DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España

FCC LISTED, REGISTRATION NUMBER: 720267

ISED LISTED REGISTRATION NUMBER IC 4621A-2

Test report No:

NIE: 54533RRF.001A1

Test report (Modification 1)
REFERENCE STANDARD:
USA FCC Part 90
CANADA IC RSS-119

Identificación del objeto ensayado.....: Identification of item tested	RF Transceiver / Mast-Mounted Base Station
Marca .....: Trade	PowerTrunk
Modelo y/o referencia tipo .....: Model and /or type reference	MBS Unit –N
Other identification of the product .....:	D148N01PT FCC ID: WT7PTMBS800B IC: 8624A-PTMBS800B
HW version .....:	CCP: 00.13.14.12
SW version .....:	CCP: 00.13.14.12
Características .....: Features	Power supply: MBS Unit –N with DC power supply: • Nominal voltage: 24 VDC. • Operational range: [21.6 – 31.2 VDC] MBS Unit –N with AC power supply: • Nominal voltage: 110/220 VAC. 50/60 Hz • Operational range: [90 – 264 VAC] Frequency band: • TX: 851-870 MHz / RX: 806-825 MHz RF output power (nominal): • TETRA: 40 dBm (10 W) / TI D-LMR: 40 dBm (10 W) See full details on pages 5 and 6
Solicitante.....: Applicant	TELTRONIC, S.A.U. Polígono Malpica, Calle C/F-Oeste (50016). Zaragoza (SPAIN).
Método de ensayo solicitado, norma.....: Test method requested, standard	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
Resultado.....: Summary	IN COMPLIANCE
Aprobado por (nombre / cargo y firma) .....: Approved by (name / position & signature)	A. Llamas RF Lab. Manager Firmado digitalmente por ALEJANDRO LLAMAS RODRIGUEZ Fecha: 2018.01.11 15:46:58 +01'00'

Fecha de realización .....: Date of issue	2018-01-11
Formato de informe No. .....: Report template No	FDT11_20

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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 conjuction 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.

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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 Nº	Description	Model	Serial number	Reception date
54533/001	MBS Unit 806-870 MHz (D148N01PT) Option VAC (O148017PT)	MBS Unit -N	3265963	2017-09-01
54533/002	MBS Unit 806-870 MHz (D148N01PT) Option VDC (O148018PT)	MBS Unit -N	3265962	2017-09-01
54008B/003	Ethernet cable	---	---	2017-09-01
54008B/004	POE/ETH cable	---	---	2017-09-01
54008B/005	POE cable	---	---	2017-09-01
54008B/006	SYNC cable	---	---	2017-09-01
54008B/007	DIV cable	---	---	2017-09-01
54008B/008	Power cable	---	---	2017-09-01

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

   All tests indicated in appendix A.

Test sample description

The MBS Unit is a TETRA and TI D-LMR single-carrier module (digital RF transceiver) designed for indoor or outdoor installation in different locations such as walls, towers or masts. Up to two MBS Units can be interconnected to deploy a full-featured Mast-mounted Base Station (MBS). It can be either DC or AC power-supplied. The MBS Unit -N operates in the frequency band 806-870 MHz and provides an RF output power of 10 W in the subband 851-870 MHz.

Features:

Power Supply:

MBS Unit –N with DC power supply:
- Nominal voltage: 24 VDC.
- Operational range: [21.6 – 31.2 VDC]

MBS Unit –N with AC power supply:
- Nominal voltage: 110/220 VAC. 50/60 Hz
- Operational range: [90 – 264 VAC]

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

Modulation scheme:
π/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: 40 dBm (10 W)
- TI D-LMR: 40 dBm (10 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:

EQUIPMENT	CODE+OPTIONS	S/N
MBS DC	D148N01PT O148018PT O148019PT O148057PT	3265962
MBS AC	D148N01PT O148017PT O148019PT O148057PT	3265963

D148N01PT: MBS UNIT 806-870 MHz POWERTRUNK
O148018PT: OPTION VDC (Power Supply: 24 VDC)
O148017PT: OPTION VAC (Power Supply: 110/220 VAC)
O148019PT: OPTION MBS SUBBAND TX851/RX806/BW19
O148057PT: OPTION LITE

Identification of the client

TELTRONIC, S.A.U.

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

Testing period

The performed test started on 2017-10-27 and finished on 2017-12-04.

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 ºC Max. = 35 ºC
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 ºC Max. = 35 ºC
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 ºC Max. = 35 ºC
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

Modifications to the reference test report

It was introduced the following modifications in respect to the test report number 54533RRF.001 related with the same samples, in the next clauses and sub-clauses:

Clauses / Sub-clauses	Modification	Justification
Cover sheet / Other identification of the product	The reference "D148N01-11" is replaced by the correct reference "D148N01PT"	Applicant's request. Change of product coding
Usage of samples / Description in table	The reference "D148N01-11" is replaced by the correct reference "D148N01PT"	Applicant's request. Change of product coding
Test sample description / Options	The reference "D148N01-11" is replaced by the correct reference "D148N01PT"	Applicant's request. Change of product coding

This modification test report cancels and replaces the test report 54533RRF.001.

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 CTS C-70/600	2017/05	2018/05
3.	DC power supply R&S NGPE 40/40	2014/11	2017/11
4.	Radiocommunication analyzer HP 8920A	2017/04	2020/04
5.	Power sensor R&S NRP-Z91	2016/04	2018/04
6.	Spectrum analyser R&S FSV40	2017/07	2019/07
7.	AC power supply ELGAR CS-AC35(351SL)	2016/05	2019/05

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

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TEST CONDITIONS

Power supply (V):

AC voltage

V_{nom} = 110.0 Vac

V_{max} = 126.5 Vac

V_{min} = 93.5 Vac

DC voltage

V_{nom} = 24.0 Vdc

V_{max} = 31.2 Vdc

V_{min} = 20.4 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 = AC or DC Voltage from external power supply

Type of antenna = external connectable antenna

Rated RF Output Power:

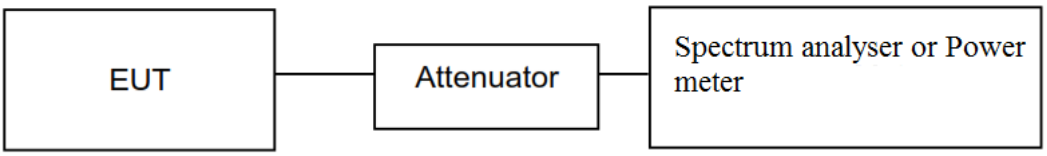
- Mode TETRA (22 kHz bandwidth): 40 dBm (10 W)
- Mode TI D-LMR (20 kHz bandwidth): 40 dBm (10 W)

TEST FREQUENCIES:

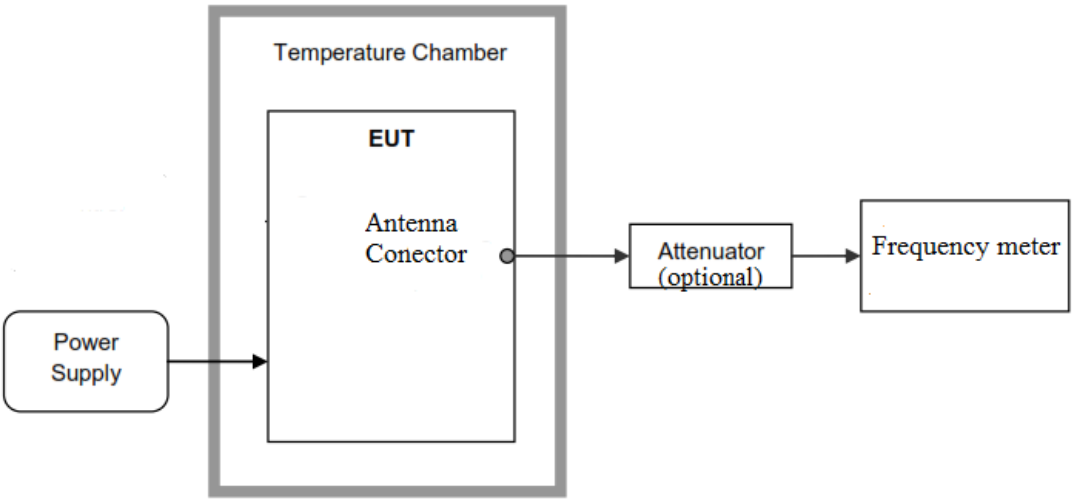
	851-869 MHz band
Lowest channel RSS-119	851.0125 MHz
Lowest channel FCC 90	854.0125 MHz
Middle channel	861.5 MHz
Highest channel	868.9875 MHz

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 and AC 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.

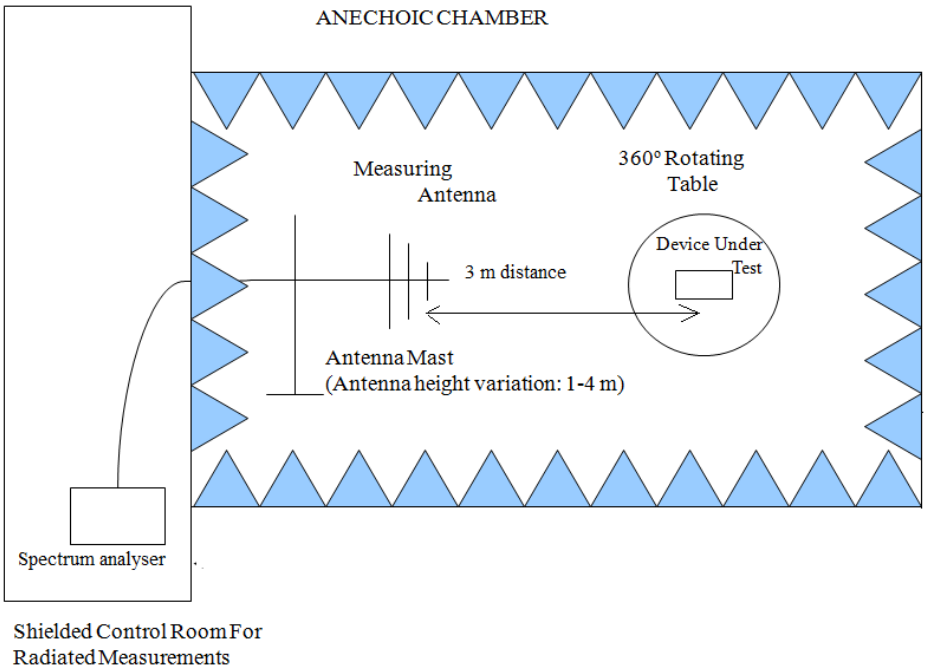
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-10 GHz (1 GHz-18 GHz Double ridge horn antenna).

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 sample is prepared so that transmits continuously when the batteries are connected

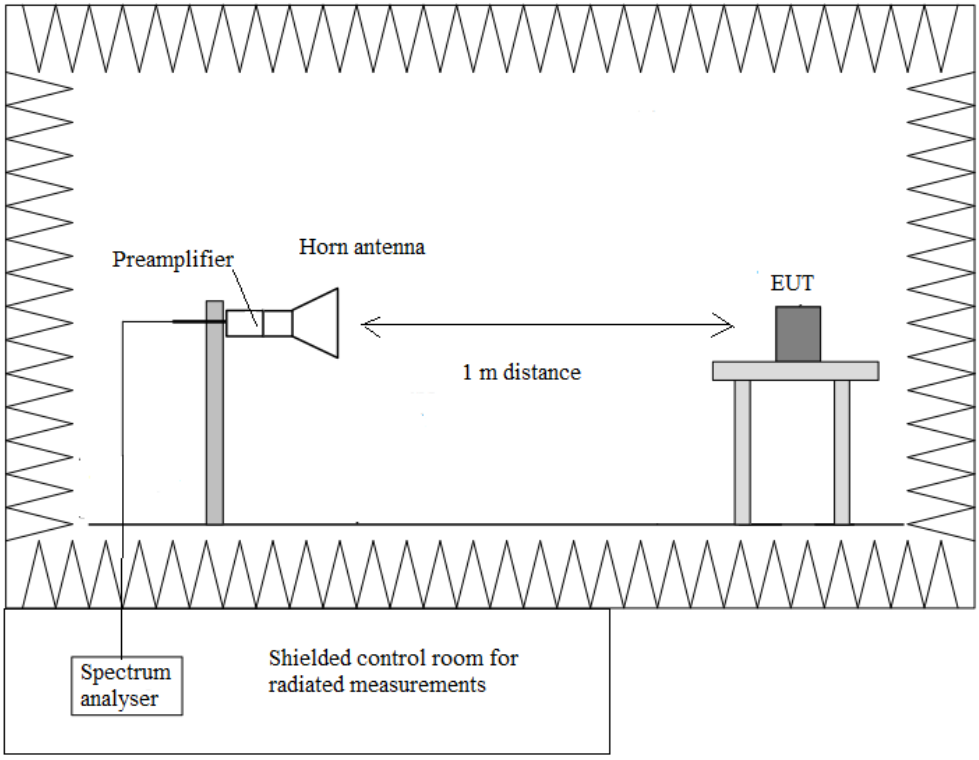
The equipment under test was set up on a non-conductive platform and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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)

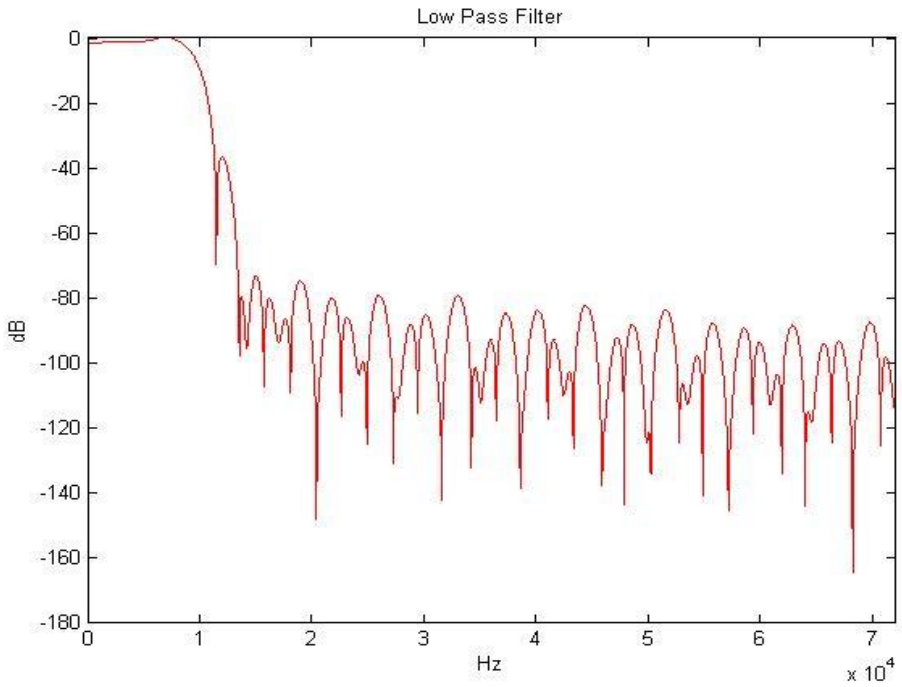
The EUT operates with π/4-shifted Differential Quaternary Phase Shift Keying (π/4-DQPSK) in both TI D-LMR and TETRA, featuring a modulation rate of 18 ksym/s (36 kbits/s).

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

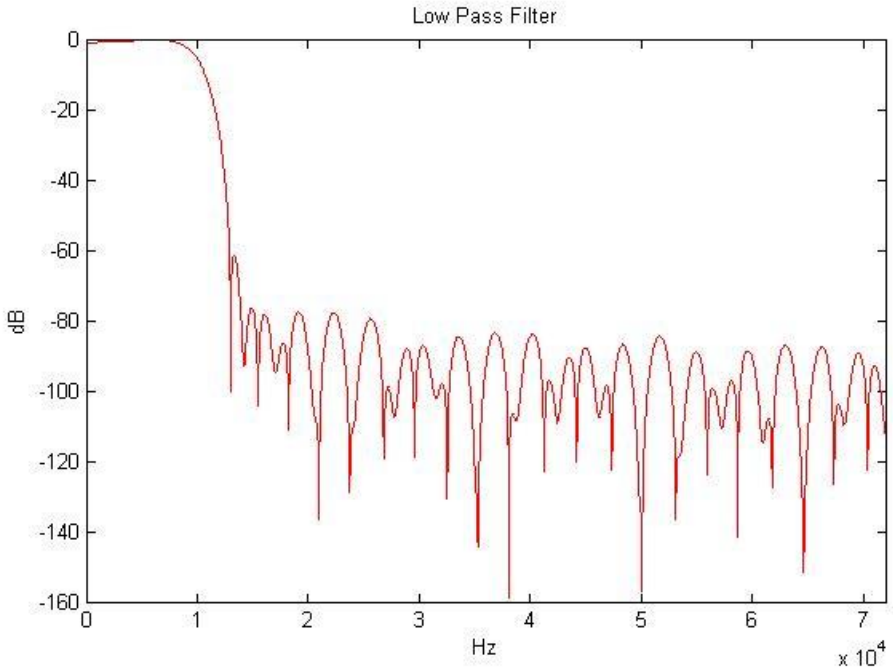
A root-raised-cosine filter (RRC) is used as a transmitting and receiving filter in both digital communication systems to perform matched filtering. The combined response of such two filters is that of the raised-cosine filter. The raised-cosine filter is often used for pulse-shaping in digital modulation,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

MBS Unit Transmitter low pass filter for TI D-LMR (20 KHz authorized bandwidth):



MBS Unit Transmitter low pass filter for TETRA (22 KHz modulation 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.

