TELTEST Laboratories
Tait International Ltd
Report Number 4140

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBDB1G BASE STATION Transceiver
Fitted with the B1 136-174 MHz Reciter

Tested in accordance with:

FCC 47 CFR Parts 22 and 90

RSS-119 Issue 12
RSS-Gen Issue 5

Report Revision:	1
Issue Date:	22 February 2021
PREPARED BY:	I. D. Russell
CHECKED & APPROVED BY:	M. C. James

Test Technician

Laboratory Technical Manager

ACCREDITED
TESTING LABORATORY
№ 9, 577

FCC Registration: 838288
ISED Registration: 737A

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

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REVISION HISTORY

Date	Revision	Comments
22 February 2021	1	Initial test report

INTRODUCTION

Type approval testing of the TBDB1G, 50 Watt, BASE STATION transceiver in order to demonstrate compliance with FCC 47 Parts 22 & 90, and RSS-119 Issue 12 & RSS-Gen Issue 5. This radio supports analogue, digital FFSK, Digital Mobile Radio (DMR), APCO P25 phase-1 modulations.

REPORT PREPARED FOR
Tait International Limited
245 Wooldridge Road
Harewood
Christchurch 8051
New Zealand

DESCRIPTION OF SAMPLE

Manufacturer	Tait International Limited
Equipment:	BASE STATION Transceiver
Type:	TBDB1G
Product Code:	TB7310-B1B0-0000-A000-10
Serial Number(s):	18331488
Frequency range	136 → 174 MHz
Transmit Power	50 Watts

Modulation		Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
Analogue FM		12.5 kHz	1	-	-
FFSK	Fast Frequency Shift Keying	12.5 kHz	-	1200	1200
Digital Mobile Radio (DMR)	4 Level FSK (2 slot TDMA) (ETSI TS102 361-1)	12.5 kHz	2	4800	9600
APCO P25 Phase 1	C4FM (TIA 102)	12.5 kHz	1	4800	9600

HARDWARE & SOFTWARE
Quantity: 1

Module	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01403-BAAA	18331256	p25-0.01.00-47875-g57afd504cf	2.01
Power Amplifier	T01-01405-BAAA	18337783	-	0.02
Front Panel	T01-01410-AAAA	4793823	1.10.03.9999	0.01

TEST CONDITIONS
All testing was performed between 12 → 18 February 2021, and under the following conditions:

Ambient temperature:	15°C → 30°C
Relative Humidity:	20% → 75%
Standard Test Voltage	120 V_{AC}

TEST REQUIREMENTS AND RESULT SUMMARY

ISED Specification	FCC Specification	Test Name	Test Methods	Result
RSS-119 5.4	FCC 47 CFR 2.1046	Transmitter Output Power (Conducted)	RSS-Gen 6.12 ANSI C63.26 5.2.4.2	P
No specification	FCC 47 CFR 2.1047 (a)	Transmitter Audio Frequency Response – Pre-emphasis	ANSI C63.26 5.3.3.2	P
No specification	FCC 47 CFR 2.1047 (b)	Transmitter Modulation Limiting	ANSI C63.26 5.3.2	P
RSS-119 5.5	FCC 47 CFR 2.1049 (c)	Transmitter Occupied (99%) Bandwidth	RSS-Gen 6.7 ANSI C63.26 5.4.4	P
RSS-119 5.5	FCC 47 CFR 90.210	Transmitter Spectrum Masks	RSS-119 4.2.2 TIA-603-E 2.2.11	P
RSS-119 5.8.9	FCC 47 CFR 90.543	Adjacent Channel Power Ratio	RSS-119 4.3 ANSI C63.26 6.5.2.4	N/A 1
RSS-119 5.8	FCC 47 CFR 2.1051	Transmitter Spurious Emissions (Conducted)	RSS-Gen 6.13 ANSI C63.26 5.7	P
RSS-119 5.8	FCC 47 CFR 2.1053	Transmitter Spurious Emissions (Radiated)	RSS-Gen 6.13 ANSI C63.26 5.5	P
No specification	FCC CFR 90.543	Transmitter Radiated Emissions in the GNSS Band	ANSI C63.26 6.5.2.7.3	N/A 1
RSS-119 5.8.9.2 rad	No specification	Transmitter Conducted Emissions in the GNSS Band	RSS-119 5.8 ANSI C63.26 6.5.2.7.4	N/A 1
RSS-119 5.9	FCC 47 CFR 90.214	Transient Frequency Behaviour	RSS-119 5.9 ANSI C63.26 6.5.2.2	P
RSS-119 5.3	FCC 47 CFR 90.214	Transmitter Frequency Stability - Temperature	RSS-Gen 6.11 ANSI C63.26 5.6.4	P
RSS-119 5.3	FCC 47 CFR 2.1055 (d) (1)	Transmitter Frequency Stability - Voltage	RSS-Gen 6.11 ANSI C63.26 5.6.5	P
RSS-Gen 7.4	FCC 47CFR 15.111	Receiver Spurious Emissions (Conducted)	RSS-Gen 7.4 TIA-603-E 2.1.2	P

Test Case Result Definitions	
No test Performed	N
Test does not apply to the test object	N/A
Test object meets requirements	P (Pass)
Test object does not meet requirements	F (Fail)
Test object is not conclusive	I (Inconclusive)

Comments:
N/A 1: Only required where the EUT transmits in the 768-776 or 798-806 MHz band (ISED), or 769-775 or 799-805 MHz band (FCC).

STATEMENT OF COMPLIANCE

We, TELTEST LABORATORIES of 558 Wairakei Road, Christchurch, New Zealand, declare under our sole responsibility that the product:

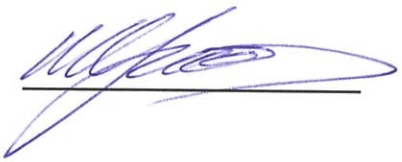
Equipment: BASE STATION Transceiver
Type: TBDB1G

Module	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01403-BAAA	18331256	p25-0.01.00-47875-g57afd504cf	2.01
Power Amplifier	T01-01405-BAAA	18337783	-	0.02
Front Panel	T01-01410-AAAA	4793823	1.10.03.9999	0.01

to which this declaration relates, is in conformity with the following standards:

FCC 47 CFR Parts 22 and 90

RSS-119 Issue 12 and RSS-Gen Issue 5

Signature: 

Mike James
Technical Manager

Date: 16 March 2021

The results obtained in this test report pertain only to the item(s) tested. Teltest does not make any claims of compliance for samples or variants that were not tested.

CHANNEL TABLE

Channel Number	Transmit Frequency	Receive Frequency	Power	Bandwidth
CH1	138.1 MHz	138.15 MHz	50W	12.5kHz
CH2	138.1 MHz	138.15 MHz	2W	12.5kHz
CH3	150.85 MHz	150.90 MHz	50W	12.5kHz
CH4	150.85 MHz	150.90 MHz	2W	12.5kHz
CH5	156.1 MHz	156.15 MHz	50W	12.5kHz
CH6	156.1 MHz	156.15 MHz	2W	12.5kHz
CH7	157.2 MHz	157.25 MHz	50W	12.5kHz
CH8	157.2 MHz	157.25 MHz	2W	12.5kHz
CH9	161.9 MHz	161.95 MHz	50W	12.5kHz
CH10	161.9 MHz	161.95 MHz	2W	12.5kHz
CH11	162.1 MHz	162.15 MHz	50W	12.5kHz
CH12	162.1 MHz	162.15 MHz	2W	12.5kHz
CH13	173.3 MHz	173.35 MHz	50W	12.5kHz
CH14	173.3 MHz	173.35 MHz	2W	12.5kHz

MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

MODULATION TYPES:

F3E	FM Analogue Voice	-	-
F2D	Fast Frequency Shift Keying	1200 symbols/sec	1200 bps
F1E	C4FM	4800 symbols/sec	9600 bps
FXW	Digital Voice / Data	4800 symbols/sec	9600 bps

CHANNEL SPACING: 12.5 kHz

EMISSION DESIGNATORS:

Analogue Voice	11K0F3E
FFSK	7K60F2D
P25 Phase 1 Digital Voice	8K10F1E
DMR Digital Voice / Data	8K00FXW

Equation: Bn = 2M + 2Dk
(M is highest modulating frequency; D is peak allowable deviation; k is a constant of 1 for FM)

Analogue Voice 12.5 kHz Channel Spacing

Necessary bandwidth	Emission Designator
M = 3.0 kHz	**11K0F3E**
D = 2.5 kHz	F3E represents an FM voice transmission
Bn = (2x3.0) + (2x2.5) x 1	
= 11.0 kHz	

Fast Frequency Shift Keying: (FFSK – 1200 bps) 12.5 kHz Channel Spacing

Necessary bandwidth	Emission Designator
M = 1.8 kHz	**7K60F2D**
D = 2.0 kHz	F2D represents a FM data transmission with
Bn = (2 x 1.8) + (2 x 2.0) x 1	the use of a modulating sub carrier
= 7.6 kHz	

P25 phase 1: Digital Voice 12.5 kHz Channel Spacing

99% bandwidth	Emission Designator
= 8.1 kHz	**8K10F1E**
	F1E represents a digital FM voice transmission

P25 phase 1: Digital Data 12.5 kHz Channel Spacing

99% bandwidth	Emission Designator
= 8.1 kHz	**8K10F1D**
	F1D represents an digital FM data transmission

DMR: Digital Voice 12.5 kHz Channel Spacing

99% bandwidth	Emission Designator
= 8.0 kHz	**8K00FXW**

FXW represents a FM Time Division Multiple Access (TDMA) combination of data and telephony

DMR: Digital Data 12.5 kHz Channel Spacing

99% bandwidth	Emission Designator
= 8.0 kHz	**8K00FXD**

FXD represents FM Time Division Multiple Access (TDMA) data only

TEST RESULTS

TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046
RSS-119 5.4

GUIDE: ANSI C63.26 5.2.4.2

MEASUREMENT PROCEDURE:
1. Refer Annex A for Equipment set up.
2. The coaxial attenuator has an impedance of 50 Ohms.
3. The unmodulated output power was measured with an RF Power meter.

EXAMPLE CALCULATION:

Example calculation

Power in dBm =	Measured power (dBm) + attenuator and cable loss (dB)
Chan 1 power (dBm) =	16.98 dBm +30.13 dB
=	47.11dBm
Power in Watts =	(10^(47.11dBm)/10)/1000
=	51.4W

MEASUREMENT RESULTS:
Manufacturer's Rated Output Power: Switchable: 50 W and 2 W

Nominal 50 W	138.1 MHz	150.85 MHz	156.1 MHz	157.2 MHz	161.9 MHz	162.1 MHz	173.3 MHz
Measured	51.4	51.3	51.9	51.3	54.4	54.4	51.8
Variation (%)	2.9	2.6	3.7	2.6	8.8	8.8	3.5
Variation (dB)	0.1	0.1	0.2	0.1	0.4	0.4	0.2
Nominal 2 W	138.1 MHz	150.85 MHz	156.1 MHz	157.2 MHz	161.9 MHz	162.1 MHz	173.3 MHz
Measured	2.0	2.0	2.1	2.0	2.1	2.1	2.1
Variation (%)	-0.4	0.3	2.8	1.9	3.9	3.9	2.6
Variation (dB)	0.0	0.0	0.1	0.1	0.2	0.2	0.1
Measurement Uncertainty	± 0.6 dB						

LIMIT CLAUSES:
FCC 47 CFR 90.205 (s)
The output power shall not exceed by more than 20%... the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

RSS-119 5.4
The output power shall be within ±1.0 dB of the manufacturer's rated power.

TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: ANSI C63.26 5.3.3.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000 Hz was applied with the level set to obtain 20% of maximum deviation. This was used as the 0 dB reference point.
3. The AF was varied while the audio level was held constant.
4. The response in dB relative to 1000 Hz was measured.

MEASUREMENT RESULTS:

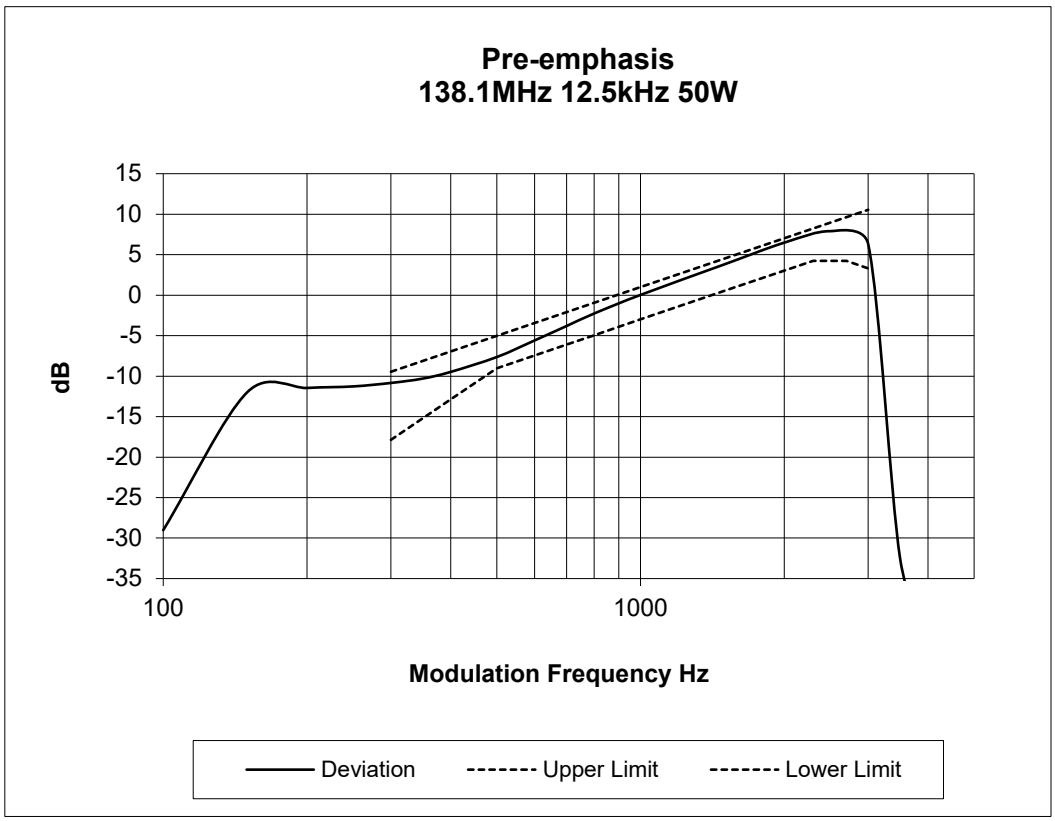
See the plots on the following pages for 12.5 kHz channel spacing tested at 50 W transmit power.

LIMIT CLAUSE: TIA/EIA-603E 3.2.6

MEASUREMENT UNCERTAINTY: ± 1.5 %

SPECIFICATION: FCC CFR 2.1047 (a)

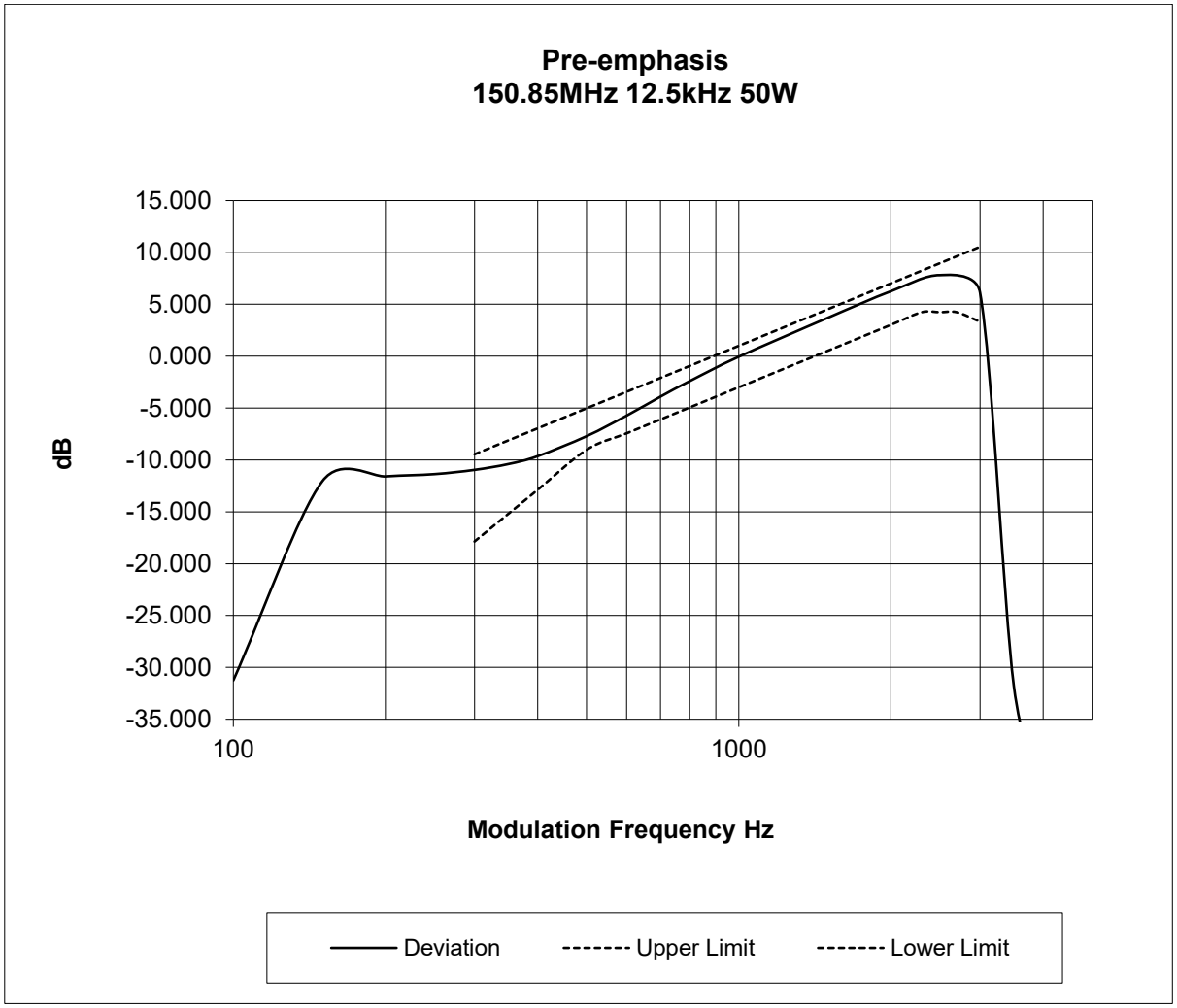
Tx FREQUENCY: 138.1 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

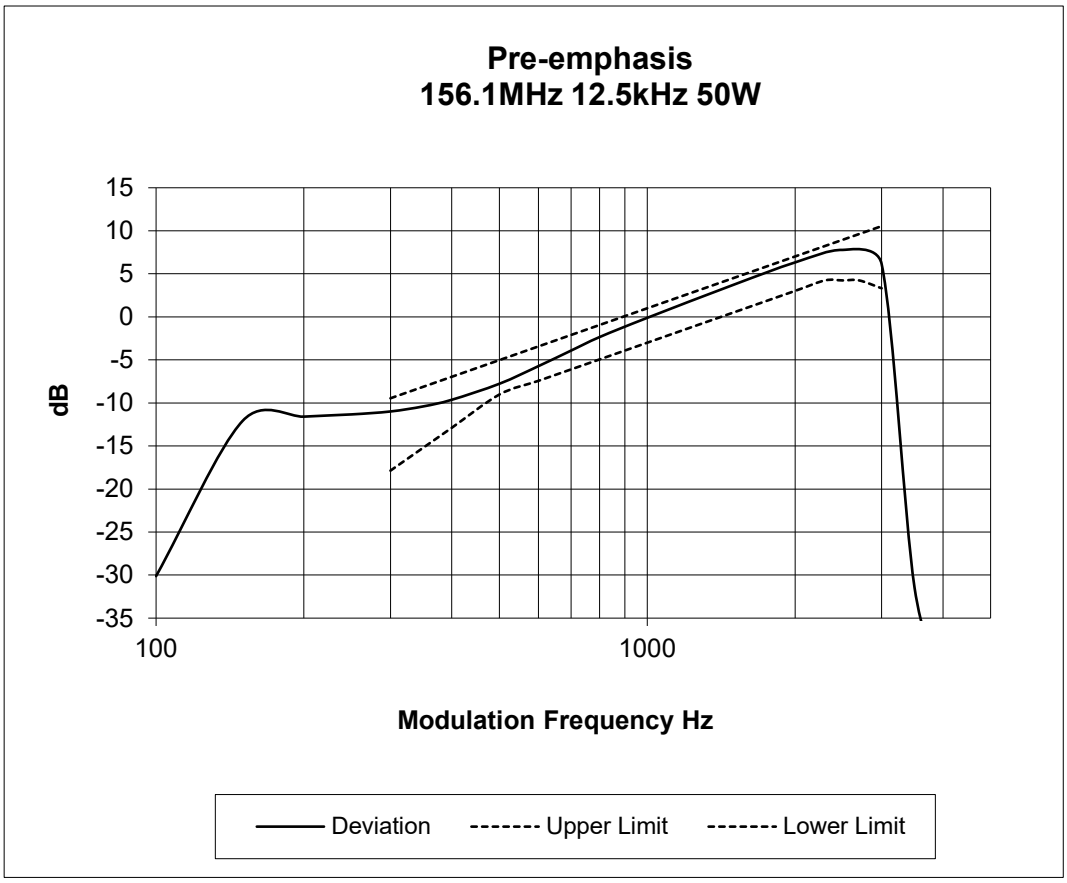
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 150.85 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

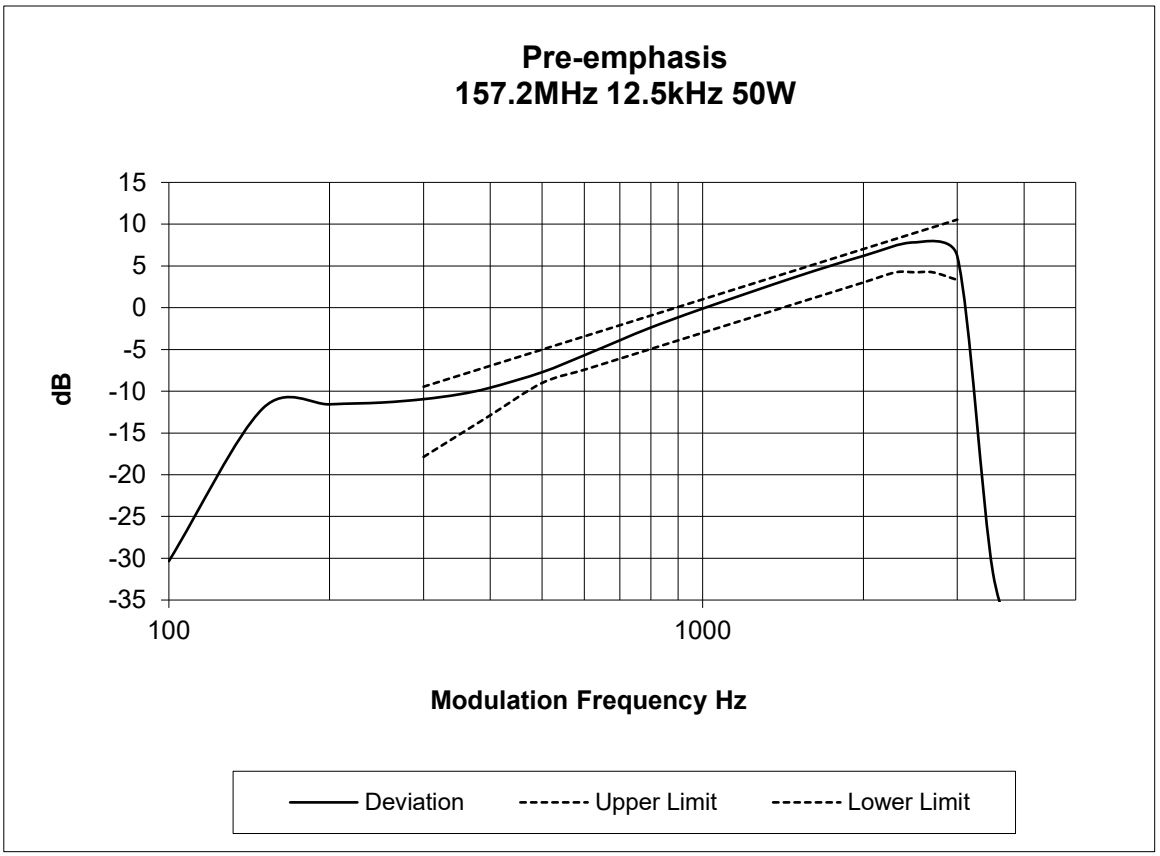
Tx FREQUENCY: 156.1 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

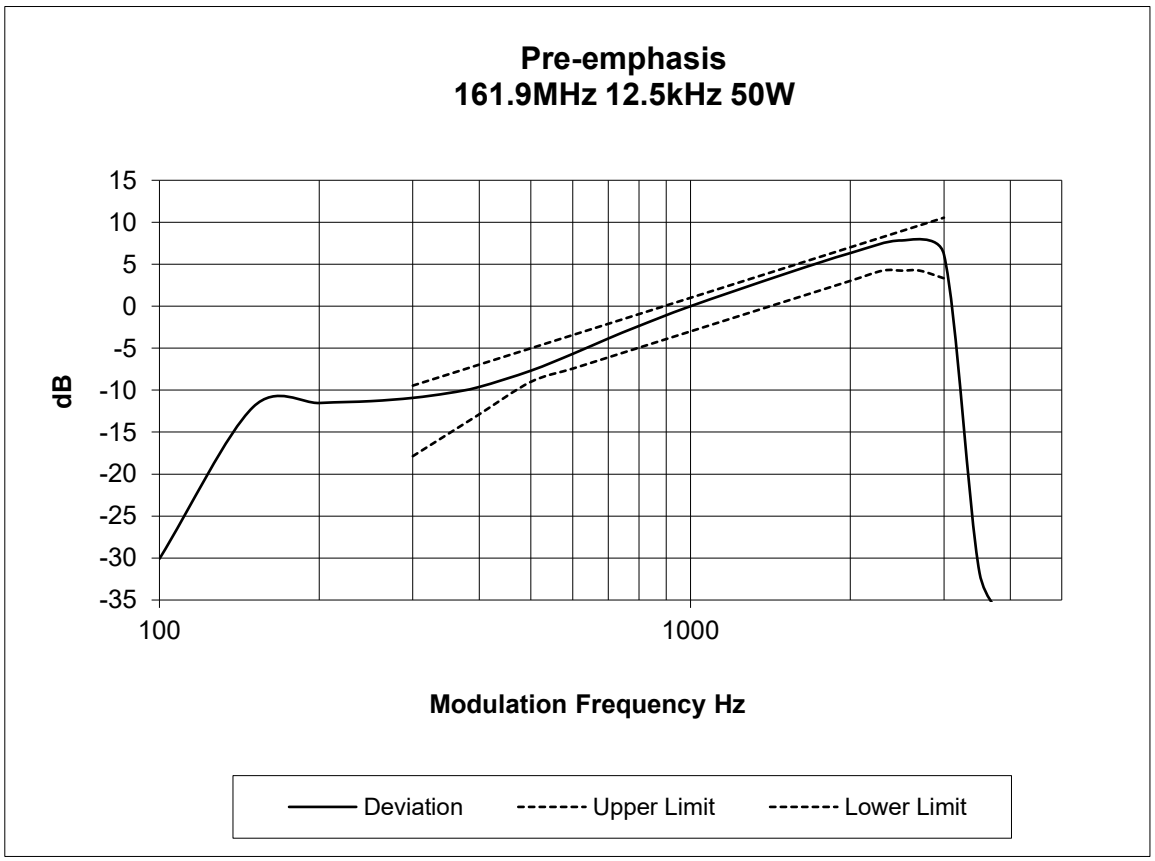
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 157.2 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

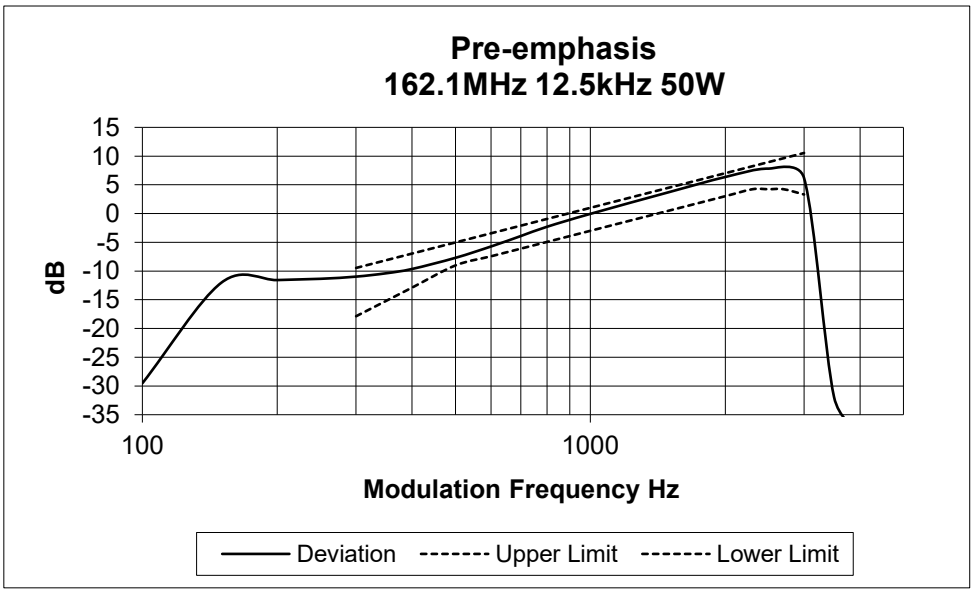
Tx FREQUENCY: 161.9 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

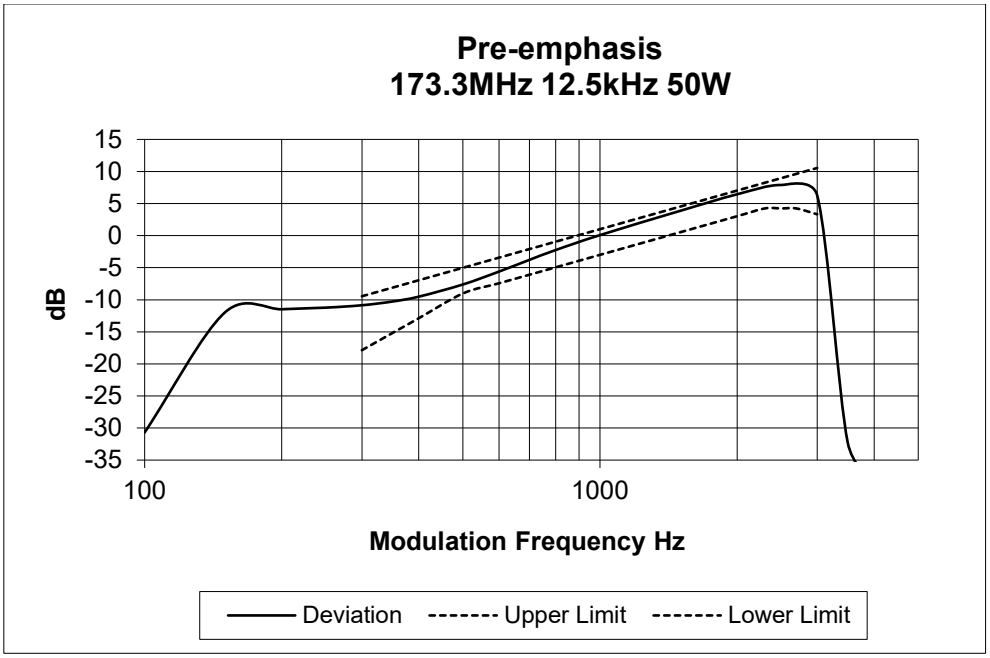
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 162.1 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 173.3 MHz 12.5 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: ANSI C63.26 5.3.2

MEASUREMENT PROCEDURE:
1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000 Hz was applied with the level set to obtain 60% of maximum deviation. This was used as the 0 dB reference point.
3. The modulation response was measured at four audio frequencies while increasing the input level in 5dB steps.
4. Additionally the level used to measure sideband spectrum (occupied bandwidth) was included in the level sweep.
5. Measurements were made for both Positive and Negative Deviation.

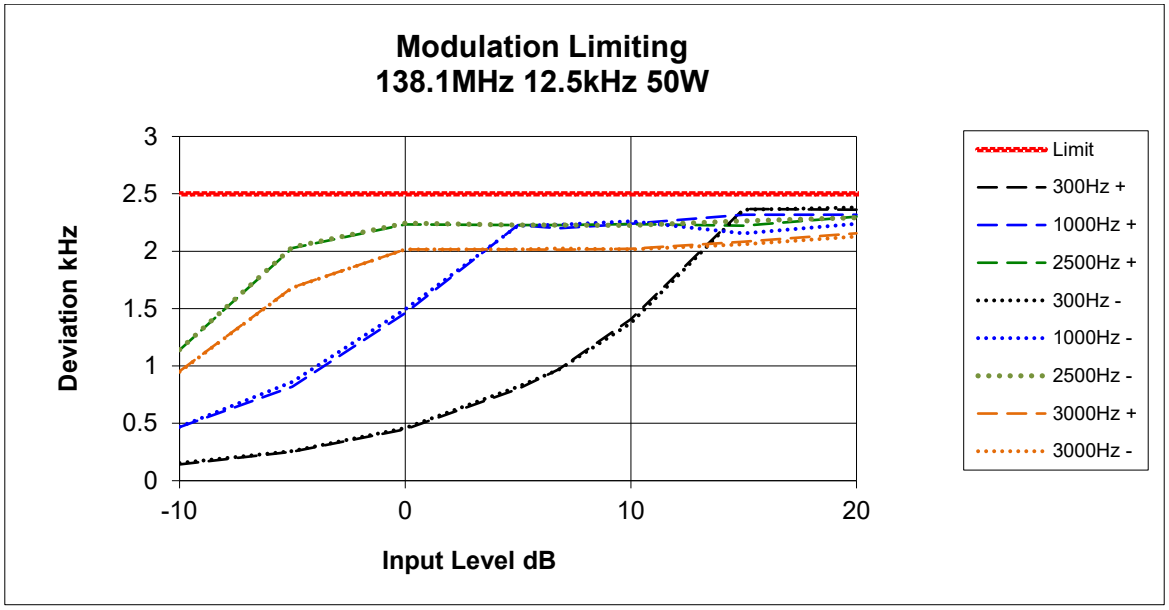
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSE: TIA/EIA-603E 1.3.4.4

MEASUREMENT UNCERTAINTY: ± 1.5 %

SPECIFICATION: FCC CFR 2.1047 (b)

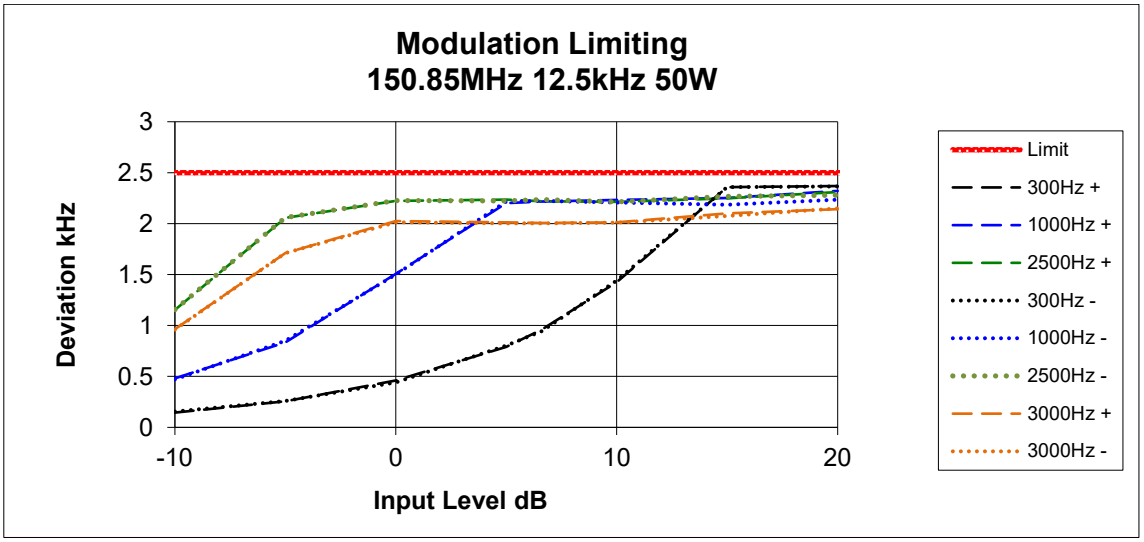
Tx FREQUENCY: 138.1 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

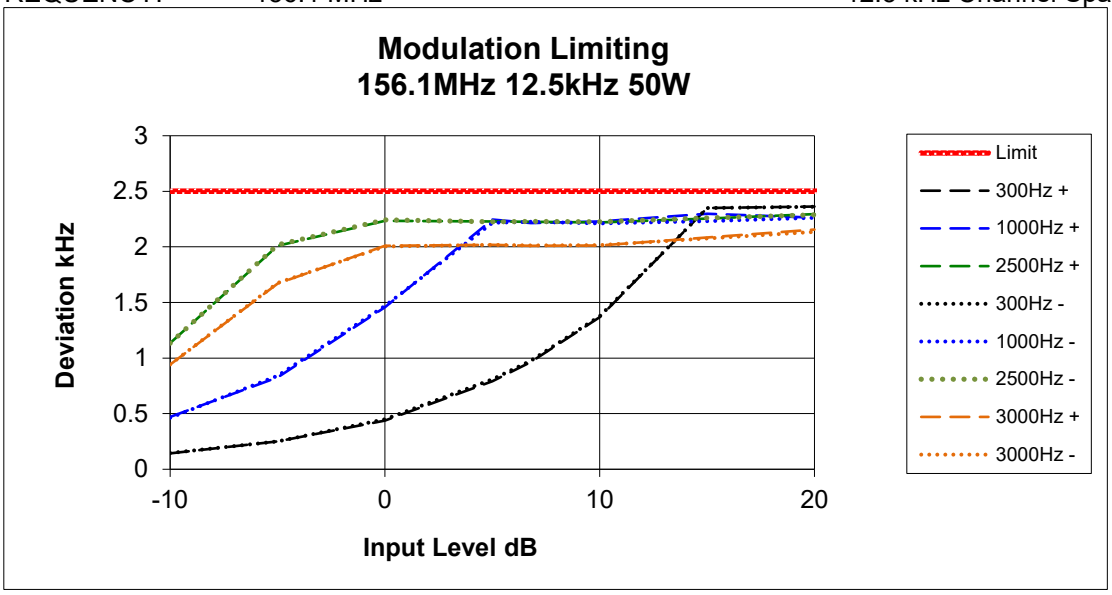
SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 150.85 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

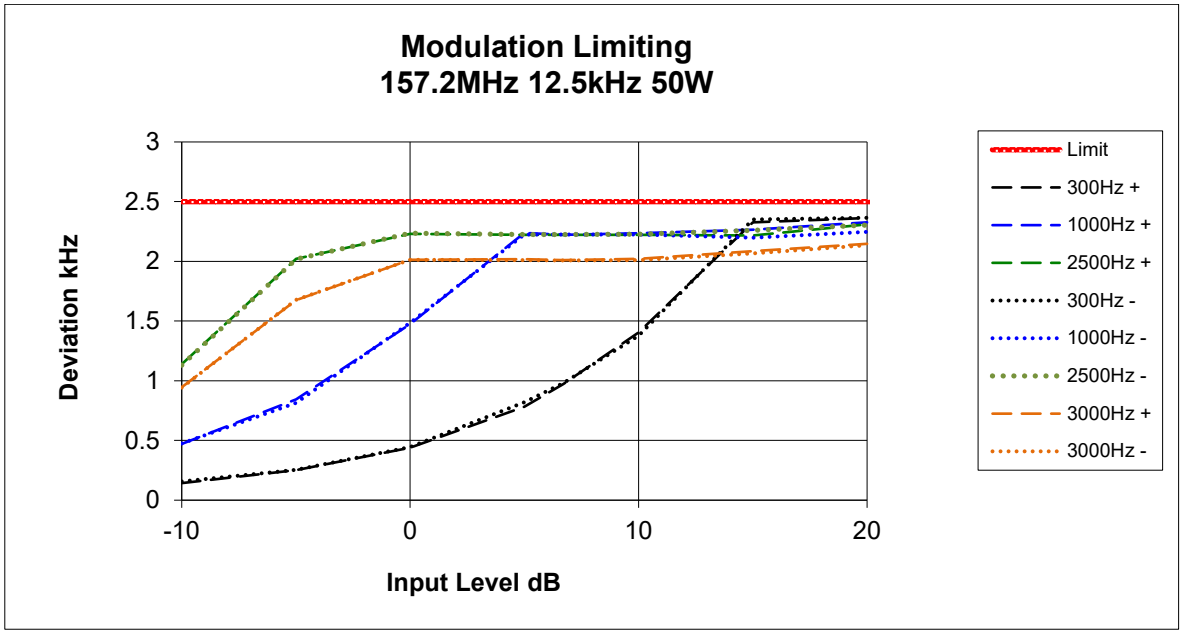
Tx FREQUENCY: 156.1 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

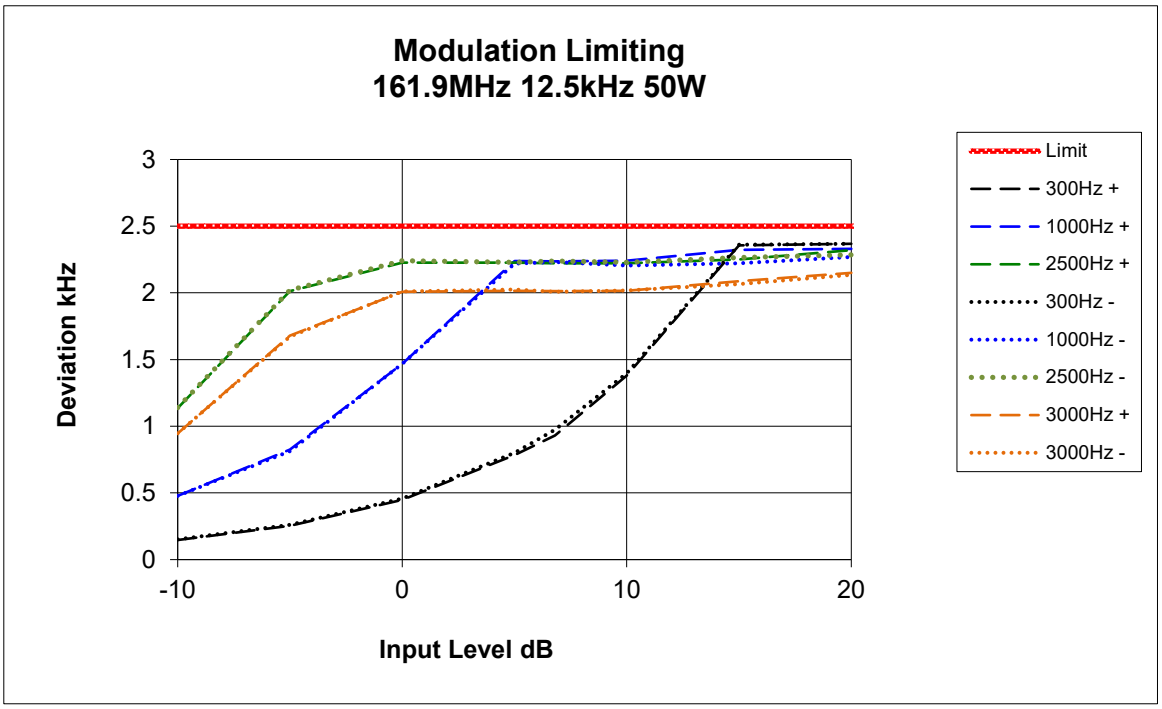
SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 157.2 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

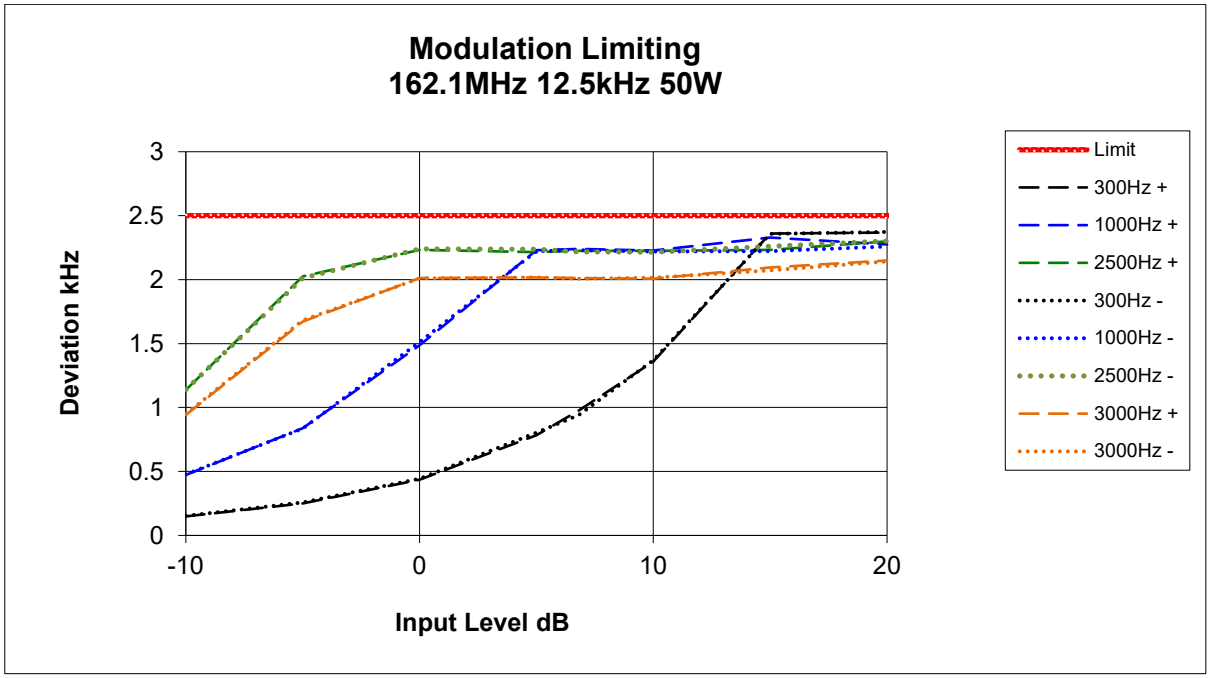
Tx FREQUENCY: 161.9 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

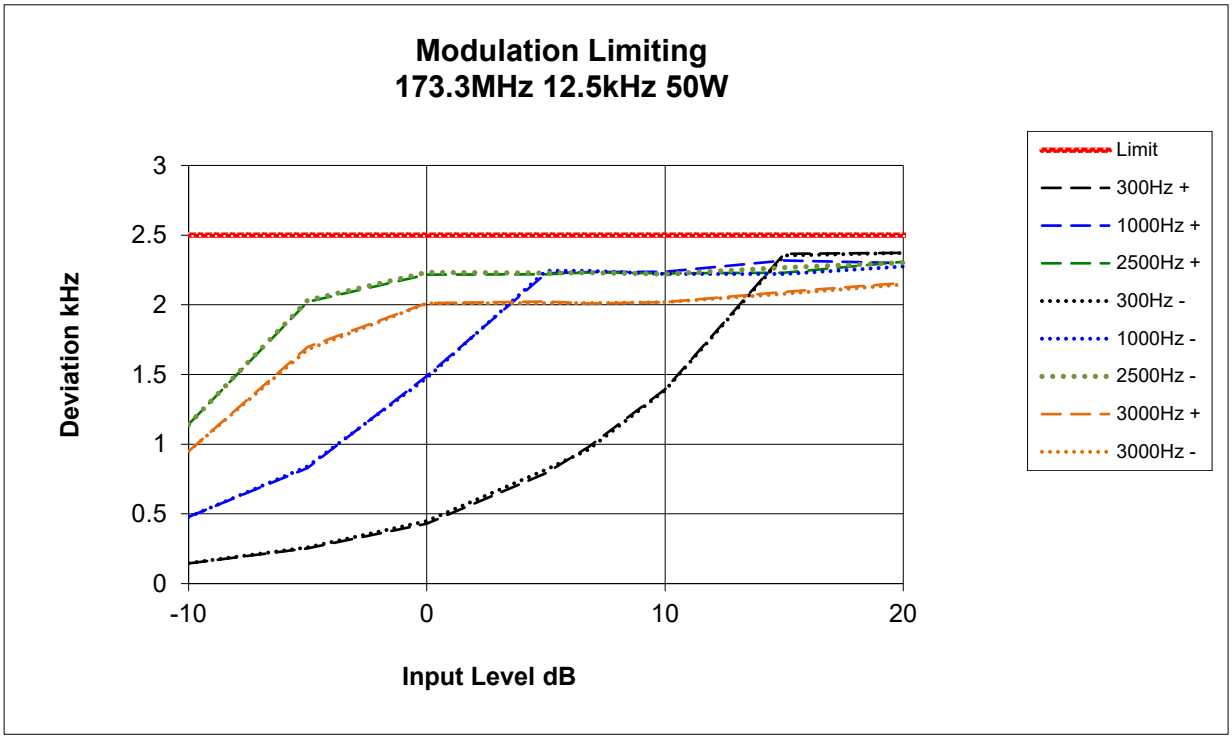
SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 162.1 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 173.3 MHz 12.5 kHz Channel Spacing



