TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 90
RSS-131 ISSUE 3, January 2017,Updated May 2017
RSS-Gen, Issue 5, April 2018

TEST REPORT

For

Hytera Communications Corporation Limited

Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, 518057
China

FCC ID: YAMDS-9300
IC: 8913A-DS9300

Report Type:	**Product Type:**
Original Report	Digital Repeater

Report Number:	RDG181009004-00A
Report Date:	2019-05-31
Reviewed By:	Jerry Zhang EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	Digital Repeater
EUT Model:	DS-9300
Equipment Type:	Class A PLMR Booster(B9A)
Operation Frequency:	Uplink: 450-460MHz(TX), Downlink: 460-470MHz(RX)
Rated Maximum Output Power: (Conducted)	1W
Rated Input Voltage:	AC 120V
External Dimension:	385 mm(L)* 300mm(W)* 142mm(H)
Serial Number:	181009004-1(450-455 MHz) 181009004-2(455-460 MHz)
EUT Received Date:	2019-03-12

Note: the two sample was only difference with passive duplexer, which have difference pass band.

Objective

This test report is prepared on behalf of *Hytera Communications Corporation Limited* in accordance with Part 2, and Part 90 of the Federal Communication Commissions rules and RSS-131 Issue 3, January 2017,Updated May 2017, RSS-Gen Issue 5, April 2018 of the Innovation, Science and Economic Development Canada.

Related Submittal(s)/Grant(s)

Part of system submittal with FCC ID: YAMDS-9300-R.
Part of system submittal with IC: 8913A-DS9300R.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as Part 90.219 – Use of signal boosters, and KDB 935210 D05 Indus Booster Basic Meas v01r03 Measurement Guidance for Industrial and Non-consumer Signal Booster, Repeater, and Amplifier Devices.

And RSS-131 Issue 3, January 2017,Updated May 2017, RSS-Gen Issue 5, April 2018 of the Innovation, Science and Economic Development Canada.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	uncertainty
Occupied Channel Bandwidth	±5%
Input/output power and amplifier gain	±1.5dB
Unwanted Emission, conducted	±1.5dB
Radiated Emissions Below 1GHz	±4.70dB
Radiated Emissions Above 1GHz	±4.80dB
Internodulation	±1.5dB
Noise Figure Measurements	±1.5dB
Temperature	±1℃
Supply voltages	±0.4%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a test mode which has been done in the factory.

EUT Exercise Software

No exercise software was used.

Special Accessories

No special accessory was used.

Equipment Modifications

No modification was made to the EUT tested.

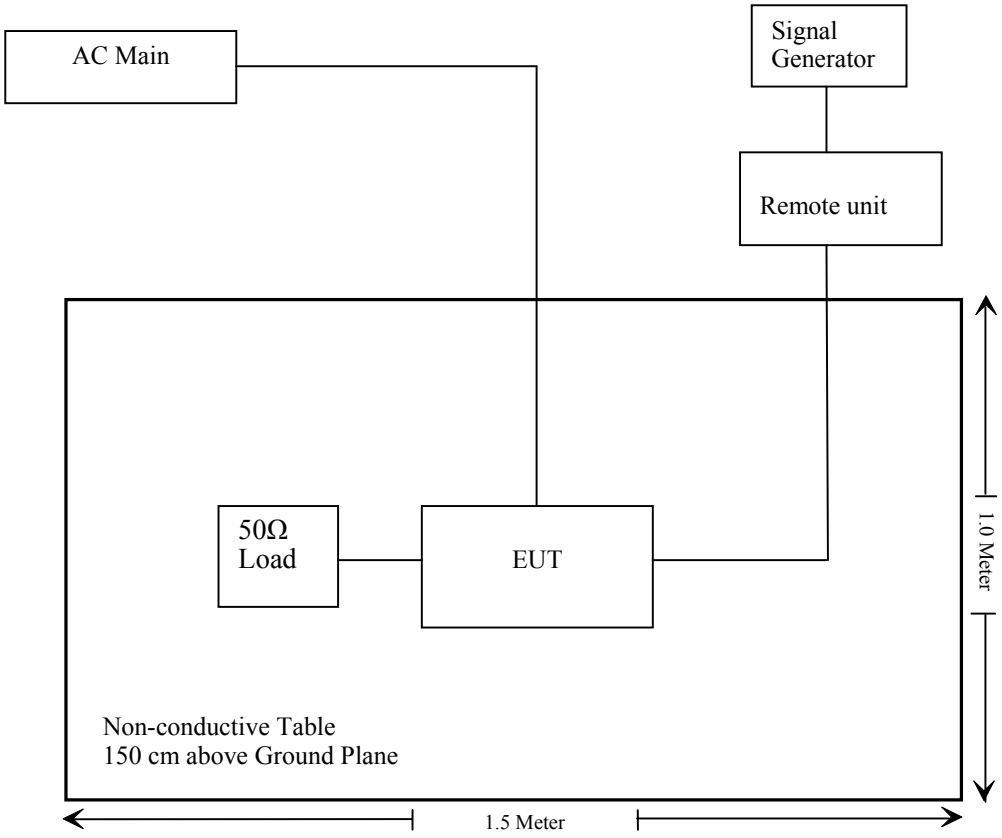
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Hytera	Remote Unit	DS-9300-R	181009005
Unknown	Load	Unknown	Unknown
Agilent	MXG Vector Signal Generator	N5182B	MY51350142

External I/O Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Coaxial Cable	Yes	No	0.5	EUT	Load
Optical Fiber	No	No	3.0	Remote unit	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1307 (b)(1), §2.1091 RSS-102 Clause 4	Maximum Permissible Exposure (MPE)	Compliance
§90.219 (e)(1)& RSS-131 Clause 6.2	Input/output power and amplifier gain	Compliance
§90.219 (e)(4)(ii) RSS-Gen Clause 6.7	Input-versus-output signal comparison: Occupied Bandwidth	Compliance
§90.219 (e)(4)(iii), §90.210 & §90.221 RSS-131 Clause 6.6	Emission Mask & Adjacent channel power limits	Compliance
§90.219 (d)(6) RSS-131 Clause 6.3	Intermodulation	Compliance
§90.219 (e)(3) RSS-131 Clause 6.5	Spurious emissions at antenna terminals	Compliance
§90.219 (e)(3) RSS-131 Clause 6.5	Radiated spurious emission	Compliance
§90.219 (e)(2) RSS-131 Clause 6.4	Noise Figure Measurements	Compliance
§90.219	Out-of-band Rejection	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI Test Receiver	ESCI	100224	2018-12-11	2019-12-11
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2018-09-05	2019-09-05
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05
Agilent	MXG Vector Signal Generator	N5182B	MY51350142	2018-05-04	2019-05-04
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-01-04	2021-01-04
ETS-Lindgren	Horn Antenna	3115	000 527 35	2019-01-05	2021-01-04
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2018-09-05	2019-09-05
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2018-09-05	2019-09-05
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2018-09-05	2019-09-05
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2018-08-03	2019-08-03
Agilent	MXG Vector Signal Generator	N5182B	MY51350142	2018-07-19	2019-07-19
Agilent	Signal Generator	E8247C	MY43321350	2018-12-10	2019-12-10
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41005012	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	
E-Microwave	Coaxial Attenuators	EMCA40-200SN-6	OE01201046	2018-09-06	2019-09-06

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§1.1307 (b)(1) & §2.1091& RSS-102 CLAUSE 4- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247(i)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

According to RSS-102 § 4Table 4, RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	**Electric Field (V/m rms)**	**Magnetic Field (A/m rms)**	**Power Density (W/m^2)**	**Reference Period (minutes)**
$0.003\text{-}10^{21}$	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Calculated formulary:

Prediction of power density at the distance of the applicable MPE limit
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Result:

Frequency (MHz)	Antenna Gain		Max. Target Power including Tolerance		Evaluation Distance (cm)	FCC Power Density (mW/cm^2)	ISEDC Power Density (W/m^2)	FCC MPE Limit (mW/cm^2)	ISEDC MPE Limit (W/m^2)
	(dBi)	(numeric)	(dBm)	(mW)					
450-460	9	7.94	30	1000	65.00	0.15	1.50	0.30	1.70

Result: Compliance, The device meet FCC MPE at 65 cm distance.

FCC §90.219 (e)(1) &RSS-131 CLAUSE 6.2- INPUT/OUTPUT POWER AND AMPLIFIER GAIN

Applicable Standard

FCC §2.1046 and §90.219 (e)(1)
The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel

RSS-131 Clause 6.2:

The output power of the zone enhancer shall comply with the transmitter output power of the equipment with which it is to be used (as specified in RSS-119) and shall be within ± 1.0 dB of the zone enhancer manufacturer's rated output power.

Test Procedure

Conducted RF Output Power:

The signal generator was connected to Remote unit, and RF output of the EUT was connected to the input of the spectrum analyzer through sufficient attenuation.

Spectrum Analyzer Setting:

R B/W	Video B/W
100 kHz	300 kHz

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Blake Yang on 2019-03-22.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Band (MHz)	Frequency (MHz)	AGC threshold (dBm)	Input Power (dBm)	Conducted Output Power (dBm)	Max Gain (dB)	Max Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)
450 - 455	452.124	AGC	-60.68	28.57	89.25	9	35.42	37
		AGC+3dB	-57.76	28.67	86.43	9	35.52	37
455 - 460	459.228	AGC	-61.67	29.60	91.27	9	36.45	37
		AGC+3dB	-58.74	29.66	88.40	9	36.51	37

Note 1: ERP= Measured Conducted Output Power (dBm) + Antenna Gain (dBi) - 2.15 (dB)
Note 2: the Rated Conducted output power is 29 dBm+/- 1dB

FCC §90.219 (e)(4)(ii) &RSS-GEN CLAUSE 6.6–INPUT-VERSUS-OUTPUT SIGNAL COMPARISON: OCCUPIED BANDWIDTH

Applicable Standard

According to FCC §90.219 (e)(4)(ii), There is no change in the occupied bandwidth of the retransmitted signals.

According to RSS-Gen §6.7

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the "x dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Test Procedure

Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r03 section 4.4

Test Data

Environmental Conditions

Temperature:	26~28 ℃
Relative Humidity:	56~57 %
ATM Pressure:	100.3~101.5 kPa

The testing was performed by Blake Yang on 2019-03-26 & 2019-05-30.

Test Mode: Transmitting

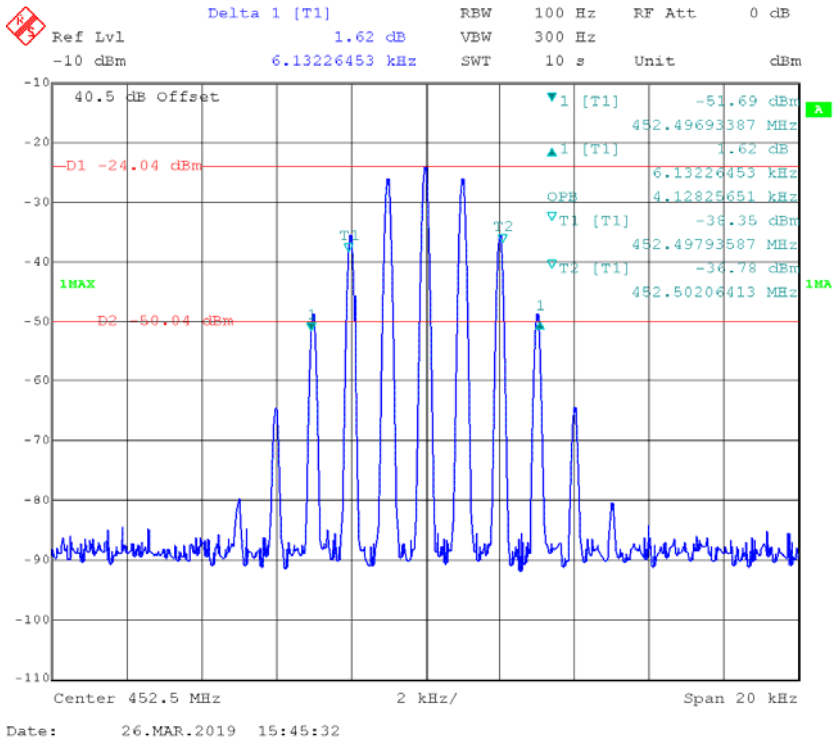
Please refer to the following tables and plots.

Signal Type	Frequency (MHz)	Input Signal Level	Input		Output	
			99% OBW (kHz)	26dB Band width (kHz)	99% OBW (kHz)	26dB Band width (kHz)
FM 6.25k	452.5	AGC	4.128	6.132	4.128	6.132
		AGC+3dB	4.128	6.092	4.128	6.132
FM 12.5k	452.5	AGC	7.876	8.267	7.876	8.267
		AGC+3dB	7.876	8.267	7.876	8.267
FM 25k	452.5	AGC	12.425	14.719	12.425	14.719
		AGC+3dB	12.425	14.719	12.425	14.719
TETRA	452.5	AGC	21.042	23.938	20.942	23.938
		AGC+3dB	21.142	23.938	20.842	23.838
4FSK	452.5	AGC	7.094	9.319	7.214	9.439
		AGC+3dB	7.335	9.259	7.275	9.198
FM 6.25k	457.5	AGC	4.128	6.132	4.128	6.132
		AGC+3dB	4.128	6.132	4.128	6.132
FM 12.5k	457.5	AGC	7.876	8.267	7.876	8.327
		AGC+3dB	7.876	8.267	7.876	8.267
FM 25k	457.5	AGC	12.425	14.719	12.425	14.780
		AGC+3dB	12.425	14.719	12.425	14.729
TETRA	457.5	AGC	21.042	23.848	21.042	23.747
		AGC+3dB	21.042	23.848	20.942	23.848
4FSK	457.5	AGC	7.515	9.679	7.335	9.259
		AGC+3dB	7.395	9.198	7.455	9.138

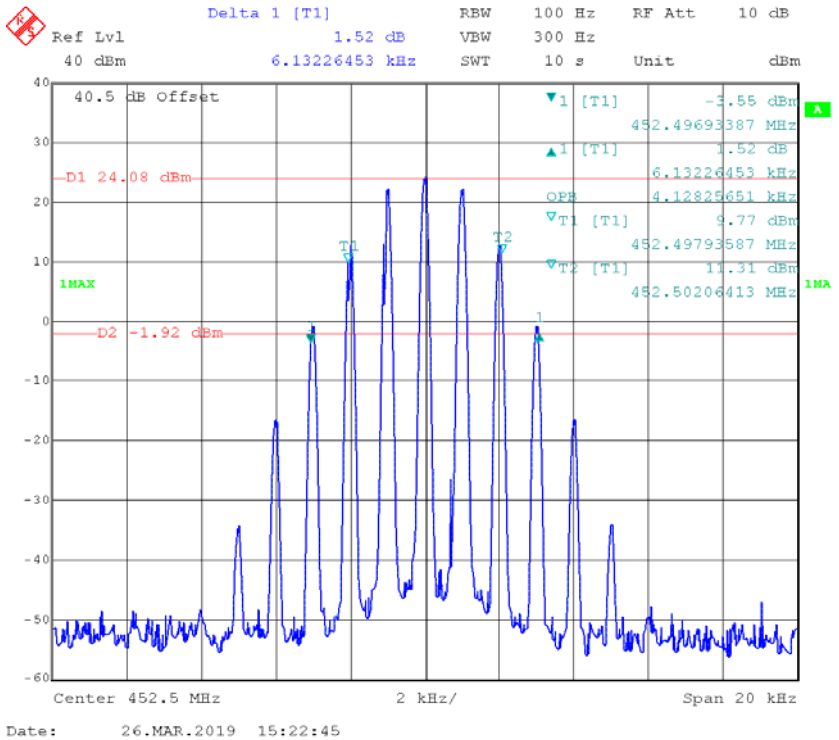
Note: Input signal level refer to the result of item: Input/output power and amplifier gain

FM 6.25K:

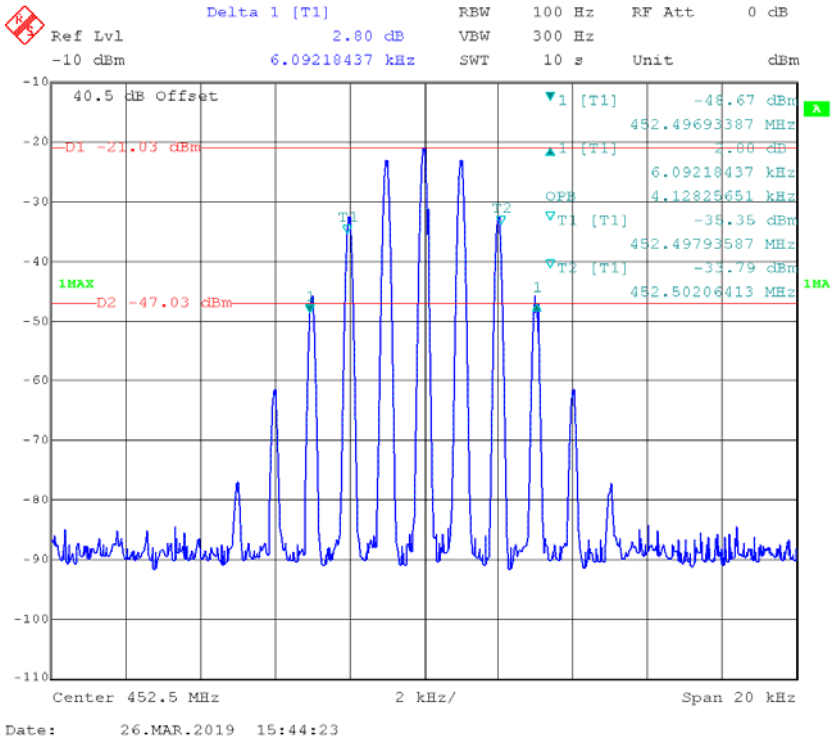
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Input



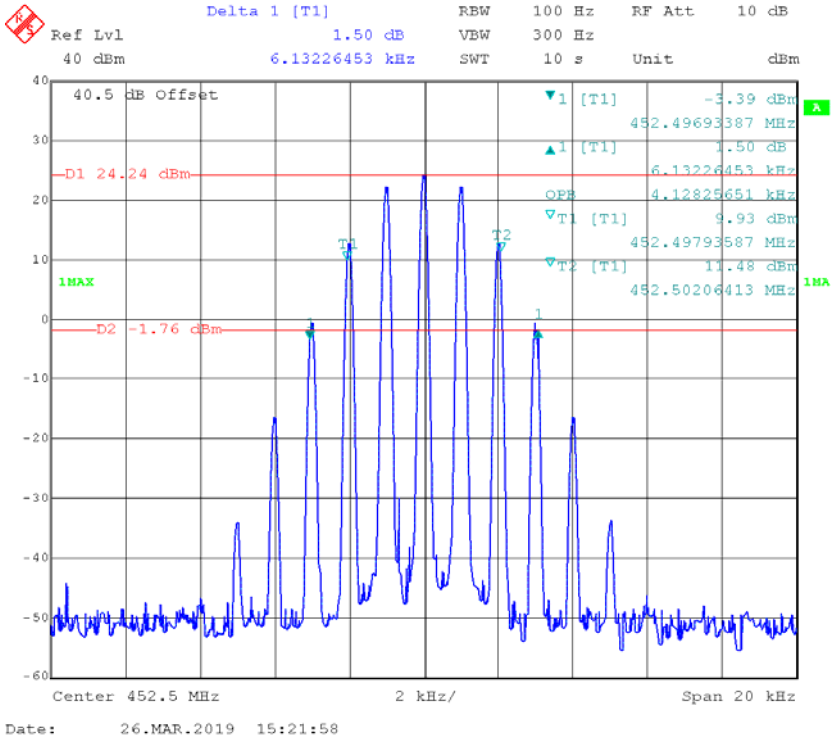
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Output



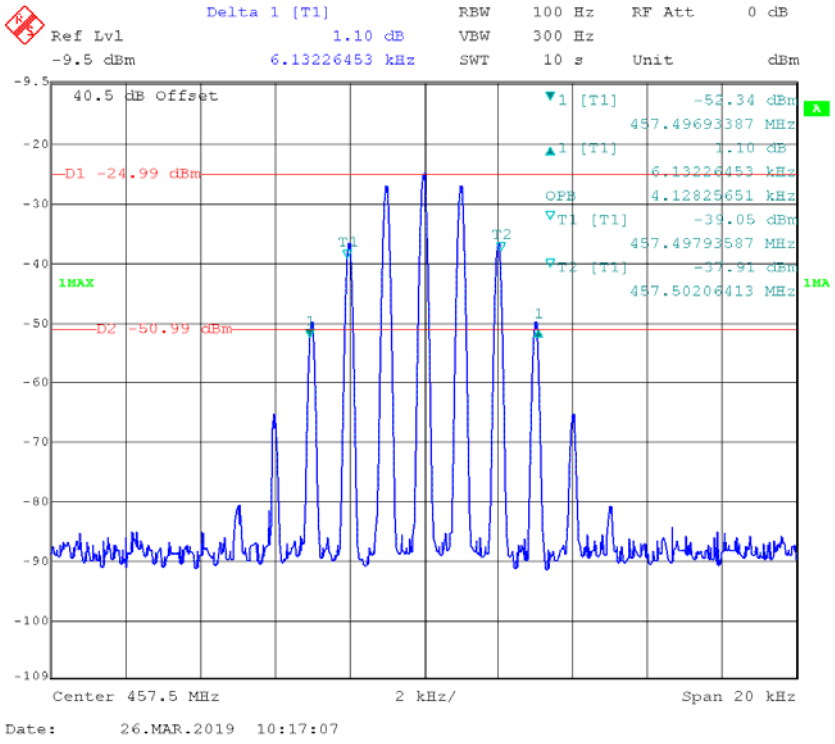
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Input



Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Output



Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Input



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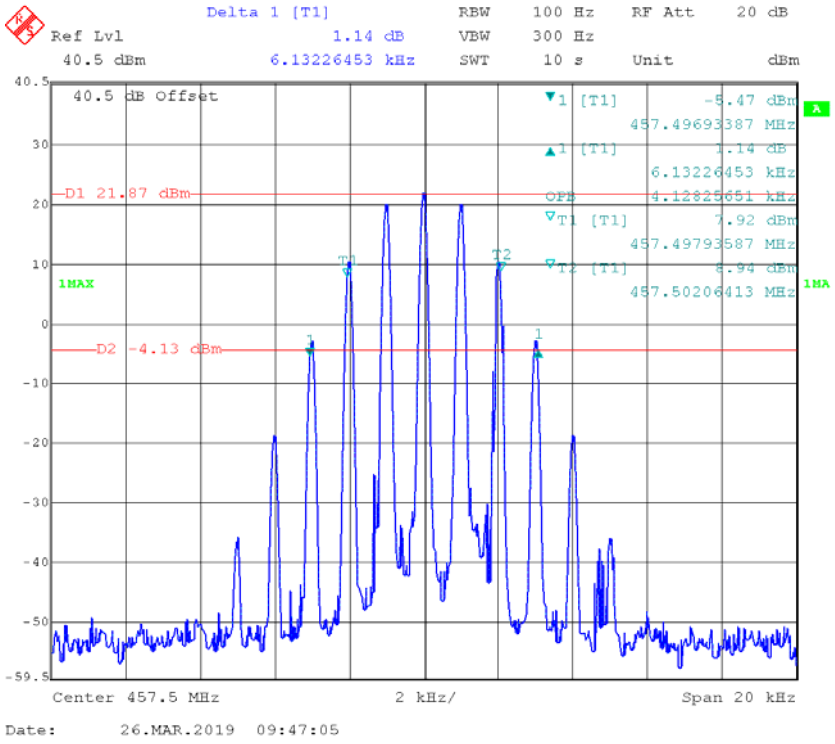