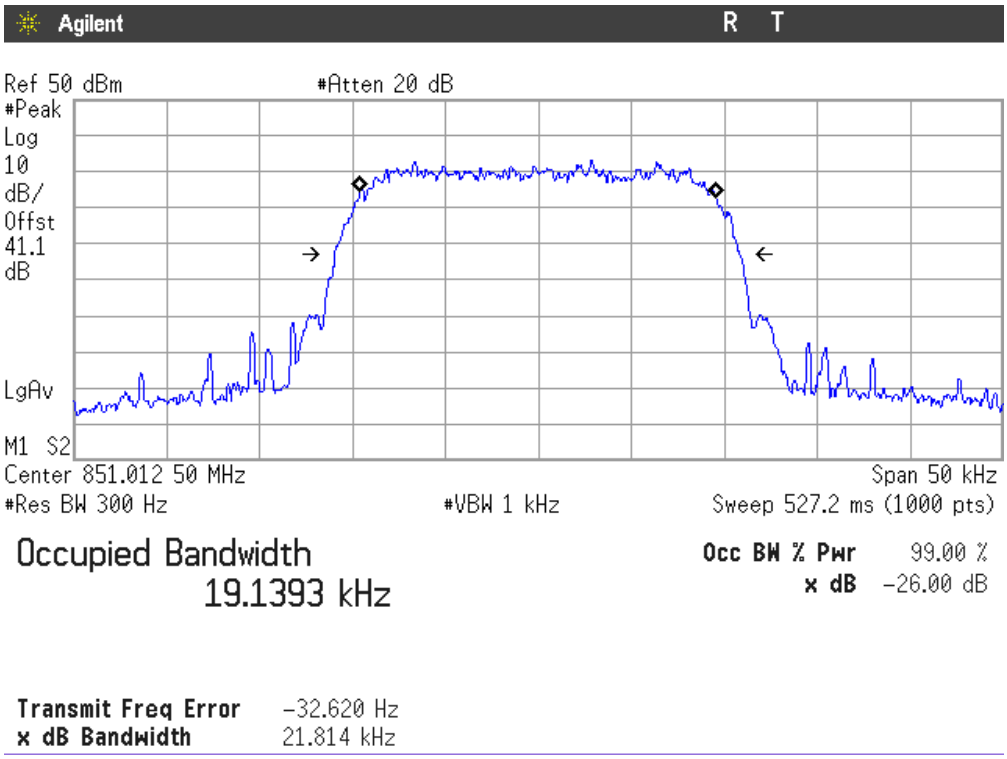
Channel	99% Occupied bandwidth (kHz)	-26 dBc bandwidth (kHz)
851.0125 MHz	19.1393	21.814
854.0125 MHz	19.2315	21.737
861.5 MHz	19.1349	21.820
868.9875 MHz	19.0651	21.879
Measurement uncertainty (kHz)	<±0.17	

TETRA 22 kHz.

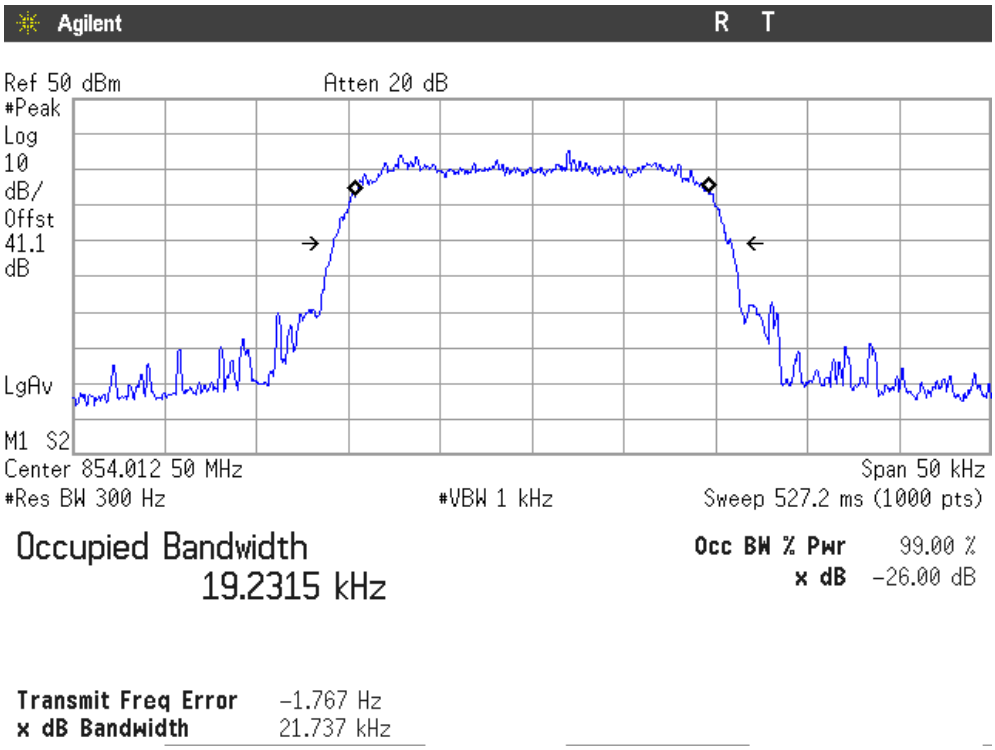
Channel	99% Occupied bandwidth (kHz)	-26 dBc bandwidth (kHz)
851.0125 MHz	20.2504	22.835
854.0125 MHz	20.3673	23.394
861.5 MHz	20.2592	23.385
868.9875 MHz	20.2407	23.055
Measurement uncertainty (kHz)	<±0.17	

TI D-LMR 20 kHz.

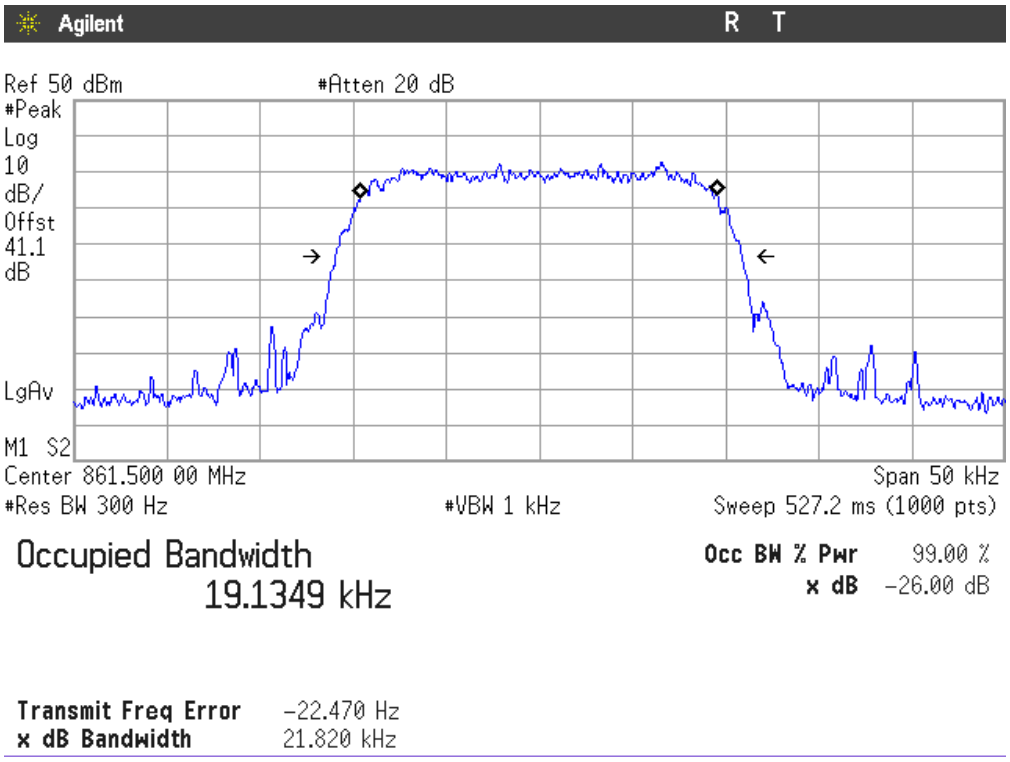
RSS-119 Lowest Channel 851.0125 MHz



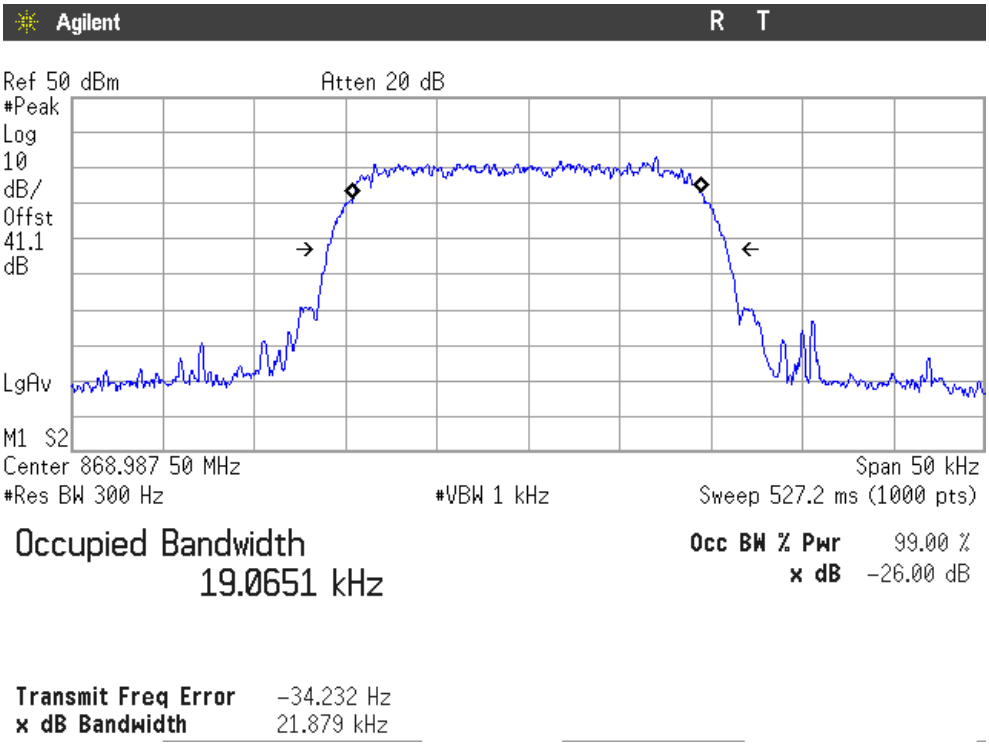
FCC 90 Lowest Channel 854.0125 MHz



Middle Channel

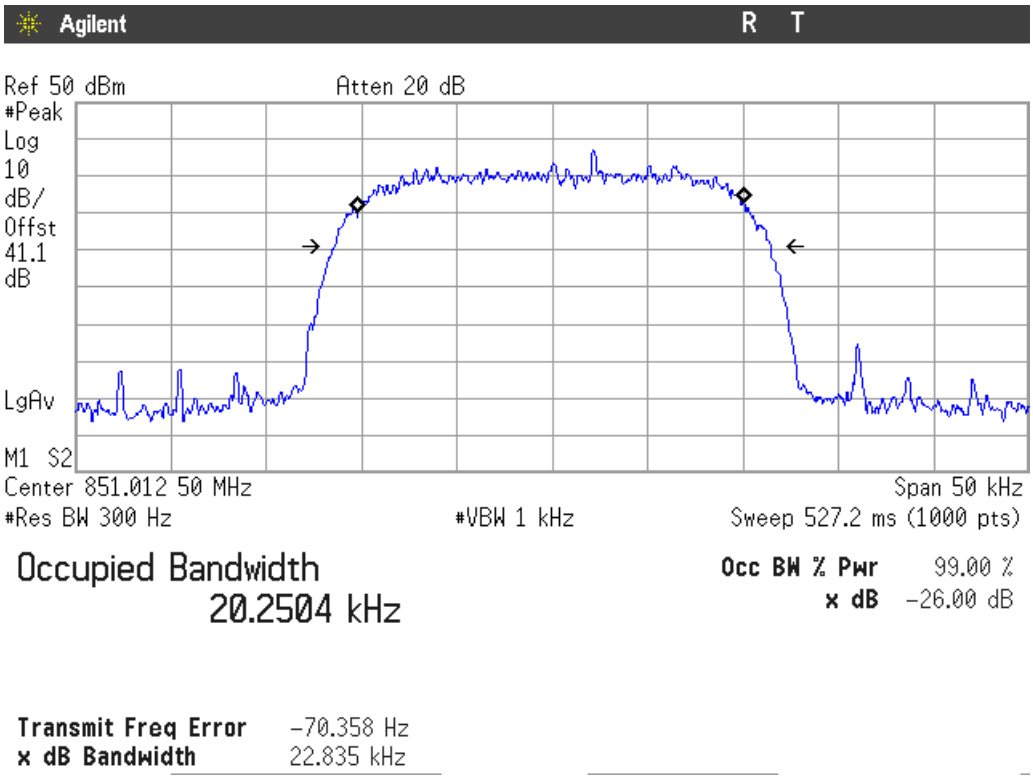


Highest Channel

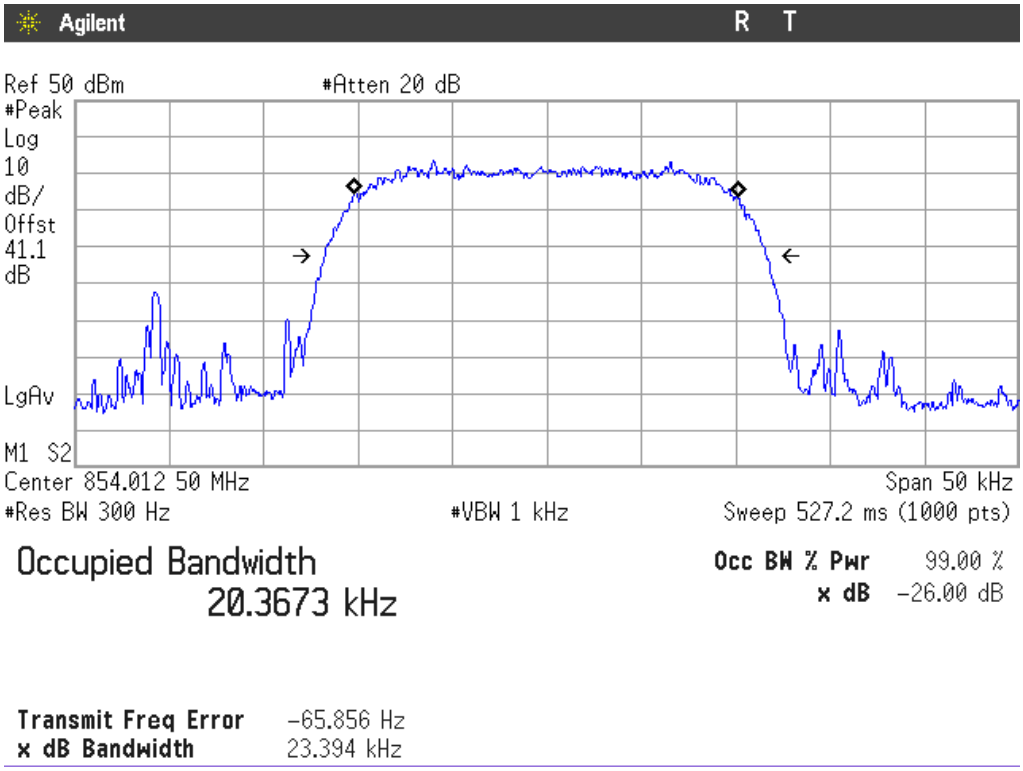


TETRA 22 kHz.

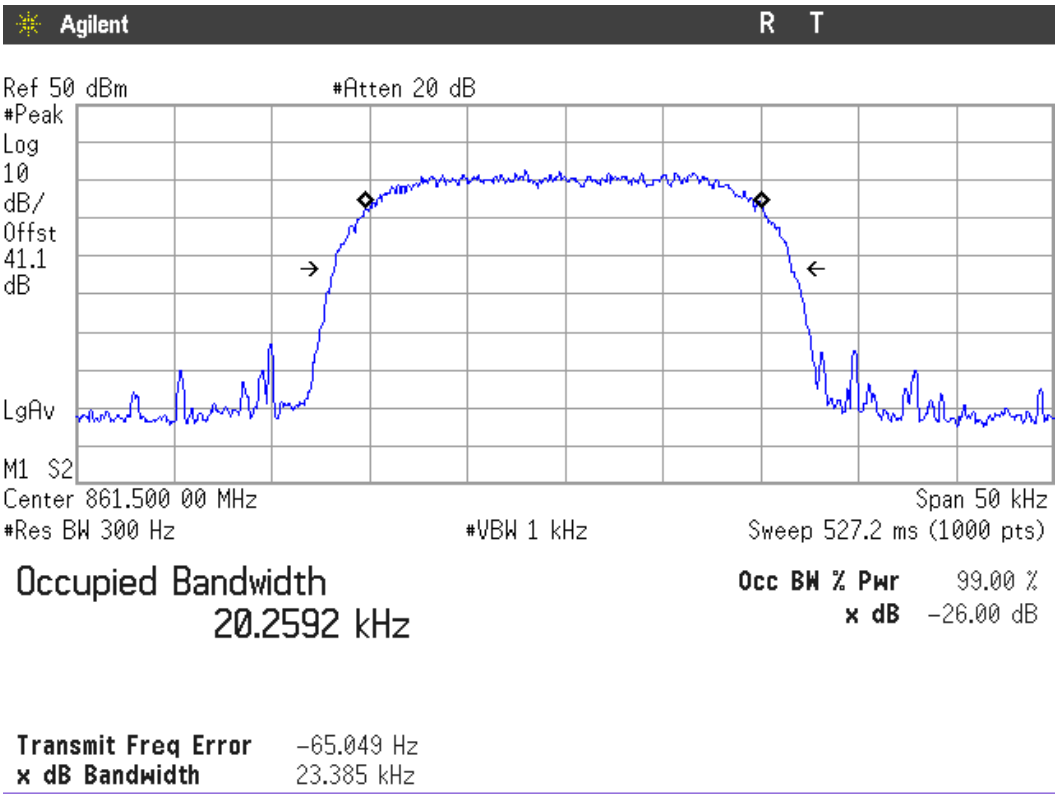
RSS-119 Lowest Channel 851.0125 MHz



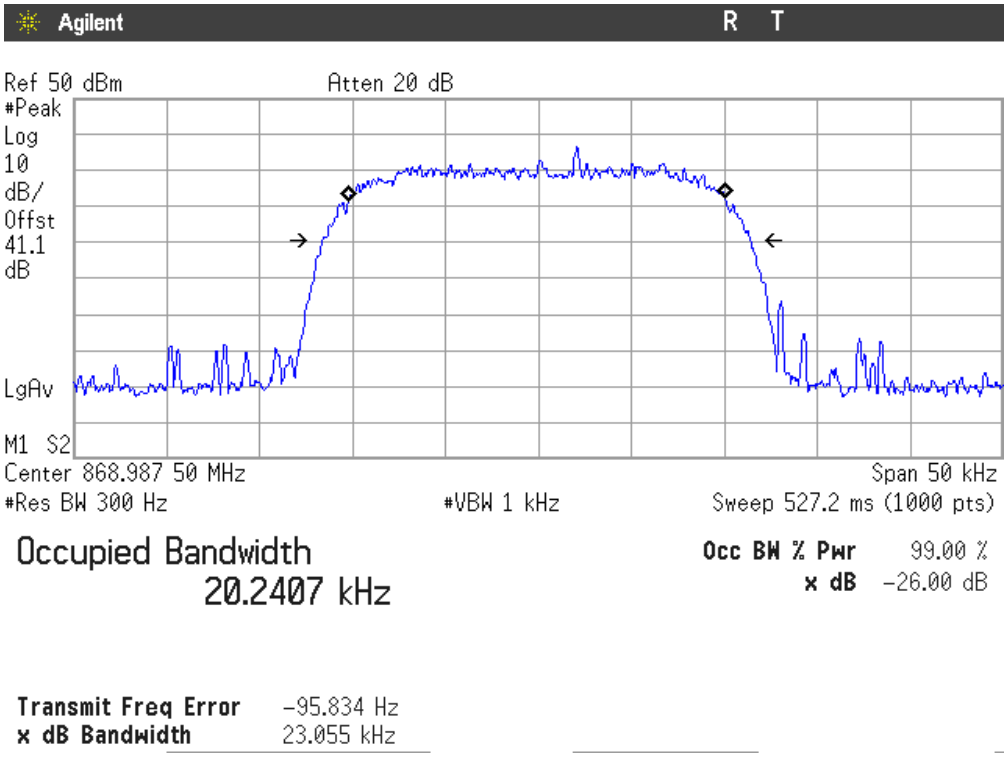
FCC 90 Lowest Channel 854.0125 MHz



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.

