Report on the Radio Testing

For

PBE Europe Ltd

on

UHF Fibre fed Band Selective Booster

Report no. TRA-055956-47-02A

27th October 2022

Report Number: TRA-055956-47-02A
Issue: A

REPORT ON THE RADIO TESTING OF A
PBE Europe Ltd
UHF Fibre fed Band Selective Booster
WITH RESPECT TO SPECIFICATION
FCC 47CFR 90

TEST DATE: 1st August 2022 to 23rd August 2022

Written by: Steven Hodgkinson
Radio Test Engineer

Digitally signed by Steven Hodgkinson
DN: cn=Steven Hodgkinson, o, ou=Element Materials Technology Ltd, email=steven.hodgkinson@element.com, c=GB
Date: 2022.10.31 11:25:36 Z

Approved by: John Charters
Laboratory Manager

Digitally signed by John Charters
DN: cn=John Charters, o, ou=Element Materials Technology Ltd., email=john.charters@element.com, c=GB
Reason: I am approving this document
Date: 2022.10.31 14:11:10 Z

Date: 27th October 2022

0026

1 Revision Record

Issue Number	*Issue Date*	*Revision History*
A	27th October 2022	Original

2 Summary

TEST REPORT NUMBER:	TRA-055956-47-02A
WORKS ORDER NUMBER:	TRA-055956-08
PURPOSE OF TEST:	USA: Testing of radio frequency equipment per the relevant authorization procedure of chapter 47 of CFR (code of federal regulations) Part 2, subpart J.
TEST SPECIFICATION:	47CFR90
EQUIPMENT UNDER TEST (EUT):	UHF Fibre fed Band Selective Booster
FCC IDENTIFIER:	NEO61-105SERIES
EUT SERIAL NUMBER:	QUSU
MANUFACTURER/AGENT:	PBE Europe Ltd
ADDRESS:	1459 Wittens Mill Road North Tazewell VA 24630 United States
CLIENT CONTACT:	Zachary Lawless ☎ 0+1276988 5055 ✉ ZLawless@pbegrp.com
TEST DATE:	1st August 2022 to 23rd August 2022
TESTED BY:	Steven Hodgkinson Element

2.1 Test Summary

Test Method and Description	*Requirement Clause* *47CFR90*	*Applicable to this equipment*	**Result / Note**
Output power	90.219(e)(1)	☒	Pass
Noise figure	90.219(e)(2)	☒	See Note 1
Retransmitted masks	90.219(e)(4)(ii); 90.219(e)(4)(iii)	☒	Pass
Spurious emissions at antenna terminals	90.219(e)(3)	☒	Pass
Intermodulation products	90.219(d)(6)(i)	☒	Pass
Field strength of spurious radiation	90.219(e)(3)	☒	Pass
Frequency stability	90.213	☒	Pass
AGC Threshold Level	KDB 935210 D05 vo1r04 (4.2)	☒	Pass
Out of Band Rejection	KDB 935210 D05 vo1r04 (4.3)	☒	Pass
Input-versus-Output signal Comparison	KDB 935210 D05 vo1r04 (4.4)	☒	Pass
Mean Output power and Amplifier Gain	KDB 935210 D05 vo1r04 (4.5)	☒	Pass
Out-of-band/Out-of-block emissions, and spurious emissions (Including intermodulation)	KDB 935210 D05 vo1r04 (4.7.2) (4.7.3)	☒	Pass
Frequency Stability	KDB 935210 D05 vo1r04 (4.8)	☒	Pass
Radiated spurious emissions	KDB 935210 D05 vo1r04 (4.9)	☒	Pass

Notes:

The results contained in this report relate only to the items tested, in the condition at time of test, and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set-up and exercised using the configurations, modes of operation and arrangements defined in this report only. Any modifications made are identified in Section 8 of this report.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 5.2 of this test report (Deviations from Test Standards).

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

To show compliance with the -70 dBm limit the following calculation shall be used
Note: The Cable Loss (dB) + Splitter Loss (dB) - antenna gain (dBi) - 2.15 dB (EIRP to ERP conversion) must be greater than or equal to 5.63dB.

2) The Uplink direction is connected via cable, and not over the air, and therefore the Uplink was not tested.

3 Contents

1 Revision Record 3
2 Summary 4
2.1 Test Summary 5
3 Contents 6
4 Introduction 8
5 Test Specifications 9
5.1 Normative References 9
5.2 Deviations from Test Standards 9
6 Glossary of Terms 10
7 Equipment Under Test 11
7.1 EUT Identification 11
7.2 System Equipment 11
7.3 EUT Mode of Operation 11
7.3.1 Transmissions downlink 11
7.4 EUT Radio Frequency Parameters 11
7.4.1 General 11
7.5 EUT Description 11
8 Modifications 12
9 EUT Test Setup 13
9.1 Block Diagram 13
9.2 General Set-up Photograph 14
9.3 Measurement software 14
10 General Technical Parameters 15
10.1 Normal Conditions 15
10.2 Varying Test Conditions 15
11 Out-of-band rejection and f0 determination 16
11.1 Definition 16
11.2 Test Parameters 16
11.3 Test Limits 16
11.4 Test Method 16
11.5 Test Equipment 17
11.6 Test Results 18
12 Input/output power and amplifier/booster gain 21
12.1 Definition 21
12.2 Test Parameters 21
12.3 Test Limits 21
12.4 Test Method 21
12.5 Test Equipment 22
12.6 Test Results 23
13 Frequency stability 26
13.1 Definition 26
13.2 Test Parameters 26
13.3 Test Limits 26
13.4 Test Method 26
13.5 Test Equipment 27
13.6 Test Results 28
14 Out-of-band/out-of-block emissions conducted measurements 31
14.1 Definition 31
14.2 Test Parameters 31
14.3 Test Limits 31
14.4 Test Method 31
14.5 Test Equipment 32
14.6 Test Results 33
15 Input-versus-output signal comparison 45
15.1 Definition 45
15.2 Test Parameters 45
15.3 Test Limits 46
15.4 Test Method 47
15.5 Test Equipment 47
15.6 Test Results 48

16 Noise figure 73
16.1 Definition 73
16.2 Test Parameters 73
16.3 Test Limits 73
16.4 Test Method 74
16.5 Test Equipment 74
16.6 Test Results 75
17 EUT spurious emissions conducted measurements 76
17.1 Definition 76
17.2 Test Parameters 76
17.3 Test Limits 76
17.4 Test Method 76
17.5 Test Equipment 77
17.6 Test Results 78
18 Field strength of spurious radiation 81
18.1 Definitions 81
18.2 Test Parameters 81
18.3 Test Limits 81
18.4 Test Method 81
18.5 Test Equipment 83
18.6 Test Results 84
19 RF Exposure 87
20 Radio Testing – General Uncertainty Schedule 88

4 Introduction

This report TRA-055956-47-02A presents the results of the Radio testing on a PBE Europe Ltd, UHF Fibre fed Band Selective Booster to specification ‘47CFR90.219 Use of signal boosters.

The testing was carried out for PBE Europe Ltd by Element, at the address detailed below.

☐ Element Hull
Unit E
South Orbital Trading Park
Hedon Road
Hull
HU9 1NJ
UK

☒ Element Skelmersdale
Unit 1
Pendle Place
Skelmersdale
West Lancashire
WN8 9PN
UK

This report details the configuration of the equipment, the test methods used and any relevant modifications where appropriate.

FCC Site Listing:
The test laboratory is accredited for the above sites under the following US-UK MRA, Designation numbers.

Element Hull	UK2007
Element Skelmersdale	UK2020

The test site requirements of ANSI C63.4-2014 are met up to 1GHz.
The test site SVSWR requirements of CISPR 16-1-4:2010 are met over the frequency range 1 GHz to 18 GHz.

5 Test Specifications

5.1 Normative References

- FCC 47 CFR Ch. I – Part 90 – Private Land Mobile Radio Services
- FCC KDB Publication 935210 D05 v01r04 April 3, 2020 – Measurements guidance for industrial and non-consumer signal booster, repeater and amplifier devices.
- TIA-603-E-2016 – Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
- ANSI C63.26-2015 – American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

5.2 Deviations from Test Standards

There were no deviations from the test standard.

6 Glossary of Terms

§	Denotes a section reference from the standard, not this document
AC	Alternating Current
AM	Amplitude Modulated
AWGN	Additive White Gaussian Noise
BW	Bandwidth
C	Celcius
CW	Continuous Wave
Class A	Class A signal booster is designed to retransmit signals on one or more specific channels where none of its passbands exceed 75kHz.
Class B	Class B signal booster is designed to retransmit any signals within a wide frequency band greater than 75kHz.
dB	Decibels
dBm	dB relative to 1 milliwatt
CDMA	Code Division Multiple Access – a modulation technique used in cellular networks
DC	Direct Current
EIRP	Equivalent Isotropically Radiated Power
emf	electromotive force
erp	Effective Radiated Power
EUT	Equipment Under Test
f	Frequency
FCC	Federal Communications Commission
GSM	Group Special Mobile – a cellular network standard
Hz	Hertz
IC	Industry Canada (now ISED)
IF	Intermediate Frequency
ISED	Innovation, Science and Economic Development Canada
ITU	International Telecommunication Union
KDB	Knowledge Data Base (of the FCC Office of Engineering and Technology).
LO	Local Oscillator
m	metre
max	Maximum
min	Minimum
N/A	Not Applicable
No.	Number
PCB	Printed Circuit Board
PDF	Portable Document Format
PLMR	Private Land Mobile Radio
RE	Radio Equipment
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	Receiver
s	Second
Tx	Transmitter
UKAS	United Kingdom Accreditation Service
V	Volt
W	Watt
Ω	Ohm

7 Equipment Under Test

7.1 EUT Identification

- Name: UHF Fibre fed Band Selective Booster
- Serial Number: QUSU
- Model Number: 61105001
- Software Revision: SW01018 CBS Target Software v2.1.3
- Build Level / Revision Number: A

7.2 System Equipment

Equipment listed below forms part of the overall test setup and is required for equipment functionality and/or monitoring during testing. The compliance levels achieved in this report relate only to the EUT and not items given in the following list.

HP ProBook 4540s

7.3 EUT Mode of Operation

7.3.1 Transmissions downlink

The repeater test software was via a Web GUI, each of the operating bands were enabled.
The test signals used: CW, FM, P25

7.4 EUT Radio Frequency Parameters

7.4.1 General

Frequency of operation:	410.0 MHz to 430.0 MHz
Passband gain:	35.51 dB
Supported channel bandwidth(s) & class:	Class B > 75 kHz
Rated mean output power (P_{rated}):	37.0 dBm
Modulations used:	16K0F3E, 11K3F3E, 8K10F1E, 9K80F1E,
Nominal Supply Voltage:	115 Vac

7.5 EUT Description

The EUT is a fibre fed repeater covering the frequency band 410.0 MHz to 430 MHz frequency band.
Only one 5 MHz portion of the 20 MHz passband can be selected at any one time.
As the equipment is Fibre fed equipment, only the downlink was measured.

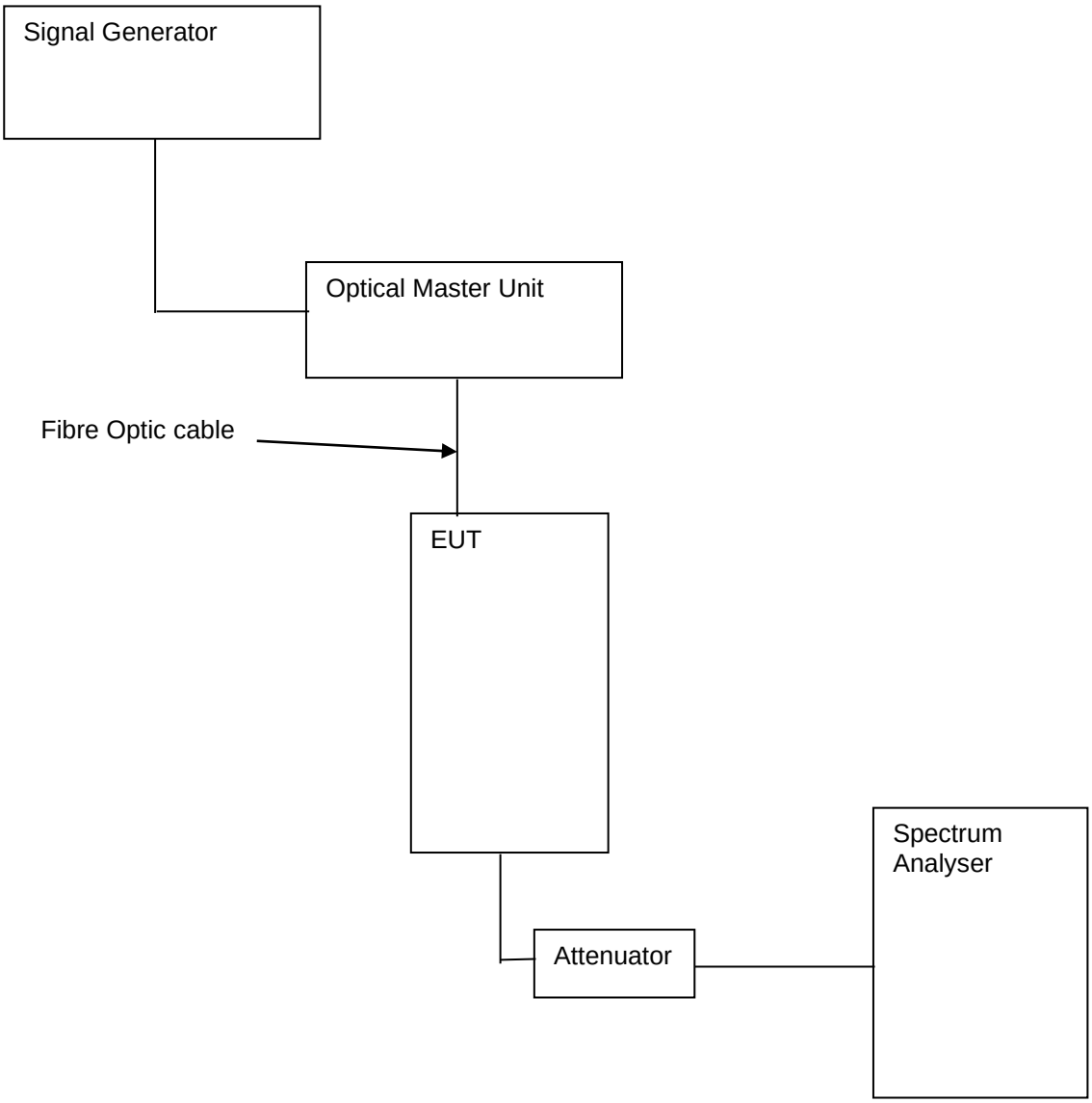
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

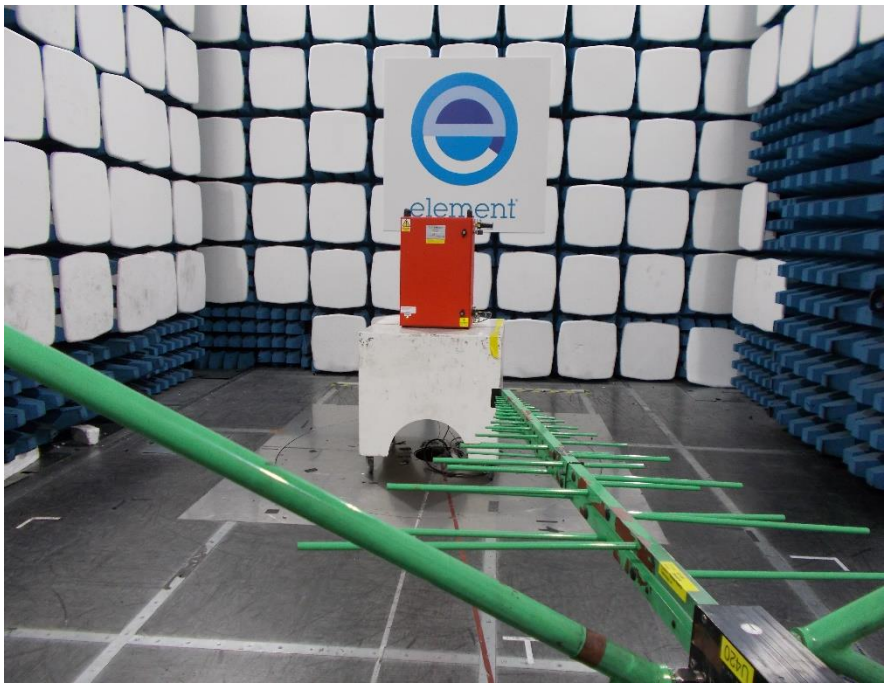
9.1 Block Diagram

The following diagram shows basic EUT interconnections:



9.2 General Set-up Photograph

The following photograph shows basic EUT set-up:



9.3 Measurement software

Where applicable, the following software was used to perform measurements contained within this report.

Element Emissions R5 (See Note)
Element Transmitter Bench Test (See Note)
ETS Lindgren EMPower V1.0.4.2

Note:

The version of the Element software used is recorded in the results sheets contained within this report.

10 General Technical Parameters

10.1 Normal Conditions

The E U T was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was 115 Vac from the mains.

10.2 Varying Test Conditions

Variation of temperature is required to ensure stability of the declared fundamental frequency. During frequency error testing the following variations were made:

	Category	***Variation***
☒	Standard	-30 to +50 C in 10 degree steps
☐	Extended	-

Variation of supply voltage is required to ensure stability of the declared output power and frequency. During carrier power and frequency error testing the following variations were made:

	Category	***Nominal***	***Variation***
☒	Mains	115V ac +/-2%	85% and 115%
☐	Battery	New battery	N/A

11 Out-of-band rejection and f0 determination

11.1 Definition

The passband is the range of frequencies over which the booster is intended to apply gain. Each booster may include one or more passbands. The bandwidth of each passband is defined by two points either side of the band where the gain has fallen by 20dB from maximum.

11.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	KDB 935210 D05 v01R04, Clause 4.3
Frequencies Measured:	410 MHz-415 MHz/417.5 MHz-422.5 MHz/425 MHz-430 MHz (+/-250% declared pass band)
Source Modulation:	CW
Maximum Source Level:	2.41 dBm (3dB below the AGC threshold)
Deviations from Standard:	None
Bandwidth:	RBW 50 kHz (1-5% pass band); VBW 200 kHz (3xRBW).
Measurement Detector:	Peak; Max-Hold.

Environmental Conditions (Normal Environment)

Temperature: 24°C	+15 ºC to +35 ºC (as declared)
Humidity: 32 %RH	20%RH to 75%RH (as declared)
Supply: 115 Vac	

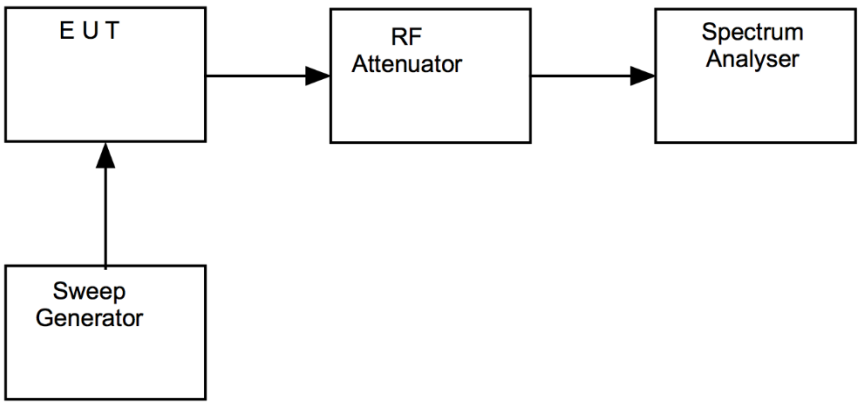
11.3 Test Limits

Not specified.

11.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure v, the 20dB bandwidth of the EUT was measured on a spectrum analyser.
The measurements were performed with EUT set at its nominal / maximum gain.

Figure v Test Setup

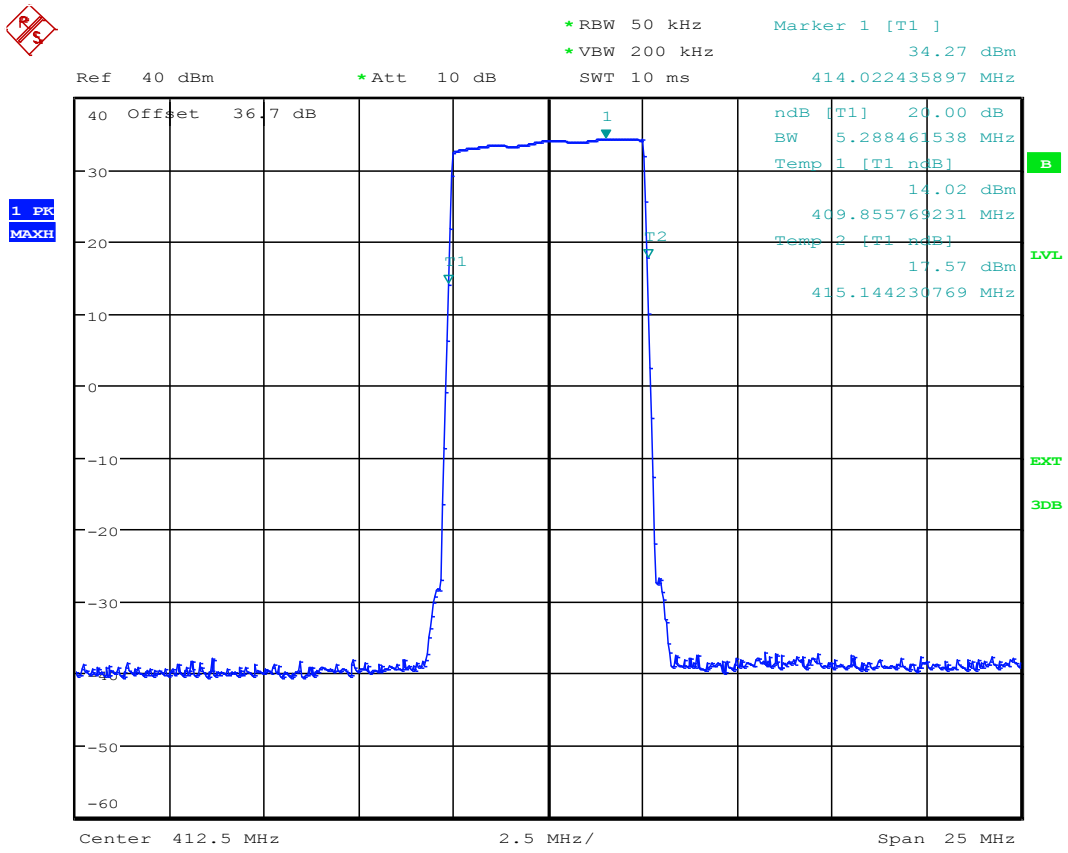


11.5 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Signal Generator	R&S	SMBV100A	REF916	2022-05-30	12	2023-05-30
Spectrum Analyser	R&S	FSU46	U405	2022-05-21	12	2023-04-21
Multimeter	Agilent	34405a	REF976	2021-12-21	12	2022-12-21
Power Supply	Kikusui	PCR4000L	UH580	USE REF976		
Attenuator	Bird	10 dB	L112	USE REF916 AND U405		
Attenuator	Aerial Facilities	20 dB	U729	USE REF916 AND U405		
Attenuator	Huber & Suhner	6 dB	U551	USE REF916 AND U405		

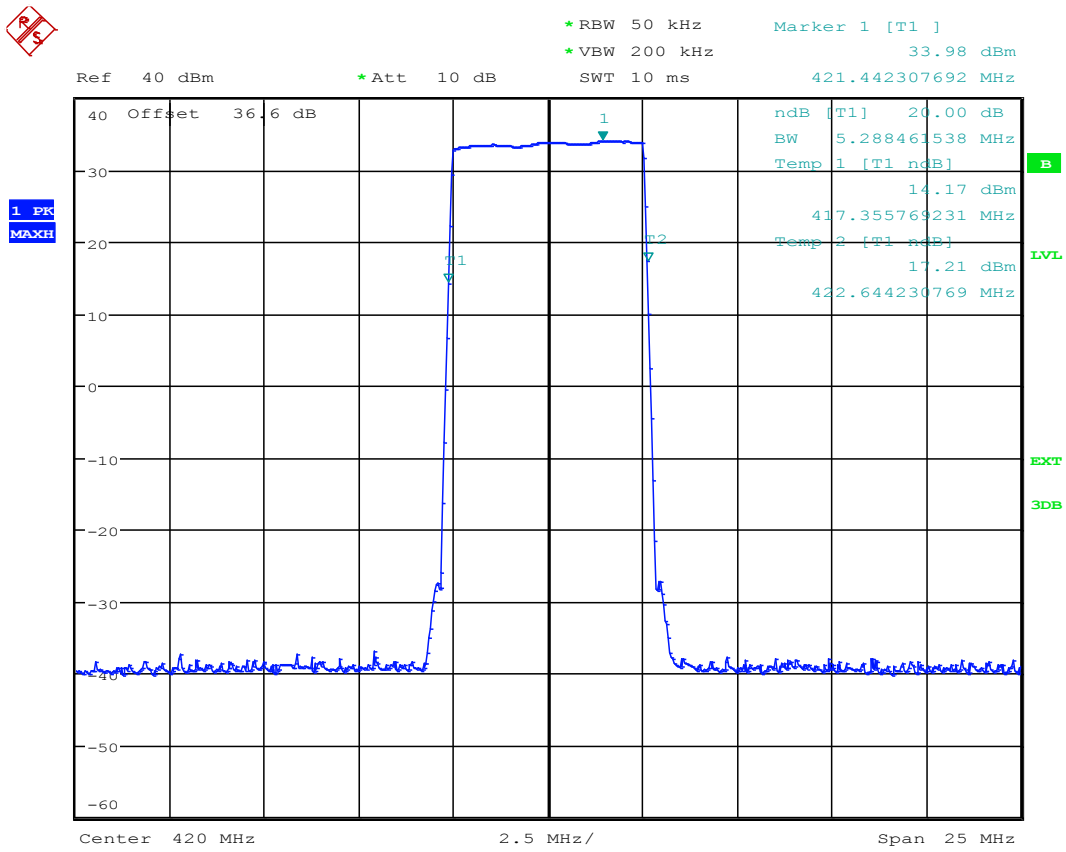
11.6 Test Results

Downlink: Bottom 5 MHz Passband 410 MHz - 415 MHz



Pass Band Nominal Centre (MHz)	*Lower Mkr Frequency (MHz)*	*Upper Mkr Frequency (MHz)*	*20dB Bandwidth (MHz)*	*F0 (MHz)*
412.5 MHz	409.855769	415.144230	5.28	414.022435