TRANSMITTER OCCUPIED (99%) BANDWIDTH

SPECIFICATION: RSS-119 5.5

GUIDE: RSS-Gen 6.7

MEASUREMENT PROCEDURE:

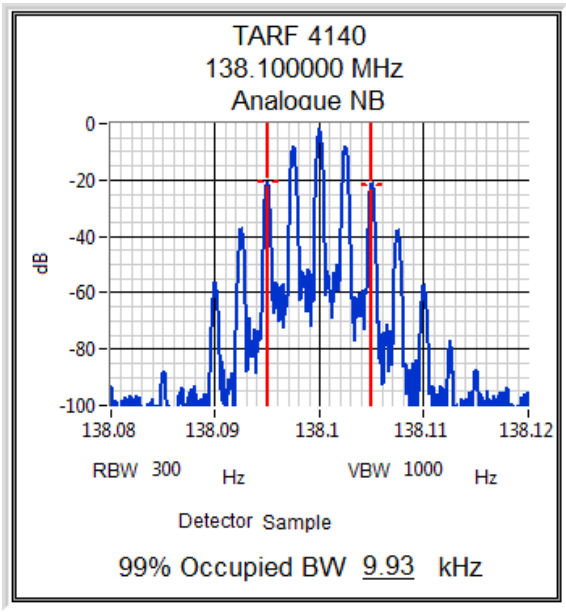
1. Refer Annex A for Equipment Set up.
2. For analogue measurements: The EUT was modulated by a 2500 Hz tone at an input level 16 dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.
   For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as follows.
   Resolution Bandwidth = 300 Hz, Video Bandwidth = 1000 Hz

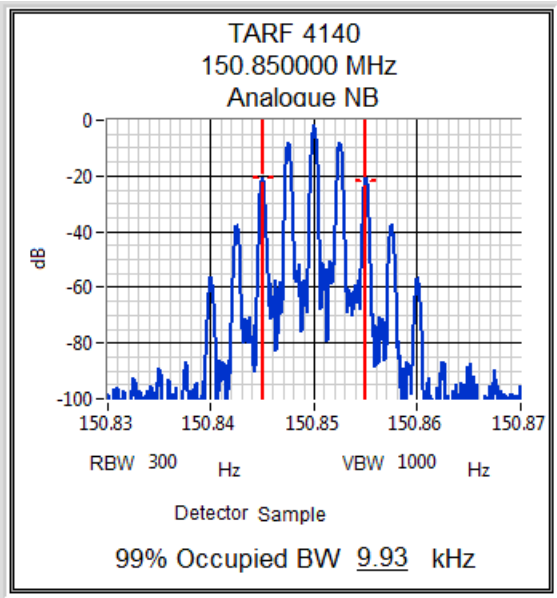
MEASUREMENT RESULTS:

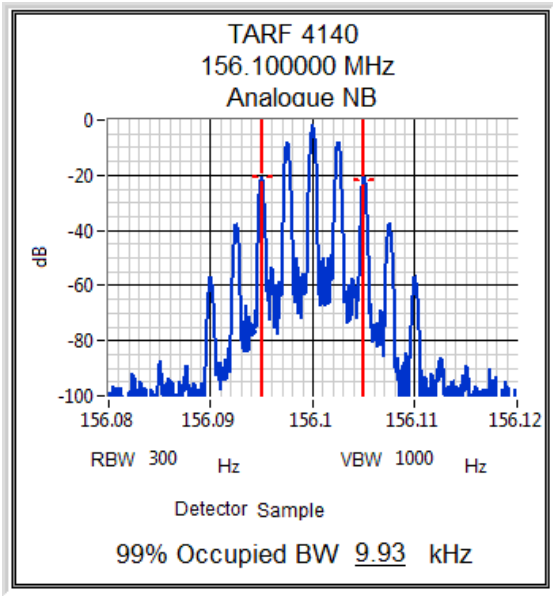
		Bandwidths (kHz)			
Channel Spacing (MHz)	Channel Spacing (kHz)	Analogue	FFSK 1200 bps	DMR	APCO P25 phase I
138.1 MHz	12.5	9.93	6.33	7.87	7.73
150.85 MHz	12.5	9.93	6.33	7.07	7.87
156.1 MHz	12.5	9.93	6.87	7.87	7.60
157.2 MHz	12.5	10.00	7.13	7.47	7.67
161.9 MHz	12.5	9.93	6.87	7.20	7.87
162.1 MHz	12.5	9.93	6.93	7.67	7.73
173.3 MHz	12.5	9.93	6.60	7.53	7.93
Limit Authorized Bandwidth 47 CFR 90.209 RSS 119 5.5		11.25	11.25	11.25	11.25
Necessary BW used in emission designator		11.0	7.6	8.0	8.1
Result		Pass	Pass	Pass	Pass

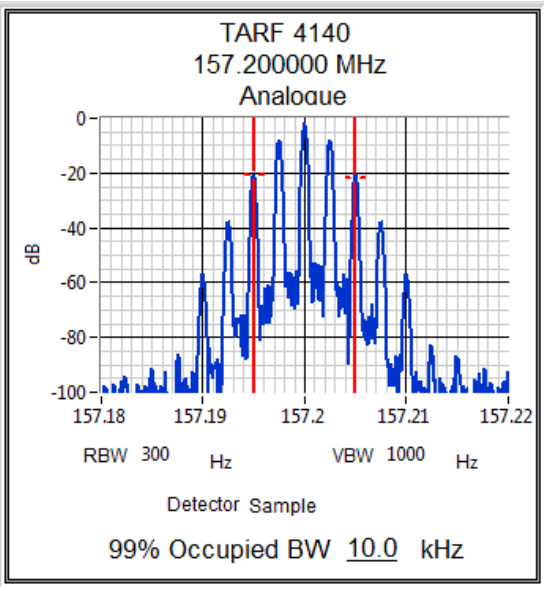
Transmitter Occupied (99%) Bandwidth

Channel 1-4 50 watts 12.5 kHz ch spacing Analogue Modulation



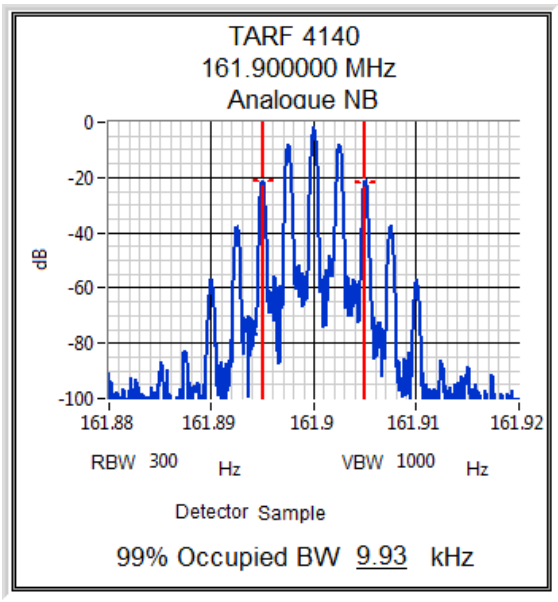


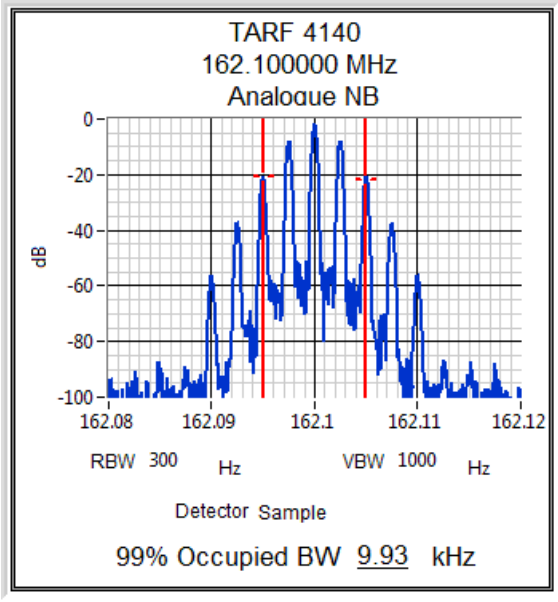


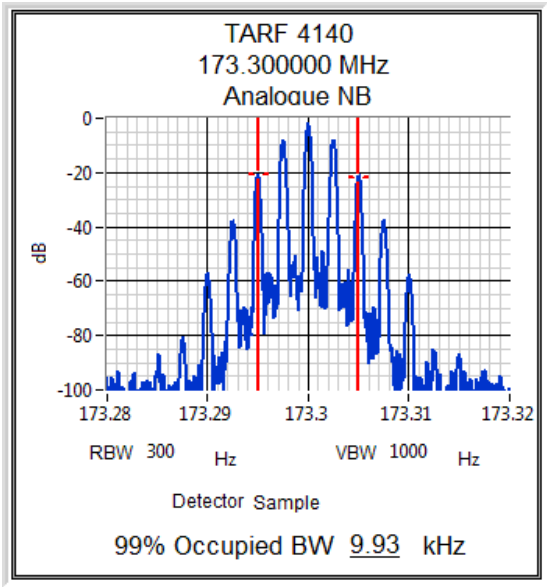


Transmitter Occupied (99%) Bandwidth

Channel 5-7 50 watts 12.5 kHz ch spacing Analogue Modulation

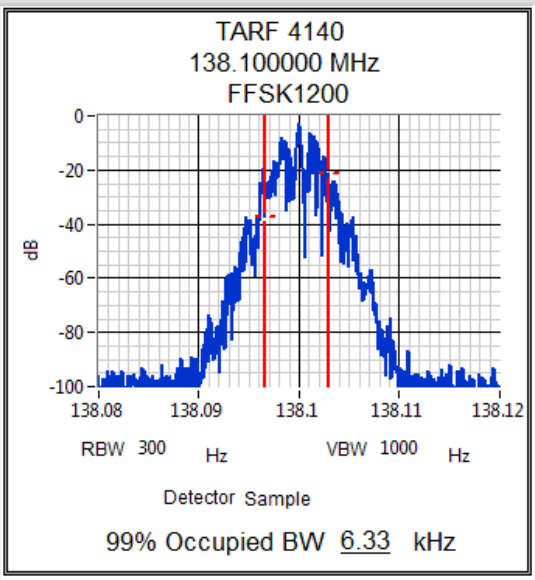


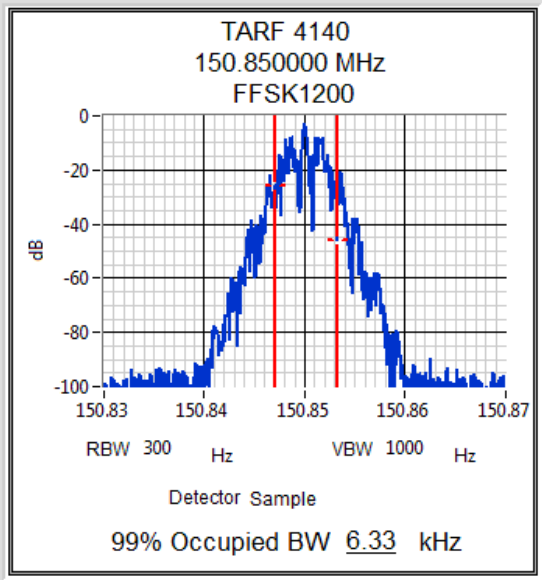


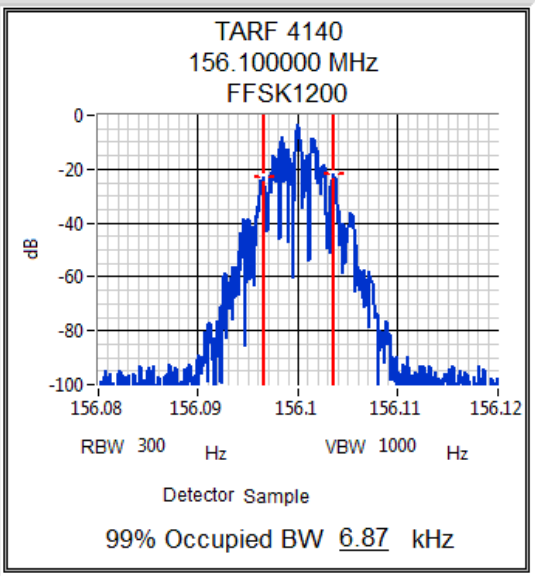


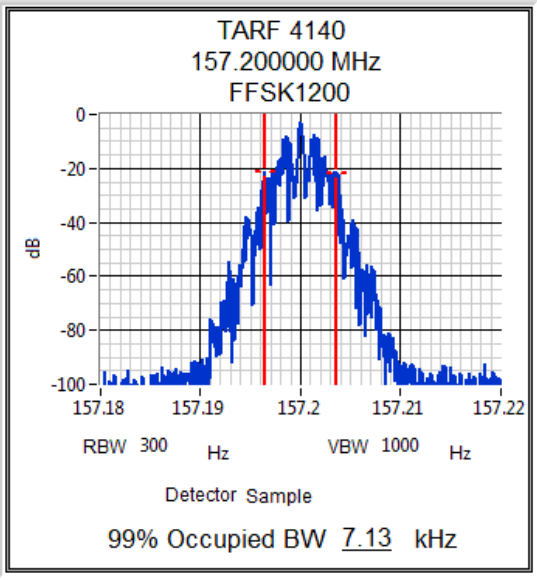
Transmitter Occupied (99%) Bandwidth

Channel 1-4 50 watts 12.5 kHz ch spacing FFSK1200 Modulation



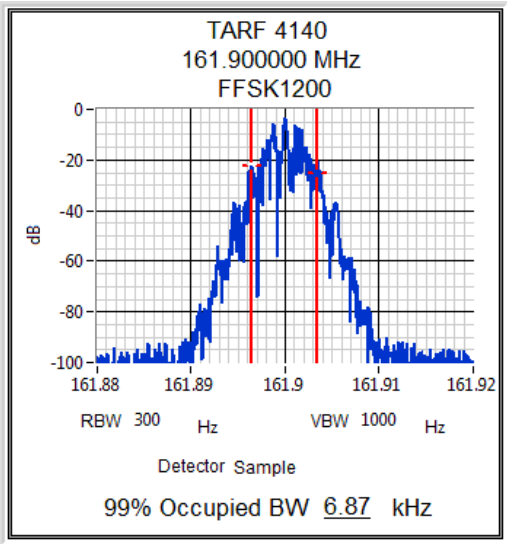


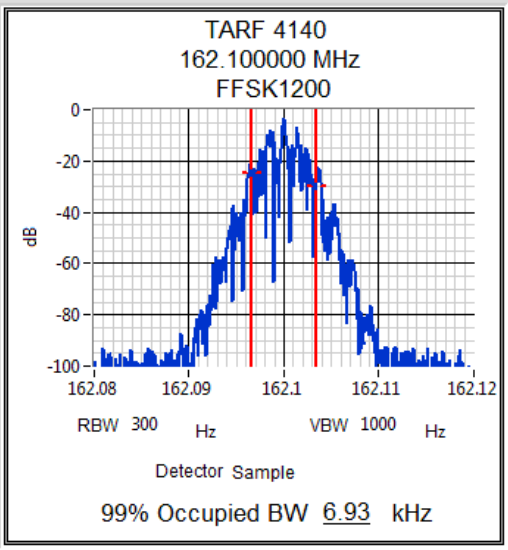


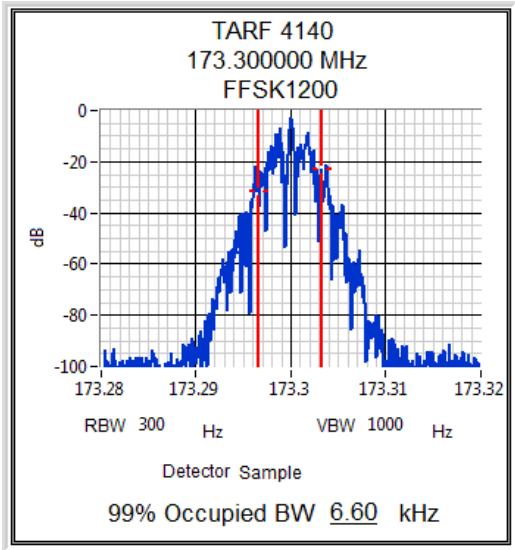


Transmitter Occupied (99%) Bandwidth

Channel 5-7 50 watts 12.5 kHz ch spacing FFSK1200 Modulation

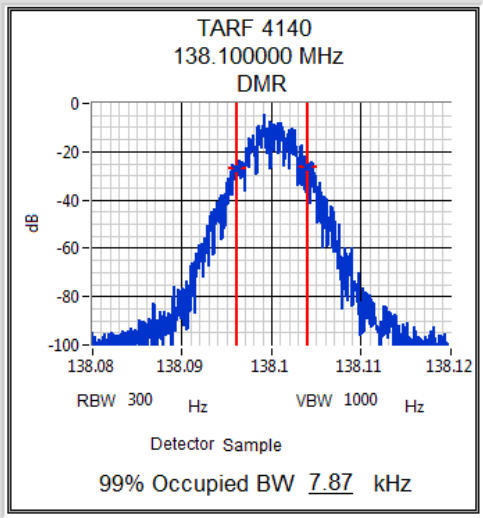


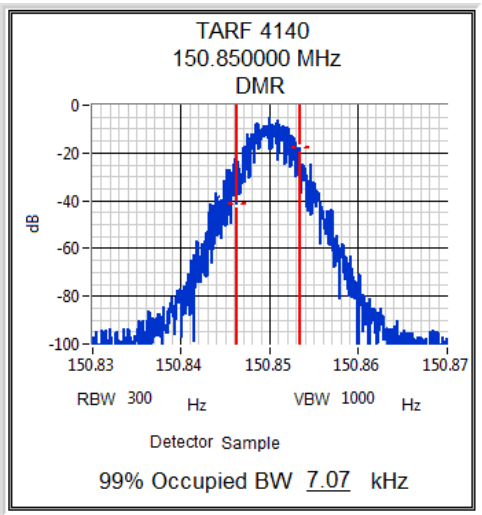


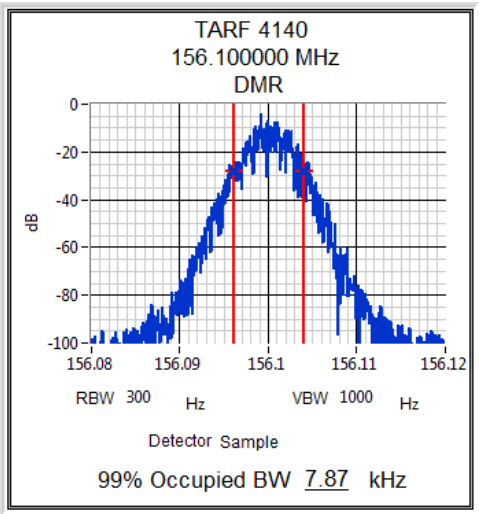


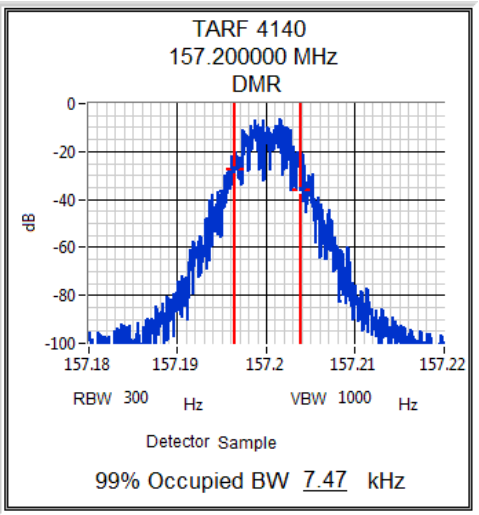
Transmitter Occupied (99%) Bandwidth

Channel 1-4 50 watts 12.5 kHz ch spacing DMR Modulation



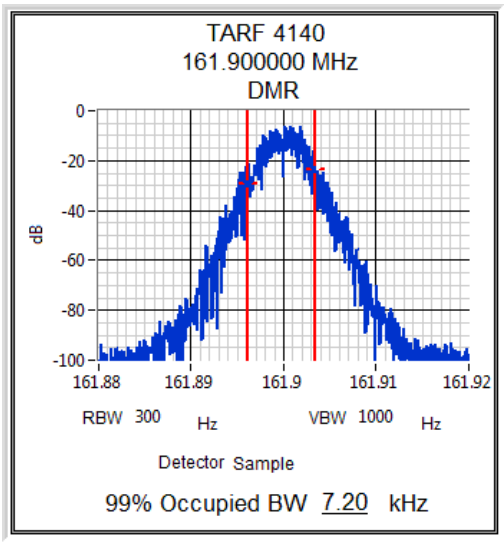


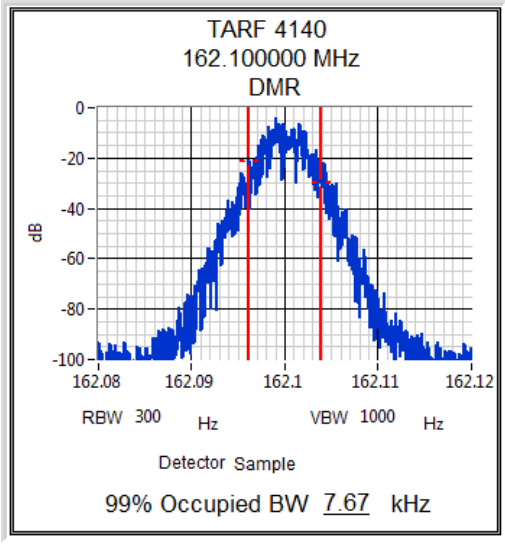


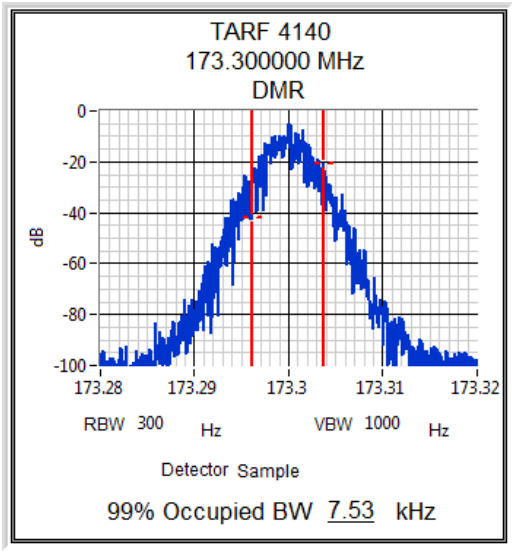


Transmitter Occupied (99%) Bandwidth

Channel 5-7 50 watts 12.5 kHz ch spacing DMR Modulation

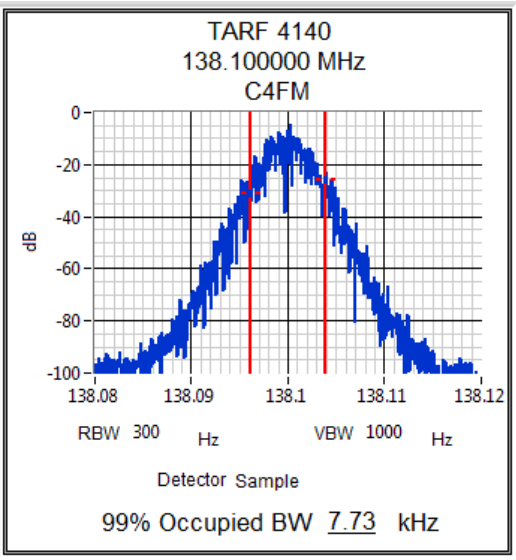


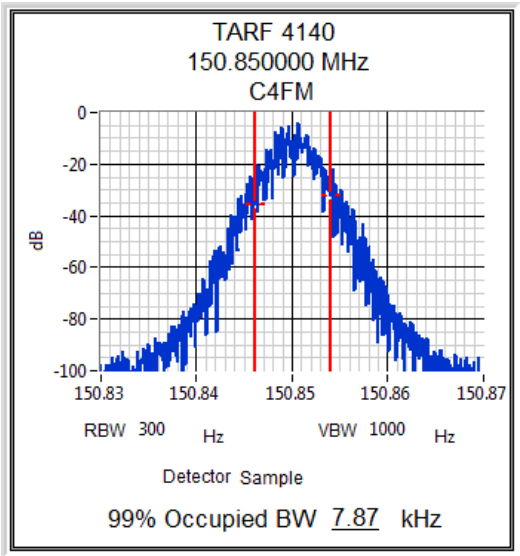


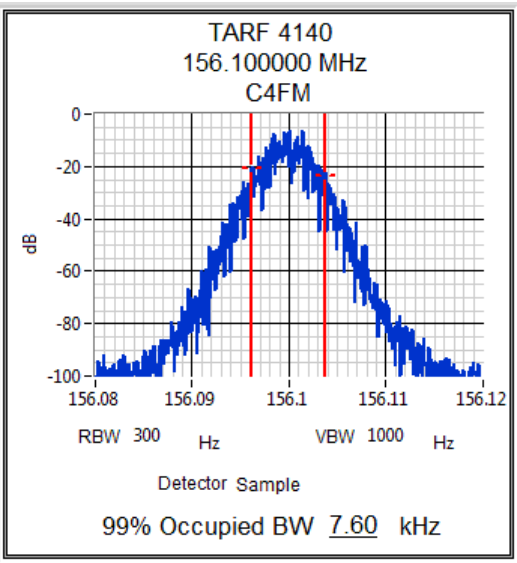


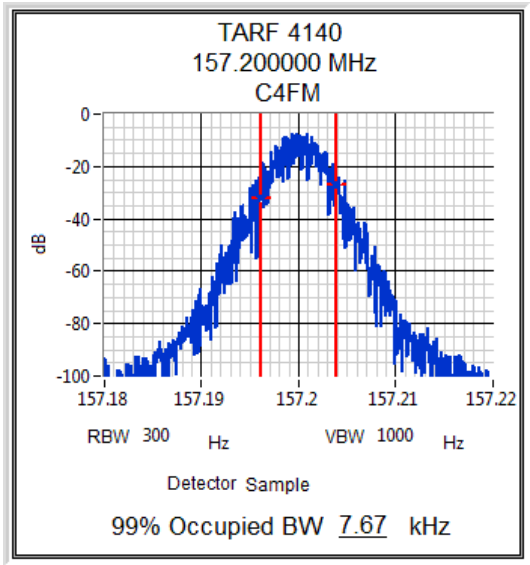
Transmitter Occupied (99%) Bandwidth

Channel 1-4 50 watts 12.5 kHz ch spacing C4FM Modulation



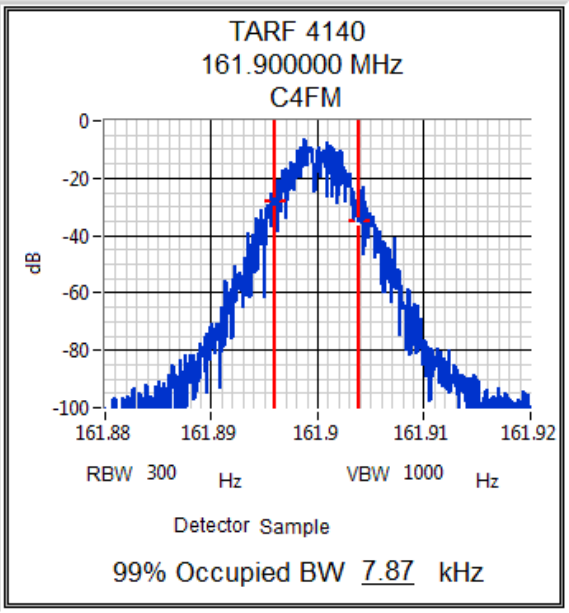


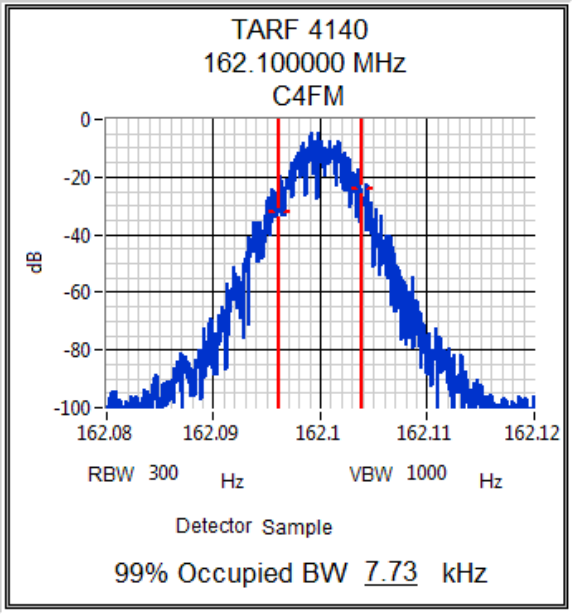


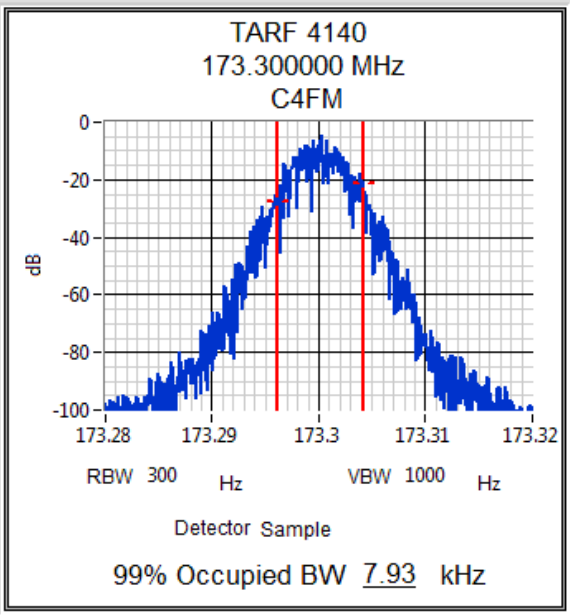


Transmitter Occupied (99%) Bandwidth

Channel 5-8 50 watts 12.5 kHz ch spacing C4FM Modulation







TRANSMITTER SPECTRUM MASKS

SPECIFICATION: FCC 47 CFR 2.1049 (c) RSS-119 5.5

GUIDE: TIA/EIA-603E 2.2.11 (Analogue)
TIA-102.CAAA-C 2.2.5 (Digital)

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
2. For Analogue measurements: The EUT was modulated by a 2500 Hz tone at an input level 16 dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.
   For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as noted on the recorded plots.

MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing.

MEASUREMENT UNCERTAINTY 95% ±0.65dB

LIMIT CLAUSE:	FCC 47 CFR 90.210	RSS-119 5.5

EMISSION MASKS

Emission Mask D	12.5 kHz Channel Spacing	Analogue, FFSK, Digital Voice/Data

DATA SPEED

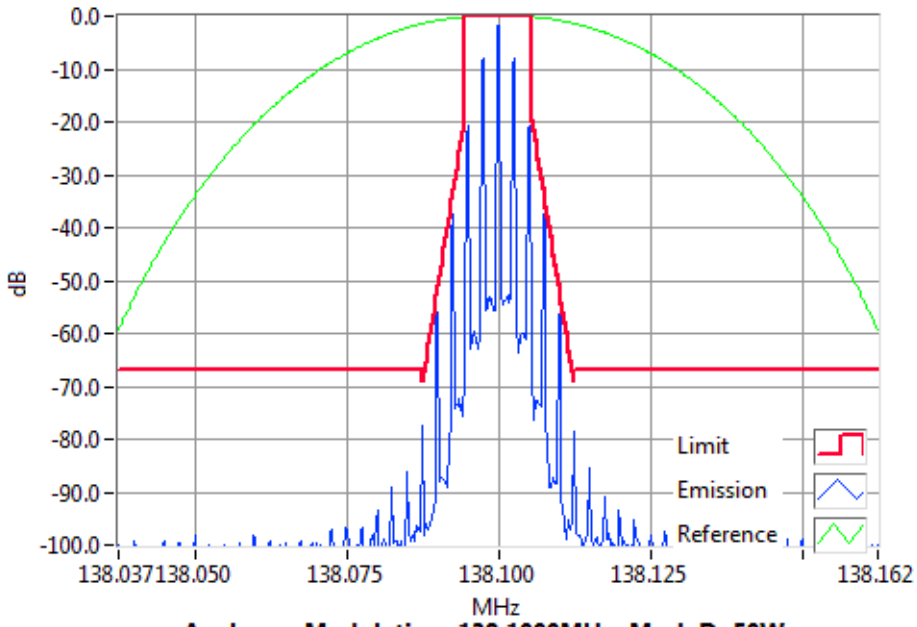
FFSK	12.5 kHz Channel Spacing	1200 bps
Digital Voice/Data	12.5 kHz Channel Spacing	9600 bps (DMR, P25 Phase I)

Transmitter Spectrum Masks

ANALOGUE VOICE

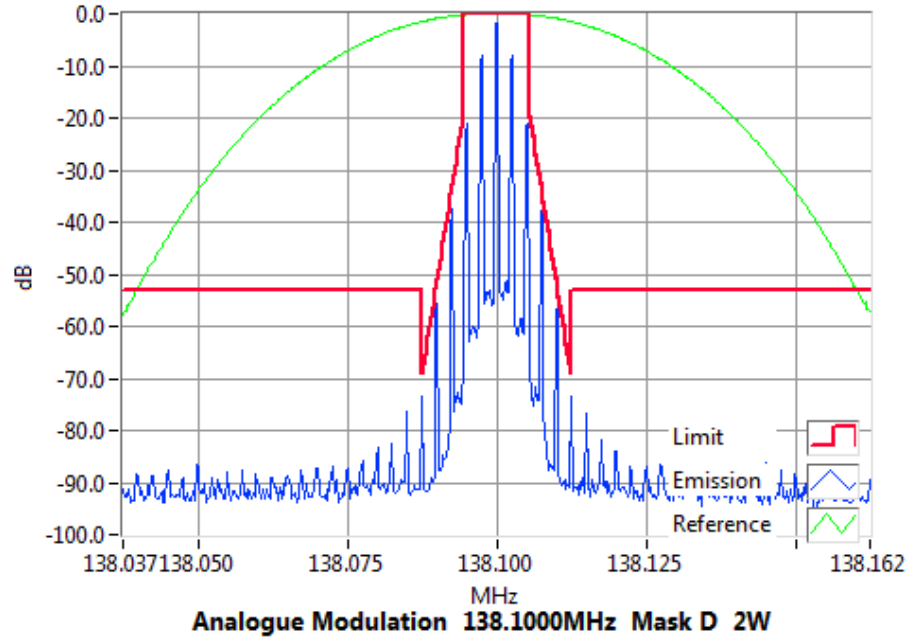
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 138.1 MHz 50 W 12.5 kHz Channel Spacing



Analogue Modulation 138.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 138.1 MHz 2 W 12.5 kHz Channel Spacing



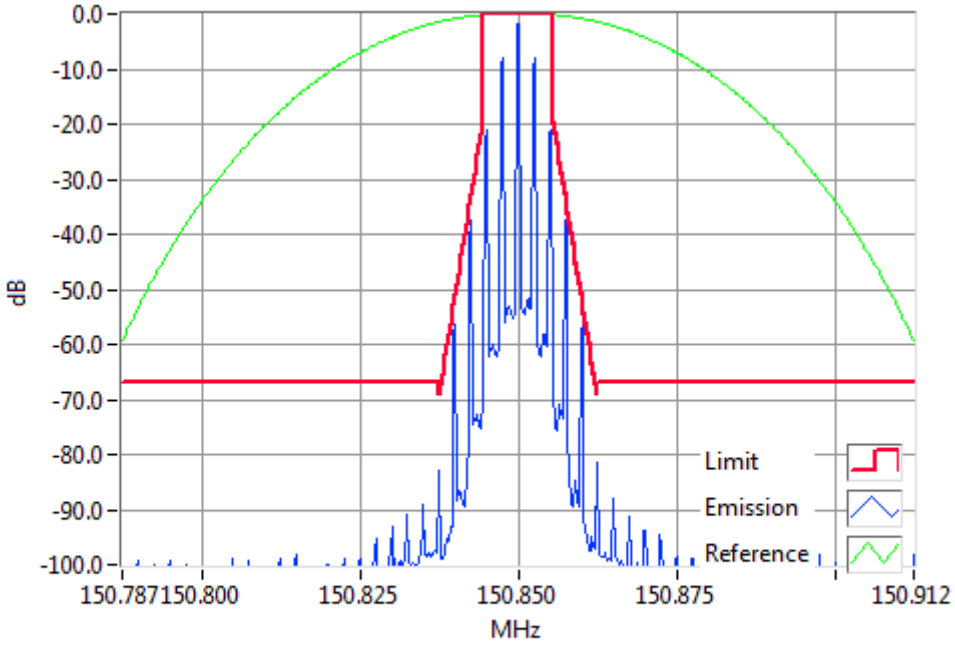
Analogue Modulation 138.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

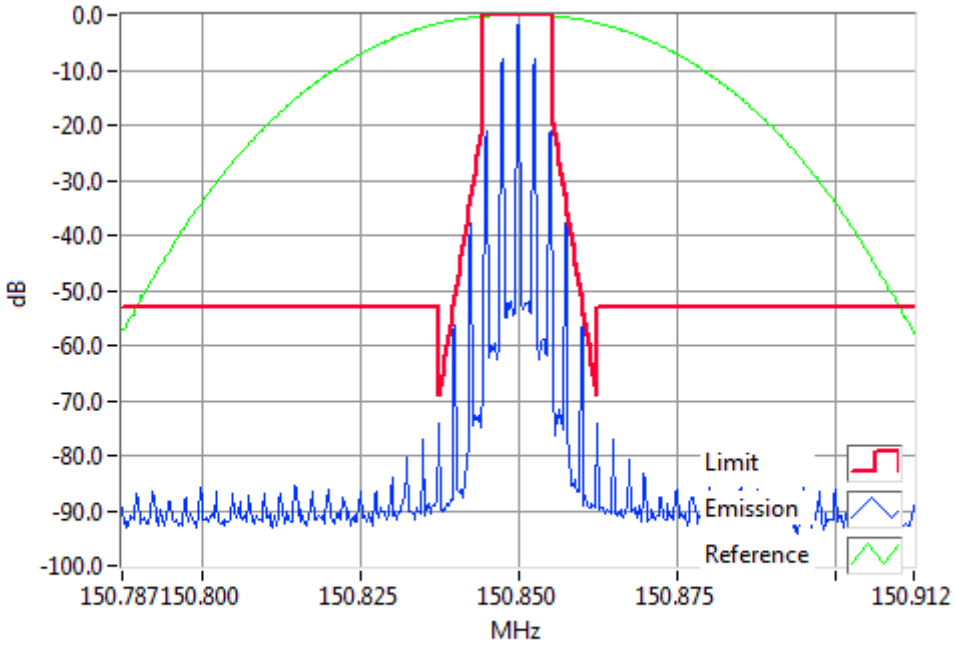
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 150.85 MHz 50 W 12.5 kHz Channel Spacing



Analogue Modulation 150.8500MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 150.85 MHz 2 W 12.5 kHz Channel Spacing



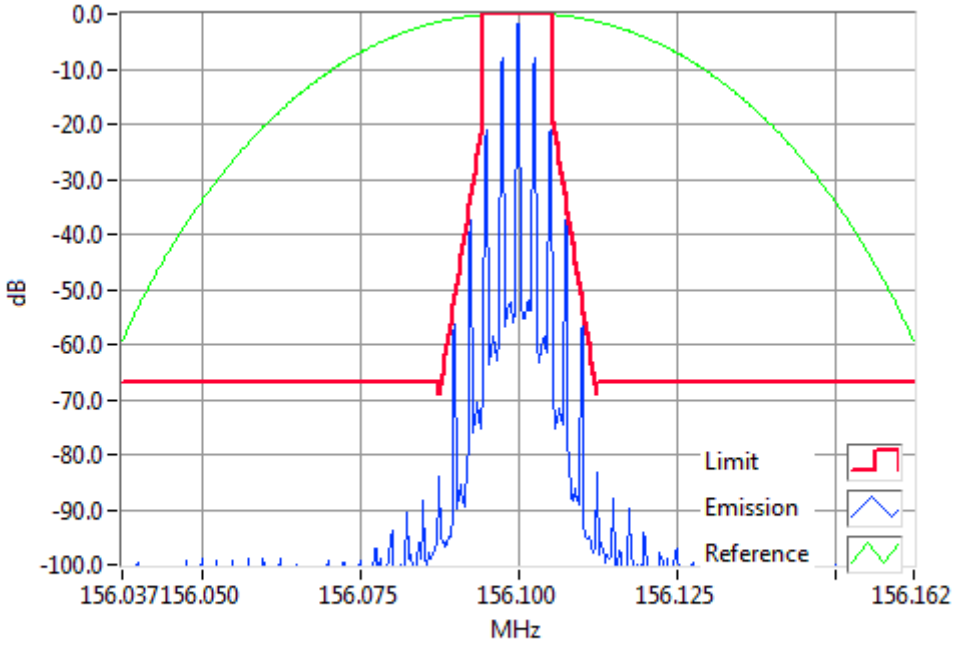
Analogue Modulation 150.8500MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

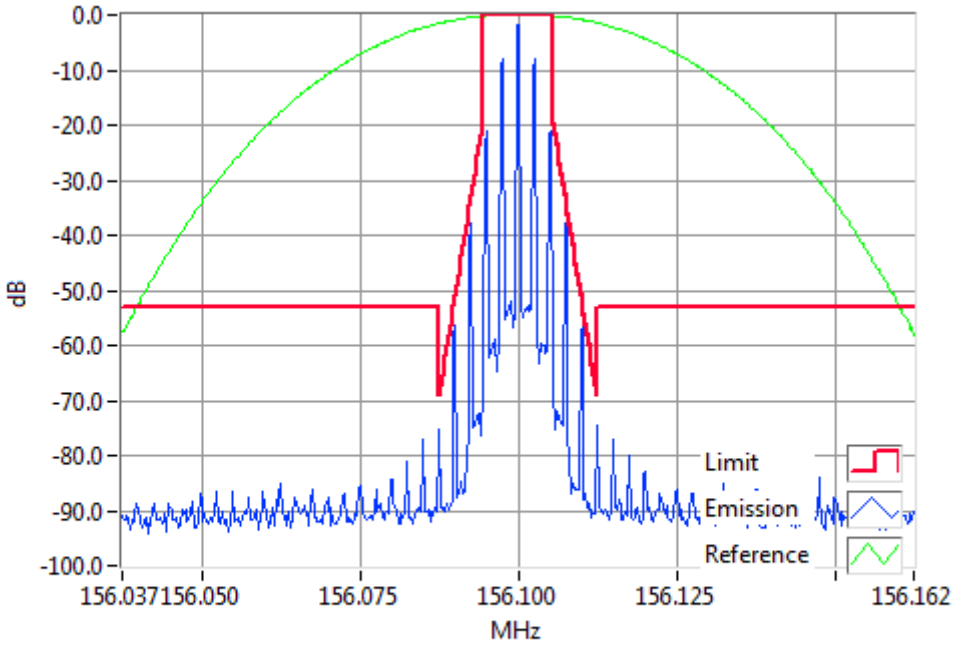
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 156.1 MHz 50 W 12.5 kHz Channel Spacing



Analogue Modulation 156.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 156.1 MHz 2 W 12.5 kHz Channel Spacing



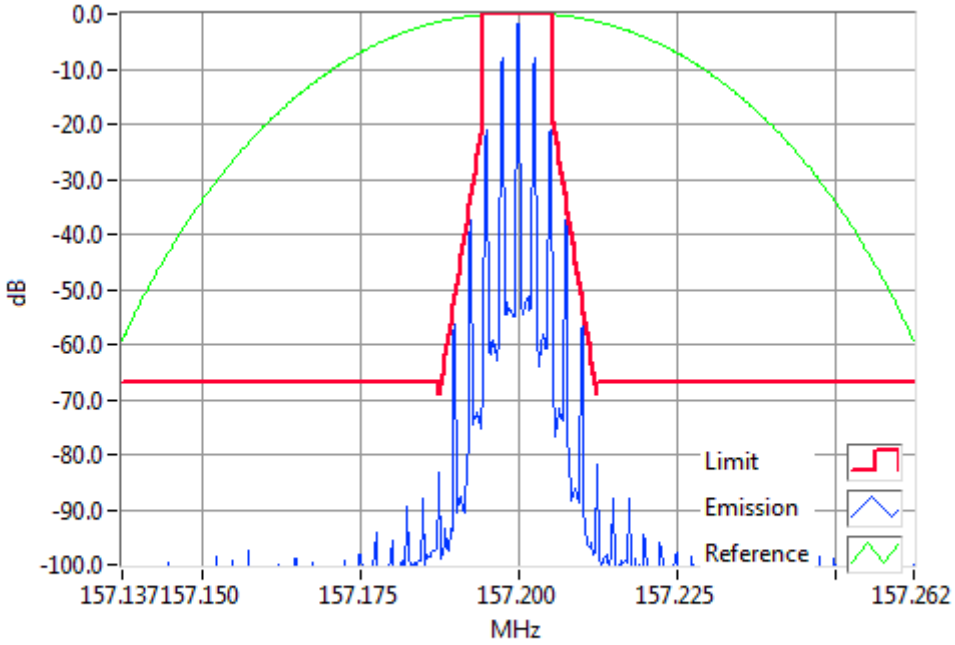
Analogue Modulation 156.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

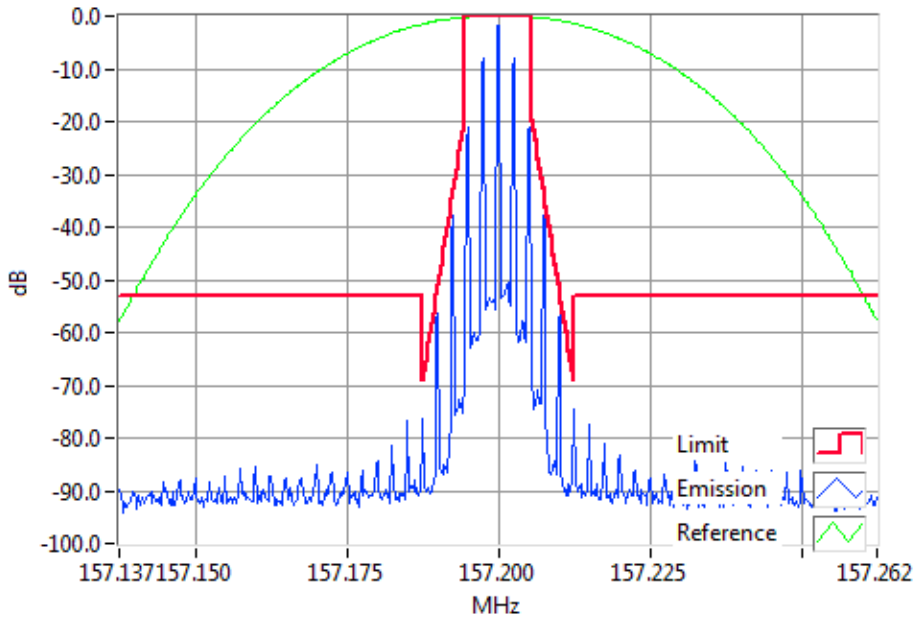
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 157.2 MHz 50 W 12.5 kHz Channel Spacing