	Transmitter Output Power (W)	
Frequency Band (MHz)	**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: 10 W (40 dBm).

TI D-LMR. 20 kHz Bandwidth	Frequency (MHz)	Maximum average power (dBm)	Maximum deviation (dB)
	851.0125	39.57	-0.43
	854.0125	39.82	-0.18
	861.5	39.61	-0.39
	868.9875	39.70	-0.30
Measurement uncertainty (dB)		<±0.33	

TETRA. 22 kHz Bandwidth	Frequency (MHz)	Maximum average power (dBm)	Maximum deviation (dB)
	851.0125	39.68	-0.32
	854.0125	39.80	-0.20
	861.5	39.61	-0.39
	868.9875	39.55	-0.45
Measurement uncertainty (dB)		<±0.33	

The sum of the system loss (dB) and antenna gain (dBd) for the worst case of conducted power (39.82 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 $Log_{10}(f/6.1)$ decibels or 50 + 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 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 + $10Log_{10}(P)$ 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.

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, fd (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
10 < fd ≤ 50	whichever is the lesser attenuation: 70 or 116 log10(fd/6.11) or 50 + 10 log10(p)	300
fd > 50	43 + 10 log10(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 ≤ 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

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)

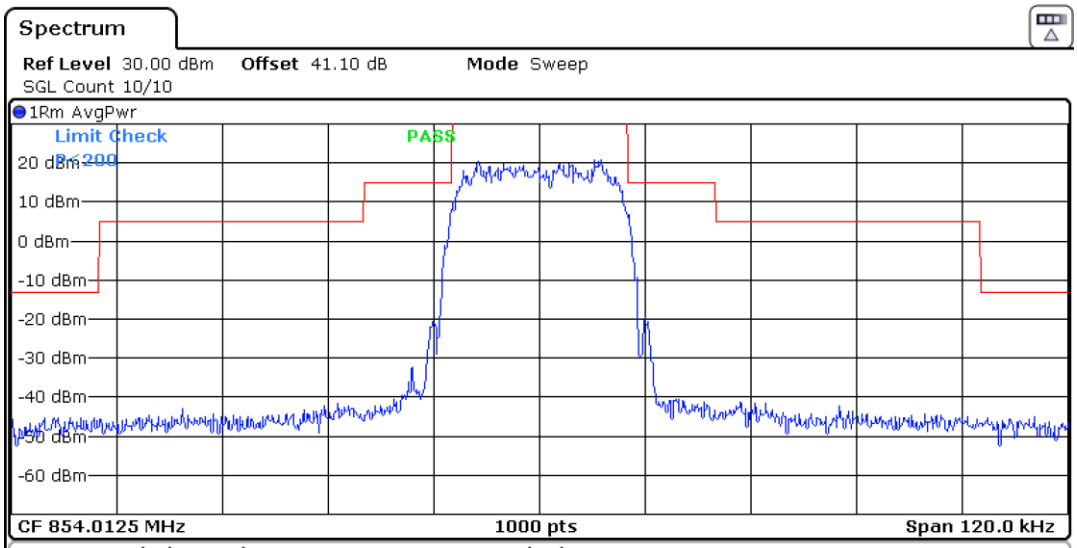
Measurement uncertainty (dB)	<±0.33

Verdict: PASS

FCC 90 Emission Mask B.

TI D-LMR 20 kHz Bandwidth.

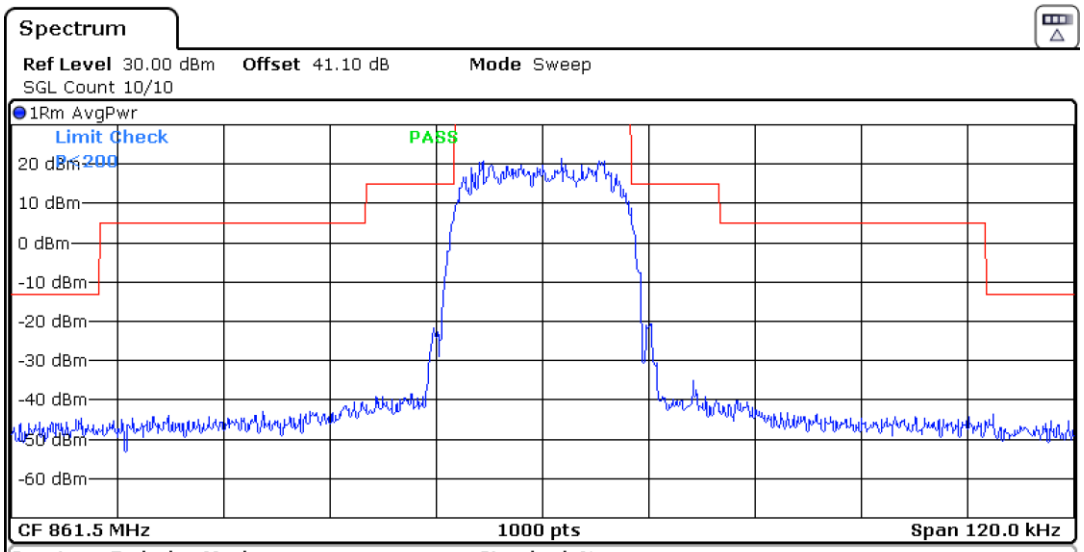
FCC 90 Lowest Channel 854.0125 MHz



Spectrum Emission Mask — Standard: None
Tx Power 39.94 dBm — Tx Bandwidth 20.000 kHz — RBW 100.000 Hz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-60.000 kHz	-50.000 kHz	100.000 Hz	853.95786 MHz	-45.32 dBm	-85.27 dB	-32.27 dB
-50.000 kHz	-20.000 kHz	100.000 Hz	853.98956 MHz	-41.43 dBm	-81.37 dB	-46.37 dB
-20.000 kHz	-10.000 kHz	100.000 Hz	854.00244 MHz	8.11 dBm	-31.83 dB	-6.83 dB
10.000 kHz	20.000 kHz	100.000 Hz	854.02268 MHz	6.56 dBm	-33.38 dB	-8.38 dB
20.000 kHz	50.000 kHz	100.000 Hz	854.03532 MHz	-41.30 dBm	-81.24 dB	-46.24 dB
50.000 kHz	60.000 kHz	100.000 Hz	854.06858 MHz	-45.15 dBm	-85.10 dB	-32.10 dB

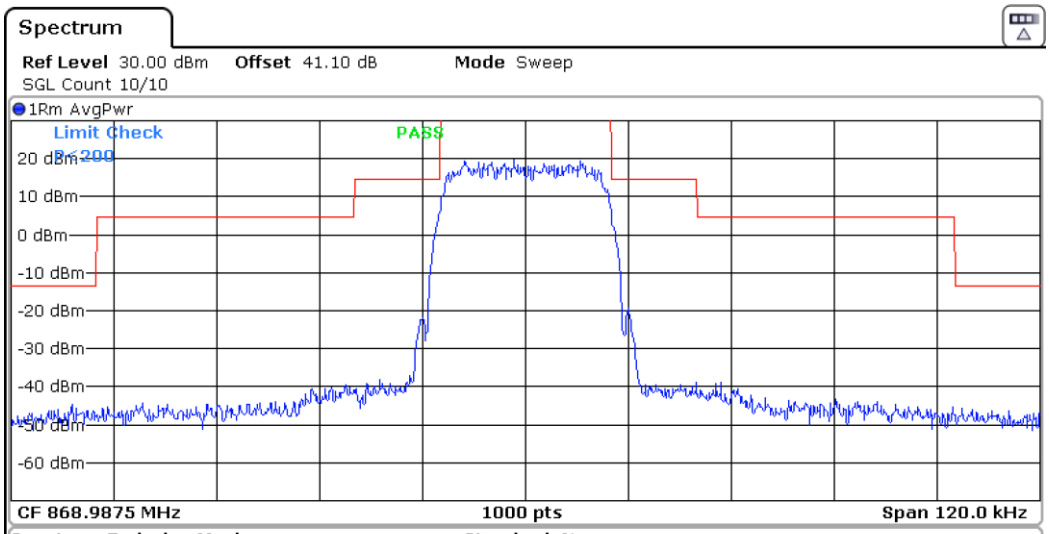
Middle Channel



Spectrum Emission Mask — Standard: None
Tx Power 39.97 dBm — Tx Bandwidth 20.000 kHz — RBW 100.000 Hz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-60.000 kHz	-50.000 kHz	100.000 Hz	861.44801 MHz	-44.72 dBm	-84.69 dB	-31.69 dB
-50.000 kHz	-20.000 kHz	100.000 Hz	861.47874 MHz	-40.38 dBm	-80.36 dB	-45.36 dB
-20.000 kHz	-10.000 kHz	100.000 Hz	861.48994 MHz	7.90 dBm	-32.07 dB	-7.07 dB
10.000 kHz	20.000 kHz	100.000 Hz	861.51006 MHz	4.66 dBm	-35.32 dB	-10.32 dB
20.000 kHz	50.000 kHz	100.000 Hz	861.52198 MHz	-40.17 dBm	-80.15 dB	-45.15 dB
50.000 kHz	60.000 kHz	100.000 Hz	861.55090 MHz	-43.71 dBm	-83.68 dB	-30.68 dB

Highest Channel



Spectrum Emission Mask **Standard: None**

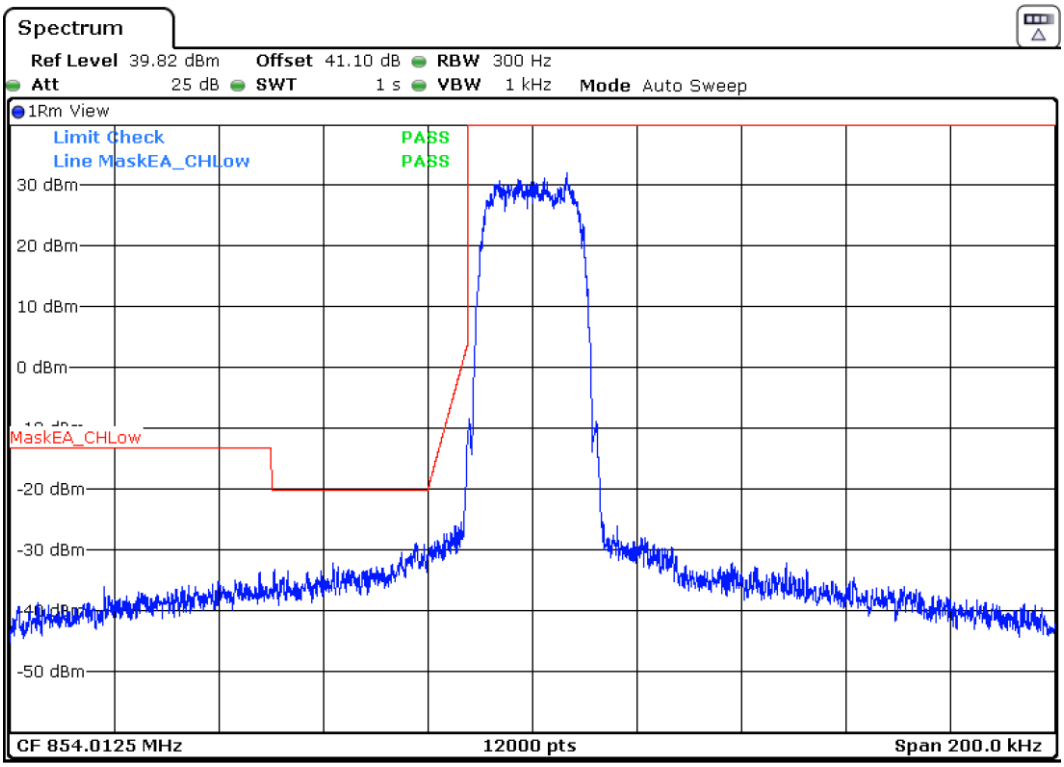
Tx Power 39.50 dBm **Tx Bandwidth 20.000 kHz** **RBW 100.000 Hz**

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-60.000 kHz	-50.000 kHz	100.000 Hz	868.93467 MHz	-44.53 dBm	-84.03 dB	-31.03 dB
-50.000 kHz	-20.000 kHz	100.000 Hz	868.96660 MHz	-39.57 dBm	-79.07 dB	-44.07 dB
-20.000 kHz	-10.000 kHz	100.000 Hz	868.97744 MHz	5.89 dBm	-33.61 dB	-8.61 dB
10.000 kHz	20.000 kHz	100.000 Hz	868.99756 MHz	2.70 dBm	-36.81 dB	-11.81 dB
20.000 kHz	50.000 kHz	100.000 Hz	869.01020 MHz	-38.93 dBm	-78.43 dB	-43.43 dB
50.000 kHz	60.000 kHz	100.000 Hz	869.03840 MHz	-45.78 dBm	-85.28 dB	-32.28 dB

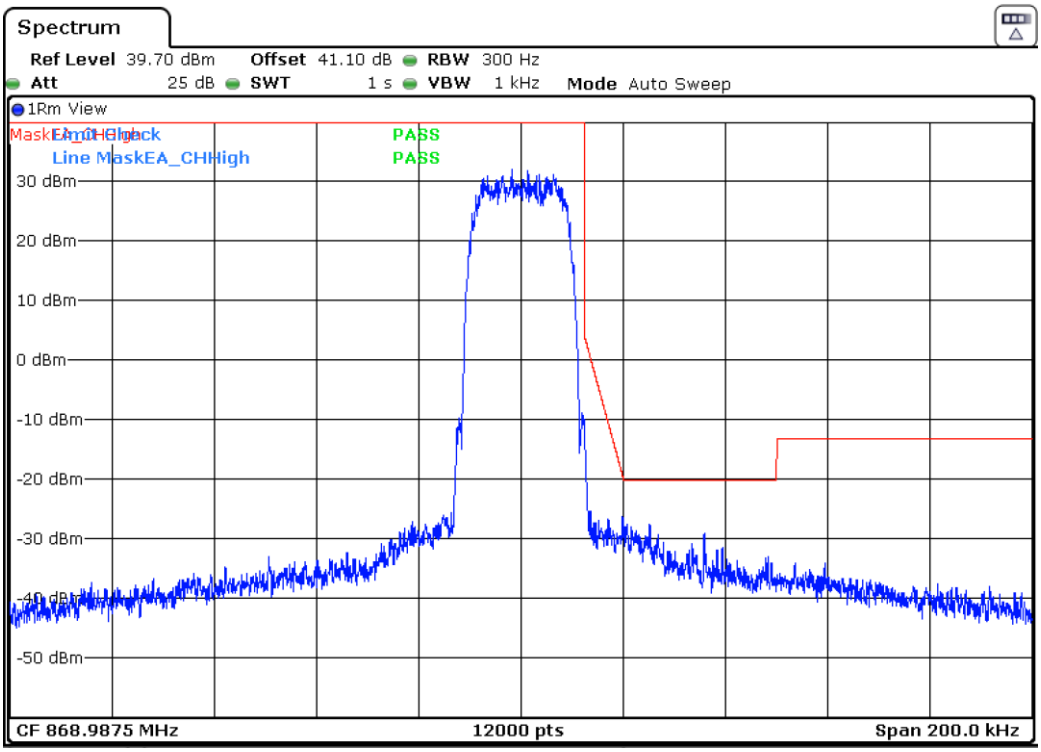
FCC 90 Emission Mask EA.

TI D-LMR 20 kHz Bandwidth.

