Test report No:
NIE: 66640RRF.001

Test report
USA FCC Part 90
CANADA ISED RSS-119

(*) Identification of item tested	RF Transceiver / Mobile Radio
(*) Trademark	PowerTrunk
(*) Model and /or type reference tested	MDT-400 806-870 MHz
Other identification of the product	D262N28PT HW version: 1.14.26.05.13 SW version: 1.14.26.05.13 FCC ID: WT7PTMDT800B IC: 8624A-PTMDT800B
(*) Features	Power Supply: - Nominal voltage: 13.2 VDC - Operational voltage range: [10.8 - 15.6 VDC] Access scheme: TDMA with 4 physical channels (time slots) per RF channel. Modulation scheme: Based on TETRA: - π/4-DQPSK digital modulation with a rate of 18 Ksym/s, equivalent to 36 Kbits/s. - Modulation low-pass filter: Square-root raised cosine filter with a roll-off factor of 0.35. 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 in TMO mode: TX: 806-825 MHz RX: 851-870 MHz Frequency band in DMO mode: TX & RX: 851-870 MHz RF output power (nominal): TETRA: 35 dBm ± 1 dB (3 W) RF authorized bandwidth: TETRA: 22 KHz Emission designators: TETRA: 22K0D7D, 22K0D7E, 22K0D7W

	Options: - O261000PT: GPS receiver - O261003PT: Programmable I/O
Manufacturer	TELTRONIC S.A.U. Polígono Malpica, C/F Oeste, 50016 Zaragoza, SPAIN
Test method requested, standard	USA FCC Part 90 10-01-19 Edition. CANADA ISED RSS-119 Issue 12, May 2015. ANSI C63.26-2015.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Jose Carlos Luque RF Lab. Supervisor Firmado digitalmente por 74841983Y JOSE CARLOS LUQUE (C:A29507456) Fecha: 2021.05.27 07:22:21 +02'00'
Date of issue	2021-05-27
Report template No	FDT08_23 (*) “Data provided by the client”

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification S.A.U. is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

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

DEKRA Testing and Certification S.A.U. 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 S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. 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.

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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.
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Uncertainty

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

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The MDT-400 mobile radio is a TETRA digital RF transceiver that can operate in the following modes:
    - TMO mode (Trunked Mode Operation), on the network infrastructure supported by a service provider.
    - DMO mode (Direct Mode Operation), by communicating directly with another radio (antenna to antenna)

    A GPS receiver can optionally be integrated in the radio.

The test sample operates in the 806-825 MHz and 851-870 MHz frequency subbands in TMO mode and only in the latter in DMO mode. It provides an RF output power of 3 W in both subbands. However, only the following frequency segments are subject to testing and certification, in accordance with the American and Canadian licensed bands currently in force:

- FCC: 809-824 MHz / 854-869 MHz
- ISED: 806-824 MHz / 851-869 MHz

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: the client.

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
66640C/002	RF Transceiver / Mobile Radio	MDT-400 806-870 MHz	000003032913060	2021/03/03
66640C/003	Power supply cable MDT-400/ M-4000 3m	D026502PT	--	2021/03/03
66640C/004	MP-400 fist microphone with PTT and AUX switches	D026608PT	--	2021/03/03
64233B/003	External speaker, 2 1/2”, 5W	D026622PT	--	2020/09/17
64233B/004	Button PTT	D026000PT	--	2020/09/17
64233B/008	In-vehicle + PEI connection kit	D026521PT	--	2020/09/17
64233B/009	GPS Antenna	--	--	2020/09/17
64233B/010	Front Console	ME261020APT	6020202	2020/09/17
66640C/007	Directional microphone	D026614PT	--	2021/03/03
64233B/001	5m remote connection cable for F-400 console	208748	--	2020/09/17

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

   All tests indicated in appendix A.

Test sample description

Ports……:	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient (3)
	DB15HD: *Female socket to connect an F-400 front console.*	25 m	☒	☒	☐
	DB26HD: *Female socket to connect any approved accessory kit.*	3 m	☒	☐	☐
	GPS: *SMB male socket to connect an approved GPS antenna.*	5 m	☒	☒	☐
	ANT: *BNC female socket to connect an approved TETRA antenna.*	5 m	☒	☒	☐
	POWER IN: *Connector for power supply input.*	3 m	☒	☐	☐
Supplementary information to the ports…… :					

Rated power supply ..... :	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: *Nominal voltage: 13.2 VDC* *Operational voltage range: [10.8 – 15.6 VDC]*					
Rated Power ..... :	35 dBm ± 1dB (3 W)						
Clock frequencies..... :	This information has been provided in the following certification documents: D262N28PT_TAD000004-03_ened0100_BlockDiagrams_FCCISED2021.pdf D262x28PT_TAD000001-03_ened0103_OperationalDescription_0.pdf						
Other parameters ..... :							

Software version ..... :	CCP: 1.14.26.05.13		
Hardware version ..... :	CCP: 1.14.26.05.13		
Dimensions in cm (WxHxD)..:	167.6 x 48.5 x 181 (MDT-400 radio unit) 167.6 x 61.2 x 209 (MDT-400 radio unit + F-400 front console)		
Mounting position ..... :	☐	Mast-mounted equipment (in real applications)	
	☐	Floor standing equipment	
	☐	Hand-held equipment	
	☒	Other: Vehicular installation; Tested as a table-top equipment	
Modules/parts..... :	Module/parts of test item	Type	Manufacturer
Accessories (not part of the test item)..... :	Description	Type	Code
	F-400 front console	Console	ME261020APT
	MP-400 fist microphone with PTT and AUX switches	Microphone	D026608PT
	External speaker, 2 1/2”, 5W	Speaker	D026622PT
	Microphone	Microphone	D026614PT
	Button PTT	PTT	D026000PT
	In-vehicle + PEI connection kit	Cable	D026521PT
	DC power cable	Cable	D026502PT
	5m remote connection cable for F-400 console	Cable	208748
	TETRA antenna (representative model)	Antenna	D02631NPT
	GPS antenna	Antenna	11779
Documents as provided by the applicant..... :	Description	File version	Issue date
	D262x28PT_TAD000009-03_ened0103_TestOperationManual_0.pdf	Ed.1.3	05/02/2021
	D262N28PT_TAD000009-03_ened0100_AdditionalInfo_FCCISED2021.pdf	Ed.1.0	16/02/2021

(3) Only for Medical Equipment

Identification of the client

TELTRONIC S.A.U.
Polígono Malpica, C/F Oeste, 50016 Zaragoza, SPAIN.

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-03-22
Date (finish)	2021-05-11

Document history

Report number	Date	Description
66640RRF.001	2021-05-27	First release

Environmental conditions

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Cristina Calle, Jose Manuel Jiménez, Nicolas Salguero and Javier Nadales.

Used instrumentation:

Conducted Measurements

		Last Cal. date	Cal. due date
1.	Climatic chamber BINDER MK56	2021/03	2022/03
2.	Digital multimeter FLUKE 175	2020/10	2021/10
3.	Radiocommunication analyser R&S CMTA84	2018/10	2021/10
4.	Power sensor R&S NRP-Z81	2019/06	2021/06
5.	Spectrum analyser R&S FSV40	2020/03	2022/03
6.	Radiocommunication analyser HP 8920A	2019/10	2021/10
7.	DC POWER SUPPLY 30V/5A 150W Agilent Technologies U8002A	N/A	N/A
8.	Spectrum analyser R&S FSW50	2020/07	2022/07

Radiated Measurements

		Last Cal. date	Cal. due date
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
3.	Hybrid Bilog Antenna 30MHz - 6GHz SUNOL SCIENCES CORPORATION JB6	2020/10	2022/10
4.	Digital multimeter FLUKE 175	2020/11	2021/11
5.	Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2020/08	2023/08
6.	RF Pre-amplifier G>40dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2020/10	2021/10
7.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2019/09	2021/09
8.	EMI Test Receiver 9kHz - 7GHz ROHDE AND SCHWARZ ESR7	2019/10	2021/10
9.	DC POWER SUPPLY 30V/5A 150W Agilent Technologies U8002A	N/A	N/A

Testing verdicts

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

Summary

FCC PART 90 / ISED RSS-119 PARAGRAPH Requirement – Test case	Verdict	Remark
FCC Clauses 2.1047, 90.207. Modulation characteristics	P	(1)
FCC Clause 90.209 / RSS-119 Clause 5.5: Occupied Bandwidth	P	
FCC Clauses 90.205, 90.635 / RSS-119 Clause 5.4: RF output power	P	
FCC Clause 90.210 / RSS-119 Clause 5.5, 5.8: Emission mask	P	
FCC Clause 90.221: Adjacent channel power	P	
FCC Clause 90.213 / RSS-119 Clause 5.3: Frequency stability	P	
FCC Clauses 90.210, 90.221 / RSS-119 Clause 5.8: Spurious emissions at antenna terminals	P	
FCC Clauses 90.210, 90.221 / RSS-119 Clause 5.8: Radiated emissions	P	
Supplementary information and remarks: 1. This information has been provided by the applicant.		

Appendix A: Test results

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TEST CONDITIONS

Power supply (V):

DC voltage

V_{nom} = 13.2 Vdc

V_{max} = 15.6 Vdc

V_{min} = 10.8 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:

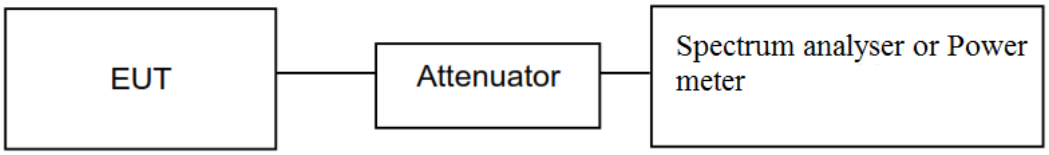
- Mode TETRA (22 kHz bandwidth): 35 dBm (3 W)

TEST FREQUENCIES:

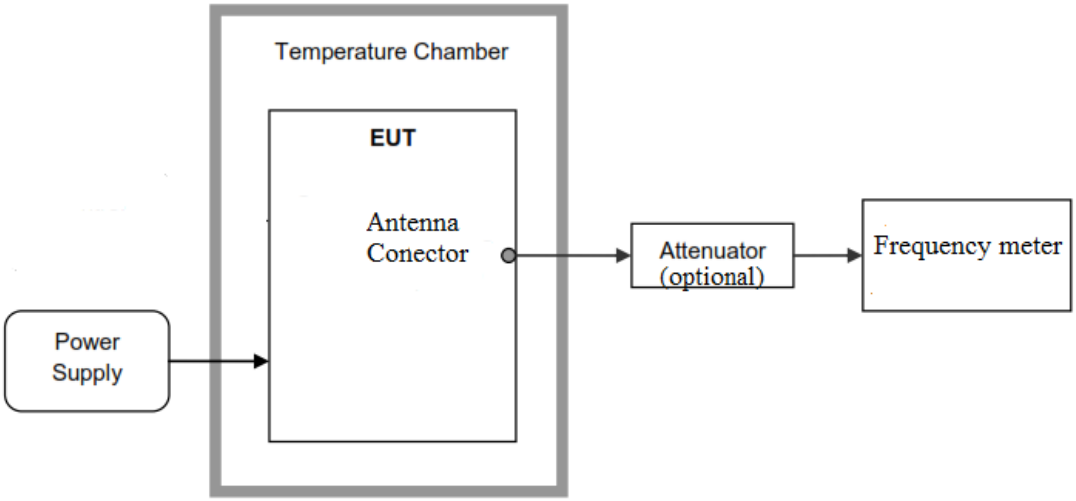
	806-824 MHz band	**851-869 MHz band**
Lowest channel RSS-119	806.0125 MHz	851.0125 MHz
Lowest channel FCC 90	809.0125 MHz	854.0125 MHz
Middle channel	815.0125 MHz	860.0125 MHz
Highest channel	823.9875 MHz	868.9875 MHz

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

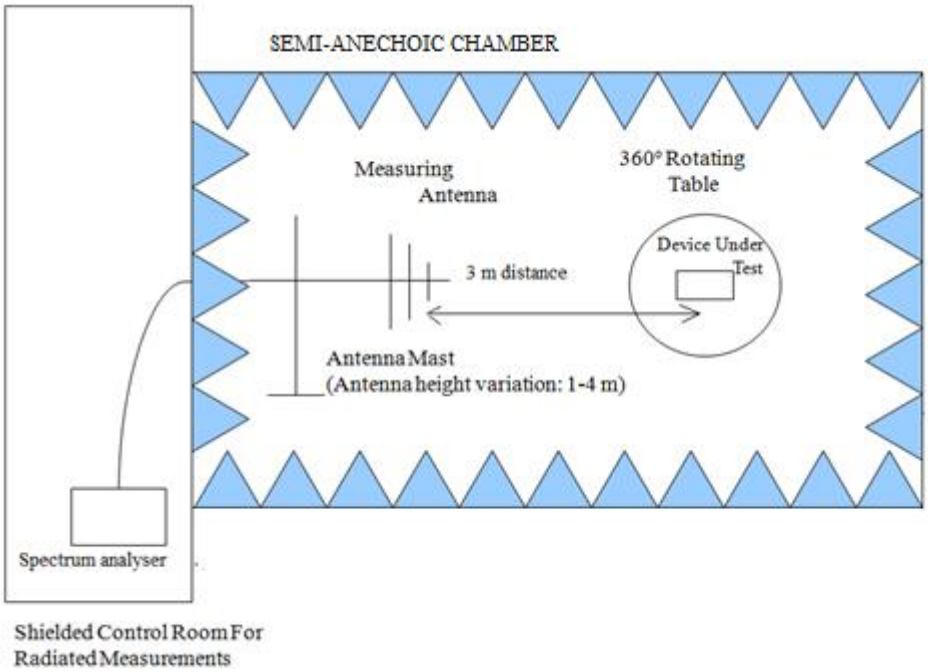
The equipment under test was scanned for spurious emissions in the frequency range 30MHz to 10 GHz.

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 3 m for the frequency range 1 GHz-10 GHz (1 GHz-18 GHz Double ridge horn antenna).

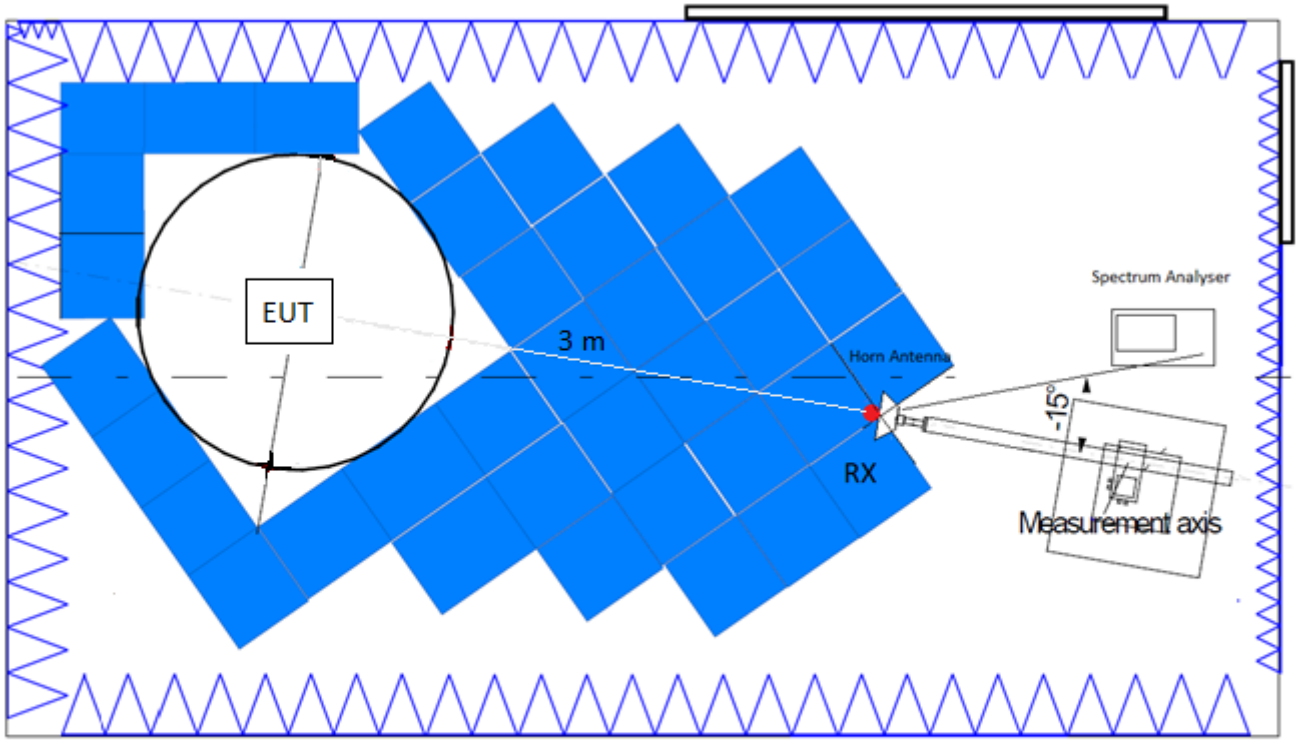
The equipment under test was set up on a non-conductive platform and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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)

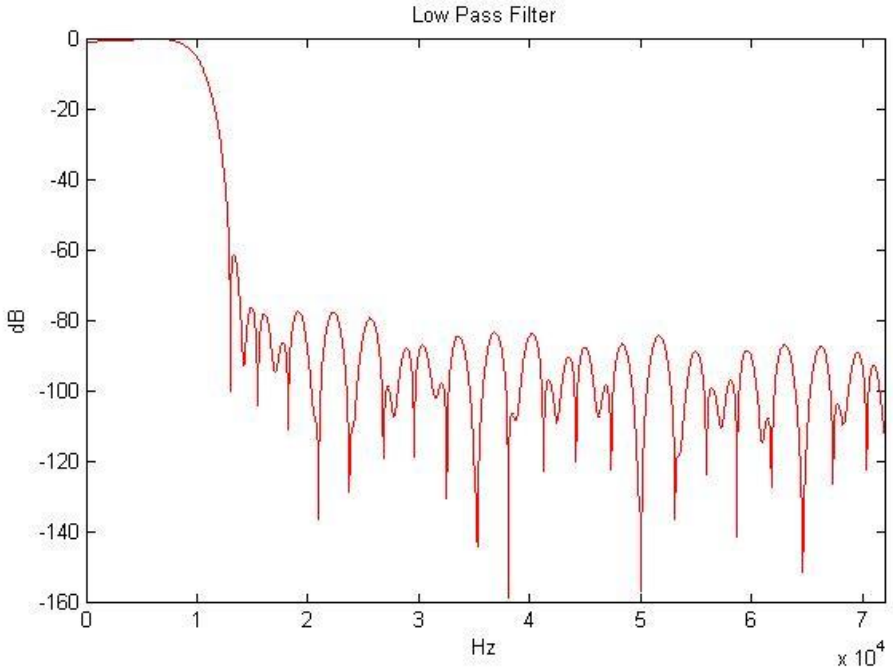
MODULATION LOW-PASS FILTER:

The operation of the EUT is based on TETRA technology with an authorized modulation bandwidth of 22 KHz, employing π/4-DQPSK (π/4-shifted Differential Quaternary Phase Shift Keying) and 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 to perform matched filtering. The combined response of both filters is that of the raised-cosine filter, which is often used for pulse-shaping in digital modulations and known for being able to minimize inter-symbol interference (ISI).

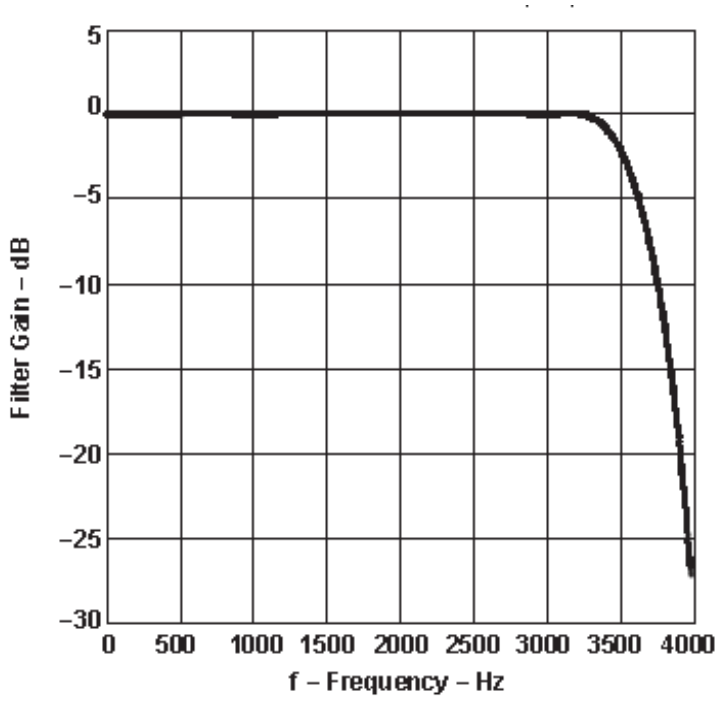
The following graph shows the transfer function of the aforementioned filter.



MDT-400 806-870 MHz transmitter low pass filter used by TETRA (22 KHz modulation bandwidth)

AUDIO LOW-PASS FILTER:

The transmitter and receiver audio functionalities are supported on an audio CODEC integrated circuit that bears an internal low-pass filter with the frequency response shown below:



Occupied Bandwidth

SPECIFICATION

FCC §2.1049, §90.209.

809-824 MHz and 854-869 MHz bands.

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
809-824 and 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.

Table 3

Frequency Band (MHz)	**Related SRSP for Channelling Plan and ERP**	**Channel Bandwidth (kHz)**	**Authorized Bandwidth (kHz)**	**Spectrum Masks for Equipment With Audio Filter**	**Spectrum Masks for Equipment Without Audio Filter**
806-821/851-866 and 821-824/866-869	SRSP-502	25	20 22	B Y	G Y
		12.5	11.25	D	D
		6.25	6	E	E

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified in Table 3 for the equipment's frequency band. The authorized bandwidth is defined as the maximum width of the band of frequencies used to derive spectrum masks and is not necessarily equivalent to the bandwidth found on radio and spectrum licences.

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 analyzer.

RESULTS (see next plots)

TETRA 22 kHz. 806-824 MHz band.

