

**FCC LISTED, REGISTRATION
 NUMBER: 720267**

Test report No:

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

NIE: 56546RRF.001

Test report

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 -K
Other identification of the product	D148K01PT FCC ID: WT7PTMBS760B IC: 8624A-PTMBS760B
HW version	CCP: 0.01.14.15.13
SW version	CCP: 0.01.14.15.13
Características Features	<u>Power Supply:</u> MBS Unit -K with DC power supply: <ul style="list-style-type: none"> ○ Nominal voltage: 24 VDC ○ Operational voltage range: [21.6 - 31.2 VDC] MBS Unit -K with AC power supply: <ul style="list-style-type: none"> ○ Nominal voltage: 110/220 VAC. 50/60 Hz ○ Operational voltage range: [90 - 264 VAC] <u>Frequency band:</u> TX: 763-776 MHz RX: 793-806 MHz <u>RF output power (nominal):</u> TETRA: 40 dBm (10 W) TI D-LMR: 40 dBm (10 W) See full details on pages 5, 6 and 7
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 10-01-17 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

Fecha de realización	2018-05-09
Date of issue	
Formato de informe No.	FDT08_20
Report template No	

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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 conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

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

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

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

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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.
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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification and the Accreditation Bodies.

Uncertainty

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

Usage of samples

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

Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
56546/001	RF Transceiver / Mast-mounted Base Station (DC power supply)	MBS Unit -K	921625	2018-02-14
56546/003	RF Transceiver / Mast-mounted Base Station (AC power supply)	MBS Unit -K	921624	2018-02-14

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

All tests indicated in appendix A, except the following tests:

Radiated emissions inside the band 1559-1610 MHz.

Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
56546/001	RF Transceiver / Mast-mounted Base Station (DC power supply)	MBS Unit -K	921625	2018-02-14
56546/003	RF Transceiver / Mast-mounted Base Station (AC power supply)	MBS Unit -K	921624	2018-02-14
56592/004	Colinear antenna	4240.06.780.00	26889	2018-02-14

1. Sample S/02 has undergone the test(s).

The following tests indicated in appendix A:

Radiated emissions inside the band 1559-1610 MHz.

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 -K operates in the frequency band 763-806 MHz and provides an RF output power of 10 W in the subband 763-776 MHz.

Features:

Power Supply:

MBS Unit -K with DC power supply:

- Nominal voltage: 24 VDC
- Operational voltage range: [21.6 - 31.2 VDC]

MBS Unit -K with AC power supply:

- Nominal voltage: 110/220 VAC. 50/60 Hz
- Operational voltage range: [90 - 264 VAC]

Access scheme:

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

Modulation scheme:

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

- TETRA:

Modulation low-pass filter: Square-root raised cosine filter with a roll-off factor of 0.35.

- TI D-LMR:

Modulation low-pass filter: Square-root raised cosine filter with a roll-off factor of 0.2.

RF channel bandwidth (channel spacing):

25 KHz

Spectral efficiency:

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

Frequency band:

TX: 763-776 MHz

RX: 793-806 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	SERIAL NUMBER
MBS AC	D148K01PT O148017PT O148020PT O148052PT O148057PT O485002PT	921624
MBS DC	D148K01PT O148018PT O148020PT O148052PT O148057PT O485002PT	921625

D148K01PT - MBS UNIT 763-806 MHZ POWERTRUNK-T
O148017PT - VAC OPTION (power supply: 220/110 VAC)
O148018PT - VDC OPTION (power supply: 24 VDC)
O148020PT - SUBBAND MBS TX763 / RX793 / BW13 OPTION
O148052PT - MBS WITHOUT BRACKETS OPTION
O148057PT - LITE OPTION
O485002PT - TETRA CARRIER AIR INTERFACE ENCRYPTION OPTION

Identification of the client

TELTRONIC, S.A.U.
Polígono Malpica, Calle C/F-Oeste (50016). Zaragoza (SPAIN).

Testing period

The radiated measurements started on 2018-02-15 and finished on the same day.
The conducted measurements started on 2018-02-26 and finished on 2018-03-15.
The tests have been performed at DEKRA Testing and Certification.

Environmental conditions

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

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

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

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

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

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

Remarks and comments

1: The tests have been performed by the technical personnel: Carlos Contreras and Carolina Postigo.

2: Used instrumentation.

Conducted Measurements

	Last Cal. date	Cal. due date
1. Spectrum analyzer 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	2018/02	2021/02
4. Radiocommunication analyzer HP 8920A	2017/04	2020/04
5. Wideband Power sensor R&S NRP-Z81	2016/04	2018/04
6. Spectrum analyzer R&S FSV40	2017/07	2019/07
7. AC power supply ELGAR CS-AC35(351SL)	2016/05	2019/05
8. Digital multimeter FLUKE 113	2017/05	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 analyzer R&S FSV40	2017/07	2019/07
6. EMI Test Receiver R&S ESU 40	2016/03	2018/03
7. RF pre-amplifier 30 MHz-6 GHz Bonn Elektronik BLNA 0360-01N	2017/07	2018/07
8. RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2016/02	2018/02
9. DC power supply KEYSIGHT TECHNOLOGIES	---	---
10. Digital multimeter FLUKE 113	2017/05	2019/05

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 90.535 / RSS-119 Clause 5.2: Modulation characteristics				NM ³
Clause 90.531 / RSS-119 Clause 5.5: Occupied Bandwidth		P		
Clause 90.205, 90.541, 90.635 / RSS-119 Clause 5.4: RF output power		P		
Clause 90.543 (a) & (b) / RSS-119 5.5, 5.8.9.1.: Adjacent channel power		P		
Clause 90.539 / RSS-119 Clause 5.3: Frequency stability		P		
Clause 90.543 (c) / RSS-119 Clause 5.8.9.2: Out-of-Band Emission limit at antenna terminals		P		
Clause 90.543 (c) & (f) / RSS-119 Clause 5.8.9.2: Out-of-Band Emission limit (Radiated)		P		

3: see point "Remarks and comments".

Appendix A – Test results

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TEST CONDITIONS

Power supply (V):

AC voltage

$$V_{\text{nom}} = 110.0 \text{ Vac}$$

$$V_{\text{max}} = 126.5 \text{ Vac}$$

$$V_{\text{min}} = 93.5 \text{ Vac}$$

DC voltage

$$V_{\text{nom}} = 24.0 \text{ Vdc}$$

$$V_{\text{max}} = 31.2 \text{ Vdc}$$

$$V_{\text{min}} = 20.4 \text{ Vdc}$$

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

Type of power supply = AC or DC Voltage from external power supply

Type of antenna = external connectable antenna

Rated RF Output Power:

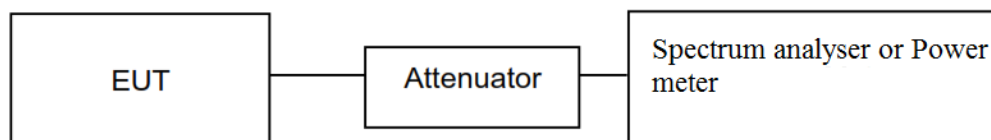
- Mode TETRA (22 kHz bandwidth): 40 dBm (10 W)
- Mode TI D-LMR (20 kHz bandwidth): 40 dBm (10 W)

TEST FREQUENCIES:

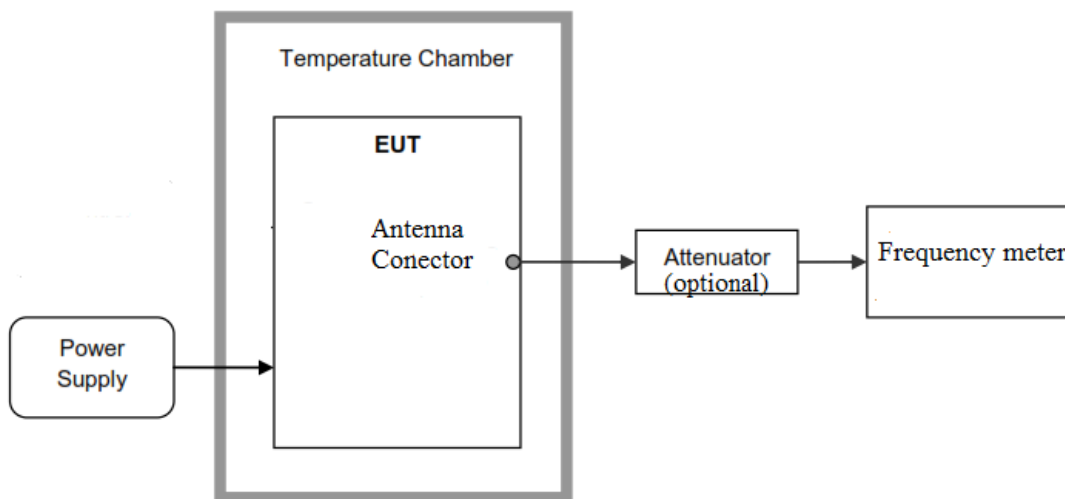
	FCC 90: 769-775 MHz band	RSS-119: 768-776 MHz band
Lowest channel	769.0125 MHz	768.0125 MHz
Highest channel	774.9875 MHz	775.9875 MHz

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 8000 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-8 GHz (1 GHz-18 GHz Double ridge horn antenna), except for the band 1559-1610 MHz where a distance of 3 m was used.

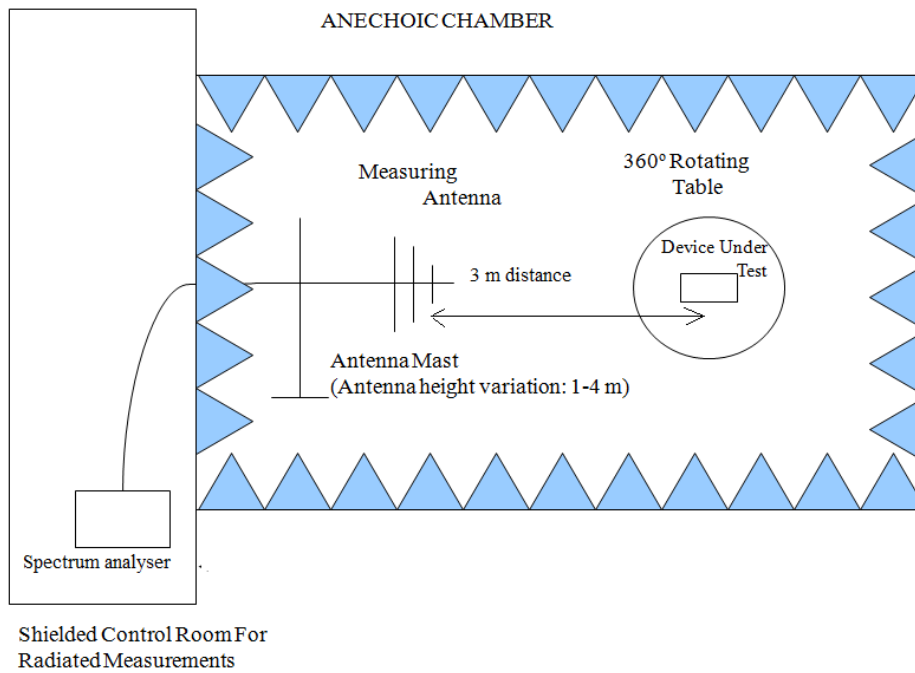
For emissions in the band 1559-1610 MHz the EUT was tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

For radiated emissions in the range 1 GHz-8 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

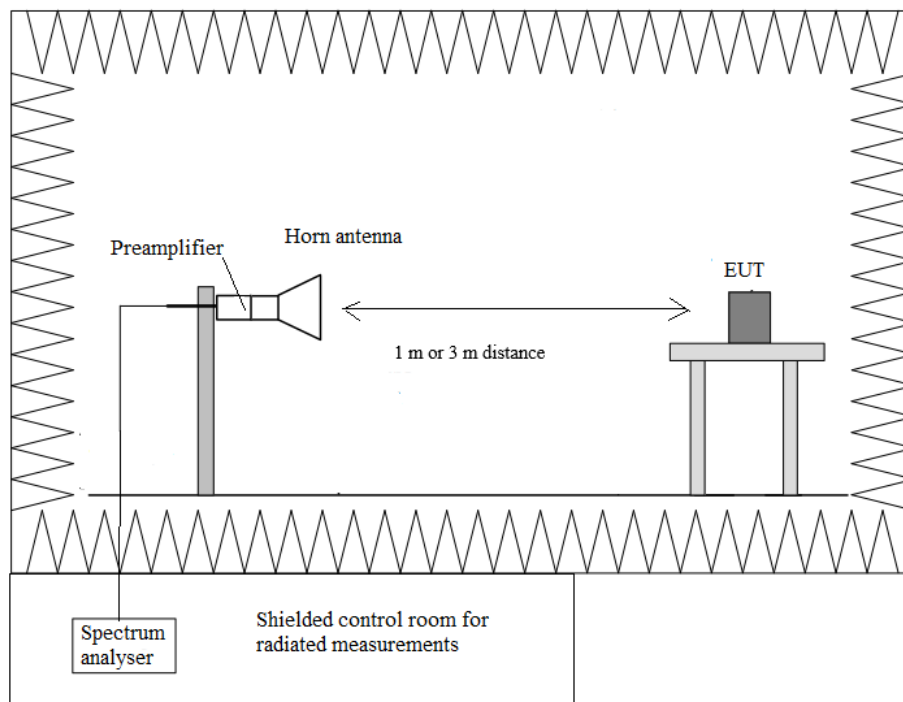
The equipment under test was set up on a non-conductive platform above the ground and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



Modulation Characteristics

SPECIFICATION

FCC §2.1047, §90.207 and §90.535

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

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

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

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

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

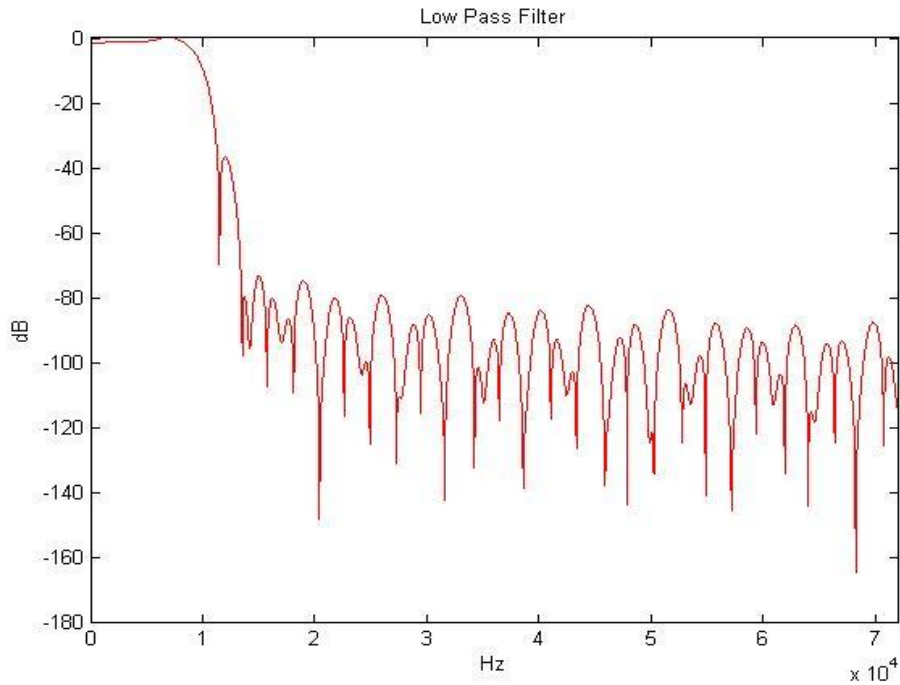
The EUT operates with $\pi/4$ -shifted Differential Quaternary Phase Shift Keying ($\pi/4$ -DQPSK) in both TI D-LMR and TETRA, featuring a modulation rate of 18 ksym/s (36 kbits/s).

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

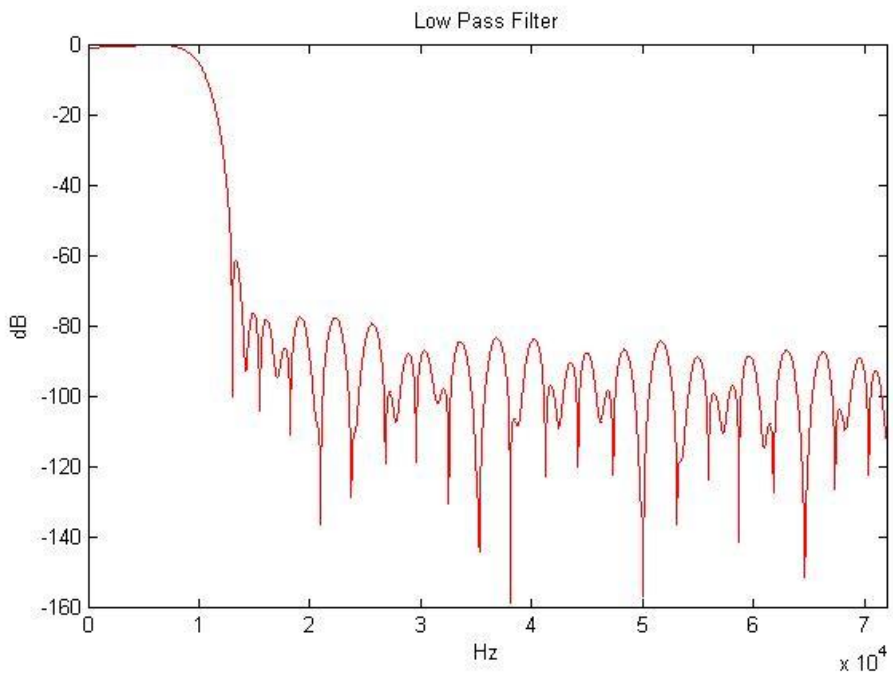
A root-raised-cosine filter (RRC) is used as a transmitting and receiving filter in both digital communication systems to perform matched filtering. The combined response of such two filters is that of the raised-cosine filter. The raised-cosine filter is often used for pulse-shaping in digital modulation,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

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

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, §90.531.

Band plan for the 758-775 MHz and 788-805 MHz bands.

Subject to compliance with the spectrum usage efficiency requirements set forth in §90.535, two or four contiguous narrowband (6.25 kHz) channels may be used in combination as 12.5 kHz or 25 kHz channels, respectively.

RSS-119 Clause 5.5.

Frequency Band (MHz)	Related SRSP for Channelling Plan and e.r.p.	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)
768-776 and 798-806	SRSP-511	25	(Note 2)

Note 2: Provided that the ACP requirements in Section 5.8.9.1 are met, any authorized bandwidth that does not exceed the channel bandwidth can be used.

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)

TI D-LMR 20 kHz. 769-775 MHz band.

Channel	99% Occupied bandwidth (kHz)	-26 dBc bandwidth (kHz)
Lowest	19.1613	21.982
Highest	19.1084	21.869
Measurement uncertainty (kHz)	<±0.17	

TI D-LMR 20 kHz. 768-776 MHz band.

Channel	99% Occupied bandwidth (kHz)	-26 dBc bandwidth (kHz)
Lowest	19.1909	21.883
Highest	19.1272	21.924
Measurement uncertainty (kHz)	<±0.17	

TETRA 22 kHz. 769-775 MHz band.

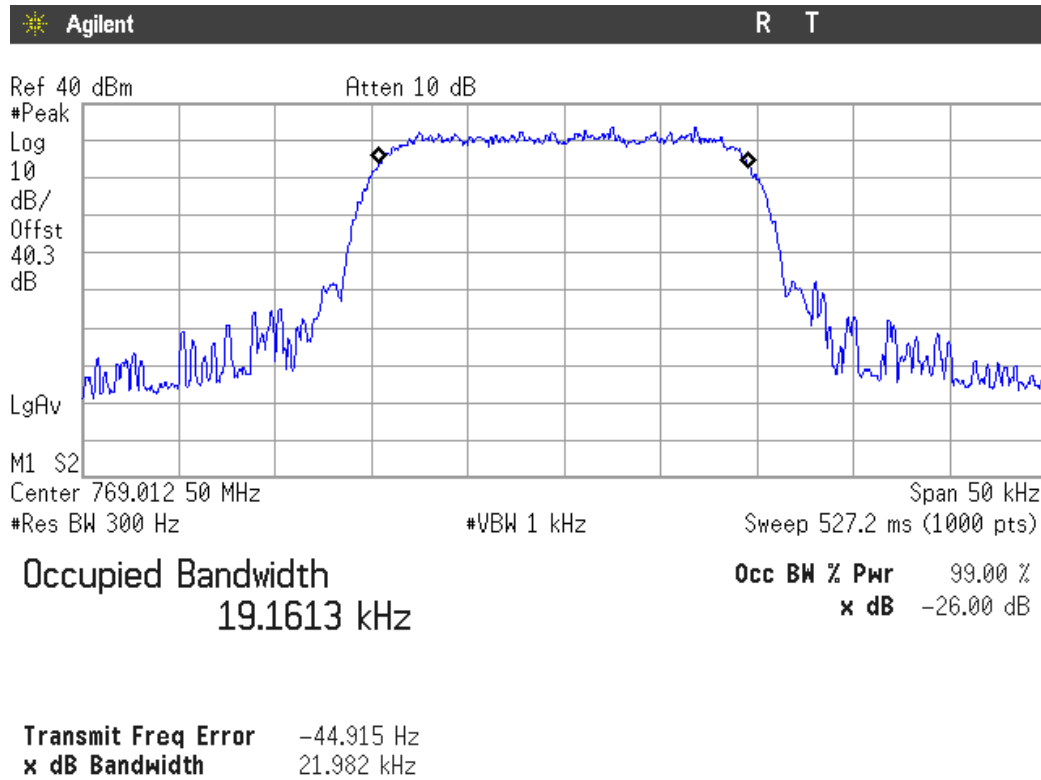
Channel	99% Occupied bandwidth (kHz)	-26 dBc bandwidth (kHz)
Lowest	20.4530	22.801
Highest	20.1748	23.393
Measurement uncertainty (kHz)	<±0.17	

TETRA 22 kHz. 768-776 MHz band.

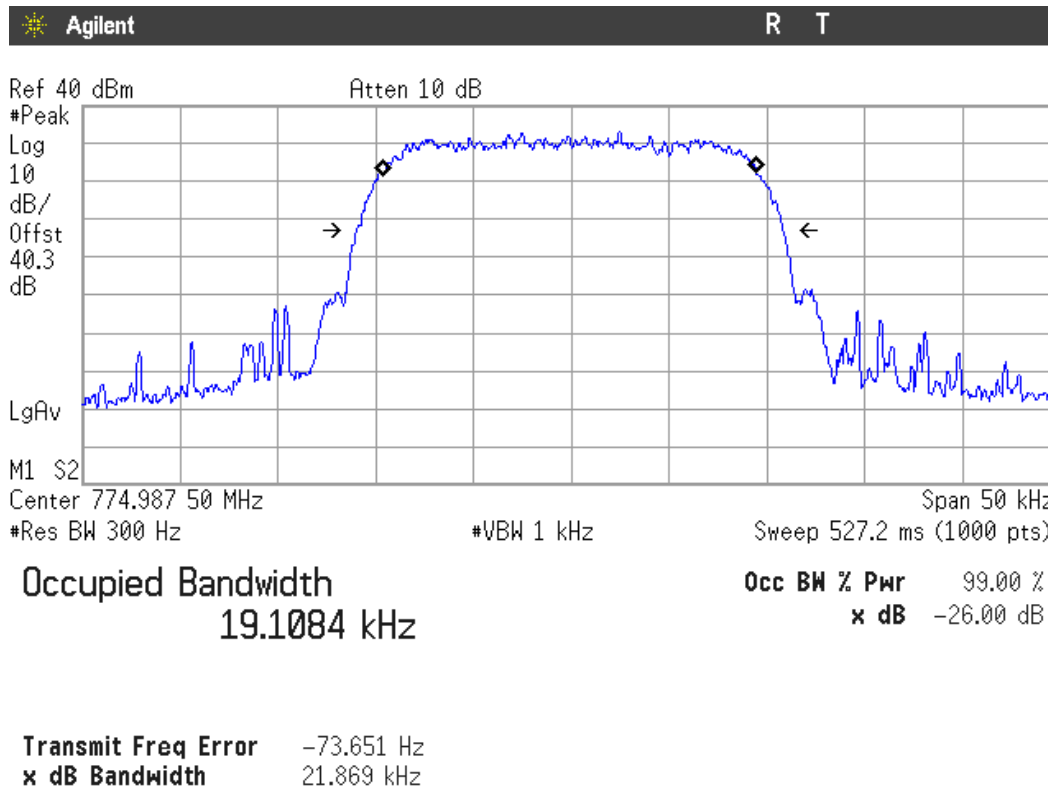
Channel	99% Occupied bandwidth (kHz)	-26 dBc bandwidth (kHz)
Lowest	20.2686	22.847
Highest	20.2261	23.321
Measurement uncertainty (kHz)	<±0.17	

TI D-LMR 20 kHz. 769-775 MHz band.

Lowest Channel

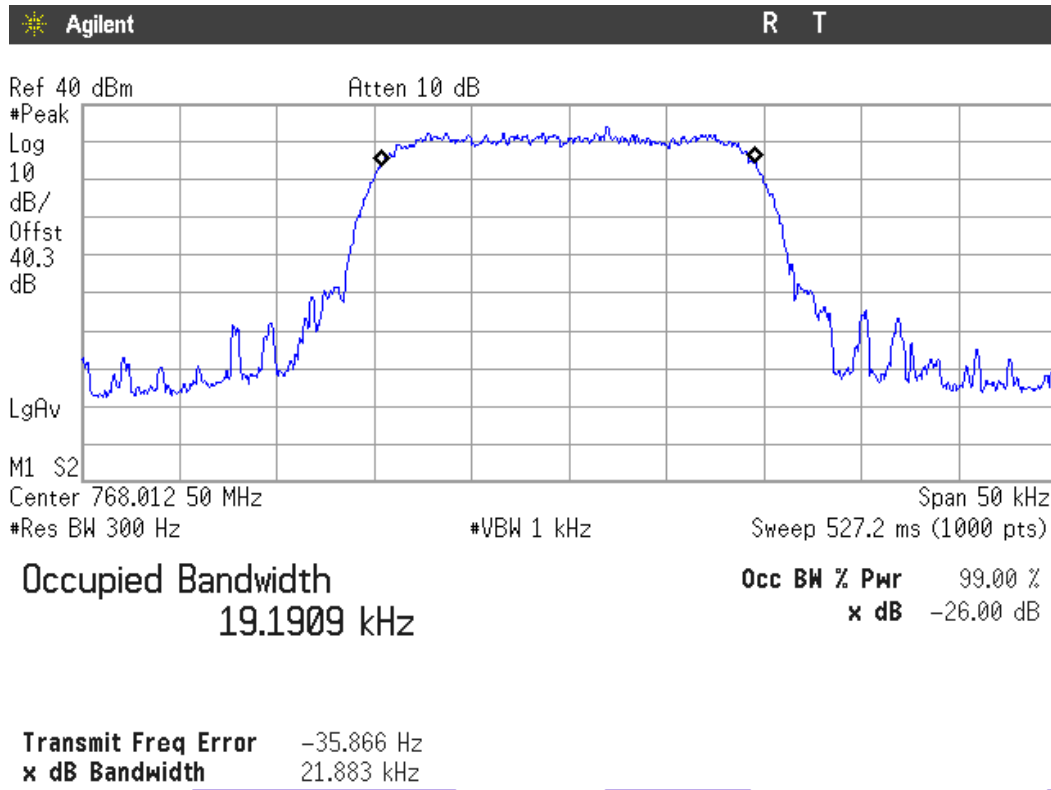


Highest Channel

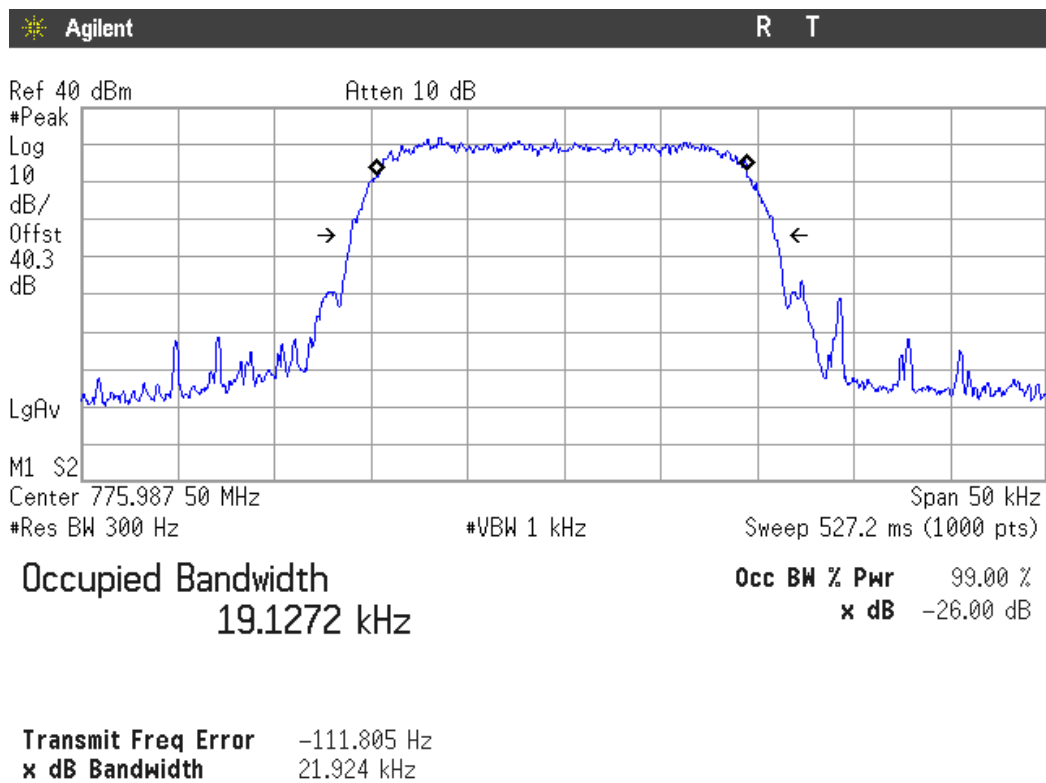


TI D-LMR 20 kHz. 768-776 MHz band.