FCC 90 Lowest Channel 854.0125 MHz



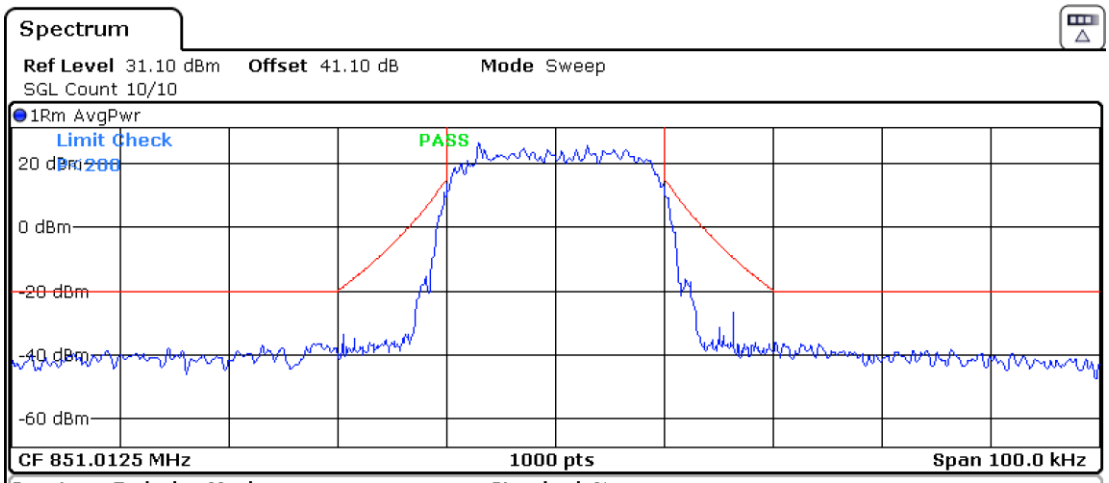
Highest Channel



RSS-119 Emission Mask G.

TI D-LMR 20 kHz Bandwidth.

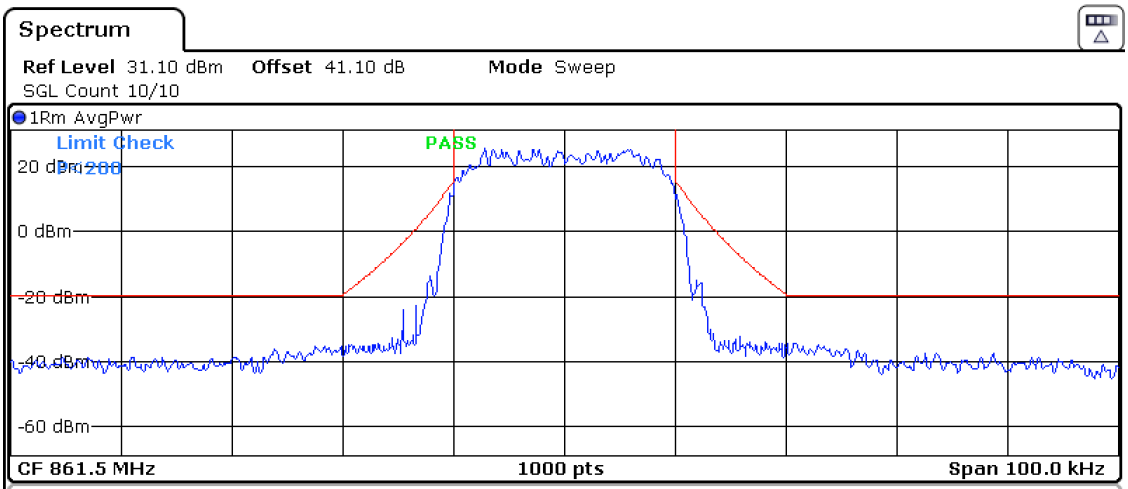
RSS-119 Lowest Channel 851.0125 MHz



Spectrum Emission Mask — Standard: None
Tx Power 39.85 dBm — Tx Bandwidth 20.000 kHz — RBW 300.000 Hz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-50.000 kHz	-20.100 kHz	300.000 Hz	850.99025 MHz	-36.49 dBm	-76.34 dB	-16.34 dB
-20.100 kHz	-19.000 kHz	300.000 Hz	850.99305 MHz	-33.59 dBm	-73.43 dB	-15.15 dB
-19.000 kHz	-17.500 kHz	300.000 Hz	850.99405 MHz	-34.85 dBm	-74.70 dB	-19.10 dB
-17.500 kHz	-16.000 kHz	300.000 Hz	850.99545 MHz	-36.27 dBm	-76.12 dB	-24.47 dB
-16.000 kHz	-14.500 kHz	300.000 Hz	850.99695 MHz	-35.26 dBm	-75.11 dB	-28.11 dB
-14.500 kHz	-13.000 kHz	300.000 Hz	850.99845 MHz	-34.80 dBm	-74.65 dB	-32.80 dB
-13.000 kHz	-11.500 kHz	300.000 Hz	851.00055 MHz	-15.29 dBm	-55.14 dB	-21.41 dB
-11.500 kHz	-10.000 kHz	300.000 Hz	851.00245 MHz	13.63 dBm	-26.22 dB	-1.18 dB
10.000 kHz	11.500 kHz	300.000 Hz	851.02255 MHz	11.31 dBm	-28.54 dB	-3.50 dB
11.500 kHz	13.000 kHz	300.000 Hz	851.02485 MHz	-17.36 dBm	-57.21 dB	-21.86 dB

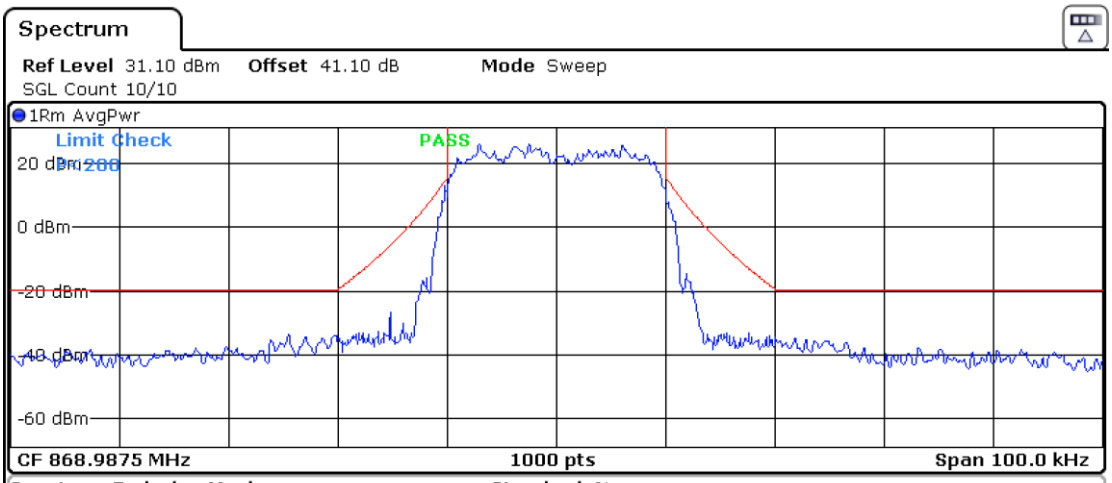
Middle Channel



Spectrum Emission Mask — Standard: None
Tx Power 40.31 dBm — Tx Bandwidth 20.000 kHz — RBW 300.000 Hz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-50.000 kHz	-20.100 kHz	300.000 Hz	861.47755 MHz	-35.19 dBm	-75.50 dB	-15.50 dB
-20.100 kHz	-19.000 kHz	300.000 Hz	861.47995 MHz	-35.26 dBm	-75.57 dB	-15.70 dB
-19.000 kHz	-17.500 kHz	300.000 Hz	861.48105 MHz	-35.46 dBm	-75.77 dB	-18.81 dB
-17.500 kHz	-16.000 kHz	300.000 Hz	861.48265 MHz	-34.73 dBm	-75.04 dB	-22.49 dB
-16.000 kHz	-14.500 kHz	300.000 Hz	861.48545 MHz	-23.94 dBm	-64.26 dB	-20.59 dB
-14.500 kHz	-13.000 kHz	300.000 Hz	861.48655 MHz	-22.77 dBm	-63.08 dB	-23.43 dB
-13.000 kHz	-11.500 kHz	300.000 Hz	861.48785 MHz	-13.67 dBm	-53.98 dB	-19.44 dB
-11.500 kHz	-10.000 kHz	300.000 Hz	861.48995 MHz	14.09 dBm	-26.22 dB	-1.19 dB
10.000 kHz	11.500 kHz	300.000 Hz	861.51015 MHz	11.16 dBm	-29.16 dB	-3.65 dB
11.500 kHz	13.000 kHz	300.000 Hz	861.51235 MHz	-16.05 dBm	-56.36 dB	-21.00 dB

Highest Channel



Spectrum Emission Mask **Standard: None**

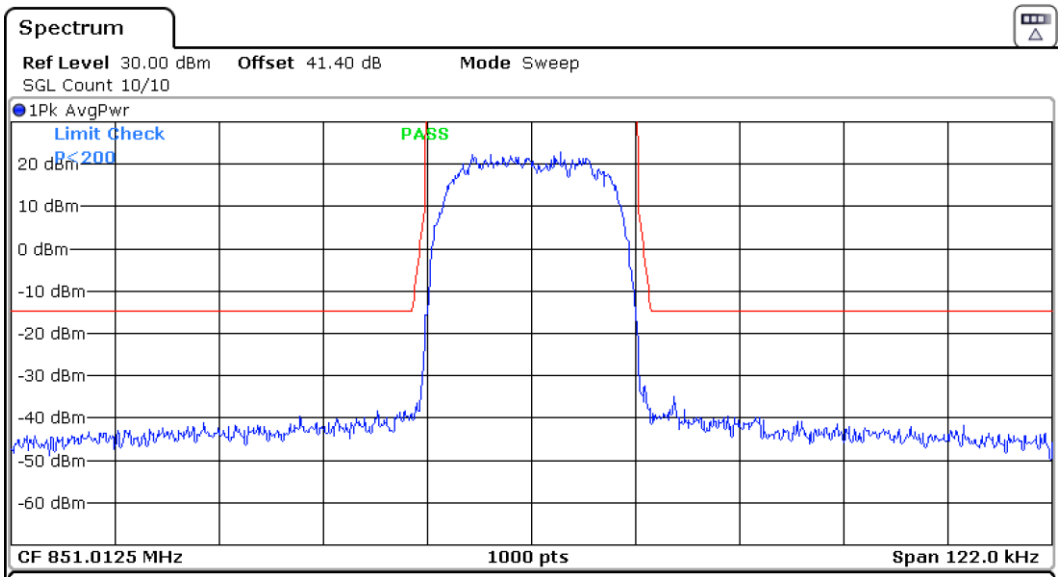
Tx Power 40.27 dBm **Tx Bandwidth** 20.000 kHz **RBW** 300.000 Hz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-50.000 kHz	-20.100 kHz	300.000 Hz	868.96295 MHz	-33.59 dBm	-73.86 dB	-13.86 dB
-20.100 kHz	-19.000 kHz	300.000 Hz	868.96755 MHz	-34.82 dBm	-75.09 dB	-15.49 dB
-19.000 kHz	-17.500 kHz	300.000 Hz	868.96885 MHz	-33.88 dBm	-74.14 dB	-18.00 dB
-17.500 kHz	-16.000 kHz	300.000 Hz	868.97025 MHz	-33.36 dBm	-73.62 dB	-21.37 dB
-16.000 kHz	-14.500 kHz	300.000 Hz	868.97235 MHz	-26.44 dBm	-66.71 dB	-21.04 dB
-14.500 kHz	-13.000 kHz	300.000 Hz	868.97345 MHz	-30.19 dBm	-70.46 dB	-28.61 dB
-13.000 kHz	-11.500 kHz	300.000 Hz	868.97525 MHz	-16.66 dBm	-56.93 dB	-21.98 dB
-11.500 kHz	-10.000 kHz	300.000 Hz	868.97725 MHz	12.89 dBm	-27.37 dB	-1.39 dB
10.000 kHz	11.500 kHz	300.000 Hz	868.99755 MHz	11.02 dBm	-29.25 dB	-4.21 dB
11.500 kHz	13.000 kHz	300.000 Hz	868.99935 MHz	-14.63 dBm	-54.90 dB	-21.57 dB

RSS-119 Emission Mask Y.

TETRA 22 kHz Bandwidth.

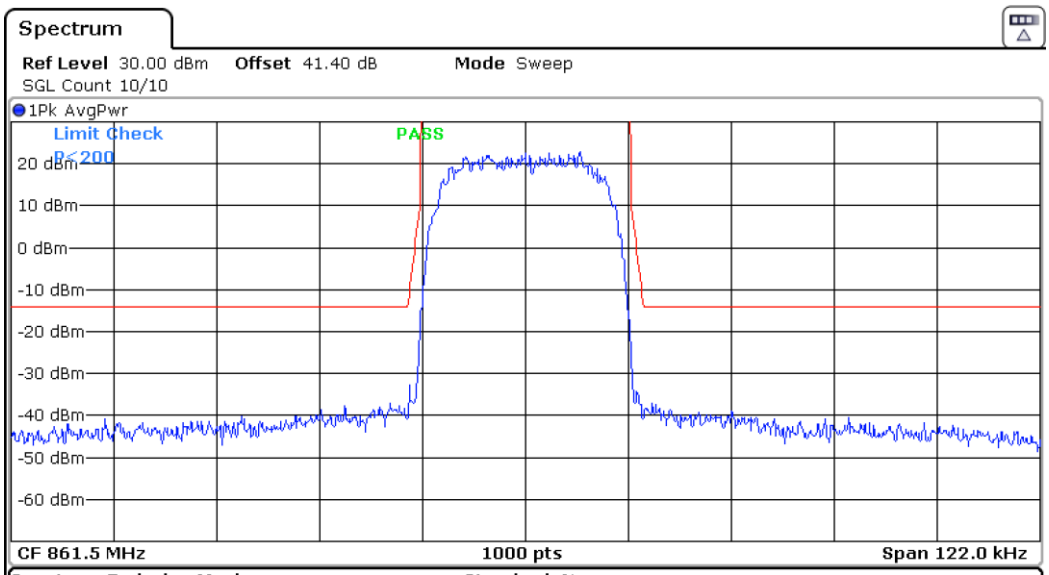
RSS-119 Lowest Channel 851.0125 MHz



Spectrum Emission Mask — Standard: None
Tx Power 42.41 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	850.99443 MHz	-38.29 dBm	-80.70 dB	-23.70 dB
-13.975 kHz	-12.375 kHz	100.000 Hz	850.99859 MHz	-40.54 dBm	-82.95 dB	-26.98 dB
12.375 kHz	13.975 kHz	100.000 Hz	851.02641 MHz	-37.70 dBm	-80.11 dB	-24.15 dB
13.975 kHz	61.000 kHz	100.000 Hz	851.02910 MHz	-35.06 dBm	-77.46 dB	-20.46 dB

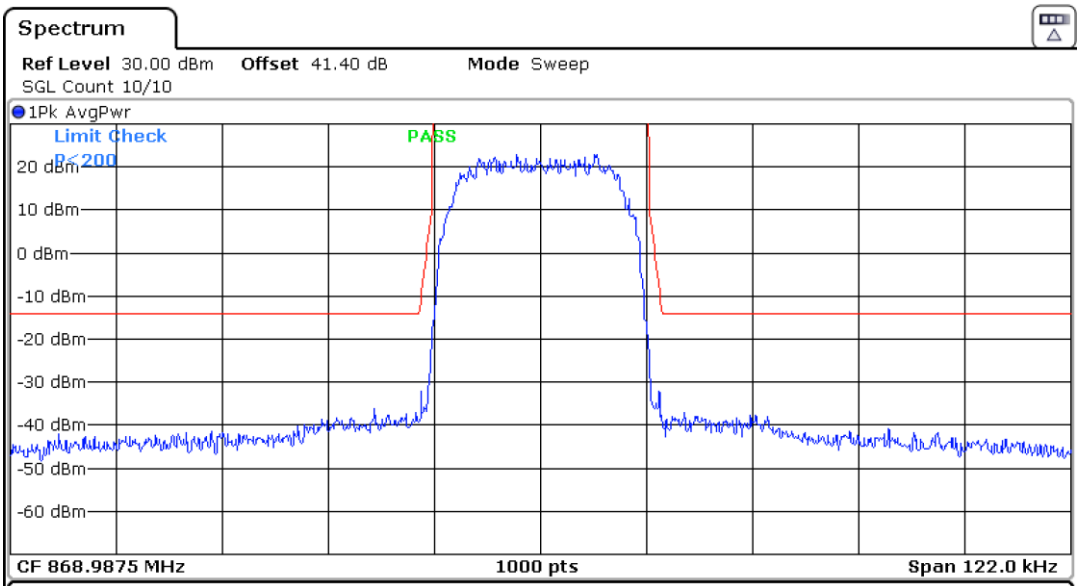
Middle Channel



Spectrum Emission Mask — Standard: None
Tx Power 42.80 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	861.48389 MHz	-37.20 dBm	-79.99 dB	-22.99 dB
-13.975 kHz	-12.375 kHz	100.000 Hz	861.48621 MHz	-32.75 dBm	-75.54 dB	-21.66 dB
12.375 kHz	13.975 kHz	100.000 Hz	861.51391 MHz	-40.84 dBm	-83.64 dB	-27.68 dB
13.975 kHz	61.000 kHz	100.000 Hz	861.51501 MHz	-37.02 dBm	-79.82 dB	-22.82 dB

Highest Channel



Spectrum Emission Mask — Standard: None
Tx Power 42.77 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	868.96833 MHz	-36.07 dBm	-78.84 dB	-21.84 dB
-13.975 kHz	-12.375 kHz	100.000 Hz	868.97371 MHz	-32.07 dBm	-74.84 dB	-20.95 dB
12.375 kHz	13.975 kHz	100.000 Hz	869.00117 MHz	-32.51 dBm	-75.27 dB	-23.47 dB
13.975 kHz	61.000 kHz	100.000 Hz	869.00398 MHz	-37.01 dBm	-79.77 dB	-22.77 dB

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

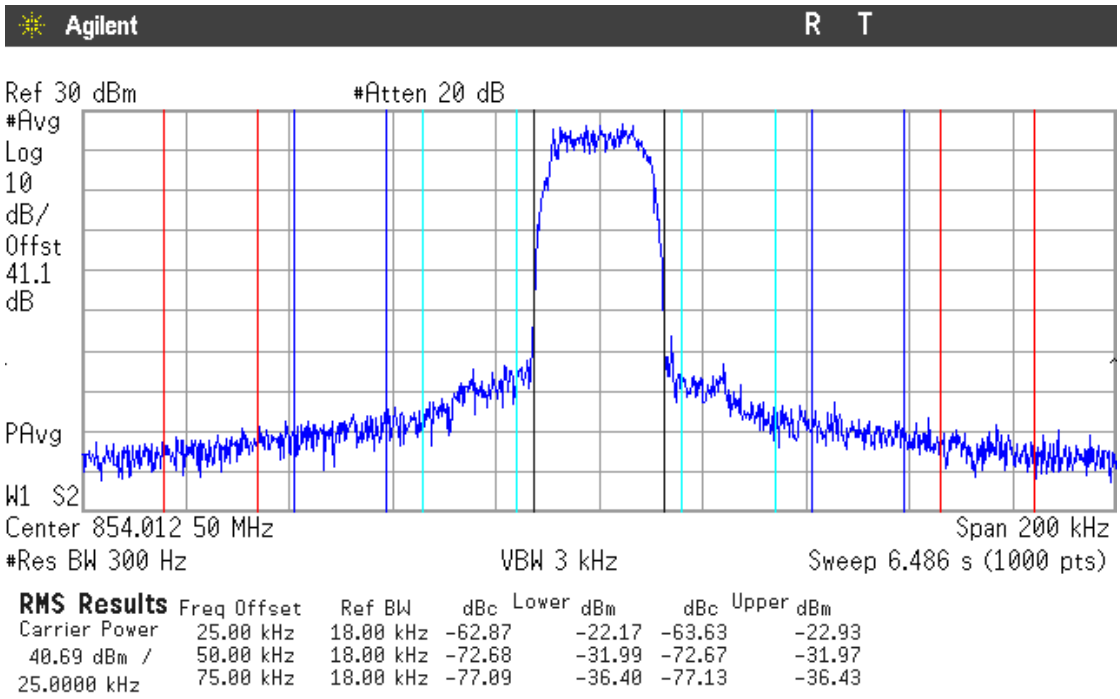
(2) In any case, no requirement in excess of -36 dBm shall apply.