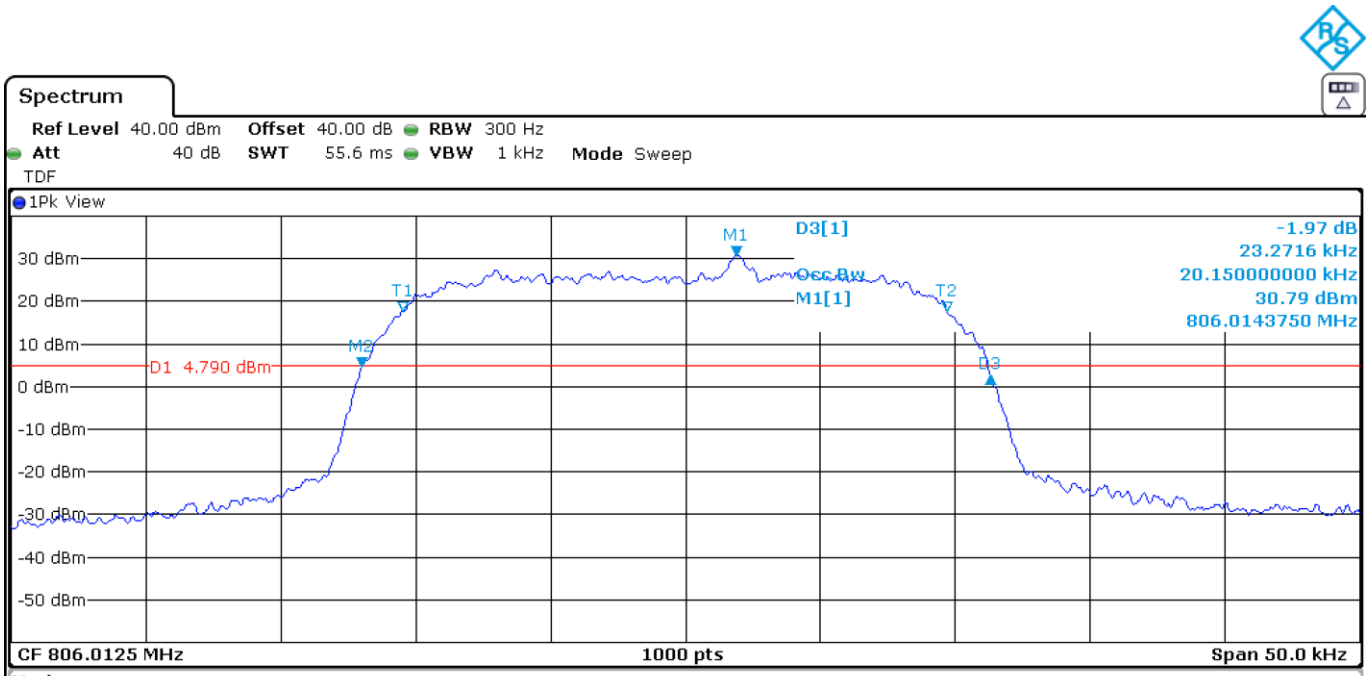
Channel	99% Occupied bandwidth (kHz)	-26 dBc bandwidth (kHz)
Lowest channel RSS-119	20.1500	23.2716
Lowest channel FCC 90	20.1500	23.2000
Middle channel	20.2000	23.1650
Highest channel	20.2000	23.1740
Measurement uncertainty (kHz)	<±0.06	

TETRA 22 kHz. 851-869 MHz band.

Channel	99% Occupied bandwidth (kHz)	-26 dBc bandwidth (kHz)
Lowest channel RSS-119	20.3000	23.2240
Lowest channel FCC 90	20.2500	23.0820
Middle channel	20.2500	23.1690
Highest channel	20.3000	23.0194
Measurement uncertainty (kHz)	<±0.06	

Verdict: PASS

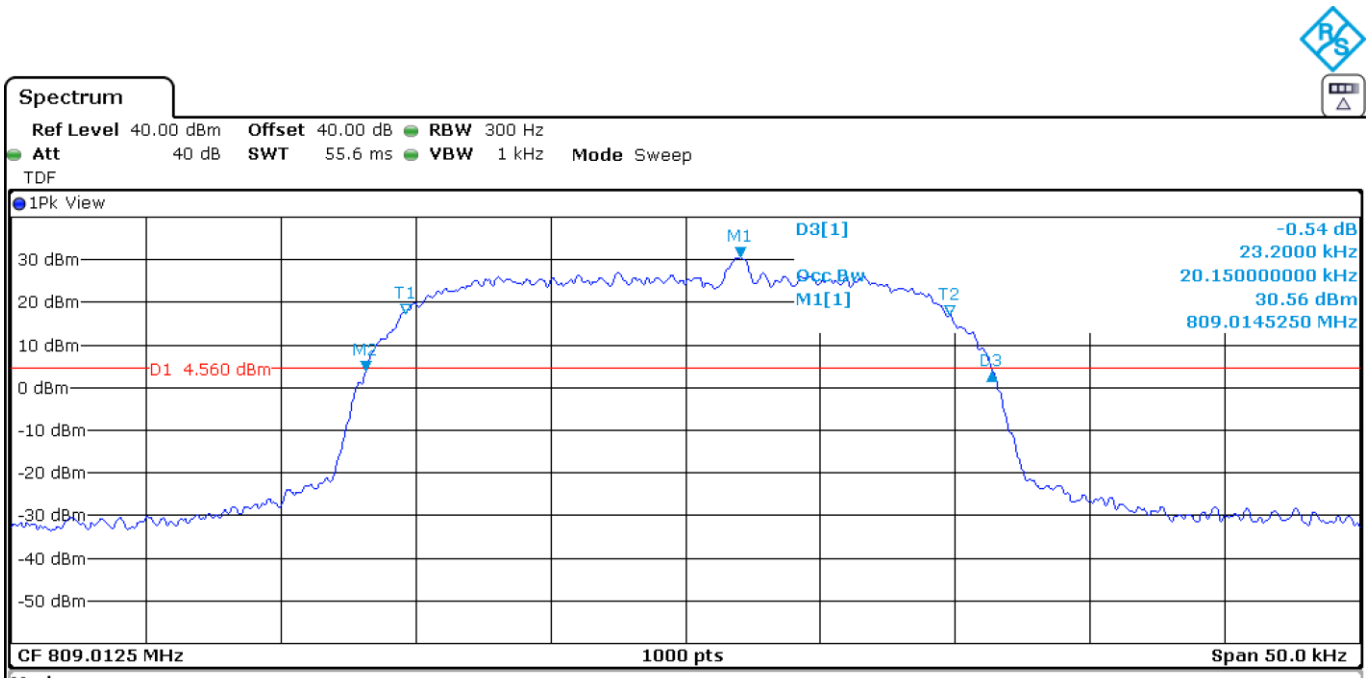
TETRA 22 kHz. 806-824 MHz band.
Lowest channel RSS-119



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	806.014375 MHz	30.79 dBm		
T1		1	806.002025 MHz	17.70 dBm	Occ Bw	20.15 kHz
T2		1	806.022175 MHz	17.54 dBm		
M2		1	806.000515 MHz	4.56 dBm		
D3	M2	1	23.2716 kHz	-1.97 dB		

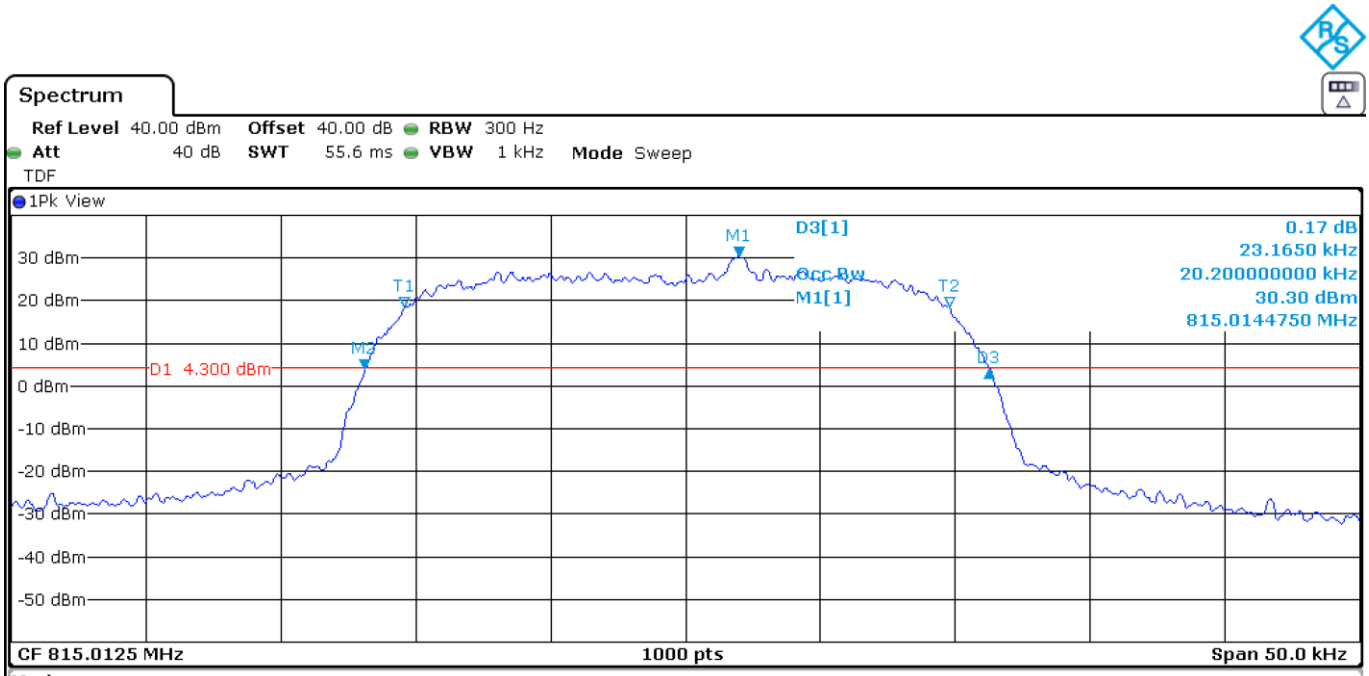
Lowest channel FCC 90



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	809.014525 MHz	30.56 dBm		
T1		1	809.002125 MHz	17.39 dBm	Occ Bw	20.15 kHz
T2		1	809.022275 MHz	17.04 dBm		
M2		1	809.000661 MHz	4.24 dBm		
D3	M2	1	23.2 kHz	-0.54 dB		

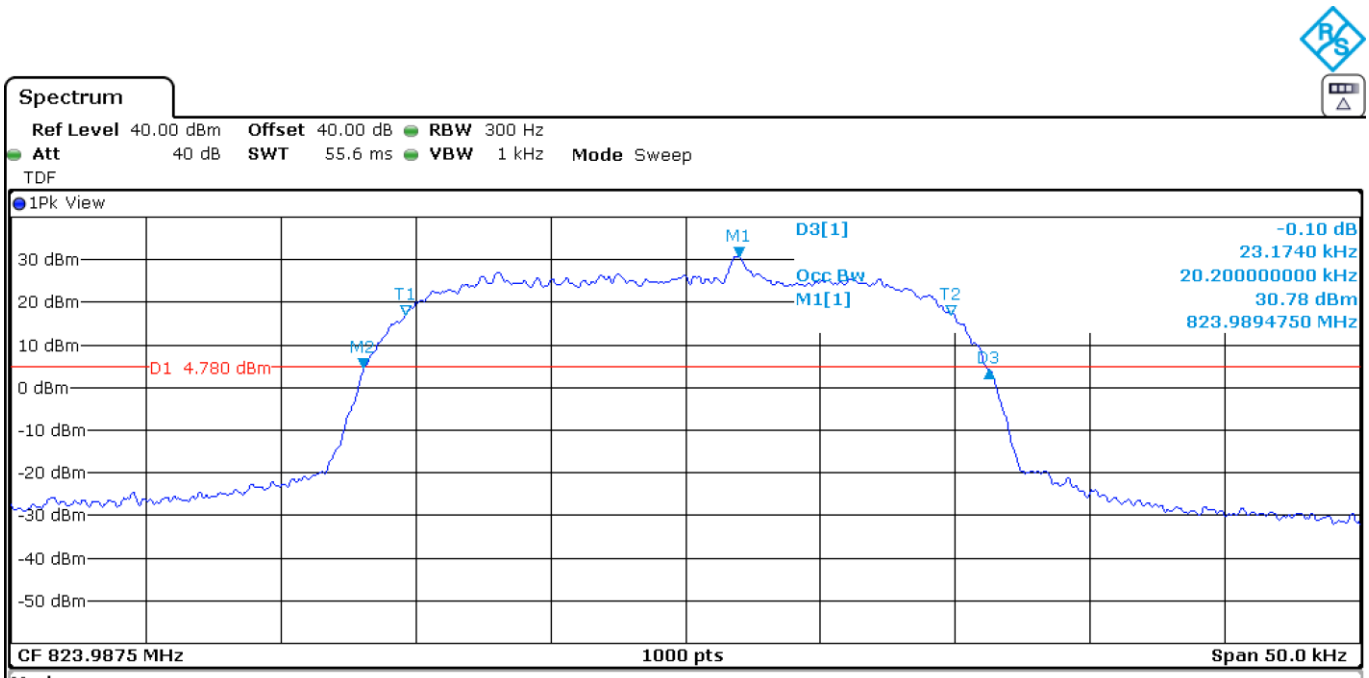
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	815.014475 MHz	30.30 dBm		
T1		1	815.002075 MHz	18.51 dBm	Occ Bw	20.2 kHz
T2		1	815.022275 MHz	18.67 dBm		
M2		1	815.000609 MHz	3.87 dBm		
D3	M2	1	23.165 kHz	0.17 dB		

Highest Channel

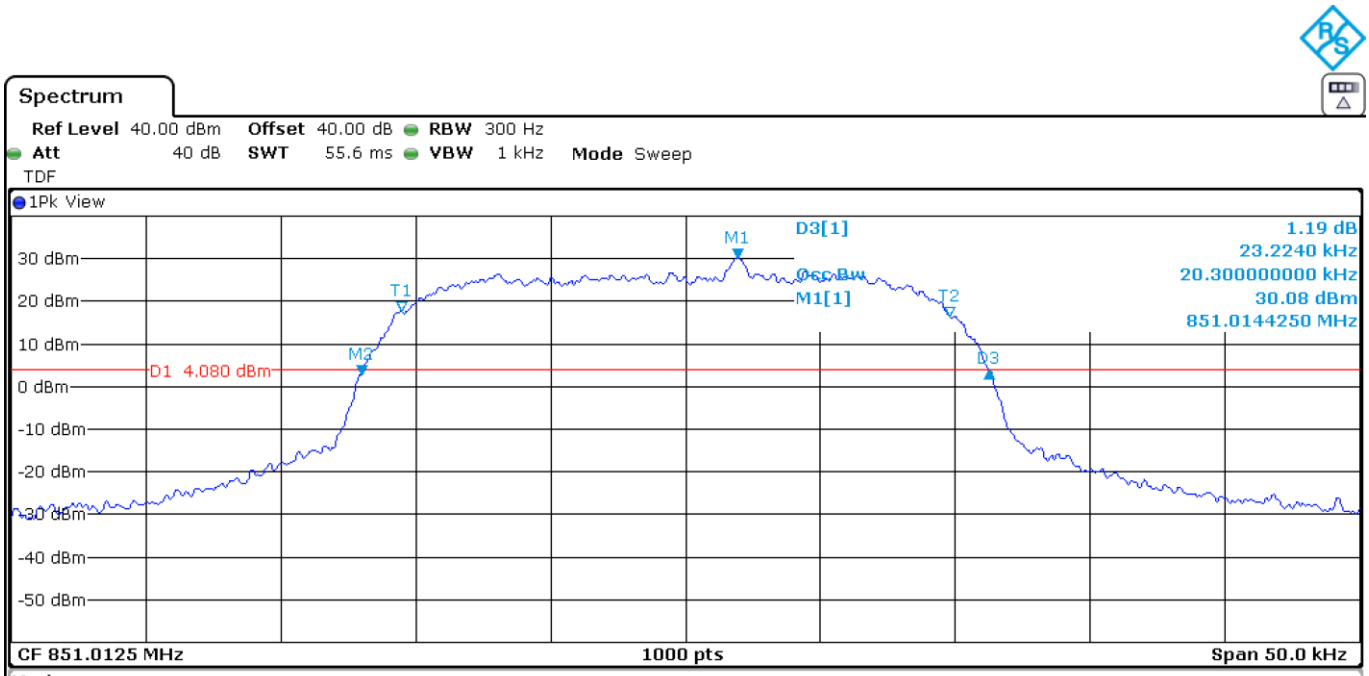


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	823.989475 MHz	30.78 dBm		
T1		1	823.977125 MHz	17.02 dBm	Occ Bw	20.2 kHz
T2		1	823.997325 MHz	17.16 dBm		
M2		1	823.975554 MHz	4.47 dBm		
D3	M2	1	23.174 kHz	-0.10 dB		

TETRA 22 kHz. 851-869 MHz band.

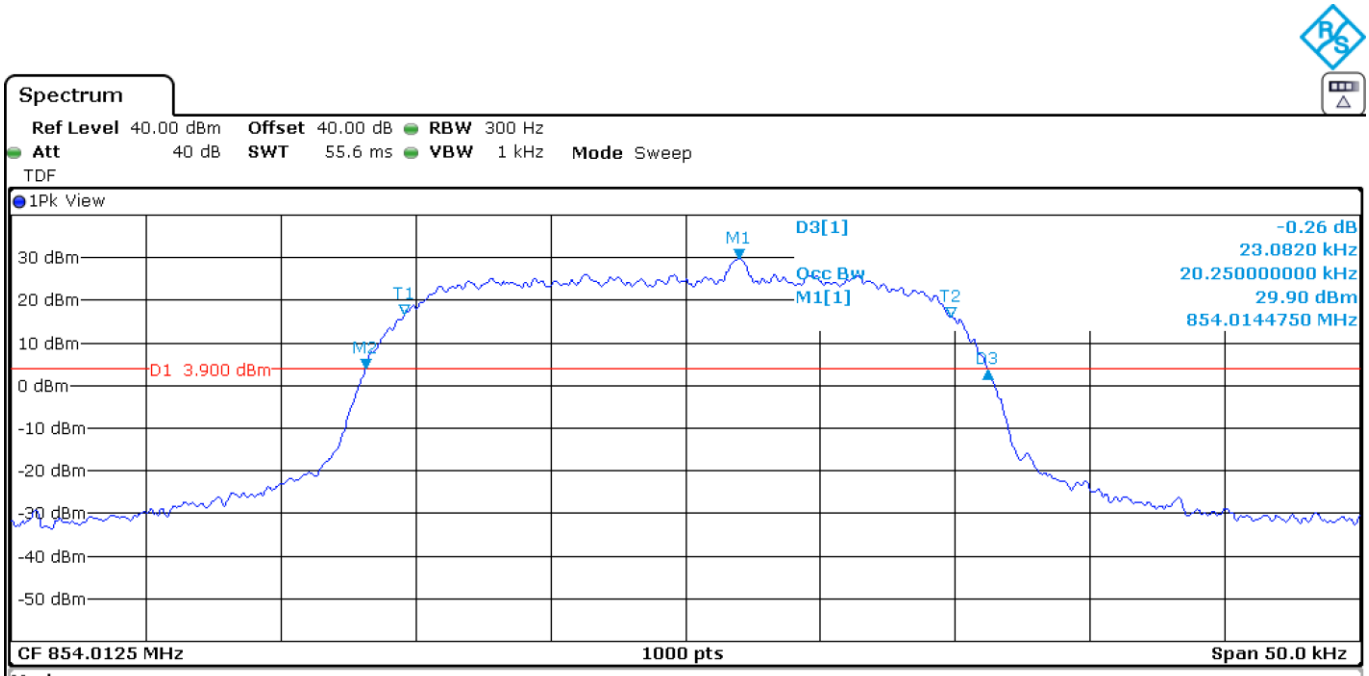
Lowest channel RSS-119



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	851.014425 MHz	30.08 dBm		
T1		1	851.001975 MHz	17.75 dBm	Occ Bw	20.3 kHz
T2		1	851.022275 MHz	16.55 dBm		
M2		1	851.000537 MHz	2.63 dBm		
D3	M2	1	23.224 kHz	1.19 dB		

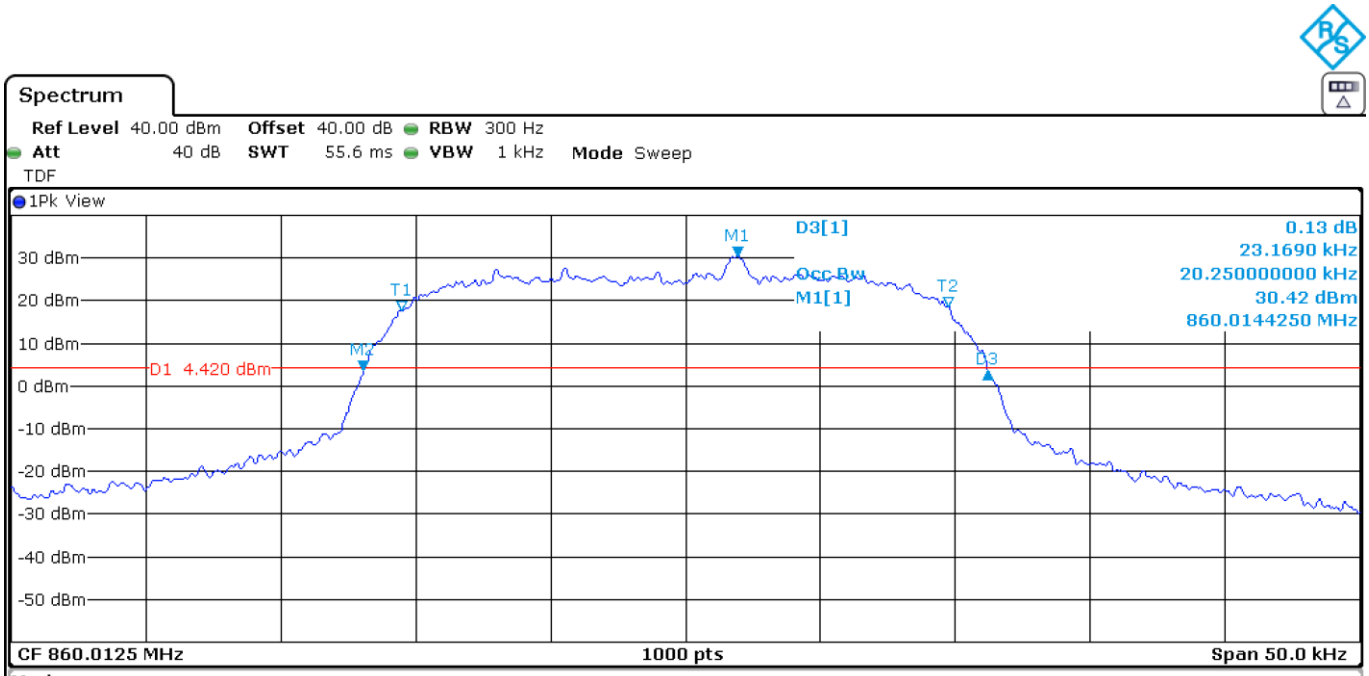
Lowest channel FCC 90



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	854.014475 MHz	29.90 dBm		
T1		1	854.002075 MHz	16.74 dBm	Occ Bw	20.25 kHz
T2		1	854.022325 MHz	16.12 dBm		
M2		1	854.000641 MHz	3.80 dBm		
D3	M2	1	23.082 kHz	-0.26 dB		