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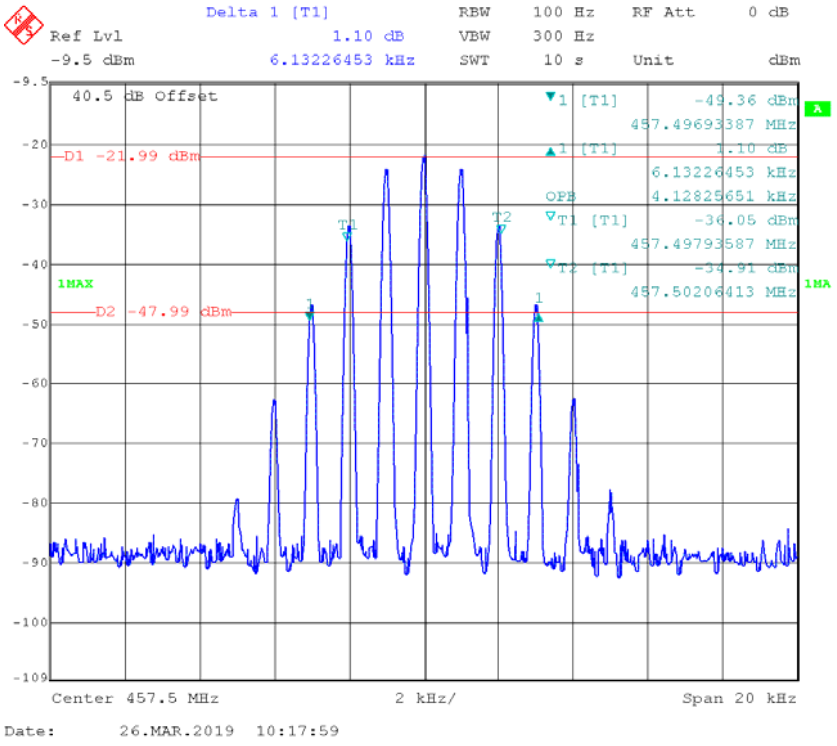
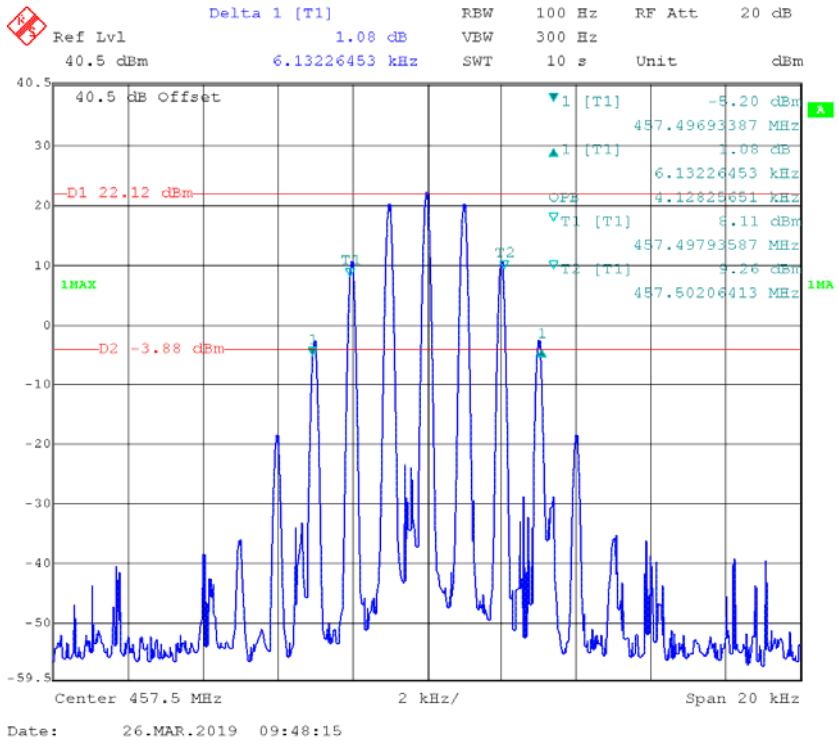
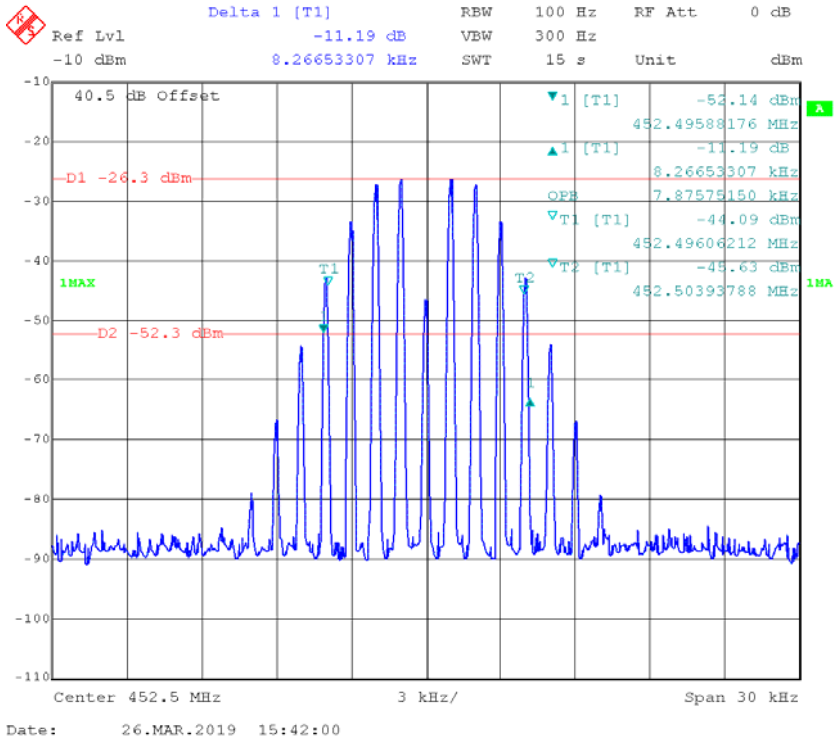


Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Output

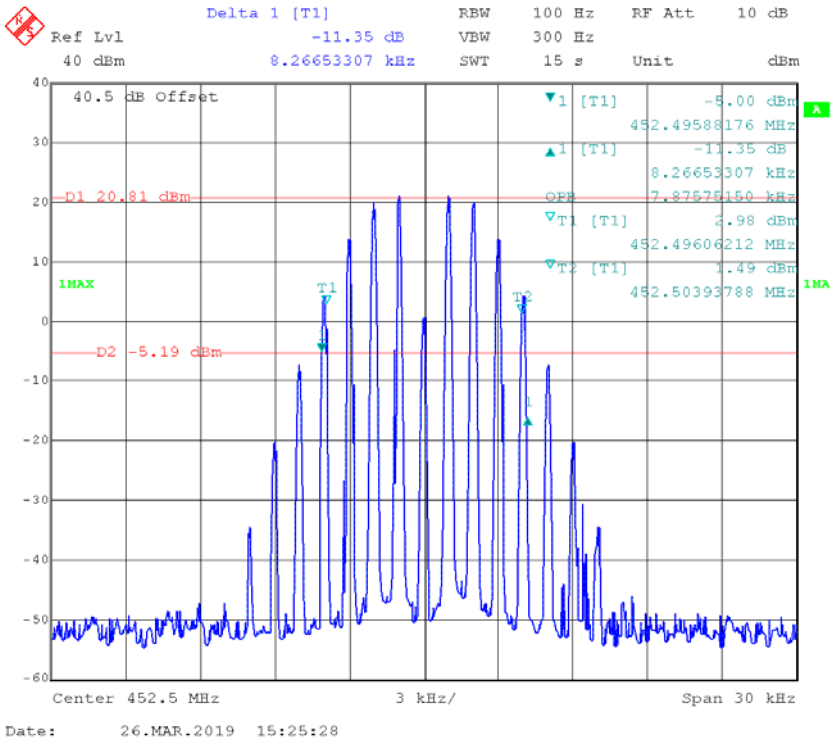


FM 12.5K:

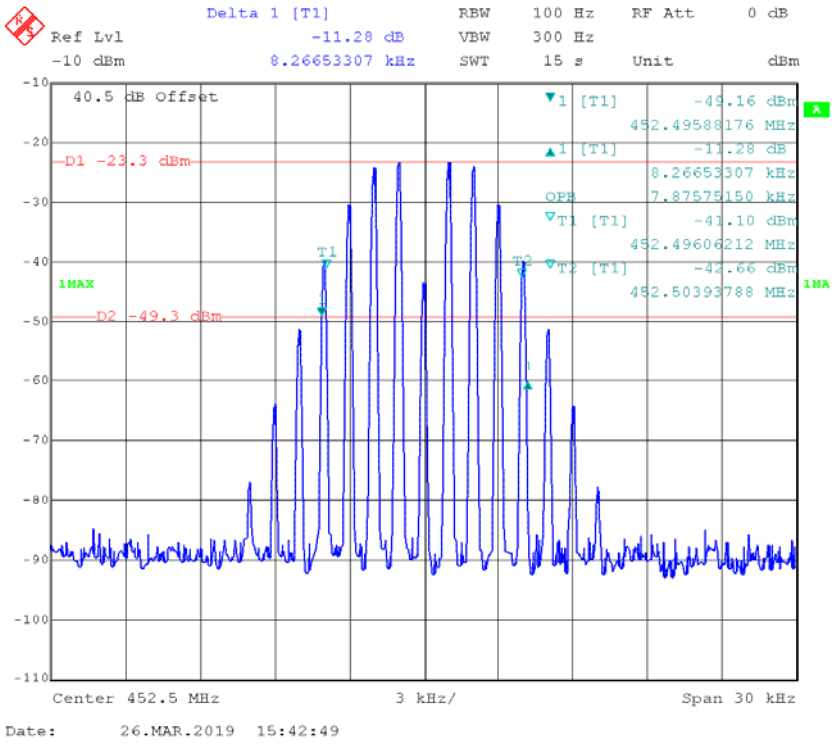
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Input



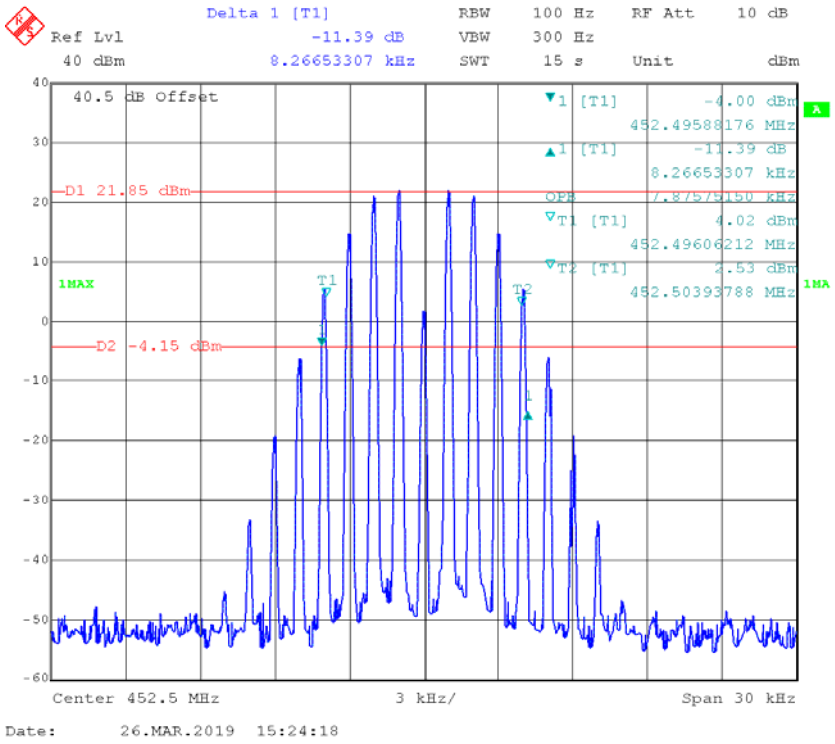
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Output



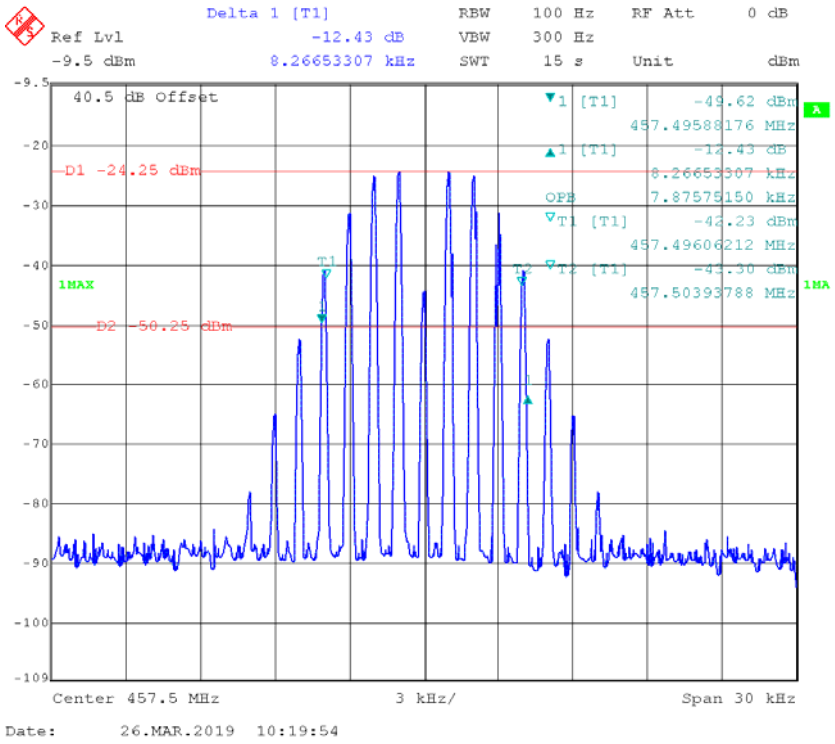
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Input



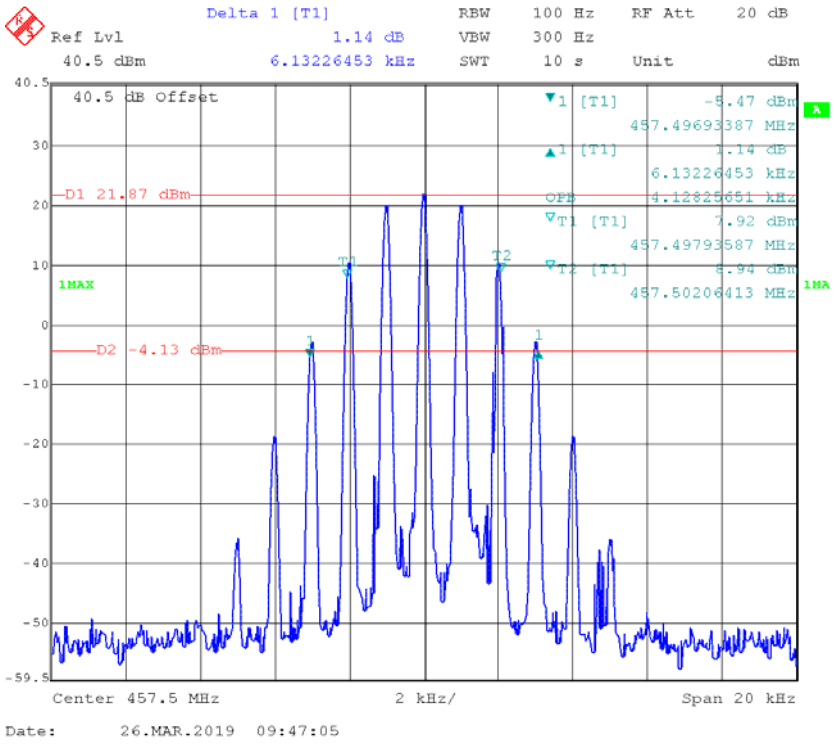
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Output



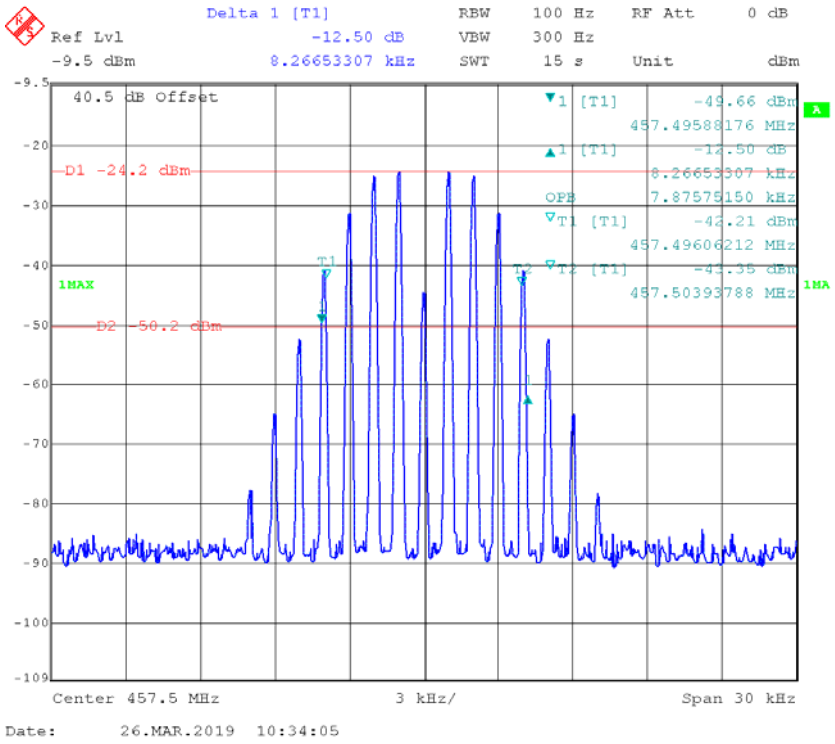
Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Input



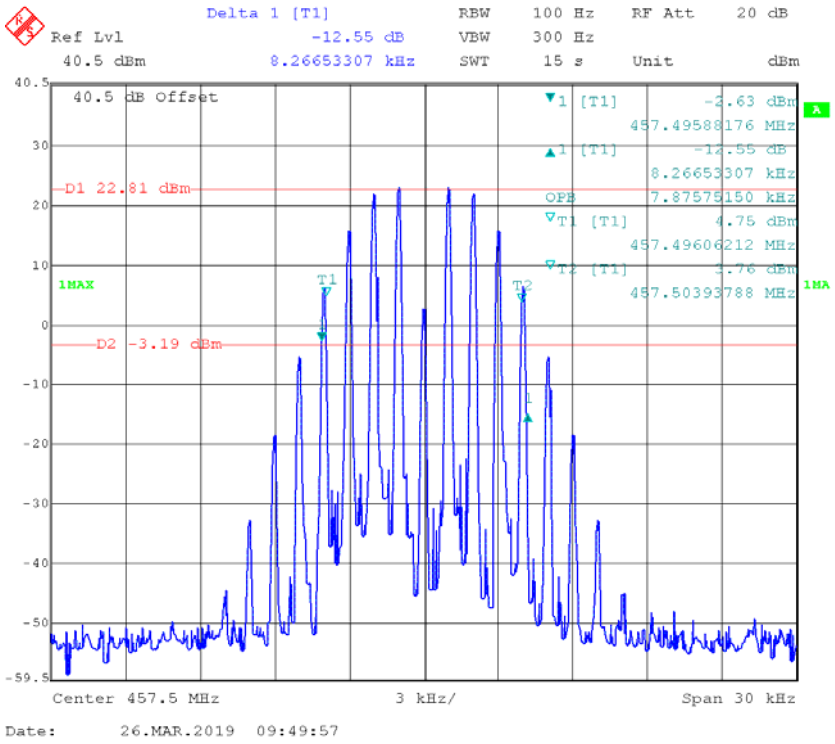
Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Output



Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Input



Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Output



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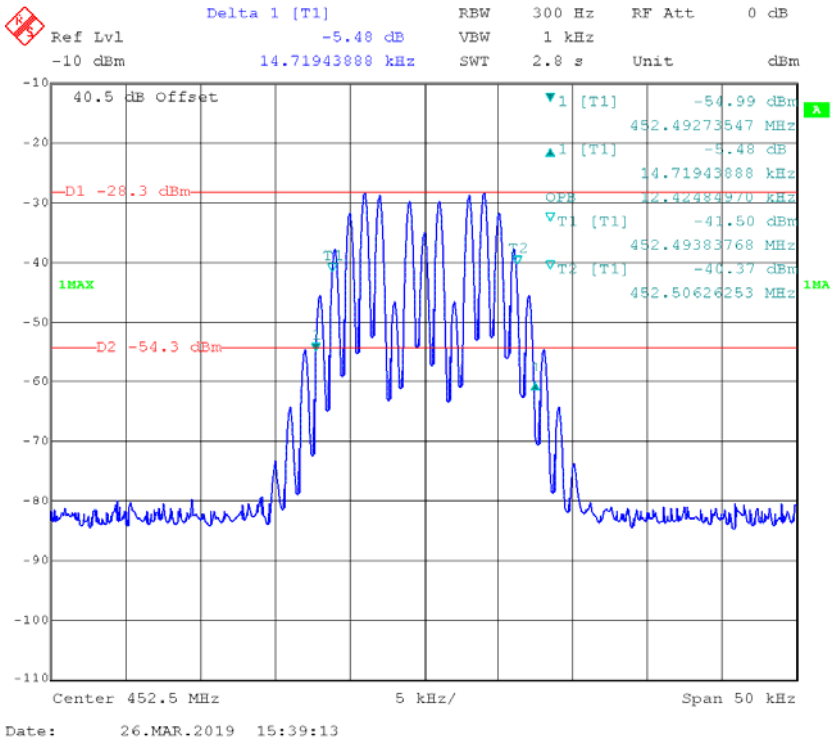
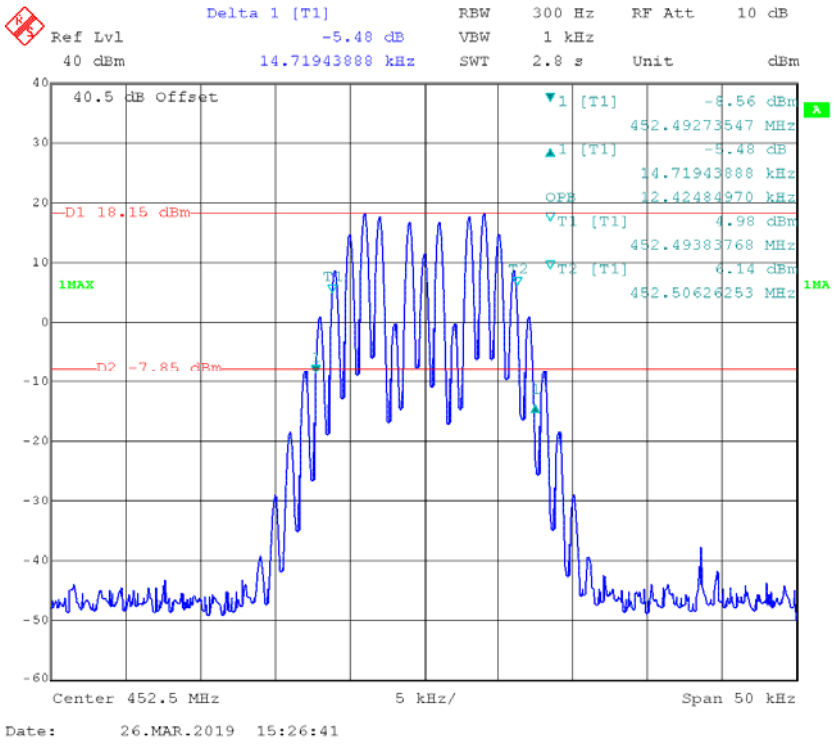
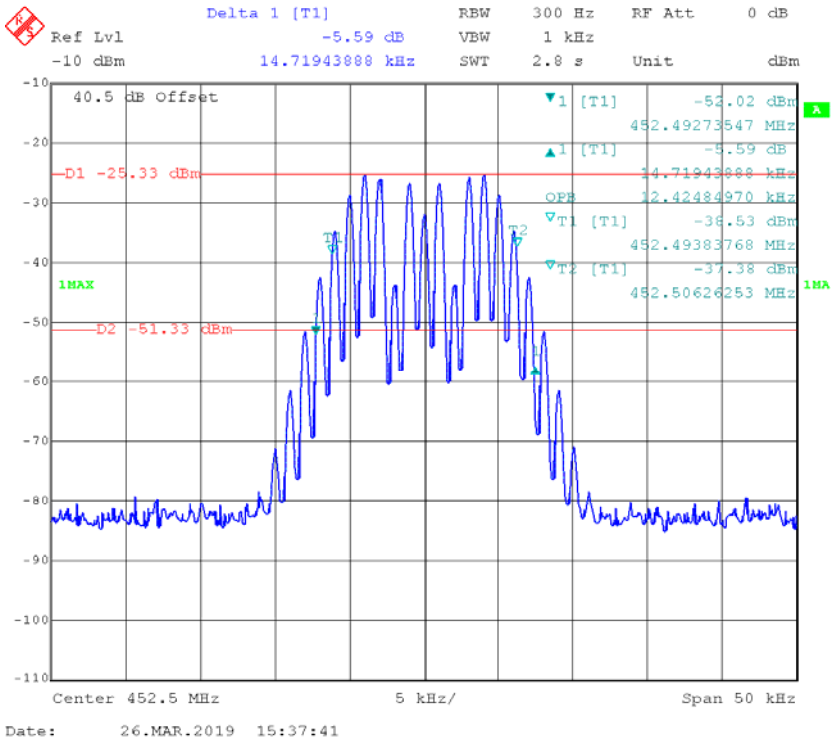
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Input



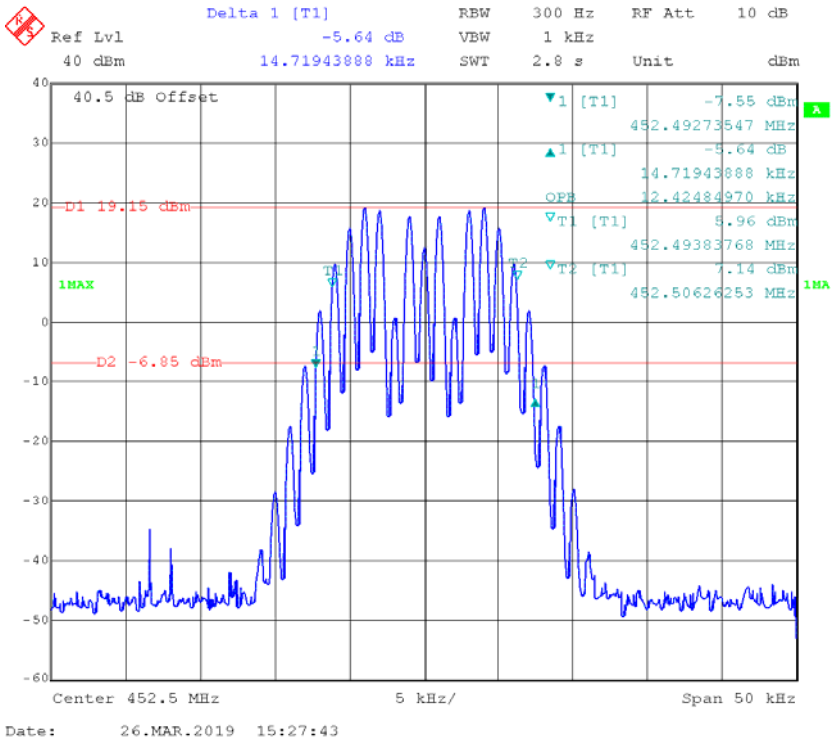
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Output



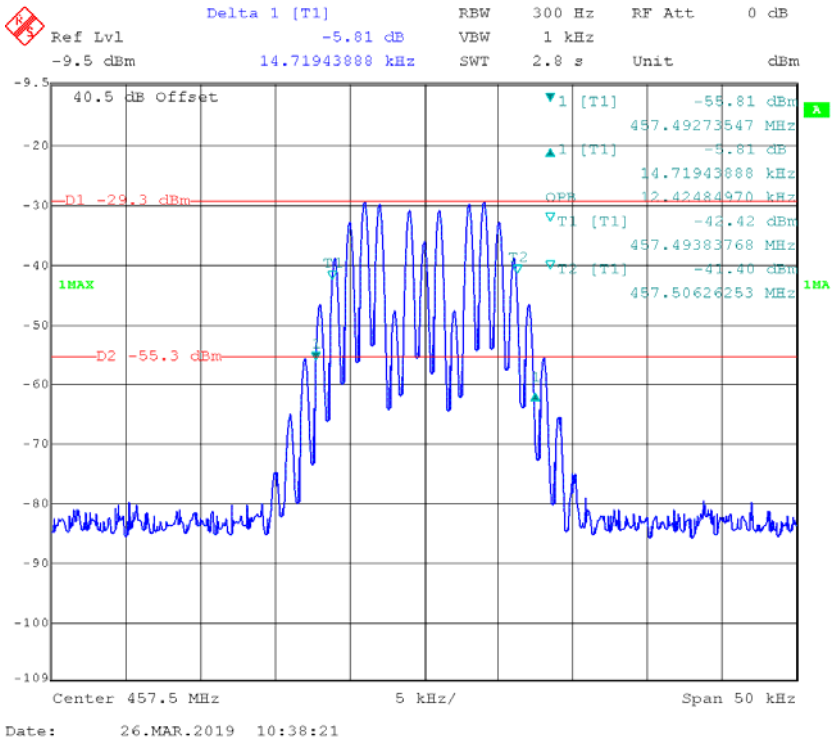
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Input



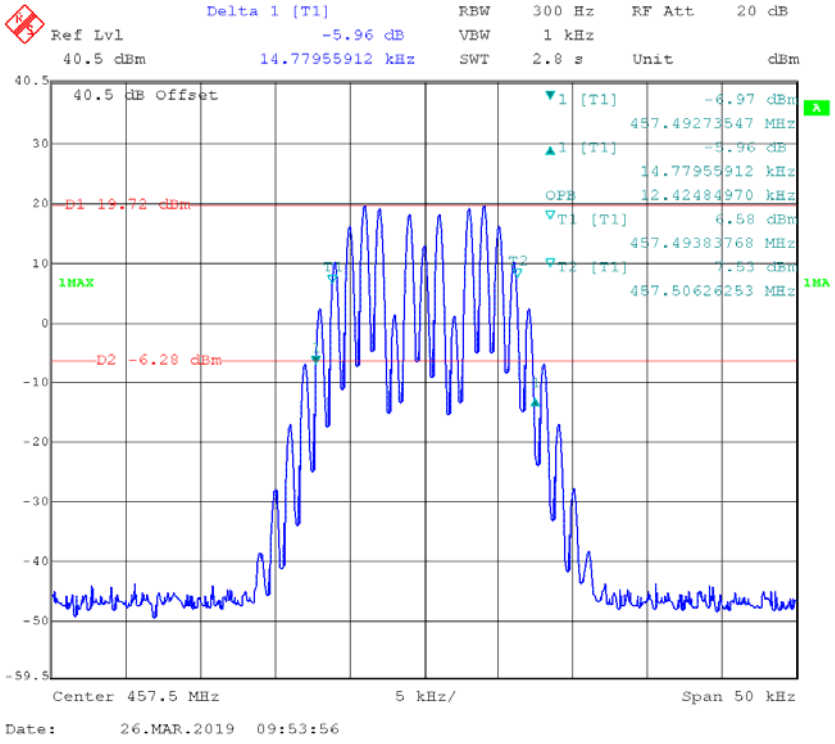
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Output



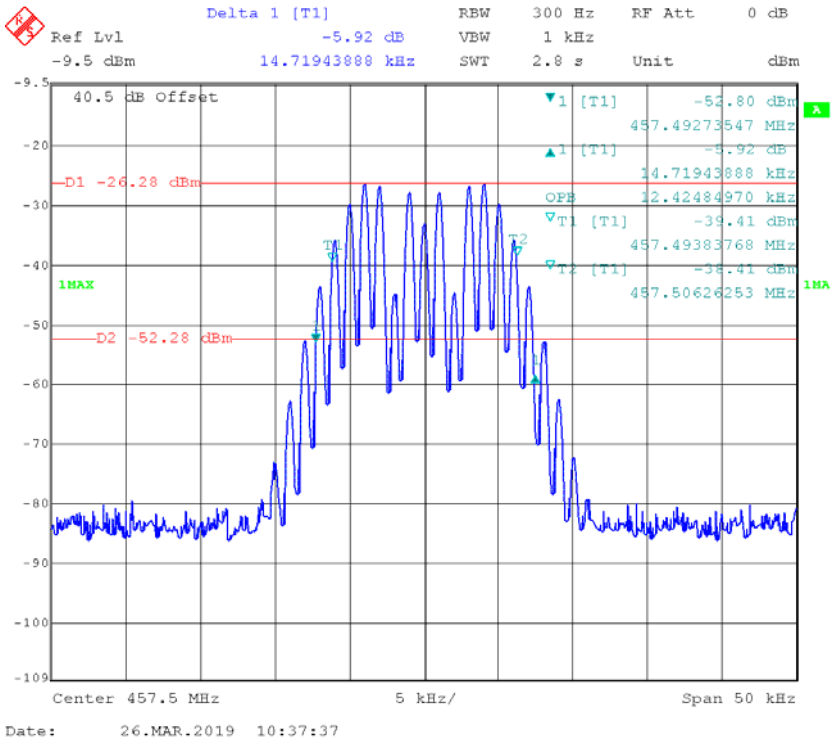
Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Input



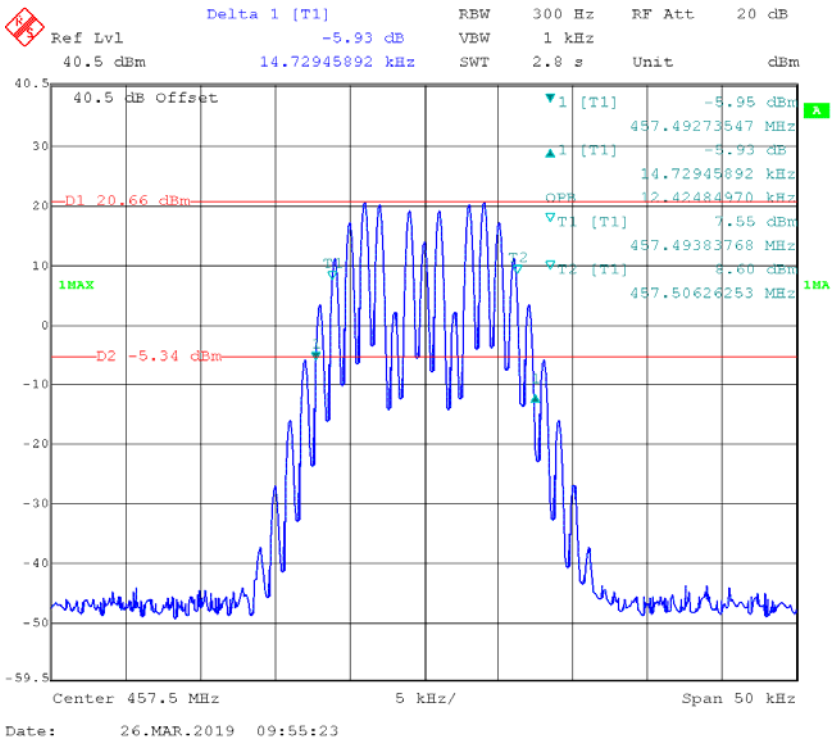
Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Output



Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Input

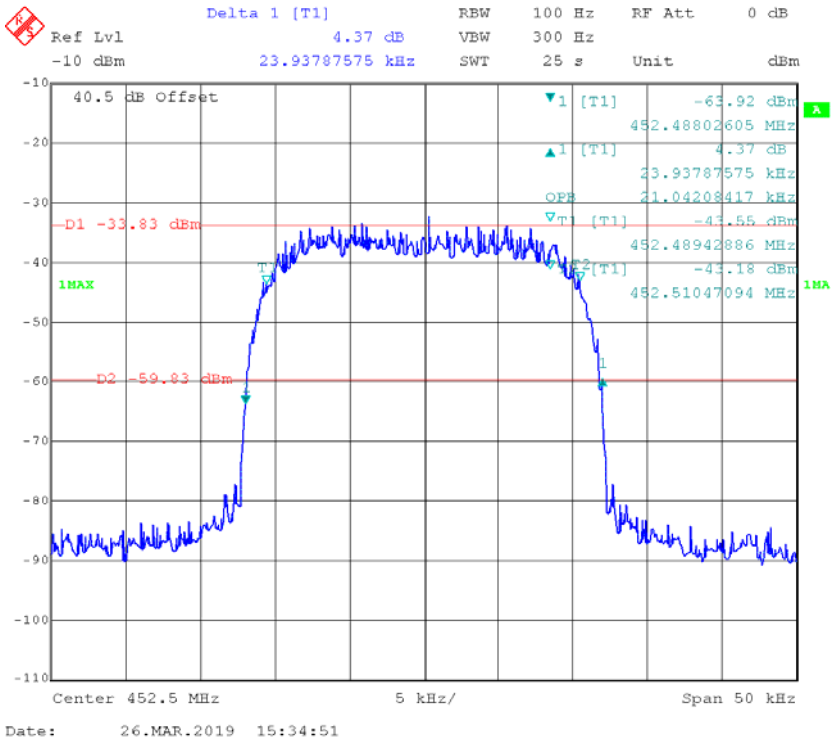


Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Output

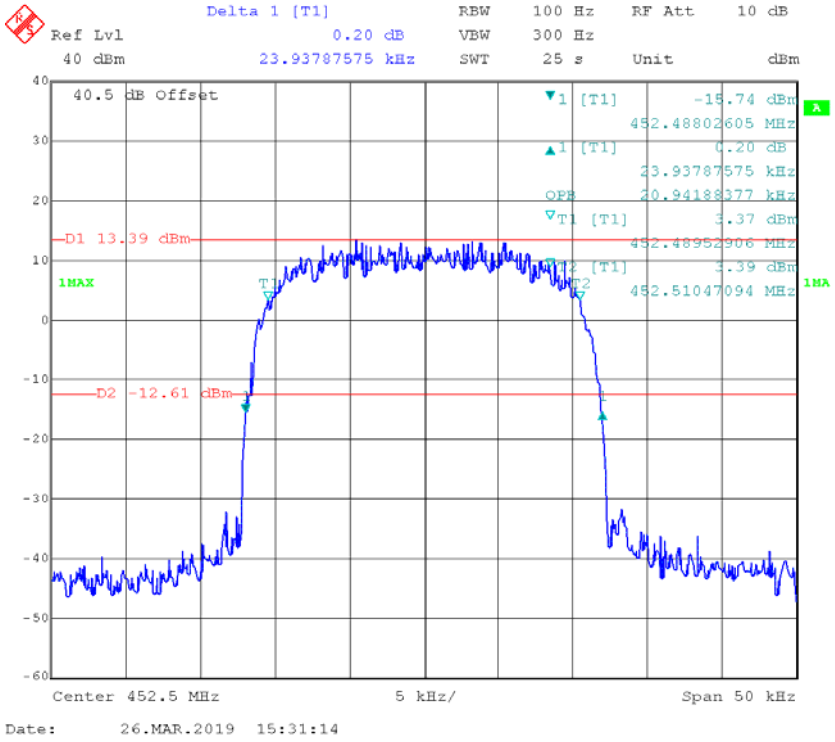


TETRA:

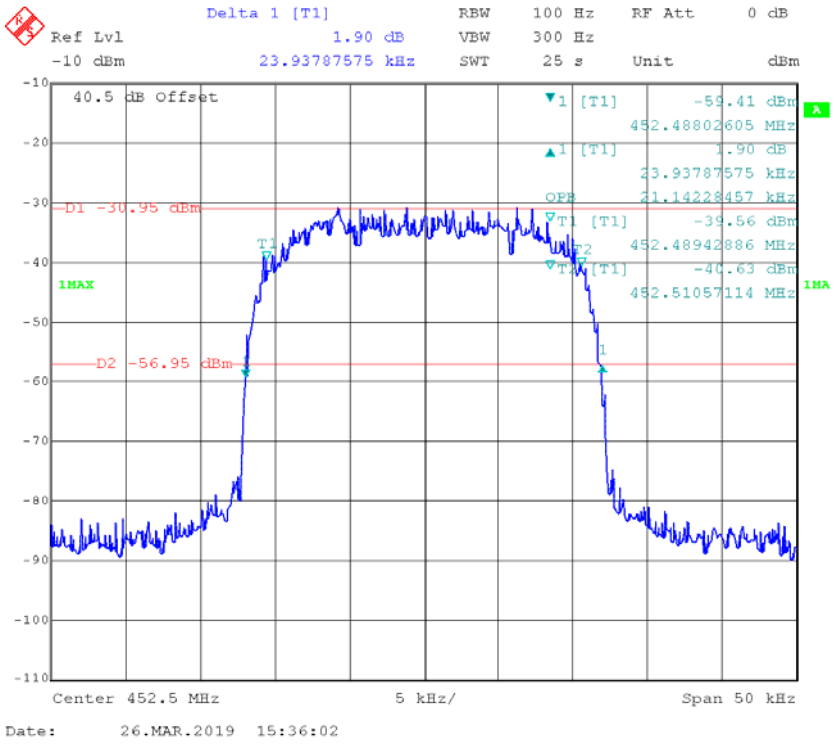
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Input



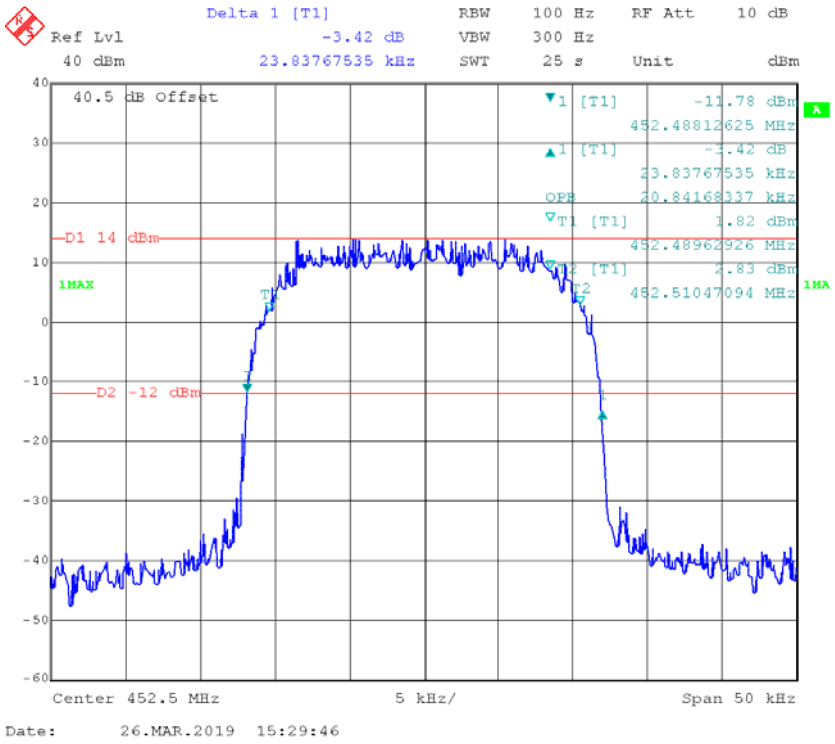
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Output



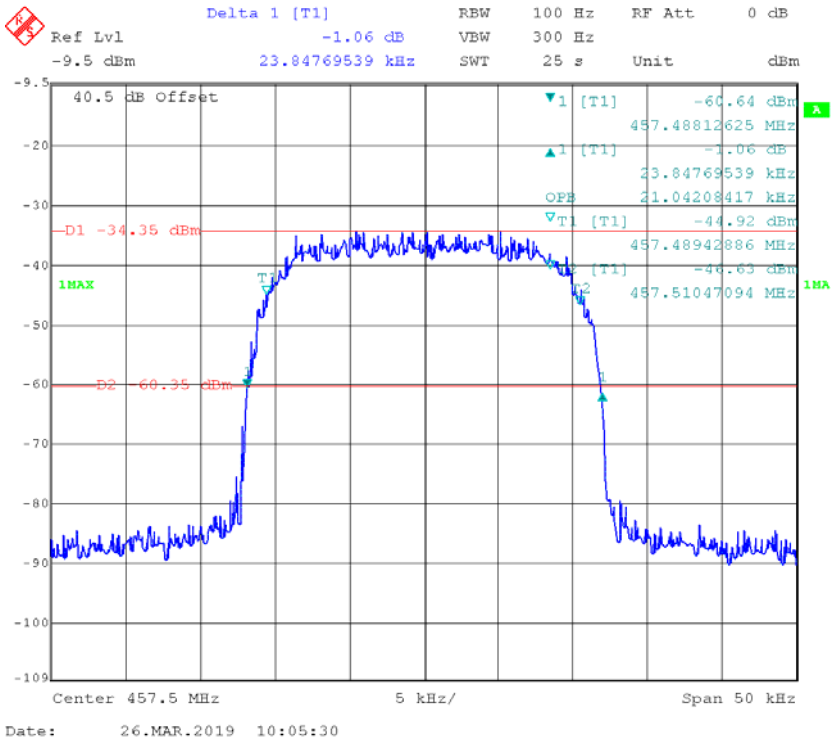
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Input



