TELTEST Laboratories
Tait International Ltd
Report Number 4220

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TBDB1F 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:	2
Issue Date:	13 October 2022
PREPARED BY:	I. D. Russell Test Technician
CHECKED & APPROVED BY:	M. C. James Laboratory Technical Manager

ACCREDITED
IANZ
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.

TELTEST Laboratories (A Division of Tait International Ltd)
PO Box 1645, 558 Wairakei Road, Christchurch, New Zealand.
Telephone: 64 3 358 3399
FAX: 64 3 359 4632

TABLE OF CONTENTS

REVISION HISTORY 3
INTRODUCTION 4
TEST REQUIREMENTS AND RESULT SUMMARY 5
STATEMENT OF COMPLIANCE 6
LIST OF ANTENNA INTENDED FOR USE WITH THE DEVICE 7
CHANNEL TABLE 8
MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS 9
TEST RESULTS 10
TRANSMITTER OUTPUT POWER (CONDUCTED) 10
TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS 11
TRANSMITTER MODULATION LIMITING 15
TRANSMITTER OCCUPIED (99%) BANDWIDTH 19
TRANSMITTER SPECTRUM MASKS 26
TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED) 36
TRANSMITTER SPURIOUS EMISSIONS (RADIATED) 56
TRANSIENT FREQUENCY BEHAVIOR 60
TRANSMITTER FREQUENCY STABILITY - TEMPERATURE 73
TRANSMITTER FREQUENCY STABILITY - VOLTAGE 76
RECEIVER SPURIOUS EMISSIONS (CONDUCTED) 77
TRANSMITTER STANDBY SPURIOUS EMISSIONS (CONDUCTED) 84
TEST EQUIPMENT LIST 91
ANNEX A – TEST SETUP DETAILS 93

REVISION HISTORY

Date	Revision	Comments
25 February 2022	1	Initial test report
13 October 2022	2	FCC ID corrected from CASTBD-B1F to CASTBDB1F ISED ID Corrected from 737A-TBD-B1F to 737A-TBDB1F Added Test dates for individual tests.

INTRODUCTION

Type Approval Testing of the TBDB1F Base Station Transceiver TB7304/TB706-B1-YY (Serial No 18290104).This transportable repeater is designed to run on an internal battery, with 15W RF output, and is useable in remote locations.
PCB IPN Reciter 220-02266-01
PCB IPN Control Board 228-36332-02

Testing in accordance with FCC 47 Parts 22 & 90, and RSS-119 Issue 12 & RSS-Gen Issue 5.
This radio supports analogue, Digital Mobile Radio (DMR), and 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:	TBDB1F
Product Code:	TB7304-B1YY (DMR), TB7306-B1YY (P25) YY refers to the Duplexer tuning range F0 or G0
Serial Number(s):	18290104
Frequency range	136 → 174 MHz
Transmit Power	15 Watts

Modulation		Channel Spacing	Speech Channels	Symbol Rate (symbols/sec)	Data Rate (bps)
Analogue FM		12.5 kHz	1	-	-
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	18340116	p25-3.20.00.0005 dmr-3.20.00.0005	2.01
Power Amplifier	T01-01405-BCAA	18290066		0.01
Front Panel			1.10.03.0001	0.01

TEST CONDITIONS
All testing was performed between 27 January → 22 February 2022, and under the following conditions:

Ambient temperature:	15°C → 30°C
Relative Humidity:	20% → 75%
Standard Test Voltage	12.8 V_{DC} for RF power, and 230 V_{AC} for emissions

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: TBD-B1F
Product code: TB7304-B1YY (DMR), TB7306-B1YY (P25)
YY refers to the Duplexer tuning range F0 or G0
Serial Numbers: 18290104
Quantity: 1

Module	Product Code	Serial Number	Firmware Version	Hardware Version
Reciter	T01-01403-BAAA	18340116	p25-3.20.00.0005 dmr-3.20.00.0005	2.01
Power Amplifier	T01-01405-BCAA	18290066		0.01
Front Panel			1.10.03.0001	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 & RSS-Gen Issue 5

for the parameters tested in this report.

Signature: 

Mike James
Technical Manager

Date: 13 October 2022

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.

LIST OF ANTENNA INTENDED FOR USE WITH THE DEVICE

The equipment tested has a 50 Ω coaxial antenna connection. No antenna was fitted to the EUT during testing the parameters in this report.

Antennas and transmitter power settings are selected with regard to the overall loss of the antenna system, the desired coverage and the EIRP limit of the license.

The radio manufacturer (Tait) does not manufacture specific antennas for this equipment but suggests the following from other suppliers.

Manufacturer	**Part Number**	**Tuning Bandwidth and / or Frequency Range - MHz**	**Gain - dBd (dBi)**
RFI	COL3, COL15, COL17, COL35	4% of 144-175MHz 3 (5.1)	
RFI	COL4, COL24, COL18, COL36	4% of 144-175MHz	4.5 (6.6)
RFI	COL37	2% of 148-250MHz	5.5 (7.6)
RFI	COL51 (-140, -160, -166, -174)	10MHz of 130-174MHz	0 (2.1)
RFI	COL53 (-140, -150, -160, -166, -174)	10MHz of 130-174MHz 4 (6.1)	
RFI	COL54 (-155, -160, -166, -174)	10MHz of 145-174MHz	6 (8.1)
RFI	BA40-41	136-174MHz	3 (5.1)
RFI	BA80-41	136-174MHz	6 (8.1)
RFI	EA40-41	136-174MHz	5 (7.1)
RFI	EA80-41	136-174MHz	8 (10.1)
RFI	OA20-41	136-174MHz	5 (7.1)
RFI	OA40-41	136-174MHz	9 (11.1)
dBSpectra	DS1E03F36U-D or N	140-150MHz	3 (5.1)
dBSpectra	DS1E06F36U-D or N	140-150MHz	6 (8.1)
dBSpectra	DS1F00F36U-D or N	150-164MHz	0 (2.1)
dBSpectra	DS1F03F36U-D/N, DS1G03F36U-D/N	150-164MHz	3 (5.1)
dBSpectra	DS1F06F36U-D/N, DS1G06F36U-D/N	150-164MHz	6 (8.1)

CHANNEL TABLE

Channel Number	Transmit Frequency MHz	Receive Frequency MHz	Power Watts (Duplexer output)	Bandwidth KHz
1	138.025	138.05	15	12.5
2	143.975	143.95	15	12.5
3	148.025	148.05	15	12.5
4	150.05	150.075	15	12.5
5	162.025	162.05	15	12.5
6	173.975	173.95	15	12.5

MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

MODULATION TYPES:

F3E	FM Analogue Voice	-	-
F1E	C4FM	4800 symbols/sec	9600 bps
F1D	C4FM	4800 symbols/sec	9600 bps
FXW	Digital Voice / Data	4800 symbols/sec	9600 bps
FXD	Digital Data	4800 symbols/sec	9600 bps

CHANNEL SPACING: 12.5 kHz

EMISSION DESIGNATORS:

Analogue Voice	11K0F3E
P25 Phase 1 Digital Voice	8K10F1E
P25 Phase 1 Digital Data	8K10F1D
DMR Digital Voice / Data	8K00FXW
DMR Digital Data	8K00FXD

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
M = 3.0 kHz
D = 2.5 kHz
Bn = (2x3.0) + (2x2.5) x 1
= 11.0 kHz

Emission Designator
11K0F3E
F3E represents an FM voice transmission

APCO P25 Phase 1 (C4FM): Digital Voice, 12.5 kHz Channel Spacing

99% bandwidth
= 8.1 kHz

Emission Designator
8K10F1E
F1E represents a digital FM voice transmission

APCO P25 Phase 1 (C4FM): Digital Data, 12.5 kHz Channel Spacing

99% bandwidth
= 8.1 kHz

Emission Designator
8K10F1D
F1D represents an digital FM data transmission

DMR: Digital Voice, 12.5 kHz Channel Spacing

99% bandwidth
= 8.0 kHz

Emission Designator
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
= 8.0 kHz

Emission Designator
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) =	11.56 dBm +30.15 dB
=	41.71dBm
Power in Watts =	(10^(41.71dBm)/10)/1000
=	14.8W

MEASUREMENT DATE: 21 February 2022

MEASUREMENT RESULTS:
Manufacturer's Power: 15W At Duplexer output: 15 W

Nominal 15 W	138.025 MHz	143.975 MHz	148.025 MHz	150.05 MHz	162.025 MHz	173.975 MHz
Measured	14.8	14.0	14.4	14.7	15.4	14.7
Variation (%)	-1.1	-6.8	-3.8	-2.1	2.6	-1.9
Variation (dB)	0.0	-0.3	-0.2	-0.1	0.1	-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 DATE: 27 January 2022

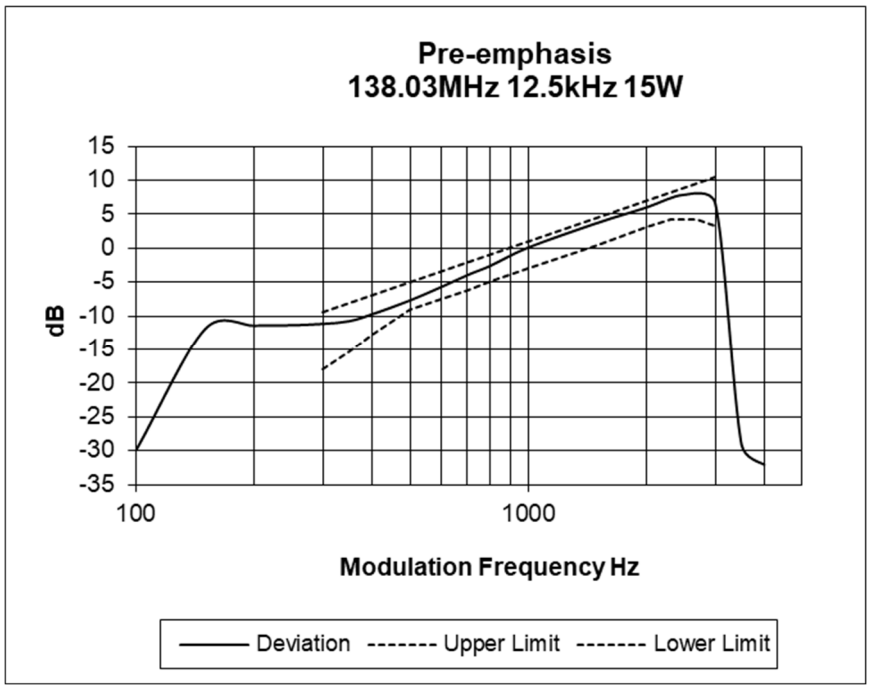
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing tested at 15 W transmit power.

LIMIT CLAUSE: TIA/EIA-603E 3.2.6

MEASUREMENT UNCERTAINTY: ± 1.5 %

SPECIFICATION: FCC CFR 2.1047 (a)

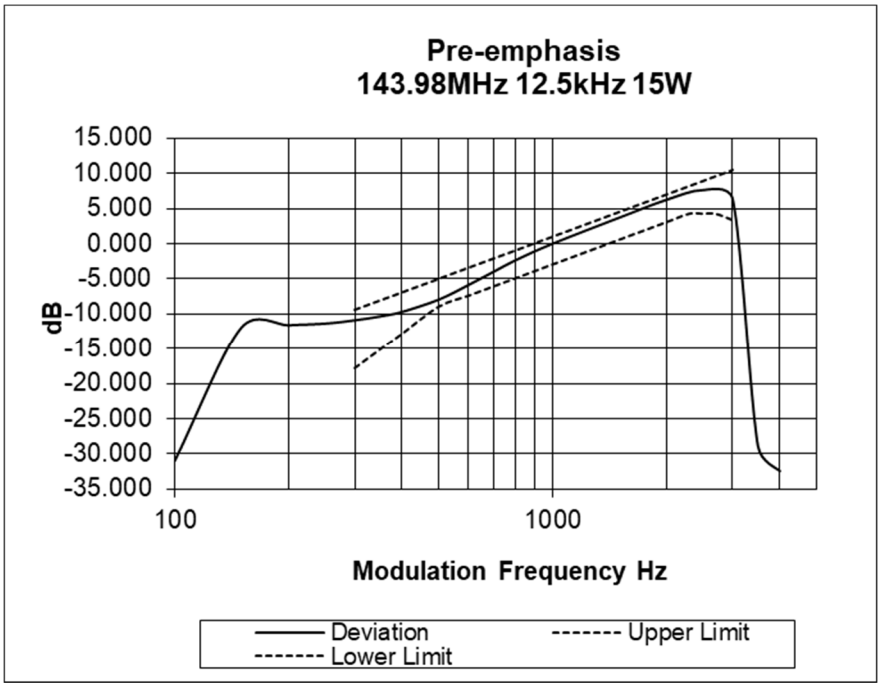
Tx FREQUENCY: 138.025 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