Analogue Modulation 157.2000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 157.2 MHz 2 W 12.5 kHz Channel Spacing



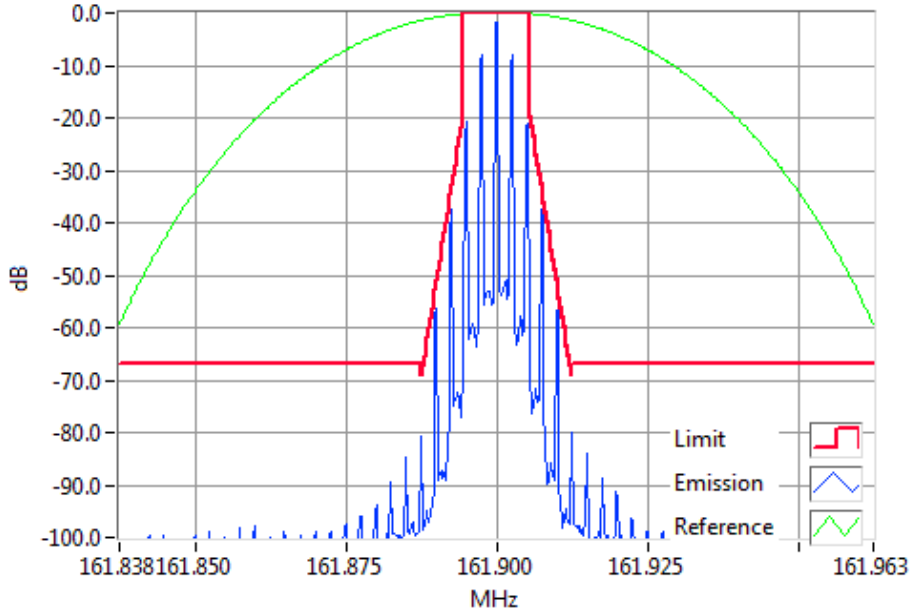
Analogue Modulation 157.2000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

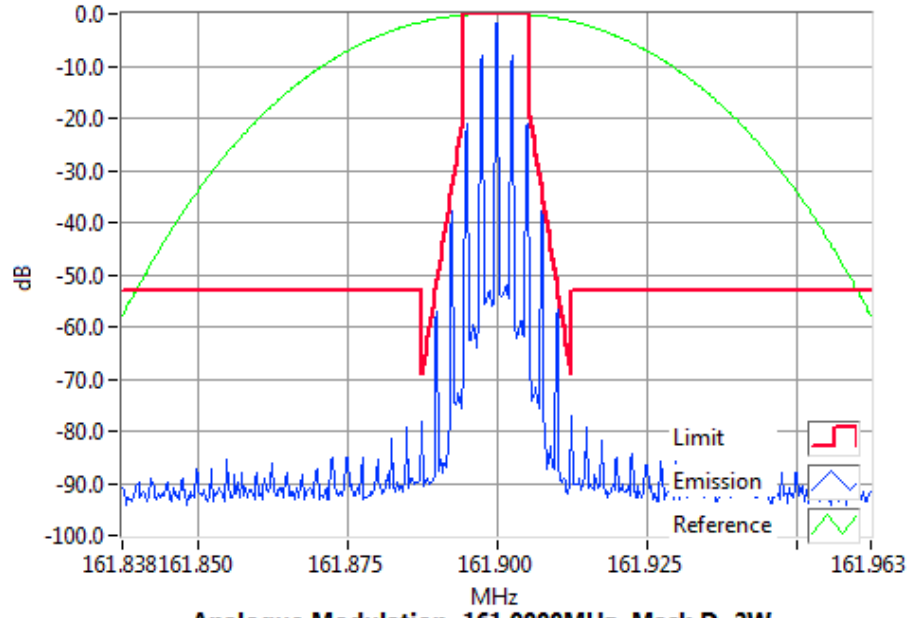
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 161.9 MHz 50 W 12.5 kHz Channel Spacing



Analogue Modulation 161.9000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 161.9 MHz 2 W 12.5 kHz Channel Spacing



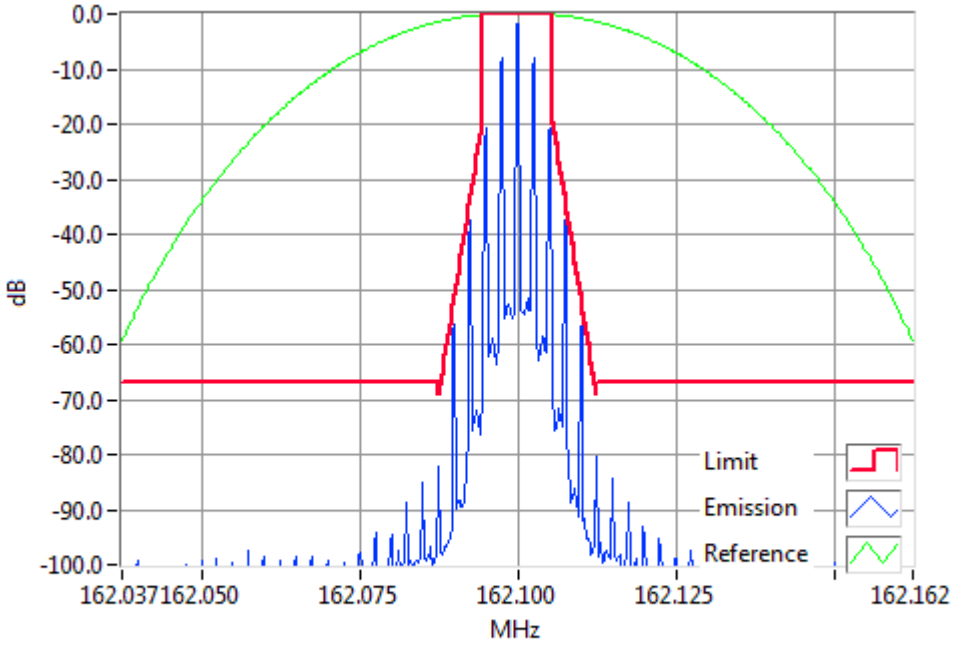
Analogue Modulation 161.9000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

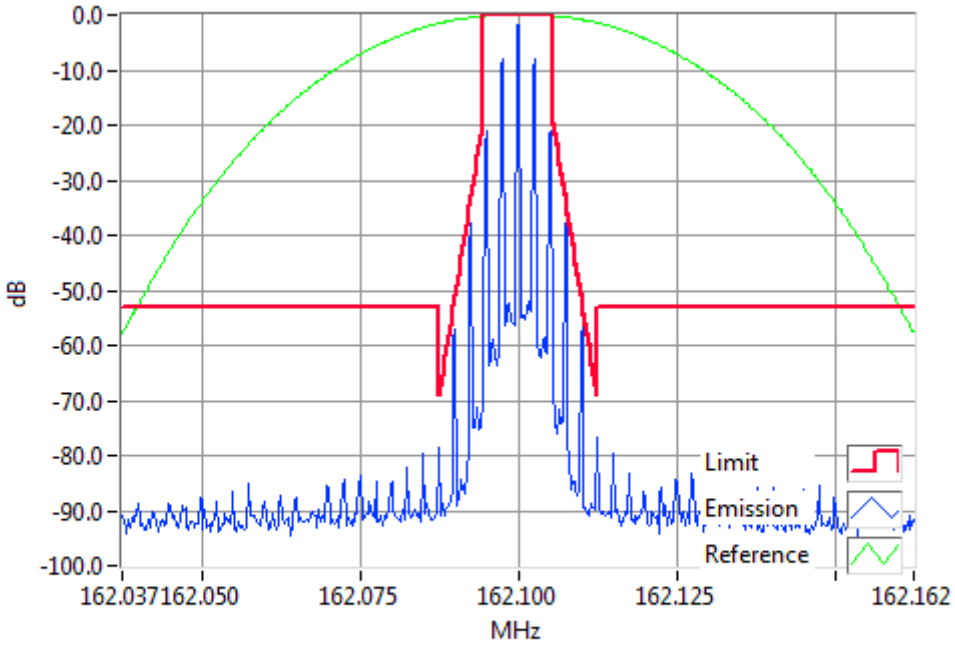
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 162.1 MHz 50 W 12.5 kHz Channel Spacing



Analogue Modulation 162.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 162.1 MHz 2 W 12.5 kHz Channel Spacing



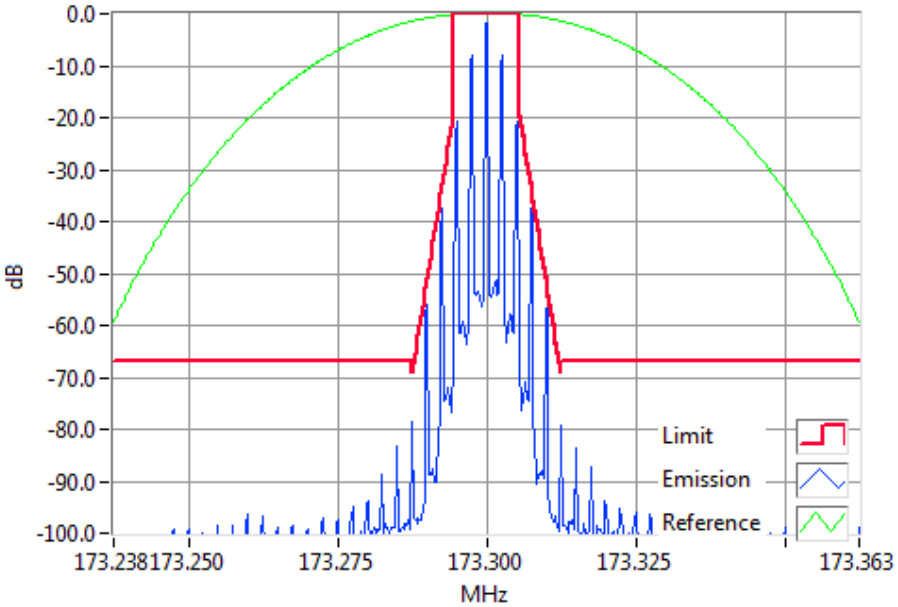
Analogue Modulation 162.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

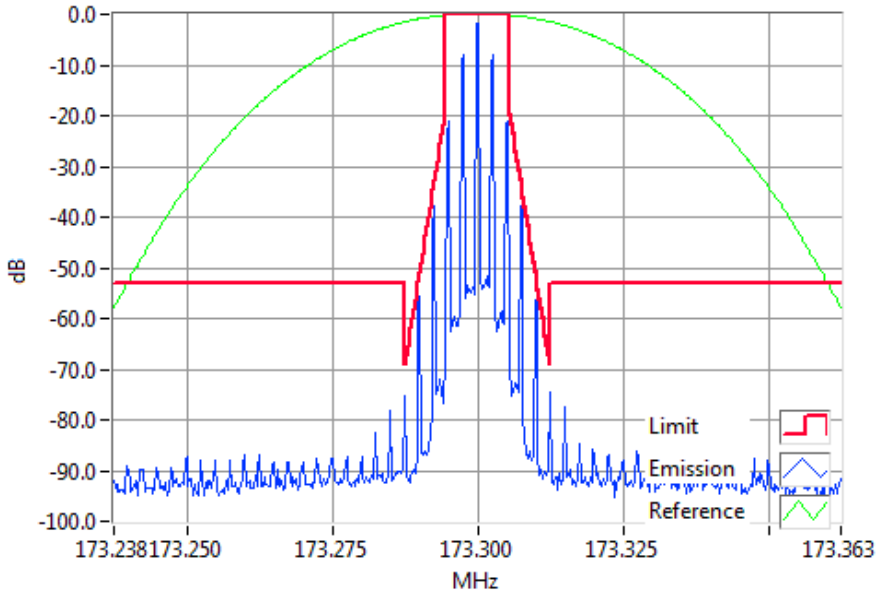
Tx FREQUENCY: 173.3 MHz 50 W 12.5 kHz Channel Spacing



Analogue Modulation 173.3000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 173.3 MHz 2 W 12.5 kHz Channel Spacing



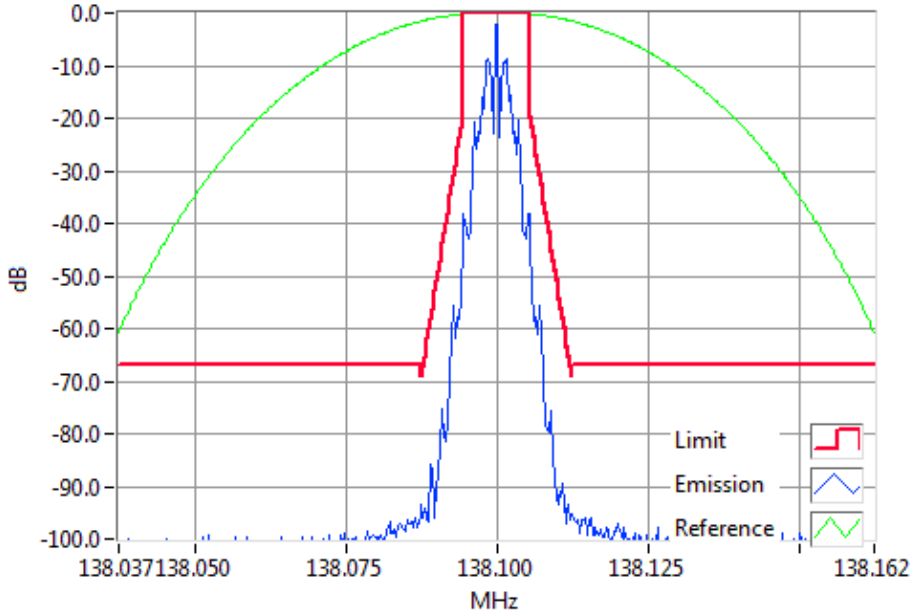
Analogue Modulation 173.3000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

FFSK, 1200 bps

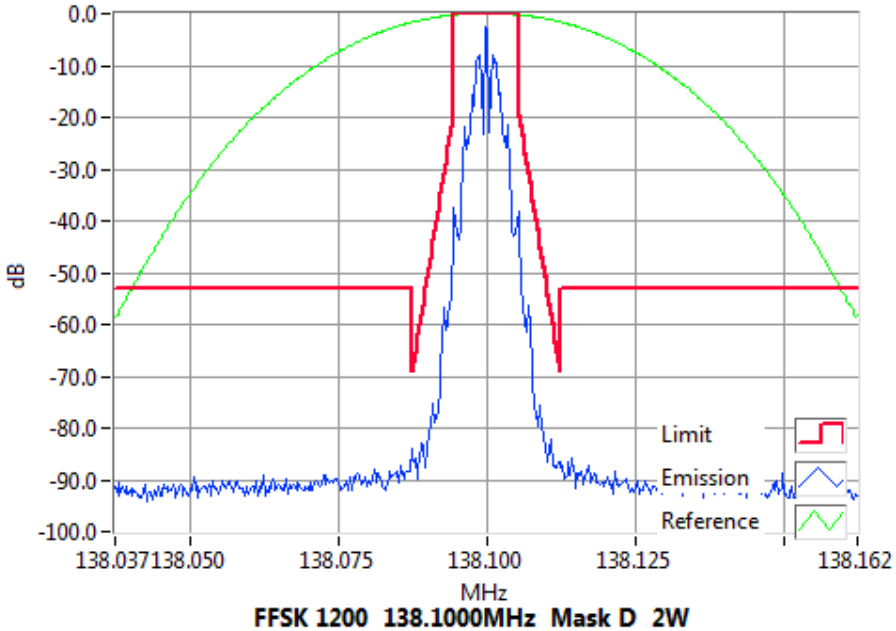
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 138.1 MHz 50 W 12.5 kHz Channel Spacing



FFSK 1200 138.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 138.1 MHz 2 W 12.5 kHz Channel Spacing



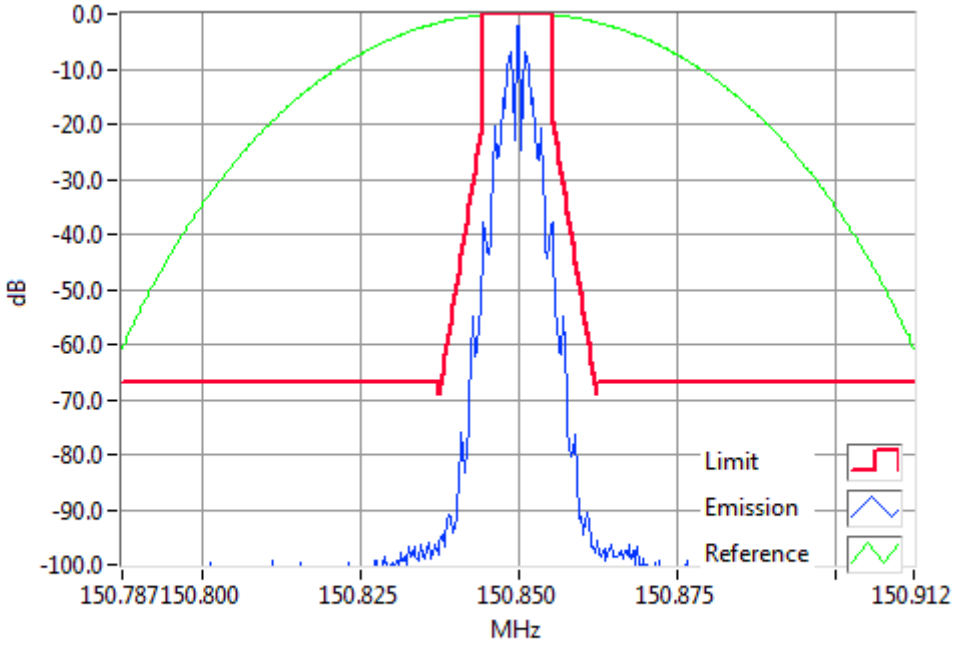
FFSK 1200 138.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

FFSK, 1200 bps

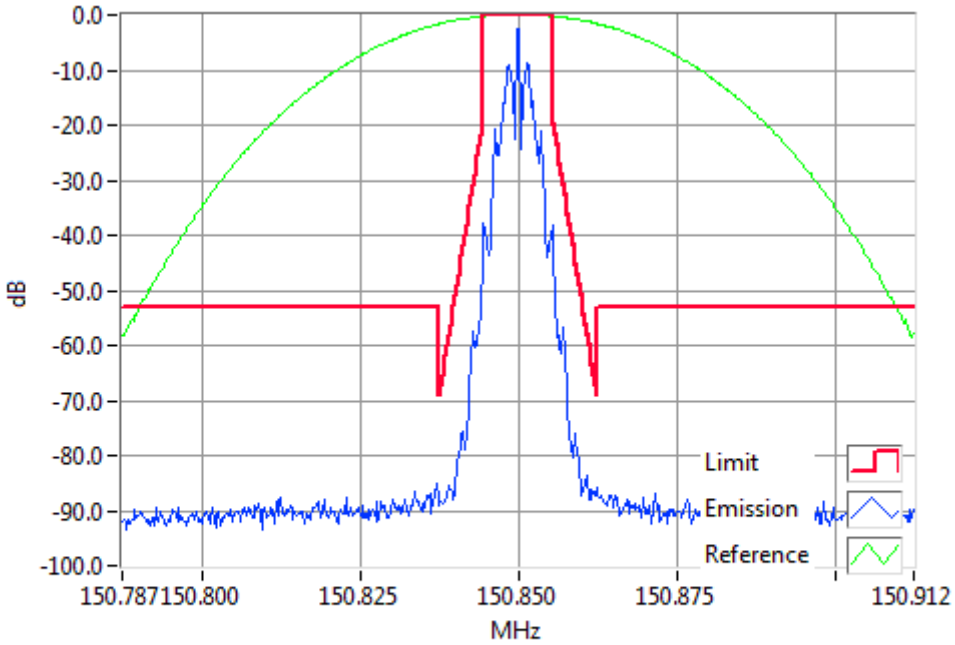
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 150.85 MHz 50 W 12.5 kHz Channel Spacing



FFSK 1200 150.8500MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 150.85 MHz 2 W 12.5 kHz Channel Spacing



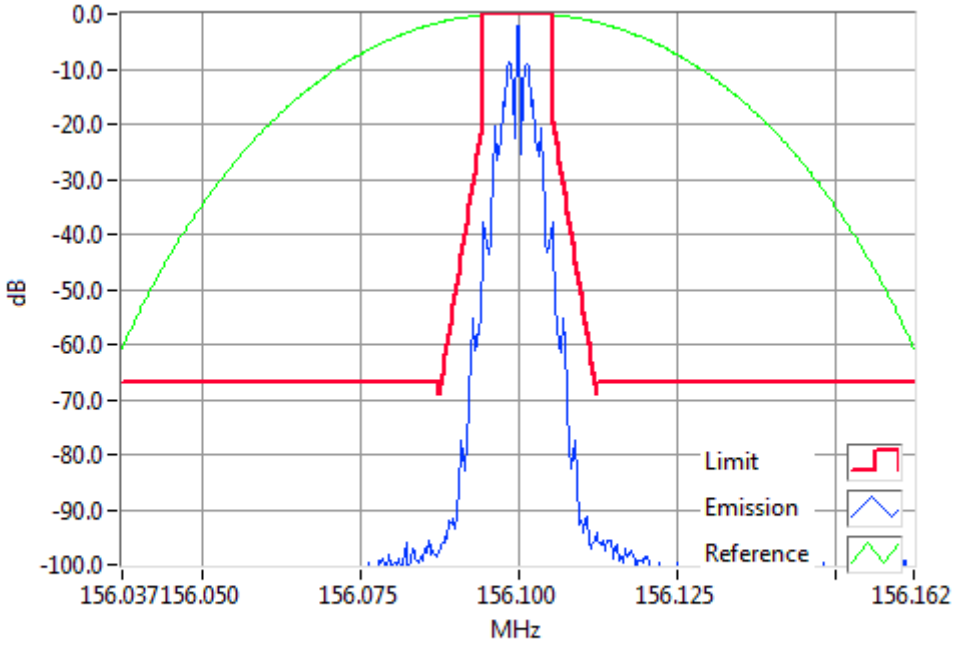
FFSK 1200 150.8500MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

FFSK, 1200 bps

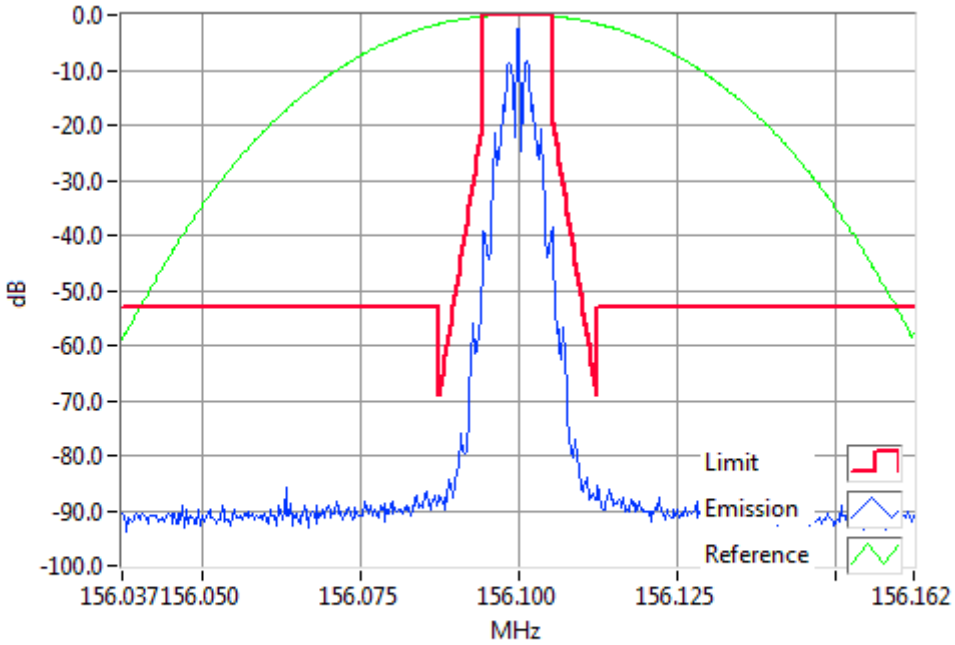
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 156.1 MHz 50 W 12.5 kHz Channel Spacing



FFSK 1200 156.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 156.1 MHz 2 W 12.5 kHz Channel Spacing



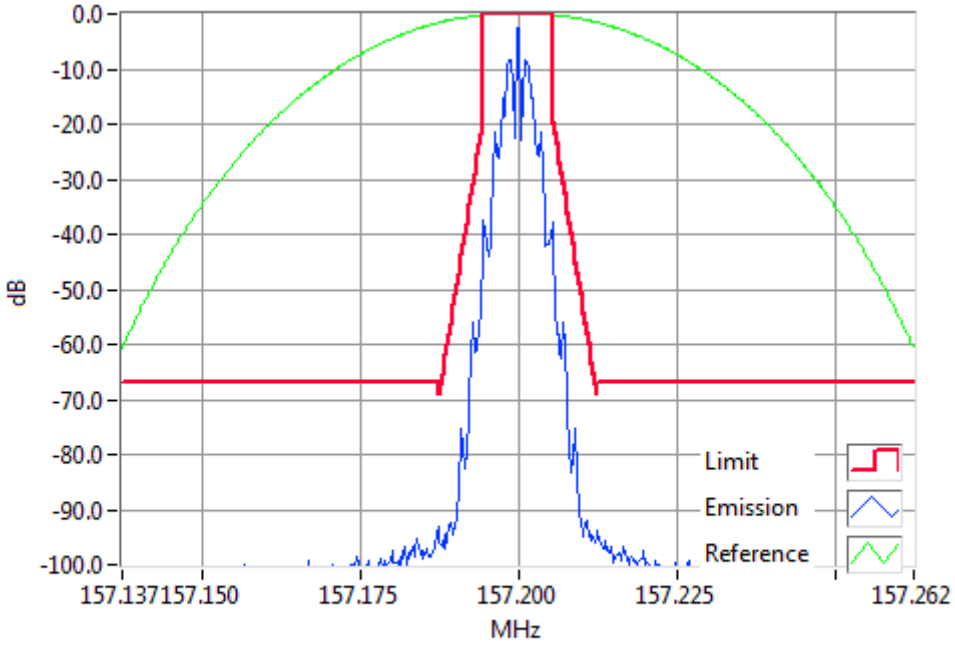
FFSK 1200 156.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

FFSK, 1200 bps

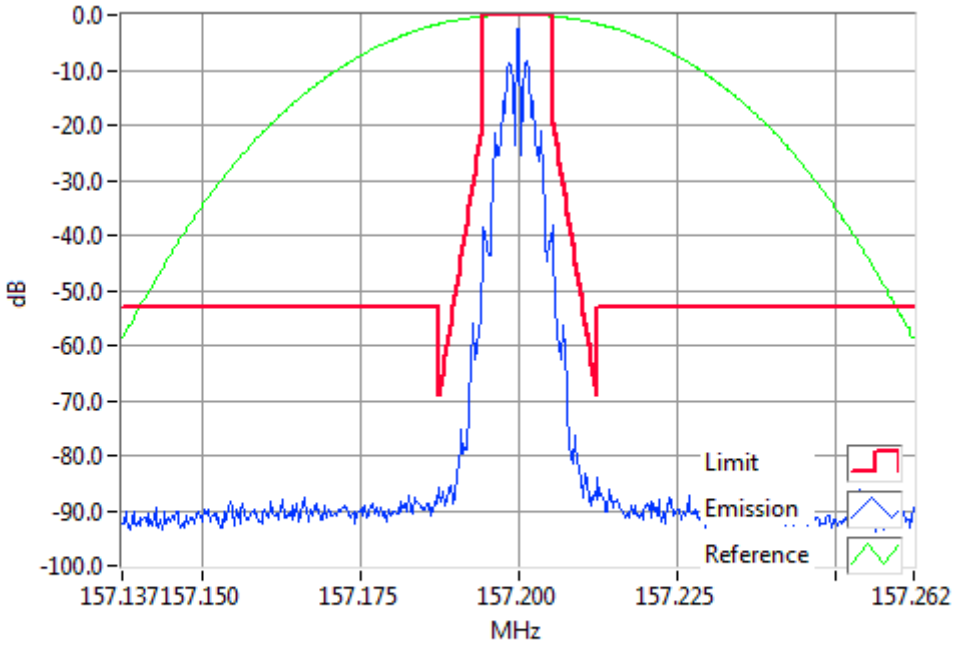
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 157.2 MHz 50 W 12.5 kHz Channel Spacing



FFSK 1200 157.2000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 157.2 MHz 2 W 12.5 kHz Channel Spacing



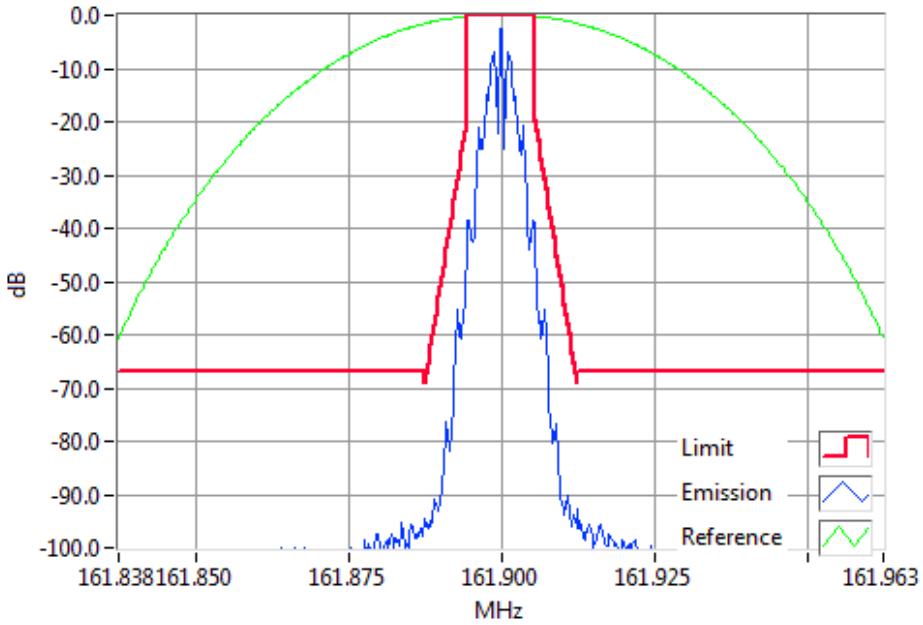
FFSK 1200 157.2000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

FFSK, 1200 bps

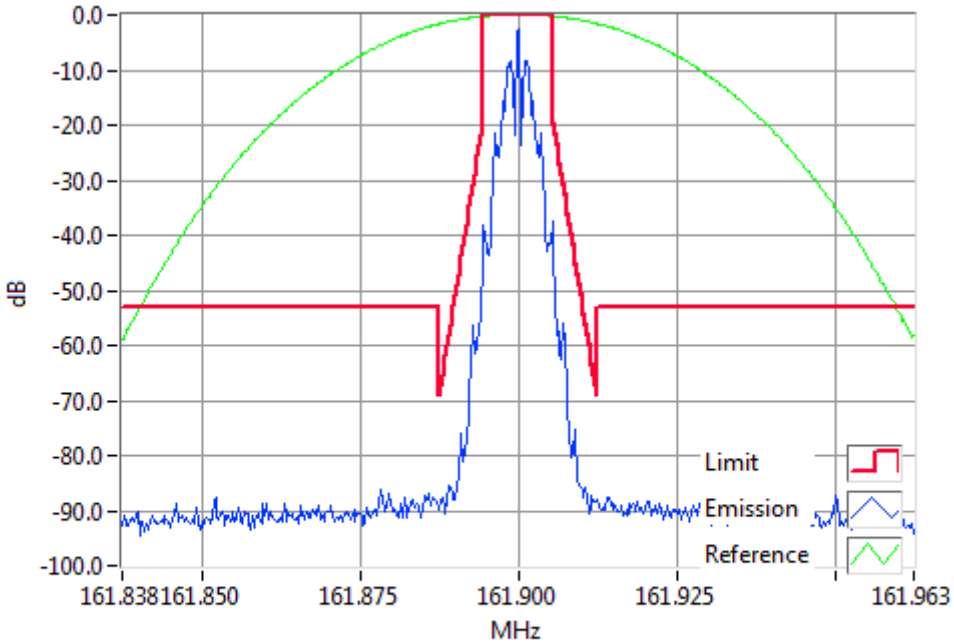
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 161.9 MHz 50 W 12.5 kHz Channel Spacing



FFSK 1200 161.9000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 161.9 MHz 2 W 12.5 kHz Channel Spacing



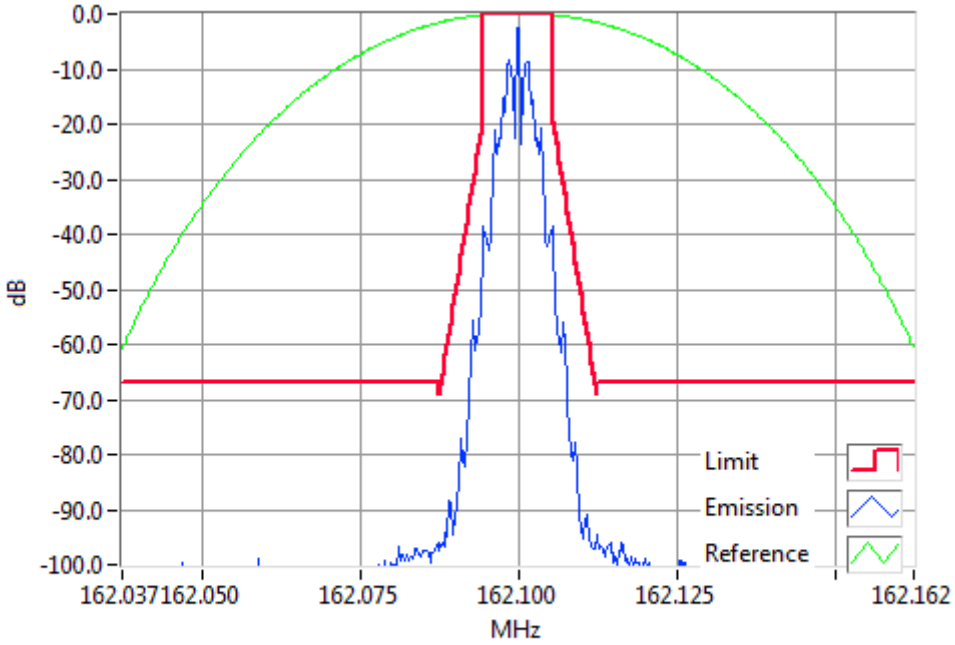
FFSK 1200 161.9000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

FFSK, 1200 bps

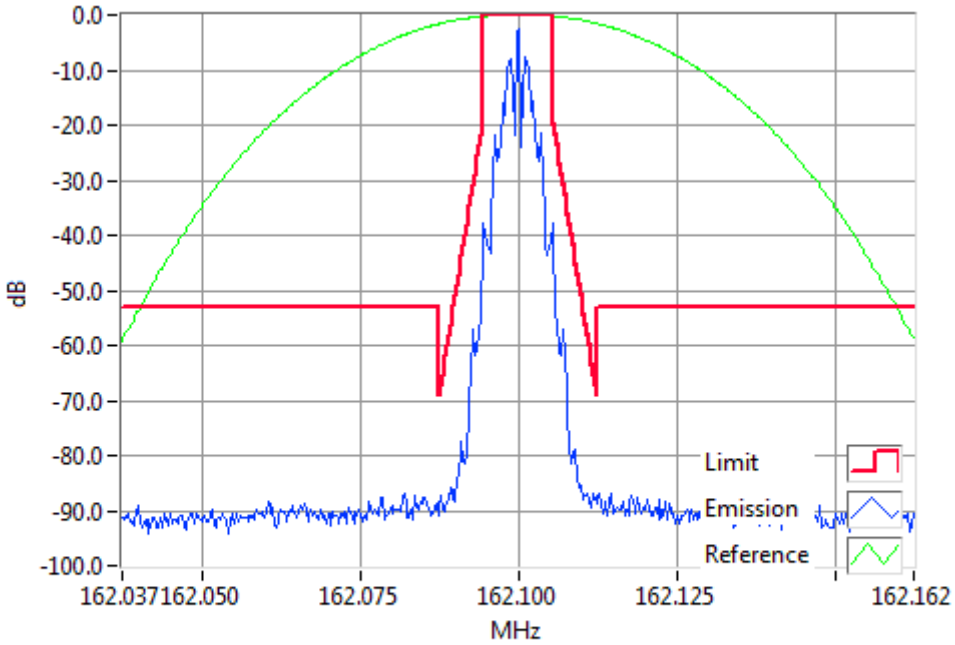
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 162.1 MHz 50 W 12.5 kHz Channel Spacing



FFSK 1200 162.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 162.1 MHz 2 W 12.5 kHz Channel Spacing



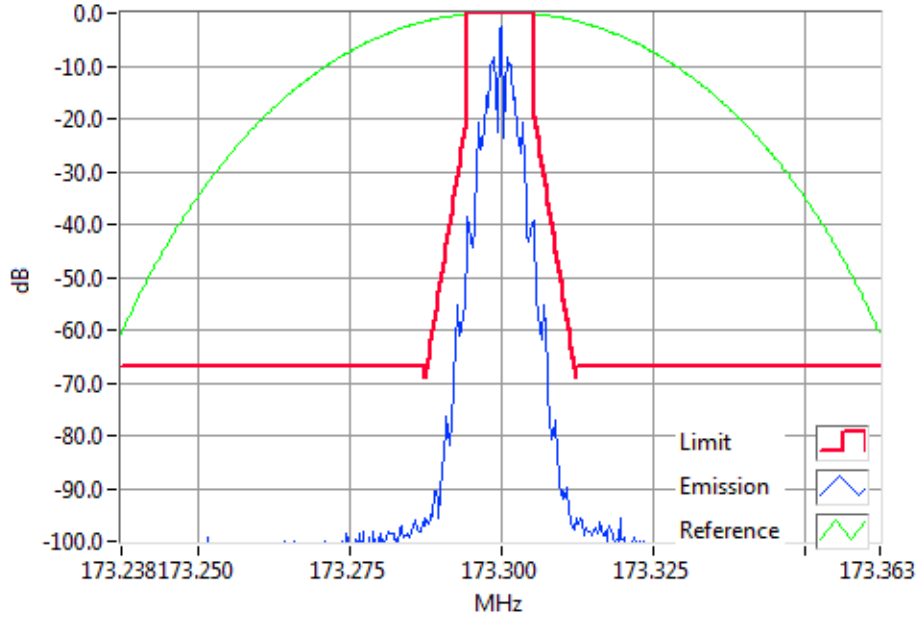
FFSK 1200 162.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

FFSK, 1200 bps

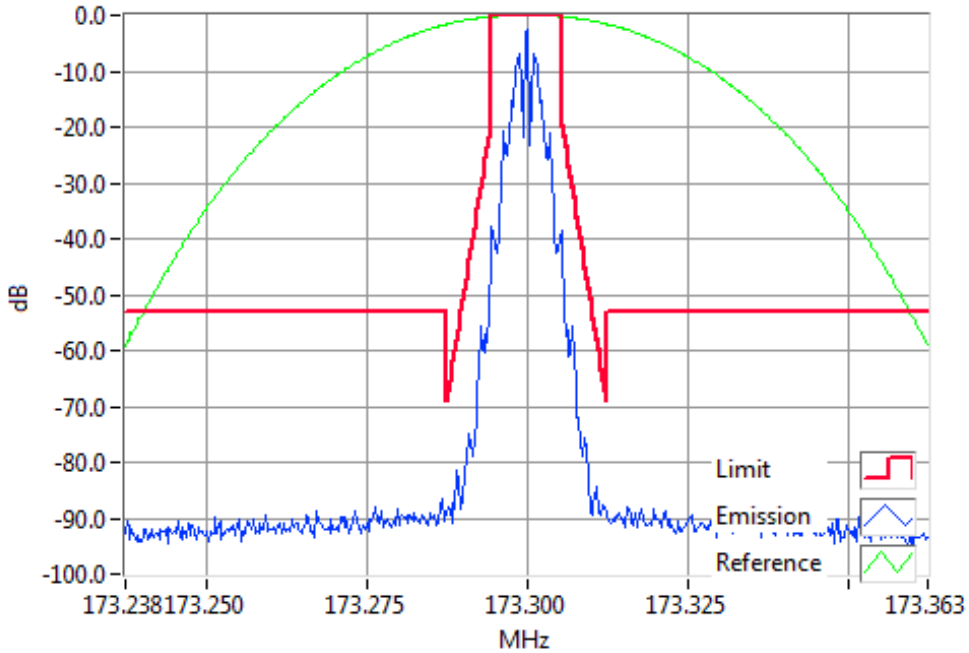
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 173.3 MHz 50 W 12.5 kHz Channel Spacing



FFSK 1200 173.3000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 173.3 MHz 2 W 12.5 kHz Channel Spacing



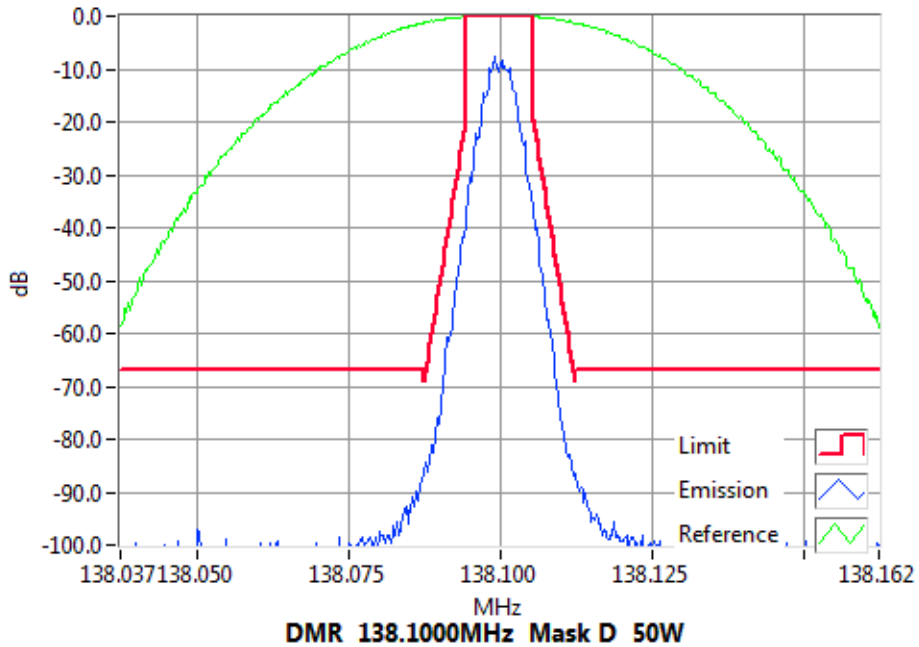
FFSK 1200 173.3000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

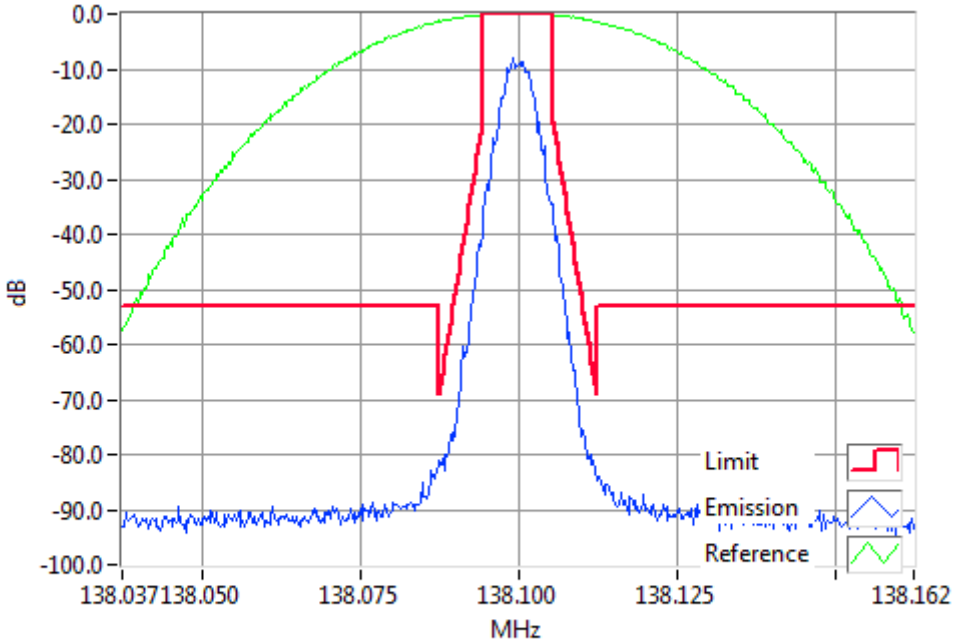
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 138.1 MHz 50 W 12.5 kHz Channel Spacing



DMR 138.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 138.1 MHz 2 W 12.5 kHz Channel Spacing



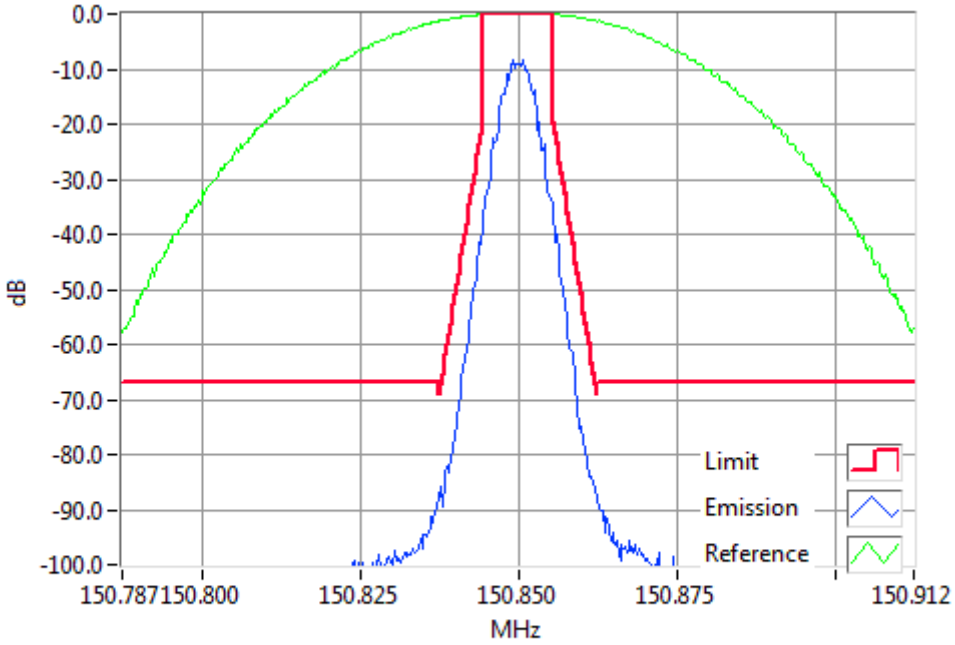
DMR 138.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