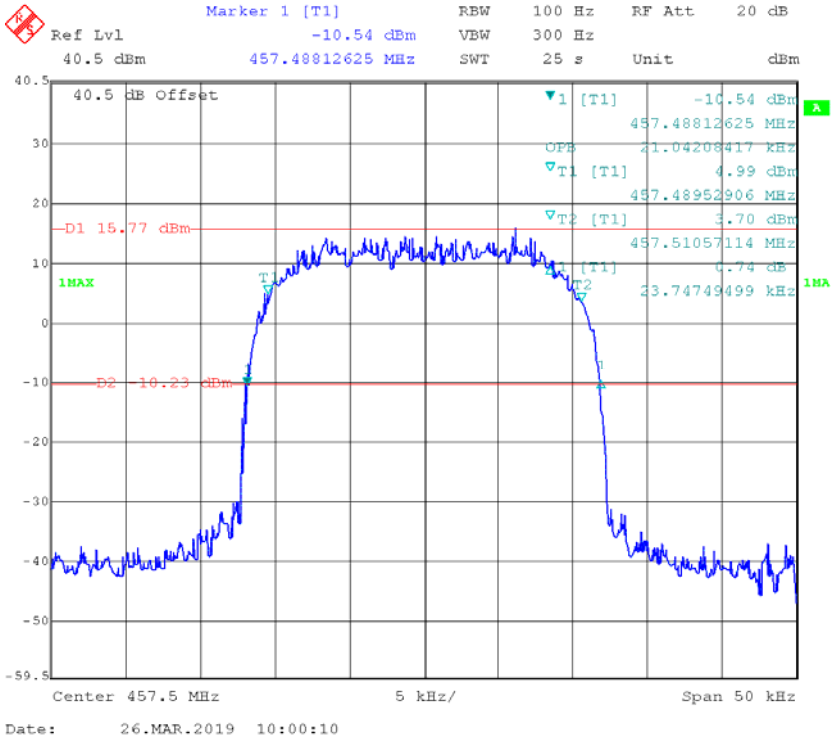
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Output



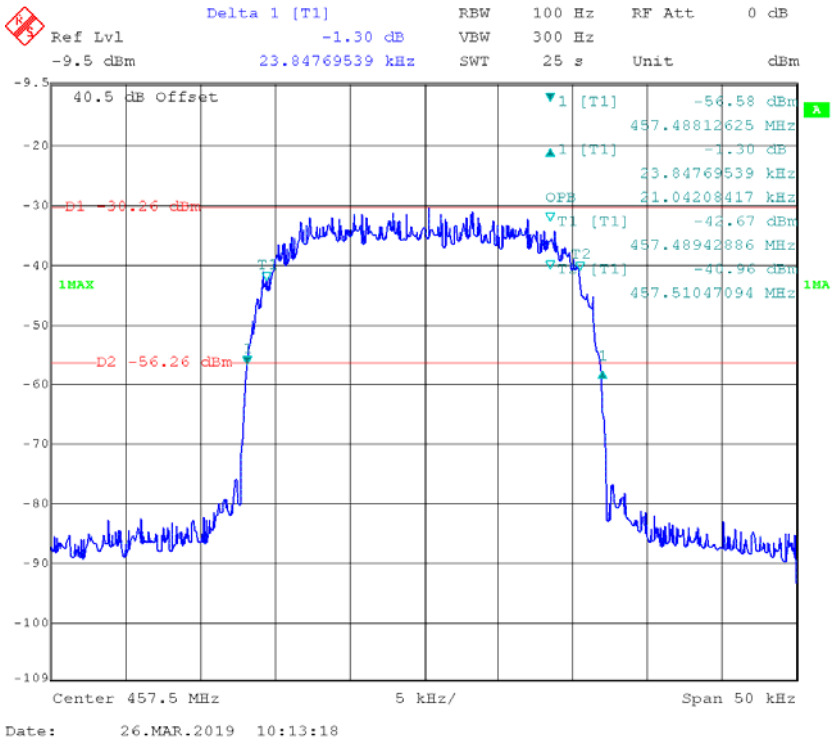
Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Input



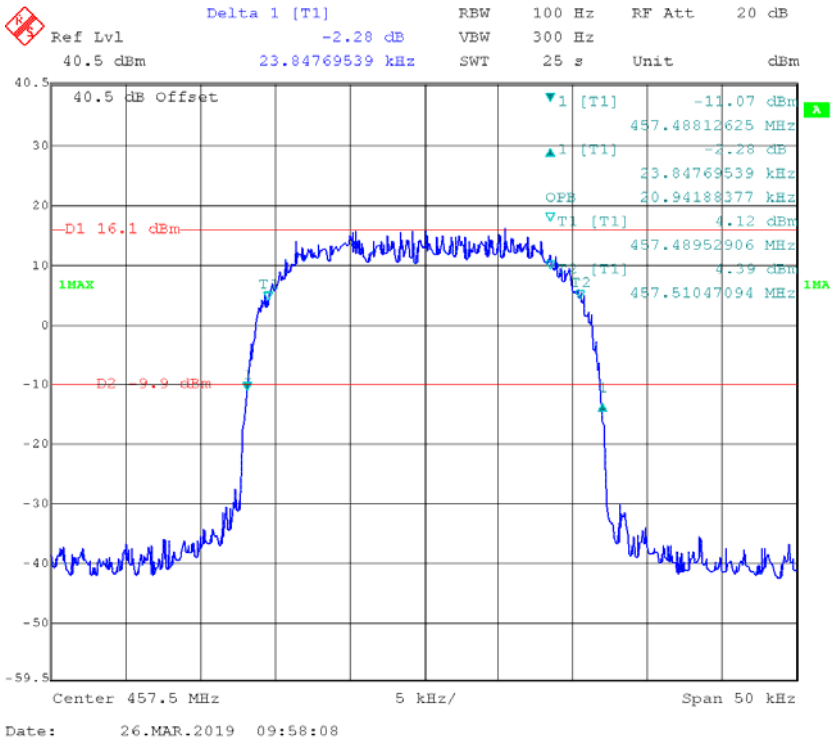
Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Output



Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Input

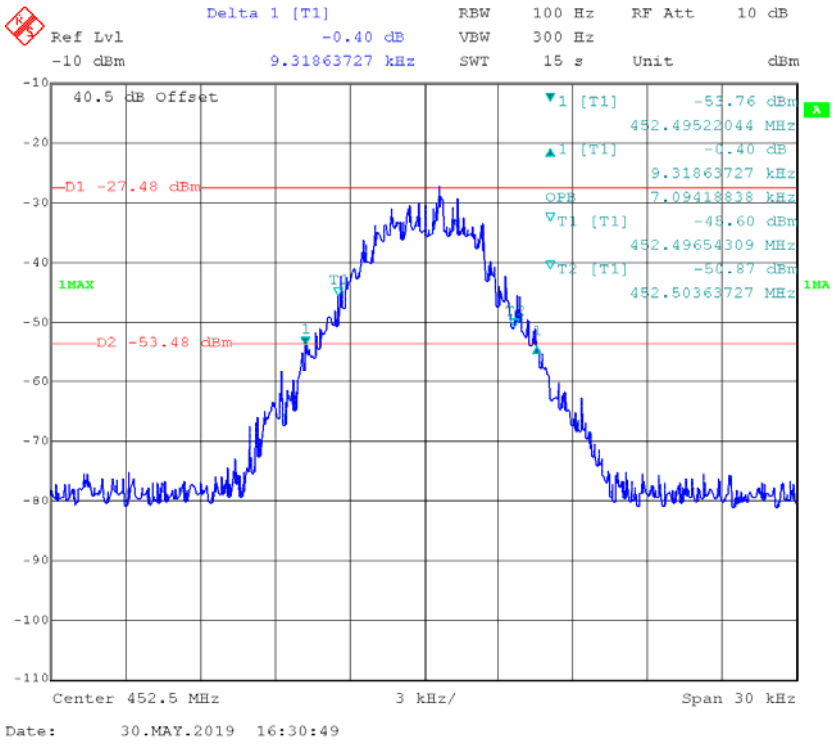


Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Output

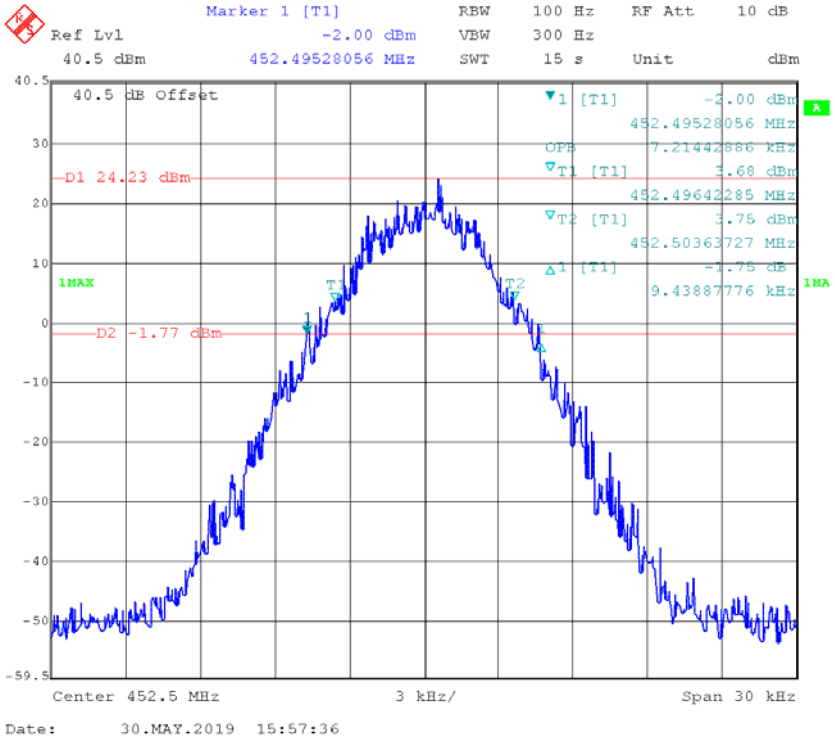


4FSK:

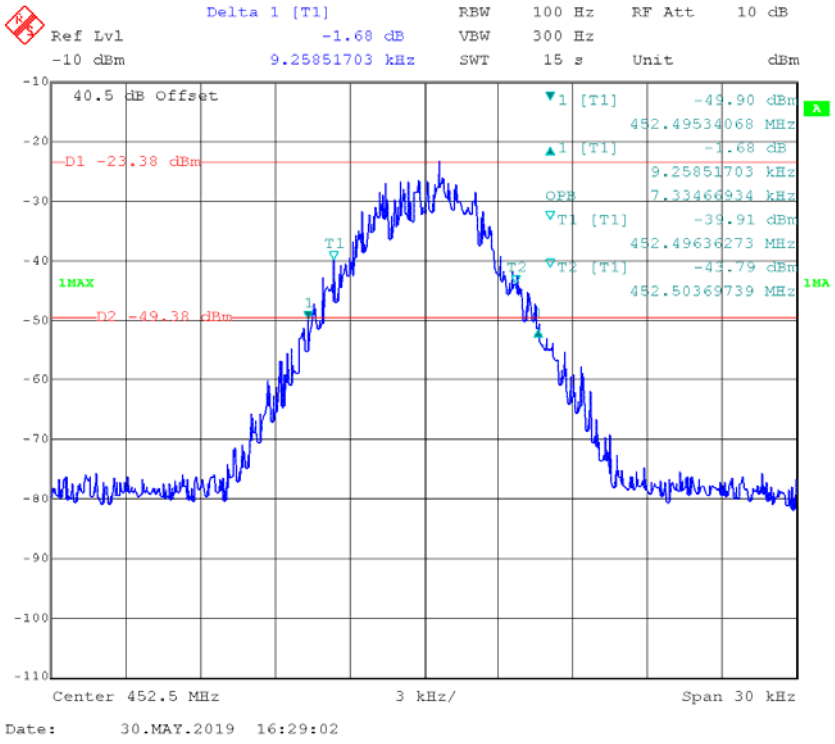
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Input



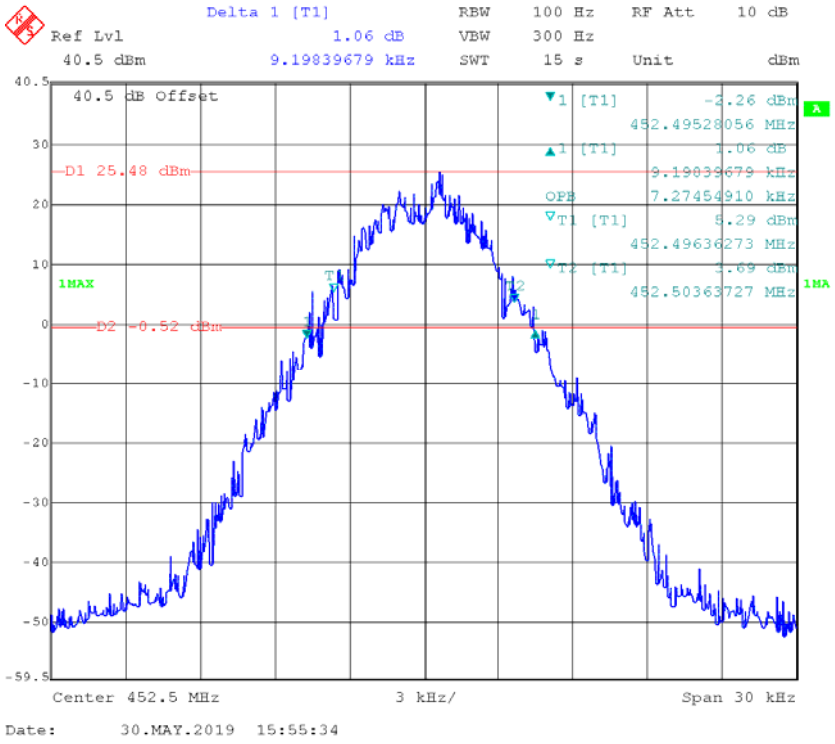
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Output



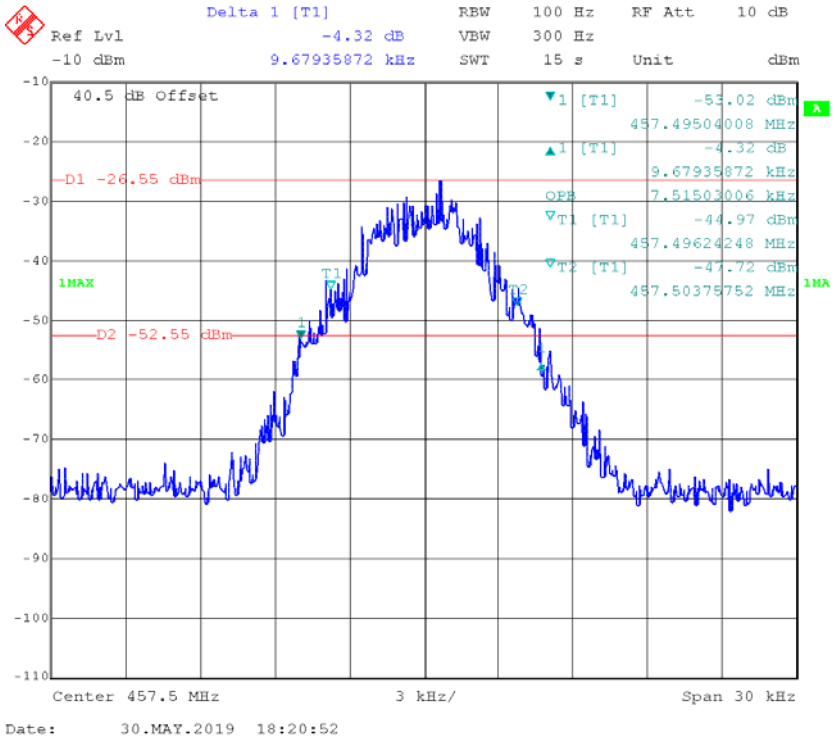
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Input



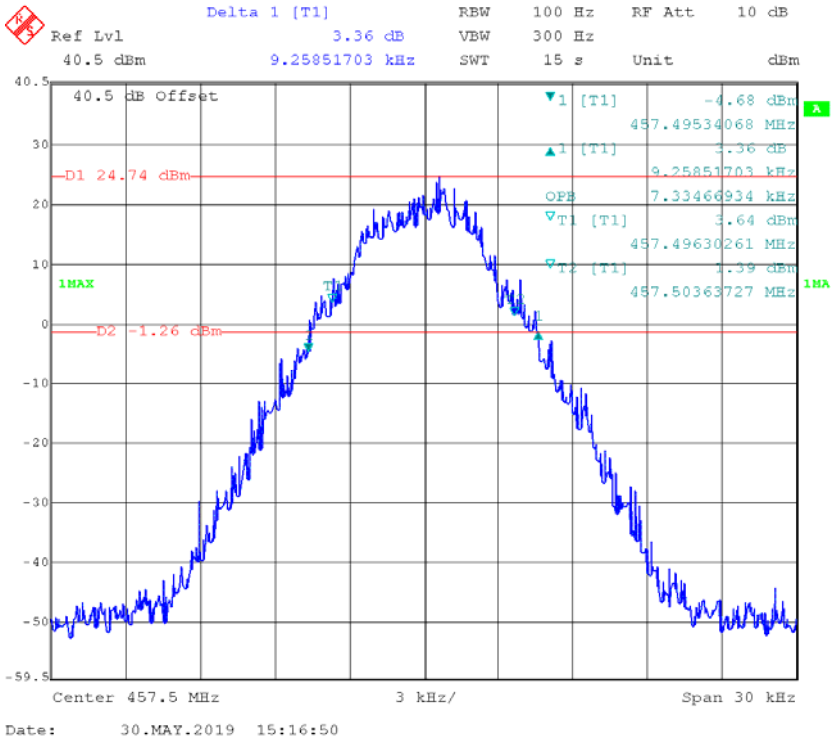
Frequency: 452.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Output



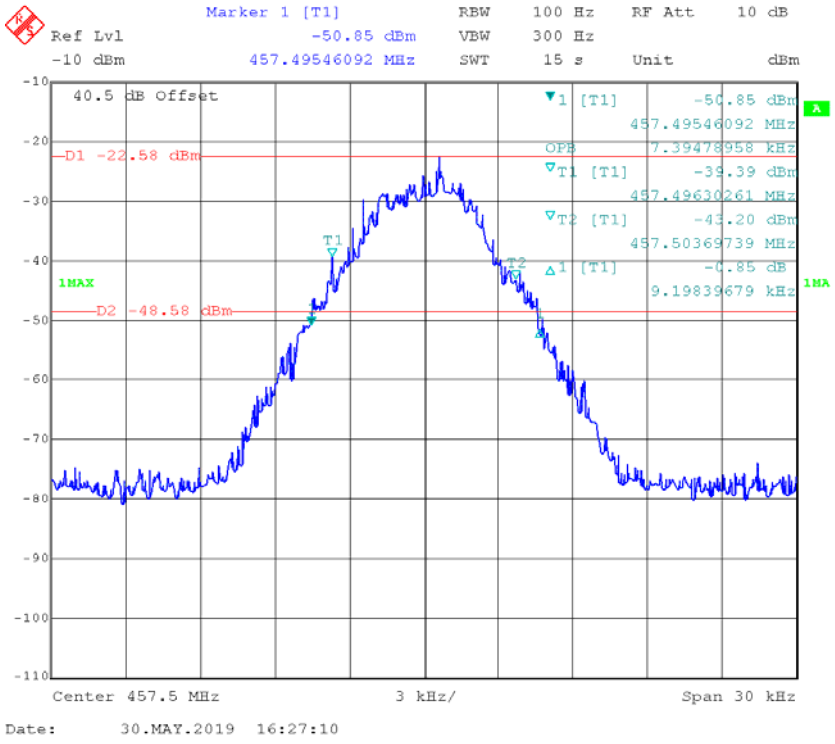
Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Input



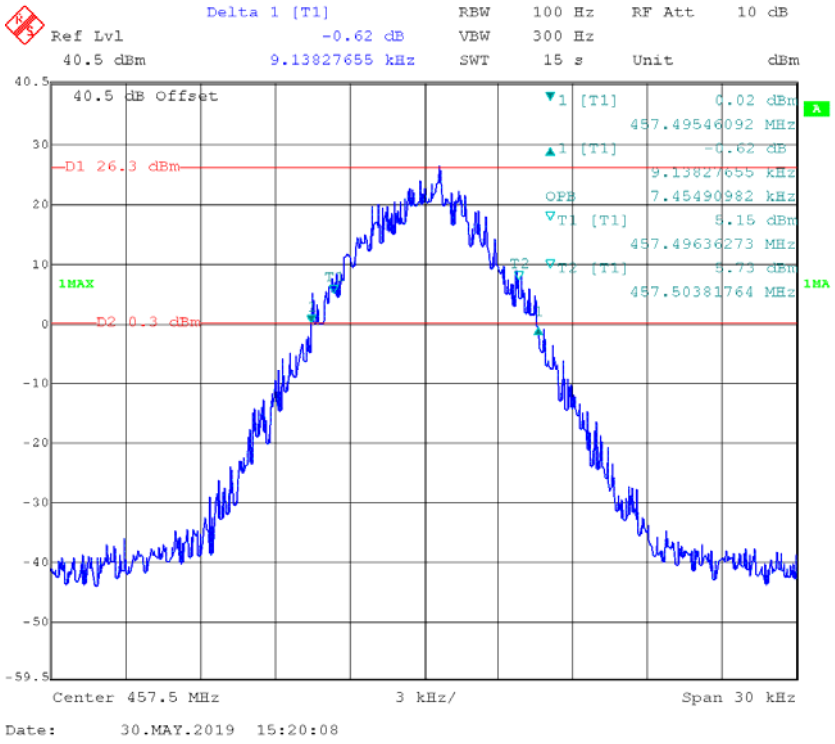
Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC Output



Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Input



Frequency: 457.5 MHz, 99% Occupied & 26 dB Bandwidth AGC+3 Output



FCC §90.219 (e)(4)(iii) & §90.210 & RSS-131 CLAUSE 6.6–EMISSION MASK & §90.221 ADJACENT CHANNEL POWER LIMITS

Applicable Standard

FCC §90.219 (e)(4)(iii) and §90.210

The retransmitted signals continue to meet the unwanted emissions limits of §90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin)

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25[1]	A or B	A or C
25-50	B	C
72-76	B	C
150-174[2]	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512[2 5]	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854[6]	B	H
809-824/854-869[3 5]	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M
5850-5925[4]		
All other bands	B	C

Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (fd/5) dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd2/11) dB or 50 dB, whichever is the lesser attenuation;

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

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd−2.88 kHz) dB.