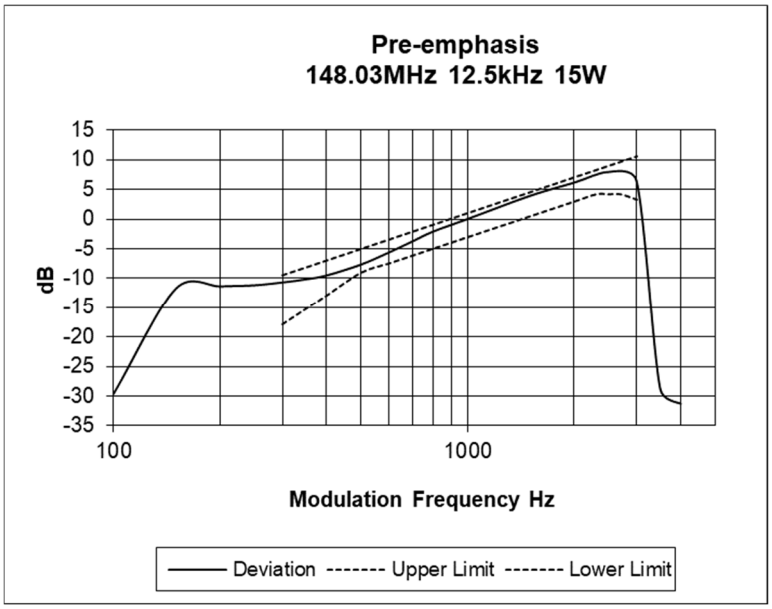
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 143.975 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

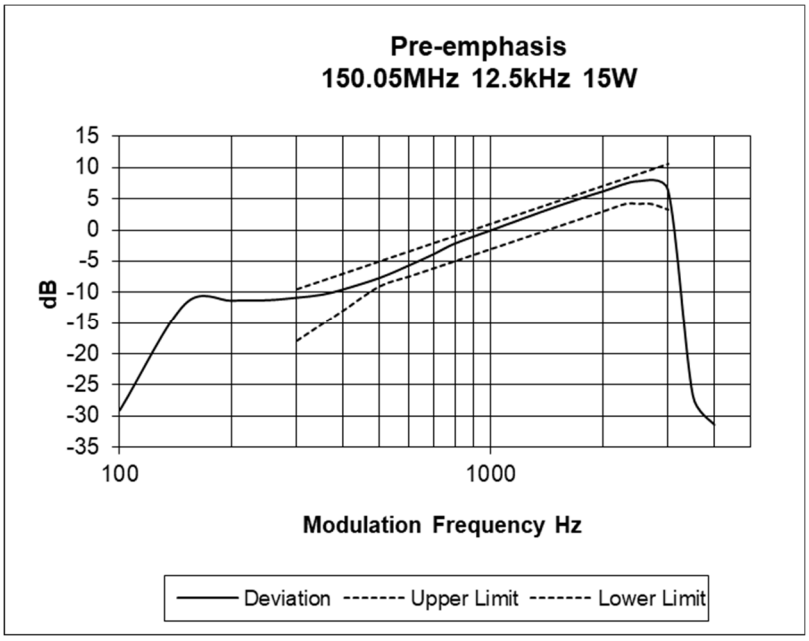
Tx FREQUENCY: 148.025 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

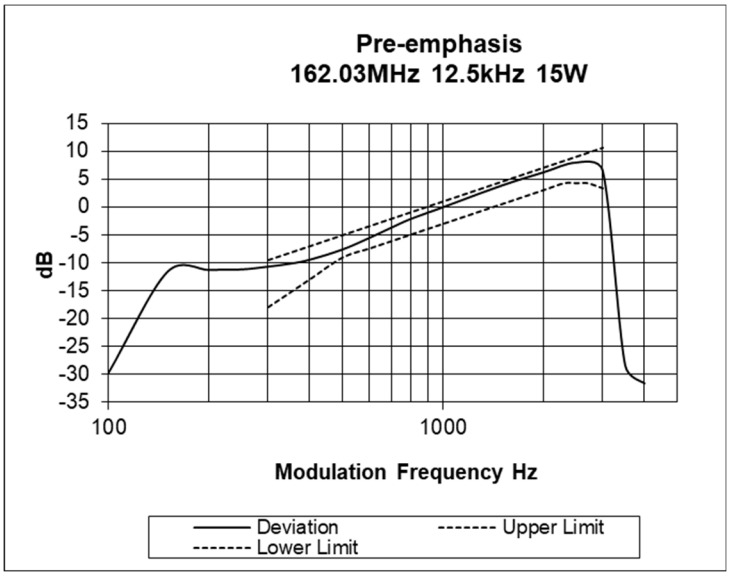
SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 150.05 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (a)

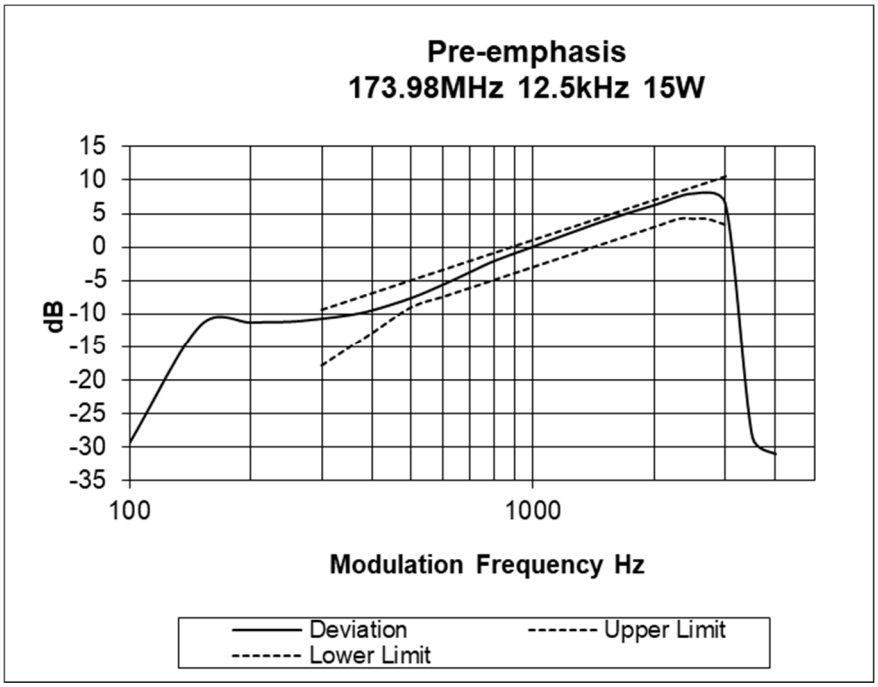
Tx FREQUENCY: 162.025 MHz 12.5 kHz Channel Spacing



Transmitter Audio Frequency Response – Pre-emphasis

SPECIFICATION: FCC CFR 2.1047 (a)

Tx FREQUENCY: 173.975 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 DATE: 27 January 2022

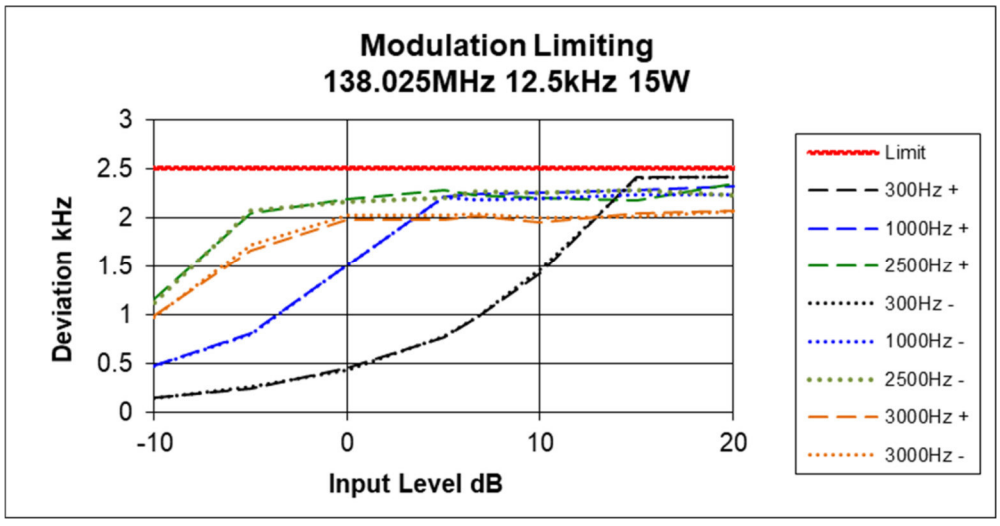
MEASUREMENT RESULTS:
See the plots on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSE: TIA/EIA-603E 1.3.4.4

MEASUREMENT UNCERTAINTY: ± 1.5 %

SPECIFICATION: FCC CFR 2.1047 (b)

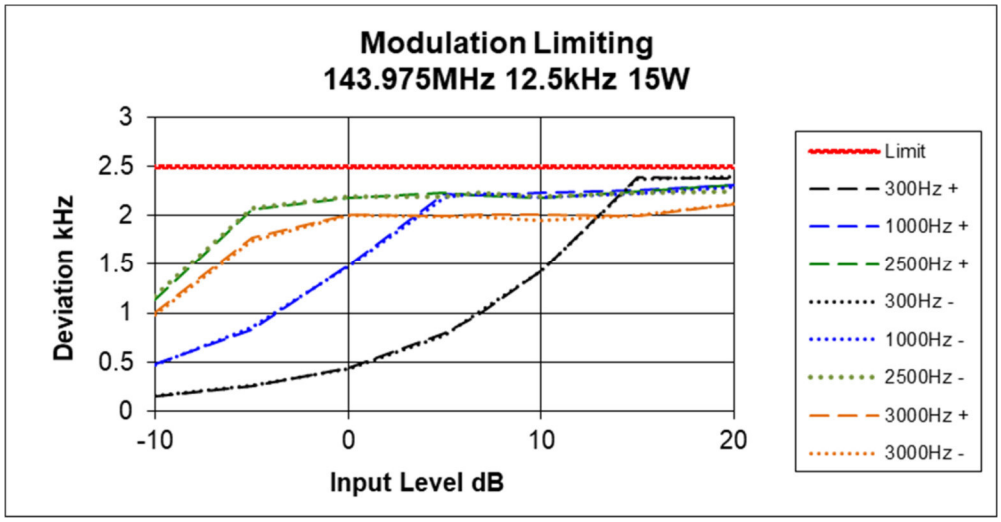
Tx FREQUENCY: 138.025 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

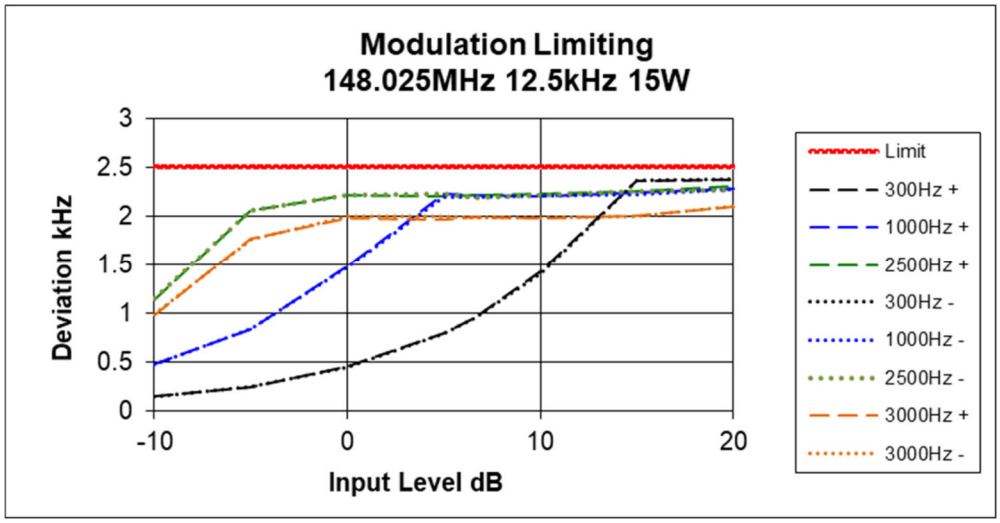
SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 143.975 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

