical channels (time slots) per RF channel.

Modulation scheme:

$\pi/4$ -DQPSK with a modulation rate of 18 Ksym/s, equivalent to 36 Kbits/s. Based upon it, two digital communication systems are supported:

- TETRA:
Modulation low-pass filter: Square-root raised cosine filter with a roll-off factor of 0.35.
- TI D-LMR:
Modulation low-pass filter: Square-root raised cosine filter with a roll-off factor of 0.2.

RF channel bandwidth (channel spacing):

25 kHz

Spectral efficiency:

One voice & data physical channel with a rate of 9 Kbits/s is allocated a 6.25 KHz equivalent channel bandwidth.

Frequency band:

TX: 851-870 MHz

RX: 806-825 MHz

RF output power (nominal):

TETRA: 48.75 dBm (75 W)

TI D-LMR: 48.75 dBm (75 W)

RF authorized bandwidth:

TETRA: 22 KHz

TI D-LMR: 20 KHz

Emission designators:

TETRA: 22K0D7D, 22K0D7E, 22K0D7W

TI D-LMR: 20K0D7D, 20K0D7E, 20K0D7W

Additional features:

Audio low-pass filter (root-raised cosine filter).

Options:

O485002PT: OPTION ENCRYPTION POWERTRUNK-T

Identification of the client

TELTRONIC, S.A.U.

Polígono Malpica, Calle C/F-Oeste (50016). Zaragoza (SPAIN).

Testing period

The radiated measurements started on 2017-11-24 and finished on 2017-11-27.

The conducted measurements started on 2017-12-11 and finished on 2017-12-19.

The tests have been performed at DEKRA Testing and Certification.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

Remarks and comments

- 1: The tests have been performed by the technical personnel: Pedro Parada and Carolina Postigo.
2: Used instrumentation.

Conducted Measurements

	Last Cal. date	Cal. due date
1. Spectrum analyser Agilent PSA E4440A	2017/10	2019/10
2. Climatic chamber VÖTSCH VCS 7018-5	2017/03	2018/03
3. DC power supply R&S NGPE 40/40	N.A.	N.A.
4. Digital multimeter FLUKE 113	2017/05	2019/05
5. Power sensor R&S NRP-Z91	2016/04	2018/04
6. Spectrum analyser R&S FSV40	2017/07	2019/07
7. Radiocommunication analyzer HP 8920A	2017/04	2020/04

Radiated Measurements

	Last Cal. date	Cal. due date
1. Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
2. BiconicalLog antenna ETS LINDGREN 3142E	2015/06	2018/06
3. Multi Device Controller EMCO 2090	N.A.	N.A.
4. Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2016/11	2019/11
5. Spectrum analyser Rohde & Schwarz FSW50	2015/12	2017/12
6. EMI Test Receiver R&S ESU 26	2015/11	2017/11
7. RF pre-amplifier 20 MHz-7 GHz A. H. SYSTEMS PAM-0207	2017/09	2018/09
8. RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2016/02	2018/02

- 3: This information has been provided by the applicant.

Testing verdicts

Not applicable	N/A
Pass	P
Fail	F
Not measured	N/M

FCC PART 90 / RSS-119 PARAGRAPH	VERDICT			
	NA	P	F	NM
Clause 2.1047, 90.207. Modulation characteristics				NM ³
Clause 90.209 / RSS-119 Clause 5.5: Occupied Bandwidth		P		
Clause 90.205, 90.635 / RSS-119 Clause 5.4: RF output power		P		
Clause 90.210, 90.691 / RSS-119 Clause 5.5, 5.8: Emission mask		P		
Clause 90.221: Adjacent channel power		P		
Clause 90.213 / RSS-119 Clause 5.3: Frequency stability		P		
Clause 90.210, 90.221, 90.691 / RSS-119 Clause 5.8: Spurious emissions at antenna terminals		P		
Clause 90.210, 90.221, 90.691 / RSS-119 Clause 5.8: Radiated emissions		P		

3: see point "Remarks and comments".

Appendix A – Test results

INDEX

TEST CONDITIONS10

Modulation Characteristics14

Occupied Bandwidth16

RF Output Power22

Emission Mask24

Adjacent channel power33

Frequency Stability.....36

Spurious emissions at antenna terminals38

Radiated emissions49

TEST CONDITIONS

Power supply (V):

$$V_{\text{nom}} = 27.40 \text{ Vdc}$$

$$V_{\text{max}} = 21.10 \text{ Vdc}$$

$$V_{\text{min}} = 31.70 \text{ Vdc}$$

The subscripts nom, min and max indicate voltage test conditions (nominal, minimum and maximum respectively, as declared by the applicant).

Type of power supply = DC Voltage from external power supply

Type of antenna = external connectable antenna

Rated RF Output Power:

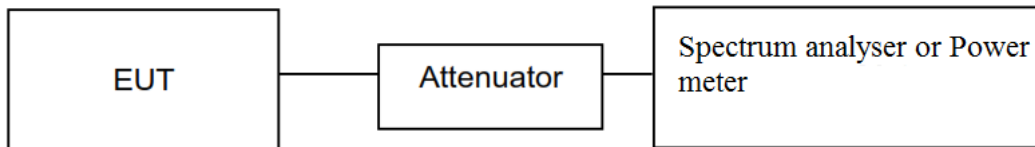
- Mode TETRA (22 kHz bandwidth): 48.75 dBm (75 W)
- Mode TI D-LMR (20 kHz bandwidth): 48.75 dBm (75 W)

TEST FREQUENCIES:

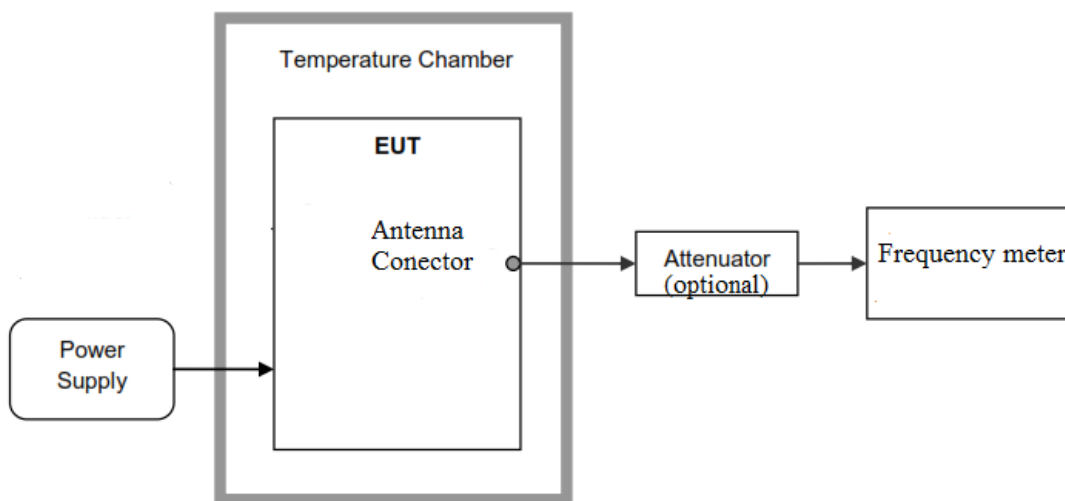
	851-869 MHz band
Lowest channel RSS-119	851.0125 MHz
Lowest channel FCC 90	854.0125 MHz
Middle channel	861.5 MHz
Highest channel	868.9875 MHz

CONDUCTED MEASUREMENTS

The equipment under test (EUT) was set up in a shielded room and it is connected to the spectrum analyzer or power meter through a calibrated attenuator and a low loss RF cable. The reading of the instrument is corrected taking into account the attenuator and cable loss.



For frequency stability test the EUT was placed inside a climatic chamber and connected to a frequency meter using a low loss cable. An external DC power supply was connected to the EUT for voltage variation test.



RADIATED MEASUREMENTS

The equipment under test was scanned for spurious emissions in the frequency range 30 to 10000 MHz.

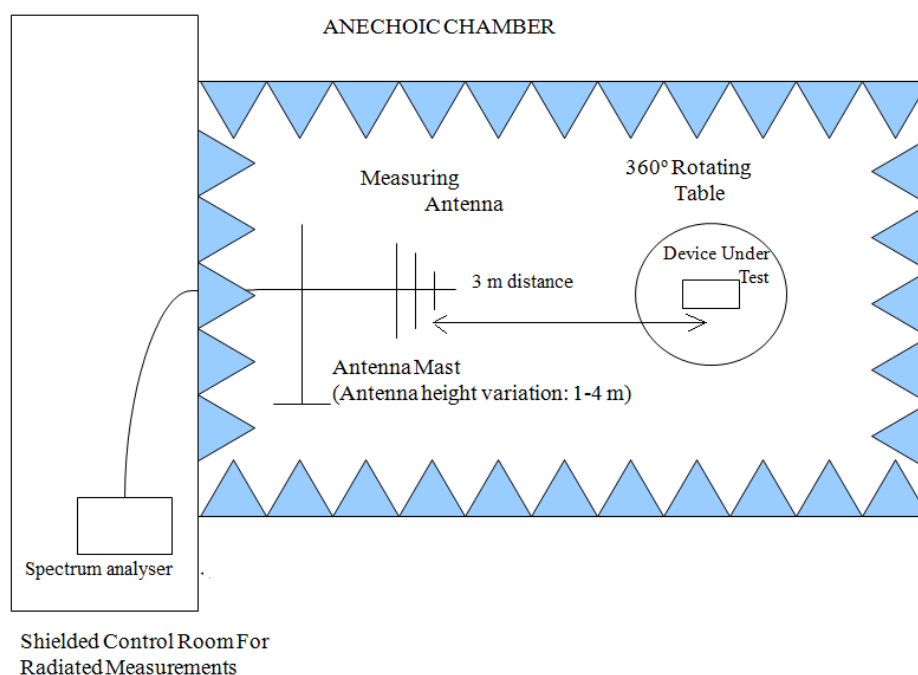
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-10 GHz (1 GHz-18 GHz Double ridge horn antenna).

For radiated emissions in the range 1 GHz-10 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

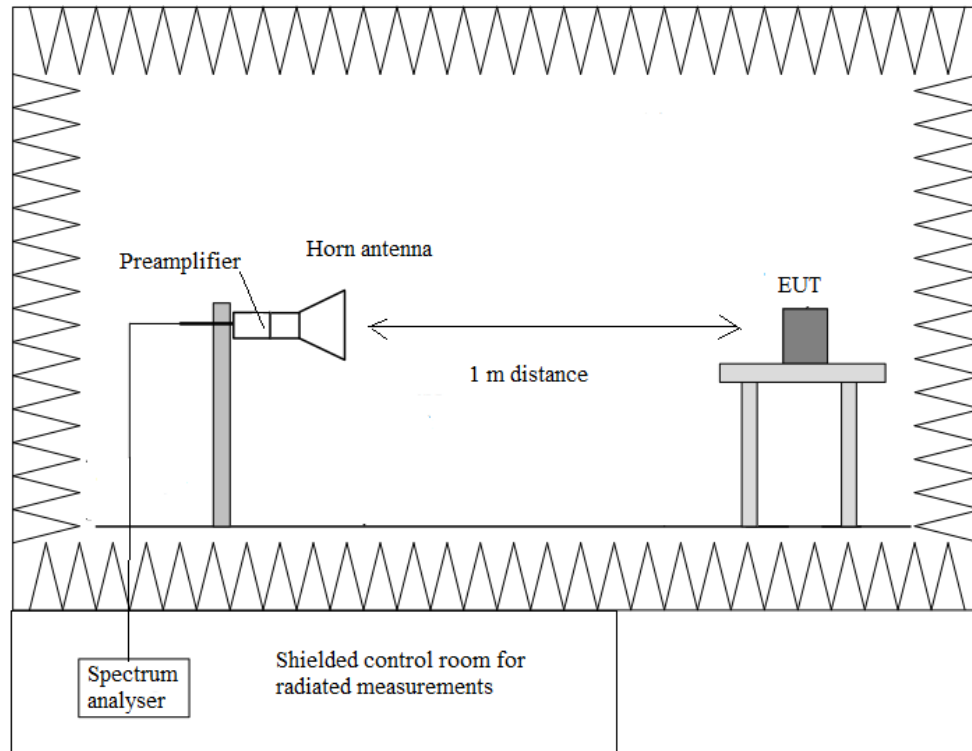
The equipment under test was set up on a non-conductive platform and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



Modulation Characteristics

SPECIFICATION

FCC §2.1047 and §90.207

(a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

(c) Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power. A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of § 2.1049 for the occupied bandwidth tests.

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

RESULTS (The following information has been provided by the applicant)

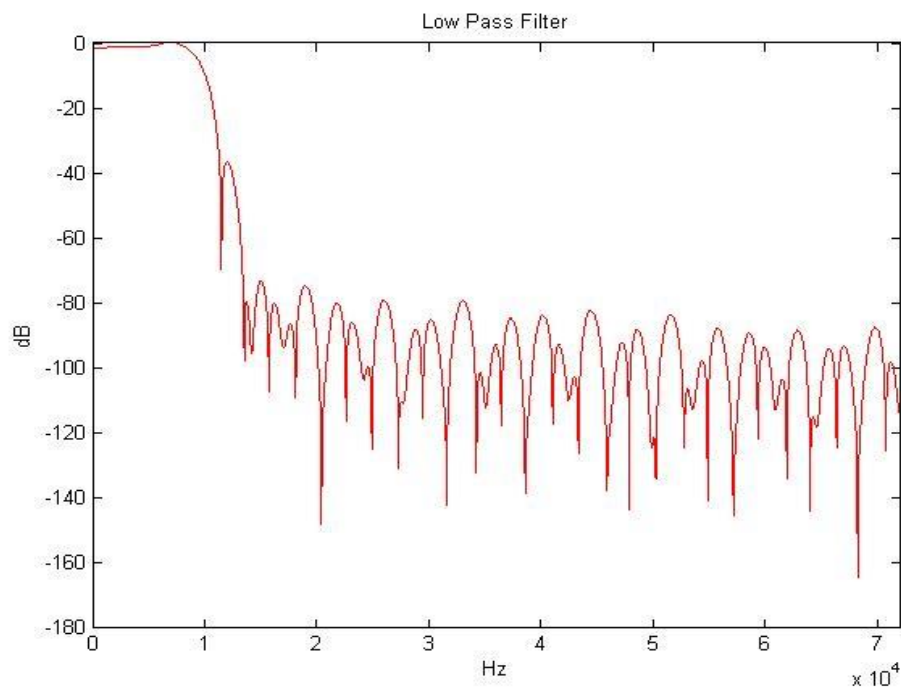
The EUT operates with $\pi/4$ -shifted Differential Quaternary Phase Shift Keying ($\pi/4$ -DQPSK) in both TI D-LMR and TETRA, featuring a modulation rate of 18 ksym/s (36 kbits/s).

The access scheme is TDMA with 4 physical channels per carrier.

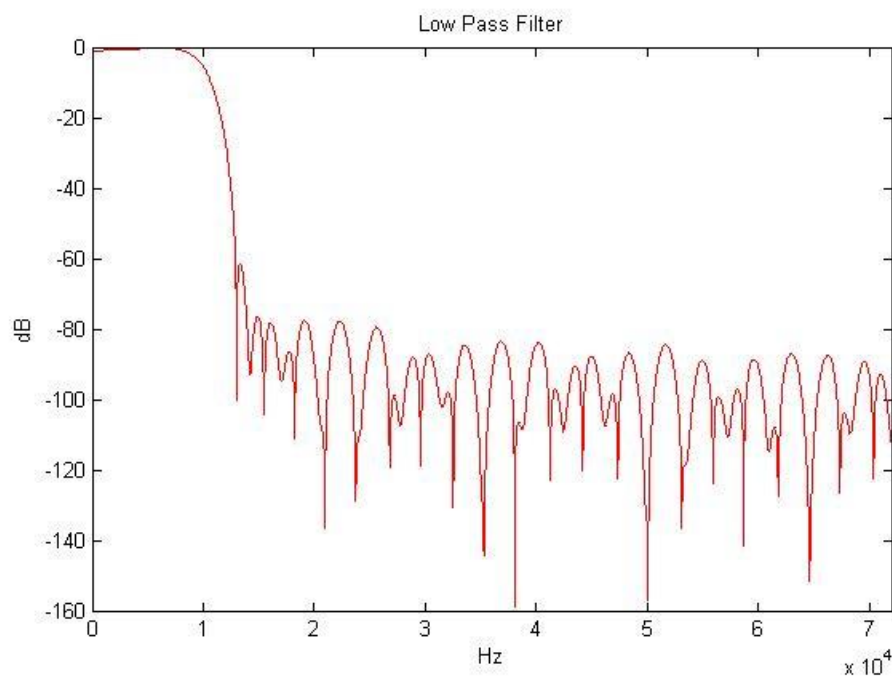
A root-raised-cosine filter (RRC) is used as a transmitting and receiving filter in both digital communication systems to perform matched filtering. The combined response of such two filters is that of the raised-cosine filter. The raised-cosine filter is often used for pulse-shaping in digital modulation, known for its ability to minimize intersymbol interference (ISI).

The graphs below show the transfer function of the aforementioned filter when the authorized modulation bandwidth is 20 kHz and 22 kHz, respectively.

BSR75 Transmitter low pass filter for TI D-LMR (20 kHz authorized bandwidth):



BSR75 Transmitter low pass filter for TETRA (22 kHz authorized bandwidth):



Occupied Bandwidth

SPECIFICATION

FCC §2.1049, §90.209.

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
854-869	25	20

Note: Operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the Adjacent Channel Power limits of § 90.221.

RSS-119 Clause 5.5.

Frequency Band (MHz)	Related SRSP for Channelling Plan and e.r.p.	Channel Spacing (kHz)	Authorized Bandwidth (kHz)
851-866 and 866-869	SRSP-502	6.25 12.5 25	6 11.25 20 / 22

METHOD

The EUT was configured to transmit a modulated carrier signal. The 99% occupied bandwidth and the -26 dBc bandwidths were measured directly using the built-in bandwidth measuring option of spectrum analyser E4440A.

RESULTS (see next plots)

TI D-LMR 20 kHz.