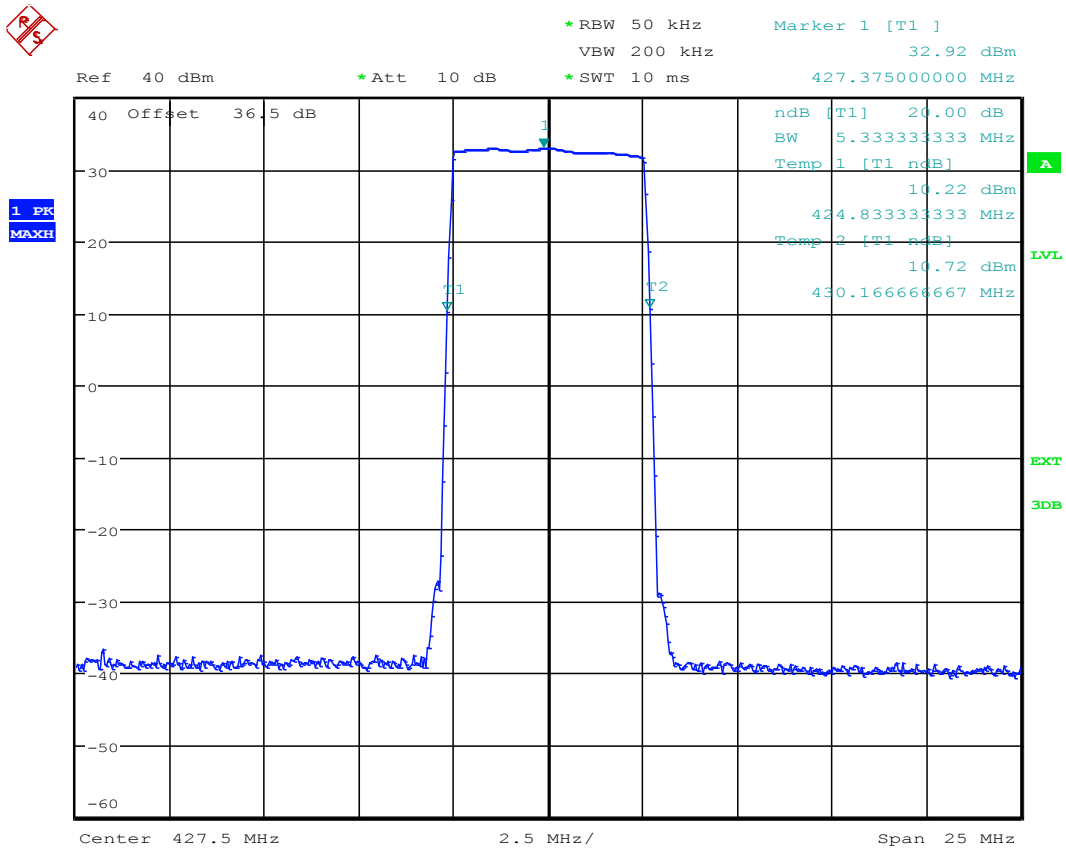
Downlink: Mid 5 MHz Passband 417.5 MHz - 422.5 MHz



Date: 10.AUG.2022 13:06:16

Pass Band Nominal Centre (MHz)	*Lower Mkr Frequency (MHz)*	*Upper Mkr Frequency (MHz)*	*20dB Bandwidth (MHz)*	*F0 (MHz)*
420.000	417.355769	422.644230	5.28	421.442307

Downlink:Top 5 MHz Passband 425 MHz-430 MHz



Date: 1.AUG.2022 13:06:06

Pass Band Nominal Centre (MHz)	*Lower Mkr Frequency (MHz)*	*Upper Mkr Frequency (MHz)*	*20dB Bandwidth (MHz)*	*F0 (MHz)*
427.500	424.833333	430.166666	5.33	427.375000

12 Input/output power and amplifier/booster gain

12.1 Definition

The average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions.

12.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	KDB 935210 D05 v01r04, clause 4.5
EUT Operating Frequencies Tested:	414.022435 MHz / 421.442307 MHz / 427.375000 MHz
Source Modulations:	CW
Source Level:	5.6 dBm (maximum input rating)
Deviations from Standard:	None
Bandwidth:	RBW 100 kHz; VBW 3xRBW
Span:	1 MHz
Measurement Detector:	Peak; Max-Hold.

Environmental Conditions (Normal Environment)

Temperature: 21°C	+15 ºC to +35 ºC (as declared)
Humidity: 36%RH	20%RH to 75%RH (as declared)
Supply: 115 Vac	

12.3 Test Limits

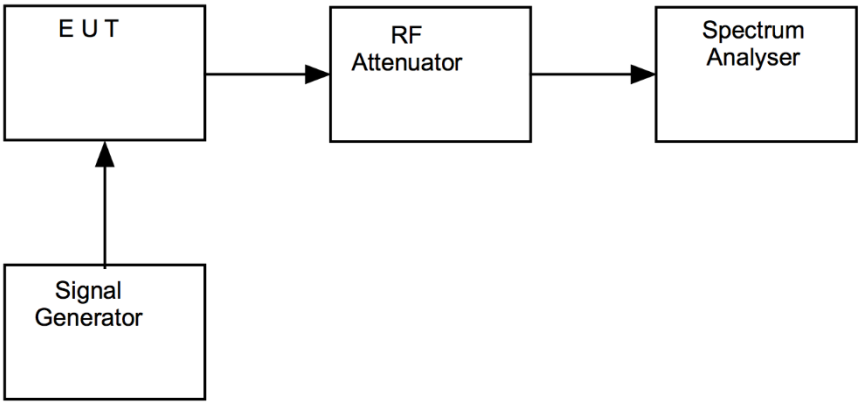
The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.[1]

12.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure i, the power of the EUT was calculated by taking into account any cable and attenuator calibration factors. It was confirmed that at the maximum input level there was no compression.
Gain was calculated by removing the EUT from the setup and measuring the signal generator to EUT level.

[1] Note, as of December 27, 2018 Railroad licensees may operate Class A signal boosters transmitting on a single channel with up to 30 Watts ERP on frequencies 452/457.9000 to 452/457.96875 MHz in areas where communication between the front and rear of trains is unsatisfactory due to distance or intervening terrain barriers.

Figure i Test Setup



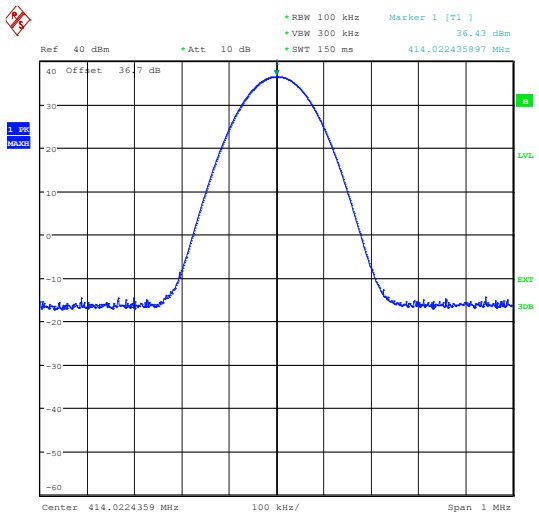
12.5 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Signal Generator	R&S	SMBV100A	REF916	2022-05-30	12	2023-05-30
Spectrum Analyser	R&S	FSU46	U405	2022-05-21	12	2023-04-21
Multimeter	Agilent	34405a	REF976	2021-12-21	12	2022-12-21
Power Supply	Kikusui	PCR4000L	UH580	USE REF976		
Attenuator	Bird	10 dB	L112	USE REF916 AND U405		
Attenuator	Aerial Facilities	20 dB	U729	USE REF916 AND U405		
Attenuator	Huber & Suhner	6 dB	U551	USE REF916 AND U405		

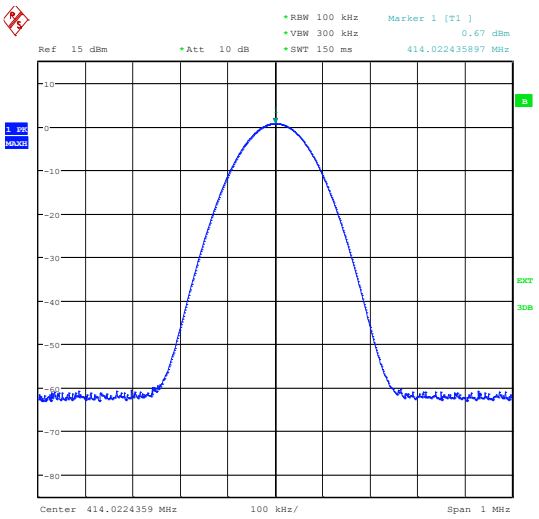
12.6 Test Results

Downlink: Lower 5 MHz Passband: AGC Threshold f0: 414.022435 MHz						
Channel Fo Frequency (MHz)	***Modulation***	***Signal Generator Input Level (dBm)***	***Conducted Output Power (dBm)***	***Rated Output Power (dBm)***	***Gain (dB)***	***Result***
414.022435	CW	0.67	36.43	37.00	35.76	PASS

EUT

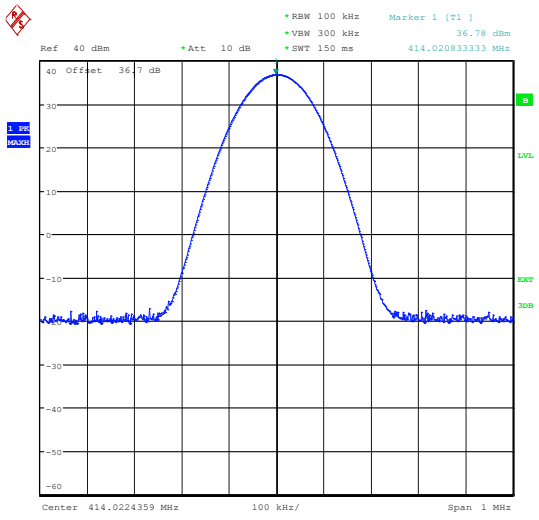


Signal Generator

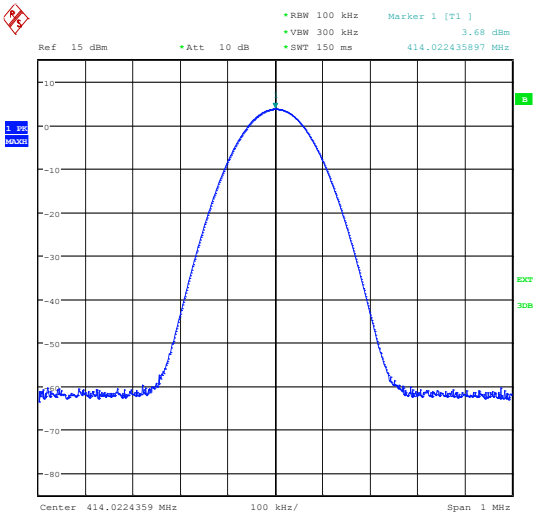


Downlink: Lower 5 MHz Passband: AGC+3 dB above threshold f0:414.022435 MHz						
Channel Fo Frequency (MHz)	***Modulation***	***Signal Generator Input Level (dBm)***	***Conducted Output Power (dBm)***	***Rated Output Power (dBm)***	***Gain (dB)***	***Result***
414.022435	CW	3.68	36.78	37.0	33.1	PASS

EUT

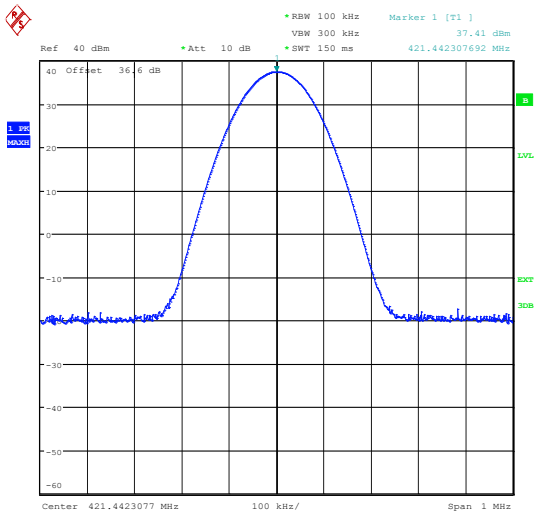


Signal Generator



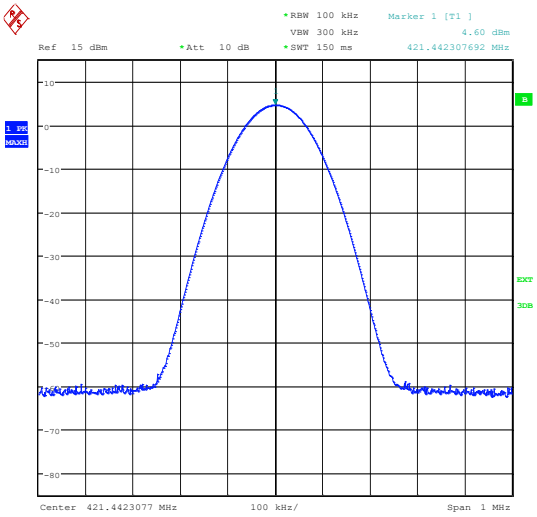
Downlink: Mid 5 MHz Passband: AGC Threshold f0:421.442307 MHz						
Channel Fo Frequency (MHz)	**Modulation**	**Signal Generator Input Level (dBm)**	**Conducted Output Power (dBm)**	**Rated Output Power (dBm)**	**Gain (dB)**	**Result**
421.442307	CW	4.60	37.41	37.00	32.81	PASS

EUT



Date: 10.AUG.2022 13:12:09

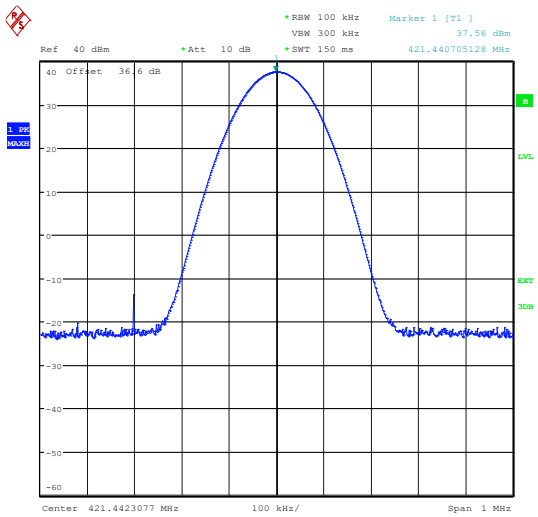
Signal Generator



Date: 10.AUG.2022 13:14:34

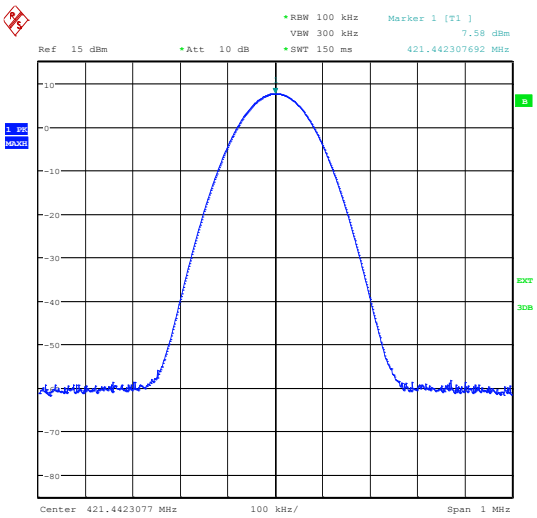
Downlink: Mid 5 MHz Passband: AGC+3 dB above threshold f0:421.442307 MHz						
Channel Fo Frequency (MHz)	**Modulation**	**Signal Generator Input Level (dBm)**	**Conducted Output Power (dBm)**	**Rated Output Power (dBm)**	**Gain (dB)**	**Result**
421.442307	CW	7.58	37.56	37.00	29.98	PASS

EUT



Date: 10.AUG.2022 13:12:47

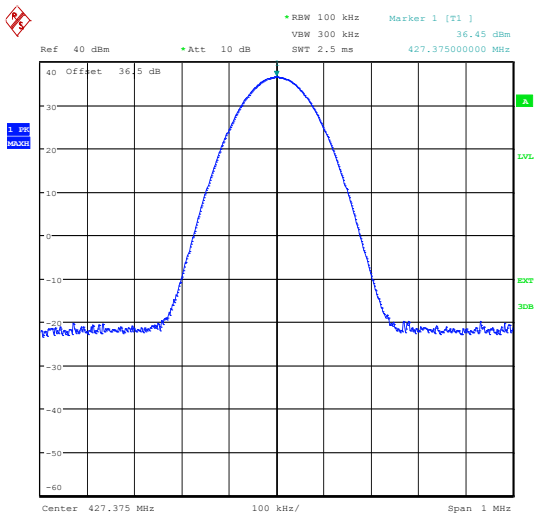
Signal Generator



Date: 10.AUG.2022 13:15:18

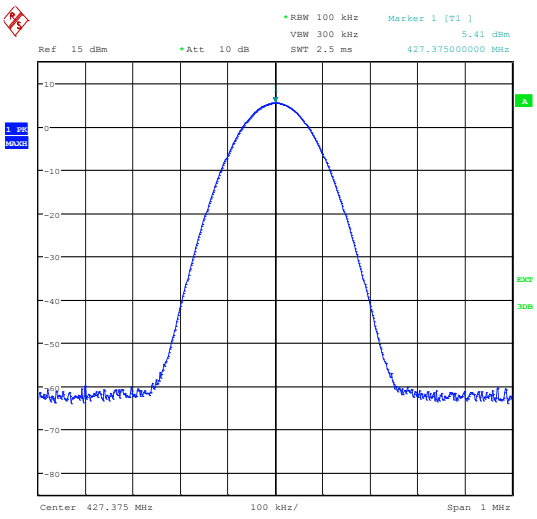
Downlink: Top 5 MHz Passband: AGC Threshold f0:427.375 MHz						
Channel Fo Frequency (MHz)	**Modulation**	**Signal Generator Input Level (dBm)**	**Conducted Output Power (dBm)**	**Rated Output Power (dBm)**	**Gain (dB)**	**Result**
427.375	CW	5.41	36.45	37.0	31.04	PASS

EUT



Date: 1.AUG.2022 13:12:20

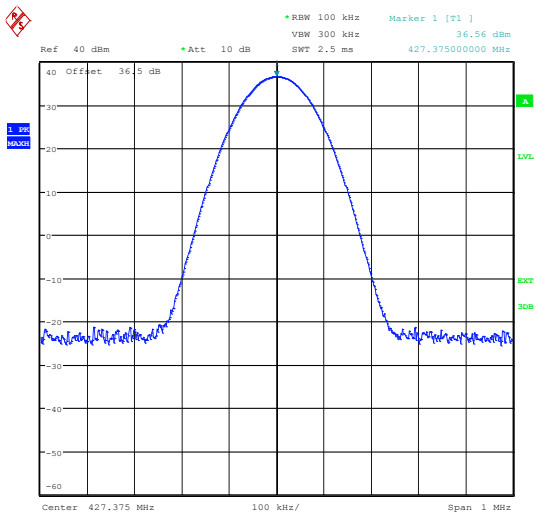
Signal Generator



Date: 1.AUG.2022 13:18:58

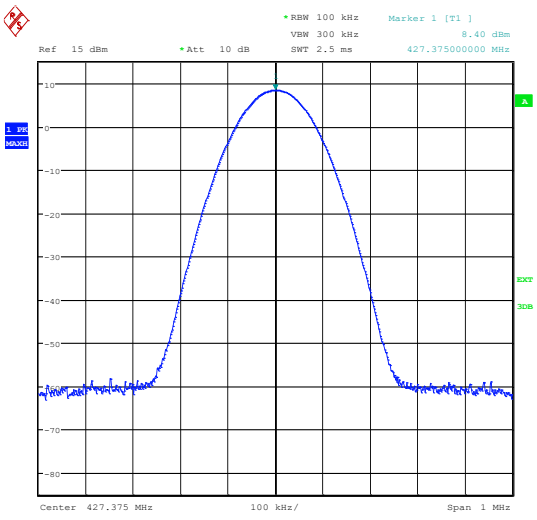
Downlink: Top 5 MHz Passband: AGC+3 dB above threshold f0: 427.375 MHz						
Channel Fo Frequency (MHz)	**Modulation**	**Signal Generator Input Level (dBm)**	**Conducted Output Power (dBm)**	**Rated Output Power (dBm)**	**Gain (dB)**	**Result**
427.375	CW	8.40	36.56	37.0	28.16	PASS

EUT



Date: 1.AUG.2022 13:14:42

Signal Generator



Date: 1.AUG.2022 13:18:33

13 Frequency stability

13.1 Definition

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20C and rated supply voltage.

13.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	Part 90.213(a), KDB 935210 D05 v01r04 (4.8) ANSI C63.26.(5.6.3)
Deviations from Standard:	None
Temperature Extreme Environment Test Range:	-30 to +50 C
Voltage Extreme Environment Test Range:	Mains Power = ±15% of Nominal; Battery: nominal and end point;

Environmental Conditions (Normal Environment)

Temperature: 24 °C	Standard Requirement: +20 ºC
Humidity: 55 %RH	20%RH to 75%RH (as declared)

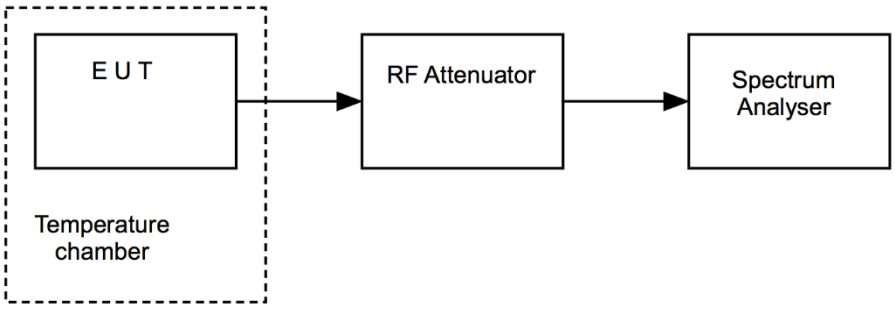
13.3 Test Limits

The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, *provided that* the retransmitted signals meet the requirements of § 90.213 (§ RSS-119) for the equipment with which the zone enhancer is to be used.

13.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure viii, the EUT local oscillator frequency was measured under varying conditions of temperature and supply voltage. Measurements were made once temperature stability was achieved at each temperature.

Figure viii Test Setup



13.5 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Signal Generator	R&S	SMBV100A	REF916	2022-05-30	12	2023-05-30
Spectrum Analyser	R&S	FSU46	U405	2022-05-21	12	2023-04-21
Temperature Indicator	52 Series II	Fluke	L426	2022-07-18	12	2023-07-18
Multimeter	Agilent	34405a	REF976	2021-12-21	12	2022-12-21
Power Supply	Kikusui	PCR4000L	UH580	USE REF976		
Temperature Chamber	ETS	ETS-S1000CHS	U522	USE L426		
Attenuator	Bird	10 dB	L112	USE REF916 AND U405		
Attenuator	Aerial Facilities	20 dB	U729	USE REF916 AND U405		
Attenuator	Huber & Suhner	6 dB	U551	USE REF916 AND U405		

13.6 Test Results

Downlink: Bottom 5 MHz passband:410.025 MHz						
Vnom Vac	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
115	-30 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass
115	-20 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass
115	-10 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass
115	0 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass
115	10 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass
115	20 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass
115	30 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass
115	40 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass
115	50 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass
Voltage Variation						
Vnom 85%-115%	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
97.75	+20 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass
132.25	+20 °C	410.02499968	-0.00032100	-0.00078288	1.5	Pass

Downlink: Bottom 5 MHz passband:414.975 MHz						
Vnom Vac	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
115	-30 °C	414.97500000	0.00000000	0.00000000	1.5	Pass
115	-20 °C	414.97500000	0.00000000	0.00000000	1.5	Pass
115	-10 °C	414.97500000	0.00000000	0.00000000	1.5	Pass
115	0 °C	414.97500000	0.00000000	0.00000000	1.5	Pass
115	10 °C	414.97500000	0.00000000	0.00000000	1.5	Pass
115	20 °C	414.97500000	0.00000000	0.00000000	1.5	Pass
115	30 °C	414.97500000	0.00000000	0.00000000	1.5	Pass
115	40 °C	414.97500000	0.00000000	0.00000000	1.5	Pass
115	50 °C	414.97500000	0.00000000	0.00000000	1.5	Pass
Voltage Variation						
Vnom 85%-115%	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
97.75	+20 °C	414.97500000	0.00000000	0.00000000	1.5	Pass
132.25	+20 °C	414.97500000	0.00000000	0.00000000	1.5	Pass

Downlink: Middle 5 MHz passband:417.525 MHz						
Vnom Vac	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
115	-30 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass
115	-20 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass
115	-10 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass
115	0 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass
115	10 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass
115	20 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass
115	30 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass
115	40 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass
115	50 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass
Voltage Variation						
Vnom 85%-115%	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
97.75	+20 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass
132.25	+20 °C	417.52499968	-0.00032100	-0.00076882	1.5	Pass

Downlink: Middle 5 MHz passband:422.475 MHz						
Vnom Vac	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
115	-30 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass
115	-20 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass
115	-10 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass
115	0 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass
115	10 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass
115	20 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass
115	30 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass
115	40 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass
115	50 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass
Voltage Variation						
Vnom 85%-115%	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
97.75	+20 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass
132.25	+20 °C	422.47499968	-0.00032100	-0.00075981	1.5	Pass

Downlink: Top 5 MHz passband:425.025 MHz						
Vnom Vac	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
115	-30 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass
115	-20 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass
115	-10 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass
115	0 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass
115	10 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass
115	20 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass
115	30 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass
115	40 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass
115	50 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass
Voltage Variation						
Vnom 85%-115%	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
97.75	+20 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass
132.25	+20 °C	425.02499966	-0.00034000	-0.00079995	1.5	Pass

Downlink: Top 5 MHz passband:429.975 MHz						
Vnom Vac	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
115	-30 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass
115	-20 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass
115	-10 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass
115	0 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass
115	10 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass
115	20 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass
115	30 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass
115	40 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass
115	50 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass
Voltage Variation						
Vnom 85%-115%	**Temperature °C**	**Frequency MHz**	**Drift kHz**	**Drift ppm**	**Limit ppm**	**Result**
97.75	+20 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass
132.25	+20 °C	429.97499966	-0.00034000	-0.00079074	1.5	Pass

14 Out-of-band/out-of-block emissions conducted measurements

14.1 Definition

Spurious intermodulation products result from intermodulation between: – the oscillations at the carrier, characteristic, or harmonic frequencies of an emission, or the oscillations resulting from the generation of the carrier or characteristic frequency; and – oscillations of the same nature, of one or several other emissions, originating from the same transmitting system or from other transmitters or transmitting systems.

