A TEST REPORT

FOR

TEAM SIMOCO Ltd

ON

SB2025NT100W

Private Land Mobile Radio

DOCUMENT NO. TRA-012399-W-US-1

TEST REPORT NO: TRA-012399W-US-1

COPY NO: 1

ISSUE NO: 1

FCC ID: U89 SB2K5354O2O2V

REPORT ON THE CERTIFICATION TESTING OF A
TEAM SIMOCO
SB2025NT100W
WITH RESPECT TO
THE FCC RULES CFR 47,
PART 90

PRIVATE LAND MOBILE RADIO.

TEST DATE: 27th Nov - 20th December 2012

APPROVED BY: _____ J CHARTERS
RADIO
PRODUCT
MANAGER

DATE: 21st December 2012

Distribution:

Copy Nos: 1. Team Simoco

2. TRaC Global

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Notes:

1. Component failure during test

YES	[ ]
NO	[X]

2. If Yes, details of failure:

3. The facilities used for the testing of the product contain in this report are FCC Listed.

CERTIFICATE OF CONFORMITY & COMPLIANCE

FCC IDENTITY:	U89 SB2K5354O2O2V
PURPOSE OF TEST:	Certification
TEST SPECIFICATION:	FCC RULES CFR 47, Part 90
TEST RESULT:	Compliant to Specification
EQUIPMENT UNDER TEST:	SB2025NT100W
EQUIPMENT TYPE:	Private Land Mobile Radio
FREQUENCY OF OPERATION:	435MHz – 470MHz
MAXIMUM OUTPUT CONDUCTED:	49.98dBm 99.54W
MODULATION TYPE:	F3E, F1E
POWER SOURCE(s):	+13.8Vdc
TEST DATE(s):	27th Nov – 20th Dec 2012
APPLICANT:	Team Simoco
ADDRESS:	Team Simoco Ltd Field House Uttoxeter Old Road Derby DE1 1NH

APPROVED BY: _____

RADIO
PRODUCT
MANAGER

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT):	SB2025NT100W 400MHz
EQUIPMENT TYPE:	Private Land Mobile Radio
PURPOSE OF TEST:	Certification
TEST SPECIFICATION(s):	FCC RULES CFR 47, Part 90
TEST RESULT:	COMPLIANT Yes [X] No [ ]
APPLICANT'S CATEGORY:	MANUFACTURER [X] IMPORTER [ ] DISTRIBUTOR [ ] TEST HOUSE [ ] AGENT [ ]
APPLICANT'S CONTACT PERSON(s):	Mr Richard Stimson
EMAIL ADDRESS	Richard.stimson@teamsimoco.com
APPLICANT:	Team Simoco Ltd
ADDRESS:	Team Simoco Ltd Field House Uttoxeter Old Road Derby DE1 1NH
TEL:	01332 375414
MANUFACTURER:	Team Simoco Ltd
EUT(s) COUNTRY OF ORIGIN:	United Kingdom
TEST LABORATORY:	TRaC Global
TEST DATE(s):	27th Nov – 20th Dec 2012
TEST REPORT No:	TRA-012399-W-US-1

EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.

TEST/EXAMINATION	RULE PART	APPLICABILITY	RESULT
RF Power Output	90.205	Yes	Complies
Audio Frequency Response (a)	2.1047	Yes	Complies
Modulation Limiting	2.1047	No	N/a
Occupied Bandwidth	90.210	Yes	Complies
Spurious Emissions at Antenna Terminals	90.210	Yes	Complies
Field Strength of Spurious Emissions	90.210	Yes	Complies
Field Strength of Un- Intentional Spurious Emissions	15.109	Yes	Complies
Frequency Stability	90.213	Yes	Complies
Transient behaviour	90.214	No	Complies
Emission Mask	90.210(d)	Yes	Complies

2. Product class: Class A [X] Class B [ ]

3. Product Use: Private Land Mobile Radio

4. Emission Designator: F3E, F1E

5. Temperatures: Ambient (Tnom) 24°C

6. Supply Voltages: Vnom +13.8Vdc

Note: Vnom voltages are as stated above unless otherwise shown on the test report page

7. Equipment Category:
   Single channel [ ]
   Two channel [ ]
   Multi-channel [X]

8. Channel spacing:
   Narrowband [X]
   Wideband [X]

9. Test Location TRaC Global
   Skelmersdale [X]

10. Modifications made during test program No modifications were performed.

System description:

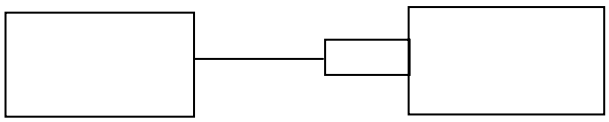
The SB2025NT100W is a radio base station capable of operating in analogue FM and digital P25 modes as a stand-alone repeater or as part of a simulcast/voted system. Inputs are provided for connection to external frequency and 1PPS timing signals to ensure the accurate frequency and modulation synchronisation necessary for simulcast operation. Dispatcher connection is via Ethernet using the TIA DFSI protocol."

COMPLIANCE TESTS

RF OUTPUT POWER – CONDUCTED – PART 2.1046

Ambient temperature = 24°C
Relative humidity = 34%
Supply voltage = +13.8Vdc
Channel number = See test results

Radio Laboratory



Frequency MHz	Level at Analyser (dBm)	Output Cable & Attenuator loss (dB)	Conducted Output Power (dBm)	Conducted Output Power (W)	Rated output Power (dBm)	Rated output Power (W)
435.0250	9.5	40.48	49.98	99.54	50	100
445.0250	9.5	40.48	49.98	99.54	50	100
452.5500	9.5	40.48	49.98	99.54	50	100
469.9750	9.2	40.48	49.68	92.89	50	100

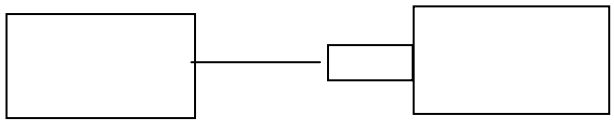
Note: Ch1 Frequency = 435.0250MHz
Ch2 Frequency = 445.0250MHz
Ch3 Frequency = 452.5500MHz
Ch4 Frequency = 469.9750MHz

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	No	ACTUAL EQUIPMENT USED
Radio communications Analyser	RHODE & SCHWARZ	CMTA52	894715/003	TRL05	**X**
CABLE	TRAC	N/A	N/A	UH271	**X**
CABLE	TRAC	N/A	N/A	UH272	**X**
ATTENUATOR	SPINNER	745357	N/A	TRLUH225	**X**
ATTENUATOR	-	-	-	20dB	**X**
ATTENUATOR	BIRD	8304-100-N	N/A	222	

TRANSMITTER TESTS

99% Bandwidth – CONDUCTED – Part 90.209

Ambient temperature	=	24°C	Radio Laboratory
Relative humidity	=	56%	
Supply voltage	=	+13.8Vdc	
Channel number	=	See test results	



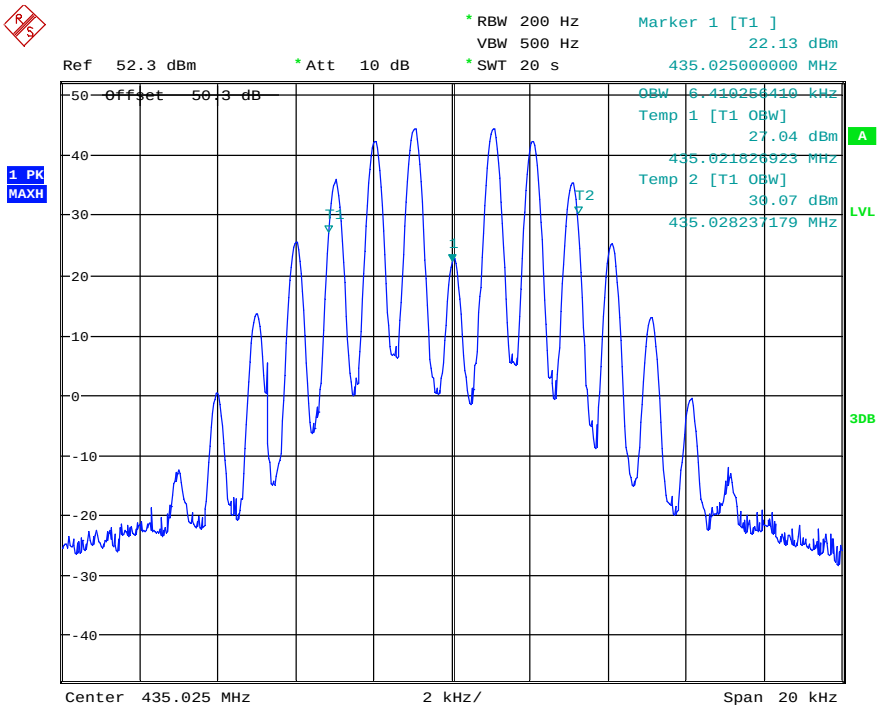
Note:

1. Cable and attenuator between EUT and spectrum analyser 50dB
2. See Table below for 99% Power Occupied Bandwidth
3. Internally generated test tone analogue speech
4. P25 Internally generated test tone C4FM

Frequency Of Operation Channel	Modulation Type
	FM 2.5kHz Deviation
435.0250MHz	99% Bandwidth =6.41kHz
445.0250MHz	99% Bandwidth =6.37kHz
452.5500MHz	99% Bandwidth =6.37kHz
469.9750MHz	99% Bandwidth =6.37kHz
	FM 5kHz Deviation
435.0250MHz	99% Bandwidth =12.25kHz
445.0250MHz	99% Bandwidth =12.25kHz
452.5500MHz	99% Bandwidth =12.25kHz
469.9750MHz	99% Bandwidth =12.11kHz
	P25
435.0250MHz	99% Bandwidth =8.52kHz
445.0250MHz	99% Bandwidth =8.39kHz
452.5500MHz	99% Bandwidth =8.39kHz
469.9750MHz	99% Bandwidth =8.20kHz

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRAC No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	**X**
CABLE	TRAC	N/A	N/A	UH271	**X**
CABLE	TRAC	N/A	N/A	UH272	**X**
ATTENUATOR	SPINNER	745357	N/A	TRLUH225	**X**
ATTENUATOR	-	-	-	20dB	**X**
ATTENUATOR	BIRD	8304-100-N	N/A	222	**X**

435.0250MHz 99% Bandwidth 12.5kHz



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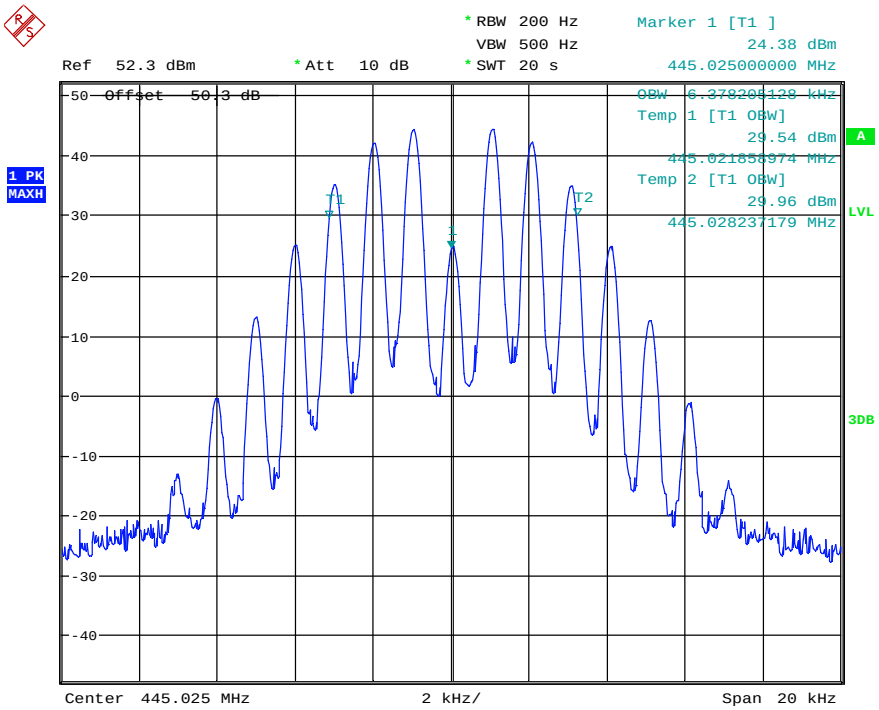
445.0250MHz 99% Bandwidth 12.5kHz



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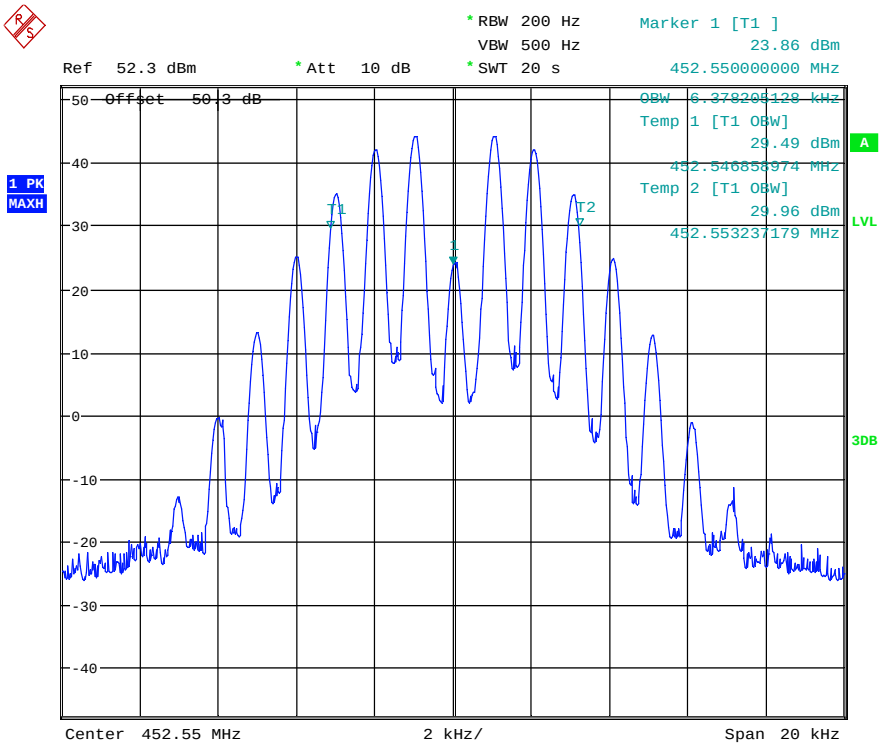
452.5500MHz 99% Bandwidth 12.5kHz



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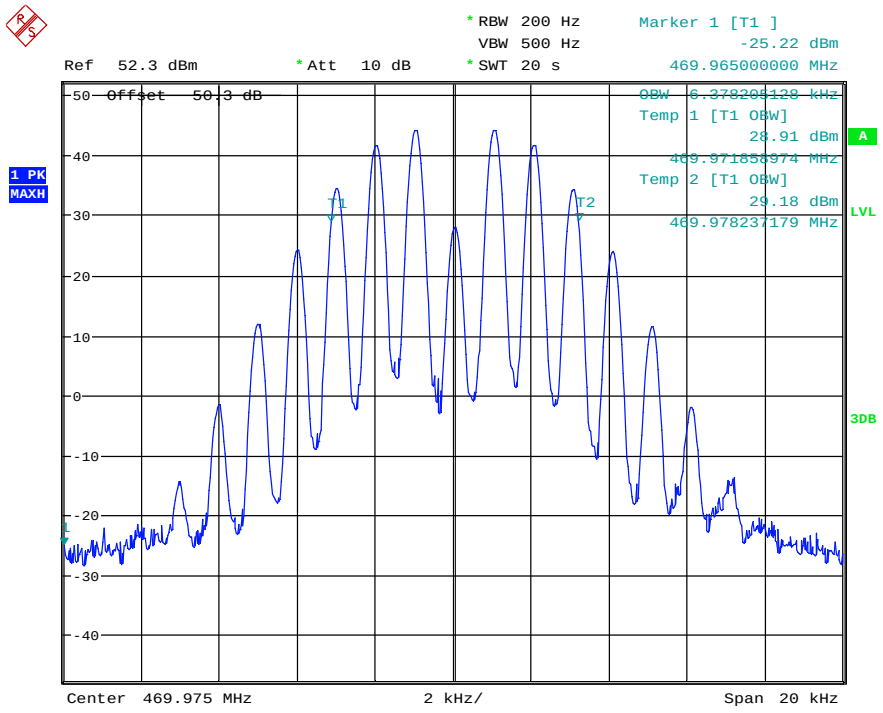
469.9750MHz 99% Bandwidth 12.5kHz



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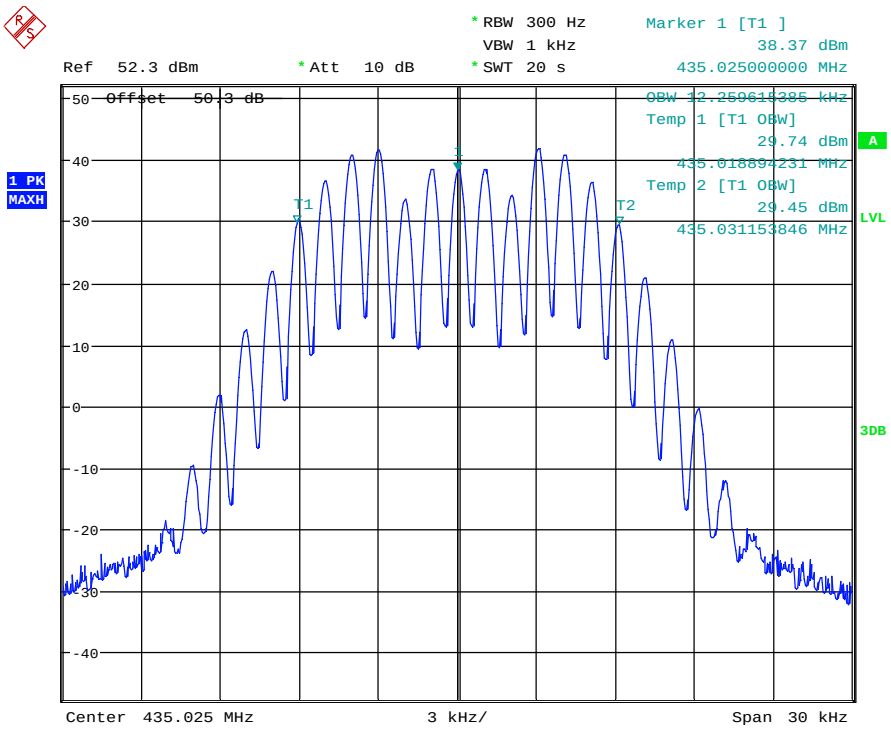
435.0250MHz 99% Bandwidth 25kHz



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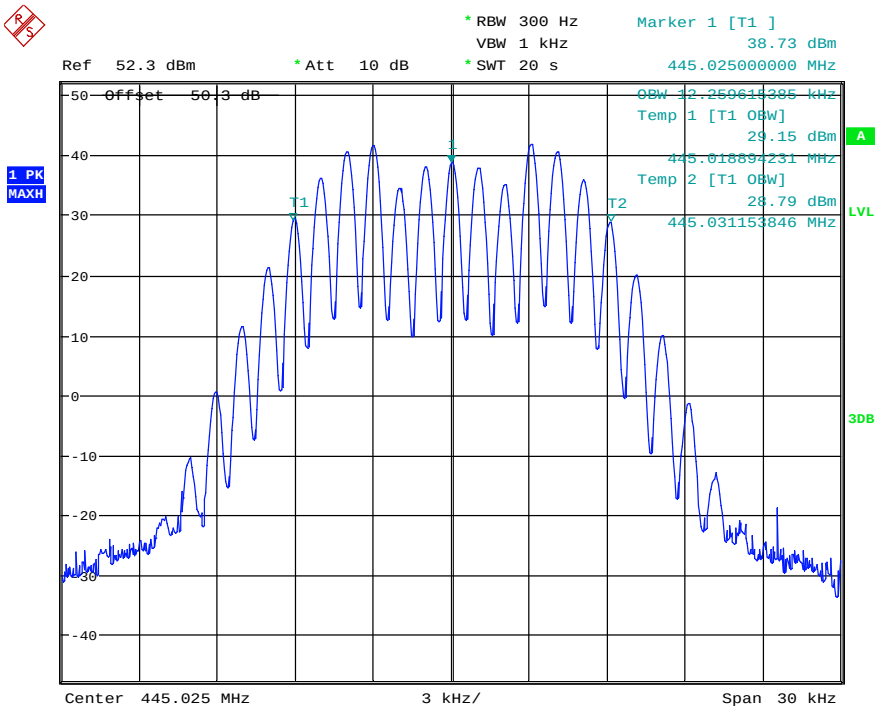
445.0250MHz 99% Bandwidth 25kHz



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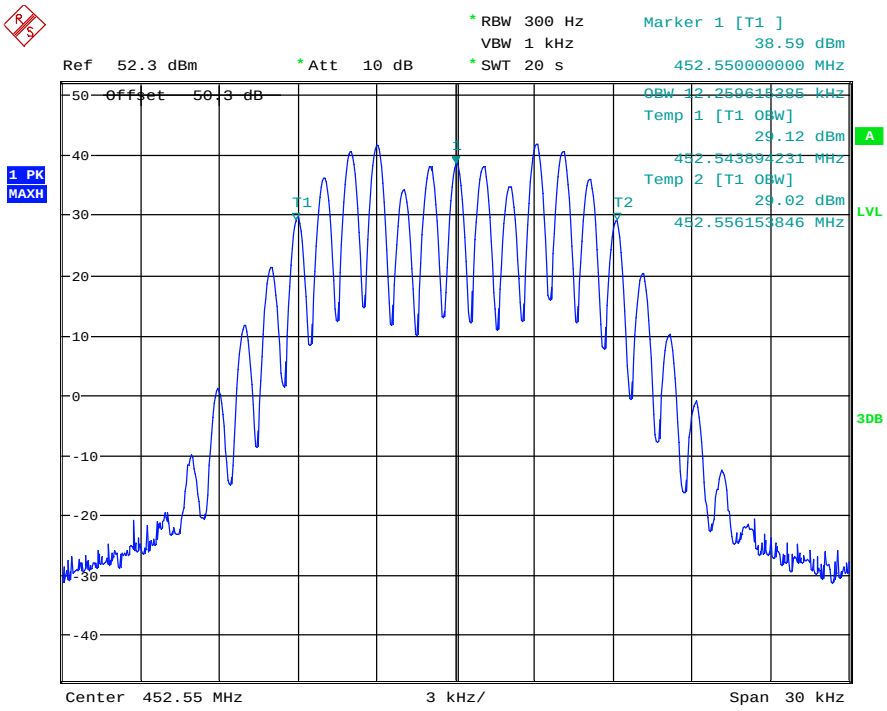
452.5500MHz 99% Bandwidth 25kHz



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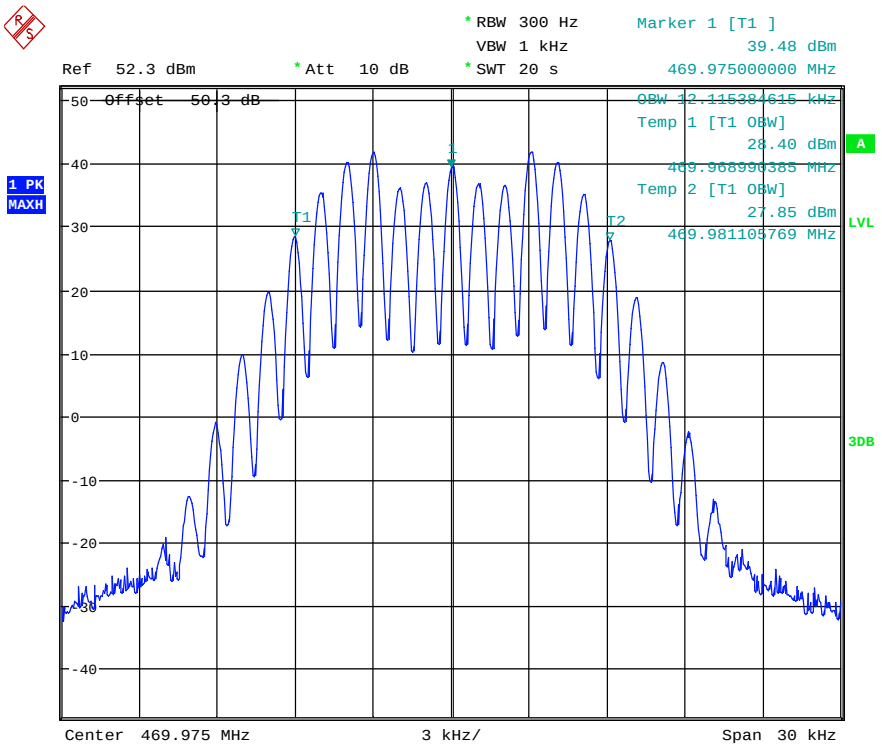
469.9750MHz 99% Bandwidth 25kHz



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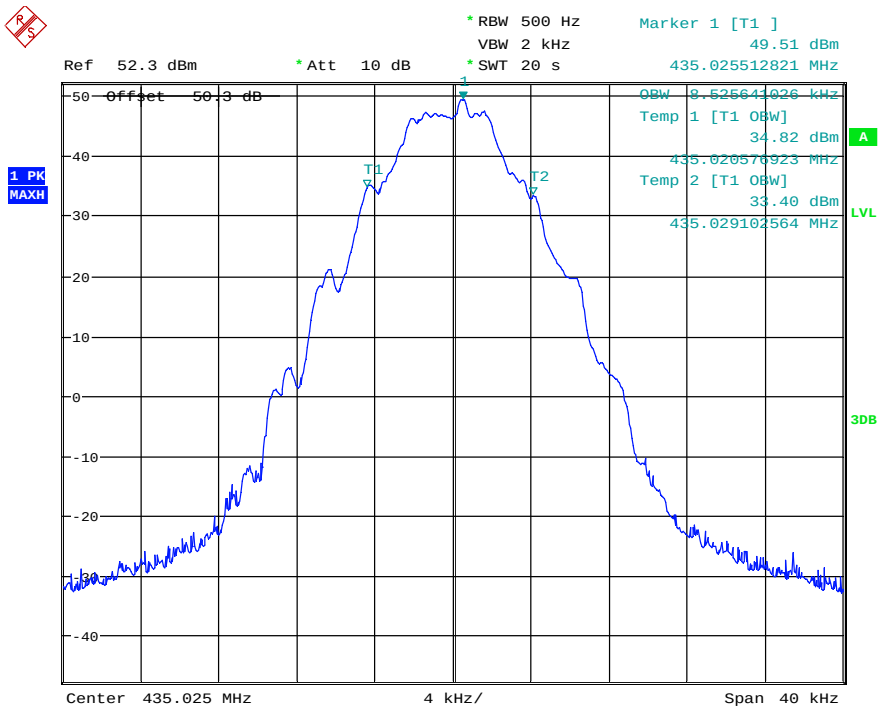
435.0250MHz 99% Bandwidth P25



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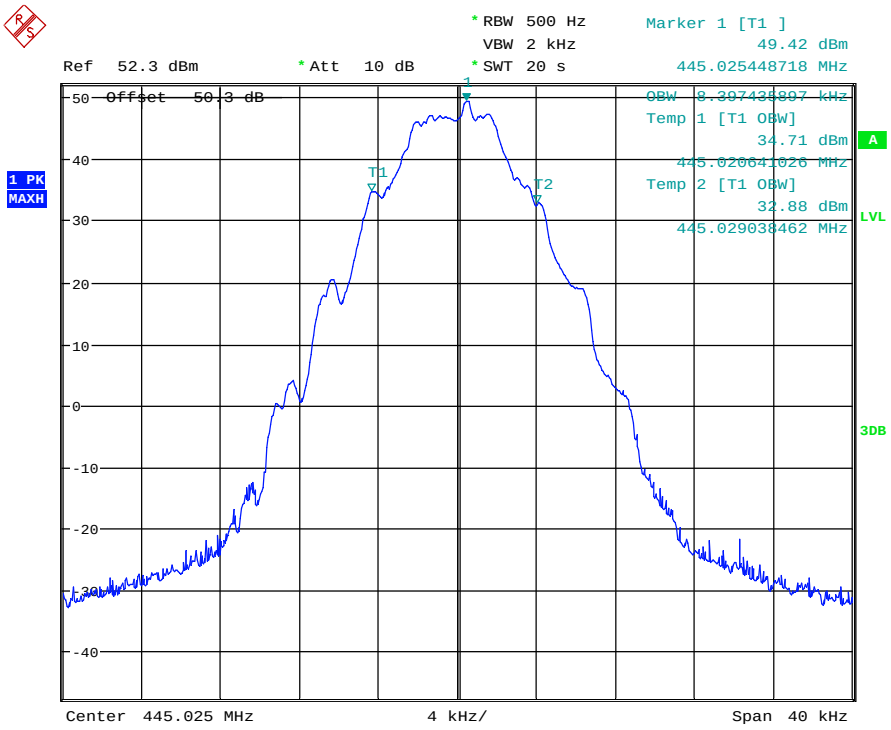
445.0250MHz 99% Bandwidth P25