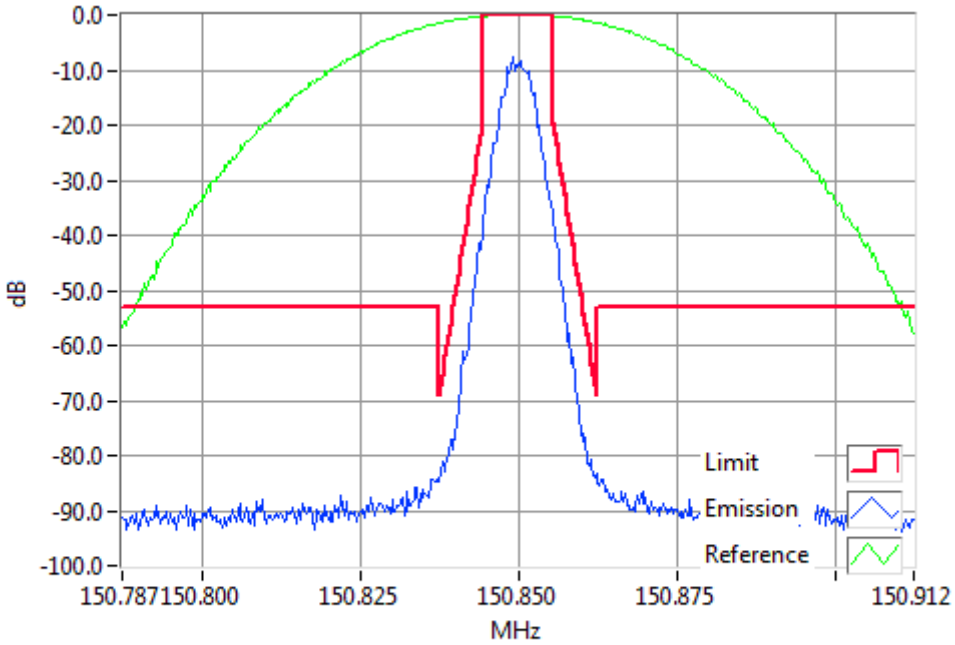
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 150.85 MHz 50 W 12.5 kHz Channel Spacing



DMR 150.8500MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 150.85 MHz 2 W 12.5 kHz Channel Spacing



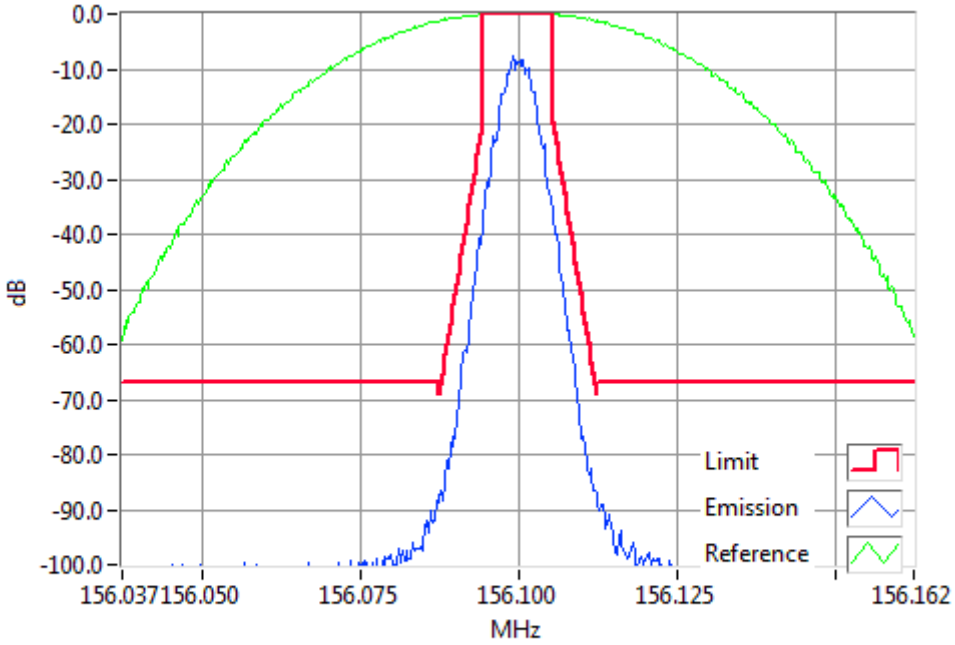
DMR 150.8500MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

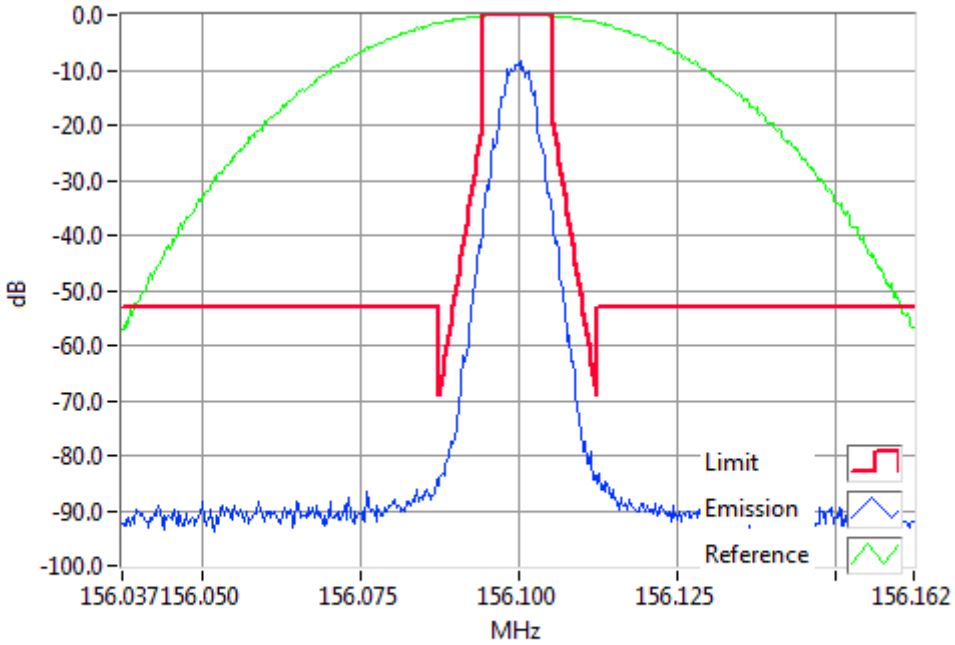
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 156.1 MHz 50 W 12.5 kHz Channel Spacing



DMR 156.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 156.1 MHz 2 W 12.5 kHz Channel Spacing



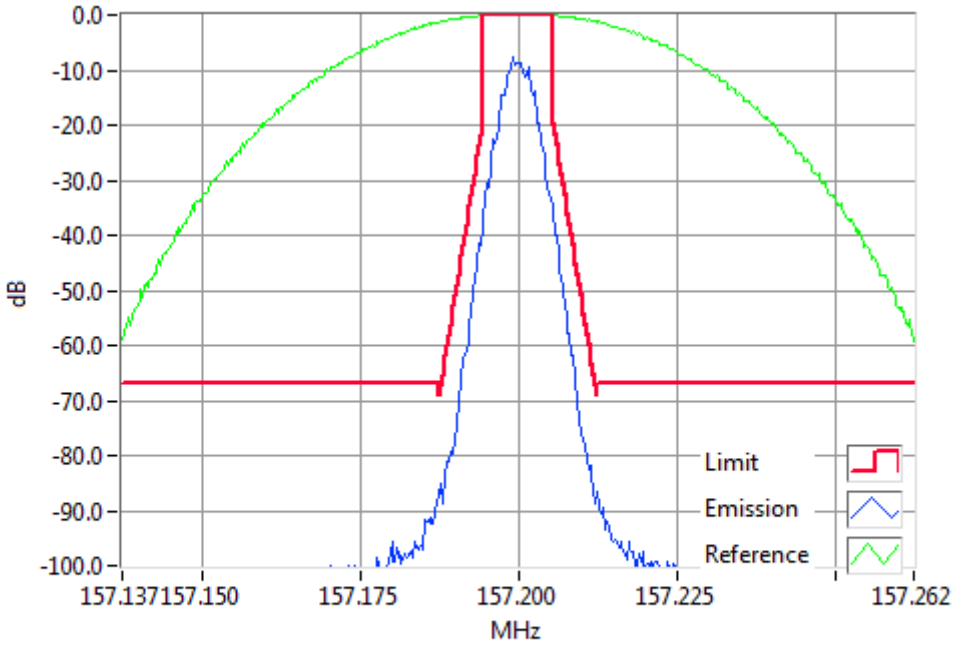
DMR 156.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

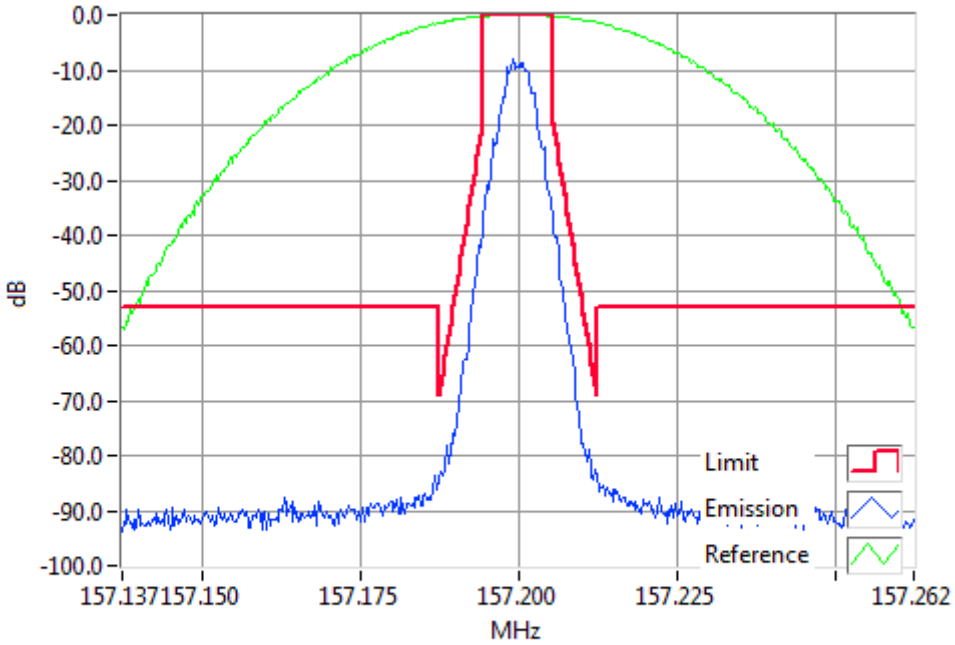
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 157.2 MHz 50 W 12.5 kHz Channel Spacing



DMR 157.2000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 157.2 MHz 2 W 12.5 kHz Channel Spacing



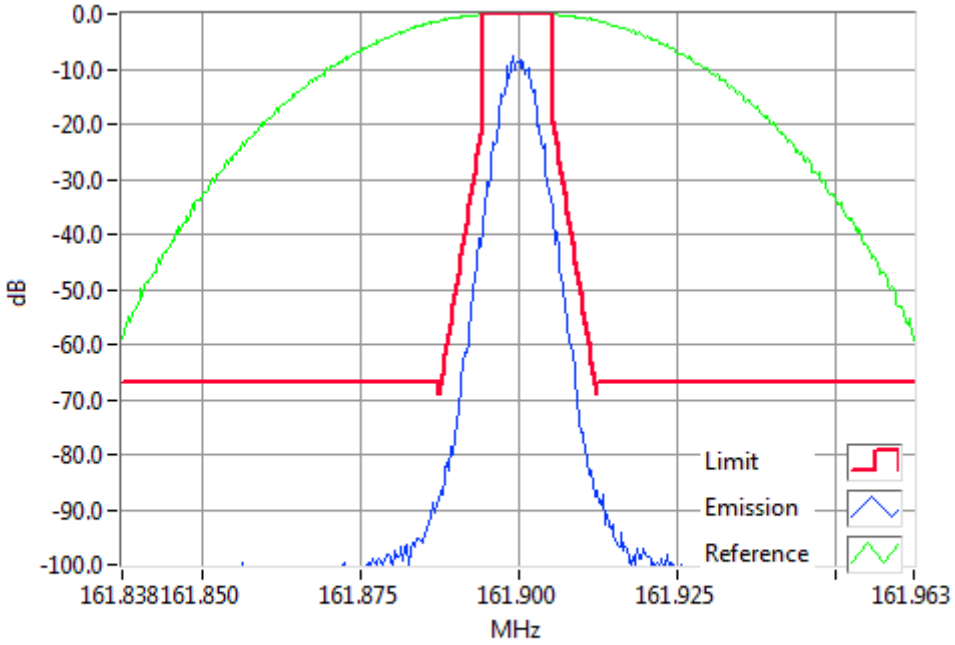
DMR 157.2000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

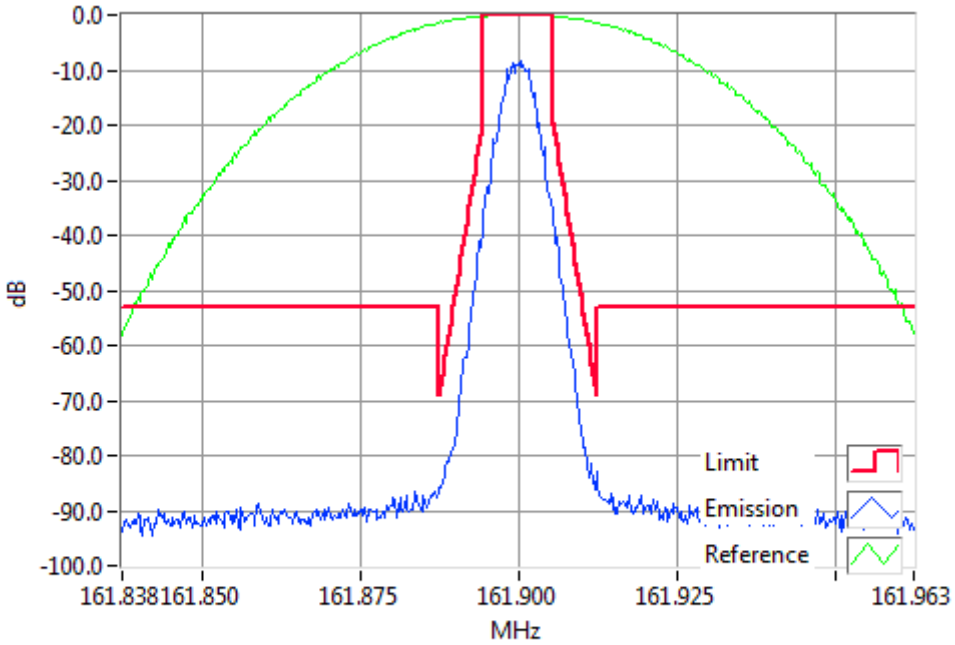
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 161.9 MHz 50 W 12.5 kHz Channel Spacing



DMR 161.9000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 161.9 MHz 2 W 12.5 kHz Channel Spacing



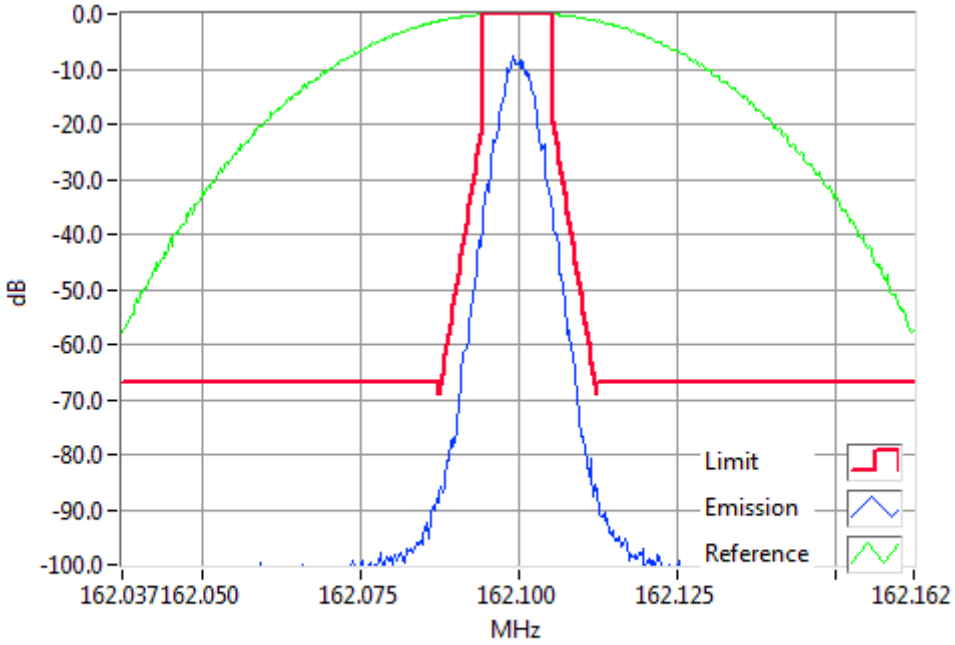
DMR 161.9000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

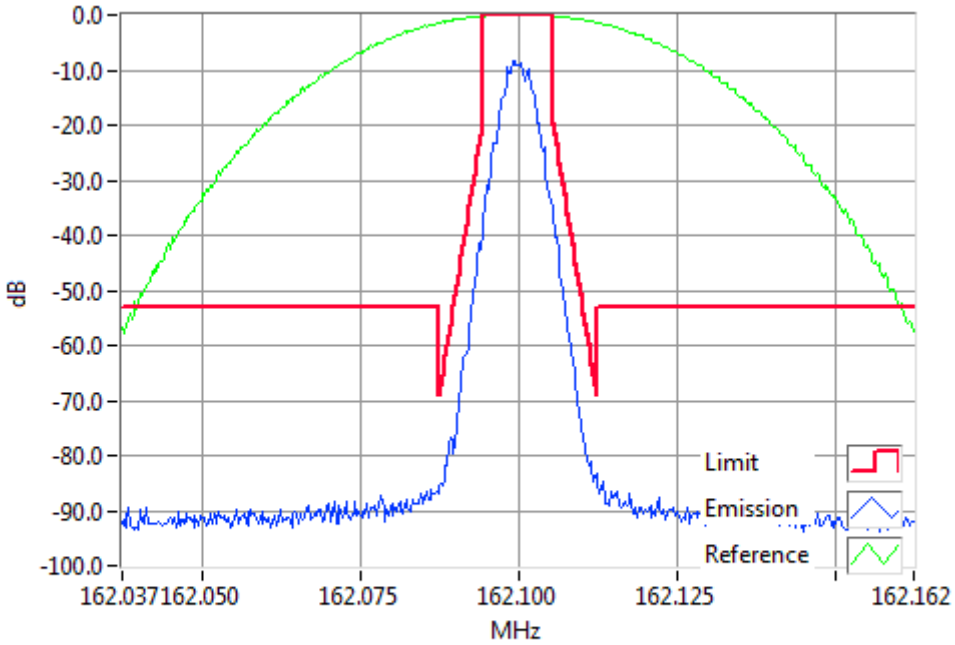
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 162.1 MHz 50 W 12.5 kHz Channel Spacing



DMR 162.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 162.1 MHz 2 W 12.5 kHz Channel Spacing



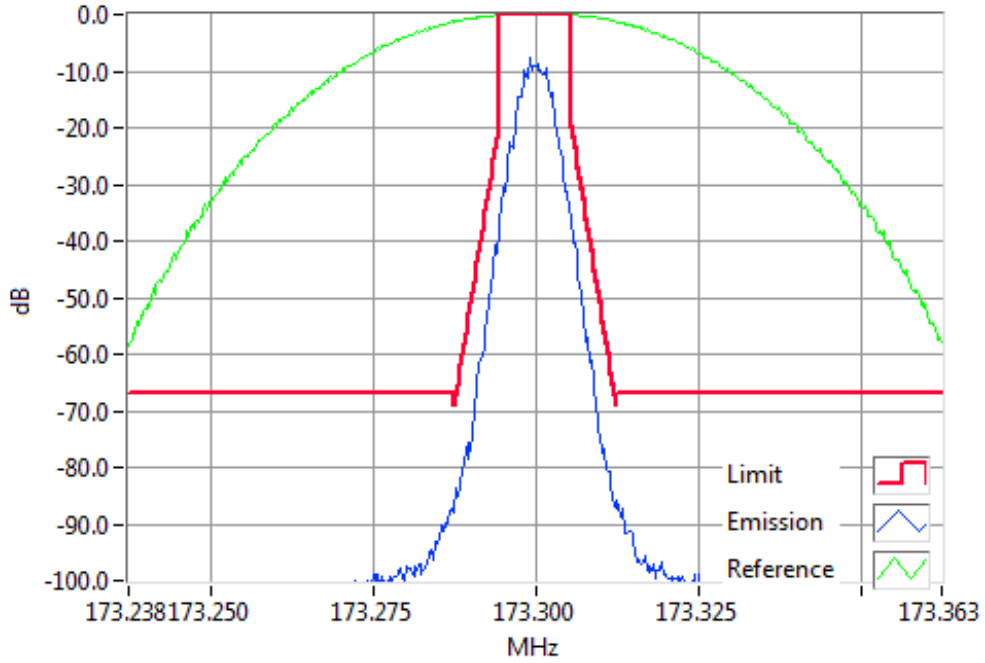
DMR 162.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

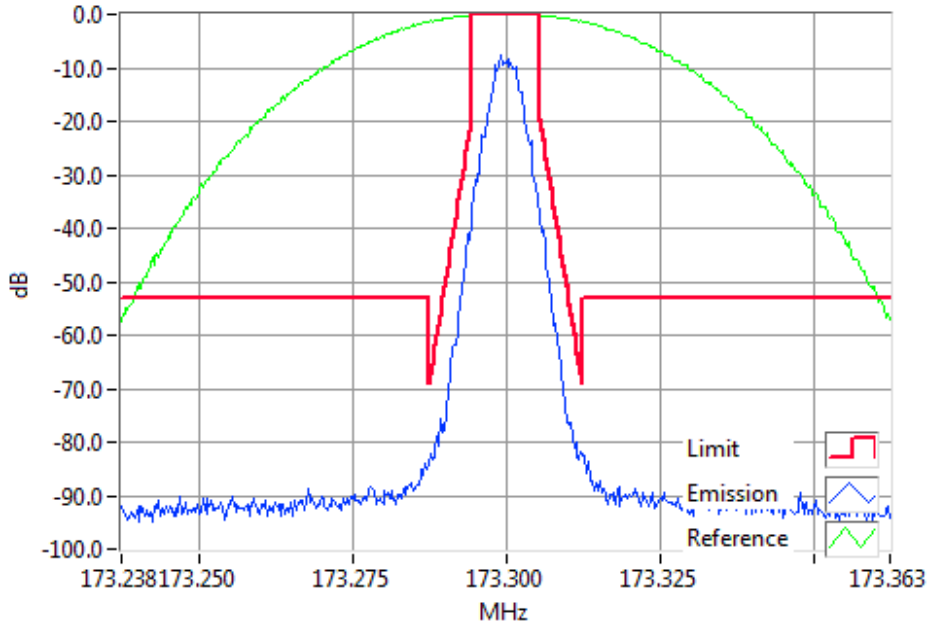
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 173.3 MHz 50 W 12.5 kHz Channel Spacing



DMR 173.3000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 173.3 MHz 2 W 12.5 kHz Channel Spacing



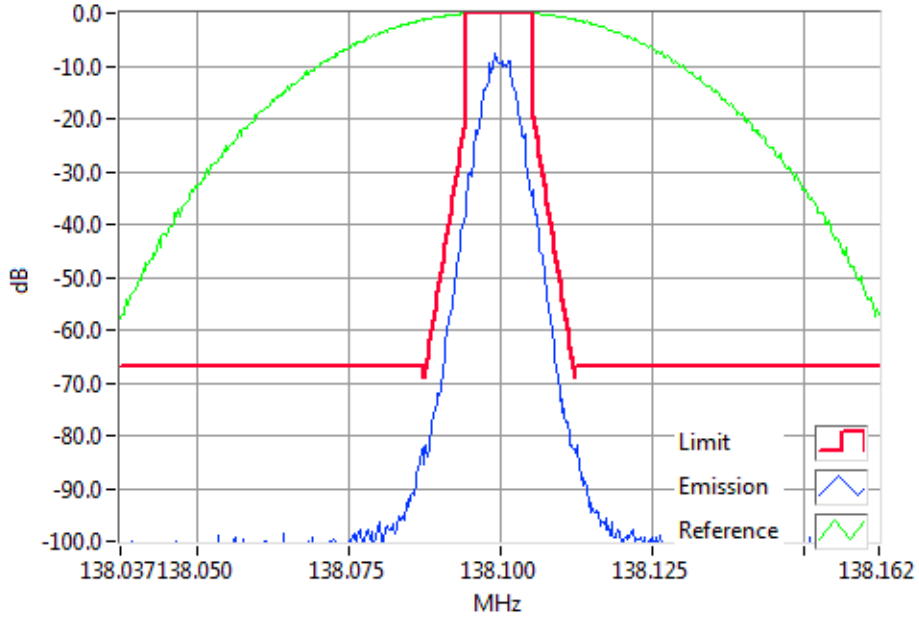
DMR 173.3000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

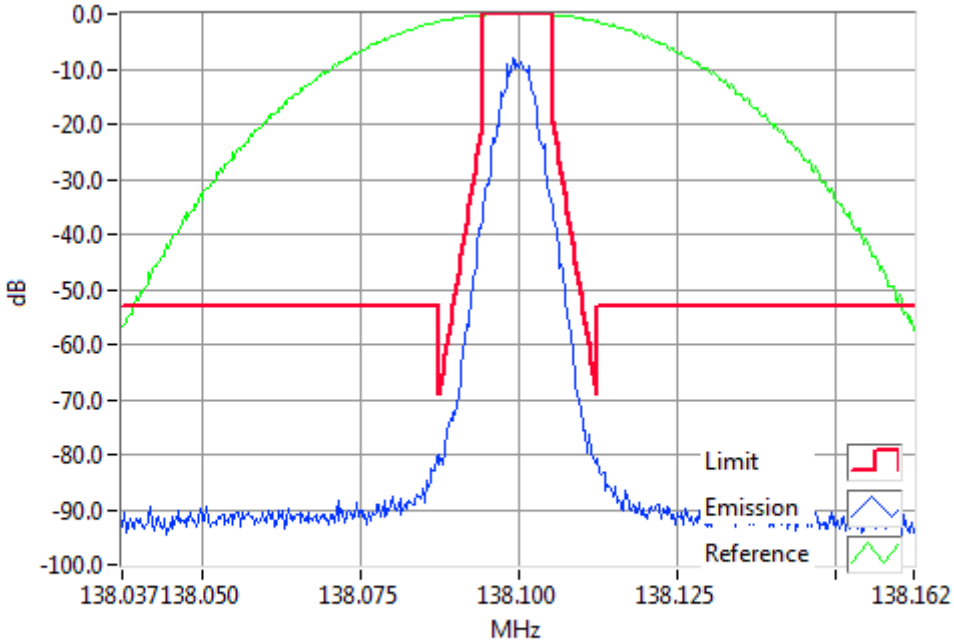
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 138.1 MHz 50 W 12.5 kHz Channel Spacing



C4FM 138.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 138.1 MHz 2 W 12.5 kHz Channel Spacing



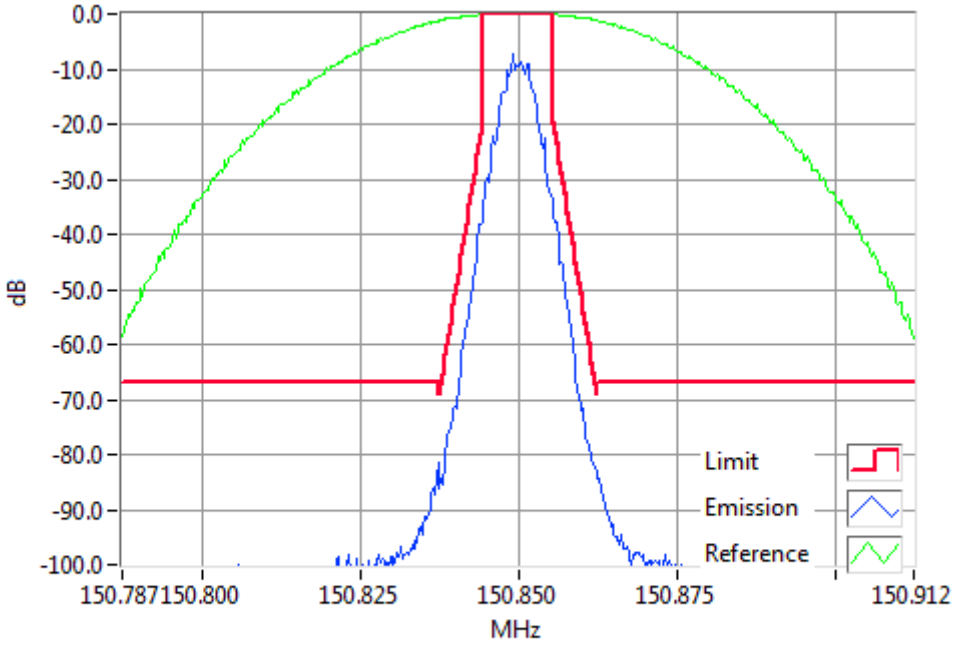
C4FM 138.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

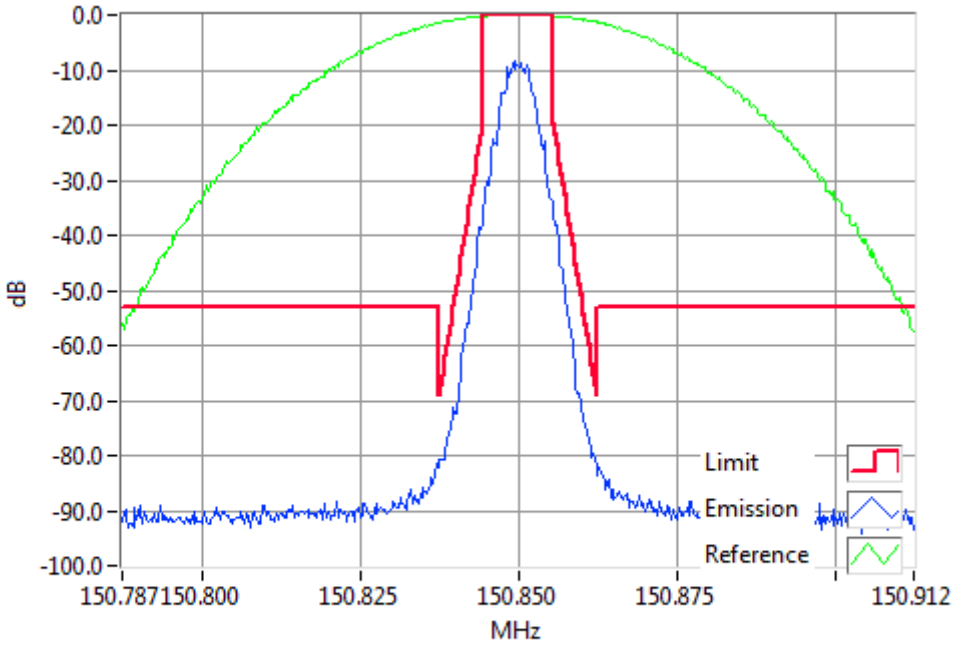
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 150.85 MHz 50 W 12.5 kHz Channel Spacing



C4FM 150.8500MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 150.85 MHz 2 W 12.5 kHz Channel Spacing



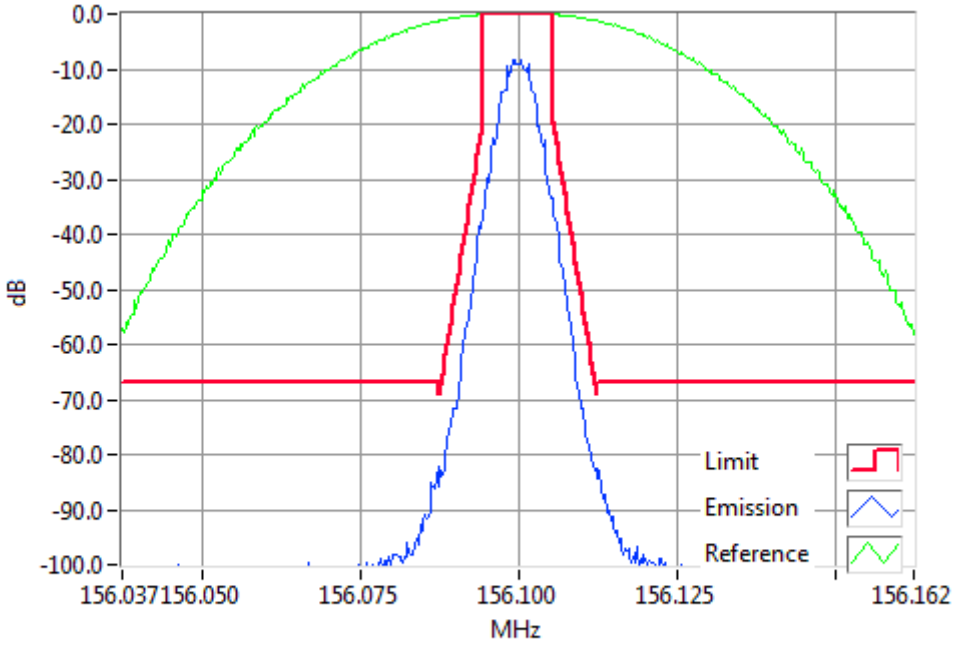
C4FM 150.8500MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

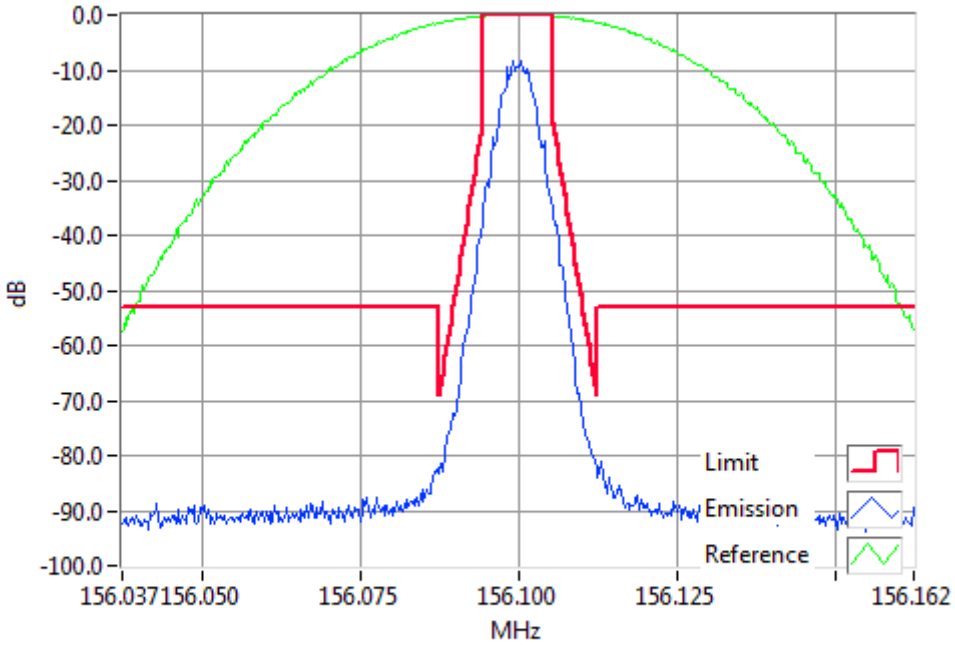
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 156.1 MHz 50 W 12.5 kHz Channel Spacing



C4FM 156.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 156.1 MHz 2 W 12.5 kHz Channel Spacing



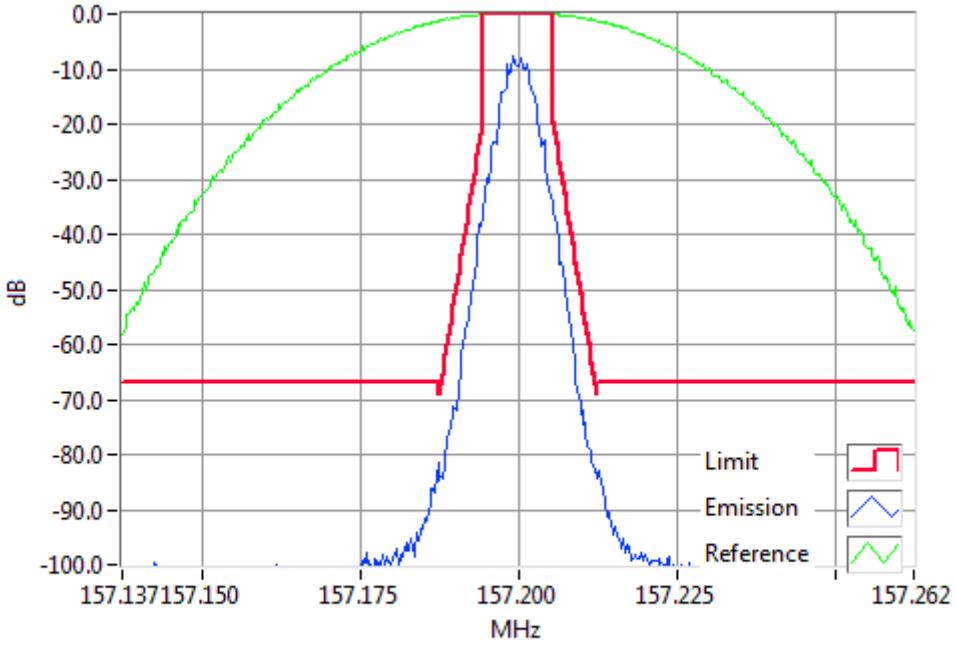
C4FM 156.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

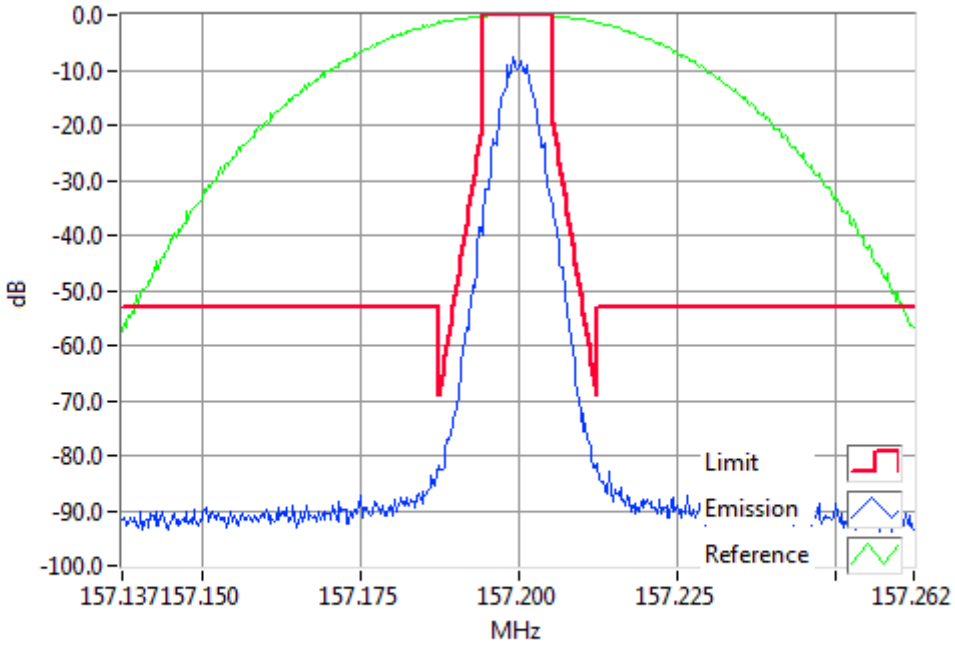
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 157.2 MHz 50 W 12.5 kHz Channel Spacing



C4FM 157.2000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 157.2 MHz 2 W 12.5 kHz Channel Spacing



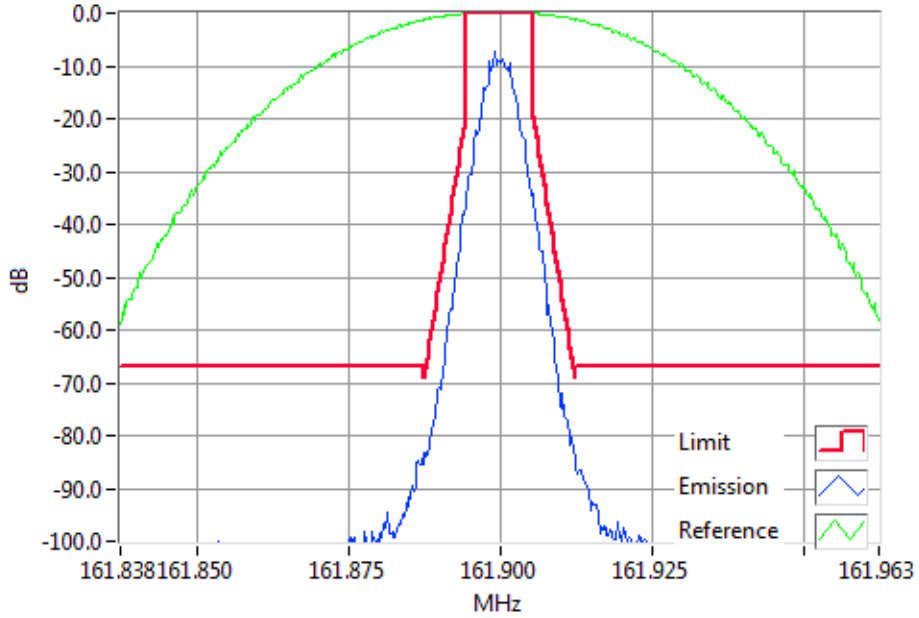
C4FM 157.2000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

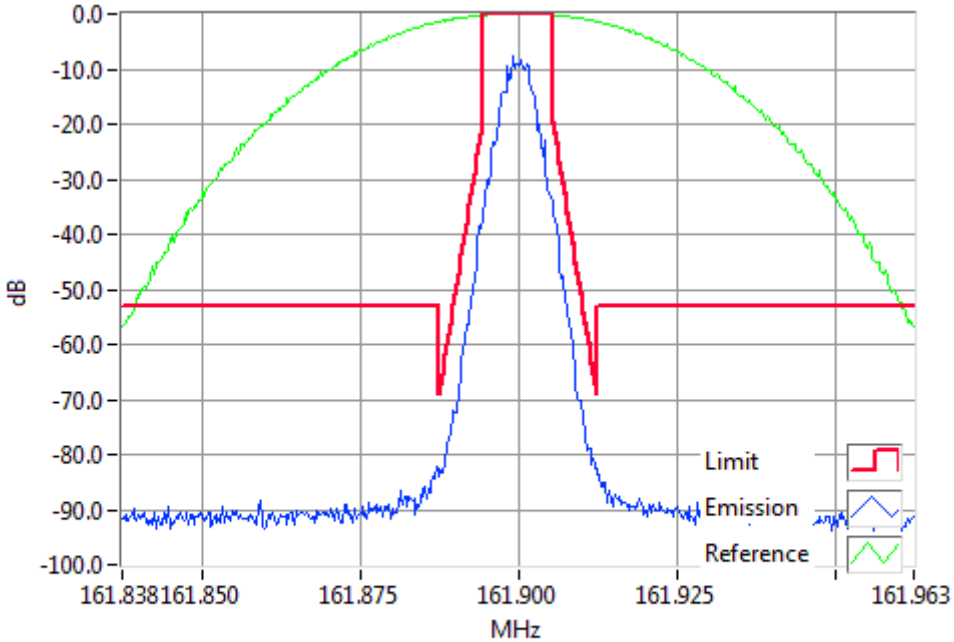
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 161.9 MHz 50 W 12.5 kHz Channel Spacing



C4FM 161.9000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 161.9 MHz 2 W 12.5 kHz Channel Spacing



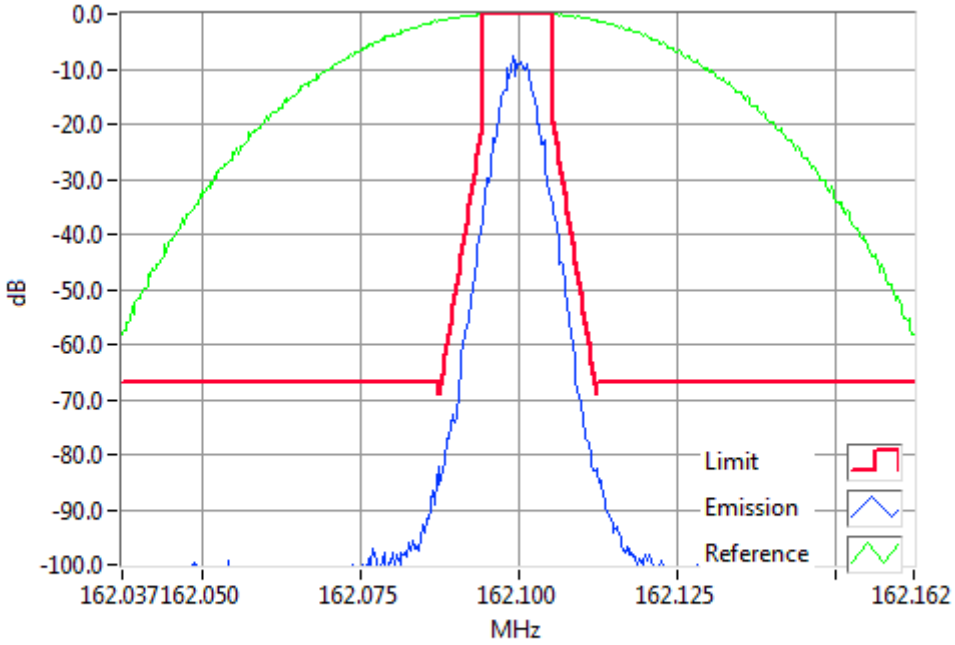
C4FM 161.9000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

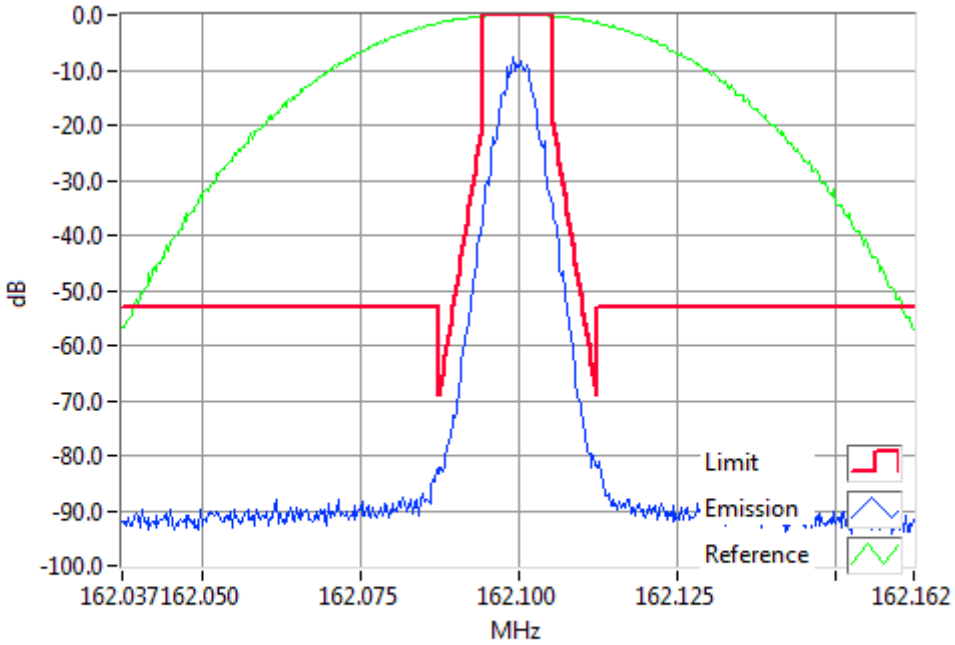
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 162.1 MHz 50 W 12.5 kHz Channel Spacing



C4FM 162.1000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 162.1 MHz 2 W 12.5 kHz Channel Spacing



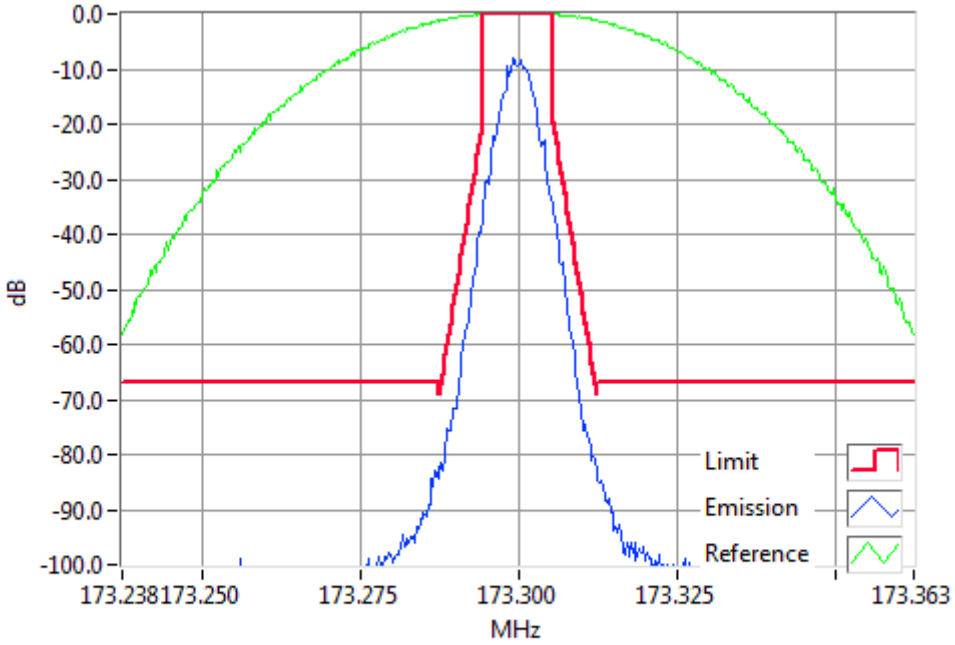
C4FM 162.1000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

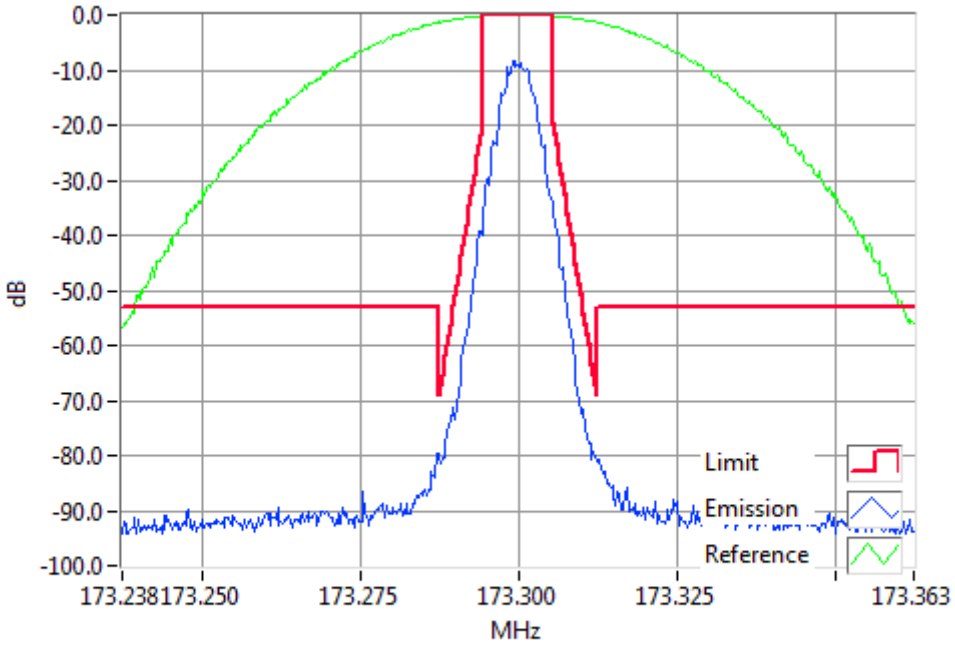
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 173.3 MHz 50 W 12.5 kHz Channel Spacing



C4FM 173.3000MHz Mask D 50W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 173.3 MHz 2 W 12.5 kHz Channel Spacing



C4FM 173.3000MHz Mask D 2W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATIONS: FCC 47 CFR 2.1051 RSS-119 5.8

GUIDE: TIA-603-E 2.2.13 (analogue)
TIA-102-CAAA-C 2.2.7 (digital)

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The frequency range examined was from the lowest frequency generated within the EUT, to a frequency higher than the 10th Harmonic: 100 kHz to Fc-BW
   Fc+ BW to 10Fc (2.0 GHz)
3. The EUT was set to transmit high or low power, modulated with DMR. A scan is performed with a resolution bandwidth of 100 kHz and a video bandwidth of 300 kHz for frequencies up to 1 GHz, and a resolution bandwidth of 1 MHz and a video bandwidth of 3 MHz for frequencies above 1 GHz. A filter was used for frequencies just below the second harmonic to 2.0 GHz.
4. For each frequency range the spectrum analyser was loaded with the appropriate calibration figures to compensate for the cables, attenuator and filter losses, allowing the emission levels to be read directly with no further calculation.
   The calibrations are loaded as an overall reference level offset plus a set of correction factors for the required frequency band.

