FCC PART 90
IC RSS-119, ISSUE 12, MAY 2015
TEST AND MEASUREMENT REPORT

For

Trimble Navigation Limited

935 Stewart Drive,

Sunnyvale, CA 94085, USA

FCC ID: KEAADL352
IC: 2368B-ADL352

Report Type: Original Report	**Product type:** UHF Transceiver

Prepared By Todd Moy

Report Number: R1504141-90 Rev B

Report Date: 2015-07-29

Simon Ma

Reviewed By: RF Lead

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732 9164

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1504141-90	Original Report	2015-05-26
1	R1504141-90 Rev A	Revised Report	2015-06-15
2	R1504141-90 Rev B	Updated Test Data	2015-07-29

1. General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf *Trimble Navigation Limited* and their product, FCC ID: KEAADL352, IC: 2368B-ADL352, model: ADL35-2, which will henceforth be referred to as the EUT (Equipment Under Test). The EUT is a UHF transceiver module operates in 430-473 MHz in U.S. and 450-470 MHz in Canada.

The EUTs are UHF Transceivers that operates under FCC Part 90 and Industrial Canada RSS-119 Issue 12.

Specifications	
Frequency Bands	Canada: 450-470 MHz USA: 430-473 MHz
Modulation Type	GMSK, 4FSK
Data Rate (bps)	4800, 8000, 9600, 19200
Emission Designator	F1D
RF Output Power	2 Watts - 35 Watts
Channel Spacing	12.5 kHz & 25 kHz
Dual Power Supply	12 V

1.2 Mechanical Description

The EUT measures approximately 11.9 cm (L) x 8.6 cm (W) x 21.3 cm (H) and weighs approximately 2 kg.

The test data gathered are from production sample, serial number: R1504141-1, assigned by BACL.

1.3 Objective

This type approval report is prepared on behalf of *Trimble Navigation Limited* in accordance Part 90 of the Federal Communication Commissions and Radio Standards Specification RSS-119, Issue 12 rules.

The objective was to determine the RF output power, Occupied Bandwidth, Spurious Emissions, Frequency Stability and Transient Frequency Behavior are in compliance with the FCC rules.

1.4 Related Submittal(s)/Grant(s)

None.

1.5 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service

RSS-119, Issue 12, Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz

Applicable Standards:TIA603-D and ANSI 63.4-2009, American National Standard for Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed by Bay Area Compliance Laboratories Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2:2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility

Bay area compliance Laboratories Corp. (BACL) is:
1- An independent Commercial Test Laboratory accredited to **ISO 17025: 2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminares and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65: 1996** by **A2LA** to certify:
2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.
3. Radio Communication Equipment for Singapore.
4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.
5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).

6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s),Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA/EIA-603-D.

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The software used were ADCONF Eng and Magnolia Editor Version 1.0.0.1, these were provided by client and was verified by BACL (Todd Moy) to comply with the standard requirements being tested against.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Internal Configuration

Manufacturers	Descriptions	Models	Serial Numbers
Trimble Navigation Ltd	PCB Assembly	E00358-1	-
Trimble Navigation Ltd	PCB Assembly	A02761 (ADL Vantage35 & TDL 450H)	-
Trimble Navigation Ltd	PCB Assembly	A02710-11 (ADL Vantage 35 & TDL 450H)	-

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Dell	Laptop	Latitude D620	G66NNC1

2.6 Local Support Equipment Power Supply and Line Filters

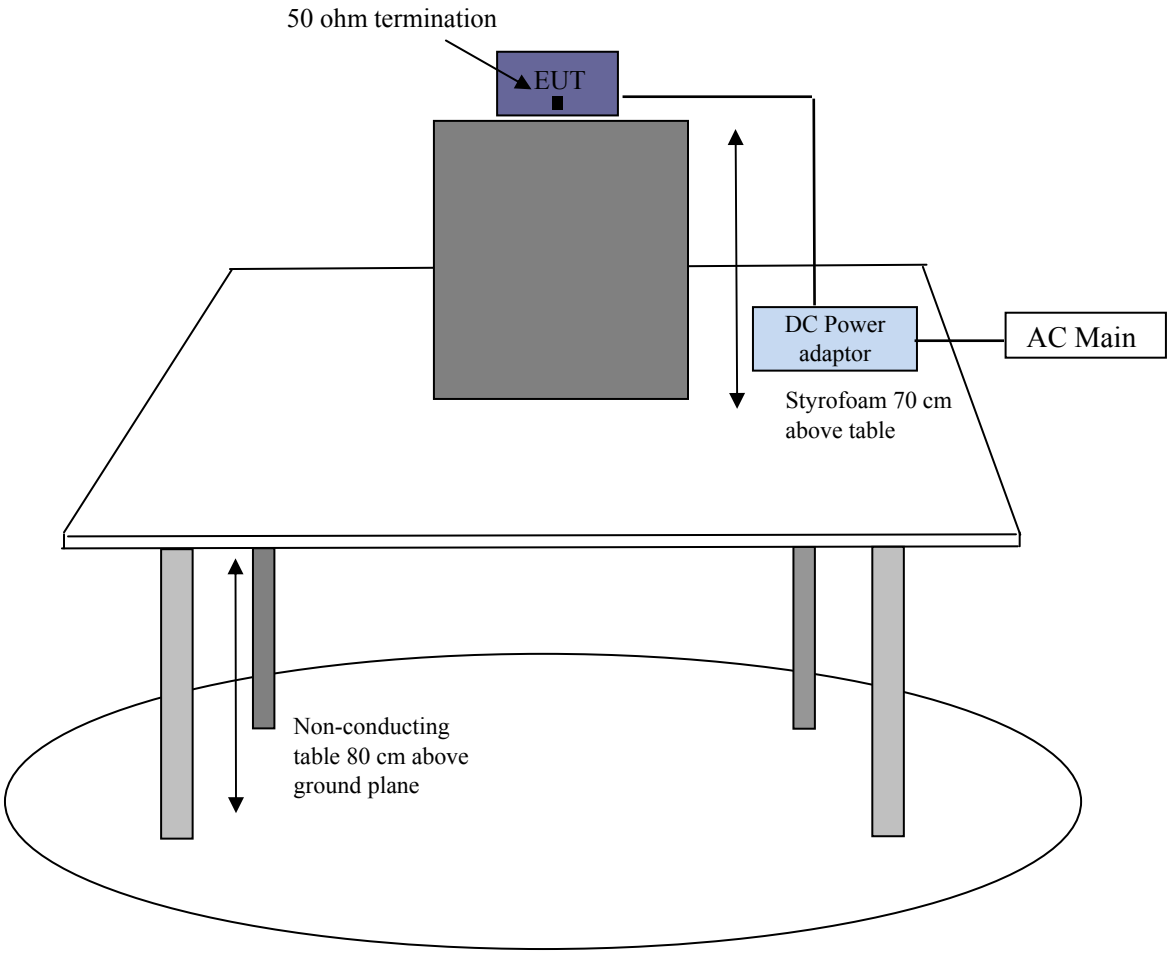
Manufacturer	Description	Model	Serial Number
KEPCO	Source, DC	25-10M	H1334526

2.7 External I/O Cabling List and Details

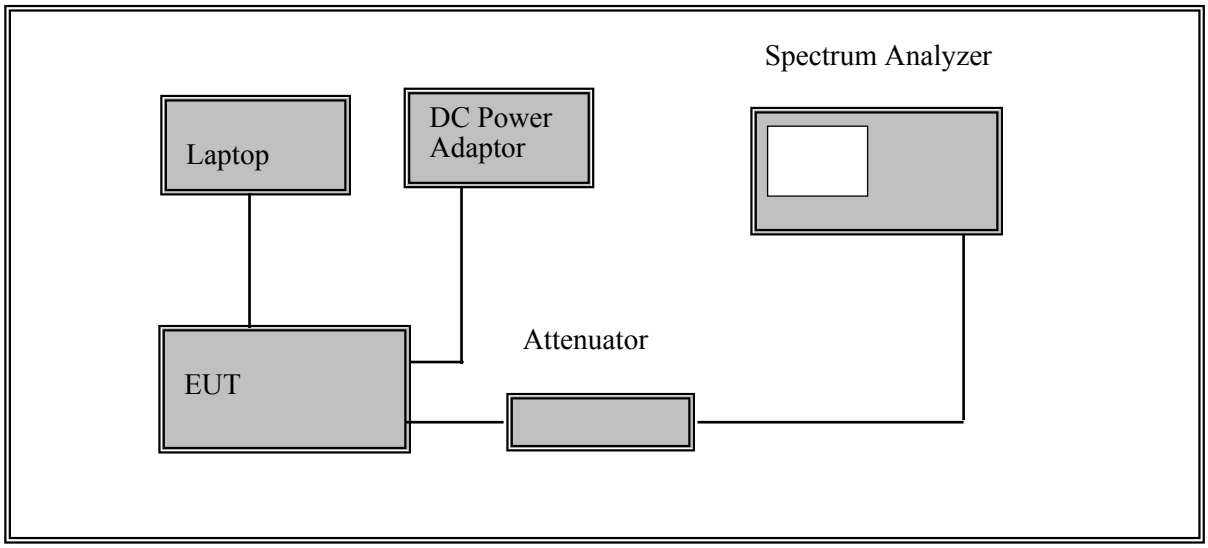
Cable Description	Length (m)	From	To
Data/Power Cable	1	EUT	Laptop
SMA cable	< 1.0	EUT	PSA

2.8 Test Setup Block Diagram

Radiated Emission Test



Antenna Port Conducted Emission Test



3 Summary of Test Results

FCC/IC Rules	Description of Tests	Results
FCC §1.1310, §2.1091 IC RSS-102 Issue 5	RF Exposure	Compliant
FCC §2.1046, §90.205 IC RSS-119 Issue 12 §5.4	RF Output Power	Compliant
FCC §2.1049, §90.209 IC RSS-119 Issue 12 §5.5	Occupied Bandwidth and Emission Mask	Compliant
FCC §2.1051, §90.210 IC RSS-119 Issue 12 §5.8	Spurious Emissions at Antenna Terminals	Compliant
FCC §2.1055, §90.213 IC RSS-119 Issue 12 §5.3	Frequency Stability	Compliant
FCC §2.1053, §90.210 IC RSS-119 Issue 12 §5.8	Field Strength of Spurious Radiation	Compliant
IC RSS-119 Issue 12 §5.11	Receiver Spurious Emissions	Compliant
FCC §90.214 IC RSS-119 Issue 12 §5.9	Transient Frequency Behavior	Compliant

4 FCC §2.1091 & IC RSS-102 - RF Exposure Information

4.1 Applicable Standards

FCC §2.1091, (a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

Limits for Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	842/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1	30

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF field

According to IC RSS-102 Issue 5 section 4, RF limits used for general public will be applied to the EUT.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Time Averaging (min)
0.003-10	170	180	-	Instantaneous*
0.1-10	-	$1.6/f$	-	6**
1.29-10	$193/f^{0.5}$	-	-	6**
10-20	61.4	0.163	-10	6
20-48	$129.8/f^{0.25}$	$0.3444/f^{0.25}$	$44.72/f^{0.5}$	6
48-100	49.33	0.1309	6.455	6
100-6000	$15.60\ f^{0.25}$	$0.04138\ f^{0.25}$	$0.6455f^{0.5}$	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	$616000/f^{1.2}$
150000-300000	$0.354\ f^{0.5}$	9.40 x 10-4 $f^{0.5}$	$3.33 \times 10^{-4}\ f$	$616000/f^{1.2}$

f = frequency in MHz
** = Plane-wave equivalent power density*
*** = Based on specific absorption rate (SAR).*

MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm):	45.70
Maximum peak output power at antenna input terminal (mW):	37153.5229
Prediction distance (cm):	120
Prediction frequency (MHz):	472.95
Maximum Antenna Gain, typical (dBi):	0
Maximum Antenna Gain (numeric):	1
Power density of prediction frequency at 120 cm (mW/cm^2):	0.2054
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.3153
Power density of prediction frequency at 120 cm (W/m^2):	2.0542
IC MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	14.038

Conclusion

The device complies with the MPE requirements by providing a safe separation distance of at least 120 cm between the antenna with maximum 0 dBi gain, including any radiating structure, and any persons when normally operated.

5 FCC §2.1046, §90.205 & IC RSS-119 §5.4 – RF Output Power

5.1 Applicable Standard

According to FCC §2.1046, and §90.205: maximum allowable station effective radiated power (ERP) is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 2.

According to RSS-119 §5.4, the output power shall be within ±1 dB of the manufacturer's rated power listed in the equipment specifications.

Frequency Bands (MHz)	Transmitter Output Power (W)	
	Base/Fixed Equipment	Mobile Equipment
27.41-28 and 29.7-50	300	30
72-76	No limit	1
138-174	110	60
217-218 and 219-220	110	30*
220-222	See SRSP-512 for ERP limit	50
406.1-430 and 450-470	110	60
768-776 and 798-806	See SRSP-511 for ERP limit	30 3 W ERP for portable equipment
806-821/851-866 and 821-824/866-869	110	30
896-901/935-940	110	60
929-930/931-932	110	30
928-929/952-953 and 932-932.5/941-941.5	110	30
932.5-935/941.5-944	110	30
*Equipment is generally authorized for effective radiated power (ERP) of less than 5 W.		

5.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2014-11-13	1 year
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2015-03-09	1year
-	SMA cable	-	C0005	Each Time[1]	N/A
Bird Electronic Corp.	30 dB attenuator	50-AFFB-30	14	Each Time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

5.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44-55 %
ATM Pressure:	101-102 kPa

The testing was performed by Todd Moy on 2015-04-20 in the RF Site.

5.5 Test Results

Channel Spacing (kHz)	Data Rate (bps)	Modulation	Frequency (MHz)	Output Power (dBm)	e.r.p (dBm)	e.r.p (Watt)
12.5	4800	GMSK	430.15	44.86	42.71	18.6638
		GMSK	450.15	44.62	42.47	17.6604
		GMSK	469.85	44.76	42.61	18.2390
		GMSK	472.95*	44.8	42.65	18.4077
	8000	GMSK	430.15	44.96	42.81	19.0985
		GMSK	450.15	45.04	42.89	19.4536
		GMSK	469.85	45	42.85	19.2752
		GMSK	472.95*	44.96	42.81	19.0985
	9600	GMSK	430.15	45.49	43.34	21.58
		GMSK	450.15	45.24	43.09	20.37
		GMSK	469.85	45.45	43.30	21.38
		GMSK	472.95*	45.69	43.54	22.59
		4FSK	430.15	45.5	43.35	21.63
		4FSK	450.15	45.36	43.21	20.94
		4FSK	469.85	45.47	43.32	21.48
		4FSK	472.95*	45.7	43.55	22.65
25	19200	GMSK	430.15	45.46	43.31	21.43
		GMSK	450.15	45.16	43.01	20.00
		GMSK	469.85	45.46	43.31	21.43
		GMSK	472.95*	45.44	43.29	21.33
		4FSK	430.15	45.5	43.35	21.63
		4FSK	450.15	45.3	43.15	20.65
		4FSK	469.85	45.45	43.30	21.38
		4FSK	472.95*	45.44	43.29	21.33

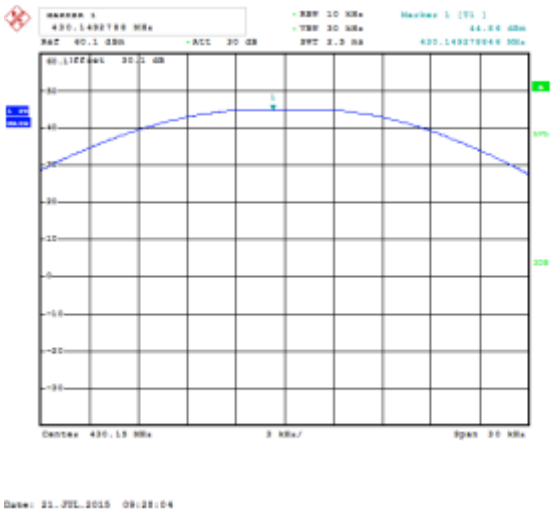
Note: 1) Output Power (ERP) = Output Power (dBm) + Antennta Gain (dBi) -2.15 dB
2) Antenna Gain: 0 dBi
3) * 472.95 MHz which refered as High Channel#2 is used for FCC regulation test only.

Please refer to the following plots for conducted output power.

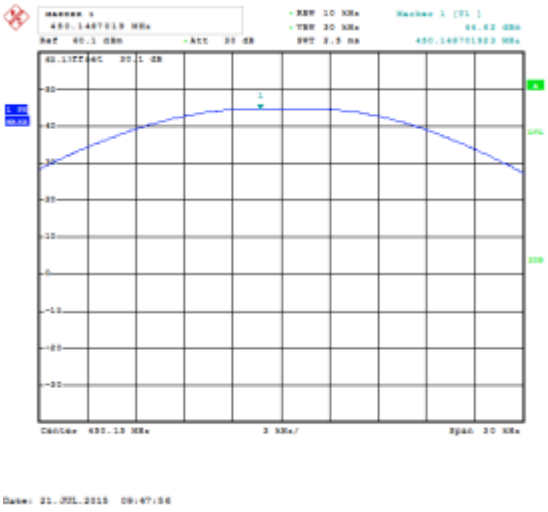
4800 baud rate

GMSK Modulation

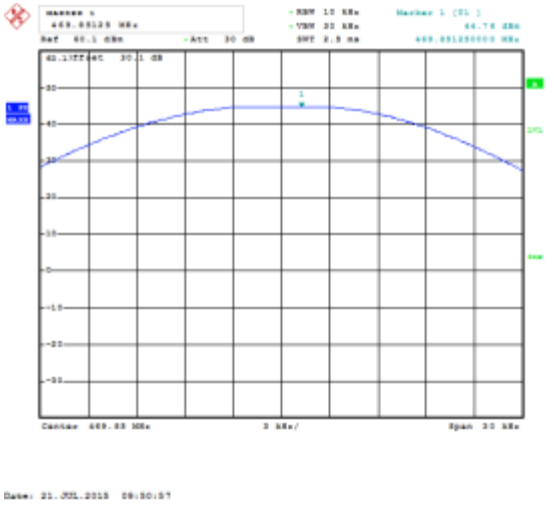
Low Channel: 430.15 MHz



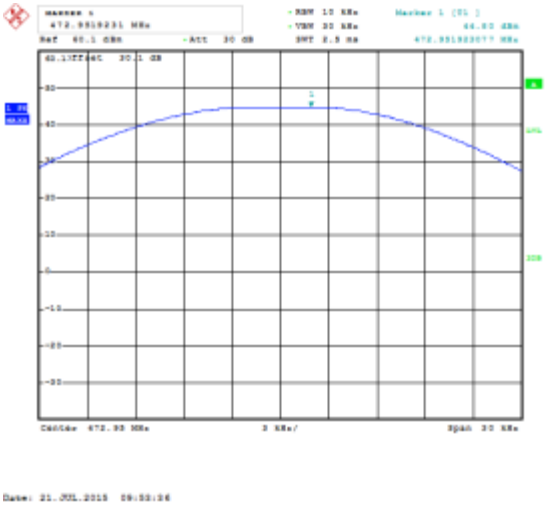
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



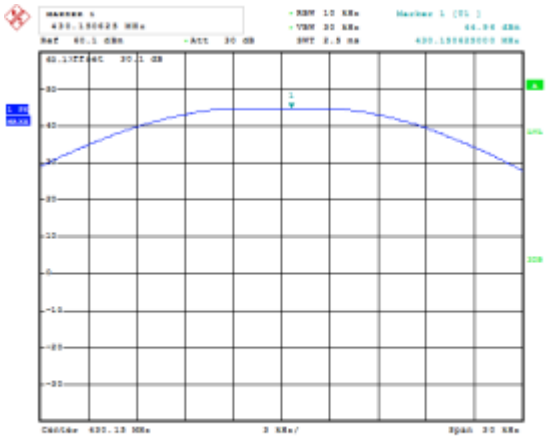
High Channel#2: 472.95 MHz



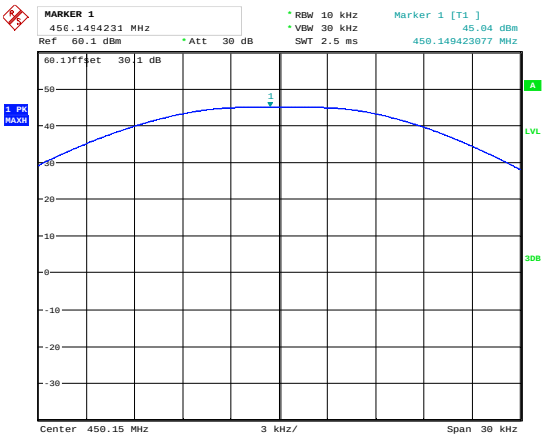
8000 baud rate

GMSK Modulation

Low Channel: 430.15 MHz

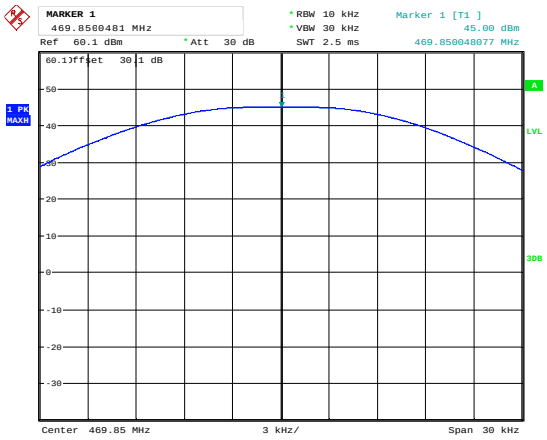


Middle Channel: 450.15 MHz



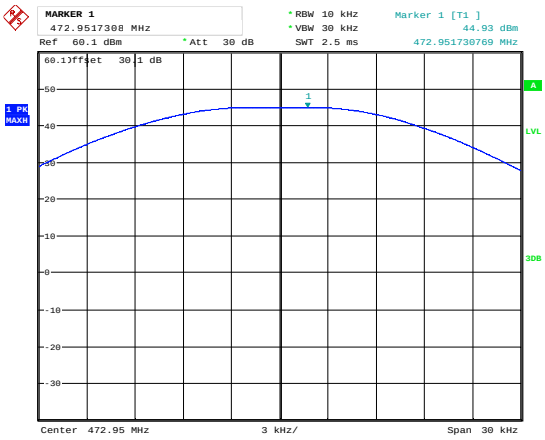
Date: 21.JUL.2015 10:01:45

High Channel: 469.85 MHz



Date: 21.JUL.2015 10:09:49

High Channel#2: 472.95 MHz

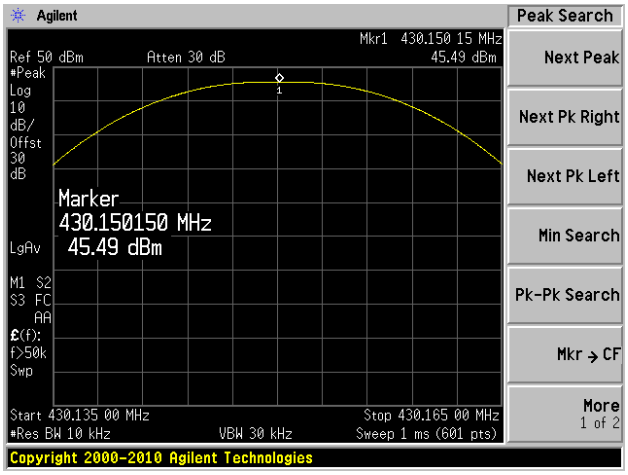


Date: 21.JUL.2015 09:56:27

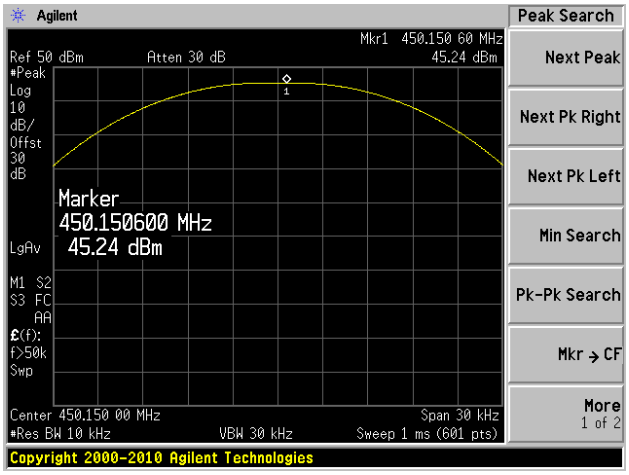
9600 baud rate

GMSK Modulation

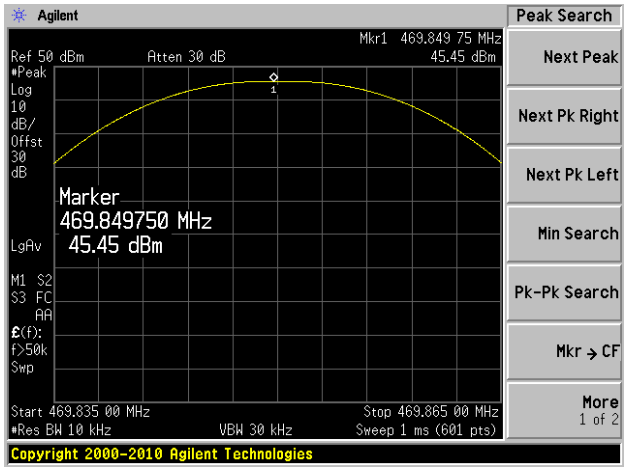
Low Channel: 430.15 MHz



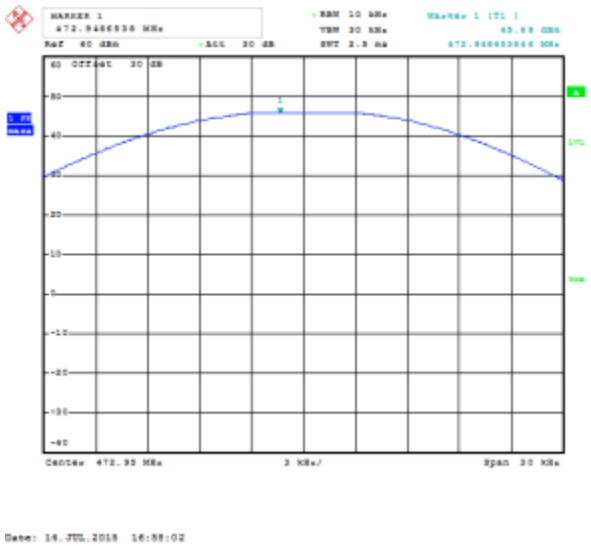
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