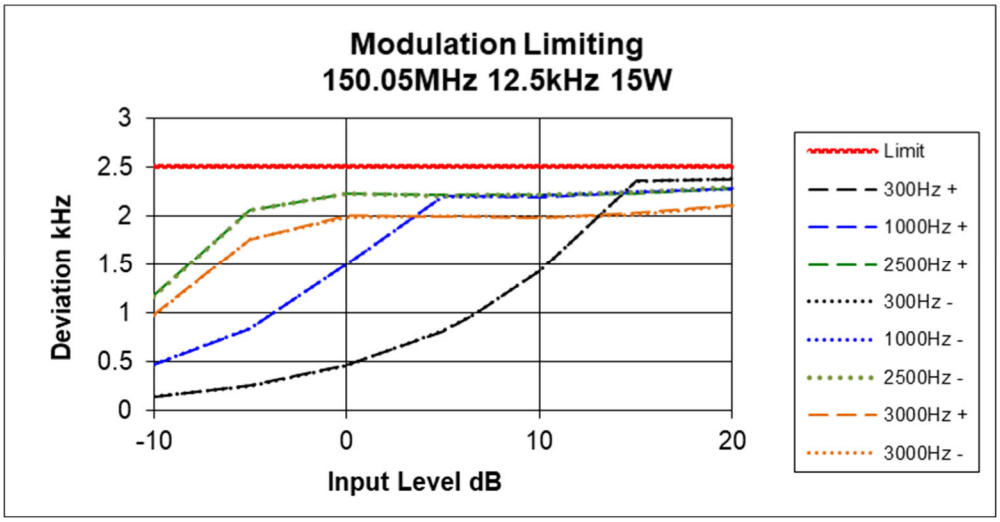
Tx FREQUENCY: 148.025 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

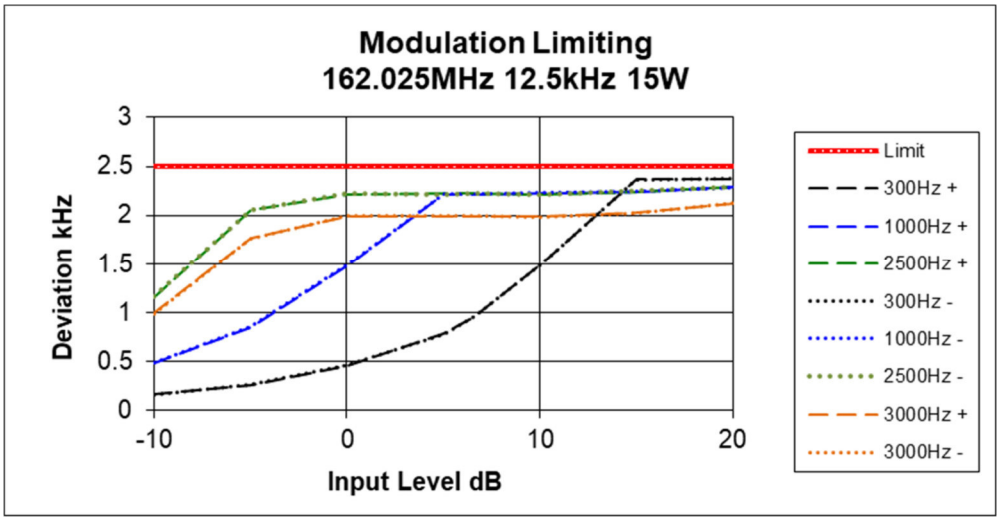
SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 150.05 MHz 12.5 kHz Channel Spacing



SPECIFICATION: FCC CFR 2.1047 (b)

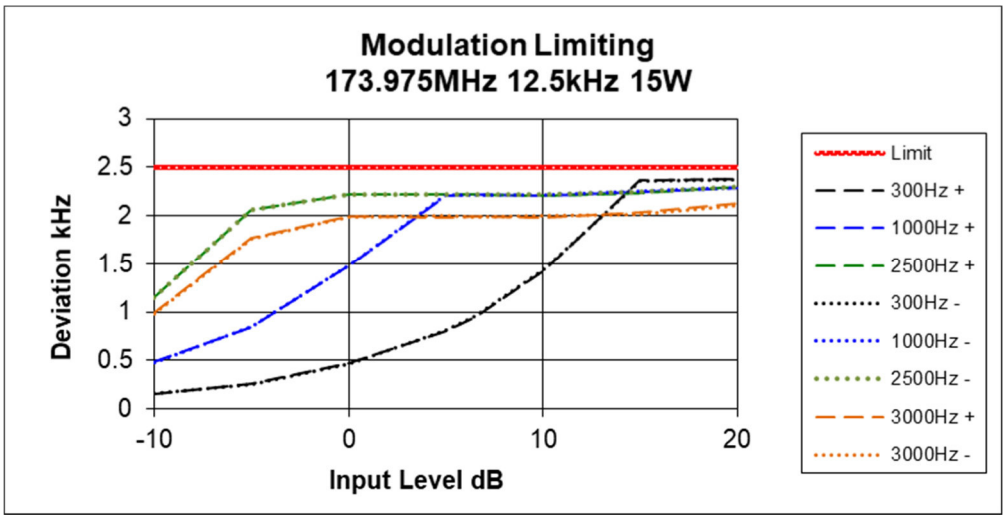
Tx FREQUENCY: 162.025 MHz 12.5 kHz Channel Spacing



Transmitter Modulation Limiting

SPECIFICATION: FCC CFR 2.1047 (b)

Tx FREQUENCY: 173.975 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

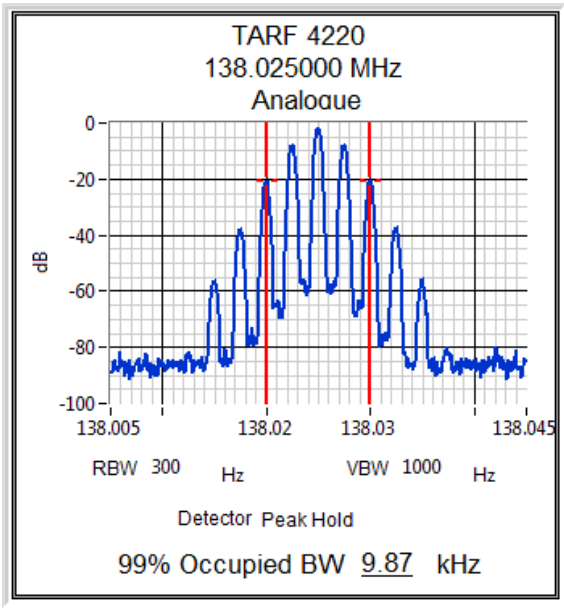
MEASUREMENT DATE: 31 January 2022

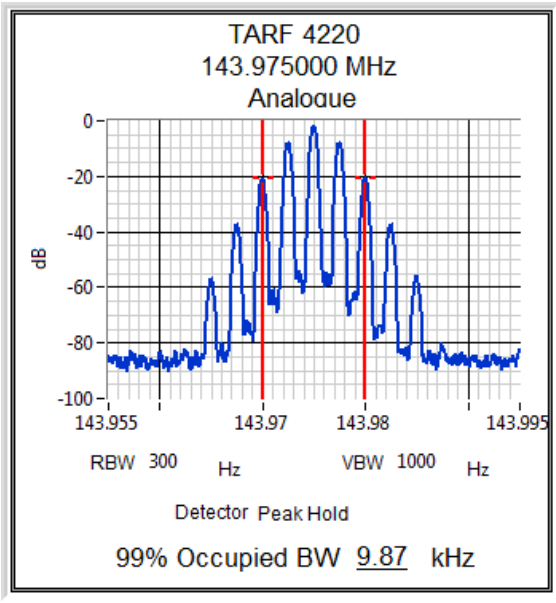
MEASUREMENT RESULTS:

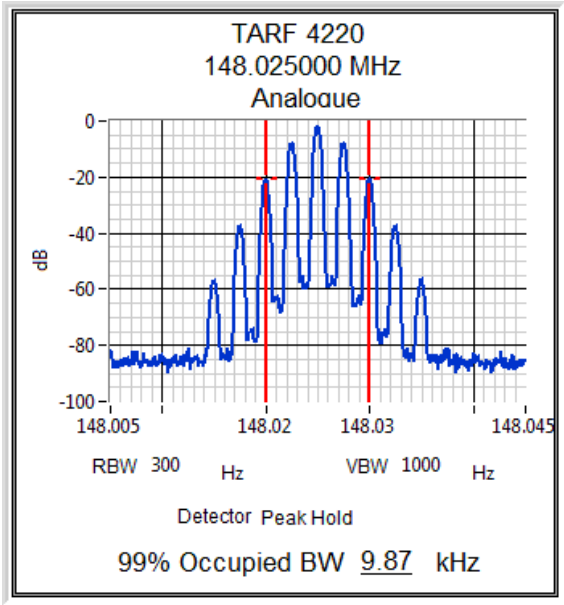
Channel Spacing (MHz)	Channel Spacing (kHz)	Analogue	DMR	APCO P25 phase I C4FM
138.025 MHz	12.5	9.87	7.73	8.07
143.975 MHz	12.5	9.87	8.00	7.87
148.025 MHz	12.5	9.87	7.67	8.00
150.05 MHz	12.5	9.87	7.73	7.87
162.025 MHz	12.5	9.87	7.67	7.87
173.975 MHz	12.5	9.87	7.87	7.87
Limit Authorized Bandwidth 47 CFR 90.209 RSS 119 5.5		11.25	11.25	11.25
Necessary BW used in emission designator		11.0	8.0	8.1
Result		Pass	Pass	Pass

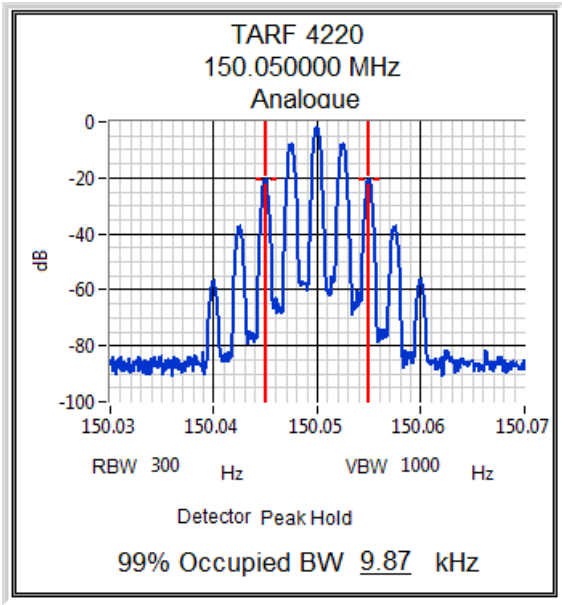
Transmitter Occupied (99%) Bandwidth

Channel 1-4 15 watts 12.5 kHz ch spacing Analogue Modulation



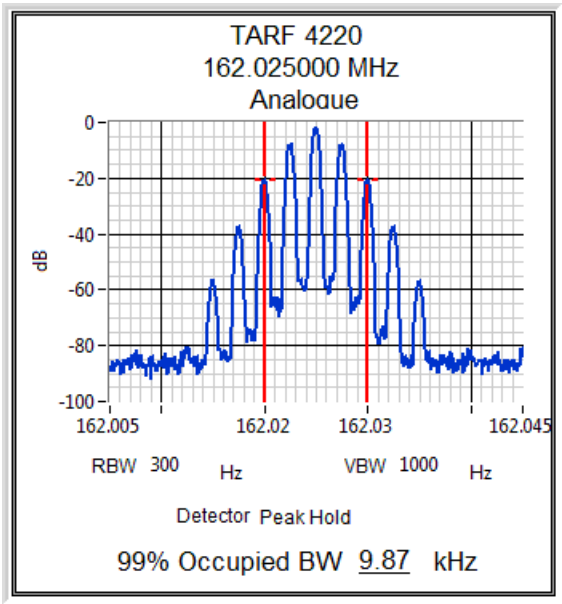


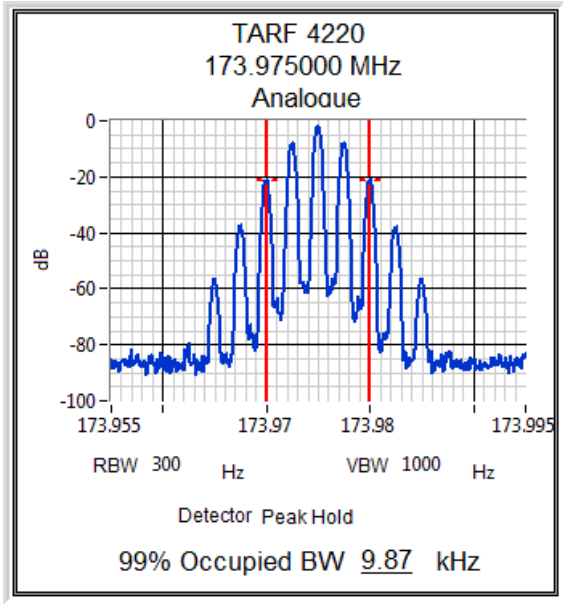




Transmitter Occupied (99%) Bandwidth

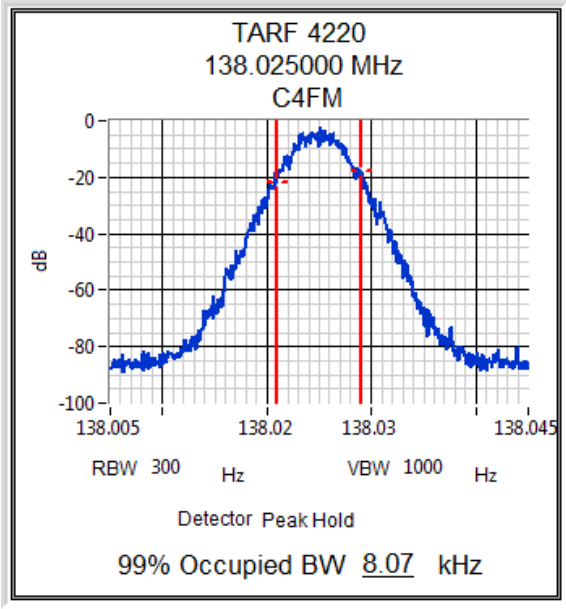
Channel 5-6 15 watts 12.5 kHz ch spacing Analogue Modulation