(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 (Pwatts) dB.

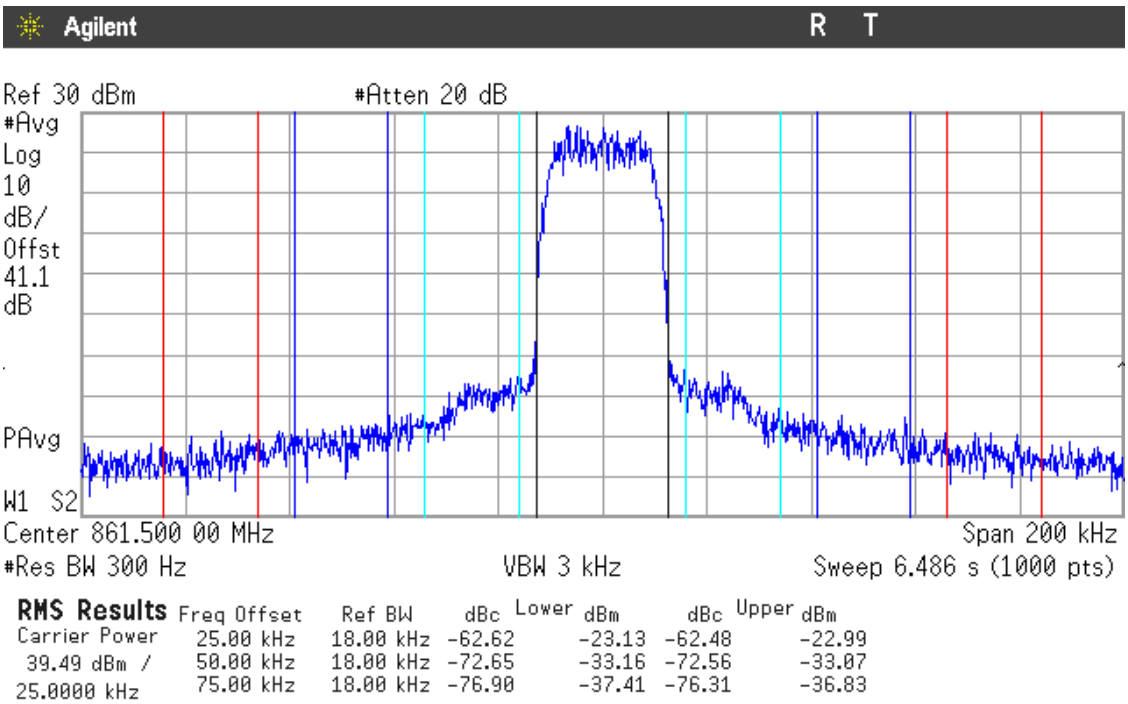
Measurement uncertainty (dB)	<±0.64

TETRA 22 kHz.

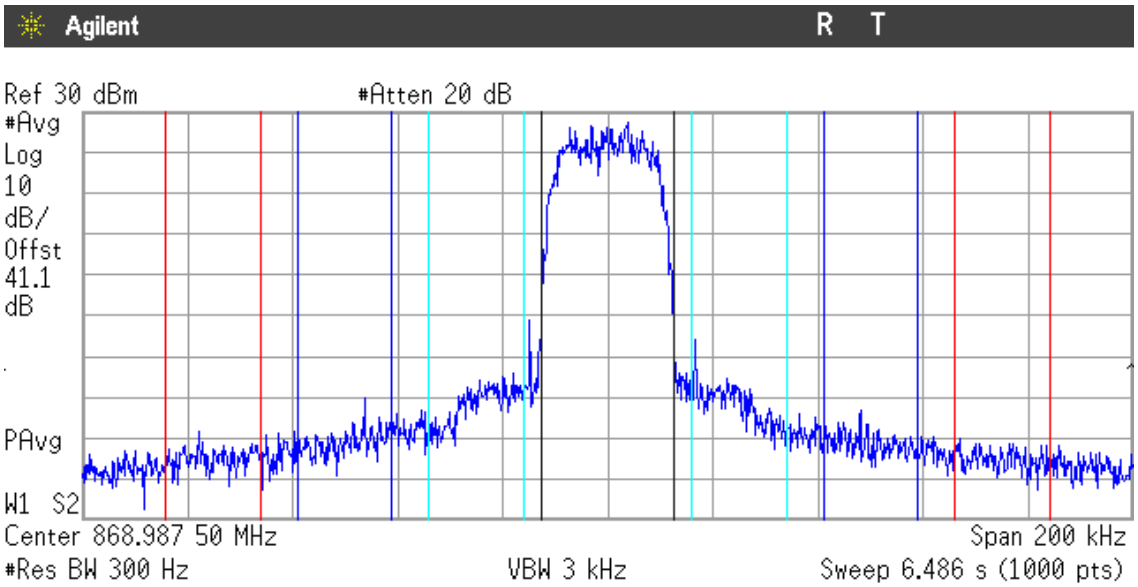
FCC 90 Lowest Channel 854.0125 MHz



Middle Channel



Highest Channel



RMS Results

	Freq Offset	Ref BW	Lower dBc	Lower dBm	Upper dBc	Upper dBm
Carrier Power 39.99 dBm / 25.0000 kHz	25.00 kHz	18.00 kHz	-62.46	-22.48	-61.57	-21.58
	50.00 kHz	18.00 kHz	-72.51	-32.53	-72.71	-32.72
	75.00 kHz	18.00 kHz	-76.80	-36.81	-77.22	-37.24

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 –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.

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 (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
Frequency stability with Temperature			
24	+50	3	0.00348
	+40	3	0.00348
	+30	3	0.00348
	+20	3	0.00348
	+10	3	0.00348
	0	3	0.00348
	-10	4	0.00464
	-20	4	0.00464
	-30	4	0.00464
Frequency stability with Supply Voltage			
20.4	20	3	0.00348
31.2	20	3	0.00348

Voltage (Vac)	Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
Frequency stability with Supply Voltage			
93.5	20	4	0.00464
126.5	20	5	0.00580

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

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 + 10Log_{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 (Pwatts) dB.

RSS-119 Clause 5.8.

Table 10 - Emission Mask G

Displacement Frequency, fd (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
10 < fd ≤ 50	whichever is the lesser attenuation: 70 or 116 log10(fd/6.11) or 50 + 10 log10(p)	300
fd > 50	43 + 10 log10(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 ≤ 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

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 10 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.

A preliminary scan determined the DC power supply configuration as the worst case.

RESULTS (see plots in next pages)

TI D-LMR 20 kHz bandwidth.

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.

TETRA 22 kHz bandwidth.

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

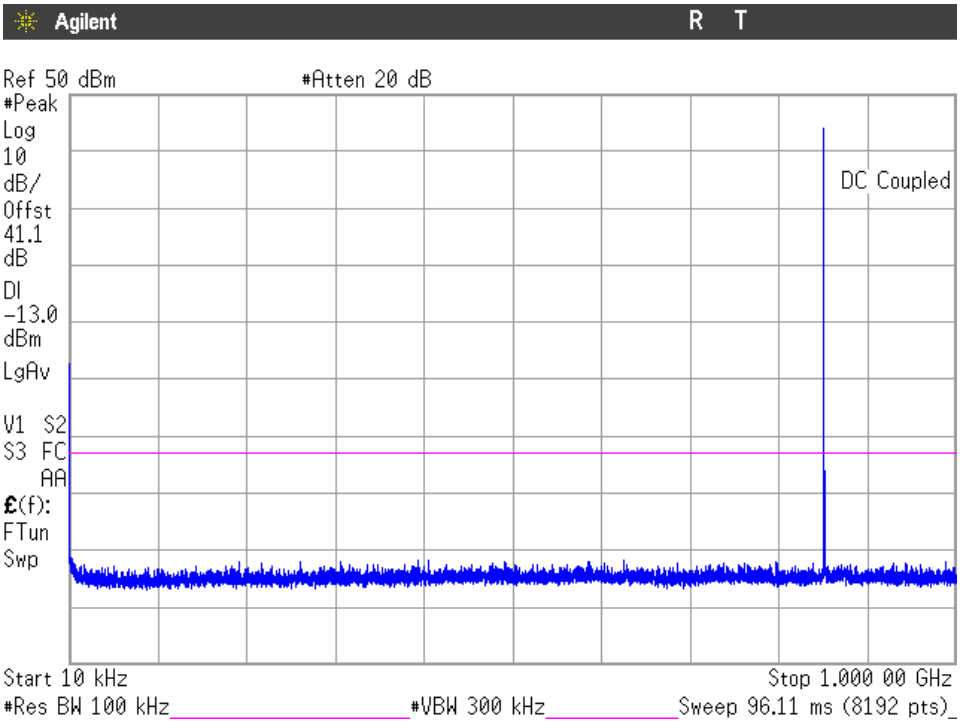
All peaks found are more than 20 dB below the limit.

Measurement uncertainty (dB)	<±2.03

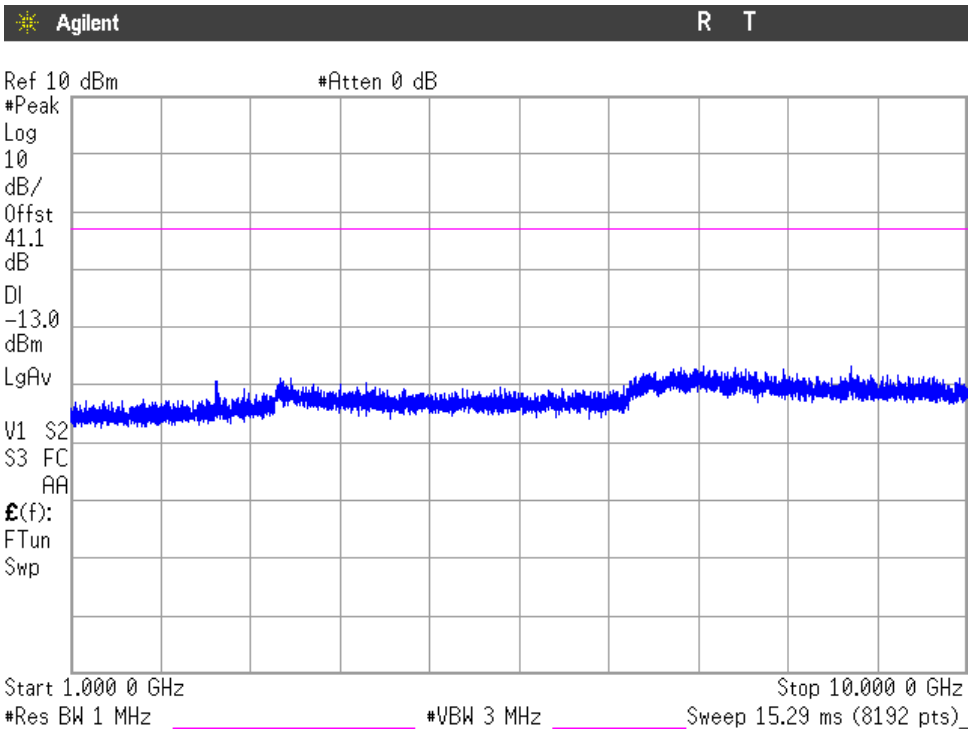
Verdict: PASS

TI D-LMR 20 kHz bandwidth.

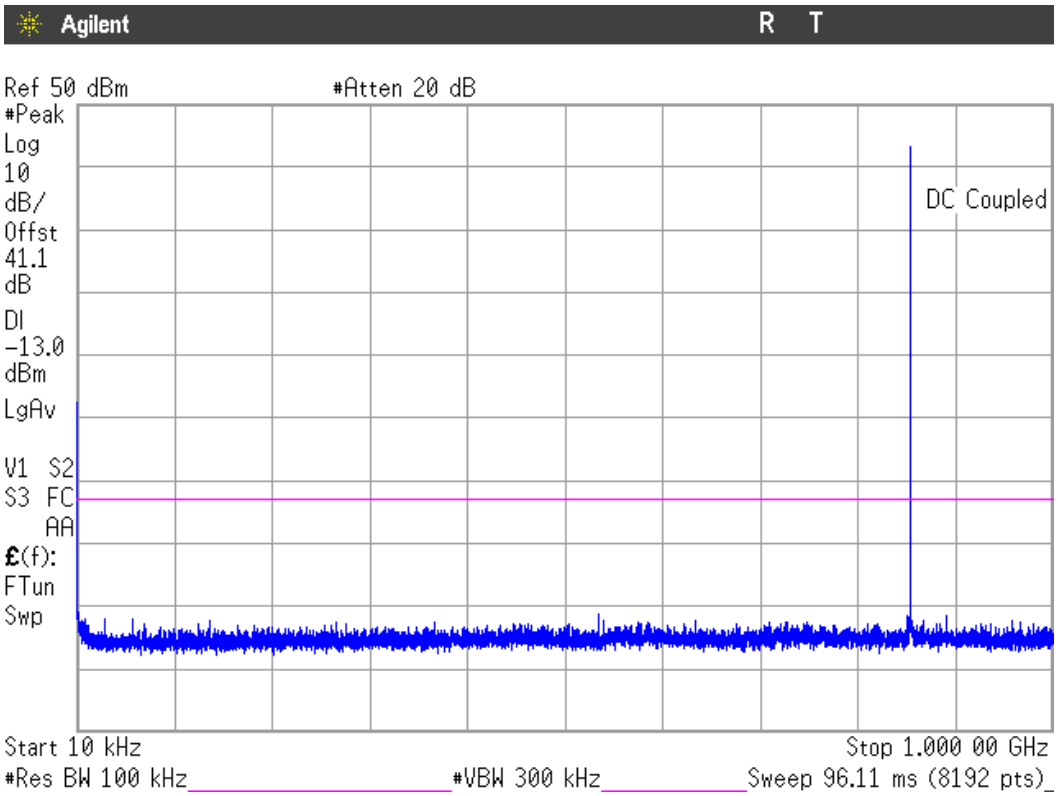
RSS-119 LOWEST CHANNEL: 851.0125 MHz



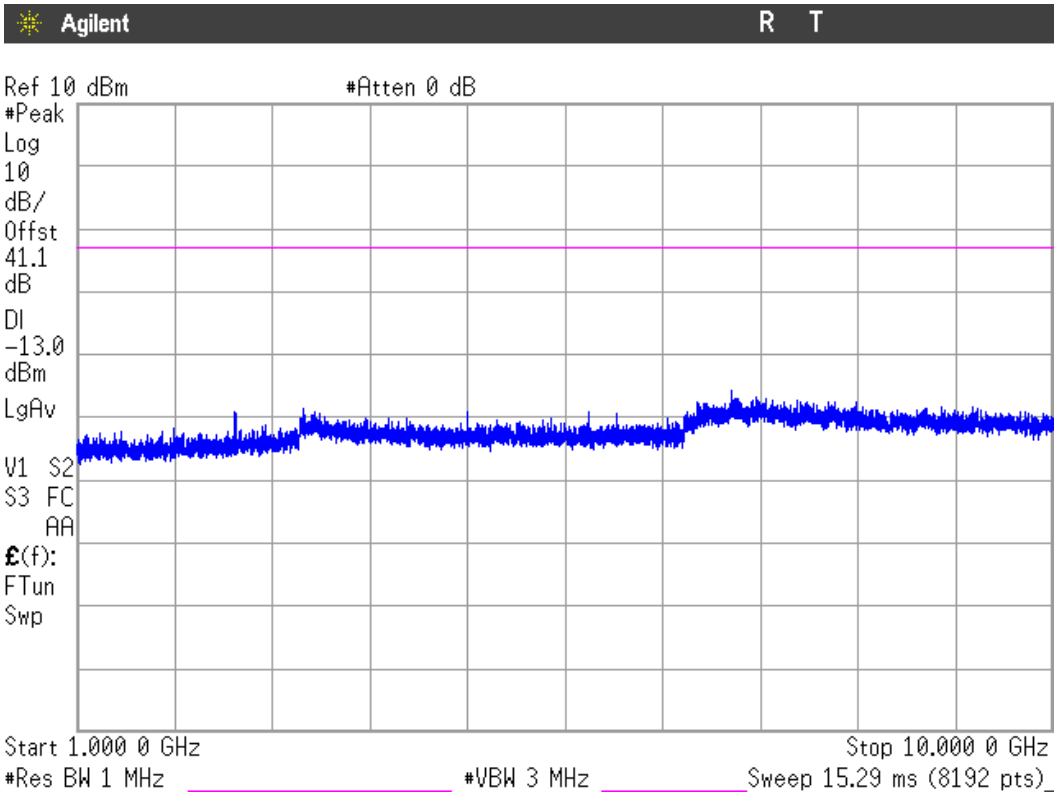
Note: The peak above the limit is the carrier frequency.