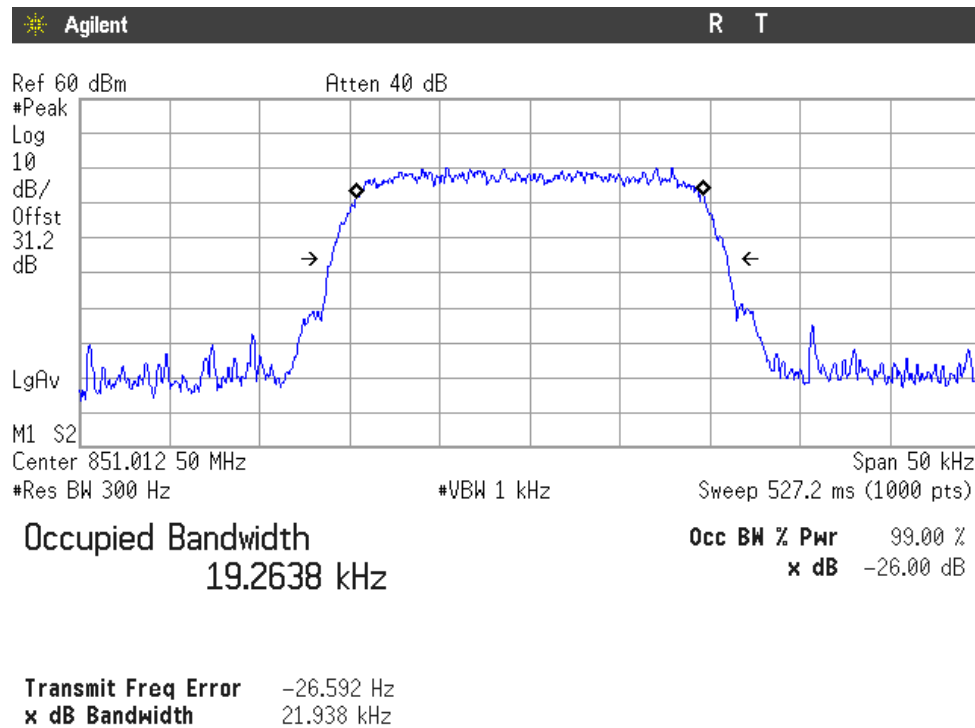
Channel	99% Occupied bandwidth (kHz)	-26 dBc bandwidth (kHz)
851.0125 MHz	19.2638	21.938
854.0125 MHz	19.1079	21.850
861.5 MHz	19.1717	21.723
868.9875 MHz	19.1689	21.905
Measurement uncertainty (kHz)	<±0.17	

TETRA 22 kHz.

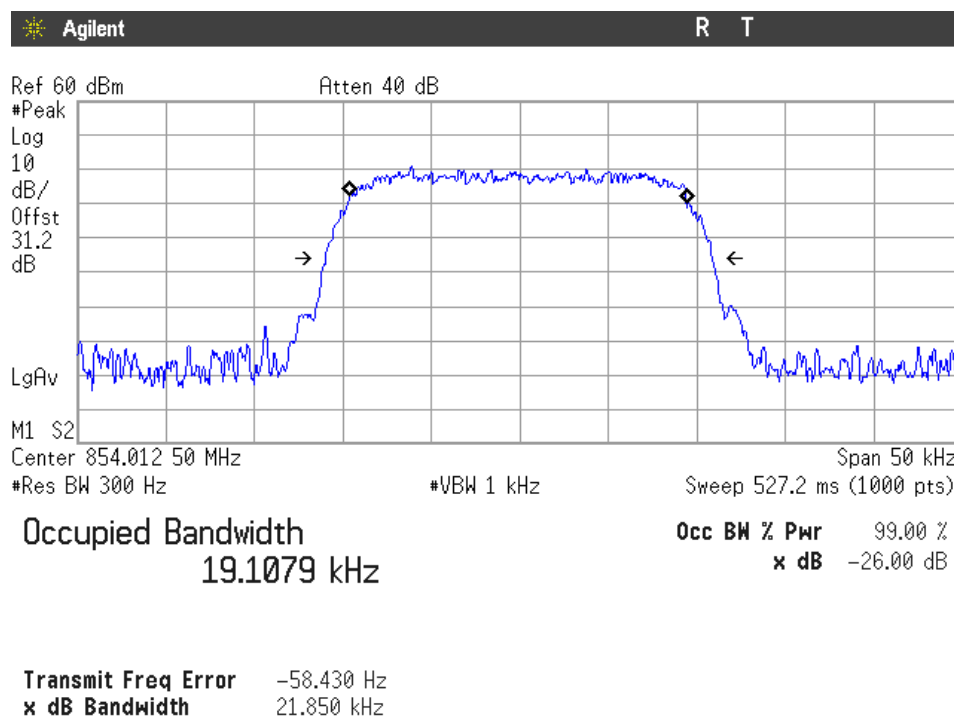
Channel	99% Occupied bandwidth (kHz)	-26 dBc bandwidth (kHz)
851.0125 MHz	20.1921	23.114
854.0125 MHz	20.2772	23.015
861.5 MHz	20.2898	23.443
868.9875 MHz	20.2629	23.497
Measurement uncertainty (kHz)	<±0.17	

TI D-LMR 20 kHz.

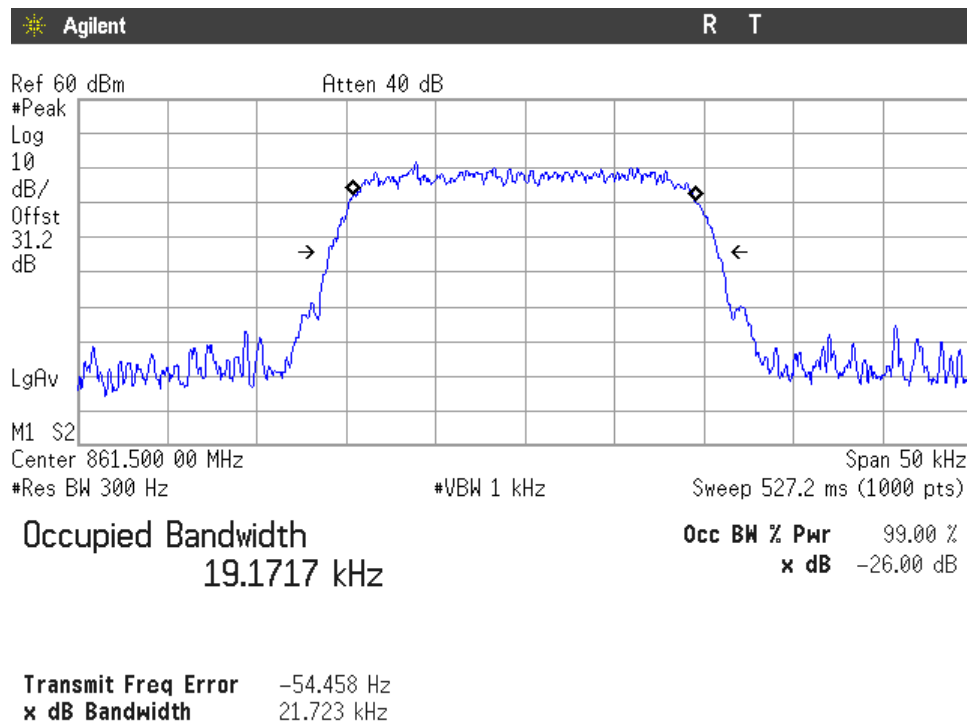
RSS-119 Lowest Channel 851.0125 MHz



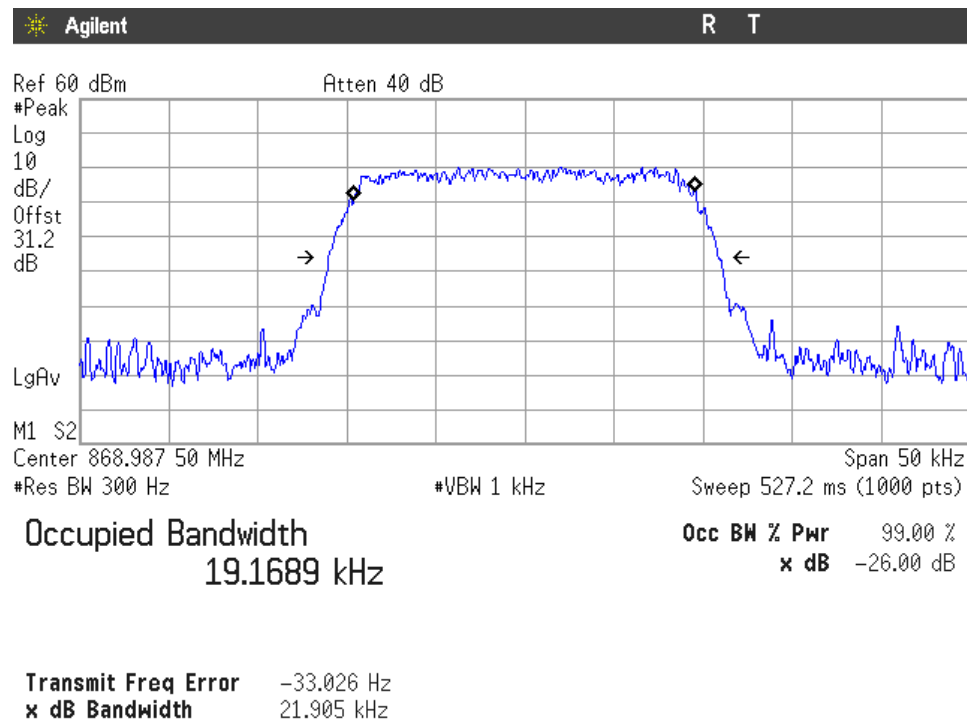
FCC 90 Lowest Channel 854.0125 MHz



Middle Channel

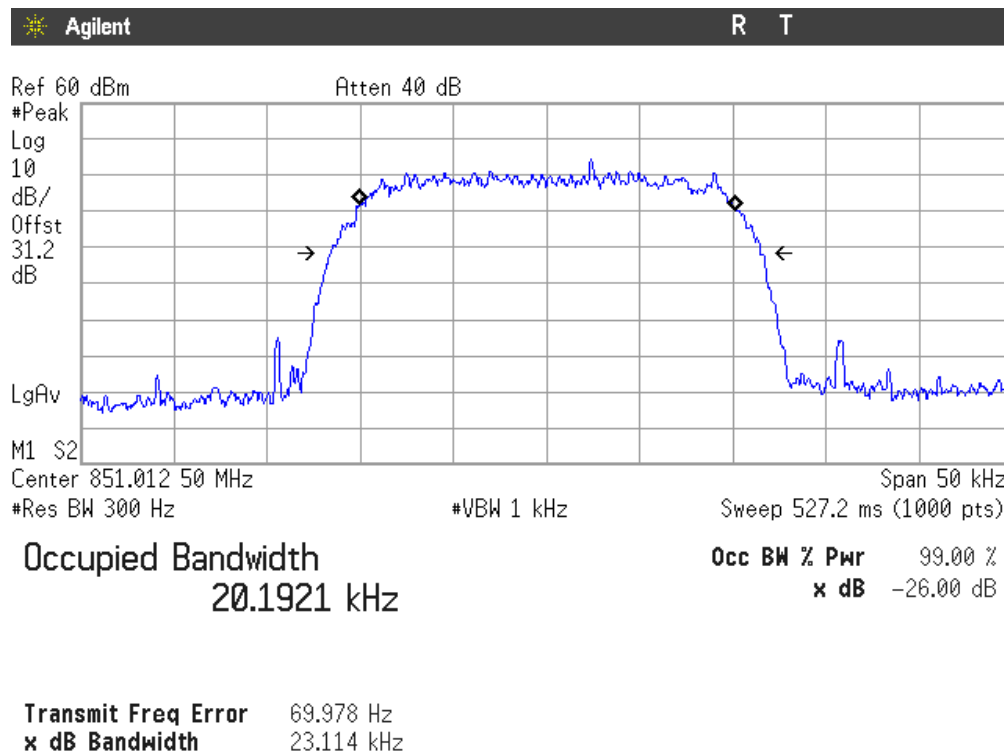


Highest Channel

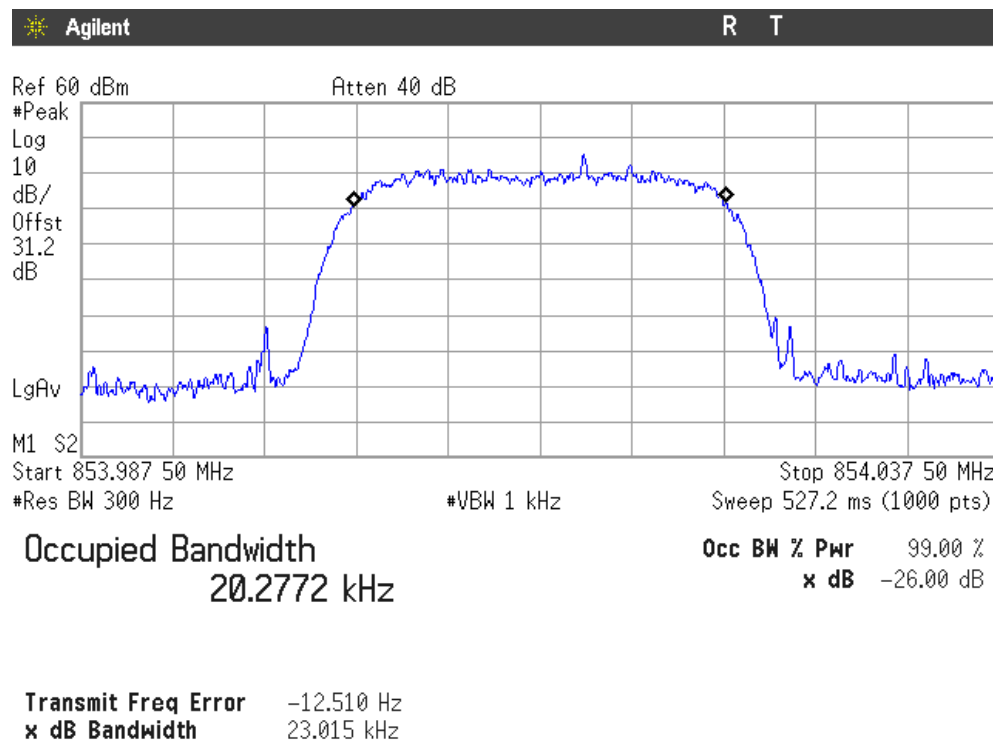


TETRA 22 kHz.

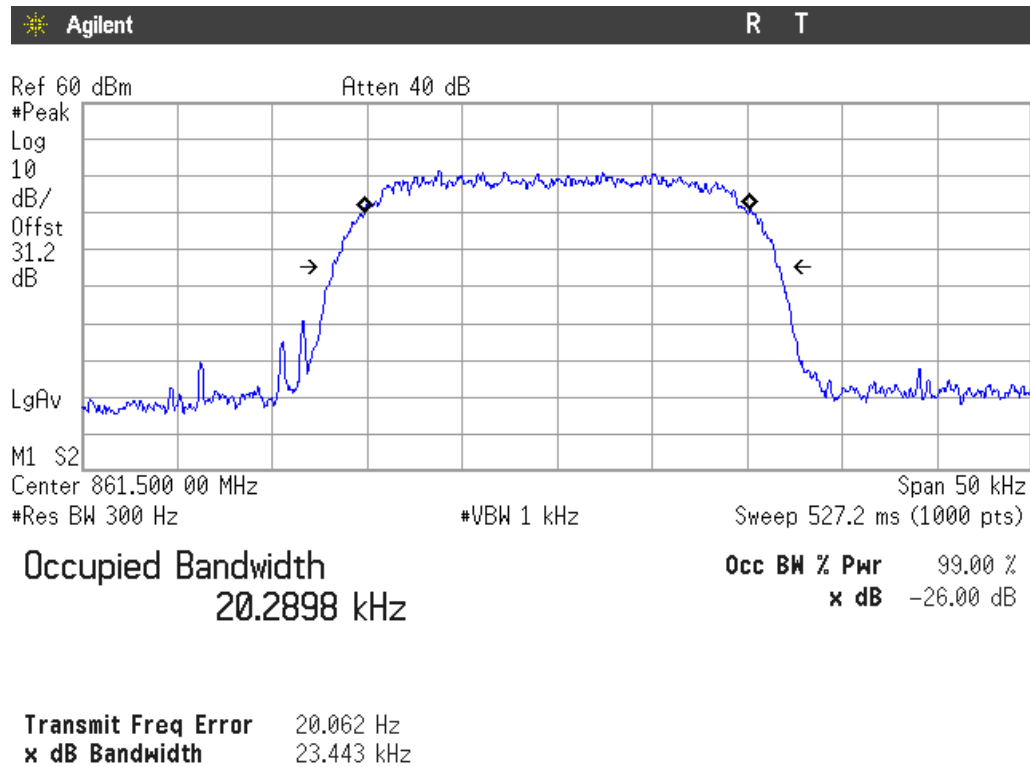
RSS-119 Lowest Channel 851.0125 MHz



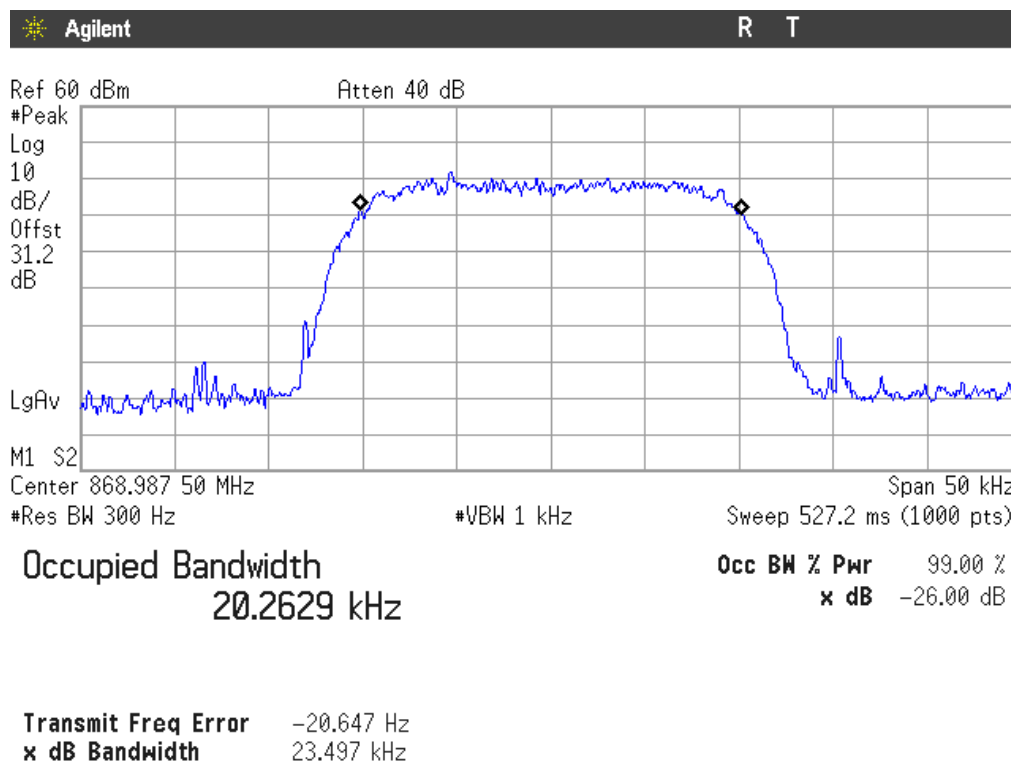
FCC 90 Lowest Channel 854.0125 MHz



Middle Channel



Highest Channel



RF Output Power

SPECIFICATION

FCC §90.205 and §90.635. 809-824 MHz and 854-869 MHz bands.

The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw / 60 dBm) and 304 m.

RSS-119 Clause 5.4.

The output power shall be within ± 1 dB of the manufacturer's rated power listed in the equipment specifications.

The transmitter output power limits set forth in the following table will come into force upon the publication of Issue 12 of this standard and will apply to newly certified equipment.