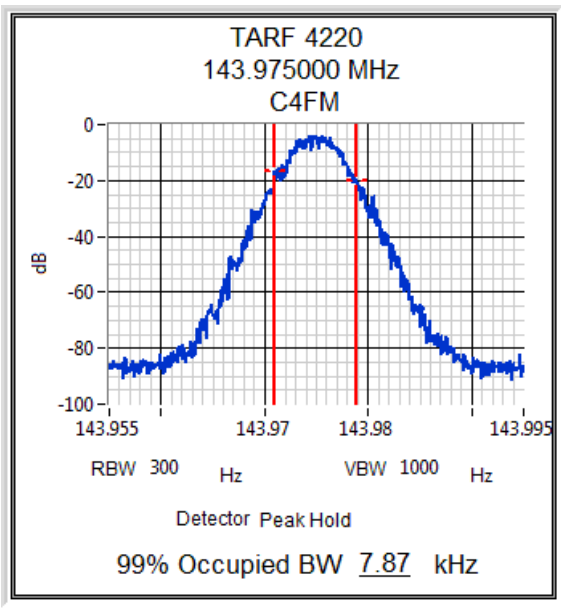


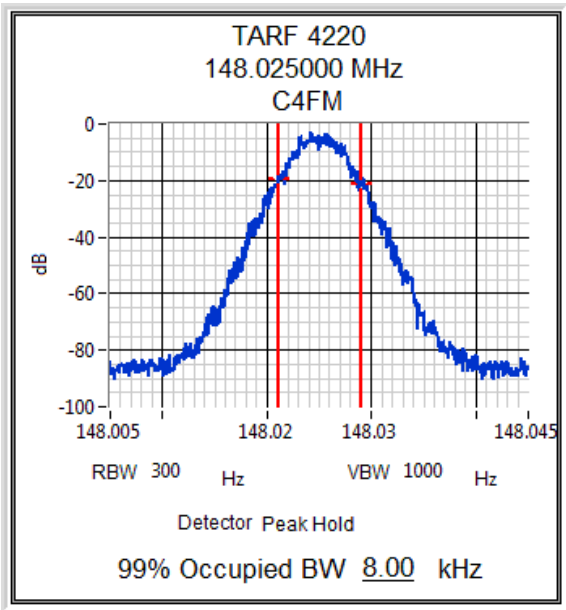


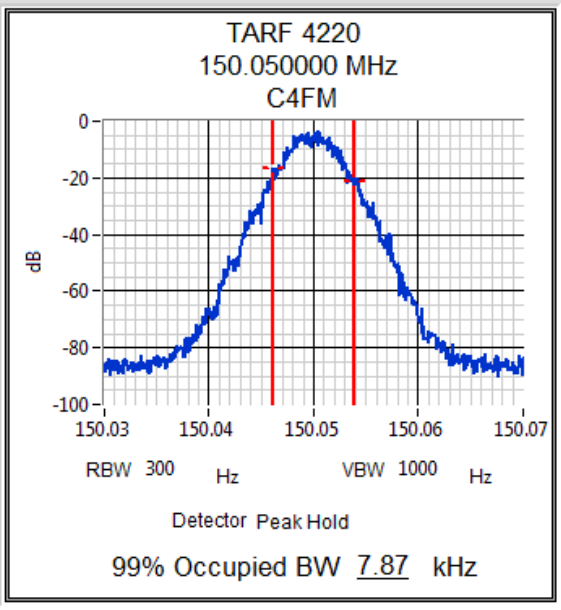
Transmitter Occupied (99%) Bandwidth

Channel 1-4 15 watts 12.5 kHz ch spacing P25 C4FM



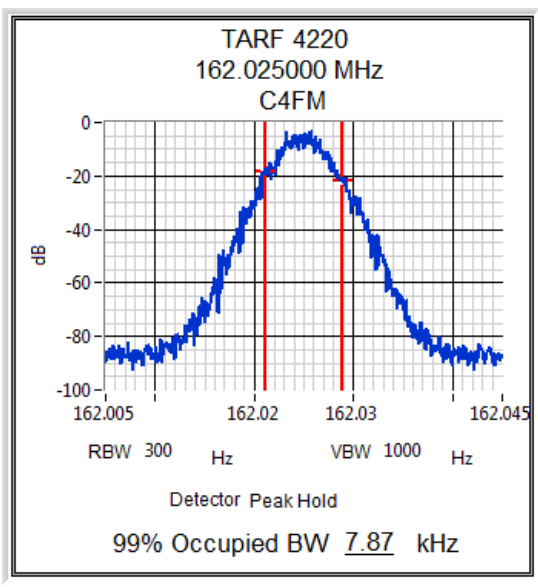


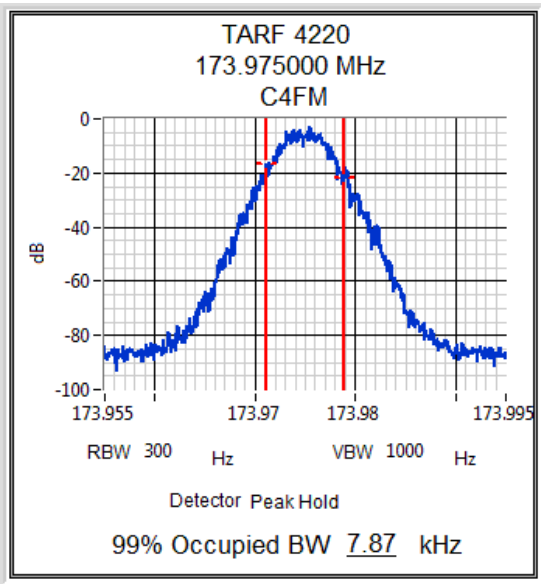




Transmitter Occupied (99%) Bandwidth

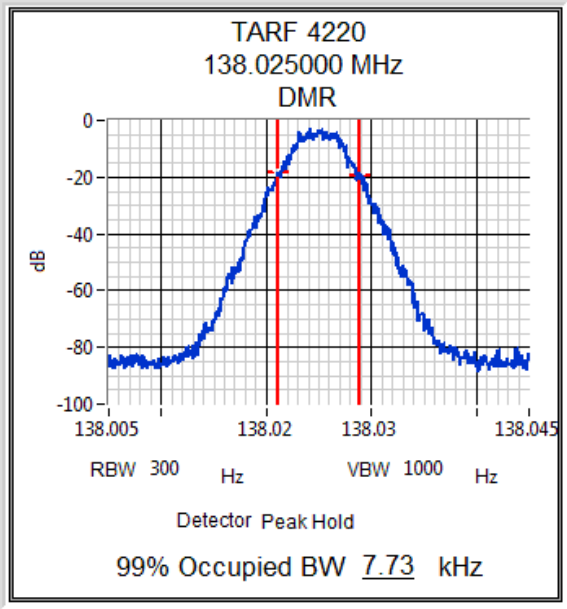
Channel 5-6 15 watts 12.5 kHz ch spacing P25 C4FM