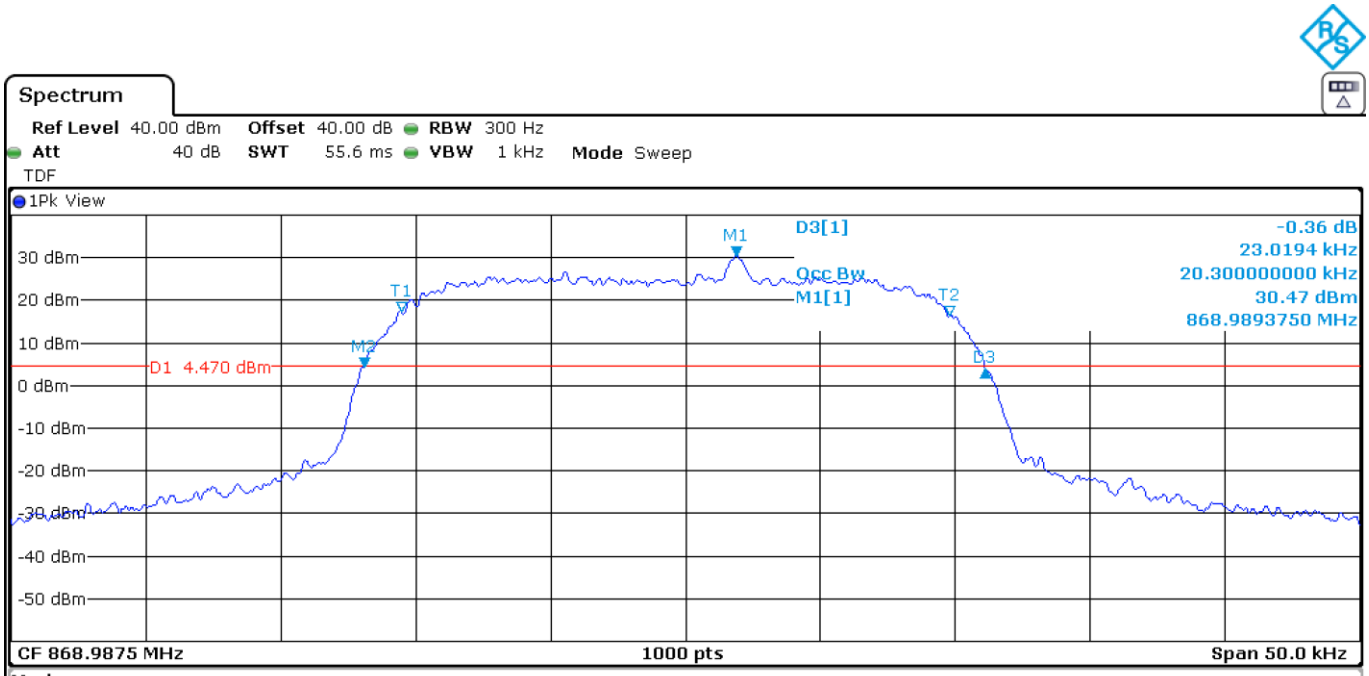
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	860.014425 MHz	30.42 dBm		
T1		1	860.001975 MHz	17.59 dBm	Occ Bw	20.25 kHz
T2		1	860.022225 MHz	18.66 dBm		
M2		1	860.00055 MHz	3.64 dBm		
D3	M2	1	23.169 kHz	0.13 dB		

Highest Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	868.989375 MHz	30.47 dBm		
T1		1	868.976975 MHz	17.48 dBm	Occ Bw	20.3 kHz
T2		1	868.997275 MHz	16.39 dBm		
M2		1	868.975596 MHz	4.42 dBm		
D3	M2	1	23.0194 kHz	-0.36 dB		

RF Output Power

SPECIFICATION

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

The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw)

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.

	Transmitter Output Power (W)	
Frequency Band (MHz)	**Base/Fixed Equipment**	**Mobile Equipment**
806-821/851-866 and 821-824/866-869	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

Type of equipment: Mobile station.

Manufacturer's rated power: 3 W (35 dBm).

TETRA. 22 kHz Bandwidth	Frequency (MHz)	Maximum average power (dBm)	Maximum deviation (dB)
	806.0125	34.748	-0.252
	809.0125	35.098	+0.098
	815.0125	34.628	-0.372
	823.9875	35.088	+0.088
Measurement uncertainty (dB)		<±1.44	

TETRA. 22 kHz Bandwidth	Frequency (MHz)	Maximum average power (dBm)	Maximum deviation (dB)
	851.0125	34.53	-0.470
	854.0125	34.52	-0.480
	860.0125	34.52	-0.480
	868.9875	34.53	-0.470
Measurement uncertainty (dB)		<±1.44	

Verdict: PASS

Emission Mask

SPECIFICATION

FCC §90.210:

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.

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**
806-821/851-866 and 821-824/866-869	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 17 - Emission Mask Y

Displacement Frequency, fd (kHz)	**Minimum Attenuation (dB)**	**Resolution Bandwidth (Hz)**
12.375 < fd ≤ 13.975	whichever is the lesser attenuation: 30 + 16.67(fd–12.375) or 55 + 10 log10(p)	Specified in Section 4.2.2
fd > 13.975	whichever is the lesser attenuation: 57 or 55 + 10 log10(p)	Specified in Section 4.2.2

Where p is the transmitter output power expressed in W.

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.
In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak mode.

RESULTS (see next plots)

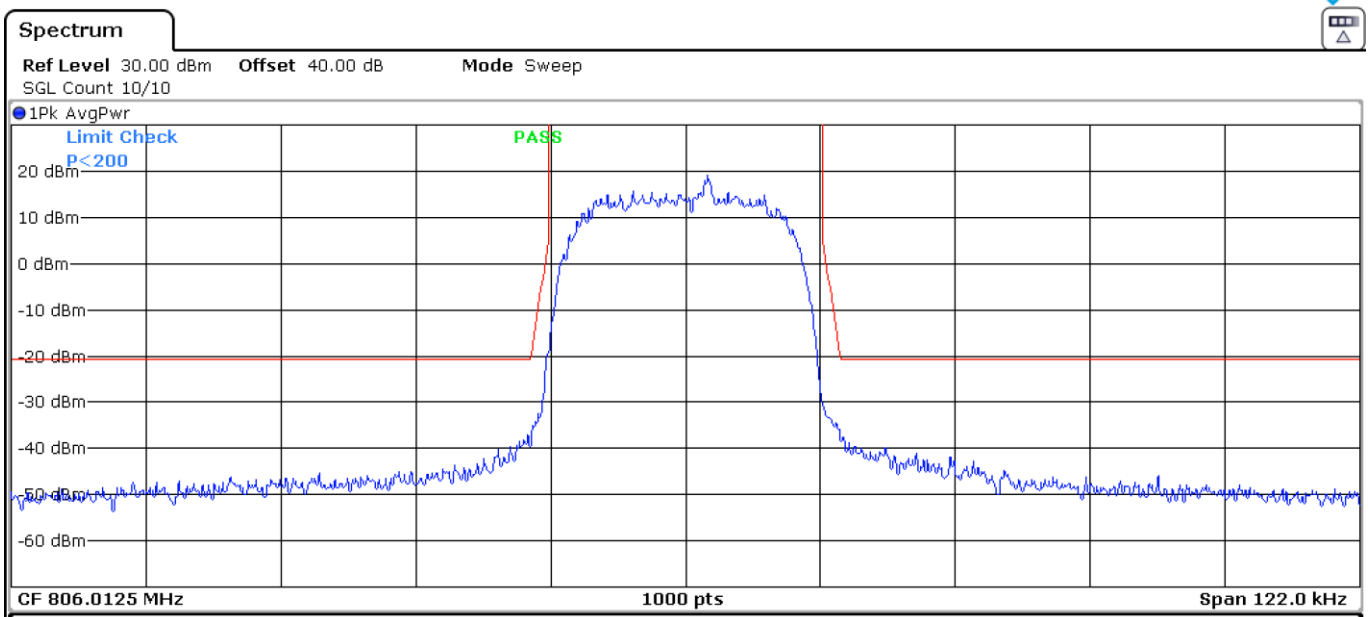
Measurement uncertainty (dB)	<±2.69

Verdict: PASS

RSS-119 Emission Mask Y.

TETRA 22 kHz. 806-824 MHz band.

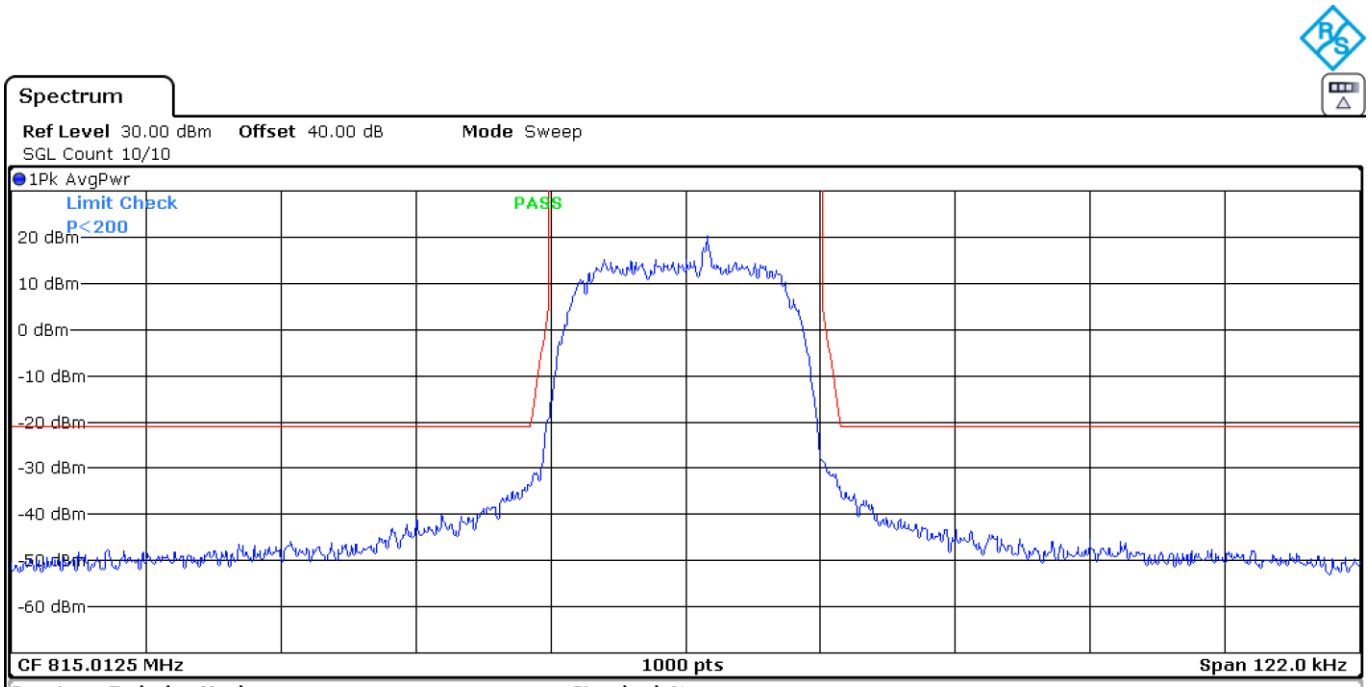
RSS-119 Lowest Channel



Spectrum Emission Mask — Standard: None
Tx Power 36.17 dBm — Tx Bandwidth 22.000 kHz — RBW 100.000 Hz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-61.000 kHz	-13.975 kHz	100.000 Hz	805.99822 MHz	-37.09 dBm	-73.27 dB	-16.27 dB
-13.975 kHz	-12.375 kHz	100.000 Hz	805.99859 MHz	-36.31 dBm	-72.48 dB	-16.52 dB
12.375 kHz	13.975 kHz	100.000 Hz	806.02641 MHz	-35.83 dBm	-72.00 dB	-16.04 dB
13.975 kHz	61.000 kHz	100.000 Hz	806.02678 MHz	-37.56 dBm	-73.73 dB	-16.73 dB

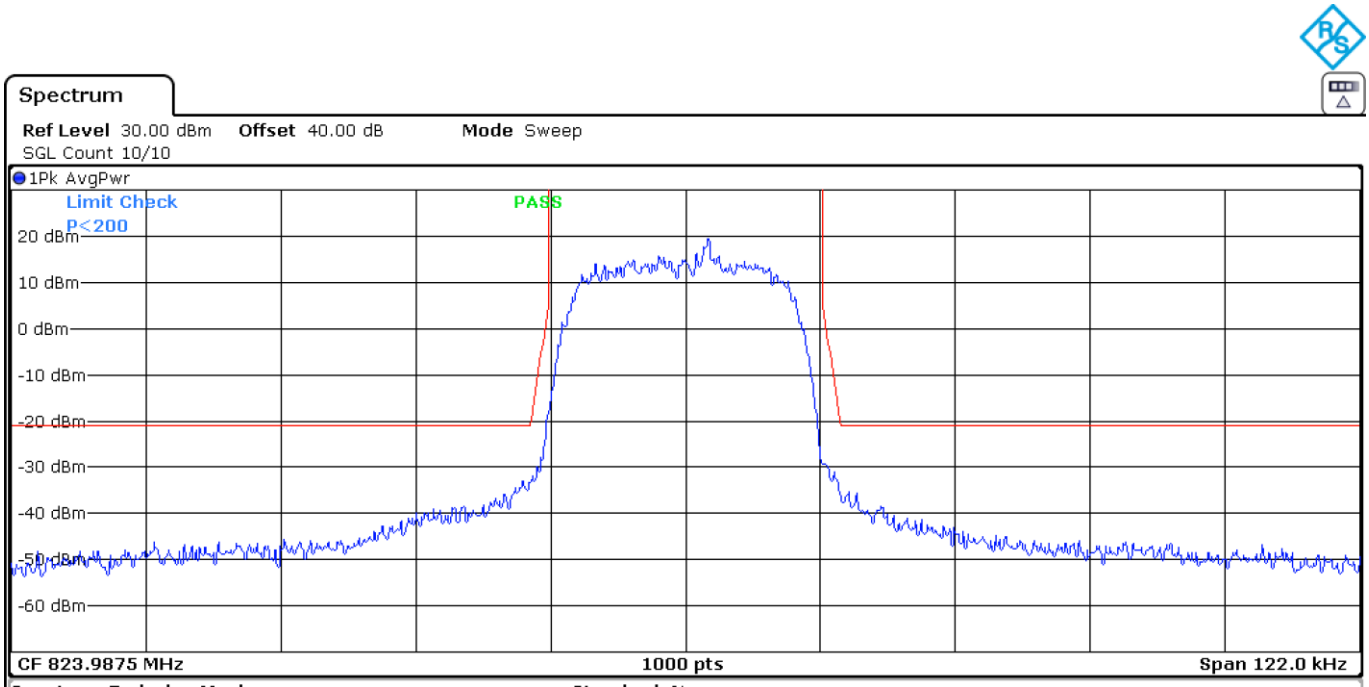
RSS-119 Middle Channel



Spectrum Emission Mask — Standard: None
Tx Power 36.03 dBm — Tx Bandwidth 22.000 kHz — RBW 100.000 Hz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-61.000 kHz	-13.975 kHz	100.000 Hz	814.99834 MHz	-33.49 dBm	-69.52 dB	-12.52 dB
-13.975 kHz	-12.375 kHz	100.000 Hz	814.99859 MHz	-33.13 dBm	-69.16 dB	-13.19 dB
12.375 kHz	13.975 kHz	100.000 Hz	815.02641 MHz	-33.82 dBm	-69.85 dB	-13.89 dB
13.975 kHz	61.000 kHz	100.000 Hz	815.02654 MHz	-35.14 dBm	-71.17 dB	-14.17 dB

RSS-119 Highest Channel

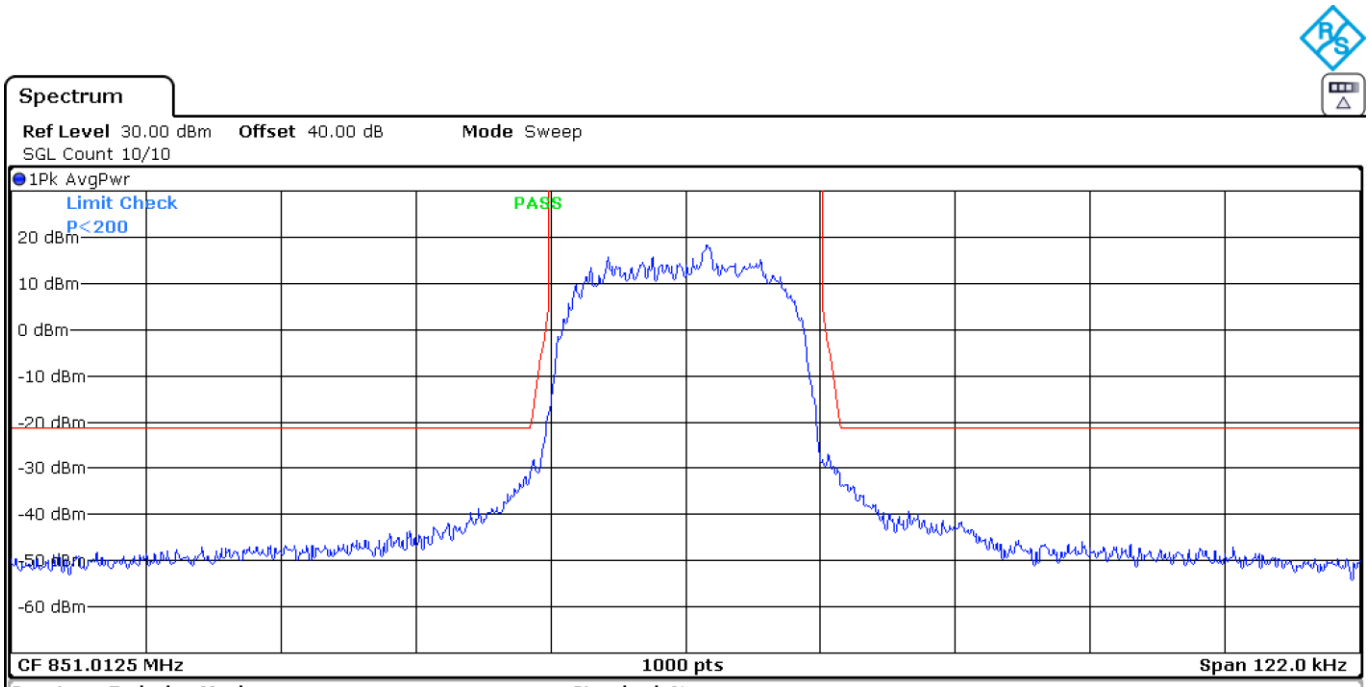


Spectrum Emission Mask — Standard: None
Tx Power 36.12 dBm — Tx Bandwidth 22.000 kHz — RBW 100.000 Hz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-61.000 kHz	-13.975 kHz	100.000 Hz	823.97273 MHz	-33.01 dBm	-69.12 dB	-12.12 dB
-13.975 kHz	-12.375 kHz	100.000 Hz	823.97359 MHz	-32.87 dBm	-68.99 dB	-13.03 dB
12.375 kHz	13.975 kHz	100.000 Hz	824.00129 MHz	-33.18 dBm	-69.30 dB	-15.42 dB
13.975 kHz	61.000 kHz	100.000 Hz	824.00227 MHz	-35.41 dBm	-71.53 dB	-14.53 dB

TETRA 22 kHz. 851-869 MHz band.