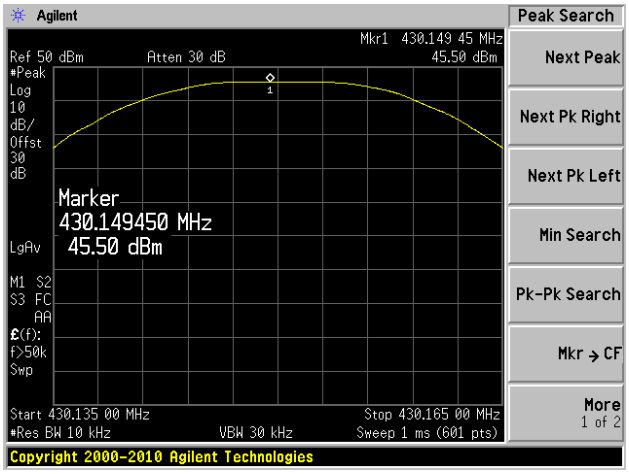
High Channel#2: 472.95 MHz



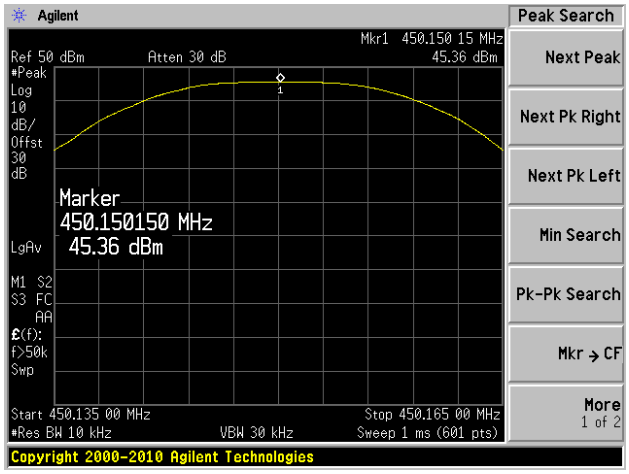
9600 baud rate

4FSK Modulation

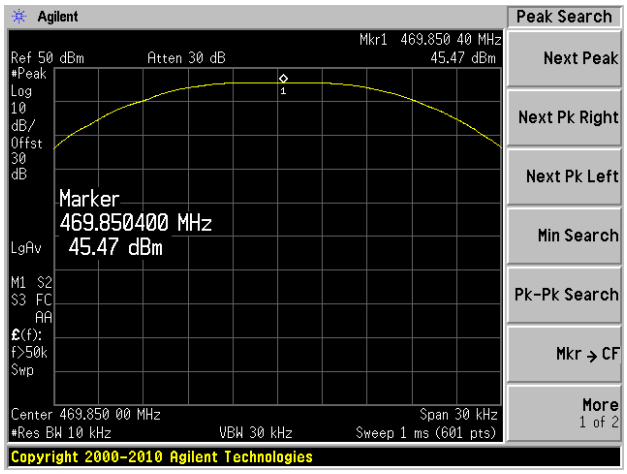
Low Channel: 430.15 MHz



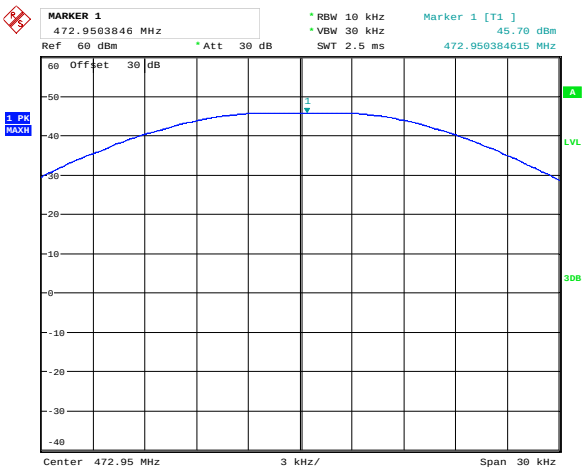
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



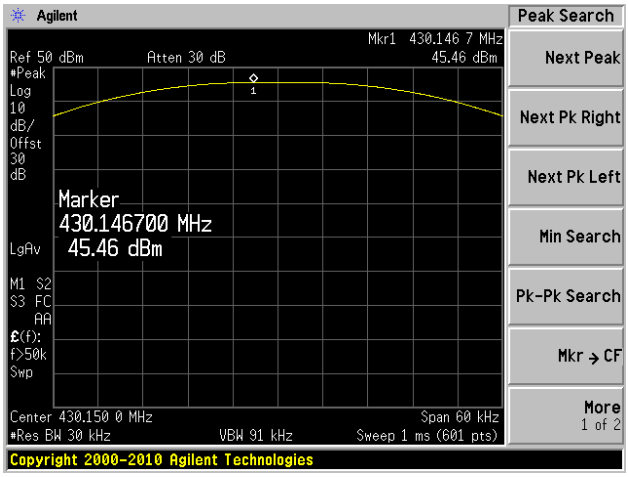
High Channel#2: 472.95 MHz



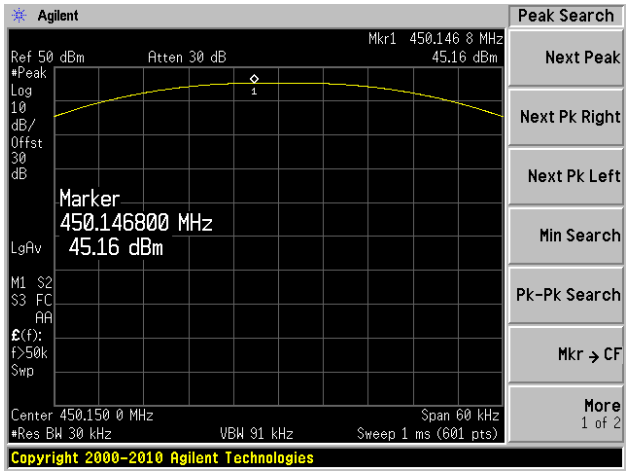
19200 baud rate

GMSK Modulation

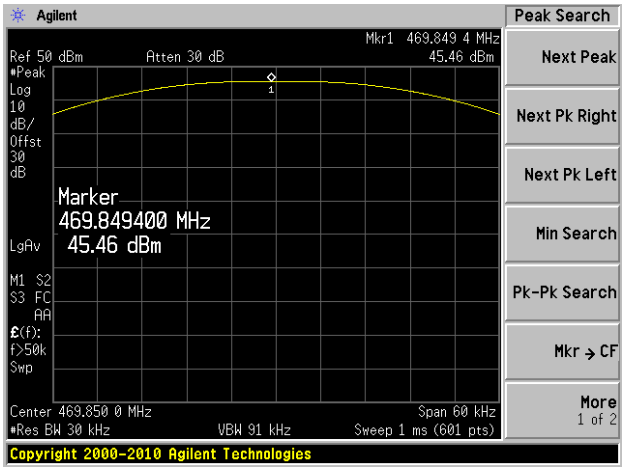
Low Channel: 430.15 MHz



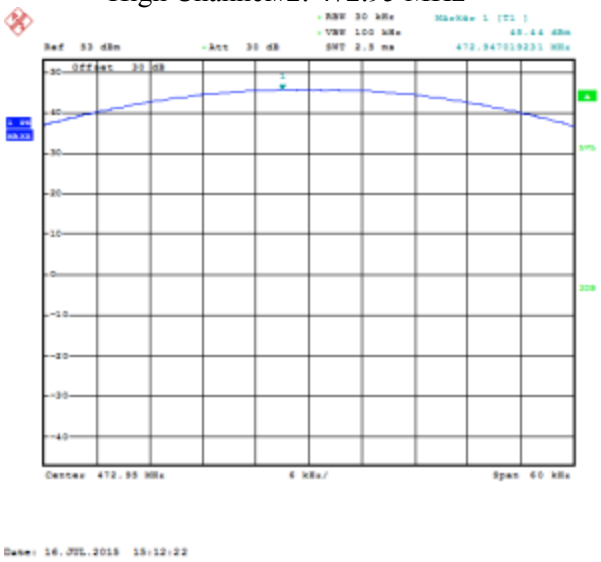
Middle Channel: 450.15 MHz



High Channel: 459.85 MHz



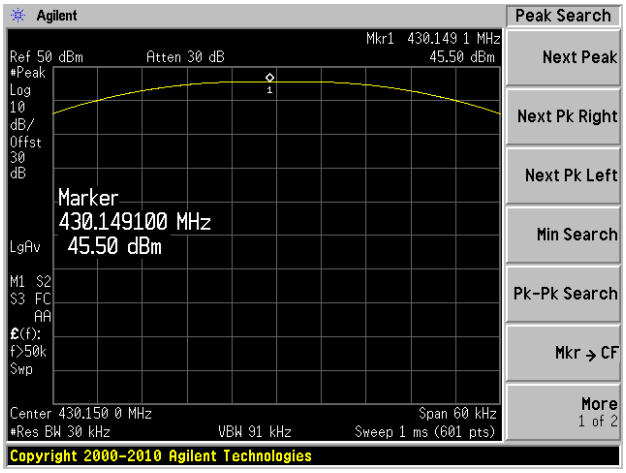
High Channel#2: 472.95 MHz



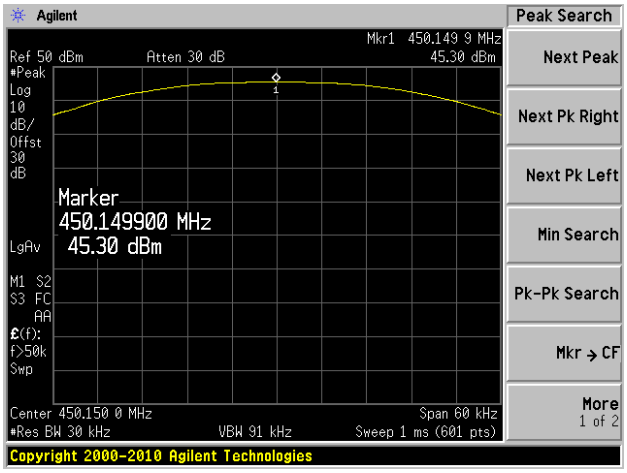
19200 baud rate

4FSK Modulation

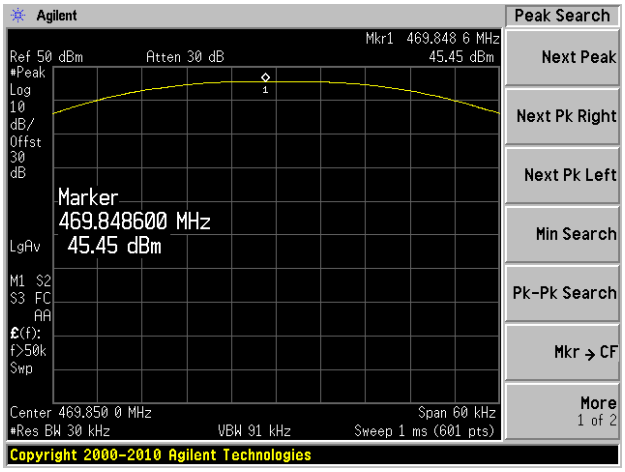
Low Channel: 430.15 MHz



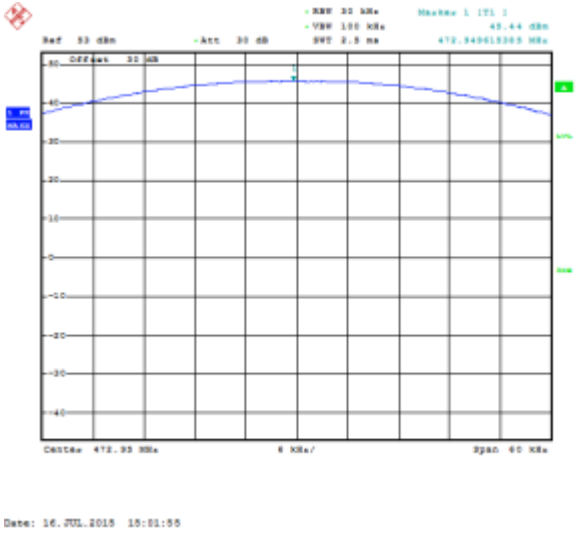
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



High Channel#2: 472.95 MHz



6 FCC §2.1049, §90.209, §90.210 & IC RSS-119 §5.5 – Occupied Bandwidth & Emission Mask

6.1 Applicable Standard

FCC §90.209

Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth.

FCC §2.1049, §90.210

Emission Mask C-25 kHz channel bandwidth equipment. 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 (fdin kHz) of more than 5kHz, but not more than 10 kHz: At least 83 log (fd/5) dB;
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fdin kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd2/11) dB or 50 dB, whichever is the lesser attenuation;
(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fdin kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd−2.88 kHz) dB.
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fdin kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

RSS-119 §5.5

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified in the following table for the equipment's frequency band. The authorized bandwidth is defined as the maximum width of the band of frequencies used to derive spectrum masks and is not necessarily equivalent to the bandwidth found on radio and spectrum licences.

The channel bandwidths, authorized bandwidths and spectrum masks are given in the following table for equipment having an output power greater than 120 mW. For equipment with an output power that does not exceed 120 mW, Section 5.10 applies.

Frequency Band (MHz)	Related SRSP for Channelling Plan and ERP	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for Equipment With Audio Filter	Spectrum Masks for Equipment Without Audio Filter
27.41-28 and 29.7-50	N/A	20	20	B	C
72-76	N/A	20	20	B	C
138-144, 148-149.9 and 150.05-174	SRSP-500	30	20	B	C
		15	11.25	D	D
		7.5	6	E	E
217-218 and 219-220	N/A	12.5	11.25	D or I	D or J
220-222	SRSP-512	5	4	F	F
406.1-430 and 450-470	SRSP-501	25	20 22	B Y	C (G) (Note 1) Y
		12.5	11.25	D	D
		6.25	6	E	E
768-776 and 798-806	SRSP-511	6.25 12.5 25 50	(Note 2)	See Section 5.8.9	See Section 5.8.9
806-821/851-866 and 821-824/866-869	SRSP-502	25	20 22	B Y	G Y
		12.5	11.25	D	D
		6.25	6	E	E
896-901/935-940	SRSP-506	12.5	13.6	I	J (G) (Note 3)
929-930 and 931-932	SRSP-504 (for paging)	25	20	B	G
928-929/952-953 and 932-932.5/941-941.5	SRSP-505	25	20	B	G
		12.5	11.25	D	D
932.5-935/941.5-944	SRSP-507	25	20	B	G
		12.5	11.25	D	D

Notes:
1. Paging transmitters in the bands 406.1-430 MHz and 450-470 MHz are to use mask G.

2. Provided that the ACP requirements in Section 5.8.9.1 are met, any authorized bandwidth that does not exceed the channel bandwidth can be used.

3. Mask G applies if two 12.5 kHz channels are aggregated. Alternatively, a mask may be used if it does not produce more adjacent channel interference than narrowband (12.5 kHz) channel equipment.

6.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the frequency band ±20 KHz from the carrier frequency.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2014-08-26	1 year
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2015-03-09	1year
-	SMA cable	-	C0005	Each Time[1]	N/A
Bird Electronic Corp.	30 dB attenuator	50-AFFB-30	14	Each Time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

6.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44-55 %
ATM Pressure:	101-102 kPa

The testing was performed by Todd Moy on 2015-04-20 in the RF Site.

6.5 Test Results

Channel Spacing (kHz)	Data Rate 9bps)	Modulation	Frequency (MHz)	OBW (kHz)	Limit (kHz)
12.5	4800	GMSK	430.15	6.4904	11.25
		GMSK	450.15	6.0096	11.25
		GMSK	469.85	5.5288	11.25
		GMSK	472.95*	5.5288	11.25
	8000	GMSK	430.15	7.4519	11.25
		GMSK	450.15	7.2917	11.25
		GMSK	469.85	7.3718	11.25
		GMSK	472.95*	7.4519	11.25
	9600	GMSK	430.15	7.5466	11.25
		GMSK	450.15	7.4722	11.25
		GMSK	469.85	7.3661	11.25
		GMSK	472.95*	7.9327	11.25
		4FSK	430.15	6.7245	11.25
		4FSK	450.15	6.3482	11.25
		4FSK	469.85	6.4558	11.25
		4FSK	472.95*	5.6891	11.25
25	19200	GMSK	430.15	13.9333	20
		GMSK	450.15	14.117	20
		GMSK	469.85	14.0587	20
		GMSK	472.95*	13.8656	20
		4FSK	430.15	10.0577	20
		4FSK	450.15	10.3836	20
		4FSK	469.85	10.3513	20
		4FSK	472.95*	10.1893	20

Note: *472.95 MHz which refered as High Channel#2 is used for FCC regulation test only.

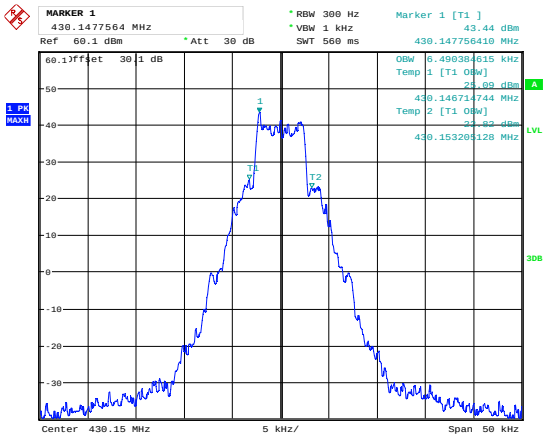
Please refer to the hereinafter plots.

Occupied Bandwidth

4800 baud rate

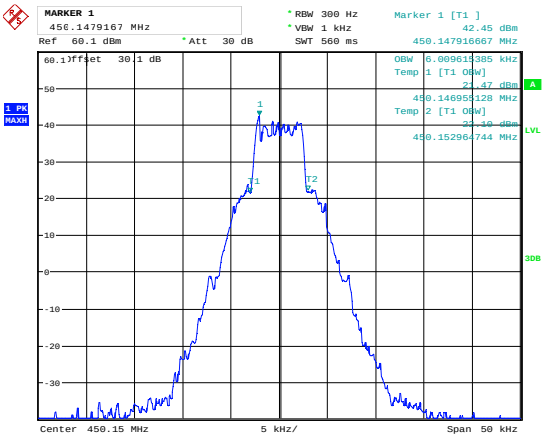
GMSK Modulation

Low Channel: 430.15 MHz



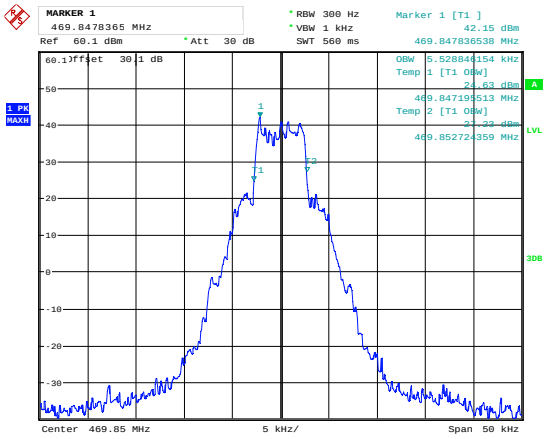
Date: 21.JUL.2015 10:26:24

Middle Channel: 450.15 MHz



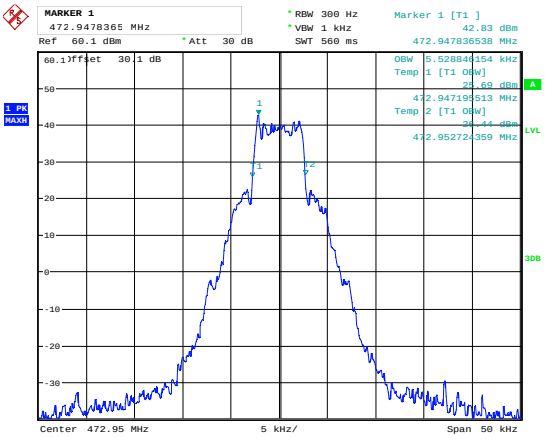
Date: 21.JUL.2015 10:31:56

High Channel: 469.85 MHz



Date: 21.JUL.2015 10:35:07

High Channel #2: 472.95 MHz

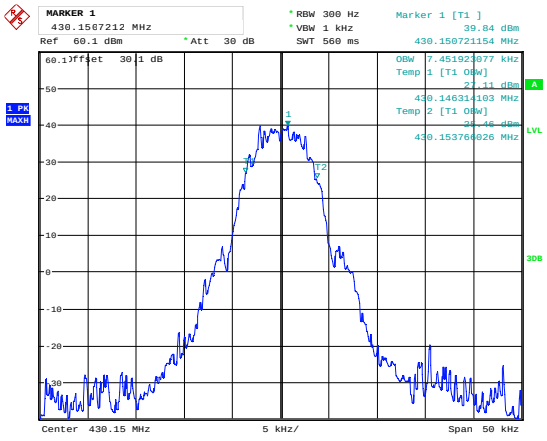


Date: 21.JUL.2015 10:37:29

8000 baud rate

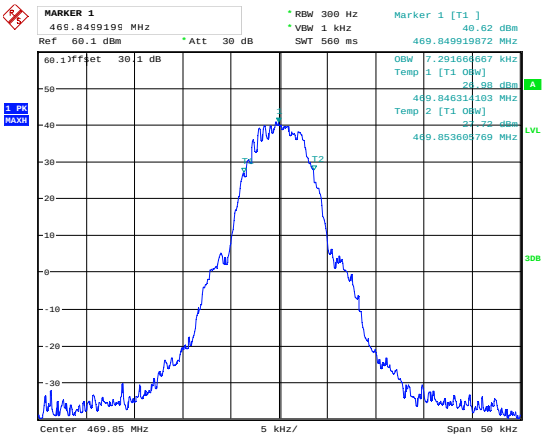
GMSK Modulation

Low Channel: 430.15 MHz



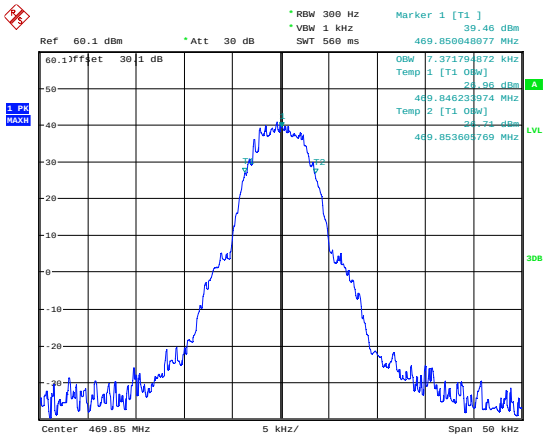
Date: 21.JUL.2015 10:20:52

Middle Channel: 450.15 MHz



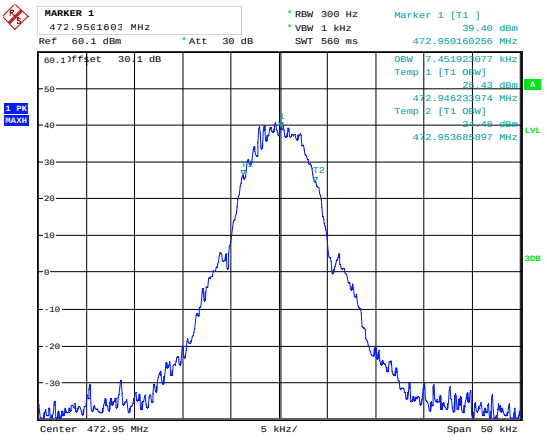
Date: 21.JUL.2015 10:17:52

High Channel: 469.85 MHz



Date: 21.JUL.2015 10:12:33

High Channel #2: 472.95 MHz

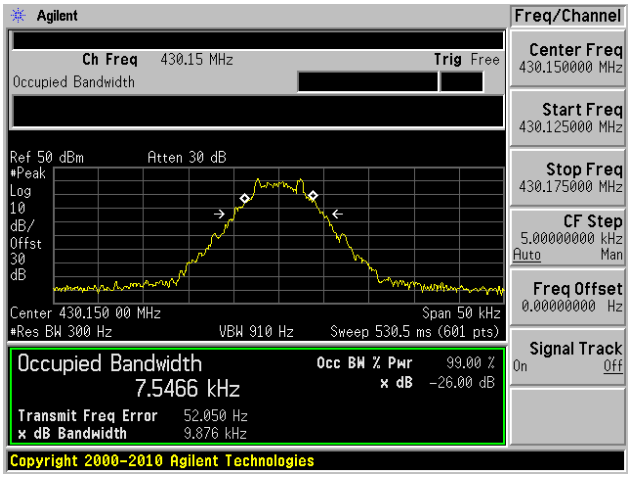


Date: 21.JUL.2015 10:23:24

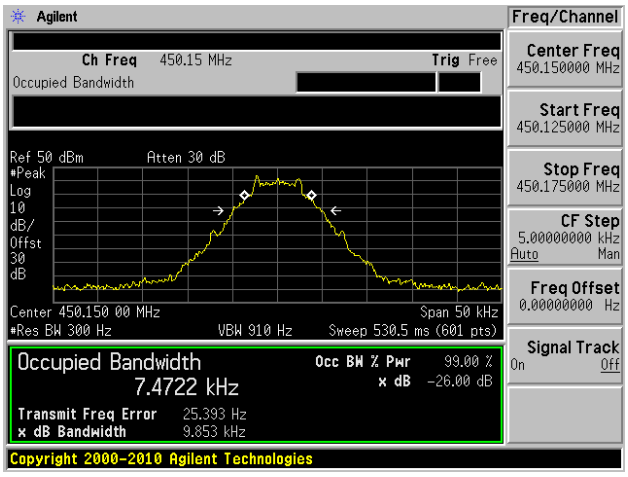
9600 baud rate

GMSK Modulation

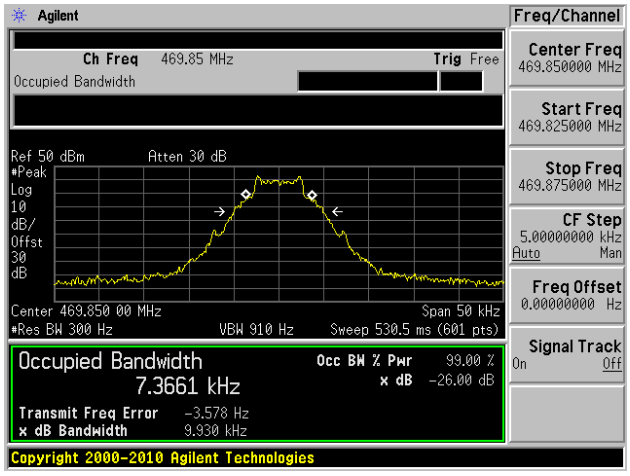
Low Channel: 430.15 MHz



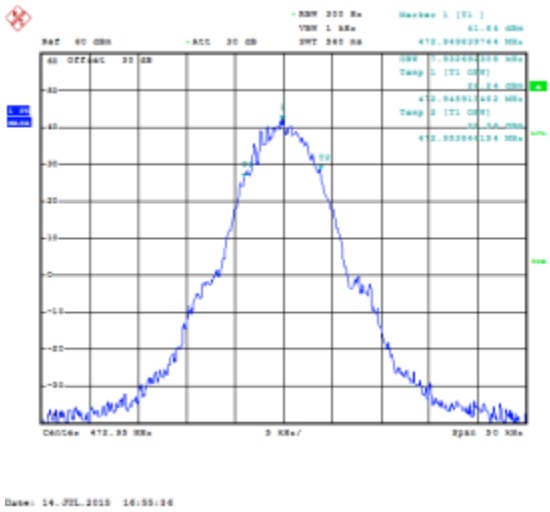
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