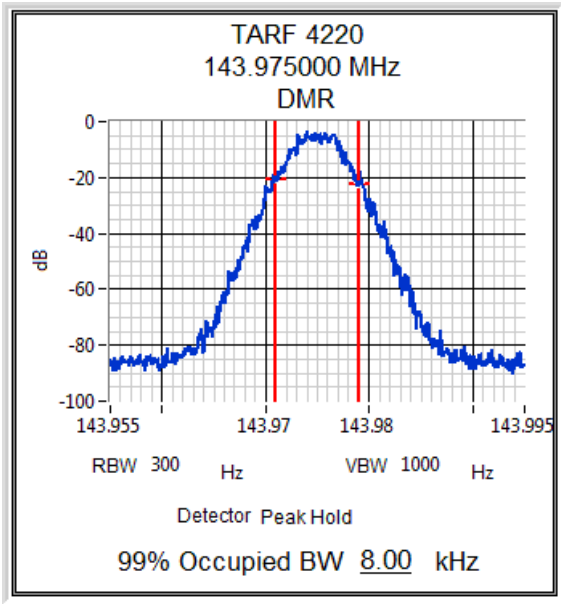


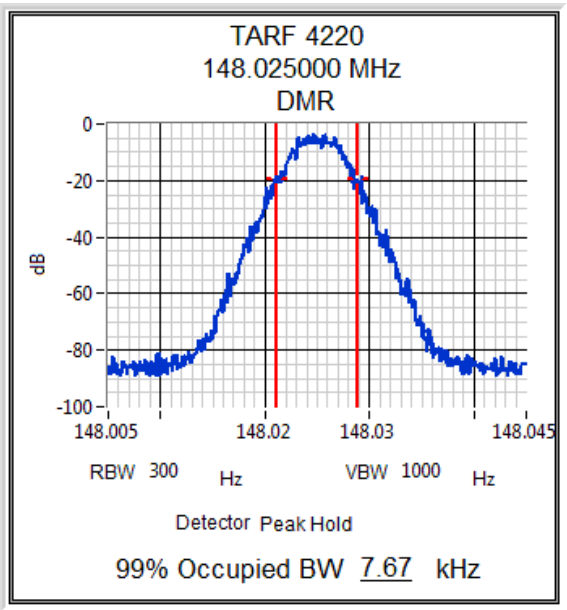


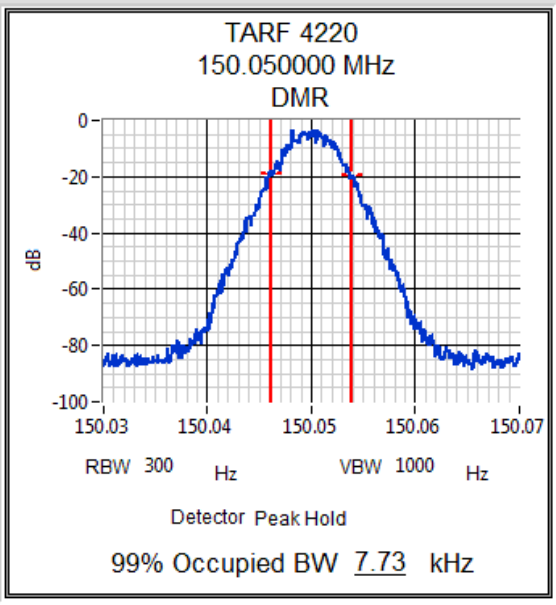
Transmitter Occupied (99%) Bandwidth

Channel 1-4 15 watts 12.5 kHz ch spacing DMR



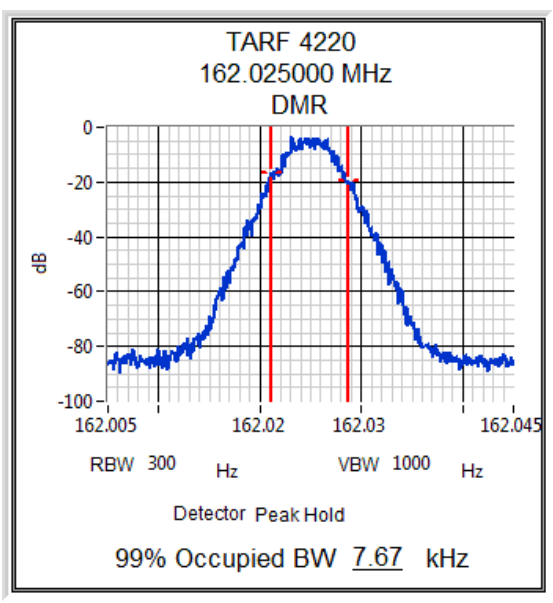


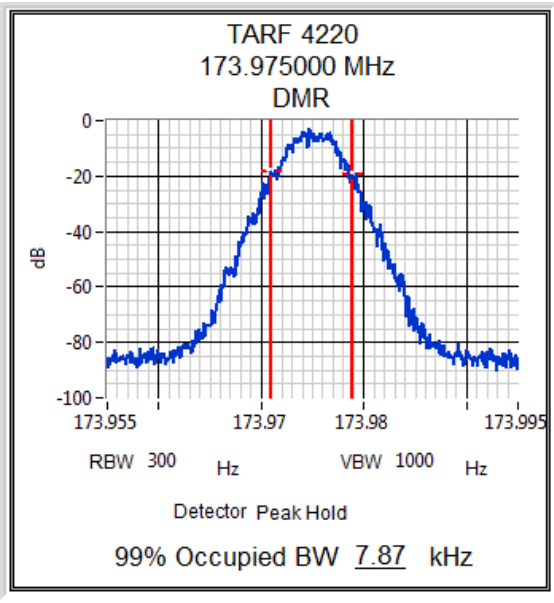




Transmitter Occupied (99%) Bandwidth

Channel 5-6 15 watts 12.5 kHz ch spacing DMR





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 DATE: 31 January 2022

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, Digital Voice/Data

DATA SPEED

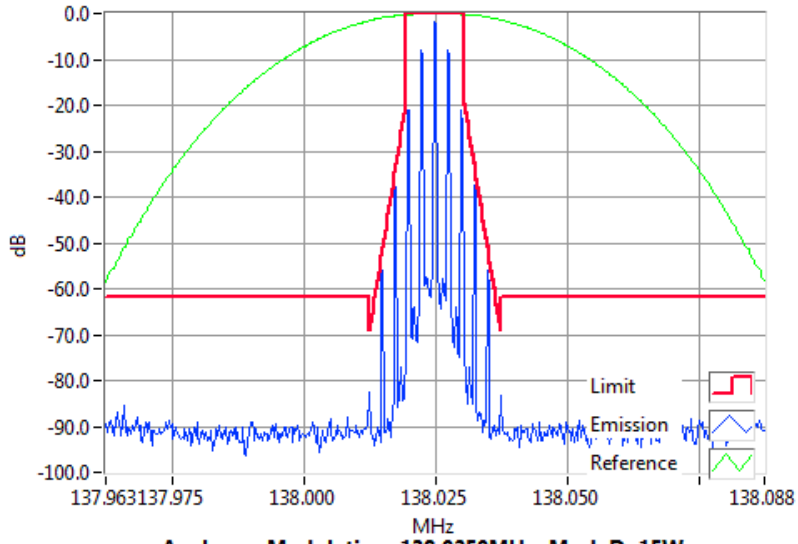
Digital Voice/Data	12.5 kHz Channel Spacing	9600 bps (DMR, P25 Phase I)

Transmitter Spectrum Masks

ANALOGUE VOICE

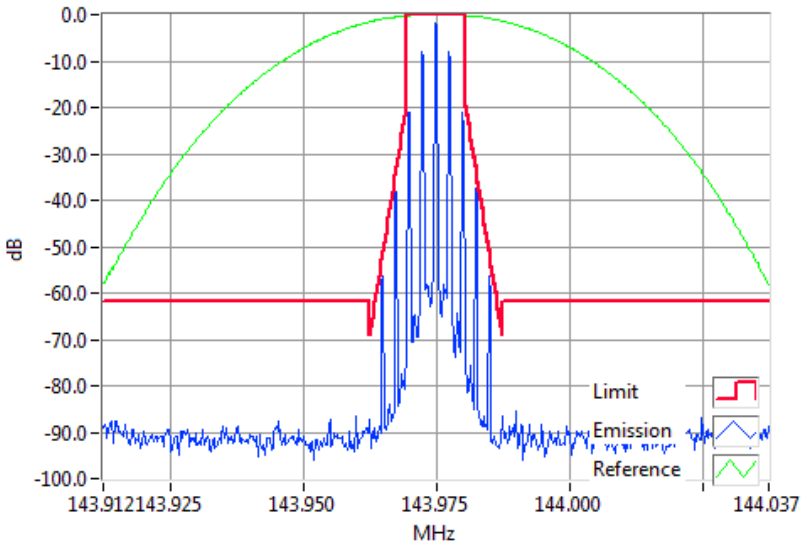
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 138.025 MHz 15 W 12.5 kHz Channel Spacing



Analogue Modulation 138.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 143.975 MHz 15 W 12.5 kHz Channel Spacing



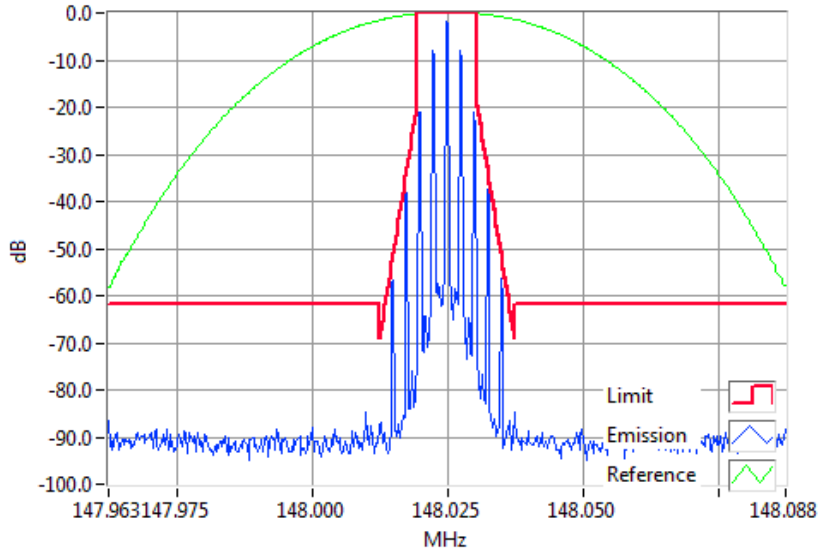
Analogue Modulation 143.9750MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

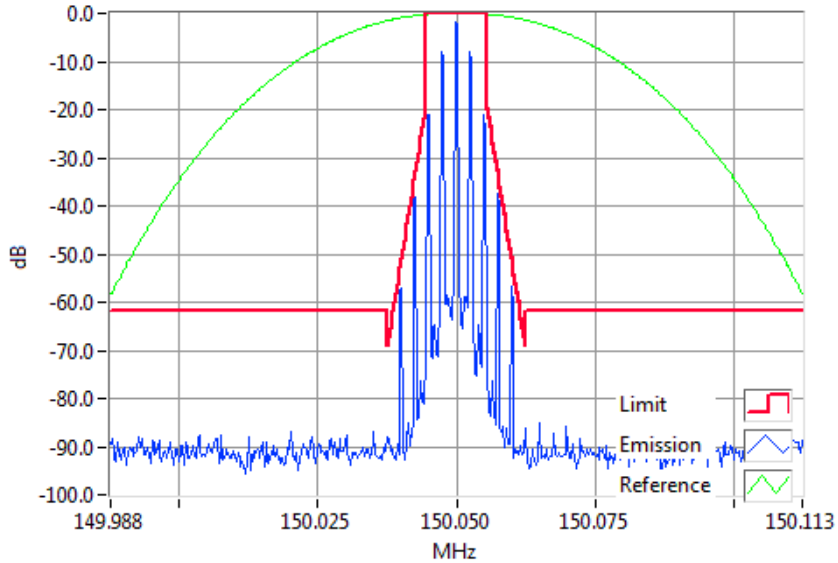
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 148.025 MHz 15 W 12.5 kHz Channel Spacing



Analogue Modulation 148.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 150.05 MHz 15 W 12.5 kHz Channel Spacing



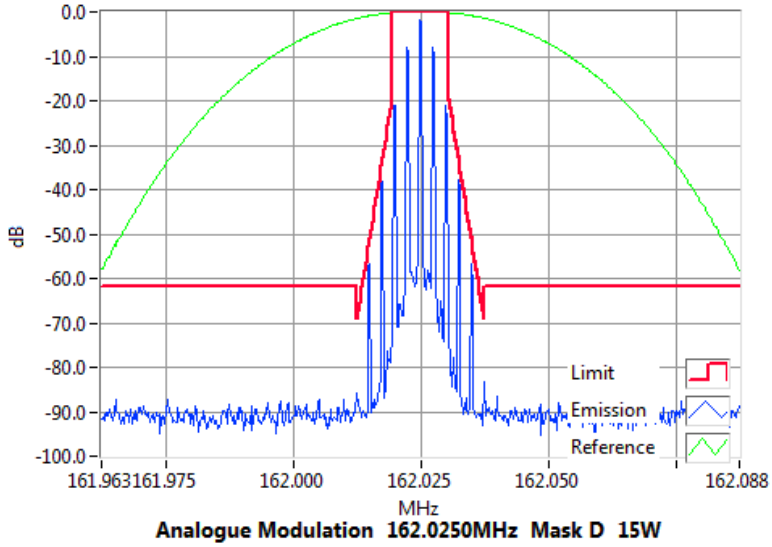
Analogue Modulation 150.0500MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

ANALOGUE VOICE

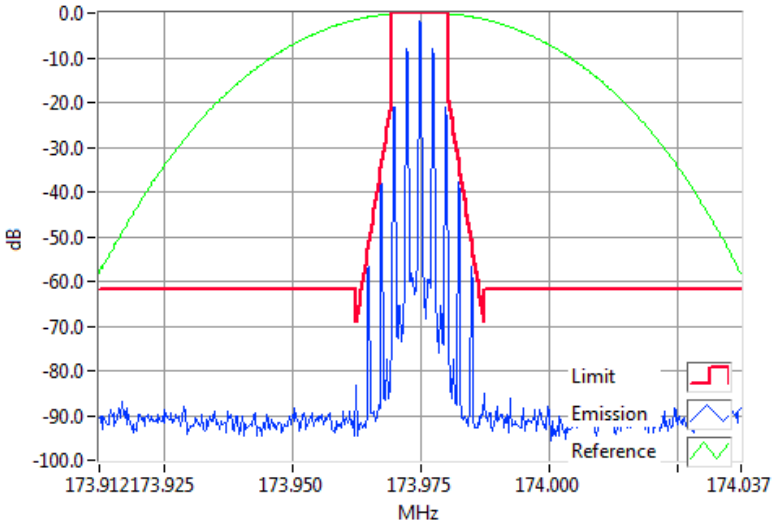
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 162.025 MHz 15 W 12.5 kHz Channel Spacing



Analogue Modulation 162.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 173.975 MHz 15 W 12.5 kHz Channel Spacing



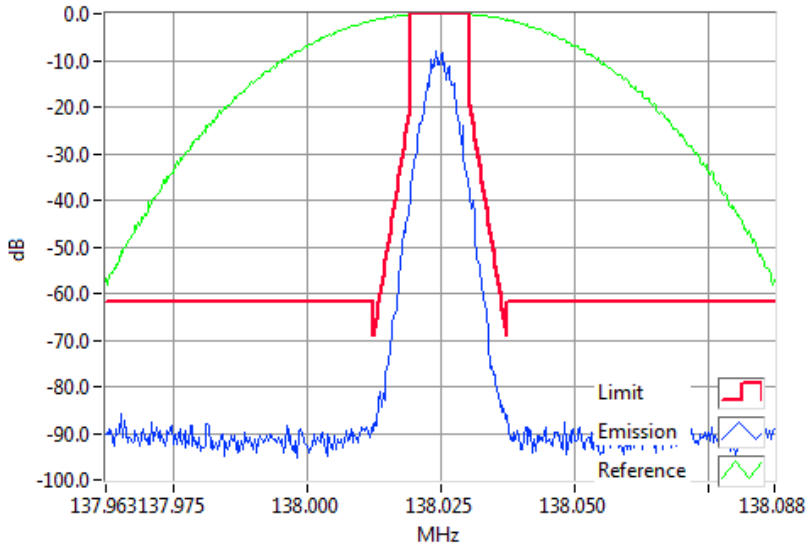
Analogue Modulation 173.9750MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

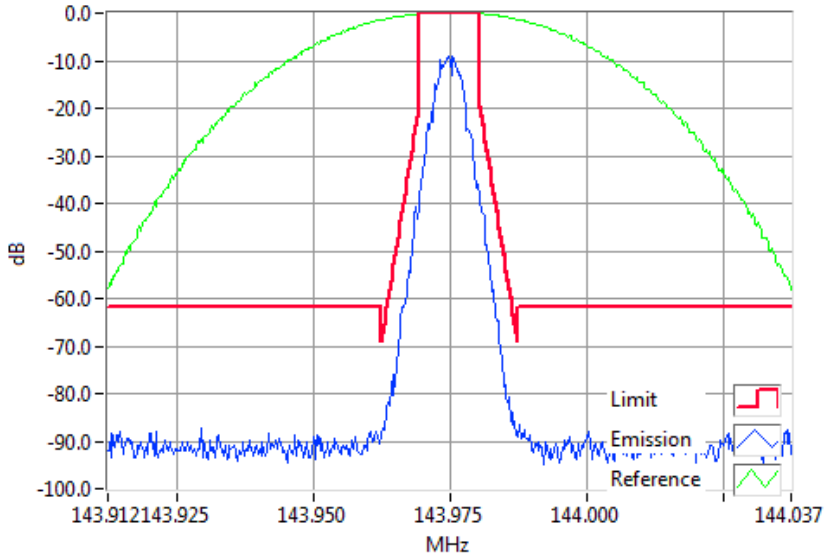
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 138.025 MHz 15 W 12.5 kHz Channel Spacing