Frequency Band (MHz)	Transmitter Output Power (W)	
	Base/Fixed Equipment	Mobile Equipment
851-866 and 866-869	110	30

METHOD

The conducted RF output power measurements were made at the RF output terminals of the EUT using an attenuator and a calibrated power sensor.

RESULTS

Manufacturer's rated power: 75 W (48.75 dBm).

TI D-LMR. 20 kHz Bandwidth	Frequency (MHz)	Maximum average power (dBm)	Maximum deviation (dB)
	851.0125	48.58	-0.17
	854.0125	48.53	-0.22
	861.5	48.35	-0.40
	868.9875	48.40	-0.35
Measurement uncertainty (dB)		< ± 0.33	

TETRA. 22 kHz Bandwidth	Frequency (MHz)	Maximum average power (dBm)	Maximum deviation (dB)
	851.0125	49.20	0.45
	854.0125	49.16	0.41
	861.5	49.08	0.33
	868.9875	49.22	0.47
Measurement uncertainty (dB)		<±0.33	

The sum of the system loss (dB) and antenna gain (dBd) for the worst case of conducted power (49.22 dBm) shall be such that the Effective Radiated Power (E.R.P.) shall not exceed the limit indicated above.

Verdict: PASS

Emission Mask

SPECIFICATION

FCC §90.210, FCC §90.691:

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
809-824/854-869 ^{3,5}	B	G

3: Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of §90.691.

5: Equipment may alternatively meet the Adjacent Channel Power limits of §90.221.

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

- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

FCC §90.691. Emission mask requirements for EA-based systems. Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

- (1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log₁₀(f/6.1) decibels or 50 + 10 Log₁₀(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.
- (2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log₁₀(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

RSS-119 Clauses 5.5 and 5.8.

Frequency Band (MHz)	Related SRSP for Channelling Plan and e.r.p.	Channel Spacing (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for equipment with Audio Filter	Spectrum Masks for equipment Without Audio Filter
851-866 and 866-869	SRSP-502	25	20	B	G
			22	Y	Y

FM transmitters with voice input may use the spectrum mask for equipment with an audio filter if they are equipped with suitable filters to be used for the audio signal only and not for other purposes. Equipment employing other modulations shall comply with the spectrum masks for equipment without an audio filter.

Table 10 - Emission Mask G

Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$10 < f_d \leq 50$	whichever is the lesser attenuation: 70 or $116 \log_{10}(f_d/6.11)$ or $50 + 10 \log_{10}(p)$	300
$f_d > 50$	$43 + 10 \log_{10}(p)$	Specified in Section 4.2.1

Table 17 - Emission Mask Y

Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$12.375 < f_d \leq 13.975$	whichever is the lesser attenuation: $30 + 16.67(f_d - 12.375)$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2
$f_d > 13.975$	whichever is the lesser attenuation: 57 or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2

METHOD

The emission masks were measured at the RF output terminals of the EUT using an attenuator and a spectrum analyser with a built-in spectrum mask measurement function.

RESULTS (see next plots)

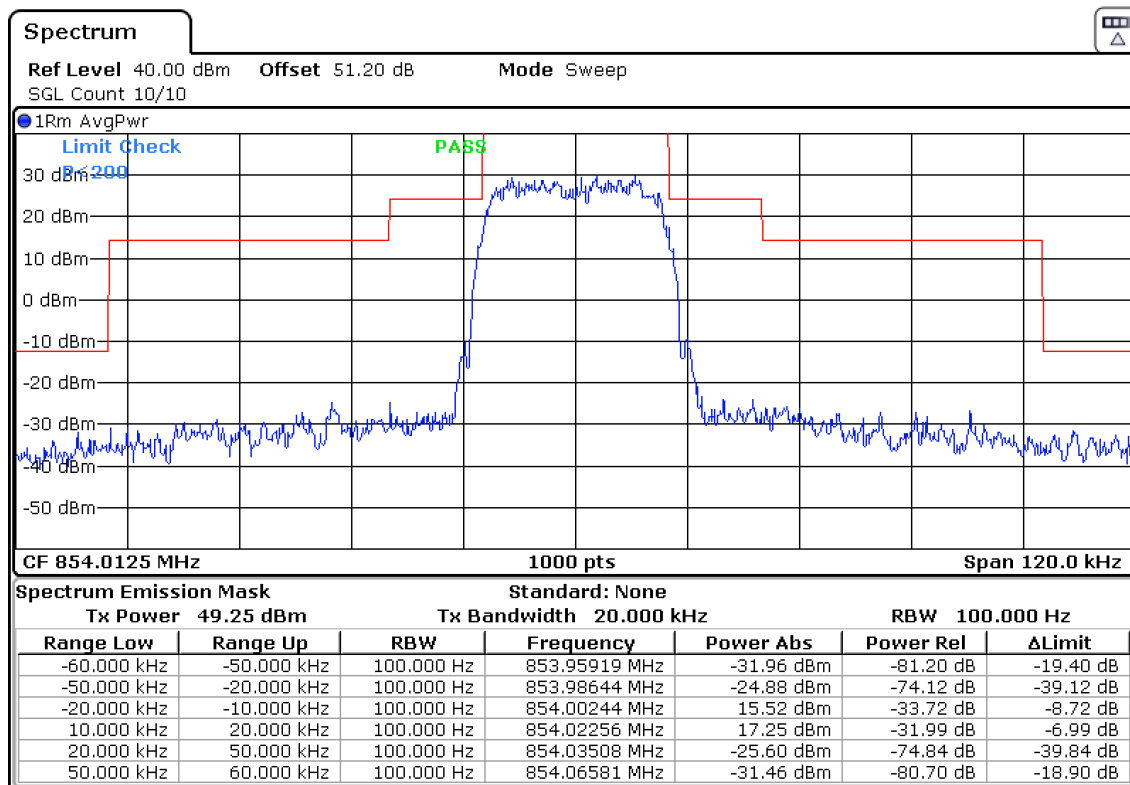
Measurement uncertainty (dB)	$< \pm 0.33$
------------------------------	--------------

Verdict: PASS

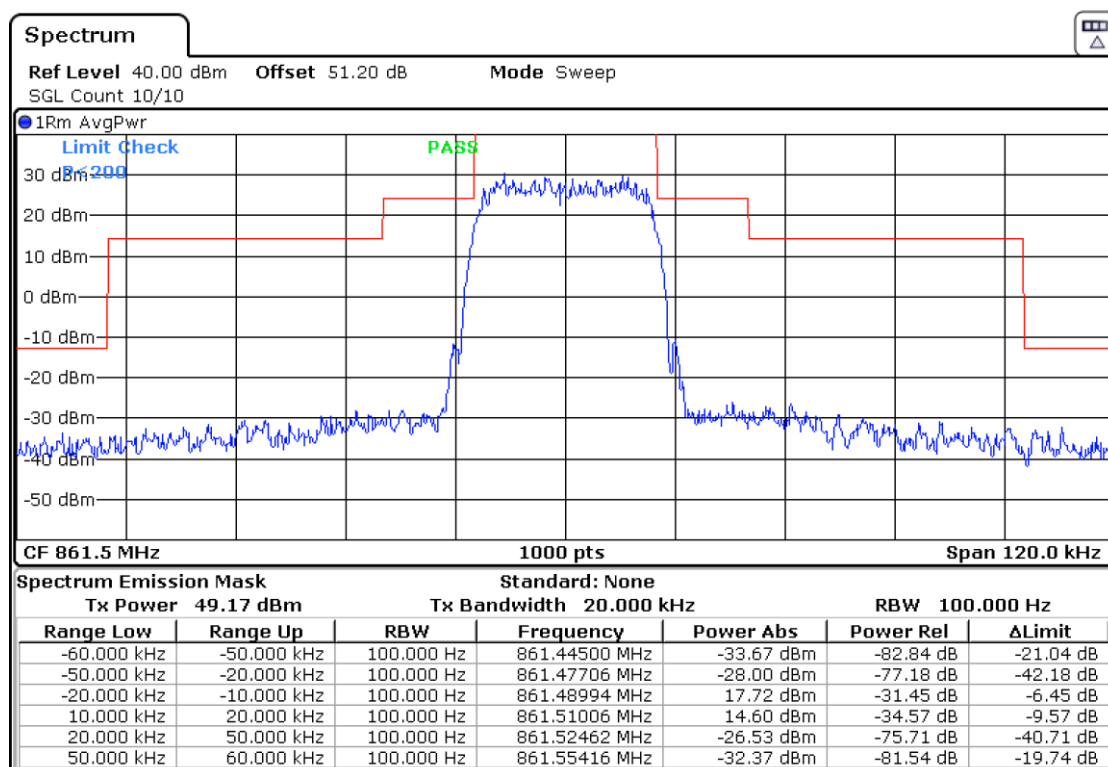
FCC 90 Emission Mask B.

TI D-LMR 20 kHz Bandwidth.

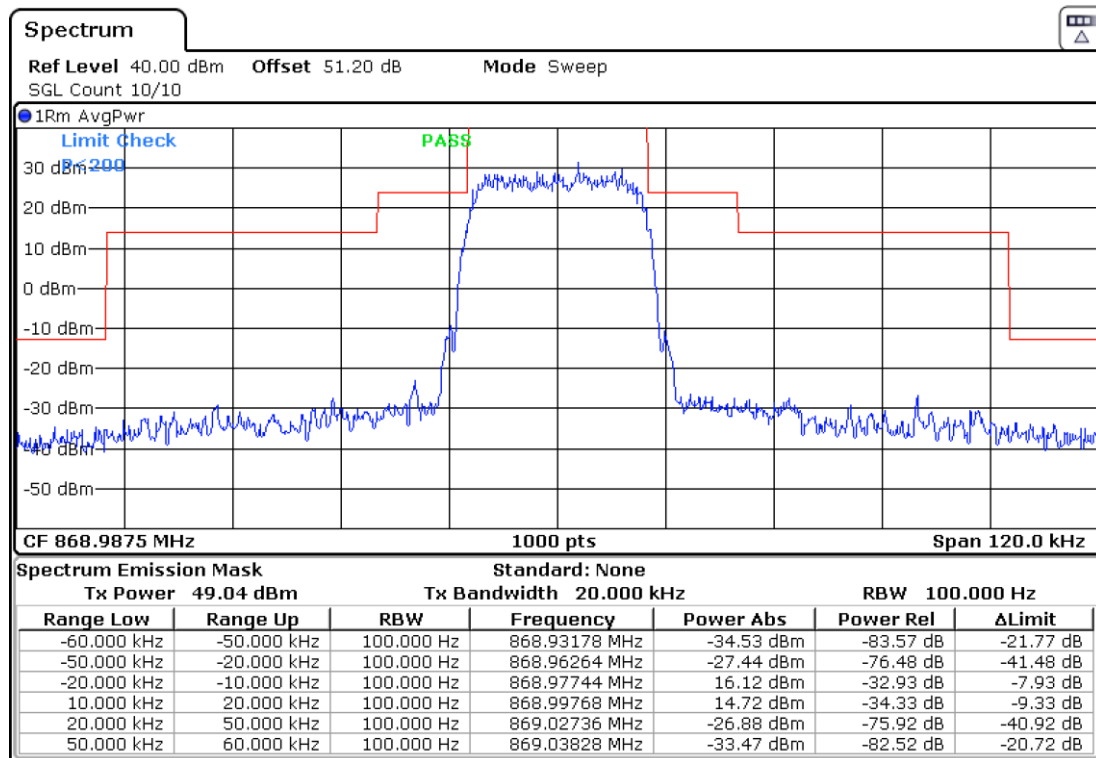
FCC 90 Lowest Channel 854.0125 MHz



Middle Channel



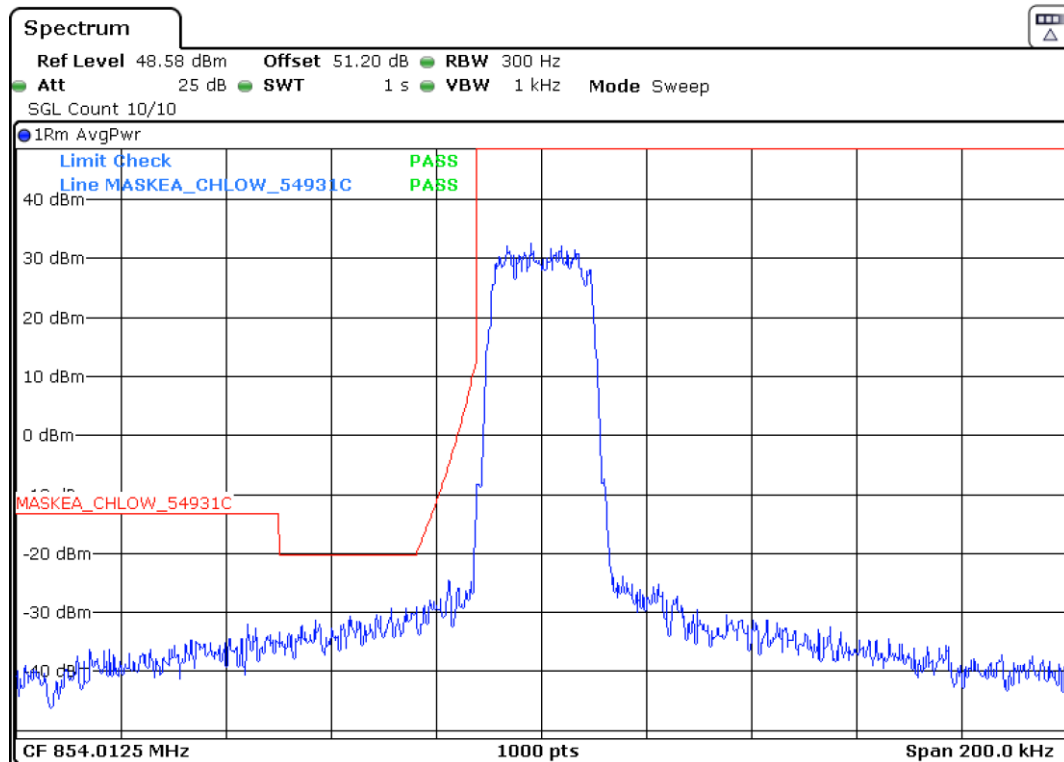
Highest Channel



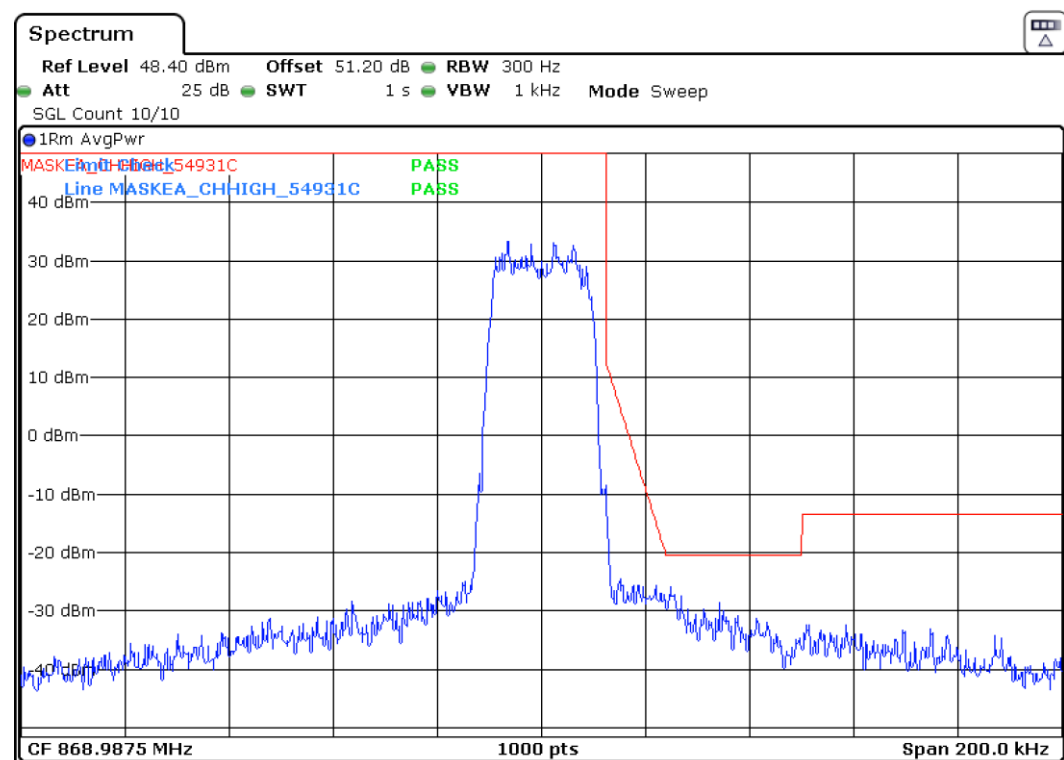
FCC 90 Emission Mask EA.

TI D-LMR 20 kHz Bandwidth.