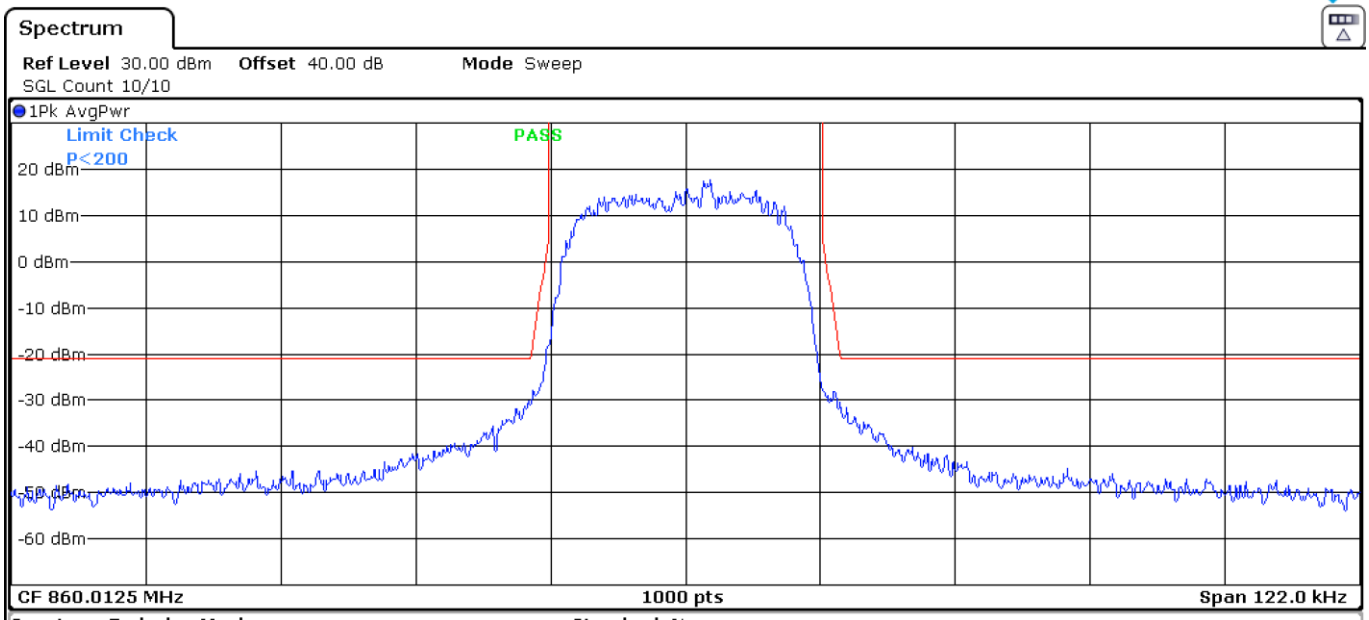
RSS-119 Lowest Channel



Spectrum Emission Mask — Standard: None
Tx Power 35.75 dBm — Tx Bandwidth 22.000 kHz — RBW 100.000 Hz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-61.000 kHz	-13.975 kHz	100.000 Hz	850.99846 MHz	-30.79 dBm	-66.54 dB	-9.54 dB
-13.975 kHz	-12.375 kHz	100.000 Hz	850.99859 MHz	-29.64 dBm	-65.39 dB	-9.43 dB
12.375 kHz	13.975 kHz	100.000 Hz	851.02641 MHz	-31.02 dBm	-66.77 dB	-10.81 dB
13.975 kHz	61.000 kHz	100.000 Hz	851.02715 MHz	-33.48 dBm	-69.23 dB	-12.23 dB

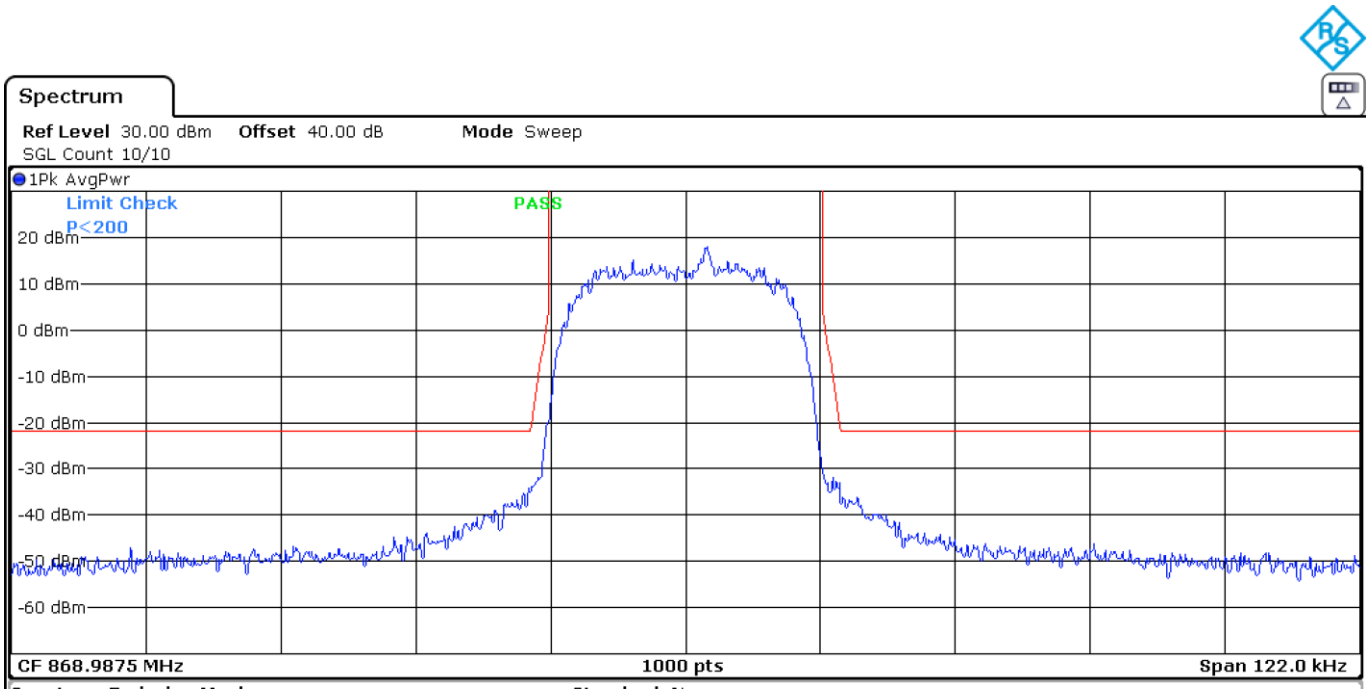
RSS-119 Middle Channel



Spectrum Emission Mask **Standard: None**
Tx Power 35.86 dBm **Tx Bandwidth 22.000 kHz** **RBW 100.000 Hz**

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-61.000 kHz	-13.975 kHz	100.000 Hz	859.99834 MHz	-30.20 dBm	-66.06 dB	-9.06 dB
-13.975 kHz	-12.375 kHz	100.000 Hz	859.99859 MHz	-29.80 dBm	-65.65 dB	-9.69 dB
12.375 kHz	13.975 kHz	100.000 Hz	860.02641 MHz	-30.33 dBm	-66.18 dB	-10.22 dB
13.975 kHz	61.000 kHz	100.000 Hz	860.02654 MHz	-31.58 dBm	-67.43 dB	-10.43 dB

RSS-119 Highest Channel



Spectrum Emission Mask **Standard: None**
Tx Power 35.25 dBm **Tx Bandwidth 22.000 kHz** **RBW 100.000 Hz**

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-61.000 kHz	-13.975 kHz	100.000 Hz	868.97334 MHz	-34.27 dBm	-69.52 dB	-12.52 dB
-13.975 kHz	-12.375 kHz	100.000 Hz	868.97359 MHz	-34.03 dBm	-69.29 dB	-13.33 dB
12.375 kHz	13.975 kHz	100.000 Hz	869.00141 MHz	-33.10 dBm	-68.36 dB	-12.39 dB
13.975 kHz	61.000 kHz	100.000 Hz	869.00300 MHz	-36.14 dBm	-71.39 dB	-14.39 dB

Verdict: PASS

Adjacent channel power

SPECIFICATION

FCC §90.221. 809–824/854–869 MHz bands.

(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 (Pwatts) dB.

METHOD

The Adjacent Channel Power measurements were made at the RF output terminals of the EUT using an attenuator and a spectrum analyser with a built-in adjacent channel power (ACP) measurement function.

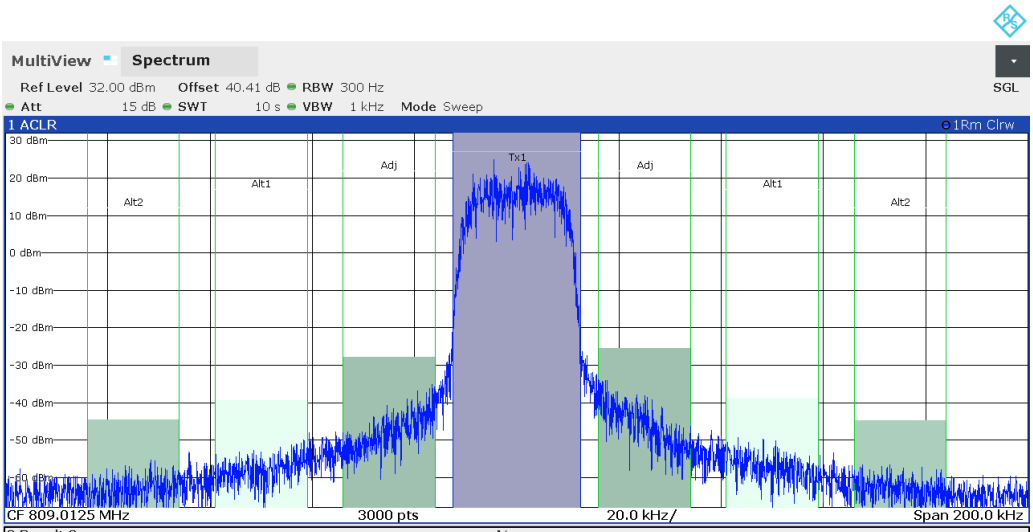
RESULTS

See next plots.

Measurement uncertainty (dB)	<±0.50 (Non-swept measurements)

TETRA 22 kHz. 809-824 MHz band.

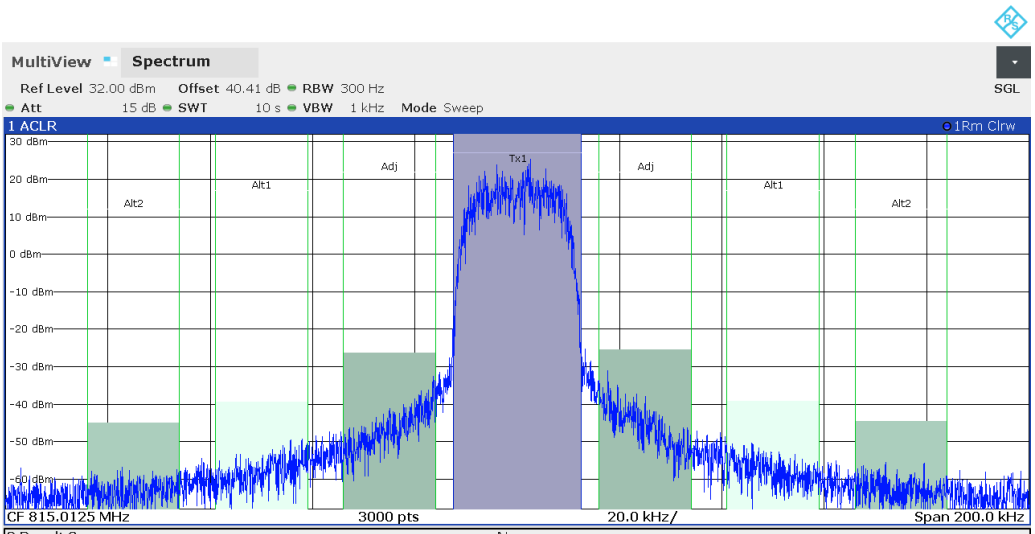
FCC 90 Lowest Channel 809.0125 MHz



2 Result Summary — None

Channel	Bandwidth	Offset	Power	
Tx1 (Ref)	25.000 kHz		**34.39 dBm**	
Tx Total			**34.39 dBm**	
Channel	**Bandwidth**	**Offset**	**Lower**	**Upper**
Adj	18.000 kHz	25.000 kHz	**-62.30 dBc**	**-59.98 dBc**
Alt1	18.000 kHz	50.000 kHz	**-73.88 dBc**	**-73.28 dBc**
Alt2	18.000 kHz	75.000 kHz	**-79.10 dBc**	**-79.19 dBc**

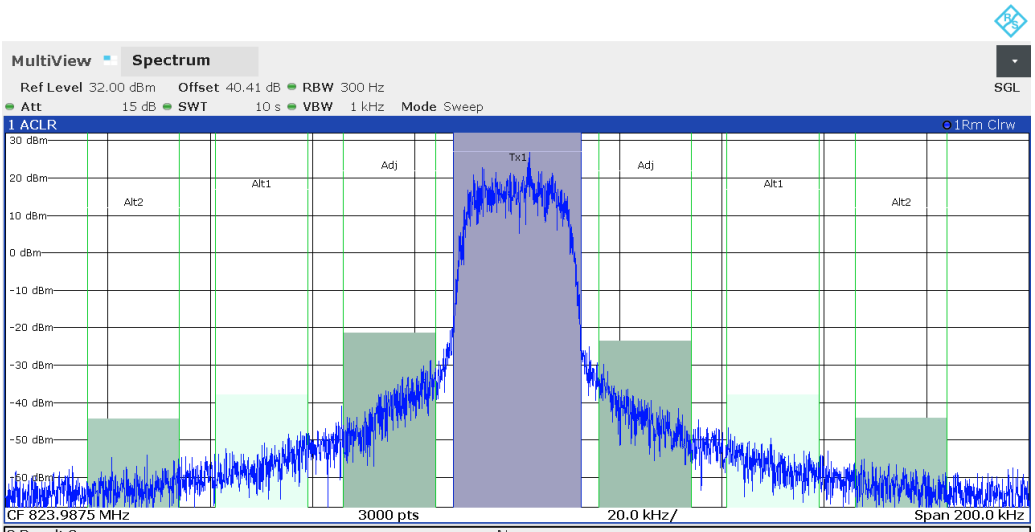
Middle Channel



2 Result Summary — None

Channel	Bandwidth	Offset	Power	
Tx1 (Ref)	25.000 kHz		**34.52 dBm**	
Tx Total			**34.52 dBm**	
Channel	**Bandwidth**	**Offset**	**Lower**	**Upper**
Adj	18.000 kHz	25.000 kHz	**-60.97 dBc**	**-59.93 dBc**
Alt1	18.000 kHz	50.000 kHz	**-73.89 dBc**	**-73.72 dBc**
Alt2	18.000 kHz	75.000 kHz	**-79.58 dBc**	**-79.04 dBc**

Highest Channel

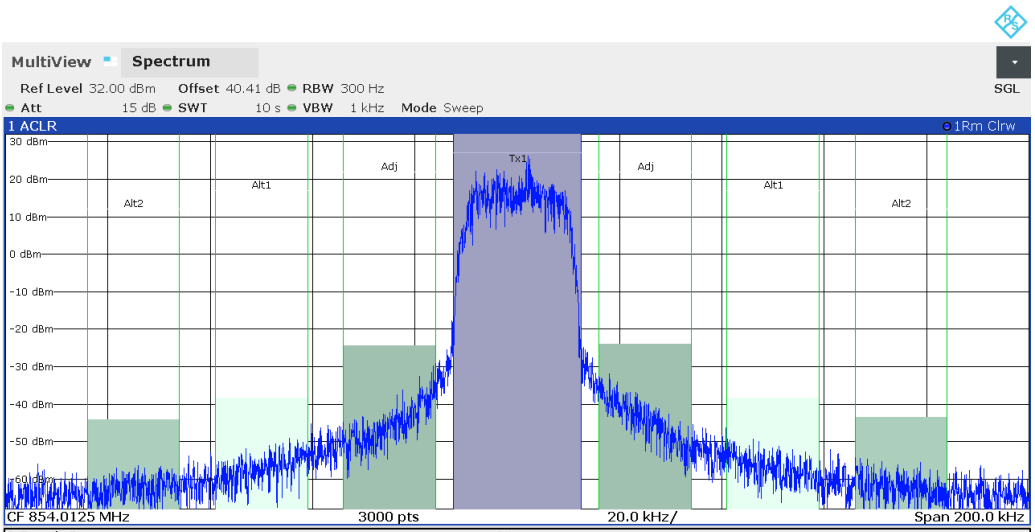


2 Result Summary — None

Channel	Bandwidth	Offset	Power	
Tx1 (Ref)	25.000 kHz		**34.69 dBm**	
Tx Total			**34.69 dBm**	
Channel	**Bandwidth**	**Offset**	**Lower**	**Upper**
Adj	18.000 kHz	25.000 kHz	**-56.12 dBc**	**-58.19 dBc**
Alt1	18.000 kHz	50.000 kHz	**-72.62 dBc**	**-72.62 dBc**
Alt2	18.000 kHz	75.000 kHz	**-79.11 dBc**	**-78.97 dBc**

TETRA 22 kHz. 854-869 MHz band.

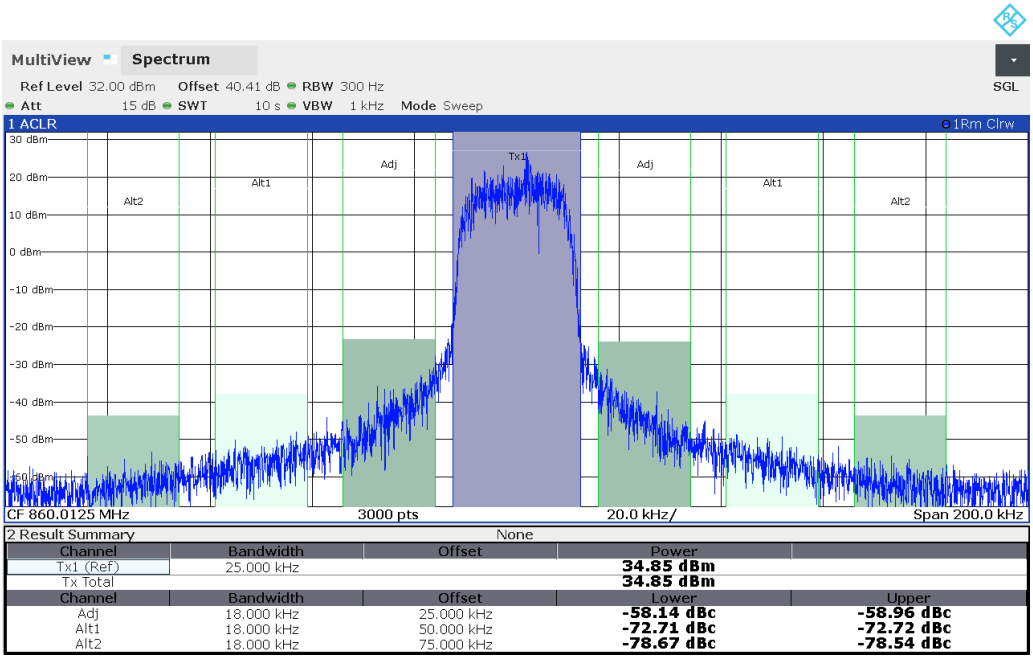
FCC 90 Lowest Channel 854.0125 MHz



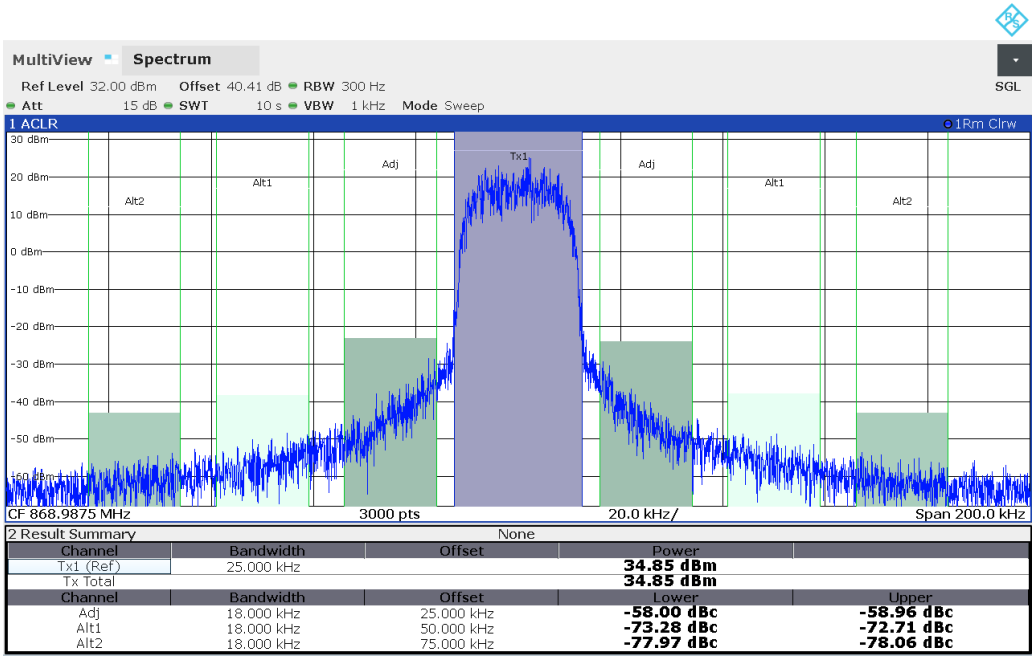
2 Result Summary — None

Channel	Bandwidth	Offset	Power	
Tx1 (Ref)	25.000 kHz		**34.63 dBm**	
Tx Total			**34.63 dBm**	
Channel	**Bandwidth**	**Offset**	**Lower**	**Upper**
Adj	18.000 kHz	25.000 kHz	**-59.13 dBc**	**-58.55 dBc**
Alt1	18.000 kHz	50.000 kHz	**-73.09 dBc**	**-72.93 dBc**
Alt2	18.000 kHz	75.000 kHz	**-78.77 dBc**	**-78.22 dBc**

Middle Channel



Highest Channel



Frequency Stability

SPECIFICATION

FCC §2.1055, §90.213. 809–824/854–869 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)	Mobile stations	
	Over 2 watts output power	2 watts or less output power
809–824	2.5 ppm	2.5 ppm
854–869	2.5 ppm	2.5 ppm

(a) The frequency stability shall be measured with variation of ambient temperature as follows:
  (1) From -30º to +50º centigrade for all equipment except that specified in paragraphs (a)(2) and (3) of this section.
(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10º centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement.
(d) The frequency stability shall be measured with variation of primary supply voltage as follows:
  (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

RSS-119 Clause 5.3 / RSS-Gen Issue 5 Clause 6.11 806-824/851-869 MHz bands.

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

Table 1

Frequency Band (MHz)	Channel Spacing (kHz)	Frequency Stability (ppm)
		Mobile Station (Output > 2 W)
806-824 and 851-869 (Note 6)	25 (Note 2)	0.1
	25	2.5
	12.5	1.5
	6.25	0.4

Note 2: This provision is for digital equipment with a channel spacing of 25 kHz and an occupied bandwidth greater than 20 kHz. The mobile station's frequency stability values given in Table 1 are for mobile, portable and control transmitters using automatic frequency control (AFC) to lock onto the base station signal. When the mobile, portable and control transmitters are operating without using AFC to lock onto the base station signal, the frequency stability limit shall be better than 1 kHz and the equipment's unwanted emissions measured with maximum frequency shift shall still comply with emission mask Y (Section 5.8.10) at nominal carrier frequency.

Note 6: Control stations may operate with the frequency tolerance specified for associated mobile frequencies.

For licensed devices, the following measurement conditions apply:

(a) At the temperatures of -30ºC (-22ºF), +20ºC (+68ºF) and +50ºC (+122ºF), and at the manufacturer´s rated supply voltage.
(b) At the temperature of +20ºC (+68ºF) and at ±15% of the manufacturer´s rated supply voltage.