DMR 138.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 143.975 MHz 15 W 12.5 kHz Channel Spacing



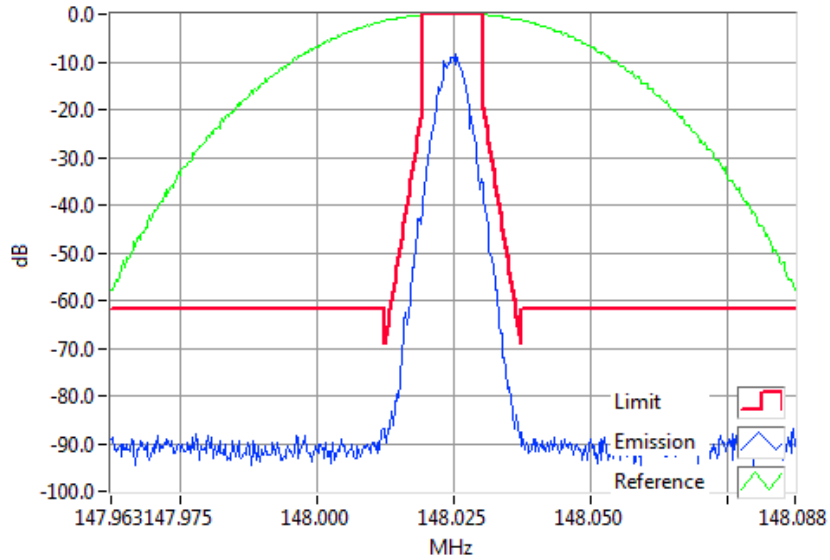
DMR 143.9750MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

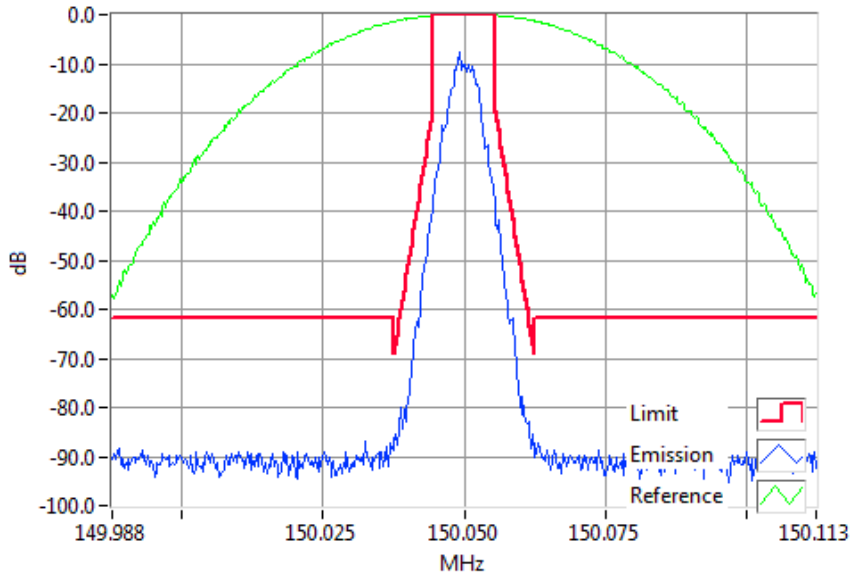
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 148.025 MHz 15 W 12.5 kHz Channel Spacing



DMR 148.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 150.05 MHz 15 W 12.5 kHz Channel Spacing



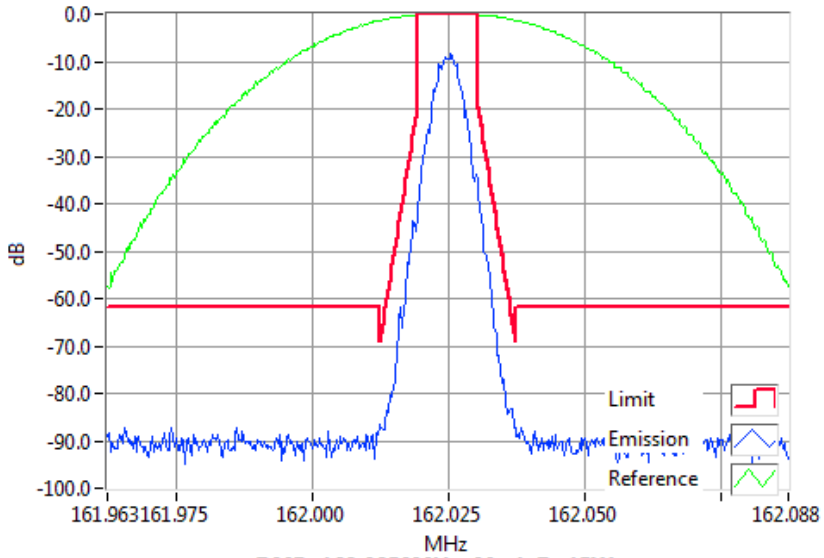
DMR 150.0500MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

DMR

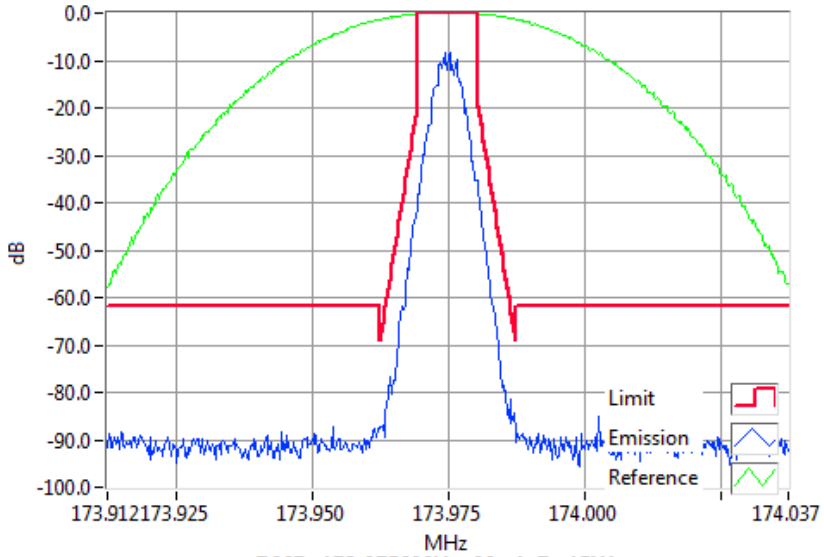
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 162.025 MHz 15 W 12.5 kHz Channel Spacing



DMR 162.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 173.975 MHz 15 W 12.5 kHz Channel Spacing



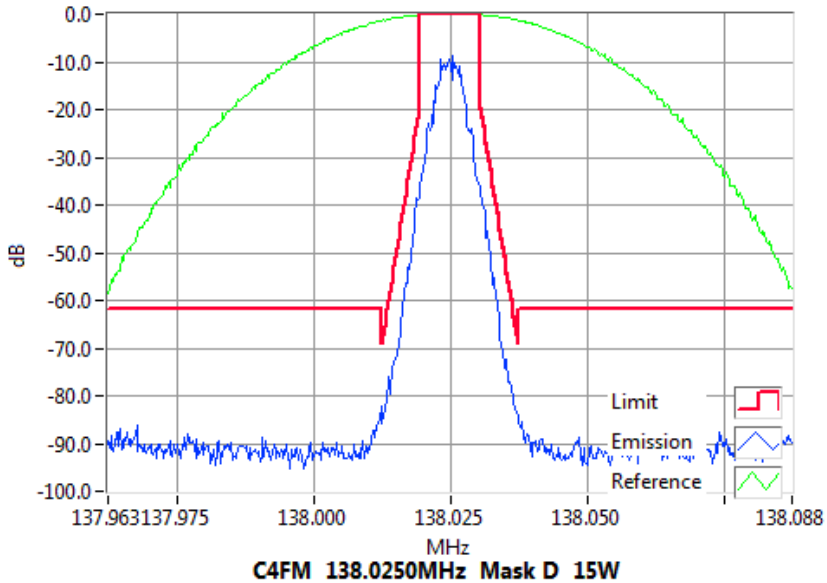
DMR 173.9750MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

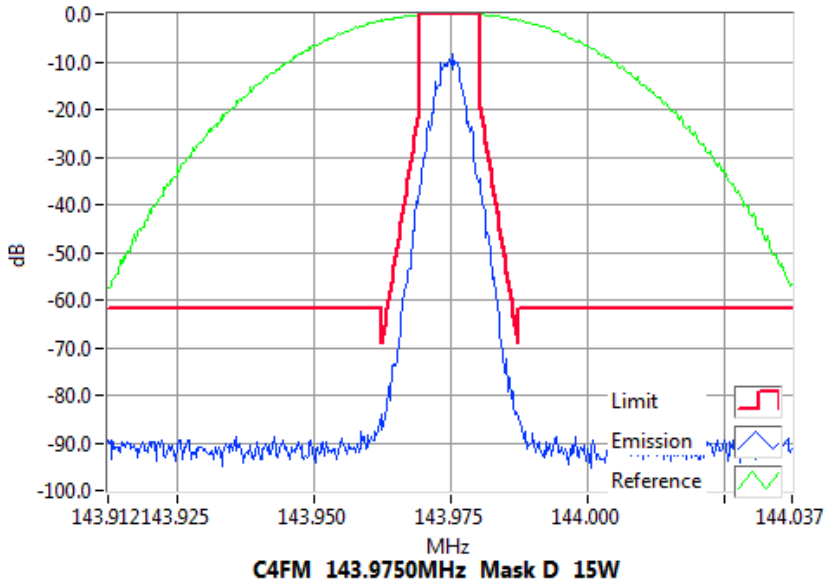
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 138.025 MHz 15 W 12.5 kHz Channel Spacing



C4FM 138.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 143.975 MHz 15 W 12.5 kHz Channel Spacing



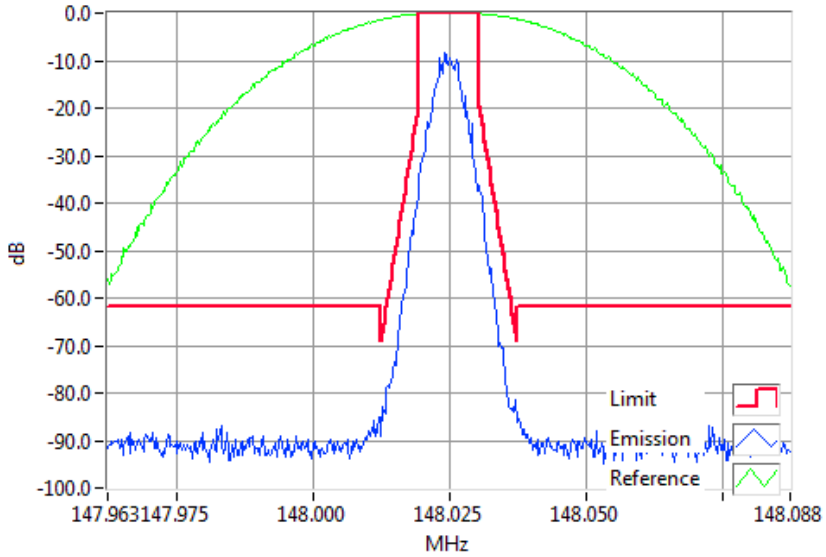
C4FM 143.9750MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

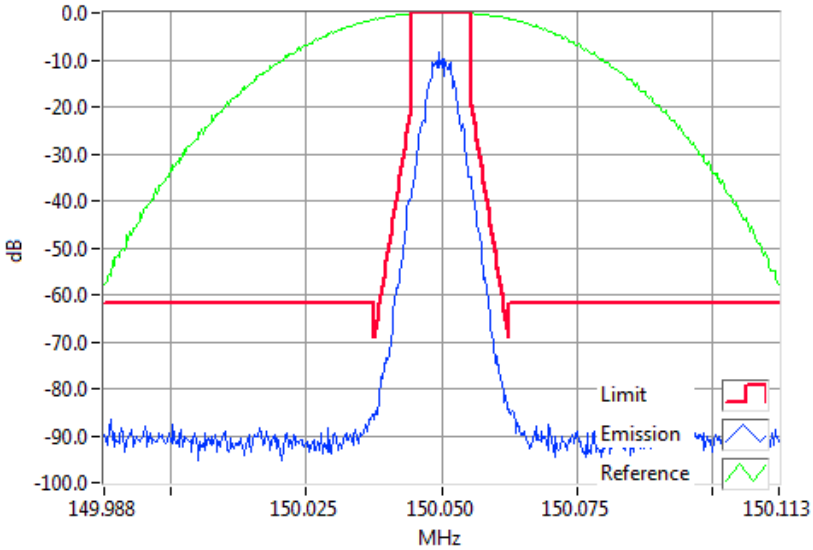
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 148.025 MHz 15 W 12.5 kHz Channel Spacing