Lowest Channel

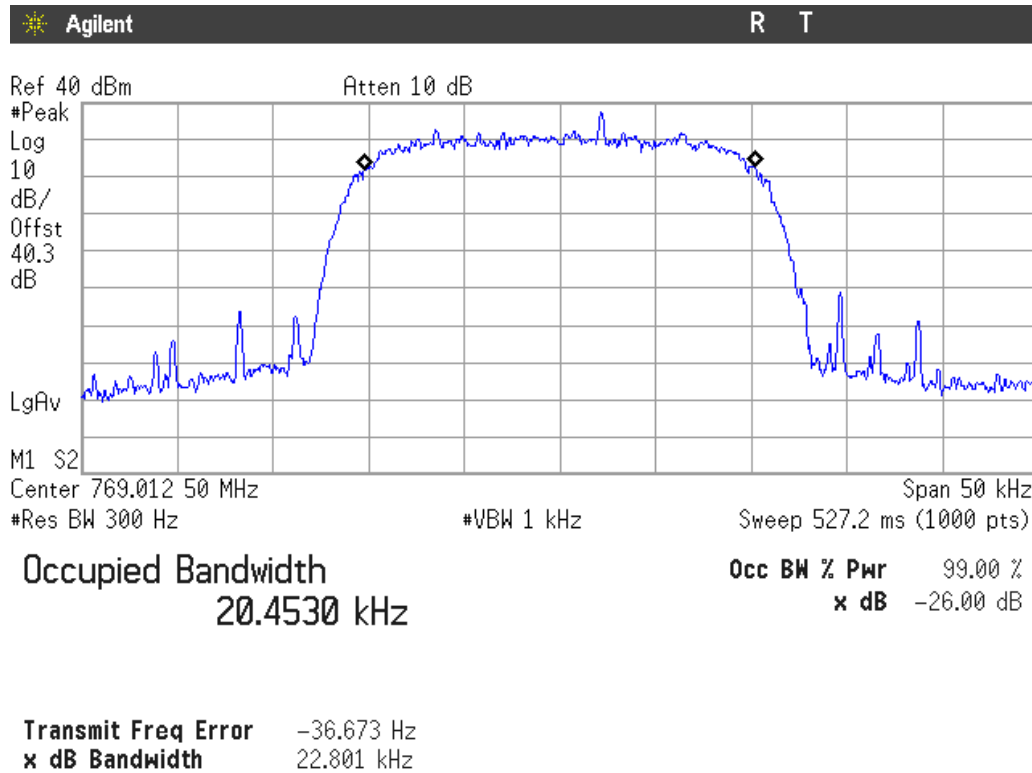


Highest Channel

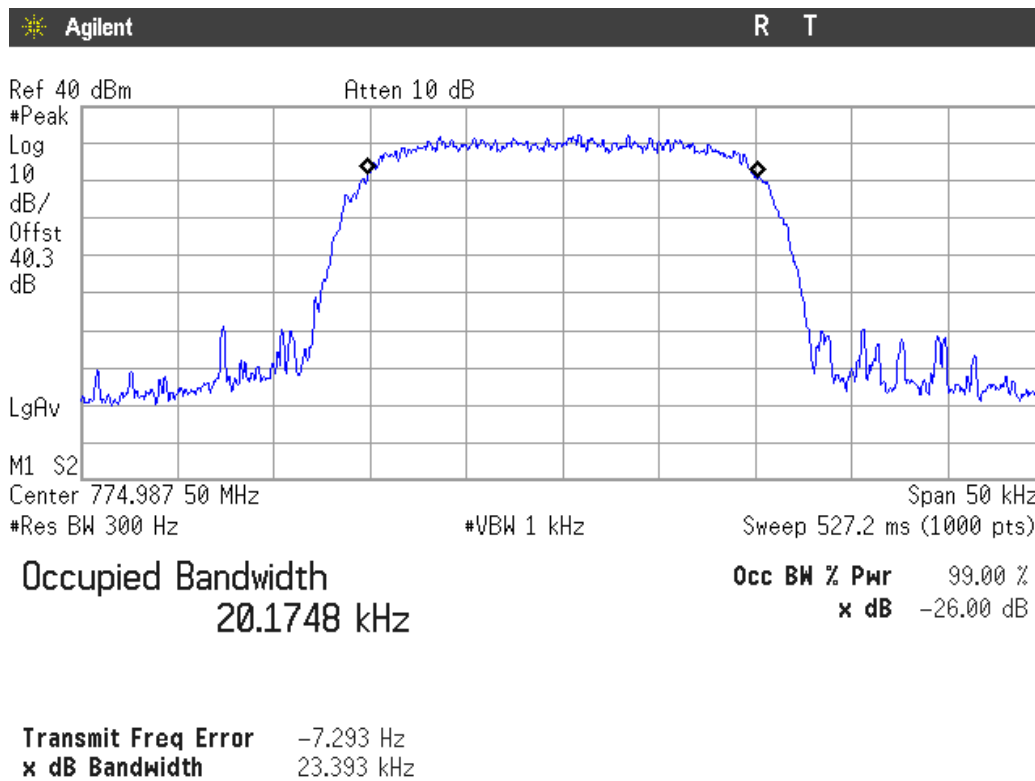


TETRA 22 kHz.769-775 MHz band.

Lowest Channel

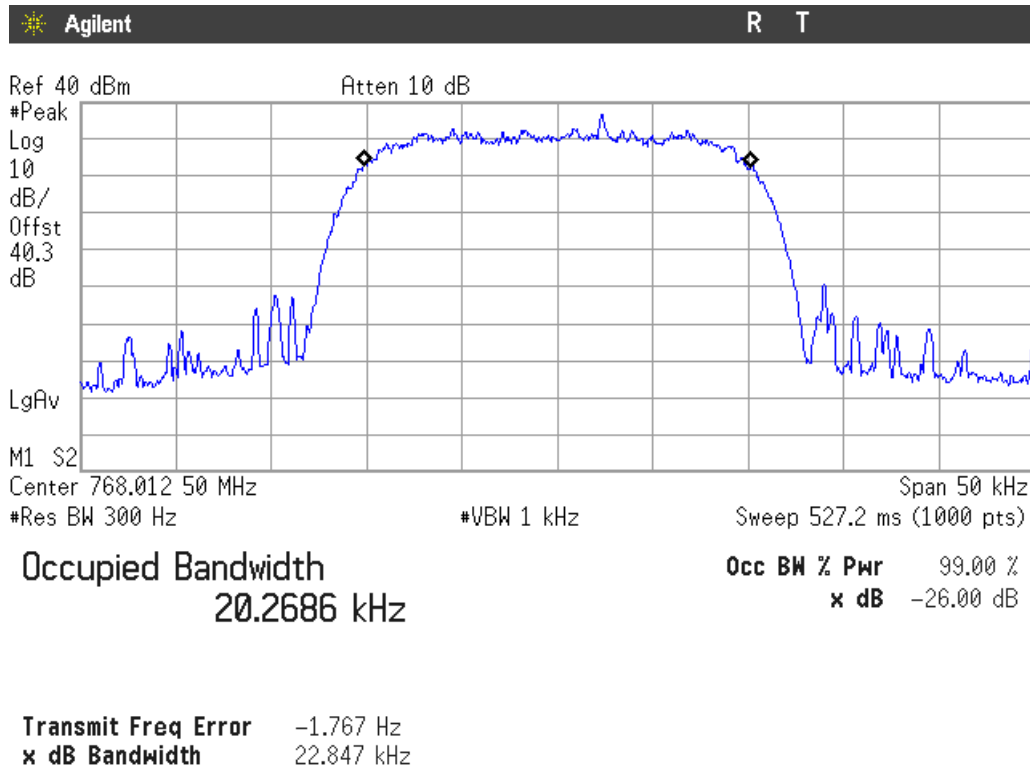


Highest Channel

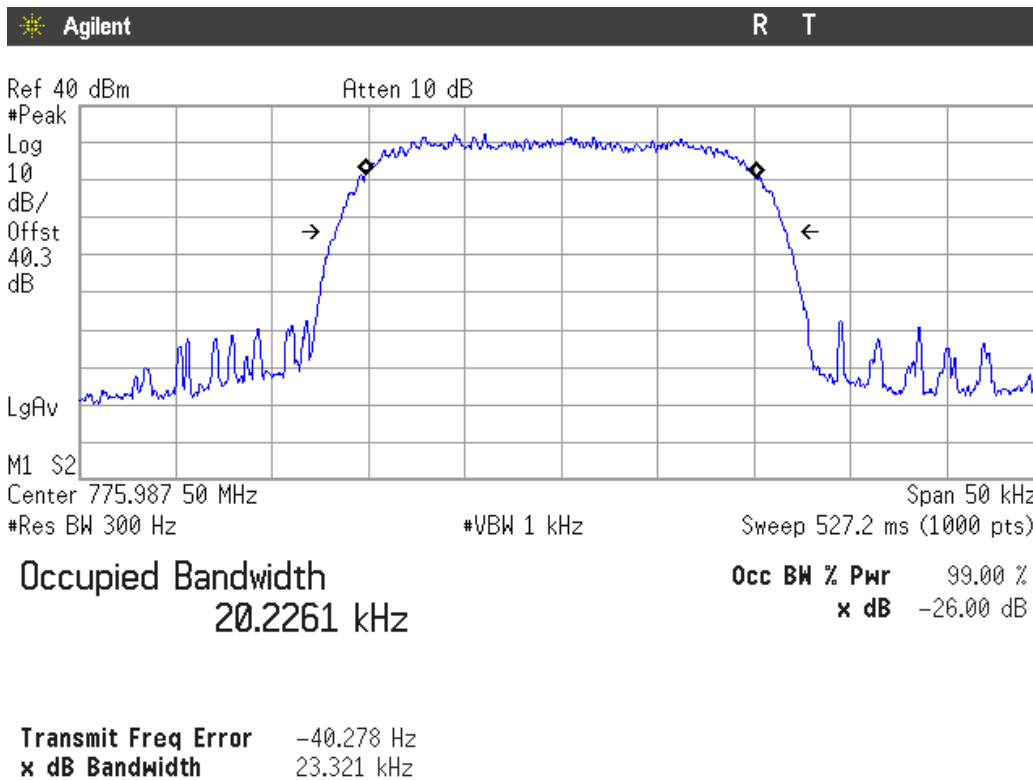


TETRA 22 kHz.768-776 MHz band.

Lowest Channel



Highest Channel



RF Output Power

SPECIFICATION

FCC §90.205, §90.541 and §90.635. 769-775 MHz and 799-805 MHz bands.

The effective radiated power (E.R.P.) and antenna height for base stations may not exceed 1 kilowatt (30 dBw/60dBm) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

RSS-119 Clause 5.4. 768-776 MHz and 798-806 MHz bands

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

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

Frequency Band (MHz)	Transmitter Output Power (W)	
	Base/Fixed Equipment	Mobile Equipment
768-776 and 798-806	See SRSP-511 for ERP limit	30 3 ERP for portable equipment

METHOD

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

RESULTS

Type of equipment: RF Transceiver / Mast-mounted Base Station.

Manufacturer's rated power: 10 W (40 dBm).

TI D-LMR. 20 kHz Bandwidth	Frequency (MHz)	Maximum average conducted power (dBm)	Maximum deviation (dB)
769-775 MHz band	769.0125	39.65	-0.35
	774.9875	39.16	-0.84
768-776 MHz band	768.0125	39.67	-0.33
	775.9875	39.30	-0.70
Measurement uncertainty (dB)		< \pm 0.33	

TETRA. 22 kHz Bandwidth	Frequency (MHz)	Maximum average conducted power (dBm)	Maximum deviation (dB)
769-775 MHz band	769.0125	39.59	-0.41
	774.9875	39.33	-0.67
768-776 MHz band	768.0125	39.59	-0.41
	775.9875	39.17	-0.83
Measurement uncertainty (dB)		<±0.33	

The sum of the system loss (dB) and antenna gain (dBd) for the worst case of conducted power (39.67 dBm) shall be such that the Effective Radiated Power (E.R.P.) shall not exceed the limits indicated above.

Verdict: PASS

Adjacent channel power

SPECIFICATION

FCC §90.543. 769–775/799–805 MHz bands.

The Adjacent Channel Power (ACP) requirements for Base transmitter and 25 kHz channel size are shown in the following table. The table specify a value for the ACP as a function of the displacement from the channel center frequency and measurement bandwidth. In the following tables, “(s)” indicates a swept measurement may be used.

25 KHz BASE TRANSMITTER ACP REQUIREMENTS

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP (dBc)
15.625	6.25	-40
21.875	6.25	-60
37.5	25	-60
62.5	25	-65
87.5	25	-65
150	100	-65
250	100	-65
350	100	-65
>400 kHz to 12 MHz	30 (s)	-80
12 MHz to paired receive band	30 (s)	-80
In the paired receive band	30 (s)	-85 ¹

1: Although we permit individual base transmitters to radiate a maximum ACP of -85 dBc in the paired receive band, licensees deploying these transmitters may not exceed an ACP of -100 dBc in the paired receive band when measured at either the transmitting antenna input port or the output of the transmitter combining network. Consequently, licensees deploying these transmitters may need to use external filters to comply with the more restrictive ACP limit.

RSS-119 5.5, 5.8.9.1. 768–776/798–806 MHz bands.

The ACP of transmitters operating in the bands 768-776 MHz and 798-806 MHz shall comply with the requirements for various transmitter channel sizes provided in the following table. The tables specify a maximum value for the ACP relative to the maximum output power as a function of the displacement f_d from the channel centre frequency. In the table, “s” indicates that a swept measurement may be used.

25 kHz Transmitter ACP Requirements

Displacement Frequency, f_d (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
15.625	-40	-40	6.25
21.875	-60	-60	6.25
37.50	-60	-60	25.00
62.50	-65	-65	25.00
87.50			25.00
150.00	-65	-65	100
250.00			
350.00			
$400 \leq f_d \leq 12$ MHz	-75	-80	30(s)
12 MHz $\leq f_d \leq$ paired receive band			
In the paired receive band	-100	-85	

METHOD

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

RESULTS

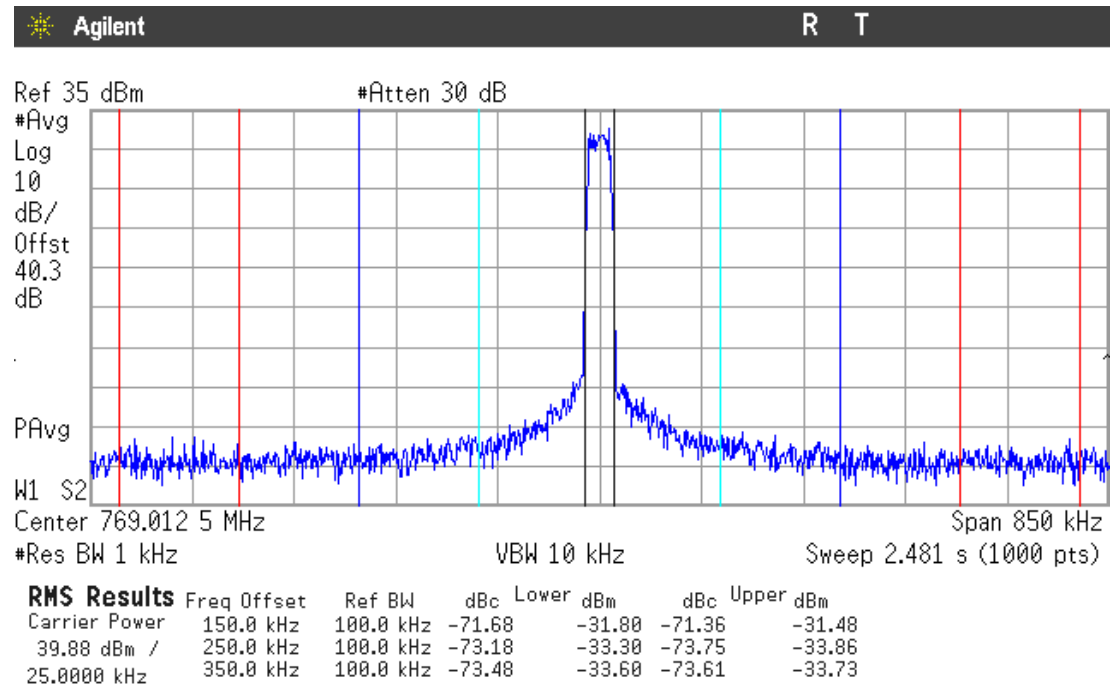
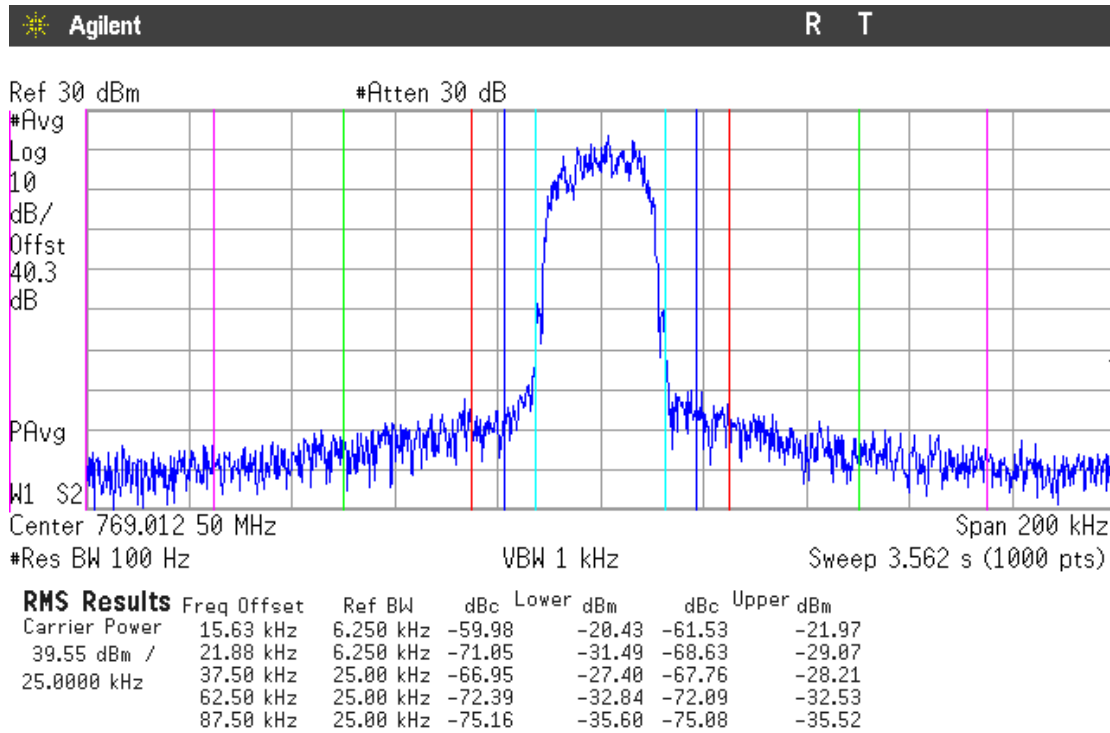
See next plots.

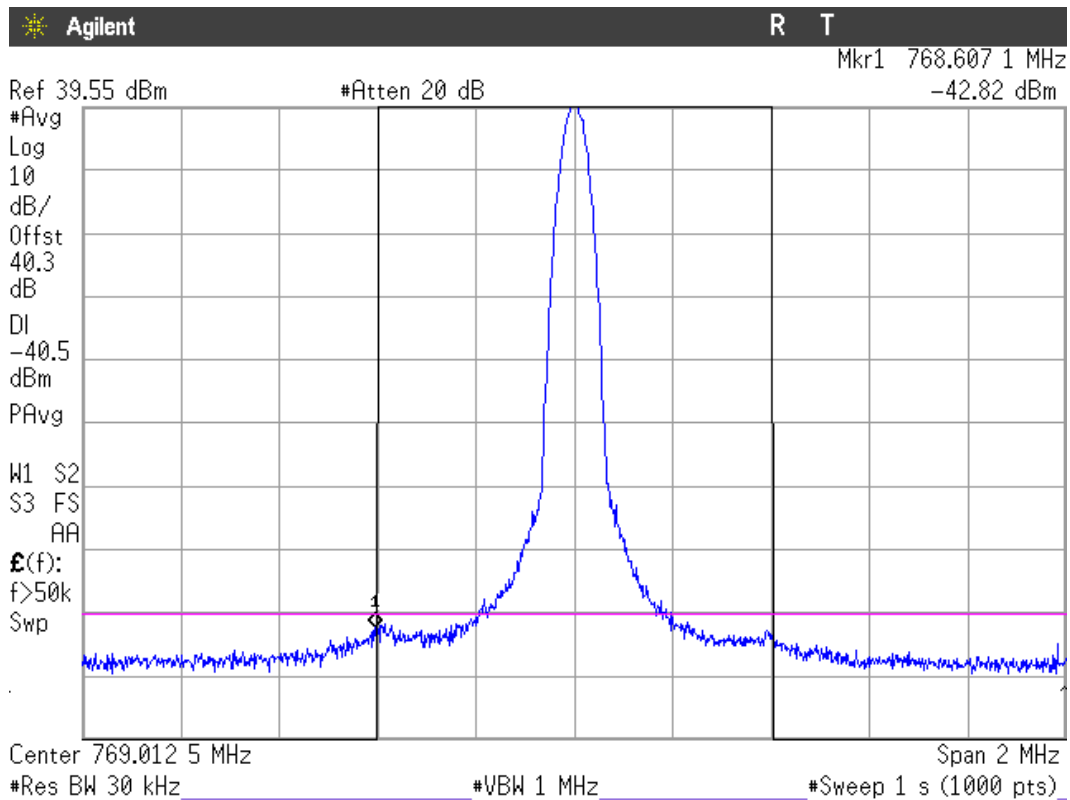
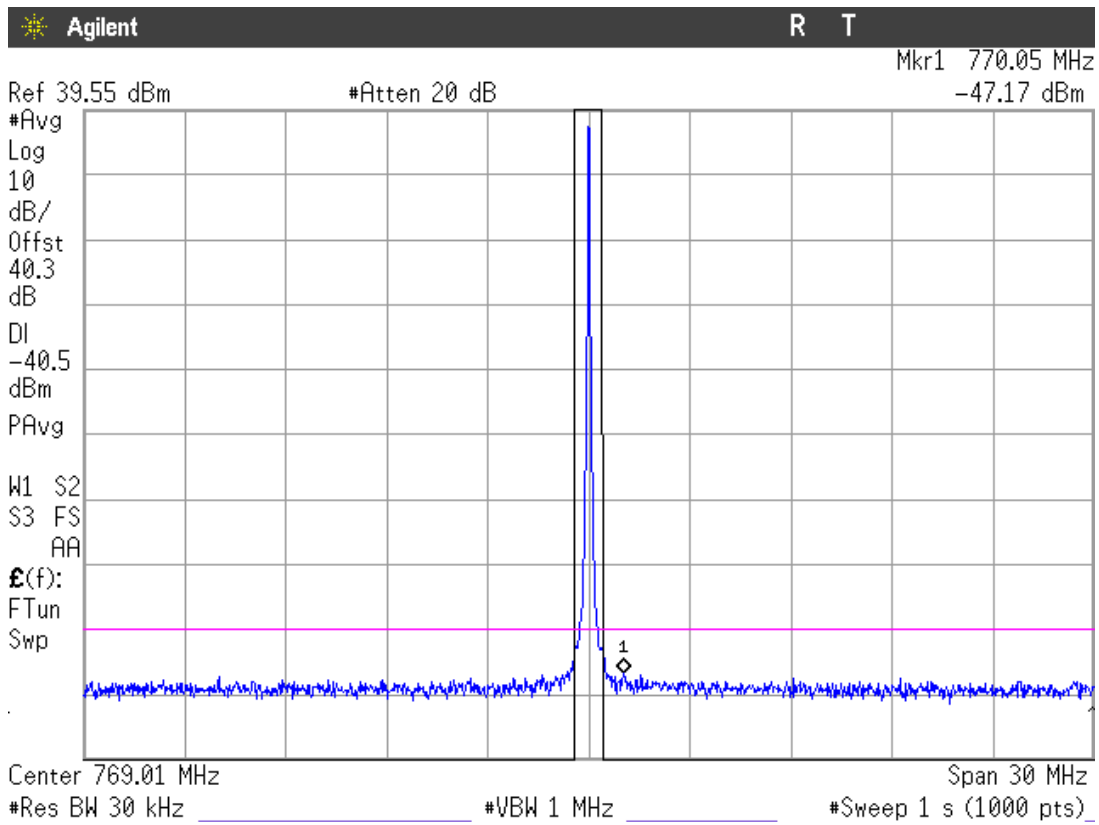
Measurement uncertainty (dB)	$<\pm 0.64$ (Non-swept measurements) $<\pm 2.03$ (Swept measurements)
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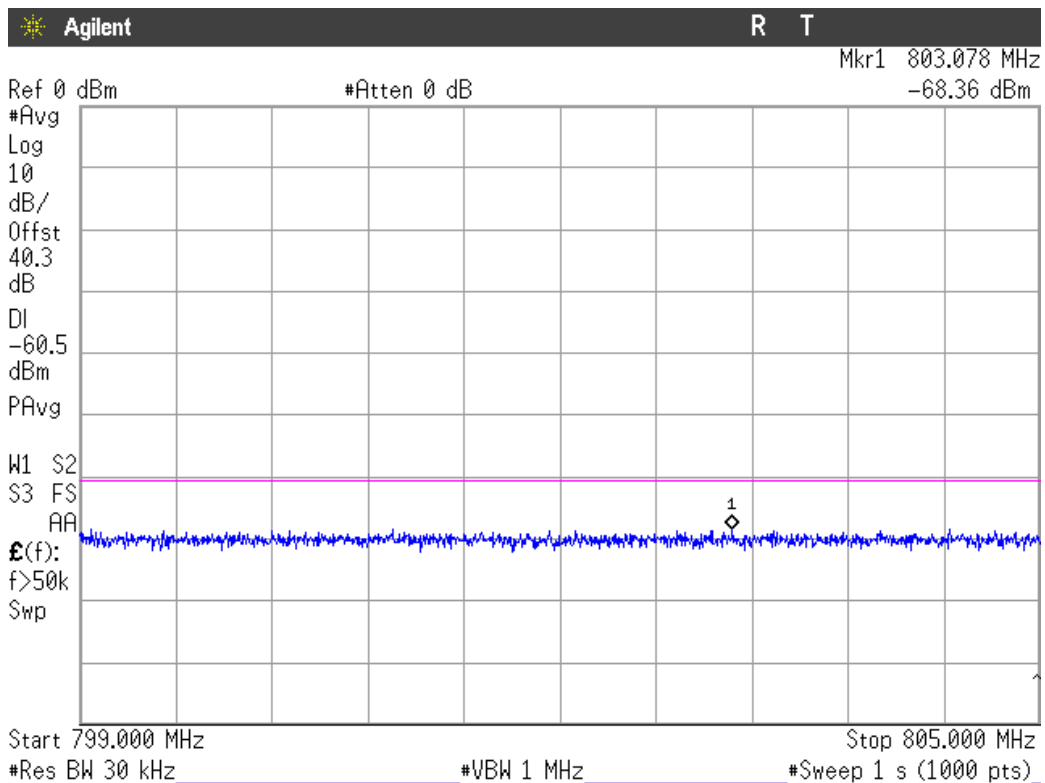
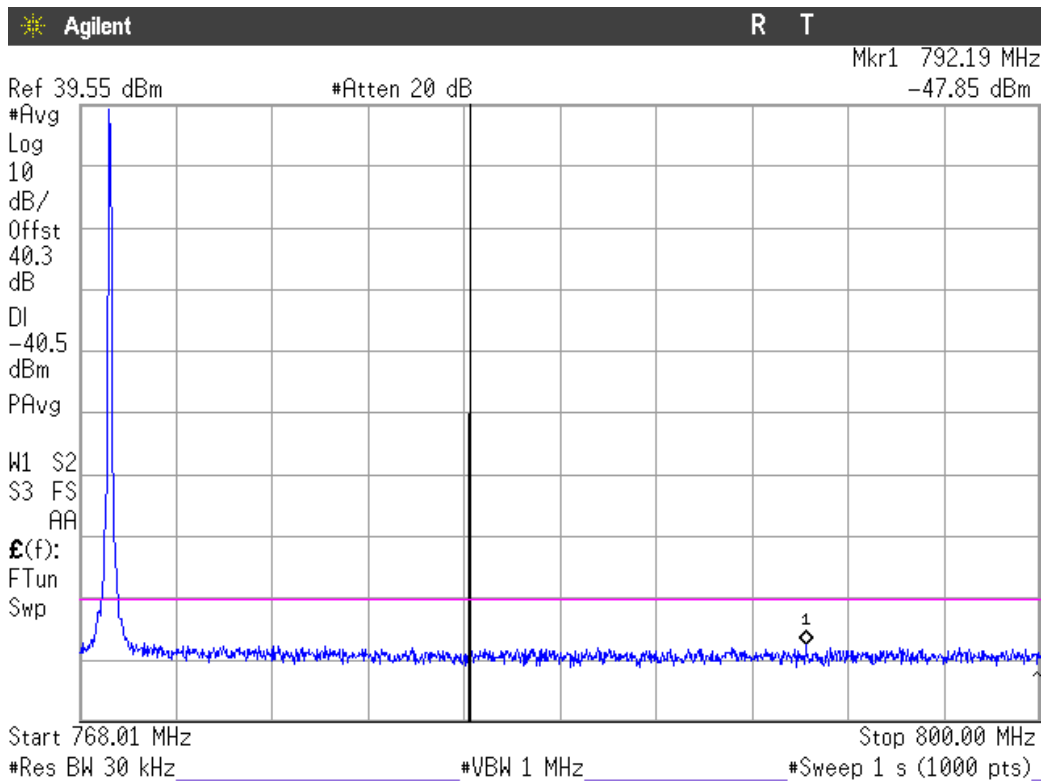
Verdict: PASS

TI D-LMR 20 kHz. 769-775 MHz band.