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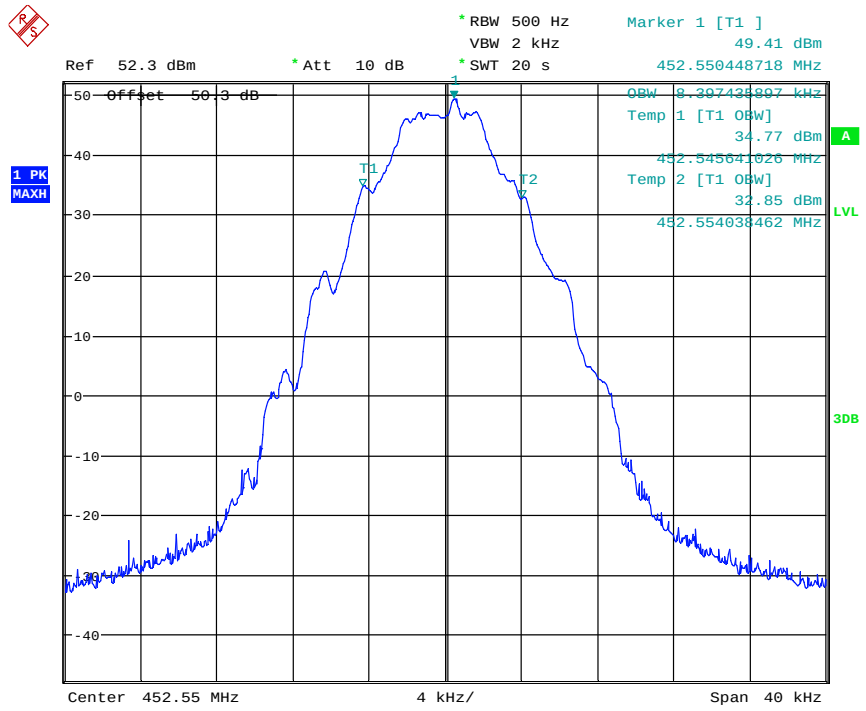
452.5500MHz 99% Bandwidth P25



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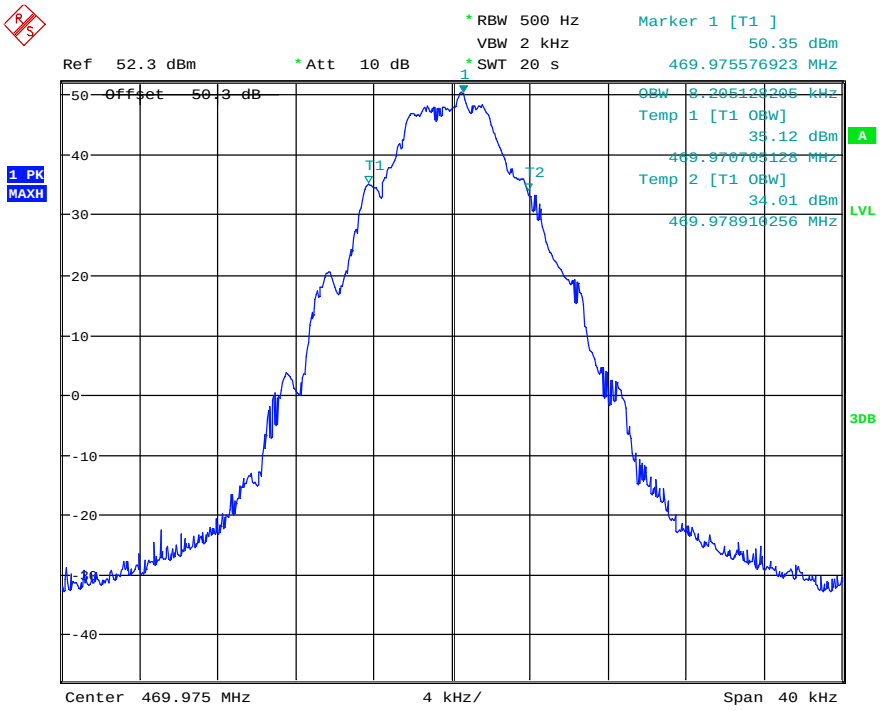
469.9750MHz 99% Bandwidth P25



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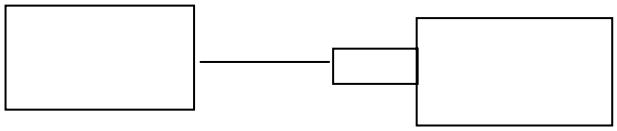
TRANSMITTER TESTS

Occupied Bandwidth
Emission Masks. Part 90.210(b)(d)

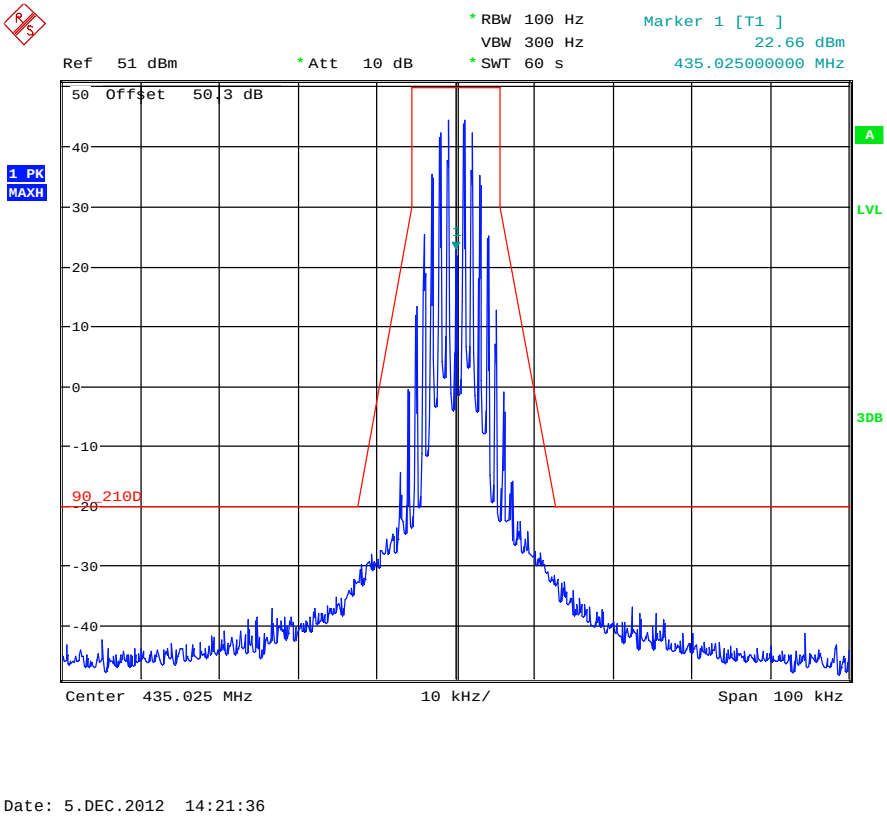
Ambient temperature	=	24°C	Radio Laboratory		
Relative humidity	=	56%	Test Signal	=	F3E
Supply voltage	=	+13.8Vdc			



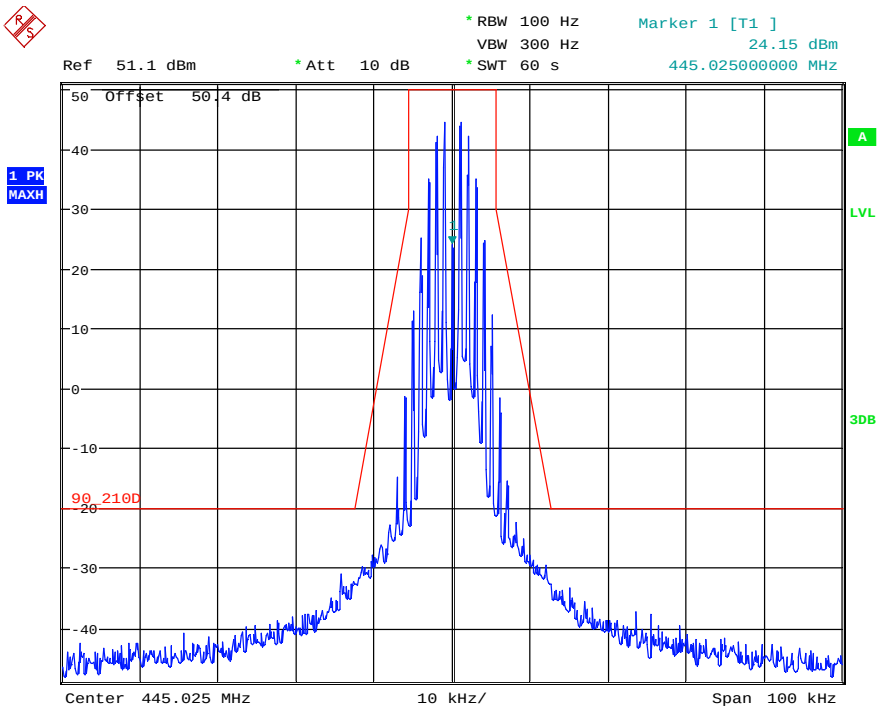
EUT Cable & Attenuator Spectrum Analyser TRL281

Note: the spectrum masks are defined in: Part 90.210(b) as the transmitter operates in the band 435MHz – 470MHzusing an authorized bandwidth of 11.25kHz as per section 90.209(5).

Emission Masks. Part 90.210(d) 435.0250MHz FM 12.5kHz



Emission Masks. Part 90.210(d) 445.025MHz FM 12.5kHz



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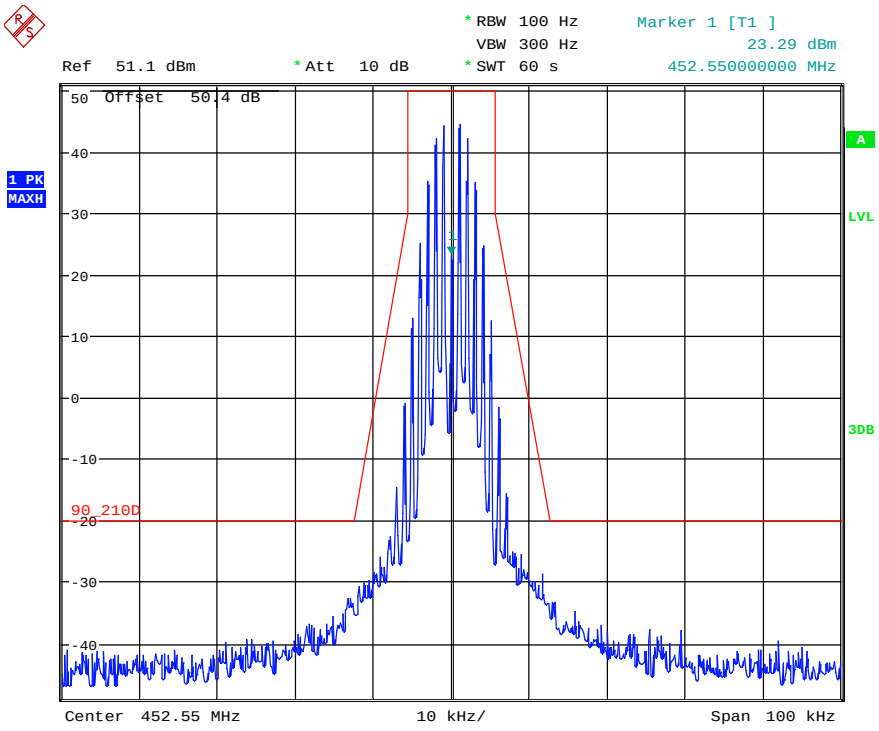
Emission Masks. Part 90.210(d) 452.55MHz FM 12.5kHz



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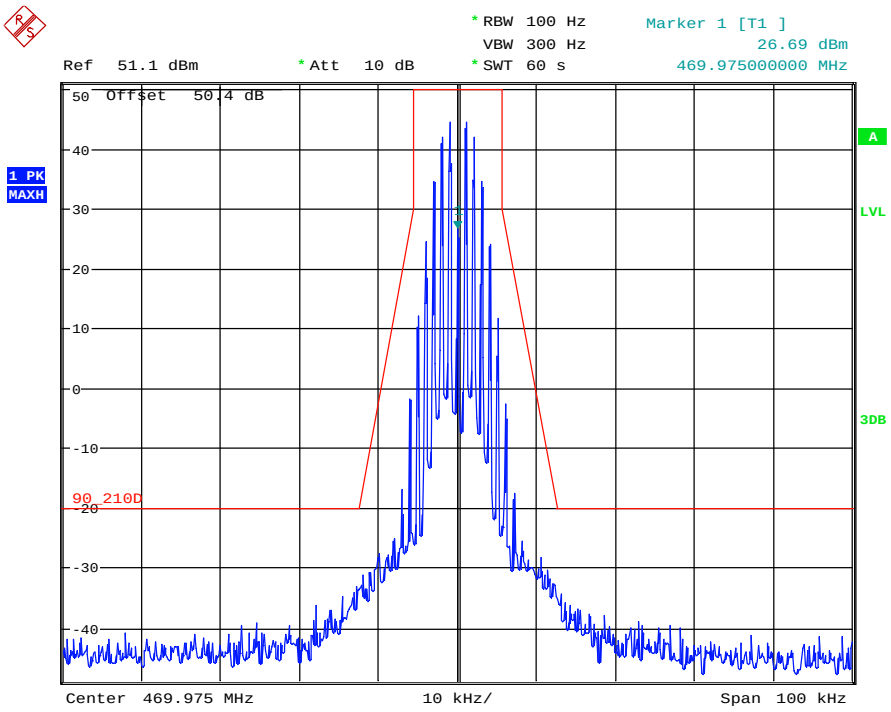
Emission Masks. Part 90.210(d) 469.9750MHz FM 12.5kHz



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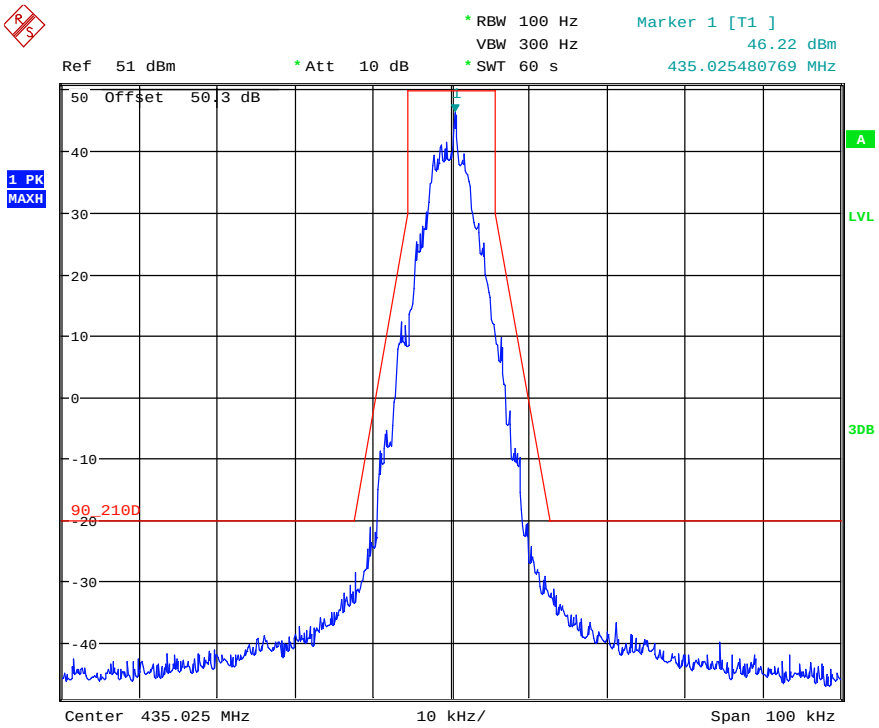
Emission Masks. Part 90.210(d) 435.0250MHz P25



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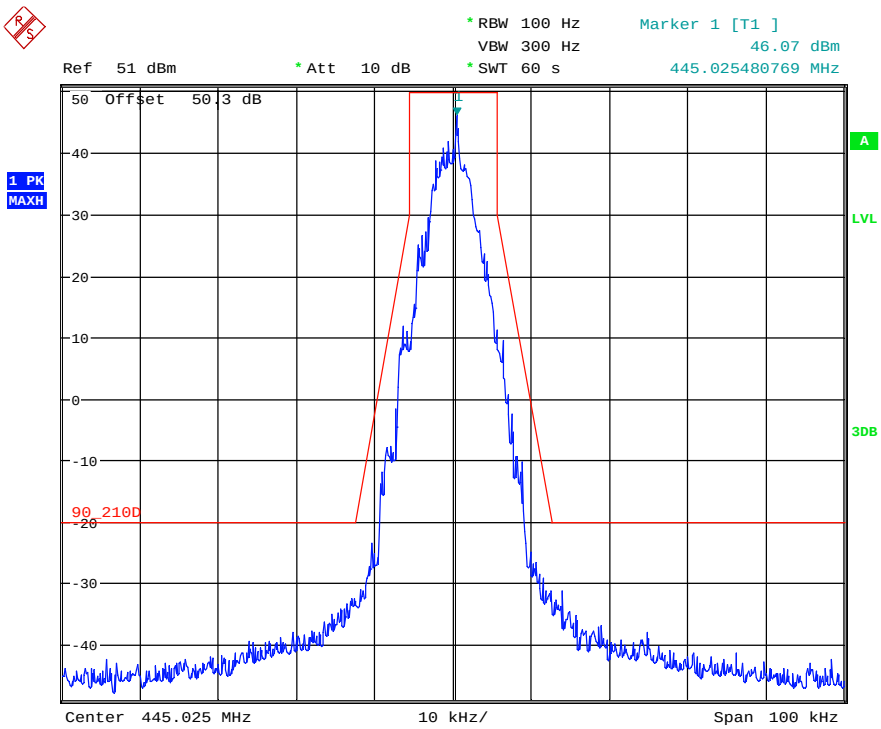
Emission Masks. Part 90.210(d) 445.0250MHz P25



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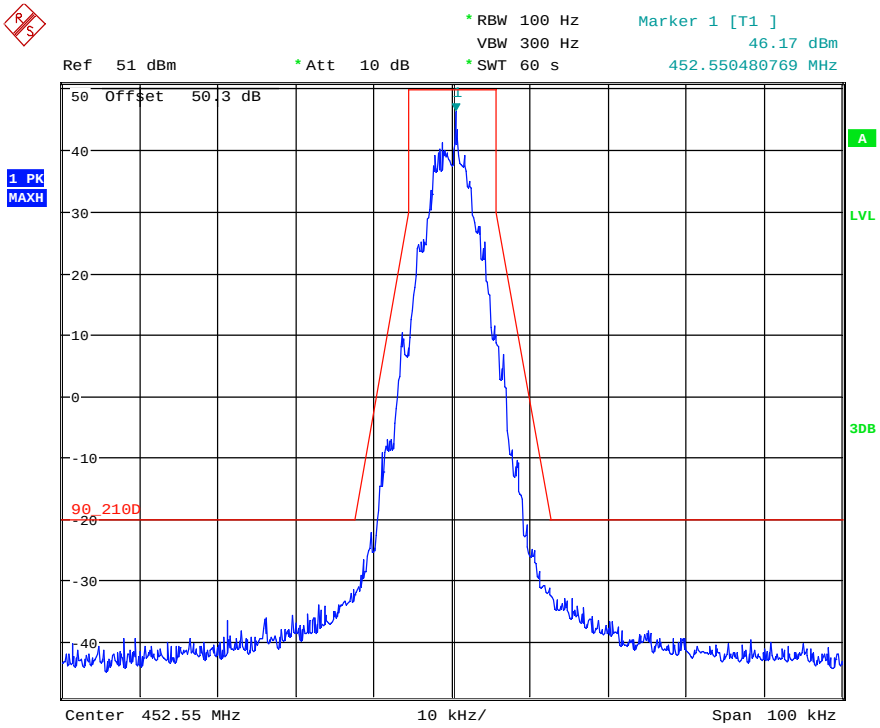
Emission Masks. Part 90.210(d) 452.5500MHz P25



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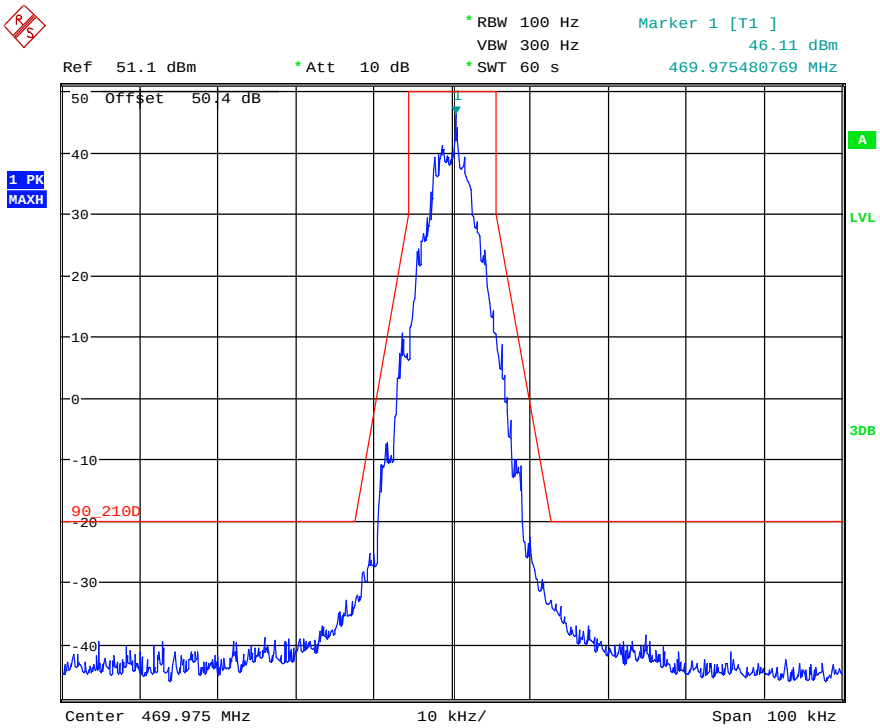
Emission Masks. Part 90.210(d) 469.9750MHz P25



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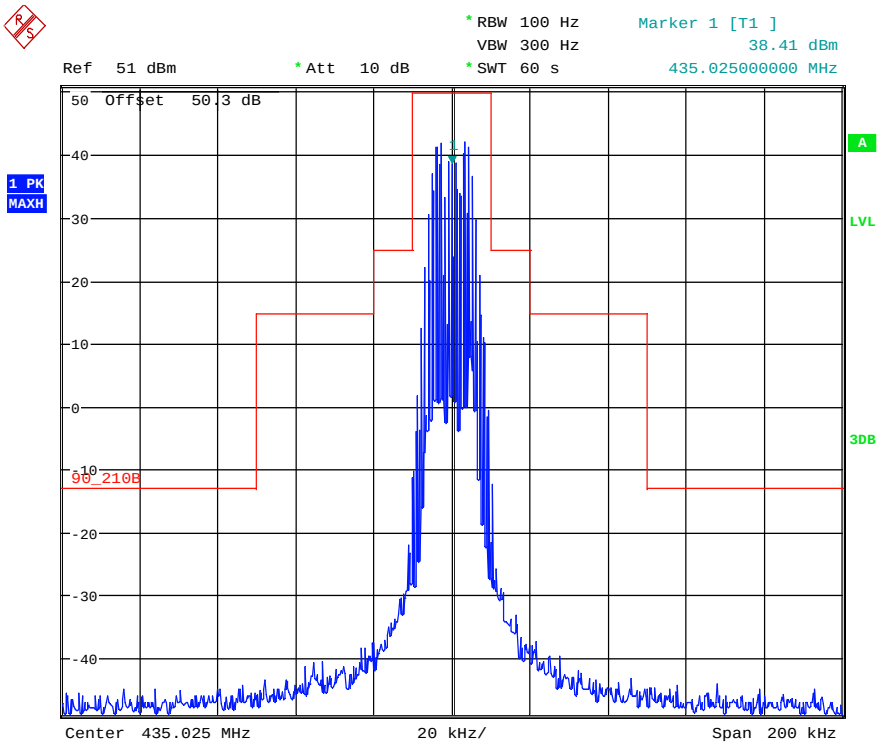
Emission Masks. Part 90.210(b) 435.0250MHz FM 25kHz



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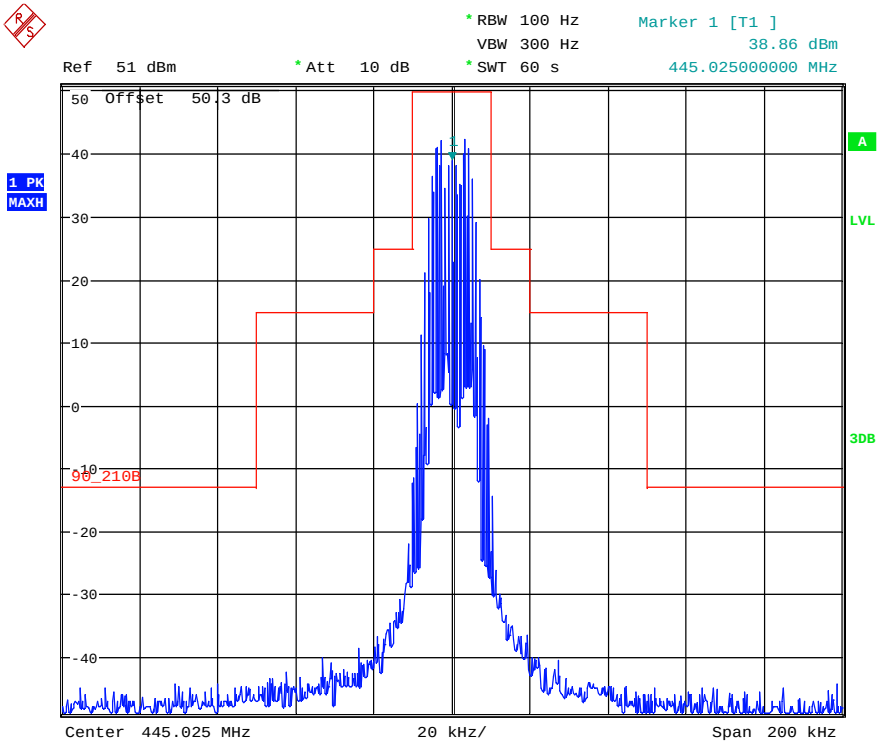
Emission Masks. Part 90.210(b) 445.0250MHz FM 25kHz



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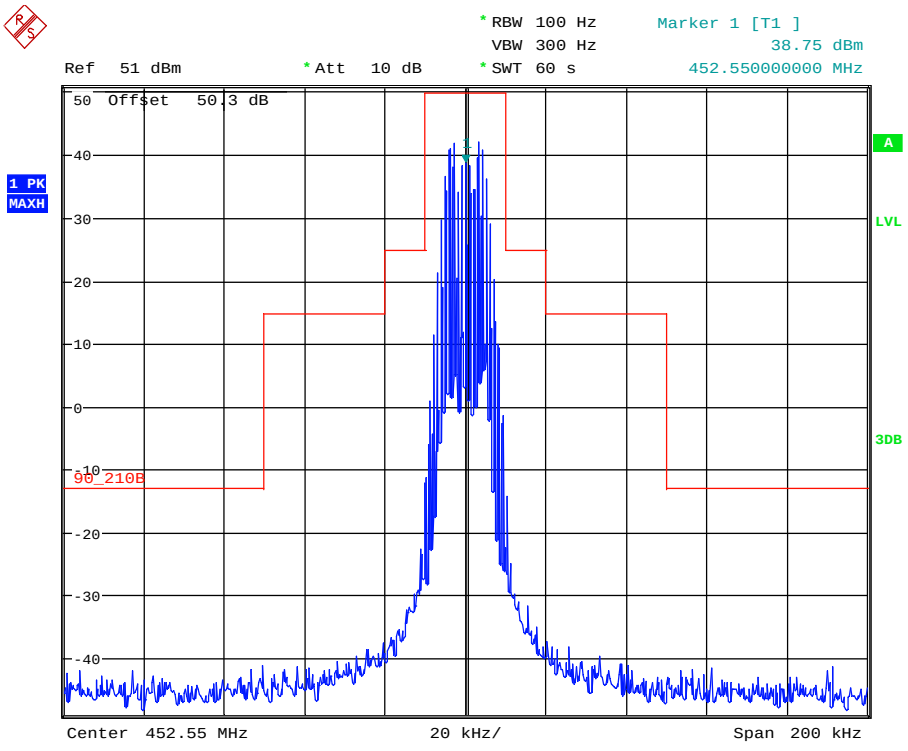
Emission Masks. Part 90.210(b) 452.5500MHz FM 25kHz



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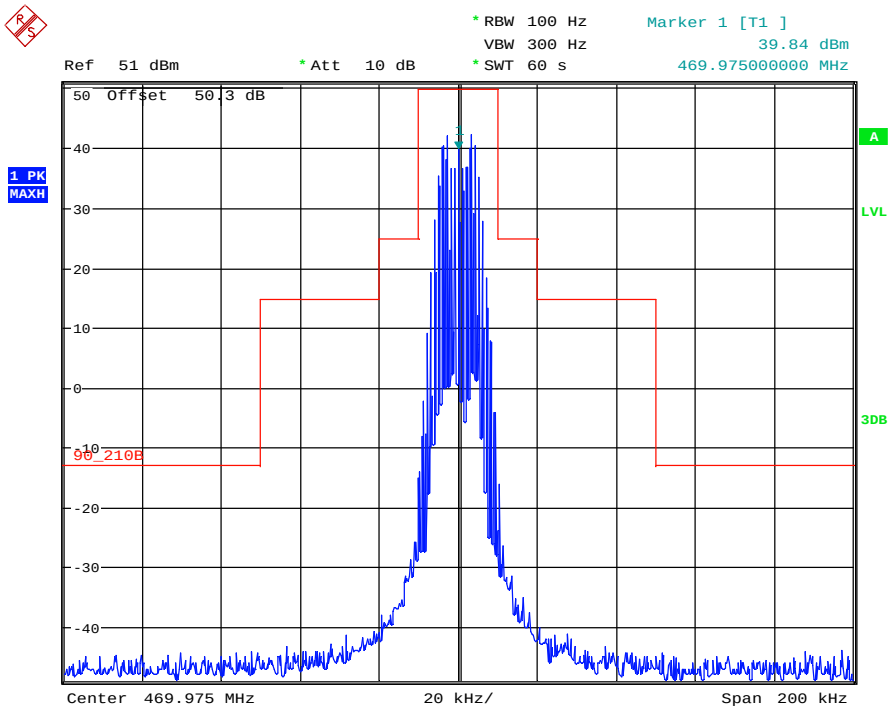
Emission Masks. Part 90.210(b) 469.9750MHz FM 25kHz



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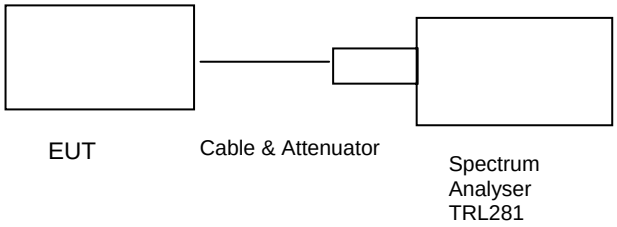
TRANSMITTER TESTS

SPURIOUS EMISSIONS – CONDUCTED – Part 2.1053
Channel 1

Ambient temperature	=	24°C	Radio Laboratory		
Relative humidity	=	56%	Test Signal	=	F3E
Supply voltage	=	+13.8Vdc			



The test was set up as per the diagram. The unit was tested operating at maximum power.