FCC 90 Lowest Channel 854.0125 MHz



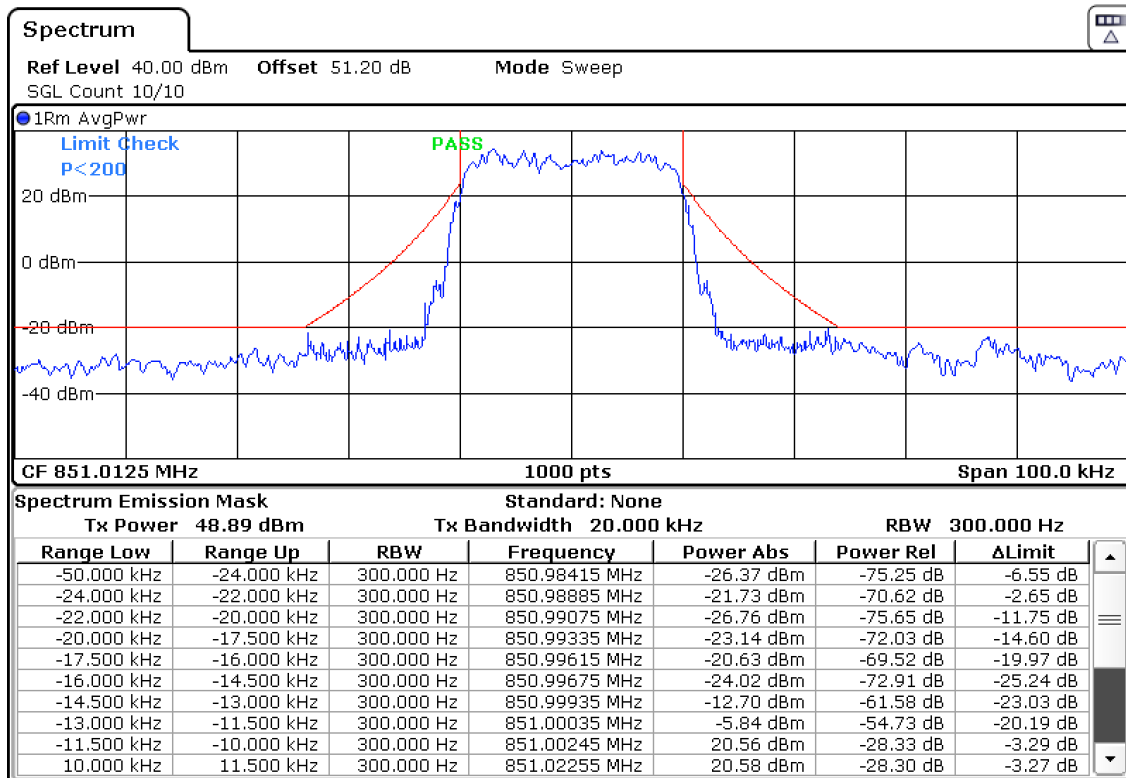
Highest Channel



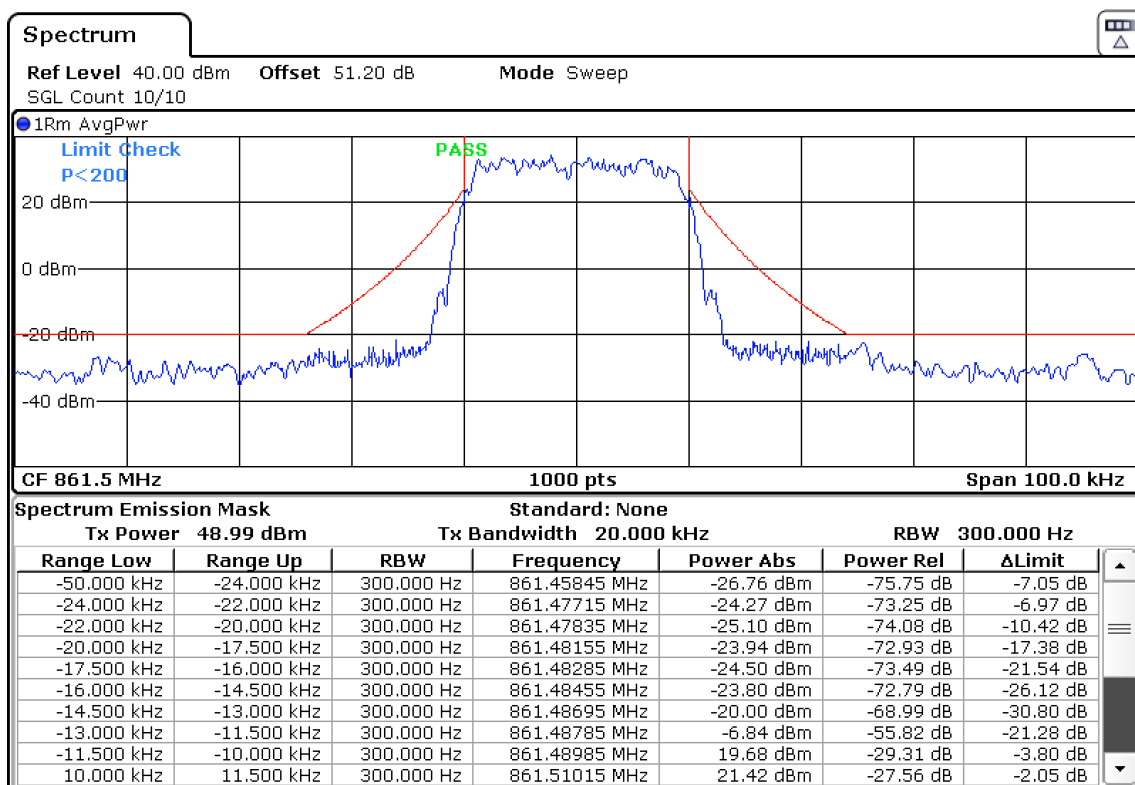
RSS-119 Emission Mask G.

TI D-LMR 20 kHz Bandwidth.

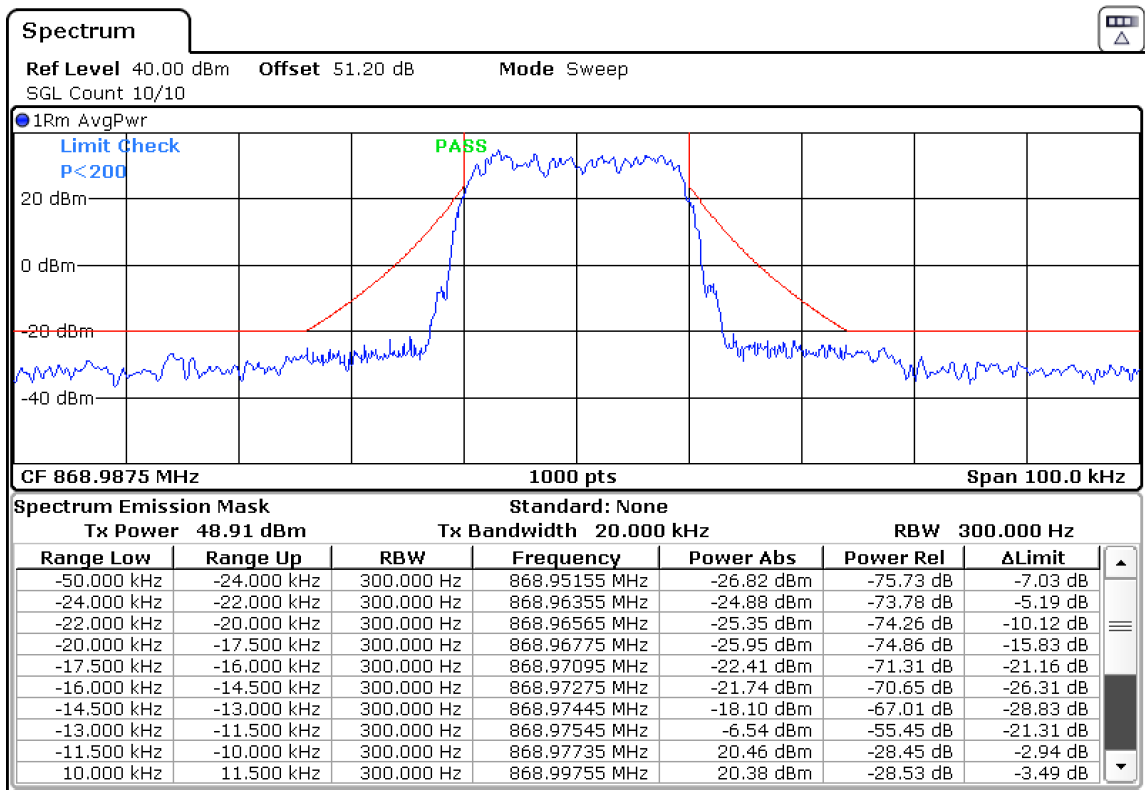
RSS-119 Lowest Channel 851.0125 MHz



Middle Channel



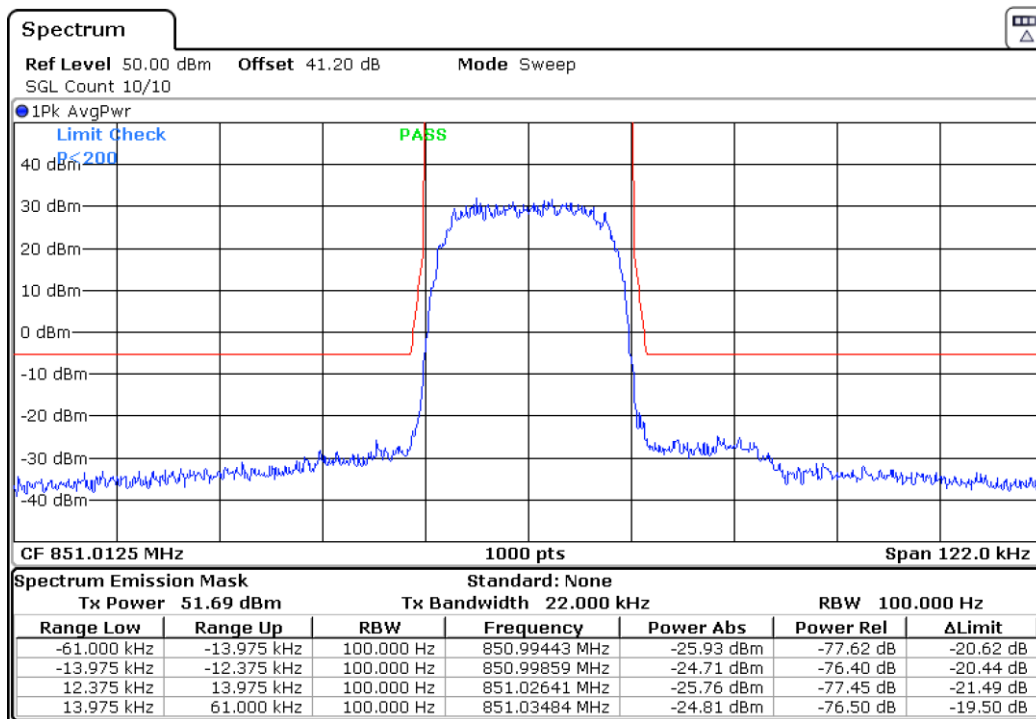
Highest Channel



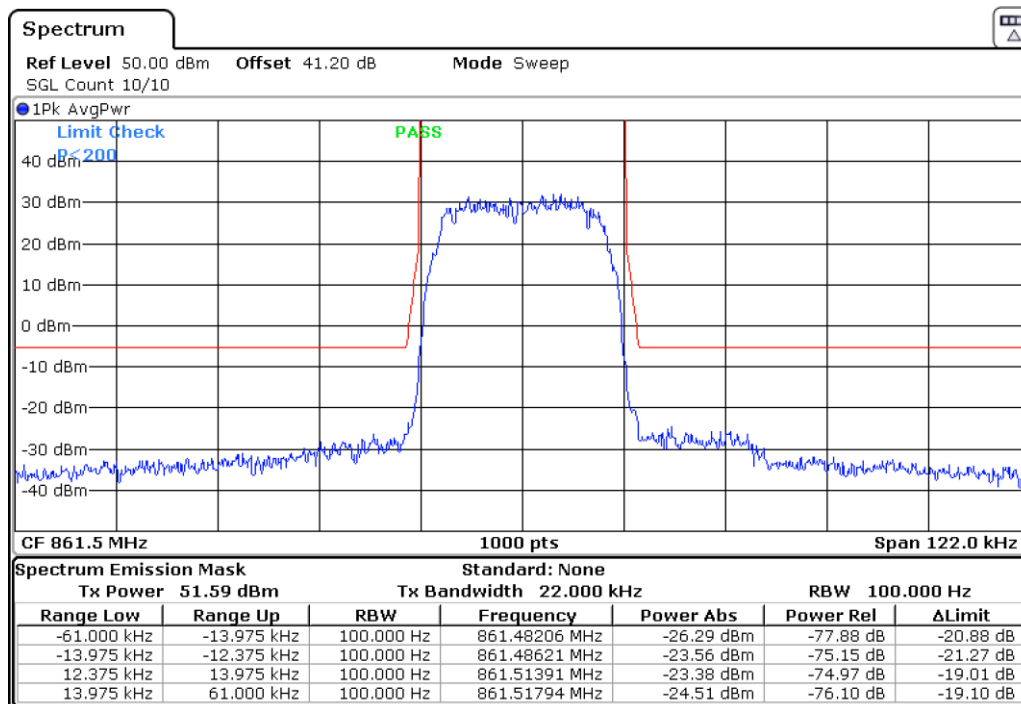
RSS-119 Emission Mask Y.

TETRA 22 kHz Bandwidth.

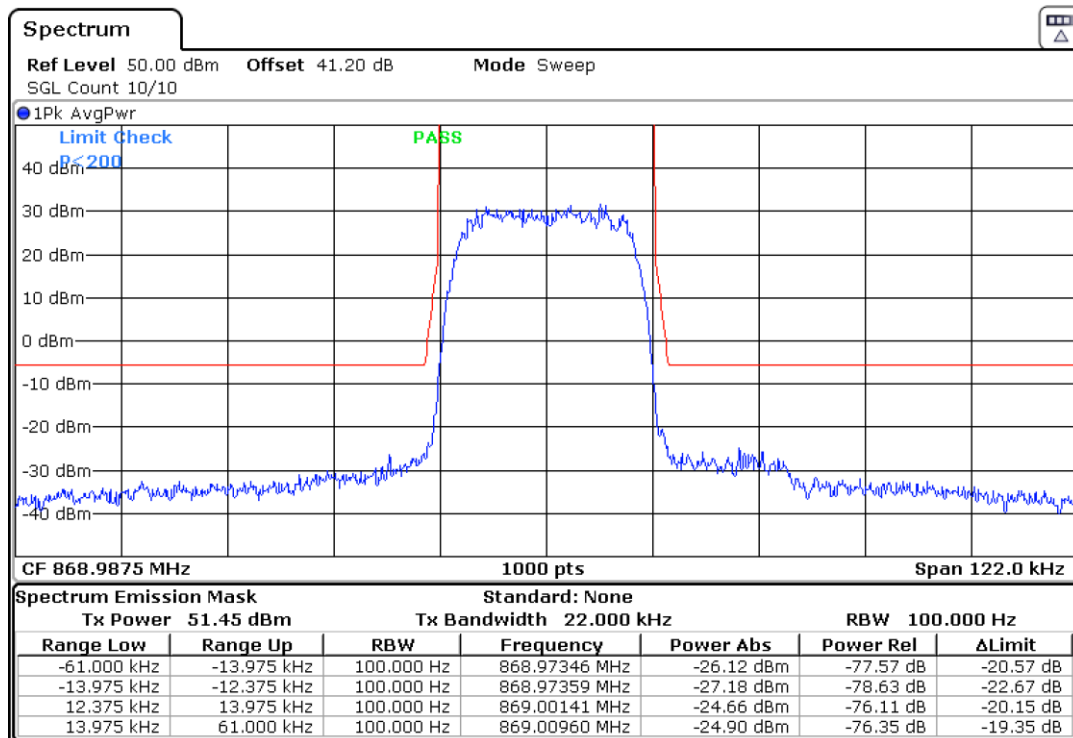
RSS-119 Lowest Channel 851.0125 MHz



Middle Channel



Highest Channel



Adjacent channel power

SPECIFICATION

FCC §90.221. 854–869 MHz band.

(a) For the frequency bands indicated below, operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the adjacent channel power (ACP) limits below. The table specifies a value for the ACP as a function of the displacement from the channel center frequency and a measurement bandwidth of 18 kHz.

(c)(1) Maximum adjacent power levels for frequencies in the 809–824/854–869 MHz band:

Frequency offset	Maximum ACP (dBc) for devices less than 15 watts	Maximum ACP (dBc) for devices 15 watts and above
25 kHz	-55 dBc	-55 dBc
50 kHz	-65 dBc	-65 dBc
75 kHz	-65 dBc	-70 dBc

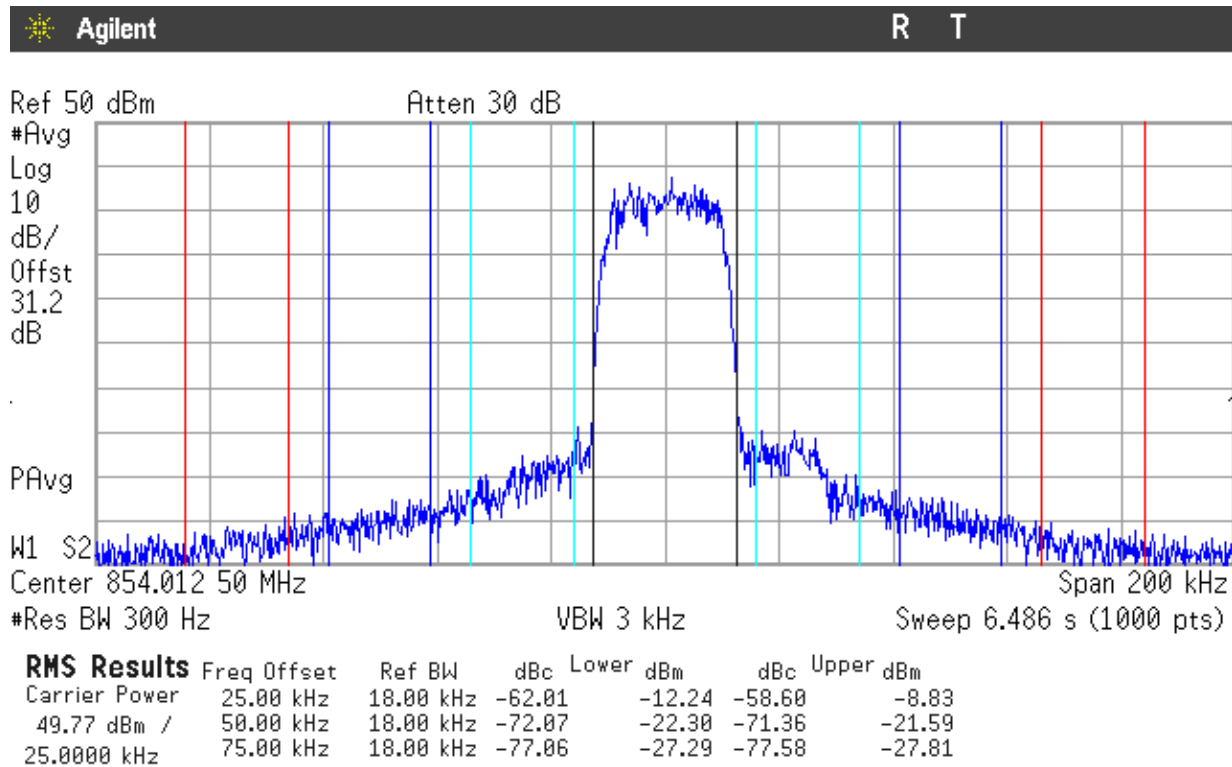
(2) In any case, no requirement in excess of -36 dBm shall apply.

(d) On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least $43 + 10 \log (P_{\text{watts}})$ dB.