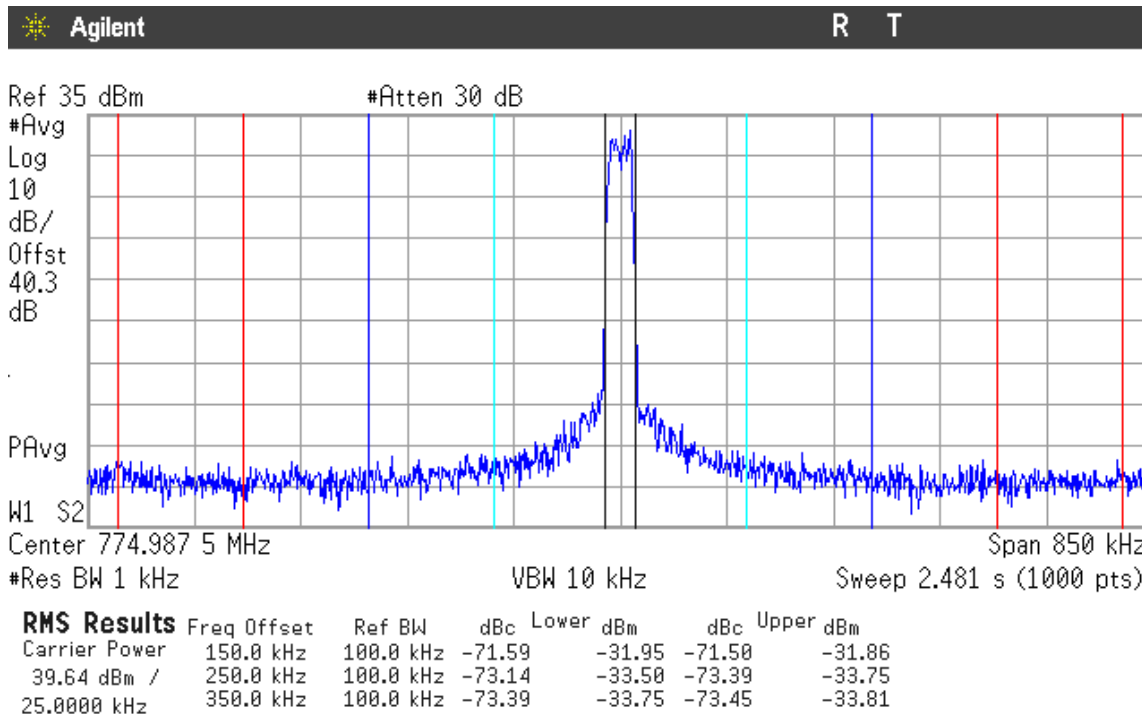
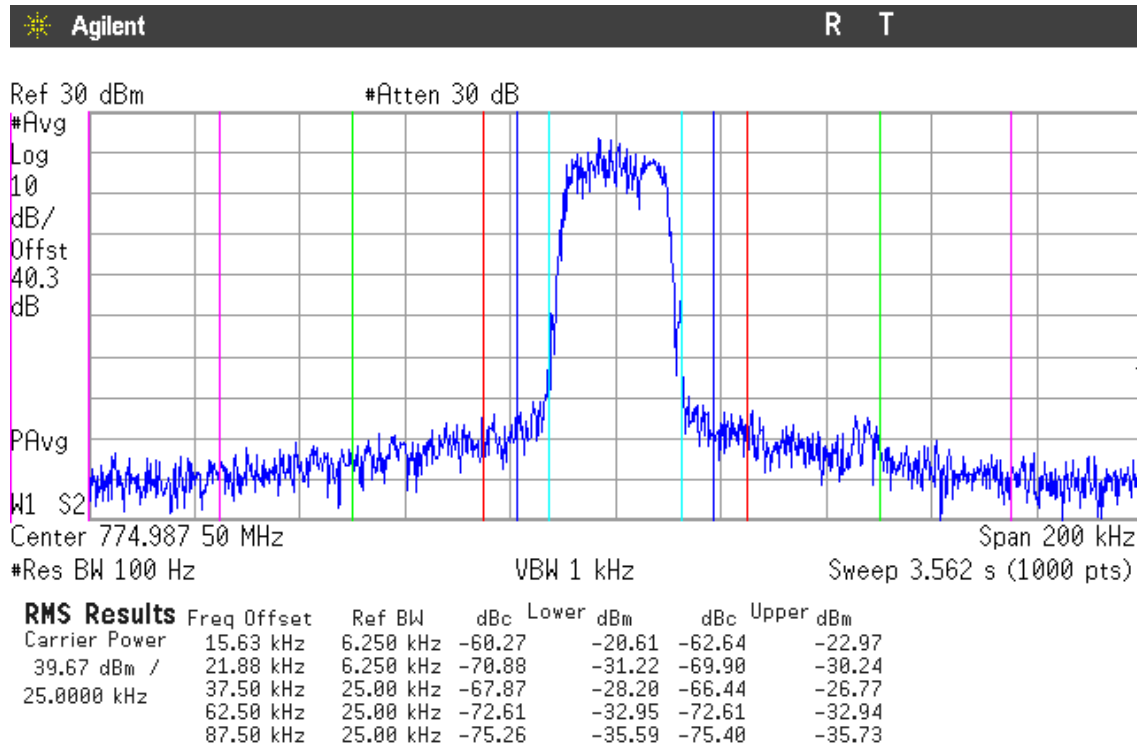
Lowest Channel

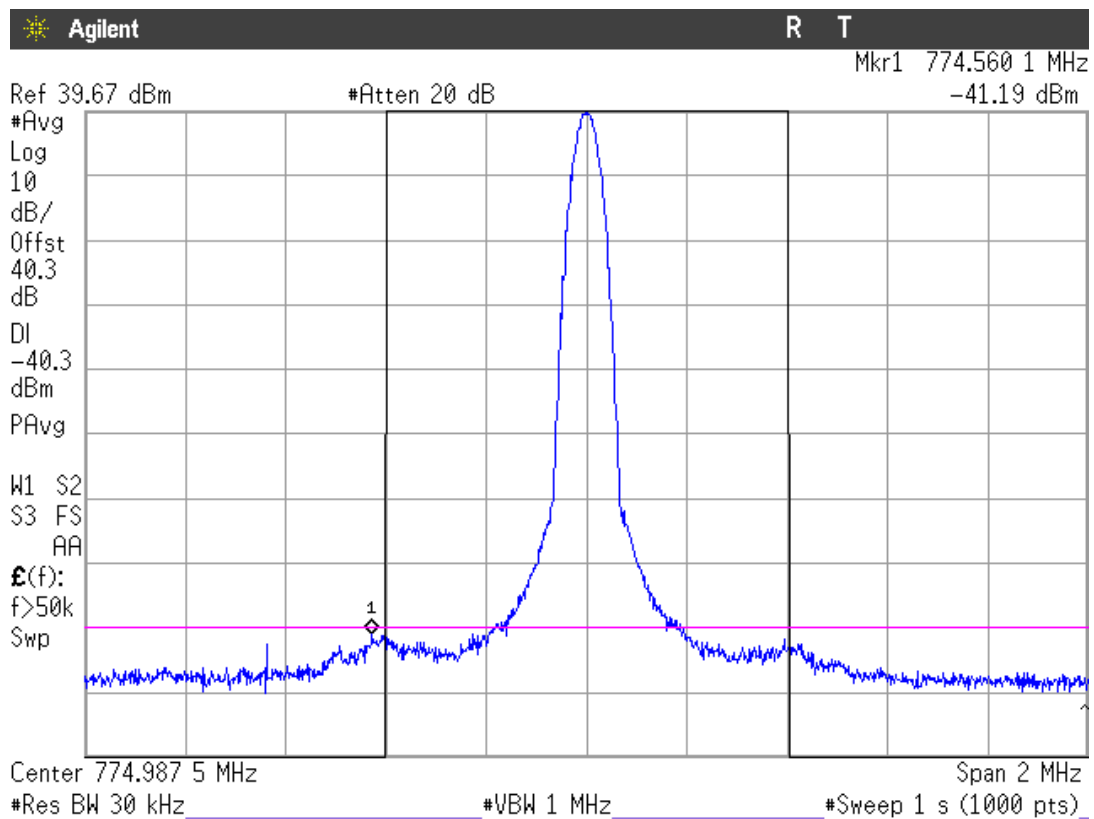
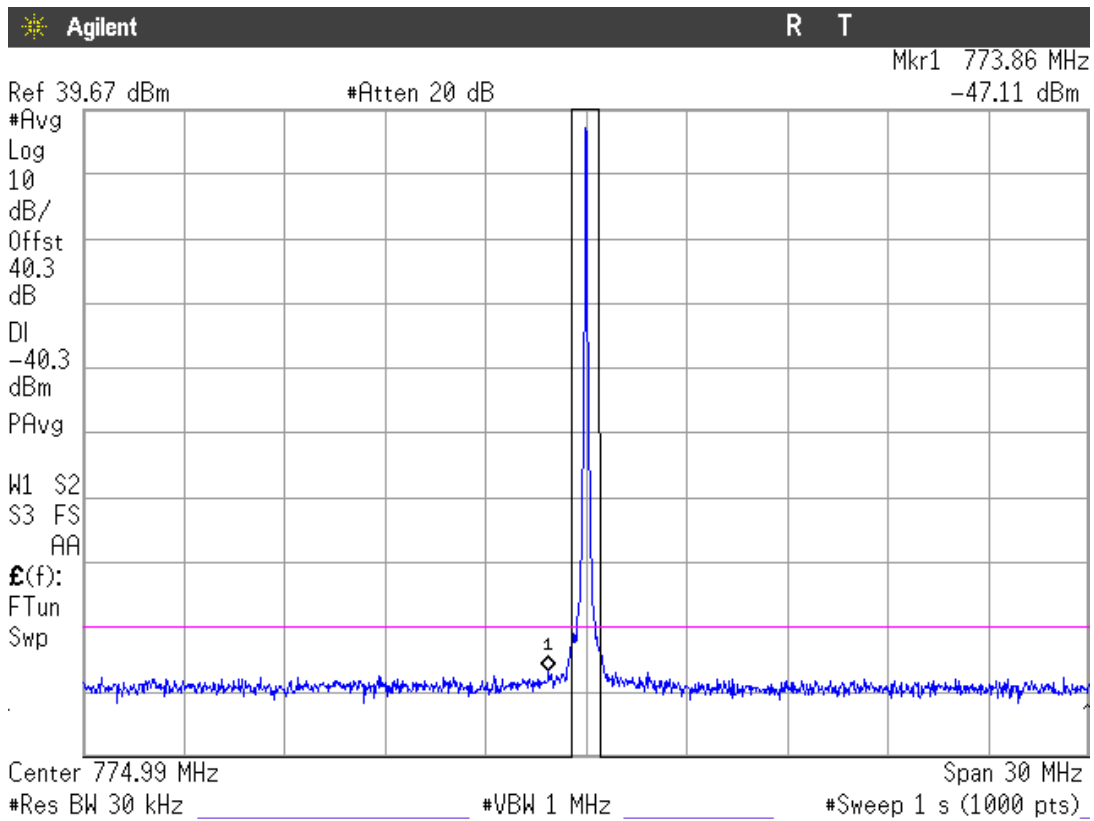


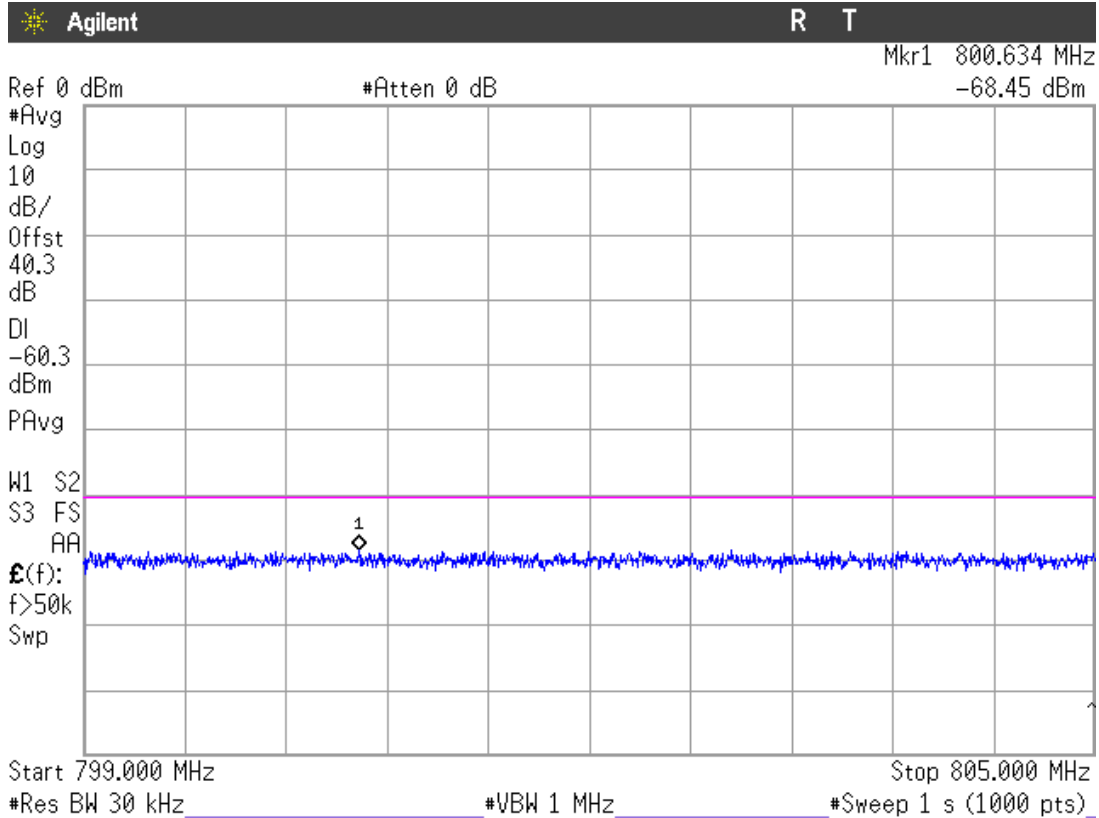
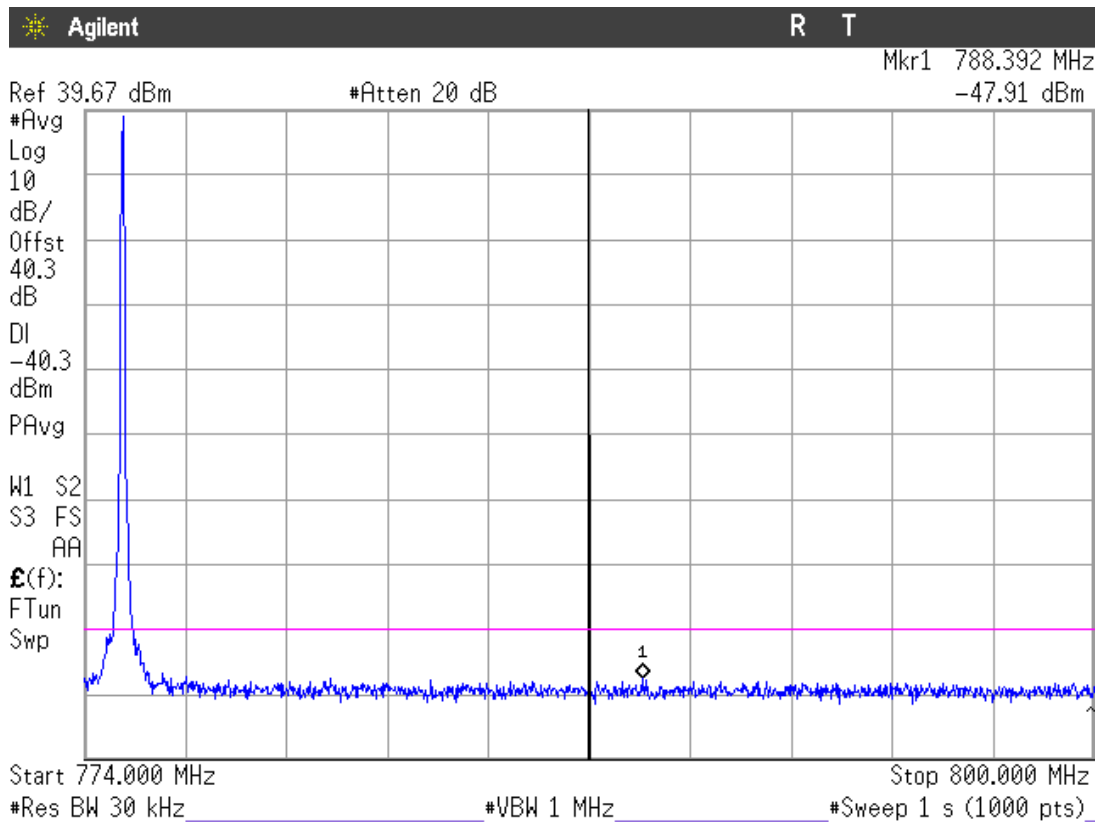




Highest Channel

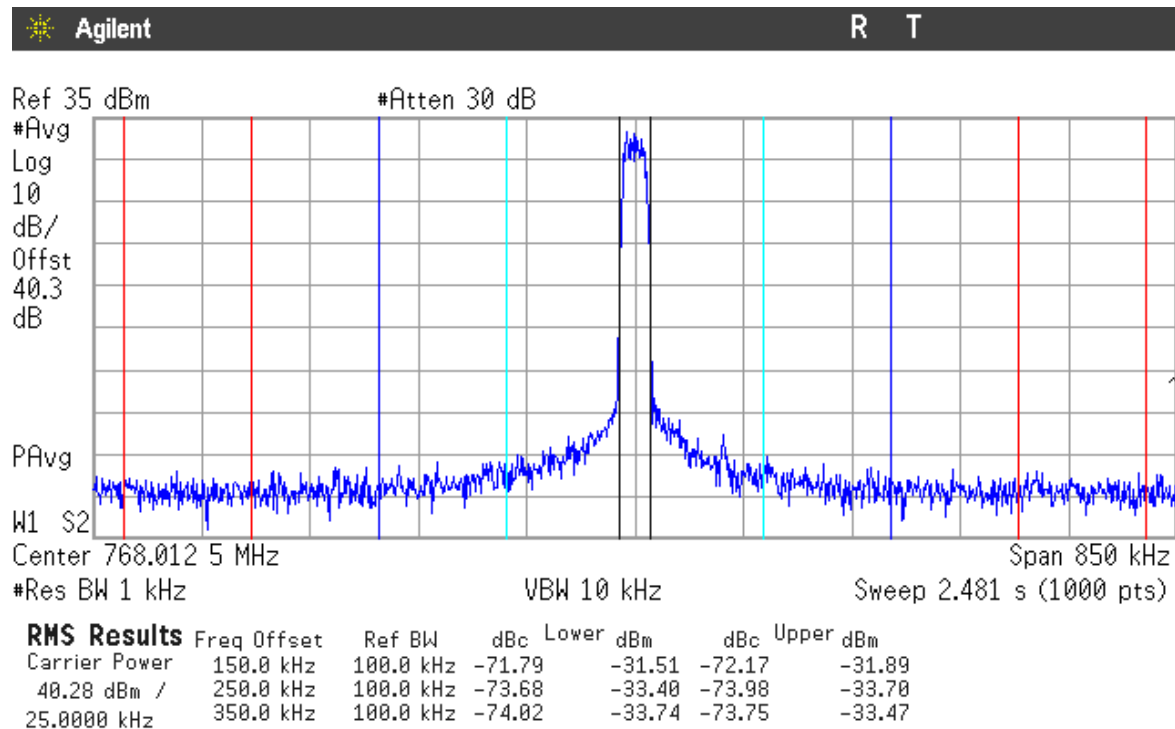
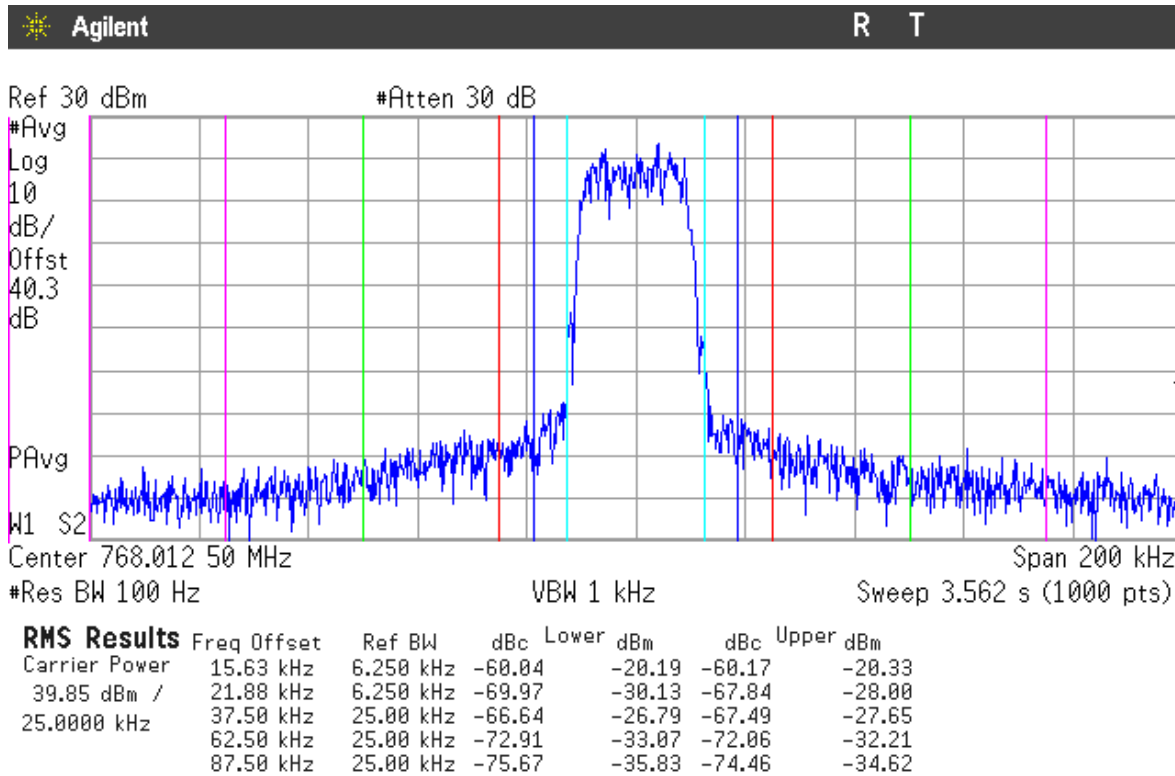


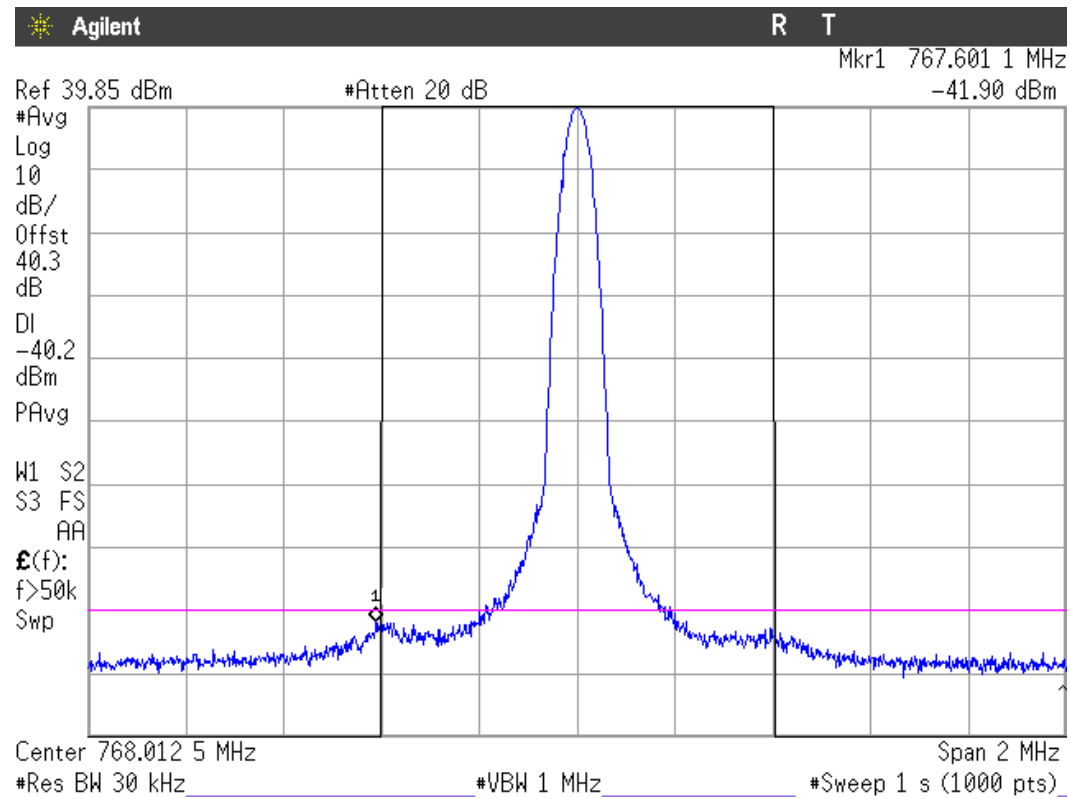
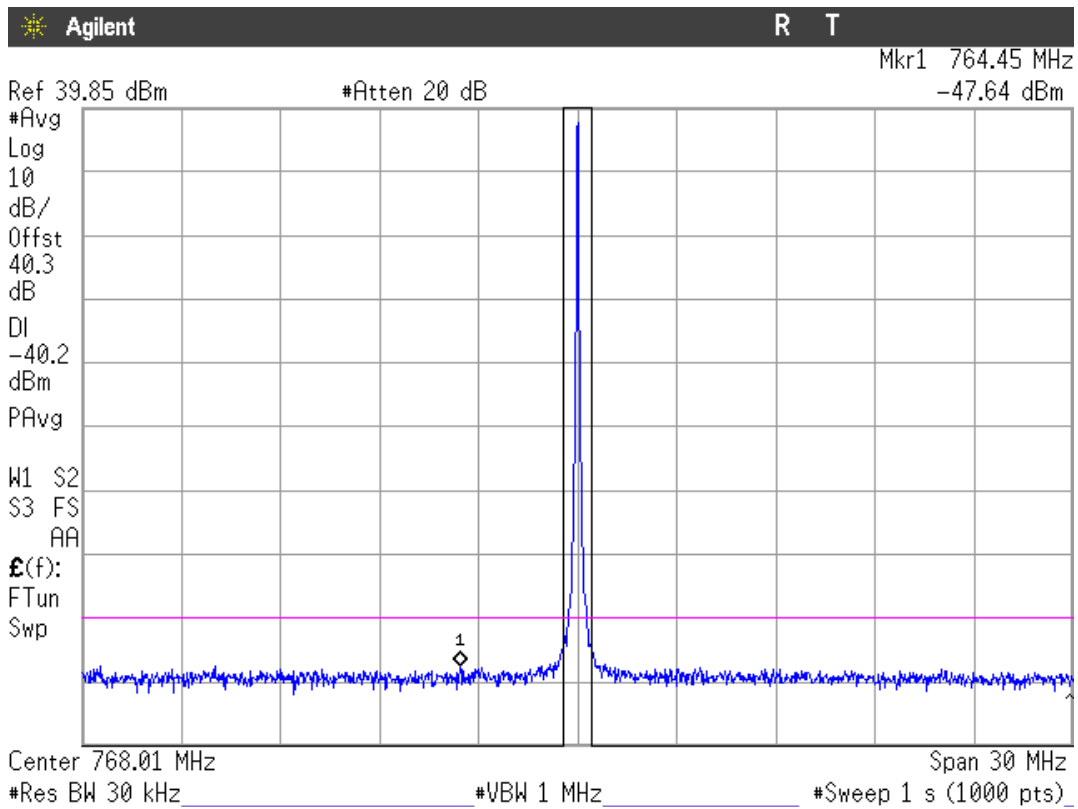


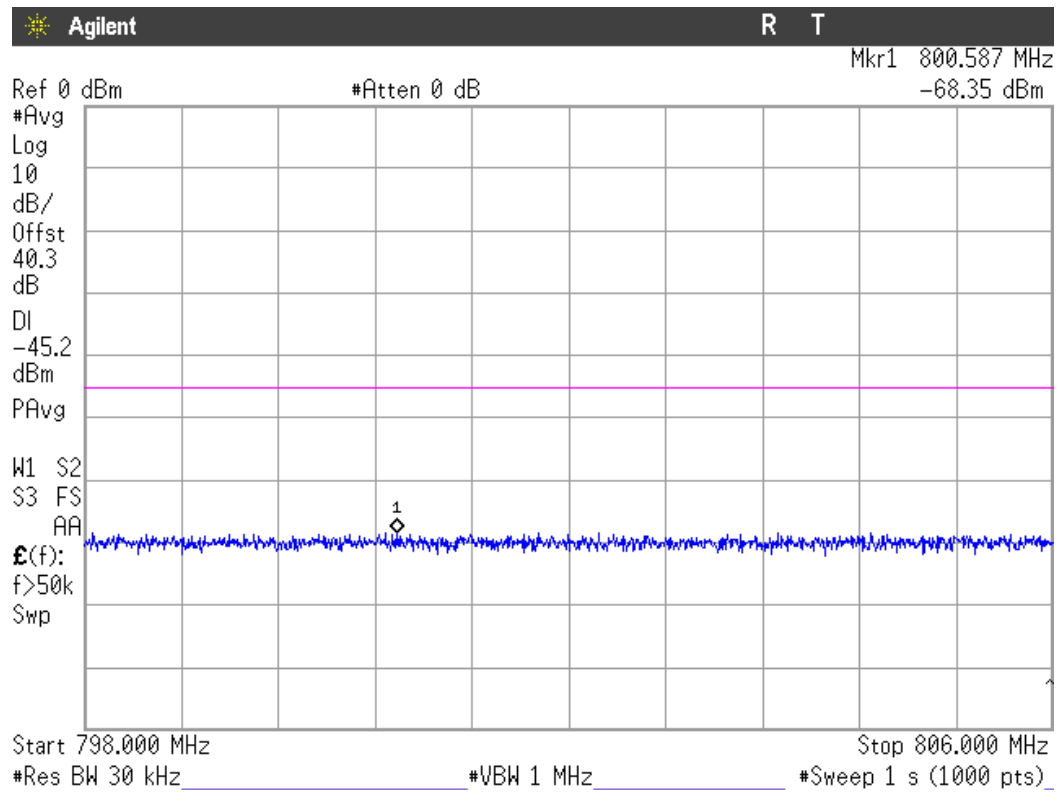
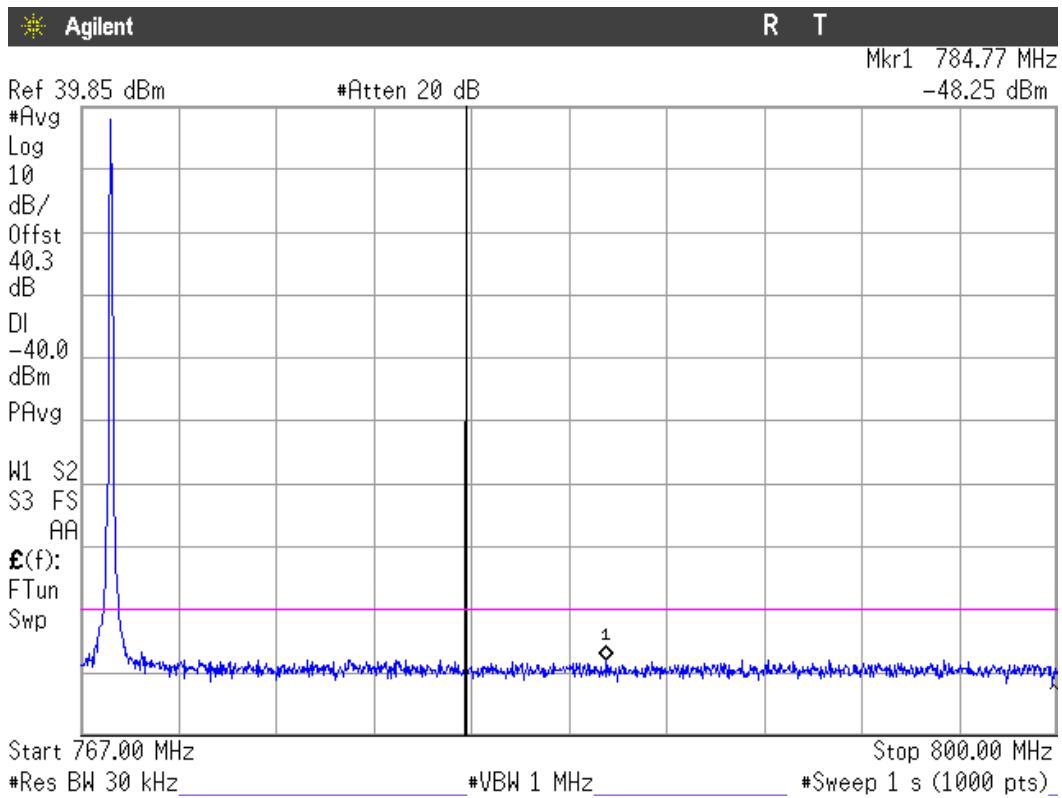


TI D-LMR 20 kHz. 768-776 MHz band.