Spurious emissions which were attenuated by more than 20 dB below the limit were not recorded.

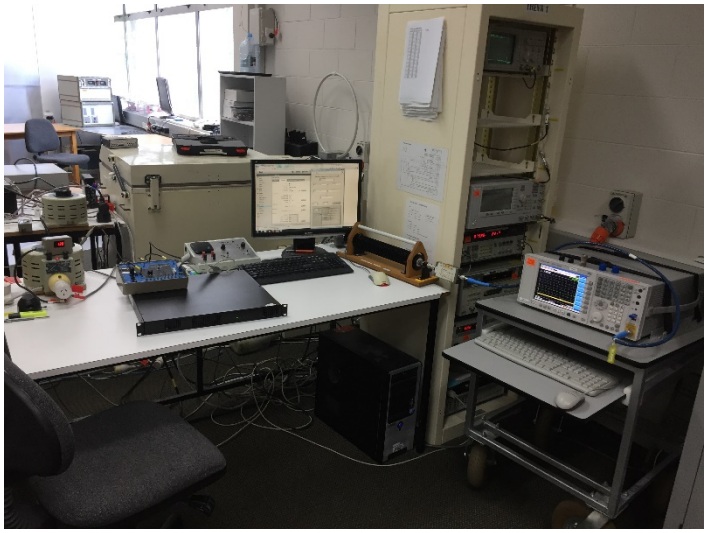
Example of attenuation correction: (dB)

E5023 30dB 350W CK9178	32	
E5015 3m Blue 503429	0.45	
E5028 1m5 Blue 501868	0.22	
E3382 135_175MHz HPBRF	0.53	
Total Attenuation @ 276.200 MHz	33.2	Sum of component attenuation (a)
Amplitude offset	33.57	(b)
Correction @ 276.200 MHz	-0.37	(a-b)

MEASUREMENT RESULTS:
See the tables and plots on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSES: FCC 47 CFR 90.210 RSS-119 5.8

Photo: Conducted Emissions Test Setup



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 138.1 MHz @ 50 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

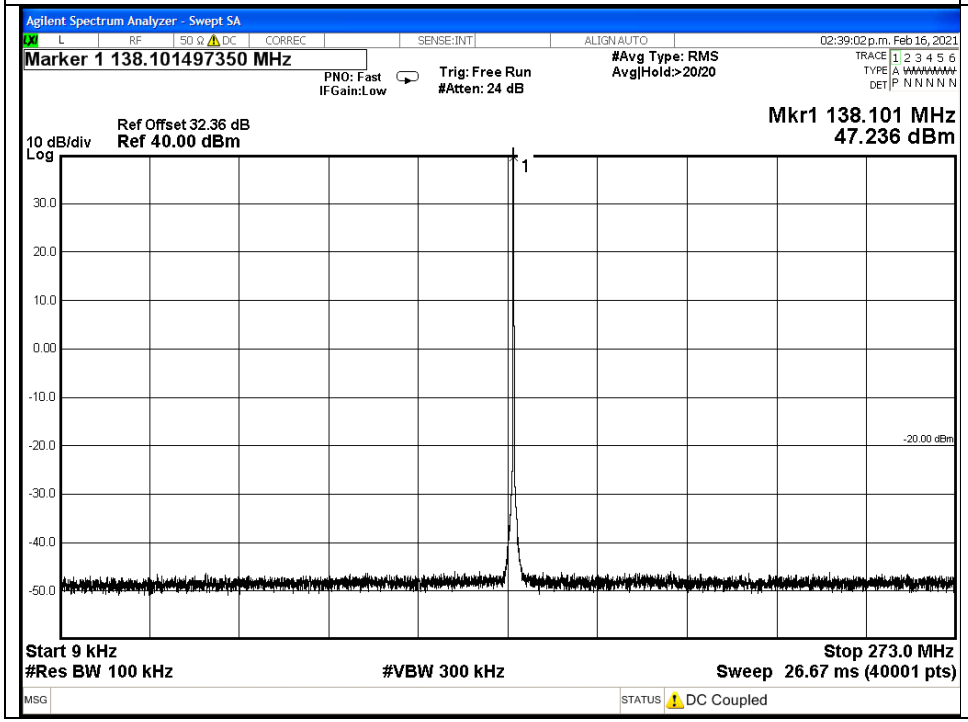
12.5 kHz Channel Spacing 138.1 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty:	≤12.75 GHz ± 3.0 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

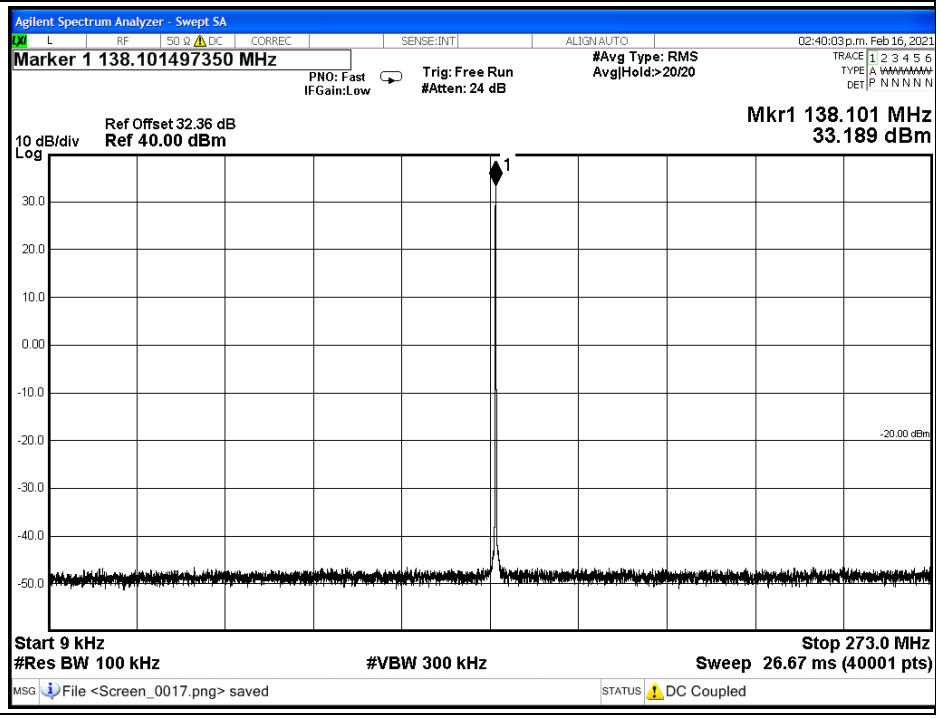
Spurious Emissions (Tx Conducted)

138.1 MHz, 9 kHz to 273 MHz scan

50 W

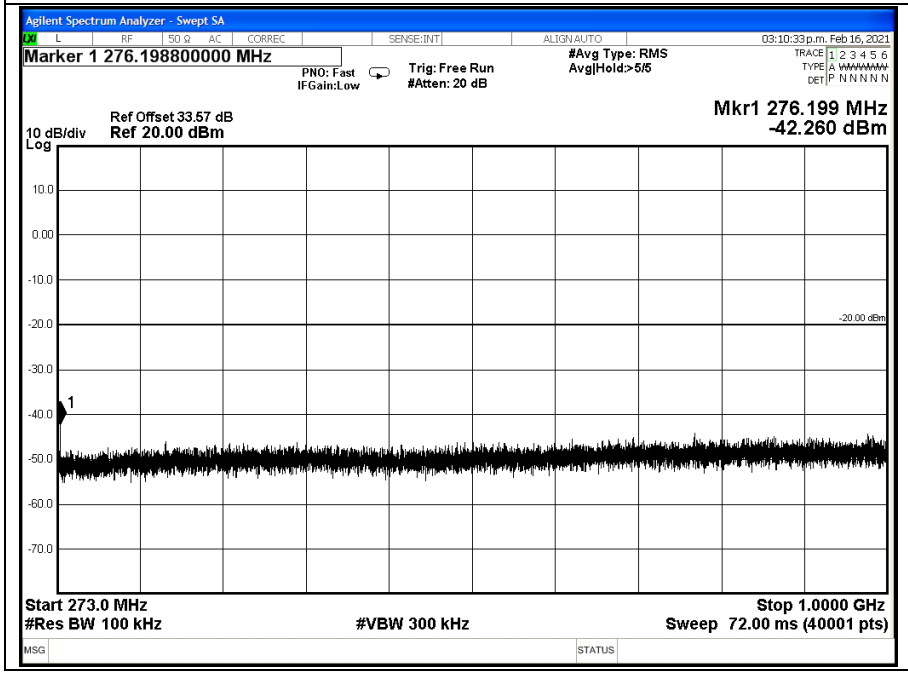
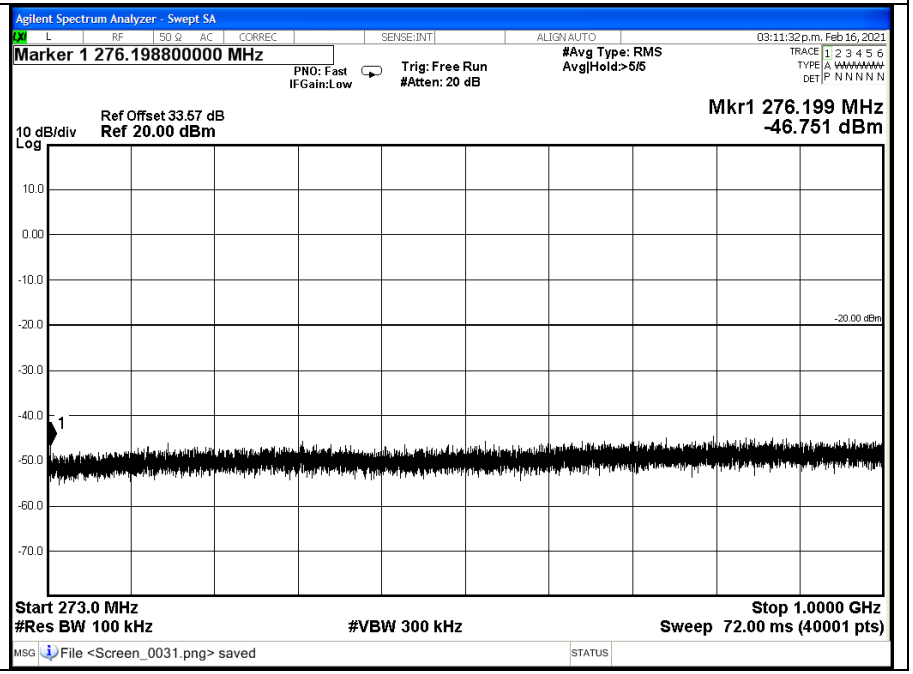


2 W



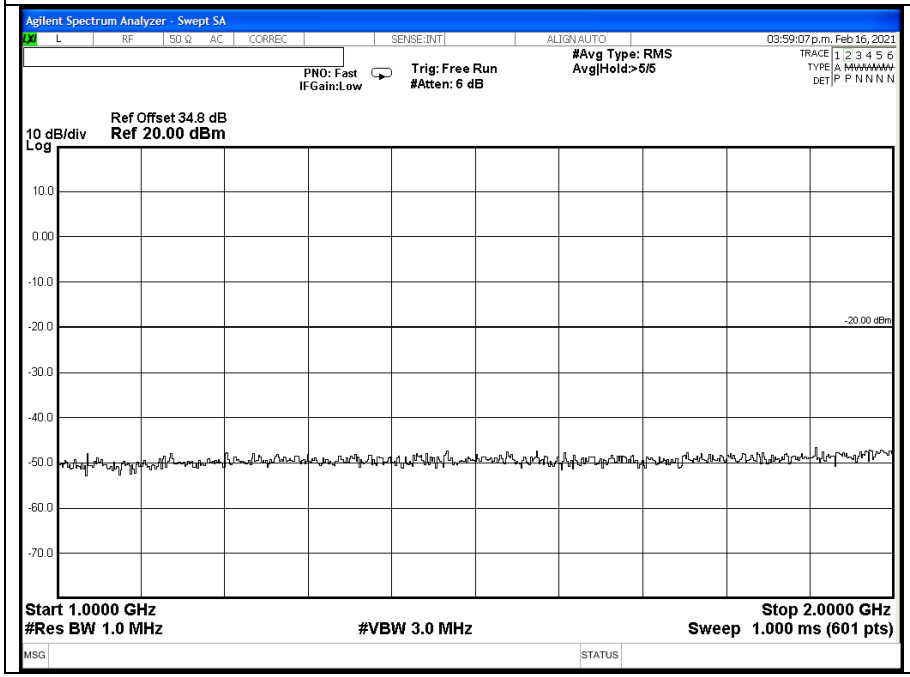
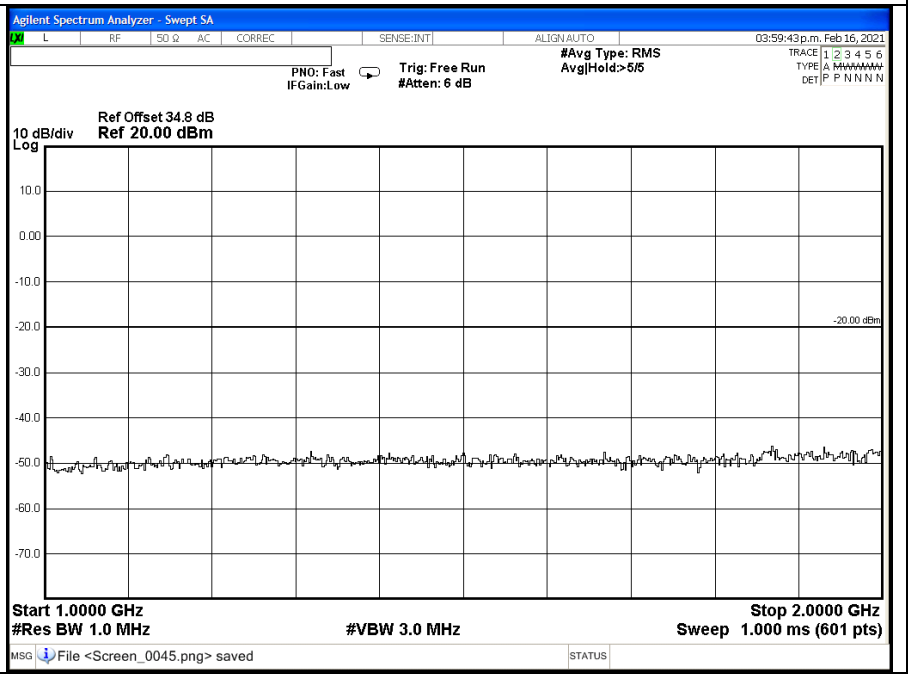
Spurious Emissions (Tx Conducted)

138.1 MHz, 273 to 1000 MHz scan

50 W	2 W
	

Spurious Emissions (Tx Conducted)

138.1 MHz, 1 to 2 GHz scan

50 W	2 W
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 150.85 MHz @ 50 W Emission Mask D

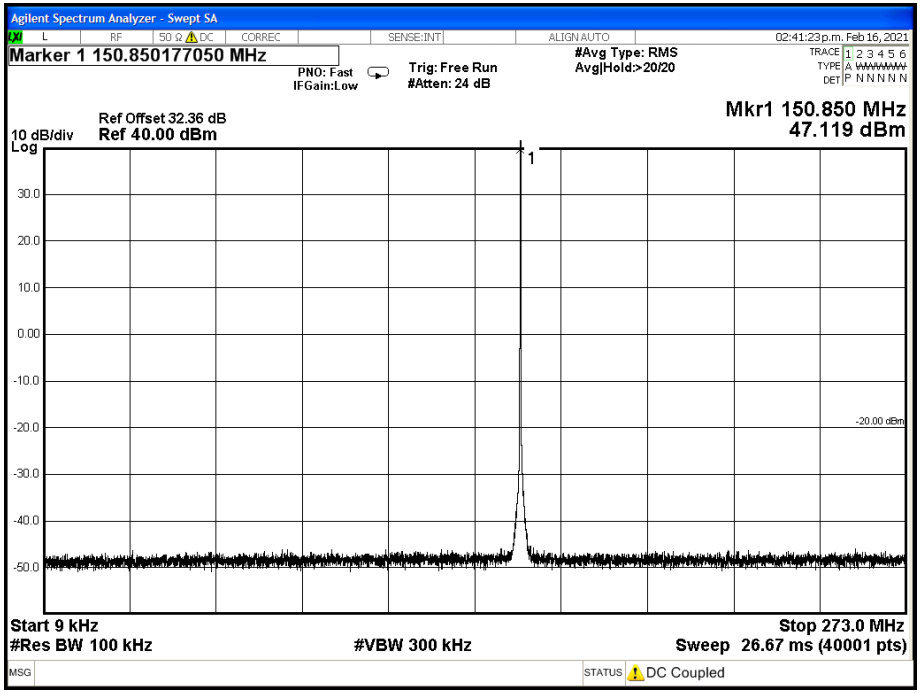
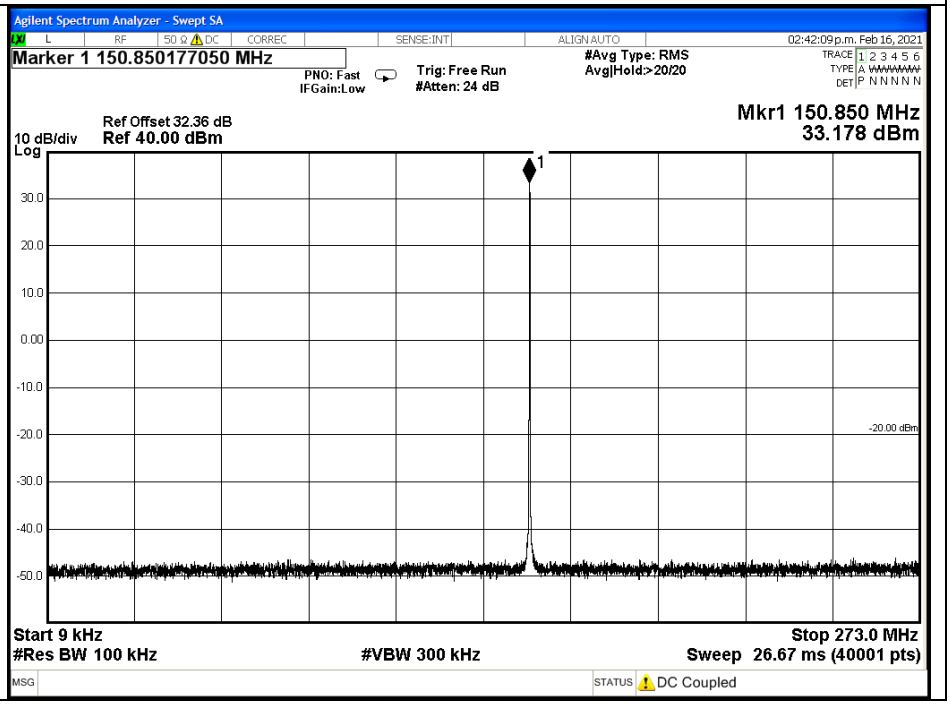
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 150.85 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty:	≤12.75 GHz ± 3.0 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

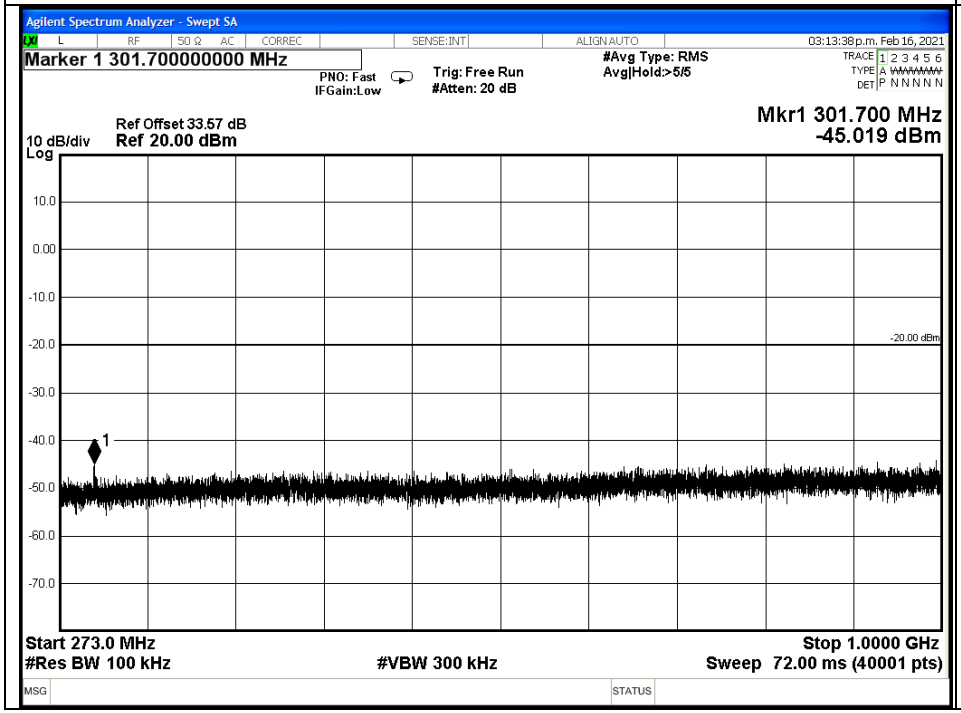
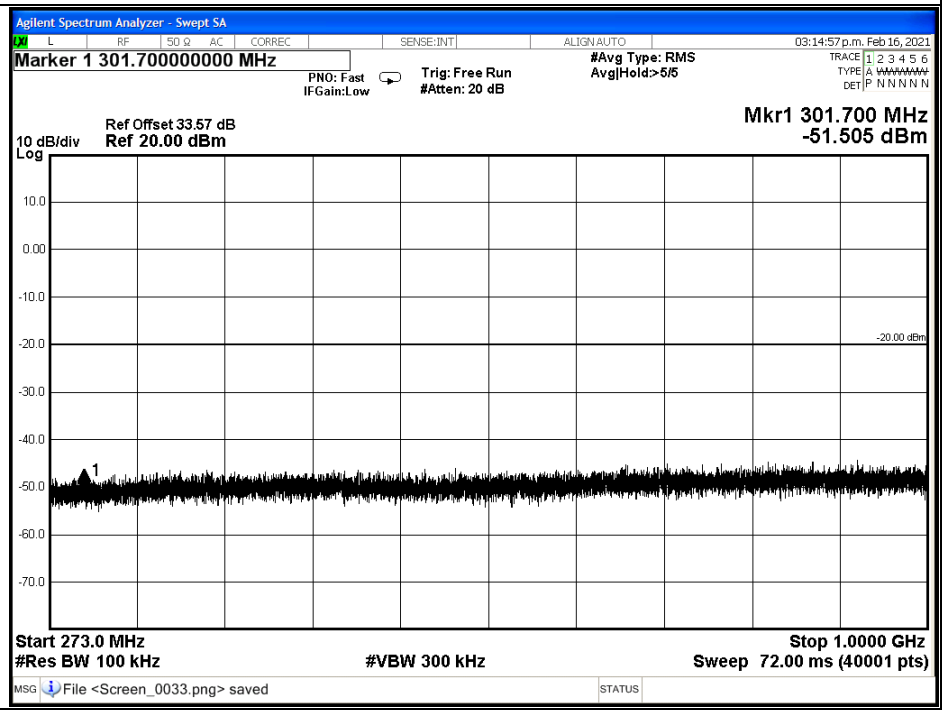
Spurious Emissions (Tx Conducted)

150.85 MHz, 9 kHz to 273 MHz scan

50 W	2 W
	

Spurious Emissions (Tx Conducted)

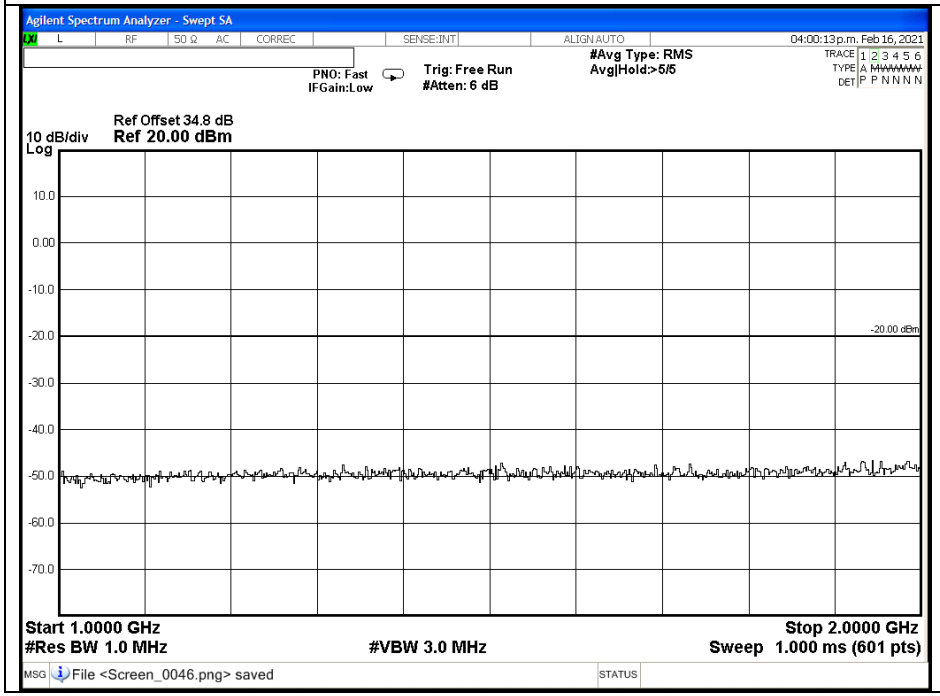
150.85 MHz, 273 to 1000MHz scan

50 W	2 W
	

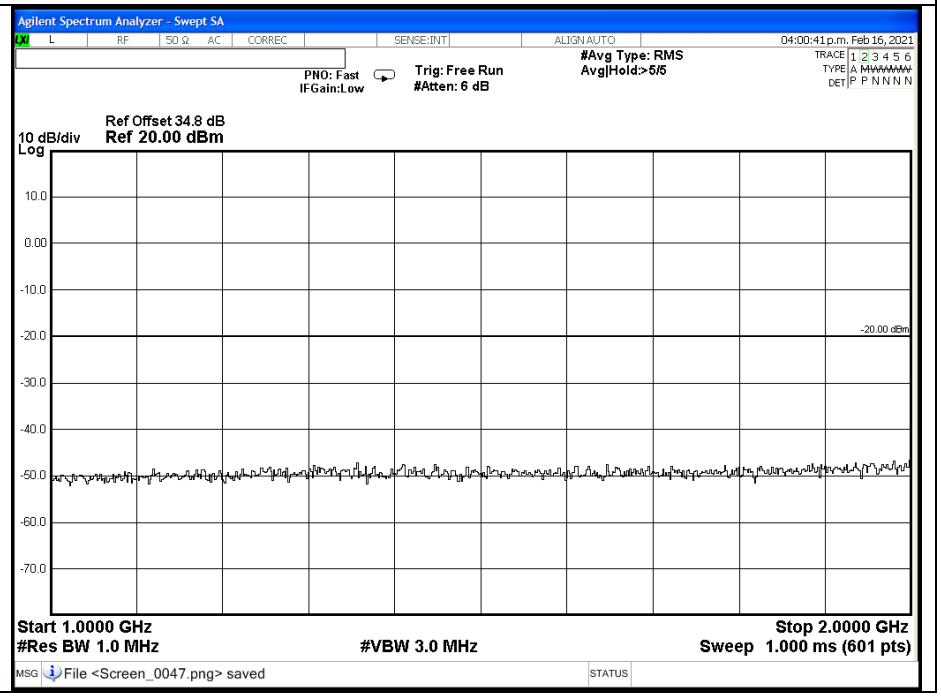
Spurious Emissions (Tx Conducted)

150.85 MHz, 1 to 2GHz scan

50 W



2 W



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 156.1 MHz @ 50 W Emission Mask D

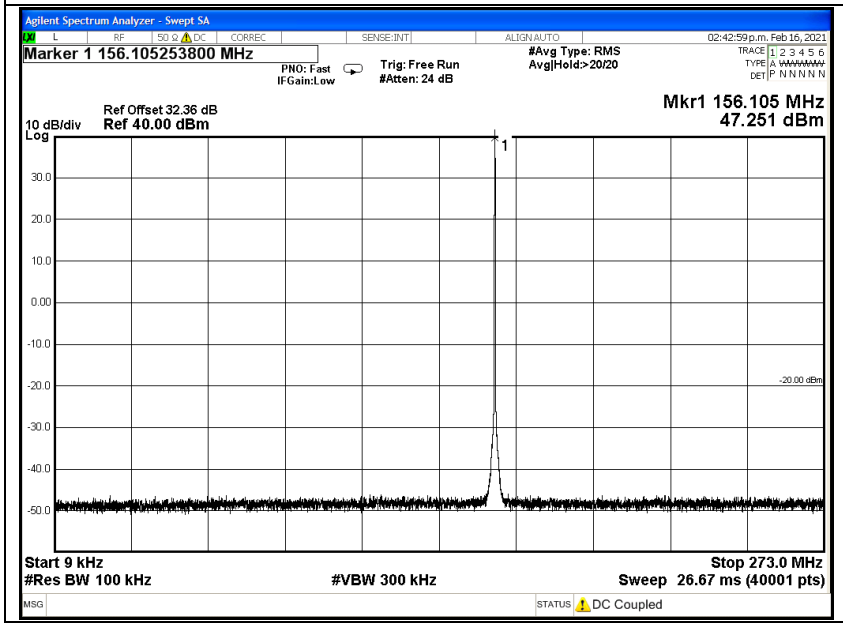
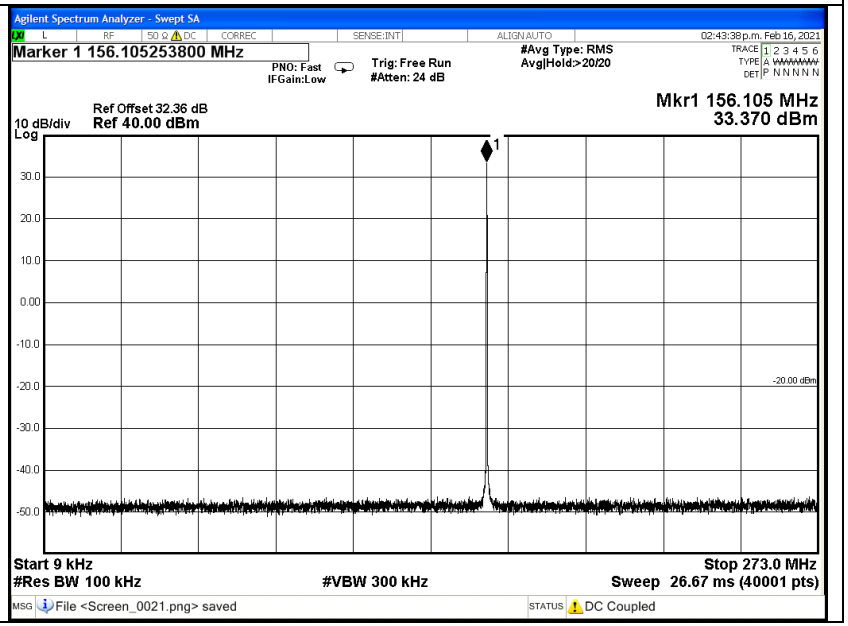
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 156.1 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty:	≤12.75 GHz ± 3.0 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

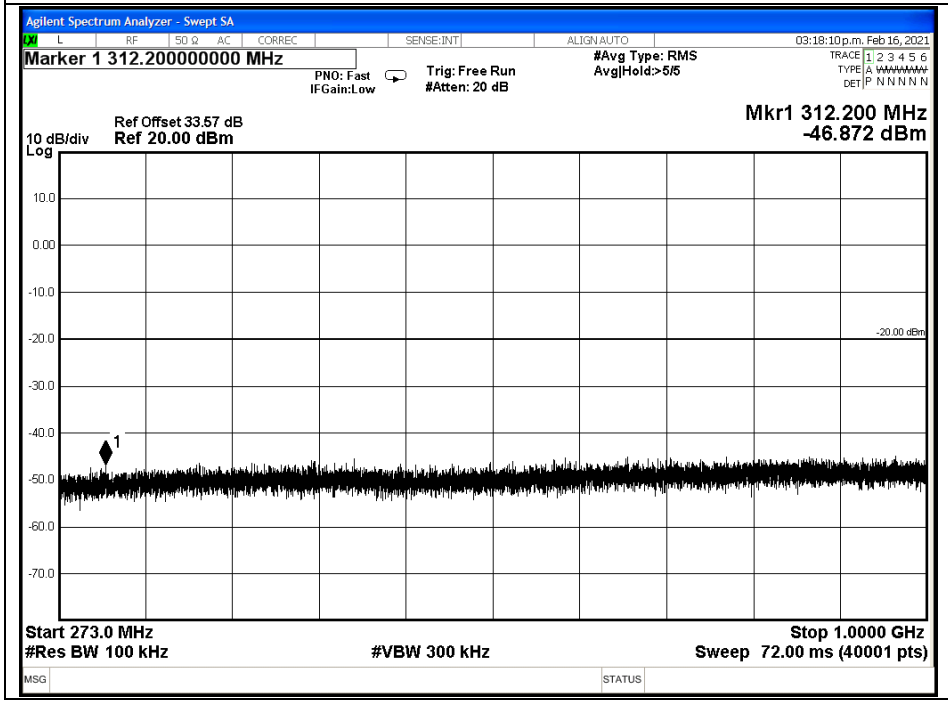
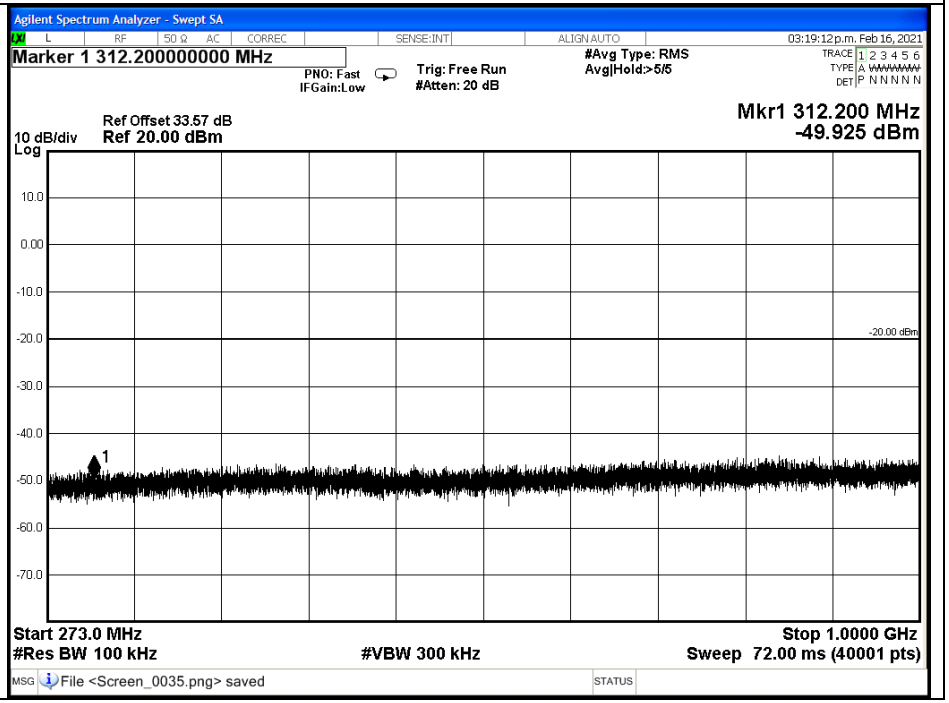
Spurious Emissions (Tx Conducted)

156.1 MHz, 9 kHz to 273 MHz scan

50 W	2 W
	

Spurious Emissions (Tx Conducted)

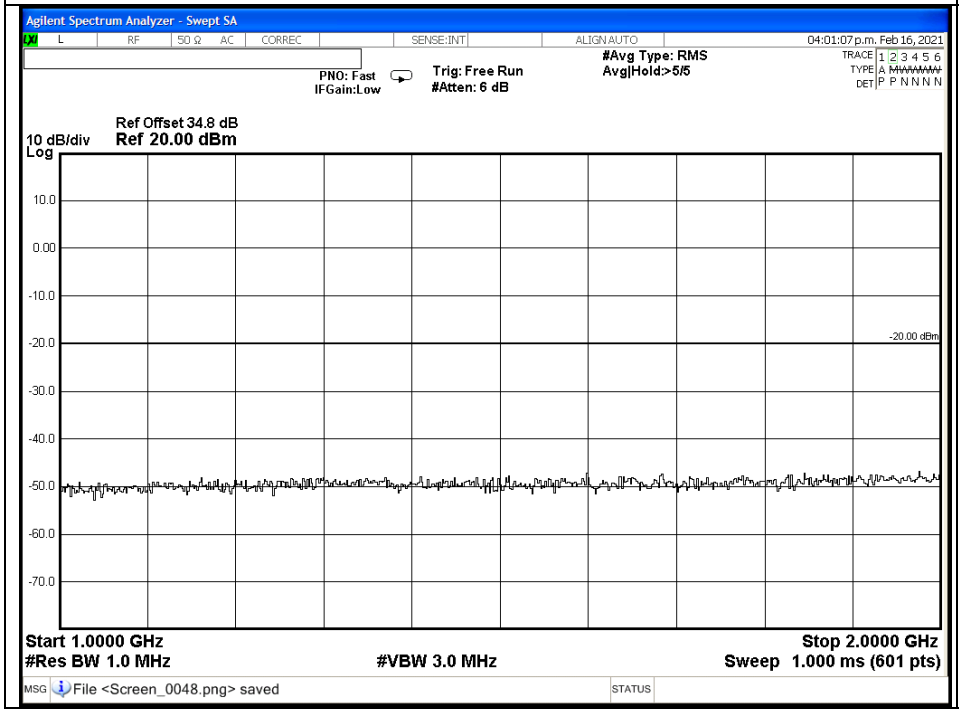
156.1 MHz, 273 to 1000MHz scan

50 W	2 W
	

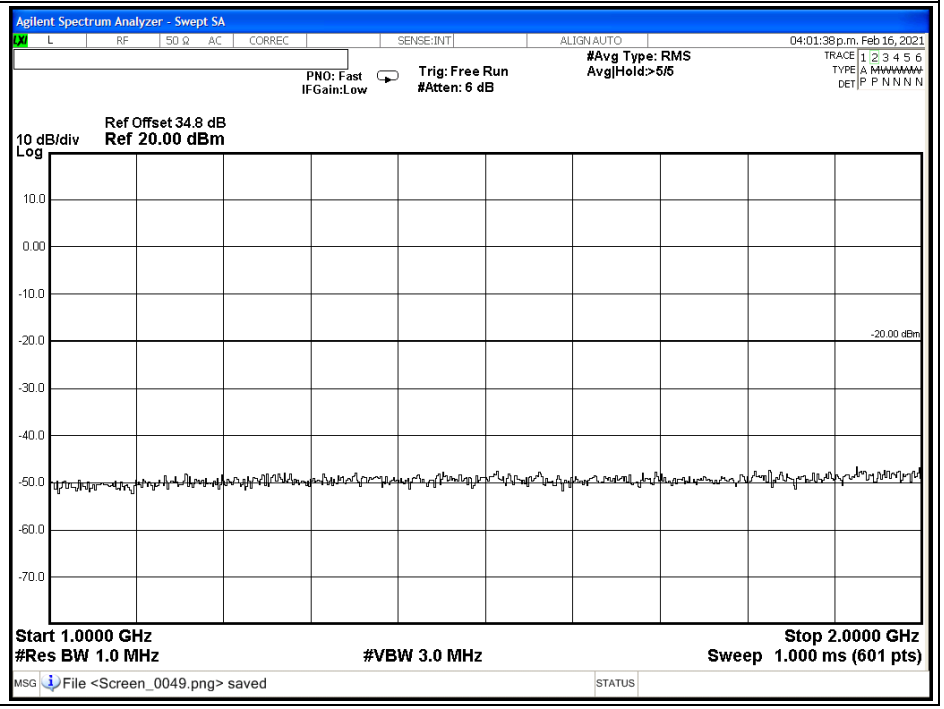
Spurious Emissions (Tx Conducted)

156.1 MHz, 1 to 2GHz scan

50 W



2 W



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 157.2 MHz @ 50 W Emission Mask D

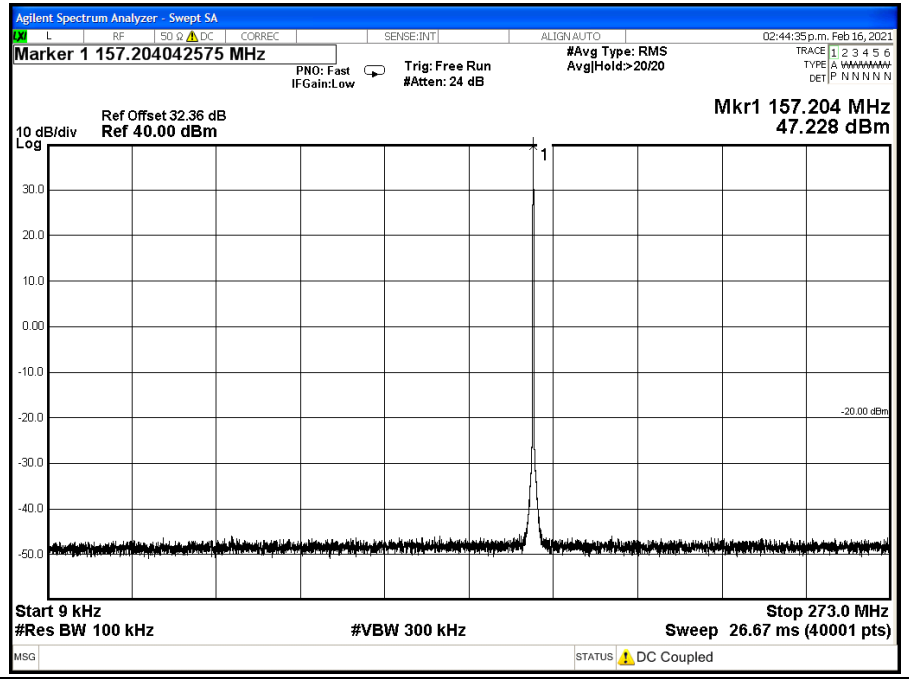
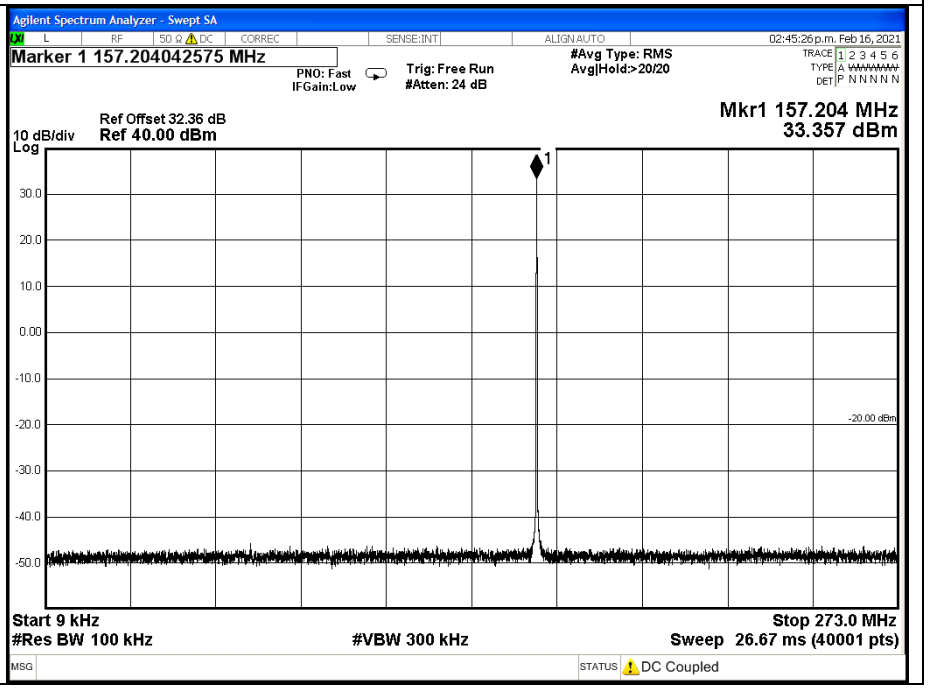
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 157.2 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty:	≤12.75 GHz ± 3.0 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