C4FM 148.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 150.05 MHz 15 W 12.5 kHz Channel Spacing



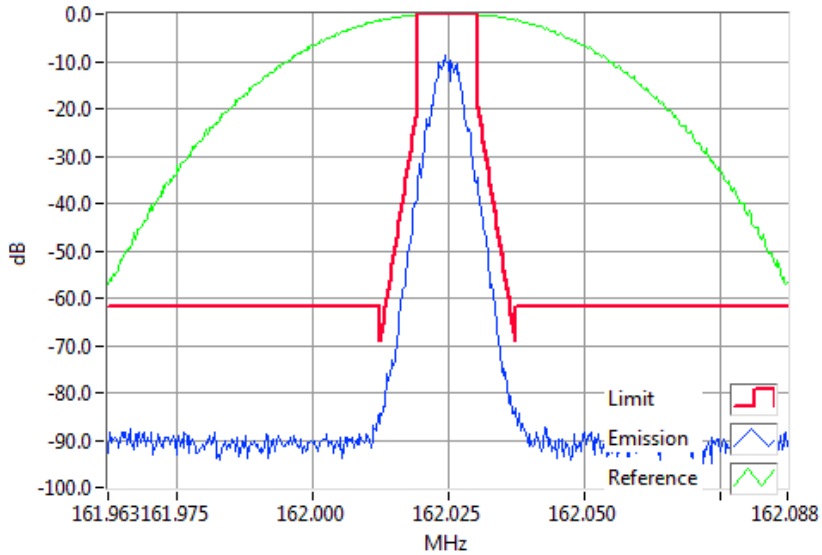
C4FM 150.0500MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Transmitter Spectrum Masks

P25 PHASE 1, C4FM

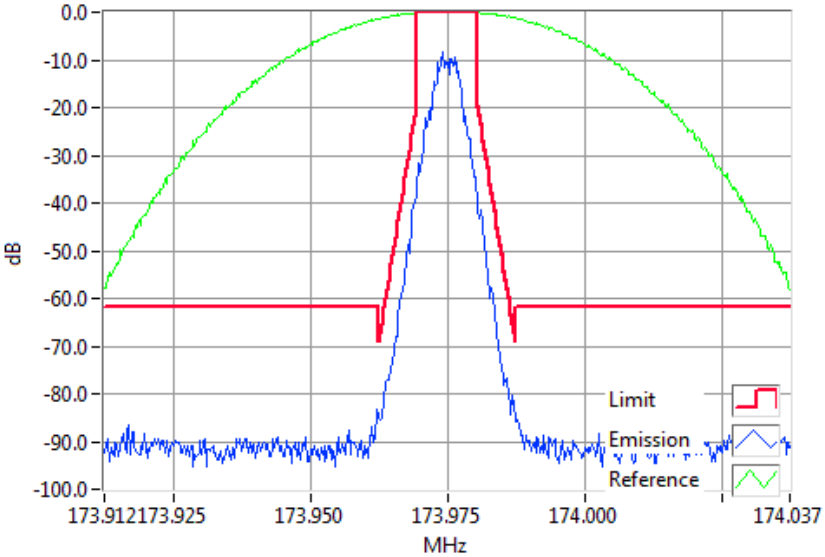
SPECIFICATION: FCC CFR 2.1049 (c) RSS-119 5.5

Tx FREQUENCY: 162.025 MHz 15 W 12.5 kHz Channel Spacing



C4FM 162.0250MHz Mask D 15W
RBW=100Hz, VBW=1000Hz, Detector Mode=Peak
Result=Pass

Tx FREQUENCY: 173.975 MHz 15 W 12.5 kHz Channel Spacing



C4FM 173.9750MHz Mask D 15W
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: 9 kHz to Fc-BW
   Fc+ BW to 10Fc (2 GHz)
3. The EUT was set to transmit 15 Watts, modulated with P25 Phase 1 (C4FM). 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 1GHz.
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)

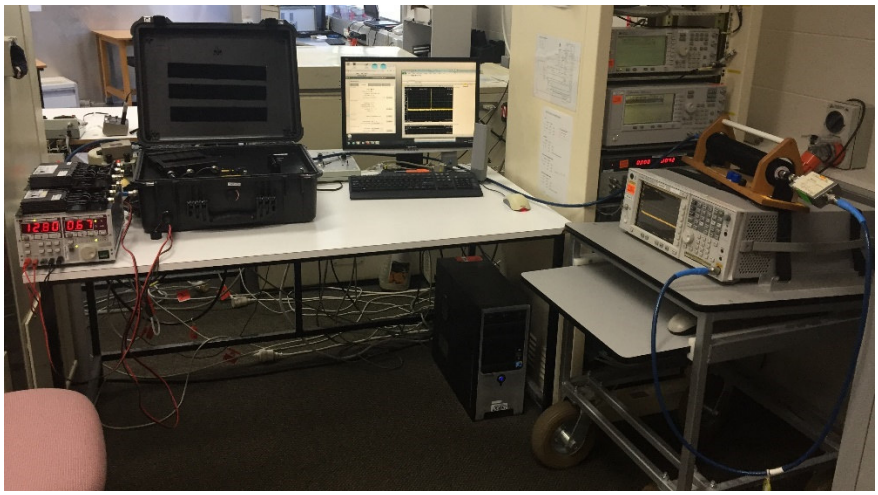
E5023 30dB 350W CK9178	31.86	
E5015 3m Blue 503429	0.36	
E5028 1m5 Blue 501868	0.14	
Total Attenuation @ 138.025MHz	32.36	Sum of component attenuation (a)
Amplitude offset	32.35	(b)
Correction @ 138.025 MHz	0.01	(a-b)

MEASUREMENT DATE: 21 February 2022

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)

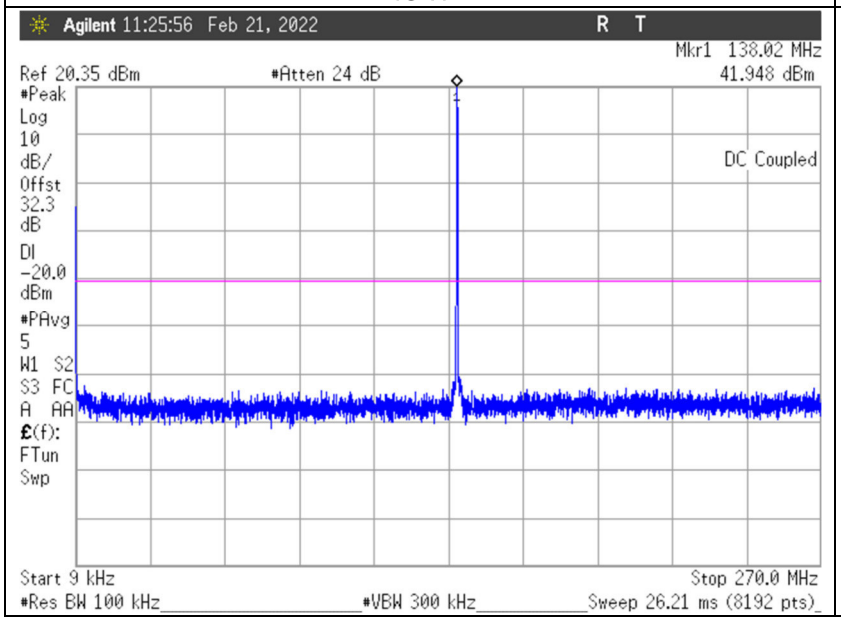
SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

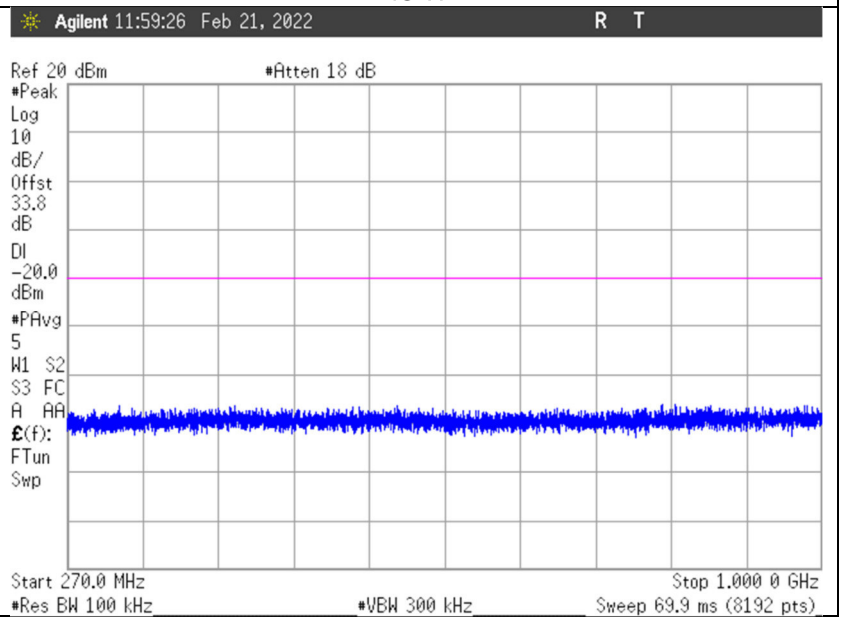
12.5 kHz Channel Spacing 138.025 MHz @ 15 W Emission Mask D

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.		

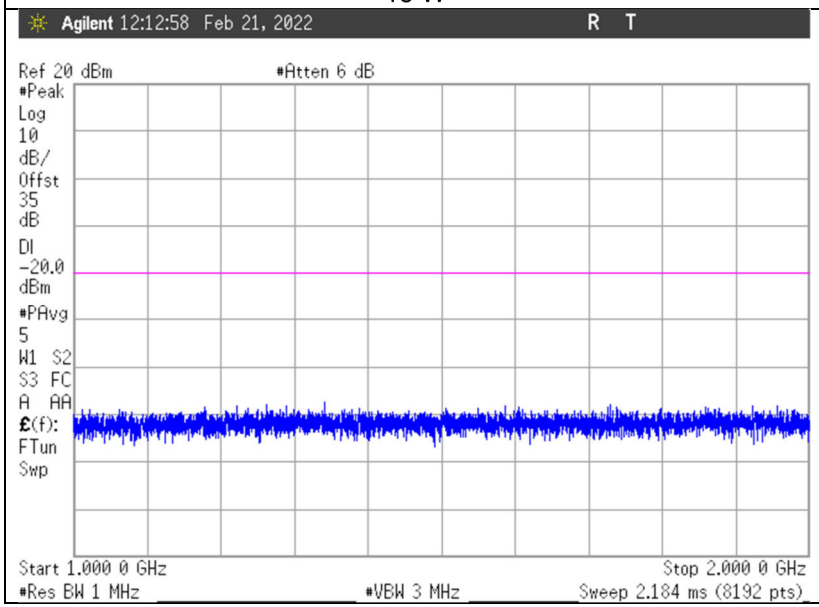
Spurious Emissions (Tx Conducted)

138.025 MHz, 9 kHz to 1 GHz scan	
15 W	15 W





Spurious Emissions (Tx Conducted)

138.025 MHz, 1 to 2 GHz scan	
15 W	
	

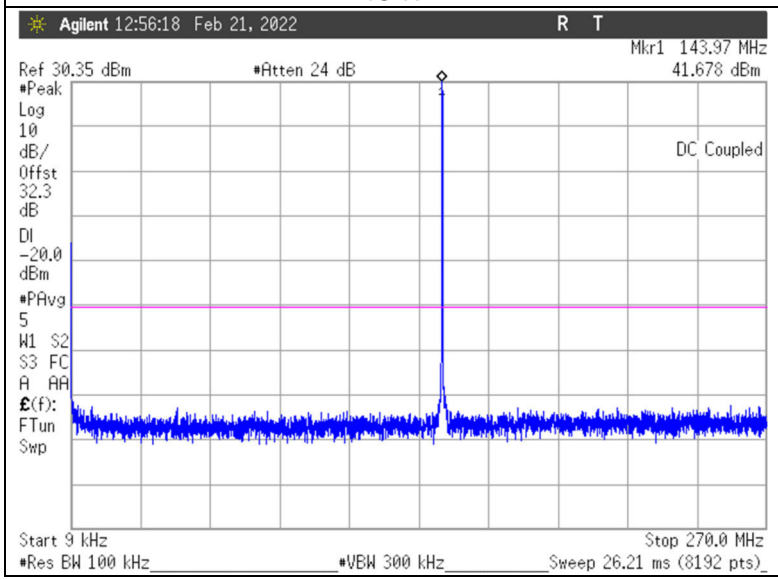
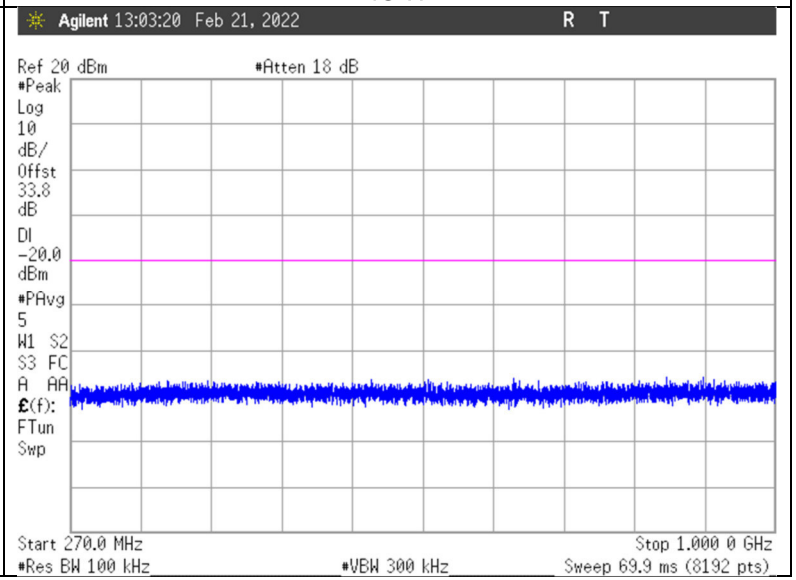
Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