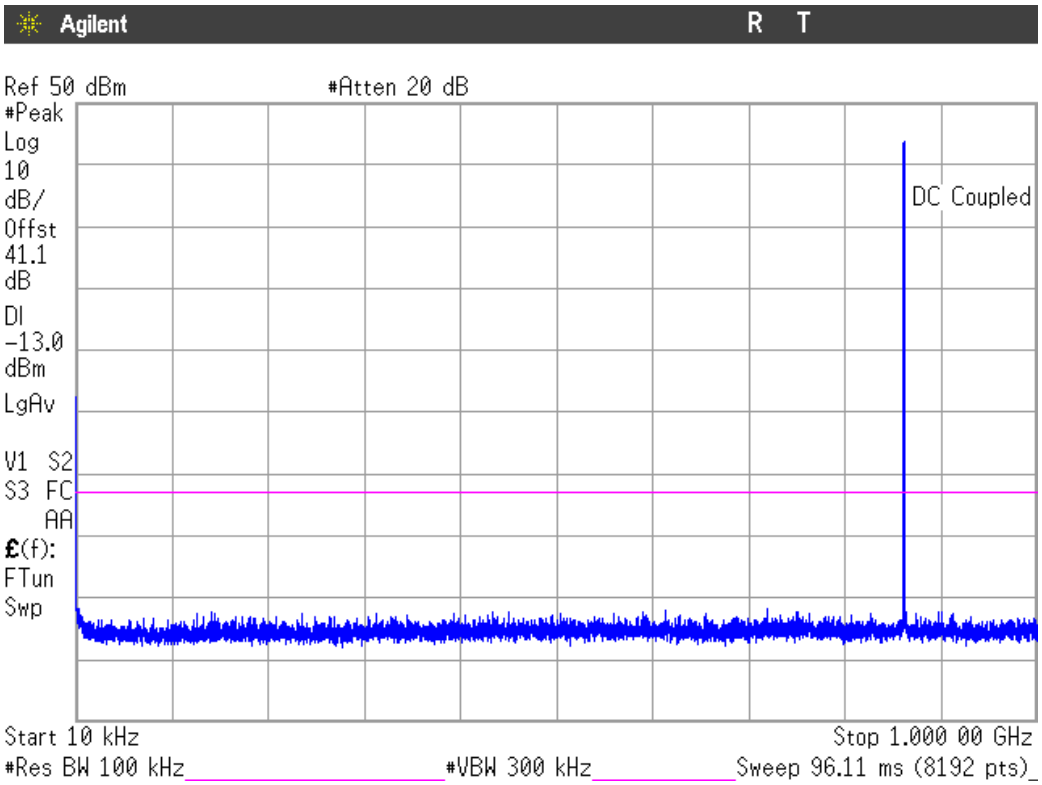
FCC 90 LOWEST CHANNEL: 854.0125 MHz



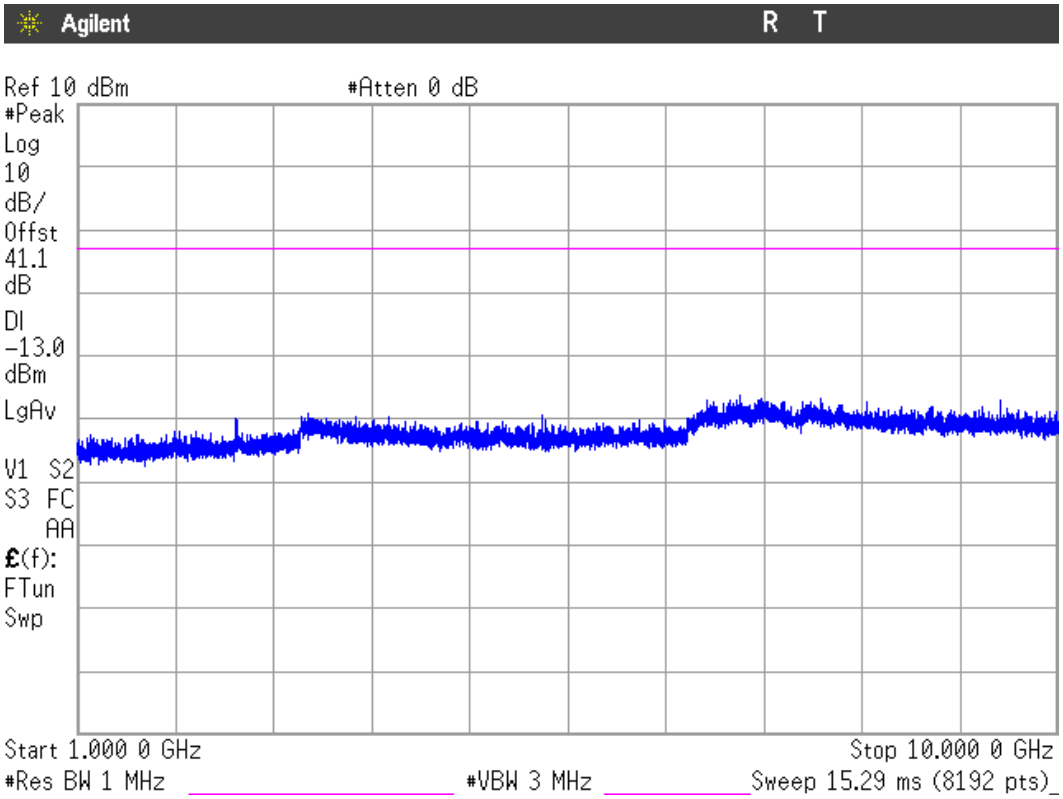
Note: The peak above the limit is the carrier frequency.



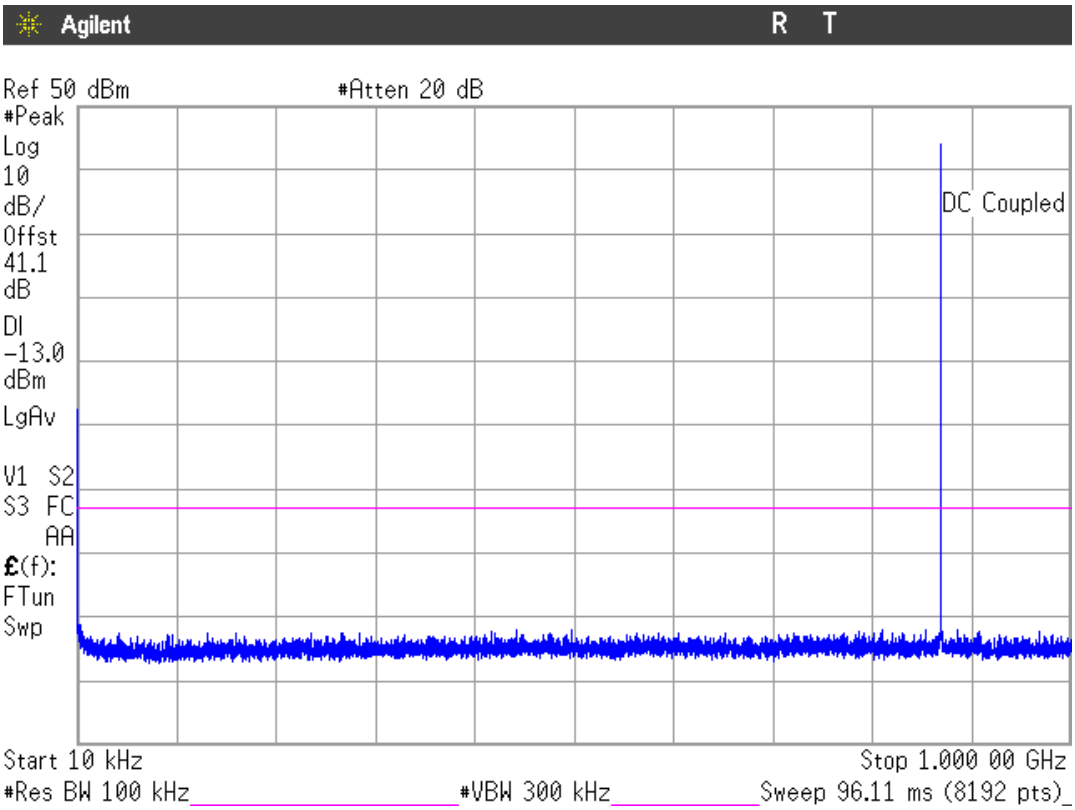
CHANNEL: MIDDLE



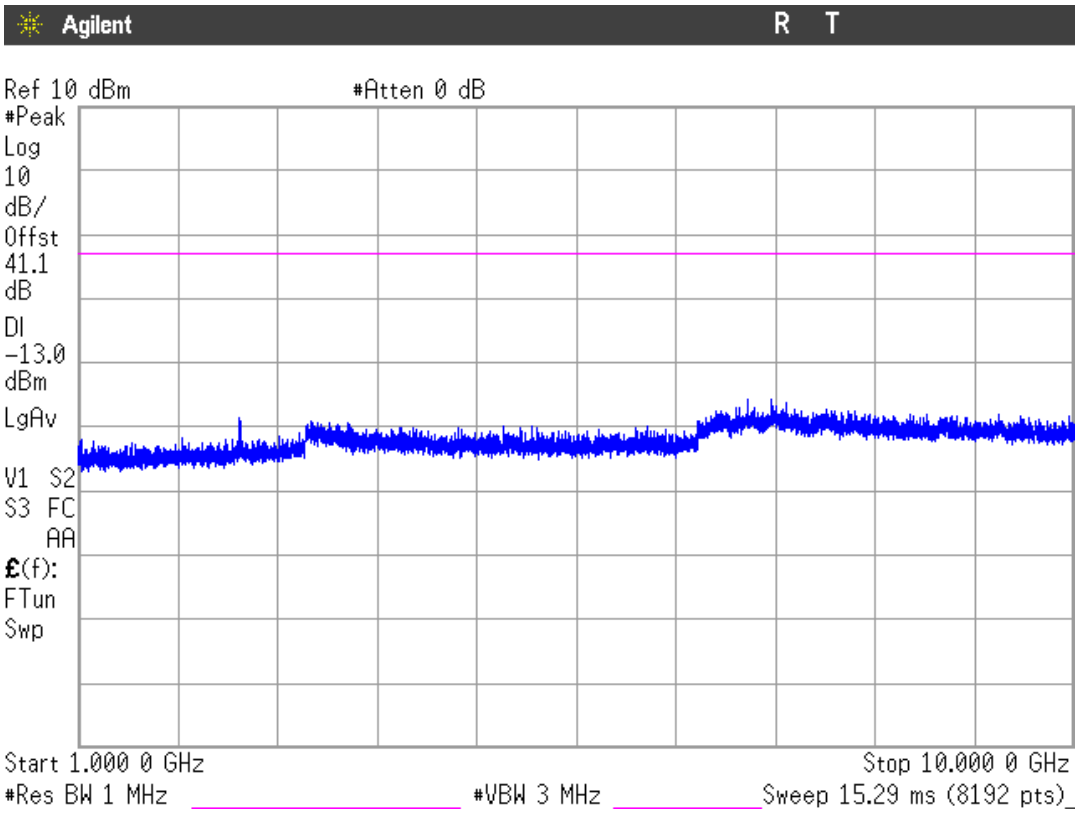
Note: The peak above the limit is the carrier frequency.



CHANNEL: HIGHEST

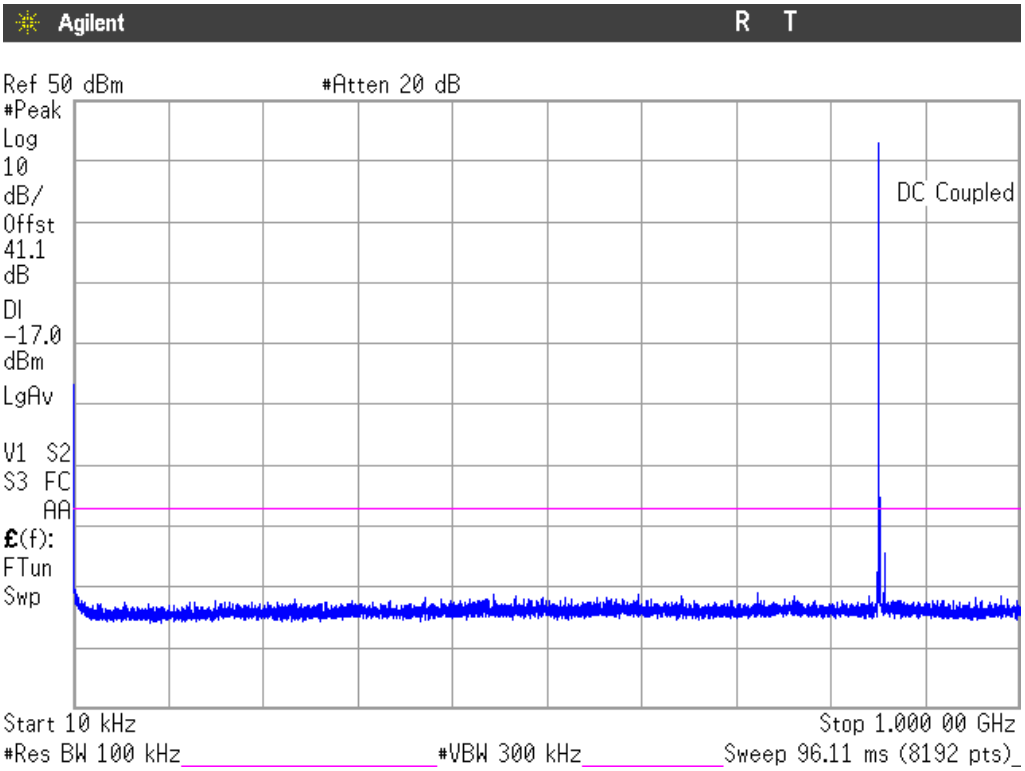


Note: The peak above the limit is the carrier frequency.

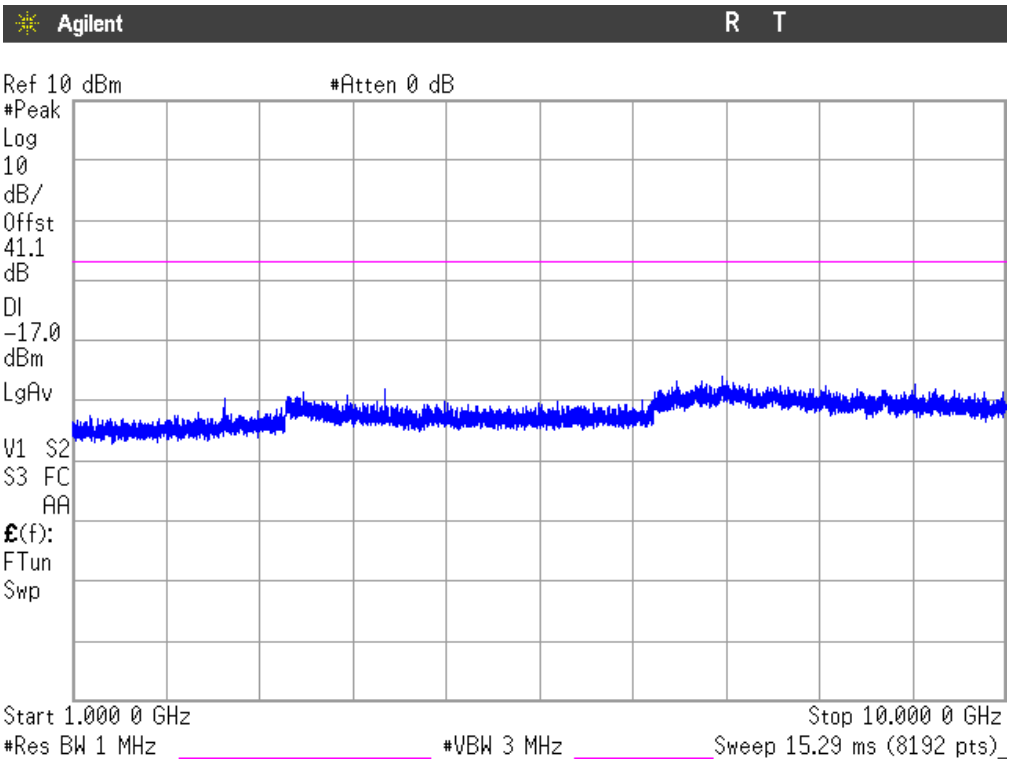


TETRA 22 kHz bandwidth.