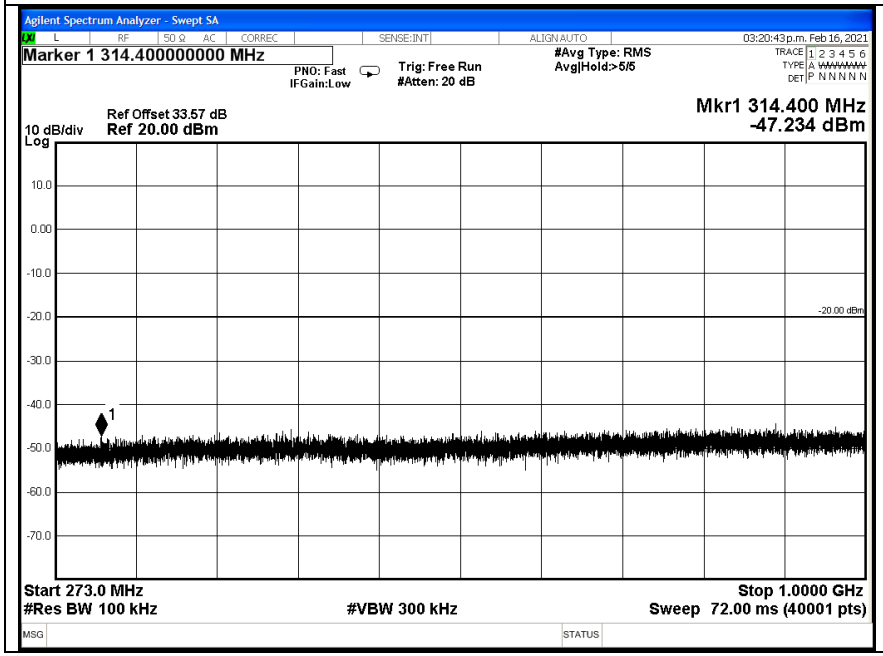
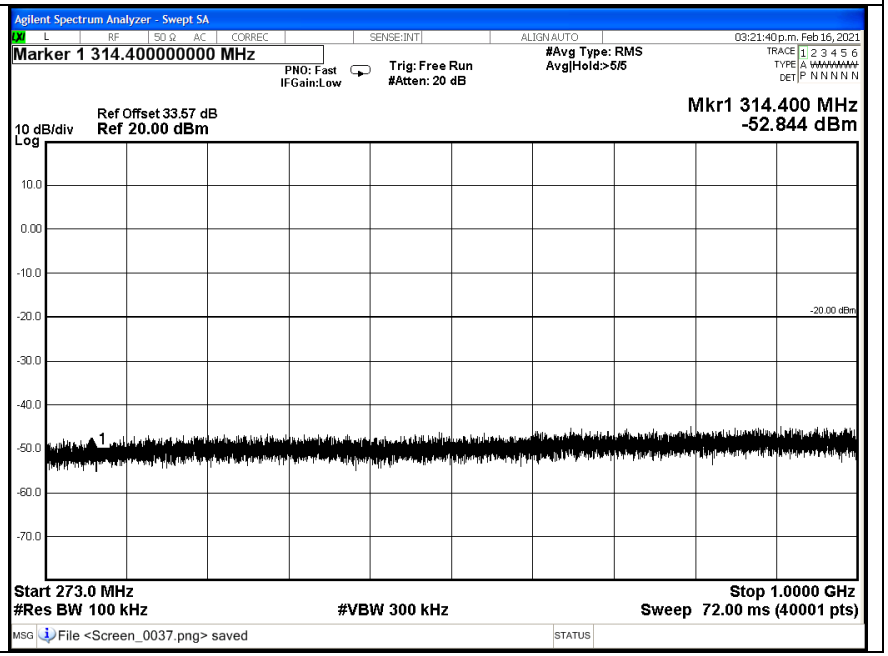
Spurious Emissions (Tx Conducted)

157.2 MHz, 9 kHz to 273 MHz scan

50 W	2 W
	

Spurious Emissions (Tx Conducted)

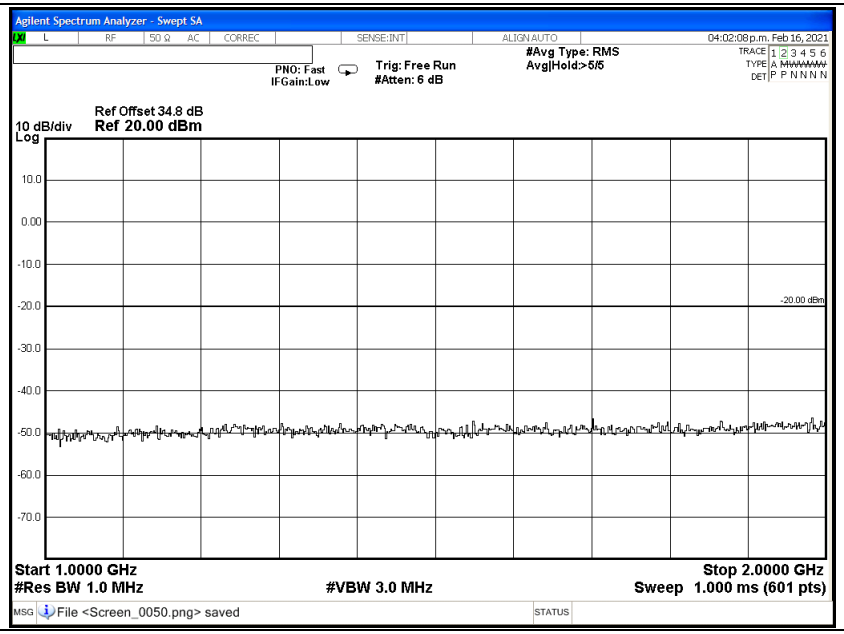
157.2 MHz, 273 to 1000MHz scan

50 W	2 W
	

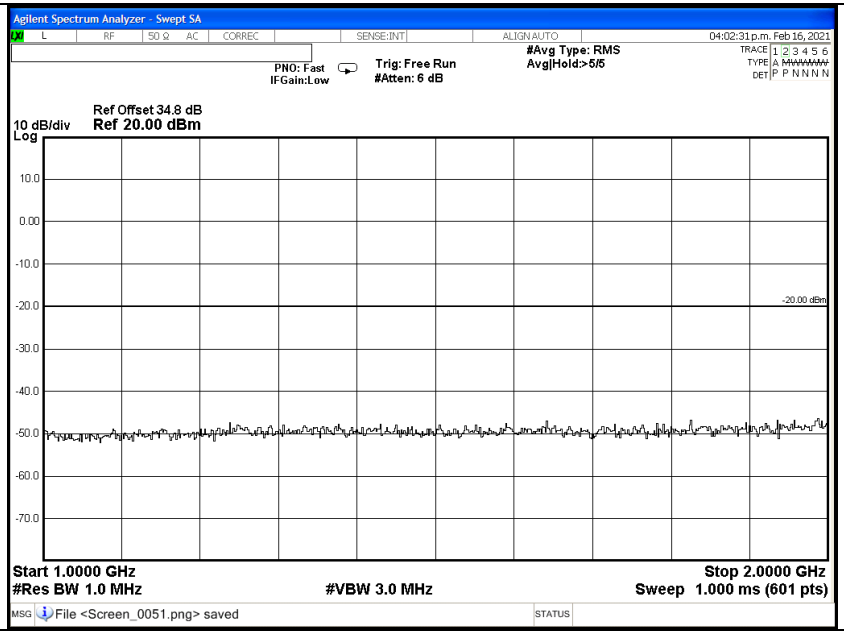
Spurious Emissions (Tx Conducted)

157.2 MHz, 1 to 2GHz scan

50 W



2 W



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 161.9 MHz @ 50 W Emission Mask D

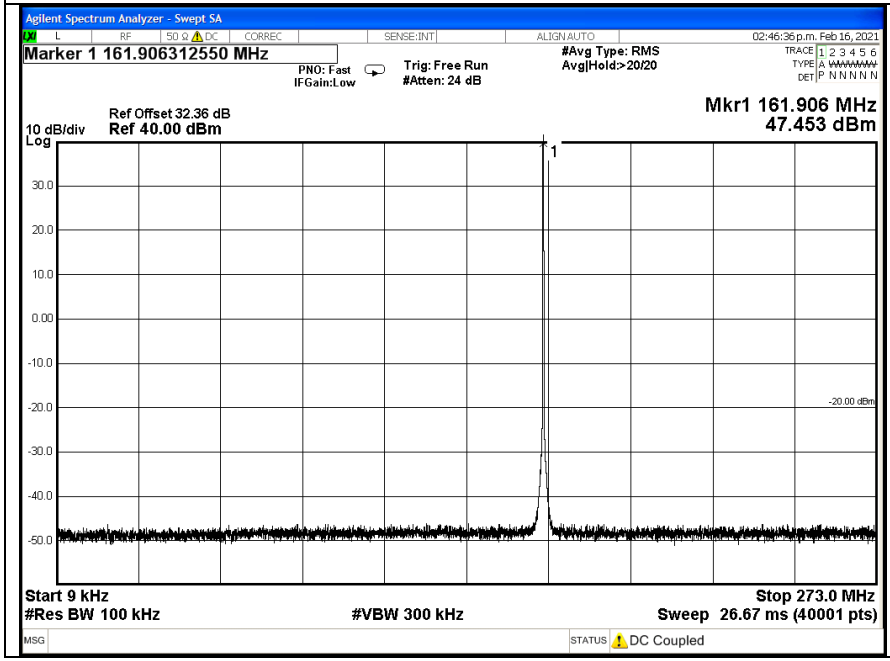
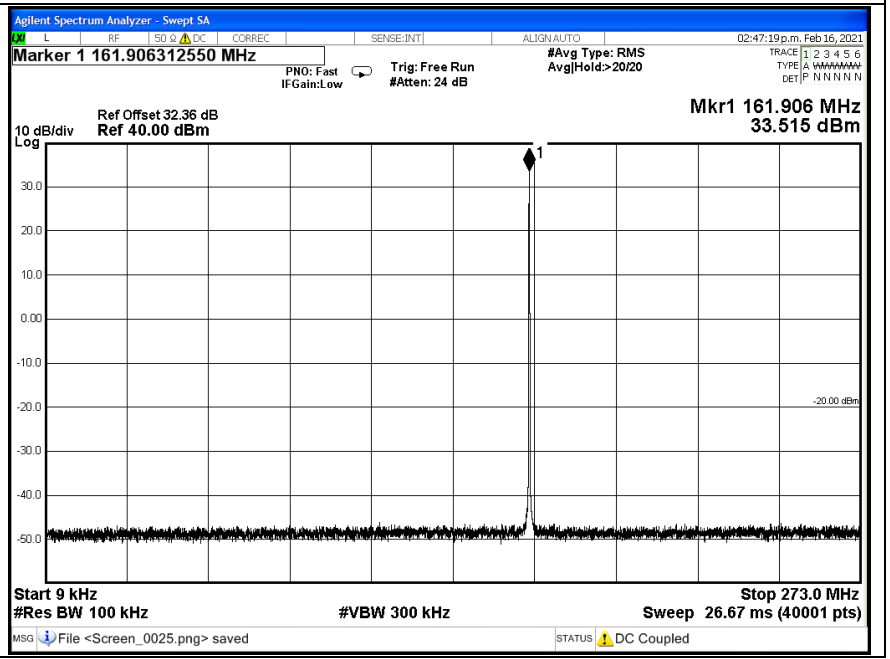
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 161.9 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty:	≤12.75 GHz ± 3.0 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

Spurious Emissions (Tx Conducted)

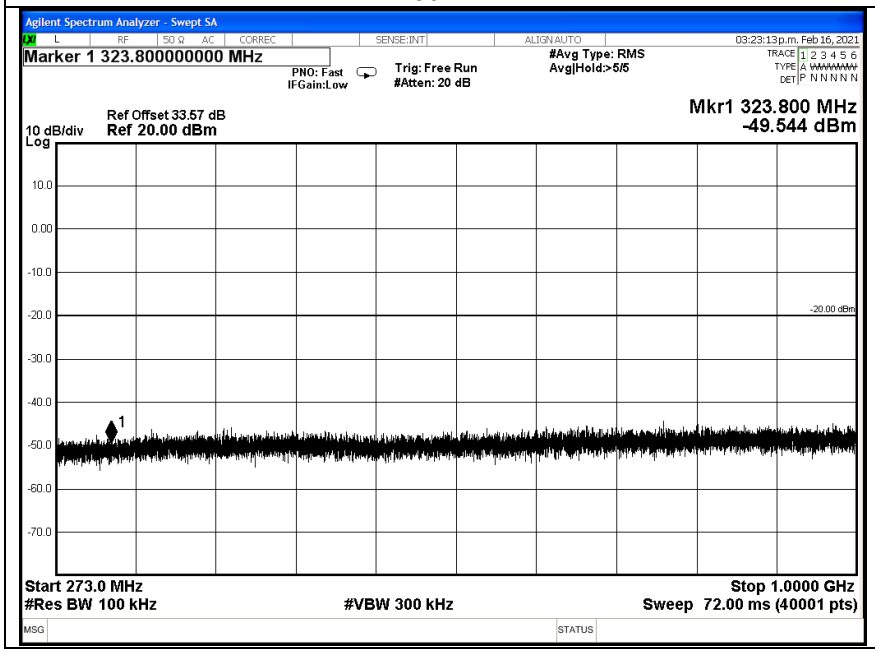
161.9 MHz, 9 kHz to 273MHz scan

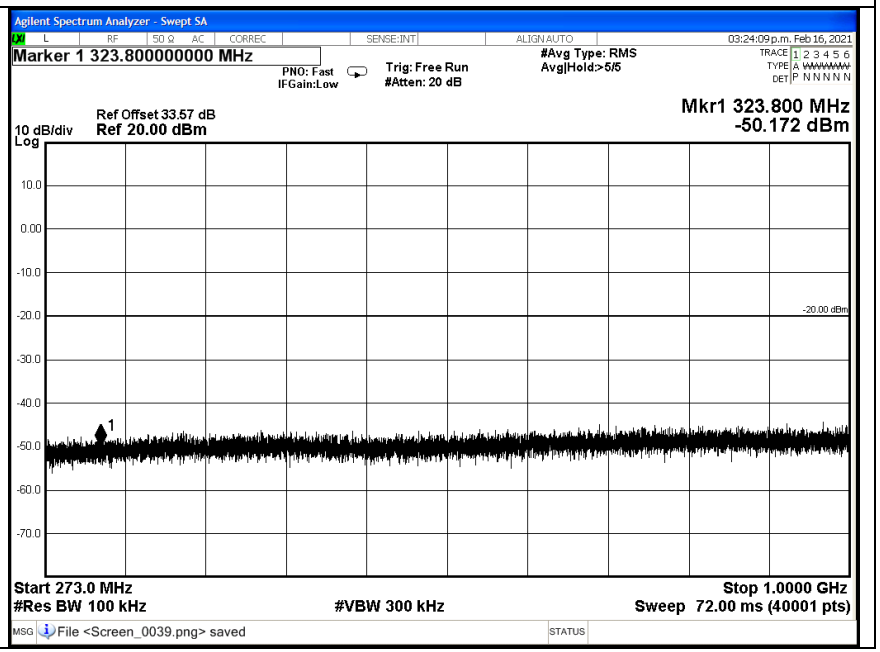
50 W	2 W
	

Spurious Emissions (Tx Conducted)

161.9 MHz, 273 to 1000MHz scan

50 W	2 W

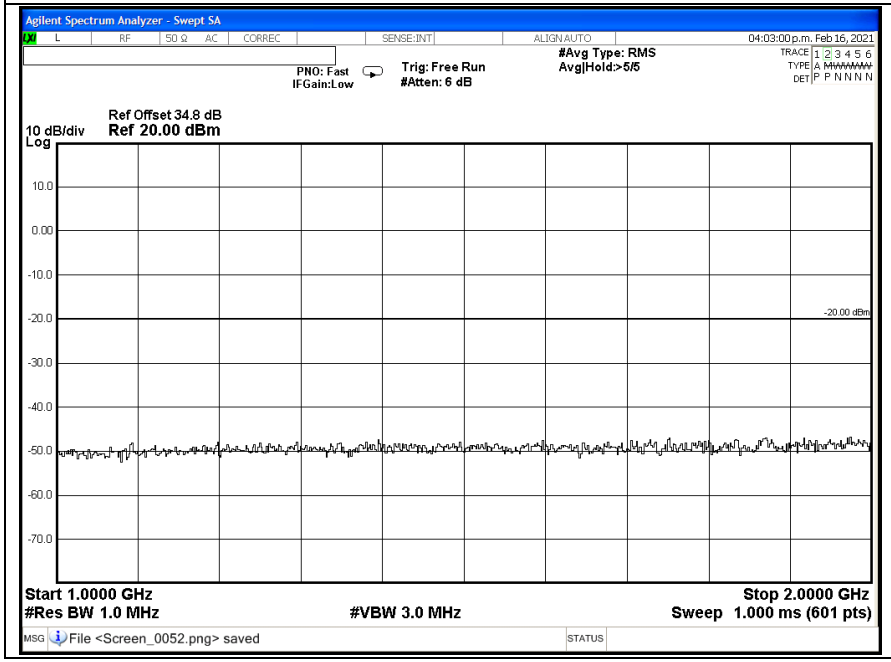




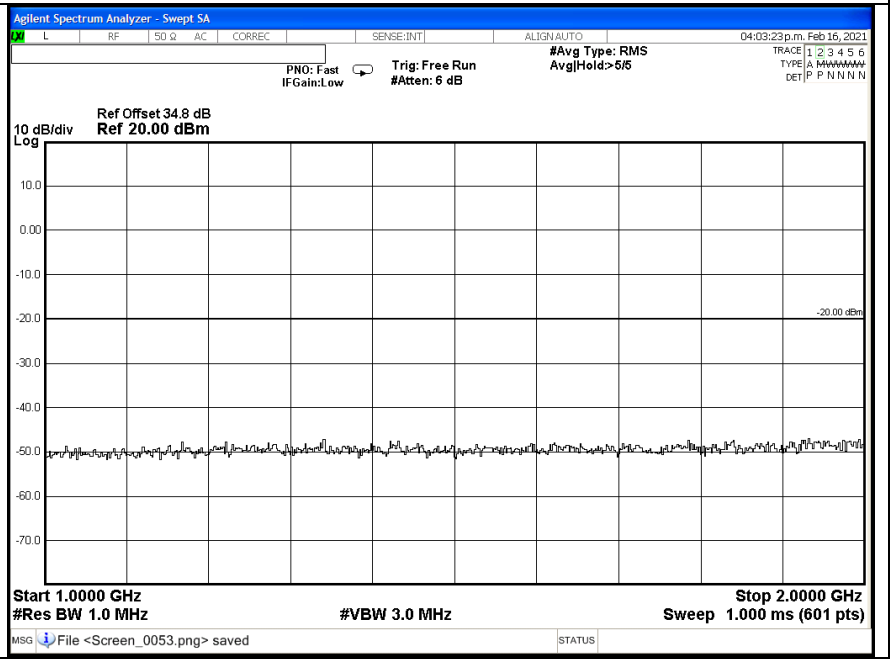
Spurious Emissions (Tx Conducted)

161.9 MHz, 1 to 2GHz scan

50 W



2 W



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 162.1 MHz @ 50 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

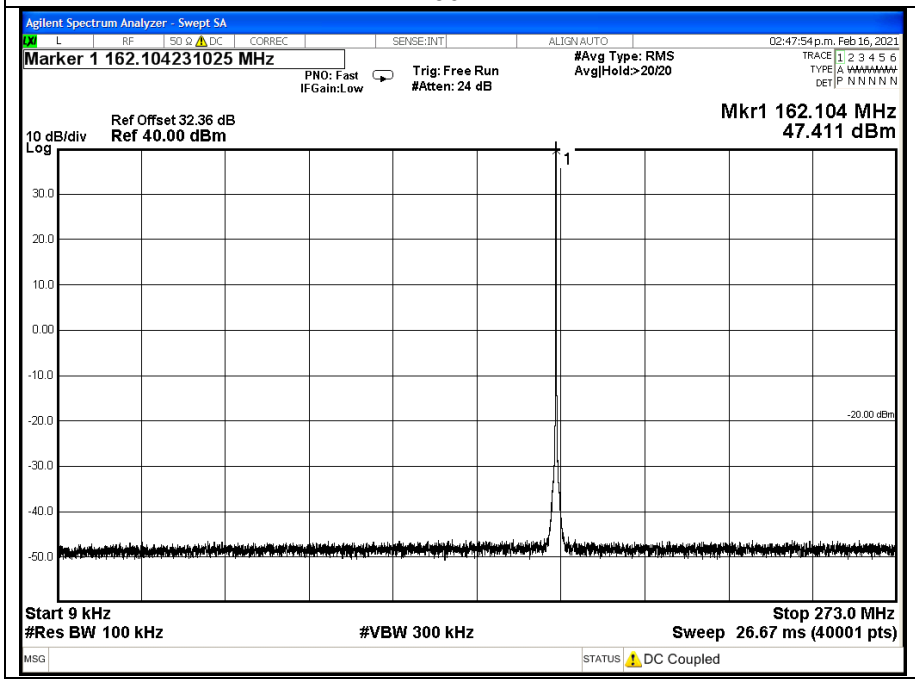
12.5 kHz Channel Spacing 162.1 MHz @ 2 W Emission Mask D

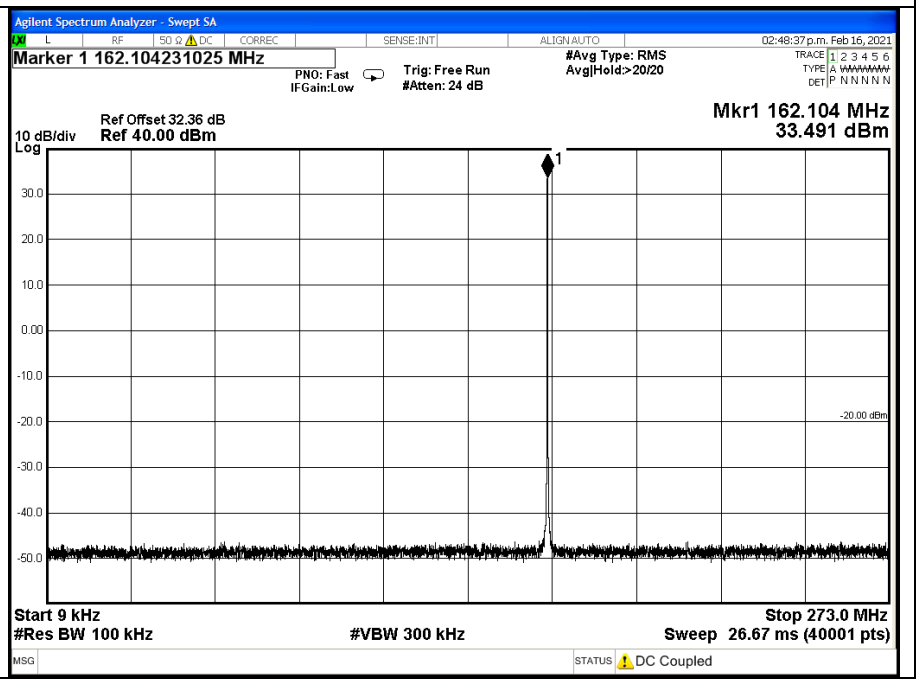
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty:	≤12.75 GHz ± 3.0 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

Spurious Emissions (Tx Conducted)

162.1 MHz, 9 kHz to 273MHz scan

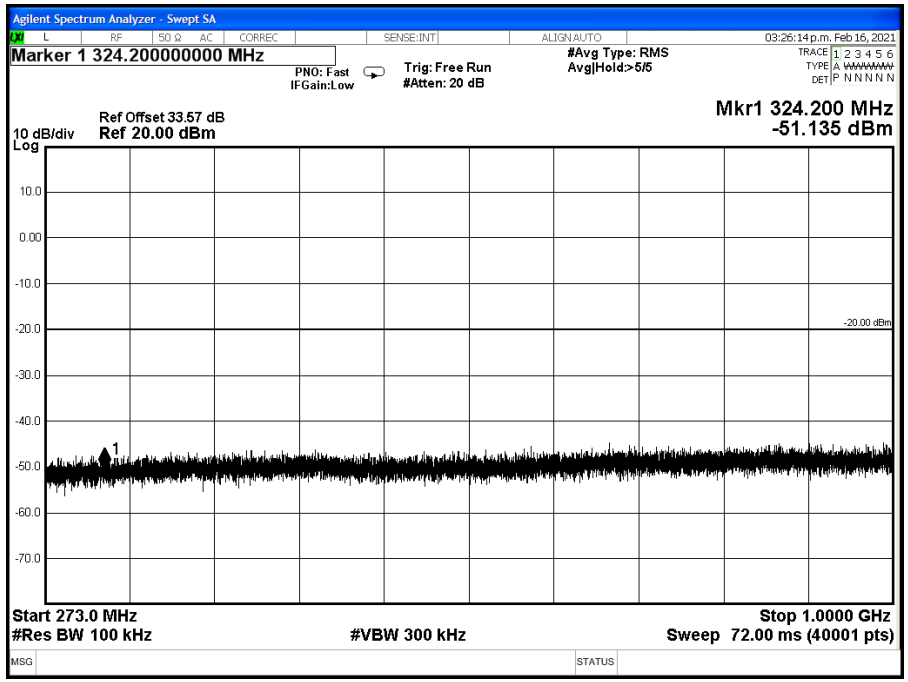
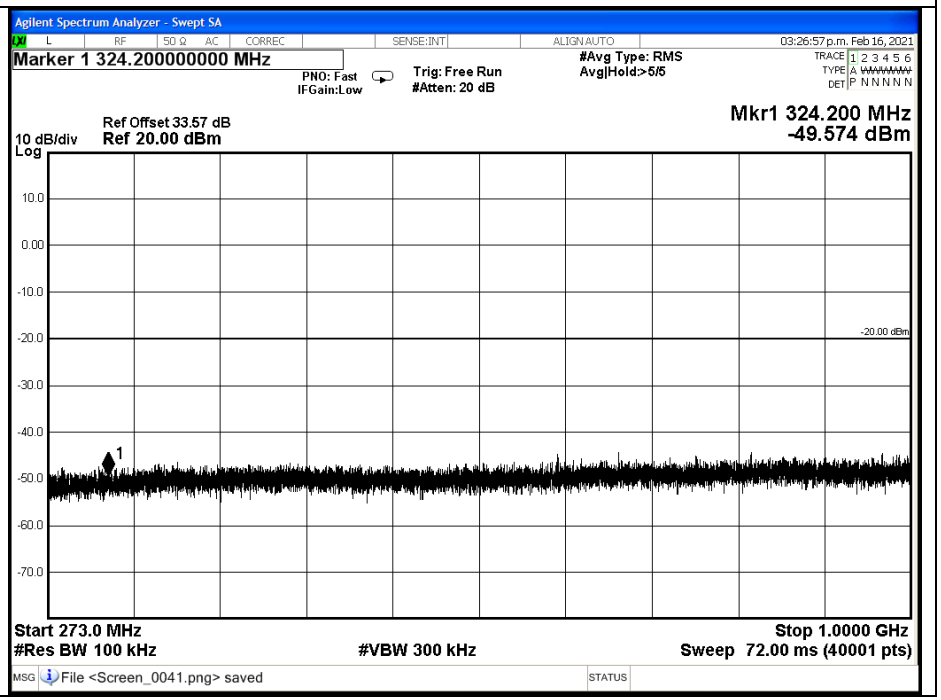
50 W	2 W





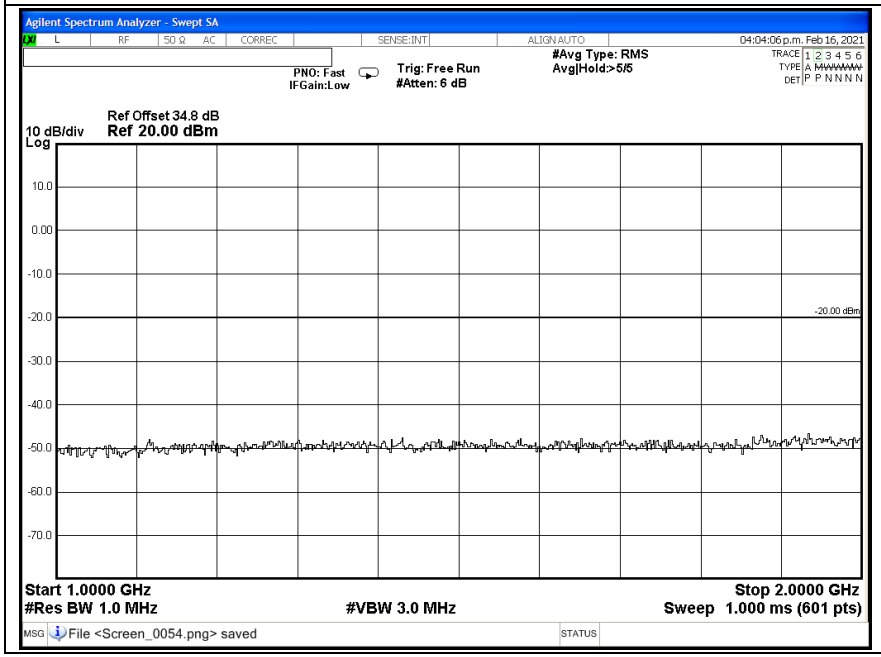
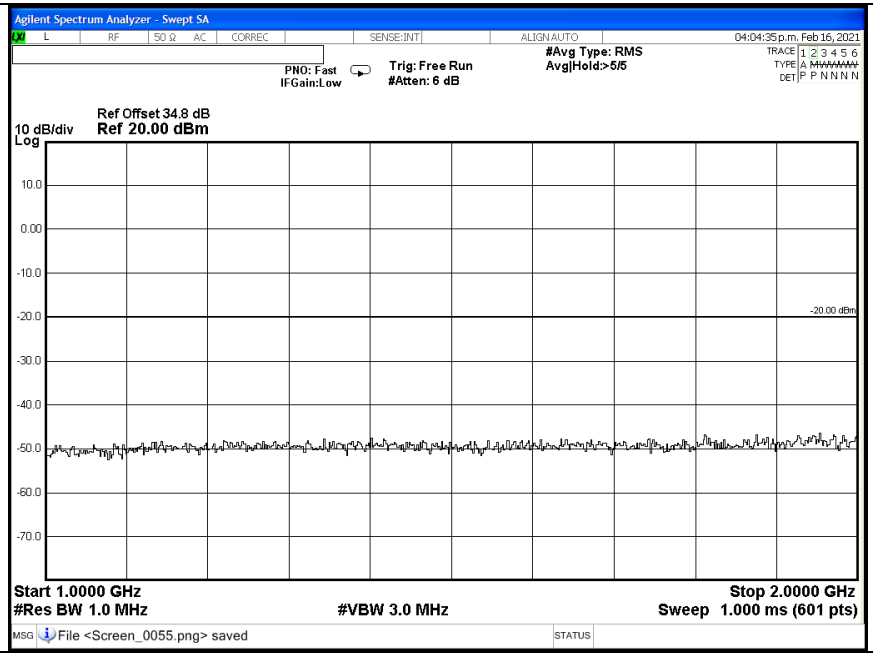
Spurious Emissions (Tx Conducted)

162.1 MHz, 273 to 1000MHz scan

50 W	2 W
	

Spurious Emissions (Tx Conducted)

162.1 MHz, 1 to 2GHz scan

50 W	2 W
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 173.3 MHz @ 50 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

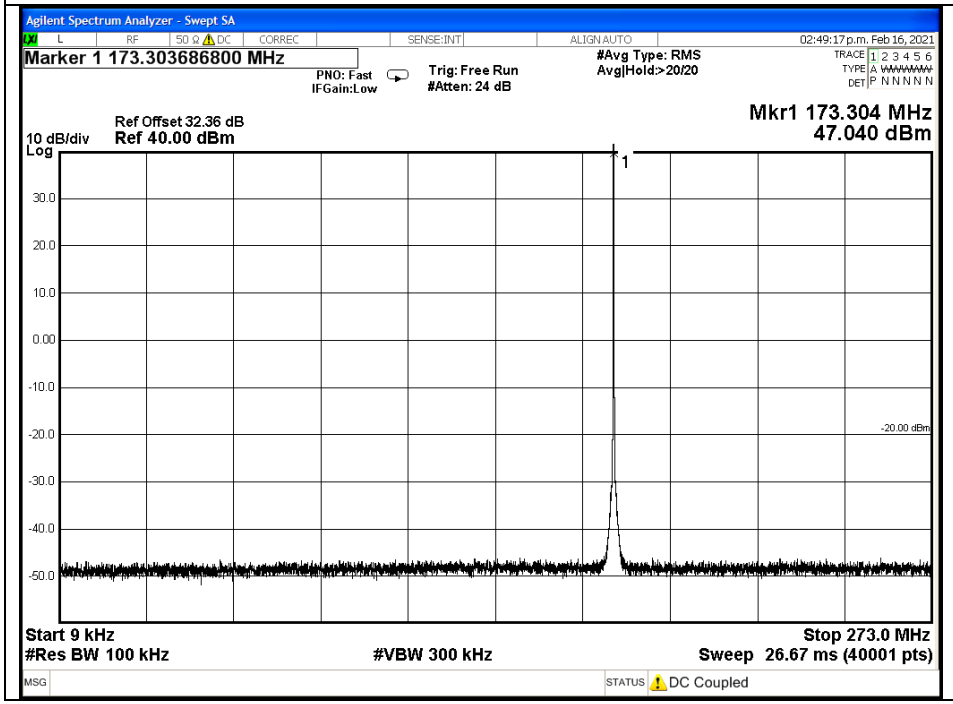
12.5 kHz Channel Spacing 173.3 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty:	≤12.75 GHz ± 3.0 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

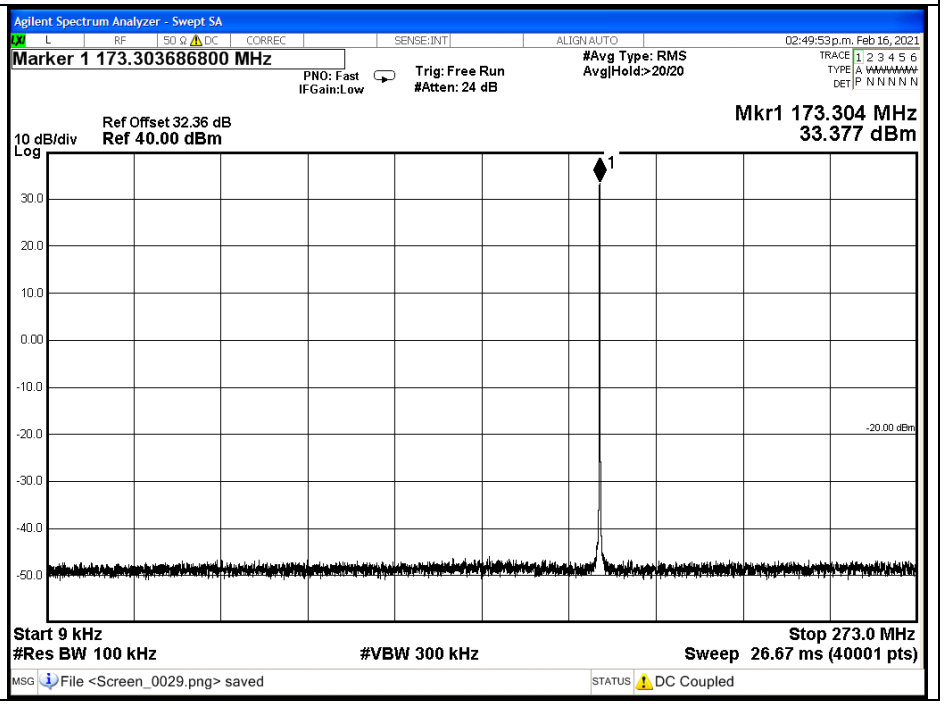
Spurious Emissions (Tx Conducted)

173.3 MHz, 9KHz to 273MHz scan

50 W



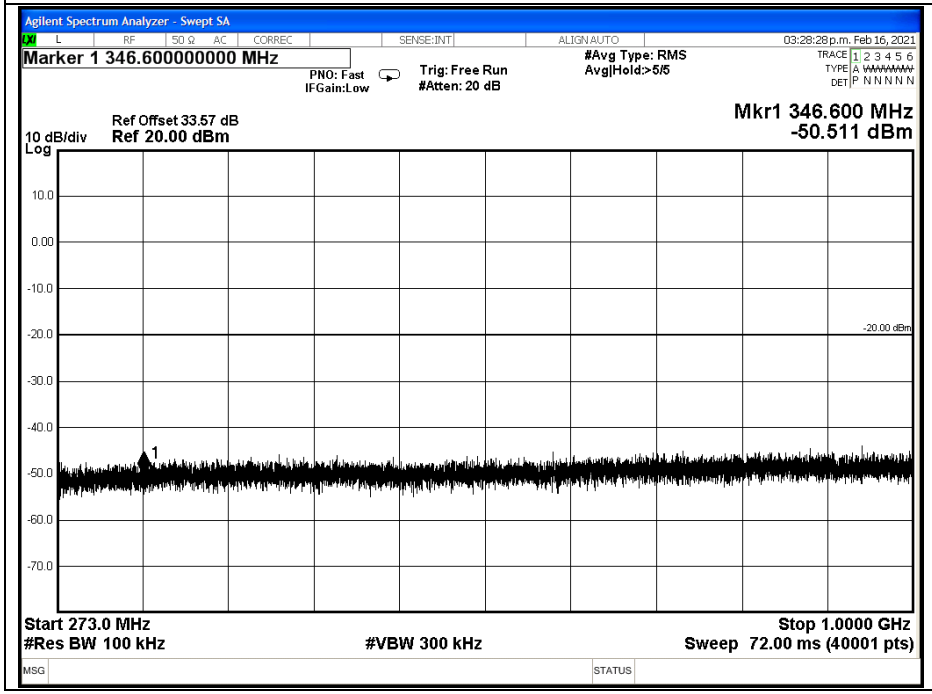
2 W

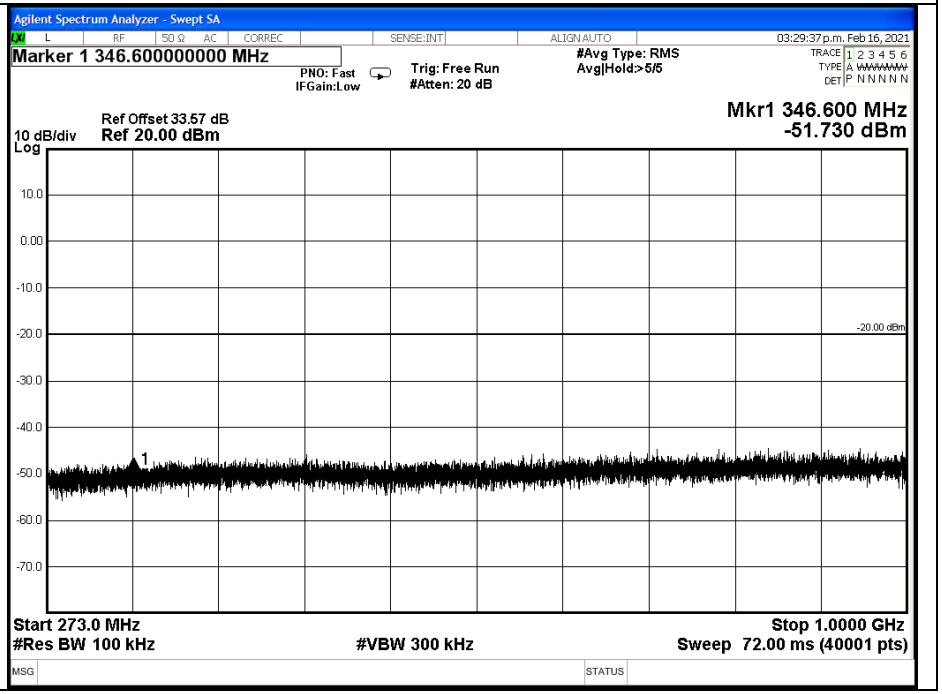


Spurious Emissions (Tx Conducted)

173.3 MHz, 273MHz to 1000MHz scan

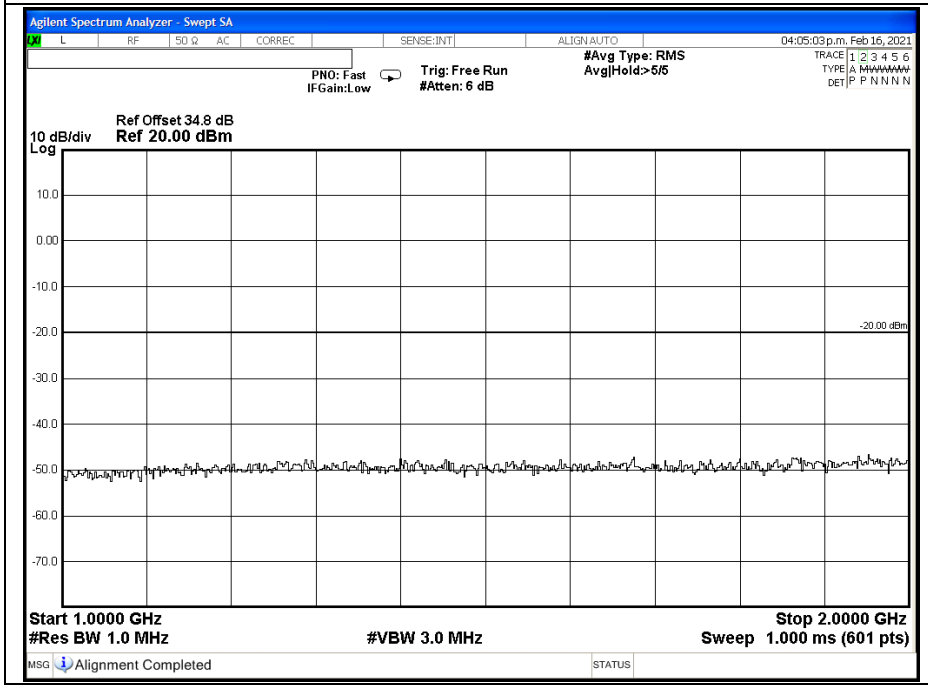
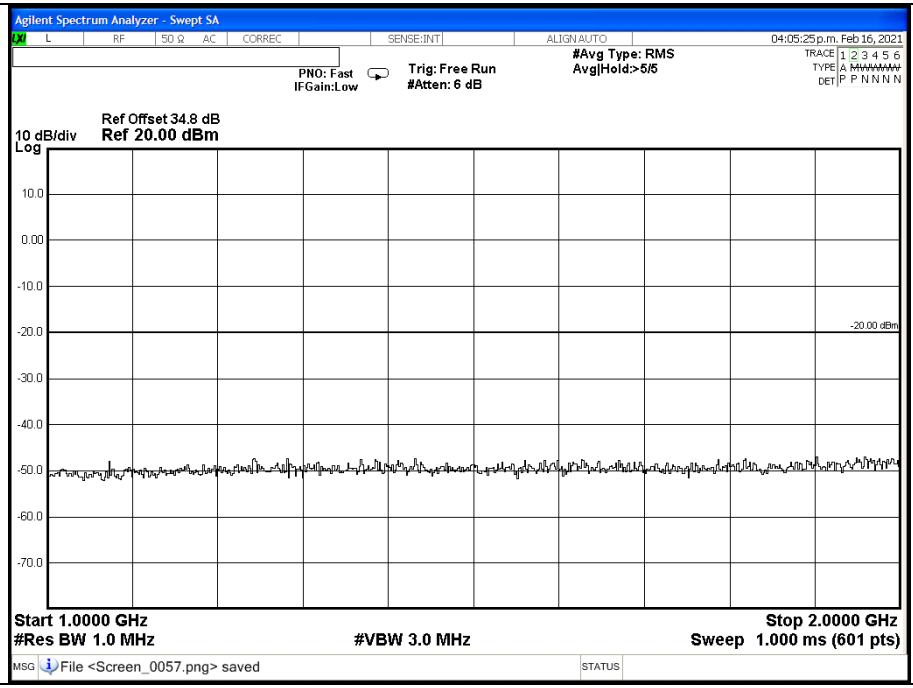
50 W	2 W





Spurious Emissions (Tx Conducted)

173.3 MHz, 1GHz to 2GHz scan

50 W	2 W
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

LIMITS: FCC 47 CFR 90.210 RSS-119 5.8

Carrier Output Power	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{Watts})$	
50 W	-20 dBm	-67 dBc
2 W	-20 dBm	-53 dBc

TRANSMITTER SPURIOUS EMISSIONS (RADIATED)

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA-102.CAAA-C 2.2.6

MEASUREMENT PROCEDURE:
Initial Scan:

1. The EUT is placed in the S-Line TEM cell and emissions are measured from 30 MHz to 800 MHz. Any emission within 20 dB of the limit is then re-tested on the OATS.
2. The EUT is placed in the reverberation chamber and emissions are measured from 800 MHz to the upper frequency required. Any emission within 20 dB of the limit is then re-tested on the OATS.
3. The harmonics emissions up to the 6th harmonic of the fundamental frequency are measured on the OATS

OATS Measurement:

1. The EUT is placed on a wooden turntable at a distance of three metres from the test antenna. The output terminal is connected to an RF dummy load.
2. The test antenna is raised from 1 m to 4 m to obtain a maximum reading; the turntable is then rotated through 360^{o} to obtain the maximum response of each spurious emission. Valid emissions are determined by switching the EUT on and off.
3. The EUT is then replaced by a signal generator and substitution antenna to make measurements by the substitution method.

MEASUREMENT RESULTS:
See the tables on the following pages

LIMIT CLAUSE: FCC 47 CFR 90.210

Spurious Emissions (Tx Radiated)

SPECIFICATION: FCC CFR 2.1053

12.5 kHz Channel Spacing 138.1 MHz @ 50 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 138.1 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty	± 4.6 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing 150.85 MHz @ 50 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 150.85 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty	± 4.6 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing 156.1 MHz @ 50 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 156.1 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty	± 4.6 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

Spurious Emissions (Tx Radiated)

SPECIFICATION: FCC CFR 2.1053

12.5 kHz Channel Spacing 157.2 MHz @ 50 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 157.2 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty	± 4.6 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing 161.9 MHz @ 50 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 161.9 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty	± 4.6 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing 162.1 MHz @ 50 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 162.1 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty	± 4.6 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

12.5 kHz Channel Spacing 173.3 MHz @ 50 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~

12.5 kHz Channel Spacing 173.3 MHz @ 2 W Emission Mask D

Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty	± 4.6 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

LIMITS: FCC CFR 2.1053

Carrier Output Power	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{Watts})$	
50 W	-20 dBm	-67 dBc
2 W	-20 dBm	-53 dBc

Tx Radiated Emissions - Continued

Open Area Test Site Results:

12.5 kHz Channel Spacing | 157.2 MHz @ 50 W | Emission Mask D

Harmonics Emission Frequency (MHz)	Level (dBm)	Level (dBc)
314.400000	-76.35	-123.35
471.600000	-71.01	-118.01
628.800000	-54.43	-101.43
786.000000	-51.45	-98.45
943.200000	-61.54	-108.54
1100.400000	-60.15	-107.15
Measurement Uncertainty	± 4.6 dB	

Sample Calculation	Measurement					Result	
	Reference	Substitution					
Emission Frequency (MHz)	Reference Level (dBm)	Sig-gen Level	Cable and Attenuator Gain	Antenna Gain (dBd)	Path and Boresight corrections	dBm	nW
786.000000	-82.11	-34.13	-16.18	-1.17	0.03	-51.45	7.1547
		A	B	C	D	E	

Result (E) = A+B+C+D

Photo: OATS Setup

TRANSIENT FREQUENCY BEHAVIOR

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

GUIDE: TIA/EIA-603E 2.2.19

MEASUREMENT PROCEDURE:
1. Refer Annex A for equipment set up.
2. Measurements and plots were made following the TIA procedure.