14.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	Part 90.219(d)(6)(i), KDB 935210 D05 v01r04, (4.7.2) (4.7.3)
EUT Operating Frequencies Tested, f_0:	414.0224359 MHz/421.4423077 MHz/427.37500 MHz
Source Tones:	f_0 +/- 12.5 kHz/25 kHz
Max Source Level:	5.1 dBm (AGC threshold); 8.1 dBm (3dB above)
Deviations from Standard:	None
Bandwidth:	RBW 300 Hz; VBW 3xRBW
Span:	100 kHz
Measurement Detector:	Max Hold, rms.

Environmental Conditions (Normal Environment)

Temperature: 21°C	+15 ºC to +35 ºC (as declared)
Humidity: 50%RH	20%RH to 75%RH (as declared)
Supply: 115 Vac	

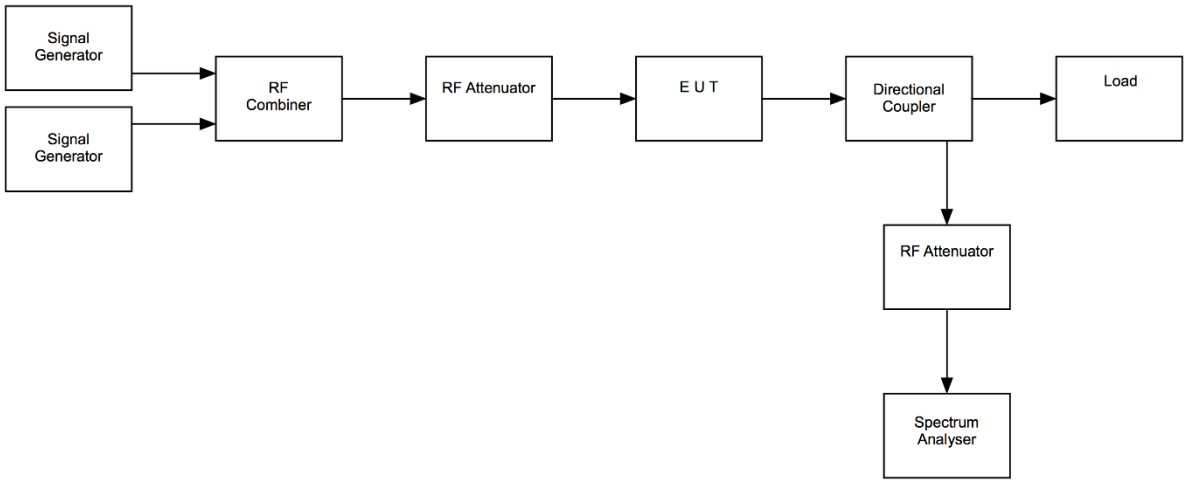
14.3 Test Limits

No specific intermodulation products are specified, instead refer to the appropriate emission 47CFR90.210 unwanted emissions limits.

14.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure vi, two tones were input to the EUT. The combined level at the EUT input was set by the attenuator to just below the EUT AGC threshold level and the intermodulation products were measured on the spectrum analyser.
The measurement was repeated with the input attenuator decreased by 3dB.

Figure vi Test Setup



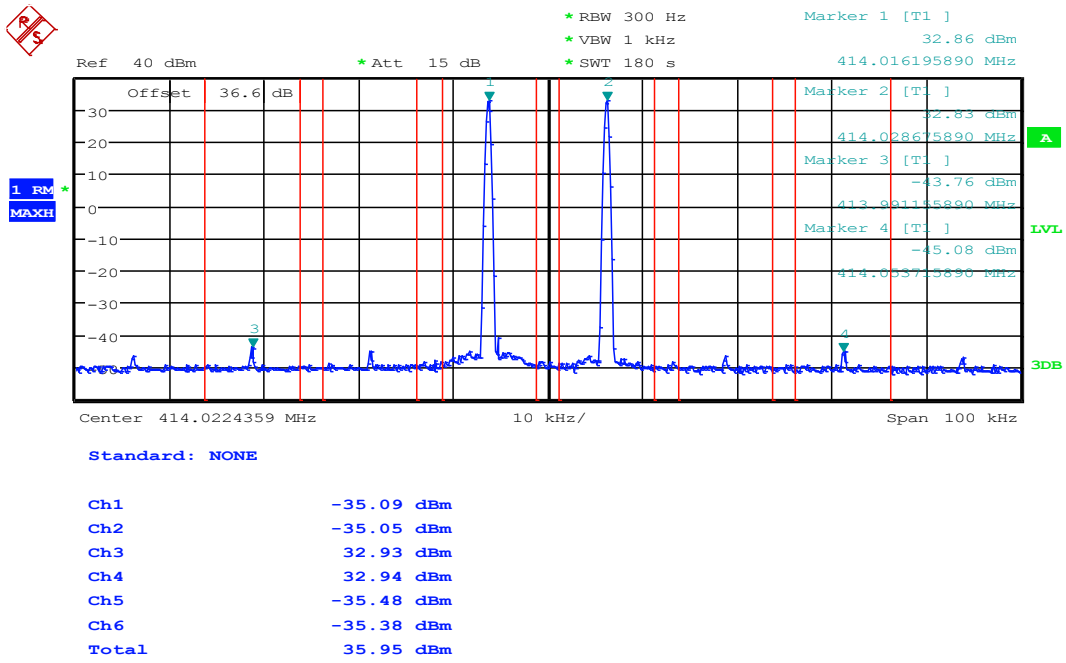
14.5 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Spectrum Analyser	R&S	FSU26	U405	2022-04-21	12	2023-04-21
Signal Generator	Marconi	2042	L176	2021-09-10	12	2022-09-10
Signal Generator	Marconi	2023	UH105	2021-08-19	12	2022-08-19
Signal Combiner	PBE	05-003503	-	Cal USE U405 AND L176		
Attenuator	Bird	10 dB	L112	Cal USE U405 AND L176		
Attenuator	Aerial Facilities	20 dB	U729	Cal USE U405 AND L176		
Attenuator	Huber & Suhner	6 dB	U551	Cal USE U405 AND L176		

14.6 Test Results

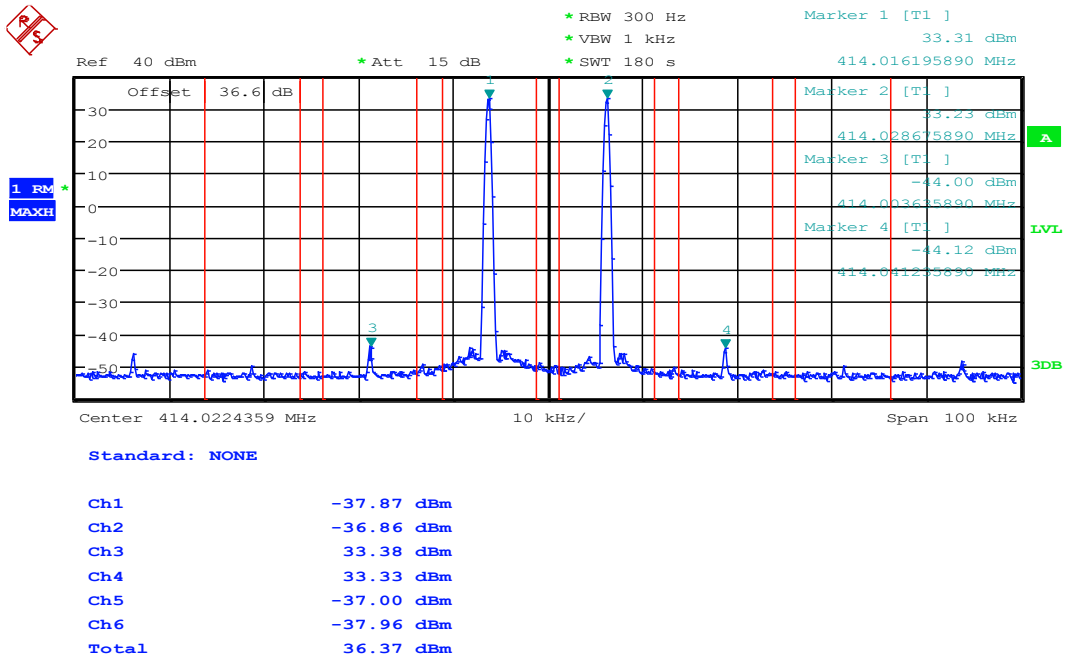
Bottom 5 MHz downlink

Downlink Intermodulation @ AGC threshold 12.5 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	****Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
414.0224359	414.0161859	414.0286859	414.003635	-35.05	-30 dBm	Pass



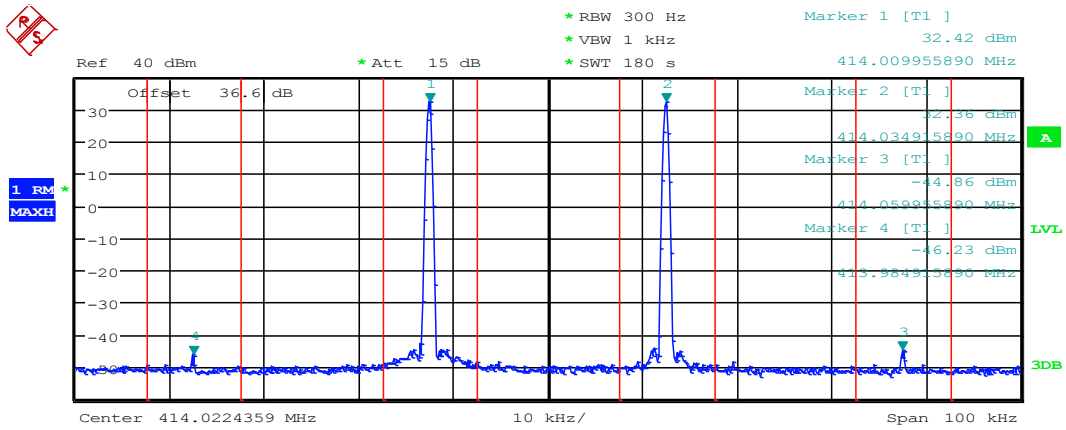
The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

Downlink Intermodulation @ 3dB above AGC threshold 12.5 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
414.0224359	414.0161859	414.0286859	414.003635	-36.86	-30 dBm	Pass



The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

Downlink Intermodulation @ AGC threshold 25 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
414.0224359	414.0099359	414.0349359	414.059955 413.984915	-35.79	-30 dBm	Pass



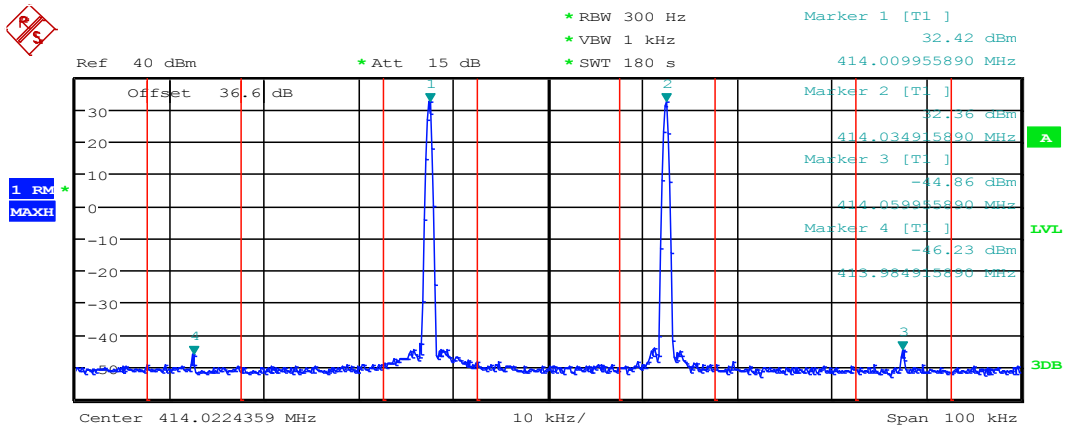
Standard: NONE

Tx Channels

Ch1	-35.79 dBm
Ch2	32.57 dBm
Ch3	32.57 dBm
Ch4	-35.79 dBm
Total	35.58 dBm

The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

Downlink Intermodulation @ 3dB above AGC threshold 25 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
414.0224359	414.0099359	414.0349359	414.059955 413.984915	-35.79	-30 dBm	Pass



Standard: NONE

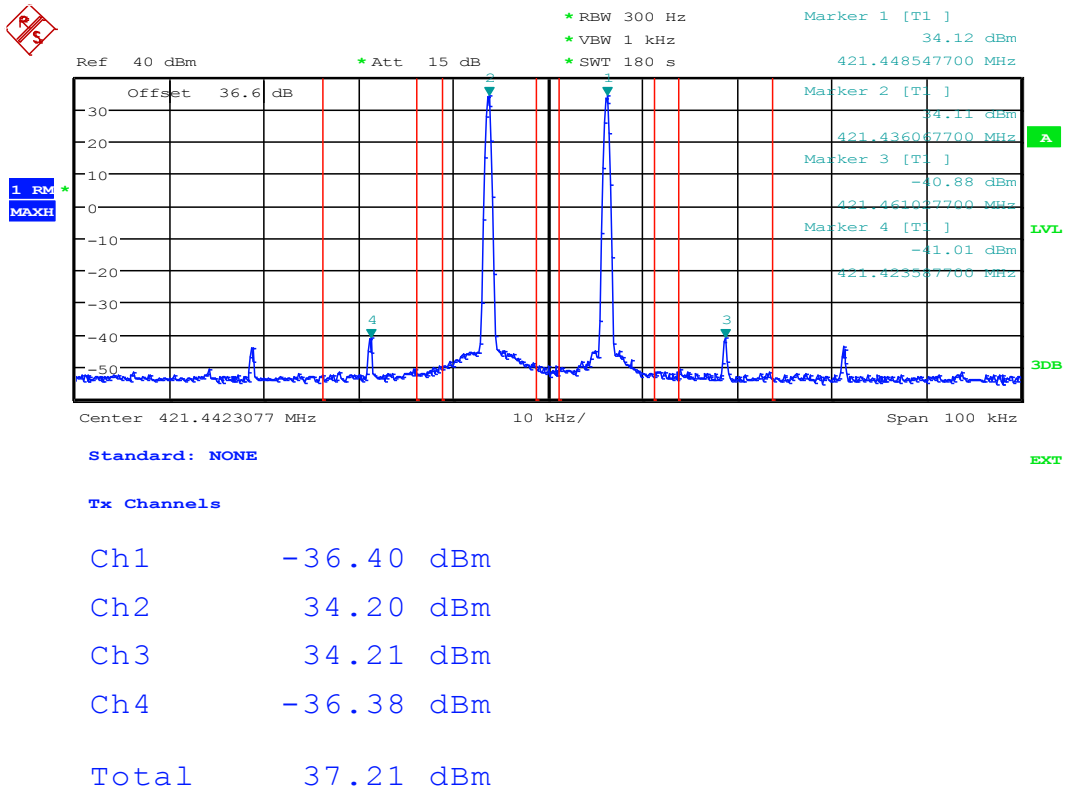
Tx Channels

Ch1	-35.79 dBm
Ch2	32.57 dBm
Ch3	32.57 dBm
Ch4	-35.79 dBm
Total	35.58 dBm

The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

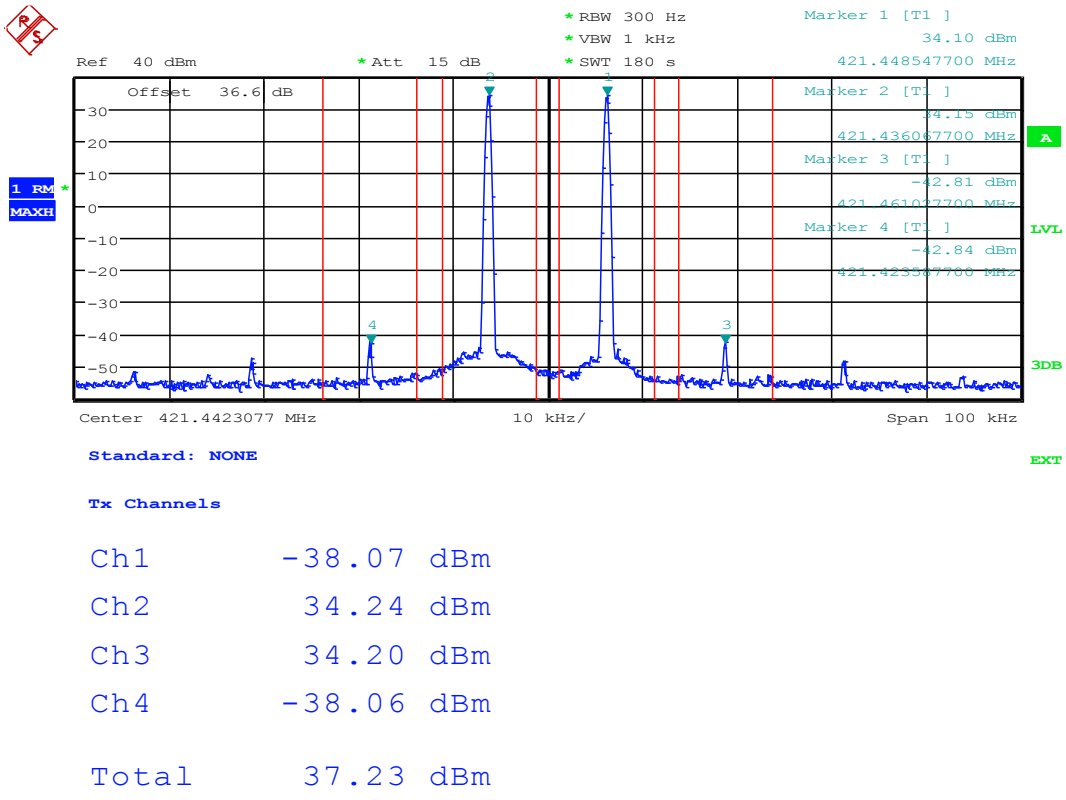
Mid 5 MHz downlink

Downlink Intermodulation @ AGC threshold 12.5 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
421.4423077	421.4360577	421.4485577	421.423587700	-36.38	-30 dBm	Pass



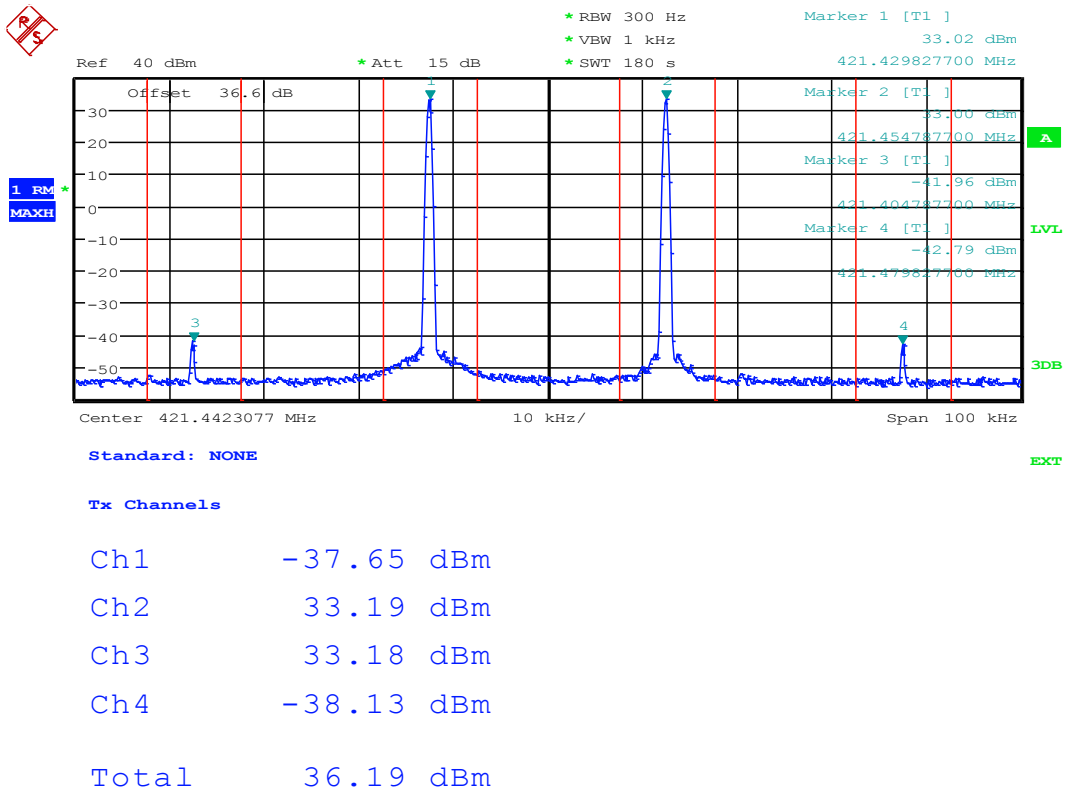
The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

Downlink Intermodulation @ 3dB above AGC threshold 12.5 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
421.4423077	421.4360577	421.4485577	421.423587700	-38.06	-30 dBm	Pass



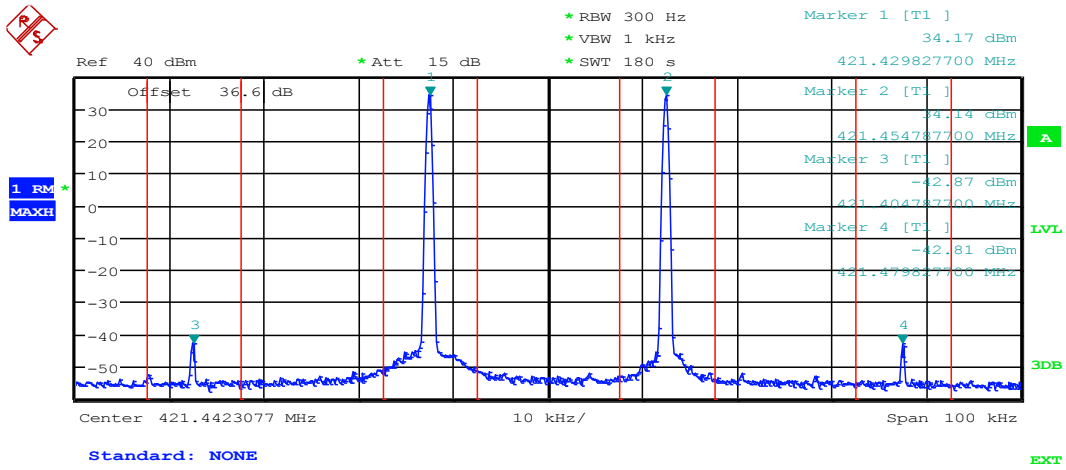
The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

Downlink Intermodulation @ AGC threshold 25 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
421.4423077	421.4298077	421.4548077	421.404787700	-37.65	-30 dBm	Pass



The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

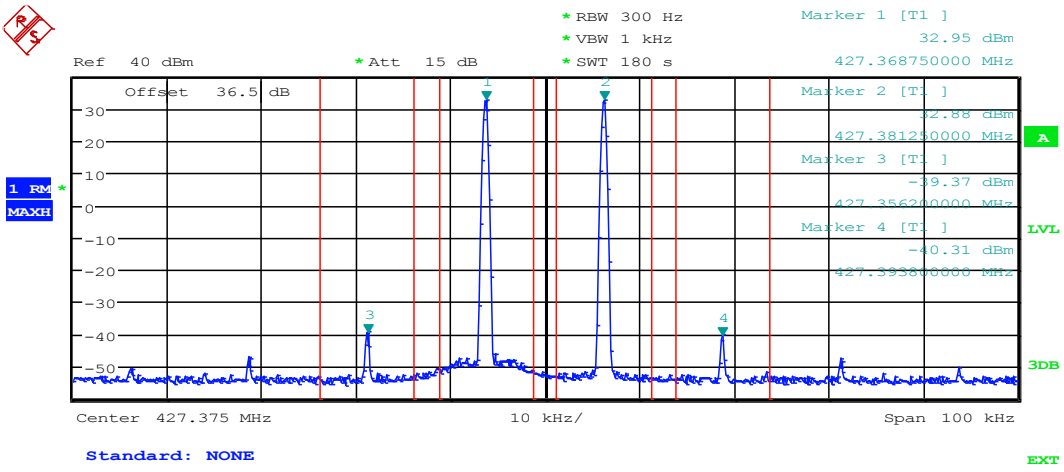
Downlink Intermodulation @ 3dB above AGC threshold 25 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
421.4423077	421.4298077	421.4548077	421.404787700	-38.34	-30 dBm	Pass