METHOD

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

Frequency Stability vs Voltage: Vary primary supply voltage between the extreme voltage values declared.

According to the FCC and ISED reference standards, the primary supply voltage must be varied from 85% to 115% of the nominal supply value, i.e, from 11.22 Vdc to 15.18 Vdc. However, as the declared extreme voltage values of 10.8 Vdc and 15.6 Vdc cover the required range, the frequency stability test has been performed considering the worst case, i.e. 10.8 Vdc and 15.6 Vdc.

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:
TETRA 22 kHz. 806-824 MHz band.

Middle Channel.

Voltage (Vdc)	Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
Frequency stability with Temperature			
13.2	+50	239	0.29325
	+40	169	0.20736
	+30	270	0.33128
	+20	344	0.42208
	+10	268	0.32883
	0	257	0.31533
	-10	253	0.31042
	-20	323	0.39631
	-30	384	0.47116
Frequency stability with Supply Voltage			
10.8	20	337	0.41349
15.6	20	332	0.40736

NOTE: The equipment was unlocked onto any base station.

TETRA 22 kHz. 851-869 MHz band.

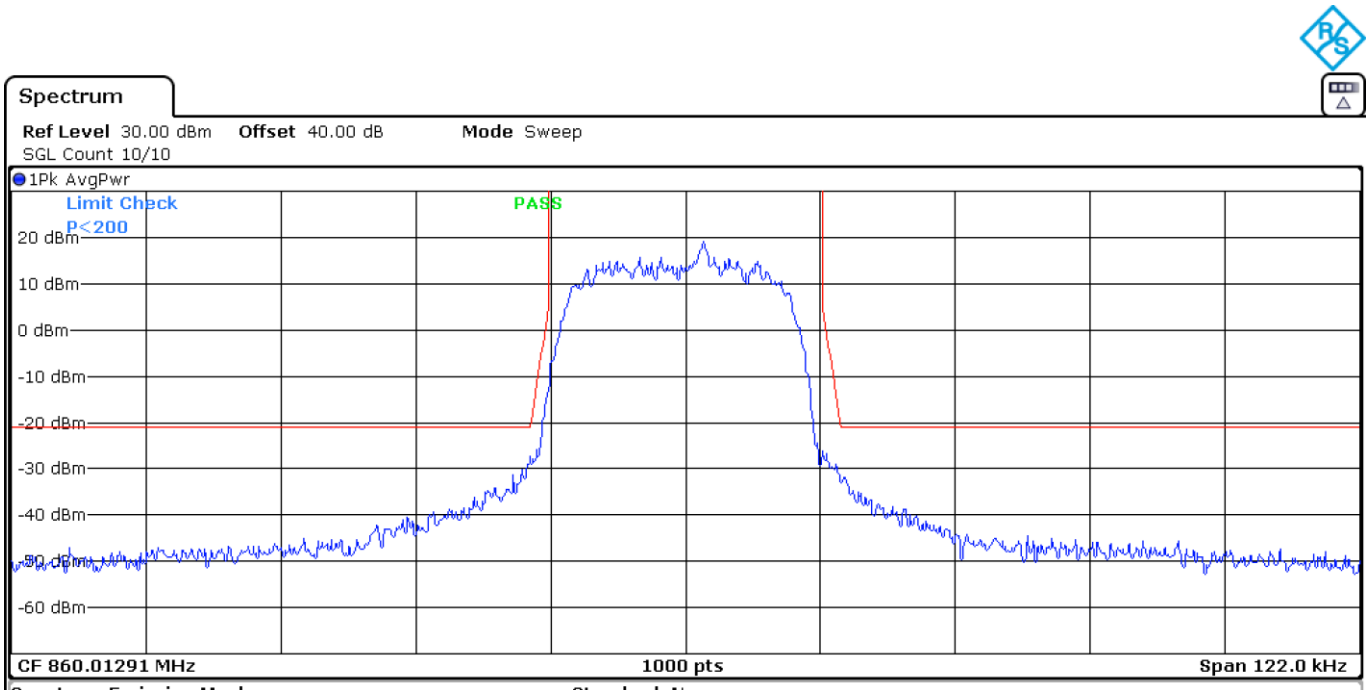
Middle Channel.

Voltage (Vdc)	Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
Frequency stability with Temperature			
13.2	+50	262	0.30465
	+40	194	0.22558
	+30	284	0.33023
	+20	366	0.42558
	+10	283	0.32906
	0	270	0.31395
	-10	266	0.30930
	-20	332	0.38604
	-30	410	0.47674
Frequency stability with Supply Voltage			
10.8	20	347	0.40348
15.6	20	349	0.40581

NOTE: The equipment was unlocked onto any base station.

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

RSS-119 Emission Mask Y (highest frequency deviation detected).
TETRA 22 kHz. 806-824 and 851-869MHz band.



Spectrum Emission Mask **Standard: None**
Tx Power 36.03 dBm **Tx Bandwidth 22.000 kHz** **RBW 100.000 Hz**

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-61.000 kHz	-13.975 kHz	100.000 Hz	859.99887 MHz	-27.19 dBm	-63.22 dB	-6.22 dB
-13.975 kHz	-12.375 kHz	100.000 Hz	859.99900 MHz	-29.03 dBm	-65.06 dB	-9.10 dB
12.375 kHz	13.975 kHz	100.000 Hz	860.02682 MHz	-31.45 dBm	-67.48 dB	-11.52 dB
13.975 kHz	61.000 kHz	100.000 Hz	860.02731 MHz	-31.91 dBm	-67.94 dB	-10.94 dB

Verdict: PASS

Spurious emissions at antenna terminals

SPECIFICATION

FCC §2.1051, §90.210, §90.221. 809–824/854–869 MHz bands.

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 (Pwatts) dB.

RSS-119 Clause 5.8.

Table 17 - Emission Mask Y

Displacement Frequency, fd (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
12.375 < fd ≤ 13.975	whichever is the lesser attenuation: 30 + 16.67(fd–12.375) or 55 + 10 log10(p)	Specified in Section 4.2.2
fd > 13.975	whichever is the lesser attenuation: 57 or 55 + 10 log10(p)	Specified in Section 4.2.2

Where p is the transmitter output power expressed in W.

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

TETRA 22 kHz. 806-824 MHz band.

RSS-119 LOWEST CHANNEL: 806.0125 MHz

Spurious Frequency (GHz)	Level (dBm)	Uncertainty (dB)
5.778	-39.92	< ± 2.95

FCC 90 LOWEST CHANNEL: 809.0125 MHz

Spurious Frequency (GHz)	Level (dBm)	Uncertainty (dB)
5.982	-29.81	< ± 2.95

CHANNEL: MIDDLE

Spurious Frequency (GHz)	Level (dBm)	Uncertainty (dB)
1.63045	-40.4	< ± 2.95
5.978	-39.81	< ± 2.95

CHANNEL: HIGHEST

Spurious Frequency (GHz)	Level (dBm)	Uncertainty (dB)
1.64815	-37.03	< ± 2.95

TETRA 22 kHz. 851-869 MHz band.

RSS-119 LOWEST CHANNEL: 851.0125 MHz

Spurious Frequency (GHz)	Level (dBm)	Uncertainty (dB)
5.798	-39.75	< ± 2.95

FCC 90 LOWEST CHANNEL: 854.0125 MHz

Spurious Frequency (GHz)	Level (dBm)	Uncertainty (dB)
5.851	-29.76	< ± 2.95

CHANNEL: MIDDLE

Spurious Frequency (GHz)	Level (dBm)	Uncertainty (dB)
5.851	-39.76	< ± 2.95

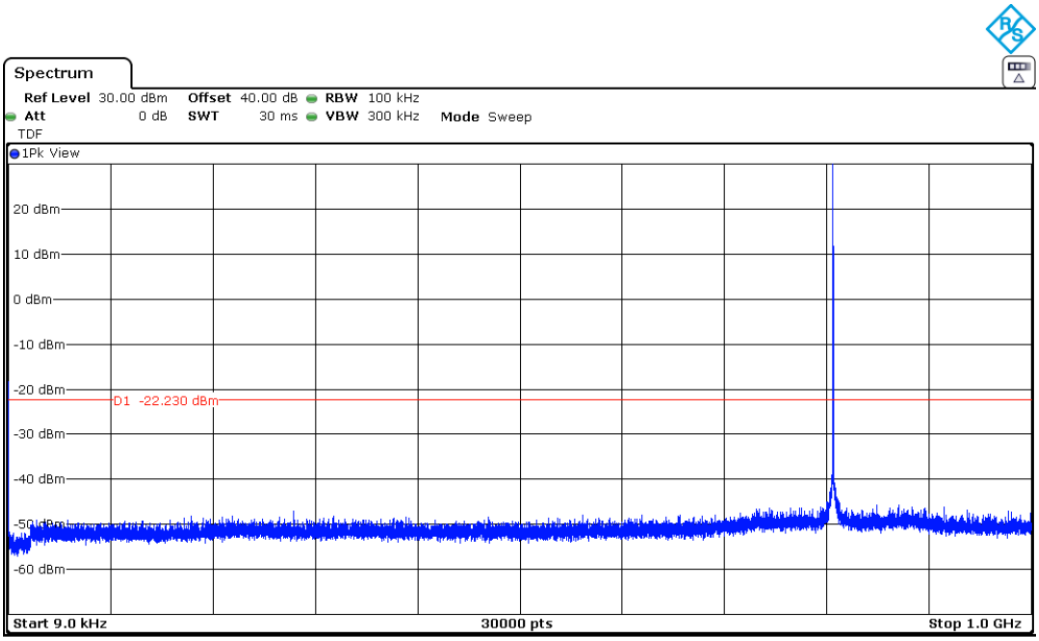
CHANNEL: HIGHEST

Spurious Frequency (GHz)	Level (dBm)	Uncertainty (dB)
5.85	-39.78	< ± 2.95

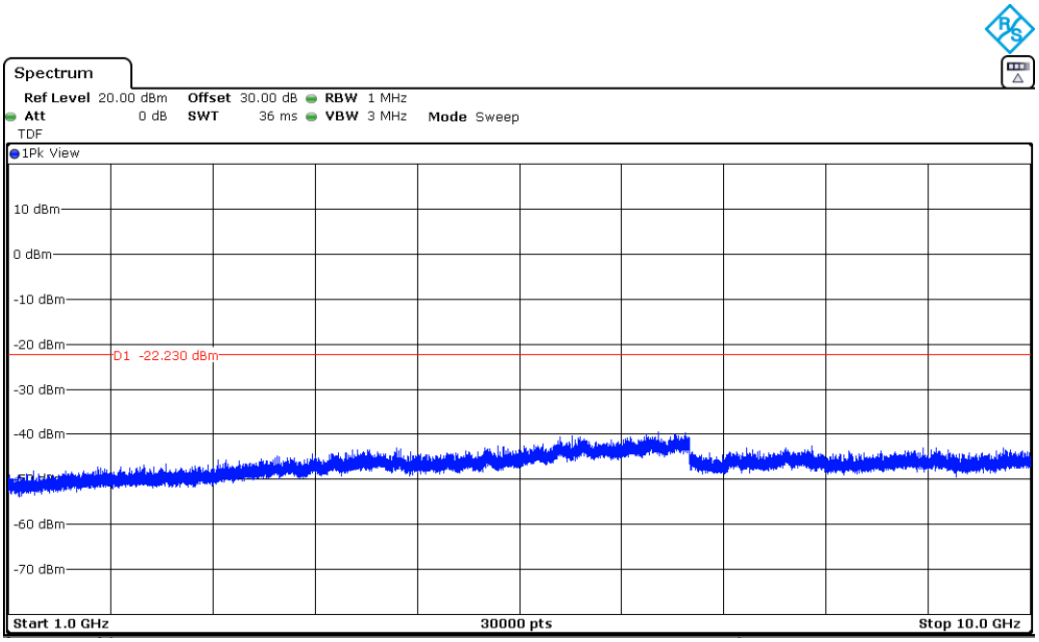
Verdict: PASS

TETRA 22 kHz. 806-824 MHz band.

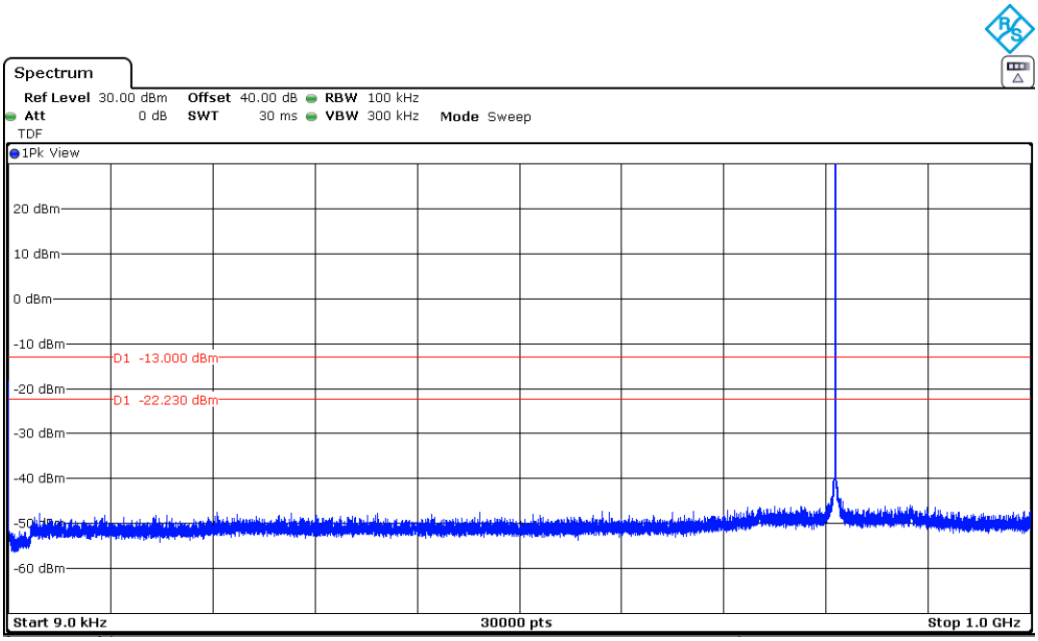
RSS-119 LOWEST CHANNEL: 806.0125 MHz



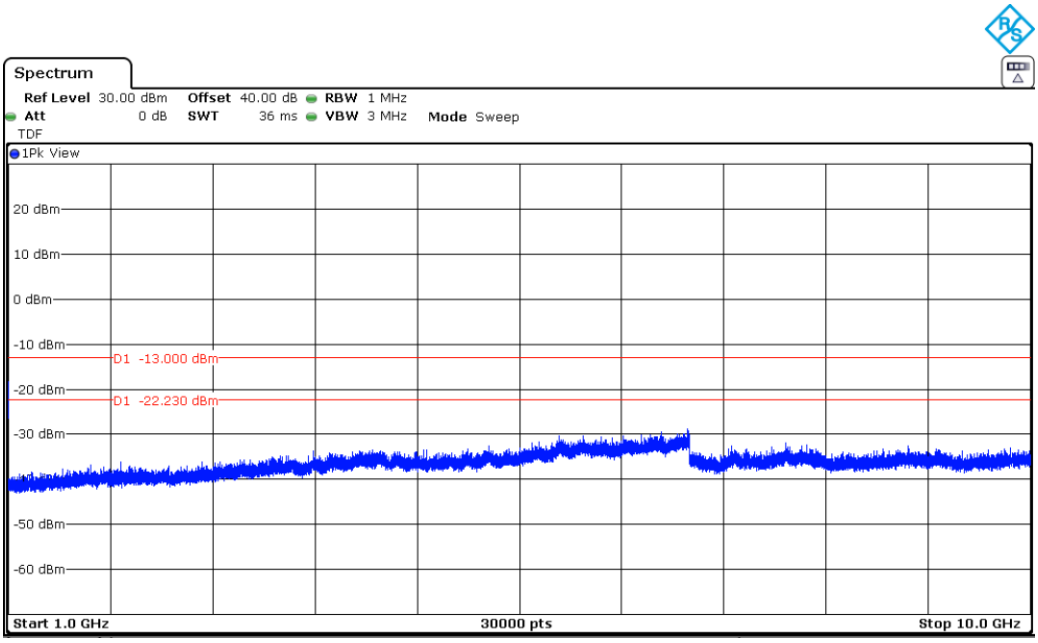
Note: The peak above the limit is the carrier frequency.



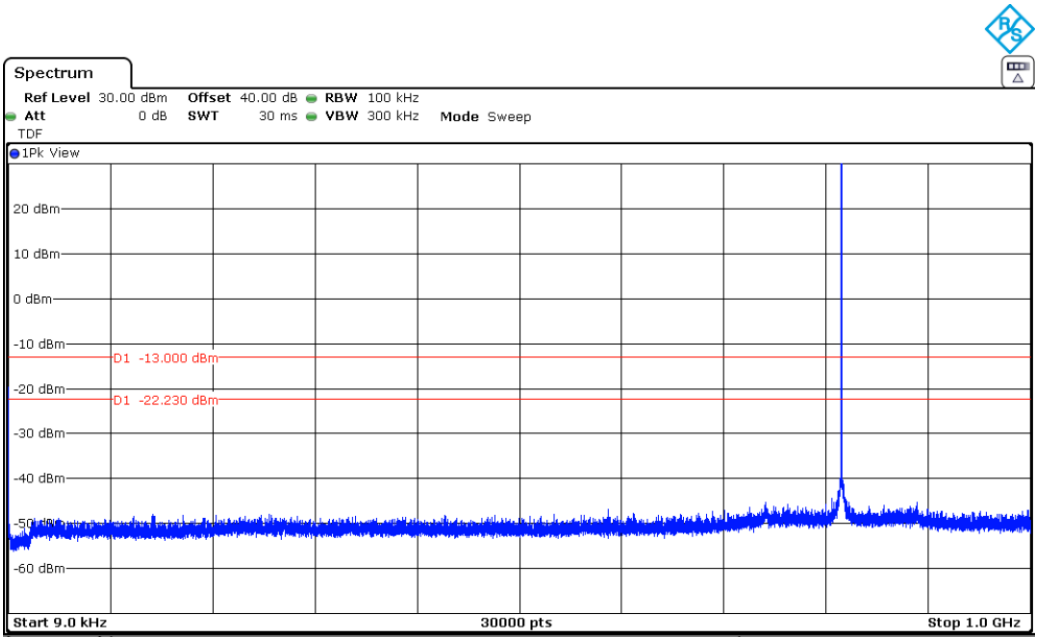
FCC 90 LOWEST CHANNEL: 809.0125 MHz



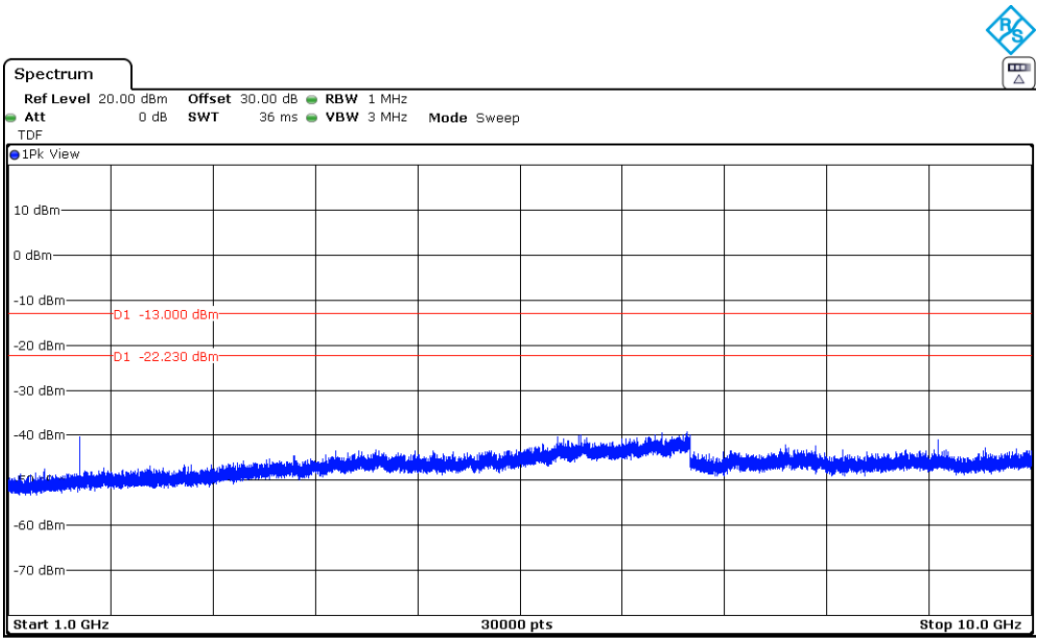
Note: The peak above the limit is the carrier frequency.