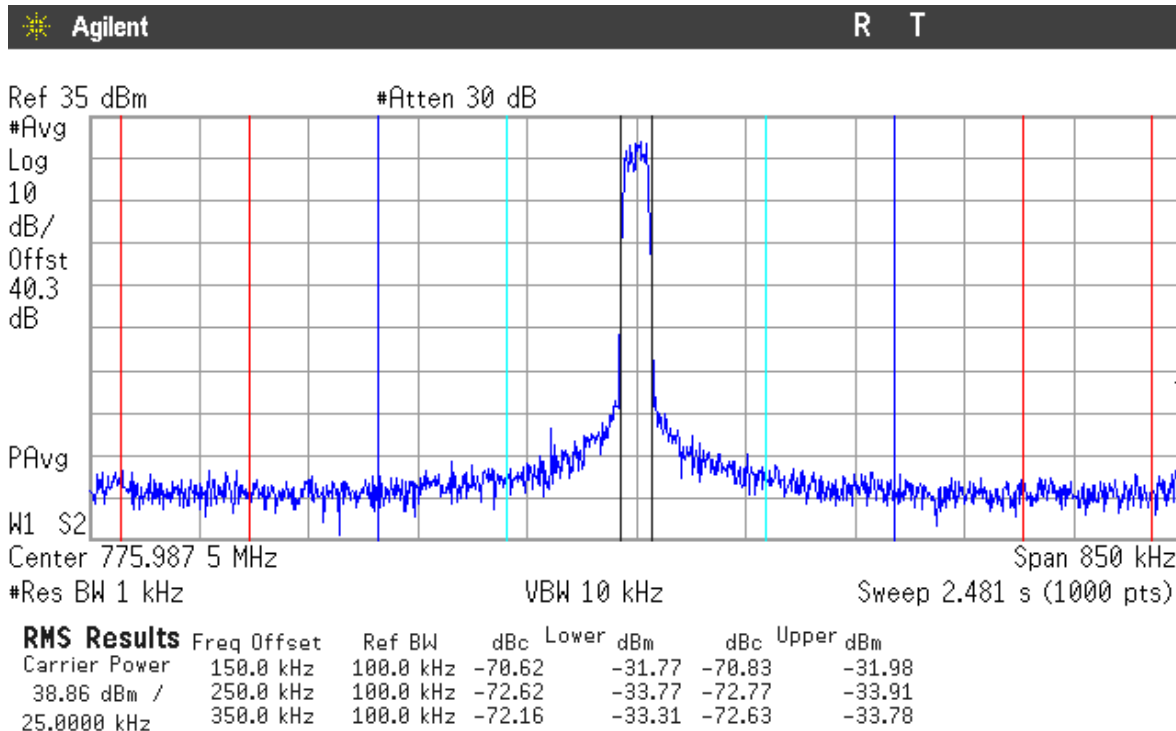
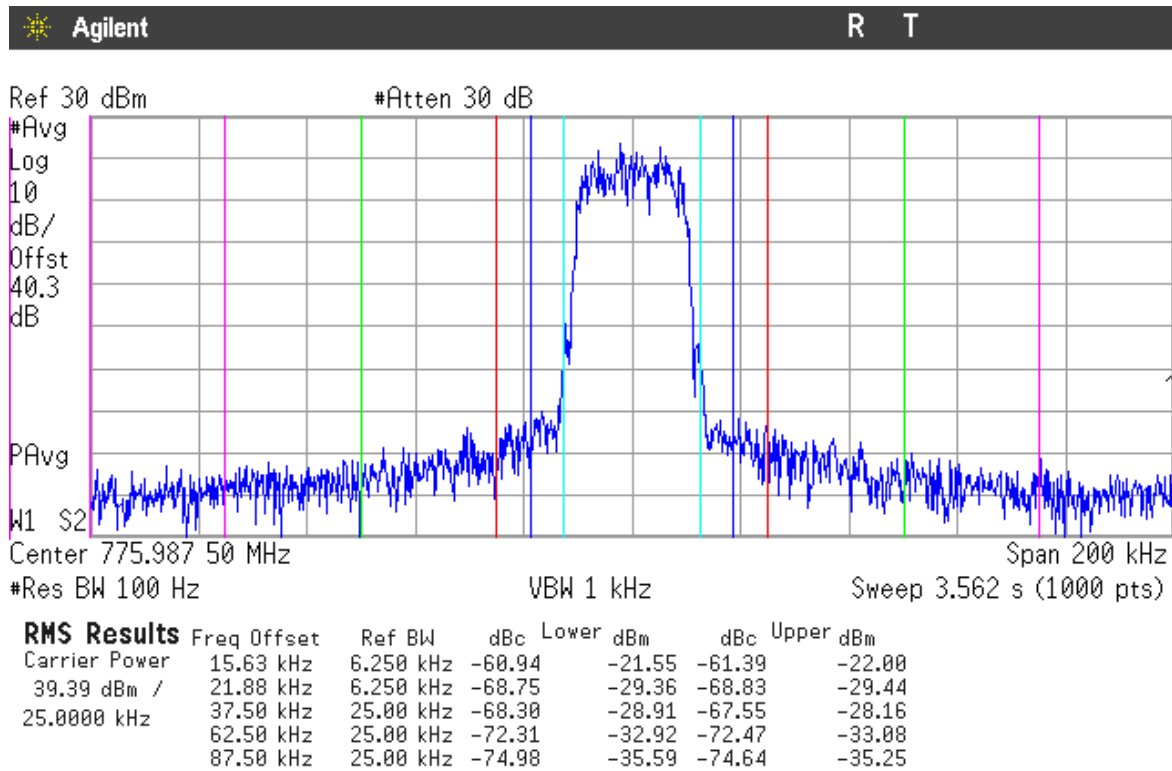
Lowest Channel

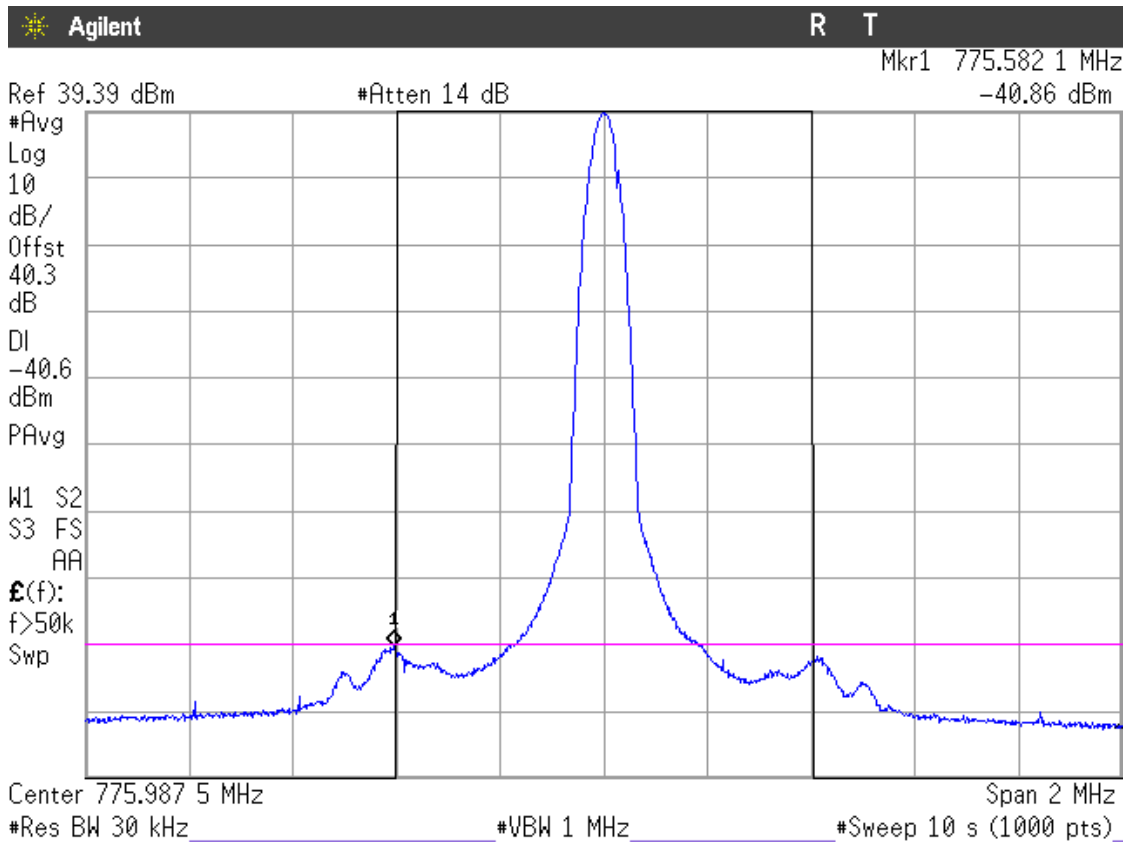
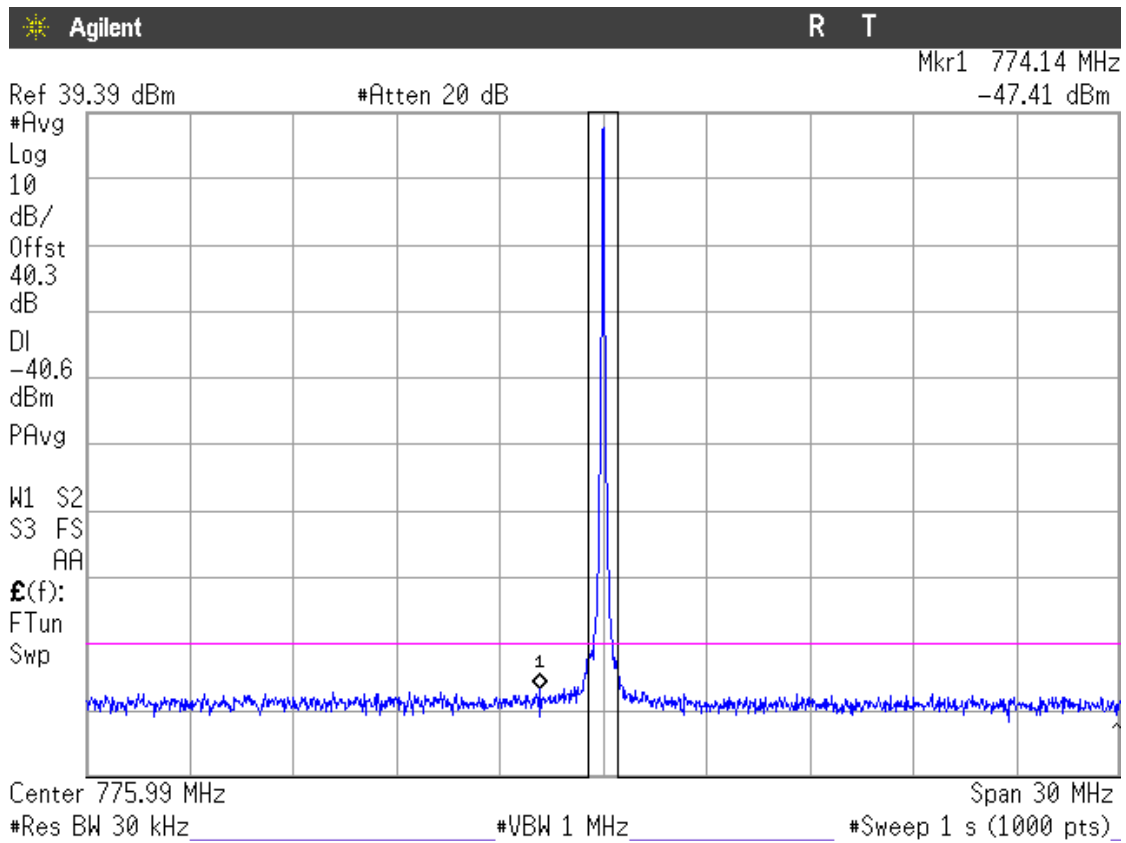


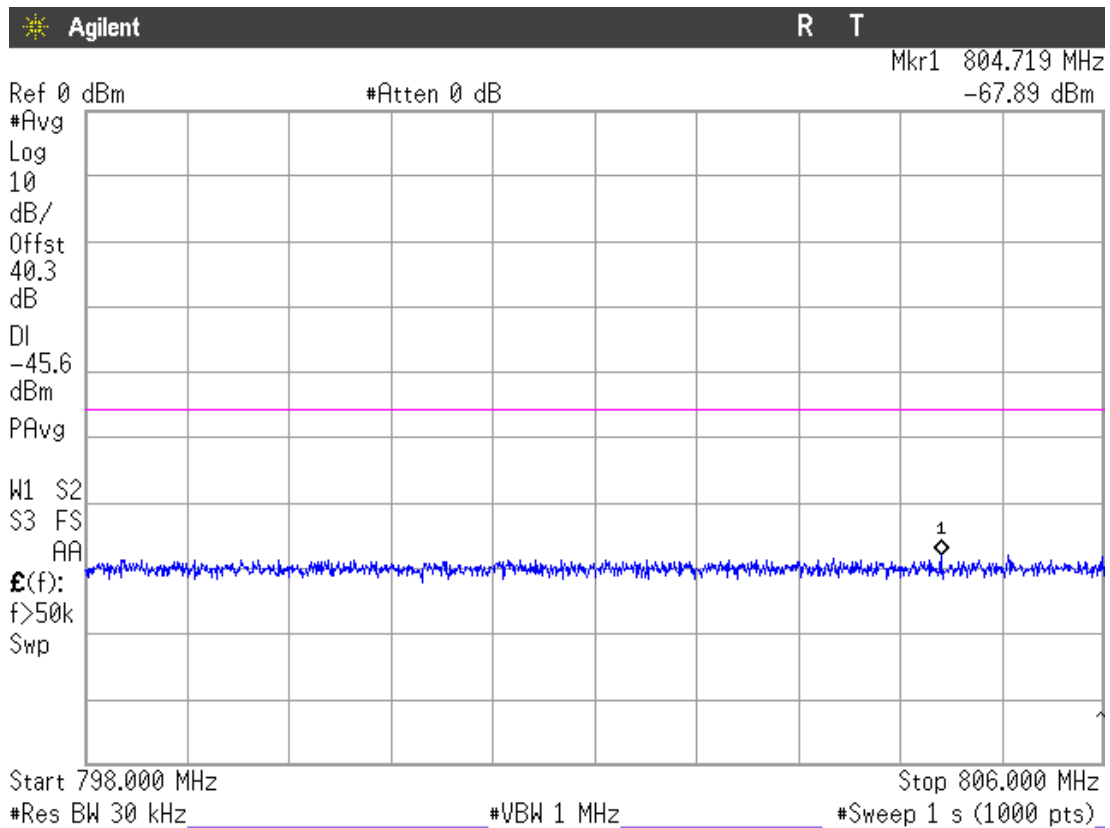
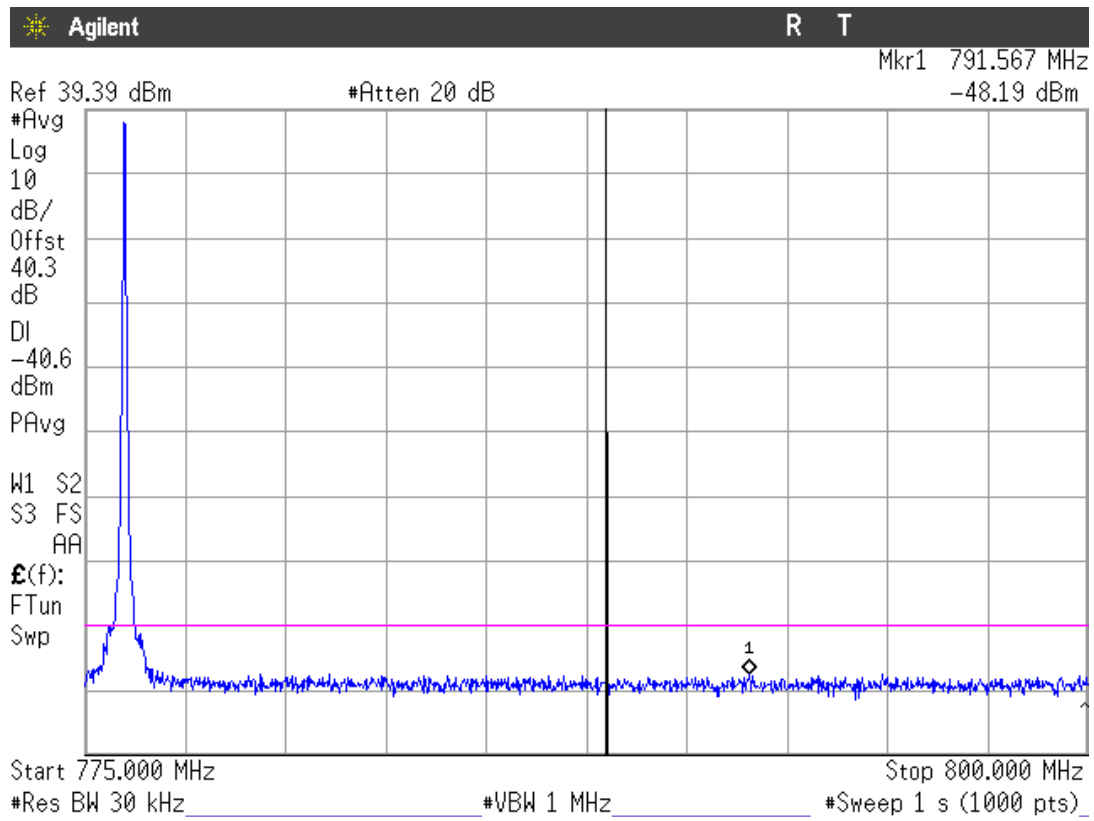




Highest Channel

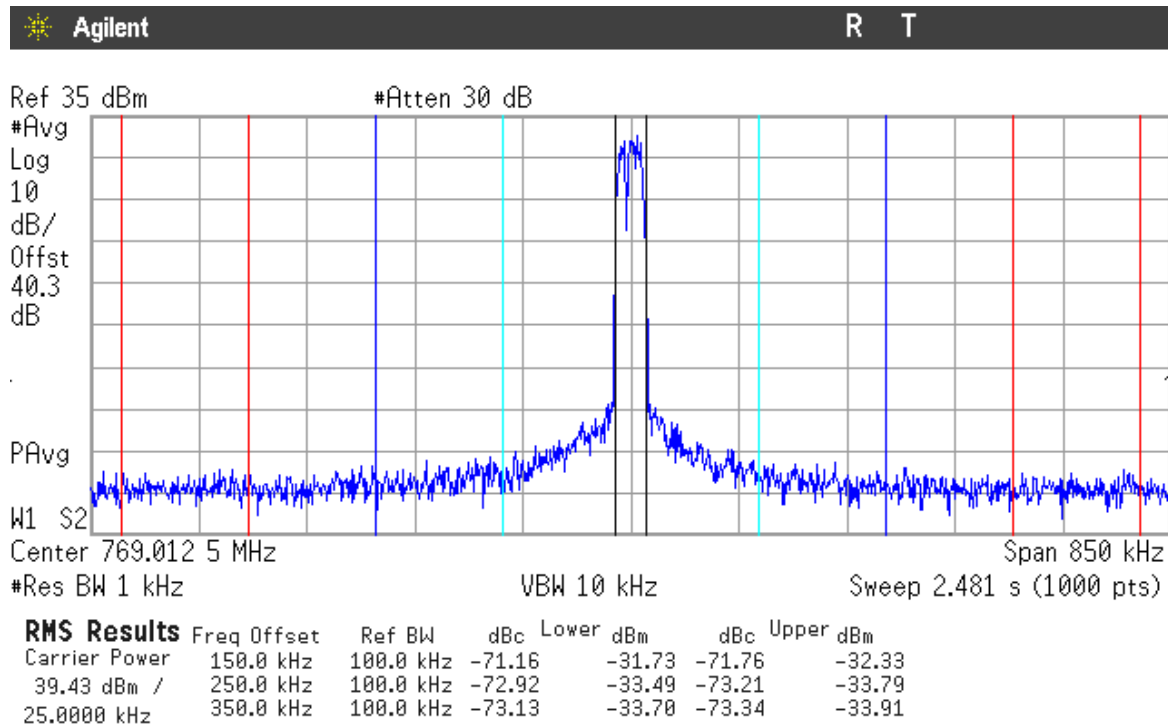
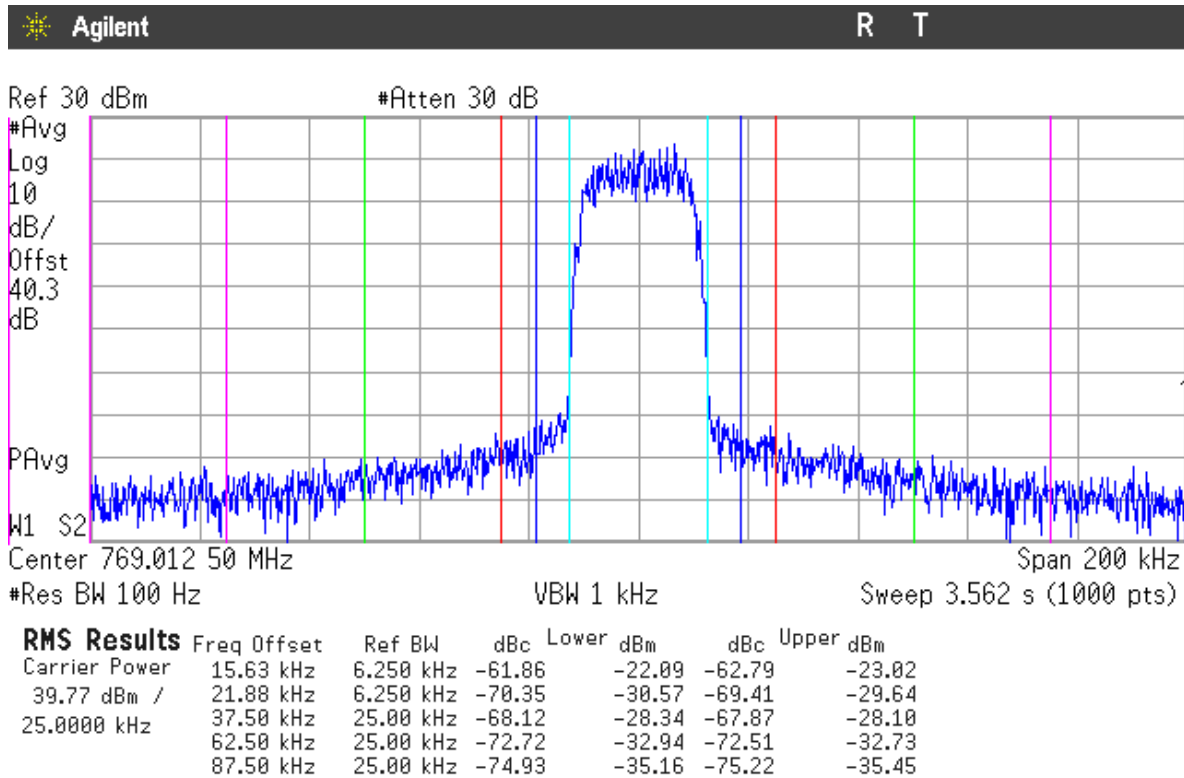


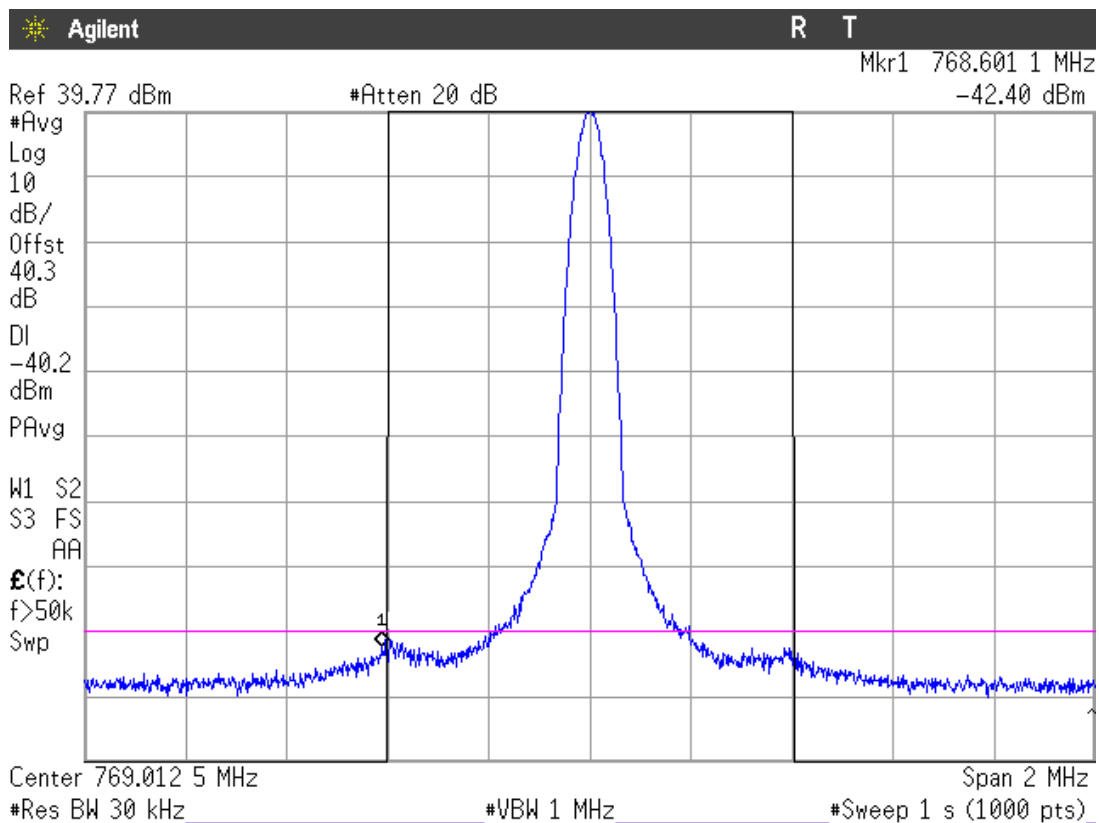
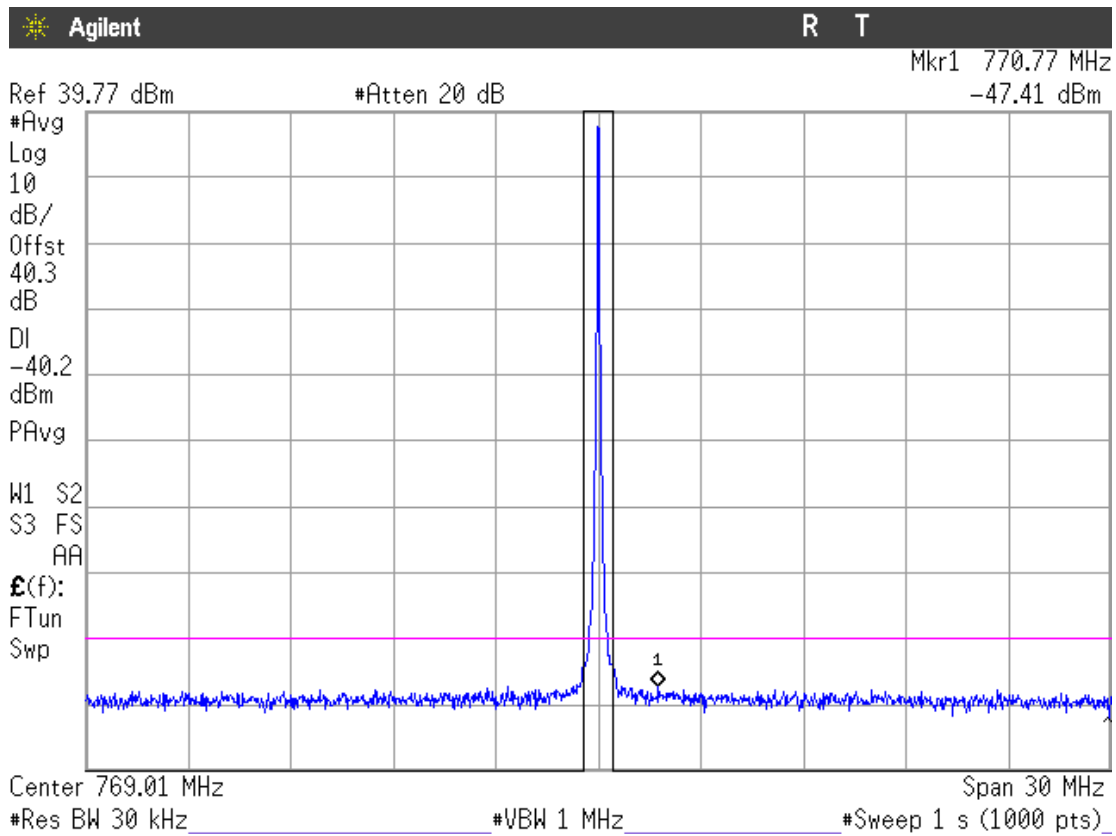


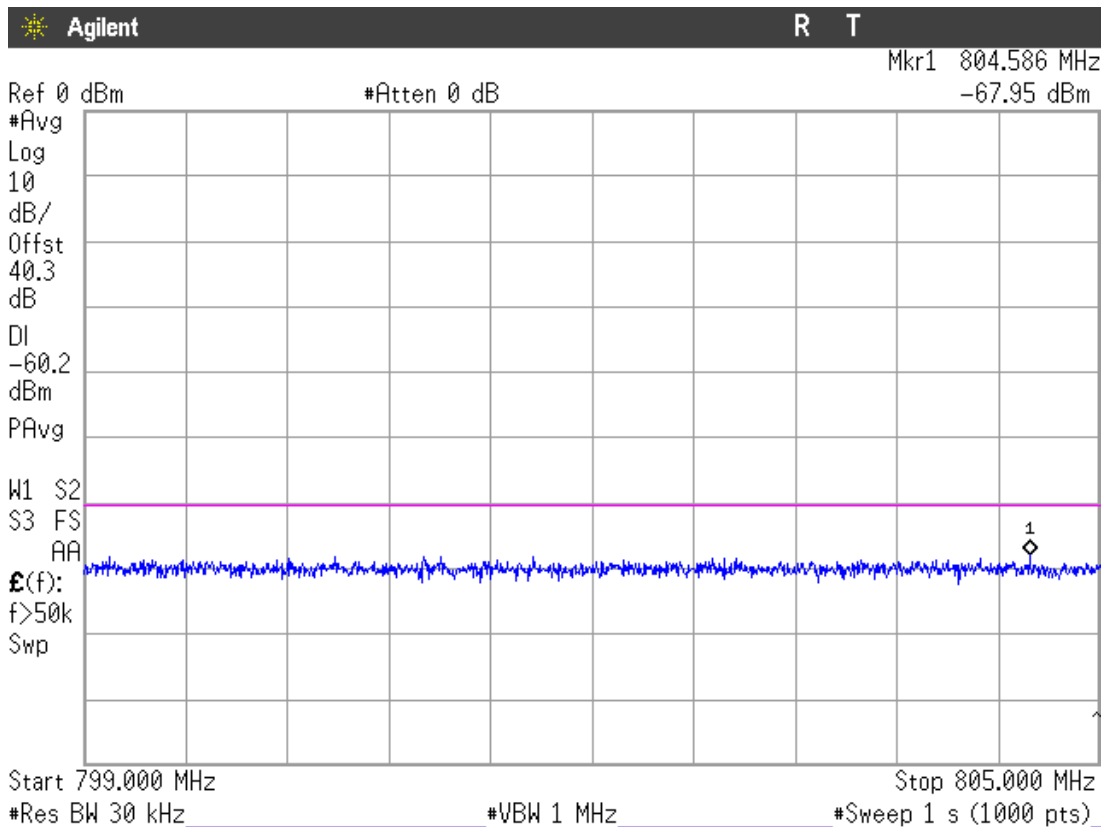
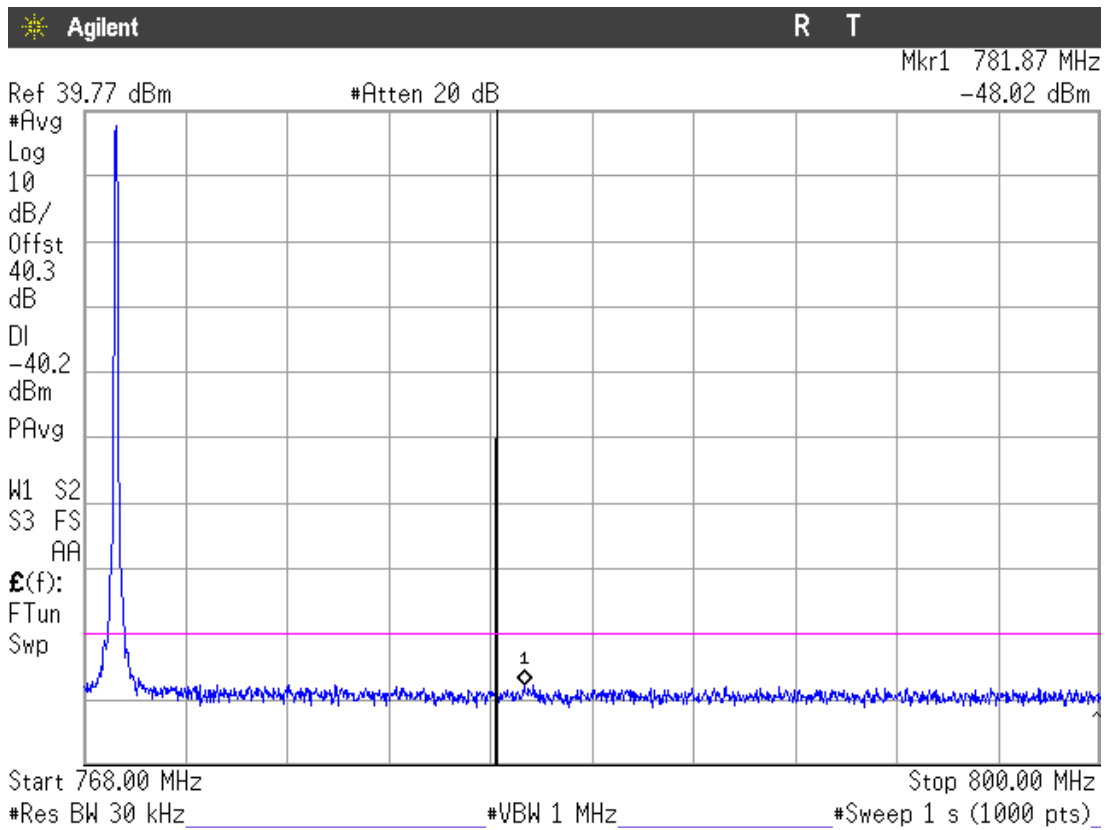


TETRA 22 kHz.769-775 MHz band.