The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

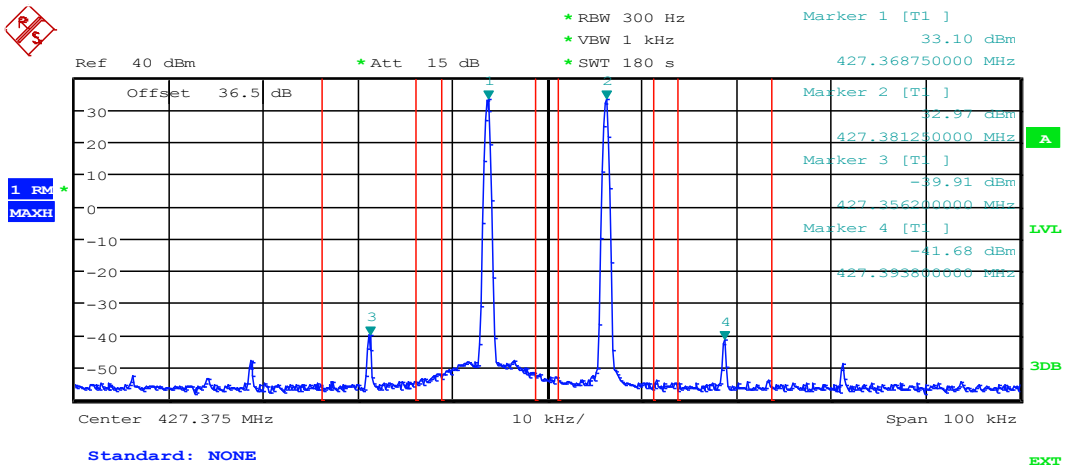
Top 5 MHz downlink

Downlink Intermodulation @ AGC threshold 12.5 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
427.37500	427.36875	427.38125	427.35620	-36.12	-30 dBm	Pass



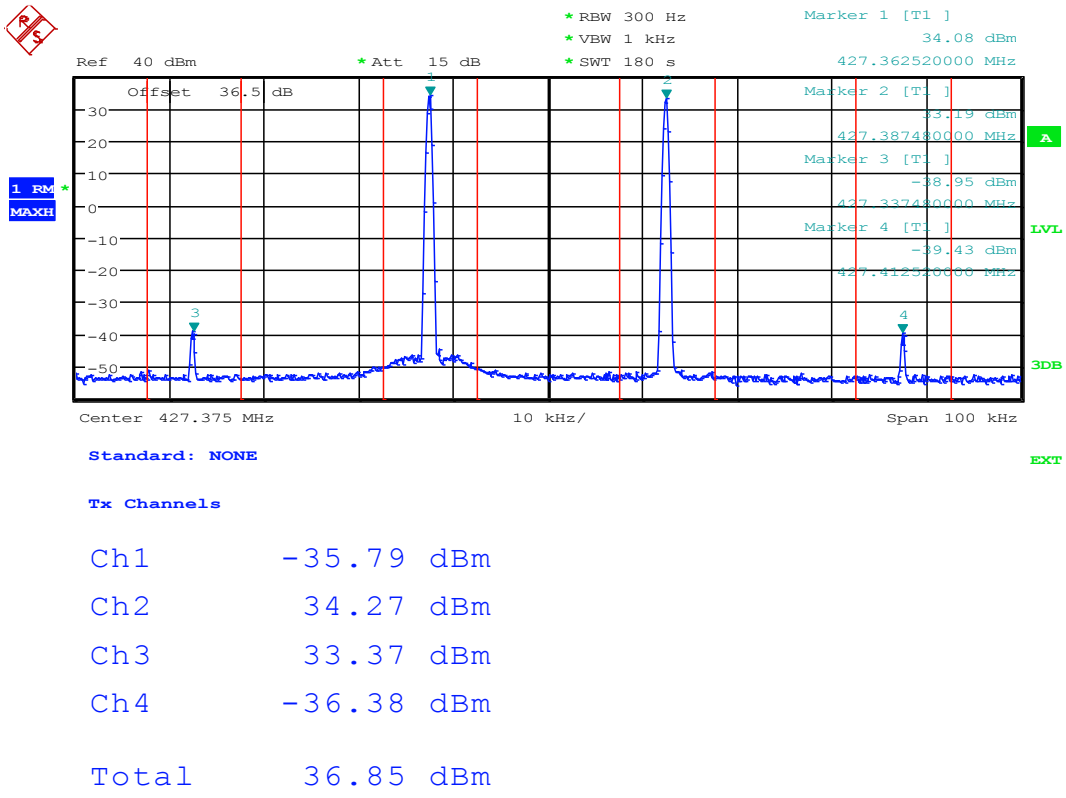
The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

Downlink Intermodulation @ 3dB above AGC threshold 12.5 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
427.37500	427.36875	427.38125	427.35620	-37.31	-30.0	Pass



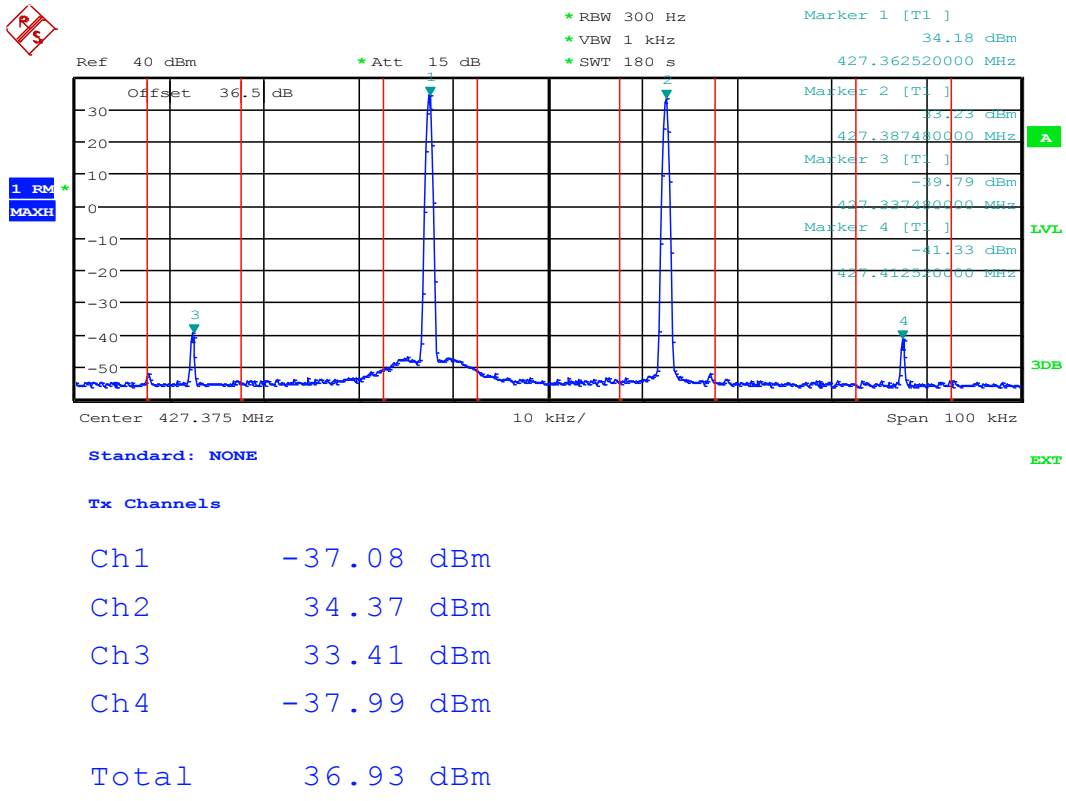
The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

Downlink Intermodulation @ AGC threshold 25.0 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
427.37500	427.36250	427.38750	427.337480	-35.79	-30 dBm	Pass



The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

Downlink Intermodulation @ 3dB above AGC threshold 25.0 kHz						
fo Frequency (MHz)	***Tone 1 (MHz)***	***Tone 2 (MHz)***	***Frequency of Intermodulation Product (MHz)***	***Highest Intermodulation Product Level (dBm)***	***Limit (dBm)***	***Result***
427.37500	427.36250	427.38750	427.337480	-37.08	-30.0	Pass



The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth, not the peak Mkr values.

15 Input-versus-output signal comparison

15.1 Definition

The emission mask is the required attenuation relative to the channel power up to 250% of the channel bandwidth. For frequencies greater than 250% of the authorized bandwidth, refer to spurious emission measurement.

15.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	Part 90.219(e)(4)(ii)(iii), KDB 935210 D05 v01, clause (4.4)
EUT Operating Frequencies Tested:	410.025 MHz-414.975 MHz 417.5125 MHz-422.4875 MHz 425.0125MHz-429.9875 MHz
Source Modulations:	16K0F3E, 11K3F3E, 8K10F1E,8K10F1W.
Maximum Source Levels:	5.41, 8.41 dBm (AGC threshold and 3dB above)
Deviations from Standard:	None
Bandwidth, RBW:	Various, see plots. VBW =3xRBW
Span:	50 kHz-100 kHz (2-5 times OBW)
Measurement Detector:	Peak; Max-Hold.

Environmental Conditions (Normal Environment)

Temperature: 24°C	+15 ºC to +35 ºC (as declared)
Humidity: 33%RH	20%RH to 75%RH (as declared)
Supply: 115 Vac	

15.3 Test Limits

(i) There is no change in the occupied bandwidth of the retransmitted signals.
(ii) The retransmitted signals continue to meet the unwanted emissions limits of §90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

Emission Mask D - 12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0: Zero dB.

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

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

Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (f_d/5) dB;

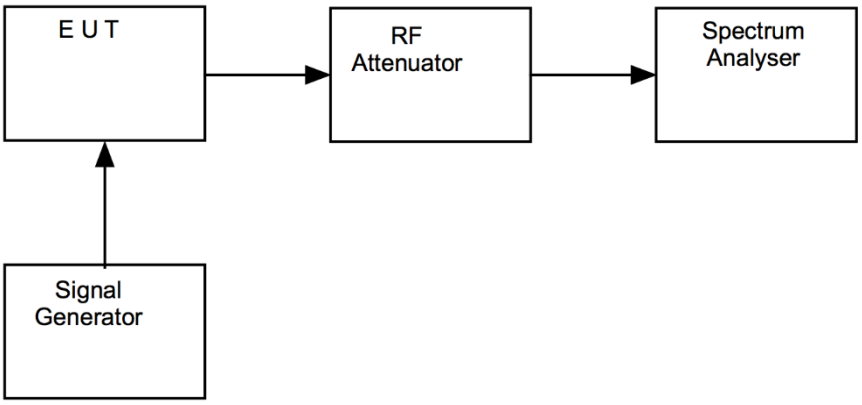
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (f_d^2/11) dB or 50 dB, whichever is the lesser attenuation;

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

15.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iii, the RF spectrum mask was measured on a spectrum analyser and compared to the signal generator output as shown on the plots.
The measurements were performed with EUT set at its nominal / maximum gain.
The measurements were repeated without input signal to measure the noise.

Figure iii Test Setup



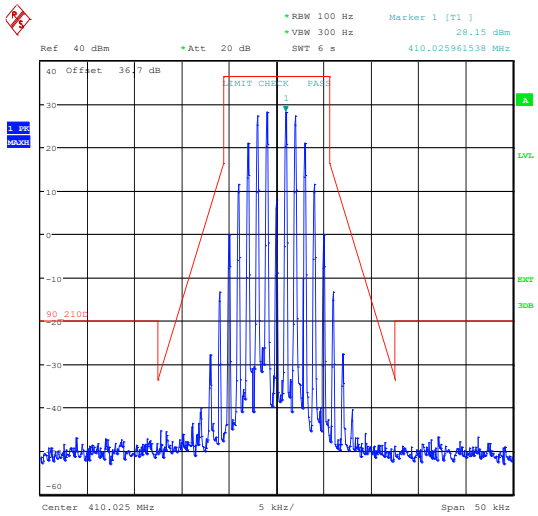
15.5 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Signal Generator	R&S	SMBV100A	REF916	2022-05-30	12	2023-05-30
Spectrum Analyser	R&S	FSU46	U405	2022-05-21	12	2023-04-21
Multimeter	Agilent	34405a	REF976	2021-12-21	12	2022-12-21
Power Supply	Kikusui	PCR4000L	UH580	USE REF976		
Attenuator	Bird	10 dB	L112	USE REF916 AND U405		
Attenuator	Aerial Facilities	20 dB	U729	USE REF916 AND U405		
Attenuator	Huber & Suhner	6 dB	U551	USE REF916 AND U405		

15.6 Test Results

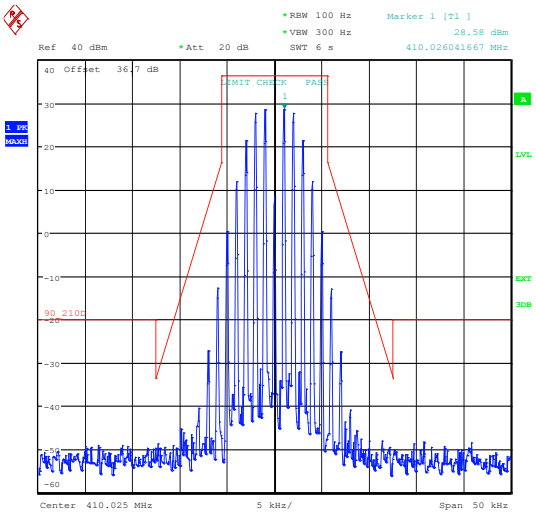
Downlink: Bottom 5 MHz passband 410.025 MHz

12.5 kHz FM Mask D @ AGC



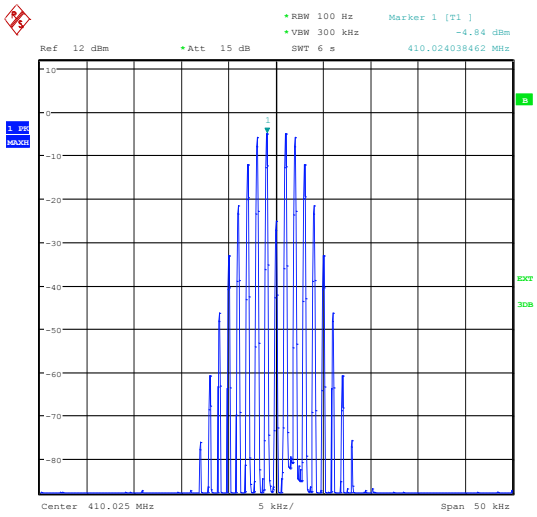
Date: 22.AUG.2022 10:21:15

12.5 kHz FM Mask D @ AGC+ 3



Date: 22.AUG.2022 10:22:44

12.5 kHz FM Signal Generator

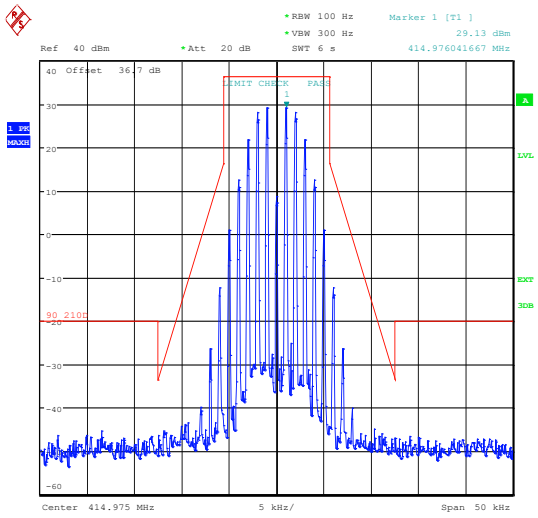


Date: 22.AUG.2022 16:12:45

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

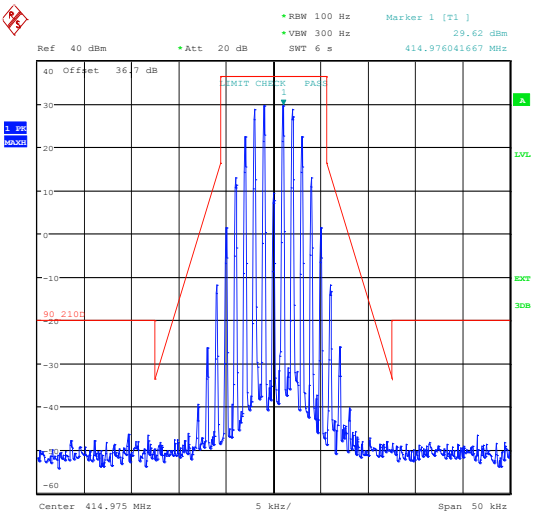
Downlink: Bottom 5 MHz passband 414.975 MHz

12.5 kHz FM Mask D @ AGC



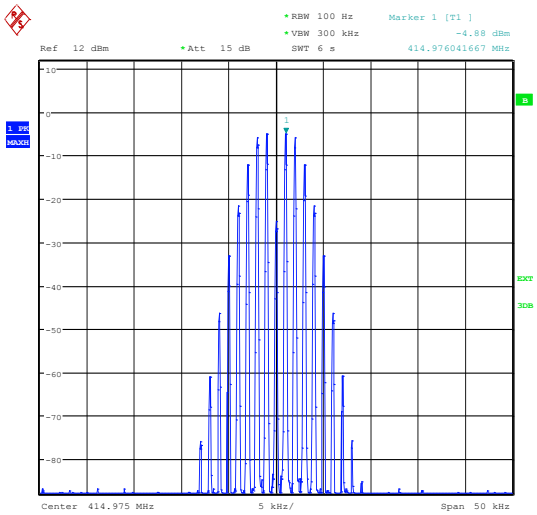
Date: 22.AUG.2022 10:25:05

12.5 kHz FM Mask D @ AGC+ 3



Date: 22.AUG.2022 10:26:54

12.5 kHz FM Signal Generator

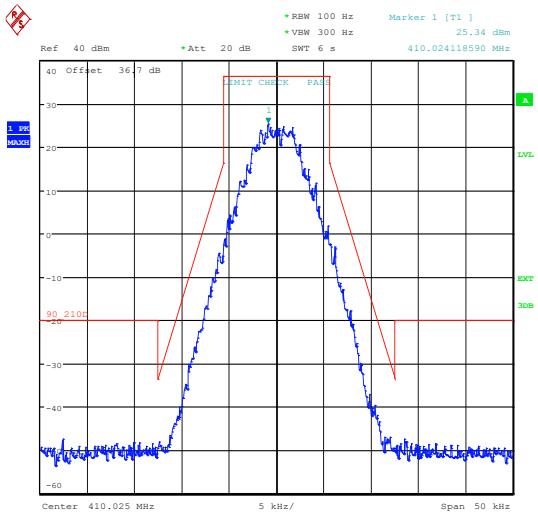


Date: 22.AUG.2022 16:13:26

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

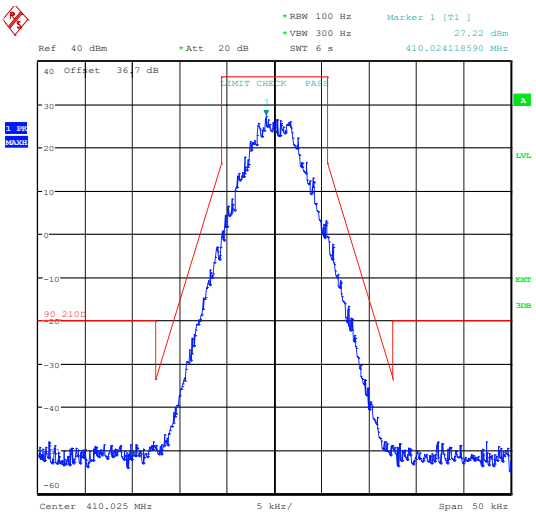
Downlink: Bottom 5 MHz passband 410.025 MHz

P25 C4FM Mask D @ AGC



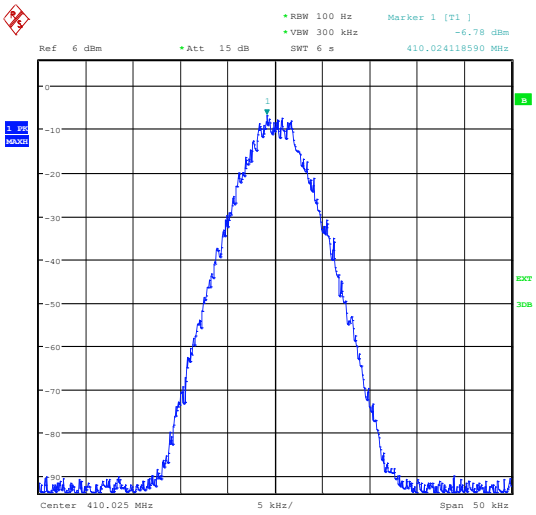
Date: 22.AUG.2022 10:42:16

P25 C4FM Mask D @ AGC+3



Date: 22.AUG.2022 10:44:12

P25 C4FM Signal Generator

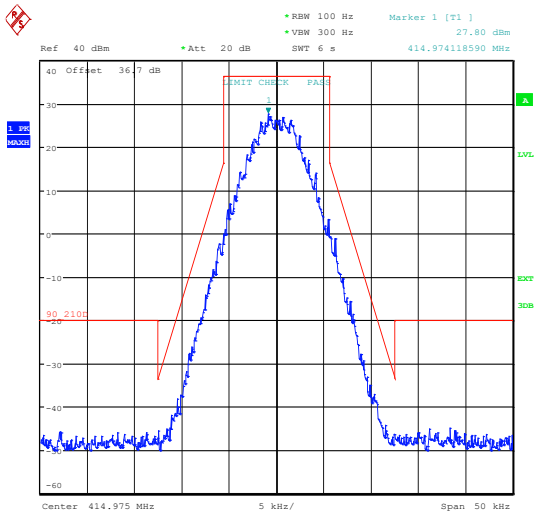


Date: 22.AUG.2022 16:19:45

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

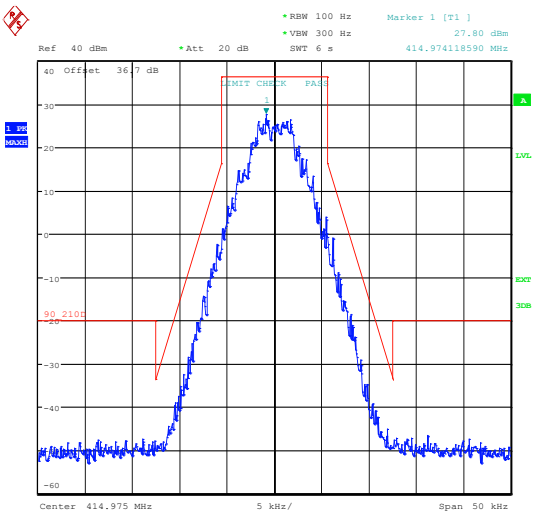
Downlink: Bottom 5 MHz passband 414.975 MHz

P25 C4FM Mask D @ AGC



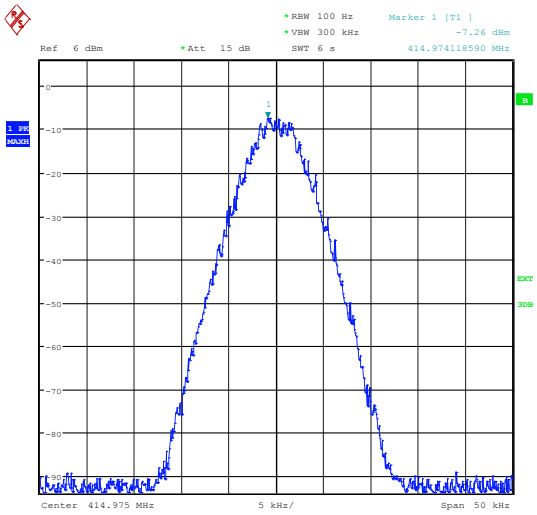
Date: 22.AUG.2022 10:35:48

P25 C4FM Mask D @ AGC+3



Date: 22.AUG.2022 10:38:37

P25 C4FM Signal Generator

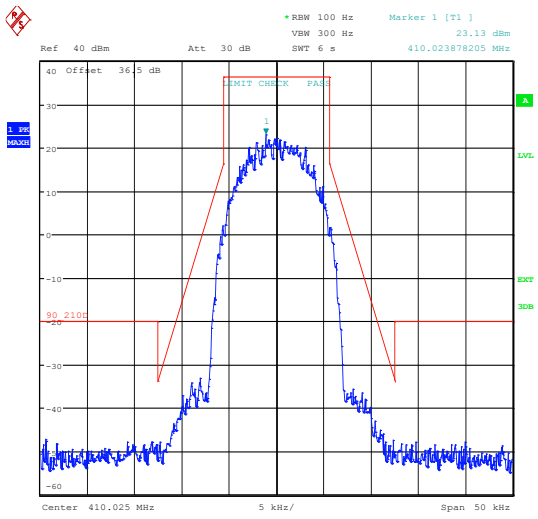


Date: 22.AUG.2022 16:17:13

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

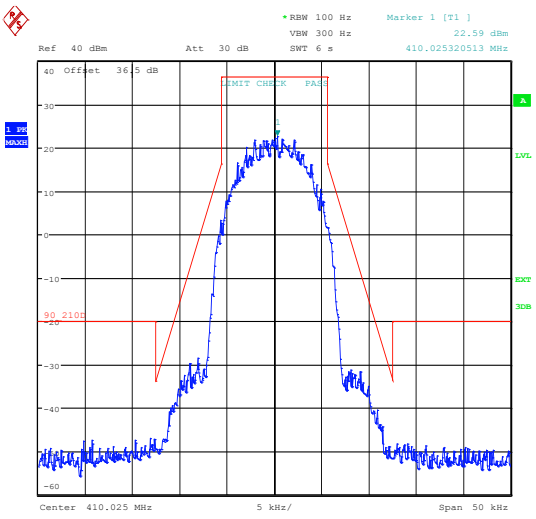
Downlink: Bottom 5 MHz passband 410.025 MHz