The Spurious limit was calculated as follows:

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

RESULTS

Channel 1

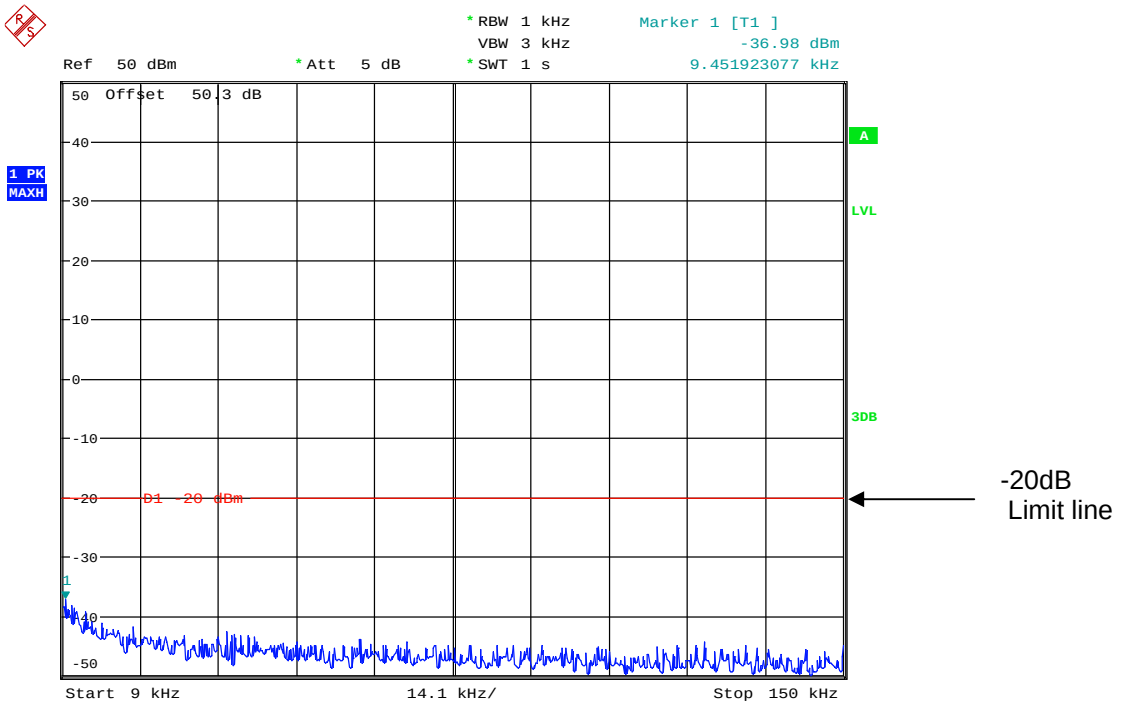
FREQUENCY RANGE	FREQ. (MHz)	MEASURED LEVEL (dBm)	LIMIT (dBm)
9kHz – 10GHz	870.05 1305.075	-34.30 -25.99	-20 -20

The test equipment used for the Transmitter Conducted Emissions:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRAC No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	**X**
CABLE	TRAC	N/A	N/A	UH271	**X**
CABLE	TRAC	N/A	N/A	UH272	**X**
ATTENUATOR	SPINNER	745357	N/A	TRLUH225	**X**
ATTENUATOR	-	-	-	20dB	**X**
ATTENUATOR	BIRD	8304-100-N	N/A	222	**X**
FILTER	TELONIC BERKELEY	TTR375-3EE	H	TRLUH265	**X**
FILTER	TELONIC BERKELEY	TTF2250-055EE	F	TRLUH275	**X**

Conducted emissions Channel 1

435.025MHz 9kHz – 150kHz



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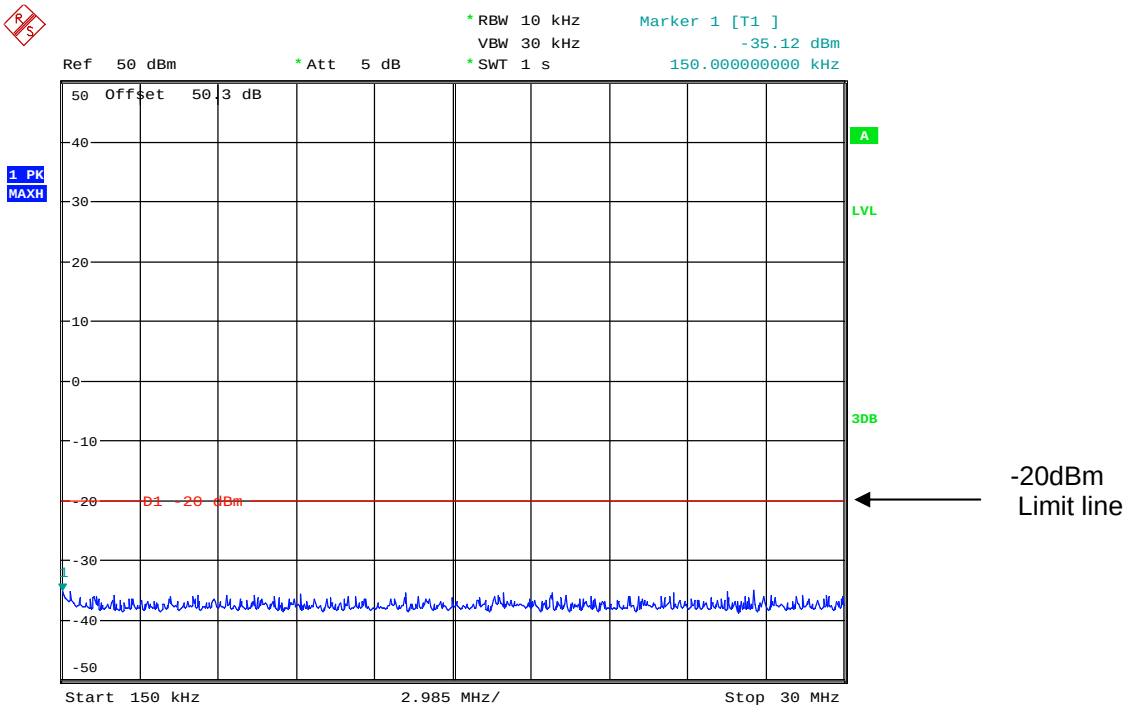
435.025MHz 150kHz-30MHz



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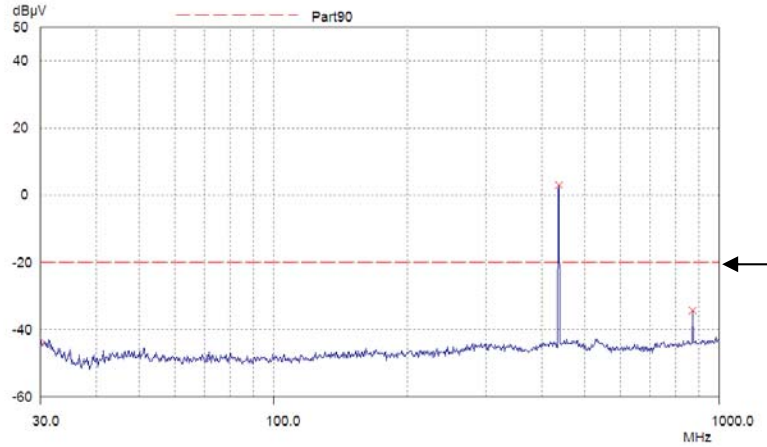
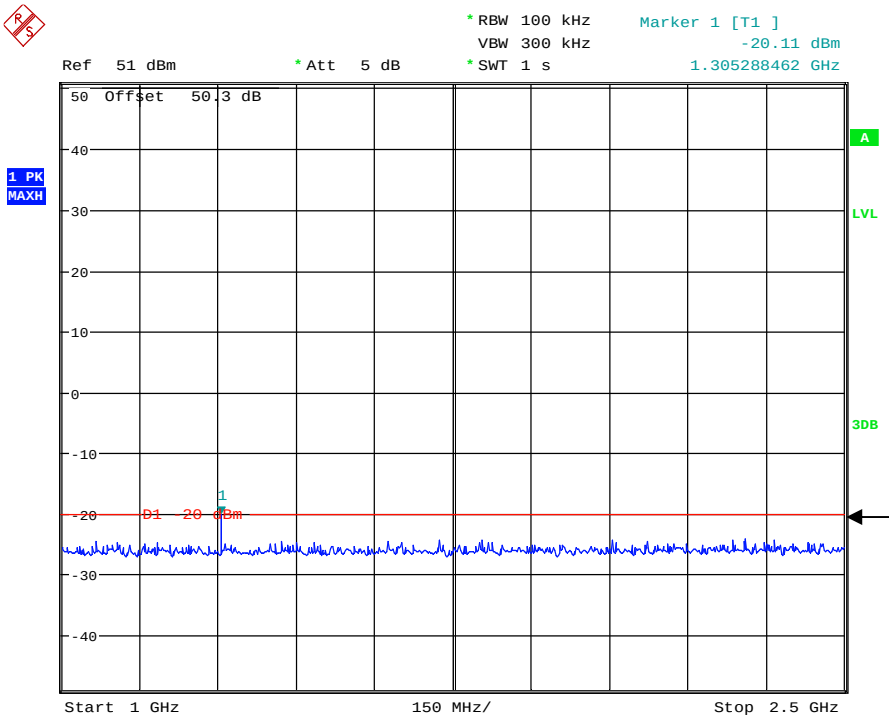
435.025MHz 30MHz-1GHz



-20dBm
Limit line

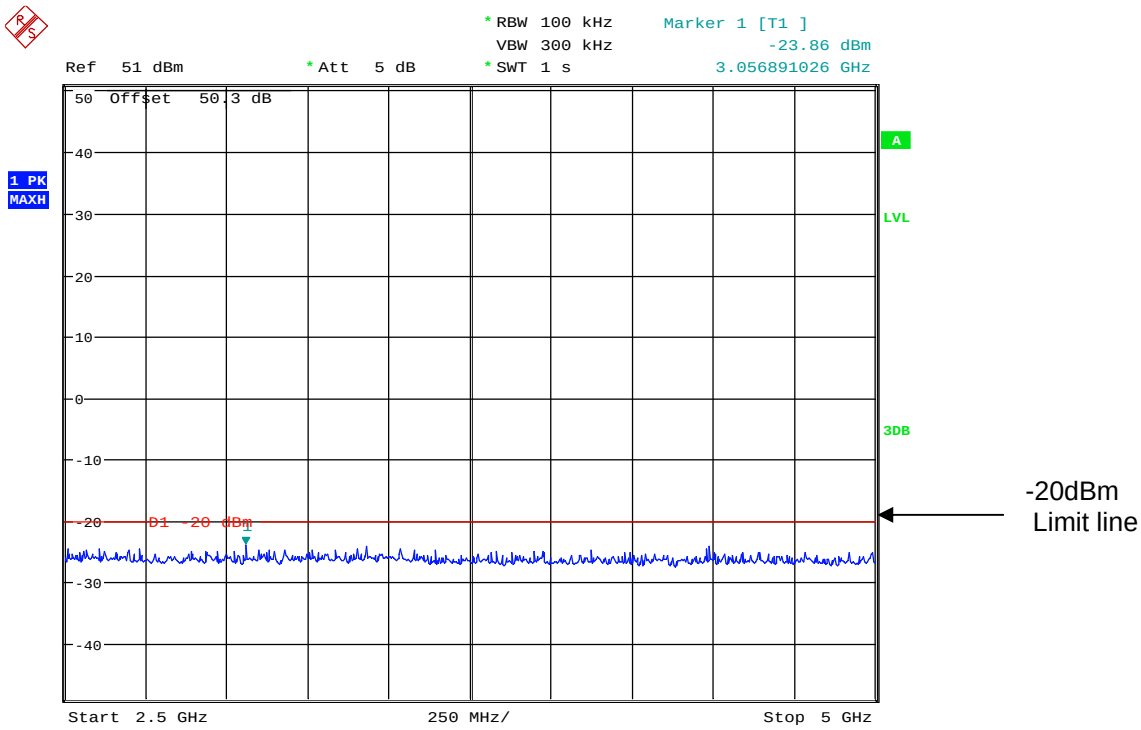
435.025MHz 1GHz – 2.5GHz



-20dBm
Limit line

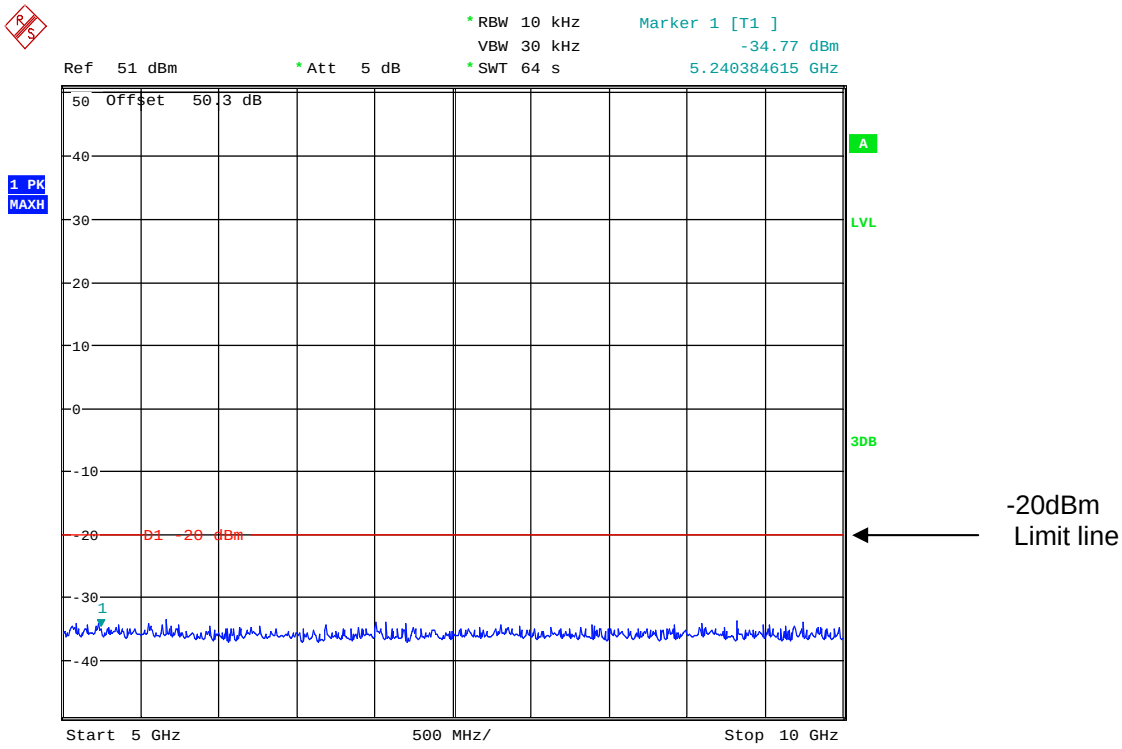
Date: 6.DEC.2012 10:47:49

435.025MHz 2.5GHz – 5GHz



Date: 6.DEC.2012 10:48:20

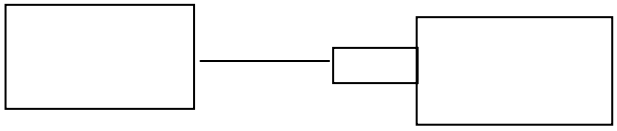
435.025MHz 5GHz – 10GHz



Date: 20.DEC.2012 11:06:33

SPURIOUS EMISSIONS – CONDUCTED – Part 2.1053
Channel 2

Ambient temperature	=	24°C	Radio Laboratory		
Relative humidity	=	56%	Test Signal	=	F3E
Supply voltage	=	+13.8Vdc			



EUT Cable & Attenuator Spectrum Analyser TRL281

The test was set up as per the diagram. The unit was tested operating at maximum power.

The Spurious limit was calculated as follows:

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

RESULTS

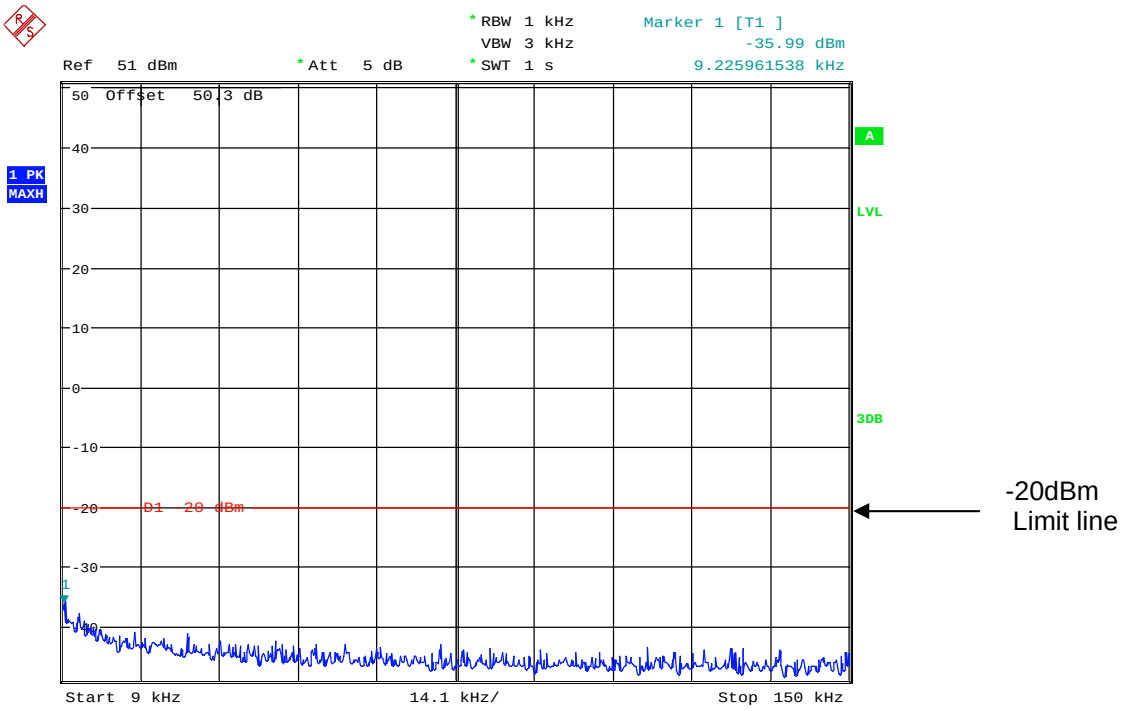
Middle Channel

FREQUENCY RANGE	FREQ. (MHz)	MEASURED LEVEL (dBm)	LIMIT (dBm)
9kHz – 10GHz	890.05 1335.075	-34.30 -24.46	-20 -20

The test equipment used for the Transmitter Conducted Emissions:

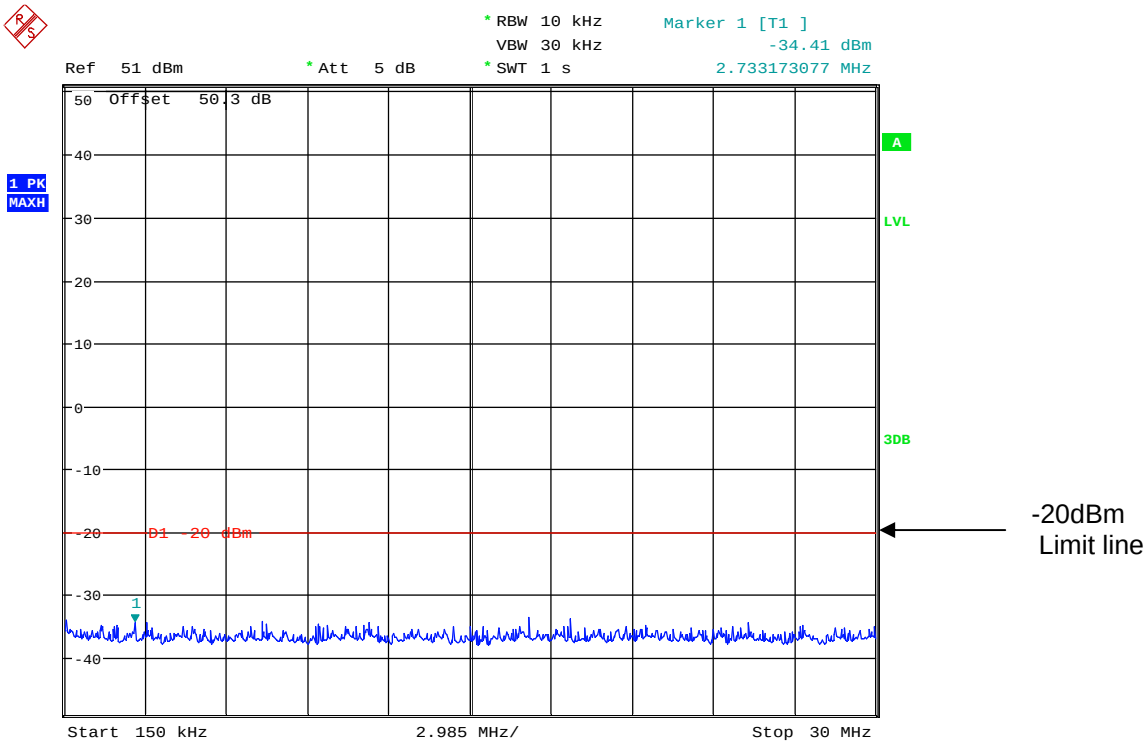
TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRAC No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	**X**
CABLE	TRAC	N/A	N/A	UH271	**X**
CABLE	TRAC	N/A	N/A	UH272	**X**
ATTENUATOR	SPINNER	745357	N/A	TRLUH225	**X**
ATTENUATOR	-	-	-	20dB	**X**
ATTENUATOR	BIRD	8304-100-N	N/A	222	**X**
FILTER	TELONIC BERKELEY	TTR375-3EE	H	TRLUH265	**X**
FILTER	TELONIC BERKELEY	TTF2250-055EE	F	TRLUH275	**X**