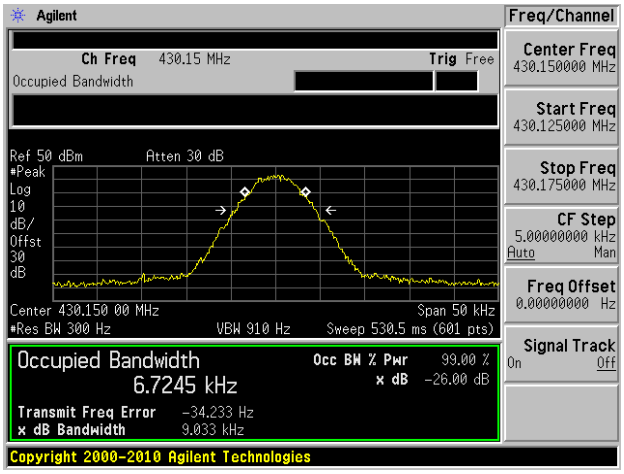
High Channel#2: 472.95 MHz



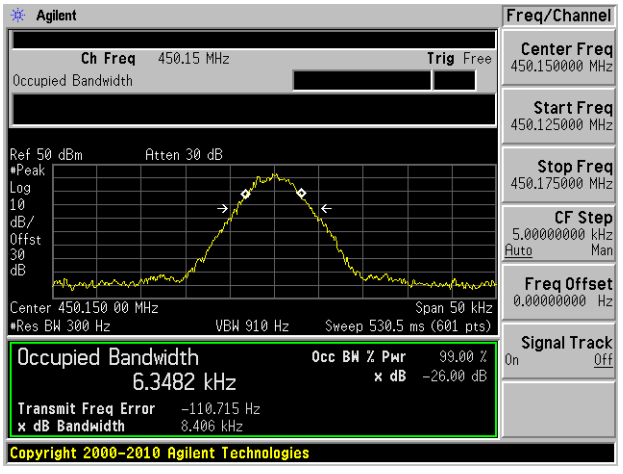
9600 baud rate

4FSK Modulation

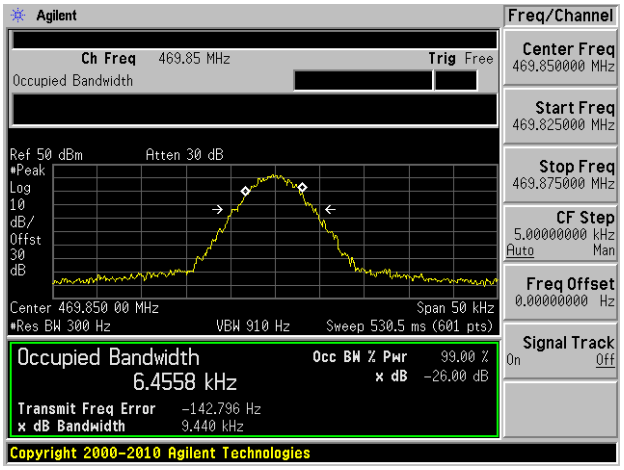
Low Channel: 430.15 MHz



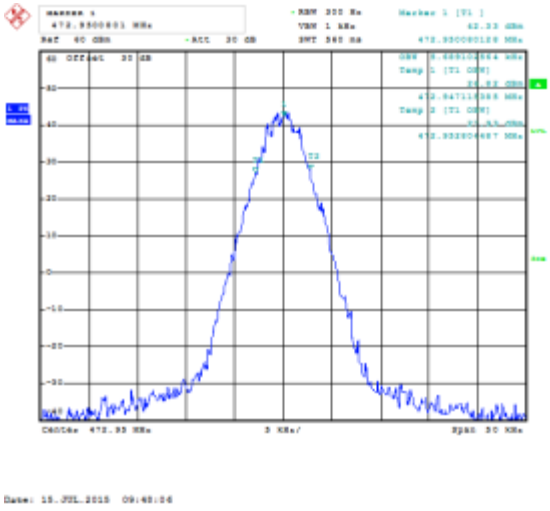
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



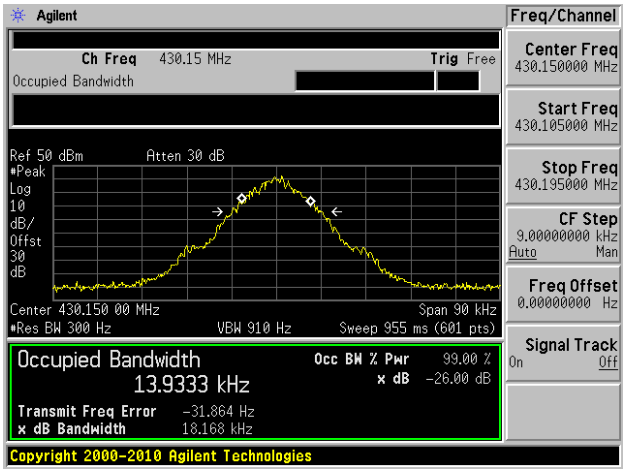
High Channel#2: 472.95 MHz



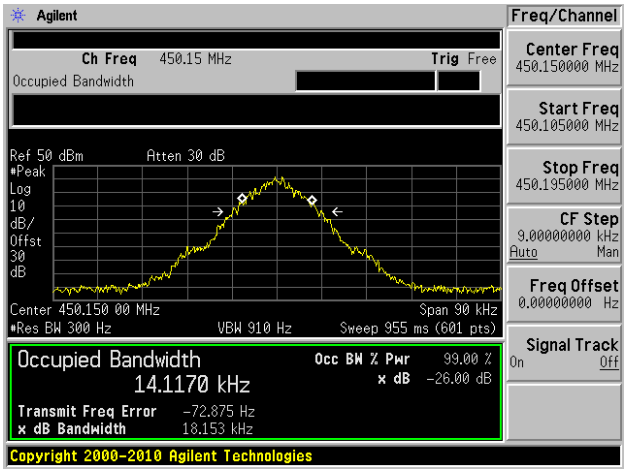
19200 baud rate

GMSK Modulation

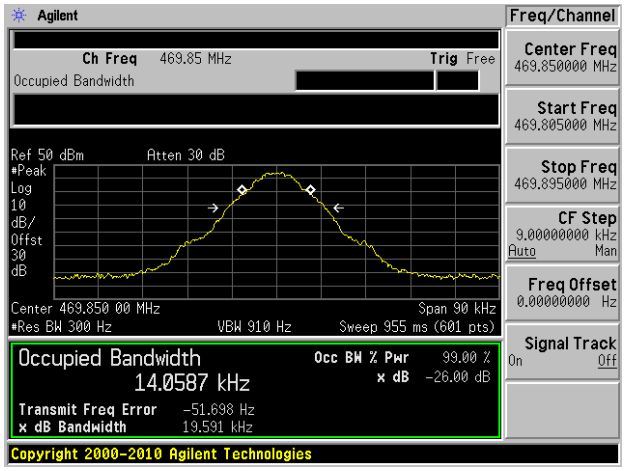
Low Channel: 430.15 MHz



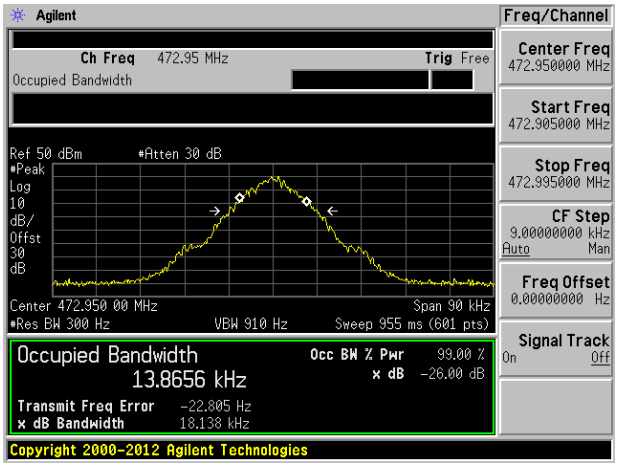
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



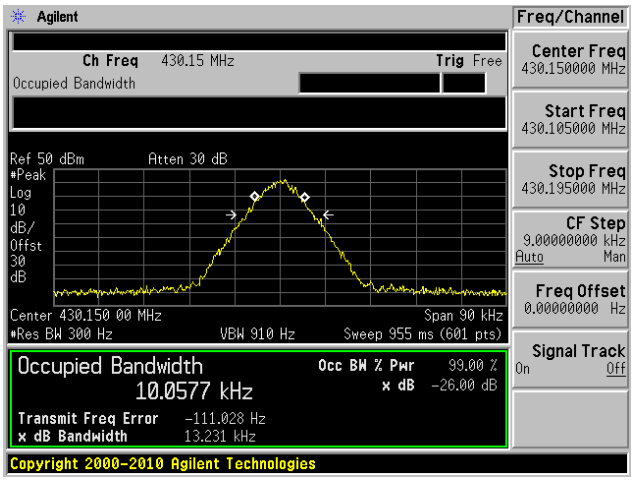
High Channel#2: 472.95 MHz



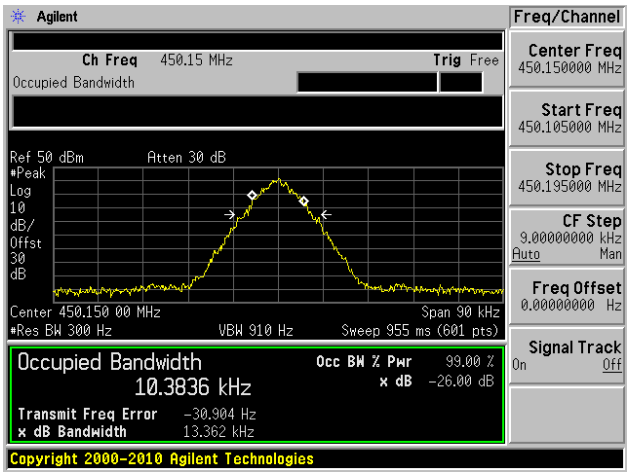
19200 baud rate

4FSK Modulation

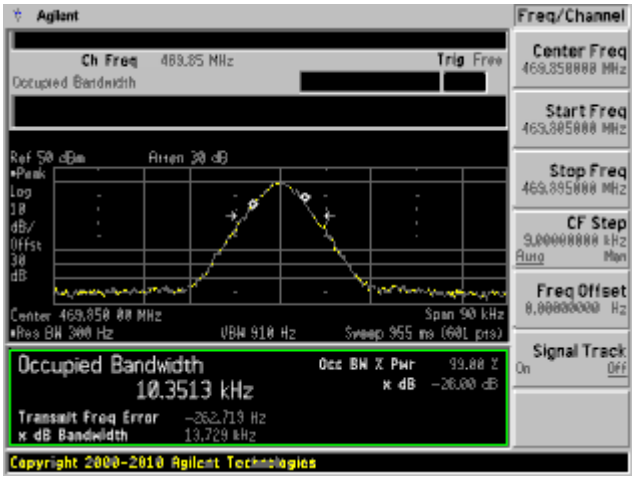
Low Channel: 430.15 MHz



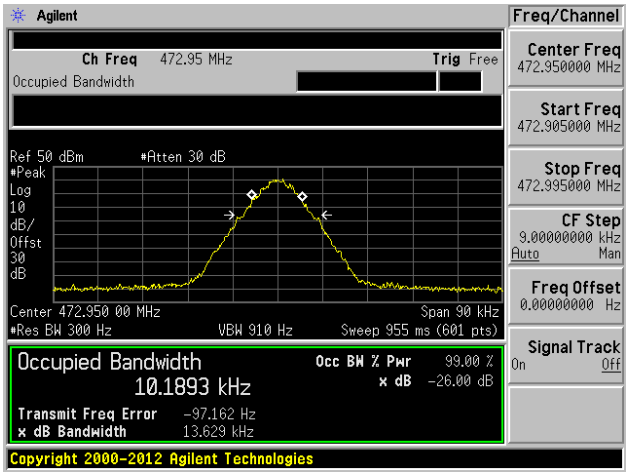
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



High Channel#2: 472.95 MHz

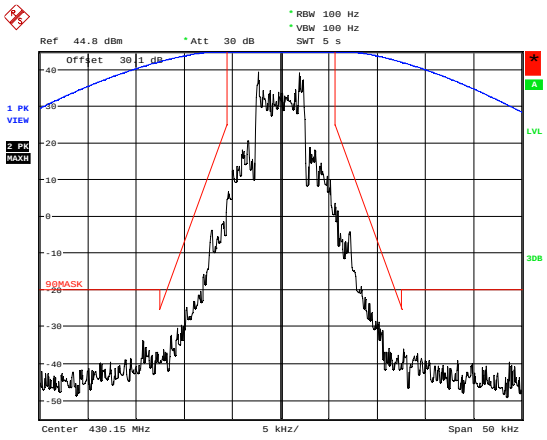


Emission Mask

4800 baud rate

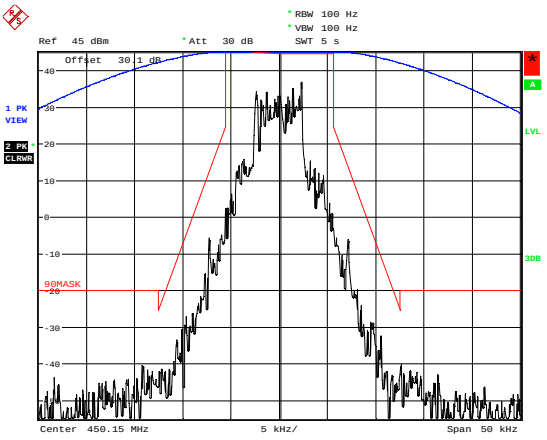
GMSK Modulation

Low Channel: 430.15 MHz



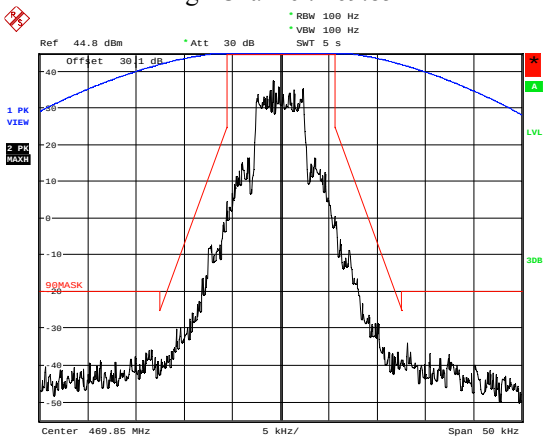
Date: 21.JUL.2015 11:49:11

Middle Channel: 450.15 MHz



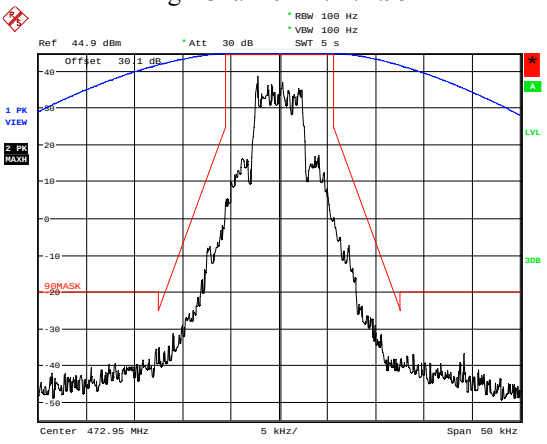
Date: 21.JUL.2015 11:41:15

High Channel: 469.85 MHz



Date: 21.JUL.2015 11:18:51

High Channel #2: 472.95 MHz

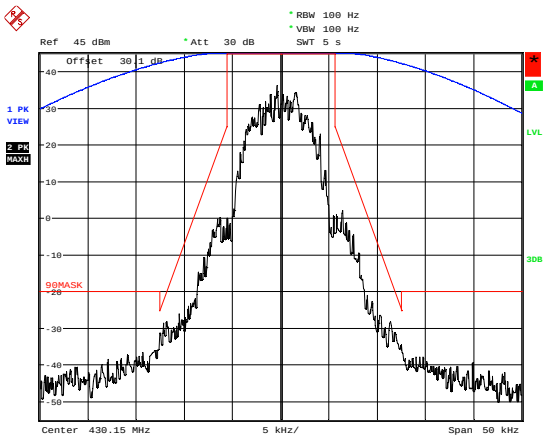


Date: 21.JUL.2015 10:50:59

8000 baud rate

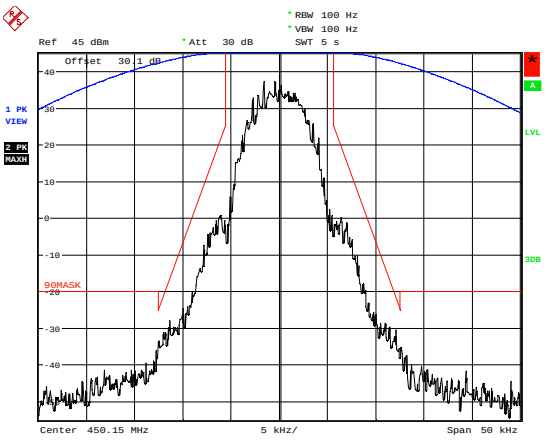
GMSK Modulation

Low Channel: 430.15 MHz



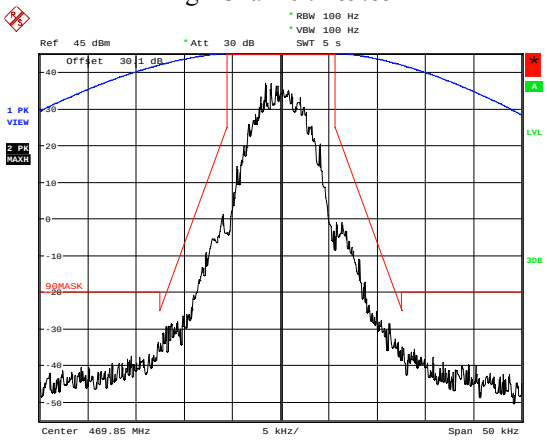
Date: 21.JUL.2015 11:52:42

Middle Channel: 450.15 MHz



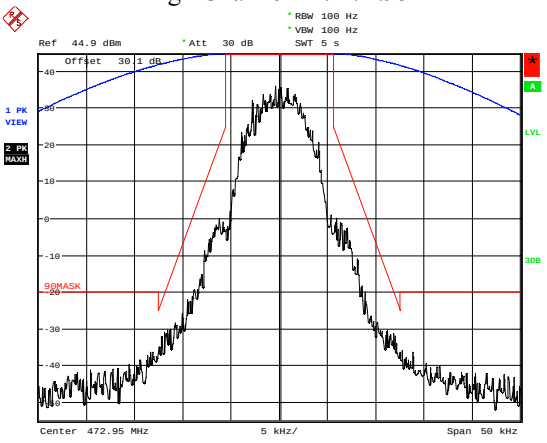
Date: 21.JUL.2015 11:35:13

High Channel: 469.85 MHz



Date: 21.JUL.2015 11:28:22

High Channel #2: 472.95 MHz

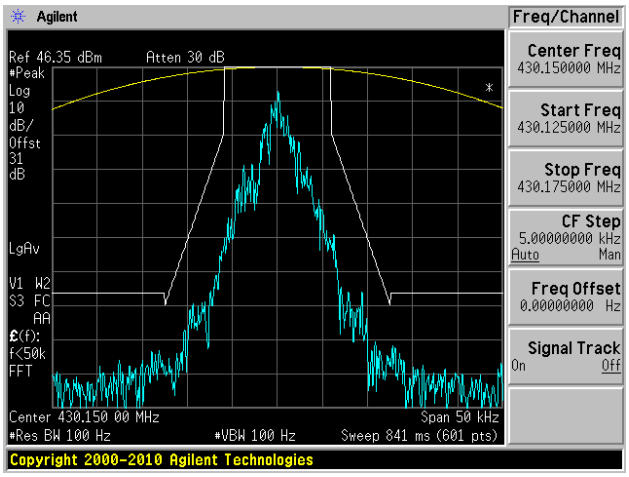


Date: 21.JUL.2015 11:59:27

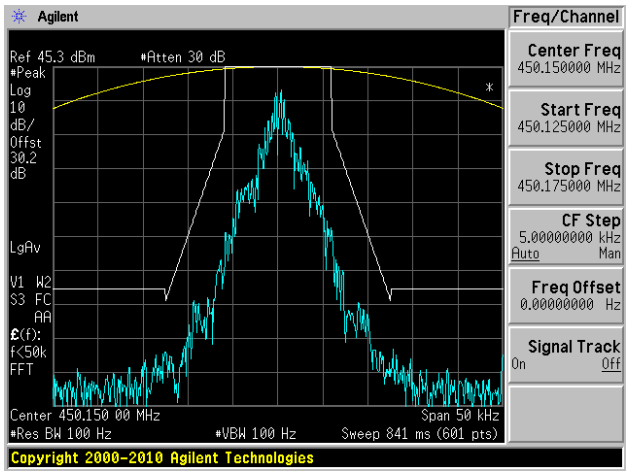
9600 baud rate

GMSK Modulation

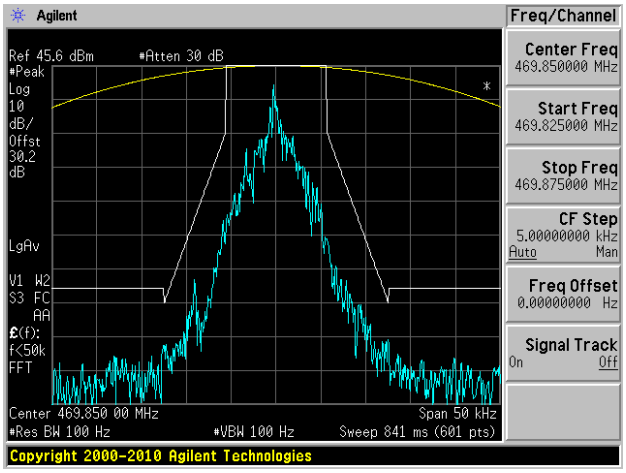
Low Channel: 430.15 MHz



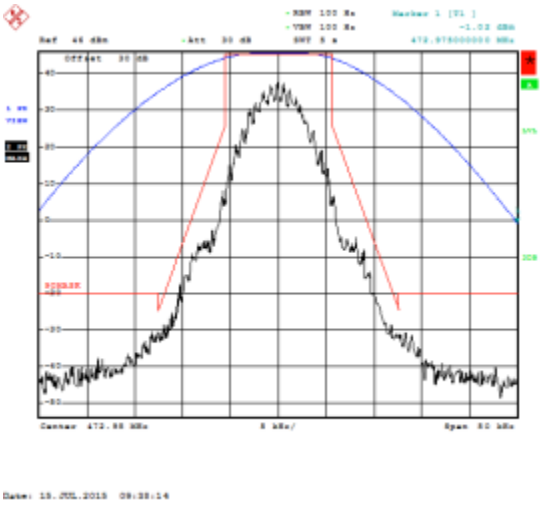
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



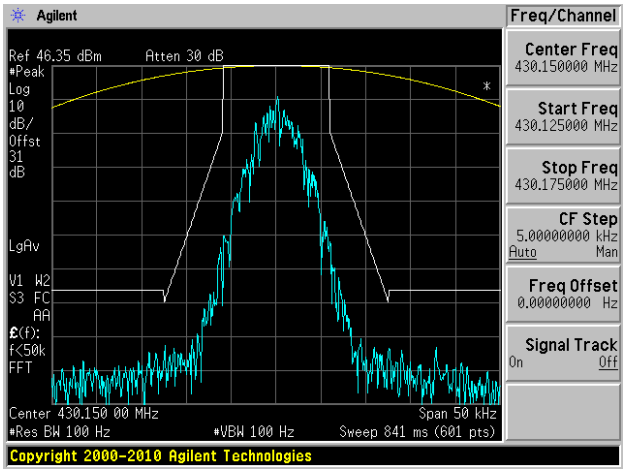
High Channel#2: 472.95 MHz



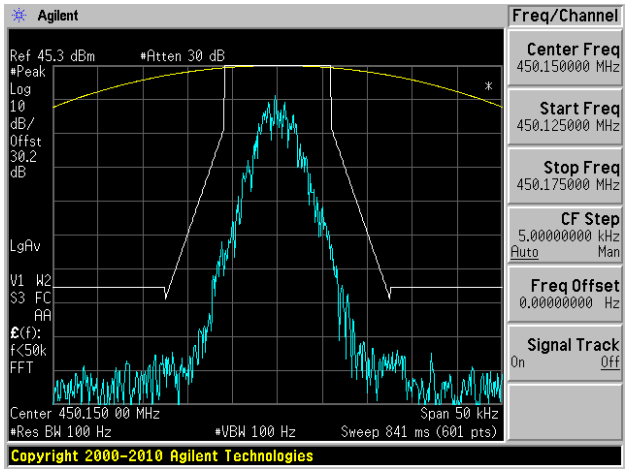
9600 baud rate

4FSK Modulation

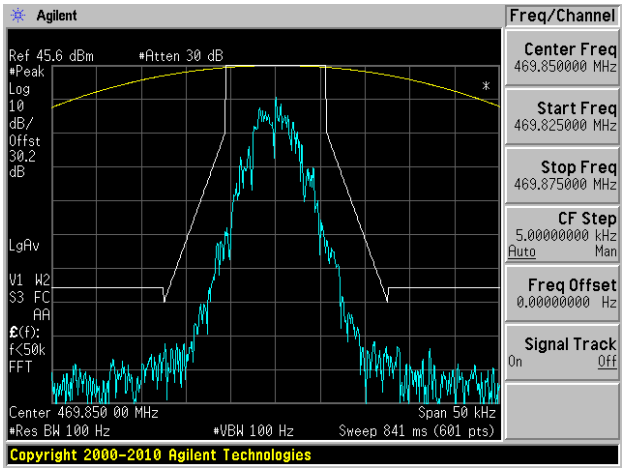
Low Channel: 430.15 MHz



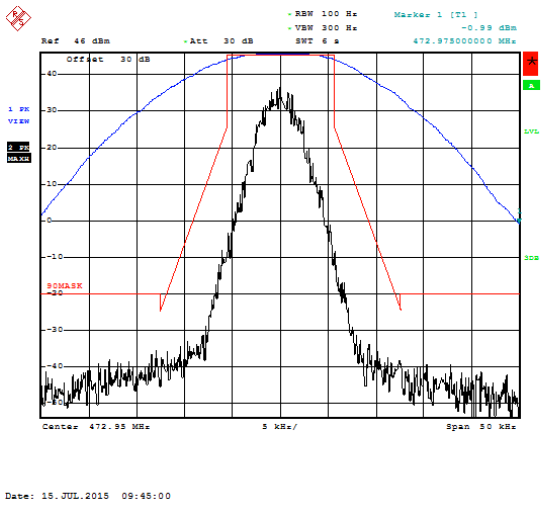
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