P25 H-DQPSK Mask D @ AGC



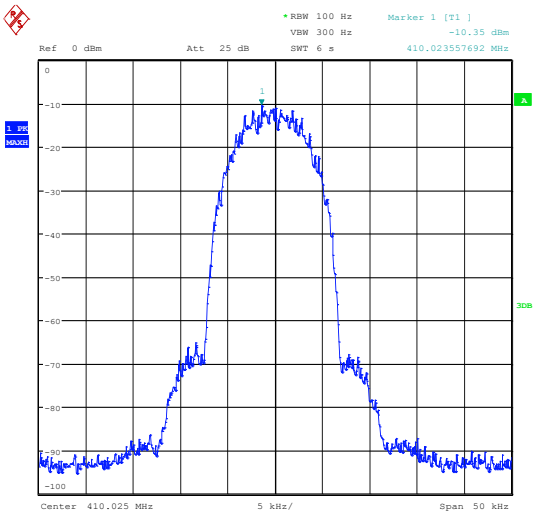
Date: 17.OCT.2022 11:27:10

P25 H-DQPSK Mask D @ AGC+3



Date: 17.OCT.2022 11:28:50

P25 H-DQPSK Signal Generator

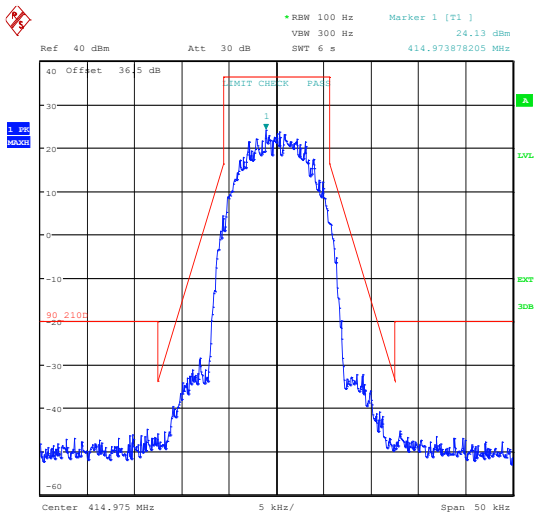


Date: 14.OCT.2022 11:10:51

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

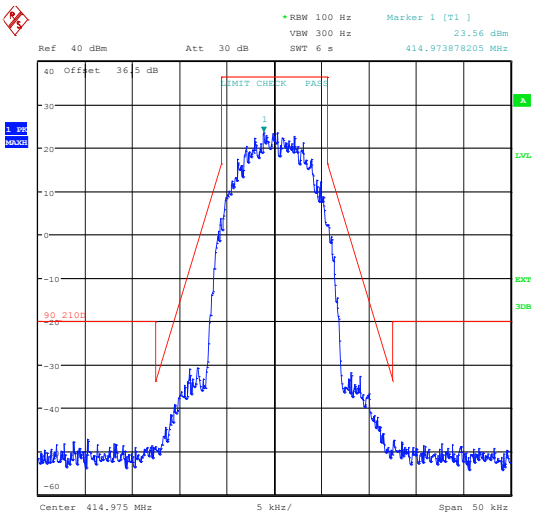
Downlink: Bottom 5 MHz passband 414.975 MHz

P25 H-DQPSK Mask D @ AGC



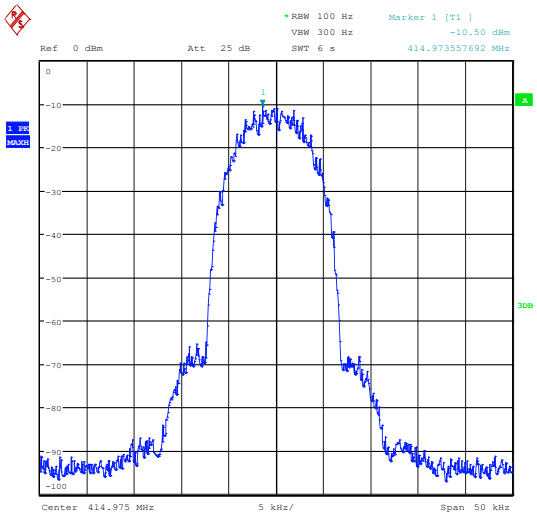
Date: 17.OCT.2022 11:32:12

P25 H-DQPSK Mask D @ AGC+3



Date: 17.OCT.2022 11:33:46

P25 H-DQPSK Signal Generator

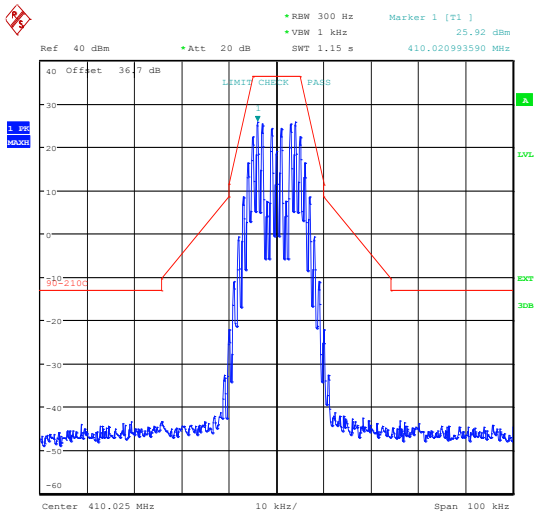


Date: 14.OCT.2022 11:12:55

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

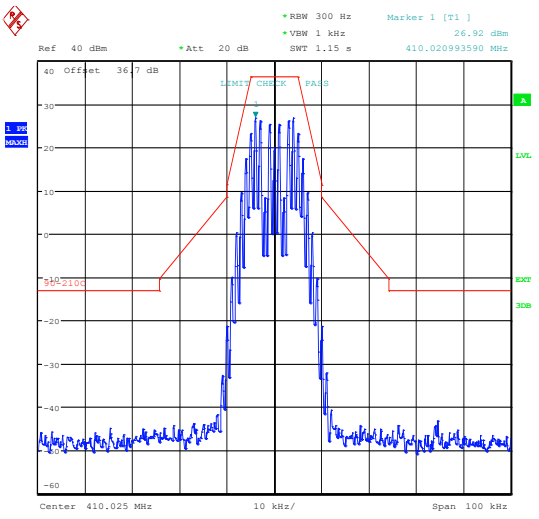
Downlink: Bottom 5 MHz passband 410.025 MHz

25 kHz FM Mask C @ AGC



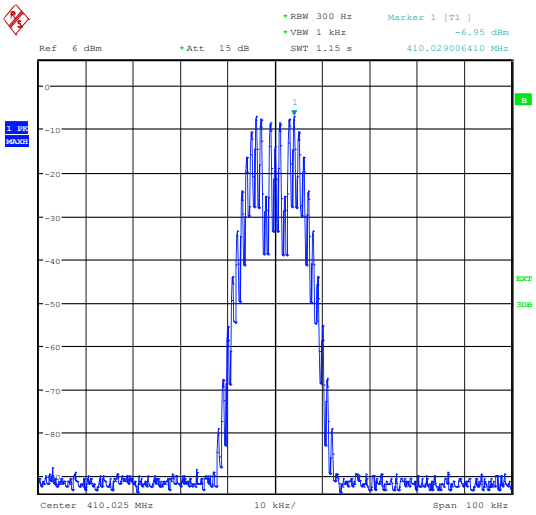
Date: 22.AUG.2022 12:04:27

25 kHz FM Mask C @ AGC+ 3



Date: 22.AUG.2022 12:05:08

25 kHz FM Signal Generator

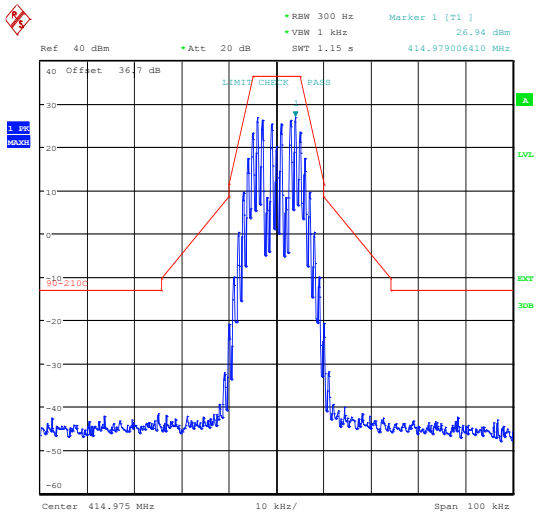


Date: 22.AUG.2022 16:27:07

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

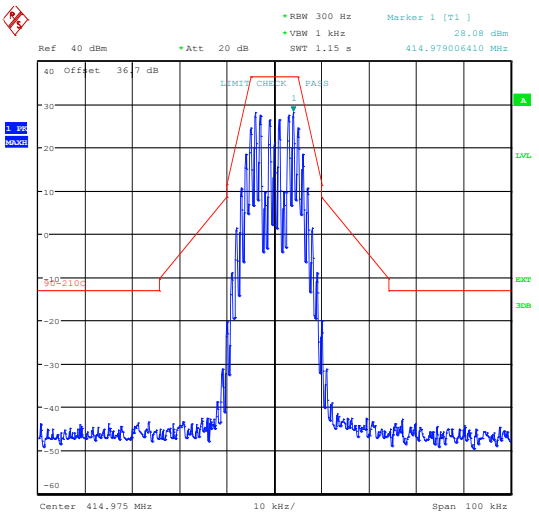
Downlink: Bottom 5 MHz passband 414.975 MHz

25 kHz FM Mask C @ AGC



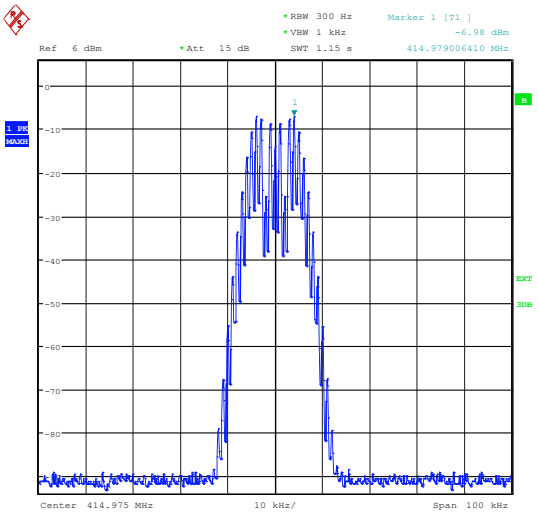
Date: 22.AUG.2022 12:02:23

25 kHz FM Mask C @ AGC+ 3



Date: 22.AUG.2022 12:03:11

25 kHz FM Signal Generator

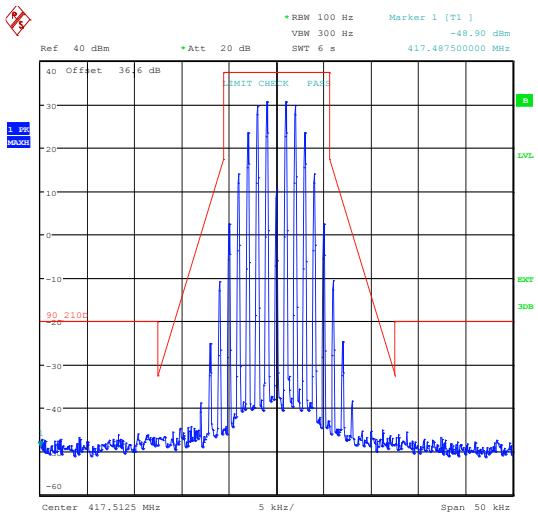


Date: 22.AUG.2022 16:26:17

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

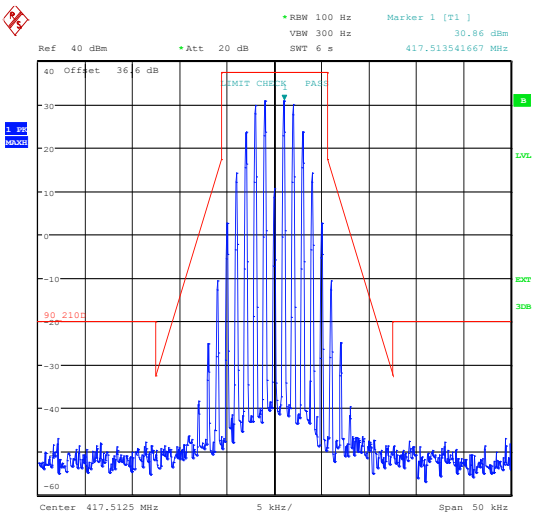
Downlink: Mid 5 MHz passband 417.5125 MHz

12.5 kHz FM Mask D @ AGC



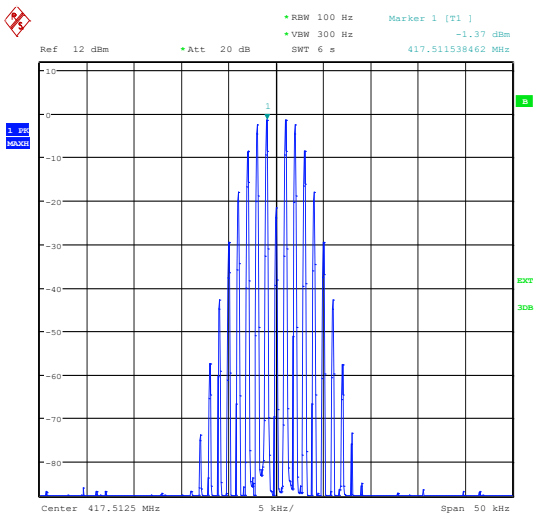
Date: 10.AUG.2022 14:50:41

12.5 kHz FM Mask D @ AGC+ 3



Date: 10.AUG.2022 14:51:38

12.5 kHz FM Signal Generator

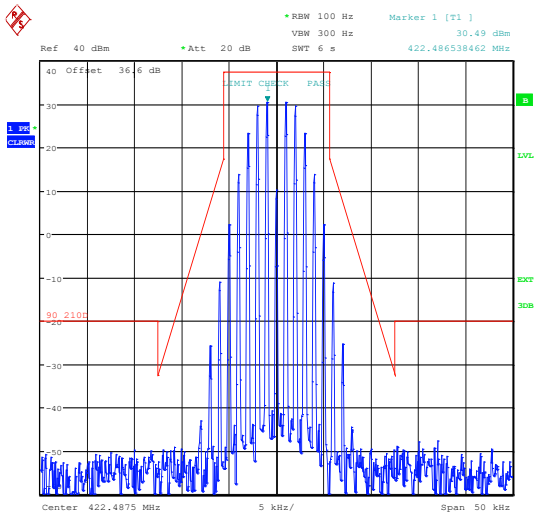


Date: 10.AUG.2022 17:29:08

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

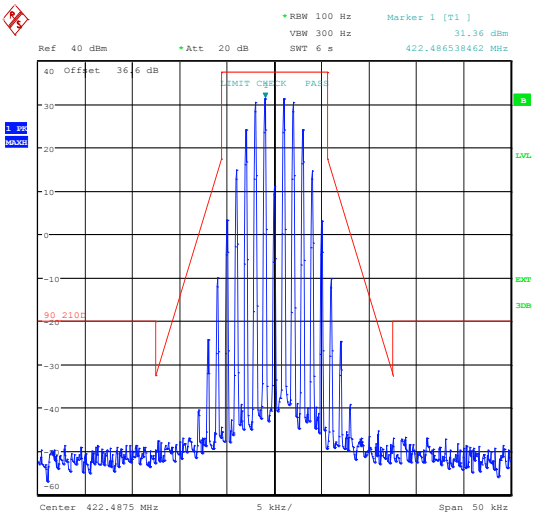
Downlink: Mid 5 MHz passband 422.4875 MHz

12.5 kHz FM Mask D @ AGC



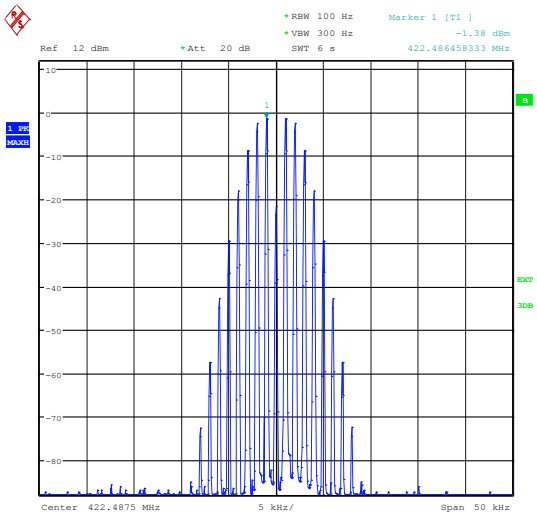
Date: 10.AUG.2022 14:54:48

12.5 kHz FM Mask D @ AGC+ 3



Date: 10.AUG.2022 14:55:38

12.5 kHz FM Signal Generator

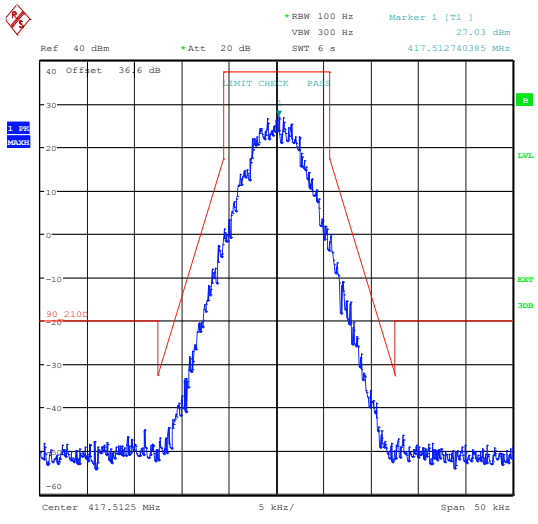


Date: 10.AUG.2022 17:30:33

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

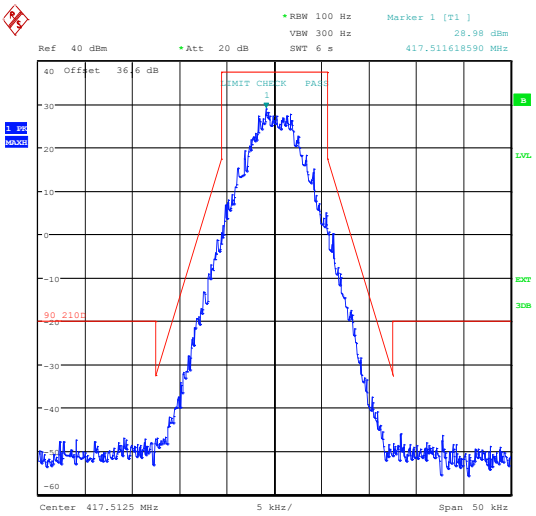
Downlink: Mid 5 MHz passband 417.5125 MHz

P25 C4FM Mask D @ AGC



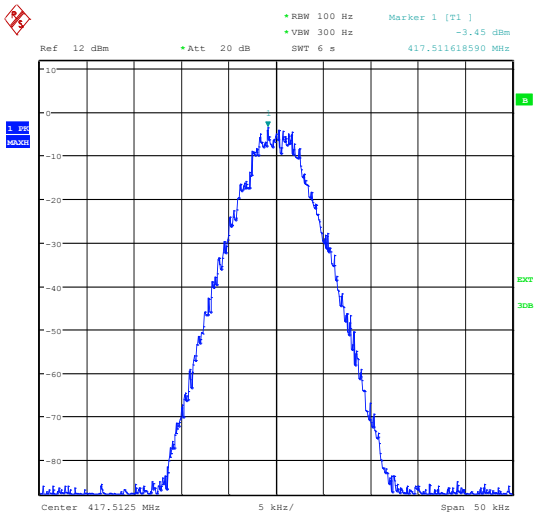
Date: 10.AUG.2022 15:05:56

P25 C4FM Mask D @ AGC+3



Date: 10.AUG.2022 15:07:08

P25 C4FM Signal Generator

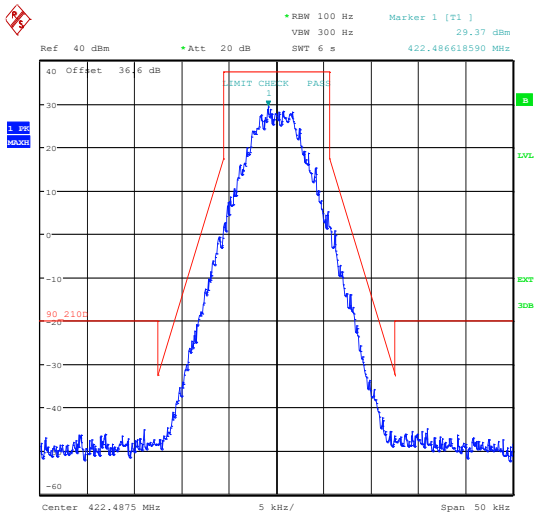


Date: 10.AUG.2022 17:54:20

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

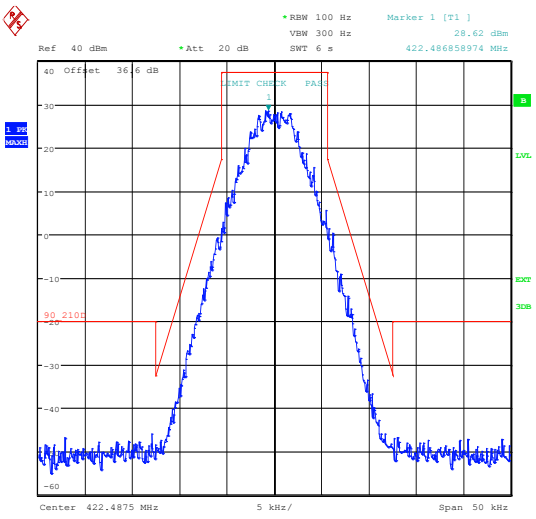
Downlink: Mid 5 MHz passband 422.4875 MHz

P25 C4FM Mask D @ AGC



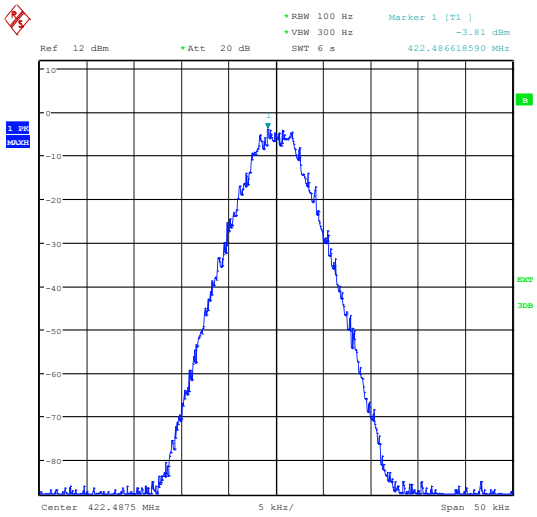
Date: 10.AUG.2022 15:01:10

P25 C4FM Mask D @ AGC+3



Date: 10.AUG.2022 15:02:21

P25 C4FM Signal Generator

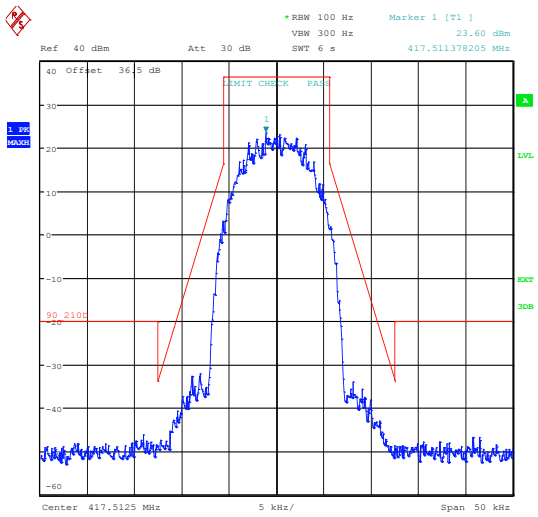


Date: 10.AUG.2022 17:52:20

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

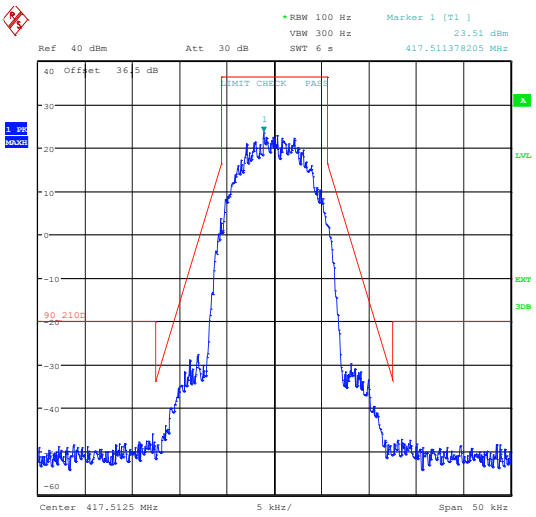
Downlink: Mid 5 MHz passband 417.5125 MHz

P25 H-DQPSK Mask D @ AGC



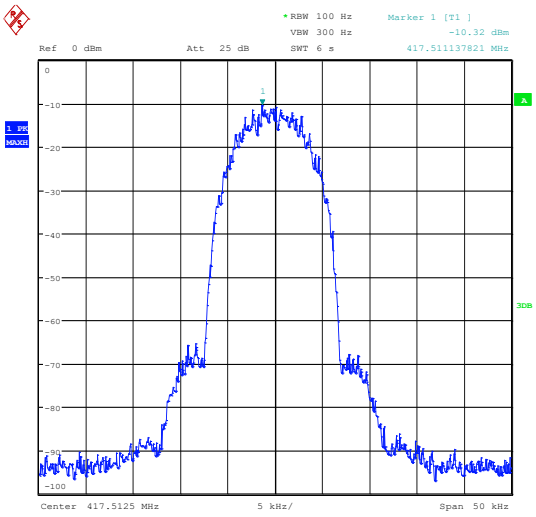
Date: 14.OCT.2022 14:44:41

P25 H-DQPSK Mask D @ AGC+3



Date: 14.OCT.2022 14:46:24

P25 H-DQPSK Signal Generator

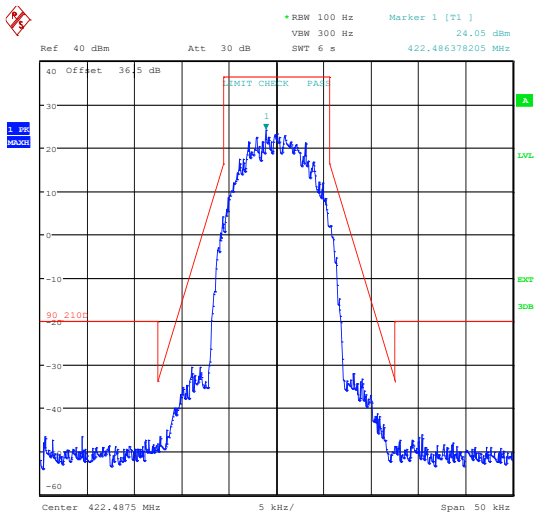


Date: 14.OCT.2022 11:14:46

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

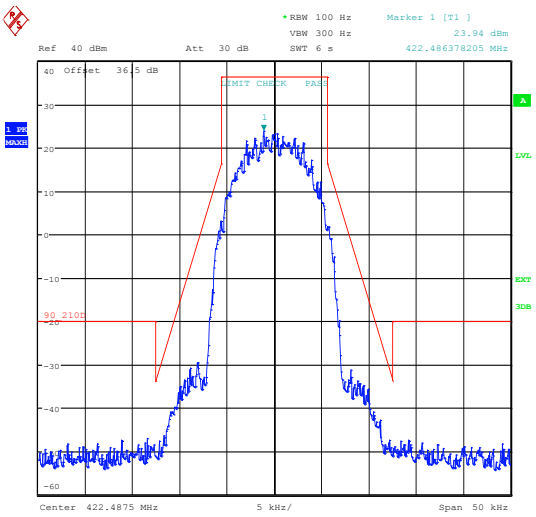
Downlink: Mid 5 MHz passband 422.4875 MHz