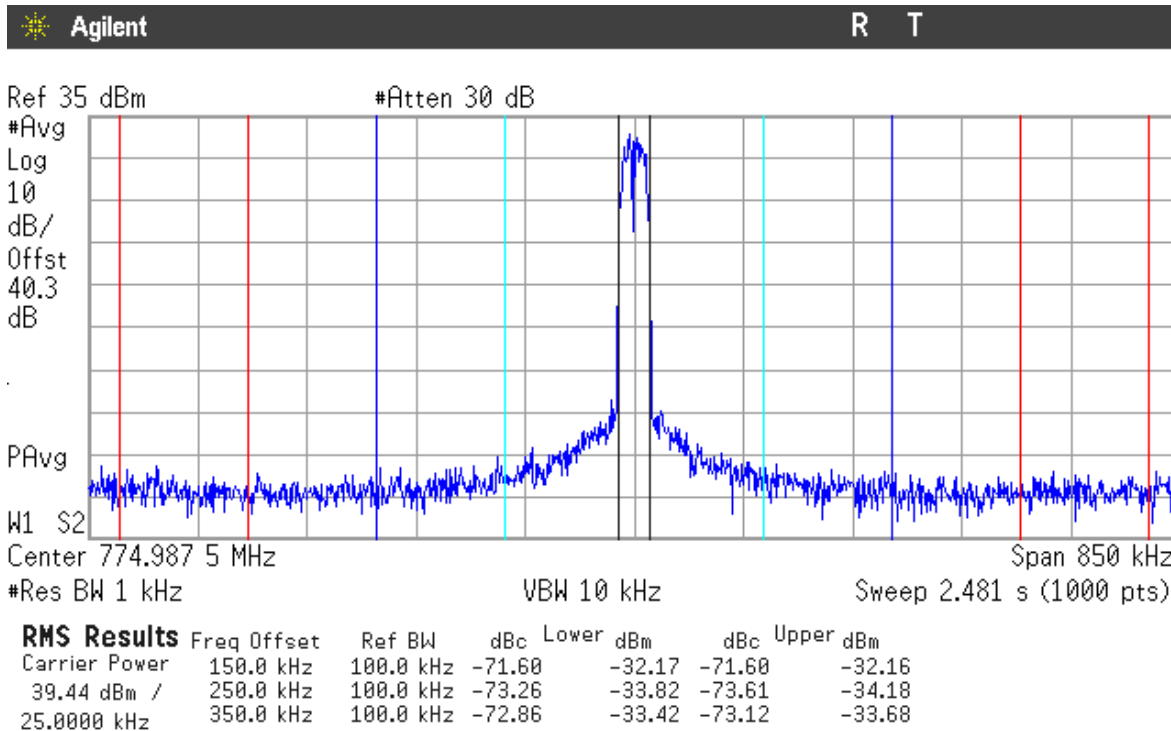
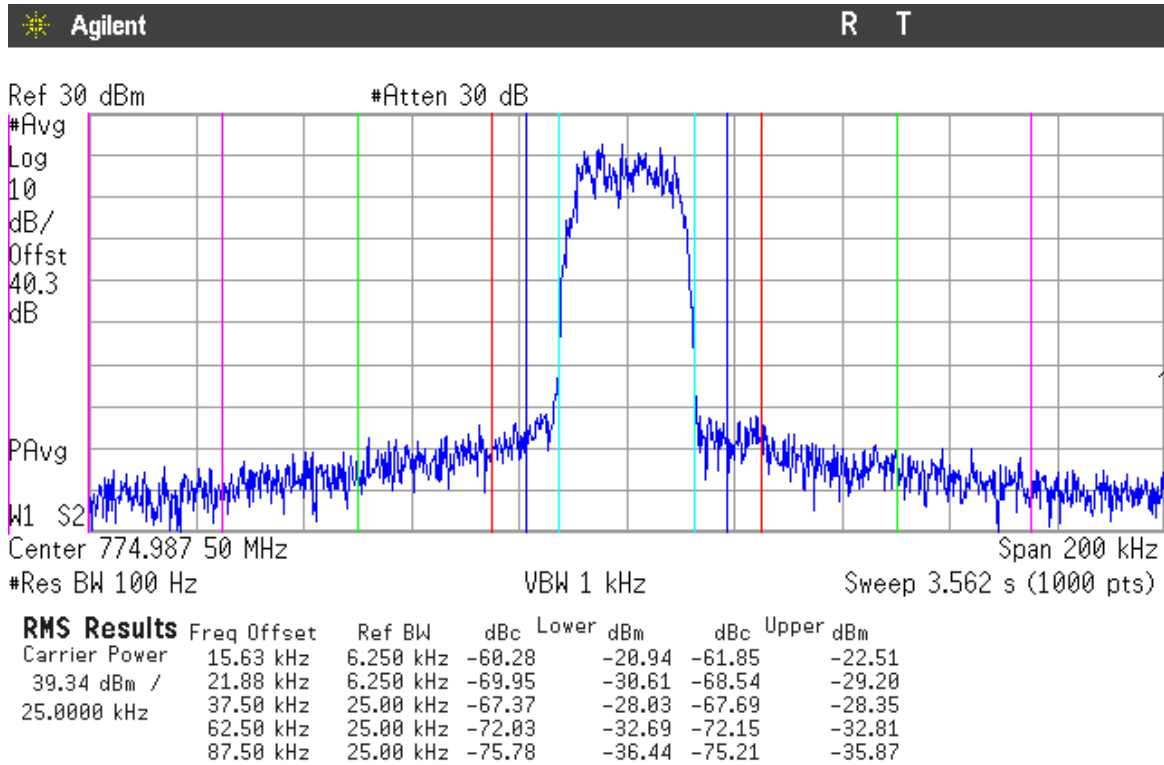
Lowest Channel

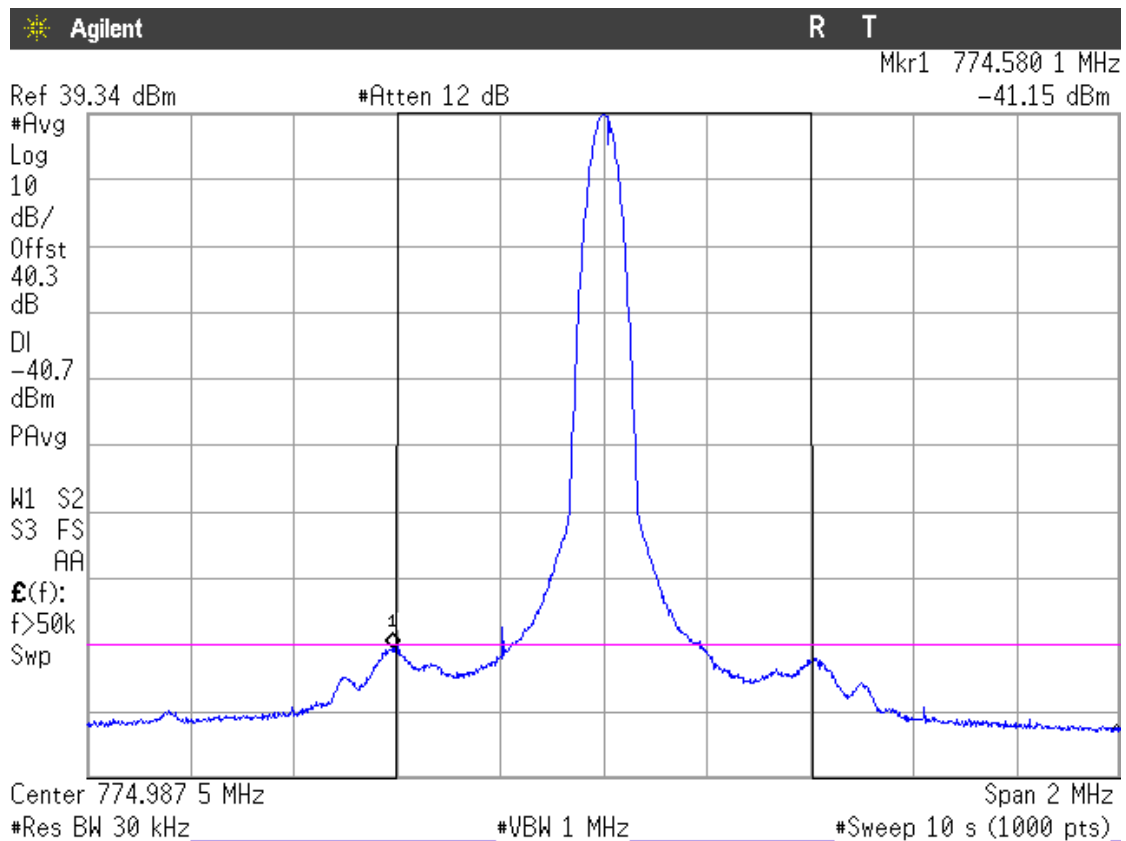
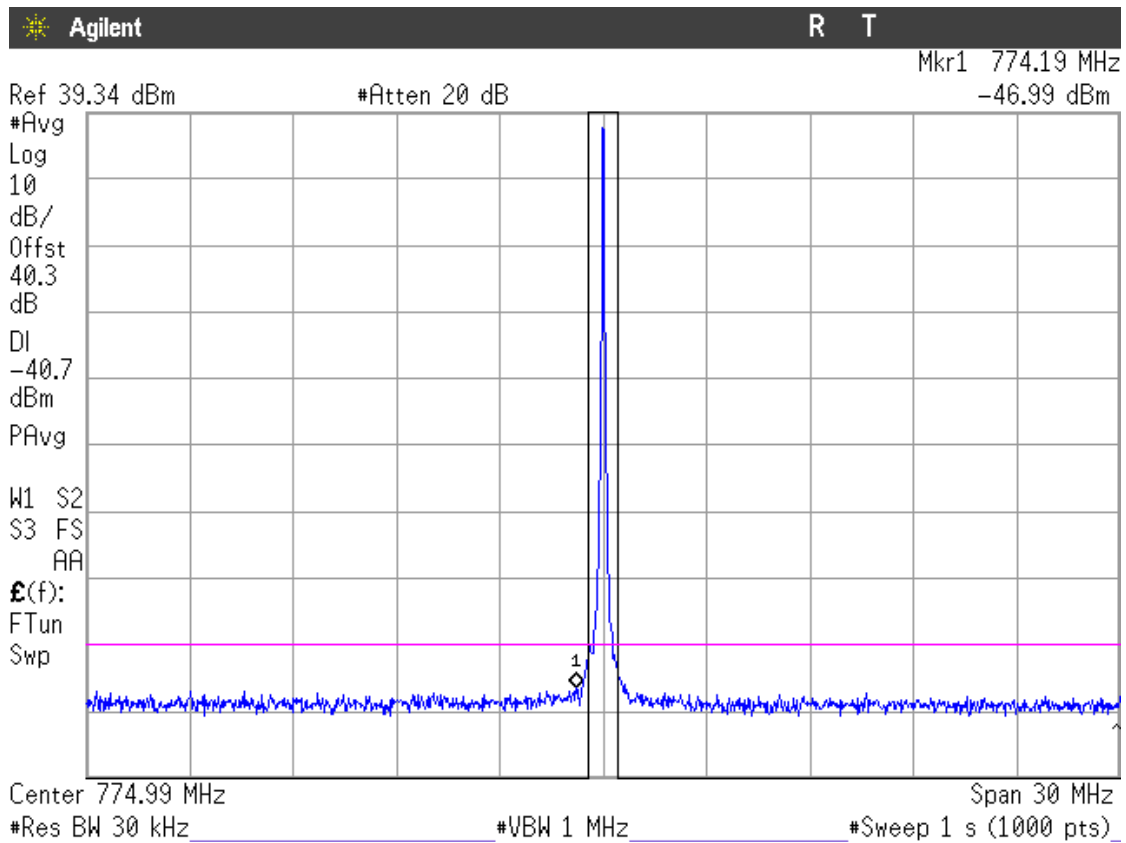


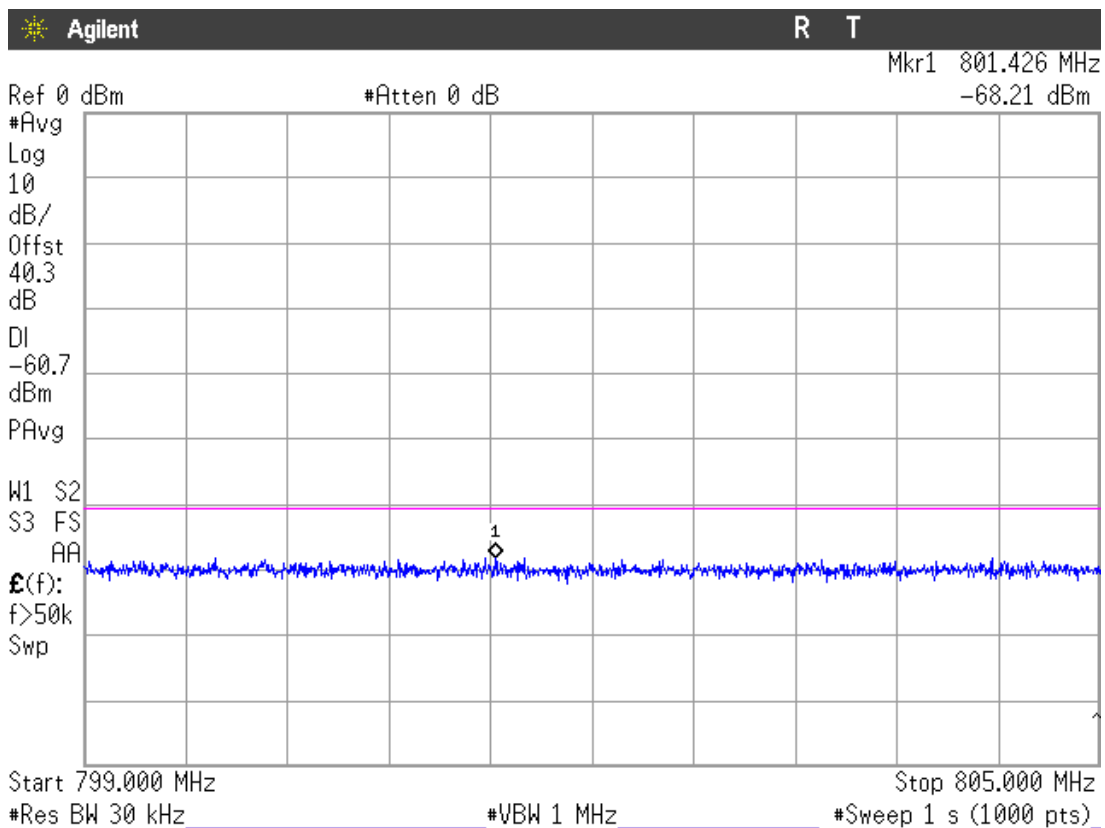
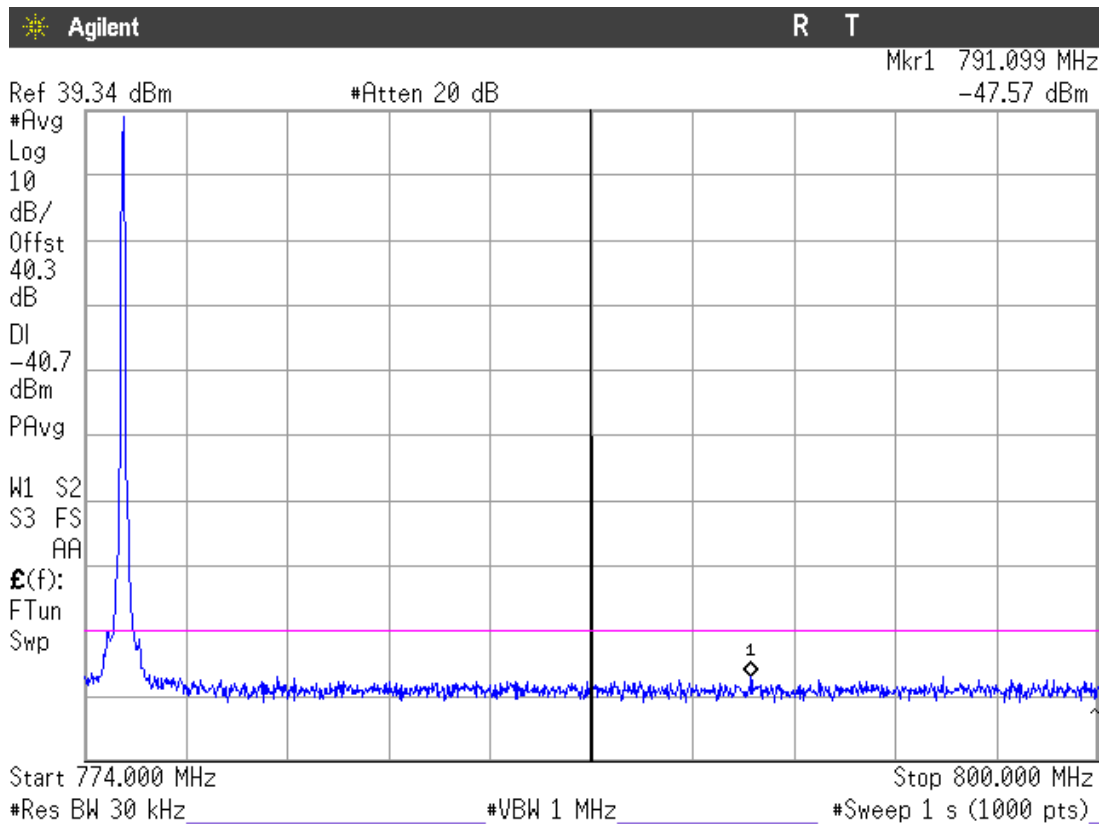




Highest Channel

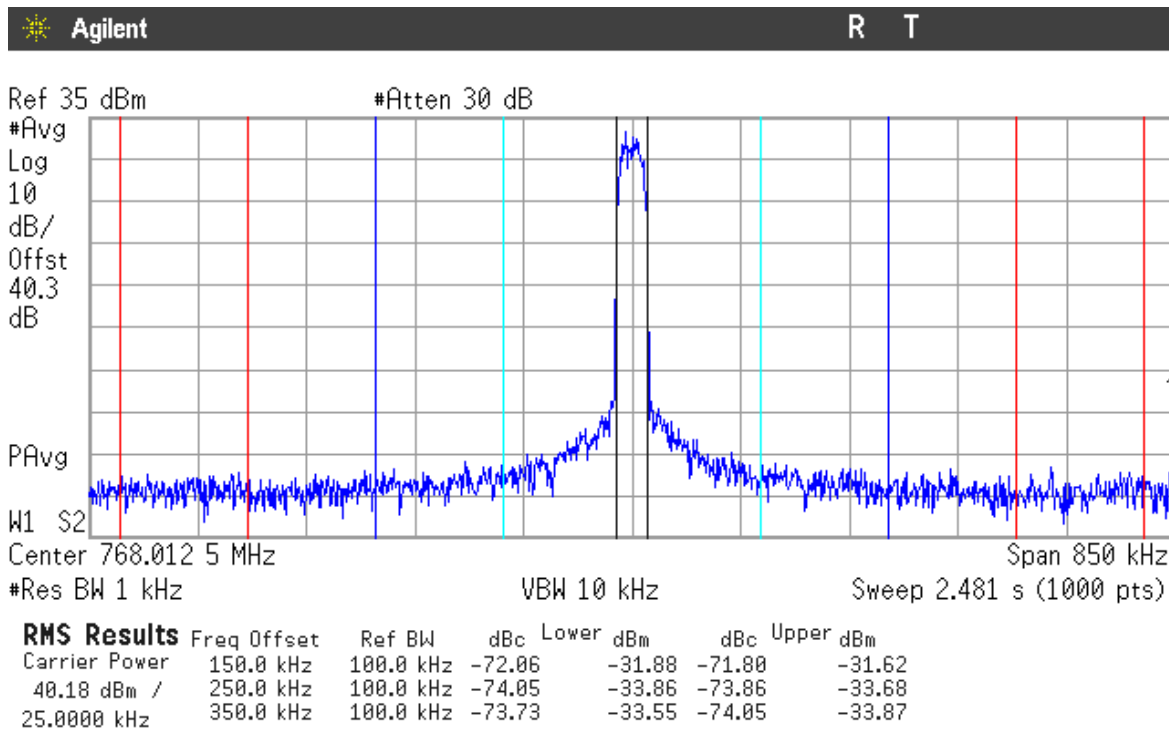
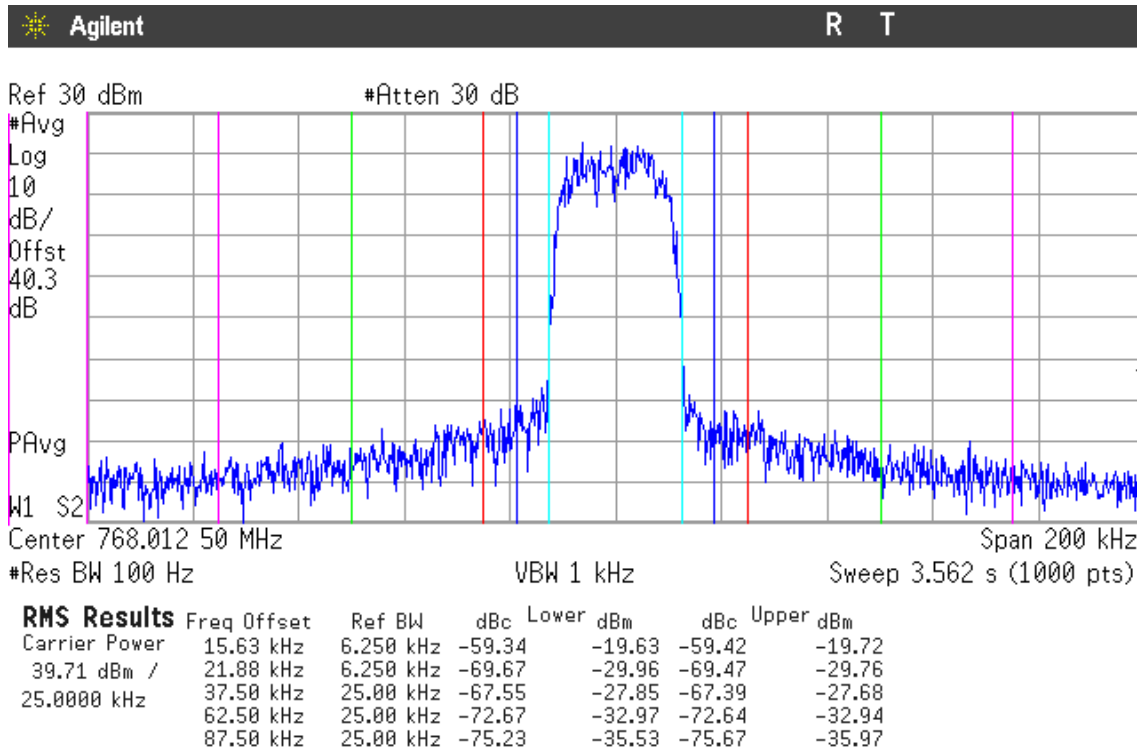


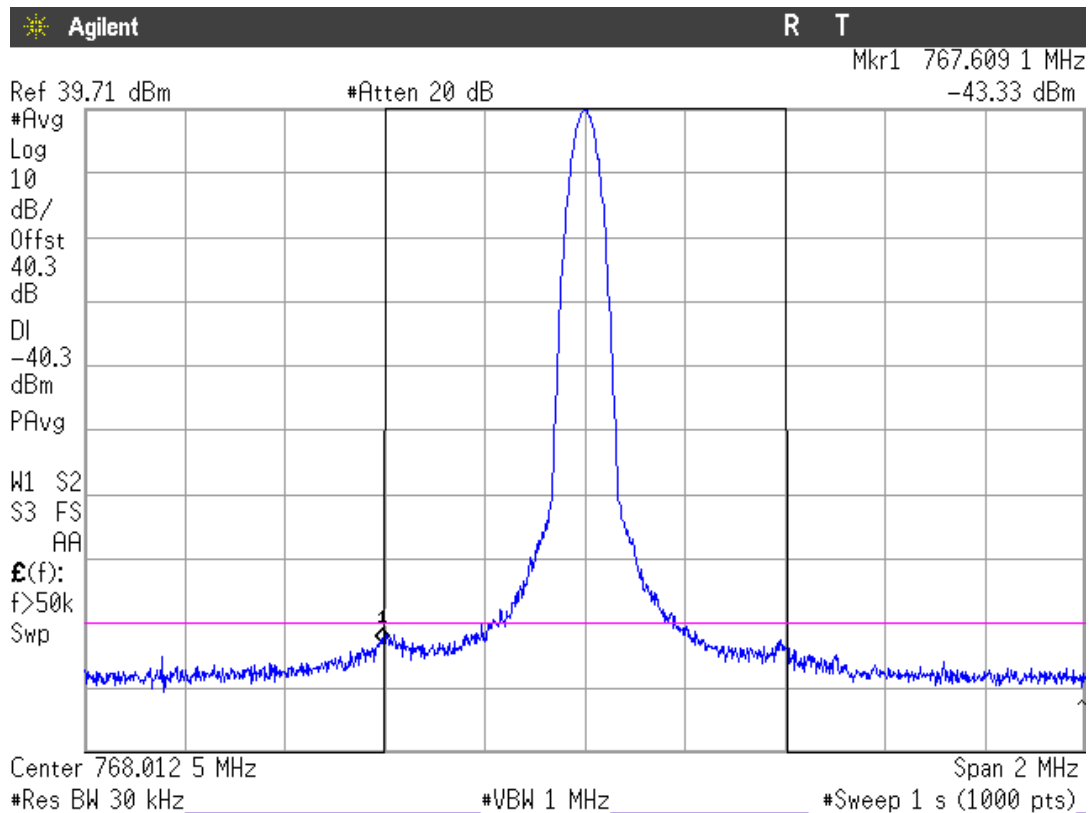
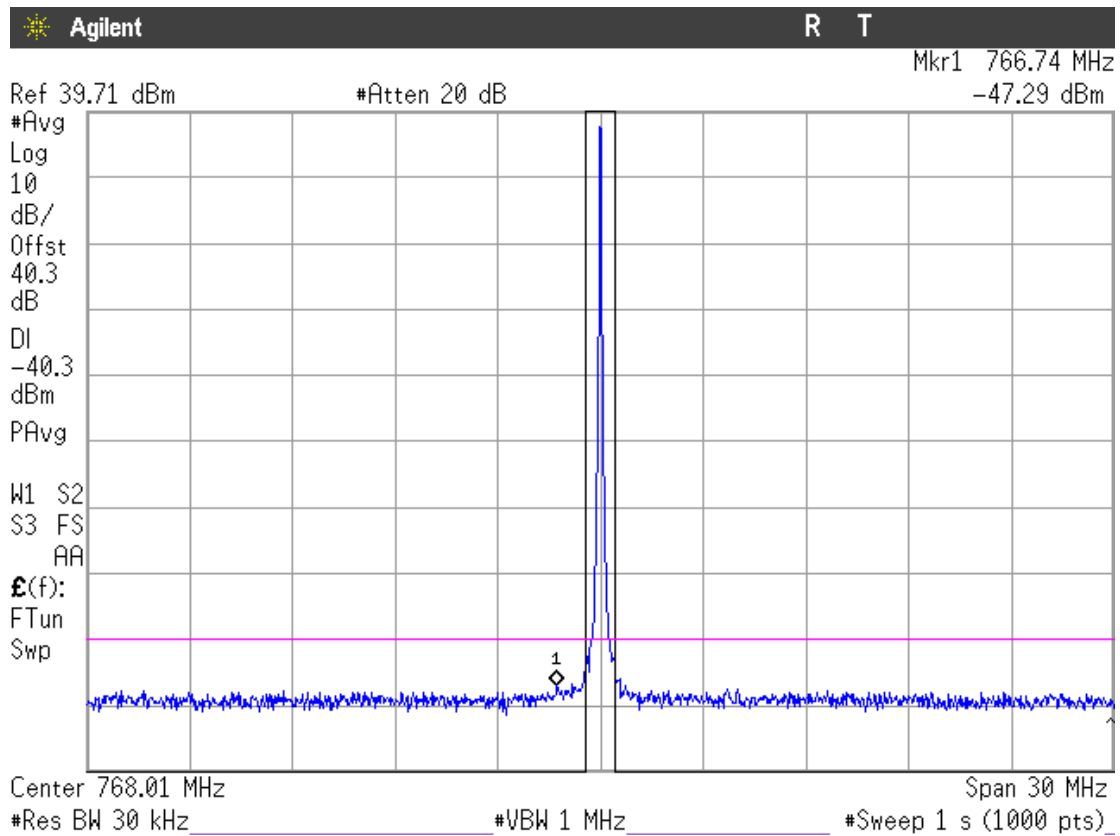


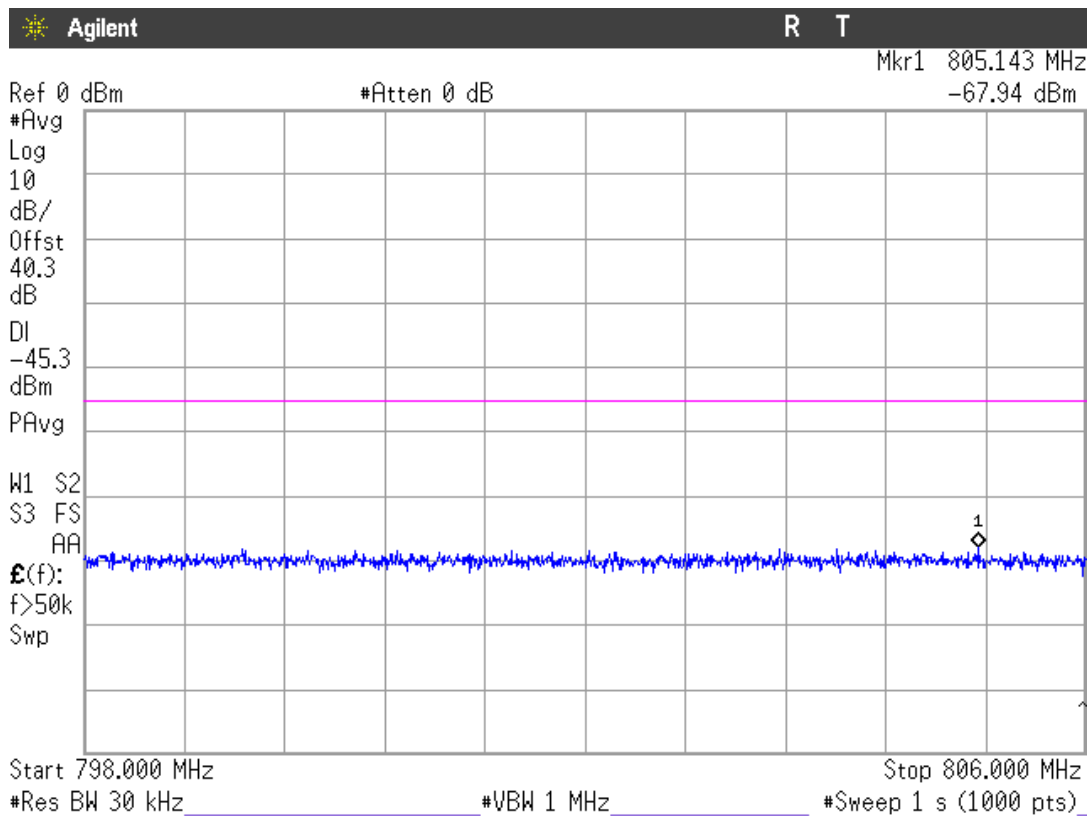
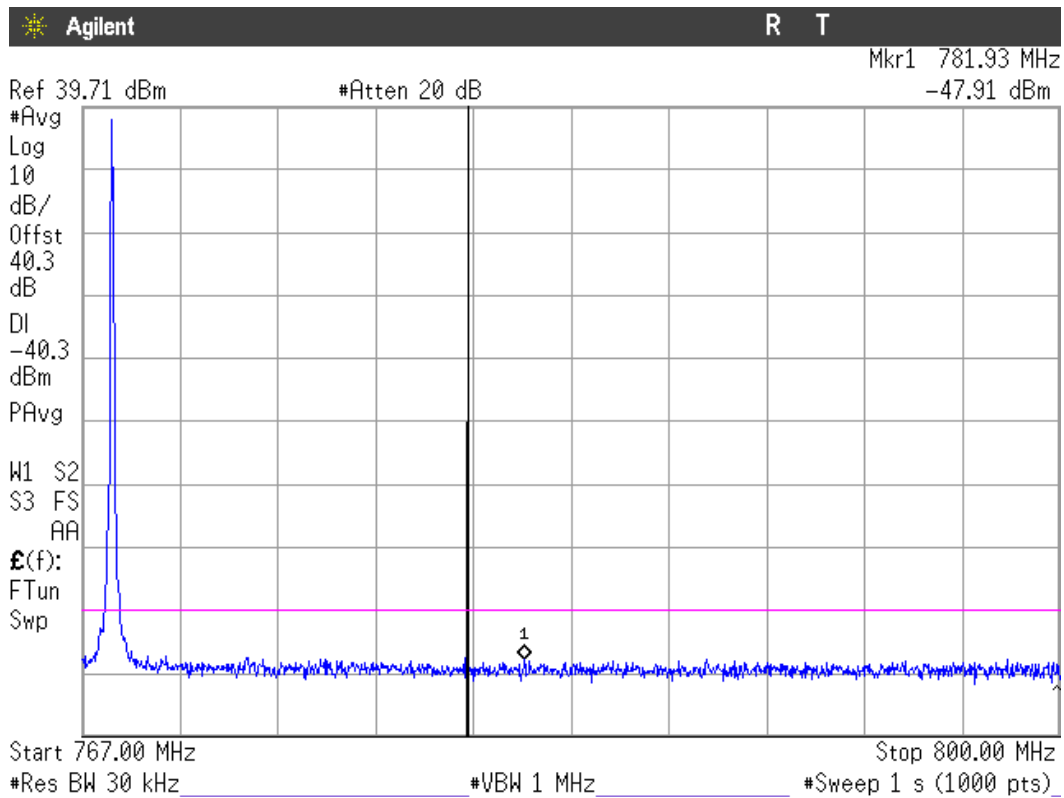


TETRA 22 kHz.768-776 MHz band.