445.0125MHz 9kHz – 150kHz



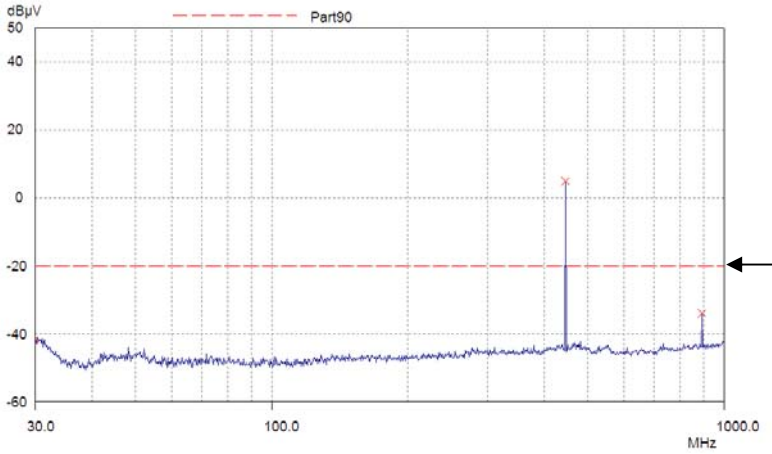
Date: 6.DEC.2012 10:50:56

445.0125MHz 150kHz – 30MHz



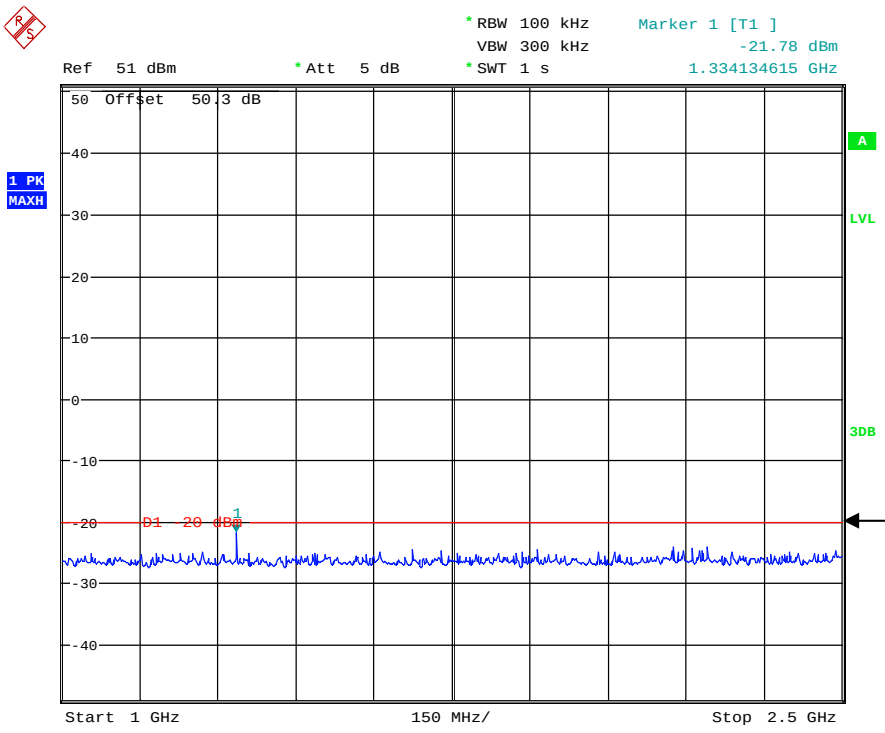
Date: 6.DEC.2012 10:51:55

445.0125MHz 30MHz- 1GHz



-20dBm
Limit line

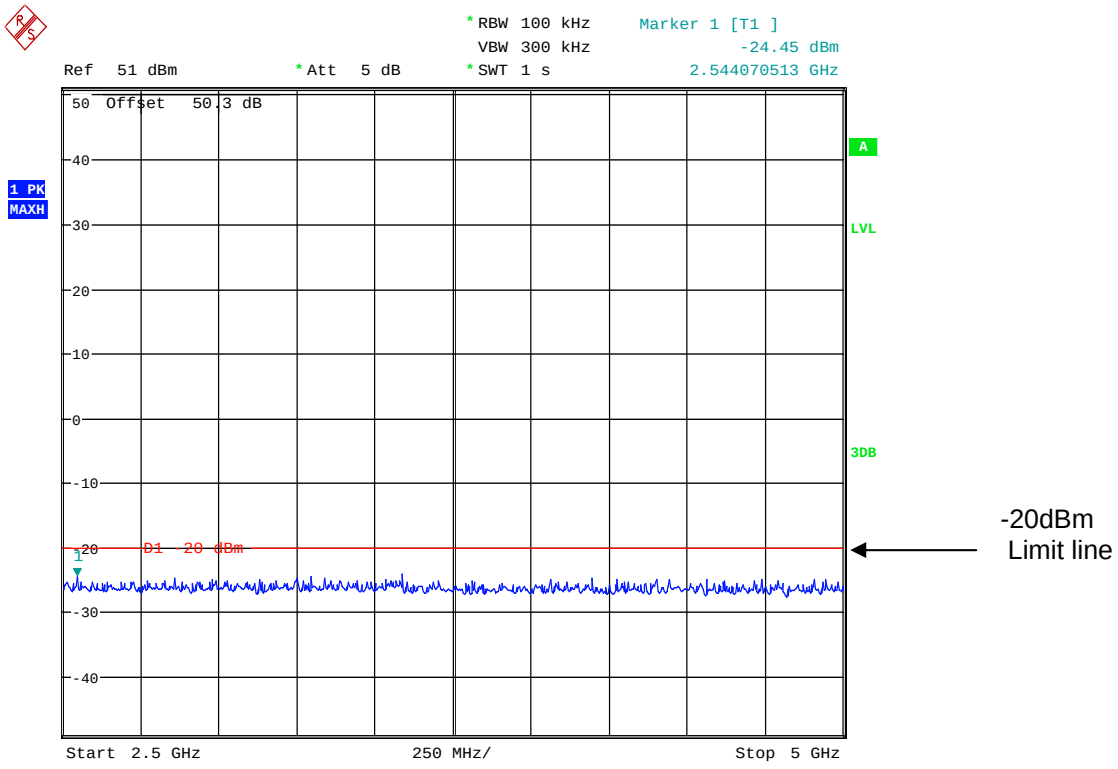
445.0125MHz 1GHz – 2.5GHz



-20dBm
Limit line

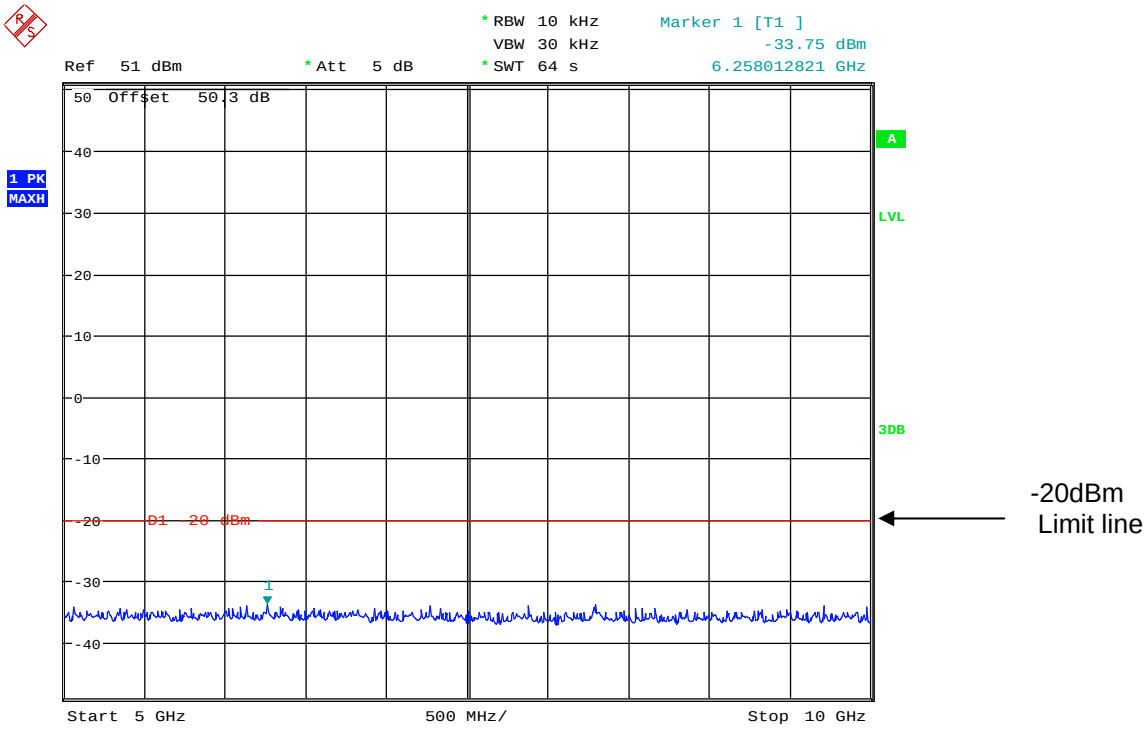
Date: 6.DEC.2012 10:53:46

445.0125MHz 2.5GHz – 5GHz



Date: 6.DEC.2012 10:54:20

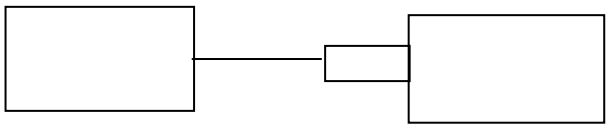
445.0125MHz 5GHz – 10GHz



Date: 20.DEC.2012 11:08:59

SPURIOUS EMISSIONS – CONDUCTED – Part 2.1053
Channel 3

Ambient temperature	=	24°C	Radio Laboratory		
Relative humidity	=	56%	Test Signal	=	F3E
Supply voltage	=	+13.8Vdc			



The test was set up as per the diagram. The unit was tested operating at maximum power .

The Spurious limit was calculated as follows:

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

RESULTS

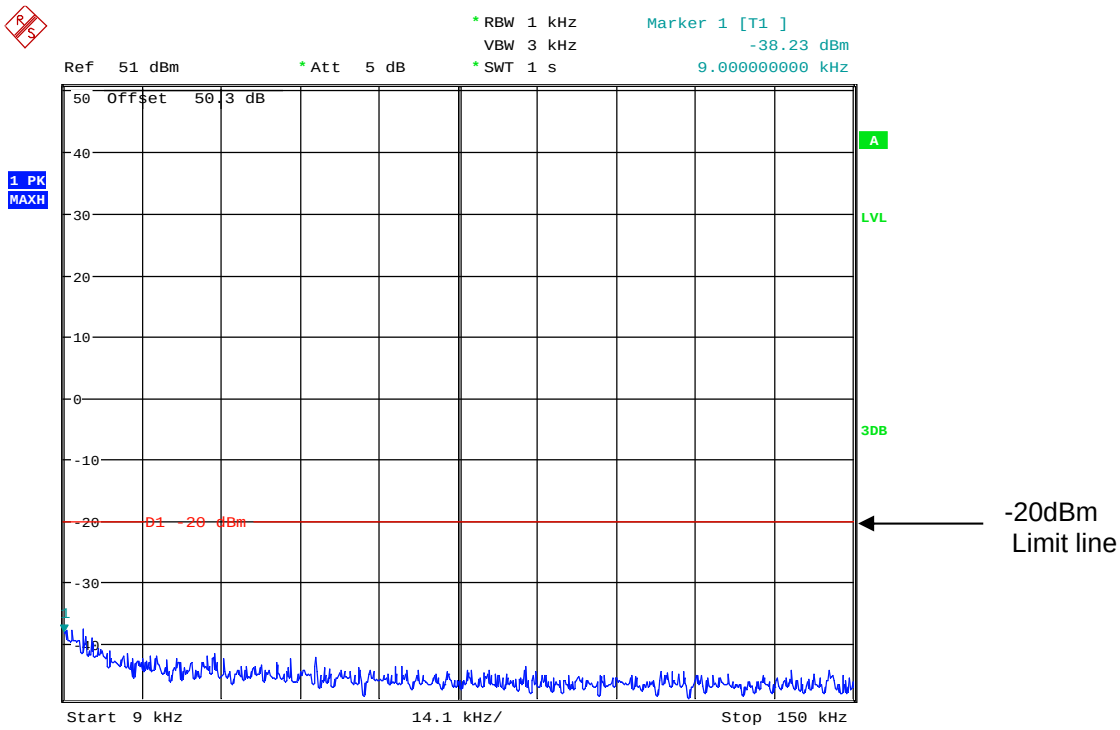
Channel 3

FREQUENCY RANGE	FREQ. (MHz)	MEASURED LEVEL (dBm)	LIMIT (dBm)
9kHz – 10GHz	905.10 1357.65	-30.68 -30.58	-20 -20

The test equipment used for the Transmitter Conducted Emissions:

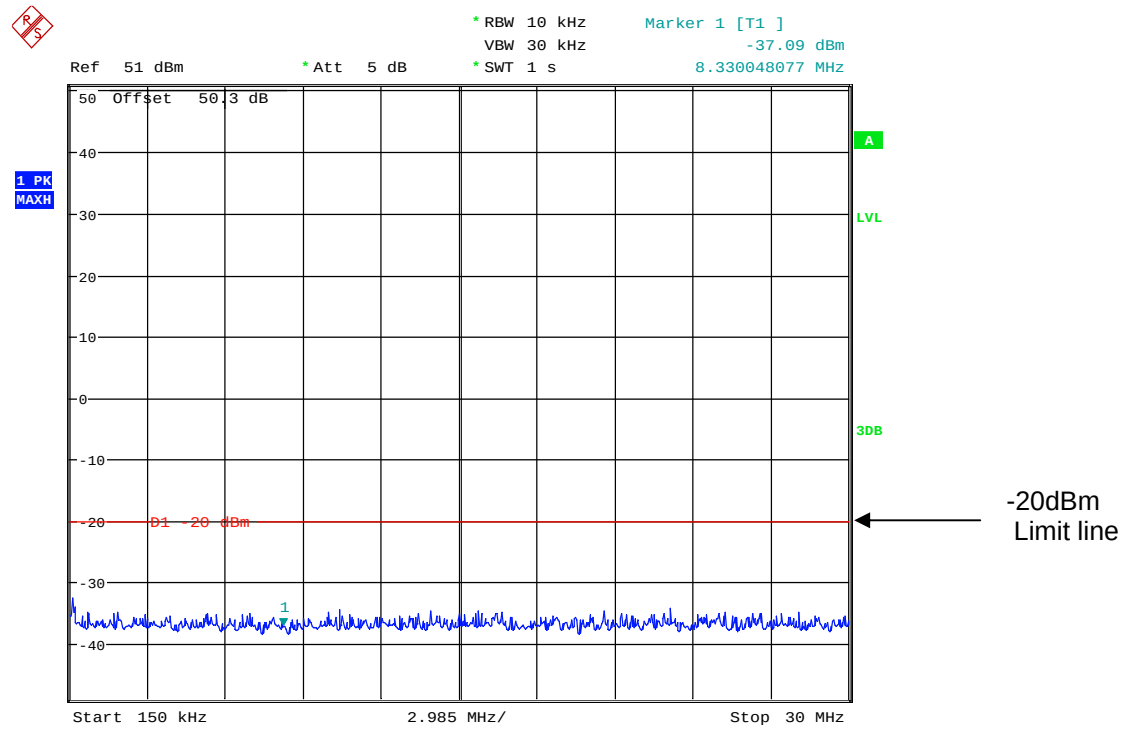
TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRAC No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	**X**
CABLE	TRAC	N/A	N/A	UH271	**X**
CABLE	TRAC	N/A	N/A	UH272	**X**
ATTENUATOR	SPINNER	745357	N/A	TRLUH225	**X**
ATTENUATOR	-	-	-	20dB	**X**
ATTENUATOR	BIRD	8304-100-N	N/A	222	**X**
FILTER	TELONIC BERKELEY	TTR375-3EE	H	TRLUH265	**X**
FILTER	TELONIC BERKELEY	TTF2250-055EE	F	TRLUH275	**X**

452.5500MHz 9kHz – 150kHz



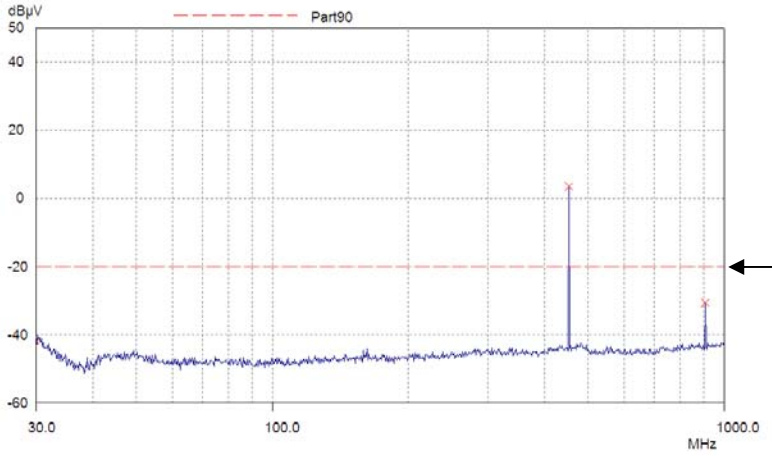
Date: 6.DEC.2012 10:55:48

452.5500MHz 150kHz -30MHz



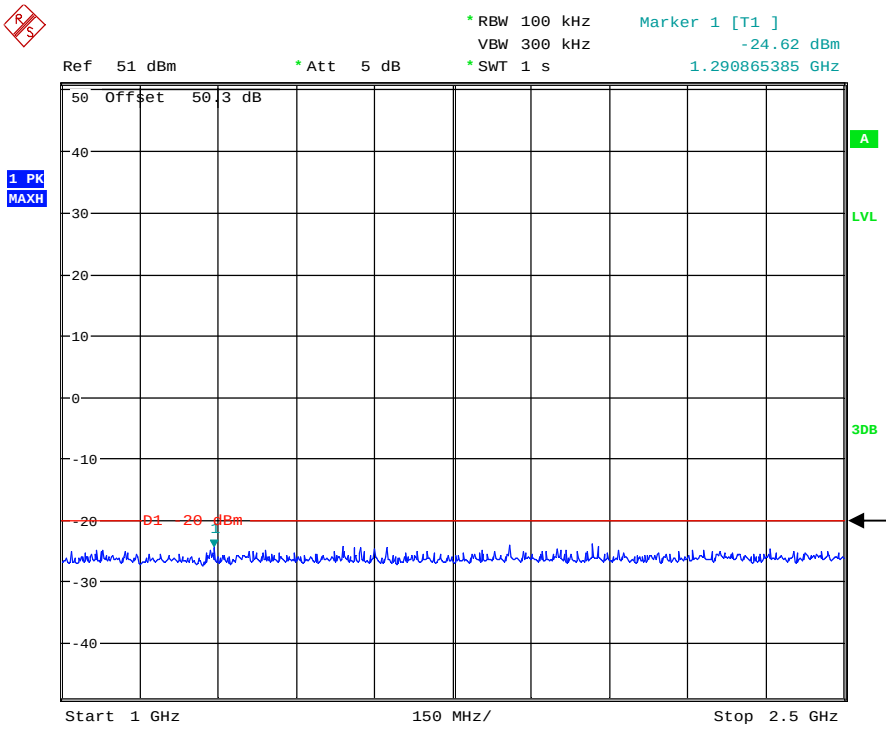
Date: 6.DEC.2012 10:56:28

452.5500MHz 30MHz-1GHz



-20dBm
Limit line

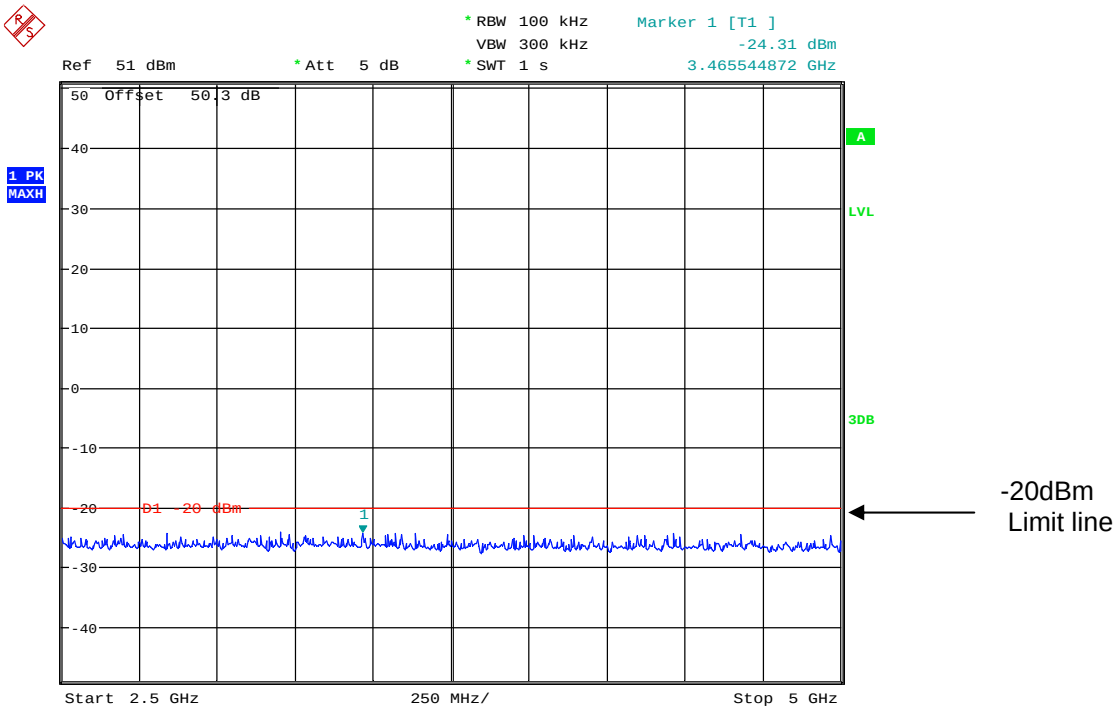
452.5500MHz 1GHz – 2.5GHz



-20dBm
Limit line

Date: 6.DEC.2012 10:57:57

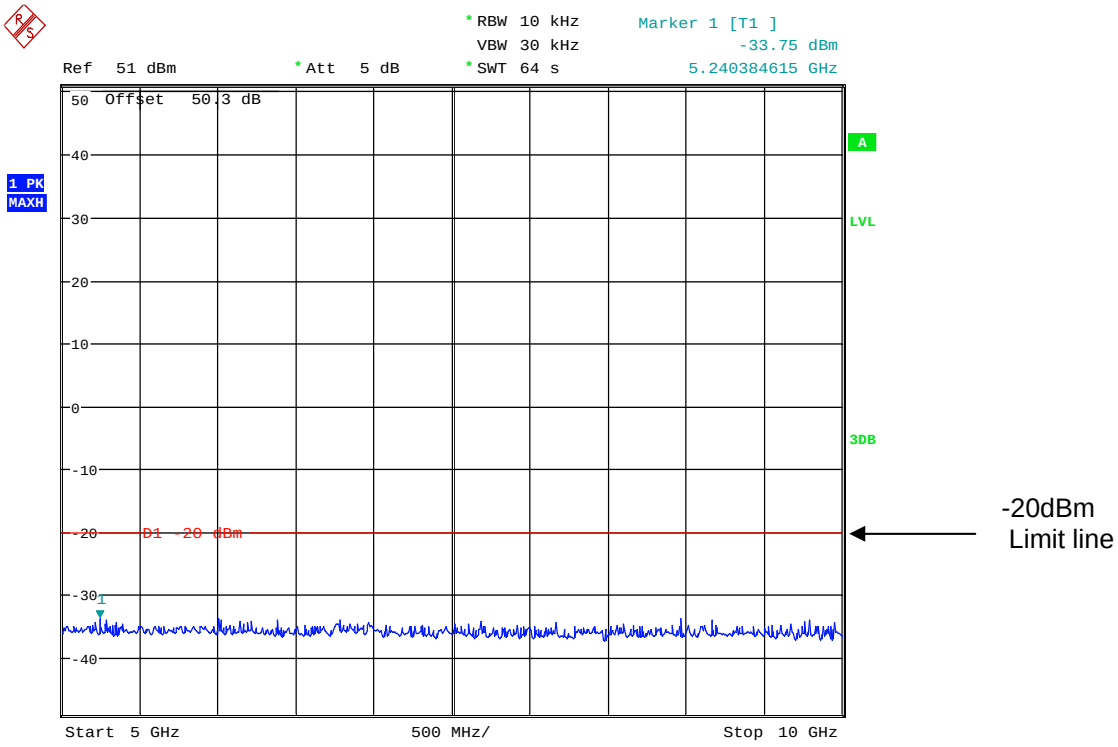
452.5500MHz 2.5GHz – 5GHz



-20dBm
Limit line

Date: 6.DEC.2012 10:58:36

452.5500MHz 5GHz – 10GHz

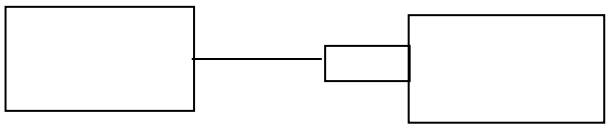


-20dBm
Limit line

Date: 20.DEC.2012 11:04:20

SPURIOUS EMISSIONS – CONDUCTED – Part 2.1053
Channel 4

Ambient temperature	=	24°C	Radio Laboratory		
Relative humidity	=	34%	Test Signal	=	F3E
Supply voltage	=	+13.8Vdc			



The test was set up as per the diagram. The unit was tested operating at maximum power .

The Spurious limit was calculated as follows:

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

RESULTS

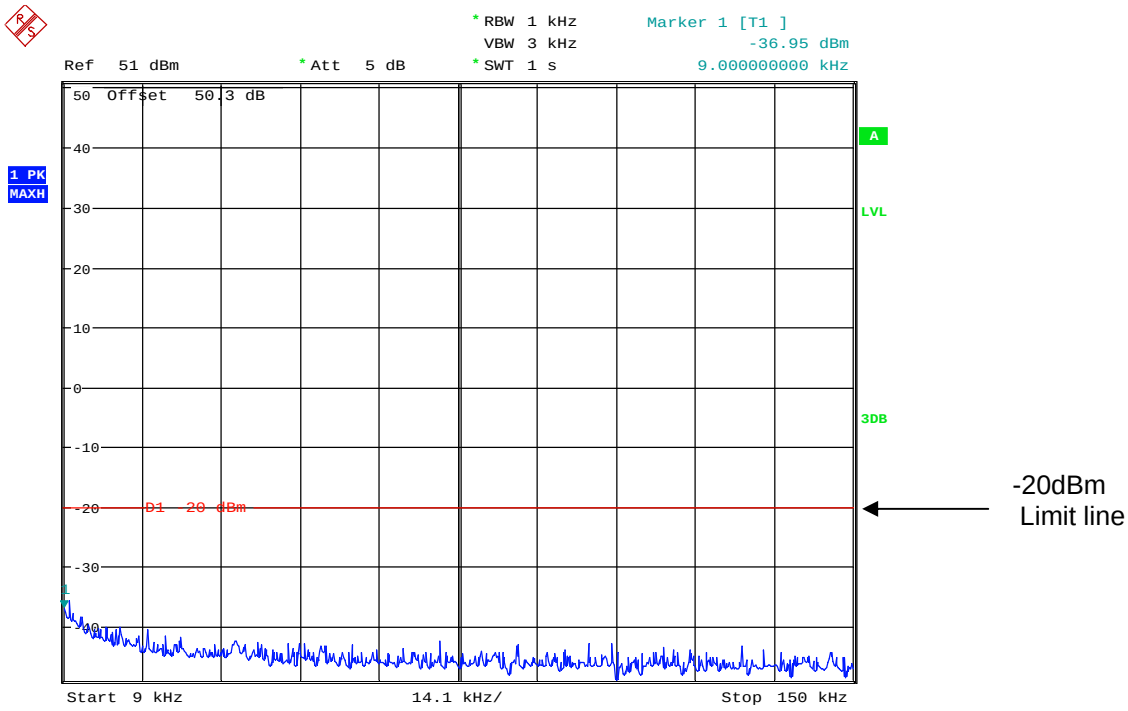
Channel 4

FREQUENCY RANGE	FREQ. (MHz)	MEASURED LEVEL (dBm)	LIMIT (dBm)
9kHz – 10GHz	939.95 1409.92	-32.43 -29.01	-20 -20

The test equipment used for the Transmitter Conducted Emissions:

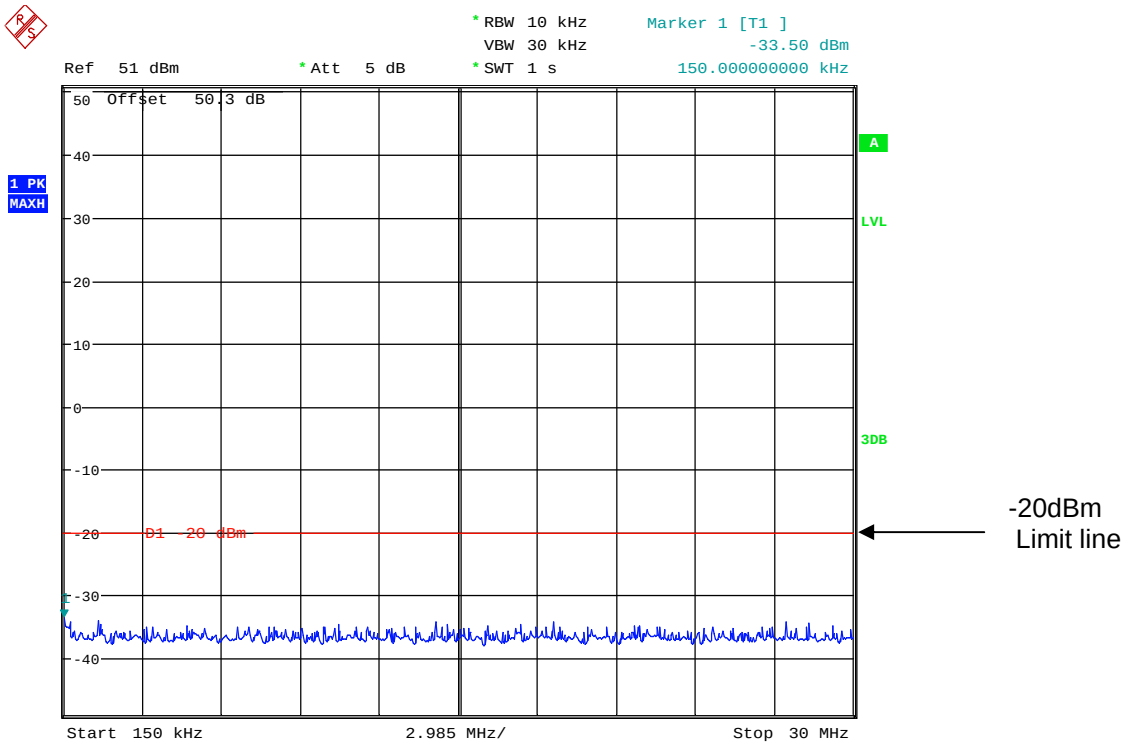
TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRAC No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	**X**
CABLE	TRAC	N/A	N/A	UH271	**X**
CABLE	TRAC	N/A	N/A	UH272	**X**
ATTENUATOR	SPINNER	745357	N/A	TRLUH225	**X**
ATTENUATOR	-	-	-	20dB	**X**
ATTENUATOR	BIRD	8304-100-N	N/A	222	**X**
FILTER	TELONIC BERKELEY	TTR375-3EE	H	TRLUH265	**X**
FILTER	TELONIC BERKELEY	TTF2250-055EE	F	TRLUH275	**X**