P25 H-DQPSK Mask D @ AGC



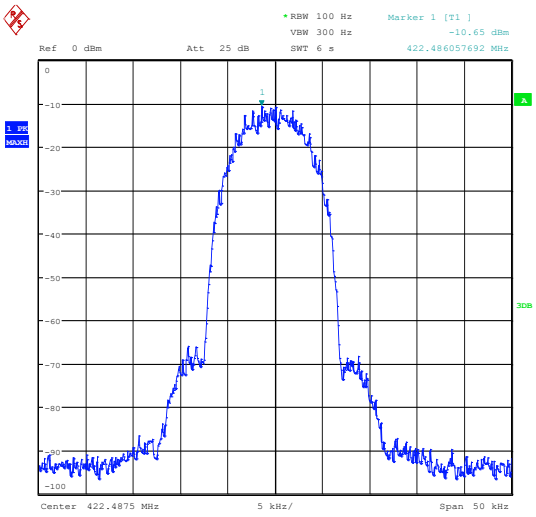
Date: 14.OCT.2022 14:38:52

P25 H-DQPSK Mask D @ AGC+3



Date: 14.OCT.2022 14:40:11

P25 H-DQPSK Signal Generator

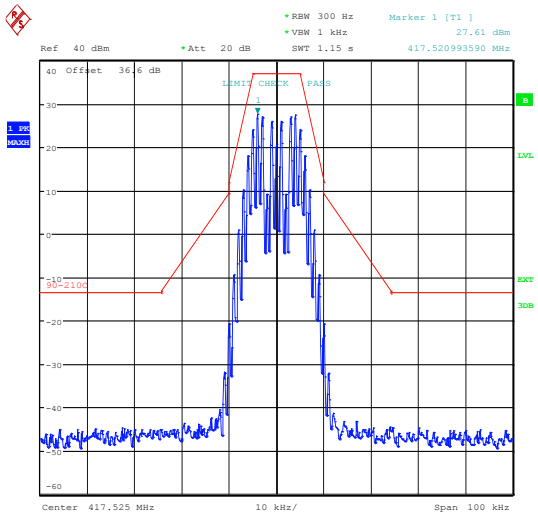


Date: 14.OCT.2022 11:16:29

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

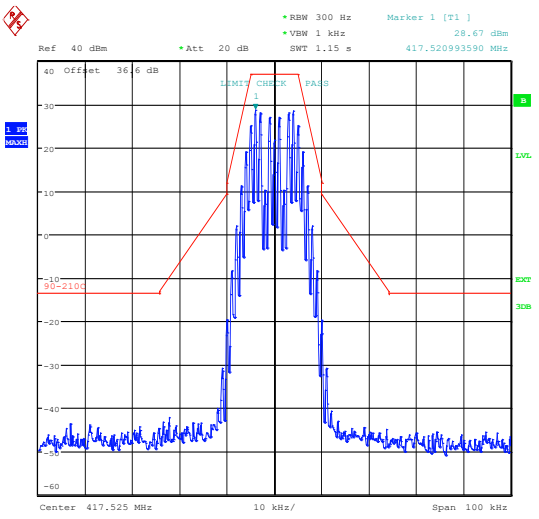
Downlink: Mid 5 MHz passband 417.525 MHz

25 kHz FM Mask C @ AGC



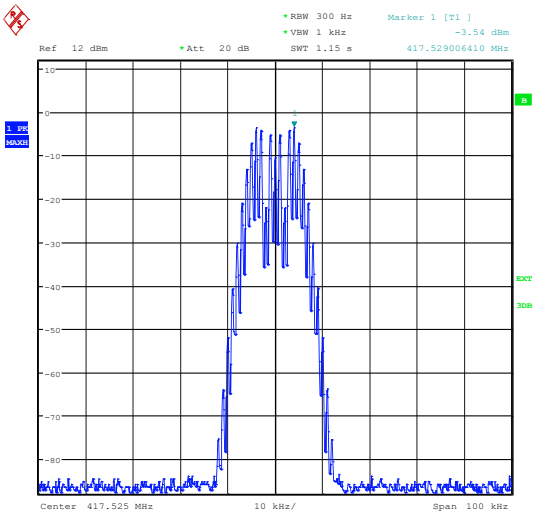
Date: 10.AUG.2022 16:09:53

25 kHz FM Mask C @ AGC+ 3



Date: 10.AUG.2022 16:11:11

25 kHz FM Signal Generator

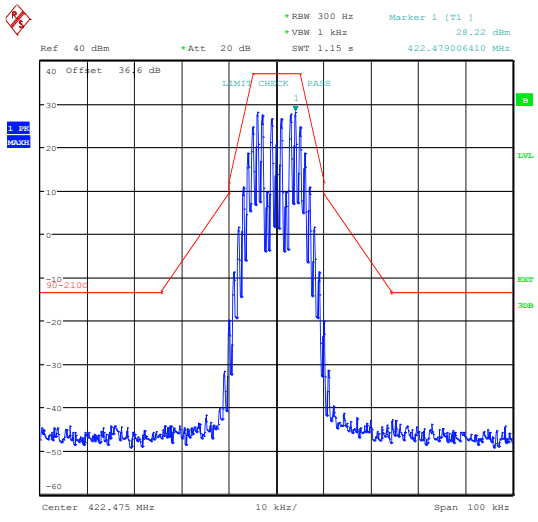


Date: 10.AUG.2022 17:24:34

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

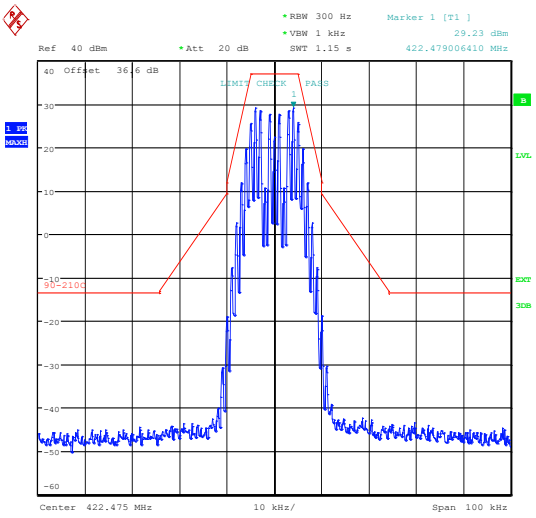
Downlink: Mid 5 MHz passband 422.475 MHz

25 kHz FM Mask C @ AGC



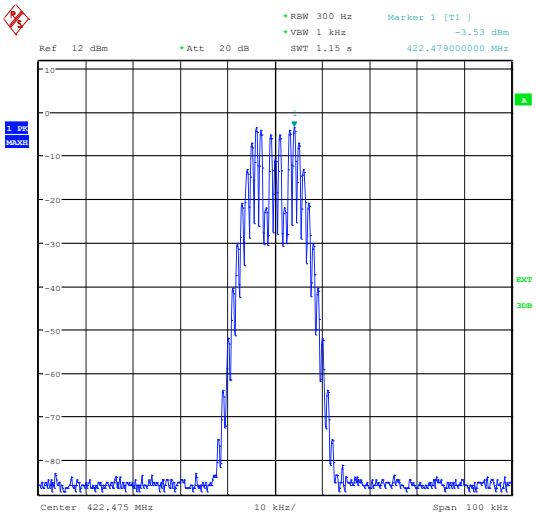
Date: 10.AUG.2022 16:07:25

25 kHz FM Mask C @ AGC+ 3



Date: 10.AUG.2022 16:08:23

25 kHz FM Signal Generator

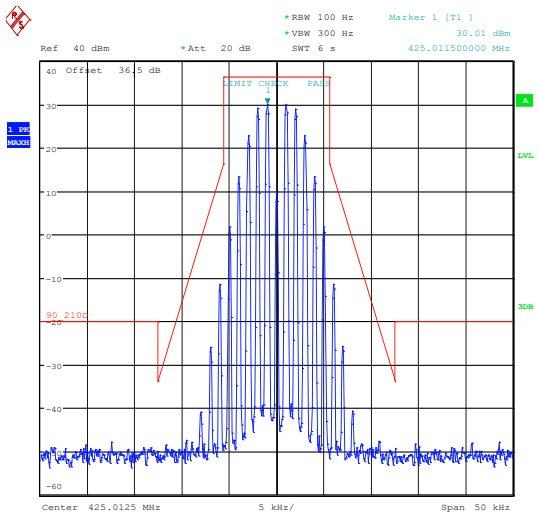


Date: 26.AUG.2022 09:58:46

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

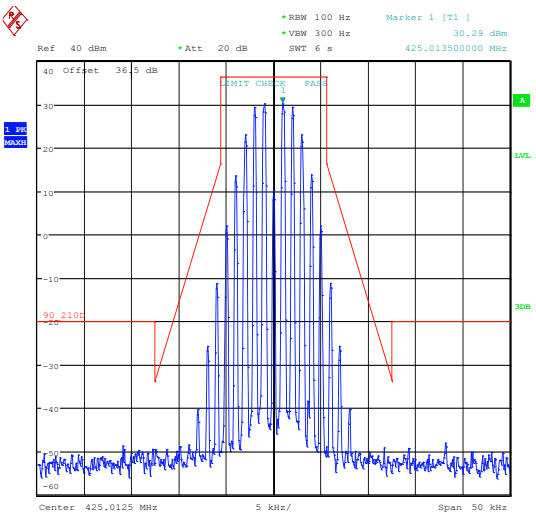
Downlink: Top 5 MHz passband 425.0125 MHz

12.5 kHz FM Mask D @ AGC



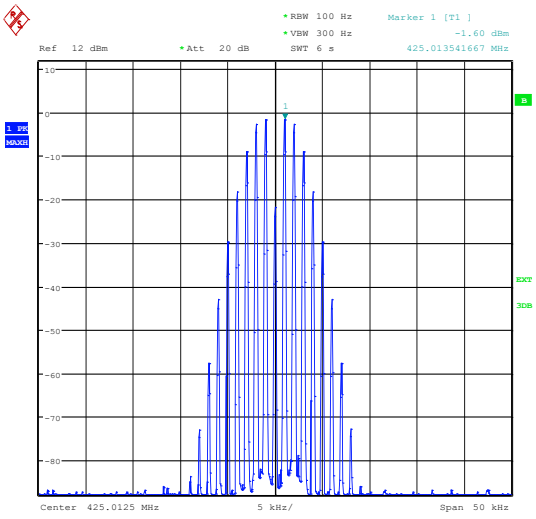
Date: 3.AUG.2022 15:51:03

12.5 kHz FM Mask D @ AGC+ 3



Date: 3.AUG.2022 15:52:30

12.5 kHz FM Signal Generator

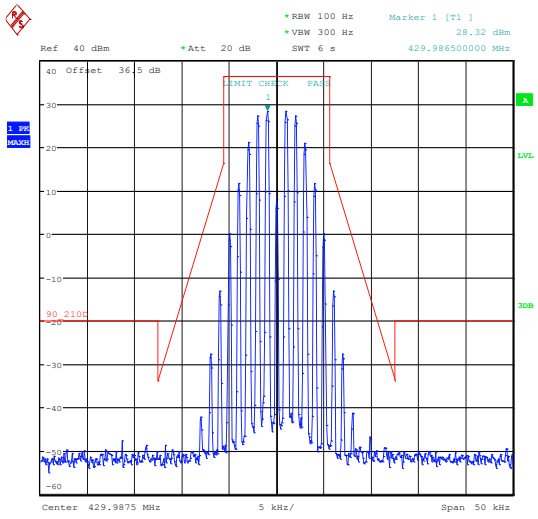


Date: 10.AUG.2022 09:50:32

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

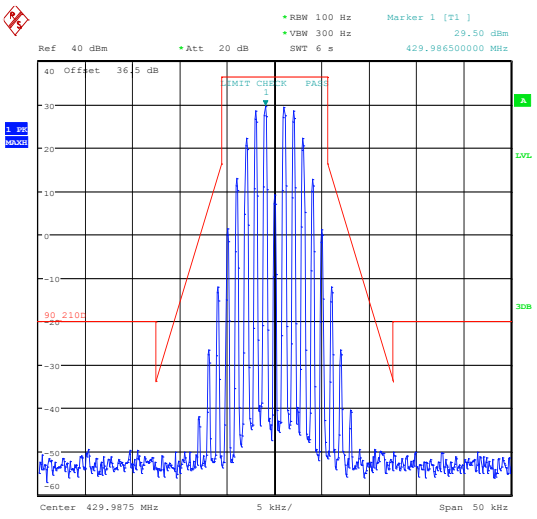
Downlink: Top 5 MHz passband 429.9875 MHz

12.5 kHz FM Mask D @ AGC



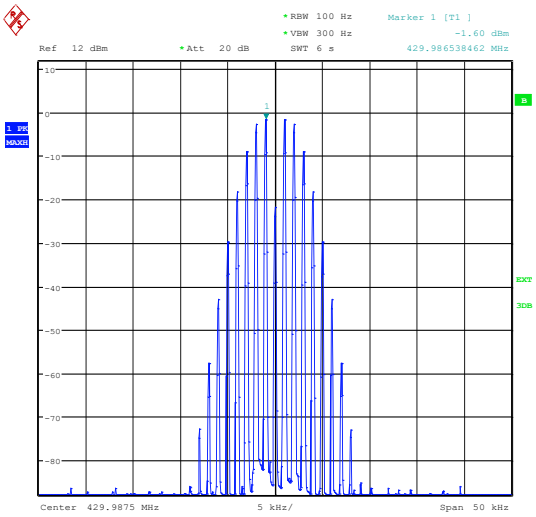
Date: 3.AUG.2022 15:57:44

12.5 kHz FM Mask D @ AGC+ 3



Date: 3.AUG.2022 15:59:06

12.5 kHz FM Signal Generator

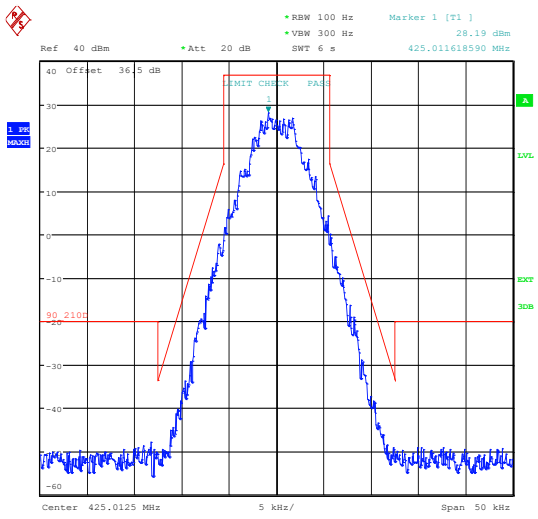


Date: 10.AUG.2022 09:51:32

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

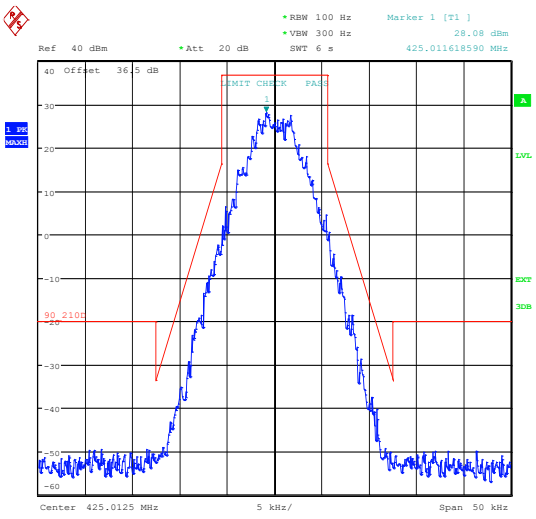
Downlink: Top 5 MHz passband 425.0125 MHz

P25 C4FM Mask D @ AGC



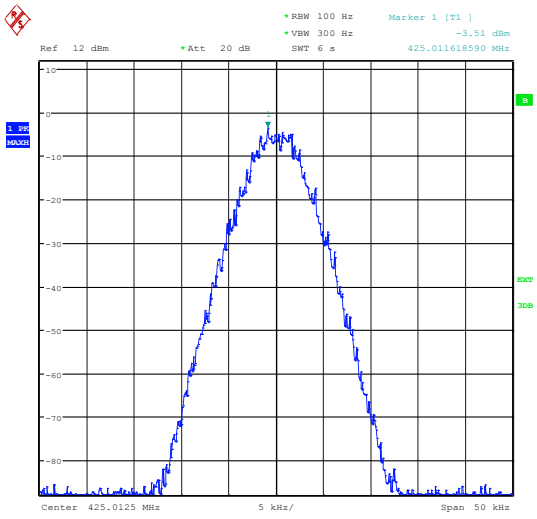
Date: 8.AUG.2022 13:24:37

P25 C4FM Mask D @ AGC+3



Date: 8.AUG.2022 13:25:31

P25 C4FM Signal Generator

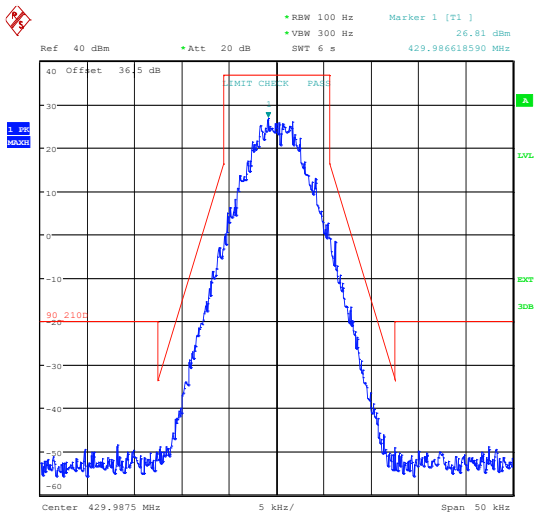


Date: 10.AUG.2022 09:56:37

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

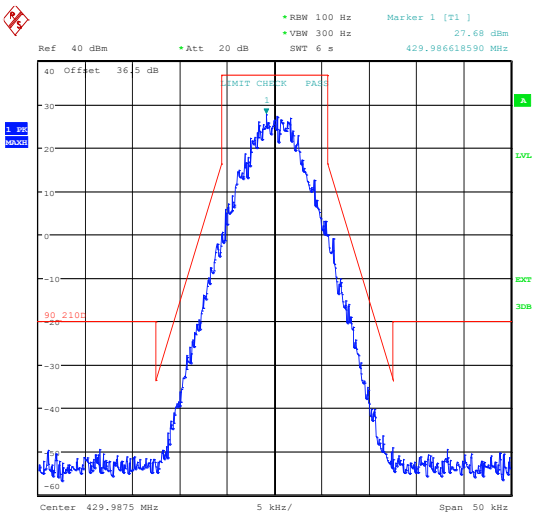
Downlink: Top 5 MHz passband 429.9875 MHz

P25 C4FM Mask D @ AGC



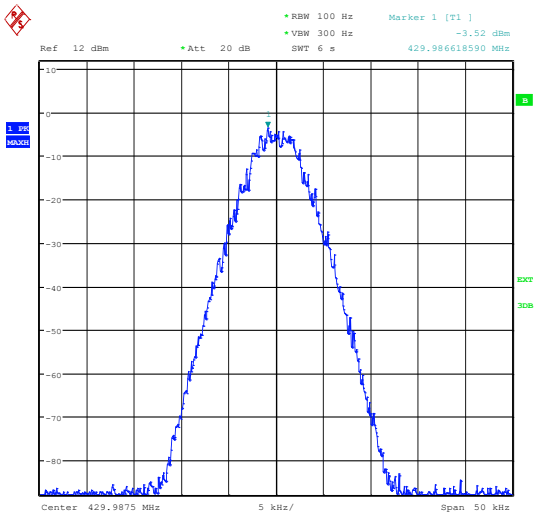
Date: 8.AUG.2022 13:30:36

P25 C4FM Mask D @ AGC+3



Date: 8.AUG.2022 13:31:37

P25 C4FM Signal Generator

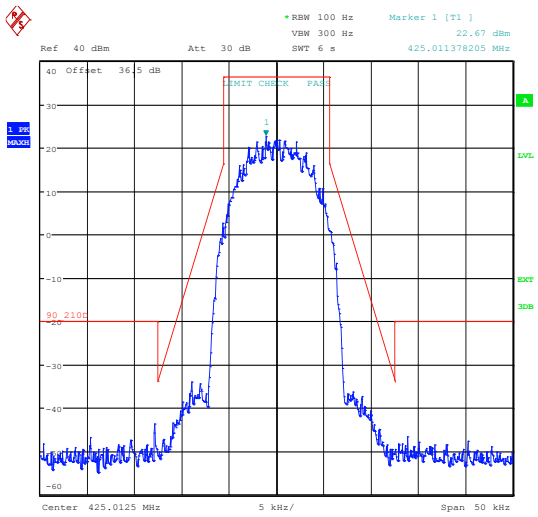


Date: 10.AUG.2022 09:55:03

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

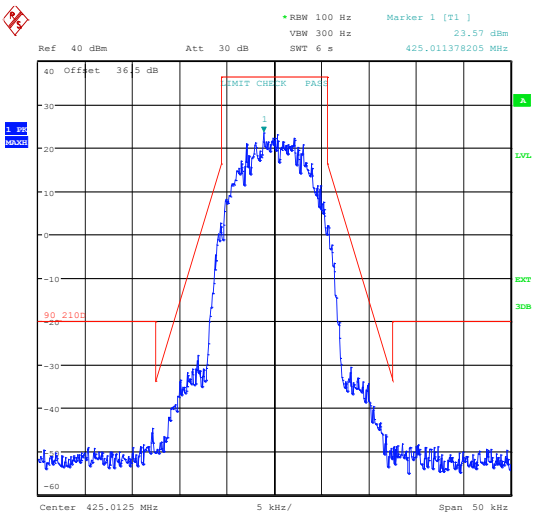
Downlink: Top 5 MHz passband 425.0125 MHz

P25 H-DQPSK Mask D @ AGC



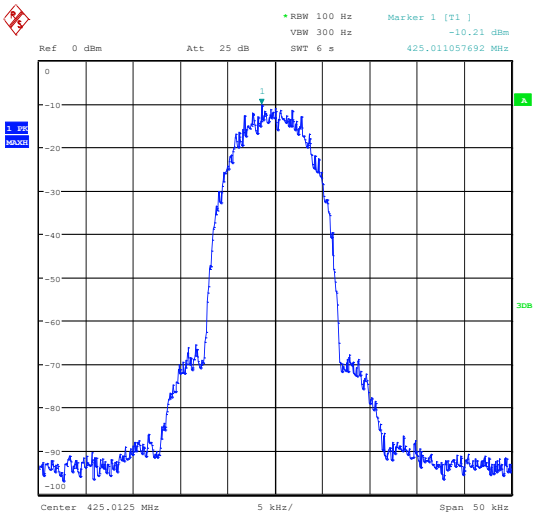
Date: 14.OCT.2022 12:36:33

P25 H-DQPSK Mask D @ AGC+3



Date: 14.OCT.2022 12:37:57

P25 H-DQPSK Signal Generator

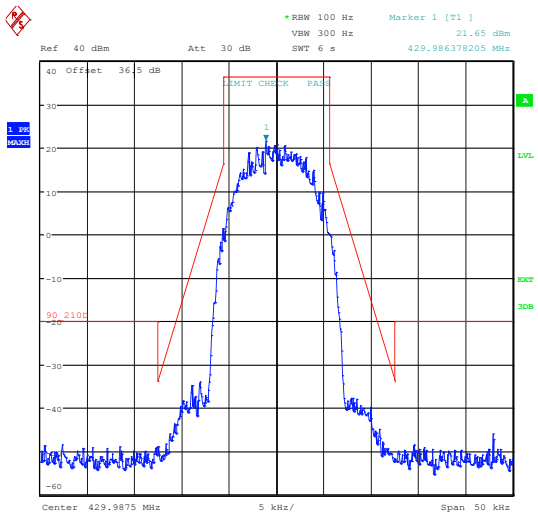


Date: 14.OCT.2022 11:18:28

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

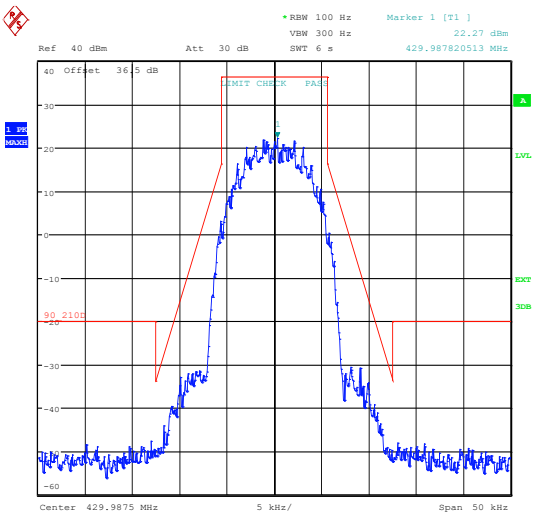
Downlink: Top 5 MHz passband 429.9875 MHz