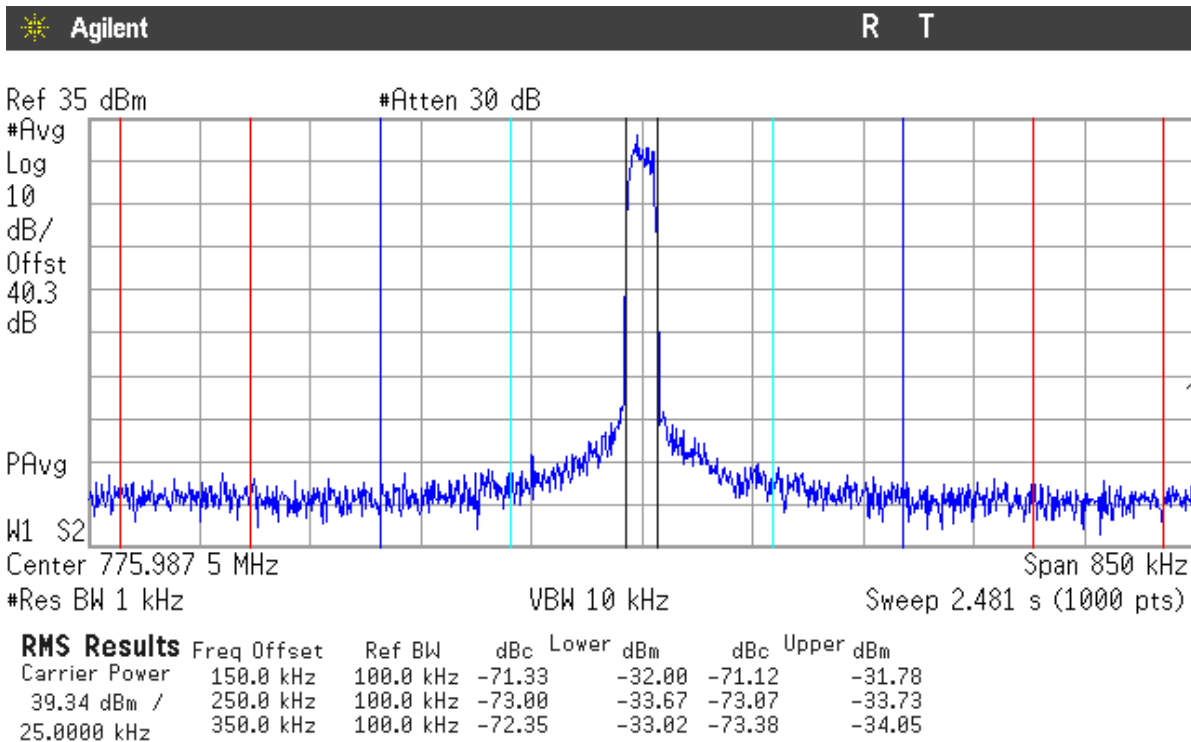
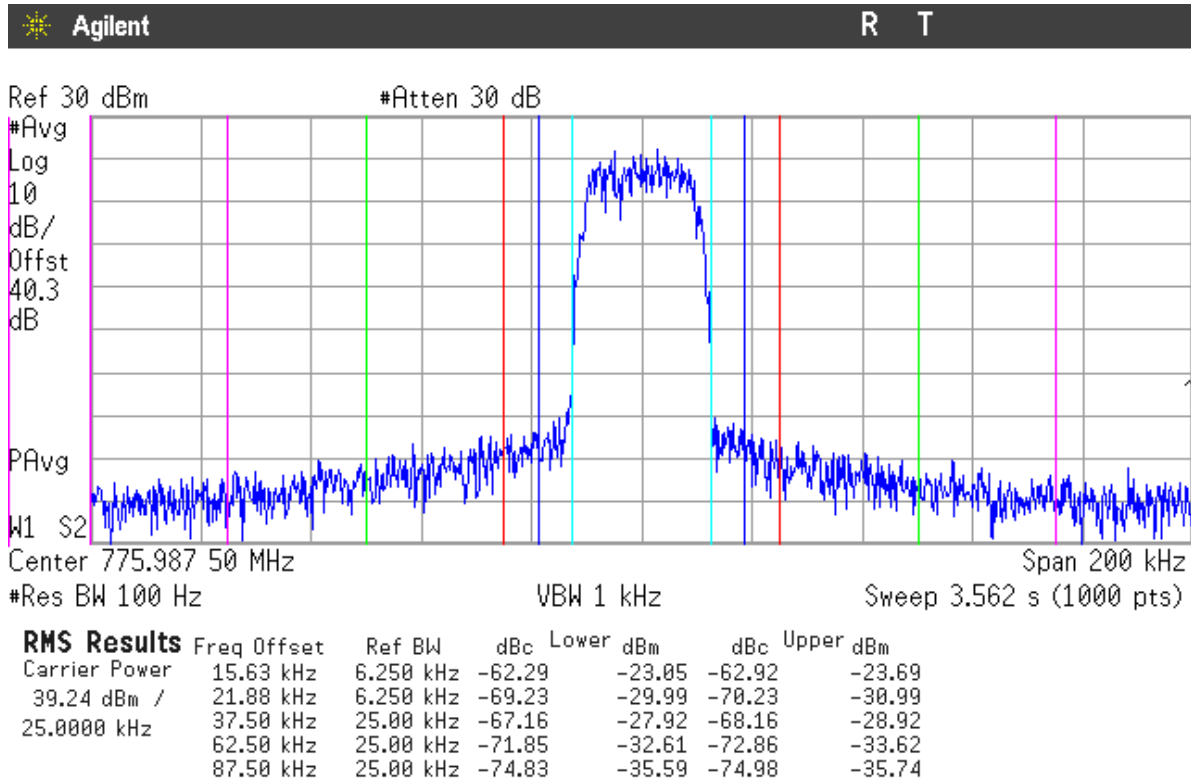
Lowest Channel

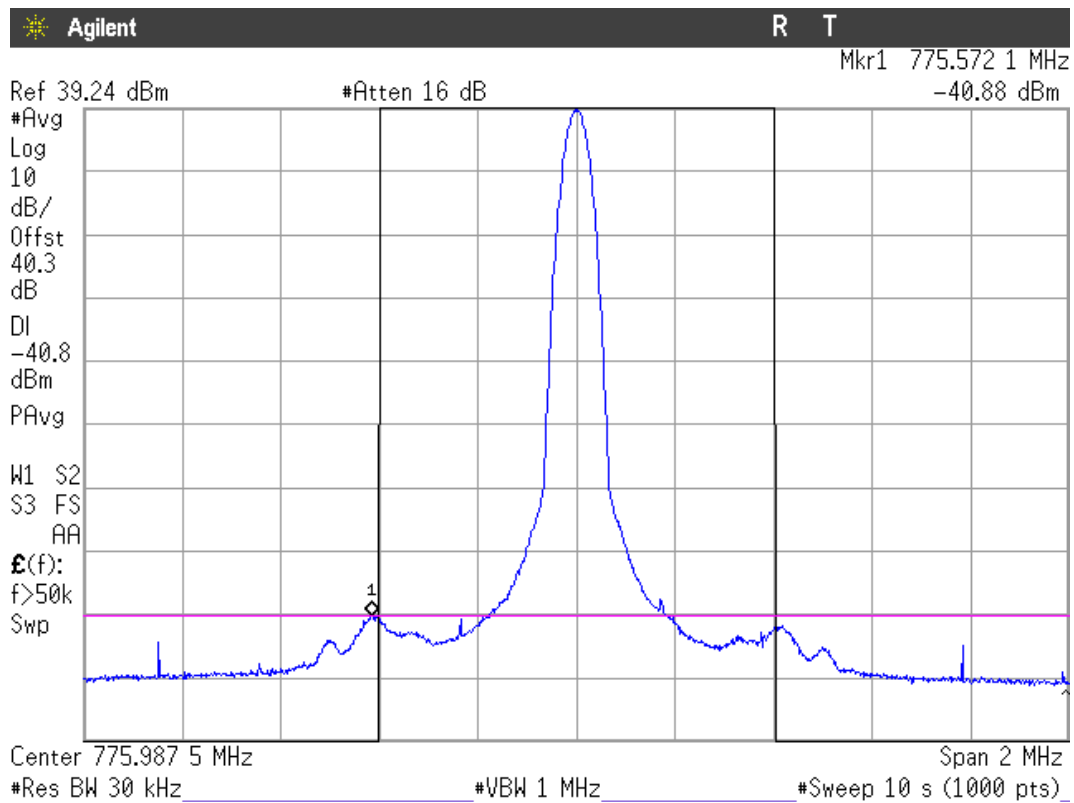
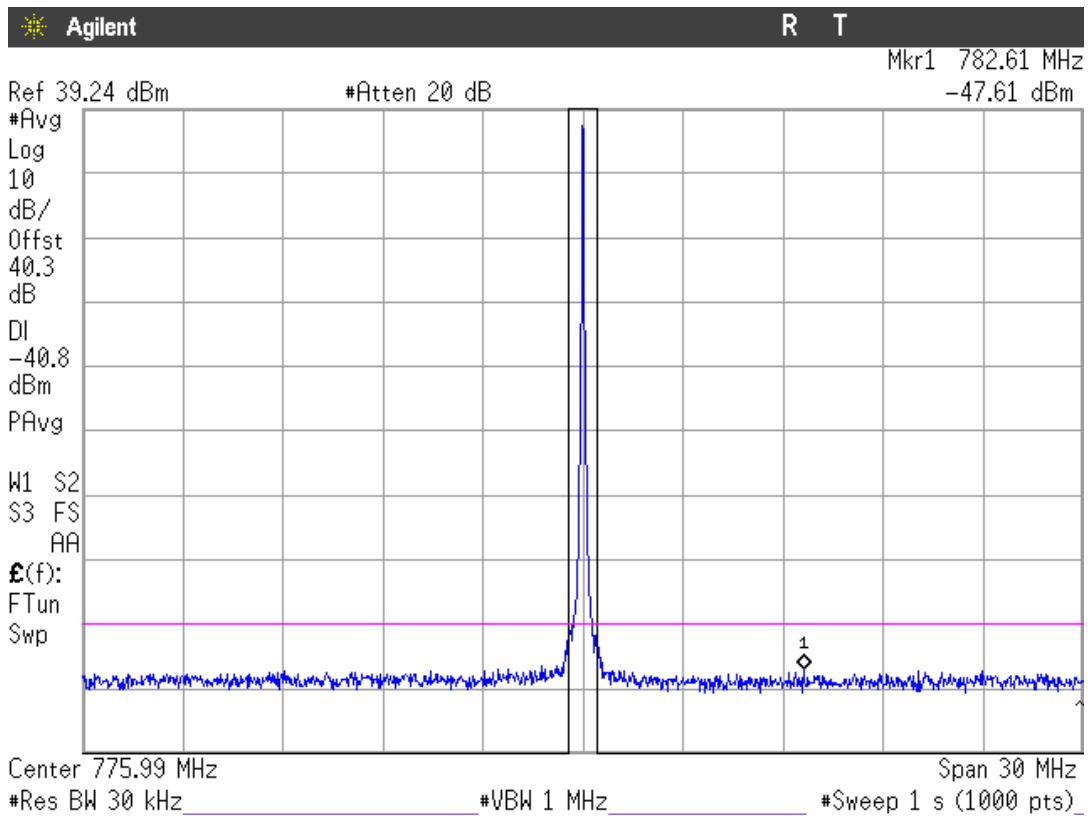


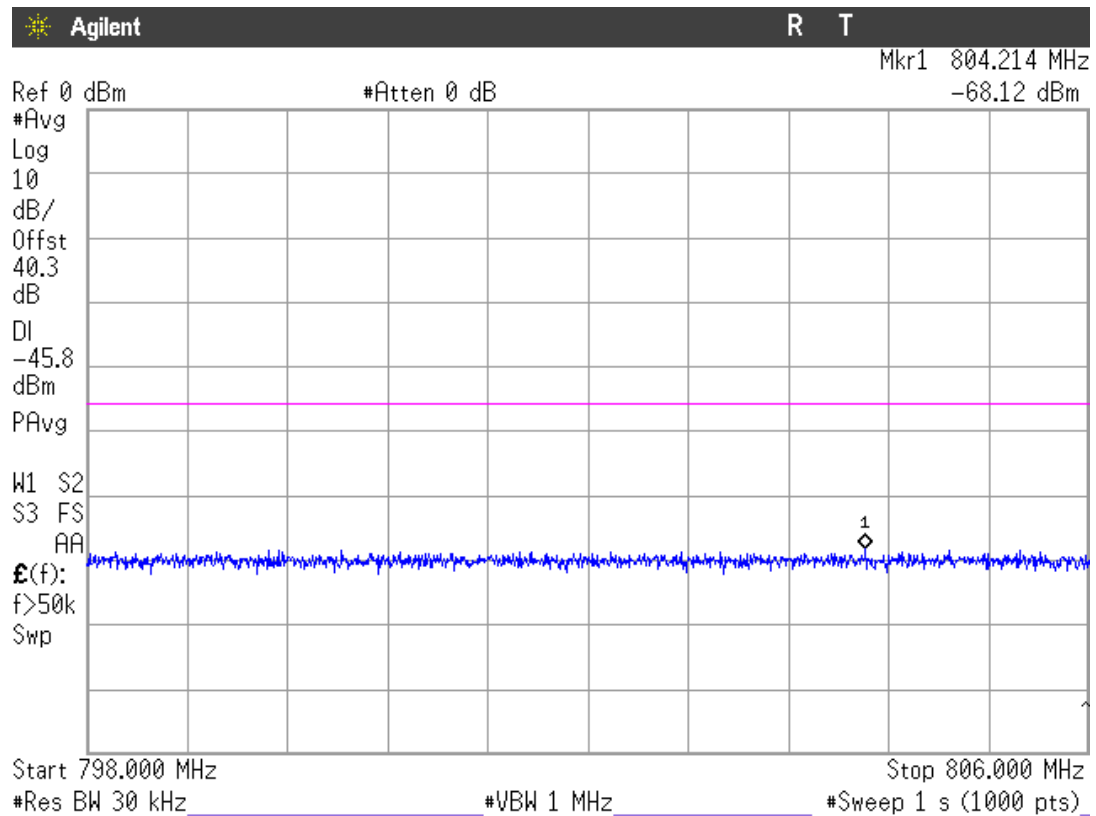
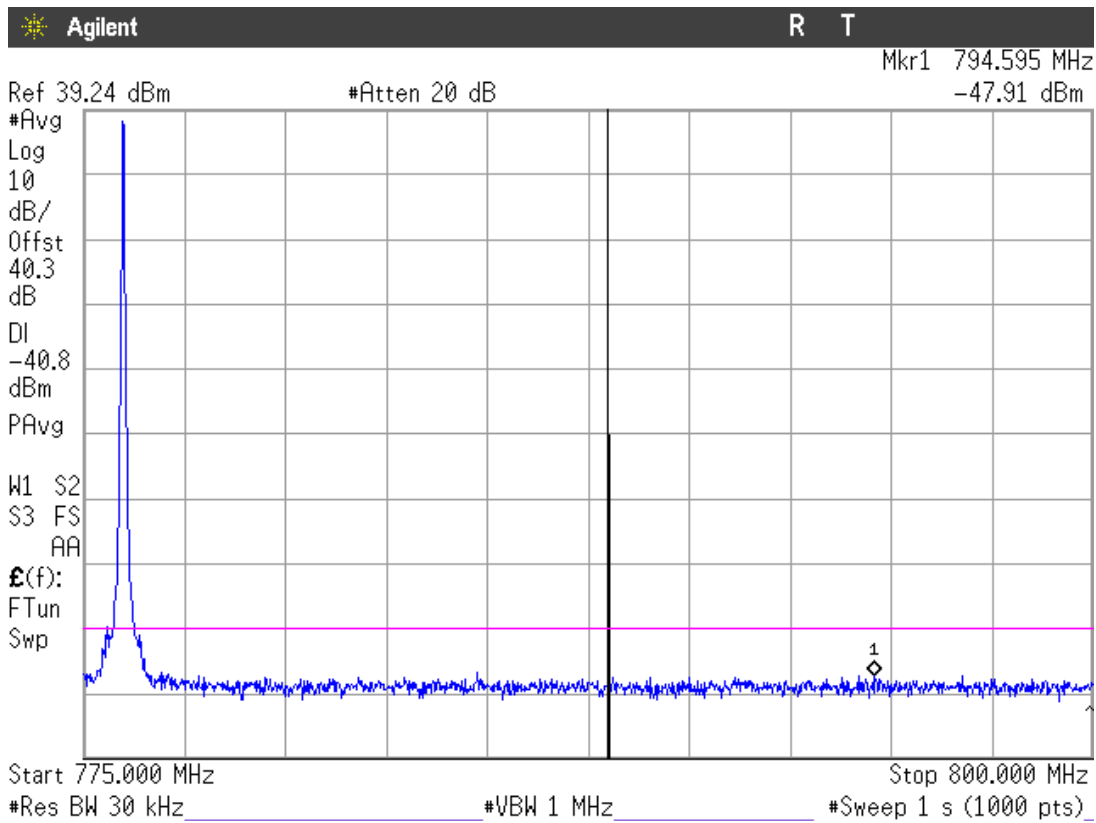




Highest Channel







Frequency Stability

SPECIFICATION

FCC §2.1055, §90.539. 769–775/799–805 MHz bands.

The frequency stability of base transmitters operating in the narrowband segment must be 100 parts per billion or better (0.1 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
768-776 and 798-806	25	0.1
	12.5	
	6.25	
	50	1

METHOD

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

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

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

RESULTS

Middle Channel (772.0125 MHz).

Voltage (Vdc)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
Frequency stability with Temperature			
24	+50	7	0.00907
	+40	7	0.00907
	+30	7	0.00907
	+20	7	0.00907
	+10	7	0.00907
	0	7	0.00907
	-10	8	0.01036
	-20	8	0.01036
	-30	8	0.01036
Frequency stability with Supply Voltage			
20.4	20	7	0.00907
31.2	20	7	0.00907

Voltage (Vac)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
Frequency stability with Supply Voltage			
93.5	20	2	0.00259
126.5	20	1	0.00130

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

Spurious emissions at antenna terminals

SPECIFICATION

FCC §90.543 (c). 769–775 and 799–805 MHz bands.

(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10\log(P)$ dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

RSS-119 Clause 5.8.9.2. 768-776 MHz and 798-806 MHz bands.

Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables, the power of any emission shall be attenuated below the mean output power P (W) by at least $43 + 10\log(P)$ dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

METHOD

The EUT RF output connector was connected to a spectrum analyzer using a 50 ohm attenuator and the resolution bandwidth of the spectrum analyzer was set to 100 kHz for frequencies < 1 GHz and 1 MHz for frequencies > 1 GHz. The spectrum was investigated from 9 kHz to 8 GHz.

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

A preliminary scan determined the AC power supply configuration as the worst case. The following tables and plots show the results for this configuration.

RESULTS (see plots in next pages)

TI D-LMR 20 kHz bandwidth. 769-775 MHz band.

CHANNEL: LOWEST

Spurious signals outside the ACP ranges at less than 20 dB respect to the limit.

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
1888.8	-27.08	$< \pm 2.03$
5216.6	-28.91	$< \pm 2.03$

CHANNEL: HIGHEST

Spurious signals outside the ACP ranges at less than 20 dB respect to the limit.

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
1888.8	-30.47	$< \pm 2.03$
5225.1	-22.14	$< \pm 2.03$

TI D-LMR 20 kHz bandwidth. 768-776 MHz band.

CHANNEL: LOWEST

Spurious signals outside the ACP ranges at less than 20 dB respect to the limit.

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
1711.0	-29.90	$< \pm 2.03$
1888.8	-27.19	$< \pm 2.03$
2527.7	-29.10	$< \pm 2.03$

CHANNEL: HIGHEST

Spurious signals outside the ACP ranges at less than 20 dB respect to the limit.

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
1735.0	-26.07	$< \pm 2.03$
1888.8	-29.28	$< \pm 2.03$
2415.2	-32.30	$< \pm 2.03$
5216.6	-21.02	$< \pm 2.03$

TETRA 22 kHz bandwidth. 769-775 MHz band.

CHANNEL: LOWEST

Spurious signals outside the ACP ranges at less than 20 dB respect to the limit.

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
1884.5	-25.96	$< \pm 2.03$
5217.4	-29.35	$< \pm 2.03$

CHANNEL: HIGHEST

Spurious signals outside the ACP ranges at less than 20 dB respect to the limit.

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
1732.4	-25.11	$< \pm 2.03$
1888.8	-29.31	$< \pm 2.03$
5216.6	-21.52	$< \pm 2.03$

TETRA 22 kHz bandwidth. 768-776 MHz band.

CHANNEL: LOWEST

Spurious signals outside the ACP ranges at less than 20 dB respect to the limit.

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
1888.8	-25.84	$< \pm 2.03$
5216.6	-28.40	$< \pm 2.03$

CHANNEL: HIGHEST

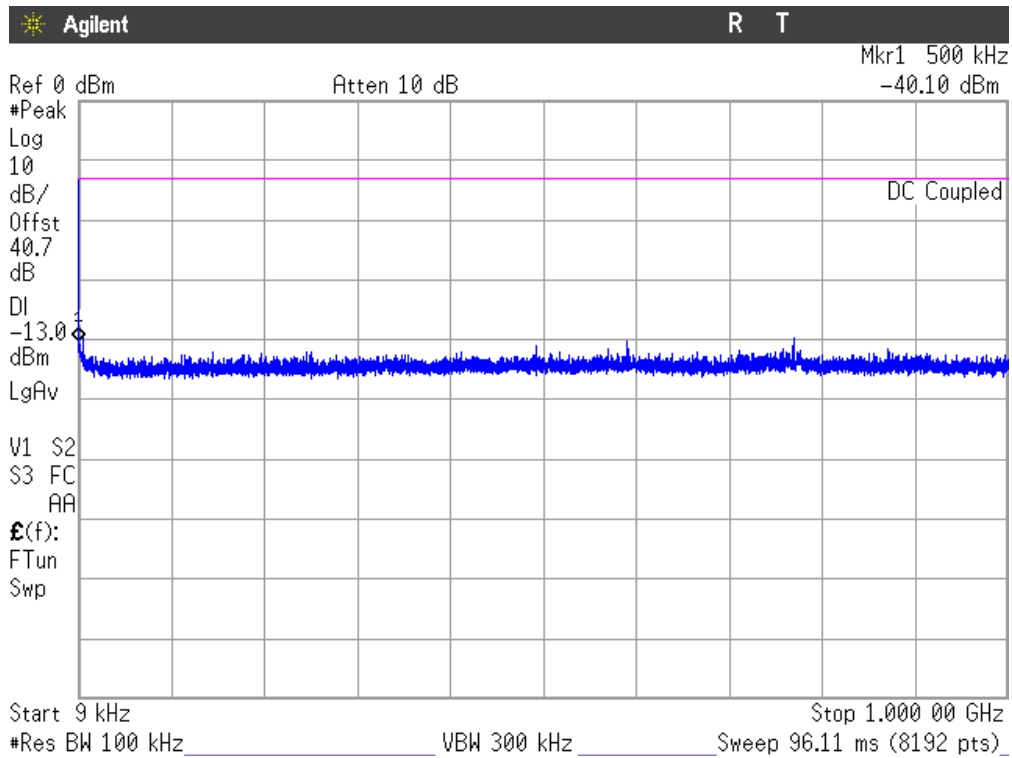
Spurious signals outside the ACP ranges at less than 20 dB respect to the limit.

Spurious Frequency (MHz)	Level (dBm)	Uncertainty (dB)
1746.1	-22.91	$< \pm 2.03$
1888.8	-29.56	$< \pm 2.03$
5226.8	-22.98	$< \pm 2.03$

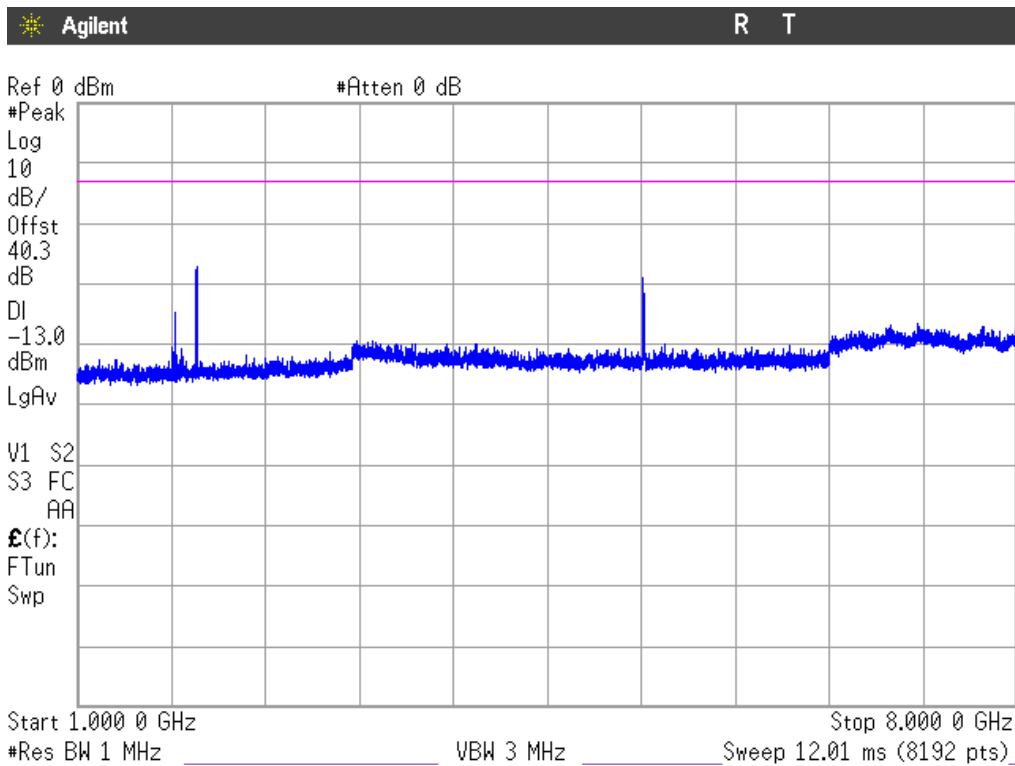
Verdict: PASS

TI D-LMR 20 kHz bandwidth. 769-775 MHz band.

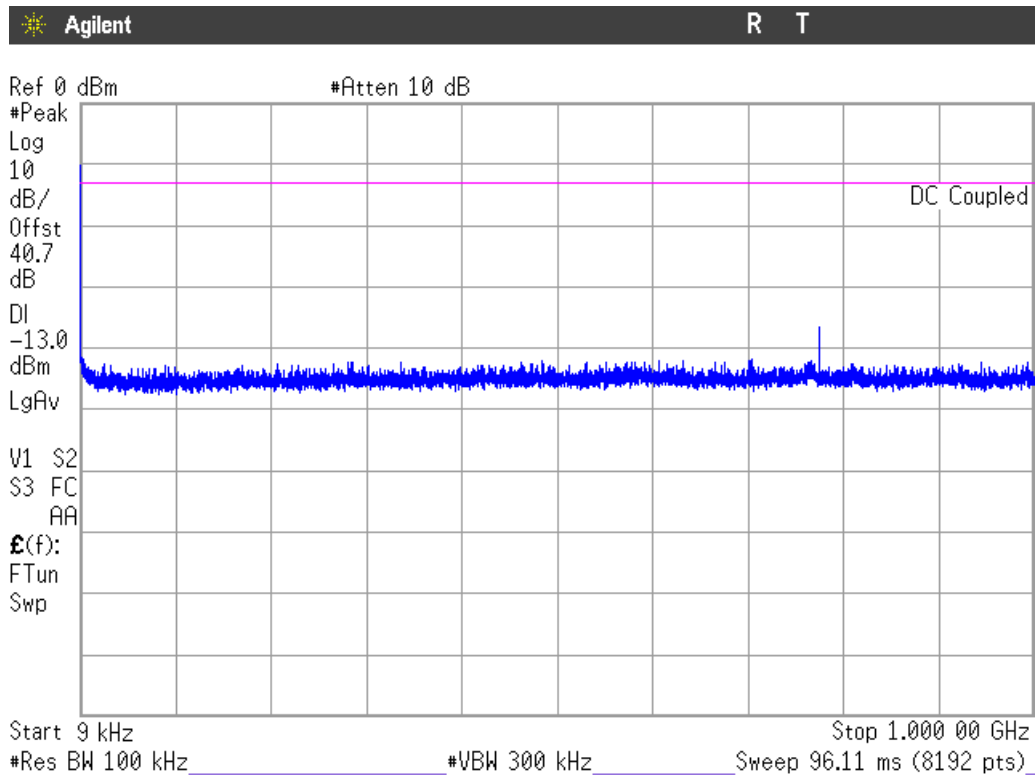
CHANNEL: LOWEST



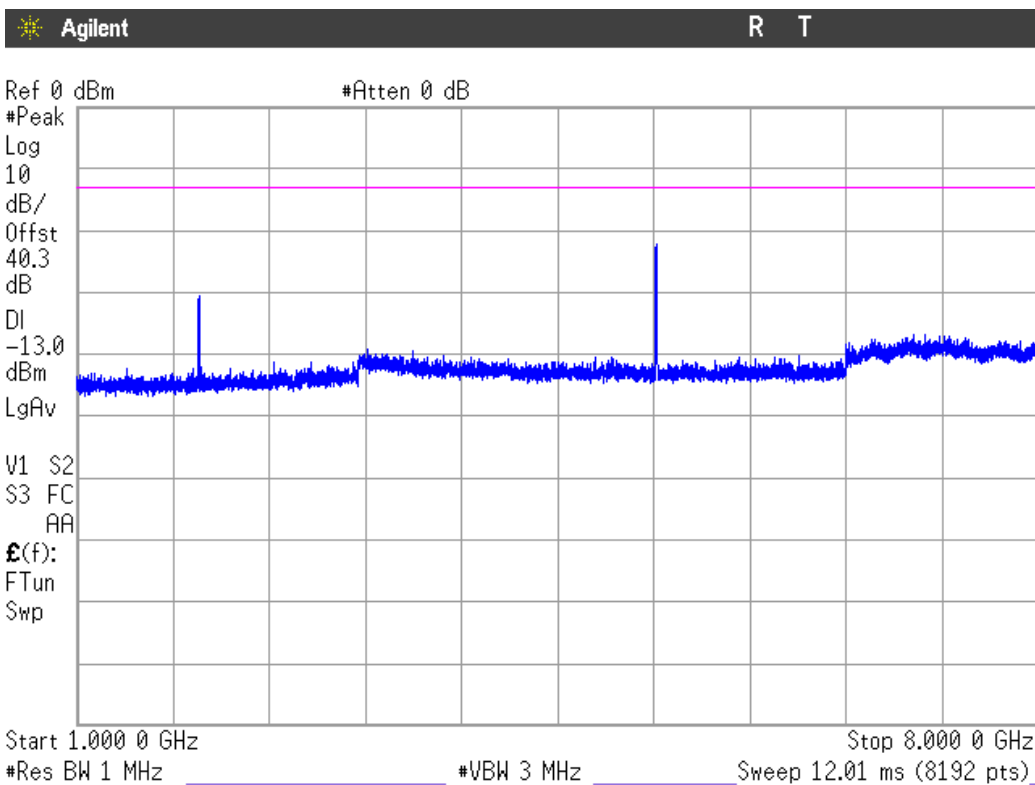
Note: The carrier frequency has been attenuated with a notch filter.