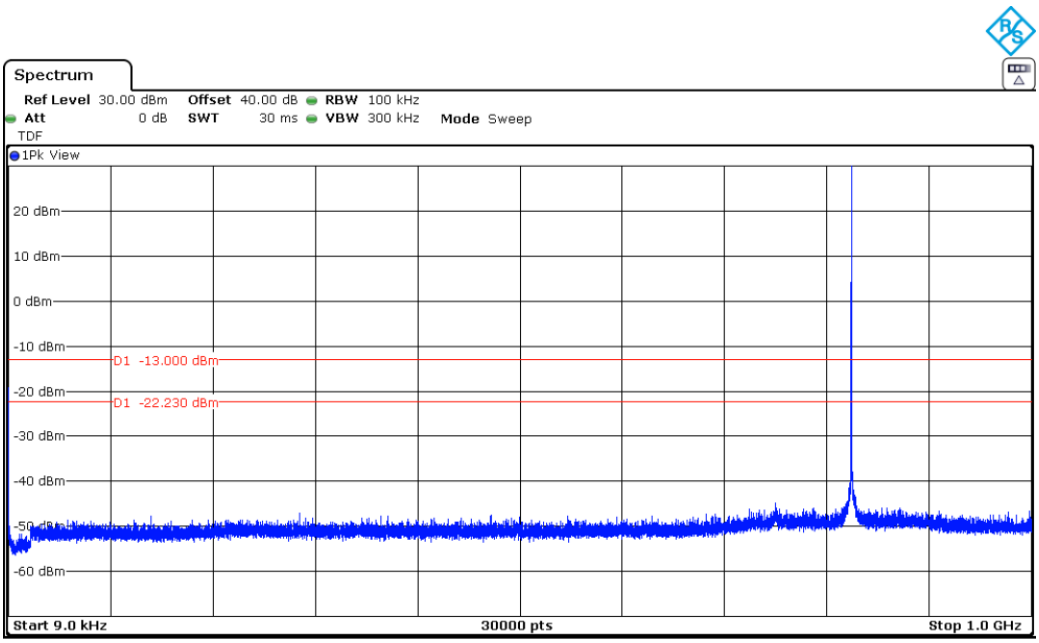
CHANNEL: MIDDLE



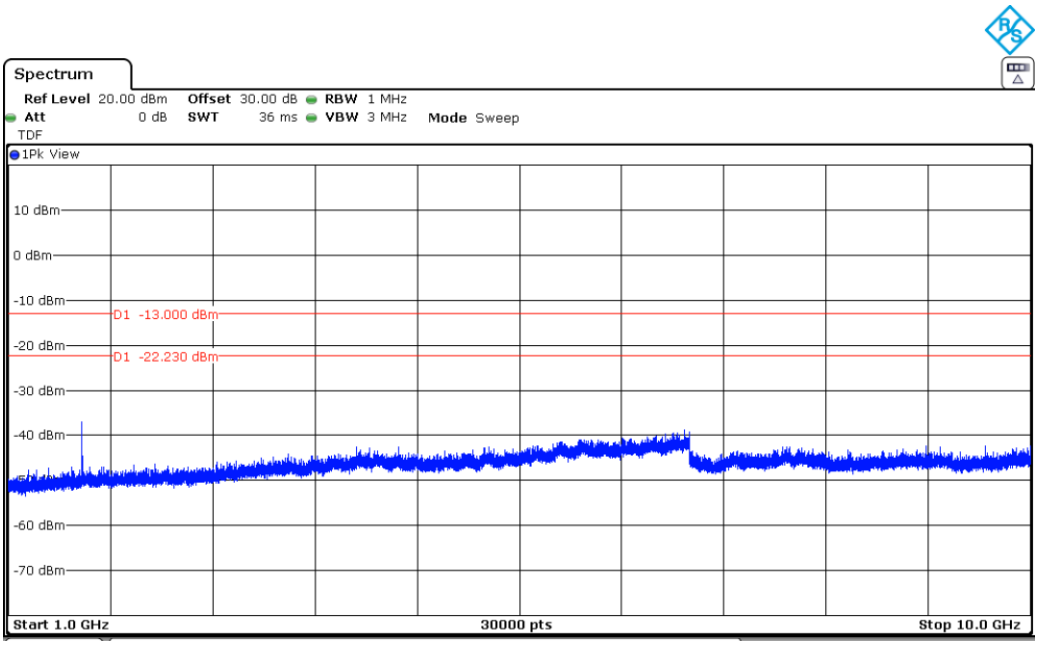
Note: The peak above the limit is the carrier frequency.



CHANNEL: HIGHEST

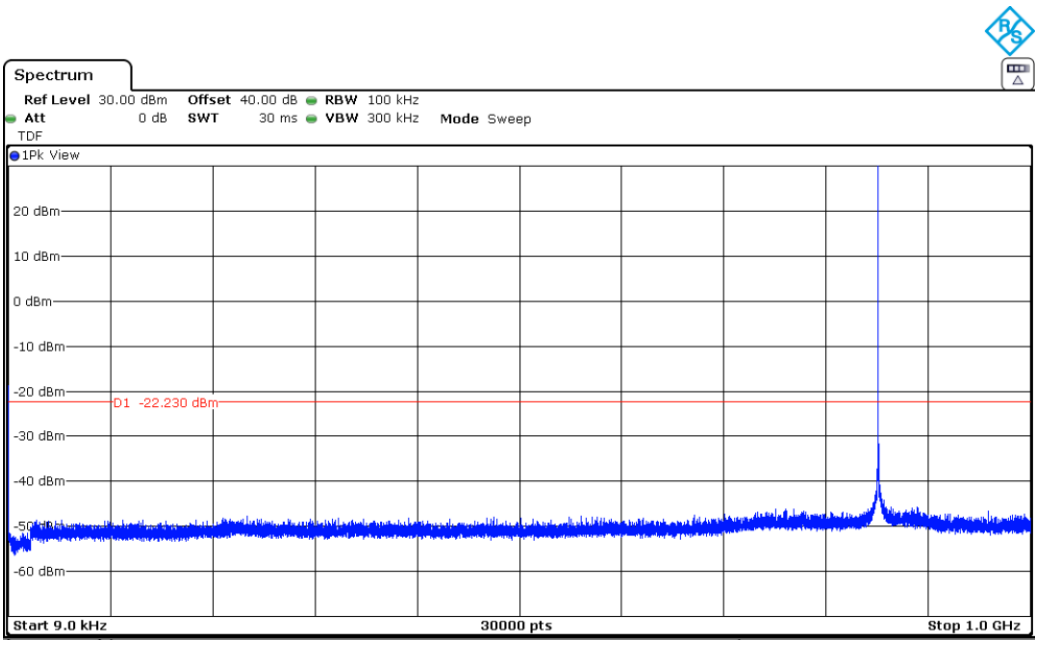


Note: The peak above the limit is the carrier frequency.

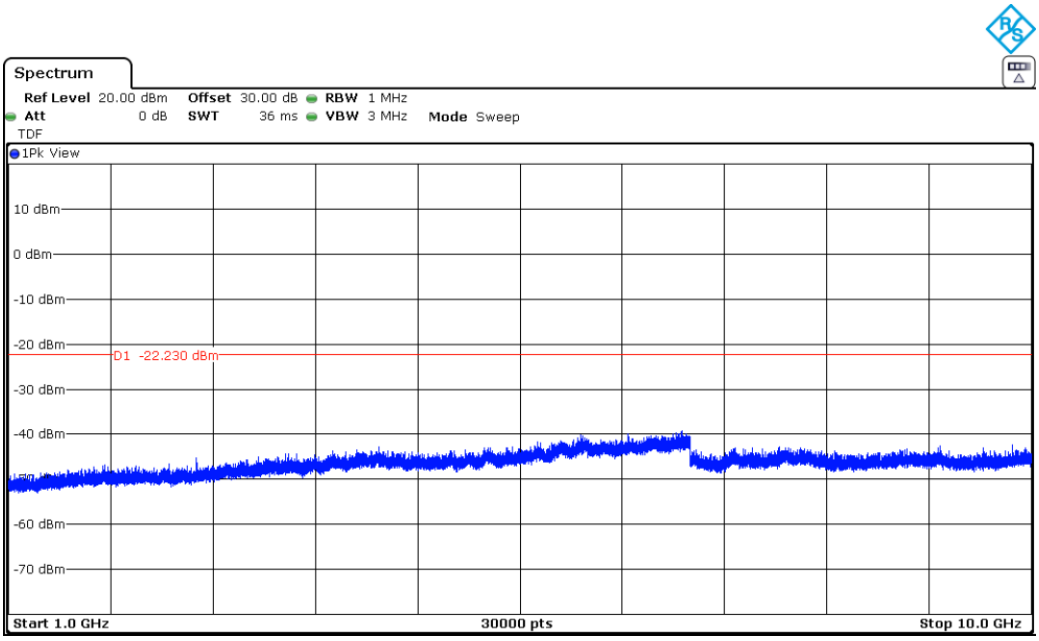


TETRA 22 kHz. 851-869 MHz band.

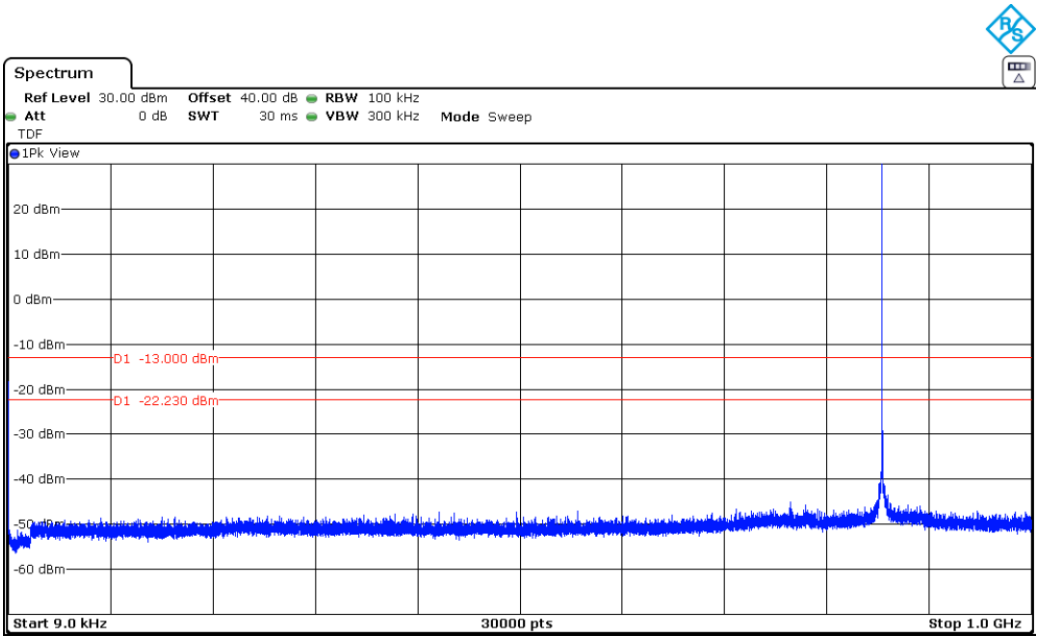
RSS-119 LOWEST CHANNEL: 851.0125 MHz



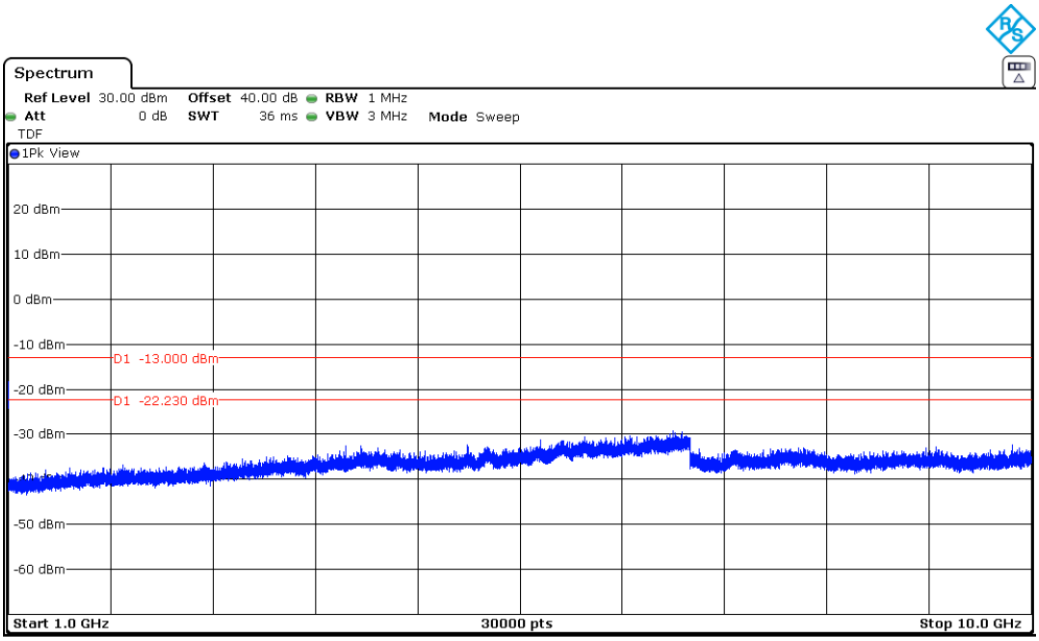
Note: The peak above the limit is the carrier frequency.



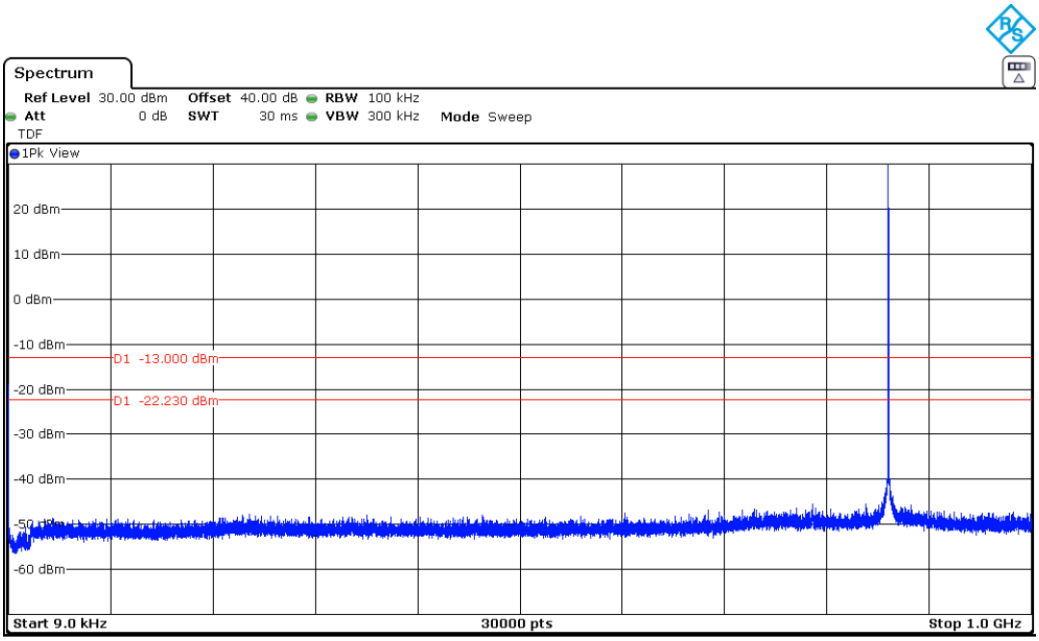
FCC-90 LOWEST CHANNEL: 854.0125 MHz



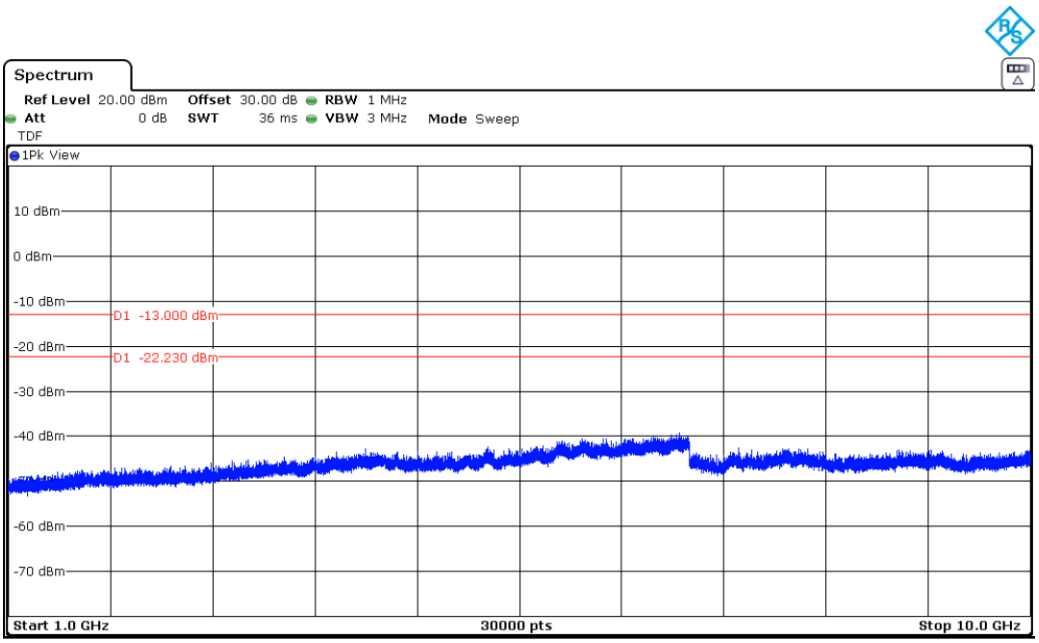
Note: The peak above the limit is the carrier frequency.



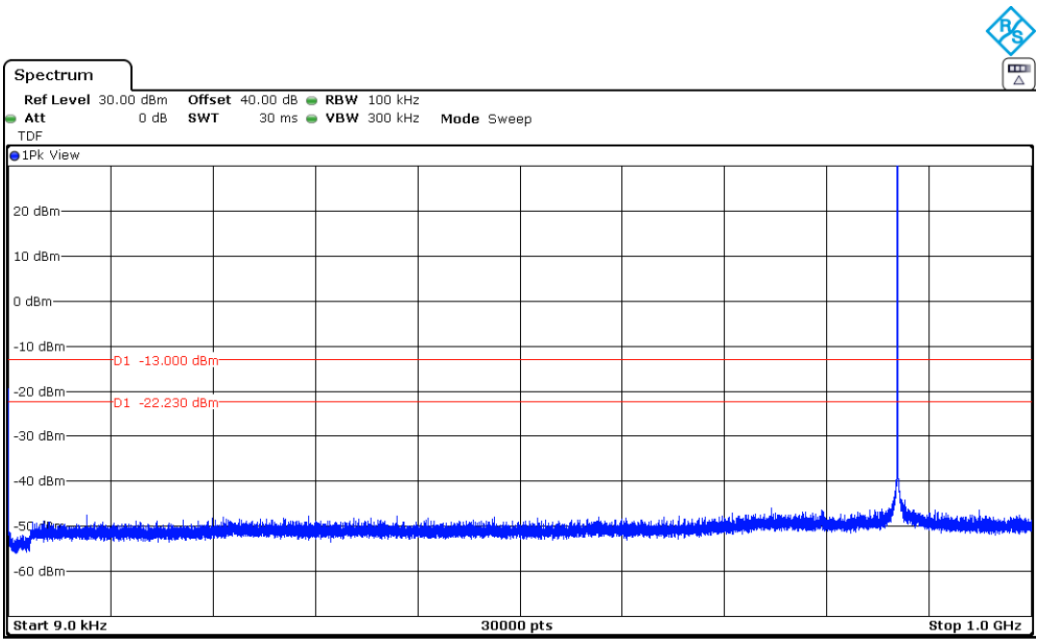
CHANNEL: MIDDLE



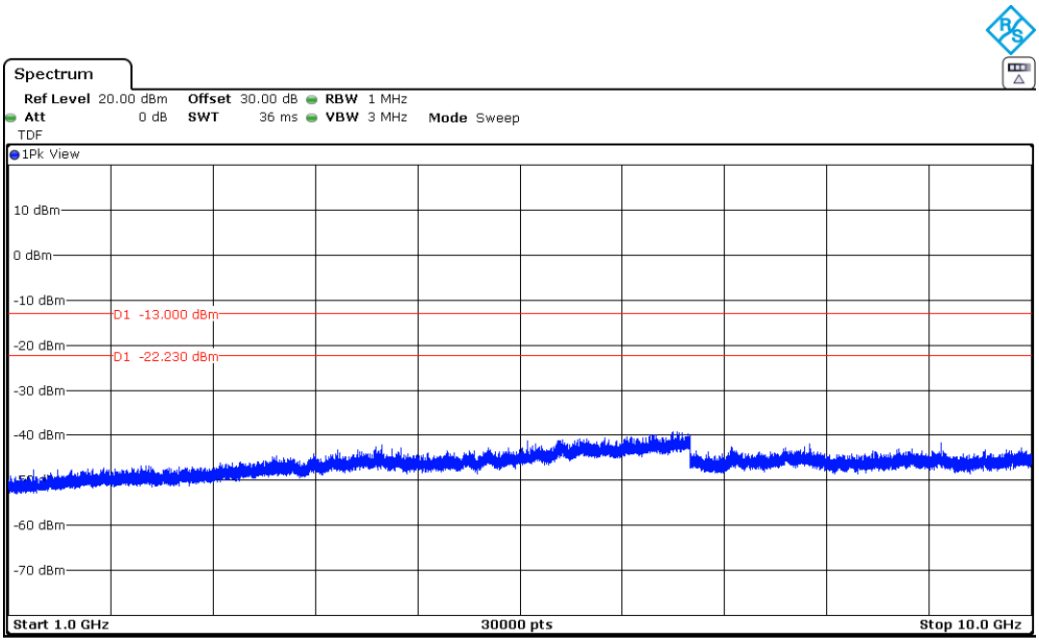
Note: The peak above the limit is the carrier frequency.



CHANNEL: HIGHEST



Note: The peak above the limit is the carrier frequency.



Radiated emissions

SPECIFICATION

FCC §2.1051, §90.210, §90.221. 809–824/854–869 MHz bands.

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 (Pwatts) dB.

RSS-119 Clause 5.8.

Table 17 - Emission Mask Y

Displacement Frequency, fd (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
12.375 < fd ≤ 13.975	whichever is the lesser attenuation: 30 + 16.67(fd–12.375) or 55 + 10 log10(p)	Specified in Section 4.2.2
fd > 13.975	whichever is the lesser attenuation: 57 or 55 + 10 log10(p)	Specified in Section 4.2.2

Where p is the transmitter output power expressed in W.

METHOD

The measurement was performed with the EUT inside a semi-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.
Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum field strength (dBµV/m) is measured and recorded.

The maximum field strength (dBµV/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

EIRP (dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in m. D = 3 m.

RESULTS

TETRA 22 kHz. 806-824 MHz band.

RSS-119 LOWEST CHANNEL: 806.0125 MHz

All peaks found are more than 20 dB below the limit.

FCC 90 LOWEST CHANNEL: 809.0125 MHz

All peaks found are more than 20 dB below the limit.

CHANNEL: MIDDLE

All peaks found are more than 20 dB below the limit.

CHANNEL: HIGHEST

All peaks found are more than 20 dB below the limit.

TETRA 22 kHz. 851-869 MHz band.

RSS-119 LOWEST CHANNEL: 851.0125 MHz

All peaks found are more than 20 dB below the limit.

FCC 90 LOWEST CHANNEL: 854.0125 MHz

All peaks found are more than 20 dB below the limit.

CHANNEL: MIDDLE

All peaks found are more than 20 dB below the limit.