469.9750MHz 9kHz – 150kHz



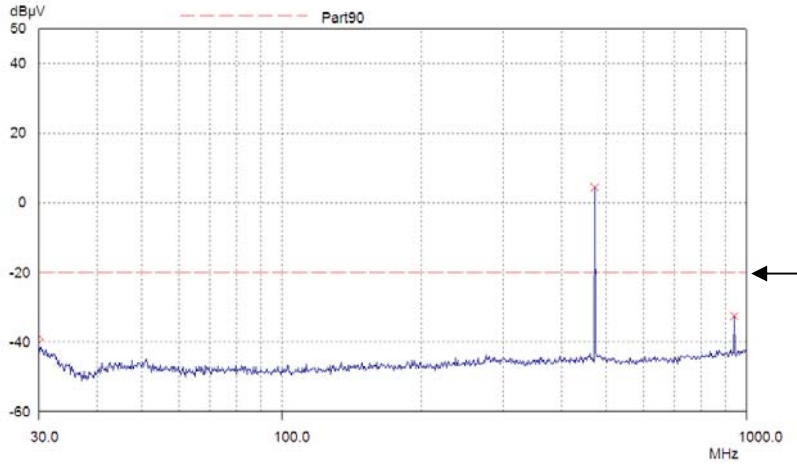
Date: 6.DEC.2012 11:00:11

469.9750MHz 150kHz -30MHz

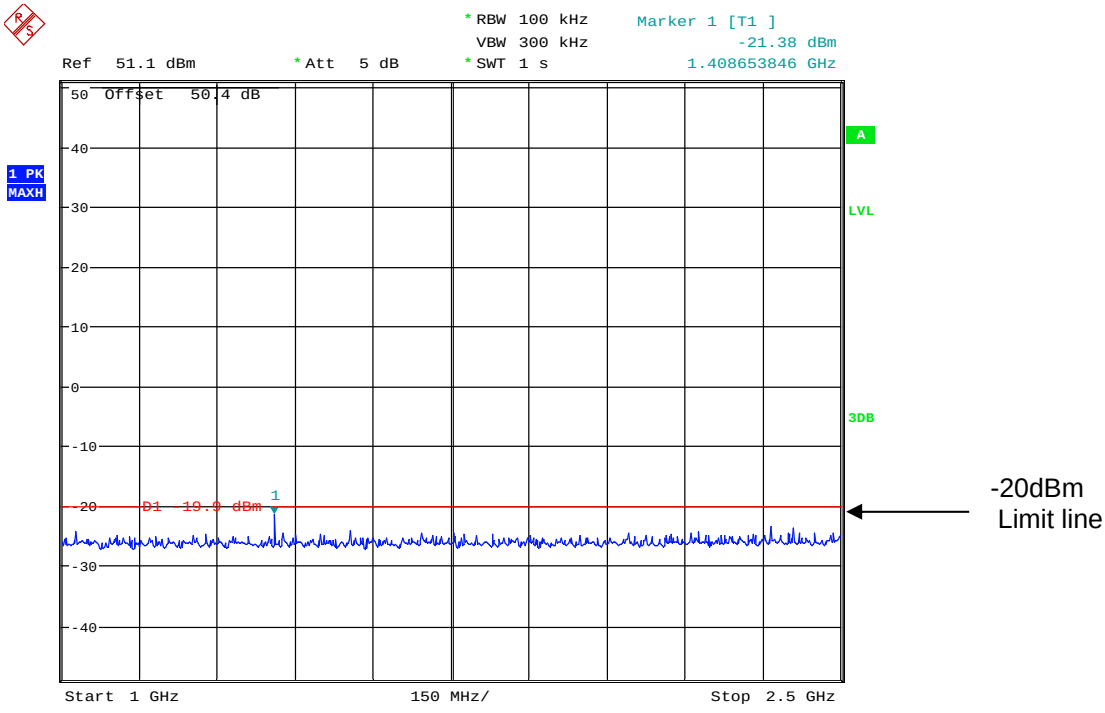


Date: 6.DEC.2012 11:01:47

469.9750MHz 30MHz-1GHz

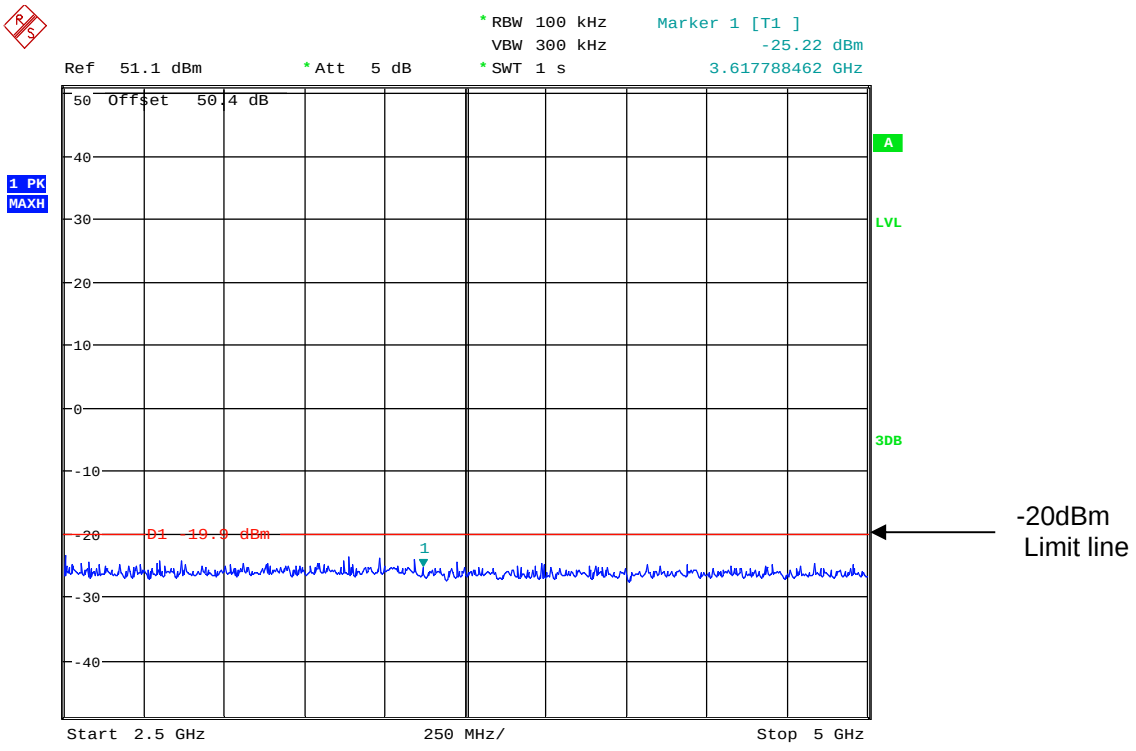


469.9750MHz 1GHz – 2.5GHz



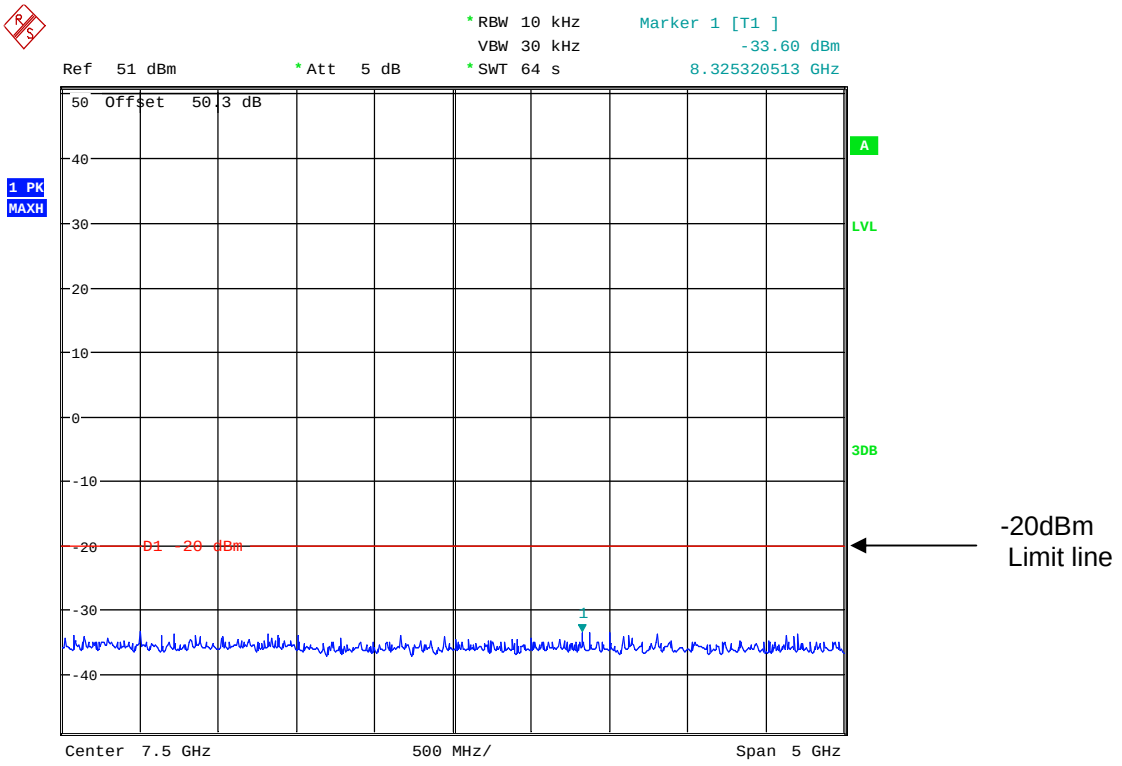
Date: 6.DEC.2012 11:03:25

469.9750MHz 2.5GHz – 5GHz



Date: 6.DEC.2012 11:04:07

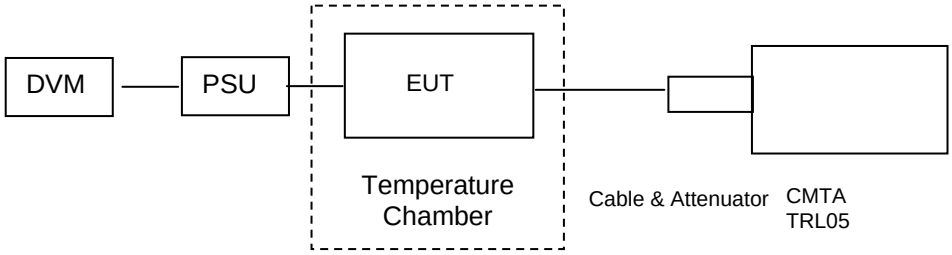
469.9750MHz 2.5GHz – 5GHz



Date: 20.DEC.2012 11:14:22

FREQUENCY STABILITY – CONDUCTED – Part 90.213

Ambient temperature	=	24°C	Radio Laboratory		
Relative humidity	=	34%	Test Signal	=	F3E
Supply voltage	=	+13.8Vdc			



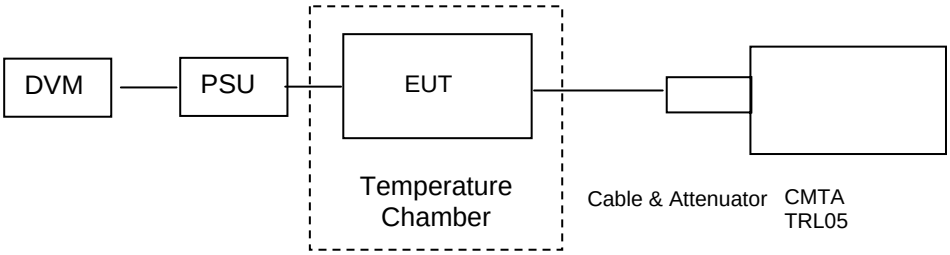
Channel 1

Temperature °C	Vnom (Vdc)	Measured Frequency (MHz)	Frequency Difference (Hz)	ppm	Limit ± 1.5ppm Pass/Fail
+50	13.8	435.025000	0	0	Pass
+40	13.8	435.025010	0.01	0.02	Pass
+30	13.8	435.025000	0	0	Pass
+20	13.8	435.025000	0	0	Pass
+10	13.8	435.025010	0.01	0.02	Pass
0	13.8	435.025000	0	0	Pass
-10	13.8	435.025000	0	0	Pass
-20	13.8	435.025000	0	0	Pass
-30	13.8	435.025000	0	0	Pass

Tnom 24 °C	85%= 11.7Vdc	115%= 15.9Vdc
Frequency (MHz)	435.025000	435.025000
Frequency Difference (Hz)	0	0
ppm	0	0
Limit ± 1.5 ppm Pass/Fail	Pass	Pass

Ambient temperature = 24°C
Relative humidity = 34%
Supply voltage = +13.8Vdc

Radio Laboratory
Test Signal = F3E



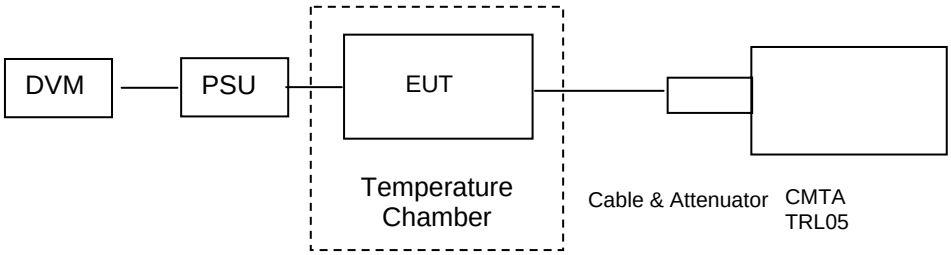
Channel 2

Temperature °C	Vnom (Vdc)	Measured Frequency (MHz)	Frequency Difference (Hz)	ppm	Limit ± 1.5 ppm Pass/Fail
+50	13.8	445.025010	0.01	0.02	Pass
+40	13.8	445.025010	0.01	0.02	Pass
+30	13.8	445.025000	0	0	Pass
+20	13.8	445.025000	0	0	Pass
+10	13.8	445.025010	0.01	0.02	Pass
0	13.8	445.025010	0.01	0.02	Pass
-10	13.8	445.025000	0	0	Pass
-20	13.8	445.025000	0	0	Pass
-30	13.8	445.025010	0.01	0.02	Pass

Tnom 24°C	85%= 11.7Vdc	115%= 15.9Vdc
Frequency (MHz)	445.025000	445.025000
Frequency Difference (Hz)	0	0
ppm	0	0
Limit ± 1.5 ppm Pass/Fail	Pass	Pass

Ambient temperature = 24°C
Relative humidity = 34%
Supply voltage = +13.8Vdc

Radio Laboratory
Test Signal = F3E



Channel 3

Temperature °C	Vnom (Vdc)	Measured Frequency (MHz)	Frequency Difference (Hz)	ppm	Limit ± 1.5 ppm Pass/Fail
+50	13.8	452.550010	0.01	0.02	Pass
+40	13.8	452.550000	0	0	Pass
+30	13.8	452.550010	0.01	0.02	Pass
+20	13.8	452.550010	0.01	0.02	Pass
+10	13.8	452.550010	0.01	0.02	Pass
0	13.8	452.550000	0	0	Pass
-10	13.8	452.550010	0.01	0.02	Pass
-20	13.8	452.550010	0.01	0.02	Pass
-30	13.8	452.550000	0	0	Pass

Tnom 24°C	85%= 11.7Vdc	115%= 15.9Vdc
Frequency (MHz)	452.550000	452.550000
Frequency Difference (Hz)	0	0
ppm	0	0
Limit ± 1.5 ppm Pass/Fail	Pass	Pass

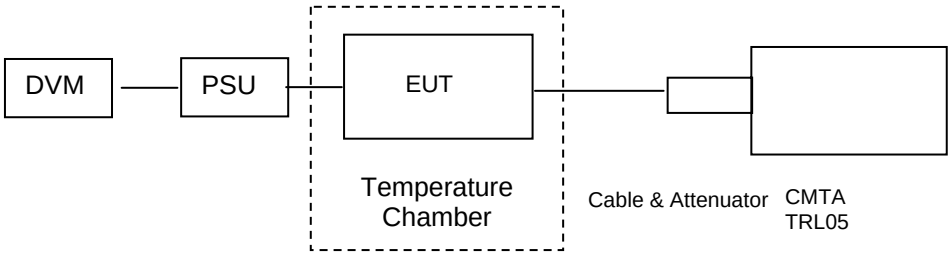
Frequency stability measurements were between -30°C and +50°C in 10°C increments.

At each temperature the transmitter was given a period of 60 minutes to stabilise. The transmitter was then turned on and the frequency error measured after a period of 1 minute.

Measurements were also made with the supply voltage varied between 115% and 85% of the nominal supply voltage(13.8Vdc). 13.8Vdc supply controls the frequency generation & stability circuits (see annex E)

Ambient temperature = 24°C
Relative humidity = 34%
Supply voltage = +13.8Vdc

Radio Laboratory
Test Signal = F3E



Channel 4

Temperature °C	Vnom (Vdc)	Measured Frequency (MHz)	Frequency Difference (Hz)	ppm	Limit ± 1.5 ppm Pass/Fail
+50	13.8	469.975000	0	0	Pass
+40	13.8	469.975000	0	0	Pass
+30	13.8	469.975000	0	0	Pass
+20	13.8	469.975000	0	0	Pass
+10	13.8	469.975000	0	0	Pass
0	13.8	469.975000	0	0	Pass
-10	13.8	469.975000	0	0	Pass
-20	13.8	469.974990	-0.01	-0.02	Pass
-30	13.8	469.974990	-0.01	-0.02	Pass

Tnom 24°C	85%= 11.7Vdc	115%= 15.9Vdc
Frequency (MHz)	469.975000	469.975000
Frequency Difference (Hz)	0	0
ppm	0	0
Limit ± 1.5 ppm Pass/Fail	Pass	Pass

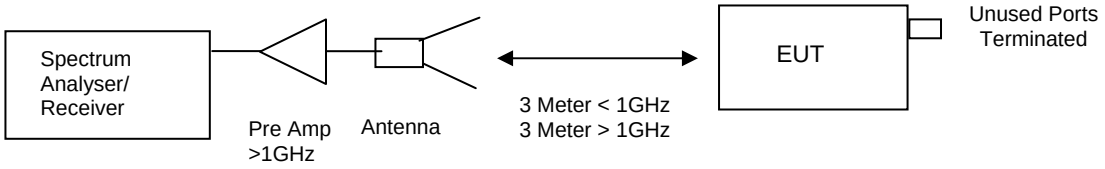
Frequency stability measurements were between -30°C and +50°C in 10°C increments.

At each temperature the transmitter was given a period of 60 minutes to stabilise. The transmitter was then turned on and the frequency error measured after a period of 1 minute.

Measurements were also made with the supply voltage varied between 115% and 85% of the nominal supply voltage(13.8Vdc). 13.8Vdc supply controls the frequency generation & stability circuits (see annex E)

INTENTIONAL RADIATOR SPURIOUS EMISSIONS – RADIATED – Part 2.1053

Ambient temperature	=	24°C	Test Signal	=	F3E
Relative humidity	=	34%			
Conditions	=	ATS			
Supply voltage	=	+13.8Vdc			
Supply Frequency	=	N/A			



The test was set up as per the diagram. The unit was tested operating maximum power on three test frequencies with a 50 ohm load on the output.

RESULTS

Channel 1

FREQUENCY RANGE	FREQ. (MHz)	Measured (dBm)	LIMIT (dBm)
30MHz – 10GHz	870.05	-38.88	-20
	1305.00	-37.95	-20
	2175.12	-32.78	-20
	2610.10	-36.37	-20
	5220.30	-34.90	-20
	5655.28	-36.75	-20

Channel 2

FREQUENCY RANGE	FREQ. (MHz)	Measured (dBm)	LIMIT (dBm)
30MHz – 10GHz	905.1	-39.88	-20
	1335.06	-37.62	-20
	2225.09	-29.56	-20
	2670.11	-26.42	-20
	3560.27	-36.21	-20
	5340.26	-34.11	-20
	5785.30	-34.93	-20

Channel 3

FREQUENCY RANGE	FREQ. (MHz)	Measured (dBm)	LIMIT (dBm)
30MHz – 10GHz	910.05	-32.88	-20
	1357.67	-36.28	-20
	2262.75	-29.66	-20
	2715.27	-29.38	-20
	3620.34	-37.30	-20
	5430.60	-31.49	-20

Channel 4

FREQUENCY RANGE	FREQ. (MHz)	Measured (dBm)	LIMIT (dBm)
30MHz – 10GHz	939.95	-39.88	-20
	1409.83	-32.75	-20
	2349.87	-27.18	-20
	2819.88	-31.68	-20
	3759.85	-37.57	-20
	4229.79	-32.46	-20
	4699.63	-39.82	-20
	5169.73	-34.82	-20
	5639.69	-36.28	-20

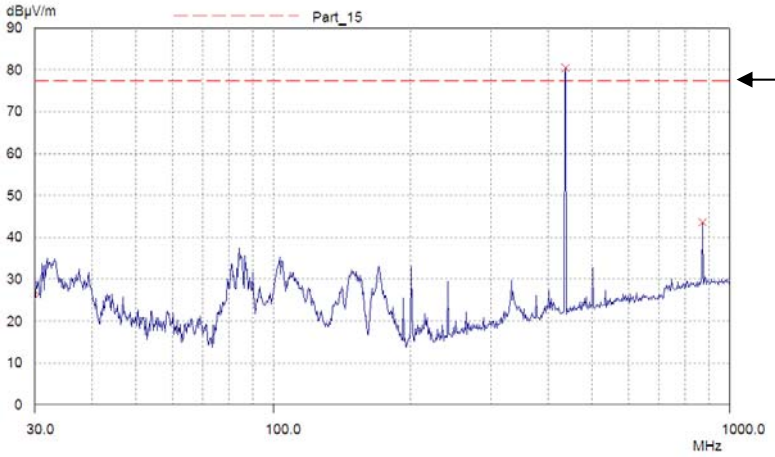
* Note: Emissions that fall below 20dB of the limit are not shown in the above table

The test equipment used for the Transmitter Spurious Emissions:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRAC No	ACTUAL EQUIPMENT USED
ANTENNA	R&S	HL050	100457	TRLUH305	**X**
SPECTRUM ANALYSER	R&S	FSU46	200034	TRL281	**X**
PRE AMPLIFIER	HP	8449B	3008A016	572	**X**
ANTENNA	YORK	CBL611/A	1618	UH191	**X**
RECEIVER	R&S	ESVS10	825892/006	UH04	**X**

Radiated emissions Channel 1

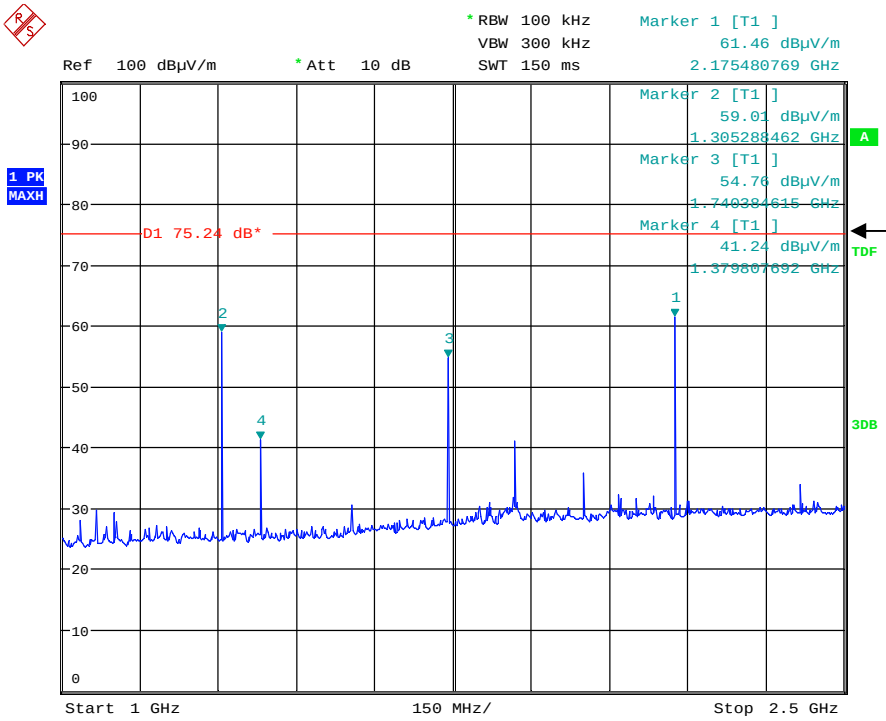
435.0250MHz 30MHz – 1GHz



-20dBm
Limit line

The above test results show that there were no emissions within 20dBs of the –20dBm limit.

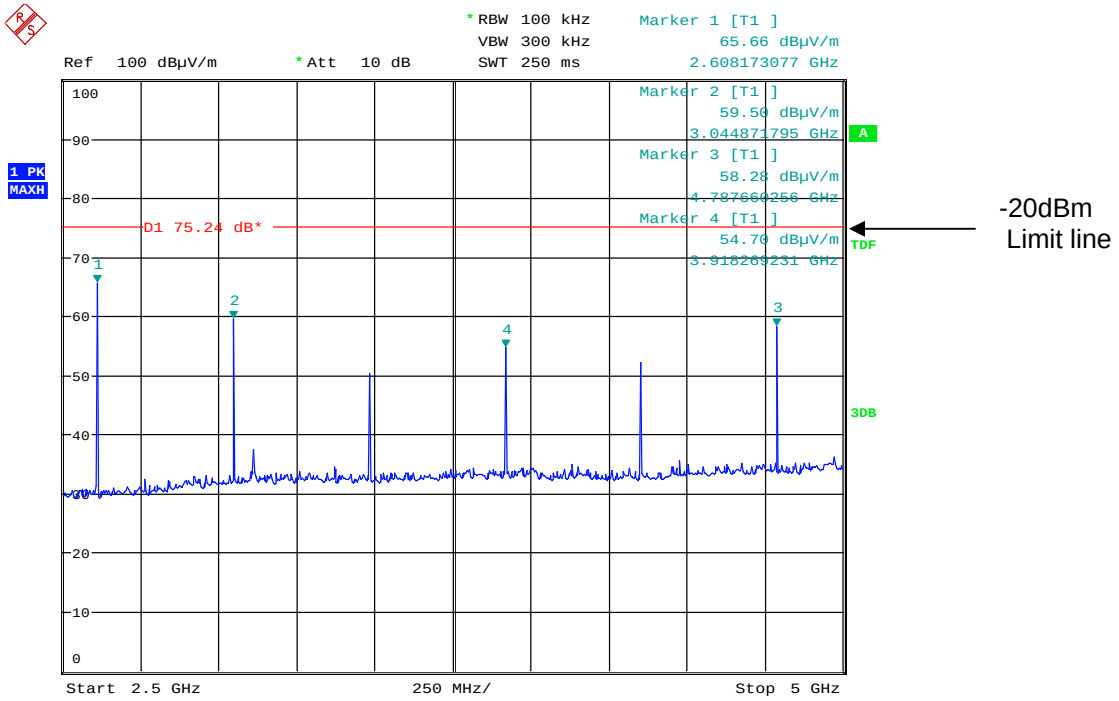
435.0250MHz 1GHz – 2.5GHz



-20dBm
Limit line

Date: 3.DEC.2012 15:52:15

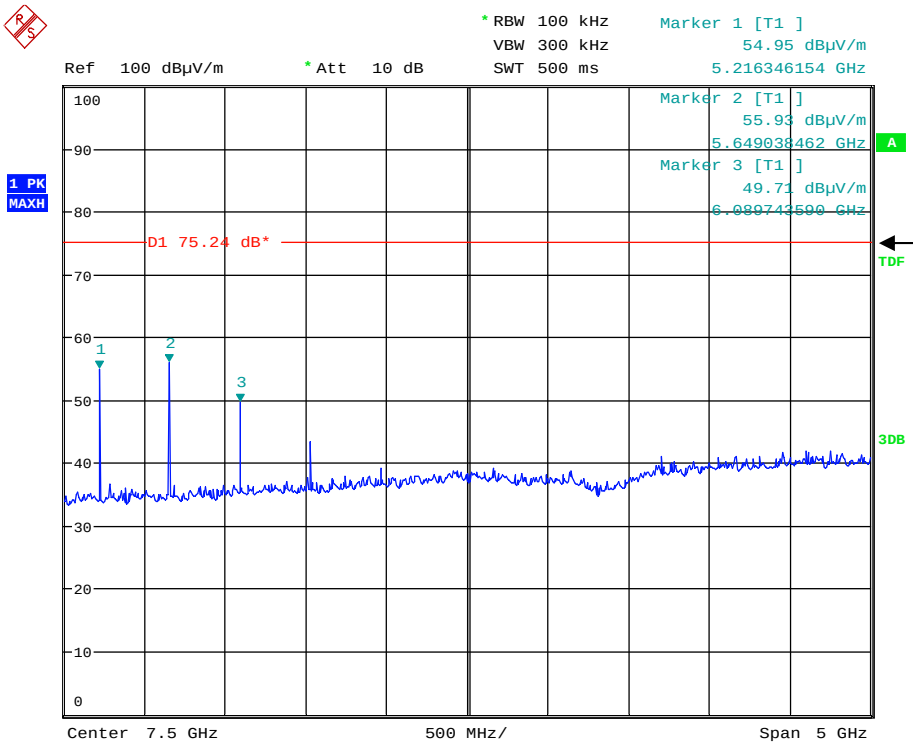
435.0250MHz 2.5GHz – 5GHz



-20dBm Limit line

Date: 3.DEC.2012 15:54:12

435.0250MHz 5GHz – 10GHz

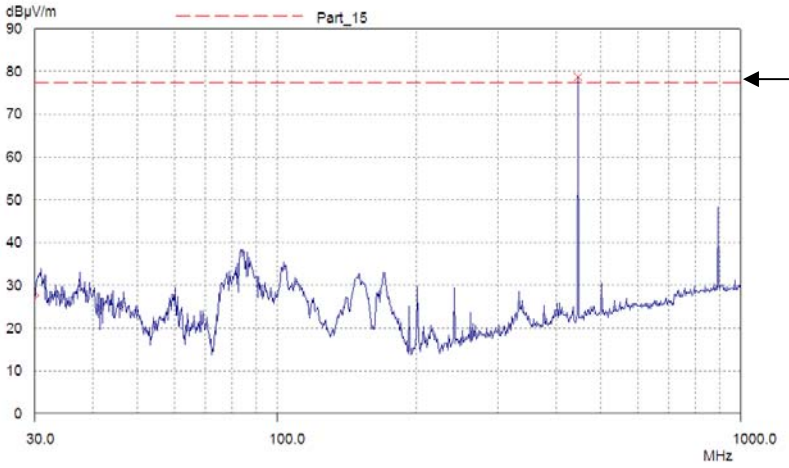


-20dBm Limit line

Date: 19.DEC.2012 15:11:36

Radiated emissions Channel 2

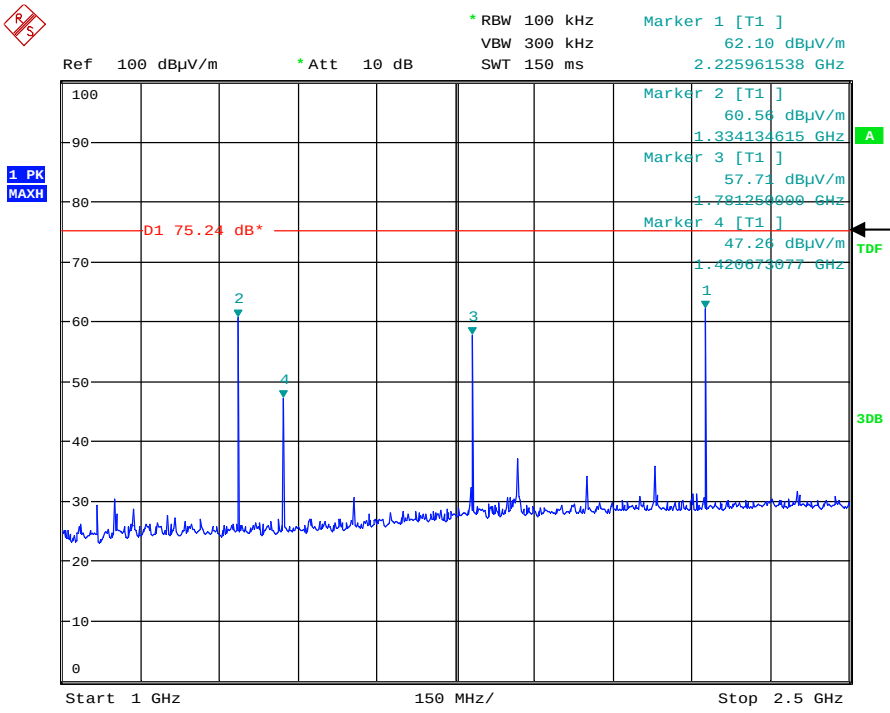
445.0250MHz 30MHz – 1GHz



-20dBm
Limit line

The above test results show that there were no emissions within 20dBs of the –20dBm limit.