P25 H-DQPSK Mask D @ AGC



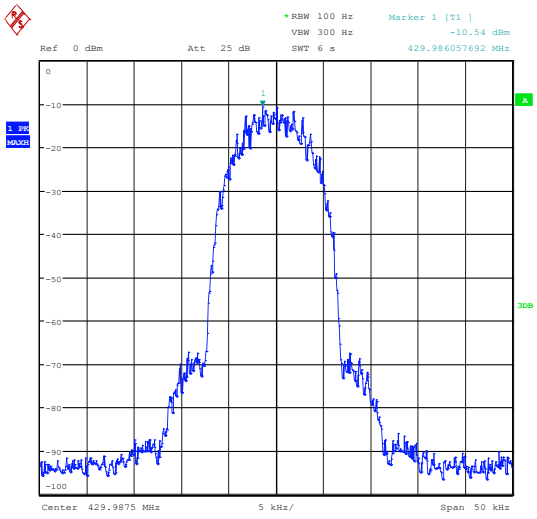
Date: 14.OCT.2022 12:40:24

P25 H-DQPSK Mask D @ AGC+3



Date: 14.OCT.2022 12:41:47

P25 H-DQPSK Signal Generator

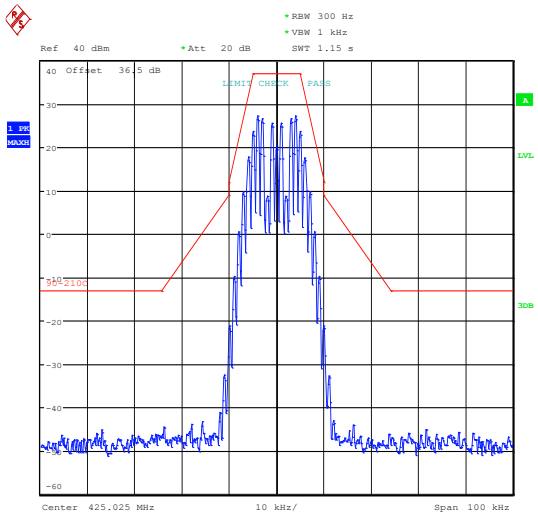


Date: 14.OCT.2022 11:20:09

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

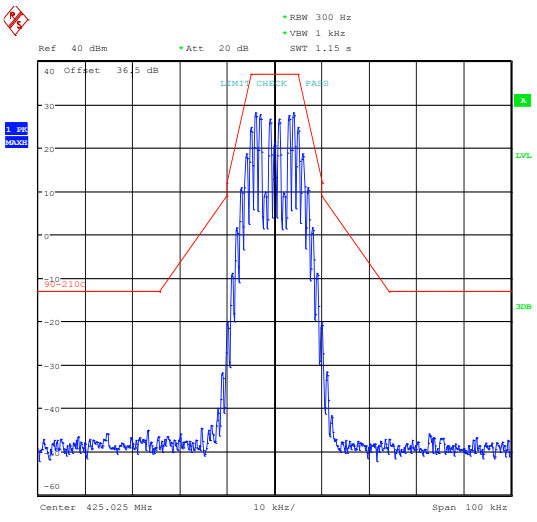
Downlink: Top 5 MHz passband 425.025 MHz

25 kHz FM Mask C @ AGC



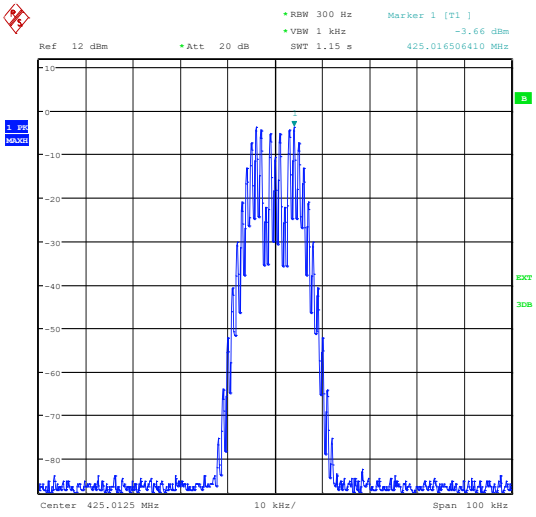
Date: 3.AUG.2022 16:31:56

25 kHz FM Mask C @ AGC+ 3



Date: 3.AUG.2022 16:32:30

25 kHz FM Signal Generator

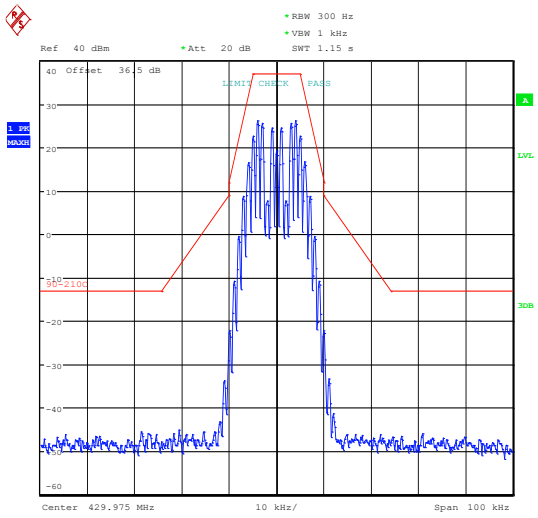


Date: 10.AUG.2022 10:05:00

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

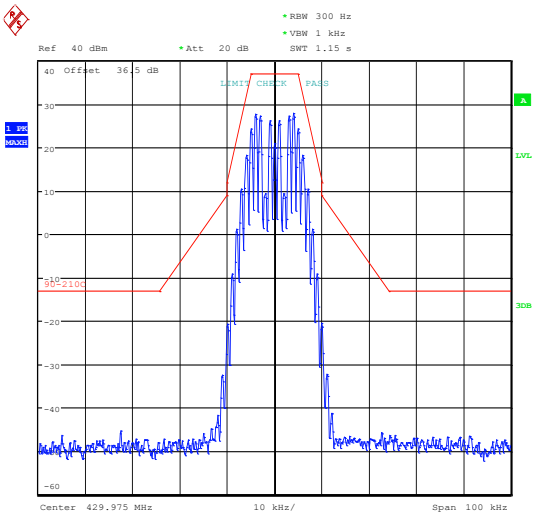
Downlink: Top 5 MHz passband 429.975 MHz

25 kHz FM Mask C @ AGC



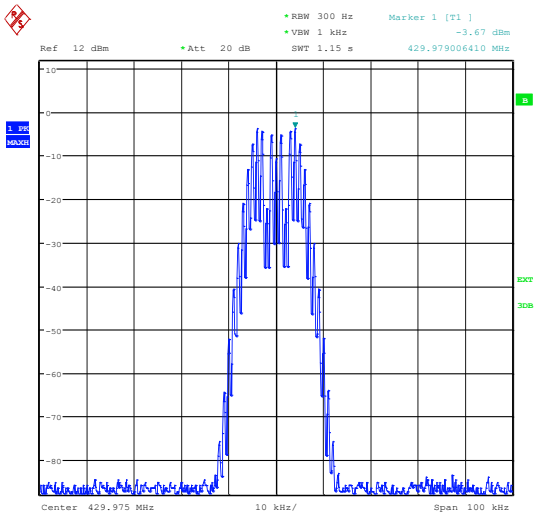
Date: 3.AUG.2022 16:33:54

25 kHz FM Mask C @ AGC+ 3



Date: 3.AUG.2022 16:34:35

25 kHz FM Signal Generator



Date: 10.AUG.2022 10:06:08

The above plots depicting the output spectra show no obvious distortion visible when compared to the input signal.

Downlink: 410.0 MHz-415.0 MHz Passband: Emission Masks D/C @ AGC Threshold					
Frequency (MHz)	Modulation Type				Result
	16K0F3E	11K3F3E	8K10F1E	9K80F1E	
410.0 MHz-415.0 MHz	Complies	Complies	Complies	Complies	PASS

Downlink: 410.0 MHz-415.0 MHz Passband: Emission Masks D/C @ AGC +3					
Frequency (MHz)	Modulation Type				Result
	16K0F3E	11K3F3E	8K10F1E	9K80F1E	
410.0 MHz-415.0 MHz	Complies	Complies	Complies	Complies	PASS

Downlink: 417.5 MHz-422.5 MHz Passband: Emission Masks D/C @ AGC Threshold					
Frequency (MHz)	Modulation Type				Result
	16K0F3E	11K3F3E	8K10F1E	9K80F1E	
417.5 MHz-422.5 MHz	Complies	Complies	Complies	Complies	PASS

Downlink: 417.5 MHz-422.5 MHz Passband: Emission Masks D/C @ AGC +3					
Frequency (MHz)	Modulation Type				Result
	16K0F3E	11K3F3E	8K10F1E	9K80F1E	
417.5 MHz-422.5 MHz	Complies	Complies	Complies	Complies	PASS

Downlink: 425.0 MHz-430.0 MHz Passband: Emission Masks D/C @ AGC Threshold					
Frequency (MHz)	Modulation Type				Result
	16K0F3E	11K3F3E	8K10F1E	9K80F1E	
425.0 MHz-430.0 MHz	Complies	Complies	Complies	Complies	PASS

Downlink: 425.0 MHz-430 MHz Passband: Emission Masks D/C @ AGC +3					
Frequency (MHz)	Modulation Type				Result
	16K0F3E	11K3F3E	8K10F1E	9K80F1E	
425.0 MHz-430.0 MHz	Complies	Complies	Complies	Complies	PASS

16 Noise figure

16.1 Definition

A measure of the noise generated within (or degradation in signal/noise ratio as a signal passes through) the device expressed as the ratio of signal/noise power ratio at the input to signal/noise ratio at the output.

16.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	Part 90.219(e)(2) KDB 935210 D05 v01r04, clause 4.6:
EUT Operating Frequencies Tested:	410 MHz- 430 MHz
Deviations from Standard:	None
Bandwidth:	RBW 10 kHz

Environmental Conditions (Normal Environment)

Temperature: 21°C	+15 ºC to +35 ºC (as declared)
Humidity: 36%RH	20%RH to 75%RH (as declared)
Supply: 115 Vac	

16.3 Test Limits

The noise figure of a signal booster must not exceed 9 dB in either direction.

For the remote unit of a conventional fiber-connected host/remote DAS booster system, it is acceptable to submit compliance information and test data consistent with Section 90.219(d)(6)(ii) (i.e., ERP of noise ≤ −43 dBm in 10 kHz RBW) for the downlink path only, in place of Section 90.219(e)(2) noise figure test data (i.e., NF ≤ 9 dB for both UL and DL).

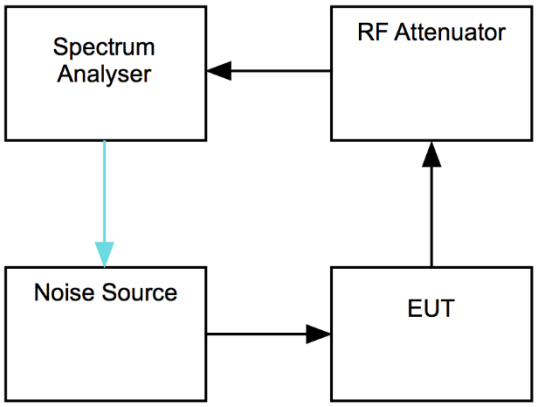
KDB 935210 D02 Signal Boosters Certification v04r02, section V. PART 90 SIGNAL BOOSTER SPECIFIC REQUIREMENTS (j)(5).

.

16.4 Test Method

The equipment was setup as shown in Figure ii. A spectrum analyser with a noise figure measurement capability was used. The spectrum analyser provided the on/off control of the noise source as well as measuring the result at its RF input. Prior to measuring the EUT, a calibration of the measurement network was performed with the EUT removed.

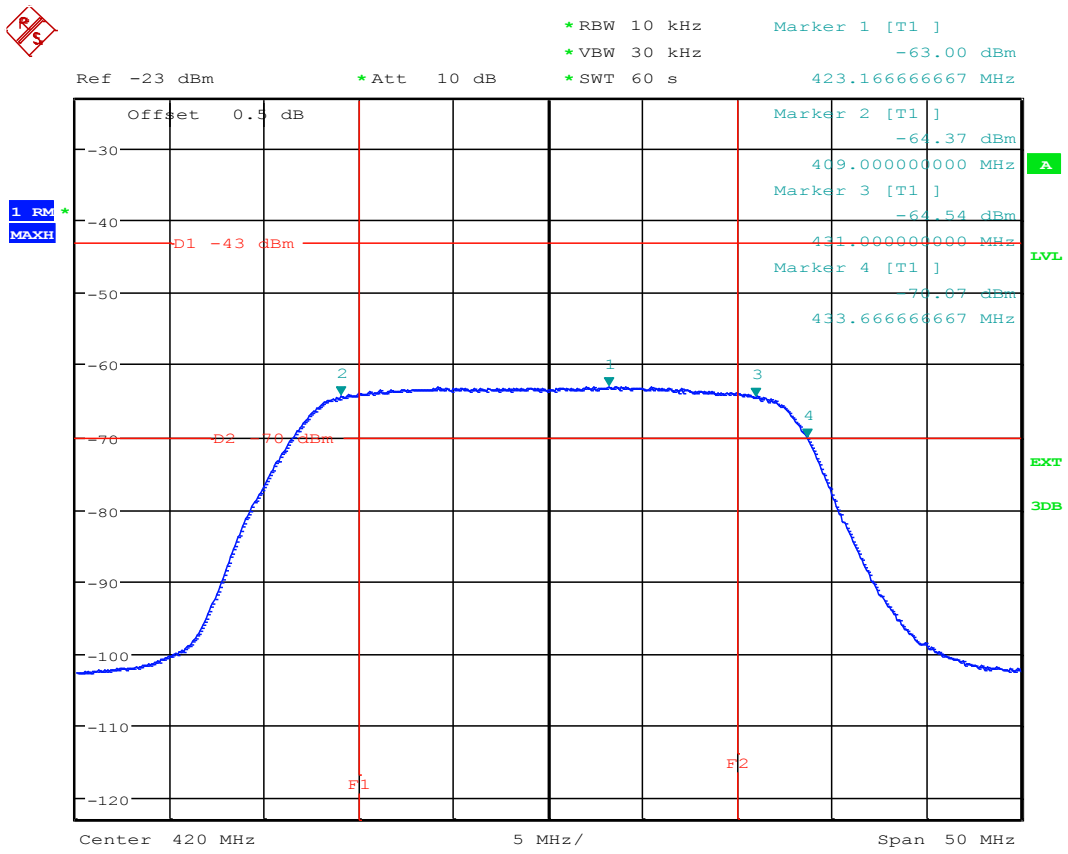
Figure ii Test Setup



16.5 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Signal Generator	R&S	SMBV100A	REF916	2022-05-30	12	2023-05-30
Spectrum Analyser	R&S	FSU46	U405	2022-05-21	12	2023-04-21
Multimeter	Agilent	34405a	REF976	2021-12-21	12	2022-12-21
Power Supply	Kikusui	PCR4000L	UH580	USE REF976		
Attenuator	Bird	10 dB	L112	USE REF916 AND U405		
Attenuator	Aerial Facilities	20 dB	U729	USE REF916 AND U405		
Attenuator	Huber & Suhner	6 dB	U551	USE REF916 AND U405		

16.6 Test Results



Date: 1.AUG.2022 14:47:26

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

To show compliance with the -70 dBm limit the following calculation shall be used

Note: The Cable Loss (dB) + Splitter Loss (dB) - antenna gain (dBi) - 2.15 dB (EIRP to ERP conversion) must be greater than or equal to 5.63dB.

Downlink	Test Result (dBm)	System Loss (dB)	ERP (dBm)	Limit = -70 (dBm)
410 MHz-430 MHz	-64.37	≥ 5.63	-70.0	Pass

17 EUT spurious emissions conducted measurements

17.1 Definition

Emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

17.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	RSS-131 (6.5) KDB 935210 D05 v01r04, clause 4.7.3
EUT Operating Frequencies Tested: Source Modulations:	427.5 MHz, 420.00 MHz, 412.5 MHz CW,
Source Level:	5.41 dBm (maximum input rating / AGC threshold)
Deviations from Standard:	None
Bandwidth:	RBW 100 kHz; VBW 3xRBW
Frequency Range Examined:	30 MHz - 5 GHz (10 x highest passband)
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 21°C	+15 ºC to +35 ºC (as declared)
Humidity: 50%RH	20%RH to 75%RH (as declared)
Supply: 115 Vac	

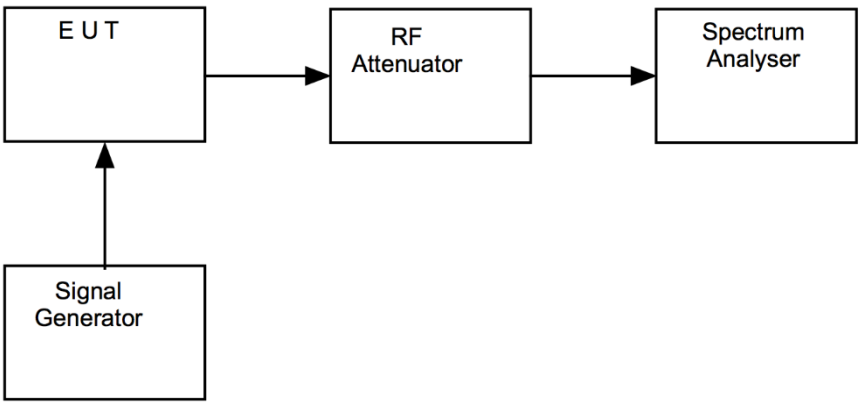
17.3 Test Limits

Spurious emissions from a signal booster (zone enhancer) must not exceed -13 dBm within any 100 kHz measurement bandwidth.

17.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure v, the emissions of the EUT were calculated by taking into account any cable and attenuator calibration factors. It was confirmed that at the maximum input level there was no compression.

Figure v Test Setup



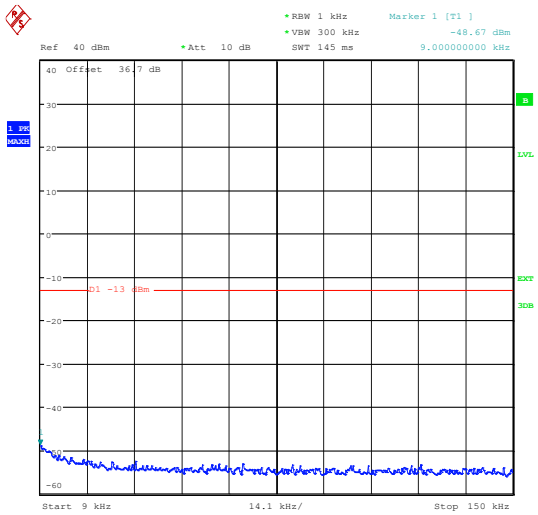
17.5 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Signal Generator	R&S	SMBV100A	REF916	2022-05-30	12	2023-05-30
Spectrum Analyser	R&S	FSU46	U405	2022-05-21	12	2023-04-21
Multimeter	Agilent	34405a	REF976	2021-12-21	12	2022-12-21
Power Supply	Kikusui	PCR4000L	UH580	USE REF976		
Attenuator	Bird	10 dB	L112	USE REF916 AND U405		
Attenuator	Aerial Facilities	20 dB	U729	USE REF916 AND U405		
Attenuator	Huber & Suhner	6 dB	U551	USE REF916 AND U405		