CHANNEL: HIGHEST

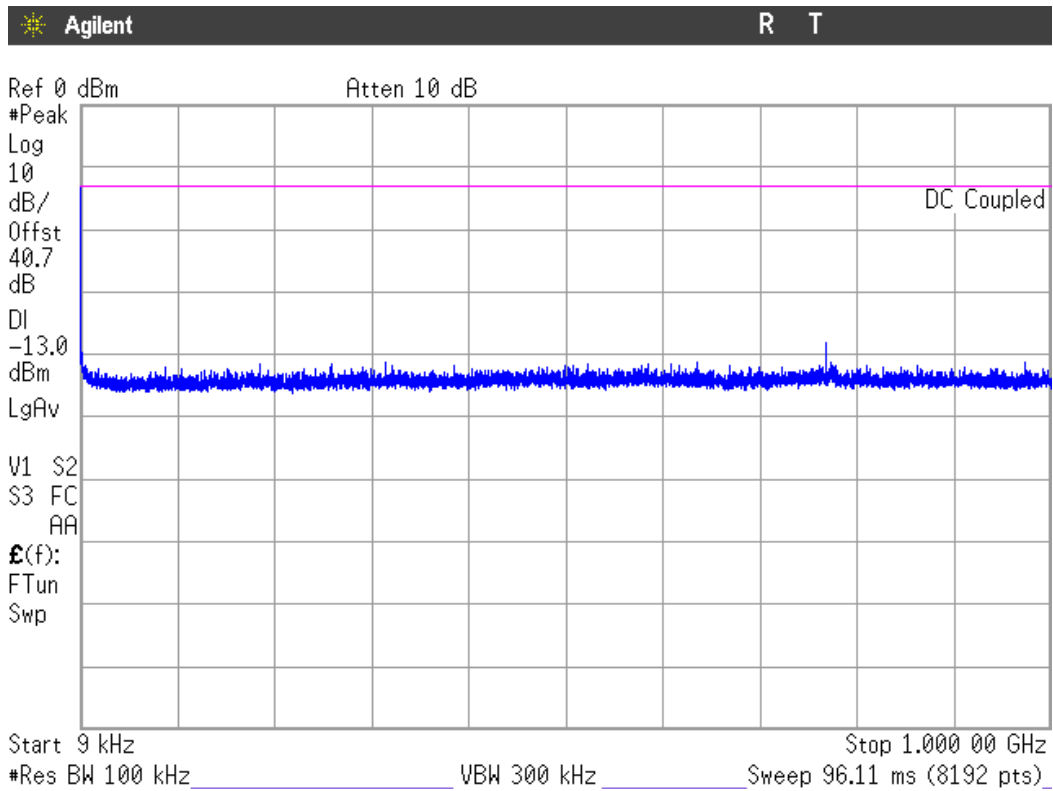


Note: The carrier frequency has been attenuated with a notch filter.

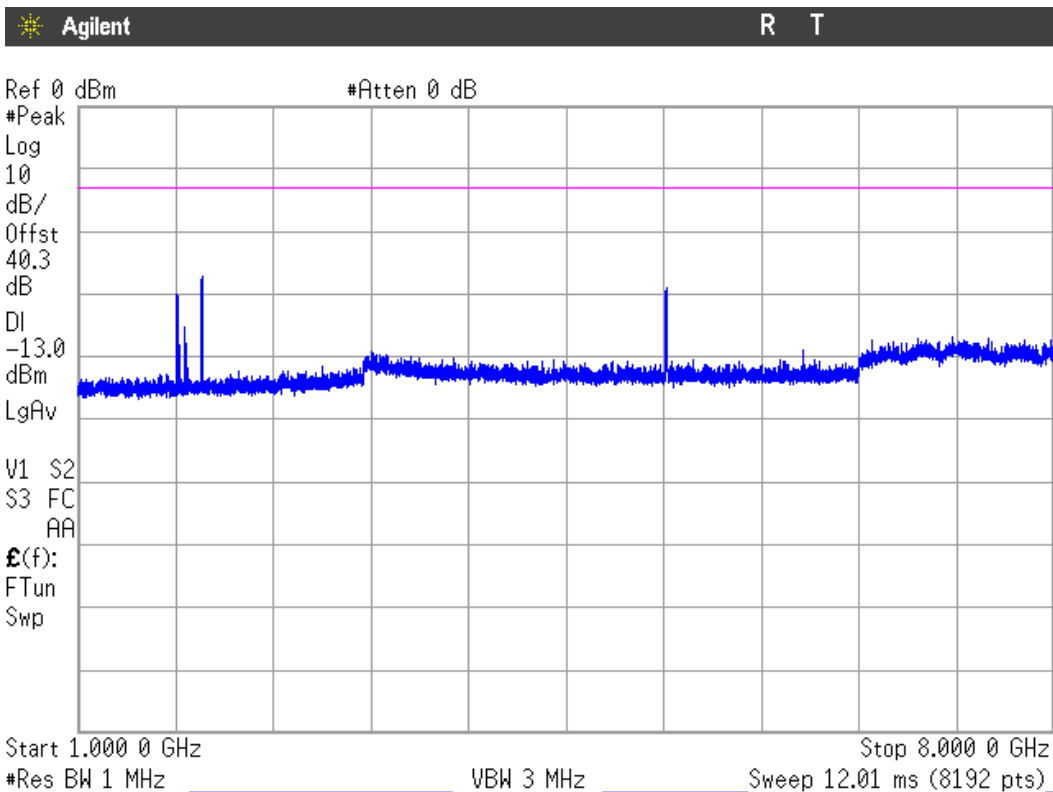


TI D-LMR 20 kHz bandwidth. 768-776 MHz band.

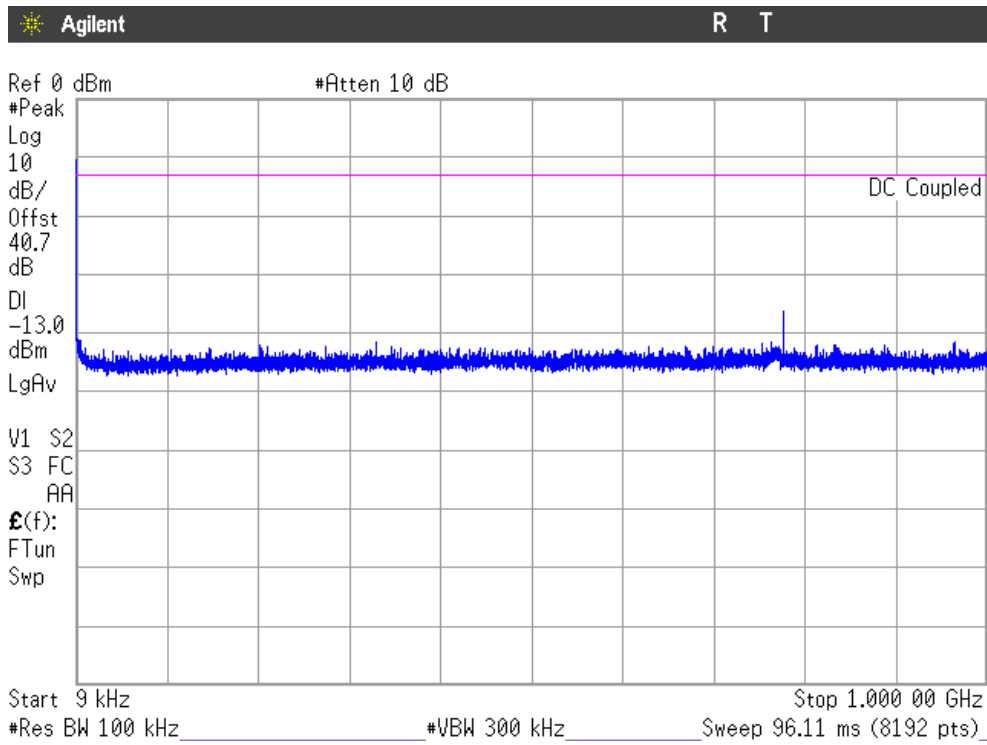
CHANNEL: LOWEST



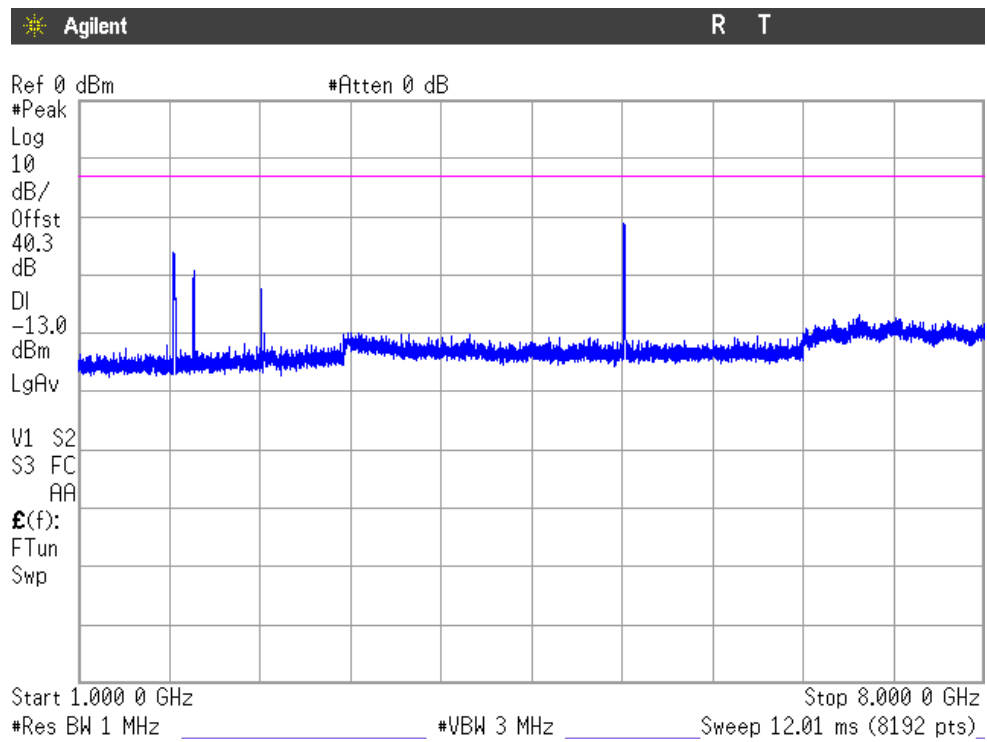
Note: The carrier frequency has been attenuated with a notch filter.



CHANNEL: HIGHEST

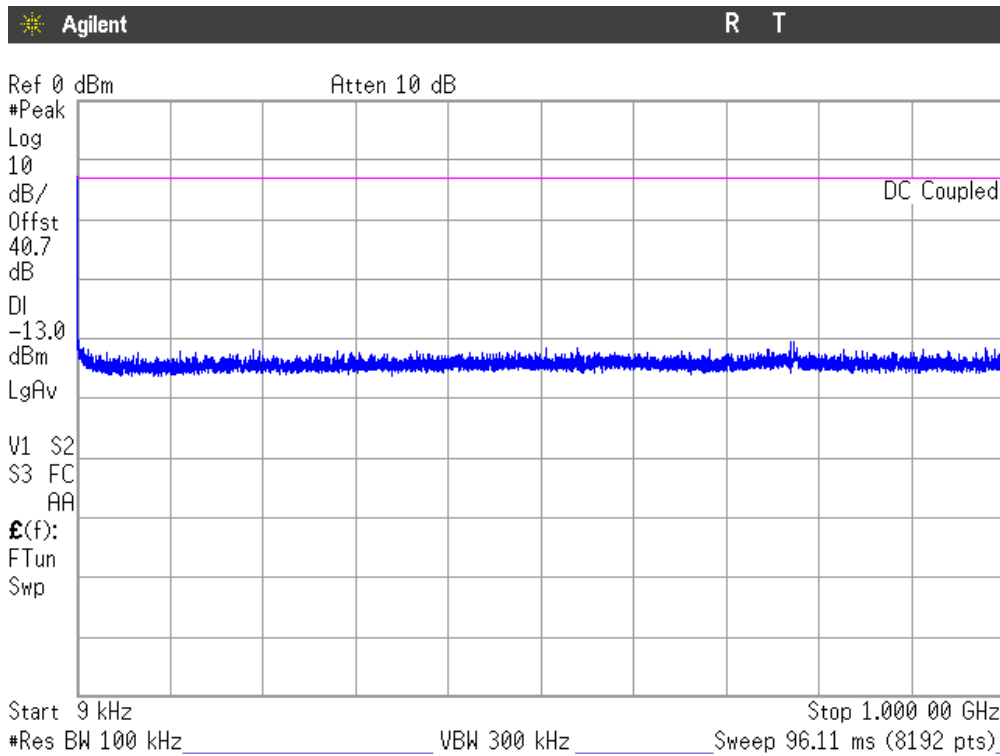


Note: The carrier frequency has been attenuated with a notch filter.

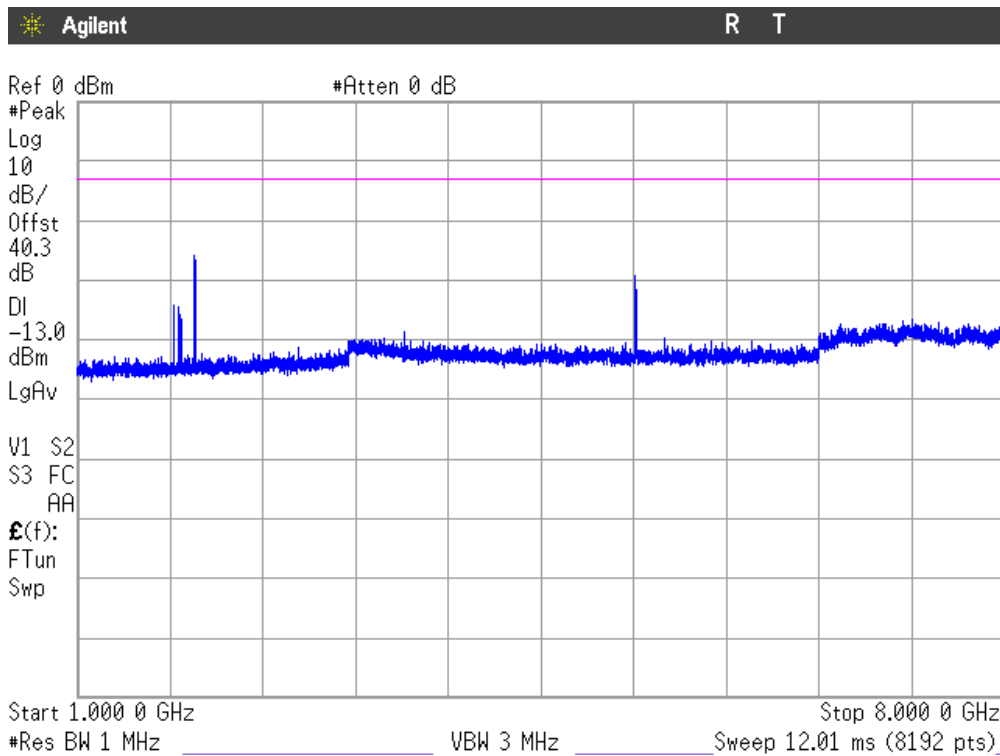


TETRA 22 kHz bandwidth. 769-775 MHz band.

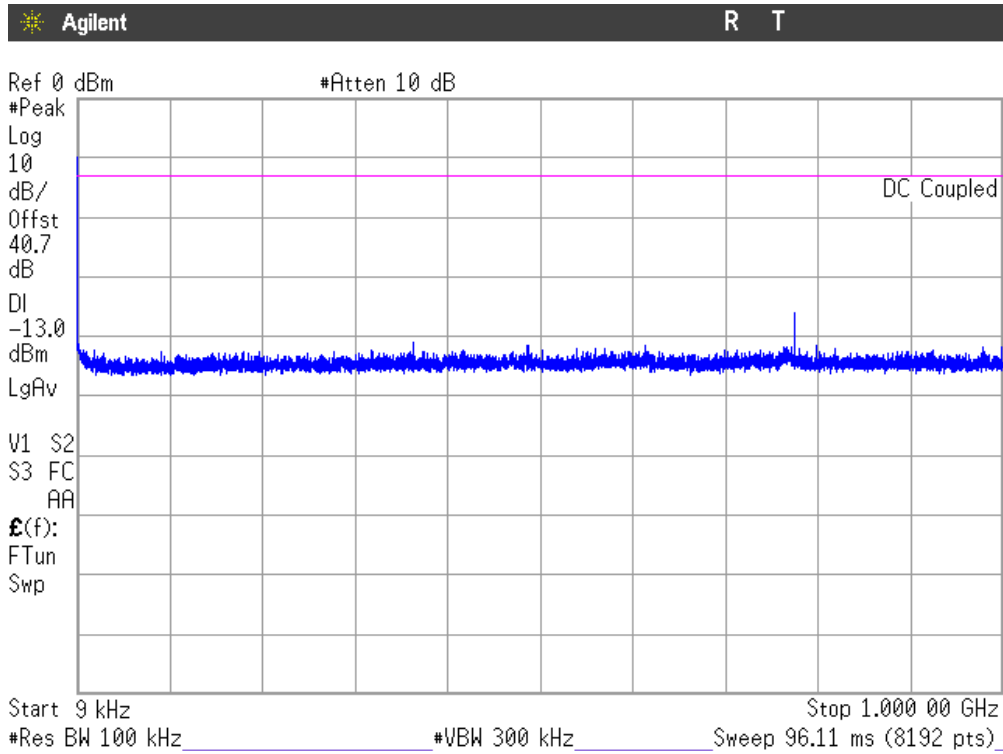
CHANNEL: LOWEST



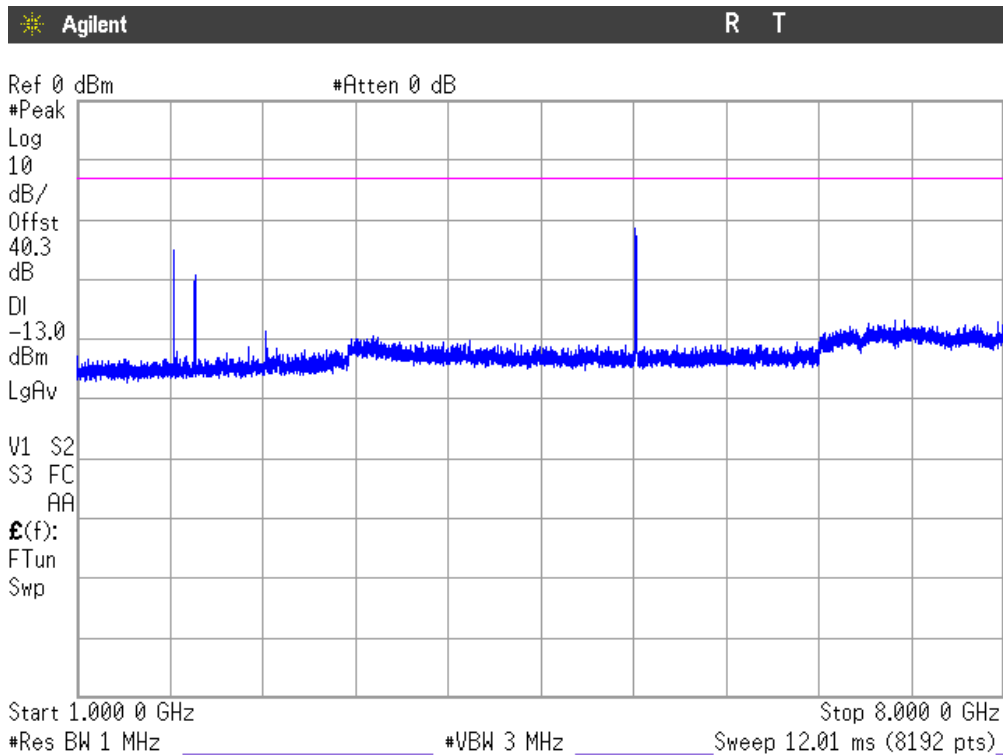
Note: The carrier frequency has been attenuated with a notch filter.



CHANNEL: HIGHEST

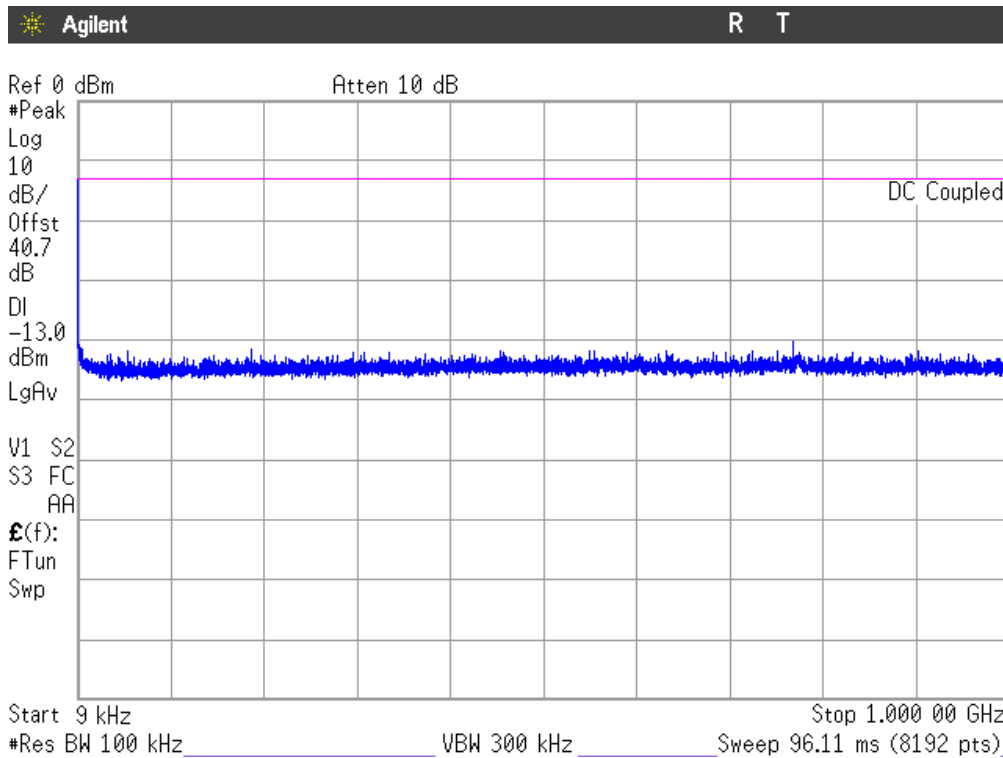


Note: The carrier frequency has been attenuated with a notch filter.

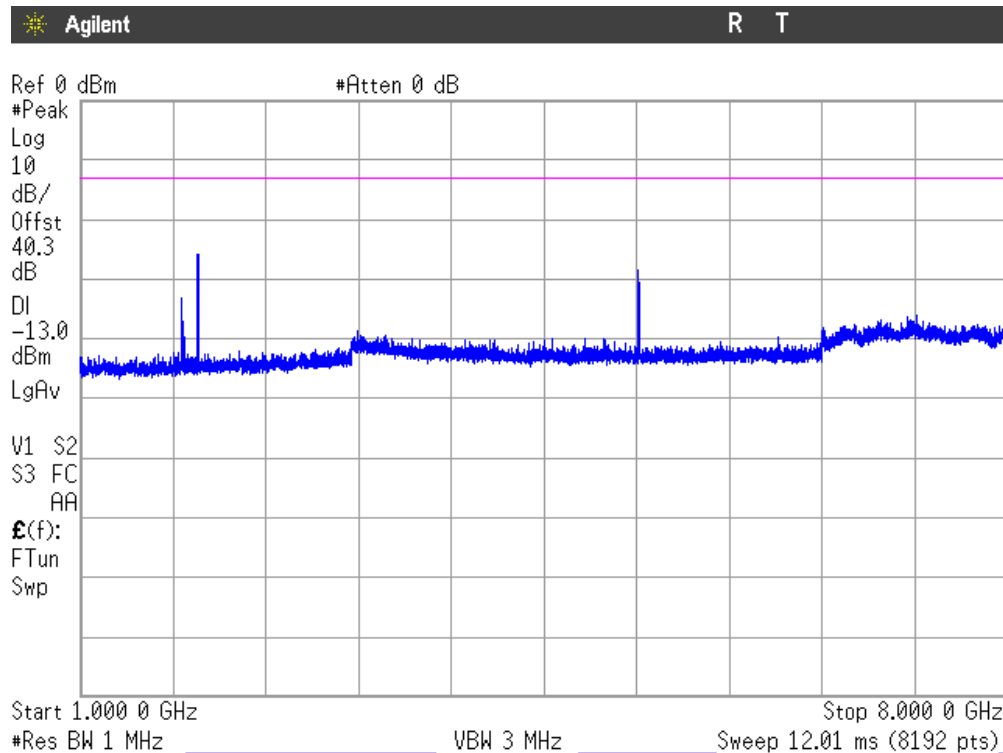


TETRA 22 kHz bandwidth. 768-776 MHz band.

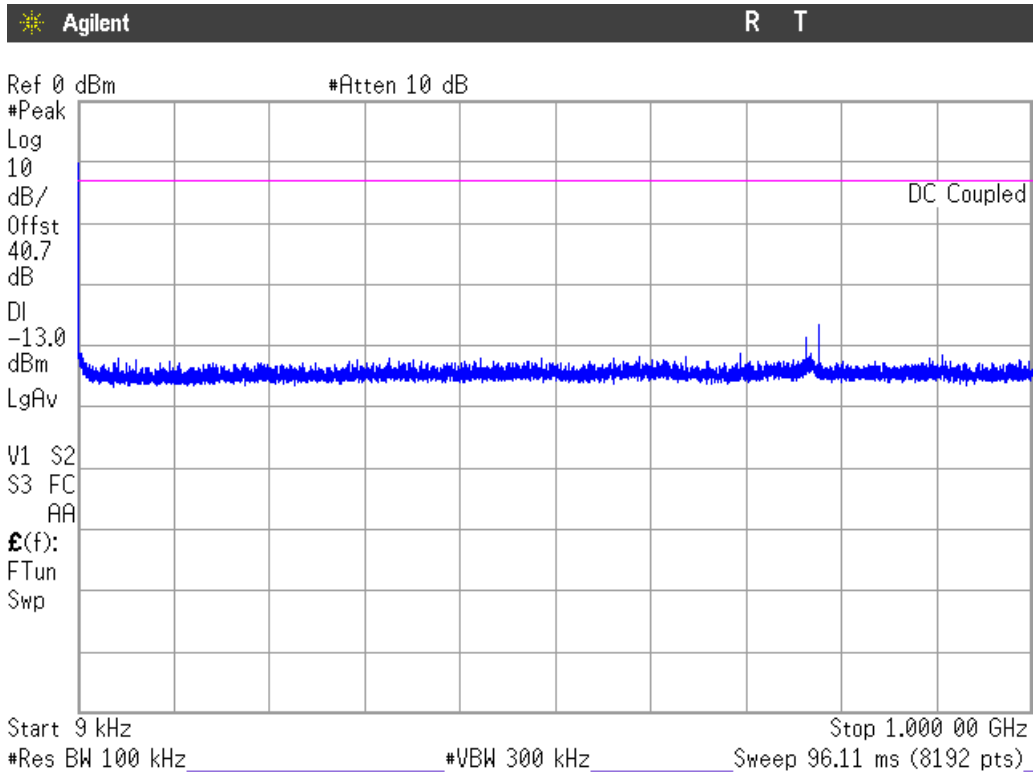
CHANNEL: LOWEST



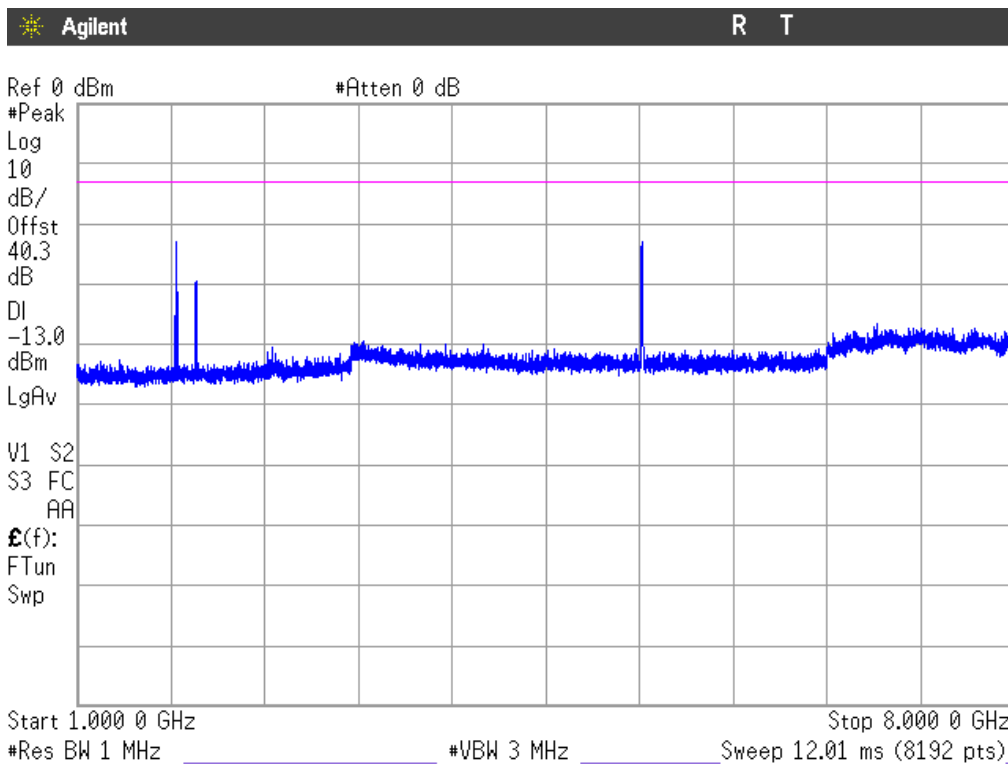
Note: The carrier frequency has been attenuated with a notch filter.