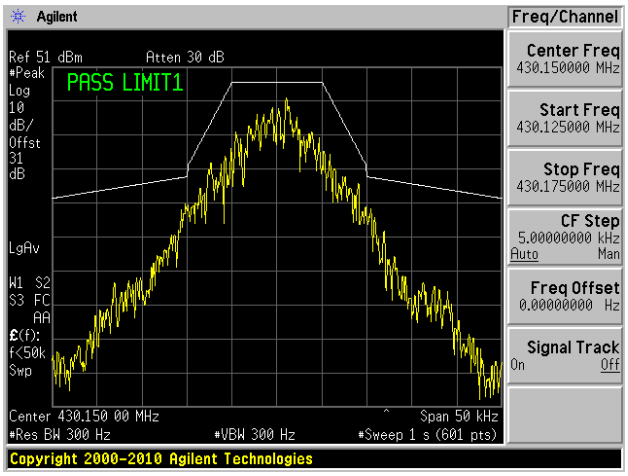
High Channel#2: 472.95 MHz



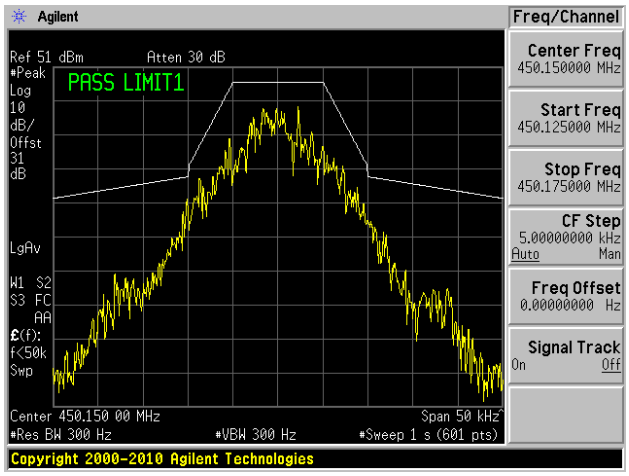
19200 baud rate

GMSK Modulation

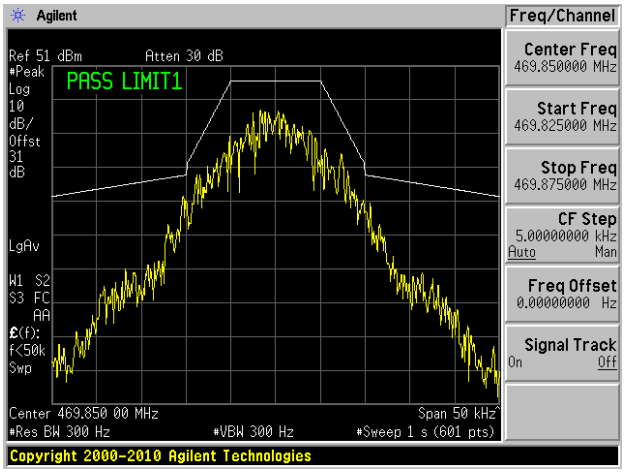
Low Channel: 430.15 MHz



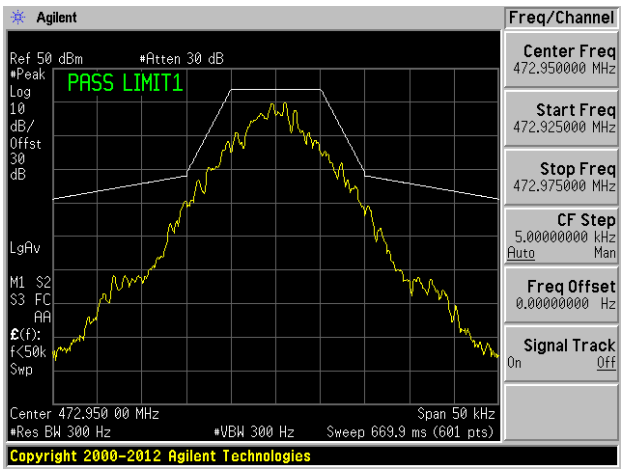
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



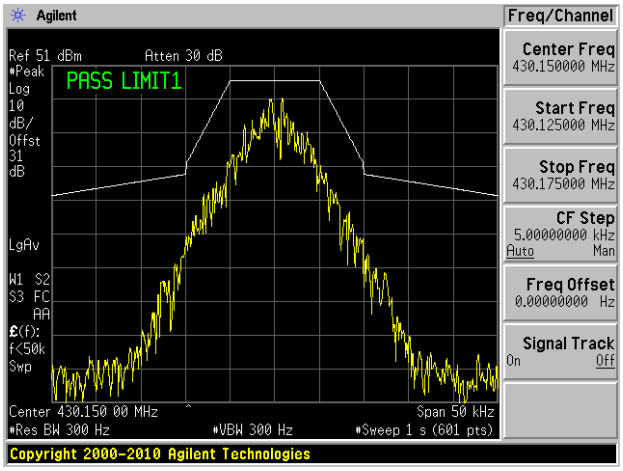
High Channel#2: 472.95 MHz



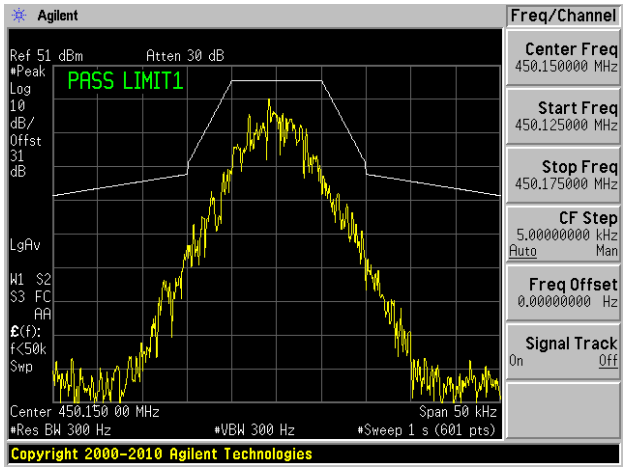
19200 baud rate

4FSK Modulation

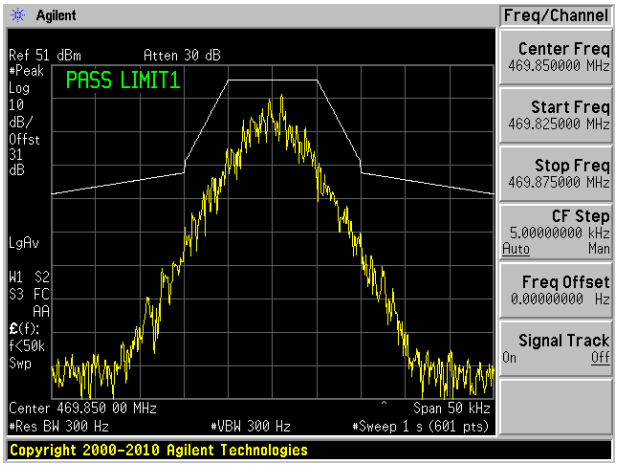
Low Channel: 430.15 MHz



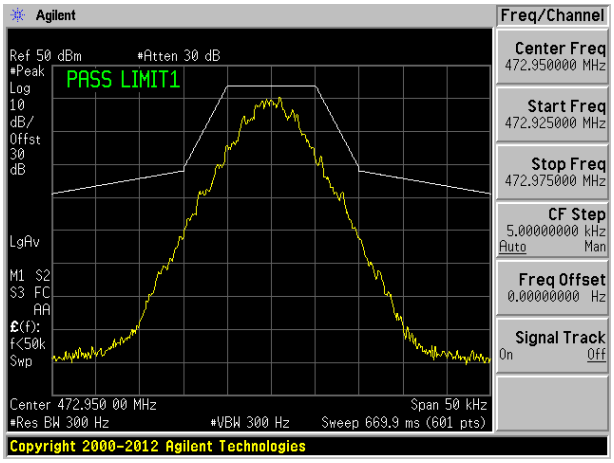
Middle Channel: 450.15 MHz



High Channel: 469.85 MHz



High Channel#2:472.95 MHz



7 FCC §2.1051, §90.210 & IC RSS-119 §5.8 - Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

FCC §90.210
For equipment using 25 kHz channel spacing, 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.

For equipment using 12.5 kHz channel spacing, 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.

RSS-119 §5.8

The spectrum plots of the unwanted emissions shall comply with the masks specified in the following table.

Descriptions of these permissible emission masks are given in the sections that follow.

The term *displacement frequency*, f_d, used in these sections refers to the difference between the channel frequency and the emission component frequency expressed in kilohertz, and *p* is the transmitter output power in Watts.

Frequency Band (MHz)	Related SRSP for Channelling Plan and ERP	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for Equipment With Audio Filter	Spectrum Masks for Equipment Without Audio Filter
27.41-28 and 29.7-50	N/A	20	20	B	C
72-76	N/A	20	20	B	C
138-144, 148-149.9 and 150.05-174	SRSP-500	30	20	B	C
		15	11.25	D	D
		7.5	6	E	E
217-218 and 219-220	N/A	12.5	11.25	D or I	D or J
220-222	SRSP-512	5	4	F	F
406.1-430 and 450-470	SRSP-501	25	20 22	B Y	C (G) (Note 1) Y
		12.5	11.25	D	D
		6.25	6	E	E
768-776 and 798-806	SRSP-511	6.25 12.5 25 50	(Note 2)	See Section 5.8.9	See Section 5.8.9
806-821/851-866 and 821-824/866-869	SRSP-502	25	20 22	B Y	G Y
		12.5	11.25	D	D
		6.25	6	E	E
896-901/935-940	SRSP-506	12.5	13.6	I	J (G) (Note 3)
929-930 and 931-932	SRSP-504 (for paging)	25	20	B	G
928-929/952-953 and 932-932.5/941-941.5	SRSP-505	25	20	B	G
		12.5	11.25	D	D
932.5-935/941.5-944	SRSP-507	25	20	B	G
		12.5	11.25	D	D

Notes:
1. Paging transmitters in the bands 406.1-430 MHz and 450-470 MHz are to use mask G.

2. Provided that the ACP requirements in Section 5.8.9.1 are met, any authorized bandwidth that does not exceed the channel bandwidth can be used.

3. Mask G applies if two 12.5 kHz channels are aggregated. Alternatively, a mask may be used if it does not produce more adjacent channel interference than narrowband (12.5 kHz) channel equipment.

7.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2014-08-26	1 year
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2015-03-09	1year
-	SMA cable	-	C0005	Each Time[1]	N/A
Bird Electronic Corp.	30 dB attenuator	50-AFFB-30	14	Each Time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44-55 %
ATM Pressure:	101-102 kPa

The testing was performed by Todd Moy on 2015-04-21 in the RF Site.

7.5 Test Results

472.95 MHz which refered as High Channel#2 is used for FCC regulation test only.

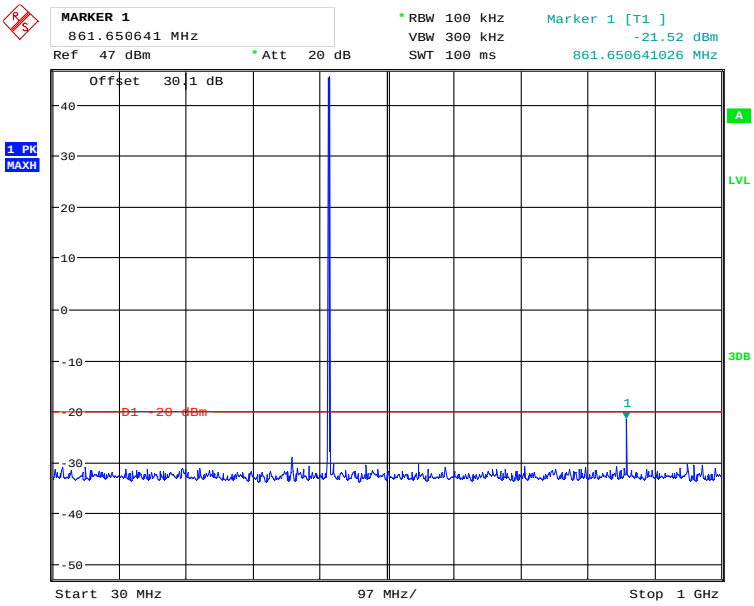
Please refer to the hereinafter plots.