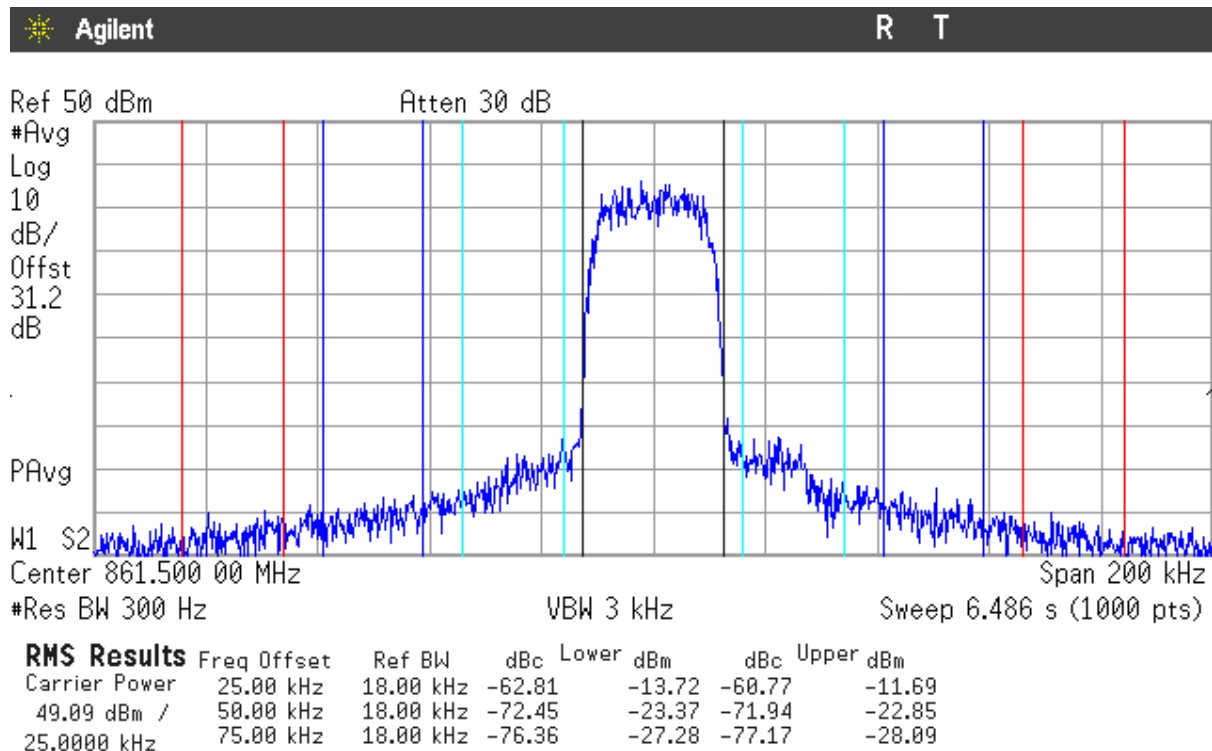
Measurement uncertainty (dB)	<±0.64
------------------------------	--------

TETRA 22 kHz.

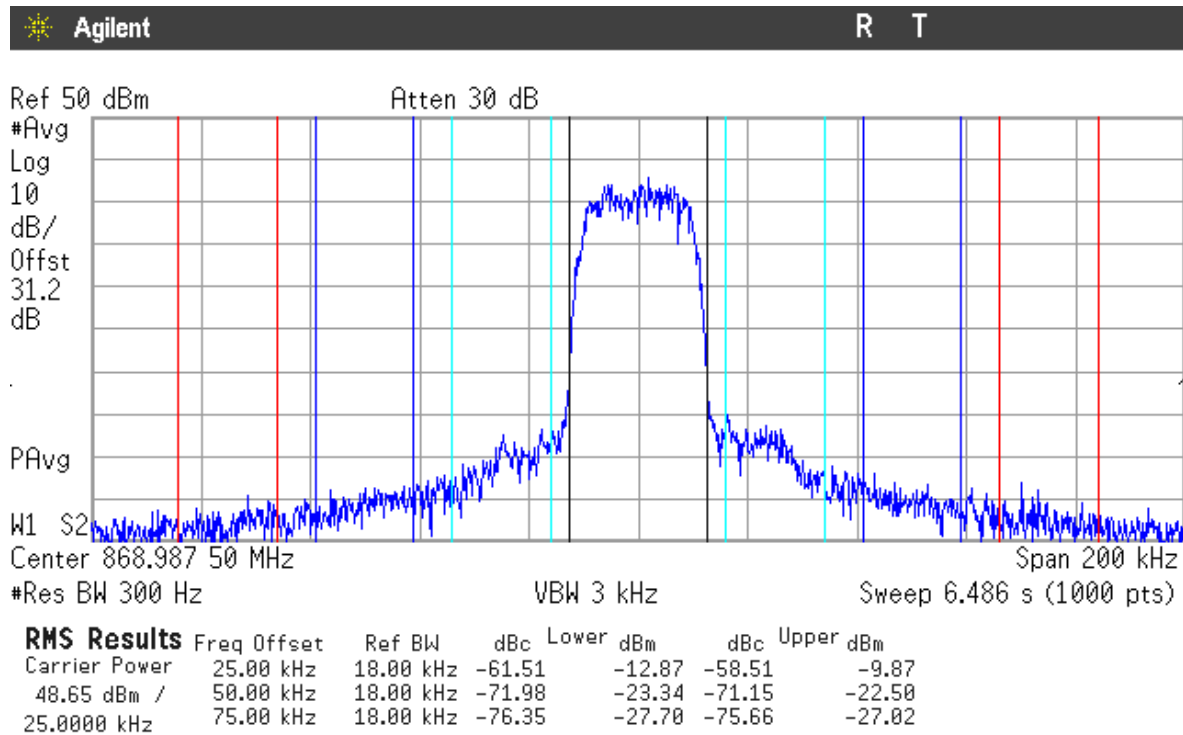
FCC 90 Lowest Channel 854.0125 MHz



Middle Channel



Highest Channel



Frequency Stability

SPECIFICATION

FCC §2.1055, §90.213. 854–869 MHz bands

Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Frequency range (MHz)	Fixed and base stations
854–869	1.5 ppm

RSS-119 Clause 5.3.

The carrier frequency shall not depart from the reference frequency in excess of the values given in the following table:

Frequency Band (MHz)	Channel Spacing (kHz)	Frequency Stability (ppm)
		Base/Fixed
851-866 and 866-869	25 (Note)	0.1
	25	1.5
	12.5	1
	6.25	0.1

Note: This provision is for digital equipment with a channel bandwidth of 25 kHz and an occupied bandwidth greater than 20 kHz.

METHOD

The frequency tolerance measurements over temperature variations were made over the temperature range of –30°C to +50°C. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10°C steps from –30°C up to +50°C.

Frequency Stability vs Voltage: Vary primary supply voltage from 85 to 115 percent of the nominal value. Extreme voltages have also been selected taking into account the operational voltage range indicated by the applicant.

The EUT is set in continuous transmission without modulation (only carrier) and the frequency is measured with the frequency meter of Radiocommunication analyzer HP 8920A.

RESULTS

Middle Channel.

Voltage (Vdc)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
Frequency stability with Temperature			
27.40	+50	-10	-0.01161
	+40	-10	-0.01161
	+30	-11	-0.01277
	+20	-11	-0.01277
	+10	-12	-0.01393
	0	-12	-0.01393
	-10	-13	-0.01509
	-20	-13	-0.01509
	-30	-14	-0.01625
Frequency stability with Supply Voltage			
21.10	20	-11	-0.01277
31.70	20	-11	-0.01277

Measurement uncertainty	$<\pm 1 \times 10^{-6}$
-------------------------	-------------------------

Verdict: PASS

Spurious emissions at antenna terminals

SPECIFICATION

FCC §2.1051, §90.210, §90.221, §90.691. 854–869 MHz band.

Emission Mask B.

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

Emission mask requirements for EA-based systems.

For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

Adjacent channel power limits.

On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least $43 + 10 \log(P_{\text{watts}})$ dB.

RSS-119 Clause 5.8.

Table 10 - Emission Mask G

Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$10 < f_d \leq 50$	whichever is the lesser attenuation: 70 or $116 \log_{10}(f_d/6.11)$ or $50 + 10 \log_{10}(p)$	300
$f_d > 50$	$43 + 10 \log_{10}(p)$	Specified in Section 4.2.1

Table 17 - Emission Mask Y

Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$12.375 < f_d \leq 13.975$	whichever is the lesser attenuation: $30 + 16.67(f_d - 12.375)$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2
$f_d > 13.975$	whichever is the lesser attenuation: 57 or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2

METHOD

The EUT RF output connector was connected to a spectrum analyser using a 50 ohm attenuator and the resolution bandwidth of the spectrum analyser was set to 100 kHz for frequencies < 1GHz and 1 MHz for frequencies > 1GHz. The spectrum was investigated from 9 kHz to 10 GHz.

The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyzer.

RESULTS (see plots in next pages)

TI D-LMR 20 kHz bandwidth.

RSS-119 LOWEST CHANNEL: 851.0125 MHz

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
425.522	-22.94	$< \pm 2.03$
1276.750	-31.71	$< \pm 2.03$

FCC 90 LOWEST CHANNEL: 854.0125 MHz

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
427.022	-22.05	$< \pm 2.03$

CHANNEL: MIDDLE

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
430.755	-22.53	$< \pm 2.03$
1292.350	-30.07	$< \pm 2.03$

CHANNEL: HIGHEST

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
434.522	-21.85	$< \pm 2.03$
1303.750	-28.79	$< \pm 2.03$

TETRA 22 kHz bandwidth.

RSS-119 LOWEST CHANNEL: 851.0125 MHz

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
425.522	-23.12	$< \pm 2.03$

FCC 90 LOWEST CHANNEL: 854.0125 MHz

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
427.022	-22.77	$< \pm 2.03$

CHANNEL: MIDDLE

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
430.755	-22.37	$< \pm 2.03$
1292.350	-29.38	$< \pm 2.03$

CHANNEL: HIGHEST

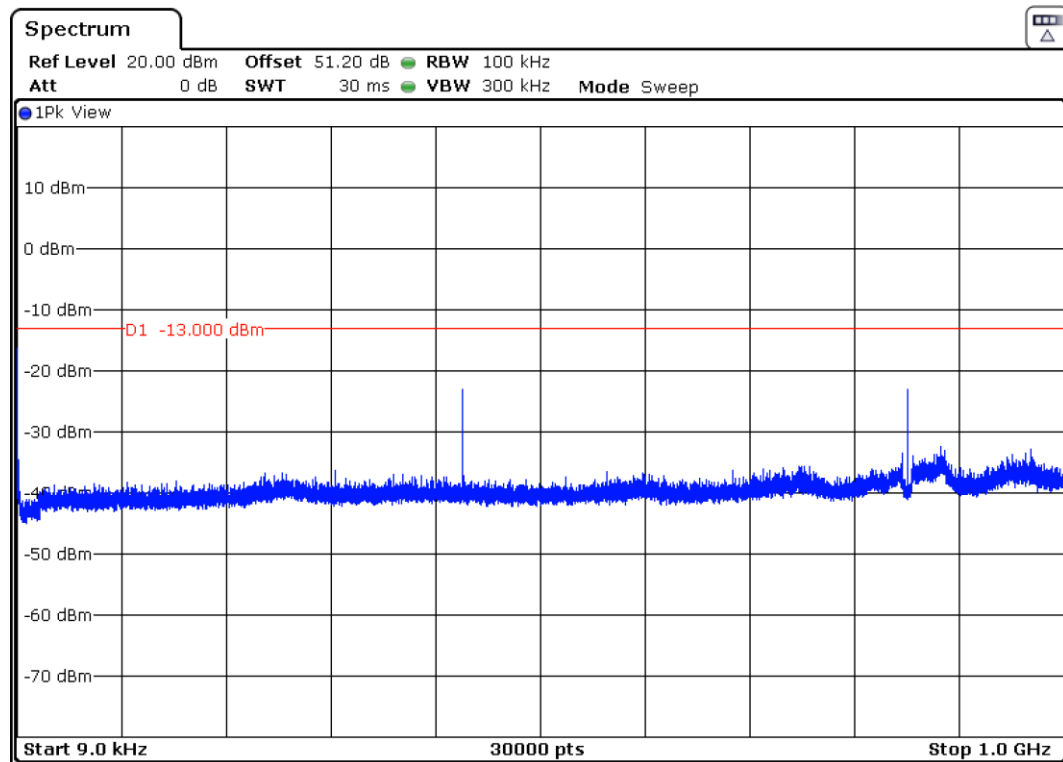
Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
434.522	-21.81	$< \pm 2.03$
1303.750	-29.22	$< \pm 2.03$

Measurement uncertainty (dB)	$< \pm 2.03$
------------------------------	--------------

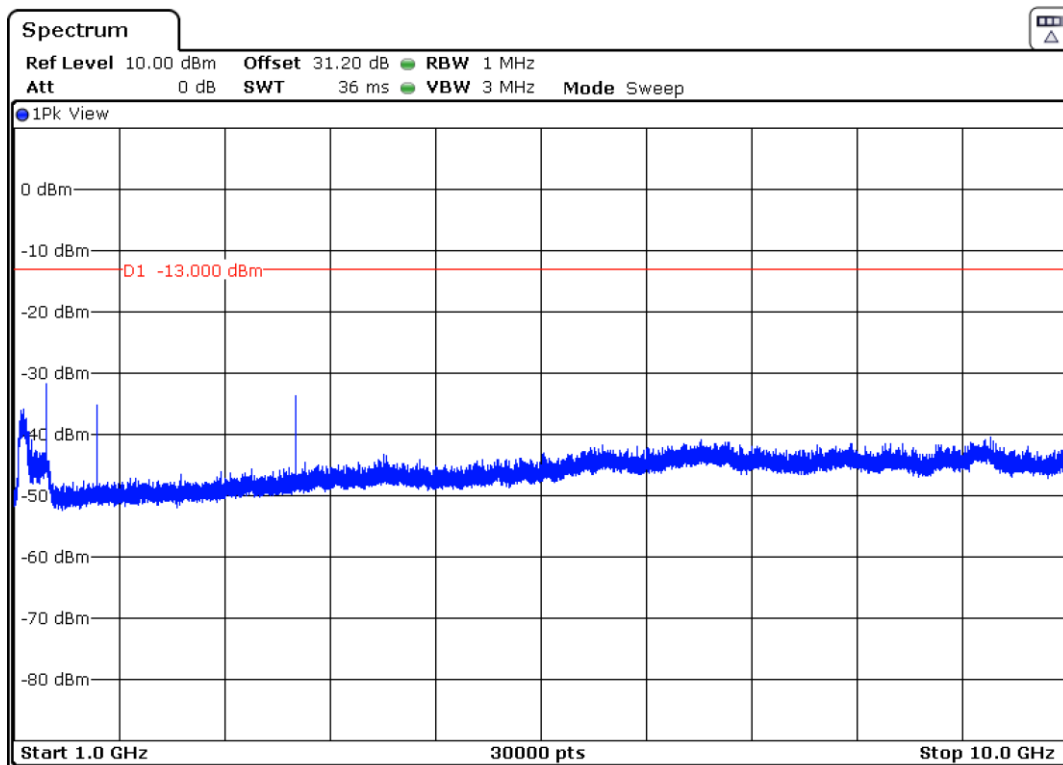
Verdict: PASS

TI D-LMR 20 kHz bandwidth.

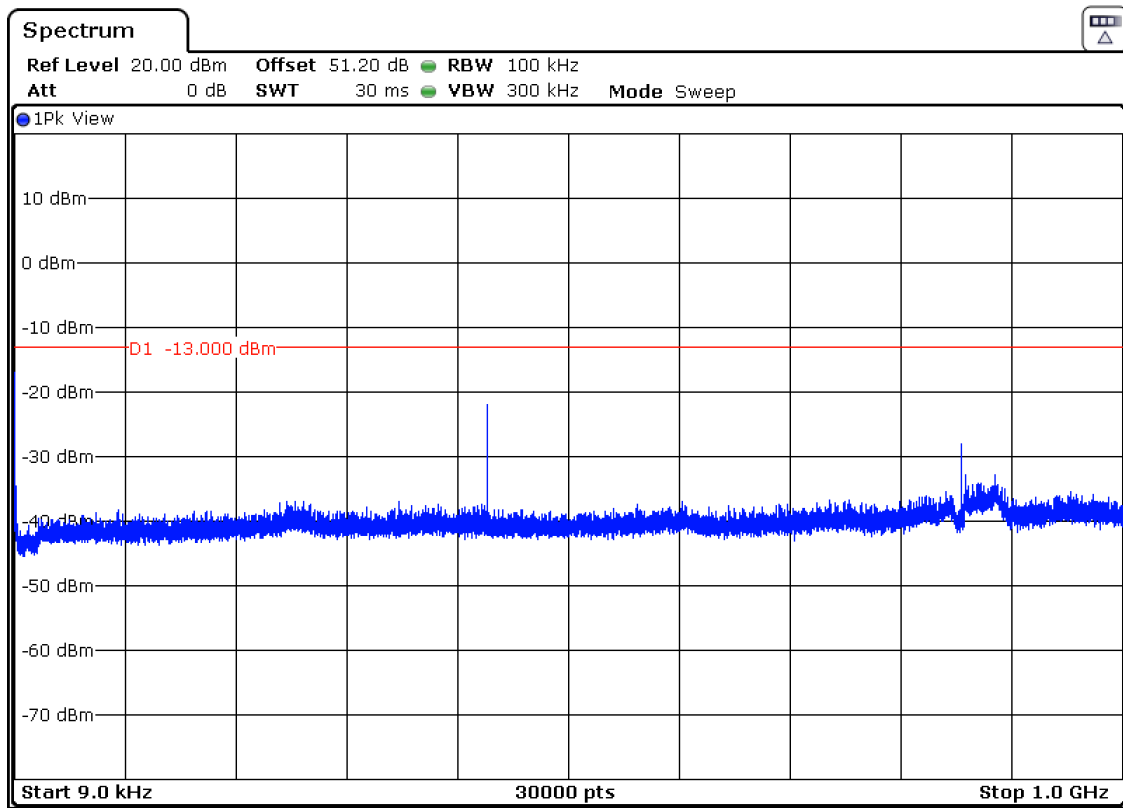
RSS-119 LOWEST CHANNEL: 851.0125 MHz



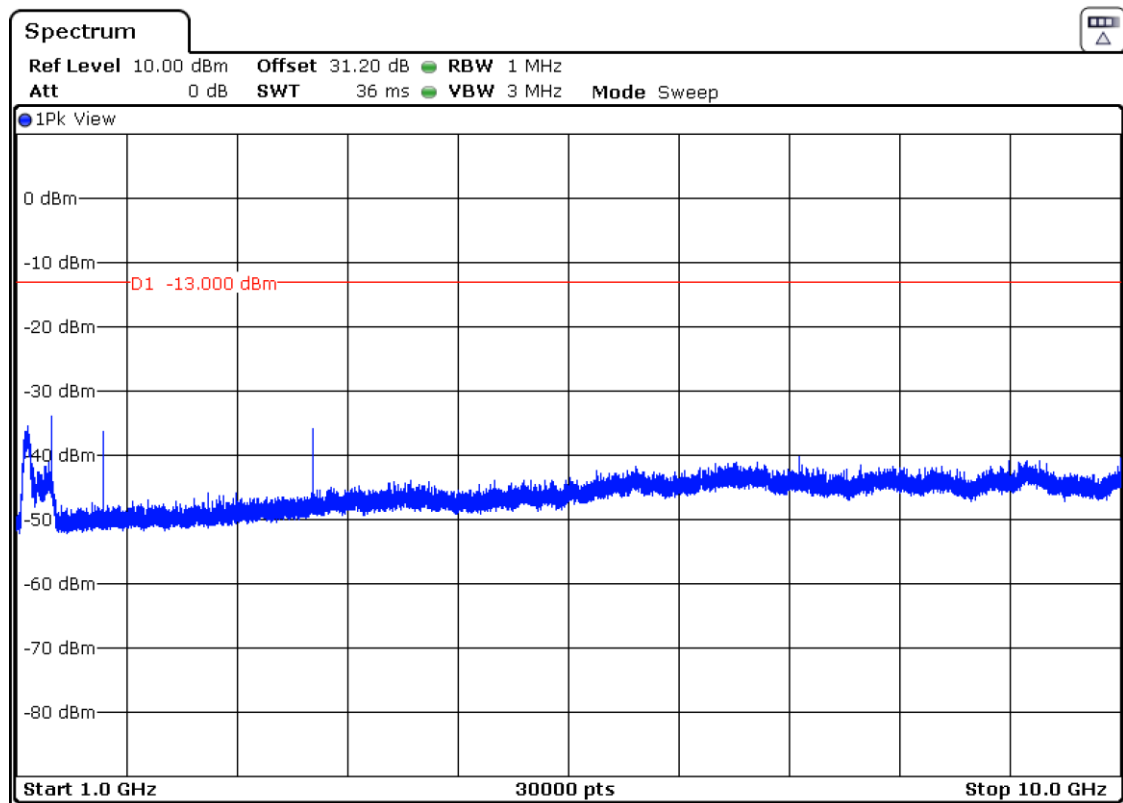
Note: The carrier frequency has been attenuated with a notch filter.