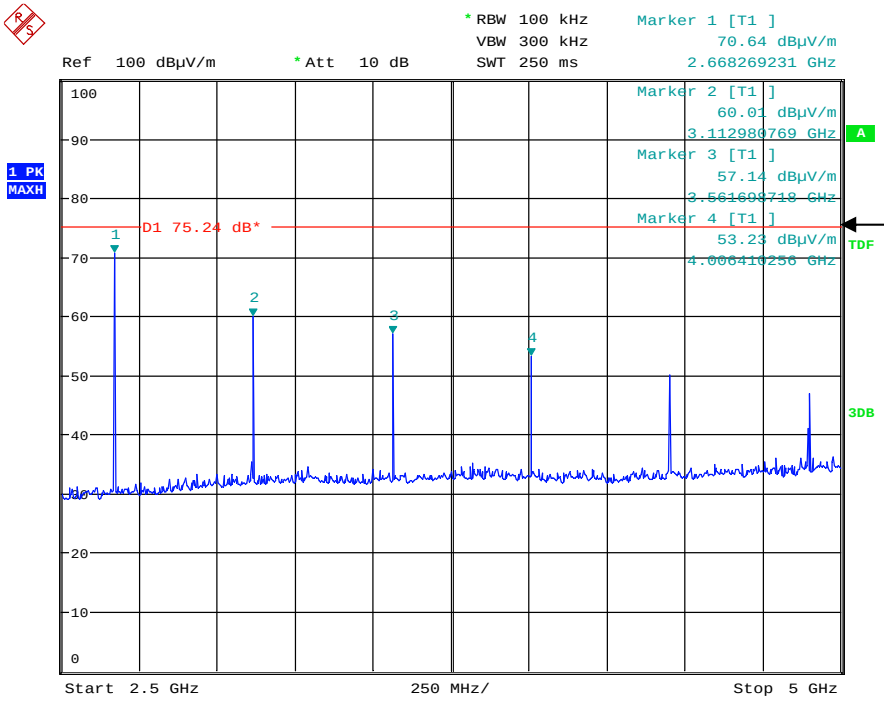
445.0250MHz 1GHz – 2.5GHz



-20dBm
Limit line

Date: 3.DEC.2012 16:07:15

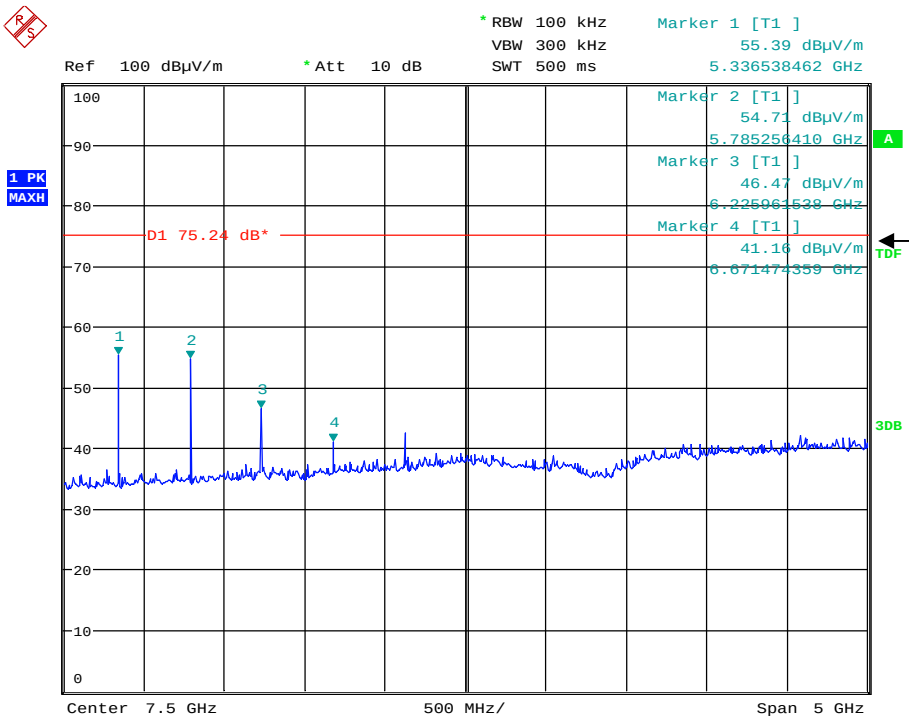
445.0250MHz 2.5GHz – 5GHz



-20dBm Limit line

Date: 3.DEC.2012 16:08:51

445.0250MHz 5GHz – 10GHz

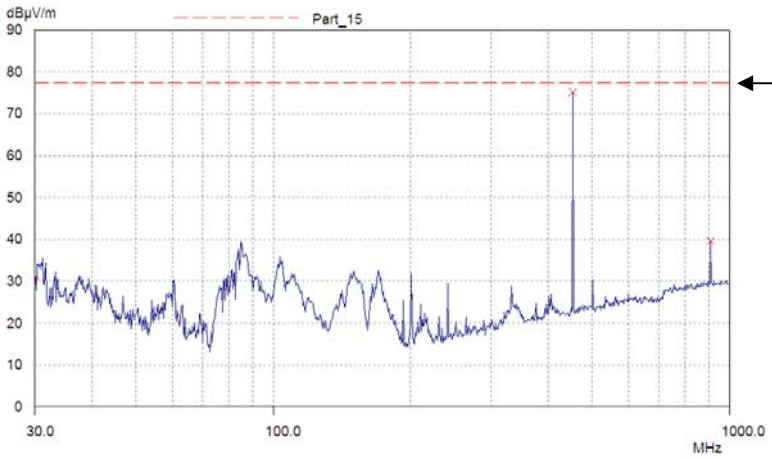


-20dBm Limit line

Date: 19.DEC.2012 15:05:14

Radiated emissions Channel 3

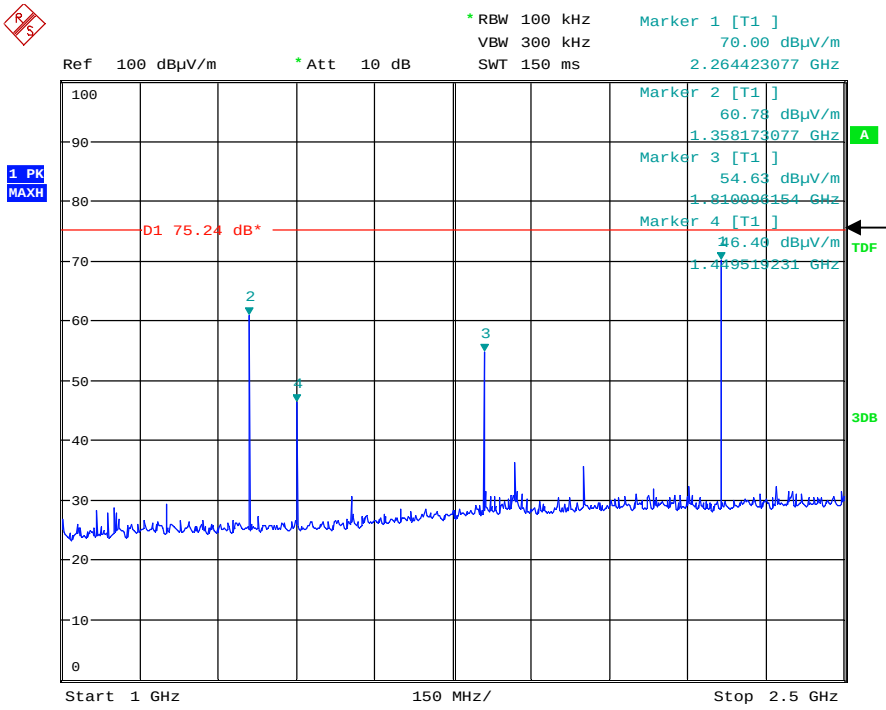
452.5500MHz - 30MHz – 1GHz



-20dBm
Limit line

The above test results show that there were no emissions within 20dBs of the –20dBm limit.

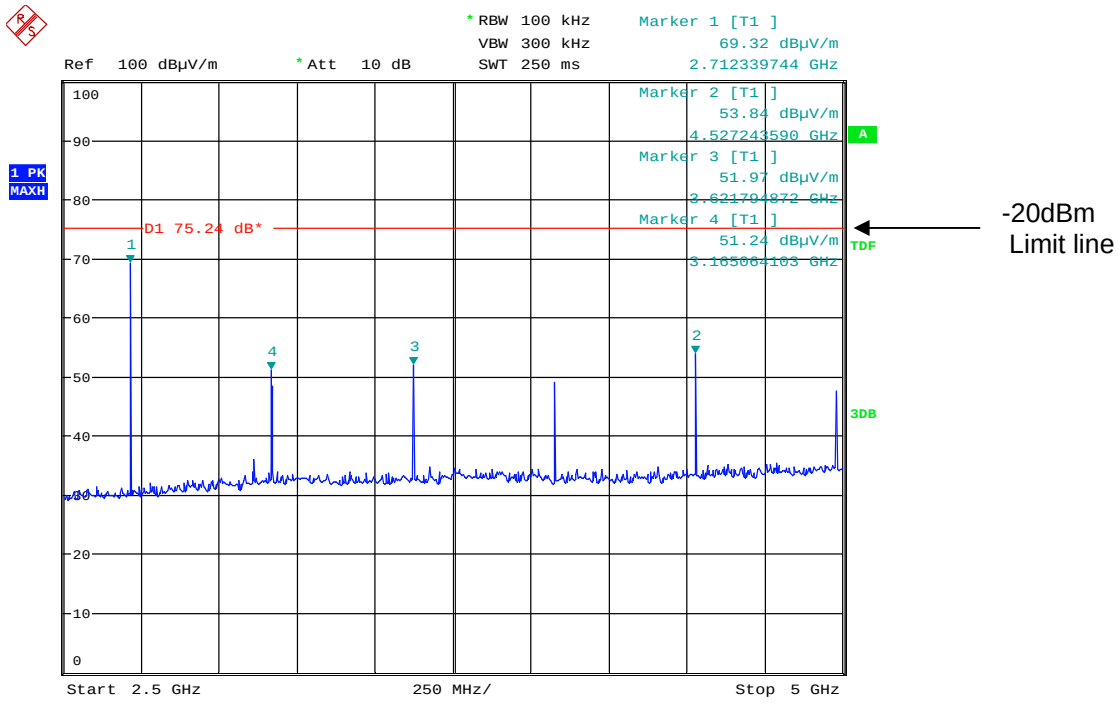
452.5500MHz 1GHz – 2.5GHz



-20dBm
Limit line

Date: 3.DEC.2012 16:17:54

452.5500MHz 2.5GHz – 5GHz



Date: 3.DEC.2012 16:19:33

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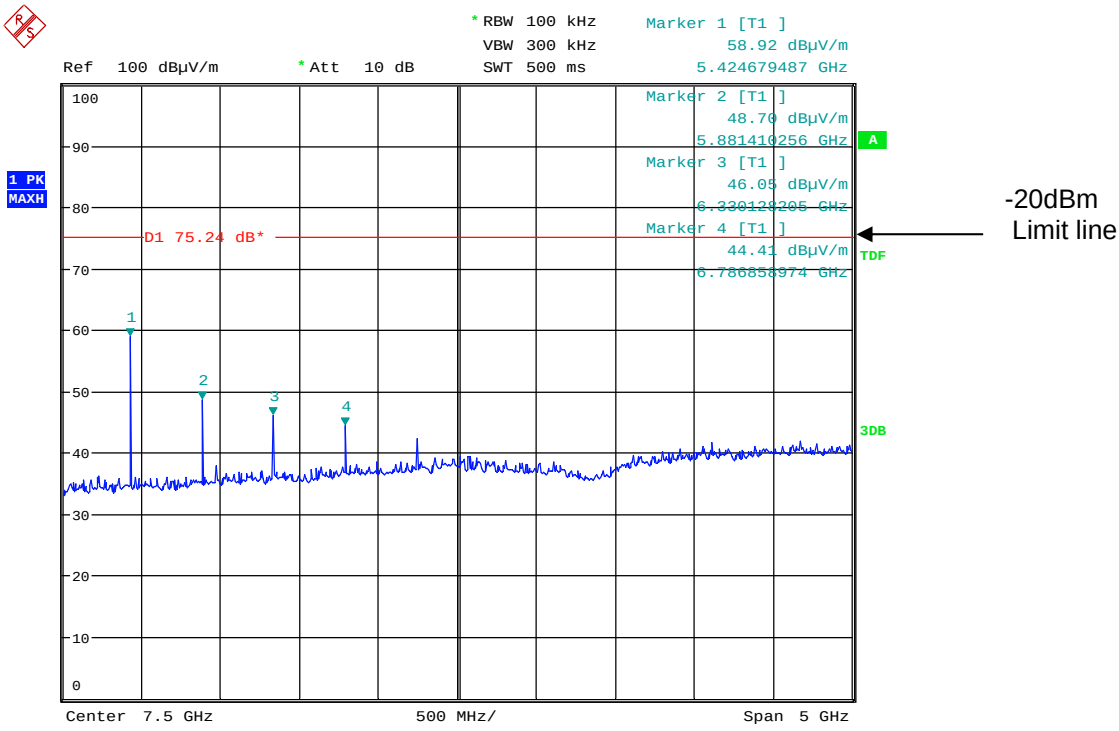
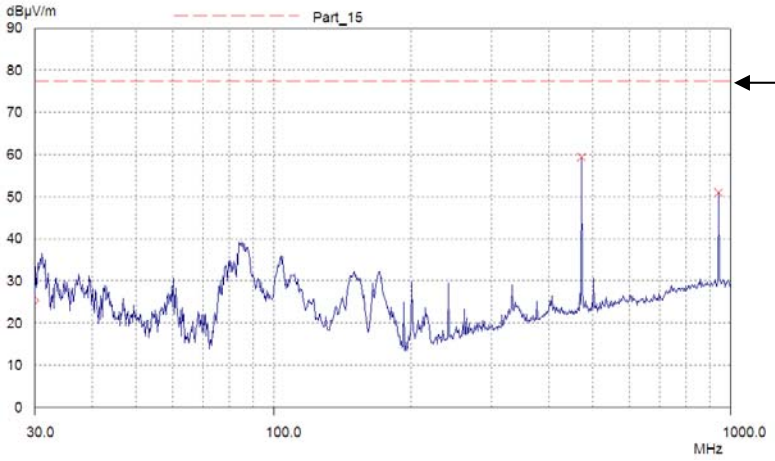
452.5500MHz 5GHz – 10GHz



Date: 19.DEC.2012 15:03:49

Radiated emissions Channel 4

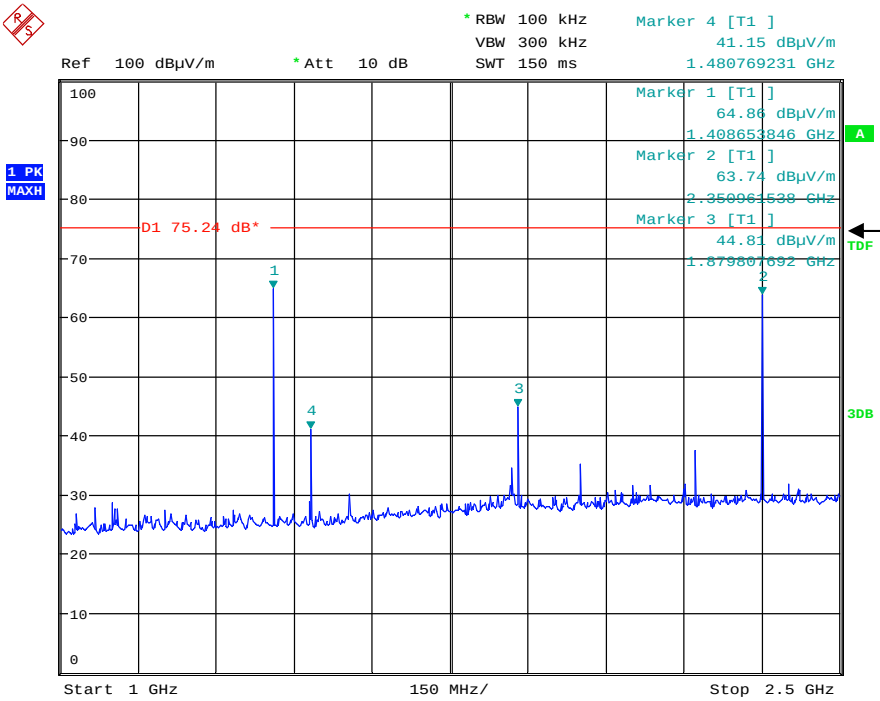
469.9750MHz - 30MHz – 1GHz



-20dBm
Limit line

The above test results show that there were no emissions within 20dBs of the –20dBm limit.

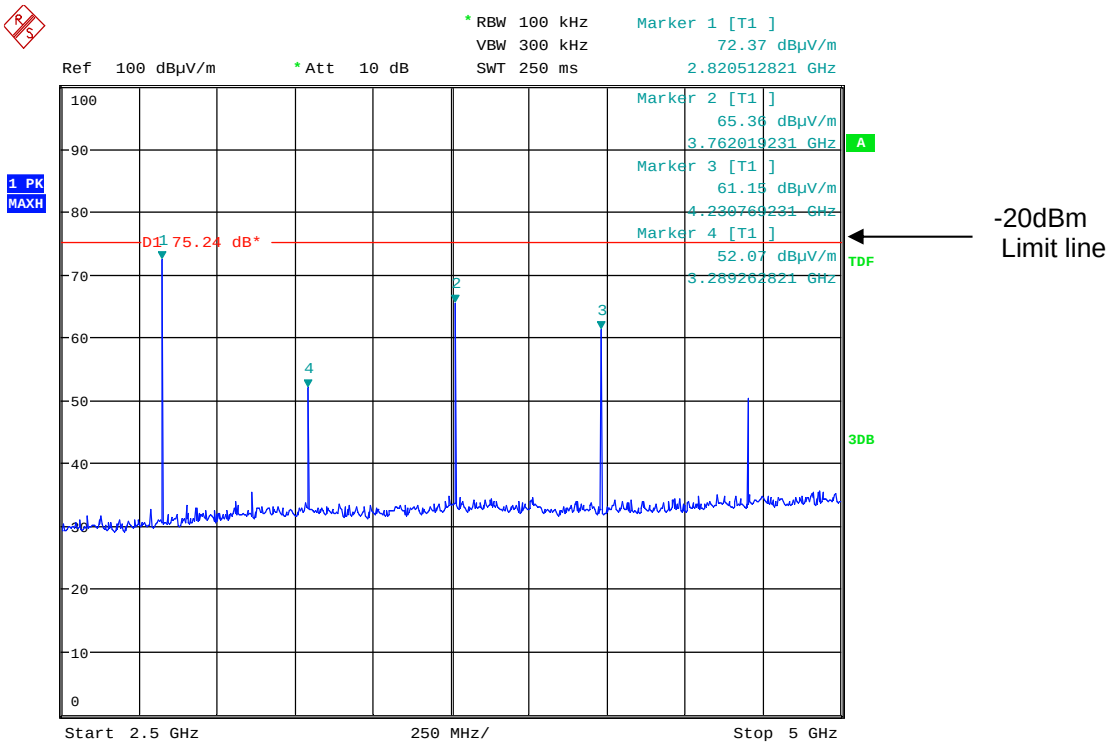
469.9750MHz 1GHz – 2.5GHz



-20dBm
Limit line

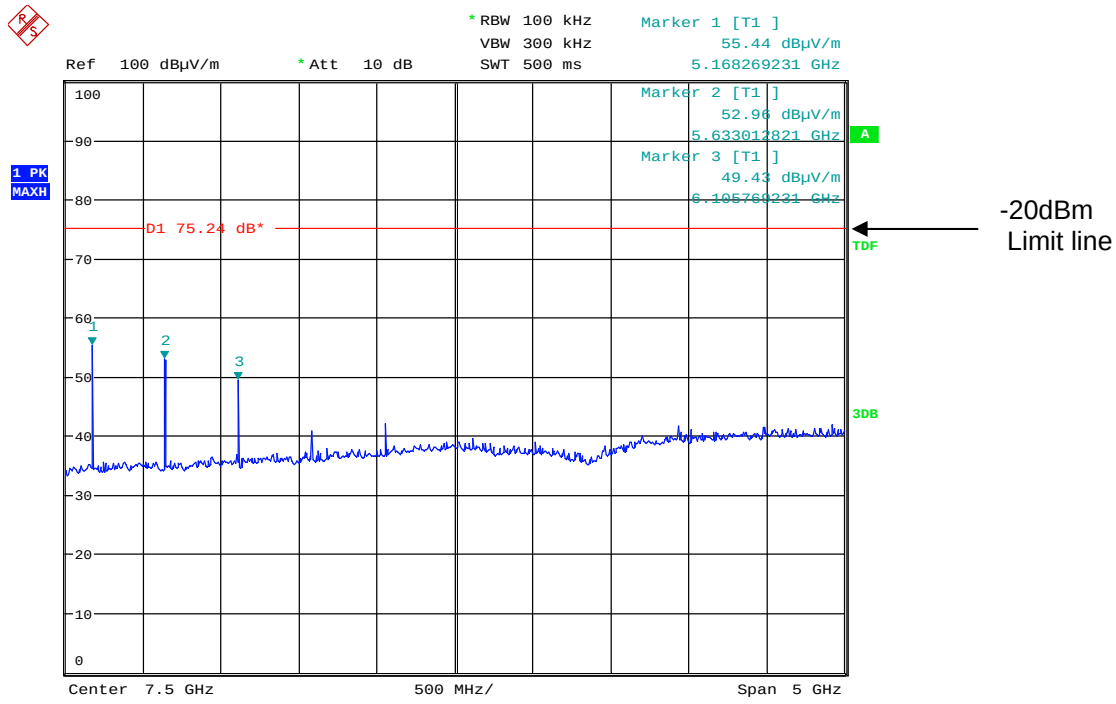
Date: 3.DEC.2012 16:24:43

469.9750MHz 2.5GHz – 5GHz



Date: 3.DEC.2012 16:25:59

469.9750MHz 5GHz – 10GHz

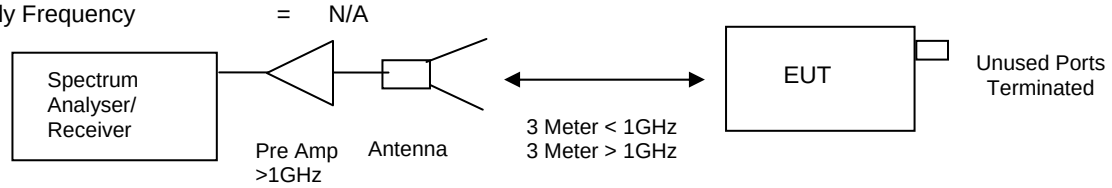


Date: 19.DEC.2012 14:59:48

UN-INTENTIONAL RADIATOR SPURIOUS EMISSIONS – RADIATED – Part 15:109

Ambient temperature = 24°C
Relative humidity = 34%
Conditions = ATS
Supply voltage = +13.8Vdc
Supply Frequency = N/A

Test Signal = F3E



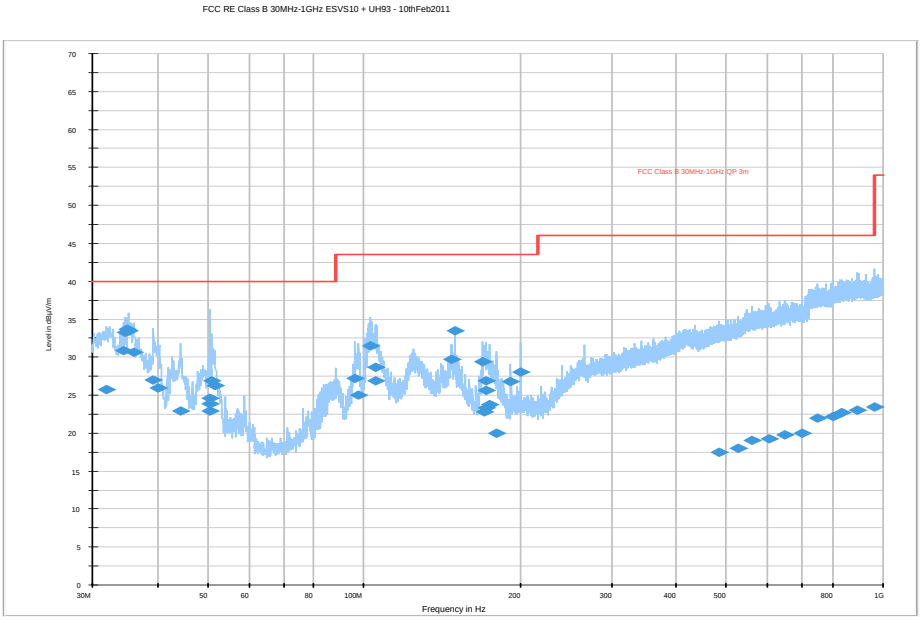
The test was set up as per the diagram, the receiver was tested while in receive mode while attached to a dummy load.
30MHz -1GHz worse case Rx mode