4800 baud rate

GMSK Modulation

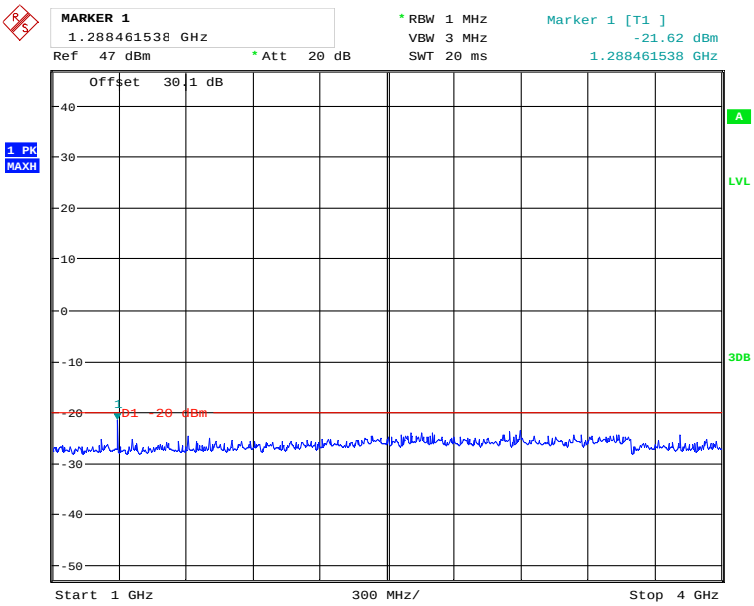
Low Channel: 430.15 MHz

30 MHz to 1 GHz



Date: 21.JUL.2015 12:23:50

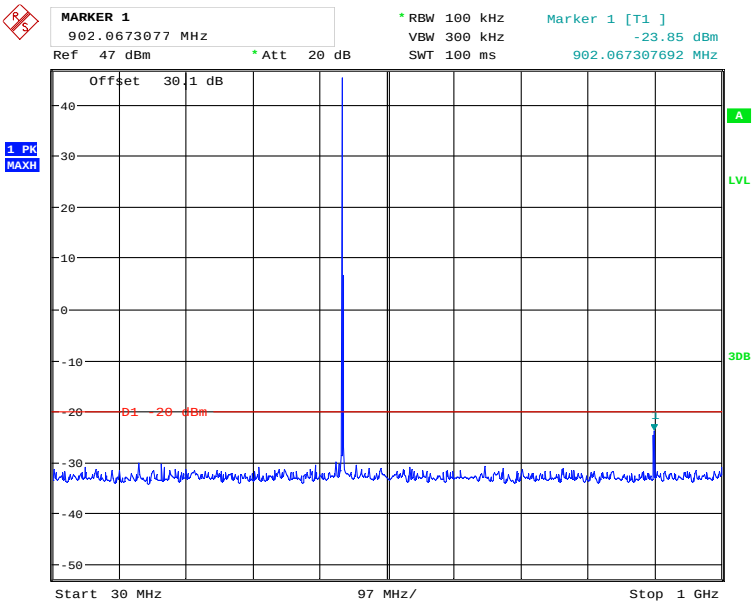
1 GHz to 4 GHz



Date: 21.JUL.2015 12:24:23

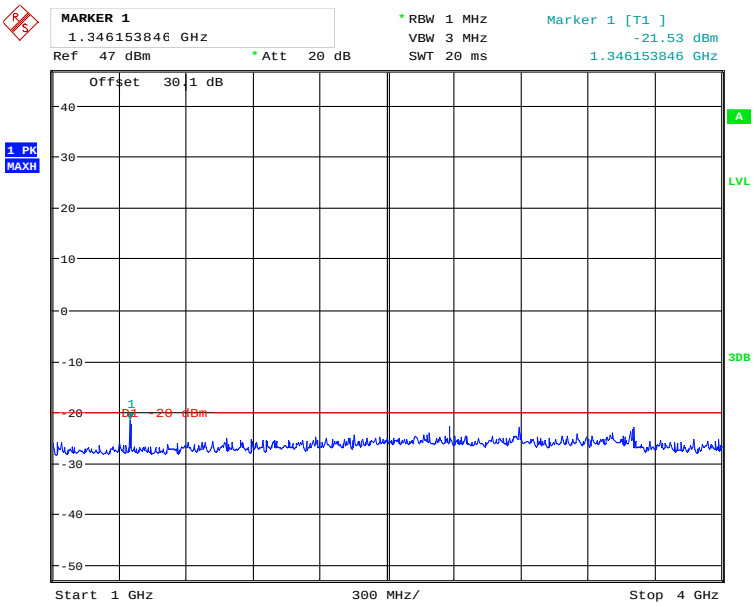
Middle Channel: 450.15 MHz

30 MHz to 1 GHz



Date: 21.JUL.2015 12:26:33

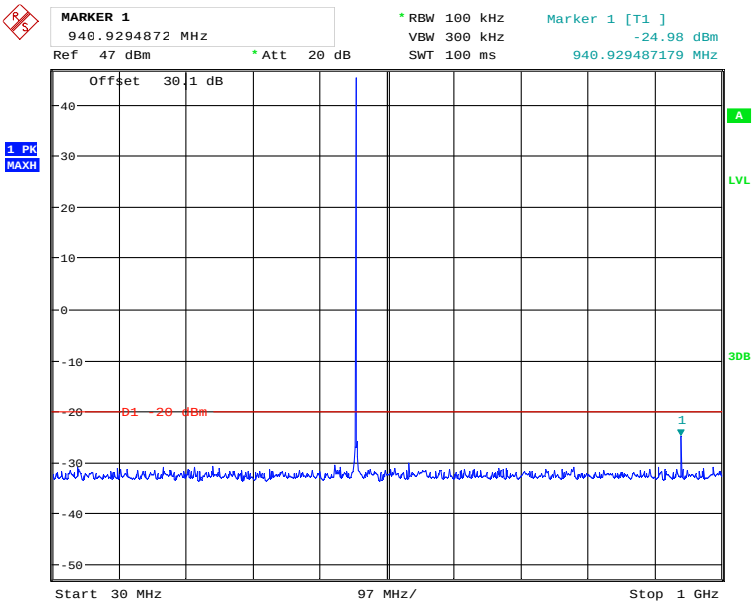
1 GHz to 4 GHz



Date: 21.JUL.2015 12:27:03

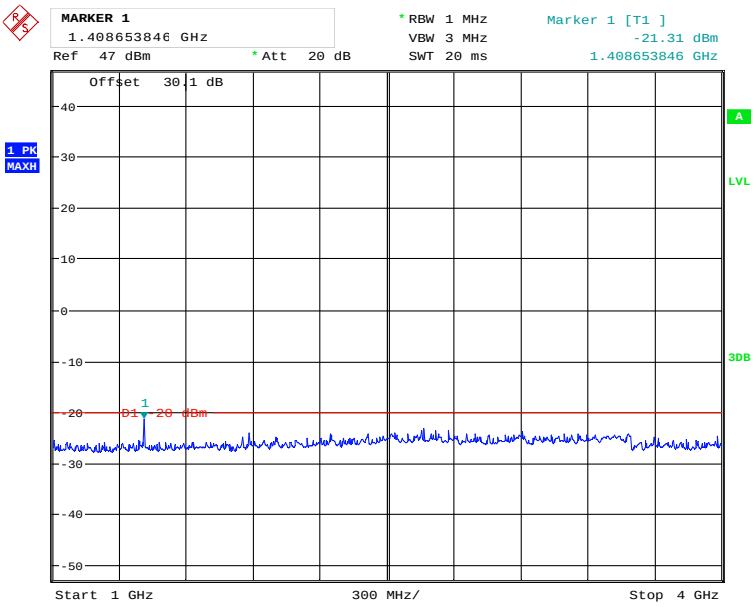
High Channel: 469.85 MHz

30 MHz to 1 GHz



Date: 21.JUL.2015 13:37:39

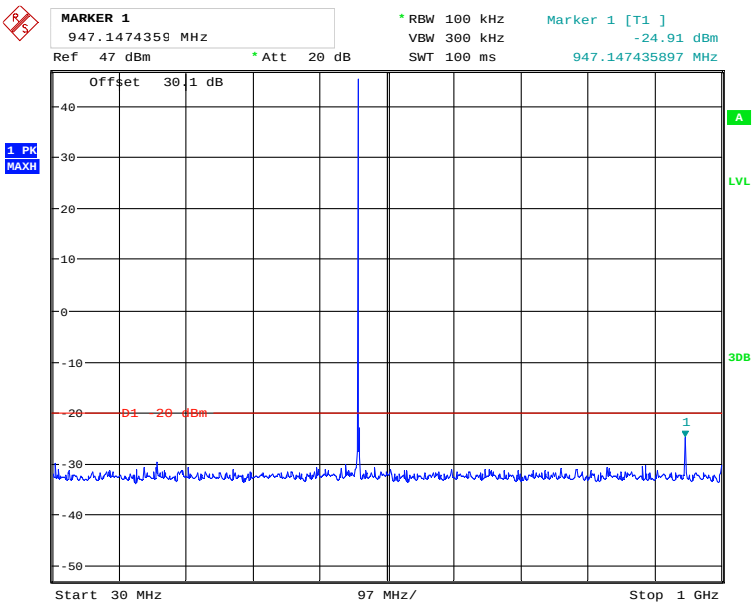
1 GHz to 4 GHz



Date: 21.JUL.2015 13:38:23

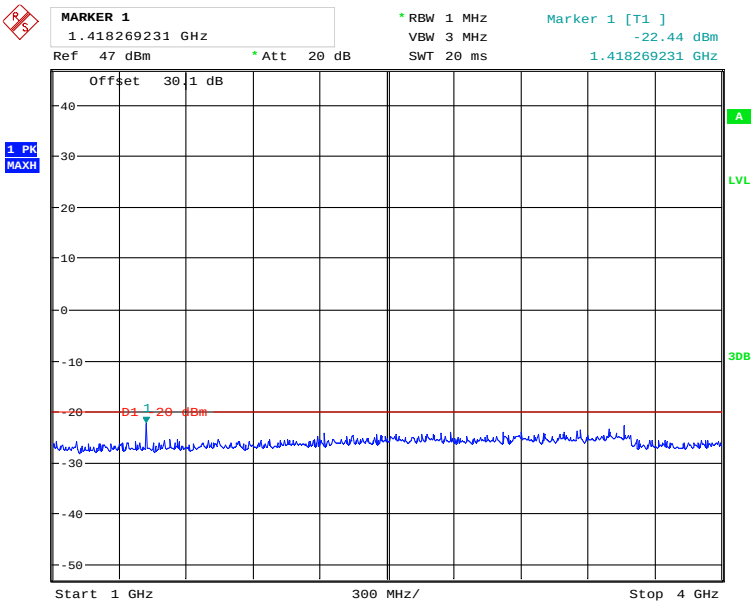
High Channel #2: 472.95 MHz

30 MHz to 1 GHz



Date: 21.JUL.2015 13:41:12

1 GHz to 4 GHz



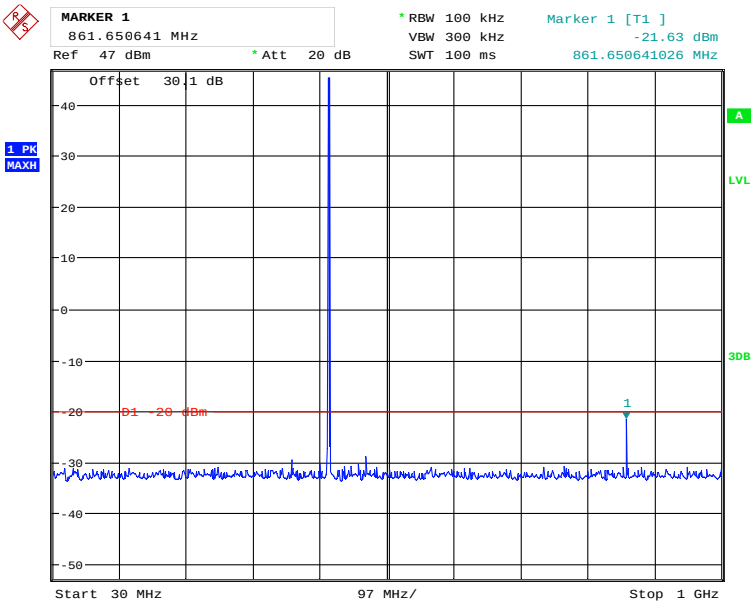
Date: 21.JUL.2015 13:41:51

8000 baud rate

GMSK Modulation

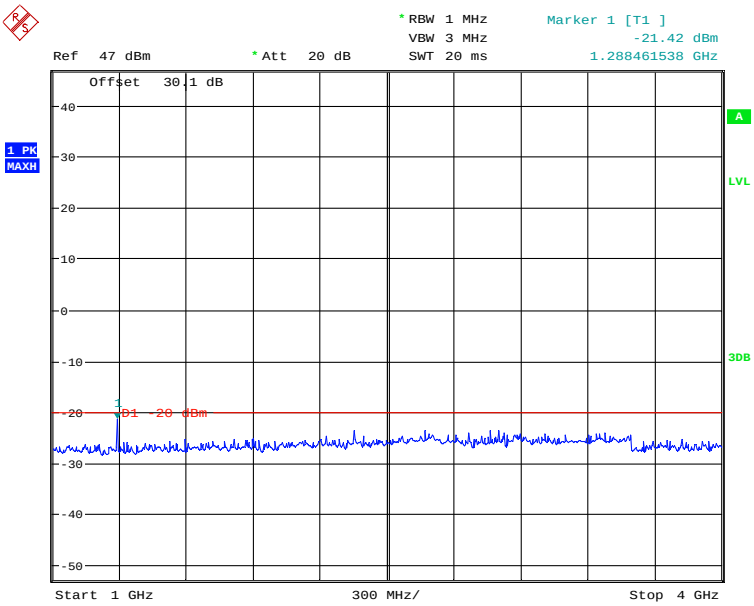
Low Channel: 430.15 MHz

30 MHz to 1 GHz



Date: 21.JUL.2015 12:19:45

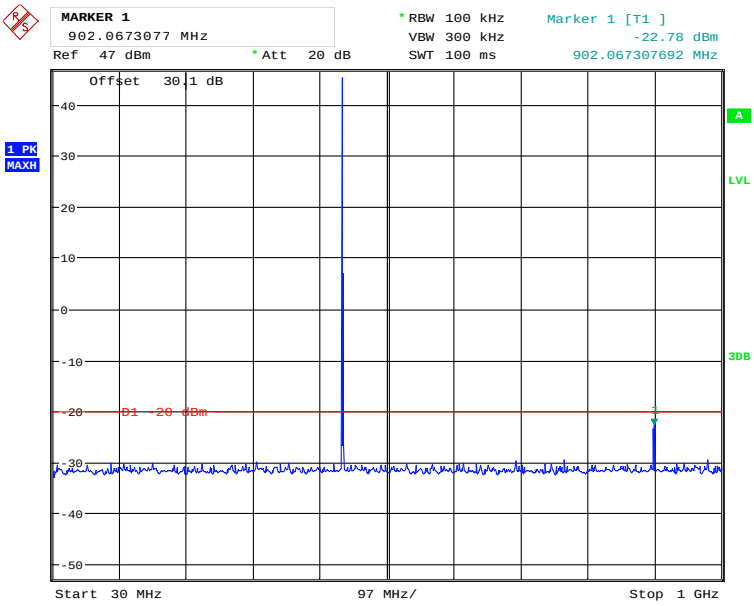
1 GHz to 4 GHz



Date: 21.JUL.2015 12:20:53

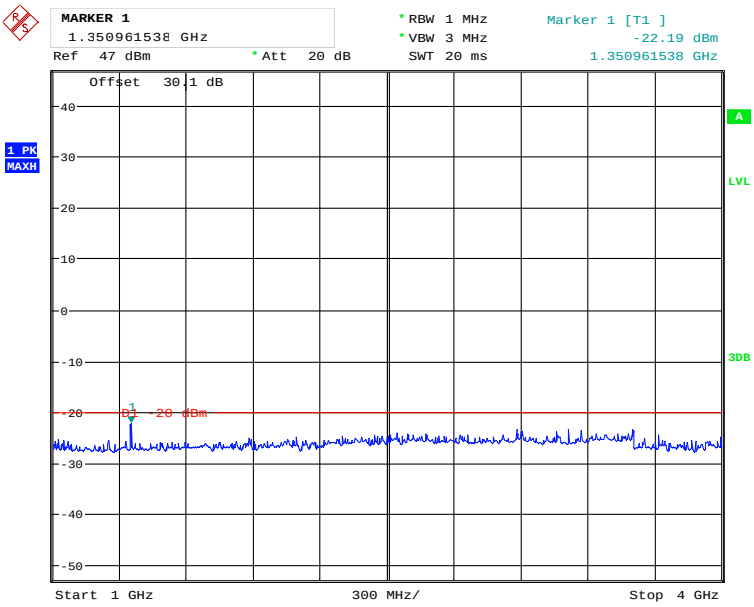
Middle Channel: 450.15 MHz

30 MHz to 1 GHz



Date: 21.JUL.2015 12:15:32

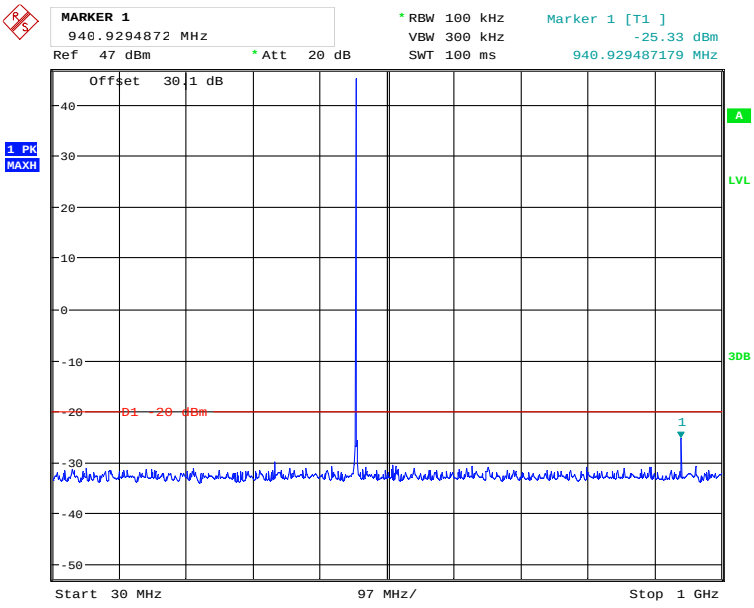
1 GHz to 4 GHz



Date: 21.JUL.2015 12:16:18

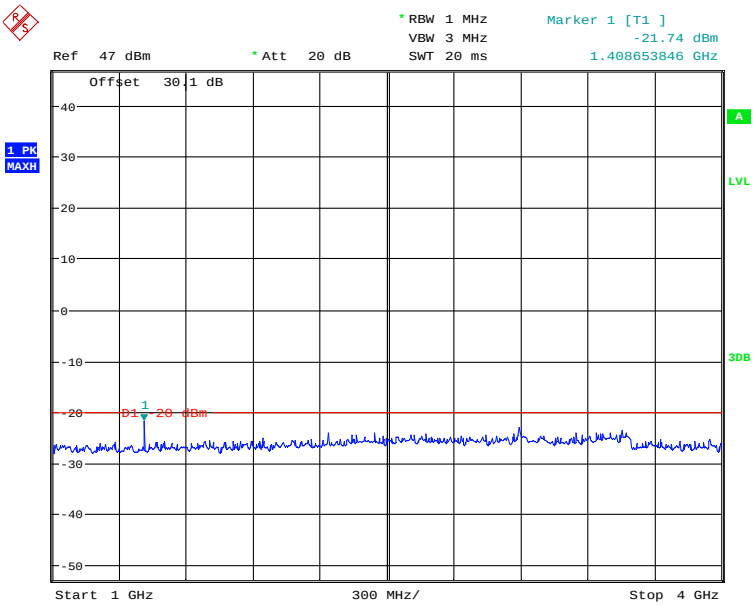
High Channel: 469.85 MHz

30 MHz to 1 GHz



Date: 21.JUL.2015 12:09:52

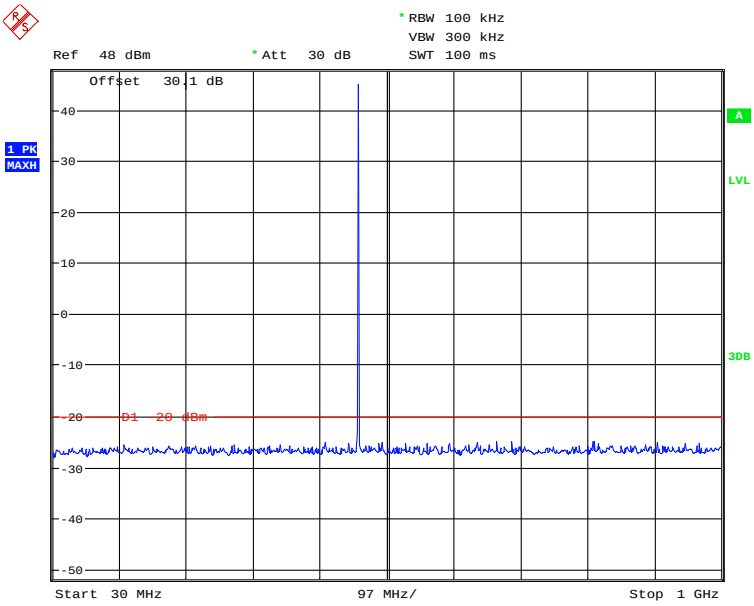
1 GHz to 4 GHz



Date: 21.JUL.2015 12:10:55

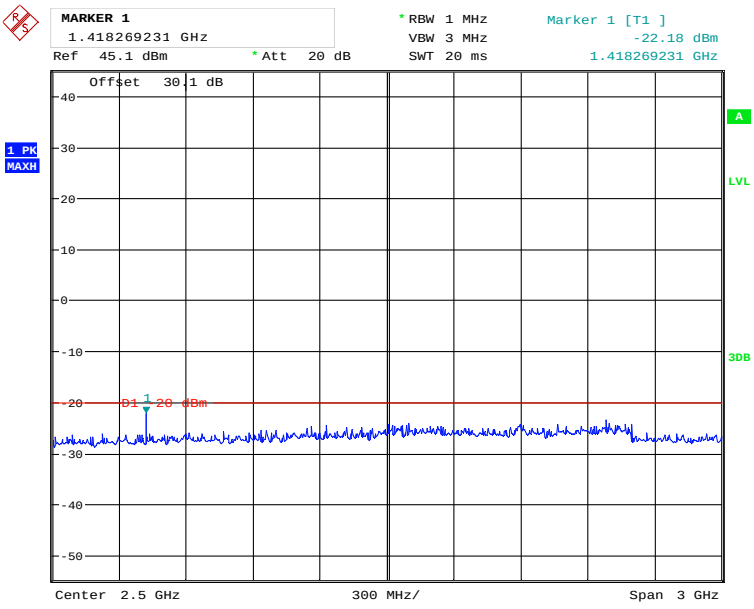
High Channel#2: 472.95 MHz

30 MHz to 1 GHz



Date: 21.JUL.2015 12:05:51

1 GHz to 4 GHz



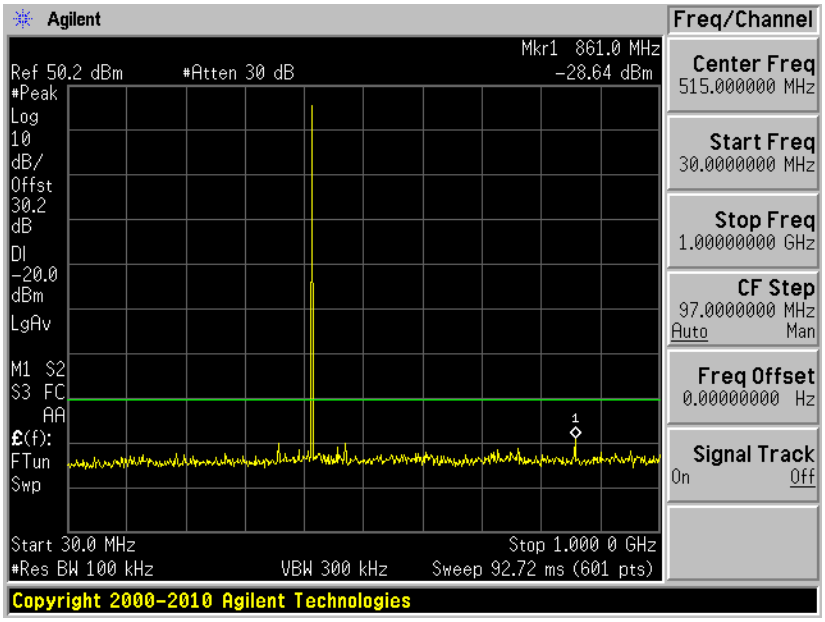
Date: 21.JUL.2015 12:07:09

9600 baud rate

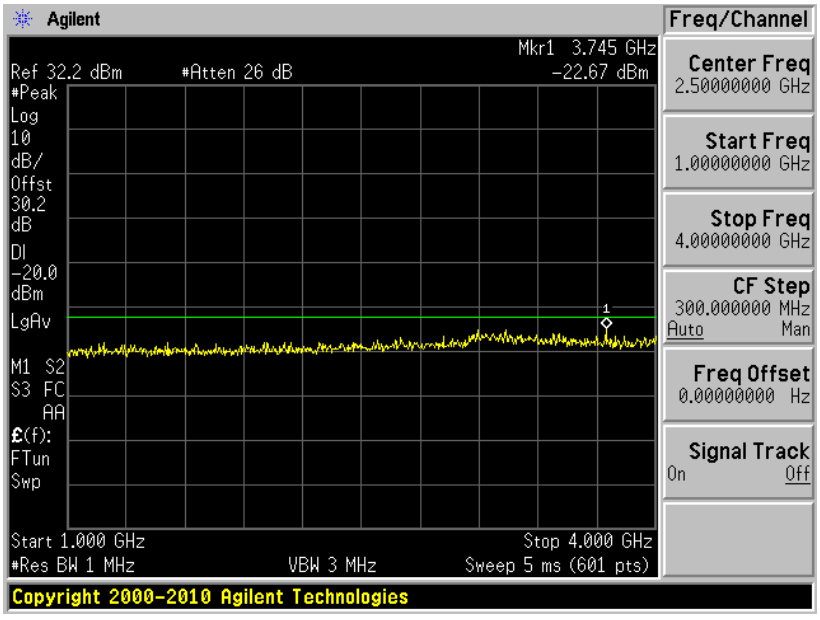
GMSK Modulation

Low Channel: 430.15 MHz

30 MHz to 1 GHz

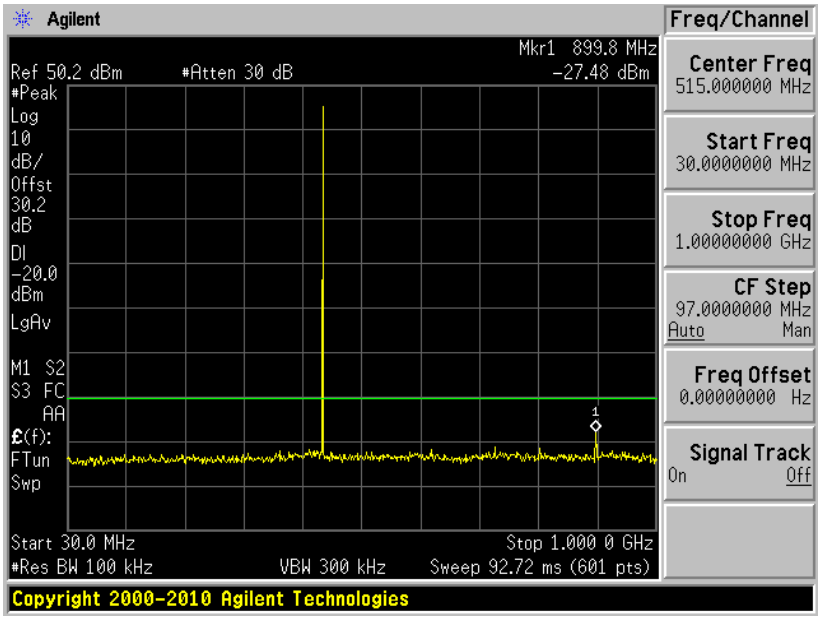


1 GHz to 4 GHz

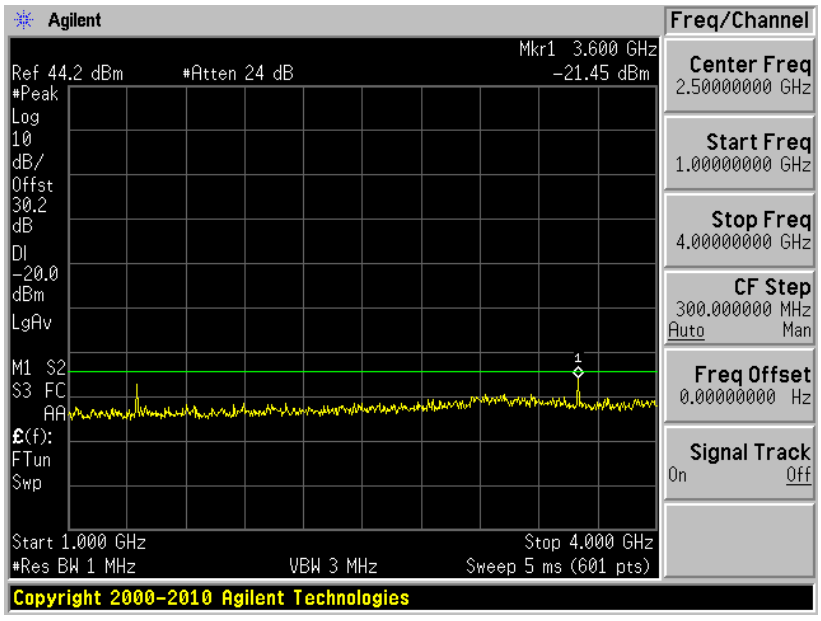


Middle Channel: 450.15 MHz

30 MHz to 1 GHz

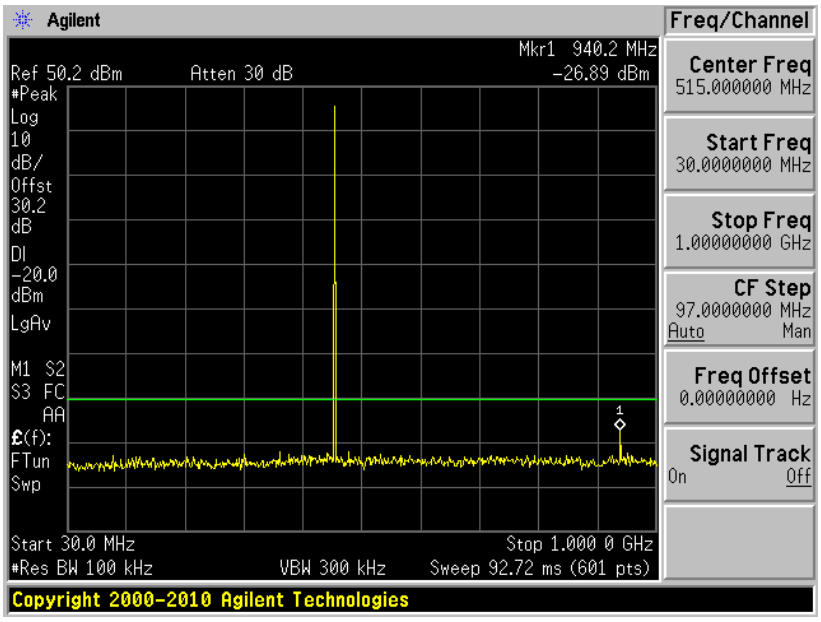


1 GHz to 4 GHz

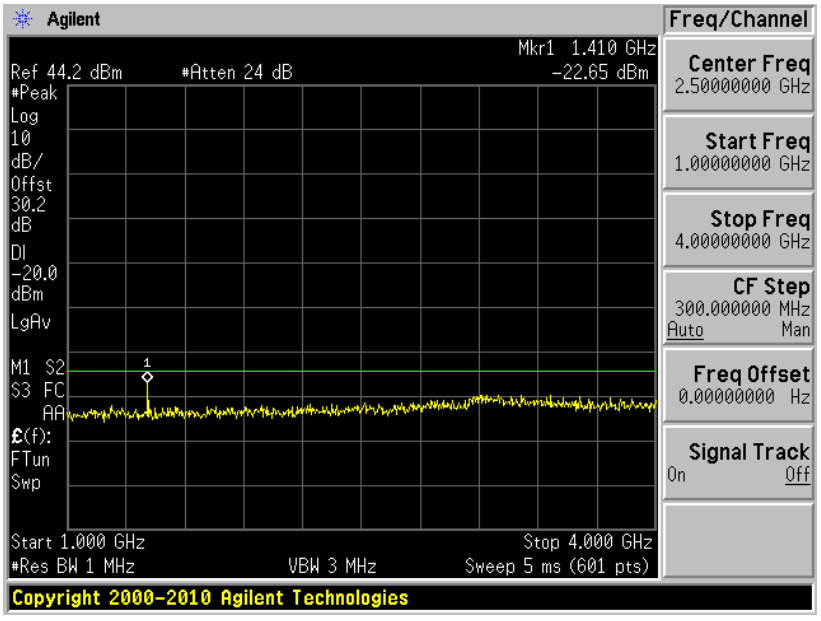


High Channel: 469.85 MHz

30 MHz to 1 GHz

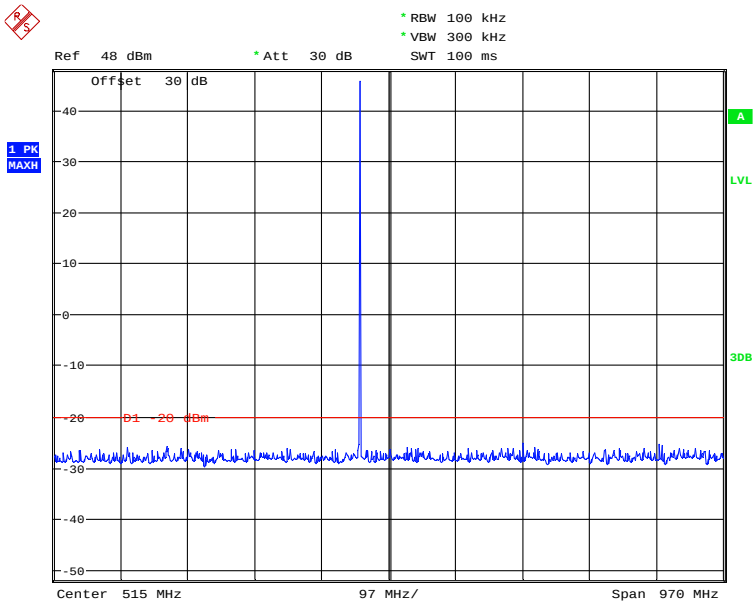


1 GHz to 4 GHz



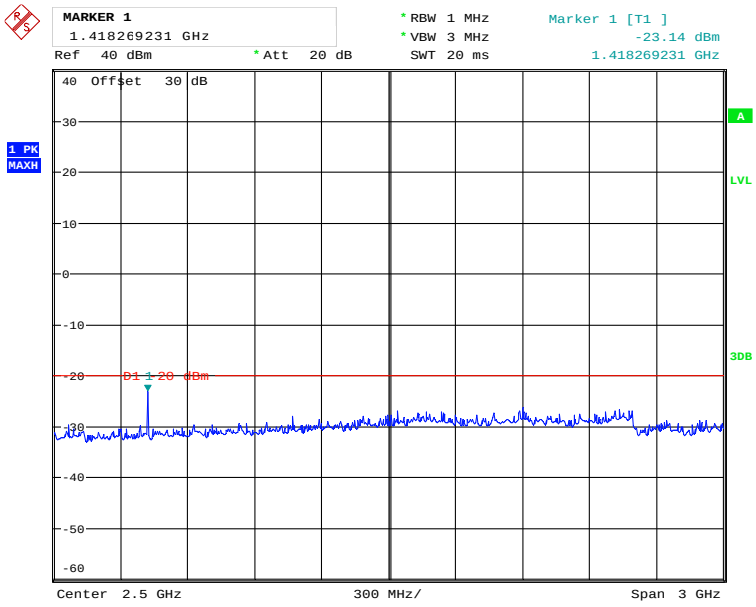
High Channel #2: 472.95 MHz

30 MHz to 1 GHz



Date: 15.JUL.2015 08:58:25

1 GHz to 4 GHz



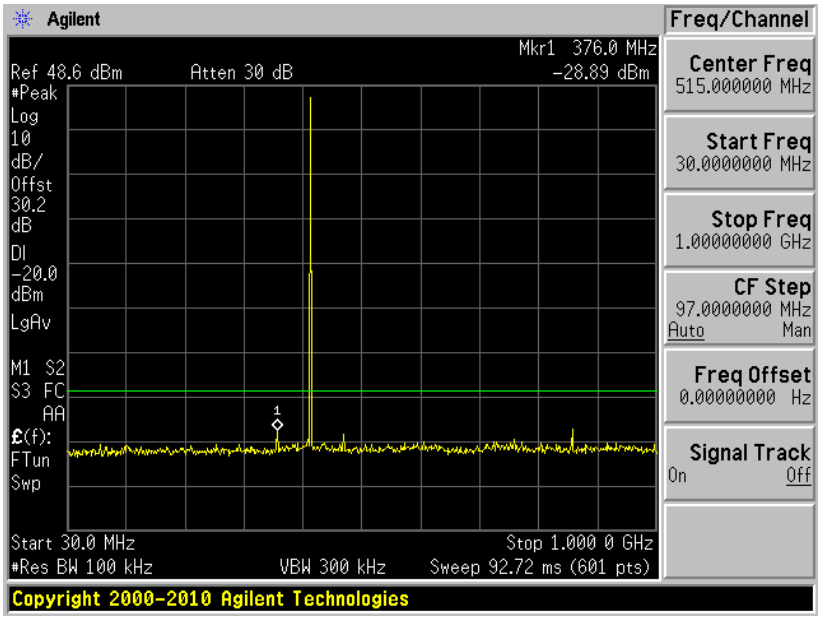
Date: 15.JUL.2015 08:59:55

9600 baud rate

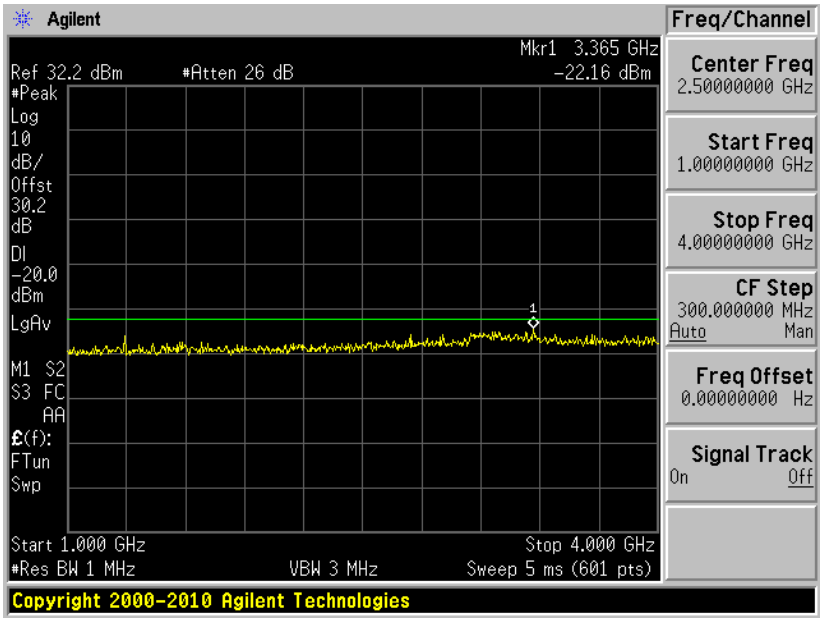
4FSK Modulation

Low Channel: 430.15 MHz

30 MHz to 1 GHz

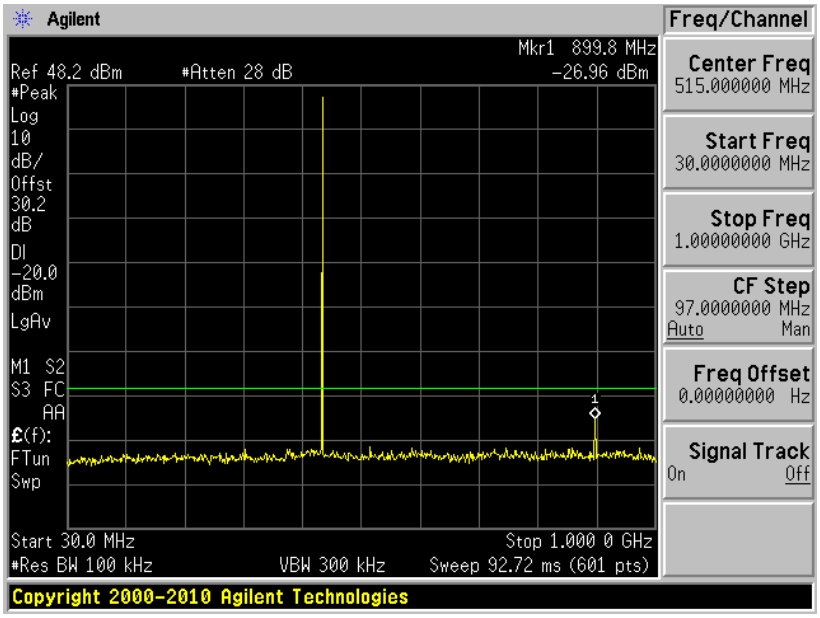


1 GHz to 4 GHz

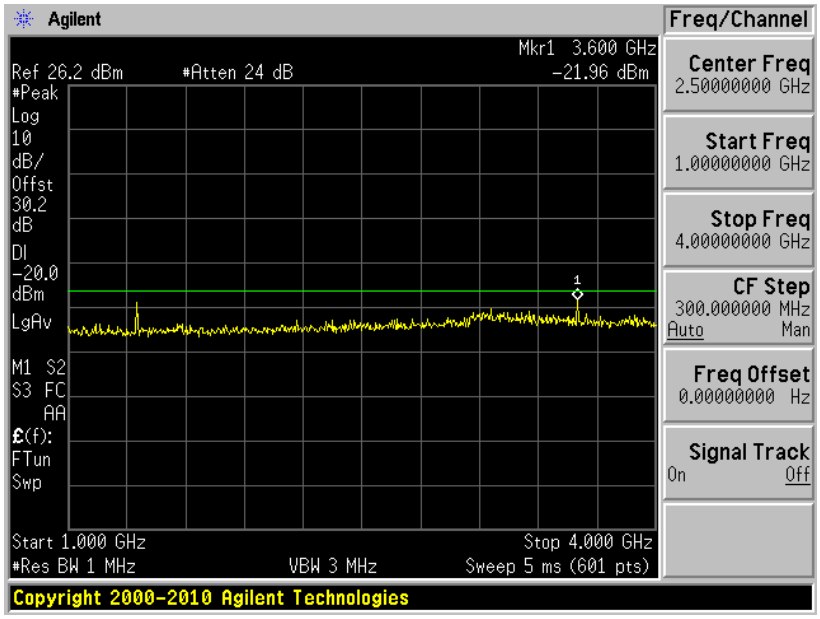


Middle Channel: 450.15 MHz

30 MHz to 1 GHz

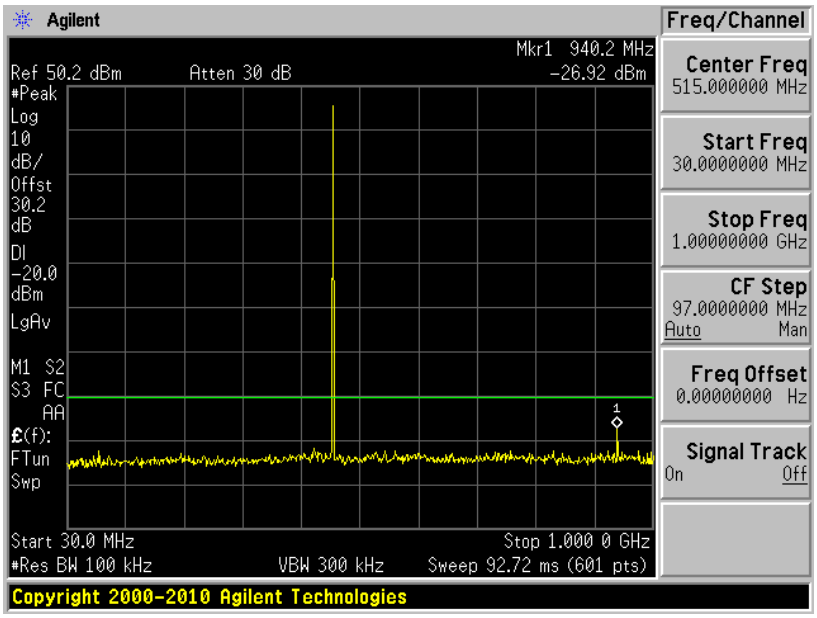


1 GHz to 4 GHz

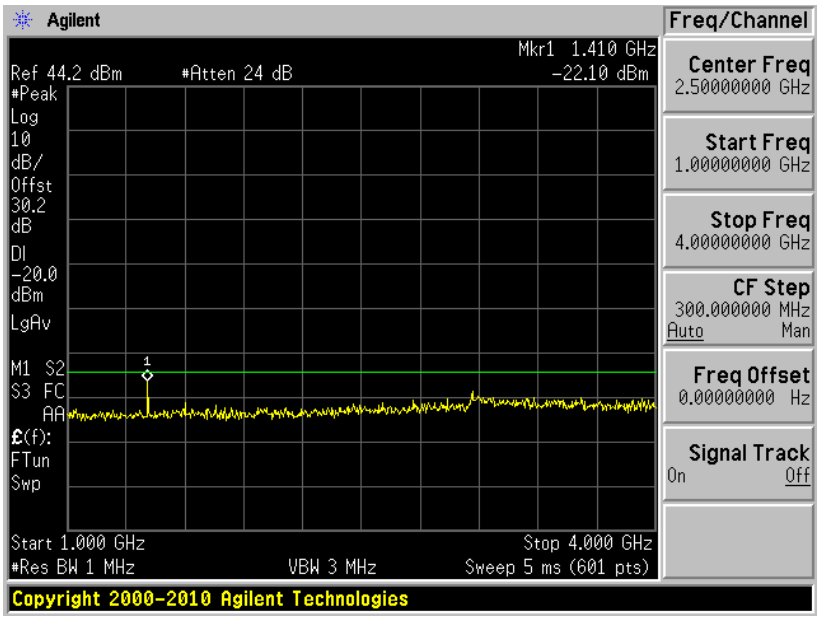


High Channel: 469.85 MHz

30 MHz to 1 GHz

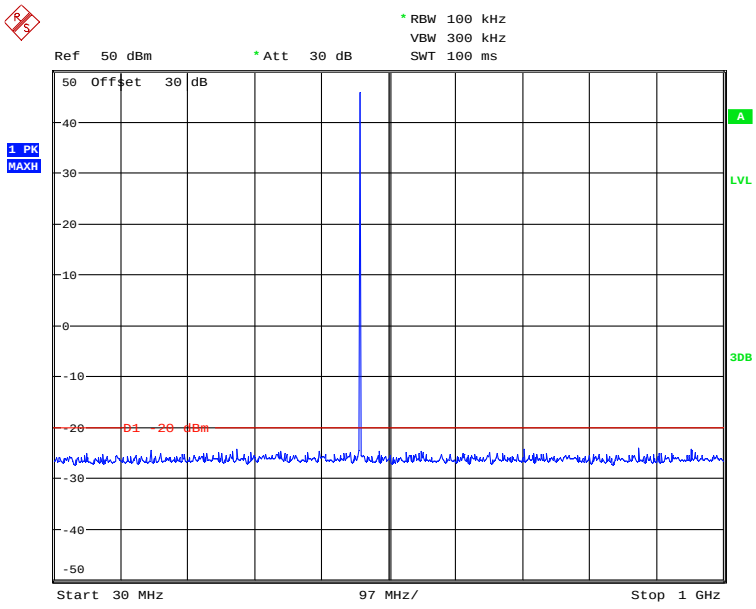


1 GHz to 4 GHz



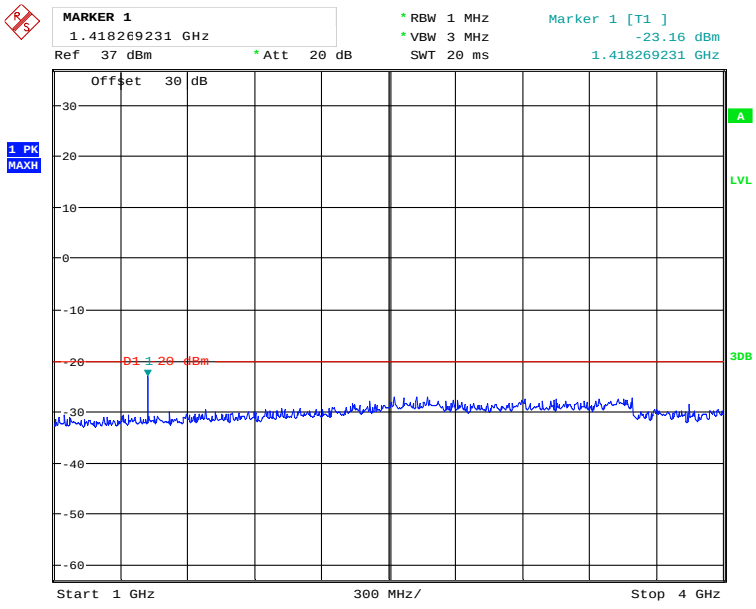
High Channel #2: 472.95 MHz

30 MHz to 1 GHz



Date: 15.JUL.2015 09:50:35

1 GHz to 4 GHz



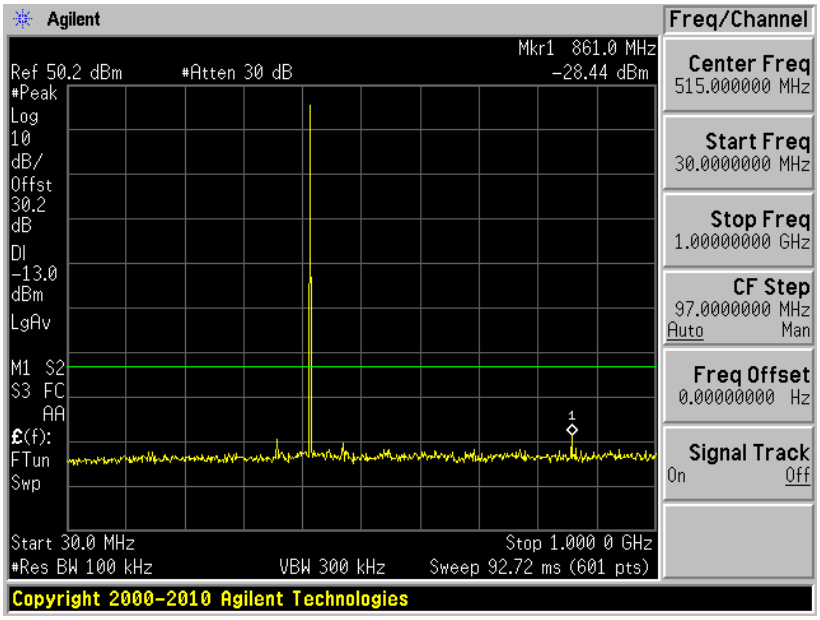
Date: 15.JUL.2015 09:52:22

19200 baud rate

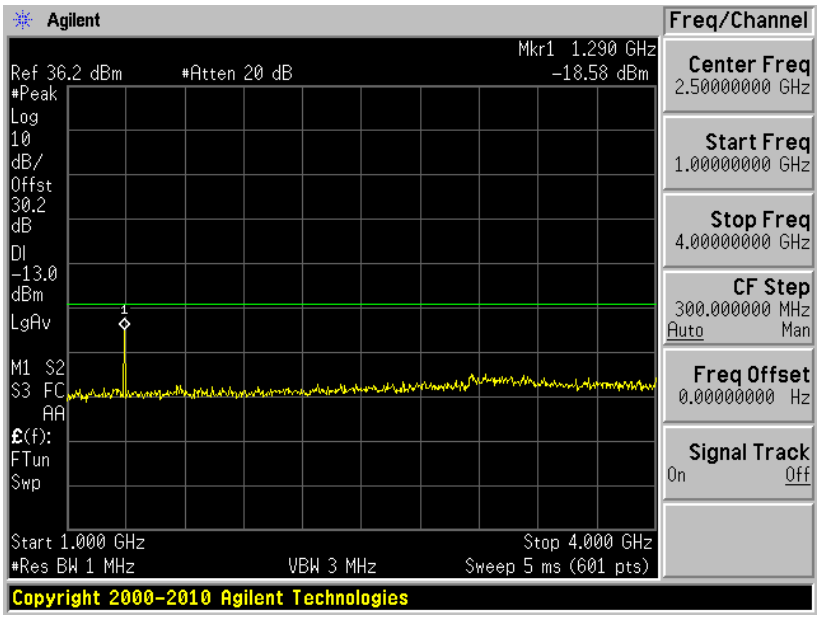
GMSK Modulation

Low Channel: 430.15 MHz

30 MHz to 1 GHz

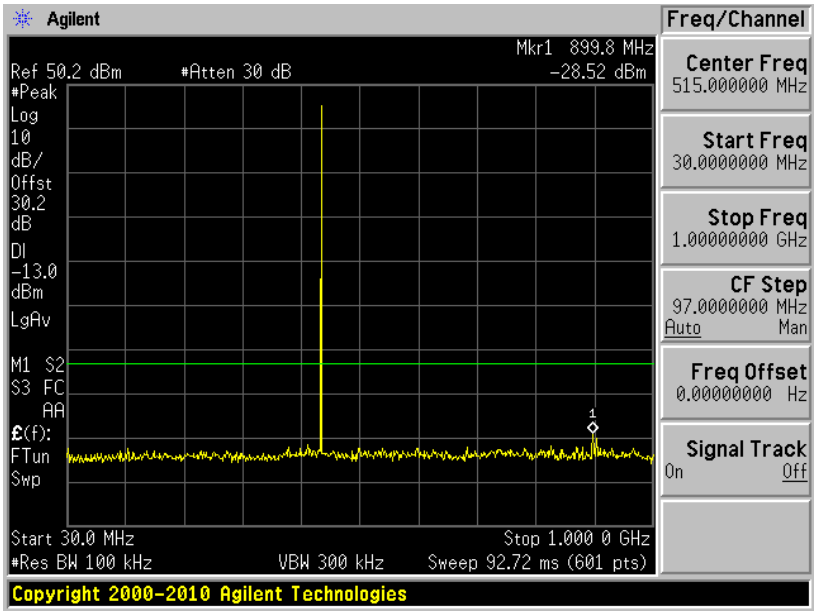


1 GHz to 4 GHz

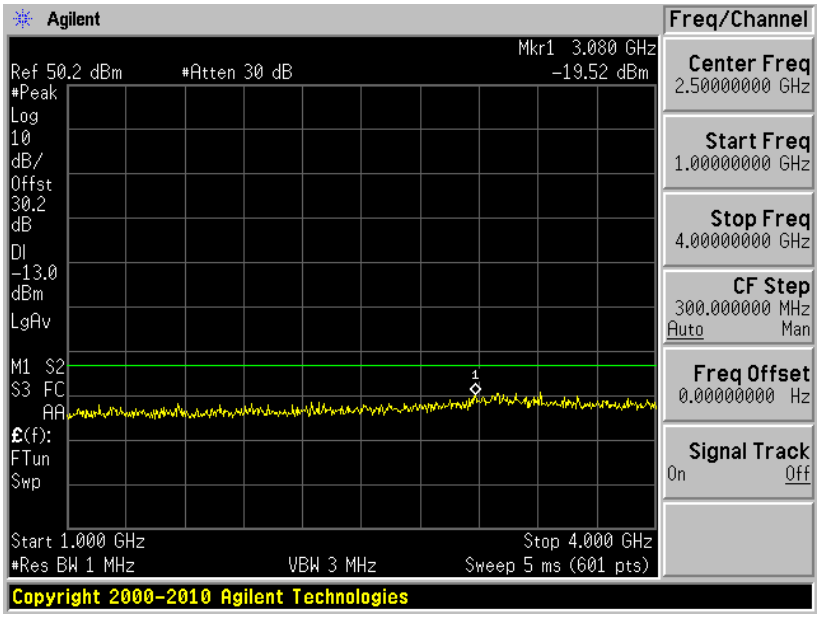


Middle Channel: 450.15 MHz

30 MHz to 1 GHz

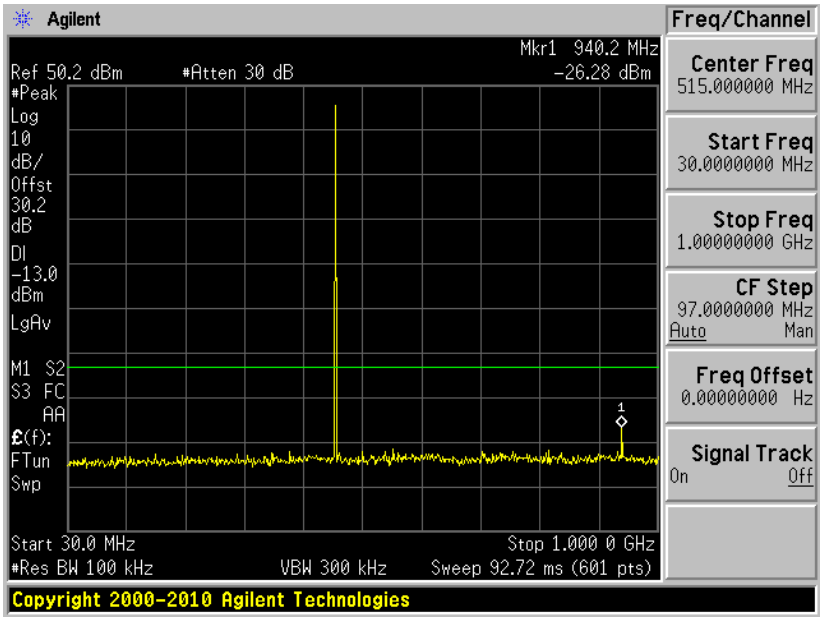


1 GHz to 4 GHz

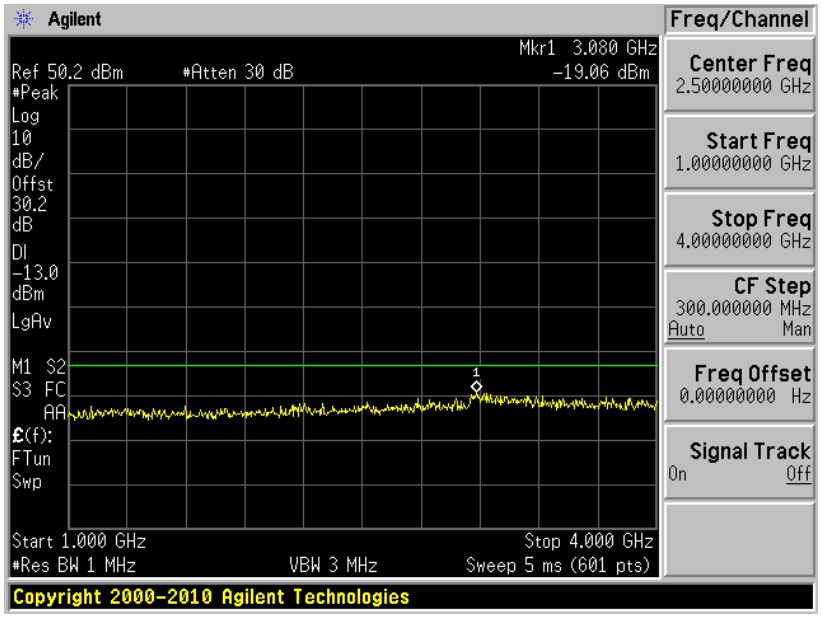


High Channel: 469.85 MHz

30 MHz to 1 GHz

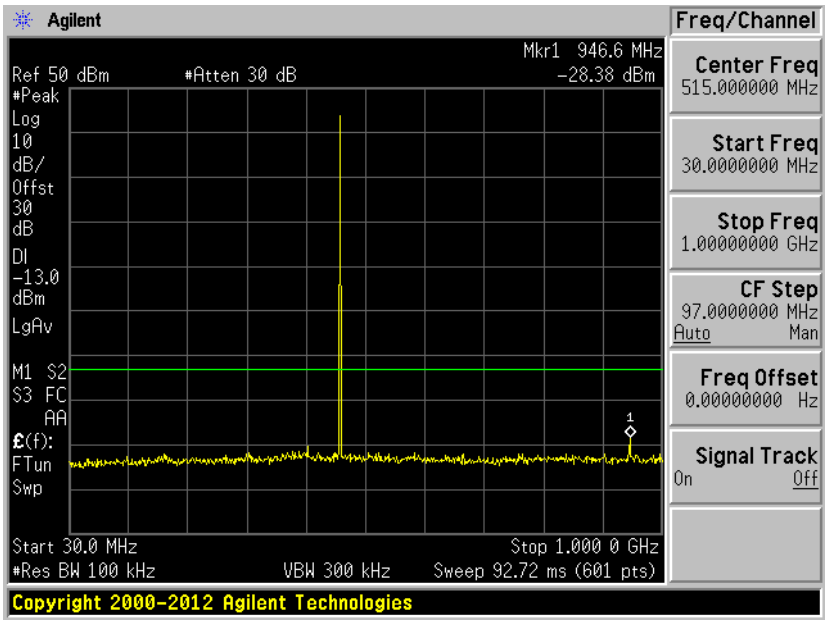


1 GHz to 4 GHz

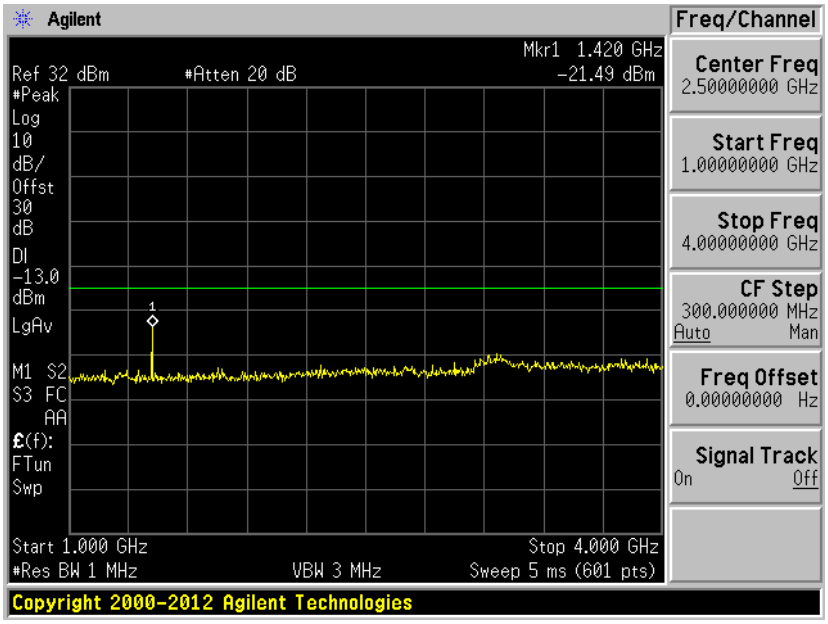


High Channel #2: 472.95 MHz

30 MHz to 1 GHz



1 GHz to 4 GHz

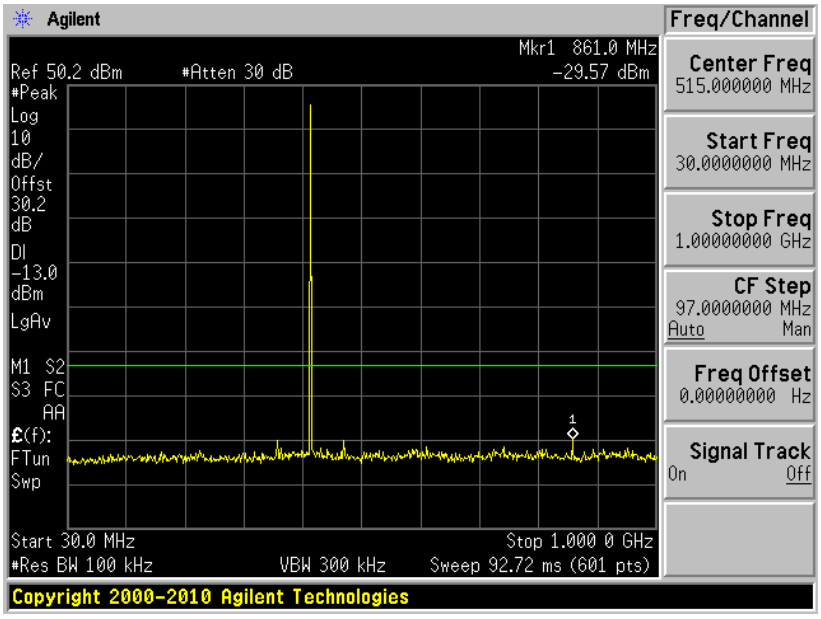


19200 baud rate

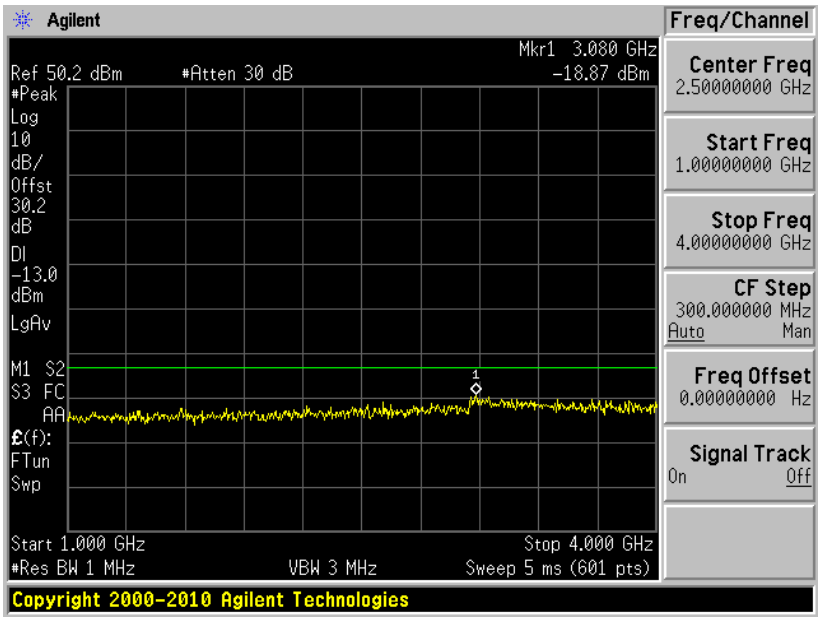
4FSK Modulation

Low Channel: 430.15 MHz

30 MHz to 1 GHz

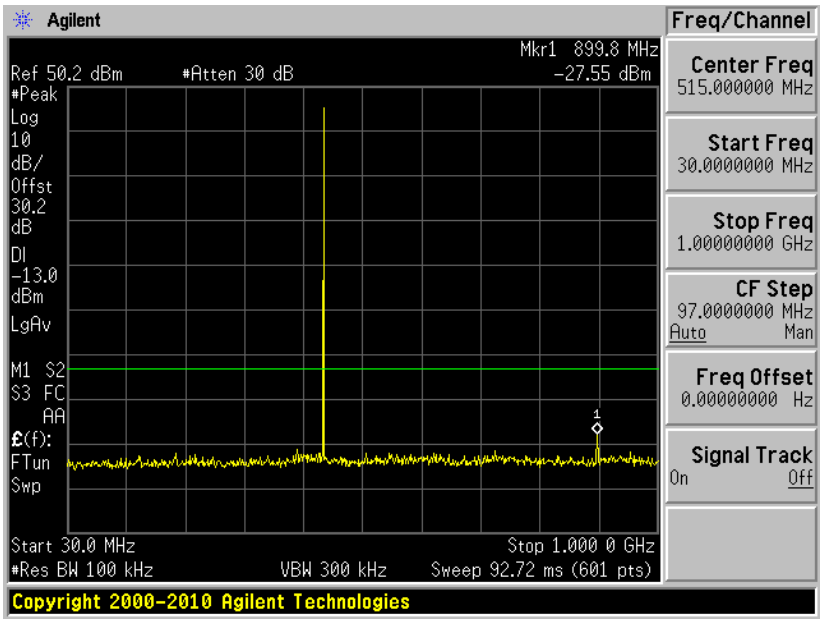


1 GHz to 4 GHz

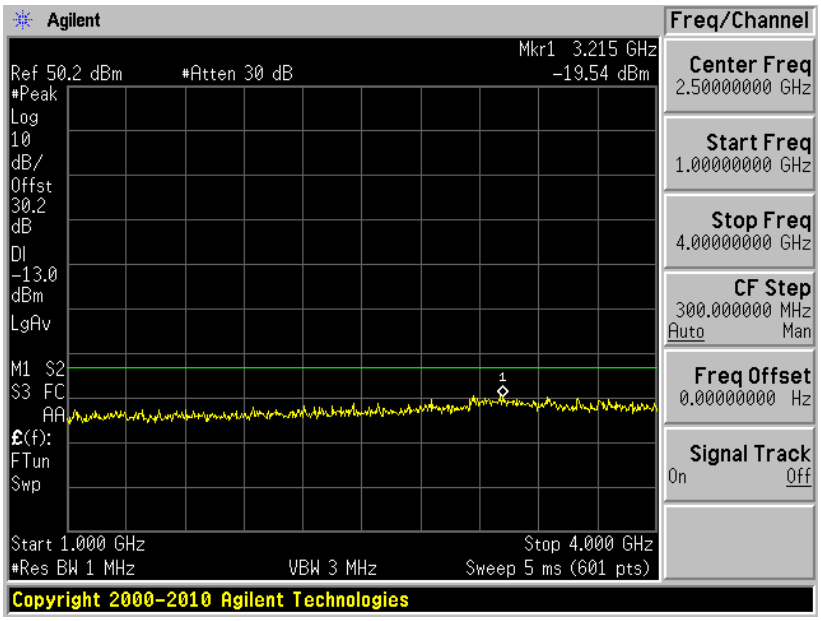


Middle Channel: 450.15 MHz

30 MHz to 1 GHz

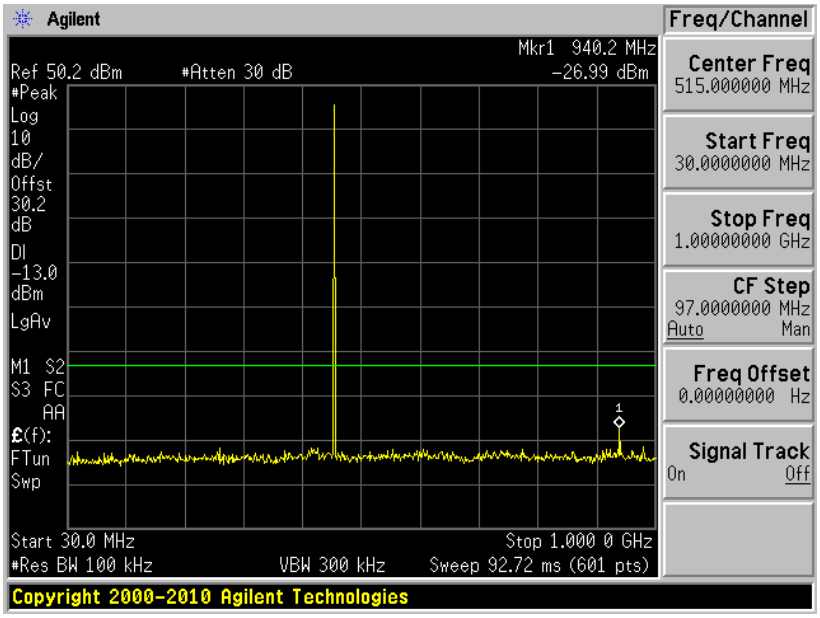


1 GHz to 4 GHz

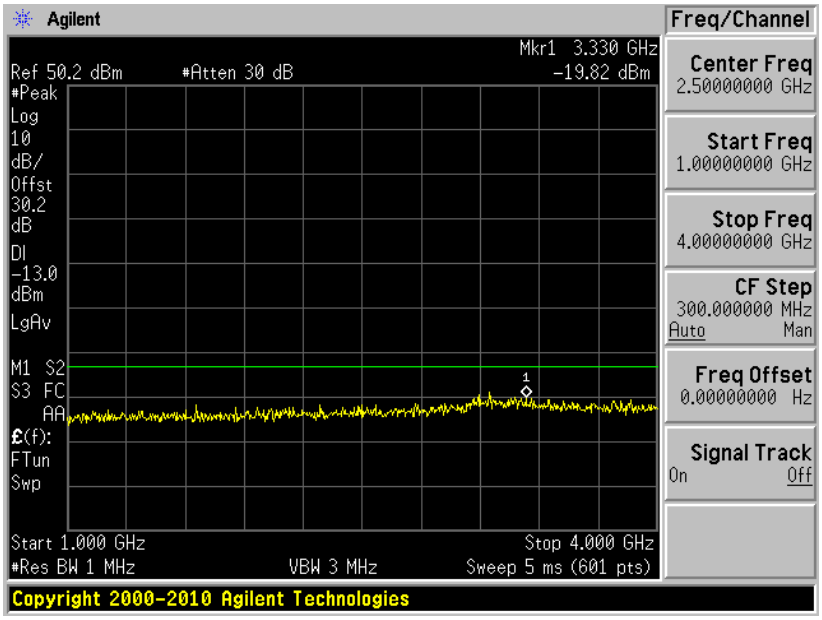


High Channel: 469.85 MHz

30 MHz to 1 GHz

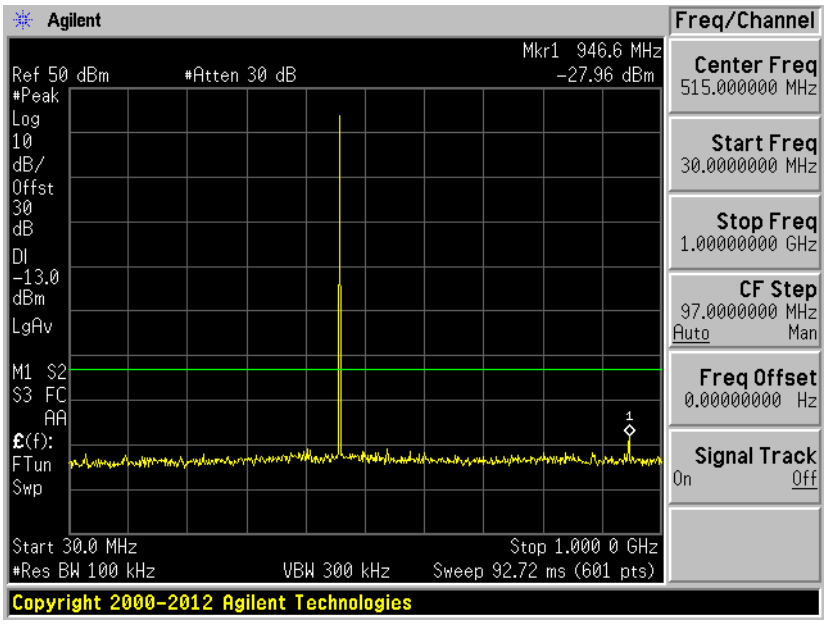


1 GHz to 4 GHz

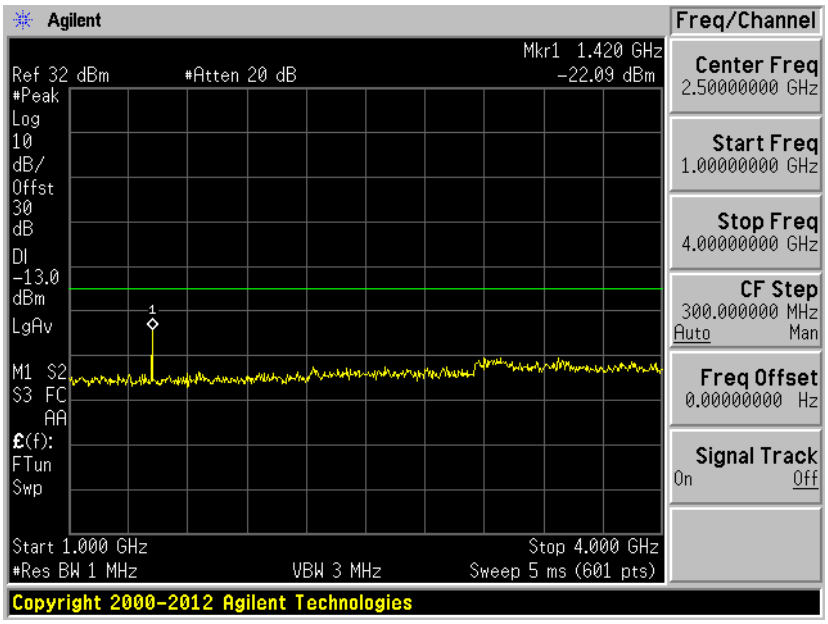


High Channel #2: 472.95 MHz

30 MHz to 1 GHz



1GHz to 4 GHz



8 FCC §2.1055 (d), §90.213 & IC RSS-119 §5.3 - Frequency Stability

8.1 Applicable Standard

FCC §2.1055, §90.213

MINIMUM FREQUENCY STABILITY

[Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1 2 3]100	100	200
25-50	20	20	50
72-76	5		50
150-174	[5 11]5	[6]5	[4 6]50
216-220	1.0		1.0
220-222[12]	0.1	1.5	1.5
421-512	[7 11 14]2.5	[8]5	[8]5
806-809	[14]1.0	1.5	1.5
809-824	[14]1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	[14]0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928[13]	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	[9]300	300	300
Above 2450[10]			

[8]In the 421–512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

RSS-119 §5.3

The carrier frequency shall not depart from the reference frequency in excess of the values given in the following table. For transmitters that have an output power of less than 120 mW, the frequency stability shall comply with the limits listed in Table 1 or, alternatively, with the conditions in Section 5.10.

For fixed and base station equipment, in lieu of meeting the frequency stability limit specified in the following table, the test report can show that the frequency stability is met by demonstrating that the unwanted emission limits, related to the equipment's nominal carrier frequency measured under normal operation, are met when the equipment is tested at the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen.

Frequency Band (MHz)	Channel Bandwidth (kHz)	Frequency Stability (ppm)		
		Base/Fixed	Mobile Station	
			Output Power >2 W	Output Power ≤2 W
27.41-28 and 29.7-50	20	20	20	50
72-76	20	5	20	50
138-174	30	5	5	5
	15	2.5	5	5
	7.5	1	2	5
217-218 and 219-220	12.5	1	5	5
220-222 (Note 1)	5	0.1	1.5	1.5
406.1-430 and 450-470 (Note 6)	25 (Note 2)	0.5	1	1
	25	2.5	5	5
	12.5	1.5	2.5	2.5
	6.25	0.5	1	1
768-776 and 798-806 (Note 3)	25	0.1	0.4 (Note 4)	0.4 (Note 4)
	12.5			
	6.25			
	50	1	1.25 (Note 5)	1.25 (Note 5)
806-821/851-866 and 821-824/866-869 (Note 6)	25 (Note 2)	0.1	0.1	0.1
	25	1.5	2.5	2.5
	12.5	1	1.5	1.5
	6.25	0.1	0.4	0.4
896-901/935-940 (Note 6)	12.5	0.1	1.5	1.5
929-930/931-932	25	1.5	N/A	N/A
928-929/952-953 and 932-932.5/941-941.5	25	1.5	N/A	N/A
	12.5	1	3 (for remote station)	N/A
932.5-935/941.5-944	25	2.5	N/A	N/A
	12.5	2.5	N/A	N/A

1. Mobile units may use synchronizing signals from associated base stations to achieve the specified carrier stability.