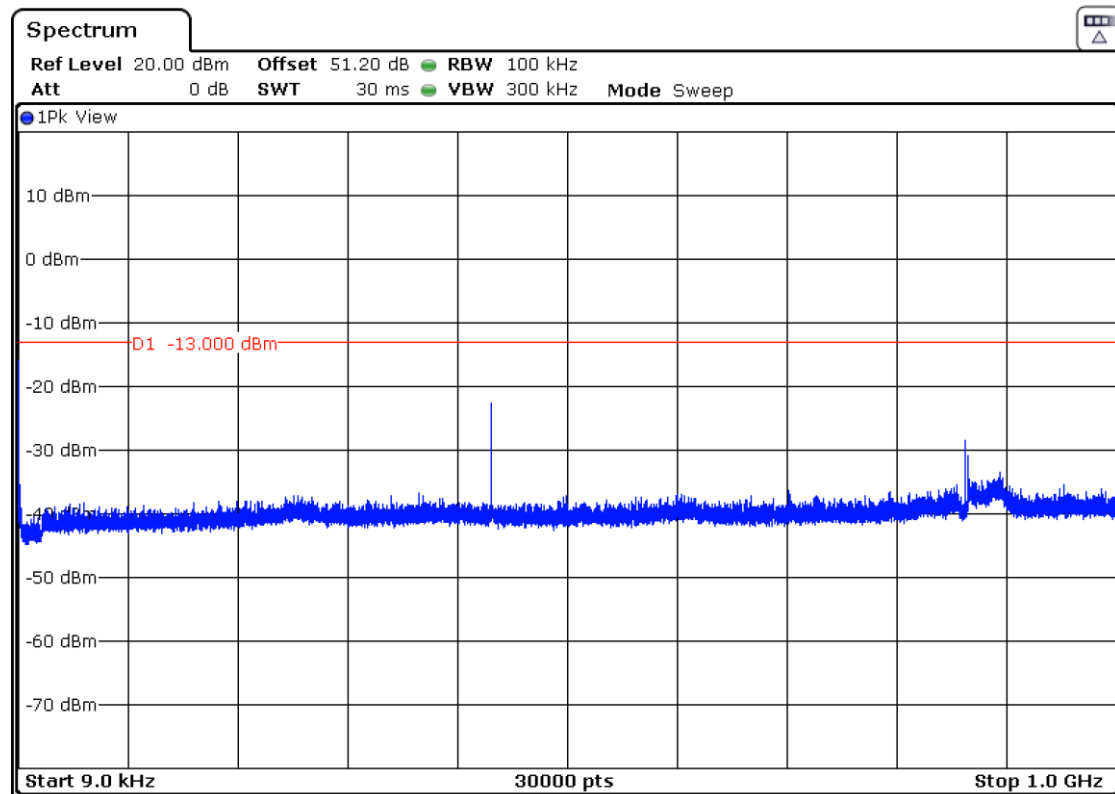
FCC 90 LOWEST CHANNEL: 854.0125 MHz



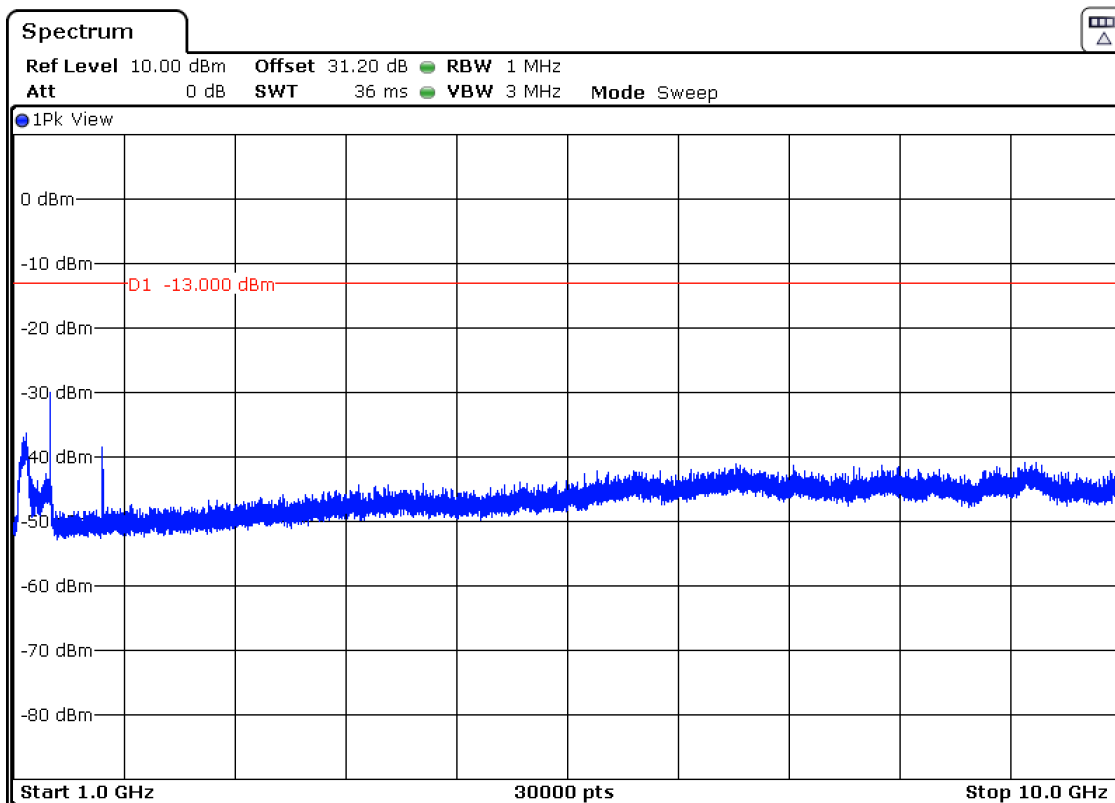
Note: The carrier frequency has been attenuated with a notch filter.



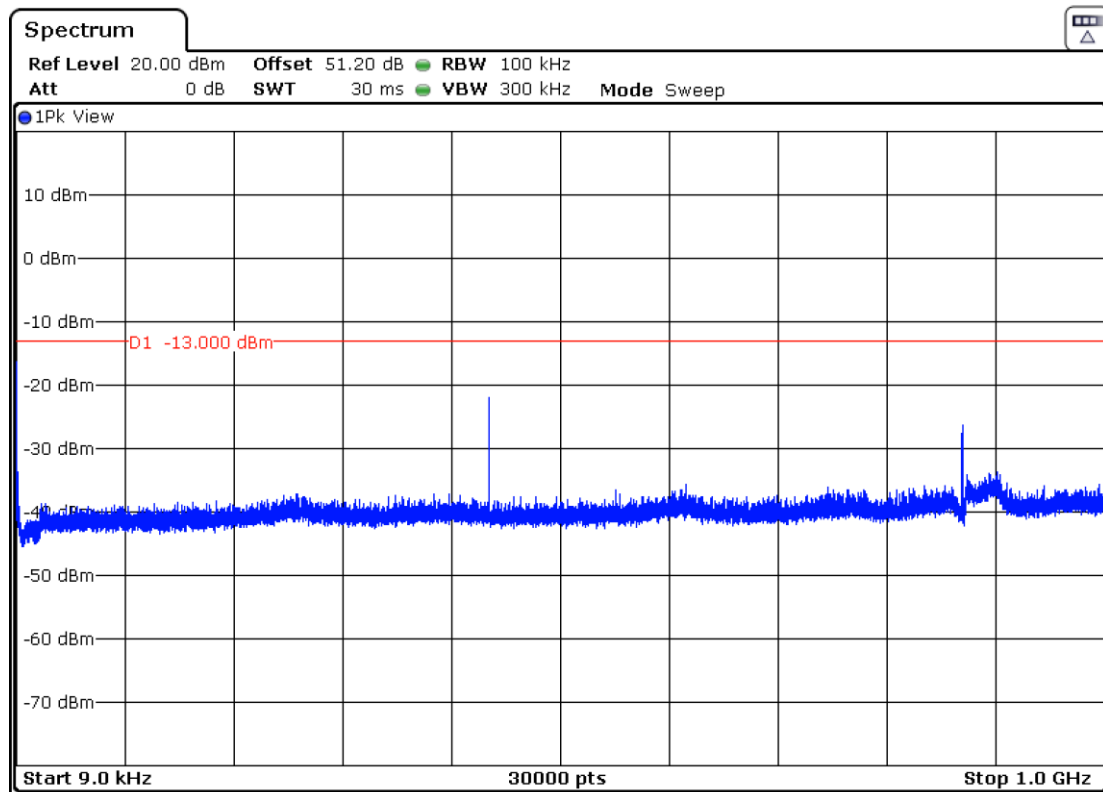
CHANNEL: MIDDLE



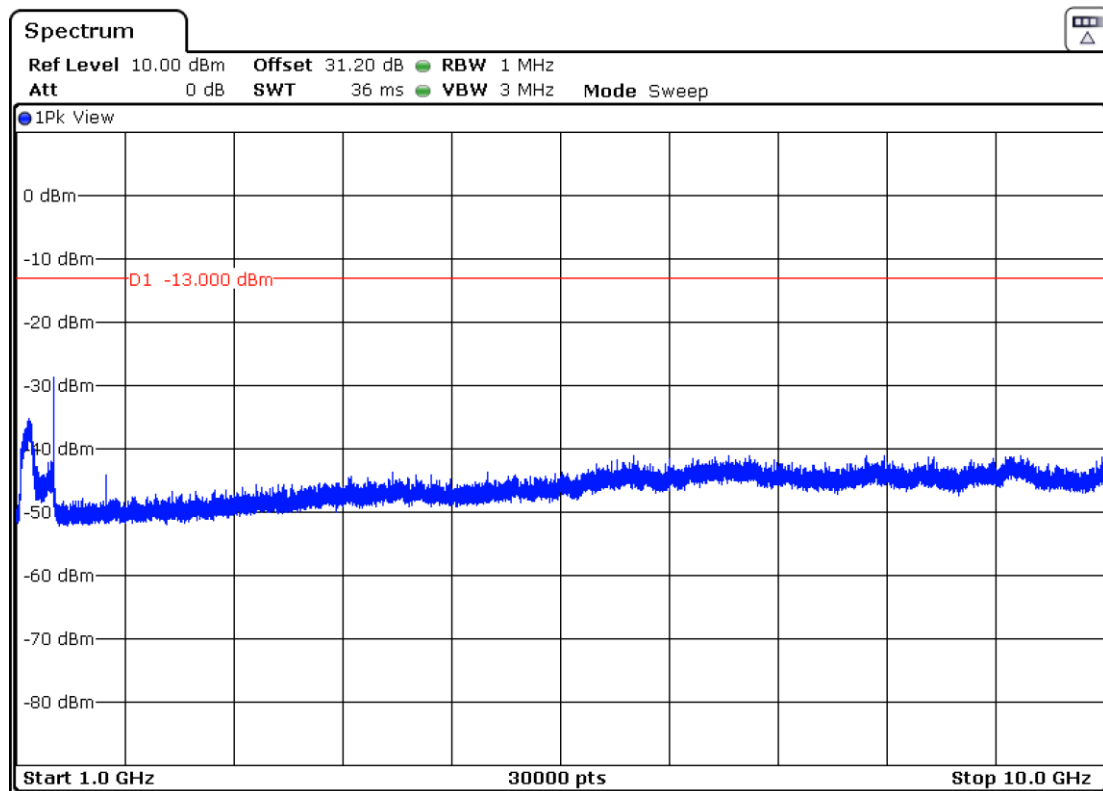
Note: The carrier frequency has been attenuated with a notch filter.



CHANNEL: HIGHEST

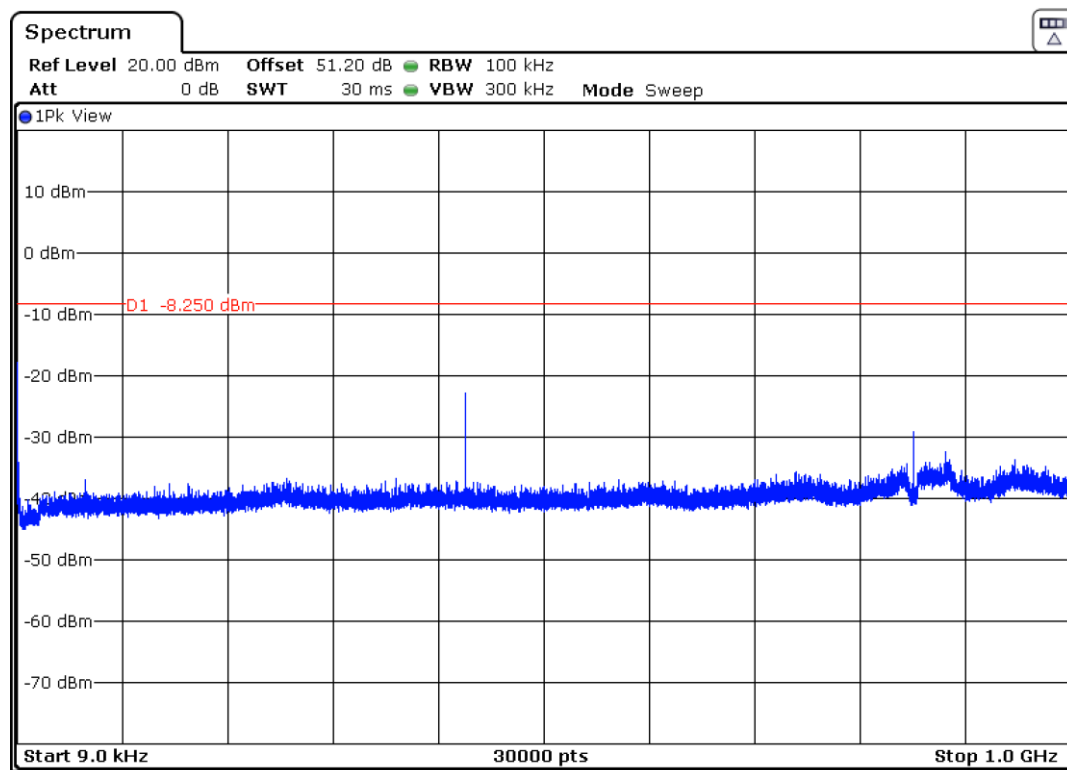


Note: The carrier frequency has been attenuated with a notch filter.

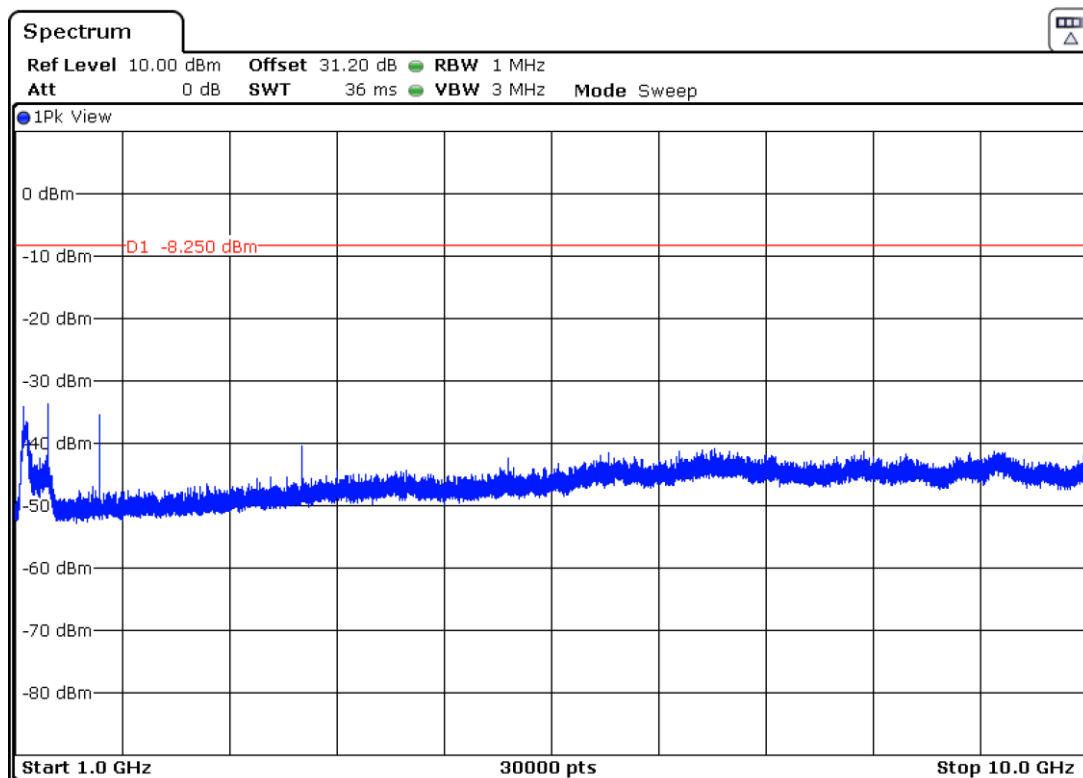


TETRA 22 kHz bandwidth.