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

Emission Mask E—6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
(1) On any frequency from the center of the authorized bandwidth f0 to 3.0 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least 30 + 16.67(fd−3 kHz) or 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

RSS-131 Clause 6.6:

The retransmitted signals shall meet the unwanted emission limits in the RSS that applies to the equipment with which the zone enhancer is to be used.

FCC §90.221

(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.

(b)(1) Maximum adjacent power levels for frequencies in the 450-470 MHz band:

Frequency offset	Maximum ACP (dBc) for devices 1 watt and less	Maximum ACP (dBc) for devices above 1 watt
25 kHz	−55 dBc	−60 dBc
50 kHz	−70 dBc	−70 dBc
75 kHz	−70 dBc	−70 dBc

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

Test Procedure

Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r03 section 4.4

The nominal RBW shall be 300 Hz for 16K0F3E, and 100 Hz for all other emissions types

Test Data

Environmental Conditions

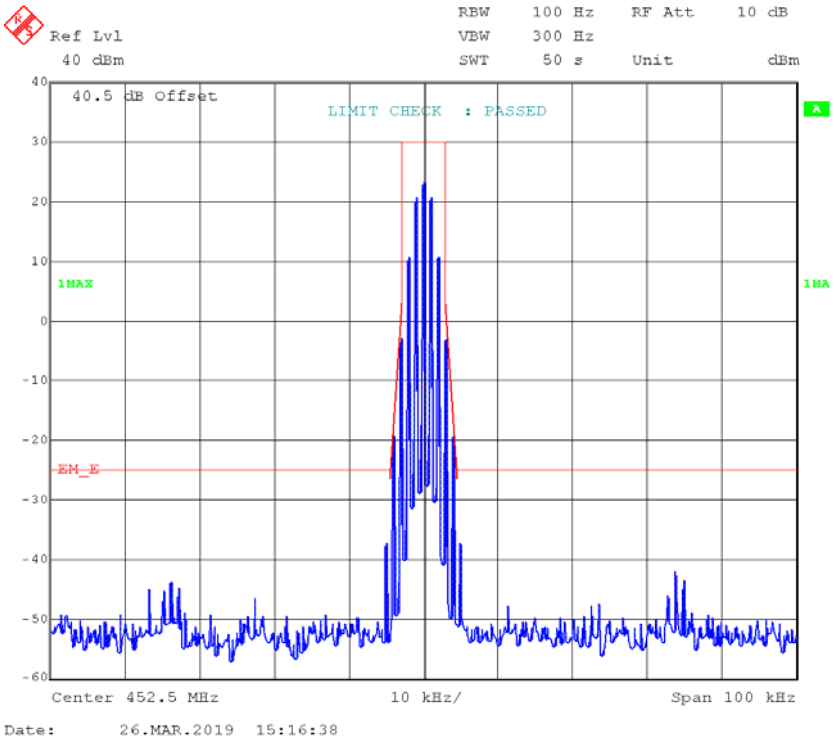
Temperature:	25~28℃
Relative Humidity:	55~61 %
ATM Pressure:	100.2~101.5 kPa

The testing was performed by Blake Yang from 2019-03-26 to 2019-05-30.

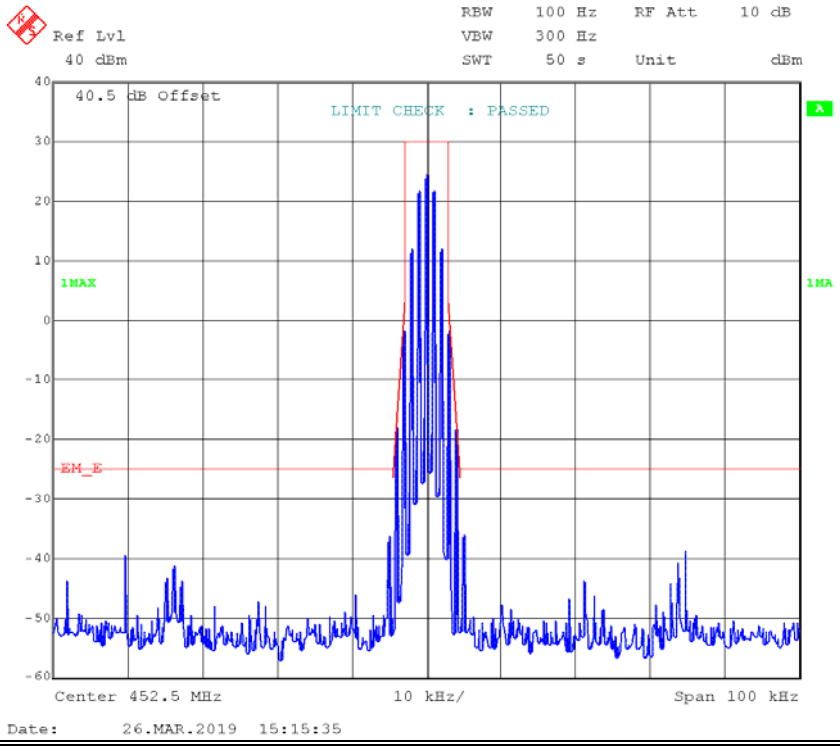
Note: the input signal level “AGC” refer to the testing item Output power&Maximum gain.

Emission Mask:
FM 6.5K:

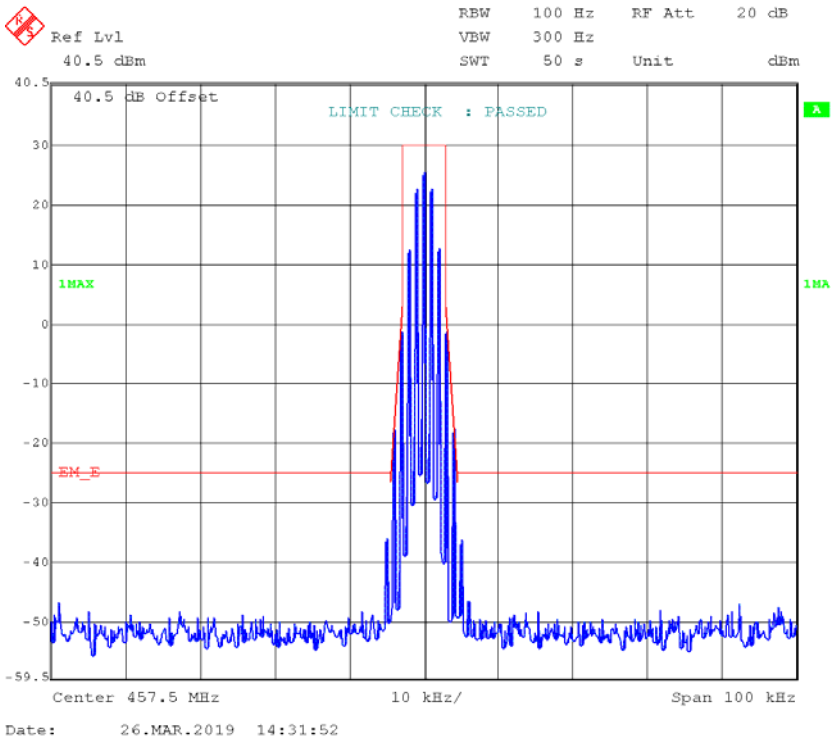
Frequency 452.5 MHz: Emission Mask E, AGC



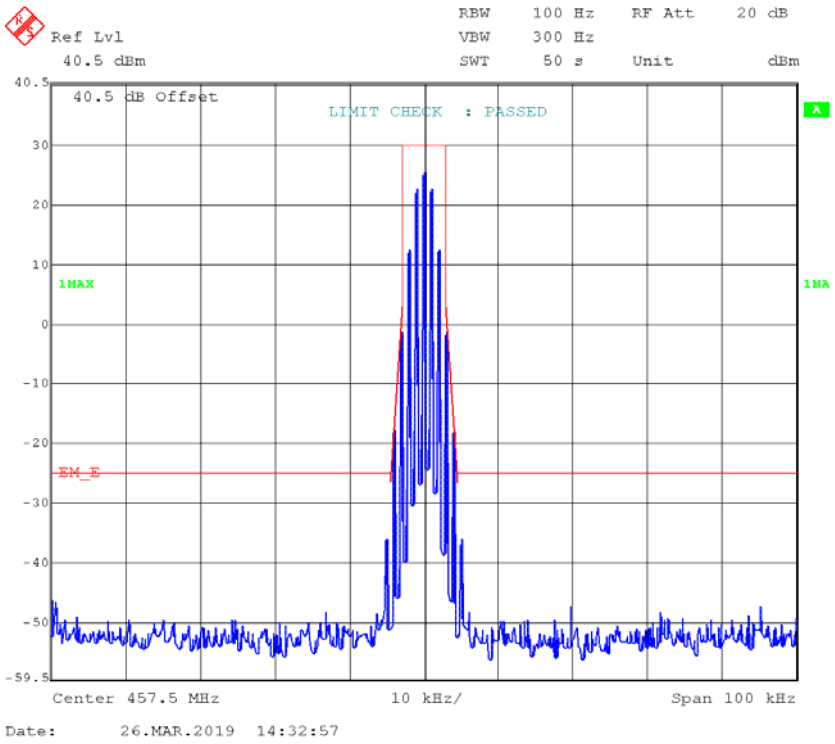
Frequency 452.5 MHz: Emission Mask E, AGC+3 dB



Frequency 457.5 MHz: Emission Mask E, AGC

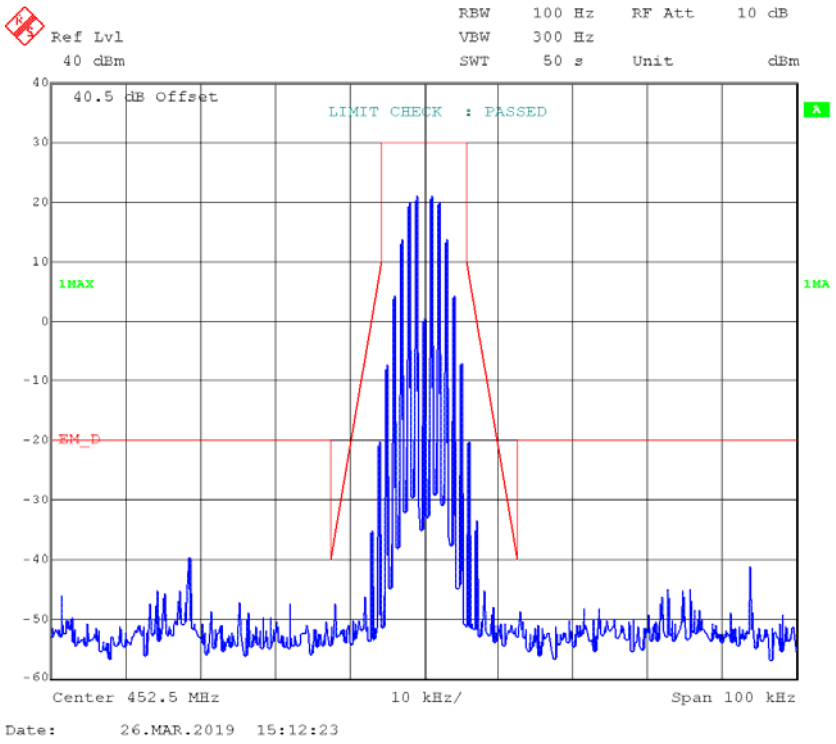


Frequency 457.5 MHz: Emission Mask E, AGC+3 dB

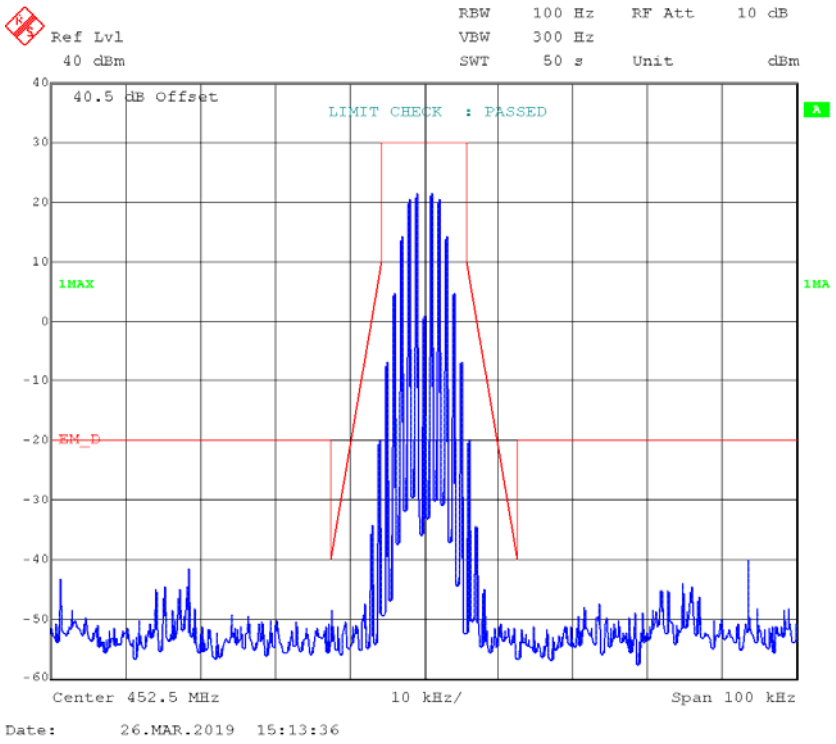


FM 12.5K:

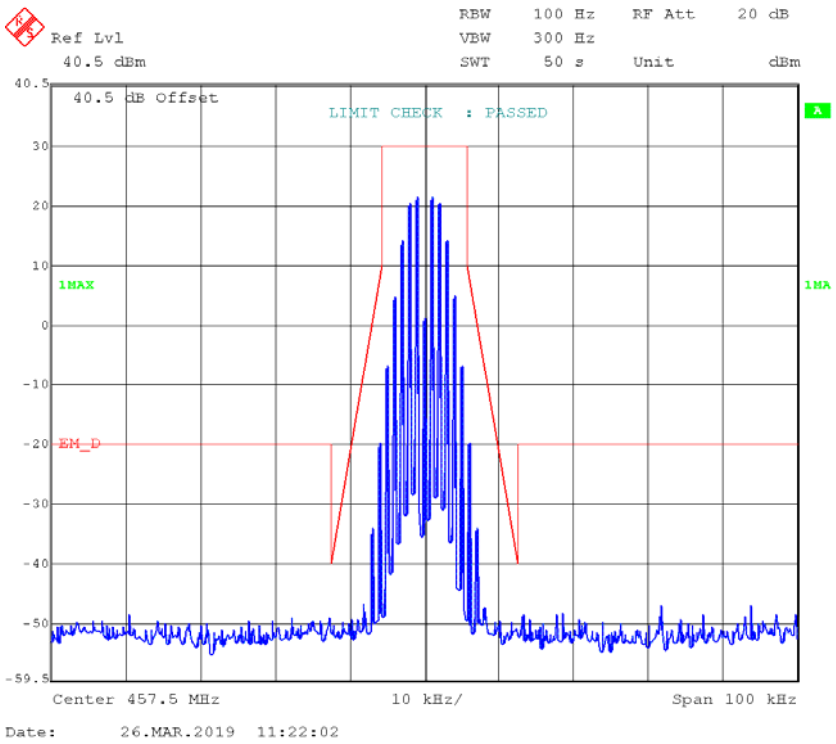
Frequency 452.5 MHz: Emission Mask D, AGC



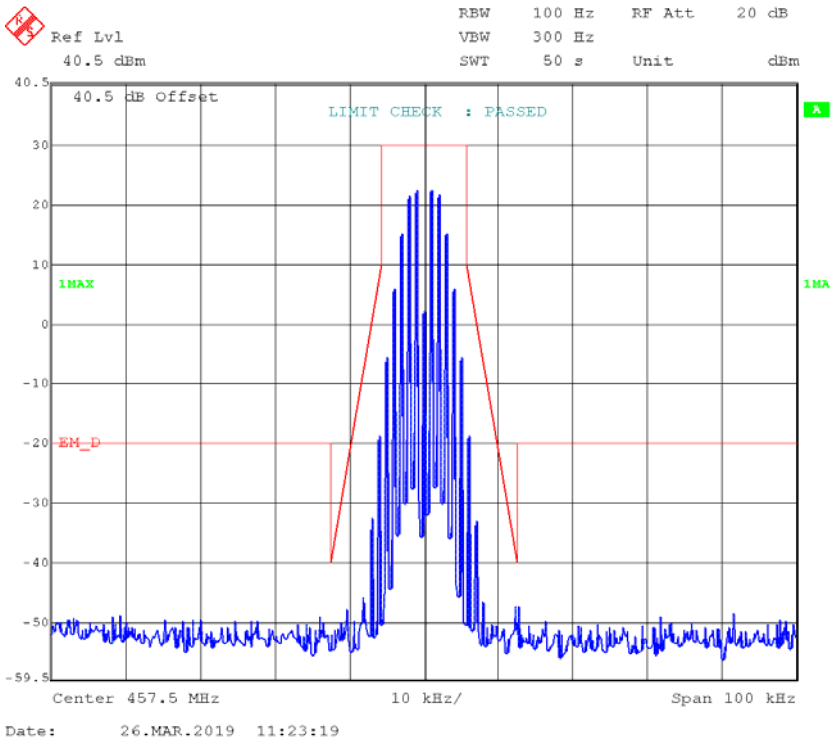
Frequency 452.5 MHz: Emission Mask D, AGC+3 dB



Frequency 457.5 MHz: Emission Mask D, AGC

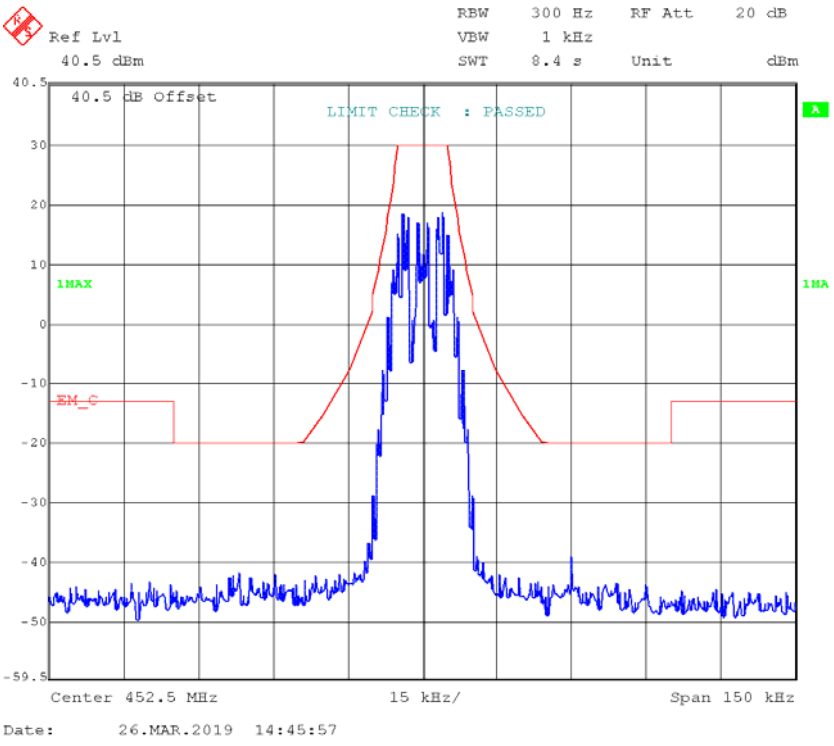


Frequency 457.5 MHz: Emission Mask D, AGC+3 dB

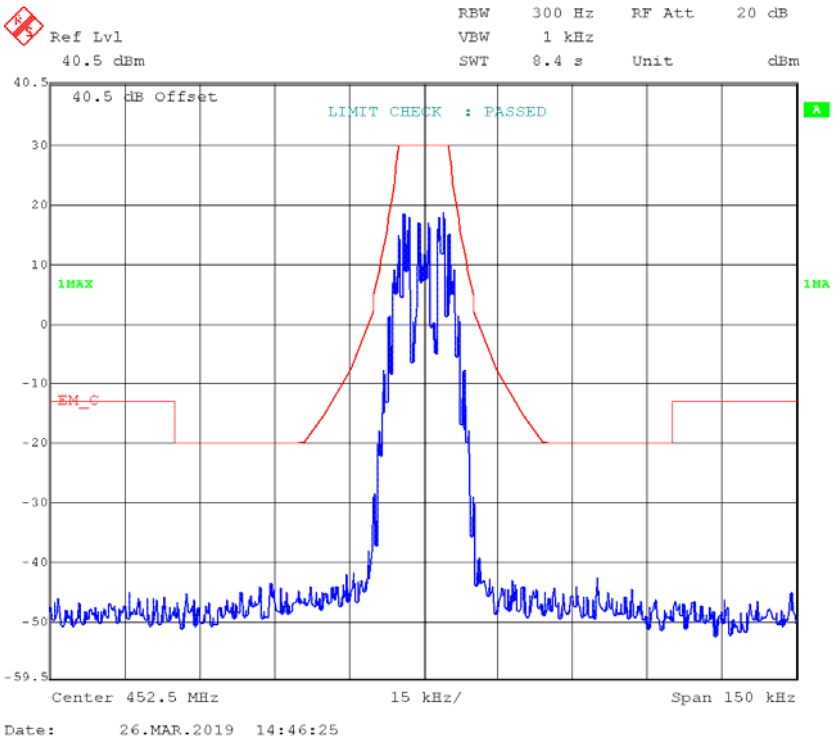


FM 25K:

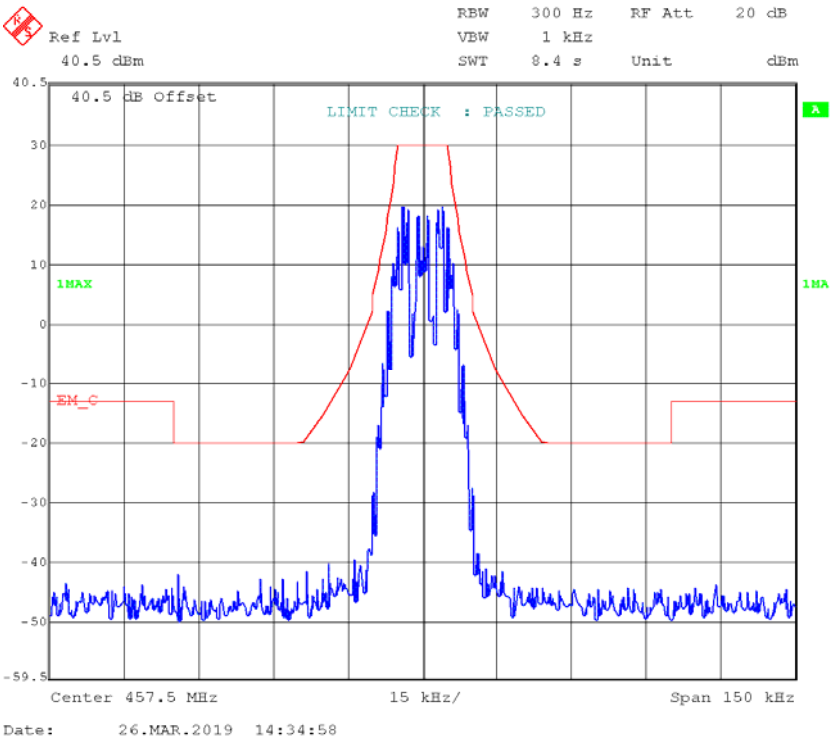
Frequency 452.5 MHz: Emission Mask C, AGC