CHANNEL: HIGHEST



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



Radiated emissions

SPECIFICATION

FCC §90.543 (c) & (f). 769–775 and 799–805 MHz bands.

(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10\log(P)$ dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

(f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

RSS-119 Clause 5.8.9.2. 768-776 MHz and 798-806 MHz bands.

Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables, the power of any emission shall be attenuated below the mean output power P (W) by at least $43 + 10\log(P)$ dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

In addition, for operations in the bands 768-776 MHz and 798-806 MHz, all emissions (including harmonics in the band 1559-1610 MHz), shall not exceed:

-70 dBW/MHz equivalent isotropically radiated power (e.i.r.p.) for wideband emissions, and

-80 dBW/kHz e.i.r.p. for discrete emissions of less than 700 Hz bandwidth.

METHOD

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

For emissions in the band 1559-1610 MHz the EUT was tested with an antenna that is representative of the type that will be used with the equipment in normal operation (Colinear antenna).

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, except for the band 1559-1610 MHz where a distance of 3 m was used.

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.

Each detected emission is substituted by the Substitution method.

RESULTS

I. FCC 90. 769-775 MHz band for 20 kHz and 22 kHz bandwidth.

A preliminary scan determined the AC power supply and TETRA 22 kHz mode as the worst case. The following tables and plots show the results for this configuration.

1. CHANNEL: LOWEST.

Frequency range 30 MHz – 8 GHz (except range 1559 MHz-1610 GHz).

All peaks found are more than 30 dB below the limit.

Frequency range 1559 MHz-1610 GHz.

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)
1.5870016	-46.99	1000	Peak	Vertical	-55.38	1.69	8.90	-48.17
1.5873790	-51.80	1000	Peak	Vertical	-60.21	1.69	8.92	-52.98
1.5885282	-50.11	1000	Peak	Horizontal	-58.52	1.69	8.92	-51.29
1.5906736	-51.16	1000	Peak	Vertical	-59.59	1.70	8.93	-52.36
1.6028915	-51.95	1000	Peak	Vertical	-60.38	1.71	8.94	-53.15
1.6041019	-50.34	1000	Peak	Vertical	-58.77	1.71	8.94	-51.54

No discrete emissions of less than 700 Hz bandwidth were found.

2. CHANNEL: HIGHEST.

Frequency range 30 MHz – 8 GHz (except range 1559 MHz-1610 GHz).

All peaks found are more than 30 dB below the limit.

Frequency range 1559 MHz-1610 GHz.

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)
1.5663704	-50.41	1000	Peak	Vertical	-58.94	1.62	8.80	-51.76
1.5754637	-43.41	1000	Peak	Horizontal	-51.86	1.66	8.81	-44.71
1.5852268	-43.04	1000	Peak	Horizontal	-51.37	1.67	8.90	-44.14
1.5859476	-49.34	1000	Peak	Horizontal	-57.67	1.67	8.90	-50.44
1.5962377	-44.25	1000	Peak	Horizontal	-52.68	1.70	8.93	-45.45
1.6086086	-48.79	1000	Peak	Horizontal	-57.21	1.72	8.94	-49.99

No discrete emissions of less than 700 Hz bandwidth were found.

II. RSS-119. 768-776 MHz band for 20 kHz and 22 kHz bandwidth.

A preliminary scan determined the AC power supply and TETRA 22 kHz mode as the worst case. The following tables and plots show the results for this configuration.

1. CHANNEL: LOWEST.

Frequency range 30 MHz – 8 GHz (except range 1559 MHz-1610 GHz).

All peaks found are more than 30 dB below the limit.

Frequency range 1559 MHz-1610 GHz.

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)
1.5606771	-46.22	1000	Peak	Horizontal	-54.92	1.60	8.80	-47.72
1.5635603	-41.99	1000	Peak	Horizontal	-50.61	1.62	8.84	-43.39
1.5698740	-45.71	1000	Peak	Horizontal	-54.24	1.62	8.80	-47.06
1.5722235	-39.94	1000	Peak	Horizontal	-48.46	1.62	8.84	-41.24
1.5734101	-47.78	1000	Peak	Horizontal	-56.23	1.66	8.81	-49.08

No discrete emissions of less than 700 Hz bandwidth were found.

2. CHANNEL: HIGHEST.

Frequency range 30 MHz – 8 GHz (except range 1559 MHz-1610 GHz).

All peaks found are more than 30 dB below the limit.

Frequency range 1559 MHz-1610 GHz.

Substitution method data

Frequency (GHz)	Instrument reading (dBm)	RBW (kHz)	Detector	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain G_i (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1.5839841	-48.35	1000	Peak	Vertical	-56.78	1.64	8.87	-49.55
1.5851962	-48.30	1000	Peak	Vertical	-56.63	1.67	8.90	-49.40
1.5889923	-46.47	1000	Peak	Horizontal	-54.88	1.69	8.92	-47.65
1.5920302	-45.82	1000	Peak	Vertical	-54.22	1.71	8.91	-47.02
1.5933987	-44.95	1000	Peak	Vertical	-53.34	1.72	8.91	-46.15
1.5943371	-46.74	1000	Peak	Horizontal	-55.14	1.72	8.92	-47.94

No discrete emissions of less than 700 Hz bandwidth were found.

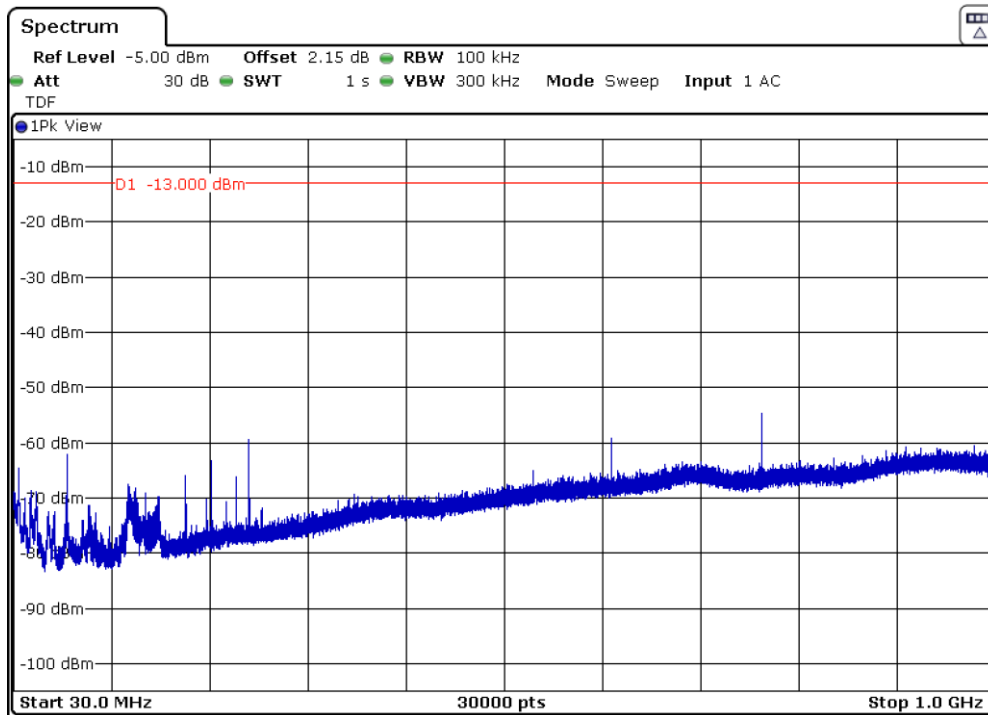
Measurement uncertainty (dB)	<±3.88 for $f < 1$ GHz <±4.87 for $f \geq 1$ GHz up to 18 GHz
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Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

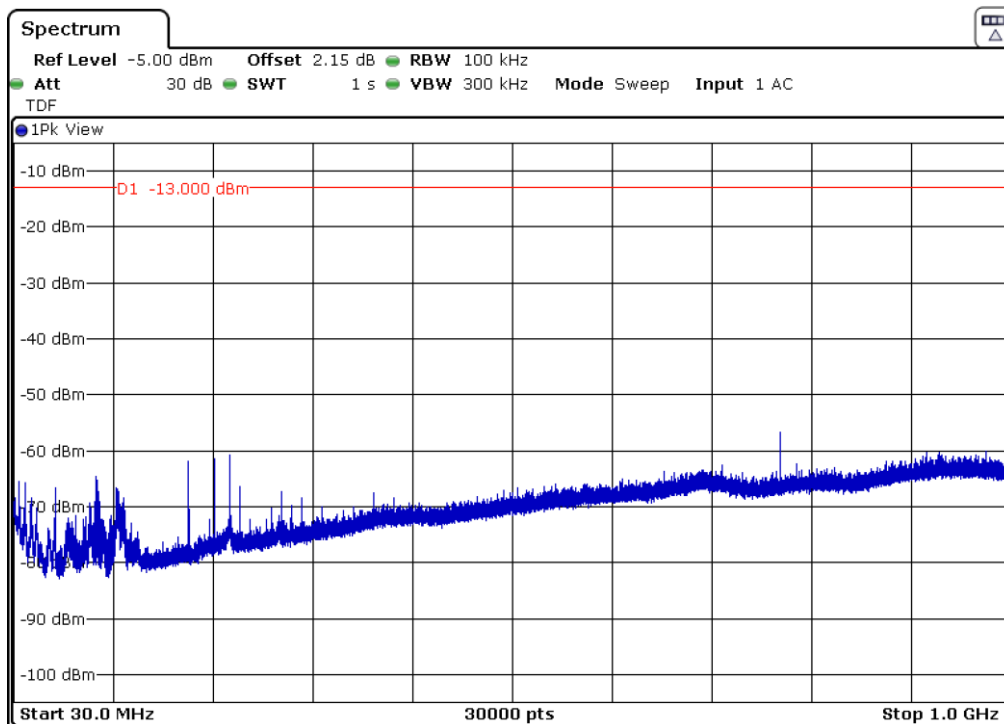
I. FCC 90 769-775 MHz band.

CHANNEL: LOWEST.



Note: The carrier is attenuated with a notch filter.

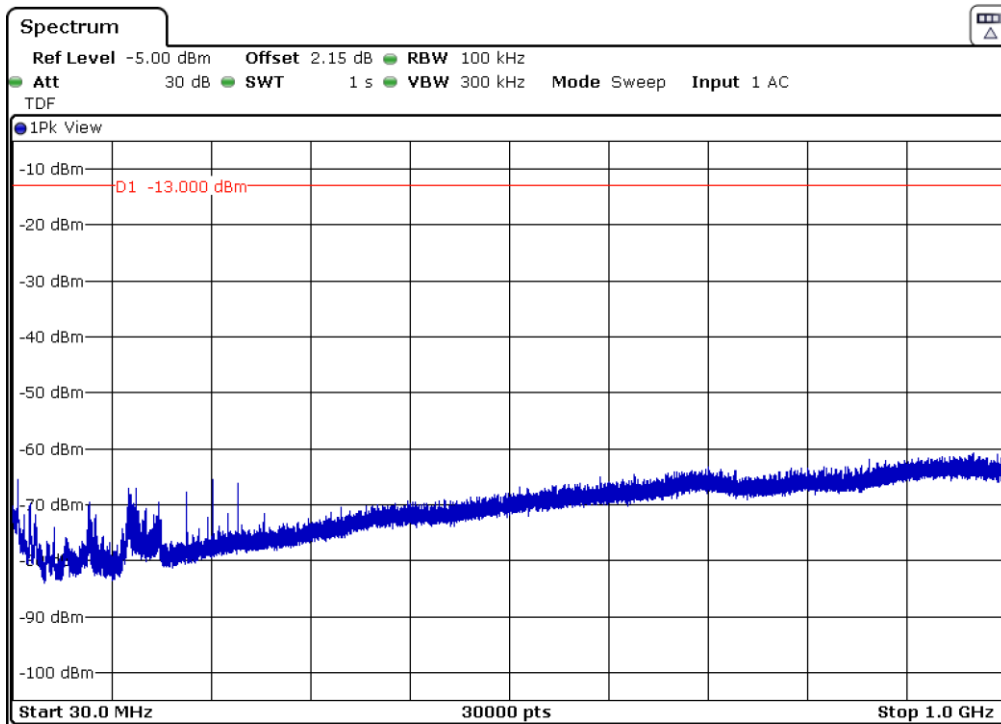
CHANNEL: HIGHEST.



Note: The carrier is attenuated with a notch filter.

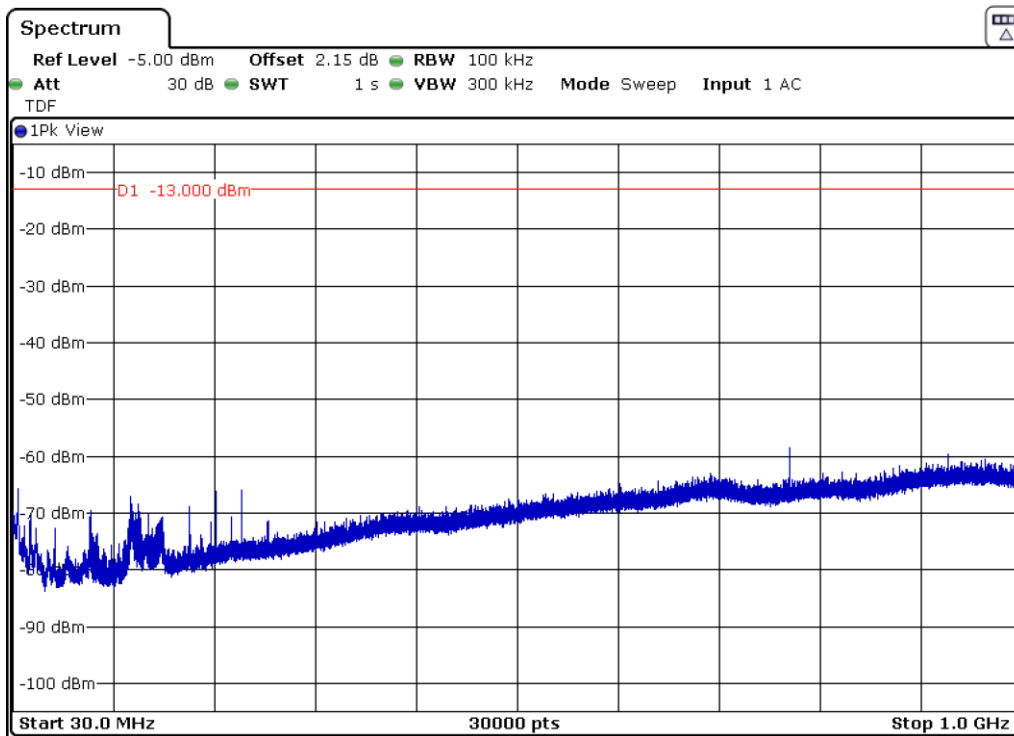
II. RSS-119 768-776 MHz band.

CHANNEL: LOWEST.



Note: The carrier is attenuated with a notch filter.

CHANNEL: HIGHEST.

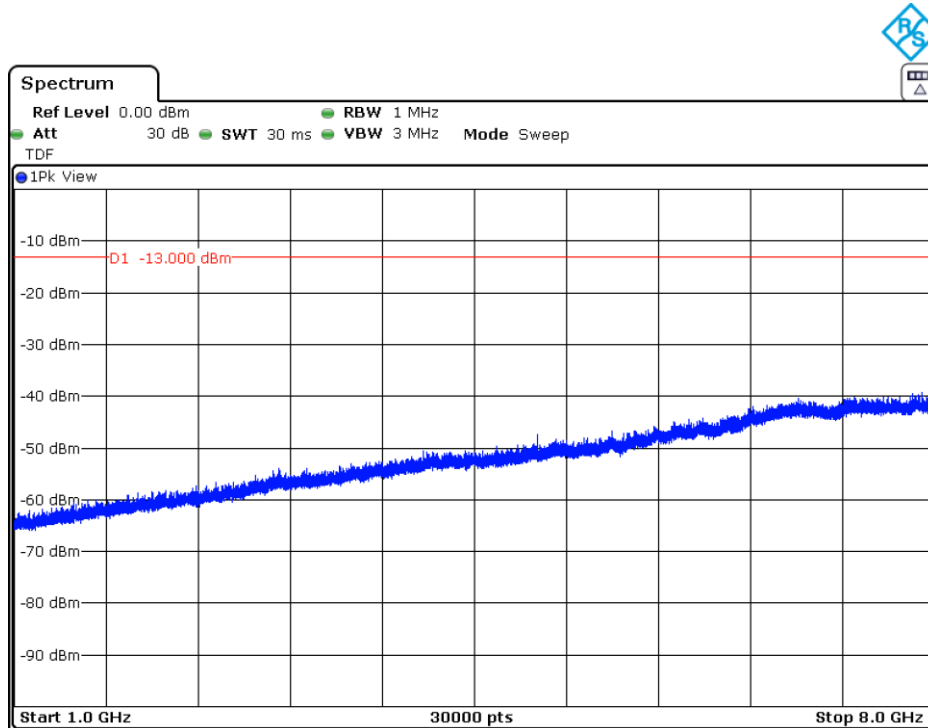


Note: The carrier is attenuated with a notch filter.

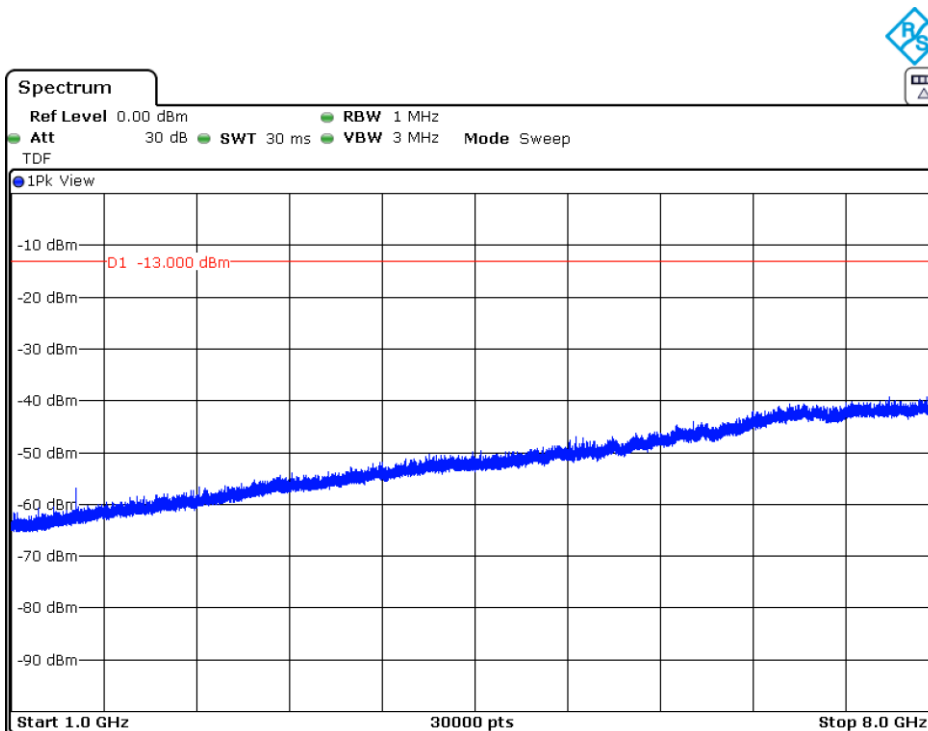
FREQUENCY RANGE 1 GHz to 8 GHz.

I. FCC 90. 769-775 MHz band.

CHANNEL: LOWEST.

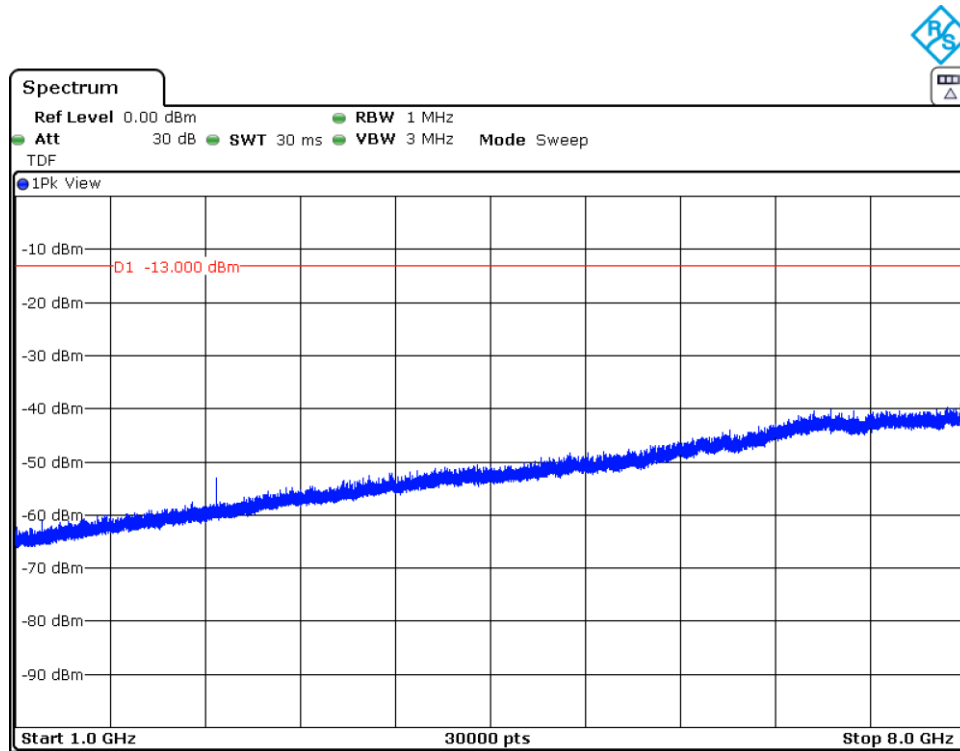


CHANNEL: HIGHEST.

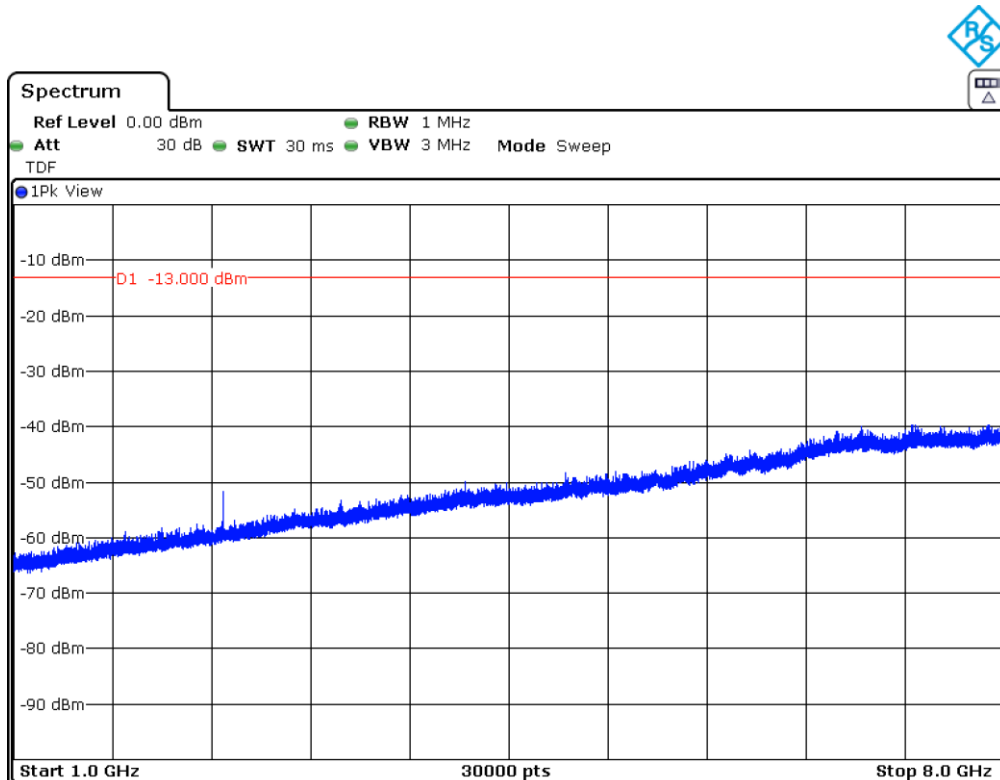


II. RSS-119. 768-776 MHz band.

CHANNEL: LOWEST.



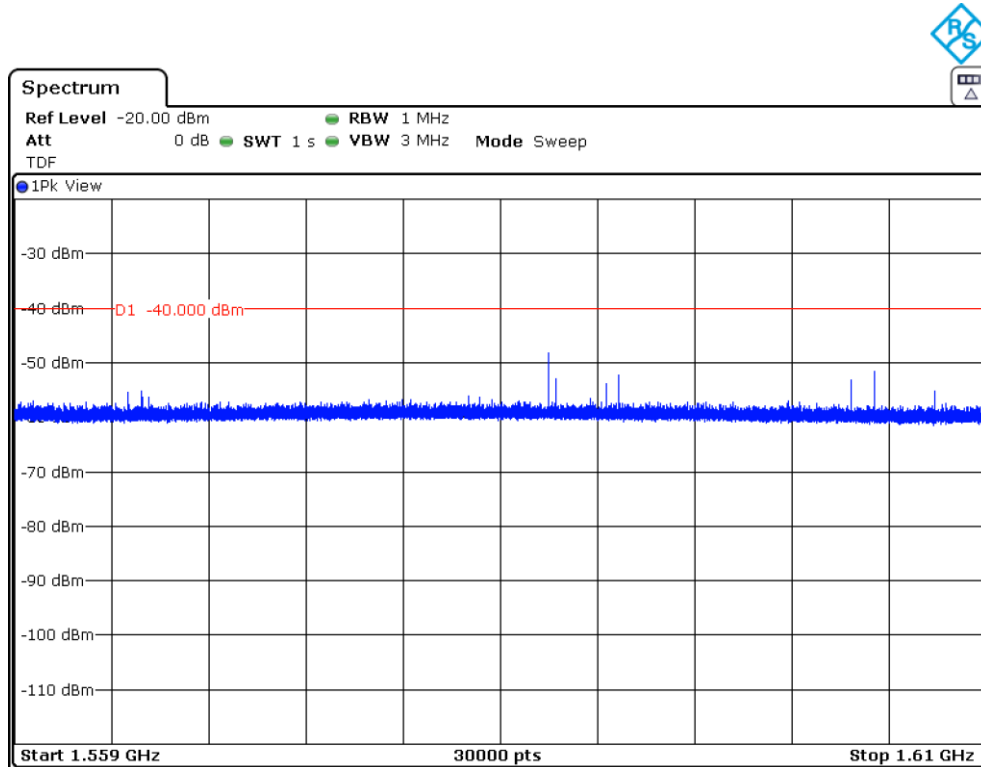
CHANNEL: HIGHEST.



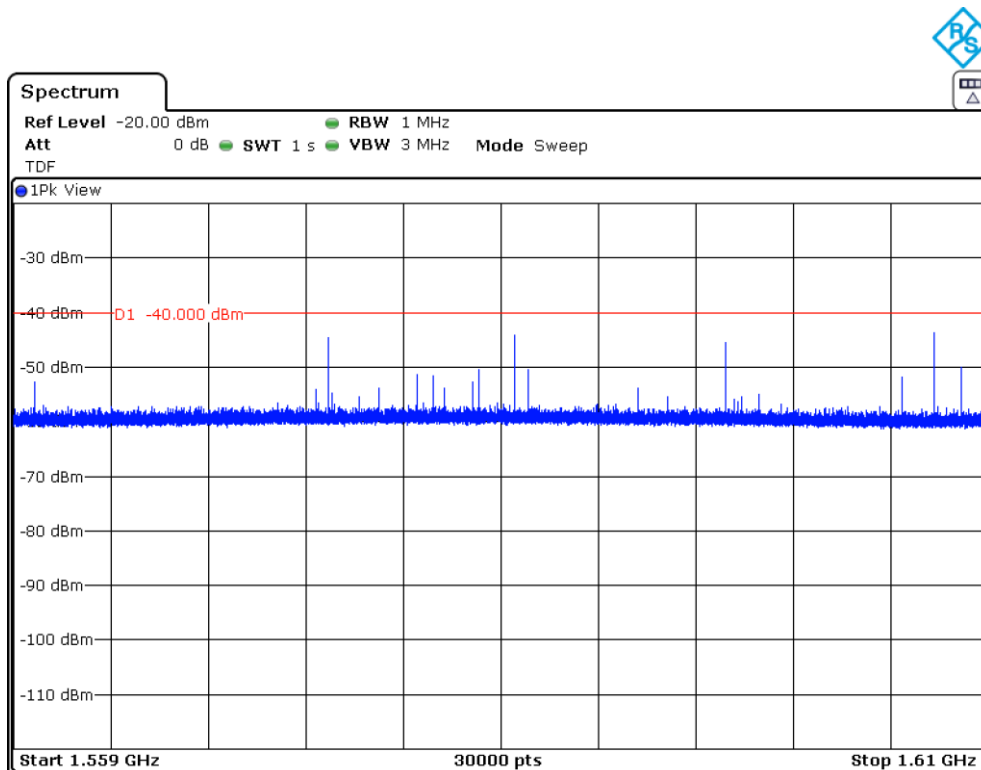
FREQUENCY RANGE 1559 MHz to 1610 MHz.

I. FCC 90. 769-775 MHz band.

CHANNEL: LOWEST.

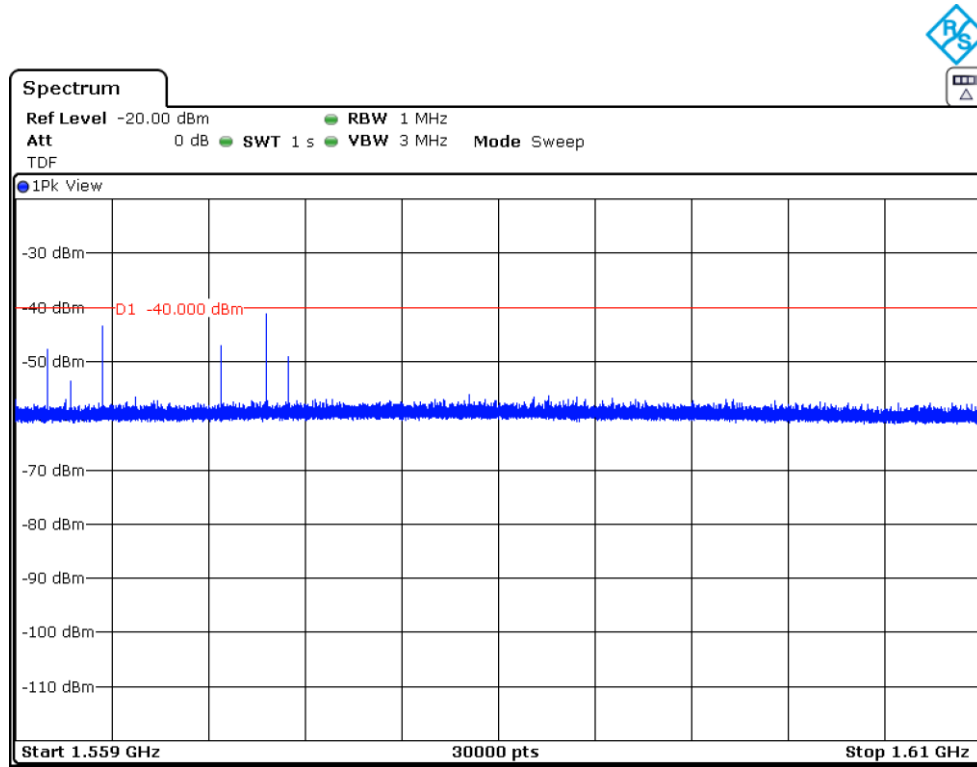


CHANNEL: HIGHEST.



II. RSS-119. 768-776 MHz band.

CHANNEL: LOWEST.



CHANNEL: HIGHEST.