MEASUREMENT RESULTS:
See the tables and plots on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSES: FCC 47 CFR 90.214 RSS-119 5.9

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 138.1 MHz 50 W 12.5 kHz Channel Spacing

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t_1	-0.1	N/A
t_2	-0.2	N/A
t_3	N/A	0.9

	YES	NO
Confirm that during periods t_1 and t_3 the frequency difference does not exceed the value of one channel separation.	✓	☐
Confirm that during the period t_2 the frequency difference does not exceed half a channel separation.	✓	☐
Confirm that during the period t_2 to t_3 the frequency difference does not exceed the frequency error limit.	✓	☐

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

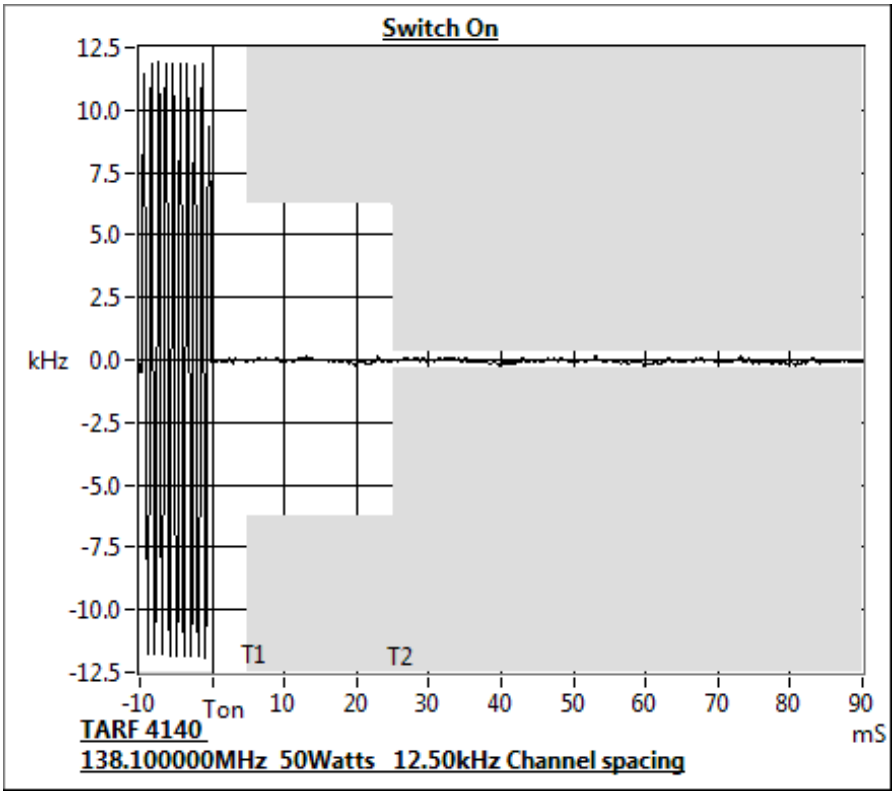
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

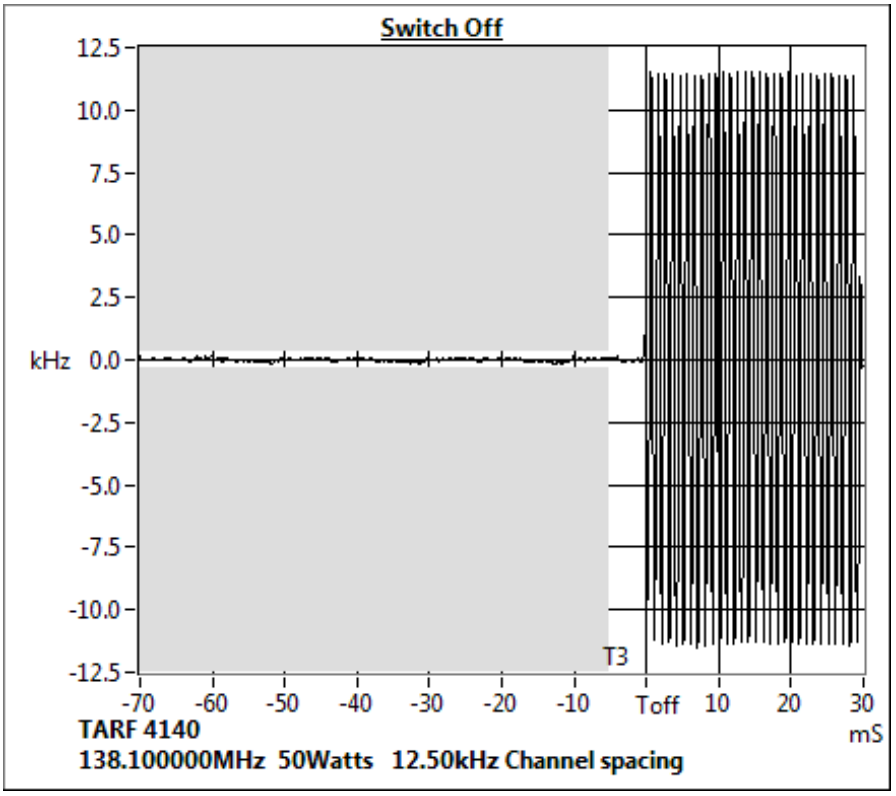
Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t_1 and t_3 may exceed the maximum frequency difference for these time periods.

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 138.1 MHz 50 W 12.5 kHz Channel Spacing





Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 150.85 MHz 50 W 12.5 kHz Channel Spacing

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.2	N/A
t2	-0.4	N/A
t3	N/A	0.2

	YES	NO
Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	✓	☐
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	☐
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	☐

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

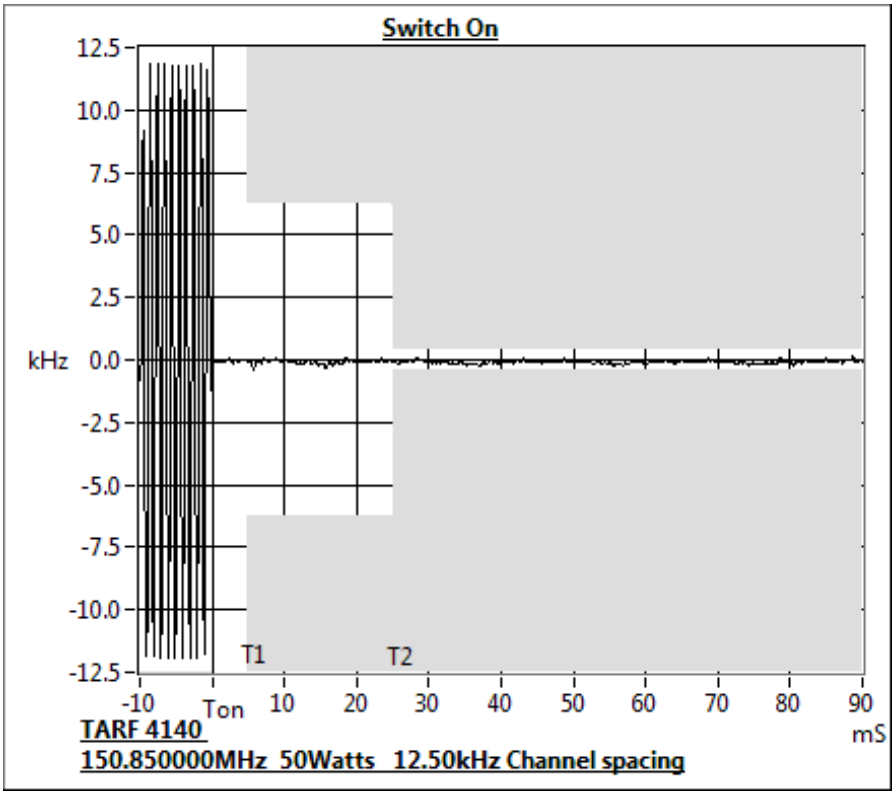
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

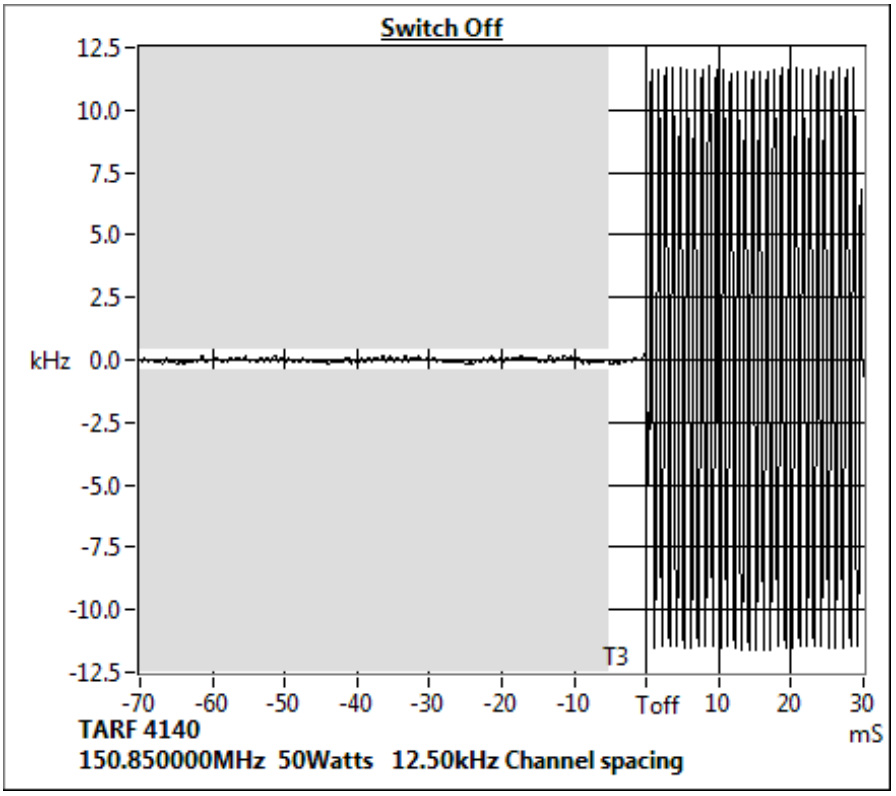
Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 150.85 MHz 50 W 12.5 kHz Channel Spacing





Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 156.1 MHz 50 W 12.5 kHz Channel Spacing

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.3	N/A
t2	-0.3	N/A
t3	N/A	-0.6

	YES	NO
Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	✓	☐
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	✓	☐
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	✓	☐

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

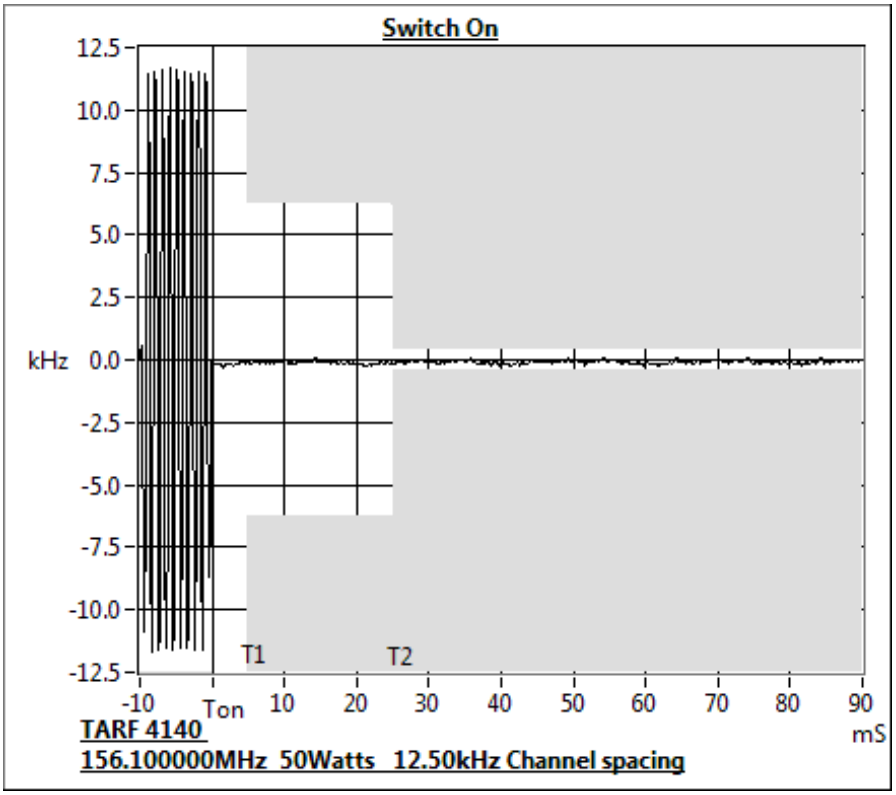
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

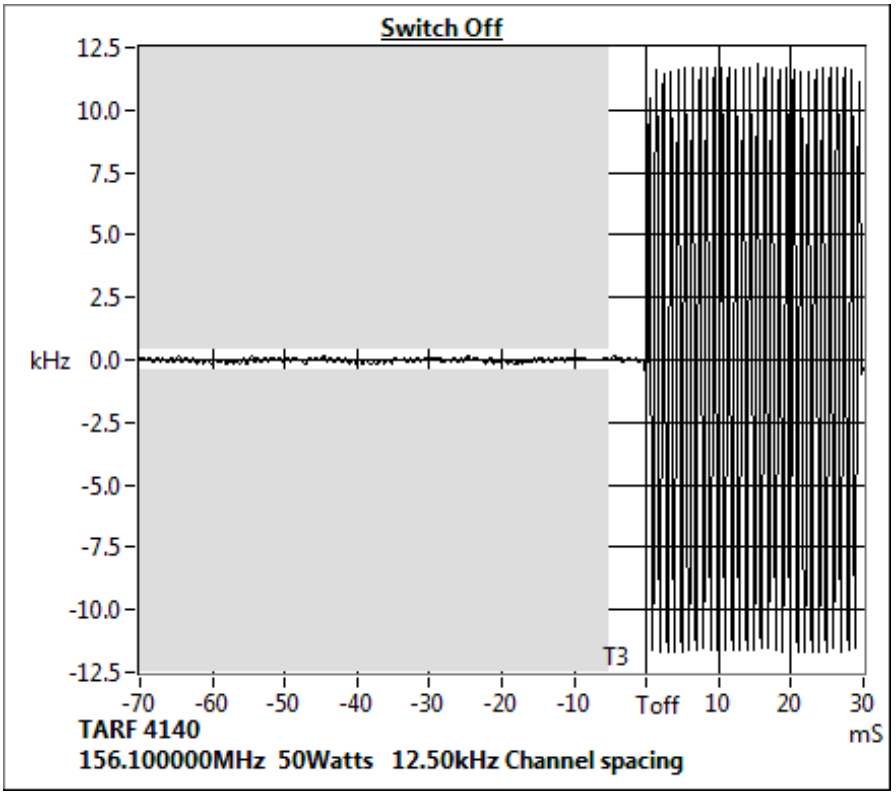
Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 156.1 MHz 50 W 12.5 kHz Channel Spacing





Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 157.2 MHz 50 W 12.5 kHz Channel Spacing

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.2	N/A
t2	-0.3	N/A
t3	N/A	-1.0

	YES	NO
Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	✓	☐
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	✓	☐
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	✓	☐

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

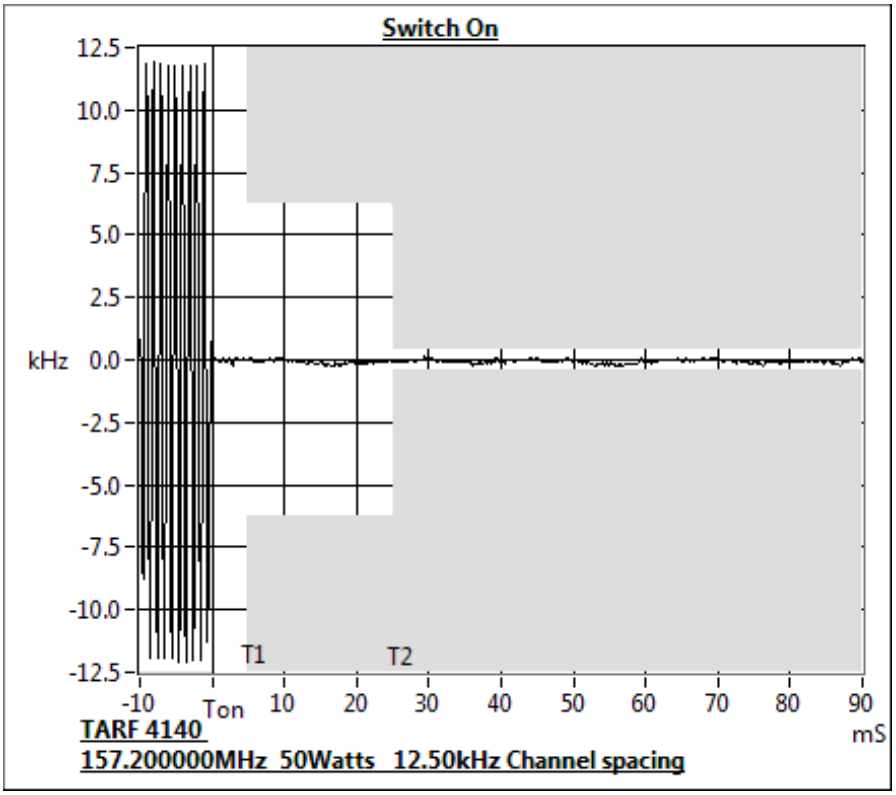
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

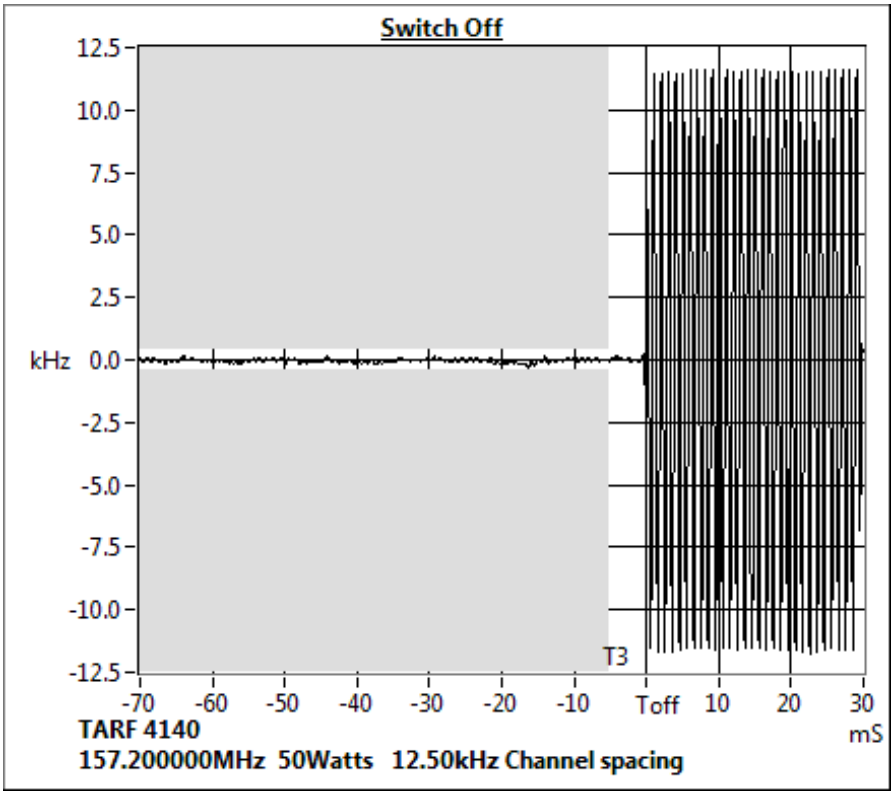
Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 157.2 MHz 50 W 12.5 kHz Channel Spacing





Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 161.9 MHz 50 W 12.5 kHz Channel Spacing

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	0.2	N/A
t2	0.5	N/A
t3	N/A	1.0

	YES	NO
Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	✓	☐
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	✓	☐
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	✓	☐

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

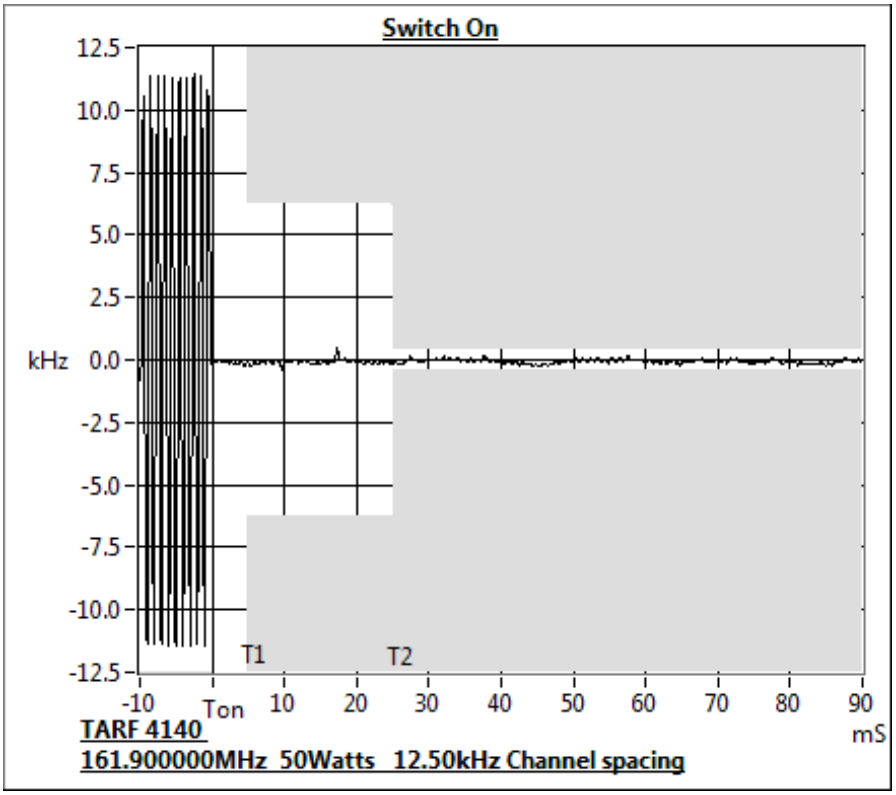
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

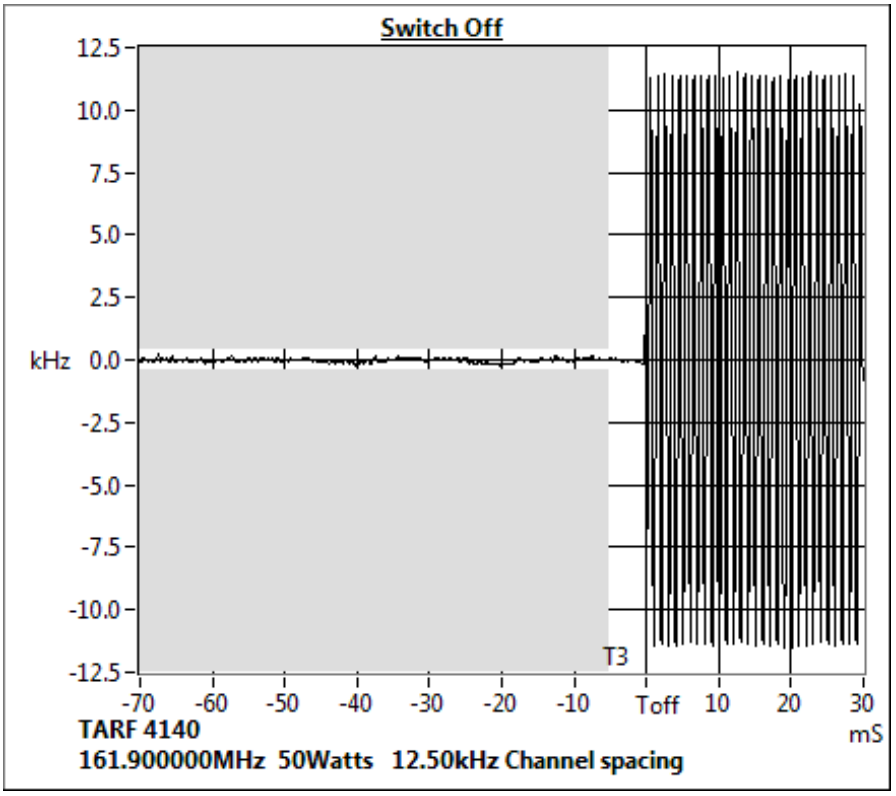
Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 161.9 MHz 50 W 12.5 kHz Channel Spacing





Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 162.1 MHz 50 W 12.5 kHz Channel Spacing

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.2	N/A
t2	-0.2	N/A
t3	N/A	1.0

	YES	NO
Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	✓	☐
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	☐
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	☐

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

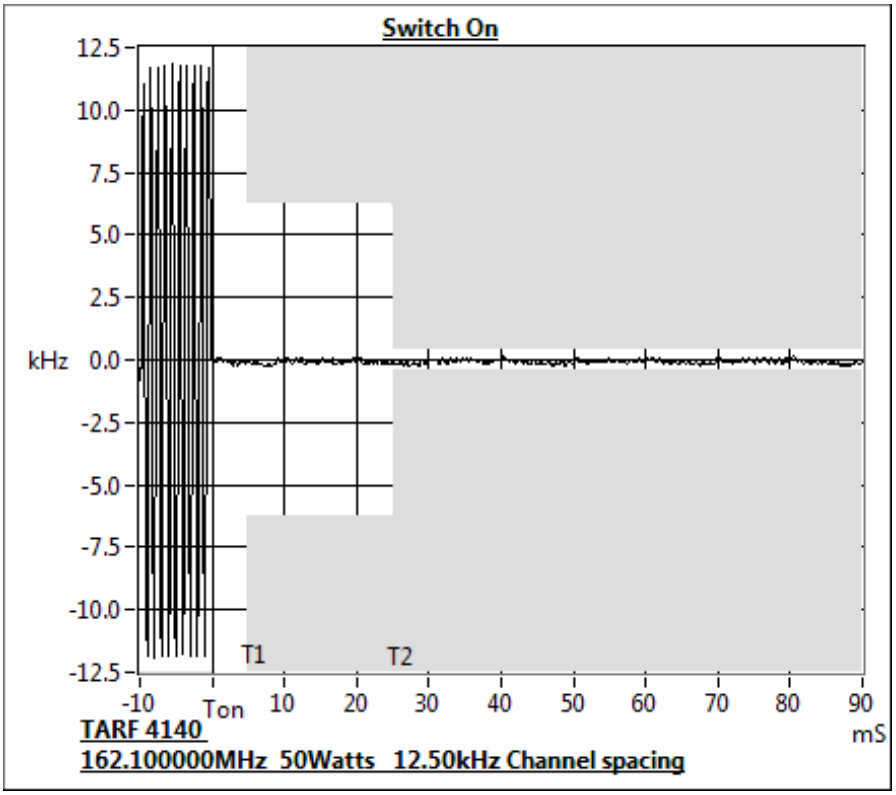
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

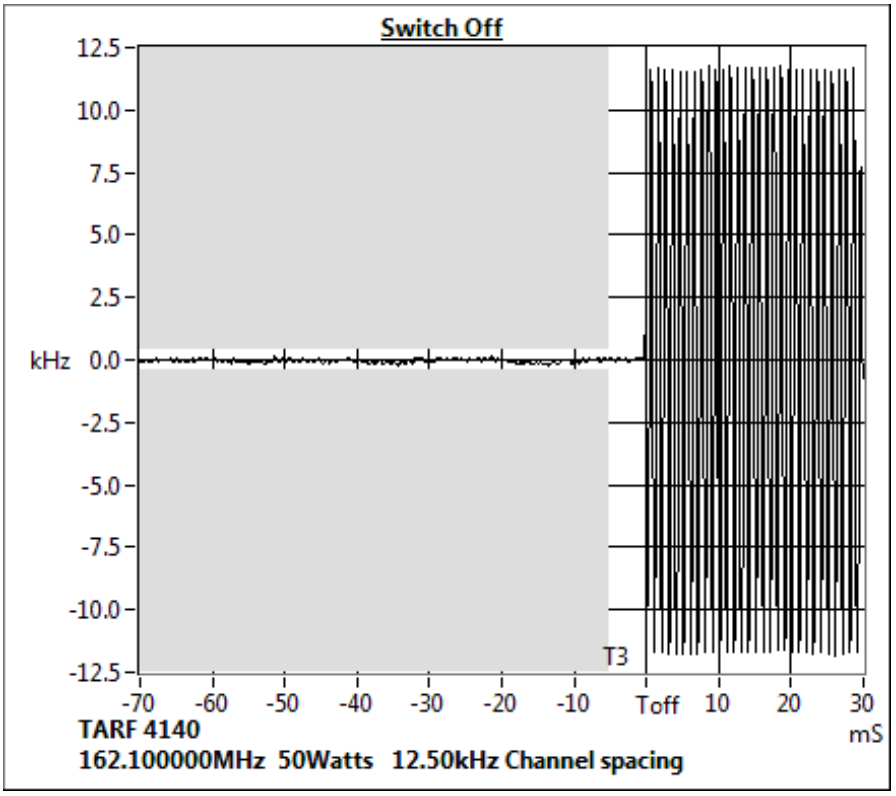
Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 162.1 MHz 50 W 12.5 kHz Channel Spacing





Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 173.3 MHz 50 W 12.5 kHz Channel Spacing

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	0.5	N/A
t2	-0.2	N/A
t3	N/A	-0.2

	YES	NO
Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	✓	☐
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	✓	☐
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	✓	☐

Measurement Uncertainty: Frequency ± 130 Hz; Time ± 0.2%

LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

LIMIT: RSS-119 5.9

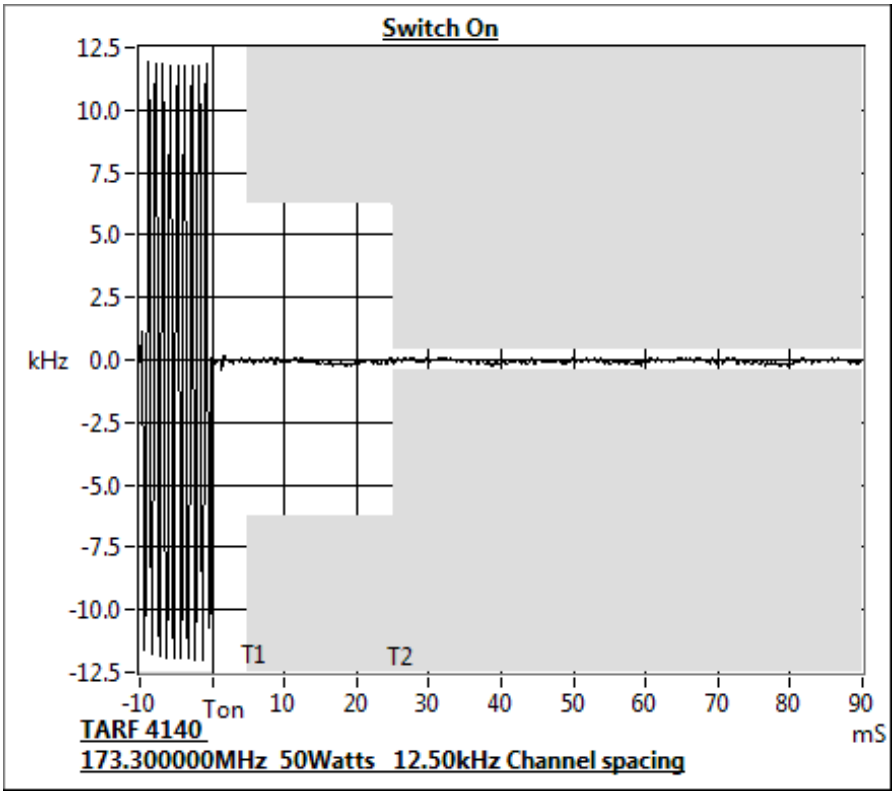
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
TRANSIENT PERIODS	Maximum Frequency Difference	FREQUENCY RANGE	
		138 – 174 MHz	406.1 – 470 MHz
t1 (ms)	± 12.5 kHz	5 ms	10 ms
t2 (ms)	± 6.25 kHz	20 ms	25 ms
t3 (ms)	± 12.5 kHz	5 ms	10 ms

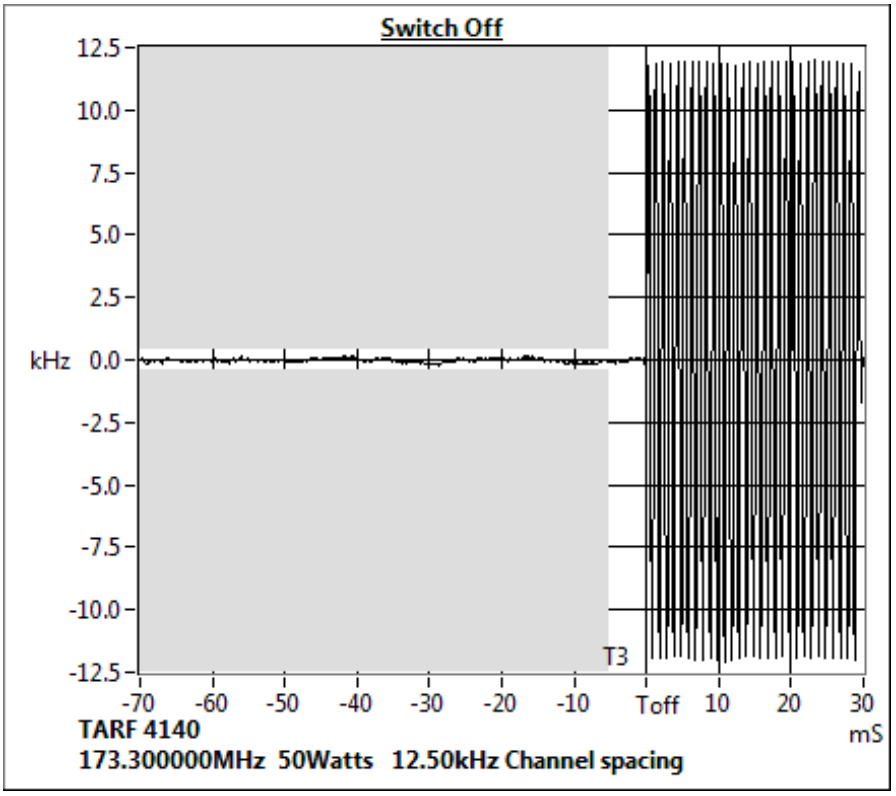
Note: RSS-119 5.9 - If the transmitter carrier output power rating is 6 Watts or less, the frequency difference during the time periods t1 and t3 may exceed the maximum frequency difference for these time periods,

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214 RSS-119 5.9

Tx FREQUENCY: 173.3 MHz 50 W 12.5 kHz Channel Spacing





TRANSMITTER FREQUENCY STABILITY - TEMPERATURE

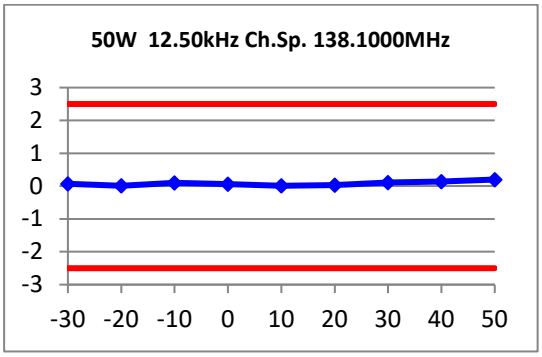
SPECIFICATION: FCC 47 CFR 2.1055 (a) (1) RSS-119 5.3

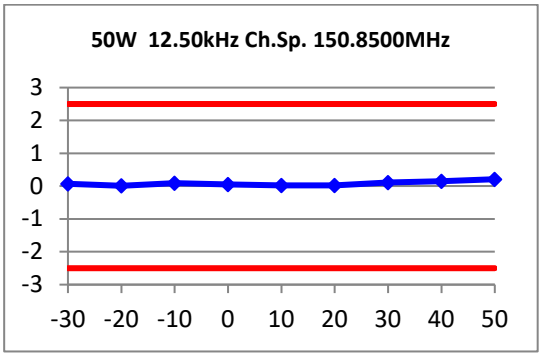
GUIDE: ANSI C63.26 5.6.4

MEASUREMENT PROCEDURE:
1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error from –30° C to +50° C in 10° C increments
3. The frequency error was recorded in parts per million (ppm).

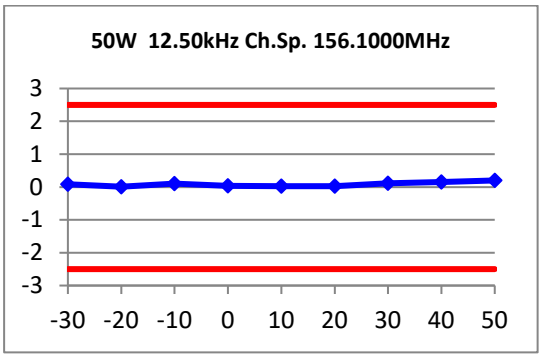
MEASUREMENT RESULTS:
See the plots on the following pages.

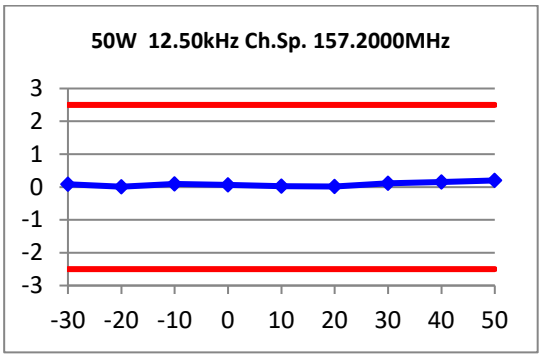
	Error (ppm)						
Temperature (ºC)	138.1 MHz	150.85 MHz	156.1 MHz	157.2 MHz	161.9 MHz	162.1 MHz	173.3 MHz
-30	0.07	0.07	0.08	0.08	0.07	0.07	0.08
-20	0.01	0.01	0.01	0.01	0.01	0.01	0
-10	0.1	0.09	0.1	0.09	0.1	0.09	0.09
0	0.06	0.05	0.04	0.06	0.04	0.06	0.05
10	0.01	0.02	0.03	0.03	0.03	0.02	0.02
20	0.03	0.02	0.03	0.02	0.02	0.02	0.02
30	0.11	0.11	0.11	0.11	0.11	0.1	0.11
40	0.14	0.15	0.15	0.15	0.14	0.14	0.14
50	0.2	0.21	0.2	0.2	0.21	0.21	0.2
Measurement Uncertainty				± 7 x 10^{-8}			

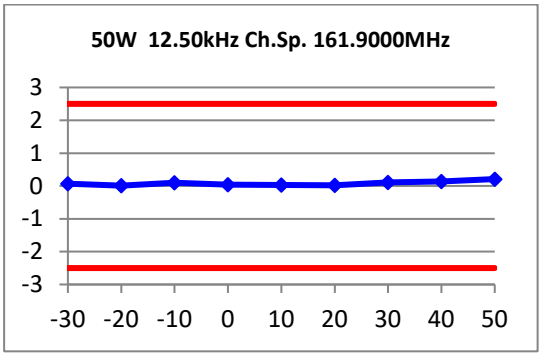


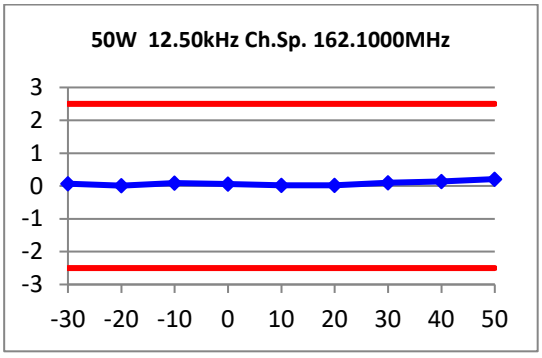


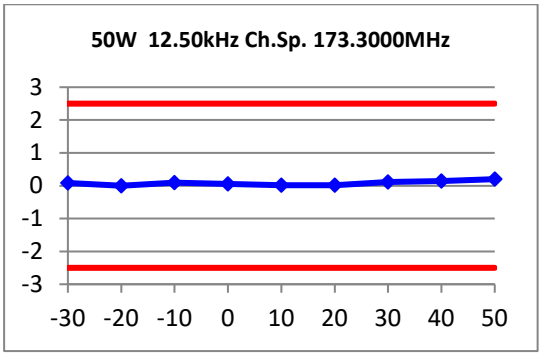
Transmitter Frequency Stability - Temperature











LIMIT: FCC 47 CFR 90.213 RSS-119 5.3

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	2.5

TRANSMITTER FREQUENCY STABILITY - VOLTAGE

SPECIFICATION: FCC 47 CFR 2.1055 (d) (1) RSS-119 5.3

GUIDE: ANSI C63.26 5.6.5

MEASUREMENT PROCEDURE:
1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error at an input voltage to the radio of 85% to 115%.
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

	FREQUENCY ERROR (ppm) for 12.5 kHz		
	120 V_{AC}	102 V_{AC}	138 V_{AC}
138.1 MHz	0.05	0.07	0.05
150.85 MHz	0.07	0.07	0.07
156.1 MHz	0.06	0.06	0.07
157.2 MHz	0.08	0.06	0.07
161.9 MHz	0.07	0.07	0.08
162.1 MHz	0.07	0.07	0.06
173.3 MHz	0.07	0.07	0.06
Measurement Uncertainty		± 7 x 10^{-8}	

LIMIT CLAUSES: FCC 47 CFR 90.213 RSS-119 5.3

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	2.5

RECEIVER SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: RSS-Gen 7.4

GUIDE: TIA-603-E 2.1.2 (analogue)
TIA-102-CAAA-C 2.1.2 (digital)

MEASUREMENT PROCEDURE:
1. Refer Annex A for Equipment set up diagram.
2. The frequency range examined was from 30 MHz to 3 times highest tunable frequency.
3. Spurious emissions which were attenuated more than 20 dB below the limit were not recorded.
4. A scan is performed with a resolution bandwidth of 100 kHz and a video bandwidth of 300 kHz for frequencies up to 1 GHz, and a resolution bandwidth of 1 MHz and a video bandwidth of 3 MHz for frequencies above 1 GHz
5. For each frequency range the spectrum analyser was loaded with the appropriate calibration figures to compensate for the cables and attenuator losses allowing the emission levels to be read directly with no further calculation .

Spurious emissions which were attenuated by more than 20 dB below the limit were not recorded.