2. This provision is for digital equipment with a channel bandwidth of 25 kHz and an occupied bandwidth greater than 20 kHz. The mobile station's frequency stability values given in Table 1 are for mobile, portable and control transmitters using automatic frequency control (AFC) to lock onto the base station signal. When the mobile, portable and control transmitters are operating without using AFC to lock onto the base station signal, the frequency stability limit shall be better than 1 kHz and the equipment's unwanted emissions measured with maximum frequency shift shall still comply with emission mask Y (Section 5.8.10) at nominal carrier frequency.

3. Mobile, portable and control transmitters operating in the bands 768-776 MHz and 798-806 MHz must normally use AFC to lock onto the base station signal. The mobile station's frequency stability values given in Table 1 are for mobile stations operating under this condition.

4. When the mobile, portable and control transmitters are operating with channel bandwidths equal to 6.25 kHz, 12.5 kHz or 25 kHz in the band 768-776 MHz and the AFC is not locked onto the base station signal, the frequency stability must be equal to or better than 1 ppm for 6.25 kHz, 1.5 ppm for 12.5 kHz (2-channel aggregate), and 2.5 ppm for 25 kHz (4-channel aggregate).

5. When the mobile, portable and control transmitters are operating with channel bandwidths equal to 50 kHz in the band 768-776 MHz and the AFC is not locked onto the base station signal, the frequency stability must be equal to or better than 5 ppm.

6. Control stations may operate with the frequency stability specified for associated mobile frequencies.

8.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to the Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable DC power supply Source. The voltage was set to 115% and 85% of the nominal value. The output frequency was recorded for each voltage.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2014-11-13	1 year
Espec	Chamber, Humidity	ESL-4CA	18010	2015-02-27	1year
KEPCO	Source, DC	25-10M	H1334526	N/A	N/A
-	SMA cable	-	C0005	Each Time[1]	-
Bird Electronic Corp.	30 dB attenuator	50-AFFB-30	14	Each Time[1]	-

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

8.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44-55 %
ATM Pressure:	101-102 kPa

The testing was performed by Todd Moy on 2015-04-22 in the RF Site.

8.5 Test Results

Reference Frequency: 450.15 MHz

Test Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (ppm)	Limit (ppm)
Voltage (Vdc)	Temperature (^{o}C)				
Frequency vs. Temperature					
12	50	450.15	450.1499439	-0.1304	2.5 ppm
12	40	450.15	450.1499439	-0.1304	2.5 ppm
12	30	450.15	450.1499439	-0.1304	2.5 ppm
12	20	450.15	450.149984	-0.0373	2.5 ppm
12	10	450.15	450.1500321	0.7451	2.5 ppm
12	0	450.15	450.149984	-0.3726	2.5 ppm
12	-10	450.15	450.1499519	-0.0745	2.5 ppm
12	-20	450.15	450.1499679	-0.0745	2.5 ppm
12	-30	450.15	450.1499038	-0.1863	2.5 ppm
Frequency vs. Voltage					
10.2	20	450.15	450.1499359	-0.1424	2.5 ppm
13.8	20	450.15	450.149917	-0.1844	2.5 ppm

9 FCC §2.1053, §90.210 & IC RSS-119 §5.8 – Field Strength of Spurious Radiation

9.1 Applicable Standard

FCC §90.210
For equipment using 25 kHz channel spacing, 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.

For equipment using 12.5 kHz channel spacing, 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.

RSS-119 §5.8

The spectrum plots of the unwanted emissions shall comply with the masks specified in the following table.

Descriptions of these permissible emission masks are given in the sections that follow.

The term *displacement frequency*, f_d, used in these sections refers to the difference between the channel frequency and the emission component frequency expressed in kilohertz, and *p* is the transmitter output power in Watts.

Frequency Band (MHz)	Related SRSP for Channelling Plan and ERP	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for Equipment With Audio Filter	Spectrum Masks for Equipment Without Audio Filter
27.41-28 and 29.7-50	N/A	20	20	B	C
72-76	N/A	20	20	B	C
138-144, 148-149.9 and 150.05-174	SRSP-500	30	20	B	C
		15	11.25	D	D
		7.5	6	E	E
217-218 and 219-220	N/A	12.5	11.25	D or I	D or J
220-222	SRSP-512	5	4	F	F
406.1-430 and 450-470	SRSP-501	25	20 22	B Y	C (G) (Note 1) Y
		12.5	11.25	D	D
		6.25	6	E	E
768-776 and 798-806	SRSP-511	6.25 12.5 25 50	(Note 2)	See Section 5.8.9	See Section 5.8.9
806-821/851-866 and 821-824/866-869	SRSP-502	25	20 22	B Y	G Y
		12.5	11.25	D	D
		6.25	6	E	E
896-901/935-940	SRSP-506	12.5	13.6	I	J (G) (Note 3)
929-930 and 931-932	SRSP-504 (for paging)	25	20	B	G
928-929/952-953 and 932-932.5/941-941.5	SRSP-505	25	20	B	G
		12.5	11.25	D	D
932.5-935/941.5-944	SRSP-507	25	20	B	G
		12.5	11.25	D	D

Notes:
1. Paging transmitters in the bands 406.1-430 MHz and 450-470 MHz are to use mask G.

2. Provided that the ACP requirements in Section 5.8.9.1 are met, any authorized bandwidth that does not exceed the channel bandwidth can be used.

3. Mask G applies if two 12.5 kHz channels are aggregated. Alternatively, a mask may be used if it does not produce more adjacent channel interference than narrowband (12.5 kHz) channel equipment.

9.2 Test Procedure

The transmitter was placed on a Styrofoam with wooden turntable, and it was normal transmitting with 50ohm termination which was also placed on the turntable.

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

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

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

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level

9.3 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	35-40 %
ATM Pressure:	101-102 kPa

The testing was performed by Todd Moy on 2015-04-27 in the 5 meter chamber 3.

9.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2014-08-26	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/A
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2014-09-18	1 year
EMCO	Horn Antenna	3115	9511-4627	2014-10-17	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	1 year
COM-POWER	Antenna, Dipole	AD-100	721033DB1,721033DB2,721033DB3,721033DB4	2014-11-03	1 year
HP	Generator, Signal	83650B	3614A00276	2014-08-06	N/A
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2014-08-08	1 year
HP/ Agilant	Pre-amplifier	8449B OPT HO2	3008A0113	2015-03-11	1 year

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

9.5 Test Results

Worst Margin: -16.69 dB at 1290 MHz in the Horizontal polarization.

12.5 kHz Channel Spacing, Low Channel – 430.15 MHz

Indicated		Turntable Azimuth (Degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