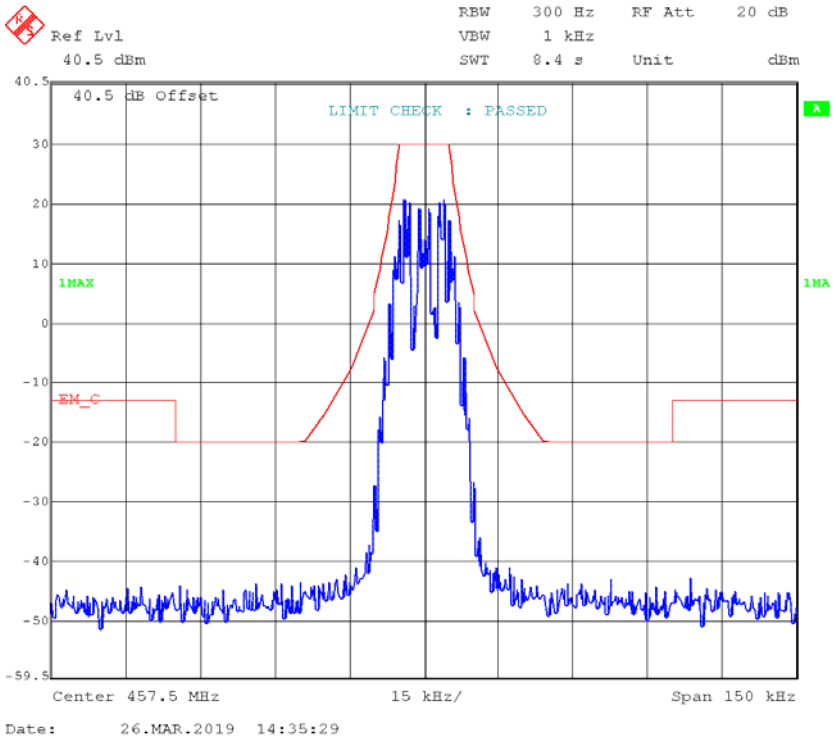
Frequency 452.5 MHz: Emission Mask C, AGC+3 dB



Frequency 457.5 MHz: Emission Mask C, AGC

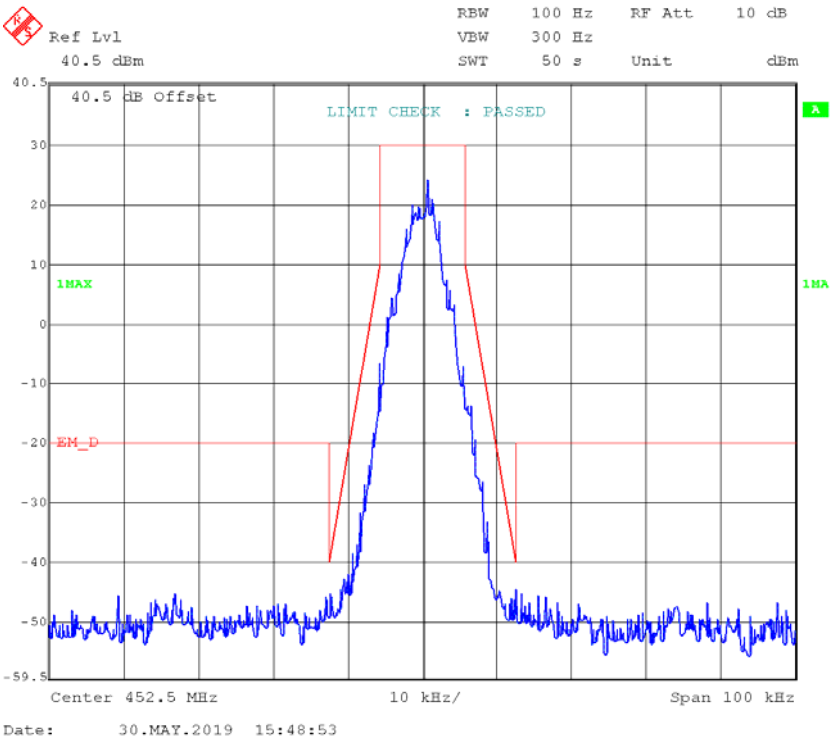


Frequency 457.5 MHz: Emission Mask C, AGC+3 dB

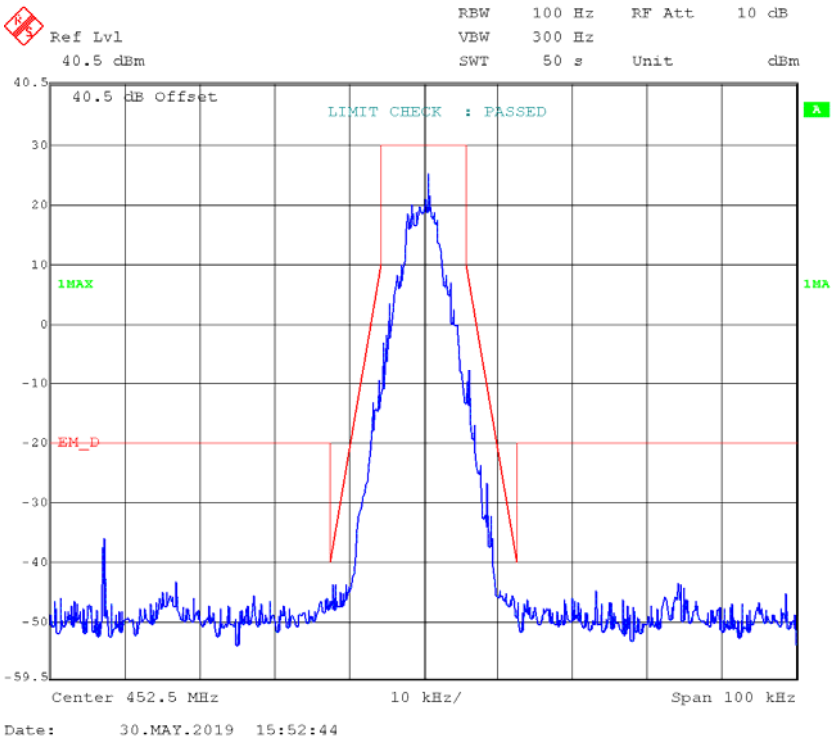


4FSK:

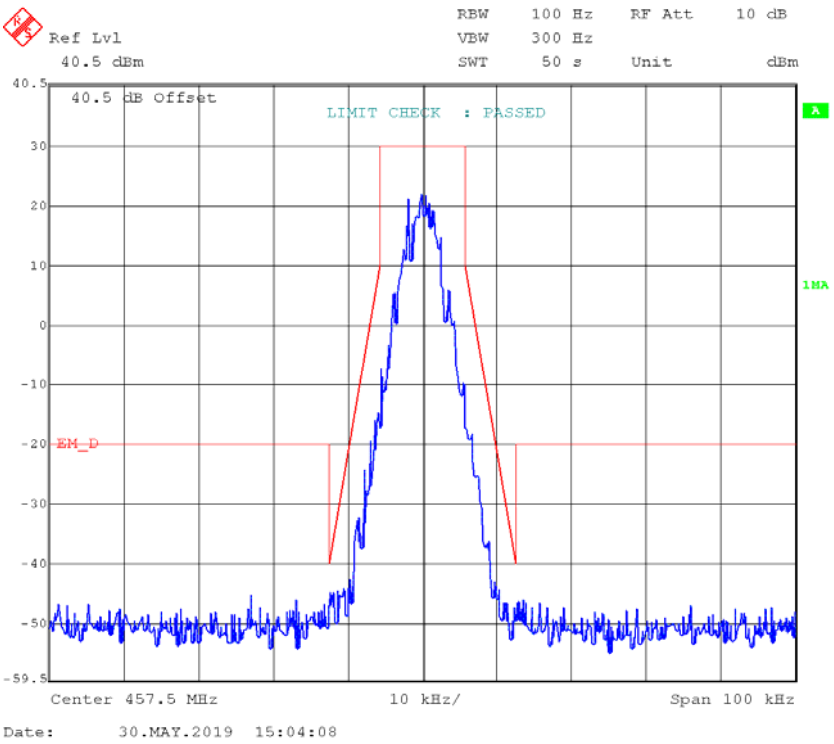
Frequency 452.5 MHz: Emission Mask D, AGC



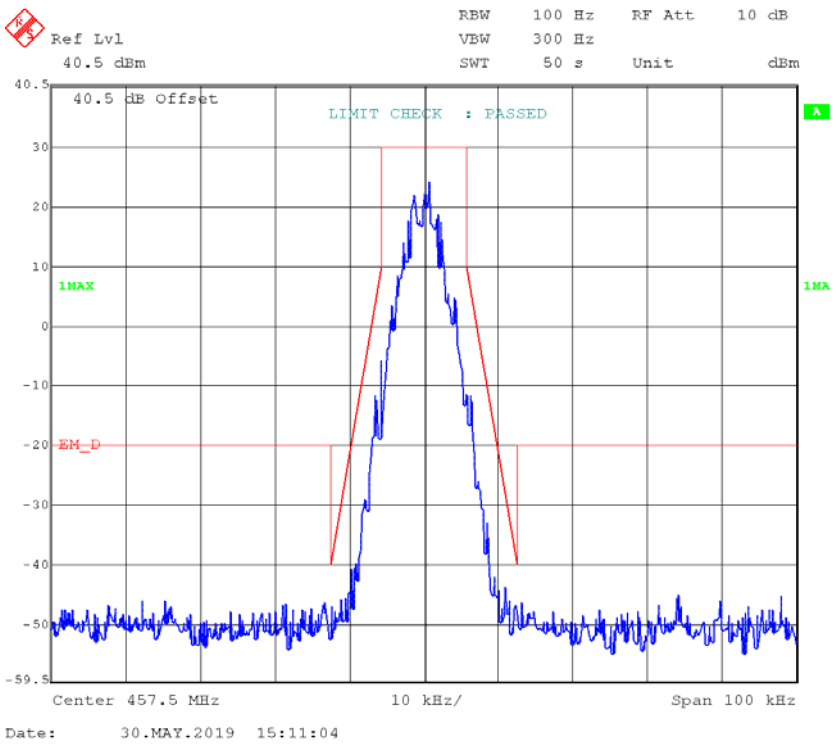
Frequency 452.5 MHz: Emission Mask D, AGC+3 dB



Frequency 457.5 MHz: Emission Mask D, AGC



Frequency 457.5 MHz: Emission Mask D, AGC+3 dB

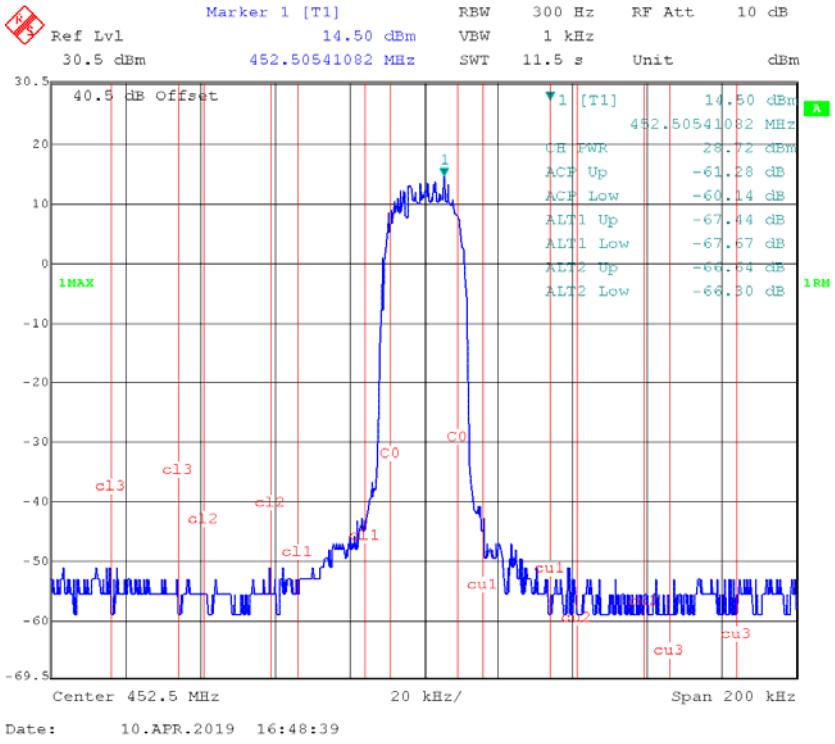


Adjacent Channel Power:

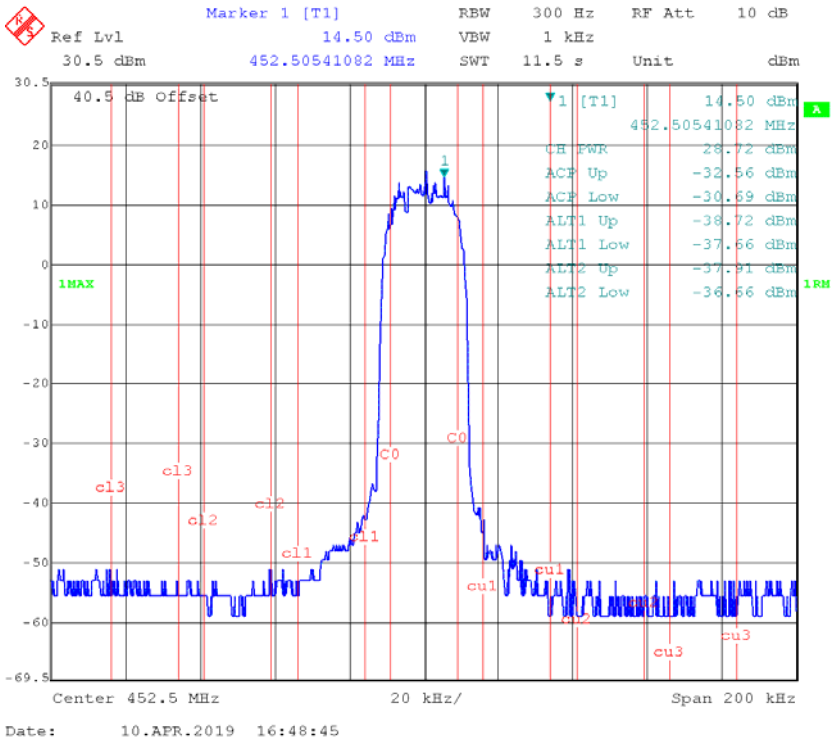
TETRA

Test Frequency (MHz)	Frequency Offset (kHz)	Reading (dB)	Limit (dB)	Reading (dBm)	Limit (dBm)	Result
452.5	25	60.14	≥55	/	/	Pass
	50	/	/	-37.66	≤-36	Pass
	75	/	/	-36.56	≤-36	Pass
457.5	25	60.14	≥55	/	/	Pass
	50	/	/	-42.72	≤-36	Pass
	75	/	/	-41.09	≤-36	Pass

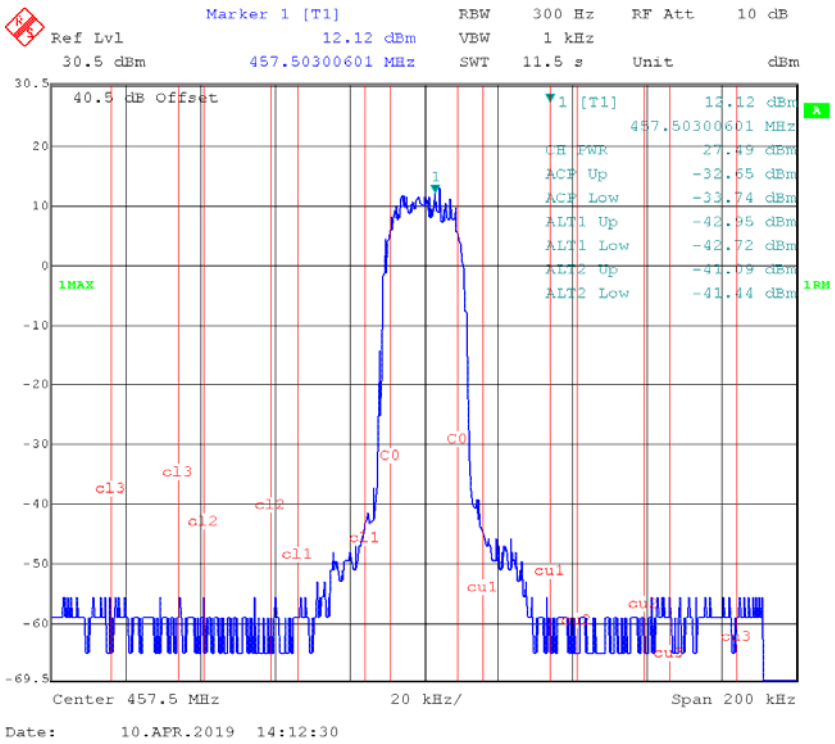
452.5M-1



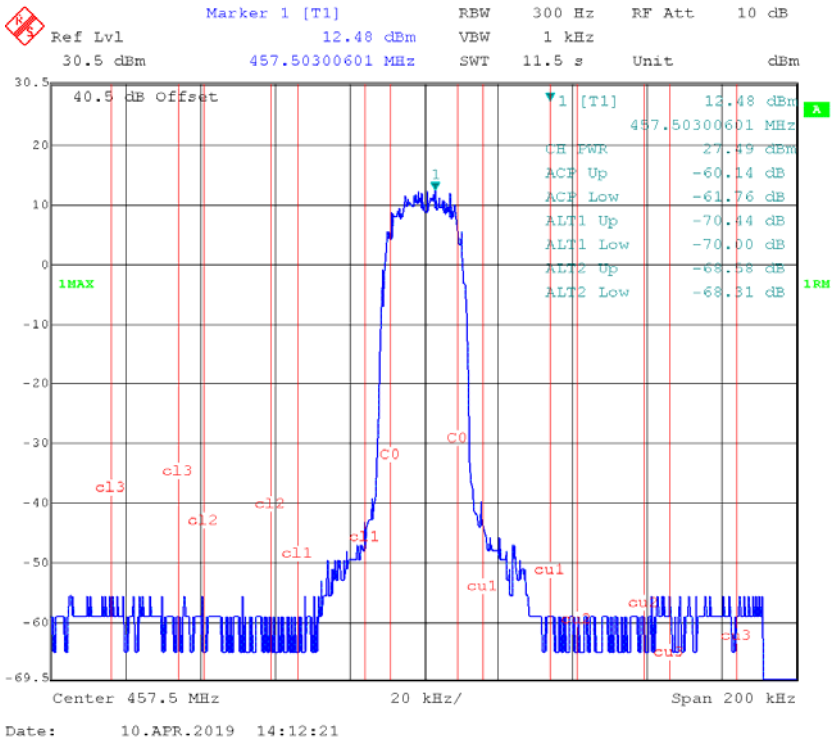
452.5M-2



457.5M-1



457.5M-2


Marker 1 [T1]
RBW 300 Hz
RF Att 10 dB
Ref Lvl
12.48 dBm
VBW 1 kHz
30.5 dBm
457.50300601 MHz
SWT 11.5 s
Unit dBm
40.5 dB Offset
1 [T1] 12.48 dBm
457.50300601 MHz
CH PWR 27.49 dBm
ACP Up -60.14 dB
ACP Low -61.76 dB
ALT1 Up -70.44 dB
ALT1 Low -70.00 dB
ALT2 Up -68.58 dB
ALT2 Low -68.31 dB
1MAX
1RM
A
30.5
20
10
0
-10
-20
-30
-40
-50
-60
-69.5
C0
cl3
cl2
cl1
cu1
Center 457.5 MHz
20 kHz/
Span 200 kHz
Date: 10.APR.2019 14:12:21

FCC §90.219 (e)(3) &RSS-131 CLAUSE 6.5 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

According to FCC §90.219 (e)(3) Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth

According to RSS-131Clause 6.5, The spurious emissions of a zone enhancer shall not exceed −13 dBm in any 100 kHz measurement bandwidth

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT .The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB =10 1g (TXpwr in Watts/0.001)-the absolute level

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Neil Liao on 2019-03-25.

Test Mode: Transmitting

30MHz - 5GHz:

Frequency (MHz)	Receiver Reading (dBµV)	Polar (H/V)	Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
452.5 MHz								
905.00	44.19	H	-52.74	1.03	0.00	-53.77	-13.00	40.77
905.00	43.87	V	-55.04	1.03	0.00	-56.07	-13.00	43.07
1357.50	36.79	H	-66.64	1.18	9.40	-58.42	-13.00	45.42
1357.50	36.70	V	-66.89	1.18	9.40	-58.67	-13.00	45.67
1810.00	37.02	H	-67.22	1.21	10.93	-57.50	-13.00	44.50
1810.00	36.87	V	-67.30	1.21	10.93	-57.58	-13.00	44.58
2262.50	36.41	H	-66.97	1.19	11.87	-56.29	-13.00	43.29
2262.50	36.63	V	-67.47	1.19	11.87	-56.79	-13.00	43.79
457.5 MHz								
915.00	43.74	H	-52.78	1.00	0.00	-53.78	-13.00	40.78
915.00	44.71	V	-53.71	1.00	0.00	-54.71	-13.00	41.71
1372.50	36.86	H	-66.69	1.19	9.46	-58.42	-13.00	45.42
1372.50	36.70	V	-66.99	1.19	9.46	-58.72	-13.00	45.72
1830.00	37.17	H	-67.05	1.20	10.99	-57.26	-13.00	44.26
1830.00	36.80	V	-67.35	1.20	10.99	-57.56	-13.00	44.56
2287.50	36.24	H	-67.08	1.19	11.90	-56.37	-13.00	43.37
2287.50	36.11	V	-68.00	1.19	11.90	-57.29	-13.00	44.29

Absolute Level = Substituted Level - Cable loss + Antenna Gain
Margin = Limit- Absolute Level
The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

FCC §90.219 (e)(3) &RSS-131 CLAUSE 6.5 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

According to FCC §90.219 (e)(3) Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth

According to RSS-131Clause 6.5, The spurious emissions of a zone enhancer shall not exceed −13 dBm in any 100 kHz measurement bandwidth

Test Procedure

Test Method: KDB 935210 D05 Indus Booster Basic Meas v01r03 section 4.7.3

a) Connect a signal generator to the input of the EUT.
b) Configure the signal generator to produce a CW signal.
c) Set the frequency of the CW signal to the center channel of the EUT passband.
d) Set the output power level so that the resultant signal is just below the AGC threshold (see 4.2).
e) Connect a spectrum analyzer to the output of the EUT, using appropriate attenuation as necessary.
f) Set the RBW = 100 kHz. (i.e., for 30 MHz to 1 GHz PLMRS and/or PSRS booster devices)
g) Set the VBW = 3 × RBW.
h) Set the Sweep time = auto-couple.
i) Set the detector to PEAK.
j) Set the spectrum analyzer start frequency to 30 MHz (or the lowest radio frequency signal generated in the EUT, without going below 9 kHz if the EUT has additional internal clock frequencies), and the stop frequency to 10 times the highest allowable frequency of the EUT passband.
k) Select MAX HOLD, and use the marker peak function to find the highest emission(s) outside the passband. (This could be either at a frequency lesser or greater than the passband frequencies.)
l) Capture a plot for inclusion in the test report.
m) Repeat steps c) to l) for each authorized frequency band/block of operation.