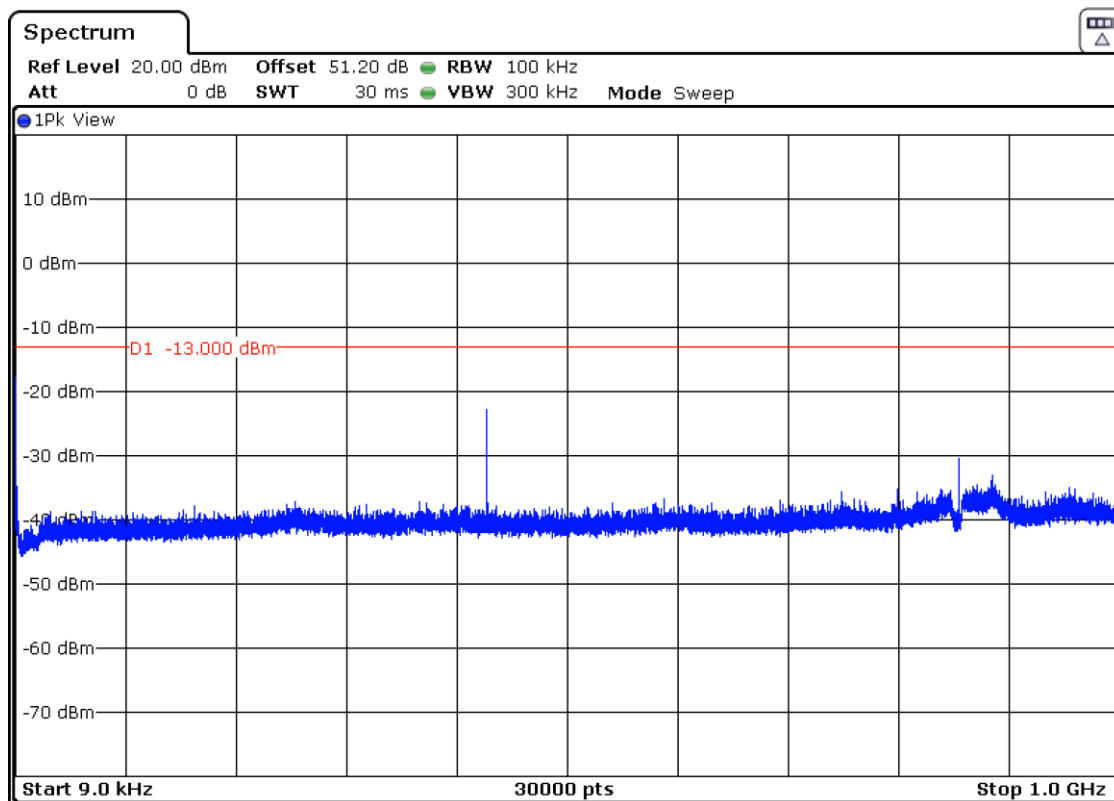
RSS-119 LOWEST CHANNEL: 851.0125 MHz



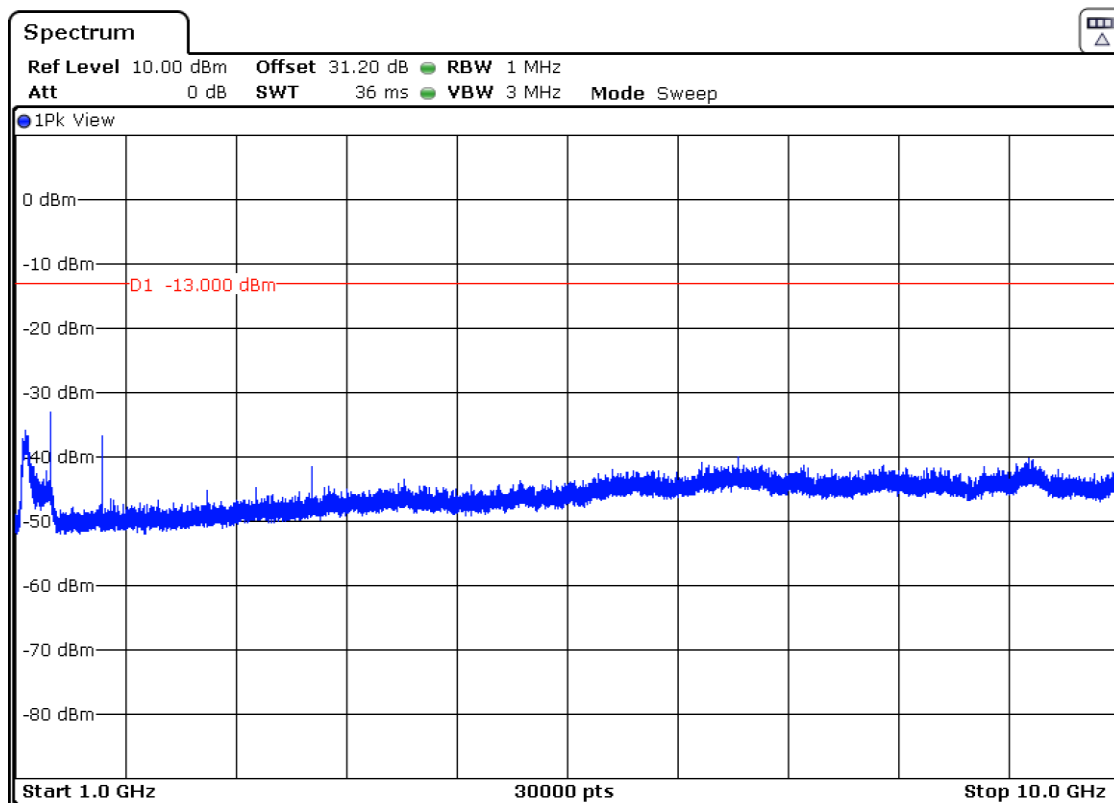
Note: The carrier frequency has been attenuated with a notch filter.



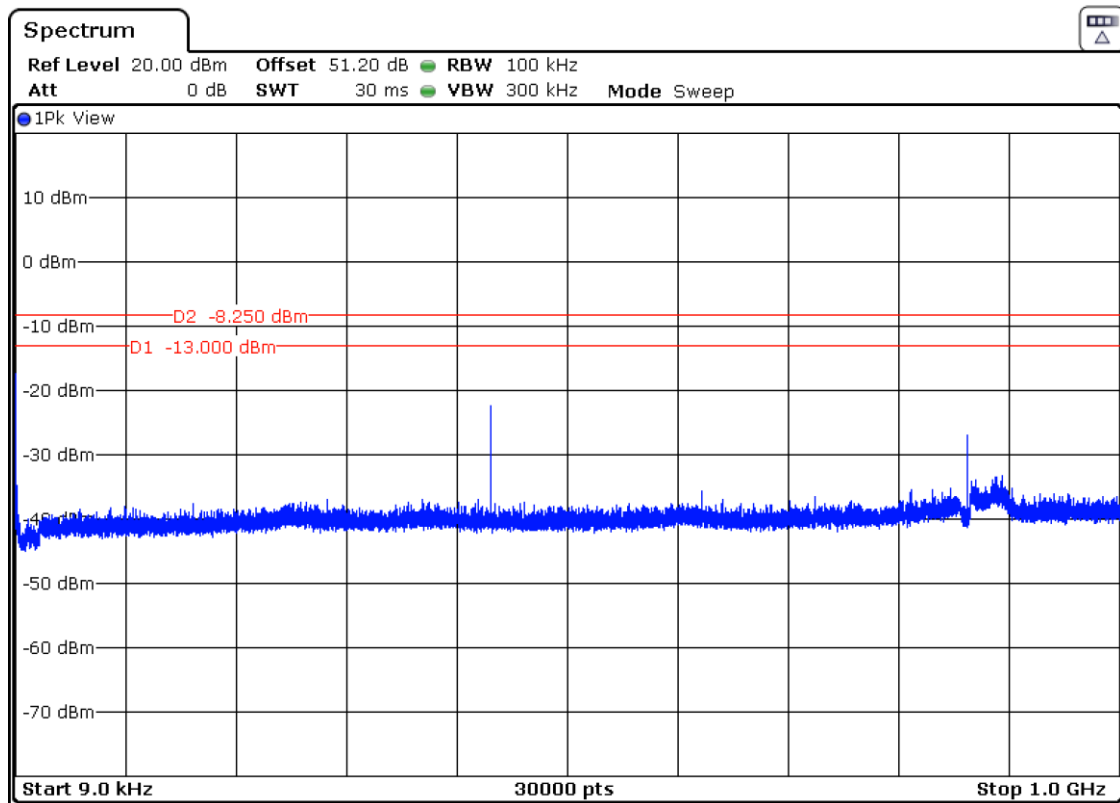
FCC 90 LOWEST CHANNEL: 854.0125 MHz



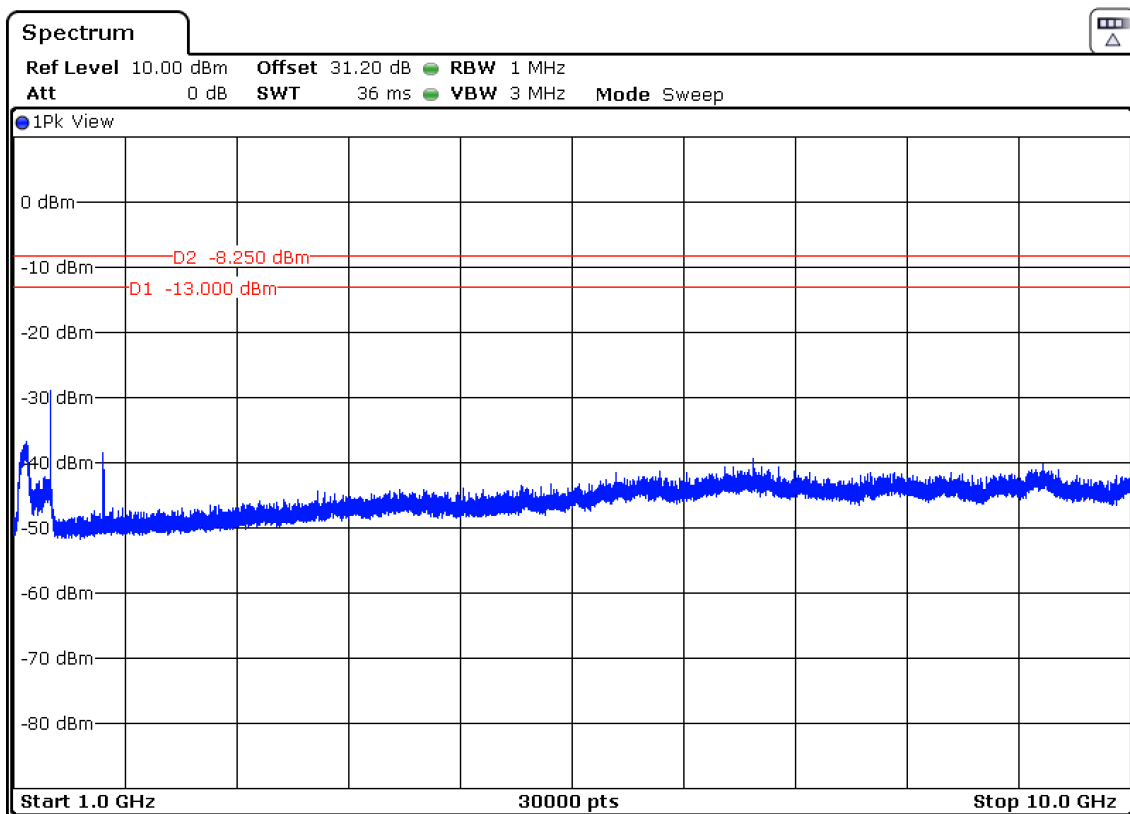
Note: The carrier frequency has been attenuated with a notch filter.



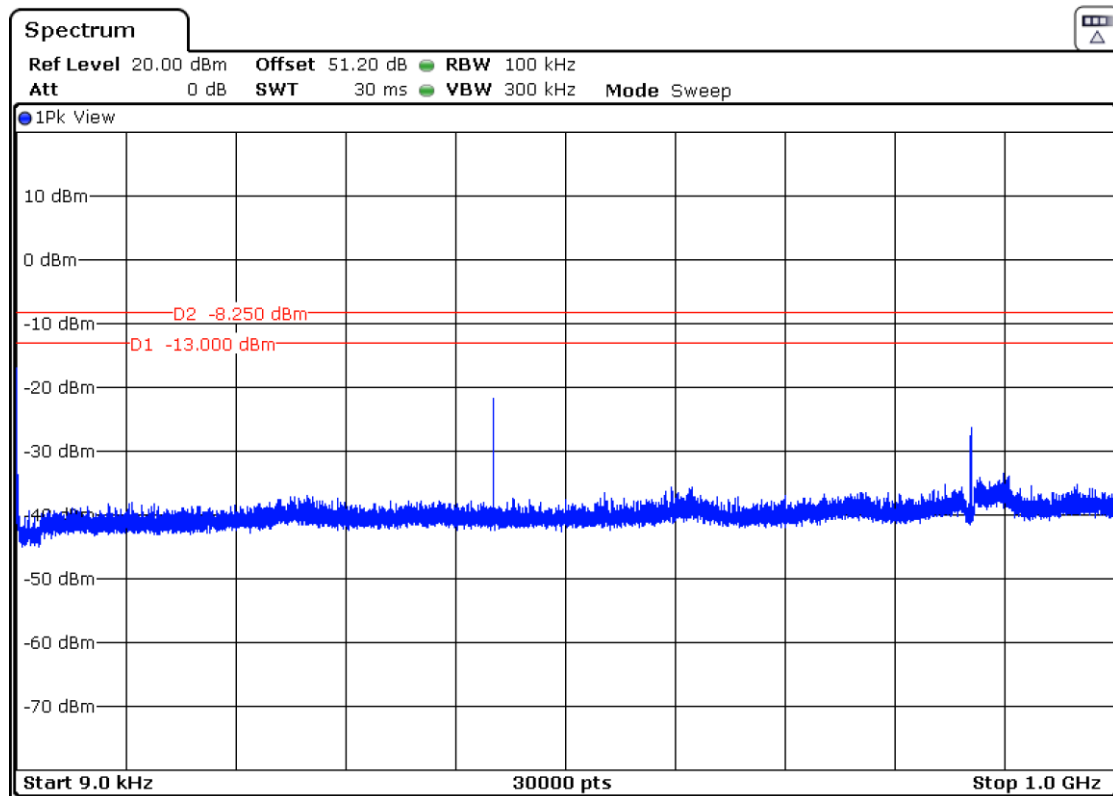
CHANNEL: MIDDLE



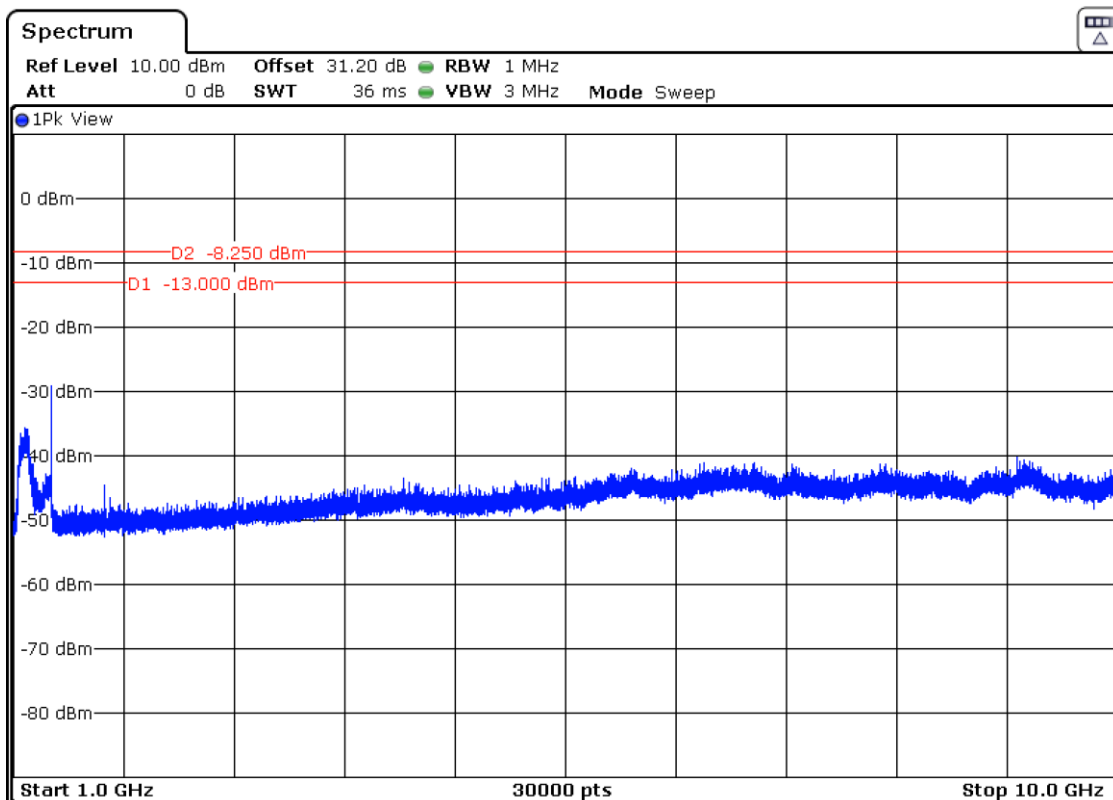
Note: The carrier frequency has been attenuated with a notch filter.



CHANNEL: HIGHEST



Note: The carrier frequency has been attenuated with a notch filter.



Radiated emissions

SPECIFICATION

FCC §2.1051, §90.210, §90.221, §90.691. 854–869 MHz band.

Emission Mask B.

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

Emission mask requirements for EA-based systems.

For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

Adjacent channel power limits.

On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least $43 + 10 \log (P_{\text{watts}})$ dB.

RSS-119 Clause 5.8.

Table 10 - Emission Mask G

Displacement Frequency, fd (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$10 < fd \leq 50$	whichever is the lesser attenuation: 70 or $116 \log_{10}(fd/6.11)$ or $50 + 10 \log_{10}(p)$	300
$fd > 50$	$43 + 10 \log_{10}(p)$	Specified in Section 4.2.1

Table 17 - Emission Mask Y

Displacement Frequency, fd (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$12.375 < fd \leq 13.975$	whichever is the lesser attenuation: $30 + 16.67(fd - 12.375)$ or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2
$fd > 13.975$	whichever is the lesser attenuation: 57 or $55 + 10 \log_{10}(p)$	Specified in Section 4.2.2

METHOD

The measurement was performed with the EUT inside an anechoic chamber with the accessories connected. The RF output connector of the EUT is terminated with an attenuator and a 50 ohm load.

The spectrum was scanned from 30 MHz to at least the 10th harmonic of the highest frequency generated within the equipment.

The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded.

A preliminary scan was performed to determine the worst case of modulation mode.
Each detected emission is substituted by the Substitution method in accordance with the ANSI/TIA-603.

RESULTS

A preliminary scan determined the TI D-LMR 20 kHz mode as the worst case. The following tables and plots show the results for this configuration.

RSS-119 LOWEST CHANNEL: 851.0125 MHz

Highest spurious signals.

Substitution method data

Frequency (GHz)	Instrument reading (dBm)	RBW (kHz)	Detector	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain G_i (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
3.40375	-31.15	1000	Peak	Vertical	-38.51	2.60	11.62	-29.49
4.25485	-48.27	1000	Peak	Vertical	-52.59	2.96	11.85	-43.70
5.10625	-38.48	1000	Peak	Vertical	-39.09	3.31	11.46	-30.94
5.95705	-55.09	1000	Peak	Vertical	-54.70	3.66	12.15	-46.21
6.80845	-55.78	1000	Peak	Vertical	-49.68	4.10	10.22	-43.56
7.65895	-54.85	1000	Peak	Horizontal	-46.88	4.25	10.50	-40.53

FCC 90 LOWEST CHANNEL: 854.0125 MHz

Highest spurious signals.