288.7	57.09	201	100	H	288.7	-51.06	0	0.09	-51.15	-20	-31.15
288.7	50.03	187	100	V	288.7	-56.51	0	0.09	-56.6	-20	-36.6
861	61.05	24	100	H	861	-39.24	0	0.3	-39.54	-20	-19.54
861	61.93	230	100	V	861	-36.86	0	0.3	-37.16	-20	-17.16
1290	70.49	106	271	H	1290	-41.31	4.98	0.36	-36.69	-20	-16.69
1290	70.48	240	100	V	1290	-40.51	4.912	0.36	-35.958	-20	-15.958
1720	57.02	158	100	H	1720	-52.91	7.631	0.5	-45.779	-20	-25.779
1720	61.03	210	178	V	1720	-48.23	7.63	0.5	-41.1	-20	-21.1

25 kHz Channel Spacing, Low Channel – 430.15 MHz

Indicated		Turntable Azimuth (Degrees)	Test Antenna		Substituted					Limit (dB)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
288.7	58.86	200	100	H	288.7	-49.29	0	0.09	-49.38	-13	-36.38
288.7	51.45	105	100	V	288.7	-55.09	0	0.09	-55.18	-13	-42.18
861	61.44	24	100	H	861	-38.85	0	0.3	-39.15	-13	-26.15
861	62.71	237	100	V	861	-36.08	0	0.3	-36.38	-13	-23.38
1290	67.6	54	271	H	1290	-44.2	4.98	0.36	-39.58	-13	-26.58
1290	70.52	240	100	V	1290	-40.47	4.912	0.36	-35.918	-13	-22.918
1720	57.62	71	100	H	1720	-52.31	7.631	0.5	-45.179	-13	-32.179
1720	60.79	221	100	V	1720	-48.47	7.63	0.5	-41.34	-13	-28.34

10 IC RSS-119 §5.11 - Receiver Spurious Emissions

10.1 Applicable Standard

RSS-119 §5.11

Receiver spurious emissions shall comply with the limits specified in RSS-Gen.

RSS-Gen §7.1

Receivers, as defined in Section 5, are required to comply with the limits of spurious emissions as set out in this section. Receiver emission measurements are to be performed as per the normative test method referenced in Section 3.

For emissions at frequencies below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. At frequencies above 1 GHz, measurements shall be performed using a linear average detector with a minimum resolution bandwidth of 1 MHz

As an alternative to CISPR quasi-peak or average measurements, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization, as required, with a measurement bandwidth equal to, or greater than, the applicable CISPR quasi-peak bandwidth or 1 MHz bandwidth, respectively.

10.2 Test Setup

Radiated emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals. The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is higher, to at least 5x the highest tunable or local oscillator frequency, whichever is higher, without exceeding 40 GHz.

10.3 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emissions was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

10.4 Test Equipment Lists and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2014-08-26	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/A
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2014-09-18	1 year
EMCO	Horn Antenna	3115	9511-4627	2014-10-17	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	1 year
COM-POWER	Antenna, Dipole	AD-100	721033DB1, 721033DB2, 721033DB3, 721033DB4	2014-11-03	1 year
HP	Generator, Signal	83650B	3614A00276	2014-08-06	N/A
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2014-08-08	1 year
HP/ Agilant	Pre-amplifier	8449B OPT HO2	3008A0113	2015-03-11	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

10.5 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	35-40 %
ATM Pressure:	101-102 kPa

The testing was performed by Todd Moy on 2015-04-27 in the 5 meter chamber 3.

10.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

10.7 Summary of Test Results

According to the test data, the EUT complied with the RSS-119/RSS-Gen, with the closest margins from the limit listed below:

Measure at 3 Meters (30 MHz – 1 GHz)

Model: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Test Range**
-8.49	288.7	Vertical	30 MHz- 1GHz

Measure at 3 Meters (Above 1 GHz)

Model: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Test Range**
-2.117	2415	Vertical	1 GHz - 2 GHz

10.8 Test Results

Measurements at 3 meters (Below 1 GHz)

Indicated		Turntable Azimuth (Degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
240.2	52.62	64	100	H	240.2	-60.96	0	0.03	-60.99	-49.21	-11.78
240.2	49.74	301	100	V	240.2	-63.84	0	0.03	-63.87	-49.21	-14.66
288.7	47.41	55	100	H	288.7	-63.66	0	0.08	-63.74	-49.21	-14.53
288.7	53.45	160	100	V	288.7	-57.62	0	0.08	-57.7	-49.21	-8.49

Measured at 3 meters (Above 1 GHz)

Indicated		Turntable Azimuth (Degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
1060	48.25	0	100	H	1060	-61.46	5.979	0.38	-55.861	-41.25	-14.611
1060	50.9	0	100	V	1060	-59.1	6.134	0.38	-53.346	-41.25	-12.096
2415	52.4	221	100	H	2415	-53.82	9.473	0.52	-44.867	-41.25	-3.617
2415	52.87	170	100	V	2415	-52.31	9.463	0.52	-43.367	-41.25	-2.117

11 FCC §90.214 & IC RSS-119 §5.9 - Transient Frequency Behavior

11.1 Applicable Standard

FCC §90.214: Transmitters designed to operate in the 150–174 MHz and 421–512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time intervals[1,2]	Maximum frequency difference[3]	All equipment
		421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels		
t_1[4]	± 25.0 kHz	10.0 ms
t_2	± 12.5 kHz	25.0 ms
t_3[4]	± 25.0 kHz	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels		
t_1[4]	± 12.5 kHz	10.0 ms
t_2	± 6.25 kHz	25.0 ms
t_3[4]	± 12.5 kHz	10.0 ms

t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

$t_1$is the time period immediately following t_{on}.
$t_2$is the time period immediately following t_1.
$t_3$is the time period from the instant when the transmitter is turned off until t_{off}.
$t_{off}$is the instant when the 1 kHz test signal starts to rise.

[2]During the time from the end of $t_2$to the beginning of t_3, the frequency difference must not exceed the limits specified in §90.213.

[3]Difference between the actual transmitter frequency and the assigned transmitter frequency.

[4]If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

11.2 Test Procedure

TIA/EIA-603-D 2.2.19

11.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2014-11-13	1 year
Tektronix Inc	Digital Phosphor Oscilloscope	DPO4054	C012309	2014-09-17	1year
Agilent	Generator, Signal	E4438C	MY45091309	2014-07-15	1 year
HP	Analyzer, RF Communications Test Set	8920A	3438A05338	2014-07-23	1 year
-	SMA cable	-	C0005	Each Time[1]	-
Bird Electronic Corp.	30 dB attenuator	50-AFFB-30	14	Each Time[1]	-
Bird Electronic Corp.	30 dB attenuator	50-AFFB-30	15	Each Time[1]	-

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

11.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44-55 %
ATM Pressure:	101-102 kPa

The testing was performed by Todd Moy on 2015-04-28 in the RF Site.

11.5 Test Results

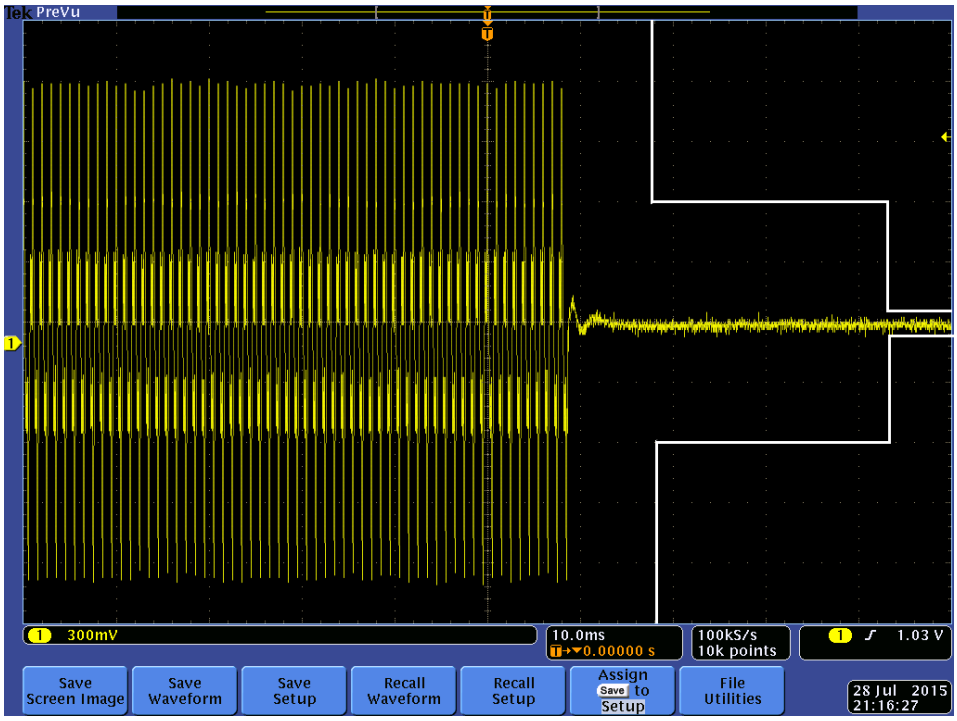
472.95 MHz which refered as High Channel#2 is used for FCC regulation test only.

Please refer to the hereinafter plots.