17.6 Test Results

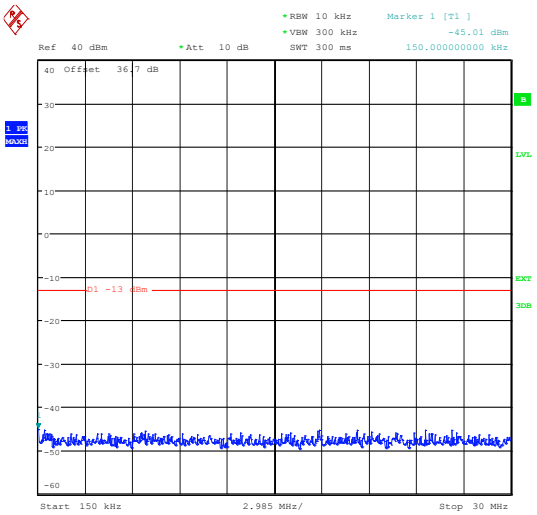
Downlink: Bottom 5 MHz band

9 kHz-150 kHz



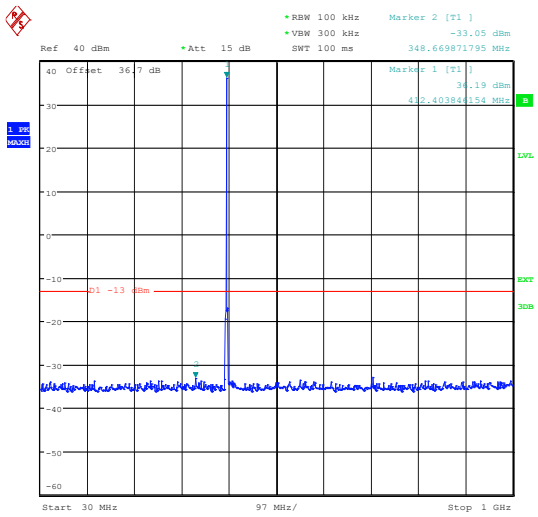
Date: 17.AUG.2022 13:30:17

150 kHz-30 MHz



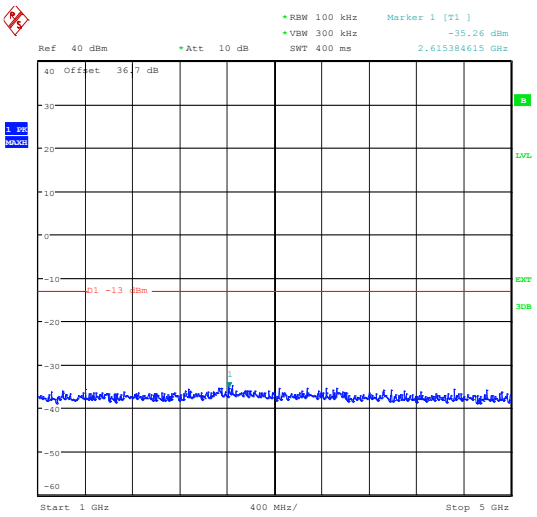
Date: 17.AUG.2022 13:30:58

30 MHz-1 GHz



Date: 17.AUG.2022 13:32:38

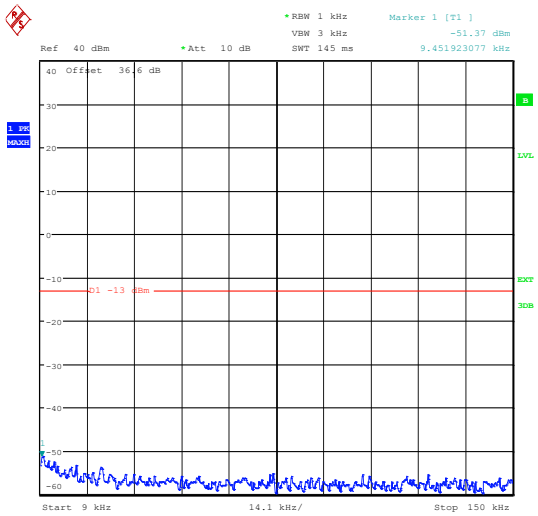
1 GHz-5 GHz



Date: 17.AUG.2022 13:33:26

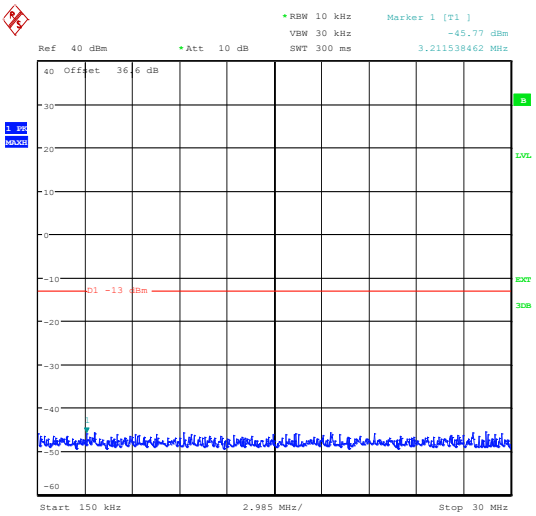
Downlink: Mid 5 MHz band

9 kHz-150 kHz



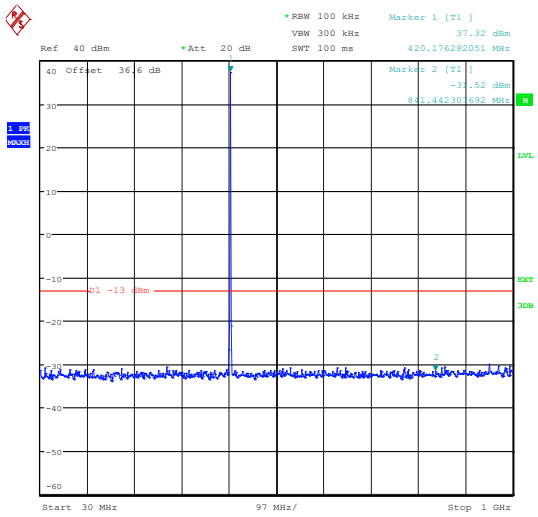
Date: 10.AUG.2022 13:37:05

150 kHz-30 MHz



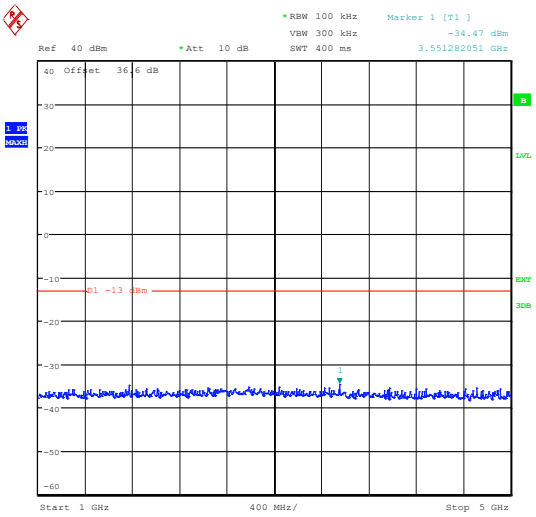
Date: 10.AUG.2022 13:37:36

30 MHz-1 GHz



Date: 10.AUG.2022 13:35:33

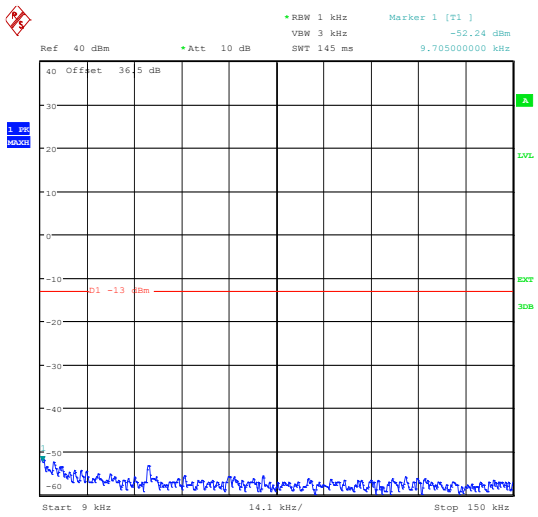
1 GHz-5 GHz



Date: 10.AUG.2022 13:36:25

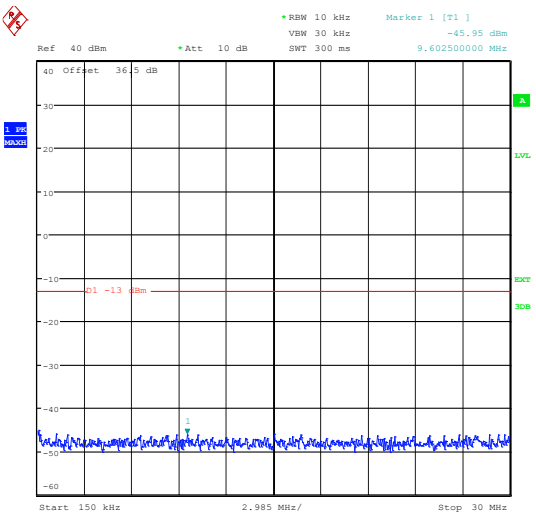
Downlink: Top 5 MHz band

9 kHz-150 kHz



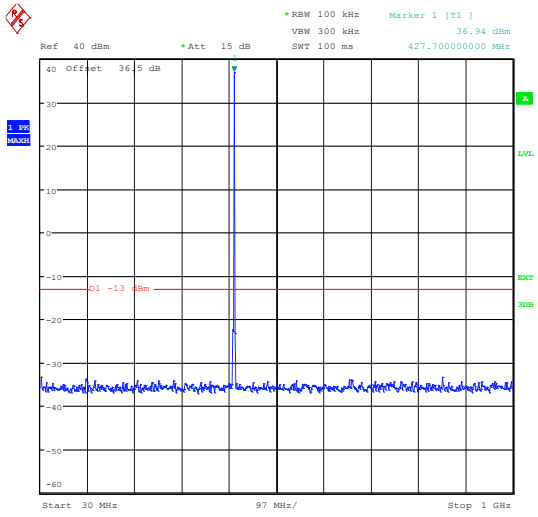
Date: 1.AUG.2022 15:26:56

150 kHz-30 MHz



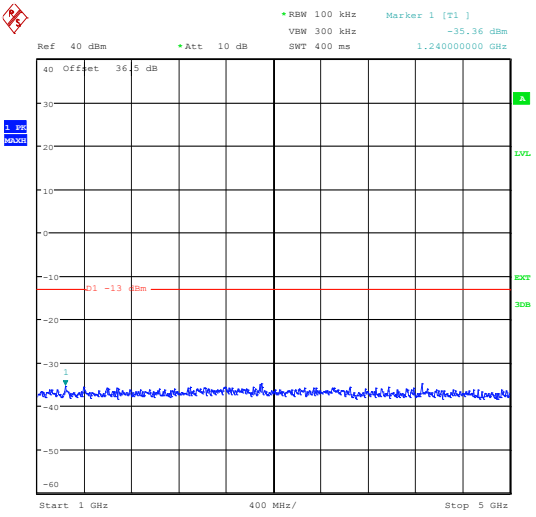
Date: 1.AUG.2022 15:27:23

30 MHz-1 GHz



Date: 1.AUG.2022 15:25:00

1 GHz-5 GHz



Date: 1.AUG.2022 15:26:23

18 Field strength of spurious radiation

18.1 Definitions

Spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation.

18.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Chamber 1
Test Standard and Clause:	2.1053, KDB 935210 D05v01r04 (4.9)
EUT Operating Frequencies Tested:	412.5 MHz / 420.0 MHz /427.5 MHz
Source Modulations:	CW,
Maximum Source Level:	5.4 dBm (maximum input rating / AGC threshold)
Deviations from Standard:	None
Frequency Range Examined:	30 MHz – 5 GHz (10 x highest passband)
Measurement BW:	30 MHz to 1 GHz: 120 kHz; Above 1 GHz: 1 MHz
Measurement Detector:	Up to 1 GHz: quasi-peak; Above 1 GHz: Peak

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 ºC to +35 ºC (as declared)
Humidity: 50 %RH	20%RH to 75%RH (as declared)
Supply: 115 Vac	

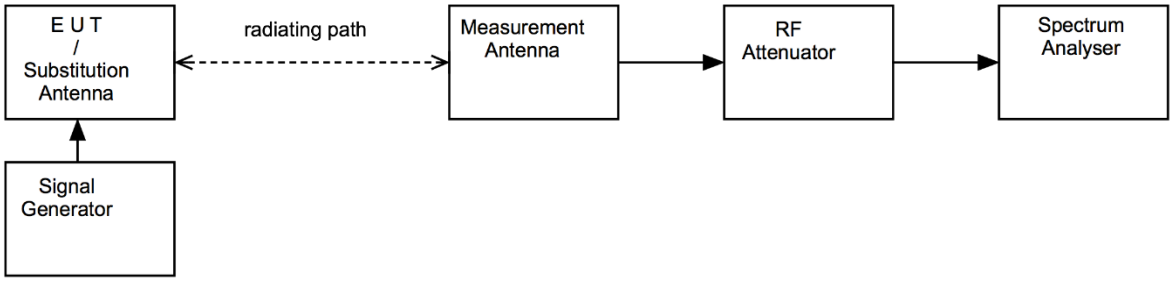
18.3 Test Limits

Spurious emissions from a signal booster (zone enhancer) must not exceed -13 dBm within any 100 kHz measurement bandwidth.

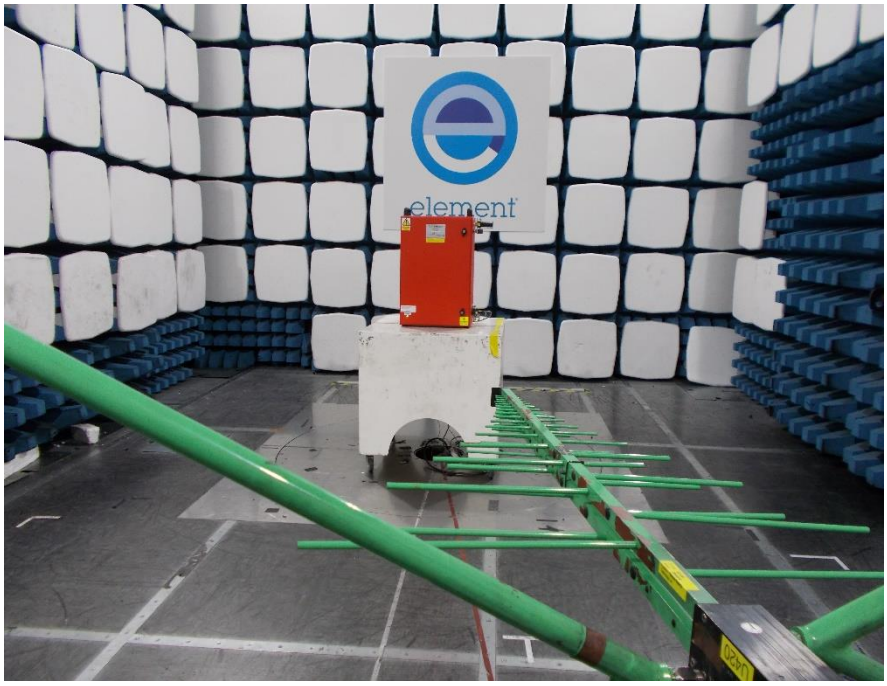
18.4 Test Method

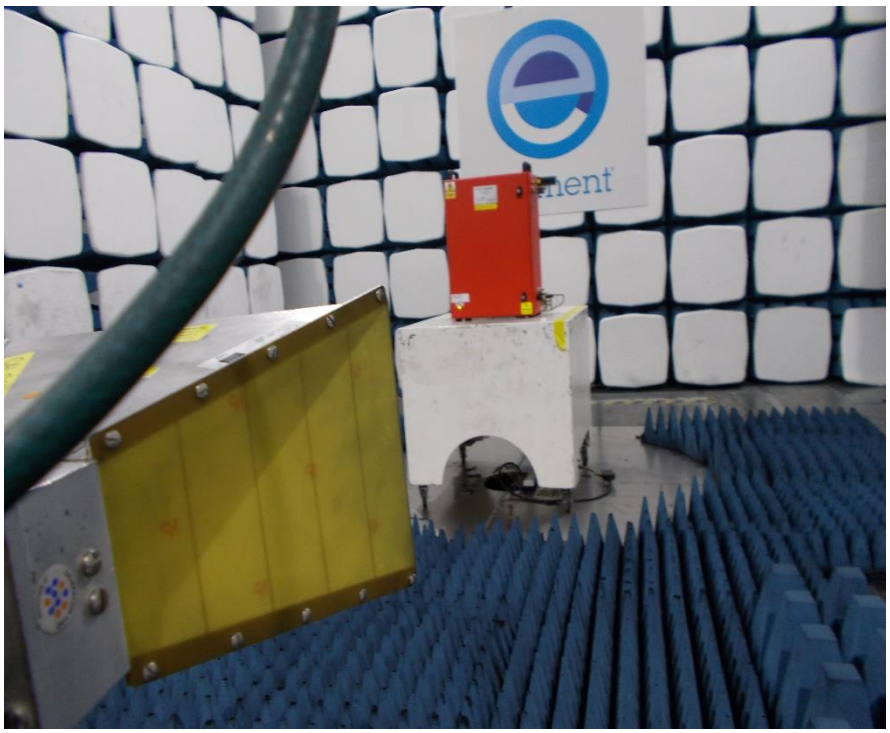
With the EUT setup as per section 9 of this report and connected as per Figure vii and with the EUT's antenna replaced by a non-radiating load, the emissions from the EUT were measured on a spectrum analyzer / EMI receiver. The EUT was rotated in three orthogonal planes and the measurement antenna height scanned (below 1GHz, from 1 to 4 m; above 1GHz as necessary) in order to maximise emissions. The measurements were performed with EUT set at its maximum gain. All modulation schemes, data rates and power settings were used to observe the worst-case configuration at each frequency.
The EUT was substituted with a known generator and antenna and for the same level achieved at the analyser, the effective radiated power was recorded.
Pre-scan plots are shown with a peak detector and 100kHz RBW.

Figure vii Test Setup



Test Setup Photograph(s)





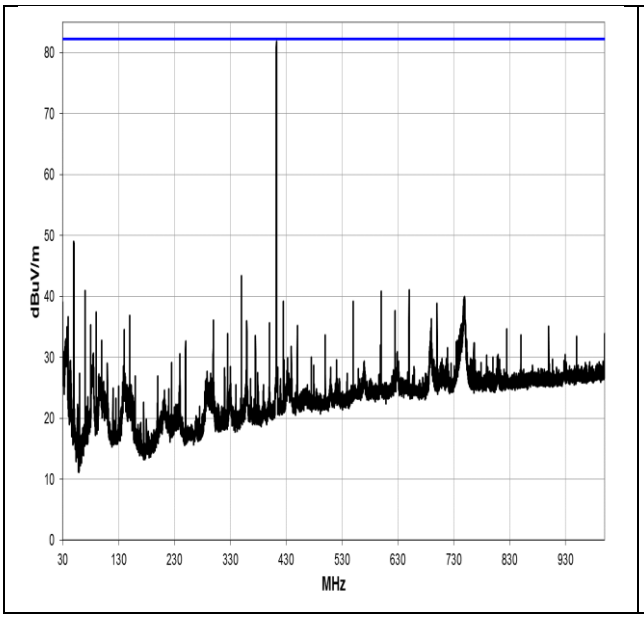
18.5 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
EMI Receiver	R&S	ESR7	U456	2022-01-25	12	2023-01-25
Pre Amp	AMETEK	LNA6901	U711	2022-03-14	12	2023-03-14
Bilog	Chase	CBL6112	U420	2021-01-28	24	2023-01-28
Pre Amp	Agilent	8449B	L572	2021-10-29	12	2022-10-29
1-18GHz Horn	EMCO	3115	U223	2021-12-13	24	2023-12-13

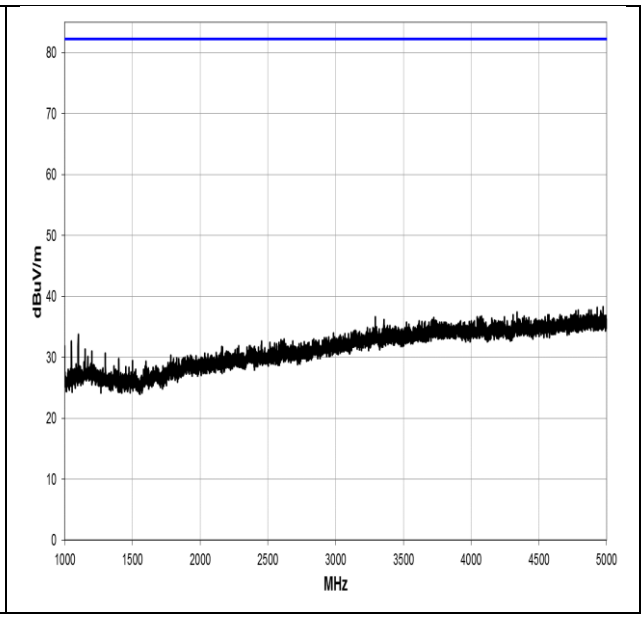
18.6 Test Results

Downlink: Bottom 5 MHz band 410 MHz-415 MHz

30 MHz-1 GHz



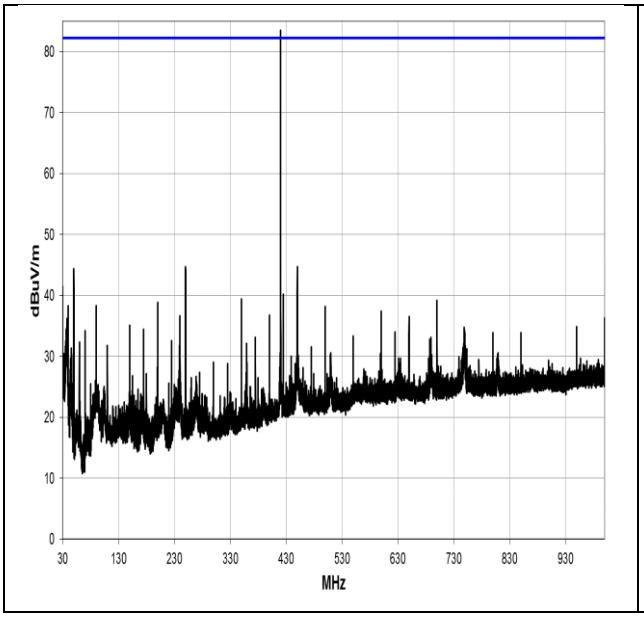
1 GHz-5 GHz



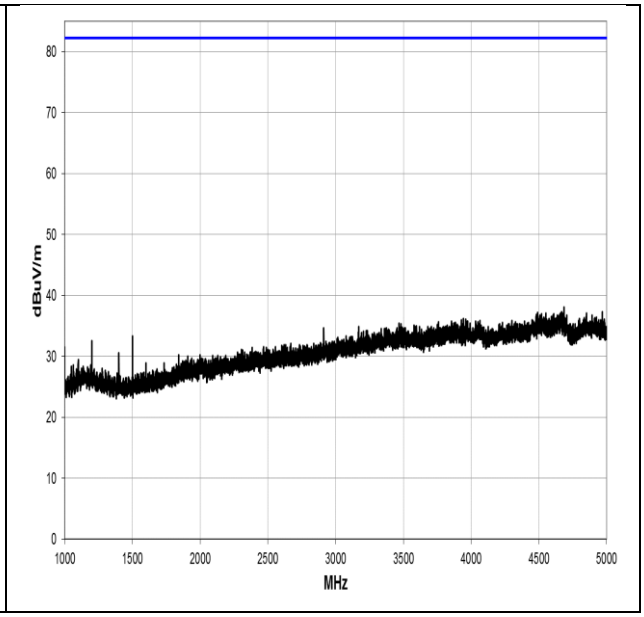
Spurious Frequency (MHz)	Spurious level (dBm)	Limit ERP (dBm)	Result
No significant emissions within 20 dB of the limit		-13.0 dBm	Pass

Downlink: Middle 5 MHz band 417.5 MHz-422.5 MHz

30 MHz-1 GHz



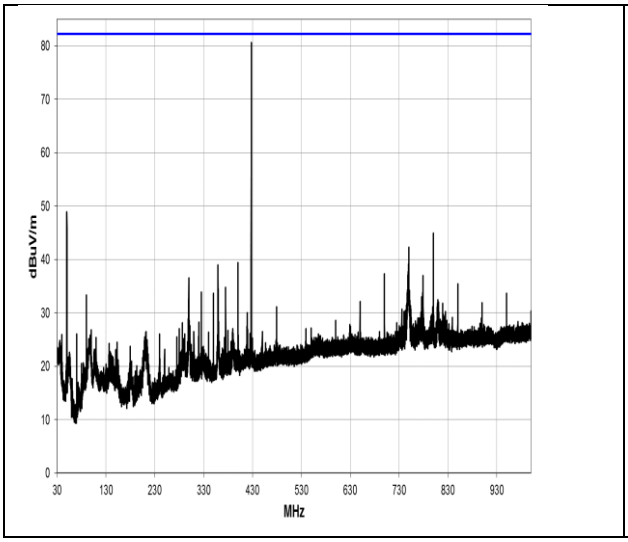
1 GHz-5 GHz



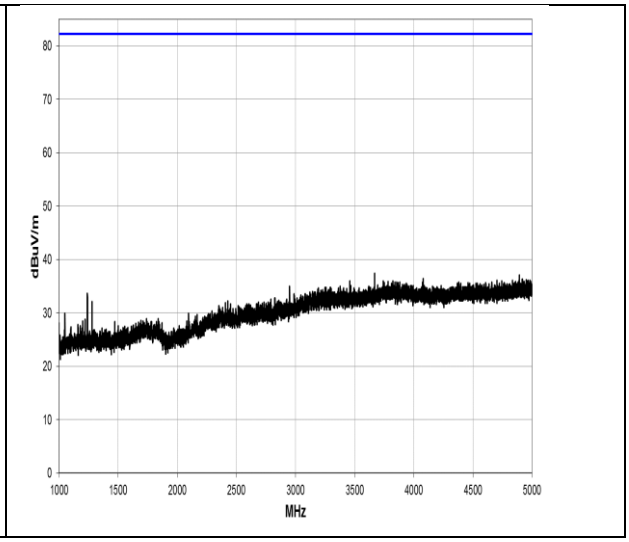
Spurious Frequency (MHz)	Spurious level (dBm)	Limit ERP (dBm)	Result
No significant emissions within 20 dB of the limit		-13.0 dBm	Pass

Downlink: Top 5 MHz band 425 MHz-430 MHz

30 MHz-1 GHz



1 GHz-5 GHz



Spurious Frequency (MHz)	Spurious level (dBm)	Limit ERP (dBm)	Result
No significant emissions within 20 dB of the limit		-13.0 dBm	Pass

19 RF Exposure

MPE Calculation

Prediction of MPE limit at a given distance

For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits. As the 20 cm separation specified under FCC rules may not be achievable under normal operation of the EUT, an RF exposure calculation is needed to show the minimum distance required to be less than the power density limit, as required under FCC rules.

Equation from IEEE C95.1

$$S = \frac{EIRP}{4\pi R^2} \quad \text{re-arranged} \quad R = \sqrt{\frac{EIRP}{S4\pi}}$$

Where:

S = power density
R = distance to the centre of radiation of the antenna
EIRP = EUT Maximum power

Result

Assessment Frequency (MHz)	***EIRP (W)***	***Power density limit (S) (mW/cm^2)***	***Distance (R) cm required to be less than the power density limit***
410	2558.6	0.273	3.10*

Note: For the above calculation the overall system loss needs to be taken into account.

To ensure all requirements are met the system loss must be greater than or equal to -5.64 dB, this is derived from the following

Cable Loss (dB) + Splitter Loss (dB) - antenna gain (dBi) - 2.15 dB (EIRP to ERP conversion)

To get an eirp level required to be used for the MPE calculation the 2.15 dB (EIRP to ERP conversion) is excluded.

Therefore the system loss to determine eirp from conducted output power is Cable Loss (dB) + Splitter Loss (dB) - antenna gain (dBi) = -3.48

The maximum output power 37.56 dBm and a -3.48 dB system loss (cables and antenna gain) taken into account above. (34.08 dBm / 2558.6 mW eirp)

Note: * The minimum distance should be 20cm.

20 Radio Testing – General Uncertainty Schedule

Radio Testing – General Uncertainty Schedule

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95 % confidence where no required test level exists.

Test/Measurement	Budget Number	MU
Conducted RF Power, Power Spectral Density, Adjacent Channel Power and Spurious emissions		
Absolute RF power (via antenna connecter) Dare RPR3006W Power Head	MU4001	**0.9 dB**
Carrier Power and PSD - Spectrum Analysers	MU4004	**0.9 dB**
Adjacent Channel Power	MU4002	**1.9 dB**
Transmitter conducted spurious emissions	MU4041	**0.9 dB**
Conducted power and spurious emissions 40 GHz to 50 GHz	MU4042	**2.4 dB**
Conducted power and spurious emissions 50 GHz to 75 GHz	MU4043	**2.5 dB**
Conducted power and spurious emissions 75 GHz to 110 GHz	MU4044	**2.4 dB**
Radiated RF Power and Spurious emissions ERP and EIRP		
Effective Radiated Power Reverb Chamber	MU4020	**3.7 dB**
Effective Radiated Power	MU4021	**4.7 dB**
TRP Emissions 30 MHz to 1 GHz using CBL6111 or CBL6112 Bilog Antenna	MU4046	**5.3 dB**
TRP Emissions 1 GHz to 18 GHz using HL050 Log Periodic Antenna	MU4047	**5.1 dB**
TRP Emissions 18 GHz to 26.5 GHz using Standard Gain Horn	MU4048	**2.7 dB**
TRP Emissions 26.5 GHz to 40 GHz using Standard Gain Horn	MU4049	**2.7 dB**
Spurious Emissions Electric and Magnetic Field		
Radiated Spurious Emissions 30 MHz to 1 GHz	MU4037	**4.7 dB**
Radiated Spurious Emissions 1-18 GHz	MU4032	**4.5 dB**
E Field Emissions 18GHz to 26 GHz	MU4024	**3.2 dB**
E Field Emissions 26GHz to 40 GHz	MU4025	**3.3 dB**
E Field Emissions 40GHz to 50 GHz	MU4026	**3.5 dB**
E Field Emissions 50GHz to 75 GHz	MU4027	**3.6 dB**
E Field Emissions 75GHz to 110 GHz	MU4028	**3.6 dB**
Radiated Magnetic Field Emissions	MU4031	**2.3 dB**
Frequency Measurements		
Frequency Deviation	MU4022	**0.316 kHz**
Frequency error using CMTA test set	MU4023	**113.441 Hz**
Frequency error using GPS locked frequency source	MU4045	**0.0413 ppm**
Bandwidth/Spectral Mask Measurements		
Channel Bandwidth	MU4005	**3.87 %**
Transmitter Mask Amplitude	MU4039	**1.3 dB**
Transmitter Mask Frequency	MU4040	**2.59 %**
Time Domain Measurements		
Transmission Time	MU4038	**4.40 %**
Dynamic Frequency Selection (DFS) Parameters)		
DFS Analyser - Measurement Time	MU4006	**679 µs**
DFS Generator - Frequency Error	MU4007	**92 Hz**
DFS Threshold Conducted	MU4008	**1.3 dB**
DFS Threshold Radiated	MU4009	**3.2 dB**

Test/Measurement	Budget Number	MU
Receiver Parameters		
EN300328 Receiver Blocking	MU4010	**1.1 dB**
EN301893 Receiver Blocking	MU4011	**1.1 dB**
EN303340 Adjacent Channel Selectivity	MU4012	**1.1 dB**
EN303340 Overloading	MU4013	**1.1 dB**
EN303340 Receiver Blocking	MU4014	**1.1 dB**
EN303340 Receiver Sensitivity	MU4015	**0.9 dB**
EN303372-1 Image Rejection	MU4016	**1.4 dB**
EN303372-1 Receiver Blocking	MU4017	**1.1 dB**
EN303372-2 Adjacent Channel Selectivity	MU4018	**1.1 dB**
EN303372-2 Dynamic Range	MU4019	**0.9 dB**
Receiver Blocking Talk Mode Conducted	MU4033	**1.2 dB**
Receiver Blocking Talk Mode- radiated	MU4034	**3.4 dB**
Rx Blocking, listen mode, blocking level	MU4035	**3.2 dB**
Rx Blocking, listen mode, radiated Threshold Measurement	MU4036	**3.4 dB**
Adjacent Sub Band Selectivity	MU4003	**4.2 dB**