CHANNEL: HIGHEST

All peaks found are more than 20 dB below the limit

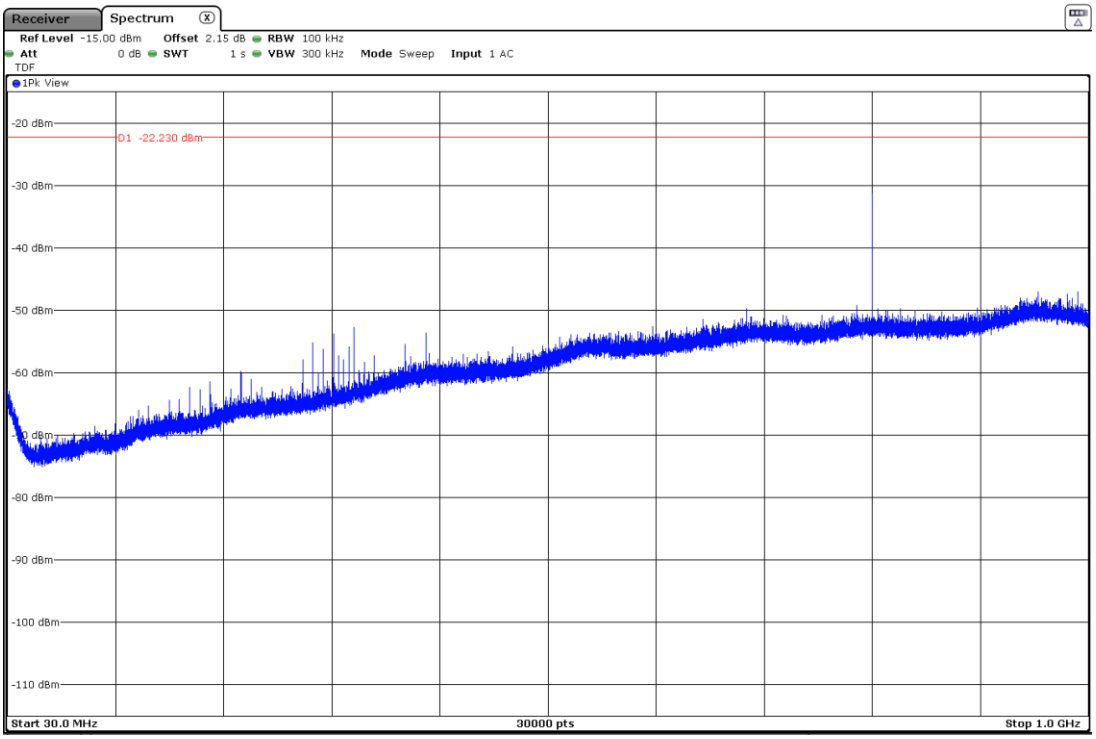
Measurement uncertainty (dB)	<±4.65 for f < 1GHz <±4.98 for f ≥ 1 GHz up to 10 GHz

Verdict: PASS

TETRA 22 kHz. 806-824 MHz band.

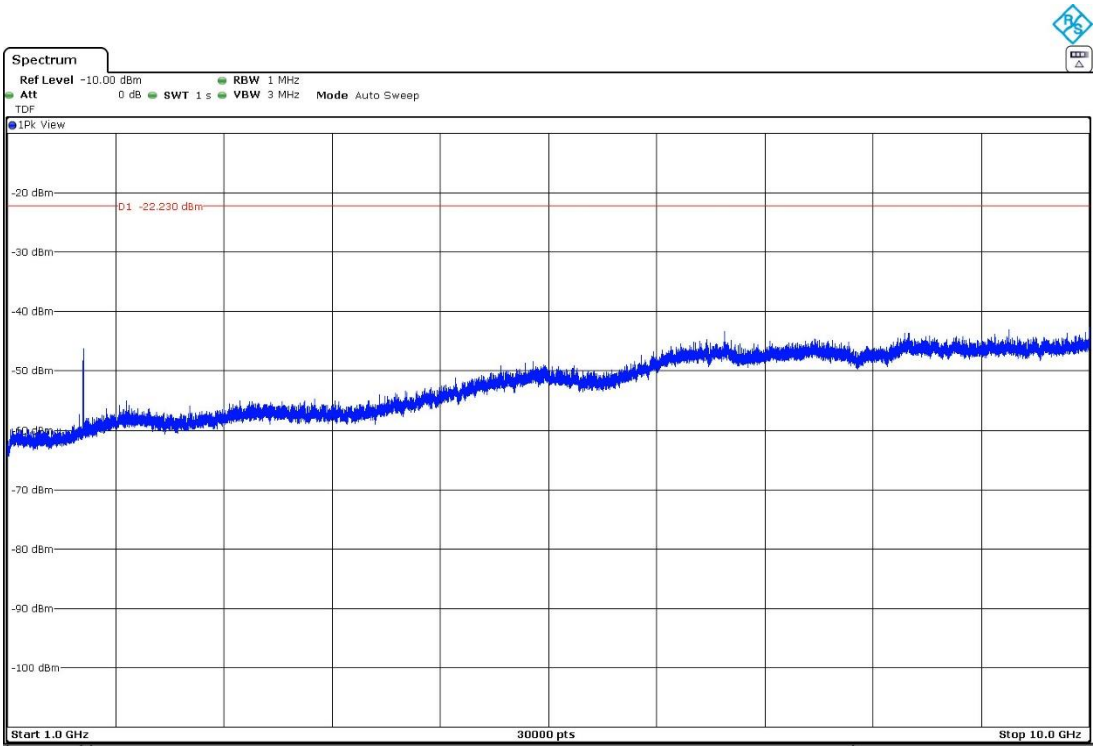
FREQUENCY RANGE 30 MHz-1000 MHz.

RSS-119 LOWEST CHANNEL: 806.0125 MHz



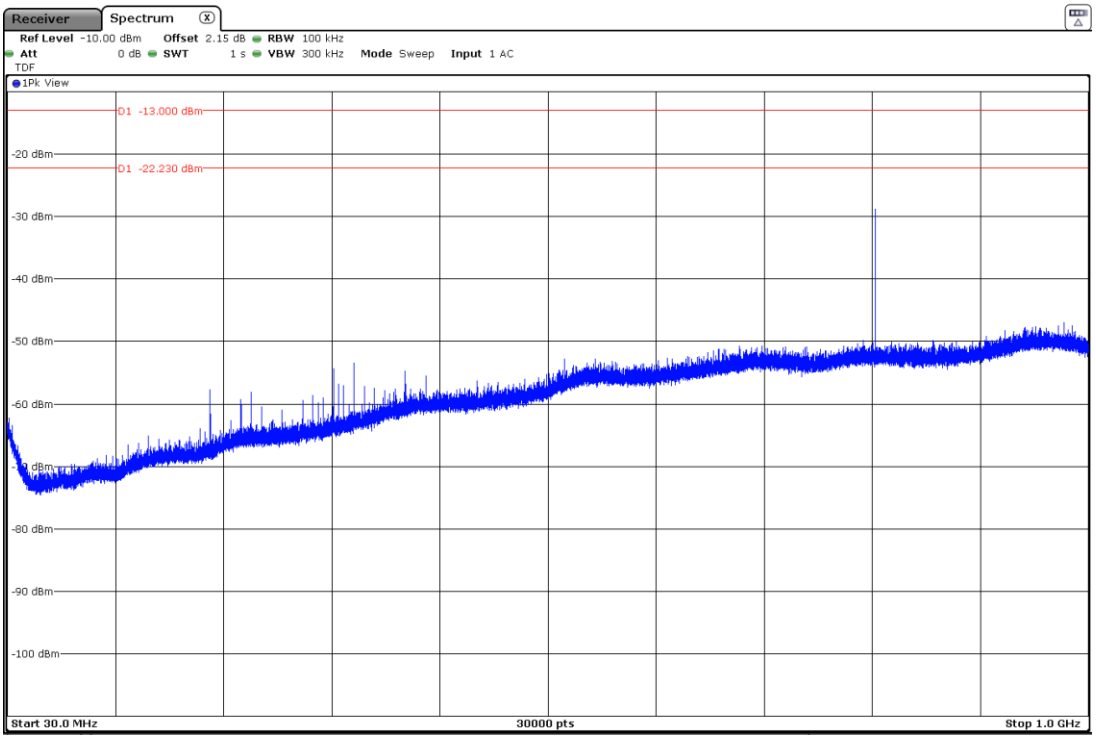
Note: The highest peak shown in the plot is the carrier frequency.

FREQUENCY RANGE 1 GHz to 10 GHz.



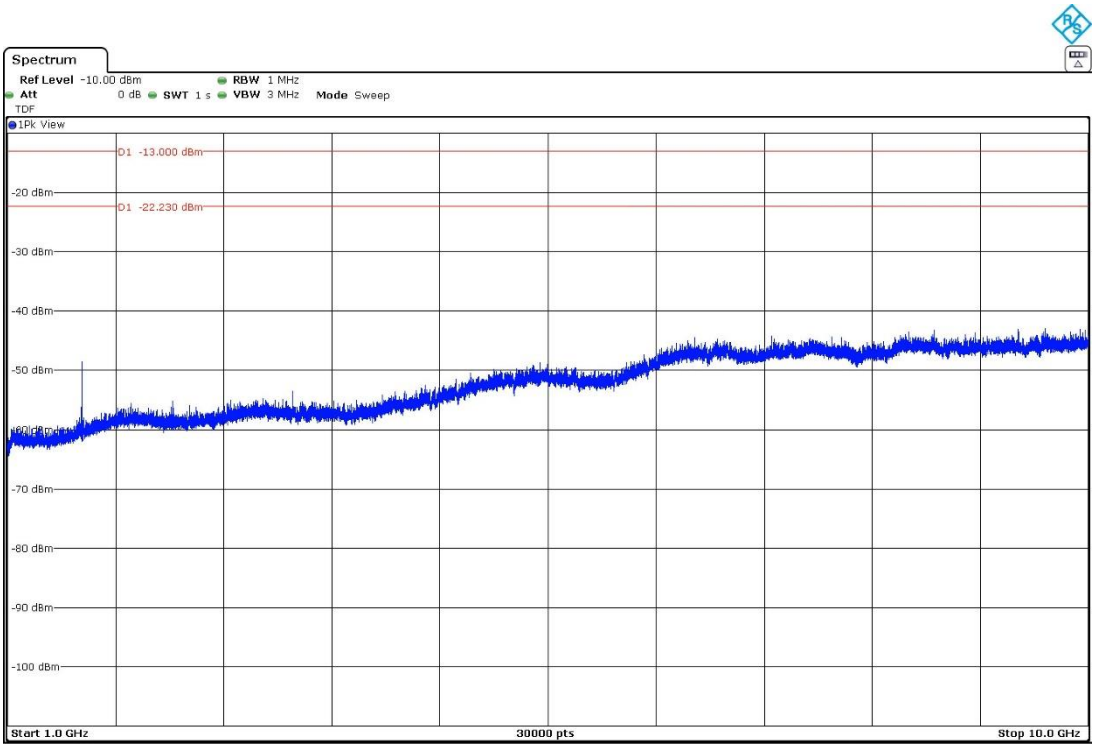
FCC 90 LOWEST CHANNEL: 809.0125 MHz

FREQUENCY RANGE 30 MHz-1000 MHz.



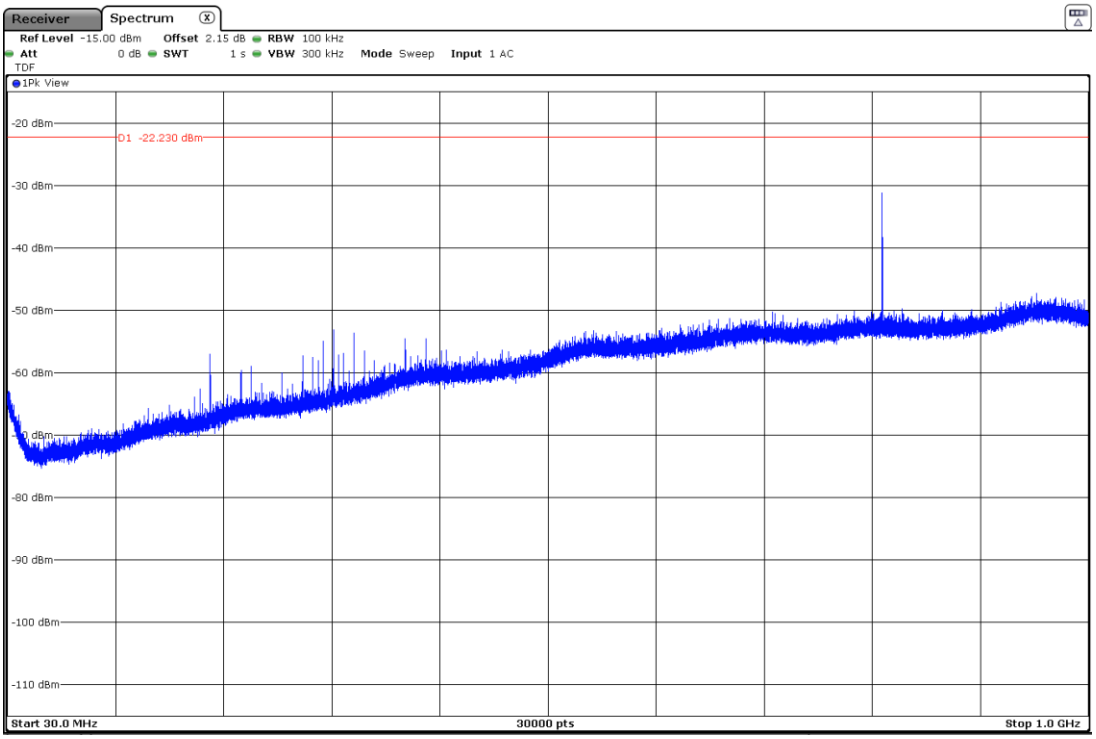
Note: The highest peak shown in the plot is the carrier frequency.

FREQUENCY RANGE 1 GHz to 10 GHz.



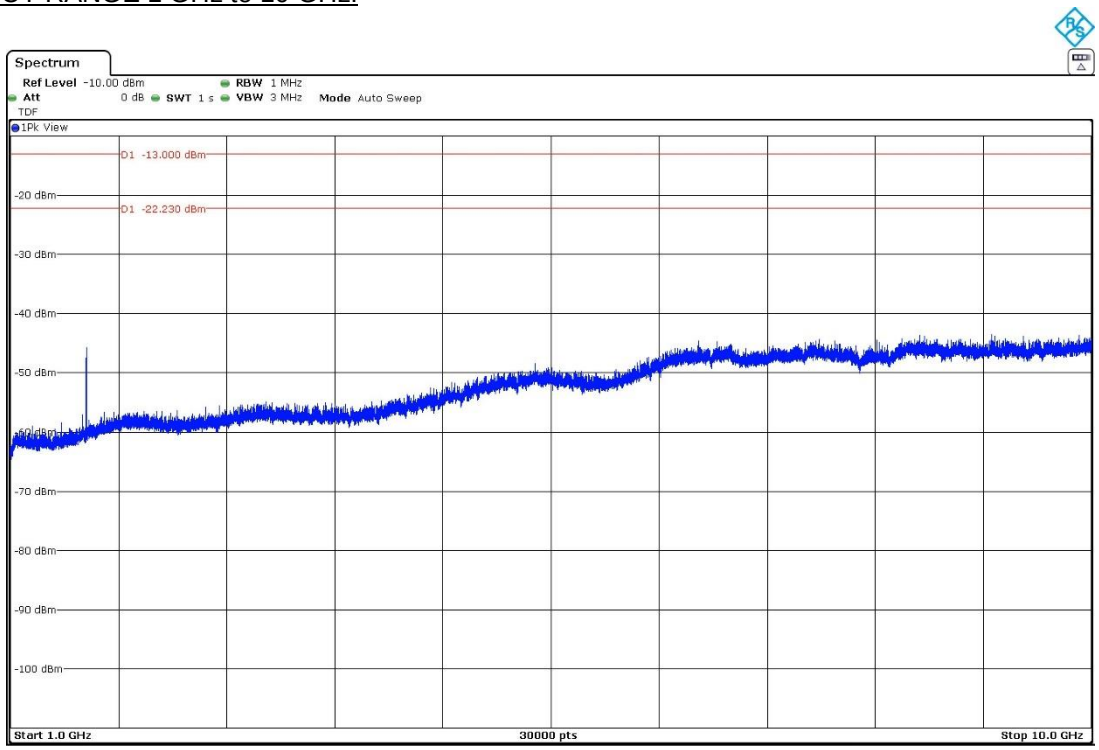
CHANNEL: MIDDLE

FREQUENCY RANGE 30 MHz-1000 MHz.



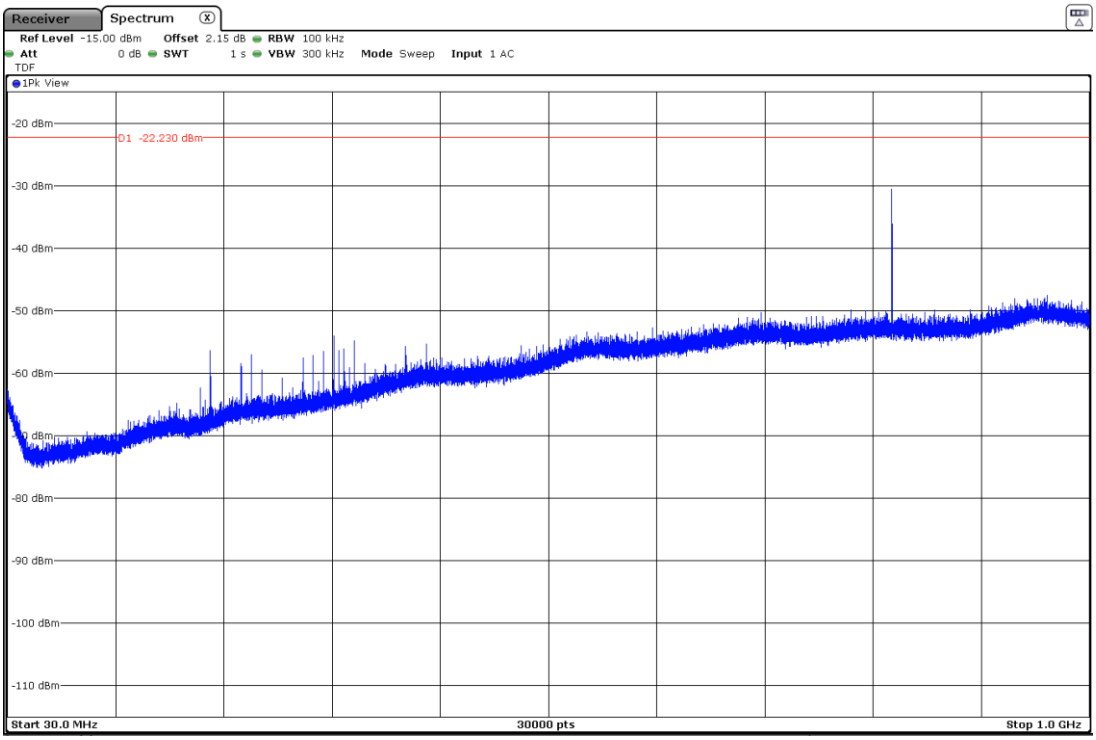
Note: The highest peak shown in the plot is the carrier frequency. The FCC limit set in -13 dBm lies above the Reference Level, thus outside the plot vertical scale. Compliance with the FCC limit is ensured, as the equipment meets the more-restrictive ISED requirement set in -22.23 dBm.

FREQUENCY RANGE 1 GHz to 10 GHz.



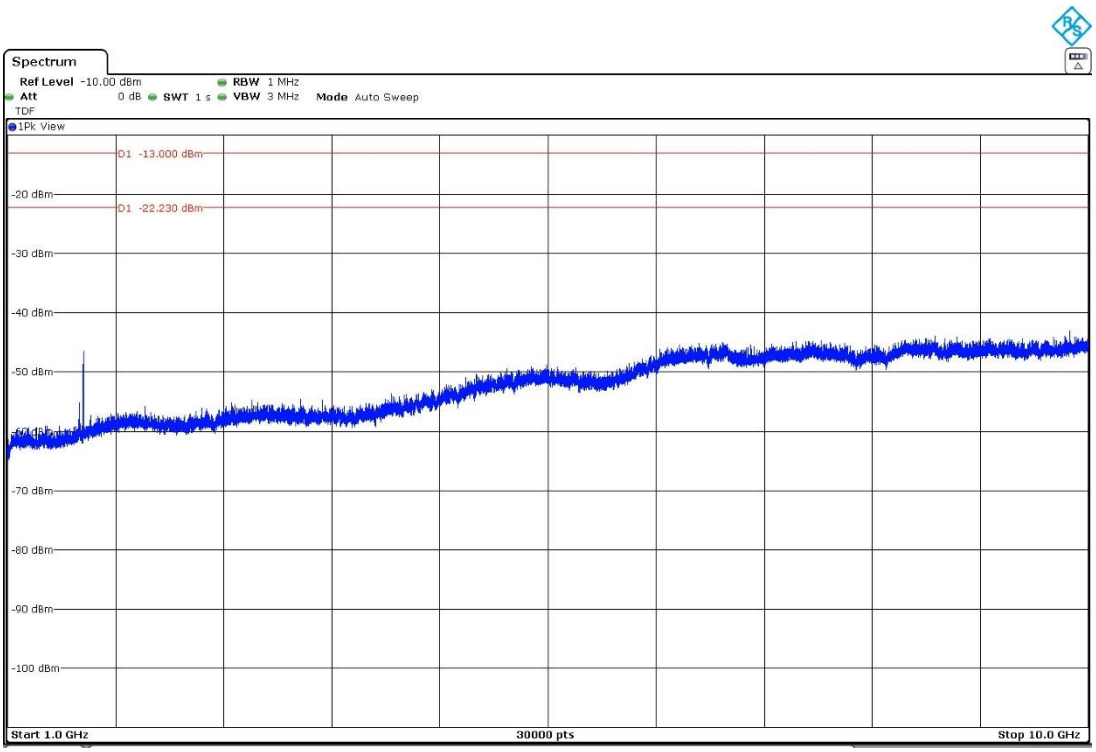
CHANNEL: HIGHEST.

FREQUENCY RANGE 30 MHz-1000 MHz.



Note: The highest peak shown in the plot is the carrier frequency. The FCC limit set in -13 dBm lies above the Reference Level, thus outside the plot vertical scale. Compliance with the FCC limit is ensured, as the equipment meets the more-restrictive ISED requirement set in -22.23 dBm.