FREQ. (MHz)	MEAS. Rx. (dBµV)	Cable Loss (dB)	Ant Factor	Pre Amp (dB)	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (µV/m)	Limit (dBµV/m)	Limit (µV/m)
31.95	8.70	0.5	16.6	-	25.80	19.49	40.00	100
34.40	14.90	0.6	15.4	-	30.90	35.07	40.00	100
34.70	17.50	0.6	15.2	-	33.30	46.23	40.00	100
35.00	18.10	0.6	15.0	-	33.70	48.41	40.00	100
35.15	18.00	0.6	14.9	-	33.50	47.31	40.00	100
35.95	15.85	0.6	14.5	-	30.95	35.27	40.00	100
39.35	13.80	0.6	12.6	-	27.00	22.38	40.00	100
40.1	13.00	0.6	12.3	-	25.90	19.72	40.00	100
44.25	11.90	0.7	10.3	-	22.90	13.96	40.00	100
50.30	14.30	0.8	7.8	-	22.90	13.96	40.00	100
50.40	15.20	0.8	7.8	-	23.80	15.48	40.00	100
50.60	16.10	0.8	7.7	-	24.60	16.98	40.00	100
51.00	18.50	0.8	7.6	-	26.90	22.13	40.00	100
51.70	18.00	0.9	7.4	-	26.30	20.65	40.00	100
95.85	16.00	1.1	10.1	-	27.20	22.90	43.52	150
97.50	13.50	1.1	10.4	-	25.00	17.78	43.52	150
103.25	19.20	1.2	11.1	-	31.50	37.58	43.52	150
104.95	14.60	1.2	11.1	-	26.90	22.13	43.52	150
105.65	16.40	1.2	11.1	-	28.70	27.22	43.52	150
147.70	18.00	1.5	10.2	-	29.70	30.54	43.52	150
149.95	22.00	1.5	10.0	-	33.50	47.31	43.52	150
169.60	18.40	1.5	9.5	-	29.40	29.51	43.52	150
171.60	14.80	1.5	9.4	-	25.70	19.27	43.52	150
172.00	16.00	1.5	9.4	-	26.90	22.13	43.52	150
174.55	13.10	1.5	9.2	-	23.80	15.48	43.52	150
192.00	16.30	1.7	8.8	-	26.80	21.87	43.52	150
200.05	17.30	1.7	9.0	-	28.00	25.11	43.52	150

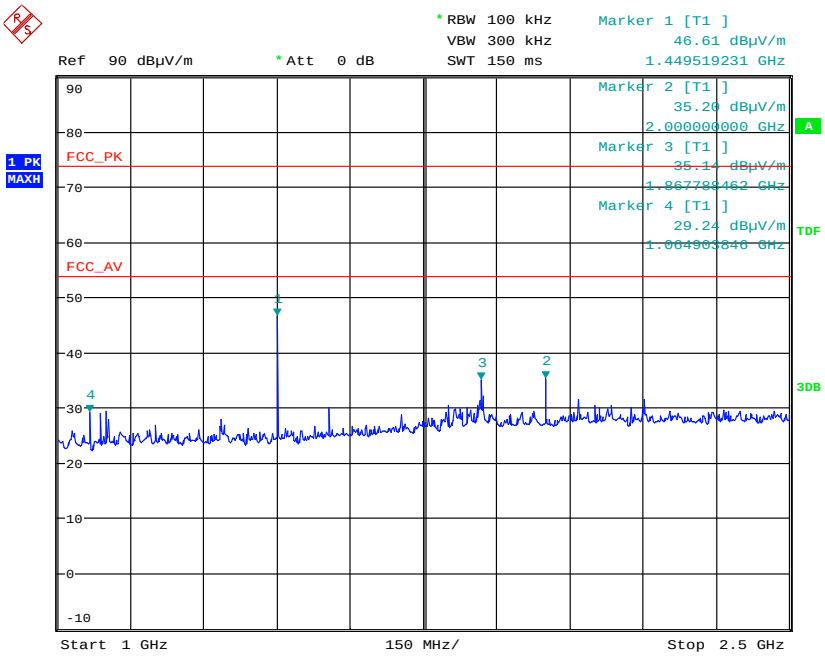
FREQ. (MHz)	MEAS. Rx. (dBµV)	Cable Loss (dB)	Ant Factor	Pre Amp (dB)	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (µV/m)	Limit (dBµV/m)	Limit (µV/m)
1380.28ch1	57.49	2.3	25.5	35.8	49.49pk	298.19	74.0pk	5011pk
1380.28ch1	55.04	2.3	25.5	35.8	47.04Av	224.90	54.0Av	500Av
1420.67ch2	57.75	2.5	25.6	35.7	50.15pk	321.73	74.0pk	5011pk
1420.67ch2	55.34	2.5	25.6	35.7	47.74Av	243.78	54.0Av	500Av
2129.80ch2	52.06	2.9	27.8	35.3	47.46pk	236.04	74.0pk	5011pk
2129.80ch2	40.33	2.9	27.8	35.3	35.73Av	61.16	54.0Av	500Av
1449.51ch3	62.42	2.6	25.7	35.7	55.02pk	563.63	74.0pk	5011pk
1449.51ch3	60.75	2.6	25.7	35.7	53.35Av	465.05	54.0Av	500Av
1139.42ch4	52.62	2.3	25.0	36.1	43.82pk	155.23	74.0pk	5011pk
1139.42ch4	45.67	2.3	25.0	36.1	36.87Av	69.74	54.0Av	500Av
1519.23ch4	58.36	2.6	25.8	35.6	51.16pk	361.41	74.0pk	5011pk
1519.23ch4	55.91	2.6	25.8	35.6	48.71Av	272.58	54.0Av	500Av
2281.25ch4	63.44	3.0	28.1	35.3	53.24pk	459.19	74.0pk	5011pk
2281.25ch4	61.00	3.0	28.1	35.3	50.80Av	346.73	54.0Av	500Av
1867.78ch3	59.72	2.7	27.4	35.3	54.52pk	532.10	74.0pk	5011pk
1867.78ch3	39.73	2.7	27.4	35.3	34.53Av	53.27	54.0Av	500Av
2000ch4	56.46	2.7	27.5	35.2	51.46pk	374.11	74.0pk	5011pk
2000ch4	46.82	2.7	27.5	35.2	41.82Av	123.31	54.0Av	500Av

Note: Ch1 Frequency = 435.0250MHz
Ch2 Frequency = 445.0250MHz
Ch3 Frequency = 452.5500MHz
Ch4 Frequency = 469.9750MHz

Rx 30MHz-1GHz

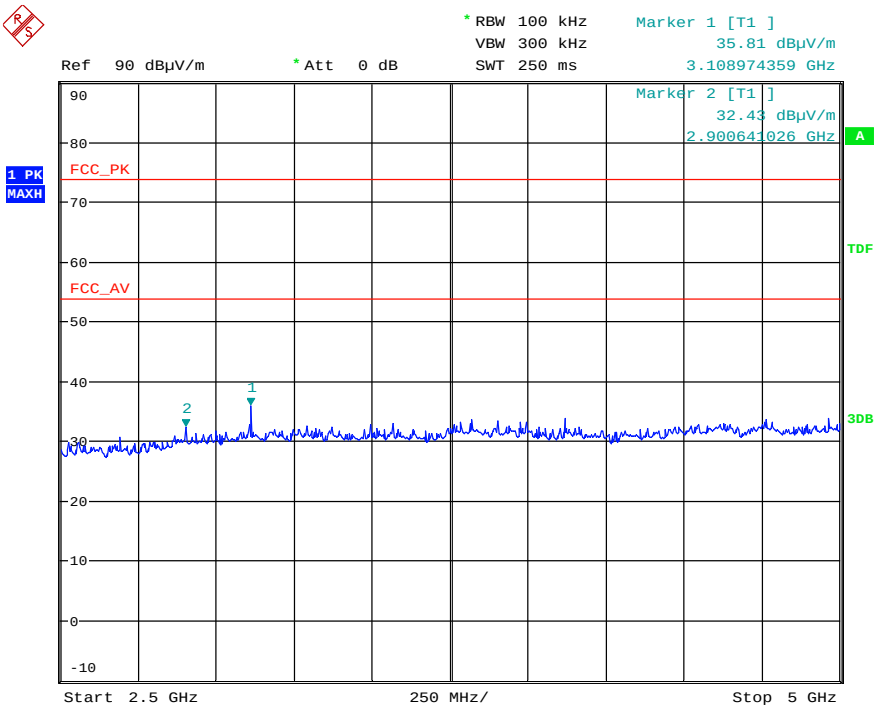


Rx 1GHz- 2.5GHz



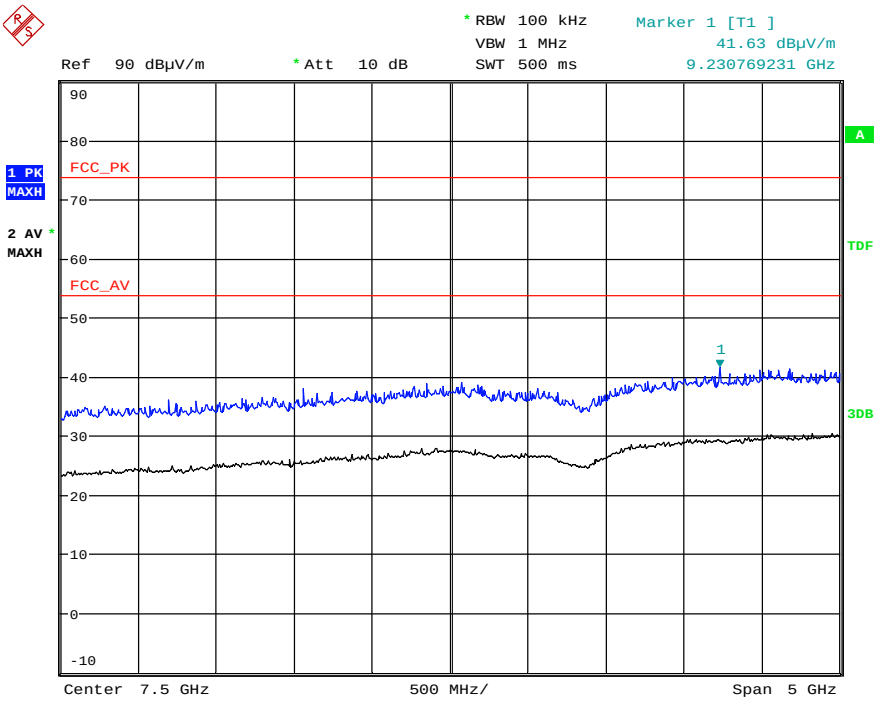
Date: 3.DEC.2012 15:33:29

Rx 2.5GHz- 5GHz



Date: 3.DEC.2012 15:35:00

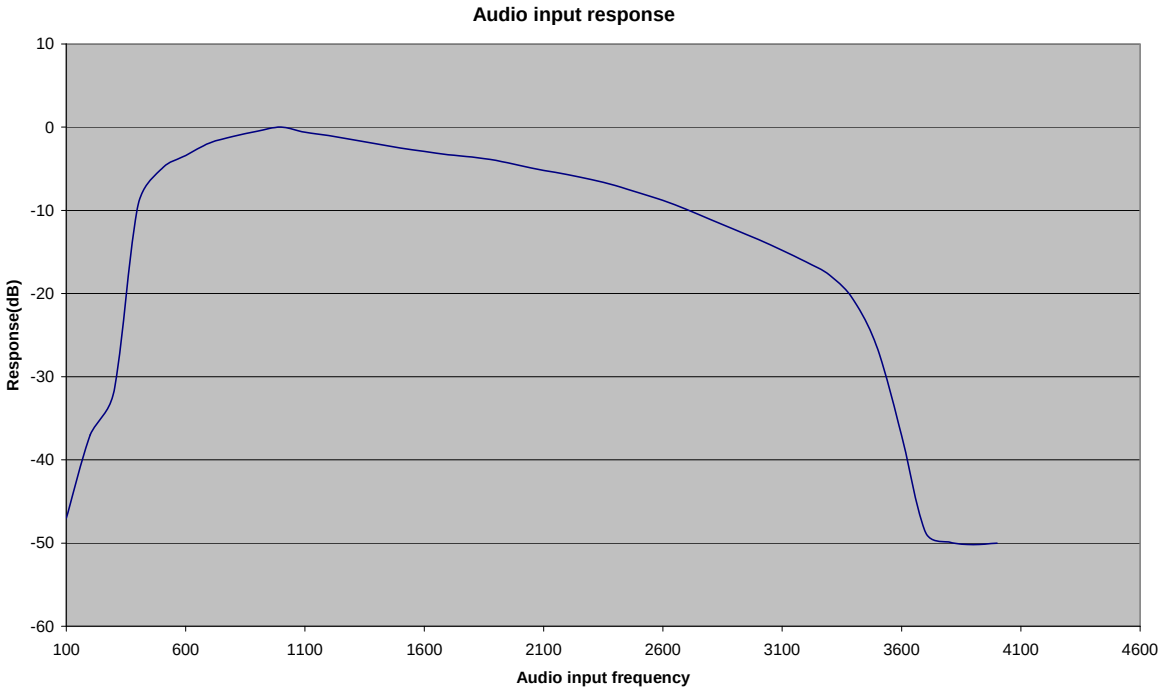
Rx 5GHz- 10GHz



Date: 19.DEC.2012 16:08:48

Modulation Characteristics: 2.1047 (a)

Ambient temperature	=	24°C	Radio Laboratory		
Relative humidity	=	34%	Test Signal	=	F3E
Supply voltage	=	+13.8Vdc			



Note: The SB2025NT100W 400MHz unit is capable of transmitting analogue speech and P25 digital audio modulation.

There are no transmitter audio frequency inputs available via a microphone socket or any other audio frequency input.

The transmitter was tested whilst operating under the following conditions:

1) A signal generator was connected into the receiver RF input, tuned to the receiver frequency, and the deviation level set to 2.5kHz, the audio frequency was then varied between 100Hz and 5kHz.

2) testing was carried out with the talk through feature enabled.
(therefore the audio response will take into account the pre emphasis and de emphasis of the receiver and transmitter).

3) A 1kHz audio signal was applied which was used as a 0dB response reference.

The above plot shows the audio response of the transmitter.

Modulation Characteristics: 2.1047 (b)

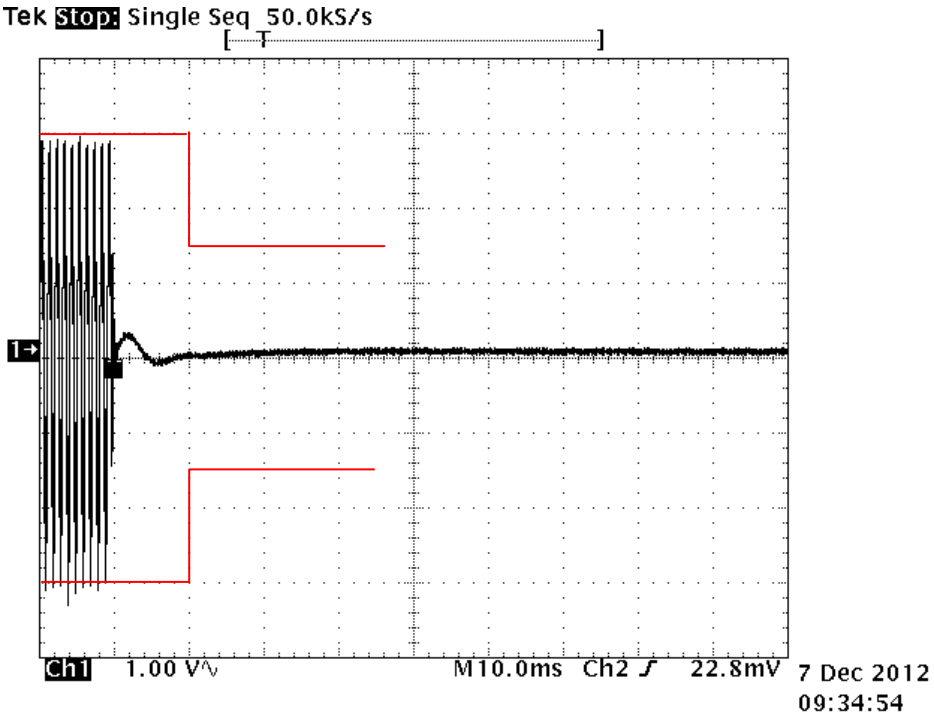
Note: The SB2025NT100W 400MHz unit is capable of transmitting analogue speech and P25 digital audio modulation.

There are no transmitter external audio inputs available via a microphone socket etc, and therefore the test was not performed. The external audio is via the receiver RF input or the digital audio input.

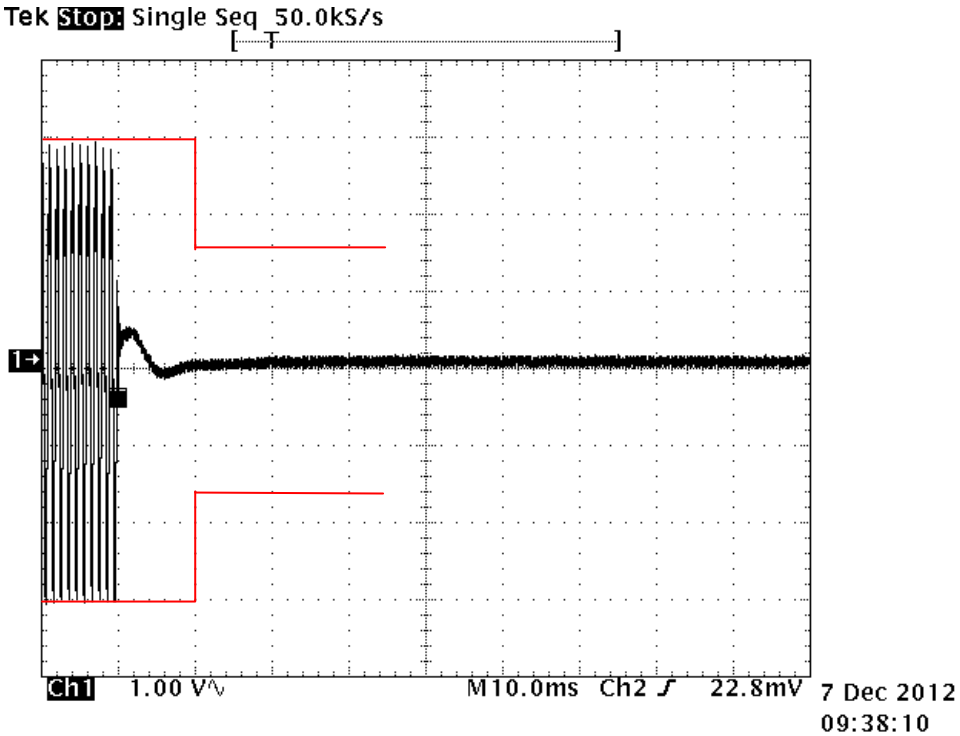
Transient frequency behavior – Part 15:214

Ambient temperature	=	24°C	Test Signal	=	F3E
Relative humidity	=	34%			
Conditions	=	ATS			
Supply voltage	=	+13.8Vdc			
Supply Frequency	=	N/A			