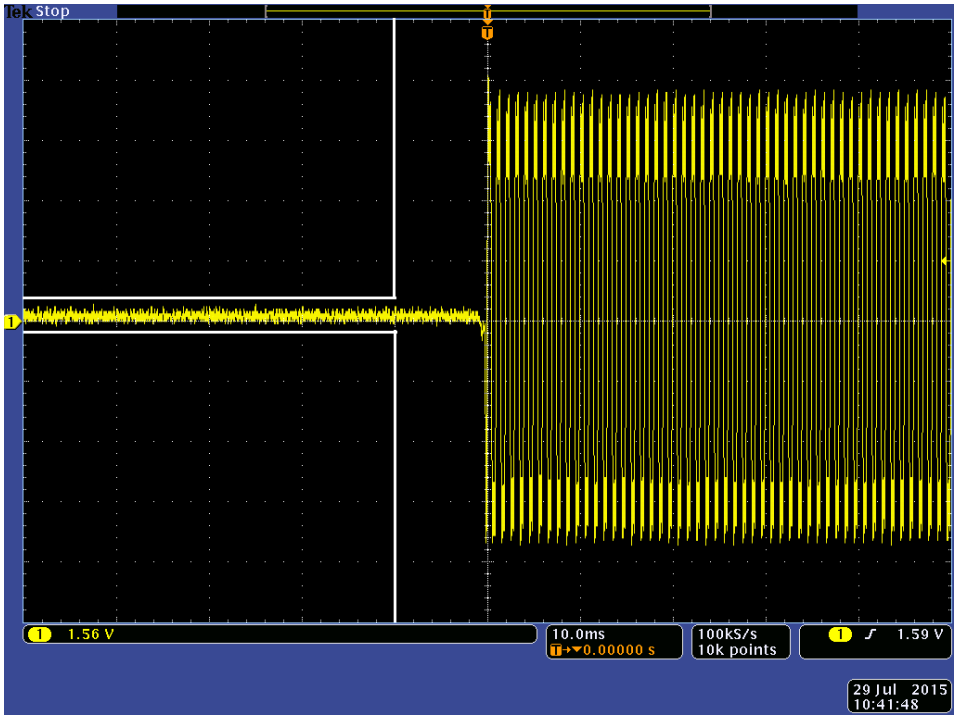
Low Channel: 430.15 MHz

12.5 kHz Channel Spacing

Powering Up

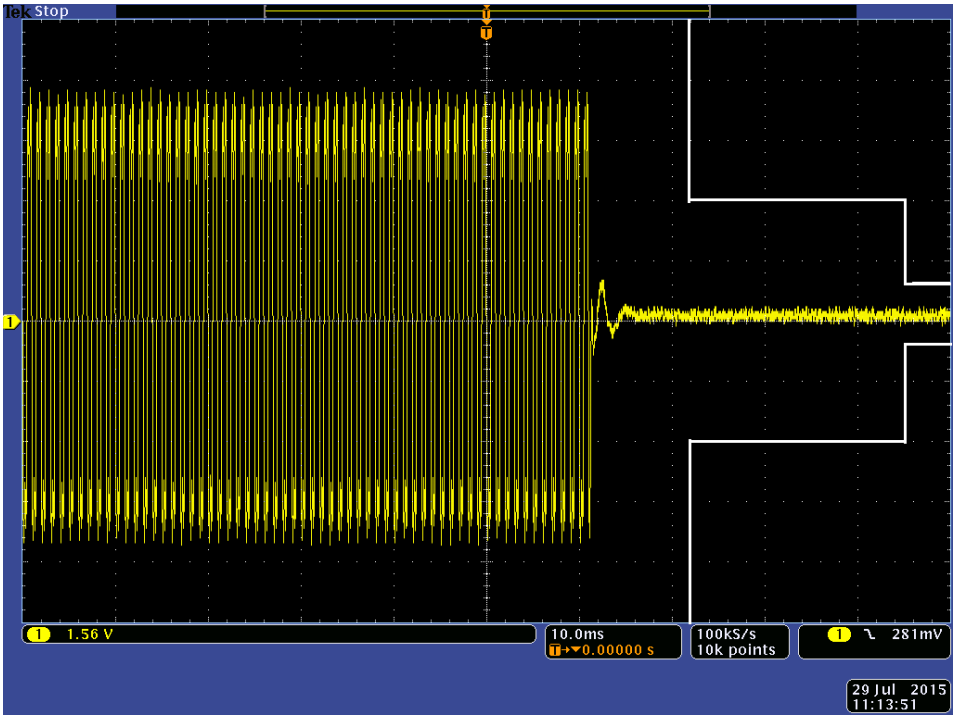


Powering Down

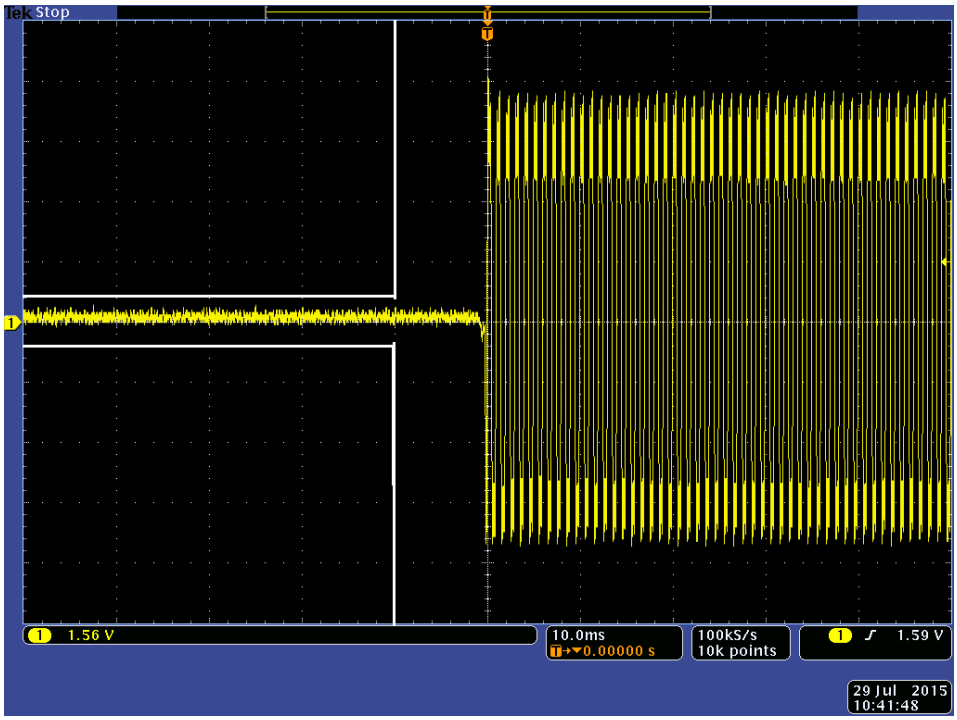


25 kHz Channel Spacing

Powering Up



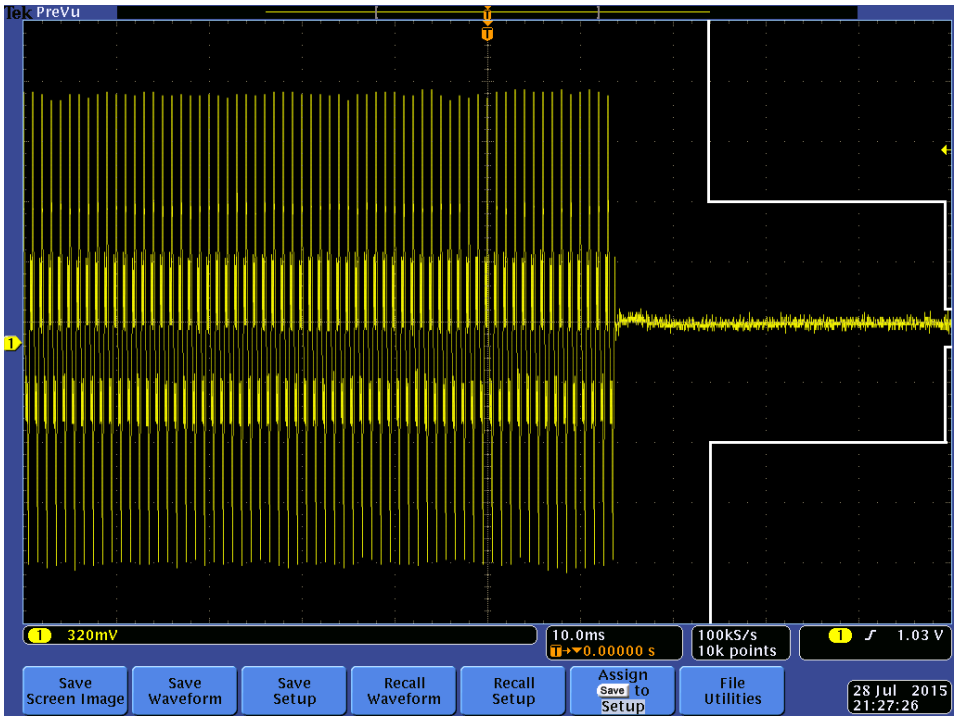
Powering Down



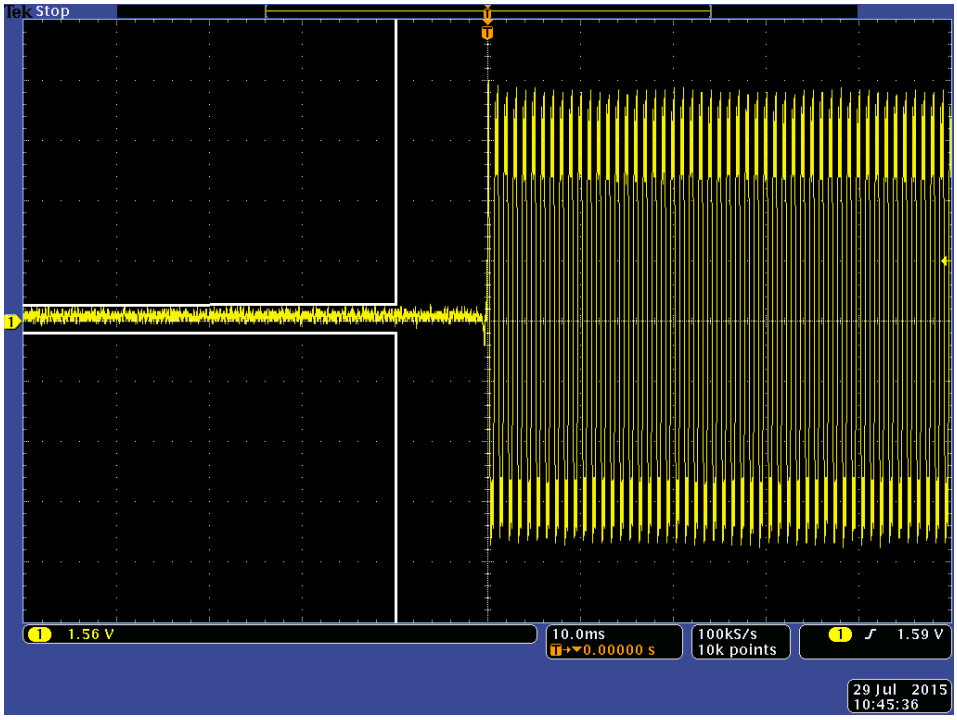
Middle Channel: 450.15 MHz

12.5 kHz Channel Spacing

Powering On

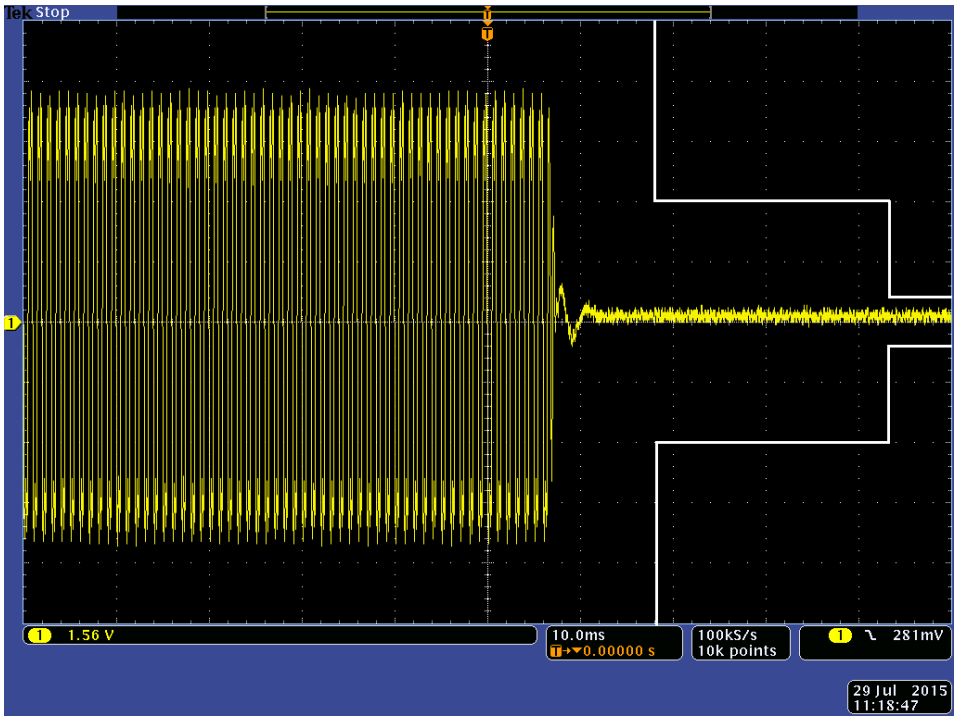


Powering Off

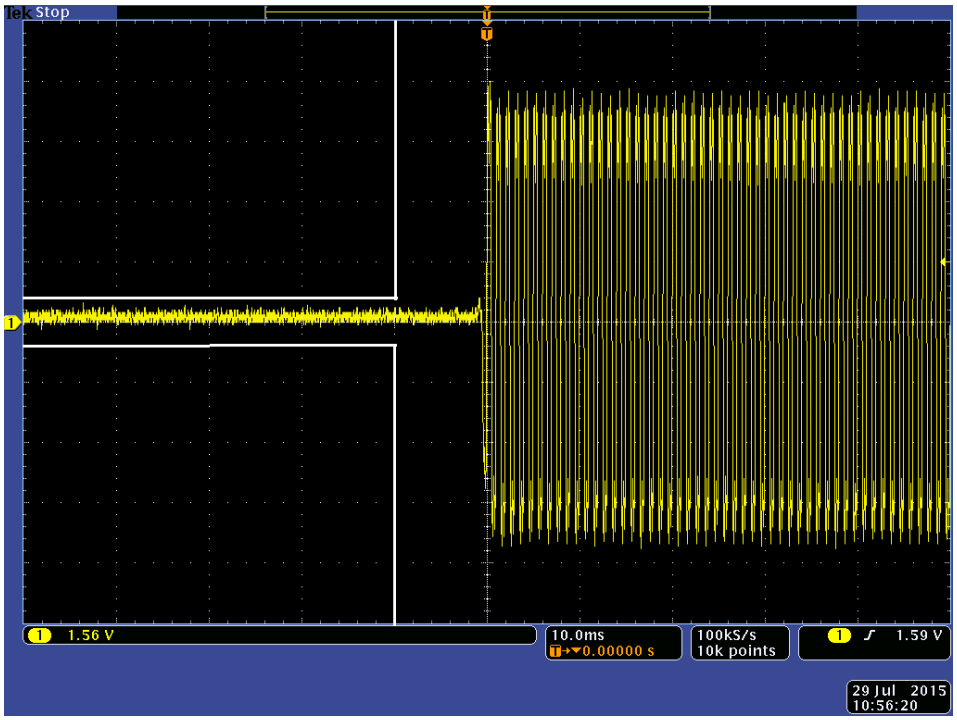


25 kHz Channel Spacing

Powering On



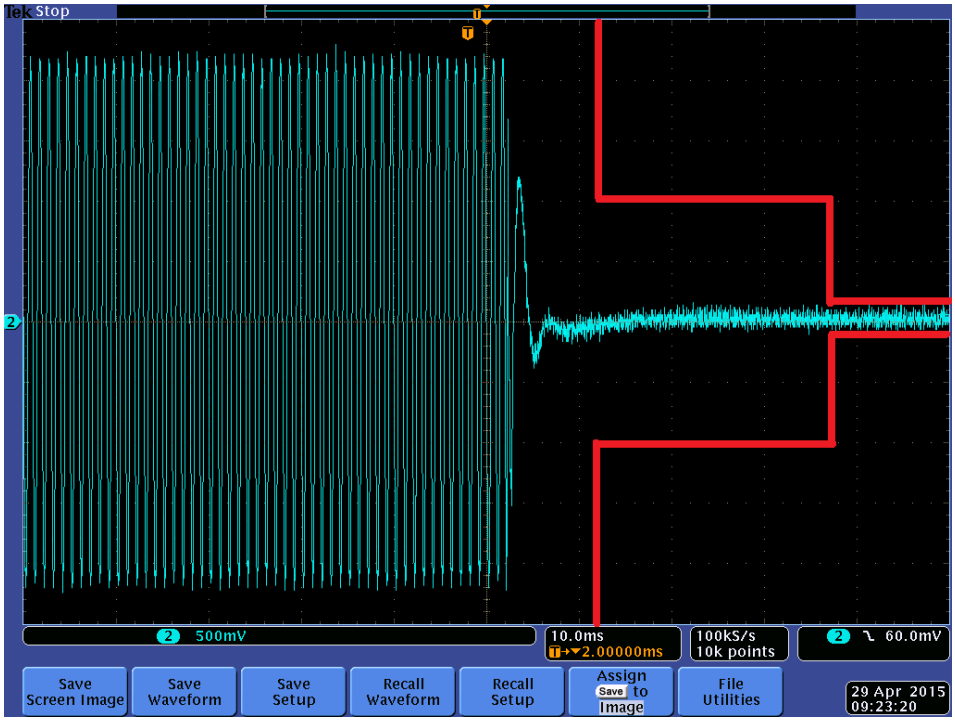
Powering Off



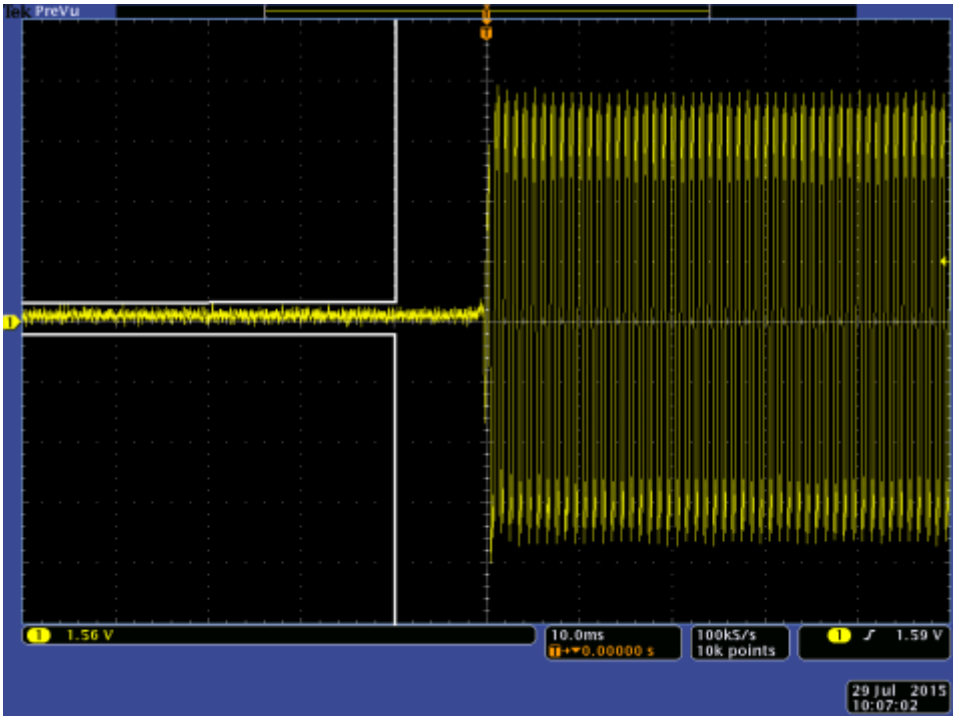
High Channel: 469.85 MHz

12.5 kHz Channel Spacing

Powering On

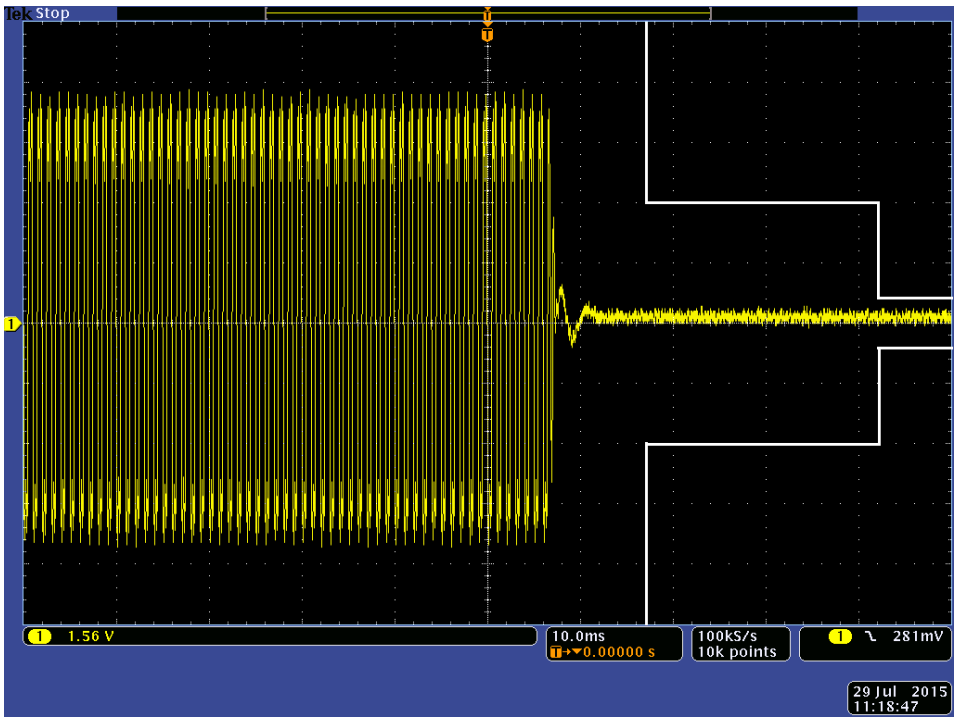


Powering Off

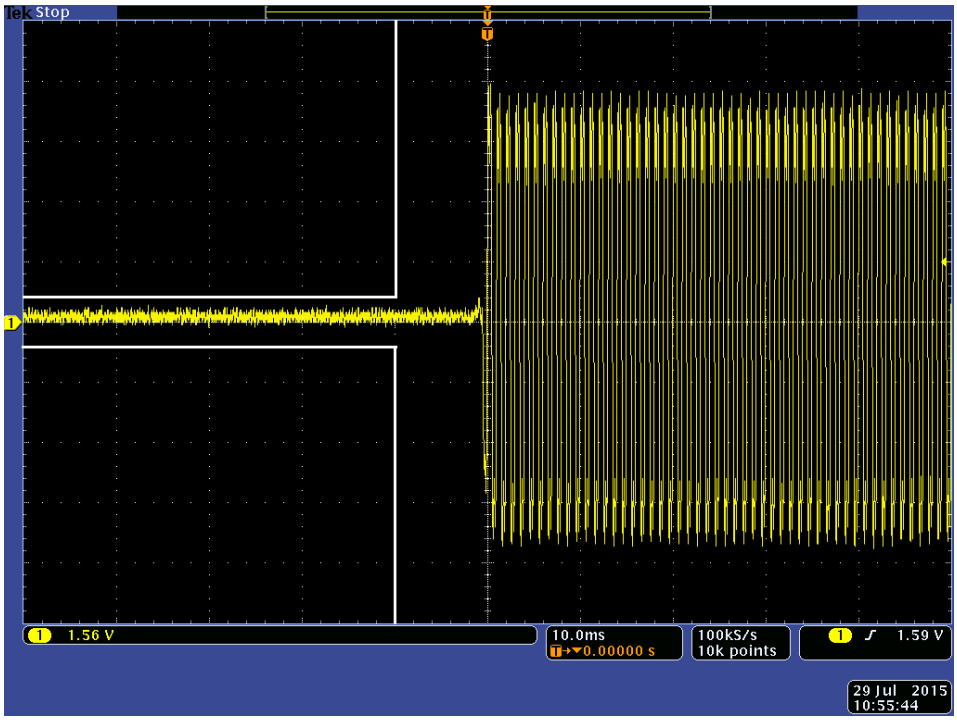


25 kHz Channel Spacing

Powering On



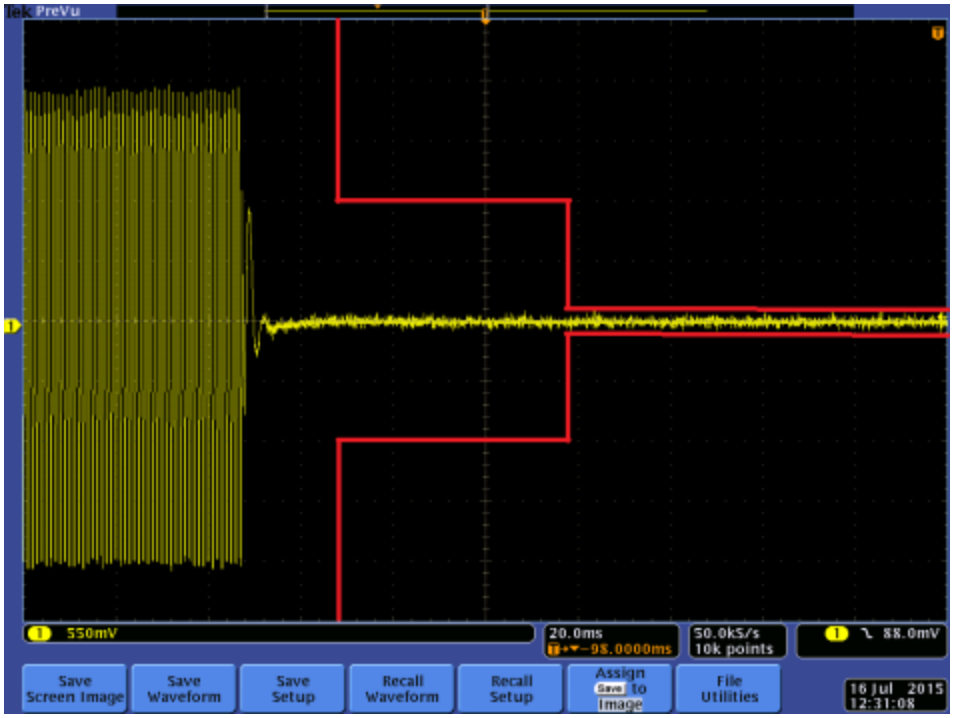
Powering Off



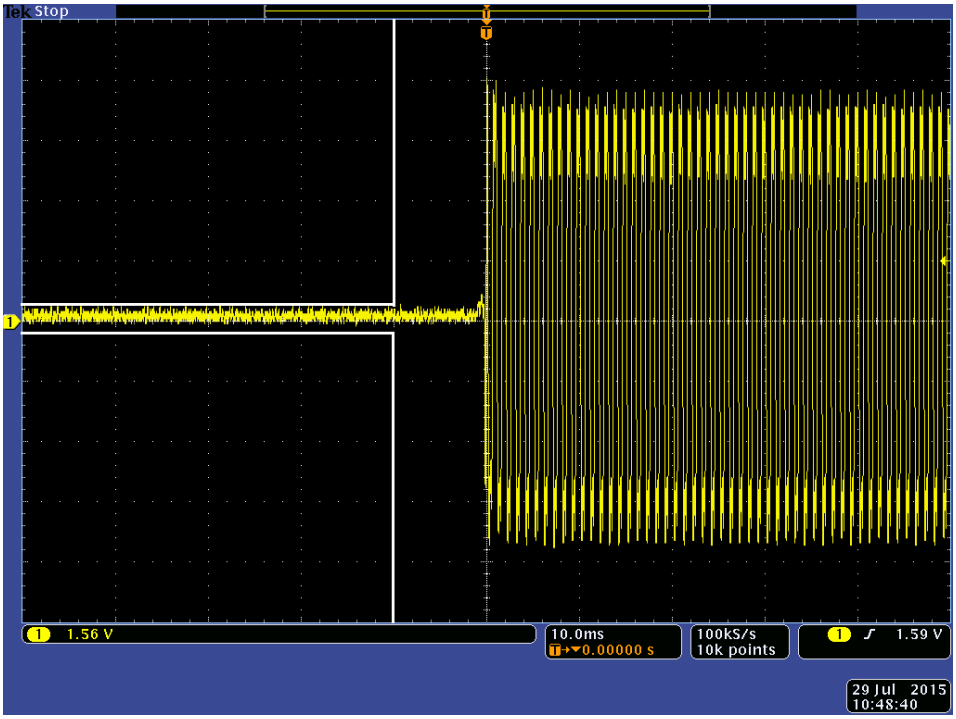
High Channel #2: 472.95 MHz

12.5 kHz Channel Spacing

Powering On

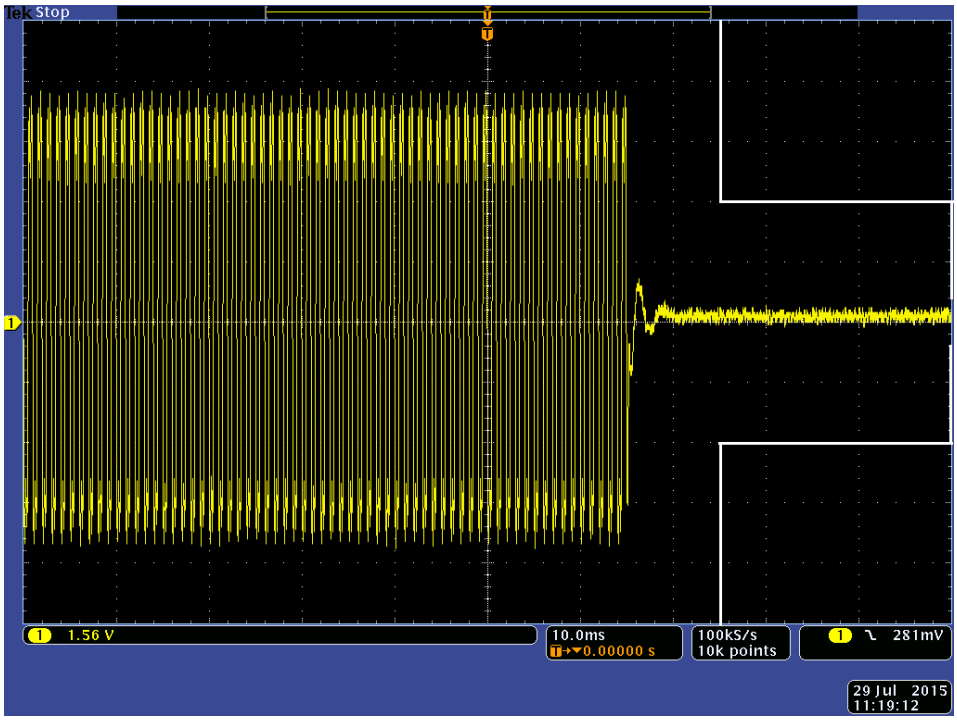


Powering Off



25 kHz Channel Spacing

Powering On



Powering Down