Substitution method data

Frequency (GHz)	Instrument reading (dBm)	RBW (kHz)	Detector	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain G_i (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
3.41575	-33.01	1000	Peak	Vertical	-40.35	2.62	11.65	-31.32
4.27015	-50.41	1000	Peak	Vertical	-54.65	2.97	11.84	-45.78
5.12425	-41.80	1000	Peak	Vertical	-42.33	3.32	11.45	-34.20
5.97835	-54.03	1000	Peak	Vertical	-53.85	3.42	12.13	-45.14
6.83215	-56.93	1000	Peak	Vertical	-51.04	3.75	10.17	-44.62
7.68595	-58.21	1000	Peak	Vertical	-50.13	4.29	10.59	-43.83

2. CHANNEL: MIDDLE.

Highest spurious signals.

Substitution method data

Frequency (GHz)	Instrument reading (dBm)	RBW (kHz)	Detector	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain G_i (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
2.58445	-44.02	1000	Peak	Vertical	-53.42	2.10	10.73	-44.79
3.44575	-43.71	1000	Peak	Vertical	-51.15	2.50	11.70	-41.95
4.30765	-54.27	1000	Peak	Vertical	-58.31	3.01	11.82	-49.50
5.16925	-39.70	1000	Peak	Vertical	-40.61	3.37	11.91	-32.07
6.03550	-57.29	1000	Peak	Vertical	-56.55	3.86	12.06	-48.35
6.89185	-54.64	1000	Peak	Vertical	-47.95	4.18	10.04	-42.09

3. CHANNEL: HIGHEST.

Highest spurious signals.

Substitution method data

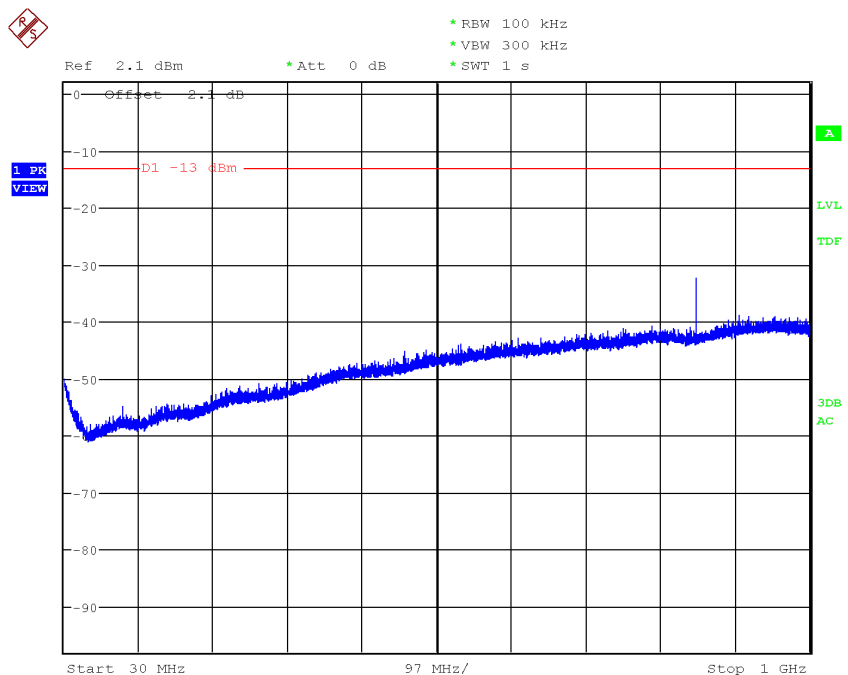
Frequency (GHz)	Instrument reading (dBm)	RBW (kHz)	Detector	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain G_i (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
2.60695	-44.58	1000	Peak	Vertical	-53.91	2.10	10.74	-45.27
3.47605	-29.58	1000	Peak	Vertical	-37.00	2.50	11.76	-27.74
4.34455	-55.63	1000	Peak	Vertical	-59.36	3.14	11.79	-50.71
5.21335	-27.03	1000	Peak	Vertical	-27.88	3.41	12.01	-19.28
6.08275	-57.05	1000	Peak	Horizontal	-56.25	3.82	12.00	-48.07
6.95185	-60.53	1000	Peak	Horizontal	-53.46	4.20	9.91	-47.75

Measurement uncertainty (dB)	$\leq \pm 3.88$ for $f < 1\text{GHz}$ $\leq \pm 4.87$ for $f \geq 1\text{GHz}$ up to 18 GHz
------------------------------	--

Verdict: PASS

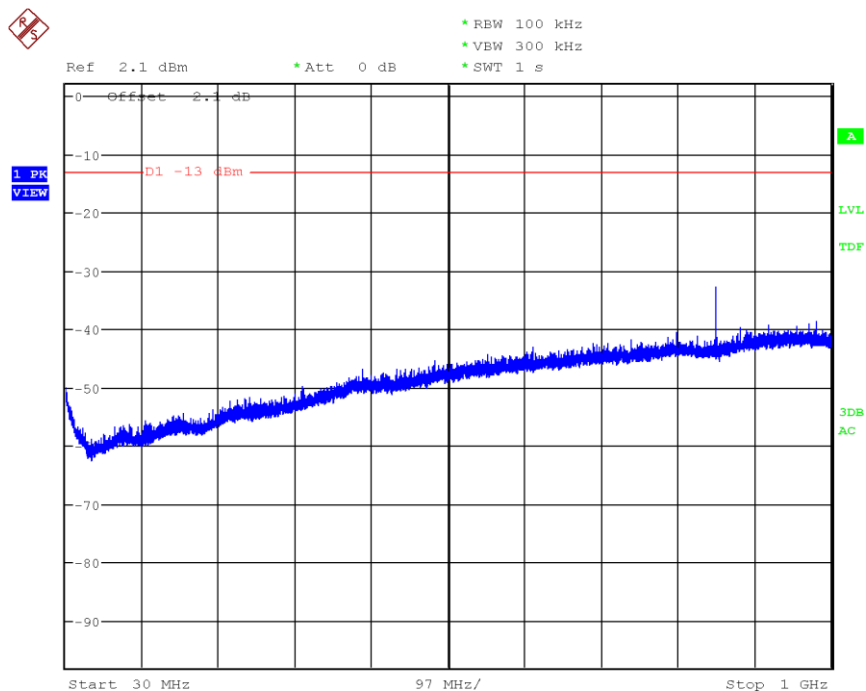
FREQUENCY RANGE 30 MHz-1000 MHz.

RSS-119 LOWEST CHANNEL: 851.0125 MHz



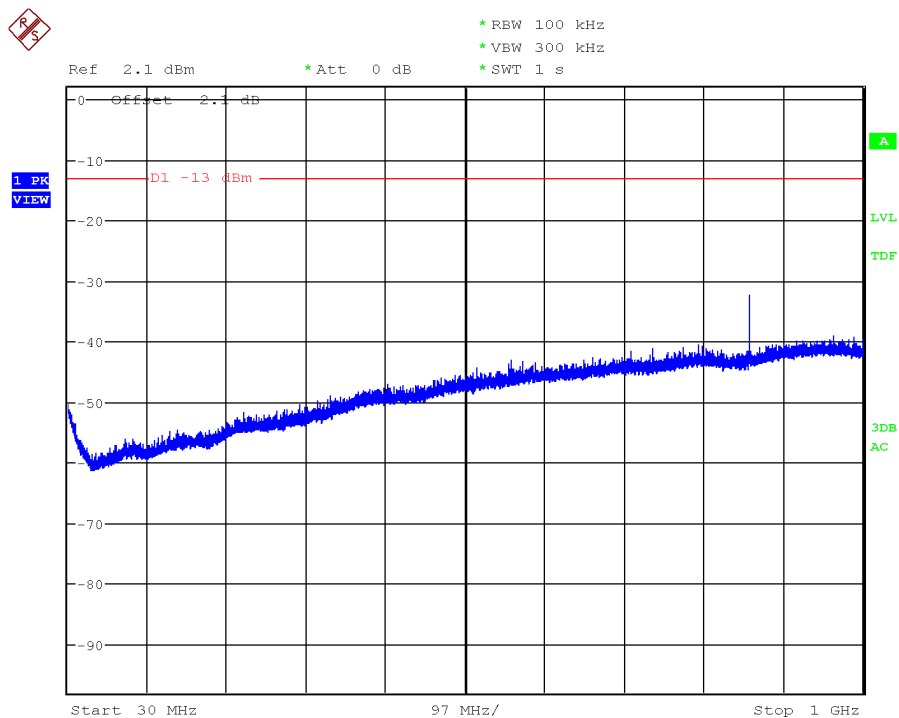
Note: The highest peak shown in the plot is the carrier frequency.

FCC 90 LOWEST CHANNEL: 854.0125 MHz



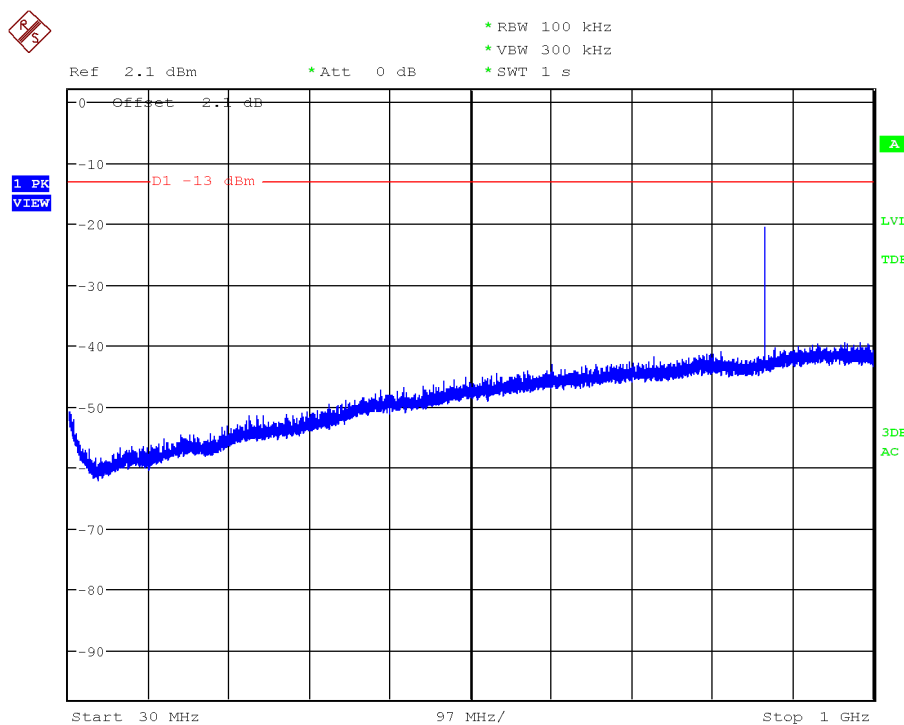
Note: The highest peak shown in the plot is the carrier frequency.

CHANNEL: MIDDLE.



Note: The highest peak shown in the plot is the carrier frequency.

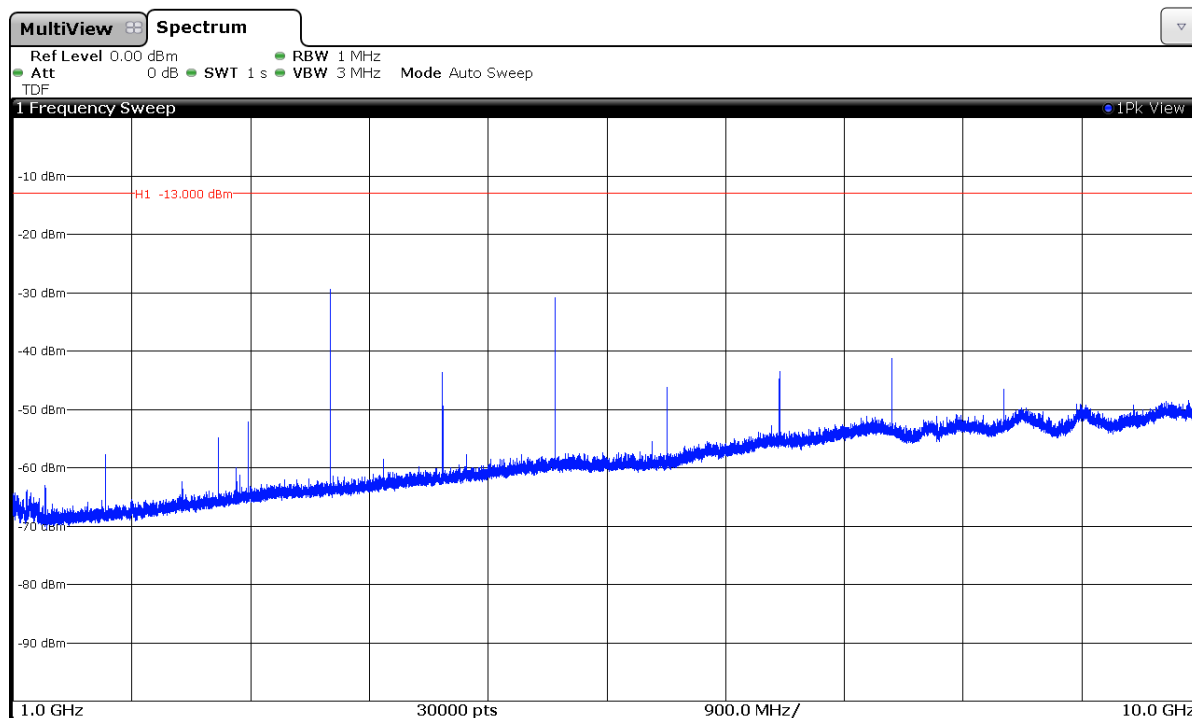
CHANNEL: HIGHEST.



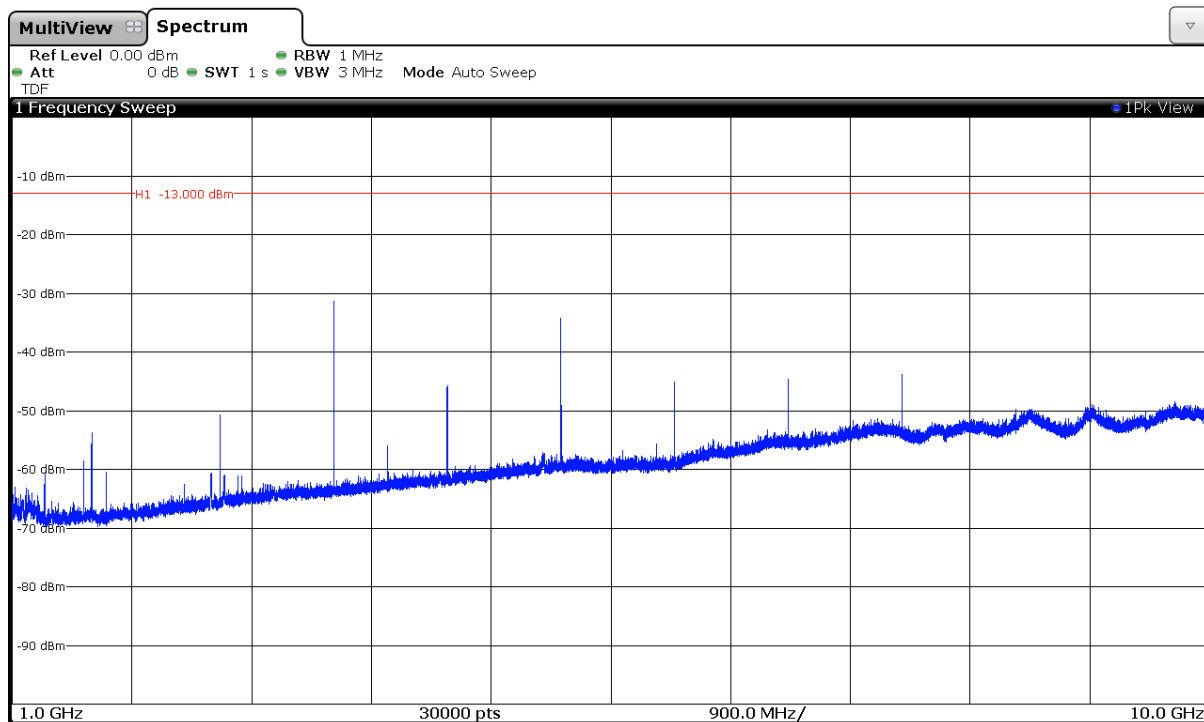
Note: The highest peak shown in the plot is the carrier frequency.

FREQUENCY RANGE 1 GHz to 10 GHz.

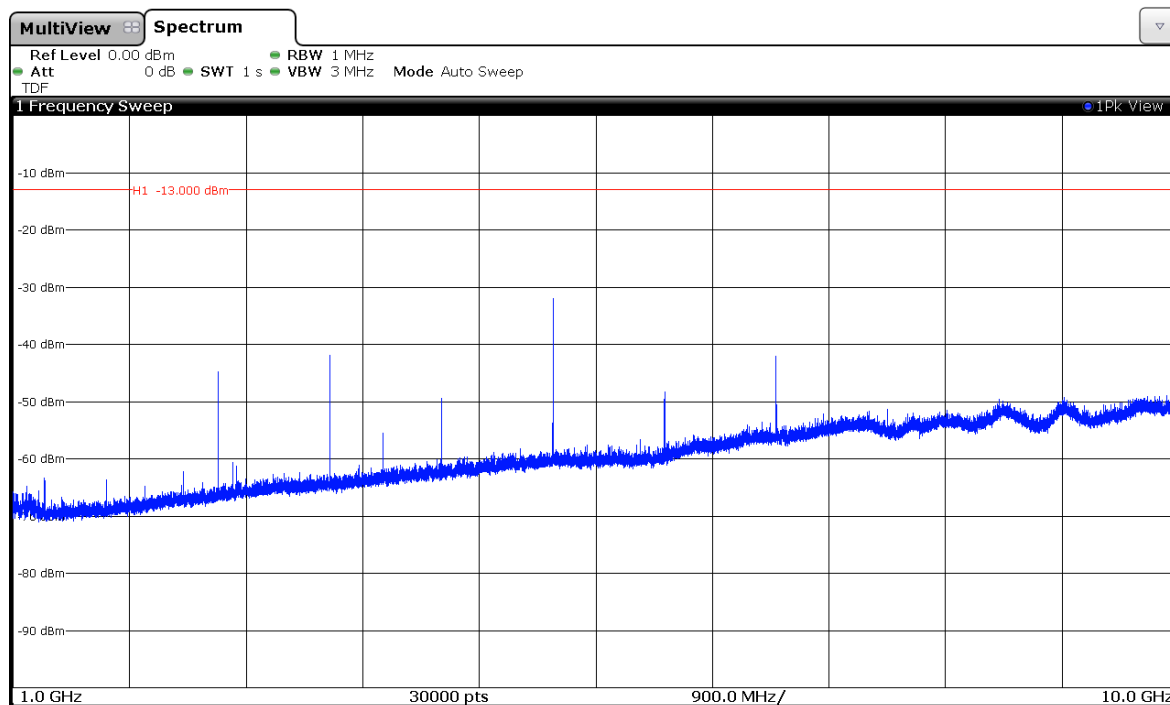
RSS-119 LOWEST CHANNEL: 851.0125 MHz



FCC 90 LOWEST CHANNEL: 854.0125 MHz



CHANNEL: MIDDLE.



CHANNEL: HIGHEST.