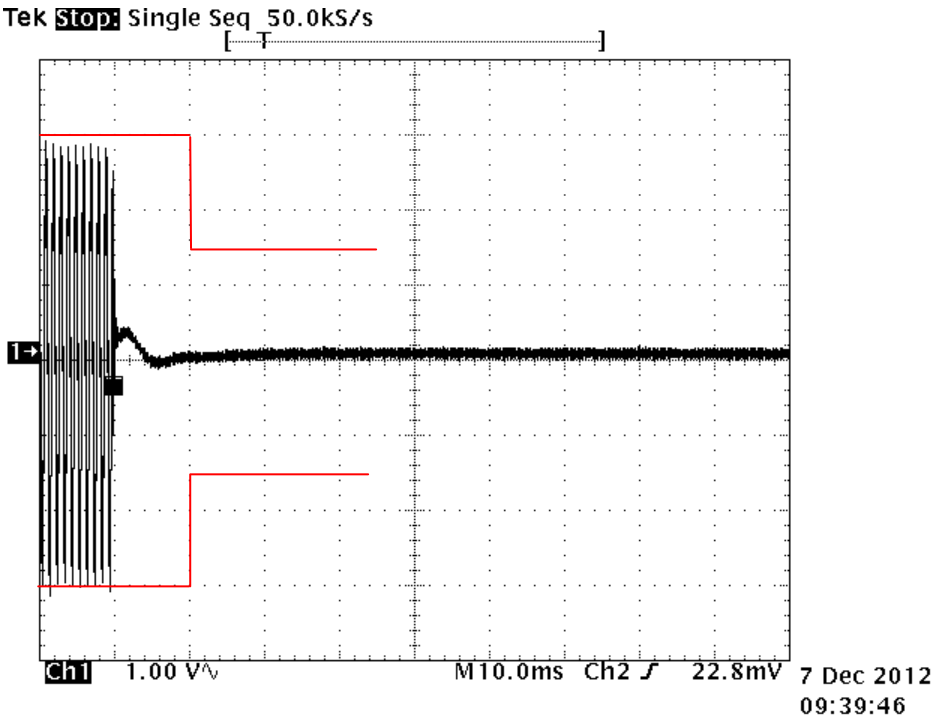
435.0250MHz Tx on 12.5kHz



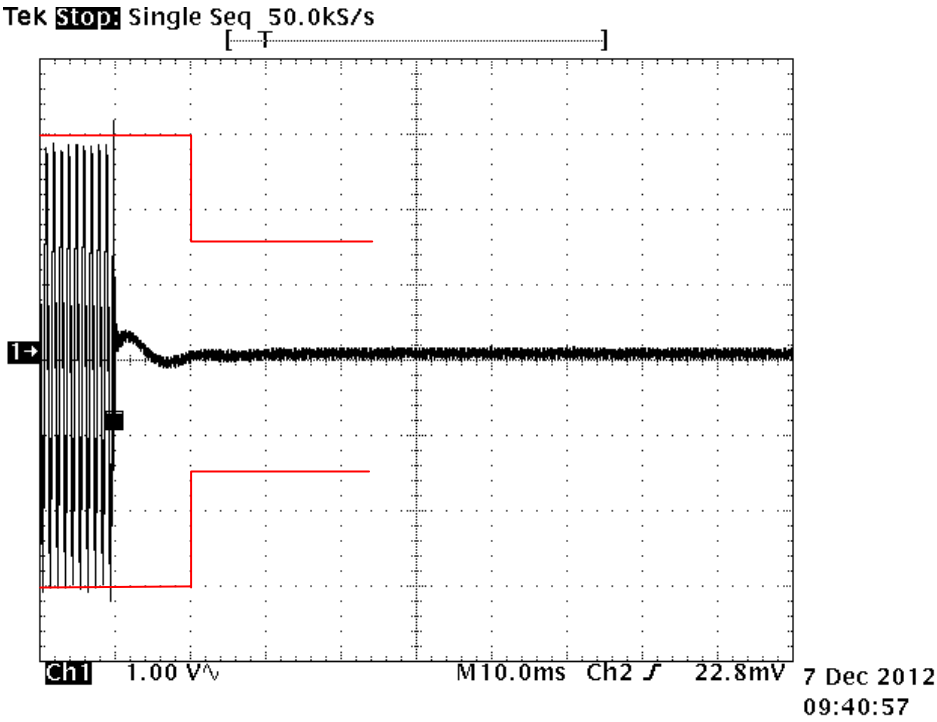
445.0250MHz Tx on 12.5kHz



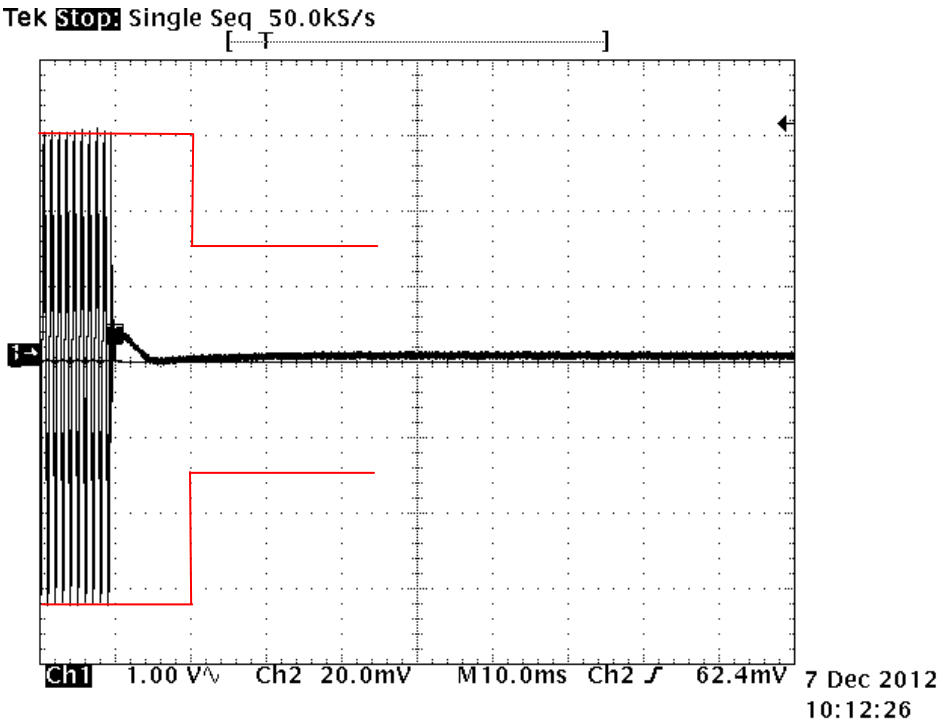
452.5500MHz Tx on 12.5kHz



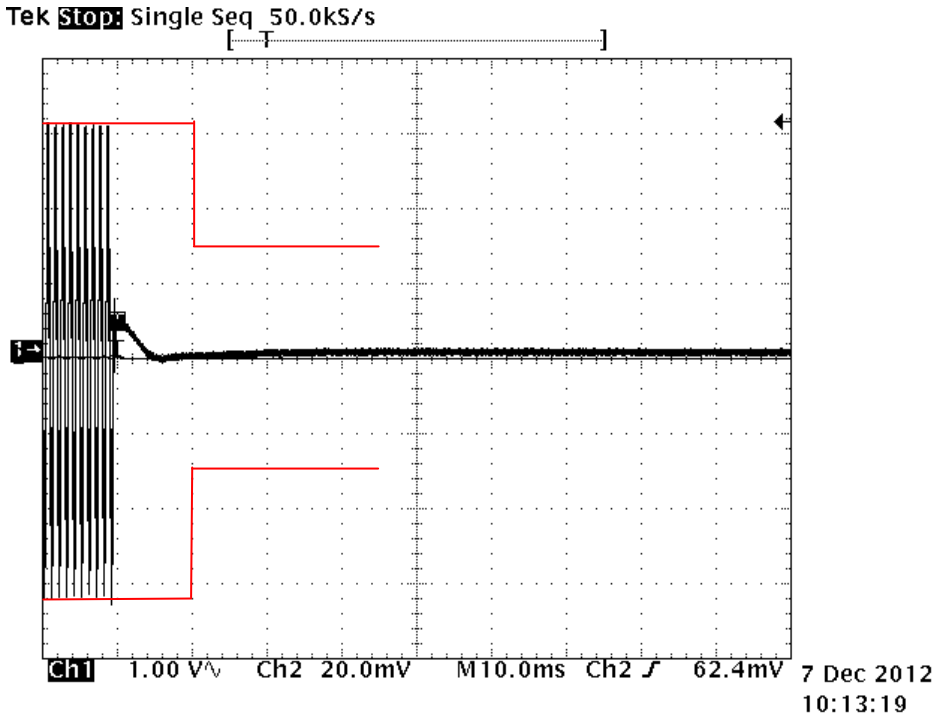
469.9750MHz Tx on 12.5kHz



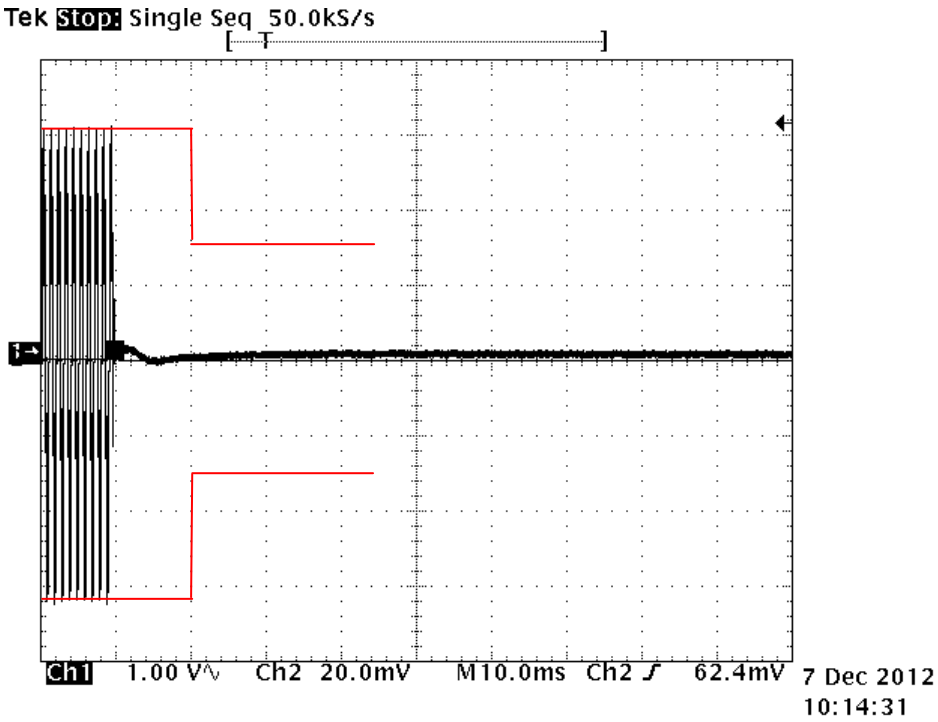
435.0250MHz Tx on 25kHz



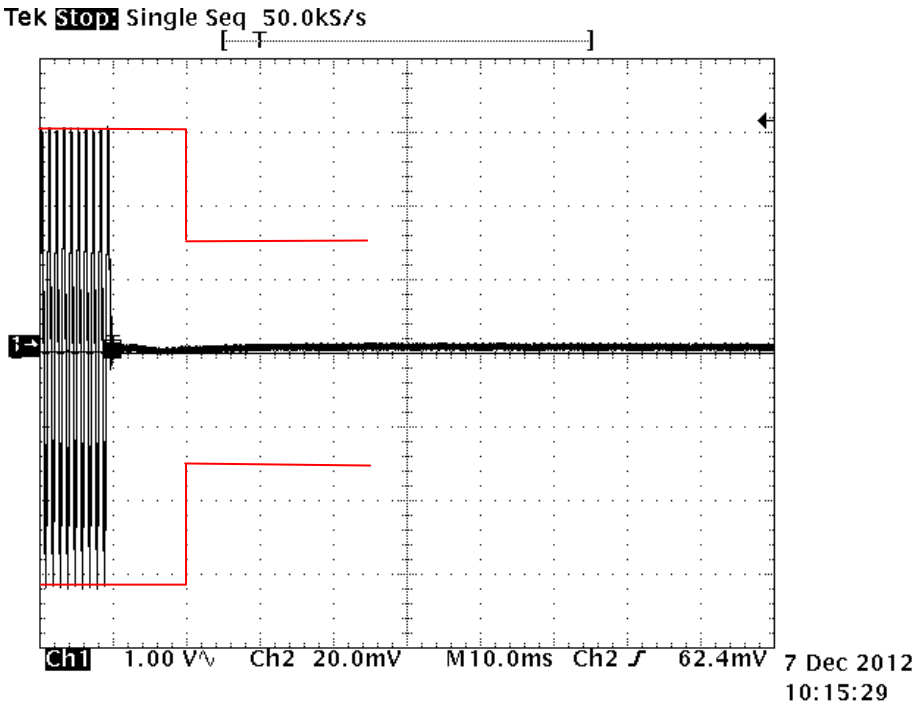
445.0250MHz Tx on 25kHz



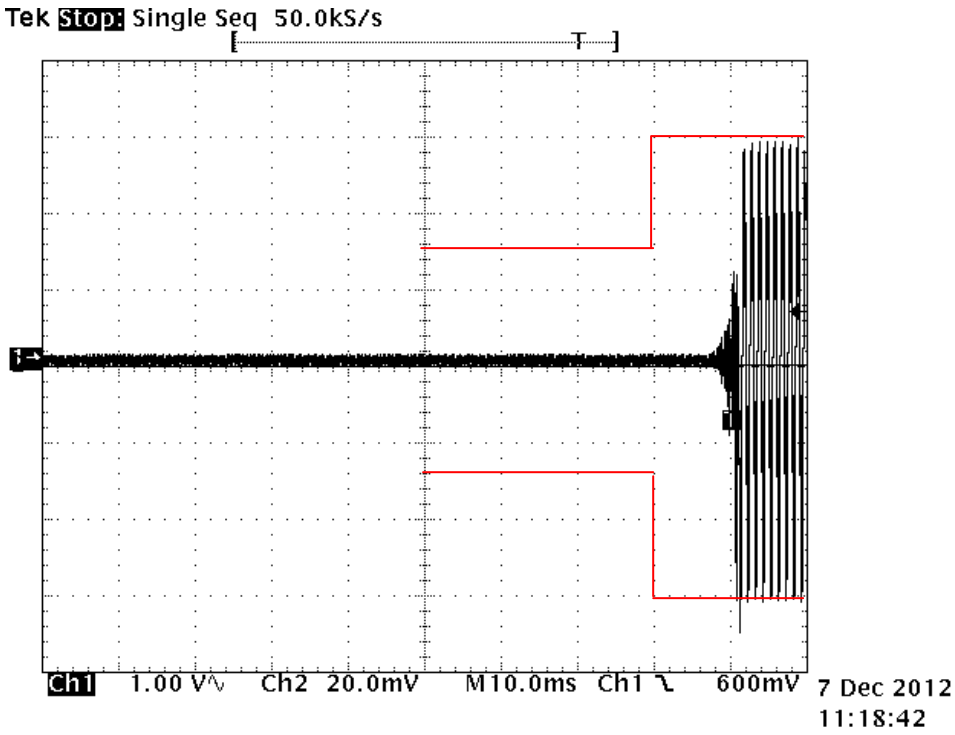
452.5500MHz Tx on 25kHz



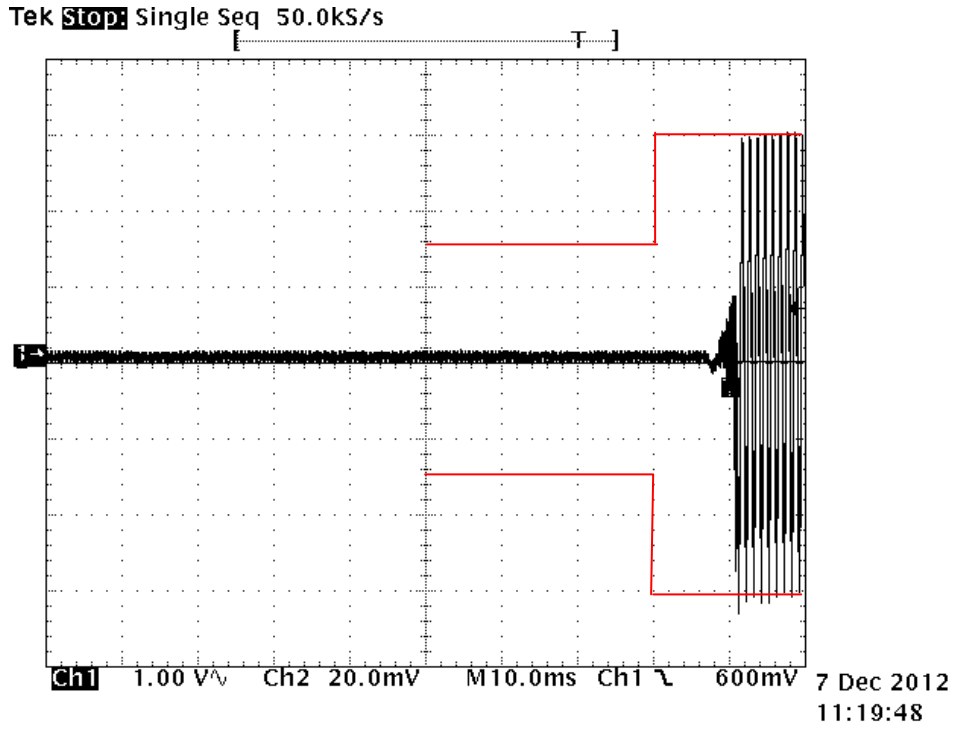
469.9750MHz Tx on 25kHz



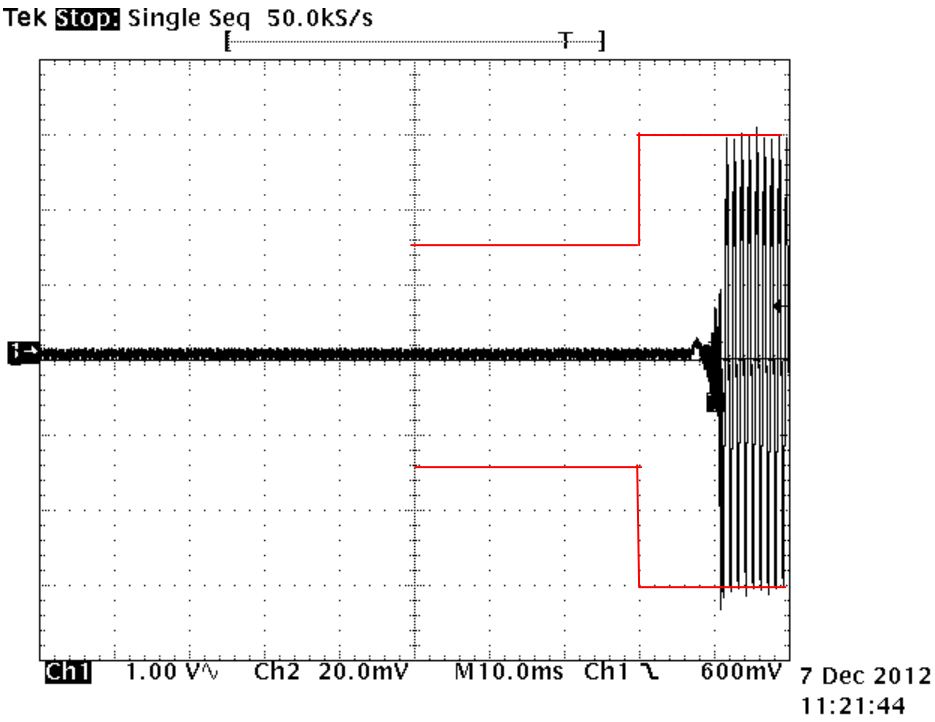
435.0250MHz Tx off 12.5kHz



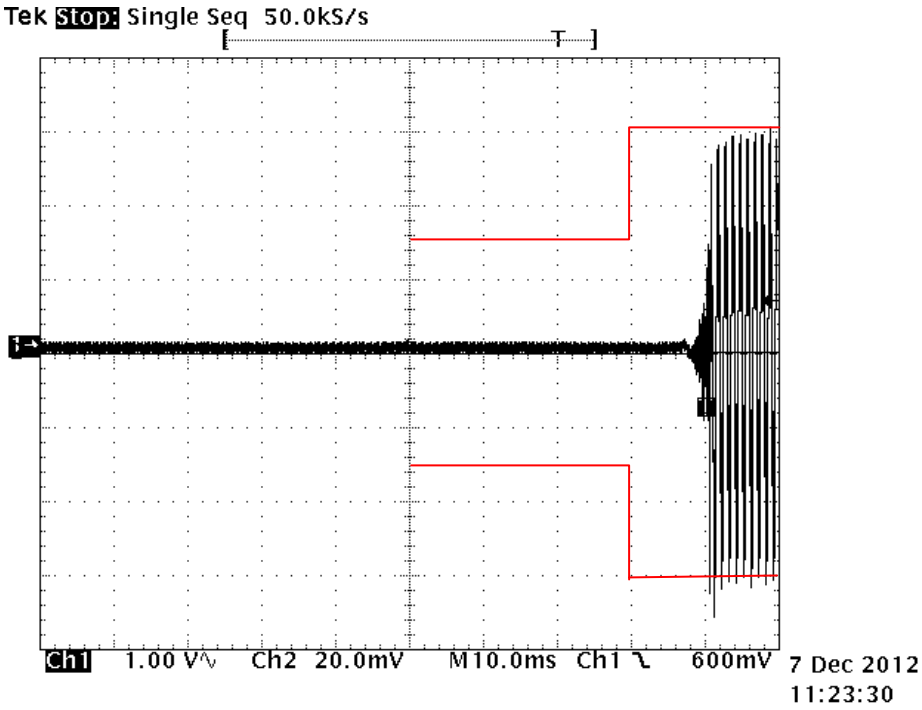
445.0250MHz Tx off 12.5kHz



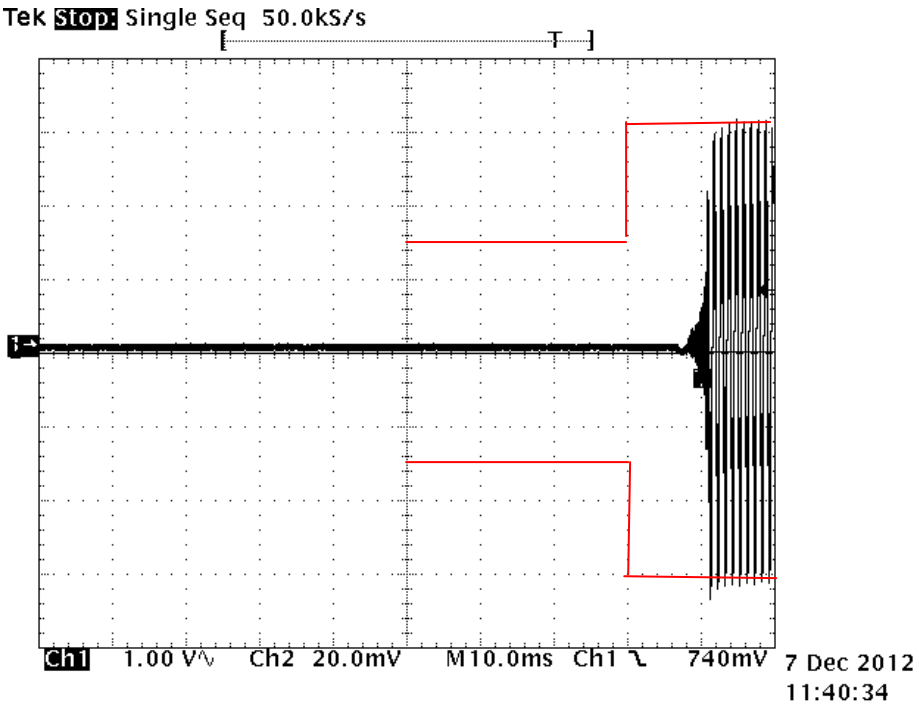
452.5500MHz Tx off 12.5kHz



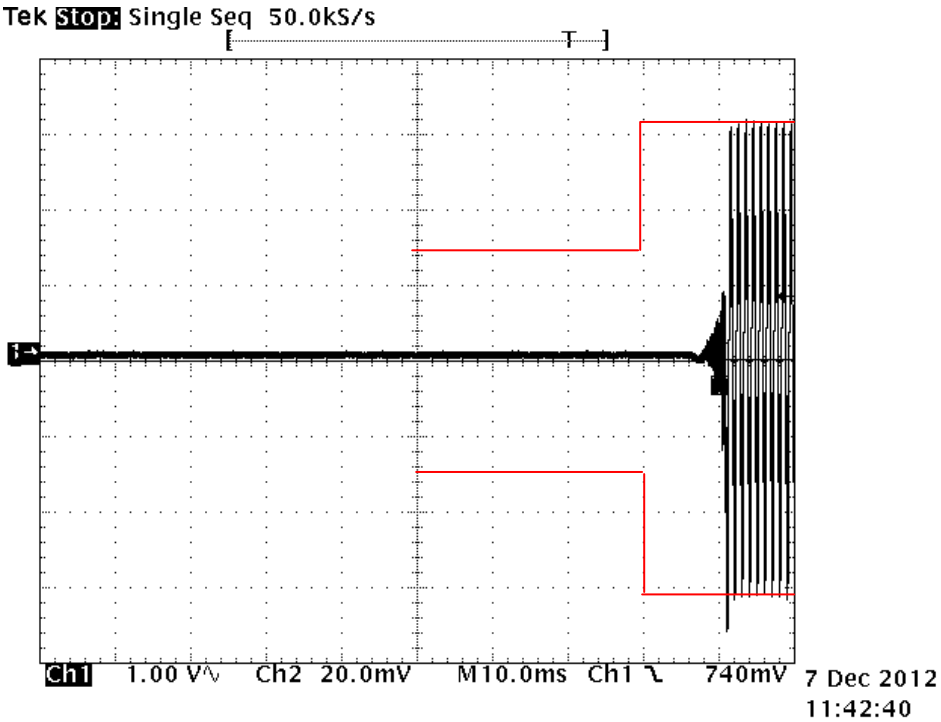
469.9750MHz Tx off 12.5kHz



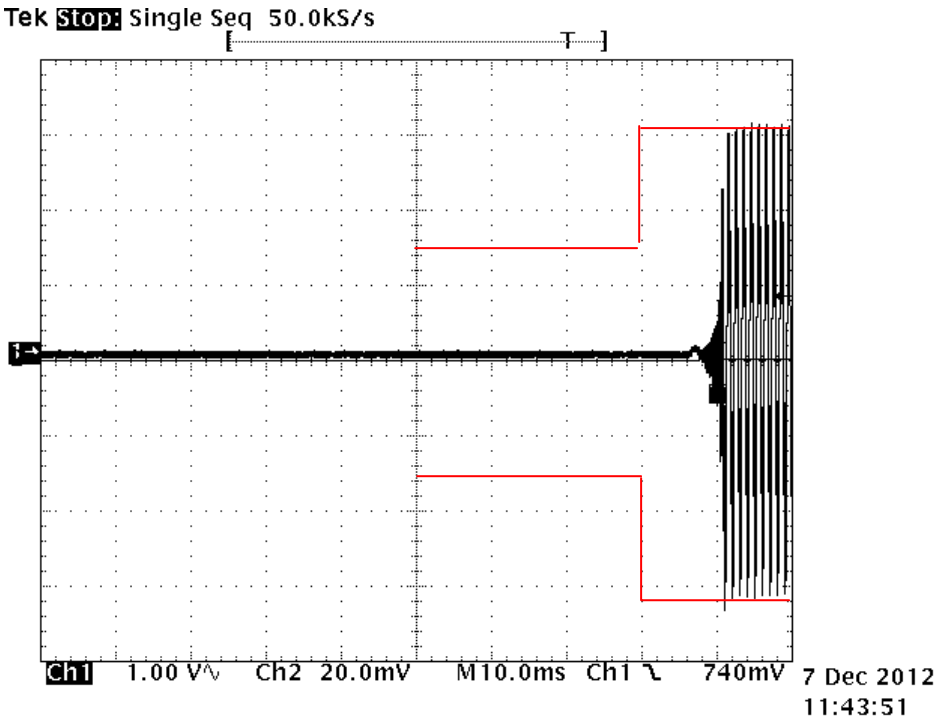
435.0250MHz Tx off 25kHz



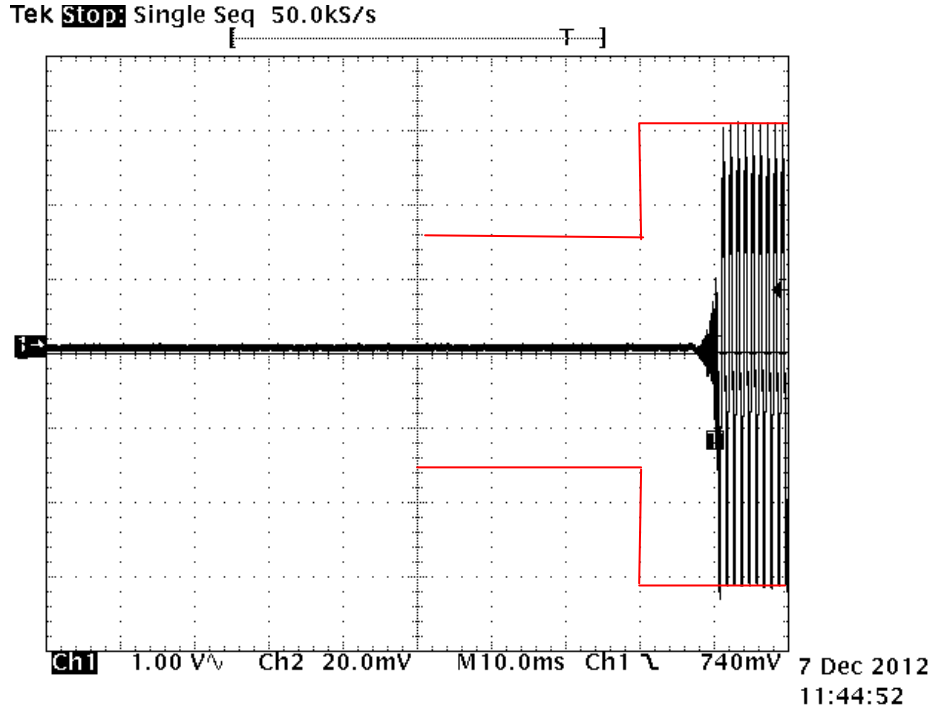
445.0250MHz Tx off 25kHz



452.5500MHz Tx off 25kHz



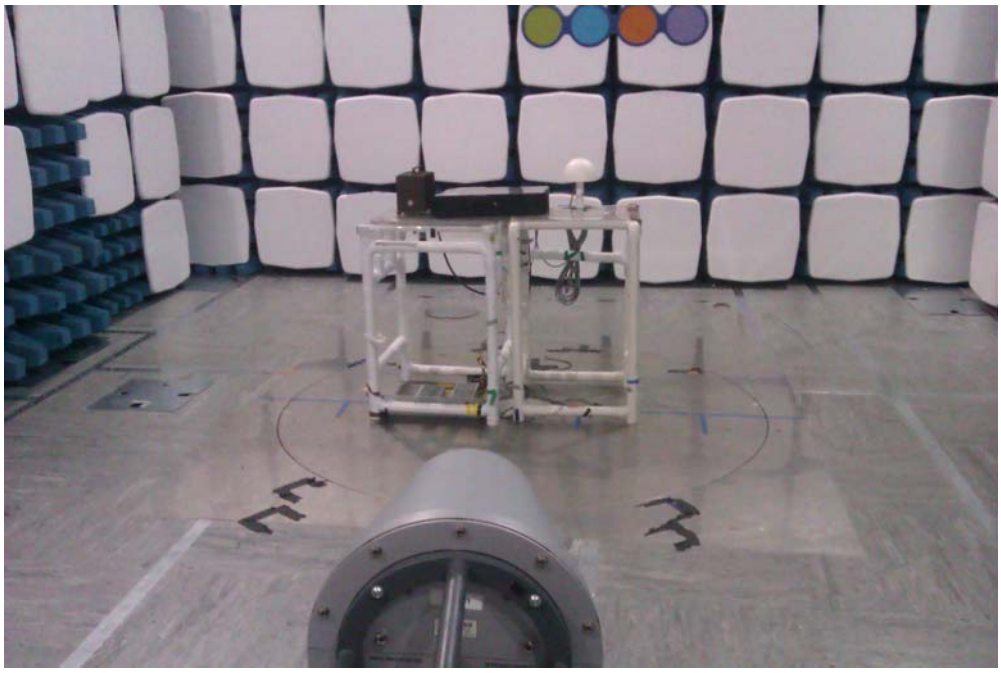
469.9750MHz Tx off 25kHz

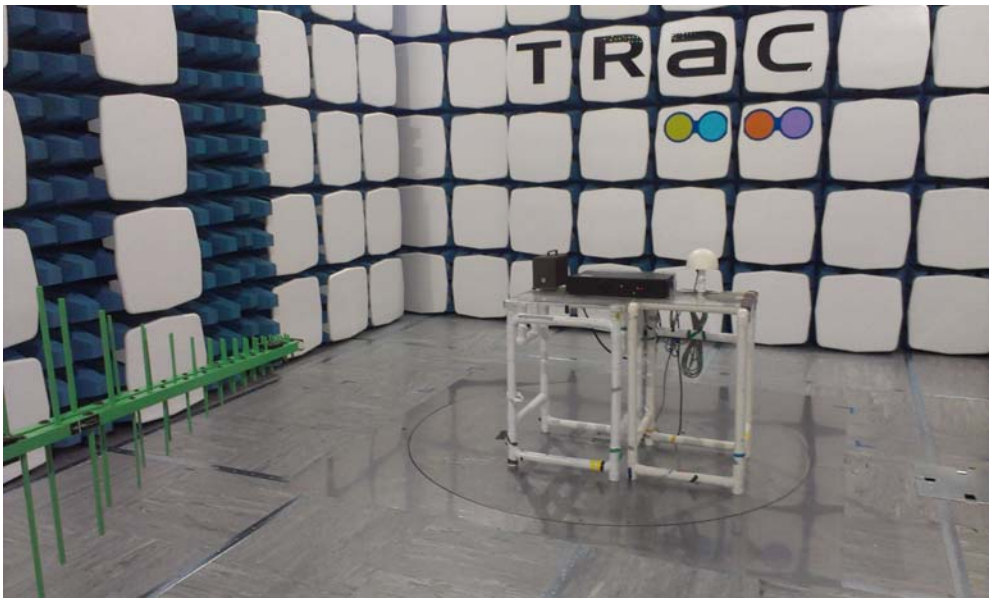


ANNEX A

PHOTOGRAPHS

Photograph 1&2: Test Setup





Photograph 3&4: Overview

ANNEX B

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

a.	TCB	-	APPLICATION	[X]
		-	FEE	[X]
b.	AGENT'S LETTER OF AUTHORISATION	-		[X]
c.	MODEL(s) vs IDENTITY	-		[ ]
d.	ALTERNATIVE TRADE NAME DECLARATION(s)	-		[ ]
e.	LABELLING	-	PHOTOGRAPHS	[ ]
		-	DECLARATION	[ ]
		-	DRAWINGS	[ ]
f.	TECHNICAL DESCRIPTION	-		[X]
g.	BLOCK DIAGRAMS	-	Tx	[X]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
h.	CIRCUIT DIAGRAMS	-	Tx	[X]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
i.	COMPONENT LOCATION	-	Tx	[ ]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
j.	PCB TRACK LAYOUT	-	Tx	[ ]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
k.	BILL OF MATERIALS	-	Tx	[X]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
l.	USER INSTALLATION / OPERATING INSTRUCTIONS	-		[X]

ANNEX C

EQUIPMENT CALIBRATION

TRAC Ref	Type	Description	Manufacturer	Date Calibrated.
TRL281	FSU46	Spectrum Analyser	Rhode & Schwarz	09/02/2012
TRL139	3115	Horn Antenna	EMCO	14/09/2011
TRL572	8449B	Pre amp	Agilent	12/12/2012
TRLUH04	ESVS10	Receiver	Rhode & Schwarz	12/01/2012
TRLUH93	CBL6112B	Antenna	Chase	20/06/2011
TRL222	8304-100-N	ATTENUATOR	BIRD	Cal In Use
TRLUH225	745357	ATTENUATOR	SPINNER	Cal In Use
REF916	SMBV100A	Signal Generator	Rhode & Schwarz	Level checked as required
TRL426	52 Series 11	Temperature Indicator	Fluke	22/03/2012
TRL11	-	Environmental Chamber	Sharetree	USE TRL426
TRLUH41	M3004	Multimeter	AVOmeter	04/03/2012
TRLUH194	AP60/50	Power Supply	Farnell	USE TRLUH41
TRL05	CMTA	Radio Analyser	Rhode & Schwarz	19/03/2012
TRLUH275		Filter		Cal In Use
TRLUH265		Filter		Cal In Use

ANNEX D

MEASUREMENT UNCERTAINTY

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.

[1] Adjacent Channel Power

Uncertainty in test result = **1.86dB**

[2] Carrier Power

Uncertainty in test result (Power Meter) = **1.08dB**
Uncertainty in test result (Spectrum Analyser) = **2.48dB**

[3] Effective Radiated Power

Uncertainty in test result = **4.71dB**

[4] Spurious Emissions

Uncertainty in test result = **4.75dB**

[5] Maximum frequency error

Uncertainty in test result (Power Meter) = **0.113ppm**
Uncertainty in test result (Spectrum Analyser) = **0.265ppm**

[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**,
Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,
Uncertainty in test result (1GHz – 18GHz) = **4.7dB**

[7] Frequency deviation

Uncertainty in test result = **3.2%**

[8] Magnetic Field Emissions

Uncertainty in test result = **2.3dB**

[9] Conducted Spurious

Uncertainty in test result – Up to 8.1GHz = **3.31dB**
Uncertainty in test result – 8.1GHz – 15.3GHz = **4.43dB**
Uncertainty in test result – 15.3GHz – 21GHz = **5.34dB**
Uncertainty in test result – Up to 26GHz = **3.14dB**

[10] Channel Bandwidth

Uncertainty in test result = **15.5%**

[11] Amplitude and Time Measurement – Oscilloscope

Uncertainty in overall test level = **2.1dB**,
Uncertainty in time measurement = **0.59%,**
Uncertainty in Amplitude measurement = **0.82%**

[12] Power Line Conduction

Uncertainty in test result = **3.4dB**

[13] Spectrum Mask Measurements

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

[14] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[15] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[16] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[17] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[18] Receiver Threshold

Uncertainty in test result = **3.23dB**

[19] Transmission Time Measurement

Uncertainty in test result = **7.98%**