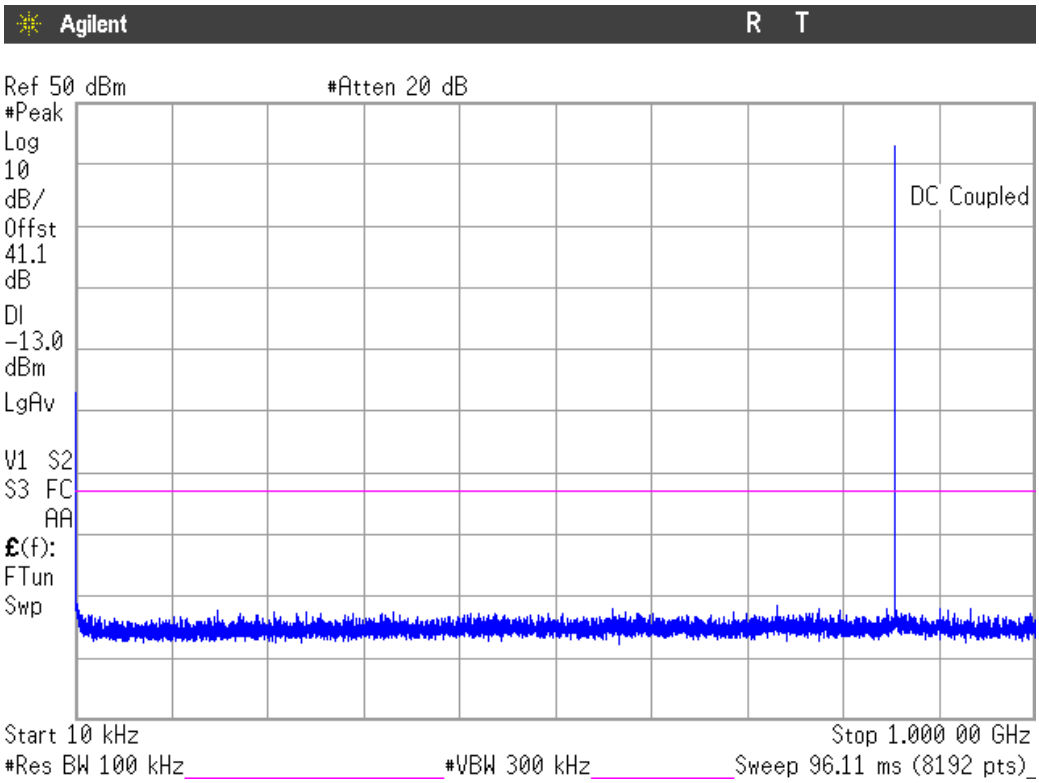
RSS-119 LOWEST CHANNEL: 851.0125 MHz



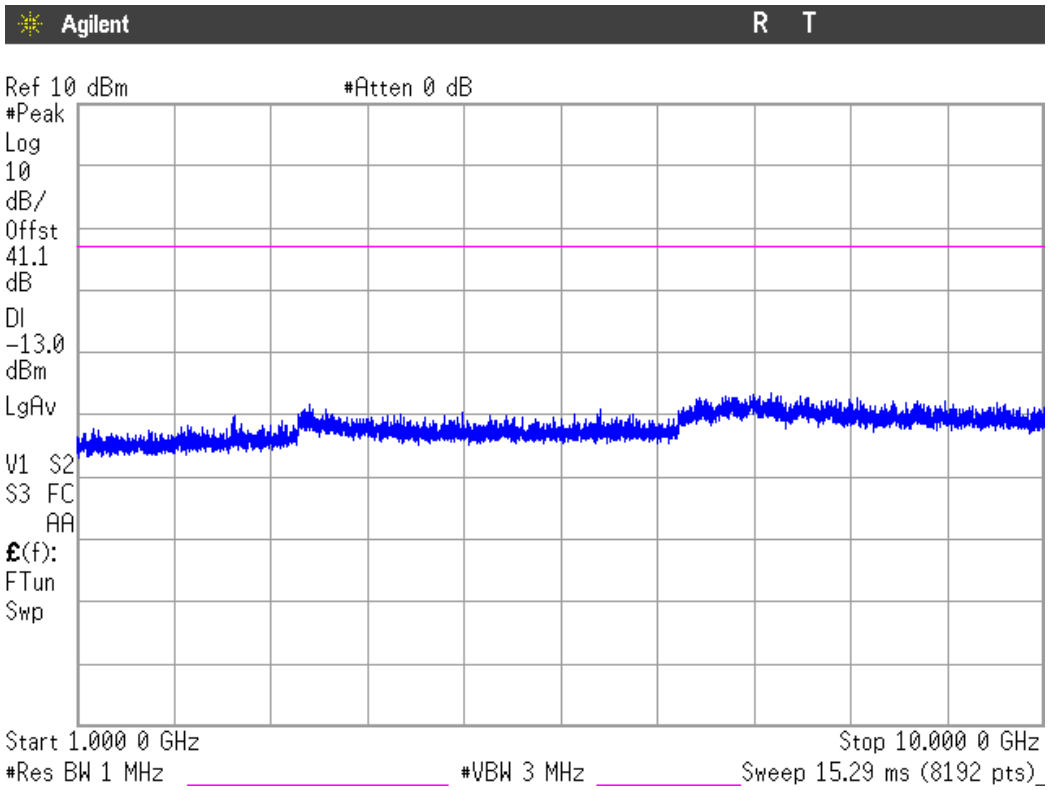
Note: The peak above the limit is the carrier frequency.



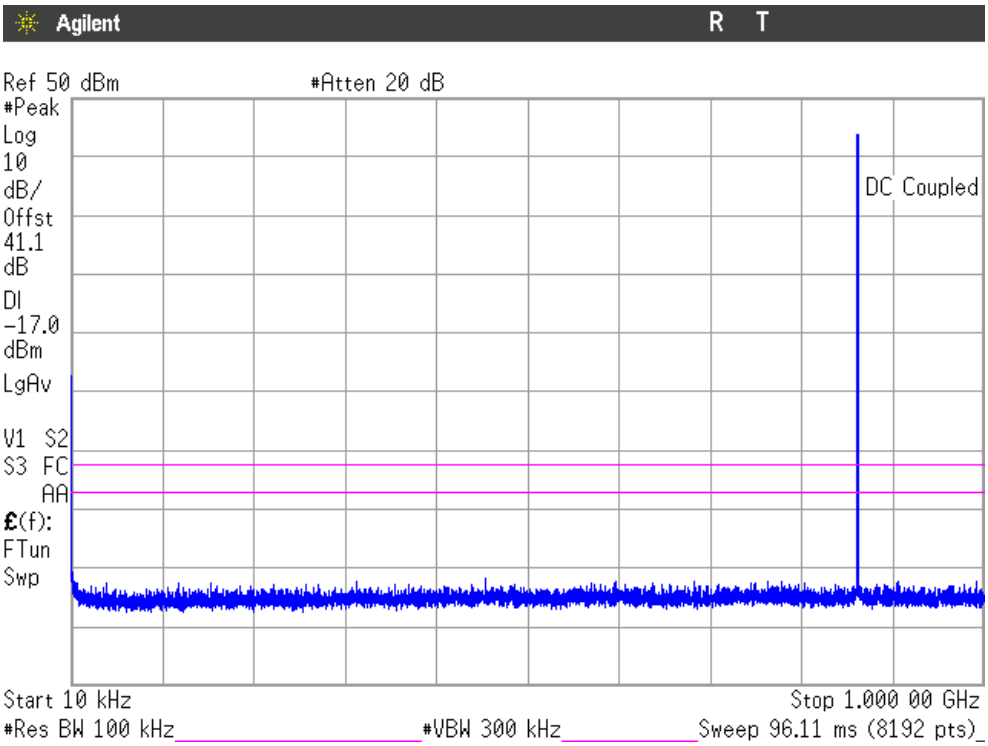
FCC 90 LOWEST CHANNEL: 854.0125 MHz



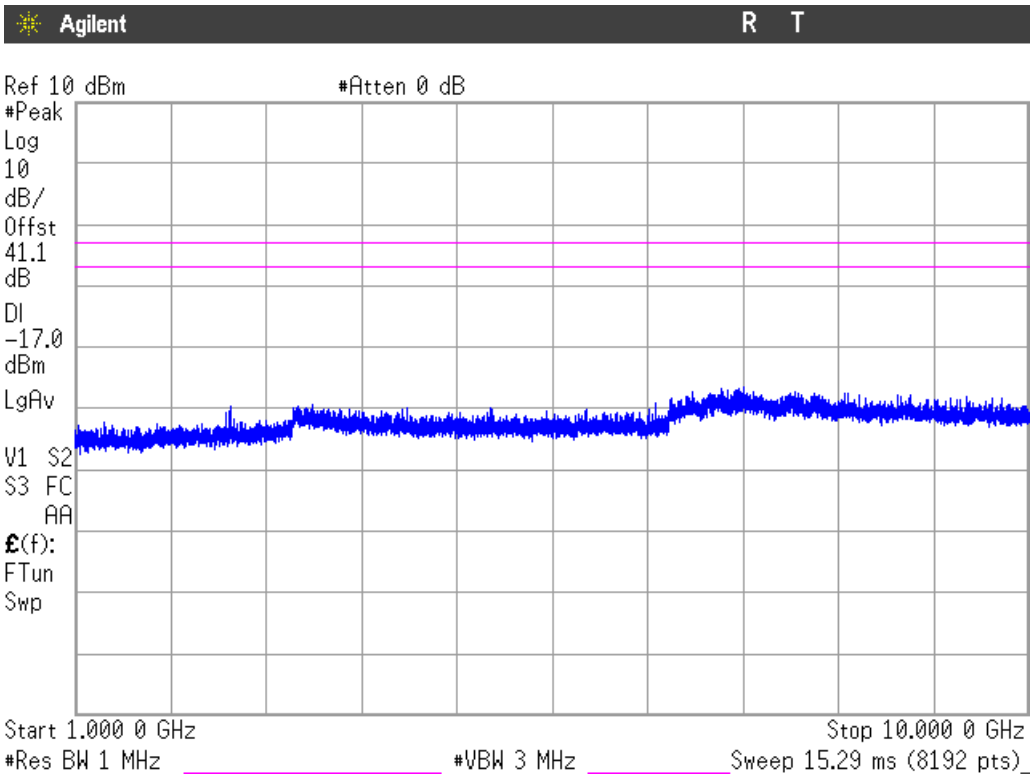
Note: The peak above the limit is the carrier frequency.



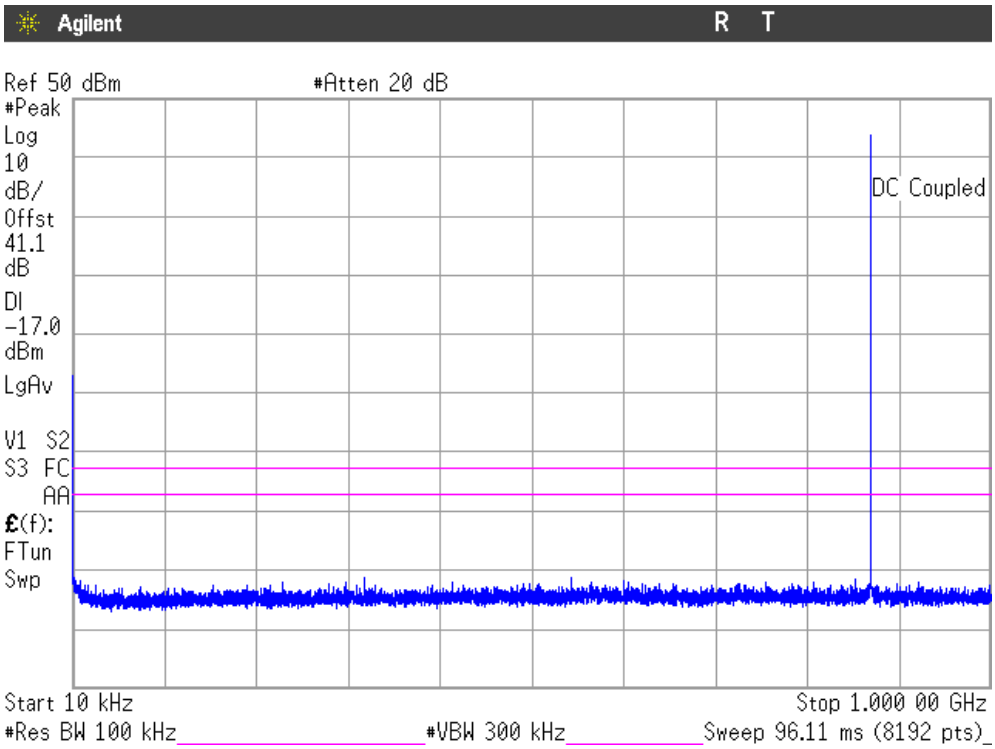
CHANNEL: MIDDLE



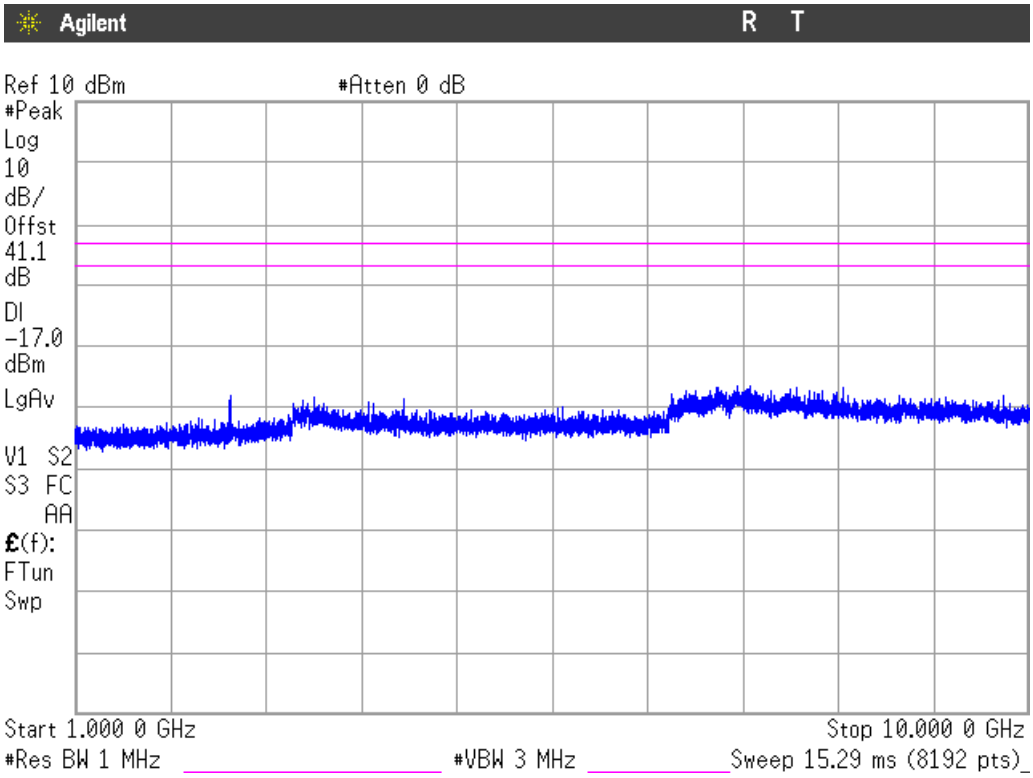
Note: The peak above the limit is the carrier frequency.



CHANNEL: HIGHEST



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



Radiated emissions

SPECIFICATION

FCC §2.1051, §90.210, §90.221, §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 + 10Log$_{10}$(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 (Pwatts) dB.

RSS-119 Clause 5.8.

Table 10 - Emission Mask G

Displacement Frequency, fd (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
10 < fd ≤ 50	whichever is the lesser attenuation: 70 or 116 log10(fd/6.11) or 50 + 10 log10(p)	300
fd > 50	43 + 10 log10(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 ≤ 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

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 power supply configuration and modulation mode.
Each detected emission is substituted by the Substitution method in accordance with the ANSI/TIA-603.

RESULTS

A preliminary scan determined the DC power supply and 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 Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
2.55295	-55.20	1000	Peak	Vertical	-64.71	2.10	10.78	-56.03

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 Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1.70785	-56.66	1000	Peak	Vertical	-67.47	2.02	8.85	-60.64
2.56195	-56.61	1000	Peak	Vertical	-66.10	2.10	10.80	-57.40

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 Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1.10035	-59.55	1000	Peak	Vertical	-71.14	0.80	6.66	-65.28
1.72315	-56.55	1000	Peak	Vertical	-67.34	2.05	8.90	-60.48

3. CHANNEL: HIGHEST.

Highest spurious signals.

Substitution method data

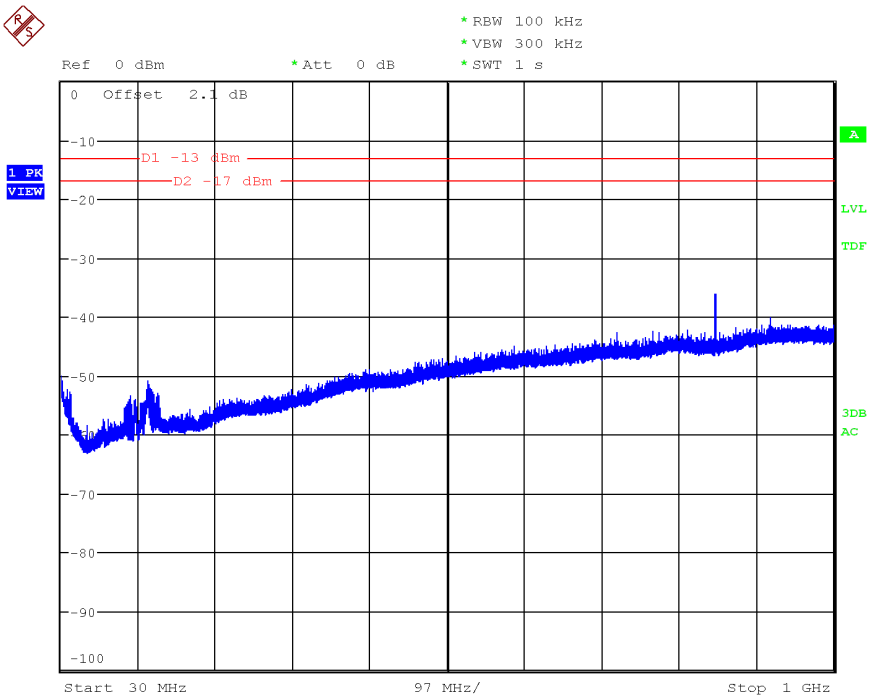
Frequency (GHz)	Instrument reading (dBm)	RBW (kHz)	Detector	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1.73815	-57.63	1000	Peak	Vertical	-68.40	2.08	8.96	-61.52

Measurement uncertainty (dB)	<±3.88 for f < 1GHz <±4.87 for f ≥ 1 GHz up to 18 GHz

Verdict: PASS

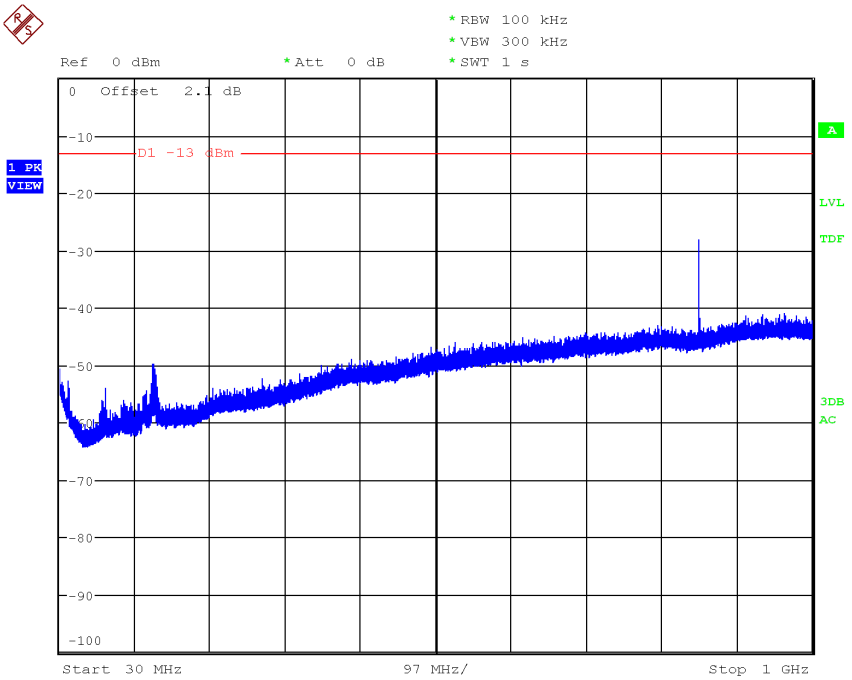
FREQUENCY RANGE 30 MHz-1000 MHz.