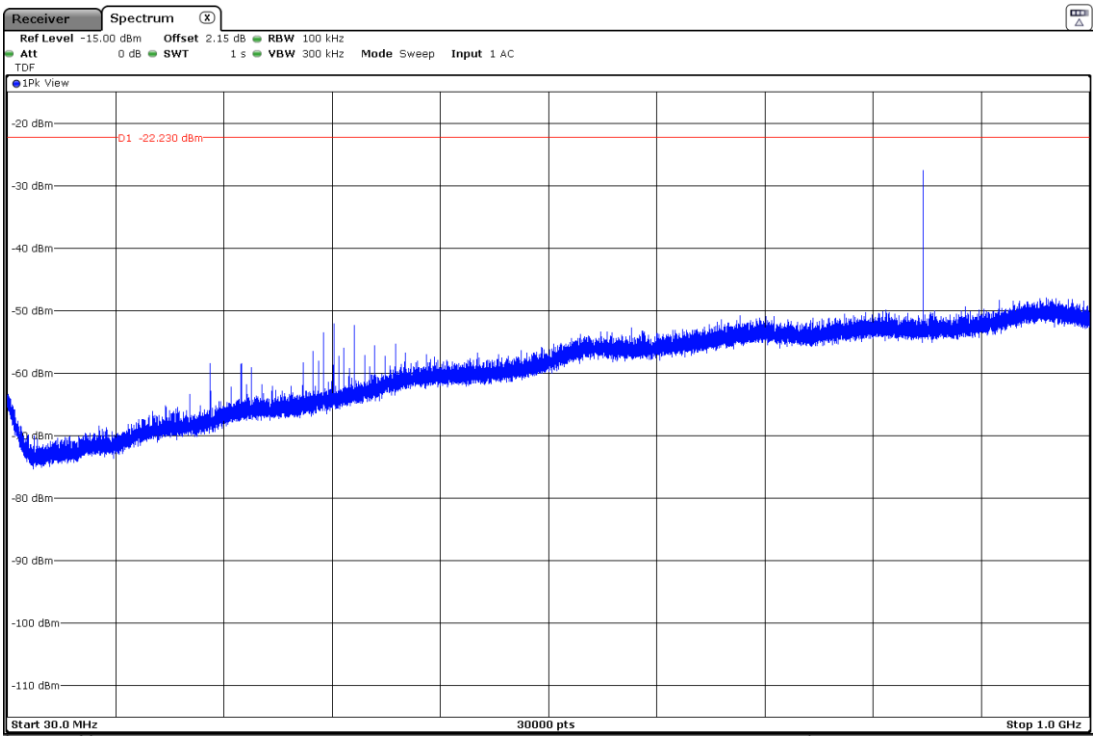
FREQUENCY RANGE 1 GHz to 10 GHz.



TETRA 22 kHz. 851-869 MHz band.

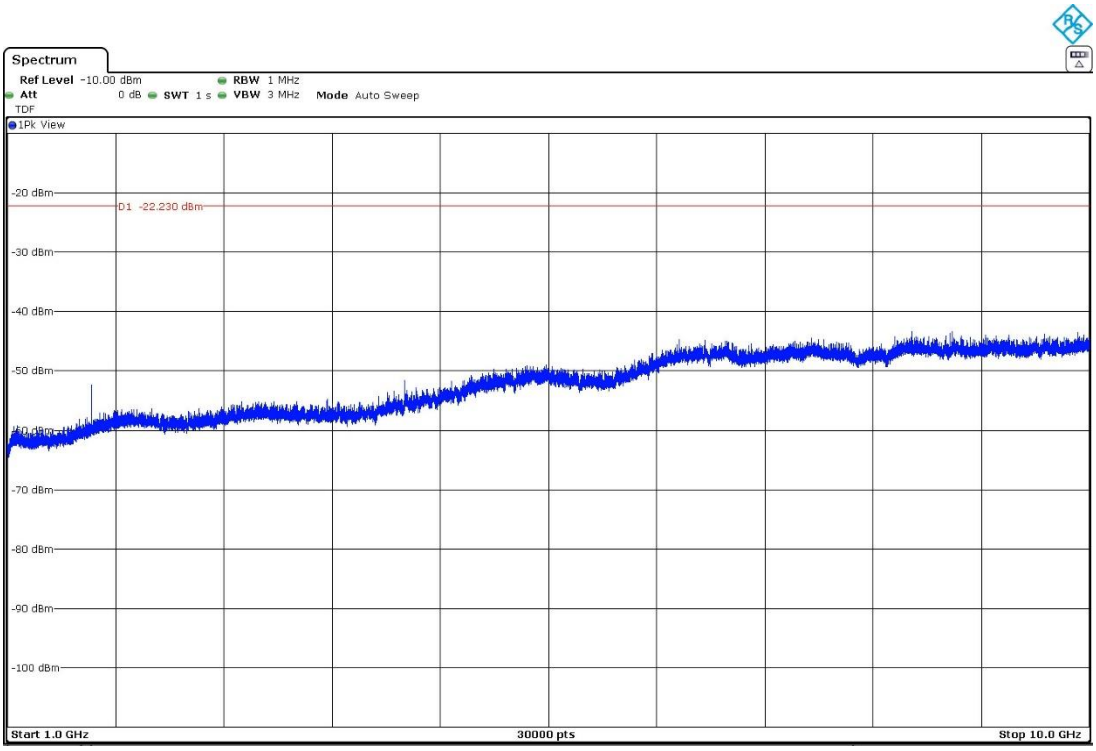
RSS-119 LOWEST CHANNEL: 851.0125 MHz

FREQUENCY RANGE 30 MHz-1000 MHz.



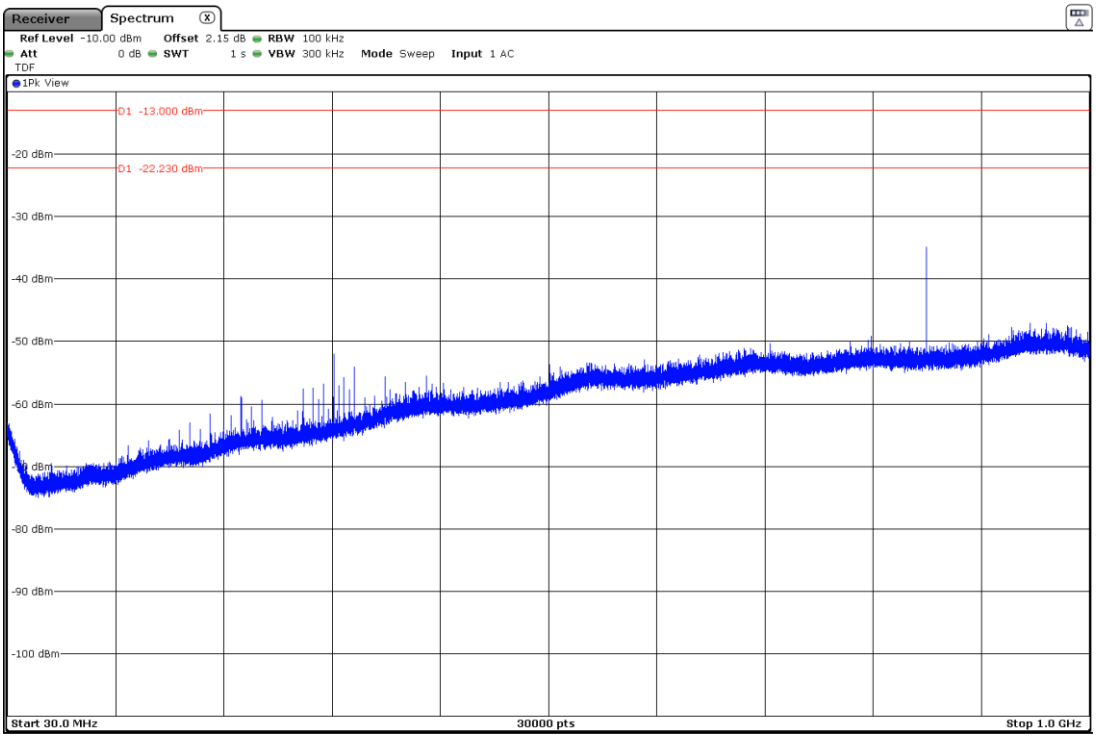
Note: The highest peak shown in the plot is the carrier frequency.

FREQUENCY RANGE 1 GHz to 10 GHz.



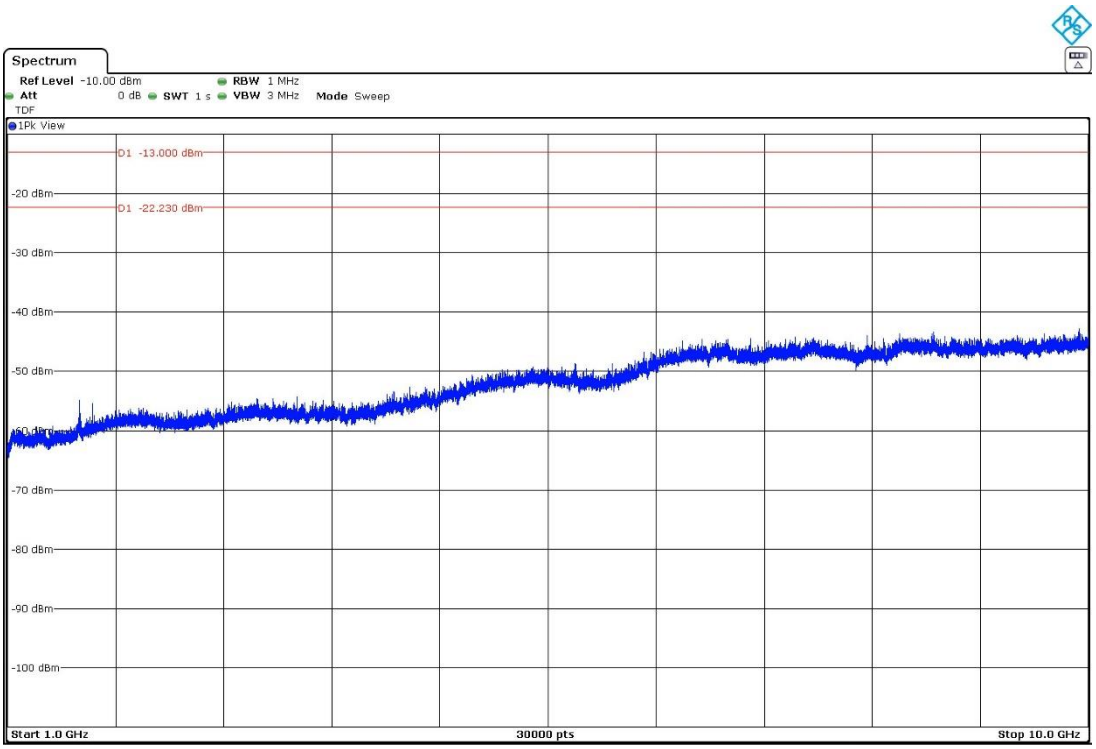
FCC 90 LOWEST CHANNEL: 854.0125 MHz

FREQUENCY RANGE 30 MHz-1000 MHz.



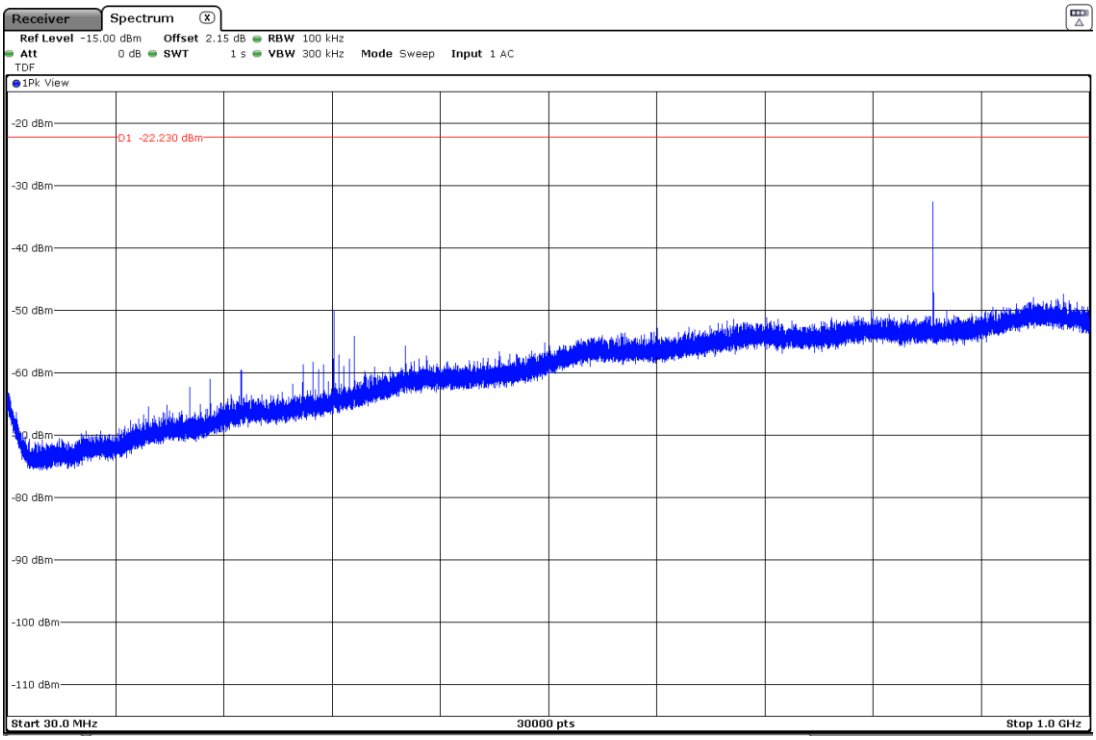
Note: The highest peak shown in the plot is the carrier frequency.

FREQUENCY RANGE 1 GHz to 10 GHz.



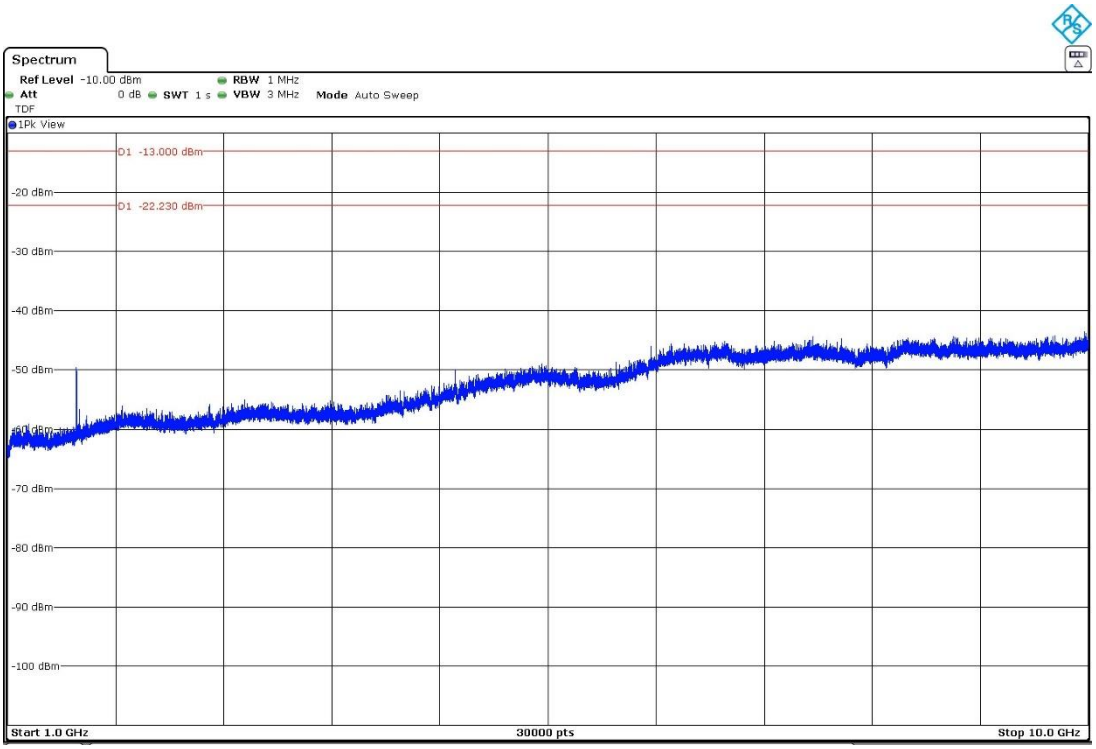
CHANNEL: MIDDLE

FREQUENCY RANGE 30 MHz-1000 MHz.



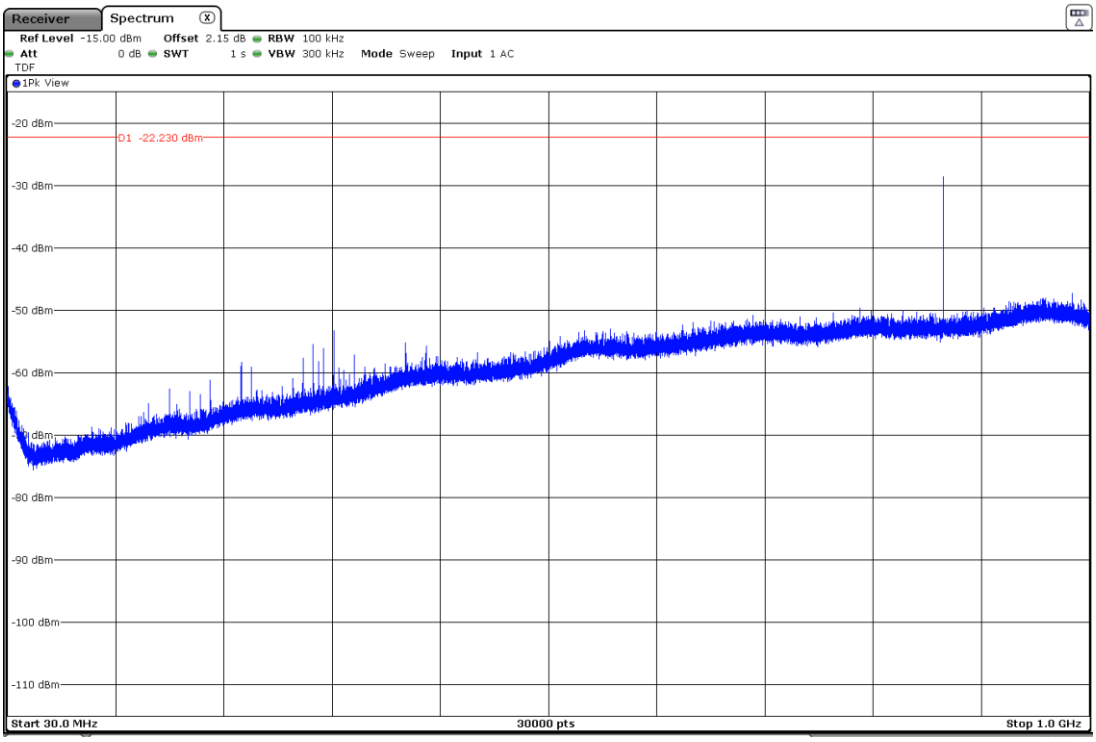
Note: The highest peak shown in the plot is the carrier frequency. The FCC limit set in -13 dBm lies above the Reference Level, thus outside the plot vertical scale. Compliance with the FCC limit is ensured, as the equipment meets the more-restrictive ISED requirement set in -22.23 dBm.

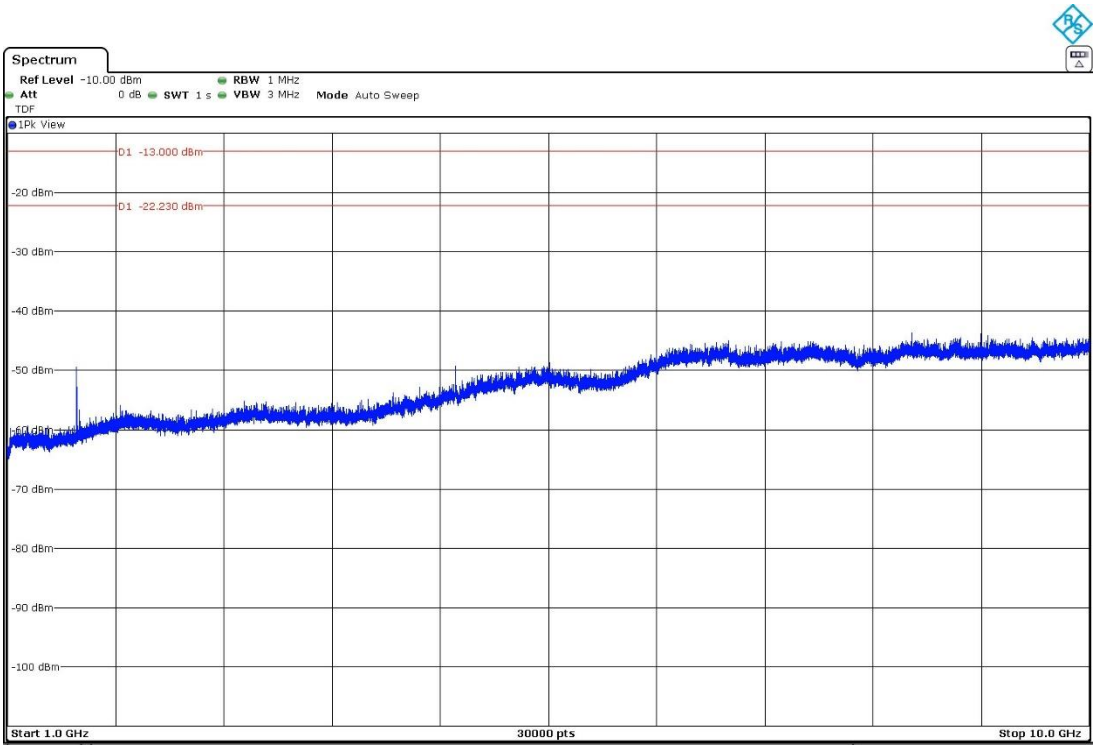
FREQUENCY RANGE 1 GHz to 10 GHz.



CHANNEL: HIGHEST.

FREQUENCY RANGE 30 MHz-1000 MHz.



Note: The highest peak shown in the plot is the carrier frequency. The FCC limit set in -13 dBm lies above the Reference Level, thus outside the plot vertical scale. Compliance with the FCC limit is ensured, as the equipment meets the more-restrictive ISED requirement set in -22.23 dBm.

FREQUENCY RANGE 1 GHz to 10 GHz.