Example of attenuation correction:

E4364 10dB 50W BC3293	9.65	
E5015 3m Blue 503429	0.33	
E5028 1m5 Blue 501868	0.15	
Total Attenuation @ 138.15 MHz	10.13	Sum of component attenuation (a)
Amplitude offset	10.53	(b)
Correction @ 138.150 MHz	-0.4	(a-b)

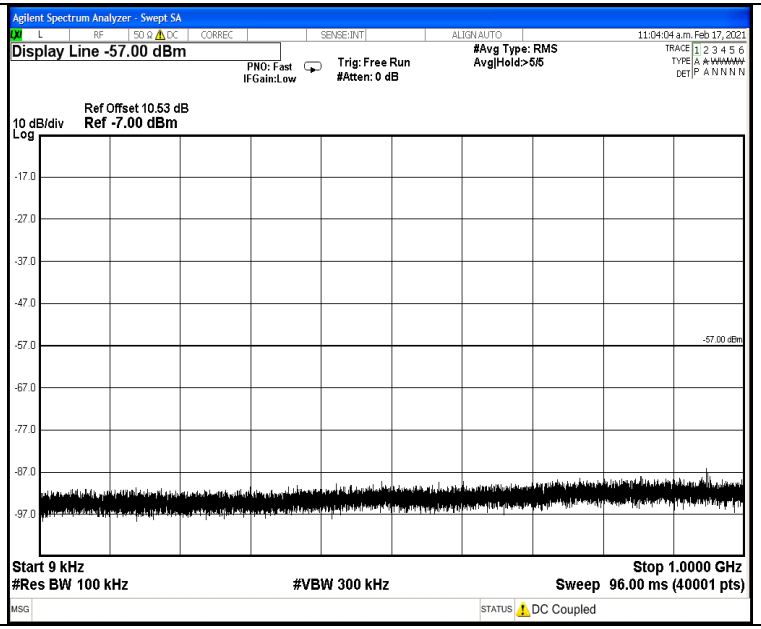
LIMIT CLAUSE: RSS-Gen 7.4

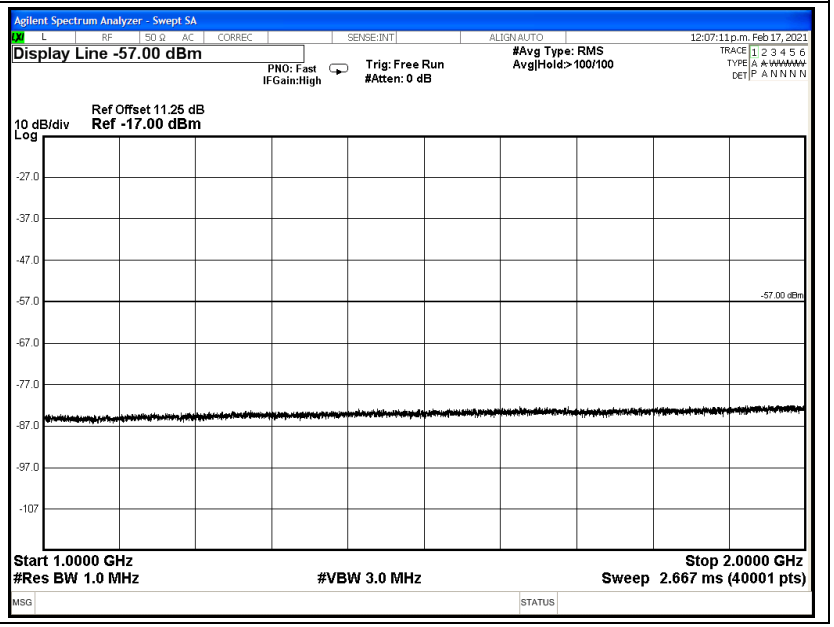
LIMIT	30 → 1000 MHz	2 nW	- 57 dBm
	> 1000 MHz	5 nW	- 53 dBm

Receiver Spurious Emissions (Conducted) – Continued

138.15 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

138.15 MHz

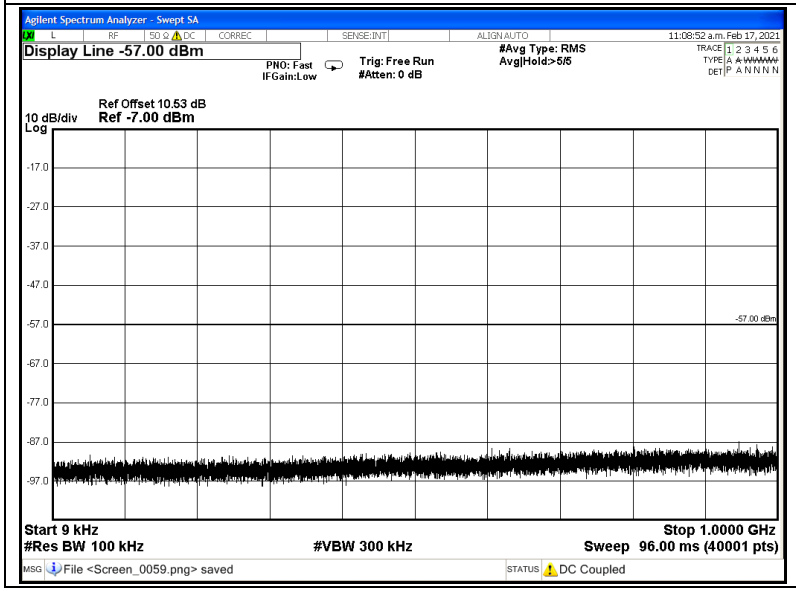


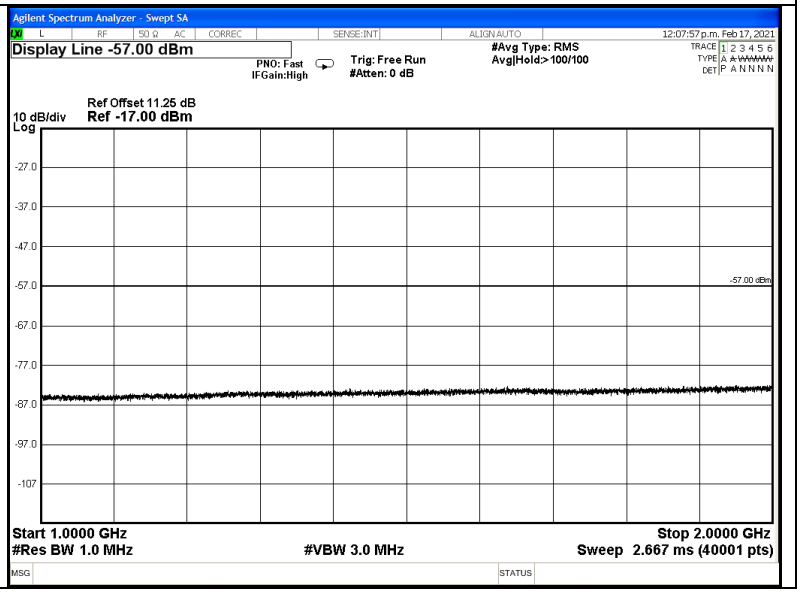


Receiver Spurious Emissions (Conducted) – Continued

150.9 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

150.9 MHz

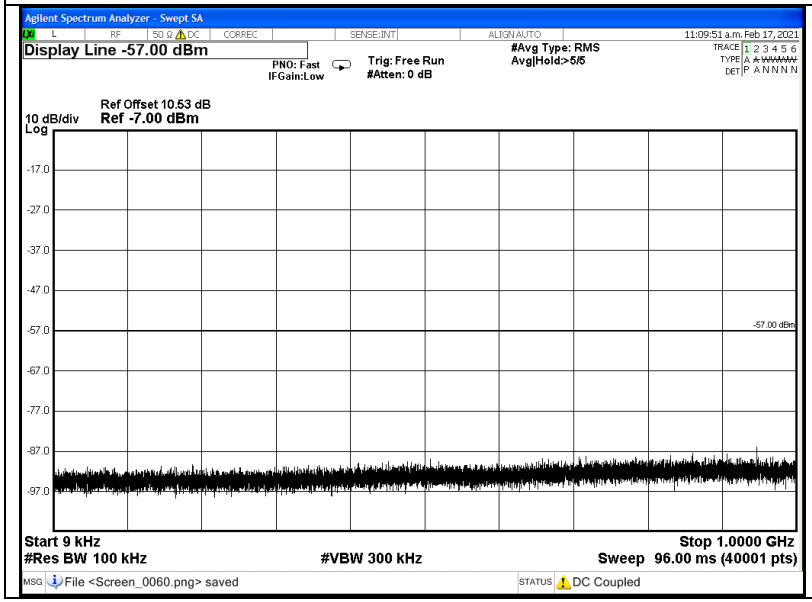


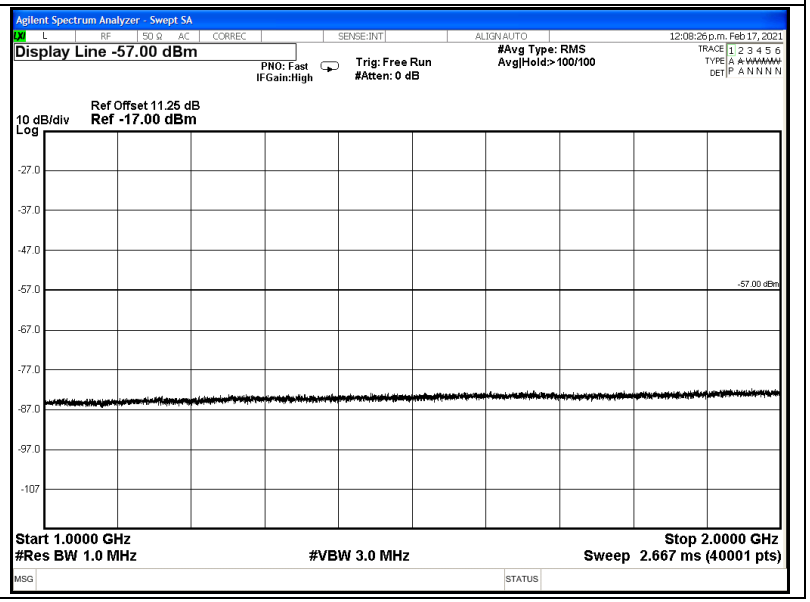


Receiver Spurious Emissions (Conducted) – Continued

156.15 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

156.15 MHz

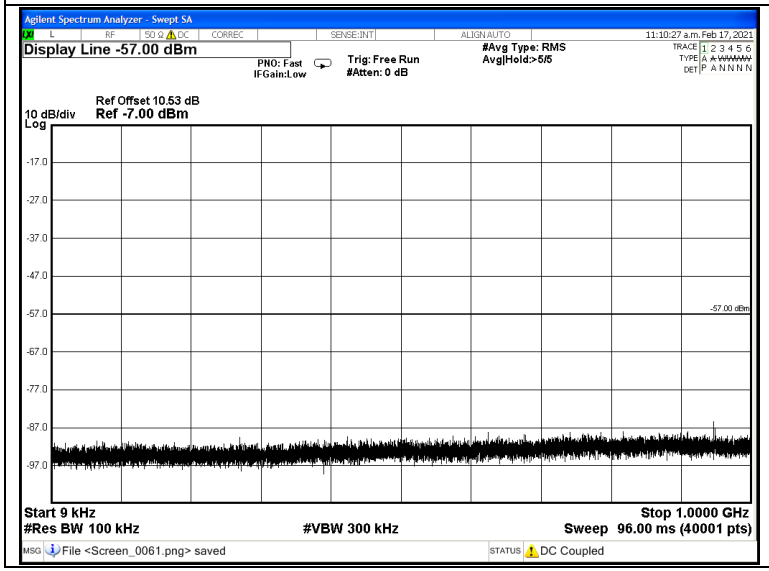


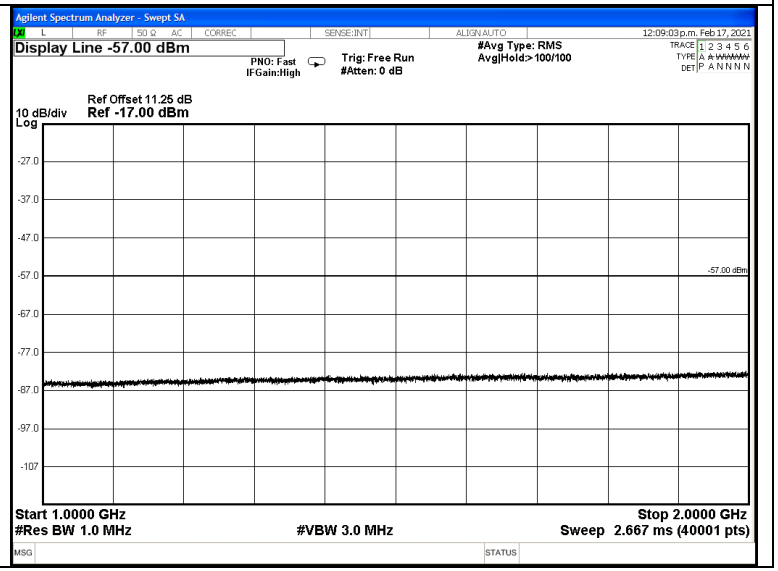


Receiver Spurious Emissions (Conducted) – Continued

157.25 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

157.25 MHz

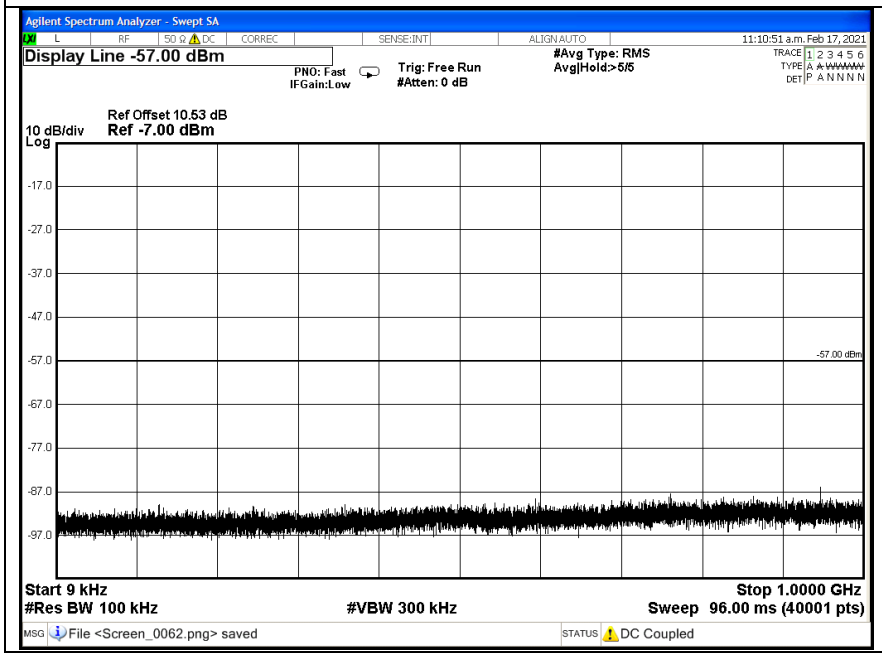


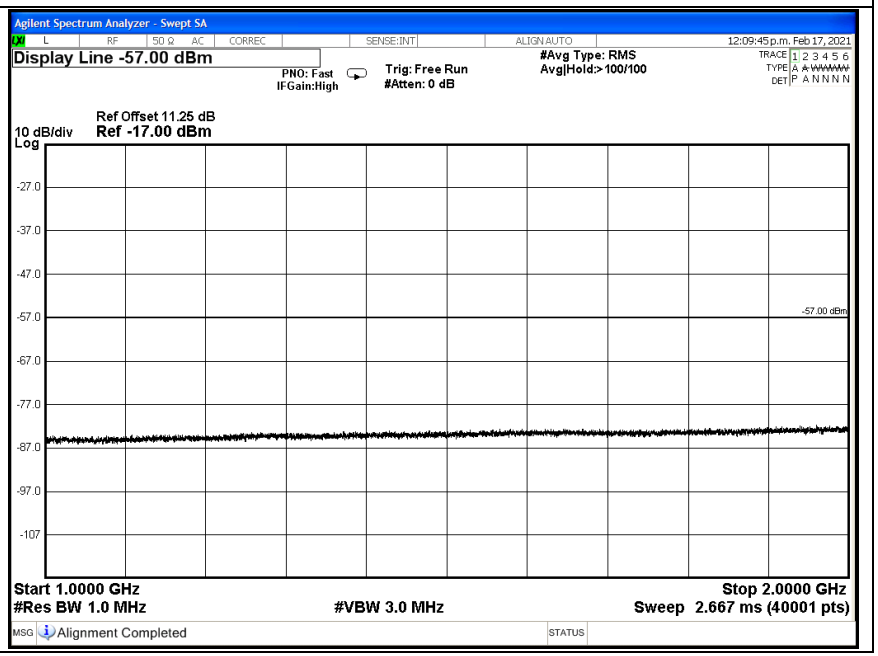


Receiver Spurious Emissions (Conducted) – Continued

161.95 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

161.95 MHz

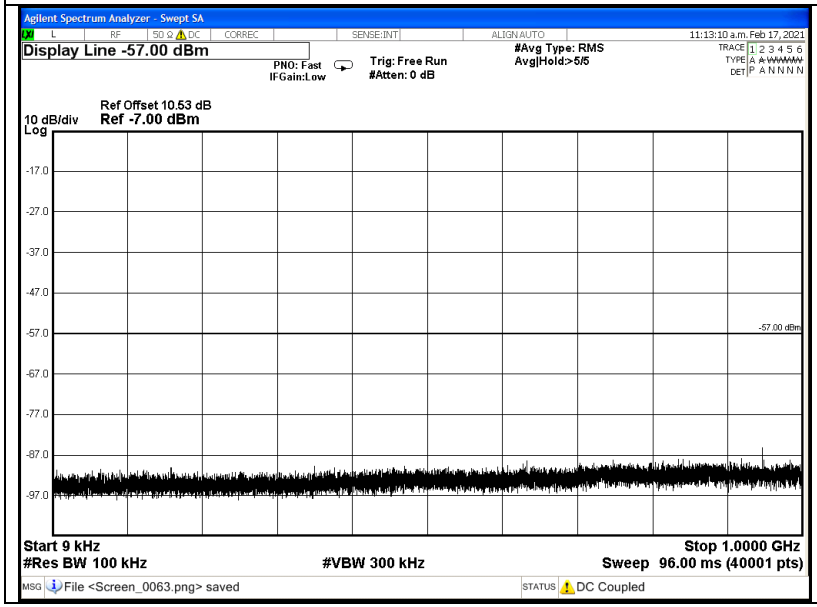


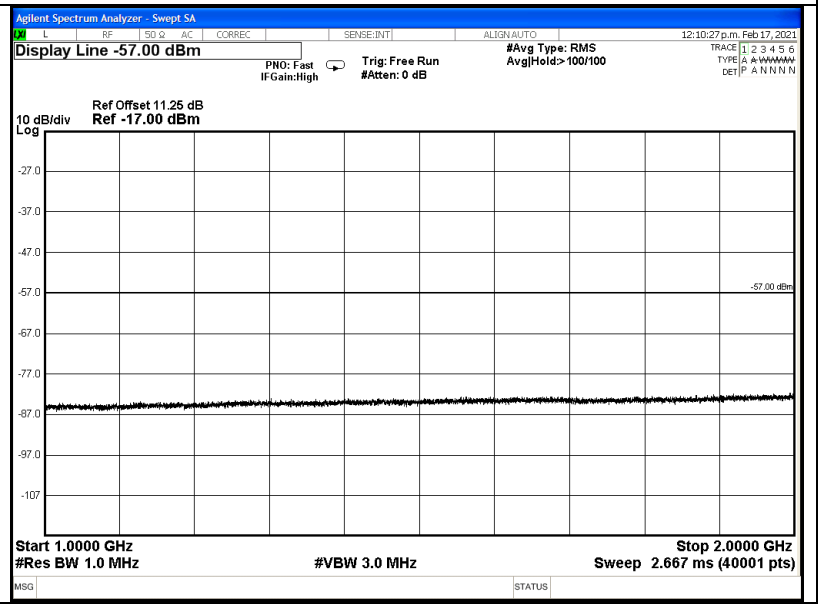


Receiver Spurious Emissions (Conducted) – Continued

162.15 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

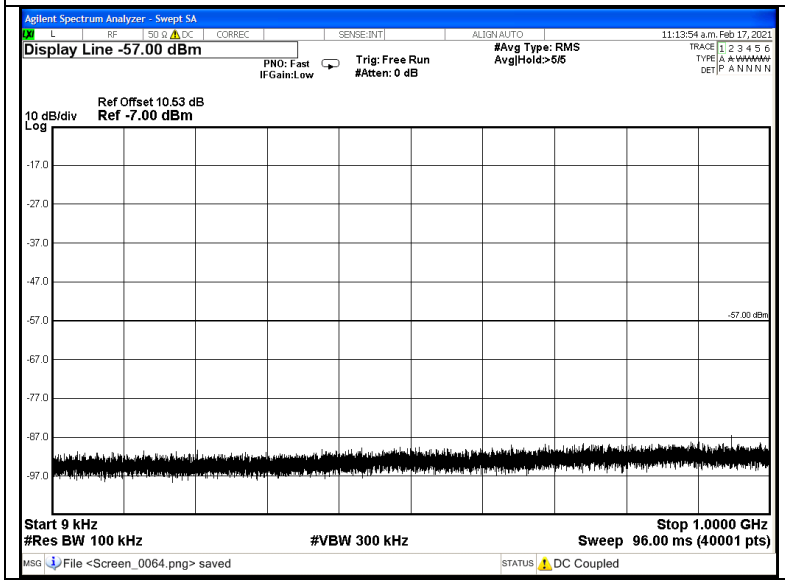
162.15 MHz

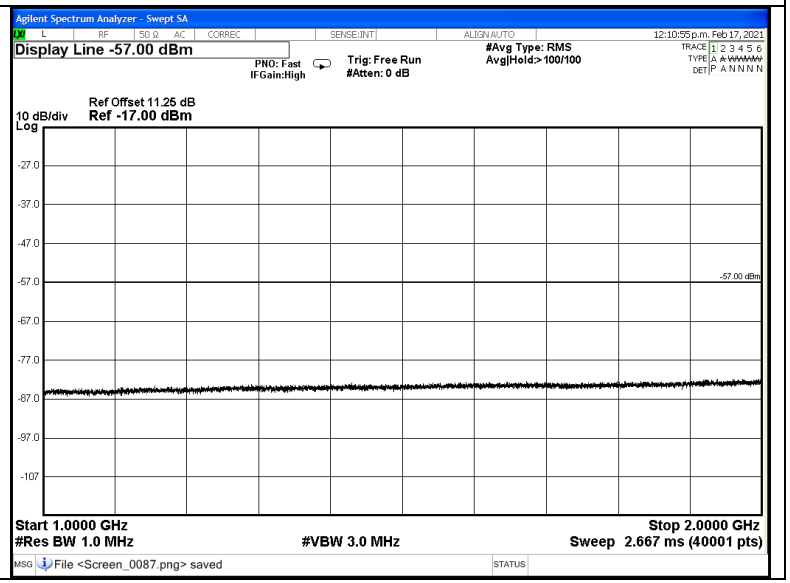




173.35 MHz Receive (Receiver Input Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

173.35 MHz





TRANSMITTER STANDBY SPURIOUS EMISSIONS (CONDUCTED)

SPECIFICATION: RSS-Gen 7.4

GUIDE: TIA-603-E 2.1.2 (analogue)
TIA-102-CAAA-C 2.1.2 (digital)

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up diagram.
2. The frequency range examined was from 30 MHz to 3 times highest tunable frequency.
3. Spurious emissions which were attenuated more than 20 dB below the limit were not recorded.
4. A scan is performed with a resolution bandwidth of 100 kHz and a video bandwidth of 300 kHz for frequencies up to 1 GHz, and a resolution bandwidth of 1 MHz and a video bandwidth of 3 MHz for frequencies above 1 GHz
5. For each frequency range the spectrum analyser was loaded with the appropriate calibration figures to compensate for the cables and attenuator losses allowing the emission levels to be read directly with no further calculation.

Spurious emissions which were attenuated by more than 20 dB below the limit were not recorded.

Example of attenuation correction:

E4364 10dB 50W BC3293	9.65	
E5015 3m Blue 503429	0.33	
E5028 1m5 Blue 501868	0.15	
Total Attenuation @ 138.15 MHz	10.13	Sum of component attenuation (a)
Amplitude offset	10.53	(b)
Correction @ 138.150 MHz	-0.4	(a-b)

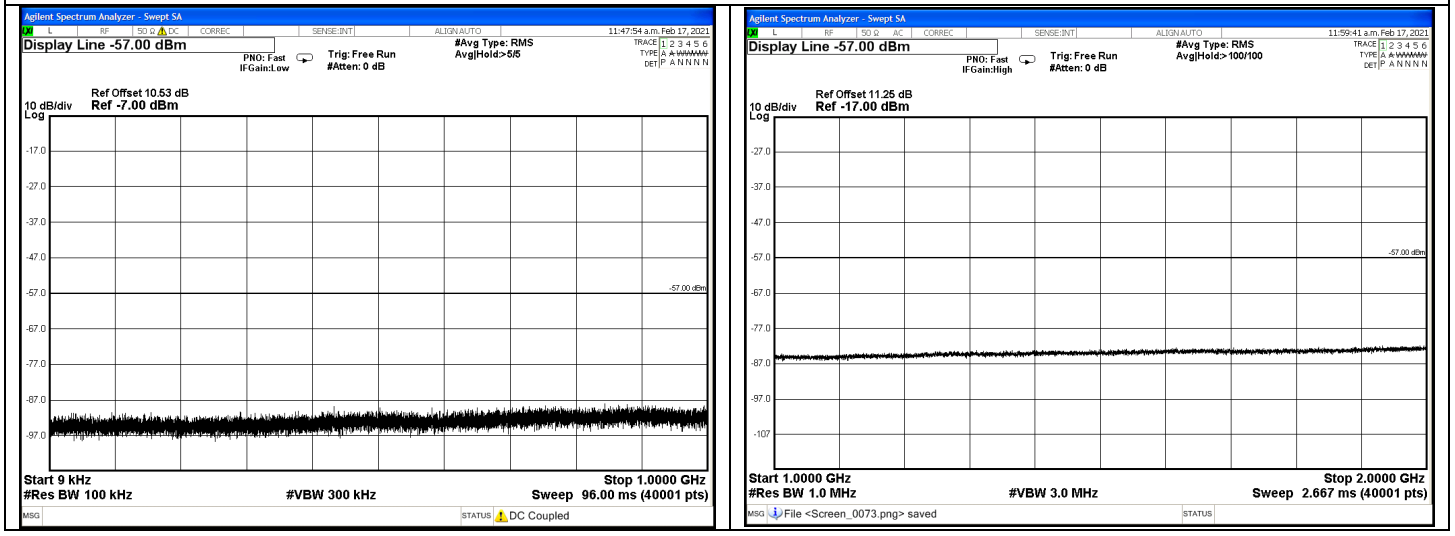
LIMIT CLAUSE: RSS-Gen 7.4

LIMIT	30 → 1000 MHz	2 nW	- 57 dBm
	> 1000 MHz	5 nW	- 53 dBm

Transmitter Standby Spurious Emissions (Conducted) – Continued

138.1 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

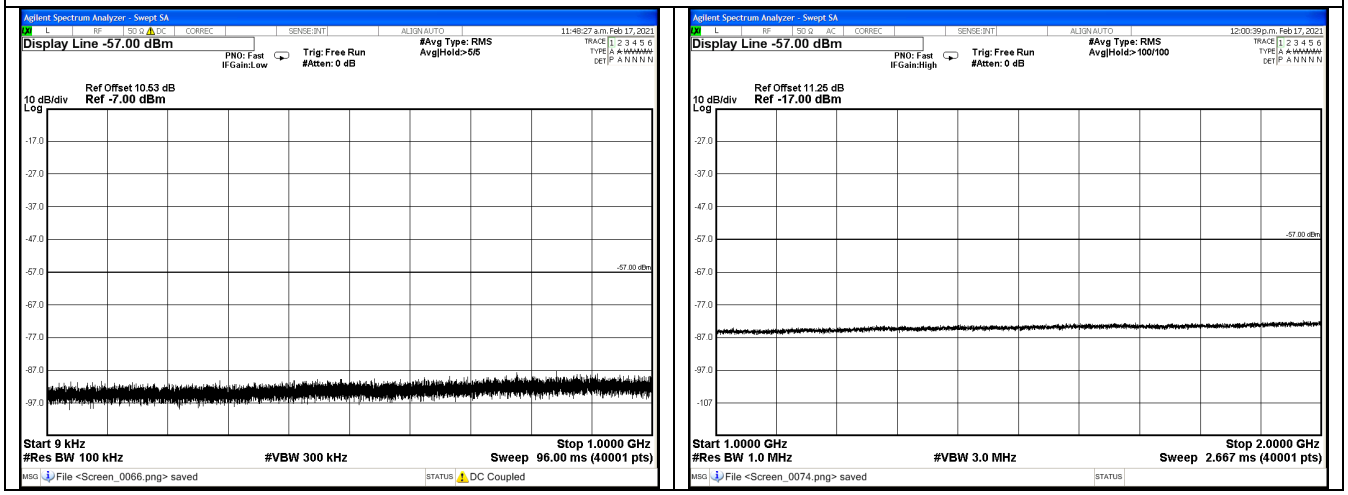
138.1 MHz



Transmitter Standby Spurious Emissions (Conducted) – Continued

150.85 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

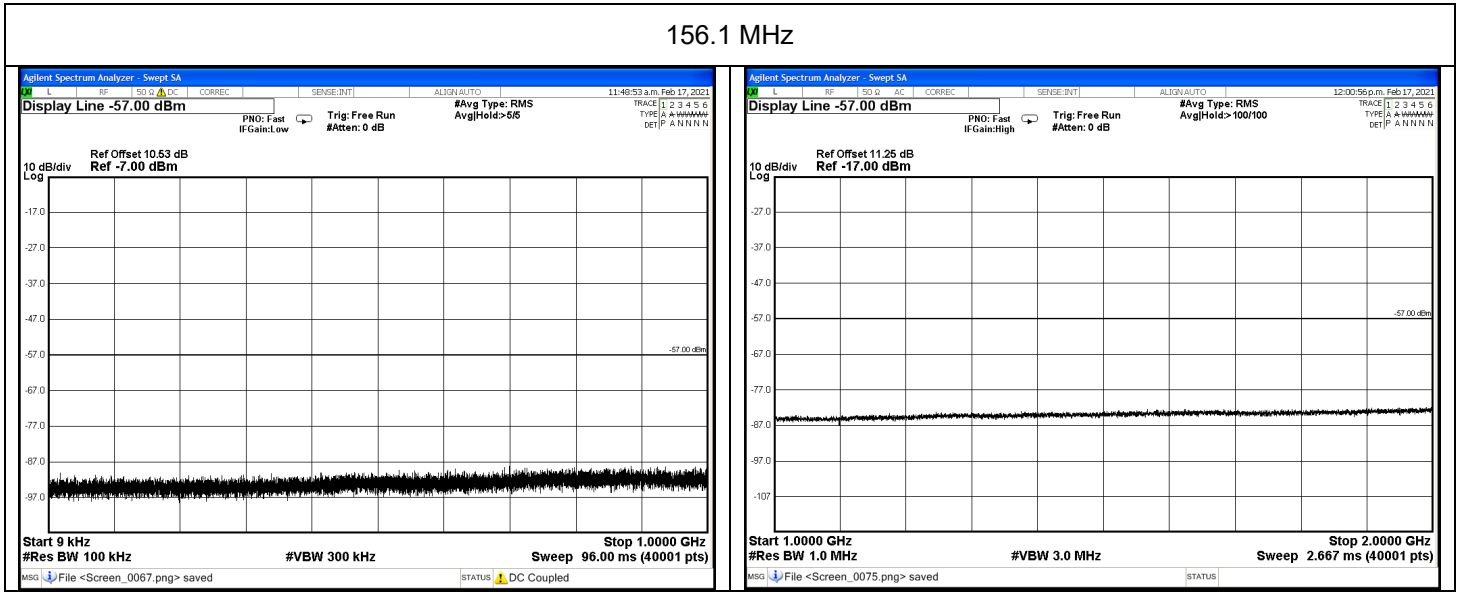
150.85 MHz



Transmitter Standby Spurious Emissions (Conducted) – Continued

156.1 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

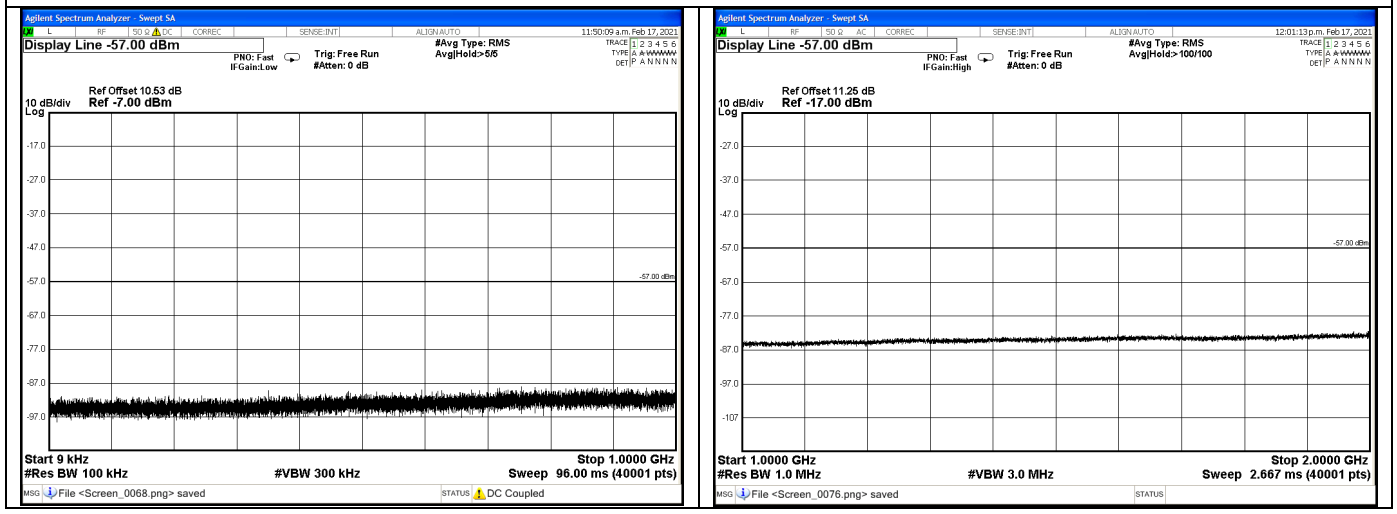
156.1 MHz



Transmitter Standby Spurious Emissions (Conducted) – Continued

157.2 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

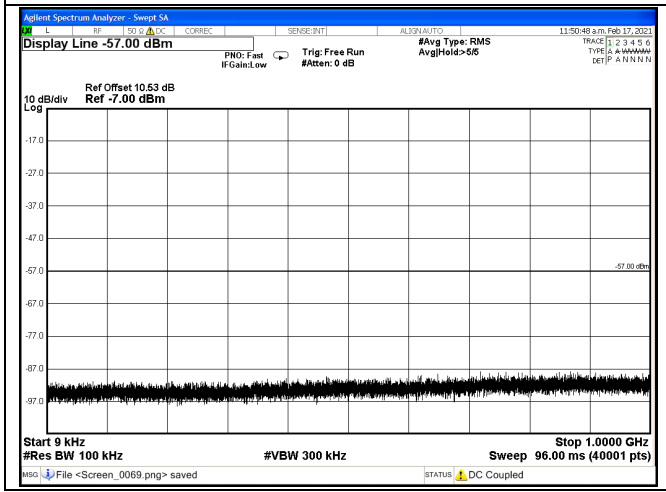
157.2 MHz

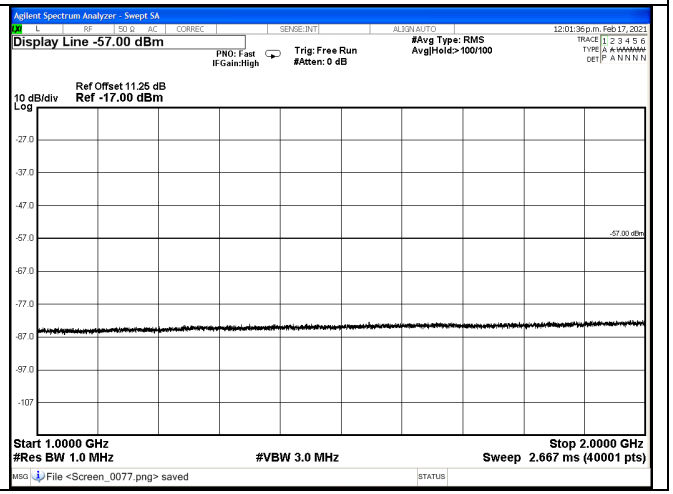


Transmitter Standby Spurious Emissions (Conducted) – Continued

161.9 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

161.9 MHz

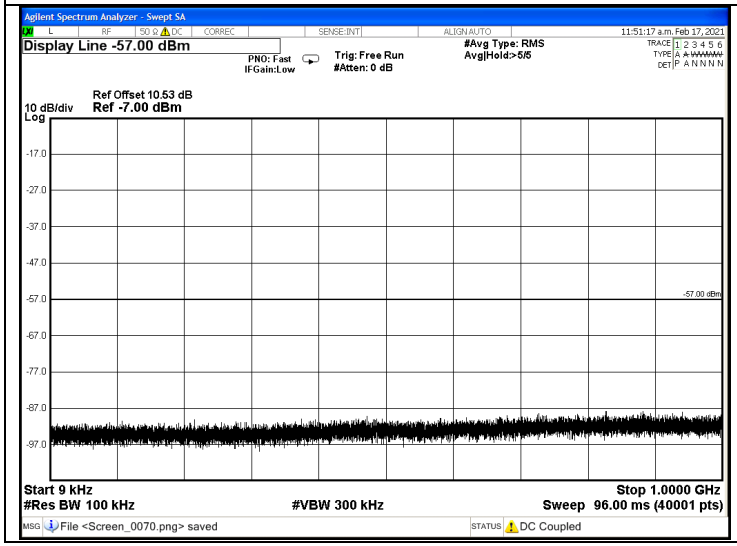


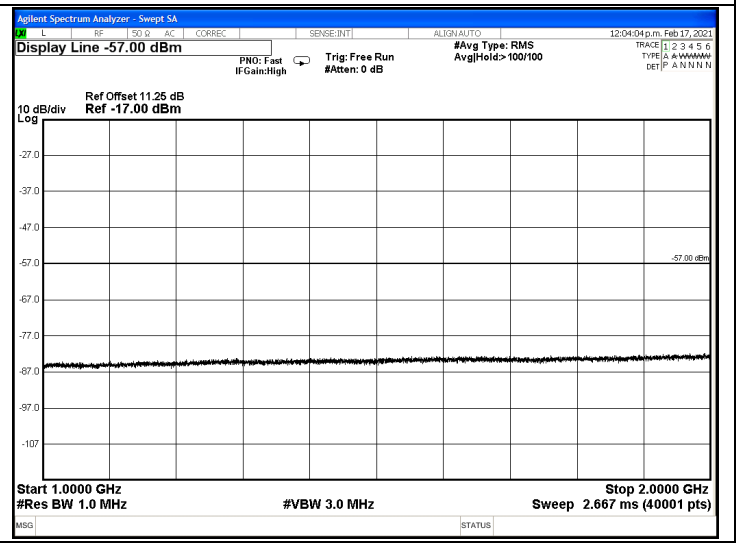


Transmitter Standby Spurious Emissions (Conducted) – Continued

162.1 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

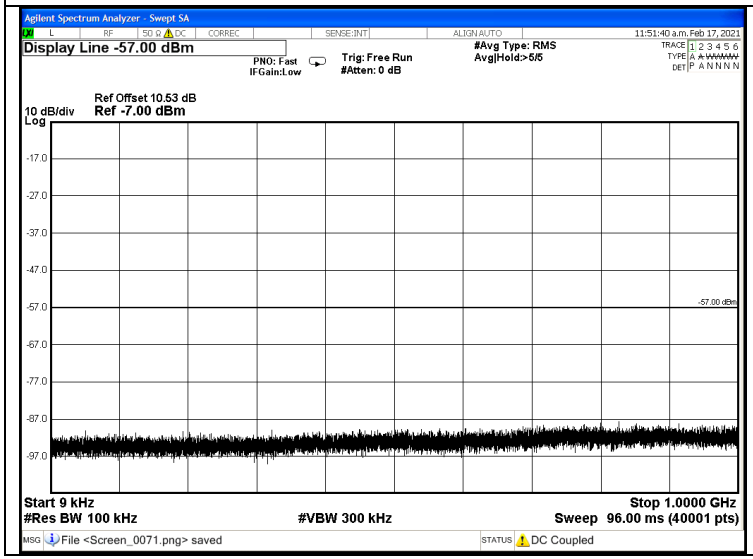
162.1 MHz

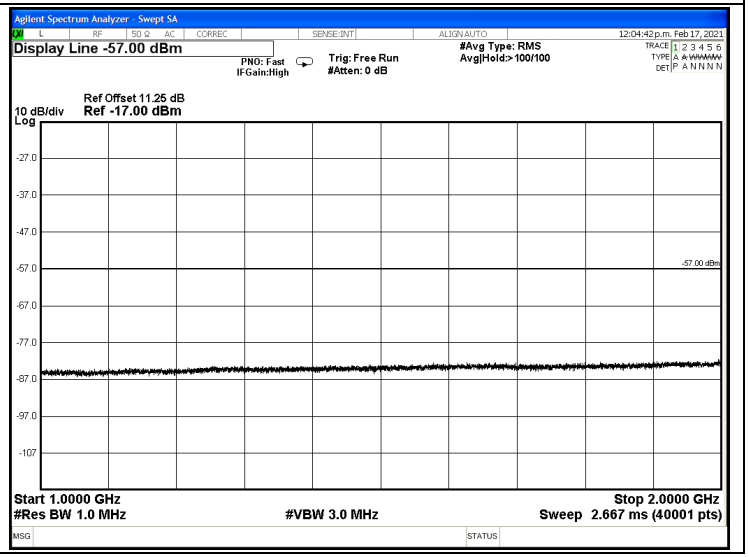




173.3 MHz Transmitter Standby (Transmitter RF Output Port)		
Emission Frequency (MHz)	Level (nW)	Level (dBm)
~	~	~
Measurement Uncertainty	≤12.75 GHz ± 3.0 dB	
No emissions were detected within 20 dB of Limit.		

173.3 MHz





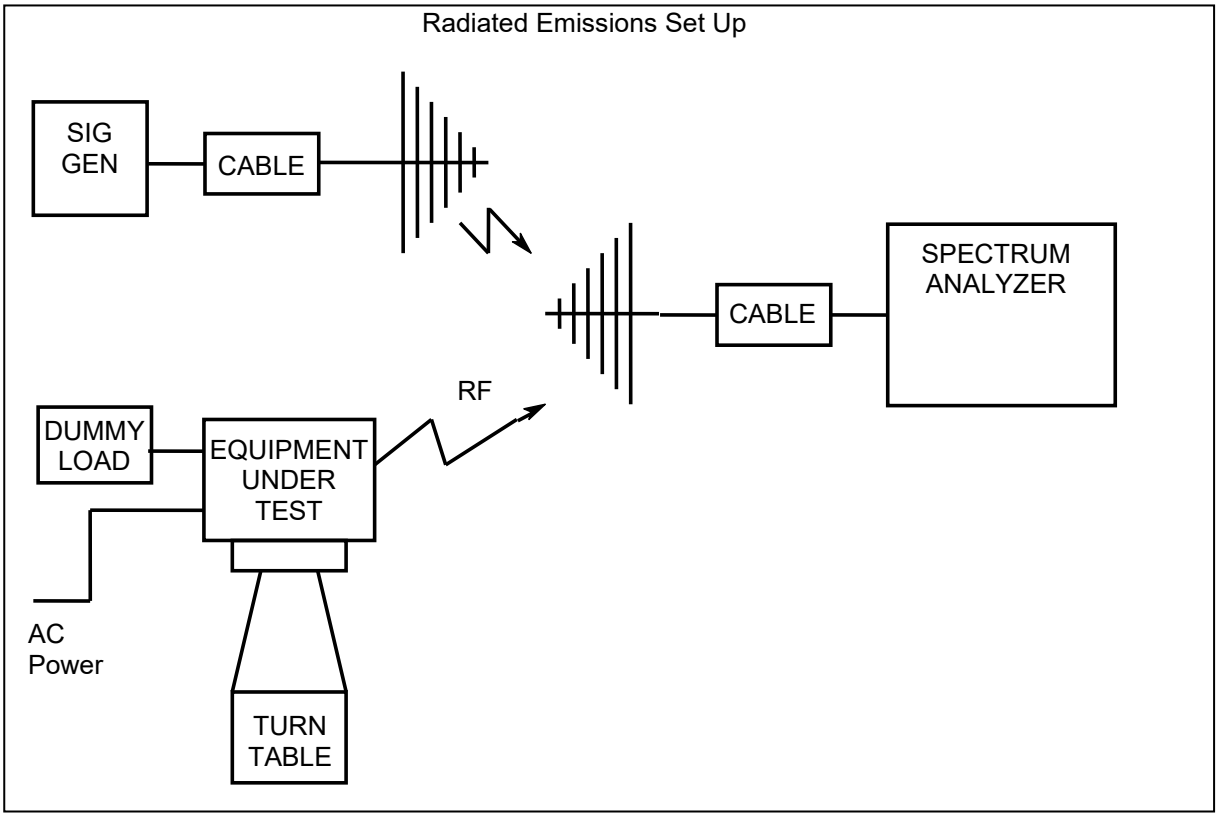
TEST EQUIPMENT LIST

Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
AC Voltmeter		Tait		1		21-May-21
Antenna	Reference Dipoles	Emco	3121C DB1	9510-1164	E3559	14-May-22
Antenna	18GHz DRG	Emco	DRG3115	9512-4638	E3560	3-Sep-20
Antenna	Log Periodic	Schwarzbeck	VUSLP	9111-219	E4617	
Antenna	Reverb - 1-18GHz DRG	Schwarzbeck	BBHA 9120 D	9120D-885	E4857	
Antenna	Reverb - 1-18GHz DRG	Schwarzbeck	BBHA 9120 D	9120D-884	E4858	
Audio Analyser	TREVA1	Hewlett Packard	HP8903A	2437A04625	E4986	25-Sep-21
Coax Cable	OATS Turntable Cable 1	Intelcom	RG214	OATS1	E4621	2-Nov-21
Coax Cable	OATS Tower Cable	Intelcom	RG214	OATS2	E4622	2-Nov-21
Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack2	E4623	30-Oct-21
Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack3	E4624	30-Oct-21
Coax Cable	Reverb - 4.5m Multiflex 141	TeltestBlue6	MF 141	TeltestBlue6	E4843	30-Oct-21
Coax Cable	Reverb - 2m Multiflex 141	TeltestBlue5	MF 141	TeltestBlue5	E4844	30-Oct-21
Coax Cable	Reverb - 2m Multiflex 141	TeltestBlue4	MF 141	TeltestBlue4	E4845	30-Oct-21
Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue3	MF 141	TeltestBlue3	E4846	30-Oct-21
Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue2	MF 141	TeltestBlue2	E4847	30-Oct-21
Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue1	MF 141	TeltestBlue1	E4848	30-Oct-21
Coax Cable	OATS Turntable Cable 2	Intelcom	RG215	OATS3	E4995	2-Nov-21
Coax Cable	3m Blue	Suhner	Sucoflex 126EA	503429/126EA	E5015	30-Oct-21
Coax Cable	Conducted Disturbance Cable	Tait	RG223/U	EMC1	E5026	3-Nov-21
Coax Cable	1.5m Blue	Suhner	Sucoflex 126EA	502868/126EA	E5028	3-Feb-22
Environ. Chamber	Upright	Contherm	5400 RHSLT.M	1416	E4051	10-Jul-21
Filter High Pass/ Notch	135 to 175MHz	Tait		N/A	E3382	8-Jun-21
Modulation Analyser	TREVA1	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073	28-Sep-21
Modulation Analyser	Includes Audio Analyser	Rohde & Schwarz	FMA0852.8500.52	842541/001	E3554	25-Mar-21
Multimeter		Fluke	77	35069359	E3237	28-Sep-21
OATS	Controller	Electrometrics	EM-4700	119	E4445	
OATS	Turntable	Electrometrics	EM-4704A	105	E4446	
OATS	Antenna Tower	Electrometrics	EM-4720-2	112	E4447	

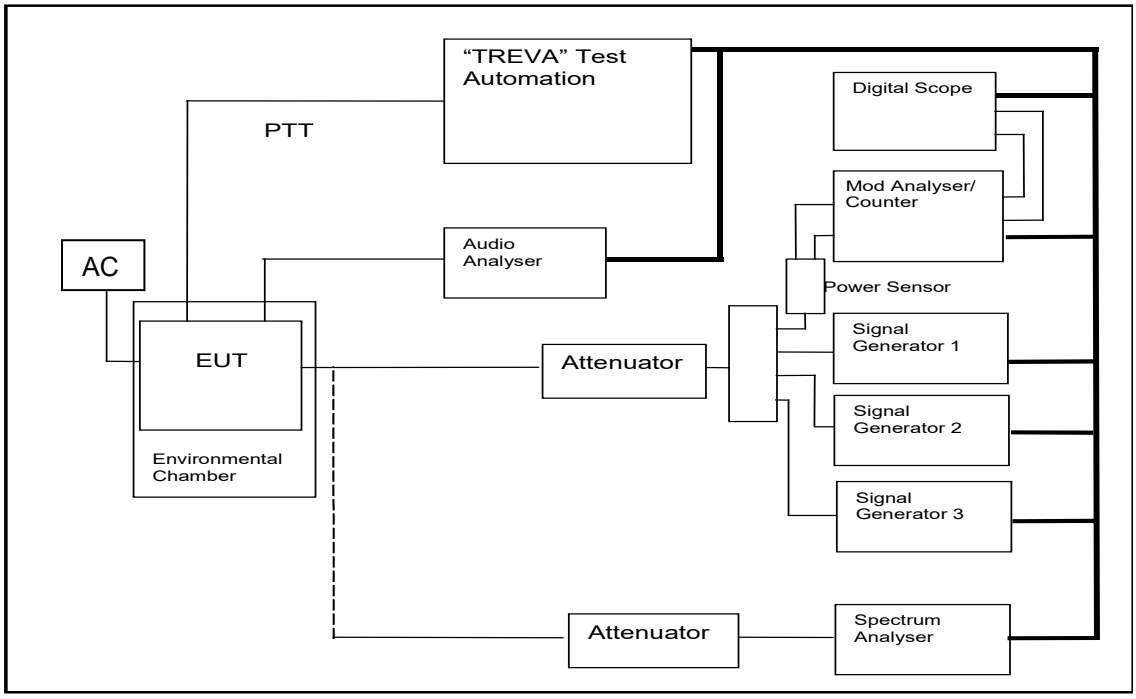
Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
OATS	NSA	Tait				18-Jun-20
Oscilloscope	400MHz	Tektronics	TDS380	B017095	E3782	28-Sep-21
Power Meter	TREVA1 Power Head for HP8901	Hewlett Packard	HP11722A	3111A05573	E7054	28-Sep-21
Power Supply	AC Variac	Yamabishi	S-260-5	TX-533	E1737	
Power Supply		Rohde & Schwarz	NGS M32/10 192.0810.31	Fnr 434	E3556	28-May-21
RF Amplifier	+21.7 dB 1GHz	Tait	ZFL-1000LN	E3660	E3360	31-Jul-21
RF Amplifier	Pre-amplifier	Agilent	87405C	MY47010688	E4941	8-Oct-21
RF Attenuator	30+3dB 350W	Weinschel	67-30-33 & BW-N3W5+	CK9178	E5023	30-Oct-21
RF Attenuator	10dB 50W	Weinschel	24-10-34	BC3293	E4364	30-Oct-21
RF Attenuator	3dB 0.5W	Weinschel	Model 1	CH6863	E5013	2-Nov-21
RF Combiner	TREVA1	Minicircuits	ZFSC-4-1	-	E4083	
RF Load	150W	Bird	8166	524	E3625	30-Oct-21
Signal Generator	Analog 4GHz	Agilent	E4422B	GB40050320	E3788	26-Sep-21
Signal Generator	Digital 3GHz	Agilent	E4438C	MY45093154	E4600	1-Oct-22
Signal Generator	Digital 4GHz	Agilent	E4437B	US39260389	E4764	9-Oct-21
Spectrum Analyser	26.5GHz	Agilent	PXA N9030A	MY49432161	E4907	3-Oct-22
Temp & Humidity datalogger		Hobo	U21-011	10134276	E4981	7-Jul-21
Transient Limiter	9kHz to 200MHz	Agilent	11947A	3107A03657	E4982	2-Oct-21
TREVA 1		Teltest	-	1	-	2-Jun-21
Testware	Conducted Emissions		March 2018	-	-	
Testware	Frequency Vs Temperature		April 2018	-	-	
Testware	Radiated Emissions		April 2018	-	-	
Testware	Reverb Emissions		May 2019	-	-	
Testware	Sideband Spectrum		February 2017	-	-	
Testware	S-Line Radiated Emissions		April 2018	-	-	
Testware	TREVA		29/01/2020	-	-	
Testware	Spec An Correction Loader		June 2019	-	-	

NOTE: Items without calibration dates are calibrated immediately before use, or set using calibrated instruments

ANNEX A – TEST SETUP DETAILS



All other testing is performed using the **T**eltest **R**adio **EVA**luation system (TREVA), which is configured as shown below. The Spectrum Analyser is connected to the EUT via the attenuator network for Conducted Emissions testing, and Occupied Bandwidth.



END OF REPORT