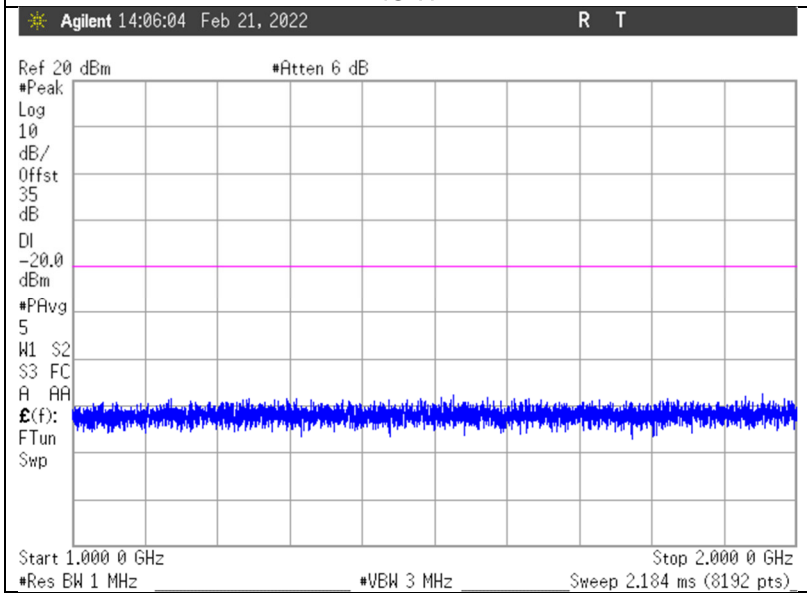
12.5 kHz Channel Spacing 143.975 MHz @ 15 W Emission Mask D

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)

143.975 MHz, 9 kHz to 1 GHz scan	
15 W	15 W
	

Spurious Emissions (Tx Conducted)

143.975 MHz, 1 to 2 GHz scan	
15 W	
	

Spurious Emissions (Tx Conducted)

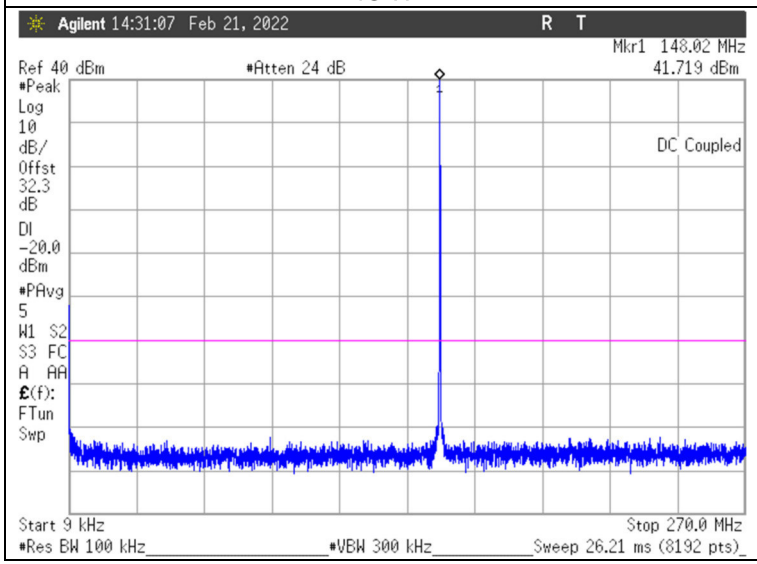
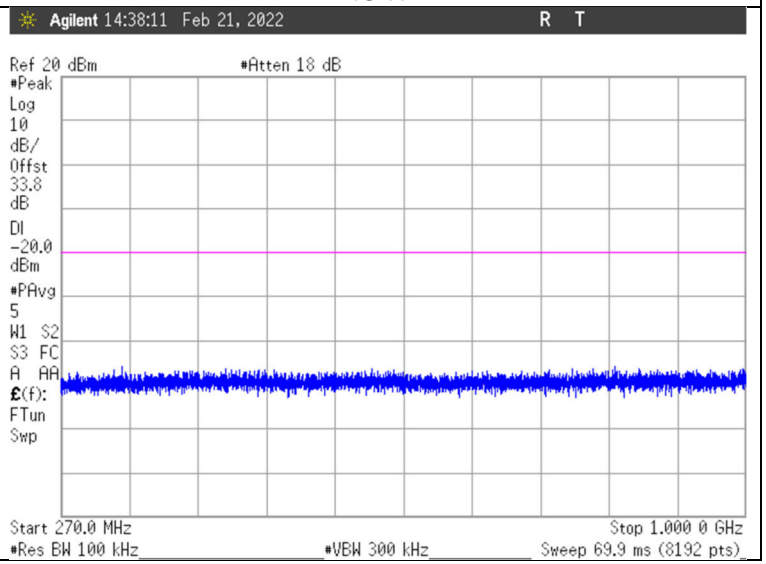
SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 148.025 MHz @ 15 W Emission Mask D

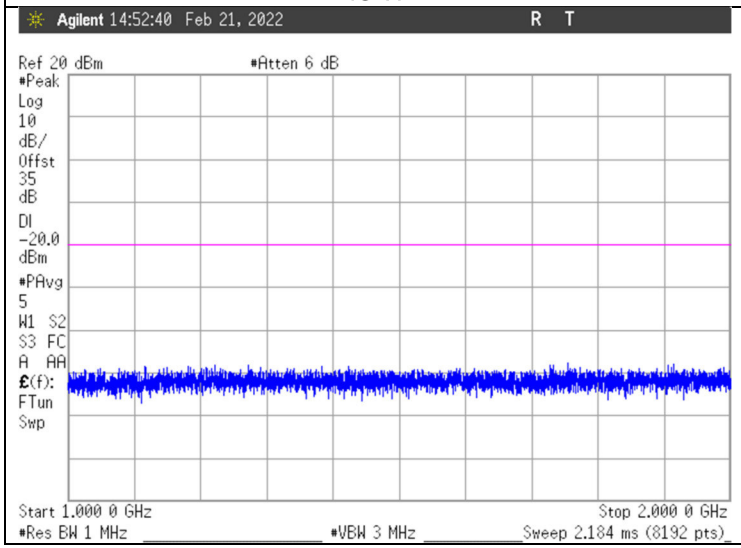
Emission Frequency (MHz)	Level (dBm)	Level (dBc)
~	~	~
Measurement Uncertainty:	≤12.75 GHz ± 3.0 dB	
No emissions were detected at a level greater than 20 dB below the limit.		

Spurious Emissions (Tx Conducted)

148.025 MHz, 9 kHz to 1 GHz scan

15 W	15 W
	

Spurious Emissions (Tx Conducted)

148.025 MHz, 1 to 2 GHz scan	
15 W	
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

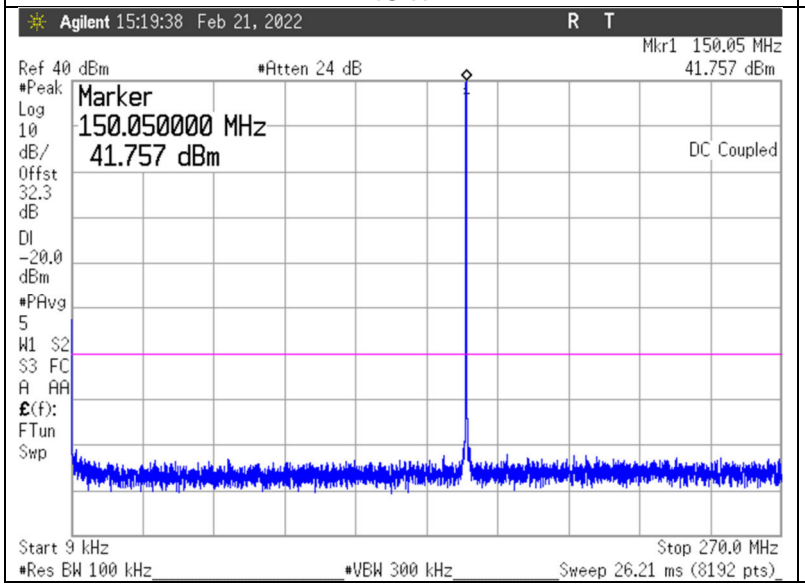
12.5 kHz Channel Spacing 150.05 MHz @ 15 W Emission Mask D

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.		

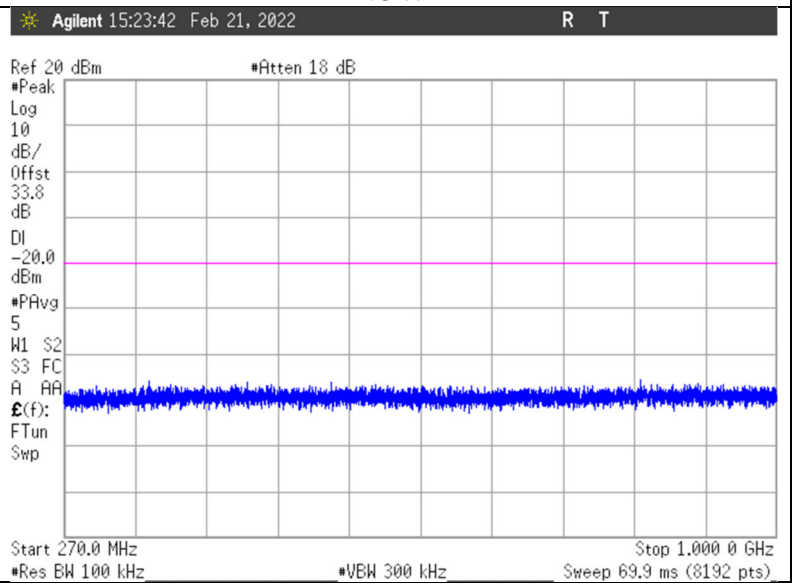
Spurious Emissions (Tx Conducted)

150.05 MHz, 9 kHz to 1 GHz scan

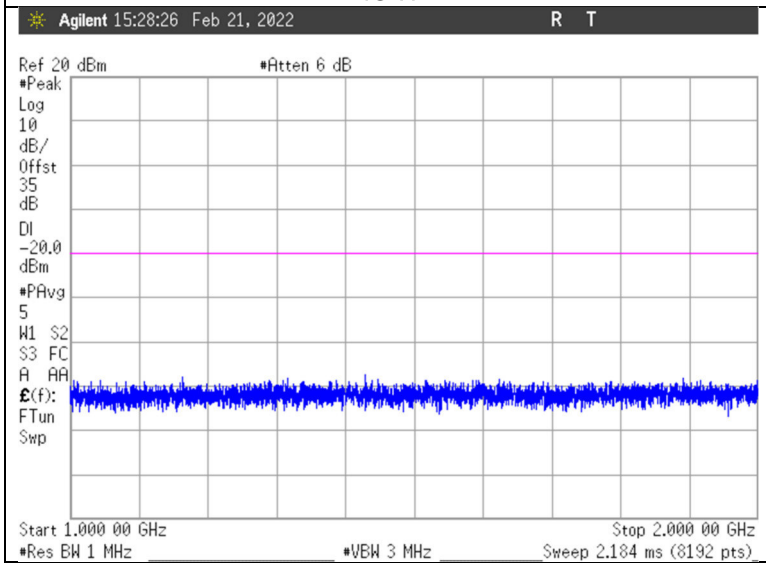
15 W



15 W



Spurious Emissions (Tx Conducted)

150.05 MHz, 1 to 2 GHz scan	
15 W	
	

Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC CFR 2.1051 RSS-119 5.8

12.5 kHz Channel Spacing 162.025 MHz @ 15 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)

162.025 MHz, 9 kHz to 1 GHz scan	
15 W	15 W