RSS-119 LOWEST CHANNEL: 851.0125 MHz



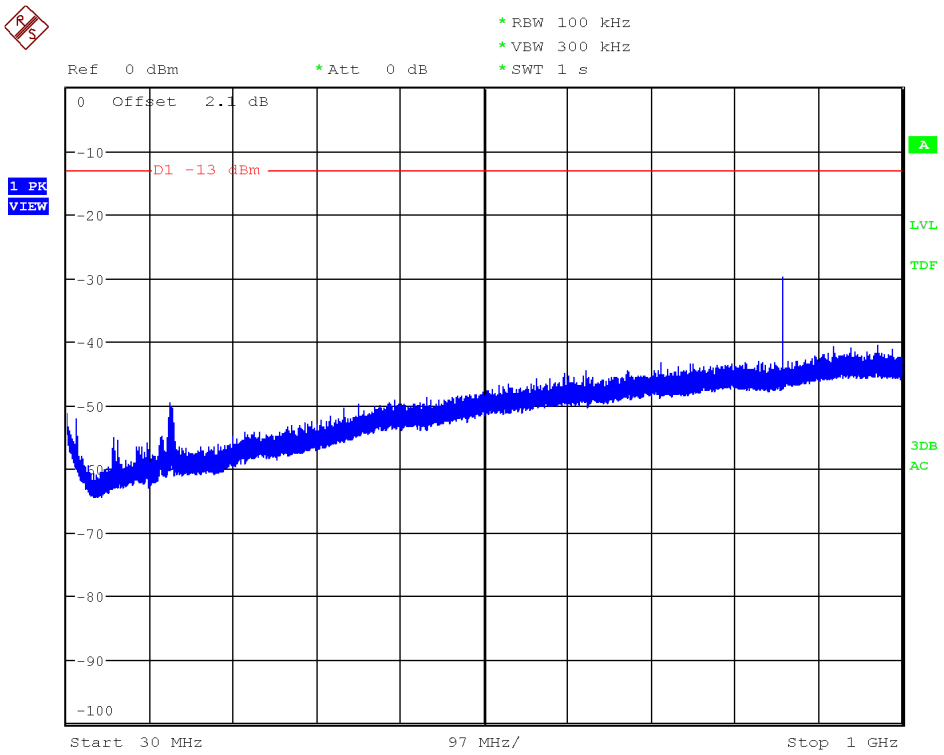
Note: The highest peak shown in the plot is the carrier frequency.

FCC 90 LOWEST CHANNEL: 854.0125 MHz



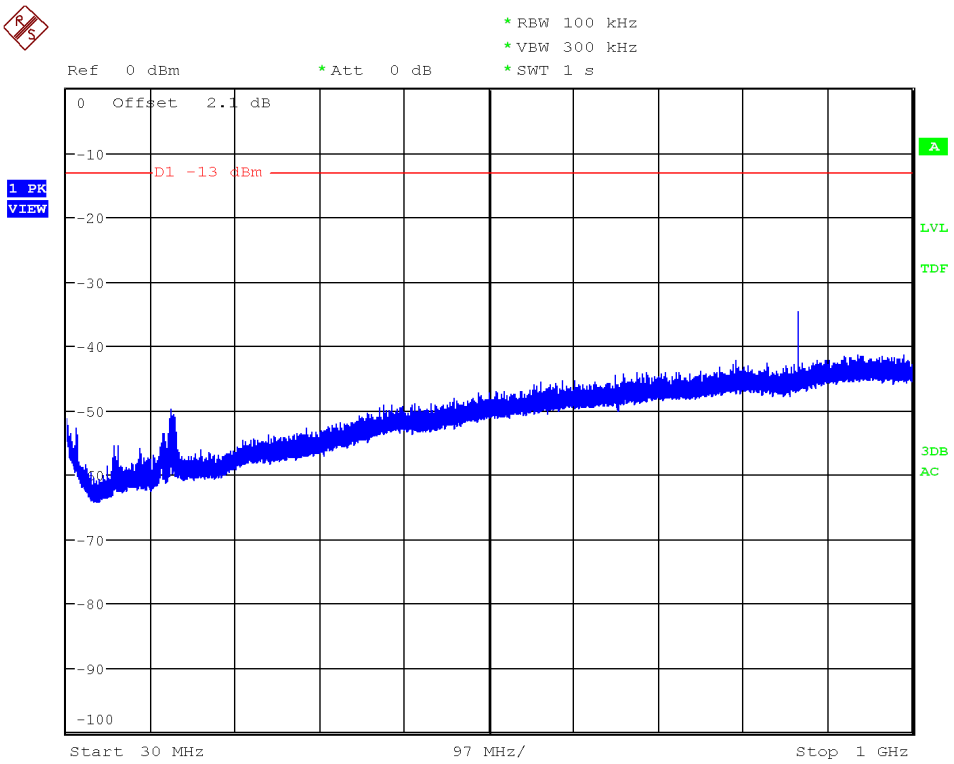
Note: The highest peak shown in the plot is the carrier frequency.

CHANNEL: MIDDLE.



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

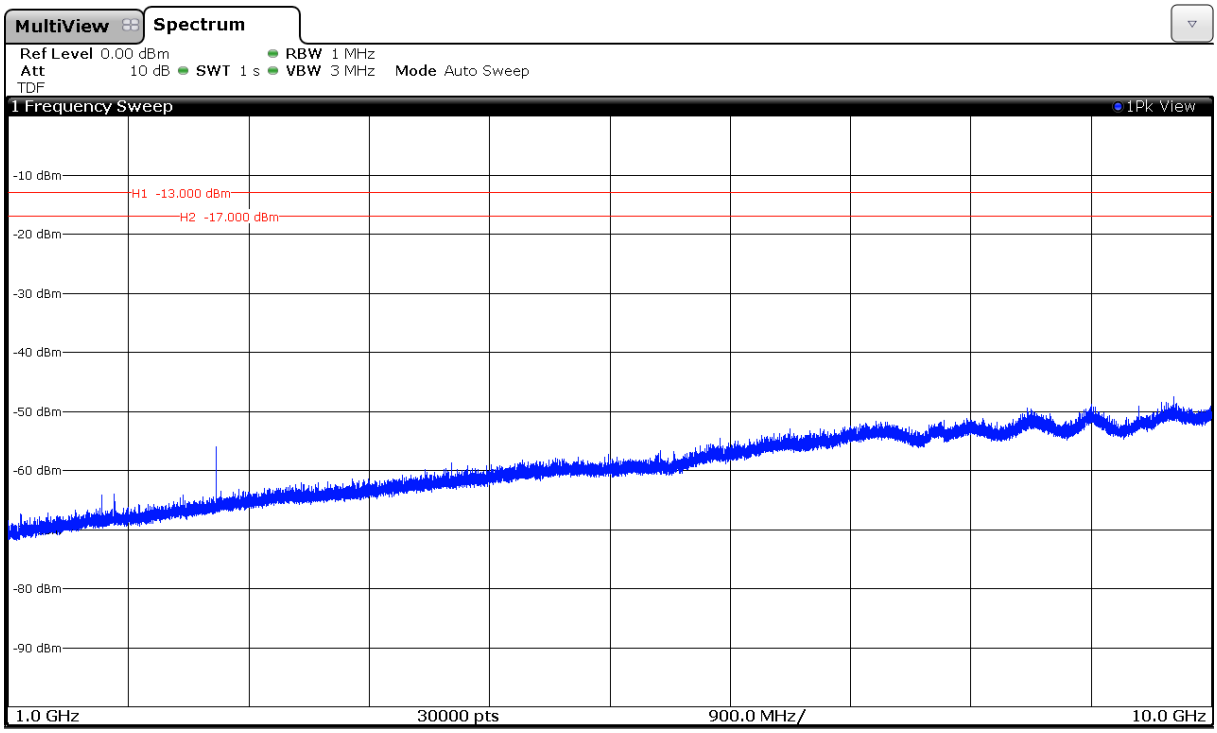
CHANNEL: HIGHEST.



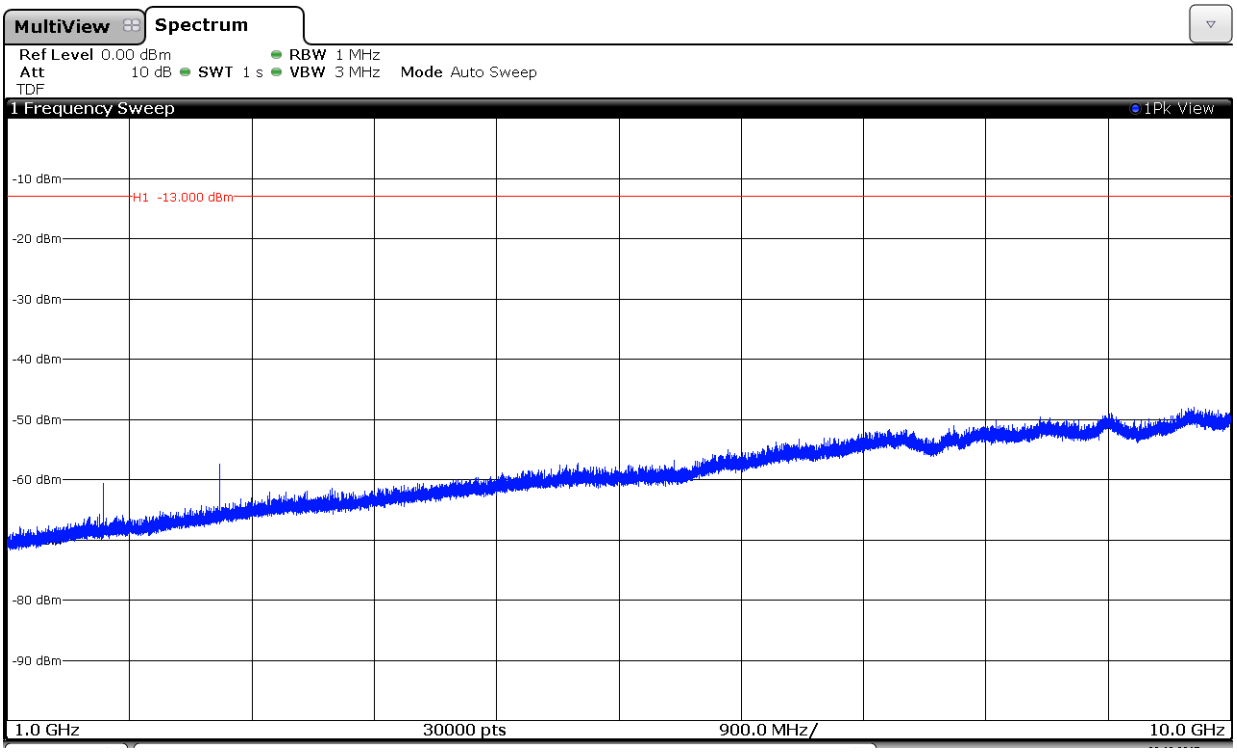
Note: The highest peak shown in the plot is the carrier frequency.

FREQUENCY RANGE 1 GHz to 10 GHz.

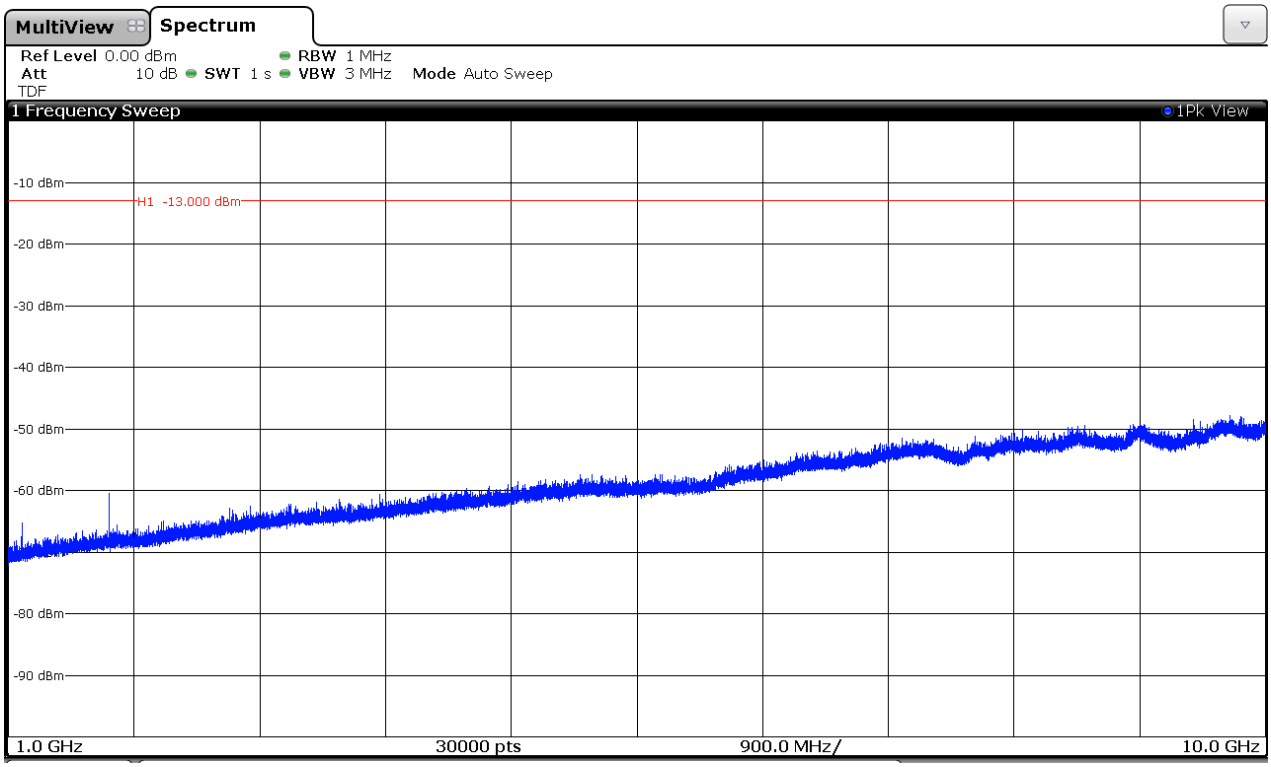
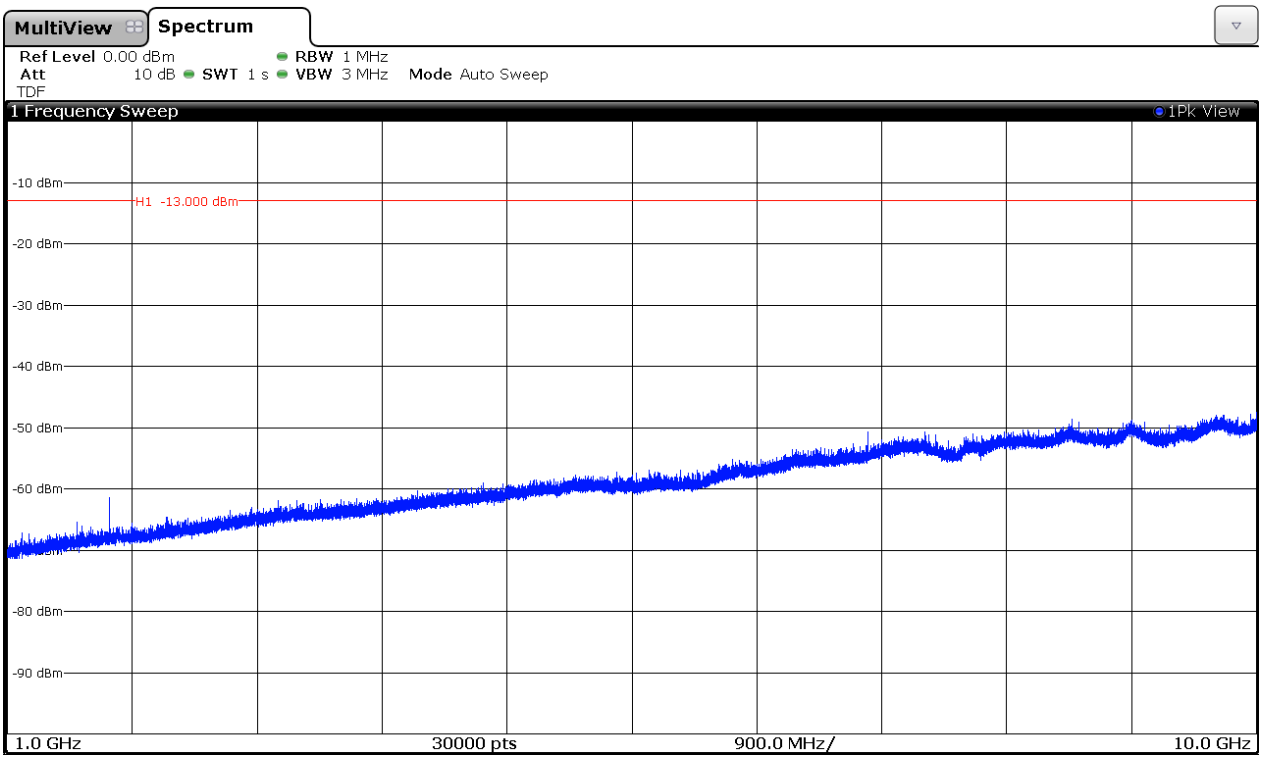
RSS-119 LOWEST CHANNEL: 851.0125 MHz



FCC 90 LOWEST CHANNEL: 854.0125 MHz



CHANNEL: MIDDLE.



CHANNEL: HIGHEST.