Test Data

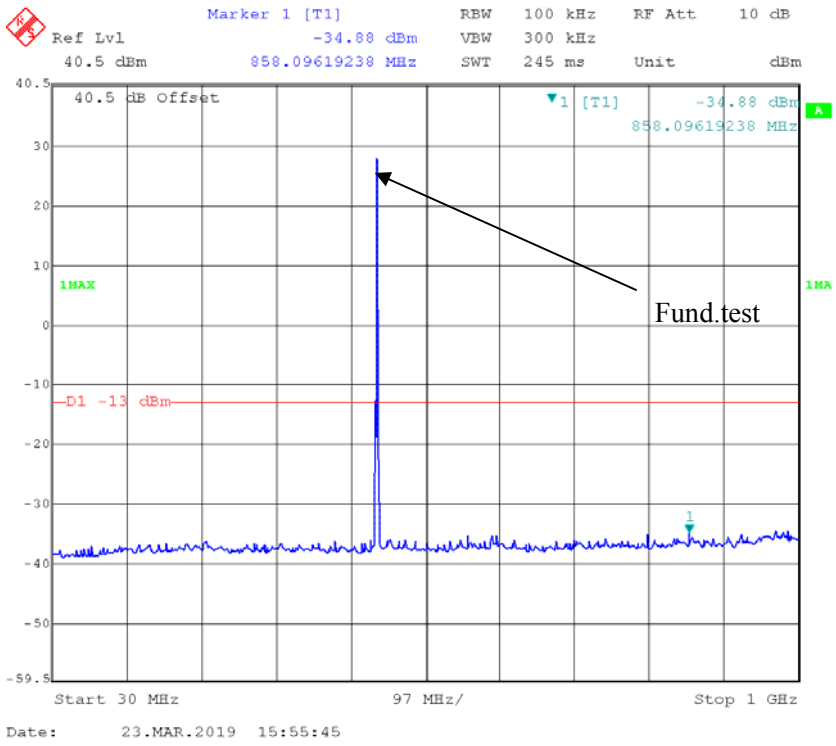
Environmental Conditions

Temperature:	25~27 ℃
Relative Humidity:	52~54 %
ATM Pressure:	100.0~101.0 kPa

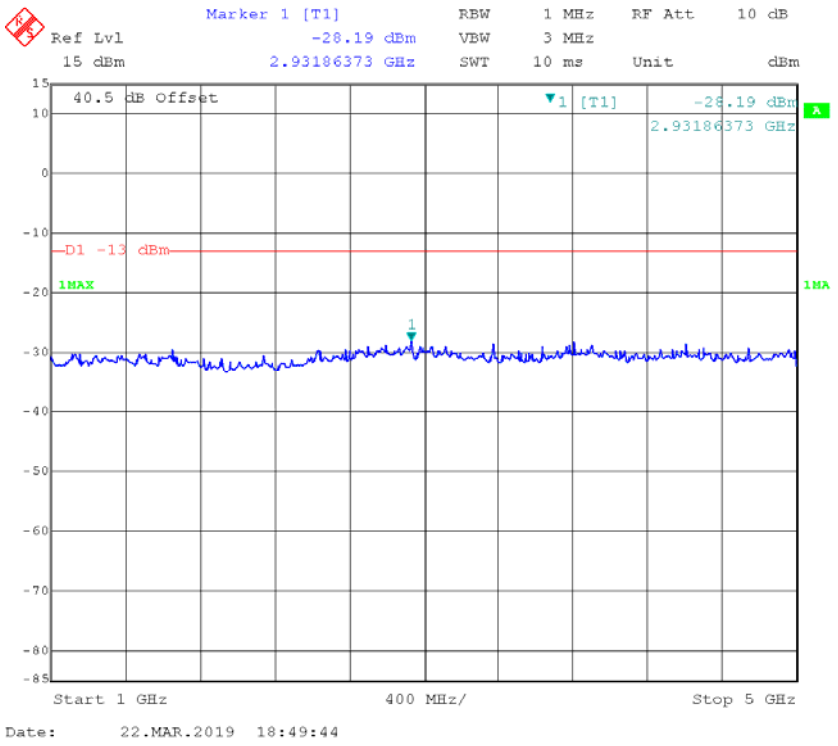
The testing was performed by Blake Yang from 2019-03-22 to 2019-03-25.

Test Mode: Transmitting, please refer to the following plots.

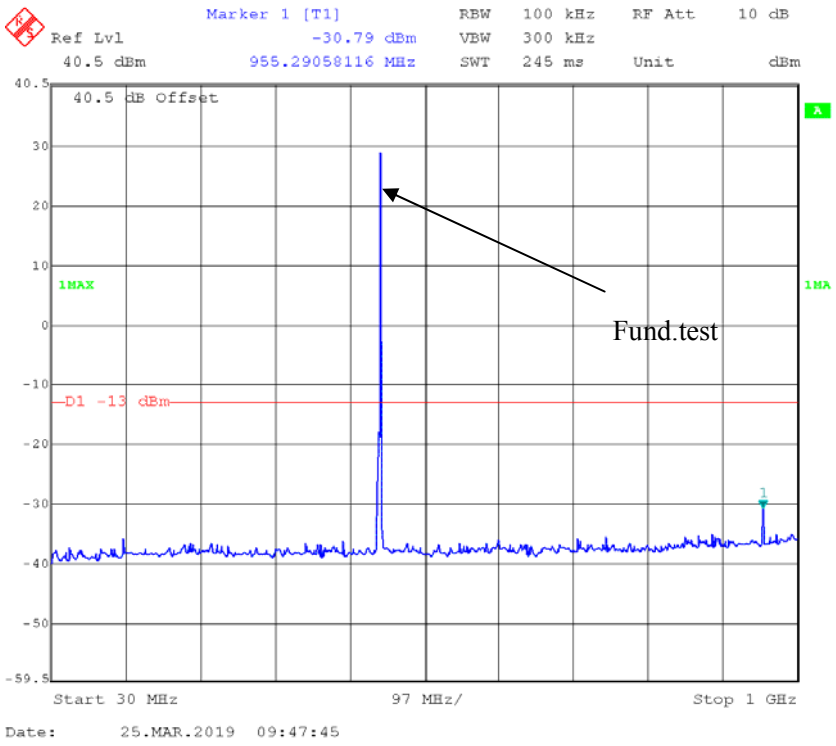
30MHz – 1 GHz, 452.2MHz Middle Channel



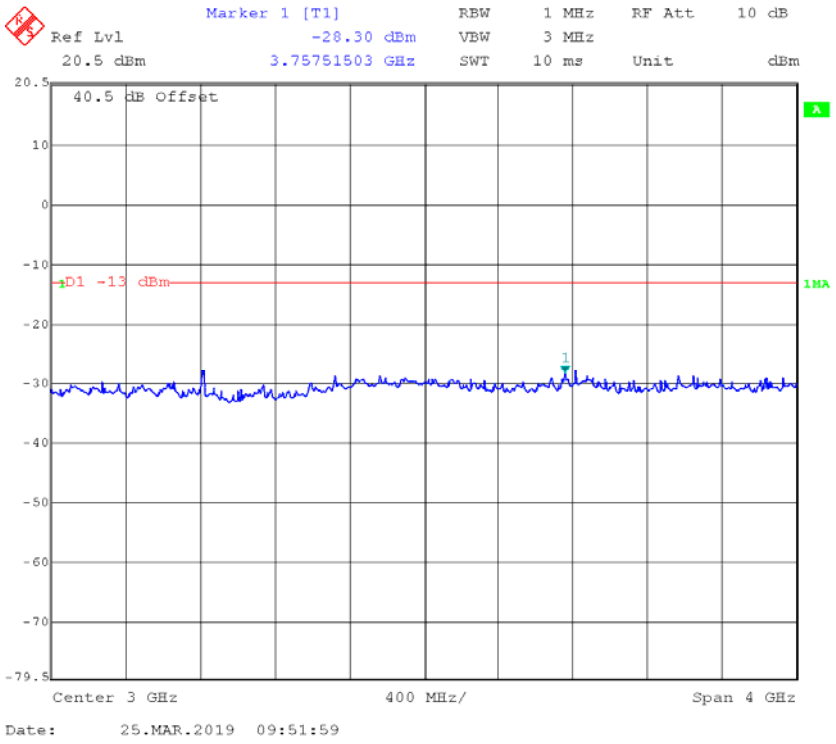
1 GHz – 5 GHz, 452.2MHz Middle Channel



30MHz – 1 GHz, 457.5MHz Middle Channel



1 GHz – 4 GHz, 457.5MH Middle Channel



FCC §90.219 (e)(3) &RSS-131 CLAUSE 6.3– INTERMODULATION

Applicable Standard

According to FCC §90.219 (e)(3) Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth

According to RSS-131Clause 6.3, The effective radiated power (ERP) of intermodulation products should not exceed −30 dBm in a 10 kHz measurement bandwidth.

Test Procedure

a) Connect a signal generator to the input of the Remote Unit
b) Configure the two signal generators to produce CW on frequencies spaced consistent with 4.7.1, with amplitude levels set to just below the AGC threshold
c) Connect a spectrum analyzer through appropriate attenuation to the EUT output
d) Set the span to 150 kHz
e) Set RBW = 1 kHz with VBW ≥ 3*RBW
f) Set the detector to power averaging(RMS)
g) Place a marker on highest intermodulation product amplitude
h) Capture the plot for inclusion in the test report
i) Repeat steps c) to h) with the composite input power lecel set to 3 dB above the AGC threshold
j) Repeat steps b) to i) for all operational bands

Test Data

Environmental Conditions

Temperature:	25~26.9℃
Relative Humidity:	55~63 %
ATM Pressure:	100.1~101.5 kPa

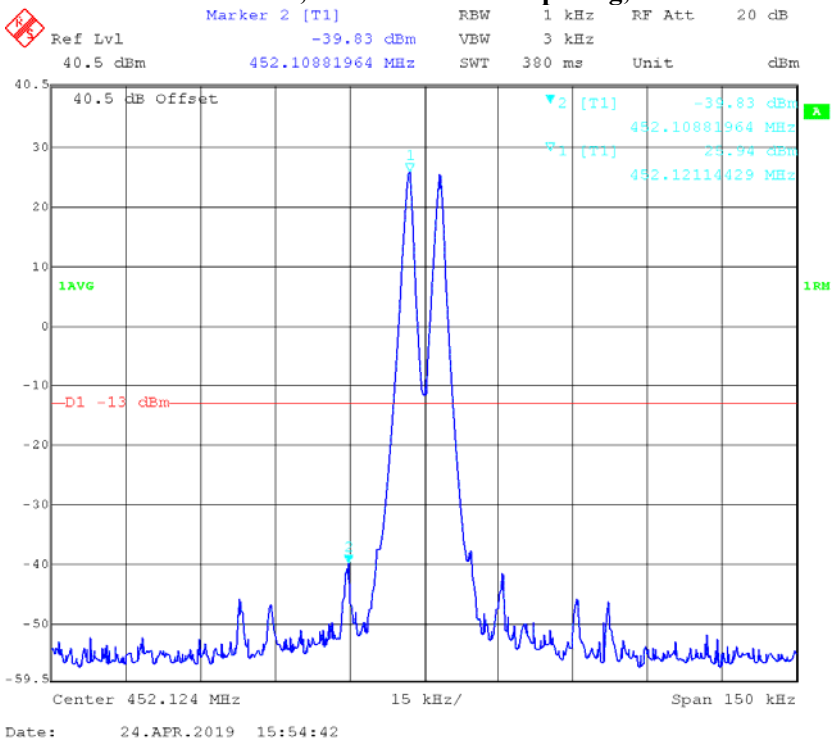
The testing was performed by Blake Yang on 2019-03-26&2019-04-24.

Test Mode: Transmitting

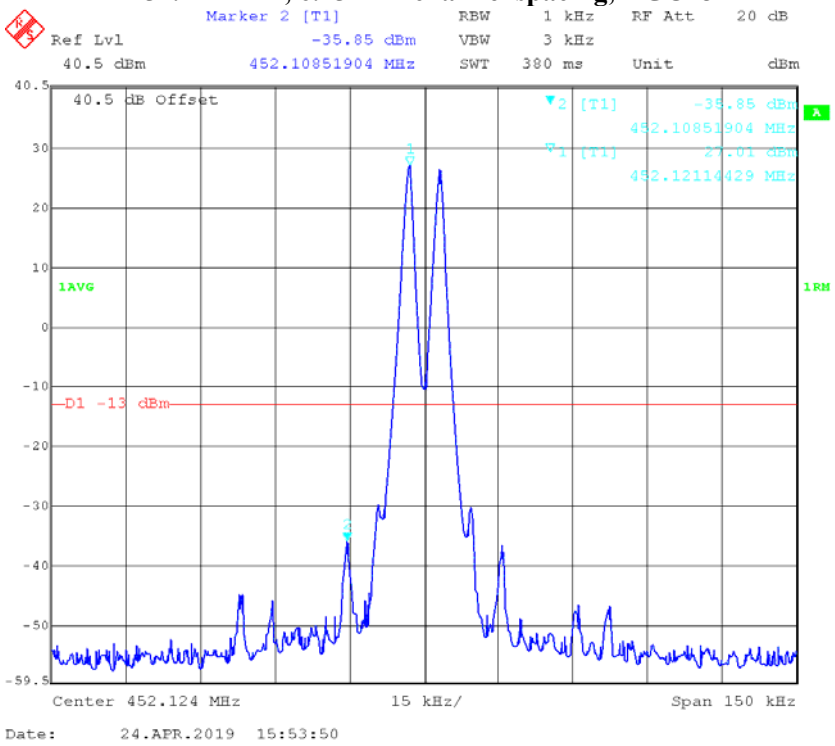
Test Result: Compliance. Please refer to following plots.

Channel spacing 6.25kHz:

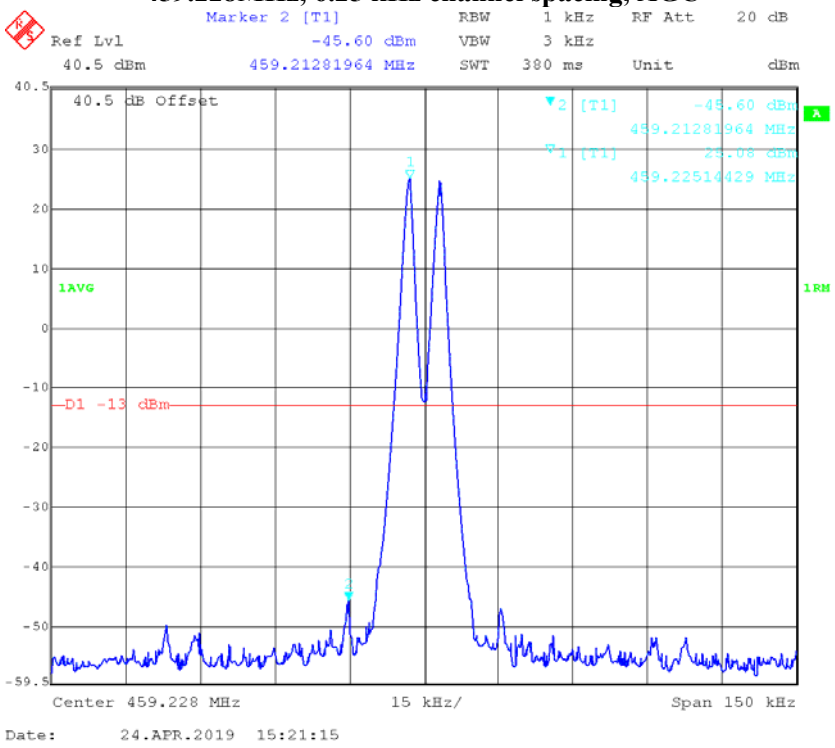
452.124MHz, 6.25 kHz channel spacing, AGC



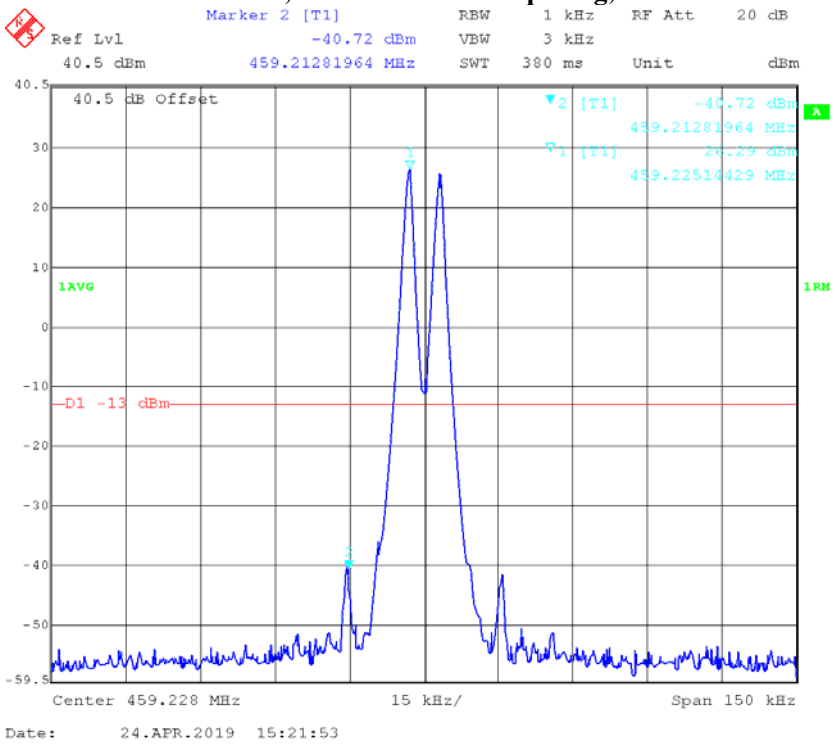
452.124MHz, 6.25 kHz channel spacing, AGC+3



459.228MHz, 6.25 kHz channel spacing, AGC

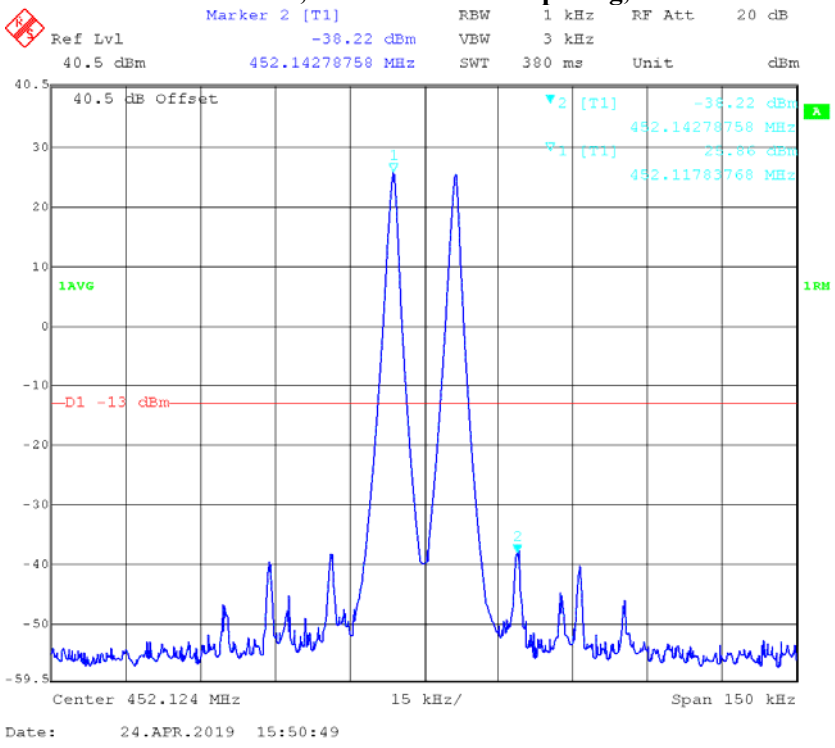


459.228MHz, 6.25 kHz channel spacing, AGC+3

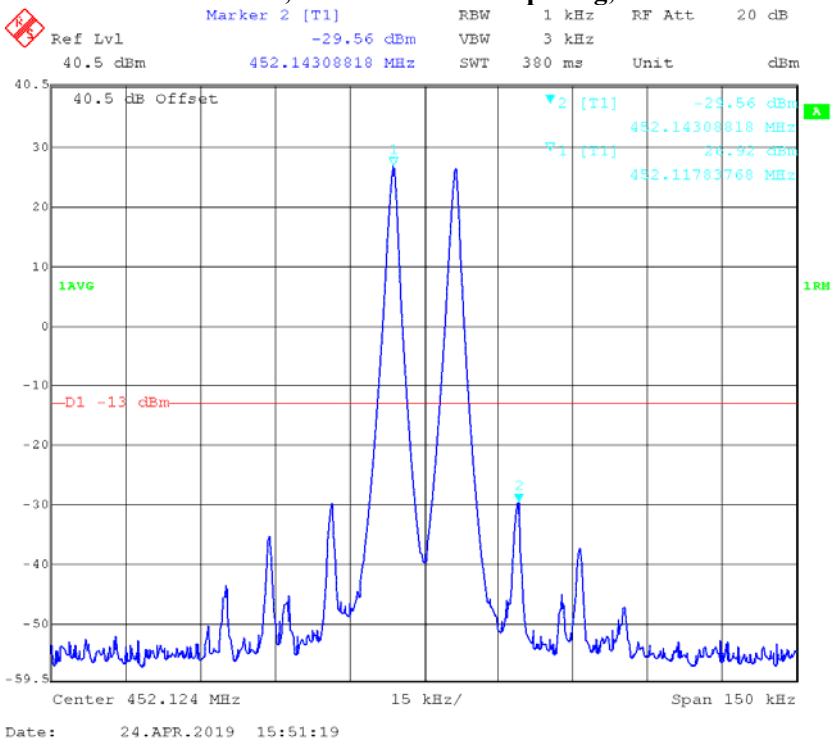


Channel spacing 12.5kHz:

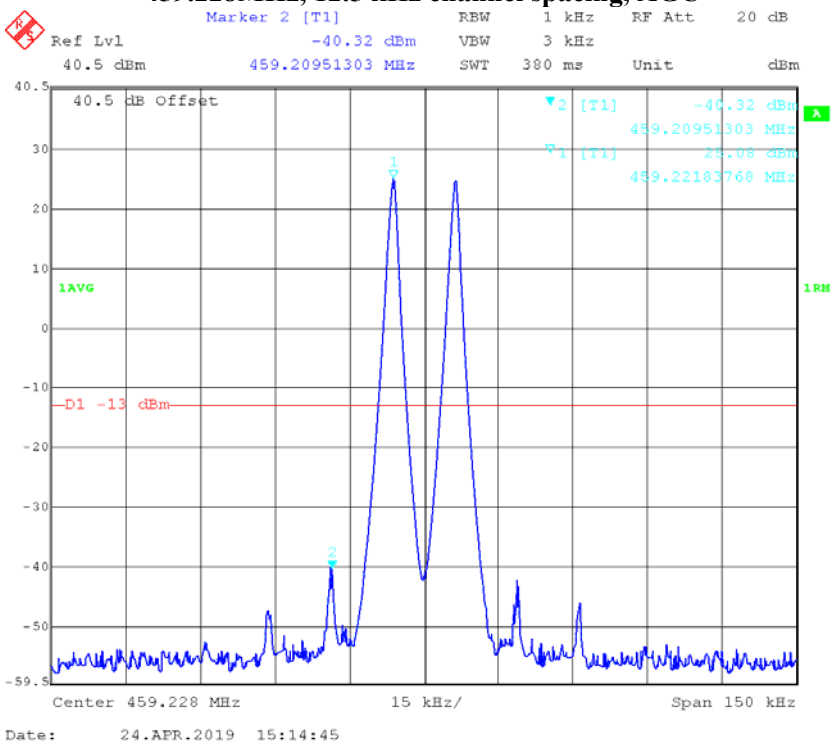
452.124MHz, 12.5 kHz channel spacing, AGC



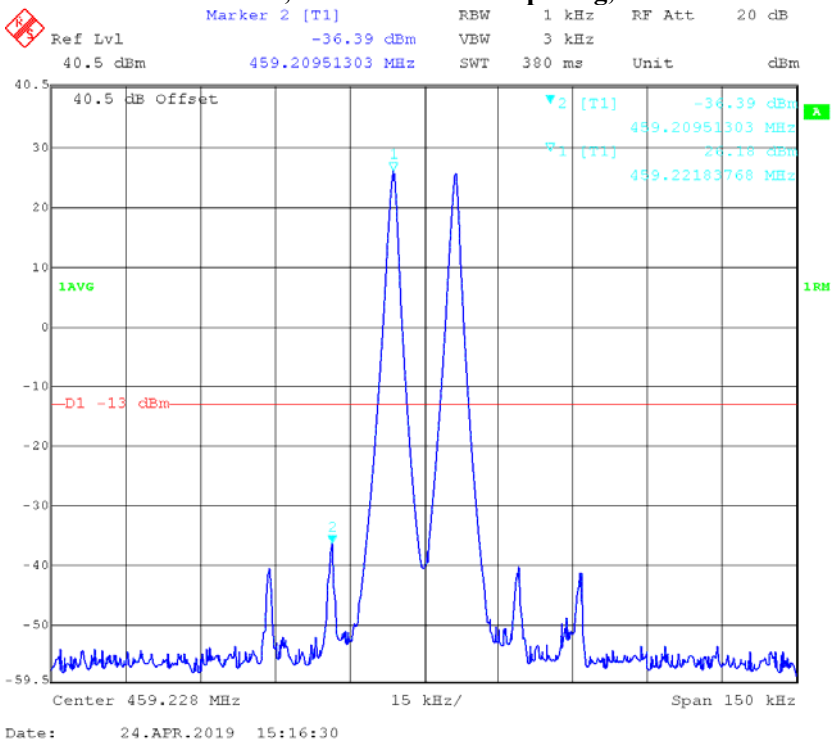
452.124MHz, 12.5 kHz channel spacing, AGC+3



459.228MHz, 12.5 kHz channel spacing, AGC

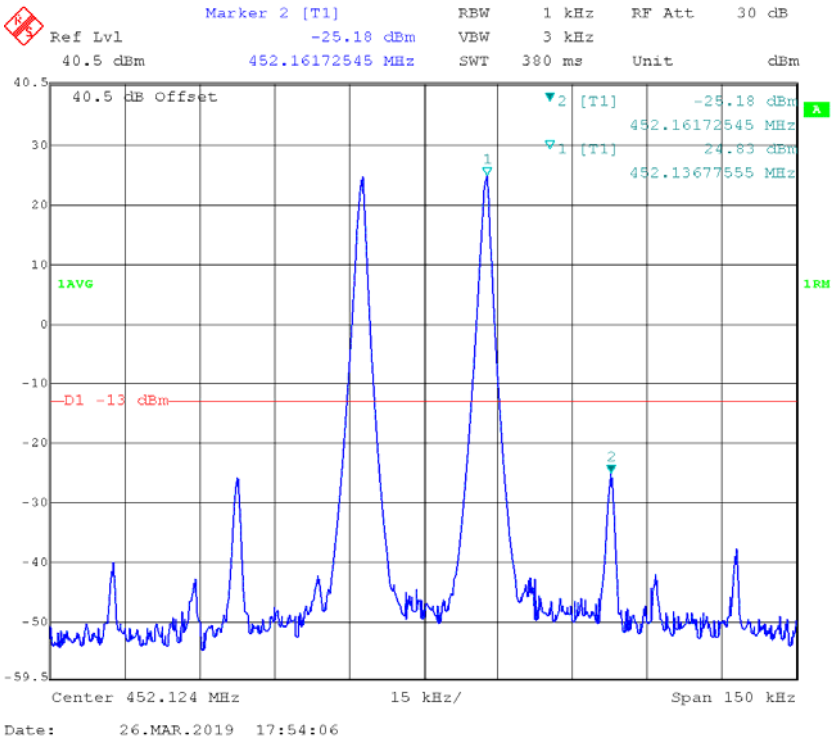


459.228MHz, 12.5 kHz channel spacing, AGC+3

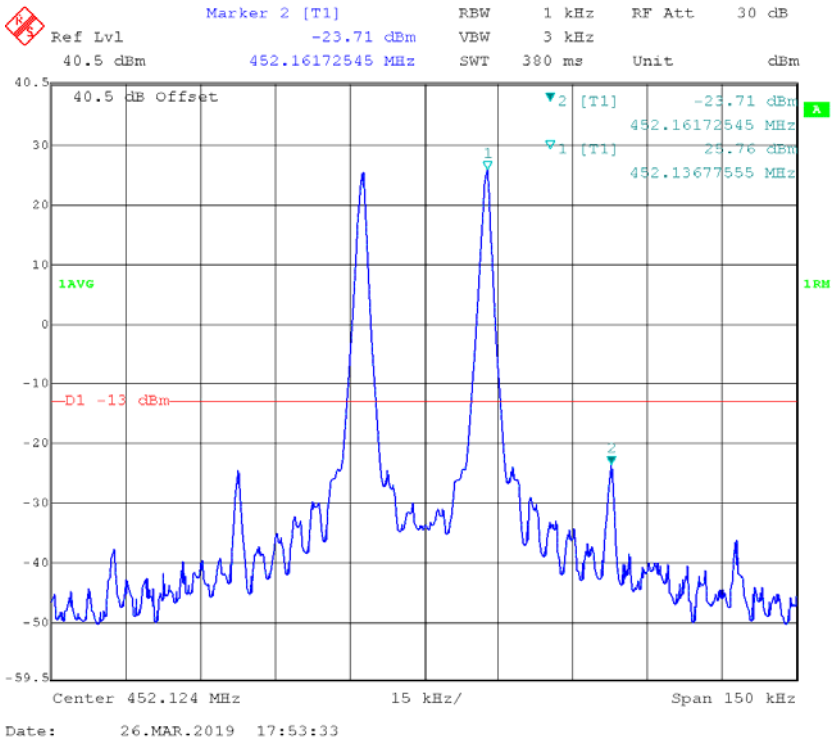


Channel spacing 25kHz:

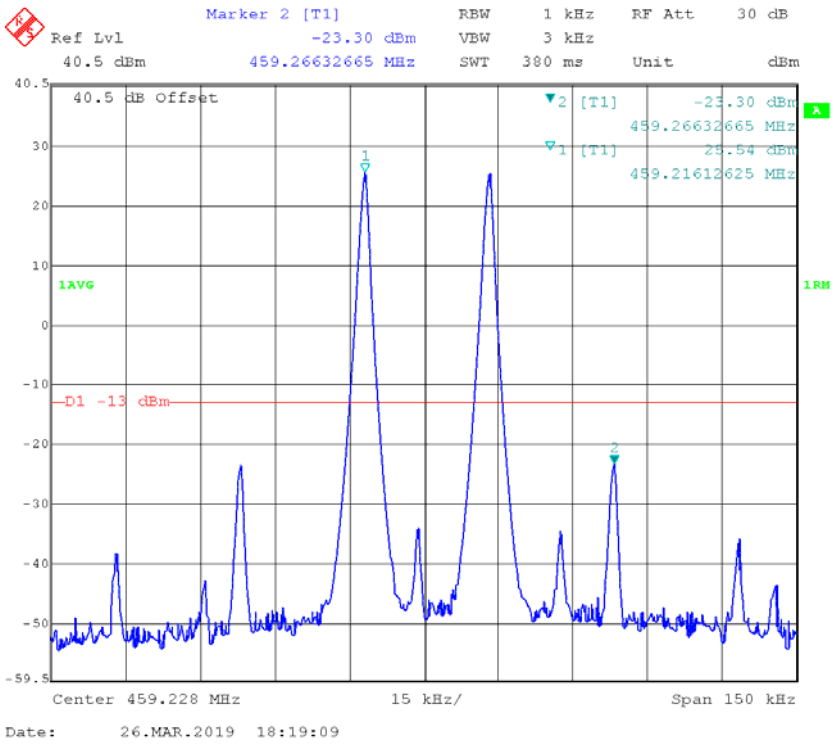
452.124MHz, 25 kHz channel spacing, AGC



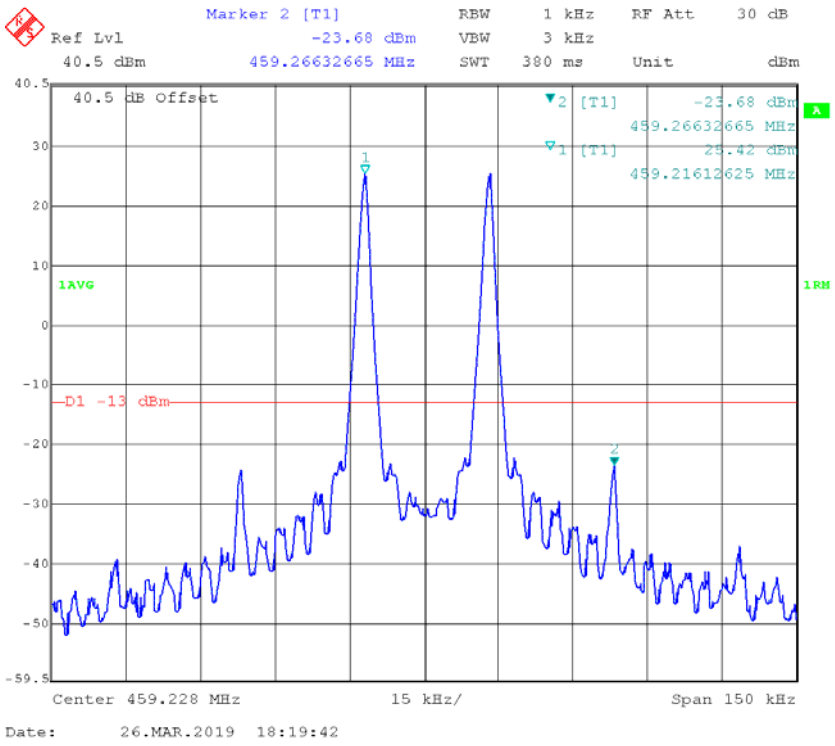
452.124MHz, 25 kHz channel spacing, AGC+3



459.228MHz, 25 kHz channel spacing, AGC



459.228MHz, 25 kHz channel spacing, AGC+3



FCC§90.219 (e)(2) &RSS-131 CLAUSE 6.4 – NOISE FIGURE MEASUREMENTS

Applicable Standard

According to FCC§90.219 (e)(2) The noise figure of a signal booster must not exceed 9 dB in either direction

According to RSS-131Clause 6.4,

The ERP of noise within the passband should not exceed −43 dBm in a 10 kHz measurement bandwidth.

The ERP of noise in spectrum more than 1 MHz outside of the passband should not exceed −70 dBm in a 10 kHz measurement bandwidth.

The noise figure of a zone enhancer shall not exceed 9 dB in either direction.

Test Procedure

a) A spectrum analyzer was connected to EUT output port
b) The Remote Unit input was terminated
c) The spectrum analyzer was set to 100 trace average in the RMS average mode
d) A peak reading was recorded
e) The noise figure was calculated using the following formula
NF= Max reading - (-174dBm/Hz +10*$\log_{10}$(RBW)+ Booster gain)
Note: 174= Thermal noise for 1Hz RBW at room temperature
RBW= Resolution Bandwidth of Spectrum Analyzer in Hz

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.5 kPa

The testing was performed by Blake Yang on 2019-03-26.

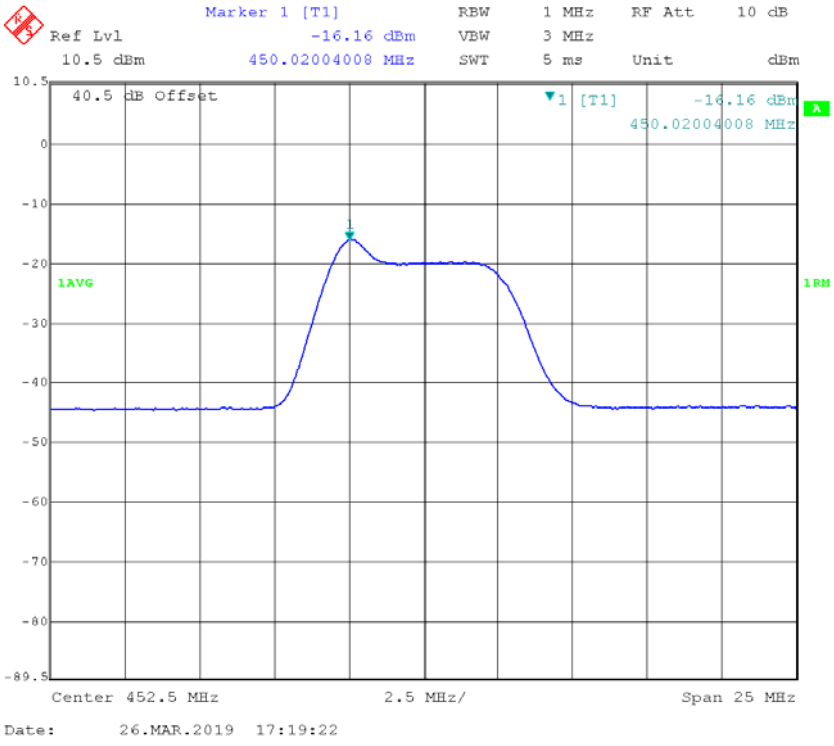
Test Mode: Transmitting

Test Result: Compliance. Please refer to following table and plots.

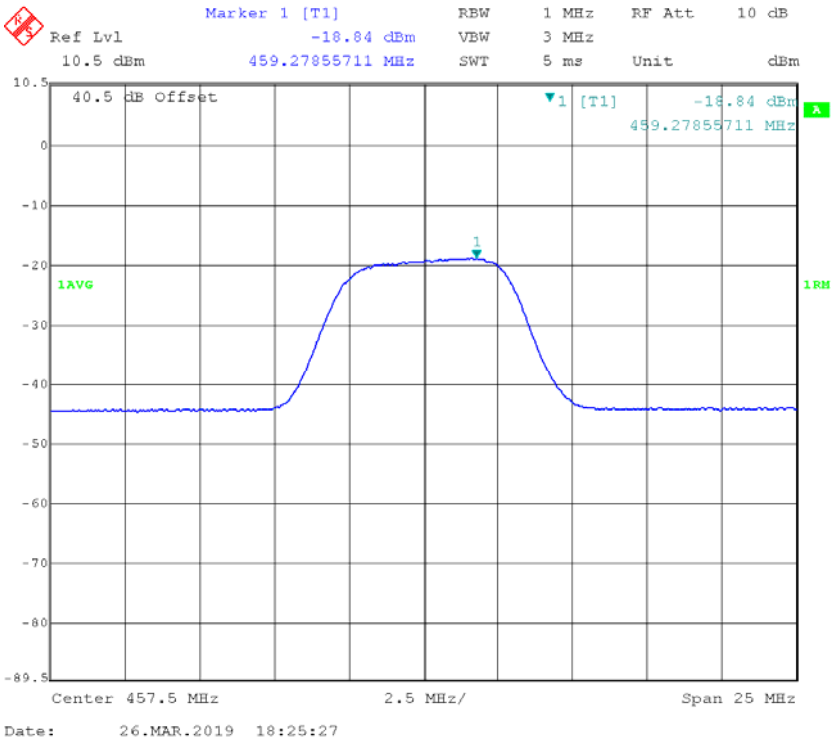
Analyzer Settings			Max Reading (dBm/MHz)	Booster Gain (dB)	Thermal Noise (dBm/MHz)	Noise Figure (dB)	Limit (dB)
Frequency (MHz)	RBW (MHz)	VBW (MHz)					
452.5	1	3	-16.16	89.25	-114	8.59	9
457.5	1	3	-18.84	91.27	-114	3.89	9

Note: Noise Figure=Max reading-(-174dBm/Hz+10*Log_{10}(RBW)+booster gain)

452.5MHz



457.5MHz



FCC§90.219 – OUT-OF-BAND REJECTION

Applicable Standard

According to FCC§20.21, a frequency selective booster shall have -20 dB at the band edge referenced to the gain in the center of the pass band of the booster, where band edges is the end of the licensee's allocated spectrum.

Test Procedure

a) Connect a signal generator to the input of the EUT.
b) Configure a swept CW signal with the following parameters:
1) Frequency range = ± 250 % of the manufacturer's specified pass band.
2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold throughout the test.
3) Dwell time = approximately 10 ms.
4) Frequency step = 50 kHz.
c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
d) Set the RBW of the spectrum analyzer to between 1 % and 5 % of the manufacturer's rated passband, and VBW = 3 × RBW.
e) Set the detector to Peak and the trace to Max-Hold.
f) After the trace is completely filled, place a marker at the peak amplitude, which is designated as f0, and with two additional markers (use the marker-delta method) at the 20 dB bandwidth (i.e., at the points where the level has fallen by 20 dB).
g) Capture the frequency response plot for inclusion in the test report.

Test Data

Environmental Conditions

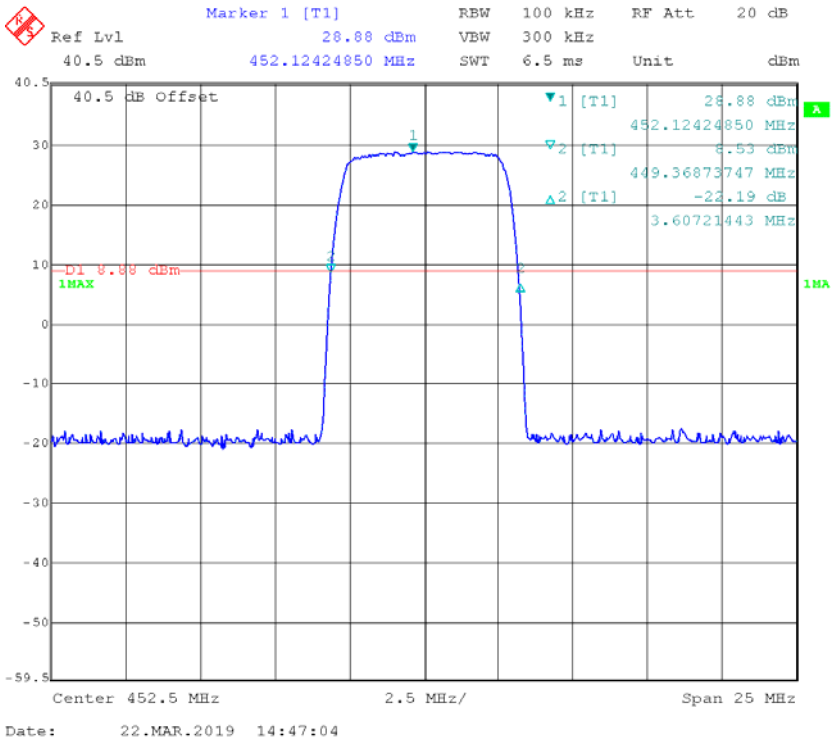
Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.5 kPa

The testing was performed by Blake Yang on 2019-03-22.

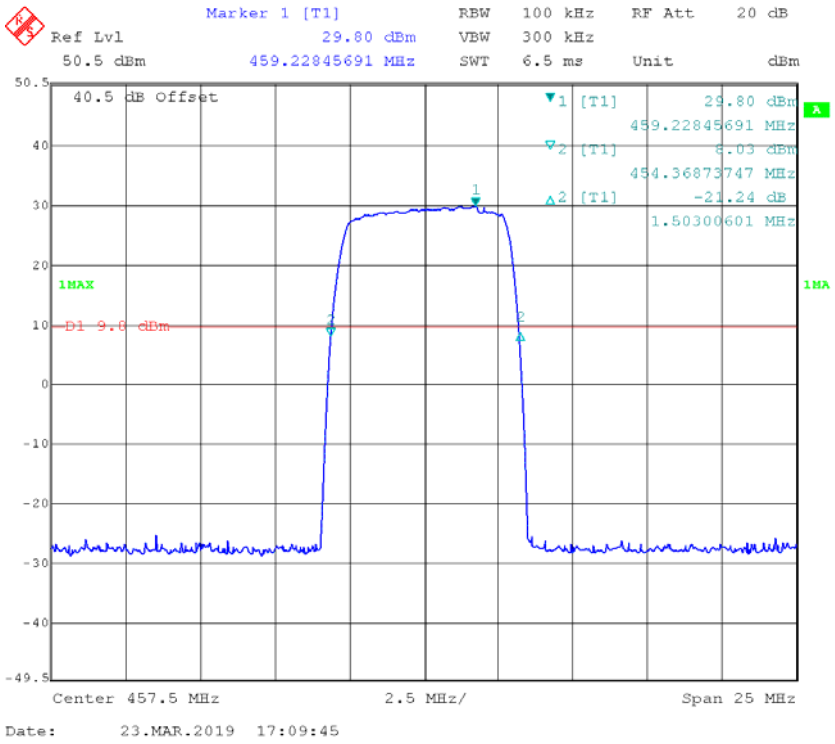
Test Mode: Transmitting

Test Result: Compliance. Please refer to following table and plots.

450-455MHz



455-460MHz



******* END OF REPORT *******